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Accident Fault Trees for Defense Waste Processing Facility

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ACCIDENT FAULT TREES FOR DEFENSE WASTE PROCESSING FACILITY (U)

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Engineering & Construction Services
Aiken, SC 29808

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ABSTRACT

The purpose of this report is to document fault tree analyses which have been completed for the Defense Waste Processing Facility (DWPF) safety analysis. Logic models for equipment failures and human error combinations that could lead to flammable gas explosions in various process tanks, or failure of critical support systems were developed for internal initiating events and for earthquakes. These fault trees provide frequency estimates for support systems failures and accidents that could lead to radioactive and hazardous chemical releases both on-site and off-site. Top event frequency results from these fault trees will be used in further APET analyses to calculate accident risk associated with DWPF facility operations. This report lists and explains important underlying assumptions, provides references for failure data sources, and briefly describes the fault tree method used. Specific commitments from DWPF to provide new procedural / administrative controls or system design changes are listed in the "Facility Commitments" section. The purpose of the "Assumptions" section is to clarify the basis for fault tree modeling, and is not necessarily a list of items required to be protected by Technical Safety Requirements (TSRs).

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LIST OF ATTACHMENTS

ABBREVIATIONS/ACRONYMS

APET	Accident Progression Event Tree
BE	Basic Event
CAFTA	Computer Aided Fault Tree Analysis
CPC	Chemical Processing Cell
CSRAM	Cut-Set Reliability, Availability, and Maintainability
DCS	Distributed Control System
DWPF	Defense Waste Processing Facility
FCV	Flow Control Valve
HEPA	High Efficiency Particulate Air (filter)
HLW	High Level Waste
LEL	Lower Explosive Limit
LFL	Lower Flammability Limit
LPPP	Low Point Pump Pit
MCC	Motor Control Center
MFT	Melter Feed Tank
MOC	Minimum Oxygen for Combustion
OE	Organic Evaporator
OECT	Organic Evaporator Condensate Tank
OGCT	Off-gas Condensate Tank
OWST	Organic Waste Storage Tank
P&ID	Piping & Instrument Drawing
PCV	Pressure Control Valve
PHA	Precipitate Hydrolysis Aqueous
PHR	Process Hazard Review
PPT	Precipitate Pump Tank (in LPPP)
PR	Precipitate Reactor
PRBT	Precipitate Reactor Bottoms Tank
PRC/D	Precipitate Reactor Condenser/Decanter
PRFT	Precipitate Reactor Feed Tank
PSV	Pressure Safety Valve
PSW	Primary Service Water (process cooling water)
PVVH	Process Vessel Vent Header
RAG	Risk Analysis Group
SAE	Safety Analysis Engineering
SAR	Safety Analysis Report
SME	Slurry Mix Evaporator
SPC	Salt Processing Cell
SPT	Sludge Pump Tank (in LPPP)
SRAT	Sludge Receipt and Adjustment Tank
SRS	Savannah River Site
SSW	Secondary Service Water (process chilled water)
TC	Type Code
WSRC	Westinghouse Savannah River Company

INTRODUCTION

A systematic, safety analysis is being conducted for the Defense Waste Processing Facility (DWPF) at the Savannah River Site to meet the requirements of DOE Order 5480.23, "Nuclear Safety Analysis Reports." Fault tree analyses for internal initiator scenarios and seismic events have been completed which provide estimates of failure rates for support systems and accident frequencies for possible explosions in process tanks and piping systems that could lead to radioactivity and hazardous chemical releases and potential consequences to people on-site and off-site. The process systems and their support systems are sufficiently complex that use of probabilistic risk assessment methods is warranted. The frequency results from these fault trees will be used in further Accident Progression Event Tree (APET) analyses to evaluate a broad spectrum of potential accident scenarios, to characterize the risk of the DWPF when waste processing operations begin.

An important input to the frequency determinations are all the underlying assumptions and data for basic component failures and human errors that can initiate and enable the sequence of events leading to an accidental release. These assumptions and data are documented in this report along with the fault tree logic used in the analyses. Information included here serves as the technical basis for assignment of each accident scenario to a given likelihood-of-occurrence range (e.g., Anticipated: 1/yr to 10^{-2}/yr, Unlikely: 10^{-2}/yr to 10^{-4}/yr, Extremely Unlikely: 10^{-4}/yr to 10^{-6}/yr, and beyond extremely unlikely: $< 10^{-6}$/yr) as defined in DOE Standard–3009, "Preparation Guide for U. S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports."

METHOD OR APPROACH

Of the accident scenarios identified in the hazard analysis for DWPF, fifteen explosion accidents (Table 1) were selected for additional analysis to determine frequencies of occurrence in various DWPF process vessels. These scenarios were for hydrogen, benzene, or steam explosions caused by internal initiator events. The fault tree method was selected as most suitable to perform the frequency analyses, with a separate tree provided for each scenario.

Components and systems which serve to prevent, detect, or mitigate potential consequences were identified in the hazard analysis and were modeled in the fault trees. Detailed design P&ID's (listed in Attachment 1) were used to define process systems and their support systems. Operating procedures were reviewed as needed to define required operator actions which could potentially prevent or mitigate the progression of an accident.

CAFTA (Computer Aided Fault Tree Analysis) software, Version 2.2e (Reference 1) was used to construct fault trees and quantitatively solve them. A revised cutset editor, CSRAM, Version 2.1e, was substituted for the CUTSET module in the code. CAFTA generated the fault tree plot, determined minimal cutsets and basic event importance, and computed the overall failure rate for each fault tree.

In addition to the logic structure of gates and events with their names and descriptions, CAFTA input included information needed to determine event probabilities or frequencies of occurrence. Depending on the information supplied, CAFTA calculated appropriate probabilities and frequencies and combined them according to specified logical relationships to calculate the frequency of the top event. Attachment 2 describes the naming convention for basic events. Attachment 3 lists the Basic Event (BE) file, which shows for each event the probability/frequency data and the reference source for each item of data. Along with the information in the BE file, the Type Code (TC) file listed in Attachment 4 has additional information used by CAFTA to evaluate probabilities for basic events. The details of how these calculations were done are described in Reference 1, which gives numerous examples.

Support system fault trees (Table 2) were developed to model possible failures of support systems. Some of these contributed as both *initiator* and *enabler* events in the accident fault trees, while some were only *enabler* events. An initiator is an event that must be included in the set of postulated failures and errors which combine in the analysis to produce the accident of concern. In a way they can be thought of as events that could start the sequence of events ending in an accident, although fault tree analysis per se does not deal with time sequences. Enabler events are those which only contribute to the possible ways that the accident could come about. An event may be either or both an initiator or an enabler. This distinction determines the types of input failure data and the data computations made in the analysis (Reference 1).

Support system failures were modeled within the accident fault trees as basic events. Also, a particular support system failure event could factor into more than one accident fault tree. Since these events were modeled as if they were independent events, it was necessary to make support system fault trees independent of each other. For example, SPC primary purge fails if normal power is lost. The purge fault tree does not include power within it, and the top event is called, "SPC Primary Purge Fails (excluding normal power)." The dependency of purge on normal power is handled by the APET, which considers the purge system in a failed state if normal power is in a failed state.

General seismic fault trees were developed for accidents initiated by earthquakes. These trees were not used to develop specific frequency numbers as for internal initiators, but provide the logic which APET combines with fragility data for various magnitude earthquakes. Each of the accident trees has a corresponding seismic tree. Many of the support system trees also have seismic counterparts; however, some support systems which did not have any seismic qualifications were assumed to fail in an earthquake (i.e., a probability of 1.0 of failure).

RESULTS

Table 1 summarize accident frequencies due to internal event initiators during normal operations, excluding maintenance activities.

Table 1. Accident Fault Tree Results (Internal Initiators)

Likelihood Range	System	Description	Frequency (per year)
Unlikely	SRAT	Sludge Receipt and Adjustment Tank explosion	9.7E-4
Unlikely	SPC	Salt Processing Cell explosion	1.1E-4
Extremely Unlikely	SME	Slurry Mix Evaporator explosion	8.8E-5
Extremely Unlikely	MFT	Melter Feed Tank explosion	4.6E-5
Extremely Unlikely	PR	Precipitate Reactor explosion	4.5E-5
Extremely Unlikely	SMELT	Steam Explosion in Melter	1.8E-5
Extremely Unlikely	OE	Organic Evaporator explosion	1.2E-5
Extremely Unlikely	PRFT	Precipitate Reactor Feed Tank explosion	8.2E-6
Extremely Unlikely	OECT	Organic Evaporator Condensate Tank explosion	6.7E-6
Extremely Unlikely	PRBT	Precipitate Reactor Bottoms Tank explosion	5.8E-6
Extremely Unlikely	PVVH	Process Vessel Vent Header explosion	3.1E-6
Extremely Unlikely	PPT	Precipitate Pump Tank (in LPPP) explosion	1.8E-6
Extremely Unlikely	OWSTTK	Organic Waste Storage Tank explosion	1.3E-6
Beyond Ext. Unlikely	SPT	Sludge Pump Tank (in LPPP) explosion	3.2E-7
Beyond Ext. Unlikely	OFFGAS	Melter Off-gas explosion	1.5E-11

None of the accidents are in the "anticipated" frequency range. Two of the explosion scenarios (SRAT and SPC) are at the low end of the "unlikely" frequency range. The remainder are distributed across the "extremely unlikely" and "beyond extremely unlikely" ranges. Fault tree plots, the most significant cutsets, and basic event importance for all the listed accidents are included in Attachment 5.

Each fault tree and cutset report is followed by two basic event importance listings. The first listing ranks each basic event by the Risk Achievement Worth importance factor, and the second listing ranks events by Risk Reduction Worth importance factor. From the Risk Achievement Worth one can tell how much more likely the top event is if a given basic event always happens. The risk achievement worth for a given basic event is equal to the top event frequency if that basic event is assumed to fail divided by the top event frequency if that basic event failure occurs at its predicted failure rate.

The Risk Reduction Worth provides a measure of how much less likely the top event is, if you assume a given basic event never occurs. The Risk Reduction Worth importance factor for a given basic event is equal to the normal top event frequency divided by the top event frequency, given that event never occurs. See Attachment 8 for further details.

Table 2 shows failure frequencies, unavailability data, and repair times for support system failures modeled by fault trees included in Attachment 6, which includes fault tree plots, significant cutsets, and basic event importance. The support system fault trees were modeled as basic event inputs in the various accident fault trees as appropriate. The failure frequency for a support system was not dependent on the type of internally initiated accident. This independence would not be true for externally caused, natural phenomena accidents, such as earthquakes.

Systems listed in Table 2 that show only unavailability data are pure enabler events. They are backup systems whose isolated failures cannot cause an accident, and their failures are expressed as probabilities with no associated frequencies. The systems which have frequencies associated with them are both initiators and enablers. Failures of these systems could be causes of accidents, or they could enable other sets of failure or human error events to progress to an accident or to more severe consequences. For example, loss of CPC primary purge can eventually lead to a hydrogen gas explosion.

The seismic fault trees are grouped together in Attachment 7.

Table 2. Support System Fault Tree Results (Internal Initiators)

Title	Description	Frequency (per hour)	Unavailability	Repair Time (hrs)
STEAM	Process Steam	2.1E-4	1.2E-2	55
SSW	Process chilled water	2.3E-5	3.3E-4	14
PSW	Process cooling water	-	2.3E-3	-
CTWCC	Cooling tower water - common	1.1E-5	5.8E-5	5.5
DEEP	Cooling tower water - deep well	-	5.4E-3	-
CTWP	Cooling tower water - pumping	6.3E-6	5.6E-4	90
BLKN2	Bulk nitrogen path	5.5E-6	1.1E-4	20
N2TNK	Bulk nitrogen supply	7.7E-6	1.3E-4	17
CPCTNK	CPC nitrogen tank supply	-	3.7E-5	-
CPCBP	CPC backup purge path	-	3.1E-3	-
CPCPP	CPC primary purge	1.9E-5	9.5E-4	51
POWD	Backup power	-	1.1E-2	-
POWN	Normal power	3.5E-5	2.9E-4	8.5
VV	Vitrification Bldg. Ventilation	-	3.3E-5	-
VV-E	Vit. Bldg. Ventilation (normal electric power lost)	-	1.1E-3	-
VV-EI	Vit. Bldg. Ventilation (normal electric power and inst. air lost)	-	7.6E-3	-
SPCPP	SPC primary purge	6.7E-5	5.9E-4	8.8
SPCBP	SPC backup purge	-	6.7E-3	-
SPCN2	SPC nitrogen blanket path	-	4.1E-4	-
LPPPN2	LPPP nitrogen supply path	-	5.3E-4	-
INAIR	Instrument air	1.1E-5	2.9E-4	26

INPUTS AND ASSUMPTIONS

Assumptions Related to Accident Fault Trees

Process Vessel Vent Header (PVVH) Explosion

The Process Vessel Vent Header (PVVH) may carry flammable concentrations of hydrogen gas and benzene vapor. Potentially explosive levels of hydrogen can only be reached in the PVVH if base load air flow fails, and hydrogen levels are high from the SRAT or SME. Hydrogen generation rates in PRBT and MFT are insufficient to produce explosive concentrations in PVVH. Explosive benzene levels may be reached in the PVVH if benzene generation in PR or OE is so high that dilution with CPC and baseload air flow is inadequate. Such a condition can occur if the condenser for those vessels fails or if the SPC is not isolated from PVVH when the base load air flow fails. Interlocks are provided to protect against these occurrences. Normally, PVVH base load air flow is designed to reduce SPC benzene off-gas and the CPC hydrogen/benzene off-gas to concentrations less than LFL. The benzene concentration is flammable in a short section of PVVH piping, but is diluted to less than LEL in the remainder of the system downstream.

The PVVH is overwhelmed by benzene if PR steam supply valves fail open and either SCVC or PRC/D is not operating. If both condensers are working, enough benzene is removed that the PVVH flow reduces it to less than LFL. OEC/D or SCVC operation is adequate to prevent benzene from OE overwhelming PVVH.

The following statements pertain to the PVVH seismic fault tree:

1. Purge failure to CPC vessels results in LFL being reached in those vessels and propogating to the PVVH, but the time it takes to reach LFL in the PVVH is sufficiently long to justify use of delayed (internal) ignition source probability.

2. Excess benzene is received by the PVVH from the SPC if they are not isolated from each other by the seismic trigger interlock.

PVVH system boundaries include ventilation piping from the Formic Acid Vent Condenser (FAVC) and the Salt Cell Vent Condenser (SCVC) up to the Zone 1 ventilation connection, heater, filters, and fans. Support systems include: nitrogen supply tank, CPC primary and backup purge systems, process cooling water, cooling tower water, chilled water, process steam, instrument air, normal electric power, and backup electric power.

A temperature monitor detects high temperature in the SCVC and gives an alarm to alert operators in addition to automatic interlock actions. Loss of base load air flow is detected by a flow monitor; low flow gives an alarm. A benzene analyzer and detector on the PVVH actuates automatic interlocks when a high concentration is detected to stop PR transfers and turn off the OE steam supply.

Sludge Receipt and Adjustment Tank (SRAT) Explosion

The Sludge Receipt and Adjustment Tank (SRAT) in CPC is purged by the primary air purge system for CPC. The nitrogen purge system for CPC vessels serves as a backup to the primary system. The purge flow prevents buildup of high concentrations of flammable hydrogen gas or benzene vapors. Excessive hydrogen levels may be reached if a failure of interlock actions occurs when purge flow fails. Improper additions of PHA, formic acid, or nitric acid into SRAT could also cause high generation of hydrogen gas that could exceed the removal capacity of the purge system. Benzene levels in SRAT could exceed LFL if transfer or operator errors result in high benzene content of material coming from the SPC.

SRAT system boundaries include CPC air purge and nitrogen purge piping, a flow control valve, a needle valve, two hydrogen gas detectors, and interlock circuitry to shut down processing operations that could contribute to high generation of hydrogen gas. Essential support systems include: normal and backup electric power, nitrogen supply system, process cooling water, cooling tower water, and instrument air.

Flow monitors on the CPC purge system detect loss of purge flow and alarm to initiate operator actions. Hydrogen gas detectors (GC's) actuate interlock circuits that shut down the SRAT steam supply, start cooling water circulation, and stop all transfers of materials to SRAT.

Three additional assumptions were made in the fault tree analysis for the SRAT. These were:

1. The fault tree analysis assumes that an out of calibration steam flow element can not cause steam to fail to the SRAT during transfer and allow steam to flow thereafter.

2. Successful interlock actions in the SRAT or SME prevent explosive mixtures from accumulating. The cause of interlock actions is repaired before radiolytic decomposition causes hydrogen concentration to reach LFL.

3. Interlock actions for SME and SRAT are unsuccessful if any of the actions are unsuccessful (stop steam, start cooling, and stop transfers).

The following statements pertain to the SRAT seismic fault tree:

1. Purge failure results in LFL being reached, but the time it takes to reach LFL is sufficiently long to justify use of delayed (internal) ignition source probability.

2. Nitric acid or PHA over-addition to the SRAT are likely enough to be considered in the seismic fault tree.

3. The frequency of inadequate sludge characterization by SRTC coupled with an earthquake is low enough to be left out of the seismic fault tree.

4. Low boil up during transfer to the SRAT is not included because steam must be restarted for significant benzene to be released from the SRAT, and seismic response procedures prevent starting process steam before ensuring it will not cause such a problem.

Slurry Mix Evaporator (SME) Explosion

The hazard in the Slurry Mix Evaporator (SME) is possible hydrogen gas accumulation in the vessel. The Chemical Processing Cell (CPC) primary purge air system purges the SME. There is a backup nitrogen purge system for CPC vessels. Excessive hydrogen gas concentrations may be reached in the SME if the primary and backup purge systems fail or the rate of hydrogen gas generation exceeds purge design. High rates of hydrogen gas generation are reduced to safe levels by an interlock system that monitors hydrogen concentration and automatically takes actions to shut down the SME process. These interlock actions cause the SME steam supply to be turned off, cooling water flow to be started, and transfers from feed and chemical addition tanks to be stopped.

The SME system boundary includes purge system piping, control valve, needle valve, hydrogen detectors, and interlock instrumentation. In addition to proper operation of the purge system, chemical additions to SME must be carefully controlled. Essential support systems include: electric power, process cooling water system, cooling tower water system, and instrument air system.

Instruments monitor purge air flow and give an alarm upon loss of flow. Gas chromatographs monitor hydrogen concentration. If a high level of hydrogen occurs, interlock circuits shut the process down and start cooling water flow to reduce the hydrogen generation rate to radiolytic decomposition.

Two additional assumptions were made in the fault tree analysis for the SME. These are:

1. Successful interlock actions in the SRAT or SME will prevent explosive mixtures of hydrogen gas from accumulating. If loss of purge air flow is the initiator of interlock action, it is assumed that purge flow will be restored before hydrogen gas concentration reaches LFL.

2. Interlock actions for SME and SRAT are unsuccessful if any single action is unsuccessful (stop steam, start cooling, and stop transfers).

The following statements pertain to the SME seismic fault tree:

1. Purge failure results in LFL being reached, but the time it takes to reach LFL is sufficiently long to justify use of delayed (internal) ignition source probability.

2. The frequency of inadequate sludge characterization by SRTC or over addition of formic acid, coupled with an earthquake is low enough to be left out of the seismic fault tree.

Precipitate Reactor Bottoms Tank (PRBT) Explosion

The Chemical Processing Cell (CPC) primary purge air system draws air through the Precipitate Reactor Bottoms Tank (PRBT) to prevent buildup of flammable hydrogen gas or benzene vapor. CPC also has a backup nitrogen blanket gas system should the primary purge system fail. In normal operation benzene vapor generation is maintained below the removal capability of the purge system by limiting the amount of benzene discharged to the PRBT from the PR in the Salt Processing Cell (SPC). Normally the precipitate reactor feed material from PRFT does not have enough benzene to cause high benzene concentrations in the PRBT with the purge air system on, even if an immediate transfer takes place from the PR before the processing is completed in the PR. It would take an operator error involving draining benzene from the PRC/D into the PR and erroneous transfer of this high benzene material to the PRBT to result in a vapor concentration greater than LFL in the PRBT.

Hydrogen gas evolves continually from the waste solution in PRBT. An extended loss of purge air flow and backup nitrogen purge would allow hydrogen to build up. If PRBT purge air stops and an alarm sounds, this analysis assumed that one of several independent nitrogen purge systems could be started by the operator before the hydrogen LFL is reached.

The following statements pertain to the PRBT seismic explosion fault tree:

1. Purge failure results in LFL being reached, but the time it takes to reach LFL is sufficiently long to justify use of delayed (internal) ignition source probability.

2. The probability of PRBT receiving a high benzene content transfer just prior to an earthquake is sufficiently low that it is negligible, when coupled with the seismic event frequency.

3. The frequency of inadequate sludge characterization by SRTC coupled with an earthquake is low enough to be left out of the seismic fault tree.

System boundaries for the PRBT fault tree include purge system piping, flow control valves, manual block valves, and purge flow monitoring instruments. The electric power system is an essential support system for CPC air purge system. The nitrogen supply tank and its associated piping are required by the backup nitrogen purge system.

Flow monitors can detect purge system failure and sound an alarm for operator actions. Conditions which cause benzene vapor generation to exceed the removal capacity of the purge system would go undetected if the equipment failures or operator errors were not recognized.

Errors in Precipitate Reactor (PR) operations are possible causes for high benzene vapor concentrations in PRBT. The PRBT is a holding tank for SRAT feed from PR. Because material transferred from PR to PRBT is going from a system that controls the gas or vapor space to minimum oxygen for combustion (MOC) to one that controls the benzene vapor concentration to its lower flammability limit (LFL), there is a potential for high benzene transferred from one system to the other. One scenario for high benzene present in the transferred fluid involves errors in PRC/D cleaning. The PRC/D is a decanter on the PR that holds some benzene from PR operations. If it is cleaned and benzene is emptied into the PR before the contents of PR are transferred to PRBT, then PRBT could receive a high benzene solution.

Melter Feed Tank (MFT) Explosion

The Chemical Processing Cell (CPC) primary purge air system draws air through the Melter Feed Tank (MFT) to prevent buildup of flammable hydrogen gas, which slowly evolves from the melter feed solution.

The following statements pertain to the MFT seismic fault tree:

1. Purge failure results in LFL being reached, but the time it takes to reach LFL is sufficiently long to justify use of delayed (internal) ignition source probability.

2. The frequency of inadequate sludge characterization by SRTC coupled with an earthquake is low enough to be left out of the seismic fault tree.

3. MFT purge can not be overwhelmed by hydrogen generation with nominal inventory, regardless of termperature.

4. MFT purge can not be overwhelmed by hydrogen generation with nominal operating temperature, regardless of conceivable chemical addition errors.

5. The case of MFT purge being overwhelmed by hydrogen generation due to chemistry errors coupled with high termerature is negligible, because the two events are each low probability and independent of each other.

System boundaries for MFT fault tree include purge system piping, flow control valve, manual block valves, and purge flow monitoring instruments with alarms. The electric power system is an essential support system for CPC air purge system. The bulk nitrogen or CPC backup purge supply tanks and associated piping are required by the backup nitrogen purge system.

Flow monitors detect loss of purge air flow. Temperature monitoring instruments detect high temperature in the MFT. Both instrument systems alarm to initiate operator actions.

Precipitate Reactor (PR) Explosion

The primary carbon dioxide purge system in the Salt Processing Cell (SPC) purges the gas space in the Precipitate Reactor (PR) vessel. The primary system generates carbon dioxide gas by vaporizing liquid CO_2 with applied heat from an electric heater. There is also a backup supply of carbon dioxide from a bank of high pressure gas cylinders. The SPC nitrogen purge system may also be used as a backup. A high benzene vapor concentration is unavoidable in the PR; consequently, the approach used to prevent possible explosions is to exclude oxygen gas by maintaining either a carbon dioxide or nitrogen atmosphere in the vessel. The precipitate reactor operation is a batch operation. The CO_2 purge rate must be checked periodically and adjusted manually. If a high concentration of oxygen is detected in the PR, an automatic interlock circuit increases the gas pressure in the vessel higher than the surrounding SPC pressure to prevent air from leaking into the PR.

For SPC vessel seismic fault trees, it is modeled that if the isolation of SPC from PVVH or nitrogen addition to SPC vessels is not successful, SPC vessels explode.

Precipitate Reactor purge system boundaries included SPC carbon dioxide piping, a purge pressure control valve, a pressure safety relief valve, vacuum breaker, and various isolation valves. There are two oxygen gas detectors and associated interlock instrumentation. Support systems include normal and backup electric power and SPC primary, backup, and nitrogen purge.

PR purge failure is detected by flow instruments that give an alarm to alert operators. Two oxygen analyzers detect possible air leaking into the vessel. High oxygen concentration will actuate an interlock circuit that closes control valves to raise the gas pressure in the PR. The interlock also stops transfers in the SPC, turns off the steam supply to the PR, starts PR cooling water circulation, and stops the vessel agitator.

Organic Evaporator (OE) Explosion

The primary carbon dioxide purge system in the Salt Processing Cell (SPC) purges the gas space in the Organic Evaporator (OE) vessel. The primary system generates carbon dioxide gas by vaporizing liquid CO_2 with applied heat from an electric heater. There is also a backup supply of carbon dioxide from a bank of high pressure gas cylinders. The SPC nitrogen purge system may also be used as a backup. A high benzene vapor concentration is unavoidable in the OE; consequently, the approach used to prevent possible explosions is to exclude oxygen gas by maintaining either a carbon dioxide or nitrogen atmosphere in the vessel. The organic evaporator operation is a batch operation. The CO_2 purge rate must be checked periodically and adjusted manually. If a high concentration of oxygen is detected in the OE, an automatic interlock circuit increases the gas pressure in the vessel higher than the surrounding SPC pressure to prevent air from leaking into the OE.

For SPC vessel seismic fault trees, it is modeled that if the isolation of SPC from PVVH or nitrogen addition to SPC vessels is not successful, SPC vessels explode.

Organic Evaporator purge system boundaries included SPC carbon dioxide piping, a purge pressure control valve, a pressure safety relief valve, vacuum breaker, and various isolation valves. There are two oxygen gas detectors and associated interlock instrumentation. Support systems include normal and backup electric power and SPC primary, backup, and nitrogen purges.

OE purge failure is detected by flow instruments that give an alarm to alert operators. Two oxygen analyzers detect possible air leaking into the vessel. High oxygen concentration will actuate an interlock circuit that closes control valves to raise the gas pressure in the OE. The interlock also stops transfers in the SPC, turns off the steam supply to the OE, starts OE cooling water circulation, and stops the vessel agitator.

Organic Evaporator Condensate Tank (OECT) Explosion

The primary carbon dioxide purge system in the Salt Processing Cell (SPC) purges the gas space in the Organic Evaporator Condensate Tank (OECT). The primary system generates carbon dioxide gas by vaporizing liquid CO_2 with applied heat from an electric heater. There is also a backup supply of carbon dioxide from a bank of high pressure gas cylinders. The SPC nitrogen purge system may also be used as a backup. A high benzene vapor concentration is unavoidable in the OECT; consequently, the approach used to prevent possible explosions is to exclude oxygen gas by maintaining either a carbon dioxide or nitrogen atmosphere in the vessel. The precipitate reactor operation is a batch operation. The CO_2 purge rate must be checked periodically and adjusted manually. If a high concentration of oxygen is detected in the OECT, an automatic interlock circuit increases the gas pressure in the vessel higher than the surrounding SPC pressure to prevent air from leaking into the OECT.

For SPC vessel seismic fault trees, it is modeled that if the isolation of SPC from PVVH or nitrogen addition to SPC vessels is not successful, SPC vessels explode.

Organic Evaporator Condensate Tank purge system boundaries included SPC carbon dioxide piping, a purge pressure control valve, a pressure safety relief valve, vacuum breaker, and various isolation valves. There are two oxygen gas detectors and associated interlock instrumentation. Support systems include normal and backup electric power and SPC primary, backup, and nitrogen purges.

OECT purge failure is detected by flow instruments that give an alarm to alert operators. Two oxygen analyzers detect air leaking into the vessel. High oxygen concentration will actuate an interlock circuit that closes control valves to raise the gas pressure in the OECT. The interlock also stops transfers in the SPC and stops the vessel agitator.

Precipitate Reactor Feed Tank (PRFT) Explosion

The primary carbon dioxide purge system in the Salt Processing Cell (SPC) purges the gas space in the Precipitate Reactor Feed Tank (PRFT). The primary system generates carbon dioxide gas by vaporizing liquid CO_2 with applied heat from an electric heater. There is also a backup supply of carbon dioxide from a bank of high pressure gas cylinders. The SPC nitrogen purge system may also be used as a backup. A high benzene vapor concentration is unavoidable in the PRFT; consequently, the approach used to prevent possible explosions is to exclude oxygen gas by maintaining either a carbon dioxide or nitrogen atmosphere in the vessel. The precipitate reactor operation is a batch operation. The CO_2 purge rate must be checked periodically and adjusted manually. If a high concentration of oxygen is detected in the PRFT, an automatic interlock circuit increases the gas pressure in the vessel higher than the surrounding SPC pressure to prevent air from leaking into the PRFT.

For SPC vessel seismic fault trees, it is modeled that if the isolation of SPC from PVVH or nitrogen addition to SPC vessels is not successful, SPC vessels explode.

Precipitate Reactor Feed Tank purge system boundaries included SPC carbon dioxide piping, a purge pressure control valve, a pressure safety relief valve, vacuum breaker, and various isolation valves. There are two oxygen gas detectors and associated interlock instrumentation. Support systems include normal and backup electric power and SPC primary, backup, and nitrogen purge systems.

PRFT purge failure is detected by flow instruments that give an alarm to alert operators. Two oxygen analyzers detect air leaking into the vessel. High oxygen concentration will actuate an interlock circuit that closes control valves to raise the gas pressure in the PRFT. The interlock also stops transfers in the SPC and stops the vessel agitator.

Steam Explosion in Melter (SMELT)

Conditions that could lead to a steam explosion in the melter require the presence of both water and partially melted excess salt. Water is a normal constituent of the process. Melter feed is a slurry which is approximately 50% water. Also, procedures require flushing of the feed tube with water before and after each feed operation. Salt content is monitored by sampling and controlled by procedures in both the Liquid Radioactive Waste Handling Facilities (LRWHF) and DWPF.

There are no major process systems or support systems modeled in the SMELT fault tree. The failure events in the tree include only human errors and failures of sampling equipment at both LRWHF and DWPF.

High salt content of feed material is detected through sampling at one location at LRWHF and at two locations at DWPF. This analysis assumed that:

1. Each macro batch to the melter (approximately one every two years) has a high salt content level. This assumption is conservatively estimated since there is no site-specific data available to accurately estimate this occurrence.

2. At least two analyzers are available at each analytical lab location for sample analysis. This assumption is based on the content of quality control procedures which require redundancy in the sampling process.

3. If an operator/analyst/engineer conducts faulty sampling at one location, he/she will fail to properly conduct any further sampling at any other locations or time with a probability of unity.

4. An excess amount of salt within a batch that is not detected will always accumulate on the top layer of the melter cap.

5. All calculations required to compare lab results to a standard at DWPF are performed in PCCS. Additionally, the DWPF process engineer must enter all lab results into PCCS to complete the sample analysis process.

6. Failure to prepare a batch for sampling according to procedure will result in a batch sample that contains an erroneously low salt content level.

7. Water is present in the melter with a probability of unity due to the frequency of water purging in the melter operations.

8. Lab sample analysis results at the tank farm are provided as a report; these results do not require any further data processing (such as input to PCCS) before the batch is transferred.

9. MFT sampling is not performed on every micro batch.

10. Two consecutive batches containing a high salt content must accumulate in the melter for sufficient molten salt to be generated for a steam explosion.

Melter Off-gas (OFFGAS) Explosion

The melter off-gas system treats gases that are driven off in the melter before these are released to the atmosphere. Features of this system control melter pressure and initiate glass pouring at the appropriate time. The lid heaters provide the energy to initiate complete combustion of gases in the melter vapor space; consequently, there will be no combustible gases in the effluent from the melter. A low temperature interlock will automatically shut down the feed pumps when low temperature resulting from lid heater failure is detected in the melter vapor space. If equipment failures or operating error release combustible gases into the off-gas piping, the gas is most likely to explode down stream of the quencher near the off-gas condensate tank. At this point, excess water vapor is condensed and conditions are most favorable for ignition of a mixture that is above LEL.

Following are assumptions specific to the Melter Off-gas Explosion fault tree:

1. An explosive concentration in the off-gas system cannot be attained unless excess organics accumulate within the system through either a loss of the dilution air flow or faulty sampling of organics in the sludge.

2. At least two analyzers are available at the analytical lab in DWPF. This assumption is based on the content of quality control procedures which require redundancy in the sampling process.

3. If an operator/analyst/engineer conducts faulty sampling at the SRAT and this person also conducts sampling at the SME, he/she necessarily fails to properly conduct sampling there.

4. All calculations required to compare lab results to a standard at DWPF are performed within PCCS. Additionally, the DWPF process engineer must enter all lab results into PCCS to complete the sample analysis process.

5. Failure to prepare a batch for sampling according to procedure will result in a batch sample that contains an erroneously low organic content.

6. Two out of four lid heater thermocouples must fail to cause failure of a lid heater. Similarly, two out of the four lid heaters must fail to cause sufficient heat loss in the melter plenum.

7. Thermocouple components do not require calibration.

8. Two out of three thermocouples in the melter plenum must fail in order to cause failure of the feed pump shut off interlock. Failure of one thermocouple will result in removal of this temperature input (will be considered as an outlier).

9. MFT sampling is not performed on every melter batch.

System boundaries for the melter off-gas system include melter feed pumps, lid heaters, backup off-gas film cooler, off-gas condensate tank, and piping connecting these pieces of equipment. Interlock controls for the feed pumps and thermocouples are also included. The plant air system and instrument air system are important support systems related to the backup off-gas film cooler air and pressure control air systems. Electric power is not needed, because a loss of electric power results in a safe condition when the feed pumps stop due to the power loss.

When the air flow for the backup off-gas film cooler fails, and automatic interlock shuts down the feed pumps and opens valves to provide an alternate flow pathway from the melter cell to the plenum. Low temperature in the melter plenum gives an alarm and shuts off the feed pump through an interlock circuit.

Sludge Pump Tank (SPT) Explosion

A Process Vessel Ventilation System (PVVS) provided in the Low Point Pump Pit (LPPP) purges combustible gas from the Sludge Pump Tank (SPT) to prevent potentially explosive hydrogen gas mixtures from accumulating therein. The ventilation system is backed up by a nitrogen blanket gas addition system, which has two, manually operated addition valves. In normal operation vessel ventilation air passes first through a HEPA filter and then enters the general volume of the LPPP cells. The SPT is maintained at a lower pressure than its surrounding cell space by the ventilation exhaust fan. As a result, ventilation air is pulled into the SPT through the tank overflow line. Exhaust air, including any combustible vapors, from the SPT flows through a moisture condenser and a mist eliminator. This stream of air then combines with the larger stream of air from the LPPP cell volume to further dilute combustible gas and vapor. The combined stream of air flows through a heater and a bank of four parallel HEPA filters. There are two redundant exhaust fans in the PVVS. Their operation is automatically controlled by an instrument system that monitors differential pressure between the Precipitate Pump Tank (PPT) and the ventilation duct downstream of the mist eliminator. If the ventilation air flow fails, nitrogen blanket gas will continue to purge the SPT, which then vents through the tank overflow line.

The primary purge system boundaries are the PVVS inlet filters and the exhaust stack. Components included in the system are ventilation ducts, valves, dampers, fans, filters, condenser, preheater, mist eliminator, and controllers based on flow and temperature. The backup nitrogen purge system consists of a nitrogen gas supply, manual actuation valves, pressure control valves, and flow monitoring instrumentation. These components in either the primary purge system of backup nitrogen purge system must operate as designed to prevent the accumulation of an explosive mixture of hydrogen gas in the SPT. Important support systems include: electric power, process steam, instrument air, and chilled water.

Inadequate SPT purge air flow is detected by differential pressure across the exhaust HEPA filters. The instrument alarms at very high, high, and low differential pressure. There is also a flow monitor with a low flow alarm in the exhaust duct just before the exhaust fans. Inadequate flow due to plugged inlet HEPA filters is detected by a differential pressure monitor and alarm. The backup nitrogen purge flow is monitored and checked during routine surveillance rounds.

Precipitate Pump Tank (PPT) Explosion

Benzene vapor explosion is the safety concern for the Precipitate Pump Tank (PPT) in the Low Point Pump Pit (LPPP). PPT is operated with a primary nitrogen gas purge to keep the oxygen concentration from reaching MOC. The primary nitrogen source is the bulk nitrogen gas system; the backup nitrogen sources are a bank of high pressure nitrogen cylinders and the local LPPP nitrogen tank supply. The backup system actuates automatically upon loss of primary purge supply. Instruments monitor oxygen concentration in the effluent stream from PPT which goes to the Process Vessel Vent. System (PVVS). If the oxygen level gets too high, an outlet control valve closes automatically isolating the tank from the PVVS, to allow nitrogen gas pressure to build up in the vessel, thereby preventing leakage of air into the PPT.

Following are assumptions specific to the PPT:

1. All maintenance performed on the nitrogen supply lines to the precipitate tank do not involve closing of manual valves in these lines (with the exception of the pressure indicators; these have manual valves located in an isolated line and do not result in a loss of flow through the line).

2. Failure of the nitrogen purge at the sources (i.e., bulk nitrogen tanks and backup cylinders) will result in a loss of the nitrogen calibration line to the oxygen analyzers. These analyzers will fail as is and will result in failure of valve HCV-8772 to close.

3. The benzene concentration in the precipitate tank is at or above the lower explosive limit (LEL).

4. Loss of the PVVS exhaust fans or inadvertent closure of valve HCV-8772 due to either a loss of power or individual component failures results in a safe configuration of the system in the PPT due to the positive pressure supplied to the precipitate tank via the nitrogen purge system. (Air does not enter PPT.)

5. Filter plugging and pressure control valve failures in the nitrogen purge lines are immediately detected.

6. The oxygen analyzers are calibrated and tested bi-weekly.

The PPT purge system boundaries include the primary and backup nitrogen system supply tanks, piping, and valves. Components included in the system are portions of PVVS ventilation ducts, control valves and controllers based on nitrogen purge flow and oxygen gas concentration. There are no essential support systems (other than the nitrogen purge systems) for PPT. Loss of electric power and loss of instrument air fail to a safe configuration.

Inadequate PPT nitrogen purge flow is detected by a flow monitor which alarms to initiate operator actions. There also are pressure indicators on the common nitrogen lines. Two oxygen analyzers are connected to the tank vent exhaust line. A high oxygen signal from either analyzer automatically closes an exhaust valve and shuts off the PPT agitator and pump.

Organic Waste Storage Tank (OWST) Explosion

The Organic Waste Storage Tank (OWST) is a 150,000 gallon tank for organic byproducts of the DWPF precipitate hydrolysis process. The major organic constituent is benzene. OWST will receive approximately 350 gallon batches of benzene every 43 hours. Benzene vapor explosions are prevented by keeping the oxygen concentration below the minimum oxygen for combustion (MOC) level with a slightly pressurized blanket of nitrogen gas in the tank. The primary source of nitrogen gas is from the same bulk liquid nitrogen system that provides nitrogen purge to the Precipitate Pump Tank (PPT) and Sludge Pump Tank (SPT) in the Low Point Pump Pit (LPPP) and other tanks and sumps. There are backup sources of nitrogen to the OWST consisting of a dedicated liquid nitrogen tank and a bank of high pressure nitrogen gas bottles. Pressure control valves regulate the flow of nitrogen gas to the OWST and prevent unwanted flow reversals through the system.

The system boundary includes nitrogen system piping, control valves (PCVs), nitrogen tanks, and various associated instrumentation. All PCVs must remain operable, and the sensors which input to the control systems must be properly calibrated. The liquid nitrogen inventory must be adequate, and the piping system must remain leak tight and not plugged.

Loss of OWST nitrogen blanket gas is detected by low pressure alarms in the OWST inner tank and in the pump well. An oxygen analyzer will also alarm if air enters the vessel.

The OWST outer tank is protected from benzene explosion by two methods:

1. The amount of time the outer tank contains benzene following a leak from the inner tank is minimized by monitoring for benzene and correcting the problem immediately after the leak is detected.

2. Ignition sources to set off an explosion in the outer tank are minimized. The tank is grounded, lightning protection is provided, and maintenance uses spark-resistant tools.

Salt Processing Cell (SPC) Explosion

The Zone 1 ventilation system purges the Salt Processing Cell (SPC) which prevents the accumulation of potentially flammable benzene vapor within the cell volume. Ventilation system failure with either SPC vessel overpressurization, vessel overheating, or spill of waste solution into the SPC sump without pumping to the PR, could result in benzene vapor concentrations reaching LFL within the SPC. Pressurization of process vessels in SPC is a safety response to detected high oxygen levels within any of these vessels. However, this increases the risk of benzene vapor accumulation in the cell volume outside the vessels. While explosion prevention by inerting is the main concern within SPC vessels, the concern in the Process Vessel Vent Header (PVVH) is LFL (dilution) control. The off-gas ventilation from SPC combines with the flow from CPC, thus diluting the benzene concentration in PVVH. If the PVVH flow gets too low, an automatic interlock closes two valves and isolates SPC from PVVH. This interlock also turns off CO_2 supply pressure to SPC vessels. SPC vessels are protected from reaching MOC by a nitrogen purge. Pressure interlocks stop the supply of steam to PR and OE and starts cooling water flow to these vessels.

Since the seismic trigger interlock is designed to isolate the SPC from the PVVH and supply a constant flow of nitrogen to SPC vessels, the SPC Explosion seismic fault tree models benzene to always enter the cell following an earthquake. The fault tree concludes that if Zone 1 ventilation fails, a cell explosion occurs.

SPC system boundaries include support systems, such as: Zone 1 ventilation system components, instrument air system, cooling tower water system, normal and backup electric power systems, and the control instrumentation associated with the PVVH low flow interlock.

Assumptions Related to Support Systems Fault Trees

Steam

The process steam system is a closed loop system that provides heat to the following process vessels: PR, OE, SME, and SRAT. The process steam generator is a heat exchanger connected to the area steam supply through a 260 pound pressure control valve. Process steam piping includes an individual flow control valve (FCV) to each of the process vessel steam coils. The pressure in each steam coil is regulated by a PCV located on the discharge side of the coil. All steam effluent pipes from the vessels connect to a common header, which goes to the steam system condenser (i.e., a heat exchanger cooled by the cooling tower water, CTW, system). Condensate collects in the condensate tank and from there is returned to the steam generator by a set of redundant pumps. If condensate return flow stops because of pump failure, the closed loop process steam system will stop functioning.

Process steam system boundaries include piping, FCV's, PCV's, and temperature sensing instruments. Essential support systems include: the 260 pound area steam system, the cooling tower water (CTW) system, normal electric power, and instrument air system.

Process steam system failure is detected by low temperature within the system and also by low temperatures in the various process vessels requiring steam heat.

Process Chilled Water

The chilled water system, which is shown as the secondary service water (SSW) system on P&ID's, is a closed loop cooling system. It serves to remove heat from several DWPF condensers and condensate tanks. These include the primary off-gas condenser and its condensate tank, the backup off-gas condenser and its condensate tank, the facility air ventilation condenser, and the salt cell ventilation condenser. Heat from the SSW is transferred through a heat exchanger to the cooling tower water (CTW) system.

System boundaries for the chilled water (SSW) system include heat exchangers pumps, valves, and instruments in the SSW piping system. Two valves on the CTW system controlled by condenser pressure are also included. CTW is an essential support system for SSW. Other support systems include normal and backup electric power, and instrument air (needed by CTW).

Failures of the SSW are detected by a low flow alarm circuit, a high temperature alarm circuit, trouble alarms, or high temperature indications within the individual systems cooled by SSW.

The fault tree for SSW assumes that the system would fail to provide needed cooling if the closed loop flow were to stop and the bypass line did not open. Failure of the chilled water system due to insufficient inventory was not modeled because a large volume of water is available in the system, an automatic makeup system is capable of handling small leaks, and large pipe leaks have a very low frequency of occurrence.

Process Cooling Water

The process cooling water system, which is shown as the primary service water (PSW) system on P&ID's, is a closed loop cooling system. It serves to remove heat from the melter sleeve, the secondary backup off-gas condenser, and other miscellaneous vessels and condensers. Heat from the PSW is transferred through a heat exchanger to the cooling tower water (CTW) system. There is a second PSW/CTW heat exchanger on standby.

System boundaries for the process cooling water (PSW) system include redundant heat exchangers, redundant pumps, pressure control and flow control valves, and instruments in the PSW piping system. A valve on the CTW system controlled by PSW temperature is also included. CTW is an essential support system for PSW. Other support systems include normal and backup electric power, and instrument air (needed by CTW).

Failures of the PSW are detected by a low flow alarm circuit, a low pressure alarm circuit, a high temperature alarm circuit, a low differential pressure alarm circuit, and temperature indications within the individual systems cooled by PSW.

The fault tree for PSW assumes that the system would fail to provide needed cooling if the closed loop flow were to stop and the bypass line did not open. Failure of the process cooling water system due to insufficient inventory was not modeled because a large volume of water is available in the system, an automatic makeup system is capable of handling small leaks, and large pipe leaks have a very low frequency of occurrence.

Cooling Tower Water

The cooling tower water (CTW) system transfers process heat from the process cooling water (PSW) system and the chilled water (SSW) system to the atmosphere. Heat exchangers provide the interfaces between the closed loop cooling systems and CTW. There are four pumps in the CTW system. Two are rated as 50% pumps and two as 25% pumps. Normally, one large and one small pump are on-line, while the other two are in standby. One 50% primary pump or two 25 % primary pumps provide adequate pumping. . A deep well water system can provide backup water to CTW for up to four hours.

A temperature control valve at the heat exchanger outlet regulates CTW flow through the PSW heat exchanger. The temperature is measured at the PSW discharge side of the heat exchanger. A pressure control valve regulates flow through the SSW chillers. The pressure sensor is in the condenser. A bypass line returns excess flow from the pump discharge line to the CTW basin. If the bypass valve fails open, the CTW system will be inoperable.

The CTW system boundaries include piping, CTW pumps, deep well pumps, heat exchangers, control valves, and the forced convection fans on the cooling tower. Fans (forced convection) are required 6 months per year, and two of the three fans must operate to provide adequate air flow. Electric power and instrument air systems are essential support systems for CTW. If normal power fails, the primary pumps fail (requiring deep well system to function). If instrument air fails, the cooling tower water system fails, due to improper valve positions (Recirculation valve opens and main flow valves close).

Low flow and pressure instruments detect possible failure of CTW pumps. Abnormal conditions produce alarms for operator actions.

The fault tree analysis for CTW assumes that the pump pit inlet screens will not plug. This assumption was made because there is no identifiable debris, the basin is visually checked regularly, and the debris would have to be of varying density so that it covered the screens at varying depths.

Bulk Nitrogen System

The bulk nitrogen system vaporizes liquid nitrogen from the bulk nitrogen tank in an ambient vaporizer. The system has a second vaporizer that is kept in standby. The bulk nitrogen system supplies primary purge gas to the PPT and backup purge to SPT in the low point pump pit, primary blanket gas to the OWST, isolation blanket gas to SPC vessels, and nitrogen blanket gas to miscellaneous cold chemical storage tanks.

System boundaries for the bulk nitrogen system include two ambient vaporizers, piping, a pressure control valve, several pressure safety relief valves, and pressure monitoring instruments with alarms. No support systems other than the bulk nitrogen supply tank are required for the bulk nitrogen system to perform its intended function.

Pressure monitors detect bulk nitrogen system failures. Also if the bulk nitrogen tank becomes depleted, the bulk nitrogen system will be unavailable. Loss of bulk nitrogen tank supply is detected by low level sensors in the tank. This instrument gives an alarm to alert operators.

Bulk Nitrogen Tank

The bulk nitrogen tank supply consists of a tank of liquid nitrogen that supplies nitrogen to the bulk nitrogen system and the CPC backup purge system.

System boundaries for the bulk nitrogen tank supply include the tank, pressure safety relief valves, and monitoring instruments to track inventory and warn of low level or loss of inventory. No support systems are required for the bulk nitrogen tank supply to perform its intended function. Level sensors in the bulk nitrogen tank detect and alarm low levels in the tank.

CPC Backup Purge Nitrogen Tank

The CPC purge nitrogen tank supply provides liquid nitrogen to the CPC purge backup system. A minimum of qa 4 day supply of liquid nitrogen is stored in a tank that is protected against overpressurization. An alternate liquid nitrogen supply can be established from the bulk nitrogen supply tank, and it is possible to provide gaseous or liquid nitrogen from a nitrogen delivery truck through piping that is separate from the normally used tanks and vaporizers.

The boundaries for the CPC purge nitrogen tank supply include the liquid nitrogen tank, piping, pressure control valves, pressure safety relief valves, and tank low level instruments and alarm. No support systems are needed for the CPC nitrogen tank supply to perform its intended function. A loss of CPC nitrogen tank supply is detected by a low level sensor in the tank. This instrument provides a low level alarm to initiate operator actions.

CPC Backup Purge

The CPC backup purge system is a nitrogen gas purge system which vaporizes liquid nitrogen in ambient pressure vaporizers. Both ambient vaporizers are required to supply proper nitrogen flow. Interlocks which monitor for loss of primary purge flow automatically isolate the primary purge system piping and initiate backup nitrogen purge flow. The isolation feature prevents loss of backup purge gas through the primary purge supply lines.

CPC backup purge system boundaries include the ambient vaporizers, piping, pressure control valves, check valves, and pressure safety relief valves. The CPC liquid nitrogen tank supply is an essential support system for backup purge. If the CPC backup purge nitrogen tank and the bulk nitrogen tank supplies fail or run out, CPC backup purge will be unavailable.

There are no specific alarms provided to detect backup purge failure. The low flow alarms associated with individual CPC vessels would indicate purge system failure. If a pressure relief safety valve fails open, it would be detected by low level in the liquid nitrogen supply tank.

CPC Primary Purge

The primary purge air system in the chemical processing cell (CPC) provides air ventilation for CPC process vessels to continuously remove flammable gases and vapors so that these do not accumulate to concentrations above LFL.

CPC system boundaries include redundant air compressors, an air receiver tank, piping, pressure relief valves, and pressure control valves that not only regulate air pressure but prevent reverse flow from the process vessels. Normal electric power is an essential support system for CPC primary purge.

Air compressor failures are detected by trouble alarms and a low receiver pressure alarm. In addition, purge air flow monitors on the individual CPC vessels actuate interlocks upon failure of primary purge.

Backup Electric Power

Backup electric power for all essential services in DWPF comes from two, 2000 kW each, diesel generator sets located in the fan house. Upon demand they can supply all the essential loads through four main load centers, which in turn, supply twenty motor control centers.

Following are assumptions specific to the Loss of Normal Power fault tree:

1. Maintenance is performed on the diesels annually.

2. All latent human errors are incorporated into the diesel generator fail to run and fail to start data. Human errors associated with failing to restore a generator following maintenance are modeled separately within the fault tree.

3. One operator is responsible for placing both diesels in standby following maintenance. Additionally, the operator will always fail to place the second diesel in standby when he fails to place the first diesel in standby.

System boundaries for backup electric power include two diesel driven generators, power cables or buses, normal power breakers, and supply breakers up to the four main load centers. Support systems include instrument air, a dedicated compressed air system for starting the diesels, 125 volts DC control system power supply from a bank of batteries, fuel oil supply, lubrication oil supply, and a closed loop jacket cooling water system with a radiator and fan.

A loss of normal electric power will first be detected as an under voltage on the load centers. This will open normal power system breakers and send a start signal to the diesel generators. When the generators are up to speed and the frequency and voltages are correct, the generator supply breakers will close. If one of the generators does not start within ten seconds of the other, the tie breaker closes and the one operating diesel generator will power all of the essential loads.

Primary (Normal) Electric Power

Normal electric power is supplied to S-Area by two overhead 13.8 kv feeders from H-Area. These are connected to separate 13.8 kv feeders. These are normally connected together through a tie breaker, which allows either feeder to supply both buses. Secondary substations step down the voltage from 13.8 kv to 480 v to supply the various loads in S-Area. Each secondary substation is connected to the two 13.8 kv primary buses through a redundant distribution system that allows selection, through a duplex interrupter switch, of one or the other of the 13.8 kv buses.

Following are assumptions specific to the Loss of Normal Power fault tree:

1. Human errors associated with maintenance activities are immediately detected and corrected. Maintenance performed on the normal power system requires lockout procedures; removal of the lockout with subsequent restoration of the power to the component is immediately detected.

2. Maintenance will not be performed on a redundant power train until power has been restored to the alternate train.

System boundaries for normal electric power include all electrical buses, feeders, and breakers necessary to supply power to the primary buses of DWPF. The 13.8 kv feeders connect to the 115 kv electric power grid through substation transformers. The 115 kv grid derives its electric power from the southeastern commercial electric power grid and the power station in D-Area. Other than the ultimate power sources, no support systems were considered in the analysis of the normal electric power system.

Normal electric power failure is self indicating through multiple equipment failure alarms and indications. The frequency that power is lost to equipment fed from a normal power bus was equated to the frequency that normal power is lost. The frequency of individual circuit breaker failures (i.e., failed open) was judged to be insignificant compared to loss of DWPF normal power.

Zone 1 Ventilation

Zone 1 ventilation system exhausts air from the vitrification building zone 1 through a sand filter before release to the atmosphere. In addition to the normal mode of operation, the fault tree analysis considered several abnormal modes of operation given electric power or instrument air system failures.

Following are assumptions specific to the Zone 1 ventilation fault tree:

1. Failure of either a discharge or suction damper to remain open on an operating fan line does not result in a complete blockage of flow in that line. Additionally, failure of a discharge damper to open or failure of the operator to open a suction damper following maintenance on the standby fan line results in failure of the fan to start.

2. Complete closure of the fan inlet vanes reduces the inlet orifice to 4" which is sufficient to maintain the fan operation.

3. Fan vibration monitors no longer have the capability to shut off a fan through DCS.

4. Fan timing relays will not cause a fan to fail to run if the relay spuriously opens following successful start-up of the fan.

5. Under a loss of normal power condition, the timing relay will automatically start up the second fan on an emergency bus when the first fan has failed to start (i.e., within a short period of time). No credit is given for automatic start-up of the second fan when the first fan fails after successfully starting.

6. It is not possible to plug the sand filter during normal operating conditions (i.e., conditions other than a seismic event).

7. Under a loss of normal power condition, the fans will not re-start if UPS power is unavailable at the time of the power loss.

8. Under loss of normal power and instrument air conditions, the time it takes for the instrument air pressure to drop below 85 psi in the fan house (i.e., the minimum pressure required for start of the fan house compressor) is greater than the time period in which the fans are re-started by the timing relay.

9. Successful operation of zone 1 ventilation is defined as one ventilation fan running.

The system includes ventilation exhaust ducts, sand filter exhaust plenum, four exhaust fans, dampers, DCS control circuits, electric power circuits, UPS power system, and monitoring instruments with alarms. Essential support systems include normal and backup electric power systems, instrument air, and the 125 volts DC battery power supply to operate mechanical circuit breakers upon loss of normal power.

Instruments monitor differential pressure between building zones and give alarms for abnormal zone pressure differences. There are high pressure alarms for continuously occupied areas and areas containing radioactive materials. Two pressure transmitters are located immediately upstream of zone 1 sand filter exhaust plenum. Air flow through each exhaust fan is also monitored.

Under normal operating conditions, when normal electric power is available, three fans are on and one is in ready standby. A high pressure indication from either transmitter in the sand filter exhaust plenum will start the fourth fan automatically. A low flow condition can also lead to automatic start of the standby fan; however, this analysis does not take credit for the low flow initiated starting feature.

If normal electric power is lost, all operating fans will stop until the backup electric power from the diesel generator comes on line. An automatic timing relay starts two fans from two separate electric power buses. If one of the fans connected to the emergency bus fails to start, the timing circuit will start the other fan connected to that same bus automatically. Operators may also restart fans manually.

SPC Primary Purge

The salt processing cell (SPC) primary purge system uses carbon dioxide gas. Liquid carbon dioxide from a large storage tank is converted to gas in an electrically heated vaporizer. Gas pressure is regulated to provide purge flow through the various SPC vessels.

System boundaries for the SPC primary purge system include the carbon dioxide storage tank, electric vaporizer, piping, supply shutoff valve, pressure control valves, pressure safety relief valves, heater control circuit, and low tank level and low pressure alarm circuits. Normal and backup electric power systems are the only support systems necessary for SPC primary purge to operate. If electric power fails, the vaporizer will not generate enough carbon dioxide gas for adequate purge flow to SPC vessels.

A failure of SPC primary purge (e.g., if the pressure control valve fails closed) is indirectly detected by a high flow alarm on the SPC backup purge system, which automatically supplies purge flow when the pressure in the primary system gets too low. Loss of liquid carbon dioxide inventory is detected by low tank level and low tank pressure alarms.

SPC Backup Purge

Salt processing cell backup purge is a carbon dioxide gas system supplied from a bank of compressed gas cylinders. Gas flow from the backup purge system is regulated by pressure in the primary purge piping system and comes on only if the primary system pressure gets too low. The backup system has enough capacity for short outages of the primary purge system.

System boundaries for SPC backup purge include four high pressure carbon dioxide cylinders, piping, isolation valves, pressure regulators, two pressure control valves, pressure safety relief valves, and alarms for low gas supply. No support systems are required for the SPC backup purge system to perform its intended function. The carbon dioxide supply for SPC backup purge is monitored by cylinder weight and pressure.

SPC Nitrogen Supply

The salt processing cell low pressure nitrogen supply system provides nitrogen purge to SPC vessels whenever SPC is isolated from the PVVH. The purpose of the low pressure blanket gas is to keep oxygen from entering the process vessels and to minimize the amount of benzene vapor released from the vessels into the surrounding cell space. Nitrogen gas is produced in ambient pressure vaporizers supplied from the bulk liquid nitrogen tank.

System boundaries for the low pressure nitrogen system include two vaporizers, piping, isolation valves, pressure control valves, and pressure safety relief valves. No support systems are required for the SPC low pressure nitrogen system to perform its intended function. Failures of the low pressure nitrogen system do not produce alarms but may be detected through DCS indications or field surveillance.

LPPP Nitrogen System

The low point pump pit (LPPP) nitrogen system supplies backup nitrogen purge gas to the precipitate pump tank (PPT) and the sludge pump tank (SPT). This system has both a liquid nitrogen supply tank and compressed nitrogen gas cylinders. The backup system automatically continues the purge flow if primary purge systems should fail.

System boundaries for the LPPP nitrogen system include the liquid nitrogen tank, a vaporizer, high pressure nitrogen gas cylinders, piping, check valves, pressure control valves, pressure safety relief valves, and nitrogen supply tank low level alarm. No support systems are required for the LPPP nitrogen system to perform its intended function.

A low level alarm instrument detects failure or depletion of the liquid nitrogen supply. Periodic surveillance would detect failures of the compressed gas supply. Also, low purge flow alarms on the SPT or PPT would indicate possible problems with the nitrogen supply system.

Instrument Air

The instrument air system supplies high pressure air to instruments and pneumatic equipment throughout the DWPF. Two compressors are on line and a third is normally in standby. The system has redundant dryers and filters so that units can be repaired or replaced while the air system remains operable.

System boundaries for instrument air include, three compressors, air receiver tank, filters, redundant dryers, supply solenoid valves, pressure control valves, pressure safety relief valves, cooling water supply piping and valves, and differential pressure monitors and alarms. Normal and backup electric power systems, and the cooling tower water system are essential support systems for instrument air.

Loss of instrument air is detected by low pressure instruments with alarms and would also be evident by numerous failures of pneumatic equipment.

General Assumptions

The following general assumptions were factored into the fault tree analysis:

1. Assumptions pertaining to individual basic events are printed in the fault trees, identified by "a:" before the assumption. For example, "a: calibrated twice/year" means that it is assumed that the piece of equipment is calibrated at that frequency.

2. Most equipment or component failures are assumed to be corrected within 8 hours or the systems are configured in such a way that those failures do not continue to put the facility at risk. Exceptions to this recovery assumption are indicated in the fault trees.

3. Possible sabotage is not included in the analysis.

4. Ammonium nitrate explosions cannot occur in any vessel or ventilation system in DWPF.

5. If a pressure safety relief valve (PSV) fails open on a pressurized gas system, it is assumed the valve will not close again and must be isolated from the system by operator action.

6. If a PSV can be isolated from the piping system by a three-way valve that connects to another PSV, system recovery time is short (e.g., 1 hour). But if a PSV must be replaced, the repair time is assumed to be 24 hours.

7. Manual valves will not fail closed if normally open, and will not fail open, if normally closed. An incorrect valve position may result from operator error.

8. Failure rates for components such as electrical breakers or switches related to individual electric motors were determined to be insignificant compared to the failure rate of the overall DWPF power system.

9. If a temperature element controlling a temperature control valve fails or a pressure element controlling a pressure control valve fails, the valve moves to the position which adversely affects system reliability.

10. If a device is out of calibration, it affects system performance adversely.

11. Temperature elements are functionally checked twice per year, unless otherwise specified.

12. If purge systems fail to the SRAT or SME, and interlock actions are unsuccessful, the flammable gases in the vessel are assumed to reach LFL. If interlock actions are successful, the purge is restored before LFL is reached.

13. If purge systems fail to the MFT or PRBT, and alarm response actions are not successfully completed, the flammable gases in the vessel are assumed to reach LFL. If alarm response actions are successfully completed, the purge is assumed to be restored before LFL is reached.

14. Each DWPF macro-batch from the tank farm will be chemically characterized by SRTC.

15. Instrument calibration errors are pure enabler events. They can cause protective equipment to not detect abnormal conditions, but they cannot initiate a failure sequence.

16. An ignition source is necessarily present for seismic scenarios that lead to an explosive mixture quickly (within a few hours) following the earthquake. For scenarios where explosive mixtures take longer, ignition probability is equivalent to the internal ignition probability.

17. CPC backup nitrogen supply, LPPP local liquid nitrogen supply, and OWST local liquid nitrogen supply all have adequate capacity that they will continue to provide nitrogen for a minimum of 96 hours following an earthquake, taking into account the possibility of additional leakage in piping due to the earthquake.

DISCUSSION

The hazard analysis for the Defense Waste Processing Facility (DWPF) identified process vessels in which flammable mixtures of hydrogen gas or benzene vapor could accumulate if certain vessel ventilation or purge systems were to fail. Once the concentration of these substances builds up above LFL, then only a spark source is required to set off a deflagration or in the extreme case a detonation that could disperse radioactive waste material into the environment. Operability of purge systems or ventilation systems is a crucial requirement in preventing explosion accidents. These important systems could fail from a number of causes such as random failures of system components (i.e., internal initiators) or from external natural disasters that damage process facilities and equipment (i.e., external initiators). This fault tree analysis included only those accidents identified in the hazards analysis which are based on internal initiators and seismic initiators. Other external initiators such as high wind storms or tornadoes and external events related to man's activities (e.g., airplane crash), are covered elsewhere in the accident analysis.

An additional limitation on the scope of this study is that only normal operations were analyzed. Unusual or major maintenance activities and special testing were not included. Routine equipment checks and instrument testing and component replacements (e.g., filters, bulbs, fuses, etc.) if covered under operating procedures, were considered to be part of normal operation and were taken into account. Similarly, unusual occurrence recovery actions specified in procedures were also included.

FACILITY COMMITMENTS

Development of explosion accident fault trees for DWPF was an iterative process with design activities. Preliminary fault trees were developed and submitted to DWPF for review. In those cases where unacceptably high accident frequencies were calculated, commitments were made by DWPF to change procedures, add administrative controls, or modify system design to reduce the likelihood of explosion accidents (Reference 5). The analyses were changed to reflect the commitments listed below in this section. Fulfillment of these commitments must be verified in order for facility design to match the accident analysis in the SAR.

1. The PRC/D drain valve operations procedure will be revised to reduce the probability of opening the drain valve after PR sampling. Changes include adding statements at the step where the valve is opened to stress the importance of not opening the valve at the wrong time, and to add a review and sign off for the technical group representative. {*Impacts PRBT fault trees*}

2. A supervisor permissive switch for opening the PRC/D drain valve will be added. This permissive switch will time out and must be approved again if not completed in the allotted time. {*Impacts PRBT fault trees*}

3. An interlock will be provided that prevents PR steam supply if PRC/D drain valve is open. {*Impacts PRBT fault trees*}

4. Sampling procedures for the precipitate reactor (PR) will be submitted for review to ensure that nominal error probabilities are justified. These procedures will be revised as necessary, based on comments generated during these reviews. {*Impacts PRBT fault trees*}

5. Training manuals, lesson plans, and objectives will be revised as necessary to emphasize the hazards of SPC (fuel rich, oxygen below MOC) contents being transferred to CPC vessels (diluted below LFL, oxygen present). {*Impacts PRBT fault trees*}

6. The SRAT double batch procedure will be revised to incorporate technical review and approval. {*Impacts SRAT fault trees*}

7. Emergency Response Procedure developed for seismic event will include warnings of restoring steam, power, or instrument air, following a seismic event. {*Impacts all seismic fault trees*}

8. SPC purge system will be modified, adding a nitrogen purge, activated by seismic triggers, loss of normal power, and low PVVH flow, as described in Reference 8. {*Impacts PR, PRFT, OE, OECT, and PVVH fault trees*}

9. SPC primary purge will have two normally open, fail closed, isolation valves in series, closed by seismic trigger activation or low PVVH flow. (See Reference 8.) {*Impacts PR, PRFT, OE, OECT, and PVVH fault trees*}

10. The SPC backup purge (CO_2 cylinders) will be modified so that it ties into the primary line upstream of the isolation valves referred to in commitment #9. (See Reference 8.) {*Impacts SPCN2 fault trees*}

11. Valves will be added to isolate the SPC nitrogen addition lines from the CO_2 supplies upon nitrogen system activation. (See Reference 8.) {*Impacts SPCN2 fault trees*}

12. Nitrogen supply to the CPC backup purge system will be increased to include a four day supply (using CPC and SPC demand rates) in a seismically qualified tank separate from the bulk nitrogen tank. (See Reference 8.) {*Impacts CPCTNK fault trees*}

13. A pressure control valve will be added in parallel to PCV-0967 on the CPC backup purge line. (See Reference 8.) {*Impacts CPCBP fault trees*}

14. A manual valve will be added in parallel to each of the CPC purge supply flow control valves. (See Reference 8.) {*Impacts SRAT, SME, MFT, and PRBT fault trees*}

15. SCVC/PVVH isolation valves HCV-1041 and HCV-9278 will each be supplied power by separate UPSs, with control logic provided that closes them on low PVVH flow, loss of control power, or high seismic activity. {*Impacts PVVH, PR, OE, PRFT, and OECT fault trees*}

16. A seismically qualified liquid nitrogen tank with a four day supply for the OWST blanket gas system will be provided. It will feed the OWST blanket supply lines downstream of the compressed nitrogen gas supply from high pressure cylinders. Dual check valves in series isolate this dedicated supply from the high pressure cylinders and the bulk nitrogen supply. (See Reference 8.) {*Impacts OWSTTK fault trees*}

17. The OWST nitrogen supply will be provided through parallel pressure control valves. (See Reference 8.) {*Impacts OWSTTK fault trees*}

18. The Low Point Pump Pit will be provided with nitrogen through parallel pressure control valves from a tank with adequate capacity to supply both the precipitate pump tank and the sludge pump tank for four days. (See Reference 8.) {*Impacts LPPPN2 fault trees*}

19. The SPT and PPT in the LPPP will be supplied by nitrogen purge through manual valves. (See Reference 8.) {*Impacts SPT and PPT fault trees*}

20. The PPT off-gas will be modified to have a second fail closed valve in series with HCV 8772. HCV 8772 and the new HCV will be provided an interlock to close upon low LPPP PVVH flow. The manual valve on the bypass line (with SV 8773) will be maintained normally closed. (See Reference 8.) {*Impacts PPT fault trees*}

21. The SPC fire damper will be removed, (reducing the frequency of cell air flow loss). {*Impacts SPC fault trees*}

22. A seismic switch will be installed to isolate the PPT from the PVVH (reducing the probability of reaching MOC in the tank). {*Impacts PPT fault trees*}

23. The SRAT nitric acid addition system will be modified so that the display reading will properly indicate the amount added. (FIC-0718 will read directly, not with a 5:8 factor difference from actual flow.) {*Impacts SRAT fault trees*}

24. MFT purge failure response procedure, AOP-S-8009, will add the procedure connector symbol between pages 2 and 3. {*Impacts MFT fault trees*}

25. MFT purge flow low, alarm response procedure, S-FAL0683, will be rewritten so that steps 3 and 4 are placed in reverse order (i.e., the purge must be re-established before any work order is performed to repair faulty low elements). {*Impacts MFT fault trees*}

26. The commitments listed in Reference 6 and 7 regarding fragility values for systems and equipment will be met. {*Impacts all seismic trees*}

27. A temperature interlock for the melter vapor space plenum will be installed to automatically shut off the operating feed pump if a low temperature signal is detected. {*Impacts Melter Offgas fault trees*}

REFERENCES

1. J. Koren, et al, "CAFTA/CAFTA 386 version 2.2c," Science Applications International Corporation, May 29, 1992 (Proprietary Software).

2. C. H. Blanton and S. A. Eide, "Savannah River Site Generic Data Base Development (U)," WSRC-TR-93-262, Rev. 0, June 30, 1993.

3. H. C. Benhardt, et al, "Savannah River Site Error Data Base Development for Nonreactor Nuclear Facilities (U)," WSRC-TR-93-581, Rev. 0, February 28, 1994,

4. E. V. Brown and A. G. Sarrack, "DWPF Accident Analysis Fault Trees – Explosions in the SPC and CPC (U)," WSRC-RAM-93-90018, August 2, 1993.

5. T. B. Calloway, "Fragility Data for DWPF Mode C Analysis (U)," OPS-DTL-940152, October 27, 1994.

6. G. B. Rawls, "Additional Seismic Fragilities for DWPF Safety Basis (U)," ECS-EAT-94-0088, October 27, 1994.

7. G. B. Rawls, "Seismic Fragilities for DWPF Safety Basis (U)," ECS-EAT-94-0084, October 18, 1994.

8. J. P. Schwenker, "Resolution of DWPF's Safety Basis (U)," WSRC-TR-94-0395, Revision 1, December, 1994.

Attachment 1
List of P&IDs used

(page 1 of 4)

Drawing	Description
750040	PPT vessel
750041	LPPP PPT vent and N2 blanket
750042	PPT cell
750104	MFT (Process Cooling Water)
750108	Melter (Process Cooling Water)
750109	Melter feed piping
750110	Melter feed piping
750115	Melter pressure relief
750116	SME Condenser
750122	RCT (Cooling Coils and Chilled water)
750123	PVVH Blowers and dampers
750124	Base Air Load to PVVH and HEPAs
750147	DWTT (Process Steam and Cooling Coils)
750152	LPPP tank ventilation prefilters
750162	SPC Sump (CO2 purge)
750172	FAVC
750179	CPC Vent Header
750181	SCVC and OG Exhauster gas sampling
750182	PVVH gas sampling
750183	PVVH gas sampling (after filter)
750184	PVVH gas sampling
750185	SRAT (Process Steam and Cooling Coils)
750186	SRAT (Air/N2 purge)
750187	SME (Process Steam and Cooling Coils)
750195	PVVH
750196	SRAT Condenser
750197	PVVH Heater and filter
750199	DWTT Condenser
750203	Melter quencher
750204	Melter shell cooling
750205	Melter vessel cooling
750208	PVVH gas sampling (before filter)
750222	Off-Gas Condensate Tank (Chilled water)

Attachment 1
List of P&IDs used

(page 2 of 4)

Drawing	Description
750224	BOGCT (Chilled water)
750225	Off-Gas Condenser (Chilled Water)
750227	BOGC (Chilled Water and Process Cooling Water)
750235	MFT (Cooling Coils)
750234	Melter electrodes
750235	MFT (Vent)
750237	Melter dome heaters
750240	Cold Feed Organic Acid Vent Cond. (Chilled water)
750251	SPT Cell
750252	RPT Cell
750253	LPPP Sludge tank (Vent)
750254	LPPP Recycle tank (Vent)
750294	LPPP Cell Vent. supply and tank vent blowers
750297	Melter dome heaters
750303	Melter dome heaters
750304	Melter dome heaters
750308	SME gas chromatographs
750312	SME (Air/N2 Purge)
750313	MFT (Air/N2 Purge)
750451	PRBT and MFT vent header
750476	SRAT Vent header
750477	CPC Vent Header to FAVC
750478	SRAT Ammonia Scrubber
750479	SME Ammonia Scrubber
750481	RCT/MFT Ammonia Scrubber
750483	SRAT gas chromatographs
750485	
750494	LPPP tank ventilation filters
751008	Liquid N2 Supply tank and steam vaporizer
751058	N2 ambient vaporizers for CPC
751539	CPC Purge compressors and receiver
751540	DeepWell System
751548	CPC Purge Supply Header
751580	CTW Tower

Attachment 1
List of P&IDs used

(page 3 of 4)

Drawing	Description
751581	CTW Pumps
751588	PCW/CTW Heat Exchangers
751589	Process Cooling Water head tank and recirc. pumps
751593	Melter Cooling Water Pumps
751594	Melter / CTW Heat Exchangers
751595	Chilled water head tank and recirc. pumps
751596	Chillers
751598	Process Steam Heat Exchanger
751602	Process Steam Cond. Tank and pumps
751603	Process Steam Generator
751610	Plant/instrument air supply (2 of 2)
751611	Instrument supply header
751612	Plant/instrument air supply (1 of 2)
751650	N2 header to PR, LPPP, and OWST
751654	CO2 main supply header and backup cylinders
751655	Liquid CO2 supply and vaporizer
751664	Process Steam supply header
751665	Process Steam return header
751669	Melter cooling distribution headers
751670	Process Cooling Water supply and return headers
751671	Chilled water supply and return headers
751672	CTW supply header
751673	CTW return header
751685	Instrument air piping
751745	N2 supply header (to LPPP precipitate tank)
751832	Zone 1 Ventilation (fan house air accumulator)
754001	PR (Process Steam)
754003	PR (Vent)
754004	PR (CO2 purge)
754006	PR (Cooling Coils)
754007	PRFT (Cooling Coils, CO2 purge)
754010	OE (Process Steam and Cooling Coils)
754011	OE (CO2 purge)
754013	OECT (CO2 purge)
754016	PRC/D

Attachment 1
List of P&IDs used

(page 4 of 4)

Drawing	Description
754018	OEC/D
754020	SCVC
754021	PRBT (Cooling Coils and Air/N2 purge)
754037	PVVH gas sampling
754061	OWST
754063	OWST HEPA
754064	N2 Supply to OWST
756677	Critical Plant air supply header
766583	Cooling Tower return valve logic (CLD)
766827	Cooling Tower discharge valve logic (CLD)
766828	Deep Well Water to CTW logic (CLD)
766829	Deep Well Water to CTW logic (CLD)
766901	SRAT and SME interlock logic (CLD)
766963	SRAT and SME interlock logic (CLD)
767909	Melter Cooling Radiation Interlock logic (CLD)
770311	Electrical Distribution (second main substation)
776559	LPPP cell vent. filters, blower and stack
776631	PVVH and Cell exhaust
776662	Sand filter and exhaust fans and dampers
776663	Exhaust fans and dampers and stack

Attachment 2

Naming Convention for Fault Trees

Form
aaabbbbbcccdefff

aaa - component (if aaa is "OPR," see human error failure mode.)
bbbbb - specific component identifier
ccc - failure mode
d - system
e - initiator / enabler designation
fff - reserved for UNCERT

(aaa) Component Abbreviations (digits 1, 2, and 3)

Abbr.	Component
AE-	Analyzing element
AEG	Gas Chromatograph
AX-	Analysis calculation module
BCH	Batch of product
BKR	Breaker
BNZ	Benzene (explosive amount)
BOT	Bottle (gas cylinder)
BUS	Electrical bus
CC-	Common cause event
CC2	Common cause: 2 events
CC3	Common cause: 3 or more events
CHL	Chiller
CMP	Compressor
CO2	Carbon dioxide
CP-	Common person (same operator)
CV-	Check valve
CYL	Gas cylinder
DCS	Distributed control system
DG-	Diesel generator
DMP	Damper
DRY	Air dryer
EXP	Explosive gas
FAL	Low flow alarm
FAN	Fan
FCV	Flow control valve
FE-	Flow element (sensor)
FED	Electrical feeder
FI-	Flow indicator
FIT	Flow indicator / transmitter
FLG	Flange

Attachment 2

Naming Convention for Fault Trees

(aaa) Component Abbreviations (Continued)

Abbr.	Component
FLT	Filter
FSH	High flow switch
FSL	Low flow switch
FT-	Flow transmitter
FY-	Flow relay
HCV	Manually controlled, motor operated valve
HPW	H-area power
HTR	Heater
HX-	Heat exchanger
IA-	Instrument air
IGN	Ignition source
INK	Interlock
JMP	Jumper
LCV	Level control valve
LE-	Level element (sensor)
LPW	Loop power
LSL	Low level switch
MOV	Motor operate valve
N2-	Nitrogen
OFV	Overflow valve
OPR	Operator (see human error type of failure mode)
PC-	Pressure control module
PCS	Process control system
PCV	Pressure control valve
PDA	Differential pressure alarm
PDE	Differential pressure element
PDS	Differential pressure switch
PDT	Differential pressure transmitter
PE-	Pressure element
PGV	Plug valve
PIC	Pressure indicator/controller
PIP	Pipe or line
PMP	Pump
POP	Process Operating Procedure (DCS)
PR-	Precipitate reactor
PSE	Rupture disk
PSH	High pressure switch
PSL	Low pressure switch

Attachment 2

Naming Convention for Fault Trees

(aaa) **Component Abbreviations** (Continued)

Abbr.	Component
PSV	Pressure relief valve
PT-	Presssure transmitter
REG	Pressure regulator
RY-	Relay
SC-	Speed controller
SLG	Sludge
SLR	Excess salt
SRA	SRAT batch
STM	Steam
SV-	Solenoid valve
TC-	Temperature controller
TCV	Temperature control valve
TE-	Temperature element
TNK	Tank
TOP	Fault tree top event
TRF	Transformer
TRS	Debris screen (in water system)
TSH	High temperature switch
TX-	Transfer
UA-	Trouble alarm
UPS	Uninterruptable Power Supply
VB-	Vacuum breaker
WE-	Weight element
WSL	Low weight alarm
WTR	Water

Attachment 2

Naming Convention for Fault Tree

(ccc) **Failure Mode Abbreviations** (digits 9, 10, and 11)

Abbr.	Failure mode
ADJ	Adjusted
BFL	Basic failure
BLU	Built up
BYP	Bypassed
CAL	Calibrated
CHK	Checked
DBL	Double
FCL	Fail closed
FHI	Fail high
FLO	Fail low
FOP	Fail open
FOU	Fouled
FTA	Fail to alarm
FTC	Fail to close
FTO	Fail to open
FTR	Fail to run
FTS	Fail to start
HI-	High condition
IDL	Idle condition
LKS	Leaks
OFF	Not on
ON-	On, running, or in use
OUT	Ran out (inventory)
PLG	Plugged
PRE	Present
REP	Replaced
RUP	Ruptured
T&M	Testing and Maintenance (out of service for T&M)
UNA	Unavailable due to T&M
USD	Used (demanded)
VCR	Vehicle crash

Attachment 2

Naming Convention for Fault Tree

(ccc) Failure Mode Abbreviations for Human Errors

Abbr.	Failure mode
AC-	Failure of an administrative control
CA-	Chemical addition or elution error
CS-	Fail to respond to a compelling signal
CV-	Check / verification error
DE-	Diagnosis error
IR-	Incorrect reading or recording of data
LA	Laboratory analysis error
MC-	Miscalibration
NC-	Failure to verify parameter with calculation
OV-	Overfilling of a tank
RA-	Random actuation / shutdown of system
RM-	Failure to restore to service following maintenance
SO-	Error in selecting control outside control room
SR-	Error in selecting control within control room
SV-	Supervisor verification error
VI-	Failure of visual inspection

The third character of each human error failure mode is either H (high), N (nominal), or L (low).

(d) System (digit 12)

The system designation is used in cases where two components with the same failure mode have different failure probabilities, due to being in different conditions. For example, a check valve in a water system may have a different probability of failing to open than a check valve in a compressed gas system. Character "d" of the naming convention allows a different type code (and thus a different value) to be used.

Example of two type codes with different system designations:
CV- FTO 1 (check valve in water system fails to open) = 5E-5/demand
CV- FTO 2 (check valve in compressed gas system fails to open) = 1E-4/demand

(e) Event Type (digit 13)

Abbr.	Event type
*	Pure intiator
#	Pure enabler
+	Initiator / enabler

Attachment 3
Basic Event (BE) File

Basic event (BE) file Master.BE contains all events used in the DWPF accident analysis fault trees. The BE file printout follows the following format:

Event	C	Input	Calc.	Description	Source

Event - The name of each basic event, which follows the naming convention in Attachment 2. Each event has a unique name shared by all branches of the fault trees that model that event.

C - Calculation type, which depends on the type of failure being entered. The result van be a probability or a frequency. Details on how the calculation types are chosen are provided in References 1 and 2 of this attachment.

Input - The input column is provided to enter data on the mission time of a component, the frequency of inspection, or other information that may be necessary to calculate the probability or frequency of component failures. See References 1 and 2 of this attachment for further details.

Calc. - Calculated probability of the event. (This column is not entered, but is derived by CAFTA.

Description - The description column allows a more detailed description of the basic event entered.

Source - The source column is provided to enter information regarding the source of failure rate data or calculation type choice.

References for Attachment 3

1. CAFTA User's Manual, CAFTA 386 Version 2.2c, SAIC, May, 1992 (proprietary software)

2. CAFTA User's Manual, CSRAM 386 Version 2.1c, SAIC, May, 1992 (proprietary software)

Basic Event Report for I:\CAFTA\DATA\MASTER.BE 11/11/94 11:42 AM

Event	C	Input	Calc.	Description	Source
AE--RAD-BFLG#	3	8H 5.0E-06H	4.00E-05	COOLING TOWER RADIATION MONITOR FAILS	a: 8 hours to repair
AE-2898-BFLG#	3	8H 5.0E-06H	4.00E-05	PROCESS CONDENSATE LINE RADIATION MONITOR FAILS	a: 8 hours to repair
AE-3405-FLOK#	5	43H 5.0E-06H	1.07E-04	SCVC O2 concentration analyzer 3405 fails low	checked once/cycle (43 hrs)
AE-3409-FLOK#	5	43H 5.0E-06H	1.07E-04	SCVC O2 concentration analyzer 3409 fails low	checked once/cycle (43 hrs)
AE-6852-BFLQ#	5	8H 1.0E-05H	4.00E-05	OXYGEN ANALYZING ELEMENT 6852 FAILS	a: 8 hours to repair
AE-68523CCAQ#	5	8H 1.0E-06H	4.00E-06	COMMON CAUSE FAILURE OF OXYGEN ANALYZING ELEMENTS 6852 AND 6853	a: 8 hrs to repair
AE-6853-BFLQ#	5	8H 1.0E-05H	4.00E-05	OXYGEN ANALYZING ELEMENT 6853 FAILS	a: 8 hours to repair
AE-9233-BFLP#	5	168H 5.0E-06H	4.20E-04	O2 Sensor Fails	OSR 3.1.2, SR 4.1.2.2, weekly functional test
AE-DWPF1CCLU#	5	86H 5.0E-07H	2.15E-05	CC: two analyzers in DWPF fail low - batch #1	a: functionally tested each batch
AE-DWPF2CCLU#	5	86H 5.0E-07H	2.15E-05	CC: two analyzers in DWPF fail low - batch #2	a: functionally tested each batch
AE-DWPFOCCLU#	5	86H 5.0E-07H	2.15E-05	CC: two analyzers in DWPF fail low	a: functionally tested each batch
AE-SRTC-CCLU#	5	86H 5.0E-07H	2.15E-05	CC: two analyzers at tank farm fail - false low reading	a: functionally tested each batch
AEG3407-FLO5#	5	86H 5.0E-05H	2.15E-03	PVVH benzene analyzer 3407 element fails low (LEL)	a: checked every batch
AEG3407-LKS5#	3	1Q 7.5E-07H	1.63E-03	Air inleakage in PVVH benzene analyzer 3407	a:checked twice/year
AEG3408-FLO5#	5	86H 5.0E-05H	2.15E-03	PVVH benzene analyzer 3408 element fails low (LEL)	a: checked every batch
AEG3408-LKS5#	3	1Q 7.5E-07H	1.63E-03	Air inleakage in PVVH benzene analyzer 3408	a:checked twice/year
AEG8795-FLO5#	5	86H 5.0E-05H	2.15E-03	SRAT offgas detector #1 analyzer element fails low (LEL)	a: checked every batch
AEG8795-LKS5#	5	.5Y 7.5E-07H	1.64E-03	Air inleakage in SRAT offgas detector #1 sample line	a:checked twice/year
AEG8796-FLO5#	5	86H 5.0E-05H	2.15E-03	SRAT offgas detector #2 analyzer element fails low (LEL)	a: checked every batch
AEG8796-LKS5#	3	1Q 7.5E-07H	1.63E-03	Air inleakage in SRAT offgas detector #2 sample line	a:checked twice/year
AEG8797-FLOD#	5	86H 5.0E-05H	2.15E-03	SME LFL analyzer 8797 fails low	a: checked every batch
AEG8797-LKS4#	5	.5Y 7.5E-07H	1.64E-03	Air inleakage in SME detector 8797 sample line	a: checked twice/year
AEG8798-FLOD#	5	86H 5.0E-05H	2.15E-03	SME hydrogen detector 2 (8798) fails low	a: checked every batch
AEG8798-LKS4#	5	.5Y 7.5E-07H	1.64E-03	Air inleakage in SME detector 8798 sample line	a: checked twice/year

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Event	C	Input	Calc.	Description	Source
AEGSRAT-LKS5#	5	.5Y 7.5E-07H	1.64E-03	Air inleakage in SRAT sampling line (common to both detectors)	a: checked twice/year
AX-8795-BFL5#	3	43H 3.0E-05H	1.29E-03	SRAT %LFL calculation switch failure	
AX-8797-BFL4#	3	1Q 3.0E-05H	6.33E-02	SME %LFL calculation and switch failure	a:checked twice/year
BCHSRAT-DBL5#	1	1N 1.0E-01N	1.00E-01N	SRAT process uses double batch of PHA	Use TC value
BCHSRAT-PRE5+	4	86H 1.2E-02H	5.08E-01	SRAT batch processed	a: 86 hour batches
BKR--5A-FOPH+	4	8.5H 3.0E-07H	2.55E-06	FAILURE OF 13.8-kV FEEDER BREAKER 5A - SPURIOUSLY OPENS	DWPF SAR 9.3.18
BKR--5B-CCEN#	1	1N 5.0E-05N	5.00E-05N	CC: BOTH DIESEL GENERATOR SUPPLY BREAKERS FAIL TO CLOSE	Use TC
BKR--5B-FOPH+	4	8.5H 3.0E-07H	2.55E-06	FAILURE OF 13.8-kV FEEDER BREAKER 5B - SPURIOUSLY OPENS	DWPF SAR 9.3.18
BKR-12--CCBR#	5	8H 3.0E-08H	1.20E-07	CC: TWO FAN BREAKERS FAIL OPEN	a: 8 hours to repair
BKR-123-C3DR#	5	8H 1.5E-08H	6.00E-08	CC: THREE FAN BREAKERS FAIL OPEN	a: 8 hours to repair
BKR-1234C3DR#	5	8H 1.5E-08H	6.00E-08	CC: FOUR FAN BREAKERS FAIL OPEN	a: 8 hours to repair
BKR-5A5BCCBH+	4	8.5H 3.0E-08H	2.55E-07	CC: FAILURE OF 13.8-kV FEEDER BREAKERS 5A/5B - SPURIOUSLY OPENS	DWPF SAR 9.3.18
BKR-A101FOPH+	4	8.5H 3.0E-07H	2.55E-06	FAILURE OF 13.8-kV FEEDER BREAKER A101 - SPURIOUSLY OPENS	DWPF SAR 9.3.18
BKR-A201FOPH+	4	8.5H 3.0E-07H	2.55E-06	FAILURE OF 13.8-kV TIE BREAKER A201 - SPURIOUSLY OPENS	DWPF SAR 9.3.18
BKR-A202FOPH+	4	8.5H 3.0E-07H	2.55E-06	FAILURE OF 13.8-kV FEEDER BREAKER A202 - SPURIOUSLY OPENS	DWPF SAR 9.3.18
BKR-HTR-CCBS+	4	4H 3.0E-08H	1.20E-07	CC: TWO LID HEATER CIRCUIT BREAKERS FAIL - SPURIOUSLY OPEN	a: detected in 1 shift
BKR-HTRAFOPS+	4	4H 3.0E-07H	1.20E-06	LID HEATER A CIRCUIT BREAKER FAILS - SPURIOUSLY OPENS	a: detected in 1 shift
BKR-HTRBFOPS+	4	4H 3.0E-07H	1.20E-06	LID HEATER B CIRCUIT BREAKER FAILS - SPURIOUSLY OPENS	a: detected in 1 shift
BKR-HTRCFOPS+	4	4H 3.0E-07H	1.20E-06	LID HEATER C CIRCUIT BREAKER FAILS - SPURIOUSLY OPENS	a: detected in 1 shift
BKR-HTRDFOPS+	4	4H 3.0E-07H	1.20E-06	LID HEATER D CIRCUIT BREAKER FAILS - SPURIOUSLY OPENS	a: detected in 1 shift
BKR-SB--FOPR#	5	8H 3.0E-07H	1.20E-06	STANDBY FAN BREAKER FAILS OPEN	a: 8 hours to repair
BKR00001FOPR#	5	8H 3.0E-07H	1.20E-06	FAN #1 BREAKER FAILS OPEN	a: 8 hours to repair
BKR00002FOPR#	5	8H 3.0E-07H	1.20E-06	FAN #2 BREAKER FAILS OPEN	a: 8 hours to repair
BKR00003FOPR#	5	8H 3.0E-07H	1.20E-06	FAN #3 BREAKER FAILS OPEN	a: 8 hours to repair

Event	C	Input	Calc.	Description	Source
BKR1/200CCBN#	3	8.5H 3.0E-08H	2.55E-07	CC: BOTH DIESEL GENERATOR SUPPLY BREAKERS TRANSFER OPEN	DWPF SAR 9.3.18
BKRA1-A2CCBH+	4	8.5H 3.0E-08H	2.55E-07	CC: FAILURE OF 13.8-kV FEEDER BREAKERS A101/A202 - SPURIOUSLY OPEN	DWPF SAR 9.3.18
BKRB102BFTON#	1	1N 5.0E-04N	5.00E-04N	NORMAL POWER BREAKER B10-2B FAILS TO OPEN	Use TC
BKRB105BFOPN#	3	8.5H 3.0E-07H	2.55E-06	SUPPLY BREAKER B10-5B TRANSFERS OPEN	DWPF SAR 9.3.18
BKRB105BFTCN#	1	1N 5.0E-04N	5.00E-04N	SUPPLY BREAKER B10-5B FAILS TO CLOSE	Use TC
BKRB9-2BFTON#	1	1N 5.0E-04N	5.00E-04N	NORMAL POWER BREAKER B9-2B FAILS TO OPEN	Use TC
BKRB9-5BFOPN#	3	8.5H 3.0E-07H	2.55E-06	SUPPLY BREAKER B9-5B TRANSFERS OPEN	DWPF SAR 9.3.18
BKRB9-5BFTCN#	1	1N 5.0E-04N	5.00E-04N	SUPPLY BREAKER B9-5B FAILS TO CLOSE	Use TC
BKRB9B10CCDN#	1	1N 5.0E-05N	5.00E-05N	CC: NORMAL POWER BREAKERS B9-2B AND B10-2B FAIL TO OPEN	Use TC
BKRSRATSFOPD#	3	8H 3.0E-07H	2.40E-06	SRAT offgas sample pump circuit breaker fails open	a: closed in 8 hours
BNZ-XFR-PREP+	4	1H 2.3E-02H	2.25E-02	Benzene transferred to OWST	Transfer lasts one hour
BNZOEHOTPREP#	3	2H 2.3E-02H	4.50E-02	Benzene being boiled off in OE	a: 2 hours per batch
BNZPRHOTPREP#	3	16H 2.3E-02H	3.08E-01	Hot benzene present in PR	a: 16 hours per batch
BOTCO2B-REP1#	5	1M 6.7E-05H	2.37E-02	Bottles were used since last refilling	a: Refilled in 1 month
BOTCO2B-T&M1#	3	7D 1Y	1.90E-02	SPC backup CO2 bottles isolated for maintenance	a: isolated annually, error corrected in 1 week
BOTCO2B1T&M1#	3	7D 1Y	1.90E-02	SPC backup CO2 bottle 1 isolated for maintenance	a: isolated annually, error corrected in 1 week
BOTCO2B2T&M1#	3	7D 1Y	1.90E-02	SPC backup CO2 bottle 2 isolated for maintenance	a: isolated annually, error corrected in 1 week
BOTCO2B3T&M1#	3	7D 1Y	1.90E-02	SPC backup CO2 bottle 3 isolated for maintenance	a: isolated annually, error corrected in 1 week
BOTCO2B4T&M1#	3	7D 1Y	1.90E-02	SPC backup CO2 bottle 4 isolated for maintenance	a: isolated annually, error corrected in 1 week
BUS--A1-BFLH+	4	8.5H 1.0E-07H	8.50E-07	FAILURE OF 13.8-kV BUS A1	DWPF SAR 9.3.18
BUS--A1-UNAH#	1	1N 3.8E-02N	3.80E-02N	BUS A1 UNAVAILABLE DUE TO TESTING/MAINTENANCE	Use TC
BUS--A2-BFLH+	4	8.5H 1.0E-07H	8.50E-07	FAILURE OF 13.8-kV BUS A2	DWPF SAR 9.3.18
BUSA1-A2CCAH+	4	8.5H 1.0E-08H	8.50E-08	CC: FAILURE OF 13.8-kV BUSSES A1 AND A2	DWPF SAR 9.3.18
CC2-AIR-DRY1+	4	8H 5.0E-08H	4.00E-07	cc: both air dryers fail	a: 0.1 X single rate, repiared in 8 hours

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Event	C	Input	Calc.	Description	Source
CC2-AIR-PT-1#	5	48H 1.0E-07H	2.40E-06	cc: both instrument air PTs fail high	a: 0.1 X single rate, repaired in 2 days
CC2-CPC-CMP2+	4	7D 5.0E-06H	8.39E-04	CC: Both CPC purge compressors fail	a: repaired in 1 week
CC2-MFT-FE-7#	3	1M 3.0E-07H	2.16E-04	CC: Both MFT purge flow elements fail high	a: .1 x single rate, repaired in 1 month
CC2-MFT-FE-7+	4	1M 3.0E-07H	2.16E-04	CC: Both MFT purge flow elements fail high	a: .1 x single rate, repaired in 1 month
CC2-PSW-PMPG#	3	8H 3.0E-06H	2.40E-05	cc: both PSW pumps fail	a: 0.1 X single rate, repaired in 8 hours
CC2-SME-H2-1#	5	1M 5.0E-06H	1.80E-03	cc: both SME hydrogen detectors fail low or miscalibrated	a: 0.1 X single failure + 0.5 X miscalibration
CC2-SPC-PCV1#	1	1N 3.0E-04N	3.00E-04N	cc: PR and PRFT vacuum breakers fail to open	a: 0.1 x single probability
CC2-VAP-PSV1+	4	4H 1.0E-06H	4.00E-06	cc: PSVs on primary and backup vaporizer fail open	a: 0.1 X single rate
CC2BENZ-AEG1#	5	1M 5.0E-06H	1.80E-03	cc: both PVVH benzene detectors fail low	a: 0.1 x single rate + 0.5 x miscalibration
CC2CHILLCHL1+	4	8H 5.0E-06H	4.00E-05	cc: both chillers fail	a: 0.1 * single failure rate
CC2CPCBPCV-J#	1	1N 5.0E-05N	5.00E-05N	cc: both check valves on CPC backup purge system fail to open	a: 0.1 times single failure
CC2CPCBPPCVJ#	1	1N 3.0E-04N	3.00E-04N	CC: both CPC backup purge PCVs fail to open	CC: = 0.1 x single failure rate
CC2CTW--FAN1+	4	7D 3.0E-06H	5.04E-04	cc: two fans fail	a: 0.1 X single rate, 1 week to repair
CC2DEEP-DG-1#	1	1N 3.0E-03N	3.00E-03N	Both deep well pumps (or diesel motors) fail to start or run	a: 0.1 X single probability
CC2LPPN2CV-J#	1	1N 5.0E-05N	5.00E-05N	cc: both LPPP N2 check valves fail to close	a: 0.1 times single failure rate
CC2LPPN2PCVJ#	1	1N 3.0E-04N	3.00E-04N	cc: both LPPP N2 bottle PCVs fail to open	a: failure = 0.1 x single probability
CC2LPPV-FAN1+	4	1H 3.0E-06H	3.00E-06	CC: both LPPP VVS fans fail	CC: rate of 1 failing x .1
CC2MAINTHCV1#	5	1M 5.0E-08H	1.80E-05	cc: both PR steam valves miscalibrated	a: corrected in 1 month
CC2OWST-PCVN#	1	1N 3.0E-04N	3.00E-04N	cc: both PCVs on OWST liquid N2 supply system fail to open	a: failure = 0.1 x single rate
CC2OWST-PT-1#	5	1Y 1.0E-07H	4.38E-04	cc: OWST pressure monitors both fail high	a: 0.1 X single rate, corrected in 1 year
CC2PRBT-FE-7#	3	1M 3.0E-07H	2.16E-04	cc: both PRBT flow elements fail high	a: 0.1 x single rate, repaired in 1 month
CC2PRBT-FE-7+	4	1M 3.0E-07H	2.16E-04	cc: both PRBT flow elements fail high	a: .1 x single rate, repaired in 1 month
CC2PURGESPCK#	1	1N 1.0E-04N	1.00E-04N	CC: both SPC purge supply isolation valves fail to close	0.1 x single failure
CC2PVVH-FAN1+	4	8H 3.0E-06H	2.40E-05	cc: both PVVH fans fail	a: 0.1 X single rate, corrected in 8 hours

Event	C	Input	Calc.	Description	Source
CC2PVVH-FE-7#	3	1M 3.0E-07H	2.16E-04	cc: both PVVH flow elements fail high	a: 0.1 x single rate, repaired in 1 month
CC2PVVH-MOV1#	1	1N 3.0E-04N	3.00E-04N	cc: both SPC/PVVH isolation valves fail to close	a: 0.1 x single rate
CC2SBSWTRMNN#	1	4.3E-02N 5.0E-03N	2.15E-04N	CC: FAIL TO RESTORE DIESELS TO STANDBY FOLLOWING MAINTENANCE	1/YR * 31D/2 (FROM OSR 3.5.1)
CC2SCVC-O2-K#	1	1N 5.0E-04N	5.00E-04N	CC: Both SCVC O2 detectors fail high	Use TC value
CC2SPCN2PCVN#	1	1N 3.0E-04N	3.00E-04N	CC: both SPC N2 PCVs fail to open	a: rate = 0.1 x single failure rate
CC2SPCN2RTH1#	1	.12N 3.0E-03N	3.60E-04N	cc: both SPC N2 addition needle valves closed	a: 0.1 x single probability, closed 1/year, checked 4/year
CC2SPCN2SV-N#	1	1N 1.0E-04N	1.00E-04N	CC: both SPC N2 HCVs fail to open	a: rate = 0.1 times single failure rate
CC2SPCN3PCVN#	1	1N 3.0E-04N	3.00E-04N	CC: both SPC N2 low pressure PCVs fail to open	a: rate = 0.1 x single failure rate
CC2SPCP-PT-K#	5	7D 1.0E-07H	8.40E-06	CC: both SPC pressure monitors fail high	a: 0.1 X single rate, corrected in 1 week
CC2SPCPPLSL1#	1	1N 3.0E-03N	3.00E-03N	cc: low level and low pressure switches miscalibrated	a: 0.1 X miscalibration rate
CC2SPCV-MOVK#	1	1N 3.0E-04N	3.00E-04N	cc: both SCVC exit valves fail to close	a: 0.1 x single rate
CC2SPTN2LINJ#	1	1N 4.1E-04N	4.10E-04N	cc: both SPT N2 supply lines fail	a: single rate x 0.1
CC2SRAT-LFL5#	5	1M 5.0E-06H	1.80E-03	cc: both SRAT LFL detectors fail low	a: 0.1 x single failure rate + 0.5 x miscalibration
CC2SRAT-SMP6#	1	1N 3.0E-05N	3.00E-05N	Common cause: PR and PRBT samples inadequate	a: .5 X single failure
CC2STEAMHCV1+	4	4H 5.0E-08H	2.00E-07	cc: both PR steam supply valves fail open	a: 0.1 X single rate, corrected in 4 hours
CC2STEAMPMPG+	4	8H 3.0E-06H	2.40E-05	CC: both steam condensate pumps fail	a: both fail at 0.1 times single rate
CC3-CTW-PMP1+	4	4H 1.5E-06H	6.00E-06	cc: CTW pumps fail	a: 0.05 X single failure rate (process shutdown in 4 hours)
CC3-SME-FSL4#	1	1N 1.1E-04N	1.10E-04N	CC: all 3 SME offgas sample flow low switches fail to open	use 0.05 x single failure rate
CC3-SPC-FE-1#	3	7D 1.5E-07H	2.52E-05	cc: SPC purge flow elements fail to detect SPC purge loss	a: 0.05 X single FE failure rate, corrected in 1 week
CC3CO2B-REG1#	5	48H 1.5E-07H	3.60E-06	CC: All 4 bottles pressure regulators fail to open	a: detected and repaired in 48 hours
CC3CO2B-RMH1#	1	1N 2.5E-03N	2.50E-03N	cc: fail to open block valve after maintenance (all bottles)	Use TC Value
CC3MAINTFSL1#	1	.2N 1.5E-03N	3.00E-04N	cc: all 3 SME low flow switches miscalibrated	a: 0.05 X miscalibration, corrected in 1 month
CC3SRAT-FSLD#	1	1N 1.1E-04N	1.10E-04N	CC: all 3 SRAT offgas flow monitors fail to close	single failure X .05
CHLBACK-FTRE#	3	8H 5.0E-05H	4.00E-04	Backup chiller fails to run	a: 8 Hours to repair

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Event	C	Input	Calc.	Description	Source
CHLBACK-FTSE#	1	1N 5.0E-03N	5.00E-03N	Backup chiller fails to start	Use TC value
CHLBACK-T&ME#	3	8H 4.0E+00Y	3.65E-03	Backup chiller unavailable due to T&M	a: out of service for 8 hours
CHLPRIM-BFLE+	4	8H 5.0E-05H	4.00E-04	Primary chiller fails	a: 8 Hours to repair
CMPAIR1-BFLV+	4	24H 5.0E-05H	1.20E-03	Primary plant/instrument air compressor fails	a: 24 hour repair time
CMPAIR2-FTRV+	4	24H 5.0E-05H	1.20E-03	Secondary plant / instrument air compressor fails	a: repaired in 24 hours
CMPAIR3-FTRV#	3	48H 5.0E-05H	2.40E-03	Third plant / instrument air compressor fails to run	a: mission time = 48 hours
CMPAIR3-FTSV#	1	1N 5.0E-03N	5.00E-03N	Third plant / instrument air compressor fails to start	Use TC value
CMPAIR3-T&MV#	3	27D 1Y	7.13E-02	Standy compressor out of service for T&M	a: 9 days per year (times 3)
CMPCPC1-BFL2+	4	8H 5.0E-05H	4.00E-04	Operating purge air compressor fails	a: 8 hour repair time
CMPCPC2-FTR2#	3	96H 5.0E-05H	4.79E-03	Standby purge air compressor fails to run	a: max repair time for primary compressor is 96 hours
CMPCPC2-FTS2#	1	1N 5.0E-03N	5.00E-03N	Standby purge air compressor fails to start	Use value from TC file
CMPCPC2-T&M2#	1	1N 3.0E-02N	3.00E-02N	Standby purge air compressor out of service for testing or maintenance	Use TC value
CMPINAIRC3CV+	4	24H 2.5E-06H	6.00E-05	CC: three plant/instrument air compressors fail	a: 24 hour repair time
CND-026-LKSG#	3	8H 1.0E-07H	8.00E-07	COIL LEAK EXISTS IN PROCESS STEAM CONDENSATE COOLER	a: 8 hours to repair
CO2BOTTLCHK1#	3	7D 3.0E-04H	4.92E-02	Fail to correct wrong bottles before system used.	a: detected in one week
CON--OE-PREG#	1	1N 1.0N	1.00E+00N	CONTAMINATION PROBABILITY GIVEN COIL LEAK	a: contamination occurs
CON--PR-PREG#	1	1N 1.0N	1.00E+00N	CONTAMINATION PROBABILITY GIVEN COIL LEAK	a: contamination occurs
CON-SME-PREG#	1	1N 1.0N	1.00E+00N	CONTAMINATION PROBABILITY GIVEN COIL LEAK	a: contamination occurs
CONDWTT-PREG#	1	1N 1.0N	1.00E+00N	CONTAMINATION PROBABILITY GIVEN COIL LEAK	a: contamination occurs
CONSRAT-PREG#	1	1N 1.0N	1.00E+00N	CONTAMINATION PROBABILITY GIVEN COIL LEAK	a: contamination occurs
CP--TF--CC-U#	1	1N 2.0E-01N	2.00E-01N	Same analyst conducts sampling at tanks 48 & 49	Use TC
CP-BATCHCC1U#	1	1N 2.0E-01N	2.00E-01N	Same personnel conduct sampling at SRAT for batch #2	
CP-DWPF1CC1U#	1	1N 2.0E-01N	2.00E-01N	Same personnel conduct sampling from SRAT to SME for batch #1	Use TC
CP-DWPF2CC1U#	1	1N 2.0E-01N	2.00E-01N	Same personnel conduct sampling from SRAT to SME for batch #2	Use TC

Event	C	Input	Calc.	Description	Source
CP-DWPFOCC1U#	1	1N 2.0E-01N	2.00E-01N	Same personnel conduct sampling from SRAT to SME	Use TC
CV-2362-FTOF#	1	1N 5.0E-05N	5.00E-05N	PSW secondary pump discharge check valve fails to open	a: 8 hour restoration time
CV-9145-FTOO#	1	1N 5.0E-05N	5.00E-05N	CTW pump #2 (50%) discharge check valve fails to open	Use TC value
CV-9147-FTOO#	1	1N 5.0E-05N	5.00E-05N	CTW pump #4 (25%) discharge check valve fails to open	Use TC value
CV-CPCB1FTOJ#	1	1N 5.0E-04N	5.00E-04N	CPC backup purge check valve 1 fails to open	Use TC value
CV-CPCB2FTOJ#	1	1N 5.0E-04N	5.00E-04N	CPC backup purge check valve 2 fails to open	Use TC value
CV-CPCB3FTCJ#	1	1N 5.0E-04N	5.00E-04N	CPC primary to backup purge check valve fails to close	Use TC value
CV-DXXX-FTCJ#	1	1N 5.0E-04N	5.00E-04N	LPPP N2 check valve DXXX fails to close	Use TC value
CV-DXXY-FTCJ#	1	1N 5.0E-04N	5.00E-04N	LPPP N2 check valve DXXY fails to close	Use TC value
CV-MAIN-FCLG+	4	8H 5.0E-07H	4.00E-06	Check valve on steam condensate supply to generator fails closed	a: Detected and repaired or process shut down in 8 hours
CV-OE---FTCJ#	1	1N 5.0E-04N	5.00E-04N	Check valve to SPC CO2 through OE line fails to close	Use TC value
CV-OECT-FTCJ#	1	1N 5.0E-04N	5.00E-04N	Check valve to SPC CO2 through OECT line fails to close	Use TC value
CV-PMP1-FCLG+	4	8H 5.0E-07H	4.00E-06	Check valve on primary pump fails closed	a: Detected and repaired or process shut down in 8 hours
CV-PMP2-FTOG#	1	1N 5.0E-05N	5.00E-05N	Check valve on secondary pump fails to open	Use TC value
CV-PR---FTOJ#	1	1N 5.0E-04N	5.00E-04N	Check valve for PR vacuum breaker purge supply fails to open	Use TC value
CV-PR1--FTCJ#	1	1N 5.0E-04N	5.00E-04N	Check valve to SPC CO2 through PR high flow line fails to close	Use TC value
CV-PR2--FTCJ#	1	1N 5.0E-04N	5.00E-04N	Check valve to SPC CO2 through PR low flow line fails to close	Use TC value
CV-PRFT-FTCJ#	1	1N 5.0E-04N	5.00E-04N	Check valve to SPC CO2 through PRFT line fails to close	Use TC value
CV-PRFT-FTOJ#	1	1N 5.0E-04N	5.00E-04N	PRFT vacuum breaker CO2 line check valve fails to open	Use TC value
CYLOWST-OUTP#	1	1N 3.6E-01N	3.60E-01N	Backup OWST N2 cylinders run out before primary N2 restored	a: supply capacity less than restoration time
DCS-----BFL2#	5	8H 3.0E-06H	1.20E-05	DCS FAILS (EXCL. POWN AND POWD EVENTS)	a: 8 hours repair time
DCS--EP-BFLE#	5	14D 3.0E-06H	5.04E-04	DCS FAILS (EXCLUDING POWN AND POWD EVENTS)	a: 14 days repair time
DG-1/200CCCN#	1	1N 1.0E-03N	1.00E-03N	CC: BOTH DIESEL GENERATORS FAIL TO START	Use TC
DG-1/200CCDN#	3	8.5H 5.0E-04H	4.24E-03	CC: BOTH DIESEL GENERATORS FAIL TO REMAIN RUNNING	DWPF SAR 9.3.18

Event	C	Input	Calc.	Description	Source
DG-DEEP1FTRO#	3	4H 5.0E-03H	1.98E-02	Primary deep well system diesel fails to run	a: 4 hour mission time
DG-DEEP1FTSO#	1	1N 1.0E-02N	1.00E-02N	Primary deep well system diesel fails to start	Use TC value
DG-DEEP2FTRO#	3	4H 5.0E-03H	1.98E-02	Secondary deep well system diesel fails to run	a: 4 hour mission time
DG-DEEP2FTSO#	1	1N 1.0E-02N	1.00E-02N	Secondary deep well system diesel fails to start	Use TC value
DG-DEEP2T&MO#	1	1N 5.0E-02N	5.00E-02N	Secondary deep well system pump/diesel out for T&M	Use TC value
DG-G100-FTRN#	3	8.5H 5.0E-03H	4.16E-02	DIESEL GENERATOR G100 FAILS TO REMAIN RUNNING	DWPF SAR 9.3.18
DG-G100-FTSN#	1	1N 1.0E-02N	1.00E-02N	DIESEL GENERATOR G100 FAILS TO START	Use TC
DG-G100-UNAN#	1	1N 4.4E-02N	4.40E-02N	DIESEL GENERATOR G100 UNAVAILABLE DUE TO MAINTENANCE	E-T/M article
DG-G200-FTRN#	3	8.5H 5.0E-03H	4.16E-02	DIESEL GENERATOR G200 FAILS TO REMAIN RUNNING	DWPF SAR 9.3.18
DG-G200-FTSN#	1	1N 1.0E-02N	1.00E-02N	DIESEL GENERATOR G200 FAILS TO START	Use TC
DMP--SB-FTOR#	1	1N 3.0E-03N	3.00E-03N	STANDBY FAN EXHAUST DAMPER FAILS TO OPEN	Use TC
DMP--W--CCBR#	1	1N 3.0E-04N	3.00E-04N	CC: FOUR FAN EXHAUST DAMPERS FAIL TO OPEN	Use TC
DMP8154-FCLT#	3	8H 3.0E-06H	2.40E-05	LPP VVH secondary fan suction damper fails closed	OSR 3.2.1, SR 4.2.1.4, checked shiftly
DMP8155-FCLT+	4	8H 3.0E-06H	2.40E-05	LPP VVH primary fan suction damper fails closed	OSR 3.2.1, SR 4.2.1.4, checked shiftly
DRYAIR2-T&MV#	3	40H 1Y	4.56E-03	Dryer #2 out of service for T&M	a: 20 hours per year (times 2)
EXP-GAS-PREQ#	1	1N 1.0N	1.00E+00N	EXPLOSIVE GAS PRESENT	Use TC
FAN-12--CCCR#	1	1N 5.0E-04N	5.00E-04N	CC: TWO FANS FAIL TO START (SAME BUS)	Use TC
FAN-12--CCDR#	5	7D 3.0E-06H	2.52E-04	CC: TWO RE-STARTED FAN LINES FAIL TO REMAIN RUNNING	a: 7 days to repair
FAN-123-C3CR#	5	7D 1.5E-06H	1.26E-04	CC: THREE FANS FAIL TO REMAIN RUNNING	a: 7 days to repair
FAN-123-C3FR#	1	1N 2.5E-04N	2.50E-04N	CC: THREE FANS FAIL TO START	Use TC
FAN-1234C3CR#	5	8H 1.5E-06H	6.00E-06	CC: FOUR FANS FAIL TO REMAIN RUNNING	a: 8 hours to repair
FAN-1234C3FR#	1	1N 2.5E-04N	2.50E-04N	CC: FOUR FANS FAIL TO START	Use TC
FAN-SB--FTRR#	5	7D 3.0E-05H	2.52E-03	STANDBY FAN FAILS TO REMAIN RUNNING	a: 7 days to repair
FAN-SB--UNAR#	1	1N 2.4E-02N	2.40E-02N	STANDBY FAN UNAVAILABLE DUE TO MAINTENANCE	Use TC

Event	C	Input	Calc.	Description	Source
FAN00001FTRR#	3	96H 3.0E-05H	2.88E-03	FAN #1 FAILS TO REMAIN RUNNING	a: 96 hr mission time (bounded by seismic event)
FAN00002FTRR#	5	7D 3.0E-05H	2.52E-03	FAN #2 FAILS TO REMAIN RUNNING	a: 7 days to repair
FAN00003FTRR#	5	3M 3.0E-05H	3.17E-02	FAN #3 FAILS TO REMAIN RUNNING	a: 3 months to repair
FAN00004FTSR#	1	1N 5.0E-03N	5.00E-03N	STANDBY FAN FAILS TO START	Use TC
FANCTW--ADJO#	1	1N 5.0E-01N	5.00E-01N	Forced convection required in cooling tower	Use TC value
FANCTW1-FTRO+	4	7D 3.0E-05H	5.01E-03	CTW tower fan 1 fails	a: detected and repaired in 1 week
FANCTW2-FTRO+	4	7D 3.0E-05H	5.01E-03	CTW tower fan 2 fails	a: detected and repaired in 1 week
FANCTW3-FTRO+	4	7D 3.0E-05H	5.01E-03	CTW tower fan 3 fails	a: detected and repaired in 1 week
FANLPPV1BFLT+	4	8H 3.0E-05H	2.40E-04	LPP VVH primary fan fails to run	OSR 3.2.1, SR 4.2.1.1, checked shiftly
FANLPPV2BFLT#	3	8H 3.0E-05H	2.40E-04	LPP VVH secondary fan fails to run	a: Primary fan repaired, or shutdown within 8 hours
FANLPPV2FTST#	1	1N 5.0E-03N	5.00E-03N	LPP VVH secondary fan fails to start	Use TC value
FANPVV1-BFLD+	4	24H 3.0E-05H	7.19E-04	Primary PVVH blower fails	a: 24 hours to repair
FANPVV2-BFLD#	3	1D 3.0E-05H	7.20E-04	PVVH backup fan fails to run	a: 24 hour mission time
FANPVV2-FTSD#	1	1N 5.0E-03N	5.00E-03N	Standby PVVH blower fails to start	Use TC value
FANPVV2-T&MD#	3	8H 4Y	3.65E-03	PVVH standby fan unavailable, due to testing or maintenance	a: out 8 hours per quarter
FCV0683-FCL7+	4	8H 1.0E-06H	8.00E-06	MFT purge supply valve fails closed	a: 8 hours to repair
FCV1027-FOP9+	4	86H 1.0E-06H	8.60E-05	PR steam supply valve FCV-1027 fails open	a: detected and corrected before next batch
FCV1893-ADJE+	4	1D 1.0Q	1.09E-02	Chilled water bypass valve required to open (no system flow)	a: demand lasts for 1 day
FCV1893-FTOE#	1	1N 1.0E-03N	1.00E-03N	Flow control valve for chilled water bypass fails to open	a: checked annually
FCV2044-FTC4#	1	1N 1.0E-03N	1.00E-03N	SME formic acid flow control valve fails to close	Use TC value
FCV2056-ADJI+	4	1H 2.3E-02H	2.25E-02	PR formic acid supply valve opened (1/43 hours)	a: valve remains open 1 hour
FCV2056-FOPI+	4	8H 1.0E-06H	8.00E-06	Formic acid addition valve to PR fails open	a: 8 hours to repair
FCV2369-ADJF#	1	1N 1.0E-03N	1.00E-03N	PSW bypass valve required to be open (no process flow)	Use TC value
FCV2369-FTOF#	1	1N 1.0E-03N	1.00E-03N	PSW bypass valve fails to open	a: checked annually

Basic Event Report for I:\CAFTA\DATA\MASTER.BE 11/11/94 11:42 AM (CONT.)

Event	C	Input	Calc.	Description	Source
FCV3000-FCL5+	4	8H 1.0E-06H	8.00E-06	Steam supply flow control valve FCV3000 fails closed	a: 8 hours to repair
FCV3000-FTCG#	5	86H 3.0E-06H	1.29E-04	SRAT steam supply valve fails to close	a: corrected before next batch
FCV3034-FCL2+	4	8H 1.0E-06H	8.00E-06	SRAT purge flow control valve fails closed	a: 8 hours to repair
FCV3080-FTC4#	1	1N 1.0E-03N	1.00E-03N	SME steam supply valve fails to close	Use TC value
FCV3216-ADJ6+	4	1H 2.3E-02H	2.25E-02	PRBT dilution flow control valve adjusted	a: detected within 1 hour
FCV3216-FCL6+	4	1H 1.0E-06H	1.00E-06	PRBT dilution supply valve fails closed	a: 1 hour to detect (low flow alarm) and shutdown
FCV8150-ADJ1+	4	7D 4.0E+00Y	7.12E-02	Flow through FCV 8150 adjusted	a: adjusted quarterly
FCV8150-FCLT+	4	1H 1.0E-06H	1.00E-06	LPP VVH flow control valve 8150 fails closed	a: responded to and shutdown or repaired within 1 hour
FCV8150-FOPT+	4	7D 1.0E-06H	1.68E-04	Low dilution because process cell flow control valve fails open	a: detected and corrected in 1 week
FCV8856-FCL4+	4	8H 1.0E-06H	8.00E-06	SME purge flow control valve fails closed	a: 8 hours to repair
FCV9152-FOPO+	4	8H 1.0E-06H	8.00E-06	Bypass valve fails open	Detected and corrected in 8 hours
FCV9301-FTC9#	1	1N 1.0E-03N	1.00E-03N	OE steam flow control valve fails to close	Use TC value
FE-0682-FHI7#	3	86H 3.0E-06H	2.58E-04	MFT purge flow element 0682 fails high	a: repaired before next batch
FE-0682-FHI7+	4	86H 3.0E-06H	2.58E-04	MFT purge flow element 0682 fails high	a: repaired before next batch
FE-0684-FHI7#	3	86H 3.0E-06H	2.58E-04	MFT purge flow element 0684 fails high	a: repaired before next batch
FE-0684-FHI7+	4	86H 3.0E-06H	2.58E-04	MFT purge flow element 0684 fails high	a: repaired before next batch
FE-1018-FHIE#	3	1M 3.0E-06H	2.16E-03	PRFT purge flow element 1018 fails to detect low flow	a: checked monthly
FE-1103-FHIE#	3	1M 3.0E-06H	2.16E-03	PR purge flow element 1103 fails to detect low flow	a: checked monthly
FE-1893-FHIE#	5	1Y 3.0E-06H	1.30E-02	Flow element for chilled water flow fails high	a: checked annually
FE-1893-FLOE+	4	8H 3.0E-06H	2.40E-05	Chilled water flow element 1893 fails low (stops pumps)	a: element repaired in 8 hours
FE-2369-FHIF#	3	8H 3.0E-06H	2.40E-05	PSW flow element fails high (closes CTW valve)	a: detected and repaired in 8 hours
FE-2369-FLOF#	3	8H 3.0E-06H	2.40E-05	PSW flow element fails low	a: detected and repaired in 8 hours
FE-3034-FHI2#	3	1Q 3.0E-06H	6.52E-03	SRAT purge flow element or transmitter fails high	a:checked twice/year
FE-3034-FHI2+	4	86H 3.0E-06H	2.58E-04	SRAT purge flow element fails high	a: detected and corrected before next batch

Event	C	Input	Calc.	Description	Source
FE-3215-FHI6#	3	86H 3.0E-06H	2.58E-04	PRBT dilution flow element 3215 fails high	Repaired before next batch
FE-3215-FHI6+	4	86H 3.0E-06H	2.58E-04	PRBT dilution flow element 3215 fails high	reparired before next batch
FE-3218-FHI6#	3	86H 3.0E-06H	2.58E-04	PRBT dilution flow element 3218 fails high	repaired before next batch
FE-3218-FHI6+	4	86H 3.0E-06H	2.58E-04	PRBT dilution flow element 3218 fails high	repaired before next batch
FE-5860-FLOK#	5	86H 3.0E-06H	1.29E-04	PVVH flow element FE-5860 fails low	a: corrected before next SRAT batch
FE-5860-FLOK+	4	8H 3.0E-06H	2.40E-05	PVVH flow element 5860 fails low	a: detected and corrected in 8 hours
FE-6041-FLOK#	5	86H 3.0E-06H	1.29E-04	PVVH flow element FE-6041 fails low	a: corrected by next SRAT batch
FE-6041-FLOK+	4	8H 3.0E-06H	2.40E-05	PVVH flow monitor 6041 fails low	a: detected and corrected in 8 hours
FE-8856-FHI4#	3	86H 3.0E-06H	2.58E-04	SME purge flow element fails high	a: repaired before next batch
FE-8856-FHI4+	4	86H 3.0E-06H	2.58E-04	SME purge flow element fails high	a: repaired before next batch
FE-9315-FHIE#	3	1M 3.0E-06H	2.16E-03	OE purge flow element 9315 fails to detect low flow	a: checked monthly
FE-9328-FHIE#	3	1M 3.0E-06H	2.16E-03	OECT purge flow element 9328 fails to detect low flow	a: checked monthly
FE-MFT--CAL1#	3	1M 1.0E+00Y	7.89E-02	MFT purge flow elements calibrated	a: calibrated annually, corrected in 1 month
FE-MFT--CAL1+	4	1M 1.0E+00Y	7.59E-02	MFT purge flow elements calibrated	a: calibrated annually, corrected in 1 month
FE-PRBT-CAL1#	3	1M 1.0E+00Y	7.89E-02	PRBT purge flow elements calibrated	a: calibrated annually, corrected in 1 month
FED--1--BFLH+	4	8.5H 1.0E-06H	8.50E-06	FAILURE OF 13.8-kV FEEDER #1	DWPF SAR 9.3.18
FED--2--BFLH+	4	8.5H 1.0E-06H	8.50E-06	FAILURE OF 13.8-kV FEEDER #2	DWPF SAR 9.3.18
FED-1-2-CCAH+	4	8.5H 1.0E-07H	8.50E-07	CC: FAILURE OF BOTH 13.8-kV FEEDERS	DWPF SAR 9.3.18
FED-PR--PREK#	3	2H 2.3E-02H	4.50E-02	PR feeding in progress	2 hours per PR batch
FIT8150-FHIT+	4	1H 3.0E-06H	3.00E-06	LPP VVH flow transmitter fails high	a: responded to and shutdown or repaired within 1 hour
FLGN2SUPLKSP+	4	8H 1.0E-06H	8.00E-06	Any of 100 joints/flanges leaks	a: 8 Hr Repair
FLGOFICELKSP#	3	8H 1.0E-06H	8.00E-06	ORIFICE LEAKS AT THE FLANGES	a: 8 hr detection
FLT-062-PLGQ+	4	4H 3.0E-06H	1.20E-05	FILTER 062 PLUGS	a: 8 hours to repair
FLT-BP--PLGQ+	4	4H 3.0E-06H	1.20E-05	FILTER IN BYPASS LINE FAILS PLUGGED	a: 8 hours to repair

Event	C	Input	Calc.	Description	Source
FLT9580APLGV+	4	48H 1.0E-04H	4.78E-03	Instrument air dryer #1 prefilter plugs	a: detected and corrected in 2 days
FLT9580BPLGV+	4	48H 1.0E-04H	4.78E-03	Instrument air dryer #1 after filter plugs	a: detected and corrected in 2 days
FLT9581APLGV#	3	48H 1.0E-04H	4.79E-03	Dryer #1 prefilter plugs	a: 48 hour mission time'
FLT9581BPLGV#	3	48H 1.0E-04H	4.79E-03	Dryer #2 afterfilter plugs	a: 48 hour mission time
FLT9620-PLGV+	4	48H 1.0E-04H	4.78E-03	Inlet filter on secondary compressor is plugged	a: detected and corrected in 48 hours
FLT9623-PLGV+	4	48H 1.0E-04H	4.78E-03	Primary compressor inlet filter plugs	a: detected and corrected in 48 hours
FLT9660-PLGV#	3	7D 1.0E-04H	1.67E-02	Inlet filter on secondary compressor is plugged	a: 1 week mission time
FLTHEME-PLGT+	4	1H 3.0E-06H	3.00E-06	LPP vessel vent system mist eliminator plugs	a: responded to and shutdown or repaired within 1 hour
FLTHEPA1PLGT+	4	1H 3.0E-06H	3.00E-06	LPP HEPA-1 plugs	a: responded to and shutdown or repaired within 1 hour
FLTHEPA2PLGT+	4	1H 3.0E-06H	3.00E-06	LPP HEPA-2 plugs	a: responded to and shutdown or repaired within 1 hour
FLTLPPH1PLGT+	4	1H 3.0E-06H	3.00E-06	LPP cell inlet HEPA plugs	a: responded to and shutdown or repaired within 1 hour
FSH2777-FTC1#	5	1Q 1.0E-06H	1.09E-03	Backup CO2 purge flow high switch fails to close	a: Checked 2/year
FSH9236-FTCP#	5	1Q 1.0E-06H	1.09E-03	Flow switch fails to close	a: Checked 4/yr
FSL1893-FCLE+	4	24H 3.0E-06H	7.20E-05	Chilled water low flow interlock switch inadvertently closes	a: detected and corrected in 24 hours
FSL2369-FCLF#	3	4H 3.0E-06H	1.20E-05	PSW low flow switch fails closed	a: detected and corrected in 4 hours
FSL3406-FTCK#	5	1Q 1.0E-06H	1.09E-03	O2 analyzer 3405 sample flow low switch fails to close	a: checked quarterly
FSL3409-FTCK#	5	1Q 1.0E-06H	1.09E-03	O2 analyzer 3409 sample flow low switch fails to close	a: checked quarterly
FSL8799-FTCD#	5	1Q 1.0E-06H	1.09E-03	SRAT low sample flow switch 8799 fails to close	a: Checked quarterly
FSL8800-FTC4#	5	1Q 1.0E-06H	1.09E-03	SME sample flow indication switch 8800 fails high	a: Checked quarterly
FSL8801-FTC5#	5	1Q 1.0E-06H	1.09E-03	SRAT GC#1 low sample flow switch 8801 fails to close	a: Checked quarterly
FSL8802-FTCD#	5	1Q 1.0E-06H	1.09E-03	SRAT GC#2 low sample flow switch 8802 fails to close	a: Checked quarterly
FSL8803-FTC4#	5	1Q 1.0E-06H	1.09E-03	SME sample low flow indication switch 8803 fails high	a: Checked quarterly
FSL8804-FTC4#	5	1Q 1.0E-06H	1.09E-03	SME sample flow indication switch 8804 fails high	a: Checked quarterly
FT-2369-FHIF#	5	1Y 3.0E-06H	1.30E-02	PSW flow transmitter fails high	a: checked annually

Event	C	Input	Calc.	Description	Source
FT-8155-FLOT#	5	1Y 3.0E-06H	1.30E-02	LPPP VVS flow transmitter fails low	a: checked annualy
FT-9152-FLOO+	4	8H 3.0E-06H	2.40E-05	Bypass flow transmitter fails low	Detected and corrected in 8 hours
FY-8150-BFLT+	4	1H 1.0E-07H	1.00E-07	LPP VVH flow control valve signal conditioner fails high	a: responded to and shutdown or repaired within 1 hour
HCV1017-FCLB+	4	8H 5.0E-07H	4.00E-06	PRFT purge supply valve 1017 fails closed	a: 8 hours to repair or shutdown
HCV1033-FTCO#	1	1N 1.0E-03N	1.00E-03N	PR PSW return valve fails to close	Use TC value
HCV1038-FOP9+	4	86H 5.0E-07H	4.30E-05	PR steam supply valve HCV-1038 fails open	a: detected and repaired before next batch
HCV1102-FCL9+	4	8H 5.0E-07H	4.00E-06	PR baseline purge supply valve 1102 fails closed	a: 8 hours to repair or shutdown
HCV1142-FTCO#	1	1N 1.0E-03N	1.00E-03N	PRFT PSW return valve fails to close	Use TC value
HCV1885-FCLE+	4	8H 5.0E-07H	4.00E-06	Primary chiller supply valve fails closed	a: 8 hours to repair
HCV1897-FTOE#	1	1N 1.0E-03N	1.00E-03N	Backup chiller supply valve fails to open	Use TC Value
HCV3010-FTCO#	1	1N 1.0E-03N	1.00E-03N	SRAT PSW return valve fails to close	Use TC value
HCV3010-FTOF#	1	1N 1.0E-03N	1.00E-03N	SRAT cooling water supply valve HCV3010 fails to open	Use TC value
HCV3089-FCL4#	3	8H 5.0E-07H	4.00E-06	SME cooling water valve manual controller fails to open	A: 8 HOURS TO REPAIR
HCV3089-FTCO#	1	1N 1.0E-03N	1.00E-03N	SME PSW return valve fails to close	Use TC value
HCV3212-FTCO#	1	1N 1.0E-03N	1.00E-03N	PRBT PSW return valve fails to close	Use TC value
HCV3252-FTCO#	1	1N 1.0E-03N	1.00E-03N	MFT PSW return valve fails to close	Use TC value
HCV5845-FTCO#	1	1N 1.0E-03N	1.00E-03N	RCT PSW return valve fails to close	Use TC value
HCV5907-FTCO#	1	1N 1.0E-03N	1.00E-03N	DWTT PSW return valve fails to close	Use TC value
HCV8772-FOPQ#	5	8H 5.0E-07H	2.00E-06	VALVE 8772 FAILS TO REMAIN CLOSED	a: 8 hours to repair
HCV8772-FTCQ#	1	1N 1.0E-03N	1.00E-03N	VALVE 8772 FAILS TO CLOSE	Use TC
HCV9116-FCLO+	4	4H 5.0E-07H	2.00E-06	Return valve 9116 fails closed	a: detected and repaired, bypassed, or shut down in 4 hours
HCV9116-FTCG#	1	1N 1.0E-03N	1.00E-03N	COOLING TOWER RETURN VALVE HCV-9116 FAILS TO CLOSE	Use TC
HCV9122-FTOG#	1	1N 1.0E-03N	1.00E-03N	COOLING TOWER EMERGENCY RETURN VALVE HCV-9122 FAILS TO OPEN	Use TC
HCV9150-FCLG#	3	8H 5.0E-07H	4.00E-06	COOLING TOWER SUPPLY VALVE 9150 FAILS CLOSED	a: 8 hours to repair

Event	C	Input	Calc.	Description	Source
HCV9150-FCLO+	4	4H 5.0E-07H	2.00E-06	CTW discharge valve fails closed	a: Detected and corrected or shutdown in 4 hours
HCV9176-LKSP#	3	8H 1.0E-08H	8.00E-08	VALVE HCV 9176 LEAKS	a: 8 hr detection
HCV9307-FTCO#	1	1N 1.0E-03N	1.00E-03N	OE PSW return valve fails to close	Use TC value
HCV9314-FCL8+	4	1H 5.0E-07H	5.00E-07	OE purge supply valve 9314 fails closed	a: detected and corrected or shutdown w/i 1 hour due to low flow alarm
HCV9327-FCLA+	4	1H 5.0E-07H	5.00E-07	OECT purge supply valve 9327 fails closed	a: detected and corrected or shutdown w/i 1 hour due to low flow alarm
HCV9601-FCLV+	4	1H 5.0E-07H	5.00E-07	Instrument air dryer #1 isolation valve fails closed	a: detected and corrected within 1 hour (switch to backup)
HCV9602-FCLV#	3	24H 5.0E-07H	1.20E-05	Instrument air dryer #2 isolation valve fails closed	a: detected and corrected within 24 hours
HCV9621-FCLV+	4	2H 5.0E-07H	1.00E-06	Cooling water supply valve to primary compressor fails closed	a: detected and bypassed within 2 hours
HCV9622-FCLV+	4	2H 5.0E-07H	1.00E-06	Cooling water supply valve to secondary compressor fails closed	a: detected and bypassed in 2 hours
HCV9650-FCLV#	5	2H 5.0E-07H	5.00E-07	Third compressor cooling water supply valve fails closed	a: detected and bypassed in 2 hours
HCVAAAC-FTOG#	1	1N 1.0E-03N	1.00E-03N	SPC N2 HCV AAAC fails to open	Use TC value
HCVAAAD-FTOG#	1	1N 1.0E-03N	1.00E-03N	SPC N2 HCV AAAD fails to open	Use TC value
HCVINAIRC3CV+	4	2H 2.5E-08H	5.00E-08	CC: All three compressor water supply valves fail closed	a: Detected and bypassed in 2 hours
HPWLP-H-BFLH+	4	8.5H 3.0E-01Y	2.91E-04	LOSS OF POWER FROM SRS GRID TO H-AREA SWITCHGEAR	DWPF SAR 9.3.18
HTRLPPVVLKST+	4	8H 3.0E-07H	2.40E-06	LPP VVH steam tube leaks (moisture high)	a: responded to within 8 hours
HX-PCW1-FOUF#	3	8H 3.0E-08H	2.40E-07	Process cooling water heat exchanger #1 fouled	a: 8 hours to switch HX
HX-PSW1-LKSO#	5	5Y 1.0E-08H	2.19E-04	PSW heat exchanger-1 leaks (PSW/CTW leak)	a: Checked for plate leaks every 5 years
HX-PSW2-LKSO#	5	5Y 1.0E-08H	2.19E-04	PSW heat exchanger-2 leaks (PSW/CTW leak)	a: Checked for plate leaks every 5 years
IA--FH--T&MR#	1	1N 3.2E-03N	3.20E-03N	FAN HOUSE INSTRUMENT AIR SYSTEM UNAVAILABLE DUE TO T&M	Use TC
IGN-MLT-PRES#	1	1N 3.0E-02N	3.00E-02N	IGNITION SOURCE IS PRESENT IN MELTER OFF-GAS SYSTEM	Use TC
IGN-PPT-PREQ#	1	1N 3.0E-02N	3.00E-02N	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	Use TC
IGNMFT--PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in MFT vessel	Use TC value
IGNOE---PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in OE vessel	Use TC value
IGNOECT-PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in OECT vessel	Use TC value

Event	C	Input	Calc.	Description	Source
IGNOWST-PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in OWST inner tank	Use TC value
IGNOWST-PRE3+	4	.1H 2.3E-5H	2.30E-06	Ignition source present in OWST outer tank	Ignition source lasts 0.1 hour
IGNPR---PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in PR vessel	Use TC value
IGNPRBT-PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in PRBT vessel	Use TC value
IGNPRFT-PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in PRFT vessel	Use TC value
IGNPVVH-PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in PVVH	Use TC value
IGNSME--PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in SME vessel	Use TC value
IGNSPC--PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in SPC	Use TC value
IGNSPT--PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in SPT vessel	Use TC value
IGNSRAT-PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in SRAT	Use TC value
INKSRLFLBYP5#	1	1N 4.6E-04N	4.60E-04N	SRAT high LFL interlock bypassed	Use TC value
JMP-HTR-CCAS+	4	4H 1.0E-09H	4.00E-09	CC: TWO FUSES FOR LID HEATERS FAIL	a: detected in 1 shift
JMP-HTRABFLS+	4	4H 1.0E-08H	4.00E-08	FUSE FOR LID HEATER A FAILS	a: detected in 1 shift
JMP-HTRBBFLS+	4	4H 1.0E-08H	4.00E-08	FUSE FOR LID HEATER B FAILS	a: detected in 1 shift
JMP-HTRCBFLS+	4	4H 1.0E-08H	4.00E-08	FUSE FOR LID HEATER C FAILS	a: detected in 1 shift
JMP-HTRDBFLS+	4	4H 1.0E-08H	4.00E-08	FUSE FOR LID HEATER D FAILS	a: detected in 1 shift
JMP-SPC-LKS1+	4	43H 2.0E-05H	8.59E-04	SPC jumper leak - benzene leaks onto SPC floor	a: corrected before next batch
LCV2220AFCLG+	4	8H 5.0E-07H	4.00E-06	Steam generator cond. level control valve A fails closed	Estimated 8 hour resotration time
LCV2220BFCLG+	4	8H 5.0E-07H	4.00E-06	Steam generator cond. level control valve B fails closed	Estimated 8 hour resotration time
LE-2220-CALG+	4	1Q 2.3E-04H	3.34E-01	Steam generator condensate level transmitter is calibrated	a: calibrated twice/year
LE-2220-FHIG+	4	8H 5.0E-07H	4.00E-06	Steam generator condensate level transmitter fails high	Estimated 8 hour resotration time
LE-2262-FLOG#	3	8H 5.0E-07H	4.00E-06	LEVEL SENSOR/SWITCH FAILS (FALSE LOW SIGNAL)	a: 8 hours to repair
LE-5925-FLOG#	5	1Y 5.0E-07H	2.19E-03	SPC sump level element fails low	a: checked annually
LPWST-LPBFLH+	4	8.5H 8.0E-04Y	7.76E-07	FAILURE TO SUPPLY POWER TO GRID FROM ON-SITE AND OFF-SITE SOURCES	DWPF SAR 9.3.18

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Event	C	Input	Calc.	Description	Source
LSL4033XFTC1#	5	2D 1.0E-06H	2.40E-05	CO2 tank low level switch fails to close	a: failure detected in 48 hours
LSL7863-FTC3#	3	1Q 1.0E-06H	2.18E-03	Low N2 tank level switch fails to close	a: Checked 2/yr
MOV1041-FCLK+	4	8H 3.0E-07H	2.40E-06	SPC/PVVH isolation valve 1041 fails closed	a: returned to open in 8 hours
MOV1041-FTCK#	1	1N 3.0E-03N	3.00E-03N	SPC/PVVH isolation valve MOV-1041 fails to close	Use TC value
MOV1100-FTCK#	1	1N 3.0E-03N	3.00E-03N	PRFT to PR transfer valve fails to close	Use TC value
MOV1131-ADJ6+	4	1H 1.0E+00Q	4.59E-04	PRCD cleaned (drain valve opened)	a: valve remains open 1 hour, quarterly
MOV1131-FTCK#	1	1N 3.0E-03N	3.00E-03N	PRC/D drain valve fails to close	Use TC value
MOV1131-LKS6+	4	24H 1.0E-06H	2.40E-05	PRCD drain valve leaks (benzene to PR)	a: detected and repaired in 24 hours
MOV5862-FCLD+	4	1D 3.0E-07H	7.20E-06	PVVH primary fan suction valve fails closed	a: repaired in 24 hours
MOV5864-FTOD#	1	1N 3.0E-03N	3.00E-03N	PVVH standby fan suction valve fails to open	Use TC value
MOV9278-FCLK+	4	8H 3.0E-07H	2.40E-06	SPC/PVVH isolation valve 9278 fails closed	a: returned to open in 8 hours
MOV9278-FTCK#	1	1N 3.0E-03N	3.00E-03N	SPC/PVVH isolation valve MOV-9278 fails to close	Use TC value
N2-CPCBPT&M1#	3	24H 1Y	2.74E-03	CPC backup purge system out of service for T&M	a: system shutdown in 24 hours
N2-CYL--USD1#	5	7D 1Y	9.53E-03	LPPP local N2 bottles empty	a: used at primary failure rate, refilled in 1 week
N2-LPPP-T&M1#	3	14D 1Y	3.76E-02	LPPP local N2 system out of service for T&M	a: 2 weeks/year
N2-OWST-T&M1#	3	14D 1Y	3.76E-02	OWST local liquid N2 system out of service for T&M	a: 14 days per year
N2-TRUCKBFL1#	1	1N 1.0E-02N	1.00E-02N	N2 delivery fails to arrive at DWPF	estimated
OFV-018-FOPP+	4	24H 5.0E-09H	1.20E-07	Overflow (inner to outer tank) fails open	a: 24 hours to repair
OPR--5B-LOHH#	1	1.8E-04N 5.0E-03N	9.00E-07N	OPERATOR FAILS TO REMOVE LOCKOUT ON FEEDER BREAKER 5B	1/5YRS * 16H/2 (WMS)
OPR--A1-LOHH#	1	1.8E-04N 5.0E-03N	9.00E-07N	OPERATOR FAILS TO REMOVE LOCKOUT ON BUS A1	1/5YRS * 16H/2 (WMS)
OPR--PT-MCHR#	1	1N 3.0E-02N	3.00E-02N	OPERATOR MISCALIBRATES PRESSURE TRANSMITTERS (OUT OF RANGE)	Use TC
OPR-2262MCHG#	1	2.5E-01N 3.0E-02N	7.50E-03N	OPERATOR MISCALIBRATES LEVEL SENSOR/SWITCH	1/yr * 0.5y/2
OPR-A201LOHH#	1	1.8E-04N 5.0E-03N	9.00E-07N	OPERATOR FAILS TO REMOVE LOCKOUT ON TIE BREAKER A201	1/5YRS * 16H/2 (WMS)
OPR-A202LOHH#	1	1.8E-04N 5.0E-03N	9.00E-07N	OPERATOR FAILS TO REMOVE LOCKOUT ON FEEDER BREAKER A202	1/5YRS * 16H/2 (WMS)

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Event	C	Input	Calc.	Description	Source
AE--RAD-BFLG#	3	8H 5.0E-06H	4.00E-05	COOLING TOWER RADIATION MONITOR FAILS	a: 8 hours to repair
AE-2898-BFLG#	3	8H 5.0E-06H	4.00E-05	PROCESS CONDENSATE LINE RADIATION MONITOR FAILS	a: 8 hours to repair
AE-3405-FLOK#	5	43H 5.0E-06H	1.07E-04	SCVC O2 concentration analyzer 3405 fails low	checked once/cycle (43 hrs)
AE-3409-FLOK#	5	43H 5.0E-06H	1.07E-04	SCVC O2 concentration analyzer 3409 fails low	checked once/cycle (43 hrs)
AE-6852-BFLQ#	5	8H 1.0E-05H	4.00E-05	OXYGEN ANALYZING ELEMENT 6852 FAILS	a: 8 hours to repair
AE-68523CCAQ#	5	8H 1.0E-06H	4.00E-06	COMMON CAUSE FAILURE OF OXYGEN ANALYZING ELEMENTS 6852 AND 6853	a: 8 hrs to repair
AE-6853-BFLQ#	5	8H 1.0E-05H	4.00E-05	OXYGEN ANALYZING ELEMENT 6853 FAILS	a: 8 hours to repair
AE-9233-BFLP#	5	168H 5.0E-06H	4.20E-04	O2 Sensor Fails	OSR 3.1.2, SR 4.1.2.2, weekly functional test
AE-DWPF1CCLU#	5	86H 5.0E-07H	2.15E-05	CC: two analyzers in DWPF fail low - batch #1	a: functionally tested each batch
AE-DWPF2CCLU#	5	86H 5.0E-07H	2.15E-05	CC: two analyzers in DWPF fail low - batch #2	a: functionally tested each batch
AE-DWPFOCCLU#	5	86H 5.0E-07H	2.15E-05	CC: two analyzers in DWPF fail low	a: functionally tested each batch
AE-SRTC-CCLU#	5	86H 5.0E-07H	2.15E-05	CC: two analyzers at tank farm fail - false low reading	a: functionally tested each batch
AEG3407-FLO5#	5	86H 5.0E-05H	2.15E-03	PVVH benzene analyzer 3407 element fails low (LEL)	a: checked every batch
AEG3407-LKS5#	3	1Q 7.5E-07H	1.63E-03	Air inleakage in PVVH benzene analyzer 3407	a:checked twice/year
AEG3408-FLO5#	5	86H 5.0E-05H	2.15E-03	PVVH benzene analyzer 3408 element fails low (LEL)	a: checked every batch
AEG3408-LKS5#	3	1Q 7.5E-07H	1.63E-03	Air inleakage in PVVH benzene analyzer 3408	a:checked twice/year
AEG8795-FLO5#	5	86H 5.0E-05H	2.15E-03	SRAT offgas detector #1 analyzer element fails low (LEL)	a: checked every batch
AEG8795-LKS5#	5	.5Y 7.5E-07H	1.64E-03	Air inleakage in SRAT offgas detector #1 sample line	a:checked twice/year
AEG8796-FLO5#	5	86H 5.0E-05H	2.15E-03	SRAT offgas detector #2 analyzer element fails low (LEL)	a: checked every batch
AEG8796-LKS5#	3	1Q 7.5E-07H	1.63E-03	Air inleakage in SRAT offgas detector #2 sample line	a:checked twice/year
AEG8797-FLOD#	5	86H 5.0E-05H	2.15E-03	SME LFL analyzer 8797 fails low	a: checked every batch
AEG8797-LKS4#	5	.5Y 7.5E-07H	1.64E-03	Air inleakage in SME detector 8797 sample line	a: checked twice/year
AEG8798-FLOD#	5	86H 5.0E-05H	2.15E-03	SME hydrogen detector 2 (8798) fails low	a: checked every batch
AEG8798-LKS4#	5	.5Y 7.5E-07H	1.64E-03	Air inleakage in SME detector 8798 sample line	a: checked twice/year

Event	C	Input	Calc.	Description	Source
AEGSRAT-LKS5#	5	.5Y 7.5E-07H	1.64E-03	Air inleakage in SRAT sampling line (common to both detectors)	a: checked twice/year
AX-8795-BFL5#	3	43H 3.0E-05H	1.29E-03	SRAT %LFL calculation switch failure	
AX-8797-BFL4#	3	1Q 3.0E-05H	6.33E-02	SME %LFL calculation and switch failure	a:checked twice/year
BCHSRAT-DBL5#	1	1N 1.0E-01N	1.00E-01N	SRAT process uses double batch of PHA	Use TC value
BCHSRAT-PRE5+	4	86H 1.2E-02H	5.08E-01	SRAT batch processed	a: 86 hour batches
BKR--5A-FOPH+	4	8.5H 3.0E-07H	2.55E-06	FAILURE OF 13.8-kV FEEDER BREAKER 5A - SPURIOUSLY OPENS	DWPF SAR 9.3.18
BKR--5B-CCEN#	1	1N 5.0E-05N	5.00E-05N	CC: BOTH DIESEL GENERATOR SUPPLY BREAKERS FAIL TO CLOSE	Use TC
BKR--5B-FOPH+	4	8.5H 3.0E-07H	2.55E-06	FAILURE OF 13.8-kV FEEDER BREAKER 5B - SPURIOUSLY OPENS	DWPF SAR 9.3.18
BKR-12--CCBR#	5	8H 3.0E-08H	1.20E-07	CC: TWO FAN BREAKERS FAIL OPEN	a: 8 hours to repair
BKR-123-C3DR#	5	8H 1.5E-08H	6.00E-08	CC: THREE FAN BREAKERS FAIL OPEN	a: 8 hours to repair
BKR-1234C3DR#	5	8H 1.5E-08H	6.00E-08	CC: FOUR FAN BREAKERS FAIL OPEN	a: 8 hours to repair
BKR-5A5BCCBH+	4	8.5H 3.0E-08H	2.55E-07	CC: FAILURE OF 13.8-kV FEEDER BREAKERS 5A/5B - SPURIOUSLY OPENS	DWPF SAR 9.3.18
BKR-A101FOPH+	4	8.5H 3.0E-07H	2.55E-06	FAILURE OF 13.8-kV FEEDER BREAKER A101 - SPURIOUSLY OPENS	DWPF SAR 9.3.18
BKR-A201FOPH+	4	8.5H 3.0E-07H	2.55E-06	FAILURE OF 13.8-kV TIE BREAKER A201 - SPURIOUSLY OPENS	DWPF SAR 9.3.18
BKR-A202FOPH+	4	8.5H 3.0E-07H	2.55E-06	FAILURE OF 13.8-kV FEEDER BREAKER A202 - SPURIOUSLY OPENS	DWPF SAR 9.3.18
BKR-HTR-CCBS+	4	4H 3.0E-08H	1.20E-07	CC: TWO LID HEATER CIRCUIT BREAKERS FAIL - SPURIOUSLY OPEN	a: detected in 1 shift
BKR-HTRAFOPS+	4	4H 3.0E-07H	1.20E-06	LID HEATER A CIRCUIT BREAKER FAILS - SPURIOUSLY OPENS	a: detected in 1 shift
BKR-HTRBFOPS+	4	4H 3.0E-07H	1.20E-06	LID HEATER B CIRCUIT BREAKER FAILS - SPURIOUSLY OPENS	a: detected in 1 shift
BKR-HTRCFOPS+	4	4H 3.0E-07H	1.20E-06	LID HEATER C CIRCUIT BREAKER FAILS - SPURIOUSLY OPENS	a: detected in 1 shift
BKR-HTRDFOPS+	4	4H 3.0E-07H	1.20E-06	LID HEATER D CIRCUIT BREAKER FAILS - SPURIOUSLY OPENS	a: detected in 1 shift
BKR-SB--FOPR#	5	8H 3.0E-07H	1.20E-06	STANDBY FAN BREAKER FAILS OPEN	a: 8 hours to repair
BKR00001FOPR#	5	8H 3.0E-07H	1.20E-06	FAN #1 BREAKER FAILS OPEN	a: 8 hours to repair
BKR00002FOPR#	5	8H 3.0E-07H	1.20E-06	FAN #2 BREAKER FAILS OPEN	a: 8 hours to repair
BKR00003FOPR#	5	8H 3.0E-07H	1.20E-06	FAN #3 BREAKER FAILS OPEN	a: 8 hours to repair

Event	C	Input	Calc.	Description	Source
BKR1/200CCBN#	3	8.5H 3.0E-08H	2.55E-07	CC: BOTH DIESEL GENERATOR SUPPLY BREAKERS TRANSFER OPEN	DWPF SAR 9.3.18
BKRA1-A2CCBH+	4	8.5H 3.0E-08H	2.55E-07	CC: FAILURE OF 13.8-kV FEEDER BREAKERS A101/A202 - SPURIOUSLY OPEN	DWPF SAR 9.3.18
BKRB102BFTON#	1	1N 5.0E-04N	5.00E-04N	NORMAL POWER BREAKER B10-2B FAILS TO OPEN	Use TC
BKRB105BFOPN#	3	8.5H 3.0E-07H	2.55E-06	SUPPLY BREAKER B10-5B TRANSFERS OPEN	DWPF SAR 9.3.18
BKRB105BFTCN#	1	1N 5.0E-04N	5.00E-04N	SUPPLY BREAKER B10-5B FAILS TO CLOSE	Use TC
BKRB9-2BFTON#	1	1N 5.0E-04N	5.00E-04N	NORMAL POWER BREAKER B9-2B FAILS TO OPEN	Use TC
BKRB9-5BFOPN#	3	8.5H 3.0E-07H	2.55E-06	SUPPLY BREAKER B9-5B TRANSFERS OPEN	DWPF SAR 9.3.18
BKRB9-5BFTCN#	1	1N 5.0E-04N	5.00E-04N	SUPPLY BREAKER B9-5B FAILS TO CLOSE	Use TC
BKRB9B10CCDN#	1	1N 5.0E-05N	5.00E-05N	CC: NORMAL POWER BREAKERS B9-2B AND B10-2B FAIL TO OPEN	Use TC
BKRSRATSFOPD#	3	8H 3.0E-07H	2.40E-06	SRAT offgas sample pump circuit breaker fails open	a: closed in 8 hours
BNZ-XFR-PREP+	4	1H 2.3E-02H	2.25E-02	Benzene transferred to OWST	Transfer lasts one hour
BNZOEHOTPREP#	3	2H 2.3E-02H	4.50E-02	Benzene being boiled off in OE	a: 2 hours per batch
BNZPRHOTPREP#	3	16H 2.3E-02H	3.08E-01	Hot benzene present in PR	a: 16 hours per batch
BOTCO2B-REP1#	5	1M 6.7E-05H	2.37E-02	Bottles were used since last refilling	a: Refilled in 1 month
BOTCO2B-T&M1#	3	7D 1Y	1.90E-02	SPC backup CO2 bottles isolated for maintenance	a: isolated annually, error corrected in 1 week
BOTCO2B1T&M1#	3	7D 1Y	1.90E-02	SPC backup CO2 bottle 1 isolated for maintenance	a: isolated annually, error corrected in 1 week
BOTCO2B2T&M1#	3	7D 1Y	1.90E-02	SPC backup CO2 bottle 2 isolated for maintenance	a: isolated annually, error corrected in 1 week
BOTCO2B3T&M1#	3	7D 1Y	1.90E-02	SPC backup CO2 bottle 3 isolated for maintenance	a: isolated annually, error corrected in 1 week
BOTCO2B4T&M1#	3	7D 1Y	1.90E-02	SPC backup CO2 bottle 4 isolated for maintenance	a: isolated annually, error corrected in 1 week
BUS--A1-BFLH+	4	8.5H 1.0E-07H	8.50E-07	FAILURE OF 13.8-kV BUS A1	DWPF SAR 9.3.18
BUS--A1-UNAH#	1	1N 3.8E-02N	3.80E-02N	BUS A1 UNAVAILABLE DUE TO TESTING/MAINTENANCE	Use TC
BUS--A2-BFLH+	4	8.5H 1.0E-07H	8.50E-07	FAILURE OF 13.8-kV BUS A2	DWPF SAR 9.3.18
BUSA1-A2CCAH+	4	8.5H 1.0E-08H	8.50E-08	CC: FAILURE OF 13.8-kV BUSSES A1 AND A2	DWPF SAR 9.3.18
CC2-AIR-DRY1+	4	8H 5.0E-08H	4.00E-07	cc: both air dryers fail	a: 0.1 X single rate, repiared in 8 hours

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Event	C	Input	Calc.	Description	Source
CC2-AIR-PT-1#	5	48H 1.0E-07H	2.40E-06	cc: both instrument air PTs fail high	a: 0.1 X single rate, repaired in 2 days
CC2-CPC-CMP2+	4	7D 5.0E-06H	8.39E-04	CC: Both CPC purge compressors fail	a: repaired in 1 week
CC2-MFT-FE-7#	3	1M 3.0E-07H	2.16E-04	CC: Both MFT purge flow elements fail high	a: .1 x single rate, repaired in 1 month
CC2-MFT-FE-7+	4	1M 3.0E-07H	2.16E-04	CC: Both MFT purge flow elements fail high	a: .1 x single rate, repaired in 1 month
CC2-PSW-PMPG#	3	8H 3.0E-06H	2.40E-05	cc: both PSW pumps fail	a: 0.1 X single rate, repaired in 8 hours
CC2-SME-H2-1#	5	1M 5.0E-06H	1.80E-03	cc: both SME hydrogen detectors fail low or miscalibrated	a: 0.1 X single failure + 0.5 X miscalibration
CC2-SPC-PCV1#	1	1N 3.0E-04N	3.00E-04N	cc: PR and PRFT vacuum breakers fail to open	a: 0.1 x single probability
CC2-VAP-PSV1+	4	4H 1.0E-06H	4.00E-06	cc: PSVs on primary and backup vaporizer fail open	a: 0.1 X single rate
CC2BENZ-AEG1#	5	1M 5.0E-06H	1.80E-03	cc: both PVVH benzene detectors fail low	a: 0.1 x single rate + 0.5 x miscalibration
CC2CHILLCHL1+	4	8H 5.0E-06H	4.00E-05	cc: both chillers fail	a: 0.1 * single failure rate
CC2CPCBPCV-J#	1	1N 5.0E-05N	5.00E-05N	cc: both check valves on CPC backup purge system fail to open	a: 0.1 times single failure
CC2CPCBPPCVJ#	1	1N 3.0E-04N	3.00E-04N	CC: both CPC backup purge PCVs fail to open	CC: = 0.1 x single failure rate
CC2CTW--FAN1+	4	7D 3.0E-06H	5.04E-04	cc: two fans fail	a: 0.1 X single rate, 1 week to repair
CC2DEEP-DG-1#	1	1N 3.0E-03N	3.00E-03N	Both deep well pumps (or diesel motors) fail to start or run	a: 0.1 X single probability
CC2LPPN2CV-J#	1	1N 5.0E-05N	5.00E-05N	cc: both LPPP N2 check valves fail to close	a: 0.1 times single failure rate
CC2LPPN2PCVJ#	1	1N 3.0E-04N	3.00E-04N	cc: both LPPP N2 bottle PCVs fail to open	a: failure = 0.1 x single probability
CC2LPPV-FAN1+	4	1H 3.0E-06H	3.00E-06	CC: both LPPP VVS fans fail	CC: rate of 1 failing x .1
CC2MAINTHCV1#	5	1M 5.0E-08H	1.80E-05	cc: both PR steam valves miscalibrated	a: corrected in 1 month
CC2OWST-PCVN#	1	1N 3.0E-04N	3.00E-04N	cc: both PCVs on OWST liquid N2 supply system fail to open	a: failure = 0.1 x single rate
CC2OWST-PT-1#	5	1Y 1.0E-07H	4.38E-04	cc: OWST pressure monitors both fail high	a: 0.1 X single rate, corrected in 1 year
CC2PRBT-FE-7#	3	1M 3.0E-07H	2.16E-04	cc: both PRBT flow elements fail high	a: 0.1 x single rate, repaired in 1 month
CC2PRBT-FE-7+	4	1M 3.0E-07H	2.16E-04	cc: both PRBT flow elements fail high	a: .1 x single rate, repaired in 1 month
CC2PURGESPCK#	1	1N 1.0E-04N	1.00E-04N	CC: both SPC purge supply isolation valves fail to close	0.1 x single failure
CC2PVVH-FAN1+	4	8H 3.0E-06H	2.40E-05	cc: both PVVH fans fail	a: 0.1 X single rate, corrected in 8 hours

Event	C	Input	Calc.	Description	Source
CC2PVVH-FE-7#	3	1M 3.0E-07H	2.16E-04	cc: both PVVH flow elements fail high	a: 0.1 x single rate, repaired in 1 month
CC2PVVH-MOV1#	1	1N 3.0E-04N	3.00E-04N	cc: both SPC/PVVH isolation valves fail to close	a: 0.1 x single rate
CC2SBSWTRMNN#	1	4.3E-02N 5.0E-03N	2.15E-04N	CC: FAIL TO RESTORE DIESELS TO STANDBY FOLLOWING MAINTENANCE	1/YR * 31D/2 (FROM OSR 3.5.1)
CC2SCVC-02-K#	1	1N 5.0E-04N	5.00E-04N	CC: Both SCVC O2 detectors fail high	Use TC value
CC2SPCN2PCVN#	1	1N 3.0E-04N	3.00E-04N	CC: both SPC N2 PCVs fail to open	a: rate = 0.1 x single failure rate
CC2SPCN2RTH1#	1	.12N 3.0E-03N	3.60E-04N	cc: both SPC N2 addition needle valves closed	a: 0.1 x single probability, closed 1/year, checked 4/year
CC2SPCN2SV-N#	1	1N 1.0E-04N	1.00E-04N	CC: both SPC N2 HCVs fail to open	a: rate = 0.1 times single failure rate
CC2SPCN3PCVN#	1	1N 3.0E-04N	3.00E-04N	CC: both SPC N2 low pressure PCVs fail to open	a: rate = 0.1 x single failure rate
CC2SPCP-PT-K#	5	7D 1.0E-07H	8.40E-06	CC: both SPC pressure monitors fail high	a: 0.1 X single rate, corrected in 1 week
CC2SPCPPLSL1#	1	1N 3.0E-03N	3.00E-03N	cc: low level and low pressure switches miscalibrated	a: 0.1 X miscalibration rate
CC2SPCV-MOVK#	1	1N 3.0E-04N	3.00E-04N	cc: both SCVC exit valves fail to close	a: 0.1 x single rate
CC2SPTN2LINJ#	1	1N 4.1E-04N	4.10E-04N	cc: both SPT N2 supply lines fail	a: single rate x 0.1
CC2SRAT-LFL5#	5	1M 5.0E-06H	1.80E-03	cc: both SRAT LFL detectors fail low	a: 0.1 x single failure rate + 0.5 x miscalibration
CC2SRAT-SMP6#	1	1N 3.0E-05N	3.00E-05N	Common cause: PR and PRBT samples inadequate	a: .5 X single failure
CC2STEAMHCV1+	4	4H 5.0E-08H	2.00E-07	cc: both PR steam supply valves fail open	a: 0.1 X single rate, corrected in 4 hours
CC2STEAMPMPG+	4	8H 3.0E-06H	2.40E-05	CC: both steam condensate pumps fail	a: both fail at 0.1 times single rate
CC3-CTW-PMP1+	4	4H 1.5E-06H	6.00E-06	cc: CTW pumps fail	a: 0.05 X single failure rate (process shutdown in 4 hours)
CC3-SME-FSL4#	1	1N 1.1E-04N	1.10E-04N	CC: all 3 SME offgas sample flow low switches fail to open	use 0.05 x single failure rate
CC3-SPC-FE-1#	3	7D 1.5E-07H	2.52E-05	cc: SPC purge flow elements fail to detect SPC purge loss	a: 0.05 X single FE failure rate, corrected in 1 week
CC3CO2B-REG1#	5	48H 1.5E-07H	3.60E-06	CC: All 4 bottles pressure regulators fail to open	a: detected and repaired in 48 hours
CC3CO2B-RMH1#	1	1N 2.5E-03N	2.50E-03N	cc: fail to open block valve after maintenance (all bottles)	Use TC Value
CC3MAINTFSL1#	1	.2N 1.5E-03N	3.00E-04N	cc: all 3 SME low flow switches miscalibrated	a: 0.05 X miscalibration, corrected in 1 month
CC3SRAT-FSLD#	1	1N 1.1E-04N	1.10E-04N	CC: all 3 SRAT offgas flow monitors fail to close	single failure X .05
CHLBACK-FTRE#	3	8H 5.0E-05H	4.00E-04	Backup chiller fails to run	a: 8 Hours to repair

Event	C	Input	Calc.	Description	Source
CHLBACK-FTSE#	1	1N 5.0E-03N	5.00E-03N	Backup chiller fails to start	Use TC value
CHLBACK-T&ME#	3	8H 4.0E+00Y	3.65E-03	Backup chiller unavailable due to T&M	a: out of service for 8 hours
CHLPRIM-BFLE+	4	8H 5.0E-05H	4.00E-04	Primary chiller fails	a: 8 Hours to repair
CMPAIR1-BFLV+	4	24H 5.0E-05H	1.20E-03	Primary plant/instrument air compressor fails	a: 24 hour repair time
CMPAIR2-FTRV+	4	24H 5.0E-05H	1.20E-03	Secondary plant / instrument air compressor fails	a: repaired in 24 hours
CMPAIR3-FTRV#	3	48H 5.0E-05H	2.40E-03	Third plant / instrument air compressor fails to run	a: mission time = 48 hours
CMPAIR3-FTSV#	1	1N 5.0E-03N	5.00E-03N	Third plant / instrument air compressor fails to start	Use TC value
CMPAIR3-T&MV#	3	27D 1Y	7.13E-02	Standy compressor out of service for T&M	a: 9 days per year (times 3)
CMPCPC1-BFL2+	4	8H 5.0E-05H	4.00E-04	Operating purge air compressor fails	a: 8 hour repair time
CMPCPC2-FTR2#	3	96H 5.0E-05H	4.79E-03	Standby purge air compressor fails to run	a: max repair time for primary compressor is 96 hours
CMPCPC2-FTS2#	1	1N 5.0E-03N	5.00E-03N	Standby purge air compressor fails to start	Use value from TC file
CMPCPC2-T&M2#	1	1N 3.0E-02N	3.00E-02N	Standby purge air compressor out of service for testing or maintenance	Use TC value
CMPINAIRC3CV+	4	24H 2.5E-06H	6.00E-05	CC: three plant/instrument air compressors fail	a: 24 hour repair time
CND-026-LKSG#	3	8H 1.0E-07H	8.00E-07	COIL LEAK EXISTS IN PROCESS STEAM CONDENSATE COOLER	a: 8 hours to repair
CO2BOTTLCHK1#	3	7D 3.0E-04H	4.92E-02	Fail to correct wrong bottles before system used	a: detected in one week
CON--OE-PREG#	1	1N 1.0N	1.00E+00N	CONTAMINATION PROBABILITY GIVEN COIL LEAK	a: contamination occurs
CON--PR-PREG#	1	1N 1.0N	1.00E+00N	CONTAMINATION PROBABILITY GIVEN COIL LEAK	a: contamination occurs
CON-SME-PREG#	1	1N 1.0N	1.00E+00N	CONTAMINATION PROBABILITY GIVEN COIL LEAK	a: contamination occurs
CONDWTT-PREG#	1	1N 1.0N	1.00E+00N	CONTAMINATION PROBABILITY GIVEN COIL LEAK	a: contamination occurs
CONSRAT-PREG#	1	1N 1.0N	1.00E+00N	CONTAMINATION PROBABILITY GIVEN COIL LEAK	a: contamination occurs
CP--TF--CC-U#	1	1N 2.0E-01N	2.00E-01N	Same analyst conducts sampling at tanks 48 & 49	Use TC
CP-BATCHCC1U#	1	1N 2.0E-01N	2.00E-01N	Same personnel conduct sampling at SRAT for batch #2	
CP-DWPF1CC1U#	1	1N 2.0E-01N	2.00E-01N	Same personnel conduct sampling from SRAT to SME for batch #1	Use TC
CP-DWPF2CC1U#	1	1N 2.0E-01N	2.00E-01N	Same personnel conduct sampling from SRAT to SME for batch #2	Use TC

Event	C	Input	Calc.	Description	Source
CP-DWPFOCC1U#	1	1N 2.0E-01N	2.00E-01N	Same personnel conduct sampling from SRAT to SME	Use TC
CV-2362-FTOF#	1	1N 5.0E-05N	5.00E-05N	PSW secondary pump discharge check valve fails to open	a: 8 hour restoration time
CV-9145-FTOO#	1	1N 5.0E-05N	5.00E-05N	CTW pump #2 (50%) discharge check valve fails to open	Use TC value
CV-9147-FTOO#	1	1N 5.0E-05N	5.00E-05N	CTW pump #4 (25%) discharge check valve fails to open	Use TC value
CV-CPCB1FTOJ#	1	1N 5.0E-04N	5.00E-04N	CPC backup purge check valve 1 fails to open	Use TC value
CV-CPCB2FTOJ#	1	1N 5.0E-04N	5.00E-04N	CPC backup purge check valve 2 fails to open	Use TC value
CV-CPCB3FTCJ#	1	1N 5.0E-04N	5.00E-04N	CPC primary to backup purge check valve fails to close	Use TC value
CV-DXXX-FTCJ#	1	1N 5.0E-04N	5.00E-04N	LPPP N2 check valve DXXX fails to close	Use TC value
CV-DXXY-FTCJ#	1	1N 5.0E-04N	5.00E-04N	LPPP N2 check valve DXXY fails to close	Use TC value
CV-MAIN-FCLG+	4	8H 5.0E-07H	4.00E-06	Check valve on steam condensate supply to generator fails closed	a: Detected and repaired or process shut down in 8 hours
CV-OE---FTCJ#	1	1N 5.0E-04N	5.00E-04N	Check valve to SPC CO2 through OE line fails to close	Use TC value
CV-OECT-FTCJ#	1	1N 5.0E-04N	5.00E-04N	Check valve to SPC CO2 through OECT line fails to close	Use TC value
CV-PMP1-FCLG+	4	8H 5.0E-07H	4.00E-06	Check valve on primary pump fails closed	a: Detected and repaired or process shut down in 8 hours
CV-PMP2-FTOG#	1	1N 5.0E-05N	5.00E-05N	Check valve on secondary pump fails to open	Use TC value
CV-PR---FTOJ#	1	1N 5.0E-04N	5.00E-04N	Check valve for PR vacuum breaker purge supply fails to open	Use TC value
CV-PR1--FTCJ#	1	1N 5.0E-04N	5.00E-04N	Check valve to SPC CO2 through PR high flow line fails to close	Use TC value
CV-PR2--FTCJ#	1	1N 5.0E-04N	5.00E-04N	Check valve to SPC CO2 through PR low flow line fails to close	Use TC value
CV-PRFT-FTCJ#	1	1N 5.0E-04N	5.00E-04N	Check valve to SPC CO2 through PRFT line fails to close	Use TC value
CV-PRFT-FTOJ#	1	1N 5.0E-04N	5.00E-04N	PRFT vacuum breaker CO2 line check valve fails to open	Use TC value
CYLOWST-OUTP#	1	1N 3.6E-01N	3.60E-01N	Backup OWST N2 cylinders run out before primary N2 restored	a: supply capacity less than restoration time
DCS-----BFL2#	5	8H 3.0E-06H	1.20E-05	DCS FAILS (EXCL. POWN AND POWD EVENTS)	a: 8 hours repair time
DCS--EP-BFLE#	5	14D 3.0E-06H	5.04E-04	DCS FAILS (EXCLUDING POWN AND POWD EVENTS)	a: 14 days repair time
DG-1/200CCCN#	1	1N 1.0E-03N	1.00E-03N	CC: BOTH DIESEL GENERATORS FAIL TO START	Use TC
DG-1/200CCDN#	3	8.5H 5.0E-04H	4.24E-03	CC: BOTH DIESEL GENERATORS FAIL TO REMAIN RUNNING	DWPF SAR 9.3.18

Event	C	Input	Calc.	Description	Source
DG-DEEP1FTRO#	3	4H 5.0E-03H	1.98E-02	Primary deep well system diesel fails to run	a: 4 hour mission time
DG-DEEP1FTSO#	1	1N 1.0E-02N	1.00E-02N	Primary deep well system diesel fails to start	Use TC value
DG-DEEP2FTRO#	3	4H 5.0E-03H	1.98E-02	Secondary deep well system diesel fails to run	a: 4 hour mission time
DG-DEEP2FTSO#	1	1N 1.0E-02N	1.00E-02N	Secondary deep well system diesel fails to start	Use TC value
DG-DEEP2T&MO#	1	1N 5.0E-02N	5.00E-02N	Secondary deep well system pump/diesel out for T&M	Use TC value
DG-G100-FTRN#	3	8.5H 5.0E-03H	4.16E-02	DIESEL GENERATOR G100 FAILS TO REMAIN RUNNING	DWPF SAR 9.3.18
DG-G100-FTSN#	1	1N 1.0E-02N	1.00E-02N	DIESEL GENERATOR G100 FAILS TO START	Use TC
DG-G100-UNAN#	1	1N 4.4E-02N	4.40E-02N	DIESEL GENERATOR G100 UNAVAILABLE DUE TO MAINTENANCE	E-T/M article
DG-G200-FTRN#	3	8.5H 5.0E-03H	4.16E-02	DIESEL GENERATOR G200 FAILS TO REMAIN RUNNING	DWPF SAR 9.3.18
DG-G200-FTSN#	1	1N 1.0E-02N	1.00E-02N	DIESEL GENERATOR G200 FAILS TO START	Use TC
DMP--SB-FTOR#	1	1N 3.0E-03N	3.00E-03N	STANDBY FAN EXHAUST DAMPER FAILS TO OPEN	Use TC
DMP--W--CCBR#	1	1N 3.0E-04N	3.00E-04N	CC: FOUR FAN EXHAUST DAMPERS FAIL TO OPEN	Use TC
DMP8154-FCLT#	3	8H 3.0E-06H	2.40E-05	LPP VVH secondary fan suction damper fails closed	OSR 3.2.1, SR 4.2.1.4, checked shiftly
DMP8155-FCLT+	4	8H 3.0E-06H	2.40E-05	LPP VVH primary fan suction damper fails closed	OSR 3.2.1, SR 4.2.1.4, checked shiftly
DRYAIR2-T&MV#	3	40H 1Y	4.56E-03	Dryer #2 out of service for T&M	a: 20 hours per year (times 2)
EXP-GAS-PREQ#	1	1N 1.0N	1.00E+00N	EXPLOSIVE GAS PRESENT	Use TC
FAN-12--CCCR#	1	1N 5.0E-04N	5.00E-04N	CC: TWO FANS FAIL TO START (SAME BUS)	Use TC
FAN-12--CCDR#	5	7D 3.0E-06H	2.52E-04	CC: TWO RE-STARTED FAN LINES FAIL TO REMAIN RUNNING	a: 7 days to repair
FAN-123-C3CR#	5	7D 1.5E-06H	1.26E-04	CC: THREE FANS FAIL TO REMAIN RUNNING	a: 7 days to repair
FAN-123-C3FR#	1	1N 2.5E-04N	2.50E-04N	CC: THREE FANS FAIL TO START	Use TC
FAN-1234C3CR#	5	8H 1.5E-06H	6.00E-06	CC: FOUR FANS FAIL TO REMAIN RUNNING	a: 8 hours to repair
FAN-1234C3FR#	1	1N 2.5E-04N	2.50E-04N	CC: FOUR FANS FAIL TO START	Use TC
FAN-SB--FTRR#	5	7D 3.0E-05H	2.52E-03	STANDBY FAN FAILS TO REMAIN RUNNING	a: 7 days to repair
FAN-SB--UNAR#	1	1N 2.4E-02N	2.40E-02N	STANDBY FAN UNAVAILABLE DUE TO MAINTENANCE	Use TC

Event	C	Input	Calc.	Description	Source
FAN00001FTRR#	3	96H 3.0E-05H	2.88E-03	FAN #1 FAILS TO REMAIN RUNNING	a: 96 hr mission time (bounded by seismic event)
FAN00002FTRR#	5	7D 3.0E-05H	2.52E-03	FAN #2 FAILS TO REMAIN RUNNING	a: 7 days to repair
FAN00003FTRR#	5	3M 3.0E-05H	3.17E-02	FAN #3 FAILS TO REMAIN RUNNING	a: 3 months to repair
FAN00004FTSR#	1	1N 5.0E-03N	5.00E-03N	STANDBY FAN FAILS TO START	Use TC
FANCTW--ADJO#	1	1N 5.0E-01N	5.00E-01N	Forced convection required in cooling tower	Use TC value
FANCTW1-FTRO+	4	7D 3.0E-05H	5.01E-03	CTW tower fan 1 fails	a: detected and repaired in 1 week
FANCTW2-FTRO+	4	7D 3.0E-05H	5.01E-03	CTW tower fan 2 fails	a: detected and repaired in 1 week
FANCTW3-FTRO+	4	7D 3.0E-05H	5.01E-03	CTW tower fan 3 fails	a: detected and repaired in 1 week
FANLPPV1BFLT+	4	8H 3.0E-05H	2.40E-04	LPP VVH primary fan fails to run	OSR 3.2.1, SR 4.2.1.1, checked shiftly
FANLPPV2BFLT#	3	8H 3.0E-05H	2.40E-04	LPP VVH secondary fan fails to run	a: Primary fan repaired, or shutdown within 8 hours
FANLPPV2FTST#	1	1N 5.0E-03N	5.00E-03N	LPP VVH secondary fan fails to start	Use TC value
FANPVV1-BFLD+	4	24H 3.0E-05H	7.19E-04	Primary PVVH blower fails	a: 24 hours to repair
FANPVV2-BFLD#	3	1D 3.0E-05H	7.20E-04	PVVH backup fan fails to run	a: 24 hour mission time
FANPVV2-FTSD#	1	1N 5.0E-03N	5.00E-03N	Standby PVVH blower fails to start	Use TC value
FANPVV2-T&MD#	3	8H 4Y	3.65E-03	PVVH standby fan unavailable, due to testing or maintenance	a: out 8 hours per quarter
FCV0683-FCL7+	4	8H 1.0E-06H	8.00E-06	MFT purge supply valve fails closed	a: 8 hours to repair
FCV1027-FOP9+	4	86H 1.0E-06H	8.60E-05	PR steam supply valve FCV-1027 fails open	a: detected and corrected before next batch
FCV1893-ADJE+	4	1D 1.0Q	1.09E-02	Chilled water bypass valve required to open (no system flow)	a: demand lasts for 1 day
FCV1893-FTOE#	1	1N 1.0E-03N	1.00E-03N	Flow control valve for chilled water bypass fails to open	a: checked annually
FCV2044-FTC4#	1	1N 1.0E-03N	1.00E-03N	SME formic acid flow control valve fails to close	Use TC value
FCV2056-ADJI+	4	1H 2.3E-02H	2.25E-02	PR formic acid supply valve opened (1/43 hours)	a: valve remains open 1 hour
FCV2056-FOPI+	4	8H 1.0E-06H	8.00E-06	Formic acid addition valve to PR fails open	a: 8 hours to repair
FCV2369-ADJF#	1	1N 1.0E-03N	1.00E-03N	PSW bypass valve required to be open (no process flow)	Use TC value
FCV2369-FTOF#	1	1N 1.0E-03N	1.00E-03N	PSW bypass valve fails to open	a: checked annually

Event	C	Input	Calc.	Description	Source
FCV3000-FCL5+	4	8H 1.0E-06H	8.00E-06	Steam supply flow control valve FCV3000 fails closed	a: 8 hours to repair
FCV3000-FTCG#	5	86H 3.0E-06H	1.29E-04	SRAT steam supply valve fails to close	a: corrected before next batch
FCV3034-FCL2+	4	8H 1.0E-06H	8.00E-06	SRAT purge flow control valve fails closed	a: 8 hours to repair
FCV3080-FTC4#	1	1N 1.0E-03N	1.00E-03N	SME steam supply valve fails to close	Use TC value
FCV3216-ADJ6+	4	1H 2.3E-02H	2.25E-02	PRBT dilution flow control valve adjusted	a: detected within 1 hour
FCV3216-FCL6+	4	1H 1.0E-06H	1.00E-06	PRBT dilution supply valve fails closed	a: 1 hour to detect (low flow alarm) and shutdown
FCV8150-ADJ1+	4	7D 4.0E+00Y	7.12E-02	Flow through FCV 8150 adjusted	a: adjusted quarterly
FCV8150-FCLT+	4	1H 1.0E-06H	1.00E-06	LPP VVH flow control valve 8150 fails closed	a: responded to and shutdown or repaired within 1 hour
FCV8150-FOPT+	4	7D 1.0E-06H	1.68E-04	Low dilution because process cell flow control valve fails open	a: detected and corrected in 1 week
FCV8856-FCL4+	4	8H 1.0E-06H	8.00E-06	SME purge flow control valve fails closed	a: 8 hours to repair
FCV9152-FOPO+	4	8H 1.0E-06H	8.00E-06	Bypass valve fails open	Detected and corrected in 8 hours
FCV9301-FTC9#	1	1N 1.0E-03N	1.00E-03N	OE steam flow control valve fails to close	Use TC value
FE-0682-FHI7#	3	86H 3.0E-06H	2.58E-04	MFT purge flow element 0682 fails high	a: repaired before next batch
FE-0682-FHI7+	4	86H 3.0E-06H	2.58E-04	MFT purge flow element 0682 fails high	a: repaired before next batch
FE-0684-FHI7#	3	86H 3.0E-06H	2.58E-04	MFT purge flow element 0684 fails high	a: repaired before next batch
FE-0684-FHI7+	4	86H 3.0E-06H	2.58E-04	MFT purge flow element 0684 fails high	a: repaired before next batch
FE-1018-FHIE#	3	1M 3.0E-06H	2.16E-03	PRFT purge flow element 1018 fails to detect low flow	a: checked monthly
FE-1103-FHIE#	3	1M 3.0E-06H	2.16E-03	PR purge flow element 1103 fails to detect low flow	a: checked monthly
FE-1893-FHIE#	5	1Y 3.0E-06H	1.30E-02	Flow element for chilled water flow fails high	a: checked annually
FE-1893-FLOE+	4	8H 3.0E-06H	2.40E-05	Chilled water flow element 1893 fails low (stops pumps)	a: element repaired in 8 hours
FE-2369-FHIF#	3	8H 3.0E-06H	2.40E-05	PSW flow element fails high (closes CTW valve)	a: detected and repaired in 8 hours
FE-2369-FLOF#	3	8H 3.0E-06H	2.40E-05	PSW flow element fails low	a: detected and repaired in 8 hours
FE-3034-FHI2#	3	1Q 3.0E-06H	6.52E-03	SRAT purge flow element or transmitter fails high	a:checked twice/year
FE-3034-FHI2+	4	86H 3.0E-06H	2.58E-04	SRAT purge flow element fails high	a: detected and corrected before next batch

Event	C	Input	Calc.	Description	Source
FE-3215-FHI6#	3	86H 3.0E-06H	2.58E-04	PRBT dilution flow element 3215 fails high	Repaired before next batch
FE-3215-FHI6+	4	86H 3.0E-06H	2.58E-04	PRBT dilution flow element 3215 fails high	reparired before next batch
FE-3218-FHI6#	3	86H 3.0E-06H	2.58E-04	PRBT dilution flow element 3218 fails high	repaired before next batch
FE-3218-FHI6+	4	86H 3.0E-06H	2.58E-04	PRBT dilution flow element 3218 fails high	repaired before next batch
FE-5860-FLOK#	5	86H 3.0E-06H	1.29E-04	PVVH flow element FE-5860 fails low	a: corrected before next SRAT batch
FE-5860-FLOK+	4	8H 3.0E-06H	2.40E-05	PVVH flow element 5860 fails low	a: detected and corrected in 8 hours
FE-6041-FLOK#	5	86H 3.0E-06H	1.29E-04	PVVH flow element FE-6041 fails low	a: corrected by next SRAT batch
FE-6041-FLOK+	4	8H 3.0E-06H	2.40E-05	PVVH flow monitor 6041 fails low	a: detected and corrected in 8 hours
FE-8856-FHI4#	3	86H 3.0E-06H	2.58E-04	SME purge flow element fails high	a: repaired before next batch
FE-8856-FHI4+	4	86H 3.0E-06H	2.58E-04	SME purge flow element fails high	a: repaired before next batch
FE-9315-FHIE#	3	1M 3.0E-06H	2.16E-03	OE purge flow element 9315 fails to detect low flow	a: checked monthly
FE-9328-FHIE#	3	1M 3.0E-06H	2.16E-03	OECT purge flow element 9328 fails to detect low flow	a: checked monthly
FE-MFT--CAL1#	3	1M 1.0E+00Y	7.89E-02	MFT purge flow elements calibrated	a: calibrated annually, corrected in 1 month
FE-MFT--CAL1+	4	1M 1.0E+00Y	7.59E-02	MFT purge flow elements calibrated	a: calibrated annually, corrected in 1 month
FE-PRBT-CAL1#	3	1M 1.0E+00Y	7.89E-02	PRBT purge flow elements calibrated	a: calibrated annually, corrected in 1 month
FED--1--BFLH+	4	8.5H 1.0E-06H	8.50E-06	FAILURE OF 13.8-kV FEEDER #1	DWPF SAR 9.3.18
FED--2--BFLH+	4	8.5H 1.0E-06H	8.50E-06	FAILURE OF 13.8-kV FEEDER #2	DWPF SAR 9.3.18
FED-1-2-CCAH+	4	8.5H 1.0E-07H	8.50E-07	CC: FAILURE OF BOTH 13.8-kV FEEDERS	DWPF SAR 9.3.18
FED-PR--PREK#	3	2H 2.3E-02H	4.50E-02	PR feeding in progress	2 hours per PR batch
FIT8150-FHIT+	4	1H 3.0E-06H	3.00E-06	LPP VVH flow transmitter fails high	a: responded to and shutdown or repaired within 1 hour
FLGN2SUPLKSP+	4	8H 1.0E-06H	8.00E-06	Any of 100 joints/flanges leaks	a: 8 Hr Repair
FLGOFICELKSP#	3	8H 1.0E-06H	8.00E-06	ORIFICE LEAKS AT THE FLANGES	a: 8 hr detection
FLT-062-PLGQ+	4	4H 3.0E-06H	1.20E-05	FILTER 062 PLUGS	a: 8 hours to repair
FLT-BP--PLGQ+	4	4H 3.0E-06H	1.20E-05	FILTER IN BYPASS LINE FAILS PLUGGED	a: 8 hours to repair

Basic Event Report for I:\CAFTA\DATA\MASTER.BE 11/11/94 11:42 AM (CONT.)

Event	C	Input	Calc.	Description	Source
FLT9580APLGV+	4	48H 1.0E-04H	4.78E-03	Instrument air dryer #1 prefilter plugs	a: detected and corrected in 2 days
FLT9580BPLGV+	4	48H 1.0E-04H	4.78E-03	Instrument air dryer #1 after filter plugs	a: detected and corrected in 2 days
FLT9581APLGV#	3	48H 1.0E-04H	4.79E-03	Dryer #1 prefilter plugs	a: 48 hour mission time
FLT9581BPLGV#	3	48H 1.0E-04H	4.79E-03	Dryer #2 afterfilter plugs	a: 48 hour mission time
FLT9620-PLGV+	4	48H 1.0E-04H	4.78E-03	Inlet filter on secondary compressor is plugged	a: detected and corrected in 48 hours
FLT9623-PLGV+	4	48H 1.0E-04H	4.78E-03	Primary compressor inlet filter plugs	a: detected and corrected in 48 hours
FLT9660-PLGV#	3	7D 1.0E-04H	1.67E-02	Inlet filter on secondary compressor is plugged	a: 1 week mission time
FLTHEME-PLGT+	4	1H 3.0E-06H	3.00E-06	LPP vessel vent system mist eliminator plugs	a: responded to and shutdown or repaired within 1 hour
FLTHEPA1PLGT+	4	1H 3.0E-06H	3.00E-06	LPP HEPA-1 plugs	a: responded to and shutdown or repaired within 1 hour
FLTHEPA2PLGT+	4	1H 3.0E-06H	3.00E-06	LPP HEPA-2 plugs	a: responded to and shutdown or repaired within 1 hour
FLTLPPH1PLGT+	4	1H 3.0E-06H	3.00E-06	LPP cell inlet HEPA plugs	a: responded to and shutdown or repaired within 1 hour
FSH2777-FTC1#	5	1Q 1.0E-06H	1.09E-03	Backup CO2 purge flow high switch fails to close	a: Checked 2/year
FSH9236-FTCP#	5	1Q 1.0E-06H	1.09E-03	Flow switch fails to close	a: Checked 4/yr
FSL1893-FCLE+	4	24H 3.0E-06H	7.20E-05	Chilled water low flow interlock switch inadvertently closes	a: detected and corrected in 24 hours
FSL2369-FCLF#	3	4H 3.0E-06H	1.20E-05	PSW low flow switch fails closed	a: detected and corrected in 4 hours
FSL3406-FTCK#	5	1Q 1.0E-06H	1.09E-03	O2 analyzer 3405 sample flow low switch fails to close	a: checked quarterly
FSL3409-FTCK#	5	1Q 1.0E-06H	1.09E-03	O2 analyzer 3409 sample flow low switch fails to close	a: checked quarterly
FSL8799-FTCD#	5	1Q 1.0E-06H	1.09E-03	SRAT low sample flow switch 8799 fails to close	a: Checked quarterly
FSL8800-FTC4#	5	1Q 1.0E-06H	1.09E-03	SME sample flow indication switch 8800 fails high	a: Checked quarterly
FSL8801-FTC5#	5	1Q 1.0E-06H	1.09E-03	SRAT GC#1 low sample flow switch 8801 fails to close	a: Checked quarterly
FSL8802-FTCD#	5	1Q 1.0E-06H	1.09E-03	SRAT GC#2 low sample flow switch 8802 fails to close	a: Checked quarterly
FSL8803-FTC4#	5	1Q 1.0E-06H	1.09E-03	SME sample low flow indication switch 8803 fails high	a: Checked quarterly
FSL8804-FTC4#	5	1Q 1.0E-06H	1.09E-03	SME sample flow indication switch 8804 fails high	a: Checked quarterly
FT-2369-FHIF#	5	1Y 3.0E-06H	1.30E-02	PSW flow transmitter fails high	a: checked annually

Event	C	Input	Calc.	Description	Source
FT-8155-FLOT#	5	1Y 3.0E-06H	1.30E-02	LPPP VVS flow transmitter fails low	a: checked annualy
FT-9152-FLOO+	4	8H 3.0E-06H	2.40E-05	Bypass flow transmitter fails low	Detected and corrected in 8 hours
FY-8150-BFLT+	4	1H 1.0E-07H	1.00E-07	LPP VVH flow control valve signal conditioner fails high	a: responded to and shutdown or repaired within 1 hour
HCV1017-FCLB+	4	8H 5.0E-07H	4.00E-06	PRFT purge supply valve 1017 fails closed	a: 8 hours to repair or shutdown
HCV1033-FTCO#	1	1N 1.0E-03N	1.00E-03N	PR PSW return valve fails to close	Use TC value
HCV1038-FOP9+	4	86H 5.0E-07H	4.30E-05	PR steam supply valve HCV-1038 fails open	a: detected and repaired before next batch
HCV1102-FCL9+	4	8H 5.0E-07H	4.00E-06	PR baseline purge supply valve 1102 fails closed	a: 8 hours to repair or shutdown
HCV1142-FTCO#	1	1N 1.0E-03N	1.00E-03N	PRFT PSW return valve fails to close	Use TC value
HCV1885-FCLE+	4	8H 5.0E-07H	4.00E-06	Primary chiller supply valve fails closed	a: 8 hours to repair
HCV1897-FTOE#	1	1N 1.0E-03N	1.00E-03N	Backup chiller supply valve fails to open	Use TC Value
HCV3010-FTCO#	1	1N 1.0E-03N	1.00E-03N	SRAT PSW return valve fails to close	Use TC value
HCV3010-FTOF#	1	1N 1.0E-03N	1.00E-03N	SRAT cooling water supply valve HCV3010 fails to open	Use TC value
HCV3089-FCL4#	3	8H 5.0E-07H	4.00E-06	SME cooling water valve manual controller fails to open	A: 8 HOURS TO REPAIR
HCV3089-FTCO#	1	1N 1.0E-03N	1.00E-03N	SME PSW return valve fails to close	Use TC value
HCV3212-FTCO#	1	1N 1.0E-03N	1.00E-03N	PRBT PSW return valve fails to close	Use TC value
HCV3252-FTCO#	1	1N 1.0E-03N	1.00E-03N	MFT PSW return valve fails to close	Use TC value
HCV5845-FTCO#	1	1N 1.0E-03N	1.00E-03N	RCT PSW return valve fails to close	Use TC value
HCV5907-FTCO#	1	1N 1.0E-03N	1.00E-03N	DWTT PSW return valve fails to close	Use TC value
HCV8772-FOPQ#	5	8H 5.0E-07H	2.00E-06	VALVE 8772 FAILS TO REMAIN CLOSED	a: 8 hours to repair
HCV8772-FTCQ#	1	1N 1.0E-03N	1.00E-03N	VALVE 8772 FAILS TO CLOSE	Use TC
HCV9116-FCLO+	4	4H 5.0E-07H	2.00E-06	Return valve 9116 fails closed	a: detected and repaired, bypassed, or shut down in 4 hours
HCV9116-FTCG#	1	1N 1.0E-03N	1.00E-03N	COOLING TOWER RETURN VALVE HCV-9116 FAILS TO CLOSE	Use TC
HCV9122-FTOG#	1	1N 1.0E-03N	1.00E-03N	COOLING TOWER EMERGENCY RETURN VALVE HCV-9122 FAILS TO OPEN	Use TC
HCV9150-FCLG#	3	8H 5.0E-07H	4.00E-06	COOLING TOWER SUPPLY VALVE 9150 FAILS CLOSED	a: 8 hours to repair

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Event	C	Input	Calc.	Description	Source
HCV9150-FCLO+	4	4H 5.0E-07H	2.00E-06	CTW discharge valve fails closed	a: Detected and corrected or shutdown in 4 hours
HCV9176-LKSP#	3	8H 1.0E-08H	8.00E-08	VALVE HCV 9176 LEAKS	a: 8 hr detection
HCV9307-FTCO#	1	1N 1.0E-03N	1.00E-03N	OE PSW return valve fails to close	Use TC value
HCV9314-FCL8+	4	1H 5.0E-07H	5.00E-07	OE purge supply valve 9314 fails closed	a: detected and corrected or shutdown w/i 1 hour due to low flow alarm
HCV9327-FCLA+	4	1H 5.0E-07H	5.00E-07	OECT purge supply valve 9327 fails closed	a: detected and corrected or shutdown w/i 1 hour due to low flow alarm
HCV9601-FCLV+	4	1H 5.0E-07H	5.00E-07	Instrument air dryer #1 isolation valve fails closed	a: detected and corrected within 1 hour (switch to backup)
HCV9602-FCLV#	3	24H 5.0E-07H	1.20E-05	Instrument air dryer #2 isolation valve fails closed	a: detected and corrected within 24 hours
HCV9621-FCLV+	4	2H 5.0E-07H	1.00E-06	Cooling water supply valve to primary compressor fails closed	a: detected and bypassed within 2 hours
HCV9622-FCLV+	4	2H 5.0E-07H	1.00E-06	Cooling water supply valve to secondary compressor fails closed	a: detected and bypassed in 2 hours
HCV9650-FCLV#	5	2H 5.0E-07H	5.00E-07	Third compressor cooling water supply valve fails closed	a: detected and bypassed in 2 hours
HCVAAAC-FTOG#	1	1N 1.0E-03N	1.00E-03N	SPC N2 HCV AAAC fails to open	Use TC value
HCVAAAD-FTOG#	1	1N 1.0E-03N	1.00E-03N	SPC N2 HCV AAAD fails to open	Use TC value
HCVINAIRC3CV+	4	2H 2.5E-08H	5.00E-08	CC: All three compressor water supply valves fail closed	a: Detected and bypassed in 2 hours
HPWLP-H-BFLH+	4	8.5H 3.0E-01Y	2.91E-04	LOSS OF POWER FROM SRS GRID TO H-AREA SWITCHGEAR	DWPF SAR 9.3.18
HTRLPPVVLKST+	4	8H 3.0E-07H	2.40E-06	LPP VVH steam tube leaks (moisture high)	a: responded to within 8 hours
HX-PCW1-FOUF#	3	8H 3.0E-08H	2.40E-07	Process cooling water heat exchanger #1 fouled	a: 8 hours to switch HX
HX-PSW1-LKSO#	5	5Y 1.0E-08H	2.19E-04	PSW heat exchanger-1 leaks (PSW/CTW leak)	a: Checked for plate leaks every 5 years
HX-PSW2-LKSO#	5	5Y 1.0E-08H	2.19E-04	PSW heat exchanger-2 leaks (PSW/CTW leak)	a: Checked for plate leaks every 5 years
IA--FH--T&MR#	1	1N 3.2E-03N	3.20E-03N	FAN HOUSE INSTRUMENT AIR SYSTEM UNAVAILABLE DUE TO T&M	Use TC
IGN-MLT-PRES#	1	1N 3.0E-02N	3.00E-02N	IGNITION SOURCE IS PRESENT IN MELTER OFF-GAS SYSTEM	Use TC
IGN-PPT-PREQ#	1	1N 3.0E-02N	3.00E-02N	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	Use TC
IGNMFT--PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in MFT vessel	Use TC value
IGNOE---PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in OE vessel	Use TC value
IGNOECT-PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in OECT vessel	Use TC value

Event	C	Input	Calc.	Description	Source
IGNOWST-PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in OWST inner tank	Use TC value
IGNOWST-PRE3+	4	.1H 2.3E-5H	2.30E-06	Ignition source present in OWST outer tank	Ignition source lasts 0.1 hour
IGNPR---PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in PR vessel	Use TC value
IGNPRBT-PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in PRBT vessel	Use TC value
IGNPRFT-PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in PRFT vessel	Use TC value
IGNPVVH-PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in PVVH	Use TC value
IGNSME--PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in SME vessel	Use TC value
IGNSPC--PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in SPC	Use TC value
IGNSPT--PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in SPT vessel	Use TC value
IGNSRAT-PRE1#	1	1N 3.0E-02N	3.00E-02N	Ignition source present in SRAT	Use TC value
INKSRLFLBYP5#	1	1N 4.6E-04N	4.60E-04N	SRAT high LFL interlock bypassed	Use TC value
JMP-HTR-CCAS+	4	4H 1.0E-09H	4.00E-09	CC: TWO FUSES FOR LID HEATERS FAIL	a: detected in 1 shift
JMP-HTRABFLS+	4	4H 1.0E-08H	4.00E-08	FUSE FOR LID HEATER A FAILS	a: detected in 1 shift
JMP-HTRBBFLS+	4	4H 1.0E-08H	4.00E-08	FUSE FOR LID HEATER B FAILS	a: detected in 1 shift
JMP-HTRCBFLS+	4	4H 1.0E-08H	4.00E-08	FUSE FOR LID HEATER C FAILS	a: detected in 1 shift
JMP-HTRDBFLS+	4	4H 1.0E-08H	4.00E-08	FUSE FOR LID HEATER D FAILS	a: detected in 1 shift
JMP-SPC-LKS1+	4	43H 2.0E-05H	8.59E-04	SPC jumper leak - benzene leaks onto SPC floor	a: corrected before next batch
LCV2220AFCLG+	4	8H 5.0E-07H	4.00E-06	Steam generator cond. level control valve A fails closed	Estimated 8 hour resotration time
LCV2220BFCLG+	4	8H 5.0E-07H	4.00E-06	Steam generator cond. level control valve B fails closed	Estimated 8 hour resotration time
LE-2220-CALG+	4	1Q 2.3E-04H	3.34E-01	Steam generator condensate level transmitter is calibrated	a: calibrated twice/year
LE-2220-FHIG+	4	8H 5.0E-07H	4.00E-06	Steam generator condensate level transmitter fails high	Estimated 8 hour resotration time
LE-2262-FLOG#	3	8H 5.0E-07H	4.00E-06	LEVEL SENSOR/SWITCH FAILS (FALSE LOW SIGNAL)	a: 8 hours to repair
LE-5925-FLOG#	5	1Y 5.0E-07H	2.19E-03	SPC sump level element fails low	a: checked annually
LPWST-LPBFLH+	4	8.5H 8.0E-04Y	7.76E-07	FAILURE TO SUPPLY POWER TO GRID FROM ON-SITE AND OFF-SITE SOURCES.	DWPF SAR 9.3.18

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Event	C	Input	Calc.	Description	Source
LSL4033XFTC1#	5	2D 1.0E-06H	2.40E-05	CO2 tank low level switch fails to close	a: failure detected in 48 hours
LSL7863-FTC3#	3	1Q 1.0E-06H	2.18E-03	Low N2 tank level switch fails to close	a: Checked 2/yr
MOV1041-FCLK+	4	8H 3.0E-07H	2.40E-06	SPC/PVVH isolation valve 1041 fails closed	a: returned to open in 8 hours
MOV1041-FTCK#	1	1N 3.0E-03N	3.00E-03N	SPC/PVVH isolation valve MOV-1041 fails to close	Use TC value
MOV1100-FTCK#	1	1N 3.0E-03N	3.00E-03N	PRFT to PR transfer valve fails to close	Use TC value
MOV1131-ADJ6+	4	1H 1.0E+00Q	4.59E-04	PRCD cleaned (drain valve opened)	a: valve remains open 1 hour, quarterly
MOV1131-FTCK#	1	1N 3.0E-03N	3.00E-03N	PRC/D drain valve fails to close	Use TC value
MOV1131-LKS6+	4	24H 1.0E-06H	2.40E-05	PRCD drain valve leaks (benzene to PR)	a: detected and repaired in 24 hours
MOV5862-FCLD+	4	1D 3.0E-07H	7.20E-06	PVVH primary fan suction valve fails closed	a: repaired in 24 hours
MOV5864-FTOD#	1	1N 3.0E-03N	3.00E-03N	PVVH standby fan suction valve fails to open	Use TC value
MOV9278-FCLK+	4	8H 3.0E-07H	2.40E-06	SPC/PVVH isolation valve 9278 fails closed	a: returned to open in 8 hours
MOV9278-FTCK#	1	1N 3.0E-03N	3.00E-03N	SPC/PVVH isolation valve MOV-9278 fails to close	Use TC value
N2-CPCBPT&M1#	3	24H 1Y	2.74E-03	CPC backup purge system out of service for T&M	a: system shutdown in 24 hours
N2-CYL--USD1#	5	7D 1Y	9.53E-03	LPPP local N2 bottles empty	a: used at primary failure rate, refilled in 1 week
N2-LPPP-T&M1#	3	14D 1Y	3.76E-02	LPPP local N2 system out of service for T&M	a: 2 weeks/year
N2-OWST-T&M1#	3	14D 1Y	3.76E-02	OWST local liquid N2 system out of service for T&M	a: 14 days per year
N2-TRUCKBFL1#	1	1N 1.0E-02N	1.00E-02N	N2 delivery fails to arrive at DWPF	estimated
OFV-018-FOPP+	4	24H 5.0E-09H	1.20E-07	Overflow (inner to outer tank) fails open	a: 24 hours to repair
OPR--5B-LOHH#	1	1.8E-04N 5.0E-03N	9.00E-07N	OPERATOR FAILS TO REMOVE LOCKOUT ON FEEDER BREAKER 5B	1/5YRS * 16H/2 (WMS)
OPR--A1-LOHH#	1	1.8E-04N 5.0E-03N	9.00E-07N	OPERATOR FAILS TO REMOVE LOCKOUT ON BUS A1	1/5YRS * 16H/2 (WMS)
OPR--PT-MCHR#	1	1N 3.0E-02N	3.00E-02N	OPERATOR MISCALIBRATES PRESSURE TRANSMITTERS (OUT OF RANGE)	Use TC
OPR-2262MCHG#	1	2.5E-01N 3.0E-02N	7.50E-03N	OPERATOR MISCALIBRATES LEVEL SENSOR/SWITCH	1/yr * 0.5y/2
OPR-A201LOHH#	1	1.8E-04N 5.0E-03N	9.00E-07N	OPERATOR FAILS TO REMOVE LOCKOUT ON TIE BREAKER A201	1/5YRS * 16H/2 (WMS)
OPR-A202LOHH#	1	1.8E-04N 5.0E-03N	9.00E-07N	OPERATOR FAILS TO REMOVE LOCKOUT ON FEEDER BREAKER A202	1/5YRS * 16H/2 (WMS)

Event	C	Input	Calc.	Description	Source
OPR-AE--MCHQ#	5	14D 1.5E-02Y	2.88E-04	OPERATOR MISCALIBRATES O2 ANALYZERS (OUT OF RANGE)	a: 2 weeks to detect & repair
OPR-AIR-CSHQ#	1	1N 1.0E-01N	1.00E-01N	Fail to respond to plant/instrument air alarm	Use TC value
OPR-AIR-MCH1#	1	1N 3.0E-02N	3.00E-02N	Instrument air DP switch miscalibrated	Use TC value
OPR-CTW-ACH1#	1	1N 5.0E-02N	5.00E-02N	Operator fails to start CTW pump, given alarm	Use TC value
OPR-FDC-IRHG#	1	1N 5.0E-01N	5.00E-01N	OPERATOR MISREADS SAMPLE RESULTS	Use TC
OPR-MFT-MCH1#	1	1N 3.0E-02N	3.00E-02N	MFT purge flow elements both - miscalibrated	a: complete dependence between FEs
OPR-MFT-SOH1#	1	1N 5.0E-02N	5.00E-02N	Fail to open MFT purge supply needle valve	Use TC value
OPR-PR3-ACN1#	1	1N 5.0E-03N	5.00E-03N	Failure to sample PR formate content	Use TC Value
OPR-PR3-ACNU#	1	1N 5.0E-03N	5.00E-03N	Failure to follow procedure for PR formate sampling	Use TC value
OPR-PSW-CSNP#	1	1N 1.0E-02N	1.00E-02N	Operator fails to respond to PSW low pressure alarm	Use TC value
OPR-SME-SOH1#	1	1N 5.0E-02N	5.00E-02N	Fail to open SME purge supply needle valve	Use TC value
OPR-TF--ACHU#	1	1N 5.0E-02N	5.00E-02N	Tank farm operator fails to follow procedure for sample preparation	Use TC
OPR-TF--IRHU#	1	1N 5.0E-01N	5.00E-01N	Tank farm analyst incorrectly reads data	Use TC
OPR-TF--LAHU#	1	1N 1.0E-03N	1.00E-03N	Analyst at tank farm fails to properly analyze sample	Use TC
OPR-XFR-ACL1#	1	1N 5.0E-04N	5.00E-04N	FAILURE TO PERFORM LEAK SURVEY	use tc value
OPR-XFR-VIN1#	1	1N 1.0E-01N	1.00E-01N	OPERATOR FAILS TO OBSERVE LEAK	use tc value
OPR0683-CSLP#	1	1N 3.0E-03N	3.00E-03N	Fail to respond to low MFT purge alarm	Use TC value
OPR0683-RAH1+	4	12H 5.0E-05H	6.00E-04	MFT purge supply valve 0683 erroneously closed	a: corrected in 12 hours
OPR1018-MCH1#	1	4E-3N 3.0E-02N	1.20E-04N	PRFT purge flow element 1018 miscalibrated	a: calibrated annually, corrected by next batch
OPR1103-MCH1#	1	4E-3N 3.0E-02N	1.20E-04N	PR purge flow element 1103 miscalibrated	a: calibrated annually, corrected by next batch
OPR1117-MCH1#	1	4E-3N 3.0E-02N	1.20E-04N	PRC/D temp element 1117 out of calibration	a: calibrated annually, corrected by next batch
OPR1131-ACL1#	1	1N 5.0E-04N	5.00E-04N	Failure to wait until PR transfer complete before cleaning PRCD	Use TC Value
OPR1131-VRH1#	1	1N 5.0E-02N	5.00E-02N	Fail to verify PRC/D drain valve closed	Use TC Value
OPR1893-MCH3#	1	.01N 3.0E-02N	3.00E-04N	Chiller flow element 1893 miscalibrated	a: calibrated annually, corrected in 1 week

Event	C	Input	Calc.	Description	Source
OPR1895-RANK+	4	1H 5.0E-06H	5.00E-06	Primary chiller PCV 1895 inadvertently closed	a: detected and corrected in 1 hour
OPR1898-MCH3#	1	1N 3.0E-02N	3.00E-02N	Backup chiller PCV 1898 miscalibrated	Use TC value
OPR1SRATIRHU#	1	1N 5.0E-01N	5.00E-01N	SRAT engineer incorrectly records data into PCCS from batch #1	Use TC
OPR2056-ACN6#	1	1N 5.0E-03N	5.00E-03N	Fail to close PR formic acid supply valve following addition	Use TC value
OPR2220LMCH3#	1	1N 3.0E-02N	3.00E-02N	Steam generator condensate level transmitter miscalibrated	Use TC value
OPR2262-OPEG#	1	1N 1.0N	1.00E+00N	OPERATOR OPENS MAIN HOLDING TANK FEED VALVE	Use TC
OPR2363-MCH1#	1	.04N 3.0E-02N	1.20E-03N	PSW pressure transmitter miscalibrated	a: calibrated annually, error corrected in 2 weeks
OPR2369-MCH1#	1	1N 3.0E-02N	3.00E-02N	PSW flow transmitter miscalibrated	Use TC value
OPR2777-CSHQ#	1	1N 1.0E-01N	1.00E-01N	Fail to respond to high backup purge flow alarm	Use TC value
OPR2779-CSL3#	1	1N 3.0E-03N	3.00E-03N	Operator fails to respond to CO2 bottle low weight alarm	Use TC value
OPR2779-MCH1#	1	1N 3.0E-02N	3.00E-02N	Weight element 2779 for CO2 backup bottles miscalibrated	Use TC value
OPR3004-MCH3#	1	1N 3.0E-02N	3.00E-02N	SRAT steam pressure control valve 3004 miscalibrated	Use TC value
OPR3034-MCH1#	1	.02N 3.0E-02N	6.00E-04N	SRAT purge flow control valve miscalibrated	a: calibrated annually, corrected in 1 week
OPR3034FMCH1#	1	0.01N 3.0E-02N	3.00E-04N	SRAT purge flow element miscalibrated	a: calibrated annually, corrected in 1 week
OPR3216-CSLP#	1	1N 3.0E-03N	3.00E-03N	Fails to respond to PRBT low dilution flow alarm	Use TC Value
OPR3216-SRN6#	1	1N 1.0E-02N	1.00E-02N	PRBT dilution flow controller erroneously set low	Use TC value
OPR3405-MCH3#	1	0.1N 3.0E-02N	3.00E-03N	O2 analyzer 3405 miscalibrated	a: calibrated 1/10 batches, corrected by next batch
OPR3407-MCH2#	1	1.2E-1N 3.0E-02N	3.60E-03N	PVVH benzene detector 3407 out of calibration	a: calibrated monthly, tested every batch
OPR3408-MCH2#	1	1.2E-1N 3.0E-02N	3.60E-03N	PVVH benzene detector 3408 out of calibration	a: calibrated monthly, tested every batch
OPR3409-MCH2#	1	0.1N 3.0E-02N	3.00E-03N	O2 analyzer 3409 miscalibrated	a: calibrated 1/10 batches, corrected by next batch
OPR5504-RMH1#	1	1N 5.0E-02N	5.00E-02N	Primary purge PSL 5504 left in wrong position following maintenance	Use TC value
OPR5860-MCH1#	1	3E-3N 3.0E-02N	9.00E-05N	PVVH flow element 5860 miscalibrated	a: calibrated annually, corrected in 24 hours
OPR5925-MCH1#	1	1N 3.0E-02N	3.00E-02N	SPC sump level element miscalibrated	Use TC value
OPR6041-MCH1#	1	3E-3N 3.0E-02N	9.00E-05N	PVVH flow element 6041 miscalibrated	a: calibrated annually, corrected in 24 hours

Event	C	Input	Calc.	Description	Source
OPR6846-CSNP#	1	1N 1.0E-02N	1.00E-02N	Operator fails to respond to LPPP VVS HEPA high DP alarm	Use TC value
OPR6846-MCH1#	1	1N 3.0E-02N	3.00E-02N	HEPA filter DP switches miscalibrated	a: complete dependence
OPR7863-MCH3#	1	1N 3.0E-02N	3.00E-02N	N2 tank low level switch out of calibration	Use TC value
OPR8150-SRH1#	1	1N 3.0E-02N	3.00E-02N	Misadjustment - FCV set low	Use TC value
OPR8152-CSNP#	1	1N 1.0E-02N	1.00E-02N	Operator fails to respond to high inlet HEPA alarm	Use TC value
OPR8152-MCH1#	1	1N 3.0E-02N	3.00E-02N	High DP switch miscalibrated	Use TC value
OPR8154-RANK#	3	24H 5.0E-06H	1.20E-04	Operator erroneously closes LPP VVH fan-2 inlet damper	a: corrected in 24 hours
OPR8155-ACN3#	1	1N 5.0E-03N	5.00E-03N	Operator fails to respond to PVV flow low alarm FAL-8155	Use TC value
OPR8155-MCH1#	1	1N 3.0E-02N	3.00E-02N	PVVH flow transmitter 8155 miscalibrated	Use TC value
OPR8155-RANK+	4	24H 5.0E-06H	1.20E-04	Operator erroneously closes LPP VVH fan-1 inlet damper	a: corrected in 24 hours
OPR8795-MCH2#	1	1.2E-1N 3.0E-02N	3.60E-03N	SRAT offgas detector #1 out of calibration	a: calibrated monthly, tested every batch
OPR8796-MCH2#	1	1.2E-1N 3.0E-02N	3.60E-03N	SRAT offgas detector #2 out of calibration	a: calibrated monthly, tested every batch
OPR8797AMCH1#	1	1.2E-1N 3.0E-02N	3.60E-03N	SME hydrogen detector 1 out of calibration	a: tested every batch, calibrated monthly
OPR8798AMCH1#	1	1.2E-1N 3.0E-02N	3.60E-03N	SME hydrogen detector 2 out of calibration	a: tested every batch, calibrated monthly
OPR8856-MCH2#	1	1E-02N 3.0E-02N	3.00E-04N	Operator miscalibrates SME purge flow element	a: calibrated annually, corrected by next batch
OPR9161-MCH3#	1	1N 3.0E-02N	3.00E-02N	Valve HCV-9161 miscalibrated	Use TC value
OPR9233-MCH1#	1	1N 3.0E-02N	3.00E-02N	O2 analyzer miscalibrated	Use TC Value
OPR9236-CSHQ#	1	1N 1.0E-01N	1.00E-01N	Operator fails to respond to high backup N2 flow alarm	Use TC value
OPR9312-MCH1#	1	3E-3N 3.0E-02N	9.00E-05N	OE vapor space PT-9312 out of calibration	a: calibrated annually, corrected in 24 hours
OPR9315-MCH1#	1	4E-3N 3.0E-02N	1.20E-04N	OE purge flow element 9315 miscalibrated	a: calibrated annually, corrected by next batch
OPR9328-MCH1#	1	4E-3N 3.0E-02N	1.20E-04N	OECT purge flow element 9328 miscalibrated	a: calibrated annually, corrected by next batch
OPR9346-MCH1#	1	4E-3N 3.0E-02N	1.20E-04N	OEC/D temp element 9346 out of calibration	a: calibrated annually, corrected by next batch
OPR9356-MCH1#	1	1N 3.0E-02N	3.00E-02N	SCVC chilled water supply valve 9356 miscalibrated	Use TC value
OPR9620-MCH1#	1	1N 3.0E-02N	3.00E-02N	Secondary compressor inlet filter DP miscalibrated	Use TC value

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Event	C	Input	Calc.	Description	Source
OPR9623-MCH1#	1	1N 3.0E-02N	3.00E-02N	Primary compressor inlet filter DP miscalibrated	Use TC value
OPR9660-MCH1#	1	1N 3.0E-02N	3.00E-02N	Third compressor inlet filter DP miscalibrated	Use TC value
OPRBATCHNCH1#	1	1N 1.0E-01N	1.00E-01N	STA incorrectly assesses PHA requirements	Use TC value
OPRBKN2-RMH1#	1	1N 5.0E-02N	5.00E-02N	Improper connection at backup purge manifold	Use TC Value
OPRBKR04RMHR#	1	1N 5.0E-02N	5.00E-02N	OPERATOR FAILS TO REMOVE LOCKOUT ON BREAKER FOLLOWING MAINTENANCE	Use TC
OPRBOT1-RMH1#	1	1N 5.0E-02N	5.00E-02N	Operator fails to open isolation valve #1 after maintenance	Use TC Value
OPRBOT2-RMH1#	1	1N 5.0E-02N	5.00E-02N	Operator fails to open isolation valve #2 after maintenance	Use TC Value
OPRBOT3-RMH1#	1	1N 5.0E-02N	5.00E-02N	Operator fails to open isolation valve #3 after maintenance	Use TC Value
OPRBOT4-RMH1#	1	1N 5.0E-02N	5.00E-02N	Operator fails to open isolation valve #4 after maintenance	Use TC Value
OPRCO2--CALK#	1	1N 3.0E-04N	3.00E-04N	Operator hooks up O2 instead of CO2 for SPC purge gas	Use TC Value
OPRCO2P-CSHQ#	1	1N 1.0E-01N	1.00E-01N	Operator fails to respond to CO2 tank low level alarm	Use TC value
OPRCO2P1ACHU#	1	1N 5.0E-02N	5.00E-02N	Operator fails to perform regular filling of CO2 tank	Use TC value
OPRCO2P2ACHU#	1	1N 5.0E-02N	5.00E-02N	Second operator fails to fill primary CO2 tank	Use TC value
OPRCOMP-CSHQ#	1	1N 1.0E-01N	1.00E-01N	Operator fails to respond to main compressor failure alarms	Use TC value
OPRCONDVRANK+	4	7D 5.0E-06H	8.39E-04	Operator erroneously closes LPP condenser drain valve	a: corrected in 1 week
OPRFDCT-ACHG#	1	1N 5.0E-02N	5.00E-02N	OPERATOR FAILS TO PULL SAMPLE FROM FDC TANK	Use TC
OPRFDCT-LAHG#	1	1N 1.0E-03N	1.00E-03N	ANALYST FAILS TO DETECT RADIATION DURING FDC TANK SAMPLING	Use TC
OPRFILT-VIH1#	1	1N 5.0E-01N	5.00E-01N	Fail to replace filter	Use TC value
OPRFLOW-ACHU#	1	1N 5.0E-02N	5.00E-02N	Operator fails to add PSW loads or shutdown PSW pumps	Use TC value
OPRG100-RMNN#	1	4.3E-02N 5.0E-03N	2.15E-04N	FAIL TO RESTORE DIESEL G100 TO STANDBY FOLLOWING MAINTENANCE	1/YR * 31D/2 (FROM OSR 3.5.1)
OPRG200-RMNN#	1	4.3E-02N 5.0E-03N	2.15E-04N	FAIL TO RESTORE DIESEL G200 TO STANDBY FOLLOWING MAINTENANCE	1/YR * 31D/2 (FROM OSR 3.5.1)
OPRHEP-VRANK+	4	7D 5.0E-06H	8.39E-04	LPP inlet HEPA filter valve erroneously closed	a: corrected in 1 week
OPRHEP1ARANK+	4	7D 5.0E-06H	8.39E-04	Operator erroneously closes LPP VVH HEPA-1 inlet damper	a: corrected in 1 week
OPRHEP1BRANK+	4	7D 5.0E-06H	8.39E-04	Operator erroneously closes LPP VVH HEPA-1 exit damper	a: corrected in 1 week

Event	C	Input	Calc.	Description	Source
OPRHEP2ARANK+	4	7D 5.0E-06H	8.39E-04	Operator erroneously closes LPP VVH HEPA-2 inlet damper	a: corrected in 1 week
OPRHEP2BRANK+	4	7D 5.0E-06H	8.39E-04	Operator erroneously closes LPP VVH HEPA-2 exit damper	a: corrected in 1 week
OPRHLDTKCSHG#	1	1N 1.0E-01N	1.00E-01N	OPERATOR FAILS TO TRANSFER HOLDING TANK CONTAMINATION TO RCT	Use TC
OPRMAINTMCH1#	1	1N 3.0E-02N	3.00E-02N	cc: all 3 SRAT low flow switches miscalibrated	a: same as single miscalibration
OPRN2AL-CSL3#	1	1N 3.0E-03N	3.00E-03N	Operator fails to respond to N2 tank low level alarm	Use TC value
OPROSRATIRHU#	1	1N 5.0E-01N	5.00E-01N	SRAT engineer incorrectly records data into PCCS	Use TC
OPROWN2-CSLP#	1	1N 3.0E-03N	3.00E-03N	Operators fail to restore nitrogen blanket before O2 reaches MOC	a: > 4 hours to MOC
OPROWPT-MCH1#	1	2E-2N 3.0E-02N	6.00E-04N	Pressure transmitters miscalibrated	a: calibrated annually, corrected in 1 week
OPRPR3--LAH1#	1	1N 1.0E-03N	1.00E-03N	Incorrect sample / analysis of PR formate content	Use TC value
OPRPR5--ACL1#	1	1N 5.0E-04N	5.00E-04N	Operator fails to sample for C6H6 before transfer to PRBT	Use Tc Value
OPRPR5--LAN1#	1	1N 3.0E-04N	3.00E-04N	Error in C6H6 sample/analysis - low	Use TC value
OPRPRBT-ACN1#	1	1N 5.0E-03N	5.00E-03N	Operator fails to sample for benzene in PRBT before transferring to SRAT	
OPRPRBT-ACNU#	1	1N 5.0E-03N	5.00E-03N	Fail to correct high benzene concentration before transfer to SRAT	Use TC value
OPRPRBT-LAH1#	1	1N 1.0E-03N	1.00E-03N	Error in PRBT benzene sample/analysis - low	
OPRPRBT-MCH1#	1	1N 3.0E-02N	3.00E-02N	PRBT purge flow elements both miscalibrated	a: complete dependence between FEs
OPRPRBT-SOH1#	1	1N 5.0E-02N	5.00E-02N	Fail to open PRBT purge supply needle valve	Use TC value
OPRPRBT3ACN1#	1	1N 5.0E-03N	5.00E-03N	Failure to sample PRBT for formate content	Use TC value
OPRPRBT3ACNU#	1	1N 5.0E-03N	5.00E-03N	Failure to follow procedure for PRBT formate sampling	Use TC value
OPRPRBT3LAH1#	1	1N 1.0E-03N	1.00E-03N	Error in formate content of PRBT sample / analysis	Use TC value
OPRPRCD-SVL1#	1	1N 1.0E-01N	1.00E-01N	Supervisor fails to prevent PRCD cleaning into PR (containing PHA)	Use TC value
OPRPVV2-RMH1#	1	.03N 5.0E-02N	1.50E-03N	Fail to restore fan to operable status following maintenance	a: maintained 2/year, corrected in 10 days
OPRSD004RMHR#	1	1N 5.0E-02N	5.00E-02N	OPERATOR FAILS TO OPEN SUCTION DAMPER FOLLOWING MAINTENANCE	Use TC
OPRSLG1-ACNU#	1	1N 5.0E-03N	5.00E-03N	Failure to follow procedure for tank sampling	Use TC value
OPRSLG1-LAH1#	1	1N 1.0E-03N	1.00E-03N	Error in sludge sample for noble metals	Use TC value

Event	C	Input	Calc.	Description	Source
OPRSMEV-RMH1#	1	1N 5.0E-02N	5.00E-02N	SME offgas sample supply valve left diverted after maint.	a: Not detected until next sample required
OPRSPCN2RTH1#	1	.12N 3.0E-02N	3.60E-03N	SPC N2 needle valve 1 left closed, following isolation	a: closed annually, checked quarterly
OPRSPCN3RTH1#	1	.12N 3.0E-02N	3.60E-03N	SPC N2 needle valve 2 left closed following isolation	a: closed annually, checked quarterly
OPRSPCPPCSHQ#	1	1N 1.0E-01N	1.00E-01N	Operator fails to rerout flow path after SPC purge PSV fails open	a: Use TV value
OPRSPT1-RANK#	3	24H 5.0E-06H	1.20E-04	SPT nitrogen supply path 1 needle valve closed erroneously	a: opened within 24 hours
OPRSPT1-RMH1#	1	.02N 5.0E-02N	1.00E-03N	SPT line 1 left out of service following maintenance	a: T&M annually, corrected in 1 week
OPRSPT2-RANK#	3	24H 5.0E-06H	1.20E-04	SPT nitrogen supply path 2 needle valve closed erroneously	a: opened within 24 hours
OPRSPT2-RMH1#	1	.02N 5.0E-02N	1.00E-03N	SPT line 2 left out of service following maintenance	a: T&M annually, corrected in 1 week
OPRSPTV-RANK+	4	7D 5.0E-06H	8.39E-04	Operator closes SPT exit vent valve (before condenser)	a: corrected in 1 week
OPRSRAT-ACN1#	1	1N 5.0E-03N	5.00E-03N	Fail to open SRAT purge supply needle valve	Use TC value
OPRSRAT-CAN1#	1	1N 3.0E-03N	3.00E-03N	Operator adds more nitric acid than calculated	Use TC
OPRSRAT-NCN1#	1	1N 3.0E-02N	3.00E-02N	Error in nitric acid calculation by technical	Use TC value
OPRSRAT1ACNU#	1	1N 5.0E-03N	5.00E-03N	SRAT operator fails to follow procedure for batch #1 sample preparation	Use TC
OPRSRAT1CVHU#	1	1N 3.0E-01N	3.00E-01N	STE at SRAT fails to verify batch #1 results	Use TC
OPRSRAT1IRHU#	1	1N 5.0E-01N	5.00E-01N	SRAT engineer incorrectly reads data from batch #1	Use TC
OPRSRAT1LAHU#	1	1N 1.0E-03N	1.00E-03N	Analyst at SRAT fails to properly analyze batch #1 sample	Use TC
OPRSRAT6ACN1#	1	1N 5.0E-03N	5.00E-03N	Failure to sample SRAT product for formate/formic acid	Use TC value
OPRSRAT6ACNU#	1	1N 5.0E-03N	5.00E-03N	Failure to follow procedure for SRAT formate sampling	Use TC value
OPRSRAT6LAH1#	1	1N 1.0E-03N	1.00E-03N	Error in SRAT sample SRAT-6	Use TC value
OPRSRAT7ACN1#	1	1N 5.0E-03N	5.00E-03N	Failure to follow procedure for SRAT nitric acid sampling	Use TC value
OPRSRAT7ACNU#	1	1N 5.0E-03N	5.00E-03N	Failure to sample SRAT product for nitric acid (pH)	Use TC value
OPRSRAT7LAH1#	1	1N 1.0E-03N	1.00E-03N	Error in SRAT product sample	Use TC value
OPRSRATOACNU#	1	1N 5.0E-03N	5.00E-03N	SRAT operator fails to follow procedure for sample preparation	Use TC
OPRSRATOCVHU#	1	1N 3.0E-01N	3.00E-01N	STE at SRAT fails to verify results	Use TC

Event	C	Input	Calc.	Description	Source
OPRSRATOIRHU#	1	1N 5.0E-01N	5.00E-01N	SRAT engineer incorrectly reads results	Use TC
OPRSRATOLAHU#	1	1N 1.0E-03N	1.00E-03N	Analyst at SRAT fails to properly analyze sample	Use TC
OPRSRATVRMH5#	1	1.4E-3N 5.0E-02N	7.00E-05N	Fail to open valve following maintenance	a: maintained annually, corrected before next batch
OPRSUMP-ACHG#	1	1N 5.0E-02N	5.00E-02N	OPERATOR FAILS TO DIVERT CONTAMINATION FROM FLOOR DRAIN CATCH TANK TO RCT	Use TC
OPRSUMP-CSHQ#	1	1N 1.0E-01N	1.00E-01N	Fail to pump out sump before SPC flammable	Use TC value
OPRSV74ARANK+	4	24H 5.0E-06H	1.20E-04	Operator closes PR CO2 supply needle valve erroneously	a: corrected in 24 hours
OPRSV74BRANK+	4	43H 5.0E-06H	2.15E-04	Operator erroneously closes OE CO2 supply needle valve	a: opened by next batch
OPRSV74CRANK+	4	43H 5.0E-06H	2.15E-04	Operator erroneously closes OECT CO2 supply needle valve	a: opened by next batch
OPRSV74DRANK+	4	43H 5.0E-06H	2.15E-04	Operator erroneously closes PRFT CO2 supply needle valve	a: opened by next batch
OPRVESL-OVH1+	4	8H 5.0E-05H	4.00E-04	Spill or overflow from OE or PR	a: 2 tanks, 4 hour recovery
OPRVVF1DRANK+	4	24H 5.0E-06H	1.20E-04	Operator erroneously closes LPP VVH fan-1 discharge damper	a:corrected in 24 hours
OPRVVF2DRANK#	3	7D 5.0E-06H	8.40E-04	Operator erroneously closes LPP VVH fan-2 discharge damper	a: corrected in 1 week
PC-1041-FLOK#	5	43H 1.0E-06H	2.15E-05	SCVC exit pressure controller fails low	a: repaired before next PR batch
PCSSRAT-BFL5#	1	1N 1.0E-03N	1.00E-03N	Fail to compensate for out of spec SRAT product data to PCCS	Use TC Value
PCV-7172FCLQ+	4	4H 3.0E-06H	1.20E-05	PRESSURE CONTROL VALVE 7172 FAILS CLOSED	a: 8 hours to repair
PCV-BP--FCLQ+	4	4H 3.0E-06H	1.20E-05	PRESSURE CONTROL VALVE IN BYPASS LINE FAILS CLOSED	a: 8 hours to repair
PCV0963-FCL2+	4	8H 3.0E-06H	2.40E-05	85 psi PCV fails closed	a: repaired or process shutdown in 8 hours
PCV0963-FTCJ#	1	1N 3.0E-03N	3.00E-03N	PCV 0963 on CPC primary purge fails to close	Use TC value
PCV0964-FCL2+	4	8H 3.0E-06H	2.40E-05	80 psi PCV fails closed	a: Repaired or process shutdown in 8 hours
PCV0967-FTOJ#	1	1N 3.0E-03N	3.00E-03N	CPC backup purge PCV 0967 fails to open	Use TC value
PCV1016-FCLB+	4	8H 3.0E-06H	2.40E-05	PRFT purge supply valve 1016 fails closed	a: repaired in 8 hours
PCV1019-FTOB#	1	1N 3.0E-03N	3.00E-03N	PRFT purge vacuum breaker PCV-1019 fails to open	Use TC value
PCV1101-FCL9+	4	8H 3.0E-06H	2.40E-05	PR CO2 purge supply valve 1101 fails closed	a: 8 Hours to repair
PCV1104-FTO9#	1	1N 3.0E-03N	3.00E-03N	PR purge vacuum breaker PCV-1104 fails to open	Use TC value

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Event	C	Input	Calc.	Description	Source
PCV1895-FCLE+	4	8H 3.0E-06H	2.40E-05	Primary chiller CTW pressure control valve fails closed	a: 8 hours to repair
PCV1898-CAL1#	5	7D 1.0E+00Y	9.53E-03	Backup chiller PCV 1898 calibrated	a: calibrated annually, error corrected in 1 week
PCV1898-FTOE#	1	1N 3.0E-03N	3.00E-03N	Backup chiller CTW pressure control valve fails to open	Use TC value
PCV2221-FCLG+	4	8H 3.0E-06H	2.40E-05	260 pound steam supply valve to steam generator fails closed	a: detected and repaired or process shutdown in 8 hours
PCV2775-FTO1#	1	1N 3.0E-03N	3.00E-03N	Backup CO2 supply pressure control valve 2775 fails to open	A:Demands will be supplied by loss of primary CO2
PCV2778XFTO1#	1	1N 3.0E-03N	3.00E-03N	Backup CO2 supply pressure control valve 2778X fails to open	A:Demands will be supplied by loss of primary CO2
PCV3004-CAL1#	3	7D 1.0E+00Y	1.90E-02	SRAT steam pressure control valve calibrated	a: calibrated annually, error corrected in 1 week
PCV3004-FCLG+	4	8H 3.0E-06H	2.40E-05	SRAT steam pressure control valve fails closed	a: 8 hours to repair
PCV7418XFTOQ#	1	1N 3.0E-03N	3.00E-03N	LPPP N2 bottle supply PCV 7418X fails to open	Use TC value
PCV7420-FTOQ#	1	1N 3.0E-03N	3.00E-03N	LPPP local bottle N2 supply PCV fails to open	Use TC value
PCV7420XFTOQ#	1	1N 3.0E-03N	3.00E-03N	LPPP N2 bottle supply PCV 7420X fails to open	Use TC value
PCV7601XFCL1+	4	1H 3.0E-06H	3.00E-06	Primary CO2 PCV 7601X fails closed	a: 1 hour to detect and rerout (high backup flow alarm)
PCV7603XFOP1#	5	1M 3.0E-06H	1.08E-03	PCV 7603X failed open	a: paths rerouted monthly
PCV7603XT&M1#	3	24H 4.0E-01Y	1.10E-03	PCV 7603X out of service for T&M	a: taken out of service for 24 hours at a time
PCV7604XFOP1+	4	24H 3.0E-06H	7.20E-05	PCV 7604 fails open (like a PSV)	a: 24 hours to repair
PCV7834-FCLI+	4	24H 3.0E-06H	7.20E-05	Bulk N2 supply pressure control valve 7834 fails closed	a: 24 hours to repair/replace
PCV9160-FCLP+	4	24H 3.0E-06H	7.20E-05	N2 PCV 9160 Fails Closed	a: 24 Hr Repair
PCV9161-CAL1+	4	7D 1.0E+00Y	1.88E-02	PCV 9161 calibrated	a: calibrated annually, corrected in 1 week
PCV9161-FTOP#	5	1N 3.0E-03N	1.50E-03N	Pressure control valve PCV-9161 fails closed	Use TC value
PCV9161AFCLP+	4	24H 3.0E-06H	7.20E-05	OWST nitrogen supply PCV 9161A fails closed	a: 24 Hr Repair
PCV9161CFCLP+	4	8H 3.0E-06H	2.40E-05	Nitrogen PCV 9161C fails closed	a: 8 Hr Repair
PCV9166XFTOP#	1	1N 3.0E-03N	3.00E-03N	Pressure control valve 9166x fails to open	Use TC value
PCV9178-FCLP+	4	24H 3.0E-06H	7.20E-05	Nitrogen PCV 9178 fails closed	a: 24 hours to detect and repair
PCV9179-FTOP#	1	1N 3.0E-03N	3.00E-03N	Backup N2 PCV 9179 fails to open	Use TC value

Event	C	Input	Calc.	Description	Source
PCV9315-FCL8+	4	8H 3.0E-06H	2.40E-05	OE purge pressure control valve fails closed	a: 8 Hr Repair
PCV9329-FCLA+	4	8H 3.0E-06H	2.40E-05	OECT purge supply pressure control valve 9329 fails closed	a: 8 hours to repair
PCVAAAD-FTO1#	1	1N 3.0E-03N	3.00E-03N	SPC N2 PCV fails to open	Use TC value
PCVAAAE-FTO1#	1	1N 3.0E-03N	3.00E-03N	SPC N2 PCV fails to open	Use TC value
PCVAAAF-FTO1#	1	1N 3.0E-03N	3.00E-03N	SPC N2 low pressure PCV-1 fails to open	Use TC value
PCVAAAG-FTO1#	1	1N 3.0E-03N	3.00E-03N	SPC N2 low pressure PCV-2 fails to open	Use TC value
PCVAIR1-FCLV+	4	24H 3.0E-06H	7.20E-05	PCV reducing pressure going to equipment fails closed	a: 24 hours to detect and repair
PCVAIR2-FCLV+	4	24H 3.0E-06H	7.20E-05	PCV back pressure control valve fails closed	a: 24 hours to detect and bypass
PCVBAAD-FTO1#	1	1N 3.0E-03N	3.00E-03N	OWST liquid N2 supply PCV-1 fails to open	Use TC value
PCVBAAE-FTO1#	1	1N 3.0E-03N	3.00E-03N	OWST liquid N2 supply PCV-2 fails to open	Use TC value
PCVSPT1-FTOJ#	1	1N 3.0E-03N	3.00E-03N	SPT nitrogen supply path 1 PCV fails to open	Use TC value
PCVSPT1-T&M1#	3	48H 4.0E-01Y	2.19E-03	SPT nitrogen path 1 out of service for T&M	a: T&M lasts 24 hours
PCVSPT2-FTOJ#	1	1N 3.0E-03N	3.00E-03N	SPT nitrogen supply path 2 PCV fails to open	Use TC value
PCVXXXX-FTOJ#	1	1N 3.0E-03N	3.00E-03N	CPC backup purge PCV xxxx fails to open	Use TC value
PDE8761-FHIT+	4	8H 1.0E-6H	8.00E-06	Fans commanded off due to PDE fails high (controls speed controller)	a: responded to within 8 hours
PDS6846-FTCT#	5	1Y 3.0E-06H	1.30E-02	HEPA DP high switch fails to close	a: Checked annually
PDS6846AFTCT#	5	1Y 3.0E-06H	1.30E-02	HEPA very high DP switch fails to close	a: Checked annually
PDS8152-FTCT#	5	1Y 3.0E-06H	1.30E-02	Inlet HEPA high DP switch fails to close	a: Checked annually
PDS9580AFTCV#	5	5Y 3.0E-06H	6.29E-02	Dryer #1 prefilter high DP switch fails to close	a: calibrated every 5 years
PDS9580BFTCV#	5	5Y 3.0E-06H	6.29E-02	Dryer #1 after-filter DP high switch fails to close	a: calibrated every 5 years
PDS9581AFTCV#	5	5Y 3.0E-06H	6.29E-02	Dryer #2 prefilter DP high switch fails to close	a: calibrated every 5 years
PDS9581BFTCV#	5	5Y 3.0E-06H	6.29E-02	Dryer #2 afterfilter DP high switch fails to close	a: calibrated every 5 years
PDS9620-FTOV#	5	5Y 3.0E-06H	6.29E-02	Secondary compressor inlet filter DP switch fails to open	a: Calibrated every 5 years
PDS9623-FTOV#	5	5Y 3.0E-06H	6.29E-02	Primary compressor inlet filter DP switch fails to open	a: Calibrated every 5 years

Basic Event Report for I:\CAFTA\DATA\MASTER.BE 11/11/94 11:42 AM (CONT.)

Event	C	Input	Calc.	Description	Source
PDS9660-FTOV#	5	5Y 3.0E-06H	6.29E-02	DP switch on third compressor inlet filter fails to open	a: calibrated every 5 years
PDT9161-BFLP#	5	1Q 3.0E-06H	3.26E-03	False high differential pressure reading	a: checked quarterly
PE-55/6-CCAR#	5	14D 1.0E-07H	1.68E-05	CC: FAILURE OF BOTH PRESSURE TRANSMITTERS (PT-5756, PT-5755)	a: 14 day repair time (OSR)
PE-5755-FLOR#	5	14D 1.0E-06H	1.68E-04	EXHAUST PATH PRESSURE TRANSMITTER 5755 FAILS (FALSE LOW SIGNAL)	a: 14 days to repair (OSR)
PE-5756-FLOR#	5	14D 1.0E-06H	1.68E-04	EXHAUST PATH PRESSURE TRANSMITTER 5756 FAILS (FALSE LOW SIGNAL)	a: 14 day repair time (OSR)
PGV-2630FTCR#	1	1N 3.0E-03N	3.00E-03N	PLUG VALVE 2630 FAILS TO CLOSE (STUCK)	Use TC
PIC9161-FLOP#	5	1Q 1.0E-05H	1.08E-02	Pressure indicator controller PIC-9161 fails high	a: checked quarterly
PIP-N2--VCR3+	4	48H 2.55E-08H	1.22E-06	Vehicle crash damages main OWST N2 piping	a: 48 hours to detect and repair
PIP-XFR-LKSP#	3	8H 9.0E-09H	7.20E-08	TRANSFER LINE LEAKAGE	a: 8 hr detection
PIP-XFR-RUPP#	3	8H 2.18E-08H	1.74E-07	OVERPRESSURE RUPTURES TRANSFER LINE	a: 8 hr detection
PIP-XFR-VCRP#	3	1H 1.27E-09H	1.27E-09	VEHICLE CRASH DAMAGES TRANSFER LINE	a: 1 hr detection
PIPCTW--BFLO+	4	4H 6.0E-06H	2.40E-05	Failure of CTW piping	a: Detected and shut down in 4 hours
PIPDWTT-LKSO#	5	5Y 1.5E-07H	3.28E-03	Leak in DWTT cooling coil	a: Checked for coil leaks every 5 years
PIPINAIRRUPV+	4	8H 2.18E-08H	1.74E-07	Major line break in instrument air piping	a: repaired or bypassed in 8 hours
PIPMFT--LKSO#	5	5Y 1.5E-07H	3.28E-03	Leak in MFT cooling tube	a: Checked for tube leaks every 5 years
PIPN2SUPLKSP+	4	750H 9.0E-09H	6.75E-06	N2 Supply Line Leaks	a: 8 Hr Repair * 750 ft of piping - TC rate 3E-9/hr-ft
PIPOE---LKSO#	5	5Y 1.5E-07H	3.28E-03	Leak in Organic Evaporator cooling tube	a: Checked for tube leaks every 5 years
PIPPR---LKSO#	5	5Y 1.5E-07H	3.28E-03	Leak in PR cooling tube	a: Checked for tube leaks every 5 years
PIPPRBT-LKSO#	5	5Y 1.5E-07H	3.28E-03	Leak in PRBT cooling tube	a: Checked for tube leaks every 5 years
PIPPRFT-LKSO#	5	5Y 1.5E-07H	3.28E-03	Leak in PRFT cooling tube	a: Checked for tube leaks every 5 years
PIPRCT--LKSO#	5	5Y 1.5E-07H	3.28E-03	Leak in RCT cooling tube	a: Checked for tube leaks every 5 years
PIPSME--LKSO#	5	5Y 1.5E-07H	3.28E-03	Leak in SME cooling tube	a: Checked for tube leaks every 5 years
PIPSRAT-LKSO#	5	5Y 1.5E-07H	3.28E-03	Leak in SRAT cooling tube	a: Checked for tube leaks every 5 years
PIPSRAT-PLG5+	4	1H 1.0E-07H	1.00E-07	SRAT vent line plugs	a: causes 1 hour purge loss

Event	C	Input	Calc.	Description	Source
PMP-011-FTRG#	5	168H 3.0E-05H	2.52E-03	FAILURE OF COOLING TOWER PUMP -011 TO RUN	a: 1 week to repair
PMP-012-FTRG#	5	8H 3.0E-05H	1.20E-04	FAILURE OF COOLING TOWER PUMP -012 TO RUN	a: 8 hours to repair
PMP-012-FTSG#	3	1N 3.0E-03N	3.00E-03N	FAILURE OF COOLING TOWER PUMP -012 TO START	Use TC
PMP-012-T&MG#	3	1N 1.0N	6.32E-01N	COOLING TOWER PUMP -012 OUT OF SERVICE	Use TC
PMP-013-FTRG#	5	168H 3.0E-05H	2.52E-03	COOLING TOWER PUMP -013 FAILS TO RUN	a: 1 week to repair
PMP-014-FTRG#	5	8H 3.0E-05H	1.20E-04	COOLING TOWER PUMP -014 FAILS TO RUN	a: 8 hours to repair
PMP-CTW-C3CG#	5	8H 1.5E-06H	6.00E-06	COMMON CAUSE FAILURE OF 3 CTW PUMPS (2-50% AND 1 OF 2-25%)	a: 8 hours to repair
PMPCHIL1FTRE+	4	8H 3.0E-05H	2.40E-04	Primary chiller pump fails to run	a: 8 hours to repair
PMPCHIL2FTRE#	3	8H 3.0E-05H	2.40E-04	Backup chiller pump fails to run	a: 8 hour mission time
PMPCHIL2FTSE#	1	1N 3.0E-03N	3.00E-03N	Backup chiller pump fails to start	Use TC Value
PMPCHIL2OFFE#	1	1N 5.0E-02N	5.00E-02N	Backup chilled water pump not in "auto" mode	estimated by system engineer
PMPCOOLABFLF#	3	8H 3.0E-05H	2.40E-04	Primary cooling water pump fails	a: 8 hour repair time
PMPCOOLBFTRF#	3	8H 3.0E-05H	2.40E-04	Secondary process cooling water pump fails to run	a: 8 hour repair time
PMPCOOLBFTSF#	1	1N 3.0E-03N	3.00E-03N	Secondary process cooling water pump fails to start	Use TC
PMPCTW1-FTRO+	4	7D 3.0E-05H	5.01E-03	Online 50% pump fails to run	a: failed pump repaired in 1 week
PMPCTW2-FTRO#	4	4H 3.0E-05H	1.20E-04	Basic failure of CTW pump #2 (50%)	a: Detected and shut down in 4 hours if standby pump fails
PMPCTW2-FTSO#	1	1N 3.0E-03N	3.00E-03N	Standby 50% pump fails to start	Use TC value
PMPCTW2-T&MO#	1	1N 1.0E-02N	1.00E-02N	Standby 50% pump out of service for testing or maintenance	
PMPCTW3-FTRO+	4	7D 3.0E-05H	5.01E-03	Failure of normally running 25% pump	a: Failed pump repaired in 1 week
PMPCTW4-FTRO#	3	4H 3.0E-05H	1.20E-04	Standby 25% pump fails to run	a: detected and process shut down in 4 hours if standby fails
PMPCTW4-FTSO#	1	1N 3.0E-03N	3.00E-03N	CTW pump #4 (25%) fails to start	a: Not repaired or noticed and shut down until next batch
PMPCTW4-T&MO#	1	1N 1.0E-02N	1.00E-02N	Standby 25% pump out of service for testing and maintenance	
PMPDEEP1FTRO#	3	4H 3.0E-05H	1.20E-04	Primary deep well system pump fails to run	a: 4 hour mission time
PMPDEEP2FTRO#	3	4H 3.0E-05H	1.20E-04	Secondary deep well system pump fails to run	a: 4 hour mission time

Event	C	Input	Calc.	Description	Source
PMPFACIDON-I+	4	1H 1.0M	1.39E-03	Formic acid feed pump on	a: pump runs 1 hour
PMPSCVO1BFLK#	3	43H 3.0E-05H	1.29E-03	O2 analyzer 3405 sample pump fails	a: repaired before next PR batch
PMPSCVO2BFLK#	3	1H 3.0E-05H	3.00E-05	O2 analyzer 3409 sample pump fails	a: high O2 actions taken
PMPSME--BFL4#	3	8H 3.0E-05H	2.40E-04	SME offgas sample pump fails	a: 8 hour repair time
PMPSRATSBFL5#	3	8H 3.0E-05H	2.40E-04	SRAT sample pump fails	a: 8 hour repair time
PMPSTEM1BFLG+	4	8H 3.0E-05H	2.40E-04	Primary steam condensate pump fails	a: 8 hour repair time
PMPSTEM2FTRG#	5	14D 3.0E-05H	5.02E-03	Secondary steam condensate pump fails to run	pumps switched bi-weekly
PMPSTEM2FTSG#	1	1N 3.0E-03N	3.00E-03N	Secondary steam condensate pump fails to start	Use TC value
PMPSTEM2T&MI#	3	8H 6.0E-05H	4.80E-04	Secondary steam condensate pump out of service	a: replaced in 8 hours
POP-SBFNOFFR#	1	1N 5.0E-02N	5.00E-02N	PROCESS OPERATING PROCEDURE FOR STANDBY FAN NOT OPERATING	a: POP off 5% of time
POPCHILLOFFE#	1	1N 5.0E-02N	5.00E-02N	Chiller Process Operating Procedure (DCS) not loaded	Use TC value
POPINAIROFFV#	1	1N 5.0E-02N	5.00E-02N	Instrument air system EMO not online or bypassed	estimated by cog engineer
POPLPPV-OFFT#	1	1N 5.0E-02N	5.00E-02N	Process operating procedure for LPPP VVH fans not operating	a: POP off 5% of time
POPPSW--OFFF#	1	1N 5.0E-02N	5.00E-02N	Process operating procedure (DCS) not loaded for PSW	Use TC value
PR-OWST-HI-P+	4	12H 1.0E+00D	3.33E-01	OWST pressure rises (daily)	a: pressure stays high 12 hours
PR-PHA--IDL6#	3	6H 2.3E-02H	1.29E-01	PR product awaiting transfer after being sampled	a: tx 6 hours after sampling
PSE-021-FOP3+	4	8H 5.0E-07H	4.00E-06	Rupture disk 021 on N2 tank spuriously ruptures	a: 8 hours to repair
PSH4033XFCL1+	4	1H 1.0E-06H	1.00E-06	CO2 tank high pressure switch fails closed	a: detected and corrected in 1 hour
PSL4033XCAL1#	5	1M 2.0E-01Y	8.17E-03	Low level detection instruments calibrated	a: calibrated every 5 years, error corrected in 1 month
PSL4033XFTC1#	3	1Q 1.0E-06H	2.18E-03	CO2 tank low pressure switch fails to close	a: Checked 2/yr
PSL5504-FTC2#	5	1Q 1.0E-06H	1.09E-03	Primary purge pressure low switch 5504 fails to close	a: checked quarterly
PSV-241-FOP3+	4	8H 5.0E-07H	4.00E-06	PSV 241 (or 239) on N2 tank fails open	a: 8 hours to repair
PSV-292-RPTQ+	4	24H 5.0E-07H	1.20E-05	PRESSURE SAFETY VALVE 292 RUPTURES	a: 24 hours to repair
PSV-700-FOP1#	3	26.4H 5.0E-07H	1.32E-05	PSV 700 ON AIR ACCUMULATOR FAILS OPEN	Primary IA system out for 26.4 hours

Event	C	Input	Calc.	Description	Source
PSV-707-FOPP+	4	24H 1.0E-06H	2.40E-05	PSV 707 fails open	a: 24 hours to repair
PSV-708-FOPP+	4	168H 1.0E-06H	1.68E-04	OWST offgas conservation valve PSV 708-fails open	a: corrected in 1 week
PSV-BP--RPTQ+	4	24H 5.0E-07H	1.20E-05	PRESSURE SAFETY VALVE IN BYPASS LINE RUPTURES	a: 24 hours to repair
PSV043--FOPV+	4	8H 5.0E-07H	4.00E-06	PSV on primary compressor discharge fails open	a: 8 hours to repair
PSV047--FOPV+	4	8H 5.0E-07H	4.00E-06	PSV on secondary compressor discharge line fails open	a: 8 hours to repair
PSV051--FOPV#	3	8H 5.0E-07H	4.00E-06	PSV on third compressor discharge fails open	a: 8 hours to repair
PSV063--FOPV+	4	8H 5.0E-07H	4.00E-06	Instrument air receiver PSV fails open	a: 8 hours to repair
PSV1216-FOP3+	4	8H 5.0E-07H	4.00E-06	PSV 1216 on N2 tank piping fails open	a: 8 hours to repair
PSV1217-FOP3+	4	8H 5.0E-07H	4.00E-06	PSV 1217 on N2 tank piping fails open	a: 8 hours to repair
PSV1239-FOP1#	3	24H 5.0E-07H	1.20E-05	Backup CO2 pressure relief valve fails open	a: repair time = 24 hours
PSV1263-FOP1+	4	24H 5.0E-07H	1.20E-05	Bulk CO2 system PSV 1263 fails open	a: 24 hours to repair
PSV1264-FOP1+	4	24H 5.0E-07H	1.20E-05	Bulk CO2 system PSV 1264 fails open	a: 24 hours to repair
PSV1272-FOP3#	3	24H 5.0E-07H	1.20E-05	LPPP N2 bottle PSV 1272 fails open	a: repaired in 24 hours
PSV1298-FOPP#	5	24H 1.0E-06H	1.20E-05	Pressure Safety Valve 1298 fails open	a: 24 hours to repair
PSV1305-FOP9+	4	24H 5.0E-07H	1.20E-05	PR overflow PSV fails open	a: 24 hours to repair
PSV1312-FOP8+	4	24H 5.0E-07H	1.20E-05	OE overflow PSV fails open	a: 24 hours to repair
PSV1333-FOP1+	4	8H 5.0E-07H	4.00E-06	Bulk CO2 system PSV 1333 fails open	a: 8 hours to repair
PSV1334-FOP1+	4	24H 5.0E-07H	1.20E-05	Bulk CO2 system PSV 1334 fails open	a: 24 hours to repair
PSV1335-FOP1+	4	24H 5.0E-07H	1.20E-05	Bulk CO2 PSV 1335 fails open	a: 24 hours to repair
PSV1336-FOP1+	4	24H 5.0E-07H	1.20E-05	Bulk CO2 system PSV 1336 fails open	a: 24ours to repair
PSV1365-FOPP+	4	8H 1.0E-06H	8.00E-06	Pressure Safety Valve Fails Open	a: 8 Hr Repair
PSV1412-FOP2+	4	8H 5.0E-07H	4.00E-06	Safety valve on air receiver fails open	a: 8 hour repair time
PSV1414-FOPJ#	5	24H 5.0E-07H	6.00E-06	PSV 1414 on CPC backup purge system fails open	a: 24 hours to repair
PSV1415-FOPJ#	5	24H 5.0E-07H	6.00E-06	PSV 1415 on CPC backup purge system fails open	a: 24 hours to repair

Event	C	Input	Calc.	Description	Source
PSV1416-FOPJ#	5	24H 5.0E-07H	6.00E-06	PSV 1416 on CPC backup purge system fails open	a: 24 hours to repair
PSV1419-FOPJ#	5	24H 5.0E-07H	6.00E-06	PSV 1419 on CPC backup purge system fails open	a: 24 hours to repair
PSV1455-FOPI+	4	24H 5.0E-07H	1.20E-05	PSV 1455 on bulk N2 supply line fails open	a: 24 hours to repair
PSV1456-FOPI+	4	8H 5.0E-07H	4.00E-06	PSV 1456 on primary bulk N2 vaporizer line fails open	a: 8 hours to repair
PSV1458-FOP3+	4	24H 5.0E-07H	1.20E-05	PSV 1458 on N2 supply to CPC fails open	a: 24 hours to repair
PSV180--FOP9+	4	24H 5.0E-07H	1.20E-05	PSV on PR purge supply line fails open	a: 24 hours to repair
PSV181--FOP8+	4	24H 5.0E-07H	1.20E-05	PSV on OE purge supply line fails open	a: 24 hours to repair
PSV182--FOPA+	4	24H 5.0E-07H	1.20E-05	PSV on OECT purge supply line fails open	a: 24 hours to repair
PSV242--FOP3+	4	24H 5.0E-07H	1.20E-05	PSV 242 on N2 tank piping fails open	a: 24 hours to repair
PSV242--FOPI+	4	24H 5.0E-07H	1.20E-05	PSV 242 on bulk N2 supply line fails open	a: 24 hours to repair
PSV244--FOPI+	4	8H 5.0E-07H	4.00E-06	PSV 244 on Bulk N2 purge line fails open	a: 8 hours to repair
PSV246--FOPI+	4	8H 5.0E-07H	4.00E-06	PSV 246 fails open	a: 8 hours to repair
PSV716--FOPB+	4	24H 5.0E-07H	1.20E-05	PSV on PRFT purge supply line fails open	a: 24 hours to repair
PSVAAAA-FOP3#	3	8H 5.0E-07H	4.00E-06	PSV AAAA on N2 supply line fails open	a: 8 hours to repair
PSVBXXU-FOP3#	3	24H 5.0E-07H	1.20E-05	PSV bxxu failed open	a: 24 hours to repair
PSVBXXV-FOP3#	3	24H 5.0E-07H	1.20E-05	PSV bxxv failed open	a: 24 hours to repair
PSVBXXX-FOP3#	3	24H 5.0E-07H	1.20E-05	PSV bxxx failed open	a: 24 hours to repair
PSVCXXU-FOP3#	3	8H 5.0E-07H	4.00E-06	PSV xxxu failed open	a: 8 hour sto repair
PSVCXXV-FOP3#	3	8H 5.0E-07H	4.00E-06	PSV xxxv failed open	a: 8 hours to repair
PSVCXXX-FOP3#	3	8H 5.0E-07H	4.00E-06	PSV xxxx failed open	a: 8 hours to repair
PSVOWST1FTOP#	1	1N 1.0E-03N	1.00E-03N	OWST conservation vent valve fails to open	Use TC value
PSVOWST2FTOP#	1	1N 1.0E-03N	1.00E-03N	OWST pressure relief valve fails to open	Use TC value
PSVSPT1-FOP3#	3	24H 5.0E-07H	1.20E-05	SPT nitrogen path 1 PSV fails open	a: 24 hours to repair
PSVSPT2-FOP3#	3	24H 5.0E-07H	1.20E-05	SPT nitrogen path 2 PSV fails open	a: 24 hours to repair

Event	C	Input	Calc.	Description	Source
PSVXXXU-FOP3#	3	24H 5.0E-07H	1.20E-05	PSV xxxu failed open	a: detected and replaced in 24 hours
PSVXXXV-FOP3#	3	24H 5.0E-07H	1.20E-05	PSV xxxv failed open	a: detected and replaced in 24 hours
PSVXXXX-FOP3#	3	24H 5.0E-07H	1.20E-05	PSV xxxx failed open	a: detected and replaced in 24 hours
PT-1041-FHIK#	5	43H 1.0E-06H	2.15E-05	PR vapor space PT-1041 fails high	a: repaired before next batch
PT-1895-FLOE+	4	8H 1.0E-06H	8.00E-06	Primary chiller PT-1895 fails low (closes CTW valve)	a: 8 hours to repair
PT-2220-FHIG+	4	8H 1.0E-06H	8.00E-06	Pressure transmitter for 260# steam supply fails high	a: Detected and repaired or process shutdown in 8 hours
PT-2363-FHIF#	5	6M 1.0E-06H	2.16E-03	PSW pump discharge pressure transmitter fails high	a: functionally checked every 6 months
PT-9168-FHIP#	5	7D 1.0E-06H	8.40E-05	OWST outer tank pressure transmitter fails high	a: corrected in 1 week
PT-9235-FHIP#	5	7D 1.0E-06H	8.40E-05	OWST outer tank pressure transmitter fails high	a: corrected in 1 week
PT-9312-FHIK#	5	43H 1.0E-06H	2.15E-05	OE vapor space PT-9312 fails high	a: repaired before next PR batch
PT-9603-FHIV#	5	48H 1.0E-06H	2.40E-05	Instrument air pressure transmitter 9603 fails high	a: detected and repaired in 2 days
PT-9664-FHIV#	5	48H 1.0E-06H	2.40E-05	Plant air pressure transmitter 9644 fails high	a: detected and repaired in 2 days
PT-AIR--CAL1#	5	1M 2.0E-01Y	8.17E-03	Instrument air PTs calibrated	a: every 5 years, error corrected in 1 month
RE-1034-FLOO#	5	6M 5.0E-06H	1.07E-02	Radiation element for PR PSW return fails low	a: checked twice per year
RE-1144-FLOO#	5	6M 5.0E-06H	1.07E-02	PRFT PSW return line radiation monitor fails low	a: checked twice per year
RE-3012-FLOO#	5	6M 5.0E-06H	1.07E-02	SRAT PSW return line radiation monitor fails low	a: checked twice per year
RE-3091-FLOO#	5	6M 5.0E-06H	1.07E-02	SME PSW return line radiation monitor fails low	a: checked twice per year
RE-3214-FLOO#	5	6M 5.0E-06H	1.07E-02	PRBT PSW return line radiation monitor fails low	a: checked twice per year
RE-3255-FLOO#	5	6M 5.0E-06H	1.07E-02	MFT PSW return line radiation monitor fails low	a: checked twice per year
RE-5846-FLOO#	5	6M 5.0E-06H	1.07E-02	RCT PSW return line radiation monitor fails low	a: checked twice per year
RE-5917-FLOO#	5	6M 5.0E-06H	1.07E-02	DWTT PSW return line radiation monitor fails low	a: checked twice per year
RE-9308-FLOO#	5	6M 5.0E-06H	1.07E-02	OE PSW return line radiation monitor fails low	a: checked twice per year
REGBOT1-FTO1#	5	48H 3.0E-06H	7.20E-05	Bottle 1 pressure regulator fails to open	a: detected and repaired in 48 hours
REGBOT2-FTO1#	5	48H 3.0E-06H	7.20E-05	Bottle 2 pressure regulator fails to open	a: detected and repaired in 48 hours

Event	C	Input	Calc.	Description	Source
REGBOT3-FTO1#	5	48H 3.0E-06H	7.20E-05	Bottle 3 pressure regulator fails to open	a: detected and repaired in 48 hours
REGBOT4-FTO1#	5	48H 3.0E-06H	7.20E-05	Bottle 4 pressure regulator fails to open	a: detected and repaired in 48 hours
RY--12--C2DR#	5	8H 3.0E-08H	1.20E-07	CC: TWO FAN RELAYS FAIL OPEN	a: 8 hours to repair
RY--12--CCER#	1	1N 1.0E-04N	1.00E-04N	CC: TWO FAN RELAYS FAIL TO CLOSE (SAME BUS)	Use TC
RY--123-C3DR#	5	8H 1.5E-08H	6.00E-08	CC: THREE FAN RELAYS FAIL OPEN	a: 8 hours to repair
RY--123-C3GR#	1	1N 5.0E-05N	5.00E-05N	CC: THREE FAN RELAYS FAIL TO CLOSE	Use TC
RY--1234C3GR#	1	1N 5.0E-05N	5.00E-05N	CC: FOUR FAN RELAYS FAIL TO CLOSE	Use TC
RY--FD--FTOS#	1	1N 1.0E-05N	1.00E-05N	FEED PUMP RELAY FAILS TO OPEN (STOP PUMP)	Use TC
RY--SB--FOPR#	5	8H 3.0E-07H	1.20E-06	STANDBY FAN RELAY FAILS OPEN	a: 8 hours to repair
RY--SB--FTCR#	1	1N 1.0E-05N	1.00E-05N	STANDBY FAN RELAY FAILS TO CLOSE	Use TC
RY-00001FOPR#	5	8H 3.0E-07H	1.20E-06	FAN #1 RELAY FAILS OPEN	a: 8 hours to repair
RY-00002FOPR#	5	8H 3.0E-07H	1.20E-06	FAN #2 RELAY FAILS OPEN	a: 8 hours to repair
RY-00003FOPR#	5	8H 3.0E-07H	1.20E-06	FAN #3 RELAY FAILS OPEN	a: 8 hours to repair
RY-1234-C3DR#	5	8H 1.5E-08H	6.00E-08	CC: FOUR FAN RELAYS FAIL OPEN	a: 8 hours to repair
RY-4041-FTO5#	1	1N 1.0E-05N	1.00E-05N	Fail to open PRBT transfer pump switch (fail to stop pump)	Use TC value
RY-9667AFTOV#	1	1N 1.0E-05N	1.00E-05N	Compressor trouble alarm fails	a: relay fails to open
RY-BASINFOPR+	4	8H 3.0E-07H	2.40E-06	CTW basin low level interlock spuriously trips pumps	a: 8 hour repair time
RY-PFSFTFTO4#	1	1N 1.0E-05N	1.00E-05N	Relay for PFSFT pump fails to open	Use TC value
RY-PRPMPFTO5#	1	1N 1.0E-05N	1.00E-05N	Fail to stop PRFT to PR transfer pump	Use TC value
RY-SRTL-FTO5#	1	1N 1.0E-05N	1.00E-05N	Fail to open SRAT steam flow low interlock relay	Use TC value
SC-8760-FLOT#	3	8H 1.0E-06H	8.00E-06	Speed controller for LPP VVH secondary fan fails low	a: Primary failure repaired or responded to within 8 hours
SC-8762-FLOT+	4	8H 1.0E-06H	8.00E-06	Speed controller for LPP VVH primary fan fails low	a: 8 hours to repair
SLGNOBL-PRE5#	1	1N 1.0E-02N	1.00E-02N	Excessive noble metals present in sludge	a: present during entire cycle
SLRSALT-BLUU#	1	1N 1.0E+00N	1.00E+00N	Excess salt build up on melter top layer	a: any salt build up results in excess amount

Event	C	Input	Calc.	Description	Source
SLRSALT-PREU+	4	2Y 5.0E-01Y	5.00E-01	Excess salt present in sludge from tank farm transferred to DWPF	a: present in macro batch
SRABATCHPRE5+	4	86H 5.0E-01Y	4.88E-03	New batch of sludge for DWPF	a: re-evaluated each SRAT batch
STMSITE-BFLG+	4	8H 2.0E-04H	1.60E-03	Site steam (to DWPF) steam generator fails	DWPF SAR 9.3.20.3
SV-2262-FTCG#	1	1N 1.0E-03N	1.00E-03N	MAKEUP FEED VALVE 2262 FAILS TO CLOSE	Use TC
SV-2277-FTOG#	1	1N 1.0E-03N	1.00E-03N	PROCESS STEAM CONDENSATE PURGE VALVE 2277 FAILS TO OPEN	Use TC
SV-4033XFOP1+	4	1H 5.0E-07H	5.00E-07	CO2 tank overpressure protection SV fails open	a: detected and corrected in 1 hour
SV-7606XFCL1+	4	8H 5.0E-07H	4.00E-06	CO2 low temp interlock solenoid valve fails closed	a: 8 hours to repair
SV-CO21-FCLQ+	4	43H 3.0E-06H	1.29E-04	SPC CO2 purge isolation valve 1 fails closed	a: corrected before next batch
SV-CO22-FCLQ+	4	43H 3.0E-06H	1.29E-04	SPC CO2 purge isolation valve 2 fails closed	a: corrected before next batch
SV-DRY1-FCLV+	4	24H 5.0E-07H	1.20E-05	Dryer #1 inlet valve fails closed	a: 24 hours to repair
SV-DRY2-FCLV#	3	24H 5.0E-07H	1.20E-05	Dryer #2 inlet valve fails closed	a: 24 hours to repair
SV-MFT--ADJ5+	4	24H 1.0E+00M	3.23E-02	MFT purge supply needle valve adjusted	a: adjusted monthly, detected in 24 hours
SV-PRBT-ADJ5+	4	24H 1.0E+00M	3.23E-02	PRBT purge supply needle valve adjusted	a: adjusted monthly, corrected in 24 hours
SV-SME--ADJ5+	4	24H 1.0E+00M	3.23E-02	SME purge supply needle valve adjusted	a: adjusted monthly, corrected in 24 hours
SV-SRAT-ADJ5+	4	24H 1.0E+00M	3.23E-02	SRAT purge supply needle valve adjusted	a: adjusted monthly, corrected in 24 hours
TC-7605XFLO1+	4	8H 3.0E-05H	2.40E-04	CO2 heater temperature controller fails low	a: 8 hours to repair
TC-7606XFLO1+	4	8H 3.0E-05H	2.40E-04	Heater low temp cutoff valve controller fails low	a: 8 hours to repair
TCV1116-FCLD+	4	43H 5.0E-07H	2.15E-05	PRC/D cooling water valve fails closed	a: detected by next batch
TCV2346-FCLF#	3	8H 5.0E-07H	4.00E-06	TCV on CTW (heat sink for PSW) fails closed	a: 8 hours to detect and repair
TCV3461-FCLD#	3	86H 5.0E-07H	4.30E-05	FAVC chilled water temperature control valve fails closed	a: corrected by next SRAT batch
TCV9346-FCLD+	4	43H 5.0E-07H	2.15E-05	OEC/D cooling water valve fails closed	a: repaired before next batch
TCV9356-CAL1+	4	43H 1M	5.64E-02	SCVC chilled water supply valve 9356 calibrated	a: detected in one batch
TCV9356-FCLD+	4	8H 5.0E-07H	4.00E-06	SCVC chilled water supply valve fails closed	a: 8 hours to repair
TE--HTR-CCAS+	4	43H 1.0E-07H	4.30E-06	CC: TWO LID HEATER THERMOCOUPLE PAIRS INDICATE FALSE HIGH TEMPERATURE	a: detected in 1 cycle

Event	C	Input	Calc.	Description	Source
TE--HTRACCAS+	4	43H 1.0E-07H	4.30E-06	CC: 2 THERMO-COUPLES IN LID HEATER A FAIL - FALSE HIGH TEMP	a: detected in 1 cycle
TE--HTRBCCAS+	4	43H 1.0E-07H	4.30E-06	CC: 2 THERMO-COUPLES IN LID HEATER B FAIL - FALSE HIGH TEMP	a: detected in 1 cycle
TE--HTRCCCAS+	4	43H 1.0E-07H	4.30E-06	CC: 2 THERMO-COUPLES IN LID HEATER C FAIL - FALSE HIGH TEMP	a: detected in 1 cycle
TE--HTRDCCAS+	4	43H 1.0E-07H	4.30E-06	CC: 2 THERMO-COUPLES IN LID HEATER D FAIL - FALSE HIGH TEMP	a: detected in 1 cycle
TE-1117-FLOD+	4	43H 1.0E-06H	4.30E-05	PRC/D temp element fails low	a: detected before next batch
TE-1HTRAFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 1 IN LID HEATER A INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-1HTRBFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 1 IN LID HEATER B INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-1HTRCFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 1 IN LID HEATER C INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-1HTRDFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 1 IN LID HEATER D INDICATES FALSE HIGH TEMPERTURE	a: detected in 1 cycle
TE-1INT-FHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 1 IN MELTER VAPOR SPACE INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-2346-FLOF#	5	6M 1.0E-06H	2.16E-03	PSW HX outlet temp element fails low (closes CTW valve)	a: Checked twice a year
TE-2HTRAFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 2 IN LID HEATER A INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-2HTRBFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 2 IN LID HEATER B INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-2HTRCFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 2 IN LID HEATER C INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-2HTRDFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 2 IN LID HEATER D INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-2INT-FHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 2 IN MELTER VAPOR SPACE INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-3HTRAFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 3 IN LID HEATER A INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-3HTRBFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 3 IN LID HEATER B INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-3HTRCFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 3 IN LID HEATER C INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-3HTRDFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 3 IN LID HEATER D INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-3INT-FHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 3 IN MELTER VAPOR SPACE INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-4HTRAFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 4 IN LID HEATER A INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-4HTRBFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 4 IN LID HEATER B INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-4HTRCFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 4 IN LID HEATER C INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle

Event	C	Input	Calc.	Description	Source
TE-4HTRDFHIS+	4	43H 1.0E-06H	4.30E-05	THERMOCOUPLE 4 IN LID HEATER D INDICATES FALSE HIGH TEMPERATURE	a: detected in 1 cycle
TE-9346-FLOD+	4	43H 1.0E-06H	4.30E-05	OEC/D temperature element controlling cooling fails low	a: repaired before next batch
TE-9356AFLOD+	4	24H 1.0E-06H	2.40E-05	SCVC vapor exit temperature element 9356A fails low	a: detected and corrected in 24 hours
TE-INT--CCAS+	4	43H 1.0E-07H	4.30E-06	CC: TWO MELTER VAPOR SPACE THERMOCOUPLES INDICATE FALSE HIGH TEMP	a: detected in one cycle
TNKBLKN2LKS3+	4	48H 1.0E-08H	4.80E-07	Liquid N2 tank leaks	a: detected and alternate source supplied in 48 hours
TNKC6H6-LKSP+	4	24H 1.0E-07H	2.40E-06	OWST inner tank leaks benzene into outer tank	a: 24 hours to rectify
TNKCO2P-USD1+	4	24H 1M	3.23E-02	Primary tank volume used up	a: 1 month supply
TNKCPCN2LKS3#	3	48H 1.0E-08H	4.80E-07	CPC backup purge N2 tank leaks	a: repaired and refilled in 48 hours
TNKLPPN2LKS3#	3	48H 1.0E-08H	4.80E-07	LPPP local liquid N2 tank leaks	a: repaired and refilled in 48 hours
TNKN2SUPUSD3+	4	24H 3.3E-01D	2.48E-01	N2 supply tank volume used	Use TC value
TNKOWN2-LKS3#	3	7D 1.0E-08H	1.68E-06	OWST local liquid N2 tank leaks	a: repaired and refilled in 1 week
TNKSTEAMLKS3+	4	8H 1.0E-08H	8.00E-08	Steam condensate tank leaks	a: Process shut down in 8 hours
TOPBLKN2BFLT+	4	20H 5.5E-06H	1.10E-04	Failure of the bulk N2 path (except N2 tank supply failure)	From fault tree Blkn2.CAF
TOPCPCBPBFLW#	1	1N 3.1E-03N	3.10E-03N	Backup CPC purge fails (except N2 tank supply failure)	From fault tree CPCBP.CAF
TOPCPCPPBFL2+	4	51H 1.9E-05H	9.68E-04	CPC primary purge system fails (excluding normal power failure)	From fault tree CPCPP.CAF
TOPCPCTKBFL7#	1	1N 3.7E-05N	3.70E-05N	CPC nitrogen tank supply failure	From fault tree CPCTNK.CAF
TOPCTWCCBFLO#	3	5.5H 1.1E-05H	6.05E-05	CTW valving or piping failure (excl. inair)	From fault tree CTWCC.CAF
TOPCTWCCBFLO+	4	5.5H 1.1E-05H	6.05E-05	Failure of CTW valving or piping (excl. INAIR)	From fault tree CTWCC.CAF
TOPCTWP-BFLB#	3	90H 6.3E-06H	5.67E-04	CTW primary pumping failure (excl. POWN)	From fault tree CTWP.CAF
TOPCTWP-BFLB+	4	90H 6.3E-06H	5.67E-04	CTW primary pumping failure (excl. POWN)	From fault tree CTWP.CAF
TOPDEEP-BFLA#	1	1N 5.4E-03N	5.40E-03N	CTW deep well pumping failure	From fault tree DEEP.CAF
TOPINAIRBFLV#	3	26H 1.1E-05H	2.86E-04	Instrument air failure	From fault tree Inair.CAF
TOPINAIRBFLV+	4	26H 1.1E-05H	2.86E-04	Instrument air failure (excl CTW or POWN/POWD)	From fault tree Inair.CAF
TOPLPPN2BFLJ#	1	1N 5.3E-04N	5.30E-04N	LPPP local N2 supply unavailable	From fault tree LPPPN2.CAF

Event	C	Input	Calc.	Description	Source
TOPN2TNKBFL3#	3	17H 7.7E-06H	1.31E-04	Bulk nitrogen tank supply failure	From fault tree N2tnk.CAF
TOPN2TNKBFL3+	4	17H 7.7E-06H	1.31E-04	Nitrogen tank supply failure	From fault tree N2tnk.CAF
TOPPOWD-BFLN#	1	1N 1.1E-02N	1.10E-02N	LOSS OF BACKUP POWER (DIESEL GENERATORS)	From fault tree POWD.CAF
TOPPOWN-BFLH#	3	8.5H 3.5E-05H	2.97E-04	Loss of normal power to DWPF	From fault tree POWN.CAF
TOPPOWN-BFLH+	4	8.5H 3.5E-05H	2.97E-04	LOSS OF NORMAL ELECTRIC POWER TO DWPF	From fault tree POWN.CAF
TOPPSW--BFLF#	1	1N 2.3E-03N	2.30E-03N	Inadequate process cooling water (excl. POWN & POWD or CTW)	From fault tree PSW.CAF
TOPSPCBPBFL0#	1	1N 6.7E-03N	6.70E-03N	Failure of backup CO2 system	From fault tree SPCBP.CAF
TOPSPCN2BFLU#	1	1N 4.1E-04N	4.10E-04N	SPC nitrogen purge system unavailable	From fault tree SPCN2.CAF
TOPSPCPPBFL1+	4	8.8H 6.7E-05H	5.89E-04	SPC primary purge fails (excluding normal power)	From fault tree SPCPP.CAF
TOPSSW--BFLE+	4	14H 2.3E-05H	3.22E-04	Process chilled water failure	From fault tree PSW.CAF
TOPSTEAMBFLG+	4	55H 2.1E-04H	1.14E-02	Inadequate steam presure in supply header (excl. POWN or INAIR)	From fault tree Steam.CAF
TOPVV-E-BFLR#	1	1N 1.1E-03N	1.10E-03N	Zone 1 ventilation unavailable (IA failed, power available)	From fault tree VV-E.CAF
TOPVV-EIBFLS#	1	1N 7.6E-03N	7.60E-03N	Zone 1 ventilation unavailable (normal power, IA avail)	From fault tree VV-EI.CAF
TOPVVENTBFLQ#	1	1N 3.3E-05N	3.30E-05N	Zone 1 ventilation unavailable (IA, norm power available)	From fault tree VV.CAF
TRF-HTR-CCAS+	4	43H 1.0E-07H	4.30E-06	CC: TWO LID HEATER TRANSFORMERS FAIL	a: detected in 1 cycle
TRF-HTRABFLS+	4	43H 1.0E-06H	4.30E-05	TRANSFORMER FOR LID HEATER A FAILS	a: detected in 1 cycle
TRF-HTRBBFLS+	4	43H 1.0E-06H	4.30E-05	TRANSFORMER FOR LID HEATER B FAILS	a: detected in 1 cycle
TRF-HTRCBFLS+	4	43H 1.0E-06H	4.30E-05	TRANSFORMER FOR LID HEATER C FAILS	a: detected in 1 cycle
TRF-HTRDBFLS+	4	43H 1.0E-06H	4.30E-05	TRANSFORMER FOR LID HEATER D FAILS	a: detected in 1 cycle
TRS-CTW-PLG1+	4	24H 5.0E-07H	1.20E-05	CTW screens into pump pit plug	a: repaired in 1 day
TSH7605XFCL1+	4	24H 1.0E-06H	2.40E-05	High temperature cutout switch for CO2 heater fails closed	a: repaired in 24 hours
TX-NITR-PRE5+	4	1H 1.2E-02H	1.19E-02	Transfer nitric acid into SRAT	a: addition lasts 1 hour
TX-PRFTPPREB+	4	2H 2.3E-02H	4.40E-02	Transfer from PRFT to PR	a: transferred in 2 hours
TX-PRPRBPRE9+	4	2H 2.3E-02H	4.40E-02	Transfer from PR to PRBT	a: transferred in 2 hours

Event	C	Input	Calc.	Description	Source
TX-SRAT-PRE5+	4	23H 1.2E-02H	2.16E-01	Transfer from PRBT to SRAT	Transfer lasts 23 hours
UA-1882-FTAE#	5	3M 3.0E-06H	3.23E-03	Chiller trouble alarm fails	a: checked quarterly
UA-5502-FTA2#	5	1Y 3.0E-06H	1.30E-02	Compressor trouble fails to alarm	a: checked annually
UPS-FAN-BFLR#	1	1N 4.7E-04N	4.70E-04N	LOSS OF UPS	Use TC
UPS1041-BFLR#	1	1N 4.7E-04N	4.70E-04N	UPS power to MOV 1041 unavailable	Use TC value
UPS9278-BFLR#	1	1N 4.7E-04N	4.70E-04N	UPS power for MOV 9278 unavailable	Use TC value
VAP--OE-LKSG+	4	8H 1.0E-07H	8.00E-07	ORGANIC EVAPORATOR COIL LEAK	a: 8 hours to repair
VAP--PR-LKSG+	4	8H 1.0E-07H	8.00E-07	PRECIPITATE REACTOR EVAPORATOR COIL LEAK	a: 8 hours to repair
VAP-SME-LKSG+	4	8H 1.0E-07H	8.00E-07	SME EVAPORATOR COIL LEAK	a: 8 hours to repair
VAPDWTT-LKSG+	4	8H 1.0E-07H	8.00E-07	DWTT EVAPORATOR COIL LEAK	a: 8 hours to repair
VAPSRAT-LKSG+	4	8H 1.0E-07H	8.00E-07	SRAT EVAPORATOR COIL LEAKS	a: 8 hours to repair
VB-418--FOPP+	4	24H 5.0E-07H	1.20E-05	Vacuum breaker 418 fails open	a: 24 hours to repair
VLV9176-LKSP#	3	8H 1.0E-08H	8.00E-08	BLOCK VALVE LEAKAGE	a: 8 hr detection
VLVDWTOTLKSP#	3	8H 1.0E-08H	8.00E-08	BLOCK VALVE LEAKS DOWNSTREAM OF THE FLOW METER	a: 8 hr detection
VLVRCIRCLKSP#	3	8H 1.0E-08H	8.00E-08	RECIRCULATION LINE BLOCK VALVE LEAKS	a: 8 hr detction
WE-2779-CAL1#	3	1M 2.0E-01Y	1.63E-02	CO2 backup bottle weight element 2779 calibrated	a: error detected in 1 month
WE-2779-FHI1#	5	12H 3.0E-06H	1.80E-05	CO2 bottle weight element fails high	a: detected and repaired in 12 hours
WSL2779BFTC1#	5	12H 3.0E-06H	1.80E-05	Backup CO2 very low weight switch fails to close	a: detected and repaired in 12 hours
WTR-MLT-PREU#	1	1N 1.0E+00N	1.00E+00N	Water in the melter	Due to water purge

Attachment 4
Type Code (TC) File

The Type Code (TC) file contains all failure types used in the DWPF accident analysis fault trees. The TC file is given in the following format and van be interpreted as follows:

Type - The type code follows the naming convention in Attachment 2. Each type code has a unique name shared by all basic events that represent the same component type, failing in the same mode, in the same type of system. For example, all pumps failing to run in water systems have the same failure frequency assigned by the TC file.

Rate - The failure rate is entered in the Rate column. This number is from reliability data, as found in References 1 and 2 or supplied by DWPF cognizant engineers (where appropriate).

U - Units for the calculation
H = Hour D = Day M = Month Q = Quarter
Y = Year N = no units (probability)

Desc. - The description column provides room for a longer description of the type code to be entered.

Source - The source column is provided to enter information regarding the source of failure rate data.

References for Attachment 4

1. WSRC-TR-93-262, SRS Generic Data Base Development (U), June 30, 1993.

2. WSRC-TR-93-581, SRS Human Error Generic Data Base Development for Non-reactor Nuclear Facilities (U), February, 1994.

Type Codes for I:\CAFTA\DATA\MASTER.TC 11/11/94 11:43 AM

Type Code	Rate	Description	Source	EF	D
AE- BFL G	5.0E-06H	ANALYZING ELEMENT BASIC FAILURE	E-RST-FA-I	5	M
AE- BFL P	5.0E-06H	ANALYZING ELEMENT BASIC FAILURE	E-ANA-FA-I	10	M
AE- BFL Q	1.0E-05H	LOSS OF HIGH O2 INTERLOCK	E-OXC-FA-I	10	M
AE- CCA Q	1.0E-06H	CC: Analyzers fail	E-OXC-FA-I * .1	10	M
AE- CCL U	5.0E-07H	CC: Analyzer element fails low (2 elements)	E-ANA-FA-I (BETA=.1)	10	M
AE- FLO K	5.0E-06H	SCVC analyzer fails low	E-ANA-FA-I	10	M
AEG FLO 5	5.0E-05H	GC analyzer element fails low	E-GCR-FA-I	10	M
AEG FLO D	5.0E-05H	GC analyzer element fails low	E-GCR-FA-I	10	M
AEG LKS 4	7.5E-07H	Incorrect analysis due to air inleakage	A:25 FEET LINE E-PIP-LE-G	10	M
AEG LKS 5	7.5E-07H	Incorrect analysis due to air inleakage	A:25 FEET LINE E-PIP-LE-G	10	M
AX- BFL 4	3.0E-05H	Analyzer calculation failure	E-PLC-FA-I	10	M
AX- BFL 5	3.0E-05H	Analyzer calculation failure	E-PLC-FA-I	10	M
BCH DBL 5	1.0E-01N	Fraction of time batch for SRAT is double batch	estimated by cog manager in mtg 3/8/94: 1/10 batches	10	M
BCH PRE 5	1.2E-02H	Batch run in SRAT	1 batch every 86 hours	10	M
BKR C3D R	1.5E-08H	CC: Circuit Breaker Transfer Open (> 2 components)	E-CBR-CO-E x 0.05	10	M
BKR CCB H	3.0E-08H	CC: Circuit breaker fails spuriously open (2 components)	E-CBR-CO-E X .1	10	M
BKR CCB N	3.0E-08H	CC: Circuit breaker fails spuriously open (2 components)	E-CBR-CO-E X .1	10	M
BKR CCB R	3.0E-08H	CC: Circuit breaker fails open (2 components)	E-CBR-CO-E * .1	10	M
BKR CCB S	3.0E-08H	CC: Circuit breaker fails spuriously open (2 components)	E-CBR-CO-E X .1	10	M
BKR CCD N	5.0E-05N	CC: Circuit breakers fail to open (2 components)	E-CBR-CC-E * .1	10	M
BKR CCE N	5.0E-05N	CC: Circuit breaker fails to close (2 components)	E-CBR-CC-E	5	M
BKR FOP D	3.0E-07H	Circuit breaker fails spuriously open	E-CBR-CO-E	10	M
BKR FOP H	3.0E-07H	Circuit breaker fails spuriously open	E-CBR-CO-E	10	M
BKR FOP N	3.0E-07H	Circuit breaker fails spuriously open	E-CBR-CO-E	10	M
BKR FOP R	3.0E-07H	Circuit breaker fails open	E-CBR-CO-E	10	M
BKR FOP S	3.0E-07H	Circuit breaker fails spuriously open	E-CBR-CO-E	10	M
BKR FTC N	5.0E-04N	Circuit breaker fails to close	E-CBR-OO-E	5	M
BKR FTO N	5.0E-04N	Circuit breaker fails to open	E-CBR-CC-E	5	M
BNZ PRE P	2.3E-02H	Benzene transfer to OWST in progress	Transfer every 43 hours	10	M
BOT REP 1	6.7E-05H	CO2 Bottled gas demanded	from fault tree SPCPP.CAF	10	M
BOT T&M 1	1Y	CO2 bottle isolated for maintenance	a: 1/year	10	M
BUS BFL H	1.0E-07H	Failure of electrical bus	E-BUM-FA-E	5	M
BUS CCA H	1.0E-08H	CC: Failure of electrical bus (2 components)	E-BUM-FA-E X .1	5	M
BUS UNA H	3.8E-02N	BUS UNAVAILABLE DUE TO TESTING/MAINTENANCE	ERD 16961-07-R ((1 week/1 year)*2)	10	M
CC2 AEG 1	5.0E-06H	cc: both gas monitors fail low	0.1 x E-GCR-FA-I	10	M
CC2 CHL 1	5.0E-06H	cc: both chiller fail	0.1 X MDC-FR-G	3	M
CC2 CMP 2	5.0E-06H	CC: Both CPC purge air compressors fail	E-MDC-FR-G x .1	3	M

Type Codes for I:\CAFTA\DATA\MASTER.TC 11/11/94 11:43 AM (CONT.)

Type Code	Rate	Description	Source	EF	D
CC2 CV- J	5.0E-05N	cc: two check valves in series fail to close	0.1 x cv- ftc j	10	M
CC2 DG- 1	3.0E-03N	cc: both deep well systems fail	0.1 X single rate (gate G-CTW-14)	10	M
CC2 DRY 1	5.0E-08H	cc: both solenoid valves fail closed	0.1 X E-SOV-OC-W	10	M
CC2 FAN 1	3.0E-06H	cc: 2 CTW fans fail to run	0.1 X E-MDF-FR-H	3	M
CC2 FE- 7	3.0E-07H	CC: two flow elements fail high	(FE- FHI 7) X (0.1)	3	M
CC2 H2- 1	5.0E-06H	cc: both hydrogen monitors fail low	0.1 x E-GCR-FA-I	10	M
CC2 HCV 1	5.0E-08H	cc: two solenoid operated valves fail open	0.1 x E-SOV-CO-G	10	M
CC2 LFL 5	5.0E-06H	cc: both gas monitors fail low	0.1 x E-GCR-FA-I	10	M
CC2 LIN J	4.1E-04N	cc: both SPT N2 supply lines fail	single failure x 0.1	10	M
CC2 LSL 1	3.0E-03N	cc: LSL and PSL both miscalibrated	0.1 X OPR MCH 1	10	M
CC2 MOV 1	3.0E-04N	Motor operated valve fails to close	0.1 x E-MOV-OO-W	5	M
CC2 MOV K	3.0E-04N	cc: two motor operated valve fails to close	0.1 times single failure rate	5	M
CC2 O2- K	5.0E-04N	cc: miscalibrate both SPC O2 analyzers	0.1 x single failure	10	M
CC2 PCV 1	3.0E-04N	cc: PCV fails to open	0.1 x E-AOV-CC-G	30	M
CC2 PCV J	3.0E-04N	cc: PCV fails to open	0.1 x E-AOV-CC-G	30	M
CC2 PCV N	3.0E-04N	cc: PCV fails to open	0.1 x E-AOV-CC-G	30	M
CC2 PMP G	3.0E-06H	cc: both pumps fail to run	0.1 x E-MDP-FR-W	10	M
CC2 PSV 1	1.0E-06H	cc: two pressure safety valves fail open	0.1 X E-SRV-LI-G	10	M
CC2 PT- 1	1.0E-07H	cc: both pressure transmitters fail high	0.1 x E-PST-FA-I	3	M
CC2 PT- K	1.0E-07H	cc: both pressure transmitters fail high	0.1 x E-PST-FA-I	3	M
CC2 RMN N	5.0E-03N	cc: fail to restore diesels to standby following maintenance	WSRC-TR-93-581, Table 4, Item 14 (SOP 292-S-4008, rev.3,step 4.18.3)	10	L
CC2 RTH 1	3.0E-03N	cc: failure to restore following testing	0.1 x WSRC-TR-93-581, Table 4, item 13	5	L
CC2 SMP 6	3.0E-05N	cc: PR and PRBT samples inadequate	0.5 x single rate (fault tree branch)	10	M
CC2 SPC K	1.0E-04N	CC: two SOVs fail to close	0.1 x hcv ftc k	10	M
CC2 SV- N	1.0E-04N	cc: two SVs fail to open	0.1 x sv- fto n	10	M
CC3 FE- 1	1.5E-07H	Flow element fails high	0.05 X E-FST-FA-I	3	M
CC3 FSL 1	1.5E-03N	cc: 3 miscalibrations - 1 person, no checks	0.05 x WSRC-TR-93-581, Table 4, item 12	5	L
CC3 FSL 4	1.1E-04N	cc: 3 FSLs fail to close	(FSL FTC D) x (.1) x (.5)	5	M
CC3 FSL D	1.1E-04N	cc: 3 FSLs fail to close	(FSL FTC D) x (.1) x (.5)	5	M
CC3 PMP 1	1.5E-06H	cc: 3 pumps fail to run	0.05 x E-MDP-FR-W	10	M
CC3 REG 1	1.5E-07H	Pressure regulator on CO2 system fails to open	CC: E-CAV-NR-G * .05	10	M
CC3 RMH 1	2.5E-03N	cc: fail to restore all 3 components following maintenance	0.05 X WSRC-TR-93-581, Table 4, item 14	10	L
CHL BFL E	5.0E-05H	Chiller Fails to Cool	a: MDC-FR-G	3	M
CHL FTR E	5.0E-05H	Chiller Stops Cooling	a: MDC-FR-G	3	M
CHL FTS E	5.0E-03N	Chiller fails to start when needed	a: MDC-FS-G	5	M
CHL T&M E	4.0E+00Y	Chiller undergoes T&M	estimated by DWPF cog eng. 3-29-94 to be 1/6 months * 2 chillers	10	M
CMP BFL 2	5.0E-05H	Operating purge air compressor fails	E-MDC-FR-G	3	M
CMP BFL V	5.0E-05H	Operating instrument air compressor fails	E-MDC-FR-G	3	M
CMP C3C V	2.5E-06H	CC: Compressor failure (>2)	E-MDC-FR-G x .05	3	M
CMP FTR 2	5.0E-05H	Purge air compressor fails to run	E-MDC-FR-G	3	M
CMP FTR V	5.0E-05H	Operating instrument air compressor fails	E-MDC-FR-G	3	M

Type Code	Rate	Description	Source	EF	D
CMP FTS 2	5.0E-03N	Purge air compressor fails to start	E-MDC-FS-G	5	M
CMP FTS V	5.0E-03N	Plant/instrument air compressor fails to start	E-MDC-FS-G	5	M
CMP T&M 2	3.0E-02N	Purge air compressor out of service	a: 2 * (1 day/quarter + (1 week)/(5 years))	10	M
CMP T&M V	1Y	T&M performed on compressors	estimated by DWPF cog eng. in mtg 3-30-94, 9 days/year * 3	10	M
CND LKS G	1.0E-07H	Condenser leaks	E-HTX-LI-W	10	M
CO2 CHK 1	3.0E-04H	CO2 bottles changed out	a: changed out as frequently as primary SPC CO2 supply fails (3E-4/hour)	10	M
CON PRE G	1.0N	Contamination present	A: assumed present		
CP- CC- U	2.0E-01N	Same analyst conducts sampling at two locations	calculated as 1/5 shifts	10	M
CP- CC1 U	2.0E-01N	Same analyst conducts sampling from SRAT to SME	calculated as 1/5 shifts	10	M
CV- FCL G	5.0E-07H	Steam condensate supply check valve fails closed	A:E-ckv-pg-G	10	M
CV- FTC J	5.0E-04N	Check valve in compressed gas system fails to open	E-CKV-OO-G	10	M
CV- FTO F	5.0E-05N	Check valve in water system fails to open	a: E-ckv-cc-w	10	M
CV- FTO G	5.0E-05N	Check valve in water system fails to open	a: E-ckv-cc-w	10	M
CV- FTO J	5.0E-04N	Check valve in compressed gas system fails to open	E-CKV-CC-G	10	M
CV- FTO O	5.0E-05N	Check valve in water system fails to open	a: E-ckv-cc-w	10	M
CYL OUT P	3.6E-01N	N2 cylinders run out of inventory	a: cyl supply = ave restore time, exp(-t/T)	10	M
DCS BFL 2	3.0E-06H	DCS fails	a: E-LOG-FA-I	5	M
DCS BFL E	3.0E-06H	DCS fails	a: E-LOG-FA-I	5	M
DG- CCC N	1.0E-03N	CC: Diesel generator fails to start (2 components)	E-DDG-FS-E X .1	3	M
DG- CCD N	5.0E-04H	CC: Diesel generator fails to run (2 components)	E-DDG-FR-E X .1	3	M
DG- FTR N	5.0E-03H	Diesel generator fails to run	E-DDG-FR-E	3	M
DG- FTR O	5.0E-03H	Diesel generator fails to run	E-DDG-FR-E	3	M
DG- FTS N	1.0E-02N	Diesel generator fails to start	E-DDG-FS-E	3	M
DG- FTS O	1.0E-02N	Diesel generator fails to start	E-DDG-FS-E	3	M
DG- T&M O	5.0E-02N	Deep well system diesel out of service for T&M	a: from cog engineer 3/2/94 (10 days / 6 months)	10	M
DG- UNA N	4.4E-02N	Diesel generator unavailable due to maintenance	E-T/M article	10	M
DMP CCB R	3.0E-04N	cc: four fan dampers fail to open	E-AOD-CC-H * .05	30	M
DMP FCL T	3.0E-06H	Solenoid operated damper fails closed	-CMD-FC-HA	10	M
DMP FTO R	3.0E-03N	Standby damper fails to open	E-XDM-CC-H	10	M
DRY T&M V	1Y	T&M performed on air dryers	estimated by DWPF cog eng. in mtg 3-30-94, 20 hrs/year * 2	10	M
EXP PRE Q	1.0N	EXPLOSIVE GAS PRESENT			
FAN ADJ O	5.0E-01N	CTW tower fan required to be operating	a: requried 50% of time, from cog eng in mtg on 2/15/94	10	M
FAN BFL D	3.0E-05H	PVVH primary blower fails	E-MDF-FR-H	3	M

Type Codes for I:\CAFTA\DATA\MASTER.TC 11/11/94 11:43 AM (CONT.)

Type Code	Rate	Description	Source	EF	D
FAN BFL T	3.0E-05H	LPP VVH fan fails	E-MDF-FR-H	3	M
FAN C3C R	1.5E-06H	CC: Fan fails to run (> 2 components)	E-MDF-FR-H X .05	3	M
FAN C3F R	2.5E-04N	CC: Three fans fail to start	E-MDF-FS-H * .05	5	M
FAN CCC R	5.0E-04N	CC: TWO FANS FAIL TO RE-START	E-MDF-FS-H * 0.1	5	M
FAN CCD R	3.0E-06H	CC: TWO RE-STARTED FAN LINES FAIL TO REMAIN RUNNING	E-MDF-FR-H * 0.1	3	M
FAN FTR O	3.0E-05H	CTW fan fails to run	E-MDF-FR-H	3	M
FAN FTR R	3.0E-05H	Fan fails to run	E-MDF-FR-H	3	M
FAN FTS D	5.0E-03N	PVVH blower fails to start	E-MDF-FS-H	5	M
FAN FTS R	5.0E-03N	Fan fails to start	E-MDF-FS-H	5	M
FAN FTS T	5.0E-03N	Fan fails to start	E-MDF-FS-H	5	M
FAN T&M D	4Y	Frequency of PVVH fan maintenance	estimated	10	M
FAN UNA R	2.4E-02N	Fan unavailable due to maintenance	E-T/M article	10	M
FCV ADJ 1	4.0E+00Y	PCV adjusted	a: adjusted annually	10	M
FCV ADJ 6	2.3E-02H	PRBT dilution flow control valve adjusted	A:1/PR batch (1/43 hours)	10	M
FCV ADJ E	1.0Q	Chilled water FCV required to be open	a: once every 3 months	10	M
FCV ADJ F	1.0E-03N	Chilled water FCV required to be open	a: estimated by cog engineer 2/14/94 meeting	10	M
FCV ADJ I	2.3E-02H	PR formic acid supply valve opened (1/43 hours)	A:1/PR batch	10	M
FCV FCL 2	1.0E-06H	Flow control valve fails closed	a:E-AOV-OC-G	10	M
FCV FCL 4	1.0E-06H	Flow control valve fails closed	a:E-AOV-OC-G	10	M
FCV FCL 5	1.0E-06H	Flow control valve fails closed	a:E-AOV-OC-G	10	M
FCV FCL 6	1.0E-06H	Flow control valve fails closed	a:E-AOV-OC-G	10	M
FCV FCL 7	1.0E-06H	Flow control valve fails closed	a:E-AOV-OC-G	10	M
FCV FCL T	1.0E-06H	Flow control valve fails closed	a:E-AOV-OC-G	10	M
FCV FOP 9	1.0E-06H	Flow control valve fails open	a:E-AOV-OC-G	10	M
FCV FOP I	1.0E-06H	Flow control valve fails open	a:E-AOV-OC-G	10	M
FCV FOP O	1.0E-06H	Flow control valve fails open	a:E-AOV-OC-G	10	M
FCV FOP T	1.0E-06H	Flow control valve fails open	a:E-AOV-OC-G	10	M
FCV FTC 4	1.0E-03N	Flow control valve fails to close	E-AOV-OO-W	30	M
FCV FTC 9	1.0E-03N	Flow control valve fails to close	E-AOV-OO-W	30	M
FCV FTC G	3.0E-06H	Compressed gas solenoid operated valve fails to close	E-CSV-NR-G	10	M
FCV FTO E	1.0E-03N	Flow control valve fails to open	E-AOV-CC-W	30	M
FCV FTO F	1.0E-03N	Flow control valve fails to open	E-AOV-CC-W	30	M
FE- CAL 1	1.0E+00Y	SRAT purge flow element calibrated	a: calibrated annually	10	M
FE- FHI 2	3.0E-06H	Flow element fails high	E-FST-FA-I	3	M
FE- FHI 4	3.0E-06H	Flow element fails high	E-FST-FA-I	3	M
FE- FHI 6	3.0E-06H	Flow element or transmitter fails high	E-FST-FA-I	3	M
FE- FHI 7	3.0E-06H	Flow element fails high	E-FST-FA-I	3	M
FE- FHI E	3.0E-06H	Flow element fails high	E-FST-FA-I	3	M
FE- FHI F	3.0E-06H	Flow element fails high	E-FST-FA-I	3	M
FE- FLO E	3.0E-06H	Flow element fails low	E-FST-FA-I	3	M
FE- FLO F	3.0E-06H	Flow element fails low	E-FST-FA-I	3	M
FE- FLO K	3.0E-06H	Flow element fails low	E-FST-FA-I	3	M
FED BFL H	1.0E-06H	Failure of electrical feeder	E-BUB-FA-E	10	M
FED CCA H	1.0E-07H	CC: Failure of electrical feeder (2 components)	E-BUB-FA-I X .1	10	M

Type Code	Rate	Description	Source	EF	D
FED PRE K	2.3E-02H	PR feeding (1 / 43 hours)	Assumed batch frequency	10	M
FIT FHI T	3.0E-06H	Flow instrument fails	E-FST-FA-I	3	M
FLG LKS P	1.0E-06H	Any of 100 flanges on OWST N2 or tank leak	100 x E-FLG-LE-W	10	M
FLT PLG Q	3.0E-06H	Filter plugs	E-FLT-PG-G	10	M
FLT PLG T	3.0E-06H	Filter in LPP VVH plugs	E-HPA-PG-H	10	M
FLT PLG V	1.0E-04H	Filter in plant/instrument air system plugs	E-MTE-FA-A	10	M
FSH FTC 1	1.0E-06H	High flow switch fails to close	E-ATS-OO-E	10	M
FSH FTC P	1.0E-06H	High flow switch fails to close	E-ATS-OO-E	10	M
FSL FCL E	3.0E-06H	Flow instrument fails	E-FST-FA-I	3	M
FSL FCL F	3.0E-06H	Flow instrument fails	E-FST-FA-I	3	M
FSL FTC 4	1.0E-06H	Flow low switch fails to close	E-ATS-OO-E	10	M
FSL FTC 5	1.0E-06H	Flow low switch fails to close	E-ATS-OO-E	10	M
FSL FTC D	1.0E-06H	Flow low switch fails to close	E-ATS-OO-E	10	M
FSL FTC K	1.0E-06H	Flow low switch fails to close	E-ATS-OO-E	10	M
FT- FHI F	3.0E-06H	Flow instrument fails	E-FST-FA-I	3	M
FT- FLO O	3.0E-06H	Flow instrument fails	E-FST-FA-I	3	M
FT- FLO T	3.0E-06H	Flow instrument fails	E-FST-FA-I	3	M
FY- BFL T	1.0E-07H	RPT dilution flow relay fails	E-RLP-OC-E	10	M
HCV C3C V	2.5E-08H	CC: 3 manually controlled, SOVs fail closed	E-SOV-OC-W * .05	10	M
HCV FCL 4	5.0E-07H	Manually controlled, solenoid operated valve fails closed	E-SOV-OC-W	10	M
HCV FCL 8	5.0E-07H	Manually controlled, solenoid operated valve fails closed	E-SOV-OC-W	10	M
HCV FCL 9	5.0E-07H	Manually controlled, solenoid operated valve fails closed	E-SOV-OC-W	10	M
HCV FCL A	5.0E-07H	Manually controlled, solenoid operated valve fails closed	E-SOV-OC-W	10	M
HCV FCL B	5.0E-07H	Manually controlled, solenoid operated valve fails closed	E-SOV-OC-W	10	M
HCV FCL E	5.0E-07H	Manually controlled, solenoid operated valve fails closed	E-SOV-OC-W	10	M
HCV FCL G	5.0E-07H	Manually controlled, solenoid operated valve fails closed	E-SOV-OC-W	10	M
HCV FCL O	5.0E-07H	Manually controlled, solenoid operated valve fails closed	E-SOV-OC-W	10	M
HCV FCL V	5.0E-07H	Manually controlled, solenoid operated valve fails closed	E-SOV-OC-W	10	M
HCV FOP 9	5.0E-07H	SOLENOID OPERATED VALVE FAILS TO REMAIN CLOSED	E-SOV-CO-G	10	M
HCV FOP Q	5.0E-07H	SOLENOID OPERATED VALVE FAILS TO REMAIN CLOSED	E-SOV-CO-G	10	M
HCV FTC G	1.0E-03N	SOLENOID-OPERATED VALVE FAILS TO CLOSE	E-SOV-OO-W	10	M
HCV FTC O	1.0E-03N	Solenoid operated valve fail to close	E-SOV-OO-W	10	M
HCV FTC Q	1.0E-03N	Solenoid operated valve fail to close	E-SOV-OO-W	10	M
HCV FTO E	1.0E-03N	Solenoid operated valve fails to open	E-SOV-CC-W	10	M
HCV FTO F	1.0E-03N	Solenoid operated valve fails to open	E-SOV-CC-W	10	M

Type Codes for I:\CAFTA\DATA\MASTER.TC 11/11/94 11:43 AM (CONT.)

Type Code	Rate	Description	Source	EF	D
HCV FTO G	1.0E-03N	Solenoid operated valve fails to open	E-SOV-CC-W	10	M
HCV LKS P	1.0E-08H	VALVE LEAKAGE	E-MOV-LE-W	10	M
HPW BFL H	3.0E-01Y	Failure of H area power	DWPF SAR 9.3.18	10	M
HTR LKS T	3.0E-07H	Heater steam tubes leak	a: 100 feet of tubing in heater, E-PIP-LE-W	10	M
HX- FOU F	3.0E-08H	Heat exchanger fouled	E-HXT-PG-W	10	M
HX- LKS O	1.0E-08H	Heat exchanger leaks (tube/shell)	E-HTX-LE-W	10	M
IA- T&M R	3.2E-03N	Fan house IA system unavailable due to T&M	Test 1hr/mo; Maint 8hrs/6mos	10	M
IGN PRE 1	3.0E-02N	Ignition source in tank probability	SRT-DCA-94-0035	10	M
IGN PRE 3	2.3E-5H	Ignition source frequency due to nearby lightning strike	DPST-87-642, Table E.15	10	M
IGN PRE Q	3.0E-02N	IGNITION SOURCE PRESENT	SRT-DCA-94-0035	10	M
IGN PRE S	3.0E-02N	Ignition source present in melter		10	M
INK BYP 5	4.6E-04N	SRAT temp low interlock bypassed	a:allowed to bypass during maint, etc. - taken to be 2/year for less than 2 hrs	10	M
JMP BFL S	1.0E-08H	ELECTRIC JUMPERS FOR LID HEATERS FAIL	a: E-FUS-CO-E	10	M
JMP CCA S	1.0E-09H	CC: ELECTRIC JUMPERS FOR LID HEATERS FAIL (2 components)	a: E-FUS-CO-E X .1	10	M
JMP LKS 1	2.0E-05H	SPC jumper leaks	20 jumpers X E-JPR-LE-C	10	M
LCV FCL G	5.0E-07H	Level control valve fails closed	E-SOV-OC-W	10	M
LE- CAL G	2.3E-04H	Level sensor is calibrated	a: twice/year	10	M
LE- FHI G	5.0E-07H	Level sensor fails high	E-LST-FA-I	3	M
LE- FLO G	5.0E-07H	LEVEL ELEMENT (SENSOR) FAILS LOW	E-LST-FA-I	3	M
LPW BFL H	8.0E-04Y	Failure to supply loop power	DWPF SAR 9.3.18	10	M
LSL FTC 1	1.0E-06H	Low level switch on CO2 system fails to close	E-ATS-OC-E	10	M
LSL FTC 3	1.0E-06H	Low level switch fails to close	E-ATS-OC-E	10	M
MOV ADJ 6	1.0E+00Q	PRCD cleaned (drain valve operated)	a: est. monthly by cog eng. (10/27/94)	10	M
MOV FCL D	3.0E-07H	Motor operated valve fails closed	E-MOV-OC-W	5	M
MOV FCL K	3.0E-07H	Motor operated valve fails closed	E-MOV-OC-W	5	M
MOV FTC K	3.0E-03N	Motor operated valve fails to close	E-MOV-OO-W	5	M
MOV FTO D	3.0E-03N	Motor operated valve fails to open	E-MOV-CC-W	5	M
MOV LKS 6	1.0E-06H	Motor operated valve leaks (internal)	E-MOV-LI-C	10	M
N2- BFL 1	1.0E-02N	DWPF liquid nitrogen delivery fails to arrive	estimated	10	M
N2- T&M 1	1Y	Maintenance of N2 system	estimated by cog engineer 9/16/94	10	M
N2- USD 1	1Y	LPPP N2 bottles used	failure rate of bulk N2 supply	10	M
OFV FOP P	5.0E-09H	Vacuum breaker fails open	a: E-VBV-RE-G	30	M
OPR ACH 1	5.0E-02N	Failure of administrative control - high	WSRC-TR-93-581, Table 4, Item 1	5	L
OPR ACH G	5.0E-02N	Failure of administrative control - high	WSRC-TR-93-581, Table 4, item 1	5	L
OPR ACH U	5.0E-02N	Failure of administrative control - high	WSRC-TR-93-581, Table 4, Item 1	5	L
OPR ACL 1	5.0E-04N	Failure of administrative control - low	WSRC-TR-93-581, Table 4, Item 1	10	L
OPR ACN 1	5.0E-03N	Failure of administrative control - nominal	WSRC-TR-93-581, Table 4, item 1	10	L
OPR ACN 3	5.0E-03N	Failure of administrative control - nominal	WSRC-TR-93-581, Table 4, item 1	10	L
OPR ACN 6	5.0E-03N	Failure of administrative control - nominal	WSRC-TR-93-581, Table 4, item 1	10	L

Type Code	Rate	Description	Source	EF	D
OPR ACN U	5.0E-03N	Failure of administrative control - nominal	WSRC-TR-93-581, Table 4, item 1 (SW4-16.2, Rev. 0, Draft)	10	L
OPR CAL K	3.0E-04N	Chemical addition error - low (simple process)	WSRC-TR-93-581, Table 4, item 16	10	L
OPR CAN 1	3.0E-03N	Chemical addition error - low (simple process)	WSRC-TR-93-581, Table 4, item 16	10	L
OPR CSH G	1.0E-01N	Failure to respond to compelling signal, many competing signals	WSRC-TR-93-581, table 4, item 2, high	10	L
OPR CSH Q	1.0E-01N	Failure to respond to compelling signal, many competing signals	WSRC-TR-93-581, table 4, item 2, high	10	L
OPR CSL 3	3.0E-03N	Failure to respond to compelling signal	WSRC-TR-93-581, table 4, item 2, low	10	L
OPR CSL P	3.0E-03N	Failure to respond to compelling signal	WSRC-TR-93-581, table 4, item 2, low	10	L
OPR CSN P	1.0E-02N	Failure to respond to compelling signal, several competing signals	WSRC-TR-93-581, table 4, item 2, nominal	10	L
OPR CVH U	3.0E-01N	Independent checker fails to verify results	WSRC-TR-93-581, Table 4, Item 8	3	L
OPR IRH G	5.0E-01N	Operator misreads results - high	WSRC-TR-93-581, Table 4, Item 11	2	L
OPR IRH U	5.0E-01N	Incorrect reading or recording of data - high	WSRC-TR-93-581, Table 4, Item 11	2	L
OPR LAH 1	1.0E-03N	Laboratory analysis error - high	WSRC-TR-93-581, Table 4, Item 19	10	L
OPR LAH G	1.0E-03N	Laboratory analysis error - high	WSRC-TR-93-581, Table 4, Item 19	10	L
OPR LAH U	1.0E-03N	Laboratory analysis error - high	WSRC-TR-93-581, Table 4, Item 19	10	L
OPR LAN 1	3.0E-04N	Laboratory analysis error - nominal	WSRC-TR-93-581, Table 4, Item 19	10	L
OPR LOH H	5.0E-03N	Fail to remove lockout on breaker	WSRC-TR-93-581, Table 4, Item 15	10	L
OPR MCH 1	3.0E-02N	Miscalibration - 1 person, no checks	WSRC-TR-93-581, Table 4, item 12	5	L
OPR MCH 2	3.0E-02N	Miscalibration - 1 person, no checks	WSRC-TR-93-581, Table 4, item 12	5	L
OPR MCH 3	3.0E-02N	Miscalibration - 1 person, no checks	WSRC-TR-93-581, Table 4, item 12	5	L
OPR MCH G	3.0E-02N	Miscalibration - 1 person, no checks	WSRC-TR-93-581, Table 4, item 12 * (1/2 years); a: calib. performed 1/2 years	5	L
OPR MCH Q	1.5E-02Y	Miscalibration - 1 person, no checks	WSRC-TR-93-581, Table 4, item 12 * (1/2 years); a: calib. performed 1/2 years	5	L
OPR MCH R	3.0E-02N	Miscalibration - 1 person, no checks	WSRC-TR-93-581, Table 4, item 12	5	L
OPR NCH 1	1.0E-01N	Fail to verify paramenter with calculation	WSRC-TR-93-581, Table 4, item 20	3	L
OPR NCN 1	3.0E-02N	Fail to verify paramenter with calculation	WSRC-TR-93-581, Table 4, item 20	5	L
OPR OPE G	1.0N	Operator opens makeup feed valve	Assumed to occur given low level signal		
OPR OVH 1	5.0E-05H	Overflow from OE, OECT, or PR	(WSRC-TR-93-581, item 18) X (3)	10	L
OPR RAH 1	5.0E-05H	Random actuation/shutdown of system	WSRC-TR-93-581, Table 4, item 21	10	L
OPR RAN K	5.0E-06H	Random actuation/shutdown of system - nominal	WSRC-TR-93-581, Table 4, item 21	10	L
OPR RMH 1	5.0E-02N	Failure to restore following maintenance	WSRC-TR-93-581, Table 4, item 14	5	L
OPR RMH 5	5.0E-02N	Failure to restore following maintenance	WSRC-TR-93-581, Table 4, item 14	5	L
OPR RMH R	5.0E-02N	Failure to restore following maintenance - high	WSRC-TR-93-581, Table 4, Item 14	5	L
OPR RMN N	5.0E-03N	Failure to restore following maintenance - nominal	WSRC-TR-93-581, Table 4, Item 14 292-s-4003/4008	10	L
OPR RTH 1	3.0E-02N	Failure to restore following testing	WSRC-TR-93-581, Table 4, item 13	5	L

Type Codes for I:\CAFTA\DATA\MASTER.TC 11/11/94 11:43 AM (CONT.)

Type Code	Rate	Description	Source	EF	D
OPR SOH 1	5.0E-02N	Error in selecting control outside control room	WSRC-TR-93-581, Table 4, item 6	5	L
OPR SRH 1	3.0E-02N	Error in selecting control within control room - high	WSRC-TR-93-581, Table 4, Item 5	5	L
OPR SRN 6	1.0E-02N	Error in selecting control within control room	WSRC-TR-93-581, Table 4, item 5	5	L
OPR SVL 1	1.0E-01N	Supervisor fails to detect problem, gives permissive	WSRC-TR-93-581, Table 4, item 9	3	L
OPR VIH 1	5.0E-01N	Fail to observe during visual inspection	WSRC-TR-93-581, Table 4, item 31	2	L
OPR VIN 1	1.0E-01N	Fail to observe during visual inspection	WSRC-TR-93-581, Table 4, item 31	3	L
OPR VRH 1	5.0E-02N	Failure to verify inside control room - high	WSRC-TR-93-581, Table 4, Item 3	10	L
PC- FLO K	1.0E-06H	Pressure controller fails low	E-PST-FA-I	3	M
PCS BFL 5	1.0E-03N	PCCS failure	a: E-RLP-CC-E	10	M
PCV CAL 1	1.0E+00Y	PCV calibrated	a: calibrated annually	10	M
PCV FCL 1	3.0E-06H	Air operated control valve fails closed	E-CAV-FC-G	10	M
PCV FCL 2	3.0E-06H	Air operated control valve fails closed	E-CAV-FC-G	10	M
PCV FCL 8	3.0E-06H	Air operated control valve fails closed	E-CAV-FC-G	10	M
PCV FCL 9	3.0E-06H	Air operated control valve fails closed	E-CAV-FC-G	10	M
PCV FCL A	3.0E-06H	Air operated control valve fails closed	E-CAV-FC-G	10	M
PCV FCL B	3.0E-06H	Air operated control valve fails closed	E-CAV-FC-G	10	M
PCV FCL E	3.0E-06H	Air operated control valve fails closed	E-CAV-FC-G	10	M
PCV FCL G	3.0E-06H	Air operated control valve fails closed	E-CAV-FC-G	10	M
PCV FCL I	3.0E-06H	Air operated control valve fails closed	E-CAV-FC-G	10	M
PCV FCL P	3.0E-06H	Air operated control valve fails closed	E-CAV-FC-G	10	M
PCV FCL Q	3.0E-06H	Air operated valve fails closed	E-CAV-FC-G	10	M
PCV FCL V	3.0E-06H	Air operated control valve fails closed	E-CAV-FC-G	10	M
PCV FOP 1	3.0E-06H	Air operated control valve fails open	E-CAV-FO-G	10	M
PCV FTC J	3.0E-03N	Pressure control valve fails to close	E-AOV-OO-G	30	M
PCV FTO 1	3.0E-03N	Pressure control valve fails to open	E-MOV-CC-W	5	M
PCV FTO 9	3.0E-03N	Pressure control valve fails to open	E-MOV-CC-W	5	M
PCV FTO B	3.0E-03N	Pressure control valve fails to open	E-MOV-CC-W	5	M
PCV FTO E	3.0E-03N	Pressure control valve fails to open	E-MOV-CC-W	5	M
PCV FTO J	3.0E-03N	Pressure control valve fails to open	E-AOV-CC-G	30	M
PCV FTO P	3.0E-03N	Pressure control valve fails to open	E-AOV-CC-G	30	M
PCV FTO Q	3.0E-03N	PRESSURE CONTROL VALVE FAILS TO OPEN	E-AOV-CC-G	30	M
PCV T&M 1	4.0E-01Y	T&M performed on a PSV	a: estimated by cog: 1/5 years * 2 valves	10	M
PDE FHI T	1.0E-6H	Differentila pressure transmitter in RPT system fails high	E-PST-FA-I	3	M
PDS FTC T	3.0E-06H	Differential pressure switch fails to close	E-DPS-FA-I	10	M
PDS FTC V	3.0E-06H	Differential pressure switch fails to close	E-DPS-FA-I	10	M
PDS FTO V	3.0E-06H	Differential pressure switch fails to open	E-DPS-FA-I	10	M
PDT BFL P	3.0E-06H	Differential pressure transmitter failure	E-DPS-FA-I	10	M
PE- CCA R	1.0E-07H	CC: FAILURE OF BOTH PRESSURE TRANSMITTERS	E-TST-FA-I * 0.1	3	M
PE- FLO R	1.0E-06H	Pressure transmitter fails (no high pressure signal)	E-PST-FA-I	3	M

Type Code	Rate	Description	Source	EF	D
PGV FTC R	3.0E-03N	Plug valve fails to close	E-SOV-OO-G	10	M
PIC FLO P	1.0E-05H	Pressure indicator/controller fails low	E-IND-FA-I.	10	M
PIP BFL O	6.0E-06H	CTW header piping breaks	E-PIP-LE-W, (estimated 2000 feet of header)	10	M
PIP LKS O	1.5E-07H	Water leak in cooling coils through vessel	a: 50 feet of piping in cooling coil, E-PIP-LE-C	10	M
PIP LKS P	9.0E-09H	PIPE LEAKAGE	E-PIP-LE-C 3E-9/HR-FT * 30 FT = 9E-9/HR	10	M
PIP PLG 5	1.0E-07H	SRAT vent inlet line plugs from NH4NO3 buildup	a:100 feet of piping and E-PIP-PG-G	10	M
PIP RUP P	2.18E-08H	PIPE RUPTURES	EGG-SSRE-9639 3E-11/HR-FT * 725 FT (UPPER BOUND)	30	M
PIP RUP V	2.18E-08H	Pipe ruptures	EGG-SSRE-9639 3E-11/HR-FT * 725 FT (UPPER BOUND)	30	M
PIP VCR 3	2.55E-08H	N2 pipe damaged from vehicle crash	DWPF SAR section 9.4.31	10	M
PIP VCR P	1.27E-09H	OWST transfer line damaged by vehicle crash	DWPF SAR section 9.4.31	10	M
PMP BFL 4	3.0E-05H	Pump fails	E-MDP-FR-W	10	M
PMP BFL 5	3.0E-05H	Pump fails	E-MDP-FR-W	10	M
PMP BFL F	3.0E-05H	Pump fails	E-MDP-FR-W	10	M
PMP BFL G	3.0E-05H	Pump fails to continue running	E-MDP-FR-W	10	M
PMP BFL K	3.0E-05H	Pump fails to continue running	E-MDP-FR-W	10	M
PMP C3C G	1.5E-06H	COMMON CAUSE FAILURE OF THREE OR MORE MOTOR-DRIVEN PUMPS TO RUN	E-MDP-FR-W X 0.05	10	M
PMP FTR E	3.0E-05H	Pump fails	E-MDP-FR-W	10	M
PMP FTR F	3.0E-05H	Pump fails to run the entire mission time	E-MDP-FR-W	10	M
PMP FTR G	3.0E-05H	Pump fails to run the entire mission time	E-MDP-FR-W	10	M
PMP FTR O	3.0E-05H	Pump fails to run the entire mission time	E-MDP-FR-W	10	M
PMP FTS E	3.0E-03N	Pump fails to start	E-MDP-FS-W	5	M
PMP FTS F	3.0E-03N	Pump fails to start	E-MDP-FS-W	5	M
PMP FTS G	3.0E-03N	Pump fails to start	E-MDP-FS-W	5	M
PMP FTS O	3.0E-03N	Pump fails to start	E-MDP-FS-W	5	M
PMP OFF E	5.0E-02N	Pump not in auto mode	a: estimated by cog eng in 2/14/94 meeting	10	M
PMP ON- I	1.0M	Formic acid feed pump started to adjust MFT	a: MFT requires adjustment 1/month	10	M
PMP T&M G	1.0N	MOTOR-DRIVEN PUMP NOT RESTORED FOLLOWING TEST & MAINTENANCE	A: NOT RESTORED	10	M
PMP T&M I	6.0E-05H	T&M performed on steam condensate pump	twice the failure rate (2 pumps)	10	M
PMP T&M O	1.0E-02N	Standby CTW pump out of service for T&M	a: 1% of the time the standby pump is out for T&M	10	M
POP OFF E	5.0E-02N	POP not loaded for chilled water system	estimated by DWPF cog eng 3-29-94 to be 5%	10	M
POP OFF F	5.0E-02N	POP not loaded for process cooling water system	estimated by DWPF cog eng 3-29-94 to be 5%	10	M
POP OFF R	5.0E-02N	POP not loaded for ventilation system	estimated by DWPF cog eng 3-29-94 to be 5%	10	M
POP OFF T	5.0E-02N	POP not loaded for LPPP vessel vent system	estimated to be 5%	10	M

Type Codes for I:\CAFTA\DATA\MASTER.TC 11/11/94 11:43 AM (CONT.)

Type Code	Rate	Description	Source	EF	D
POP OFF V	5.0E-02N	EMO bypassed or not online for air compressors	estimated by DWPF cog eng 3-30-94 to be 5%	10	M
PR- HI- P	1.0E+00D	Pressure of OWST rises	Daily temp swings documented from ops data	3	M
PR- IDL 6	2.3E-02H	PR batch idle in PR	a: 43 hour batch	10	M
PSE FOP 3	5.0E-07H	Rupture disk on compressed gas system fails open	a: E-SRV-RI-G	10	M
PSH FCL 1	1.0E-06H	High pressure switch fails closed	E-ATS-OC-E	10	M
PSL CAL 1	2.0E-01Y	PSL calibrated	a: calibrated every 5 years	10	M
PSL FTC 1	1.0E-06H	Low pressure switch fails to close	E-ATS-OO-E	10	M
PSL FTC 2	1.0E-06H	Low pressure switch fails to close	E-ATS-OO-E	10	M
PSV FOP 1	5.0E-07H	Pressure Safety valve fails open	E-SRV-RI-G	30	M
PSV FOP 2	5.0E-07H	Pressure Safety valve fails open	E-SRV-RI-G	30	M
PSV FOP 3	5.0E-07H	Pressure Safety valve fails open	E-SRV-RI-G	30	M
PSV FOP 8	5.0E-07H	Pressure Safety valve fails open	E-SRV-RI-G	30	M
PSV FOP 9	5.0E-07H	Pressure Safety valve fails open	E-SRV-RI-G	30	M
PSV FOP A	5.0E-07H	Pressure Safety valve fails open	E-SRV-RI-G	30	M
PSV FOP B	5.0E-07H	Pressure Safety valve fails open	E-SRV-RI-G	30	M
PSV FOP I	5.0E-07H	Pressure Safety valve fails open	E-SRV-RI-G	30	M
PSV FOP J	5.0E-07H	Pressure Safety valve fails open	E-SRV-RI-G	30	M
PSV FOP P	1.0E-06H	PSV fails open - chemical	E-SRV-LI-C	10	M
PSV FOP V	5.0E-07H	Pressure Safety valve fails open	E-SRV-RI-G	30	M
PSV FTO P	1.0E-03N	Manual valve fails to open	E-XVM-CC-G	10	M
PSV RPT Q	5.0E-07H	Pressure safety valve ruptures	E-SRV-RI-G	30	M
PT- CAL 1	2.0E-01Y	PT calibrated	a: calibrated every 5 years	10	M
PT- FHI F	1.0E-06H	Pressure transmitter fails high	E-PST-FA-I	3	M
PT- FHI G	1.0E-06H	Pressure transmitter fails high	E-PST-FA-I	3	M
PT- FHI K	1.0E-06H	Pressure transmitter fails high	E-PST-FA-I	3	M
PT- FHI P	1.0E-06H	Pressure transmitter fails high	E-PST-FA-I	3	M
PT- FHI V	1.0E-06H	Pressure transmitter fails high	E-PST-FA-I	3	M
PT- FLO E	1.0E-06H	Pressure transmitter fails low	E-PST-FA-I-W	3	M
RE- FLO O	5.0E-06H	Radiation element fails low	E-RST-FA-I	5	M
REG FTO 1	3.0E-06H	Pressure regulator on CO2 system fails to open	E-CAV-NR-G	10	M
RY- C2D R	3.0E-08H	CC: Two relays fail open	E-RLC-CO-E * .1	30	M
RY- C3D R	1.5E-08H	CC: Three relays fail open	E-RLC-CO-E * .05	30	M
RY- C3G R	5.0E-05N	Relay fails to close	E-RLP-OO-E * .05	10	M
RY- CCE R	1.0E-04N	Relay fails to close (> 2 components)	E-RLP-OO-E * .1	10	M
RY- FOP R	3.0E-07H	Relay fails open	E-RLC-CO-E	30	M
RY- FTC R	1.0E-05N	Relay fails to open	E-BIS-OO-E	10	M
RY- FTO 4	1.0E-05N	Relay fails to open	E-BIS-CC-E	10	M
RY- FTO 5	1.0E-05N	Relay fails to open	E-BIS-CC-E	10	M
RY- FTO S	1.0E-05N	Relay fails to open	E-BIS-CC-E	10	M
RY- FTO V	1.0E-05N	Relay fails to open	E-BIS-CC-E	10	M
SC- FLO T	1.0E-06H	LPP VVH fan speed controller fails low	E-TFI-FA-E	10	M
SLG PRE 5	1.0E-02N	Excessive noble metals present in sludge at SRAT	estimated by DWPF/TNX in 2/8/94 meeting	10	M
SLR BLU U	1.0E+00N	Excess salt build up	a: excess build up when salt present in melter	10	M

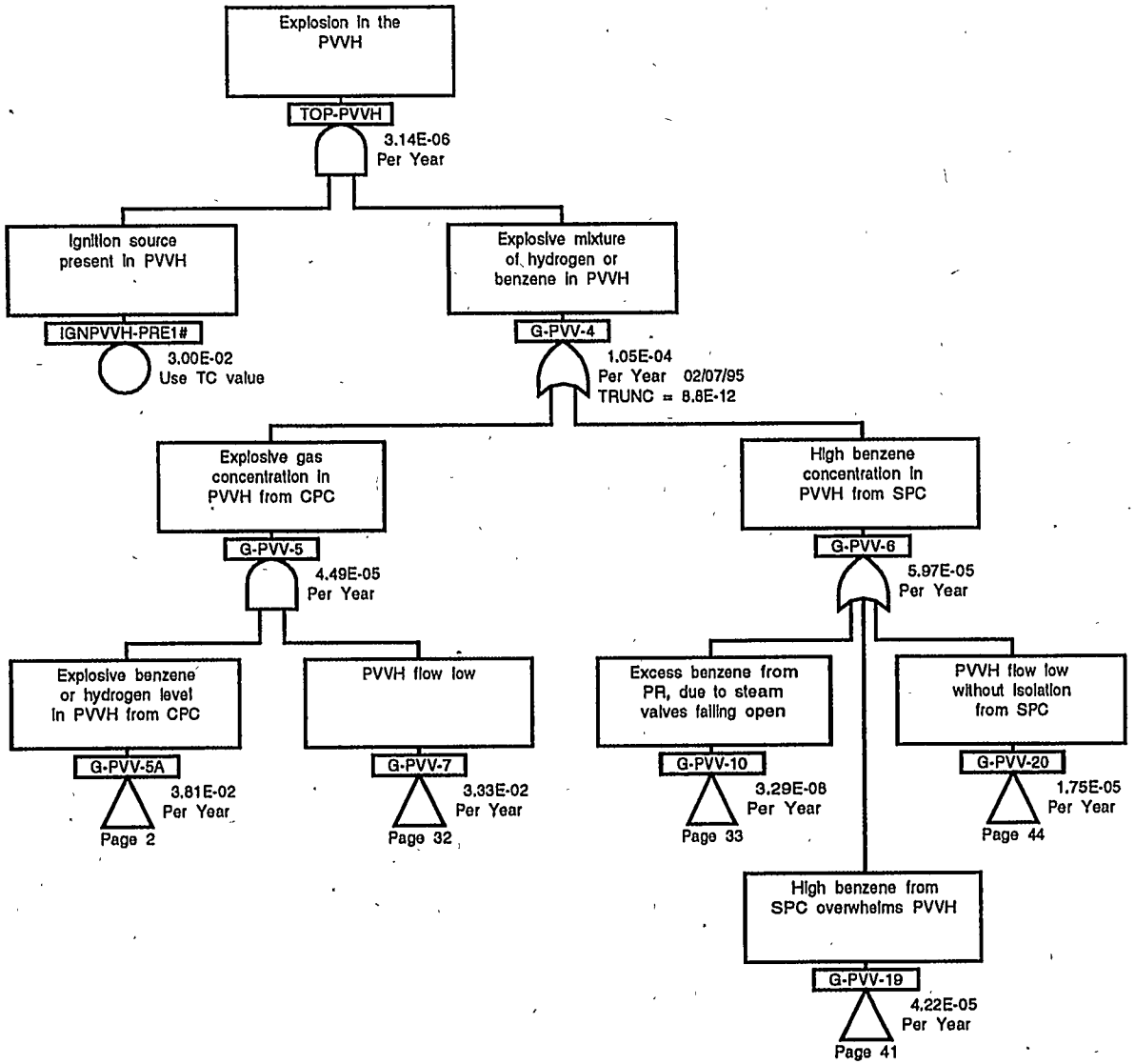
Type Code	Rate	Description	Source	EF	D
SLR PRE U	5.0E-01Y	Excessive salt content present in melter feed solution	assumed present every batch (1/86 hours)	10	M
SRA PRE 5	5.0E-01Y	Macro batch of sludge to DWPF (every 2 years)	Estimated by TNX and DWPF (in meeting minutes 3/8/94)	10	M
STM BFL G	2.0E-04H	Site steam (to DWPF) steam generator fails	DWPF SAR Section 9.3.20.3 Steam Supply and Distribution Systems, Frequency	10	M
SV- ADJ 5	1.0E+00M	Needle valve adjusted	estimated by cog eng	10	M
SV- FCL 1	5.0E-07H	Solenoid valve fails closed	E-SOV-OC-W	10	M
SV- FCL Q	3.0E-06H	Solenoid operated valve fails closed	E-CSV-FC-G	10	M
SV- FCL V	5.0E-07H	Solenoid valve fails closed	E-SOV-OC-W	10	M
SV- FOP 1	5.0E-07H	Solenoid valve fails open	E-SOV-CO-W	10	M
SV- FTC G	1.0E-03N	Solenoid valve fails to close	E-SOV-OO-W	10	M
SV- FTO G	1.0E-03N	SOLENOID VALVE FAILS TO OPEN	E-SOV-CC-W	10	M
TC- FLO 1	3.0E-05H	Temperature controller fails low	E-PLC-FA-I	10	M
TCV CAL 1	1M	Maintenance performed on SCVC chilled water system	estimated	10	M
TCV FCL D	5.0E-07H	Temperature control valve (solenoid operated) fails closed	E-SOV-OC-W	10	M
TCV FCL F	5.0E-07H	Temperature control valve (solenoid operated) fails closed	E-SOV-OC-W	10	M
TE- CCA S	1.0E-07H	CC: Temperature elements fail (2 components)	a: E-TST-FA-I X .1	3	M
TE- FHI S	1.0E-06H	Temperature element fails	E-TST-FA-I	3	M
TE- FLO D	1.0E-06H	Temperature element fails	E-TST-FA-W	3	M
TE- FLO F	1.0E-06H	Temperature element fails	E-TST-FA-I	3	M
TNK LKS 3	1.0E-08H	Liquid N2 tank leaks	E-TKP-LE-W	10	M
TNK LKS P	1.0E-07H	TANK LEAKS	E-TKP-LE-G	10	M
TNK USD 1	1M	CO2 supply tank volume used	estimated by cog eng. supply = 30 days	10	M
TNK USD 3	3.3E-01D	N2 supply tank volume used	a: Told by cog eng. supply = 7 days	10	M
TOP BFL 0	6.7E-03N	Failure of CO2 backup system	Fault tree calculation of SPCBP.CAF (10-6-94)	5	M
TOP BFL 1	6.7E-05H	SPC primary purge system fails	Fault tree SPCPP.CAF (10-6-94)	10	M
TOP BFL 2	1.9E-05H	Loss of CPC primary (air) purge system	Fault tree calculation of CPCPP.CAF (10-6-94)	5	M
TOP BFL 3	7.7E-06H	Bulk N2 tank supply failure	Fault tree calculation of N2TNK.CAF (10-6-94)	5	M
TOP BFL 7	3.7E-05N	CPC nitrogen tank supply failure	Fault tree calculation of CPCTNK.CAF (10-6-94)	5	M
TOP BFL A	5.4E-03N	CTW Deep well system unavailable	Fault tree calculation of Deep.CAF (10-6-94)	10	M
TOP BFL B	6.3E-06H	CTW primary pumps fail	Fault tree calculation of CTWP.CAF (10-6-94)	10	M
TOP BFL E	2.3E-05H	Inadequate chilled water to supply header	Fault tree calculation of CHW.CAF (10-6-94)	10	M
TOP BFL F	2.3E-03N	Inadequate process cooling water to supply header	Fault tree calculation of PSW.CAF (10-6-94)	10	M
TOP BFL G	2.1E-04H	Failure to supply steam to supply header	Fault tree calculation of STEAM.CAF (10-6-94)	10	M

Type Codes for I:\CAFTA\DATA\MASTER.TC 11/11/94 11:43 AM (CONT.)

Type Code	Rate	Description	Source	EF	D
TOP BFL H	3.5E-05H	Loss of normal power	Fault tree calculation of POWN.CAF (10-6-94)	10	M
TOP BFL J	5.3E-04N	Local LPPP N2 unavailable	Fault tree LPPPN2.CAF (10-6-94)	10	M
TOP BFL N	1.1E-02N	Failure of backup power	Fault tree calculation of POWD.CAF (10-6-94)	10	M
TOP BFL O	1.1E-05H	CTW loss due to valves or piping	Fault tree calculation of CTWCC.CAF (10-6-94)	10	M
TOP BFL Q	3.3E-05N	Vitvent failure (normal power and IA available)	Fault tree VV.CAF (10-25-94)	10	M
TOP BFL R	1.1E-03N	Vitvent failure (norm power unavail, IA avail)	Fault tree VV-E.CAF (10-25-94)	10	M
TOP BFL S	7.6E-03N	Vitvent failure (norm power, IA unavailable)	Fault tree VV-EI.CAF (10-25-94)	10	M
TOP BFL T	5.5E-06H	BULK N2 PATH FAILURE (EXCL. N2 TANK SUPPLY FAILURE)	Fault tree BLKN2.CAF (10-6-94)	10	M
TOP BFL U	4.1E-04N	SPC N2 supply unavailable	Fault tree SPCN2.CAF (10-6-94)	10	M
TOP BFL V	1.1E-05H	Loss of instrument air	Fault tree calculation of Inair.CAF (10-25-94)	10	M
TOP BFL W	3.1E-03N	CPC backup purge unavailable	Fault tree CPCBP.CAF (10-6-94)	10	M
TRF BFL S	1.0E-06H	LID HEATER TRANSFORMER FAILS	E-TFP-FA-E	10	M
TRF CCA S	1.0E-07H	CC: 2 LID HEATER TRANSFORMERS FAIL	E-TFP-FA-E X .1	10	M
TRS PLG 1	5.0E-07H	Traveling screen plugs in water system	E-TRS-PG-W	10	M
TSH FCL 1	1.0E-06H	High temperature switch on CO2 system fails closed	E-TST-FA-1	3	M
TX- PRE 5	1.2E-02H	Transfer from PRBT to SRAT	1 per 86 hours	10	M
TX- PRE 9	2.3E-02H	PR transfer	1 per 43 hours	10	M
TX- PRE B	2.3E-02H	PRFT transfer	1 per 43 hours	10	M
UA- FTA 2	3.0E-06H	Compressor trouble alarm fails	E-LOG-FA-I	5	M
UA- FTA E	3.0E-06H	DCS module failure	E-LOG-FA-I	5	M
UPS BFL R	4.7E-04N	Loss of UPS to ventilation system	DPST-87-642, Table E.6	2	M
VAP LKS G	1.0E-07H	VAPORIZER LEAKS	a:HTX-LI-W	10	M
VB- FOP P	5.0E-07H	Vacuum breaker fails open	E-VBV-RI-G	30	M
VLV LKS P	1.0E-08H	VALVE LEAKAGE	E-MOV-LE-W	10	M
WE- CAL 1	2.0E-01Y	WSL calibrated	a: calibrated every 5 years	10	M
WE- FHI 1	3.0E-06H	Weighing element for CO2 system fails high	E-LST-FA-I (assumed to be similar to flow sensor)	10	M
WSL FTC 1	3.0E-06H	Low weight switch fails to close	E-LST-FA-I (assumed to be similar to flow sensor)	10	M
WTR PRE U	1.0E+00N	Water in the melter	a: present due to water purge	10	M

Attachment 5
Accident Fault Tree Plots and Cutsets

PVVH Explosion



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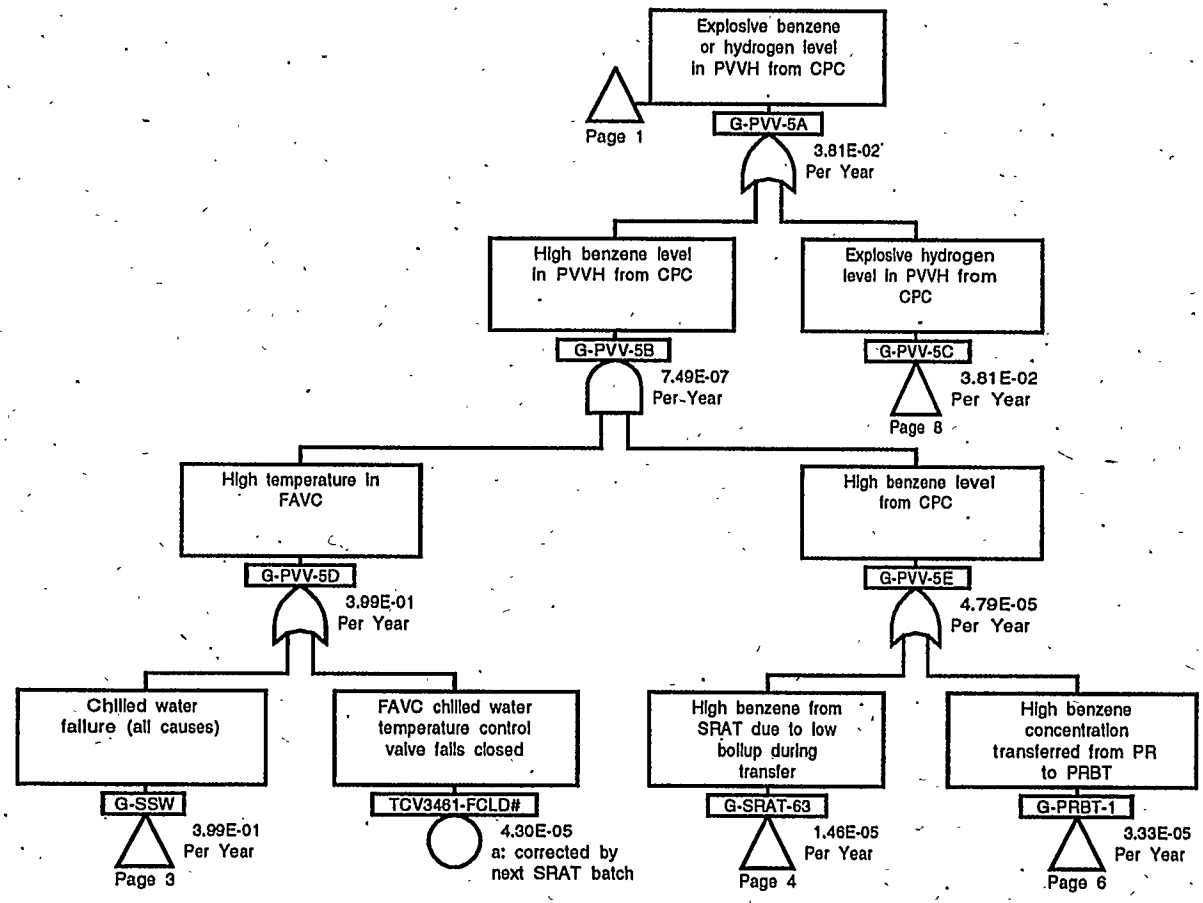

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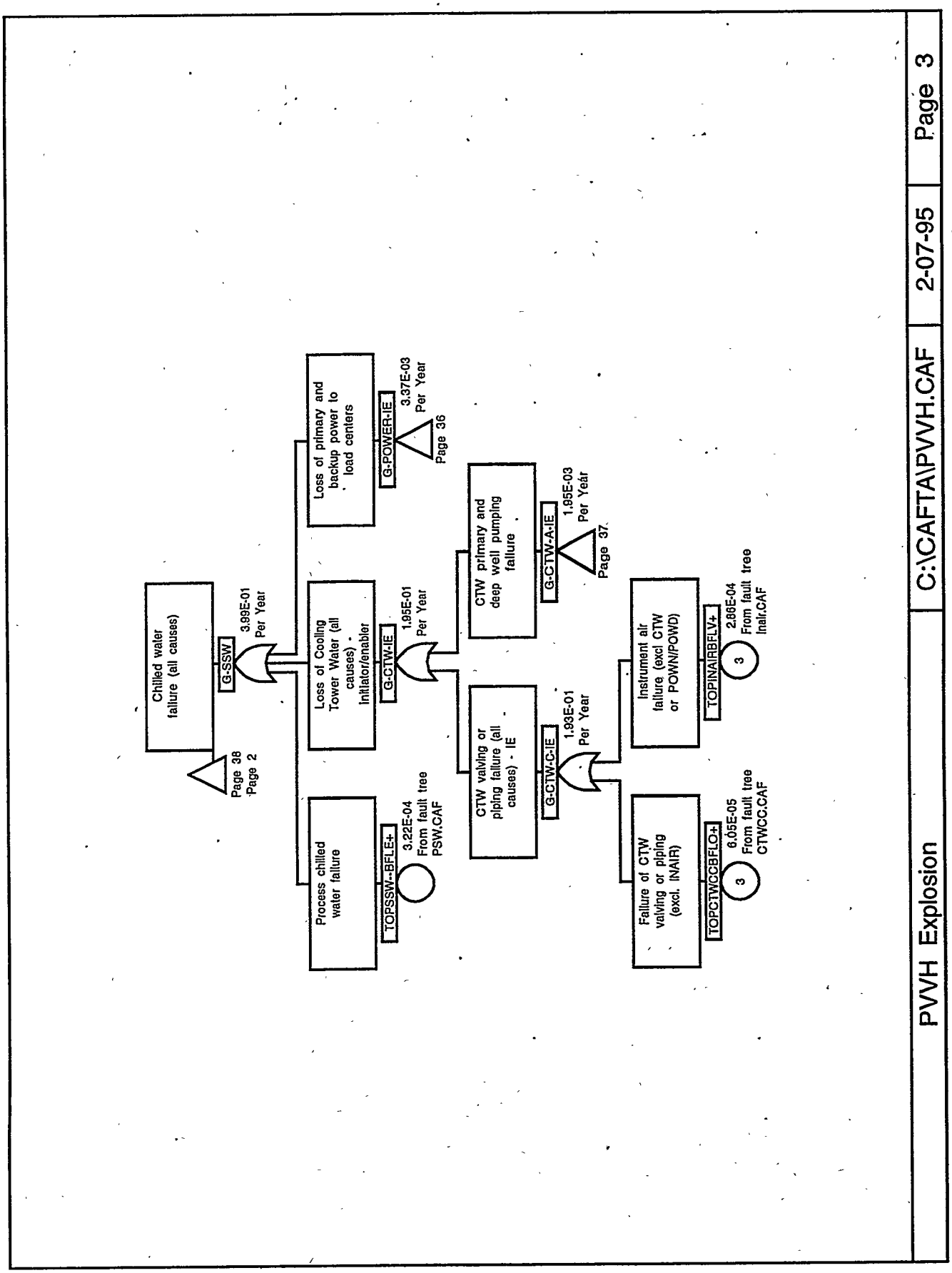
Chilled water failure (all causes)
G-SSW
3.99E-01 Per Year
Page 38 Page 2
Loss of Cooling Tower Water (all causes) - Initiator/enabler
G-CTW-IE
1.95E-01 Per Year
Loss of primary and backup power to load centers
G-POWER-IE
3.37E-03 Per Year
Page 36
CTW primary and deep well pumping failure
G-CTW-A-IE
1.85E-03 Per Year
Page 37
Process chilled water failure
TOPSSW--BFLE+
3.22E-04 From fault tree PSW.CAF
CTW valving or piping failure (all causes) - IE
G-CTW-C-IE
1.93E-01 Per Year
Instrument air failure (excl CTW or POWN/POWD)
TOPINAIRBFLV+
2.86E-04 From fault tree Inair.CAF
3
Failure of CTW valving or piping (excl. INAIR)
TOPCTWCCBFLO+
6.05E-05 From fault tree CTWCC.CAF
3
PVVH Explosion
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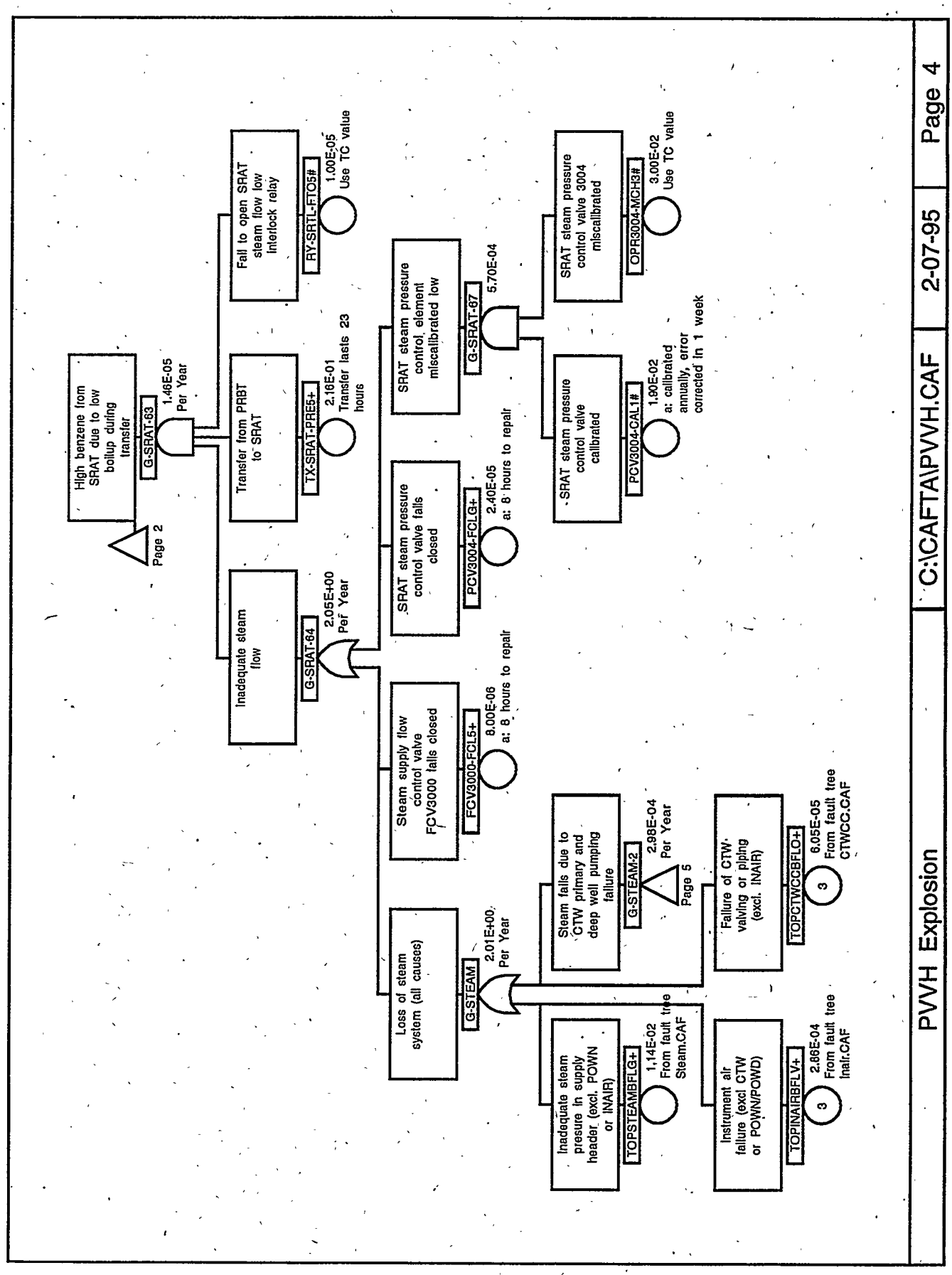
PVVH Explosion
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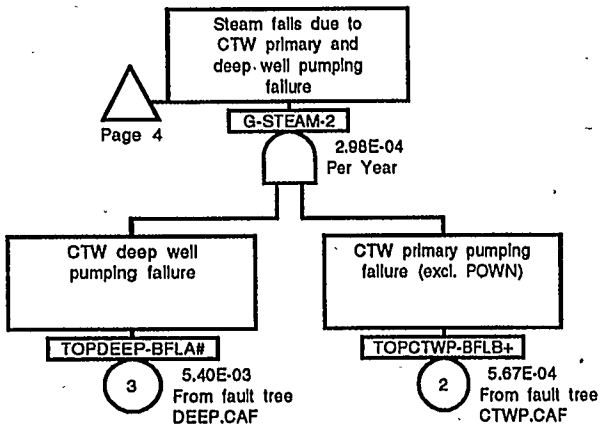
Page 4
High benzene from SRAT due to low boilup during transfer
G-SRAT-63
1.46E-05 Per Year
Page 2
Inadequate steam flow
G-SRAT-64
2.05E+00 Per Year
Transfer from PRBT to SRAT
TX-SRAT-PRE5+
2.16E-01 Transfer lasts 23 hours
Fail to open SRAT steam flow low interlock relay
RY-SRTL-FTO5#
1.00E-05 Use TC value
SRAT steam pressure control element miscalibrated low
G-SRAT-67
5.70E-04
SRAT steam pressure control valve fails closed
PCV3004-FCLG+
2.40E-05 a: 8 hours to repair
SRAT steam pressure control valve 3004 miscalibrated
OPR3004-MCH3#
3.00E-02 Use TC value
SRAT steam pressure control valve calibrated
PCV3004-CAL1#
1.90E-02 a: calibrated annually, error corrected in 1 week
Steam supply flow control valve FCV3000 falls closed
FCV3000-FCL5+
8.00E-06 a: 8 hours to repair
Loss of steam system (all causes)
G-STEAM
2.01E+00 Per Year
Steam falls due to CTW primary and deep well pumping failure
G-STEAM-2
2.98E-04 Per Year
Page 5
Failure of CTW valving or piping (excl. INAIR)
TOPCTWCCBFLO+
3
6.05E-05 From fault tree CTWCC.CAF
Inadequate steam presure in supply header (excl. POWN or INAIR)
TOPSTEAMBFLG+
1.14E-02 From fault tree Steam.CAF
Instrument air failure (excl CTW or POWN/POWD)
TOPINAIRBFLY+
3
2.86E-04 From fault tree Inair.CAF



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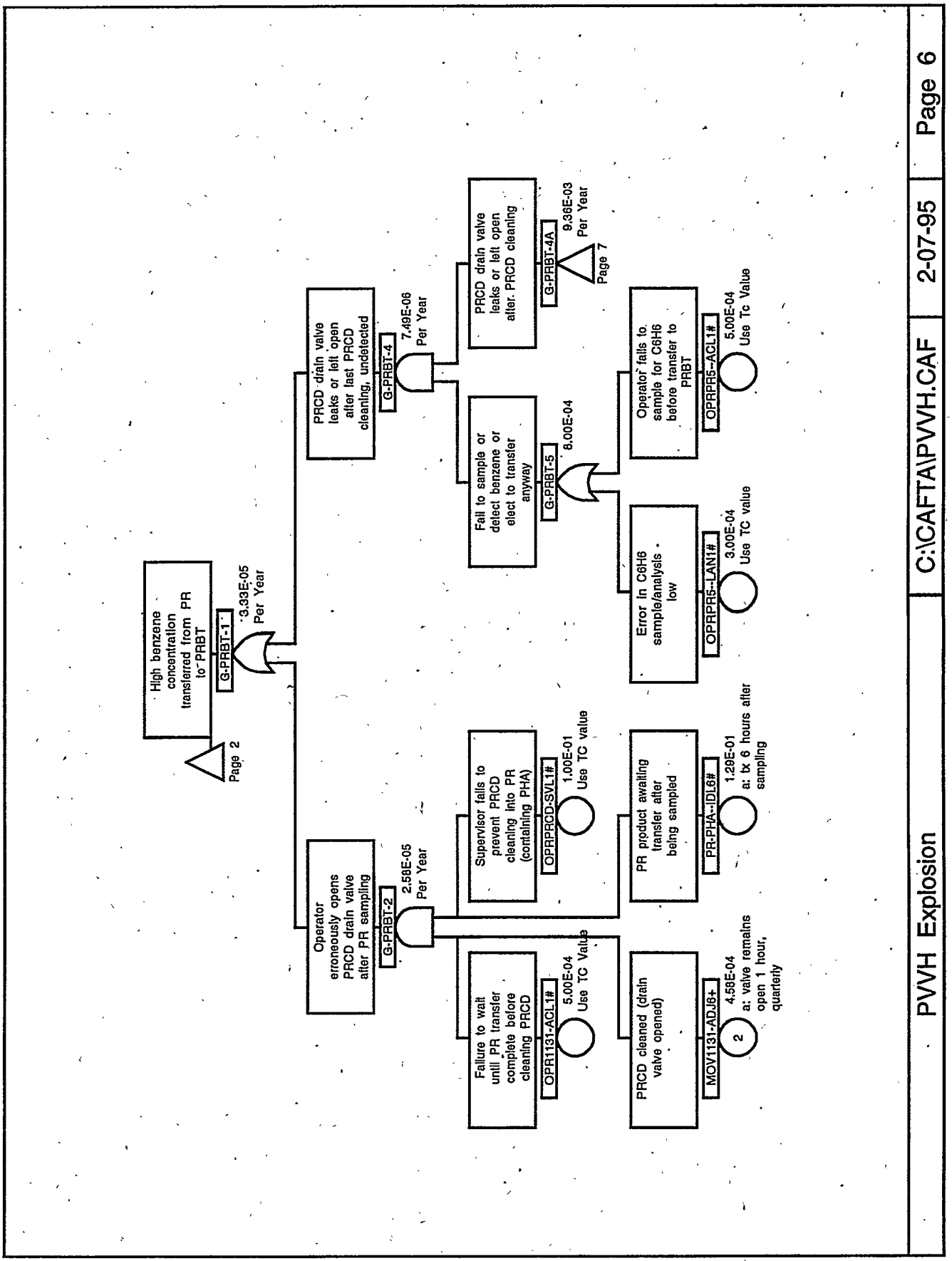
High benzene concentration transferred from PR to PRBT
G-PRBT-1
3.33E-05 Per Year
Page 2
PRCD drain valve leaks or left open after last PRCD cleaning, undetected
G-PRBT-4
7.49E-06 Per Year
PRCD drain valve leaks or left open after. PRCD cleaning
G-PRBT-4A
9.36E-03 Per Year
Page 7
Fail to sample or detect benzene or elect to transfer anyway
G-PRBT-5
8.00E-04
Operator fails to sample for C6H6 before transfer to PRBT
OPRPR6--ACL1#
5.00E-04 Use Tc Value
Error in C6H6 sample/analysis - low
OPRPR6--LAN1#
3.00E-04 Use TC value
Operator erroneously opens PRCD drain valve after PR sampling
G-PRBT-2
2.58E-05 Per Year
Supervisor fails to prevent PRCD cleaning into PR (containing PHA)
OPRPRCD-SVL1#
1.00E-01 Use TC value
PR product awaiting transfer after being sampled
PR-PHA--IDL6#
1.29E-01 a: tx 6 hours after sampling
Failure to wait until PR transfer complete before cleaning PRCD
OPR1131-ACL1#
5.00E-04 Use TC Value
PRCD cleaned (drain valve opened)
MOV1131-ADJ6+
2
4.58E-04 a: valve remains open 1 hour, quarterly
PVVH Explosion
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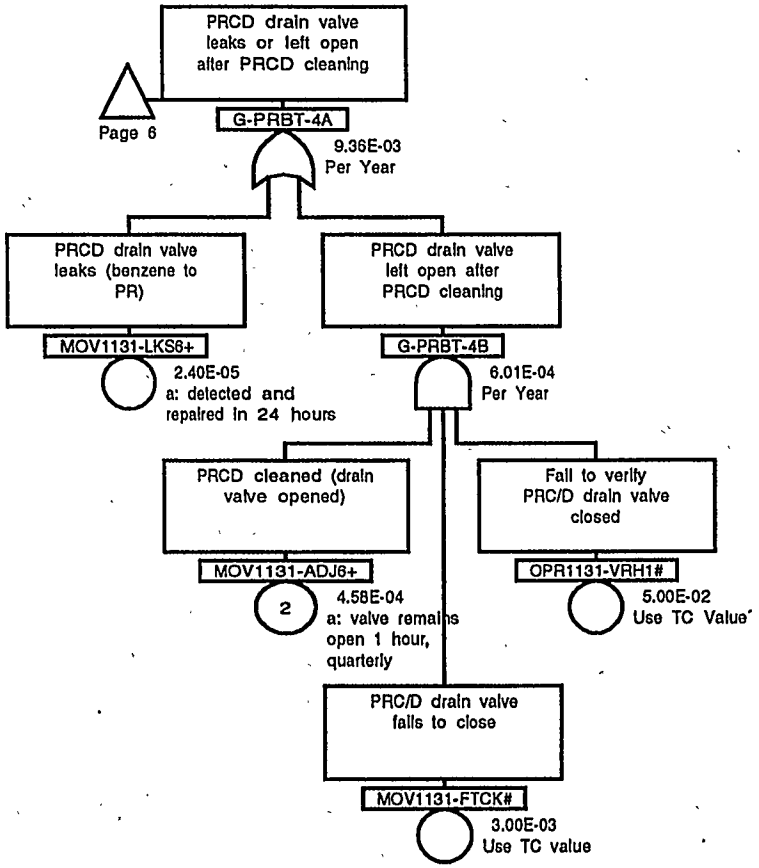
Page 6



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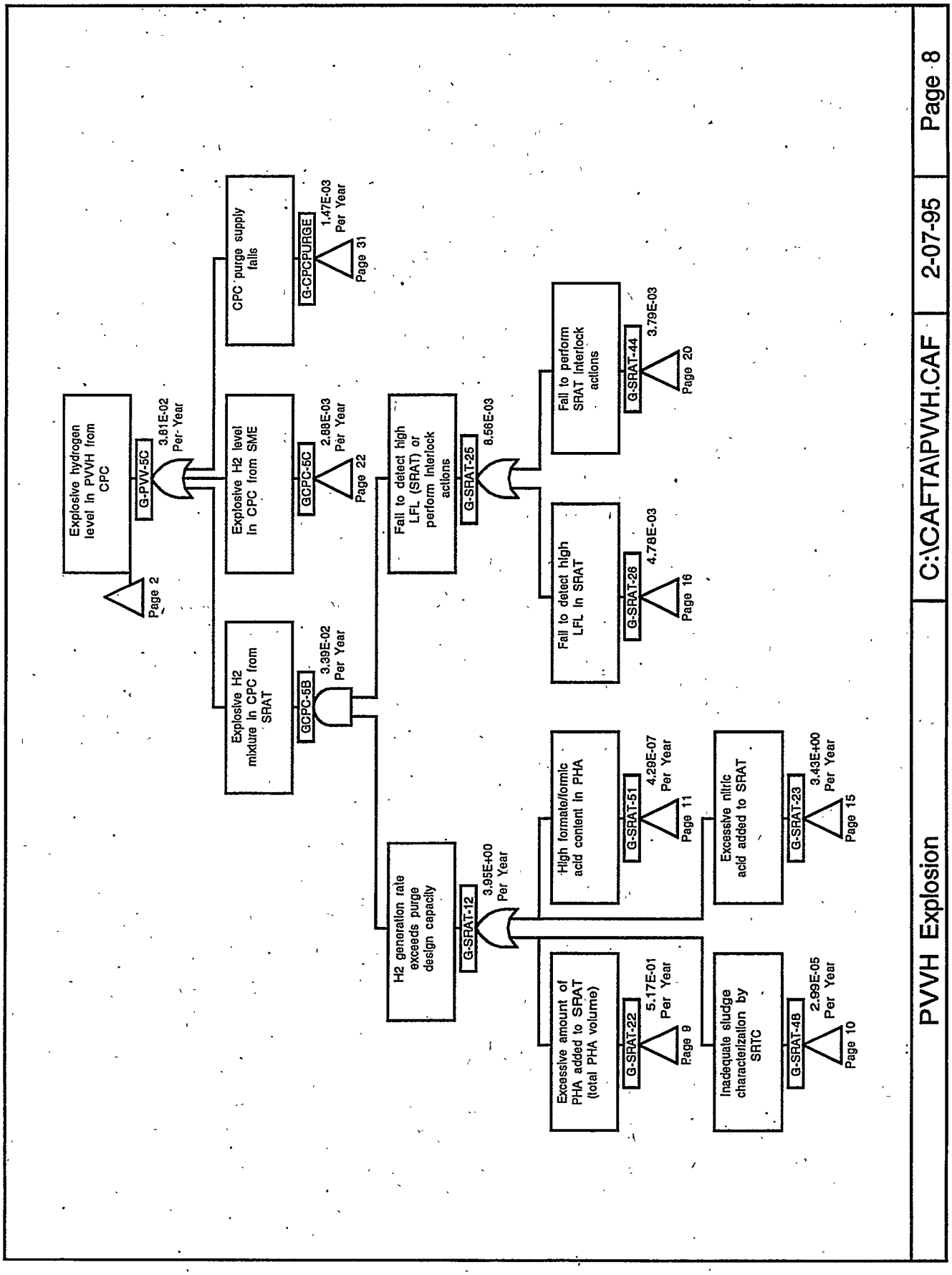
PVVH Explosion
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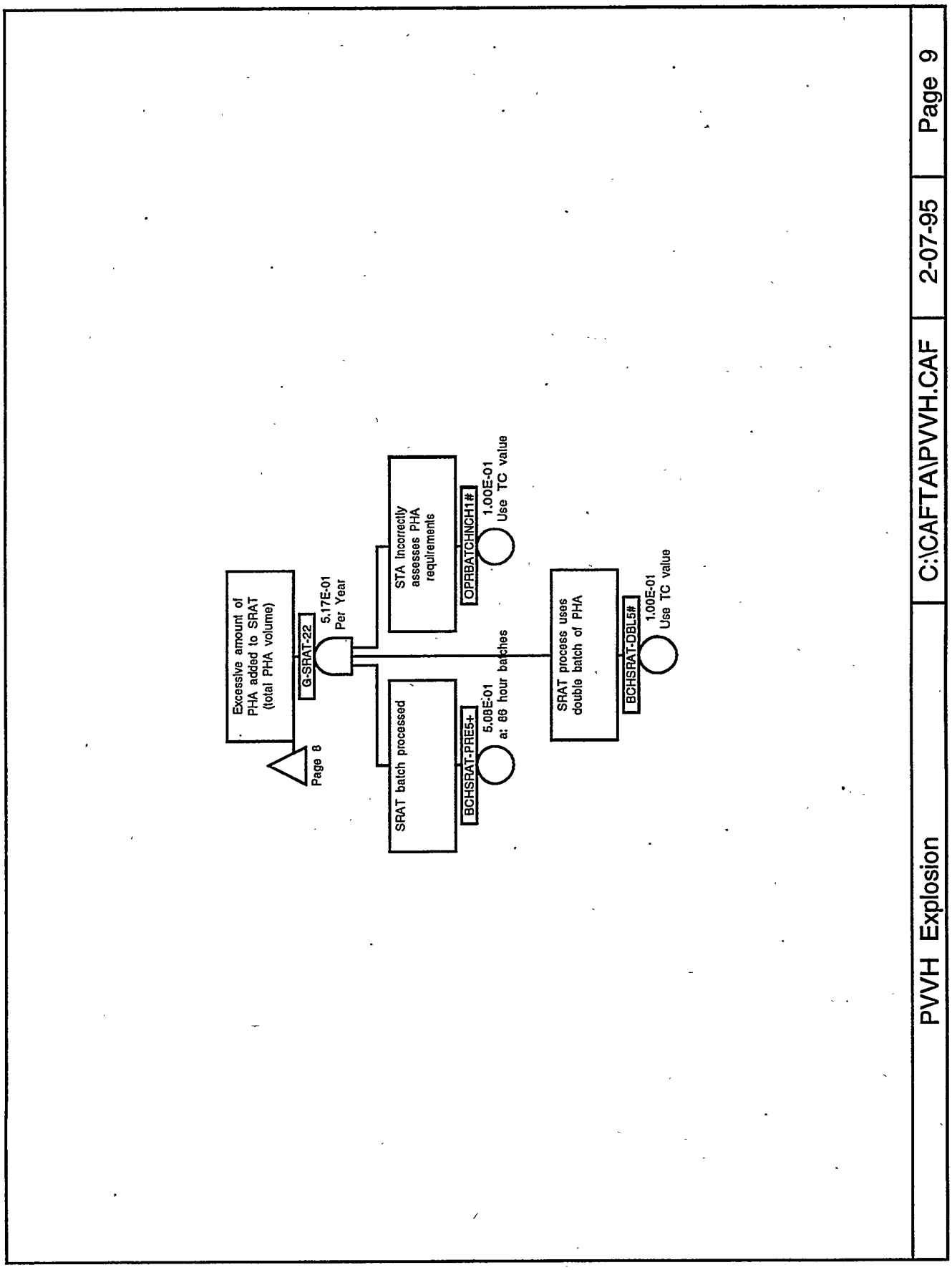
Page 8
Explosive hydrogen level in PVVH from CPC
G-PVV-5C
3.81E-02 Per Year
Page 2
CPC purge supply fails
G-CPCPURGE
1.47E-03 Per Year
Page 31
Explosive H2 level in CPC from SME
GCPC-5C
2.88E-03 Per Year
Page 22
Explosive H2 mixture in CPC from SRAT
GCPC-5B
3.39E-02 Per Year
Fail to detect high LFL (SRAT) or perform Interlock actions
G-SRAT-25
8.56E-03
Fail to perform SRAT interlock actions
G-SRAT-44
3.79E-03
Page 20
Fail to detect high LFL in SRAT
G-SRAT-26
4.78E-03
Page 16
H2 generation rate exceeds purge design capacity
G-SRAT-12
3.95E+00 Per Year
High formate/formic acid content in PHA
G-SRAT-51
4.28E-07 Per Year
Page 11
Excessive nitric acid added to SRAT
G-SRAT-23
3.43E+00 Per Year
Page 15
Excessive amount of PHA added to SRAT (total PHA volume)
G-SRAT-22
5.17E-01 Per Year
Page 9
Inadequate sludge characterization by SRTC
G-SRAT-48
2.99E-05 Per Year
Page 10


Excessive amount of PHA added to SRAT (total PHA volume)
G-SRAT-22
5.17E-01
Per Year
Page 8
SRAT batch processed
BCHSRAT-PRE5+
5.08E-01
a: 86 hour batches
STA incorrectly assesses PHA requirements
OPRBATCHNCH1#
1.00E-01
Use TC value
SRAT process uses double batch of PHA
BCHSRAT-DBL5#
1.00E-01
Use TC value
PVVH Explosion
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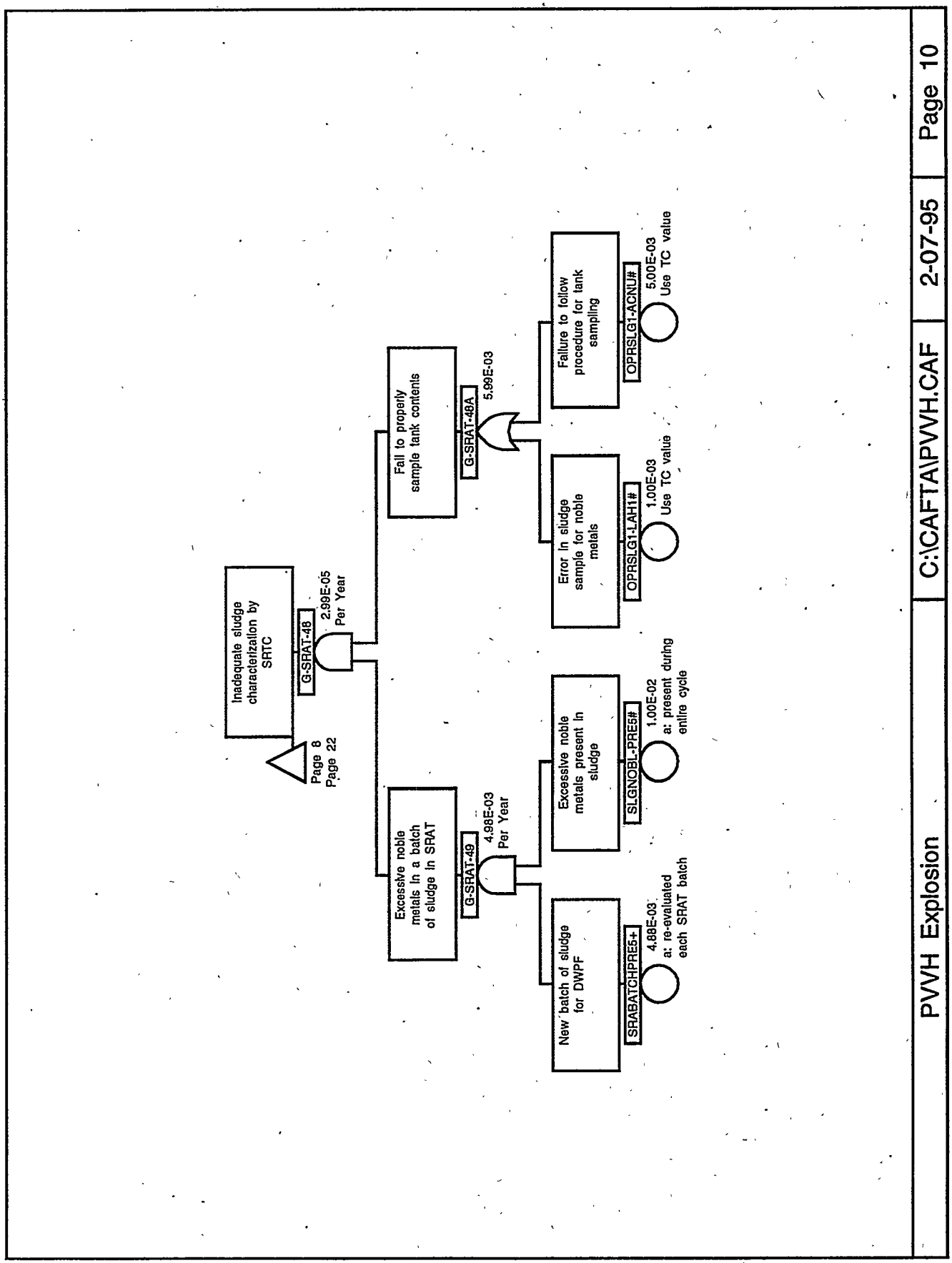
PVVH Explosion
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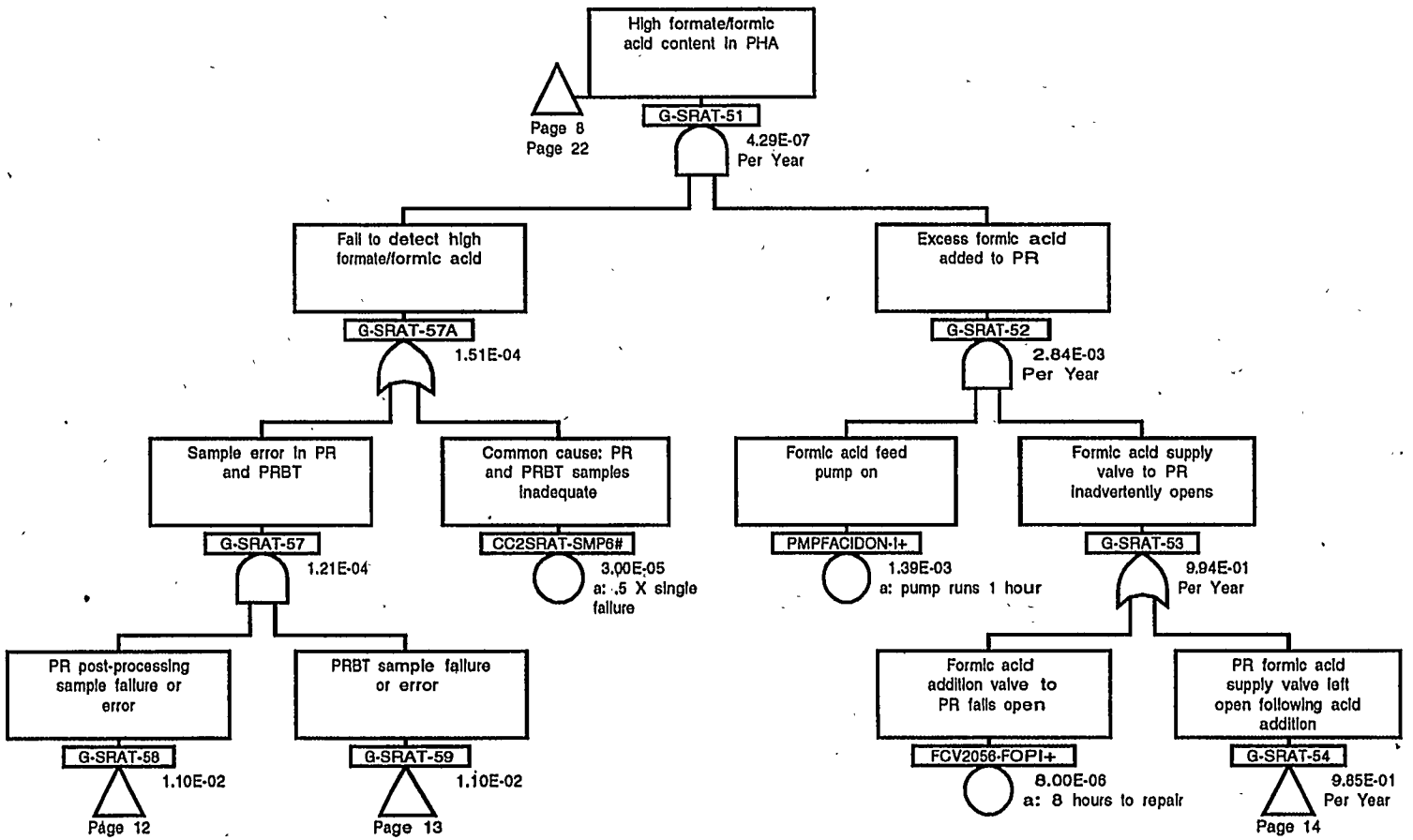
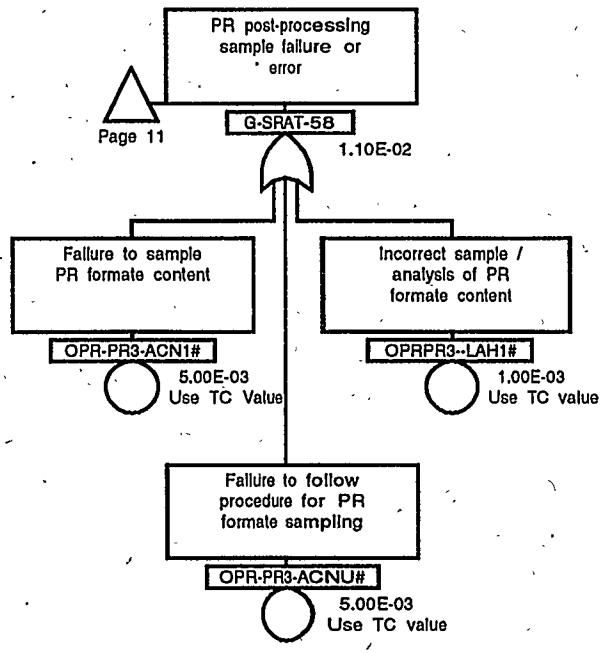
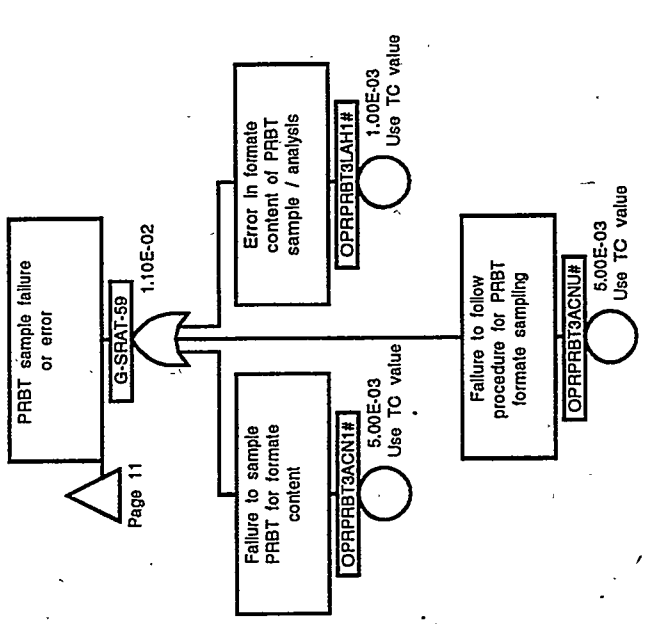
Page 10
Inadequate sludge characterization by SRTC
Page 8
Page 22
G-SRAT-48
2.99E-05
Per Year
Excessive noble metals in a batch of sludge in SRAT
G-SRAT-49
4.98E-03
Per Year
New batch of sludge for DWPF
SRABATCHPRE5+
4.88E-03
a: re-evaluated each SRAT batch
Excessive noble metals present in sludge
SLGNOBL-PRE5#
1.00E-02
a: present during entire cycle
Fail to properly sample tank contents
G-SRAT-48A
5.99E-03
Error in sludge sample for noble metals
OPRSLG1-LAH1#
1.00E-03
Use TC value
Failure to follow procedure for tank sampling
OPRSLG1-ACNU#
5.00E-03
Use TC value



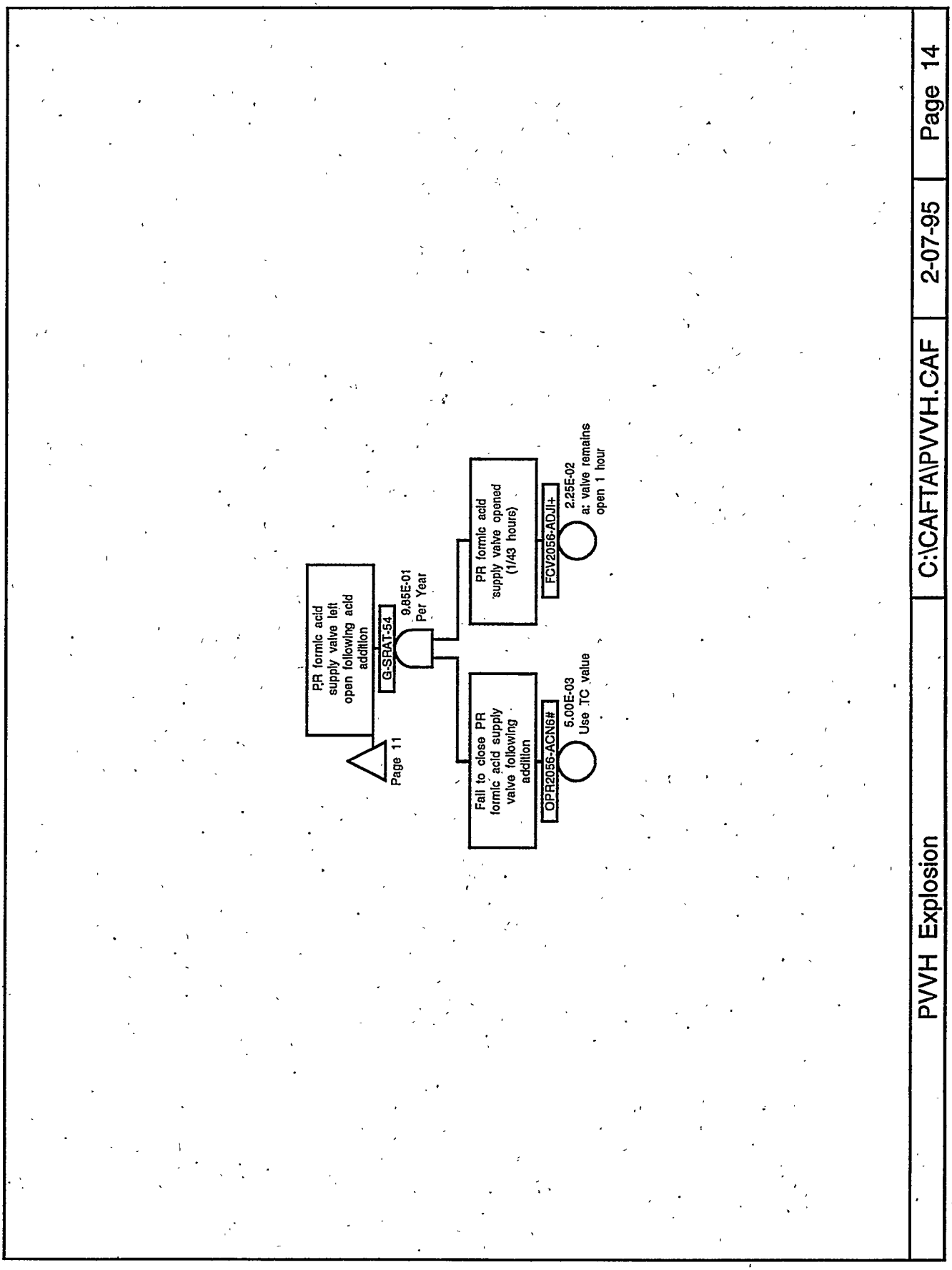
PVVH Explosion	C:\CAFTA\PVVH.CAF	2-07-95	Page 11



PVVH Explosion	C:\CAFTA\PVVH.CAF	2-07-95	Page 12



PVVH Explosion | C:\CAFTA\PVVH.CAF | 2-07-95 | Page 13


PV/VH Explosion
C:\CAFTA\PVVH.CAF
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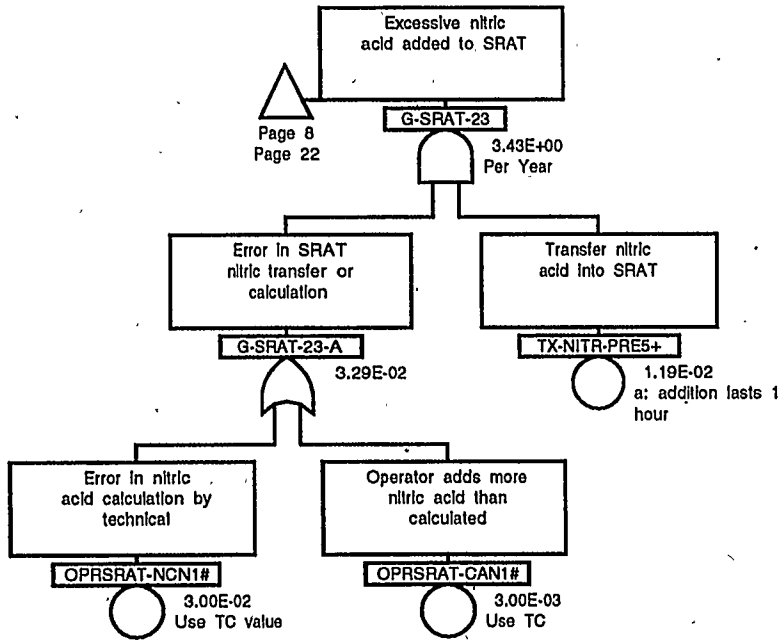
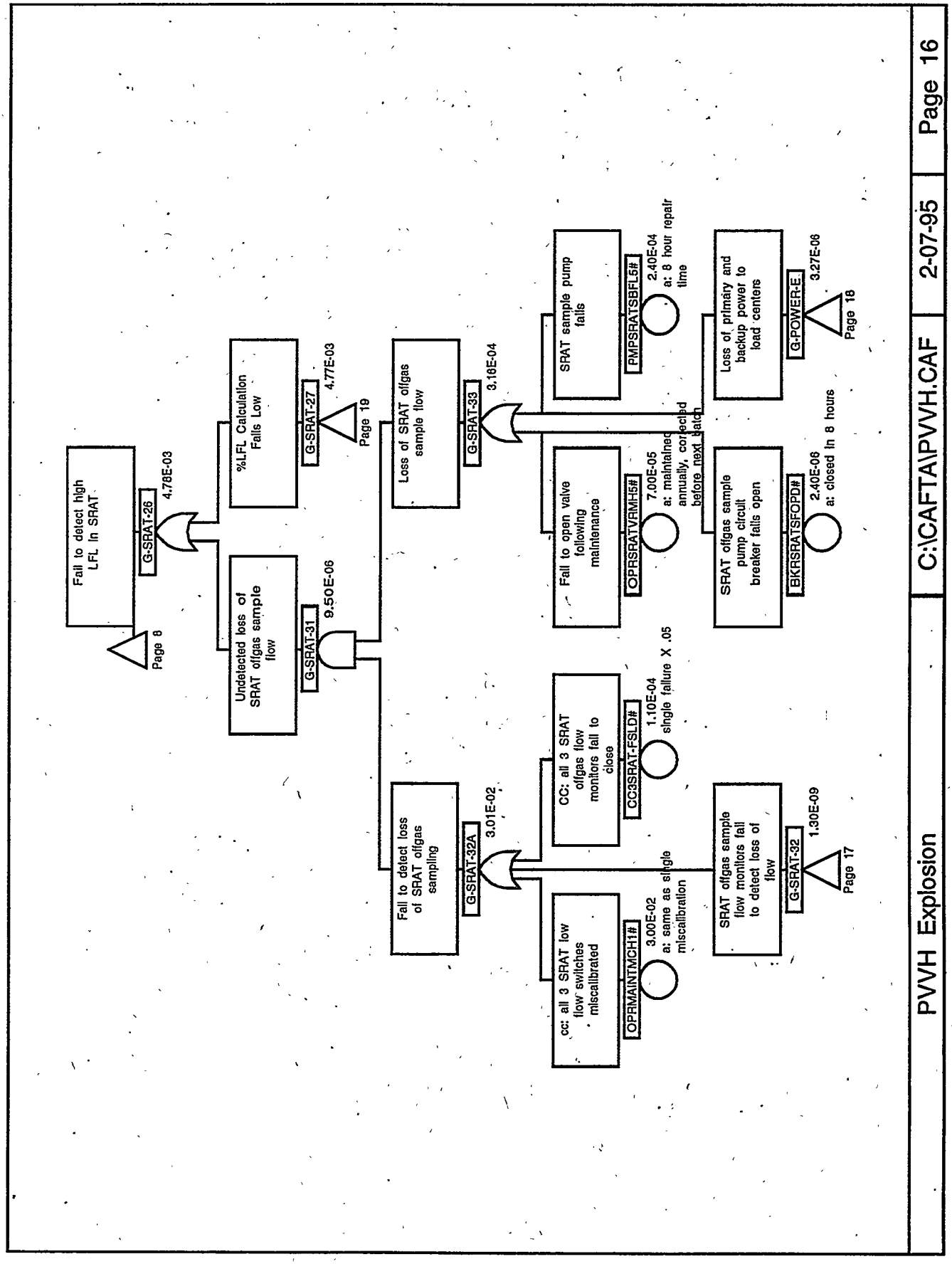
Page 14
PR formic acid supply valve left open following acid addition
Page 11
G-SRAT-54
9.85E-01 Per Year
PR formic acid supply valve opened (1/43 hours)
FCV2056-ADJ/+
2.25E-02 a: valve remains open 1 hour
Fail to close PR formic acid supply valve following addition
OPR2056-ACN6#
5.00E-03 Use TC value


Excessive nitric acid added to SRAT
G-SRAT-23
3.43E+00
Per Year
Page 8
Page 22
Error in SRAT nitric transfer or calculation
G-SRAT-23-A
3.29E-02
Transfer nitric acid into SRAT
TX-NITR-PRE5+
1.19E-02
a: addition lasts 1 hour
Error in nitric acid calculation by technical
OPRSRAT-NCN1#
3.00E-02
Use TC value
Operator adds more nitric acid than calculated
OPRSRAT-CAN1#
3.00E-03
Use TC


Fail to detect high LFL in SRAT
G-SRAT-26
4.78E-03
Page 8
%LFL Calculation Fails Low
G-SRAT-27
4.77E-03
Page 19
Undetected loss of SRAT offgas sample flow
G-SRAT-31
9.50E-06
Loss of SRAT offgas sample flow
G-SRAT-33
3.16E-04
SRAT sample pump fails
PMPSRATSBFL5#
2.40E-04
a: 8 hour repair time
Loss of primary and backup power to load centers
G-POWER-E
3.27E-06
Page 18
Fail to open valve following maintenance
OPRSRATVRMH5#
7.00E-05
a: maintained annually, corrected before next batch
SRAT offgas sample pump circuit breaker fails open
BKRSRATSFOPD#
2.40E-06
a: closed in 8 hours
Fail to detect loss of SRAT offgas sampling
G-SRAT-32A
3.01E-02
CC: all 3 SRAT offgas flow monitors fail to close
CC3SRAT-FSLD#
1.10E-04
single failure X .05
cc: all 3 SRAT low flow switches miscalibrated
OPRMAINTMCH1#
3.00E-02
a: same as single miscalibration
SRAT offgas sample flow monitors fail to detect loss of flow
G-SRAT-32
1.30E-09
Page 17
PVVH Explosion
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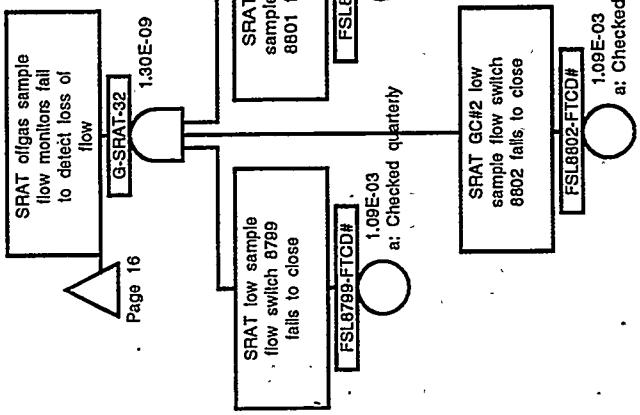

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G-POWER-E Outputs:
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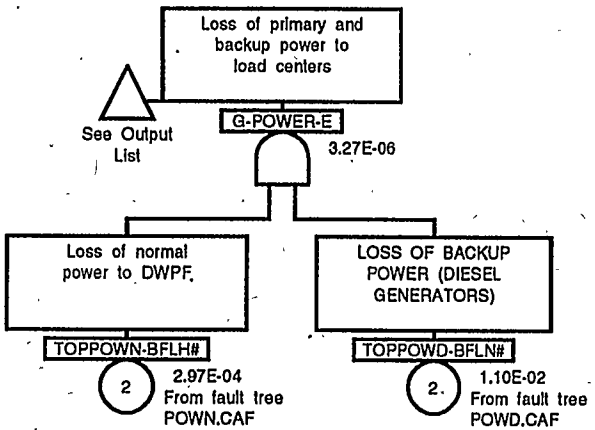

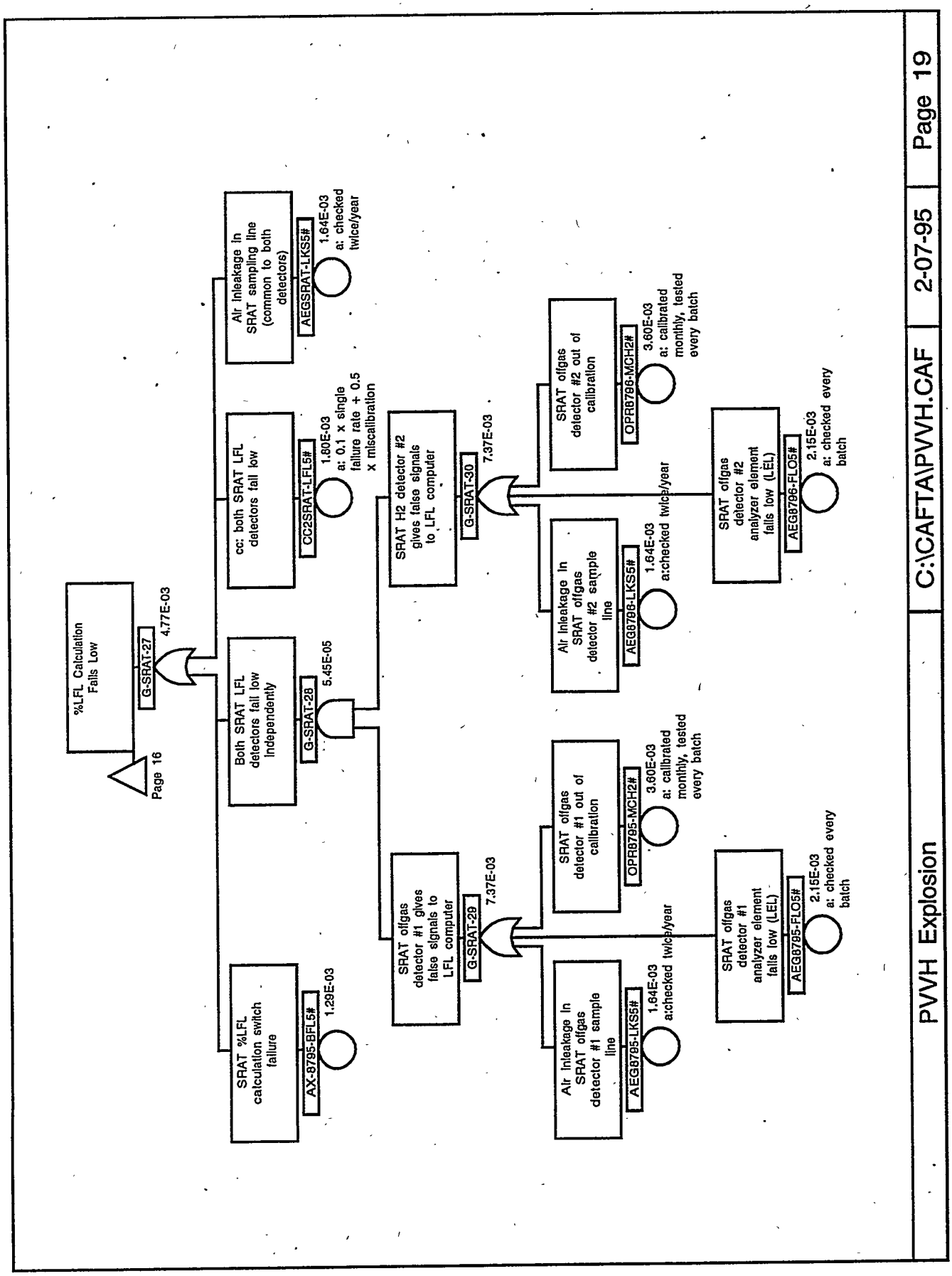
%LFL Calculation Falls Low
4.77E-03
G-SRAT-27
Page 16
Both SRAT LFL detectors fail low independently
5.45E-05
G-SRAT-28
SRAT %LFL calculation switch failure
1.29E-03
AX-8795-BFL5#
SRAT offgas detector #1 gives false signals to LFL computer
7.37E-03
G-SRAT-29
SRAT offgas detector #1 out of calibration
3.60E-03
a: calibrated monthly, tested every batch
OPR8795-MCH2#
Air Inleakage In SRAT offgas detector #1 sample line
1.64E-03
a:checked twice/year
AEG8795-LKS5#
SRAT offgas detector #1 analyzer element fails low (LEL)
2.15E-03
a: checked every batch
AEG8795-FLO5#
SRAT H2 detector #2 gives false signals to LFL computer
7.37E-03
G-SRAT-30
SRAT offgas detector #2 out of calibration
3.60E-03
a: calibrated monthly, tested every batch
OPR8796-MCH2#
Air Inleakage In SRAT offgas detector #2 sample line
1.64E-03
a:checked twice/year
AEG8796-LKS5#
SRAT offgas detector #2 analyzer element fails low (LEL)
2.15E-03
a: checked every batch
AEG8796-FLO5#
cc: both SRAT LFL detectors fail low
1.80E-03
a: 0.1 x single failure rate + 0.5 x miscalibration
CC2SRAT-LFL5#
Air Inleakage In SRAT sampling line (common to both detectors)
1.64E-03
a: checked twice/year
AEGSRAT-LKS5#
PVVH Explosion
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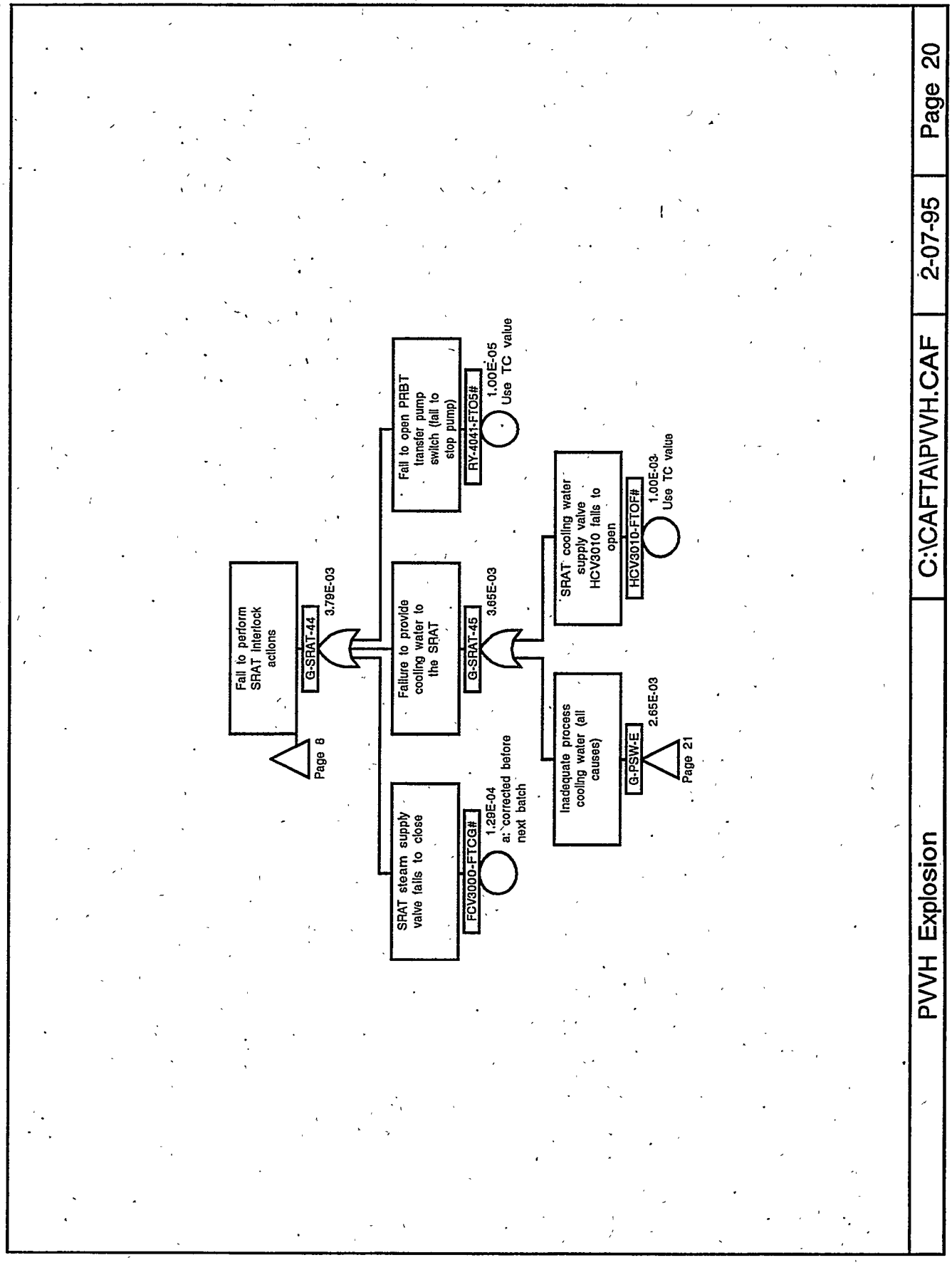
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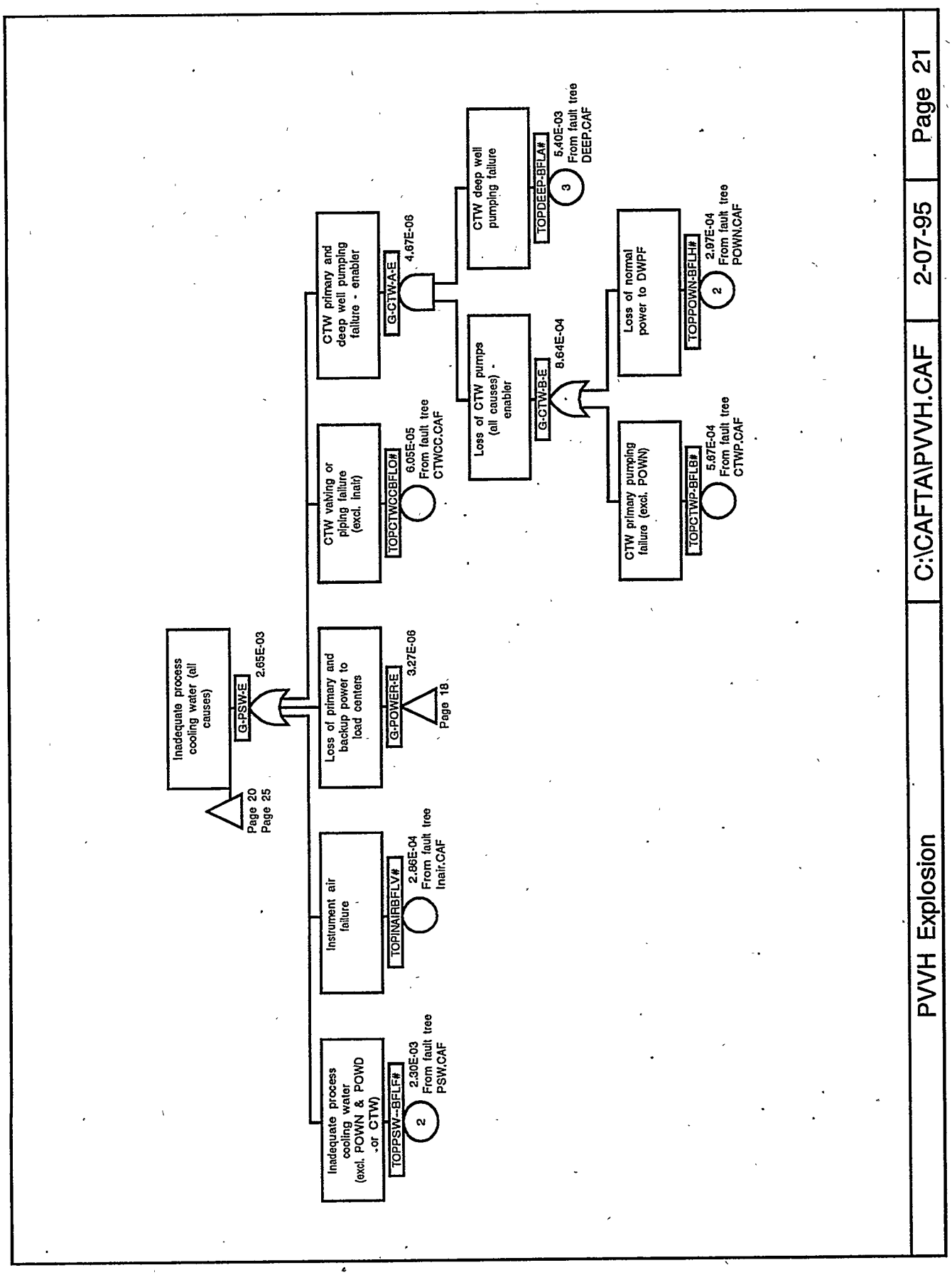
Page 20
Fail to perform SRAT interlock actions
G-SRAT-44
3.79E-03
Page 8
Failure to provide cooling water to the SRAT
G-SRAT-45
3.65E-03
Fail to open PRBT transfer pump switch (fail to stop pump)
RY-4041-FTOS#
1.00E-05
Use TC value
SRAT steam supply valve fails to close
FCV3000-FTCG#
1.29E-04
a: corrected before next batch
Inadequate process cooling water (all causes)
G-PSW-E
2.65E-03
Page 21
SRAT cooling water supply valve HCV3010 fails to open
HCV3010-FTOF#
1.00E-03
Use TC value


Inadequate process cooling water (all causes)
G-PSW-E
2.85E-03
Page 20
Page 25
Inadequate process cooling water (excl. POWN & POWD or CTW)
TOPPSW--BFLF#
2.30E-03
From fault tree PSW.CAF
Instrument air failure
TOPINAIRBFLV#
2.86E-04
From fault tree Inair.CAF
Loss of primary and backup power to load centers
G-POWER-E
3.27E-06
Page 18
CTW valving or piping failure (excl. Inair)
TOPCTWCCBFLOW
6.05E-05
From fault tree CTWCC.CAF
CTW primary and deep well pumping failure - enabler
G-CTW-A-E
4.67E-06
Loss of CTW pumps (all causes) - enabler
G-CTW-B-E
8.64E-04
CTW deep well pumping failure
TOPDEEP-BFLA#
5.40E-03
From fault tree DEEP.CAF
CTW primary pumping failure (excl. POWN)
TOPCTWP-BFLB#
5.67E-04
From fault tree CTWP.CAF
Loss of normal power to DWPF
TOPPOWN-BFLH#
2.97E-04
From fault tree POWN.CAF
PVVH Explosion
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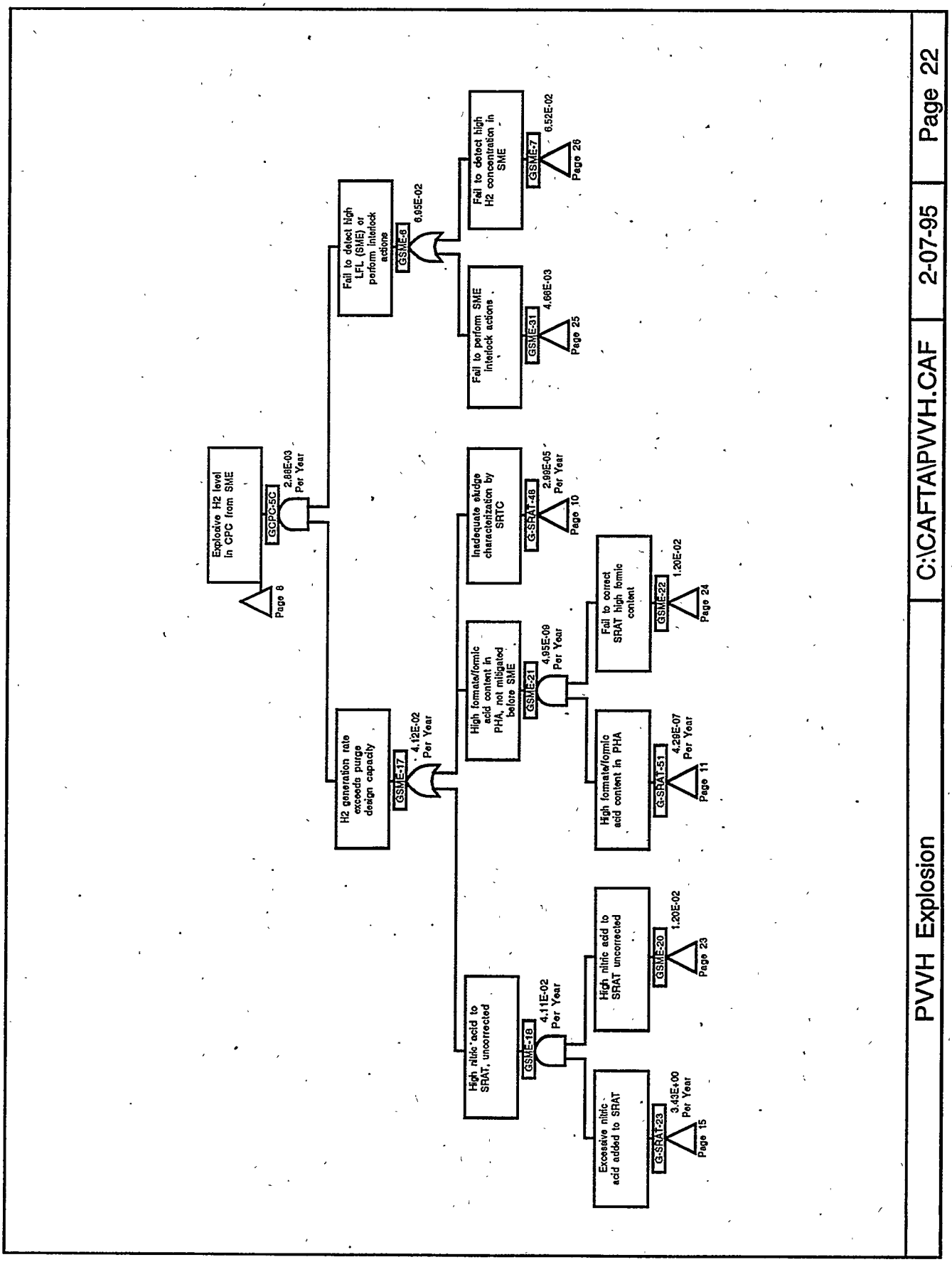
PVVH Explosion
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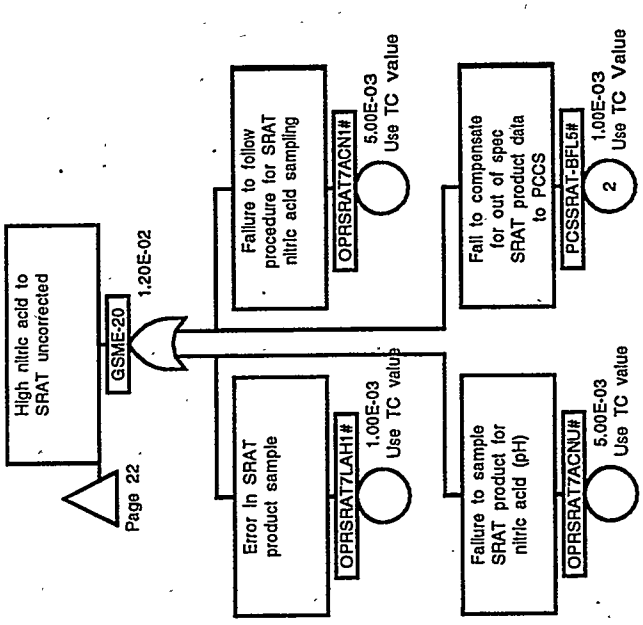
Page 22
Explosive H2 level in CPC from SME
GGPC-5C
2.88E-03 Per Year
Page 8
Fail to detect high LFL (SME) or perform interlock actions
GSME-6
6.95E-02
Fail to detect high H2 concentration in SME
GSME-7
6.52E-02
Page 26
Fail to perform SME interlock actions
GSME-31
4.66E-03
Page 25
H2 generation rate exceeds purge design capacity
GSME-17
4.12E-02 Per Year
Inadequate sludge characterization by SRTC
G-SRAT-48
2.99E-05 Per Year
Page 10
High formate/formic acid content in PHA, not mitigated before SME
GSME-21
4.95E-08 Per Year
Fail to correct SRAT high formic content
GSME-22
1.20E-02
Page 24
High formate/formic acid content in PHA
G-SRAT-51
4.29E-07 Per Year
Page 11
High nitric acid to SRAT, uncorrected
GSME-18
4.11E-02 Per Year
High nitric acid to SRAT uncorrected
GSME-20
1.20E-02
Page 23
Excessive nitric acid added to SRAT
G-SRAT-23
3.43E+00 Per Year
Page 15



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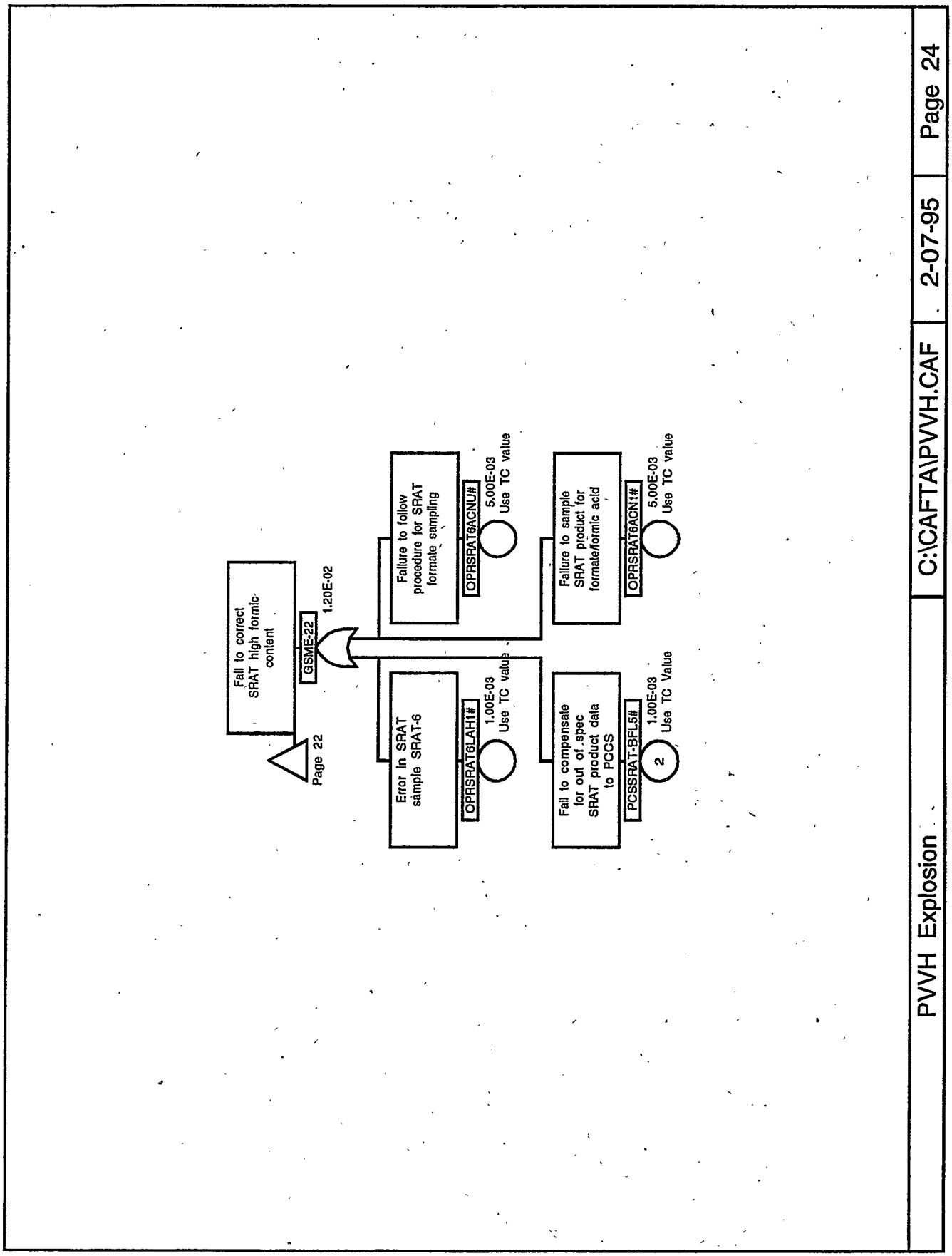
Fail to correct SRAT high formic content
GSME-22
1.20E-02
Page 22
Failure to follow procedure for SRAT formate sampling
OPRSRAT6ACNU#
5.00E-03
Use TC value
Error in SRAT sample SRAT-6
OPRSRAT6LAH1#
1.00E-03
Use TC value
Failure to sample SRAT product for formate/formic acid
OPRSRAT6ACN1#
5.00E-03
Use TC value
Fail to compensate for out of spec SRAT product data to PCCS
PCSSRAT-BFL5#
2
1.00E-03
Use TC Value
PVVH Explosion
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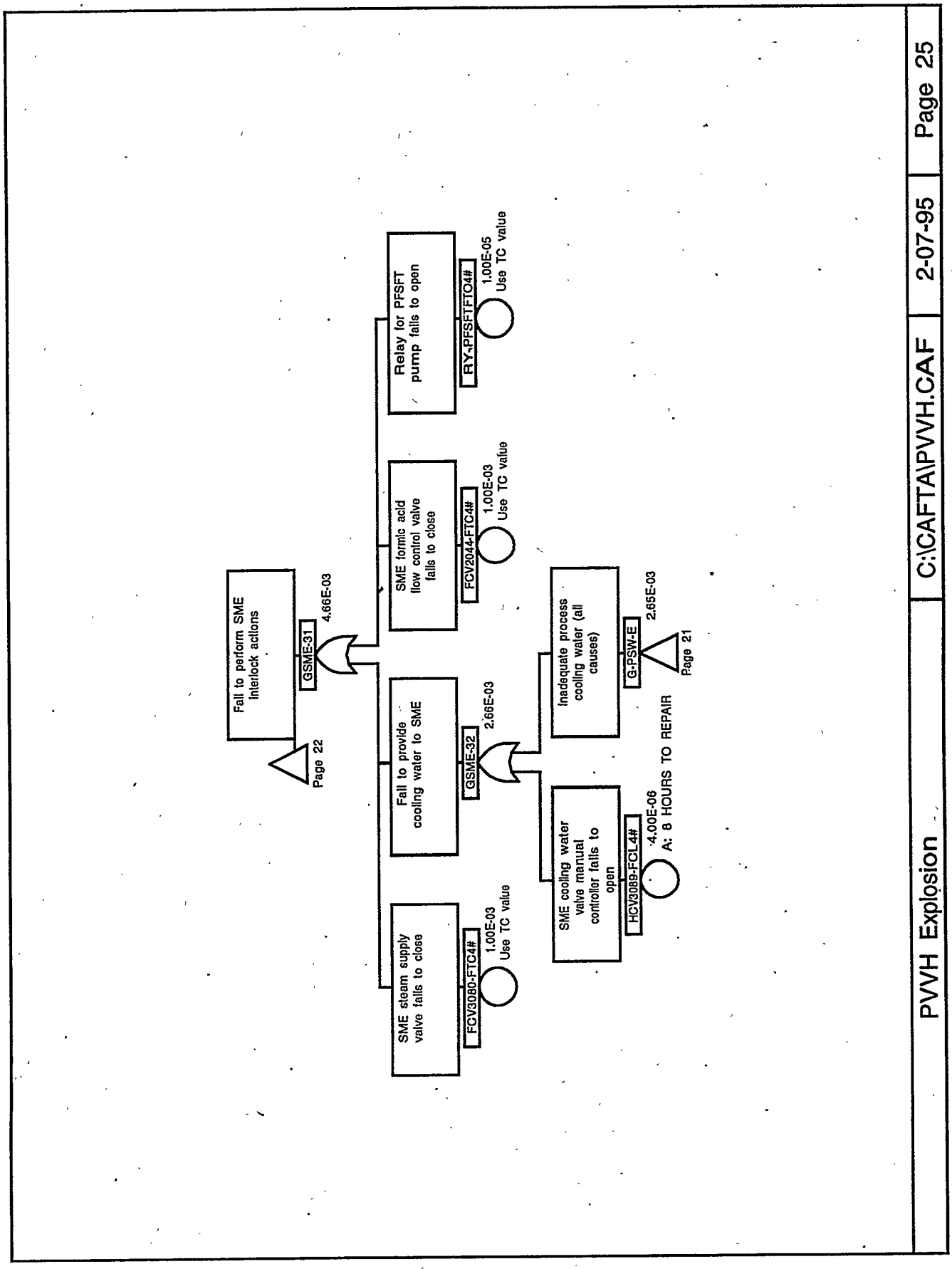
PVVH Explosion
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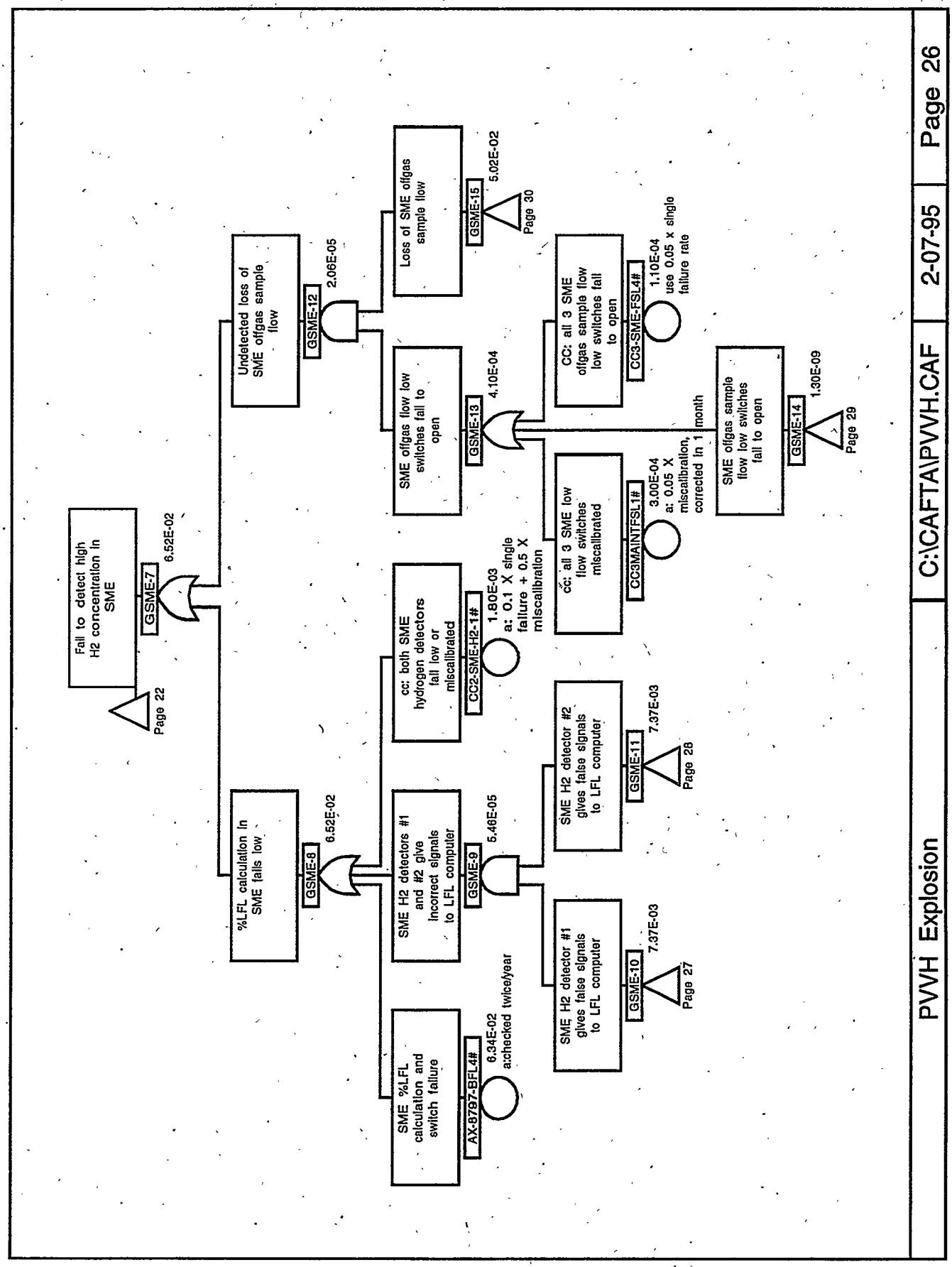
Page 25
Fail to perform SME Interlock actions
GSME-31
4.66E-03
Page 22
Relay for PFSFT pump fails to open
RY-PFSFTFTO4#
1.00E-05
Use TC value
SME formic acid flow control valve fails to close
FCV2044-FTC4#
1.00E-03
Use TC value
Fail to provide cooling water to SME
GSME-32
2.66E-03
SME steam supply valve fails to close
FCV3080-FTC4#
1.00E-03
Use TC value
Inadequate process cooling water (all causes)
G-PSW-E
2.65E-03
Page 21
SME cooling water valve manual controller fails to open
HCV3089-FCL4#
4.00E-06
A: 8 HOURS TO REPAIR


PVVH Explosion
C:\CAFTA\PVVH.CAF
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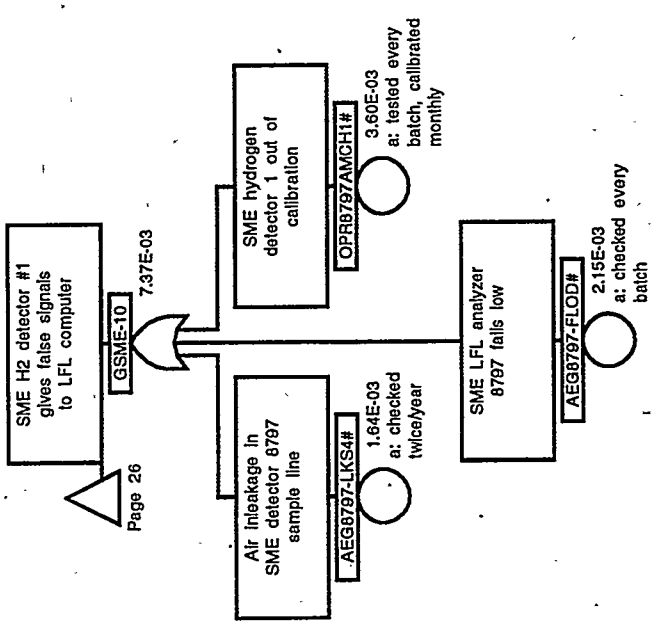
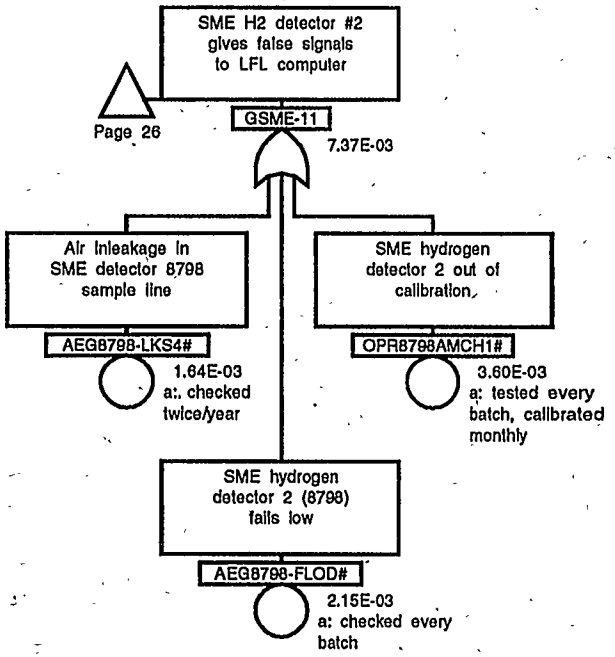
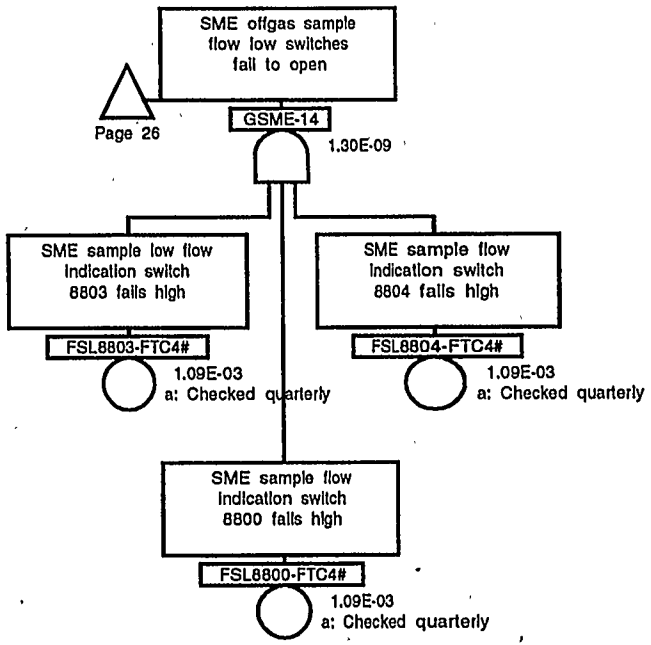
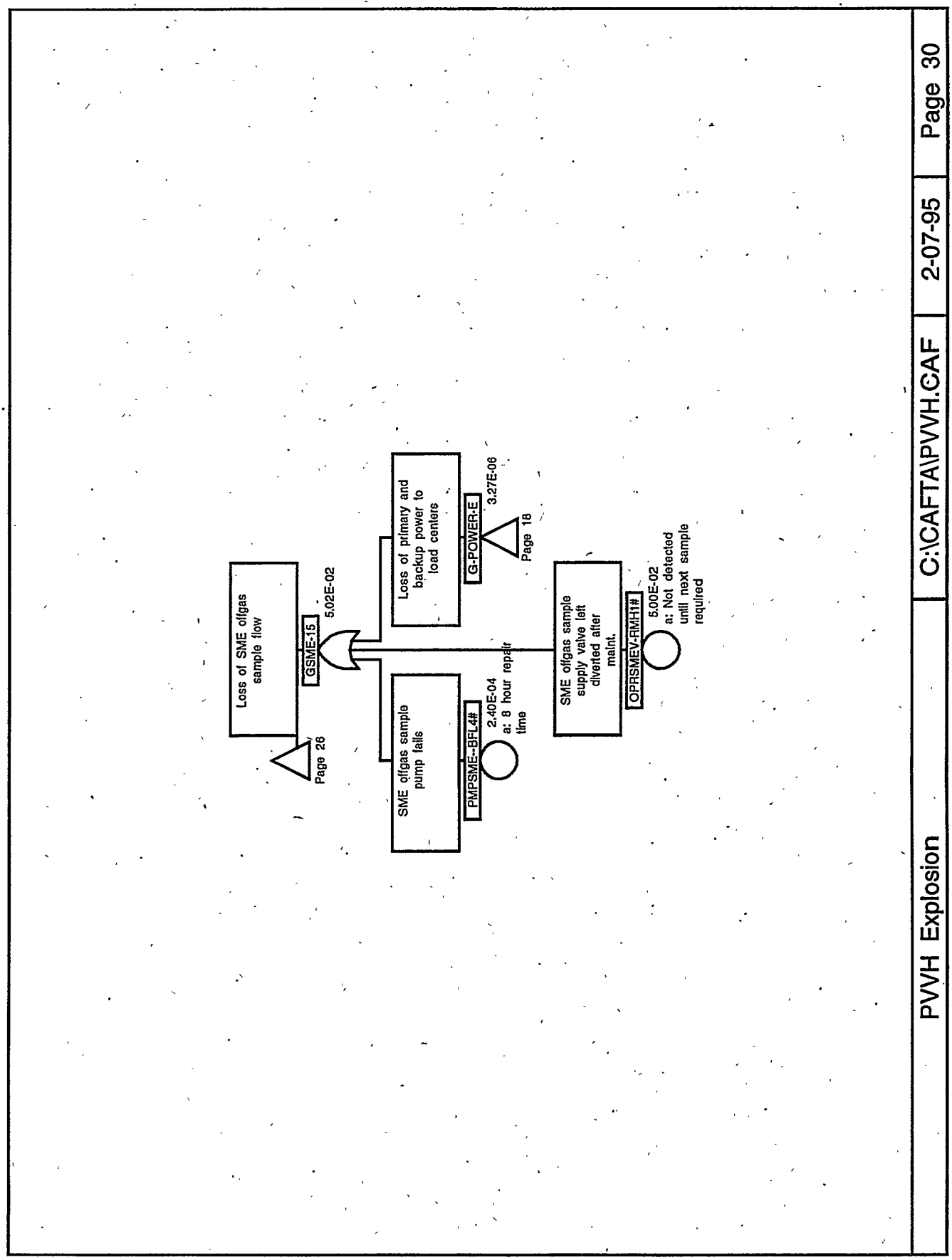
Page 26
Fail to detect high H2 concentration in SME
GSME-7
6.52E-02
Page 22
Undetected loss of SME offgas sample flow
GSME-12
2.06E-05
Loss of SME offgas sample flow
GSME-15
5.02E-02
Page 30
SME offgas flow low switches fail to open
GSME-13
4.10E-04
CC: all 3 SME offgas sample flow low switches fail to open
CC3-SME-FSL4#
1.10E-04
use 0.05 x single failure rate
%LFL calculation in SME fails low
GSME-8
6.52E-02
cc: both SME hydrogen detectors fail low or miscalibrated
CC2-SME-H2-1#
1.80E-03
a: 0.1 X single failure + 0.5 X miscalibration
cc: all 3 SME low flow switches miscalibrated
CC3MAINTFSL1#
3.00E-04
a: 0.05 X miscalibration, corrected in 1 month
SME offgas sample flow low switches fail to open
GSME-14
1.30E-09
Page 29
SME H2 detectors #1 and #2 give incorrect signals to LFL computer
GSME-9
5.46E-05
SME H2 detector #2 gives false signals to LFL computer
GSME-11
7.37E-03
Page 28
SME %LFL calculation and switch failure
AX-8797-BFL4#
6.34E-02
a:checked twice/year
SME H2 detector #1 gives false signals to LFL computer
GSME-10
7.37E-03
Page 27



PVVH Explosion | C:\CAFTA\PVVH.CAF | 2-07-95 | Page 27


SME H2 detector #2 gives false signals to LFL computer
Page 26
GSME-11
7.37E-03
Air Inleakage In SME detector 8798 sample line
SME hydrogen detector 2 out of calibration
AEG8798-LKS4#
1.64E-03
a:. checked twice/year
OPR8798AMCH1#
3.60E-03
a: tested every batch, callbrated monthly
SME hydrogen detector 2 (8798) fails low
AEG8798-FLOD#
2.15E-03
a: checked every batch


SME offgas sample flow low switches fail to open
Page 26
GSME-14
1.30E-09
SME sample low flow indication switch 8803 fails high
FSL8803-FTC4#
1.09E-03
a: Checked quarterly
SME sample flow indication switch 8804 fails high
FSL8804-FTC4#
1.09E-03
a: Checked quarterly
SME sample flow indication switch 8800 fails high
FSL8800-FTC4#
1.09E-03
a: Checked quarterly


PVVH Explosion
C:\CAFTA\PVVH.CAF
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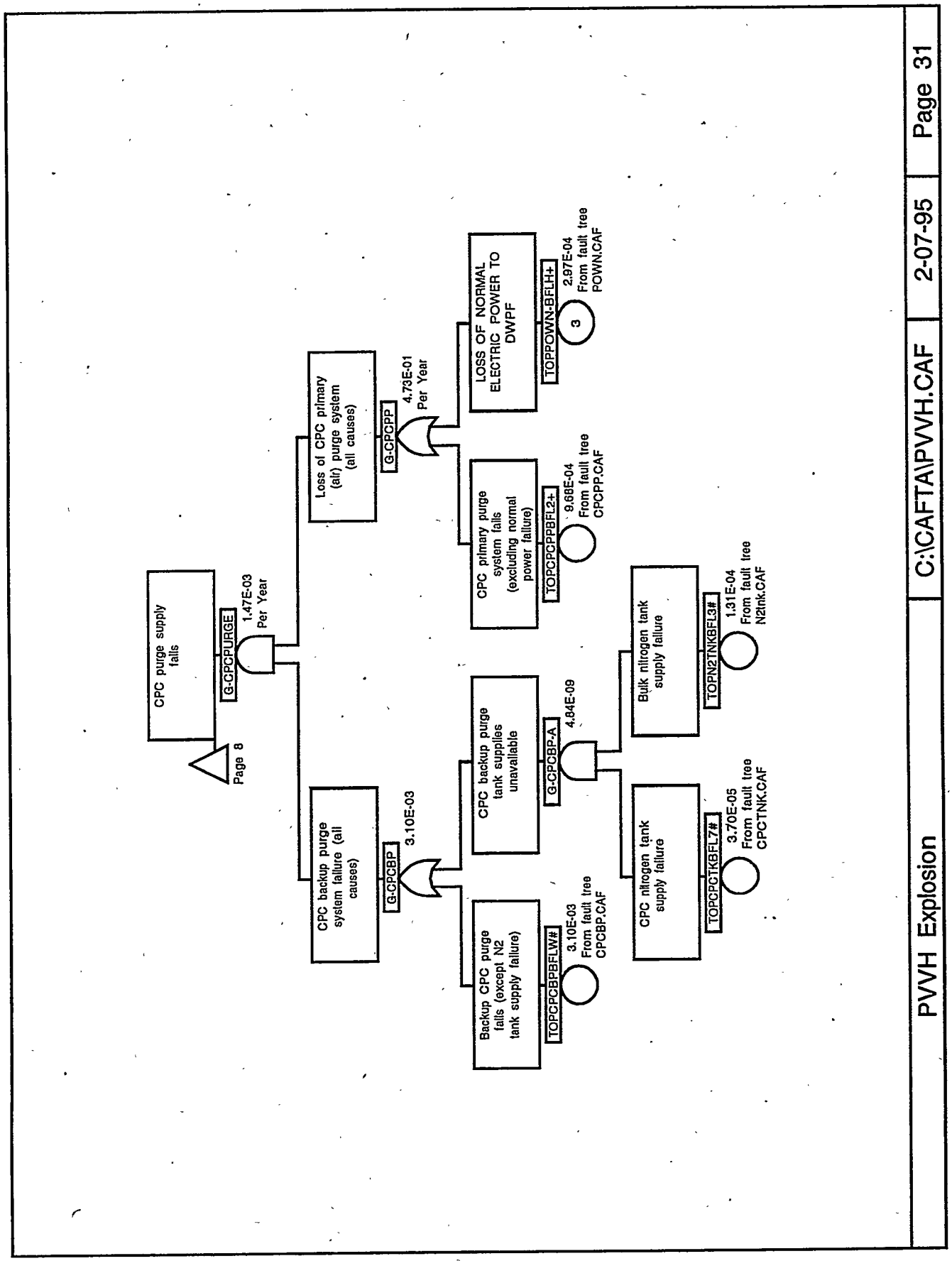
Page 30
Loss of SME offgas sample flow
Page 26
GSME-15
5.02E-02
Loss of primary and backup power to load centers
G-POWER-E
3.27E-06
Page 18
SME offgas sample pump fails
PMPSME--BFL4#
2.40E-04
a: 8 hour repair time
SME offgas sample supply valve left diverted after maint.
OPRSMEV-RMH1#
5.00E-02
a: Not detected until next sample required


CPC purge supply fails
G-CPCPURGE
1.47E-03
Per Year
Page 8
CPC backup purge system failure (all causes)
G-CPCBP
3.10E-03
Loss of CPC primary (air) purge system (all causes)
G-CPCPP
4.73E-01
Per Year
Backup CPC purge fails (except N2 tank supply failure)
TOPCPCBPBFLW#
3.10E-03
From fault tree
CPCBP.CAF
CPC backup purge tank supplies unavailable
G-CPCBP-A
4.84E-09
CPC primary purge system fails (excluding normal power failure)
TOPCPCPPBFL2+
9.68E-04
From fault tree
CPCPP.CAF
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
3
2.97E-04
From fault tree
POWN.CAF
CPC nitrogen tank supply failure
TOPCPCTKBFL7#
3.70E-05
From fault tree
CPCTNK.CAF
Bulk nitrogen tank supply failure
TOPN2TNKBFL3#
1.31E-04
From fault tree
N2tnk.CAF
PVVH Explosion
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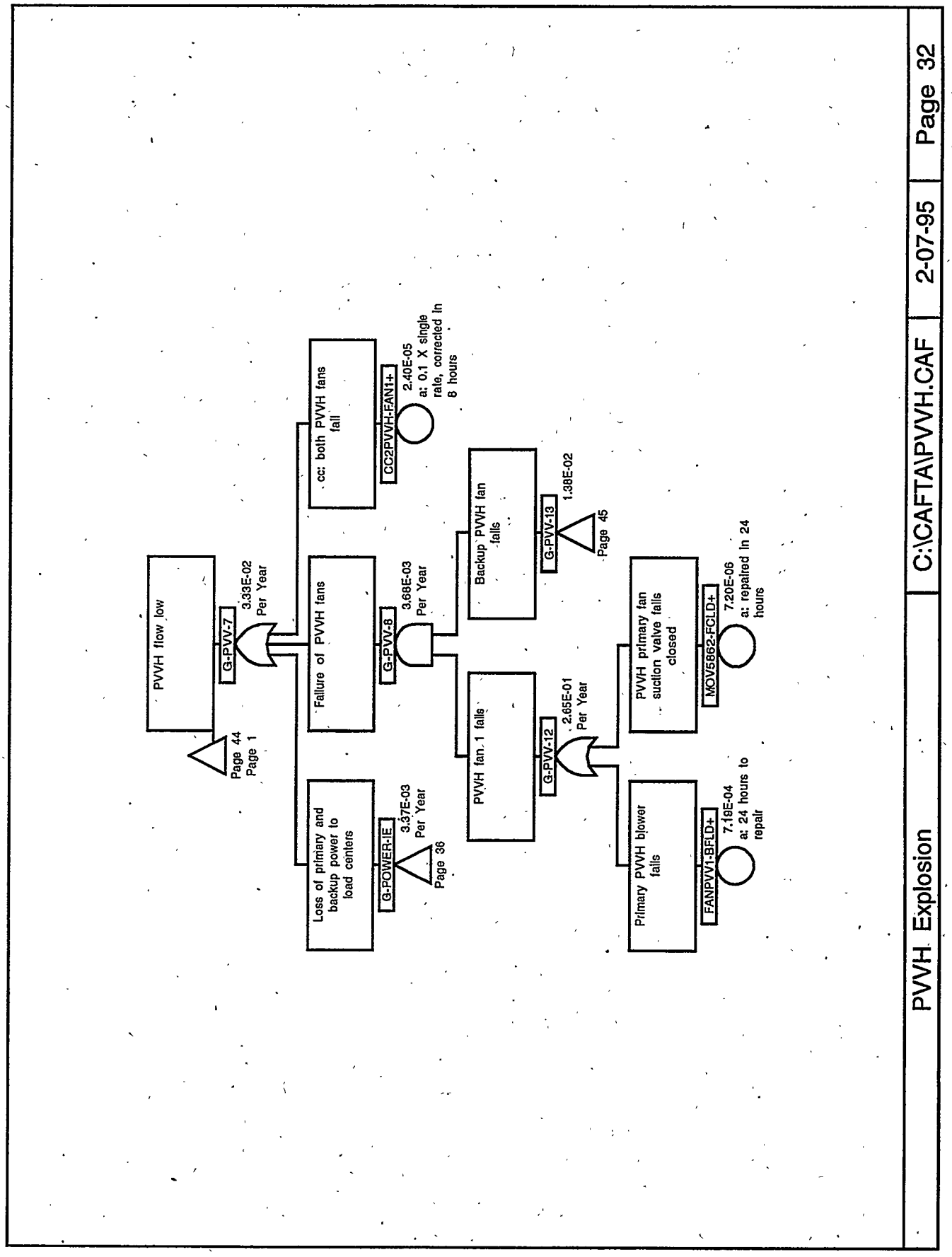
Page 31


PVVH Explosion
C:\CAFTA\PVVH.CAF
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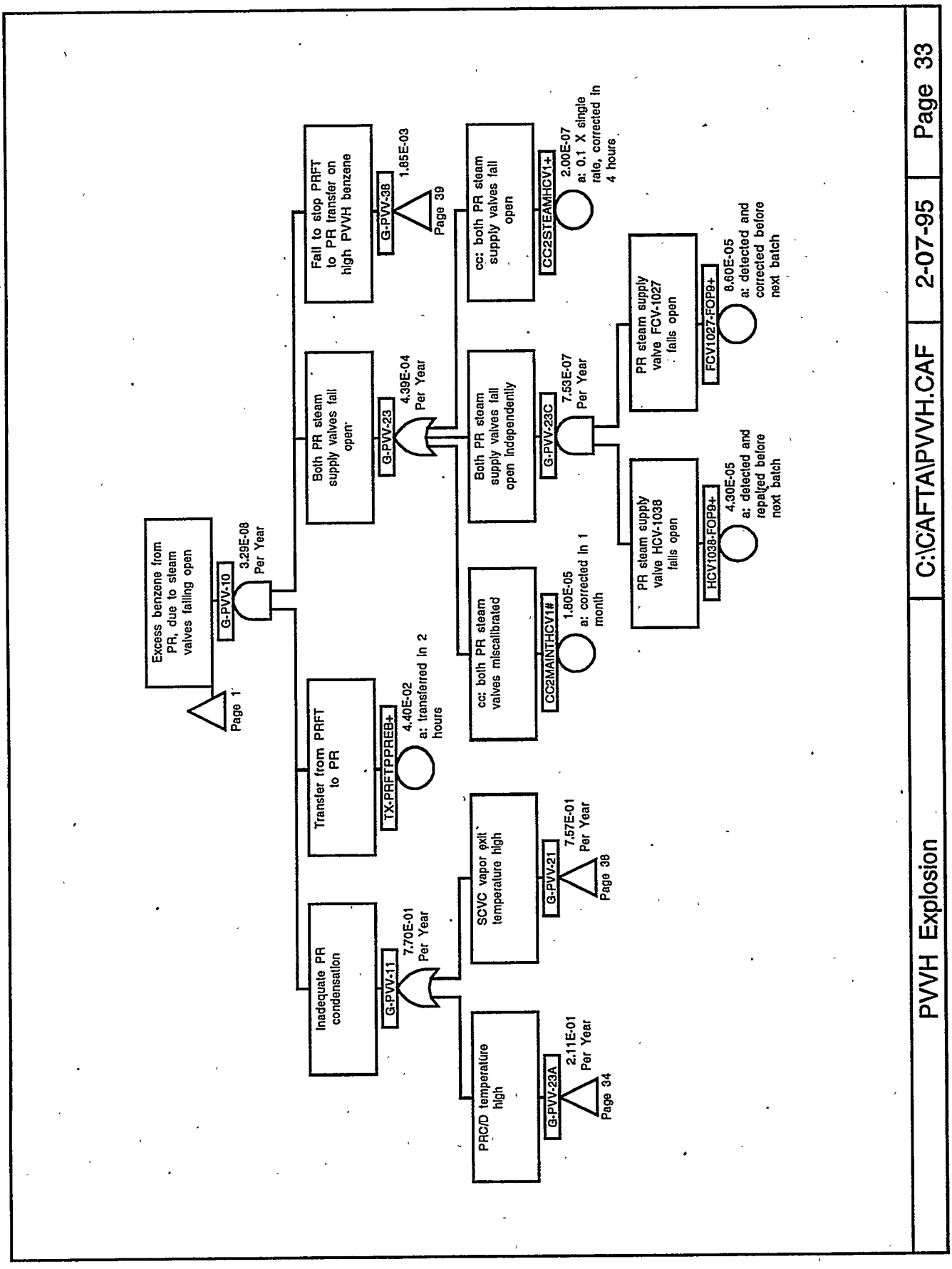
Page 32
PVVH flow low
G-PVV-7
3.33E-02
Per Year
Page 44
Page 1
Failure of PVVH fans
G-PVV-8
3.68E-03
Per Year
cc: both PVVH fans fail
CC2PVVH-FAN1+
2.40E-05
a: 0.1 X single rate, corrected in 8 hours
Backup PVVH fan fails
G-PVV-13
1.38E-02
Page 45
PVVH fan 1 fails
G-PVV-12
2.65E-01
Per Year
PVVH primary fan suction valve fails
MOV5862-FCLD+
7.20E-06
a: repaired in 24 hours
Primary PVVH blower fails
FANPVV1-BFLD+
7.19E-04
a: 24 hours to repair
Loss of primary and backup power to load centers
G-POWER-IE
3.37E-03
Per Year
Page 36


Excess benzene from PR, due to steam valves failing open
Page 1
G-PVV-10
3.29E-08 Per Year
Inadequate PR condensation
Transfer from PRFT to PR
Both PR steam supply valves fail open
Fail to stop PRFT to PR transfer on high PVVH benzene
G-PVV-38
1.85E-03
Page 39
G-PVV-11
7.70E-01 Per Year
TX-PRFTPPREB+
4.40E-02 a: transferred in 2 hours
G-PVV-23
4.39E-04 Per Year
cc: both PR steam valves miscalibrated
Both PR steam supply valves fail open independently
cc: both PR steam supply valves fail open
CC2MAINTHCV1#
1.80E-05 a: corrected in 1 month
G-PVV-23C
7.53E-07 Per Year
CC2STEAMHCV1+
2.00E-07 a: 0.1 X single rate, corrected in 4 hours
SCVC vapor exit temperature high
G-PVV-21
7.57E-01 Per Year
Page 38
PR steam supply valve HCV-1038 fails open
PR steam supply valve FCV-1027 fails open
FCV1027-FOP9+
8.60E-05 a: detected and corrected before next batch
HCV1038-FOP9+
4.30E-05 a: detected and repaired before next batch
PRC/D temperature high
G-PVV-23A
2.11E-01 Per Year
Page 34
PVVH Explosion
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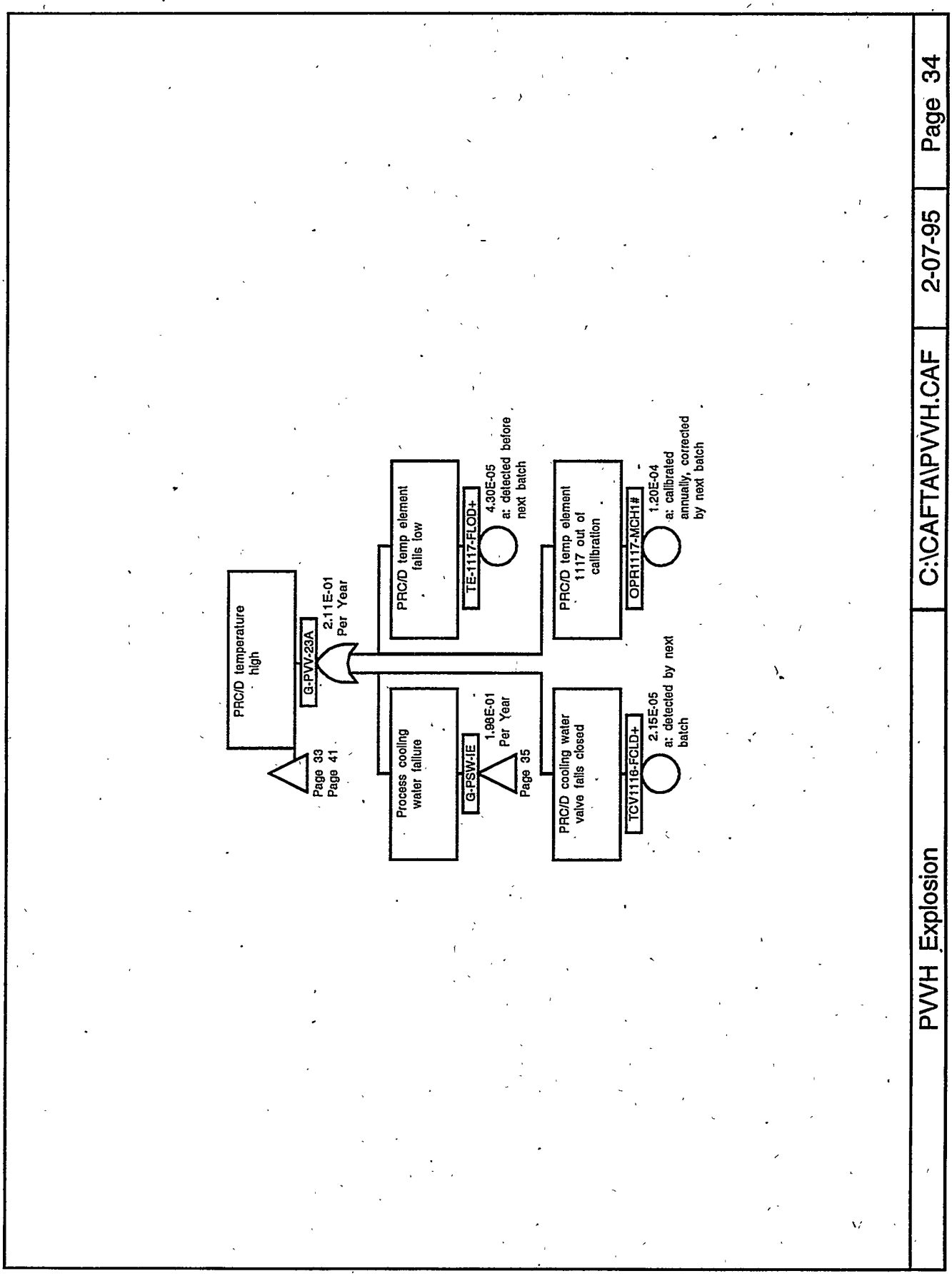
Page 33


PRC/D temperature high
Page 33
Page 41
G-PVV-23A
2.11E-01
Per Year
Process cooling water failure
G-PSW-IE
1.98E-01
Per Year
Page 35
PRC/D temp element falls low
TE-1117-FLOD+
4.30E-05
a: detected before next batch
PRC/D cooling water valve fails closed
TCV1116-FCLD+
2.15E-05
a: detected by next batch
PRC/D temp element 1117 out of calibration
OPR1117-MCH1#
1.20E-04
a: calibrated annually, corrected by next batch
PVVH Explosion
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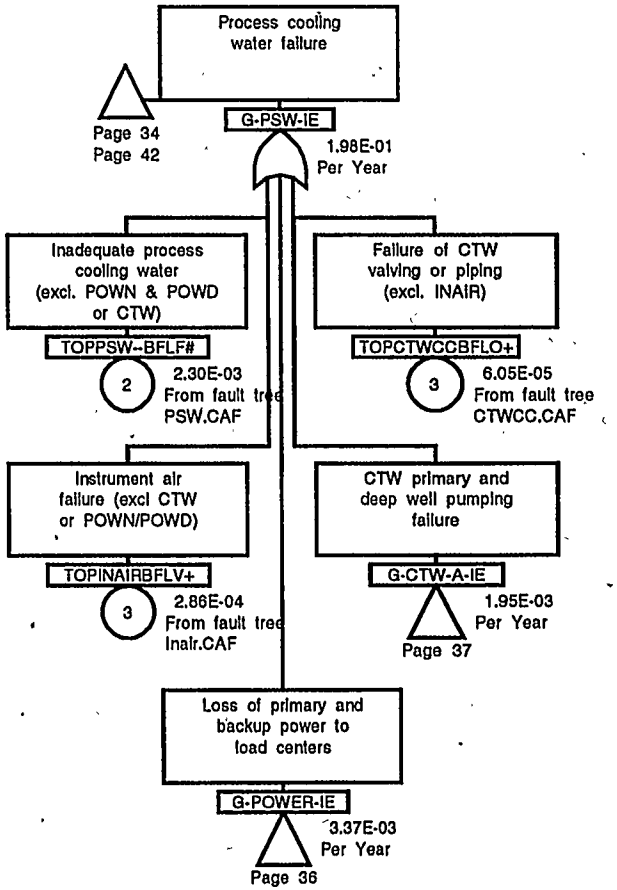
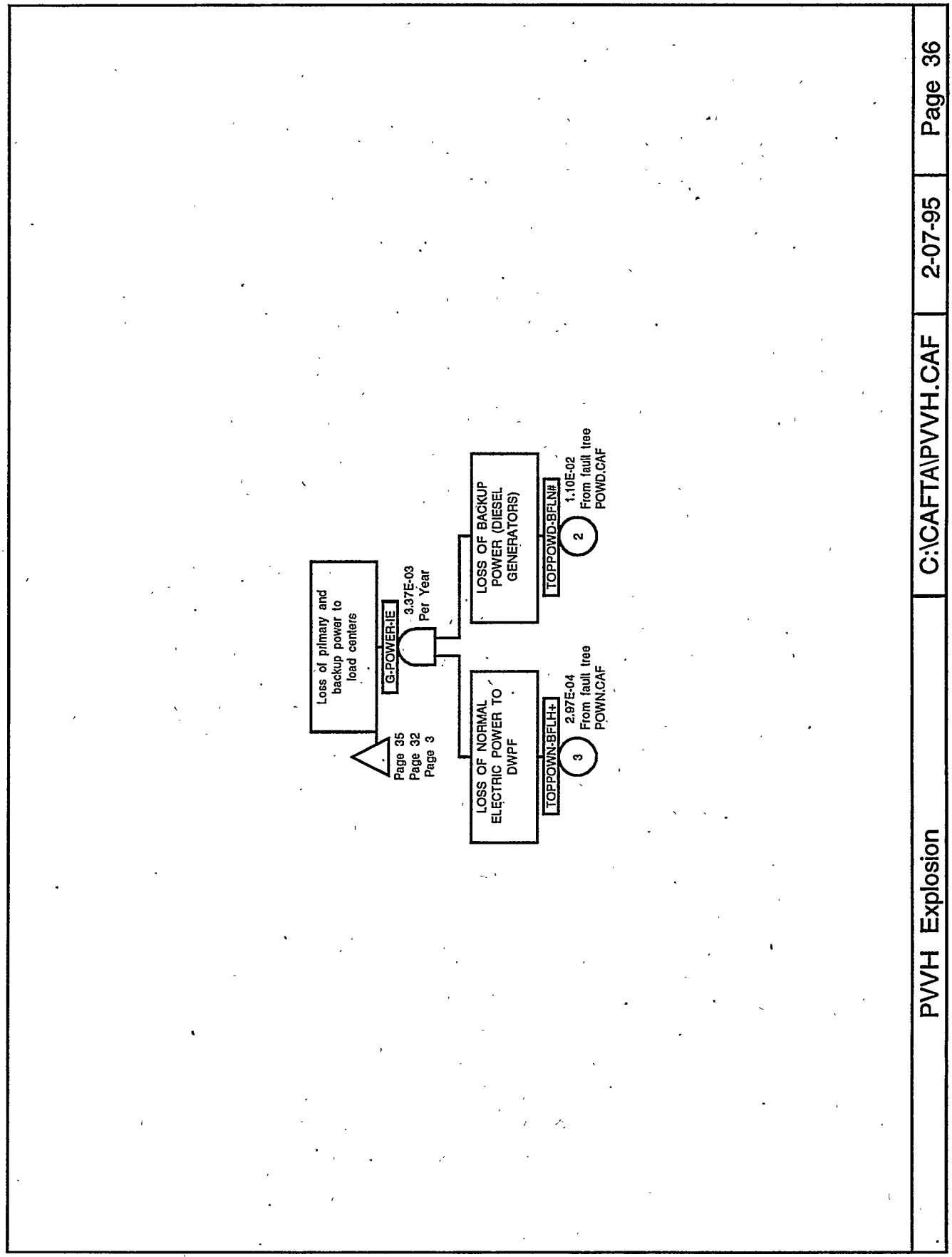
Page 34



PVVH Explosion	C:\CAFTA\PVVH.CAF	2-07-95	Page 35


Loss of primary and backup power to load centers
G-POWER-IE
3.37E-03
Per Year
Page 35
Page 32
Page 3
LOSS OF BACKUP POWER (DIESEL GENERATORS)
TOPPOWD-BFLN#
2
1.10E-02
From fault tree
POWD.CAF
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
3
2.97E-04
From fault tree
POWN.CAF
PVVH Explosion
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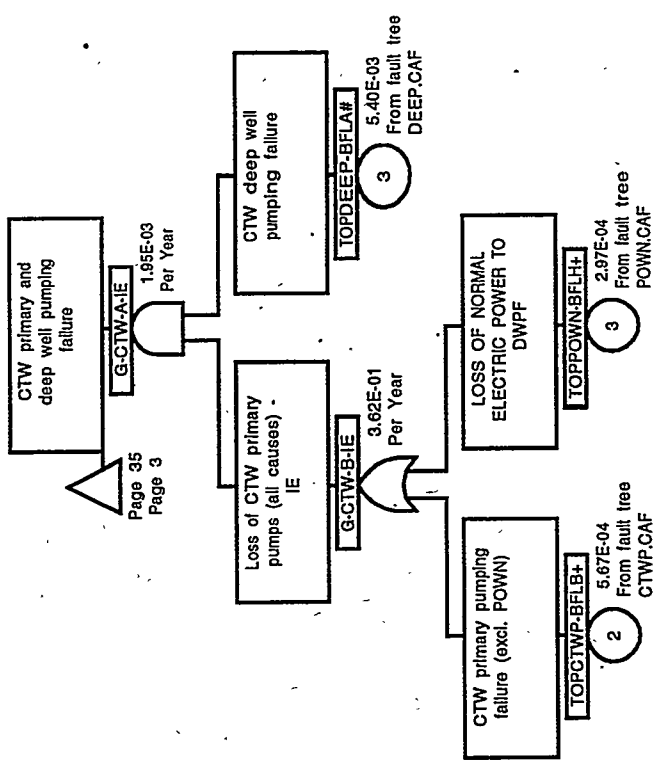
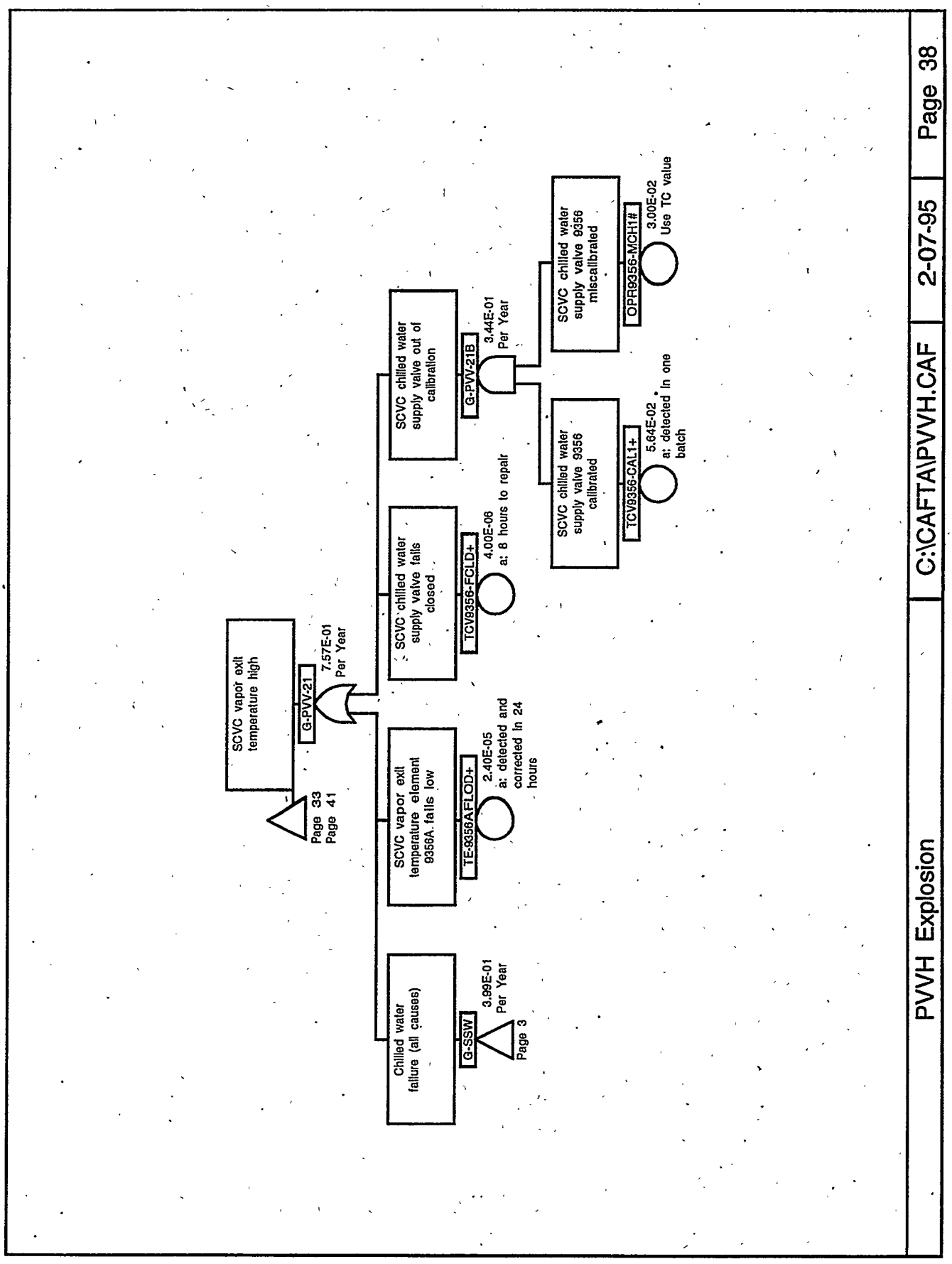
Page 36



PVVH Explosion | C:\CAFTA\PVVH.CAF | 2-07-95 | Page 37


PVVH Explosion
C:\CAFTA\PVVH.CAF
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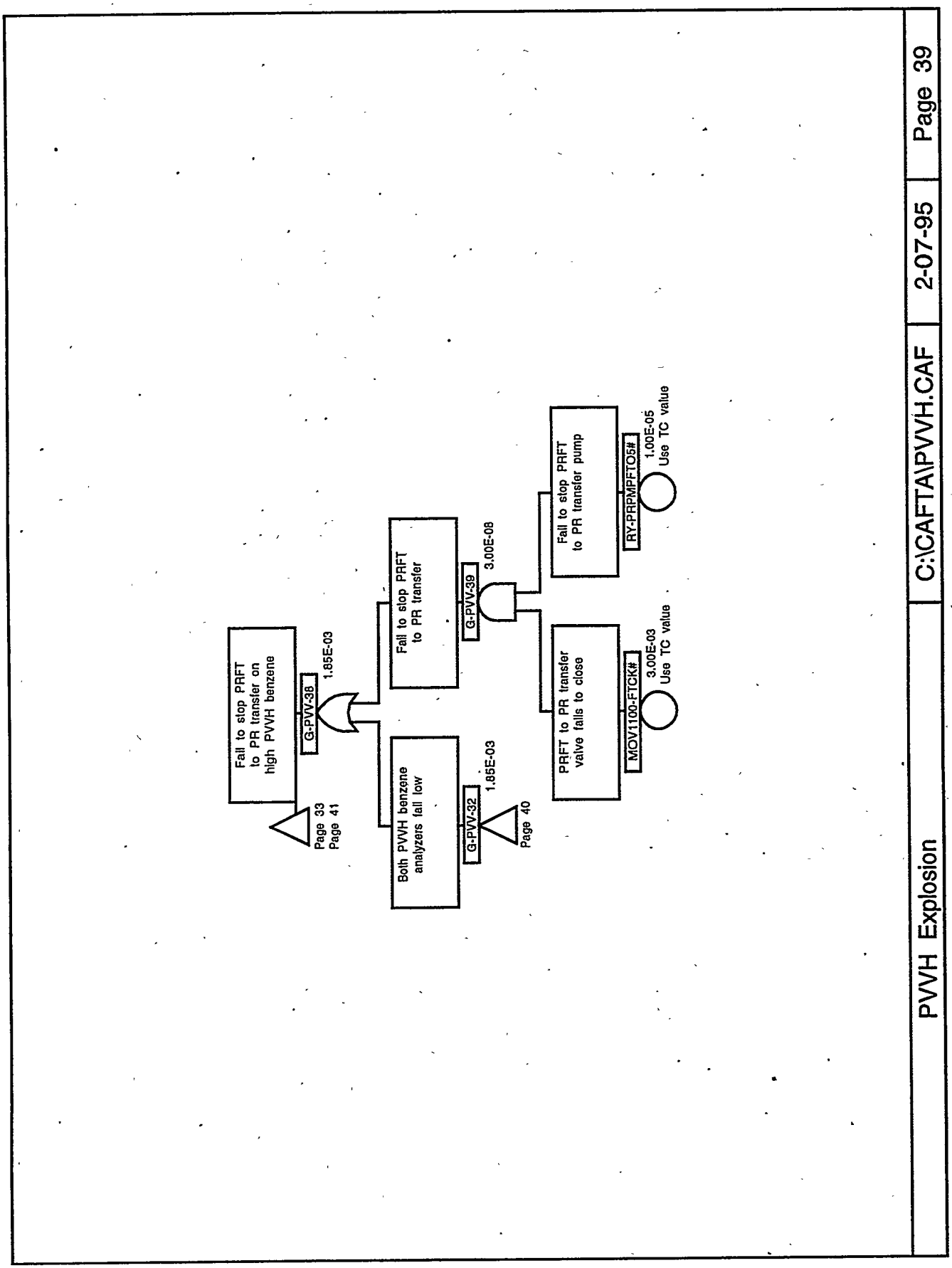
Page 38
SCVC vapor exit temperature high
G-PVV-21
7.57E-01 Per Year
Page 33
Page 41
SCVC vapor exit temperature element 9356A fails low
TE-9356AFLOD+
2.40E-05 a: detected and corrected in 24 hours
SCVC chilled water supply valve fails closed
TCV9356-FCLD+
4.00E-06 a: 8 hours to repair
Chilled water failure (all causes)
G-SSW
3.99E-01 Per Year
Page 3
SCVC chilled water supply valve out of calibration
G-PVV-21B
3.44E-01 Per Year
SCVC chilled water supply valve 9356 calibrated
TCV9356-CAL1+
5.64E-02 a: detected in one batch
SCVC chilled water supply valve 9356 miscalibrated
ORR9356-MCH1#
3.00E-02 Use TC value


PVVH Explosion
C:\CAFTA\PVVH.CAF
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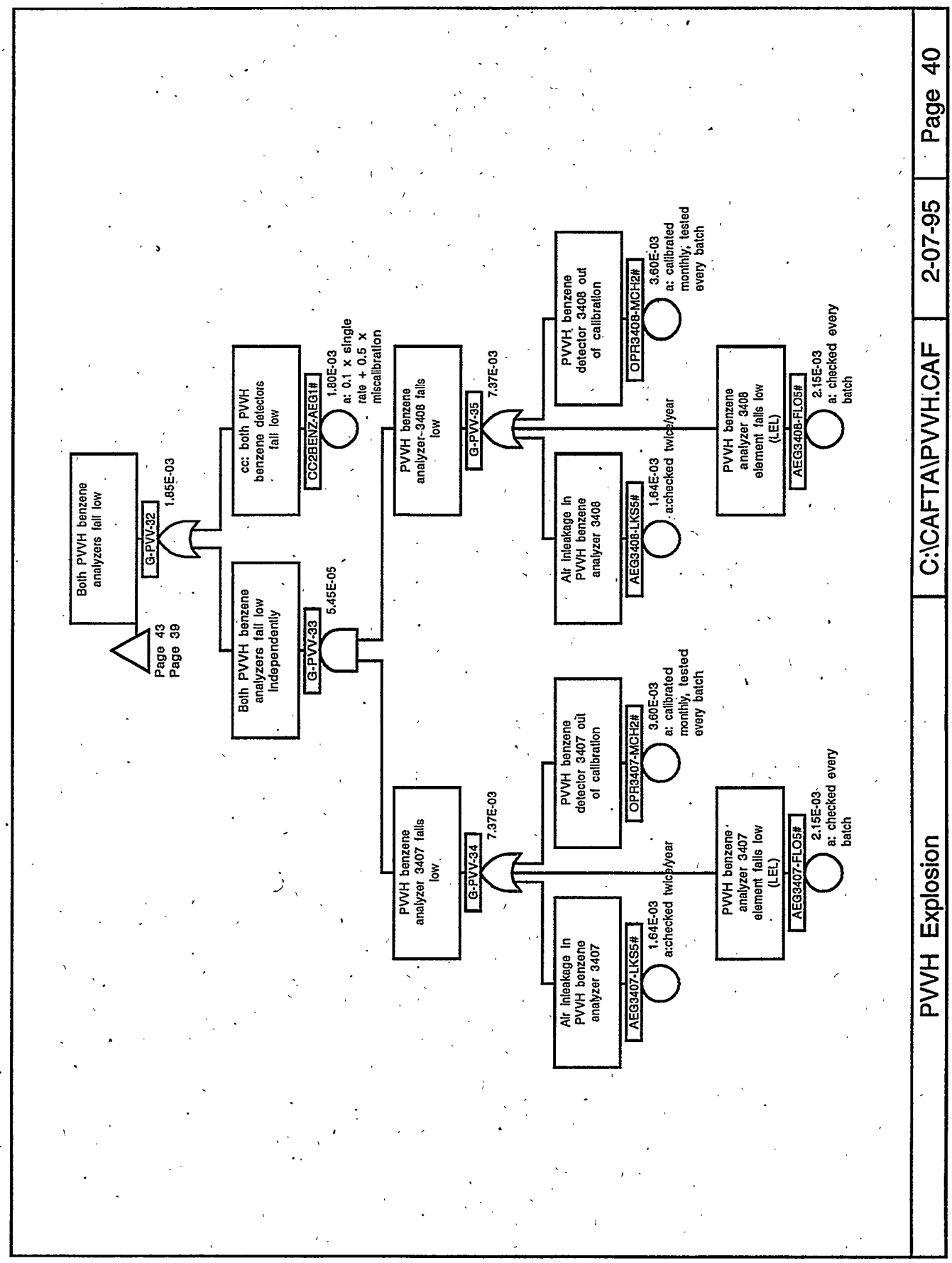
Page 39
Fail to stop PRFT to PR transfer on high PVVH benzene
G-PVV-38
1.85E-03
Page 33
Page 41
Fail to stop PRFT to PR transfer
G-PVV-39
3.00E-08
Both PVVH benzene analyzers fail low
G-PVV-32
1.85E-03
Page 40
Fail to stop PRFT to PR transfer pump
RY-PRPMPFTO5#
1.00E-05
Use TC value
PRFT to PR transfer valve fails to close
MOV1100-FTCK#
3.00E-03
Use TC value


Both PVVH benzene analyzers fail low
G-PVV-32
1.85E-03
Page 43
Page 39
cc: both PVVH benzene detectors fail low
CC2BENZ-AEG1#
1.80E-03
a: 0.1 x single rate + 0.5 x miscalibration
Both PVVH benzene analyzers fail low independently
G-PVV-33
5.45E-05
PVVH benzene analyzer 3408 falls low
G-PVV-35
7.37E-03
PVVH benzene detector 3408 out of calibration
OPR3408-MCH2#
3.60E-03
a: calibrated monthly, tested every batch
Air inleakage in PVVH benzene analyzer 3408
AEG3408-LKS5#
1.64E-03
a:checked twice/year
PVVH benzene analyzer 3408 element fails low (LEL)
AEG3408-FLO5#
2.15E-03
a: checked every batch
PVVH benzene analyzer 3407 falls low
G-PVV-34
7.37E-03
PVVH benzene detector 3407 out of calibration
OPR3407-MCH2#
3.60E-03
a: calibrated monthly, tested every batch
Air inleakage in PVVH benzene analyzer 3407
AEG3407-LKS5#
1.64E-03
a:checked twice/year
PVVH benzene analyzer 3407 element fails low (LEL)
AEG3407-FLO5#
2.15E-03
a: checked every batch
PVVH Explosion
C:\CAFTA\PVVH.CAF
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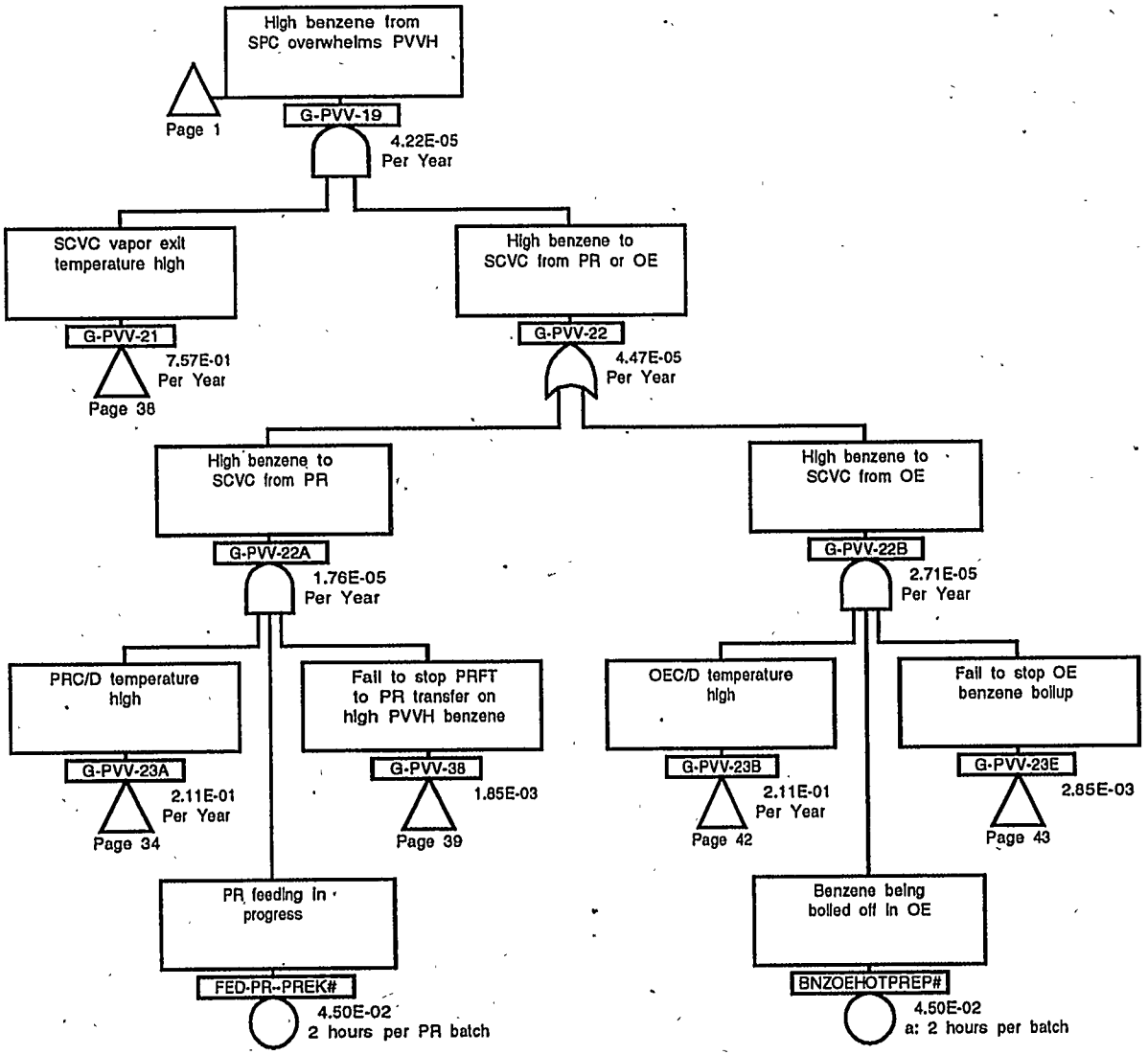
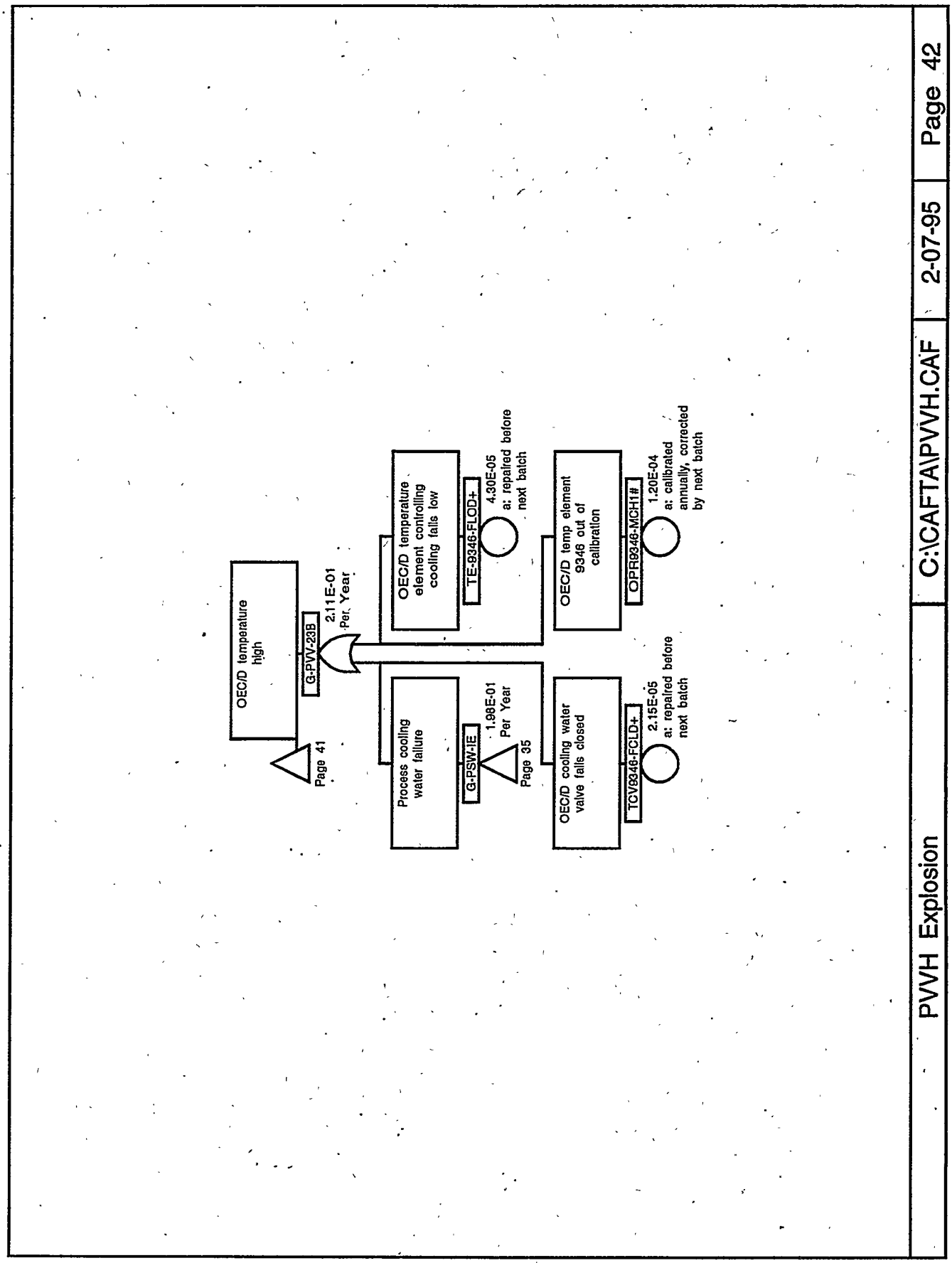


PVVH Explosion	C:\CAFTA\PVVH.CAF	2-07-95	Page 41


PVVH Explosion
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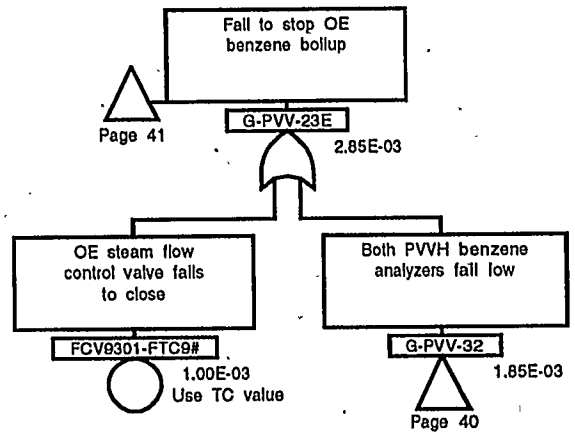
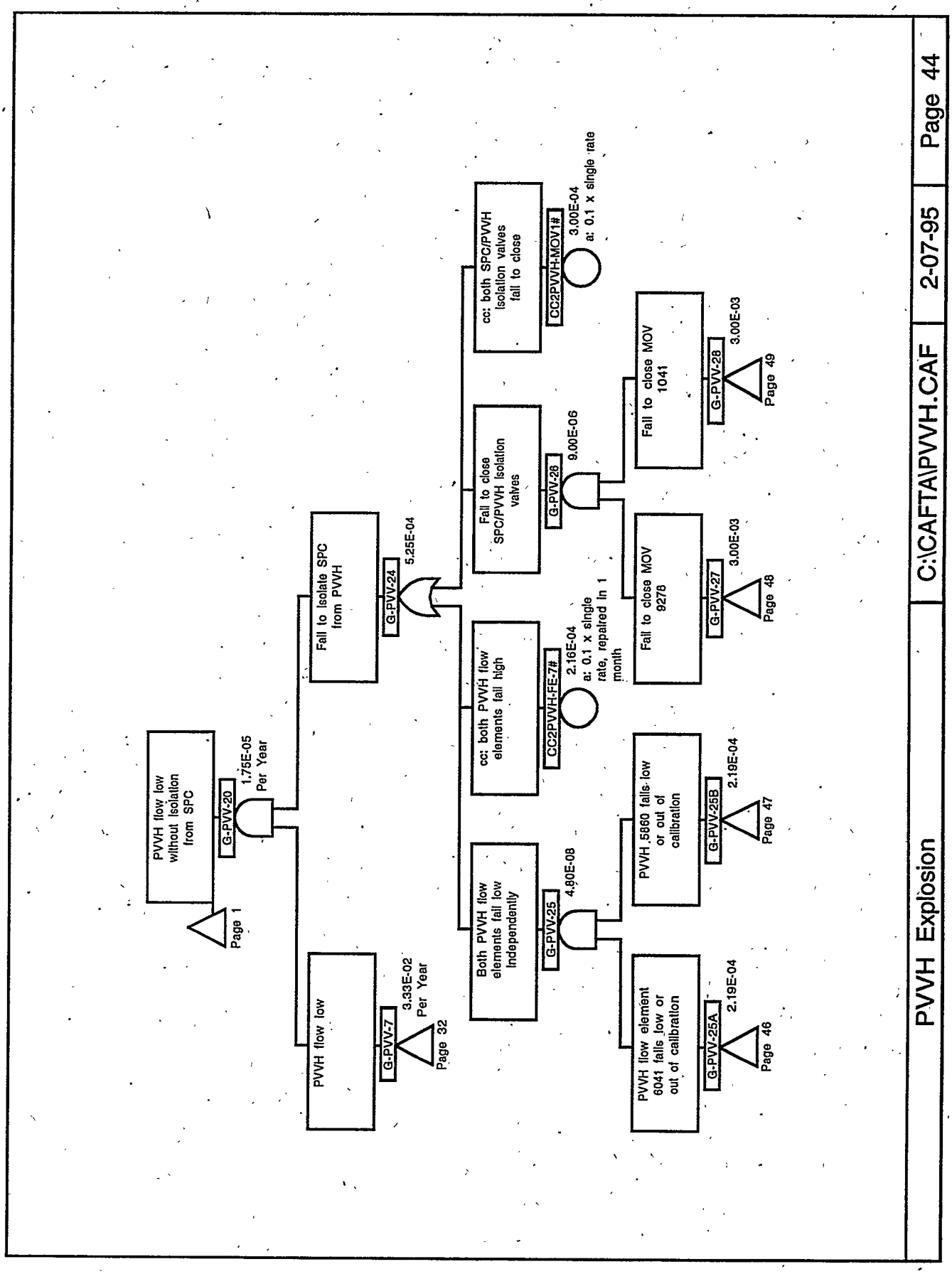
Page 42
OEC/D temperature high
G-PVV-23B
2.11E-01 Per Year
Page 41
OEC/D temperature element controlling cooling falls low
TE-9346-FLOD+
4.30E-05 a: repaired before next batch
OEC/D temp element 9346 out of calibration
OPR9346-MCH1#
1.20E-04 a: calibrated annually, corrected by next batch
Process cooling water failure
G-PSW-IIE
1.98E-01 Per Year
Page 35
OEC/D cooling water valve fails closed
TCV9346-FCLD+
2.15E-05 a: repaired before next batch



PVVH Explosion	C:\CAFTA\PVVH.CAF	2-07-95	Page 43


PVVH Explosion
C:\CAFTA\PVVH.CAF
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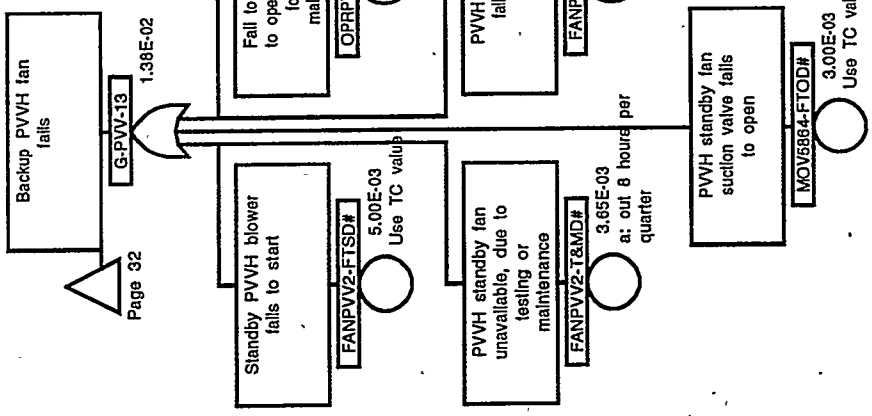
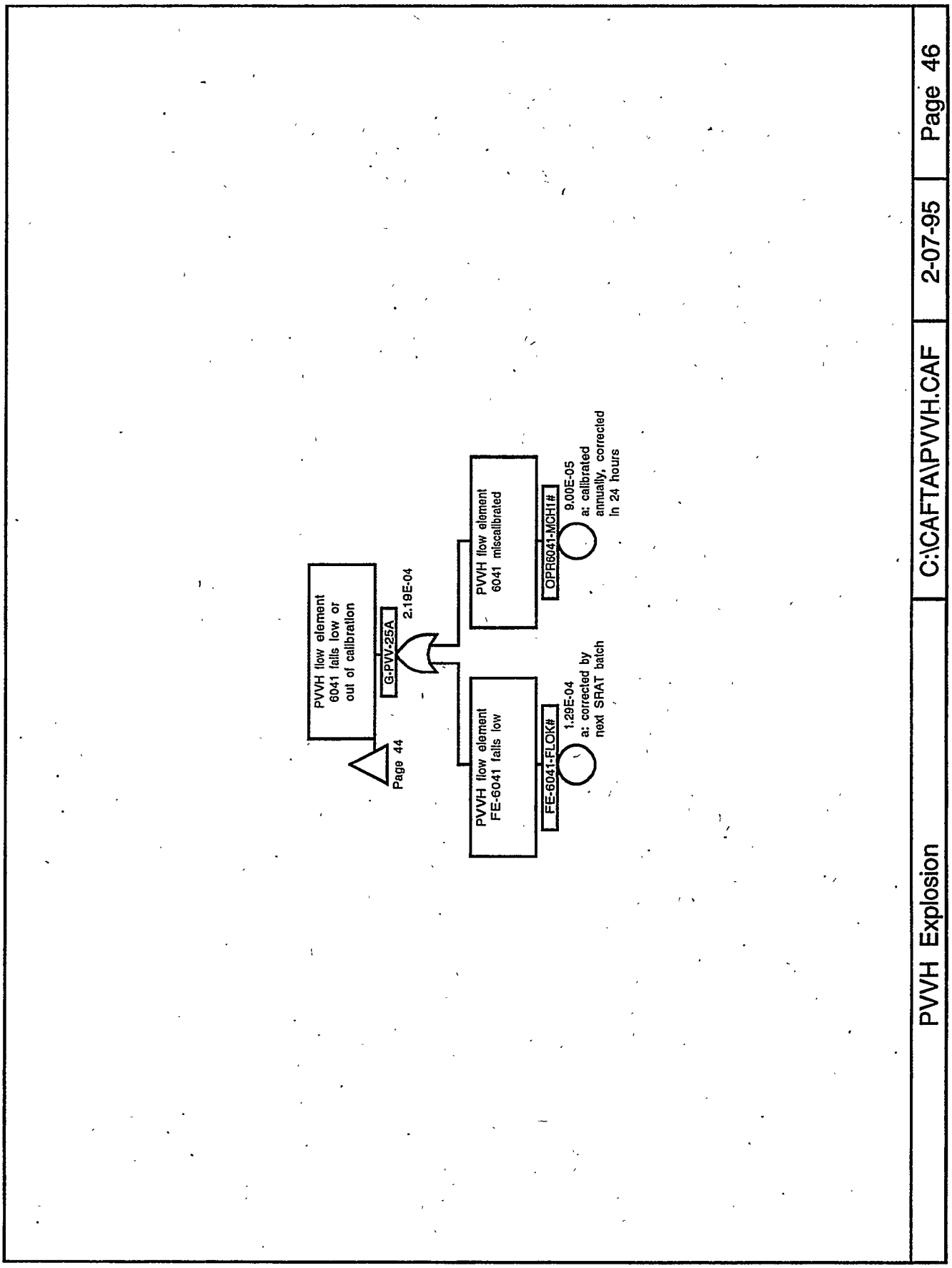
Page 44
PVVH flow low without isolation from SPC
G-PVV-20
1.75E-05 Per Year
Page 1
PVVH flow low
G-PVV-7
3.33E-02 Per Year
Page 32
Fail to isolate SPC from PVVH
G-PVV-24
5.25E-04
Both PVVH flow elements fail low independently
G-PVV-25
4.80E-08
cc: both PVVH flow elements fail high
CC2PVVH-FE-7#
2.16E-04 a: 0.1 x single rate, repaired in 1 month
Fail to close SPC/PVVH isolation valves
G-PVV-26
9.00E-06
cc: both SPC/PVVH isolation valves fail to close
CC2PVVH-MOV1#
3.00E-04 a: 0.1 x single rate
PVVH flow element 6041 fails low or out of calibration
G-PVV-25A
2.19E-04
Page 46
PVVH 5860 fails low or out of calibration
G-PVV-25B
2.19E-04
Page 47
Fail to close MOV 9278
G-PVV-27
3.00E-03
Page 48
Fail to close MOV 1041
G-PVV-28
3.00E-03
Page 49



PVVH Explosion | C:\CAFTA\PVVH.CAF | 2-07-95 | Page 45


PVVH Explosion
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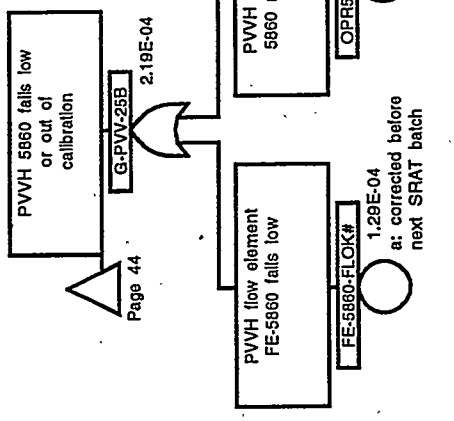
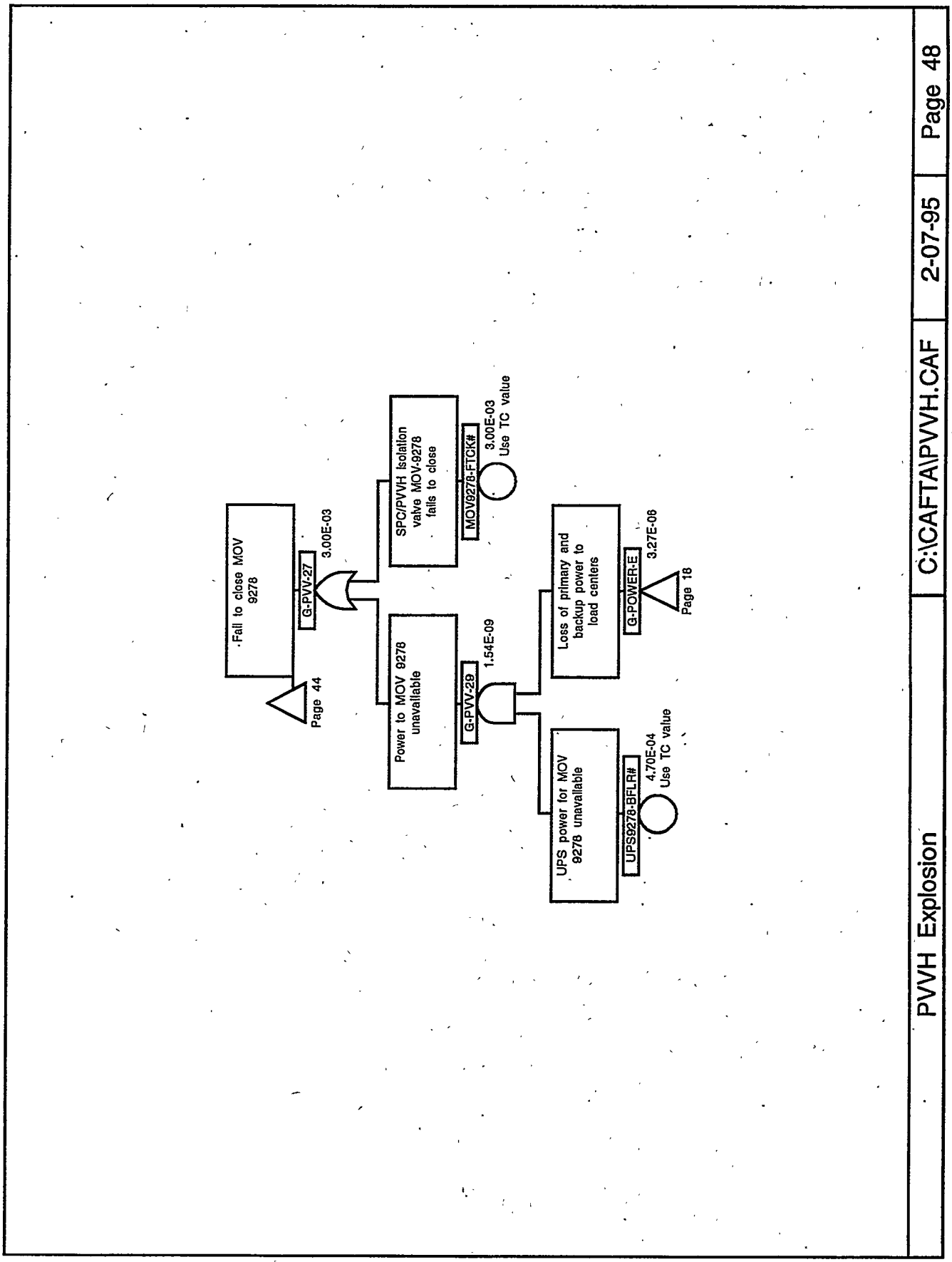
Page 46
PVVH flow element 6041 fails low or out of calibration
Page 44
G-PVV-25A
2.19E-04
PVVH flow element FE-6041 fails low
FE-6041-FLOK#
1.29E-04
a: corrected by next SRAT batch
PVVH flow element 6041 miscalibrated
OPR6041-MCH1#
9.00E-05
a: calibrated annually, corrected in 24 hours



PVVH Explosion | C:\CAFTA\PVVH.CAF | 2-07-95 | Page 47


Fail to close MOV 9278
G-PVV-27
3.00E-03
Page 44
SPC/PVVH Isolation valve MOV-9278 fails to close
MOV9278-FTCK#
3.00E-03
Use TC value
Power to MOV 9278 unavailable
G-PVV-29
1.54E-09
Loss of primary and backup power to load centers
G-POWER-E
3.27E-06
Page 18
UPS power for MOV 9278 unavailable
UPS9278-BFLR#
4.70E-04
Use TC value
PVVH Explosion
C:\CAFTA\PVVH.CAF
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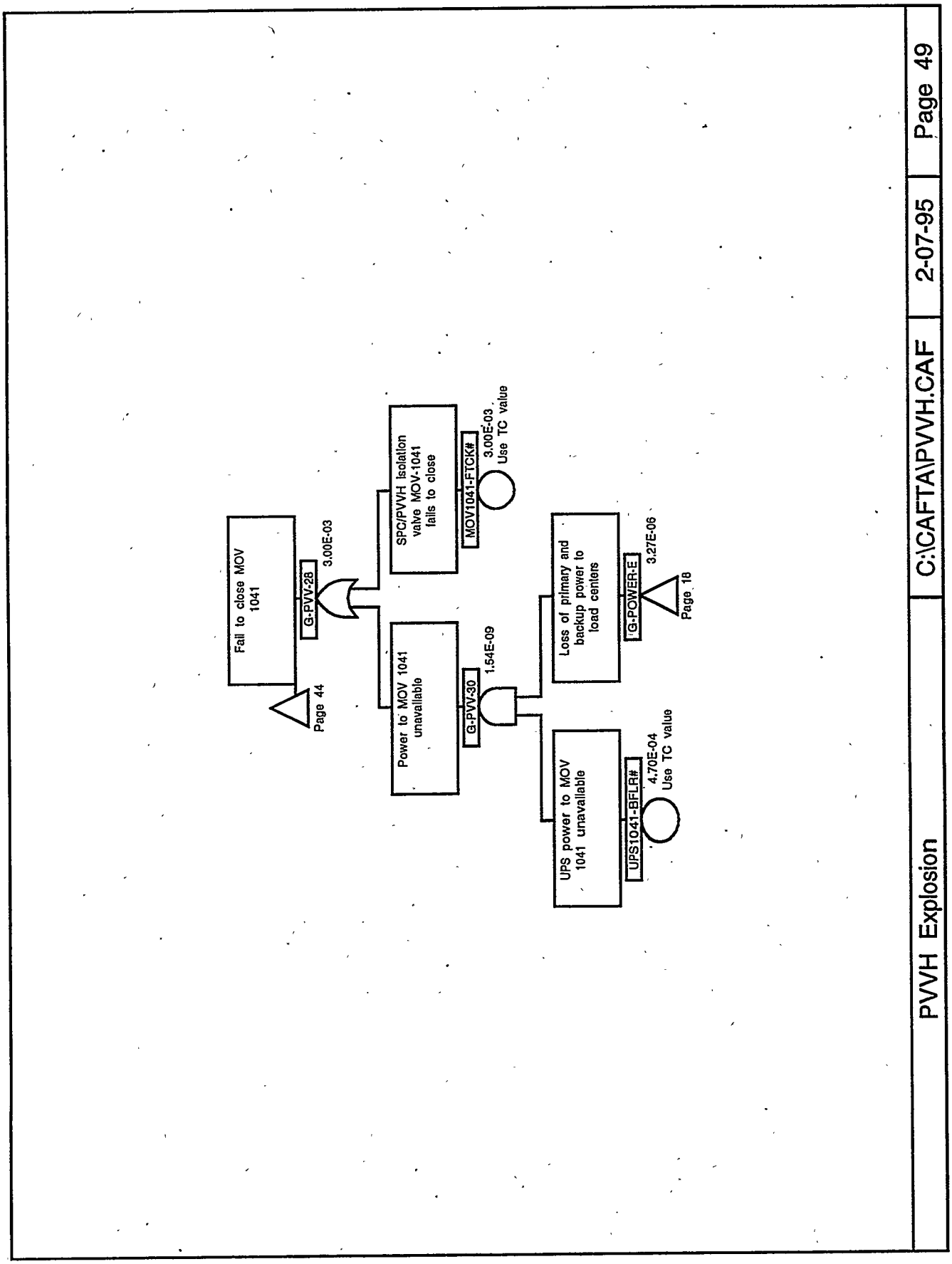
PVVH Explosion
C:\CAFTA\PVVH.CAF
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Page 49
Fail to close MOV 1041
G-PVV-28
3.00E-03
Page 44
SPC/PVVH isolation valve MOV-1041 fails to close
MOV1041-FTCK#
3.00E-03
Use TC value
Power to MOV 1041 unavailable
G-PVV-30
1.54E-09
Loss of primary and backup power to load centers
G-POWER-E
3.27E-06
Page 18
UPS power to MOV 1041 unavailable
UPS1041-BFLR#
4.70E-04
Use TC value

Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
AEG3407-FLO5#	40		FCV2056-FOPI+	11		G-PRBT-1	6		G-PVV-23E	43	
AEG3407-LKS5#	40		FCV3000-FCL5+	4		G-PRBT-2	6		G-PVV-24	44	
AEG3408-FLO5#	40		FCV3000-FTCG#	20		G-PRBT-4	6		G-PVV-25	44	
AEG3408-LKS5#	40		FCV3080-FTC4#	25		G-PRBT-4A	6		G-PVV-25A	44	
AEG8795-FLO5#	19		FCV9301-FTC9#	43		G-PRBT-4A	7		G-PVV-25A	46	
AEG8795-LKS5#	19		FE-5860-FLOK#	47		G-PRBT-4B	7		G-PVV-25B	44	
AEG8796-FLO5#	19		FE-6041-FLOK#	46		G-PRBT-5	6		G-PVV-25B	47	
AEG8796-LKS5#	19		FED-PR--PREK#	41		G-PSW-E	20		G-PVV-26	44	
AEG8797-FLOD#	27		FSL8799-FTCD#	17		G-PSW-E	21		G-PVV-27	44	
AEG8797-LKS4#	27		FSL8800-FTC4#	29		G-PSW-E	25		G-PVV-27	48	
AEG8798-FLOD#	28		FSL8801-FTC5#	17		G-PSW-IE	34		G-PVV-28	44	
AEG8798-LKS4#	28		FSL8802-FTCD#	17		G-PSW-IE	35		G-PVV-28	49	
AEGSRAT-LKS5#	19		FSL8803-FTC4#	29		G-PSW-IE	42		G-PVV-29	48	
AX-8795-BFL5#	19		FSL8804-FTC4#	29		G-PVV-10	1		G-PVV-30	49	
AX-8797-BFL4#	26		G-CPCBP	31		G-PVV-10	33		G-PVV-32	39	
BCHSRAT-DBL5#	9		G-CPCBP-A	31		G-PVV-11	33		G-PVV-32	40	
BCHSRAT-PRE5+	9		G-CPCPP	31		G-PVV-12	32		G-PVV-32	43	
BKRSRATSFOPD#	16		G-CPCPURGE	8		G-PVV-13	32		G-PVV-33	40	
BNZOEHOTPREP#	41		G-CPCPURGE	31		G-PVV-13	45		G-PVV-34	40	
CC2-SME-H2-1#	26		G-CTW-A-E	21		G-PVV-19	1		G-PVV-35	40	
CC2BENZ-AEG1#	40		G-CTW-A-IE	3		G-PVV-19	41		G-PVV-38	33	
CC2MAINTHCV1#	33		G-CTW-A-IE	35		G-PVV-20	1		G-PVV-38	39	
CC2PVVH-FAN1+	32		G-CTW-A-IE	37		G-PVV-20	44		G-PVV-38	41	
CC2PVVH-FE-7#	44		G-CTW-B-E	21		G-PVV-21	33		G-PVV-39	39	
CC2PVVH-MOV1#	44		G-CTW-B-IE	37		G-PVV-21	38		G-PVV-4	1	
CC2SRAT-LFL5#	19		G-CTW-C-IE	3		G-PVV-21	41		G-PVV-5	1	
CC2SRAT-SMP6#	11		G-CTW-IE	3		G-PVV-21B	38		G-PVV-5A	1	
CC2STEAMHCV1+	33		G-POWER-E	16		G-PVV-22	41		G-PVV-5A	2	
CC3-SME-FSL4#	26		G-POWER-E	18		G-PVV-22A	41		G-PVV-5B	2	
CC3MAINTFSL1#	26		G-POWER-E	21		G-PVV-22B	41		G-PVV-5C	2	
CC3SRAT-FSLD#	16		G-POWER-E	30		G-PVV-23	33		G-PVV-5C	8	
FANPVV1-BFLD+	32		G-POWER-E	48		G-PVV-23A	33		G-PVV-5D	2	
FANPVV2-BFLD#	45		G-POWER-E	49		G-PVV-23A	34		G-PVV-5E	2	
FANPVV2-FTSD#	45		G-POWER-IE	3		G-PVV-23A	41		G-PVV-6	1	
FANPVV2-T&MD#	45		G-POWER-IE	32		G-PVV-23B	41		G-PVV-7	1	
FCV1027-FOP9+	33		G-POWER-IE	35		G-PVV-23B	42		G-PVV-7	32	
FCV2044-FTC4#	25		G-POWER-IE	36		G-PVV-23C	33		G-PVV-7	44	
FCV2056-ADJI+	14		G-PRBT-1	2		G-PVV-23E	41		G-PVV-8	32	

Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
G-SRAT-12	8		G-SRAT-58	12		GSME-7	26		OPRPRBT3ACN1#	13	
G-SRAT-22	8		G-SRAT-59	11		GSME-8	26		OPRPRBT3ACNU#	13	
G-SRAT-22	9		G-SRAT-59	13		GSME-9	26		OPRPRBT3LAH1#	13	
G-SRAT-23	8		G-SRAT-63	2		HCV1038-FOP9+	33		OPRPRCD-SVL1#	6	
G-SRAT-23	15		G-SRAT-63	4		HCV3010-FTOF#	20		OPRPVV2-RMH1#	45	
G-SRAT-23	22		G-SRAT-64	4		HCV3089-FCL4#	25		OPRSLG1-ACNU#	10	
G-SRAT-23-A	15		G-SRAT-67	4		IGNPVVH-PRE1#	1		OPRSLG1-LAH1#	10	
G-SRAT-25	8		G-SSW	2		MOV1041-FTCK#	49		OPRSMEV-RMH1#	30	
G-SRAT-26	8		G-SSW	3		MOV1100-FTCK#	39		OPRSRAT-CAN1#	15	
G-SRAT-26	16		G-SSW	38		MOV1131-ADJ6+	6		OPRSRAT-NCN1#	15	
G-SRAT-27	16		G-STEAM	4		MOV1131-ADJ6+	7		OPRSRAT6ACN1#	24	
G-SRAT-27	19		G-STEAM-2	4		MOV1131-FTCK#	7		OPRSRAT6ACNU#	24	
G-SRAT-28	19		G-STEAM-2	5		MOV1131-LKS6+	7		OPRSRAT6LAH1#	24	
G-SRAT-29	19		GCPC-5B	8		MOV5862-FCLD+	32		OPRSRAT7ACN1#	23	
G-SRAT-30	19		GCPC-5C	8		MOV5864-FTOD#	45		OPRSRAT7ACNU#	23	
G-SRAT-31	16		GCPC-5C	22		MOV9278-FTCK#	48		OPRSRAT7LAH1#	23	
G-SRAT-32	16		GSME-10	26		OPR-PR3-ACN1#	12		OPRSRATVRMH5#	16	
G-SRAT-32	17		GSME-10	27		OPR-PR3-ACNU#	12		PCSSRAT-BFL5#	23	
G-SRAT-32A	16		GSME-11	26		OPR1117-MCH1#	34		PCSSRAT-BFL5#	24	
G-SRAT-33	16		GSME-11	28		OPR1131-ACL1#	6		PCV3004-CAL1#	4	
G-SRAT-44	8		GSME-12	26		OPR1131-VRH1#	7		PCV3004-FCLG+	4	
G-SRAT-44	20		GSME-13	26		OPR2056-ACN6#	14		PMPFACIDON-I+	11	
G-SRAT-45	20		GSME-14	26		OPR3004-MCH3#	4		PMPSME--BFL4#	30	
G-SRAT-48	8		GSME-14	29		OPR3407-MCH2#	40		PMPSRATSBFL5#	16	
G-SRAT-48	10		GSME-15	26		OPR3408-MCH2#	40		PR-PHA--IDL6#	6	
G-SRAT-48	22		GSME-15	30		OPR5860-MCH1#	47		RY-4041-FTO5#	20	
G-SRAT-48A	10		GSME-17	22		OPR6041-MCH1#	46		RY-PFSFTFTO4#	25	
G-SRAT-49	10		GSME-18	22		OPR8795-MCH2#	19		RY-PRPMPFTO5#	39	
G-SRAT-51	8		GSME-20	22		OPR8796-MCH2#	19		RY-SRTL-FTO5#	4	
G-SRAT-51	11		GSME-20	23		OPR8797AMCH1#	27		SLGNOBL-PRE5#	10	
G-SRAT-51	22		GSME-21	22		OPR8798AMCH1#	28		SRABATCHPRE5+	10	
G-SRAT-52	11		GSME-22	22		OPR9346-MCH1#	42		TCV1116-FCLD+	34	
G-SRAT-53	11		GSME-22	24		OPR9356-MCH1#	38		TCV3461-FCLD#	2	
G-SRAT-54	11		GSME-31	22		OPRBATCHNCH1#	9		TCV9346-FCLD+	42	
G-SRAT-54	14		GSME-31	25		OPRMAINTMCH1#	16		TCV9356-CAL1+	38	
G-SRAT-57	11		GSME-32	25		OPRPR3--LAH1#	12		TCV9356-FCLD+	38	
G-SRAT-57A	11		GSME-6	22		OPRPR5--ACL1#	6		TE-1117-FLOD+	34	
G-SRAT-58	11		GSME-7	22		OPRPR5--LAN1#	6		TE-9346-FLOD+	42	

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TE-9356AFLOD+	38										
TOP-PVVH	1										
TOPCPCBPBFLW#	31										
TOPCPCPPBFL2+	31										
TOPCPCTKBFL7#	31										
TOPCTWCCBFLO#	21										
TOPCTWCCBFLO+	3										
TOPCTWCCBFLO+	4										
TOPCTWCCBFLO+	35										
TOPCTWP-BFLB#	21										
TOPCTWP-BFLB+	5										
TOPCTWP-BFLB+	37										
TOPDEEP-BFLA#	5										
TOPDEEP-BFLA#	21										
TOPDEEP-BFLA#	37										
TOPINAIRBFLV#	21										
TOPINAIRBFLV+	3										
TOPINAIRBFLV+	4										
TOPINAIRBFLV+	35										
TOPN2TNKBFL3#	31										
TOPPOWD-BFLN#	18										
TOPPOWD-BFLN#	36										
TOPPOWN-BFLH#	18										
TOPPOWN-BFLH#	21										
TOPPOWN-BFLH+	31										
TOPPOWN-BFLH+	36										
TOPPOWN-BFLH+	37										
TOPPSW--BFLF#	21										
TOPPSW--BFLF#	35										
TOPSSW--BFLE+	3										
TOPSTEAMBFLG+	4										
TX-NITR-PRE5+	15										
TX-PRFTPPREB+	33										
TX-SRAT-PRE5+	4										
UPS1041-BFLR#	49										
UPS9278-BFLR#	48										

Cutsets for C:\CAFTA\PVVH.CSR 2/07/95 12:37 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-PVVH					3.13E-06
1.	BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1	1N 1.0E-01N	1.00E-01N	5.64E-07
	BCHSRAT-PRE5+	SRAT batch processed	4	86H 1.2E-02H	5.08E-01	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1	1N 1.0E-01N	1.00E-01N	
	TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1	1N 1.1E-02N	1.10E-02N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
2.	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	3.42E-07
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1	1N 1.1E-02N	1.10E-02N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
3.	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	3.14E-07
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1	1N 1.1E-02N	1.10E-02N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
4.	CC2PVVH-FAN1+	cc: both PVVH fans fail	4	8H 3.0E-06H	2.40E-05	2.37E-07
	CC2PVVH-MOV1#	cc: both SPC/PVVH isolation valves fail to close	1	1N 3.0E-04N	3.00E-04N	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
5.	BNZOEHOTPREP#	Benzene being boiled off in OE	3	2H 2.3E-02H	4.50E-02	2.34E-07
	CC2BENZ-AEG1#	cc: both PVVH benzene detectors fail low	5	1M 5.0E-06H	1.80E-03	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOPCTWCCBFLO+	Failure of CTW valving or piping (excl. INAIR)	4	5.5H 1.1E-05H	6.05E-05	
6.	CC2BENZ-AEG1#	cc: both PVVH benzene detectors fail low	5	1M 5.0E-06H	1.80E-03	2.34E-07
	FED-PR--PREK#	PR feeding in progress	3	2H 2.3E-02H	4.50E-02	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	TOPCTWCCBFLO+	Failure of CTW valving or piping (excl. INAIR)	4	5.5H 1.1E-05H	6.05E-05	
7.	CC2BENZ-AEG1#	cc: both PVVH benzene detectors fail low	5	1M 5.0E-06H	1.80E-03	2.34E-07
	FED-PR--PREK#	PR feeding in progress	3	2H 2.3E-02H	4.50E-02	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	TOPINAIRBFLV+	Instrument air failure (excl CTW or POWN/POWD)	4	26H 1.1E-05H	2.86E-04	
8.	BNZOEHOTPREP#	Benzene being boiled off in OE	3	2H 2.3E-02H	4.50E-02	2.34E-07
	CC2BENZ-AEG1#	cc: both PVVH benzene detectors fail low	5	1M 5.0E-06H	1.80E-03	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	TOPINAIRBFLV+	Instrument air failure (excl CTW or POWN/POWD)	4	26H 1.1E-05H	2.86E-04	
9.	CC2PVVH-FAN1+	cc: both PVVH fans fail	4	8H 3.0E-06H	2.40E-05	1.70E-07
	CC2PVVH-FE-7#	cc: both PVVH flow elements fail high	3	1M 3.0E-07H	2.16E-04	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
10.	BNZOEHOTPREP#	Benzene being boiled off in OE	3	2H 2.3E-02H	4.50E-02	1.30E-07
	FCV9301-FTC9#	OE steam flow control valve fails to close	1	1N 1.0E-03N	1.00E-03N	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	TOPCTWCCBFLO+	Failure of CTW valving or piping (excl. INAIR)	4	5.5H 1.1E-05H	6.05E-05	
11.	BNZOEHOTPREP#	Benzene being boiled off in OE	3	2H 2.3E-02H	4.50E-02	1.30E-07

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	FCV9301-FTC9#	OE steam flow control valve fails to close	1	1N 1.0E-03N	1.00E-03N	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	TOPINAIRBFLV+	Instrument air failure (excl CTW or POWN/POWD)	4	26H 1.1E-05H	2.86E-04	
12.	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	3.42E-08
	OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	1	1N 3.0E-03N	3.00E-03N	
	TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1	1N 1.1E-02N	1.10E-02N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
13.	CC2PVVH-MOV1#	cc: both SPC/PVVH isolation valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.03E-08
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1	1N 1.1E-02N	1.10E-02N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
14.	CC2PVVH-FE-7#	cc: both PVVH flow elements fail high	3	1M 3.0E-07H	2.16E-04	2.18E-08
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1	1N 1.1E-02N	1.10E-02N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
15.	CC2PVVH-MOV1#	cc: both SPC/PVVH isolation valves fail to close	1	1N 3.0E-04N	3.00E-04N	1.18E-08
	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	
	FANPVV2-FTSD#	Standby PVVH blower fails to start	1	1N 5.0E-03N	5.00E-03N	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
16.	BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1	1N 1.0E-01N	1.00E-01N	1.01E-08

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	BCHSRAT-PRE5+	SRAT batch processed	4	86H 1.2E-02H	5.08E-01	
	CC2PVVH-FAN1+	cc: both PVVH fans fail	4	8H 3.0E-06H	2.40E-05	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1	1N 1.0E-01N	1.00E-01N	
	TOPPSW--BFLF#	Inadequate process cooling water (excl. POWN & POWD or CTW	1	1N 2.3E-03N	2.30E-03N	
17.	CC2PVVH-MOV1#	cc: both SPC/PVVH isolation valves fail to close	1	1N 3.0E-04N	3.00E-04N	8.62E-09
	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	
	FANPVV2-T&MD#	PVVH standby fan unavailable, due to testing or maintenance	3	8H 4Y	3.65E-03	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
18.	CC2PVVH-FE-7#	cc: both PVVH flow elements fail high	3	1M 3.0E-07H	2.16E-04	8.51E-09
	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	
	FANPVV2-FTSD#	Standby PVVH blower fails to start	1	1N 5.0E-03N	5.00E-03N	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
19.	BNZOEHOTPREP#	Benzene being boiled off in OE	3	2H 2.3E-02H	4.50E-02	8.18E-09
	CC2BENZ-AEG1#	cc: both PVVH benzene detectors fail low	5	1M 5.0E-06H	1.80E-03	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1	1N 1.1E-02N	1.10E-02N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
20.	CC2BENZ-AEG1#	cc: both PVVH benzene detectors fail low	5	1M 5.0E-06H	1.80E-03	8.18E-09
	FED-PR--PREK#	PR feeding in progress	3	2H 2.3E-02H	4.50E-02	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1	1N 1.1E-02N	1.10E-02N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
21.	BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1	1N 1.0E-01N	1.00E-01N	7.87E-09
	BCHSRAT-PRE5+	SRAT batch processed	4	86H 1.2E-02H	5.08E-01	
	CC2PVVH-FAN1+	cc: both PVVH fans fail	4	8H 3.0E-06H	2.40E-05	
	CC2SRAT-LFL5#	cc: both SRAT LFL detectors fail low	5	1M 5.0E-06H	1.80E-03	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1	1N 1.0E-01N	1.00E-01N	
22.	AEGSRAT-LKS5#	Air inleakage in SRAT sampling line (common to both detectors)	5	.5Y 7.5E-07H	1.64E-03	7.18E-09
	BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1	1N 1.0E-01N	1.00E-01N	
	BCHSRAT-PRE5+	SRAT batch processed	4	86H 1.2E-02H	5.08E-01	
	CC2PVVH-FAN1+	cc: both PVVH fans fail	4	8H 3.0E-06H	2.40E-05	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1	1N 1.0E-01N	1.00E-01N	
23.	CC2PVVH-FAN1+	cc: both PVVH fans fail	4	8H 3.0E-06H	2.40E-05	7.10E-09
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	MOV1041-FTCK#	SPC/PVVH isolation valve MOV-1041 fails to close	1	1N 3.0E-03N	3.00E-03N	
	MOV9278-FTCK#	SPC/PVVH isolation valve MOV-9278 fails to close	1	1N 3.0E-03N	3.00E-03N	
24.	CC2PVVH-MOV1#	cc: both SPC/PVVH isolation valves fail to close	1	1N 3.0E-04N	3.00E-04N	7.09E-09
	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	
	IGNPVVH-PRE1#	Ignition source present in PVVH	1	1N 3.0E-02N	3.00E-02N	
	MOV5864-FTOD#	PVVH standby fan suction valve fails to open	1	1N 3.0E-03N	3.00E-03N	

Explosion in the PVVH Top Event Frequency: 3.13E-06/YR

Risk Achievement Worth

(page 1 of 2)

Basic Event Name	Description	Prob/Freq	AchW
CC2PVVH-FAN1+-IC	cc: both PVVH fans fail	3.00E-06/H	4.87E+04
TOPCTWCCBFLO+-IC	Failure of CTW valving or piping (excl. INAIR)	1.10E-05/H	1.78E+04
TOPINAIRBFLV+-IC	Instrument air failure (excl CTW or POWN/POWD)	1.10E-05/H	1.78E+04
TOPPOWN-BFLH+-IC	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	9.12E+03
FANPVV1-BFLD+-IC	Primary PVVH blower fails	3.00E-05/H	6.76E+02
MOV5862-FCLD+-IC	PVVH primary fan suction valve fails closed	3.00E-07/H	6.69E+02
CC2PVVH-FE-7#	cc: both PVVH flow elements fail high	2.16E-04	3.20E+02
CC2PVVH-MOV1#	cc: both SPC/PVVH isolation valves fail to close	3.00E-04	3.20E+02
CC2BENZ-AEG1#	cc: both PVVH benzene detectors fail low	1.80E-03	1.73E+02
TOPCTWP-BFLB+-IC	CTW primary pumping failure (excl. POWN)	6.29E-06/H	9.69E+01
FCV9301-FTC9#	OE steam flow control valve fails to close	1.00E-03	8.68E+01
TOPSSW--BFLE+-IC	Process chilled water failure	2.30E-05/H	4.53E+01
TE-9356AFLOD+-IC	SCVC vapor exit temperature element 9356A fails low	1.00E-06/H	4.52E+01
TCV9356-FCLD+-IC	SCVC chilled water supply valve fails closed	5.00E-07/H	4.36E+01
TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1.10E-02	3.92E+01
TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	3.10E-03	3.37E+01
IGNPVVH-PRE1#	Ignition source present in PVVH	3.00E-02	3.33E+01
CC2STEAMHCV1+-IC	cc: both PR steam supply valves fail open	5.00E-08/H	3.17E+01
TE-9346-FLOD+-IC	OEC/D temperature element controlling cooling fails low	1.00E-06/H	2.33E+01
TCV9346-FCLD+-IC	OEC/D cooling water valve fails closed	5.00E-07/H	2.31E+01
CC2MAINTHCV1#	cc: both PR steam valves miscalibrated	1.80E-05	1.82E+01
TE-1117-FLOD+-IC	PRC/D temp element fails low	1.00E-06/H	1.56E+01
TCV1116-FCLD+-IC	PRC/D cooling water valve fails closed	5.00E-07/H	1.55E+01
TX-NITR-PRE5+-IC	Transfer nitric acid into SRAT	1.19E-02/H	1.20E+01
TOPCPCPPBFL2+-IC	CPC primary purge system fails (excl. normal power)	1.90E-05/H	1.08E+01
BNZOEHOTPREP#	Benzene being boiled off in OE	4.50E-02	6.21E+00
TOPPSW--BFLF#	Inadequate ooling water (excl. POWN & POWD or CTW)	2.30E-03	5.04E+00
OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	3.00E-03	4.96E+00
OPRSRAT-NCN1#	Error in nitric acid calculation by technical	3.00E-02	4.87E+00
FED-PR--PREK#	PR feeding in progress	4.50E-02	4.38E+00
BCHSRAT-PRE5+-IC	SRAT batch processed	5.90E-03/H	4.15E+00
HCV3010-FTOF#	SRAT cooling water supply valve HCV3010 fails to open	1.00E-03	3.85E+00
CC2SRAT-LFL5#	cc: both SRAT LFL detectors fail low	1.80E-03	3.85E+00
AX-8795-BFL5#	SRAT %LFL calculation switch failure	1.29E-03	3.85E+00
AEGSRAT-LKS5#	Air inleakage in SRAT sampling line (both detectors)	1.64E-03	3.85E+00
FCV3000-FTCG#	SRAT steam supply valve fails to close	1.29E-04	3.81E+00
RY-4041-FTO5#	Fail to open PRBT transfer pump switch (fail to stop pump)	1.00E-05	3.42E+00
OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1.00E-01	2.75E+00
BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1.00E-01	2.75E+00
MOV5864-FTOD#	PVVH standby fan suction valve fails to open	3.00E-03	2.72E+00
OPRPVV2-RMH1#	Fail to restore fan to operable status following maintenance	1.50E-03	2.72E+00
FANPVV2-T&MD#	PVVH standby fan unavailable, due to T&M	3.65E-03	2.72E+00
FANPVV2-FTSD#	Standby PVVH blower fails to start	5.00E-03	2.72E+00
FANPVV2-BFLD#	PVVH backup fan fails to run	7.20E-04	2.71E+00
TCV9356-CAL1+-IC	SCVC chilled water supply valve 9356 calibrated	1.31E-03/H	2.33E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) x (risk achievement worth).

Explosion in the PVVH Top Event Frequency: 3.13E-06/YR

Risk Achievement Worth

(page 2 of 2)

Basic Event Name	Description	Prob/Freq	AchW
AEG3408-LKS5#	Air inleakage in PVVH benzene analyzer 3408	1.64E-03	2.27E+00
AEG3407-LKS5#	Air inleakage in PVVH benzene analyzer 3407	1.64E-03	2.27E+00
AEG3408-FLO5#	PVVH benzene analyzer 3408 element fails low (LEL)	2.15E-03	2.27E+00
AEG3407-FLO5#	PVVH benzene analyzer 3407 element fails low (LEL)	2.15E-03	2.27E+00
OPR3408-MCH2#	PVVH benzene detector 3408 out of calibration	3.60E-03	2.27E+00
OPR3407-MCH2#	PVVH benzene detector 3407 out of calibration	3.60E-03	2.27E+00
MOV9278-FTCK#	SPC/PVVH isolation valve MOV-9278 fails to close	3.00E-03	1.97E+00
MOV1041-FTCK#	SPC/PVVH isolation valve MOV-1041 fails to close	3.00E-03	1.97E+00
TOPDEEP-BFLA#	CTW deep well pumping failure	5.40E-03	1.73E+00
OPR9346-MCH1#	OEC/D temp element 9346 out of calibration	1.20E-04	1.68E+00
OPR1117-MCH1#	PRC/D temp element 1117 out of calibration	1.20E-04	1.50E+00
RY-PRPMPFTO5#	Fail to stop PRFT to PR transfer pump	1.00E-05	1.26E+00
MOV1131-LKS6+-IC	PRCD drain valve leaks (benzene to PR)	1.00E-06/H	1.25E+00
RY-SRTL-FTO5#	Fail to open SRAT steam flow low interlock relay	1.00E-05	1.18E+00
UPS1041-BFLR#	UPS power to MOV 1041 unavailable	4.70E-04	1.11E+00
UPS9278-BFLR#	UPS power for MOV 9278 unavailable	4.70E-04	1.11E+00
OPRSRAT7ACNU#	Failure to sample SRAT product for nitric acid (pH)	5.00E-03	1.08E+00
OPRSRAT7ACN1#	Failure to follow procedure for SRAT nitric acid sampling	5.00E-03	1.08E+00
PCSSRAT-BFL5#	Fail to compensate: out of spec SRAT product data to PCCS	1.00E-03	1.07E+00
OPRSRAT7LAH1#	Error in SRAT product sample	1.00E-03	1.07E+00
PMPSRATSBFL5#	SRAT sample pump fails	2.40E-04	1.07E+00
FE-5860-FLOK#	PVVH flow element FE-5860 fails low	1.29E-04	1.07E+00
FE-6041-FLOK#	PVVH flow element FE-6041 fails low	1.29E-04	1.07E+00
OPR6041-MCH1#	PVVH flow element 6041 miscalibrated	9.00E-05	1.06E+00
OPR5860-MCH1#	PVVH flow element 5860 miscalibrated	9.00E-05	1.06E+00
OPR9356-MCH1#	SCVC chilled water supply valve 9356 miscalibrated	3.00E-02	1.06E+00
OPRSRATVRMH5#	Fail to open valve following maintenance	7.00E-05	1.04E+00
SRABATCHPRE5+-IC	New batch of sludge for DWPF	5.68E-05/H	1.03E+00
OPR8796-MCH2#	SRAT offgas detector #2 out of calibration	3.60E-03	1.02E+00
OPR8795-MCH2#	SRAT offgas detector #1 out of calibration	3.60E-03	1.02E+00
AEG8796-FLO5#	SRAT offgas detector #2 analyzer element fails low (LEL)	2.15E-03	1.02E+00
AEG8795-FLO5#	SRAT offgas detector #1 analyzer element fails low (LEL)	2.15E-03	1.02E+00
AEG8796-LKS5#	Air inleakage in SRAT offgas detector #2 sample line	1.64E-03	1.01E+00
AEG8795-LKS5#	Air inleakage in SRAT offgas detector #1 sample line	1.64E-03	1.01E+00
TX-PRFTPPREB+-IC	Transfer from PRFT to PR	2.20E-02/H	1.01E+00
AX-8797-BFL4#	SME %LFL calculation and switch failure	6.34E-02	1.01E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) x (risk achievement worth).

Explosion in the PVVH Top Event Frequency: 3.13E-06/YR

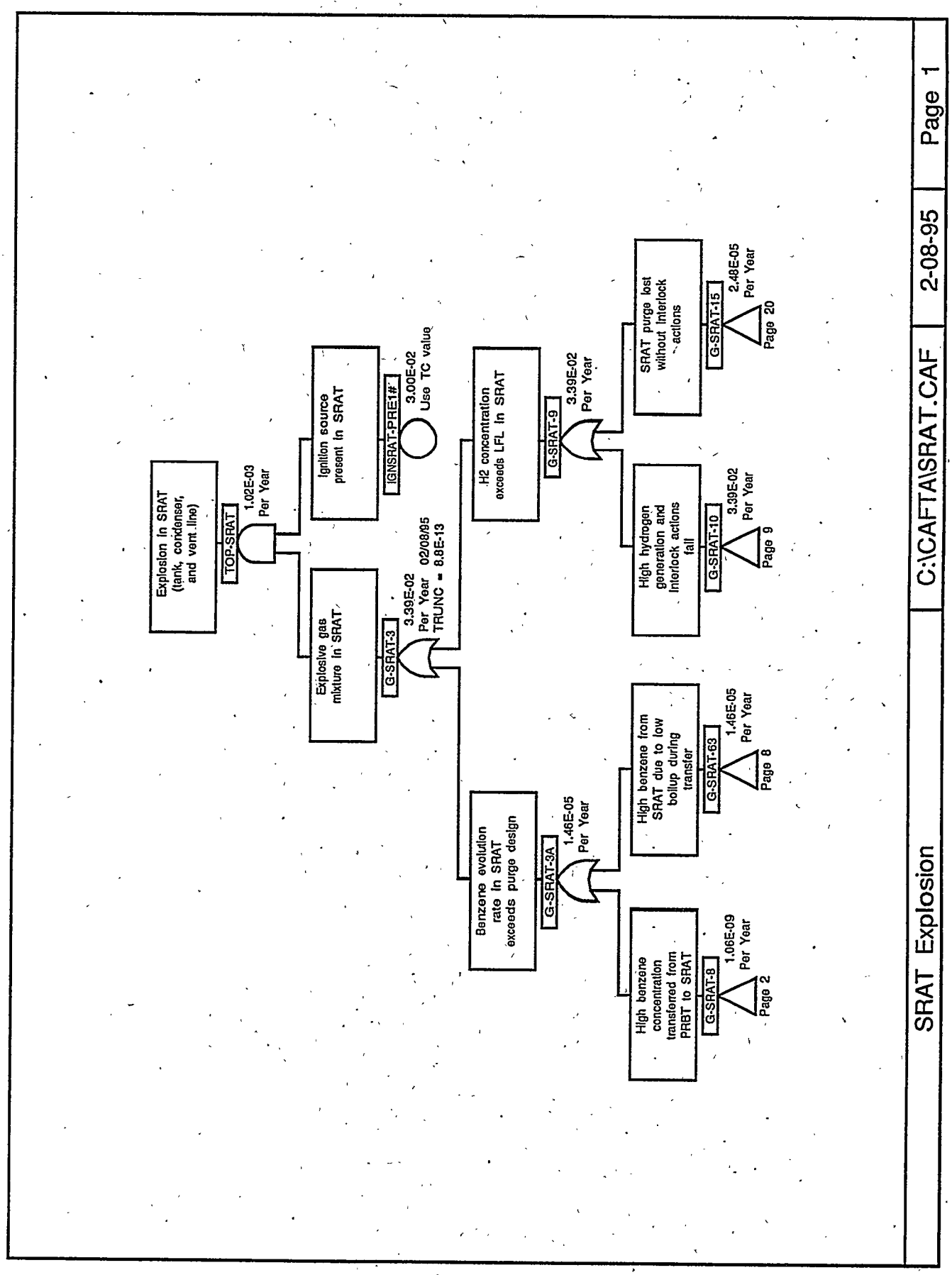
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
*IGNPVVH-PRE1#	Ignition source present in PVVH	3.00E-02	0.00E+00
TOPPOWN-BFLH+-IC	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	1.75E+00
TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1.10E-02	1.74E+00
CC2BENZ-AEG1#	cc: both PVVH benzene detectors fail low	1.80E-03	1.45E+00
BNZOEHOTPREP#	Benzene being boiled off in OE	4.50E-02	1.32E+00
TOPINAIRBFLV+-IC	Instrument air failure (excl CTW or POWN/POWD)	1.10E-05/H	1.24E+00
TOPCTWCCBFLO+-IC	Failure of CTW valving or piping (excl. INAIR)	1.10E-05/H	1.24E+00
OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1.00E-01	1.24E+00
BCHSRAT-PRE5+-IC	SRAT batch processed	5.90E-03/H	1.24E+00
BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1.00E-01	1.24E+00
FED-PR--PREK#	PR feeding in progress	4.50E-02	1.19E+00
CC2PVVH-FAN1+-IC	cc: both PVVH fans fail	3.00E-06/H	1.18E+00
TX-NITR-PRE5+-IC	Transfer nitric acid into SRAT	1.19E-02/H	1.15E+00
OPRSRAT-NCN1#	Error in nitric acid calculation by technical	3.00E-02	1.14E+00
TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	3.10E-03	1.11E+00
CC2PVVH-MOV1#	cc: both SPC/PVVH isolation valves fail to close	3.00E-04	1.11E+00
FCV9301-FTC9#	OE steam flow control valve fails to close	1.00E-03	1.09E+00
CC2PVVH-FE-7#	cc: both PVVH flow elements fail high	2.16E-04	1.07E+00
FANPVV1-BFLD+-IC	Primary PVVH blower fails	3.00E-05/H	1.02E+00
OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	3.00E-03	1.01E+00

* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included. Modified top event frequency = (top event frequency) / (risk reductionworth).

SRAT Explosion


Explosion in SRAT (tank, condenser, and vent line)
TOP-SRAT
1.02E-03 Per Year
Explosive gas mixture in SRAT
G-SRAT-3
3.39E-02 Per Year 02/08/95 TRUNC = 8.8E-13
Ignition source present in SRAT
IGNSRAT-PRE1#
3.00E-02 Use TC value
H2 concentration exceeds LFL in SRAT
G-SRAT-9
3.39E-02 Per Year
High hydrogen generation and interlock actions fail
G-SRAT-10
3.39E-02 Per Year
Page 9
SRAT purge lost without interlock actions
G-SRAT-15
2.48E-05 Per Year
Page 20
Benzene evolution rate in SRAT exceeds purge design
G-SRAT-3A
1.46E-05 Per Year
High benzene from SRAT due to low boilup during transfer
G-SRAT-63
1.46E-05 Per Year
Page 8
High benzene concentration transfered from PRBT to SRAT
G-SRAT-8
1.06E-09 Per Year
Page 2
SRAT Explosion
C:\CAFTA\SRAT.CAF
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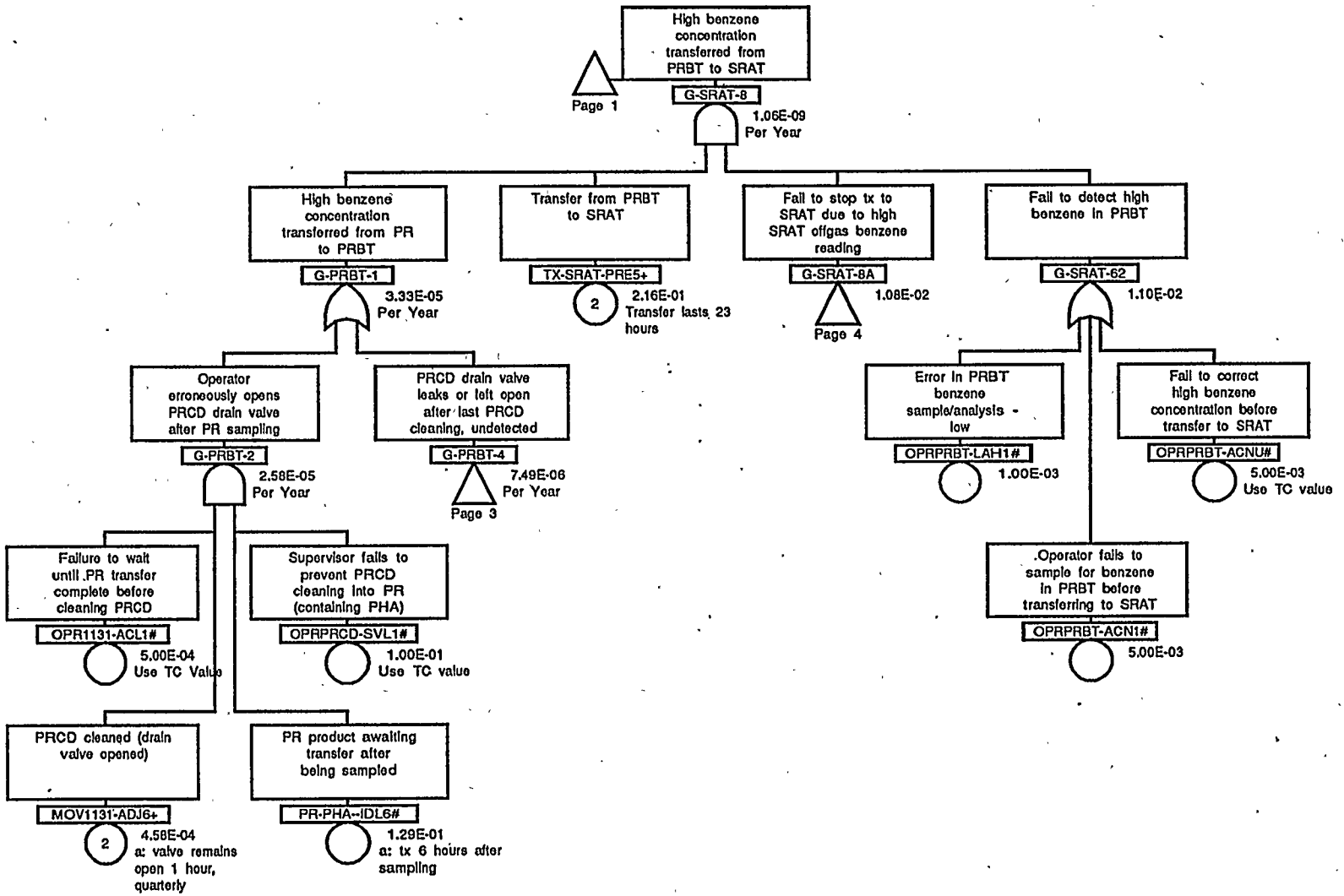
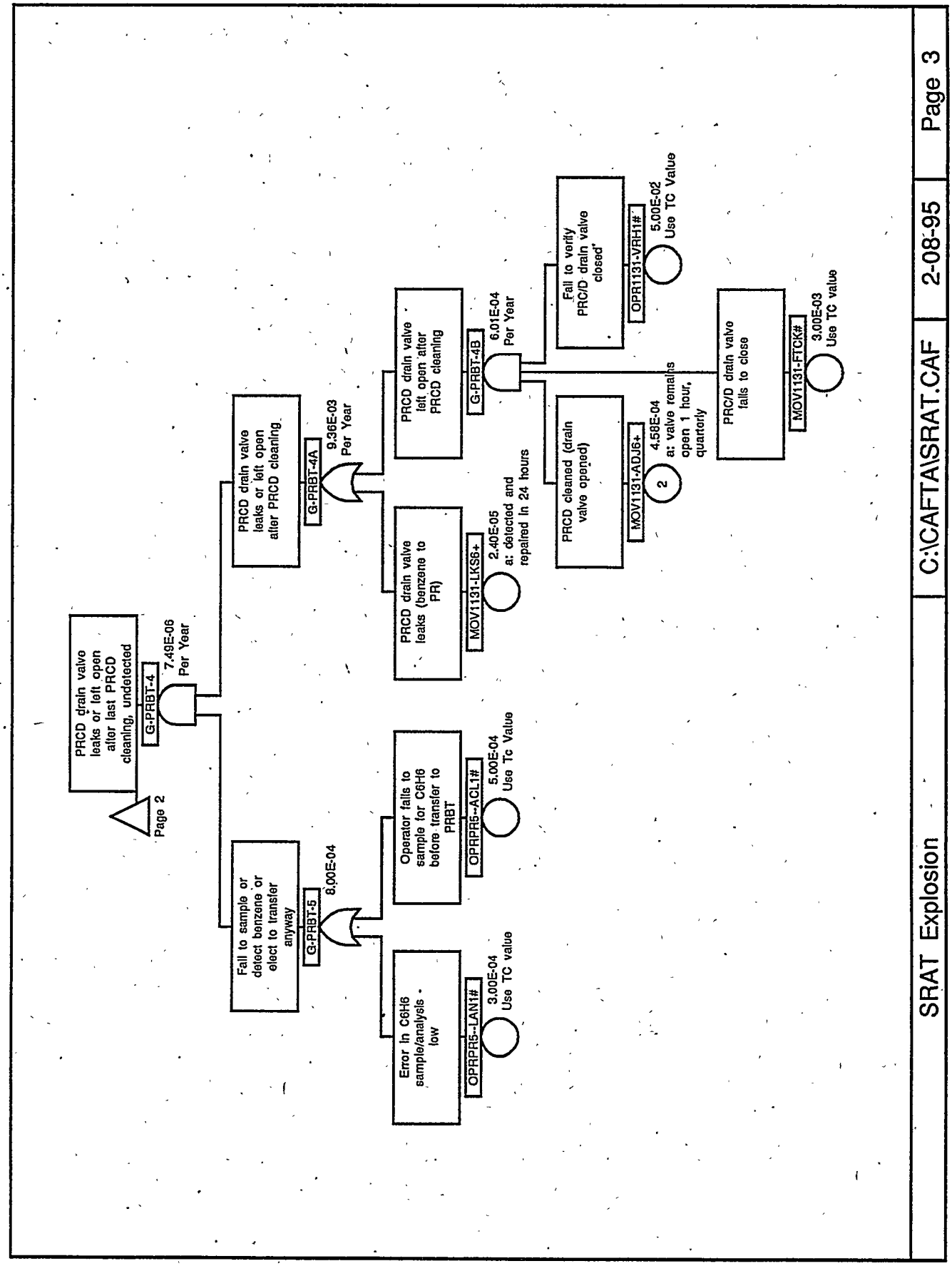
Page 1



SRAT Explosion	C:\CAFTA\SRAT.CAF	2-08-95	Page 2


PRCD drain valve leaks or left open after last PRCD cleaning, undetected
G-PRBT-4
7.49E-06 Per Year
Page 2
PRCD drain valve leaks or left open after PRCD cleaning
G-PRBT-4A
9.36E-03 Per Year
Fail to sample or detect benzene or elect to transfer anyway
G-PRBT-5
8.00E-04
Error in C6H6 sample/analysis - low
OPRPR5--LAN1#
3.00E-04 Use TC value
Operator fails to sample for C6H6 before transfer to PRBT
OPRPR5--ACL1#
5.00E-04 Use Tc Value
PRCD drain valve leaks (benzene to PR)
MOV1131-LKS6+
2.40E-05 a: detected and repaired in 24 hours
PRCD drain valve left open after PRCD cleaning
G-PRBT-4B
6.01E-04 Per Year
PRCD cleaned (drain valve opened)
MOV1131-ADJ6+
2
4.58E-04 a: valve remains open 1 hour, quarterly
Fail to verify PRC/D drain valve closed*
OPR1131-VRH1#
5.00E-02 Use TC Value
PRC/D drain valve fails to close
MOV1131-FTCK#
3.00E-03 Use TC value
SRAT Explosion
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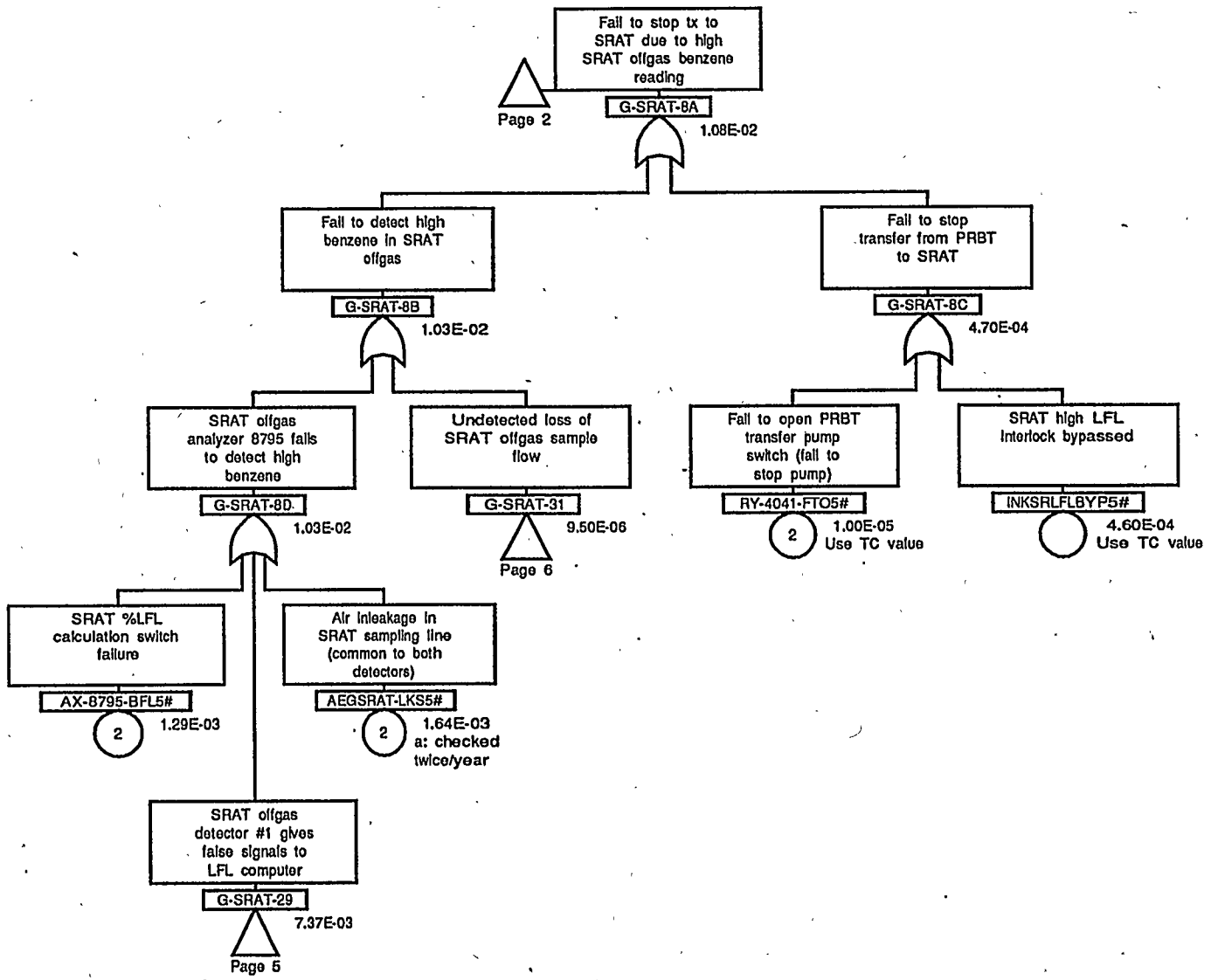
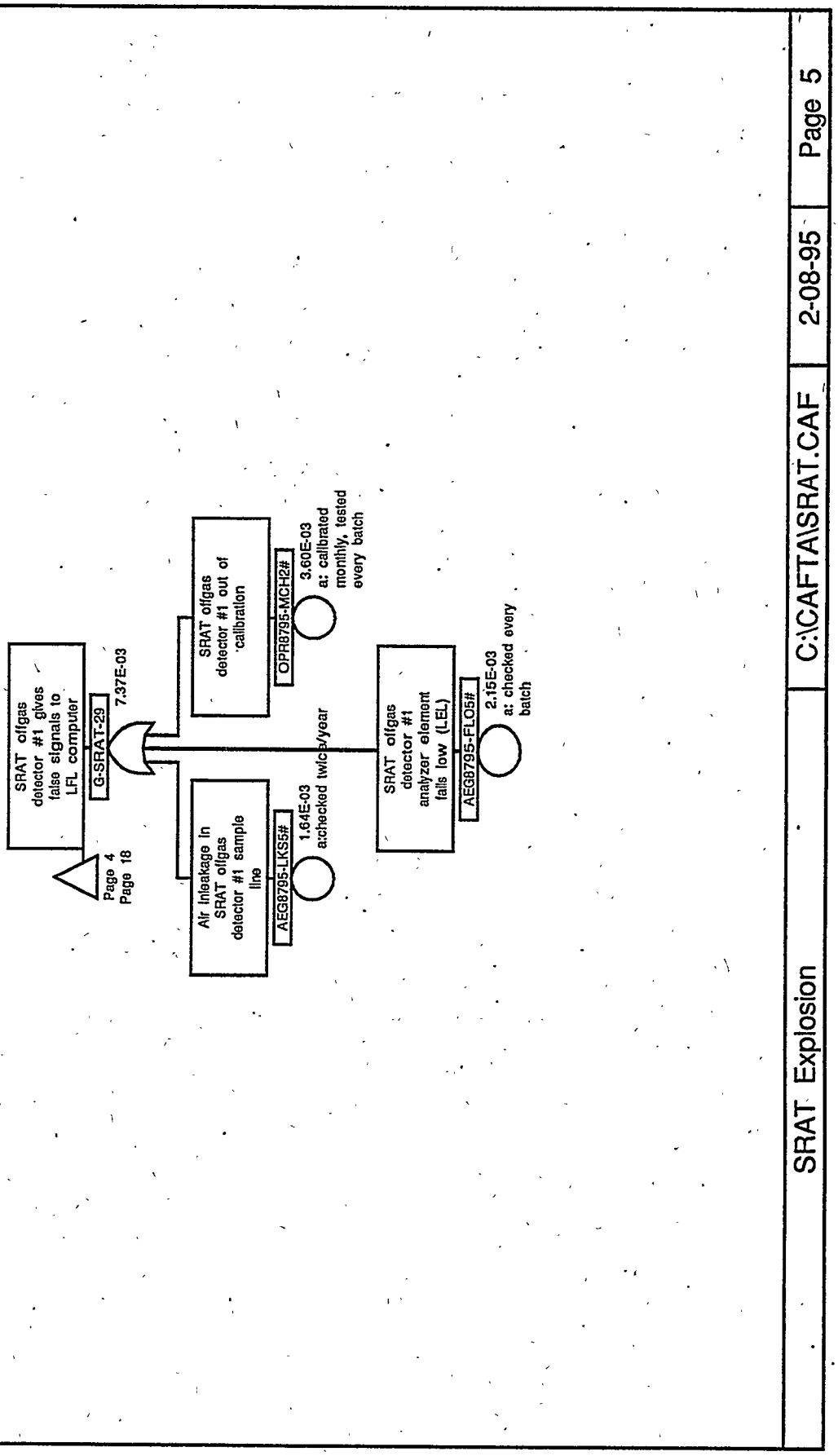
Page 3



SRAT Explosion	C:\CAFTA\SRAT.CAF	2-08-95	Page 4


SRAT olfgas detector #1 gives false signals to LFL computer
G-SRAT-29
7.37E-03
Page 4 Page 18
SRAT olfgas detector #1 out of calibration
OPR8795-MCH2#
3.60E-03
a: calibrated monthly, tested every batch
Air Inleakage in SRAT olfgas detector #1 sample line
AEG8795-LKS5#
1.64E-03
a:checked twice/year
SRAT olfgas detector #1 analyzer element fails low (LEL)
AEG8795-FLO5#
2.15E-03
a: checked every batch
SRAT Explosion
C:\CAFTA\SRAT.CAF
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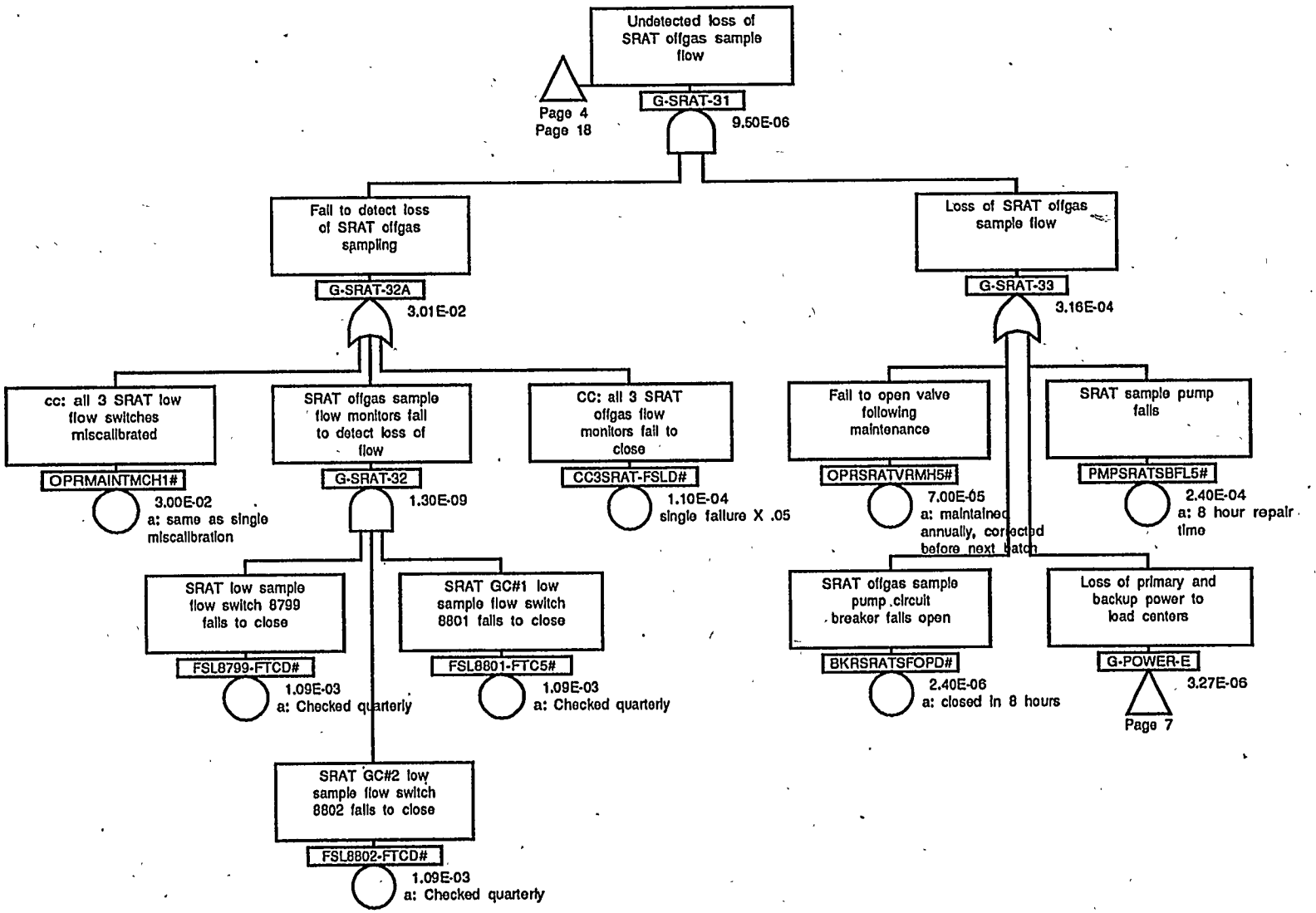
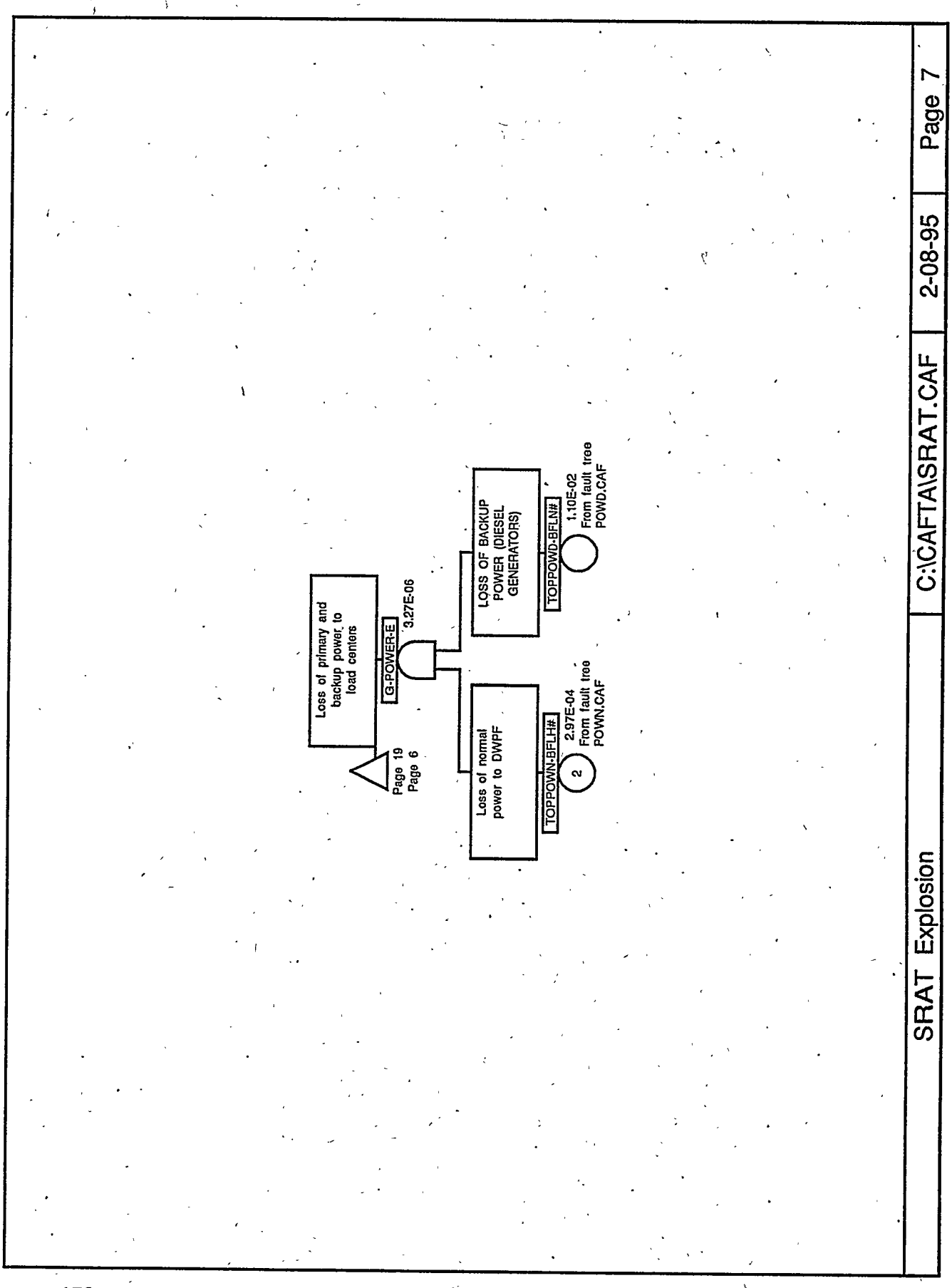
Page 5



SRAT Explosion	C:\CAFTA\SRAT.CAF	2-08-95	Page 6


SRAT Explosion
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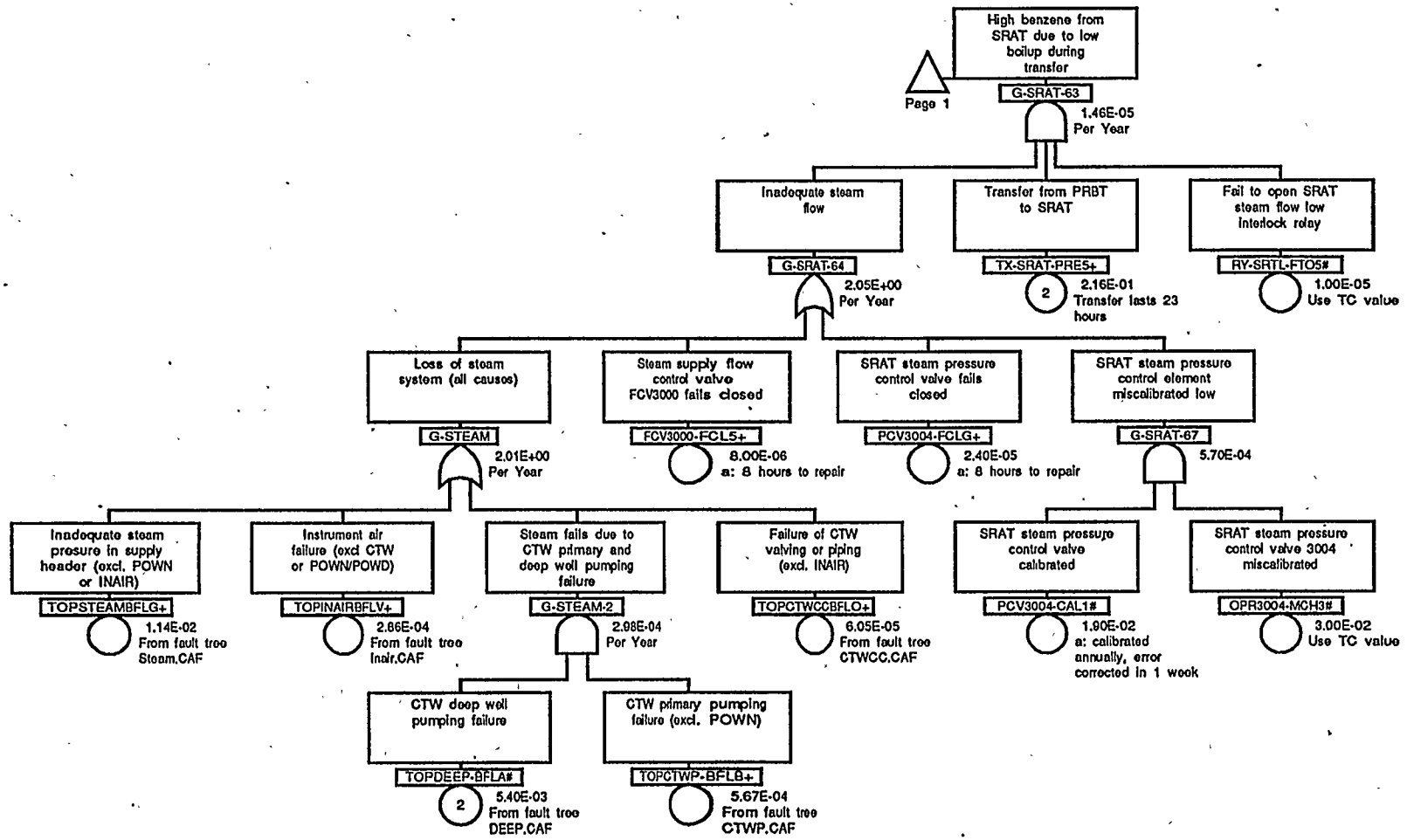
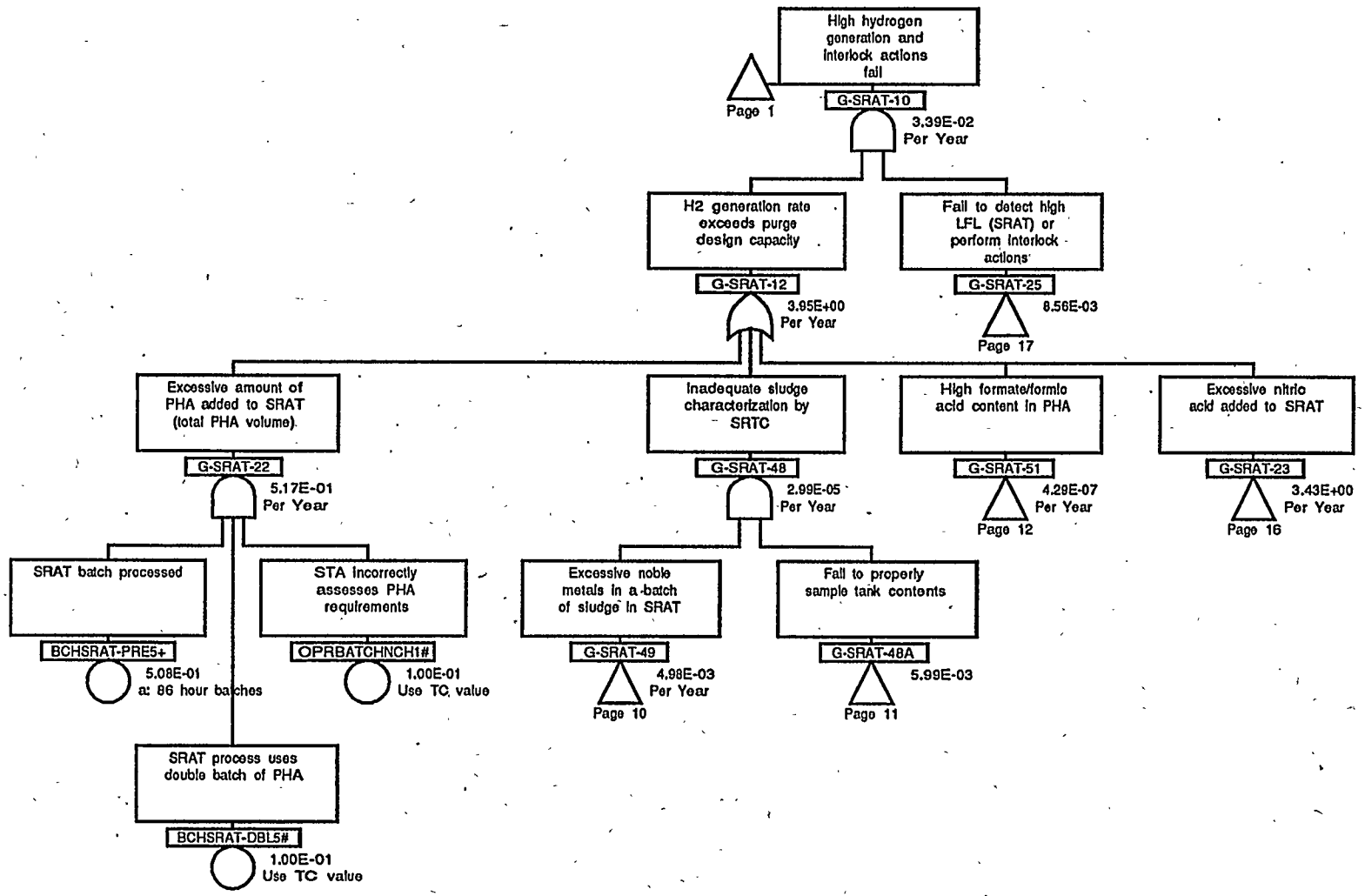
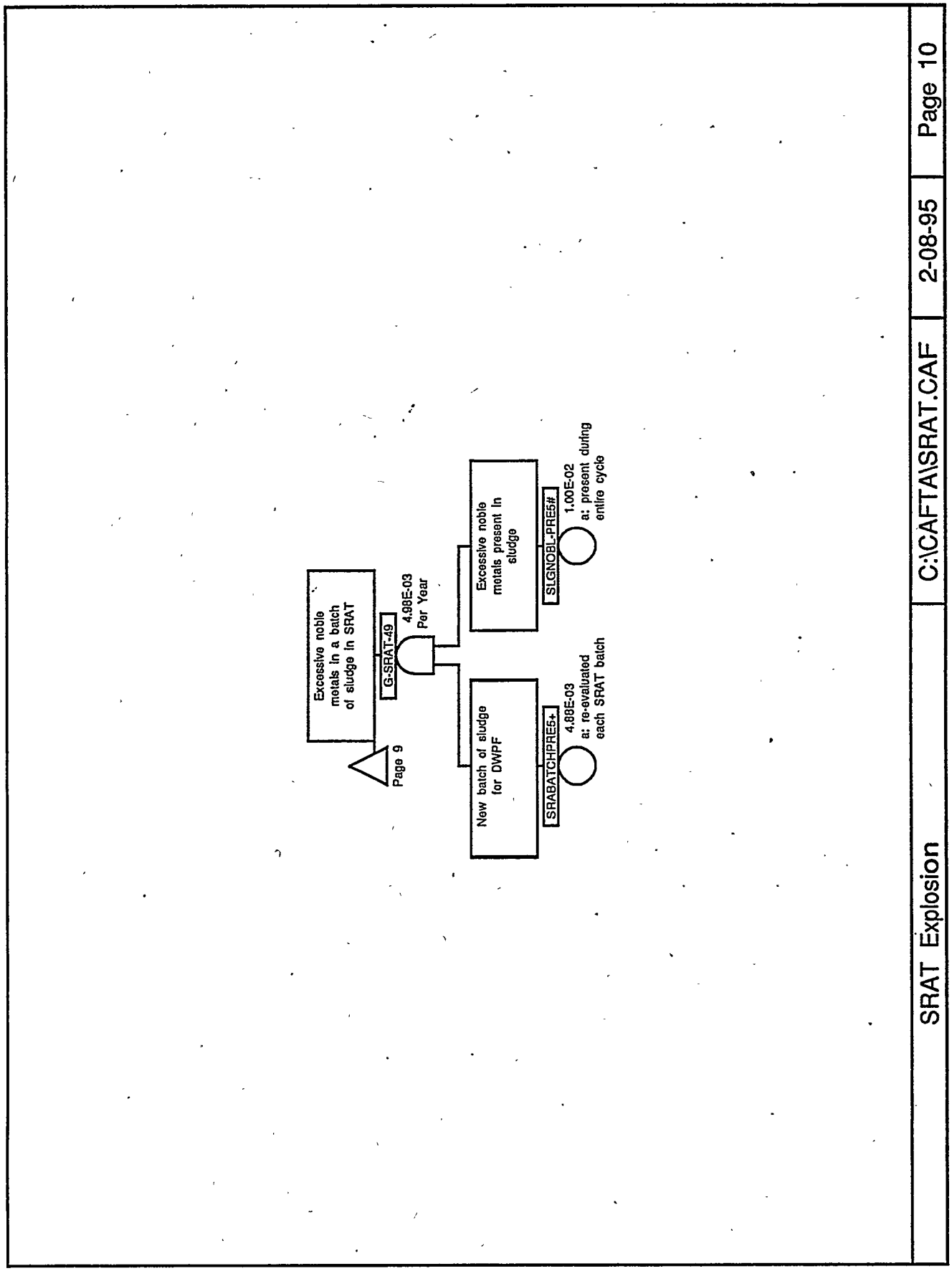
Page 7
Loss of primary and backup power to load centers
G-POWER-E
3.27E-06
Page 19
Page 6
LOSS OF BACKUP POWER (DIESEL GENERATORS)
TOPPOWD-BFLN#
1.10E-02
From fault tree POWD.CAF
Loss of normal power to DWPF
TOPPOWN-BFLH#
2
2.97E-04
From fault tree POWN.CAF



SRAT Explosion	C:\CAFTA\SRAT.CAF	2-08-95	Page 8



SRAT Explosion	C:\CAFTA\SRAT.CAF	2-08-95	Page 9


Excessive noble metals in a batch of sludge in SRAT
Page 9
G-SRAT-49
4.98E-03
Per Year
Excessive noble metals present in sludge
SLGNOBL-PRE5#
1.00E-02
a: present during entire cycle
New batch of sludge for DWPF
SRABATCHPRE5+
4.88E-03
a: re-evaluated each SRAT batch
SRAT Explosion
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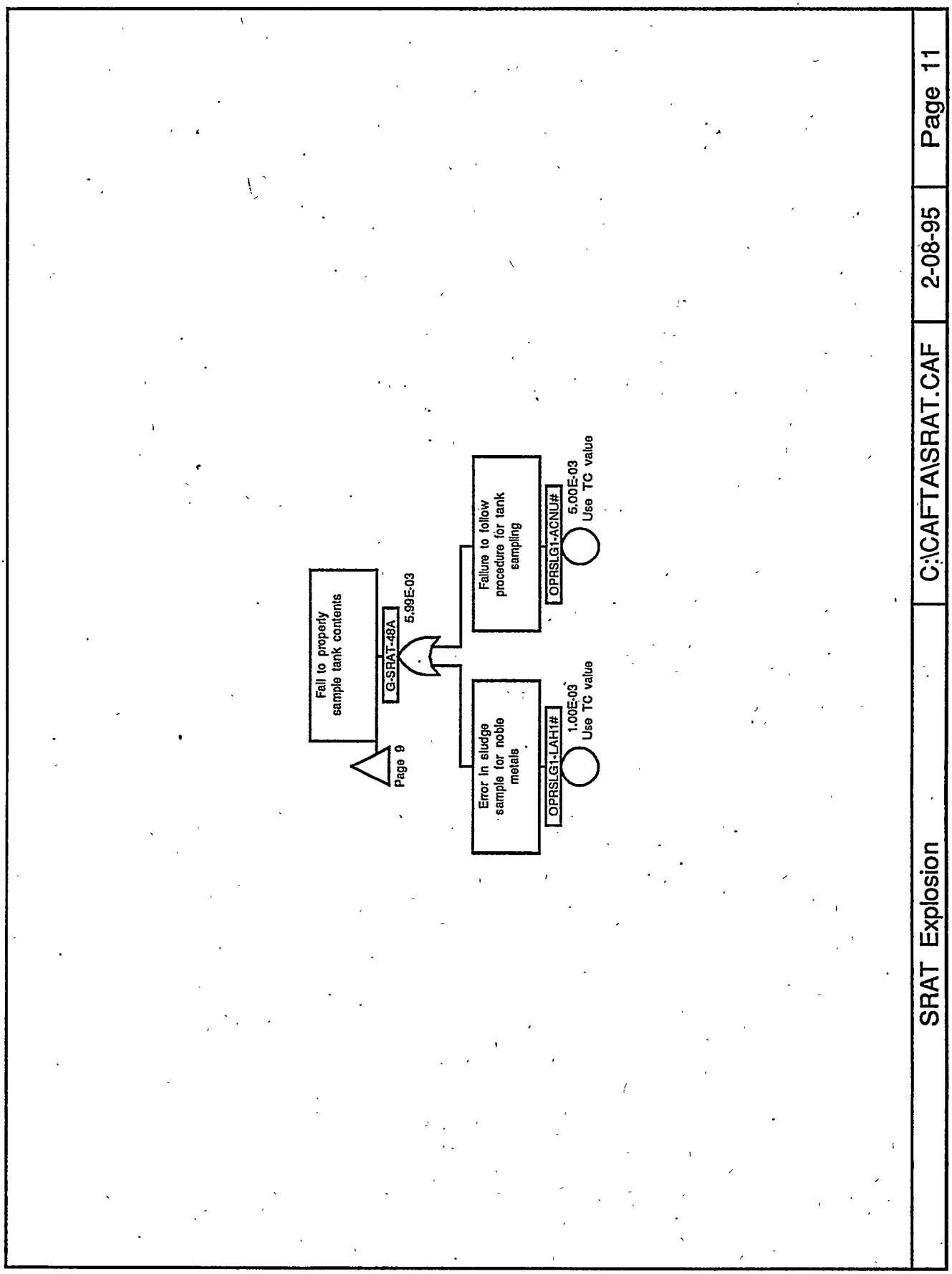
Page 10


SRAT Explosion
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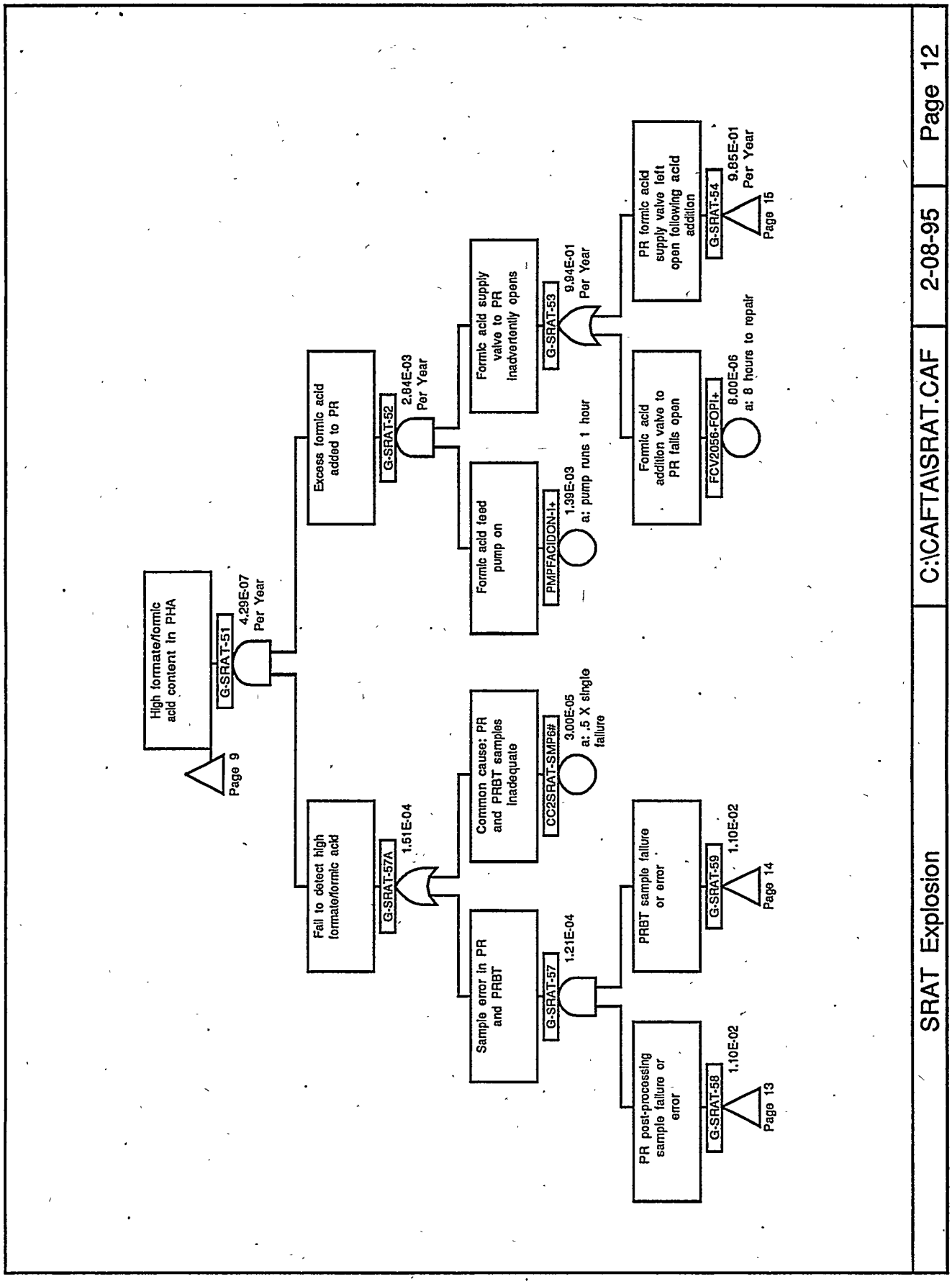
Page 11
Fail to properly sample tank contents
Page 9
G-SRAT-48A
5.99E-03
Error in sludge sample for noble metals
OPRSLG1-LAH1#
1.00E-03
Use TC value
Failure to follow procedure for tank sampling
OPRSLG1-ACNU#
5.00E-03
Use TC value


SRAT Explosion
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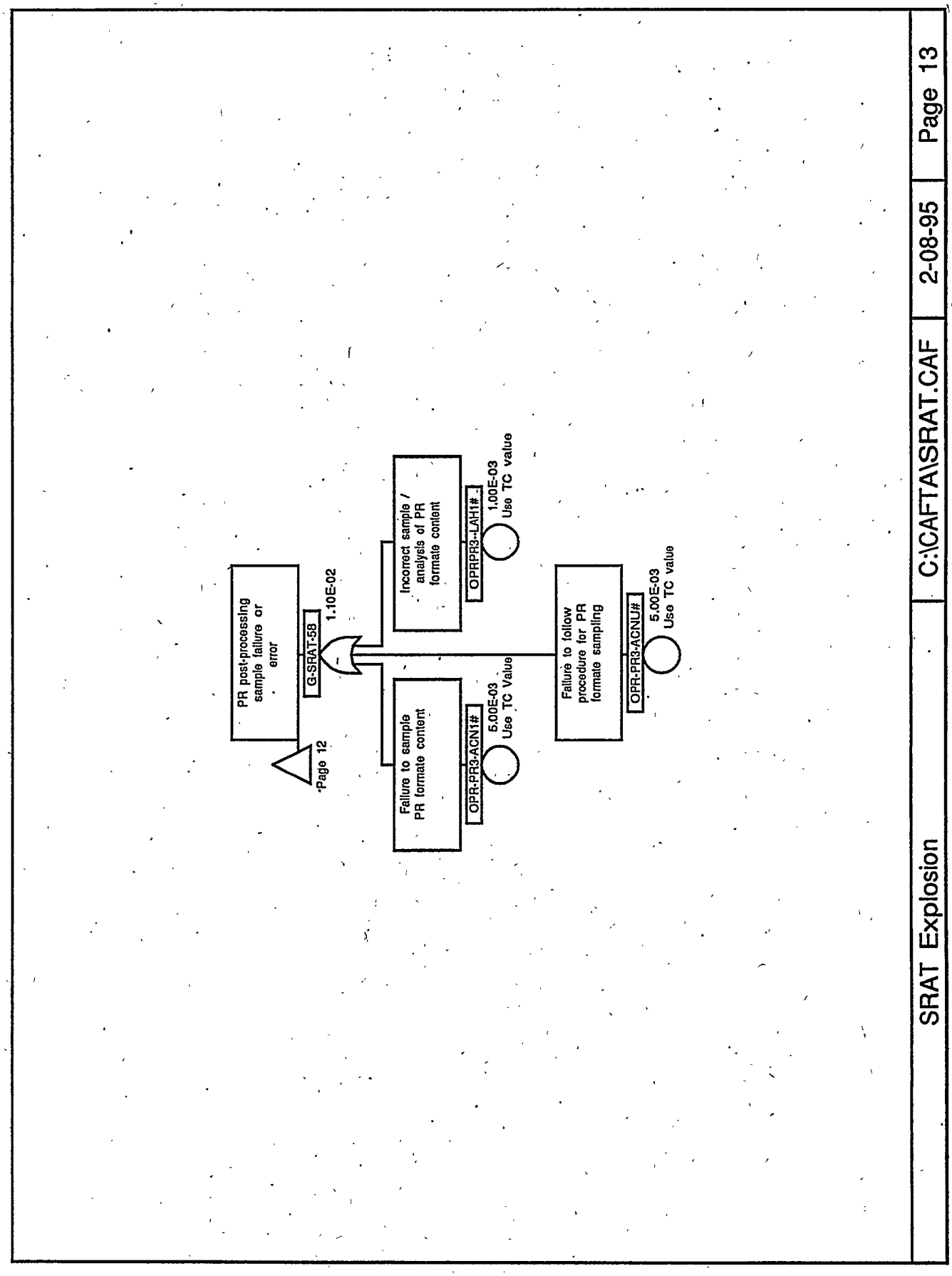
Page 12
High formate/formic acid content in PHA
Page 9
G-SRAT-51
4.29E-07 Per Year
Excess formic acid added to PR
G-SRAT-52
2.84E-03 Per Year
Formic acid supply valve to PR inadvertently opens
G-SRAT-53
9.94E-01 Per Year
PR formic acid supply valve left open following acid addition
G-SRAT-54
9.85E-01 Per Year
Page 15
Formic acid feed pump on
PMPFACIDON-I+
1.39E-03 a: pump runs 1 hour
Formic acid addition valve to PR fails open
FCV2056-FOPI+
8.00E-06 a: 8 hours to repair
Fail to detect high formate/formic acid
G-SRAT-57A
1.51E-04
Common cause: PR and PRBT samples inadequate
CC2SRAT-SMP6#
3.00E-05 a: .5 X single failure
Sample error in PR and PRBT
G-SRAT-57
1.21E-04
PRBT sample failure or error
G-SRAT-59
1.10E-02
Page 14
PR post-processing sample failure or error
G-SRAT-58
1.10E-02
Page 13


SRAT Explosion
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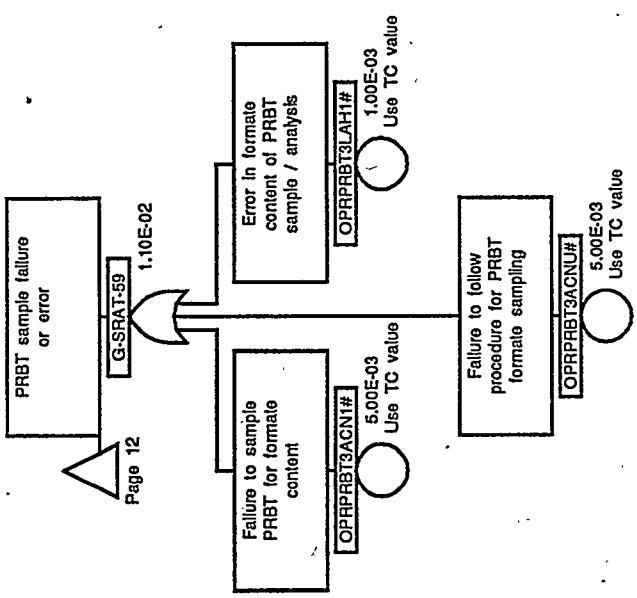
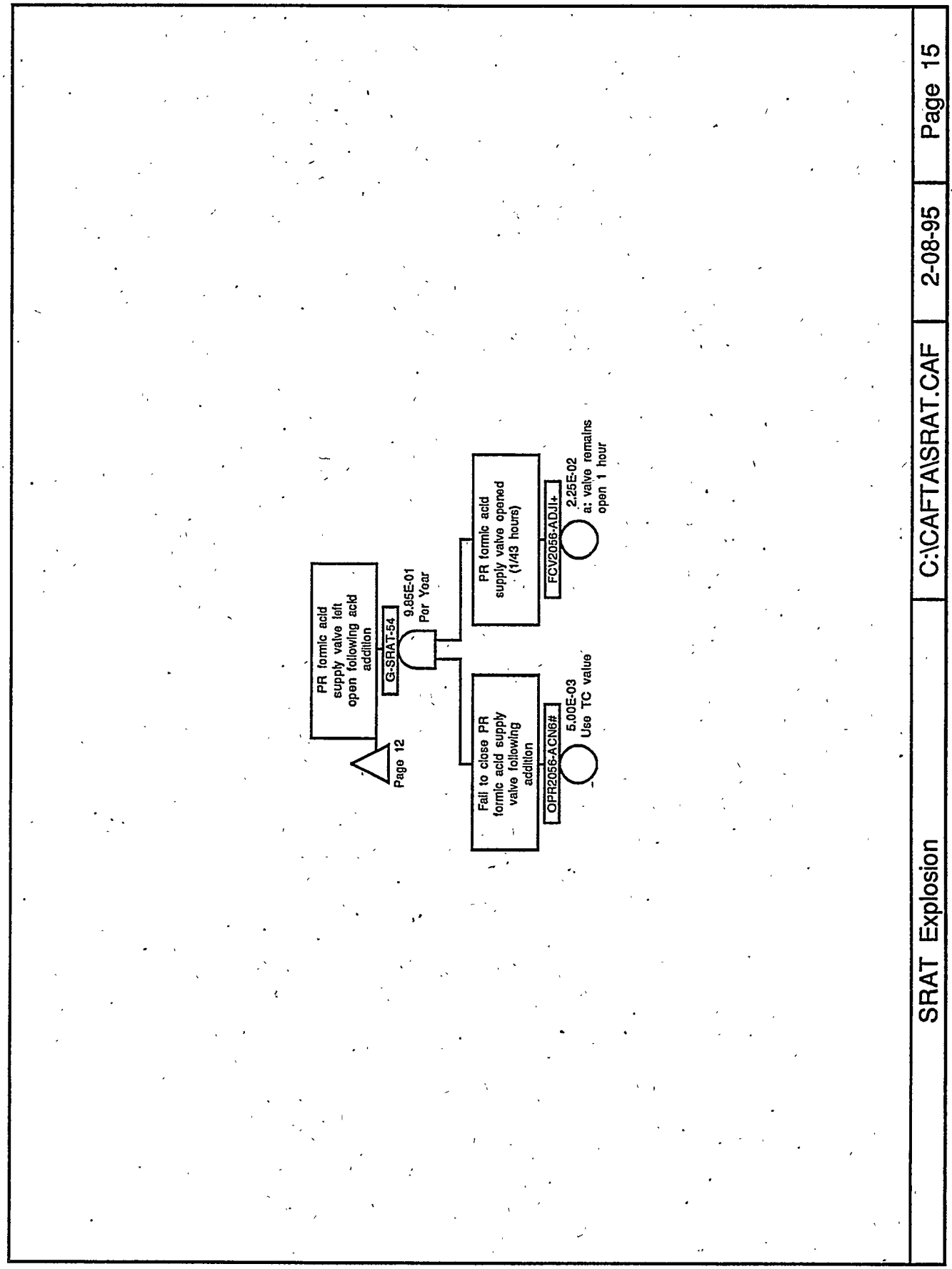
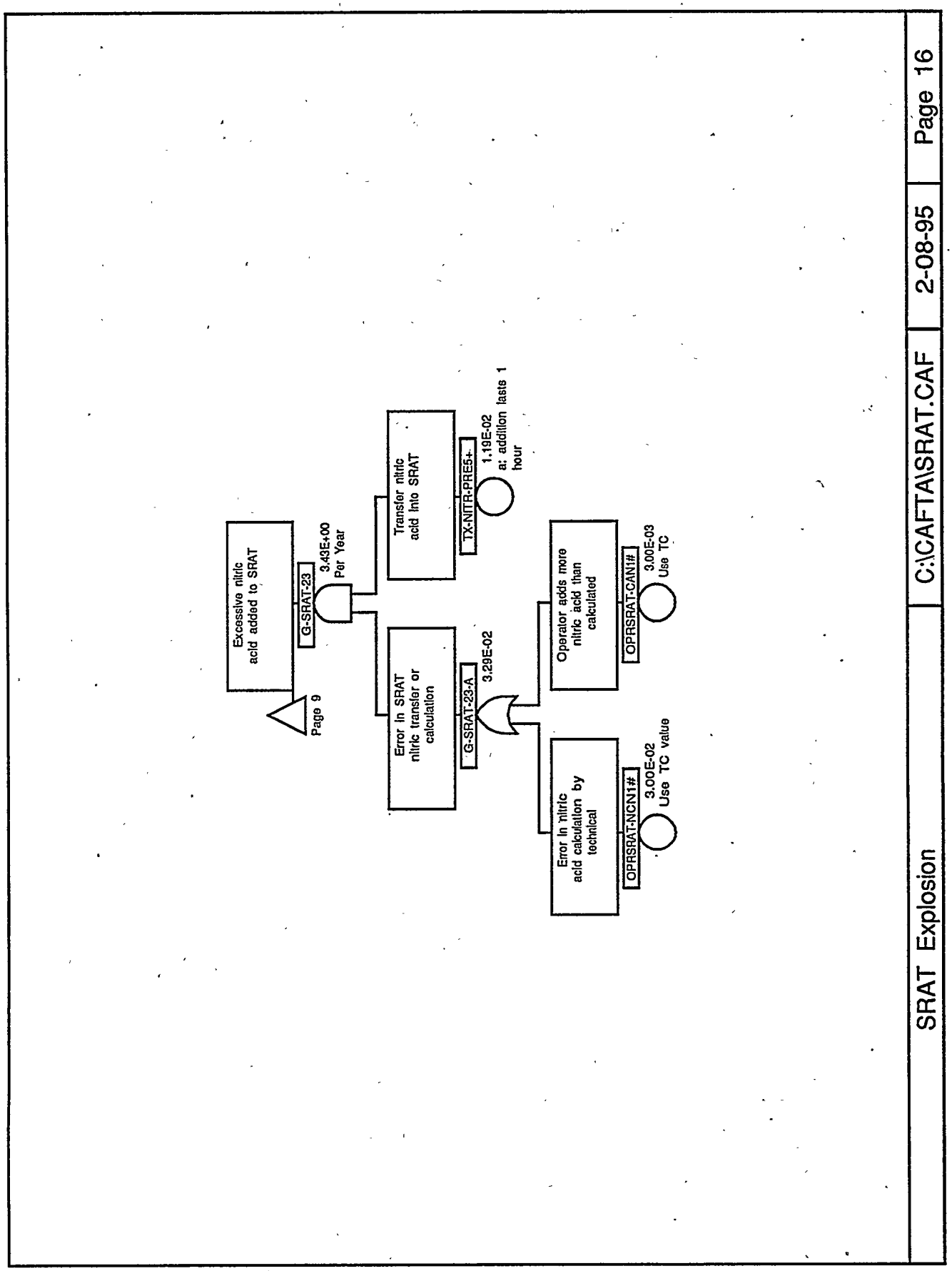
Page 13
PR post-processing sample failure or error
G-SRAT-58
1.10E-02
Page 12
Incorrect sample / analysis of PR formate content
OPRPR3-LAH1#
1.00E-03
Use TC value
Failure to sample PR formate content
OPR-PR3-ACN1#
5.00E-03
Use TC Value
Failure to follow procedure for PR formate sampling
OPR-PR3-ACNU#
5.00E-03
Use TC value



SRAT Explosion	C:\CAFTA\SRAT.CAF	2-08-95	Page 14


PR formic acid supply valve left open following acid addition
G-SRAT-54
9.85E-01 Per Year
Page 12
PR formic acid supply valve opened (1/43 hours)
FCV2056-ADJ1+
2.25E-02 a: valve remains open 1 hour
Fail to close PR formic acid supply valve following addition
OPR2056-ACN6#
5.00E-03 Use TC value
SRAT Explosion
C:\CAFTA\SRAT.CAF
2-08-95
Page 15


Excessive nitric acid added to SRAT
G-SRAT-23
3.43E+00 Per Year
Page 9
Transfer nitric acid into SRAT
TX-NITR-PRE5+
1.19E-02 a: addition lasts 1 hour
Error in SRAT nitric transfer or calculation
G-SRAT-23-A
3.29E-02
Operator adds more nitric acid than calculated
OPRSRAT-CAN1#
3.00E-03 Use TC
Error in nitric acid calculation by technical
OPRSRAT-NCN1#
3.00E-02 Use TC value
SRAT Explosion
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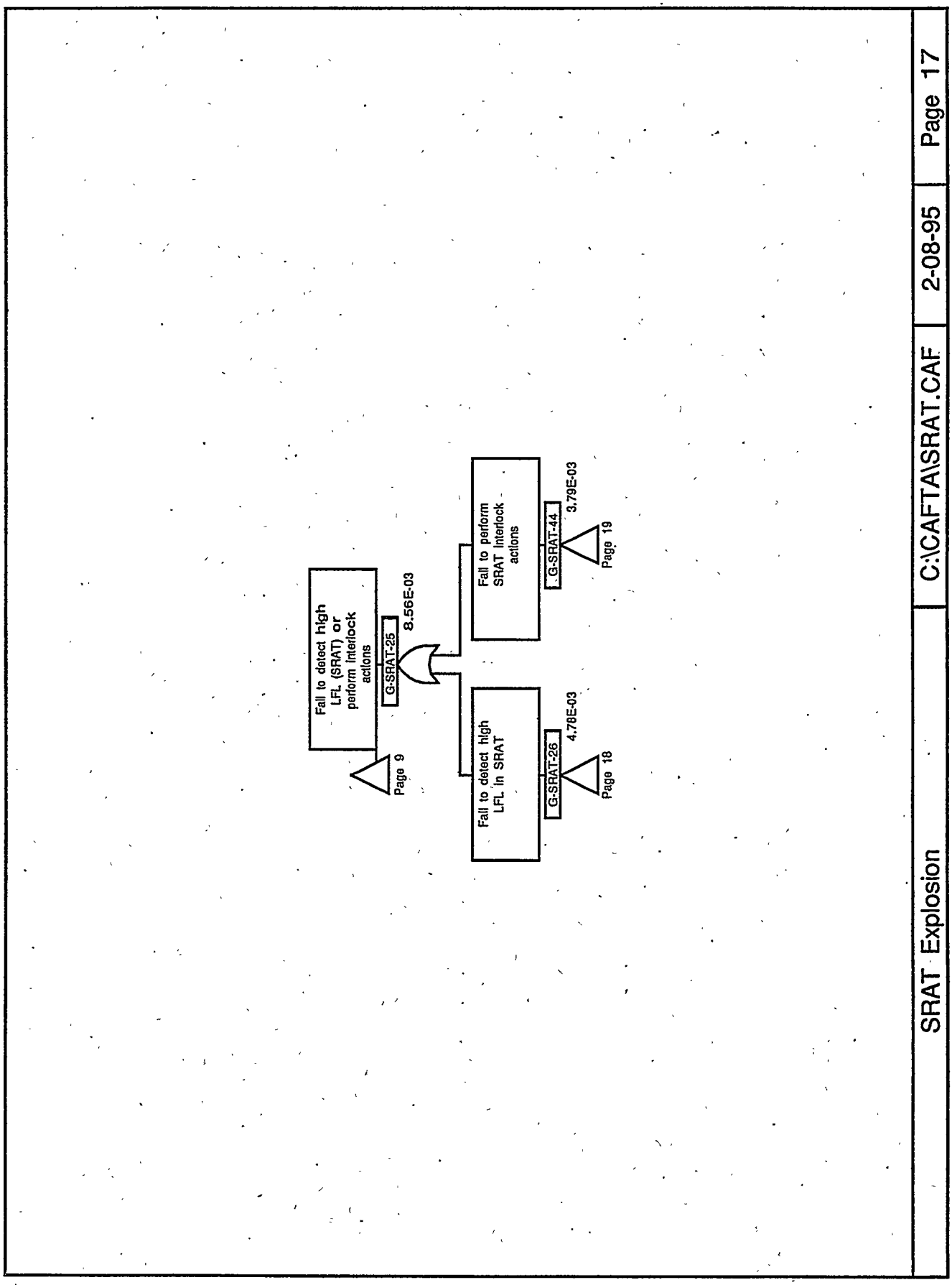
SRAT Explosion
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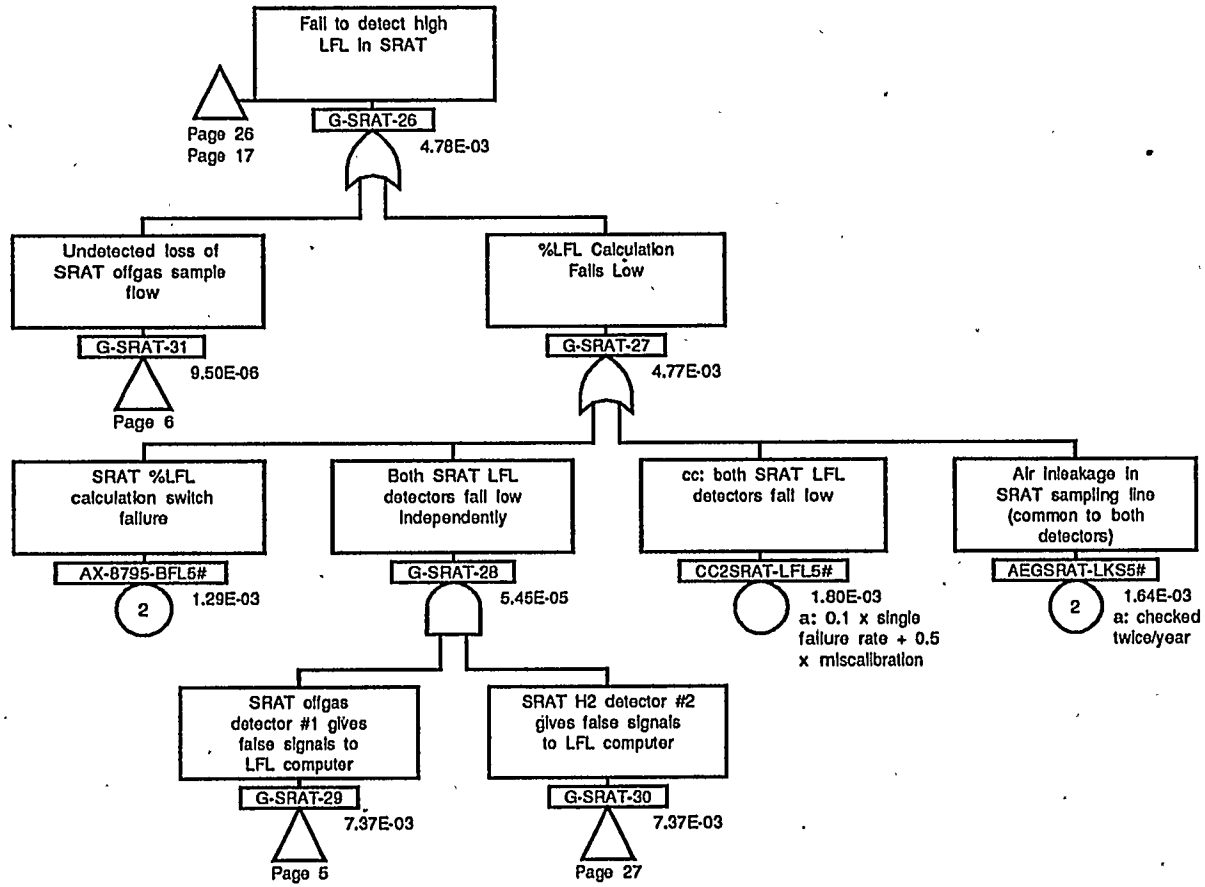
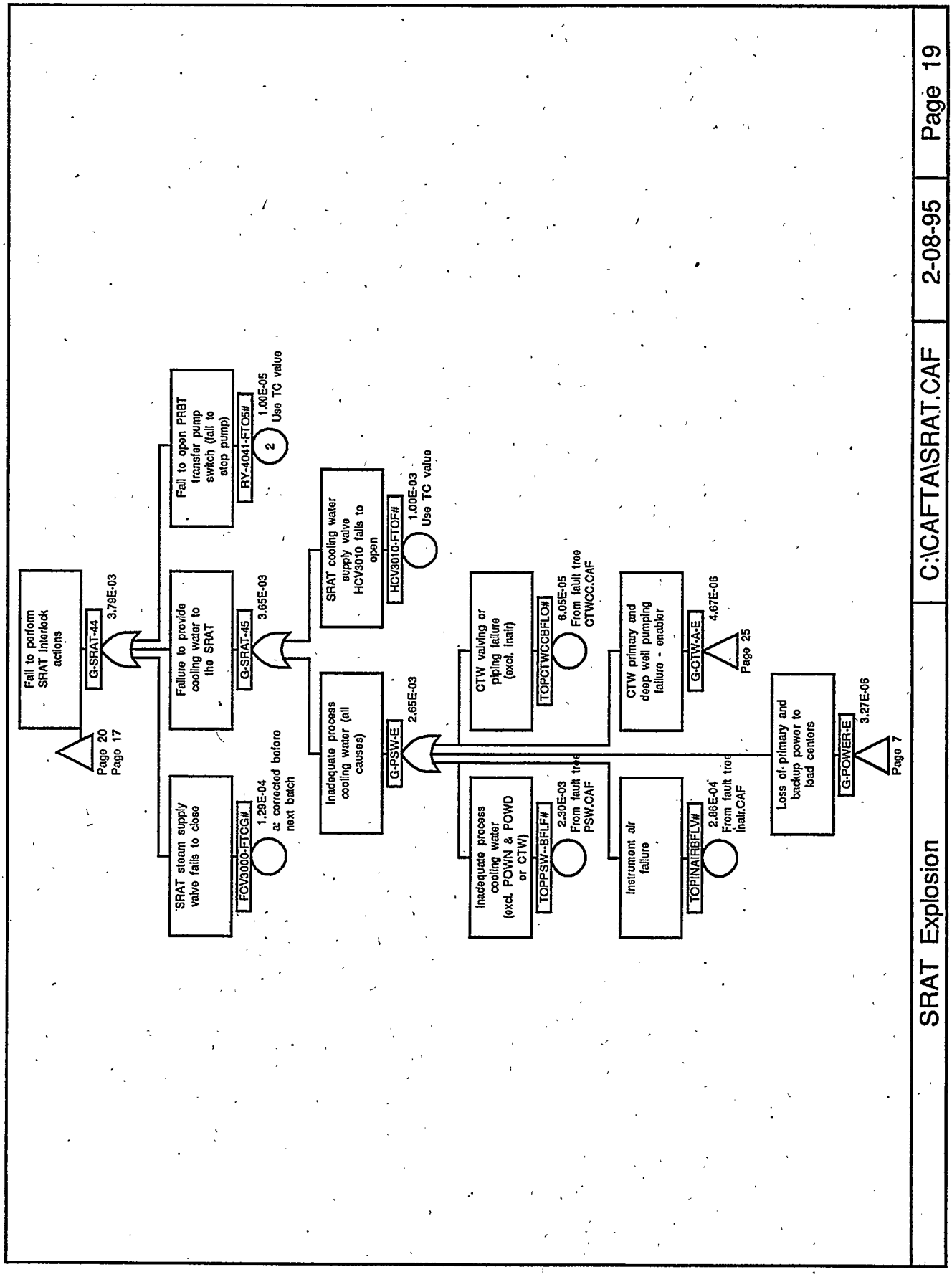
Page 17
Fail to detect high LFL (SRAT) or perform interlock actions
G-SRAT-25
8.56E-03
Page 9
Fail to perform SRAT interlock actions
G-SRAT-44
3.79E-03
Page 19
Fail to detect high LFL in SRAT
G-SRAT-26
4.78E-03
Page 18



SRAT Explosion	C:\CAFTA\SRAT.CAF	2-08-95	Page 18.


SRAT Explosion
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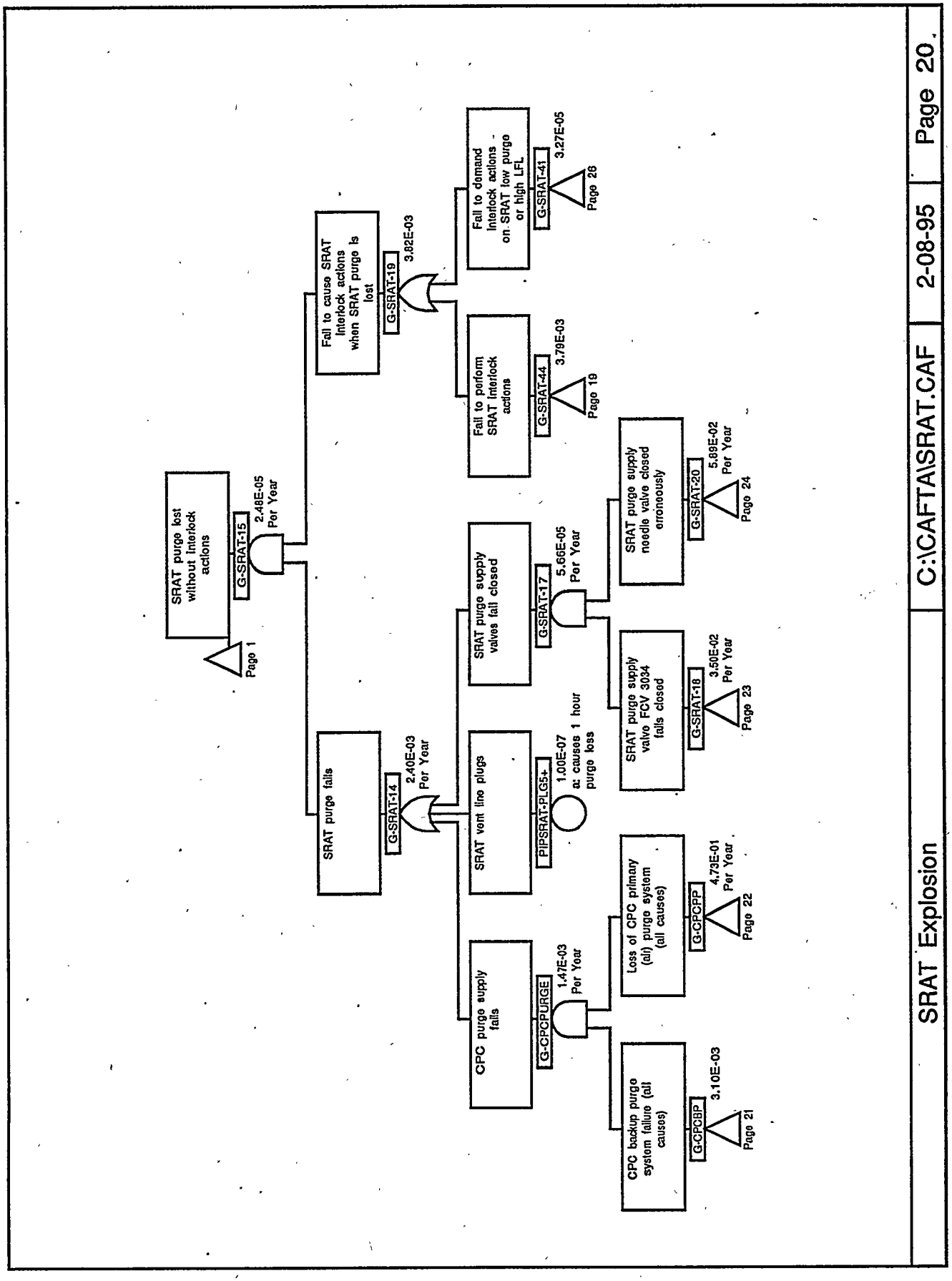
Page 19
Fail to perform SRAT interlock actions
G-SRAT-44
3.79E-03
Page 20
Page 17
SRAT steam supply valve fails to close
FCV3000-FTCG#
1.29E-04
a: corrected before next batch
Failure to provide cooling water to the SRAT
G-SRAT-45
3.65E-03
Fail to open PRBT transfer pump switch (fail to stop pump)
RY-4041-FTO5#
2
1.00E-05
Use TC value
Inadequate process cooling water (all causes)
G-PSW-E
2.65E-03
SRAT cooling water supply valve HCV3010 fails to open
HCV3010-FTOF#
1.00E-03
Use TC value
Inadequate process cooling water (excl. POWN & POWD or CTW)
TOPPSW--BFLF#
2.30E-03
From fault tree PSW.CAF
CTW valving or piping failure (excl. Instr)
TOPCTWCCBFLO#
6.05E-05
From fault tree CTWCC.CAF
Instrument air failure
TOPINAIRBFLV#
2.86E-04
From fault tree Instr.CAF
CTW primary and deep well pumping failure - enabler
G-CTW-A-E
4.67E-06
Page 25
Loss of primary and backup power to load centers
G-POWER-E
3.27E-06
Page 7


SRAT Explosion
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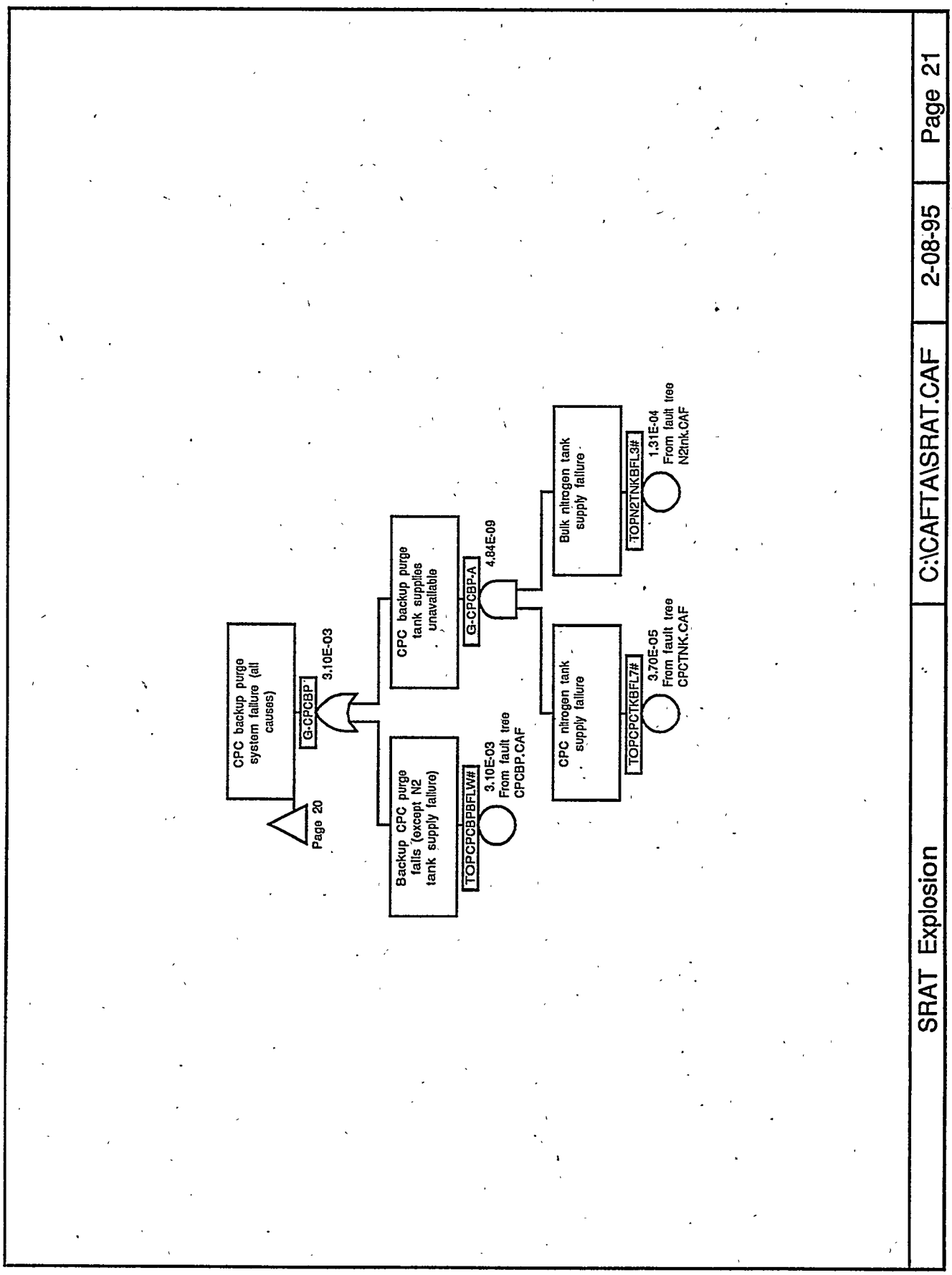
Page 20
SRAT purge lost without interlock actions
G-SRAT-15
2.48E-05 Per Year
Page 1
SRAT purge fails
G-SRAT-14
2.40E-03 Per Year
CPC purge supply fails
G-CPCPURGE
1.47E-03 Per Year
CPC backup purge system failure (all causes)
G-CPCBP
3.10E-03
Page 21
Loss of CPC primary (all) purge system (all causes)
G-CPCPP
4.73E-01 Per Year
Page 22
SRAT vent line plugs
PIPSRAT-PLGS+
1.00E-07 a: causes 1 hour purge loss
SRAT purge supply valves fail closed
G-SRAT-17
5.66E-05 Per Year
SRAT purge supply valve FCV 3034 fails closed
G-SRAT-18
3.50E-02 Per Year
Page 23
SRAT purge supply needle valve closed erroneously
G-SRAT-20
5.89E-02 Per Year
Page 24
Fail to cause SRAT interlock actions when SRAT purge is lost
G-SRAT-19
3.82E-03
Fail to perform SRAT interlock actions
G-SRAT-44
3.79E-03
Page 19
Fail to demand interlock actions - on SRAT low purge or high LFL
G-SRAT-41
3.27E-05
Page 26


SRAT Explosion
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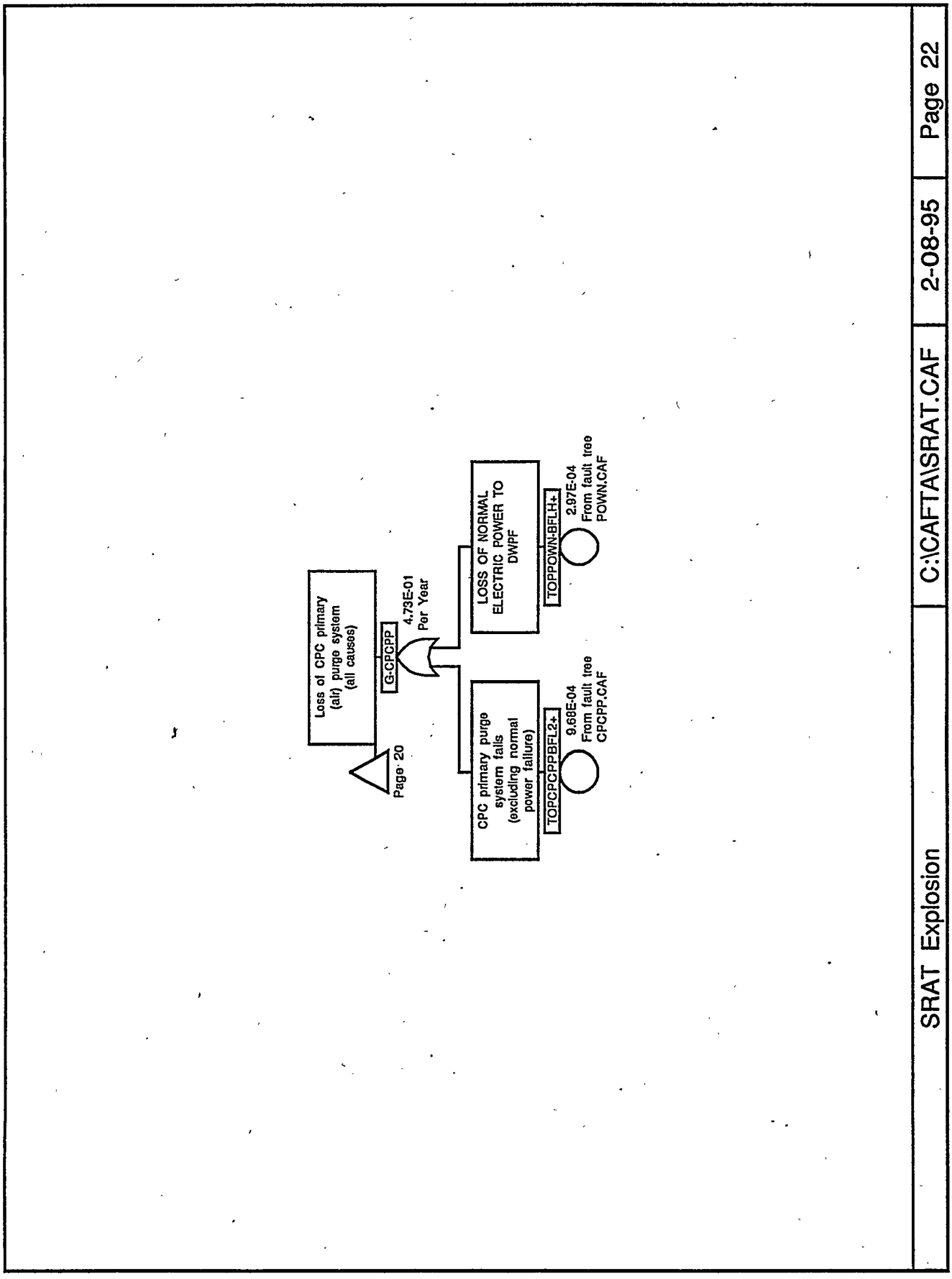
Page 21
CPC backup purge system failure (all causes)
G-CPCBP
3.10E-03
Page 20
CPC backup purge tank supplies unavailable
Backup CPC purge fails (except N2 tank supply failure)
TOPCPCBPBFLW#
3.10E-03
From fault tree CPCBP.CAF
G-CPCBP-A
4.84E-09
Bulk nitrogen tank supply failure
TOPN2TNKBFL3#
1.31E-04
From fault tree N2tnk.CAF
CPC nitrogen tank supply failure
TOPCPCTKBFL7#
3.70E-05
From fault tree CPCTNK.CAF


Loss of CPC primary (air) purge system (all causes)
Page 20
G-CPCPP
4.73E-01 Per Year
CPC primary purge system fails (excluding normal power failure)
TOPCPCPPBFL2+
9.68E-04
From fault tree CPCPP.CAF
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
2.97E-04
From fault tree POWN.CAF
SRAT Explosion
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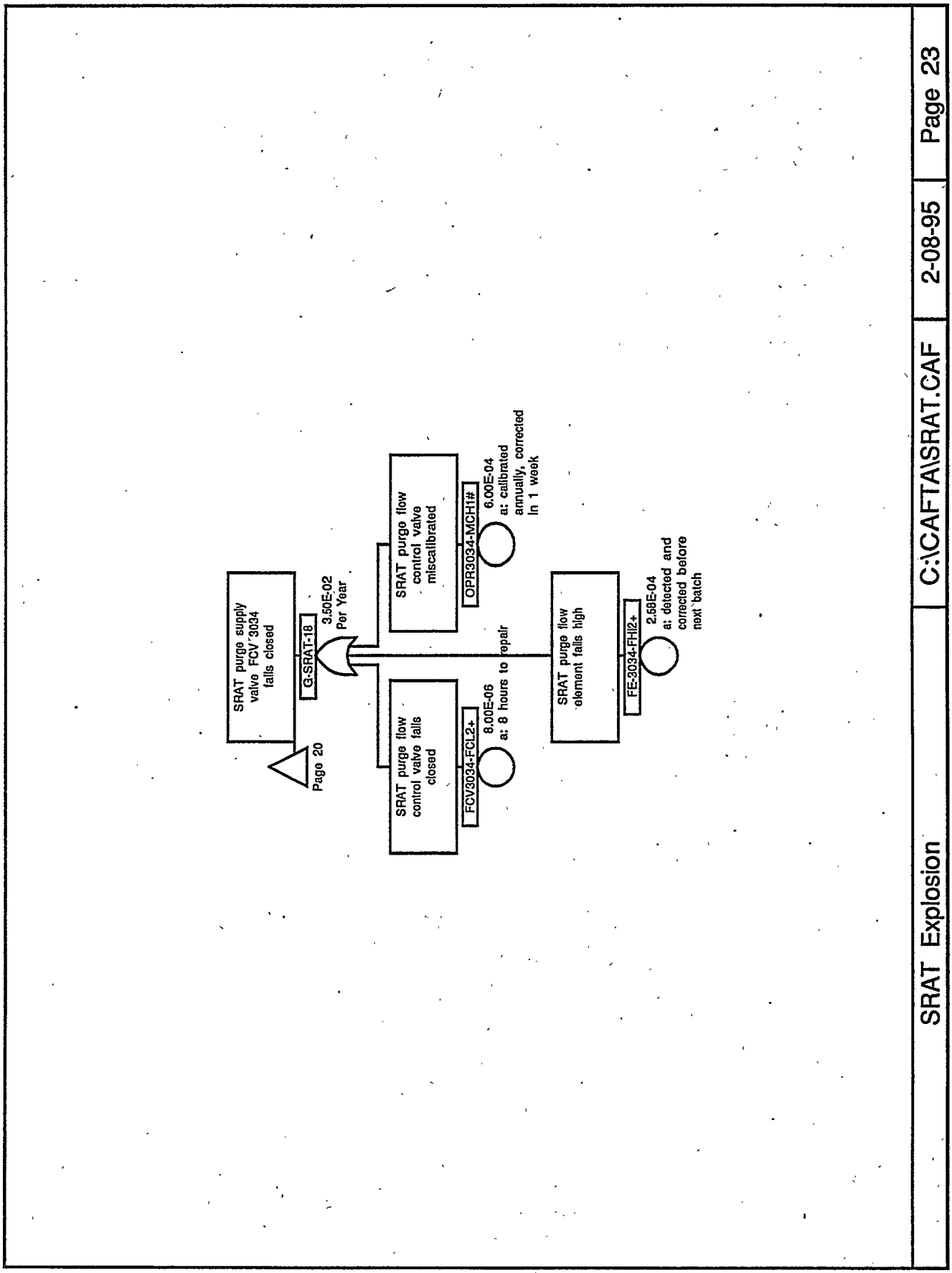
SRAT Explosion
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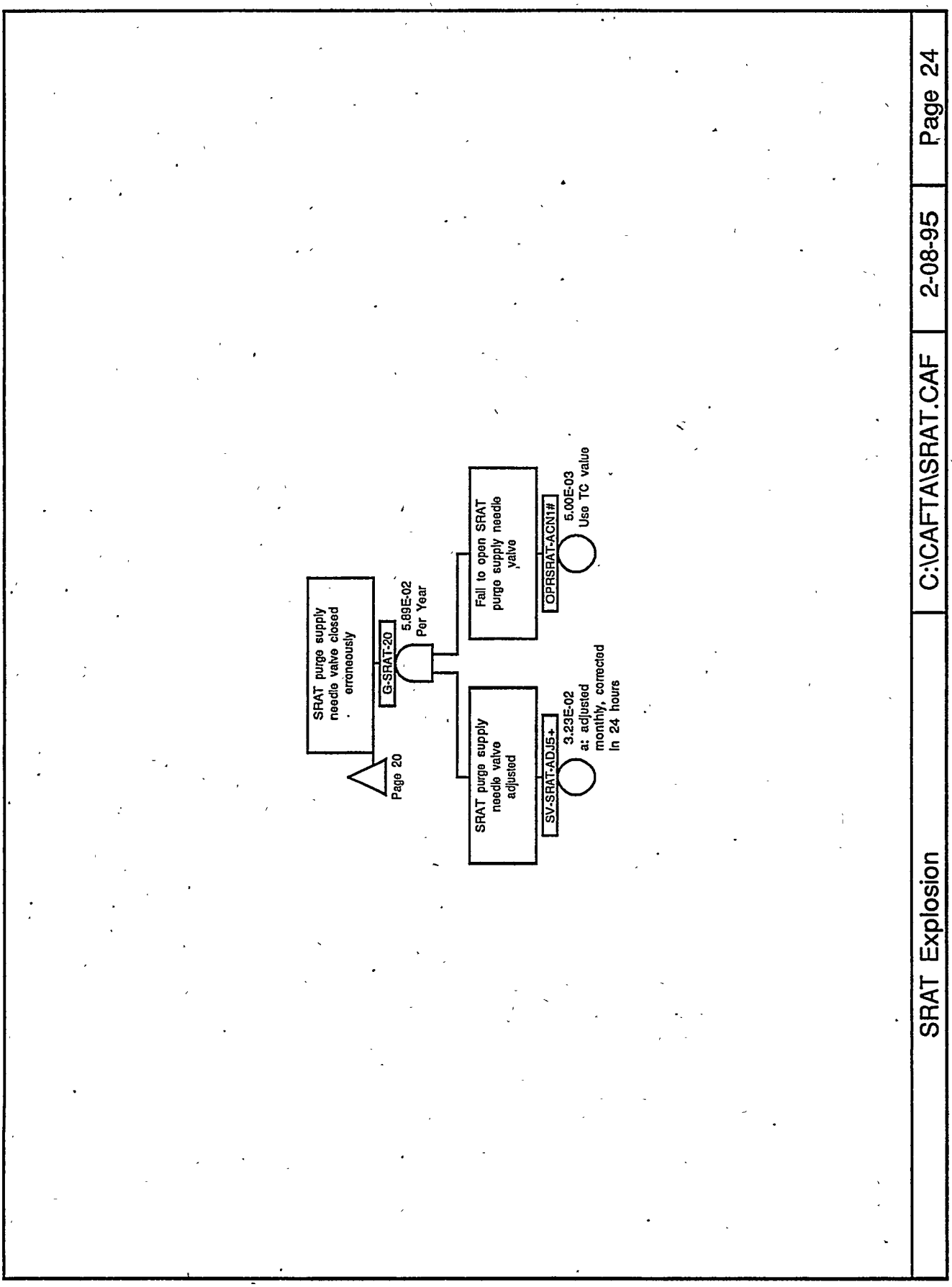
Page 23
SRAT purge supply valve FCV 3034 falls closed
G-SRAT-18
3.50E-02 Per Year
Page 20
SRAT purge flow control valve miscalibrated
OPR3034-MCH1#
6.00E-04 a: calibrated annually, corrected in 1 week
SRAT purge flow control valve falls closed
FCV3034-FCL2+
8.00E-06 a: 8 hours to repair
SRAT purge flow element fails high
FE-3034-FHI2+
2.58E-04 a: detected and corrected before next batch


SRAT purge supply needle valve closed erroneously
G-SRAT-20
5.89E-02
Per Year
Page 20
Fail to open SRAT purge supply needle valve
OPRSRAT-ACN1#
5.00E-03
Use TC value
SRAT purge supply needle valve adjusted
SV-SRAT-ADJ5+
3.23E-02
a: adjusted monthly, corrected in 24 hours
SRAT Explosion
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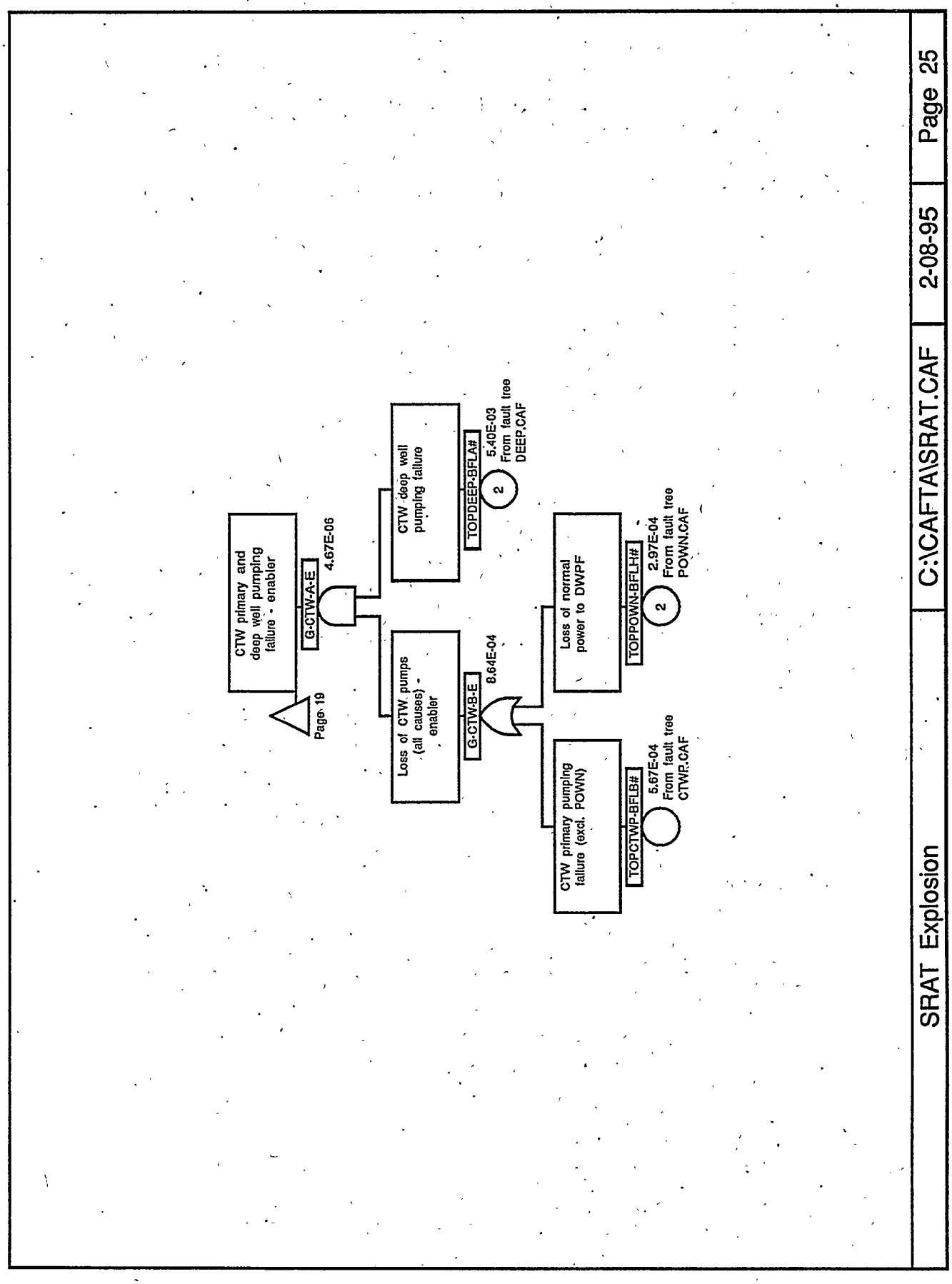
CTW primary and deep well pumping failure - enabler
G-CTW-A-E
4.67E-06
Page 19
CTW deep well pumping failure
TOPDEEP-BFLA#
2
5.40E-03
From fault tree DEEP.CAF
Loss of CTW pumps (all causes) - enabler
G-CTW-B-E
8.64E-04
Loss of normal power to DWPF
TOPPOWN-BFLH#
2
2.97E-04
From fault tree POWN.CAF
CTW primary pumping failure (excl. POWN)
TOPCTWP-BFLB#
5.67E-04
From fault tree CTWP.CAF
SRAT Explosion
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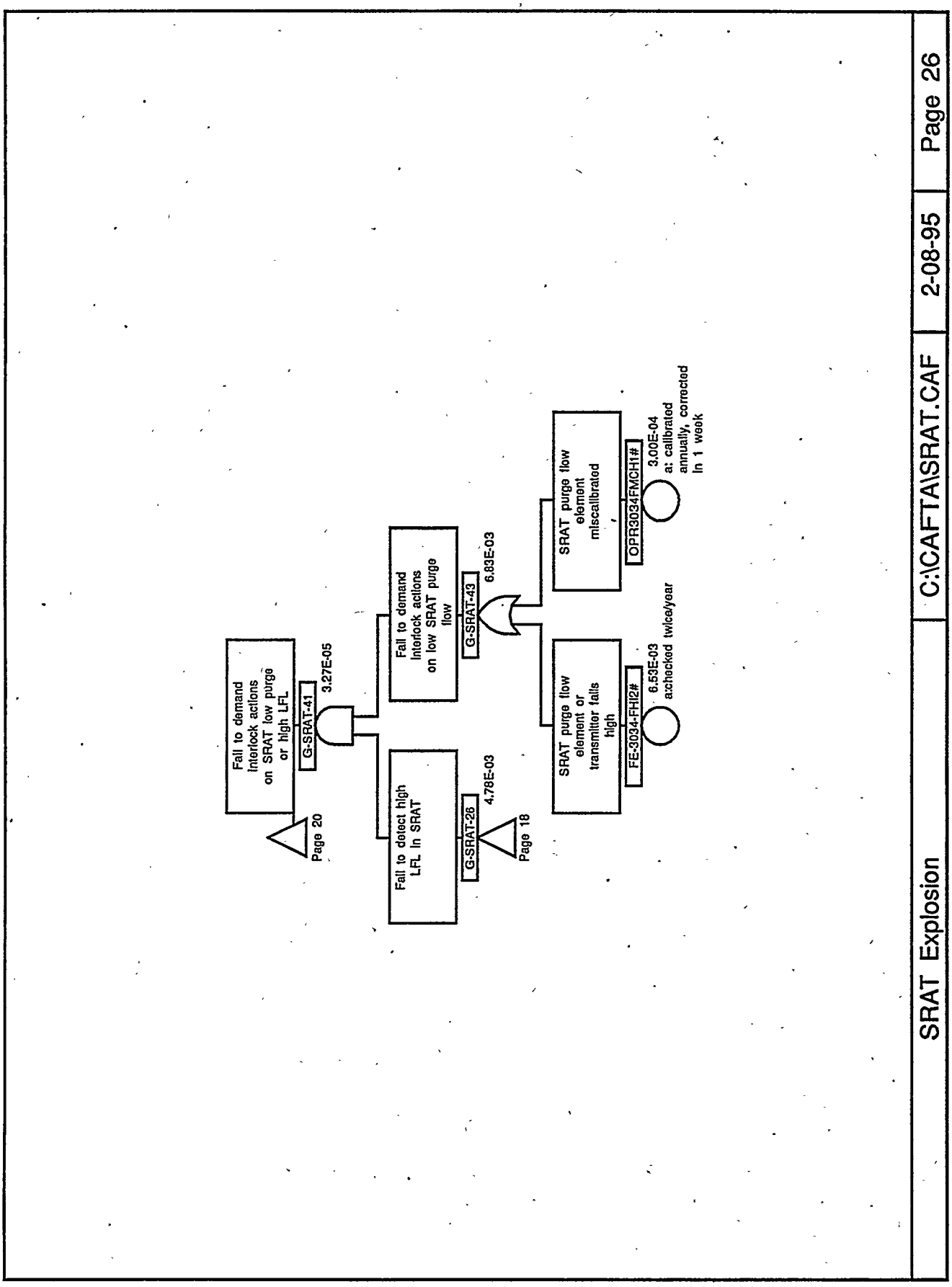
Fail to demand interlock actions on SRAT low purge or high LFL
G-SRAT-41
3.27E-05
Page 20
Fail to demand interlock actions on low SRAT purge flow
G-SRAT-43
6.83E-03
Fail to detect high LFL in SRAT
G-SRAT-28
4.78E-03
Page 18
SRAT purge flow element miscalibrated
OPR3034FMCH1#
3.00E-04
a: calibrated annually, corrected in 1 week
SRAT purge flow element or transmitter fails high
FE-3034-FHI2#
6.53E-03
a:checked twice/year
SRAT Explosion
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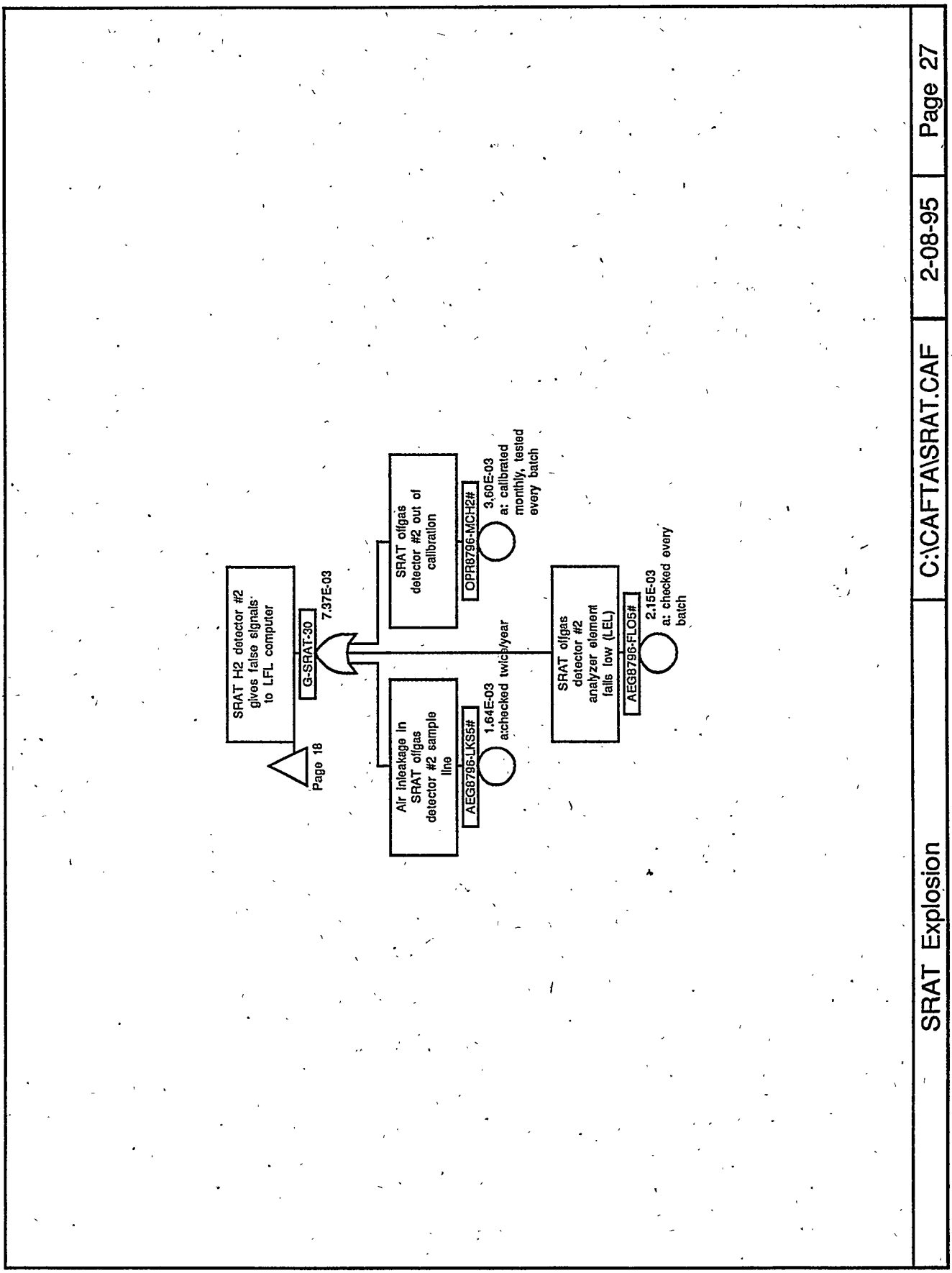
SRAT Explosion
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Page 27
SRAT H2 detector #2 gives false signals to LFL computer
G-SRAT-30
7.37E-03
Page 18
SRAT olfgas detector #2 out of calibration
OPR8796-MCH2#
3.60E-03
a: calibrated monthly, tested every batch
Air Inleakage In SRAT olfgas detector #2 sample line
AEG8796-LKS6#
1.64E-03
a:checked twice/year
SRAT olfgas detector #2 analyzer element fails low (LEL)
AEG8796-FLO5#
2.15E-03
a: checked every batch

Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
AEG8795-FLO5#	5		G-PRBT-4	2		G-SRAT-32	6		G-SRAT-8C	4	
AEG8795-LKS5#	5		G-PRBT-4	3		G-SRAT-32A	6		G-SRAT-8D	4	
AEG8796-FLO5#	27		G-PRBT-4A	3		G-SRAT-33	6		G-SRAT-9	1	
AEG8796-LKS5#	27		G-PRBT-4B	3		G-SRAT-3A	1		G-STEAM	8	
AEGSRAT-LKS5#	4		G-PRBT-5	3		G-SRAT-41	20		G-STEAM-2	8	
AEGSRAT-LKS5#	18		G-PSW-E	19		G-SRAT-41	26		HCV3010-FTOF#	19	
AX-8795-BFL5#	4		G-SRAT-10	1		G-SRAT-43	26		IGNSRAT-PRE1#	1	
AX-8795-BFL5#	18		G-SRAT-10	9		G-SRAT-44	17		INKSRLFLBYP5#	4	
BCHSRAT-DBL5#	9		G-SRAT-12	9		G-SRAT-44	19		MOV1131-ADJ6+	2	
BCHSRAT-PRE5+	9		G-SRAT-14	20		G-SRAT-44	20		MOV1131-ADJ6+	3	
BKRSRATSFOPD#	6		G-SRAT-15	1		G-SRAT-45	19		MOV1131-FTCK#	3	
CC2SRAT-LFL5#	18		G-SRAT-15	20		G-SRAT-48	9		MOV1131-LKS6+	3	
CC2SRAT-SMP6#	12		G-SRAT-17	20		G-SRAT-48A	9		OPR-PR3-ACN1#	13	
CC3SRAT-FSLD#	6		G-SRAT-18	20		G-SRAT-48A	11		OPR-PR3-ACNU#	13	
FCV2056-ADJI+	15		G-SRAT-18	23		G-SRAT-49	9		OPR1131-ACL1#	2	
FCV2056-FOPI+	12		G-SRAT-19	20		G-SRAT-49	10		OPR1131-VRH1#	3	
FCV3000-FCL5+	8		G-SRAT-20	20		G-SRAT-51	9		OPR2056-ACN6#	15	
FCV3000-FTCG#	19		G-SRAT-20	24		G-SRAT-51	12		OPR3004-MCH3#	8	
FCV3034-FCL2+	23		G-SRAT-22	9		G-SRAT-52	12		OPR3034-MCH1#	23	
FE-3034-FHI2#	26		G-SRAT-23	9		G-SRAT-53	12		OPR3034FMCH1#	26	
FE-3034-FHI2+	23		G-SRAT-23	16		G-SRAT-54	12		OPR8795-MCH2#	5	
FSL8799-FTCD#	6		G-SRAT-23-A	16		G-SRAT-54	15		OPR8796-MCH2#	27	
FSL8801-FTC5#	6		G-SRAT-25	9		G-SRAT-57	12		OPRBATCHNCH1#	9	
FSL8802-FTCD#	6		G-SRAT-25	17		G-SRAT-57A	12		OPRMAINTMCH1#	6	
G-CPCBP	20		G-SRAT-26	17		G-SRAT-58	12		OPRPR3--LAH1#	13	
G-CPCBP	21		G-SRAT-26	18		G-SRAT-58	13		OPRPR5--ACL1#	3	
G-CPCBP-A	21		G-SRAT-26	26		G-SRAT-59	12		OPRPR5--LAN1#	3	
G-CPCPP	20		G-SRAT-27	18		G-SRAT-59	14		OPRPRBT-ACN1#	2	
G-CPCPP	22		G-SRAT-28	18		G-SRAT-62	2		OPRPRBT-ACNU#	2	
G-CPCPURGE	20		G-SRAT-29	4		G-SRAT-63	1		OPRPRBT-LAH1#	2	
G-CTW-A-E	19		G-SRAT-29	5		G-SRAT-63	8		OPRPRBT3ACN1#	14	
G-CTW-A-E	25		G-SRAT-29	18		G-SRAT-64	8		OPRPRBT3ACNU#	14	
G-CTW-B-E	25		G-SRAT-3	1		G-SRAT-67	8		OPRPRBT3LAH1#	14	
G-POWER-E	6		G-SRAT-30	18		G-SRAT-8	1		OPRPRCD-SVL1#	2	
G-POWER-E	7		G-SRAT-30	27		G-SRAT-8	2		OPRSLG1-ACNU#	11	
G-POWER-E	19		G-SRAT-31	4		G-SRAT-8A	2		OPRSLG1-LAH1#	11	
G-PRBT-1	2		G-SRAT-31	6		G-SRAT-8A	4		OPRSRAT-ACN1#	24	
G-PRBT-2	2		G-SRAT-31	18		G-SRAT-8B	4		OPRSRAT-CAN1#	16	

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Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
OPRSRAT-NCN1#	16										
OPRSRATVRMH5#	6										
PCV3004-CAL1#	8										
PCV3004-FCLG+	8										
PIPSRAT-PLG5+	20										
PMPFACIDON-I+	12										
PMPSRATSBFL5#	6										
PR-PHA--IDL6#	2										
RY-4041-FTO5#	4										
RY-4041-FTO5#	19										
RY-SRTL-FTO5#	8										
SLGNOBL-PRE5#	10										
SRABATCHPRE5+	10										
SV-SRAT-ADJ5+	24										
TOP-SRAT	1										
TOPCPCBPBFLW#	21										
TOPCPCPPBFL2+	22										
TOPCPCTKBFL7#	21										
TOPCTWCCBFLO#	19										
TOPCTWCCBFLO+	8										
TOPCTWP-BFLB#	25										
TOPCTWP-BFLB+	8										
TOPDEEP-BFLA#	8										
TOPDEEP-BFLA#	25										
TOPINAIRBFLV#	19										
TOPINAIRBFLV+	8										
TOPN2TNKBFL3#	21										
TOPPOWD-BFLN#	7										
TOPPOWN-BFLH#	7										
TOPPOWN-BFLH#	25										
TOPPOWN-BFLH+	22										
TOPPSW--BFLF#	19										
TOPSTEAMBFLG+	8										
TX-NITR-PRE5+	16										
TX-SRAT-PRE5+	2										
TX-SRAT-PRE5+	8										

Cutsets for C:\CAFTA\SRAT.CSR 2/08/95 10:36 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-SRAT					1.02E-03
1.	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	2.15E-04
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	TOPPSW--BFLF#	Inadequate process cooling water (excl. POWN & POWD or CTW)	1	1N 2.3E-03N	2.30E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
2.	CC2SRAT-LFL5#	cc: both SRAT LFL detectors fail low	5	1M 5.0E-06H	1.80E-03	1.68E-04
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
3.	AEGSRAT-LKS5#	Air inleakage in SRAT sampling line (common to both detectors)	5	.5Y 7.5E-07H	1.64E-03	1.53E-04
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
4.	AX-8795-BFL5#	SRAT %LFL calculation switch failure	3	43H 3.0E-05H	1.29E-03	1.21E-04
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
5.	HCV3010-FTOF#	SRAT cooling water supply valve HCV3010 fails to open	1	1N 1.0E-03N	1.00E-03N	9.35E-05
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	

Cutsets for C:\CAFTA\SRAT.CSR 2/08/95 10:36 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
6.	BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1	1N 1.0E-01N	1.00E-01N	3.57E-05
	BCHSRAT-PRE5+	SRAT batch processed	4	86H 1.2E-02H	5.08E-01	
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1	1N 1.0E-01N	1.00E-01N	
	TOPPSW--BFLF#	Inadequate process cooling water (excl. POWN & POWD or CTW)	1	1N 2.3E-03N	2.30E-03N	
7.	BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1	1N 1.0E-01N	1.00E-01N	2.79E-05
	BCHSRAT-PRE5+	SRAT batch processed	4	86H 1.2E-02H	5.08E-01	
	CC2SRAT-LFL5#	cc: both SRAT LFL detectors fail low	5	1M 5.0E-06H	1.80E-03	
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1	1N 1.0E-01N	1.00E-01N	
8.	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	2.67E-05
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	TOPINAIRBFLV#	Instrument air failure	3	26H 1.1E-05H	2.86E-04	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
9.	AEGSRAT-LKS5#	Air inleakage in SRAT sampling line (common to both detectors)	5	.5Y 7.5E-07H	1.64E-03	2.55E-05
	BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1	1N 1.0E-01N	1.00E-01N	
	BCHSRAT-PRE5+	SRAT batch processed	4	86H 1.2E-02H	5.08E-01	
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1	1N 1.0E-01N	1.00E-01N	
10.	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	2.15E-05
	OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	1	1N 3.0E-03N	3.00E-03N	
	TOPPSW--BFLF#	Inadequate process cooling water (excl. POWN & POWD or CTW)	1	1N 2.3E-03N	2.30E-03N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
11.	AX-8795-BFL5#	SRAT %LFL calculation switch failure	3	43H 3.0E-05H	1.29E-03	2.00E-05
	BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1	1N 1.0E-01N	1.00E-01N	
	BCHSRAT-PRE5+	SRAT batch processed	4	86H 1.2E-02H	5.08E-01	
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1	1N 1.0E-01N	1.00E-01N	
12.	CC2SRAT-LFL5#	cc: both SRAT LFL detectors fail low	5	1M 5.0E-06H	1.80E-03	1.68E-05
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	1	1N 3.0E-03N	3.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
13.	BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1	1N 1.0E-01N	1.00E-01N	1.55E-05
	BCHSRAT-PRE5+	SRAT batch processed	4	86H 1.2E-02H	5.08E-01	
	HCV3010-FTOF#	SRAT cooling water supply valve HCV3010 fails to open	1	1N 1.0E-03N	1.00E-03N	
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1	1N 1.0E-01N	1.00E-01N	
14.	AEGSRAT-LKS5#	Air inleakage in SRAT sampling line (common to both detectors)	5	.5Y 7.5E-07H	1.64E-03	1.53E-05
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	1	1N 3.0E-03N	3.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
15.	FCV3000-FTCG#	SRAT steam supply valve fails to close	5	86H 3.0E-06H	1.29E-04	1.21E-05
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
16.	AX-8795-BFL5#	SRAT %LFL calculation switch failure	3	43H 3.0E-05H	1.29E-03	1.21E-05
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	1	1N 3.0E-03N	3.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
17.	HCV3010-FTOF#	SRAT cooling water supply valve HCV3010 fails to open	1	1N 1.0E-03N	1.00E-03N	9.35E-06
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	1	1N 3.0E-03N	3.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
18.	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	5.66E-06
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	TOPCTWCCBFLO#	CTW valving or piping failure (excl. inair)	3	5.5H 1.1E-05H	6.05E-05	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
19.	BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1	1N 1.0E-01N	1.00E-01N	4.44E-06
	BCHSRAT-PRE5+	SRAT batch processed	4	86H 1.2E-02H	5.08E-01	
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1	1N 1.0E-01N	1.00E-01N	
	TOPINAIRBFLV#	Instrument air failure	3	26H 1.1E-05H	2.86E-04	
20.	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	2.67E-06
	OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	1	1N 3.0E-03N	3.00E-03N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOPINAIRBFLV#	Instrument air failure	3	26H 1.1E-05H	2.86E-04	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
21.	BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1	1N 1.0E-01N	1.00E-01N	2.00E-06
	BCHSRAT-PRE5+	SRAT batch processed	4	86H 1.2E-02H	5.08E-01	
	FCV3000-FTCG#	SRAT steam supply valve fails to close	5	86H 3.0E-06H	1.29E-04	
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1	1N 1.0E-01N	1.00E-01N	
22.	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	1.21E-06
	OPR8795-MCH2#	SRAT offgas detector #1 out of calibration	1	1.2E-1N 3.0E-02N	3.60E-03N	
	OPR8796-MCH2#	SRAT offgas detector #2 out of calibration	1	1.2E-1N 3.0E-02N	3.60E-03N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
23.	FCV3000-FTCG#	SRAT steam supply valve fails to close	5	86H 3.0E-06H	1.29E-04	1.21E-06
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	1	1N 3.0E-03N	3.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
24.	BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1	1N 1.0E-01N	1.00E-01N	9.39E-07
	BCHSRAT-PRE5+	SRAT batch processed	4	86H 1.2E-02H	5.08E-01	
	IGNSRAT-PRE1#	Ignition source present in SRAT	1	1N 3.0E-02N	3.00E-02N	
	OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1	1N 1.0E-01N	1.00E-01N	
	TOPCTWCCBFLO#	CTW valving or piping failure (excl. inair)	3	5.5H 1.1E-05H	6.05E-05	

Explosion in SRAT
Top Event Frequency: 1.02E-03/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
PIPSRAT-PLG5+-I	SRAT vent line plugs	1.00E-07/H	9.90E+02
TOPCTWCCBFLO+-IC	Failure of CTW valving or piping (excl. INAIR)	1.10E-05/H	1.18E+02
TOPINAIRBFLV+-IC	Instrument air failure (excl CTW or POWN/POWD)	1.10E-05/H	1.18E+02
RY-4041-FTO5#	Fail to open PRBT transfer pump switch (fail to stop pump)	1.00E-05	1.17E+02
FCV3000-FTCG#	SRAT steam supply valve fails to close	1.29E-04	1.17E+02
HCV3010-FTOF#	SRAT cooling water supply valve HCV3010 fails to open	1.00E-03	1.17E+02
AX-8795-BFL5#	SRAT %LFL calculation switch failure	1.29E-03	1.17E+02
AEGSRAT-LKS5#	Air inleakage in SRAT sampling line (both detectors)	1.64E-03	1.17E+02
TOPPSW--BFLF#	Inadequate cooling water (excl. POWN & POWD or CTW)	2.30E-03	1.17E+02
CC2SRAT-LFL5#	cc: both SRAT LFL detectors fail low	1.80E-03	1.17E+02
TX-NITR-PRE5+-I	Transfer nitric acid into SRAT	1.19E-02/H	7.33E+01
RY-SRTL-FTO5#	Fail to open SRAT steam flow low interlock relay	1.00E-05	4.41E+01
IGNSRAT-PRE1#	Ignition source present in SRAT	3.00E-02	3.33E+01
OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	3.00E-03	2.72E+01
OPRSRAT-NCN1#	Error in nitric acid calculation by technical	3.00E-02	2.65E+01
BCHSRAT-PRE5+-I	SRAT batch processed	5.90E-03/H	2.31E+01
TOPPOWN-BFLH+-IC	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	1.91E+01
OPRSRATVRMH5#	Fail to open valve following maintenance	7.00E-05	4.50E+00
PMPSRATSBFL5#	SRAT sample pump fails	2.40E-04	4.50E+00
BKRSRATSFOPD#	SRAT offgas sample pump circuit breaker fails open	2.40E-06	4.50E+00
TOPCPCPPBFL2+-I	CPC primary purge system fails (excl.normal power failure)	1.90E-05/H	4.06E+00
BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1.00E-01	2.18E+00
OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1.00E-01	2.18E+00
AEG8796-LKS5#	Air inleakage in SRAT offgas detector #2 sample line	1.64E-03	1.86E+00
AEG8796-FLO5#	SRAT offgas detector #2 analyzer element fails low (LEL)	2.15E-03	1.86E+00
AEG8795-LKS5#	Air inleakage in SRAT offgas detector #1 sample line	1.64E-03	1.86E+00
AEG8795-FLO5#	SRAT offgas detector #1 analyzer element fails low (LEL)	2.15E-03	1.86E+00
OPR8796-MCH2#	SRAT offgas detector #2 out of calibration	3.60E-03	1.86E+00
OPR8795-MCH2#	SRAT offgas detector #1 out of calibration	3.60E-03	1.86E+00
TOPCTWP-BFLB+-IC	CTW primary pumping failure (excl. POWN)	6.29E-06/H	1.63E+00
FCV3000-FCL5+-IC	Steam supply flow control valve FCV3000 fails closed	1.00E-06/H	1.58E+00
PCV3004-FCLG+-IC	SRAT steam pressure control valve fails closed	3.00E-06/H	1.58E+00
TOPSTEAMBFLG+-IC	Inadequate steam presure (excl. POWN or INAIR)	2.08E-04/H	1.58E+00
FE-3034-FHI2+-IC	SRAT purge flow element fails high	3.00E-06/H	1.37E+00
TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	3.10E-03	1.20E+00
FCV3034-FCL2+-IC	SRAT purge flow control valve fails closed	1.00E-06/H	1.17E+00
SRABATCHPRE5+-I	New batch of sludge for DWPF	5.68E-05/H	1.13E+00
TOPDEEP-BFLA#	CTW deep well pumping failure	5.40E-03	1.13E+00
TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1.10E-02	1.06E+00
CC3SRAT-FSLD#	CC: all 3 SRAT offgas flow monitors fail to close	1.10E-04	1.04E+00
OPRMAINTMCH1#	cc: all 3 SRAT low flow switches miscalibrated	3.00E-02	1.04E+00
TX-SRAT-PRE5+-IC	Transfer from PRBT to SRAT	9.41E-03/H	1.03E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) x (risk achievement worth).

Explosion in SRAT
Top Event Frequency: 1.02E-03/YR

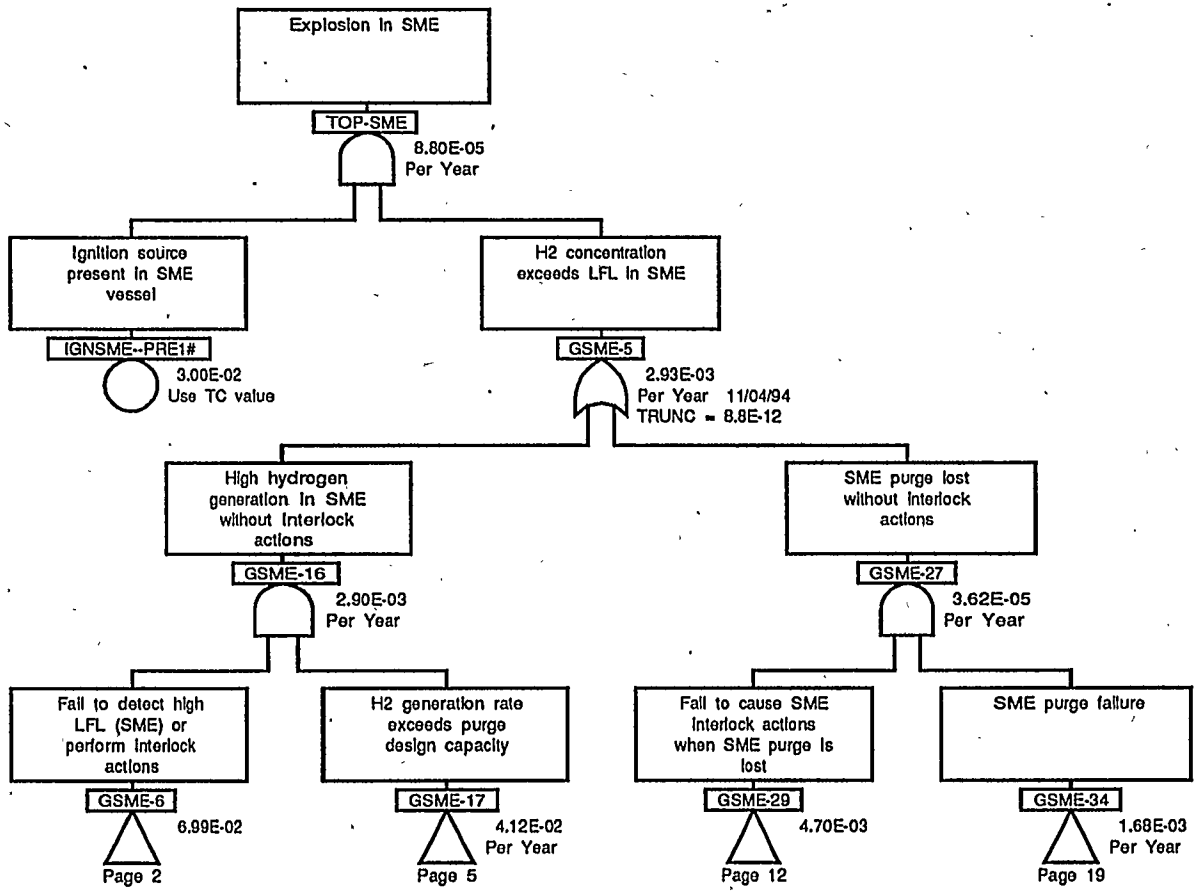
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
*IGNSRAT-PRE1#	Ignition source present in SRAT	3.00E-02	0.00E+00
TX-NITR-PRE5+-I	Transfer nitric acid into SRAT	1.19E-02/H	7.57E+00
OPRSRAT-NCN1#	Error in nitric acid calculation by technical	3.00E-02	4.74E+00
TOPPSW--BFLF#	Inadequate cooling water (excl. POWN & POWD or CTW)	2.30E-03	1.37E+00
CC2SRAT-LFL5#	cc: both SRAT LFL detectors fail low	1.80E-03	1.26E+00
AEGSRAT-LKS5#	Air inleakage in SRAT sampling line (both detectors)	1.64E-03	1.24E+00
AX-8795-BFL5#	SRAT %LFL calculation switch failure	1.29E-03	1.18E+00
OPRBATCHNCH1#	STA incorrectly assesses PHA requirements	1.00E-01	1.15E+00
BCHSRAT-PRE5+-I	SRAT batch processed	5.90E-03/H	1.15E+00
BCHSRAT-DBL5#	SRAT process uses double batch of PHA	1.00E-01	1.15E+00
HCV3010-FTOF#	SRAT cooling water supply valve HCV3010 fails to open	1.00E-03	1.13E+00
OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	3.00E-03	1.09E+00
TOPINAIRBFLV+-IC	Instrument air failure (excl CTW or POWN/POWD)	1.10E-05/H	1.03E+00
FCV3000-FTCG#	SRAT steam supply valve fails to close	1.29E-04	1.02E+00

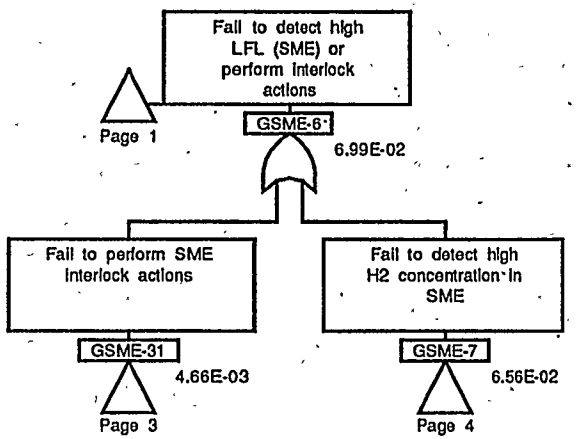
* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

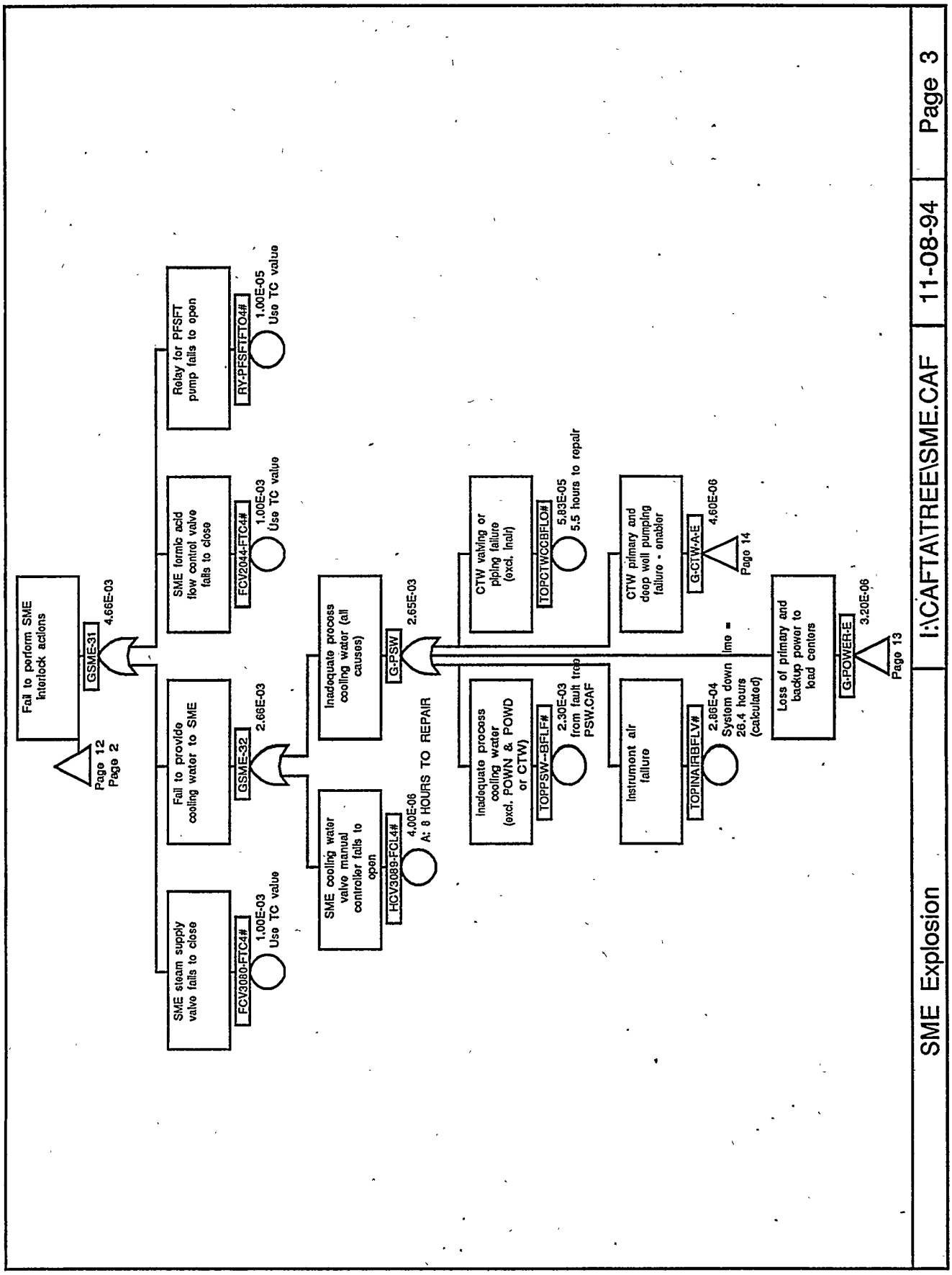
SME Explosion

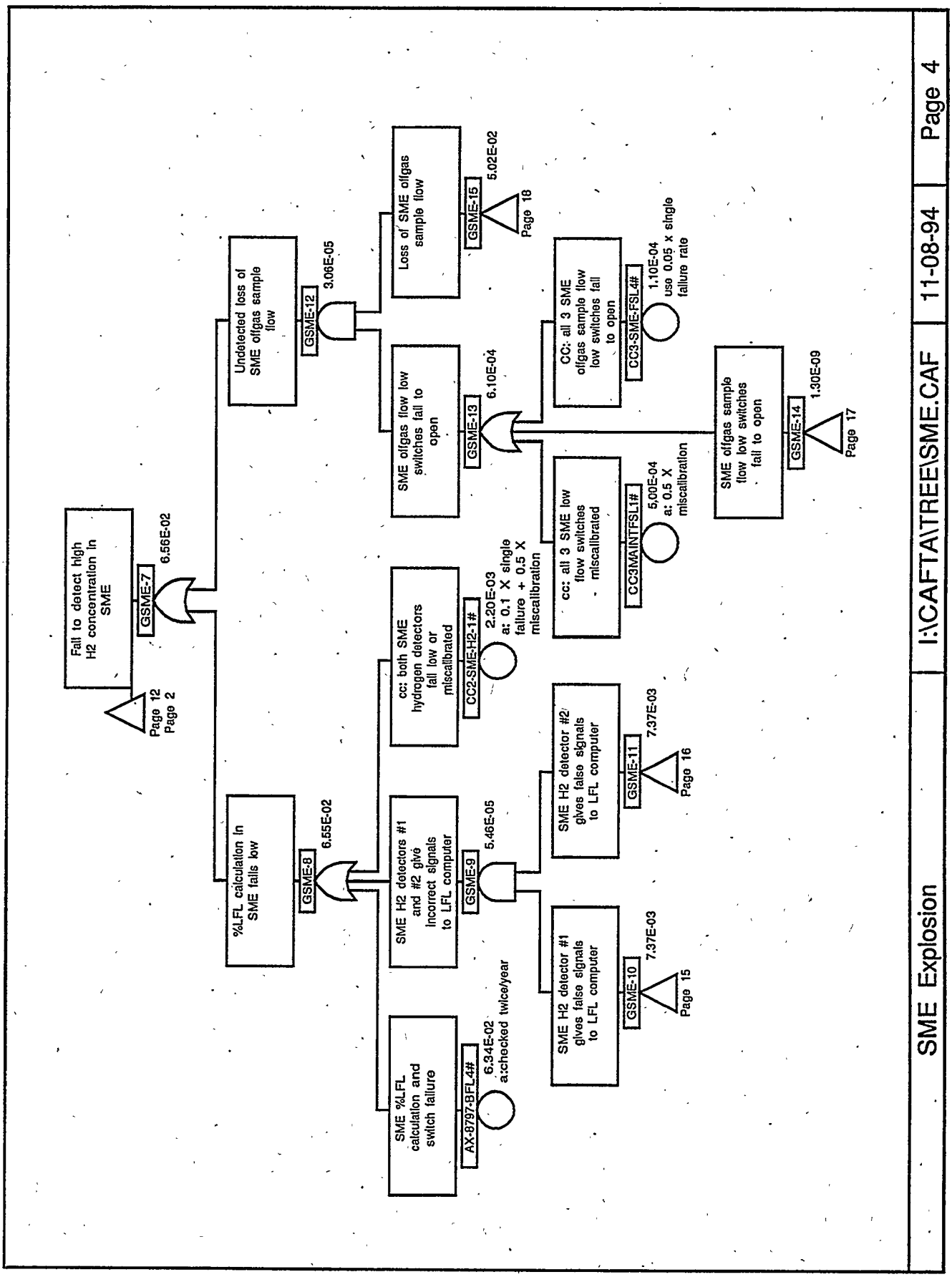


SME Explosion	I:\CAFTA\TREE\SME.CAF	11-08-94	Page 1



SME Explosion	I:\CAFTA\TREE\SME.CAF	11-08-94	Page 2


SME Explosion
I:\CAFTA\TREE\SME.CAF
11-08-94
Page 3
Fail to perform SME interlock actions
GSME-31
4.66E-03
Page 12
Page 2
Fail to provide cooling water to SME
GSME-32
2.66E-03
SME steam supply valve fails to close
FCV3080-FTC4#
1.00E-03
Use TC value
SME cooling water valve manual controller fails to open
HCV3089-FCL4#
4.00E-06
A: 8 HOURS TO REPAIR
Inadequate process cooling water (all causes)
G-PSW
2.65E-03
SME formic acid flow control valve fails to close
FCV2044-FTC4#
1.00E-03
Use TC value
Relay for PFSFT pump fails to open
RY-PFSFTFTO4#
1.00E-05
Use TC value
Inadequate process cooling water (excl. POWN & POWD or CTW)
TOPPSW--BFLF#
2.30E-03
from fault tree PSW.CAF
CTW valving or piping failure (excl. inair)
TOPCTWCCBFLO#
5.83E-05
5.5 hours to repair
Instrument air failure
TOPINAIRBFLV#
2.86E-04
System down 26.4 hours (calculated)
CTW primary and deep well pumping failure - enabler
G-CTW-A-E
4.60E-06
Page 14
Loss of primary and backup power to load centers
G-POWER-E
3.20E-06
Page 13
time =


Fail to detect high H2 concentration in SME
GSME-7
6.56E-02
Page 12
Page 2
%LFL calculation in SME fails low
GSME-8
6.55E-02
Undetected loss of SME offgas sample flow
GSME-12
3.06E-05
SME %LFL calculation and switch failure
AX-8797-BFL4#
6.34E-02
a:checked twice/year
SME H2 detectors #1 and #2 give incorrect signals to LFL computer
GSME-9
5.46E-05
cc: both SME hydrogen detectors fail low or miscalibrated
CC2-SME-H2-1#
2.20E-03
a: 0.1 X single failure + 0.5 X miscalibration
SME H2 detector #1 gives false signals to LFL computer
GSME-10
7.37E-03
Page 15
SME H2 detector #2 gives false signals to LFL computer
GSME-11
7.37E-03
Page 16
Loss of SME offgas sample flow
GSME-15
5.02E-02
Page 18
SME offgas flow low switches fail to open
GSME-13
6.10E-04
cc: all 3 SME low flow switches - miscalibrated
CC3MAINTFSL1#
5.00E-04
a: 0.5 X miscalibration
CC: all 3 SME offgas sample flow low switches fail to open
CC3-SME-FSL4#
1.10E-04
use 0.05 x single failure rate
SME offgas sample flow low switches fail to open
GSME-14
1.30E-09
Page 17
SME Explosion
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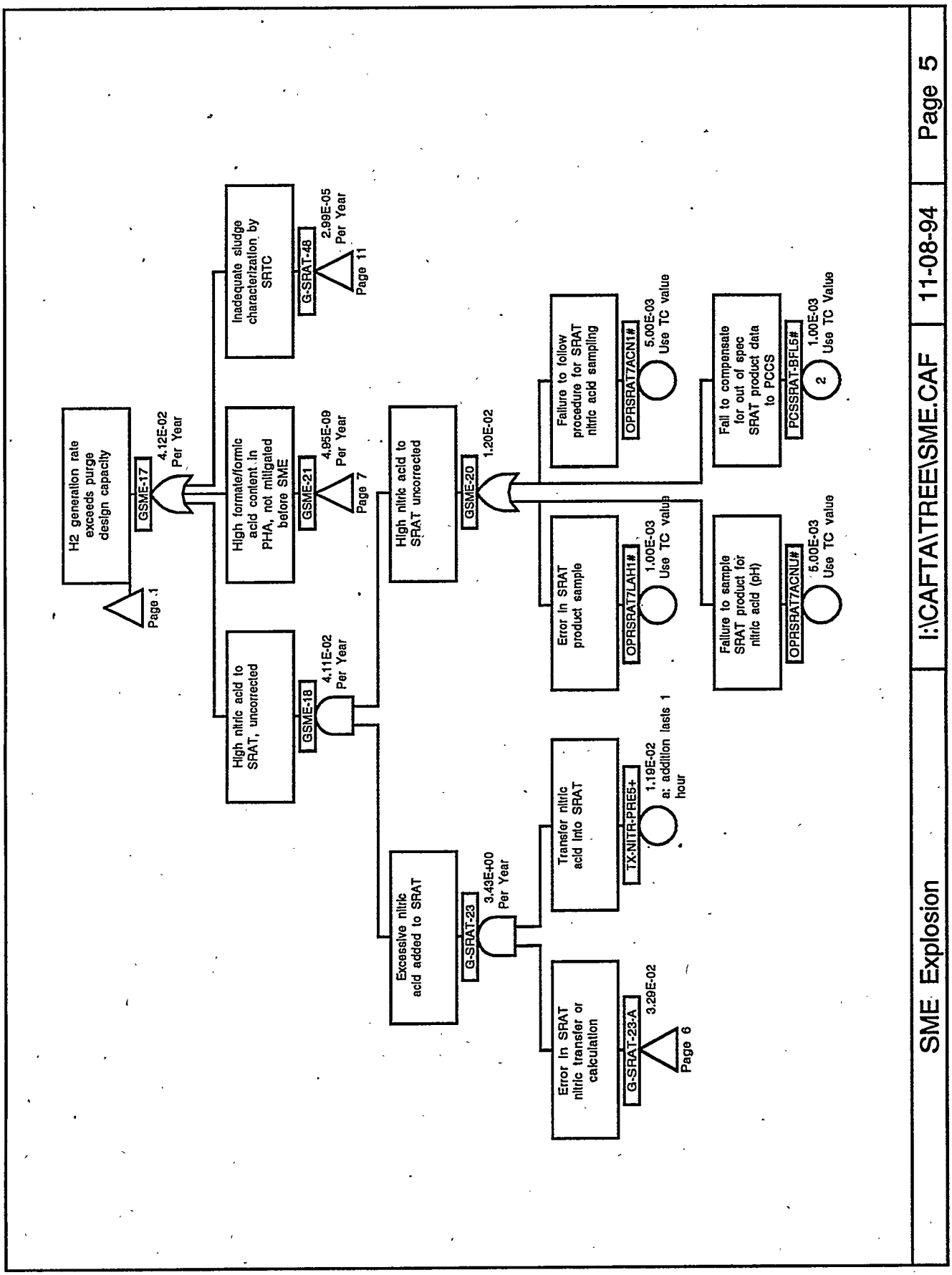
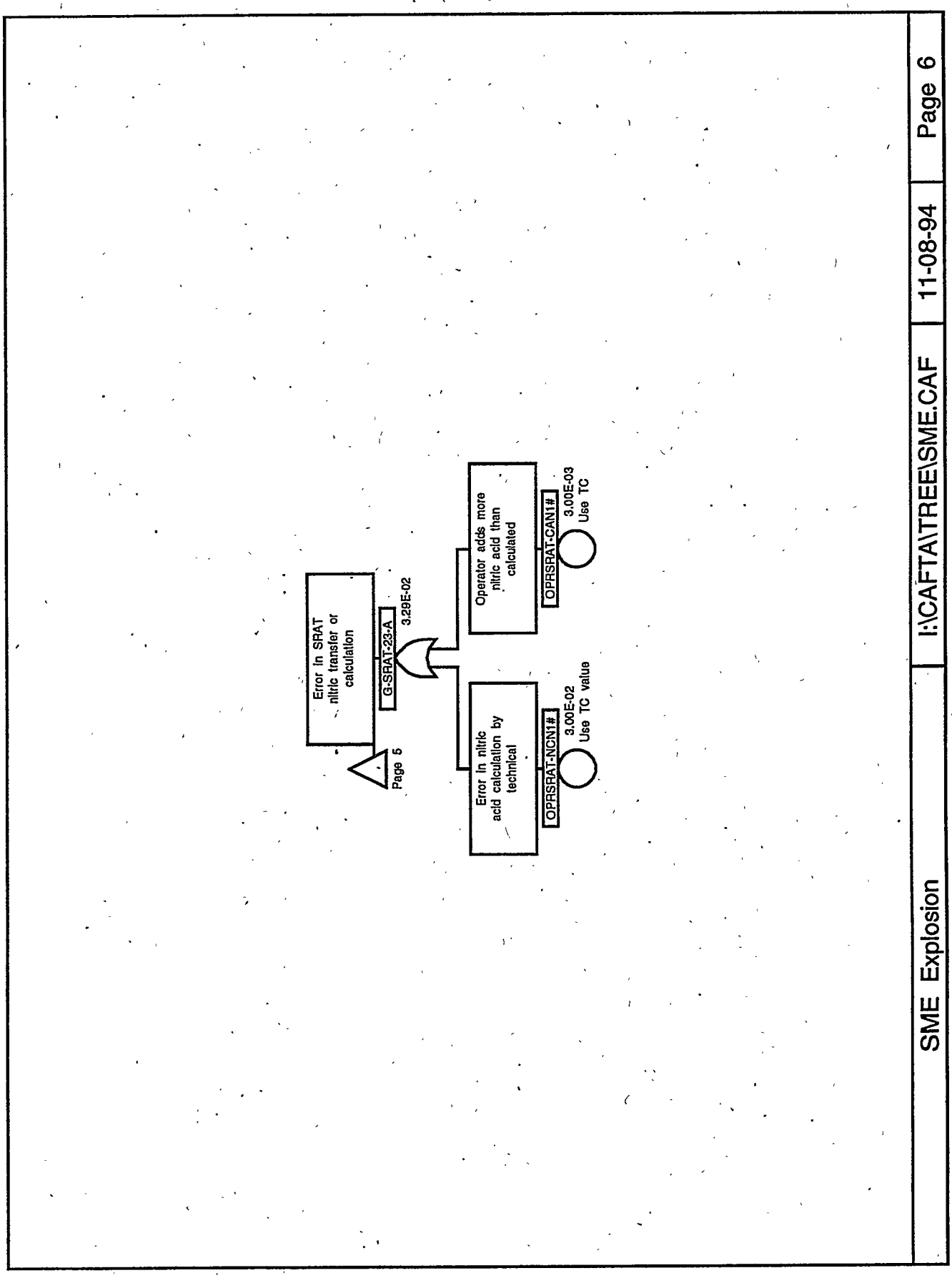
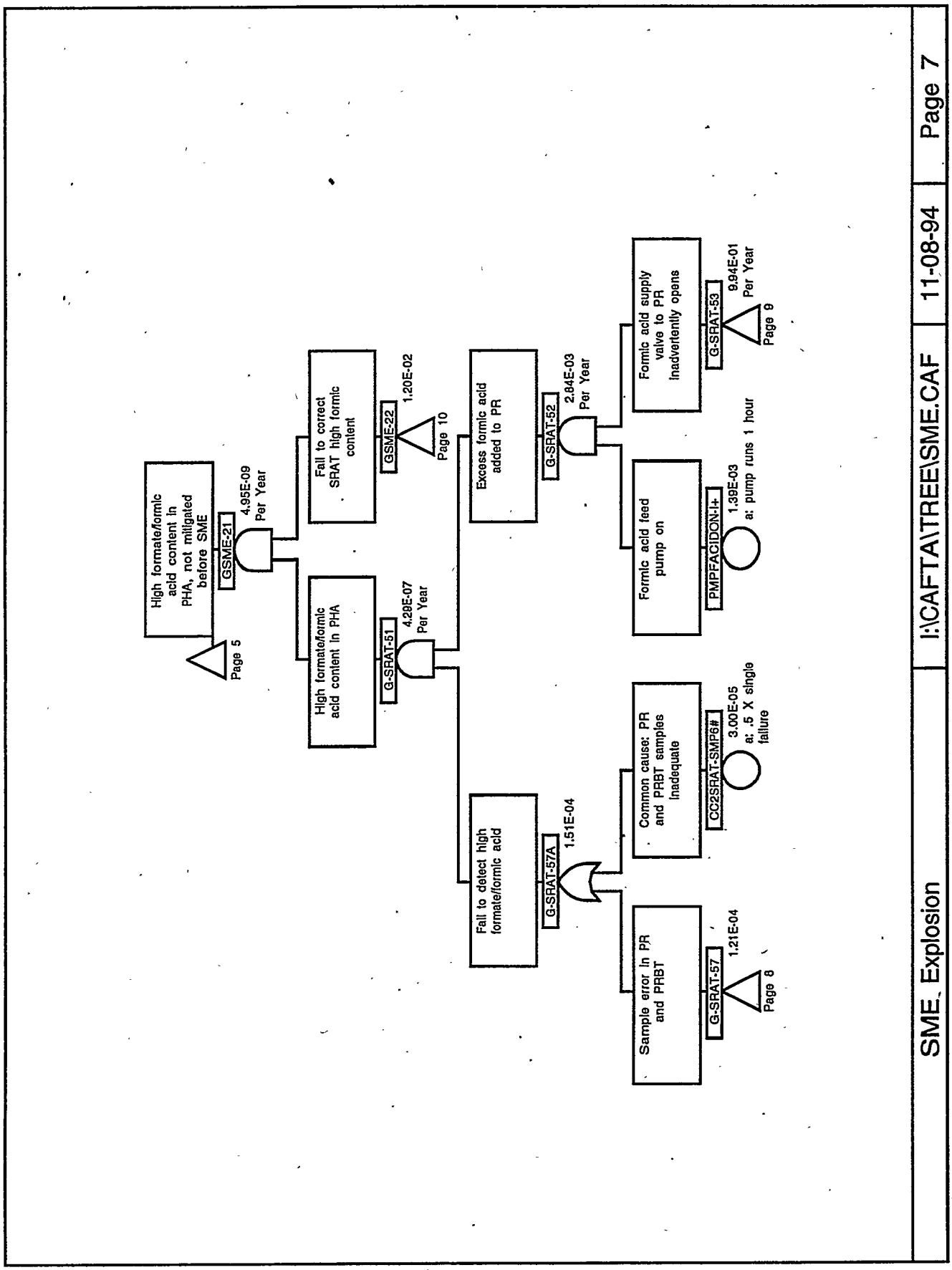

SME Explosion
I:\CAFTA\TREE\SME.CAF
11-08-94
Page 5
H2 generation rate exceeds purge design capacity
GSME-17
4.12E-02 Per Year
Page 1
High nitric acid to SRAT, uncorrected
GSME-18
4.11E-02 Per Year
High formate/formic acid content in PHA, not mitigated before SME
GSME-21
4.85E-09 Per Year
Page 7
Inadequate sludge characterization by SRTC
G-SRAT-48
2.99E-05 Per Year
Page 11
High nitric acid to SRAT uncorrected
GSME-20
1.20E-02
Excessive nitric acid added to SRAT
G-SRAT-23
3.43E+00 Per Year
Error in SRAT nitric transfer or calculation
G-SRAT-23-A
3.29E-02
Page 6
Transfer nitric acid into SRAT
TX:NITR-PRE6+
1.19E-02
a: addition lasts 1 hour
Error in SRAT product sample
OPRSRAT7LAH1#
1.00E-03
Use TC value
Failure to follow procedure for SRAT nitric acid sampling
OPRSRAT7ACN1#
5.00E-03
Use TC value
Failure to sample SRAT product for nitric acid (pH)
OPRSRAT7ACNU#
5.00E-03
Use TC value
Fail to compensate for out of spec SRAT product data to PCCS
PCSSRAT-BFL5#
2
1.00E-03
Use TC Value


SME Explosion
I:\CAFTA\TREE\SME.CAF
11-08-94
Page 6
Error in SRAT nitric transfer or calculation
G-SRAT-23-A
3.29E-02
Page 5
Operator adds more nitric acid than calculated
OPRSRAT-CAN1#
3.00E-03
Use TC
Error in nitric acid calculation by technical
OPRSRAT-NCN1#
3.00E-02
Use TC value


SME_Explosion
I:\CAFTA\TREE\SME.CAF
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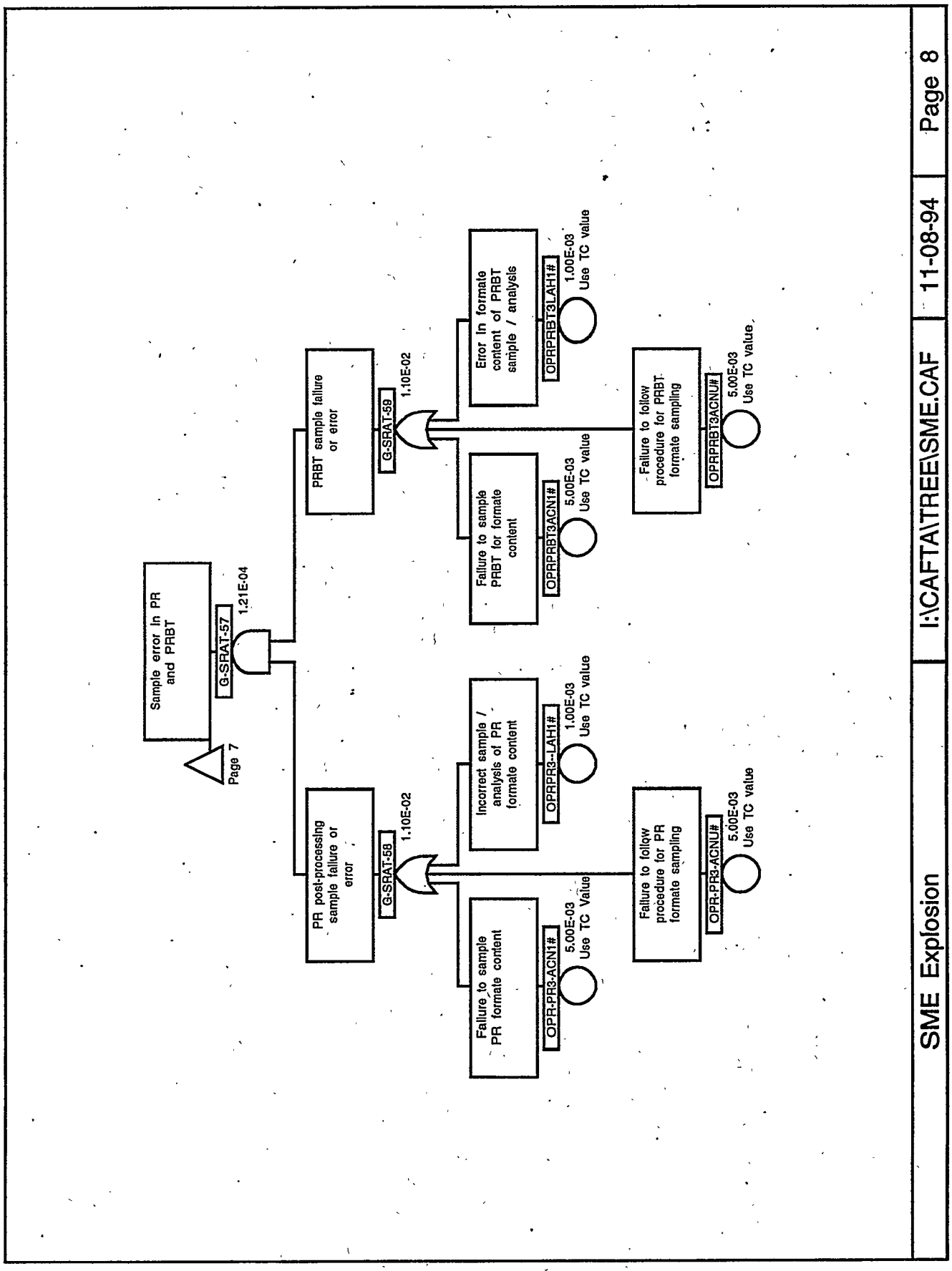
Page 7
High formate/formic acid content in PHA, not mitigated before SME
Page 5
GSME-21
4.95E-09 Per Year
Fail to correct SRAT high formic content
GSME-22
1.20E-02
Page 10
High formate/formic acid content in PHA
G-SRAT-51
4.28E-07 Per Year
Excess formic acid added to PR
G-SRAT-52
2.84E-03 Per Year
Formic acid supply valve to PR inadvertently opens
G-SRAT-53
9.94E-01 Per Year
Page 9
Formic acid feed pump on
PMPFACIDON-I+
1.39E-03
a: pump runs 1 hour
Fail to detect high formate/formic acid
G-SRAT-57A
1.51E-04
Common cause: PR and PRBT samples inadequate
CC2SRAT-SMP6#
3.00E-05
a: .5 X single failure
Sample error in PR and PRBT
G-SRAT-57
1.21E-04
Page 8


SME Explosion
I:\CAFTA\TREE\SME.CAF
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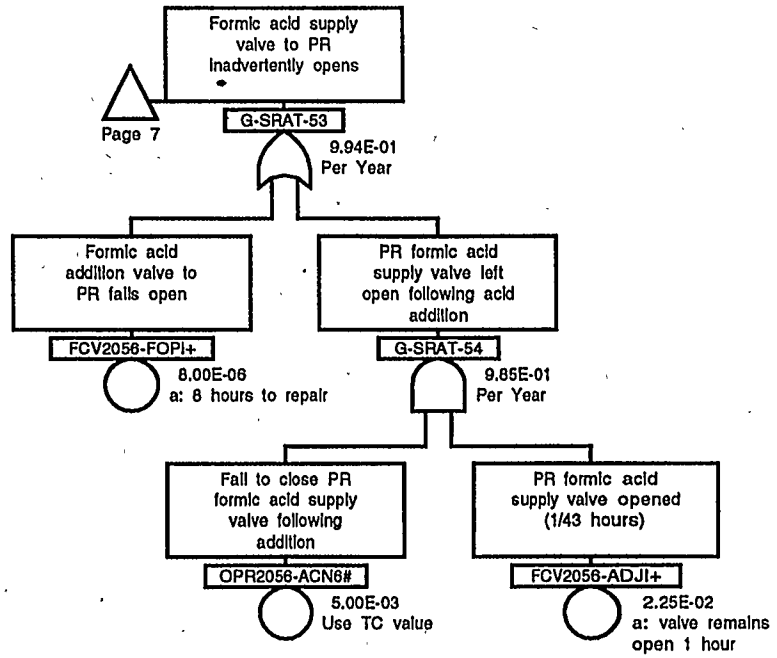
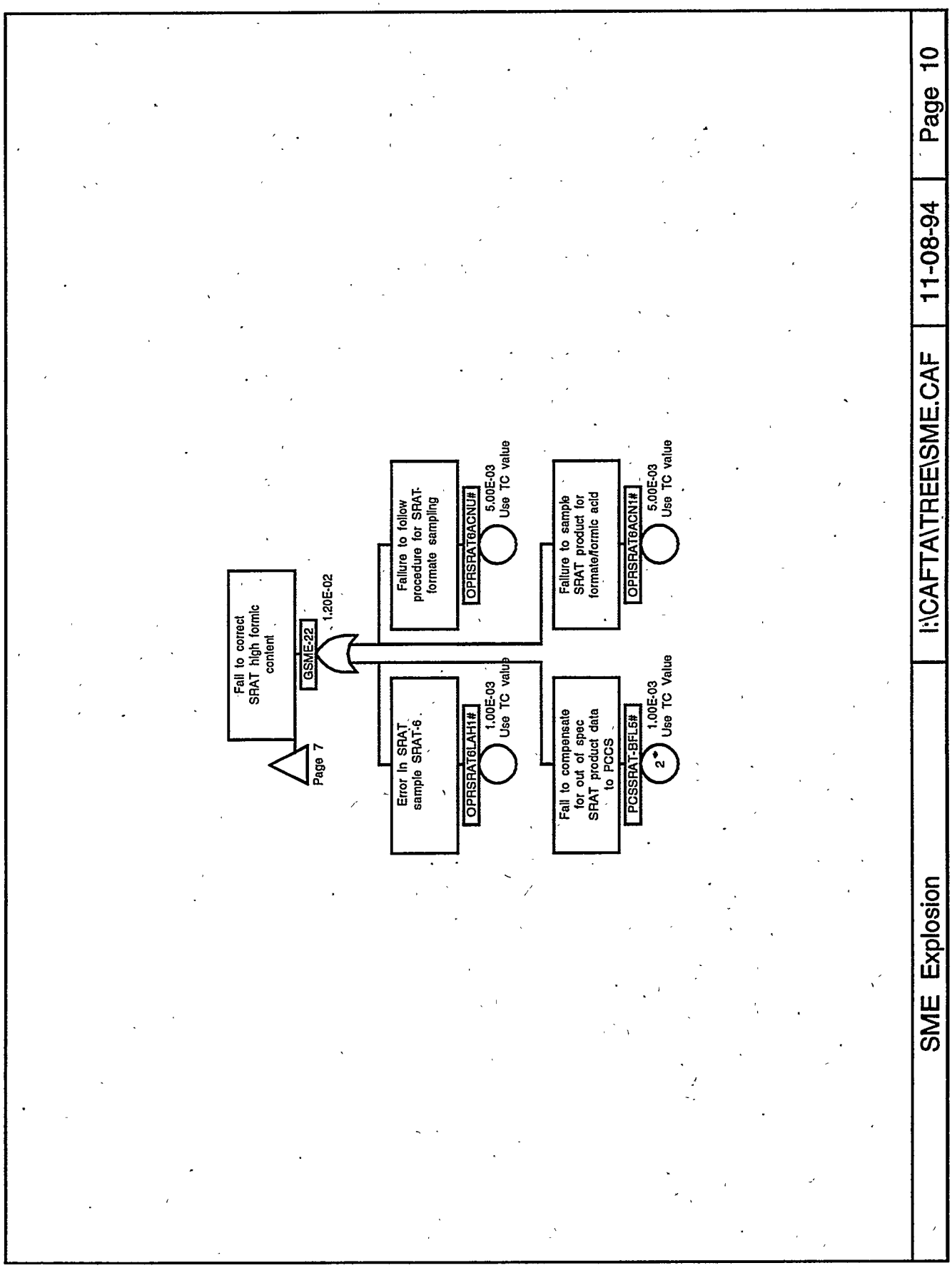
Page 8
Sample error in PR and PRBT
G-SRAT-57
1.21E-04
Page 7
PR post-processing sample failure or error
G-SRAT-58
1.10E-02
Failure to sample PR formate content
OPR-PR3-ACN1#
5.00E-03
Use TC Value
Incorrect sample / analysis of PR formate content
OPRPR3--LAH1#
1.00E-03
Use TC value
Failure to follow procedure for PR formate sampling
OPR-PR3-ACNU#
5.00E-03
Use TC value
PRBT sample failure or error
G-SRAT-59
1.10E-02
Failure to sample PRBT for formate content
OPRPRBT3ACN1#
5.00E-03
Use TC value
Error in formate content of PRBT sample / analysis
OPRPRBT3LAH1#
1.00E-03
Use TC value
Failure to follow procedure for PRBT formate sampling
OPRPRBT3ACNU#
5.00E-03
Use TC value



SME Explosion	I:\CAFTA\TREE\SME.CAF	11-08-94	Page 9


SME Explosion
I:\CAFTA\TREE\SME.CAF
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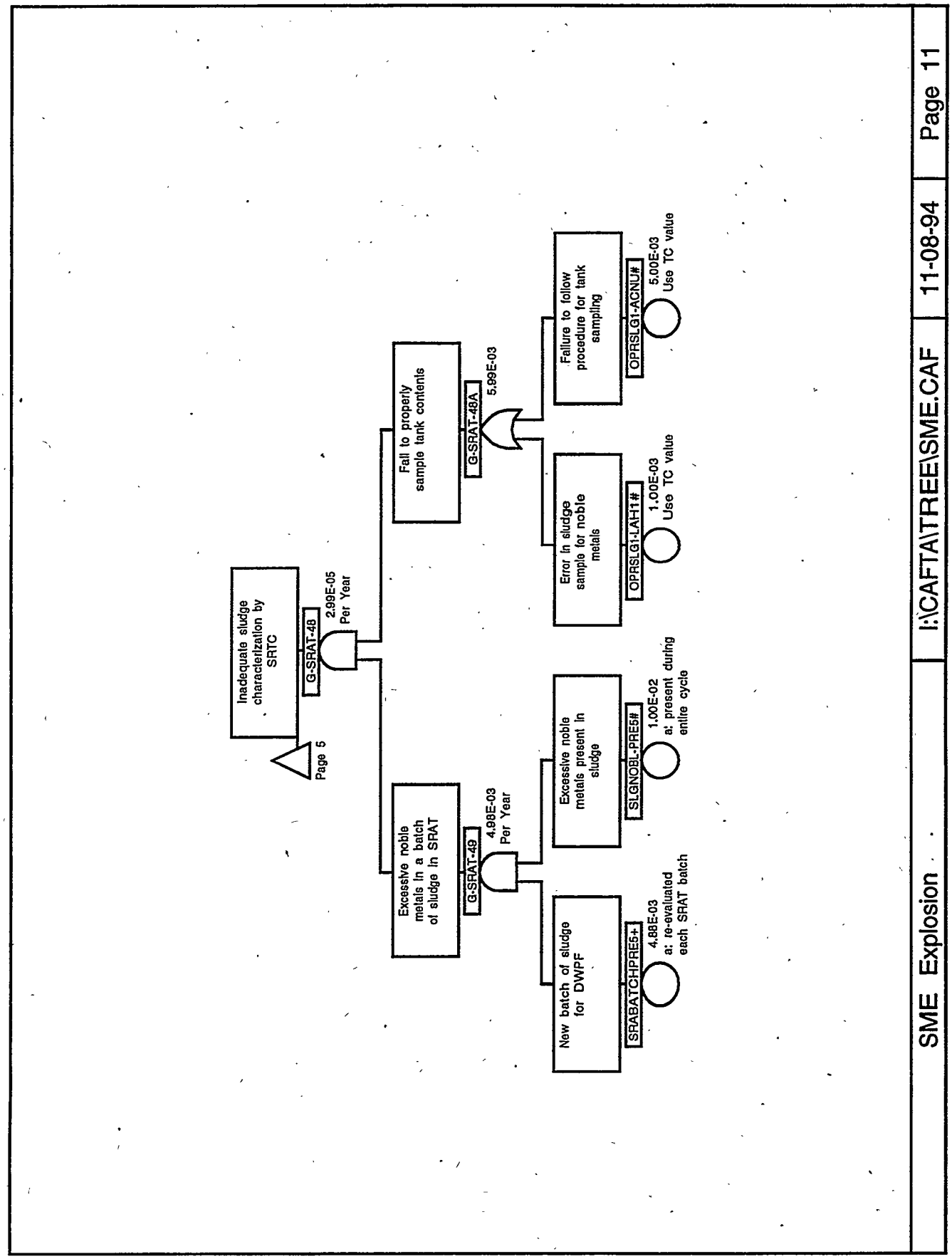
Page 10
Fail to correct SRAT high formic content
GSME-22
1.20E-02
Page 7
Error In SRAT sample SRAT-6
OPRSRAT6LAH1#
1.00E-03
Use TC value
Failure to follow procedure for SRAT-formate sampling
OPRSRAT6ACNU#
5.00E-03
Use TC value
Fail to compensate for out of spec SRAT product data to PCCS
PCSSRAT-BFL5#
2*
1.00E-03
Use TC Value
Failure to sample SRAT product for formate/formic acid
OPRSRAT6ACN1#
5.00E-03
Use TC value


Inadequate sludge characterization by SRTC
Page 5
G-SRAT-48
2.99E-05 Per Year
Excessive noble metals in a batch of sludge in SRAT
Fail to properly sample tank contents
G-SRAT-48A
5.99E-03
G-SRAT-49
4.88E-03 Per Year
New batch of sludge for DWPF
SRABATCHPRE5+
4.88E-03 a: re-evaluated each SRAT batch
Excessive noble metals present in sludge
SLGNOBL-PRE5#
1.00E-02 a: present during entire cycle
Error in sludge sample for noble metals
OPRSLG1-LAH1#
1.00E-03 Use TC value
Failure to follow procedure for tank sampling
OPRSLG1-ACNU#
5.00E-03 Use TC value
SME Explosion
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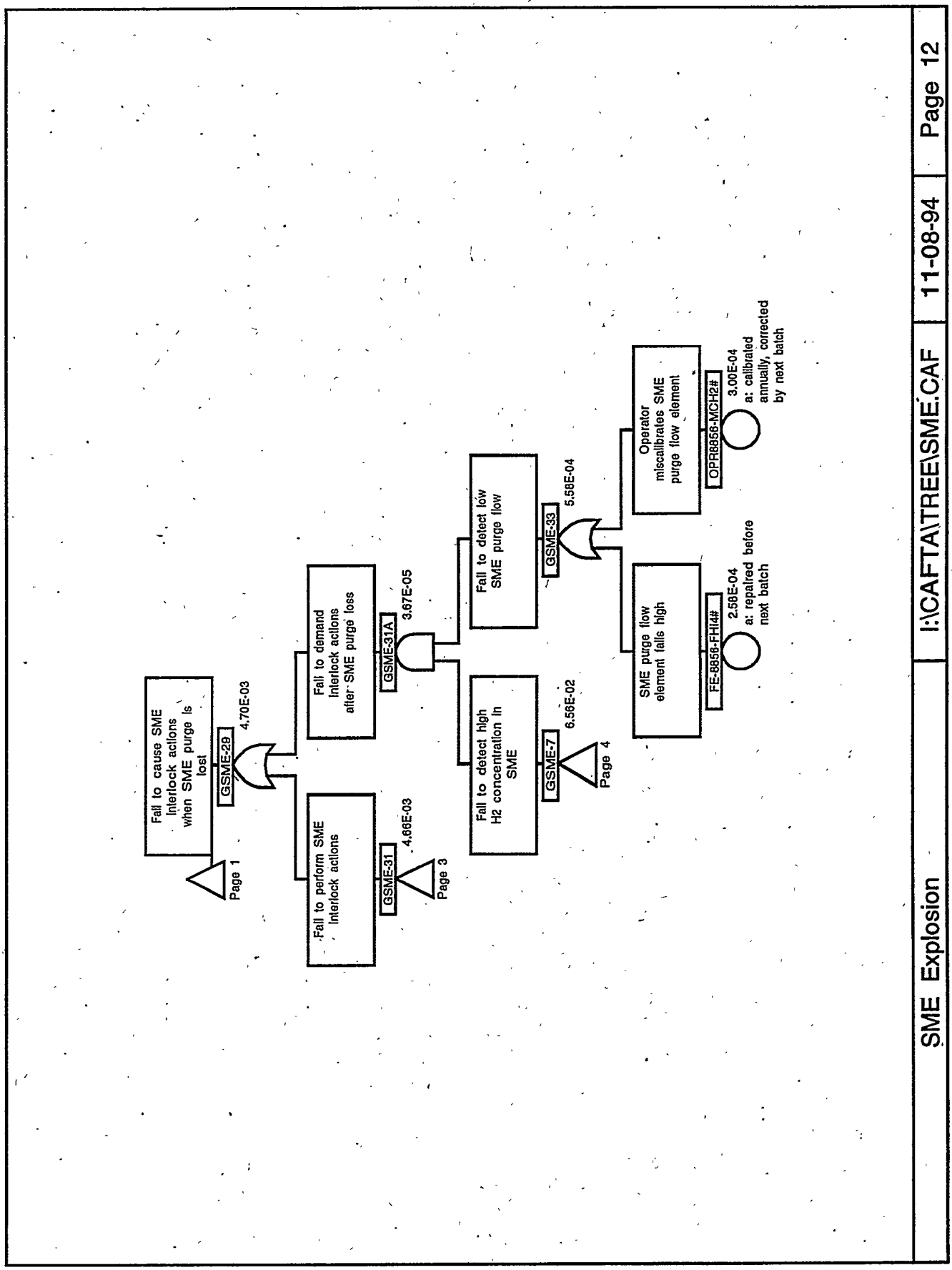
Fail to cause SME Interlock actions when SME purge is lost
GSME-28
4.70E-03
Page 1
Fail to perform SME Interlock actions
GSME-31
4.66E-03
Page 3
Fail to demand Interlock actions after SME purge loss
GSME-31A
3.67E-05
Fail to detect high H2 concentration in SME
GSME-7
6.56E-02
Page 4
Fail to detect low SME purge flow
GSME-33
5.58E-04
SME purge flow element fails high
FE-8858-FH14#
2.58E-04
a: repaired before next batch
Operator miscalibrates SME purge flow element
OPR8858-MCH2#
3.00E-04
a: calibrated annually, corrected by next batch
SME Explosion
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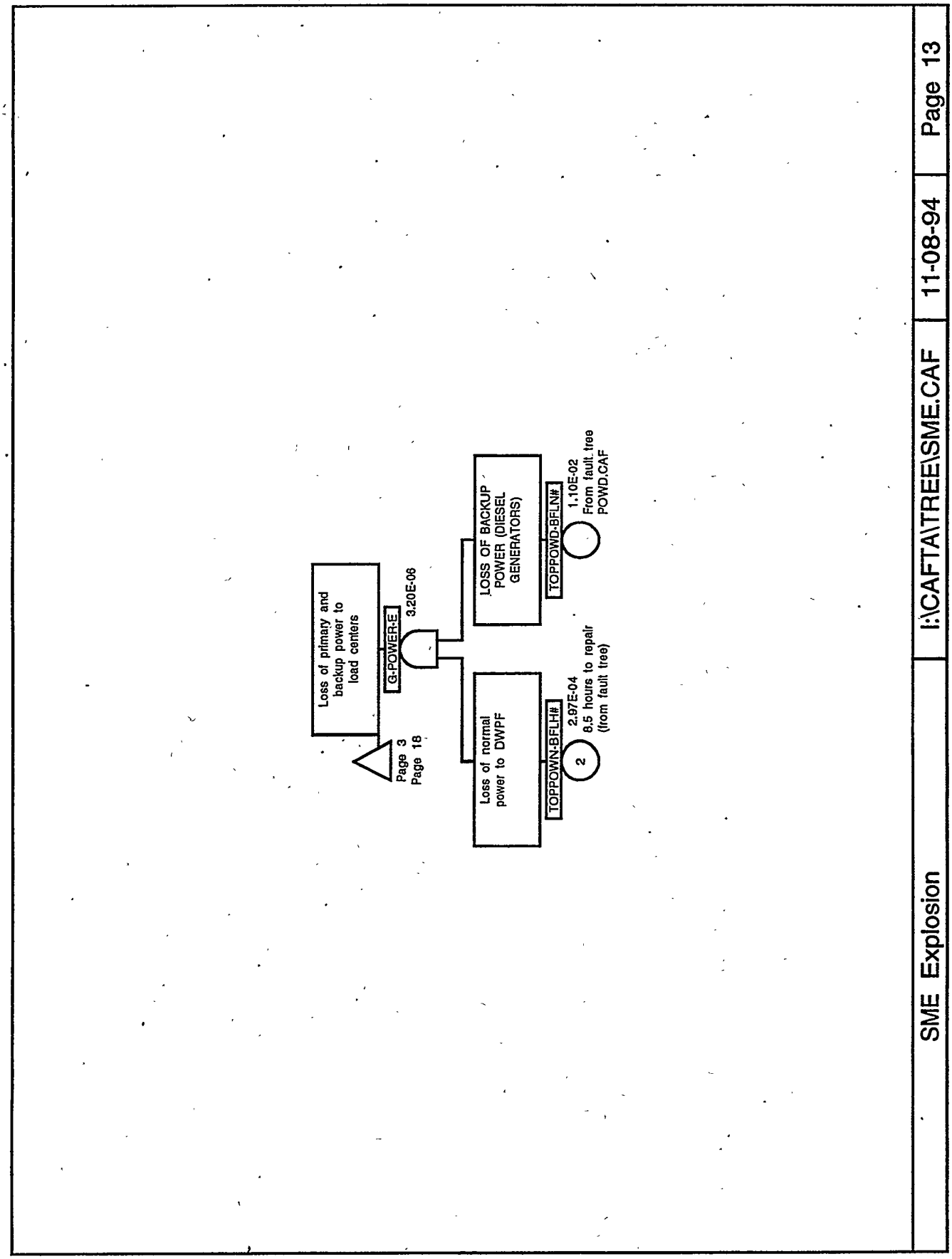
Loss of primary and backup power to load centers
G-POWER-E
3.20E-06
Page 3
Page 18
LOSS OF BACKUP POWER (DIESEL GENERATORS)
TOPPOWD-BFLN#
1.10E-02
From fault tree POWD.CAF
Loss of normal power to DWPF
TOPPOWN-BFLH#
2.97E-04
8.5 hours to repair (from fault tree)
2
SME Explosion
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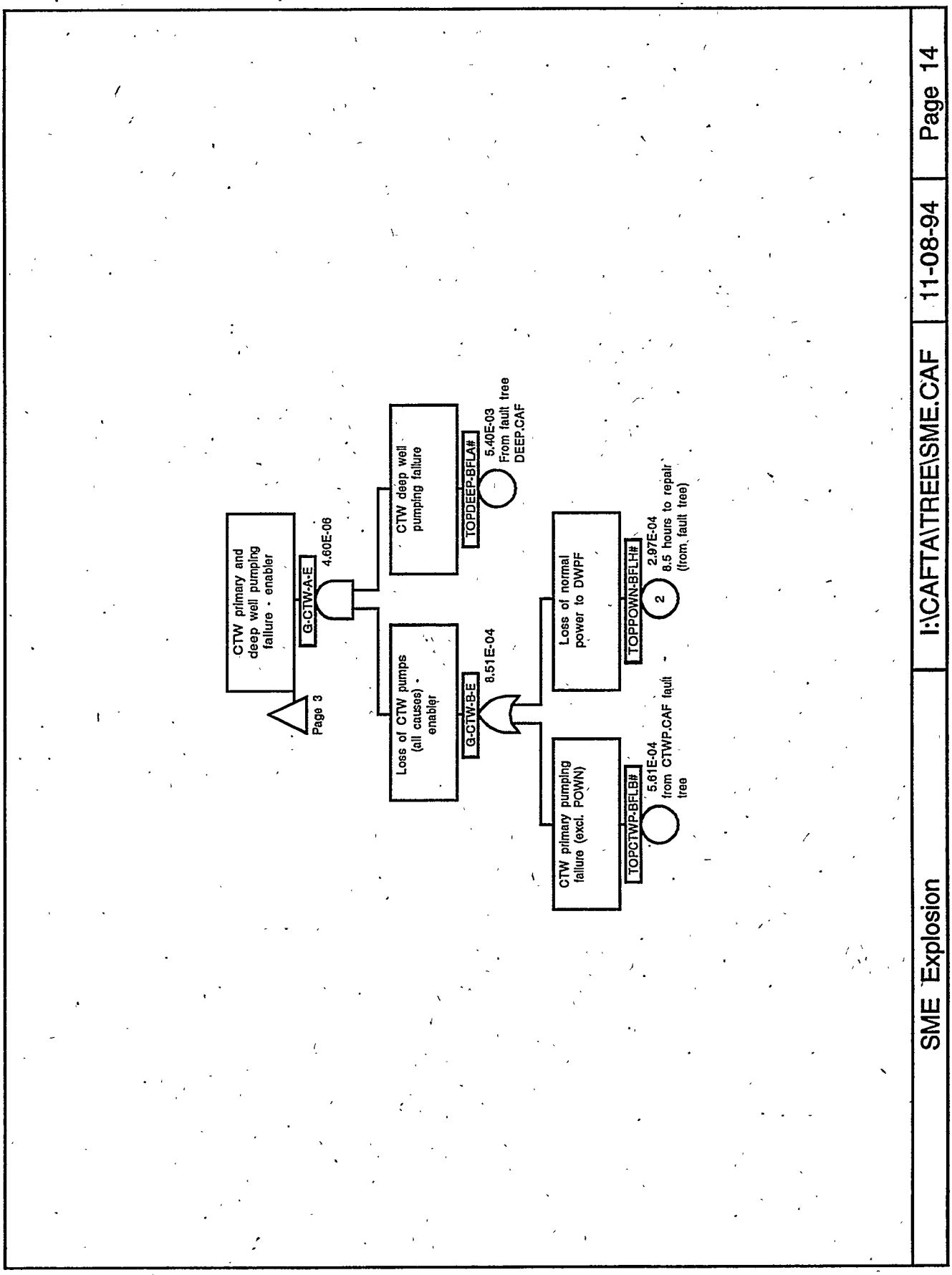
CTW primary and deep well pumping failure - enabler
G-CTW-A-E
4.60E-06
Page 3
CTW deep well pumping failure
TOPDEEP-BFLA#
5.40E-03
From fault tree DEEP.CAF
Loss of CTW pumps (all causes) - enabler
G-CTW-B-E
8.51E-04
Loss of normal power to DWPF
TOPPOWN-BFLH#
2.97E-04
8.5 hours to repair (from fault tree)
2
CTW primary pumping failure (excl. POWN)
TOPCTWP-BFLB#
5.61E-04
from CTWP.CAF fault tree
SME Explosion
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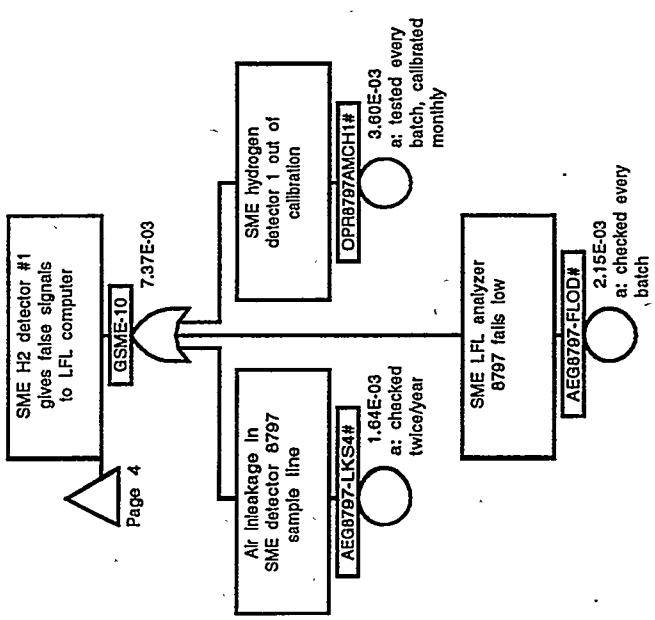
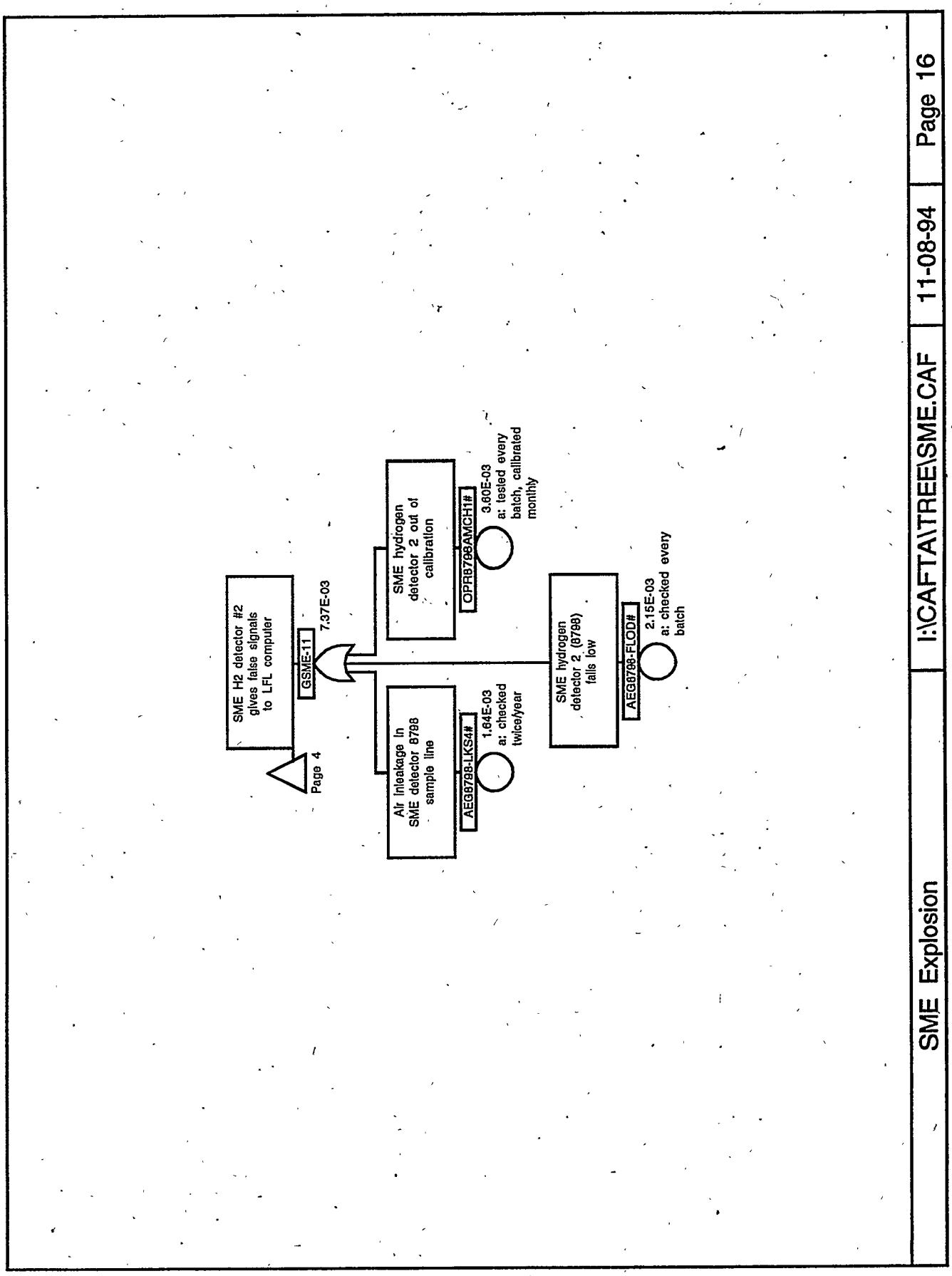


SME Explosion | I:\CAFTA\TREE\SME.CAF | 11-08-94 | Page 15


SME Explosion
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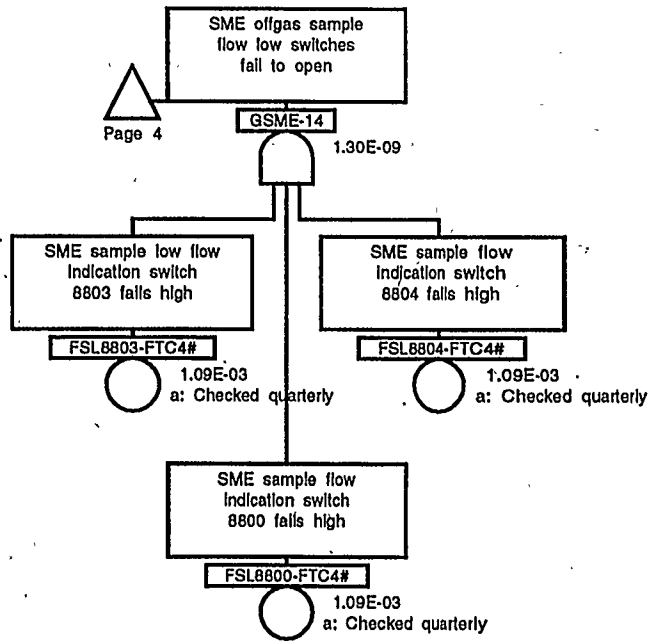
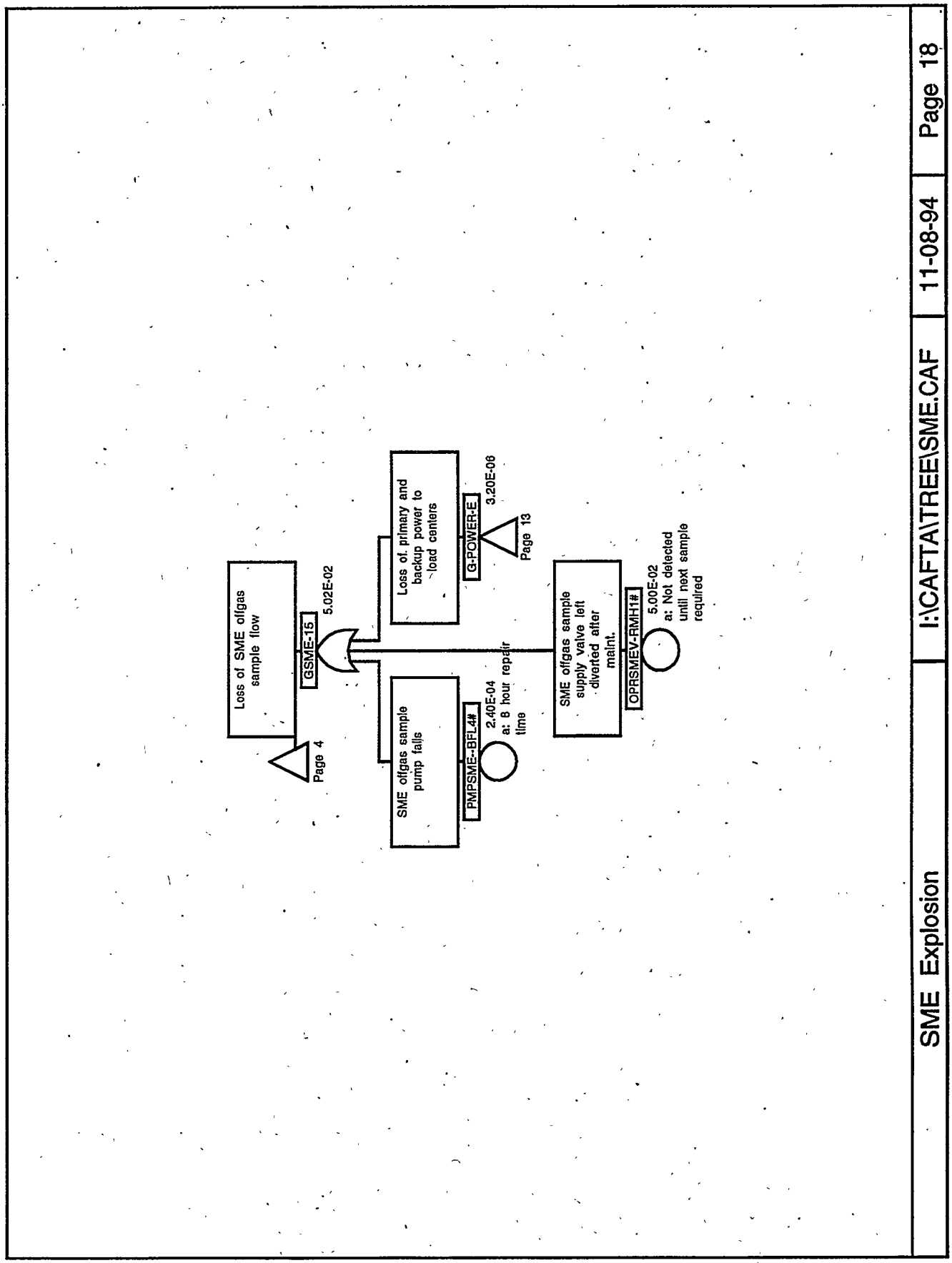
Page 16
SME H2 detector #2 gives false signals to LFL computer
GSME-11
7.37E-03
Page 4
Air Inleakage In SME detector 8798 sample line
AEG8798-LKS4#
1.64E-03
a: checked twice/year
SME hydrogen detector 2 out of calibration
OPR8798AMCH1#
3.60E-03
a: tested every batch, calibrated monthly
SME hydrogen detector 2 (8798) falls low
AEG8798-FLOD#
2.15E-03
a: checked every batch



SME Explosion	I:\CAFTA\TREE\SME.CAF	11-08-94	Page 17


SME Explosion
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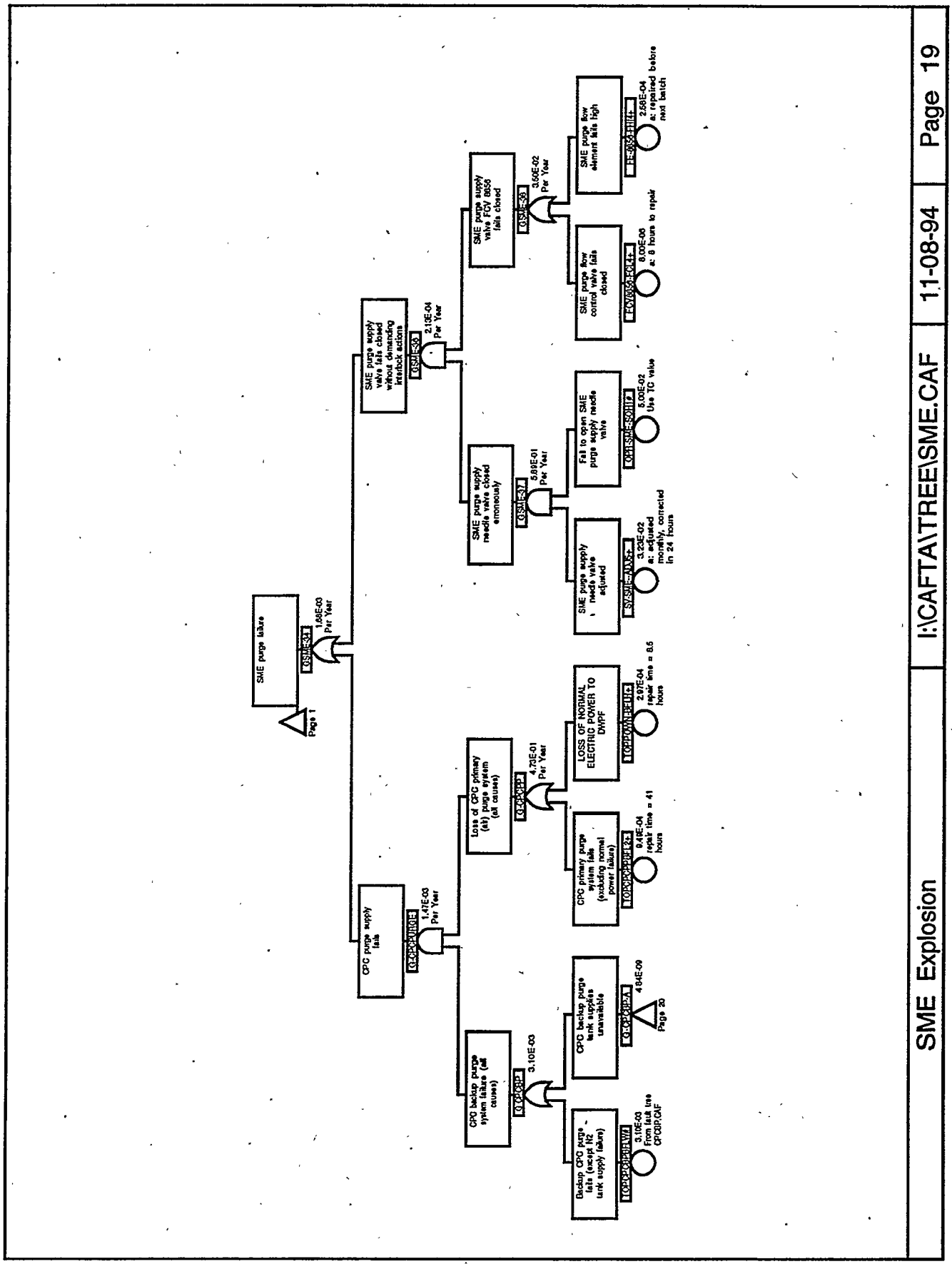
Page 18
Loss of SME offgas sample flow
GSME-15
5.02E-02
Page 4
SME offgas sample pump fails
PMPSME--BFL4#
2.40E-04
a: 8 hour repair time
Loss of primary and backup power to load centers
G-POWER-E
3.20E-06
Page 13
SME offgas sample supply valve left diverted after maint.
OPRSMEV-RMH1#
5.00E-02
a: Not detected until next sample required


SME Explosion
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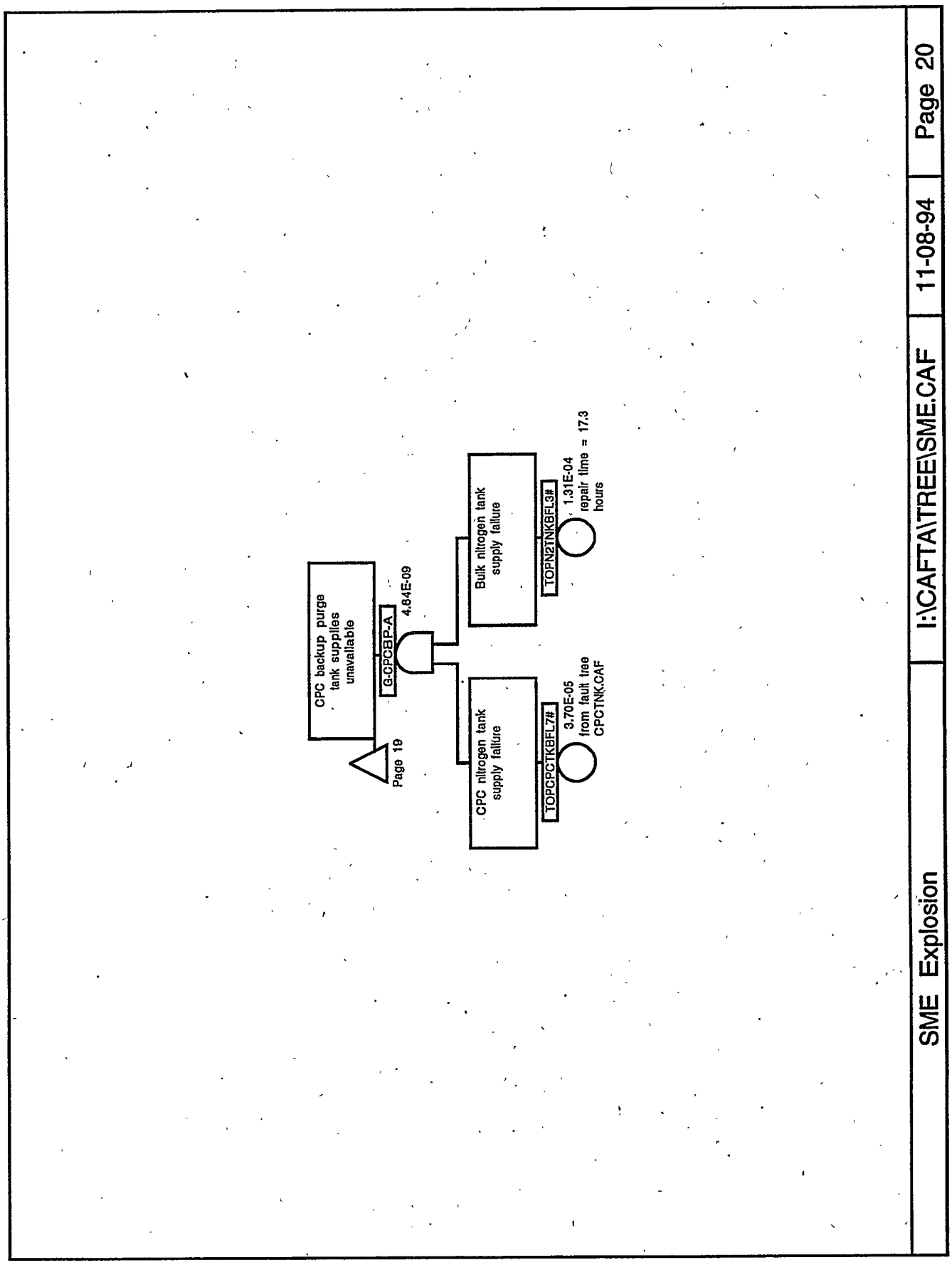
Page 19
SME purge failure
Page 1
1.98E-00 Per Year
CPC purge supply fails
1.47E-03 Per Year
Loss of CPC primary (air) purge system (all causes)
4.70E-01 Per Year
CPC primary purge system fails (excluding normal power failure)
9.4E-04 repair time = 41 hours
LOSS OF NORMAL ELECTRIC POWER TO DWPF
2.9E-04 repair time = 8.5 hours
CPC backup purge system failure (all causes)
3.10E-03
CPC backup purge tank supplies unavailable
4.84E-06
Page 20
Backup CPC purge fails (except N2 tank supply failure)
3.10E-03 From fault tree CPCBP.CAF
SME purge supply valve fails closed without demanding interlock actions
2.13E-04 Per Year
SME purge supply needle valve closed erroneously
5.89E-01 Per Year
SME purge supply needle valve adjusted
3.20E-02 a: adjusted monthly, corrected in 24 hours
Fail to open SME purge supply needle valve
5.00E-02 Use TC valve
SME purge supply valve FGV 8656 fails closed
3.00E-02 Per Year
SME purge flow control valve fails closed
8.00E-06 a: 8 hours to repair
SME purge flow element fails high
2.58E-04 a: repaired before next batch


CPC backup purge tank supplies unavailable
G-CPCBP-A
4.84E-09
Page 19
CPC nitrogen tank supply failure
TOPCPCTKBFL7#
3.70E-05
from fault tree CPCTNK.CAF
Bulk nitrogen tank supply failure
TOPN2TNKBFL3#
1.31E-04
repair time = 17.3 hours
SME Explosion
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Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
AEG8797-FLOD#	15		G-SRAT-51	7		GSME-34	1		PCSSRAT-BFL5#	10	
AEG8797-LKS4#	15		G-SRAT-52	7		GSME-34	19		PMPFACIDON-I+	7	
AEG8798-FLOD#	16		G-SRAT-53	7		GSME-36	19		PMPSME--BFL4#	18	
AEG8798-LKS4#	16		G-SRAT-53	9		GSME-37	19		RY-PFSFTFTO4#	3	
AX-8797-BFL4#	4		G-SRAT-54	9		GSME-38	19		SLGNOBL-PRE5#	11	
CC2-SME-H2-1#	4		G-SRAT-57	7		GSME-5	1		SRABATCHPRE5+	11	
CC2SRAT-SMP6#	7		G-SRAT-57	8		GSME-6	1		SV-SME--ADJ5+	19	
CC3-SME-FSL4#	4		G-SRAT-57A	7		GSME-6	2		TOP-SME	1	
CC3MAINTFSL1#	4		G-SRAT-58	8		GSME-7	2		TOPCPCBPBFLW#	19	
FCV2044-FTC4#	3		G-SRAT-59	8		GSME-7	4		TOPCPCPPBFL2+	19	
FCV2056-ADJI+	9		GSME-10	4		GSME-7	12		TOPCPCTKBFL7#	20	
FCV2056-FOPI+	9		GSME-10	15		GSME-8	4		TOPCTWCCBFLO#	3	
FCV3080-FTC4#	3		GSME-11	4		GSME-9	4		TOPCTWP-BFLB#	14	
FCV8856-FCL4+	19		GSME-11	16		HCV3089-FCL4#	3		TOPDEEP-BFLA#	14	
FE-8856-FHI4#	12		GSME-12	4		IGNSME--PRE1#	1		TOPINAIRBFLV#	3	
FE-8856-FHI4+	19		GSME-13	4		OPR-PR3-ACN1#	8		TOPN2TNKBFL3#	20	
FSL8800-FTC4#	17		GSME-14	4		OPR-PR3-ACNU#	8		TOPPOWD-BFLN#	13	
FSL8803-FTC4#	17		GSME-14	17		OPR-SME-SOH1#	19		TOPPOWN-BFLH#	13	
FSL8804-FTC4#	17		GSME-15	4		OPR2056-ACN6#	9		TOPPOWN-BFLH#	14	
G-CPCBP	19		GSME-15	18		OPR8797AMCH1#	15		TOPPOWN-BFLH+	19	
G-CPCBP-A	19		GSME-16	1		OPR8798AMCH1#	16		TOPPSW--BFLF#	3	
G-CPCBP-A	20		GSME-17	1		OPR8856-MCH2#	12		TX-NITR-PRE5+	5	
G-CPCPP	19		GSME-17	5		OPRPR3--LAH1#	8				
G-CPCPURGE	19		GSME-18	5		OPRPRBT3ACN1#	8				
G-CTW-A-E	3		GSME-20	5		OPRPRBT3ACNU#	8				
G-CTW-A-E	14		GSME-21	5		OPRPRBT3LAH1#	8				
G-CTW-B-E	14		GSME-21	7		OPRSLG1-ACNU#	11				
G-POWER-E	3		GSME-22	7		OPRSLG1-LAH1#	11				
G-POWER-E	13		GSME-22	10		OPRSMEV-RMH1#	18				
G-POWER-E	18		GSME-27	1		OPRSRAT-CAN1#	6				
G-PSW	3		GSME-29	1		OPRSRAT-NCN1#	6				
G-SRAT-23	5		GSME-29	12		OPRSRAT6ACN1#	10				
G-SRAT-23-A	5		GSME-31	2		OPRSRAT6ACNU#	10				
G-SRAT-23-A	6		GSME-31	3		OPRSRAT6LAH1#	10				
G-SRAT-48	5		GSME-31	12		OPRSRAT7ACN1#	5				
G-SRAT-48	11		GSME-31A	12		OPRSRAT7ACNU#	5				
G-SRAT-48A	11		GSME-32	3		OPRSRAT7LAH1#	5				
G-SRAT-49	11		GSME-33	12		PCSSRAT-BFL5#	5				

SME Explosion	I:\CAFTA\TREE\SME.CAF	11-08-94	Page 21

Cutsets for I:\CAFTA\CUT\SME.CSR 11/08/94 12:24 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-SME					8.80E-05
1.	AX-8797-BFL4#	SME %LFL calculation and switch failure	3	1Q 3.0E-05H	6.33E-02	2.96E-05
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7ACN1#	Failure to follow procedure for SRAT nitric acid sampling	1	1N 5.0E-03N	5.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
2.	AX-8797-BFL4#	SME %LFL calculation and switch failure	3	1Q 3.0E-05H	6.33E-02	2.96E-05
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7ACNU#	Failure to sample SRAT product for nitric acid (pH)	1	1N 5.0E-03N	5.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
3.	AX-8797-BFL4#	SME %LFL calculation and switch failure	3	1Q 3.0E-05H	6.33E-02	5.93E-06
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	PCSSRAT-BFL5#	Fail to compensate for out of spec SRAT product data to PCCS	1	1N 1.0E-03N	1.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
4.	AX-8797-BFL4#	SME %LFL calculation and switch failure	3	1Q 3.0E-05H	6.33E-02	5.93E-06
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7LAH1#	Error in SRAT product sample	1	1N 1.0E-03N	1.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
5.	AX-8797-BFL4#	SME %LFL calculation and switch failure	3	1Q 3.0E-05H	6.33E-02	2.96E-06

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	1	1N 3.0E-03N	3.00E-03N	
	OPRSRAT7ACNU#	Failure to sample SRAT product for nitric acid (pH)	1	1N 5.0E-03N	5.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
6.	AX-8797-BFL4#	SME %LFL calculation and switch failure	3	1Q 3.0E-05H	6.33E-02	2.96E-06
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	1	1N 3.0E-03N	3.00E-03N	
	OPRSRAT7ACN1#	Failure to follow procedure for SRAT nitric acid sampling	1	1N 5.0E-03N	5.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
7.	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	1.08E-06
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7ACNU#	Failure to sample SRAT product for nitric acid (pH)	1	1N 5.0E-03N	5.00E-03N	
	TOPPSW--BFLF#	Inadequate process cooling water (excl. POWN & POWD or CTW)	1	1N 2.3E-03N	2.30E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
8.	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	1.08E-06
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7ACN1#	Failure to follow procedure for SRAT nitric acid sampling	1	1N 5.0E-03N	5.00E-03N	
	TOPPSW--BFLF#	Inadequate process cooling water (excl. POWN & POWD or CTW)	1	1N 2.3E-03N	2.30E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
9.	CC2-SME-H2-1# IGNSME--PRE1#	cc: both SME hydrogen detectors fail low or miscalibrated Ignition source present in SME vessel	1	2.2E-3N 1N 3.0E-02N	2.20E-03 3.00E-02N	1.03E-06
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	

Cutsets for I:\CAFTA\CUT\SME.CSR 11/08/94 12:24 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	OPRSRAT7ACNU#	Failure to sample SRAT product for nitric acid (pH)	1	1N 5.0E-03N	5.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
10.	CC2-SME-H2-1#	cc: both SME hydrogen detectors fail low or miscalibrated		2.2E-3N	2.20E-03	1.03E-06
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7ACN1#	Failure to follow procedure for SRAT nitric acid sampling	1	1N 5.0E-03N	5.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
11.	AX-8797-BFL4#	SME %LFL calculation and switch failure	3	1Q 3.0E-05H	6.33E-02	5.93E-07
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	1	1N 3.0E-03N	3.00E-03N	
	PCSSRAT-BFL5#	Fail to compensate for out of spec SRAT product data to PCCS	1	1N 1.0E-03N	1.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
12.	AX-8797-BFL4#	SME %LFL calculation and switch failure	3	1Q 3.0E-05H	6.33E-02	5.93E-07
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	1	1N 3.0E-03N	3.00E-03N	
	OPRSRAT7LAH1#	Error in SRAT product sample	1	1N 1.0E-03N	1.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
13.	FCV2044-FTC4#	SME formic acid flow control valve fails to close	1	1N 1.0E-03N	1.00E-03N	4.67E-07
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7ACNU#	Failure to sample SRAT product for nitric acid (pH)	1	1N 5.0E-03N	5.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
14.	FCV3080-FTC4#	SME steam supply valve fails to close	1	1N 1.0E-03N	1.00E-03N	4.67E-07
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7ACNU#	Failure to sample SRAT product for nitric acid (pH)	1	1N 5.0E-03N	5.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
15.	FCV3080-FTC4#	SME steam supply valve fails to close	1	1N 1.0E-03N	1.00E-03N	4.67E-07
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7ACN1#	Failure to follow procedure for SRAT nitric acid sampling	1	1N 5.0E-03N	5.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
16.	FCV2044-FTC4#	SME formic acid flow control valve fails to close	1	1N 1.0E-03N	1.00E-03N	4.67E-07
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7ACN1#	Failure to follow procedure for SRAT nitric acid sampling	1	1N 5.0E-03N	5.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
17.	AX-8797-BFL4#	SME %LFL calculation and switch failure	3	1Q 3.0E-05H	6.33E-02	3.70E-07
	FE-8856-FHI4+	SME purge flow element fails high	4	86H 3.0E-06H	2.58E-04	
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-SME-SOH1#	Fail to open SME purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-SME--ADJ5+	SME purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
18.	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	3.14E-07

Cutsets for I:\CAFTA\CUT\SME.CSR 11/08/94 12:24 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1	1N 1.1E-02N	1.10E-02N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
19.	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	2.15E-07
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	PCSSRAT-BFL5#	Fail to compensate for out of spec SRAT product data to PCCS	1	1N 1.0E-03N	1.00E-03N	
	TOPPSW--BFLF#	Inadequate process cooling water (excl. POWN & POWD or CTW)	1	1N 2.3E-03N	2.30E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
20.	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	2.15E-07
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7LAH1#	Error in SRAT product sample	1	1N 1.0E-03N	1.00E-03N	
	TOPPSW--BFLF#	Inadequate process cooling water (excl. POWN & POWD or CTW)	1	1N 2.3E-03N	2.30E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
21.	CC2-SME-H2-1#	cc: both SME hydrogen detectors fail low or miscalibrated		2.2E-3N	2.20E-03	2.06E-07
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7LAH1#	Error in SRAT product sample	1	1N 1.0E-03N	1.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
22.	CC2-SME-H2-1#	cc: both SME hydrogen detectors fail low or miscalibrated		2.2E-3N	2.20E-03	2.06E-07
	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	PCSSRAT-BFL5#	Fail to compensate for out of spec SRAT product data to PCCS	1	1N 1.0E-03N	1.00E-03N	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
23.	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	1.54E-07
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPDEEP-BFLA#	CTW deep well pumping failure	1	1N 5.4E-03N	5.40E-03N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
24.	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	1.34E-07
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7ACNU#	Failure to sample SRAT product for nitric acid (pH)	1	1N 5.0E-03N	5.00E-03N	
	TOPINAIRBFLV#	Instrument air failure	3	26H 1.1E-05H	2.86E-04	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	
25.	IGNSME--PRE1#	Ignition source present in SME vessel	1	1N 3.0E-02N	3.00E-02N	1.34E-07
	OPRSRAT-NCN1#	Error in nitric acid calculation by technical	1	1N 3.0E-02N	3.00E-02N	
	OPRSRAT7ACN1#	Failure to follow procedure for SRAT nitric acid sampling	1	1N 5.0E-03N	5.00E-03N	
	TOPINAIRBFLV#	Instrument air failure	3	26H 1.1E-05H	2.86E-04	
	TX-NITR-PRE5+	Transfer nitric acid into SRAT	4	1H 1.2E-02H	1.19E-02	

Explosion in SME Top Event Frequency: 8.75E-05/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
FE-8856-FHI4+-IC	SME purge flow element fails high	3.00E-06/H	3.54E+02
TOPPOWN-BFLH+-IC	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	1.98E+02
TX-NITR-PRE5+-I	Transfer nitric acid into SRAT	1.19E-02/H	8.33E+01
OPRSRAT7LAH1#	Error in SRAT product sample	1.00E-03	8.32E+01
PCSSRAT-BFL5#	Fail to compensate out of spec SRAT product data to PCCS	1.00E-03	8.32E+01
OPRSRAT7ACN1#	Failure to follow procedure for SRAT nitric acid sampling	5.00E-03	8.28E+01
OPRSRAT7ACNU#	Failure to sample SRAT product for nitric acid (pH)	5.00E-03	8.28E+01
TOPCPCPPBFL2+-I	CPC primary purge system fails (excluding normal power)	1.90E-05/H	4.48E+01
IGNSME--PRE1#	Ignition source present in SME vessel	3.00E-02	3.33E+01
OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	3.00E-03	3.08E+01
OPRSRAT-NCN1#	Error in nitric acid calculation by technical	3.00E-02	3.00E+01
FCV8856-FCL4+-IC	SME purge flow control valve fails closed	1.00E-06/H	2.47E+01
HCV3089-FCL4#	SME cooling water valve manual controller fails to open	4.00E-06	1.57E+01
RY-PFSFTFTO4#	Relay for PFSFT pump fails to open	1.00E-05	1.57E+01
TOPCTWCCBFLO#	CTW valving or piping failure (excl. inair)	6.05E-05	1.57E+01
TOPINAIRBFLV#	Instrument air failure	2.86E-04	1.57E+01
FCV2044-FTC4#	SME formic acid flow control valve fails to close	1.00E-03	1.57E+01
FCV3080-FTC4#	SME steam supply valve fails to close	1.00E-03	1.57E+01
TOPPSW--BFLF#	Inadequate cooling water (excl. POWN & POWD or CTW)	2.30E-03	1.57E+01
CC2-SME-H2-1#	cc: both SME hydrogen detectors fail low or miscalibrated	1.80E-03	1.52E+01
AX-8797-BFL4#	SME %LFL calculation and switch failure	6.34E-02	1.43E+01
SRABATCHPRE5+-I	New batch of sludge for DWPF	5.68E-05/H	1.36E+01
SV-SME--ADJ5+-IC	SME purge supply needle valve adjusted	1.34E-03/H	3.74E+00
TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	3.10E-03	3.48E+00
CC3MAINTFSL1#	cc: all 3 SME low flow switches miscalibrated	3.00E-04	1.71E+00
CC3-SME-FSL4#	CC: all 3 SME offgas sample flow low switches fail to open	1.10E-04	1.71E+00
TOPDEEP-BFLA#	CTW deep well pumping failure	5.40E-03	1.34E+00
TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1.10E-02	1.33E+00
OPRSLG1-LAH1#	Error in sludge sample for noble metals	1.00E-03	1.12E+00
OPRSLG1-ACNU#	Failure to follow procedure for tank sampling	5.00E-03	1.12E+00
AEG8797-LKS4#	Air inleakage in SME detector 8797 sample line	1.64E-03	1.10E+00
AEG8798-LKS4#	Air inleakage in SME detector 8798 sample line	1.64E-03	1.10E+00
AEG8798-FLOD#	SME hydrogen detector 2 (8798) fails low	2.15E-03	1.10E+00
AEG8797-FLOD#	SME LFL analyzer 8797 fails low	2.15E-03	1.10E+00
OPR8798AMCH1#	SME hydrogen detector 2 out of calibration	3.60E-03	1.10E+00
OPR8797AMCH1#	SME hydrogen detector 1 out of calibration	3.60E-03	1.10E+00
OPR-SME-SOH1#	Fail to open SME purge supply needle valve	5.00E-02	1.09E+00
TOPCTWP-BFLB#	CTW primary pumping failure (excl. POWN)	5.67E-04	1.08E+00
SLGNOBL-PRE5#	Excessive noble metals present in sludge	1.00E-02	1.07E+00
OPR8856-MCH2#	Operator miscalibrates SME purge flow element	3.00E-04	1.03E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) x (risk achievement worth).

Explosion in SME Top Event Frequency: 8.75E-05/YR

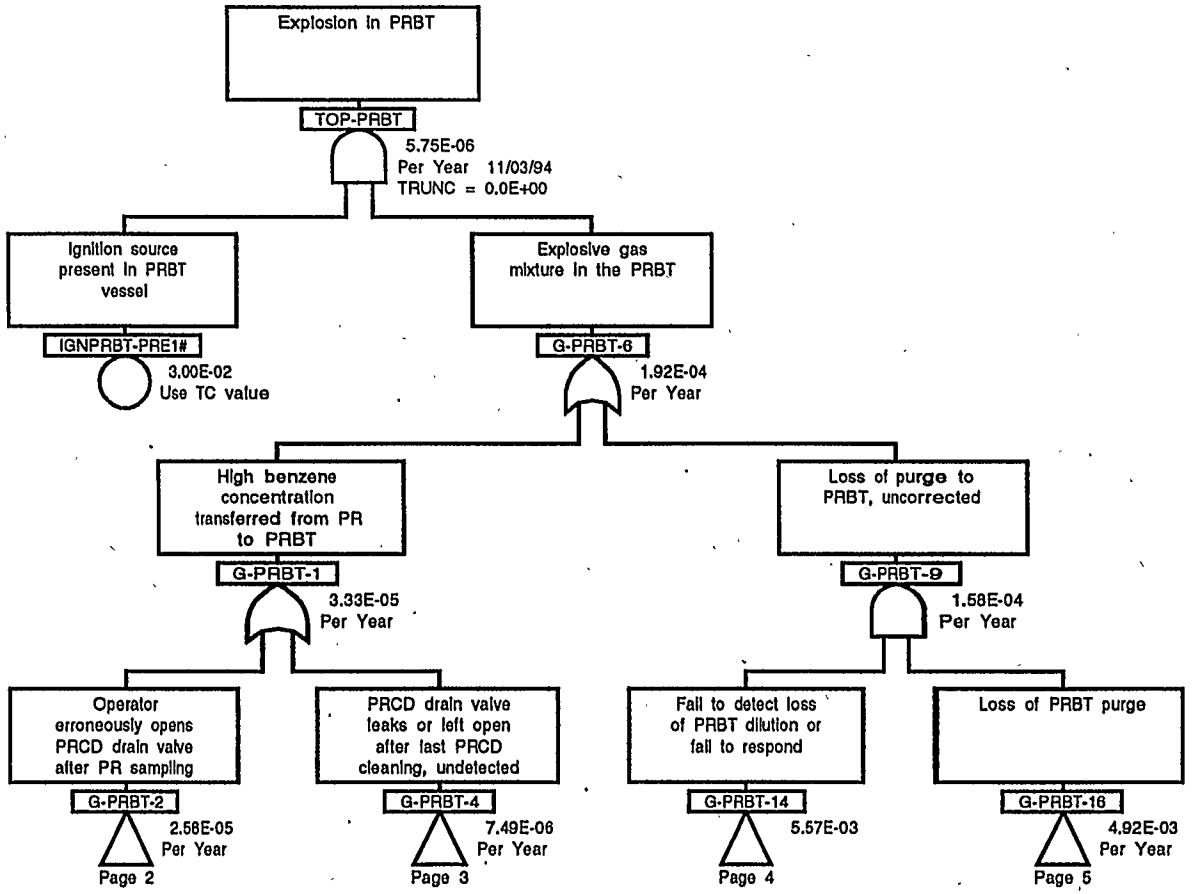
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
*IGNSME--PRE1#	Ignition source present in SME vessel	3.00E-02	0.00E+00
TX-NITR-PRE5+-I	Transfer nitric acid into SRAT	1.19E-02/H	7.62E+01
AX-8797-BFL4#	SME %LFL calculation and switch failure	6.34E-02	9.95E+00
OPRSRAT-NCN1#	Error in nitric acid calculation by technical	3.00E-02	9.72E+00
OPRSRAT7ACN1#	Failure to follow procedure for SRAT nitric acid sampling	5.00E-03	1.70E+00
OPRSRAT7ACNU#	Failure to sample SRAT product for nitric acid (pH)	5.00E-03	1.70E+00
OPRSRAT-CAN1#	Operator adds more nitric acid than calculated	3.00E-03	1.10E+00
PCSSRAT-BFL5#	Fail to compensate out of spec SRAT product data to PCCS	1.00E-03	1.09E+00
OPRSRAT7LAH1#	Error in SRAT product sample	1.00E-03	1.09E+00
TOPPSW--BFLF#	Inadequate cooling water (excl. POWN & POWD or CTW)	2.30E-03	1.03E+00
CC2-SME-H2-1#	cc: both SME hydrogen detectors fail low or miscalibrated	1.80E-03	1.03E+00
FCV2044-FTC4#	SME formic acid flow control valve fails to close	1.00E-03	1.01E+00
FCV3080-FTC4#	SME steam supply valve fails to close	1.00E-03	1.01E+00

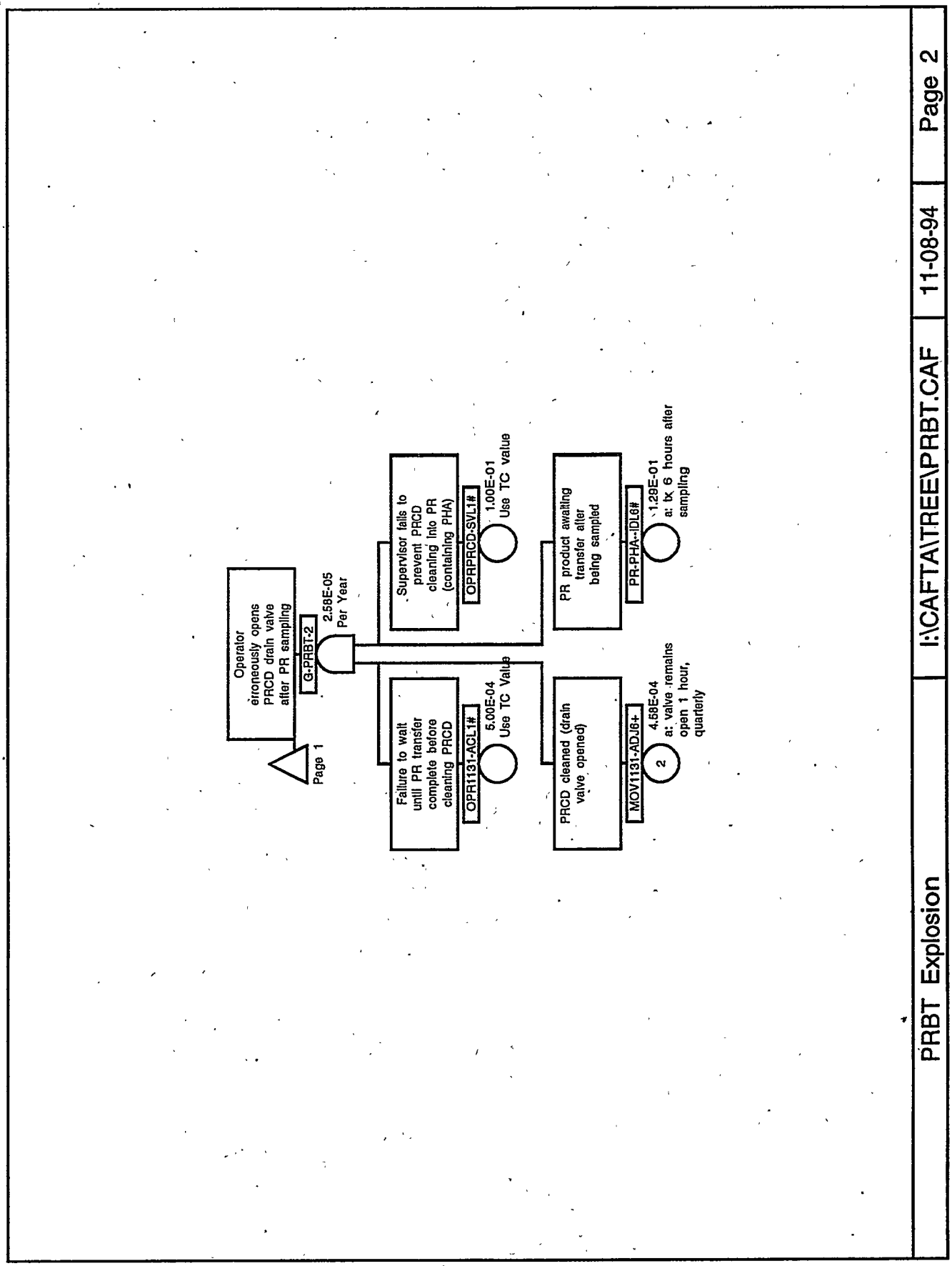
* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

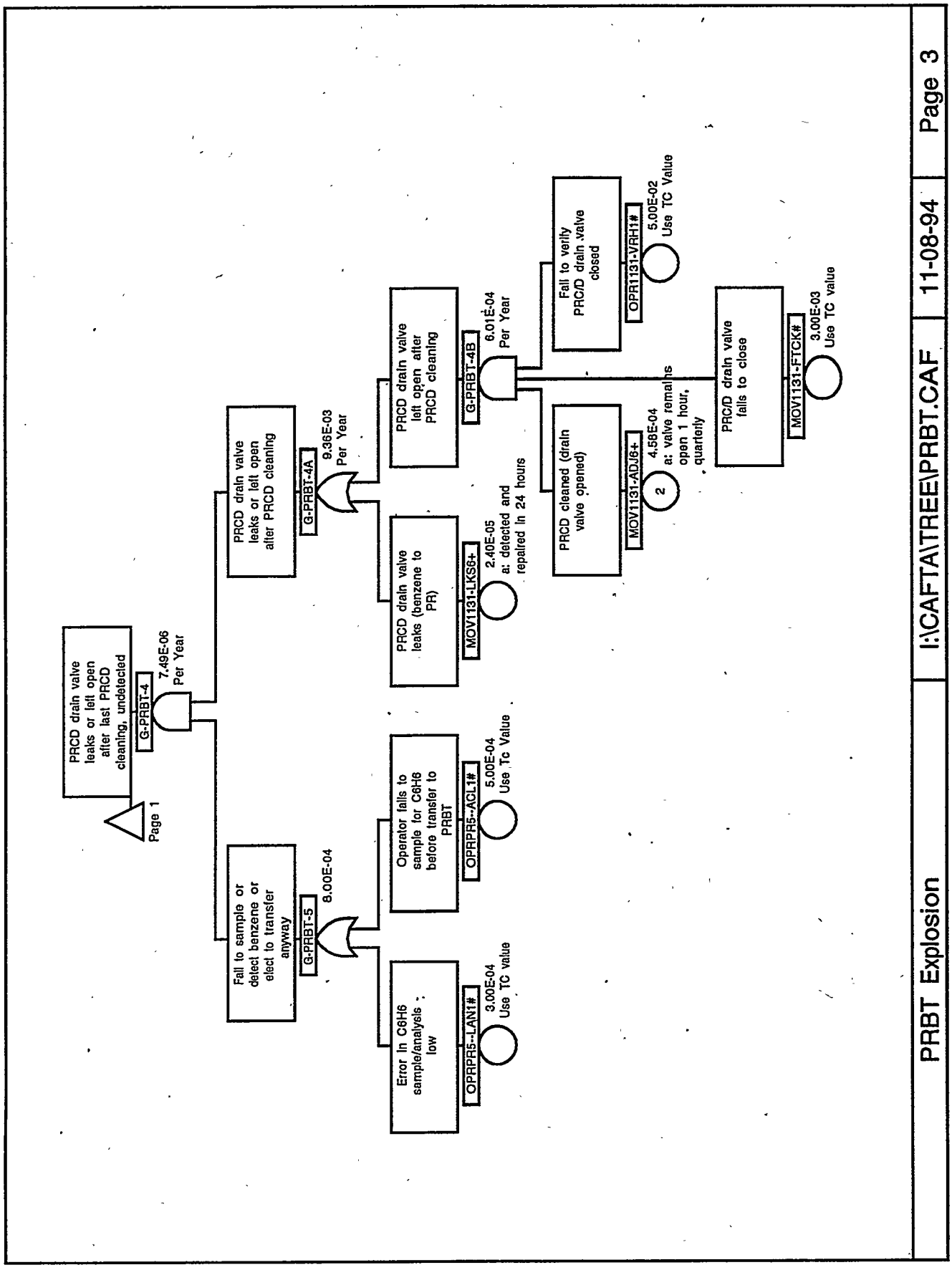
Note: Events that make less than 1% difference to the importance factor are not included. Modified top event frequency = (top event frequency) / (risk reduction worth).

PRBT Explosion



PRBT Explosion	I:\CAFTA\TREE\PRBT.CAF	11-08-94	Page 1


PRBT Explosion
I:\CAFTA\TREE\PRBT.CAF
11-08-94
Page 2
Operator erroneously opens PRCD drain valve after PR sampling
G-PRBT-2
2.58E-05 Per Year
Page 1
Supervisor fails to prevent PRCD cleaning into PR (containing PHA)
OPRPRCD-SVL1#
1.00E-01 Use TC value
Failure to wait until PR transfer complete before cleaning PRCD
OPR1131-ACL1#
5.00E-04 Use TC Value
PR product awaiting transfer after being sampled
PR-PHA--IDL6#
1.29E-01 a: bt 6 hours after sampling
PRCD cleaned (drain valve opened)
MOV1131-ADJ6+
2
4.68E-04 a: valve remains open 1 hour, quarterly


PRBT Explosion
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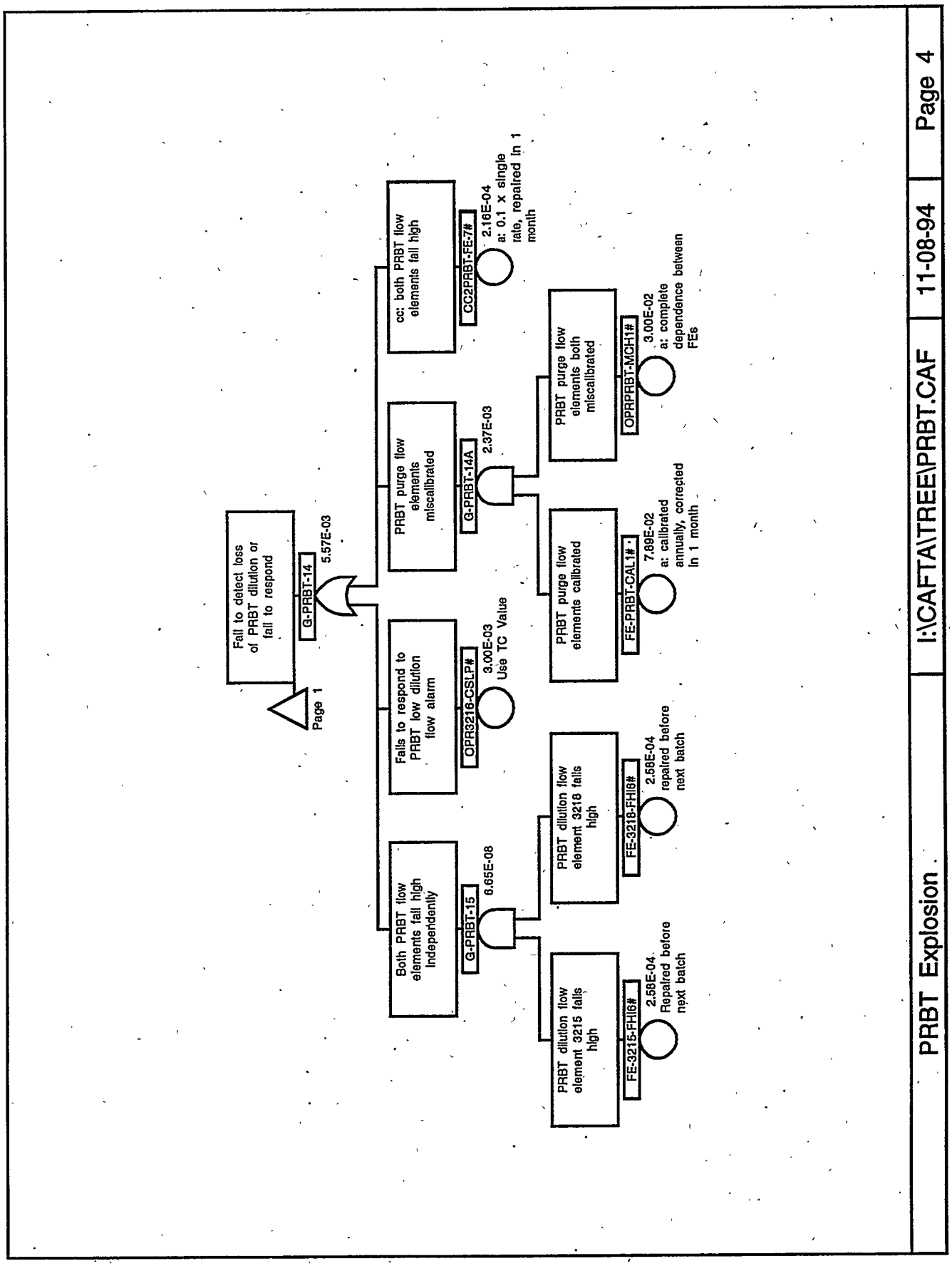
Page 3
PRCD drain valve leaks or left open after last PRCD cleaning, undetected
G-PRBT-4
7.49E-06 Per Year
Page 1
Fail to sample or detect benzene or elect to transfer anyway
G-PRBT-5
8.00E-04
Error in C6H6 sample/analysis : low
OPRPR5--LAN1#
3.00E-04 Use TC value
Operator fails to sample for C6H6 before transfer to PRBT
OPRPR5--AGL1#
5.00E-04 Use Tc Value
PRCD drain valve leaks or left open after PRCD cleaning
G-PRBT-4A
9.36E-03 Per Year
PRCD drain valve leaks (benzene to PR)
MOV1131-LKS6+
2.40E-05 a: detected and repaired in 24 hours
PRCD drain valve left open after PRCD cleaning
G-PRBT-4B
6.01E-04 Per Year
PRCD cleaned (drain valve opened)
MOV1131-ADJ6+
2
4.58E-04 a: valve remains open 1 hour, quarterly
Fail to verify PRC/D drain valve closed
OPR1131-VRH1#
5.00E-02 Use TC Value
PRC/D drain valve fails to close
MOV1131-FTCK#
3.00E-03 Use TC value


Fail to detect loss of PRBT dilution or fail to respond
G-PRBT-14
5.57E-03
Page 1
PRBT purge flow elements miscalibrated
G-PRBT-14A
2.37E-03
PRBT purge flow elements both miscalibrated
OPRPRBT-MCH1#
3.00E-02
a: complete dependence between FEs
PRBT purge flow elements calibrated
FE-PRBT-CAL1#
7.89E-02
a: calibrated annually, corrected in 1 month
Falls to respond to PRBT low dilution flow alarm
OPR3216-CSLP#
3.00E-03
Use TC Value
Both PRBT flow elements fail high Independently
G-PRBT-15
6.65E-08
PRBT dilution flow element 3218 fails high
FE-3218-FHI6#
2.58E-04
repaired before next batch
PRBT dilution flow element 3215 fails high
FE-3215-FHI6#
2.58E-04.
Repaired before next batch
cc: both PRBT flow elements fail high
CC2PRBT-FE-7#
2.16E-04
a: 0.1 x single rate, repaired in 1 month
PRBT Explosion
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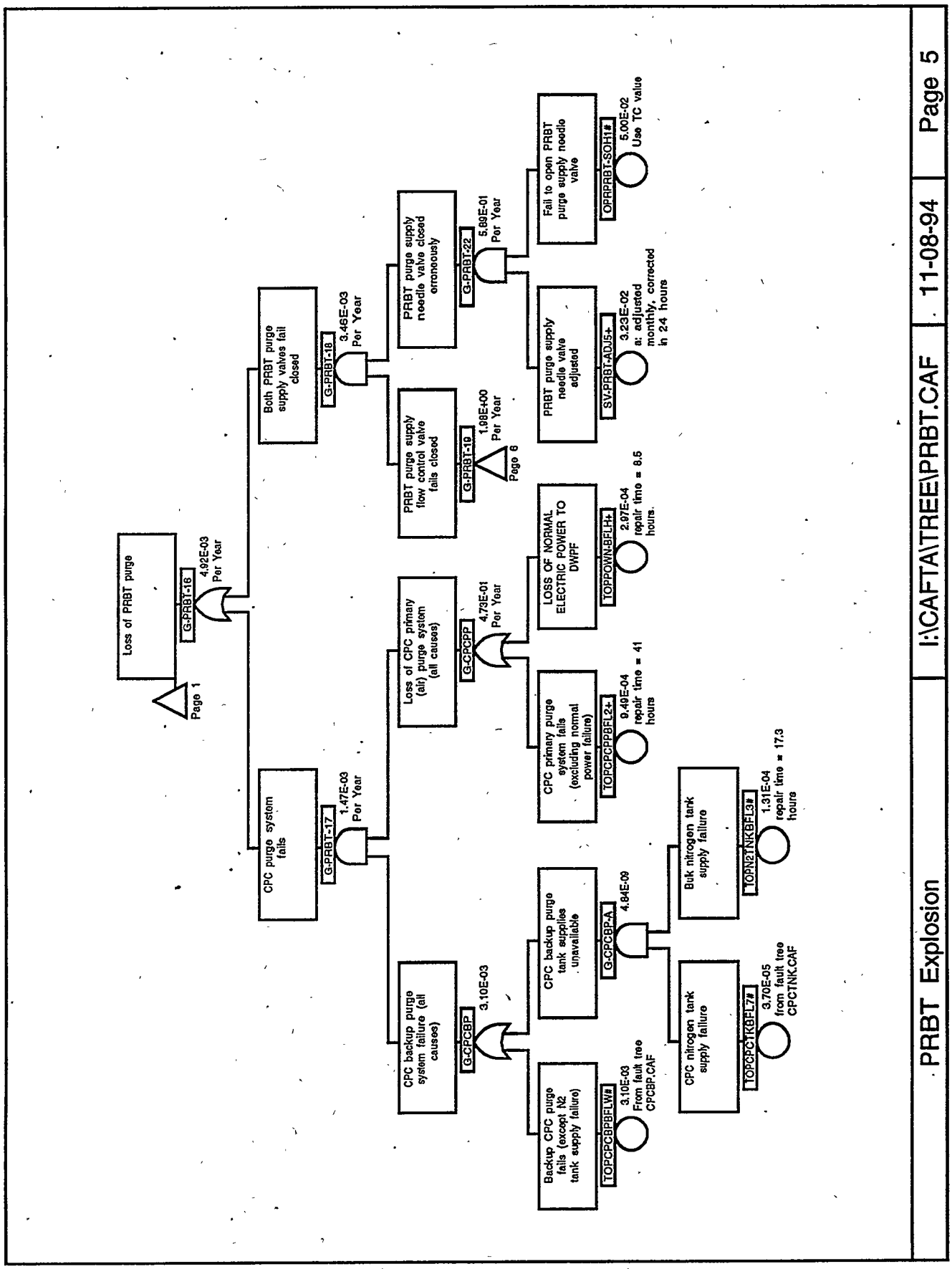
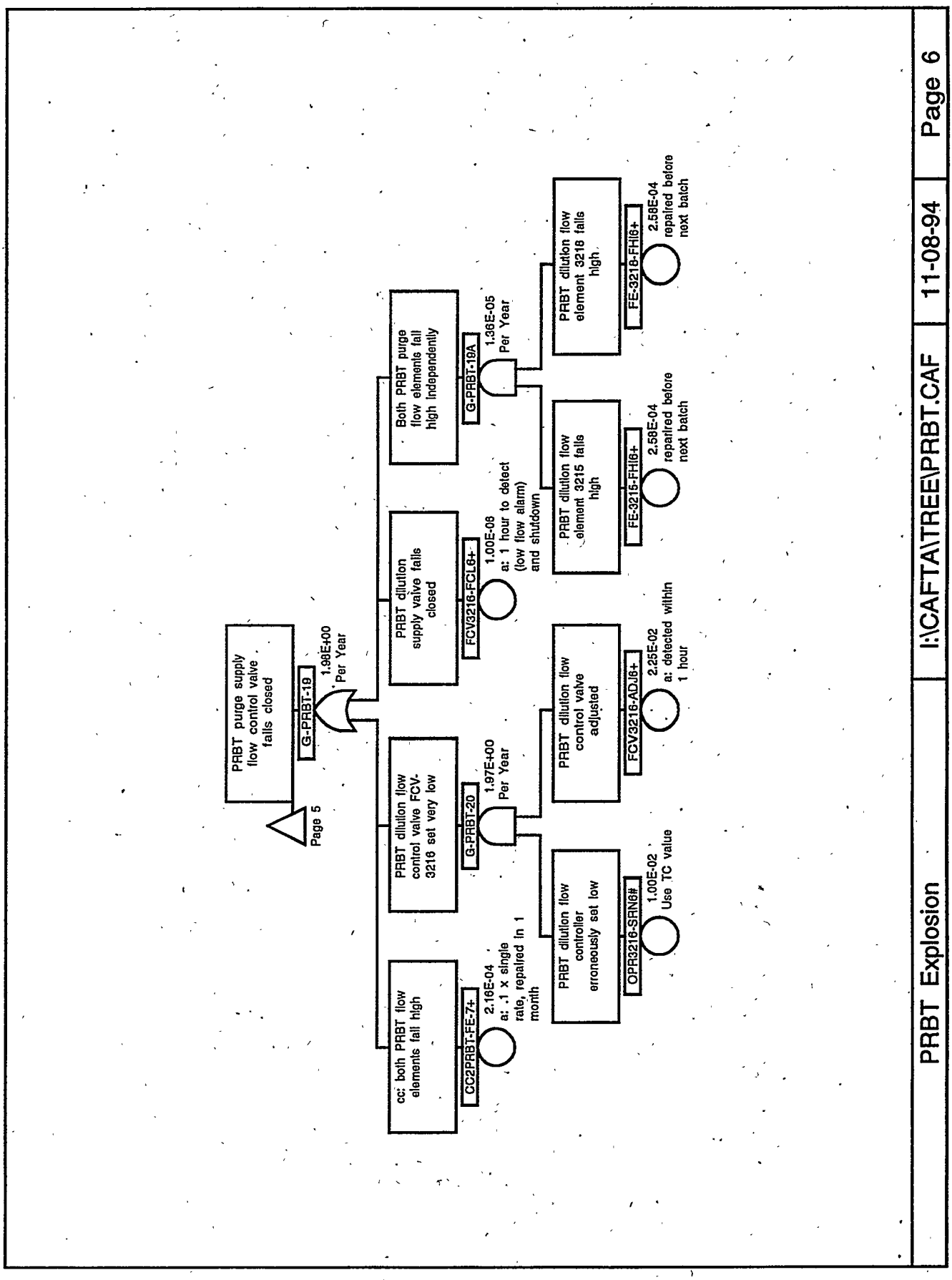

Loss of PRBT purge
Page 1
G-PRBT-16
4.92E-03
Per Year
CPC purge system fails
G-PRBT-17
1.47E-03
Per Year
Both PRBT purge supply valves fail closed
G-PRBT-18
3.46E-03
Per Year
CPC backup purge system failure (all causes)
G-CPCBP
3.10E-03
Loss of CPC primary (air) purge system (all causes)
G-CPCPP
4.73E-01
Per Year
PRBT purge supply flow control valve fails closed
G-PRBT-19
1.98E+00
Per Year
Page 6
PRBT purge supply needle valve closed erroneously
G-PRBT-22
5.89E-01
Per Year
Backup CPC purge fails (except N2 tank supply failure)
TOPCPCBPBFLW#
3.10E-03
From fault tree CPCBP.CAF
CPC backup purge tank supplies unavailable
G-CPCBP-A
4.84E-09
CPC primary purge system fails (excluding normal power failure)
TOPCPCPPBFL2+
9.49E-04
repair time = 41 hours
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
2.97E-04
repair time = 8.5 hours
PRBT purge supply needle valve adjusted
SV-PRBT-ADJS+
3.23E-02
a: adjusted monthly, corrected in 24 hours
Fail to open PRBT purge supply needle valve
OPRPRBT-SOH1#
5.00E-02
Use TC value
CPC nitrogen tank supply failure
TOPCPCTNKBFL7#
3.70E-05
from fault tree CPCTNK.CAF
Buk nitrogen tank supply failure
TOPN2TNKBFL3#
1.31E-04
repair time = 17.3 hours
PRBT Explosion
I:\CAFTA\TREE\PRBT.CAF
11-08-94
Page 5


PRBT Explosion
I:\CAFTA\TREE\PRBT.CAF
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Page 6
PRBT purge supply flow control valve falls closed
G-PRBT-19
1.98E+00 Per Year
Page 5
PRBT dilution flow control valve FCV-3216 set very low
G-PRBT-20
1.97E+00 Per Year
cc: both PRBT flow elements fail high
CC2PRBT-FE-74+
2.16E-04 a: .1 x single rate, repaired in 1 month
PRBT dilution flow controller erroneously set low
OPR3216-SRN0#
1.00E-02 Use TC value
PRBT dilution flow control valve adjusted
FCV3216-ADJ6+
2.25E-02 a: detected within 1 hour
PRBT dilution supply valve falls closed
FCV3216-FCL6+
1.00E-08 a: 1 hour to detect (low flow alarm) and shutdown
Both PRBT purge flow elements fail high independently
G-PRBT-18A
1.36E-05 Per Year
PRBT dilution flow element 3215 falls high
FE-3215-FHI6+
2.58E-04 repaired before next batch
PRBT dilution flow element 3216 falls high
FE-3216-FHI6+
2.58E-04 repaired before next batch

Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
CC2PRBT-FE-7#	4		MOV1131-FTCK#	3							
CC2PRBT-FE-7+	6		MOV1131-LKS6+	3							
FCV3216-ADJ6+	6		OPR1131-ACL1#	2							
FCV3216-FCL6+	6		OPR1131-VRH1#	3							
FE-3215-FHI6#	4		OPR3216-CSLP#	4							
FE-3215-FHI6+	6		OPR3216-SRN6#	6							
FE-3218-FHI6#	4		OPRPR5--ACL1#	3							
FE-3218-FHI6+	6		OPRPR5--LAN1#	3							
FE-PRBT-CAL1#	4		OPRPRBT-MCH1#	4							
G-CPCBP	5		OPRPRBT-SOH1#	5							
G-CPCBP-A	5		OPRPRCD-SVL1#	2							
G-CPCPP	5		PR-PHA--IDL6#	2							
G-PRBT-1	1		SV-PRBT-ADJ5+	5							
G-PRBT-14	1		TOP-PRBT	1							
G-PRBT-14	4		TOPCPCBPBFLW#	5							
G-PRBT-14A	4		TOPCPCPPBFL2+	5							
G-PRBT-15	4		TOPCPCTKBFL7#	5							
G-PRBT-16	1		TOPN2TNKBFL3#	5							
G-PRBT-16	5		TOPPOWN-BFLH+	5							
G-PRBT-17	5										
G-PRBT-18	5										
G-PRBT-19	5										
G-PRBT-19	6										
G-PRBT-19A	6										
G-PRBT-2	1										
G-PRBT-2	2										
G-PRBT-20	6										
G-PRBT-22	5										
G-PRBT-4	1										
G-PRBT-4	3										
G-PRBT-4A	3										
G-PRBT-4B	3										
G-PRBT-5	3										
G-PRBT-6	1										
G-PRBT-9	1										
IGNPRBT-PRE1#	1										
MOV1131-ADJ6+	2										
MOV1131-ADJ6+	3										

Cutsets for I:\CAFTA\CUT\PRBT.CSR 11/08/94 12:26 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-PRBT					5.75E-06
1.	CC2PRBT-FE-7+	cc: both PRBT flow elements fail high	4	1M 3.0E-07H	2.16E-04	3.94E-06
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRPRBT-SOH1#	Fail to open PRBT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-PRBT-ADJ5+	PRBT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
2.	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	7.75E-07
	MOV1131-ADJ6+	PRCD cleaned (drain valve opened)	4	1H 1.0E+00Q	4.59E-04	
	OPR1131-ACL1#	Failure to wait until PR transfer complete before cleaning PRCD	1	1N 5.0E-04N	5.00E-04N	
	OPRPRCD-SVL1#	Supervisor fails to prevent PRCD cleaning into PR (containing PHA)	1	1N 1.0E-01N	1.00E-01N	
	PR-PHA--IDL6#	PR product awaiting transfer after being sampled	3	6H 2.3E-02H	1.29E-01	
3.	FCV3216-ADJ6+	PRBT dilution flow control valve adjusted	4	1H 2.3E-02H	2.25E-02	2.98E-07
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR3216-CSLP#	Fails to respond to PRBT low dilution flow alarm	1	1N 3.0E-03N	3.00E-03N	
	OPR3216-SRN6#	PRBT dilution flow controller erroneously set low	1	1N 1.0E-02N	1.00E-02N	
	OPRPRBT-SOH1#	Fail to open PRBT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-PRBT-ADJ5+	PRBT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
4.	FCV3216-ADJ6+	PRBT dilution flow control valve adjusted	4	1H 2.3E-02H	2.25E-02	2.35E-07
	FE-PRBT-CAL1#	PRBT purge flow elements calibrated	3	1M 1.0E+00Y	7.89E-02	
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR3216-SRN6#	PRBT dilution flow controller erroneously set low	1	1N 1.0E-02N	1.00E-02N	
	OPRPRBT-MCH1#	PRBT purge flow elements both miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	OPRPRBT-SOH1#	Fail to open PRBT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	SV-PRBT-ADJ5+	PRBT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
5.	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	1.31E-07
	MOV1131-LKS6+	PRCD drain valve leaks (benzene to PR)	4	24H 1.0E-06H	2.40E-05	
	OPRPR5--ACL1#	Operator fails to sample for C6H6 before transfer to PRBT	1	1N 5.0E-04N	5.00E-04N	
6.	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	8.55E-08
	OPR3216-CSLP#	Fails to respond to PRBT low dilution flow alarm	1	1N 3.0E-03N	3.00E-03N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
7.	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	7.88E-08
	MOV1131-LKS6+	PRCD drain valve leaks (benzene to PR)	4	24H 1.0E-06H	2.40E-05	
	OPRPR5--LAN1#	Error in C6H6 sample/analysis - low	1	1N 3.0E-04N	3.00E-04N	
8.	FE-PRBT-CAL1#	PRBT purge flow elements calibrated	3	1M 1.0E+00Y	7.89E-02	6.75E-08
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRPRBT-MCH1#	PRBT purge flow elements both miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
9.	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	4.64E-08
	OPR3216-CSLP#	Fails to respond to PRBT low dilution flow alarm	1	1N 3.0E-03N	3.00E-03N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	
10.	FE-PRBT-CAL1#	PRBT purge flow elements calibrated	3	1M 1.0E+00Y	7.89E-02	3.66E-08

Cutsets for I:\CAFTA\CUT\PRBT.CSR 11/08/94 12:26 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRPRBT-MCH1#	PRBT purge flow elements both miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	
11.	CC2PRBT-FE-7#	cc: both PRBT flow elements fail high	3	1M 3.0E-07H	2.16E-04	2.14E-08
	FCV3216-ADJ6+	PRBT dilution flow control valve adjusted	4	1H 2.3E-02H	2.25E-02	
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR3216-SRN6#	PRBT dilution flow controller erroneously set low	1	1N 1.0E-02N	1.00E-02N	
	OPRPRBT-SOH1#	Fail to open PRBT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-PRBT-ADJ5+	PRBT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
12.	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	9.02E-09
	MOV1131-ADJ6+	PRCD cleaned (drain valve opened)	4	1H 1.0E+00Q	4.59E-04	
	MOV1131-FTCK#	PRC/D drain valve fails to close	1	1N 3.0E-03N	3.00E-03N	
	OPR1131-VRH1#	Fail to verify PRC/D drain valve closed	1	1N 5.0E-02N	5.00E-02N	
	OPRPR5--ACL1#	Operator fails to sample for C6H6 before transfer to PRBT	1	1N 5.0E-04N	5.00E-04N	
13.	CC2PRBT-FE-7#	cc: both PRBT flow elements fail high	3	1M 3.0E-07H	2.16E-04	6.16E-09
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
14.	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	5.41E-09
	MOV1131-ADJ6+	PRCD cleaned (drain valve opened)	4	1H 1.0E+00Q	4.59E-04	
	MOV1131-FTCK#	PRC/D drain valve fails to close	1	1N 3.0E-03N	3.00E-03N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	OPR1131-VRH1#	Fail to verify PRC/D drain valve closed	1	1N 5.0E-02N	5.00E-02N	
	OPRPR5--LAN1#	Error in C6H6 sample/analysis - low	1	1N 3.0E-04N	3.00E-04N	
15.	CC2PRBT-FE-7#	cc: both PRBT flow elements fail high	3	1M 3.0E-07H	2.16E-04	3.34E-09
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	
16.	FE-3215-FHI6+	PRBT dilution flow element 3215 fails high	4	86H 3.0E-06H	2.58E-04	1.83E-09
	FE-3218-FHI6+	PRBT dilution flow element 3218 fails high	4	86H 3.0E-06H	2.58E-04	
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRPRBT-SOH1#	Fail to open PRBT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-PRBT-ADJ5+	PRBT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
17.	FCV3216-FCL6+	PRBT dilution supply valve fails closed	4	1H 1.0E-06H	1.00E-06	1.32E-09
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR3216-CSLP#	Fails to respond to PRBT low dilution flow alarm	1	1N 3.0E-03N	3.00E-03N	
	OPRPRBT-SOH1#	Fail to open PRBT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-PRBT-ADJ5+	PRBT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
18.	FCV3216-FCL6+	PRBT dilution supply valve fails closed	4	1H 1.0E-06H	1.00E-06	1.05E-09
	FE-PRBT-CAL1#	PRBT purge flow elements calibrated	3	1M 1.0E+00Y	7.89E-02	
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRPRBT-MCH1#	PRBT purge flow elements both miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	OPRPRBT-SOH1#	Fail to open PRBT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-PRBT-ADJ5+	PRBT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
19.	CC2PRBT-FE-7#	cc: both PRBT flow elements fail high	3	1M 3.0E-07H	2.16E-04	9.54E-11
	FCV3216-FCL6+	PRBT dilution supply valve fails closed	4	1H 1.0E-06H	1.00E-06	
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRPRBT-SOH1#	Fail to open PRBT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-PRBT-ADJ5+	PRBT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
20.	FCV3216-ADJ6+	PRBT dilution flow control valve adjusted	4	1H 2.3E-02H	2.25E-02	6.61E-12
	FE-3215-FHI6#	PRBT dilution flow element 3215 fails high	3	86H 3.0E-06H	2.58E-04	
	FE-3218-FHI6#	PRBT dilution flow element 3218 fails high	3	86H 3.0E-06H	2.58E-04	
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR3216-SRN6#	PRBT dilution flow controller erroneously set low	1	1N 1.0E-02N	1.00E-02N	
	OPRPRBT-SOH1#	Fail to open PRBT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-PRBT-ADJ5+	PRBT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
21.	FE-3215-FHI6#	PRBT dilution flow element 3215 fails high	3	86H 3.0E-06H	2.58E-04	1.90E-12
	FE-3218-FHI6#	PRBT dilution flow element 3218 fails high	3	86H 3.0E-06H	2.58E-04	
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
22.	FE-3215-FHI6#	PRBT dilution flow element 3215 fails high	3	86H 3.0E-06H	2.58E-04	1.03E-12
	FE-3218-FHI6#	PRBT dilution flow element 3218 fails high	3	86H 3.0E-06H	2.58E-04	
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
23.	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	1.34E-13
	OPR3216-CSLP#	Fails to respond to PRBT low dilution flow alarm	1	1N 3.0E-03N	3.00E-03N	
	TOPCPCTKBFL7#	CPC nitrogen tank supply failure	1	1N 3.7E-05N	3.70E-05N	
	TOPN2TNKBFL3#	Bulk nitrogen tank supply failure	3	17H 7.7E-06H	1.31E-04	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
24.	FE-PRBT-CAL1#	PRBT purge flow elements calibrated	3	1M 1.0E+00Y	7.89E-02	1.05E-13
	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRPRBT-MCH1#	PRBT purge flow elements both miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCTKBFL7#	CPC nitrogen tank supply failure	1	1N 3.7E-05N	3.70E-05N	
	TOPN2TNKBFL3#	Bulk nitrogen tank supply failure	3	17H 7.7E-06H	1.31E-04	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
25.	IGNPRBT-PRE1#	Ignition source present in PRBT vessel	1	1N 3.0E-02N	3.00E-02N	7.25E-14
	OPR3216-CSLP#	Fails to respond to PRBT low dilution flow alarm	1	1N 3.0E-03N	3.00E-03N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	
	TOPCPCTKBFL7#	CPC nitrogen tank supply failure	1	1N 3.7E-05N	3.70E-05N	
	TOPN2TNKBFL3#	Bulk nitrogen tank supply failure	3	17H 7.7E-06H	1.31E-04	

Explosion in PRBT Top Event Frequency: 5.75E-06/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
CC2PRBT-FE-7+-IC	cc: both PRBT flow elements fail high	3.00E-07/H	7.69E+04
MOV1131-LKS6+-I	PRCD drain valve leaks (benzene to PR)	1.00E-06/H	3.66E+04
TOPCPCPPBFL2+-I	CPC primary purge system fails (excluding normal power)	1.90E-05/H	7.92E+02
TOPPOWN-BFLH+-I	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	7.92E+02
SV-PRBT-ADJ5+-IC	PRBT purge supply needle valve adjusted	1.34E-03/H	5.01E+02
FCV3216-FCL6+-IC	PRBT dilution supply valve fails closed	1.00E-06/H	4.30E+02
MOV1131-ADJ6+-I	PRCD cleaned (drain valve opened)	4.58E-04/H	3.01E+02
OPR1131-ACL1#	Failure to wait until PR transfer before cleaning PRCD	5.00E-04	2.71E+02
OPRPR5--LAN1#	Error in C6H6 sample/analysis - low	3.00E-04	4.99E+01
OPRPR5--ACL1#	Operator fails to sample for C6H6 before transfer to PRBT	5.00E-04	4.98E+01
IGNPRBT-PRE1#	Ignition source present in PRBT vessel	3.00E-02	3.33E+01
OPR3216-CSLP#	Fails to respond to PRBT low dilution flow alarm	3.00E-03	2.59E+01
FE-3215-FHI6+-IC	PRBT dilution flow element 3215 fails high	3.00E-06/H	2.10E+01
FE-3218-FHI6+-IC	PRBT dilution flow element 3218 fails high	3.00E-06/H	2.10E+01
OPRPRBT-SOH1#	Fail to open PRBT purge supply needle valve	5.00E-02	1.59E+01
TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	3.10E-03	1.47E+01
OPR3216-SRN6#	PRBT dilution flow controller erroneously set low	1.00E-02	1.06E+01
FCV3216-ADJ6+-IC	PRBT dilution flow control valve adjusted	2.25E-02/H	5.19E+00
OPRPRBT-MCH1#	PRBT purge flow elements both miscalibrated	3.00E-02	2.91E+00
OPRPRCD-SVL1#	Supervisor fails to prevent PRCD cleaning into PR	1.00E-01	2.21E+00
PR-PHA--IDL6#	PR product awaiting transfer after being sampled	1.29E-01	1.91E+00
MOV1131-FTCK#	PRC/D drain valve fails to close	3.00E-03	1.84E+00
FE-PRBT-CAL1#	PRBT purge flow elements calibrated	7.89E-02	1.69E+00
OPR1131-VRH1#	Fail to verify PRC/D drain valve closed	5.00E-02	1.05E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) x (risk achievement worth).

Explosion in PRBT Top Event Frequency: 5.75E-06/YR

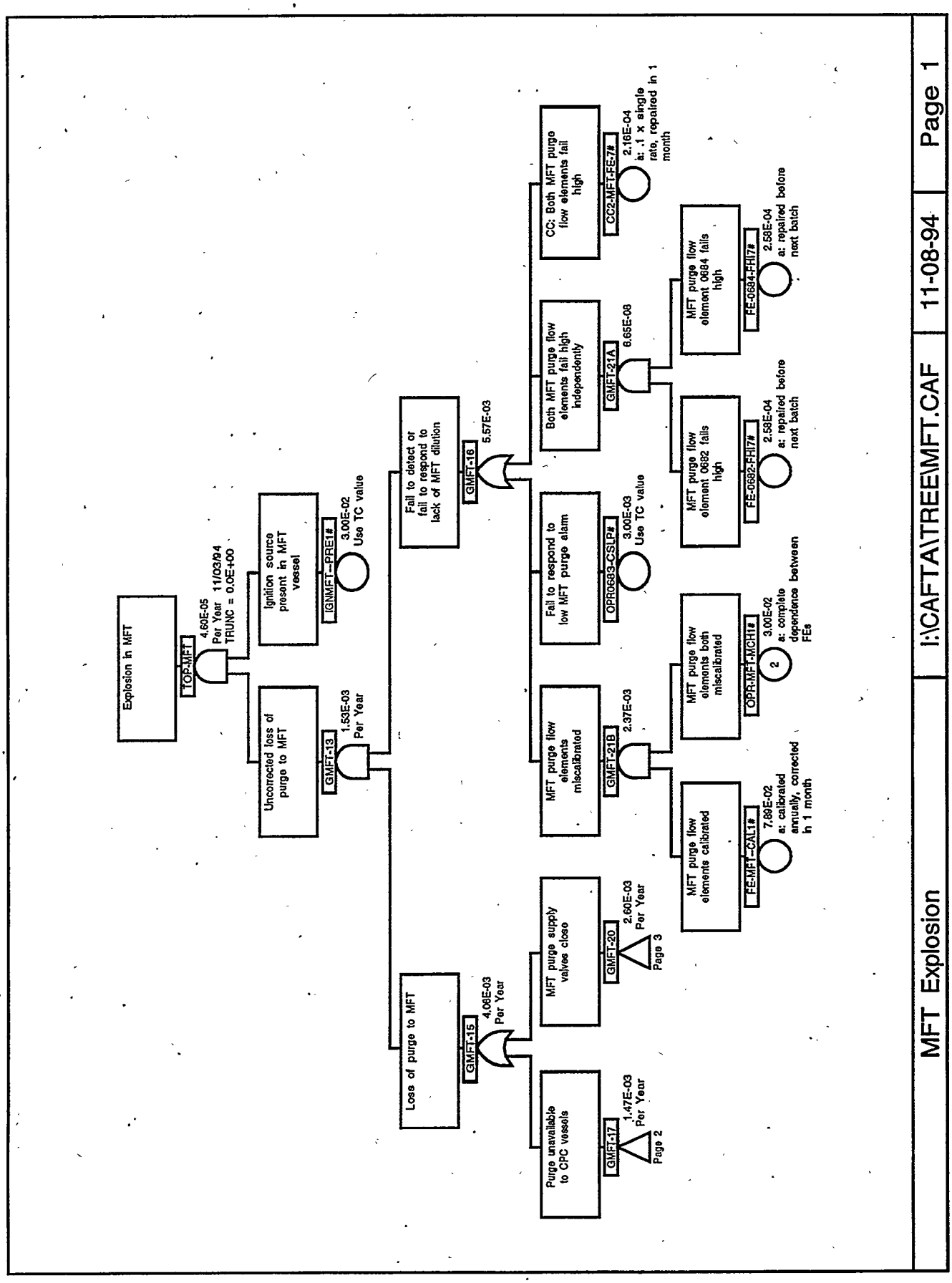
Risk Reduction Worth

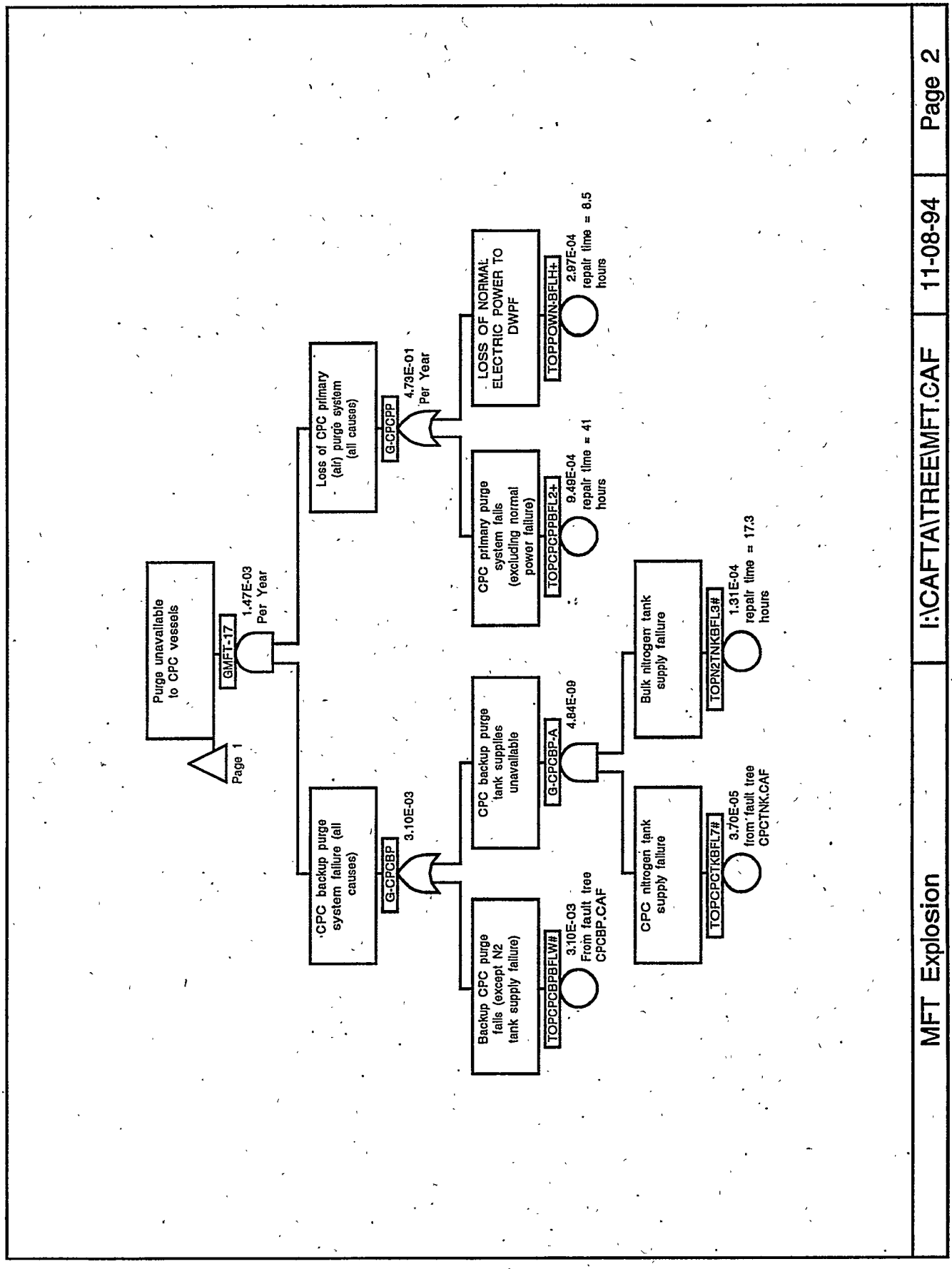
Basic Event Name	Description	Prob/Freq	RedW
*IGNPRBT-PRE1#	Ignition source present in PRBT vessel	3.00E-02	0.00E+00
OPRPRBT-SOH1#	Fail to open PRBT purge supply needle valve	5.00E-02	4.61E+00
SV-PRBT-ADJ5+-IC	PRBT purge supply needle valve adjusted	1.34E-03/H	4.61E+00
CC2PRBT-FE-7+-IC	cc: both PRBT flow elements fail high	3.00E-07/H	3.24E+00
MOV1131-ADJ6+-I	PRCD cleaned (drain valve opened)	4.58E-04/H	1.16E+00
OPR1131-ACL1#	Failure to wait until PR transfer before cleaning PRCD	5.00E-04	1.16E+00
OPRPRCD-SVL1#	Supervisor fails to prevent PRCD cleaning into PR	1.00E-01	1.16E+00
PR-PHA--IDL6#	PR product awaiting transfer after being sampled	1.29E-01	1.16E+00
FCV3216-ADJ6+-IC	PRBT dilution flow control valve adjusted	2.25E-02/H	1.11E+00
OPR3216-SRN6#	PRBT dilution flow controller erroneously set low	1.00E-02	1.11E+00
OPR3216-CSLP#	Fails to respond to PRBT low dilution flow alarm	3.00E-03	1.08E+00
OPRPRBT-MCH1#	PRBT purge flow elements both miscalibrated	3.00E-02	1.06E+00
FE-PRBT-CAL1#	PRBT purge flow elements calibrated	7.89E-02	1.06E+00
TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	3.10E-03	1.04E+00
MOV1131-LKS6+-I	PRCD drain valve leaks (benzene to PR)	1.00E-06/H	1.04E+00
TOPPOWN-BFLH+-I	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	1.03E+00
OPRPR5--ACL1#	Operator fails to sample for C6H6 before transfer to PRBT	5.00E-04	1.03E+00
TOPCPCPPBFL2+-I	CPC primary purge system fails (excluding normal power)	1.90E-05/H	1.02E+00
OPRPR5--LAN1#	Error in C6H6 sample/analysis - low	3.00E-04	1.01E+00

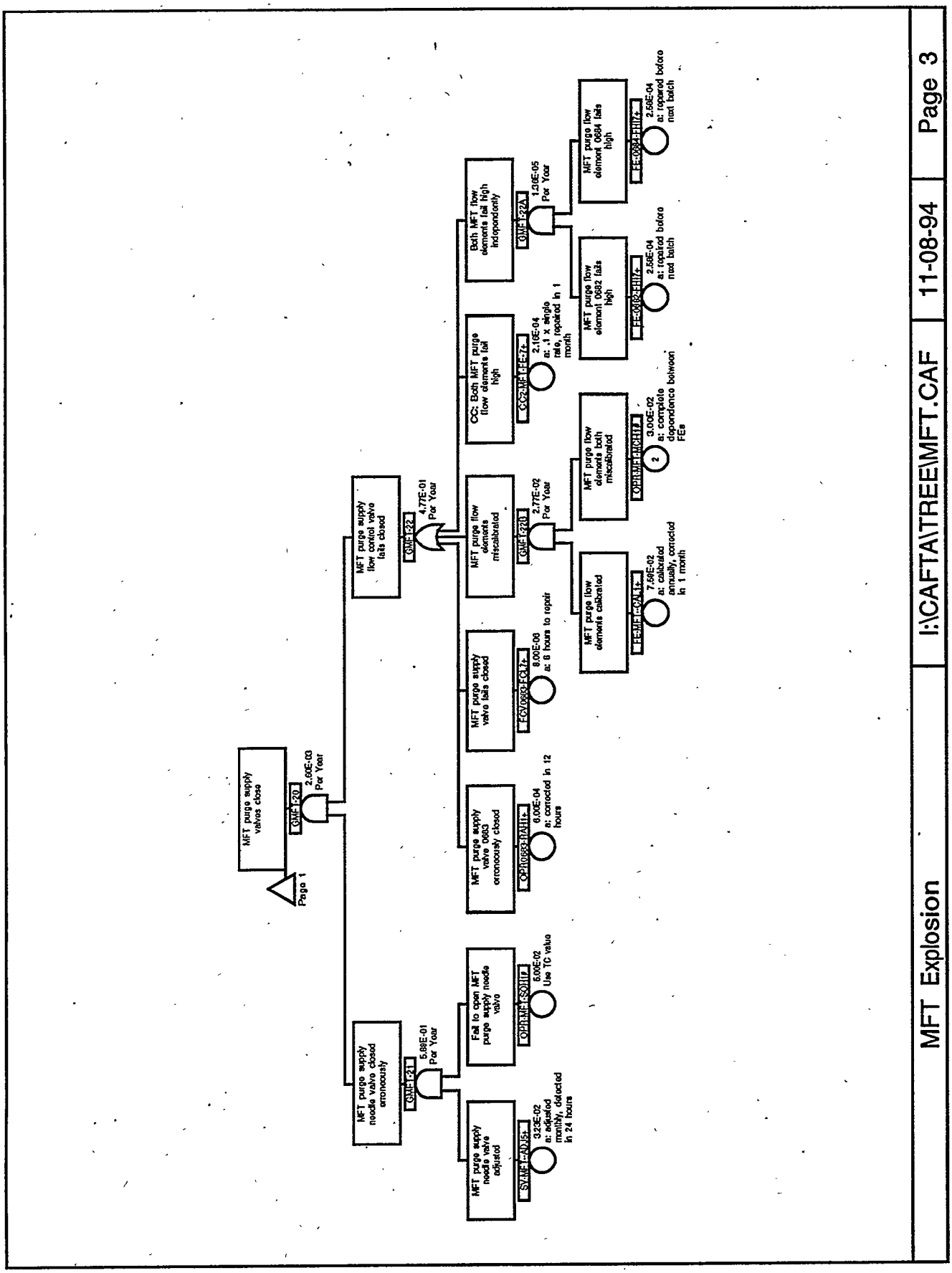
* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included. Modified top event frequency = (top event frequency) / (risk reduction worth).

MFT Explosion


Explosion in MFT
TOP-MFT
4.60E-05
Per Year 11/03/94
TRUNC = 0.0E+00
Uncorrected loss of purge to MFT
GMFT-13
1.53E-03
Per Year
Ignition source present in MFT vessel
IGNMFT--PRE1#
3.00E-02
Use TC value
Loss of purge to MFT
GMFT-15
4.06E-03
Per Year
Purge unavailable to CPC vessels
GMFT-17
1.47E-03
Per Year
Page 2
MFT purge supply valves close
GMFT-20
2.60E-03
Per Year
Page 3
Fail to detect or fail to respond to lack of MFT dilution
GMFT-16
5.57E-03
MFT purge flow elements miscalibrated
GMFT-21B
2.37E-03
MFT purge flow elements calibrated
FE-MFT--CAL1#
7.89E-02
a: calibrated annually, corrected in 1 month
MFT purge flow elements both miscalibrated
OPR-MFT-MCH1#
2
3.00E-02
a: complete dependance between FEs
Fail to respond to low MFT purge alarm
OPR0683-CSLP#
3.00E-03
Use TC value
Both MFT purge flow elements fail high independently
GMFT-21A
6.65E-06
MFT purge flow element 0682 fails high
FE-0682-FHI7#
2.58E-04
a: repaired before next batch
MFT purge flow element 0684 fails high
FE-0684-FHI7#
2.58E-04
a: repaired before next batch
CC: Both MFT purge flow elements fail high
CC2-MFT-FE-7#
2.16E-04
a: .1 x single rate, repaired in 1 month
MFT Explosion
I:\CAFTA\TREE\MFT.CAF
11-08-94
Page 1


Purge unavailable to CPC vessels
GMFT-17
1.47E-03 Per Year
Page 1
CPC backup purge system failure (all causes)
G-CPCBP
3.10E-03
Loss of CPC primary (air) purge system (all causes)
G-CPCPP
4.73E-01 Per Year
CPC backup purge tank supplies unavailable
G-CPCBP-A
4.84E-09
Backup CPC purge fails (except N2 tank supply failure)
TOPCPCBPBFLW#
3.10E-03 From fault tree CPCBP.CAF
CPC primary purge system fails (excluding normal power failure)
TOPCPCPPBFL2+
9.48E-04 repair time = 41 hours
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
2.97E-04 repair time = 8.5 hours
Bulk nitrogen tank supply failure
TOPN2TNKBFL3#
1.31E-04 repair time = 17.3 hours
CPC nitrogen tank supply failure
TOPCPCTKBFL7#
3.70E-05 from fault tree CPCTNK.CAF
MFT Explosion
I:\CAFTA\TREE\MFT.CAF
11-08-94
Page 2


MFT Explosion
I:\CAFTA\TREE\MFT.CAF
11-08-94
Page 3
MFT purge supply valves close
GMF-T20
2.00E-03 Per Year
Page 1
MFT purge supply nozzle valve closed erroneously
GMF-T21
5.88E-01 Per Year
MFT purge supply nozzle valve adjusted
SNMF-CANVS
3.23E-02 a: adjusted monthly, detected in 24 hours
Fail to open MFT purge supply nozzle valve
OPMMF-CSOHV
5.00E-02 Use TC valve
MFT purge supply valve 0683 erroneously closed
OPMOSS-MANUL
6.00E-04 a: corrected in 12 hours
MFT purge supply valve fails closed
FCVOSS-CC1F
8.00E-03 a: 8 hours to repair
MFT purge supply flow control valve fails closed
GMF-T22
4.77E-01 Per Year
MFT purge flow elements miscalibrated
GMF-T230
2.77E-02 Per Year
MFT purge flow elements calibrated
FE-MFT-CALIF
7.58E-02 a: calibrated annually, corrected in 1 month
MFT purge flow elements both miscalibrated
OPFMMFTHOHTF
2
3.00E-02 a: complete dependence between FEs
CC: Both MFT purge flow elements fail high
CCFMFTFEFF
2.10E-04 a: .1 x single rate, repaired in 1 month
Both MFT flow elements fail high independently
GMF-T23A
1.30E-05 Per Year
MFT purge flow element 0682 fails high
FE-0682-HIIF
2.58E-04 a: repaired before next batch
MFT purge flow element 0684 fails high
FE-0684-HIIF
2.58E-04 a: repaired before next batch

Cutsets for I:\CAFTA\CUT\MFT.CSR 11/08/94 12:27 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-MFT					4.60E-05
1.	FE-MFT--CAL1+	MFT purge flow elements calibrated	4	1M 1.0E+00Y	7.59E-02	4.16E-05
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-MCH1#	MFT purge flow elements both miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-MFT--ADJ5+	MFT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
2.	CC2-MFT-FE-7+	CC: Both MFT purge flow elements fail high	4	1M 3.0E-07H	2.16E-04	3.94E-06
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-MFT--ADJ5+	MFT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
3.	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	9.53E-08
	OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	OPR0683-CSLP#	Fail to respond to low MFT purge alarm	1	1N 3.0E-03N	3.00E-03N	
	OPR0683-RAH1+	MFT purge supply valve 0683 erroneously closed	4	12H 5.0E-05H	6.00E-04	
	SV-MFT--ADJ5+	MFT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
4.	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	8.55E-08
	OPR0683-CSLP#	Fail to respond to low MFT purge alarm	1	1N 3.0E-03N	3.00E-03N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
5.	FE-MFT--CAL1#	MFT purge flow elements calibrated	3	1M 1.0E+00Y	7.89E-02	7.52E-08
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-MCH1#	MFT purge flow elements both miscalibrated	1	1N 3.0E-02N	3.00E-02N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	OPR0683-RAH1+	MFT purge supply valve 0683 erroneously closed	4	12H 5.0E-05H	6.00E-04	
	SV-MFT--ADJ5+	MFT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
6.	FE-MFT--CAL1#	MFT purge flow elements calibrated	3	1M 1.0E+00Y	7.89E-02	6.75E-08
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-MCH1#	MFT purge flow elements both miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
7.	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	4.64E-08
	OPR0683-CSLP#	Fail to respond to low MFT purge alarm	1	1N 3.0E-03N	3.00E-03N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	
8.	FE-MFT--CAL1#	MFT purge flow elements calibrated	3	1M 1.0E+00Y	7.89E-02	3.66E-08
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-MCH1#	MFT purge flow elements both miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	
9.	CC2-MFT-FE-7#	CC: Both MFT purge flow elements fail high	3	1M 3.0E-07H	2.16E-04	6.86E-09
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	OPR0683-RAH1+	MFT purge supply valve 0683 erroneously closed	4	12H 5.0E-05H	6.00E-04	
	SV-MFT--ADJ5+	MFT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
10.	CC2-MFT-FE-7#	CC: Both MFT purge flow elements fail high	3	1M 3.0E-07H	2.16E-04	6.16E-09
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
11.	CC2-MFT-FE-7#	CC: Both MFT purge flow elements fail high	3	1M 3.0E-07H	2.16E-04	3.34E-09
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	
12.	FE-0682-FHI7+	MFT purge flow element 0682 fails high	4	86H 3.0E-06H	2.58E-04	1.83E-09
	FE-0684-FHI7+	MFT purge flow element 0684 fails high	4	86H 3.0E-06H	2.58E-04	
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-MFT--ADJ5+	MFT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
13.	FCV0683-FCL7+	MFT purge supply valve fails closed	4	8H 1.0E-06H	8.00E-06	1.70E-09
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	OPR0683-CSLP#	Fail to respond to low MFT purge alarm	1	1N 3.0E-03N	3.00E-03N	
	SV-MFT--ADJ5+	MFT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
14.	FCV0683-FCL7+	MFT purge supply valve fails closed	4	8H 1.0E-06H	8.00E-06	1.34E-09
	FE-MFT--CAL1#	MFT purge flow elements calibrated	3	1M 1.0E+00Y	7.89E-02	
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	OPR-MFT-MCH1#	MFT purge flow elements both miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-MFT--ADJ5+	MFT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
15.	CC2-MFT-FE-7#	CC: Both MFT purge flow elements fail high	3	1M 3.0E-07H	2.16E-04	1.22E-10
	FCV0683-FCL7+	MFT purge supply valve fails closed	4	8H 1.0E-06H	8.00E-06	
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-MFT--ADJ5+	MFT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
16.	FE-0682-FHI7#	MFT purge flow element 0682 fails high	3	86H 3.0E-06H	2.58E-04	2.11E-12
	FE-0684-FHI7#	MFT purge flow element 0684 fails high	3	86H 3.0E-06H	2.58E-04	
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	OPR0683-RAH1+	MFT purge supply valve 0683 erroneously closed	4	12H 5.0E-05H	6.00E-04	
	SV-MFT--ADJ5+	MFT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
17.	FE-0682-FHI7#	MFT purge flow element 0682 fails high	3	86H 3.0E-06H	2.58E-04	1.90E-12
	FE-0684-FHI7#	MFT purge flow element 0684 fails high	3	86H 3.0E-06H	2.58E-04	
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
18.	FE-0682-FHI7#	MFT purge flow element 0682 fails high	3	86H 3.0E-06H	2.58E-04	1.03E-12
	FE-0684-FHI7#	MFT purge flow element 0684 fails high	3	86H 3.0E-06H	2.58E-04	
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	1	1N 3.1E-03N	3.10E-03N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	
19.	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	1.34E-13
	OPR0683-CSLP#	Fail to respond to low MFT purge alarm	1	1N 3.0E-03N	3.00E-03N	
	TOPCPCTKBFL7#	CPC nitrogen tank supply failure	1	1N 3.7E-05N	3.70E-05N	
	TOPN2TNKBFL3#	Bulk nitrogen tank supply failure	3	17H 7.7E-06H	1.31E-04	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
20.	FE-MFT--CAL1#	MFT purge flow elements calibrated	3	1M 1.0E+00Y	7.89E-02	1.05E-13
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-MCH1#	MFT purge flow elements both miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCTKBFL7#	CPC nitrogen tank supply failure	1	1N 3.7E-05N	3.70E-05N	
	TOPN2TNKBFL3#	Bulk nitrogen tank supply failure	3	17H 7.7E-06H	1.31E-04	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
21.	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	7.25E-14
	OPR0683-CSLP#	Fail to respond to low MFT purge alarm	1	1N 3.0E-03N	3.00E-03N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	
	TOPCPCTKBFL7#	CPC nitrogen tank supply failure	1	1N 3.7E-05N	3.70E-05N	
	TOPN2TNKBFL3#	Bulk nitrogen tank supply failure	3	17H 7.7E-06H	1.31E-04	
22.	FE-MFT--CAL1#	MFT purge flow elements calibrated	3	1M 1.0E+00Y	7.89E-02	5.72E-14
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-MCH1#	MFT purge flow elements both miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOPCPCTKBFL7#	CPC nitrogen tank supply failure	1	1N 3.7E-05N	3.70E-05N	
	TOPN2TNKBFL3#	Bulk nitrogen tank supply failure	3	17H 7.7E-06H	1.31E-04	
23.	FCV0683-FCL7+	MFT purge supply valve fails closed	4	8H 1.0E-06H	8.00E-06	3.76E-14
	FE-0682-FHI7#	MFT purge flow element 0682 fails high	3	86H 3.0E-06H	2.58E-04	
	FE-0684-FHI7#	MFT purge flow element 0684 fails high	3	86H 3.0E-06H	2.58E-04	
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	1	1N 5.0E-02N	5.00E-02N	
	SV-MFT--ADJ5+	MFT purge supply needle valve adjusted	4	24H 1.0E+00M	3.23E-02	
24.	CC2-MFT-FE-7#	CC: Both MFT purge flow elements fail high	3	1M 3.0E-07H	2.16E-04	9.62E-15
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCTKBFL7#	CPC nitrogen tank supply failure	1	1N 3.7E-05N	3.70E-05N	
	TOPN2TNKBFL3#	Bulk nitrogen tank supply failure	3	17H 7.7E-06H	1.31E-04	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
25.	CC2-MFT-FE-7#	CC: Both MFT purge flow elements fail high	3	1M 3.0E-07H	2.16E-04	5.22E-15
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	
	TOPCPCTKBFL7#	CPC nitrogen tank supply failure	1	1N 3.7E-05N	3.70E-05N	
	TOPN2TNKBFL3#	Bulk nitrogen tank supply failure	3	17H 7.7E-06H	1.31E-04	
26.	FE-0682-FHI7#	MFT purge flow element 0682 fails high	3	86H 3.0E-06H	2.58E-04	2.96E-18
	FE-0684-FHI7#	MFT purge flow element 0684 fails high	3	86H 3.0E-06H	2.58E-04	
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCTKBFL7#	CPC nitrogen tank supply failure	1	1N 3.7E-05N	3.70E-05N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	TOPN2TNKBFL3#	Bulk nitrogen tank supply failure	3	17H 7.7E-06H	1.31E-04	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
27.	FE-0682-FHI7#	MFT purge flow element 0682 fails high	3	86H 3.0E-06H	2.58E-04	1.61E-18
	FE-0684-FHI7#	MFT purge flow element 0684 fails high	3	86H 3.0E-06H	2.58E-04	
	IGNMFT--PRE1#	Ignition source present in MFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPCPCPPBFL2+	CPC primary purge system fails (excluding normal power failure)	4	50H 1.9E-05H	9.49E-04	
	TOPCPCTKBFL7#	CPC nitrogen tank supply failure	1	1N 3.7E-05N	3.70E-05N	
	TOPN2TNKBFL3#	Bulk nitrogen tank supply failure	3	17H 7.7E-06H	1.31E-04	

Explosion in MFT Top Event Frequency: 4.60E-05/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
CC2-MFT-FE-7+-IC	CC: Both MFT purge flow elements fail high	3.00E-07/H	9.61E+03
SV-MFT--ADJ5+-IC	MFT purge supply needle valve adjusted	1.34E-03/H	7.15E+02
FE-MFT--CAL1+-IC	MFT purge flow elements calibrated	1.05E-04/H	2.88E+02
TOPCPCPPBFL2+-I	CPC primary purge system fails (excluding normal power)	1.90E-05/H	1.00E+02
TOPPOWN-BFLH+-I	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	1.00E+02
FCV0683-FCL7+-IC	MFT purge supply valve fails closed	1.00E-06/H	5.46E+01
OPR0683-RAH1+-IC	MFT purge supply valve 0683 erroneously closed	4.99E-05/H	5.46E+01
IGNMFT--PRE1#	Ignition source present in MFT vessel	3.00E-02	3.33E+01
OPR-MFT-MCH1#	MFT purge flow elements both miscalibrated	3.00E-02	3.04E+01
OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	5.00E-02	1.99E+01
FE-0684-FHI7+-IC	MFT purge flow element 0684 fails high	3.00E-06/H	3.51E+00
FE-0682-FHI7+-IC	MFT purge flow element 0682 fails high	3.00E-06/H	3.51E+00
TOPCPCBPBFLW#	Backup CPC purge fails (except N2 tank supply failure)	3.10E-03	2.72E+00
OPR0683-CSLP#	Fail to respond to low MFT purge alarm	3.00E-03	2.66E+00

Modified top event frequency = (top event frequency) / (risk reduction worth).

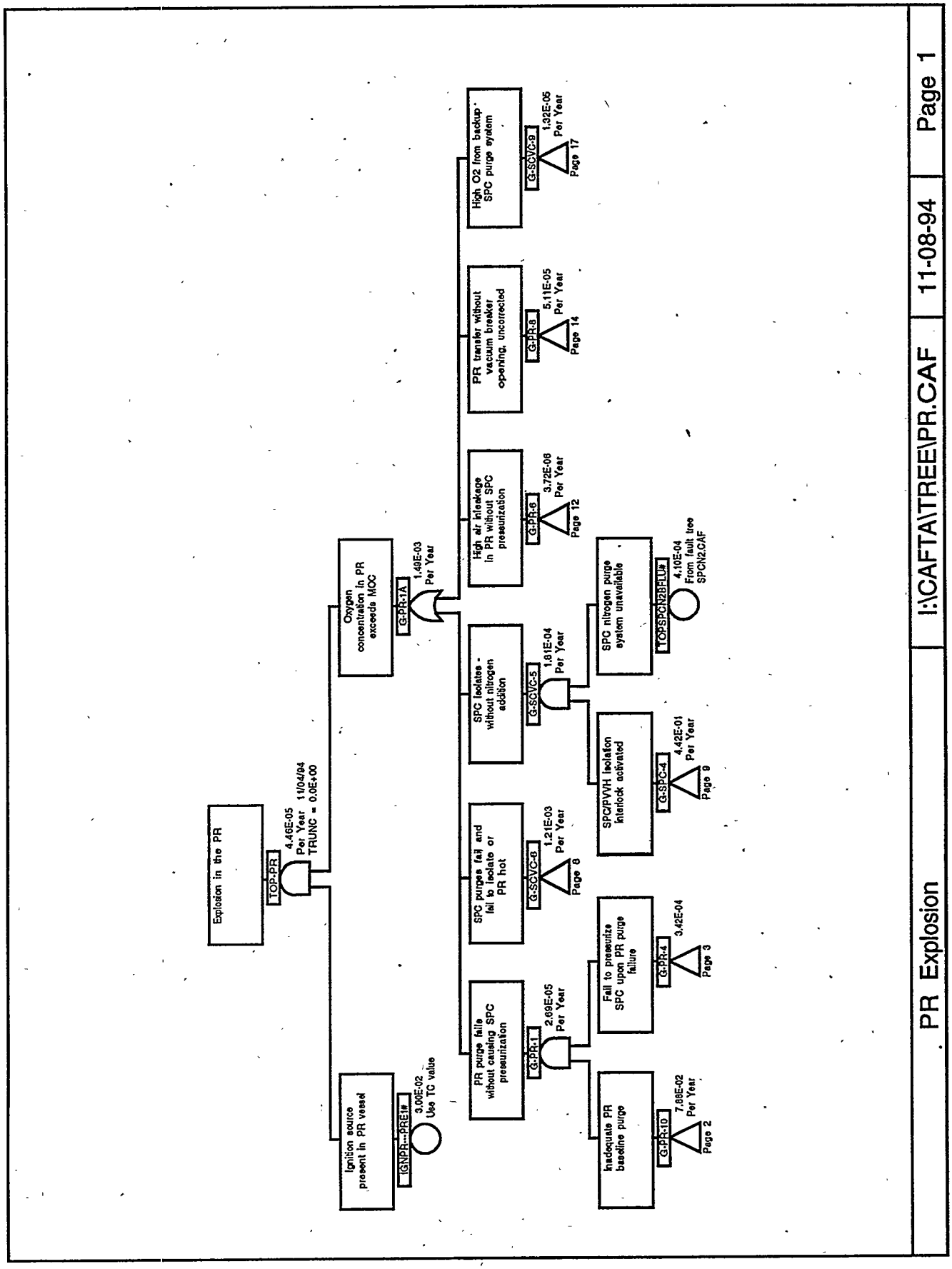
Risk Reduction Worth

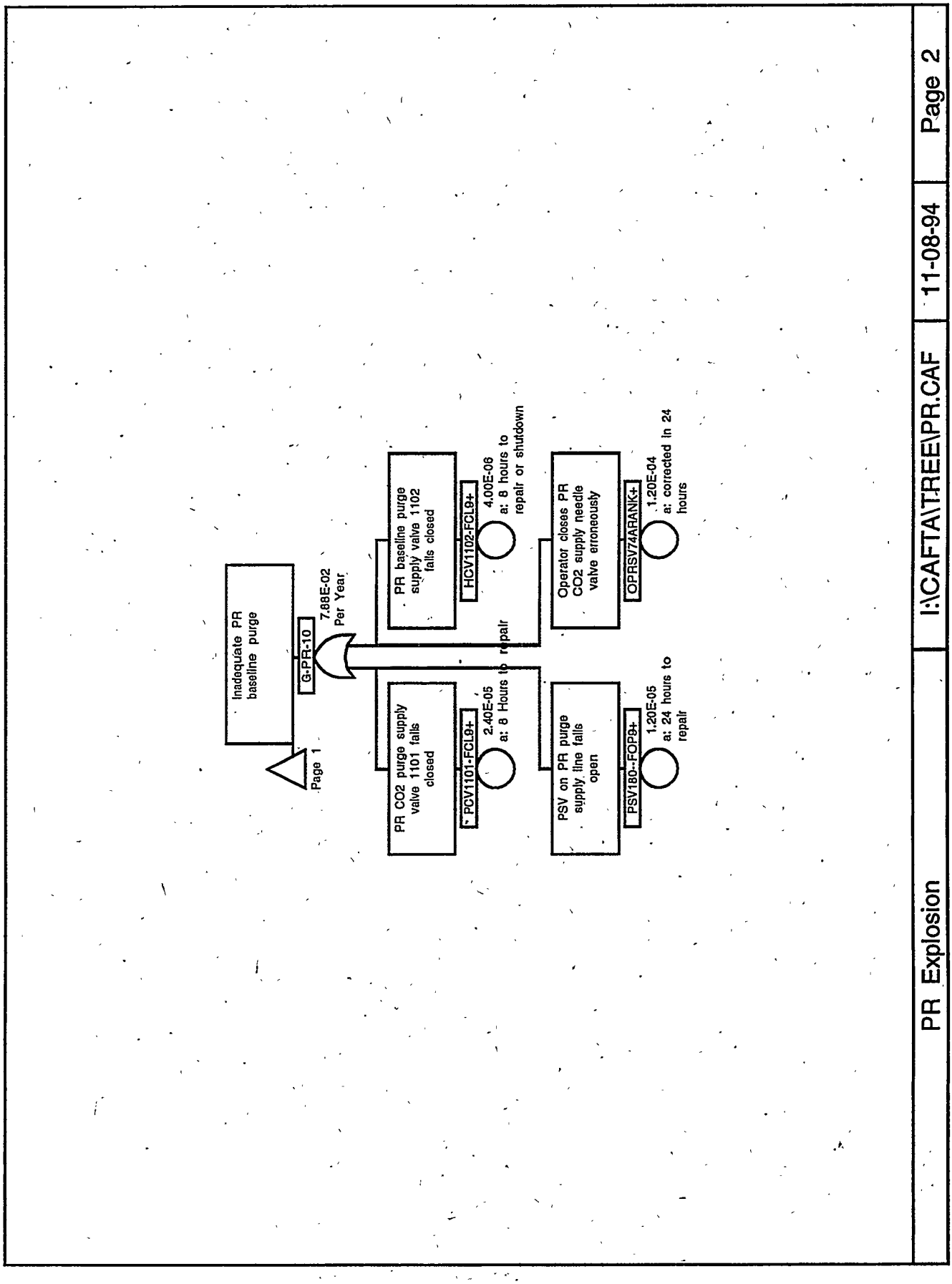
Basic Event Name	Description	Prob/Freq	RedW
*IGNMFT--PRE1#	Ignition source present in MFT vessel	3.00E-02	0.00E+00
OPR-MFT-SOH1#	Fail to open MFT purge supply needle valve	5.00E-02	1.87E+02
SV-MFT--ADJ5+-IC	MFT purge supply needle valve adjusted	1.34E-03/H	1.87E+02
FE-MFT--CAL1+-IC	MFT purge flow elements calibrated	1.05E-04/H	1.10E+01
OPR-MFT-MCH1#	MFT purge flow elements both miscalibrated	3.00E-02	1.10E+01
CC2-MFT-FE-7+-IC	CC: Both MFT purge flow elements fail high	3.00E-07/H	1.09E+00

* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

PR Explosion


PR Explosion
I:\CAFTA\TREE\PR.CAF
11-08-94
Page 1
Explosion in the PR
TOP-PR
4.46E-05
Per Year
11/04/94
TRUNC = 0.0E+00
Ignition source present in PR vessel
IGNPR---PRE1#
3.00E-02
Use TC value
Oxygen concentration in PR exceeds MOC
G-PR-1A
1.49E-03
Per Year
PR purge fails without causing SPC pressurization
G-PR-1
2.69E-05
Per Year
Inadequate PR baseline purge
G-PR-10
7.88E-02
Per Year
Page 2
Fail to pressurize SPC upon PR purge failure
G-PR-4
3.42E-04
Page 3
SPC purges fail and fail to isolate or PR hot
G-SCVC-8
1.21E-03
Per Year
Page 8
SPC isolates - without nitrogen addition
G-SCVC-5
1.81E-04
Per Year
SPC/PVVH isolation interlock activated
G-SPC-4
4.42E-01
Per Year
Page 9
SPC nitrogen purge system unavailable
TOPSPCN2BFLU#
4.10E-04
From fault tree SPCN2.CAF
High air inleakage in PR without SPC pressurization
G-PR-6
3.72E-06
Per Year
Page 12
PR transfer without vacuum breaker opening, uncorrected
G-PR-8
5.11E-05
Per Year
Page 14
High O2 from backup SPC purge system
G-SCVC-9
1.32E-05
Per Year
Page 17


Inadequate PR baseline purge
G-PR-10
7.88E-02 Per Year
Page 1
PR CO2 purge supply valve 1101 fails closed
PCV1101-FCL9+
2.40E-05 a: 8 Hours to repair
PR baseline purge supply valve 1102 fails closed
HCV1102-FCL9+
4.00E-06 a: 8 hours to repair or shutdown
PSV on PR purge supply line fails open
PSV180--FOP9+
1.20E-05 a: 24 hours to repair
Operator closes PR CO2 supply needle valve erroneously
OPRSV74ARANK+
1.20E-04 a: corrected in 24 hours
PR Explosion
I:\CAFTA\TREE\PR.CAF
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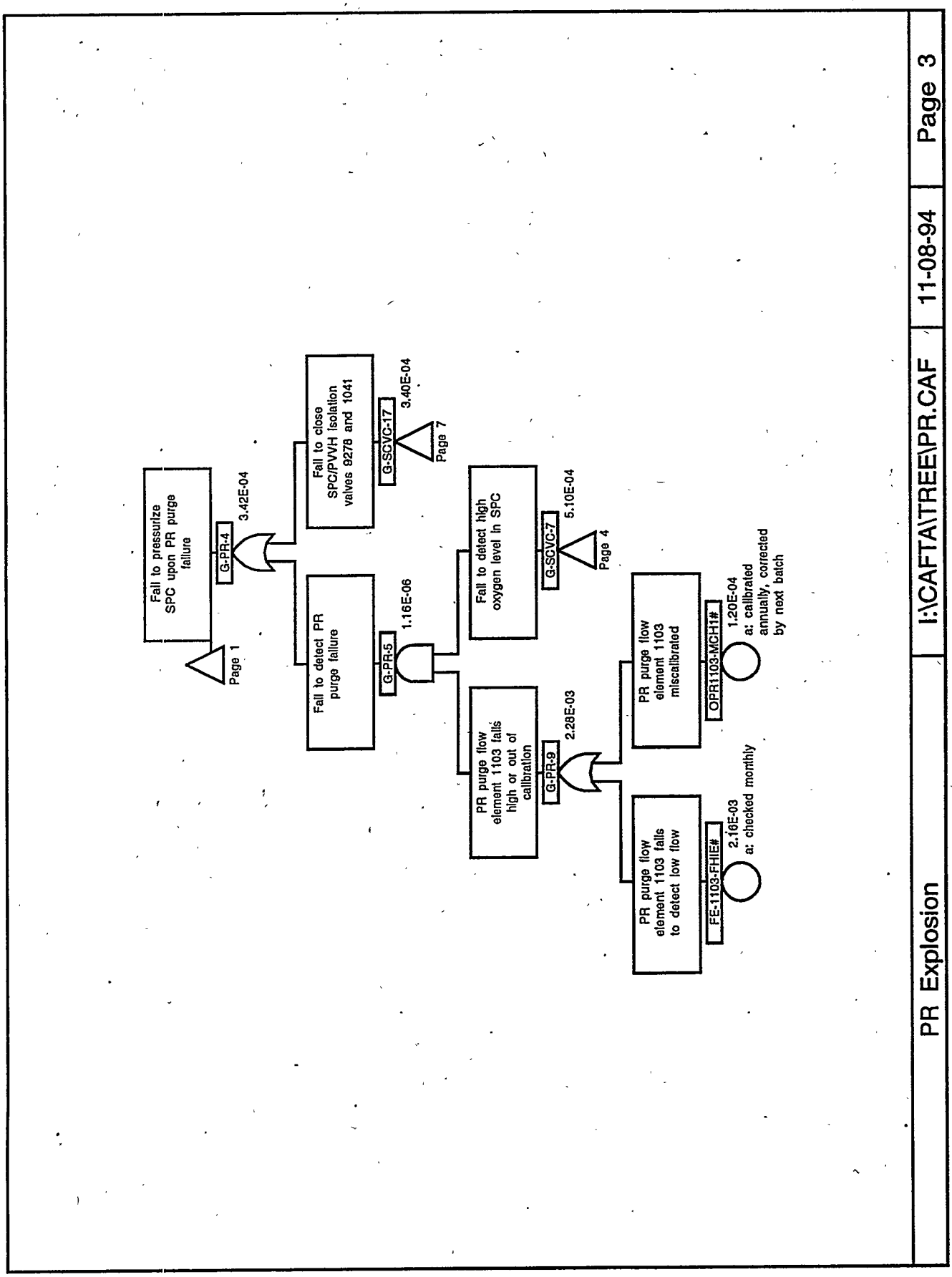
Page 2


Fail to pressurize SPC upon PR purge failure
G-PR-4
3.42E-04
Page 1
Fail to close SPC/PVVH isolation valves 9278 and 1041
G-SCVC-17
3.40E-04
Page 7
Fail to detect PR purge failure
G-PR-5
1.16E-06
Fail to detect high oxygen level in SPC
G-SCVC-7
5.10E-04
Page 4
PR purge flow element 1103 falls high or out of calibration
G-PR-9
2.28E-03
PR purge flow element 1103 miscalibrated
OPR1103-MCH1#
1.20E-04
a: calibrated annually, corrected by next batch
PR purge flow element 1103 falls to detect low flow
FE-1103-FHIE#
2.16E-03
a: checked monthly
PR Explosion
I:\CAFTA\TREE\PR.CAF
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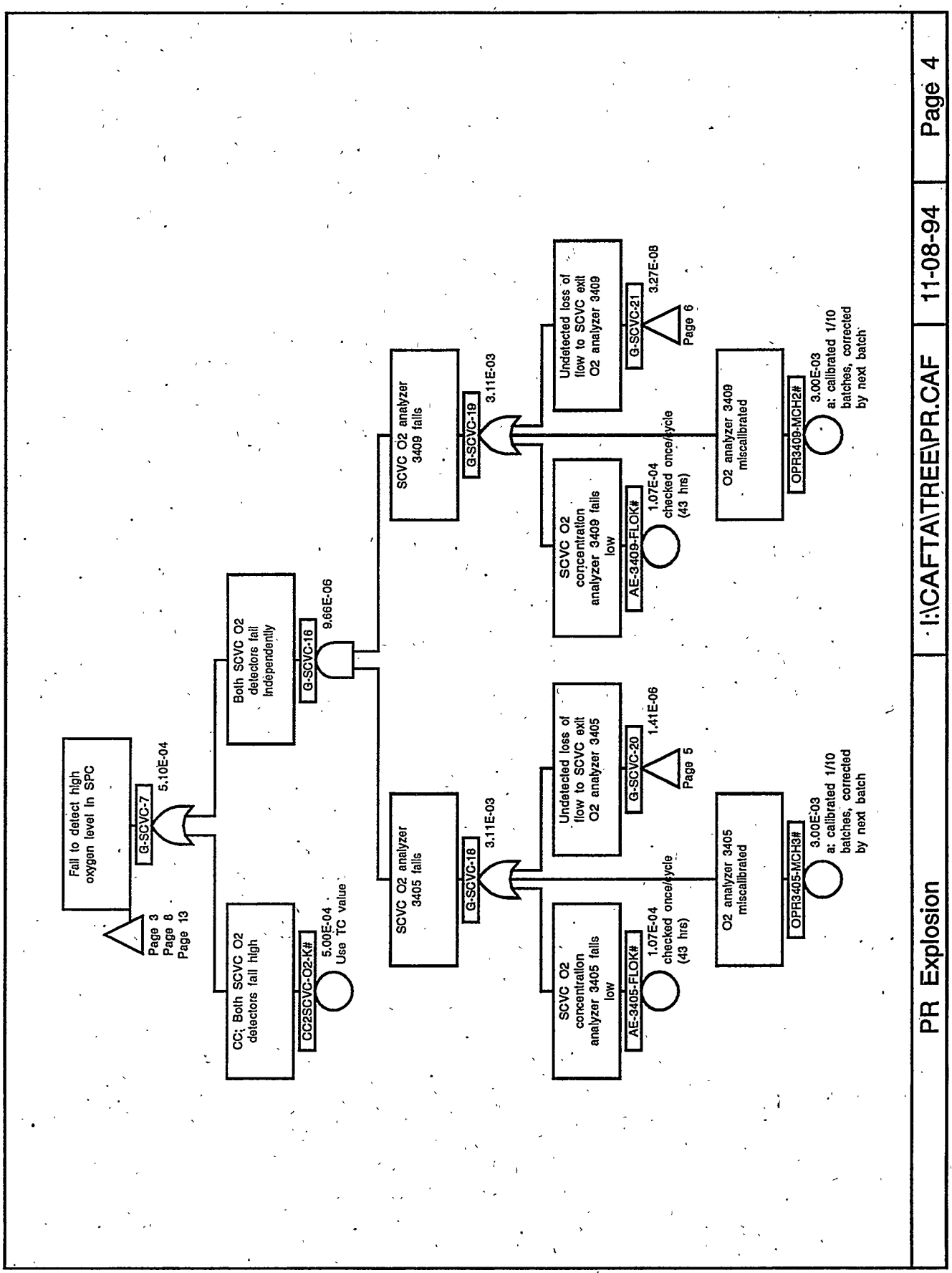
Page 3


Fail to detect high oxygen level in SPC
G-SCVC-7
5.10E-04
Page 3
Page 8
Page 13
Both SCVC O2 detectors fail independently
G-SCVC-16
9.66E-06
CC; Both SCVC O2 detectors fail high
CC2SCVC-O2-K#
5.00E-04
Use TC value
SCVC O2 analyzer 3409 falls
G-SCVC-19
3.11E-03
Undetected loss of flow to SCVC exit O2 analyzer 3409
G-SCVC-21
3.27E-08
Page 6
SCVC O2 concentration analyzer 3409 falls low
AE-3409-FLOK#
1.07E-04
checked once/cycle (43 hrs)
O2 analyzer 3409 miscalibrated
OPR3409-MCH2#
3.00E-03
a: calibrated 1/10 batches, corrected by next batch
SCVC O2 analyzer 3405 falls
G-SCVC-18
3.11E-03
Undetected loss of flow to SCVC exit O2 analyzer 3405
G-SCVC-20
1.41E-06
Page 5
SCVC O2 concentration analyzer 3405 falls low
AE-3405-FLOK#
1.07E-04
checked once/cycle (43 hrs)
O2 analyzer 3405 miscalibrated
OPR3405-MCH3#
3.00E-03
a: calibrated 1/10 batches, corrected by next batch
PR Explosion
I:\CAFTA\TREE\PR.CAF
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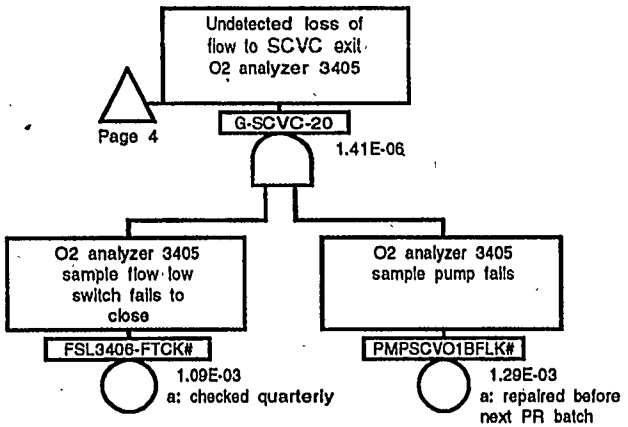
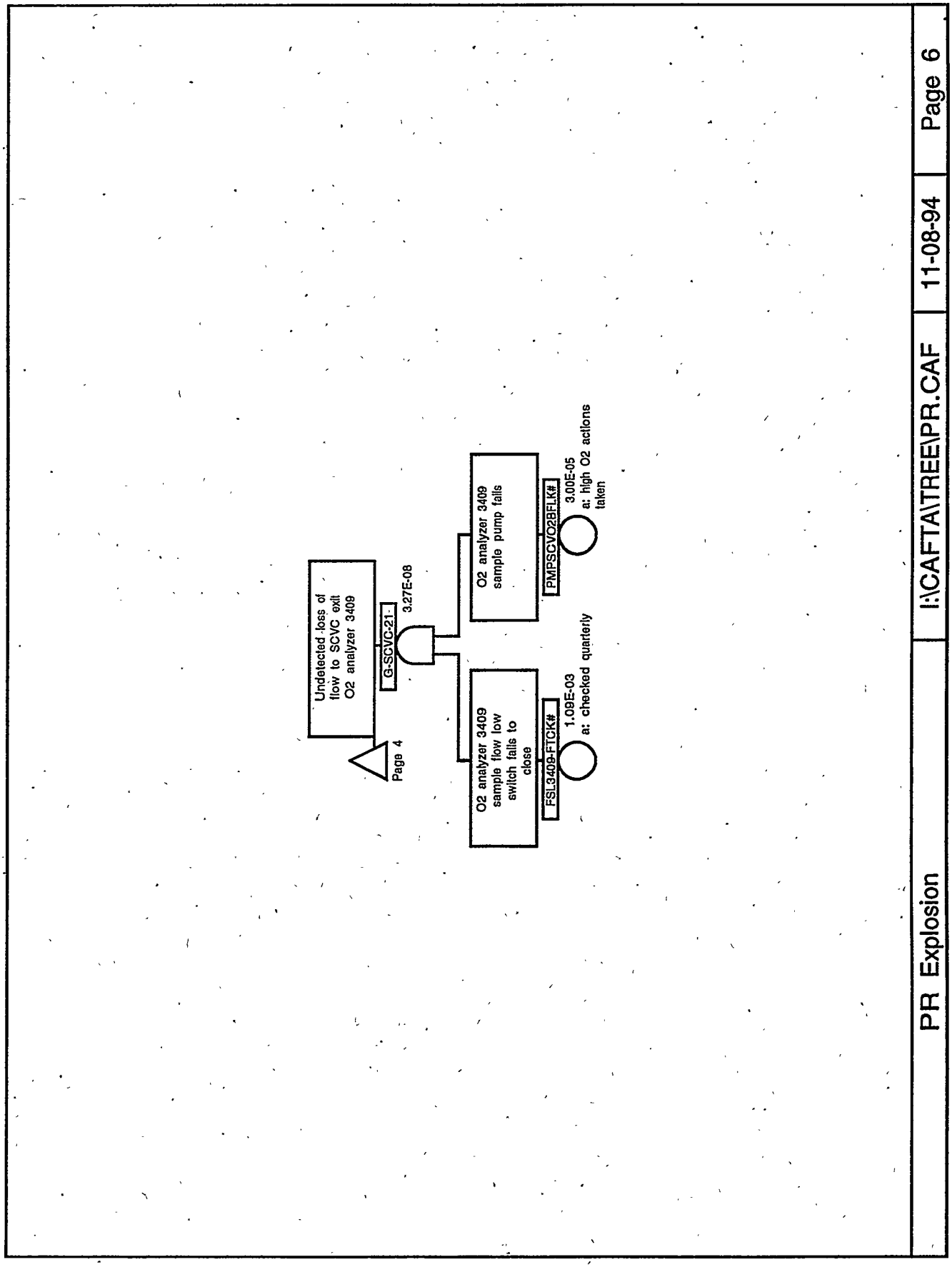
Page 4



PR Explosion	I:\CAFTA\TREE\PR.CAF	11-08-94	Page 5


Undetected loss of flow to SCVC exit O2 analyzer 3409
G-SCVC-21
3.27E-08
Page 4
O2 analyzer 3409 sample flow low switch fails to close
FSL3409-FTCK#
1.09E-03
a: checked quarterly
O2 analyzer 3409 sample pump fails
PMPSCVO2BFLK#
3.00E-05
a: high O2 actions taken
PR Explosion
I:\CAFTA\TREE\PR.CAF
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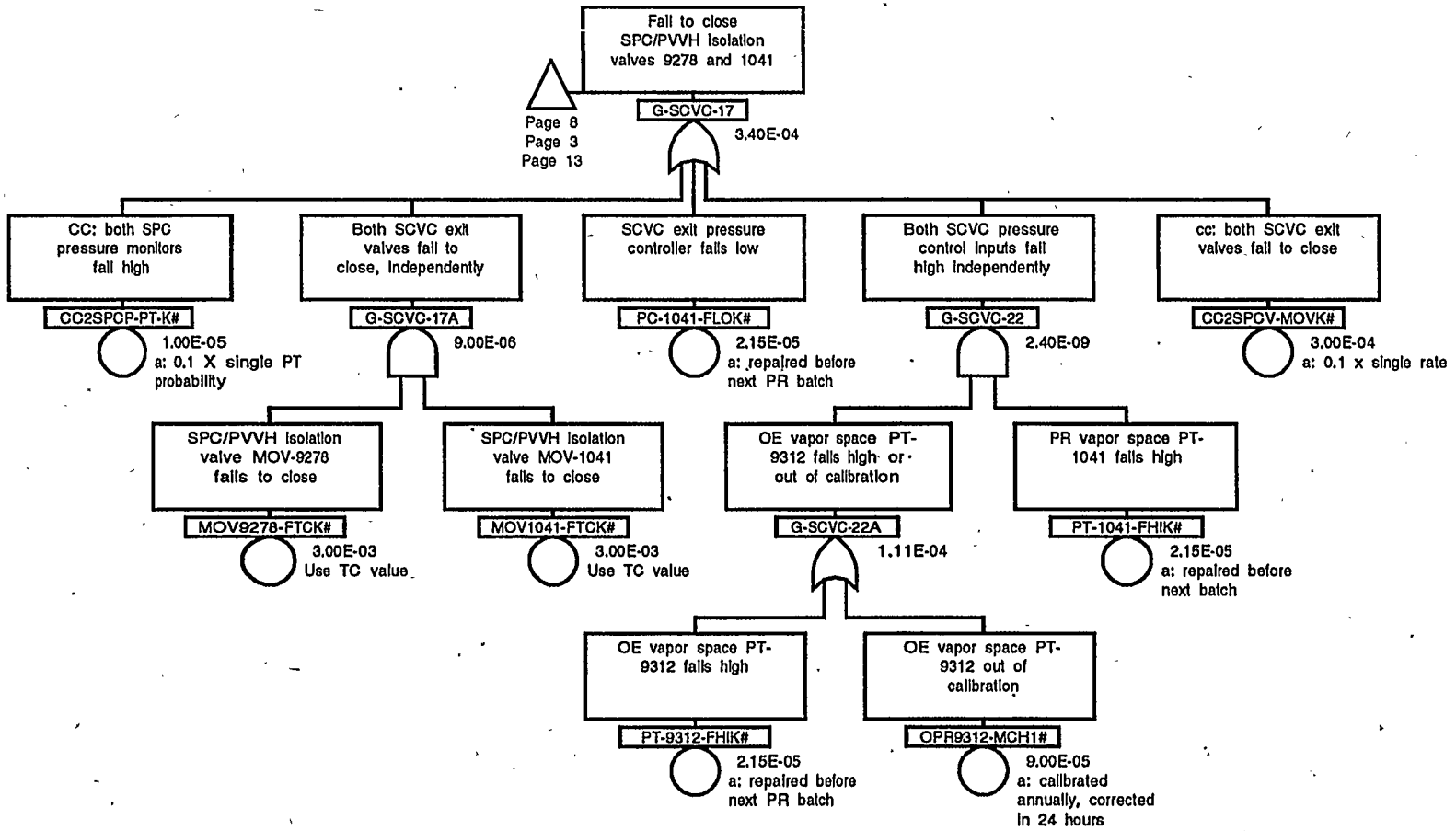
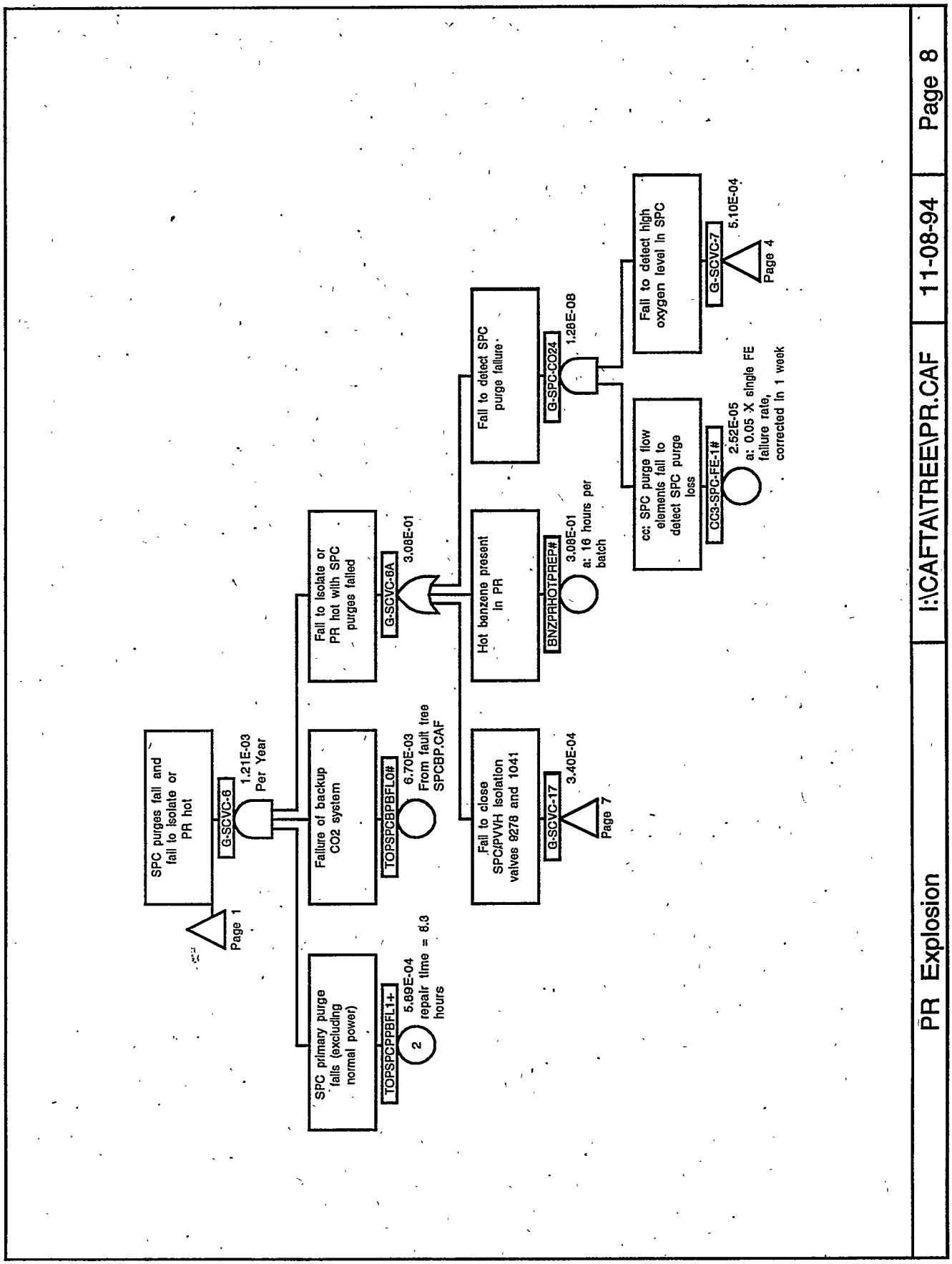
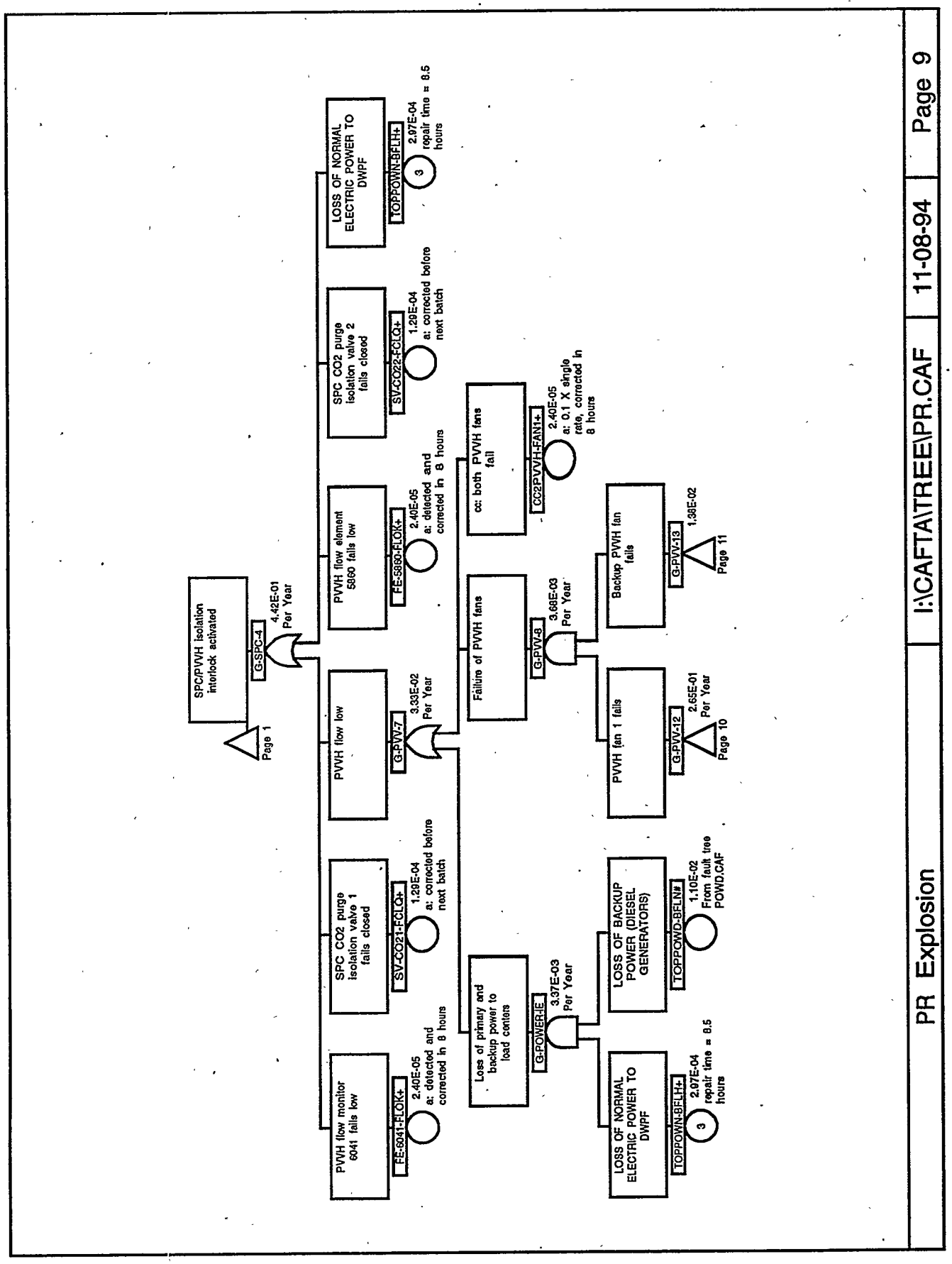
Page 6



PR Explosion	I:\CAFTA\TREE\PR.CAF	11-08-94	Page 7


PR Explosion
I:\CAFTA\TREE\PR.CAF
11-08-94
Page 8
SPC purges fail and fail to isolate or PR hot
G-SCVC-6
1.21E-03 Per Year
Page 1
SPC primary purge fails (excluding normal power)
TOPSPCPPBFL1+
2
5.89E-04 repair time = 8.3 hours
Failure of backup CO2 system
TOPSPCBPBFL0#
6.70E-03 From fault tree SPCBP.CAF
Fail to isolate or PR hot with SPC purges failed
G-SCVC-8A
3.08E-01
Fail to close SPC/PVVH isolation valves 9278 and 1041
G-SCVC-17
3.40E-04
Page 7
Hot benzene present in PR
BNZPRHOTPREP#
3.08E-01 a: 16 hours per batch
Fail to detect SPC purge failure
G-SPC-CO24
1.28E-08
cc: SPC purge flow elements fail to detect SPC purge loss
CC3-SPC-FE-1#
2.52E-05 a: 0.05 X single FE failure rate, corrected in 1 week
Fail to detect high oxygen level in SPC
G-SCVC-7
5.10E-04
Page 4


SPC/PVVH isolation interlock activated
Page 1
G-SPC-4
4.42E-01 Per Year
PVVH flow monitor 6041 fails low
FE-6041-FLOK+
2.40E-05 a: detected and corrected in 8 hours
SPC CO2 purge isolation valve 1 fails closed
SV-CO21-FCLO+
1.29E-04 a: corrected before next batch
PVVH flow low
G-PVV-7
3.33E-02 Per Year
PVVH flow element 5860 fails low
FE-5860-FLOK+
2.40E-05 a: detected and corrected in 8 hours
SPC CO2 purge isolation valve 2 fails closed
SV-CO22-FCLO+
1.29E-04 a: corrected before next batch
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
3
2.97E-04 repair time = 8.5 hours
Loss of primary and backup power to load centers
G-POWER-IE
3.37E-03 Per Year
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
3
2.97E-04 repair time = 8.5 hours
LOSS OF BACKUP POWER (DIESEL GENERATORS)
TOPPOWD-BFLN#
1.10E-02 From fault tree POWD.CAF
Failure of PVVH fans
G-PVV-8
3.68E-03 Per Year
cc: both PVVH fans fail
CC2PVVH-FAN1+
2.40E-05 a: 0.1 X single rate, corrected in 8 hours
PVVH fan 1 fails
G-PVV-12
2.65E-01 Per Year
Page 10
Backup PVVH fan fails
G-PVV-13
1.38E-02
Page 11
PR Explosion
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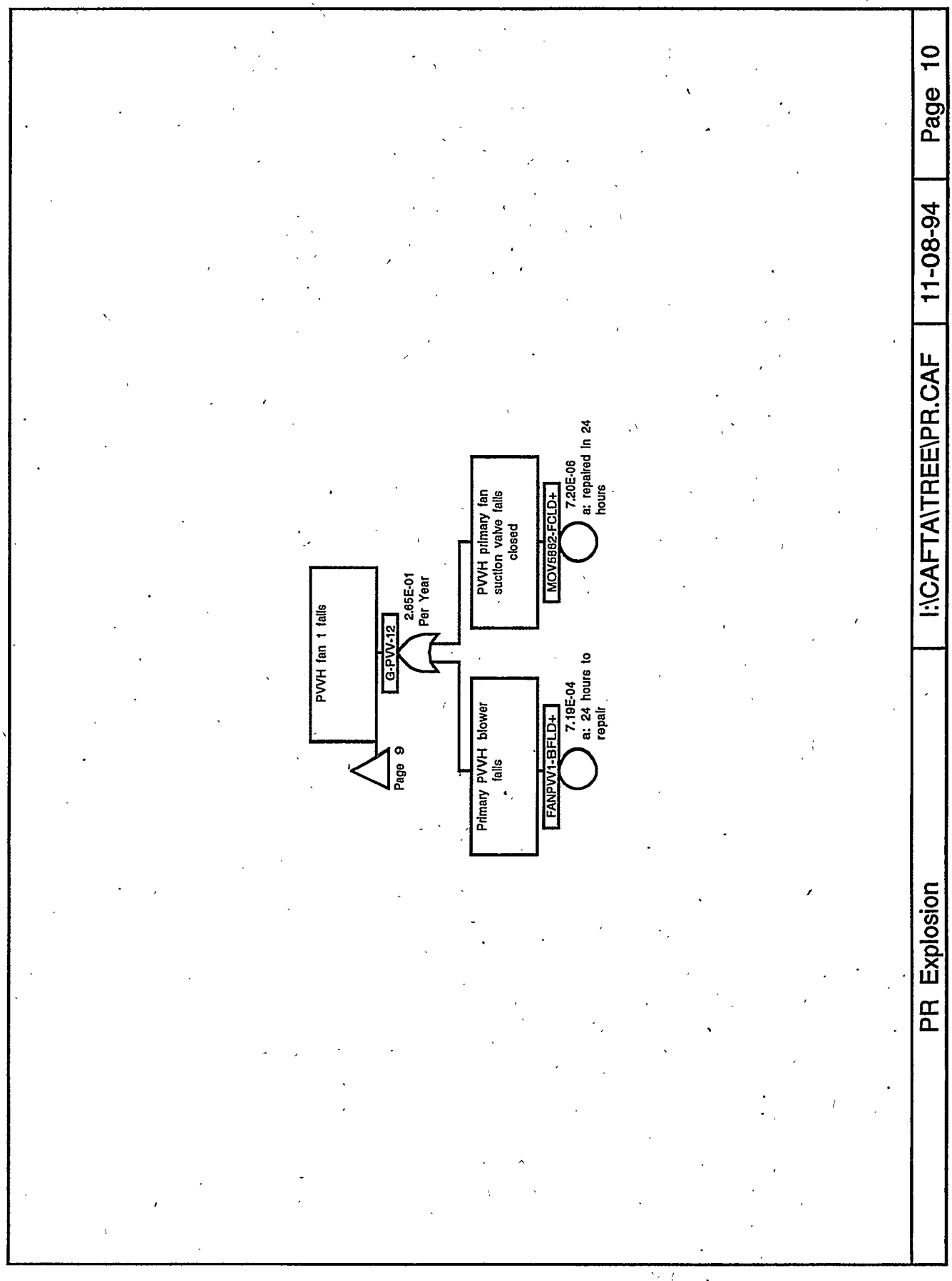
Page 9


PR Explosion
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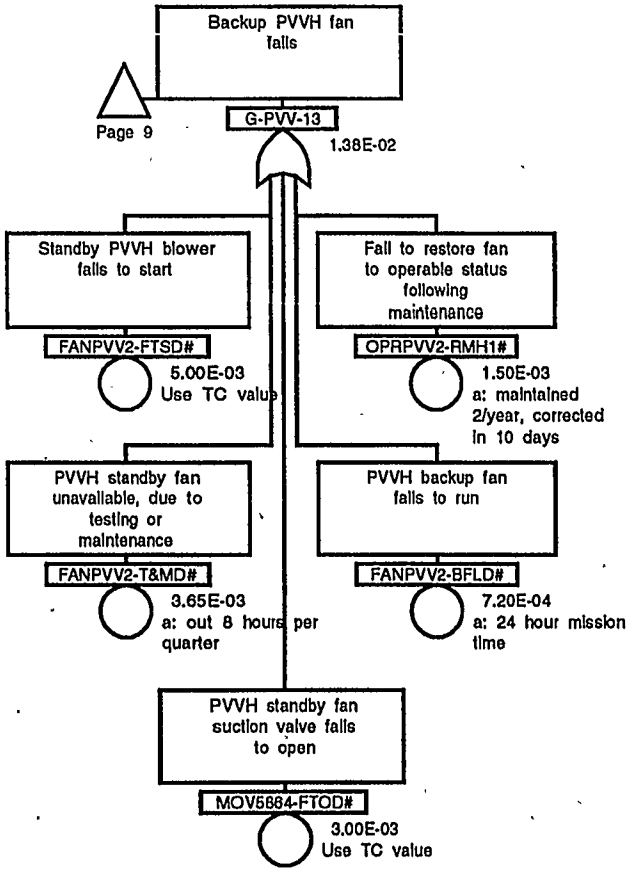
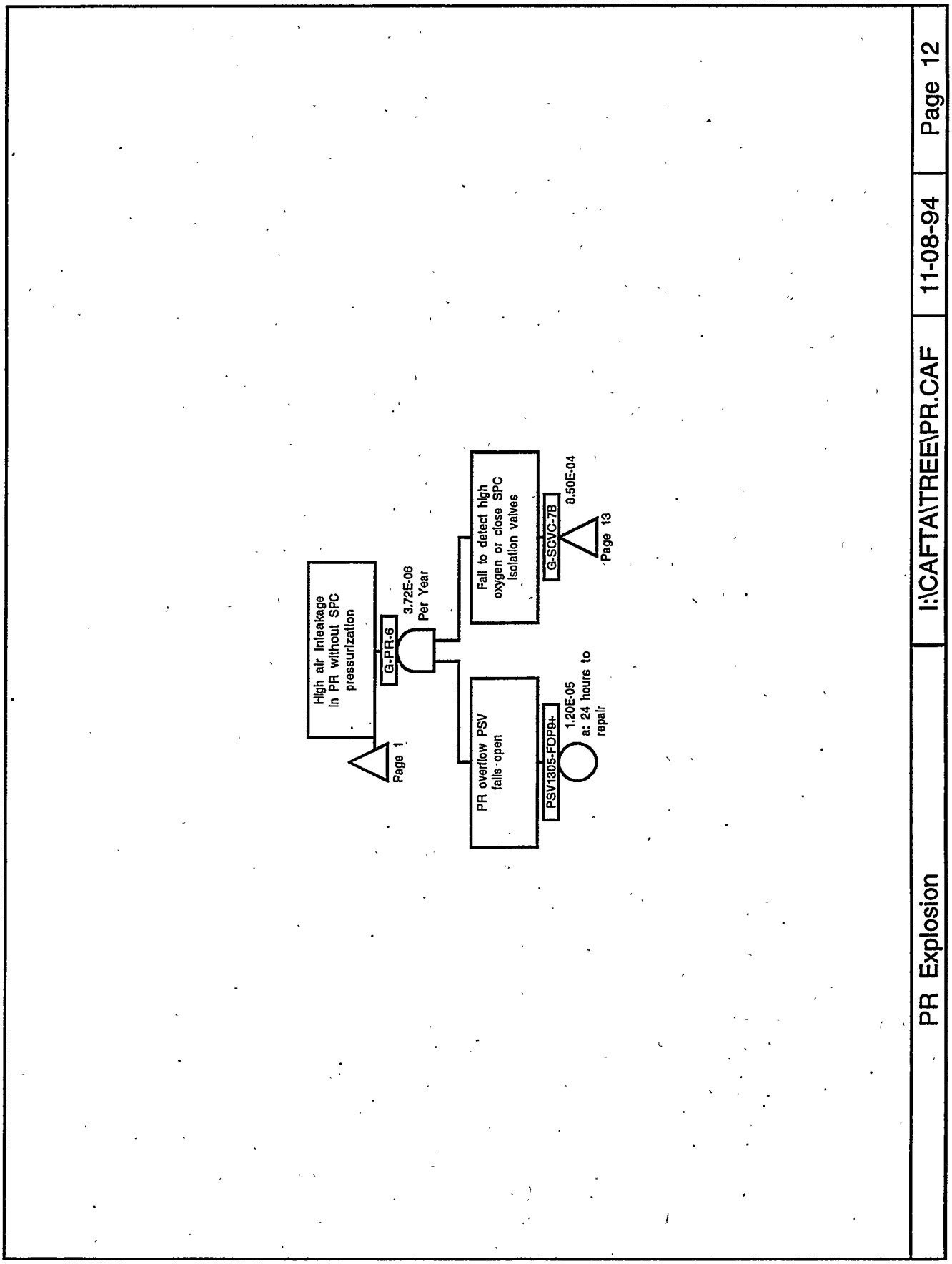
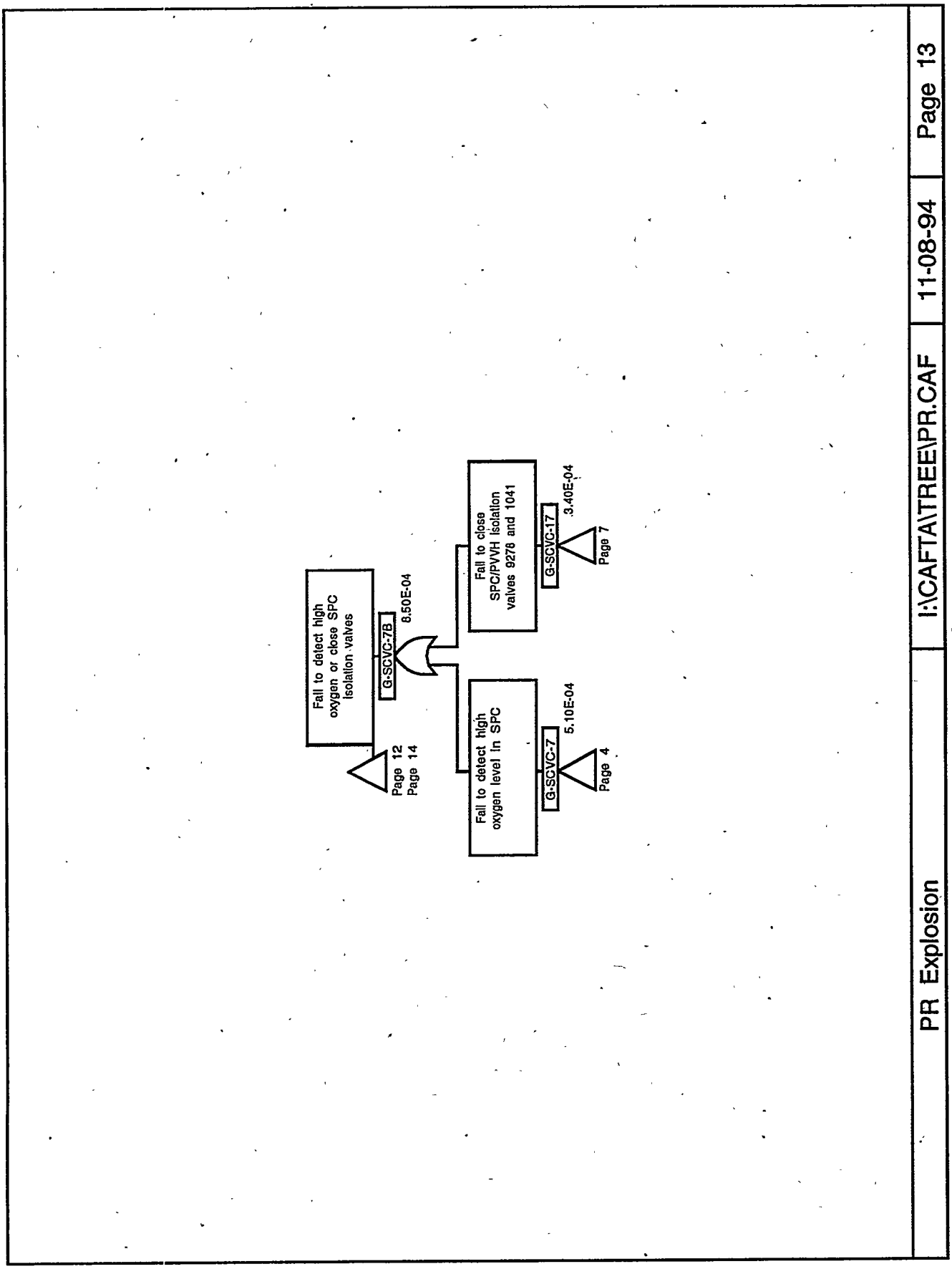
Page 10
PVVH fan 1 falls
G-PVV-12
2.65E-01
Per Year
Page 9
PVVH primary fan suction valve falls closed
MOV5882-FCLD+
7.20E-06
a: repaired in 24 hours
Primary PVVH blower falls
FANPVV1-BFLD+
7.19E-04
a: 24 hours to repair



PR Explosion	I:\CAFTA\TREE\PR.CAF	11-08-94	Page 11


PR Explosion
I:\CAFTA\TREE\PR.CAF
11-08-94
Page 12
High air Inleakage In PR without SPC pressurization
Page 1
G-PR-6
3.72E-06 Per Year
Fail to detect high oxygen or close SPC Isolation valves
G-SCVC-7B
8.50E-04
Page 13
PR overflow PSV fails open
PSV1305-FOP9
1.20E-05
a: 24 hours to repair


Fail to detect high oxygen or close SPC isolation valves
G-SCVC-7B
8.50E-04
Page 12
Page 14
Fail to close SPC/PVH isolation valves 9278 and 1041
G-SCVC-17
3.40E-04
Page 7
Fail to detect high oxygen level in SPC
G-SCVC-7
5.10E-04
Page 4
PR Explosion
I:\CAFTA\TREE\PR.CAF
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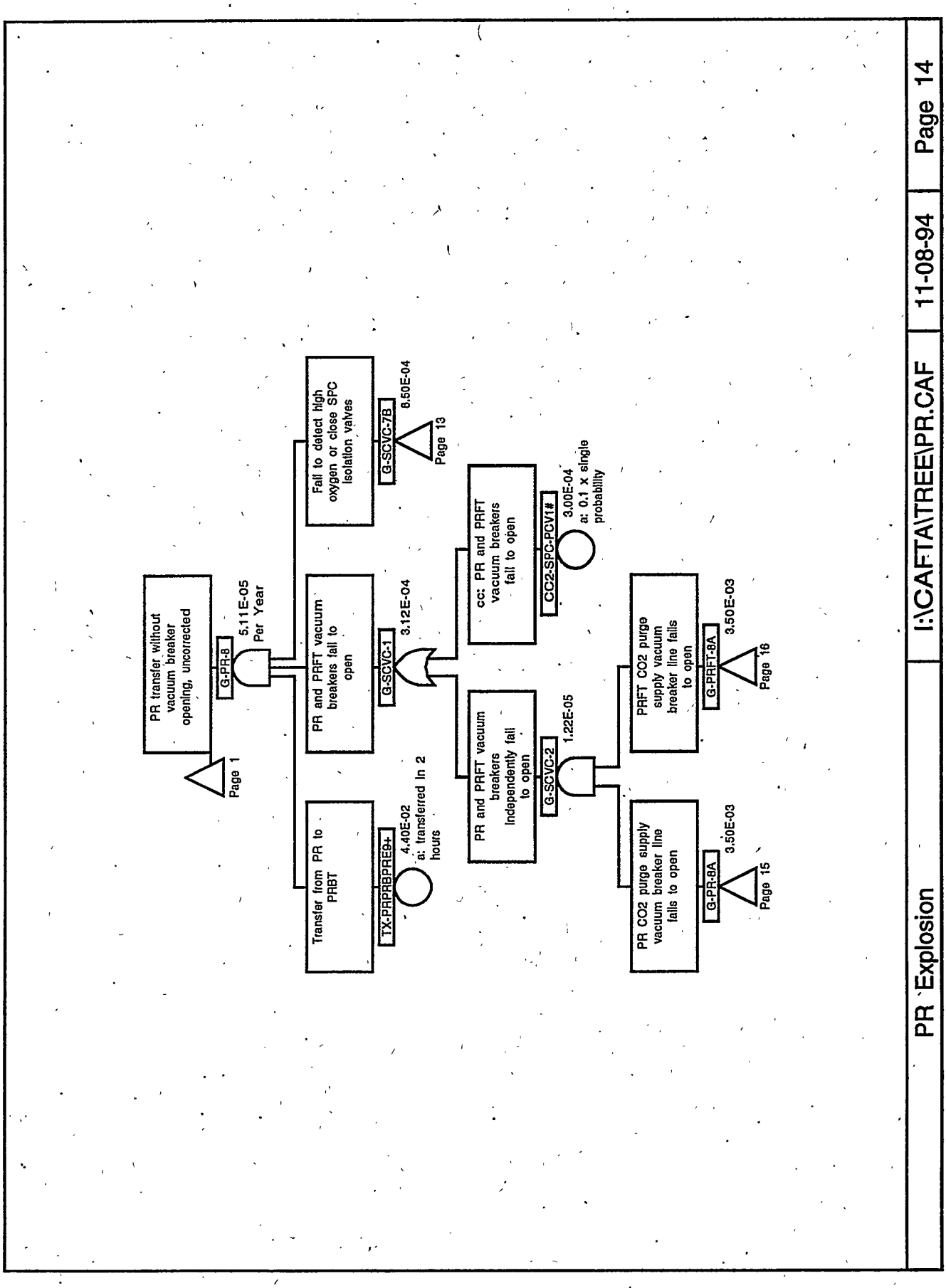
Page 13


PR transfer without vacuum breaker opening, uncorrected
G-PR-8
5.11E-05 Per Year
Page 1
PR and PRFT vacuum breakers fail to open
G-SCVC-1
3.12E-04
Fail to detect high oxygen or close SPC isolation valves
G-SCVC-7B
8.50E-04
Page 13
Transfer from PR to PRBT
TX-PRPRBPRE9+
4.40E-02 a: transferred in 2 hours
PR and PRFT vacuum breakers independently fail to open
G-SCVC-2
1.22E-05
cc: PR and PRFT vacuum breakers fail to open
CC2-SPC-PCV1#
3.00E-04 a: 0.1 x single probability
PR CO2 purge supply vacuum breaker line fails to open
G-PR-9A
3.50E-03
Page 15
PRFT CO2 purge supply vacuum breaker line fails to open
G-PRFT-8A
3.50E-03
Page 16
PR Explosion
I:\CAFTA\TREE\PR.CAF
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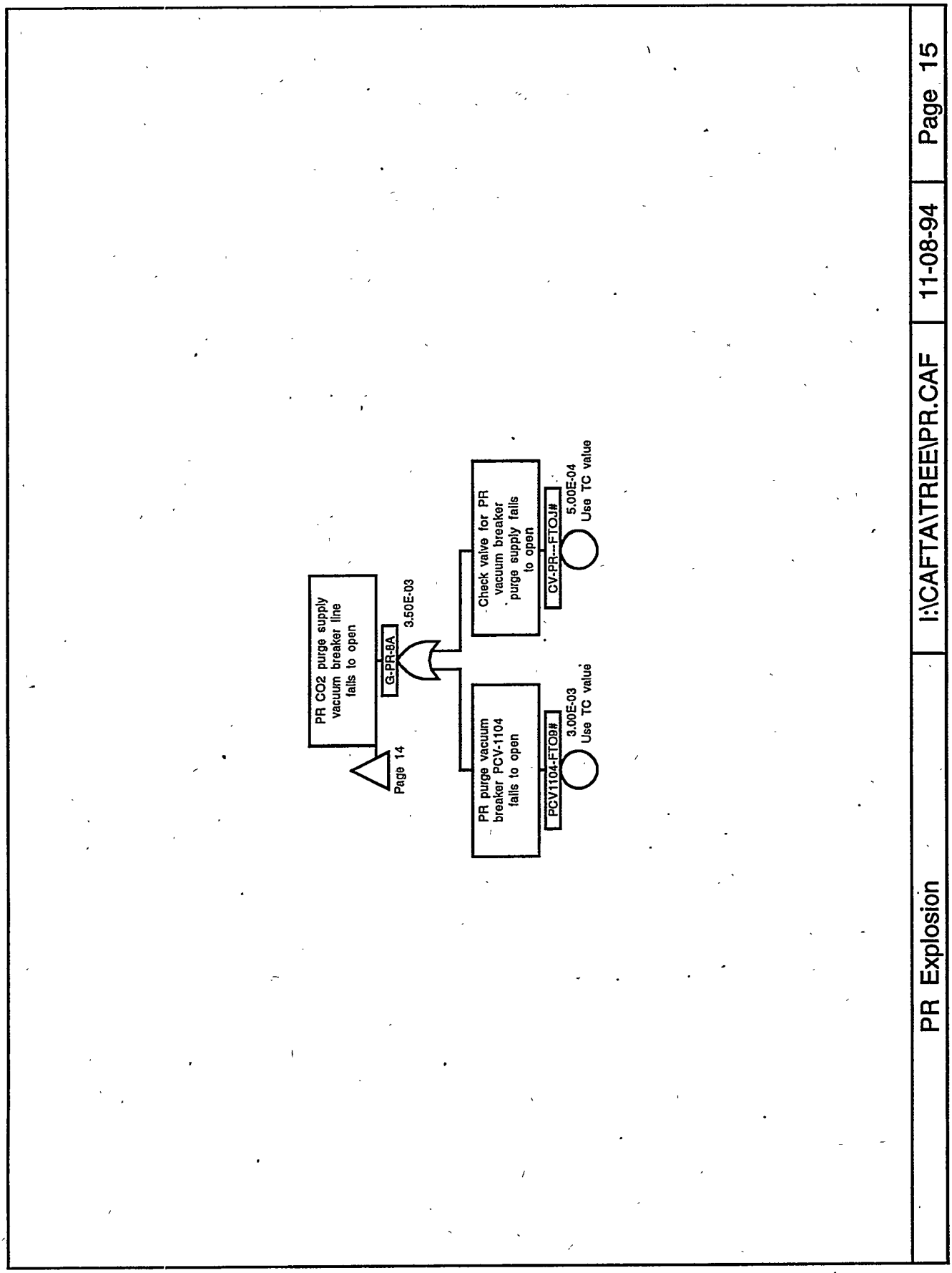
PR CO2 purge supply vacuum breaker line falls to open
G-PR-8A
3.50E-03
Page 14
PR purge vacuum breaker PCV-1104 falls to open
PCV1104-FTO#
3.00E-03
Use TC value
Check valve for PR vacuum breaker purge supply fails to open
CV-PR--FTO#
5.00E-04
Use TC value
PR Explosion
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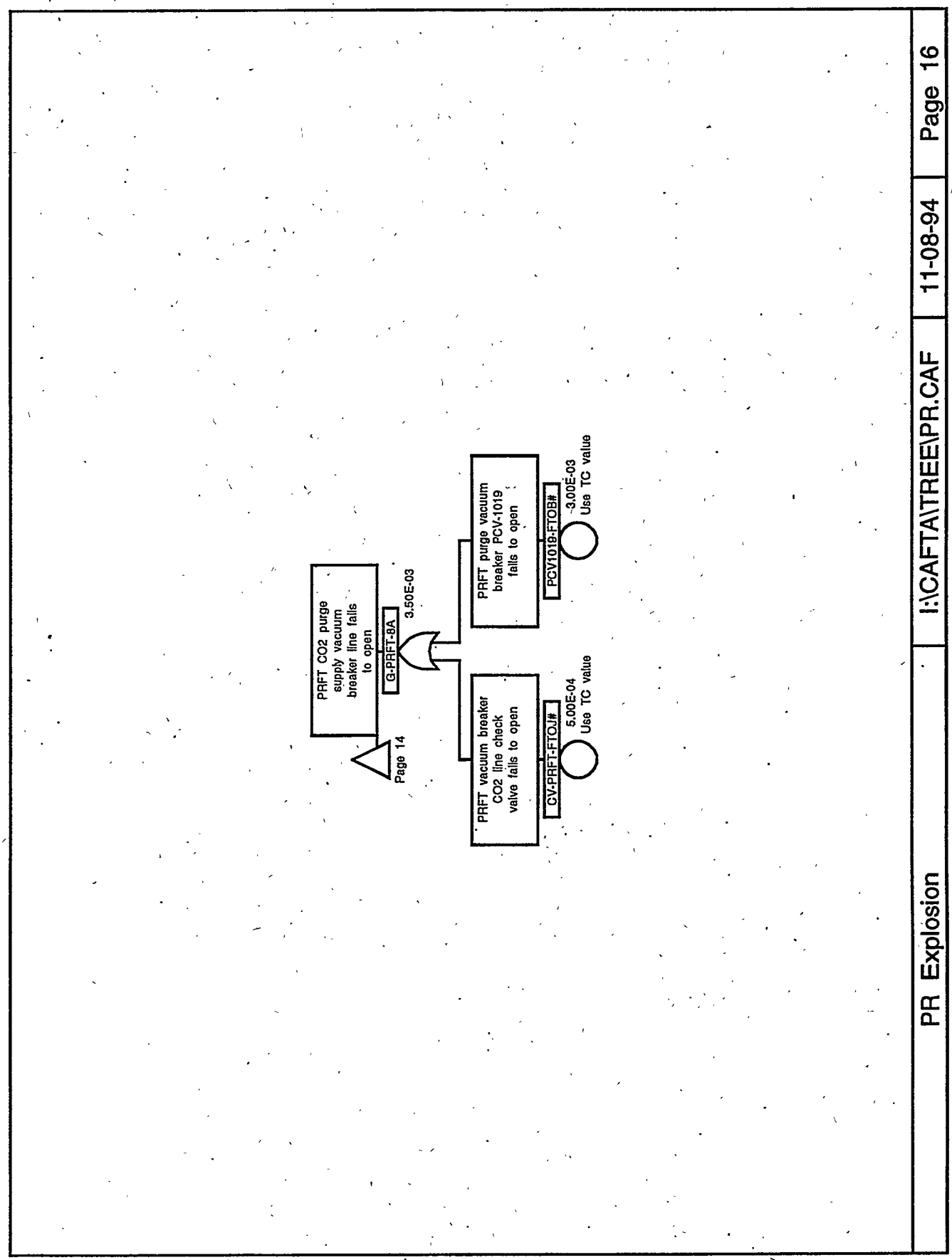
PR Explosion
I:\CAFTA\TREE\PR.CAF
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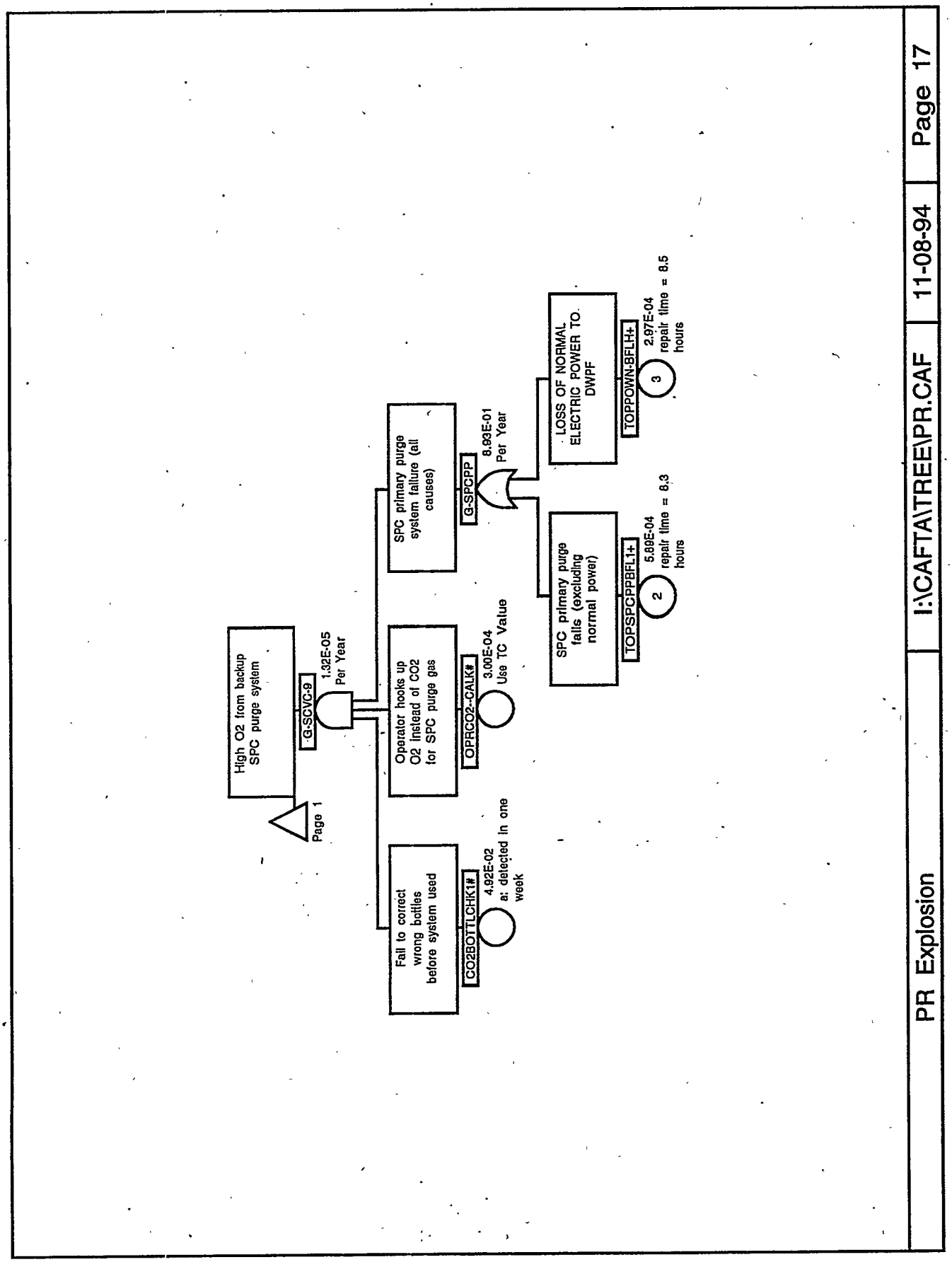
Page 16
PRFT CO2 purge supply vacuum breaker line fails to open
G-PRFT-8A
3.50E-03
Page 14
PRFT vacuum breaker CO2 line check valve fails to open
CV-PRFT-FTOJ#
5.00E-04
Use TC value
PRFT purge vacuum breaker PCV-1019 fails to open
PCV1019-FTOB#
3.00E-03
Use TC value


High O2 from backup SPC purge system
Page 1
G-SCVC-9
1.32E-05 Per Year
Fail to correct wrong bottles before system used
CO2BOTTLCHK1#
4.92E-02 a: detected in one week
Operator hooks up O2 instead of CO2 for SPC purge gas
OPRCO2--CALK#
3.00E-04 Use TC Value
SPC primary purge system failure (all causes)
G-SPCPP
8.93E-01 Per Year
SPC primary purge fails (excluding normal power)
TOPSPCPPBFL1+
2
5.89E-04 repair time = 8.3 hours
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
3
2.97E-04 repair time = 8.5 hours
PR Explosion
I:\CAFTA\TREE\PR.CAF
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Page 17

Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
AE-3405-FLOK#	4		G-PVV-12	9		G-SPCPP	17				
AE-3409-FLOK#	4		G-PVV-12	10		HCV1102-FCL9+	2				
BNZPRHOTPREP#	8		G-PVV-13	9		IGNPR---PRE1#	1				
CC2-SPC-PCV1#	14		G-PVV-13	11		MOV1041-FTCK#	7				
CC2PVVH-FAN1+	9		G-PVV-7	9		MOV5862-FCLD+	10				
CC2SCVC-O2-K#	4		G-PVV-8	9		MOV5864-FTOD#	11				
CC2SPCP-PT-K#	7		G-SCVC-1	14		MOV9278-FTCK#	7				
CC2SPCV-MOVK#	7		G-SCVC-16	4		OPR1103-MCH1#	3				
CC3-SPC-FE-1#	8		G-SCVC-17	3		OPR3405-MCH3#	4				
CO2BOTTLCHK1#	17		G-SCVC-17	7		OPR3409-MCH2#	4				
CV-PR---FTOJ#	15		G-SCVC-17	8		OPR9312-MCH1#	7				
CV-PRFT-FTOJ#	16		G-SCVC-17	13		OPRCO2--CALK#	17				
FANPVV1-BFLD+	10		G-SCVC-17A	7		OPRPVV2-RMH1#	11				
FANPVV2-BFLD#	11		G-SCVC-18	4		OPRSV74ARANK+	2				
FANPVV2-FTSD#	11		G-SCVC-19	4		PC-1041-FLOK#	7				
FANPVV2-T&MD#	11		G-SCVC-2	14		PCV1019-FTOB#	16				
FE-1103-FHIE#	3		G-SCVC-20	4		PCV1101-FCL9+	2				
FE-5860-FLOK+	9		G-SCVC-20	5		PCV1104-FTO9#	15				
FE-6041-FLOK+	9		G-SCVC-21	4		PMPSCVO1BFLK#	5				
FSL3406-FTCK#	5		G-SCVC-21	6		PMPSCVO2BFLK#	6				
FSL3409-FTCK#	6		G-SCVC-22	7		PSV1305-FOP9+	12				
G-POWER-IE	9		G-SCVC-22A	7		PSV180--FOP9+	2				
G-PR-1	1		G-SCVC-5	1		PT-1041-FHIK#	7				
G-PR-10	1		G-SCVC-6	1		PT-9312-FHIK#	7				
G-PR-10	2		G-SCVC-6	8		SV-CO21-FCLQ+	9				
G-PR-1A	1		G-SCVC-6A	8		SV-CO22-FCLQ+	9				
G-PR-4	1		G-SCVC-7	3		TOP-PR	1				
G-PR-4	3		G-SCVC-7	4		TOPPOWD-BFLN#	9				
G-PR-5	3		G-SCVC-7	8		TOPPOWN-BFLH+	9				
G-PR-6	1		G-SCVC-7	13		TOPPOWN-BFLH+	9				
G-PR-6	12		G-SCVC-7B	12		TOPPOWN-BFLH+	17				
G-PR-8	1		G-SCVC-7B	13		TOPSPCBPBFL0#	8				
G-PR-8	14		G-SCVC-7B	14		TOPSPCN2BFLU#	1				
G-PR-8A	14		G-SCVC-9	1		TOPSPCPPBFL1+	8				
G-PR-8A	15		G-SCVC-9	17		TOPSPCPPBFL1+	17				
G-PR-9	3		G-SPC-4	1		TX-PRPRBPRE9+	14				
G-PRFT-8A	14		G-SPC-4	9							
G-PRFT-8A	16		G-SPC-CO24	8							

Cutsets for I:\CAFTA\CUT\PR.CSR 11/08/94 12:29 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	TOP-PR					4.46E-05
1.	BNZPRHOTPREP#	Hot benzene present in PR	3	16H 2.3E-02H	3.08E-01	3.63E-05
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCBPBFL0#	Failure of backup CO2 system	1	1N 6.7E-03N	6.70E-03N	
	TOPSPCPPBFL1+	SPC primary purge fails (excluding normal power)	4	8.8H 6.7E-05H	5.89E-04	
2.	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	3.77E-06
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
3.	CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	1	1N 3.0E-04N	3.00E-04N	8.67E-07
	CC2SCVC-O2-K#	CC: Both SCVC O2 detectors fail high	1	1N 5.0E-04N	5.00E-04N	
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	TX-PRPRBPRE9+	Transfer from PR to PRBT	4	2H 2.3E-02H	4.40E-02	
4.	CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	1	1N 3.0E-04N	3.00E-04N	5.20E-07
	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	TX-PRPRBPRE9+	Transfer from PR to PRBT	4	2H 2.3E-02H	4.40E-02	
5.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-07
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSV74ARANK+	Operator closes PR CO2 supply needle valve erroneously	4	24H 5.0E-06H	1.20E-04	
6.	FE-5860-FLOK+	PVVH flow element 5860 fails low	4	8H 3.0E-06H	2.40E-05	3.23E-07
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	

Cutsets for I:\CAFTA\CUT\PR.CSR 11/08/94 12:29 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
7.	FE-6041-FLOK+	PVVH flow monitor 6041 fails low	4	8H 3.0E-06H	2.40E-05	3.23E-07
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
8.	CC2PVVH-FAN1+	cc: both PVVH fans fail	4	8H 3.0E-06H	2.40E-05	3.23E-07
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
9.	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	3.23E-07
	SV-CO22-FCLQ+	SPC CO2 purge isolation valve 2 fails closed	4	43H 3.0E-06H	1.29E-04	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
10.	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	3.23E-07
	SV-CO21-FCLQ+	SPC CO2 purge isolation valve 1 fails closed	4	43H 3.0E-06H	1.29E-04	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
11.	CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	3	7D 3.0E-04H	4.92E-02	2.59E-07
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	1	1N 3.0E-04N	3.00E-04N	
	TOPSPCPPBFL1+	SPC primary purge fails (excluding normal power)	4	8.8H 6.7E-05H	5.89E-04	
12.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	2.37E-07
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	PCV1101-FCL9+	PR CO2 purge supply valve 1101 fails closed	4	8H 3.0E-06H	2.40E-05	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
13.	CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	3	7D 3.0E-04H	4.92E-02	1.36E-07
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	1	1N 3.0E-04N	3.00E-04N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
14.	CC2SCVC-O2-K#	CC: Both SCVC O2 detectors fail high	1	1N 5.0E-04N	5.00E-04N	6.57E-08
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	PSV1305-FOP9+	PR overflow PSV fails open	4	24H 5.0E-07H	1.20E-05	
15.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-08
	HCV1102-FCL9+	PR baseline purge supply valve 1102 fails closed	4	8H 5.0E-07H	4.00E-06	
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
16.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-08
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	PSV180--FOP9+	PSV on PR purge supply line fails open	4	24H 5.0E-07H	1.20E-05	
17.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-08
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	PSV1305-FOP9+	PR overflow PSV fails open	4	24H 5.0E-07H	1.20E-05	
18.	CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	1	1N 3.0E-04N	3.00E-04N	3.73E-08
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	PC-1041-FLOK#	SCVC exit pressure controller fails low	5	43H 1.0E-06H	2.15E-05	
	TX-PRPRBPRE9+	Transfer from PR to PRBT	4	2H 2.3E-02H	4.40E-02	
19.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.54E-08

Cutsets for I:\CAFTA\CUT\PR.CSR 11/08/94 12:29 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCBPBFL0#	Failure of backup CO2 system	1	1N 6.7E-03N	6.70E-03N	
	TOPSPCPPBFL1+	SPC primary purge fails (excluding normal power)	4	8.8H 6.7E-05H	5.89E-04	
20.	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	2.82E-08
	OPRSV74ARANK+	Operator closes PR CO2 supply needle valve erroneously	4	24H 5.0E-06H	1.20E-04	
	PC-1041-FLOK#	SCVC exit pressure controller fails low	5	43H 1.0E-06H	2.15E-05	
21.	CC2SCVC-O2-K#	CC: Both SCVC O2 detectors fail high	1	1N 5.0E-04N	5.00E-04N	2.60E-08
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	PCV1019-FTOB#	PRFT purge vacuum breaker PCV-1019 fails to open	1	1N 3.0E-03N	3.00E-03N	
	PCV1104-FTO9#	PR purge vacuum breaker PCV-1104 fails to open	1	1N 3.0E-03N	3.00E-03N	
	TX-PRPRBPRE9+	Transfer from PR to PRBT	4	2H 2.3E-02H	4.40E-02	
22.	CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	1	1N 3.0E-04N	3.00E-04N	1.73E-08
	CC2SPCP-PT-K#	CC: both SPC pressure monitors fail high		1E-5N	1.00E-05	
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	TX-PRPRBPRE9+	Transfer from PR to PRBT	4	2H 2.3E-02H	4.40E-02	
23.	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	1.69E-08
	PC-1041-FLOK#	SCVC exit pressure controller fails low	5	43H 1.0E-06H	2.15E-05	
	PCV1101-FCL9+	PR CO2 purge supply valve 1101 fails closed	4	8H 3.0E-06H	2.40E-05	
24.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	1.62E-08
	FANPVV2-FTSD#	Standby PVVH blower fails to start	1	1N 5.0E-03N	5.00E-03N	
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
25.	CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	1	1N 3.0E-04N	3.00E-04N	1.56E-08
	IGNPR---PRE1#	Ignition source present in PR vessel	1	1N 3.0E-02N	3.00E-02N	
	MOV1041-FTCK#	SPC/PVVH isolation valve MOV-1041 fails to close	1	1N 3.0E-03N	3.00E-03N	
	MOV9278-FTCK#	SPC/PVVH isolation valve MOV-9278 fails to close	1	1N 3.0E-03N	3.00E-03N	
	TX-PRPRBPRE9+	Transfer from PR to PRBT	4	2H 2.3E-02H	4.40E-02	

Explosion in the PR Top Event Frequency: 4.46E-05/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
TOPSPCPPBFL1+-I	SPC primary purge fails (excluding normal power)	6.69E-05/H	1.23E+04
PSV1305-FOP9+-I	PR overflow PSV fails open	5.00E-07/H	5.00E+03
TOPPOWN-BFLH+-I	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	2.50E+03
FE-6041-FLOK+-I	PVVH flow monitor 6041 fails low	3.00E-06/H	2.42E+03
SV-CO22-FCLQ+-I	SPC CO2 purge isolation valve 2 fails closed	3.00E-06/H	2.42E+03
SV-CO21-FCLQ+-I	SPC CO2 purge isolation valve 1 fails closed	3.00E-06/H	2.42E+03
CC2PVVH-FAN1+-I	cc: both PVVH fans fail	3.00E-06/H	2.42E+03
FE-5860-FLOK+-I	PVVH flow element 5860 fails low	3.00E-06/H	2.42E+03
OPRSV74ARANK+-I	Operator closes PR CO2 supply needle valve erroneously	5.00E-06/H	2.00E+03
PCV1101-FCL9+-I	PR CO2 purge supply valve 1101 fails closed	3.00E-06/H	2.00E+03
PSV180--FOP9+-I	PSV on PR purge supply line fails open	5.00E-07/H	2.00E+03
HCV1102-FCL9+-I	PR baseline purge supply valve 1102 fails closed	5.00E-07/H	2.00E+03
TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	4.10E-04	2.98E+02
TOPSPCBPBFL0#	Failure of backup CO2 system	6.70E-03	1.22E+02
CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	3.00E-04	1.11E+02
CC2SPCP-PT-K#	CC: both SPC pressure monitors fail high	8.40E-06	1.00E+02
PC-1041-FLOK#	SCVC exit pressure controller fails low	2.15E-05	1.00E+02
CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	3.00E-04	1.00E+02
CC2SCVC-O2-K#	CC: Both SCVC O2 detectors fail high	5.00E-04	4.45E+01
MOV5862-FCLD+-I	PVVH primary fan suction valve fails closed	3.00E-07/H	3.45E+01
FANPVV1-BFLD+-I	Primary PVVH blower fails	3.00E-05/H	3.45E+01
IGNPR---PRE1#	Ignition source present in PR vessel	3.00E-02	3.33E+01
OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	3.00E-04	3.05E+01
BNZPRHOTPREP#	Hot benzene present in PR	3.08E-01	2.83E+00
TX-PRPRBPRE9+-I	Transfer from PR to PRBT	2.20E-02/H	2.53E+00
CV-PRFT-FTOJ#	PRFT vacuum breaker CO2 line check valve fails to open	5.00E-04	1.38E+00
CV-PR---FTOJ#	Check valve for PR vacuum breaker purge fails to open	5.00E-04	1.38E+00
PCV1019-FTOB#	PRFT purge vacuum breaker PCV-1019 fails to open	3.00E-03	1.38E+00
PCV1104-FTO9#	PR purge vacuum breaker PCV-1104 fails to open	3.00E-03	1.38E+00
MOV1041-FTCK#	SPC/PVVH isolation valve MOV-1041 fails to close	3.00E-03	1.30E+00
MOV9278-FTCK#	SPC/PVVH isolation valve MOV-9278 fails to close	3.00E-03	1.30E+00
CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	4.92E-02	1.17E+00
OPR3409-MCH2#	O2 analyzer 3409 miscalibrated	3.00E-03	1.13E+00
OPR3405-MCH3#	O2 analyzer 3405 miscalibrated	3.00E-03	1.13E+00
AE-3409-FLOK#	SCVC O2 concentration analyzer 3409 fails low	1.07E-04	1.13E+00
AE-3405-FLOK#	SCVC O2 concentration analyzer 3405 fails low	1.07E-04	1.13E+00
FANPVV2-BFLD#	PVVH backup fan fails to run	7.20E-04	1.07E+00
OPRPVV2-RMH1#	Fail to restore fan to operable status following maintenance	1.50E-03	1.07E+00
MOV5864-FTOD#	PVVH standby fan suction valve fails to open	3.00E-03	1.07E+00
FANPVV2-T&MD#	PVVH standby fan unavailable, due to T&M	3.65E-03	1.07E+00
FANPVV2-FTSD#	Standby PVVH blower fails to start	5.00E-03	1.07E+00
FE-1103-FHIE#	PR purge flow element 1103 fails to detect low flow	2.16E-03	1.03E+00
OPR1103-MCH1#	PR purge flow element 1103 miscalibrated	1.20E-04	1.03E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) x (risk achievement worth).

Explosion in the PR Top Event Frequency: 4.46E-05/YR

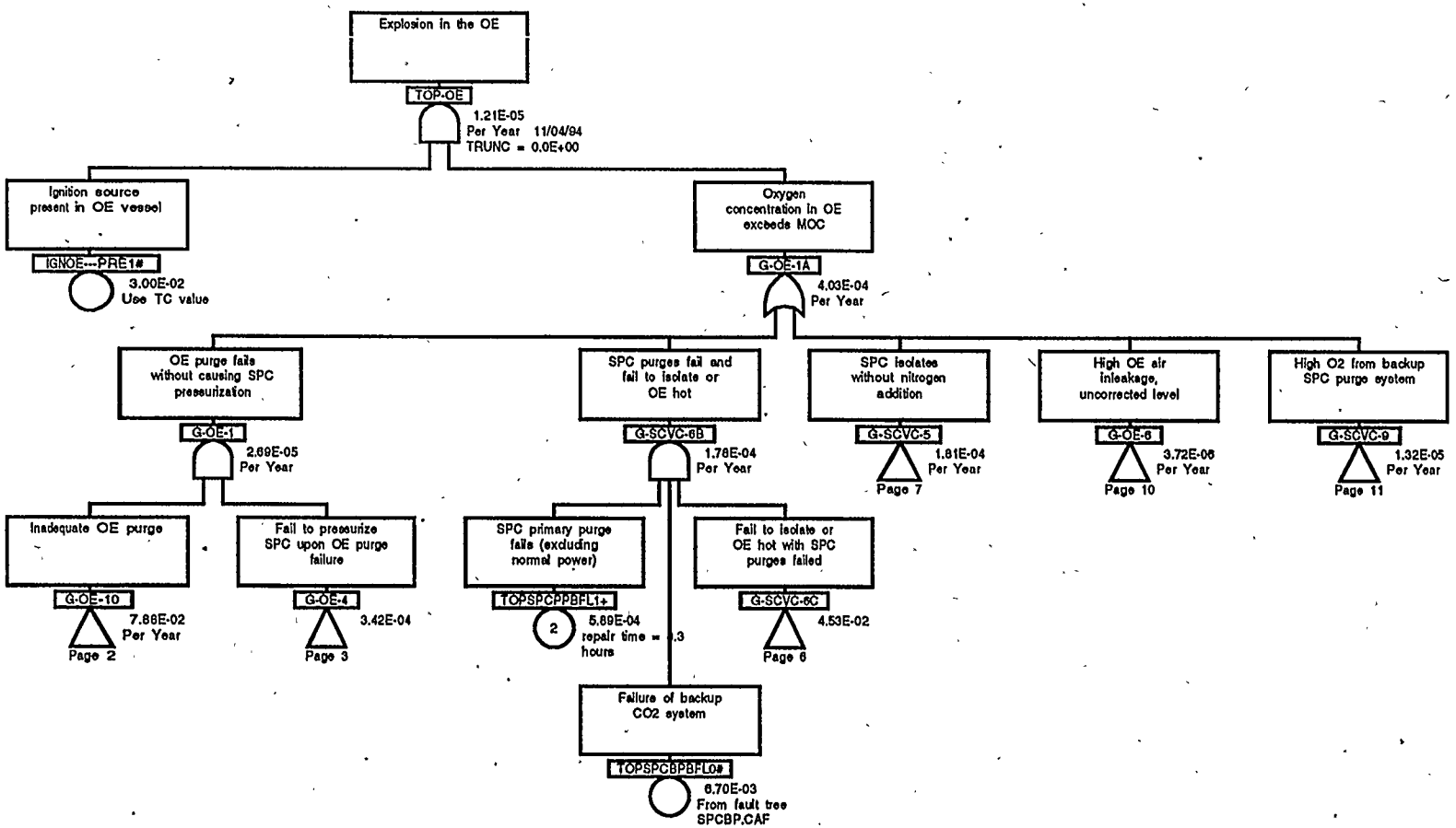
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
*IGNPR---PRE1#	Ignition source present in PR vessel	3.00E-02	0.00E+00
TOPSPCPPBFL1+-I	SPC primary purge fails (excluding normal power)	6.69E-05/H	5.56E+00
TOPSPCBPBFL0#	Failure of backup CO2 system	6.70E-03	5.39E+00
BNZPRHOTPREP#	Hot benzene present in PR	3.08E-01	5.36E+00
TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	4.10E-04	1.14E+00
TOPPOWN-BFLH+-I	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	1.10E+00
TX-PRPRBPRE9+-I	Transfer from PR to PRBT	2.20E-02/H	1.04E+00
CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	3.00E-04	1.03E+00
CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	3.00E-04	1.03E+00
CC2SCVC-O2-K#	CC: Both SCVC O2 detectors fail high	5.00E-04	1.02E+00
OPRSV74ARANK+-I	Operator closes PR CO2 supply needle valve erroneously	5.00E-06/H	1.01E+00

* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included. Modified top event frequency = (top event frequency) / (risk reduction worth).

OE Explosion



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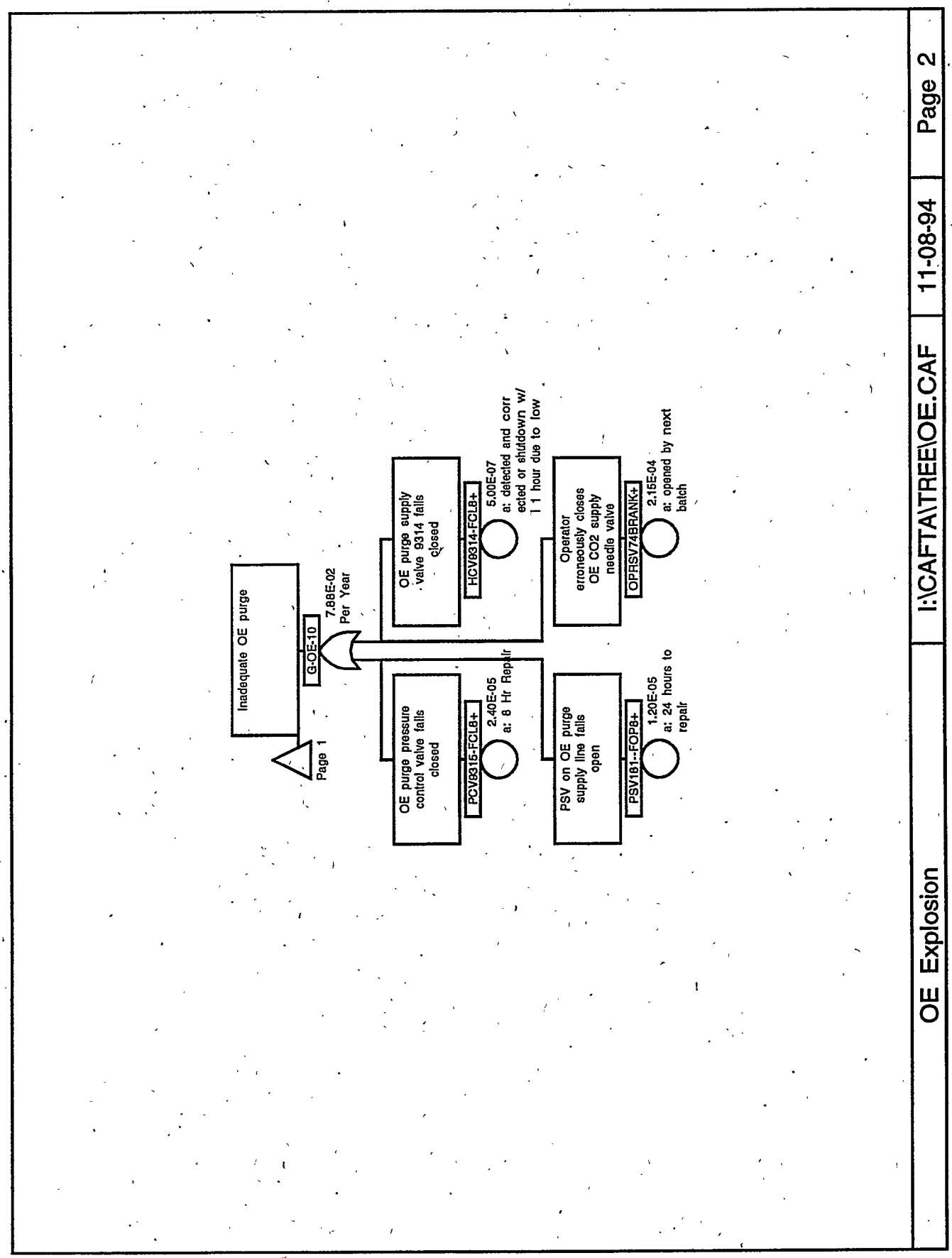
OE Explosion
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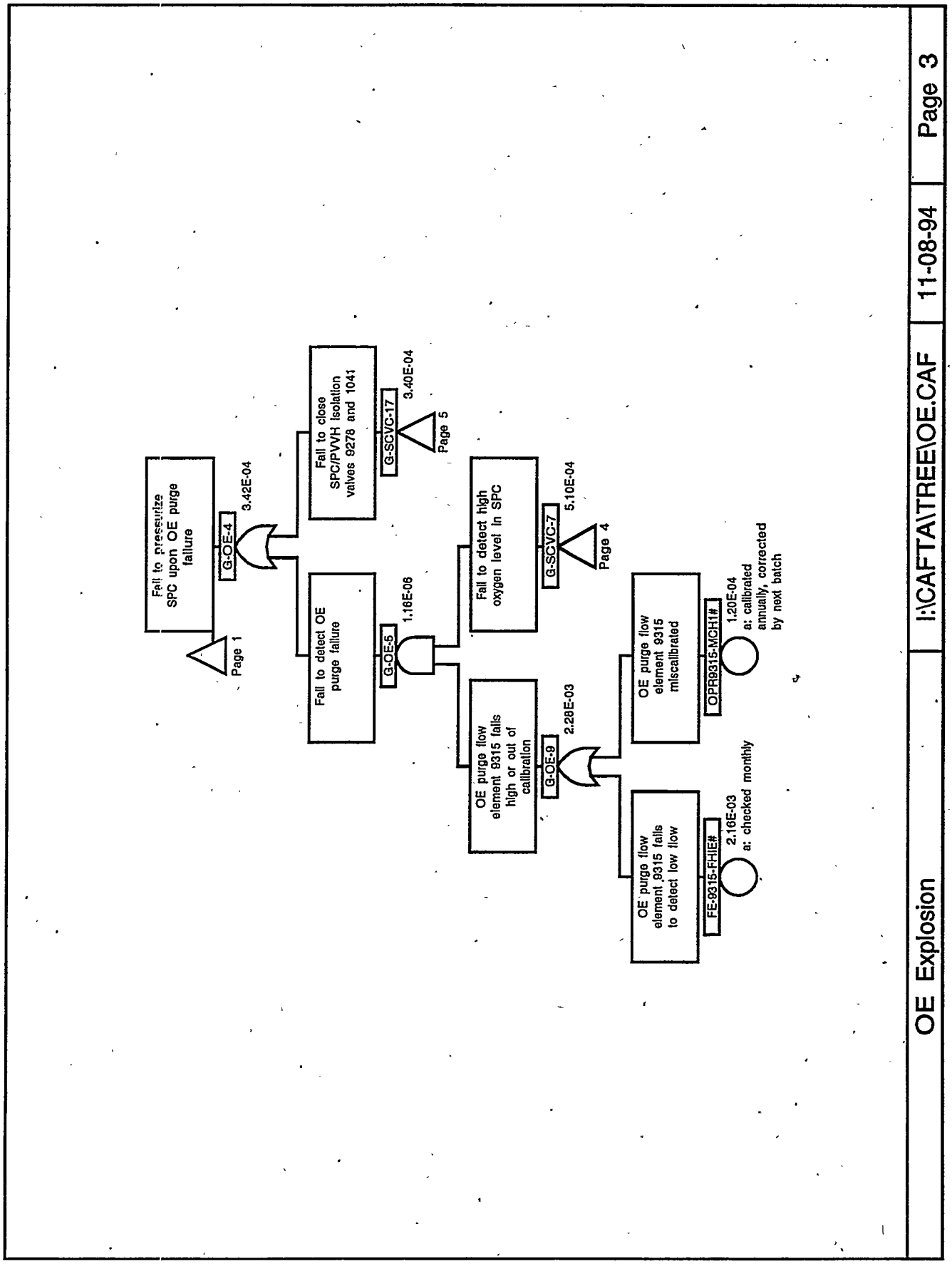
Page 2
Inadequate OE purge
G-OE-10
7.88E-02
Per Year
Page 1
OE purge supply valve 9314 falls closed
HCV9314-FCL8+
5.00E-07
a: detected and corr ected or shutdown w/ 1 1 hour due to low
Operator erroneously closes OE CO2 supply needle valve
OPRSV74BRANK+
2.15E-04
a: opened by next batch
OE purge pressure control valve falls closed
PCV9315-FCL8+
2.40E-05
a: 8 Hr Repair
PSV on OE purge supply line falls open
PSV181--FOP8+
1.20E-05
a: 24 hours to repair


Fail to pressurize SPC upon OE purge failure
G-OE-4
3.42E-04
Page 1
Fail to detect OE purge failure
G-OE-5
1.16E-06
Fail to close SPC/PVVH isolation valves 9278 and 1041
G-SCVC-17
3.40E-04
Page 5
Fail to detect high oxygen level in SPC
G-SCVC-7
5.10E-04
Page 4
OE purge flow element 9315 fails high or out of calibration
G-OE-9
2.28E-03
OE purge flow element 9315 miscalibrated
OPR9315-MCH1#
1.20E-04
a: calibrated annually, corrected by next batch
OE purge flow element 9315 fails to detect low flow
FE-9315-FHIE#
2.16E-03
a: checked monthly
OE Explosion
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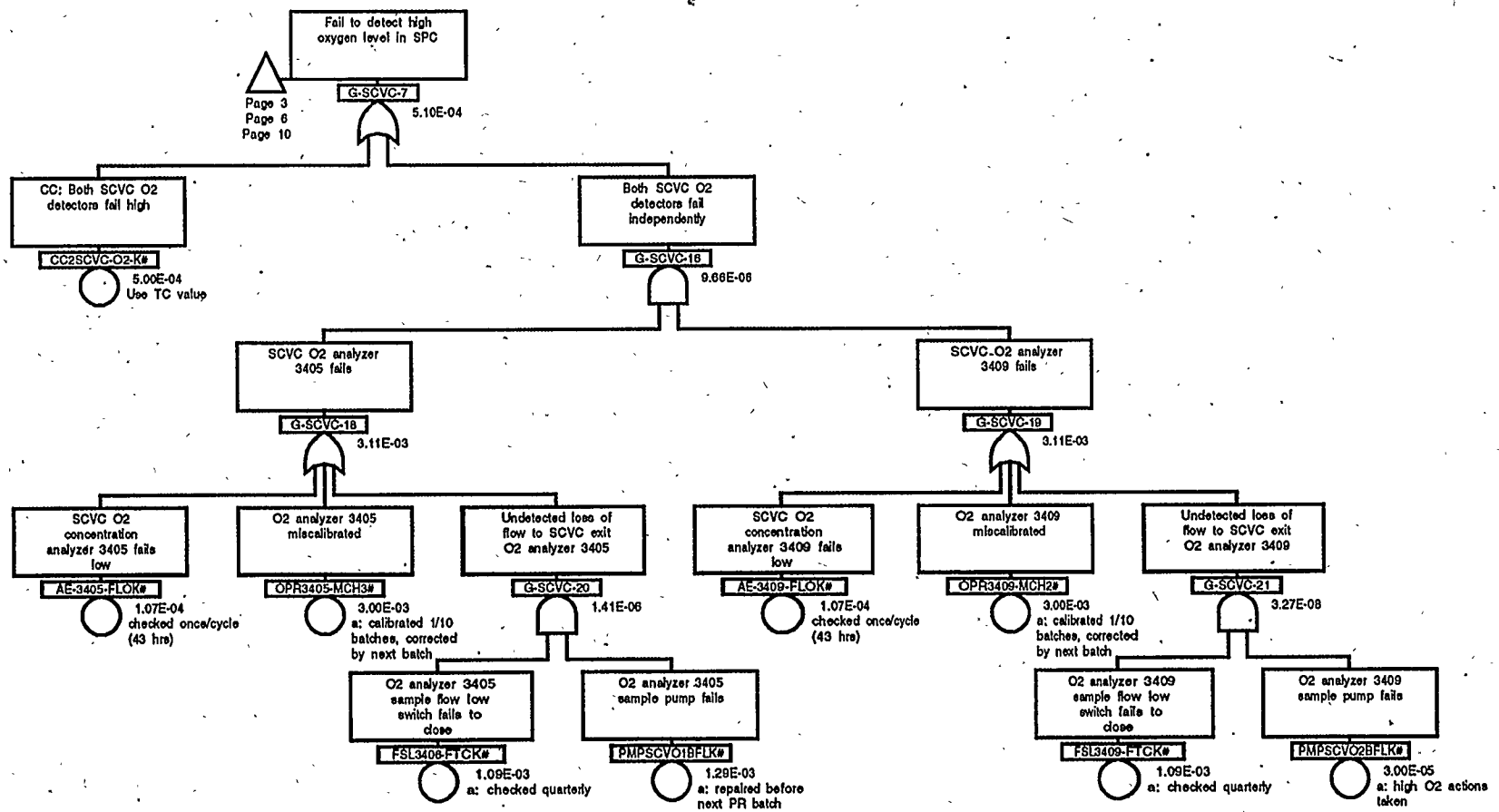
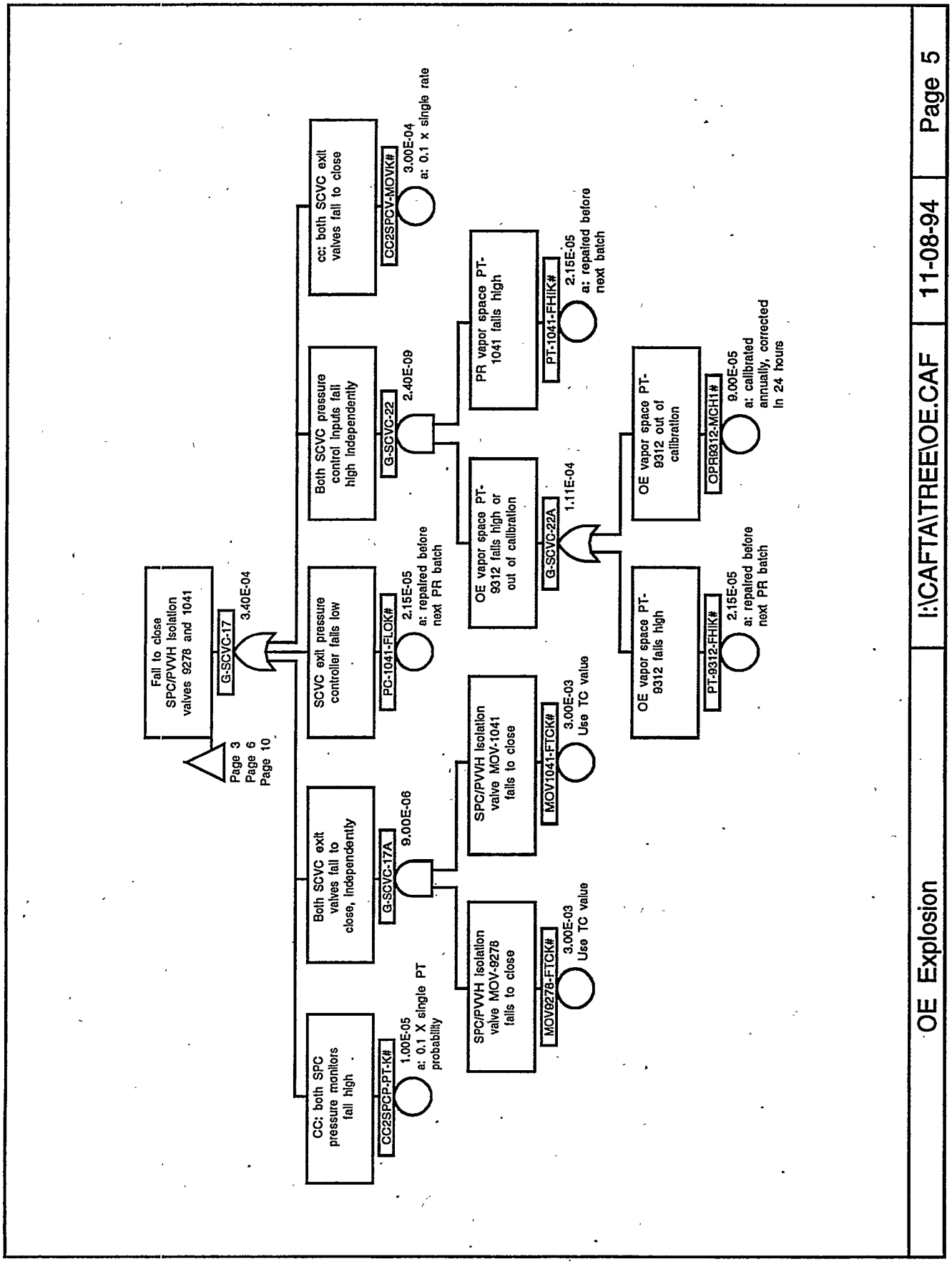


OE- Explosion	I:\CAFTA\TREE\OE.CAF	11-08-94	Page 4


Fail to close SPC/PVVH Isolation valves 9278 and 1041
G-SCVC-17
3.40E-04
Page 3
Page 6
Page 10
CC: both SPC pressure monitors fail high
CC2SPCP-PT-K#
1.00E-05
a: 0.1 X single PT probability
Both SCVC exit valves fail to close, independently
G-SCVC-17A
9.00E-06
SPC/PVVH Isolation valve MOV-9278 fails to close
MOV9278-FTCK#
3.00E-03
Use TC value
SPC/PVVH Isolation valve MOV-1041 fails to close
MOV1041-FTCK#
3.00E-03
Use TC value
SCVC exit pressure controller fails low
PC-1041-FLOK#
2.15E-05
a: repaired before next PR batch
Both SCVC pressure control inputs fail high independently
G-SCVC-22
2.40E-09
OE vapor space PT-9312 falls high or out of calibration
G-SCVC-22A
1.11E-04
PR vapor space PT-1041 falls high
PT-1041-FHIK#
2.15E-05
a: repaired before next batch
cc: both SCVC exit valves fail to close
CC2SPCV-MOVK#
3.00E-04
a: 0.1 x single rate
OE vapor space PT-9312 falls high
PT-9312-FHIK#
2.15E-05
a: repaired before next PR batch
OE vapor space PT-9312 out of calibration
OPPR9312-MCH1#
9.00E-05
a: calibrated annually, corrected in 24 hours
OE Explosion
I:\CAFTA\TREE\OE.CAF
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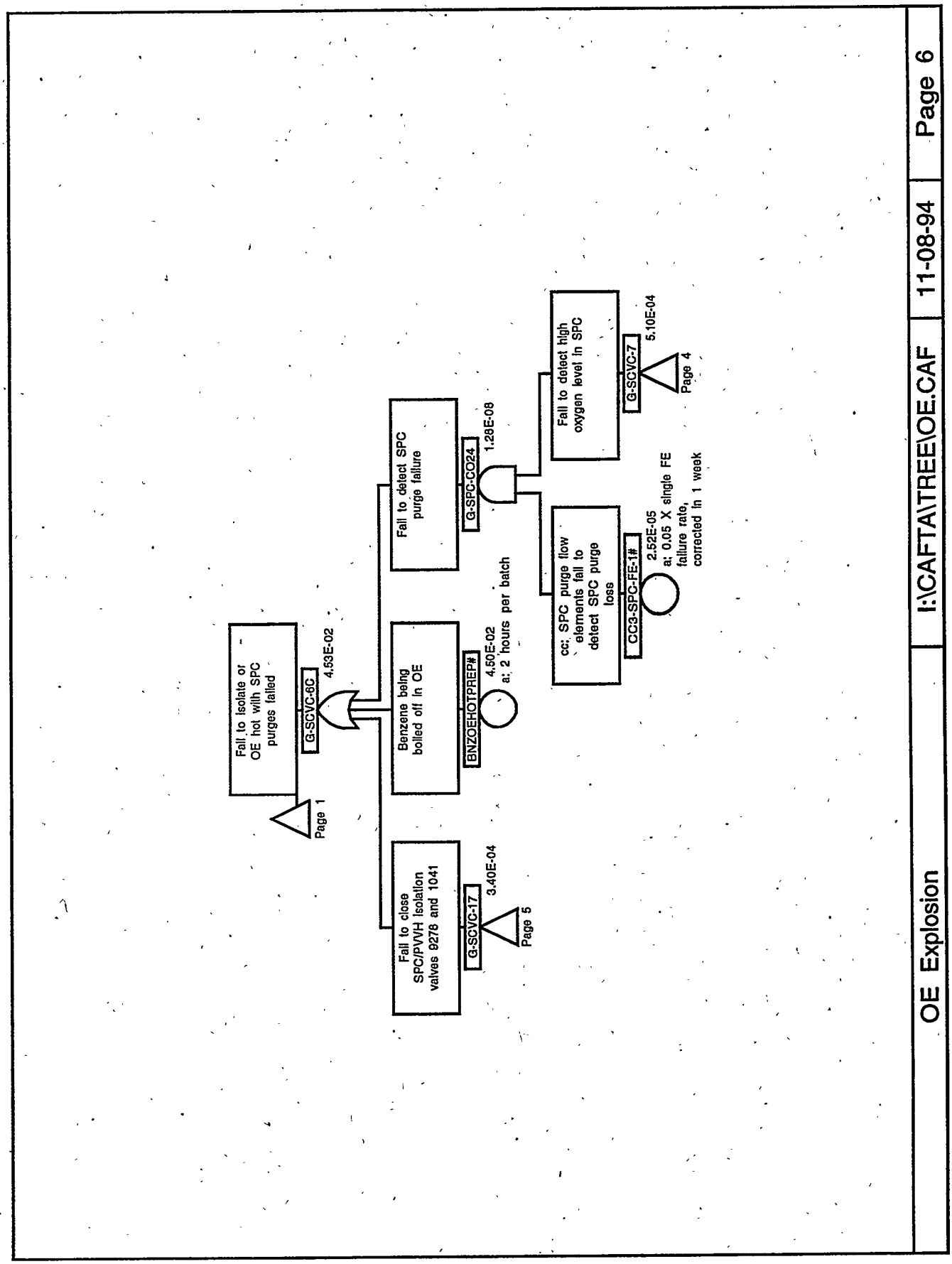
OE Explosion
I:\CAFTA\TREE\OE.CAF
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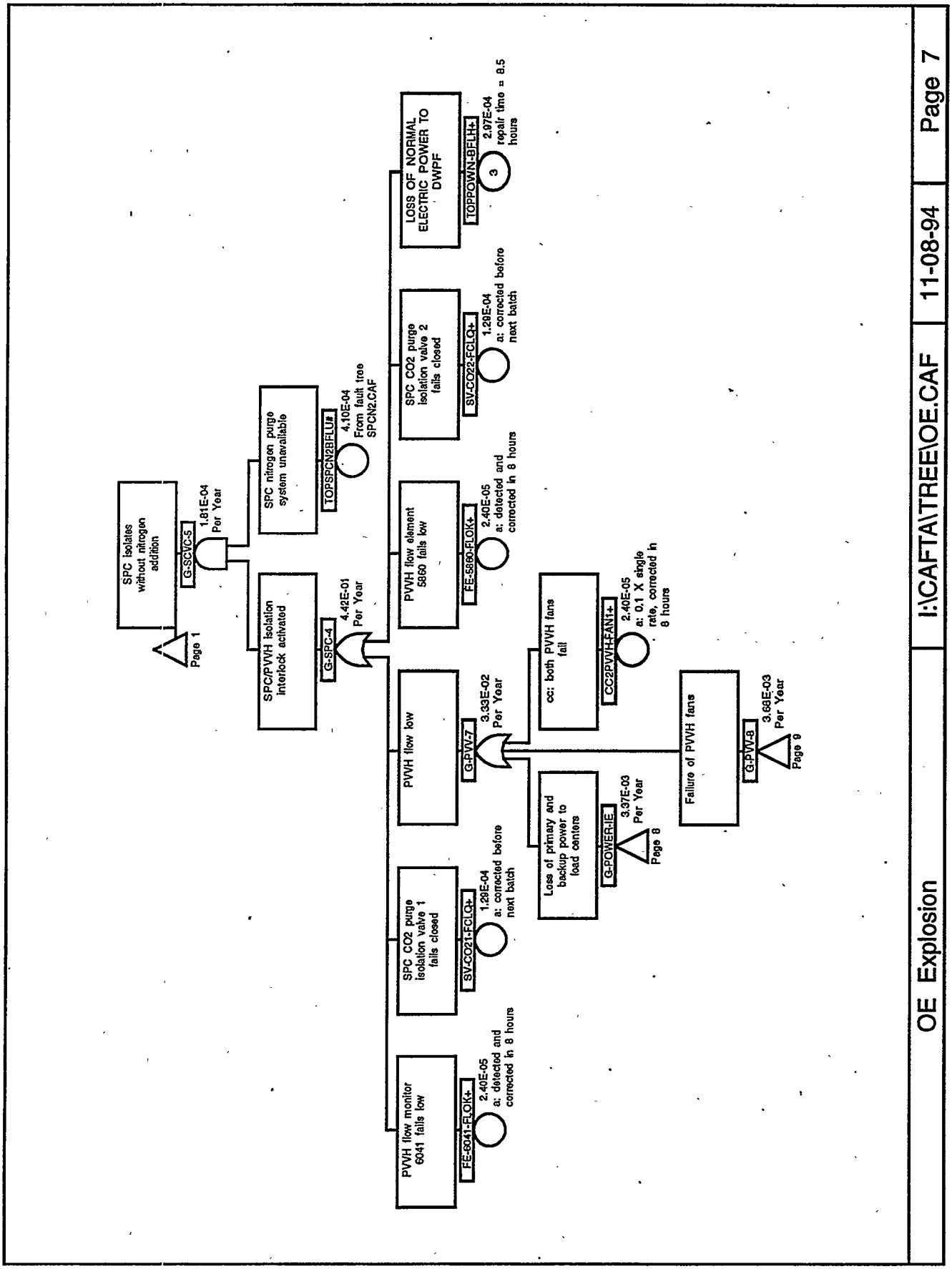
Page 6
Fail to isolate or OE hot with SPC purges failed
G-SCVC-6C
4.53E-02
Page 1
Benzene being boiled off in OE
BNZOEHOTPREP#
4.50E-02
a; 2 hours per batch
Fail to close SPC/PVVH isolation valves 8278 and 1041
G-SCVC-17
3.40E-04
Page 5
Fail to detect SPC purge failure
G-SPC-CO24
1.28E-08
cc; SPC purge flow elements fail to detect SPC purge loss
CC3-SPC-FE-1#
2.52E-05
a; 0.05 X single FE failure rate, corrected in 1 week
Fail to detect high oxygen level in SPC
G-SCVC-7
5.10E-04
Page 4


OE Explosion
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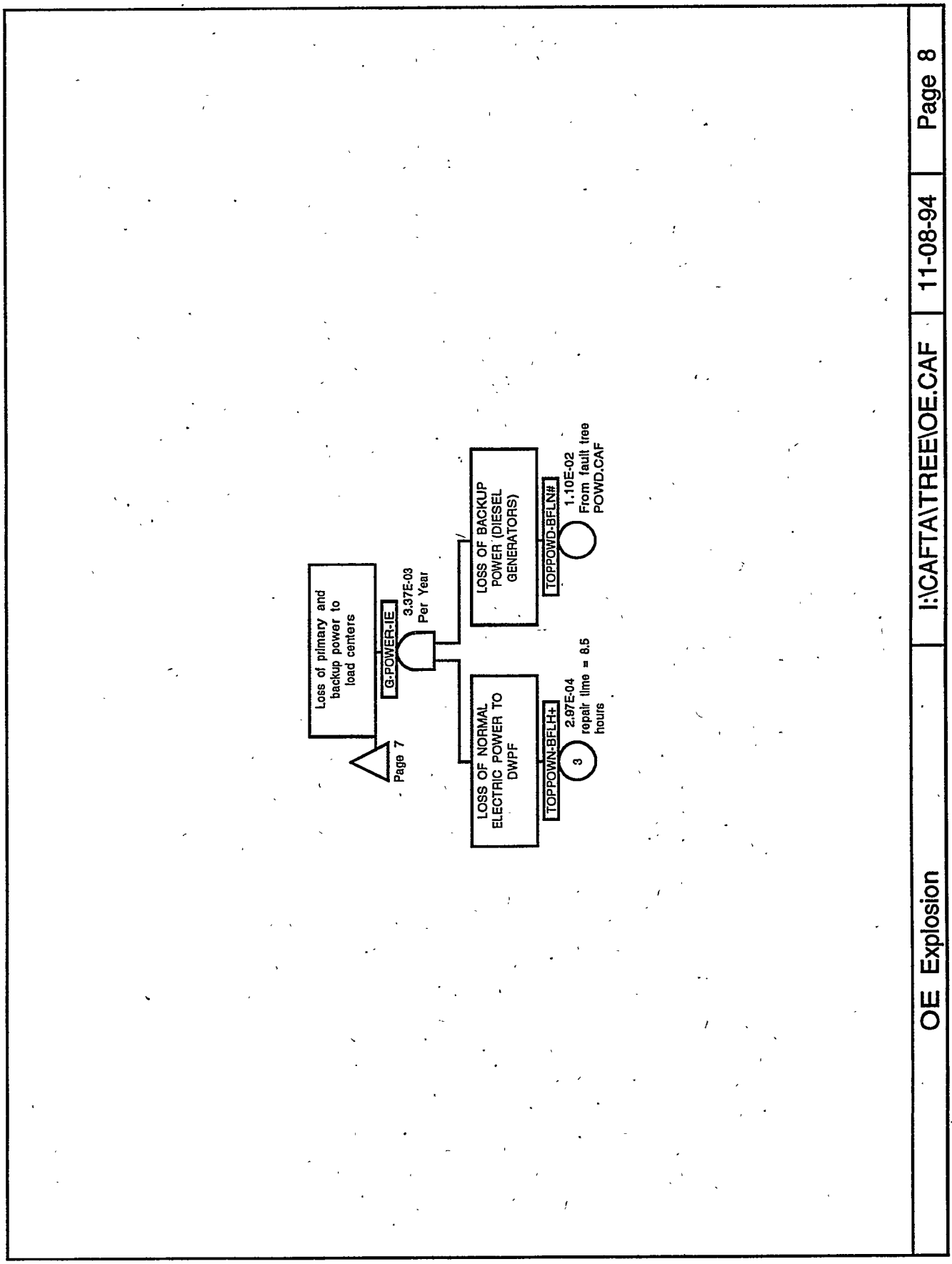
Page 7
SPC isolates without nitrogen addition
Page 1
G-SCVC-5
1.81E-04 Per Year
SPC/PVVH isolation interlock activated
SPC nitrogen purge system unavailable
TOPSPCN2BFLU+
4.10E-04 From fault tree SPCN2.CAF
G-SPC-4
4.42E-01 Per Year
PVVH flow monitor 6041 fails low
FE-6041-FLOK+
2.40E-05 a: detected and corrected in 8 hours
SPC CO2 purge isolation valve 1 fails closed
SV-CO21-FCLQ+
1.28E-04 a: corrected before next batch
PVVH flow low
G-PVV-7
3.33E-02 Per Year
Loss of primary and backup power to load centers
G-POWER-IE
3.37E-03 Per Year
Page 8
cc: both PVVH fans fail
CC2PVVH-FAN1+
2.40E-05 a: 0.1 X single rate, corrected in 8 hours
Failure of PVVH fans
G-PVV-8
3.68E-03 Per Year
Page 9
PVVH flow element 5860 fails low
FE-5860-FLOK+
2.40E-05 a: detected and corrected in 8 hours
SPC CO2 purge isolation valve 2 fails closed
SV-CO22-FCLQ+
1.28E-04 a: corrected before next batch
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-8FLH+
3
2.97E-04 repair time = 8.5 hours


OE Explosion
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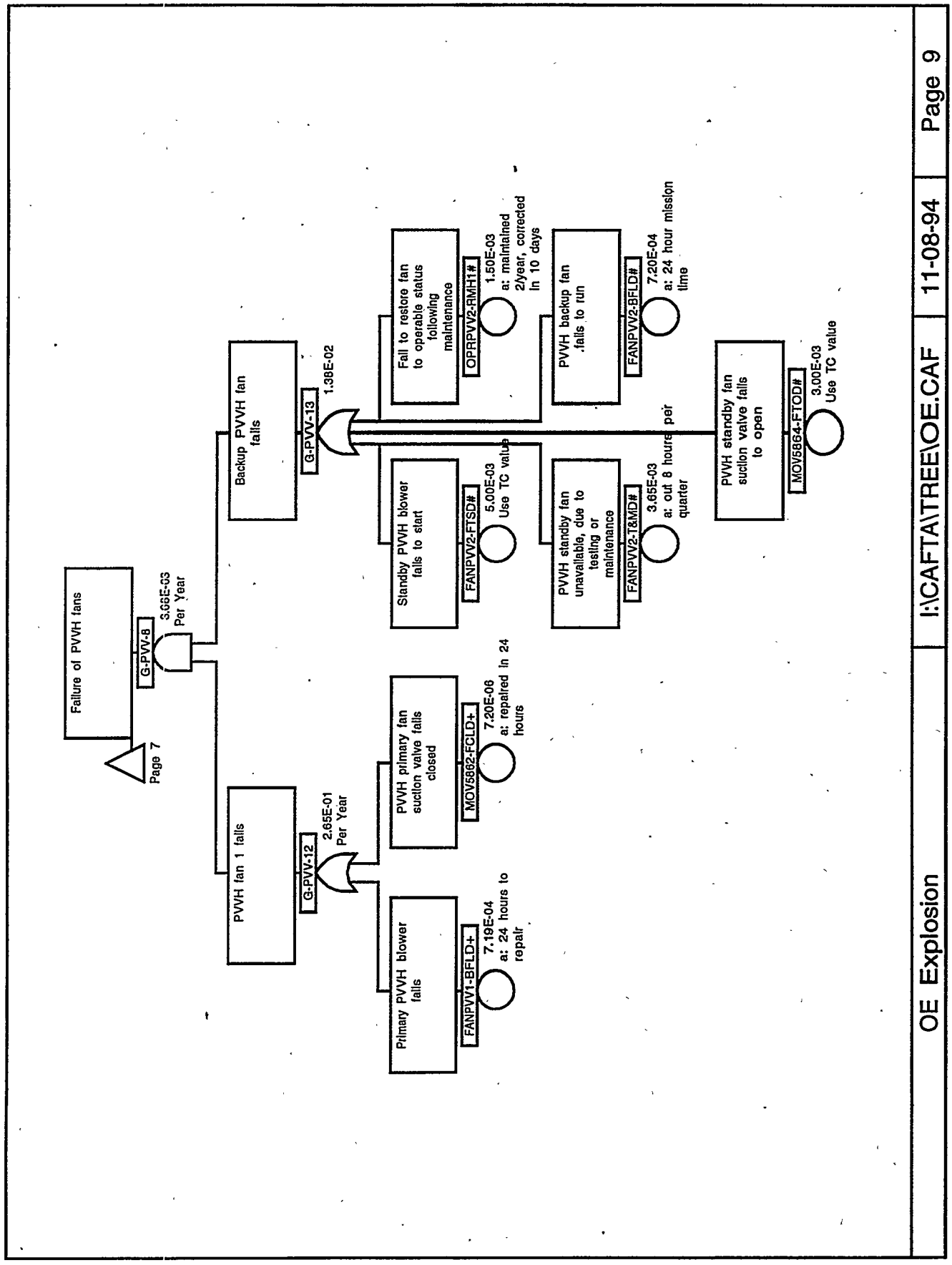
Page 8
Loss of primary and backup power to load centers
G-POWER-IE
3.37E-03
Per Year
Page 7
LOSS OF BACKUP POWER (DIESEL GENERATORS)
TOPPOWD-BFLN#
1.10E-02
From fault tree POWD.CAF
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
3
2.97E-04
repair time = 8.5 hours


OE Explosion
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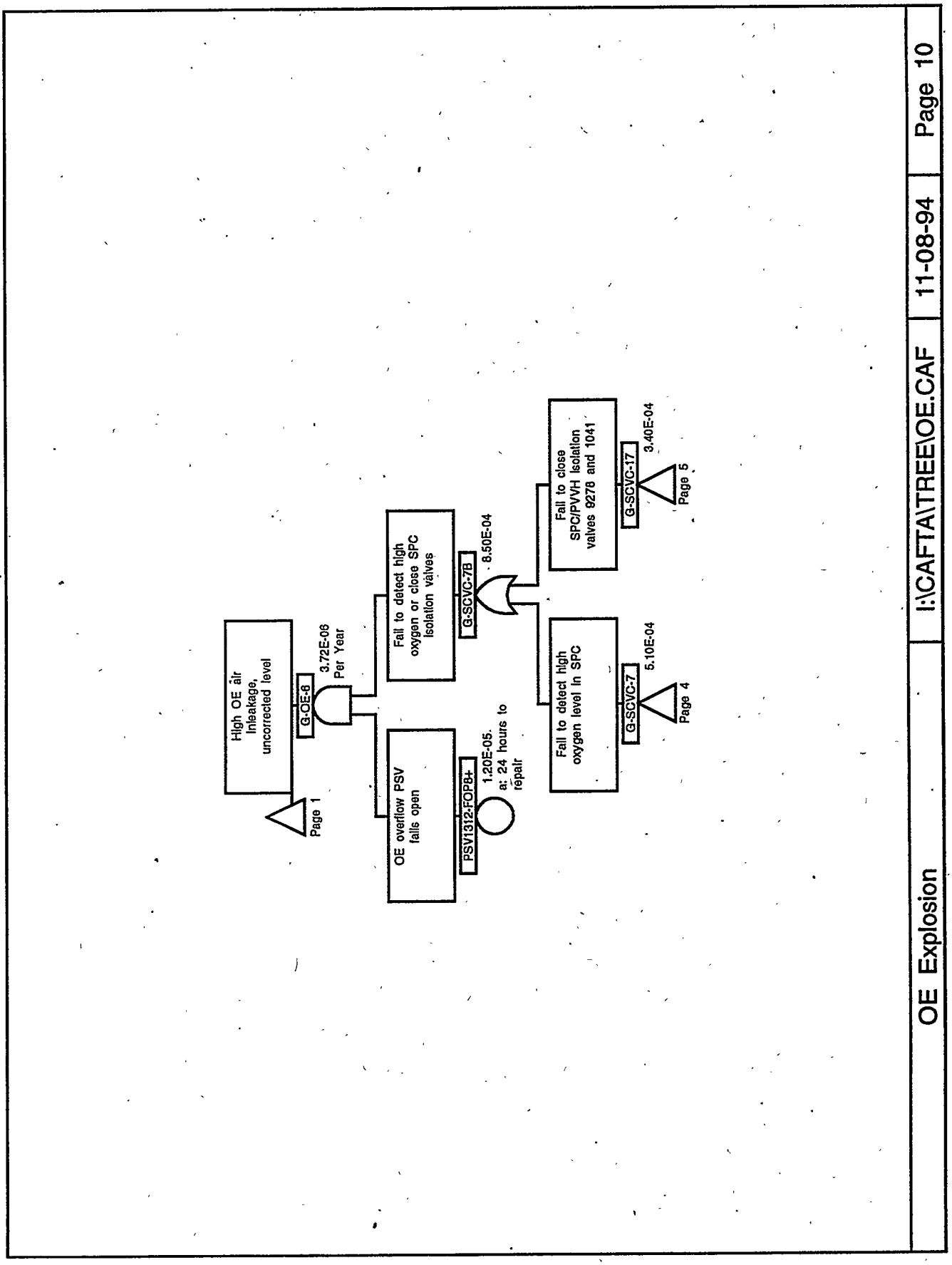
Page 9
Failure of PVVH fans
G-PVV-8
3.66E-03
Per Year
Page 7
Backup PVVH fan fails
G-PVV-13
1.38E-02
Fail to restore fan to operable status following maintenance
OPRPVV2-RMH1#
1.50E-03
a: maintained 2/year, corrected in 10 days
Standby PVVH blower fails to start
FANPVV2-FTSD#
5.00E-03
Use TC value
PVVH backup fan .fails to run
FANPVV2-BFLD#
7.20E-04
a: 24 hour mission time
PVVH standby fan unavailable, due to testing or maintenance
FANPVV2-T&MD#
3.65E-03
a: out 8 hours per quarter
PVVH standby fan suction valve falls to open
MOV5864-FTOD#
3.00E-03
Use TC value
PVVH fan 1 falls
G-PVV-12
2.65E-01
Per Year
PVVH primary fan suction valve falls closed
MOV5862-FCLD+
7.20E-06
a: repaired in 24 hours
Primary PVVH blower falls
FANPVV1-BFLD+
7.19E-04
a: 24 hours to repair


OE Explosion
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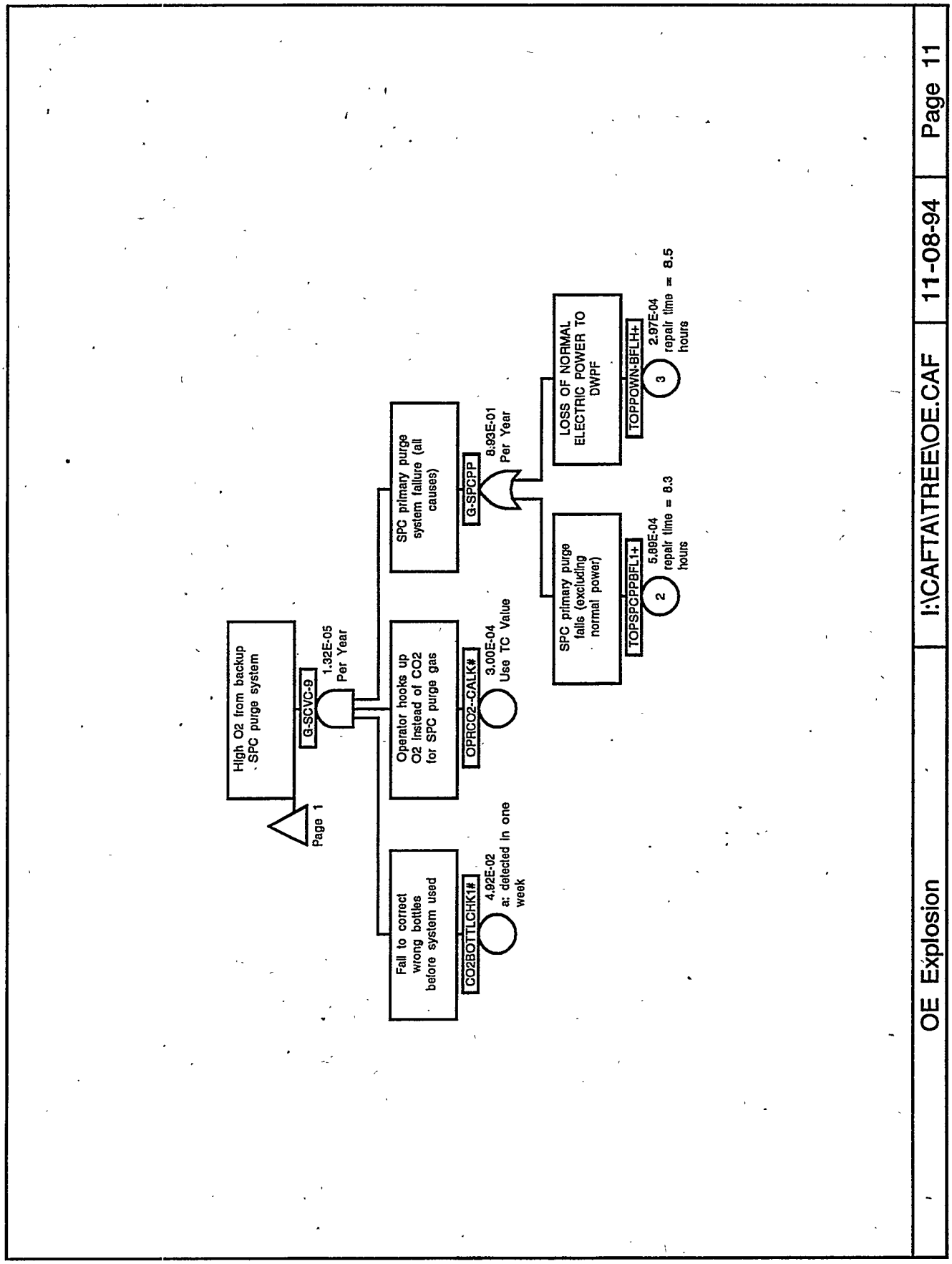
Page 10
High OE air Inleakage, uncorrected level
Page 1
G-OE-8
3.72E-06 Per Year
OE overflow PSV fails open
PSV1312-FOP8+
1.20E-05. a: 24 hours to repair
Fail to detect high oxygen or close SPC isolation valves
G-SCVC-7B
8.50E-04
Fail to detect high oxygen level in SPC
G-SCVC-7
5.10E-04
Page 4
Fail to close SPC/PVVH isolation valves 9278 and 1041
G-SCVC-17
3.40E-04
Page 5


High O2 from backup SPC purge system
Page 1
G-SCVC-9
1.32E-05 Per Year
Operator hooks up O2 instead of CO2 for SPC purge gas
OPRCO2-CALK#
3.00E-04 Use TC Value
Fail to correct wrong bottles before system used
CO2BOTTLCHK1#
4.92E-02 a: detected in one week
SPC primary purge system failure (all causes)
G-SPCPP
8.93E-01 Per Year
SPC primary purge fails (excluding normal power)
2
TOPSPCPP8FL1+
5.89E-04 repair time = 8.3 hours
LOSS OF NORMAL ELECTRIC POWER TO DWPF
3
TOPPOWN-BFLH+
2.97E-04 repair time = 8.5 hours
OE Explosion
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Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
AE-3405-FLOK#	4		G-SCVC-17	6		PCV9315-FCL8+	2				
AE-3409-FLOK#	4		G-SCVC-17	10		PMPSCV01BFLK#	4				
BNZOEHOTPREP#	6		G-SCVC-17A	5		PMPSCV02BFLK#	4				
CC2PVVH-FAN1+	7		G-SCVC-18	4		PSV1312-FOP8+	10				
CC2SCVC-02-K#	4		G-SCVC-19	4		PSV181--FOP8+	2				
CC2SPCP-PT-K#	5		G-SCVC-20	4		PT-1041-FHIK#	5				
CC2SPCV-MOVK#	5		G-SCVC-21	4		PT-9312-FHIK#	5				
CC3-SPC-FE-1#	6		G-SCVC-22	5		SV-CO21-FCLQ+	7				
CO2BOTTLCHK1#	11		G-SCVC-22A	5		SV-CO22-FCLQ+	7				
FANPVV1-BFLD+	9		G-SCVC-5	1		TOP-OE	1				
FANPVV2-BFLD#	9		G-SCVC-5	7		TOPPOWD-BFLN#	8				
FANPVV2-FTSD#	9		G-SCVC-6B	1		TOPPOWN-BFLH+	7				
FANPVV2-T&MD#	9		G-SCVC-6C	1		TOPPOWN-BFLH+	8				
FE-5860-FLOK+	7		G-SCVC-6C	6		TOPPOWN-BFLH+	11				
FE-6041-FLOK+	7		G-SCVC-7	3		TOPSPCBPBFL0#	1				
FE-9315-FHIE#	3		G-SCVC-7	4		TOPSPCN2BFLU#	7				
FSL3406-FTCK#	4		G-SCVC-7	6		TOPSPCPPBFL1+	1				
FSL3409-FTCK#	4		G-SCVC-7	10		TOPSPCPPBFL1+	11				
G-OE-1	1		G-SCVC-7B	10							
G-OE-10	1		G-SCVC-9	1							
G-OE-10	2		G-SCVC-9	11							
G-OE-1A	1		G-SPC-4	7							
G-OE-4	1		G-SPC-CO24	6							
G-OE-4	3		G-SPCPP	11							
G-OE-5	3		HCV9314-FCL8+	2							
G-OE-6	1		IGNOE---PRE1#	1							
G-OE-6	10		MOV1041-FTCK#	5							
G-OE-9	3		MOV5862-FCLD+	9							
G-POWER-IE	7		MOV5864-FTOD#	9							
G-POWER-IE	8		MOV9278-FTCK#	5							
G-PVV-12	9		OPR3405-MCH3#	4							
G-PVV-13	9		OPR3409-MCH2#	4							
G-PVV-7	7		OPR9312-MCH1#	5							
G-PVV-8	7		OPR9315-MCH1#	3							
G-PVV-8	9		OPRCO2--CALK#	11							
G-SCVC-16	4		OPRPVV2-RMH1#	9							
G-SCVC-17	3		OPRSV74BRANK+	2							
G-SCVC-17	5		PC-1041-FLOK#	5							

Cutsets for I:\CAFTA\CUT\OE.CSR 11/08/94 12:30 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-OE					1.21E-05
1.	BNZOEHOTPREP#	Benzene being boiled off in OE	3	2H 2.3E-02H	4.50E-02	5.30E-06
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCBPBFL0#	Failure of backup CO2 system	1	1N 6.7E-03N	6.70E-03N	
	TOPSPCPPBFL1+	SPC primary purge fails (excluding normal power)	4	8.8H 6.7E-05H	5.89E-04	
2.	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	3.77E-06
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
3.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-07
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSV74BRANK+	Operator erroneously closes OE CO2 supply needle valve	4	43H 5.0E-06H	2.15E-04	
4.	CC2PVVH-FAN1+	cc: both PVVH fans fail	4	8H 3.0E-06H	2.40E-05	3.23E-07
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
5.	FE-6041-FLOK+	PVVH flow monitor 6041 fails low	4	8H 3.0E-06H	2.40E-05	3.23E-07
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
6.	FE-5860-FLOK+	PVVH flow element 5860 fails low	4	8H 3.0E-06H	2.40E-05	3.23E-07
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
7.	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	3.23E-07

Cutsets for I:\CAFTA\CUT\OE.CSR 11/08/94 12:30 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	SV-CO22-FCLQ+	SPC CO2 purge isolation valve 2 fails closed	4	43H 3.0E-06H	1.29E-04	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
8.	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	3.23E-07
	SV-CO21-FCLQ+	SPC CO2 purge isolation valve 1 fails closed	4	43H 3.0E-06H	1.29E-04	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
9.	CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	3	7D 3.0E-04H	4.92E-02	2.59E-07
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	1	1N 3.0E-04N	3.00E-04N	
	TOPSPCPPBFL1+	SPC primary purge fails (excluding normal power)	4	8.8H 6.7E-05H	5.89E-04	
10.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	2.37E-07
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	PCV9315-FCL8+	OE purge pressure control valve fails closed	4	8H 3.0E-06H	2.40E-05	
11.	CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	3	7D 3.0E-04H	4.92E-02	1.36E-07
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	1	1N 3.0E-04N	3.00E-04N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
12.	CC2SCVC-O2-K#	CC: Both SCVC O2 detectors fail high	1	1N 5.0E-04N	5.00E-04N	6.57E-08
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	PSV1312-FOP8+	OE overflow PSV fails open	4	24H 5.0E-07H	1.20E-05	
13.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-08
	HCV9314-FCL8+	OE purge supply valve 9314 fails closed	4	1H 5.0E-07H	5.00E-07	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
14.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-08
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	PSV1312-FOP8+	OE overflow PSV fails open	4	24H 5.0E-07H	1.20E-05	
15.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-08
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	PSV181--FOP8+	PSV on OE purge supply line fails open	4	24H 5.0E-07H	1.20E-05	
16.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.54E-08
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCBPBFL0#	Failure of backup CO2 system	1	1N 6.7E-03N	6.70E-03N	
	TOPSPCPPBFL1+	SPC primary purge fails (excluding normal power)	4	8.8H 6.7E-05H	5.89E-04	
17.	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	2.82E-08
	OPRSV74BRANK+	Operator erroneously closes OE CO2 supply needle valve	4	43H 5.0E-06H	2.15E-04	
	PC-1041-FLOK#	SCVC exit pressure controller fails low	5	43H 1.0E-06H	2.15E-05	
18.	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	1.69E-08
	PC-1041-FLOK#	SCVC exit pressure controller fails low	5	43H 1.0E-06H	2.15E-05	
	PCV9315-FCL8+	OE purge pressure control valve fails closed	4	8H 3.0E-06H	2.40E-05	
19.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	1.62E-08
	FANPVV2-FTSD#	Standby PVVH blower fails to start	1	1N 5.0E-03N	5.00E-03N	
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
20.	CC2SPCP-PT-K#	CC: both SPC pressure monitors fail high		1E-5N	1.00E-05	1.31E-08
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSV74BRANK+	Operator erroneously closes OE CO2 supply needle valve	4	43H 5.0E-06H	2.15E-04	
21.	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	1.18E-08
	MOV1041-FTCK#	SPC/PVVH isolation valve MOV-1041 fails to close	1	1N 3.0E-03N	3.00E-03N	
	MOV9278-FTCK#	SPC/PVVH isolation valve MOV-9278 fails to close	1	1N 3.0E-03N	3.00E-03N	
	OPRSV74BRANK+	Operator erroneously closes OE CO2 supply needle valve	4	43H 5.0E-06H	2.15E-04	
22.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	1.18E-08
	FANPVV2-T&MD#	PVVH standby fan unavailable, due to testing or maintenance	3	8H 4Y	3.65E-03	
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
23.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	9.69E-09
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	MOV5864-FTOD#	PVVH standby fan suction valve fails to open	1	1N 3.0E-03N	3.00E-03N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
24.	CC2SPCP-PT-K#	CC: both SPC pressure monitors fail high		1E-5N	1.00E-05	7.88E-09
	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	
	PCV9315-FCL8+	OE purge pressure control valve fails closed	4	8H 3.0E-06H	2.40E-05	
25.	IGNOE---PRE1#	Ignition source present in OE vessel	1	1N 3.0E-02N	3.00E-02N	7.10E-09
	MOV1041-FTCK#	SPC/PVVH isolation valve MOV-1041 fails to close	1	1N 3.0E-03N	3.00E-03N	
	MOV9278-FTCK#	SPC/PVVH isolation valve MOV-9278 fails to close	1	1N 3.0E-03N	3.00E-03N	
	PCV9315-FCL8+	OE purge pressure control valve fails closed	4	8H 3.0E-06H	2.40E-05	

Explosion in the OE Top Event Frequency: 1.21E-05/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
PSV1312-FOP8+-I	OE overflow PSV fails open	5.00E-07/H	1.85E+04
TOPPOWN-BFLH+-I	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	9.24E+03
CC2PVVH-FAN1+-I	cc: both PVVH fans fail	3.00E-06/H	8.92E+03
FE-6041-FLOK+-I	PVVH flow monitor 6041 fails low	3.00E-06/H	8.92E+03
FE-5860-FLOK+-I	PVVH flow element 5860 fails low	3.00E-06/H	8.92E+03
SV-CO21-FCLQ+-I	SPC CO2 purge isolation valve 1 fails closed	3.00E-06/H	8.92E+03
SV-CO22-FCLQ+-I	SPC CO2 purge isolation valve 2 fails closed	3.00E-06/H	8.92E+03
OPRSV74BRANK+-I	Operator erroneously closes OE CO2 supply needle valve	5.00E-06/H	7.40E+03
PCV9315-FCL8+-I	OE purge pressure control valve fails closed	3.00E-06/H	7.40E+03
PSV181--FOP8+-I	PSV on OE purge supply line fails open	5.00E-07/H	7.40E+03
HCV9314-FCL8+-I	OE purge supply valve 9314 fails closed	5.00E-07/H	7.40E+03
TOPSPCPPBFL1+-I	SPC primary purge fails (excluding normal power)	6.69E-05/H	6.92E+03
TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	4.10E-04	1.10E+03
CC2SPCP-PT-K#	CC: both SPC pressure monitors fail high	8.40E-06	2.17E+02
PC-1041-FLOK#	SCVC exit pressure controller fails low	2.15E-05	2.17E+02
CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	3.00E-04	2.17E+02
MOV5862-FCLD+-I	PVVH primary fan suction valve fails closed	3.00E-07/H	1.25E+02
FANPVV1-BFLD+-I	Primary PVVH blower fails	3.00E-05/H	1.25E+02
OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	3.00E-04	1.10E+02
TOPSPCBPBFL0#	Failure of backup CO2 system	6.70E-03	6.65E+01
IGNOE--PRE1#	Ignition source present in OE vessel	3.00E-02	3.33E+01
CC2SCVC-O2-K#	CC: Both SCVC O2 detectors fail high	5.00E-04	1.23E+01
BNZOEHOTPREP#	Benzene being boiled off in OE	4.50E-02	1.03E+01
MOV1041-FTCK#	SPC/PVVH isolation valve MOV-1041 fails to close	3.00E-03	1.65E+00
MOV9278-FTCK#	SPC/PVVH isolation valve MOV-9278 fails to close	3.00E-03	1.65E+00
CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	4.92E-02	1.63E+00
FANPVV2-BFLD#	PVVH backup fan fails to run	7.20E-04	1.27E+00
OPRPVV2-RMH1#	Fail to restore fan to operable status following maintenance	1.50E-03	1.27E+00
MOV5864-FTOD#	PVVH standby fan suction valve fails to open	3.00E-03	1.27E+00
FANPVV2-T&MD#	PVVH standby fan unavailable, due to T&M	3.65E-03	1.27E+00
FANPVV2-FTSD#	Standby PVVH blower fails to start	5.00E-03	1.27E+00
FE-9315-FHIE#	OE purge flow element 9315 fails to detect low flow	2.16E-03	1.10E+00
OPR9315-MCH1#	OE purge flow element 9315 miscalibrated	1.20E-04	1.09E+00
OPR3409-MCH2#	O2 analyzer 3409 miscalibrated	3.00E-03	1.03E+00
OPR3405-MCH3#	O2 analyzer 3405 miscalibrated	3.00E-03	1.03E+00
AE-3405-FLOK#	SCVC O2 concentration analyzer 3405 fails low	1.07E-04	1.03E+00
AE-3409-FLOK#	SCVC O2 concentration analyzer 3409 fails low	1.07E-04	1.03E+00
PT-1041-FHIK#	PR vapor space PT-1041 fails high	2.15E-05	1.02E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) x (risk achievement worth).

Explosion in the OE Top Event Frequency: 1.21E-05/YR

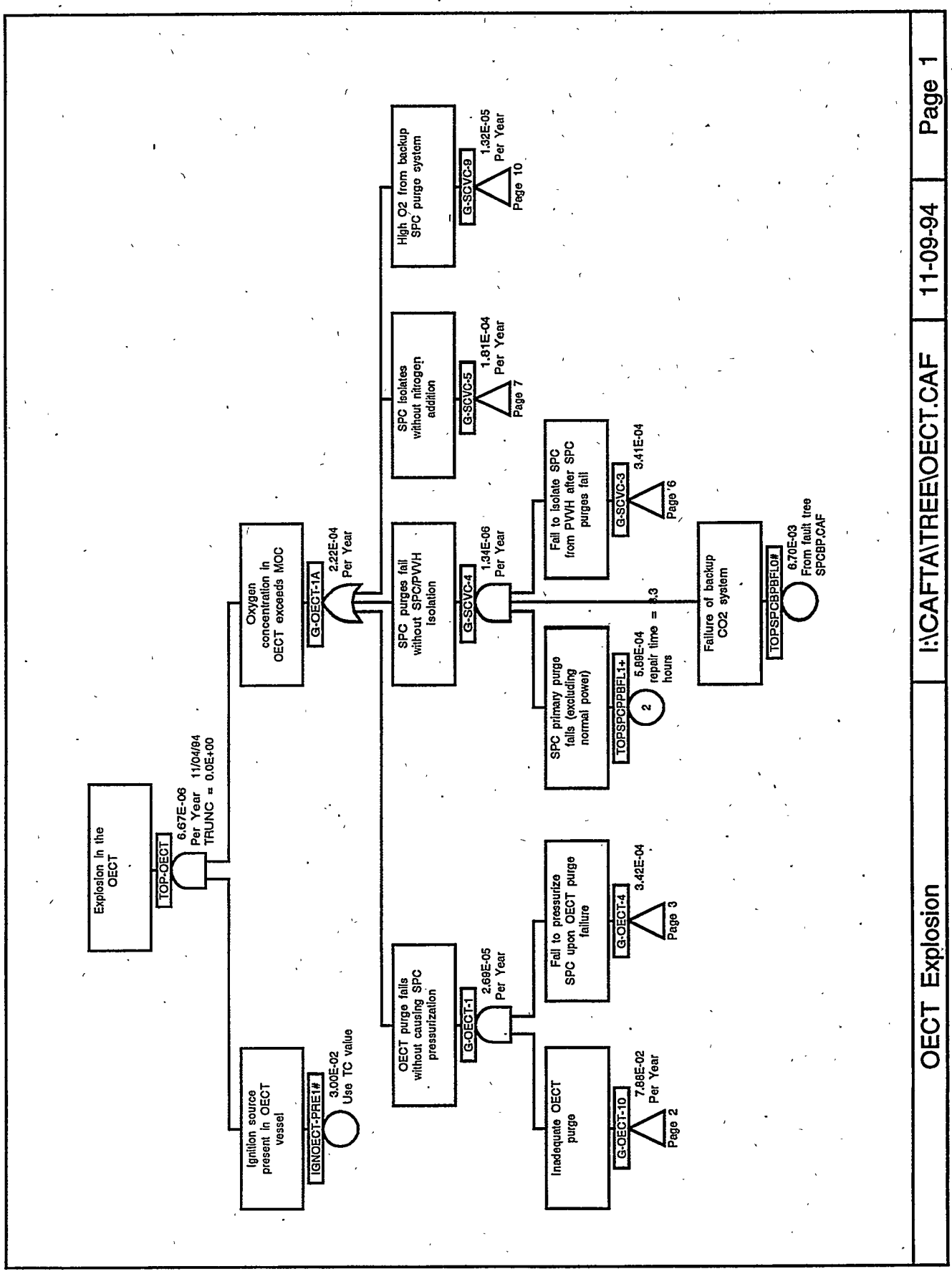
Risk Reduction Worth

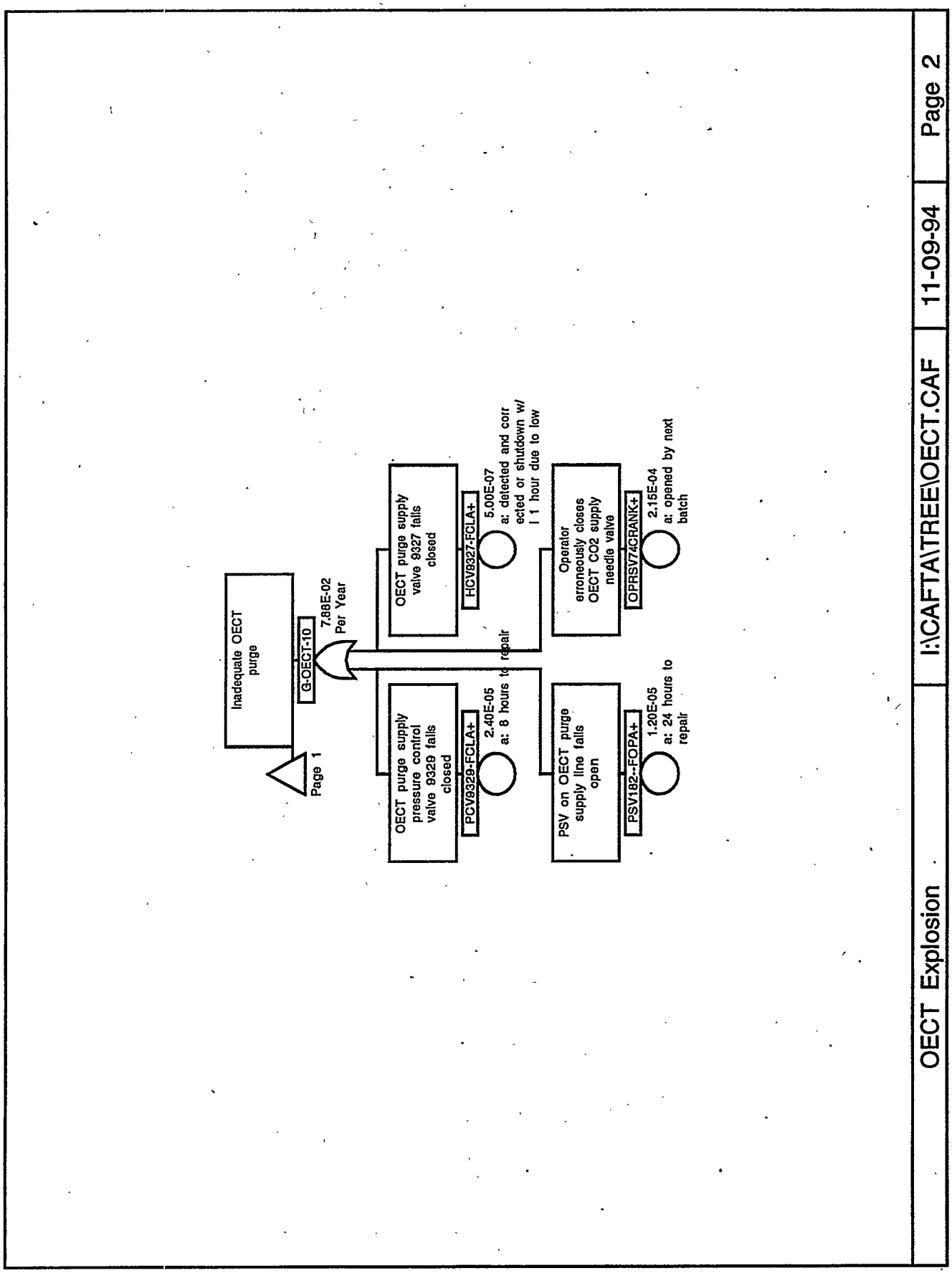
Basic Event Name	Description	Prob/Freq	RedW
*IGNOE---PRE1#	Ignition source present in OE vessel	3.00E-02	0.00E+00
TOPSPCPPBFL1+-I	SPC primary purge fails (excluding normal power)	6.69E-05/H	1.86E+00
TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	4.10E-04	1.82E+00
TOPSPCBPBFL0#	Failure of backup CO2 system	6.70E-03	1.79E+00
BNZOEHOTPREP#	Benzene being boiled off in OE	4.50E-02	1.78E+00
TOPPOWN-BFLH+-I	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	1.48E+00
CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	3.00E-04	1.07E+00
OPRSV74BRANK+-I	Operator erroneously closes OE CO2 supply needle valve	5.00E-06/H	1.04E+00
CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	4.92E-02	1.03E+00
OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	3.00E-04	1.03E+00
SV-CO22-FCLQ+-I	SPC CO2 purge isolation valve 2 fails closed	3.00E-06/H	1.03E+00
SV-CO21-FCLQ+-I	SPC CO2 purge isolation valve 1 fails closed	3.00E-06/H	1.03E+00
FE-6041-FLOK+-I	PVVH flow monitor 6041 fails low	3.00E-06/H	1.03E+00
FE-5860-FLOK+-I	PVVH flow element 5860 fails low	3.00E-06/H	1.03E+00
CC2PVVH-FAN1+-I	cc: both PVVH fans fail	3.00E-06/H	1.03E+00
PCV9315-FCL8+-I	OE purge pressure control valve fails closed	3.00E-06/H	1.02E+00

* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

OECT Explosion


OECT Explosion
I:\CAFTA\TREE\OECT.CAF
11-09-94
Page 1
Explosion in the OECT
TOP-OECT
6.67E-06 Per Year 11/04/94 TRUNC = 0.0E+00
Ignition source present in OECT vessel
IGNOECT-PRE1#
3.00E-02 Use TC value
Oxygen concentration in OECT exceeds MOC
G-OECT-1A
2.22E-04 Per Year
OECT purge fails without causing SPC pressurization
G-OECT-1
2.69E-05 Per Year
Inadequate OECT purge
G-OECT-10
7.88E-02 Per Year
Page 2
Fail to pressurize SPC upon OECT purge failure
G-OECT-4
3.42E-04
Page 3
SPC purges fail without SPC/PVH Isolation
G-SCVC-4
1.34E-06 Per Year
SPC primary purge fails (excluding normal power)
TOPSPCPPBFL1+
2
5.89E-04 repair time = 8.3 hours
Fail to isolate SPC from PVH after SPC purges fail
G-SCVC-3
3.41E-04
Page 6
Failure of backup CO2 system
TOPSPCBPBFL0#
6.70E-03 From fault tree SPCBP.CAF
SPC isolates without nitrogen addition
G-SCVC-5
1.81E-04 Per Year
Page 7
High O2 from backup SPC purge system
G-SCVC-9
1.32E-05 Per Year
Page 10


OECT Explosion
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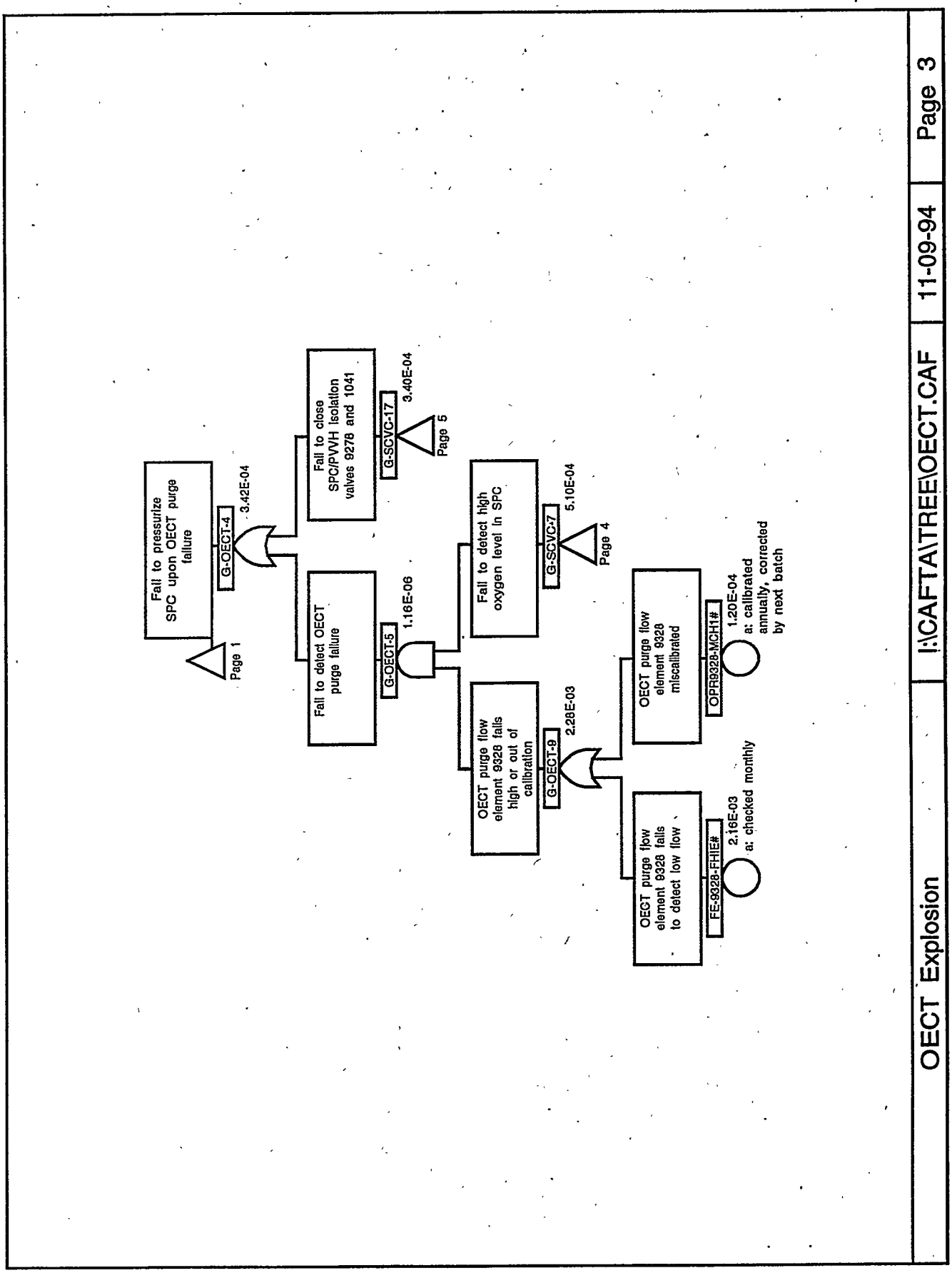
Page 2
Inadequate OECT purge
G-OECT-10
7.88E-02 Per Year
Page 1
OECT purge supply pressure control valve 9329 fails closed
PCV9329-FCLA+
2.40E-05 a: 8 hours to repair
OECT purge supply valve 9327 fails closed
HCV9327-FCLA+
5.00E-07 a: detected and corrected or shutdown w/ 1 1 hour due to low
PSV on OECT purge supply line fails open
PSV182+-FOPA+
1.20E-05 a: 24 hours to repair
Operator erroneously closes OECT CO2 supply needle valve
OPRSV74CRANK+
2.15E-04 a: opened by next batch


Fail to pressurize SPC upon OECT purge failure
Page 1
G-OECT-4
3.42E-04
Fail to detect OECT purge failure
G-OECT-5
1.16E-06
Fail to close SPC/PVVH isolation valves 9278 and 1041
G-SCVC-17
3.40E-04
Page 5
Fail to detect high oxygen level in SPC
G-SCVC-7
5.10E-04
Page 4
OECT purge flow element 9328 fails high or out of calibration
G-OECT-9
2.28E-03
OECT purge flow element 9328 miscalibrated
OPR9328-MCH1#
1.20E-04
a: calibrated annually, corrected by next batch
OECT purge flow element 9328 fails to detect low flow
FE-9328-FHIE#
2.16E-03
a: checked monthly
OECT Explosion
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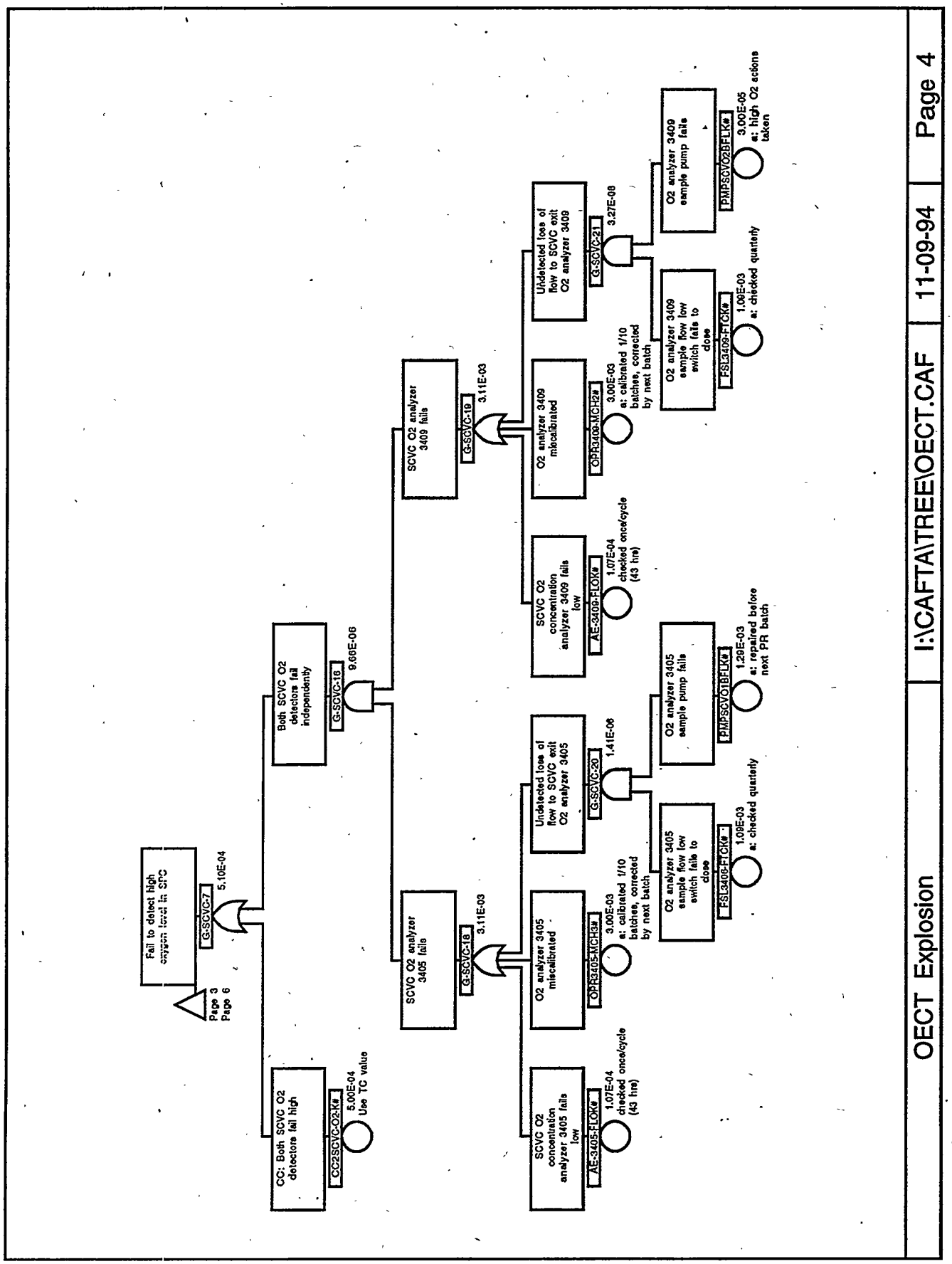
Fail to detect high oxygen level in SFC
G-SCVC-7
5.10E-04
Page 3
Page 6
CC: Both SCVC O2 detectors fail high
CC2SCVC-O2-K#
5.00E-04
Use TC value
Both SCVC O2 detectors fail independently
G-SCVC-16
9.86E-06
SCVC O2 analyzer 3405 fails
G-SCVC-18
3.11E-03
SCVC O2 concentration analyzer 3405 fails low
AE-3405-FLOK#
1.07E-04
checked once/cycle (43 hrs)
O2 analyzer 3405 miscalibrated
OPR3405-MCH3#
3.00E-03
a: calibrated 1/10 batches, corrected by next batch
Undetected loss of flow to SCVC exit O2 analyzer 3405
G-SCVC-20
1.41E-06
O2 analyzer 3405 sample pump fails
PMPSCVC1BFLK#
1.29E-03
a: repaired before next PR batch
O2 analyzer 3405 sample flow low switch fails to close
FSL3406-FLOK#
1.08E-03
a: checked quarterly
SCVC O2 analyzer 3409 fails
G-SCVC-19
3.11E-03
SCVC O2 concentration analyzer 3409 fails low
AE-3409-FLOK#
1.07E-04
checked once/cycle (43 hrs)
O2 analyzer 3409 miscalibrated
OPR3409-MCH2#
3.00E-03
a: calibrated 1/10 batches, corrected by next batch
Undetected loss of flow to SCVC exit O2 analyzer 3409
G-SCVC-21
3.27E-08
O2 analyzer 3409 sample pump fails
PMPSCVC2BFLK#
3.00E-05
a: high O2 actions taken
O2 analyzer 3409 sample flow low switch fails to close
FSL3409-FLOK#
1.08E-03
a: checked quarterly
OECT Explosion
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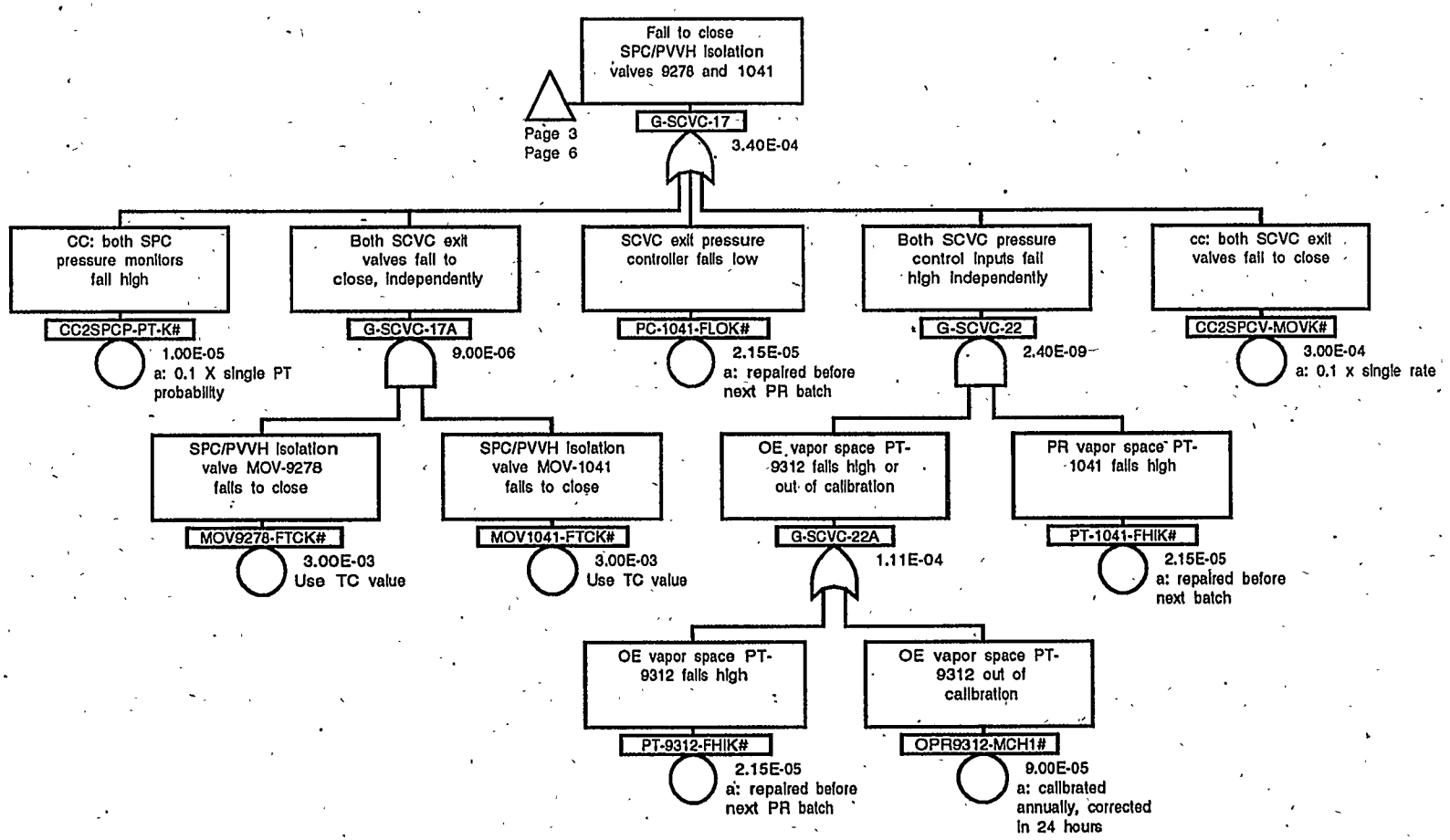
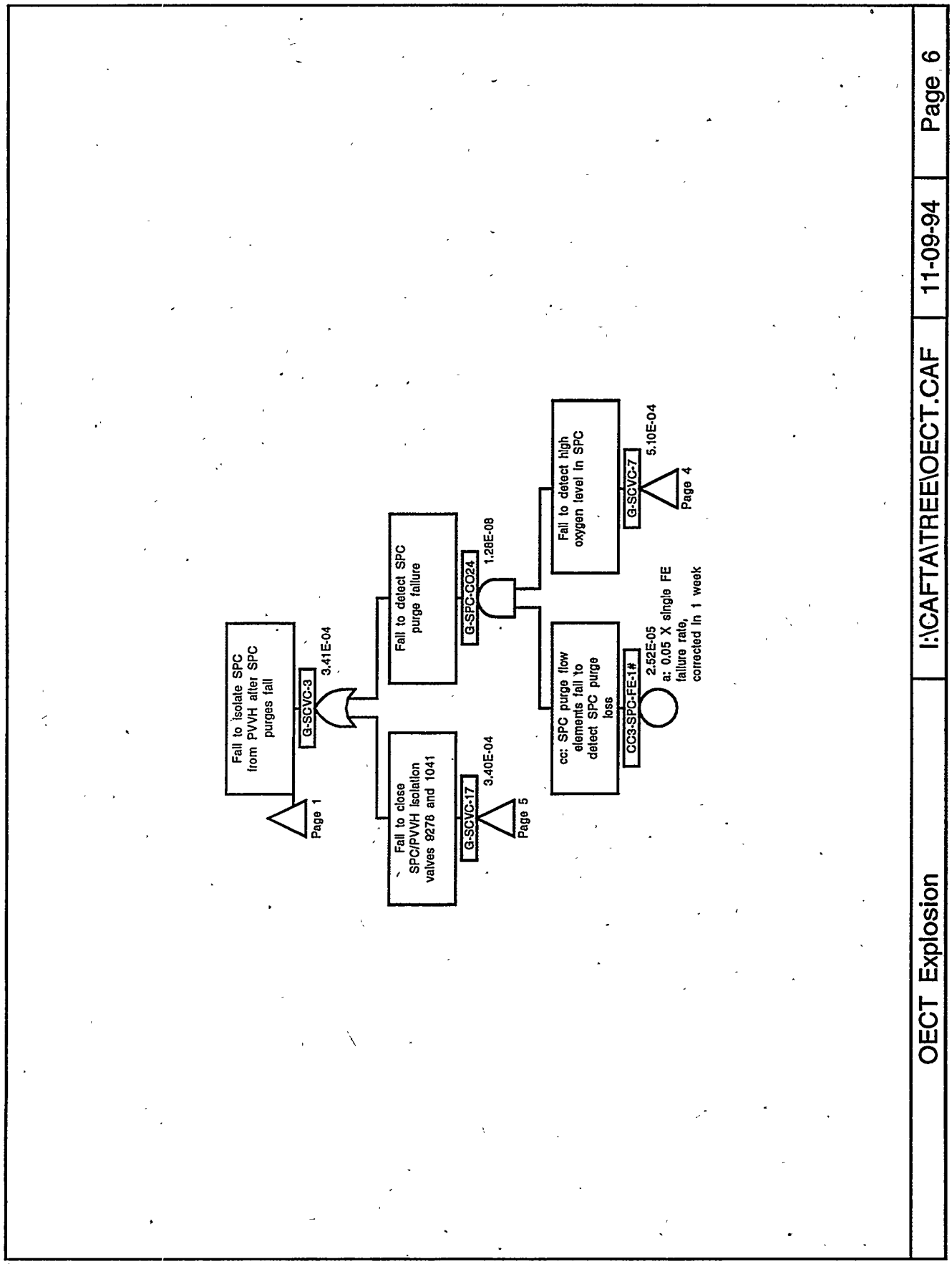
Page 4


Fail to close SPC/PVVH Isolation valves 9278 and 1041
G-SCVC-17
3.40E-04
Page 3
Page 6
CC: both SPC pressure monitors fail high
CC2SPCP-PT-K#
1.00E-05
a: 0.1 X single PT probability
Both SCVC exit valves fail to close, independently
G-SCVC-17A
9.00E-06
SCVC exit pressure controller fails low
PC-1041-FLOK#
2.15E-05
a: repaired before next PR batch
Both SCVC pressure control inputs fail high independently
G-SCVC-22
2.40E-09
cc: both SCVC exit valves fail to close
CC2SPCV-MOVK#
3.00E-04
a: 0.1 x single rate
SPC/PVVH Isolation valve MOV-9278 fails to close
MOV9278-FTCK#
3.00E-03
Use TC value
SPC/PVVH Isolation valve MOV-1041 fails to close
MOV1041-FTCK#
3.00E-03
Use TC value
OE vapor space PT-9312 fails high or out of calibration
G-SCVC-22A
1.11E-04
PR vapor space PT-1041 fails high
PT-1041-FHIK#
2.15E-05
a: repaired before next batch
OE vapor space PT-9312 fails high
PT-9312-FHIK#
2.15E-05
a: repaired before next PR batch
OE vapor space PT-9312 out of calibration
OPR9312-MCH1#
9.00E-05
a: calibrated annually, corrected in 24 hours


OECT Explosion
I:\CAFTA\TREE\OECT.CAF
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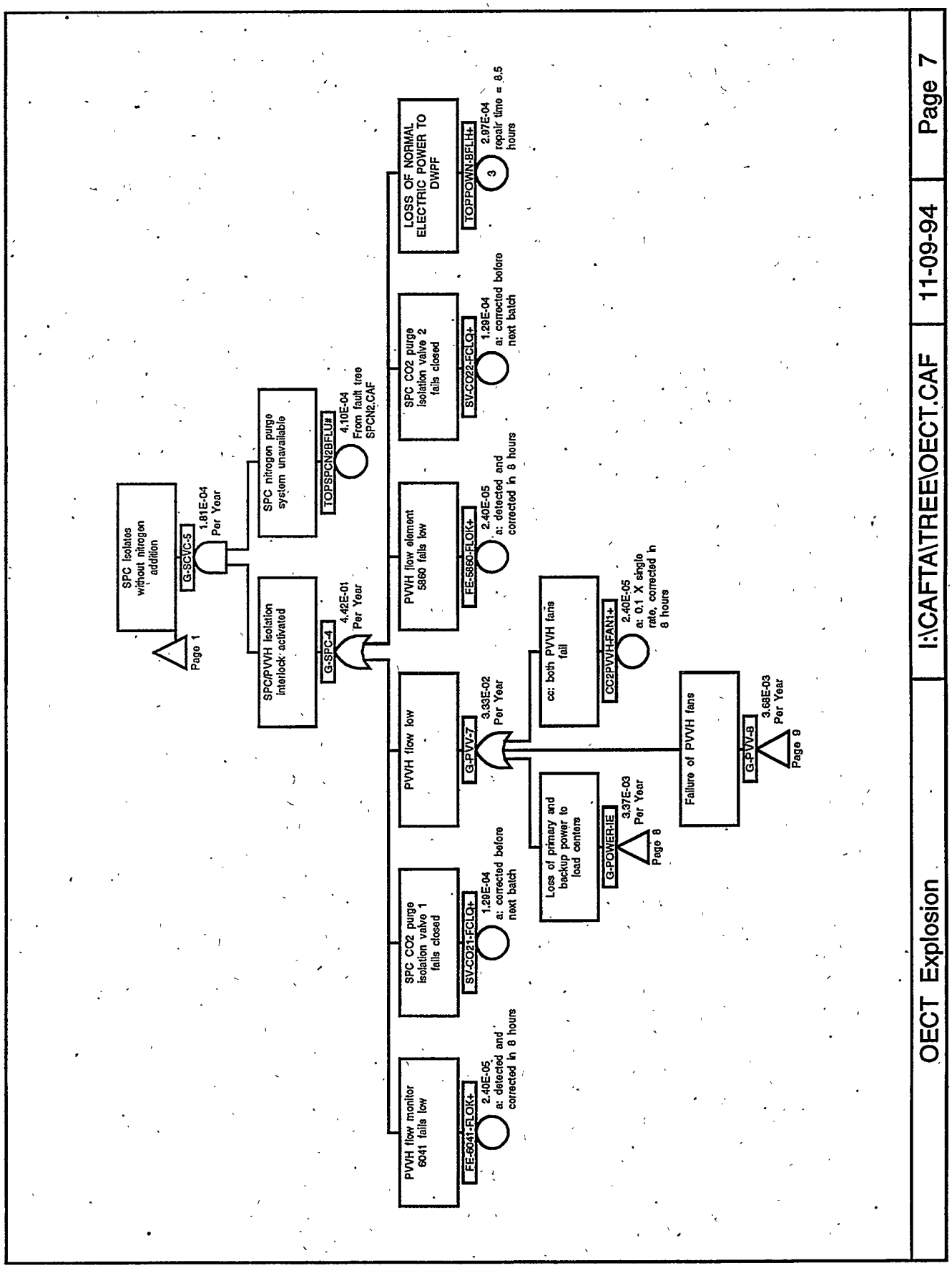
Page 6
Fail to isolate SPC from PVVH after SPC purges fail
G-SCVC-3
3.41E-04
Page 1
Fail to close SPC/PVVH isolation valves 9278 and 1041
G-SCVC-17
3.40E-04
Page 5
Fail to detect SPC purge failure
G-SPC-CO24
1.28E-08
cc: SPC purge flow elements fail to detect SPC purge loss
CC3-SPC-FE-1#
2.52E-05
a: 0.05 X single FE failure rate, corrected in 1 week
Fail to detect high oxygen level in SPC
G-SCVC-7
5.10E-04
Page 4


OECT Explosion
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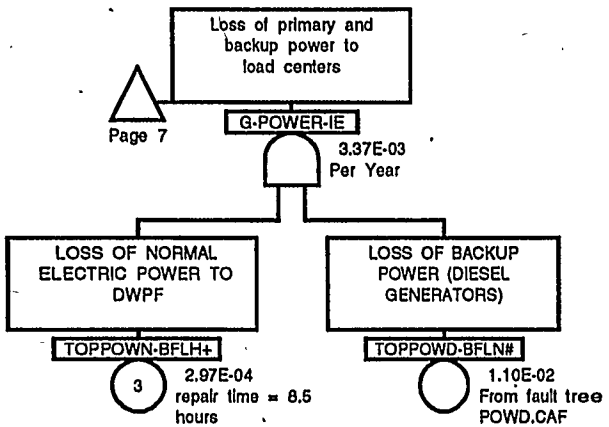
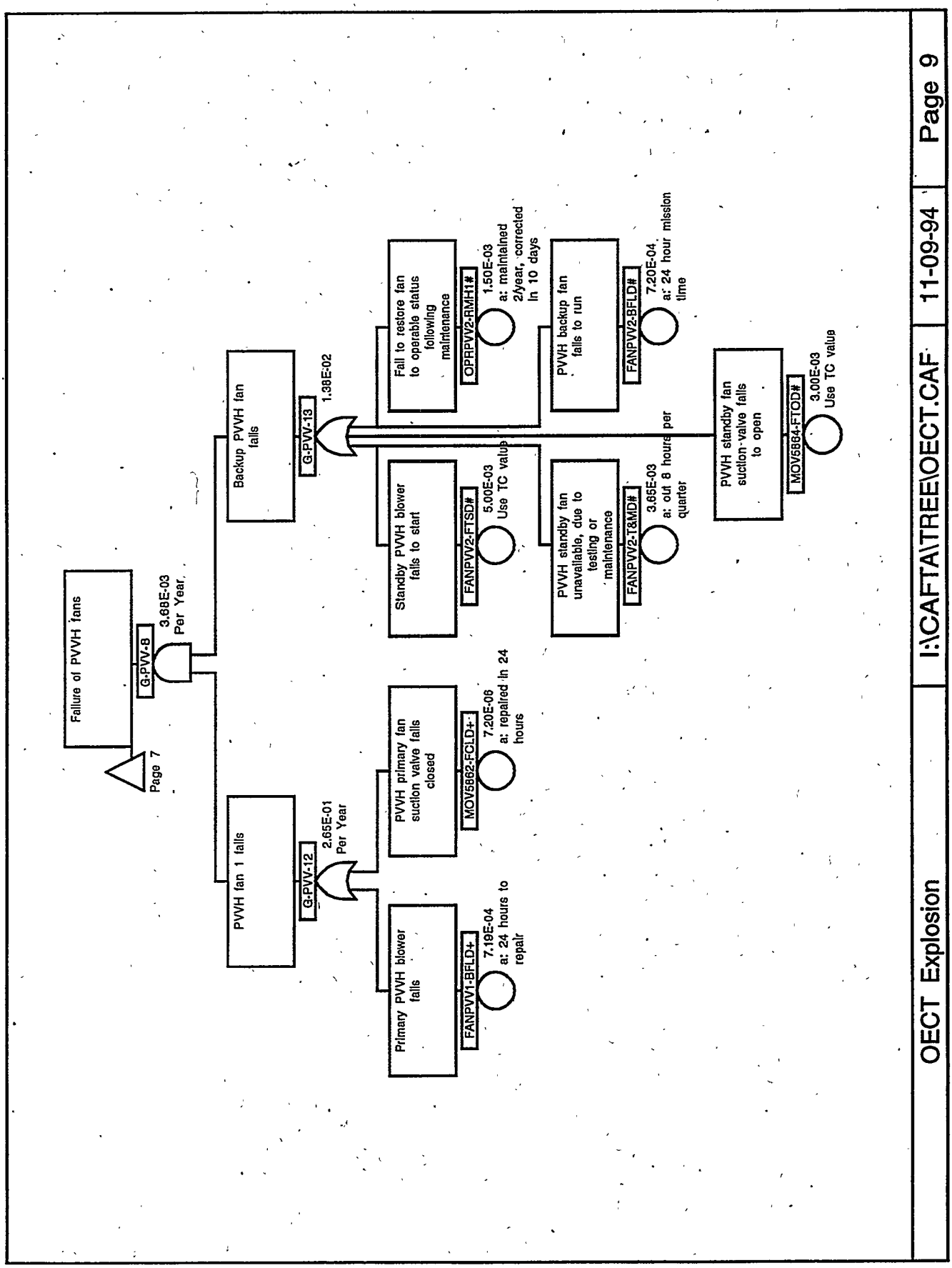
Page 7
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
2.97E-04
repair time = 8.5 hours
3
SPC CO2 purge Isolation valve 2 fails closed
SV-CO22-FCLO+
1.29E-04
a: corrected before next batch
SPC nitrogen purge system unavailable
TOPSPCN2BFLU#
4.10E-04
From fault tree SPCN2.CAF
SPC isolates without nitrogen addition
G-SCVC-5
1.81E-04
Per Year
Page 1
SPC/PVVH isolation interlock activated
G-SPC-4
4.42E-01
Per Year
PVVH flow element 5860 fails low
FE-5860-FLOK+
2.40E-05
a: detected and corrected in 8 hours
PVVH flow low
G-PVV-7
3.33E-02
Per Year
cc: both PVVH fans fail
CC2PVVH-FAN1+
2.40E-05
a: 0.1 X single rate, corrected in 8 hours
SPC CO2 purge Isolation valve 1 fails closed
SV-CO21-FCLO+
1.29E-04
a: corrected before next batch
Loss of primary and backup power to load centers
G-POWER-IE
3.37E-03
Per Year
Page 8
Failure of PVVH fans
G-PVV-8
3.68E-03
Per Year
Page 8
PVVH flow monitor 6041 fails low
FE-6041-FLOK+
2.40E-05
a: detected and corrected in 8 hours



OECT Explosion	I:\CAFTA\TREE\OECT.CAF	11-09-94	Page 8


Failure of PVVH fans
G-PVV-8
3.68E-03
Per Year
Page 7
Backup PVVH fan fails
G-PVV-13
1.38E-02
Fail to restore fan to operable status following maintenance
OPRPVV2-RMH1#
1.50E-03
a: maintained 2/year, corrected ln 10 days
PVVH backup fan fails to run
FANPVV2-BFLD#
7.20E-04
a: 24 hour mission time
Standby PVVH blower fails to start
FANPVV2-FTSD#
5.00E-03
Use TC value
PVVH standby fan unavailable, due to testing or maintenance
FANPVV2-T&MD#
3.65E-03
a: out 8 hours per quarter
PVVH standby fan suction valve fails to open
MOV6864-FTOD#
3.00E-03
Use TC value
PVVH fan 1 fails
G-PVV-12
2.65E-01
Per Year
PVVH primary fan suction valve fails closed
MOV5862-FCLD+
7.20E-06
a: repaired ln 24 hours
Primary PVVH blower fails
FANPVV1-BFLD+
7.19E-04
a: 24 hours to repair
OECT Explosion
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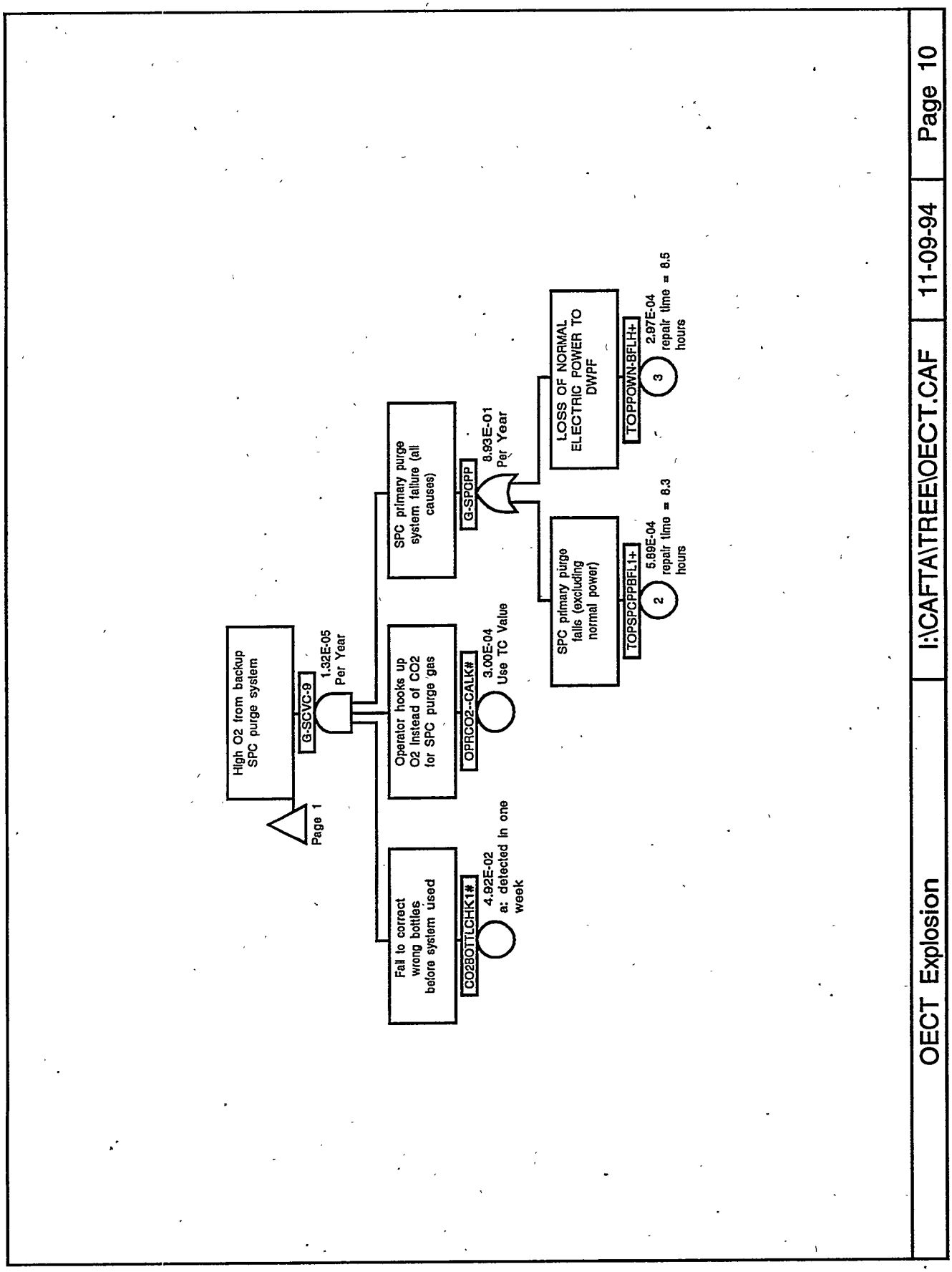
OECT Explosion
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Page 10
High O2 from backup SPC purge system
Page 1
G-SCVC-9
1.32E-05 Per Year
Fail to correct wrong bottles before system used
CO2BOTTLCHK1#
4.92E-02 a: detected in one week
Operator hooks up O2 instead of CO2 for SPC purge gas
OPRCO2--CALK#
3.00E-04 Use TC Value
SPC primary purge system failure (all causes)
G-SPOPP
8.93E-01 Per Year
SPC primary purge fails (excluding normal power)
TOPSPCPPBFL1+
2
5.89E-04 repair time = 8.3 hours
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
3
2.97E-04 repair time = 8.5 hours

Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
AE-3405-FLOK#	4		G-SCVC-19	4		SV-CO21-FCLQ+	7				
AE-3409-FLOK#	4		G-SCVC-20	4		SV-CO22-FCLQ+	7				
CC2PVVH-FAN1+	7		G-SCVC-21	4		TOP-OECT	1				
CC2SCVC-O2-K#	4		G-SCVC-22	5		TOPPOWD-BFLN#	8				
CC2SPCP-PT-K#	5		G-SCVC-22A	5		TOPPOWN-BFLH+	7				
CC2SPCV-MOVK#	5		G-SCVC-3	1		TOPPOWN-BFLH+	8				
CC3-SPC-FE-1#	6		G-SCVC-3	6		TOPPOWN-BFLH+	10				
CO2BOTTLCHK1#	10		G-SCVC-4	1		TOPSPCBPBFL0#	1				
FANPVV1-BFLD+	9		G-SCVC-5	1		TOPSPCN2BFLU#	7				
FANPVV2-BFLD#	9		G-SCVC-5	7		TOPSPCPPBFL1+	1				
FANPVV2-FTSD#	9		G-SCVC-7	3		TOPSPCPPBFL1+	10				
FANPVV2-T&MD#	9		G-SCVC-7	4							
FE-5860-FLOK+	7		G-SCVC-7	6							
FE-6041-FLOK+	7		G-SCVC-9	1							
FE-9328-FHIE#	3		G-SCVC-9	10							
FSL3406-FTCK#	4		G-SPC-4	7							
FSL3409-FTCK#	4		G-SPC-CO24	6							
G-OECT-1	1		G-SPCPP	10							
G-OECT-10	1		HCV9327-FCLA+	2							
G-OECT-10	2		IGNOECT-PRE1#	1							
G-OECT-1A	1		MOV1041-FTCK#	5							
G-OECT-4	1		MOV5862-FCLD+	9							
G-OECT-4	3		MOV5864-FTOD#	9							
G-OECT-5	3		MOV9278-FTCK#	5							
G-OECT-9	3		OPR3405-MCH3#	4							
G-POWER-IE	7		OPR3409-MCH2#	4							
G-POWER-IE	8		OPR9312-MCH1#	5							
G-PVV-12	9		OPR9328-MCH1#	3							
G-PVV-13	9		OPRCO2--CALK#	10							
G-PVV-7	7		OPRPVV2-RMH1#	9							
G-PVV-8	7		OPRSV74CRANK+	2							
G-PVV-8	9		PC-1041-FLOK#	5							
G-SCVC-16	4		PCV9329-FCLA+	2							
G-SCVC-17	3		PMPSCVO1BFLK#	4							
G-SCVC-17	5		PMPSCVO2BFLK#	4							
G-SCVC-17	6		PSV182--FOPA+	2							
G-SCVC-17A	5		PT-1041-FHIK#	5							
G-SCVC-18	4		PT-9312-FHIK#	5							

Cutsets for I:\CAFTA\CUT\OECT.CSR 11/09/94 10:25 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-OECT					6.67E-06
1.	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	3.77E-06
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
2.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-07
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSV74CRANK+	Operator erroneously closes OECT CO2 supply needle valve	4	43H 5.0E-06H	2.15E-04	
3.	CC2PVVH-FAN1+	cc: both PVVH fans fail	4	8H 3.0E-06H	2.40E-05	3.23E-07
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
4.	FE-5860-FLOK+	PVVH flow element 5860 fails low	4	8H 3.0E-06H	2.40E-05	3.23E-07
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
5.	FE-6041-FLOK+	PVVH flow monitor 6041 fails low	4	8H 3.0E-06H	2.40E-05	3.23E-07
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
6.	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	3.23E-07
	SV-CO22-FCLQ+	SPC CO2 purge isolation valve 2 fails closed	4	43H 3.0E-06H	1.29E-04	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
7.	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	3.23E-07
	SV-CO21-FCLQ+	SPC CO2 purge isolation valve 1 fails closed	4	43H 3.0E-06H	1.29E-04	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
8.	CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	3	7D 3.0E-04H	4.92E-02	2.59E-07
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	1	1N 3.0E-04N	3.00E-04N	
	TOPSPCPPBFL1+	SPC primary purge fails (excluding normal power)	4	8.8H 6.7E-05H	5.89E-04	
9.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	2.37E-07
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	PCV9329-FCLA+	OECT purge supply pressure control valve 9329 fails closed	4	8H 3.0E-06H	2.40E-05	
10.	CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	3	7D 3.0E-04H	4.92E-02	1.36E-07
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	1	1N 3.0E-04N	3.00E-04N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
11.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-08
	HCV9327-FCLA+	OECT purge supply valve 9327 fails closed	4	1H 5.0E-07H	5.00E-07	
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
12.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-08
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	PSV182--FOPA+	PSV on OECT purge supply line fails open	4	24H 5.0E-07H	1.20E-05	
13.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.54E-08
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCBPBFL0#	Failure of backup CO2 system	1	1N 6.7E-03N	6.70E-03N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	TOPSPCPPBFL1+	SPC primary purge fails (excluding normal power)	4	8.8H 6.7E-05H	5.89E-04	
14.	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	2.82E-08
	OPRSV74CRANK+	Operator erroneously closes OECT CO2 supply needle valve	4	43H 5.0E-06H	2.15E-04	
	PC-1041-FLOK#	SCVC exit pressure controller fails low	5	43H 1.0E-06H	2.15E-05	
15.	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	1.69E-08
	PC-1041-FLOK#	SCVC exit pressure controller fails low	5	43H 1.0E-06H	2.15E-05	
	PCV9329-FCLA+	OECT purge supply pressure control valve 9329 fails closed	4	8H 3.0E-06H	2.40E-05	
16.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	1.62E-08
	FANPVV2-FTSD#	Standby PVVH blower fails to start	1	1N 5.0E-03N	5.00E-03N	
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
17.	CC2SPCP-PT-K#	CC: both SPC pressure monitors fail high		1E-5N	1.00E-05	1.31E-08
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSV74CRANK+	Operator erroneously closes OECT CO2 supply needle valve	4	43H 5.0E-06H	2.15E-04	
18.	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	1.18E-08
	MOV1041-FTCK#	SPC/PVVH isolation valve MOV-1041 fails to close	1	1N 3.0E-03N	3.00E-03N	
	MOV9278-FTCK#	SPC/PVVH isolation valve MOV-9278 fails to close	1	1N 3.0E-03N	3.00E-03N	
	OPRSV74CRANK+	Operator erroneously closes OECT CO2 supply needle valve	4	43H 5.0E-06H	2.15E-04	
19.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	1.18E-08
	FANPVV2-T&MD#	PVVH standby fan unavailable, due to testing or maintenance	3	8H 4Y	3.65E-03	
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
20.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	9.69E-09
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	MOV5864-FTOD#	PVVH standby fan suction valve fails to open	1	1N 3.0E-03N	3.00E-03N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
21.	CC2SPCP-PT-K#	CC: both SPC pressure monitors fail high		1E-5N	1.00E-05	7.88E-09
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	PCV9329-FCLA+	OECT purge supply pressure control valve 9329 fails closed	4	8H 3.0E-06H	2.40E-05	
22.	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	7.10E-09
	MOV1041-FTCK#	SPC/PVVH isolation valve MOV-1041 fails to close	1	1N 3.0E-03N	3.00E-03N	
	MOV9278-FTCK#	SPC/PVVH isolation valve MOV-9278 fails to close	1	1N 3.0E-03N	3.00E-03N	
	PCV9329-FCLA+	OECT purge supply pressure control valve 9329 fails closed	4	8H 3.0E-06H	2.40E-05	
23.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	4.85E-09
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRPVV2-RMH1#	Fail to restore fan to operable status following maintenance	1	.03N 5.0E-02N	1.50E-03N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
24.	HCV9327-FCLA+	OECT purge supply valve 9327 fails closed	4	1H 5.0E-07H	5.00E-07	2.83E-09
	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	
	PC-1041-FLOK#	SCVC exit pressure controller fails low	5	43H 1.0E-06H	2.15E-05	
25.	IGNOECT-PRE1#	Ignition source present in OECT vessel	1	1N 3.0E-02N	3.00E-02N	2.83E-09
	PC-1041-FLOK#	SCVC exit pressure controller fails low	5	43H 1.0E-06H	2.15E-05	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	PSV182--FOPA+	PSV on OECT purge supply line fails open	4	24H 5.0E-07H	1.20E-05	

Explosion in the OECT Top Event Frequency: 6.67E-06/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
TOPPOWN-BFLH+-I	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	1.67E+04
FE-5860-FLOK+-I	PVVH flow element 5860 fails low	3.00E-06/H	1.62E+04
FE-6041-FLOK+-I	PVVH flow monitor 6041 fails low	3.00E-06/H	1.62E+04
CC2PVVH-FAN1+-I	cc: both PVVH fans fail	3.00E-06/H	1.62E+04
SV-CO22-FCLQ+-I	SPC CO2 purge isolation valve 2 fails closed	3.00E-06/H	1.62E+04
SV-CO21-FCLQ+-I	SPC CO2 purge isolation valve 1 fails closed	3.00E-06/H	1.62E+04
OPRSV74CRANK+-I	Operator erroneously closes OECT CO2 supply needle valve	5.00E-06/H	1.34E+04
PCV9329-FCLA+-I	OECT purge supply pressure control valve 9329 fails closed	3.00E-06/H	1.34E+04
PSV182--FOPA+-I	PSV on OECT purge supply line fails open	5.00E-07/H	1.34E+04
HCV9327-FCLA+-I	OECT purge supply valve 9327 fails closed	5.00E-07/H	1.34E+04
TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	4.10E-04	1.99E+03
TOPSPCPPBFL1+-I	SPC primary purge fails (excluding normal power)	6.69E-05/H	6.71E+02
CC2SPCP-PT-K#	CC: both SPC pressure monitors fail high	8.40E-06	3.73E+02
PC-1041-FLOK#	SCVC exit pressure controller fails low	2.15E-05	3.73E+02
CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	3.00E-04	3.73E+02
MOV5862-FCLD+-I	PVVH primary fan suction valve fails closed	3.00E-07/H	2.25E+02
FANPVV1-BFLD+-I	Primary PVVH blower fails	3.00E-05/H	2.25E+02
OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	3.00E-04	1.98E+02
IGNOECT-PRE1#	Ignition source present in OECT vessel	3.00E-02	3.33E+01
CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	4.92E-02	2.15E+00
MOV1041-FTCK#	SPC/PVVH isolation valve MOV-1041 fails to close	3.00E-03	2.11E+00
MOV9278-FTCK#	SPC/PVVH isolation valve MOV-9278 fails to close	3.00E-03	2.11E+00
TOPSPCBPBFL0#	Failure of backup CO2 system	6.70E-03	1.89E+00
CC2SCVC-O2-K#	CC: Both SCVC O2 detectors fail high	5.00E-04	1.81E+00
FANPVV2-BFLD#	PVVH backup fan fails to run	7.20E-04	1.49E+00
OPRPVV2-RMH1#	Fail to restore fan to operable status following maintenance	1.50E-03	1.49E+00
MOV5864-FTOD#	PVVH standby fan suction valve fails to open	3.00E-03	1.49E+00
FANPVV2-T&MD#	PVVH standby fan unavailable, due to T&M	3.65E-03	1.49E+00
FANPVV2-FTSD#	Standby PVVH blower fails to start	5.00E-03	1.49E+00
FE-9328-FHIE#	OECT purge flow element 9328 fails to detect low flow	2.16E-03	1.18E+00
OPR9328-MCH1#	OECT purge flow element 9328 miscalibrated	1.20E-04	1.17E+00
PT-1041-FHIK#	PR vapor space PT-1041 fails high	2.15E-05	1.03E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) x (risk achievement worth).

Explosion in the OECT Top Event Frequency: 6.67E-06/YR

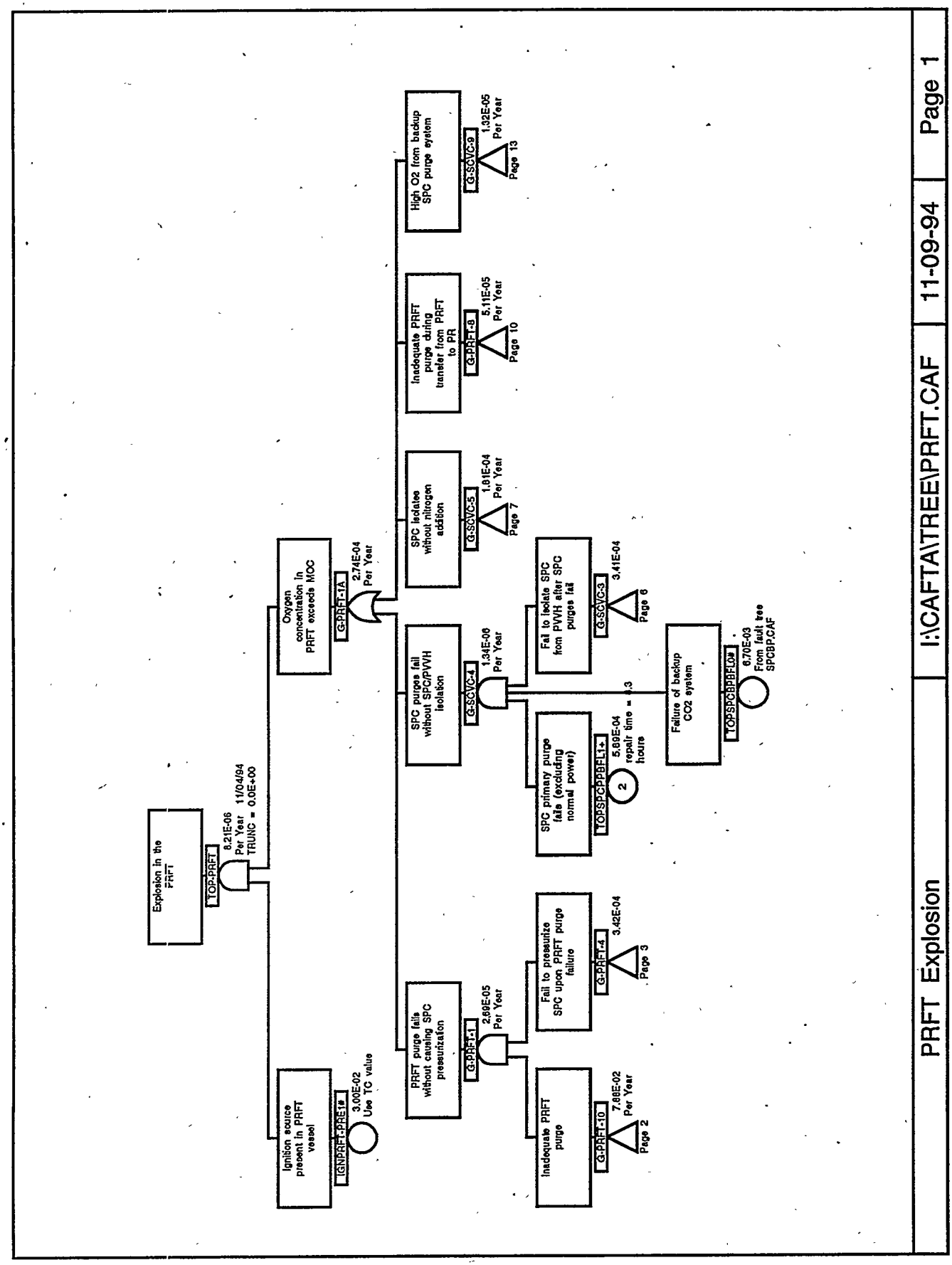
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
*IGNOECT-PRE1#	Ignition source present in OECT vessel	3.00E-02	0.00E+00
TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	4.10E-04	5.38E+00
TOPPOWN-BFLH+-I	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	2.41E+00
CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	3.00E-04	1.13E+00
OPRSV74CRANK+-I	Operator erroneously closes OECT CO2 supply needle valve	5.00E-06/H	1.07E+00
OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	3.00E-04	1.06E+00
CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	4.92E-02	1.06E+00
SV-CO21-FCLQ+-I	SPC CO2 purge isolation valve 1 fails closed	3.00E-06/H	1.05E+00
SV-CO22-FCLQ+-I	SPC CO2 purge isolation valve 2 fails closed	3.00E-06/H	1.05E+00
CC2PVVH-FAN1+-I	cc: both PVVH fans fail	3.00E-06/H	1.05E+00
FE-6041-FLOK+-I	PVVH flow monitor 6041 fails low	3.00E-06/H	1.05E+00
FE-5860-FLOK+-I	PVVH flow element 5860 fails low	3.00E-06/H	1.05E+00
TOPSPCPPBFL1+-I	SPC primary purge fails (excluding normal power)	6.69E-05/H	1.05E+00
PCV9329-FCLA+-I	OECT purge supply pressure control valve 9329 fails closed	3.00E-06/H	1.04E+00

* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included. Modified top event frequency = (top event frequency) / (risk reduction worth).

PRFT Explosion


PRFT Explosion
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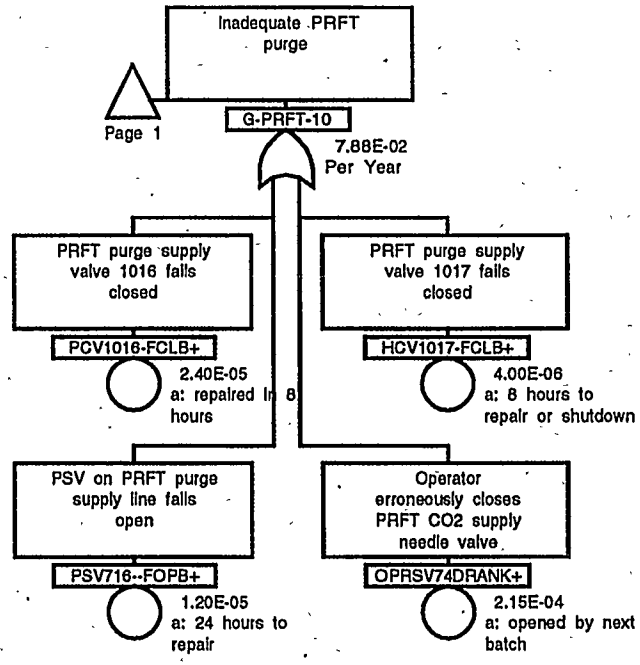
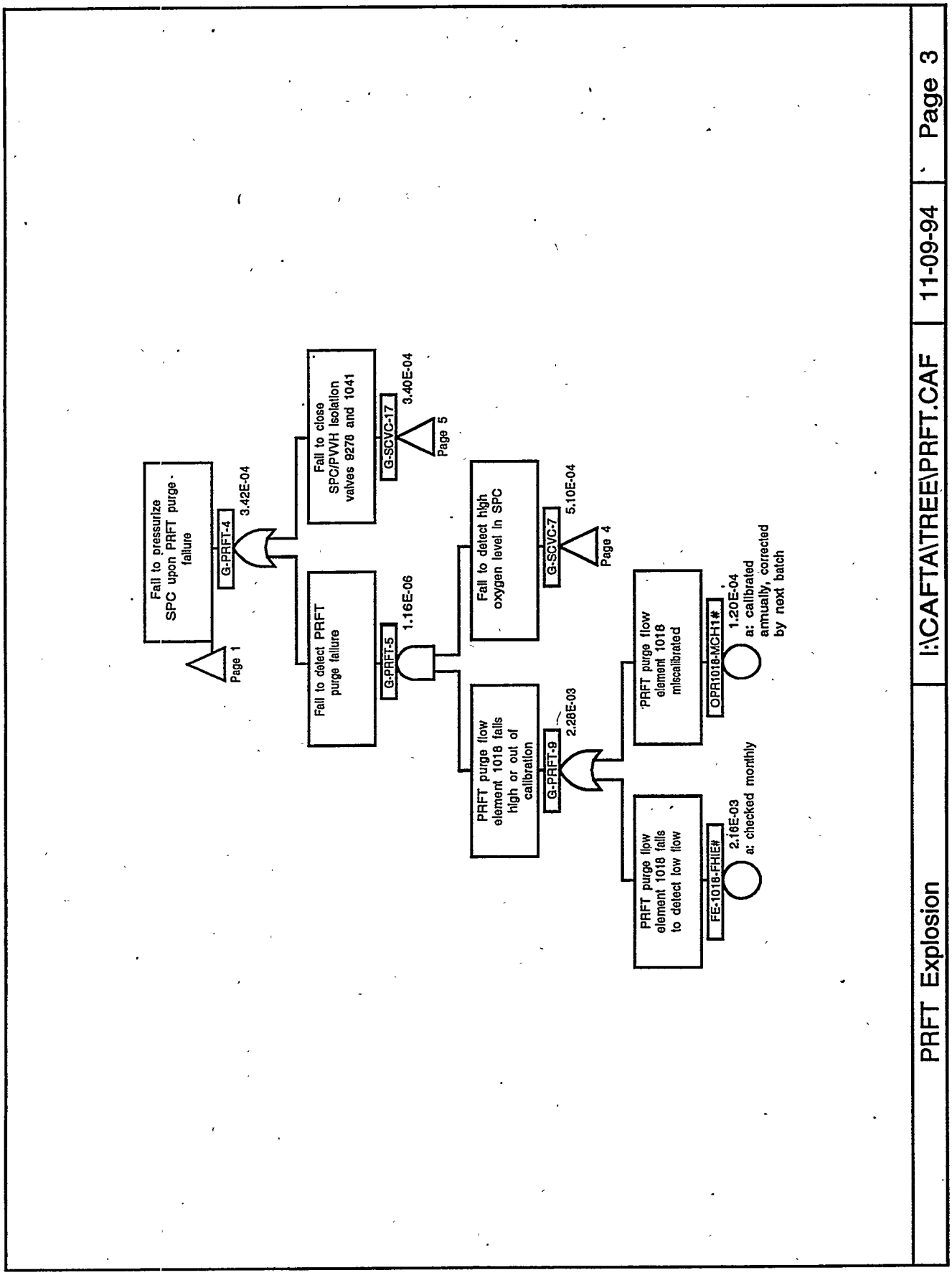
Page 1
Explosion in the PRFT
TOP-PRFT
8.21E-06 Per Year
11/04/94
TRUNC = 0.0E+00
Ignition source present in PRFT vessel
IGNPRFT-PRE1#
3.00E-02
Use TC value
Oxygen concentration in PRFT exceeds MOC
G-PRFT-1A
2.74E-04 Per Year
PRFT purge fails without causing SPC pressurization
G-PRFT-1
2.69E-05 Per Year
Inadequate PRFT purge
G-PRFT-10
7.88E-02 Per Year
Page 2
Fail to pressurize SPC upon PRFT purge failure
G-PRFT-4
3.42E-04
Page 3
SPC purges fail without SPC/PVVH isolation
G-SCVC-4
1.34E-06 Per Year
SPC primary purge fails (excluding normal power)
TOPSPCPPBFL1+
5.89E-04
repair time = 4.3 hours
Fail to isolate SPC from PVVH after SPC purges fail
G-SCVC-3
3.41E-04
Page 6
Failure of backup CO2 system
TOPSPCBPBFLOM
6.70E-03
From fault tree SPCBP.CAF
SPC isolates without nitrogen addition
G-SCVC-5
1.81E-04 Per Year
Page 7
Inadequate PRFT purge during transfer from PRFT to PR
G-PRFT-8
5.11E-05 Per Year
Page 10
High O2 from backup SPC purge system
G-SCVC-9
1.32E-05 Per Year
Page 13



PRFT Explosion	I:\CAFTA\TREE\PRFT.CAF	11-09-94	Page 2


Fail to pressurize SPC upon PRFT purge - failure
G-PRFT-4
3.42E-04
Page 1
Fail to detect PRFT purge failure
G-PRFT-5
1.16E-06
Fail to close SPC/PVH Isolation valves 9278 and 1041
G-SCVC-17
3.40E-04
Page 5
Fail to detect high oxygen level in SPC
G-SCVC-7
5.10E-04
Page 4
PRFT purge flow element 1018 falls high or out of calibration
G-PRFT-9
2.28E-03
PRFT purge flow element 1018 miscalibrated
OPR1018-MCH1#
1.20E-04
a: callbrated annually, corrected by next batch
PRFT purge flow element 1018 falls to detect low flow
FE-1018-FHIE#
2.16E-03
a: checked monthly
PRFT Explosion
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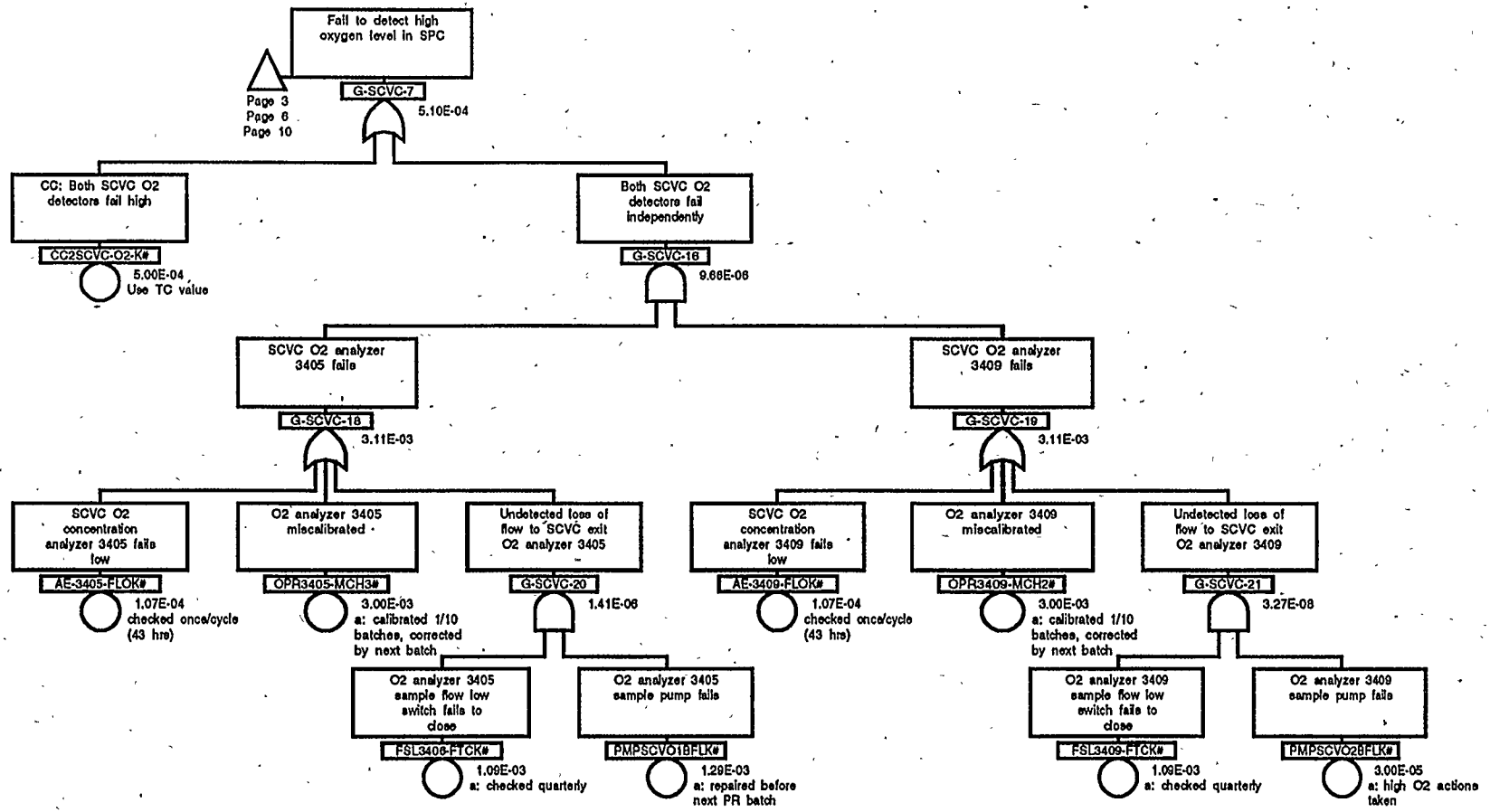
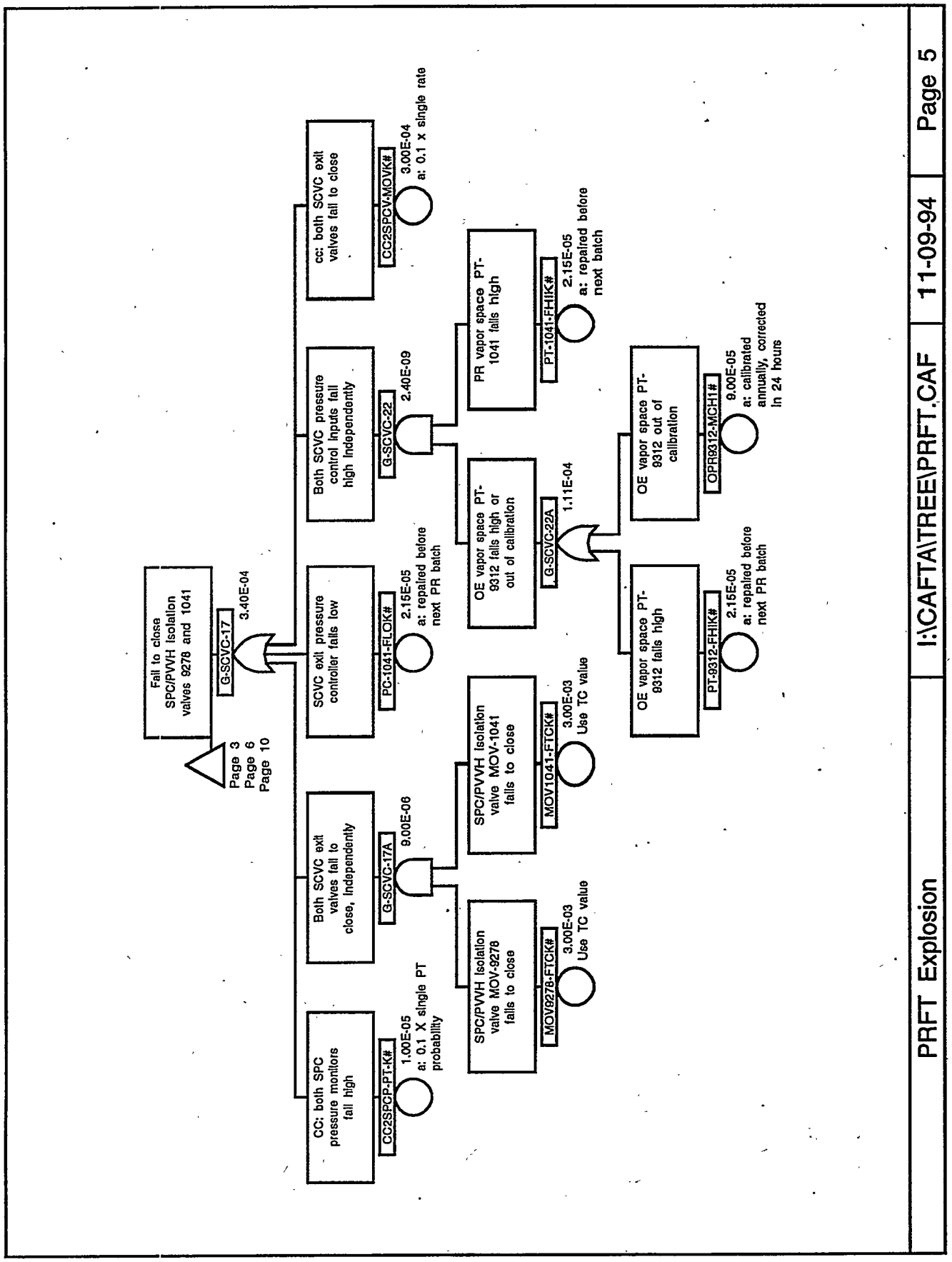


PRFT Explosion	I:\CAFTA\TREE\PRFT.CAF	11-09-94	Page 4


PRFT Explosion
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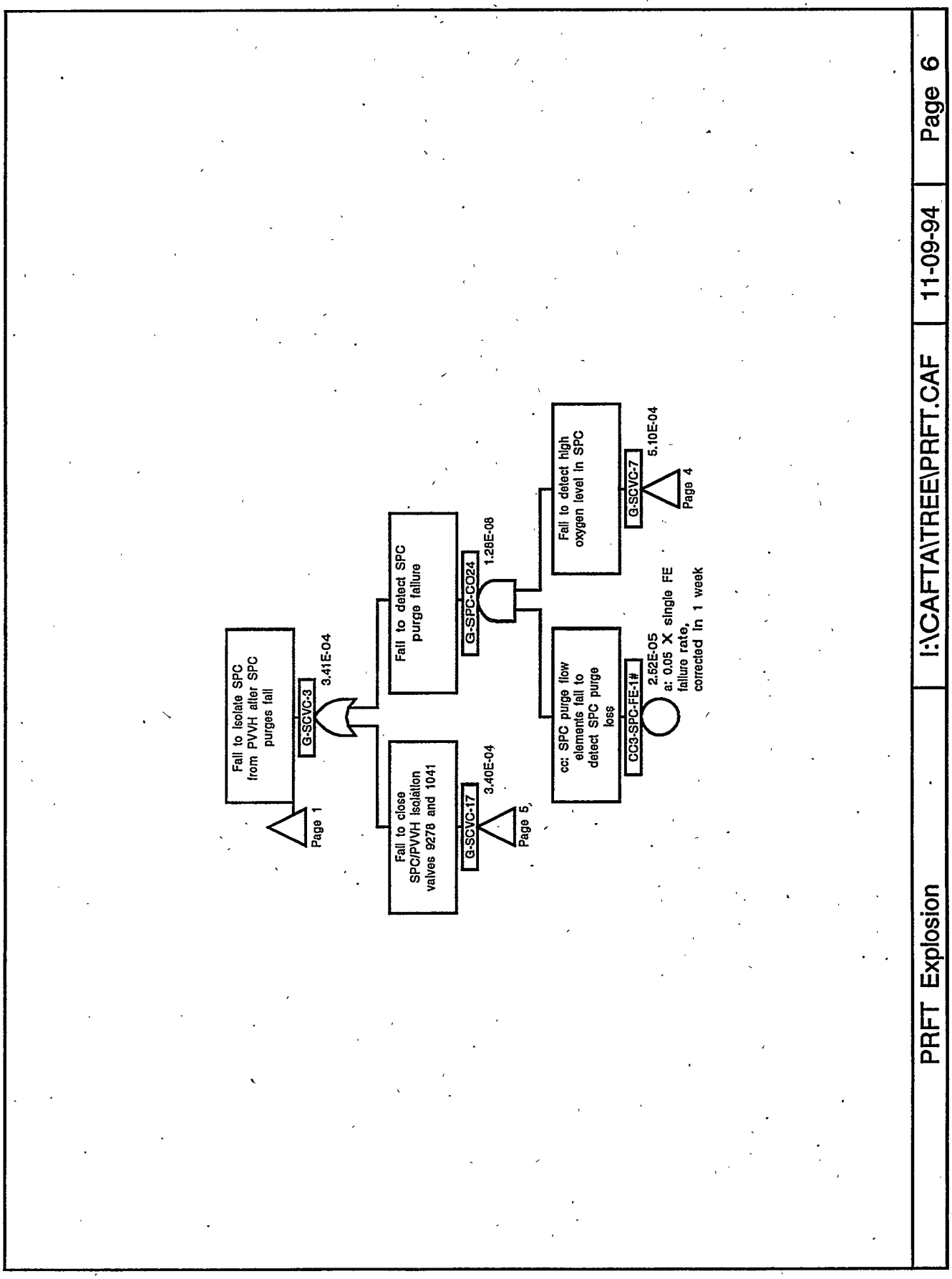
Page 5
Fail to close SPC/PVVH Isolation valves 9278 and 1041
G-SCVC-17
3.40E-04
Page 3
Page 6
Page 10
CC: both SPC pressure monitors fail high
CC2SPCP-PT-K#
1.00E-05
a: 0.1 X single PT probability
Both SCVC exit valves fail to close, independently
G-SCVC-17A
9.00E-06
SPC/PVVH Isolation valve MOV-9278 falls to close
MOV9278-FTCK#
3.00E-03
Use TC value
SPC/PVVH Isolation valve MOV-1041 falls to close
MOV1041-FTCK#
3.00E-03
Use TC value
SCVC exit pressure controller fails low
PC-1041-FLCK#
2.15E-05
a: repaired before next PR batch
Both SCVC pressure control inputs fail high independently
G-SCVC-22
2.40E-09
OE vapor space PT-9312 falls high or out of calibration
G-SCVC-22A
1.11E-04
OE vapor space PT-9312 falls high
PT-9312-FHIK#
2.15E-05
a: repaired before next PR batch
OE vapor space PT-9312 out of calibration
OPR9312-MCH1#
9.00E-05
a: calibrated annually, corrected in 24 hours
PR vapor space PT-1041 falls high
PT-1041-FHIK#
2.15E-05
a: repaired before next batch
cc: both SCVC exit valves fail to close
CC2SPCV-MOVK#
3.00E-04
a: 0.1 x single rate


Fail to isolate SPC from PVVH after SPC purges fail
G-SCVC-3
3.41E-04
Page 1
Fail to close SPC/PVVH isolation valves 9278 and 1041
G-SCVC-17
3.40E-04
Page 5
Fail to detect SPC purge failure
G-SPC-CO24
1.28E-08
cc: SPC purge flow elements fail to detect SPC purge loss
CC3-SPC-FE-1#
2.52E-05
a: 0.05 X single FE failure rate, corrected in 1 week
Fail to detect high oxygen level in SPC
G-SCVC-7
5.10E-04
Page 4
PRFT Explosion
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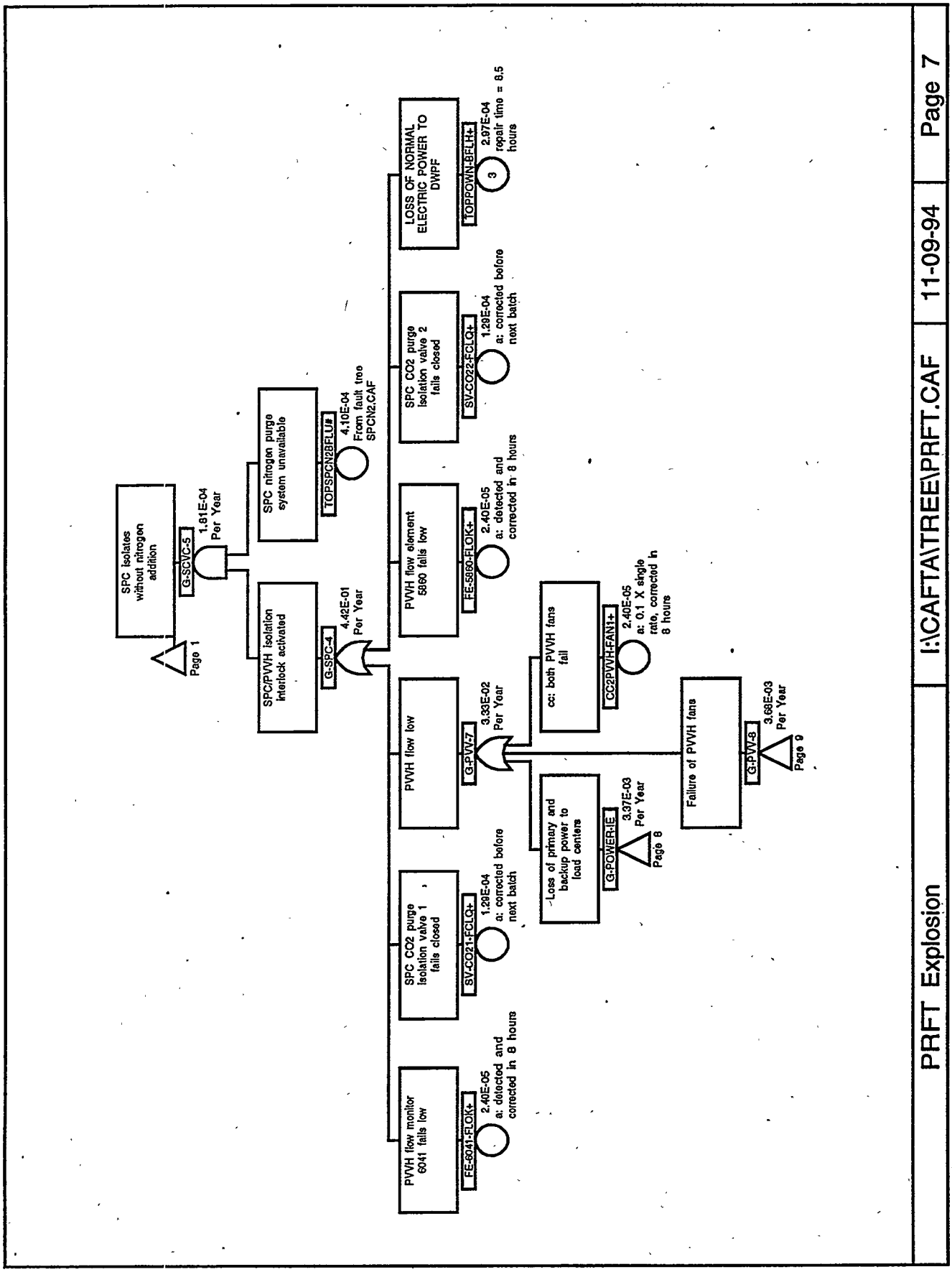
PRFT Explosion
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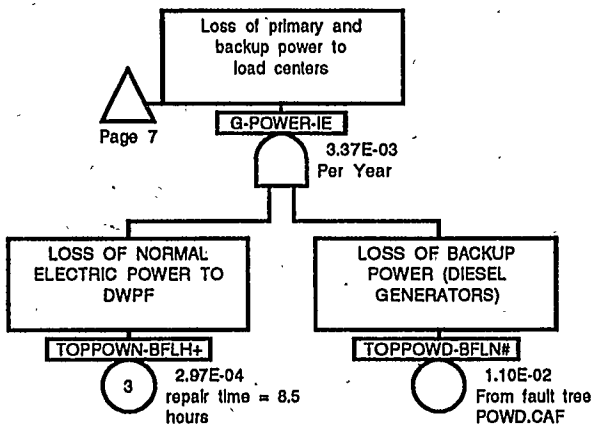
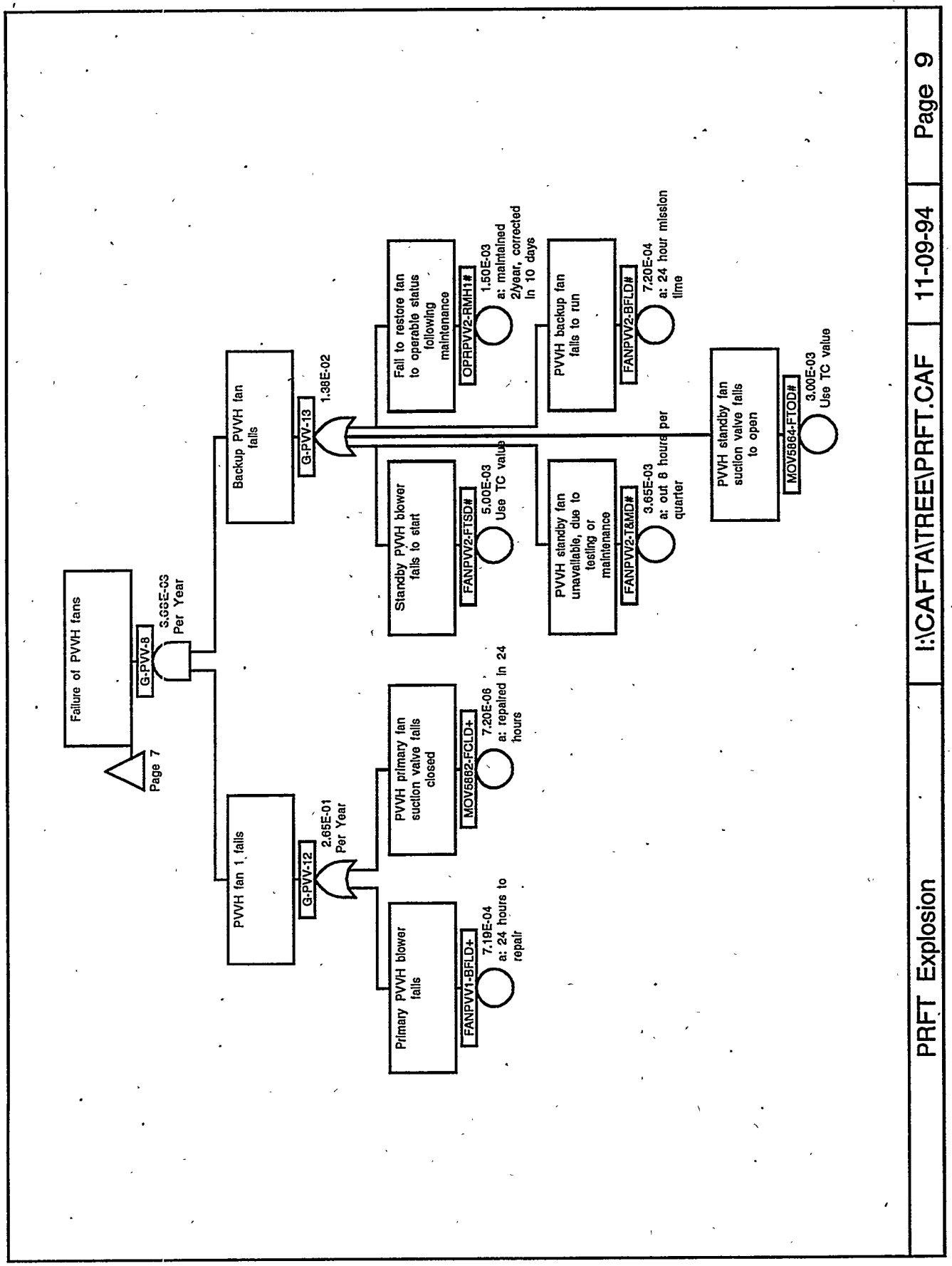
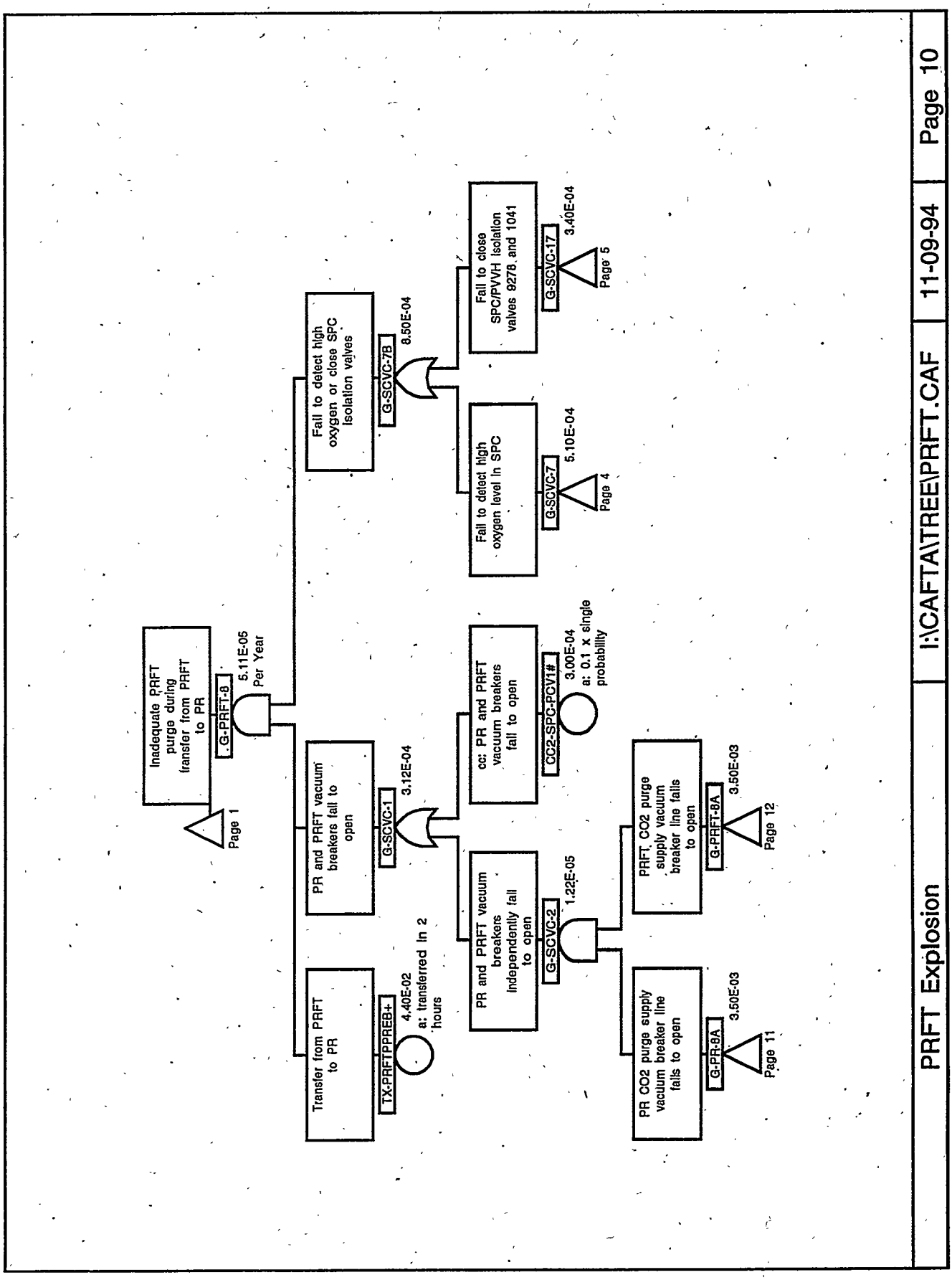
Page 7
SPC isolates without nitrogen addition
G-SCVC-5
1.61E-04 Per Year
Page 1
SPC nitrogen purge system unavailable
TOPSPCN2BFLU#
4.10E-04 From fault tree SPCN2.CAF
SPC/PVVH isolation interlock activated
G-SPC-4
4.42E-01 Per Year
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
3
2.97E-04 repair time = 8.5 hours
SPC CO2 purge isolation valve 2 fails closed
SV-CO22-FCLO+
1.29E-04 a: corrected before next batch
PVVH flow element 6860 fails low
FE-6860-FLOK+
2.40E-05 a: detected and corrected in 8 hours
PVVH flow low
G-PVV-7
3.33E-02 Per Year
cc: both PVVH fans fail
CC2PVVH-FAN1+
2.40E-05 a: 0.1 X single rate, corrected in 8 hours
Loss of primary and backup power to load centers
G-POWER-IE
3.37E-03 Per Year
Page 8
Failure of PVVH fans
G-PVV-8
3.68E-03 Per Year
Page 9
SPC CO2 purge isolation valve 1 fails closed
SV-CO21-FCLO+
1.29E-04 a: corrected before next batch
PVVH flow monitor 6041 fails low
FE-6041-FLOK+
2.40E-05 a: detected and corrected in 8 hours


Loss of primary and backup power to load centers
Page 7
G-POWER-IE
3.37E-03
Per Year
LOSS OF NORMAL ELECTRIC POWER TO DWPF
LOSS OF BACKUP POWER (DIESEL GENERATORS)
TOPPOWN-BFLH+
TOPPOWD-BFLN#
3
2.97E-04
repair time = 8.5 hours
1.10E-02
From fault tree POWD.CAF


PRFT Explosion
I:\CAFTA\TREE\PRFT.CAF
11-09-94
Page 9
Failure of PVVH fans
G-PVV-8
3.03E-03
Per Year
Page 7
PVVH fan 1 falls
G-PVV-12
2.65E-01
Per Year
Primary PVVH blower fails
FANPVV1-BFLD+
7.19E-04
a: 24 hours to repair
PVVH primary fan suction valve falls closed
MOV5882-FCLD+
7.20E-06
a: repaired in 24 hours
Backup PVVH fan fails
G-PVV-13
1.38E-02
Standby PVVH blower fails to start
FANPVV2-FTSD#
5.00E-03
Use TC value
PVVH standby fan unavailable, due to testing or maintenance
FANPVV2-T&MD#
3.65E-03
a: out 8 hours per quarter
Fail to restore fan to operable status following maintenance
OPRPVV2-RMH1#
1.50E-03
a: maintained 2/year, corrected in 10 days
PVVH backup fan fails to run
FANPVV2-BFLD#
7.20E-04
a: 24 hour mission time
PVVH standby fan suction valve fails to open
MOV5864-FTOD#
3.00E-03
Use TC value


Inadequate PRFT purge during transfer from PRFT to PR
G-PRFT-8
5.11E-05 Per Year
Page 1
PR and PRFT vacuum breakers fail to open
G-SCVC-1
3.12E-04
Transfer from PRFT to PR
TX-PRFTPPREB+
4.40E-02 a: transferred in 2 hours
PR and PRFT vacuum breakers independently fail to open
G-SCVC-2
1.22E-05
cc: PR and PRFT vacuum breakers fail to open
CC2-SPC-PCV1#
3.00E-04 a: 0.1 x single probability
PR CO2 purge supply vacuum breaker line fails to open
G-PR-8A
3.50E-03
Page 11
PRFT CO2 purge supply vacuum breaker line fails to open
G-PRFT-8A
3.50E-03
Page 12
Fail to detect high oxygen or close SPC isolation valves
G-SCVC-7B
8.50E-04
Fail to detect high oxygen level in SPC
G-SCVC-7
5.10E-04
Page 4
Fail to close SPC/PVVH isolation valves 8278. and 1041
G-SCVC-17
3.40E-04
Page 5
PRFT Explosion
I:\CAFTA\TREE\PRFT.CAF
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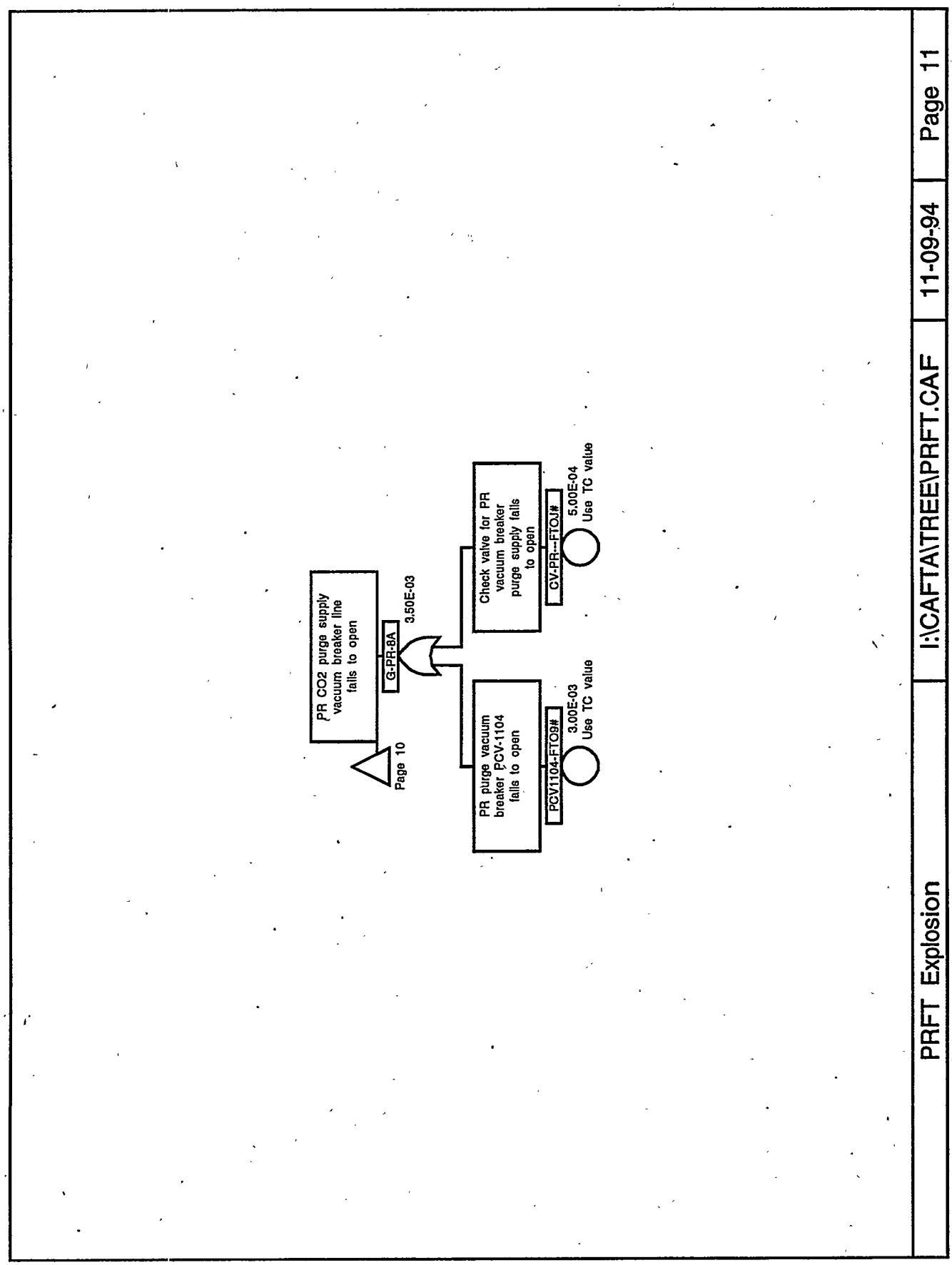
Page 10


PRFT Explosion
I:\CAFTA\TREE\PRFT.CAF
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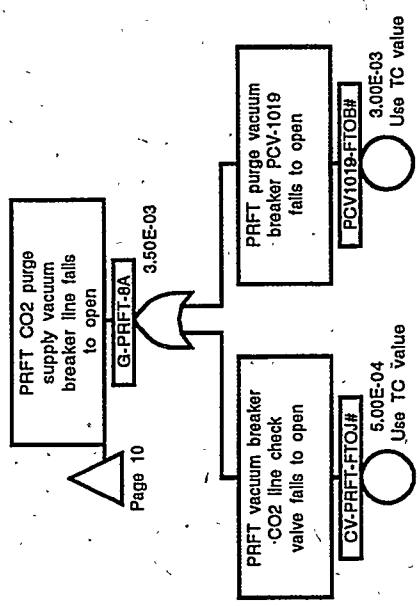
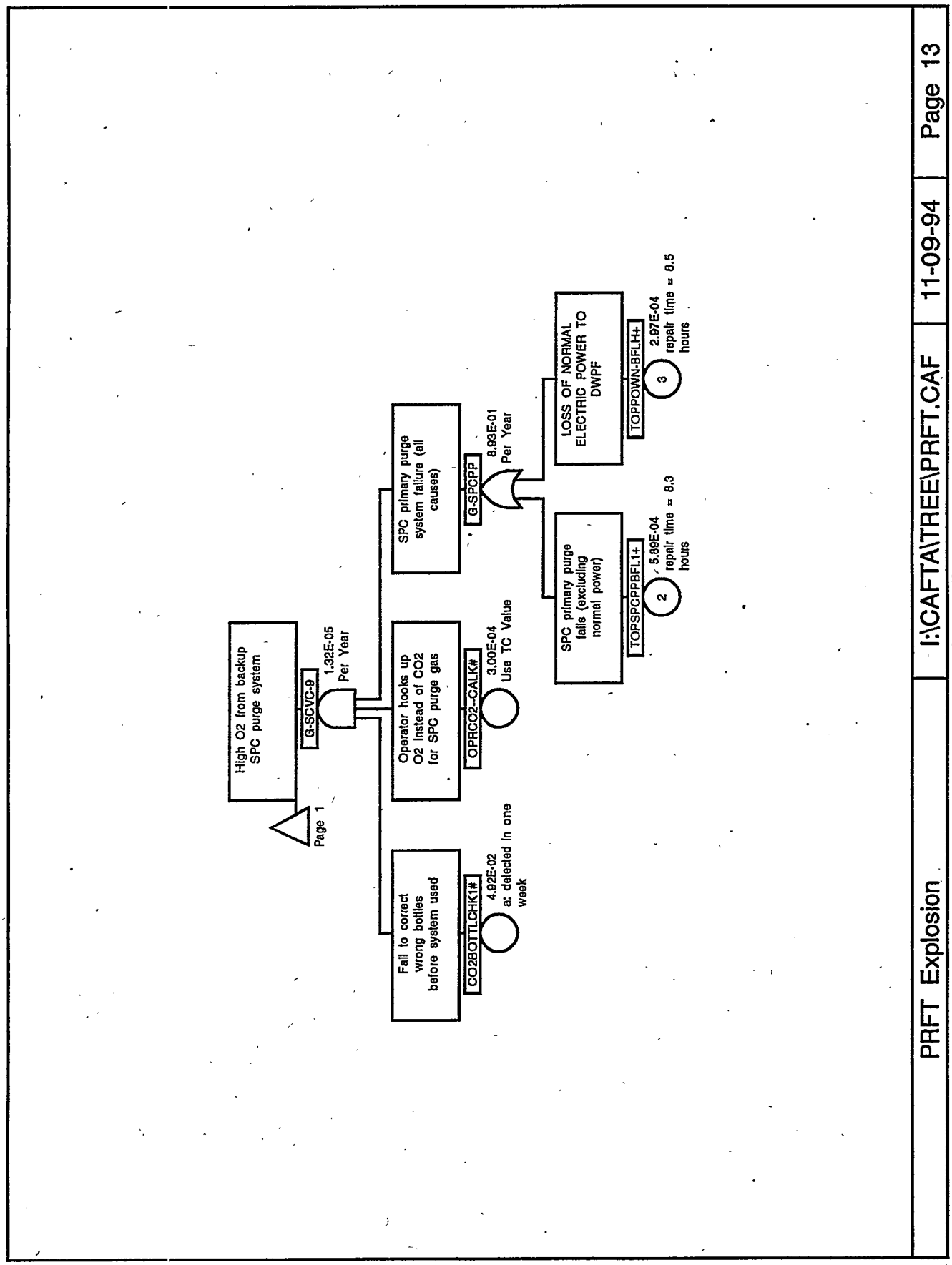
Page 11
PR CO2 purge supply vacuum breaker line fails to open
G-PR-8A
3.50E-03
Page 10
PR purge vacuum breaker PCV-1104 fails to open
PCV1104-FTO9#
3.00E-03
Use TC value
Check valve for PR vacuum breaker purge supply fails to open
CV-PR--FTO1#
5.00E-04
Use TC value



PRFT Explosion | I:\CAFTA\TREE\PRFT.CAF | 11-09-94 | Page 12


PRFT Explosion
I:\CAFTA\TREE\PRFT.CAF
11-09-94
Page 13
High O2 from backup SPC purge system
G-SCVC-9
1.32E-05 Per Year
Page 1
Fail to correct wrong bottles before system used
CO2BOTTLCHK1#
4.92E-02 a: detected in one week
Operator hooks up O2 Instead of CO2 for SPC purge gas
OPRCO2--CALK#
3.00E-04 Use TC Value
SPC primary purge system failure (all causes)
G-SPCPP
8.93E-01 Per Year
SPC primary purge fails (excluding normal power)
TOPSPCPPBFL1+
2 5.89E-04 repair time = 8.3 hours
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
3 2.97E-04 repair time = 8.5 hours

Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
AE-3405-FLOK#	4		G-PVV-7	7		OPR1018-MCH1#	3				
AE-3409-FLOK#	4		G-PVV-8	7		OPR3405-MCH3#	4				
CC2-SPC-PCV1#	10		G-PVV-8	9		OPR3409-MCH2#	4				
CC2PVVH-FAN1+	7		G-SCVC-1	10		OPR9312-MCH1#	5				
CC2SCVC-O2-K#	4		G-SCVC-16	4		OPRCO2--CALK#	13				
CC2SPCP-PT-K#	5		G-SCVC-17	3		OPRPVV2-RMH1#	9				
CC2SPCV-MOVK#	5		G-SCVC-17	5		OPRSV74DRANK+	2				
CC3-SPC-FE-1#	6		G-SCVC-17	6		PC-1041-FLOK#	5				
CO2BOTTLCHK1#	13		G-SCVC-17	10		PCV1016-FCLB+	2				
CV-PR---FTOJ#	11		G-SCVC-17A	5		PCV1019-FTOB#	12				
CV-PRFT-FTOJ#	12		G-SCVC-18	4		PCV1104-FTO9#	11				
FANPVV1-BFLD+	9		G-SCVC-19	4		PMPSCVO1BFLK#	4				
FANPVV2-BFLD#	9		G-SCVC-2	10		PMPSCVO2BFLK#	4				
FANPVV2-FTSD#	9		G-SCVC-20	4		PSV716--FOPB+	2				
FANPVV2-T&MD#	9		G-SCVC-21	4		PT-1041-FHIK#	5				
FE-1018-FHIE#	3		G-SCVC-22	5		PT-9312-FHIK#	5				
FE-5860-FLOK+	7		G-SCVC-22A	5		SV-CO21-FCLQ+	7				
FE-6041-FLOK+	7		G-SCVC-3	1		SV-CO22-FCLQ+	7				
FSL3406-FTCK#	4		G-SCVC-3	6		TOP-PRFT	1				
FSL3409-FTCK#	4		G-SCVC-4	1		TOPPOWD-BFLN#	8				
G-POWER-IE	7		G-SCVC-5	1		TOPPOWN-BFLH+	7				
G-POWER-IE	8		G-SCVC-5	7		TOPPOWN-BFLH+	8				
G-PR-8A	10		G-SCVC-7	3		TOPPOWN-BFLH+	13				
G-PR-8A	11		G-SCVC-7	4		TOPSPCBPBFL0#	1				
G-PRFT-1	1		G-SCVC-7	6		TOPSPCN2BFLU#	7				
G-PRFT-10	1		G-SCVC-7	10		TOPSPCPPBFL1+	1				
G-PRFT-10	2		G-SCVC-7B	10		TOPSPCPPBFL1+	13				
G-PRFT-1A	1		G-SCVC-9	1		TX-PRFTPPREB+	10				
G-PRFT-4	1		G-SCVC-9	13							
G-PRFT-4	3		G-SPC-4	7							
G-PRFT-5	3		G-SPC-CO24	6							
G-PRFT-8	1		G-SPCPP	13							
G-PRFT-8	10		HCV1017-FCLB+	2							
G-PRFT-8A	10		IGNPRFT-PRE1#	1							
G-PRFT-8A	12		MOV1041-FTCK#	5							
G-PRFT-9	3		MOV5862-FCLD+	9							
G-PVV-12	9		MOV5864-FTOD#	9							
G-PVV-13	9		MOV9278-FTCK#	5							

Cutsets for I:\CAFTA\CUT\PRFT.CSR 11/09/94 10:26 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-PRFT					8.21E-06
1.	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	3.77E-06
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
2.	CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	1	1N 3.0E-04N	3.00E-04N	8.67E-07
	CC2SCVC-O2-K#	CC: Both SCVC O2 detectors fail high	1	1N 5.0E-04N	5.00E-04N	
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TX-PRFTPPREB+	Transfer from PRFT to PR	4	2H 2.3E-02H	4.40E-02	
3.	CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	1	1N 3.0E-04N	3.00E-04N	5.20E-07
	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TX-PRFTPPREB+	Transfer from PRFT to PR	4	2H 2.3E-02H	4.40E-02	
4.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-07
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSV74DRANK+	Operator erroneously closes PRFT CO2 supply needle valve	4	43H 5.0E-06H	2.15E-04	
5.	CC2PVVH-FAN1+	cc: both PVVH fans fail	4	8H 3.0E-06H	2.40E-05	3.23E-07
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
6.	FE-6041-FLOK+	PVVH flow monitor 6041 fails low	4	8H 3.0E-06H	2.40E-05	3.23E-07
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	

Cutsets for I:\CAFTA\CUT\PRFT.CSR 11/09/94 10:26 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
7.	FE-5860-FLOK+	PVVH flow element 5860 fails low	4	8H 3.0E-06H	2.40E-05	3.23E-07
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
8.	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	3.23E-07
	SV-CO21-FCLQ+	SPC CO2 purge isolation valve 1 fails closed	4	43H 3.0E-06H	1.29E-04	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
9.	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	3.23E-07
	SV-CO22-FCLQ+	SPC CO2 purge isolation valve 2 fails closed	4	43H 3.0E-06H	1.29E-04	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
10.	CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	3	7D 3.0E-04H	4.92E-02	2.59E-07
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	1	1N 3.0E-04N	3.00E-04N	
	TOPSPCPPBFL1+	SPC primary purge fails (excluding normal power)	4	8.8H 6.7E-05H	5.89E-04	
11.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	2.37E-07
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	PCV1016-FCLB+	PRFT purge supply valve 1016 fails closed	4	8H 3.0E-06H	2.40E-05	
12.	CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	3	7D 3.0E-04H	4.92E-02	1.36E-07
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	1	1N 3.0E-04N	3.00E-04N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
13.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-08
	HCV1017-FCLB+	PRFT purge supply valve 1017 fails closed	4	8H 5.0E-07H	4.00E-06	
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
14.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.94E-08
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	PSV716--FOPB+	PSV on PRFT purge supply line fails open	4	24H 5.0E-07H	1.20E-05	
15.	CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	1	1N 3.0E-04N	3.00E-04N	3.73E-08
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	PC-1041-FLOK#	SCVC exit pressure controller fails low	5	43H 1.0E-06H	2.15E-05	
	TX-PRFTPPREB+	Transfer from PRFT to PR	4	2H 2.3E-02H	4.40E-02	
16.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	3.54E-08
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCBPBFL0#	Failure of backup CO2 system	1	1N 6.7E-03N	6.70E-03N	
	TOPSPCPPBFL1+	SPC primary purge fails (excluding normal power)	4	8.8H 6.7E-05H	5.89E-04	
17.	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	2.82E-08
	OPRSV74DRANK+	Operator erroneously closes PRFT CO2 supply needle valve	4	43H 5.0E-06H	2.15E-04	
	PC-1041-FLOK#	SCVC exit pressure controller fails low	5	43H 1.0E-06H	2.15E-05	
18.	CC2SCVC-O2-K#	CC: Both SCVC O2 detectors fail high	1	1N 5.0E-04N	5.00E-04N	2.60E-08
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	PCV1019-FTOB#	PRFT purge vacuum breaker PCV-1019 fails to open	1	1N 3.0E-03N	3.00E-03N	
	PCV1104-FTO9#	PR purge vacuum breaker PCV-1104 fails to open	1	1N 3.0E-03N	3.00E-03N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TX-PRFTPPREB+	Transfer from PRFT to PR	4	2H 2.3E-02H	4.40E-02	
19.	CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	1	1N 3.0E-04N	3.00E-04N	1.73E-08
	CC2SPCP-PT-K#	CC: both SPC pressure monitors fail high		1E-5N	1.00E-05	
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TX-PRFTPPREB+	Transfer from PRFT to PR	4	2H 2.3E-02H	4.40E-02	
20.	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	1.69E-08
	PC-1041-FLOK#	SCVC exit pressure controller fails low	5	43H 1.0E-06H	2.15E-05	
	PCV1016-FCLB+	PRFT purge supply valve 1016 fails closed	4	8H 3.0E-06H	2.40E-05	
21.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	1.62E-08
	FANPVV2-FTSD#	Standby PVVH blower fails to start	1	1N 5.0E-03N	5.00E-03N	
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	1	1N 4.1E-04N	4.10E-04N	
22.	CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	1	1N 3.0E-04N	3.00E-04N	1.56E-08
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR3405-MCH3#	O2 analyzer 3405 miscalibrated	1	0.1N 3.0E-02N	3.00E-03N	
	OPR3409-MCH2#	O2 analyzer 3409 miscalibrated	1	0.1N 3.0E-02N	3.00E-03N	
	TX-PRFTPPREB+	Transfer from PRFT to PR	4	2H 2.3E-02H	4.40E-02	
23.	CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	1	1N 3.0E-04N	3.00E-04N	1.56E-08
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	MOV1041-FTCK#	SPC/PVVH isolation valve MOV-1041 fails to close	1	1N 3.0E-03N	3.00E-03N	
	MOV9278-FTCK#	SPC/PVVH isolation valve MOV-9278 fails to close	1	1N 3.0E-03N	3.00E-03N	
	TX-PRFTPPREB+	Transfer from PRFT to PR	4	2H 2.3E-02H	4.40E-02	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
24.	CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	1	1N 3.0E-04N	3.00E-04N	1.56E-08
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	PCV1019-FTOB#	PRFT purge vacuum breaker PCV-1019 fails to open	1	1N 3.0E-03N	3.00E-03N	
	PCV1104-FTO9#	PR purge vacuum breaker PCV-1104 fails to open	1	1N 3.0E-03N	3.00E-03N	
	TX-PRFTPPREB+	Transfer from PRFT to PR	4	2H 2.3E-02H	4.40E-02	
25.	CC2SPCP-PT-K#	CC: both SPC pressure monitors fail high		1E-5N	1.00E-05	1.31E-08
	IGNPRFT-PRE1#	Ignition source present in PRFT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSV74DRANK+	Operator erroneously closes PRFT CO2 supply needle valve	4	43H 5.0E-06H	2.15E-04	

Explosion in the PRFT Top Event Frequency: 8.20E-06/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
TOPPOWN-BFLH+-I	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	1.36E+04
FE-5860-FLOK+-I	PVVH flow element 5860 fails low	3.00E-06/H	1.31E+04
FE-6041-FLOK+-I	PVVH flow monitor 6041 fails low	3.00E-06/H	1.31E+04
CC2PVVH-FAN1+-I	cc: both PVVH fans fail	3.00E-06/H	1.31E+04
SV-CO22-FCLQ+-I	SPC CO2 purge isolation valve 2 fails closed	3.00E-06/H	1.31E+04
SV-CO21-FCLQ+-I	SPC CO2 purge isolation valve 1 fails closed	3.00E-06/H	1.31E+04
OPRSV74DRANK+-I	Operator erroneously closes PRFT CO2 supply needle valve	5.00E-06/H	1.09E+04
PCV1016-FCLB+-I	PRFT purge supply valve 1016 fails closed	3.00E-06/H	1.09E+04
PSV716--FOPB+-I	PSV on PRFT purge supply line fails open	5.00E-07/H	1.09E+04
HCV1017-FCLB+-I	PRFT purge supply valve 1017 fails closed	5.00E-07/H	1.09E+04
TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	4.10E-04	1.62E+03
CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	3.00E-04	5.99E+02
TOPSPCPPBFL1+-I	SPC primary purge fails (excluding normal power)	6.69E-05/H	5.46E+02
CC2SPCP-PT-K#	CC: both SPC pressure monitors fail high	8.40E-06	5.24E+02
PC-1041-FLOK#	SCVC exit pressure controller fails low	2.15E-05	5.24E+02
CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	3.00E-04	5.24E+02
CC2SCVC-O2-K#	CC: Both SCVC O2 detectors fail high	5.00E-04	2.22E+02
MOV5862-FCLD+-I	PVVH primary fan suction valve fails closed	3.00E-07/H	1.83E+02
FANPVV1-BFLD+-I	Primary PVVH blower fails	3.00E-05/H	1.83E+02
OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	3.00E-04	1.61E+02
IGNPRFT-PRE1#	Ignition source present in PRFT vessel	3.00E-02	3.33E+01
TX-PRFTPPREB+-I	Transfer from PRFT to PR	2.20E-02/H	9.30E+00
CV-PRFT-FTOJ#	PRFT vacuum breaker CO2 line check valve fails to open	5.00E-04	3.09E+00
CV-PR---FTOJ#	Check valve for PR vacuum breaker purge fails to open	5.00E-04	3.09E+00
PCV1104-FTO9#	PR purge vacuum breaker PCV-1104 fails to open	3.00E-03	3.09E+00
PCV1019-FTOB#	PRFT purge vacuum breaker PCV-1019 fails to open	3.00E-03	3.09E+00
MOV1041-FTCK#	SPC/PVVH isolation valve MOV-1041 fails to close	3.00E-03	2.56E+00
MOV9278-FTCK#	SPC/PVVH isolation valve MOV-9278 fails to close	3.00E-03	2.56E+00
CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	4.92E-02	1.93E+00
TOPSPCBPBFL0#	Failure of backup CO2 system	6.70E-03	1.72E+00
OPR3409-MCH2#	O2 analyzer 3409 miscalibrated	3.00E-03	1.68E+00
OPR3405-MCH3#	O2 analyzer 3405 miscalibrated	3.00E-03	1.68E+00
AE-3409-FLOK#	SCVC O2 concentration analyzer 3409 fails low	1.07E-04	1.68E+00
AE-3405-FLOK#	SCVC O2 concentration analyzer 3405 fails low	1.07E-04	1.68E+00
FANPVV2-BFLD#	PVVH backup fan fails to run	7.20E-04	1.40E+00
OPRPVV2-RMH1#	Fail to restore fan to operable status following maintenance	1.50E-03	1.40E+00
MOV5864-FTOD#	PVVH standby fan suction valve fails to open	3.00E-03	1.40E+00
FANPVV2-T&MD#	PVVH standby fan unavailable, due to T&M	3.65E-03	1.40E+00
FANPVV2-FTSD#	Standby PVVH blower fails to start	5.00E-03	1.40E+00
FE-1018-FHIE#	PRFT purge flow element 1018 fails to detect low flow	2.16E-03	1.15E+00
OPR1018-MCH1#	PRFT purge flow element 1018 miscalibrated	1.20E-04	1.15E+00
PT-1041-FHIK#	PR vapor space PT-1041 fails high	2.15E-05	1.03E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) x (risk achievement worth).

Explosion in the PRFT Top Event Frequency: 8.20E-06/YR

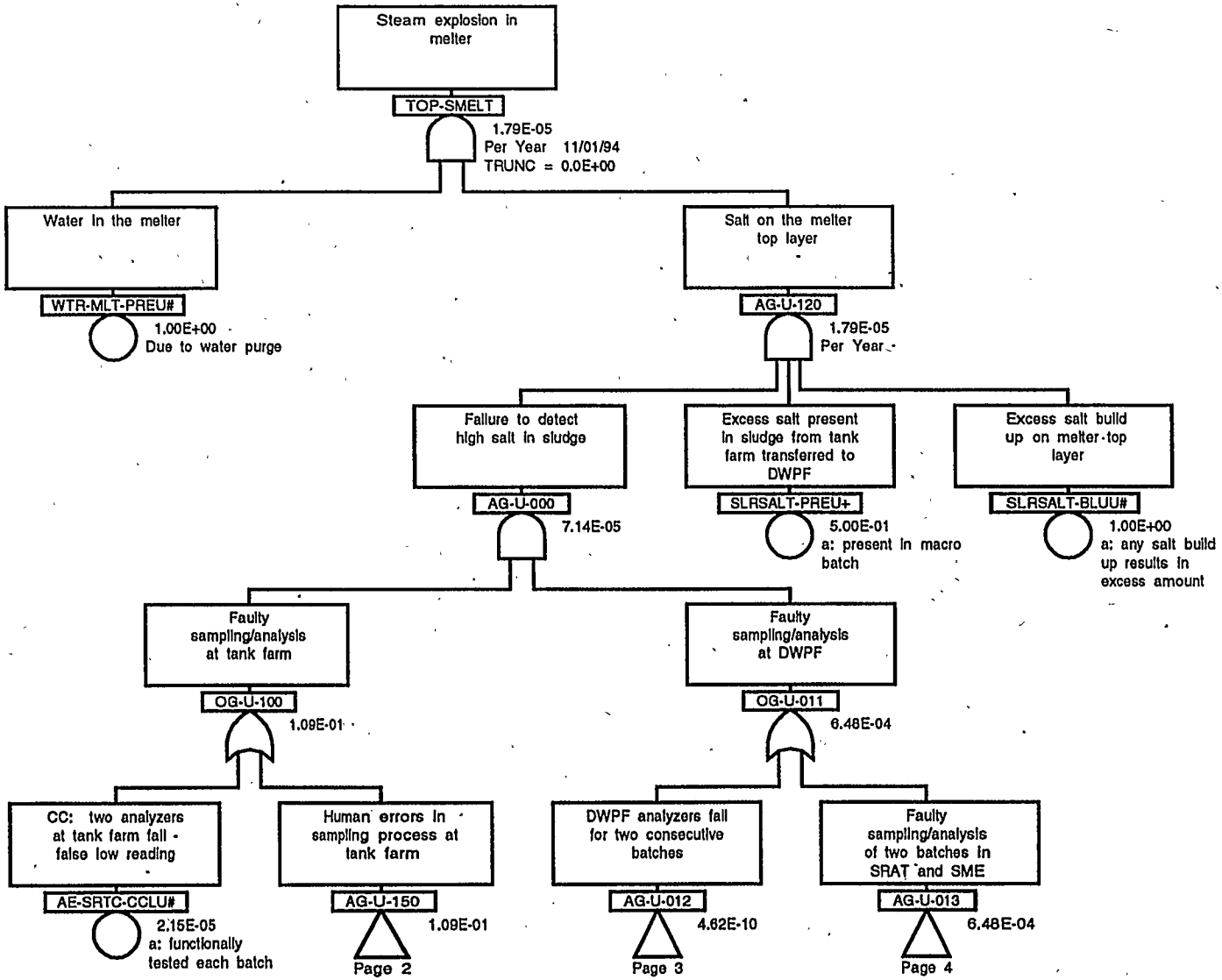
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
*IGNPRFT-PRE1#	Ignition source present in PRFT vessel	3.00E-02	0.00E+00
TOPSPCN2BFLU#	SPC nitrogen purge system unavailable	4.10E-04	2.96E+00
TOPPOWN-BFLH+-I	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	1.91E+00
TX-PRFTPPREB+-I	Transfer from PRFT to PR	2.20E-02/H	1.23E+00
CC2-SPC-PCV1#	cc: PR and PRFT vacuum breakers fail to open	3.00E-04	1.22E+00
CC2SPCV-MOVK#	cc: both SCVC exit valves fail to close	3.00E-04	1.19E+00
CC2SCVC-O2-K#	CC: Both SCVC O2 detectors fail high	5.00E-04	1.12E+00
OPRSV74DRANK+-I	Operator erroneously closes PRFT CO2 supply needle valve	5.00E-06/H	1.06E+00
CO2BOTTLCHK1#	Fail to correct wrong bottles before system used	4.92E-02	1.05E+00
OPRCO2--CALK#	Operator hooks up O2 instead of CO2 for SPC purge gas	3.00E-04	1.05E+00
SV-CO22-FCLQ+-I	SPC CO2 purge isolation valve 2 fails closed	3.00E-06/H	1.04E+00
FE-5860-FLOK+-I	PVVH flow element 5860 fails low	3.00E-06/H	1.04E+00
FE-6041-FLOK+-I	PVVH flow monitor 6041 fails low	3.00E-06/H	1.04E+00
SV-CO21-FCLQ+-I	SPC CO2 purge isolation valve 1 fails closed	3.00E-06/H	1.04E+00
CC2PVVH-FAN1+-I	cc: both PVVH fans fail	3.00E-06/H	1.04E+00
TOPSPCPPBFL1+-I	SPC primary purge fails (excluding normal power)	6.69E-05/H	1.04E+00
PCV1016-FCLB+-I	PRFT purge supply valve 1016 fails closed	3.00E-06/H	1.03E+00
PC-1041-FLOK#	SCVC exit pressure controller fails low	2.15E-05	1.01E+00

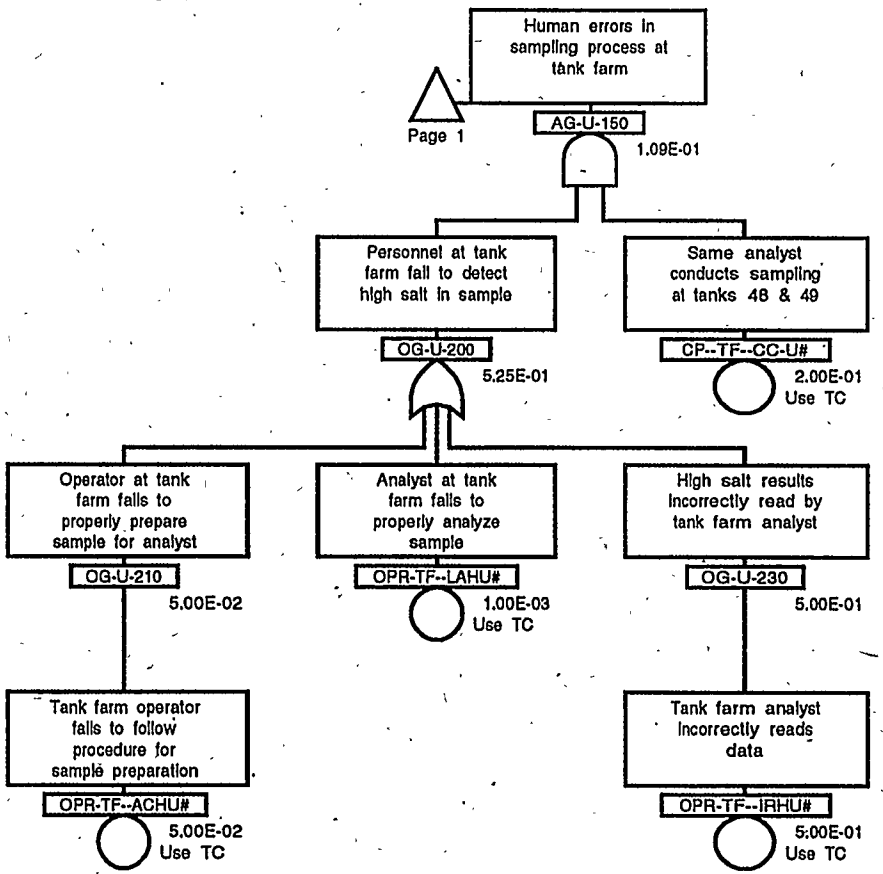
* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included. Modified top event frequency = (top event frequency) / (risk reduction worth).

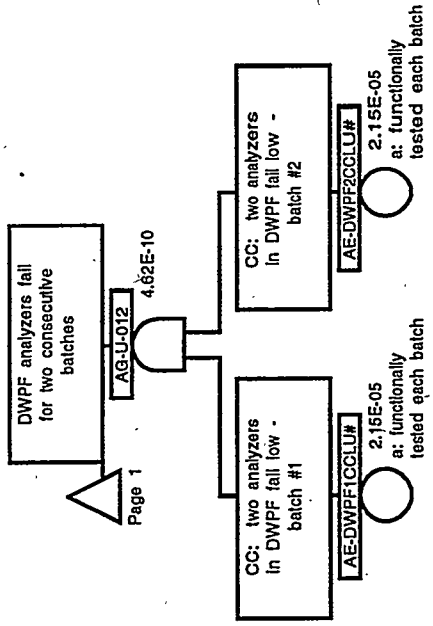
Steam Explosion in the Melter



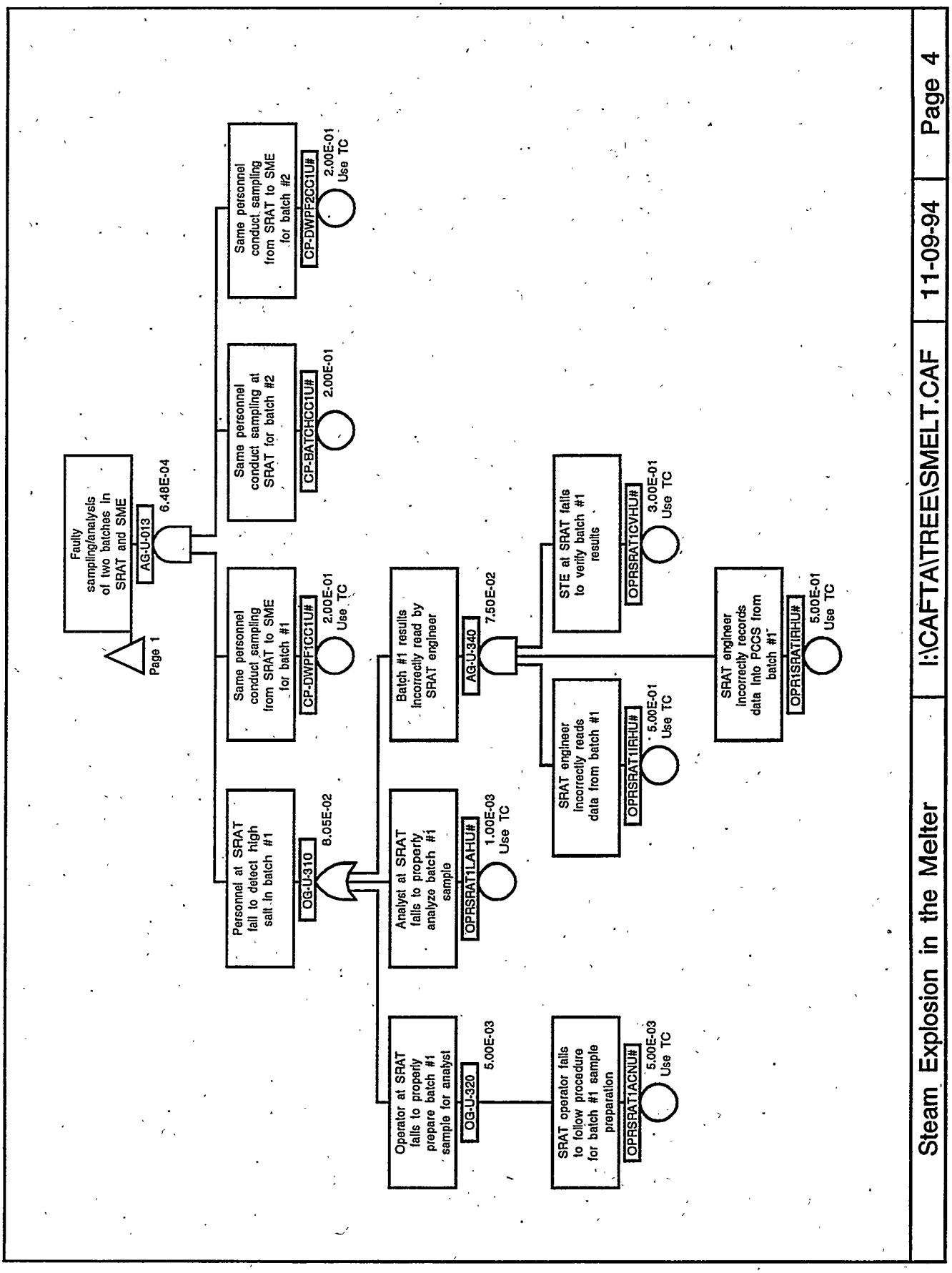
Steam Explosion in the Melter	I:\CAFTA\TREE\SMELT.CAF	11-09-94	Page 1



Steam Explosion in the Melter	I:\CAFTA\TREE\SMELT.CAF	11-09-94	Page 2



Steam Explosion in the Melter | I:\CAFTA\TREE\SMELT.CAF | 11-09-94 | Page 3


Faulty sampling/analysis of two batches in SRAT and SME
AG-U-013
6.48E-04
Page 1
Same personnel conduct sampling from SRAT to SME for batch #2
CP-DWPF2CC1U#
2.00E-01
Use TC
Same personnel conduct sampling at SRAT for batch #2
CP-BATCHCC1U#
2.00E-01
Same personnel conduct sampling from SRAT to SME for batch #1
CP-DWPF1CC1U#
2.00E-01
Use TC
Personnel at SRAT fail to detect high salt in batch #1
OG-U-310
8.05E-02
Batch #1 results incorrectly read by SRAT engineer
AG-U-340
7.50E-02
Analyst at SRAT fails to properly analyze batch #1 sample
OPRSRAT1LAHU#
1.00E-03
Use TC
STE at SRAT fails to verify batch #1 results
OPRSRAT1CVHU#
3.00E-01
Use TC
SRAT engineer incorrectly reads data from batch #1
OPRSRAT1IRHU#
5.00E-01
Use TC
SRAT engineer incorrectly records data into PCCS from batch #1
OPR1SRATIRHU#
5.00E-01
Use TC
Operator at SRAT fails to properly prepare batch #1 sample for analyst
OG-U-320
5.00E-03
SRAT operator fails to follow procedure for batch #1 sample preparation
OPRSRAT1ACNU#
5.00E-03
Use TC
Steam Explosion in the Melter
I:\CAFTA\TREE\SMELT.CAF
11-09-94
Page 4

Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
AE-DWPF1CCLU#	3										
AE-DWPF2CCLU#	3										
AE-SRTC-CCLU#	1										
AG-U-000	1										
AG-U-012	1										
AG-U-012	3										
AG-U-013	1										
AG-U-013	4										
AG-U-120	1										
AG-U-150	1										
AG-U-150	2										
AG-U-340	4										
CP--TF--CC-U#	2										
CP-BATCHCC1U#	4										
CP-DWPF1CC1U#	4										
CP-DWPF2CC1U#	4										
OG-U-011	1										
OG-U-100	1										
OG-U-200	2										
OG-U-210	2										
OG-U-230	2										
OG-U-310	4										
OG-U-320	4										
OPR-TF--ACHU#	2										
OPR-TF--IRHU#	2										
OPR-TF--LAHU#	2										
OPR1SRATIRHU#	4										
OPRSRAT1ACNU#	4										
OPRSRAT1CVHU#	4										
OPRSRAT1IRHU#	4										
OPRSRAT1LAHU#	4										
SLRSALT-BLUU#	1										
SLRSALT-PREU+	1										
TOP-SMELT	1										
WTR-MLT-PREU#	1										

Cutsets for I:\CAFTA\CUT\SMELT.CSR 11/09/94 10:28 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	TOP-SMELT					1.79E-05
1.	CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	1	1N 2.0E-01N	2.00E-01N	1.50E-05
	CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF1CC1U#	Same personnel conduct sampling from SRAT to SME for batch #1	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF2CC1U#	Same personnel conduct sampling from SRAT to SME for batch #2	1	1N 2.0E-01N	2.00E-01N	
	OPR-TF--IRHU#	Tank farm analyst incorrectly reads data	1	1N 5.0E-01N	5.00E-01N	
	OPR1SRATIRHU#	SRAT engineer incorrectly records data into PCCS from batch #1	1	1N 5.0E-01N	5.00E-01N	
	OPRSRAT1CVHU#	STE at SRAT fails to verify batch #1 results	1	1N 3.0E-01N	3.00E-01N	
	OPRSRAT1IRHU#	SRAT engineer incorrectly reads data from batch #1	1	1N 5.0E-01N	5.00E-01N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
2.	CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	1	1N 2.0E-01N	2.00E-01N	1.50E-06
	CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF1CC1U#	Same personnel conduct sampling from SRAT to SME for batch #1	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF2CC1U#	Same personnel conduct sampling from SRAT to SME for batch #2	1	1N 2.0E-01N	2.00E-01N	
	OPR-TF--ACHU#	Tank farm operator fails to follow procedure for sample preparation	1	1N 5.0E-02N	5.00E-02N	
	OPR1SRATIRHU#	SRAT engineer incorrectly records data into PCCS from batch #1	1	1N 5.0E-01N	5.00E-01N	
	OPRSRAT1CVHU#	STE at SRAT fails to verify batch #1 results	1	1N 3.0E-01N	3.00E-01N	
	OPRSRAT1IRHU#	SRAT engineer incorrectly reads data from batch #1	1	1N 5.0E-01N	5.00E-01N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
3.	CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	1	1N 2.0E-01N	2.00E-01N	1.00E-06
	CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF1CC1U#	Same personnel conduct sampling from SRAT to SME for batch #1	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF2CC1U#	Same personnel conduct sampling from SRAT to SME for batch #2	1	1N 2.0E-01N	2.00E-01N	
	OPR-TF--IRHU#	Tank farm analyst incorrectly reads data	1	1N 5.0E-01N	5.00E-01N	
	OPRSRAT1ACNU#	SRAT operator fails to follow procedure for batch #1 sample preparation	1	1N 5.0E-03N	5.00E-03N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
4.	CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	1	1N 2.0E-01N	2.00E-01N	2.00E-07
	CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF1CC1U#	Same personnel conduct sampling from SRAT to SME for batch #1	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF2CC1U#	Same personnel conduct sampling from SRAT to SME for batch #2	1	1N 2.0E-01N	2.00E-01N	
	OPR-TF--IRHU#	Tank farm analyst incorrectly reads data	1	1N 5.0E-01N	5.00E-01N	
	OPRSRAT1LAHU#	Analyst at SRAT fails to properly analyze batch #1 sample	1	1N 1.0E-03N	1.00E-03N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
5.	CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	1	1N 2.0E-01N	2.00E-01N	1.00E-07
	CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF1CC1U#	Same personnel conduct sampling from SRAT to SME for batch #1	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF2CC1U#	Same personnel conduct sampling from SRAT to SME for batch #2	1	1N 2.0E-01N	2.00E-01N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	OPR-TF--ACHU#	Tank farm operator fails to follow procedure for sample preparation	1	1N 5.0E-02N	5.00E-02N	
	OPRSRAT1ACNU#	SRAT operator fails to follow procedure for batch #1 sample preparation	1	1N 5.0E-03N	5.00E-03N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
6.	CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	1	1N 2.0E-01N	2.00E-01N	3.00E-08
	CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF1CC1U#	Same personnel conduct sampling from SRAT to SME for batch #1	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF2CC1U#	Same personnel conduct sampling from SRAT to SME for batch #2	1	1N 2.0E-01N	2.00E-01N	
	OPR-TF--LAHU#	Analyst at tank farm fails to properly analyze sample	1	1N 1.0E-03N	1.00E-03N	
	OPR1SRATIRHU#	SRAT engineer incorrectly records data into PCCS from batch #1	1	1N 5.0E-01N	5.00E-01N	
	OPRSRAT1CVHU#	STE at SRAT fails to verify batch #1 results	1	1N 3.0E-01N	3.00E-01N	
	OPRSRAT1IRHU#	SRAT engineer incorrectly reads data from batch #1	1	1N 5.0E-01N	5.00E-01N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
7.	CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	1	1N 2.0E-01N	2.00E-01N	2.00E-08
	CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF1CC1U#	Same personnel conduct sampling from SRAT to SME for batch #1	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF2CC1U#	Same personnel conduct sampling from SRAT to SME for batch #2	1	1N 2.0E-01N	2.00E-01N	
	OPR-TF--ACHU#	Tank farm operator fails to follow procedure for sample preparation	1	1N 5.0E-02N	5.00E-02N	
	OPRSRAT1LAHU#	Analyst at SRAT fails to properly analyze batch #1 sample	1	1N 1.0E-03N	1.00E-03N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
8.	AE-SRTC-CCLU#	CC: two analyzers at tank farm fail - false low reading	5	86H 5.0E-07H	2.15E-05	3.22E-09
	CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF1CC1U#	Same personnel conduct sampling from SRAT to SME for batch #1	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF2CC1U#	Same personnel conduct sampling from SRAT to SME for batch #2	1	1N 2.0E-01N	2.00E-01N	
	OPR1SRATIRHU#	SRAT engineer incorrectly records data into PCCS from batch #1	1	1N 5.0E-01N	5.00E-01N	
	OPRSRAT1CVHU#	STE at SRAT fails to verify batch #1 results	1	1N 3.0E-01N	3.00E-01N	
	OPRSRAT1IRHU#	SRAT engineer incorrectly reads data from batch #1	1	1N 5.0E-01N	5.00E-01N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
9.	CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	1	1N 2.0E-01N	2.00E-01N	2.00E-09
	CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF1CC1U#	Same personnel conduct sampling from SRAT to SME for batch #1	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF2CC1U#	Same personnel conduct sampling from SRAT to SME for batch #2	1	1N 2.0E-01N	2.00E-01N	
	OPR-TF--LAHU#	Analyst at tank farm fails to properly analyze sample	1	1N 1.0E-03N	1.00E-03N	
	OPRSRAT1ACNU#	SRAT operator fails to follow procedure for batch #1 sample preparation	1	1N 5.0E-03N	5.00E-03N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
10.	CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	1	1N 2.0E-01N	2.00E-01N	4.00E-10

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF1CC1U#	Same personnel conduct sampling from SRAT to SME for batch #1	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF2CC1U#	Same personnel conduct sampling from SRAT to SME for batch #2	1	1N 2.0E-01N	2.00E-01N	
	OPR-TF--LAHU#	Analyst at tank farm fails to properly analyze sample	1	1N 1.0E-03N	1.00E-03N	
	OPRSRAT1LAHU#	Analyst at SRAT fails to properly analyze batch #1 sample	1	1N 1.0E-03N	1.00E-03N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
11.	AE-SRTC-CCLU#	CC: two analyzers at tank farm fail - false low reading	5	86H 5.0E-07H	2.15E-05	2.15E-10
	CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF1CC1U#	Same personnel conduct sampling from SRAT to SME for batch #1	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF2CC1U#	Same personnel conduct sampling from SRAT to SME for batch #2	1	1N 2.0E-01N	2.00E-01N	
	OPRSRAT1ACNU#	SRAT operator fails to follow procedure for batch #1 sample preparation	1	1N 5.0E-03N	5.00E-03N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
12.	AE-SRTC-CCLU#	CC: two analyzers at tank farm fail - false low reading	5	86H 5.0E-07H	2.15E-05	4.30E-11
	CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF1CC1U#	Same personnel conduct sampling from SRAT to SME for batch #1	1	1N 2.0E-01N	2.00E-01N	
	CP-DWPF2CC1U#	Same personnel conduct sampling from SRAT to SME for batch #2	1	1N 2.0E-01N	2.00E-01N	
	OPRSRAT1LAHU#	Analyst at SRAT fails to properly analyze batch #1 sample	1	1N 1.0E-03N	1.00E-03N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result.	Cutset Freq.(/yr)
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
13.	AE-DWPF1CCLU#	CC: two analyzers in DWPF fail low - batch #1	5	86H 5.0E-07H	2.15E-05	1.16E-11
	AE-DWPF2CCLU#	CC: two analyzers in DWPF fail low - batch #2	5	86H 5.0E-07H	2.15E-05	
	CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	1	1N 2.0E-01N	2.00E-01N	
	OPR-TF--IRHU#	Tank farm analyst incorrectly reads data	1	1N 5.0E-01N	5.00E-01N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
14.	AE-DWPF1CCLU#	CC: two analyzers in DWPF fail low - batch #1	5	86H 5.0E-07H	2.15E-05	1.16E-12
	AE-DWPF2CCLU#	CC: two analyzers in DWPF fail low - batch #2	5	86H 5.0E-07H	2.15E-05	
	CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	1	1N 2.0E-01N	2.00E-01N	
	OPR-TF--ACHU#	Tank farm operator fails to follow procedure for sample preparation	1	1N 5.0E-02N	5.00E-02N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	
15.	AE-DWPF1CCLU#	CC: two analyzers in DWPF fail low - batch #1	5	86H 5.0E-07H	2.15E-05	2.31E-14
	AE-DWPF2CCLU#	CC: two analyzers in DWPF fail low - batch #2	5	86H 5.0E-07H	2.15E-05	
	CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	1	1N 2.0E-01N	2.00E-01N	
	OPR-TF--LAHU#	Analyst at tank farm fails to properly analyze sample	1	1N 1.0E-03N	1.00E-03N	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	

Cutsets for I:\CAFTA\CUT\SMELT.CSR 11/09/94 10:28 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
16.	AE-DWPF1CCLU#	CC: two analyzers in DWPF fail low - batch #1	5	86H 5.0E-07H	2.15E-05	2.48E-15
	AE-DWPF2CCLU#	CC: two analyzers in DWPF fail low - batch #2	5	86H 5.0E-07H	2.15E-05	
	AE-SRTC-CCLU#	CC: two analyzers at tank farm fail - false low reading	5	86H 5.0E-07H	2.15E-05	
	SLRSALT-BLUU#	Excess salt build up on melter top layer	1	1N 1.0E+00N	1.00E+00N	
	SLRSALT-PREU+	Excess salt present in sludge from tank farm transferred to DWPF	4	2Y 5.0E-01Y	5.00E-01	
	WTR-MLT-PREU#	Water in the melter	1	1N 1.0E+00N	1.00E+00N	

Steam explosion in melter Top Event Frequency: 1.79E-05/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
SLRSALT-PREU+-I	Excess salt in sludge from tank farm transferred to DWPF	2.85E-05/H	3.50E+04
OPRSRAT1LAHU#	Analyst at SRAT fails to properly analyze batch #1 sample	1.00E-03	1.33E+01
OPRSRAT1ACNU#	Fail to follow procedure batch #1 sample prep.	5.00E-03	1.33E+01
AE-SRTC-CCLU#	CC: two analyzers at tank farm fail - false low reading	2.15E-05	1.01E+01
CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	2.00E-01	5.00E+00
CP-DWPF1CC1U#	Same personnel conduct sampling: SRAT to SME: batch #1	2.00E-01	5.00E+00
CP-DWPF2CC1U#	Same personnel conduct sampling :SRAT to SME: batch #2	2.00E-01	5.00E+00
CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	2.00E-01	5.00E+00
OPRSRAT1CVHU#	STE at SRAT fails to verify batch #1 results	3.00E-01	3.16E+00
OPR-TF--LAHU#	Analyst at tank farm fails to properly analyze sample	1.00E-03	2.81E+00
OPR-TF--ACHU#	Tank farm :fails to follow procedure for sample preparation	5.00E-02	2.72E+00
OPRSRAT1IRHU#	SRAT engineer incorrectly reads data from batch #1	5.00E-01	1.93E+00
OPR1SRATIRHU#	SRAT engineer incorrectly records data into PCCS: batch #1	5.00E-01	1.93E+00
OPR-TF--IRHU#	Tank farm analyst incorrectly reads data	5.00E-01	1.91E+00
AE-DWPF1CCLU#	CC: two analyzers in DWPF fail low - batch #1	2.15E-05	1.03E+00
AE-DWPF2CCLU#	CC: two analyzers in DWPF fail low - batch #2	2.15E-05	1.03E+00

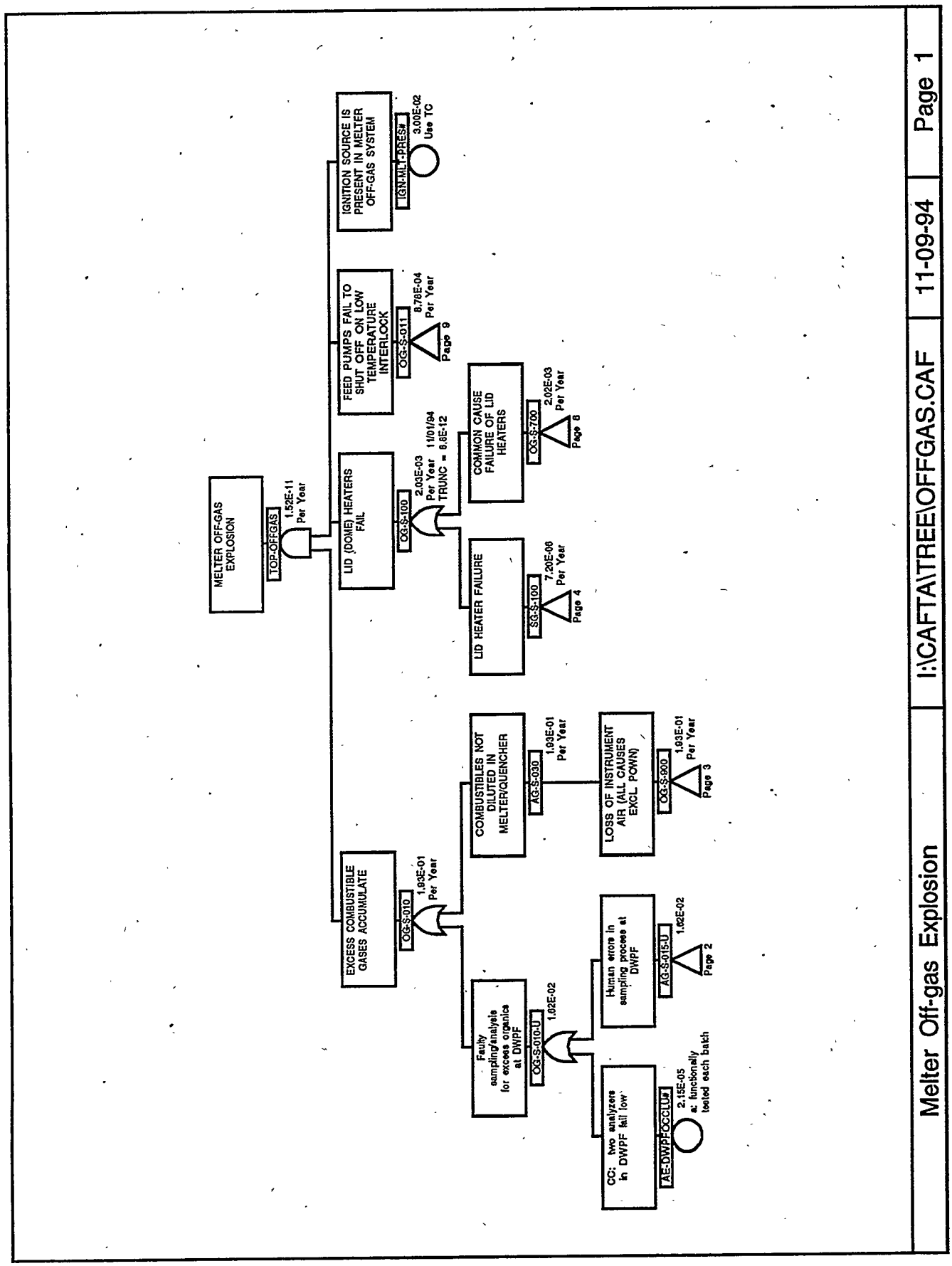
Risk Reduction Worth

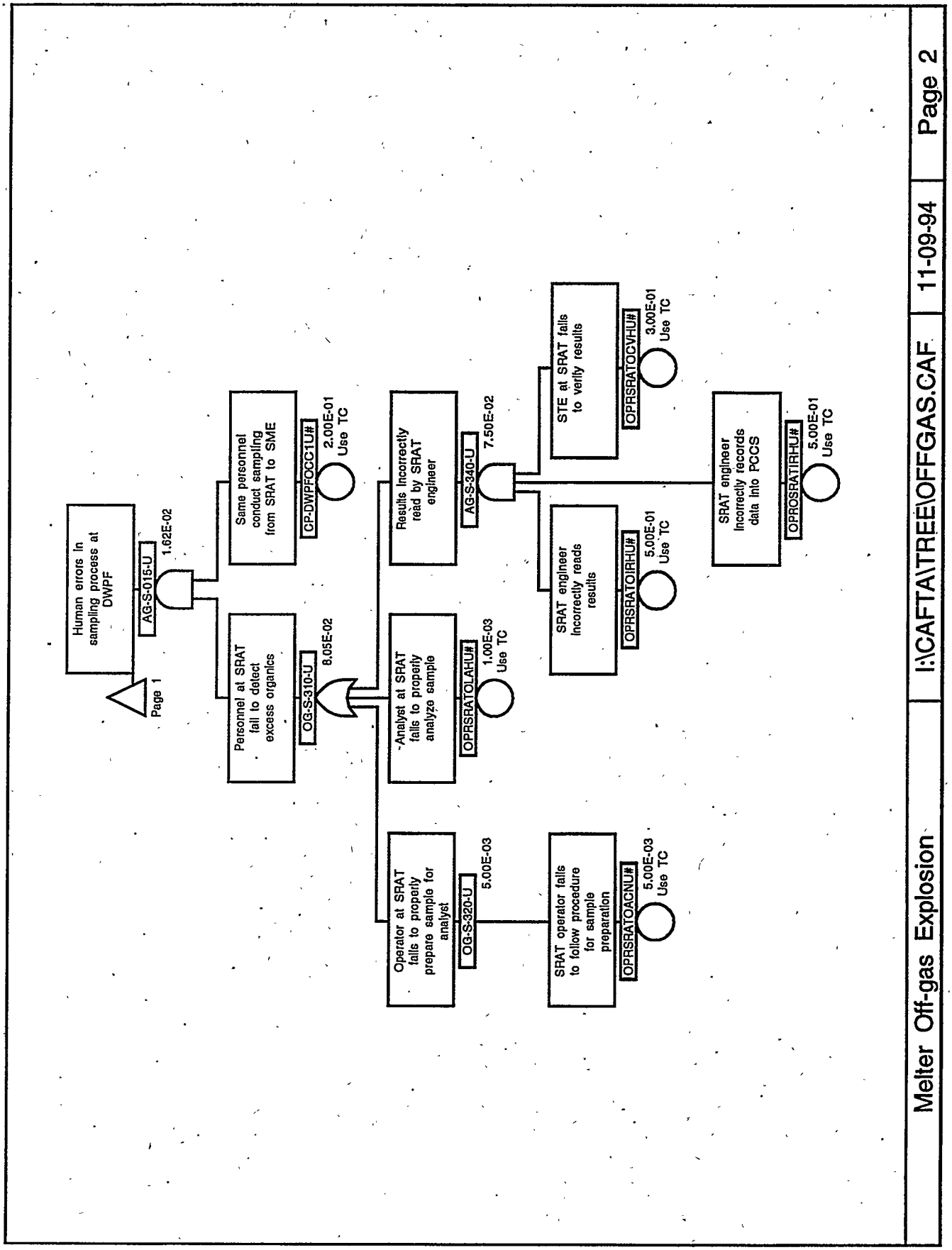
Basic Event Name	Description	Prob/Freq	RedW
*SLRSALT-BLUU#	Excess salt build up on melter top layer	1.00E+00	0.00E+00
*SLRSALT-PREU+-I	Excess salt in sludge from tank farm transferred to DWPF	2.85E-05/H	0.00E+00
*WTR-MLT-PREU#	Water in the melter	1.00E+00	0.00E+00
CP-DWPF1CC1U#	Same personnel conduct sampling : SRAT to SME: batch #1	2.00E-01	1.53E+06
CP-DWPF2CC1U#	Same personnel conduct sampling: SRAT to SME: batch #2	2.00E-01	1.53E+06
CP-BATCHCC1U#	Same personnel conduct sampling at SRAT for batch #2	2.00E-01	1.53E+06
CP--TF--CC-U#	Same analyst conducts sampling at tanks 48 & 49	2.00E-01	5.13E+03
OPRSRAT1CVHU#	STE at SRAT fails to verify batch #1 results	3.00E-01	1.35E+01
OPRSRAT1IRHU#	SRAT engineer incorrectly reads data from batch #1	5.00E-01	1.35E+01
OPR1SRATIRHU#	SRAT engineer incorrectly records data into PCCS: batch #1	5.00E-01	1.35E+01
OPR-TF--IRHU#	Tank farm analyst incorrectly reads data	5.00E-01	1.08E+01
OPR-TF--ACHU#	Tank farm operator fails to follow procedure: sample prep.	5.00E-02	1.10E+00
OPRSRAT1ACNU#	Fail to follow procedure for batch #1 sample preparation	5.00E-03	1.07E+00
OPRSRAT1LAHU#	Analyst at SRAT fails to properly analyze batch #1 sample	1.00E-03	1.01E+00

* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included.

Melter Offgas Explosion


MELTER OFF-GAS EXPLOSION
TOP-OFFGAS
1.52E-11 Per Year
IGNITION SOURCE IS PRESENT IN MELTER OFF-GAS SYSTEM
IGN-MLT-PRES#
3.00E-02 Use TC
FEED PUMPS FAIL TO SHUT OFF ON LOW TEMPERATURE INTERLOCK
OG-S-011
8.78E-04 Per Year
Page 9
LID (DOME) HEATERS FAIL
OG-S-100
2.03E-03 Per Year 11/01/94 TRUNC = 8.8E-12
COMMON CAUSE FAILURE OF LID HEATERS
OG-S-700
2.02E-03 Per Year
Page 8
LID HEATER FAILURE
SG-S-100
7.20E-06 Per Year
Page 4
EXCESS COMBUSTIBLE GASES ACCUMULATE
OG-S-010
1.93E-01 Per Year
COMBUSTIBLES NOT DILUTED IN MELTER/QUENCHER
AG-S-030
1.93E-01 Per Year
LOSS OF INSTRUMENT AIR (ALL CAUSES EXCL POWN)
OG-S-900
1.93E-01 Per Year
Page 3
Faulty sampling/analysis for excess organics at DWPF
OG-S-010-U
1.02E-02
Human errors in sampling process at DWPF
AG-S-015-U
1.02E-02
Page 2
CC: two analyzers in DWPF fail low
AE-DWPFOCCLU
2.15E-05 a: functionally tested each batch
Melter Off-gas Explosion
I:\CAFTA\TREE\OFFGAS.CAF
11-09-94
Page 1


Melter Off-gas Explosion
I:\CAFTA\TREE\OFFGAS.CAF
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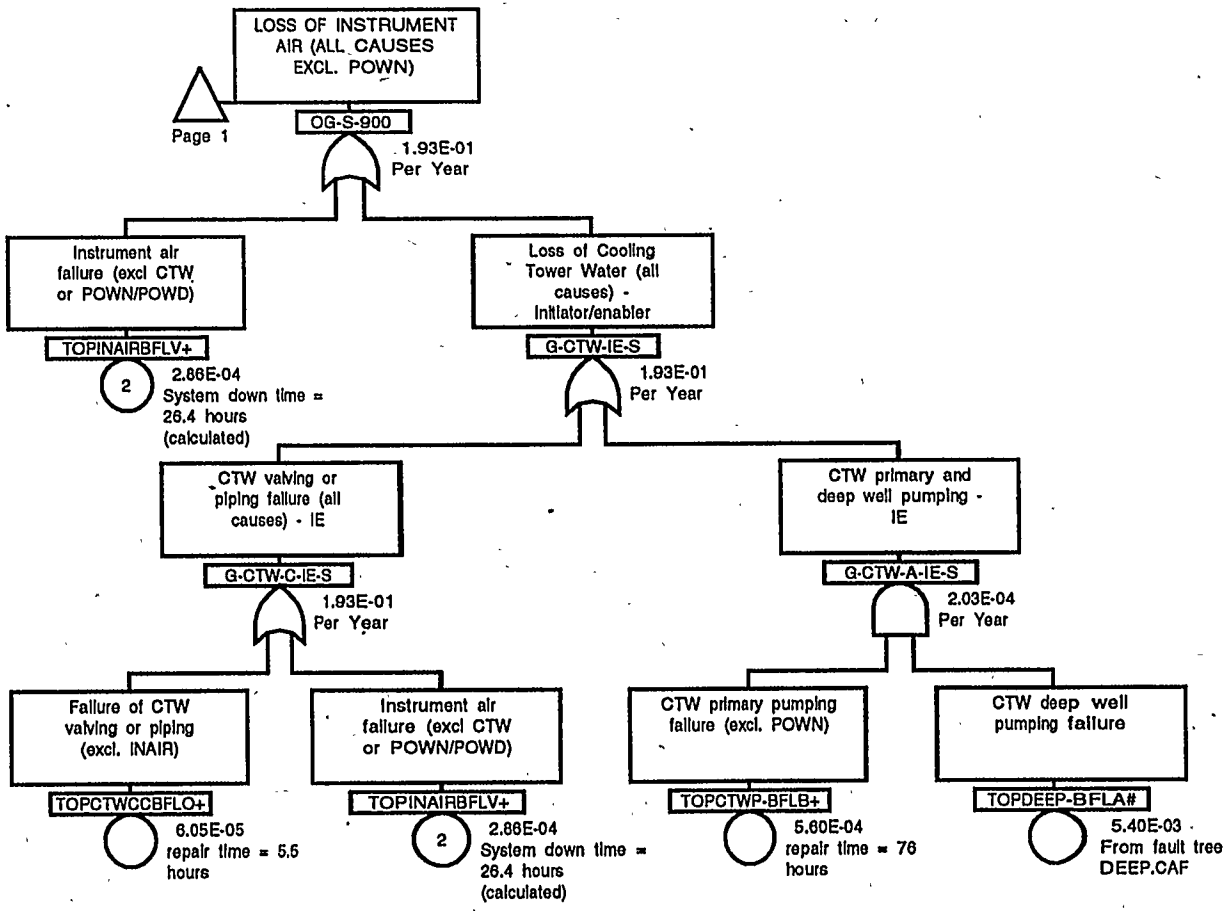
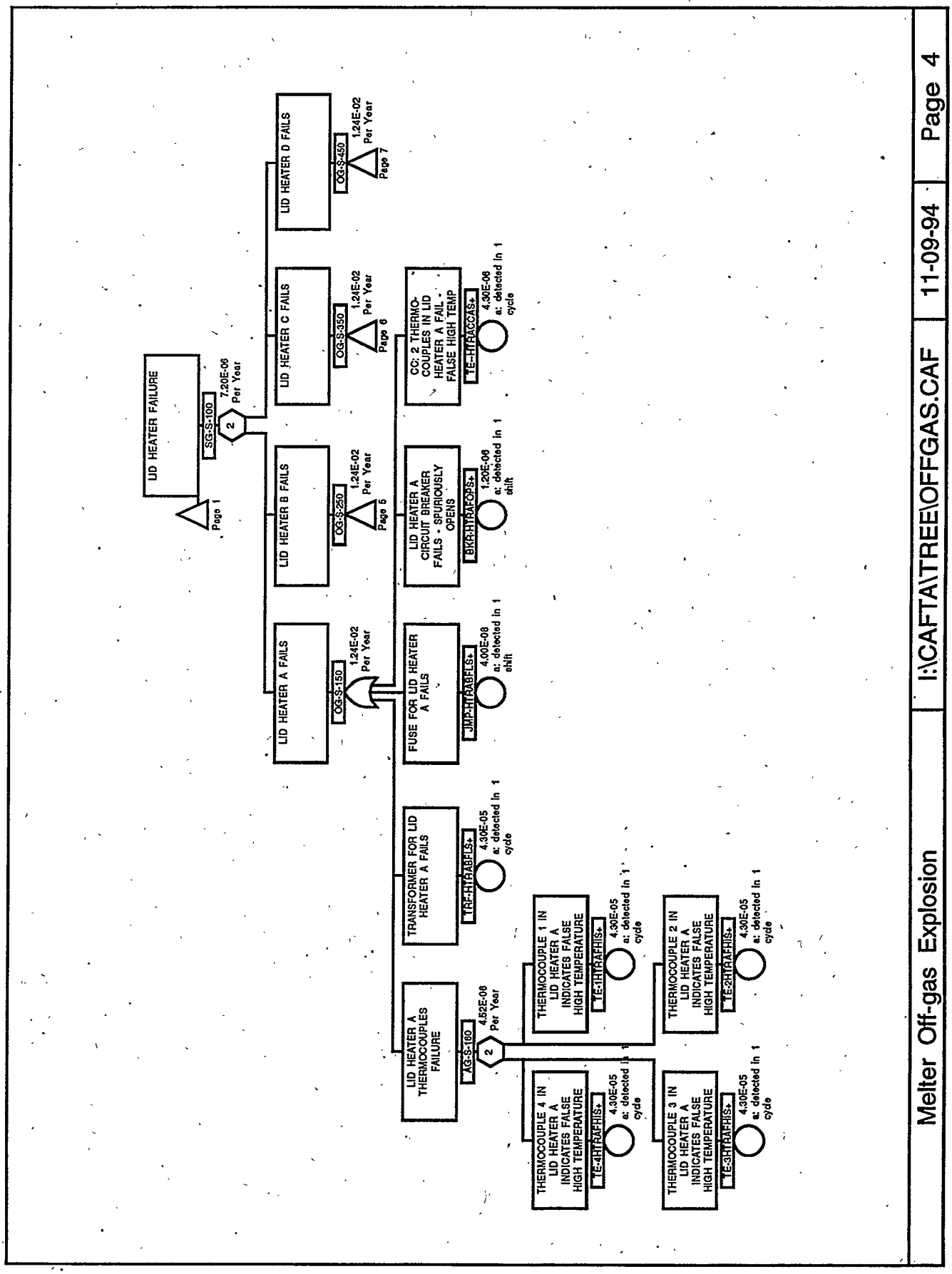
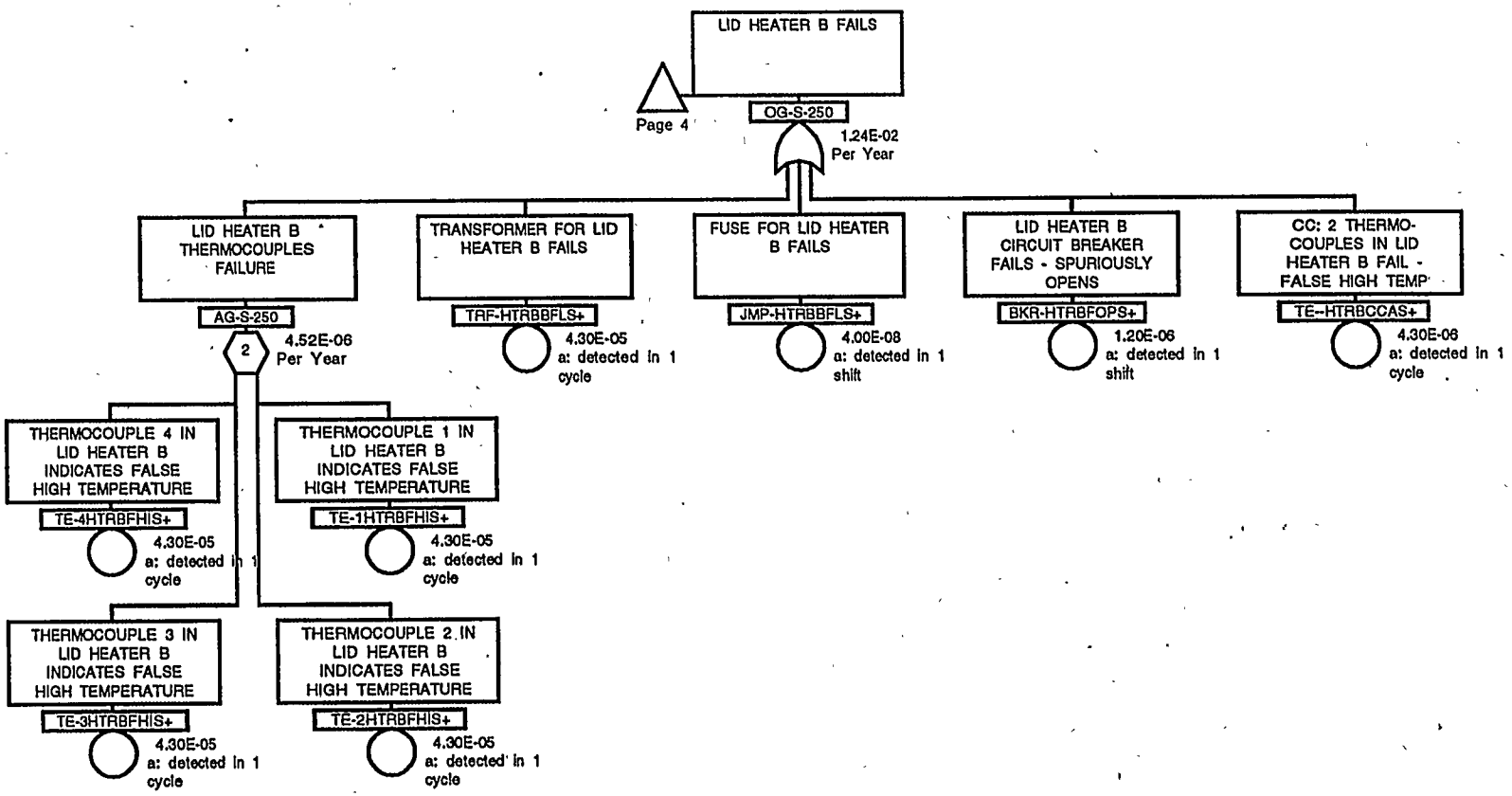
Page 2
Human errors in sampling process at DWPF
AG-S-015-U
1.62E-02
Page 1
Personnel at SRAT fail to detect excess organics
OG-S-310-U
8.05E-02
Same personnel conduct sampling from SRAT to SME
OP-DWPFOGC1U#
2.00E-01
Use TC
Analyst at SRAT fails to properly analyze sample
OPRSRATOLAHU#
1.00E-03
Use TC
Results incorrectly read by SRAT engineer
AG-S-340-U
7.50E-02
SRAT engineer incorrectly reads results
OPRSRATOIRHU#
5.00E-01
Use TC
STE at SRAT fails to verify results
OPRSRATOCVHU#
3.00E-01
Use TC
SRAT engineer incorrectly records data into PCCS
OPROSRATIRHU#
5.00E-01
Use TC
Operator at SRAT fails to properly prepare sample for analyst
OG-S-320-U
5.00E-03
SRAT operator fails to follow procedure for sample preparation
OPRSRATOACNU#
5.00E-03
Use TC

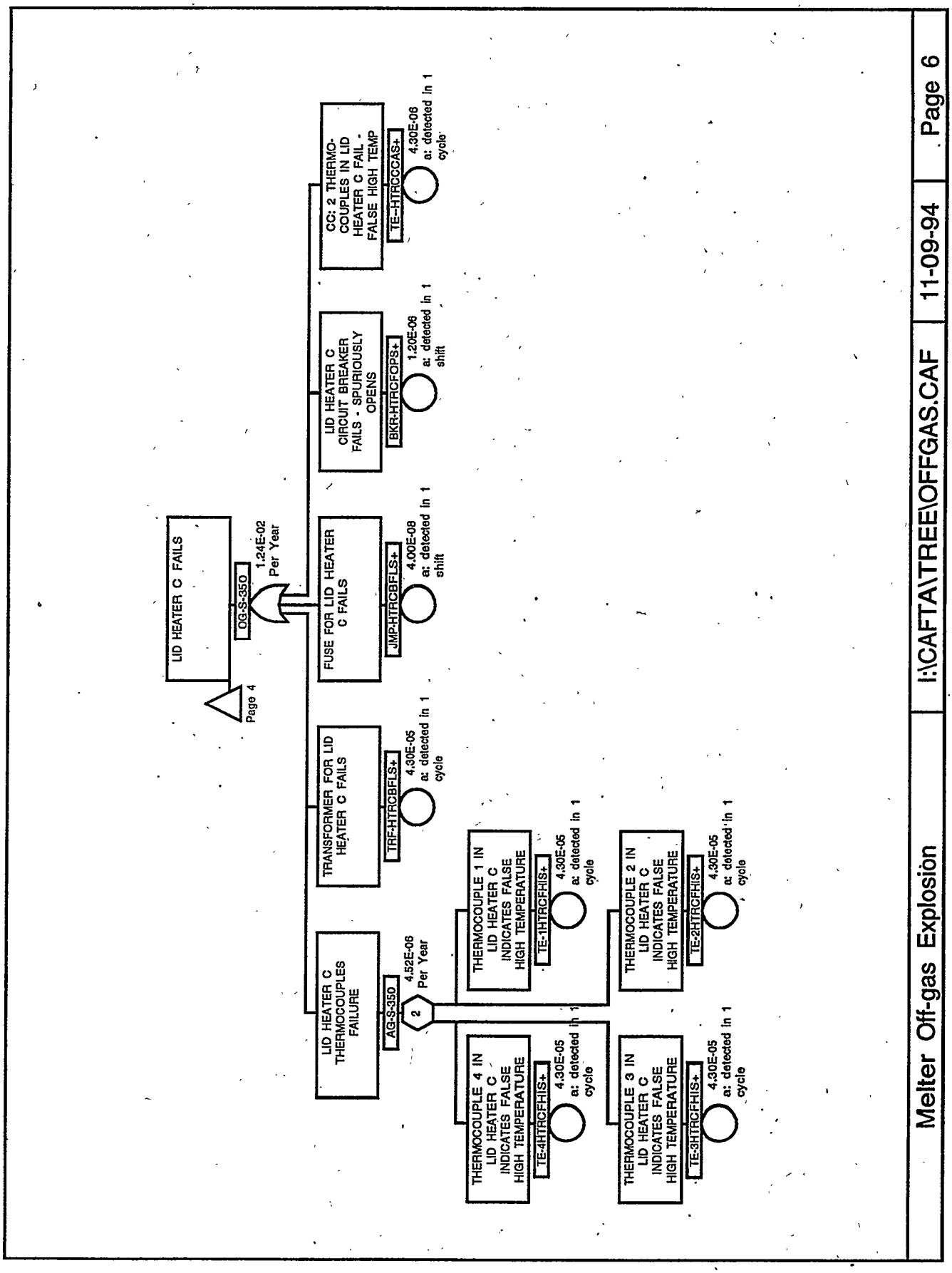


Melter Off-gas Explosion	I:\CAFTA\TREE\OFFGAS.CAF	11-09-94	Page 3


LID HEATER FAILURE
Page 1
SG-S-100
2
7.20E-06 Per Year
LID HEATER A FAILS
OG-S-150
1.24E-02 Per Year
LID HEATER B FAILS
OG-S-250
1.24E-02 Per Year
Page 5
LID HEATER C FAILS
OG-S-350
1.24E-02 Per Year
Page 6
LID HEATER D FAILS
OG-S-450
1.24E-02 Per Year
Page 7
LID HEATER A THERMOCOUPLES FAILURE
AG-S-160
2
4.52E-06 Per Year
THERMOCOUPLE 4 IN LID HEATER A INDICATES FALSE HIGH TEMPERATURE
TE-4HTAAFHS+
4.30E-05 a: detected in 1 cycle
THERMOCOUPLE 3 IN LID HEATER A INDICATES FALSE HIGH TEMPERATURE
TE-3HTAAFHS+
4.30E-05 a: detected in 1 cycle
THERMOCOUPLE 1 IN LID HEATER A INDICATES FALSE HIGH TEMPERATURE
TE-1HTAAFHS+
4.30E-05 a: detected in 1 cycle
THERMOCOUPLE 2 IN LID HEATER A INDICATES FALSE HIGH TEMPERATURE
TE-2HTAAFHS+
4.30E-05 a: detected in 1 cycle
TRANSFORMER FOR LID HEATER A FAILS
TRF-HTAABFLS+
4.30E-05 a: detected in 1 cycle
FUSE FOR LID HEATER A FAILS
JMP-HTAABFLS+
4.00E-08 a: detected in 1 shift
LID HEATER A CIRCUIT BREAKER FAILS - SPURIOUSLY OPENS
BKR-HTRAF-OPS+
1.20E-08 a: detected in 1 shift
CC: 2 THERMO-COUPLES IN LID HEATER A FAIL - FALSE HIGH TEMP
TE-HTAACCAS+
4.30E-06 a: detected in 1 cycle
Melter Off-gas Explosion
I:\CAFTA\TREE\OFFGAS.CAF
11-09-94
Page 4



Melter Off-gas Explosion	I:\CAFTA\TREE\OFFGAS.CAF	11-09-94	Page 5


LID HEATER C FAILS
OG-S-350
1.24E-02 Per Year
Page 4
TRANSFORMER FOR LID HEATER C FAILS
TRF-HTRCBFLS+
4.30E-05 a: detected in 1 cycle
FUSE FOR LID HEATER C FAILS
JMP-HTRCBFLS+
4.00E-08 a: detected in 1 shift
LID HEATER C CIRCUIT BREAKER FAILS - SPURIOUSLY OPENS
BKR-HTRCFOPS+
1.20E-06 a: detected in 1 shift
CC: 2 THERMO-COUPLES IN LID HEATER C FAIL - FALSE HIGH TEMP
TE--HTRCCAS+
4.30E-06 a: detected in 1 cycle
LID HEATER C THERMOCOUPLES FAILURE
AG-S-350
4.52E-06 Per Year
2
THERMOCOUPLE 1 IN LID HEATER C INDICATES FALSE HIGH TEMPERATURE
TE-1HTRCFHIS+
4.30E-05 a: detected in 1 cycle
THERMOCOUPLE 2 IN LID HEATER C INDICATES FALSE HIGH TEMPERATURE
TE-2HTRCFHIS+
4.30E-05 a: detected in 1 cycle
THERMOCOUPLE 4 IN LID HEATER C INDICATES FALSE HIGH TEMPERATURE
TE-4HTRCFHIS+
4.30E-05 a: detected in 1 cycle
THERMOCOUPLE 3 IN LID HEATER C INDICATES FALSE HIGH TEMPERATURE
TE-3HTRCFHIS+
4.30E-05 a: detected in 1 cycle
Melter Off-gas Explosion
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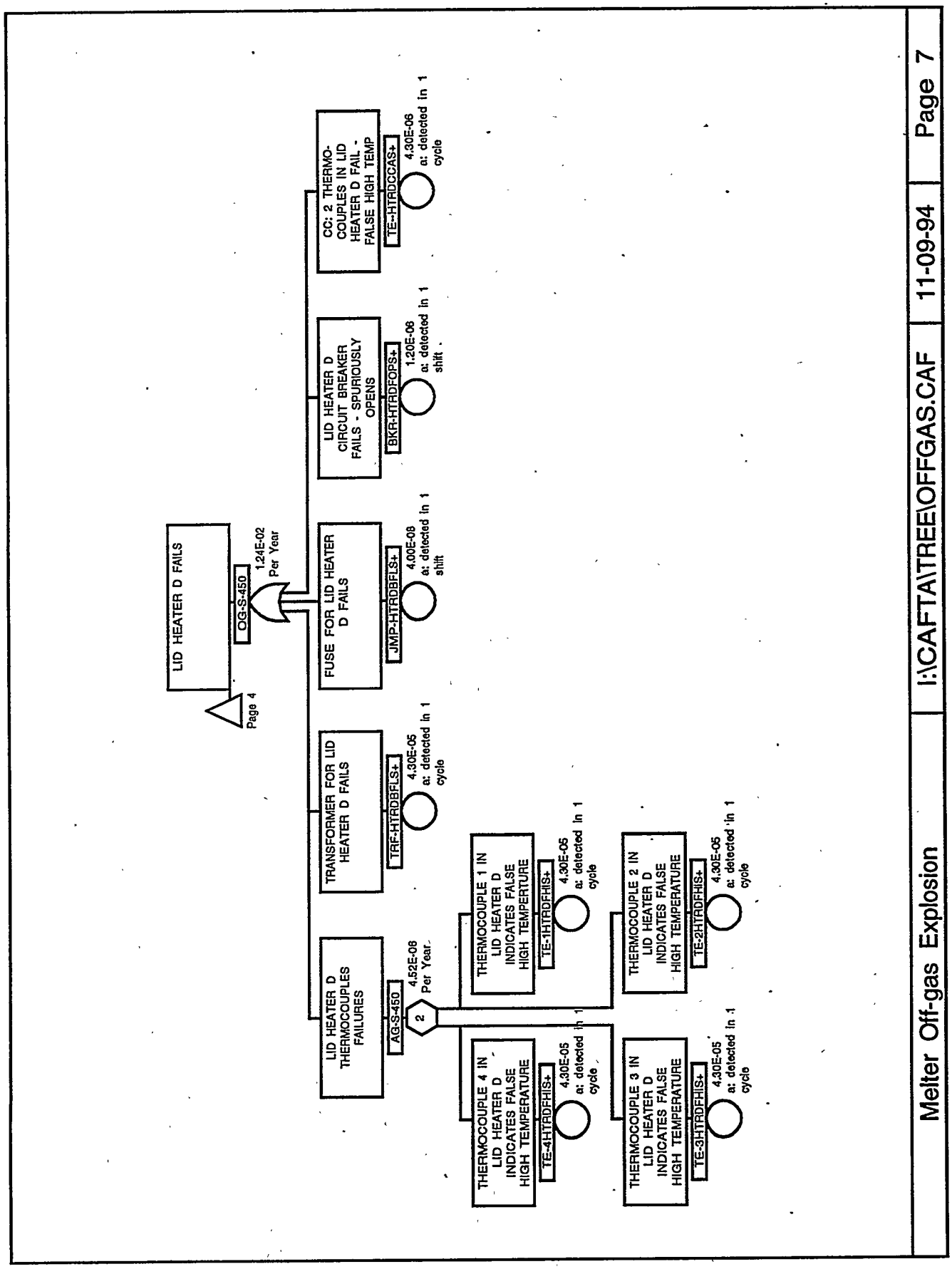
LID HEATER D FAILS
OG-S-450
1.24E-02 Per Year
Page 4
LID HEATER D THERMOCOUPLES FAILURES
AG-S-450
4.52E-06 Per Year
2
TRANSFORMER FOR LID HEATER D FAILS
TRF-HTRDBFLS+
4.30E-05 a: detected in 1 cycle
FUSE FOR LID HEATER D FAILS
JMP-HTRDBFLS+
4.00E-06 a: detected in 1 shift
LID HEATER D CIRCUIT BREAKER FAILS - SPURIOUSLY OPENS
BKR-HTRDFOPS+
1.20E-06 a: detected in 1 shift
CC: 2 THERMO-COUPLES IN LID HEATER D FAIL - FALSE HIGH TEMP
TE-HTRDCCAS+
4.30E-06 a: detected in 1 cycle
THERMOCOUPLE 1 IN LID HEATER D INDICATES FALSE HIGH TEMPERTURE
TE-1HTRDFHIS+
4.30E-05 a: detected in 1 cycle
THERMOCOUPLE 2 IN LID HEATER D INDICATES FALSE HIGH TEMPERATURE
TE-2HTRDFHIS+
4.30E-05 a: detected in 1 cycle
THERMOCOUPLE 4 IN LID HEATER D INDICATES FALSE HIGH TEMPERATURE
TE-4HTRDFHIS+
4.30E-05 a: detected in 1 cycle
THERMOCOUPLE 3 IN LID HEATER D INDICATES FALSE HIGH TEMPERATURE
TE-3HTRDFHIS+
4.30E-05 a: detected in 1 cycle
Melter Off-gas Explosion
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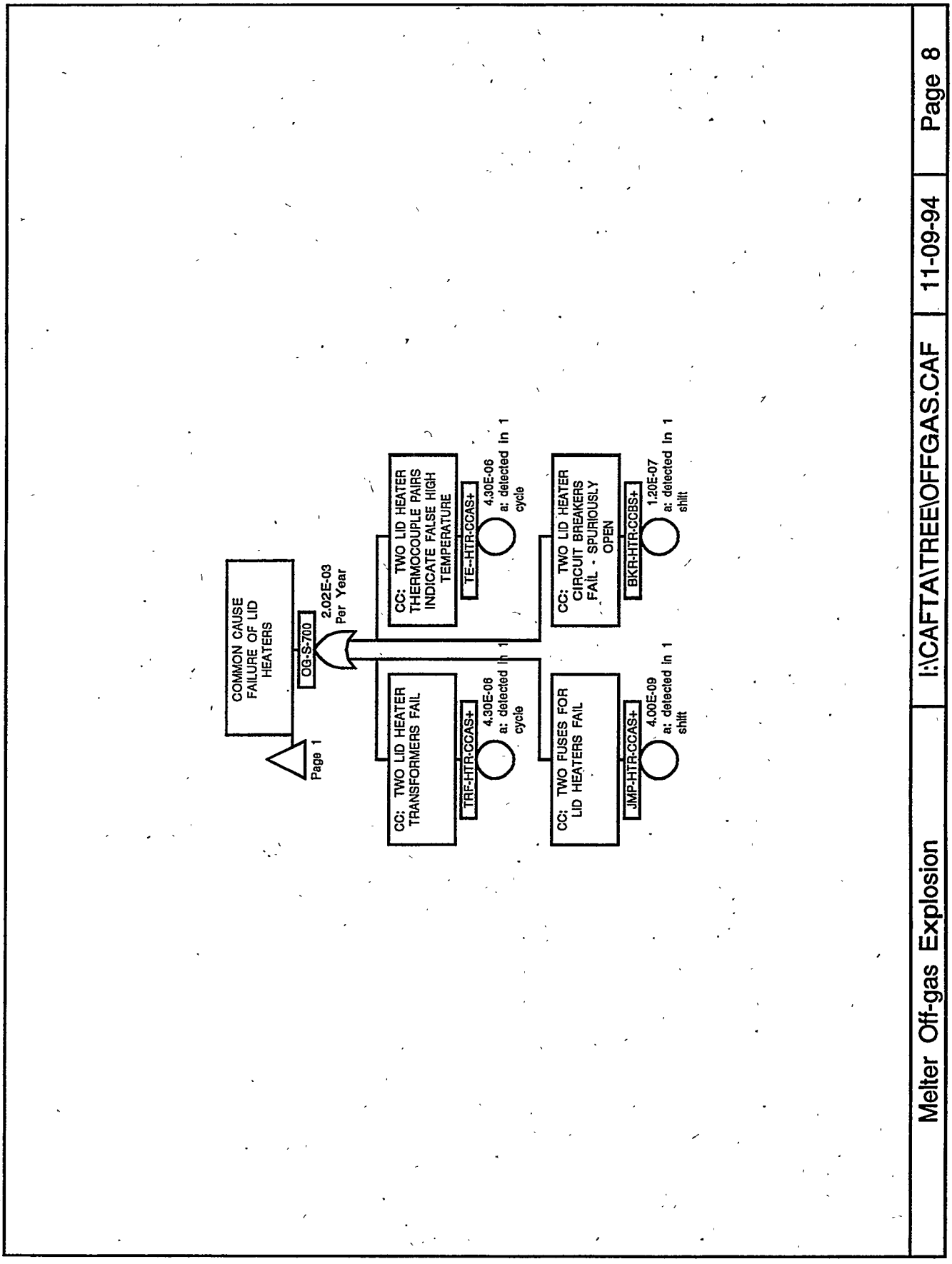
COMMON CAUSE FAILURE OF LID HEATERS
Page 1
OG-S-700
2.02E-03 Per Year
CC: TWO LID HEATER TRANSFORMERS FAIL
TRF-HTR-CCAS+
4.30E-06 a: detected in 1 cycle
CC: TWO LID HEATER THERMOCOUPLE PAIRS INDICATE FALSE HIGH TEMPERATURE
TE--HTR-CCAS+
4.30E-06 a: detected in 1 cycle
CC: TWO FUSES FOR LID HEATERS FAIL
JMP-HTR-CCAS+
4.00E-09 a: detected in 1 shift
CC: TWO LID HEATER CIRCUIT BREAKERS FAIL - SPURIOUSLY OPEN
BKR-HTR-CCBS+
1.20E-07 a: detected in 1 shift
Melter Off-gas Explosion
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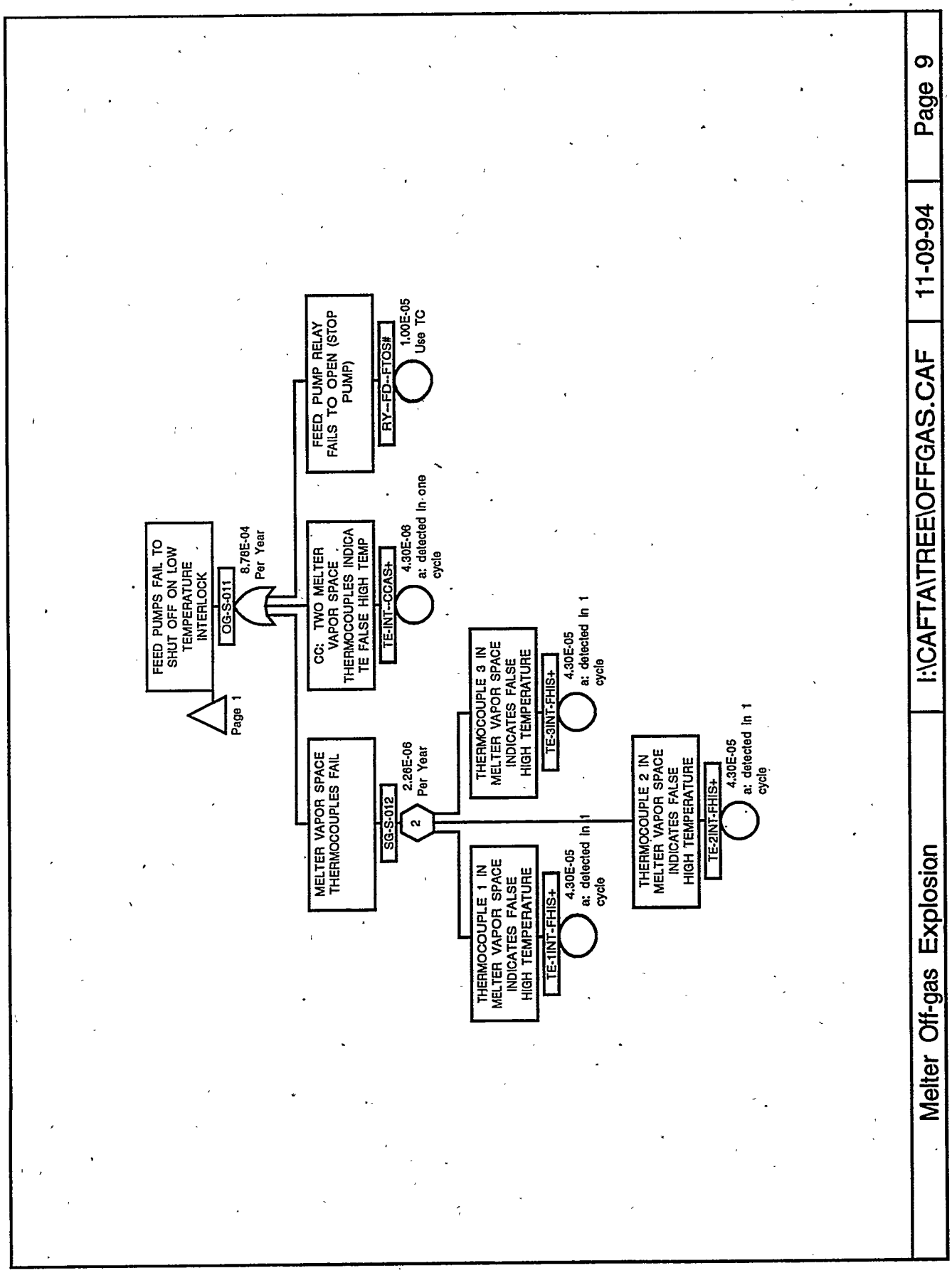
FEED PUMPS FAIL TO SHUT OFF ON LOW TEMPERATURE INTERLOCK
OG-S-011
8.78E-04 Per Year
Page 1
FEED PUMP RELAY FAILS TO OPEN (STOP PUMP)
RY--FD--FTOS#
1.00E-05 Use TC
CC: TWO MELTER VAPOR SPACE THERMOCOUPLES INDICA TE FALSE HIGH TEMP
TE-INT-CCAS+
4.30E-06 a: detected in one cycle
MELTER VAPOR SPACE THERMOCOUPLES FAIL
SG-S-012
2.28E-06 Per Year
2
THERMOCOUPLE 3 IN MELTER VAPOR SPACE INDICATES FALSE HIGH TEMPERATURE
TE-3INT-FHIS+
4.30E-05 a: detected in 1 cycle
THERMOCOUPLE 1 IN MELTER VAPOR SPACE INDICATES FALSE HIGH TEMPERATURE
TE-1INT-FHIS+
4.30E-05 a: detected in 1 cycle
THERMOCOUPLE 2 IN MELTER VAPOR SPACE INDICATES FALSE HIGH TEMPERATURE
TE-2INT-FHIS+
4.30E-05 a: detected in 1 cycle
Melter Off-gas Explosion
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Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
AE-DWPFOCGLU#	1		OG-S-700	1		TOP-OFFGAS	1				
AG-S-015-U	1		OG-S-700	8		TOPCTWCCBFLO+	3				
AG-S-015-U	2		OG-S-900	1		TOPCTWP-BFLB+	3				
AG-S-030	1		OG-S-900	3		TOPDEEP-BFLA#	3				
AG-S-160	4		OPROSRATIRHU#	2		TOPINAIRBFLV+	3				
AG-S-250	5		OPRSRATOACNU#	2		TOPINAIRBFLV+	3				
AG-S-340-U	2		OPRSRATOCVHU#	2		TRF-HTR-CCAS+	8				
AG-S-350	6		OPRSRATOIRHU#	2		TRF-HTRABFLS+	4				
AG-S-450	7		OPRSRATOLAHU#	2		TRF-HTRBBFLS+	5				
BKR-HTR-CCBS+	8		RY--FD--FTOS#	9		TRF-HTRCBFLS+	6				
BKR-HTRAFOPS+	4		SG-S-012	9		TRF-HTRDBFLS+	7				
BKR-HTRBFOPS+	5		SG-S-100	1							
BKR-HTRCFOPS+	6		SG-S-100	4							
BKR-HTRDFOPS+	7		TE--HTR-CCAS+	8							
CP-DWPFOCC1U#	2		TE--HTRACCAS+	4							
G-CTW-A-IE-S	3		TE--HTRBCCAS+	5							
G-CTW-C-IE-S	3		TE--HTRCCCAS+	6							
G-CTW-IE-S	3		TE--HTRDCCAS+	7							
IGN-MLT-PRES#	1		TE-1HTRAFHIS+	4							
JMP-HTR-CCAS+	8		TE-1HTRBFHIS+	5							
JMP-HTRABFLS+	4		TE-1HTRCFHIS+	6							
JMP-HTRBBFLS+	5		TE-1HTRDFHIS+	7							
JMP-HTRCBFLS+	6		TE-1INT-FHIS+	9							
JMP-HTRDBFLS+	7		TE-2HTRAFHIS+	4							
OG-S-010	1		TE-2HTRBFHIS+	5							
OG-S-010-U	1		TE-2HTRCFHIS+	6							
OG-S-011	1		TE-2HTRDFHIS+	7							
OG-S-011	9		TE-2INT-FHIS+	9							
OG-S-100	1		TE-3HTRAFHIS+	4							
OG-S-150	4		TE-3HTRBFHIS+	5							
OG-S-250	4		TE-3HTRCFHIS+	6							
OG-S-250	5		TE-3HTRDFHIS+	7							
OG-S-310-U	2		TE-3INT-FHIS+	9							
OG-S-320-U	2		TE-4HTRAFHIS+	4							
OG-S-350	4		TE-4HTRBFHIS+	5							
OG-S-350	6		TE-4HTRCFHIS+	6							
OG-S-450	4		TE-4HTRDFHIS+	7							
OG-S-450	7		TE-INT--CCAS+	9							

Cutsets for I:\CAFTA\CUT\OFFGAS.CSR 11/09/94 10:29 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	TOP-OFFGAS					1.52E-11
1.	CP-DWPFOCC1U#	Same personnel conduct sampling from SRAT to SME	1	1N 2.0E-01N	2.00E-01N	3.94E-12
	IGN-MLT-PRES#	IGNITION SOURCE IS PRESENT IN MELTER OFF-GAS SYSTEM	1	1N 3.0E-02N	3.00E-02N	
	OPROSRATIRHU#	SRAT engineer incorrectly records data into PCCS	1	1N 5.0E-01N	5.00E-01N	
	OPRSRATOCVHU#	STE at SRAT fails to verify results	1	1N 3.0E-01N	3.00E-01N	
	OPRSRATOIRHU#	SRAT engineer incorrectly reads results	1	1N 5.0E-01N	5.00E-01N	
	RY--FD--FTOS#	FEED PUMP RELAY FAILS TO OPEN (STOP PUMP)	1	1N 1.0E-05N	1.00E-05N	
	TE--HTR-CCAS+	CC: TWO LID HEATER THERMOCOUPLE PAIRS INDICATE FALSE HIGH TEMPERATURE	4	43H 1.0E-07H	4.30E-06	
2.	CP-DWPFOCC1U#	Same personnel conduct sampling from SRAT to SME	1	1N 2.0E-01N	2.00E-01N	3.94E-12
	IGN-MLT-PRES#	IGNITION SOURCE IS PRESENT IN MELTER OFF-GAS SYSTEM	1	1N 3.0E-02N	3.00E-02N	
	OPROSRATIRHU#	SRAT engineer incorrectly records data into PCCS	1	1N 5.0E-01N	5.00E-01N	
	OPRSRATOCVHU#	STE at SRAT fails to verify results	1	1N 3.0E-01N	3.00E-01N	
	OPRSRATOIRHU#	SRAT engineer incorrectly reads results	1	1N 5.0E-01N	5.00E-01N	
	RY--FD--FTOS#	FEED PUMP RELAY FAILS TO OPEN (STOP PUMP)	1	1N 1.0E-05N	1.00E-05N	
	TRF-HTR-CCAS+	CC: TWO LID HEATER TRANSFORMERS FAIL	4	43H 1.0E-07H	4.30E-06	
3.	CP-DWPFOCC1U#	Same personnel conduct sampling from SRAT to SME	1	1N 2.0E-01N	2.00E-01N	3.39E-12
	IGN-MLT-PRES#	IGNITION SOURCE IS PRESENT IN MELTER OFF-GAS SYSTEM	1	1N 3.0E-02N	3.00E-02N	
	OPROSRATIRHU#	SRAT engineer incorrectly records data into PCCS	1	1N 5.0E-01N	5.00E-01N	
	OPRSRATOCVHU#	STE at SRAT fails to verify results	1	1N 3.0E-01N	3.00E-01N	
	OPRSRATOIRHU#	SRAT engineer incorrectly reads results	1	1N 5.0E-01N	5.00E-01N	
	TE-INT--CCAS+	CC: TWO MELTER VAPOR SPACE THERMOCOUPLES INDICATE FALSE HIGH TEMP	4	43H 1.0E-07H	4.30E-06	
	TRF-HTR-CCAS+	CC: TWO LID HEATER TRANSFORMERS FAIL	4	43H 1.0E-07H	4.30E-06	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
4.	CP-DWPFOCC1U#	Same personnel conduct sampling from SRAT to SME	1	1N 2.0E-01N	2.00E-01N	3.39E-12
	IGN-MLT-PRES#	IGNITION SOURCE IS PRESENT IN MELTER OFF-GAS SYSTEM	1	1N 3.0E-02N	3.00E-02N	
	OPROSRATIRHU#	SRAT engineer incorrectly records data into PCCS	1	1N 5.0E-01N	5.00E-01N	
	OPRSRATOCVHU#	STE at SRAT fails to verify results	1	1N 3.0E-01N	3.00E-01N	
	OPRSRATOIRHU#	SRAT engineer incorrectly reads results	1	1N 5.0E-01N	5.00E-01N	
	TE--HTR-CCAS+	CC: TWO LID HEATER THERMOCOUPLE PAIRS INDICATE FALSE HIGH TEMPERATURE	4	43H 1.0E-07H	4.30E-06	
	TE-INT--CCAS+	CC: TWO MELTER VAPOR SPACE THERMOCOUPLES INDICATE FALSE HIGH TEMP	4	43H 1.0E-07H	4.30E-06	
5.	CP-DWPFOCC1U#	Same personnel conduct sampling from SRAT to SME	1	1N 2.0E-01N	2.00E-01N	2.63E-13
	IGN-MLT-PRES#	IGNITION SOURCE IS PRESENT IN MELTER OFF-GAS SYSTEM	1	1N 3.0E-02N	3.00E-02N	
	OPRSRATOACNU#	SRAT operator fails to follow procedure for sample preparation	1	1N 5.0E-03N	5.00E-03N	
	RY--FD--FTOS#	FEED PUMP RELAY FAILS TO OPEN (STOP PUMP)	1	1N 1.0E-05N	1.00E-05N	
	TE--HTR-CCAS+	CC: TWO LID HEATER THERMOCOUPLE PAIRS INDICATE FALSE HIGH TEMPERATURE	4	43H 1.0E-07H	4.30E-06	
6.	CP-DWPFOCC1U#	Same personnel conduct sampling from SRAT to SME	1	1N 2.0E-01N	2.00E-01N	2.63E-13
	IGN-MLT-PRES#	IGNITION SOURCE IS PRESENT IN MELTER OFF-GAS SYSTEM	1	1N 3.0E-02N	3.00E-02N	
	OPRSRATOACNU#	SRAT operator fails to follow procedure for sample preparation	1	1N 5.0E-03N	5.00E-03N	
	RY--FD--FTOS#	FEED PUMP RELAY FAILS TO OPEN (STOP PUMP)	1	1N 1.0E-05N	1.00E-05N	
	TRF-HTR-CCAS+	CC: TWO LID HEATER TRANSFORMERS FAIL	4	43H 1.0E-07H	4.30E-06	

MELTER OFF-GAS EXPLOSION Top Event Frequency: 1.63E-11/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
TE--HTR-CCAS+-IC	CC: TWO LID HEATER TC PAIRS FAIL HIGH	1.00E-07/H	3.73E+06
TRF-HTR-CCAS+-IC	CC: TWO LID HEATER TRANSFORMERS FAIL	1.00E-07/H	3.73E+06
TE-INT--CCAS+-IC	CC: TWO MELTER VAPOR SPACE TCS FAIL HIGH	1.00E-07/H	2.18E+06
BKR-HTR-CCBS+-IC	CC: TWO LID HEATER CIRCUIT BRKRS FAIL OPEN	3.00E-08/H	8.62E+04
JMP-HTR-CCAS+-IC	CC: TWO FUSES FOR LID HEATERS FAIL	1.00E-09/H	5.99E+04
RY--FD--FTOS#	FEED PUMP RELAY FAILS TO OPEN (STOP PUMP)	1.00E-05	5.60E+04
TOPINAIRBFLV+-IC	Instrument air failure (excl CTW or POWN/POWD)	1.10E-05/H	2.08E+03
TOPCTWCCBFLO+-IC	Failure of CTW valving or piping (excl. INAIR)	1.10E-05/H	2.08E+03
IGN-MLT-PRES#	IGNITION SOURCE IS PRESENT IN MELTER OFF-GAS	3.00E-02	3.33E+01
TOPCTWP-BFLB+-IC	CTW primary pumping failure (excl. POWN)	6.29E-06/H	1.23E+01
OPRSRATOACNU#	Fail to follow procedure for SRAT sample preparation	5.00E-03	7.45E+00
CP-DWPFOCC1U#	Same personnel conduct sampling from SRAT to SME	2.00E-01	4.70E+00
OPRSRATOCVHU#	STE at SRAT fails to verify results	3.00E-01	3.15E+00
OPROSRATIRHU#	SRAT engineer incorrectly records data into PCCS	5.00E-01	1.72E+00
OPRSRATOIRHU#	SRAT engineer incorrectly reads results	5.00E-01	1.72E+00

Modified top event frequency = (top event frequency) x (risk achievement worth).

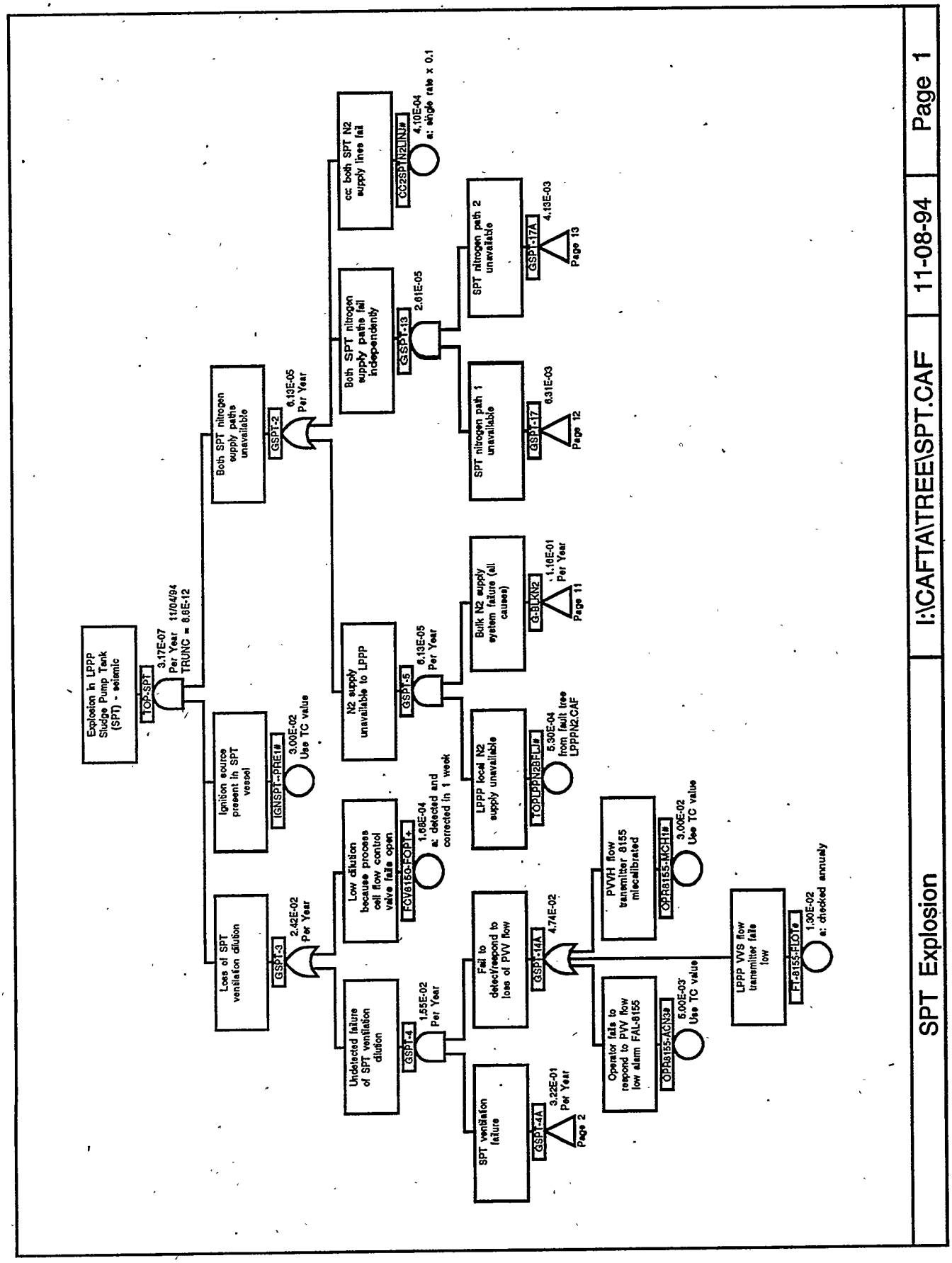
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
*IGN-MLT-PRES#	IGNITION SOURCE IS PRESENT IN MELTER OFF-GAS	3.00E-02	0.00E+00
OPRSRATOCVHU#	STE at SRAT fails to verify results	3.00E-01	2.22E+01
OPRSRATOIRHU#	SRAT engineer incorrectly reads results	5.00E-01	2.22E+01
CP-DWPFOCC1U#	Same personnel conduct sampling from SRAT to SME	2.00E-01	2.22E+01
OPROSRATIRHU#	SRAT engineer incorrectly records data into PCCS	5.00E-01	2.22E+01
RY--FD--FTOS#	FEED PUMP RELAY FAILS TO OPEN (STOP PUMP)	1.00E-05	1.91E+00
TRF-HTR-CCAS+-IC	CC: TWO LID HEATER TRANSFORMERS FAIL	1.00E-07/H	1.91E+00
TE-INT--CCAS+-IC	CC: TWO MELTER VAPOR SPACE TTCS FAIL HIGH	1.00E-07/H	1.91E+00
TE--HTR-CCAS+-IC	CC: TWO LID HEATER TC PAIRS FAIL HIGH	1.00E-07/H	1.91E+00

* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

LPPP SPT Explosion


Explosion in LPPP Sludge Pump Tank (SPT) - seismic
TOP-SPT
3.17E-07 Per Year 11/04/94 TRUNC = 8.8E-12
Loss of SPT ventilation dilution
GSPT-3
2.42E-02 Per Year
Ignition source present in SPT vessel
IGNSPT--PRE1#
3.00E-02 Use TC value
Low dilution because process cell flow control valve fails open
FCV8150-FOPT+
1.68E-04 a: detected and corrected in 1 week
Undetected failure of SPT ventilation dilution
GSPT-4
1.55E-02 Per Year
SPT ventilation failure
GSPT-4A
3.22E-01 Per Year
Page 2
Fail to detect/respond to loss of PVV flow
GSPT-14A
4.74E-02
Operator fails to respond to PVV flow low alarm FAL-8155
OPR8155-ACN3#
5.00E-03 Use TC value
PVVH flow transmitter 8155 miscalibrated
OPR8155-MCH1#
3.00E-02 Use TC value
LPPP VVS flow transmitter fails low
FT-8155-FLO1#
1.30E-02 a: checked annualy
Both SPT nitrogen supply paths unavailable
GSPT-2
6.13E-05 Per Year
N2 supply unavailable to LPPP
GSPT-5
6.13E-05 Per Year
LPPP local N2 supply unavailable
TOPLPPN2BFLI#
5.30E-04 from fault tree LPPPN2.CAF
Bulk N2 supply system failure (all causes)
G-BLKN2
1.16E-01 Per Year
Page 11
Both SPT nitrogen supply paths fail independently
GSPT-13
2.61E-05
cc: both SPT N2 supply lines fail
CC2SPTN2LIN#
4.10E-04 a: single rate x 0.1
SPT nitrogen path 1 unavailable
GSPT-17
6.31E-03
Page 12
SPT nitrogen path 2 unavailable
GSPT-17A
4.13E-03
Page 13
SPT Explosion
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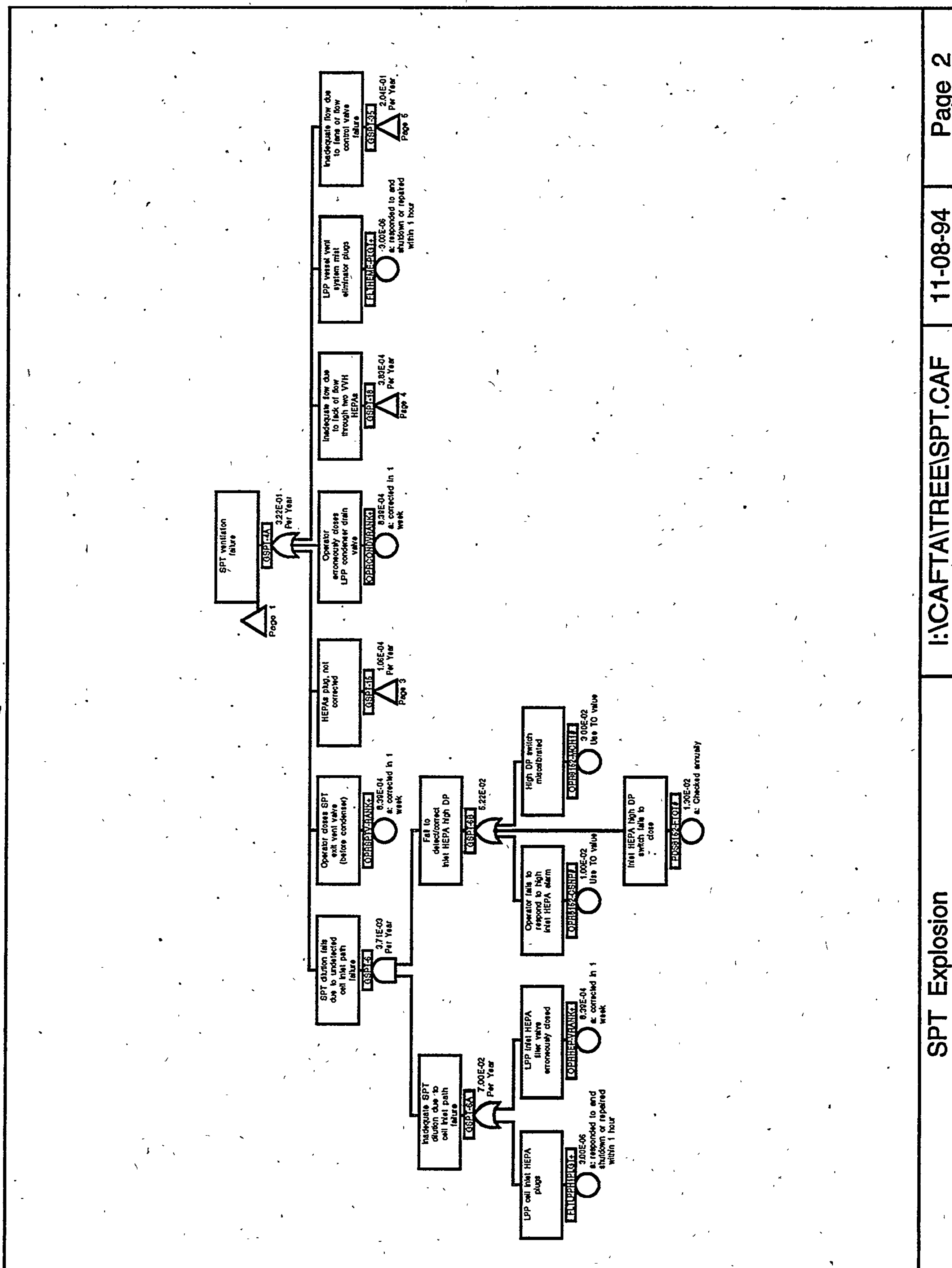
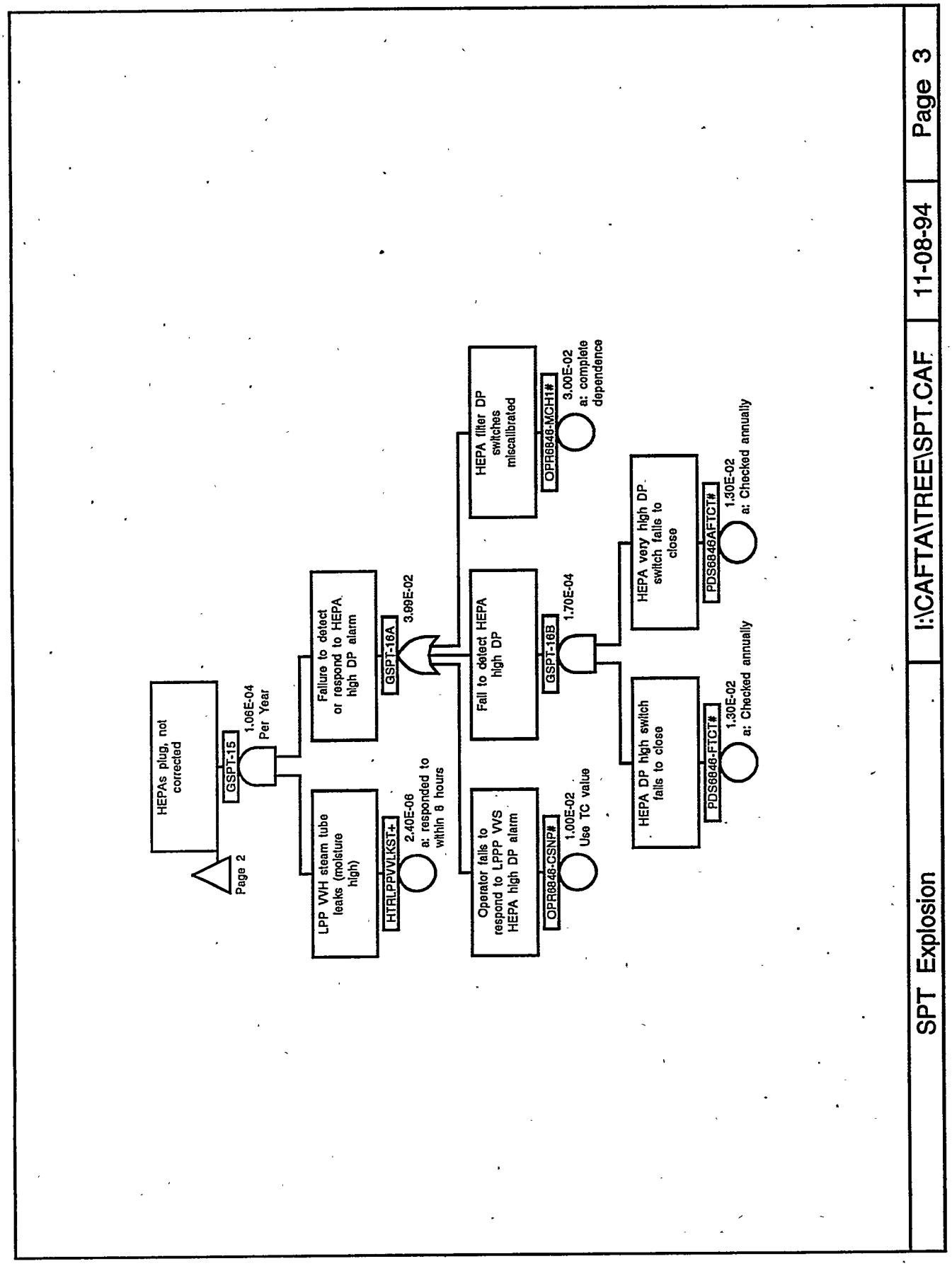

SPT ventilation failure
3.22E-01 Per Year
Page 1
HEPAs plug, not corrected
1.06E-04 Per Year
Page 3
Operator erroneously closes LPP condenser drain valve
8.39E-04 a: corrected in 1 week
Inadequate flow due to lack of flow through two VVH HEPAs
3.83E-04 Per Year
Page 4
LPP vessel vent system mist eliminator plugs
3.00E-06 a: responded to and shutdown or repaired within 1 hour
Inadequate flow due to fans or flow control valve failure
2.04E-01 Per Year
Page 5
Operator closes SPT exit vent valve (before condenser)
8.39E-04 a: corrected in 1 week
SPT dilution fails due to undetected cell inlet path failure
3.71E-03 Per Year
Fail to detect/correct inlet HEPA high DP
6.22E-02
High DP switch miscalibrated
3.00E-02 Use TO value
Operator fails to respond to high inlet HEPA alarm
1.00E-02 Use TO value
Inlet HEPA high DP switch fails to close
1.30E-02 a: Checked annually
Inadequate SPT dilution due to cell inlet path failure
7.00E-02 Per Year
LPP inlet HEPA filter valve erroneously closed
8.39E-04 a: corrected in 1 week
LPP cell inlet HEPA plugs
3.00E-06 a: responded to and shutdown or repaired within 1 hour
SPT Explosion
I:\CAFTA\TREE\SPT.CAF
11-08-94
Page 2


HEPAs plug, not corrected
GSPT-15
1.06E-04 Per Year
Page 2
LPP VVH steam tube leaks (moisture high)
HTRLPPVVLKST+
2.40E-06 a: responded to within 8 hours
Failure to detect or respond to HEPA high DP alarm
GSPT-16A
3.99E-02
Operator fails to respond to LPPP VVS HEPA high DP alarm
OPR6846-CSNP#
1.00E-02 Use TC value
Fail to detect HEPA high DP
GSPT-16B
1.70E-04
HEPA filter DP switches miscalibrated
OPR6846-MCH1#
3.00E-02 a: complete dependence
HEPA DP high switch fails to close
PDS6846-FTCT#
1.30E-02 a: Checked annually
HEPA very high DP switch fails to close
PDS6846AFTCT#
1.30E-02 a: Checked annually
SPT Explosion
I:\CAFTA\TREE\SPT.CAF
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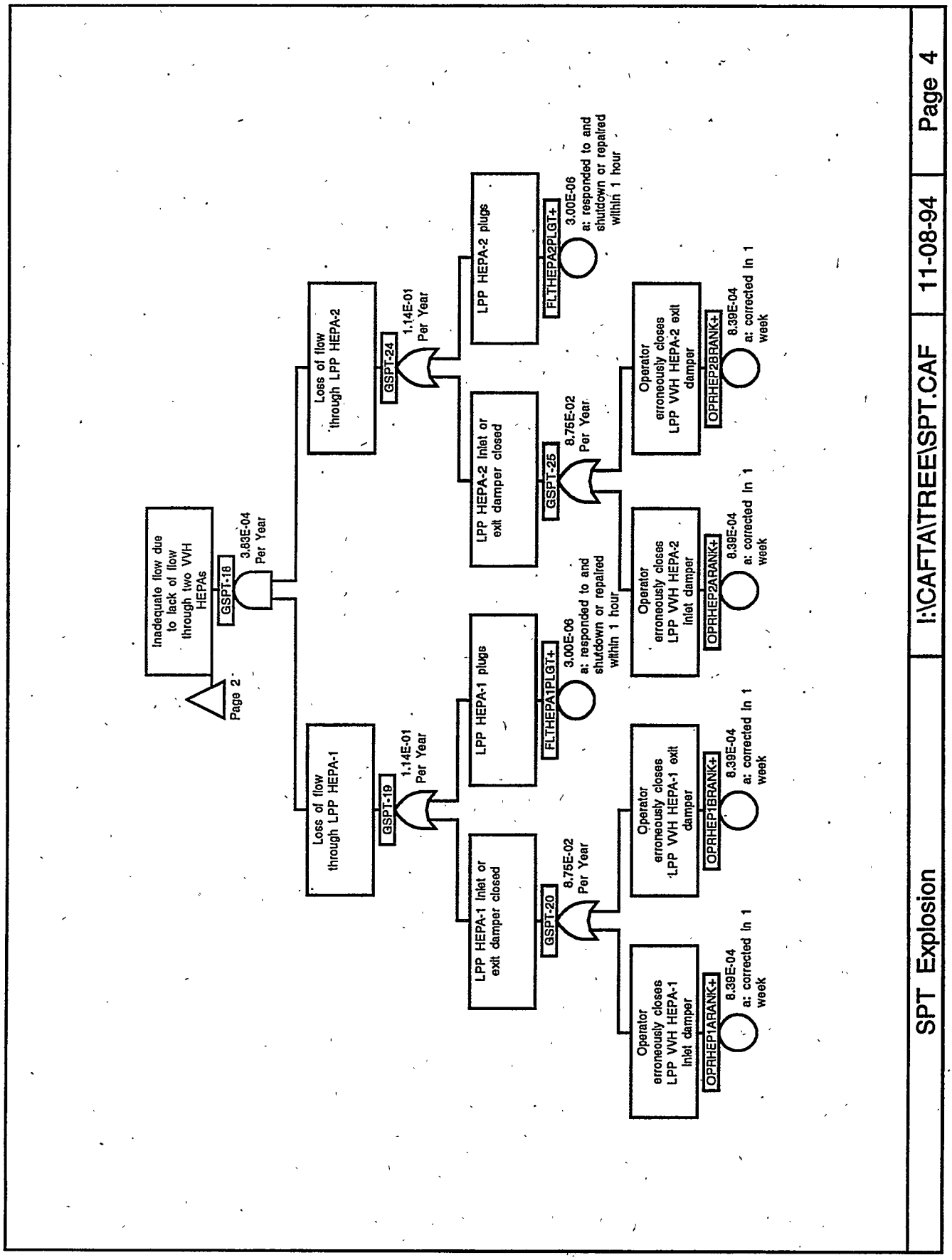
Page 3


Inadequate flow due to lack of flow through two VVH HEPAs
GSPT-18
3.83E-04 Per Year
Page 2
Loss of flow through LPP HEPA-1
GSPT-19
1.14E-01 Per Year
LPP HEPA-1 plugs
FLTHEPA1PLGT+
3.00E-06 a: responded to and shutdown or repaired within 1 hour
LPP HEPA-1 inlet or exit damper closed
GSPT-20
8.75E-02 Per Year
Operator erroneously closes LPP VVH HEPA-1 exit damper
OPRHEP1BRANK+
8.39E-04 a: corrected in 1 week
Operator erroneously closes LPP VVH HEPA-1 inlet damper
OPRHEP1ARANK+
8.39E-04 a: corrected in 1 week
Loss of flow through LPP HEPA-2
GSPT-24
1.14E-01 Per Year
LPP HEPA-2 plugs
FLTHEPA2PLGT+
3.00E-06 a: responded to and shutdown or repaired within 1 hour
LPP HEPA-2 inlet or exit damper closed
GSPT-25
8.75E-02 Per Year
Operator erroneously closes LPP VVH HEPA-2 exit damper
OPRHEP2BRANK+
8.39E-04 a: corrected in 1 week
Operator erroneously closes LPP VVH HEPA-2 inlet damper
OPRHEP2ARANK+
8.39E-04 a: corrected in 1 week
SPT Explosion
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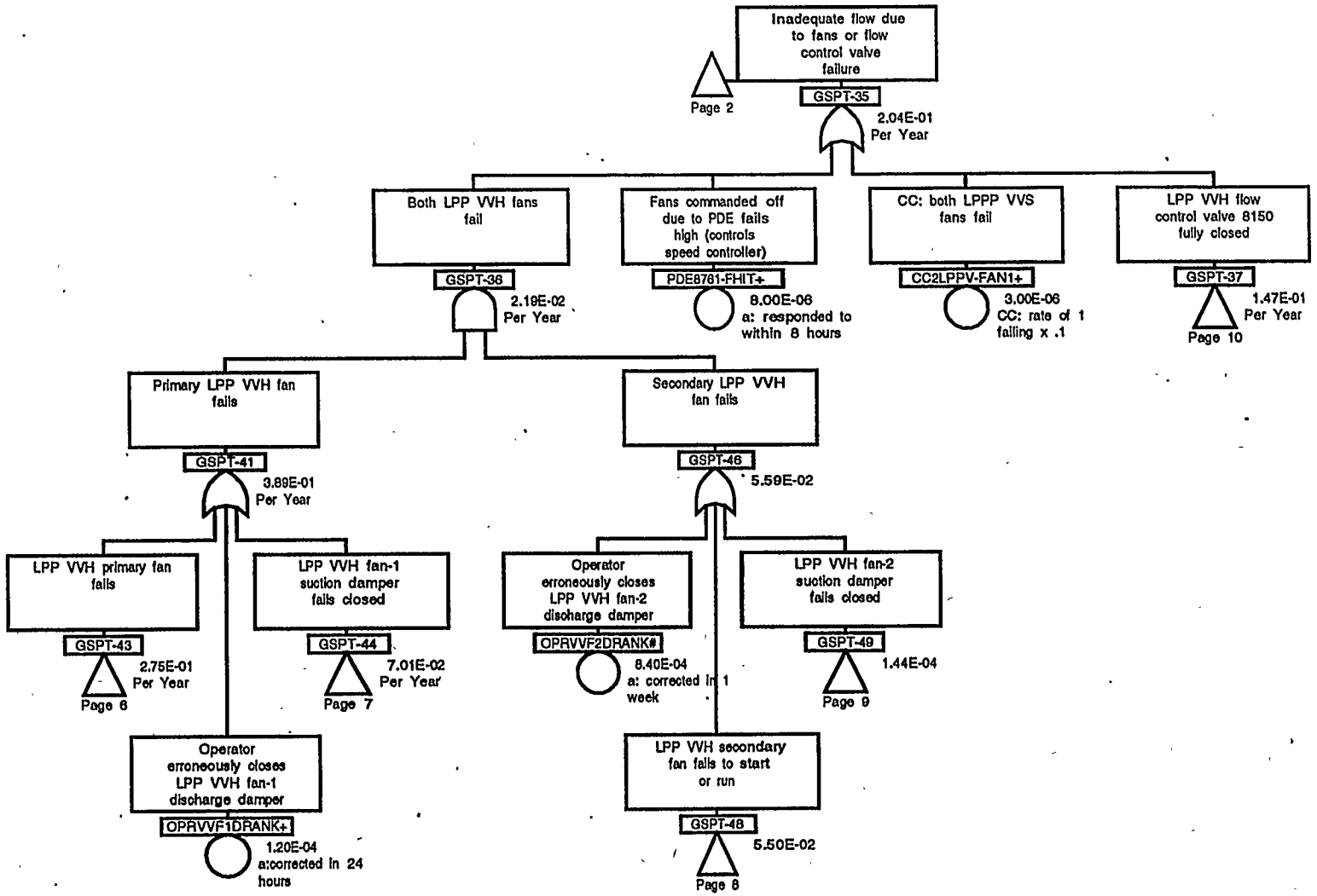
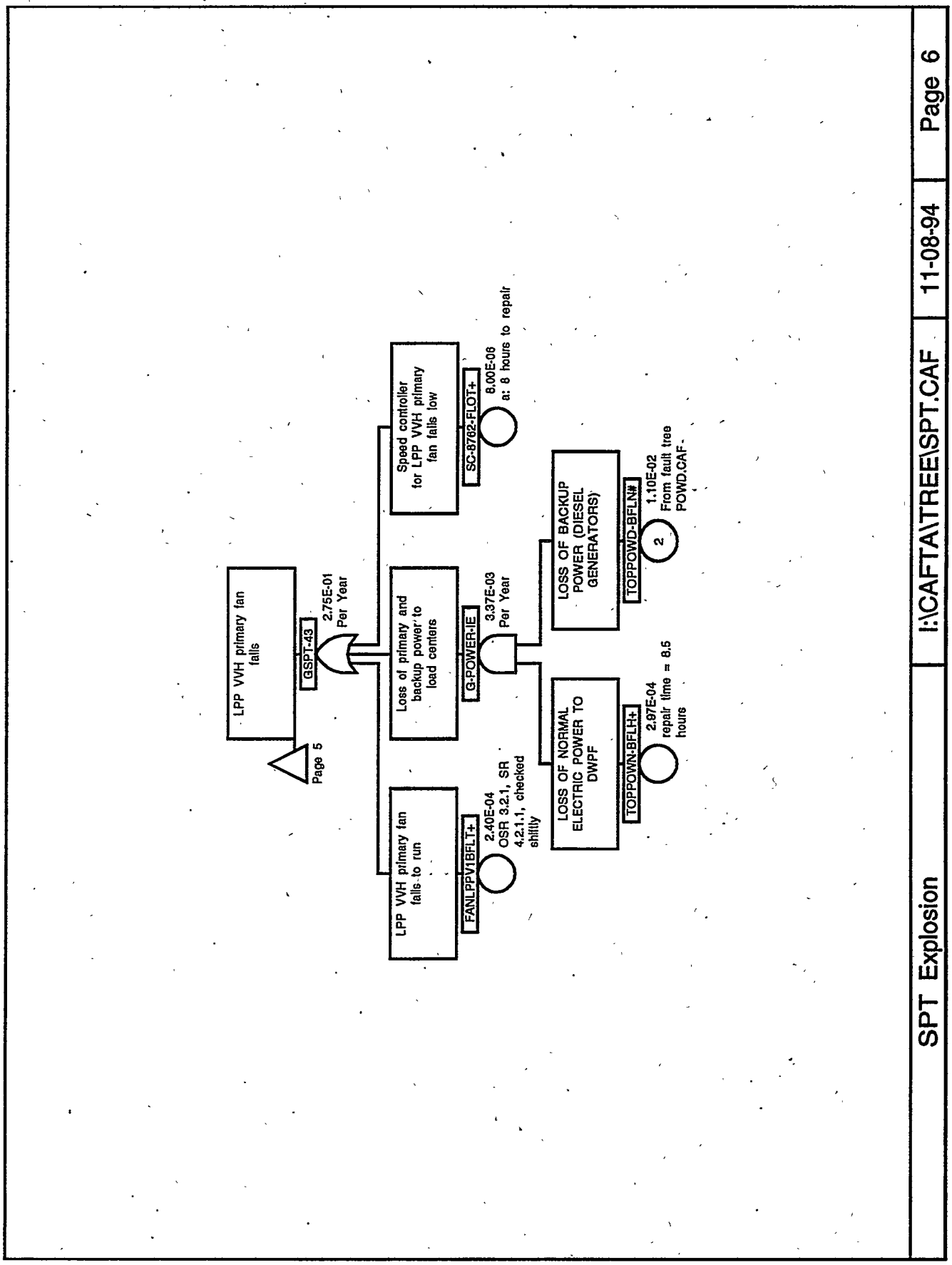
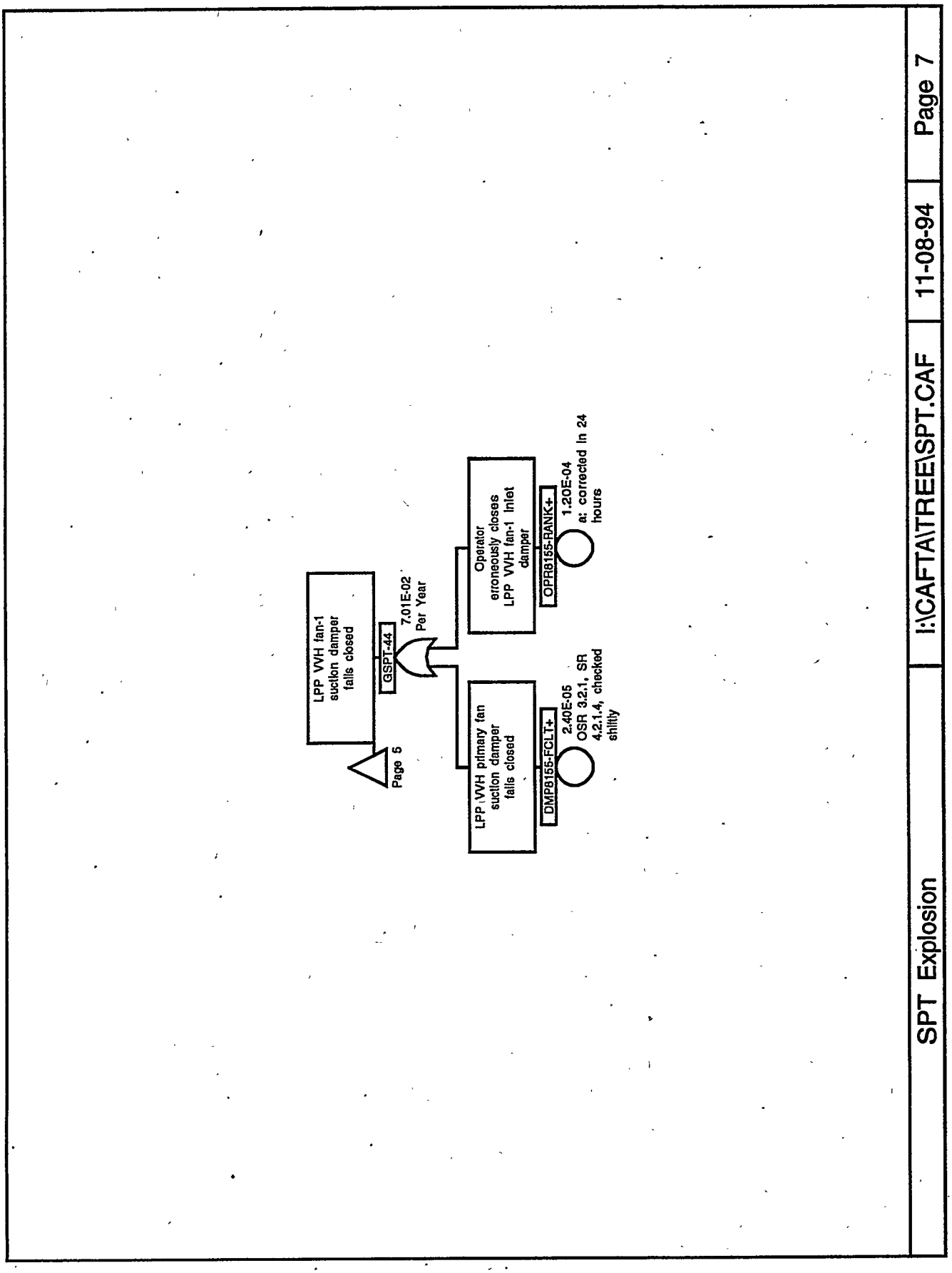


SPT . Explosion	I:\CAFTA\TREE\SPT.CAF	11-08-94	Page 5


SPT Explosion
I:\CAFTA\TREE\SPT.CAF
11-08-94
Page 6
LPP VVH primary fan falls
GSPT-43
2.75E-01 Per Year
Page 5
Loss of primary and backup power to load centers
G-POWER-IE
3.37E-03 Per Year
Speed controller for LPP VVH primary fan falls low
SC-8762-FLOT+
8.00E-06 a: 8 hours to repair
LPP VVH primary fan fails to run
FANLPPV1BFLT+
2.40E-04 OSR 3.2.1, SR 4.2.1.1, checked shfitly
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
2.97E-04 repair time = 8.5 hours
LOSS OF BACKUP POWER (DIESEL GENERATORS)
TOPPOWD-BFLN#
2
1.10E-02 From fault tree POWD.CAF-


LPP VVH fan-1 suction damper falls closed
GSPT-44
7.01E-02 Per Year
Page 6
LPP VVH primary fan suction damper falls closed
DMP8155-FCLT+
2.40E-05 OSR 3.2.1, SR 4.2.1.4, checked shiftly
Operator erroneously closes LPP VVH fan-1 inlet damper
OPR8155-RANK+
1.20E-04 a: corrected in 24 hours
SPT Explosion
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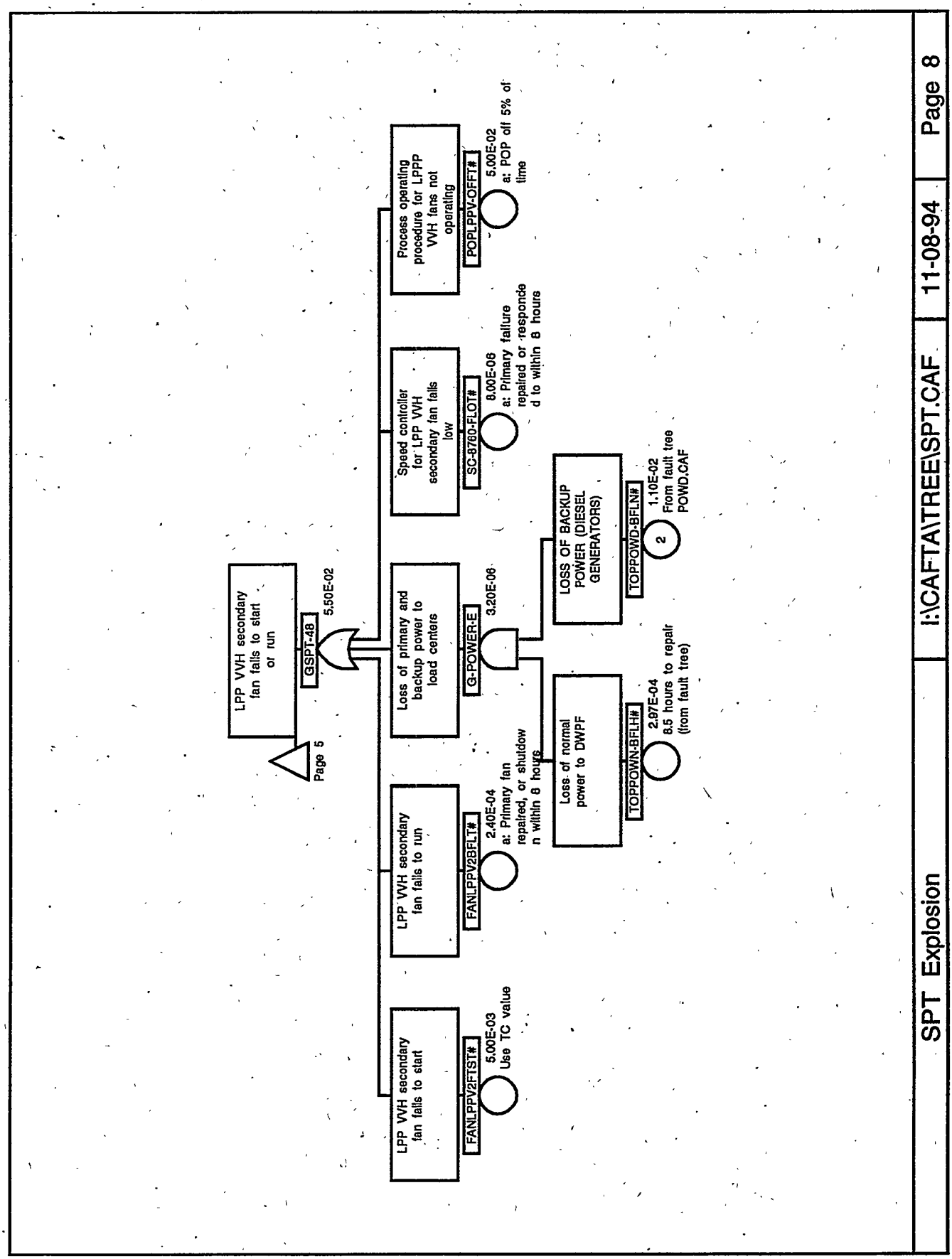
LPP VVH secondary fan falls to start or run
GSPT-48
5.50E-02
Page 5
Loss of primary and backup power to load centers
G-POWER-E
3.20E-06
Speed controller for LPP VVH secondary fan falls low
SC-8760-FLOT#
8.00E-06
a: Primary failure repaired or responde d to within 8 hours
Process operating procedure for LPPP VVH fans not operating
POPLPPV-OFFT#
5.00E-02
a: POP off 5% of time
LPP VVH secondary fan falls to run
FANLPPV2BFLT#
2.40E-04
a: Primary fan repaired, or shutdow n within 8 hours
LPP VVH secondary fan falls to start
FANLPPV2FTST#
5.00E-03
Use TC value
Loss of normal power to DWPF
TOPPOWN-BFLH#
2.97E-04
8.5 hours to repair (from fault tree)
LOSS OF BACKUP POWER (DIESEL GENERATORS)
TOPPOWD-BFLN#
2
1.10E-02
From fault tree POWD.CAF
SPT Explosion
I:\CAFTA\TREE\SPT.CAF
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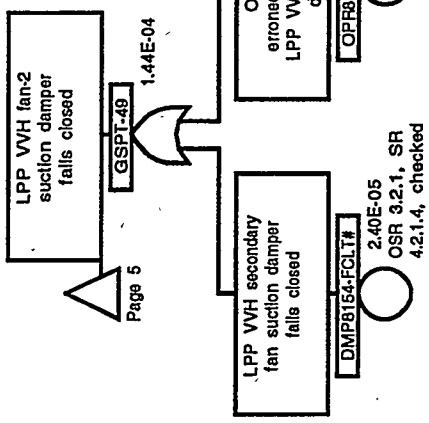
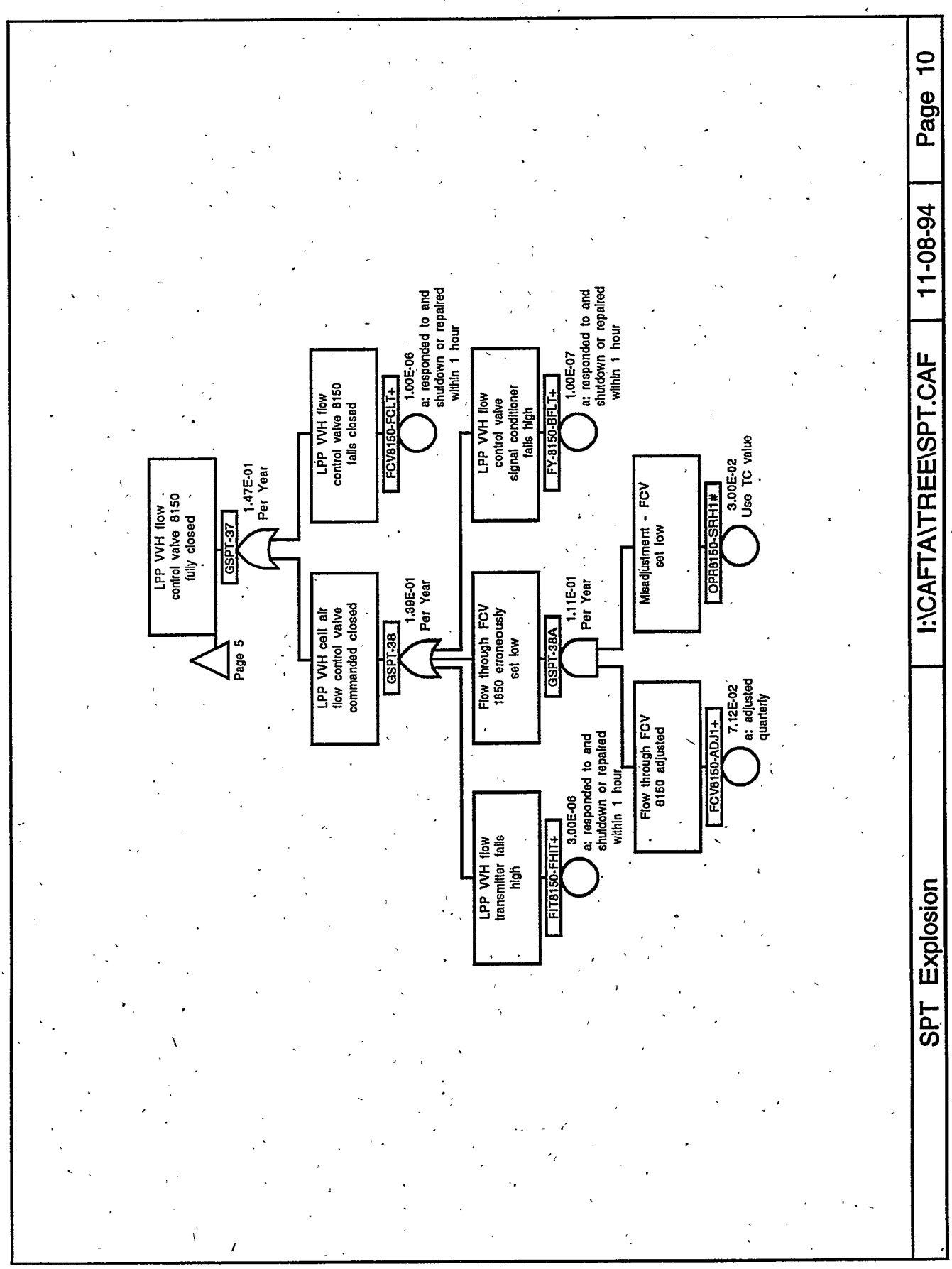


SPT Explosion	I:\CAFTA\TREE\SPT.CAF	11-08-94	Page 9


LPP VVH flow control valve 8150 fully closed
GSPT-37
1.47E-01 Per Year
Page 5
LPP VVH flow control valve 8150 falls closed
FCV8150-FCLT+
1.00E-06 a: responded to and shutdown or repaired within 1 hour
LPP VVH cell air flow control valve commanded closed
GSPT-38
1.39E-01 Per Year
LPP VVH flow control valve signal conditioner fails high
FY-8150-BFLT+
1.00E-07 a: responded to and shutdown or repaired within 1 hour
Flow through FCV 1850 erroneously set low
GSPT-38A
1.11E-01 Per Year
Misadjustment - FCV set low
OPR8150-SRH1#
3.00E-02 Use TC value
LPP VVH flow transmitter falls high
FIT8150-FHIT+
3.00E-06 a: responded to and shutdown or repaired within 1 hour
Flow through FCV 8150 adjusted
FCV8150-ADJ1+
7.12E-02 a: adjusted quarterly
SPT Explosion
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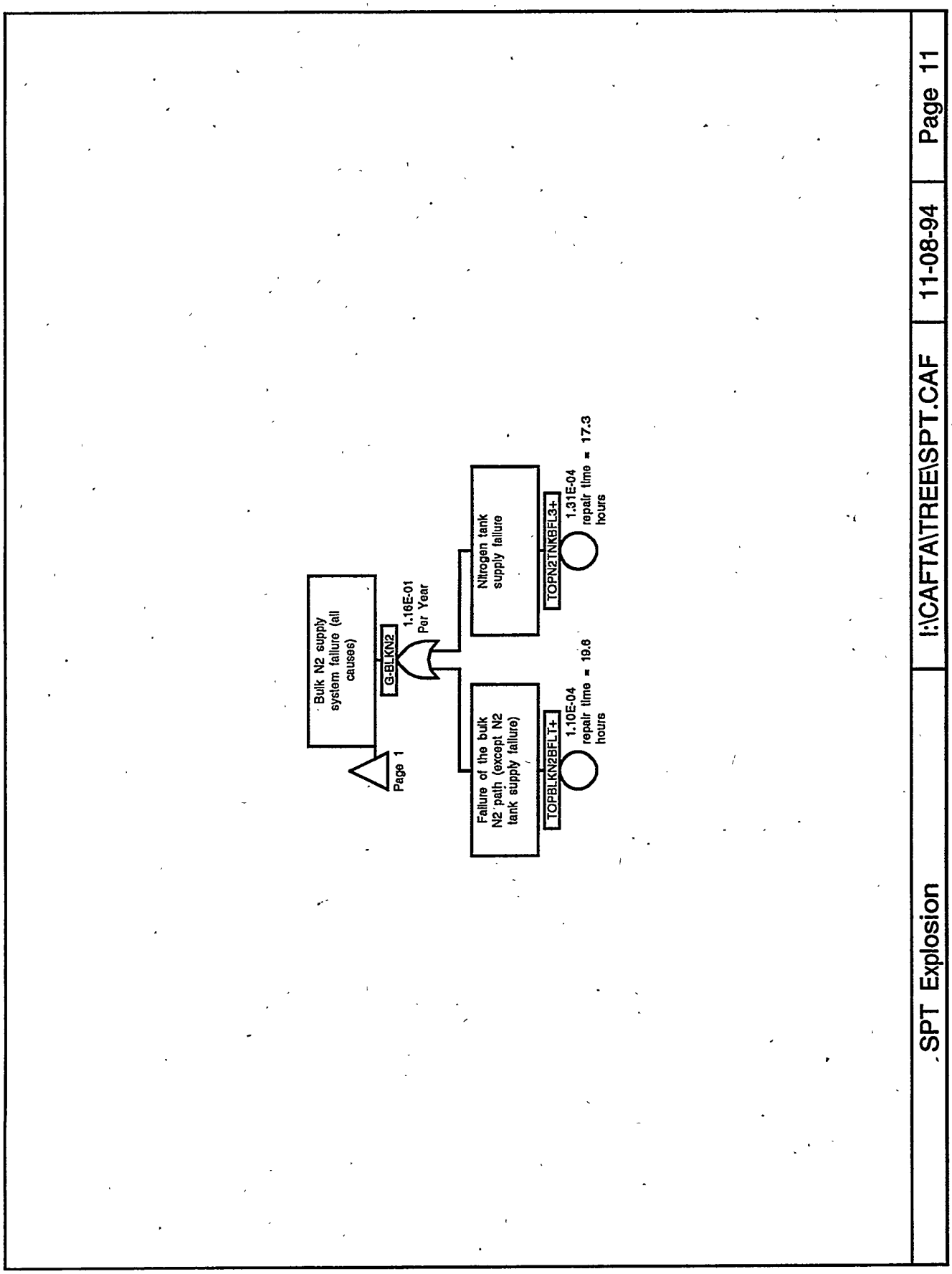
Bulk N2 supply system failure (all causes)
G-BLKN2
1.16E-01 Per Year
Page 1
Failure of the bulk N2 path (except N2 tank supply failure)
TOPBLKN2BFLT+
1.10E-04 repair time = 19.8 hours
Nitrogen tank supply failure
TOPN2TNKBFL3+
1.31E-04 repair time = 17.3 hours
SPT Explosion
I:\CAFTA\TREE\SPT.CAF
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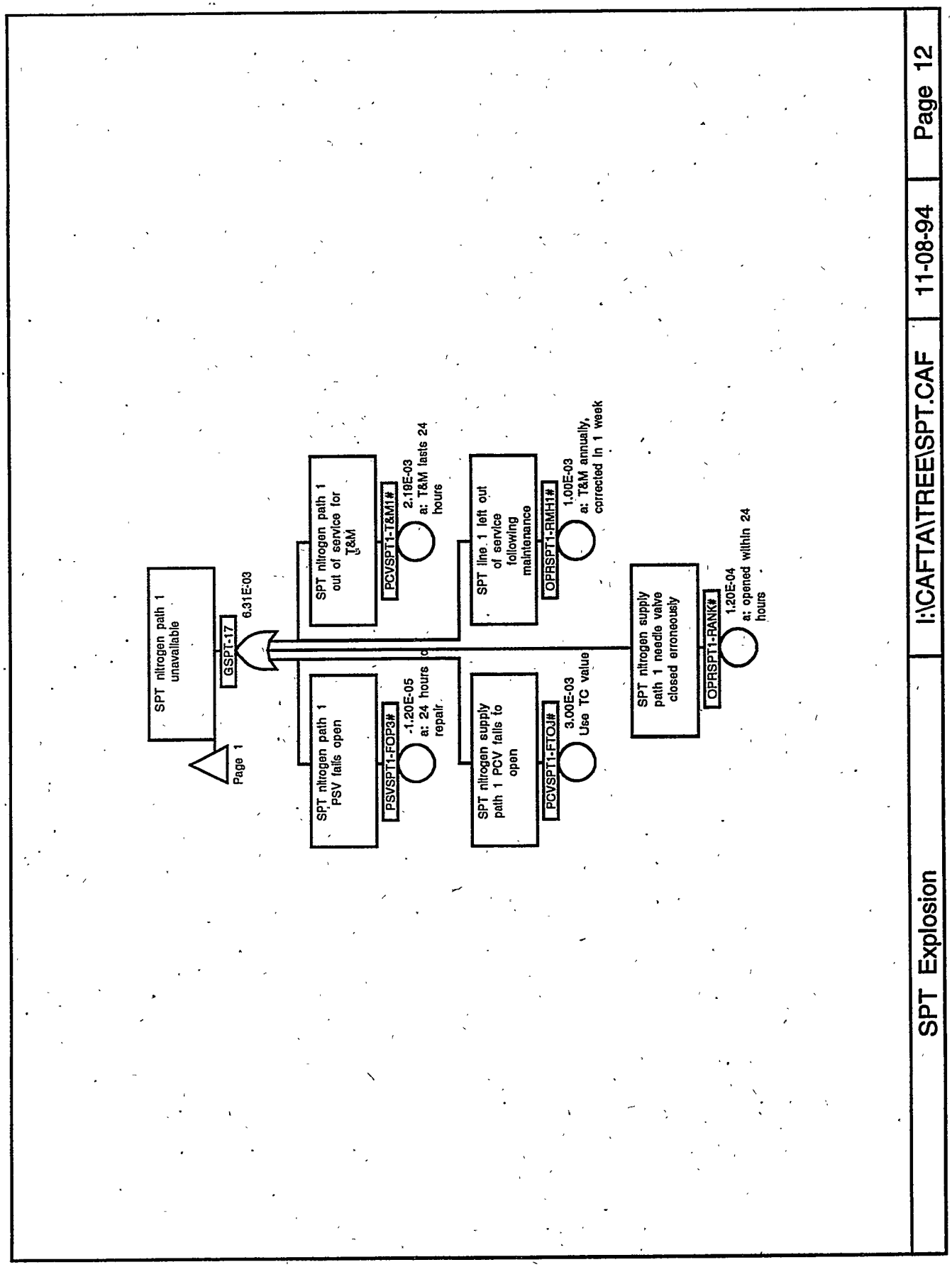
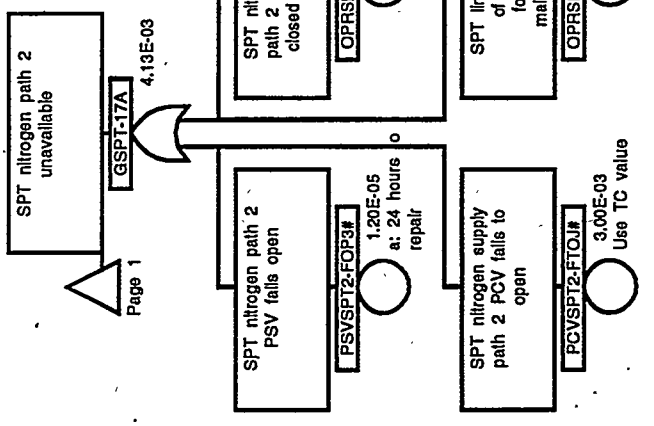

SPT Explosion
I:\CAFTA\TREE\SPT.CAF
11-08-94
Page 12
SPT nitrogen path 1 unavailable
Page 1
GSPT-17
6.31E-03
SPT nitrogen path 1 PSV fails open
PSVSPT1-FOP3#
-1.20E-05
a: 24 hours repair
SPT nitrogen path 1 out of service for T&M
PCVSPT1-T&M1#
2.19E-03
a: T&M lasts 24 hours
SPT nitrogen supply path 1 PCV fails to open
PCVSPT1-FTOJ#
3.00E-03
Use TC value
SPT line 1 left out of service following maintenance
OPRSPT1-RMH1#
1.00E-03
a: T&M annually, corrected in 1 week
SPT nitrogen supply path 1 needle valve closed erroneously
OPRSPT1-RANK#
1.20E-04
a: opened within 24 hours



SPT Explosion	I:\CAFTA\TREE\SPT.CAF	11-08-94	Page 13

Cutsets for I:\CAFTA\CUT\SPT.CSR 11/08/94 12:39 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-SPT					3.17E-07
1.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	1.08E-07
	FCV8150-FOPT+	Low dilution because process cell flow control valve fails open	4	7D 1.0E-06H	1.68E-04	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
2.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	4.11E-08
	FCV8150-ADJ1+	Flow through FCV 8150 adjusted	4	7D 4.0E+00Y	7.12E-02	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8150-SRH1#	Misadjustment - FCV set low	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-MCH1#	PVVH flow transmitter 8155 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
3.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	1.79E-08
	FCV8150-ADJ1+	Flow through FCV 8150 adjusted	4	7D 4.0E+00Y	7.12E-02	
	FT-8155-FLOT#	LPPP VVS flow transmitter fails low	5	1Y 3.0E-06H	1.30E-02	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8150-SRH1#	Misadjustment - FCV set low	1	1N 3.0E-02N	3.00E-02N	
4.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	1.61E-08
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-MCH1#	PVVH flow transmitter 8155 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	OPRCONDVRANK+	Operator erroneously closes LPP condenser drain valve	4	7D 5.0E-06H	8.39E-04	
5.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	1.61E-08
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-MCH1#	PVVH flow transmitter 8155 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	OPRSPTV-RANK+	Operator closes SPT exit vent valve (before condenser)	4	7D 5.0E-06H	8.39E-04	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
6.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	9.70E-09
	FIT8150-FHIT+	LPP VVH flow transmitter fails high	4	1H 3.0E-06H	3.00E-06	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-MCH1#	PVVH flow transmitter 8155 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
7.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	9.70E-09
	FLTHEME-PLGT+	LPP vessel vent system mist eliminator plugs	4	1H 3.0E-06H	3.00E-06	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-MCH1#	PVVH flow transmitter 8155 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
8.	CC2LPPV-FAN1+	CC: both LPPP VVS fans fail	4	1H 3.0E-06H	3.00E-06	9.70E-09
	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-MCH1#	PVVH flow transmitter 8155 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
9.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	7.01E-09
	FT-8155-FLOT#	LPPP VVS flow transmitter fails low	5	1Y 3.0E-06H	1.30E-02	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRSPTV-RANK+	Operator closes SPT exit vent valve (before condenser)	4	7D 5.0E-06H	8.39E-04	
10.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	7.01E-09
	FT-8155-FLOT#	LPPP VVS flow transmitter fails low	5	1Y 3.0E-06H	1.30E-02	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPRCONDVRANK+	Operator erroneously closes LPP condenser drain valve	4	7D 5.0E-06H	8.39E-04	
11.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	6.85E-09

Cutsets for I:\CAFTA\CUT\SPT.CSR 11/08/94 12:39 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	FCV8150-ADJ1+	Flow through FCV 8150 adjusted	4	7D 4.0E+00Y	7.12E-02	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8150-SRH1#	Misadjustment - FCV set low	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-ACN3#	Operator fails to respond to PVV flow low alarm FAL-8155	1	1N 5.0E-03N	5.00E-03N	
12.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	4.85E-09
	FANLPPV1BFLT+	LPP VVH primary fan fails to run	4	8H 3.0E-05H	2.40E-04	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-MCH1#	PVVH flow transmitter 8155 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	POPLPPV-OFFT#	Process operating procedure for LPPP VVH fans not operating	1	1N 5.0E-02N	5.00E-02N	
13.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	4.21E-09
	FLTHEME-PLGT+	LPP vessel vent system mist eliminator plugs	4	1H 3.0E-06H	3.00E-06	
	FT-8155-FLOT#	LPPP VVS flow transmitter fails low	5	1Y 3.0E-06H	1.30E-02	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
14.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	4.21E-09
	FIT8150-FHIT+	LPP VVH flow transmitter fails high	4	1H 3.0E-06H	3.00E-06	
	FT-8155-FLOT#	LPPP VVS flow transmitter fails low	5	1Y 3.0E-06H	1.30E-02	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
15.	CC2LPPV-FAN1+	CC: both LPPP VVS fans fail	4	1H 3.0E-06H	3.00E-06	4.21E-09
	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	
	FT-8155-FLOT#	LPPP VVS flow transmitter fails low	5	1Y 3.0E-06H	1.30E-02	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
16.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	3.23E-09
	FCV8150-FCLT+	LPP VVH flow control valve 8150 fails closed	4	1H 1.0E-06H	1.00E-06	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-MCH1#	PVVH flow transmitter 8155 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
17.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	3.23E-09
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-MCH1#	PVVH flow transmitter 8155 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	PDE8761-PHIT+	Fans commanded off due to PDE fails high (controls speed controller)	4	8H 1.0E-6H	8.00E-06	
18.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	2.69E-09
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-ACN3#	Operator fails to respond to PVV flow low alarm FAL-8155	1	1N 5.0E-03N	5.00E-03N	
	OPRCONDVRANK+	Operator erroneously closes LPP condenser drain valve	4	7D 5.0E-06H	8.39E-04	
19.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	2.69E-09
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-ACN3#	Operator fails to respond to PVV flow low alarm FAL-8155	1	1N 5.0E-03N	5.00E-03N	
	OPRSPTV-RANK+	Operator closes SPT exit vent valve (before condenser)	4	7D 5.0E-06H	8.39E-04	
20.	FCV8150-FOPT+	Low dilution because process cell flow control valve fails open	4	7D 1.0E-06H	1.68E-04	2.36E-09
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	PCVSPT1-FTOJ#	SPT nitrogen supply path 1 PCV fails to open	1	1N 3.0E-03N	3.00E-03N	
	PCVSPT2-FTOJ#	SPT nitrogen supply path 2 PCV fails to open	1	1N 3.0E-03N	3.00E-03N	
21.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	2.10E-09

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	FANLPPV1BFLT+	LPP VVH primary fan fails to run	4	8H 3.0E-05H	2.40E-04	
	FT-8155-FLOT#	LPPP VVS flow transmitter fails low	5	1Y 3.0E-06H	1.30E-02	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	POPLPPV-OFFT#	Process operating procedure for LPPP VVH fans not operating	1	1N 5.0E-02N	5.00E-02N	
22.	FCV8150-FOPT+	Low dilution because process cell flow control valve fails open	4	7D 1.0E-06H	1.68E-04	1.73E-09
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	PCVSPT1-T&M1#	SPT nitrogen path 1 out of service for T&M	3	48H 4.0E-01Y	2.19E-03	
	PCVSPT2-FTOJ#	SPT nitrogen supply path 2 PCV fails to open	1	1N 3.0E-03N	3.00E-03N	
23.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	1.62E-09
	FIT8150-FHIT+	LPP VVH flow transmitter fails high	4	1H 3.0E-06H	3.00E-06	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-ACN3#	Operator fails to respond to PVV flow low alarm FAL-8155	1	1N 5.0E-03N	5.00E-03N	
24.	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	1.62E-09
	FLTHEME-PLGT+	LPP vessel vent system mist eliminator plugs	4	1H 3.0E-06H	3.00E-06	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-ACN3#	Operator fails to respond to PVV flow low alarm FAL-8155	1	1N 5.0E-03N	5.00E-03N	
25.	CC2LPPV-FAN1+	CC: both LPPP VVS fans fail	4	1H 3.0E-06H	3.00E-06	1.62E-09
	CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	1	1N 4.1E-04N	4.10E-04N	
	IGNSPT--PRE1#	Ignition source present in SPT vessel	1	1N 3.0E-02N	3.00E-02N	
	OPR8155-ACN3#	Operator fails to respond to PVV flow low alarm FAL-8155	1	1N 5.0E-03N	5.00E-03N	

Explosion in LPPP Sludge Pump Tank (SPT) Top Event Frequency: 3.18E-07/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
FCV8150-FOPT+-I	Low dilution because process cell FCV fails open	1.00E-06/H	3.61E+05
OPRCONDVRANK+-I	Operator erroneously closes LPP condenser drain valve	4.99E-06/H	1.73E+04
OPRSPTV-RANK+-I	Operator closes SPT exit vent valve (before condenser)	4.99E-06/H	1.73E+04
PDE8761-FHIT+-I	Fans commanded off due to PDE fails high	1.00E-06/H	1.73E+04
CC2LPPV-FAN1+-I	CC: both LPPP VVS fans fail	3.00E-06/H	1.73E+04
FIT8150-FHIT+-I	LPP VVH flow transmitter fails high	3.00E-06/H	1.73E+04
FLTHEME-PLGT+-I	LPP vessel vent system mist eliminator plugs	3.00E-06/H	1.73E+04
FCV8150-FCLT+-I	LPP VVH flow control valve 8150 fails closed	1.00E-06/H	1.71E+04
FY-8150-BFLT+-I	LPP VVH flow control valve signal conditioner fails high	1.00E-07/H	1.63E+04
CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	4.10E-04	2.30E+03
FANLPPV1BFLT+-I	LPP VVH primary fan fails to run	3.00E-05/H	9.72E+02
OPRVVF1DRANK+-I	Erroneaous closure of LPP VVH fan-1 discharge damper	5.00E-06/H	9.70E+02
OPR8155-RANK+-I	Operator erroneously closes LPP VVH fan-1 inlet damper	5.00E-06/H	9.70E+02
DMP8155-FCLT+-I	LPP VVH primary fan suction damper fails closed	3.00E-06/H	9.61E+02
SC-8762-FLOT+-I	Speed controller for LPP VVH primary fan fails low	1.00E-06/H	9.44E+02
OPRHEP-VRANK+-I	LPP inlet HEPA filter valve erroneously closed	4.99E-06/H	9.19E+02
FLTLPPH1PLGT+-I	LPP cell inlet HEPA plugs	3.00E-06/H	8.64E+02
HTRLPPVVLKST+-I	LPP VVH steam tube leaks (moisture high)	3.00E-07/H	6.52E+02
FCV8150-ADJ1+-I	Flow through FCV 8150 adjusted	4.24E-04/H	5.20E+02
TOPPOWN-BFLH+-I	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	1.91E+02
IGNSPT--PRE1#	Ignition source present in SPT vessel	3.00E-02	3.34E+01
OPRHEP2ARANK+-IC	Operator closes LPP VVH HEPA-2 inlet damper	4.99E-06/H	2.98E+01
OPRHEP1BRANK+-IC	Operator erroneously closes LPP VVH HEPA-1 exit damper	4.99E-06/H	2.98E+01
OPRHEP1ARANK+-IC	Operator closes LPP VVH HEPA-1 inlet damper	4.99E-06/H	2.98E+01
OPRHEP2BRANK+-IC	Operator erroneously closes LPP VVH HEPA-2 exit damper	4.99E-06/H	2.98E+01
PCVSPT2-FTOJ#	SPT nitrogen supply path 2 PCV fails to open	3.00E-03	1.53E+01
OPRSPT2-RMH1#	SPT line 2 left out of service following maintenance	1.00E-03	1.51E+01
OPR8155-ACN3#	Operator fails to respond to PVV flow low alarm FAL-8155	5.00E-03	1.43E+01
FT-8155-FLOT#	LPPP VVS flow transmitter fails low	1.30E-02	1.42E+01
OPR8155-MCH1#	PVVH flow transmitter 8155 miscalibrated	3.00E-02	1.40E+01
OPRSPT2-RANK#	SPT nitrogen supply path 2 needle valve closed erroneously	1.20E-04	1.26E+01
PSVSPT2-FOP3#	SPT nitrogen path 2 PSV fails open	1.20E-05	1.20E+01
PCVSPT1-FTOJ#	SPT nitrogen supply path 1 PCV fails to open	3.00E-03	1.04E+01
PCVSPT1-T&M1#	SPT nitrogen path 1 out of service for T&M	2.19E-03	1.03E+01
OPRSPT1-RMH1#	SPT line 1 left out of service following maintenance	1.00E-03	1.03E+01
OPRSPT1-RANK#	SPT nitrogen supply path 1 needle valve closed erroneously	1.20E-04	8.58E+00
PSVSPT1-FOP3#	SPT nitrogen path 1 PSV fails open	1.20E-05	8.16E+00
OPR8150-SRH1#	Misadjustment - FCV set low	3.00E-02	8.13E+00
TOPBLKN2BFLT#	Bulk N2 path unavailable	1.10E-04	2.22E+00
TOPN2TNKBFL3#	Bulk nitrogen tank supply failure	1.31E-04	2.22E+00
FANLPPV2FTST#	LPP VVH secondary fan fails to start	5.00E-03	1.75E+00
OPRVVF2DRANK#	Operator closes LPP VVH fan-2 discharge damper	8.40E-04	1.73E+00
POPLPPV-OFFT#	POP for LPPP VVH fans not operating	5.00E-02	1.72E+00
FANLPPV2BFLT#	LPP VVH secondary fan fails to run	2.40E-04	1.68E+00
OPR8154-RANK#	Operator erroneously closes LPP VVH fan-2 inlet damper	1.20E-04	1.66E+00
TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1.10E-02	1.60E+00
TOPLPPN2BFLJ#	LPPP local N2 supply unavailable	5.30E-04	1.55E+00
DMP8154-FCLT#	LPP VVH secondary fan suction damper fails closed	2.40E-05	1.41E+00
OPR8152-CSNP#	Operator fails to respond to high inlet HEPA alarm	1.00E-02	1.13E+00
PDS8152-FTCT#	Inlet HEPA high DP switch fails to close	1.30E-02	1.13E+00
OPR8152-MCH1#	High DP switch miscalibrated	3.00E-02	1.13E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) x (risk achievement worth).

Explosion in LPPP Sludge Pump Tank (SPT) Top Event Frequency: 3.18E-07/YR

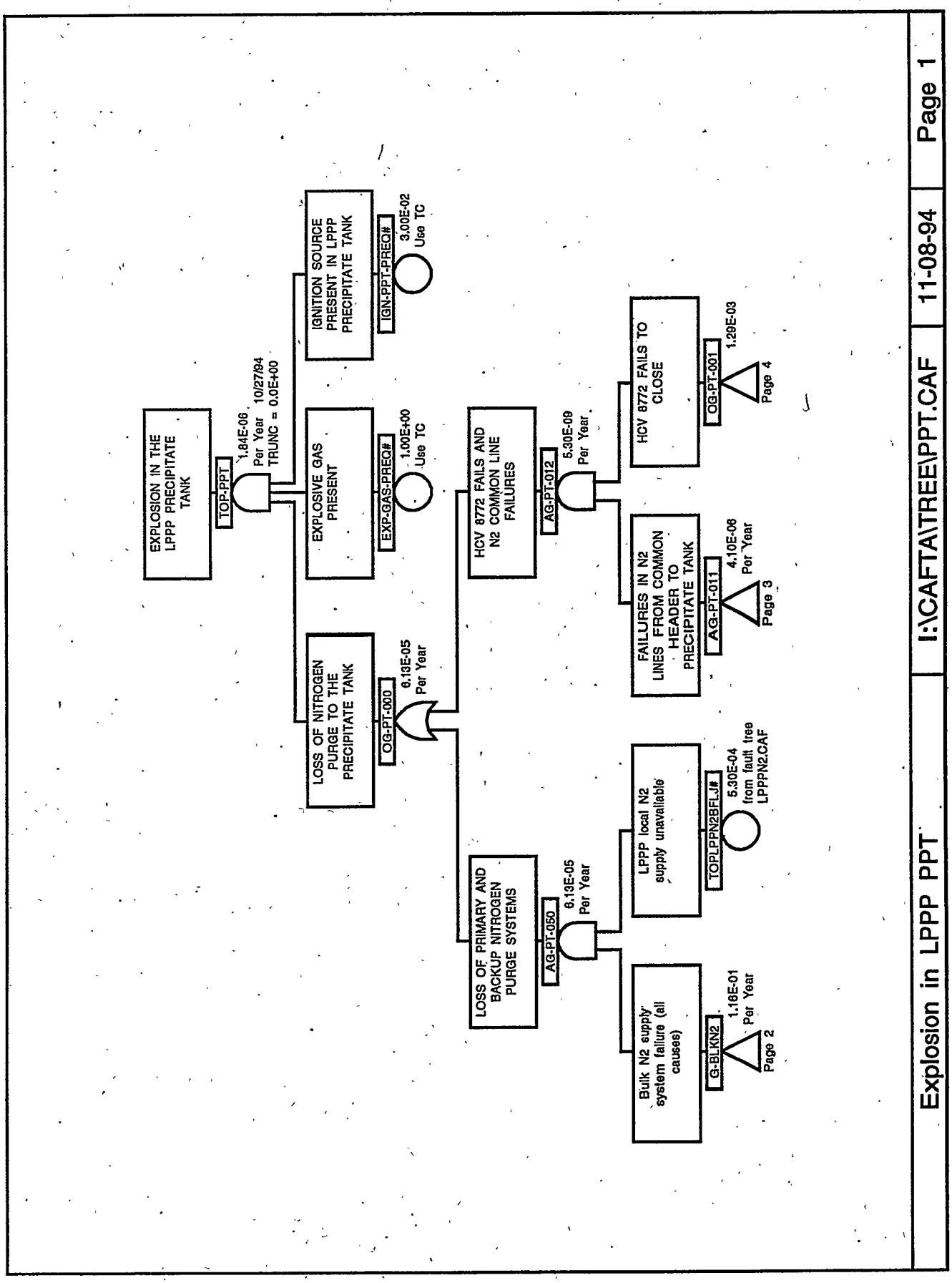
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
*IGNSPT--PRE1#	Ignition source present in SPT vessel	3.00E-02	0.00E+00
CC2SPTN2LINJ#	cc: both SPT N2 supply lines fail	4.10E-04	1.77E+01
OPR8155-MCH1#	PVVH flow transmitter 8155 miscalibrated	3.00E-02	1.67E+00
FCV8150-FOPT+-I	Low dilution because process cell FCV fails open	1.00E-06/H	1.56E+00
FCV8150-ADJ1+-I	Flow through FCV 8150 adjusted	4.24E-04/H	1.28E+00
OPR8150-SRH1#	Misadjustment - FCV set low	3.00E-02	1.28E+00
FT-8155-FLOT#	LPPP VVS flow transmitter fails low	1.30E-02	1.21E+00
OPRSPTV-RANK+-I	Operator closes SPT exit vent valve (before condenser)	4.99E-06/H	1.09E+00
OPRCONDVRANK+-I	Operator erroneously closes LPP condenser drain valve	4.99E-06/H	1.09E+00
OPR8155-ACN3#	Operator fails to respond to PVV flow low alarm FAL-8155	5.00E-03	1.07E+00
FLTHEME-PLGT+-I	LPP vessel vent system mist eliminator plugs	3.00E-06/H	1.05E+00
FIT8150-FHIT+-I	LPP VVH flow transmitter fails high	3.00E-06/H	1.05E+00
CC2LPPV-FAN1+-I	CC: both LPPP VVS fans fail	3.00E-06/H	1.05E+00
PCVSPT2-FTOJ#	SPT nitrogen supply path 2 PCV fails to open	3.00E-03	1.05E+00
POPLPPV-OFFT#	POP for LPPP VVH fans not operating	5.00E-02	1.04E+00
FANLPPV1BFLT+-I	LPP VVH primary fan fails to run	3.00E-05/H	1.03E+00
PCVSPT1-FTOJ#	SPT nitrogen supply path 1 PCV fails to open	3.00E-03	1.03E+00
PCVSPT1-T&M1#	SPT nitrogen path 1 out of service for T&M	2.19E-03	1.02E+00
PDE8761-FHIT+-I	Fans commanded off due to PDE fails high	1.00E-06/H	1.02E+00
FCV8150-FCLT+-I	LPP VVH flow control valve 8150 fails closed	1.00E-06/H	1.02E+00
OPRSPT2-RMH1#	SPT line 2 left out of service following maintenance	1.00E-03	1.01E+00

* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included. Modified top event frequency = (top event frequency) / (risk reduction worth).

LPPP PPT Explosion


EXPLOSION IN THE LPPP PRECIPITATE TANK
TOP-PPT
1.84E-06 Per Year 10/27/94 TRUNC = 0.0E+00
LOSS OF NITROGEN PURGE TO THE PRECIPITATE TANK
OG-PT-000
6.13E-05 Per Year
EXPLOSIVE GAS PRESENT
EXP-GAS-PREQ#
1.00E+00 Use TC
IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK
IGN-PPT-PREQ#
3.00E-02 Use TC
LOSS OF PRIMARY AND BACKUP NITROGEN PURGE SYSTEMS
AG-PT-050
6.13E-05 Per Year
Bulk N2 supply system failure (all causes)
G-BLKN2
1.16E-01 Per Year
Page 2
LPPP local N2 supply unavailable
TOPLPPN2BFL/#
5.30E-04 from fault tree LPPPN2.CAF
HCV 8772 FAILS AND N2 COMMON LINE FAILURES
AG-PT-012
5.30E-09 Per Year
FAILURES IN N2 LINES FROM COMMON HEADER TO PRECIPITATE TANK
AG-PT-011
4.10E-06 Per Year
Page 3
HCV 8772 FAILS TO CLOSE
OG-PT-001
1.29E-03
Page 4
Explosion in LPPP PPT
I:\CAFTA\TREE\PPT.CAF
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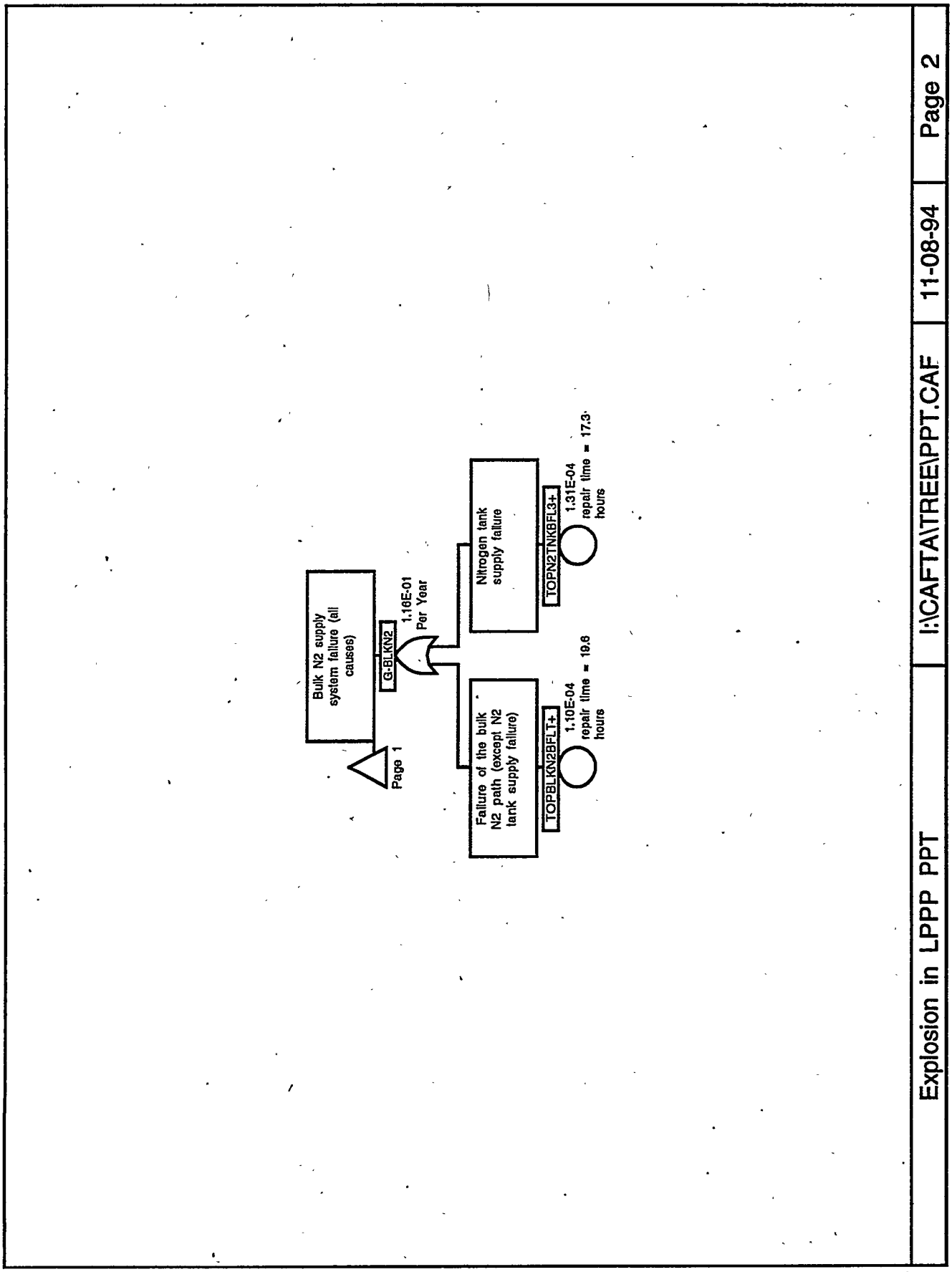
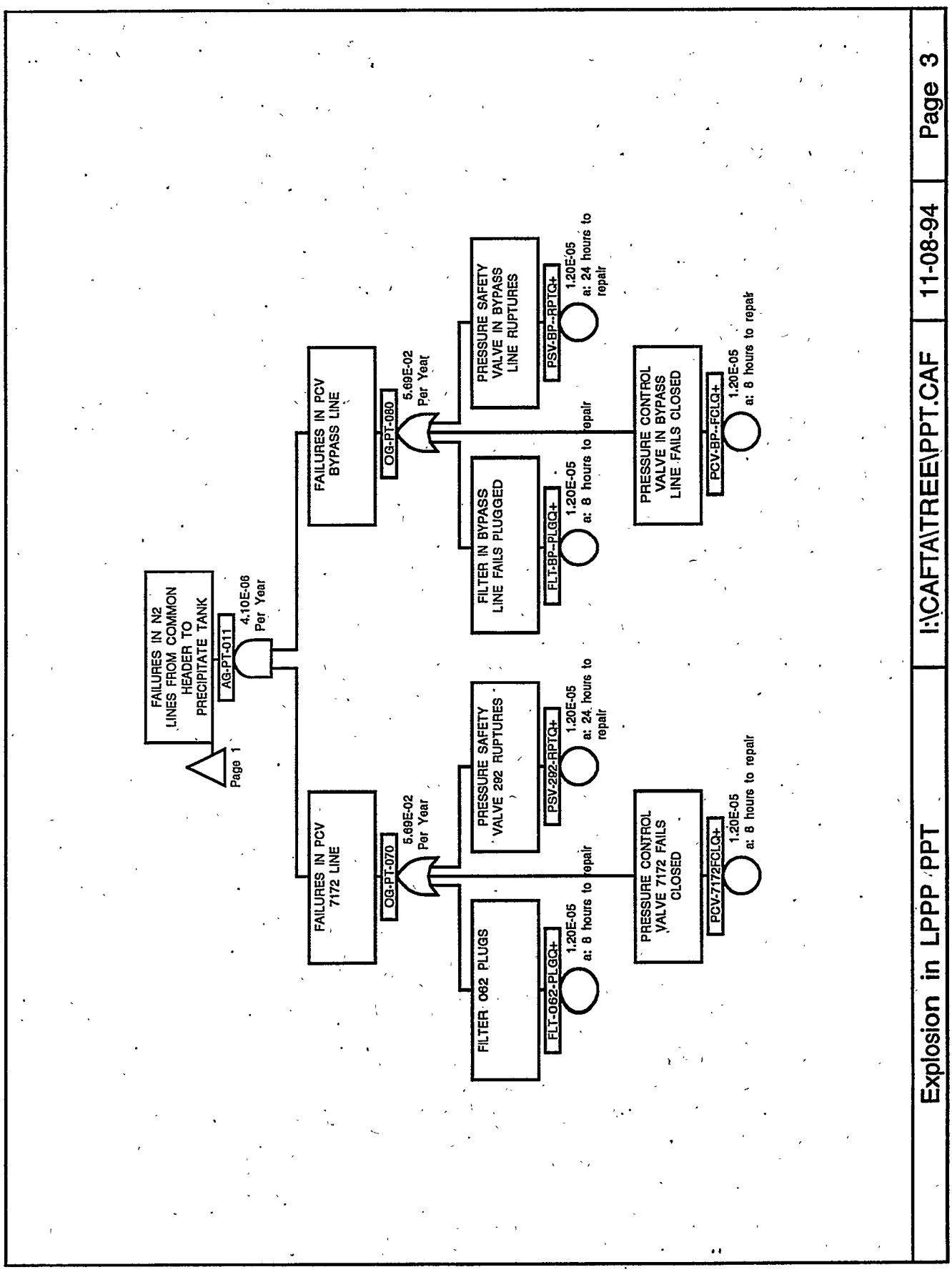
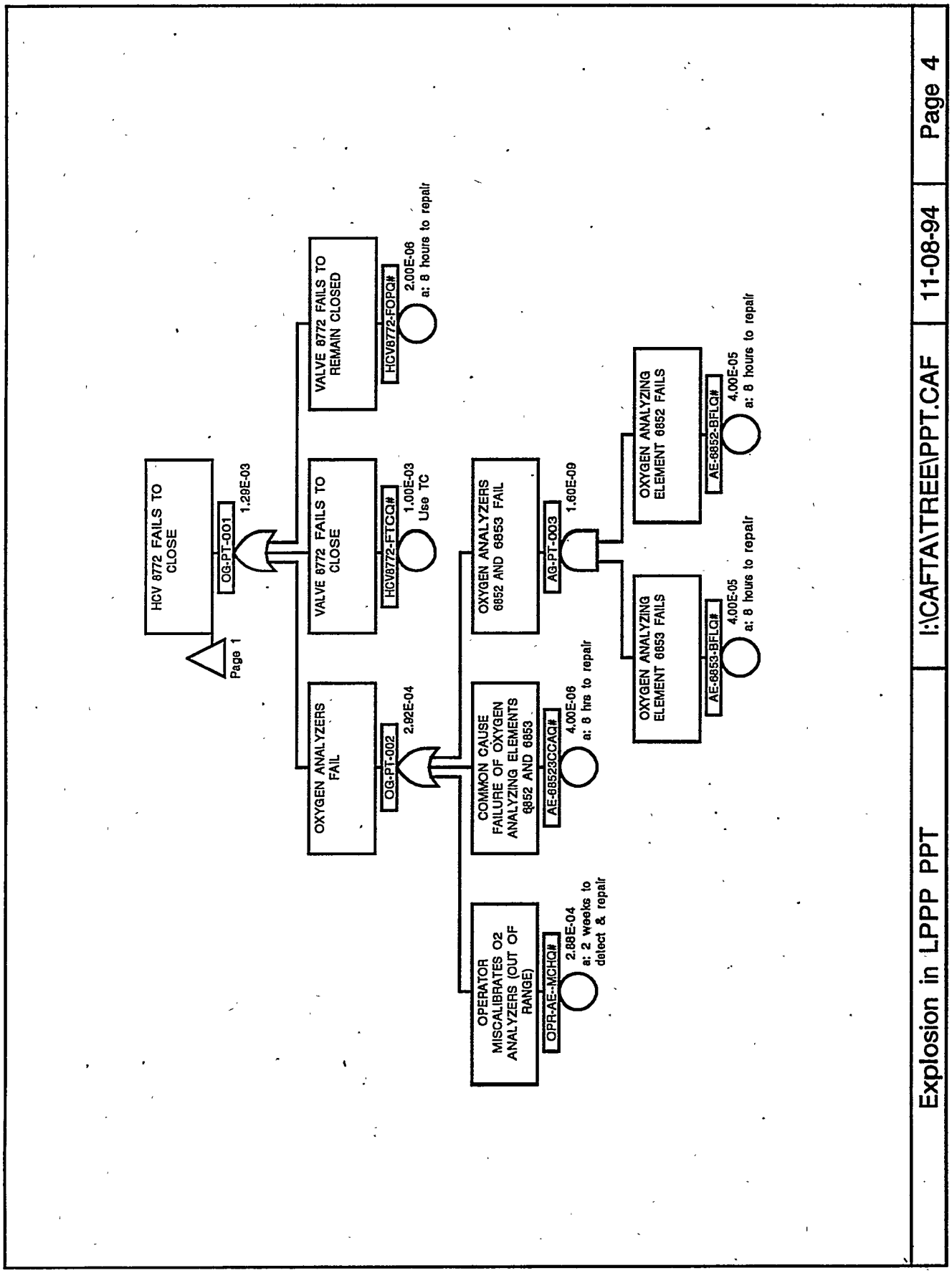
Page 1


Bulk N2 supply system failure (all causes)
G-BLKN2
1.16E-01 Per Year
Page 1
Failure of the bulk N2 path (except N2 tank supply failure)
TOPBLKN2BFLT+
1.10E-04 repair time = 19.6 hours
Nitrogen tank supply failure
TOPN2TNKBFL3+
1.31E-04 repair time = 17.3 hours
Explosion in LPPP PPT
I:\CAFTA\TREE\PPT.CAF
11-08-94
Page 2


Explosion in LPPP PPT
I:\CAFTA\TREE\PPT.CAF
11-08-94
Page 3
FAILURES IN N2 LINES FROM COMMON HEADER TO PRECIPITATE TANK
Page 1
AG-PT-011
4.10E-06 Per Year
FAILURES IN PCV 7172 LINE
OG-PT-070
5.69E-02 Per Year
FILTER 062 PLUGS
FLT-062-PLGQ+
1.20E-05 a: 8 hours to repair
PRESSURE SAFETY VALVE 292 RUPTURES
PSV-292-RPTQ+
1.20E-05 a: 24 hours to repair
PRESSURE CONTROL VALVE 7172 FAILS CLOSED
PCV-7172FCLQ+
1.20E-05 a: 8 hours to repair
FAILURES IN PCV BYPASS LINE
OG-PT-080
5.69E-02 Per Year
FILTER IN BYPASS LINE FAILS PLUGGED
FLT-BP--PLGQ+
1.20E-05 a: 8 hours to repair
PRESSURE SAFETY VALVE IN BYPASS LINE RUPTURES
PSV-BP--RPTQ+
1.20E-05 a: 24 hours to repair
PRESSURE CONTROL VALVE IN BYPASS LINE FAILS CLOSED
PCV-BP--FCLQ+
1.20E-05 a: 8 hours to repair


HCV 8772 FAILS TO CLOSE
OG-PT-001
1.29E-03
Page 1
VALVE 8772 FAILS TO REMAIN CLOSED
HCV8772-FOPQ#
2.00E-06
a: 8 hours to repair
VALVE 8772 FAILS TO CLOSE
HCV8772-FTCQ#
1.00E-03
Use TC
OXYGEN ANALYZERS FAIL
OG-PT-002
2.92E-04
OXYGEN ANALYZERS 6852 AND 6853 FAIL
AG-PT-003
1.60E-09
COMMON CAUSE FAILURE OF OXYGEN ANALYZING ELEMENTS 6852 AND 6853
AE-68523CCAQ#
4.00E-06
a: 8 hrs to repair
OXYGEN ANALYZING ELEMENT 6852 FAILS
AE-6852-BFLQ#
4.00E-05
a: 8 hours to repair
OXYGEN ANALYZING ELEMENT 6853 FAILS
AE-6853-BFLQ#
4.00E-05
a: 8 hours to repair
OPERATOR MISCALIBRATES O2 ANALYZERS (OUT OF RANGE)
OPR-AE-MCHQ#
2.88E-04
a: 2 weeks to detect & repair
Explosion in LPPP PPT
I:\CAFTA\TREE\PPT.CAF
11-08-94
Page 4

Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
AE-6852-BFLQ#	4										
AE-68523CCAQ#	4										
AE-6853-BFLQ#	4										
AG-PT-003	4										
AG-PT-011	1										
AG-PT-011	3										
AG-PT-012	1										
AG-PT-050	1										
EXP-GAS-PREQ#	1										
FLT-062-PLGQ+	3										
FLT-BP--PLGQ+	3										
G-BLKN2	1										
G-BLKN2	2										
HCV8772-FOPQ#	4										
HCV8772-FTCQ#	4										
IGN-PPT-PREQ#	1										
OG-PT-000	1										
OG-PT-001	1										
OG-PT-001	4										
OG-PT-002	4										
OG-PT-070	3										
OG-PT-080	3										
OPR-AE--MCHQ#	4										
PCV-7172FCLQ+	3										
PCV-BP--FCLQ+	3										
PSV-292-RPTQ+	3										
PSV-BP--RPTQ+	3										
TOP-PPT	1										
TOPBLKN2BFLT+	2										
TOPLPPN2BFLJ#	1										
TOPN2TNKBFL3+	2										

Cutsets for I:\CAFTA\CUT\PPT.CSR 11/08/94 12:41 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-PPT					1.84E-06
1.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	1.07E-06
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	TOPLPPN2BFLJ#	LPPP local N2 supply unavailable	1	1N 5.3E-04N	5.30E-04N	
	TOPN2TNKBFL3+	Nitrogen tank supply failure	4	17H 7.7E-06H	1.31E-04	
2.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	7.66E-07
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	TOPBLKN2BFLT+	Failure of the bulk N2 path (except N2 tank supply failure)	4	20H 5.5E-06H	1.10E-04	
	TOPLPPN2BFLJ#	LPPP local N2 supply unavailable	1	1N 5.3E-04N	5.30E-04N	
3.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	1.89E-11
	FLT-062-PLGQ+	FILTER 062 PLUGS	4	4H 3.0E-06H	1.20E-05	
	HCV8772-FTCQ#	VALVE 8772 FAILS TO CLOSE	1	1N 1.0E-03N	1.00E-03N	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	PCV-BP--FCLQ+	PRESSURE CONTROL VALVE IN BYPASS LINE FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
4.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	1.89E-11
	FLT-062-PLGQ+	FILTER 062 PLUGS	4	4H 3.0E-06H	1.20E-05	
	FLT-BP--PLGQ+	FILTER IN BYPASS LINE FAILS PLUGGED	4	4H 3.0E-06H	1.20E-05	
	HCV8772-FTCQ#	VALVE 8772 FAILS TO CLOSE	1	1N 1.0E-03N	1.00E-03N	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
5.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	1.89E-11
	FLT-BP--PLGQ+	FILTER IN BYPASS LINE FAILS PLUGGED	4	4H 3.0E-06H	1.20E-05	
	HCV8772-FTCQ#	VALVE 8772 FAILS TO CLOSE	1	1N 1.0E-03N	1.00E-03N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	PCV-7172FCLQ+	PRESSURE CONTROL VALVE 7172 FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
6.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	1.89E-11
	HCV8772-FTCQ#	VALVE 8772 FAILS TO CLOSE	1	1N 1.0E-03N	1.00E-03N	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	PCV-7172FCLQ+	PRESSURE CONTROL VALVE 7172 FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
	PCV-BP--FCLQ+	PRESSURE CONTROL VALVE IN BYPASS LINE FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
7.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	1.10E-11
	HCV8772-FTCQ#	VALVE 8772 FAILS TO CLOSE	1	1N 1.0E-03N	1.00E-03N	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	PCV-7172FCLQ+	PRESSURE CONTROL VALVE 7172 FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
	PSV-BP--RPTQ+	PRESSURE SAFETY VALVE IN BYPASS LINE RUPTURES	4	24H 5.0E-07H	1.20E-05	
8.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	1.10E-11
	FLT-BP--PLGQ+	FILTER IN BYPASS LINE FAILS PLUGGED	4	4H 3.0E-06H	1.20E-05	
	HCV8772-FTCQ#	VALVE 8772 FAILS TO CLOSE	1	1N 1.0E-03N	1.00E-03N	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	PSV-292-RPTQ+	PRESSURE SAFETY VALVE 292 RUPTURES	4	24H 5.0E-07H	1.20E-05	
9.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	1.10E-11
	FLT-062-PLGQ+	FILTER 062 PLUGS	4	4H 3.0E-06H	1.20E-05	
	HCV8772-FTCQ#	VALVE 8772 FAILS TO CLOSE	1	1N 1.0E-03N	1.00E-03N	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	PSV-BP--RPTQ+	PRESSURE SAFETY VALVE IN BYPASS LINE RUPTURES	4	24H 5.0E-07H	1.20E-05	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
10.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	1.10E-11
	HCV8772-FTCQ#	VALVE 8772 FAILS TO CLOSE	1	1N 1.0E-03N	1.00E-03N	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	PCV-BP--FCLQ+	PRESSURE CONTROL VALVE IN BYPASS LINE FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
	PSV-292-RPTQ+	PRESSURE SAFETY VALVE 292 RUPTURES	4	24H 5.0E-07H	1.20E-05	
11.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	5.44E-12
	FLT-062-PLGQ+	FILTER 062 PLUGS	4	4H 3.0E-06H	1.20E-05	
	FLT-BP--PLGQ+	FILTER IN BYPASS LINE FAILS PLUGGED	4	4H 3.0E-06H	1.20E-05	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	OPR-AE--MCHQ#	OPERATOR MISCALIBRATES O2 ANALYZERS (OUT OF RANGE)	5	14D 1.5E-02Y	2.88E-04	
12.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	5.44E-12
	FLT-062-PLGQ+	FILTER 062 PLUGS	4	4H 3.0E-06H	1.20E-05	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	OPR-AE--MCHQ#	OPERATOR MISCALIBRATES O2 ANALYZERS (OUT OF RANGE)	5	14D 1.5E-02Y	2.88E-04	
	PCV-BP--FCLQ+	PRESSURE CONTROL VALVE IN BYPASS LINE FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
13.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	5.44E-12
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	OPR-AE--MCHQ#	OPERATOR MISCALIBRATES O2 ANALYZERS (OUT OF RANGE)	5	14D 1.5E-02Y	2.88E-04	
	PCV-7172FCLQ+	PRESSURE CONTROL VALVE 7172 FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
	PCV-BP--FCLQ+	PRESSURE CONTROL VALVE IN BYPASS LINE FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
14.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	5.44E-12

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	FLT-BP--PLGQ+	FILTER IN BYPASS LINE FAILS PLUGGED	4	4H 3.0E-06H	1.20E-05	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	OPR-AE--MCHQ#	OPERATOR MISCALIBRATES O2 ANALYZERS (OUT OF RANGE)	5	14D 1.5E-02Y	2.88E-04	
	PCV-7172FCLQ+	PRESSURE CONTROL VALVE 7172 FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
15.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	3.17E-12
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	OPR-AE--MCHQ#	OPERATOR MISCALIBRATES O2 ANALYZERS (OUT OF RANGE)	5	14D 1.5E-02Y	2.88E-04	
	PCV-7172FCLQ+	PRESSURE CONTROL VALVE 7172 FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
	PSV-BP--RPTQ+	PRESSURE SAFETY VALVE IN BYPASS LINE RUPTURES	4	24H 5.0E-07H	1.20E-05	
16.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	3.17E-12
	FLT-062-PLGQ+	FILTER 062 PLUGS	4	4H 3.0E-06H	1.20E-05	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	OPR-AE--MCHQ#	OPERATOR MISCALIBRATES O2 ANALYZERS (OUT OF RANGE)	5	14D 1.5E-02Y	2.88E-04	
	PSV-BP--RPTQ+	PRESSURE SAFETY VALVE IN BYPASS LINE RUPTURES	4	24H 5.0E-07H	1.20E-05	
17.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	3.17E-12
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	OPR-AE--MCHQ#	OPERATOR MISCALIBRATES O2 ANALYZERS (OUT OF RANGE)	5	14D 1.5E-02Y	2.88E-04	
	PCV-BP--FCLQ+	PRESSURE CONTROL VALVE IN BYPASS LINE FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
	PSV-292-RPTQ+	PRESSURE SAFETY VALVE 292 RUPTURES	4	24H 5.0E-07H	1.20E-05	
18.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	3.17E-12
	FLT-BP--PLGQ+	FILTER IN BYPASS LINE FAILS PLUGGED	4	4H 3.0E-06H	1.20E-05	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	OPR-AE--MCHQ#	OPERATOR MISCALIBRATES O2 ANALYZERS (OUT OF RANGE)	5	14D 1.5E-02Y	2.88E-04	
	PSV-292-RPTQ+	PRESSURE SAFETY VALVE 292 RUPTURES	4	24H 5.0E-07H	1.20E-05	
19.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	3.15E-12
	HCV8772-FTCQ#	VALVE 8772 FAILS TO CLOSE	1	1N 1.0E-03N	1.00E-03N	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	PSV-292-RPTQ+	PRESSURE SAFETY VALVE 292 RUPTURES	4	24H 5.0E-07H	1.20E-05	
	PSV-BP--RPTQ+	PRESSURE SAFETY VALVE IN BYPASS LINE RUPTURES	4	24H 5.0E-07H	1.20E-05	
20.	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	9.07E-13
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	OPR-AE--MCHQ#	OPERATOR MISCALIBRATES O2 ANALYZERS (OUT OF RANGE)	5	14D 1.5E-02Y	2.88E-04	
	PSV-292-RPTQ+	PRESSURE SAFETY VALVE 292 RUPTURES	4	24H 5.0E-07H	1.20E-05	
	PSV-BP--RPTQ+	PRESSURE SAFETY VALVE IN BYPASS LINE RUPTURES	4	24H 5.0E-07H	1.20E-05	
21.	AE-68523CCAQ#	COMMON CAUSE FAILURE OF OXYGEN ANALYZING ELEMENTS 6852 AND 6853	5	8H 1.0E-06H	4.00E-06	7.57E-14
	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	PCV-7172FCLQ+	PRESSURE CONTROL VALVE 7172 FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
	PCV-BP--FCLQ+	PRESSURE CONTROL VALVE IN BYPASS LINE FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
22.	AE-68523CCAQ#	COMMON CAUSE FAILURE OF OXYGEN ANALYZING ELEMENTS 6852 AND 6853	5	8H 1.0E-06H	4.00E-06	7.57E-14
	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	
	FLT-BP--PLGQ+	FILTER IN BYPASS LINE FAILS PLUGGED	4	4H 3.0E-06H	1.20E-05	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	PCV-7172FCLQ+	PRESSURE CONTROL VALVE 7172 FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
23.	AE-68523CCAQ#	COMMON CAUSE FAILURE OF OXYGEN ANALYZING ELEMENTS 6852 AND 6853	5	8H 1.0E-06H	4.00E-06	7.57E-14
	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	
	FLT-062-PLGQ+	FILTER 062 PLUGS	4	4H 3.0E-06H	1.20E-05	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	PCV-BP--FCLQ+	PRESSURE CONTROL VALVE IN BYPASS LINE FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
24.	AE-68523CCAQ#	COMMON CAUSE FAILURE OF OXYGEN ANALYZING ELEMENTS 6852 AND 6853	5	8H 1.0E-06H	4.00E-06	7.57E-14
	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	
	FLT-062-PLGQ+	FILTER 062 PLUGS	4	4H 3.0E-06H	1.20E-05	
	FLT-BP--PLGQ+	FILTER IN BYPASS LINE FAILS PLUGGED	4	4H 3.0E-06H	1.20E-05	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
25.	AE-68523CCAQ#	COMMON CAUSE FAILURE OF OXYGEN ANALYZING ELEMENTS 6852 AND 6853	5	8H 1.0E-06H	4.00E-06	4.41E-14
	EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1	1N 1.0N	1.00E+00N	
	IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK	1	1N 3.0E-02N	3.00E-02N	
	PCV-BP--FCLQ+	PRESSURE CONTROL VALVE IN BYPASS LINE FAILS CLOSED	4	4H 3.0E-06H	1.20E-05	
	PSV-292-RPTQ+	PRESSURE SAFETY VALVE 292 RUPTURES	4	24H 5.0E-07H	1.20E-05	

EXPLOSION IN THE LPPP PRECIPITATE TANK
Top Event Frequency: 1.84E-06/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
TOPBLKN2BFLT+-I	Failure of the bulk N2 path	5.50E-06/H	7.58E+04
TOPN2TNKBFL3+-I	Nitrogen tank supply failure	7.70E-06/H	7.58E+04
TOPLPPN2BFLJ#	LPPP local N2 supply unavailable	5.30E-04	1.89E+03
IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN PRECIPITATE TANK	3.00E-02	3.33E+01
PSV-292-RPTQ+-IC	PRESSURE SAFETY VALVE 292 RUPTURES	5.00E-07/H	8.82E+00
PSV-BP--RPTQ+-IC	PSV IN BYPASS LINE RUPTURES	5.00E-07/H	8.82E+00
PCV-7172FCLQ+-IC	PRESSURE CONTROL VALVE 7172 FAILS CLOSED	3.00E-06/H	8.82E+00
FLT-BP--PLGQ+-IC	FILTER IN BYPASS LINE FAILS PLUGGED	3.00E-06/H	8.82E+00
FLT-062-PLGQ+-IC	FILTER 062 PLUGS	3.00E-06/H	8.82E+00
PCV-BP--FCLQ+-IC	PCV IN BYPASS LINE FAILS CLOSED	3.00E-06/H	8.82E+00
OPR-AE--MCHQ#	OPERATOR MISCALIBRATES O2 ANALYZERS	2.88E-04	1.07E+00
HCV8772-FTCQ#	VALVE 8772 FAILS TO CLOSE	1.00E-03	1.07E+00

Modified top event frequency = (top event frequency) x (risk achievement worth).

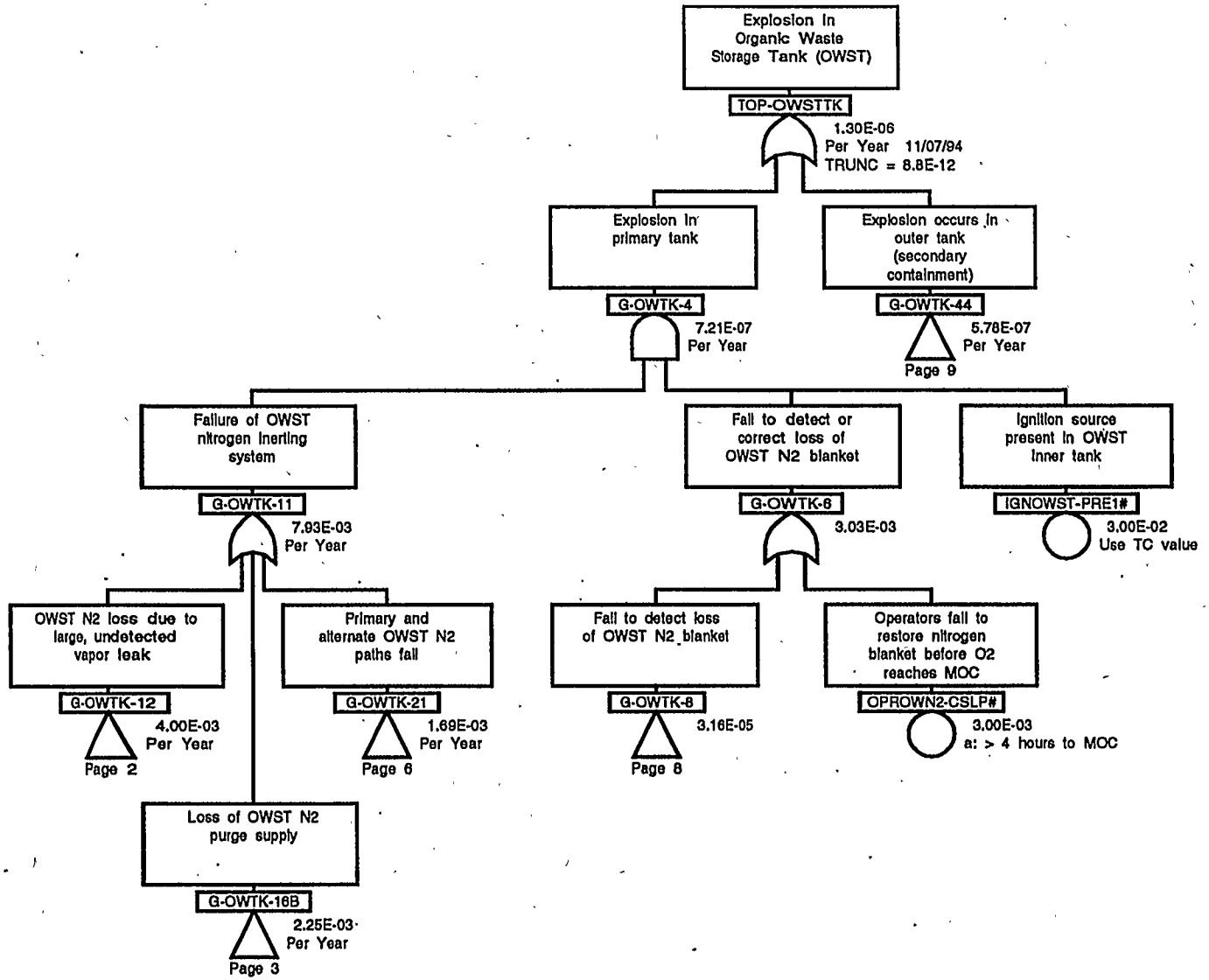
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
*EXP-GAS-PREQ#	EXPLOSIVE GAS PRESENT	1.00E+00	0.00E+00
*IGN-PPT-PREQ#	IGNITION SOURCE PRESENT IN PRECIPITATE TANK	3.00E-02	0.00E+00
TOPLPPN2BFLJ#	LPPP local N2 supply unavailable	5.30E-04	1.13E+04
TOPN2TNKBFL3+-I	Nitrogen tank supply failure	7.70E-06/H	2.40E+00
TOPBLKN2BFLT+-I	Failure of the bulk N2 path	5.50E-06/H	1.71E+00

* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

OWST Explosion


Explosion In Organic Waste Storage Tank (OWST)
TOP-OWSTTK
1.30E-06
Per Year 11/07/94
TRUNC = 8.8E-12
Explosion In primary tank
Explosion occurs in outer tank (secondary containment)
G-OWTK-4
7.21E-07
Per Year
G-OWTK-44
5.78E-07
Per Year
Page 9
Failure of OWST nitrogen inerting system
Fail to detect or correct loss of OWST N2 blanket
Ignition source present in OWST Inner tank
G-OWTK-11
7.93E-03
Per Year
G-OWTK-6
3.03E-03
IGNOWST-PRE1#
3.00E-02
Use TC value
OWST N2 loss due to large, undetected vapor leak
Primary and alternate OWST N2 paths fail
Fail to detect loss of OWST N2 blanket
Operators fail to restore nitrogen blanket before O2 reaches MOC
G-OWTK-12
4.00E-03
Per Year
Page 2
G-OWTK-21
1.69E-03
Per Year
Page 6
G-OWTK-8
3.16E-05
Page 8
OPROWN2-CSLP#
3.00E-03
a: > 4 hours to MOC
Loss of OWST N2 purge supply
G-OWTK-16B
2.25E-03
Per Year
Page 3
OWST Explosion
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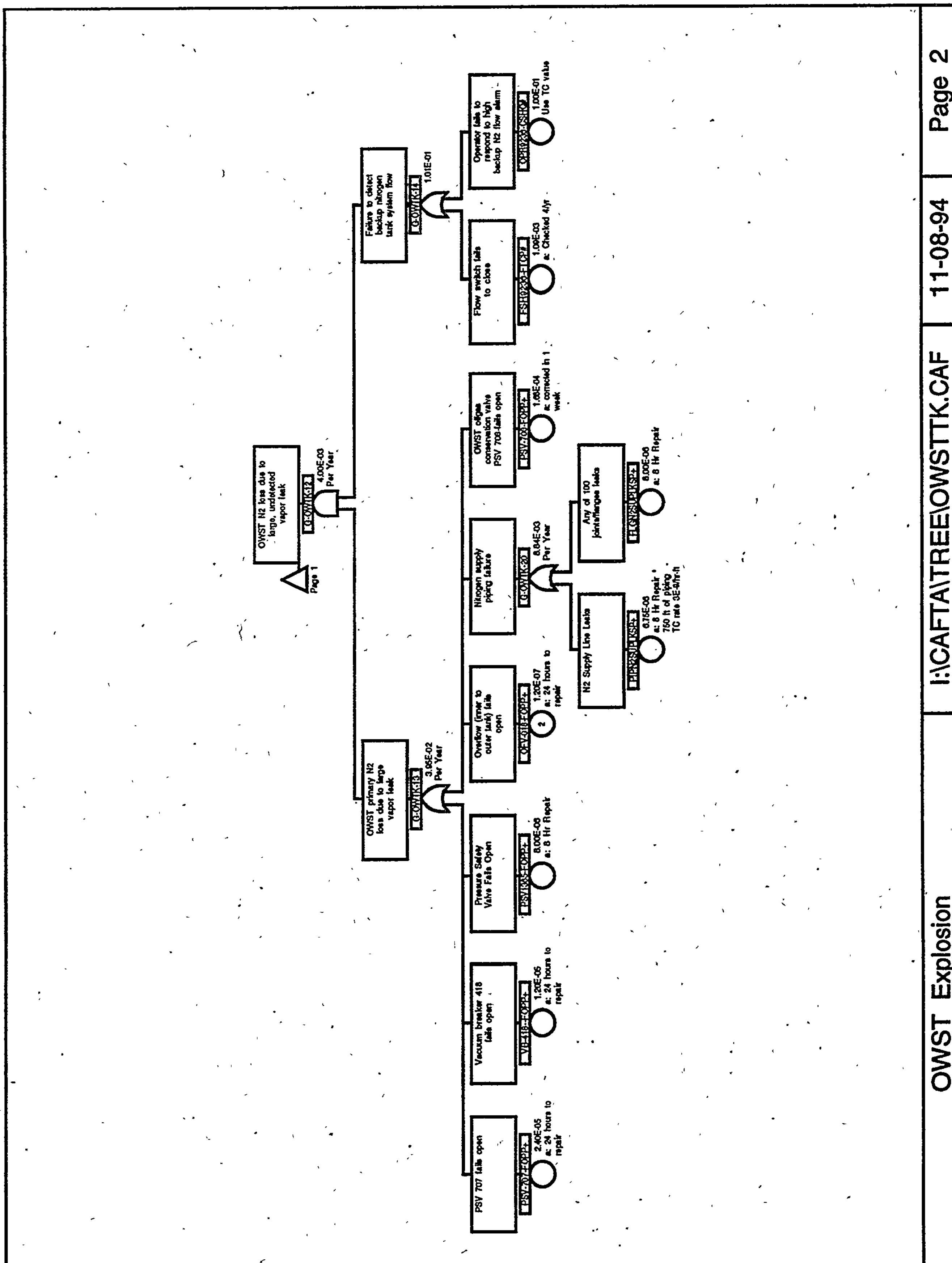
Page 1


OWST N2 loss due to large, undetected vapor leak
G-OWTK-12
4.00E-03 Per Year
Page 1
OWST primary N2 loss due to large vapor leak
G-OWTK-13
3.95E-02 Per Year
Failure to detect backup nitrogen tank system flow
G-OWTK-14
1.01E-01
PSV 707 fails open
PSV-707-FOPP+
2.40E-05
a: 24 hours to repair
Vacuum breaker 418 fails open
VB-418-FOPP+
1.20E-05
a: 24 hours to repair
Pressure Safety Valve Fails Open
8.00E-06
a: 8 Hr Repair
Overflow (inner to outer tank) fails open
OFV-018-FOPP+
1.20E-07
a: 24 hours to repair
Nitrogen supply piping failure
G-OWTK-20
8.84E-03 Per Year
OWST offgas conservation valve PSV 708 fails open
PSV-700-FOPP+
1.65E-04
a: corrected in 1 week
Flow switch fails to close
1.00E-03
a: Checked 4/yr
Operator fails to respond to high backup N2 flow alarm
1.00E-01
Use TC value
N2 Supply Line Leaks
PIPN2SUPLKSP+
6.75E-08
a: 8 Hr Repair * 750 ft of piping TC rate 3E-8/hr-ft
Any of 100 joints/flanges leaks
FLGN2SUPLKSP+
8.00E-06
a: 8 Hr Repair
OWST Explosion
I:\CAFTA\TREE\OWSTTK.CAF
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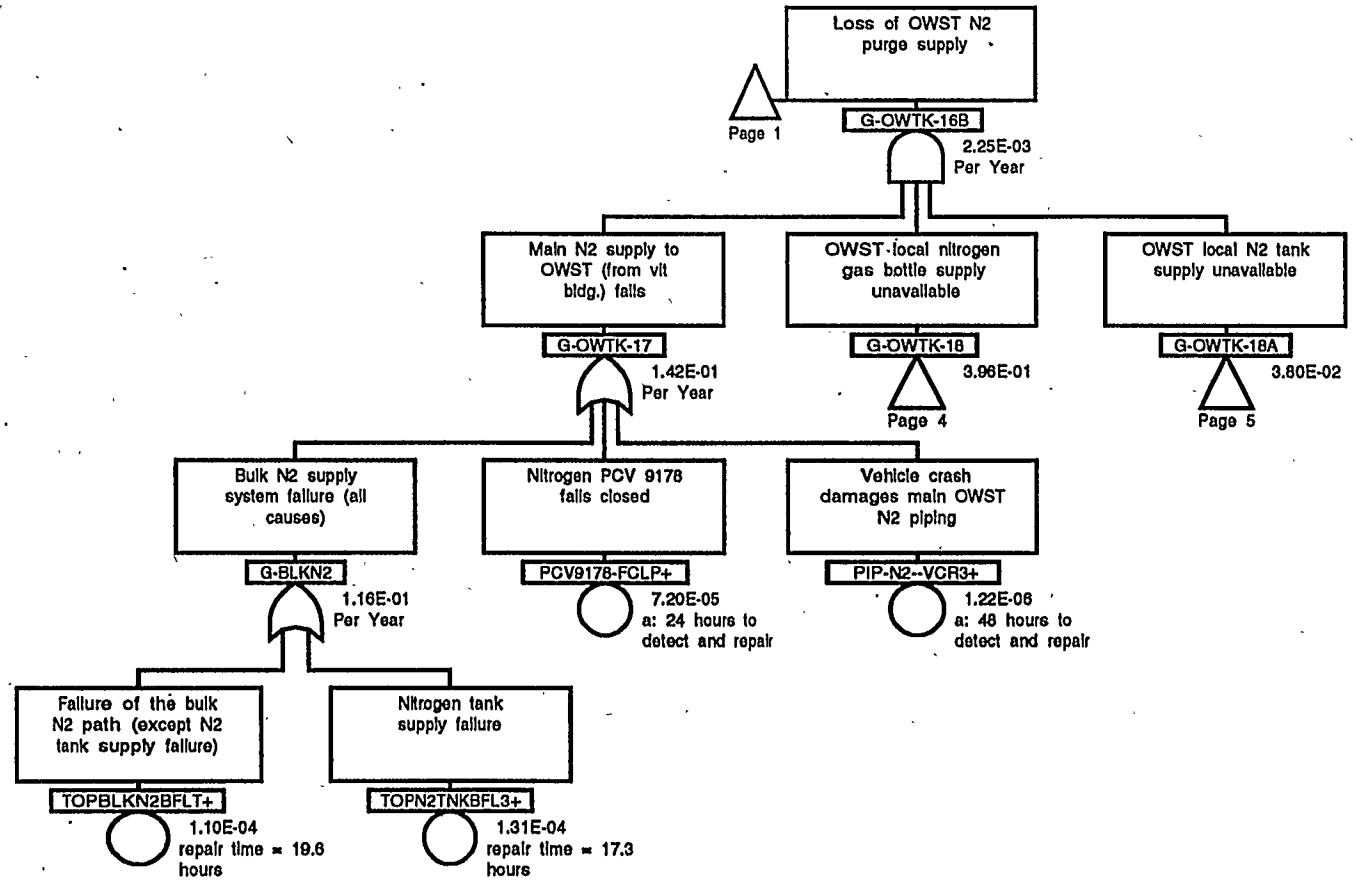
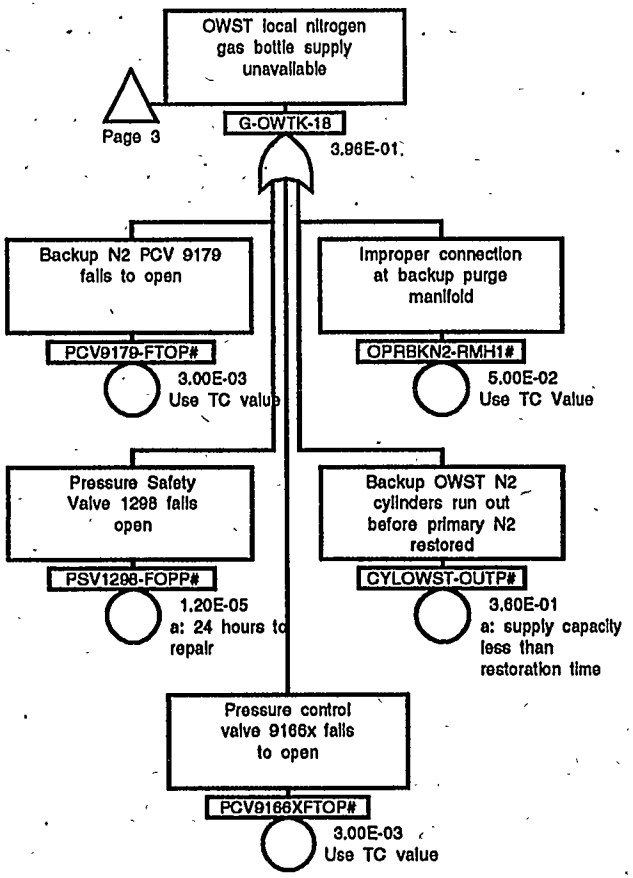
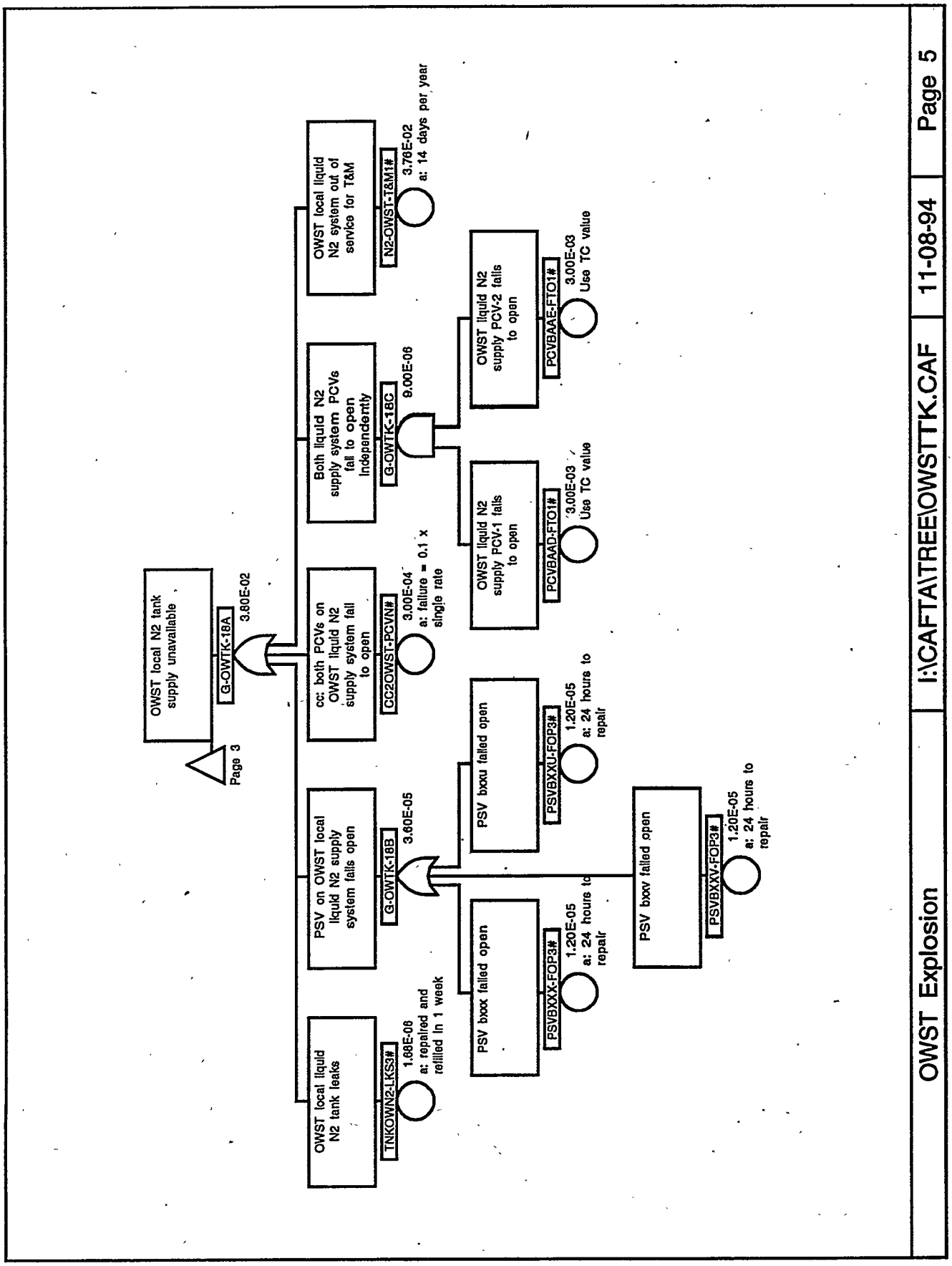
Page 2



OWST Explosion	I:\CAFTA\TREE\OWSTTK.CAF	11-08-94	Page 3



OWST Explosion	I:\CAFTA\TREE\OWSTTK.CAF	11-08-94	Page 4


OWST local N2 tank supply unavailable
G-OWTK-18A
3.80E-02
Page 3
OWST local liquid N2 tank leaks
TNKOWN2-LKS3#
1.68E-06
a: repaired and refilled in 1 week
PSV on OWST local liquid N2 supply system fails open
G-OWTK-18B
3.60E-05
PSV bxxx failed open
PSVBXXX-FOP3#
1.20E-05
a: 24 hours to repair
PSV bxxu failed open
PSVBXXU-FOP3#
1.20E-05
a: 24 hours to repair
PSV bxxv failed open
PSVBXXV-FOP3#
1.20E-05
a: 24 hours to repair
cc: both PCVs on OWST liquid N2 supply system fail to open
GC2OWST-PCVN#
3.00E-04
a: failure = 0.1 x single rate
Both liquid N2 supply system PCVs fail to open independently
G-OWTK-18C
9.00E-06
OWST liquid N2 supply PCV-1 fails to open
PCVBAAD-FTO1#
3.00E-03
Use TC value
OWST liquid N2 supply PCV-2 fails to open
PCVBAAE-FTO1#
3.00E-03
Use TC value
OWST local liquid N2 system out of service for T&M
N2-OWST-T&M1#
3.76E-02
a: 14 days per year
OWST Explosion
I:\CAFTA\TREE\OWSTTK.CAF
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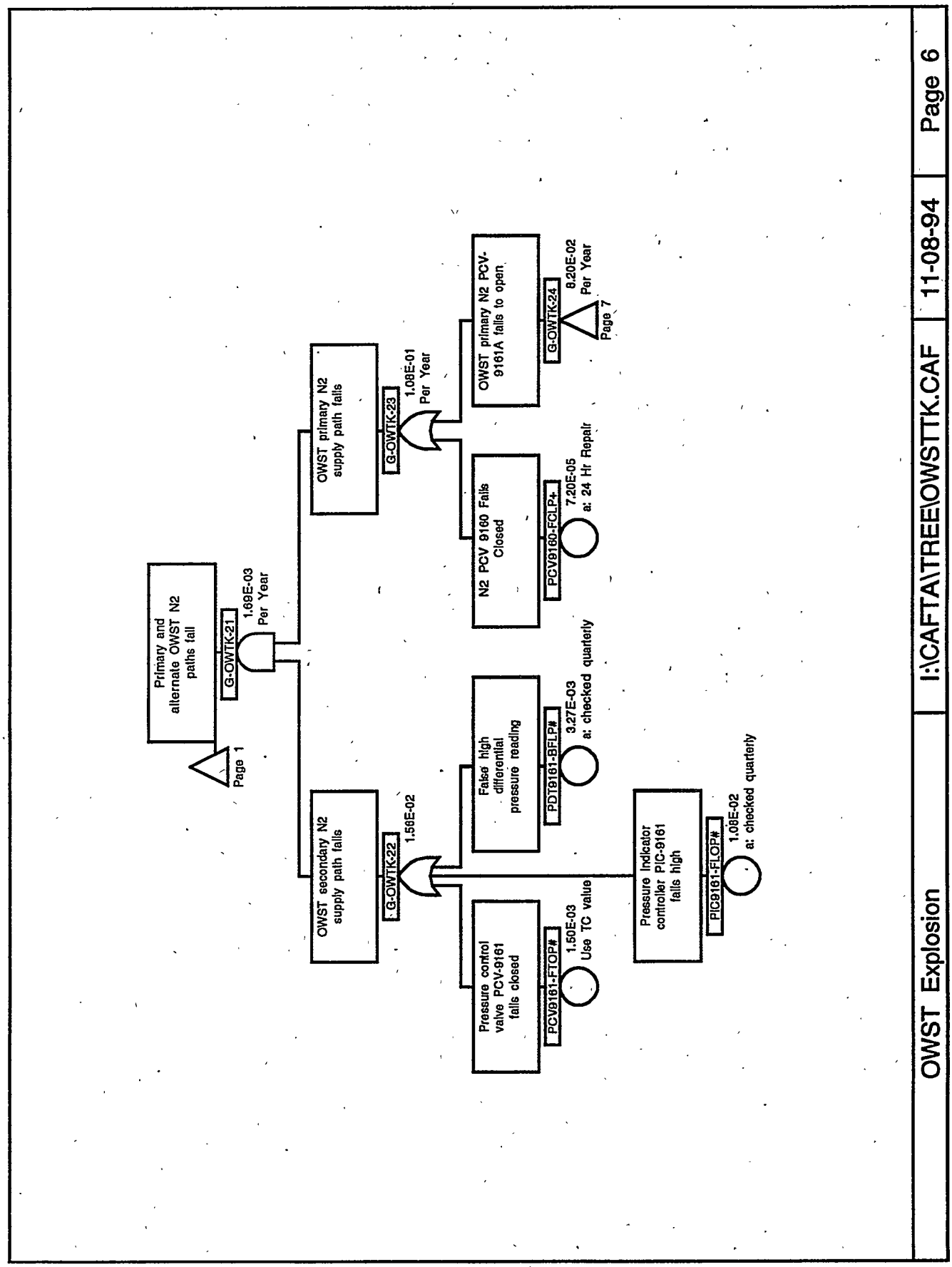
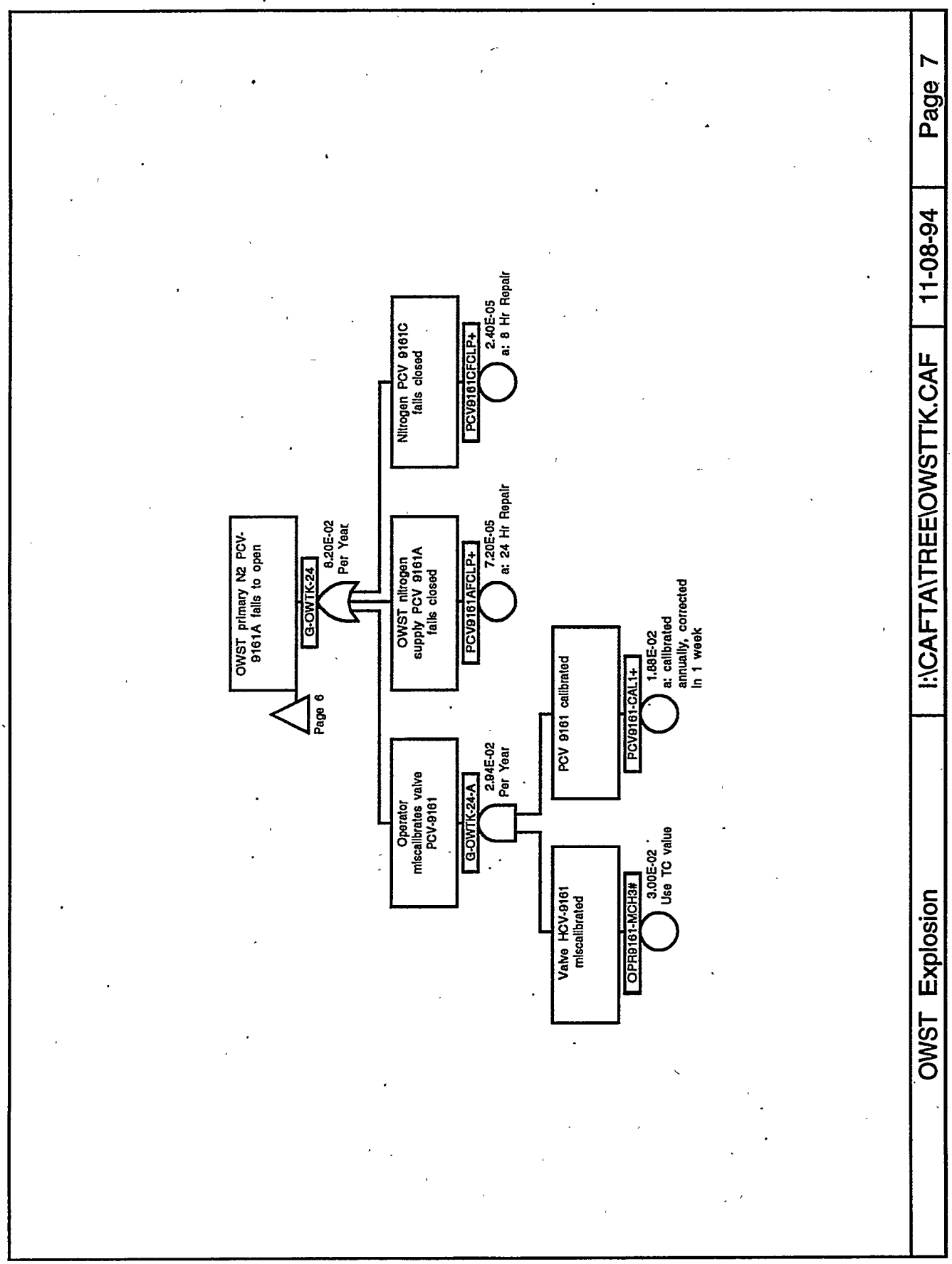
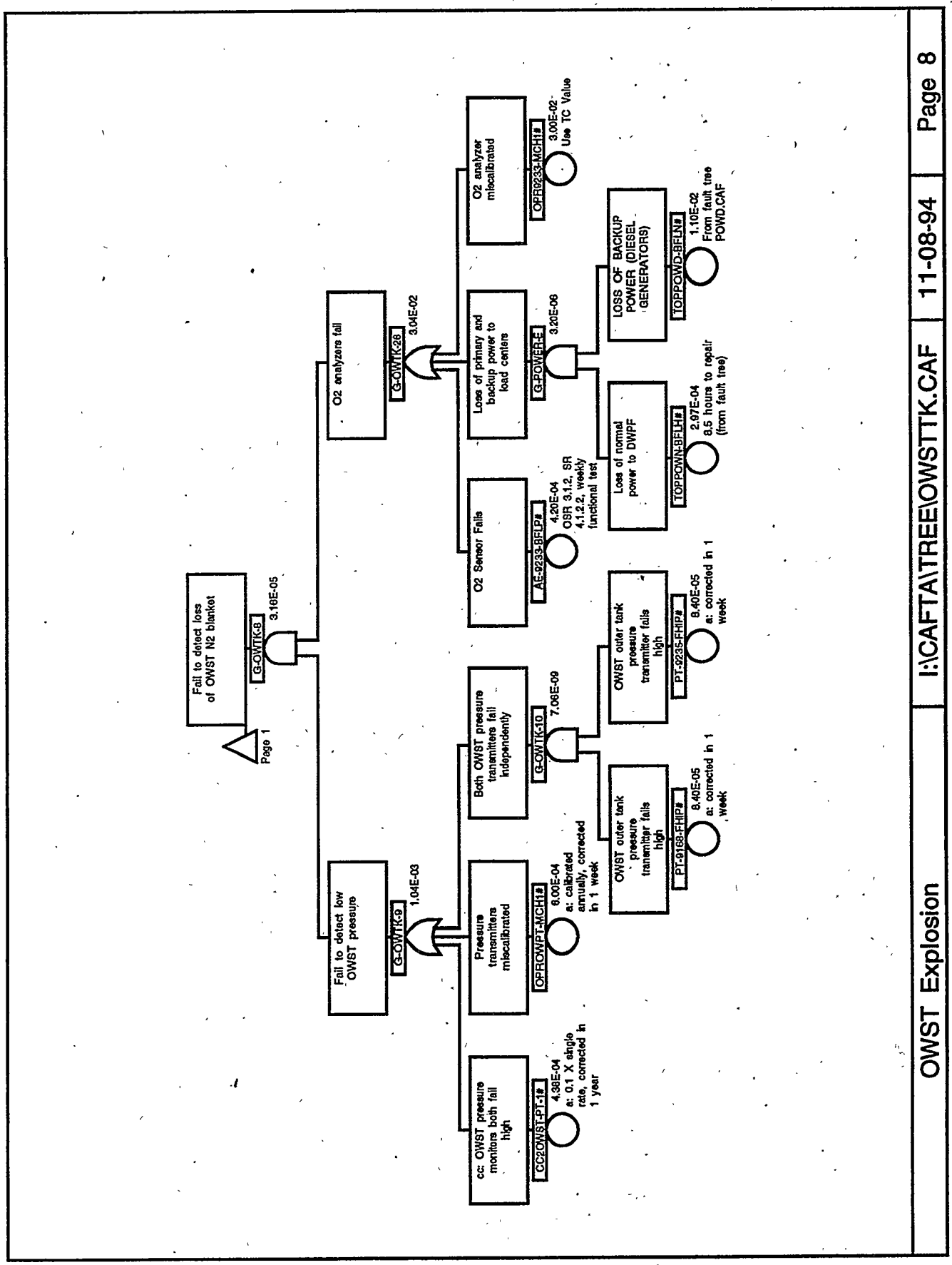
Page 5


OWST Explosion
I:\CAFTA\TREE\OWSTTK.CAF
11-08-94
Page 6
Primary and alternate OWST N2 paths fail
G-OWTK-21
1.69E-03 Per Year
Page 1
OWST primary N2 supply path fails
G-OWTK-23
1.08E-01 Per Year
OWST primary N2 PCV-9161A fails to open
G-OWTK-24
8.20E-02 Per Year
Page 7
N2 PCV 9160 Fails Closed
PCV9160-FCLP+
7.20E-05 a: 24 Hr Repair
OWST secondary N2 supply path fails
G-OWTK-22
1.50E-02
Fake high differential pressure reading
PDT9161-BFLP#
3.27E-03 a: checked quarterly
Pressure control valve PCV-9161 falls closed
PCV9161-FTOP#
1.50E-03 Use TC value
Pressure Indicator controller PIC-9161 falls high
PIC9161-FLOP#
1.08E-02 a: checked quarterly


OWST Explosion
I:\CAFTA\TREE\OWSTTK.CAF
11-08-94
Page 7
OWST primary N2 PCV-9161A fails to open
G-OWTK-24
8.20E-02 Per Year
Page 6
OWST nitrogen supply PCV 9161A fails closed
PCV9161AFCLP+
7.20E-05 a: 24 Hr Repair
Nitrogen PCV 9161C fails closed
PCV9161CFCLP+
2.40E-05 a: 8 Hr Repair
Operator miscalibrates valve PCV-9161
G-OWTK-24-A
2.94E-02 Per Year
PCV 9161 calibrated
PCV9161-CAL1+
1.88E-02 a: calibrated annually, corrected in 1 week
Valve HCV-9161 miscalibrated
OPR9161-MCH3#
3.00E-02 Use TC value


OWST Explosion
I:\CAFTA\TREE\OWSTTK.CAF
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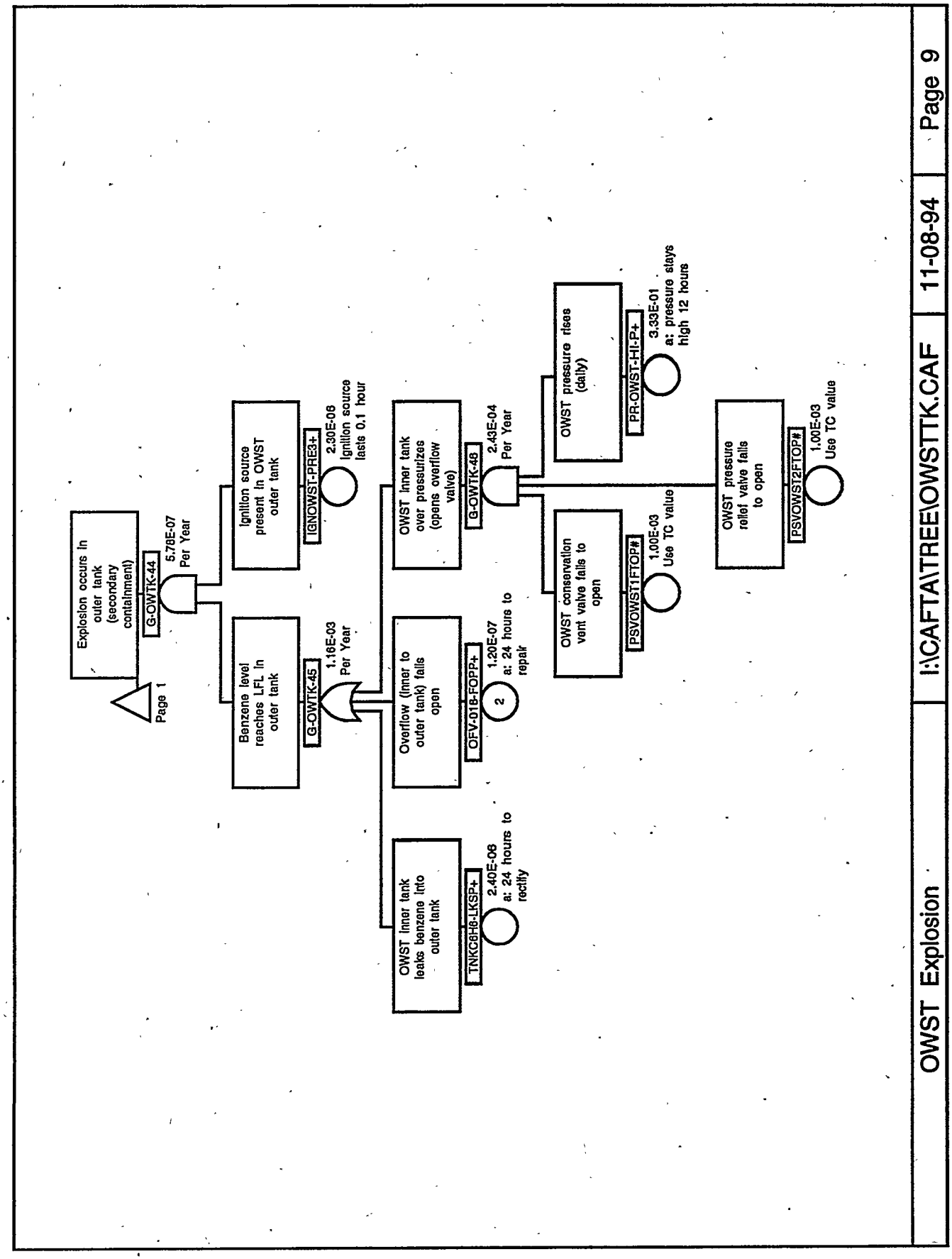
Page 8
Fail to detect loss of OWST N2 blanket
G-OWTK-8
3.16E-05
Page 1
Fail to detect low OWST pressure
G-OWTK-9
1.04E-03
O2 analyzers fail
G-OWTK-28
3.04E-02
cc: OWST pressure monitors both fail high
CC2OWST-PT-1#
4.38E-04
a: 0.1 X single rate, corrected in 1 year
Pressure transmitters miscalibrated
OPRIOWPT-MCH1#
6.00E-04
a: calibrated annually, corrected in 1 week
Both OWST pressure transmitters fail independently
G-OWTK-10
7.06E-09
OWST outer tank pressure transmitter fails high
PT-9168-FHIP#
8.40E-05
a: corrected in 1 week
OWST outer tank pressure transmitter fails high
PT-9235-FHIP#
8.40E-05
a: corrected in 1 week
O2 Sensor Fails
AE-9233-BFLP#
4.20E-04
OSR 3.1.2, SR 4.1.2.2, weekly functional test
Loss of primary and backup power to load centers
G-POWER-E
3.20E-06
O2 analyzer miscalibrated
OPR9233-MCH1#
3.00E-02
Use TC Value
Loss of normal power to DWPF
TOPPOWN-BFLH#
2.67E-04
8.5 hours to repair (from fault tree)
LOSS OF BACKUP POWER (DIESEL GENERATORS)
TOPPOWD-BFLN#
1.10E-02
From fault tree POWD.CAF


OWST Explosion
I:\CAFTA\TREE\OWSTTK.CAF
11-08-94
Page 9
Explosion occurs in outer tank (secondary containment)
G-OWTK-44
5.78E-07 Per Year
Page 1
Ignition source present in OWST outer tank
IGNOWST-PRE3+
2.30E-06 Ignition source lasts 0.1 hour
Benzene level reaches LFL in outer tank
G-OWTK-45
1.16E-03 Per Year
OWST inner tank over pressurizes (opens overflow valve)
G-OWTK-48
2.43E-04 Per Year
Overflow (inner to outer tank) fails open
OFV-018-FOPP+
2
1.20E-07 a: 24 hours to repair
OWST inner tank leaks benzene into outer tank
TNKC6H6-LKSP+
2.40E-06 a: 24 hours to rectify
OWST pressure rises (daily)
PR-OWST-HI-P+
3.33E-01 a: pressure stays high 12 hours
OWST conservation vent valve fails to open
PSVOWST1FTOP#
1.00E-03 Use TC value
OWST pressure relief valve fails to open
PSVOWST2FTOP#
1.00E-03 Use TC value

Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
AE-9233-BFLP#	8		G-OWTK-8	8		PT-9168-FHIP#	8				
CC2OWST-PCVN#	5		G-OWTK-9	8		PT-9235-FHIP#	8				
CC2OWST-PT-1#	8		G-POWER-E	8		TNKC6H6-LKSP+	9				
CYLOWST-OUTP#	4		IGNOWST-PRE1#	1		TNKOWN2-LKS3#	5				
FLGN2SUPLKSP+	2		IGNOWST-PRE3+	9		TOP-OWSTTK	1				
FSH9236-FTCP#	2		N2-OWST-T&M1#	5		TOPBLKN2BFLT+	3				
G-BLKN2	3		OFV-018-FOPP+	2		TOPN2TNKBFL3+	3				
G-OWTK-10	8		OFV-018-FOPP+	9		TOPPOWD-BFLN#	8				
G-OWTK-11	1		OPR9161-MCH3#	7		TOPPOWN-BFLH#	8				
G-OWTK-12	1		OPR9233-MCH1#	8		VB-418--FOPP+	2				
G-OWTK-12	2		OPR9236-CSHQ#	2							
G-OWTK-13	2		OPRBKN2-RMH1#	4							
G-OWTK-14	2		OPROWN2-CSLP#	1							
G-OWTK-16B	1		OPROWPT-MCH1#	8							
G-OWTK-16B	3		PCV9160-FCLP+	6							
G-OWTK-17	3		PCV9161-CAL1+	7							
G-OWTK-18	3		PCV9161-FTOP#	6							
G-OWTK-18	4		PCV9161AFCLP+	7							
G-OWTK-18A	3		PCV9161CFCLP+	7							
G-OWTK-18A	5		PCV9166XFTOP#	4							
G-OWTK-18B	5		PCV9178-FCLP+	3							
G-OWTK-18C	5		PCV9179-FTOP#	4							
G-OWTK-20	2		PCVBAAD-FTO1#	5							
G-OWTK-21	1		PCVBAAE-FTO1#	5							
G-OWTK-21	6		PDT9161-BFLP#	6							
G-OWTK-22	6		PIC9161-FLOP#	6							
G-OWTK-23	6		PIP-N2--VCR3+	3							
G-OWTK-24	6		PIPN2SUPLKSP+	2							
G-OWTK-24	7		PR-OWST-HI-P+	9							
G-OWTK-24-A	7		PSV-707-FOPP+	2							
G-OWTK-26	8		PSV-708-FOPP+	2							
G-OWTK-4	1		PSV1298-FOPP#	4							
G-OWTK-44	1		PSV1365-FOPP+	2							
G-OWTK-44	9		PSVBXXU-FOP3#	5							
G-OWTK-45	9		PSVBXXV-FOP3#	5							
G-OWTK-46	9		PSVBXXX-FOP3#	5							
G-OWTK-6	1		PSVOWST1FTOP#	9							
G-OWTK-8	1		PSVOWST2FTOP#	9							

Cutsets for I:\CAFTA\CUT\OWSTTK.CSR 11/08/94 12:42 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	TOP-OWSTTK					1.30E-06
1.	IGNOWST-PRE3+	Ignition source present in OWST outer tank	4	.1H 2.3E-5H	2.30E-06	4.86E-07
	TNKC6H6-LKSP+	OWST inner tank leaks benzene into outer tank	4	24H 1.0E-07H	2.40E-06	
2.	CYLOWST-OUTP#	Backup OWST N2 cylinders run out before primary N2 restored	1	1N 3.6E-01N	3.60E-01N	8.22E-08
	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	
	N2-OWST-T&M1#	OWST local liquid N2 system out of service for T&M	3	14D 1Y	3.76E-02	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	TOPN2TNKBFL3+	Nitrogen tank supply failure	4	17H 7.7E-06H	1.31E-04	
3.	FLGN2SUPLKSP+	Any of 100 joints/flanges leaks	4	8H 1.0E-06H	8.00E-06	7.88E-08
	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	
	OPR9236-CSHQ#	Operator fails to respond to high backup N2 flow alarm	1	1N 1.0E-01N	1.00E-01N	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
4.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	7.88E-08
	OPR9236-CSHQ#	Operator fails to respond to high backup N2 flow alarm	1	1N 1.0E-01N	1.00E-01N	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PSV1365-FOPP+	Pressure Safety Valve Fails Open	4	8H 1.0E-06H	8.00E-06	
5.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	7.88E-08
	OPR9236-CSHQ#	Operator fails to respond to high backup N2 flow alarm	1	1N 1.0E-01N	1.00E-01N	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PSV-707-FOPP+	PSV 707 fails open	4	24H 1.0E-06H	2.40E-05	
6.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	7.88E-08

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	OPR9236-CSHQ#	Operator fails to respond to high backup N2 flow alarm	1	1N 1.0E-01N	1.00E-01N	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PSV-708-FOPP+	OWST offgas conservation valve PSV 708-fails open	4	168H 1.0E-06H	1.68E-04	
7.	IGNOWST-PRE3+	Ignition source present in OWST outer tank	4	.1H 2.3E-5H	2.30E-06	6.77E-08
	PR-OWST-HI-P+	OWST pressure rises (daily)	4	12H 1.0E+00D	3.33E-01	
	PSVOWST1FTOP#	OWST conservation vent valve fails to open	1	1N 1.0E-03N	1.00E-03N	
	PSVOWST2FTOP#	OWST pressure relief valve fails to open	1	1N 1.0E-03N	1.00E-03N	
8.	CYLOWST-OUTP#	Backup OWST N2 cylinders run out before primary N2 restored	1	1N 3.6E-01N	3.60E-01N	5.87E-08
	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	
	N2-OWST-T&M1#	OWST local liquid N2 system out of service for T&M	3	14D 1Y	3.76E-02	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	TOPBLKN2BFLT+	Failure of the bulk N2 path (except N2 tank supply failure)	4	20H 5.5E-06H	1.10E-04	
9.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	3.94E-08
	OPR9236-CSHQ#	Operator fails to respond to high backup N2 flow alarm	1	1N 1.0E-01N	1.00E-01N	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	VB-418--FOPP+	Vacuum breaker 418 fails open	4	24H 5.0E-07H	1.20E-05	
10.	CYLOWST-OUTP#	Backup OWST N2 cylinders run out before primary N2 restored	1	1N 3.6E-01N	3.60E-01N	3.20E-08
	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	
	N2-OWST-T&M1#	OWST local liquid N2 system out of service for T&M	3	14D 1Y	3.76E-02	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9178-FCLP+	Nitrogen PCV 9178 fails-closed	4	24H 3.0E-06H	7.20E-05	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
11.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	2.87E-08
	OPR9161-MCH3#	Valve HCV-9161 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9161-CAL1+	PCV 9161 calibrated	4	7D 1.0E+00Y	1.88E-02	
	PIC9161-FLOP#	Pressure indicator controller PIC-9161 fails high	5	1Q 1.0E-05H	1.08E-02	
12.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	2.56E-08
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9161CFCLP+	Nitrogen PCV 9161C fails closed	4	8H 3.0E-06H	2.40E-05	
	PIC9161-FLOP#	Pressure indicator controller PIC-9161 fails high	5	1Q 1.0E-05H	1.08E-02	
13.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	2.56E-08
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9160-FCLP+	N2 PCV 9160 Fails Closed	4	24H 3.0E-06H	7.20E-05	
	PIC9161-FLOP#	Pressure indicator controller PIC-9161 fails high	5	1Q 1.0E-05H	1.08E-02	
14.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	2.56E-08
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9161AFCLP+	OWST nitrogen supply PCV 9161A fails closed	4	24H 3.0E-06H	7.20E-05	
	PIC9161-FLOP#	Pressure indicator controller PIC-9161 fails high	5	1Q 1.0E-05H	1.08E-02	
15.	IGNOWST-PRE3+	Ignition source present in OWST outer tank	4	.1H 2.3E-5H	2.30E-06	2.43E-08
	OFV-018-FOPP+	Overflow (inner to outer tank) fails open	4	24H 5.0E-09H	1.20E-07	
16.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	1.14E-08
	N2-OWST-T&M1#	OWST local liquid N2 system out of service for T&M	3	14D 1Y	3.76E-02	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	OPRBKN2-RMH1#	Improper connection at backup purge manifold	1	1N 5.0E-02N	5.00E-02N	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	TOPN2TNKBFL3+	Nitrogen tank supply failure	4	17H 7.7E-06H	1.31E-04	
17.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	8.66E-09
	OPR9161-MCH3#	Valve HCV-9161 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9161-CAL1+	PCV 9161 calibrated	4	7D 1.0E+00Y	1.88E-02	
	PDT9161-BFLP#	False high differential pressure reading	5	1Q 3.0E-06H	3.26E-03	
18.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	8.16E-09
	N2-OWST-T&M1#	OWST local liquid N2 system out of service for T&M	3	14D 1Y	3.76E-02	
	OPRBKN2-RMH1#	Improper connection at backup purge manifold	1	1N 5.0E-02N	5.00E-02N	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	TOPBLKN2BFLT+	Failure of the bulk N2 path (except N2 tank supply failure)	4	20H 5.5E-06H	1.10E-04	
19.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	7.73E-09
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9161CFCLP+	Nitrogen PCV 9161C fails closed	4	8H 3.0E-06H	2.40E-05	
	PDT9161-BFLP#	False high differential pressure reading	5	1Q 3.0E-06H	3.26E-03	
20.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	7.73E-09
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9161AFCLP+	OWST nitrogen supply PCV 9161A fails closed	4	24H 3.0E-06H	7.20E-05	
	PDT9161-BFLP#	False high differential pressure reading	5	1Q 3.0E-06H	3.26E-03	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
21.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	7.73E-09
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9160-FCLP+	N2 PCV 9160 Fails Closed	4	24H 3.0E-06H	7.20E-05	
	PDT9161-BFLP#	False high differential pressure reading	5	1Q 3.0E-06H	3.26E-03	
22.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	4.45E-09
	N2-OWST-T&M1#	OWST local liquid N2 system out of service for T&M	3	14D 1Y	3.76E-02	
	OPRBKN2-RMH1#	Improper connection at backup purge manifold	1	1N 5.0E-02N	5.00E-02N	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9178-FCLP+	Nitrogen PCV 9178 fails closed	4	24H 3.0E-06H	7.20E-05	
23.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	3.97E-09
	OPR9161-MCH3#	Valve HCV-9161 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9161-CAL1+	PCV 9161 calibrated	4	7D 1.0E+00Y	1.88E-02	
	PCV9161-FTOP#	Pressure control valve PCV-9161 fails closed	5	1N 3.0E-03N	1.50E-03N	
24.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	3.54E-09
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9161-FTOP#	Pressure control valve PCV-9161 fails closed	5	1N 3.0E-03N	1.50E-03N	
	PCV9161CFCLP+	Nitrogen PCV 9161C fails closed	4	8H 3.0E-06H	2.40E-05	
25.	IGNOWST-PRE1#	Ignition source present in OWST inner tank	1	1N 3.0E-02N	3.00E-02N	3.54E-09
	OPROWN2-CSLP#	Operators fail to restore nitrogen blanket before O2 reaches MOC	1	1N 3.0E-03N	3.00E-03N	
	PCV9160-FCLP+	N2 PCV 9160 Fails Closed	4	24H 3.0E-06H	7.20E-05	
	PCV9161-FTOP#	Pressure control valve PCV-9161 fails closed	5	1N 3.0E-03N	1.50E-03N	

Explosion In Organic Waste Storage Tank (OWST)
Top Event Frequency: 1.30E-06/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
OFV-018-FOPP+-IC	Overflow (inner to outer tank) fails open	5.00E-09/H	2.33E+05
TNKC6H6-LKSP+-IC	OWST inner tank leaks benzene into outer tank	1.00E-07/H	1.71E+05
PSV-708-FOPP+-I	OWST offgas conservation valve PSV 708-fails open	1.00E-06/H	6.20E+04
PIPN2SUPLKSP+-I	N2 Supply Line Leaks	9.00E-09/H	6.20E+04
VB-418--FOPP+-I	Vacuum breaker 418 fails open	5.00E-07/H	6.20E+04
PSV1365-FOPP+-I	Pressure Safety Valve Fails Open	1.00E-06/H	6.20E+04
PSV-707-FOPP+-I	PSV 707 fails open	1.00E-06/H	6.20E+04
FLGN2SUPLKSP+-I	Any of 100 joints/flanges leaks	1.00E-06/H	6.20E+04
IGNOWST-PRE3+-IC	Ignition source present in OWST outer tank	2.30E-05/H	2.01E+04
TOPBLKN2BFLT+-I	Failure of the bulk N2 path	5.50E-06/H	9.69E+03
TOPN2TNKBFL3+-I	Nitrogen tank supply failure	7.70E-06/H	9.69E+03
PCV9178-FCLP+-I	Nitrogen PCV 9178 fails closed	3.00E-06/H	9.69E+03
PIP-N2--VCR3+-I	Vehicle crash damages main OWST N2 piping	2.55E-08/H	9.67E+03
PCV9160-FCLP+-I	N2 PCV 9160 Fails Closed	3.00E-06/H	9.57E+03
PCV9161AFCLP+-I	OWST nitrogen supply PCV 9161A fails closed	3.00E-06/H	9.57E+03
PCV9161CFCLP+-I	Nitrogen PCV 9161C fails closed	3.00E-06/H	9.57E+03
PCV9161-CAL1+-I	PCV 9161 calibrated	1.12E-04/H	2.88E+02
OPROWN2-CSLP#	Fail to restore nitrogen blanket before O2 reaches MOC	3.00E-03	1.84E+02
PSVOWST1FTOP#	OWST conservation vent valve fails to open	1.00E-03	5.31E+01
PSVOWST2FTOP#	OWST pressure relief valve fails to open	1.00E-03	5.31E+01
IGNOWST-PRE1#	Ignition source present in OWST inner tank	3.00E-02	1.90E+01
PCV9161-FTOP#	Pressure control valve PCV-9161 fails closed	1.50E-03	8.57E+00
PDT9161-BFLP#	False high differential pressure reading	3.27E-03	8.56E+00
PIC9161-FLOP#	Pressure indicator controller PIC-9161 fails high	1.08E-02	8.50E+00
CC2OWST-PT-1#	cc: OWST pressure monitors both fail high	4.38E-04	6.57E+00
OPROWPT-MCH1#	Pressure transmitters miscalibrated	6.00E-04	6.57E+00
CC2OWST-PCVN#	cc: both PCVs on OWST liquid N2 supply fail to open	3.00E-04	5.14E+00
PSVBXXX-FOP3#	PSV bxxx failed open	1.20E-05	5.11E+00
PSVBXXV-FOP3#	PSV bxxv failed open	1.20E-05	5.11E+00
PSVBXXU-FOP3#	PSV bxxu failed open	1.20E-05	5.11E+00
TNKOWN2-LKS3#	OWST local liquid N2 tank leaks	1.68E-06	5.02E+00
N2-OWST-T&M1#	OWST local liquid N2 system out of service for T&M	3.76E-02	4.98E+00
FSH9236-FTCP#	Flow switch fails to close	1.09E-03	3.77E+00
OPR9236-CSHQ#	Operator fails to respond to high backup N2 flow alarm	1.00E-01	3.49E+00
OPR9161-MCH3#	Valve HCV-9161 miscalibrated	3.00E-02	2.04E+00
PCV9166XFTOP#	Pressure control valve 9166x fails to open	3.00E-03	1.38E+00
PCV9179-FTOP#	Backup N2 PCV 9179 fails to open	3.00E-03	1.38E+00
PSV1298-FOPP#	Pressure Safety Valve 1298 fails open	1.20E-05	1.38E+00
OPRBKN2-RMH1#	Improper connection at backup purge manifold	5.00E-02	1.36E+00
CYLOWST-OUTP#	Backup OWST N2 cylinders run out before N2 restored	3.60E-01	1.24E+00
OPR9233-MCH1#	O2 analyzer miscalibrated	3.00E-02	1.18E+00
AE-9233-BFLP#	O2 Sensor Fails	4.20E-04	1.18E+00
PR-OWST-HI-P+-IC	OWST pressure rises (daily)	2.78E-02/H	1.12E+00
PCVBAAE-FTO1#	OWST liquid N2 supply PCV-2 fails to open	3.00E-03	1.01E+00
PCVBAAD-FTO1#	OWST liquid N2 supply PCV-1 fails to open	3.00E-03	1.01E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) x (risk achievement worth).

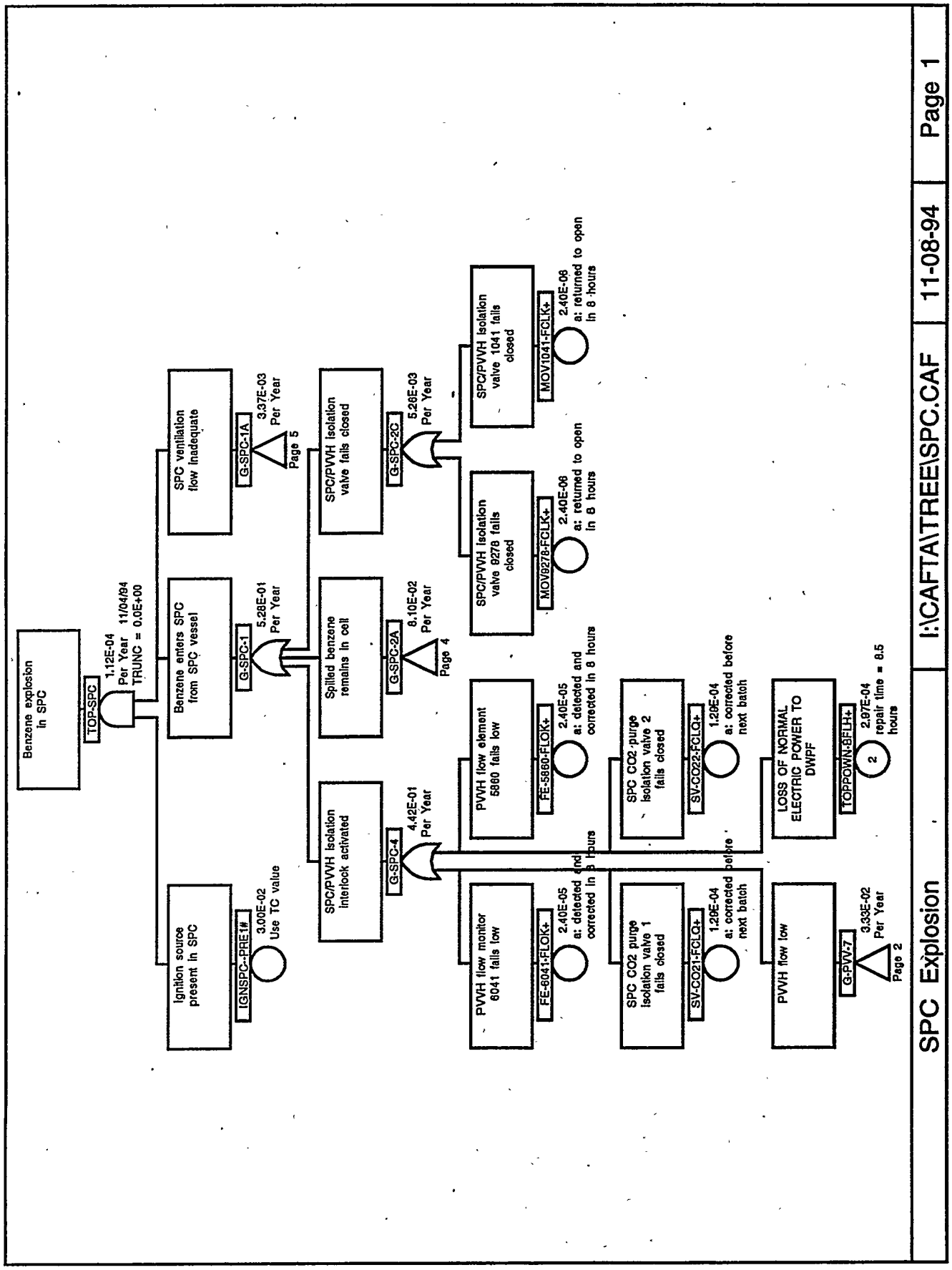
Explosion In Organic Waste Storage Tank (OWST)
Top Event Frequency: 1.30E-06/YR

Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
IGNOWST-PRE1#	Ignition source present in OWST inner tank	3.00E-02	2.25E+00
OPROWN2-CSLP#	Fail to restore nitrogen blanket before O2 reaches MOC	3.00E-03	2.22E+00
IGNOWST-PRE3+-IC	Ignition source present in OWST outer tank	2.30E-05/H	1.80E+00
TNKC6H6-LKSP+-IC	OWST inner tank leaks benzene into outer tank	1.00E-07/H	1.60E+00
OPR9236-CSHQ#	Operator fails to respond to high backup N2 flow alarm	1.00E-01	1.38E+00
N2-OWST-T&M1#	OWST local liquid N2 system out of service for T&M	3.76E-02	1.18E+00
CYLOWST-OUTP#	Backup OWST N2 cylinders run out before N2 restored	3.60E-01	1.16E+00
PIC9161-FLOP#	Pressure indicator controller PIC-9161 fails high	1.08E-02	1.09E+00
TOPN2TNKBFL3+-I	Nitrogen tank supply failure	7.70E-06/H	1.08E+00
FLGN2SUPLKSP+-I	Any of 100 joints/flanges leaks	1.00E-06/H	1.07E+00
PSV-708-FOPP+-I	OWST offgas conservation valve PSV 708-fails open	1.00E-06/H	1.07E+00
PSV-707-FOPP+-I	PSV 707 fails open	1.00E-06/H	1.07E+00
PSV1365-FOPP+-I	Pressure Safety Valve Fails Open	1.00E-06/H	1.07E+00
TOPBLKN2BFLT+-I	Failure of the bulk N2 path	5.50E-06/H	1.06E+00
PSVOWST1FTOP#	OWST conservation vent valve fails to open	1.00E-03	1.05E+00
PSVOWST2FTOP#	OWST pressure relief valve fails to open	1.00E-03	1.05E+00
PR-OWST-HI-P+-IC	OWST pressure rises (daily)	2.78E-02/H	1.05E+00
OPR9161-MCH3#	Valve HCV-9161 miscalibrated	3.00E-02	1.03E+00
PCV9161-CAL1+-I	PCV 9161 calibrated	1.12E-04/H	1.03E+00
VB-418--FOPP+-I	Vacuum breaker 418 fails open	5.00E-07/H	1.03E+00
PCV9178-FCLP+-I	Nitrogen PCV 9178 fails closed	3.00E-06/H	1.03E+00
PCV9160-FCLP+-I	N2 PCV 9160 Fails Closed	3.00E-06/H	1.03E+00
PCV9161AFCLP+-I	OWST nitrogen supply PCV 9161A fails closed	3.00E-06/H	1.03E+00
PCV9161CFCLP+-I	Nitrogen PCV 9161C fails closed	3.00E-06/H	1.03E+00
PDT9161-BFLP#	False high differential pressure reading	3.27E-03	1.03E+00
OFV-018-FOPP+-IC	Overflow (inner to outer tank) fails open	5.00E-09/H	1.02E+00
OPRBKN2-RMH1#	Improper connection at backup purge manifold	5.00E-02	1.02E+00
PCV9161-FTOP#	Pressure control valve PCV-9161 fails closed	1.50E-03	1.01E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

SPC Explosion


SPC Explosion
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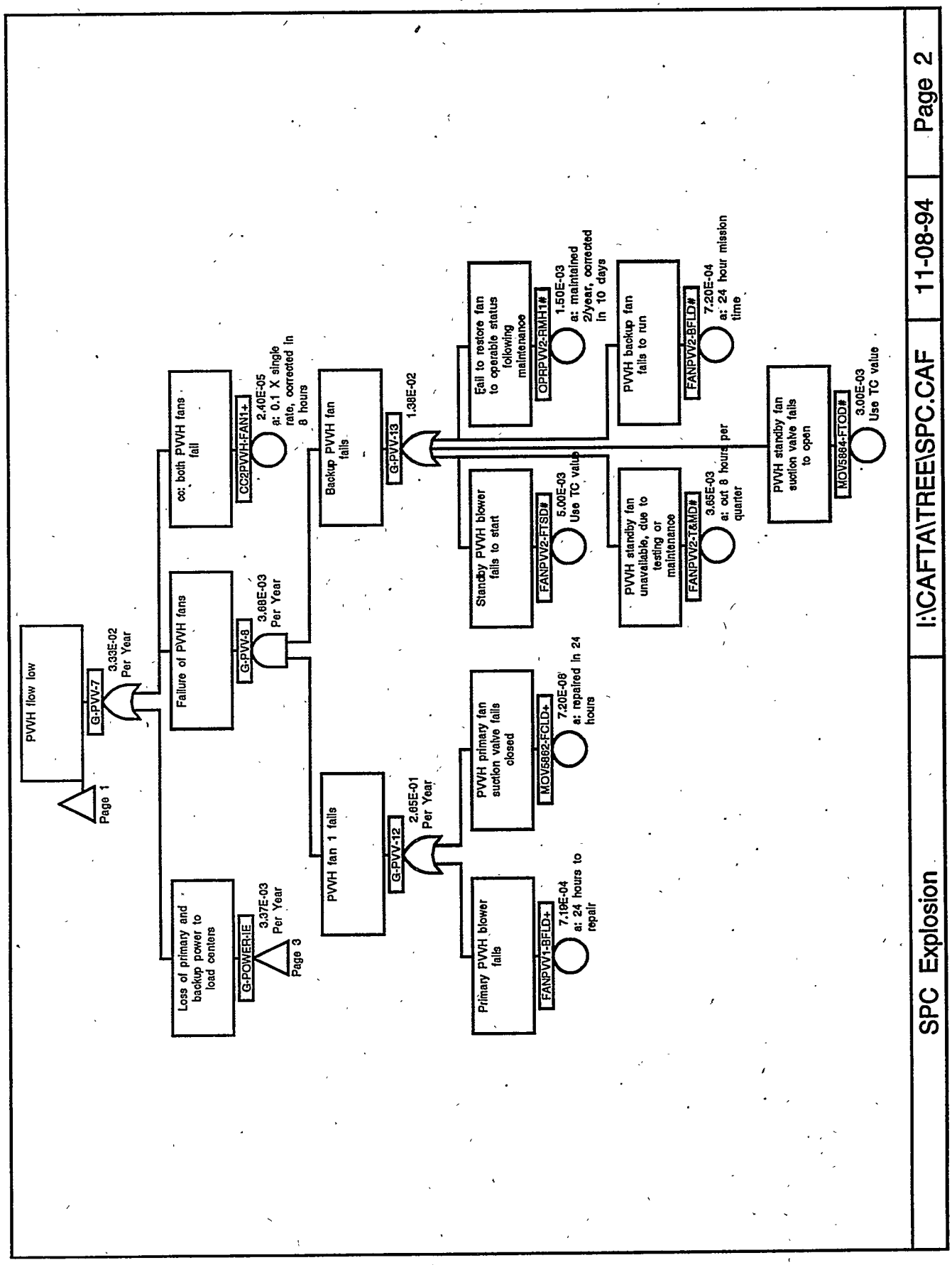
11-08-94
Page 1
Benzene explosion in SPC
TOP-SPC
1.12E-04 Per Year 11/04/94 TRUNC = 0.0E+00
Benzene enters SPC from SPC vessel
SPC ventilation flow inadequate
G-SPC-1
5.28E-01 Per Year
G-SPC-1A
3.37E-03 Per Year
Page 5
Ignition source present in SPC
IGNSPC-PRE1#
3.00E-02 Use TC value
Spilled benzene remains in cell
SPC/PVVH isolation valve fails closed
G-SPC-2A
8.10E-02 Per Year
Page 4
G-SPC-2C
5.26E-03 Per Year
SPC/PVVH isolation interlock activated
G-SPC-4
4.42E-01 Per Year
SPC/PVVH isolation valve 1041 fails closed
MOV1041-FCLK+
2.40E-06 a: returned to open in 8 hours
SPC/PVVH isolation valve 9278 fails closed
MOV9278-FCLK+
2.40E-06 a: returned to open in 8 hours
PVVH flow element 5860 fails low
FE-5860-FLOK+
2.40E-05 a: detected and corrected in 8 hours
PVVH flow monitor 6041 fails low
FE-6041-FLOK+
2.40E-05 a: detected and corrected in 8 hours
SPC CO2 purge isolation valve 2 fails closed
SV-CO22-FCLQ+
1.28E-04 a: corrected before next batch
SPC CO2 purge isolation valve 1 fails closed
SV-CO21-FCLQ+
1.28E-04 a: corrected before next batch
LOSS OF NORMAL ELECTRIC POWER TO DWPF
TOPPOWN-BFLH+
2.97E-04 repair time = 8.5 hours
2
PVVH flow low
G-PVV-7
3.33E-02 Per Year
Page 2


SPC Explosion
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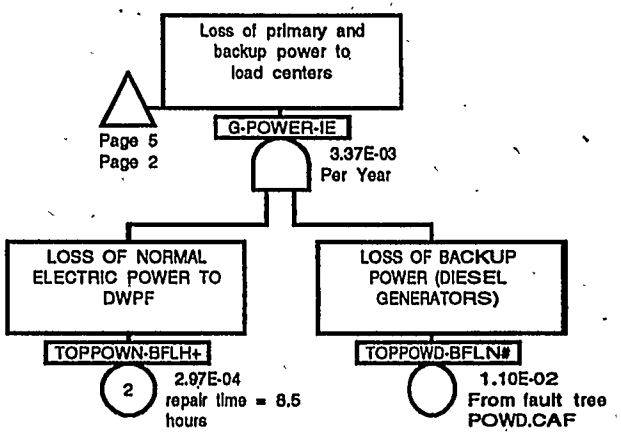
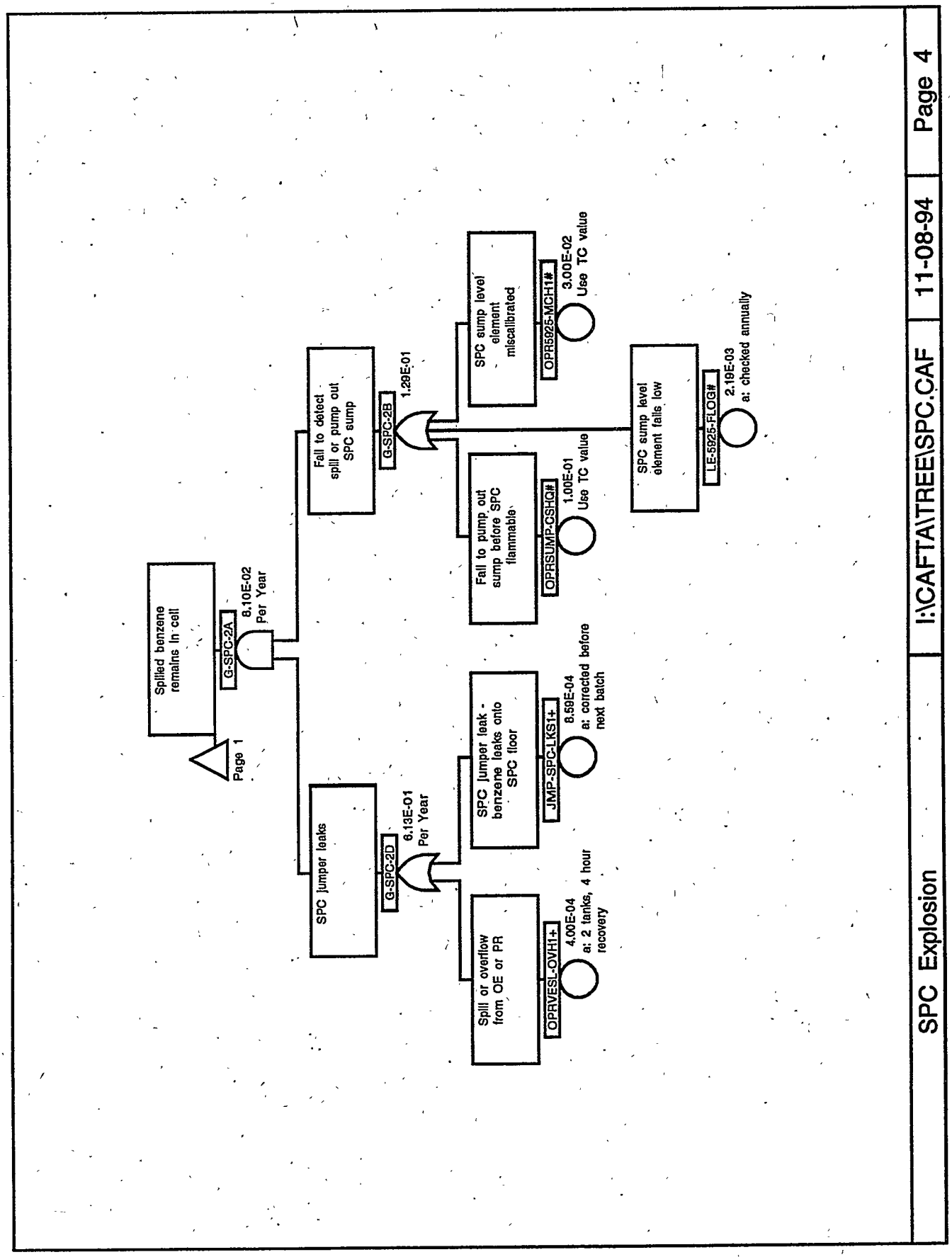
Page 2
PVVH flow low
G-PVV-7
3.33E-02 Per Year
Page 1
Failure of PVVH fans
G-PVV-8
3.68E-03 Per Year
cc: both PVVH fans fail
CC2PVVH-FAN1+
2.40E-05 a: 0.1 X single rate, corrected in 8 hours
Backup PVVH fan fails
G-PVV-13
1.38E-02
Fail to restore fan to operable status following maintenance
OPRPVV2-RMH1#
1.50E-03 a: maintained 2/year, corrected in 10 days
Standby PVVH blower fails to start
FANPVV2-FTSD#
5.00E-03 Use TC value
PVVH backup fan fails to run
FANPVV2-BFLD#
7.20E-04 a: 24 hour mission time
PVVH standby fan unavailable, due to testing or maintenance
FANPVV2-T&MD#
3.65E-03 a: out 8 hours per quarter
PVVH standby fan suction valve fails to open
MOV5864-FTOD#
3.00E-03 Use TC value
Loss of primary and backup power to load centers
G-POWER-IE
3.37E-03 Per Year
Page 3
PVVH fan 1 fails
G-PVV-12
2.65E-01 Per Year
PVVH primary fan suction valve fails closed
MOV5862-FCLD+
7.20E-06 a: repaired in 24 hours
Primary PVVH blower fails
FANPVV1-BFLD+
7.19E-04 a: 24 hours to repair



SPC Explosion	I:\CAFTA\TREE\SPC.CAF	11-08-94	Page 3


Spilled benzene remains in cell
G-SPC-2A
8.10E-02 Per Year
Page 1
Fail to detect spill or pump out SPC sump
G-SPC-2B
1.29E-01
SPC sump level element miscalibrated
OPR5925-MCH1#
3.00E-02 Use TC value
Fail to pump out sump before SPC flammable
OPRSUMP-OSHQ#
1.00E-01 Use TC value
SPC sump level element fails low
LE-5925-FLOG#
2.19E-03 a: checked annually
SPC jumper leaks
G-SPC-2D
6.13E-01 Per Year
SPC jumper leak - benzene leaks onto SPC floor
JMP-SPC-LKS1+
8.59E-04 a: corrected before next batch
Spill or overflow from OE or PR
OPRVESL-OVH1+
4.00E-04 a: 2 tanks, 4 hour recovery
SPC Explosion
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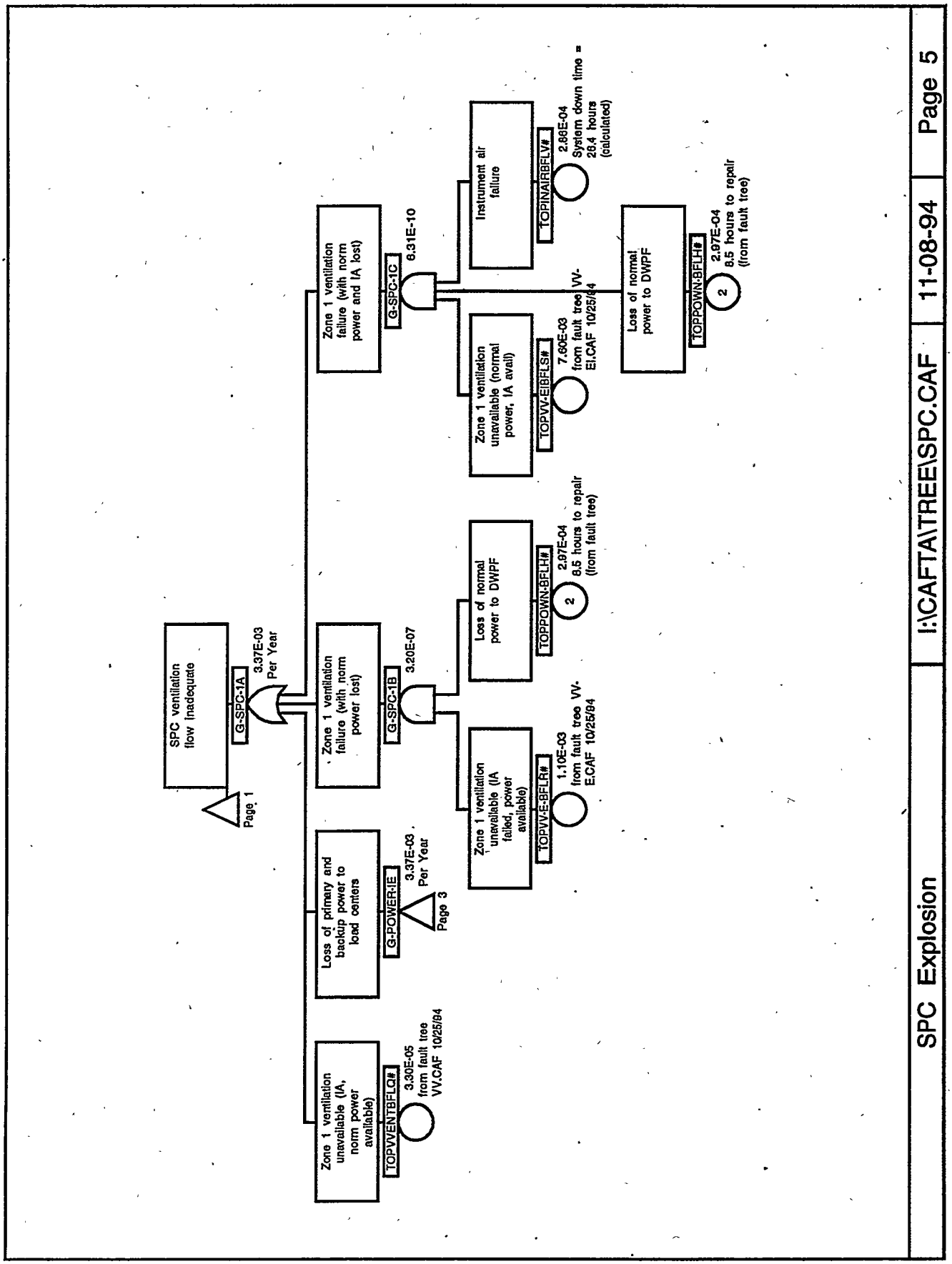
SPC Explosion
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Page 5
SPC ventilation flow inadequate
G-SPC-1A
3.37E-03 Per Year
Page 1
Zone 1 ventilation failure (with norm power and IA lost)
G-SPC-1C
6.31E-10
Instrument air failure
TOPINAIRBFLV#
2.88E-04 System down time = 28.4 hours (calculated)
Zone 1 ventilation unavailable (normal power, IA avail)
TOPVV-EIBFLS#
7.60E-03 from fault tree VV-EI.CAF 10/25/94
Loss of normal power to DWPF
TOPPOWN-BFLH#
2
2.97E-04 8.5 hours to repair (from fault tree)
Zone 1 ventilation failure (with norm power lost)
G-SPC-1B
3.20E-07
Loss of normal power to DWPF
TOPPOWN-BFLH#
2
2.97E-04 8.5 hours to repair (from fault tree)
Zone 1 ventilation unavailable (IA failed, power available)
TOPVV-E-BFLR#
1.10E-03 from fault tree VV-E.CAF 10/25/94
Loss of primary and backup power to load centers
G-POWER-1E
3.37E-03 Per Year
Page 3
Zone 1 ventilation unavailable (IA, norm power available)
TOPVVENTBFLQ#
3.30E-05 from fault tree VV.CAF 10/25/94

Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
CC2PVVH-FAN1+	2		SV-C022-FCLQ+	1							
FANPVV1-BFLD+	2		TOP-SPC	1							
FANPVV2-BFLD#	2		TOPINAIRBFLV#	5							
FANPVV2-FTSD#	2		TOPPOWD-BFLN#	3							
FANPVV2-T&MD#	2		TOPPOWN-BFLH#	5							
FE-5860-FLOK+	1		TOPPOWN-BFLH#	5							
FE-6041-FLOK+	1		TOPPOWN-BFLH+	1							
G-POWER-IE	2		TOPPOWN-BFLH+	3							
G-POWER-IE	3		TOPVV-E-BFLR#	5							
G-POWER-IE	5		TOPVV-EIBFLS#	5							
G-PVV-12	2		TOPVVENTBFLQ#	5							
G-PVV-13	2										
G-PVV-7	1										
G-PVV-7	2										
G-PVV-8	2										
G-SPC-1	1										
G-SPC-1A	1										
G-SPC-1A	5										
G-SPC-1B	5										
G-SPC-1C	5										
G-SPC-2A	1										
G-SPC-2A	4										
G-SPC-2B	4										
G-SPC-2C	1										
G-SPC-2D	4										
G-SPC-4	1										
IGNSPC--PRE1#	1										
JMP-SPC-LKS1+	4										
LE-5925-FLOG#	4										
MOV1041-FCLK+	1										
MOV5862-FCLD+	2										
MOV5864-FTOD#	2										
MOV9278-FCLK+	1										
OPR5925-MCH1#	4										
OPRPVV2-RMH1#	2										
OPRSUMP-CSHQ#	4										
OPRVESL-OVH1+	4										
SV-C021-FCLQ+	1										

Cutsets for I:\CAFTA\CUT\SPC.CSR 11/08/94 12:43 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-SPC					1.12E-04
1.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	1.01E-04
	TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1	1N 1.1E-02N	1.10E-02N	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
2.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	1.01E-05
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
	TOPVV-E-BFLR#	Zone 1 ventilation unavailable (IA failed, power available)	1	1N 1.1E-03N	1.10E-03N	
3.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	3.03E-07
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
4.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	4.33E-08
	OPRSUMP-CSHQ#	Fail to pump out sump before SPC flammable	1	1N 1.0E-01N	1.00E-01N	
	OPRVESL-OVH1+	Spill or overflow from OE or PR	4	8H 5.0E-05H	4.00E-04	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
5.	FE-6041-FLOK+	PVVH flow monitor 6041 fails low	4	8H 3.0E-06H	2.40E-05	2.60E-08
	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
6.	CC2PVVH-FAN1+	cc: both PVVH fans fail	4	8H 3.0E-06H	2.40E-05	2.60E-08
	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
7.	FE-5860-FLOK+	PVVH flow element 5860 fails low	4	8H 3.0E-06H	2.40E-05	2.60E-08

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
8.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	2.60E-08
	SV-CO21-FCLQ+	SPC CO2 purge isolation valve 1 fails closed	4	43H 3.0E-06H	1.29E-04	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
9.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	2.60E-08
	SV-CO22-FCLQ+	SPC CO2 purge isolation valve 2 fails closed	4	43H 3.0E-06H	1.29E-04	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
10.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	2.00E-08
	TOPINAIRBFLV#	Instrument air failure	3	26H 1.1E-05H	2.86E-04	
	TOPPOWN-BFLH+	LOSS OF NORMAL ELECTRIC POWER TO DWPF	4	8.5H 3.5E-05H	2.97E-04	
	TOPVV-EIBFLS#	Zone 1 ventilation unavailable (normal power, IA avail)	1	1N 7.6E-03N	7.60E-03N	
11.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	1.73E-08
	JMP-SPC-LKS1+	SPC jumper leak - benzene leaks onto SPC floor	4	43H 2.0E-05H	8.59E-04	
	OPRSUMP-CSHQ#	Fail to pump out sump before SPC flammable	1	1N 1.0E-01N	1.00E-01N	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
12.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	1.30E-08
	OPR5925-MCH1#	SPC sump level element miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	OPRVESL-OVH1+	Spill or overflow from OE or PR	4	8H 5.0E-05H	4.00E-04	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
13.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	5.20E-09

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	JMP-SPC-LKS1+	SPC jumper leak - benzene leaks onto SPC floor	4	43H 2.0E-05H	8.59E-04	
	OPR5925-MCH1#	SPC sump level element miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
14.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	2.60E-09
	MOV9278-FCLK+	SPC/PVVH isolation valve 9278 fails closed	4	8H 3.0E-07H	2.40E-06	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
15.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	2.60E-09
	MOV1041-FCLK+	SPC/PVVH isolation valve 1041 fails closed	4	8H 3.0E-07H	2.40E-06	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
16.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	1.30E-09
	FANPVV2-FTSD#	Standby PVVH blower fails to start	1	1N 5.0E-03N	5.00E-03N	
	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
17.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	9.48E-10
	FANPVV2-T&MD#	PVVH standby fan unavailable, due to testing or maintenance	3	8H 4Y	3.65E-03	
	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
18.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	9.48E-10
	LE-5925-FLOG#	SPC sump level element fails low	5	1Y 5.0E-07H	2.19E-03	
	OPRVESL-OVH1+	Spill or overflow from OE or PR	4	8H 5.0E-05H	4.00E-04	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	

Cutsets for I:\CAFTA\CUT\SPC.CSR 11/08/94 12:43 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
19.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	7.80E-10
	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	
	MOV5864-FTOD#	PVVH standby fan suction valve fails to open	1	1N 3.0E-03N	3.00E-03N	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
20.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	4.20E-10
	OPRSUMP-CSHQ#	Fail to pump out sump before SPC flammable	1	1N 1.0E-01N	1.00E-01N	
	OPRVESL-OVH1+	Spill or overflow from OE or PR	4	8H 5.0E-05H	4.00E-04	
	TOPPOWN-BFLH#	Loss of normal power to DWPF	3	8.5H 3.5E-05H	2.97E-04	
	TOPVV-E-BFLR#	Zone 1 ventilation unavailable (IA failed, power available)	1	1N 1.1E-03N	1.10E-03N	
21.	FANPVV1-BFLD+	Primary PVVH blower fails	4	24H 3.0E-05H	7.19E-04	3.90E-10
	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	
	OPRPVV2-RMH1#	Fail to restore fan to operable status following maintenance	1	.03N 5.0E-02N	1.50E-03N	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
22.	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	3.79E-10
	JMP-SPC-LKS1+	SPC jumper leak - benzene leaks onto SPC floor	4	43H 2.0E-05H	8.59E-04	
	LE-5925-FLOG#	SPC sump level element fails low	5	1Y 5.0E-07H	2.19E-03	
	TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	1	1N 3.3E-05N	3.30E-05N	
23.	CC2PVVH-FAN1+	cc: both PVVH fans fail	4	8H 3.0E-06H	2.40E-05	2.52E-10
	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	
	TOPPOWN-BFLH#	Loss of normal power to DWPF	3	8.5H 3.5E-05H	2.97E-04	
	TOPVV-E-BFLR#	Zone 1 ventilation unavailable (IA failed, power available)	1	1N 1.1E-03N	1.10E-03N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
24.	FE-5860-FLOK+	PVVH flow element 5860 fails low	4	8H 3.0E-06H	2.40E-05	2.52E-10
	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	
	TOPPOWN-BFLH#	Loss of normal power to DWPF	3	8.5H 3.5E-05H	2.97E-04	
	TOPVV-E-BFLR#	Zone 1 ventilation unavailable (IA failed, power available)	1	1N 1.1E-03N	1.10E-03N	
25.	FE-6041-FLOK+	PVVH flow monitor 6041 fails low	4	8H 3.0E-06H	2.40E-05	2.52E-10
	IGNSPC--PRE1#	Ignition source present in SPC	1	1N 3.0E-02N	3.00E-02N	
	TOPPOWN-BFLH#	Loss of normal power to DWPF	3	8.5H 3.5E-05H	2.97E-04	
	TOPVV-E-BFLR#	Zone 1 ventilation unavailable (IA failed, power available)	1	1N 1.1E-03N	1.10E-03N	

Benzene explosion in SPC Top Event Frequency: 1.12E-04/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
TOPPOWN-BFLH+-IC	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	2.85E+04
TOPVVENTBFLQ#	Zone 1 ventilation unavailable (IA, norm power available)	3.30E-05	1.43E+02
TOPVV-E-BFLR#	Zone 1 ventilation unavailable (IA failed, power available)	1.10E-03	8.32E+01
TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1.10E-02	8.23E+01
MOV1041-FCLK+-I	SPC/PVVH isolation valve 1041 fails closed	3.00E-07/H	7.93E+01
MOV9278-FCLK+-I	SPC/PVVH isolation valve 9278 fails closed	3.00E-07/H	7.93E+01
FE-5860-FLOK+-I	PVVH flow element 5860 fails low	3.00E-06/H	7.93E+01
SV-CO21-FCLQ+-I	SPC CO2 purge isolation valve 1 fails closed	3.00E-06/H	7.93E+01
SV-CO22-FCLQ+-I	SPC CO2 purge isolation valve 2 fails closed	3.00E-06/H	7.93E+01
FE-6041-FLOK+-I	PVVH flow monitor 6041 fails low	3.00E-06/H	7.93E+01
CC2PVVH-FAN1+-I	cc: both PVVH fans fail	3.00E-06/H	7.93E+01
IGNSPC--PRE1#	Ignition source present in SPC	3.00E-02	3.33E+01
JMP-SPC-LKS1+-I	SPC jumper leak - benzene leaks onto SPC floor	2.00E-05/H	1.14E+01
OPRVESL-OVH1+-I	Spill or overflow from OE or PR	5.00E-05/H	1.14E+01
MOV5862-FCLD+-I	PVVH primary fan suction valve fails closed	3.00E-07/H	2.09E+00
FANPVV1-BFLD+-I	Primary PVVH blower fails	3.00E-05/H	2.09E+00
TOPINAIRBFLV#	Instrument air failure	2.86E-04	1.62E+00
TOPVV-EIBFLS#	Zone 1 ventilation unavailable (normal power, IA avail)	7.60E-03	1.02E+00

Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
*IGNSPC--PRE1#	Ignition source present in SPC	3.00E-02	0.00E+00
TOPPOWN-BFLH+-IC	LOSS OF NORMAL ELECTRIC POWER TO DWPF	3.50E-05/H	5.10E+02
TOPPOWD-BFLN#	LOSS OF BACKUP POWER (DIESEL GENERATORS)	1.10E-02	1.05E+01
TOPVV-E-BFLR#	Zone 1 ventilation unavailable (IA failed, power available)	1.10E-03	1.10E+00

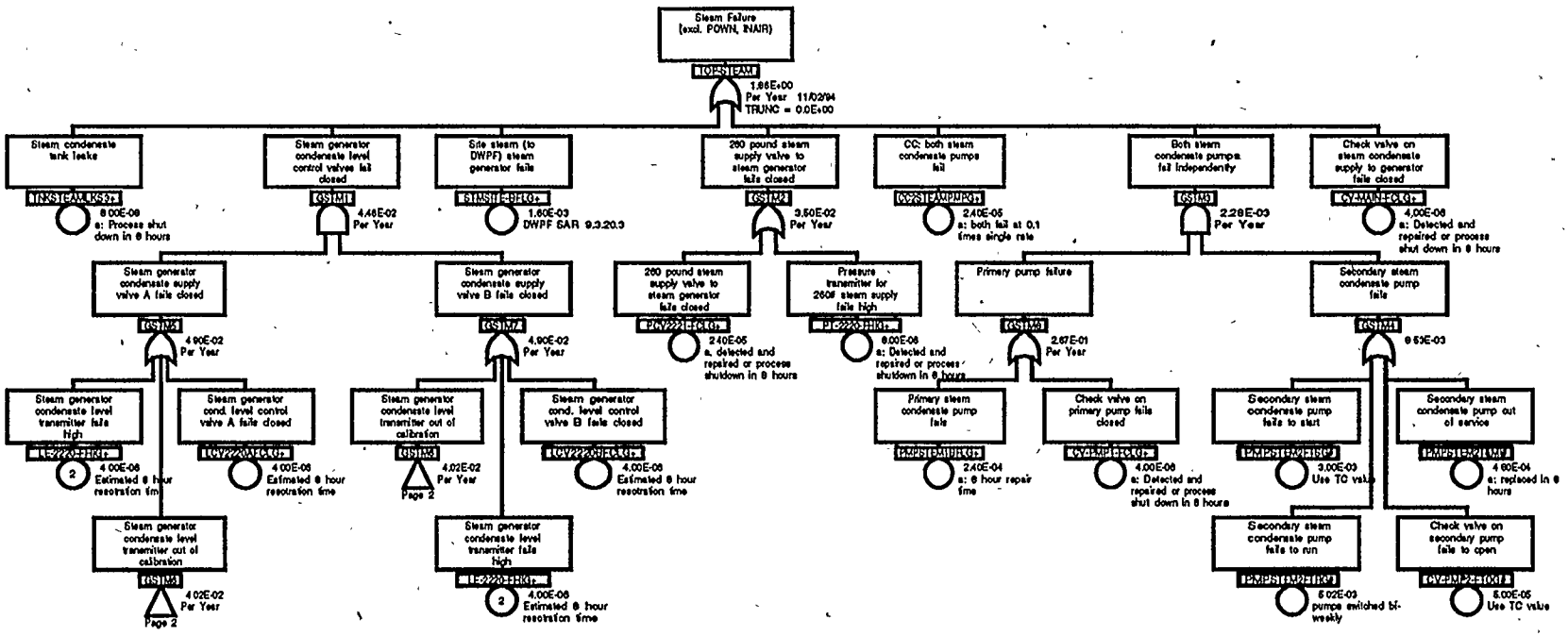
* A Reduction Worth of 0.0E+00 indicates event appears in every cutset could serve as a single event preventor for the accident.

Note: Events that make less than 1% difference to the importance factor are not included.

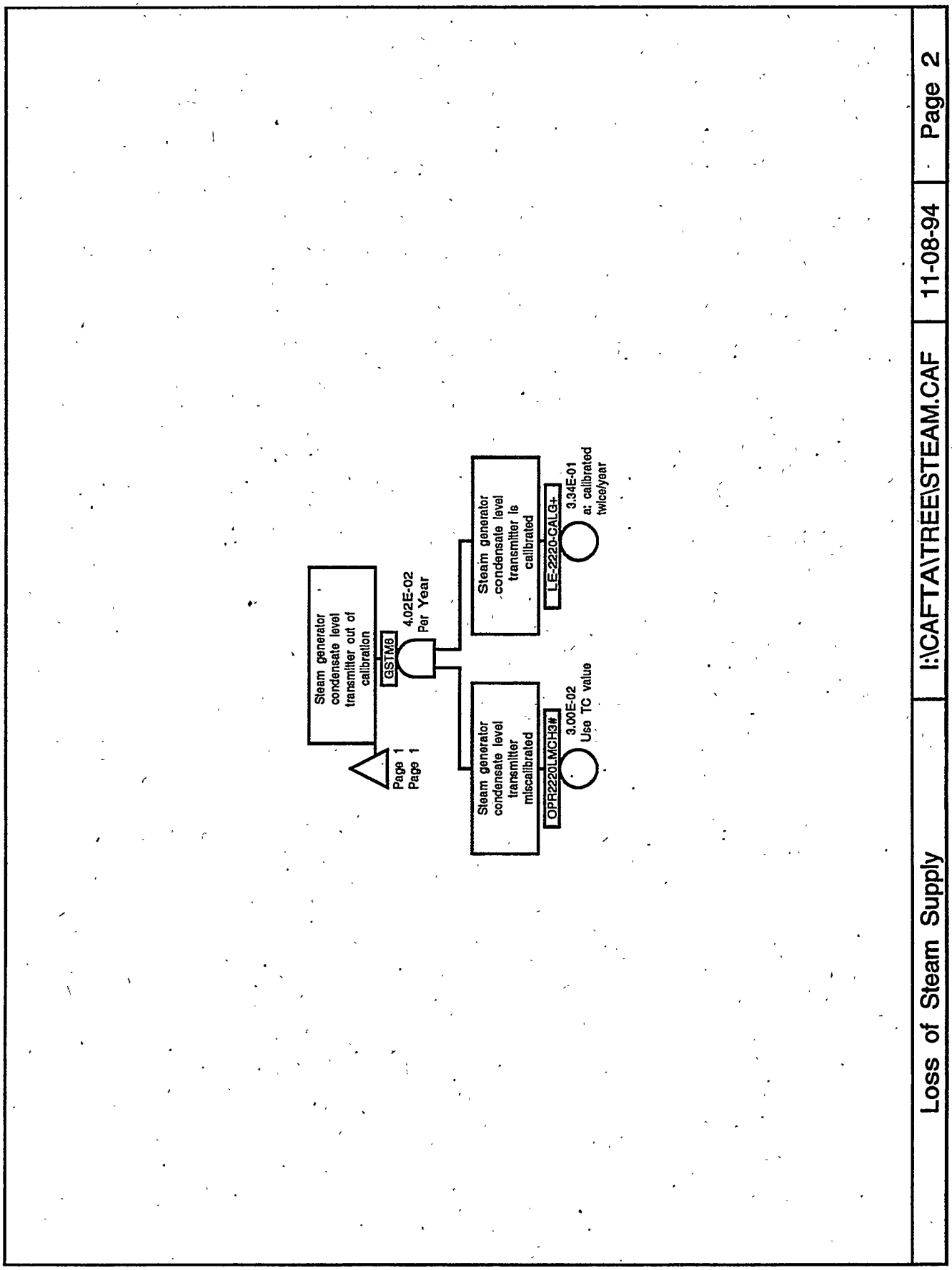
Attachment 6

Support System Fault Tree Plots and Cut Sets

Process Steam Unavailable



Loss of Steam Supply	I:\CAFTA\TREE\STEAM.CAF	11-08-94	Page 1


Loss of Steam Supply
I:\CAFTA\TREE\STEAM.CAF
11-08-94
Page 2
Steam generator condensate level transmitter out of calibration
GSTM6
4.02E-02
Per Year
Page 1
Page 1
Steam generator condensate level transmitter is calibrated
LE-2220-CALG+
3.34E-01
a: calibrated twice/year
Steam generator condensate level transmitter miscalibrated
OPR2220LMCH3#
3.00E-02
Use TC value

Cutsets for I:\CAFTA\CUT\STEAM.CSR 11/08/94 11:34 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	TOP-STEAM					1.86E+00
1.	STMSITE-BFLG+	Site steam (to DWPF) steam generator fails	4	8H 2.0E-04H	1.60E-03	1.75E+00
2.	LE-2220-CALG+	Steam generator condensate level transmitter is calibrated	4	1Q 2.3E-04H	3.34E-01	4.02E-02
	OPR2220LMCH3#	Steam generator condensate level transmitter miscalibrated	1	1N 3.0E-02N	3.00E-02N	
3.	PCV2221-FCLG+	260 pound steam supply valve to steam generator fails closed	4	8H 3.0E-06H	2.40E-05	2.63E-02
4.	CC2STEAMPMPG+	CC: both steam condensate pumps fail	4	8H 3.0E-06H	2.40E-05	2.63E-02
5.	PT-2220-FHIG+	Pressure transmitter for 260# steam supply fails high	4	8H 1.0E-06H	8.00E-06	8.76E-03
6.	CV-MAIN-FCLG+	Check valve on steam condensate supply to generator fails closed	4	8H 5.0E-07H	4.00E-06	4.38E-03
7.	LE-2220-FHIG+	Steam generator condensate level transmitter fails high	4	8H 5.0E-07H	4.00E-06	4.38E-03
8.	PMPSTEM1BFLG+	Primary steam condensate pump fails	4	8H 3.0E-05H	2.40E-04	1.32E-03
	PMPSTEM2FTRG#	Secondary steam condensate pump fails to run	5	14D 3.0E-05H	5.02E-03	
9.	PMPSTEM1BFLG+	Primary steam condensate pump fails	4	8H 3.0E-05H	2.40E-04	7.88E-04
	PMPSTEM2FTSG#	Secondary steam condensate pump fails to start	1	1N 3.0E-03N	3.00E-03N	
10.	PMPSTEM1BFLG+	Primary steam condensate pump fails	4	8H 3.0E-05H	2.40E-04	1.26E-04
	PMPSTEM2T&MI#	Secondary steam condensate pump out of service	3	8H 6.0E-05H	4.80E-04	
11.	TNKSTEAMLKS3+	Steam condensate tank leaks	4	8H 1.0E-08H	8.00E-08	8.76E-05
12.	CV-PMP1-FCLG+	Check valve on primary pump fails closed	4	8H 5.0E-07H	4.00E-06	2.20E-05
	PMPSTEM2FTRG#	Secondary steam condensate pump fails to run	5	14D 3.0E-05H	5.02E-03	

Cutsets for I:\CAFTA\CUT\STEAM.CSR 11/08/94 11:34 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
13.	CV-PMP1-FCLG+	Check valve on primary pump fails closed	4	8H 5.0E-07H	4.00E-06	1.31E-05
	PMPSTEM2FTSG#	Secondary steam condensate pump fails to start	1	1N 3.0E-03N	3.00E-03N	
14.	CV-PMP2-FTOG#	Check valve on secondary pump fails to open	1	1N 5.0E-05N	5.00E-05N	1.31E-05
	PMPSTEM1BFLG+	Primary steam condensate pump fails	4	8H 3.0E-05H	2.40E-04	
15.	CV-PMP1-FCLG+	Check valve on primary pump fails closed	4	8H 5.0E-07H	4.00E-06	2.10E-06
	PMPSTEM2T&MI#	Secondary steam condensate pump out of service	3	8H 6.0E-05H	4.80E-04	
16.	CV-PMP1-FCLG+	Check valve on primary pump fails closed	4	8H 5.0E-07H	4.00E-06	2.19E-07
	CV-PMP2-FTOG#	Check valve on secondary pump fails to open	1	1N 5.0E-05N	5.00E-05N	
17.	LCV2220AFCLG+	Steam generator cond. level control valve A fails closed	4	8H 5.0E-07H	4.00E-06	3.50E-08
	LCV2220BFCLG+	Steam generator cond. level control valve B fails closed	4	8H 5.0E-07H	4.00E-06	

Steam Failure (excl. POWN, INAIR) Top Event Frequency: 1.86E+00/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
CV-MAIN-FCLG+-I	Check valve on steam condensate supply fails closed	5.00E-07/H	4.71E+03
PT-2220-FHIG+-I	Pressure transmitter for 260# steam supply fails high	1.00E-06/H	4.71E+03
TNKSTEAMLKS3+-I	Steam condensate tank leaks	1.00E-08/H	4.71E+03
LE-2220-FHIG+-I	Steam generator condensate level transmitter fails high	5.00E-07/H	4.71E+03
CC2STEAMPMPG+-I	CC: both steam condensate pumps fail	3.00E-06/H	4.71E+03
STMSITE-BFLG+-I	Site steam (to DWPF) steam generator fails	2.00E-04/H	4.71E+03
PCV2221-FCLG+-I	260 pound steam valve to steam generator fails closed	3.00E-06/H	4.71E+03
LE-2220-CALG+-I	Steam generator condensate level transmitter is calibrated	1.53E-04/H	1.42E+02
CV-PMP1-FCLG+-I	Check valve on primary pump fails closed	5.00E-07/H	4.12E+01
PMPSTEM1BFLG+-I	Primary steam condensate pump fails	3.00E-05/H	4.12E+01
OPR2220LMCH3#	Steam generator condensate level transmitter miscalibrated	3.00E-02	1.70E+00
CV-PMP2-FTOG#	Check valve on secondary pump fails to open	5.00E-05	1.14E+00
PMPSTEM2T&MI#	Secondary steam condensate pump out of service	4.80E-04	1.14E+00
PMPSTEM2FTSG#	Secondary steam condensate pump fails to start	3.00E-03	1.14E+00
PMPSTEM2FTRG#	Secondary steam condensate pump fails to run	5.02E-03	1.14E+00
LCV2220BFCLG+-IC	Steam generator cond. level control valve B fails closed	5.00E-07/H	1.02E+00
LCV2220AFCLG+-IC	Steam generator cond. level control valve A fails closed	5.00E-07/H	1.02E+00

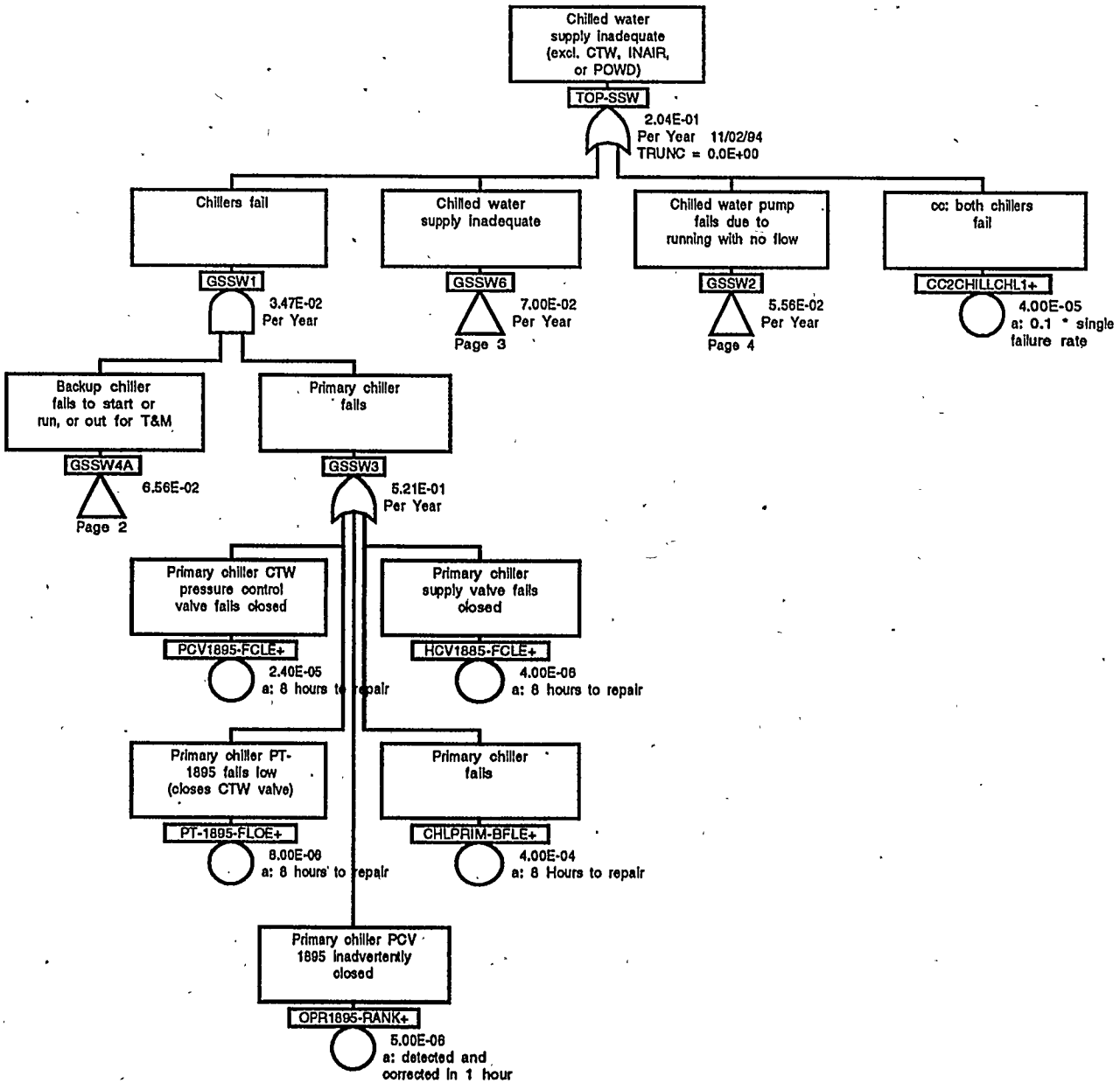
Modified top event frequency = (top event frequency) x (risk achievement worth).

Risk Reduction Worth

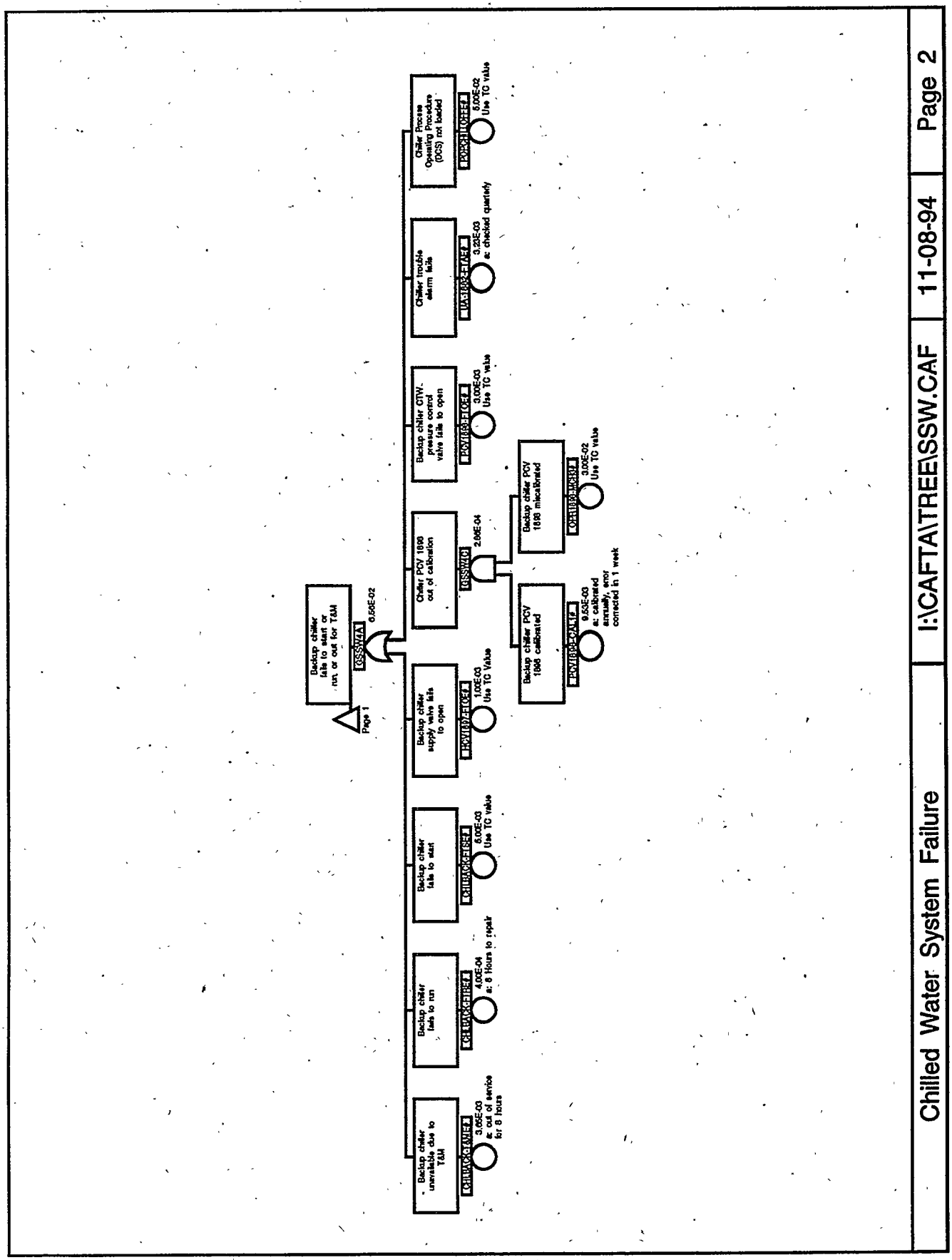
Basic Event Name	Description	Prob/Freq	RedW
STMSITE-BFLG+-I	Site steam (to DWPF) steam generator fails	2.00E-04/H	1.65E+01
OPR2220LMCH3#	Steam generator condensate level transmitter miscalibrated	3.00E-02	1.02E+00
LE-2220-CALG+-I	Steam generator condensate level transmitter is calibrated	1.53E-04/H	1.02E+00
CC2STEAMPMPG+-I	CC: both steam condensate pumps fail	3.00E-06/H	1.01E+00
PCV2221-FCLG+-I	260 pound steam valve to steam generator fails closed	3.00E-06/H	1.01E+00

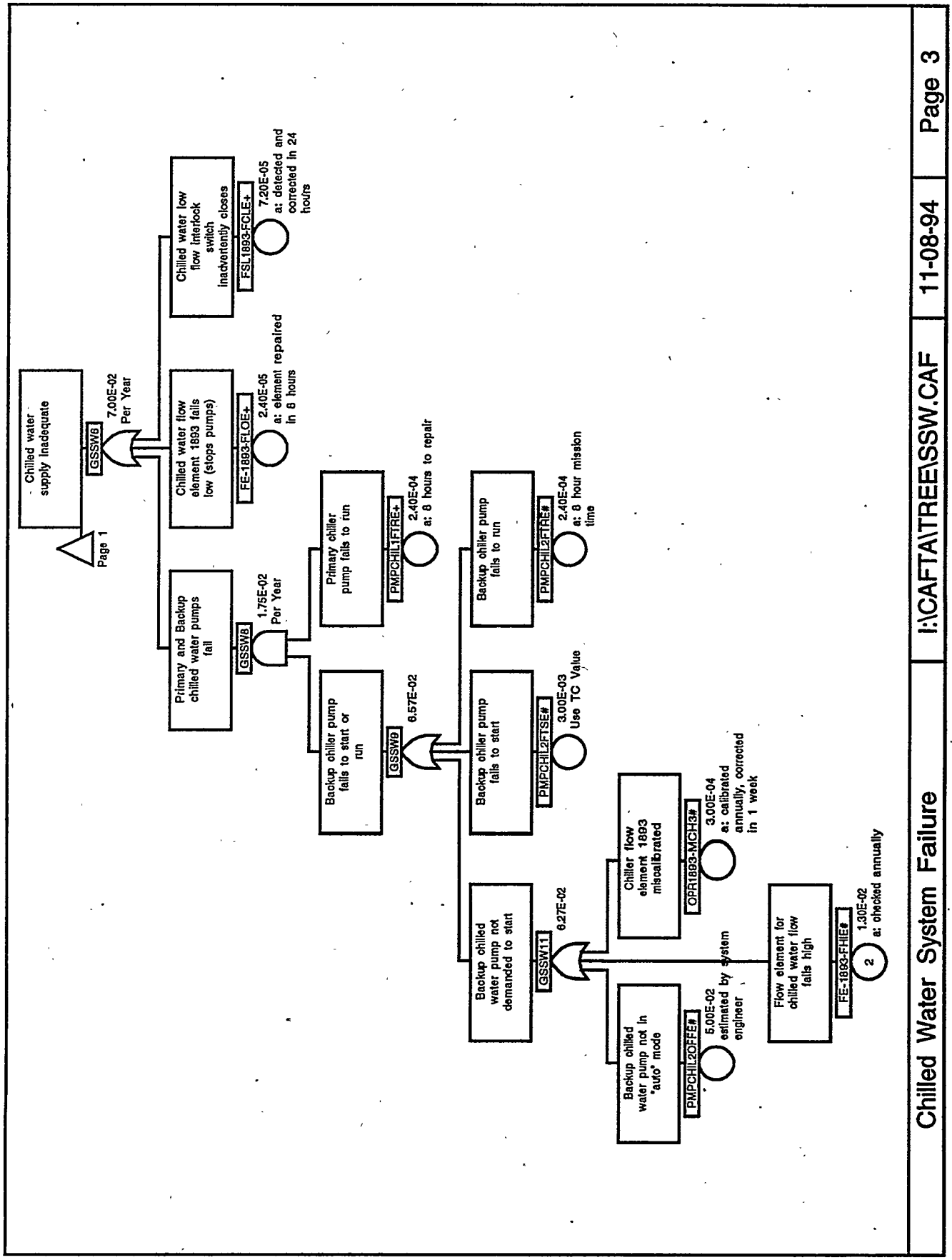
Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

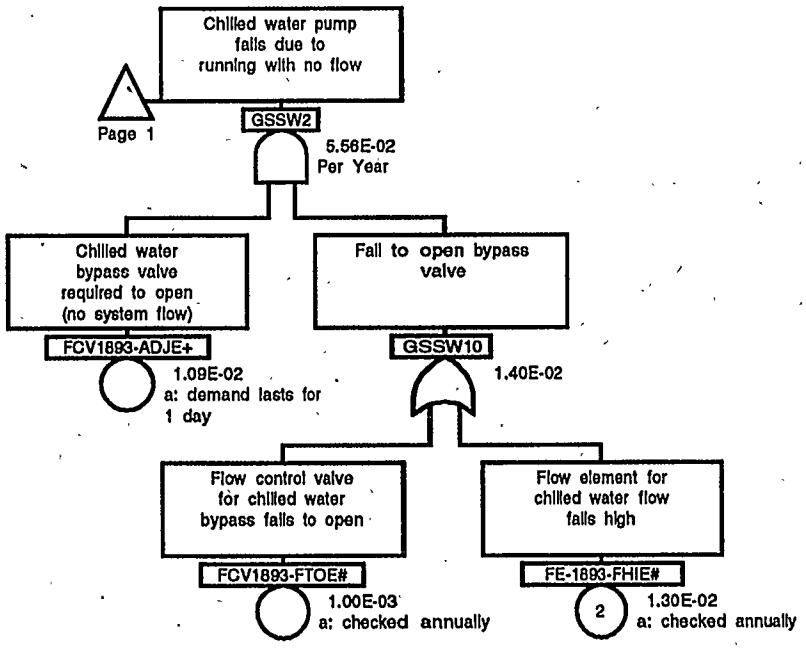
Process Chilled Water System Failure



Chilled Water System Failure	I:\CAFTA\TREE\SSW.CAF	11-08-94	Page 1


Chilled Water System Failure
I:\CAFTA\TREE\SSW.CAF
11-08-94
Page 2
Backup chiller fails to start or run, or out for T&M
SSSWAN
0.50E-02
Page 1
Backup chiller unavailable due to T&M
CHIMAINTUNAVL
3.05E-03
a: out of service for 8 hours
Backup chiller fails to run
CHILLMKRUNFAIL
4.00E-04
a: 8 Hours to repair
Backup chiller fails to start
CHILLMKRSTFAIL
6.00E-03
Use TO value
Backup chiller supply valve fails to open
HOV1868-BTOFF
1.00E-03
Use TO Value
Chiller PCV 1868 out of calibration
SSSWA01
2.00E-04
Backup chiller PCV 1868 calibrated
HOV1868-PCALTF
9.50E-03
a: calibrated annually, error corrected in 1 week
Backup chiller PCV 1868 miscalibrated
CHI1868-MCBRT
3.00E-02
Use TO value
Backup chiller CTW pressure control valve fails to open
HOV1868-BTOFF
3.00E-03
Use TO value
Chiller trouble alarm fails
UAS1868-BTAFF
3.23E-03
a: checked quarterly
Chiller Process Operating Procedure (OOS) not loaded
HOV1868-BTOFF
5.00E-02
Use TO value


Chilled Water System Failure
I:\CAFTA\TREE\SSW.CAF
11-08-94
Page 3
Chilled water supply inadequate
Page 1
GSSW6
7.00E-02 Per Year
Primary and Backup chilled water pumps fail
Chilled water flow element 1893 fails low (stops pumps)
FE-1893-FLOE+
2.40E-05 a: element repaired in 8 hours
Chilled water low flow interlock switch inadvertently closes
FSL1893-FCLE+
7.20E-05 a: detected and corrected in 24 hours
GSSW8
1.75E-02 Per Year
Backup chiller pump fails to start or run
Primary chiller pump fails to run
PMPCHIL1FTRE+
2.40E-04 a: 8 hours to repair
GSSW9
6.57E-02
Backup chilled water pump not demanded to start
Backup chiller pump fails to start
PMPCHIL2FTSE#
3.00E-03 Use TC Value
Backup chiller pump fails to run
PMPCHIL2FTRE#
2.40E-04 a: 8 hour mission time
GSSW11
6.27E-02
Backup chilled water pump not in "auto" mode
Chiller flow element 1893 miscalibrated
OPR1893-MCH3#
3.00E-04 a: calibrated annually, corrected in 1 week
PMPCHIL2OFFE#
5.00E-02 estimated by system engineer
Flow element for chilled water flow fails high
FE-1893-FHIE#
2
1.30E-02 a: checked annually


Chilled water pump fails due to running with no flow
Page 1
GSSW2
5.56E-02
Per Year
Chilled water bypass valve required to open (no system flow)
Fail to open bypass valve
FCV1893-ADJE+
1.09E-02
a: demand lasts for 1 day
GSSW10
1.40E-02
Flow control valve for chilled water bypass fails to open
Flow element for chilled water flow fails high
FCV1893-FTOE#
1.00E-03
a: checked annually
FE-1893-FHIE#
2
1.30E-02
a: checked annually

Cutsets for I:\CAFTA\CUT\SSW.CSR 11/08/94 11:51 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-SSW					2.04E-01
1.	FCV1893-ADJE+	Chilled water bypass valve required to open (no system flow)	4	1D 1.0Q	1.09E-02	5.17E-02
	FE-1893-FHIE#	Flow element for chilled water flow fails high	5	1Y 3.0E-06H	1.30E-02	
2.	CC2CHILLCHL1+	cc: both chillers fail	4	8H 5.0E-06H	4.00E-05	4.38E-02
3.	FE-1893-FLOE+	Chilled water flow element 1893 fails low (stops pumps)	4	8H 3.0E-06H	2.40E-05	2.63E-02
4.	FSL1893-FCLE+	Chilled water low flow interlock switch inadvertently closes	4	24H 3.0E-06H	7.20E-05	2.63E-02
5.	CHLPRIM-BFLE+	Primary chiller fails	4	8H 5.0E-05H	4.00E-04	2.19E-02
	POPCHILLOFFE#	Chiller Process Operating Procedure (DCS) not loaded	1	1N 5.0E-02N	5.00E-02N	
6.	PMPCHIL1FTRE+	Primary chiller pump fails to run	4	8H 3.0E-05H	2.40E-04	1.31E-02
	PMPCHIL2OFFE#	Backup chilled water pump not in "auto" mode	1	1N 5.0E-02N	5.00E-02N	
7.	FCV1893-ADJE+	Chilled water bypass valve required to open (no system flow)	4	1D 1.0Q	1.09E-02	3.97E-03
	FCV1893-FTOE#	Flow control valve for chilled water bypass fails to open	1	1N 1.0E-03N	1.00E-03N	
8.	FE-1893-FHIE#	Flow element for chilled water flow fails high	5	1Y 3.0E-06H	1.30E-02	3.42E-03
	PMPCHIL1FTRE+	Primary chiller pump fails to run	4	8H 3.0E-05H	2.40E-04	
9.	OPR1895-RANK+	Primary chiller PCV 1895 inadvertently closed	4	1H 5.0E-06H	5.00E-06	2.19E-03
	POPCHILLOFFE#	Chiller Process Operating Procedure (DCS) not loaded	1	1N 5.0E-02N	5.00E-02N	
10.	CHLBACK-FTSE#	Backup chiller fails to start	1	1N 5.0E-03N	5.00E-03N	2.19E-03
	CHLPRIM-BFLE+	Primary chiller fails	4	8H 5.0E-05H	4.00E-04	
11.	CHLBACK-T&ME#	Backup chiller unavailable due to T&M	3	8H 4.0E+00Y	3.65E-03	1.60E-03

Cutsets for I:\CAFTA\CUT\SSW.CSR 11/08/94 11:51 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	CHLPRIM-BFLE+	Primary chiller fails	4	8H 5.0E-05H	4.00E-04	
12.	CHLPRIM-BFLE+	Primary chiller fails	4	8H 5.0E-05H	4.00E-04	1.42E-03
	UA-1882-FTAE#	Chiller trouble alarm fails	5	3M 3.0E-06H	3.23E-03	
13.	PCV1895-FCLE+	Primary chiller CTW pressure control valve fails closed	4	8H 3.0E-06H	2.40E-05	1.31E-03
	POPCHILLOFFE#	Chiller Process Operating Procedure (DCS) not loaded	1	1N 5.0E-02N	5.00E-02N	
14.	CHLPRIM-BFLE+	Primary chiller fails	4	8H 5.0E-05H	4.00E-04	1.31E-03
	PCV1898-FTOE#	Backup chiller CTW pressure control valve fails to open	1	1N 3.0E-03N	3.00E-03N	
15.	PMPCHIL1FTRE+	Primary chiller pump fails to run	4	8H 3.0E-05H	2.40E-04	7.88E-04
	PMPCHIL2FTSE#	Backup chiller pump fails to start	1	1N 3.0E-03N	3.00E-03N	
16.	POPCHILLOFFE#	Chiller Process Operating Procedure (DCS) not loaded	1	1N 5.0E-02N	5.00E-02N	4.38E-04
	PT-1895-FLOE+	Primary chiller PT-1895 fails low (closes CTW valve)	4	8H 1.0E-06H	8.00E-06	
17.	CHLPRIM-BFLE+	Primary chiller fails	4	8H 5.0E-05H	4.00E-04	4.38E-04
	HCV1897-FTOE#	Backup chiller supply valve fails to open	1	1N 1.0E-03N	1.00E-03N	
18.	HCV1885-FCLE+	Primary chiller supply valve fails closed	4	8H 5.0E-07H	4.00E-06	2.19E-04
	POPCHILLOFFE#	Chiller Process Operating Procedure (DCS) not loaded	1	1N 5.0E-02N	5.00E-02N	
19.	CHLBACK-FTSE#	Backup chiller fails to start	1	1N 5.0E-03N	5.00E-03N	2.19E-04
	OPR1895-RANK+	Primary chiller PCV 1895 inadvertently closed	4	1H 5.0E-06H	5.00E-06	
20.	CHLBACK-FTRE#	Backup chiller fails to run	3	8H 5.0E-05H	4.00E-04	1.75E-04
	CHLPRIM-BFLE+	Primary chiller fails	4	8H 5.0E-05H	4.00E-04	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
21.	CHLBACK-T&ME#	Backup chiller unavailable due to T&M	3	8H 4.0E+00Y	3.65E-03	1.60E-04
	OPR1895-RANK+	Primary chiller PCV 1895 inadvertently closed	4	1H 5.0E-06H	5.00E-06	
22.	OPR1895-RANK+	Primary chiller PCV 1895 inadvertently closed	4	1H 5.0E-06H	5.00E-06	1.42E-04
	UA-1882-FTAE#	Chiller trouble alarm fails	5	3M 3.0E-06H	3.23E-03	
23.	OPR1895-RANK+	Primary chiller PCV 1895 inadvertently closed	4	1H 5.0E-06H	5.00E-06	1.31E-04
	PCV1898-FTOE#	Backup chiller CTW pressure control valve fails to open	1	1N 3.0E-03N	3.00E-03N	
24.	CHLBACK-FTSE#	Backup chiller fails to start	1	1N 5.0E-03N	5.00E-03N	1.31E-04
	PCV1895-FCLE+	Primary chiller CTW pressure control valve fails closed	4	8H 3.0E-06H	2.40E-05	
25.	CHLPRIM-BFLE+	Primary chiller fails	4	8H 5.0E-05H	4.00E-04	1.25E-04
	OPR1898-MCH3#	Backup chiller PCV 1898 miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	PCV1898-CAL1#	Backup chiller PCV 1898 calibrated	5	7D 1.0E+00Y	9.53E-03	

Chilled water supply inadequate (excl. CTW, INAIR, or POWD)
Top Event Frequency: 2.04E-01/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
CC2CHILLCHL1+-I	cc: both chillers fail	5.00E-06/H	4.29E+04
FE-1893-FLOE+-I	Chilled water flow element 1893 fails low (stops pumps)	3.00E-06/H	4.29E+04
FSL1893-FCLE+-I	Chilled water low flow interlock switch inadvertently closes	3.00E-06/H	4.29E+04
PMPCHIL1FTRE+-I	Primary chiller pump fails to run	3.00E-05/H	2.82E+03
HCV1885-FCLE+-I	Primary chiller supply valve fails closed	5.00E-07/H	2.82E+03
PT-1895-FLOE+-I	Primary chiller PT-1895 fails low (closes CTW valve)	1.00E-06/H	2.82E+03
PCV1895-FCLE+-I	Primary chiller CTW pressure control valve fails closed	3.00E-06/H	2.82E+03
OPR1895-RANK+-I	Primary chiller PCV 1895 inadvertently closed	5.00E-06/H	2.82E+03
CHLPRIM-BFLE+-I	Primary chiller fails	5.00E-05/H	2.82E+03
FCV1893-ADJE+-I	Chilled water bypass valve required to open	4.53E-04/H	6.02E+02
FE-1893-FHIE#	Flow element for chilled water flow fails high	1.30E-02	2.14E+01
FCV1893-FTOE#	Flow control valve for chilled water bypass fails to open	1.00E-03	2.04E+01
CHLBACK-FTRE#	Backup chiller fails to run	4.00E-04	3.55E+00
HCV1897-FTOE#	Backup chiller supply valve fails to open	1.00E-03	3.55E+00
PCV1898-FTOE#	Backup chiller CTW pressure control valve fails to open	3.00E-03	3.54E+00
UA-1882-FTAE#	Chiller trouble alarm fails	3.23E-03	3.54E+00
CHLBACK-T&ME#	Backup chiller unavailable due to T&M	3.65E-03	3.54E+00
CHLBACK-FTSE#	Backup chiller fails to start	5.00E-03	3.54E+00
POPCHILLOFFE#	Chiller Process Operating Procedure (DCS) not loaded	5.00E-02	3.42E+00
PMPCHIL2FTRE#	Backup chiller pump fails to run	2.40E-04	2.29E+00
OPR1893-MCH3#	Chiller flow element 1893 miscalibrated	3.00E-04	2.29E+00
PMPCHIL2FTSE#	Backup chiller pump fails to start	3.00E-03	2.28E+00
PMPCHIL2OFFE#	Backup chilled water pump not in "auto" mode	5.00E-02	2.22E+00
PCV1898-CAL1#	Backup chiller PCV 1898 calibrated	9.53E-03	1.08E+00
OPR1898-MCH3#	Backup chiller PCV 1898 miscalibrated	3.00E-02	1.02E+00

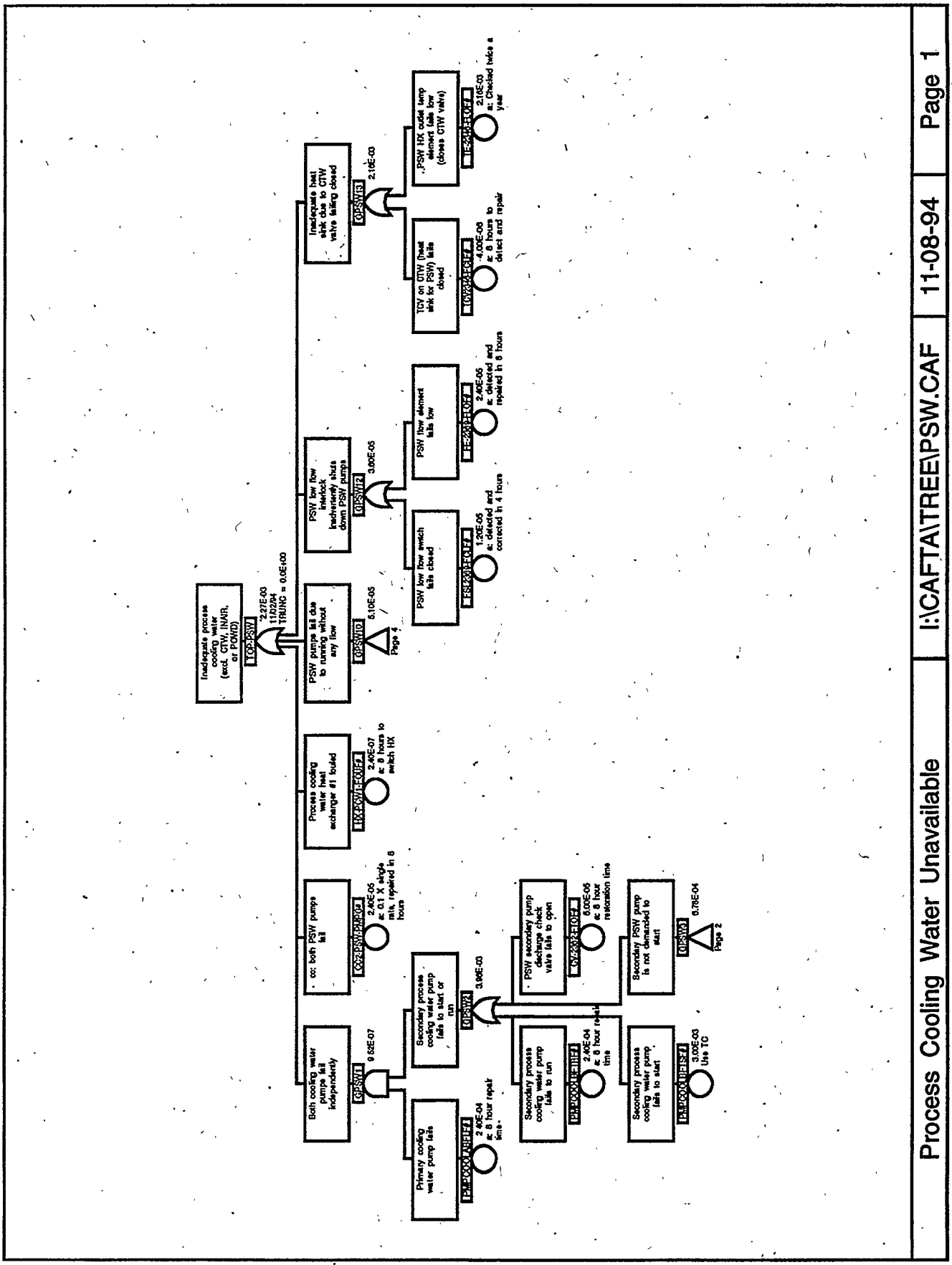
Modified top event frequency = (top event frequency) x (risk achievement worth).

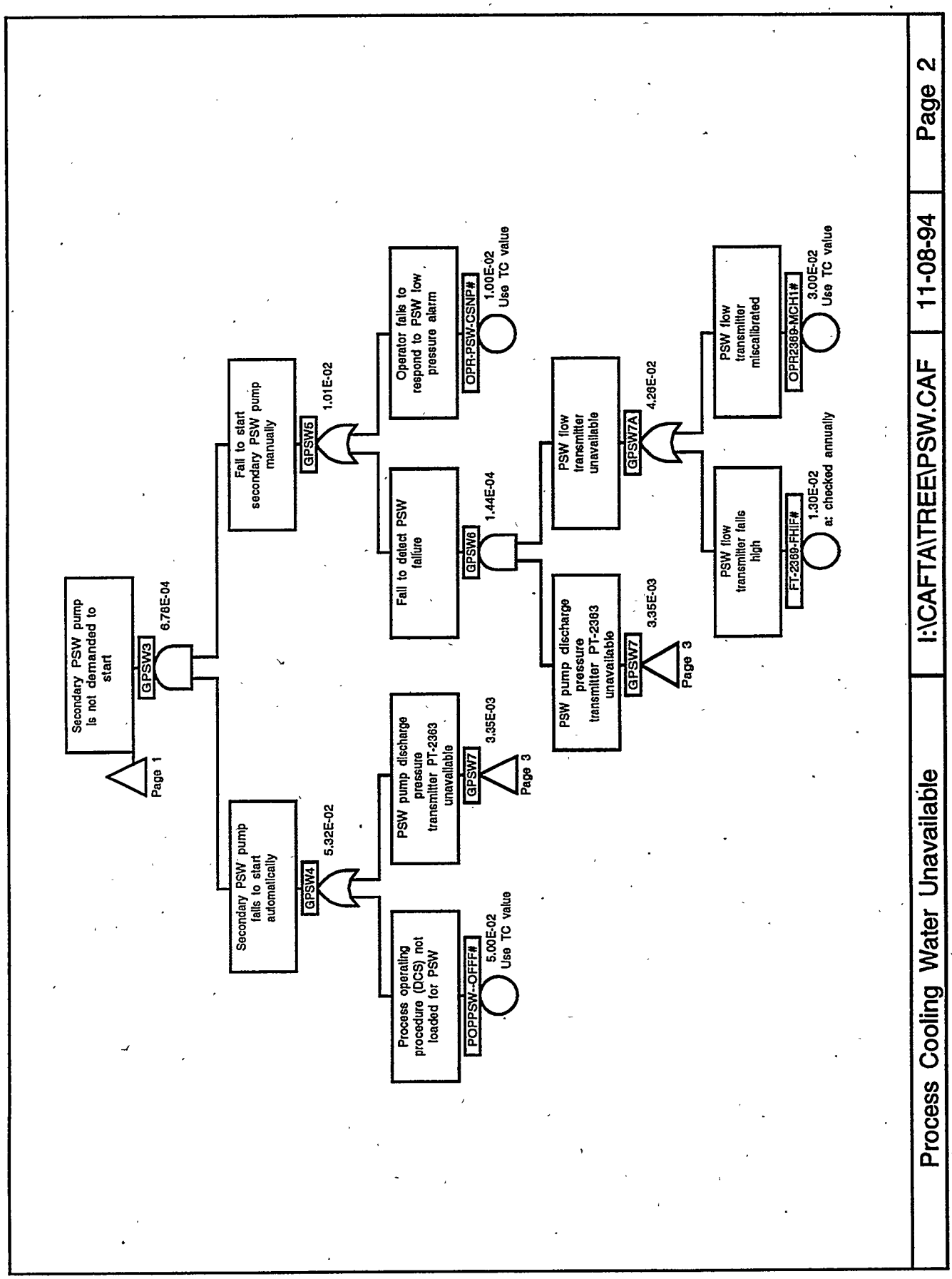
Risk Reduction Worth

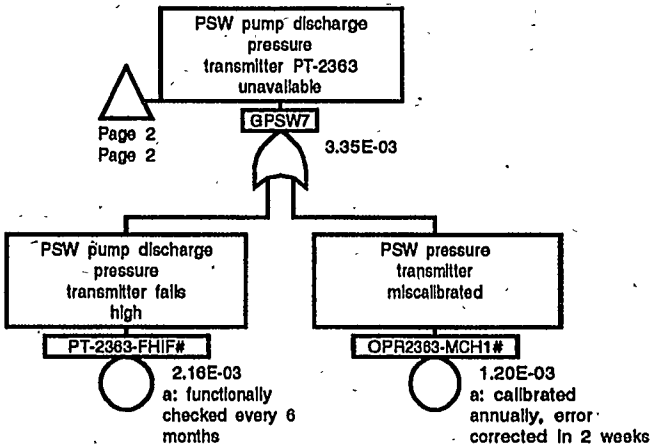
Basic Event Name	Description	Prob/Freq	RedW
FCV1893-ADJE+-I	Chilled water bypass valve required to open	4.53E-04/H	1.37E+00
FE-1893-FHIE#	Flow element for chilled water flow fails high	1.30E-02	1.37E+00
CC2CHILLCHL1+-I	cc: both chillers fail	5.00E-06/H	1.27E+00
CHLPRIM-BFLE+-I	Primary chiller fails	5.00E-05/H	1.17E+00
FE-1893-FLOE+-I	Chilled water flow element 1893 fails low (stops pumps)	3.00E-06/H	1.15E+00
FSL1893-FCLE+-I	Chilled water low flow interlock switch inadvertently closes	3.00E-06/H	1.15E+00
POPCHILLOFFE#	Chiller Process Operating Procedure (DCS) not loaded	5.00E-02	1.15E+00
PMPCHIL1FTRE+-I	Primary chiller pump fails to run	3.00E-05/H	1.09E+00
PMPCHIL2OFFE#	Backup chilled water pump not in "auto" mode	5.00E-02	1.07E+00
FCV1893-FTOE#	Flow control valve for chilled water bypass fails to open	1.00E-03	1.02E+00
OPR1895-RANK+-I	Primary chiller PCV 1895 inadvertently closed	5.00E-06/H	1.01E+00
CHLBACK-FTSE#	Backup chiller fails to start	5.00E-03	1.01E+00

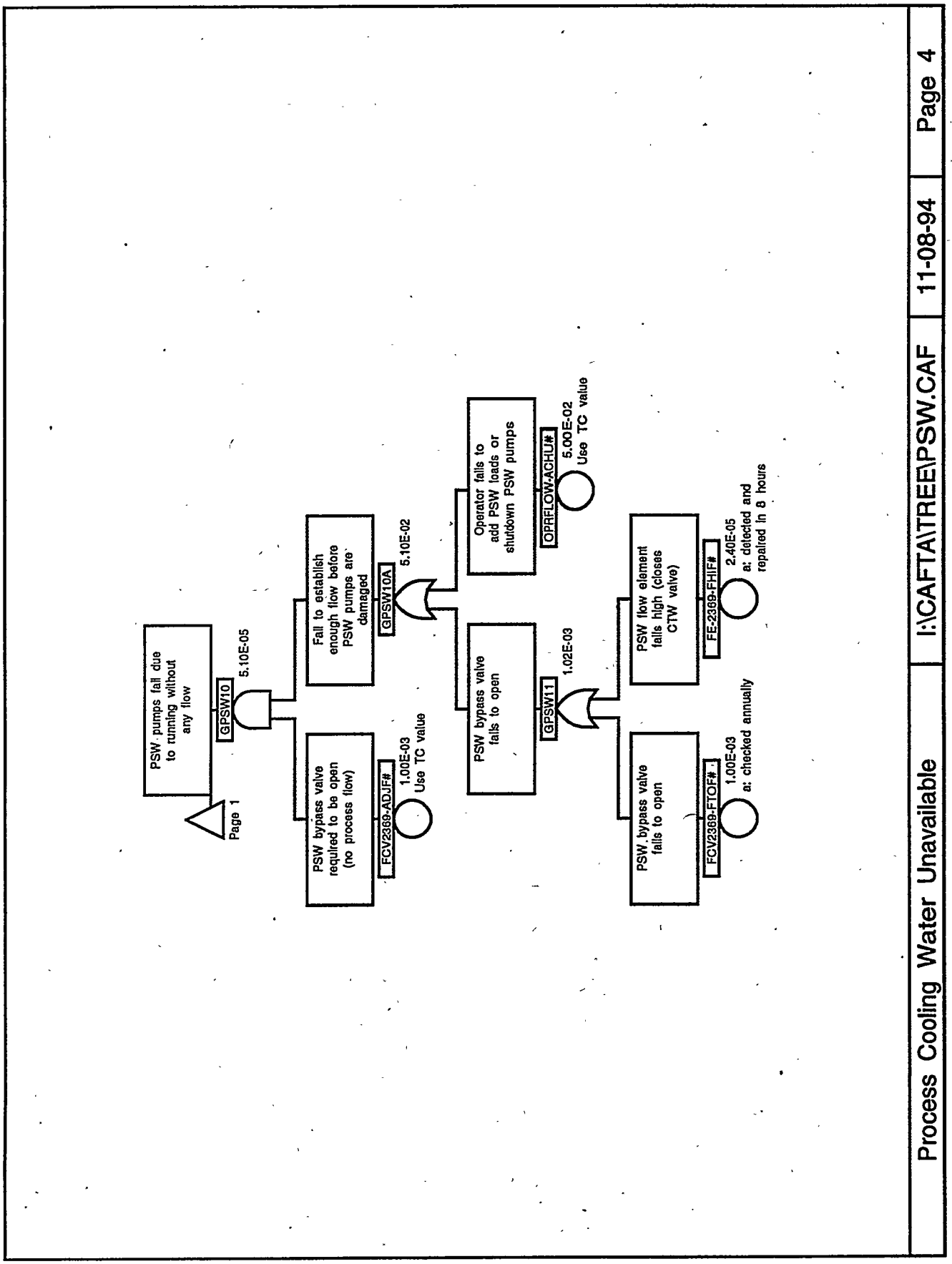
Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

Process Cooling Water System Unavailable


Process Cooling Water Unavailable
I:\CAFTA\TREE\PSW.CAF
11-08-94
Page 1
Inadequate process cooling water (excl. CTW, INAIR, or POWD)
TOP-PSW
2.27E-03
11/02/94
TRUNC = 0.0E+00
PSW pumps fail due to running without any flow
OR-SW13
5.10E-05
Page 4
Inadequate heat sink due to CTW valve failing closed
OR-SW15
2.10E-03
PSW HX outlet temp element fails low (closes CTW valve)
2.10E-03
a: Checked twice a year
TCV on CTW (heat sink for PSW) fails closed
4.00E-06
a: 8 hours to detect and repair
PSW low flow interlock inadvertently shuts down PSW pumps
OR-SW12
3.00E-05
PSW flow element fails low
2.40E-05
a: detected and repaired in 8 hours
PSW low flow switch fails closed
1.20E-05
a: detected and corrected in 4 hours
Process cooling water heat exchanger #1 fouled
2.40E-07
a: 8 hours to switch HX
both PSW pumps fail
2.40E-05
a: 0.1 X single mtk, repaired in 8 hours
Both cooling water pumps fail independently
OR-SW11
9.62E-07
Secondary process cooling water pump fails to start or run
OR-SW10
3.90E-03
Primary cooling water pump fails
2.40E-04
a: 8 hour repair time
Secondary process cooling water pump fails to run
2.40E-04
a: 8 hour repair time
PSW secondary pump discharge check valve fails to open
5.00E-05
a: 8 hour restoration time
Secondary process cooling water pump fails to start
3.00E-03
Use TC
Secondary PSW pump is not demanded to start
OR-SW1
5.78E-04
Page 2


Process Cooling Water Unavailable
I:\CAFTA\TREE\PSW.CAF
11-08-94
Page 2
Secondary PSW pump is not demanded to start
GPSW3
6.76E-04
Page 1
Fail to start secondary PSW pump manually
GPSW5
1.01E-02
Operator fails to respond to PSW low pressure alarm
OPR-PSW-CSNP#
1.00E-02
Use TC value
Fail to detect PSW failure
GPSW6
1.44E-04
PSW flow transmitter unavailable
GPSW7A
4.26E-02
PSW flow transmitter miscalibrated
OPR2389-MCH1#
3.00E-02
Use TC value
PSW flow transmitter fails high
FT-2389-FHIF#
1.30E-02
a: checked annually
PSW pump discharge pressure transmitter PT-2383 unavailable
GPSW7
3.35E-03
Page 3
Secondary PSW pump fails to start automatically
GPSW4
5.32E-02
PSW pump discharge pressure transmitter PT-2383 unavailable
GPSW7
3.35E-03
Page 3
Process operating procedure (DCS) not loaded for PSW
POPPSW--OFF#
5.00E-02
Use TC value


PSW pump discharge pressure transmitter PT-2363 unavailable
GPSW7
3.35E-03
Page 2
Page 2
PSW pump discharge pressure transmitter fails high
PT-2363-FHIF#
2.16E-03
a: functionally checked every 6 months
PSW pressure transmitter miscalibrated
OPR2363-MCH1#
1.20E-03
a: calibrated annually, error corrected in 2 weeks


PSW pumps fail due to running without any flow
GPSW10
5.10E-05
Page 1
Fail to establish enough flow before PSW pumps are damaged
GPSW10A
5.10E-02
PSW bypass valve required to be open (no process flow)
FCV2369-ADJF#
1.00E-03
Use TC value
Operator fails to add PSW loads or shutdown PSW pumps
OPRFLOW-ACHU#
5.00E-02
Use TC value
PSW bypass valve fails to open
GPSW11
1.02E-03
PSW flow element fails high (closes CTW valve)
FE-2369-FHIF#
2.40E-05
a: detected and repaired in 8 hours
PSW bypass valve fails to open
FCV2369-FTOF#
1.00E-03
a: checked annually
Process Cooling Water Unavailable
I:\CAFTA\TREE\PSW.CAF
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Page 4

Cutsets for I:\CAFTA\CUT\PSW.CSR 11/08/94 11:53 AM

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	TOP-PSW					2.27E-03
1.	TE-2346-FLOF#	PSW HX outlet temp element fails low (closes CTW valve)	5	6M 1.0E-06H	2.16E-03	2.16E-03
2.	FCV2369-ADJF#	PSW bypass valve required to be open (no process flow)	1	1N 1.0E-03N	1.00E-03N	5.00E-05
	OPRFLOW-ACHU#	Operator fails to add PSW loads or shutdown PSW pumps	1	1N 5.0E-02N	5.00E-02N	
3.	FE-2369-FLOF#	PSW flow element fails low	3	8H 3.0E-06H	2.40E-05	2.40E-05
4.	CC2-PSW-PMPG#	cc: both PSW pumps fail	3	8H 3.0E-06H	2.40E-05	2.40E-05
5.	FSL2369-FCLF#	PSW low flow switch fails closed	3	4H 3.0E-06H	1.20E-05	1.20E-05
6.	TCV2346-FCLF#	TCV on CTW (heat sink for PSW) fails closed	3	8H 5.0E-07H	4.00E-06	4.00E-06
7.	FCV2369-ADJF#	PSW bypass valve required to be open (no process flow)	1	1N 1.0E-03N	1.00E-03N	1.00E-06
	FCV2369-FTOF#	PSW bypass valve fails to open	1	1N 1.0E-03N	1.00E-03N	
8.	PMPCOOLABFLF#	Primary cooling water pump fails	3	8H 3.0E-05H	2.40E-04	7.20E-07
	PMPCOOLBFTSF#	Secondary process cooling water pump fails to start	1	1N 3.0E-03N	3.00E-03N	
9.	HX-PCW1-FOUF#	Process cooling water heat exchanger #1 fouled	3	8H 3.0E-08H	2.40E-07	2.40E-07
10.	OPR-PSW-CSNP#	Operator fails to respond to PSW low pressure alarm	1	1N 1.0E-02N	1.00E-02N	1.20E-07
	PMPCOOLABFLF#	Primary cooling water pump fails	3	8H 3.0E-05H	2.40E-04	
	POPPSW--OFFF#	Process operating procedure (DCS) not loaded for PSW	1	1N 5.0E-02N	5.00E-02N	
11.	PMPCOOLABFLF#	Primary cooling water pump fails	3	8H 3.0E-05H	2.40E-04	5.76E-08
	PMPCOOLBFTRF#	Secondary process cooling water pump fails to run	3	8H 3.0E-05H	2.40E-04	

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
12.	FCV2369-ADJF#	PSW bypass valve required to be open (no process flow)	1	1N 1.0E-03N	1.00E-03N	2.40E-08
	FE-2369-FHIF#	PSW flow element fails high (closes CTW valve)	3	8H 3.0E-06H	2.40E-05	
13.	OPR2369-MCH1#	PSW flow transmitter miscalibrated	1	1N 3.0E-02N	3.00E-02N	1.55E-08
	PMPCOOLABFLF#	Primary cooling water pump fails	3	8H 3.0E-05H	2.40E-04	
	PT-2363-FHIF#	PSW pump discharge pressure transmitter fails high	5	6M 1.0E-06H	2.16E-03	
14.	CV-2362-FTOF#	PSW secondary pump discharge check valve fails to open	1	1N 5.0E-05N	5.00E-05N	1.20E-08
	PMPCOOLABFLF#	Primary cooling water pump fails	3	8H 3.0E-05H	2.40E-04	
15.	OPR2363-MCH1#	PSW pressure transmitter miscalibrated	1	.04N 3.0E-02N	1.20E-03N	8.64E-09
	OPR2369-MCH1#	PSW flow transmitter miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	PMPCOOLABFLF#	Primary cooling water pump fails	3	8H 3.0E-05H	2.40E-04	
16.	FT-2369-FHIF#	PSW flow transmitter fails high	5	1Y 3.0E-06H	1.30E-02	6.74E-09
	PMPCOOLABFLF#	Primary cooling water pump fails	3	8H 3.0E-05H	2.40E-04	
	PT-2363-FHIF#	PSW pump discharge pressure transmitter fails high	5	6M 1.0E-06H	2.16E-03	
17.	OPR-PSW-CSNP#	Operator fails to respond to PSW low pressure alarm	1	1N 1.0E-02N	1.00E-02N	5.18E-09
	PMPCOOLABFLF#	Primary cooling water pump fails	3	8H 3.0E-05H	2.40E-04	
	PT-2363-FHIF#	PSW pump discharge pressure transmitter fails high	5	6M 1.0E-06H	2.16E-03	
18.	FT-2369-FHIF#	PSW flow transmitter fails high	5	1Y 3.0E-06H	1.30E-02	3.75E-09
	OPR2363-MCH1#	PSW pressure transmitter miscalibrated	1	.04N 3.0E-02N	1.20E-03N	
	PMPCOOLABFLF#	Primary cooling water pump fails	3	8H 3.0E-05H	2.40E-04	
19.	OPR-PSW-CSNP#	Operator fails to respond to PSW low pressure alarm	1	1N 1.0E-02N	1.00E-02N	2.88E-09

Cutsets for I:\CAFTA\CUT\PSW.CSR 11/08/94 11:53 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	OPR2363-MCH1#	PSW pressure transmitter miscalibrated	1	.04N 3.0E-02N	1.20E-03N	
	PMPCOOLABFLF#	Primary cooling water pump fails	3	8H 3.0E-05H	2.40E-04	

Inadequate process cooling water (excl. CTW, INAIR, or POWD)
Top Event Probability: 2.27E-03

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
FSL2369-FCLF#	PSW low flow switch fails closed	1.20E-05	4.40E+02
CC2-PSW-PMPG#	cc: both PSW pumps fail	2.40E-05	4.40E+02
HX-PCW1-FOUF#	Process cooling water heat exchanger #1 fouled	2.40E-07	4.40E+02
TCV2346-FCLF#	TCV on CTW (heat sink for PSW) fails closed	4.00E-06	4.40E+02
TE-2346-FLOF#	PSW HX outlet temp element fails low (closes CTW valve)	2.16E-03	4.40E+02
FE-2369-FLOF#	PSW flow element fails low	2.40E-05	4.40E+02
FCV2369-ADJF#	PSW bypass valve required to be open (no process flow)	1.00E-03	2.34E+01
PMPCOOLABFLF#	Primary cooling water pump fails	2.40E-04	2.74E+00
FE-2369-FHIF#	PSW flow element fails high (closes CTW valve)	2.40E-05	1.44E+00
FCV2369-FTOF#	PSW bypass valve fails to open	1.00E-03	1.44E+00
OPRFLOW-ACHU#	Operator fails to add PSW loads or shutdown PSW pumps	5.00E-02	1.42E+00
CV-2362-FTOF#	PSW secondary pump discharge check valve fails to open	5.00E-05	1.11E+00
PMPCOOLBFTRF#	Secondary process cooling water pump fails to run	2.40E-04	1.11E+00
PMPCOOLBFTSF#	Secondary process cooling water pump fails to start	3.00E-03	1.11E+00

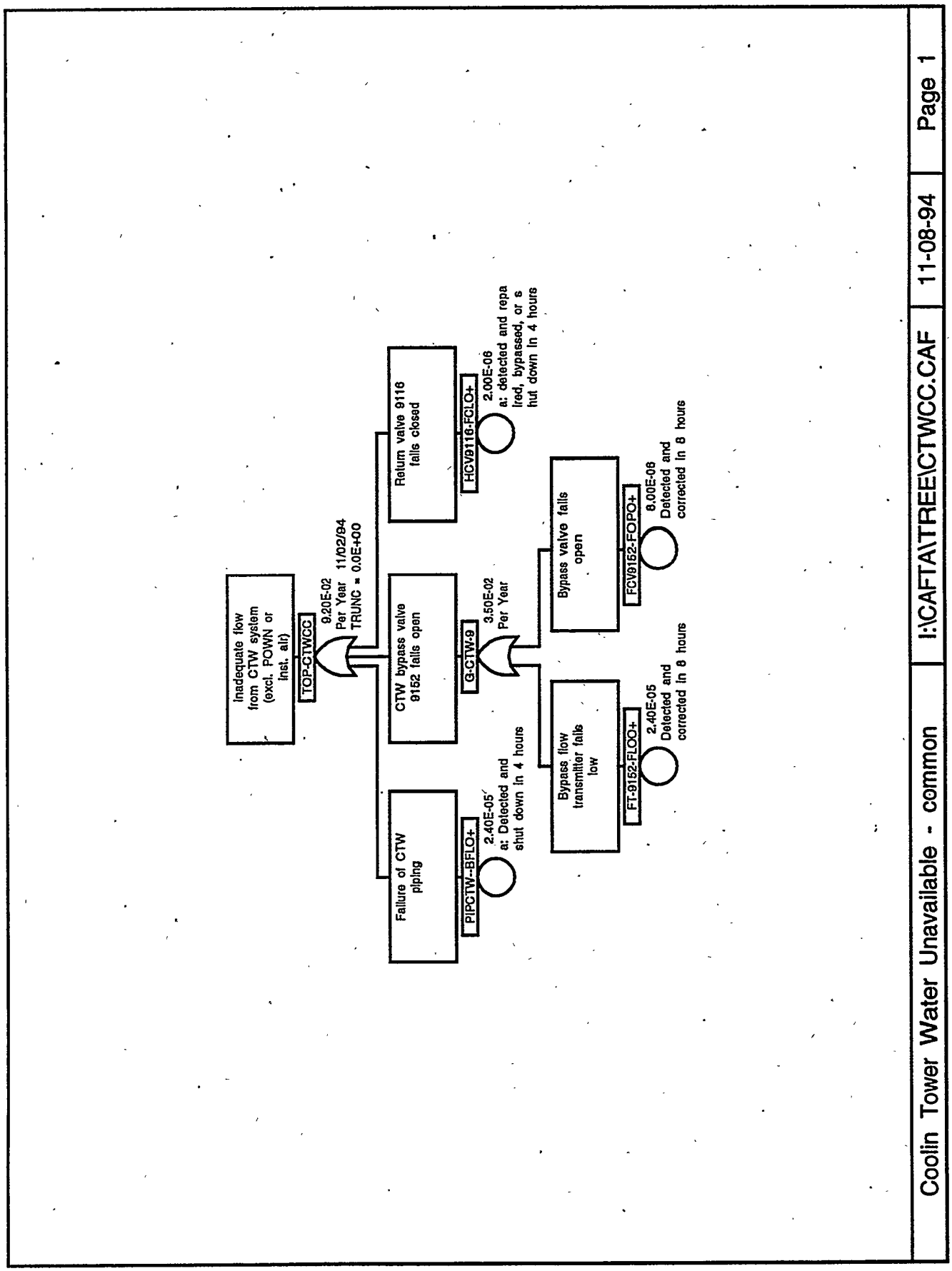
Modified top event frequency = (top event frequency) x (risk achievement worth).

Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
TE-2346-FLOF#	PSW HX outlet temp element fails low (closes CTW valve)	2.16E-03	1.96E+01
FCV2369-ADJF#	PSW bypass valve required to be open (no process flow)	1.00E-03	1.02E+00
OPRFLOW-ACHU#	Operator fails to add PSW loads or shutdown PSW pumps	5.00E-02	1.02E+00
CC2-PSW-PMPG#	cc: both PSW pumps fail	2.40E-05	1.01E+00
FE-2369-FLOF#	PSW flow element fails low	2.40E-05	1.01E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

Cooling Tower Water System Unavailable - common equipment


Coolin Tower Water Unavailable - common
I:\CAFTA\TREE\CTWCC.CAF
11-08-94
Page 1
Inadequate flow from CTW system (excl. POWN or inst. air)
TOP-CTWCC
9.20E-02
Per Year
11/02/94
TRUNC = 0.0E+00
CTW bypass valve 9152 fails open
Failure of CTW piping
PIPCTW-BFLO+
2.40E-05
a: Detected and shut down in 4 hours
G-CTW-9
3.50E-02
Per Year
Bypass flow transmitter fails low
FT-9152-FLOO+
2.40E-05
Detected and corrected in 8 hours
Bypass valve fails open
FCV9162-FOPO+
8.00E-06
Detected and corrected in 8 hours
Return valve 9116 fails closed
HCV9116-FCLO+
2.00E-06
a: detected and repaired, bypassed, or shut down in 4 hours

Cutsets for I:\CAFTA\CUT\CTWCC.CSR 11/08/94 11:54 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-CTWCC					9.20E-02
1.	PIPCTW--BFLO+	Failure of CTW piping	4	4H 6.0E-06H	2.40E-05	5.26E-02
2.	FT-9152-FLOO+	Bypass flow transmitter fails low	4	8H 3.0E-06H	2.40E-05	2.63E-02
3.	FCV9152-FOPO+	Bypass valve fails open	4	8H 1.0E-06H	8.00E-06	8.76E-03
4.	HCV9116-FCLO+	Return valve 9116 fails closed	4	4H 5.0E-07H	2.00E-06	4.38E-03

Inadequate flow from CTW system (excl. POWN or inst. air)
Top Event Frequency: 9.20E-02/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
FCV9152-FOPO+-I	Bypass valve fails open	1.00E-06/H	9.52E+04
HCV9116-FCLO+-I	Return valve 9116 fails closed	5.00E-07/H	9.52E+04
PIPCTW--BFLO+-I	Failure of CTW piping	6.00E-06/H	9.52E+04
FT-9152-FLOO+-I	Bypass flow transmitter fails low	3.00E-06/H	9.52E+04

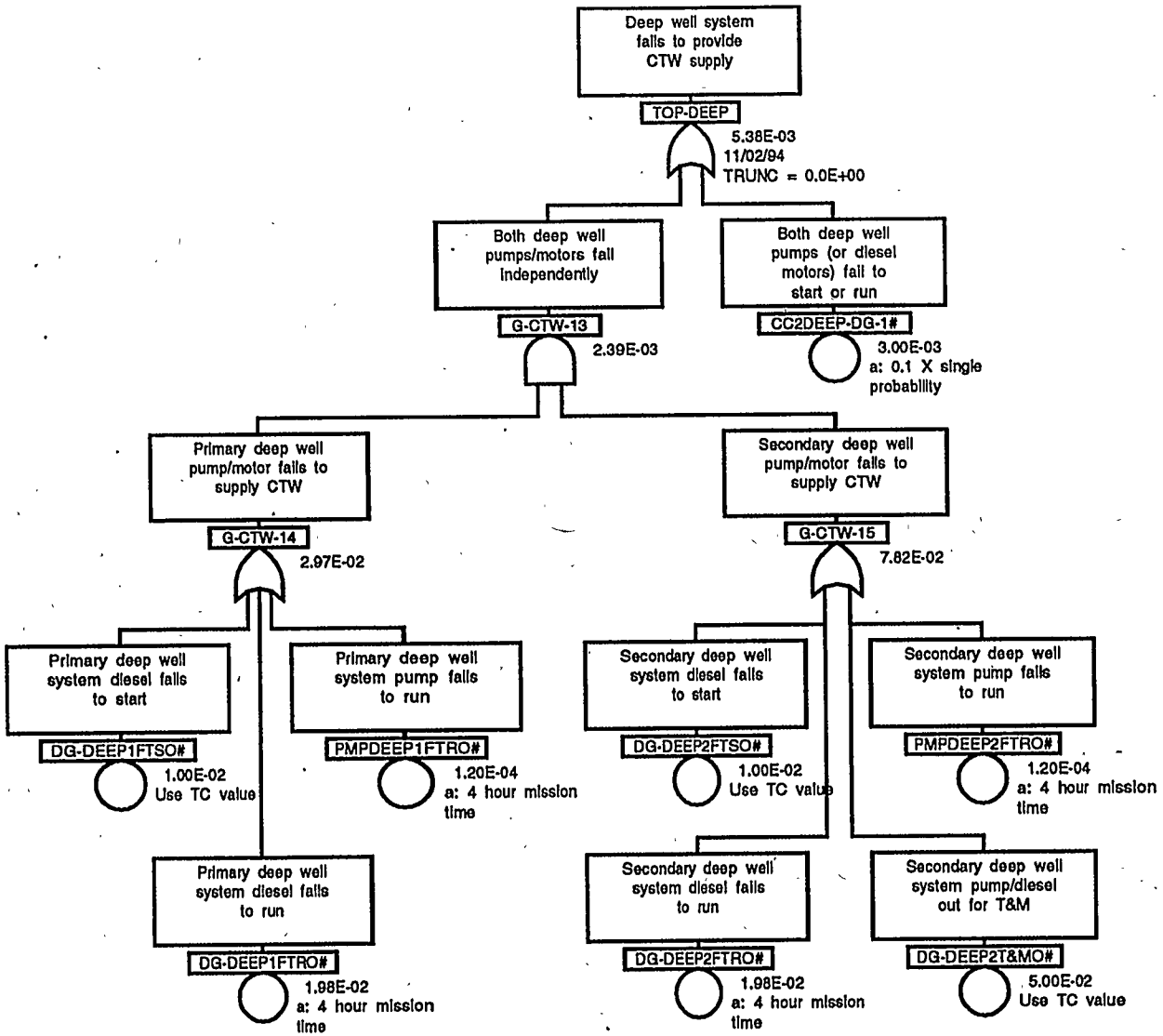
Modified top event frequency = (top event frequency) x (risk achievement worth).

Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
PIPCTW--BFLO+-I	Failure of CTW piping	6.00E-06/H	2.33E+00
FT-9152-FLOO+-I	Bypass flow transmitter fails low	3.00E-06/H	1.40E+00
FCV9152-FOPO+-I	Bypass valve fails open	1.00E-06/H	1.11E+00
HCV9116-FCLO+-I	Return valve 9116 fails closed	5.00E-07/H	1.05E+00

Modified top event frequency = (top event frequency) / (risk reduction worth).

Deep Well System Unavailable



Cooling Tower Water Unavailable - Deep	I:\CAFTA\TREE\DEEP.CAF	11-08-94	Page 1

Cutsets for I:\CAFTA\CUT\DEEP.CSR. 11/08/94 11:55 AM

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	TOP-DEEP					5.38E-03
1.	CC2DEEP-DG-1#	Both deep well pumps (or diesel motors) fail to start or run	1	1N 3.0E-03N	3.00E-03N	3.00E-03
2.	DG-DEEP1FTRO#	Primary deep well system diesel fails to run	3	4H 5.0E-03H	1.98E-02	9.90E-04
	DG-DEEP2T&MO#	Secondary deep well system pump/diesel out for T&M	1	1N 5.0E-02N	5.00E-02N	
3.	DG-DEEP1FTSO#	Primary deep well system diesel fails to start	1	1N 1.0E-02N	1.00E-02N	5.00E-04
	DG-DEEP2T&MO#	Secondary deep well system pump/diesel out for T&M	1	1N 5.0E-02N	5.00E-02N	
4.	DG-DEEP1FTRO#	Primary deep well system diesel fails to run	3	4H 5.0E-03H	1.98E-02	3.92E-04
	DG-DEEP2FTRO#	Secondary deep well system diesel fails to run	3	4H 5.0E-03H	1.98E-02	
5.	DG-DEEP1FTRO#	Primary deep well system diesel fails to run	3	4H 5.0E-03H	1.98E-02	1.98E-04
	DG-DEEP2FTSO#	Secondary deep well system diesel fails to start	1	1N 1.0E-02N	1.00E-02N	
6.	DG-DEEP1FTSO#	Primary deep well system diesel fails to start	1	1N 1.0E-02N	1.00E-02N	1.98E-04
	DG-DEEP2FTRO#	Secondary deep well system diesel fails to run	3	4H 5.0E-03H	1.98E-02	
7.	DG-DEEP1FTSO#	Primary deep well system diesel fails to start	1	1N 1.0E-02N	1.00E-02N	1.00E-04
	DG-DEEP2FTSO#	Secondary deep well system diesel fails to start	1	1N 1.0E-02N	1.00E-02N	
8.	DG-DEEP2T&MO#	Secondary deep well system pump/diesel out for T&M	1	1N 5.0E-02N	5.00E-02N	6.00E-06
	PMPDEEP1FTRO#	Primary deep well system pump fails to run	3	4H 3.0E-05H	1.20E-04	
9.	DG-DEEP2FTRO#	Secondary deep well system diesel fails to run	3	4H 5.0E-03H	1.98E-02	2.38E-06
	PMPDEEP1FTRO#	Primary deep well system pump fails to run	3	4H 3.0E-05H	1.20E-04	
10.	DG-DEEP1FTRO#	Primary deep well system diesel fails to run	3	4H 5.0E-03H	1.98E-02	2.38E-06

Cutsets for I:\CAFTA\CUT\DEEP.CSR 11/08/94 11:55 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	PMPDEEP2FTRO#	Secondary deep well system pump fails to run	3	4H 3.0E-05H	1.20E-04	
11.	DG-DEEP1FTSO#	Primary deep well system diesel fails to start	1	1N 1.0E-02N	1.00E-02N	1.20E-06
	PMPDEEP2FTRO#	Secondary deep well system pump fails to run	3	4H 3.0E-05H	1.20E-04	
12.	DG-DEEP2FTSO#	Secondary deep well system diesel fails to start	1	1N 1.0E-02N	1.00E-02N	1.20E-06
	PMPDEEP1FTRO#	Primary deep well system pump fails to run	3	4H 3.0E-05H	1.20E-04	
13.	PMPDEEP1FTRO#	Primary deep well system pump fails to run	3	4H 3.0E-05H	1.20E-04	1.44E-08
	PMPDEEP2FTRO#	Secondary deep well system pump fails to run	3	4H 3.0E-05H	1.20E-04	

Deep well system fails to provide CTW supply Top Event Probability: 5.38E-03

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
CC2DEEP-DG-1#	Both deep well pumps (or diesel motors) fail to start or run	3.00E-03	1.86E+02
PMPDEEP1FTRO#	Primary deep well system pump fails to run	1.20E-04	1.55E+01
DG-DEEP1FTSO#	Primary deep well system diesel fails to start	1.00E-02	1.53E+01
DG-DEEP1FTRO#	Primary deep well system diesel fails to run	1.98E-02	1.52E+01
PMPDEEP2FTRO#	Secondary deep well system pump fails to run	1.20E-04	6.49E+00
DG-DEEP2FTSO#	Secondary deep well system diesel fails to start	1.00E-02	6.44E+00
DG-DEEP2FTRO#	Secondary deep well system diesel fails to run	1.98E-02	6.39E+00
DG-DEEP2T&MO#	Secondary deep well system pump/diesel out for T&M	5.00E-02	6.22E+00

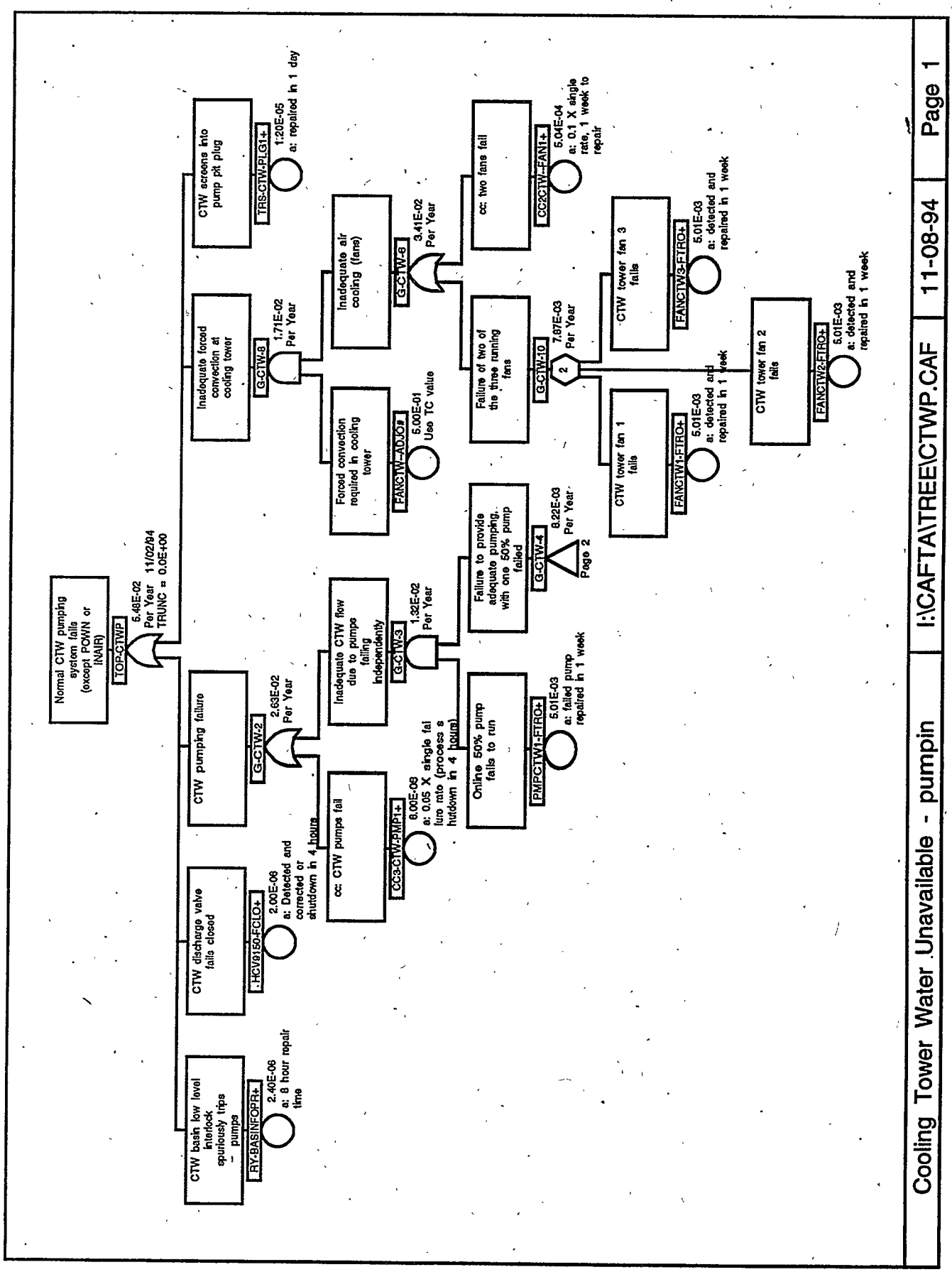
Modified top event frequency = (top event frequency) x (risk achievement worth).

Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
CC2DEEP-DG-1#	Both deep well pumps (or diesel motors) fail to start or run	3.00E-03	2.25E+00
DG-DEEP1FTRO#	Primary deep well system diesel fails to run	1.98E-02	1.41E+00
DG-DEEP2T&MO#	Secondary deep well system pump/diesel out for T&M	5.00E-02	1.38E+00
DG-DEEP1FTSO#	Primary deep well system diesel fails to start	1.00E-02	1.17E+00
DG-DEEP2FTRO#	Secondary deep well system diesel fails to run	1.98E-02	1.12E+00
DG-DEEP2FTSO#	Secondary deep well system diesel fails to start	1.00E-02	1.06E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

Cooling Tower Water System Unavailable - pumping


Normal CTW pumping system fails (except POWN or INAIR)
TOP-CTWP
5.48E-02 Per Year 11/02/94 TRUNC = 0.0E+00
CTW basin low level interlock spuriously trips pumps
RY-BASINFOPR+
2.40E-06 a: 8 hour repair time
CTW discharge valve fails closed
HCV9150-FCLO+
2.00E-06 a: Detected and corrected or shutdown in 4 hours
CTW pumping failure
G-CTW-2
2.63E-02 Per Year
cc: CTW pumps fail
CC3-CTW-PMP1+
8.00E-06 a: 0.05 X single failure rate (process shutdown in 4 hours)
Inadequate CTW flow due to pumps failing independently
G-CTW-3
1.32E-02 Per Year
Online 50% pump fails to run
PMPCTW1-FTRO+
5.01E-03 a: failed pump repaired in 1 week
Failure to provide adequate pumping, with one 50% pump failed
G-CTW-4
8.22E-03 Per Year
Page 2
Inadequate forced convection at cooling tower
G-CTW-8
1.71E-02 Per Year
CTW screens into pump pit plug
TRS-CTW-PLG1+
1.20E-05 a: repaired in 1 day
Forced convection required in cooling tower
FANCTW-ADJO+
5.00E-01 Use TC value
Inadequate air cooling (fans)
G-CTW-6
3.41E-02 Per Year
Failure of two of the three running fans
G-CTW-10
2
7.87E-03 Per Year
cc: two fans fail
CC2CTW-FAN1+
5.04E-04 a: 0.1 X single rate, 1 week to repair
CTW tower fan 1 fails
FANCTW1-FTRO+
5.01E-03 a: detected and repaired in 1 week
CTW tower fan 3 fails
FANCTW3-FTRO+
5.01E-03 a: detected and repaired in 1 week
CTW tower fan 2 fails
FANCTW2-FTRO+
5.01E-03 a: detected and repaired in 1 week
Cooling Tower Water Unavailable - pumpin
I:\CAFTA\TREE\CTWP.CAF
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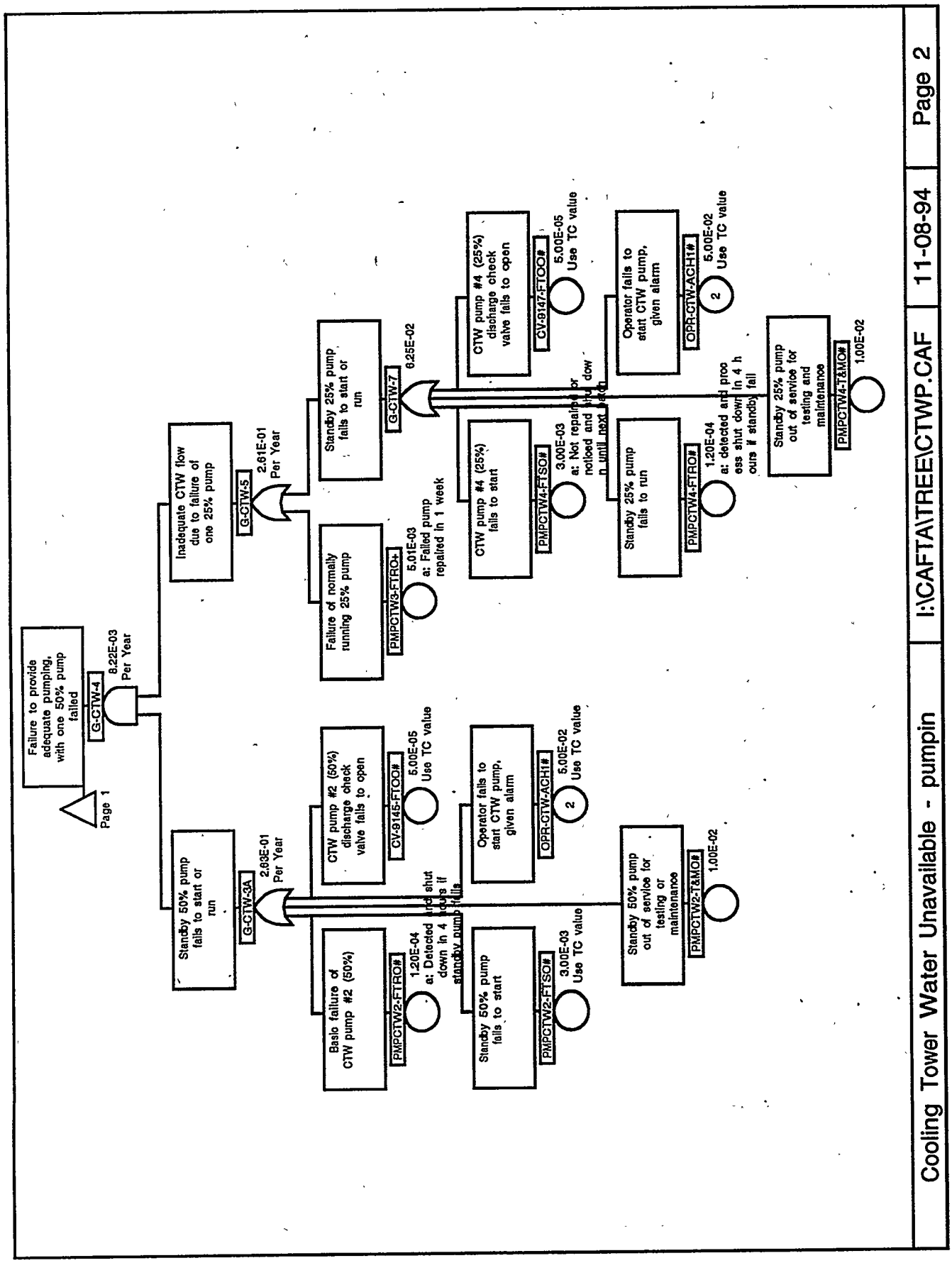
Failure to provide adequate pumping, with one 50% pump failed
G-CTW-4
8.22E-03 Per Year
Page 1
Inadequate CTW flow due to failure of one 25% pump
G-CTW-5
2.61E-01 Per Year
Standby 50% pump fails to start or run
G-CTW-3A
2.83E-01 Per Year
Standby 25% pump fails to start or run
G-CTW-7
6.25E-02
Basic failure of CTW pump #2 (50%)
PMPCTW2-FTRO#
1.20E-04
a: Detected and shut down in 4 hours if standby pump fails
CTW pump #2 (50%) discharge check valve fails to open
CV-9145-FTOO#
5.00E-05
Use TC value
Standby 50% pump fails to start
PMPCTW2-FTSO#
3.00E-03
Use TC value
Operator fails to start CTW pump, given alarm
OPR-CTW-ACH1#
2
5.00E-02
Use TC value
Standby 50% pump out of service for testing or maintenance
PMPCTW2-T&MO#
1.00E-02
Failure of normally running 25% pump
PMPCTW3-FTRO+
5.01E-03
a: Failed pump repaired in 1 week
CTW pump #4 (25%) fails to start
PMPCTW4-FTSO#
3.00E-03
a: Not repaired or noticed and shut dow n until next test
CTW pump #4 (25%) discharge check valve fails to open
CV-9147-FTOO#
5.00E-05
Use TC value
Standby 25% pump fails to run
PMPCTW4-FTRO#
1.20E-04
a: detected and proc ess shut down in 4 h ours if standby fail
Operator fails to start CTW pump, given alarm
OPR-CTW-ACH1#
2
5.00E-02
Use TC value
Standby 25% pump out of service for testing and maintenance
PMPCTW4-T&MO#
1.00E-02
Cooling Tower Water Unavailable - pumpin
I:\CAFTA\TREE\CTWP.CAF
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Cutsets for I:\CAFTA\CUT\CTWP.CSR 11/08/94 11:56 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	TOP-CTWP					5.48E-02
1.	CC3-CTW-PMP1+	cc: CTW pumps fail	4	4H 1.5E-06H	6.00E-06	1.31E-02
2.	CC2CTW--FAN1+	cc: two fans fail	4	7D 3.0E-06H	5.04E-04	1.31E-02
	FANCTW--ADJO#	Forced convection required in cooling tower	1	1N 5.0E-01N	5.00E-01N	
3.	OPR-CTW-ACH1#	Operator fails to start CTW pump, given alarm	1	1N 5.0E-02N	5.00E-02N	1.31E-02
	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	
4.	HCV9150-FCLO+	CTW discharge valve fails closed	4	4H 5.0E-07H	2.00E-06	4.38E-03
5.	TRS-CTW-PLG1+	CTW screens into pump pit plug	4	24H 5.0E-07H	1.20E-05	4.38E-03
6.	RY-BASINFOPR+	CTW basin low level interlock spuriously trips pumps	4	8H 3.0E-07H	2.40E-06	2.63E-03
7.	FANCTW--ADJO#	Forced convection required in cooling tower	1	1N 5.0E-01N	5.00E-01N	1.31E-03
	FANCTW1-FTRO+	CTW tower fan 1 fails	4	7D 3.0E-05H	5.01E-03	
	FANCTW3-FTRO+	CTW tower fan 3 fails	4	7D 3.0E-05H	5.01E-03	
8.	FANCTW--ADJO#	Forced convection required in cooling tower	1	1N 5.0E-01N	5.00E-01N	1.31E-03
	FANCTW1-FTRO+	CTW tower fan 1 fails	4	7D 3.0E-05H	5.01E-03	
	FANCTW2-FTRO+	CTW tower fan 2 fails	4	7D 3.0E-05H	5.01E-03	
9.	FANCTW--ADJO#	Forced convection required in cooling tower	1	1N 5.0E-01N	5.00E-01N	1.31E-03
	FANCTW2-FTRO+	CTW tower fan 2 fails	4	7D 3.0E-05H	5.01E-03	
	FANCTW3-FTRO+	CTW tower fan 3 fails	4	7D 3.0E-05H	5.01E-03	
10.	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	2.62E-05

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	PMPCTW2-T&MO#	Standby 50% pump out of service for testing or maintenance	1	1N 1.0E-02N	1.00E-02N	
	PMPCTW3-FTRO+	Failure of normally running 25% pump	4	7D 3.0E-05H	5.01E-03	
11.	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	2.61E-05
	PMPCTW2-T&MO#	Standby 50% pump out of service for testing or maintenance	1	1N 1.0E-02N	1.00E-02N	
	PMPCTW4-T&MO#	Standby 25% pump out of service for testing and maintenance	1	1N 1.0E-02N	1.00E-02N	
12.	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	1.35E-05
	PMPCTW2-FTRO#	Basic failure of CTW pump #2 (50%)	4	4H 3.0E-05H	1.20E-04	
	PMPCTW4-T&MO#	Standby 25% pump out of service for testing and maintenance	1	1N 1.0E-02N	1.00E-02N	
13.	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	7.87E-06
	PMPCTW2-FTSO#	Standby 50% pump fails to start	1	1N 3.0E-03N	3.00E-03N	
	PMPCTW3-FTRO+	Failure of normally running 25% pump	4	7D 3.0E-05H	5.01E-03	
14.	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	7.84E-06
	PMPCTW2-FTSO#	Standby 50% pump fails to start	1	1N 3.0E-03N	3.00E-03N	
	PMPCTW4-T&MO#	Standby 25% pump out of service for testing and maintenance	1	1N 1.0E-02N	1.00E-02N	
15.	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	7.84E-06
	PMPCTW2-T&MO#	Standby 50% pump out of service for testing or maintenance	1	1N 1.0E-02N	1.00E-02N	
	PMPCTW4-FTSO#	CTW pump #4 (25%) fails to start	1	1N 3.0E-03N	3.00E-03N	
16.	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	6.92E-06
	PMPCTW2-FTRO#	Basic failure of CTW pump #2 (50%)	4	4H 3.0E-05H	1.20E-04	
	PMPCTW3-FTRO+	Failure of normally running 25% pump	4	7D 3.0E-05H	5.01E-03	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
17.	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	4.05E-06
	PMPCTW2-FTRO#	Basic failure of CTW pump #2 (50%)	4	4H 3.0E-05H	1.20E-04	
	PMPCTW4-FTSO#	CTW pump #4 (25%) fails to start	1	1N 3.0E-03N	3.00E-03N	
18.	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	2.35E-06
	PMPCTW2-FTSO#	Standby 50% pump fails to start	1	1N 3.0E-03N	3.00E-03N	
	PMPCTW4-FTSO#	CTW pump #4 (25%) fails to start	1	1N 3.0E-03N	3.00E-03N	
19.	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	3.14E-07
	PMPCTW2-T&MO#	Standby 50% pump out of service for testing or maintenance	1	1N 1.0E-02N	1.00E-02N	
	PMPCTW4-FTRO#	Standby 25% pump fails to run	3	4H 3.0E-05H	1.20E-04	
20.	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	1.62E-07
	PMPCTW2-FTRO#	Basic failure of CTW pump #2 (50%)	4	4H 3.0E-05H	1.20E-04	
	PMPCTW4-FTRO#	Standby 25% pump fails to run	3	4H 3.0E-05H	1.20E-04	
21.	CV-9145-FTOO#	CTW pump #2 (50%) discharge check valve fails to open	1	1N 5.0E-05N	5.00E-05N	1.31E-07
	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	
	PMPCTW3-FTRO+	Failure of normally running 25% pump	4	7D 3.0E-05H	5.01E-03	
22.	CV-9145-FTOO#	CTW pump #2 (50%) discharge check valve fails to open	1	1N 5.0E-05N	5.00E-05N	1.31E-07
	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	
	PMPCTW4-T&MO#	Standby 25% pump out of service for testing and maintenance	1	1N 1.0E-02N	1.00E-02N	
23.	CV-9147-FTOO#	CTW pump #4 (25%) discharge check valve fails to open	1	1N 5.0E-05N	5.00E-05N	1.31E-07
	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	
	PMPCTW2-T&MO#	Standby 50% pump out of service for testing or maintenance	1	1N 1.0E-02N	1.00E-02N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
24.	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	9.41E-08
	PMPCTW2-FTSO#	Standby 50% pump fails to start	1	1N 3.0E-03N	3.00E-03N	
	PMPCTW4-FTRO#	Standby 25% pump fails to run	3	4H 3.0E-05H	1.20E-04	
25.	CV-9147-FTOO#	CTW pump #4 (25%) discharge check valve fails to open	1	1N 5.0E-05N	5.00E-05N	6.75E-08
	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	
	PMPCTW2-FTRO#	Basic failure of CTW pump #2 (50%)	4	4H 3.0E-05H	1.20E-04	
26.	CV-9147-FTOO#	CTW pump #4 (25%) discharge check valve fails to open	1	1N 5.0E-05N	5.00E-05N	3.92E-08
	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	
	PMPCTW2-FTSO#	Standby 50% pump fails to start	1	1N 3.0E-03N	3.00E-03N	
27.	CV-9145-FTOO#	CTW pump #2 (50%) discharge check valve fails to open	1	1N 5.0E-05N	5.00E-05N	3.92E-08
	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	
	PMPCTW4-FTSO#	CTW pump #4 (25%) fails to start	1	1N 3.0E-03N	3.00E-03N	
28.	CV-9145-FTOO#	CTW pump #2 (50%) discharge check valve fails to open	1	1N 5.0E-05N	5.00E-05N	1.57E-09
	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	
	PMPCTW4-FTRO#	Standby 25% pump fails to run	3	4H 3.0E-05H	1.20E-04	
29.	CV-9145-FTOO#	CTW pump #2 (50%) discharge check valve fails to open	1	1N 5.0E-05N	5.00E-05N	6.54E-10
	CV-9147-FTOO#	CTW pump #4 (25%) discharge check valve fails to open	1	1N 5.0E-05N	5.00E-05N	
	PMPCTW1-FTRO+	Online 50% pump fails to run	4	7D 3.0E-05H	5.01E-03	

Normal CTW pumping system fails (except POWN or INAIR)
Top Event Frequency: 5.47E-02/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
HCV9150-FCLO+-I	CTW discharge valve fails closed	5.00E-07/H	1.60E+05
TRS-CTW-PLG1+-I	CTW screens into pump pit plug	5.00E-07/H	1.60E+05
RY-BASINFOPR+-I	CTW basin low level interlock spuriously trips pumps	3.00E-07/H	1.60E+05
CC3-CTW-PMP1+-I	cc: CTW pumps fail	1.50E-06/H	1.60E+05
CC2CTW--FAN1+-I	cc: two fans fail	3.00E-06/H	8.00E+04
PMPCTW1-FTRO+-IC	Online 50% pump fails to run	2.98E-05/H	8.04E+03
FANCTW2-FTRO+-IC	CTW tower fan 2 fails	2.98E-05/H	8.07E+02
FANCTW3-FTRO+-IC	CTW tower fan 3 fails	2.98E-05/H	8.07E+02
FANCTW1-FTRO+-IC	CTW tower fan 1 fails	2.98E-05/H	8.07E+02
PMPCTW3-FTRO+-IC	Failure of normally running 25% pump	2.98E-05/H	1.16E+01
OPR-CTW-ACH1#	Operator fails to start CTW pump, given alarm	5.00E-02	5.54E+00
FANCTW--ADJO#	Forced convection required in cooling tower	5.00E-01	1.31E+00
CV-9145-FTOO#	CTW pump #2 (50%) discharge check valve fails to open	5.00E-05	1.11E+00
PMPCTW2-FTRO#	Basic failure of CTW pump #2 (50%)	1.20E-04	1.11E+00
PMPCTW2-FTSO#	Standby 50% pump fails to start	3.00E-03	1.11E+00
PMPCTW2-T&MO#	Standby 50% pump out of service for testing or maintenance	1.00E-02	1.11E+00
CV-9147-FTOO#	CTW pump #4 (25%) discharge check valve fails to open	5.00E-05	1.06E+00
PMPCTW4-FTRO#	Standby 25% pump fails to run	1.20E-04	1.06E+00
PMPCTW4-FTSO#	CTW pump #4 (25%) fails to start	3.00E-03	1.06E+00
PMPCTW4-T&MO#	Standby 25% pump out of service for T&M	1.00E-02	1.06E+00

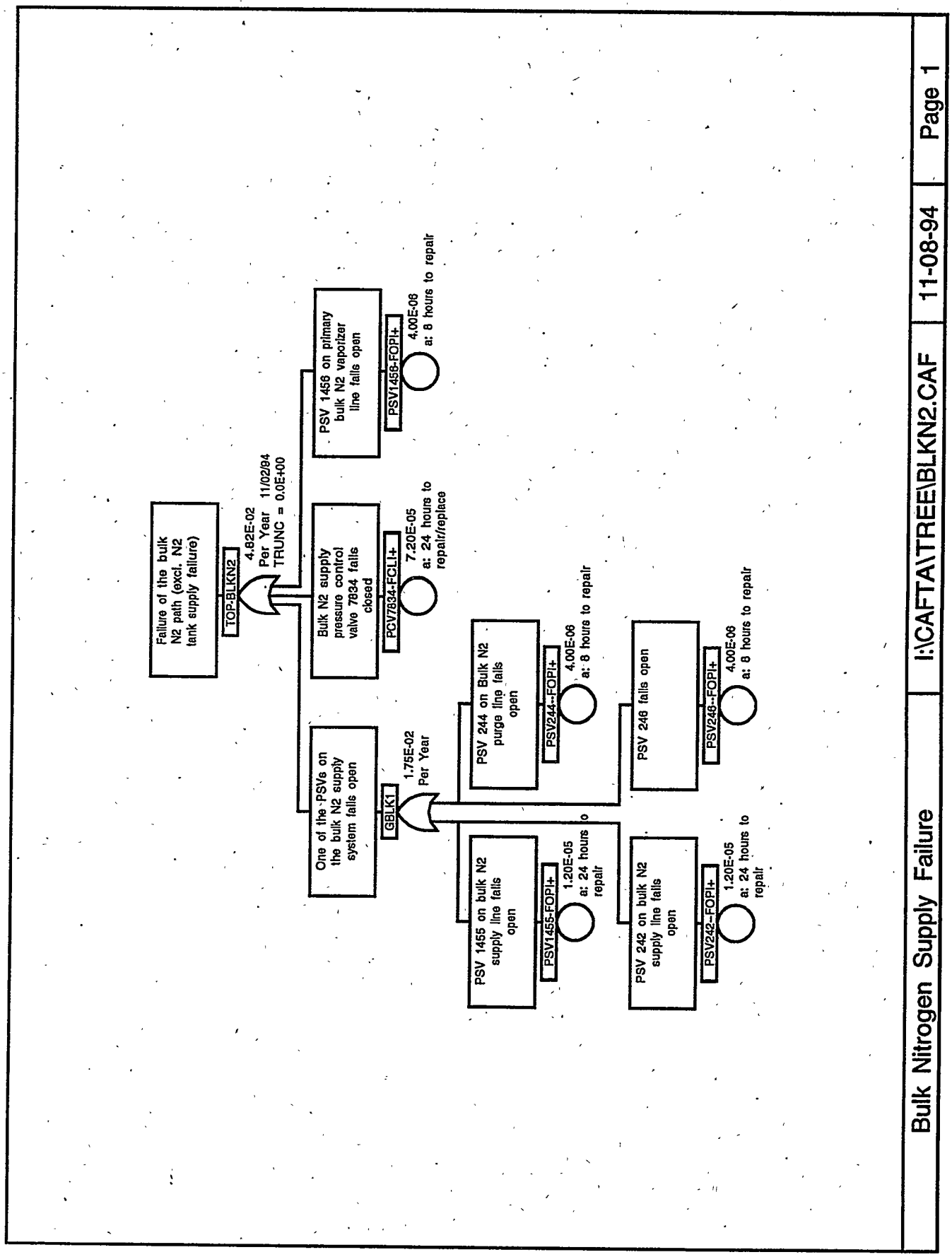
Modified top event frequency = (top event frequency) x (risk achievement worth).

Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
FANCTW--ADJO#	Forced convection required in cooling tower	5.00E-01	1.45E+00
PMPCTW1-FTRO+-IC	Online 50% pump fails to run	2.98E-05/H	1.32E+00
CC3-CTW-PMP1+-I	cc: CTW pumps fail	1.50E-06/H	1.32E+00
CC2CTW--FAN1+-I	cc: two fans fail	3.00E-06/H	1.32E+00
OPR-CTW-ACH1#	Operator fails to start CTW pump, given alarm	5.00E-02	1.31E+00
TRS-CTW-PLG1+-I	CTW screens into pump pit plug	5.00E-07/H	1.09E+00
HCV9150-FCLO+-I	CTW discharge valve fails closed	5.00E-07/H	1.09E+00
RY-BASINFOPR+-I	CTW basin low level interlock spuriously trips pumps	3.00E-07/H	1.05E+00
FANCTW3-FTRO+-IC	CTW tower fan 3 fails	2.98E-05/H	1.05E+00
FANCTW2-FTRO+-IC	CTW tower fan 2 fails	2.98E-05/H	1.05E+00
FANCTW1-FTRO+-IC	CTW tower fan 1 fails	2.98E-05/H	1.05E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

Bulk Nitrogen Supply Path Failure


Failure of the bulk N2 path (excl. N2 tank supply failure)
TOP-BLKN2
4.82E-02 Per Year
11/02/94 TRUNC = 0.0E+00
Bulk N2 supply pressure control valve 7834 fails closed
PCV7834-FCLI+
7.20E-05 a: 24 hours to repair/replace
PSV 1456 on primary bulk N2 vaporizer line fails open
PSV1456-FOPI+
4.00E-06 a: 8 hours to repair
One of the PSVs on the bulk N2 supply fails open
GBLK1
1.75E-02 Per Year
PSV 244 on Bulk N2 purge line fails open
PSV244--FOPI+
4.00E-06 a: 8 hours to repair
PSV 246 fails open
PSV246--FOPI+
4.00E-06 a: 8 hours to repair
PSV 1455 on bulk N2 supply line fails open
PSV1455-FOPI+
1.20E-05 a: 24 hours to repair
PSV 242 on bulk N2 supply line fails open
PSV242--FOPI+
1.20E-05 a: 24 hours to repair
Bulk Nitrogen Supply Failure
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Cutsets for I:\CAFTA\CUT\BLKN2.CSR 11/08/94 11:57 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	TOP-BLKN2					4.82E-02
1.	PCV7834-FCLI+	Bulk N2 supply pressure control valve 7834 fails closed	4	24H 3.0E-06H	7.20E-05	2.63E-02
2.	PSV1456-FOPI+	PSV 1456 on primary bulk N2 vaporizer line fails open	4	8H 5.0E-07H	4.00E-06	4.38E-03
3.	PSV246--FOPI+	PSV 246 fails open	4	8H 5.0E-07H	4.00E-06	4.38E-03
4.	PSV244--FOPI+	PSV 244 on Bulk N2 purge line fails open	4	8H 5.0E-07H	4.00E-06	4.38E-03
5.	PSV242--FOPI+	PSV 242 on bulk N2 supply line fails open	4	24H 5.0E-07H	1.20E-05	4.38E-03
6.	PSV1455-FOPI+	PSV 1455 on bulk N2 supply line fails open	4	24H 5.0E-07H	1.20E-05	4.38E-03

Failure of the bulk N2 path (excl. N2 tank supply failure)
Top Event Frequency: 4.82E-02/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
PSV244--FOPI+-I	PSV 244 on Bulk N2 purge line fails open	5.00E-07/H	1.82E+05
PSV242--FOPI+-I	PSV 242 on bulk N2 supply line fails open	5.00E-07/H	1.82E+05
PSV1455-FOPI+-I	PSV 1455 on bulk N2 supply line fails open	5.00E-07/H	1.82E+05
PCV7834-FCLI+-I	Bulk N2 supply pressure control valve 7834 fails closed	3.00E-06/H	1.82E+05
PSV1456-FOPI+-I	PSV 1456 on primary bulk N2 vaporizer line fails open	5.00E-07/H	1.82E+05
PSV246--FOPI+-I	PSV 246 fails open	5.00E-07/H	1.82E+05

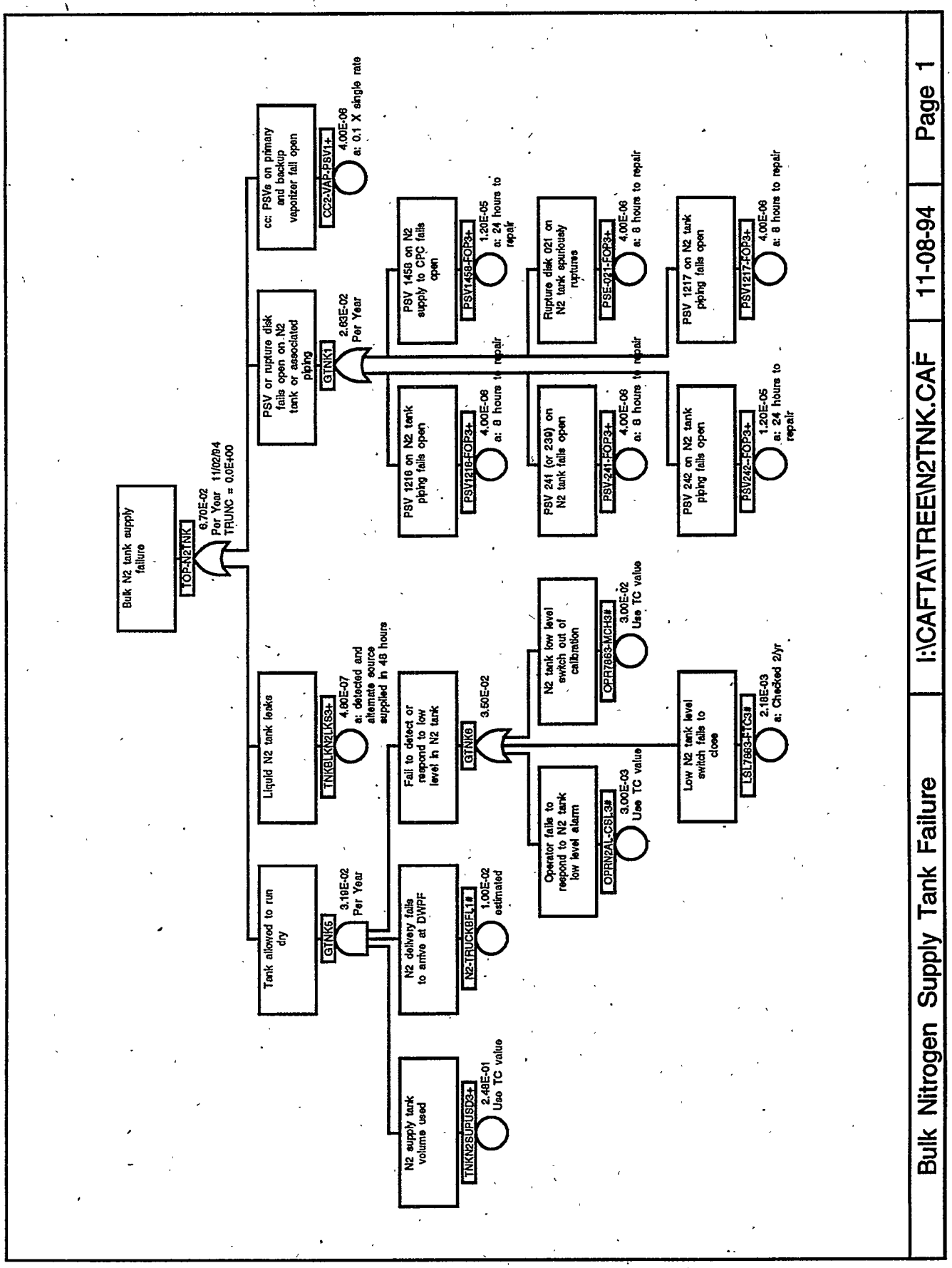
Modified top event frequency = (top event frequency) x (risk achievement worth).

Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
PCV7834-FCLI+-I	Bulk N2 supply pressure control valve 7834 fails closed	3.00E-06/H	2.20E+00
PSV242--FOPI+-I	PSV 242 on bulk N2 supply line fails open	5.00E-07/H	1.10E+00
PSV1455-FOPI+-I	PSV 1455 on bulk N2 supply line fails open	5.00E-07/H	1.10E+00
PSV244--FOPI+-I	PSV 244 on Bulk N2 purge line fails open	5.00E-07/H	1.10E+00
PSV1456-FOPI+-I	PSV 1456 on primary bulk N2 vaporizer line fails open	5.00E-07/H	1.10E+00
PSV246--FOPI+-I	PSV 246 fails open	5.00E-07/H	1.10E+00

Modified top event frequency = (top event frequency) / (risk reduction worth).

Bulk Nitrogen Tank Supply Failure


Bulk Nitrogen Supply Tank Failure
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Bulk N2 tank supply failure
TOP-N2TNK
6.70E-02 Per Year 11/02/94
TRUNC = 0.0E+00
PSV or rupture disk fails open on N2 tank or associated piping
GTNK1
2.63E-02 Per Year
cc: PSVs on primary and backup vaporizer fail open
CC2-VAP-PSV1+
4.00E-06 a: 0.1 X single rate
PSV 1458 on N2 supply to CPC fails open
PSV1458-FOP3+
1.20E-05 a: 24 hours to repair
Rupture disk 021 on N2 tank spuriously ruptures
PSE-021-FOP3+
4.00E-06 a: 8 hours to repair
PSV 1217 on N2 tank piping fails open
PSV1217-FOP3+
4.00E-06 a: 8 hours to repair
PSV 1216 on N2 tank piping fails open
PSV1216-FOP3+
4.00E-06 a: 8 hours to repair
PSV 241 (or 239) on N2 tank fails open
PSV241-FOP3+
4.00E-06 a: 8 hours to repair
PSV 242 on N2 tank piping fails open
PSV242-FOP3+
1.20E-05 a: 24 hours to repair
Liquid N2 tank leaks
TNKBLKN2LK83+
4.80E-07 a: detected and alternate source supplied in 48 hours
Fail to detect or respond to low level in N2 tank
GTNK6
3.50E-02
N2 tank low level switch out of calibration
OPR7863-MCHS#
3.00E-02 Use TC value
Operator fails to respond to N2 tank low level alarm
OPRN2AL-CSL-3#
3.00E-03 Use TC value
Low N2 tank level switch fails to close
LSL7863-FTC3#
2.18E-03 a: Checked 2/yr
Tank allowed to run dry
GTNK6
3.19E-02 Per Year
N2 delivery fails to arrive at DWPF
N2-TRUCKBFL1#
1.00E-02 estimated
N2 supply tank volume used
TNKN2BUPUSD3+
2.49E-01 Use TC value

Cutsets for I:\CAFTA\CUT\N2TNK.CSR 11/08/94 11:59 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-N2TNK					6.70E-02
1.	N2-TRUCKBFL1#	N2 delivery fails to arrive at DWPF	1	1N 1.0E-02N	1.00E-02N	2.72E-02
	OPR7863-MCH3#	N2 tank low level switch out of calibration	1	1N 3.0E-02N	3.00E-02N	
	TNKN2SUPUSD3+	N2 supply tank volume used	4	24H 3.3E-01D	2.48E-01	
2.	CC2-VAP-PSV1+	cc: PSVs on primary and backup vaporizer fail open	4	4H 1.0E-06H	4.00E-06	8.76E-03
3.	PSE-021-FOP3+	Rupture disk 021 on N2 tank spuriously ruptures	4	8H 5.0E-07H	4.00E-06	4.38E-03
4.	PSV1216-FOP3+	PSV 1216 on N2 tank piping fails open	4	8H 5.0E-07H	4.00E-06	4.38E-03
5.	PSV1217-FOP3+	PSV 1217 on N2 tank piping fails open	4	8H 5.0E-07H	4.00E-06	4.38E-03
6.	PSV-241-FOP3+	PSV 241 (or 239) on N2 tank fails open	4	8H 5.0E-07H	4.00E-06	4.38E-03
7.	PSV1458-FOP3+	PSV 1458 on N2 supply to CPC fails open	4	24H 5.0E-07H	1.20E-05	4.38E-03
8.	PSV242--FOP3+	PSV 242 on N2 tank piping fails open	4	24H 5.0E-07H	1.20E-05	4.38E-03
9.	N2-TRUCKBFL1#	N2 delivery fails to arrive at DWPF	1	1N 1.0E-02N	1.00E-02N	2.72E-03
	OPRN2AL-CSL3#	Operator fails to respond to N2 tank low level alarm	1	1N 3.0E-03N	3.00E-03N	
	TNKN2SUPUSD3+	N2 supply tank volume used	4	24H 3.3E-01D	2.48E-01	
10.	LSL7863-FTC3#	Low N2 tank level switch fails to close	3	1Q 1.0E-06H	2.18E-03	1.98E-03
	N2-TRUCKBFL1#	N2 delivery fails to arrive at DWPF	1	1N 1.0E-02N	1.00E-02N	
	TNKN2SUPUSD3+	N2 supply tank volume used	4	24H 3.3E-01D	2.48E-01	
11.	TNKBLKN2LKS3+	Liquid N2 tank leaks	4	48H 1.0E-08H	4.80E-07	8.76E-05

Bulk N2 tank supply failure Top Event Frequency: 6.70E-02/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
PSV-241-FOP3+-I	PSV 241 (or 239) on N2 tank fails open	5.00E-07/H	1.31E+05
PSV1217-FOP3+-I	PSV 1217 on N2 tank piping fails open	5.00E-07/H	1.31E+05
PSV1458-FOP3+-I	PSV 1458 on N2 supply to CPC fails open	5.00E-07/H	1.31E+05
TNKBLKN2LKS3+-I	Liquid N2 tank leaks	1.00E-08/H	1.31E+05
PSV242--FOP3+-I	PSV 242 on N2 tank piping fails open	5.00E-07/H	1.31E+05
PSV1216-FOP3+-I	PSV 1216 on N2 tank piping fails open	5.00E-07/H	1.31E+05
CC2-VAP-PSV1+-I	cc: PSVs on primary and backup vaporizer fail open	1.00E-06/H	1.31E+05
PSE-021-FOP3+-I	Rupture disk 021 on N2 tank spuriously ruptures	5.00E-07/H	1.31E+05
N2-TRUCKBFL1#	N2 delivery fails to arrive at DWPF	1.00E-02	4.81E+01
TNKN2SUPUSD3+-I	N2 supply tank volume used	1.03E-02/H	4.65E+01
LSL7863-FTC3#	Low N2 tank level switch fails to close	2.18E-03	1.45E+01
OPRN2AL-CSL3#	Operator fails to respond to N2 tank low level alarm	3.00E-03	1.45E+01
OPR7863-MCH3#	N2 tank low level switch out of calibration	3.00E-02	1.41E+01

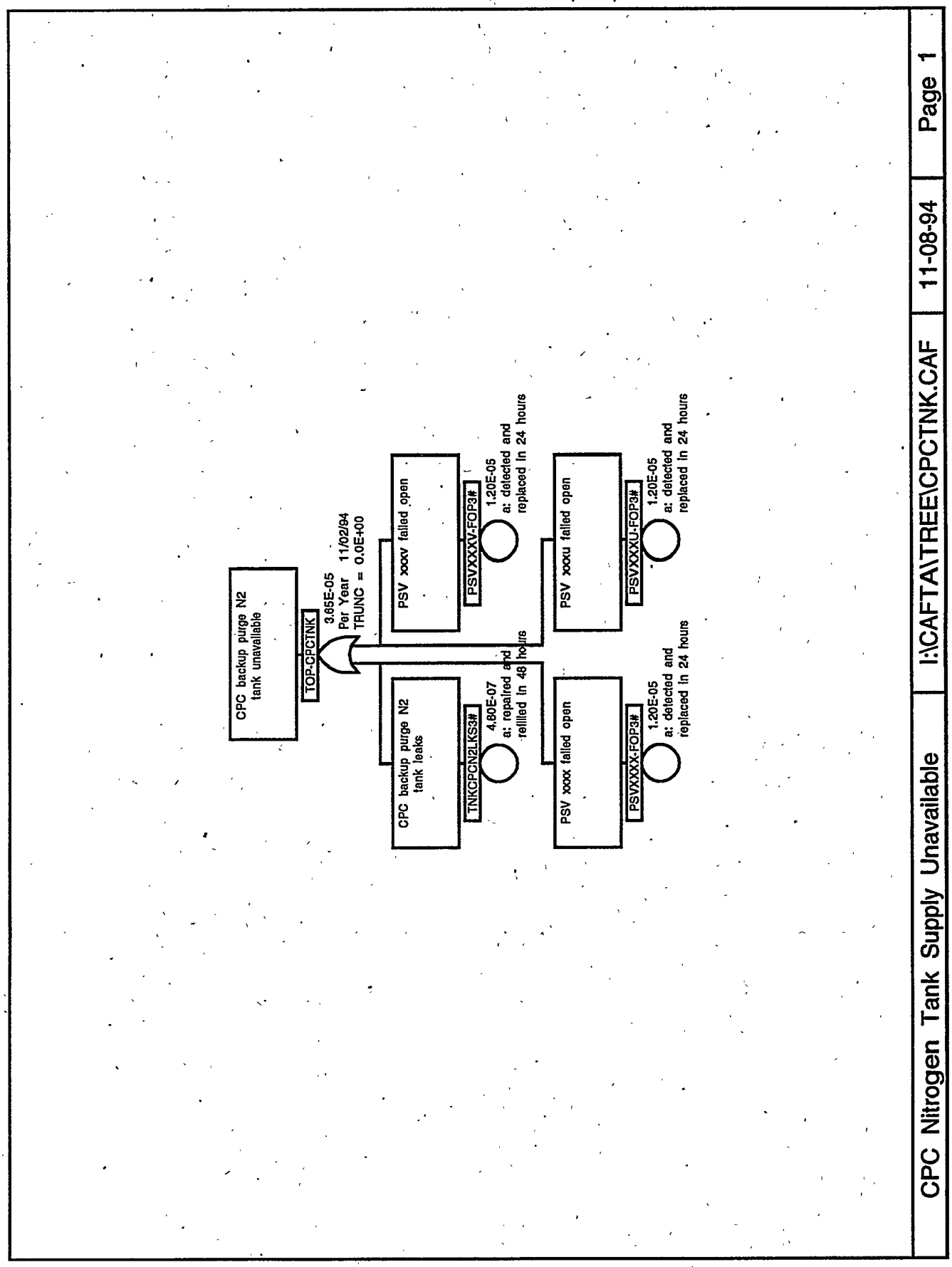
Modified top event frequency = (top event frequency) x (risk achievement worth).

Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
TNKN2SUPUSD3+-I	N2 supply tank volume used	1.03E-02/H	1.91E+00
N2-TRUCKBFL1#	N2 delivery fails to arrive at DWPF	1.00E-02	1.91E+00
OPR7863-MCH3#	N2 tank low level switch out of calibration	3.00E-02	1.68E+00
CC2-VAP-PSV1+-I	cc: PSVs on primary and backup vaporizer fail open	1.00E-06/H	1.15E+00
PSV-241-FOP3+-I	PSV 241 (or 239) on N2 tank fails open	5.00E-07/H	1.07E+00
PSV1458-FOP3+-I	PSV 1458 on N2 supply to CPC fails open	5.00E-07/H	1.07E+00
PSV242--FOP3+-I	PSV 242 on N2 tank piping fails open	5.00E-07/H	1.07E+00
PSE-021-FOP3+-I	Rupture disk 021 on N2 tank spuriously ruptures	5.00E-07/H	1.07E+00
PSV1216-FOP3+-I	PSV 1216 on N2 tank piping fails open	5.00E-07/H	1.07E+00
PSV1217-FOP3+-I	PSV 1217 on N2 tank piping fails open	5.00E-07/H	1.07E+00
OPRN2AL-CSL3#	Operator fails to respond to N2 tank low level alarm	3.00E-03	1.04E+00
LSL7863-FTC3#	Low N2 tank level switch fails to close	2.18E-03	1.03E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

CPC Nitrogen Supply Tank Unavailable


CPC backup purge N2 tank unavailable
TOP-CPCTNK
3.65E-05 Per Year 11/02/94 TRUNC = 0.0E+00
PSV xxxv failed open
PSVXXXV-FOP3#
1.20E-05 a: detected and replaced in 24 hours
PSV xxxu failed open
PSVXXXU-FOP3#
1.20E-05 a: detected and replaced in 24 hours
CPC backup purge N2 tank leaks
TNKCPCN2LKS3#
4.80E-07 a: repaired and refilled in 48 hours
PSV xxxx failed open
PSVXXXX-FOP3#
1.20E-05 a: detected and replaced in 24 hours
CPC Nitrogen Tank Supply Unavailable
I:\CAFTA\TREE\CPCTNK.CAF
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Cutsets for I:\CAFTA\CUT\CPCTNK.CSR 11/08/94 12:00 AM

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	TOP-CPCTNK					3.65E-05
1.	PSVXXXV-FOP3#	PSV xxxv failed open	3	24H 5.0E-07H	1.20E-05	1.20E-05
2.	PSVXXXU-FOP3#	PSV xxxu failed open	3	24H 5.0E-07H	1.20E-05	1.20E-05
3.	PSVXXXX-FOP3#	PSV xxxx failed open	3	24H 5.0E-07H	1.20E-05	1.20E-05
4.	TNKCPCN2LKS3#	CPC backup purge N2 tank leaks	3	48H 1.0E-08H	4.80E-07	4.80E-07

CPC backup purge N2 tank unavailable Top Event Probability: 3.65E-05

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
PSVXXXX-FOP3#	PSV xxxx failed open	1.20E-05	2.74E+04
TNKCPCN2LKS3#	CPC backup purge N2 tank leaks	4.80E-07	2.74E+04
PSVXXXV-FOP3#	PSV xxxv failed open	1.20E-05	2.74E+04
PSVXXXU-FOP3#	PSV xxxu failed open	1.20E-05	2.74E+04

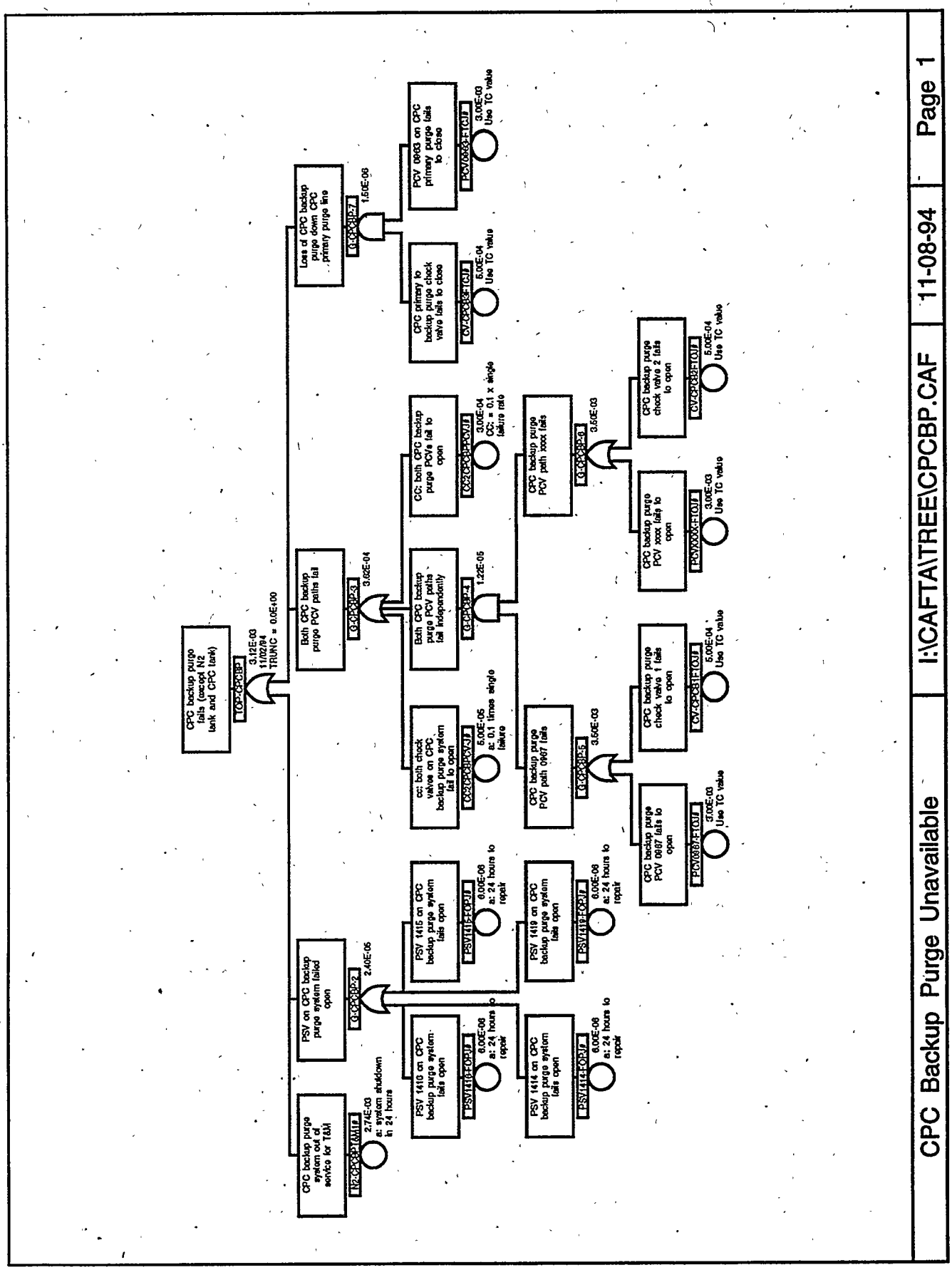
Modified top event frequency = (top event frequency) (risk achievement worth).

Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
PSVXXXX-FOP3#	PSV xxxx failed open	1.20E-05	1.49E+00
PSVXXXU-FOP3#	PSV xxxu failed open	1.20E-05	1.49E+00
PSVXXXV-FOP3#	PSV xxxv failed open	1.20E-05	1.49E+00
TNKCPCN2LKS3#	CPC backup purge N2 tank leaks	4.80E-07	1.01E+00

Modified top event frequency = (top event frequency) / (risk reduction worth).

CPC Backup Purge Path Unavailable


CPC backup purge fails (except N2 tank and CPC tank)
3.12E-03
11/02/94
TRUNC = 0.0E+00
Both CPC backup purge PCV paths fail
3.60E-04
Loss of CPC backup purge down CPC primary purge line
1.50E-06
PCV 0663 on CPC primary purge fails to close
3.00E-03
Use TC value
CPC primary to backup purge check valve fails to close
5.00E-04
Use TC value
Both CPC backup purge PCV paths fail independently
1.22E-05
CC: both CPC backup purge PCVs fail to open
3.00E-04
CC: = 0.1 x single failure rate
cc: both check valves on CPC backup purge system fail to open
5.00E-05
a: 0.1 times single failure
CPC backup purge PCV path xxxx fails
3.60E-03
CPC backup purge PCV path 0667 fails
3.60E-03
CPC backup purge check valve 2 fails to open
5.00E-04
Use TC value
CPC backup purge PCV xxxx fails to open
3.00E-03
Use TC value
CPC backup purge check valve 1 fails to open
5.00E-04
Use TC value
CPC backup purge PCV 0667 fails to open
3.00E-03
Use TC value
PSV on CPC backup purge system failed open
2.40E-05
PSV 1415 on CPC backup purge system fails open
6.00E-06
a: 24 hours to repair
PSV 1419 on CPC backup purge system fails open
6.00E-06
a: 24 hours to repair
CPC backup purge system out of service for TAM
2.74E-03
a: system shutdown in 24 hours
PSV 1410 on CPC backup purge system fails open
6.00E-06
a: 24 hours to repair
PSV 1414 on CPC backup purge system fails open
6.00E-06
a: 24 hours to repair
CPC Backup Purge Unavailable
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Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	TOP-CPCBP					3.12E-03
1.	N2-CPCBPT&M1#	CPC backup purge system out of service for T&M	3	24H 1Y	2.74E-03	2.74E-03
2.	CC2CPCBPPCVJ#	CC: both CPC backup purge PCVs fail to open	1	1N 3.0E-04N	3.00E-04N	3.00E-04
3.	CC2CPCBPCV-J#	cc: both check valves on CPC backup purge system fail to open	1	1N 5.0E-05N	5.00E-05N	5.00E-05
4.	PCV0967-FTOJ#	CPC backup purge PCV 0967 fails to open	1	1N 3.0E-03N	3.00E-03N	9.00E-06
	PCVXXXX-FTOJ#	CPC backup purge PCV xxxx fails to open	1	1N 3.0E-03N	3.00E-03N	
5.	PSV1414-FOPJ#	PSV 1414 on CPC backup purge system fails open	5	24H 5.0E-07H	6.00E-06	6.00E-06
6.	PSV1419-FOPJ#	PSV 1419 on CPC backup purge system fails open	5	24H 5.0E-07H	6.00E-06	6.00E-06
7.	PSV1416-FOPJ#	PSV 1416 on CPC backup purge system fails open	5	24H 5.0E-07H	6.00E-06	6.00E-06
8.	PSV1415-FOPJ#	PSV 1415 on CPC backup purge system fails open	5	24H 5.0E-07H	6.00E-06	6.00E-06
9.	CV-CPCB1FTOJ#	CPC backup purge check valve 1 fails to open	1	1N 5.0E-04N	5.00E-04N	1.50E-06
	PCVXXXX-FTOJ#	CPC backup purge PCV xxxx fails to open	1	1N 3.0E-03N	3.00E-03N	
10.	CV-CPCB2FTOJ#	CPC backup purge check valve 2 fails to open	1	1N 5.0E-04N	5.00E-04N	1.50E-06
	PCV0967-FTOJ#	CPC backup purge PCV 0967 fails to open	1	1N 3.0E-03N	3.00E-03N	
11.	CV-CPCB3FTCJ#	CPC primary to backup purge check valve fails to close	1	1N 5.0E-04N	5.00E-04N	1.50E-06
	PCV0963-FTCJ#	PCV 0963 on CPC primary purge fails to close	1	1N 3.0E-03N	3.00E-03N	
12.	CV-CPCB1FTOJ#	CPC backup purge check valve 1 fails to open	1	1N 5.0E-04N	5.00E-04N	2.50E-07
	CV-CPCB2FTOJ#	CPC backup purge check valve 2 fails to open	1	1N 5.0E-04N	5.00E-04N	

CPC backup purge fails (except N2 tank and CPC tank)
Top Event Probability: 3.12E-03

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
PSV1419-FOPJ#	PSV 1419 on CPC backup purge system fails open	6.00E-06	3.20E+02
PSV1414-FOPJ#	PSV 1414 on CPC backup purge system fails open	6.00E-06	3.20E+02
PSV1415-FOPJ#	PSV 1415 on CPC backup purge system fails open	6.00E-06	3.20E+02
PSV1416-FOPJ#	PSV 1416 on CPC backup purge system fails open	6.00E-06	3.20E+02
CC2CPCBPPCVJ#	CC: both CPC backup purge PCVs fail to open	3.00E-04	3.20E+02
N2-CPCBPT&M1#	CPC backup purge system out of service for T&M	2.74E-03	3.20E+02
CC2CPCBPCV-J#	cc: both check valves on CPC backup purge fail to open	5.00E-05	3.20E+02
CV-CPCB1FTOJ#	CPC backup purge check valve 1 fails to open	5.00E-04	2.12E+00
CV-CPCB2FTOJ#	CPC backup purge check valve 2 fails to open	5.00E-04	2.12E+00
PCV0967-FTOJ#	CPC backup purge PCV 0967 fails to open	3.00E-03	2.11E+00
PCVXXXX-FTOJ#	CPC backup purge PCV xxxx fails to open	3.00E-03	2.11E+00
CV-CPCB3FTCJ#	CPC primary to backup purge check valve fails to close	5.00E-04	1.96E+00
PCV0963-FTCJ#	PCV 0963 on CPC primary purge fails to close	3.00E-03	1.16E+00

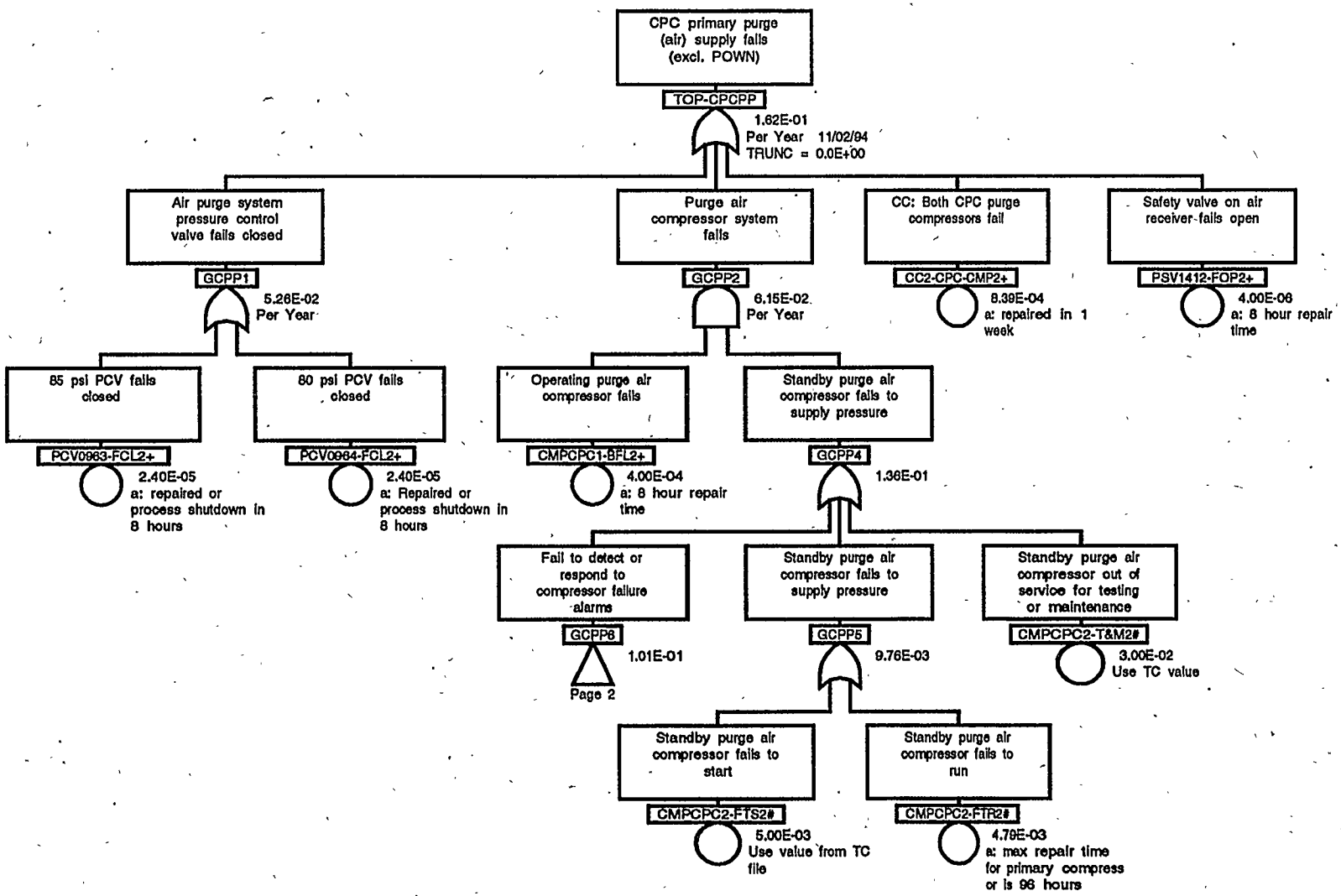
Modified top event frequency = (top event frequency) x (risk achievement worth).

Risk Reduction Worth

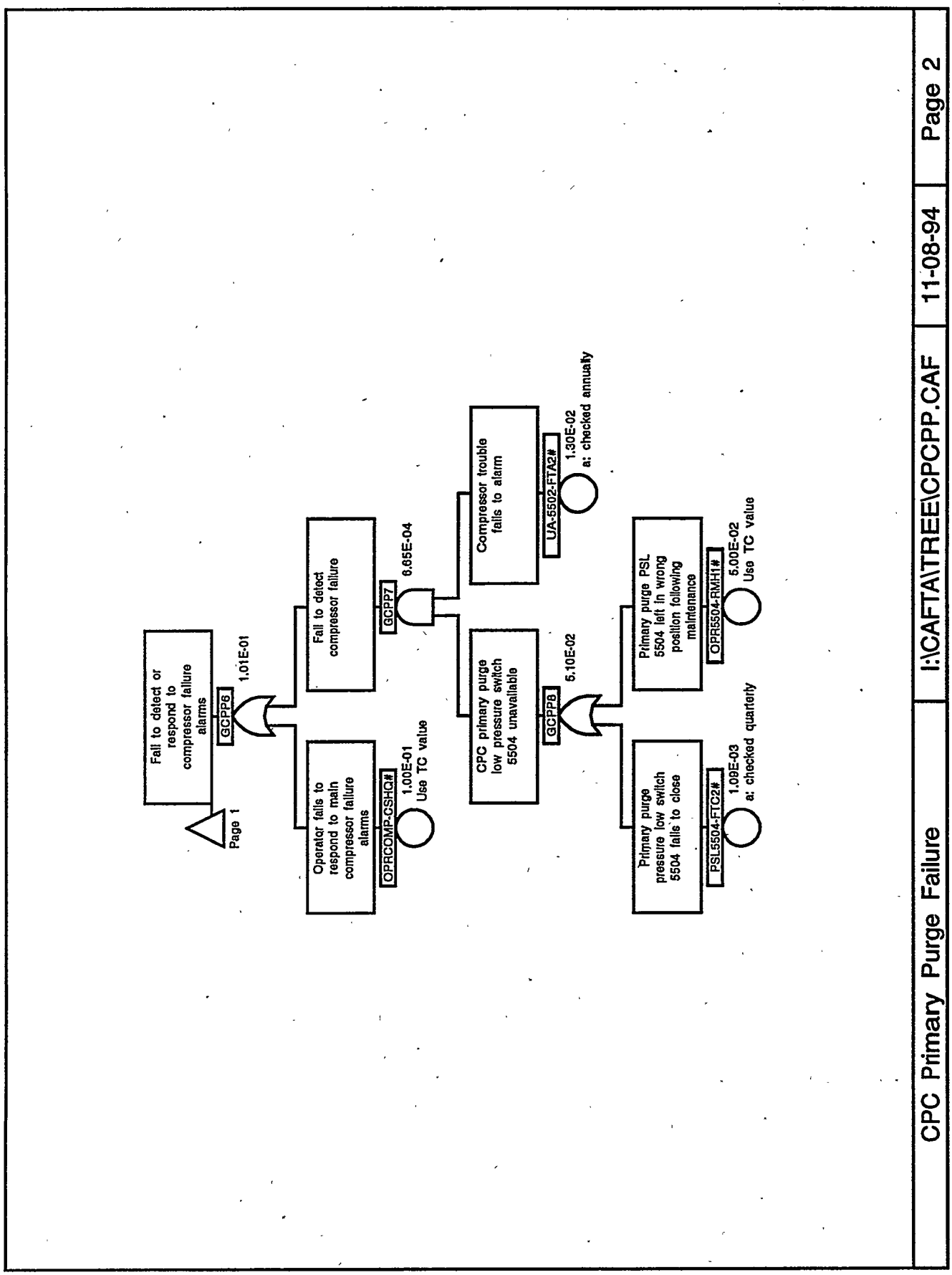
Basic Event Name	Description	Prob/Freq	RedW
N2-CPCBPT&M1#	CPC backup purge system out of service for T&M	2.74E-03	8.05E+00
CC2CPCBPPCVJ#	CC: both CPC backup purge PCVs fail to open	3.00E-04	1.11E+00
CC2CPCBPCV-J#	cc: both check valves on CPC backup purge fail to open	5.00E-05	1.02E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

CPC Primary Purge Failure



CPC Primary Purge Failure	I:\CAFTA\TREE\CPCPP.CAF	11-08-94	Page 1


Fail to detect or respond to compressor failure alarms
GCPP6
1.01E-01
Page 1
Operator fails to respond to main compressor failure alarms
OPRCOMP-GSHQ#
1.00E-01
Use TC value
Fail to detect compressor failure
GCPP7
6.65E-04
CPC primary purge low pressure switch 5504 unavailable
GCPP8
5.10E-02
Primary purge pressure low switch 5504 fails to close
PSL5504-FTC2#
1.09E-03
a: checked quarterly
Primary purge PSL 5504 left in wrong position following maintenance
OPR5504-RMH1#
5.00E-02
Use TC value
Compressor trouble fails to alarm
UA-5502-FTA2#
1.30E-02
a: checked annually
CPC Primary Purge Failure
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11-08-94
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Cutsets for I:\CAFTA\CUT\CPCPP.CSR 11/08/94 12:03 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-CPCPP					1.62E-01
1.	CMPCPC1-BFL2+	Operating purge air compressor fails	4	8H 5.0E-05H	4.00E-04	4.38E-02
	OPRCOMP-CSHQ#	Operator fails to respond to main compressor failure alarms	1	1N 1.0E-01N	1.00E-01N	
2.	CC2-CPC-CMP2+	CC: Both CPC purge compressors fail	4	7D 5.0E-06H	8.39E-04	4.38E-02
3.	PCV0964-FCL2+	80 psi PCV fails closed	4	8H 3.0E-06H	2.40E-05	2.63E-02
4.	PCV0963-FCL2+	85 psi PCV fails closed	4	8H 3.0E-06H	2.40E-05	2.63E-02
5.	CMPCPC1-BFL2+	Operating purge air compressor fails	4	8H 5.0E-05H	4.00E-04	1.31E-02
	CMPCPC2-T&M2#	Standby purge air compressor out of service for testing or maintenance	1	1N 3.0E-02N	3.00E-02N	
6.	PSV1412-FOP2+	Safety valve on air receiver fails open	4	8H 5.0E-07H	4.00E-06	4.38E-03
7.	CMPCPC1-BFL2+	Operating purge air compressor fails	4	8H 5.0E-05H	4.00E-04	2.19E-03
	CMPCPC2-FTS2#	Standby purge air compressor fails to start	1	1N 5.0E-03N	5.00E-03N	
8.	CMPCPC1-BFL2+	Operating purge air compressor fails	4	8H 5.0E-05H	4.00E-04	2.10E-03
	CMPCPC2-FTR2#	Standby purge air compressor fails to run	3	96H 5.0E-05H	4.79E-03	
9.	CMPCPC1-BFL2+	Operating purge air compressor fails	4	8H 5.0E-05H	4.00E-04	2.85E-04
	OPR5504-RMH1#	Primary purge PSL 5504 left in wrong position following maintenance	1	1N 5.0E-02N	5.00E-02N	
	UA-5502-FTA2#	Compressor trouble fails to alarm	5	1Y 3.0E-06H	1.30E-02	
10.	CMPCPC1-BFL2+	Operating purge air compressor fails	4	8H 5.0E-05H	4.00E-04	6.22E-06
	PSL5504-FTC2#	Primary purge pressure low switch 5504 fails to close	5	1Q 1.0E-06H	1.09E-03	
	UA-5502-FTA2#	Compressor trouble fails to alarm	5	1Y 3.0E-06H	1.30E-02	

CPC primary purge (air) supply fails (excl. POWN)
Top Event Frequency: 1.62E-01/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
PCV0964-FCL2+-I	80 psi PCV fails closed	3.00E-06/H	5.40E+04
PCV0963-FCL2+-I	85 psi PCV fails closed	3.00E-06/H	5.40E+04
PSV1412-FOP2+-I	Safety valve on air receiver fails open	5.00E-07/H	5.40E+04
CC2-CPC-CMP2+-I	CC: Both CPC purge compressors fail	4.99E-06/H	5.40E+04
CMPCPC1-BFL2+-I	Operating purge air compressor fails	5.00E-05/H	7.35E+03
CMPCPC2-FTR2#	Standby purge air compressor fails to run	4.79E-03	3.69E+00
CMPCPC2-FTS2#	Standby purge air compressor fails to start	5.00E-03	3.69E+00
CMPCPC2-T&M2#	Standby purge air compressor out of service for T&M	3.00E-02	3.62E+00
OPRCOMP-CSHQ#	Operator fails to respond to main compressor failure alarms	1.00E-01	3.43E+00
UA-5502-FTA2#	Compressor trouble fails to alarm	1.30E-02	1.14E+00
PSL5504-FTC2#	Primary purge pressure low switch 5504 fails to close	1.09E-03	1.04E+00
OPR5504-RMH1#	Primary purge PSL 5504 left in wrong position after maint.	5.00E-02	1.03E+00

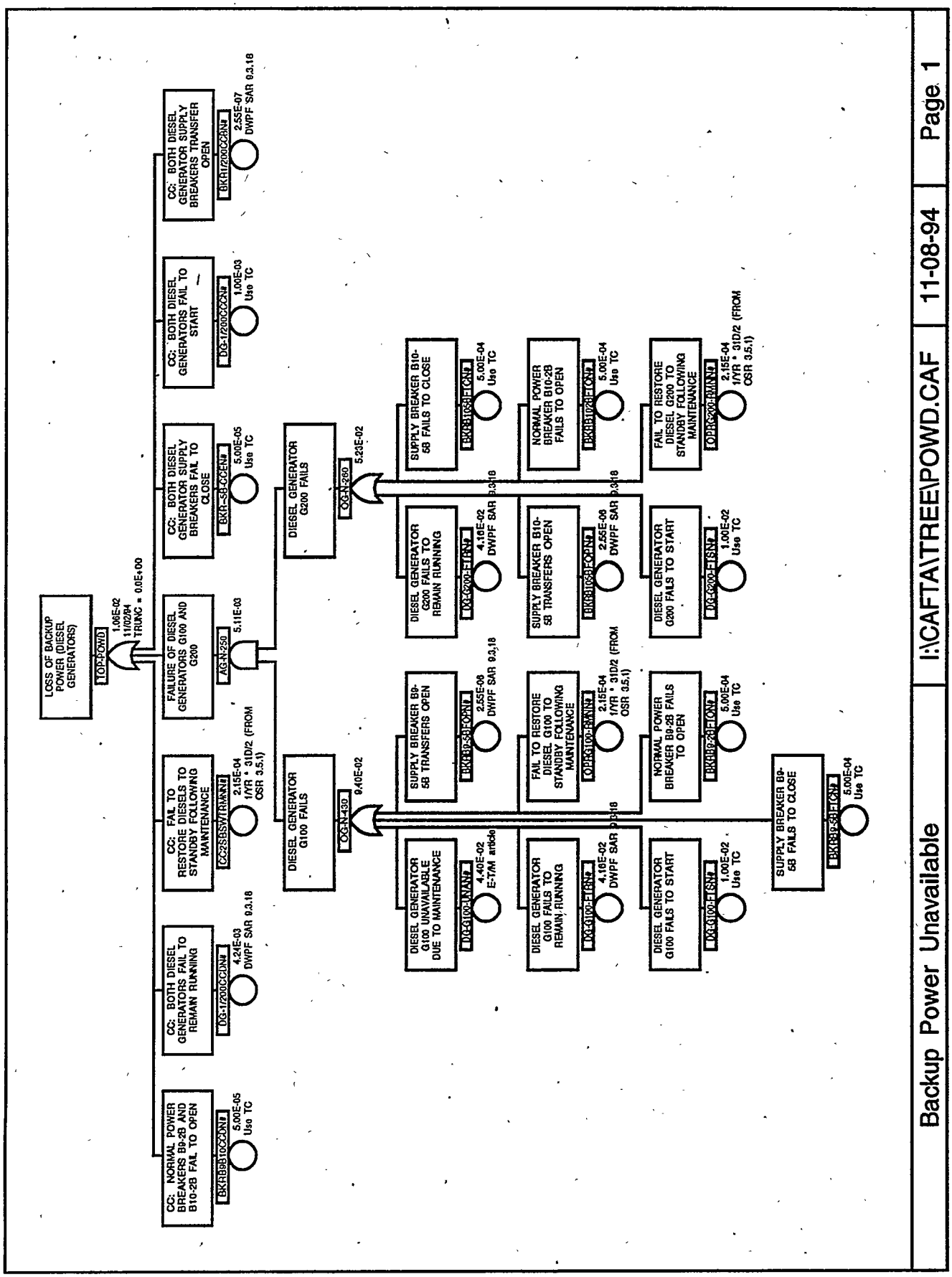
Modified top event frequency = (top event frequency) x (risk achievement worth).

Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
CMPCPC1-BFL2+-I	Operating purge air compressor fails	5.00E-05/H	1.61E+00
OPRCOMP-CSHQ#	Operator fails to respond to main compressor failure alarms	1.00E-01	1.37E+00
CC2-CPC-CMP2+-I	CC: Both CPC purge compressors fail	4.99E-06/H	1.37E+00
PCV0963-FCL2+-I	85 psi PCV fails closed	3.00E-06/H	1.19E+00
PCV0964-FCL2+-I	80 psi PCV fails closed	3.00E-06/H	1.19E+00
CMPCPC2-T&M2#	Standby purge air compressor out of service for T&M	3.00E-02	1.09E+00
PSV1412-FOP2+-I	Safety valve on air receiver fails open	5.00E-07/H	1.03E+00
CMPCPC2-FTS2#	Standby purge air compressor fails to start	5.00E-03	1.01E+00
CMPCPC2-FTR2#	Standby purge air compressor fails to run	4.79E-03	1.01E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

Backup Power Unavailable


LOSS OF BACKUP POWER (DIESEL GENERATORS)
TOP-POWD
1.06E-02
11/02/94
TRUNC = 0.0E+00
CC: NORMAL POWER BREAKERS B9-2B AND B10-2B FAIL TO OPEN
BKRB9B10CCON#
5.00E-05
Use TC
CC: BOTH DIESEL GENERATORS FAIL TO REMAIN RUNNING
DG-1200CCON#
4.24E-03
DWPF SAR 9.3.18
CC: FAIL TO RESTORE DIESELS TO STANDBY FOLLOWING MAINTENANCE
CC23BSWTRMAN#
2.15E-04
1/YR * 31D/2 (FROM OSR 3.5.1)
FAILURE OF DIESEL GENERATORS G100 AND G200
AG-N-250
5.11E-03
CC: BOTH DIESEL GENERATOR SUPPLY BREAKERS FAIL TO CLOSE
BKR--58-CCON#
5.00E-05
Use TC
CC: BOTH DIESEL GENERATORS FAIL TO START
DG-1200CCON#
1.00E-03
Use TC
CC: BOTH DIESEL GENERATOR SUPPLY BREAKERS TRANSFER OPEN
BKRT200CCN#
2.55E-07
DWPF SAR 9.3.18
DIESEL GENERATOR G100 FAILS
OG-N-430
9.40E-02
DIESEL GENERATOR G200 FAILS
OG-N-260
5.23E-02
DIESEL GENERATOR G100 UNAVAILABLE DUE TO MAINTENANCE
DG-G100-UNAV#
4.40E-02
E-17M article
SUPPLY BREAKER B9-5B TRANSFERS OPEN
BKRB9-58-FOPN#
2.55E-06
DWPF SAR 9.3.18
DIESEL GENERATOR G100 FAILS TO REMAIN RUNNING
DG-G100-FTRN#
4.16E-02
DWPF SAR 9.3.18
FAIL TO RESTORE DIESEL G100 TO STANDBY FOLLOWING MAINTENANCE
OPR-G100-RMAN#
2.15E-04
1/YR * 31D/2 (FROM OSR 3.5.1)
NORMAL POWER BREAKER B9-2B FAILS TO OPEN
BKRB9-2B-FTON#
5.00E-04
Use TC
DIESEL GENERATOR G100 FAILS TO START
DG-G100-FTSN#
1.00E-02
Use TC
SUPPLY BREAKER B9-5B FAILS TO CLOSE
BKRB9-58-FTCN#
5.00E-04
Use TC
DIESEL GENERATOR G200 FAILS TO REMAIN RUNNING
DG-G200-FTRN#
4.16E-02
DWPF SAR 9.3.18
SUPPLY BREAKER B10-5B TRANSFERS OPEN
BKRB10-58-FOPN#
2.55E-06
DWPF SAR 9.3.18
DIESEL GENERATOR G200 FAILS TO START
DG-G200-FTSN#
1.00E-02
Use TC
SUPPLY BREAKER B10-5B FAILS TO CLOSE
BKRB10-58-FTCN#
5.00E-04
Use TC
NORMAL POWER BREAKER B10-2B FAILS TO OPEN
BKRB10-2B-FTON#
5.00E-04
Use TC
FAIL TO RESTORE DIESEL G200 TO STANDBY FOLLOWING MAINTENANCE
OPR-G200-RMAN#
2.15E-04
1/YR * 31D/2 (FROM OSR 3.5.1)
Backup Power Unavailable
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Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	TOP-POWD					1.06E-02
1.	DG-1/200CCDN#	CC: BOTH DIESEL GENERATORS FAIL TO REMAIN RUNNING	3	8.5H 5.0E-04H	4.24E-03	4.24E-03
2.	DG-G100-UNAN#	DIESEL GENERATOR G100 UNAVAILABLE DUE TO MAINTENANCE	1	1N 4.4E-02N	4.40E-02N	1.83E-03
	DG-G200-FTRN#	DIESEL GENERATOR G200 FAILS TO REMAIN RUNNING	3	8.5H 5.0E-03H	4.16E-02	
3.	DG-G100-FTRN#	DIESEL GENERATOR G100 FAILS TO REMAIN RUNNING	3	8.5H 5.0E-03H	4.16E-02	1.73E-03
	DG-G200-FTRN#	DIESEL GENERATOR G200 FAILS TO REMAIN RUNNING	3	8.5H 5.0E-03H	4.16E-02	
4.	DG-1/200CCCN#	CC: BOTH DIESEL GENERATORS FAIL TO START	1	1N 1.0E-03N	1.00E-03N	1.00E-03
5.	DG-G100-UNAN#	DIESEL GENERATOR G100 UNAVAILABLE DUE TO MAINTENANCE	1	1N 4.4E-02N	4.40E-02N	4.40E-04
	DG-G200-FTSN#	DIESEL GENERATOR G200 FAILS TO START	1	1N 1.0E-02N	1.00E-02N	
6.	DG-G100-FTRN#	DIESEL GENERATOR G100 FAILS TO REMAIN RUNNING	3	8.5H 5.0E-03H	4.16E-02	4.16E-04
	DG-G200-FTSN#	DIESEL GENERATOR G200 FAILS TO START	1	1N 1.0E-02N	1.00E-02N	
7.	DG-G100-FTSN#	DIESEL GENERATOR G100 FAILS TO START	1	1N 1.0E-02N	1.00E-02N	4.16E-04
	DG-G200-FTRN#	DIESEL GENERATOR G200 FAILS TO REMAIN RUNNING	3	8.5H 5.0E-03H	4.16E-02	
8.	CC2SBSWTRMNN#	CC: FAIL TO RESTORE DIESELS TO STANDBY FOLLOWING MAINTENANCE	1	4.3E-02N 5.0E-03N	2.15E-04N	2.15E-04
9.	DG-G100-FTSN#	DIESEL GENERATOR G100 FAILS TO START	1	1N 1.0E-02N	1.00E-02N	1.00E-04
	DG-G200-FTSN#	DIESEL GENERATOR G200 FAILS TO START	1	1N 1.0E-02N	1.00E-02N	
10.	BKR--5B-CCEN#	CC: BOTH DIESEL GENERATOR SUPPLY BREAKERS FAIL TO CLOSE	1	1N 5.0E-05N	5.00E-05N	5.00E-05
11.	BKRB9B10CCDN#	CC: NORMAL POWER BREAKERS B9-2B AND B10-2B FAIL TO OPEN	1	1N 5.0E-05N	5.00E-05N	5.00E-05

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
12.	BKRB105BFTCN#	SUPPLY BREAKER B10-5B FAILS TO CLOSE	1	1N 5.0E-04N	5.00E-04N	2.20E-05
	DG-G100-UNAN#	DIESEL GENERATOR G100 UNAVAILABLE DUE TO MAINTENANCE	1	1N 4.4E-02N	4.40E-02N	
13.	BKRB102BFTON#	NORMAL POWER BREAKER B10-2B FAILS TO OPEN	1	1N 5.0E-04N	5.00E-04N	2.20E-05
	DG-G100-UNAN#	DIESEL GENERATOR G100 UNAVAILABLE DUE TO MAINTENANCE	1	1N 4.4E-02N	4.40E-02N	
14.	BKRB9-5BFTCN#	SUPPLY BREAKER B9-5B FAILS TO CLOSE	1	1N 5.0E-04N	5.00E-04N	2.08E-05
	DG-G200-FTRN#	DIESEL GENERATOR G200 FAILS TO REMAIN RUNNING	3	8.5H 5.0E-03H	4.16E-02	
15.	BKRB102BFTON#	NORMAL POWER BREAKER B10-2B FAILS TO OPEN	1	1N 5.0E-04N	5.00E-04N	2.08E-05
	DG-G100-FTRN#	DIESEL GENERATOR G100 FAILS TO REMAIN RUNNING	3	8.5H 5.0E-03H	4.16E-02	
16.	BKRB9-2BFTON#	NORMAL POWER BREAKER B9-2B FAILS TO OPEN	1	1N 5.0E-04N	5.00E-04N	2.08E-05
	DG-G200-FTRN#	DIESEL GENERATOR G200 FAILS TO REMAIN RUNNING	3	8.5H 5.0E-03H	4.16E-02	
17.	BKRB105BFTCN#	SUPPLY BREAKER B10-5B FAILS TO CLOSE	1	1N 5.0E-04N	5.00E-04N	2.08E-05
	DG-G100-FTRN#	DIESEL GENERATOR G100 FAILS TO REMAIN RUNNING	3	8.5H 5.0E-03H	4.16E-02	
18.	DG-G100-UNAN#	DIESEL GENERATOR G100 UNAVAILABLE DUE TO MAINTENANCE	1	1N 4.4E-02N	4.40E-02N	9.46E-06
	OPRG200-RMNN#	FAIL TO RESTORE DIESEL G200 TO STANDBY FOLLOWING MAINTENANCE	1	4.3E-02N 5.0E-03N	2.15E-04N	
19.	DG-G100-FTRN#	DIESEL GENERATOR G100 FAILS TO REMAIN RUNNING	3	8.5H 5.0E-03H	4.16E-02	8.95E-06
	OPRG200-RMNN#	FAIL TO RESTORE DIESEL G200 TO STANDBY FOLLOWING MAINTENANCE	1	4.3E-02N 5.0E-03N	2.15E-04N	
20.	DG-G200-FTRN#	DIESEL GENERATOR G200 FAILS TO REMAIN RUNNING	3	8.5H 5.0E-03H	4.16E-02	8.95E-06
	OPRG100-RMNN#	FAIL TO RESTORE DIESEL G100 TO STANDBY FOLLOWING MAINTENANCE	1	4.3E-02N 5.0E-03N	2.15E-04N	
21.	BKRB9-2BFTON#	NORMAL POWER BREAKER B9-2B FAILS TO OPEN	1	1N 5.0E-04N	5.00E-04N	5.00E-06

Cutsets for I:\CAFTA\CUT\POWD.CSR 11/08/94 12:05 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	DG-G200-FTSN#	DIESEL GENERATOR G200 FAILS TO START	1	1N 1.0E-02N	1.00E-02N	
22.	BKRB102BFTON#	NORMAL POWER BREAKER B10-2B FAILS TO OPEN	1	1N 5.0E-04N	5.00E-04N	5.00E-06
	DG-G100-FTSN#	DIESEL GENERATOR G100 FAILS TO START	1	1N 1.0E-02N	1.00E-02N	
23.	BKRB9-5BFTCN#	SUPPLY BREAKER B9-5B FAILS TO CLOSE	1	1N 5.0E-04N	5.00E-04N	5.00E-06
	DG-G200-FTSN#	DIESEL GENERATOR G200 FAILS TO START	1	1N 1.0E-02N	1.00E-02N	
24.	BKRB105BFTCN#	SUPPLY BREAKER B10-5B FAILS TO CLOSE	1	1N 5.0E-04N	5.00E-04N	5.00E-06
	DG-G100-FTSN#	DIESEL GENERATOR G100 FAILS TO START	1	1N 1.0E-02N	1.00E-02N	
25.	DG-G100-FTSN#	DIESEL GENERATOR G100 FAILS TO START	1	1N 1.0E-02N	1.00E-02N	2.15E-06
	OPRG200-RMNN#	FAIL TO RESTORE DIESEL G200 TO STANDBY FOLLOWING MAINTENANCE	1	4.3E-02N 5.0E-03N	2.15E-04N	

LOSS OF BACKUP POWER (DIESEL GENERATORS)
Top Event Probability: 1.06E-02

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
BKR--5B-CCEN#	CC: BOTH DIESEL SUPPLY BRKRS FAIL TO CLOSE	5.00E-05	9.41E+01
CC2SBSWTRMNN#	CC: FAIL TO RESTORE DIESELS TO STANDBY	2.15E-04	9.41E+01
BKR1/200CCBN#	CC: BOTH DIESEL SUPPLY BRKRS TRANSFER OPEN	2.55E-07	9.41E+01
BKRB9B10CCDN#	CC: NORM BRKRS B9-2B AND B10-2B FAIL TO OPEN	5.00E-05	9.41E+01
DG-1/200CCCN#	CC: BOTH DIESEL GENERATORS FAIL TO START	1.00E-03	9.41E+01
DG-1/200CCDN#	CC: BOTH DIESELS FAIL TO REMAIN RUNNING	4.24E-03	9.41E+01
BKRB105BFOPN#	SUPPLY BREAKER B10-5B TRANSFERS OPEN	2.55E-06	9.76E+00
OPRG200-RMNN#	FAIL TO RESTORE DIESEL G200 TO STANDBY	2.15E-04	9.75E+00
BKRB105BFTCN#	SUPPLY BREAKER B10-5B FAILS TO CLOSE	5.00E-04	9.75E+00
BKRB102BFTON#	NORMAL POWER BREAKER B10-2B FAILS TO OPEN	5.00E-04	9.75E+00
DG-G200-FTSN#	DIESEL GENERATOR G200 FAILS TO START	1.00E-02	9.67E+00
DG-G200-FTRN#	DIESEL G200 FAILS TO REMAIN RUNNING	4.16E-02	9.41E+00
BKRB9-5BFOPN#	SUPPLY BREAKER B9-5B TRANSFERS OPEN	2.55E-06	5.87E+00
OPRG100-RMNN#	FAIL TO RESTORE DIESEL G100 TO STANDBY	2.15E-04	5.87E+00
BKRB9-5BFTCN#	SUPPLY BREAKER B9-5B FAILS TO CLOSE	5.00E-04	5.87E+00
BKRB9-2BFTON#	NORMAL POWER BREAKER B9-2B FAILS TO OPEN	5.00E-04	5.87E+00
DG-G100-FTSN#	DIESEL GENERATOR G100 FAILS TO START	1.00E-02	5.83E+00
DG-G100-FTRN#	DIESEL G100 FAILS TO REMAIN RUNNING	4.16E-02	5.68E+00
DG-G100-UNAN#	DIESEL G100 UNAVAILABLE DUE TO T&M	4.40E-02	5.67E+00

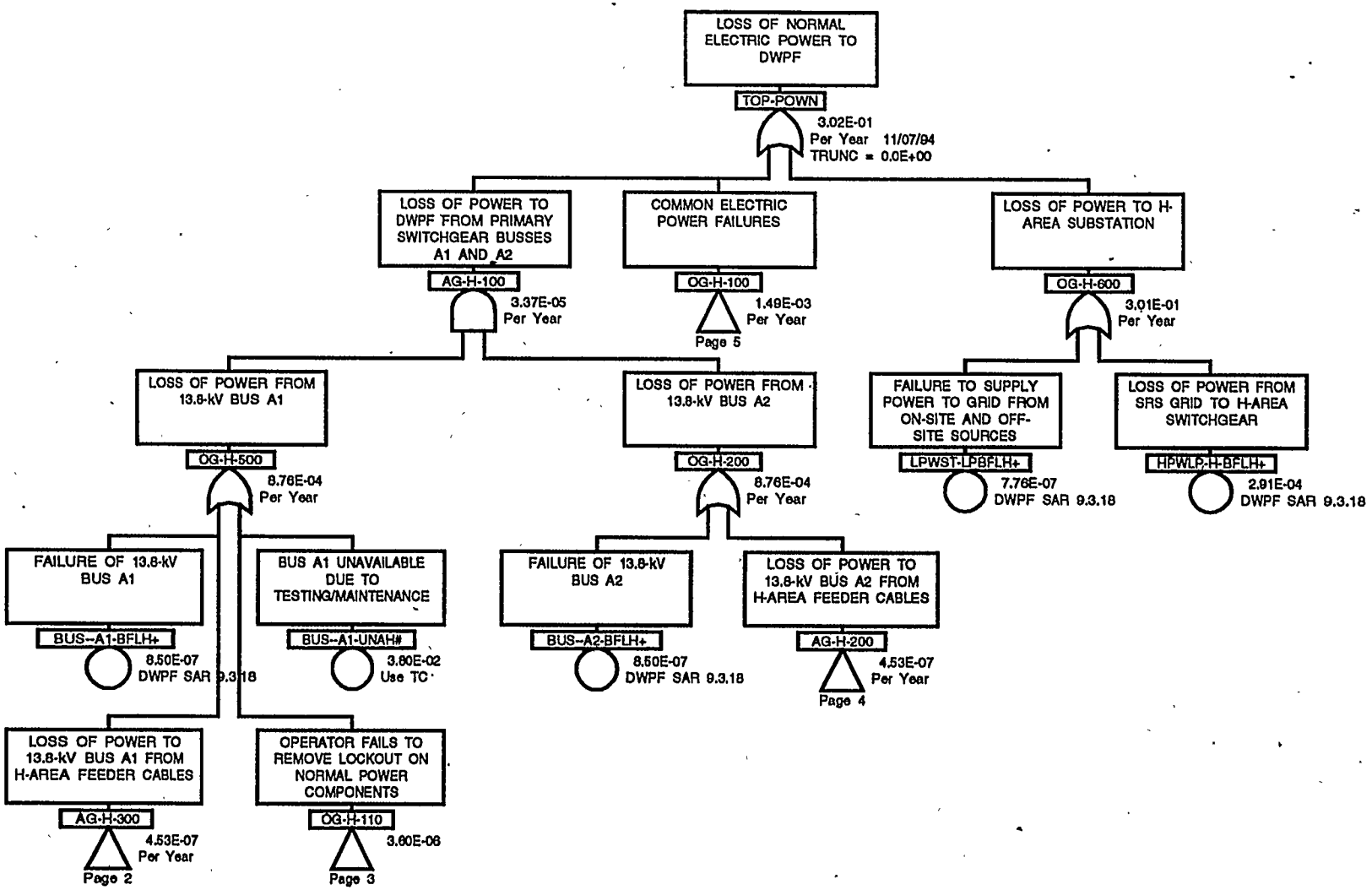
Modified top event frequency = (top event frequency) x (risk achievement worth).

Risk Reduction Worth

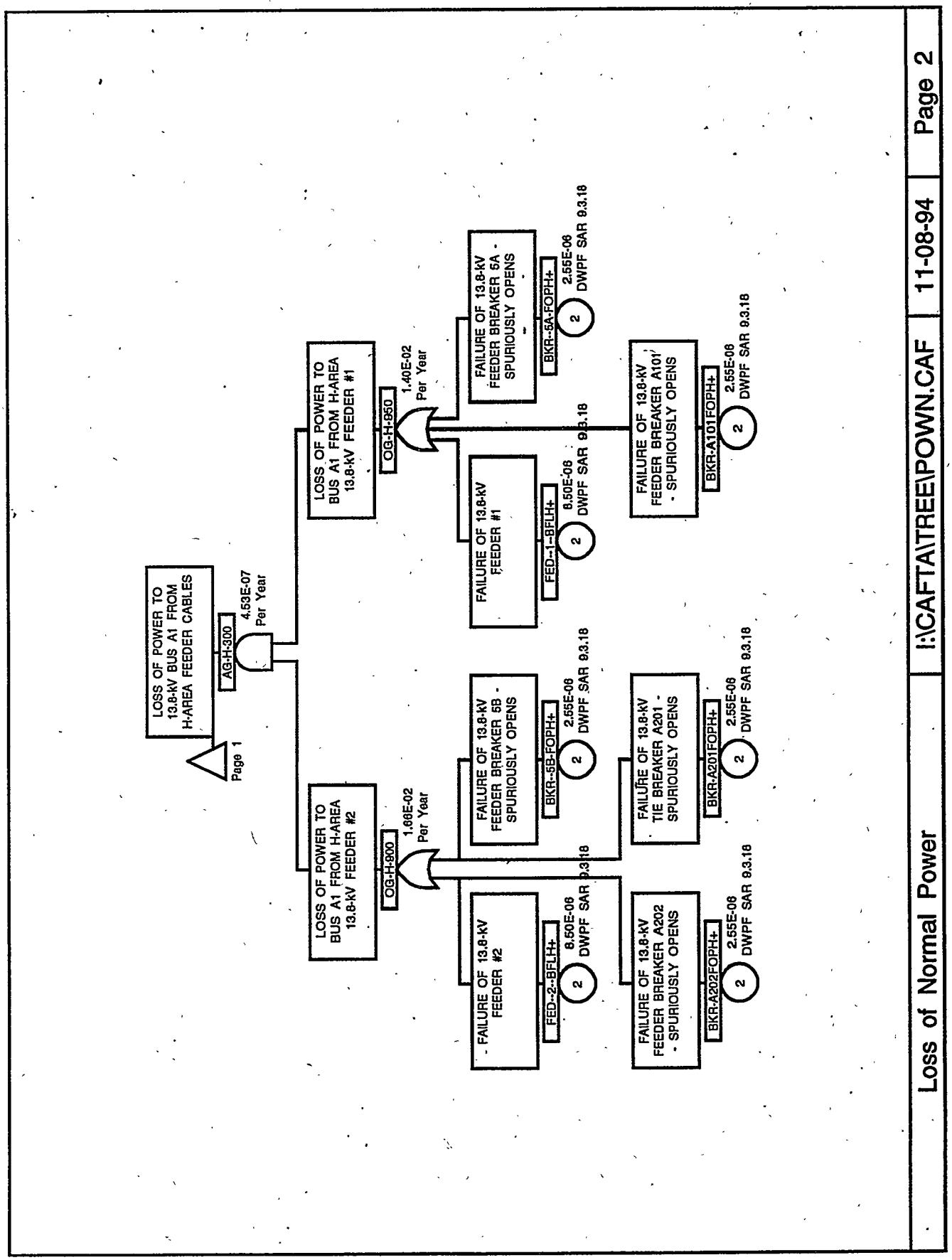
Basic Event Name	Description	Prob/Freq	RedW
DG-1/200CCDN#	CC: BOTH DIESELS FAIL TO REMAIN RUNNING	4.24E-03	1.66E+00
DG-G200-FTRN#	DIESEL G200 FAILS TO REMAIN RUNNING	4.16E-02	1.60E+00
DG-G100-UNAN#	DIESEL G100 UNAVAILABLE DUE TO T&M	4.40E-02	1.28E+00
DG-G100-FTRN#	DIESEL G100 FAILS TO REMAIN RUNNING	4.16E-02	1.26E+00
DG-1/200CCCN#	CC: BOTH DIESEL GENERATORS FAIL TO START	1.00E-03	1.10E+00
DG-G200-FTSN#	DIESEL GENERATOR G200 FAILS TO START	1.00E-02	1.10E+00
DG-G100-FTSN#	DIESEL GENERATOR G100 FAILS TO START	1.00E-02	1.05E+00
CC2SBSWTRMNN#	CC: FAIL TO RESTORE DIESELS TO STANDBY	2.15E-04	1.02E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

Normal Power Failure



Loss of Normal Power	I:\CAFTA\TREE\POWN.CAF	11-08-94	Page 1


LOSS OF POWER TO 13.8-kV BUS A1 FROM H-AREA FEEDER CABLES
Page 1
AG-H-300
4.53E-07 Per Year
LOSS OF POWER TO BUS A1 FROM H-AREA 13.8-kV FEEDER #1
OG-H-950
1.40E-02 Per Year
FAILURE OF 13.8-kV FEEDER #1
FED-1-BFLH+
2
8.50E-06 DWPF SAR 9.3.18
FAILURE OF 13.8-kV FEEDER BREAKER 5A - SPURIOUSLY OPENS
BKR-5A-FOPH+
2
2.55E-06 DWPF SAR 9.3.18
LOSS OF POWER TO BUS A1 FROM H-AREA 13.8-kV FEEDER #2
OG-H-800
1.66E-02 Per Year
FAILURE OF 13.8-kV FEEDER #2
FED-2-BFLH+
2
8.50E-06 DWPF SAR 9.3.18
FAILURE OF 13.8-kV FEEDER BREAKER 5B - SPURIOUSLY OPENS
BKR-5B-FOPH+
2
2.55E-06 DWPF SAR 9.3.18
FAILURE OF 13.8-kV FEEDER BREAKER A101 - SPURIOUSLY OPENS
BKR-A101FOPH+
2
2.55E-06 DWPF SAR 9.3.18
FAILURE OF 13.8-kV FEEDER BREAKER A202 - SPURIOUSLY OPENS
BKR-A202FOPH+
2
2.55E-06 DWPF SAR 9.3.18
FAILURE OF 13.8-kV TIE BREAKER A201 - SPURIOUSLY OPENS
BKR-A201FOPH+
2
2.55E-06 DWPF SAR 9.3.18
Loss of Normal Power
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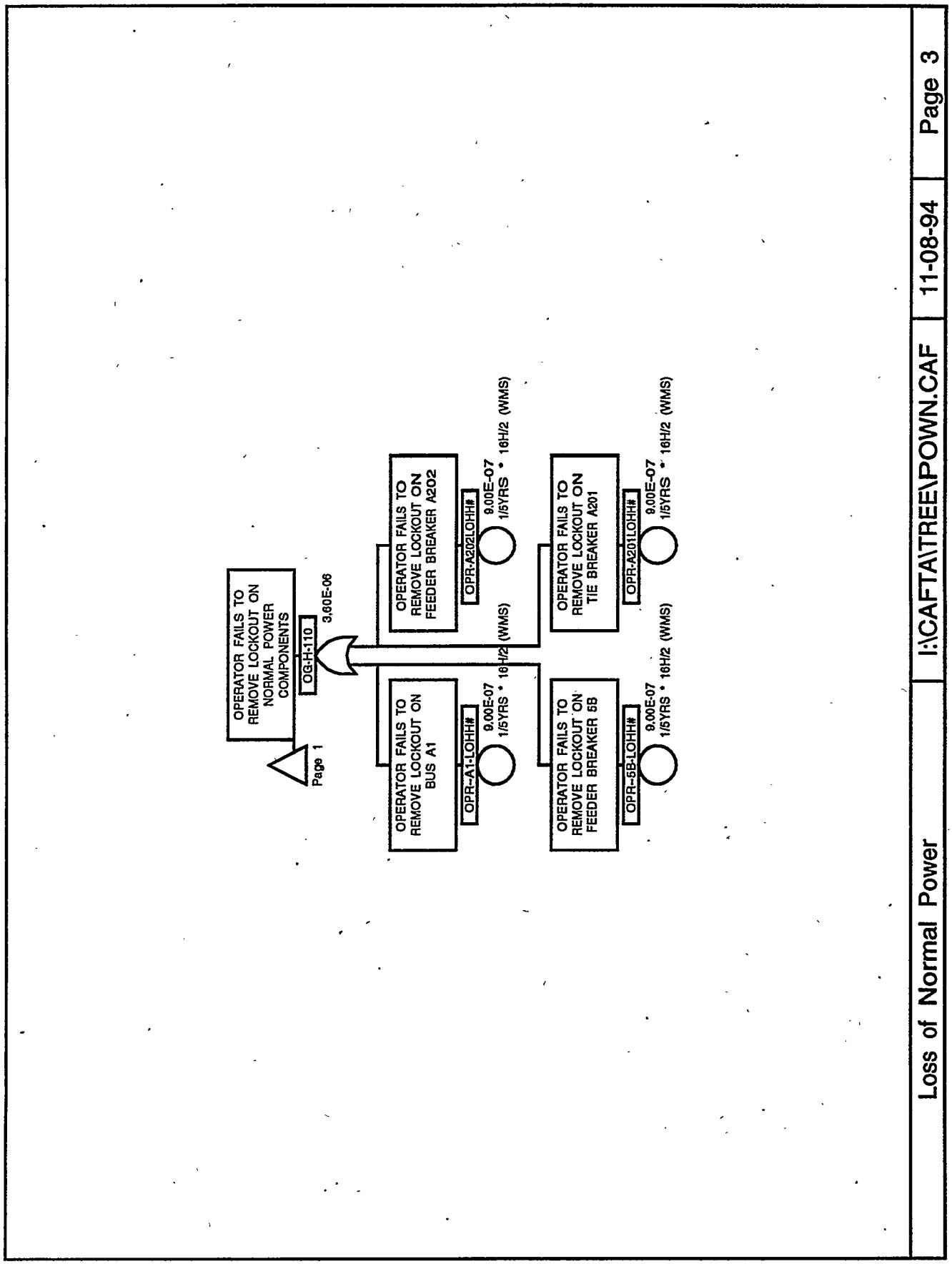
OPERATOR FAILS TO REMOVE LOCKOUT ON NORMAL POWER COMPONENTS
OG-H-110
3.60E-06
Page 1
OPERATOR FAILS TO REMOVE LOCKOUT ON BUS A1
OPR-A1-LOHH#
9.00E-07
1/5YRS * 16H/2 (WMS)
OPERATOR FAILS TO REMOVE LOCKOUT ON FEEDER BREAKER A202
OPR-A202LOHH#
9.00E-07
1/5YRS * 16H/2 (WMS)
OPERATOR FAILS TO REMOVE LOCKOUT ON FEEDER BREAKER 6B
OPR-6B-LOHH#
9.00E-07
1/5YRS * 16H/2 (WMS)
OPERATOR FAILS TO REMOVE LOCKOUT ON TIE BREAKER A201
OPR-A201LOHH#
9.00E-07
1/5YRS * 16H/2 (WMS)
Loss of Normal Power
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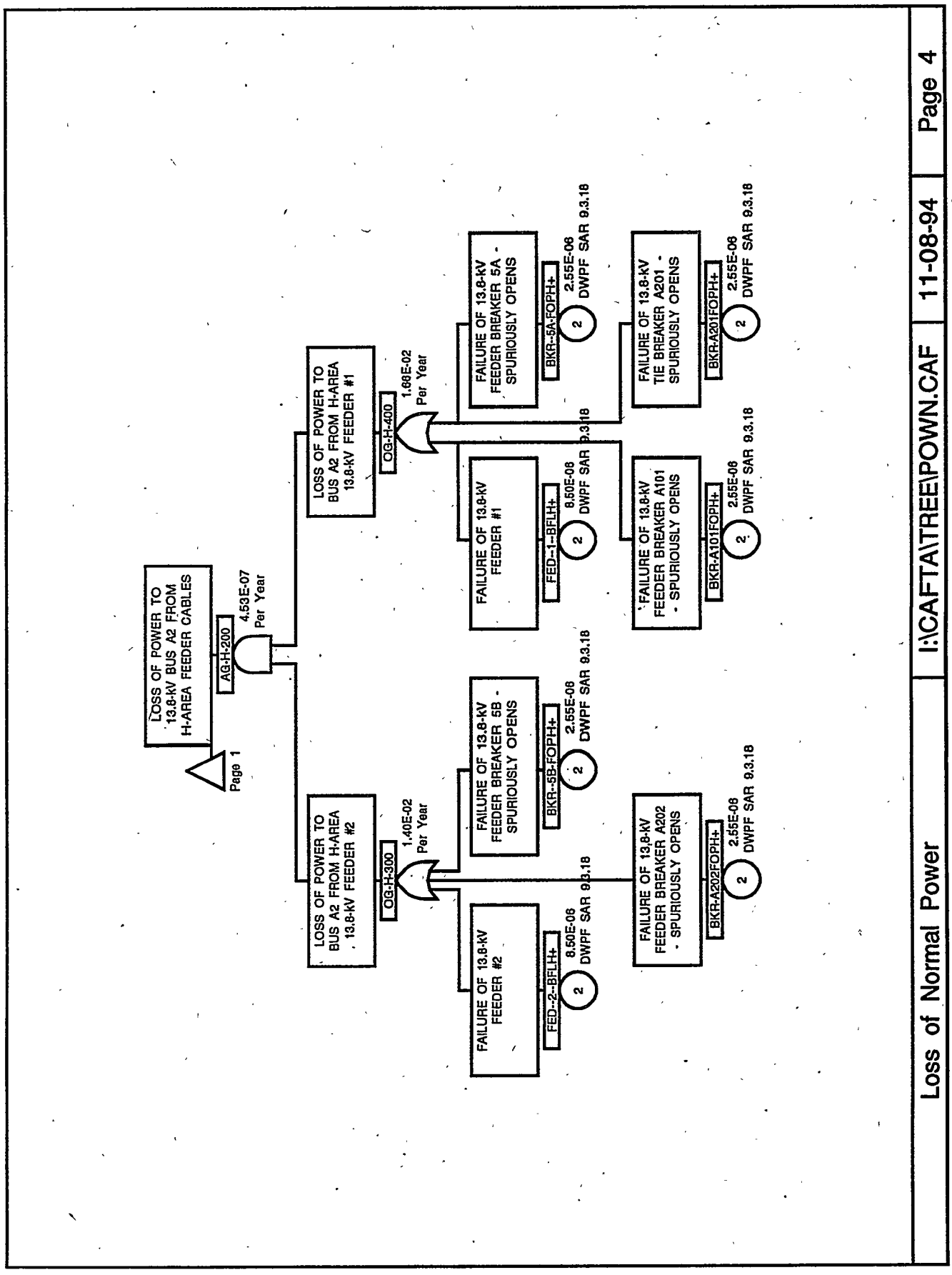
LOSS OF POWER TO 13.8-kV BUS A2 FROM H-AREA FEEDER CABLES
AG-H-200
4.53E-07 Per Year
Page 1
LOSS OF POWER TO BUS A2 FROM H-AREA 13.8-kV FEEDER #1
OG-H-400
1.68E-02 Per Year
LOSS OF POWER TO BUS A2 FROM H-AREA 13.8-kV FEEDER #2
OG-H-300
1.40E-02 Per Year
FAILURE OF 13.8-kV FEEDER #1
FED-1-BFLH+
2
8.50E-06 DWPF SAR 9.3.18
FAILURE OF 13.8-kV FEEDER BREAKER 5A - SPURIOUSLY OPENS
BKR-5A-FOPH+
2
2.55E-06 DWPF SAR 9.3.18
FAILURE OF 13.8-kV FEEDER BREAKER A101 - SPURIOUSLY OPENS
BKR-A101FOPH+
2
2.55E-06 DWPF SAR 9.3.18
FAILURE OF 13.8-kV TIE BREAKER A201 - SPURIOUSLY OPENS
BKR-A201FOPH+
2
2.55E-06 DWPF SAR 9.3.18
FAILURE OF 13.8-kV FEEDER #2
FED-2-BFLH+
2
8.50E-06 DWPF SAR 9.3.18
FAILURE OF 13.8-kV FEEDER BREAKER 5B - SPURIOUSLY OPENS
BKR-5B-FOPH+
2
2.55E-06 DWPF SAR 9.3.18
FAILURE OF 13.8-kV FEEDER BREAKER A202 - SPURIOUSLY OPENS
BKR-A202FOPH+
2
2.55E-06 DWPF SAR 9.3.18
Loss of Normal Power
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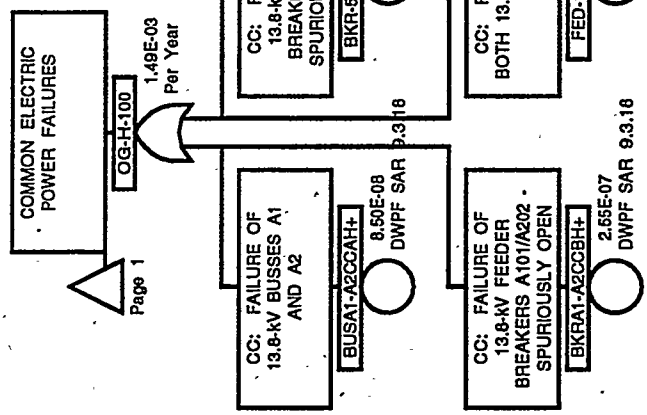


Loss of Normal Power	I:\CAFTA\TREE\POWN.CAF	11-08-94	Page 5

Cutsets for I:\CAFTA\CUT\POWN.CSR 11/08/94 12:06 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-POWN					3.02E-01
1.	HPWLP-H-BFLH+	LOSS OF POWER FROM SRS GRID TO H-AREA SWITCHGEAR	4	8.5H 3.0E-01Y	2.91E-04	3.00E-01
2.	FED-1-2-CCAH+	CC: FAILURE OF BOTH 13.8-kV FEEDERS	4	8.5H 1.0E-07H	8.50E-07	8.76E-04
3.	LPWST-LPBFLH+	FAILURE TO SUPPLY POWER TO GRID FROM ON-SITE AND OFF-SITE SOURCES	4	8.5H 8.0E-04Y	7.76E-07	8.00E-04
4.	BKRA1-A2CCBH+	CC: FAILURE OF 13.8-kV FEEDER BREAKERS A101/A202 - SPURIOUSLY OPEN	4	8.5H 3.0E-08H	2.55E-07	2.63E-04
5.	BKR-5A5BCCBH+	CC: FAILURE OF 13.8-kV FEEDER BREAKERS 5A/5B - SPURIOUSLY OPENS	4	8.5H 3.0E-08H	2.55E-07	2.63E-04
6.	BUSA1-A2CCAH+	CC: FAILURE OF 13.8-kV BUSSES A1 AND A2	4	8.5H 1.0E-08H	8.50E-08	8.76E-05
7.	BUS--A1-UNAH#	BUS A1 UNAVAILABLE DUE TO TESTING/MAINTENANCE	1	1N 3.8E-02N	3.80E-02N	3.33E-05
	BUS--A2-BFLH+	FAILURE OF 13.8-kV BUS A2	4	8.5H 1.0E-07H	8.50E-07	
8.	FED--1--BFLH+	FAILURE OF 13.8-kV FEEDER #1	4	8.5H 1.0E-06H	8.50E-06	1.49E-07
	FED--2--BFLH+	FAILURE OF 13.8-kV FEEDER #2	4	8.5H 1.0E-06H	8.50E-06	
9.	BKR-A101FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER A101 - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	4.47E-08
	FED--2--BFLH+	FAILURE OF 13.8-kV FEEDER #2	4	8.5H 1.0E-06H	8.50E-06	
10.	BKR-A202FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER A202 - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	4.47E-08
	FED--1--BFLH+	FAILURE OF 13.8-kV FEEDER #1	4	8.5H 1.0E-06H	8.50E-06	
11.	BKR--5A-FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER 5A - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	4.47E-08
	FED--2--BFLH+	FAILURE OF 13.8-kV FEEDER #2	4	8.5H 1.0E-06H	8.50E-06	
12.	BKR--5B-FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER 5B - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	4.47E-08

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	FED--1--BFLH+	FAILURE OF 13.8-kV FEEDER #1	4	8.5H 1.0E-06H	8.50E-06	
13.	BKR--5A-FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER 5A - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	1.34E-08
	BKR-A202FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER A202 - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	
14.	BKR--5A-FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER 5A - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	1.34E-08
	BKR--5B-FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER 5B - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	
15.	BKR-A101FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER A101 - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	1.34E-08
	BKR-A202FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER A202 - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	
16.	BKR--5B-FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER 5B - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	1.34E-08
	BKR-A101FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER A101 - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	
17.	BKR-A201FOPH+	FAILURE OF 13.8-kV TIE BREAKER A201 - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	1.70E-09
	BUS--A1-UNAH#	BUS A1 UNAVAILABLE DUE TO TESTING/MAINTENANCE	1	1N 3.8E-02N	3.80E-02N	
	FED--2--BFLH+	FAILURE OF 13.8-kV FEEDER #2	4	8.5H 1.0E-06H	8.50E-06	
18.	BUS--A1-BFLH+	FAILURE OF 13.8-kV BUS A1	4	8.5H 1.0E-07H	8.50E-07	1.49E-09
	BUS--A2-BFLH+	FAILURE OF 13.8-kV BUS A2	4	8.5H 1.0E-07H	8.50E-07	
19.	BUS--A2-BFLH+	FAILURE OF 13.8-kV BUS A2	4	8.5H 1.0E-07H	8.50E-07	7.88E-10
	OPR--5B-LOHH#	OPERATOR FAILS TO REMOVE LOCKOUT ON FEEDER BREAKER 5B	1	1.8E-04N 5.0E-03N	9.00E-07N	
20.	BUS--A2-BFLH+	FAILURE OF 13.8-kV BUS A2	4	8.5H 1.0E-07H	8.50E-07	7.88E-10
	OPR--A1-LOHH#	OPERATOR FAILS TO REMOVE LOCKOUT ON BUS A1	1	1.8E-04N 5.0E-03N	9.00E-07N	
21.	BUS--A2-BFLH+	FAILURE OF 13.8-kV BUS A2	4	8.5H 1.0E-07H	8.50E-07	7.88E-10

Cutsets for I:\CAFTA\CUT\POWN.CSR 11/08/94 12:06 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	OPR-A201LOHH#	OPERATOR FAILS TO REMOVE LOCKOUT ON TIE BREAKER A201	1	1.8E-04N 5.0E-03N	9.00E-07N	
22.	BUS--A2-BFLH+	FAILURE OF 13.8-kV BUS A2	4	8.5H 1.0E-07H	8.50E-07	7.88E-10
	OPR-A202LOHH#	OPERATOR FAILS TO REMOVE LOCKOUT ON FEEDER BREAKER A202	1	1.8E-04N 5.0E-03N	9.00E-07N	
23.	BKR-A201FOPH+	FAILURE OF 13.8-kV TIE BREAKER A201 - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	5.09E-10
	BKR-A202FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER A202 - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	
	BUS--A1-UNAH#	BUS A1 UNAVAILABLE DUE TO TESTING/MAINTENANCE	1	1N 3.8E-02N	3.80E-02N	
24.	BKR--5B-FOPH+	FAILURE OF 13.8-kV FEEDER BREAKER 5B - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	5.09E-10
	BKR-A201FOPH+	FAILURE OF 13.8-kV TIE BREAKER A201 - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	
	BUS--A1-UNAH#	BUS A1 UNAVAILABLE DUE TO TESTING/MAINTENANCE	1	1N 3.8E-02N	3.80E-02N	
25.	BKR-A201FOPH+	FAILURE OF 13.8-kV TIE BREAKER A201 - SPURIOUSLY OPENS	4	8.5H 3.0E-07H	2.55E-06	5.70E-14
	BUS--A2-BFLH+	FAILURE OF 13.8-kV BUS A2	4	8.5H 1.0E-07H	8.50E-07	
	FED--1--BFLH+	FAILURE OF 13.8-kV FEEDER #1	4	8.5H 1.0E-06H	8.50E-06	

LOSS OF NORMAL ELECTRIC POWER TO DWPF
Top Event Frequency: 3.02E-01/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
BKRA1-A2CCBH+-I	CC: FEEDER BRKRS A101/A202 SPURIOUSLY OPEN	3.00E-08/H	2.90E+04
BKR-5A5BCCBH+-I	CC: FEEDER BREAKERS 5A/5B SPURIOUSLY OPEN	3.00E-08/H	2.90E+04
BUSA1-A2CCAH+-I	CC: FAILURE OF 13.8-kV BUSSES A1 AND A2	1.00E-08/H	2.90E+04
HPWLP-H-BFLH+-I	LOSS OF POWER FROM SRS GRID TO H-AREA	3.42E-05/H	2.90E+04
FED-1-2-CCAH+-I	CC: FAILURE OF BOTH 13.8-kV FEEDERS	1.00E-07/H	2.90E+04
LPWST-LPBFLH+-I	FAILURE OF ON-SITE AND OFF-SITE SOURCES	9.13E-08/H	2.90E+04
BUS--A2-BFLH+-IC	FAILURE OF 13.8-kV BUS A2	1.00E-07/H	1.10E+03
BKR-A202FOPH+-IC	FEEDER BREAKER A202 - SPURIOUSLY OPENS	3.00E-07/H	1.44E+00
BKR--5B-FOPH+-IC	13.8-kV FEEDER BREAKER 5B - SPURIOUSLY OPENS	3.00E-07/H	1.44E+00
FED--2--BFLH+-IC	FAILURE OF 13.8-kV FEEDER #2	1.00E-06/H	1.44E+00
BKR-A101FOPH+-IC	FEEDER BREAKER A101 SPURIOUSLY OPENS	3.00E-07/H	1.44E+00
BKR--5A-FOPH+-IC	13.8-kV FEEDER BREAKER 5A SPURIOUSLY OPENS	3.00E-07/H	1.44E+00
FED--1--BFLH+-IC	FAILURE OF 13.8-kV FEEDER #1	1.00E-06/H	1.44E+00
BUS--A1-BFLH+-IC	FAILURE OF 13.8-kV BUS A1	1.00E-07/H	1.03E+00
BKR-A201FOPH+-IC	TIE BREAKER A201 - SPURIOUSLY OPENS	3.00E-07/H	1.02E+00

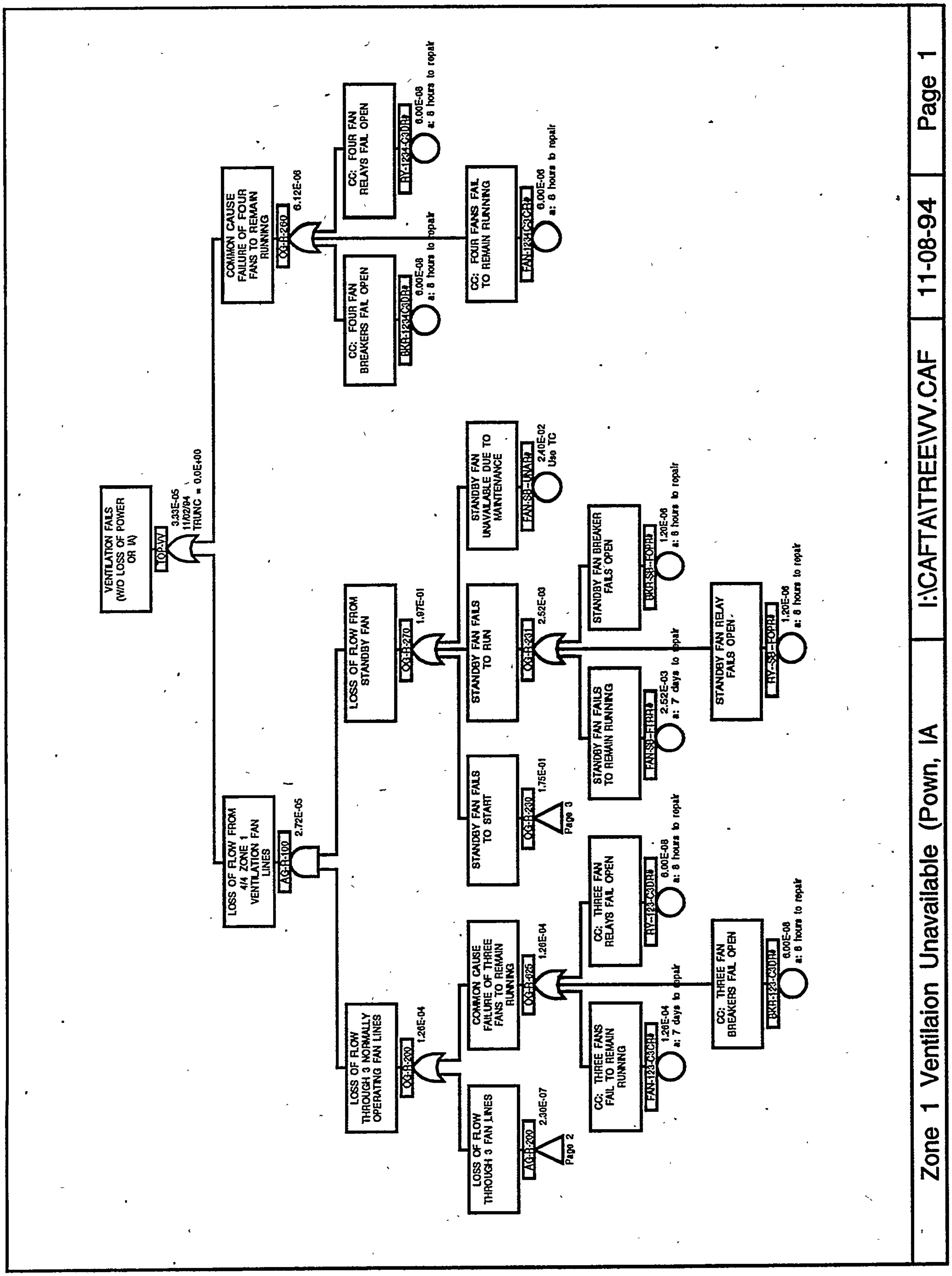
Modified top event frequency = (top event frequency) x (risk achievement worth).

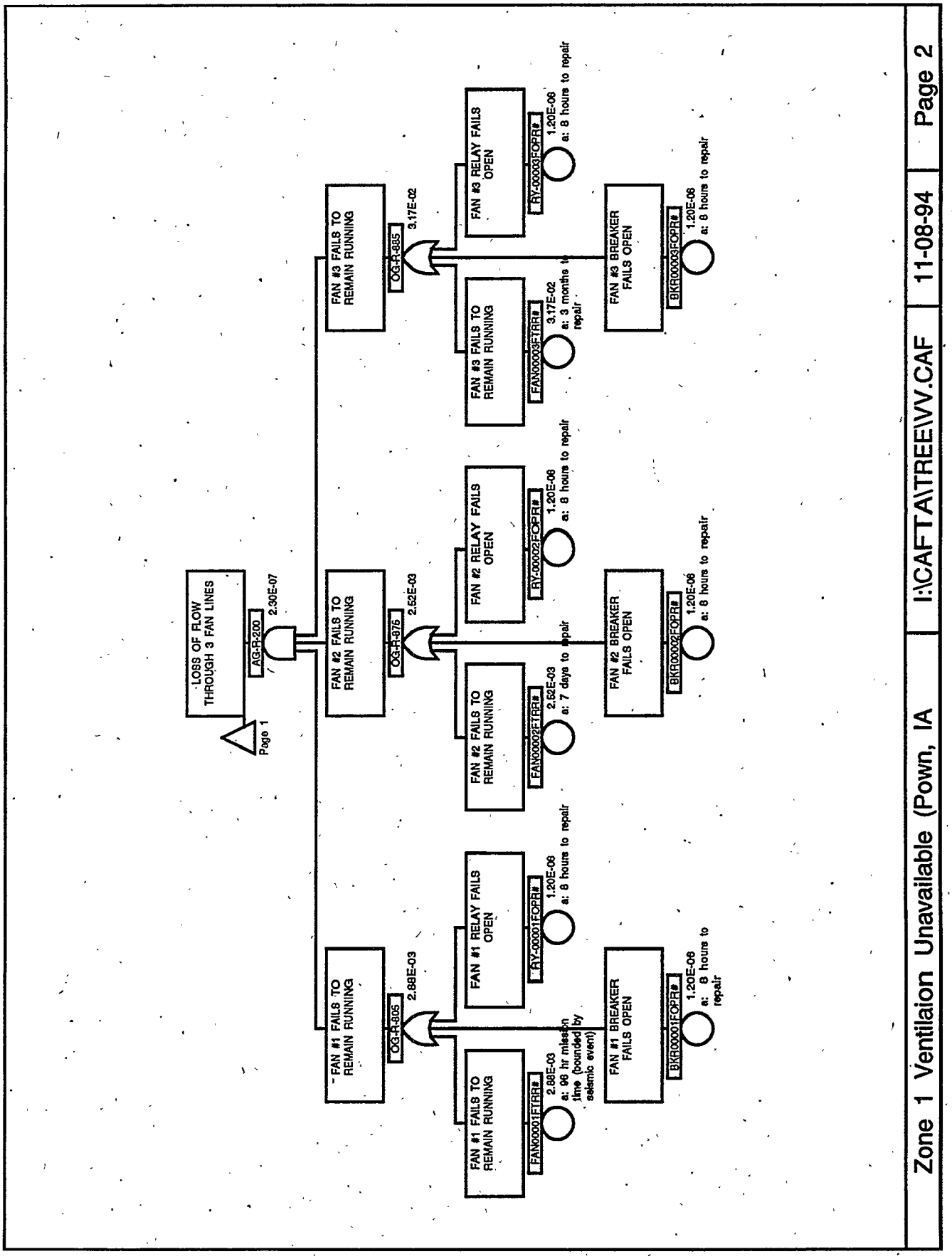
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
HPWLP-H-BFLH+-I	LOSS OF POWER FROM SRS GRID TO H-AREA	3.42E-05/H	1.30E+02

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

Zone 1 Ventilation Unavailable
(with normal power and instrument air available)


VENTILATION FAILS (W/O LOSS OF POWER OR IA)
TOP-VV
3.33E-05
11/02/94
TRUNC = 0.0E+00
LOSS OF FLOW FROM 4/4 ZONE 1 VENTILATION FAN LINES
AG-B-100
2.72E-05
COMMON CAUSE FAILURE OF FOUR FANS TO REMAIN RUNNING
OG-B-260
6.12E-08
CC: FOUR FAN BREAKERS FAIL OPEN
BKR-1234-C3DR#
6.00E-08
a: 8 hours to repair
CC: FOUR FAN RELAYS FAIL OPEN
RY-1234-C3DR#
6.00E-08
a: 8 hours to repair
CC: FOUR FANS FAIL TO REMAIN RUNNING
FAN-1234-C3CR#
6.00E-08
a: 8 hours to repair
LOSS OF FLOW THROUGH 3 NORMALLY OPERATING FAN LINES
OG-B-200
1.26E-04
LOSS OF FLOW THROUGH 3 FAN LINES
AG-B-200
2.30E-07
Page 2
COMMON CAUSE FAILURE OF THREE FANS TO REMAIN RUNNING
OG-B-225
1.26E-04
CC: THREE FANS FAIL TO REMAIN RUNNING
FAN-123-C3CR#
1.26E-04
a: 7 days to repair
CC: THREE FAN RELAYS FAIL OPEN
RY-123-C3DR#
6.00E-08
a: 8 hours to repair
CC: THREE FAN BREAKERS FAIL OPEN
BKR-123-C3DR#
6.00E-08
a: 8 hours to repair
LOSS OF FLOW FROM STANDBY FAN
OG-B-270
1.07E-01
STANDBY FAN FAILS TO START
OG-B-230
1.75E-01
Page 3
STANDBY FAN FAILS TO RUN
OG-B-231
2.52E-03
STANDBY FAN FAILS TO REMAIN RUNNING
FAN-SB-FTRR#
2.52E-03
a: 7 days to repair
STANDBY FAN BREAKER FAILS OPEN
BKR-SB-FOPR#
1.20E-06
a: 8 hours to repair
STANDBY FAN RELAY FAILS OPEN
RY-SB-FOPR#
1.20E-06
a: 8 hours to repair
STANDBY FAN UNAVAILABLE DUE TO MAINTENANCE
FAN-SB-UNAR#
2.40E-02
Use TC
Zone 1 Ventilaion Unavailable (Pown, IA
I:\CAFTA\TREE\VV.CAF
11-08-94
Page 1


LOSS OF FLOW THROUGH 3 FAN LINES
AG-R-200
2.30E-07
Page 1
FAN #1 FAILS TO REMAIN RUNNING
OG-R-805
2.88E-03
FAN #1 FAILS TO REMAIN RUNNING
FAN00001FTRR#
2.88E-03
a: 96 hr mission time (bounded by seismic event)
FAN #1 RELAY FAILS OPEN
AY-00001FOPR#
1.20E-06
a: 8 hours to repair
FAN #1 BREAKER FAILS OPEN
BKR00001FOPR#
1.20E-06
a: 8 hours to repair
FAN #2 FAILS TO REMAIN RUNNING
OG-R-875
2.52E-03
FAN #2 FAILS TO REMAIN RUNNING
FAN00002FTRR#
2.52E-03
a: 7 days to repair
FAN #2 RELAY FAILS OPEN
AY-00002FOPR#
1.20E-06
a: 8 hours to repair
FAN #2 BREAKER FAILS OPEN
BKR00002FOPR#
1.20E-06
a: 8 hours to repair
FAN #3 FAILS TO REMAIN RUNNING
OG-R-885
3.17E-02
FAN #3 FAILS TO REMAIN RUNNING
FAN00003FTRR#
3.17E-02
a: 3 months to repair
FAN #3 RELAY FAILS OPEN
AY-00003FOPR#
1.20E-06
a: 8 hours to repair
FAN #3 BREAKER FAILS OPEN
BKR00003FOPR#
1.20E-06
a: 8 hours to repair
Zone 1 Ventilaion Unavailable (Pown, IA
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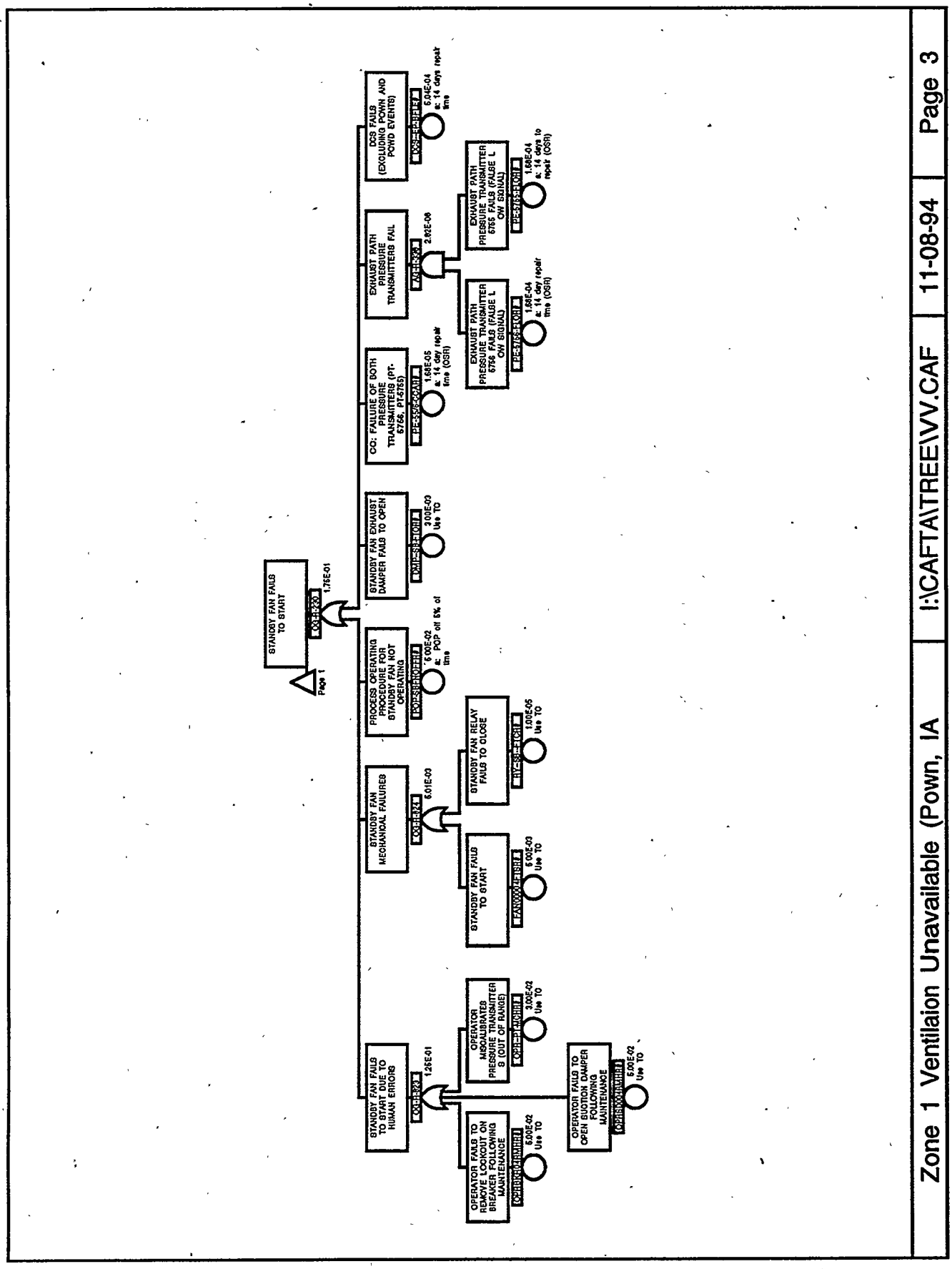
11-08-94
Page 2


Zone 1 Ventilaion Unavailable (Pown, IA
I:\CAFTA\TREE\WV.CAF
11-08-94
Page 3
STANDBY FAN FAILS TO START
1.75E-01
Page 1
STANDBY FAN FAILS TO START DUE TO HUMAN ERRORS
1.25E-01
OPERATOR FAILS TO REMOVE LOCKOUT ON BREAKER FOLLOWING MAINTENANCE
5.00E-02 Use TO
OPERATOR MISCALIBRATES PRESSURE TRANSMITTER B (OUT OF RANGE)
3.00E-02 Use TO
OPERATOR FAILS TO OPEN EXHAUST DAMPER FOLLOWING MAINTENANCE
5.00E-02 Use TO
STANDBY FAN MECHANICAL FAILUREB
6.01E-03
STANDBY FAN FAILS TO START
5.00E-03 Use TO
STANDBY FAN RELAY FAILS TO CLOSE
1.00E-05 Use TO
PROCESS OPERATING PROCEDURE FOR STANDBY FAN NOT OPERATING
6.00E-02 a: POP off 5% of time
STANDBY FAN EXHAUST DAMPER FAILS TO OPEN
2.00E-03 Use TO
CC: FAILURE OF BOTH PRESSURE TRANSMITTERS (PT-6756, PT-6755)
1.68E-05 a: 14 day repair time (OSH)
EXHAUST PATH PRESSURE TRANSMITTERB FAIL
2.62E-06
EXHAUST PATH PRESSURE TRANSMITTER 6756 FAILS (FALSE L CW SIGNAL)
1.68E-04 a: 14 day repair time (OSH)
EXHAUST PATH PRESSURE TRANSMITTER 6755 FAILS (FALSE L CW SIGNAL)
1.68E-04 a: 14 days to repair (OSH)
DCS FAILS (EXCLUDING POWN AND POWD EVENTS)
5.04E-04 a: 14 days repair time

Cutsets for I:\CAFTA\CUT\VV.CSR 11/08/94 12:08 AM

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	TOP-VV					3.33E-05
1.	FAN-123-C3CR#	CC: THREE FANS FAIL TO REMAIN RUNNING	5	7D 1.5E-06H	1.26E-04	6.30E-06
	OPRSD004RMHR#	OPERATOR FAILS TO OPEN SUCTION DAMPER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	
2.	FAN-123-C3CR#	CC: THREE FANS FAIL TO REMAIN RUNNING	5	7D 1.5E-06H	1.26E-04	6.30E-06
	OPRBKR04RMHR#	OPERATOR FAILS TO REMOVE LOCKOUT ON BREAKER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	
3.	FAN-123-C3CR#	CC: THREE FANS FAIL TO REMAIN RUNNING	5	7D 1.5E-06H	1.26E-04	6.30E-06
	POP-SBFNOFFR#	PROCESS OPERATING PROCEDURE FOR STANDBY FAN NOT OPERATING	1	1N 5.0E-02N	5.00E-02N	
4.	FAN-1234C3CR#	CC: FOUR FANS FAIL TO REMAIN RUNNING	5	8H 1.5E-06H	6.00E-06	6.00E-06
5.	FAN-123-C3CR#	CC: THREE FANS FAIL TO REMAIN RUNNING	5	7D 1.5E-06H	1.26E-04	3.78E-06
	OPR--PT-MCHR#	OPERATOR MISCALIBRATES PRESSURE TRANSMITTERS (OUT OF RANGE)	1	1N 3.0E-02N	3.00E-02N	
6.	FAN-123-C3CR#	CC: THREE FANS FAIL TO REMAIN RUNNING	5	7D 1.5E-06H	1.26E-04	3.02E-06
	FAN-SB--UNAR#	STANDBY FAN UNAVAILABLE DUE TO MAINTENANCE	1	1N 2.4E-02N	2.40E-02N	
7.	FAN-123-C3CR#	CC: THREE FANS FAIL TO REMAIN RUNNING	5	7D 1.5E-06H	1.26E-04	6.30E-07
	FAN00004FTSR#	STANDBY FAN FAILS TO START	1	1N 5.0E-03N	5.00E-03N	
8.	DMP--SB-FTOR#	STANDBY FAN EXHAUST DAMPER FAILS TO OPEN	1	1N 3.0E-03N	3.00E-03N	3.78E-07
	FAN-123-C3CR#	CC: THREE FANS FAIL TO REMAIN RUNNING	5	7D 1.5E-06H	1.26E-04	
9.	FAN-123-C3CR#	CC: THREE FANS FAIL TO REMAIN RUNNING	5	7D 1.5E-06H	1.26E-04	3.17E-07
	FAN-SB--FTRR#	STANDBY FAN FAILS TO REMAIN RUNNING	5	7D 3.0E-05H	2.52E-03	
10.	DCS--EP-BFLE#	DCS FAILS (EXCLUDING POWN AND POWD EVENTS)	5	14D 3.0E-06H	5.04E-04	6.35E-08

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	FAN-123-C3CR#	CC: THREE FANS FAIL TO REMAIN RUNNING	5	7D 1.5E-06H	1.26E-04	
11.	RY-1234-C3DR#	CC: FOUR FAN RELAYS FAIL OPEN	5	8H 1.5E-08H	6.00E-08	6.00E-08
12.	BKR-1234C3DR#	CC: FOUR FAN BREAKERS FAIL OPEN	5	8H 1.5E-08H	6.00E-08	6.00E-08
13.	FAN00001FTRR#	FAN #1 FAILS TO REMAIN RUNNING	3	96H 3.0E-05H	2.88E-03	1.15E-08
	FAN00002FTRR#	FAN #2 FAILS TO REMAIN RUNNING	5	7D 3.0E-05H	2.52E-03	
	FAN00003FTRR#	FAN #3 FAILS TO REMAIN RUNNING	5	3M 3.0E-05H	3.17E-02	
	OPRBKR04RMHR#	OPERATOR FAILS TO REMOVE LOCKOUT ON BREAKER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	
14.	FAN00001FTRR#	FAN #1 FAILS TO REMAIN RUNNING	3	96H 3.0E-05H	2.88E-03	1.15E-08
	FAN00002FTRR#	FAN #2 FAILS TO REMAIN RUNNING	5	7D 3.0E-05H	2.52E-03	
	FAN00003FTRR#	FAN #3 FAILS TO REMAIN RUNNING	5	3M 3.0E-05H	3.17E-02	
	POP-SBFNOFFR#	PROCESS OPERATING PROCEDURE FOR STANDBY FAN NOT OPERATING	1	1N 5.0E-02N	5.00E-02N	
15.	FAN00001FTRR#	FAN #1 FAILS TO REMAIN RUNNING	3	96H 3.0E-05H	2.88E-03	1.15E-08
	FAN00002FTRR#	FAN #2 FAILS TO REMAIN RUNNING	5	7D 3.0E-05H	2.52E-03	
	FAN00003FTRR#	FAN #3 FAILS TO REMAIN RUNNING	5	3M 3.0E-05H	3.17E-02	
	OPRSD004RMHR#	OPERATOR FAILS TO OPEN SUCTION DAMPER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	
16.	FAN00001FTRR#	FAN #1 FAILS TO REMAIN RUNNING	3	96H 3.0E-05H	2.88E-03	6.88E-09
	FAN00002FTRR#	FAN #2 FAILS TO REMAIN RUNNING	5	7D 3.0E-05H	2.52E-03	
	FAN00003FTRR#	FAN #3 FAILS TO REMAIN RUNNING	5	3M 3.0E-05H	3.17E-02	
	OPR--PT-MCHR#	OPERATOR MISCALIBRATES PRESSURE TRANSMITTERS (OUT OF RANGE)	1	1N 3.0E-02N	3.00E-02N	
17.	FAN-SB--UNAR#	STANDBY FAN UNAVAILABLE DUE TO MAINTENANCE	1	1N 2.4E-02N	2.40E-02N	5.51E-09

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	FAN00001FTRR#	FAN #1 FAILS TO REMAIN RUNNING	3	96H 3.0E-05H	2.88E-03	
	FAN00002FTRR#	FAN #2 FAILS TO REMAIN RUNNING	5	7D 3.0E-05H	2.52E-03	
	FAN00003FTRR#	FAN #3 FAILS TO REMAIN RUNNING	5	3M 3.0E-05H	3.17E-02	
18.	POP-SBFNOFFR#	PROCESS OPERATING PROCEDURE FOR STANDBY FAN NOT OPERATING	1	1N 5.0E-02N	5.00E-02N	3.00E-09
	RY--123-C3DR#	CC: THREE FAN RELAYS FAIL OPEN	5	8H 1.5E-08H	6.00E-08	
19.	OPRSD004RMHR#	OPERATOR FAILS TO OPEN SUCTION DAMPER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	3.00E-09
	RY--123-C3DR#	CC: THREE FAN RELAYS FAIL OPEN	5	8H 1.5E-08H	6.00E-08	
20.	OPRBKR04RMHR#	OPERATOR FAILS TO REMOVE LOCKOUT ON BREAKER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	3.00E-09
	RY--123-C3DR#	CC: THREE FAN RELAYS FAIL OPEN	5	8H 1.5E-08H	6.00E-08	
21.	BKR-123-C3DR#	CC: THREE FAN BREAKERS FAIL OPEN	5	8H 1.5E-08H	6.00E-08	3.00E-09
	OPRSD004RMHR#	OPERATOR FAILS TO OPEN SUCTION DAMPER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	
22.	BKR-123-C3DR#	CC: THREE FAN BREAKERS FAIL OPEN	5	8H 1.5E-08H	6.00E-08	3.00E-09
	OPRBKR04RMHR#	OPERATOR FAILS TO REMOVE LOCKOUT ON BREAKER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	
23.	BKR-123-C3DR#	CC: THREE FAN BREAKERS FAIL OPEN	5	8H 1.5E-08H	6.00E-08	3.00E-09
	POP-SBFNOFFR#	PROCESS OPERATING PROCEDURE FOR STANDBY FAN NOT OPERATING	1	1N 5.0E-02N	5.00E-02N	
24.	FAN-123-C3CR#	CC: THREE FANS FAIL TO REMAIN RUNNING	5	7D 1.5E-06H	1.26E-04	2.12E-09
	PE-55/6-CCAR#	CC: FAILURE OF BOTH PRESSURE TRANSMITTERS (PT-5756, PT-5755)	5	14D 1.0E-07H	1.68E-05	
25.	OPR--PT-MCHR#	OPERATOR MISCALIBRATES PRESSURE TRANSMITTERS (OUT OF RANGE)	1	1N 3.0E-02N	3.00E-02N	1.80E-09
	RY--123-C3DR#	CC: THREE FAN RELAYS FAIL OPEN	5	8H 1.5E-08H	6.00E-08	

VENTILATION FAILS (W/O LOSS OF POWER OR IA)
Top Event Probability: 3.33E-05

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
FAN-1234C3CR#	CC: FOUR FANS FAIL TO REMAIN RUNNING	6.00E-06	3.00E+04
BKR-1234C3DR#	CC: FOUR FAN BREAKERS FAIL OPEN	6.00E-08	3.00E+04
RY-1234-C3DR#	CC: FOUR FAN RELAYS FAIL OPEN	6.00E-08	3.00E+04
BKR-123-C3DR#	CC: THREE FAN BREAKERS FAIL OPEN	6.00E-08	5.93E+03
RY--123-C3DR#	CC: THREE FAN RELAYS FAIL OPEN	6.00E-08	5.93E+03
FAN-123-C3CR#	CC: THREE FANS FAIL TO REMAIN RUNNING	1.26E-04	5.93E+03
BKR-SB--FOPR#	STANDBY FAN BREAKER FAILS OPEN	1.20E-06	4.80E+00
RY--SB--FOPR#	STANDBY FAN RELAY FAILS OPEN	1.20E-06	4.80E+00
RY--SB--FTCR#	STANDBY FAN RELAY FAILS TO CLOSE	1.00E-05	4.80E+00
PE-55/6-CCAR#	CC: FAILURE OF BOTH PRESSURE TRANSMITTERS	1.68E-05	4.80E+00
DCS--EP-BFLE#	DCS FAILS (EXCLUDING POWN AND POWD)	5.04E-04	4.79E+00
FAN-SB--FTRR#	STANDBY FAN FAILS TO REMAIN RUNNING	2.52E-03	4.79E+00
DMP--SB-FTOR#	STANDBY FAN EXHAUST DAMPER FAILS TO OPEN	3.00E-03	4.78E+00
FAN00004FTSR#	STANDBY FAN FAILS TO START	5.00E-03	4.78E+00
FAN-SB--UNAR#	STANDBY FAN UNAVAILABLE DUE TO T&M	2.40E-02	4.70E+00
OPR--PT-MCHR#	PRESSURE TRANSMITTERS MISCALIBRATED	3.00E-02	4.68E+00
OPRBKR04RMHR#	FAIL TO REMOVE LOCKOUT FOLLOWING T&M	5.00E-02	4.61E+00
OPRSD004RMHR#	FAIL TO OPEN SUCTION DAMPER AFTER T&M	5.00E-02	4.61E+00
POP-SBFNOFFR#	POP FOR STANDBY FAN NOT OPERATING	5.00E-02	4.61E+00
BKR00002FOPR#	FAN #2 BREAKER FAILS OPEN	1.20E-06	1.59E+00
RY-00002FOPR#	FAN #2 RELAY FAILS OPEN	1.20E-06	1.59E+00
FAN00002FTRR#	FAN #2 FAILS TO REMAIN RUNNING	2.52E-03	1.59E+00
BKR00001FOPR#	FAN #1 BREAKER FAILS OPEN	1.20E-06	1.52E+00
RY-00001FOPR#	FAN #1 RELAY FAILS OPEN	1.20E-06	1.52E+00
FAN00001FTRR#	FAN #1 FAILS TO REMAIN RUNNING	2.88E-03	1.51E+00
RY-00003FOPR#	FAN #3 RELAY FAILS OPEN	1.20E-06	1.05E+00
BKR00003FOPR#	FAN #3 BREAKER FAILS OPEN	1.20E-06	1.05E+00
FAN00003FTRR#	FAN #3 FAILS TO REMAIN RUNNING	3.17E-02	1.05E+00

Modified top event frequency = (top event frequency) x (risk achievement worth).

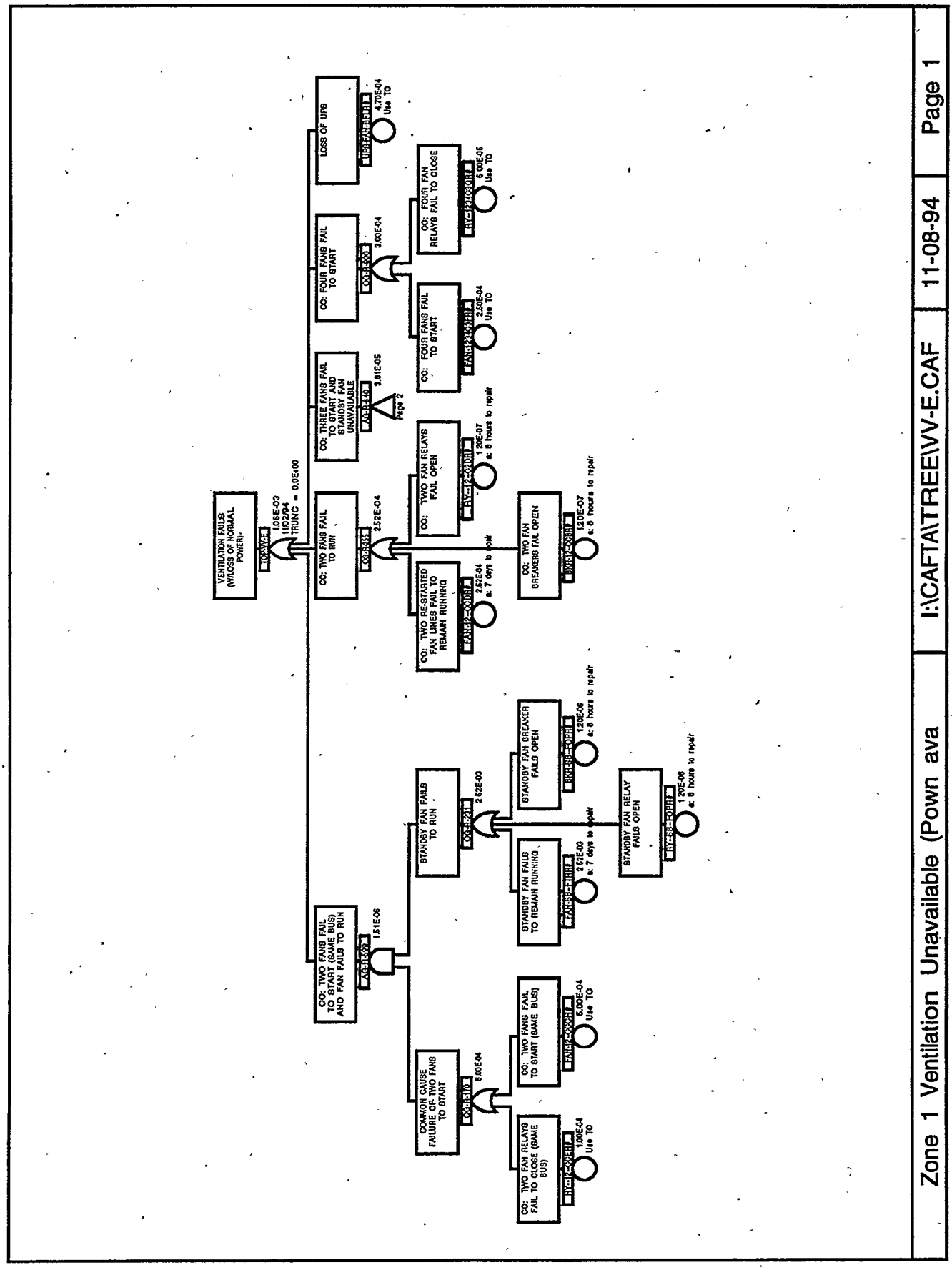
Risk Reduction Worth

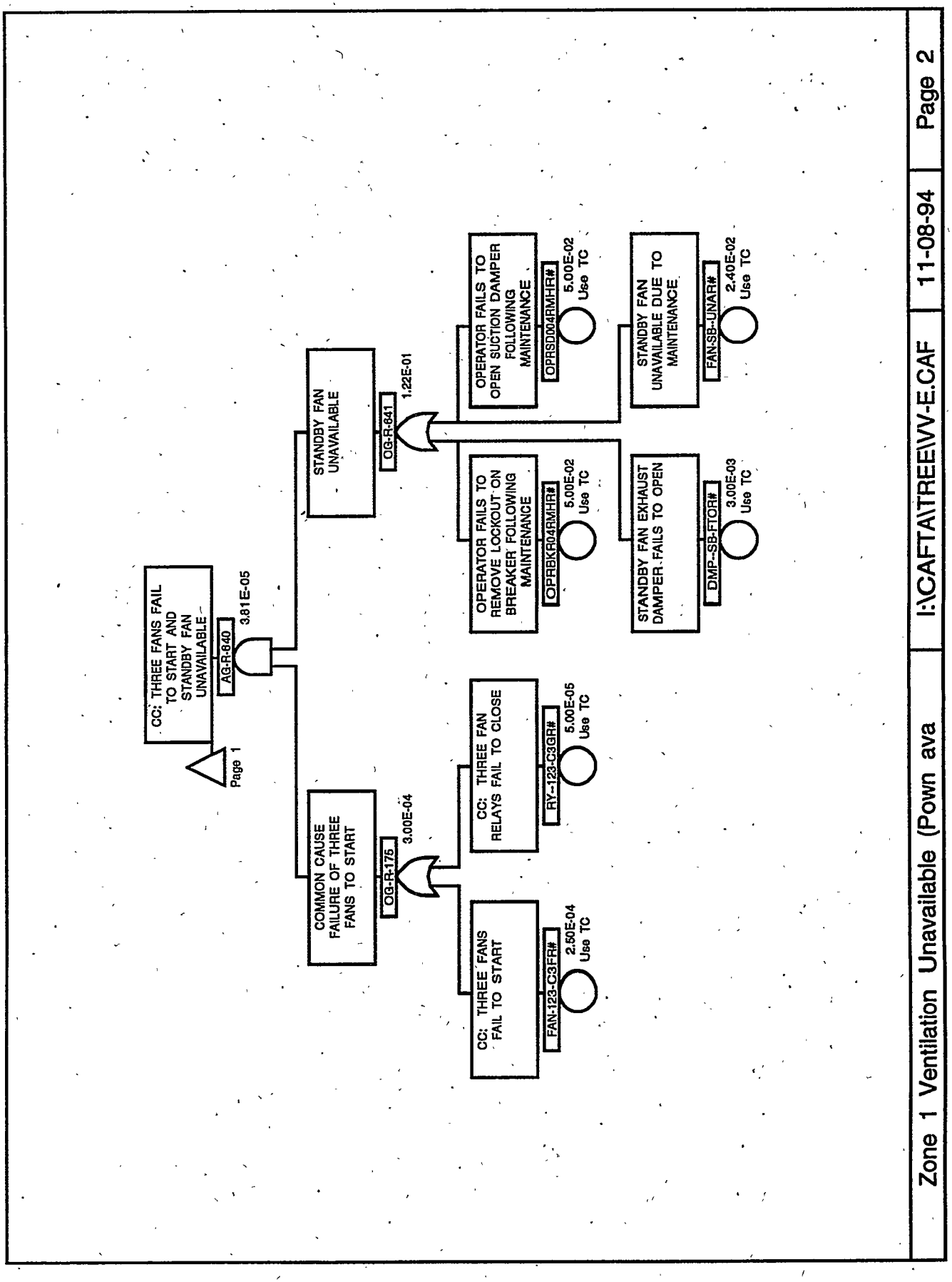
Basic Event Name	Description	Prob/Freq	RedW
FAN-123-C3CR#	CC: THREE FANS FAIL TO REMAIN RUNNING	1.26E-04	5.37E+00
POP-SBFNOFFR#	POP FOR STANDBY FAN NOT OPERATING	5.00E-02	1.23E+00
OPRBKR04RMHR#	FAIL TO REMOVE LOCKOUT FOLLOWING T&M	5.00E-02	1.23E+00
OPRSD004RMHR#	FAIL TO OPEN SUCTION DAMPER AFTER T&M	5.00E-02	1.23E+00
FAN-1234C3CR#	CC: FOUR FANS FAIL TO REMAIN RUNNING	6.00E-06	1.22E+00
OPR--PT-MCHR#	PRESSURE TRANSMITTERS MISCALIBRATED	3.00E-02	1.13E+00
FAN-SB--UNAR#	STANDBY FAN UNAVAILABLE DUE TO T&M	2.40E-02	1.10E+00
FAN00004FTSR#	STANDBY FAN FAILS TO START	5.00E-03	1.02E+00
DMP--SB-FTOR#	STANDBY FAN EXHAUST DAMPER FAILS TO OPEN	3.00E-03	1.01E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

Zone 1 Ventilation Unavailable

(with instrument air available, normal power lost)


VENTILATION FAILS (W/LOSS OF NORMAL POWER)
1.08E-03
11/02/94
TRUNC = 0.0E+00
CO: TWO FANS FAIL TO RUN
2.52E-04
CO: TWO FANS FAIL TO START (SAME BUS) AND FAN FAILS TO RUN
1.81E-06
COMMON CAUSE FAILURE OF TWO FANS TO START
6.00E-04
CO: TWO FAN RELAYS FAIL TO CLOSE (SAME BUS)
1.00E-04
Use TO
CO: TWO FANS FAIL TO START (SAME BUS)
5.00E-04
Use TO
STANDBY FAN FAILS TO RUN
2.52E-03
STANDBY FAN FAILS TO REMAIN RUNNING
2.52E-03
a: 7 days to repair
STANDBY FAN BREAKER FAILS OPEN
1.20E-06
a: 8 hours to repair
STANDBY FAN RELAY FAILS OPEN
1.20E-06
a: 8 hours to repair
CO: TWO RE-STARTED FAN LINES FAIL TO REMAIN RUNNING
2.52E-04
a: 7 days to repair
CO: TWO FAN RELAYS FAIL OPEN
1.20E-07
a: 8 hours to repair
CO: TWO FAN BREAKERS FAIL OPEN
1.20E-07
a: 8 hours to repair
CO: THREE FANS FAIL TO START AND STANDBY FAN UNAVAILABLE
3.81E-05
Page 2
CO: FOUR FANS FAIL TO START
3.00E-04
LOSS OF UPS
4.70E-04
Use TO
CO: FOUR FAN RELAYS FAIL TO CLOSE
6.00E-05
Use TO
CO: FOUR FANS FAIL TO START
2.50E-04
Use TO
Zone 1 Ventilation Unavailable (Pown ava
I:\CAFTA\TREE\VV-E.CAF
11-08-94
Page 1


CC: THREE FANS FAIL TO START AND STANDBY FAN UNAVAILABLE
AG-R-640
3.81E-05
Page 1
COMMON CAUSE FAILURE OF THREE FANS TO START
OG-R-175
3.00E-04
CC: THREE FANS FAIL TO START
FAN-123-C3FR#
2.50E-04
Use TC
CC: THREE FAN RELAYS FAIL TO CLOSE
RY--123-C3GR#
5.00E-05
Use TC
STANDBY FAN UNAVAILABLE
OG-R-641
1.22E-01
OPERATOR FAILS TO REMOVE LOCKOUT ON BREAKER FOLLOWING MAINTENANCE
OPRBKR04RMHR#
5.00E-02
Use TC
STANDBY FAN EXHAUST DAMPER FAILS TO OPEN
DMP--SB-FTOR#
3.00E-03
Use TC
OPERATOR FAILS TO OPEN SUCTION DAMPER FOLLOWING MAINTENANCE
OPRSD004RMHR#
5.00E-02
Use TC
STANDBY FAN UNAVAILABLE DUE TO MAINTENANCE
FAN-SB--UNAR#
2.40E-02
Use TC
Zone 1 Ventilation Unavailable (Pown ava
I:\CAFTA\TREE\VV-E.CAF
11-08-94
Page 2

Cutsets for I:\CAFTA\CUT\VV-E.CSR 11/08/94 12:10 AM

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	TOP-VV-E					1.06E-03
1.	UPS-FAN-BFLR#	LOSS OF UPS	1	1N 4.7E-04N	4.70E-04N	4.70E-04
2.	FAN-12--CCDR#	CC: TWO RE-STARTED FAN LINES FAIL TO REMAIN RUNNING	5	7D 3.0E-06H	2.52E-04	2.52E-04
3.	FAN-1234C3FR#	CC: FOUR FANS FAIL TO START	1	1N 2.5E-04N	2.50E-04N	2.50E-04
4.	RY--1234C3GR#	CC: FOUR FAN RELAYS FAIL TO CLOSE	1	1N 5.0E-05N	5.00E-05N	5.00E-05
5.	FAN-123-C3FR#	CC: THREE FANS FAIL TO START	1	1N 2.5E-04N	2.50E-04N	1.25E-05
	OPRSD004RMHR#	OPERATOR FAILS TO OPEN SUCTION DAMPER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	
6.	FAN-123-C3FR#	CC: THREE FANS FAIL TO START	1	1N 2.5E-04N	2.50E-04N	1.25E-05
	OPRBKR04RMHR#	OPERATOR FAILS TO REMOVE LOCKOUT ON BREAKER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	
7.	FAN-123-C3FR#	CC: THREE FANS FAIL TO START	1	1N 2.5E-04N	2.50E-04N	6.00E-06
	FAN-SB--UNAR#	STANDBY FAN UNAVAILABLE DUE TO MAINTENANCE	1	1N 2.4E-02N	2.40E-02N	
8.	OPRBKR04RMHR#	OPERATOR FAILS TO REMOVE LOCKOUT ON BREAKER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	2.50E-06
	RY--123-C3GR#	CC: THREE FAN RELAYS FAIL TO CLOSE	1	1N 5.0E-05N	5.00E-05N	
9.	OPRSD004RMHR#	OPERATOR FAILS TO OPEN SUCTION DAMPER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	2.50E-06
	RY--123-C3GR#	CC: THREE FAN RELAYS FAIL TO CLOSE	1	1N 5.0E-05N	5.00E-05N	
10.	FAN-12--CCCR#	CC: TWO FANS FAIL TO START (SAME BUS)	1	1N 5.0E-04N	5.00E-04N	1.26E-06
	FAN-SB--FTRR#	STANDBY FAN FAILS TO REMAIN RUNNING	5	7D 3.0E-05H	2.52E-03	
11.	FAN-SB--UNAR#	STANDBY FAN UNAVAILABLE DUE TO MAINTENANCE	1	1N 2.4E-02N	2.40E-02N	1.20E-06
	RY--123-C3GR#	CC: THREE FAN RELAYS FAIL TO CLOSE	1	1N 5.0E-05N	5.00E-05N	

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
12.	DMP--SB-FTOR#	STANDBY FAN EXHAUST DAMPER FAILS TO OPEN	1	1N 3.0E-03N	3.00E-03N	7.50E-07
	FAN-123-C3FR#	CC: THREE FANS FAIL TO START	1	1N 2.5E-04N	2.50E-04N	
13.	FAN-SB--FTRR#	STANDBY FAN FAILS TO REMAIN RUNNING	5	7D 3.0E-05H	2.52E-03	2.52E-07
	RY--12--CCER#	CC: TWO FAN RELAYS FAIL TO CLOSE (SAME BUS)	1	1N 1.0E-04N	1.00E-04N	
14.	DMP--SB-FTOR#	STANDBY FAN EXHAUST DAMPER FAILS TO OPEN	1	1N 3.0E-03N	3.00E-03N	1.50E-07
	RY--123-C3GR#	CC: THREE FAN RELAYS FAIL TO CLOSE	1	1N 5.0E-05N	5.00E-05N	
15.	BKR-12--CCBR#	CC: TWO FAN BREAKERS FAIL OPEN	5	8H 3.0E-08H	1.20E-07	1.20E-07
16.	RY--12--C2DR#	CC: TWO FAN RELAYS FAIL OPEN	5	8H 3.0E-08H	1.20E-07	1.20E-07
17.	FAN-12--CCCR#	CC: TWO FANS FAIL TO START (SAME BUS)	1	1N 5.0E-04N	5.00E-04N	6.00E-10
	RY--SB--FOPR#	STANDBY FAN RELAY FAILS OPEN	5	8H 3.0E-07H	1.20E-06	
18.	BKR-SB--FOPR#	STANDBY FAN BREAKER FAILS OPEN	5	8H 3.0E-07H	1.20E-06	6.00E-10
	FAN-12--CCCR#	CC: TWO FANS FAIL TO START (SAME BUS)	1	1N 5.0E-04N	5.00E-04N	
19.	RY--12--CCER#	CC: TWO FAN RELAYS FAIL TO CLOSE (SAME BUS)	1	1N 1.0E-04N	1.00E-04N	1.20E-10
	RY--SB--FOPR#	STANDBY FAN RELAY FAILS OPEN	5	8H 3.0E-07H	1.20E-06	
20.	BKR-SB--FOPR#	STANDBY FAN BREAKER FAILS OPEN	5	8H 3.0E-07H	1.20E-06	1.20E-10
	RY--12--CCER#	CC: TWO FAN RELAYS FAIL TO CLOSE (SAME BUS)	1	1N 1.0E-04N	1.00E-04N	

VENTILATION FAILS (W/LOSS OF NORMAL POWER)
Top Event Probability: 1.06E-03

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
RY--1234C3GR#	CC: FOUR FAN RELAYS FAIL TO CLOSE	5.00E-05	9.42E+02
RY--12--C2DR#	CC: TWO FAN RELAYS FAIL OPEN	1.20E-07	9.42E+02
BKR-12--CCBR#	CC: TWO FAN BREAKERS FAIL OPEN	1.20E-07	9.42E+02
UPS-FAN-BFLR#	LOSS OF UPS	4.70E-04	9.42E+02
FAN-12--CCDR#	CC: TWO RE-STARTED FAN LINES FAIL TO RUN	2.52E-04	9.42E+02
FAN-1234C3FR#	CC: FOUR FANS FAIL TO START	2.50E-04	9.42E+02
RY--123-C3GR#	CC: THREE FAN RELAYS FAIL TO CLOSE	5.00E-05	1.16E+02
FAN-123-C3FR#	CC: THREE FANS FAIL TO START	2.50E-04	1.16E+02
RY--12--CCER#	CC: TWO FAN RELAYS FAIL TO CLOSE (SAME BUS)	1.00E-04	3.37E+00
FAN-12--CCCR#	CC: TWO FANS FAIL TO START (SAME BUS)	5.00E-04	3.37E+00
BKR-SB--FOPR#	STANDBY FAN BREAKER FAILS OPEN	1.20E-06	1.56E+00
RY--SB--FOPR#	STANDBY FAN RELAY FAILS OPEN	1.20E-06	1.56E+00
FAN-SB--FTRR#	STANDBY FAN FAILS TO REMAIN RUNNING	2.52E-03	1.56E+00
DMP--SB-FTOR#	STANDBY FAN EXHAUST DAMPER FAILS TO OPEN	3.00E-03	1.28E+00
FAN-SB--UNAR#	STANDBY FAN UNAVAILABLE DUE TO T&M	2.40E-02	1.28E+00
OPRBKR04RMHR#	FAIL TO REMOVE LOCKOUT FOLLOWING T&M	5.00E-02	1.27E+00
OPRSD004RMHR#	FAIL TO OPEN SUCTION DAMPER AFTER T&M	5.00E-02	1.27E+00

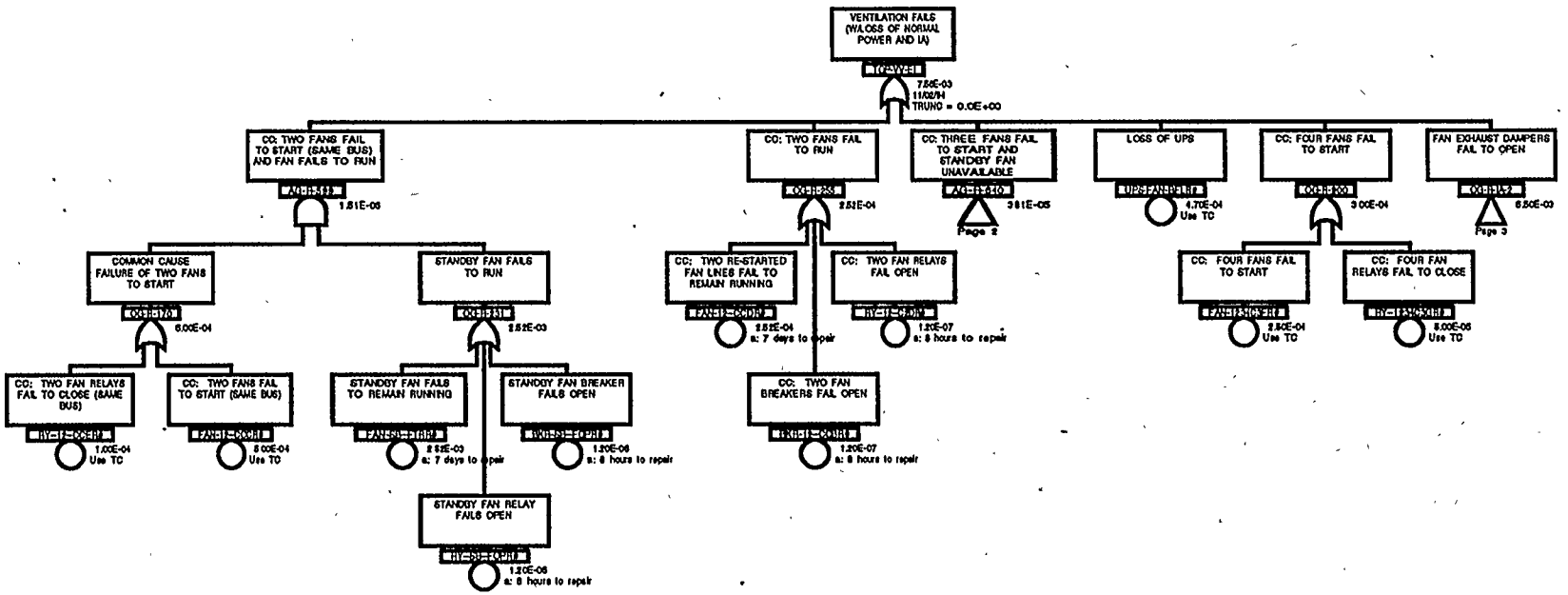
Modified top event frequency = (top event frequency) x (risk achievement worth).

Risk Reduction Worth

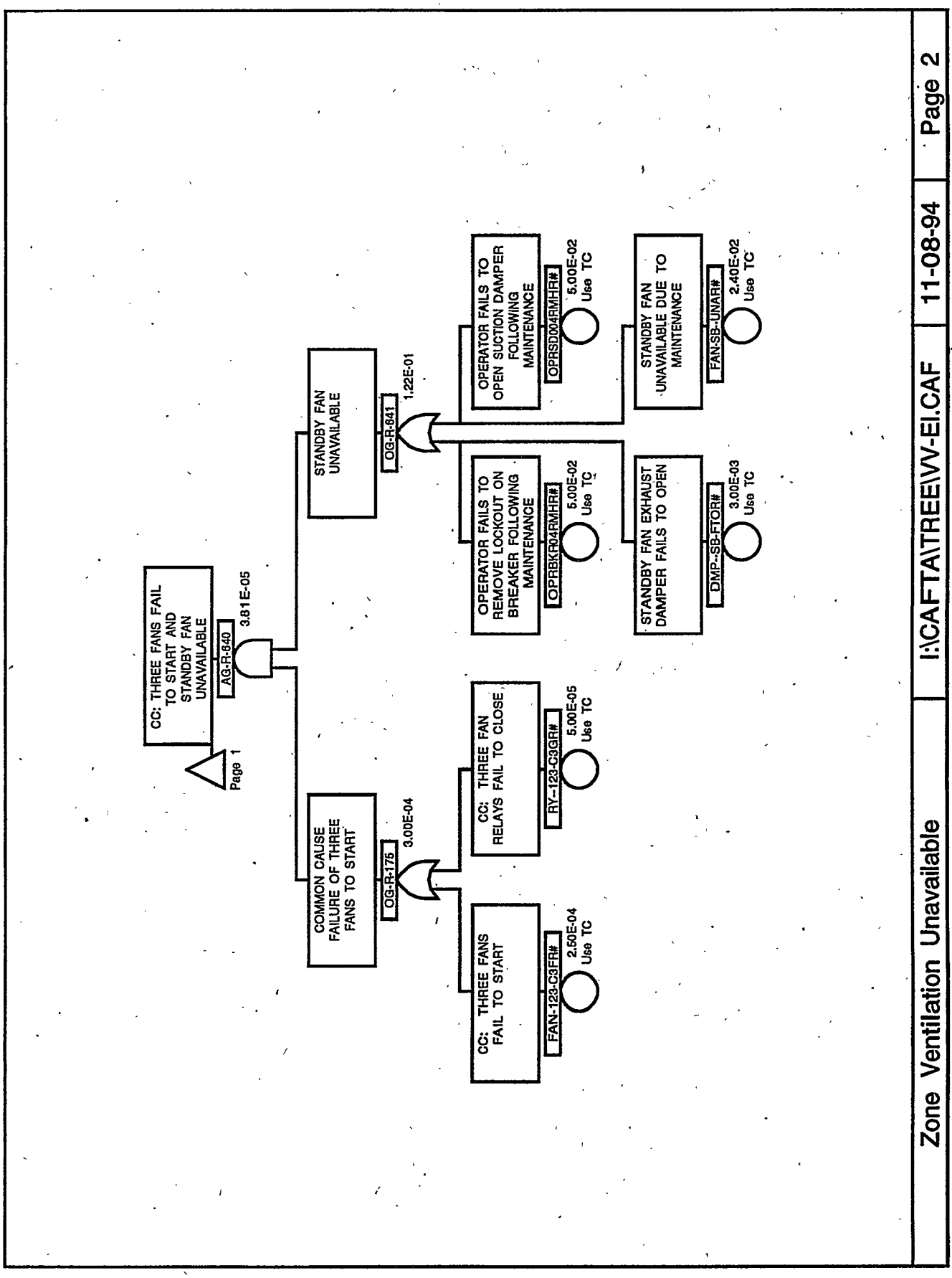
Basic Event Name	Description	Prob/Freq	RedW
UPS-FAN-BFLR#	LOSS OF UPS	4.70E-04	1.79E+00
FAN-12--CCDR#	CC: TWO RE-STARTED FAN LINES FAIL TO RUN	2.52E-04	1.31E+00
FAN-1234C3FR#	CC: FOUR FANS FAIL TO START	2.50E-04	1.31E+00
RY--1234C3GR#	CC: FOUR FAN RELAYS FAIL TO CLOSE	5.00E-05	1.05E+00
FAN-123-C3FR#	CC: THREE FANS FAIL TO START	2.50E-04	1.03E+00
OPRBKR04RMHR#	FAIL TO REMOVE LOCKOUT FOLLOWING T&M	5.00E-02	1.01E+00
OPRSD004RMHR#	FAIL TO OPEN SUCTION DAMPER AFTERT&M	5.00E-02	1.01E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

Zone 1 Ventilation Unavailable
(with normal power and instrument air lost)



Zone Ventilation Unavailable	I:\CAFTA\TREE\VV-EI.CAF	11-08-94	Page 1


CC: THREE FANS FAIL TO START AND STANDBY FAN UNAVAILABLE
AG-R-640
3.81E-05
Page 1
COMMON CAUSE FAILURE OF THREE FANS TO START
OG-R-175
3.00E-04
CC: THREE FANS FAIL TO START
FAN-123-C3FR#
2.50E-04
Use TC
CC: THREE FAN RELAYS FAIL TO CLOSE
RY--123-C3GR#
5.00E-05
Use TC
STANDBY FAN UNAVAILABLE
OG-R-641
1.22E-01
OPERATOR FAILS TO REMOVE LOCKOUT ON BREAKER FOLLOWING MAINTENANCE
OPRBKR04RMHR#
5.00E-02
Use TC
STANDBY FAN EXHAUST DAMPER FAILS TO OPEN
DMP--SB-FTOR#
3.00E-03
Use TC
OPERATOR FAILS TO OPEN SUCTION DAMPER FOLLOWING MAINTENANCE
OPRSD004RMHR#
5.00E-02
Use TC
STANDBY FAN UNAVAILABLE DUE TO MAINTENANCE
FAN-SB--UNAR#
2.40E-02
Use TC
Zone Ventilation Unavailable
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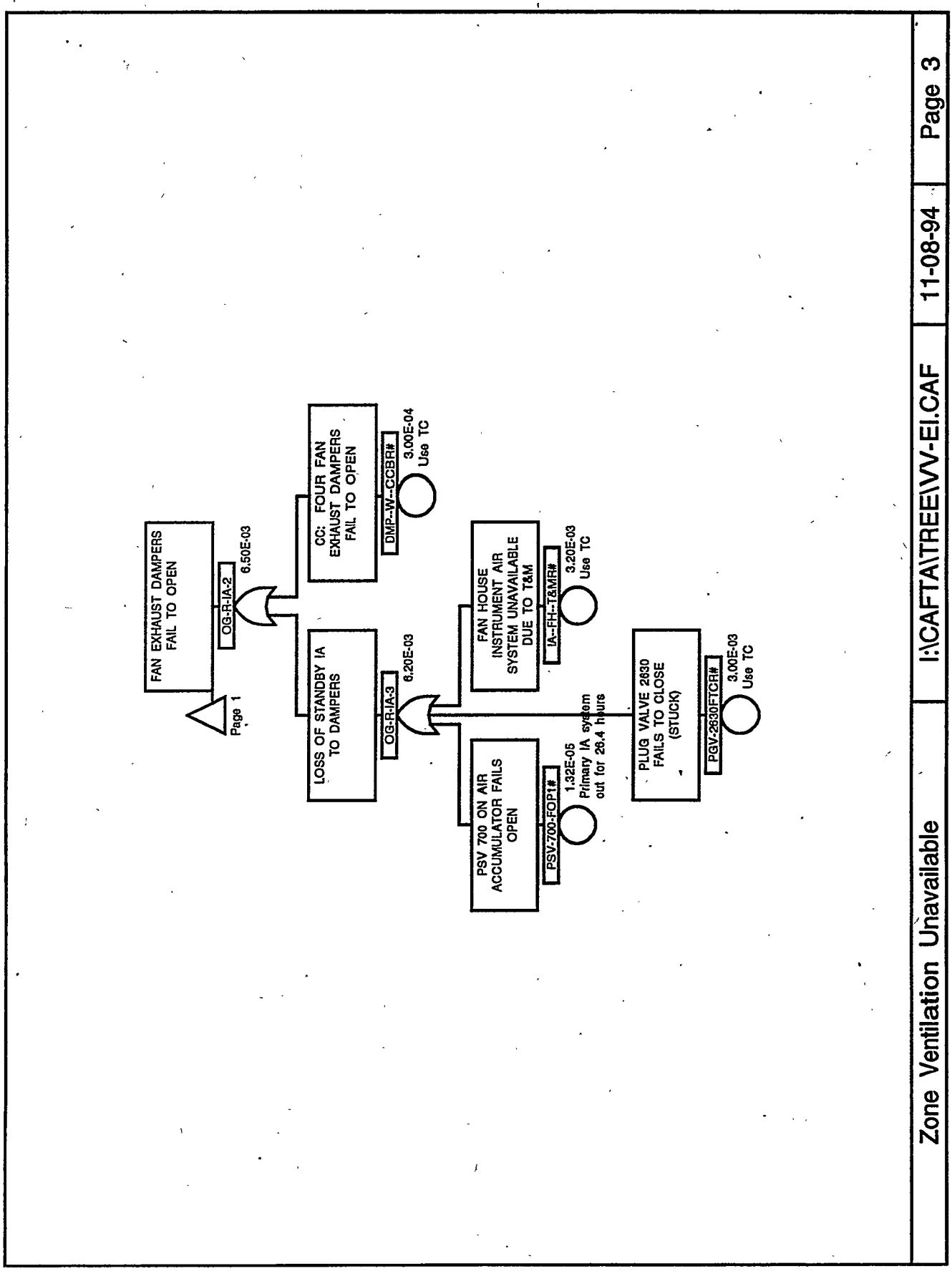
FAN EXHAUST DAMPERS FAIL TO OPEN
OG-R-IA-2
6.50E-03
Page 1
CC: FOUR FAN EXHAUST DAMPERS FAIL TO OPEN
DMP-W--CCBR#
3.00E-04
Use TC
LOSS OF STANDBY IA TO DAMPERS
OG-R-IA-3
6.20E-03
FAN HOUSE INSTRUMENT AIR SYSTEM UNAVAILABLE DUE TO T&M
IA--FH--T&MR#
3.20E-03
Use TC
PSV 700 ON AIR ACCUMULATOR FAILS OPEN
PSV-700-FOP1#
1.32E-05
Primary IA system out for 28.4 hours
PLUG VALVE 2630 FAILS TO CLOSE (STUCK)
PGV-2630FTCR#
3.00E-03
Use TC
Zone Ventilation Unavailable
I:\CAFTA\TREE\VV-EI.CAF
11-08-94
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Cutsets for I:\CAFTA\CUT\VV-EI.CSR 11/08/94 12:11 AM

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	TOP-VV-EI					7.56E-03
1.	IA--FH--T&MR#	FAN HOUSE INSTRUMENT AIR SYSTEM UNAVAILABLE DUE TO T&M	1	1N 3.2E-03N	3.20E-03N	3.20E-03
2.	PGV-2630FTCR#	PLUG VALVE 2630 FAILS TO CLOSE (STUCK)	1	1N 3.0E-03N	3.00E-03N	3.00E-03
3.	UPS-FAN-BFLR#	LOSS OF UPS	1	1N 4.7E-04N	4.70E-04N	4.70E-04
4.	DMP--W--CCBR#	CC: FOUR FAN EXHAUST DAMPERS FAIL TO OPEN	1	1N 3.0E-04N	3.00E-04N	3.00E-04
5.	FAN-12--CCDR#	CC: TWO RE-STARTED FAN LINES FAIL TO REMAIN RUNNING	5	7D 3.0E-06H	2.52E-04	2.52E-04
6.	FAN-1234C3FR#	CC: FOUR FANS FAIL TO START	1	1N 2.5E-04N	2.50E-04N	2.50E-04
7.	RY--1234C3GR#	CC: FOUR FAN RELAYS FAIL TO CLOSE	1	1N 5.0E-05N	5.00E-05N	5.00E-05
8.	PSV-700-FOP1#	PSV 700 ON AIR ACCUMULATOR FAILS OPEN	3	26.4H 5.0E-07H	1.32E-05	1.32E-05
9.	FAN-123-C3FR#	CC: THREE FANS FAIL TO START	1	1N 2.5E-04N	2.50E-04N	1.25E-05
	OPRBKR04RMHR#	OPERATOR FAILS TO REMOVE LOCKOUT ON BREAKER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	
10.	FAN-123-C3FR#	CC: THREE FANS FAIL TO START	1	1N 2.5E-04N	2.50E-04N	1.25E-05
	OPRSD004RMHR#	OPERATOR FAILS TO OPEN SUCTION DAMPER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	
11.	FAN-123-C3FR#	CC: THREE FANS FAIL TO START	1	1N 2.5E-04N	2.50E-04N	6.00E-06
	FAN-SB--UNAR#	STANDBY FAN UNAVAILABLE DUE TO MAINTENANCE	1	1N 2.4E-02N	2.40E-02N	
12.	OPRSD004RMHR#	OPERATOR FAILS TO OPEN SUCTION DAMPER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	2.50E-06
	RY--123-C3GR#	CC: THREE FAN RELAYS FAIL TO CLOSE	1	1N 5.0E-05N	5.00E-05N	
13.	OPRBKR04RMHR#	OPERATOR FAILS TO REMOVE LOCKOUT ON BREAKER FOLLOWING MAINTENANCE	1	1N 5.0E-02N	5.00E-02N	2.50E-06

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	RY--123-C3GR#	CC: THREE FAN RELAYS FAIL TO CLOSE	1	1N 5.0E-05N	5.00E-05N	
14.	FAN-12--CCCR#	CC: TWO FANS FAIL TO START (SAME BUS)	1	1N 5.0E-04N	5.00E-04N	1.26E-06
	FAN-SB--FTRR#	STANDBY FAN FAILS TO REMAIN RUNNING	5	7D 3.0E-05H	2.52E-03	
15.	FAN-SB--UNAR#	STANDBY FAN UNAVAILABLE DUE TO MAINTENANCE	1	1N 2.4E-02N	2.40E-02N	1.20E-06
	RY--123-C3GR#	CC: THREE FAN RELAYS FAIL TO CLOSE	1	1N 5.0E-05N	5.00E-05N	
16.	DMP--SB-FTOR#	STANDBY FAN EXHAUST DAMPER FAILS TO OPEN	1	1N 3.0E-03N	3.00E-03N	7.50E-07
	FAN-123-C3FR#	CC: THREE FANS FAIL TO START	1	1N 2.5E-04N	2.50E-04N	
17.	FAN-SB--FTRR#	STANDBY FAN FAILS TO REMAIN RUNNING	5	7D 3.0E-05H	2.52E-03	2.52E-07
	RY--12--CCER#	CC: TWO FAN RELAYS FAIL TO CLOSE (SAME BUS)	1	1N 1.0E-04N	1.00E-04N	
18.	DMP--SB-FTOR#	STANDBY FAN EXHAUST DAMPER FAILS TO OPEN	1	1N 3.0E-03N	3.00E-03N	1.50E-07
	RY--123-C3GR#	CC: THREE FAN RELAYS FAIL TO CLOSE	1	1N 5.0E-05N	5.00E-05N	
19.	BKR-12--CCBR#	CC: TWO FAN BREAKERS FAIL OPEN	5	8H 3.0E-08H	1.20E-07	1.20E-07
20.	RY--12--C2DR#	CC: TWO FAN RELAYS FAIL OPEN	5	8H 3.0E-08H	1.20E-07	1.20E-07
21.	FAN-12--CCCR#	CC: TWO FANS FAIL TO START (SAME BUS)	1	1N 5.0E-04N	5.00E-04N	6.00E-10
	RY--SB--FOPR#	STANDBY FAN RELAY FAILS OPEN	5	8H 3.0E-07H	1.20E-06	
22.	BKR-SB--FOPR#	STANDBY FAN BREAKER FAILS OPEN	5	8H 3.0E-07H	1.20E-06	6.00E-10
	FAN-12--CCCR#	CC: TWO FANS FAIL TO START (SAME BUS)	1	1N 5.0E-04N	5.00E-04N	
23.	RY--12--CCER#	CC: TWO FAN RELAYS FAIL TO CLOSE (SAME BUS)	1	1N 1.0E-04N	1.00E-04N	1.20E-10
	RY--SB--FOPR#	STANDBY FAN RELAY FAILS OPEN	5	8H 3.0E-07H	1.20E-06	

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
24.	BKR-SB--FOPR#	STANDBY FAN BREAKER FAILS OPEN	5	8H 3.0E-07H	1.20E-06	1.20E-10
	RY--12--CCER#	CC: TWO FAN RELAYS FAIL TO CLOSE (SAME BUS)	1	1N 1.0E-04N	1.00E-04N	

VENTILATION FAILS (W/LOSS OF NORMAL POWER AND IA)
Top Event Probability: 7.56E-03

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
RY--1234C3GR#	CC: FOUR FAN RELAYS FAIL TO CLOSE	5.00E-05	1.32E+02
FAN-1234C3FR#	CC: FOUR FANS FAIL TO START	2.50E-04	1.32E+02
PSV-700-FOP1#	PSV 700 ON AIR ACCUMULATOR FAILS OPEN	1.32E-05	1.32E+02
BKR-12--CCBR#	CC: TWO FAN BREAKERS FAIL OPEN	1.20E-07	1.32E+02
RY--12--C2DR#	CC: TWO FAN RELAYS FAIL OPEN	1.20E-07	1.32E+02
PGV-2630FTCR#	PLUG VALVE 2630 FAILS TO CLOSE (STUCK)	3.00E-03	1.32E+02
IA--FH--T&MR#	FAN HOUSE AIR SYSTEM UNAVAILABLE: T&M	3.20E-03	1.32E+02
UPS-FAN-BFLR#	LOSS OF UPS	4.70E-04	1.32E+02
FAN-12--CCDR#	CC: TWO RE-STARTED FAN LINES FAIL TO RUN	2.52E-04	1.32E+02
DMP--W--CCBR#	CC: FOUR FAN EXHAUST DAMPERS FAIL TO OPEN	3.00E-04	1.32E+02
RY--123-C3GR#	CC: THREE FAN RELAYS FAIL TO CLOSE	5.00E-05	1.70E+01
FAN-123-C3FR#	CC: THREE FANS FAIL TO START	2.50E-04	1.70E+01
RY--12--CCER#	CC: TWO FAN RELAYS FAIL TO CLOSE (SAME BUS)	1.00E-04	1.33E+00
FAN-12--CCCR#	CC: TWO FANS FAIL TO START (SAME BUS)	5.00E-04	1.33E+00
BKR-SB--FOPR#	STANDBY FAN BREAKER FAILS OPEN	1.20E-06	1.08E+00
RY--SB--FOPR#	STANDBY FAN RELAY FAILS OPEN	1.20E-06	1.08E+00
FAN-SB--FTRR#	STANDBY FAN FAILS TO REMAIN RUNNING	2.52E-03	1.08E+00
DMP--SB-FTOR#	STANDBY FAN EXHAUST DAMPER FAILS TO OPEN	3.00E-03	1.04E+00
FAN-SB--UNAR#	STANDBY FAN UNAVAILABLE DUE TO T&M	2.40E-02	1.04E+00
OPRBKR04RMHR#	FAIL TO REMOVE LOCKOUT FOLLOWING T&M	5.00E-02	1.04E+00
OPRSD004RMHR#	FAIL TO OPEN SUCTION DAMPER AFTER T&M	5.00E-02	1.04E+00

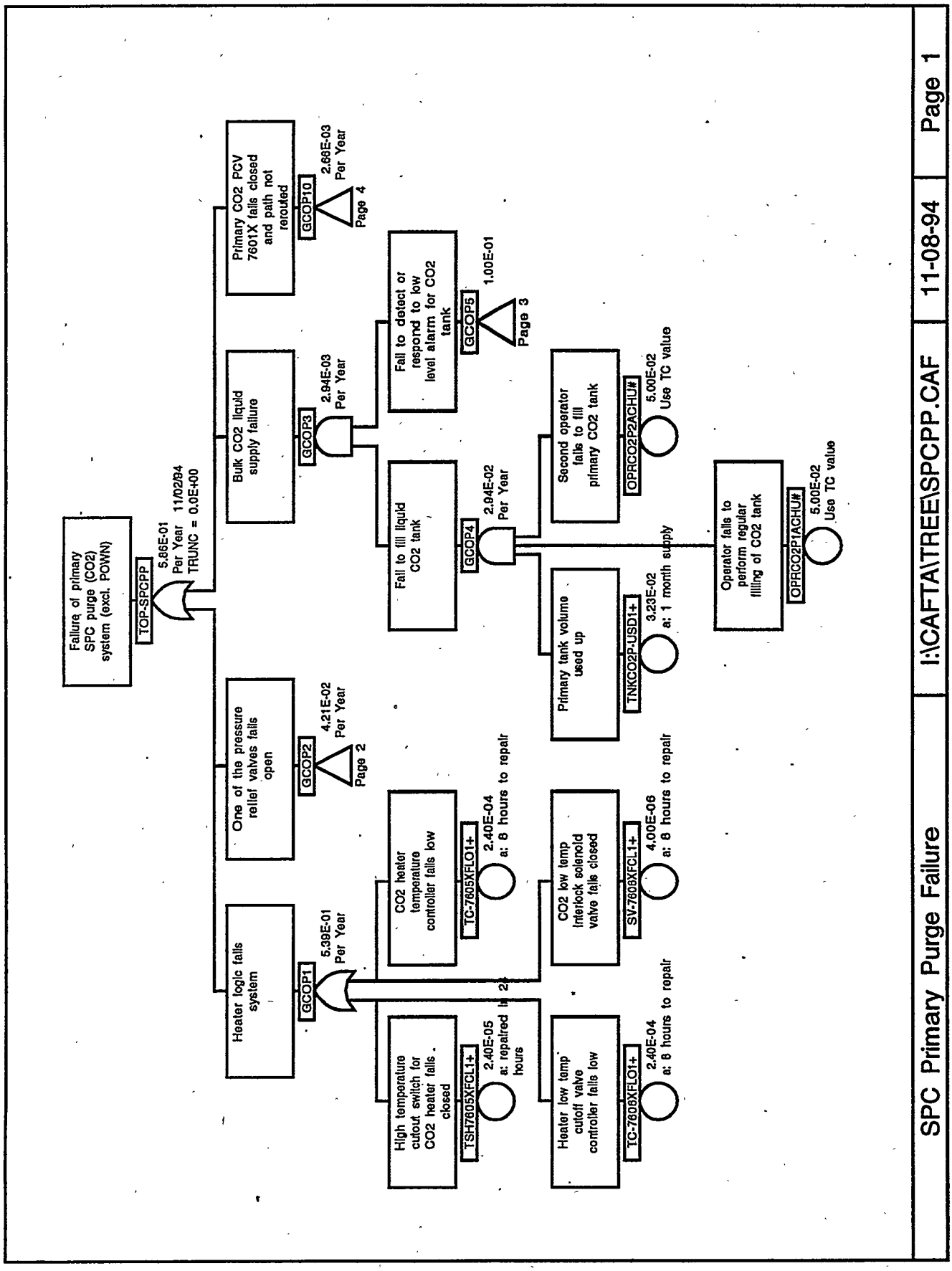
Modified top event frequency = (top event frequency) x (risk achievement worth).

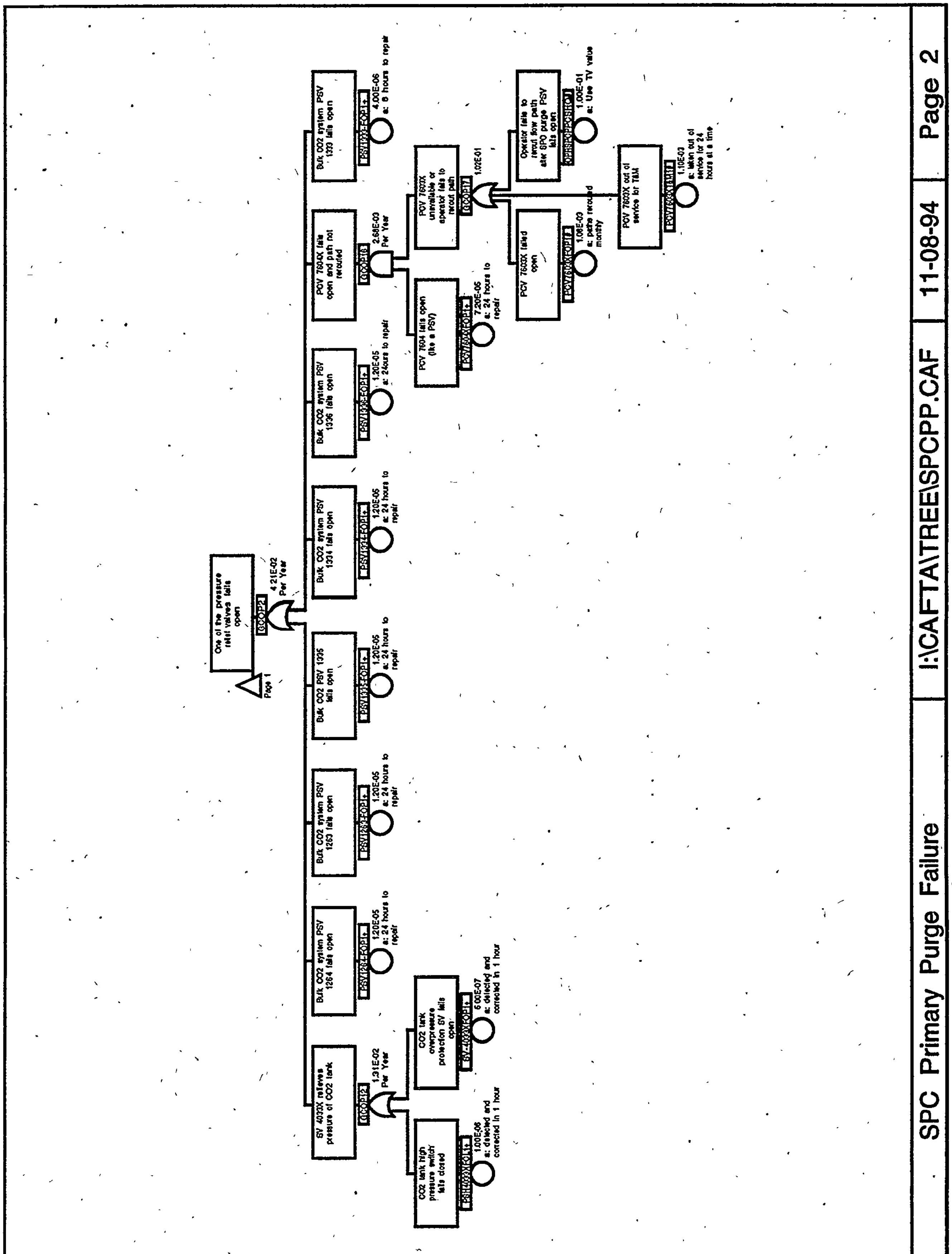
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
IA--FH--T&MR#	FAN HOUSE AIR UNAVAILABLE DUE TO T&M	3.20E-03	1.73E+00
PGV-2630FTCR#	PLUG VALVE 2630 FAILS TO CLOSE (STUCK)	3.00E-03	1.65E+00
UPS-FAN-BFLR#	LOSS OF UPS	4.70E-04	1.07E+00
DMP--W--CCBR#	CC: FOUR FAN EXHAUST DAMPERS FAIL TO OPEN	3.00E-04	1.04E+00
FAN-12--CCDR#	CC: TWO RE-STARTED FAN LINES FAIL TO RUN	2.52E-04	1.03E+00
FAN-1234C3FR#	CC: FOUR FANS FAIL TO START	2.50E-04	1.03E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

SPC Primary Purge Failure


SPC Primary Purge Failure
I:\CAFTA\TREE\SPCPP.CAF
11-08-94
Page 1
Failure of primary SPC purge (CO2) system (excl. POWN)
TOP-SPCPP
5.86E-01 Per Year
11/02/94 TRUNC = 0.0E+00
Heater logic fails system
GCOP1
5.39E-01 Per Year
High temperature cutout switch for CO2 heater fails - closed
TSH-7605XFCL1+
2.40E-05 a: repaired hours
Heater low temp cutoff valve controller fails low
TC-7606XFLO1+
2.40E-04 a: 8 hours to repair
One of the pressure relief valves fails open
GCOP2
4.21E-02 Per Year
Page 2
CO2 heater temperature controller fails low
TC-7605XFLO1+
2.40E-04 a: 8 hours to repair
CO2 low temp interlock solenoid valve fails closed
SV-7606XFCL1+
4.00E-06 a: 8 hours to repair
Bulk CO2 liquid supply failure
GCOP3
2.94E-03 Per Year
Fail to fill liquid CO2 tank
GCOP4
2.94E-02 Per Year
Primary tank volume used up
TNKCO2P-USD1+
3.23E-02 a: 1 month supply
Fail to detect or respond to low level alarm for CO2 tank
GCOP5
1.00E-01
Page 3
Second operator fails to fill primary CO2 tank
OPRCO2P2ACHU#
5.00E-02 Use TC value
Primary CO2 PCV 7601X fails closed and path not rerouted
GCOP10
2.66E-03 Per Year
Page 4
Operator fails to perform regular filling of CO2 tank
OPRCO2P1ACHU#
5.00E-02 Use TC value


One of the pressure relief valves fails open
4.21E-02 Per Year
Page 1
SV 4033X relieves pressure of CO2 tank
1.31E-02 Per Year
CO2 tank high pressure switch fails closed
1.00E-06 a: detected and corrected in 1 hour
CO2 tank overpressure protection SV fails open
6.00E-07 a: detected and corrected in 1 hour
Bulk CO2 system PSV 1264 fails open
1.20E-05 a: 24 hours to repair
Bulk CO2 system PSV 1263 fails open
1.20E-05 a: 24 hours to repair
Bulk CO2 PSV 1335 fails open
1.20E-05 a: 24 hours to repair
Bulk CO2 system PSV 1334 fails open
1.20E-05 a: 24 hours to repair
Bulk CO2 system PSV 1336 fails open
1.20E-05 a: 24hours to repair
PCV 7604X fails open and path not rerouted
2.68E-03 Per Year
PCV 7604 fails open (like a PSV)
7.20E-05 a: 24 hours to repair
PCV 7603X unavailable or operator fails to reroute path
1.02E-01
PCV 7603X failed open
1.08E-03 a: paths rerouted monthly
PCV 7603X out of service for T&M
1.10E-03 a: taken out of service for 24 hours at a time
Operator fails to reroute flow path after SPC purge PSV fails open
1.00E-01 a: Use TV value
Bulk CO2 system PSV 1333 fails open
4.00E-06 a: 8 hours to repair
SPC Primary Purge Failure
I:\CAFTA\TREE\SPCPP.CAF
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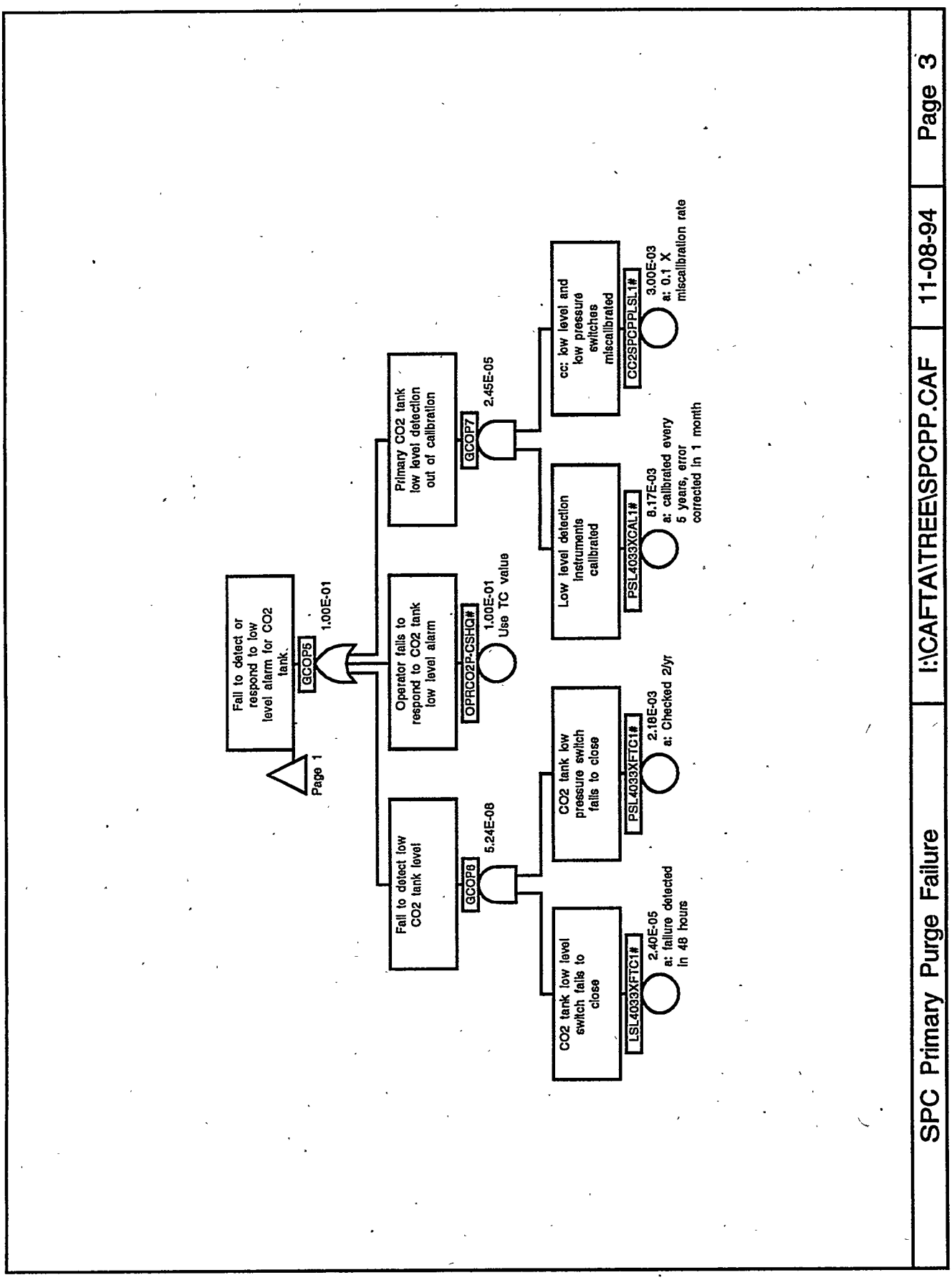
Fail to detect or respond to low level alarm for CO2 tank.
GCOP5
1.00E-01
Page 1
Fail to detect low CO2 tank level
GCOP6
5.24E-08
CO2 tank low level switch fails to close
LSL4033XFTC1#
2.40E-05
a: failure detected in 48 hours
CO2 tank low pressure switch fails to close
PSL4033XFTC1#
2.18E-03
a: Checked 2/yr
Operator fails to respond to CO2 tank low level alarm
OPRCO2P-CSHQ#
1.00E-01
Use TC value
Primary CO2 tank low level detection out of calibration
GCOP7
2.45E-05
Low level detection instruments calibrated
PSL4033XCAL1#
8.17E-03
a: calibrated every 5 years, error corrected in 1 month
cc: low level and low pressure switches miscalibrated
CC2SPCPPLSL1#
3.00E-03
a: 0.1 X miscalibration rate
SPC Primary Purge Failure
I:\CAFTA\TREE\SPCPP.CAF
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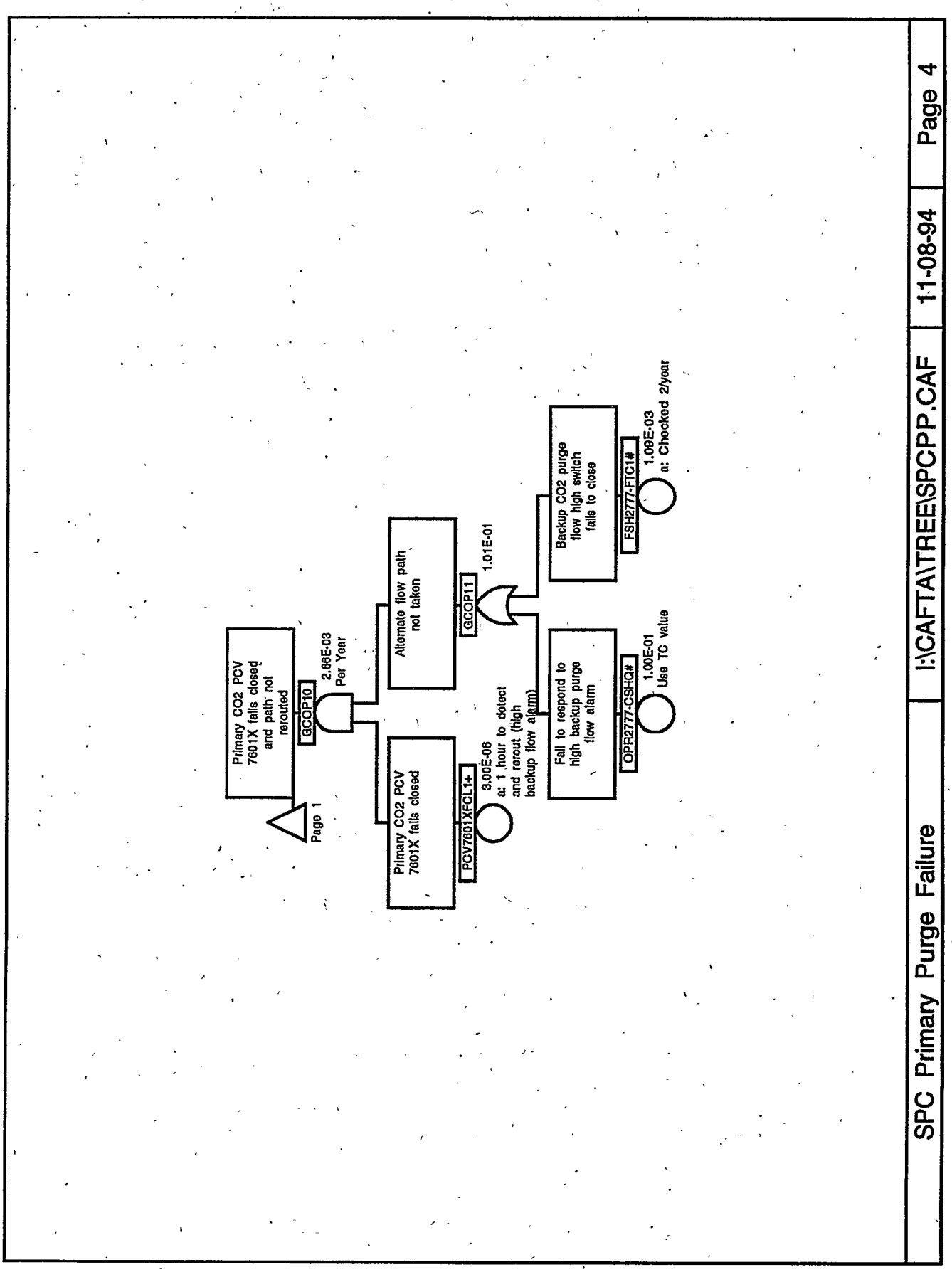
SPC Primary Purge Failure
I:\CAFTA\TREE\SPCPP.CAF
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Page 4
Primary CO2 PCV 7601X fails closed and path not rerouted
Page 1
GCOP10
2.66E-03 Per Year
Primary CO2 PCV 7601X fails closed
PCV7601XFCL1+
3.00E-06 a: 1 hour to detect and rerout (high backup flow alarm)
Alternate flow path not taken
GCOP11
1.01E-01
Fail to respond to high backup purge flow alarm
OPR2777-CSHQ#
1.00E-01 Use TC value
Backup CO2 purge flow high switch fails to close
FSH2777-FTC1#
1.09E-03 a: Checked 2/year

Cutsets for I:\CAFTA\CUT\SPCPP.CSR 11/08/94 12:12 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
	TOP-SPCPP					5.86E-01
1.	TC-7606XFLO1+	Heater low temp cutoff valve controller fails low	4	8H 3.0E-05H	2.40E-04	2.63E-01
2.	TC-7605XFLO1+	CO2 heater temperature controller fails low	4	8H 3.0E-05H	2.40E-04	2.63E-01
3.	PSH4033XFCL1+	CO2 tank high pressure switch fails closed	4	1H 1.0E-06H	1.00E-06	8.76E-03
4.	TSH7605XFCL1+	High temperature cutout switch for CO2 heater fails closed	4	24H 1.0E-06H	2.40E-05	8.76E-03
5.	SV-4033XFOP1+	CO2 tank overpressure protection SV fails open	4	1H 5.0E-07H	5.00E-07	4.38E-03
6.	SV-7606XFCL1+	CO2 low temp interlock solenoid valve fails closed	4	8H 5.0E-07H	4.00E-06	4.38E-03
7.	PSV1333-FOP1+	Bulk CO2 system PSV 1333 fails open	4	8H 5.0E-07H	4.00E-06	4.38E-03
8.	PSV1334-FOP1+	Bulk CO2 system PSV 1334 fails open	4	24H 5.0E-07H	1.20E-05	4.38E-03
9.	PSV1336-FOP1+	Bulk CO2 system PSV 1336 fails open	4	24H 5.0E-07H	1.20E-05	4.38E-03
10.	PSV1264-FOP1+	Bulk CO2 system PSV 1264 fails open	4	24H 5.0E-07H	1.20E-05	4.38E-03
11.	PSV1263-FOP1+	Bulk CO2 system PSV 1263 fails open	4	24H 5.0E-07H	1.20E-05	4.38E-03
12.	PSV1335-FOP1+	Bulk CO2 PSV 1335 fails open	4	24H 5.0E-07H	1.20E-05	4.38E-03
13.	OPRCO2P-CSHQ#	Operator fails to respond to CO2 tank low level alarm	1	1N 1.0E-01N	1.00E-01N	2.94E-03
	OPRCO2P1ACHU#	Operator fails to perform regular filling of CO2 tank	1	1N 5.0E-02N	5.00E-02N	
	OPRCO2P2ACHU#	Second operator fails to fill primary CO2 tank	1	1N 5.0E-02N	5.00E-02N	
	TNKCO2P-USD1+	Primary tank volume used up	4	24H 1M	3.23E-02	

Cutsets for I:\CAFTA\CUT\SPCPP.CSR 11/08/94 12:12 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
14.	OPR2777-CSHQ#	Fail to respond to high backup purge flow alarm	1	1N 1.0E-01N	1.00E-01N	2.63E-03
	PCV7601XFCL1+	Primary CO2 PCV 7601X fails closed	4	1H 3.0E-06H	3.00E-06	
15.	OPRSPCPPCSHQ#	Operator fails to rerout flow path after SPC purge PSV fails open	1	1N 1.0E-01N	1.00E-01N	2.63E-03
	PCV7604XFOP1+	PCV 7604 fails open (like a PSV)	4	24H 3.0E-06H	7.20E-05	
16.	PCV7603XT&M1#	PCV 7603X out of service for T&M	3	24H 4.0E-01Y	1.10E-03	2.88E-05
	PCV7604XFOP1+	PCV 7604 fails open (like a PSV)	4	24H 3.0E-06H	7.20E-05	
17.	FSH2777-FTC1#	Backup CO2 purge flow high switch fails to close	5	1Q 1.0E-06H	1.09E-03	2.87E-05
	PCV7601XFCL1+	Primary CO2 PCV 7601X fails closed	4	1H 3.0E-06H	3.00E-06	
18.	PCV7603XFOP1#	PCV 7603X failed open	5	1M 3.0E-06H	1.08E-03	2.84E-05
	PCV7604XFOP1+	PCV 7604 fails open (like a PSV)	4	24H 3.0E-06H	7.20E-05	
19.	CC2SPCPPLSL1#	cc: low level and low pressure switches miscalibrated	1	1N 3.0E-03N	3.00E-03N	7.22E-07
	OPRCO2P1ACHU#	Operator fails to perform regular filling of CO2 tank	1	1N 5.0E-02N	5.00E-02N	
	OPRCO2P2ACHU#	Second operator fails to fill primary CO2 tank	1	1N 5.0E-02N	5.00E-02N	
	PSL4033XCAL1#	Low level detection instruments calibrated	5	1M 2.0E-01Y	8.17E-03	
	TNKCO2P-USD1+	Primary tank volume used up	4	24H 1M	3.23E-02	
20.	LSL4033XFTC1#	CO2 tank low level switch fails to close	5	2D 1.0E-06H	2.40E-05	1.54E-09
	OPRCO2P1ACHU#	Operator fails to perform regular filling of CO2 tank	1	1N 5.0E-02N	5.00E-02N	
	OPRCO2P2ACHU#	Second operator fails to fill primary CO2 tank	1	1N 5.0E-02N	5.00E-02N	
	PSL4033XFTC1#	CO2 tank low pressure switch fails to close	3	1Q 1.0E-06H	2.18E-03	
	TNKCO2P-USD1+	Primary tank volume used up	4	24H 1M	3.23E-02	

Failure of primary SPC purge (CO2) system (excl. POWN)
Top Event Frequency: 5.86E-01/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
PSV1336-FOP1+-I	Bulk CO2 system PSV 1336 fails open	5.00E-07/H	1.49E+04
PSV1334-FOP1+-I	Bulk CO2 system PSV 1334 fails open	5.00E-07/H	1.49E+04
PSV1333-FOP1+-I	Bulk CO2 system PSV 1333 fails open	5.00E-07/H	1.49E+04
PSV1335-FOP1+-I	Bulk CO2 PSV 1335 fails open	5.00E-07/H	1.49E+04
PSV1263-FOP1+-I	Bulk CO2 system PSV 1263 fails open	5.00E-07/H	1.49E+04
PSV1264-FOP1+-I	Bulk CO2 system PSV 1264 fails open	5.00E-07/H	1.49E+04
PSH4033XFCL1+-I	CO2 tank high pressure switch fails closed	1.00E-06/H	1.49E+04
TC-7605XFLO1+-I	CO2 heater temperature controller fails low	3.00E-05/H	1.49E+04
TC-7606XFLO1+-I	Heater low temp cutoff valve controller fails low	3.00E-05/H	1.49E+04
SV-7606XFCL1+-I	CO2 low temp interlock solenoid valve fails closed	5.00E-07/H	1.49E+04
SV-4033XFOP1+-I	CO2 tank overpressure protection SV fails open	5.00E-07/H	1.49E+04
TSH7605XFCL1+-I	High temperature cutout switch for CO2 heater fails closed	1.00E-06/H	1.49E+04
PCV7604XFOP1+-I	PCV 7604 fails open (like a PSV)	3.00E-06/H	1.52E+03
PCV7601XFCL1+-I	Primary CO2 PCV 7601X fails closed	3.00E-06/H	1.51E+03
TNKCO2P-USD1+-I	Primary tank volume used up	1.34E-03/H	4.73E+00
OPRCO2P1ACHU#	Operator fails to perform regular filling of CO2 tank	5.00E-02	1.10E+00
OPRCO2P2ACHU#	Second operator fails to fill primary CO2 tank	5.00E-02	1.10E+00
OPRCO2P-CSHQ#	Operator fails to respond to CO2 tank low level alarm	1.00E-01	1.05E+00
PCV7603XFOP1#	PCV 7603X failed open	1.08E-03	1.04E+00
FSH2777-FTC1#	Backup CO2 purge flow high switch fails to close	1.09E-03	1.04E+00
PCV7603XT&M1#	PCV 7603X out of service for T&M	1.10E-03	1.04E+00
OPR2777-CSHQ#	Fail to respond to high backup purge flow alarm	1.00E-01	1.04E+00
OPRSPCPPCSHQ#	Fail to rerout flow path after SPC purge PSV fails open	1.00E-01	1.04E+00

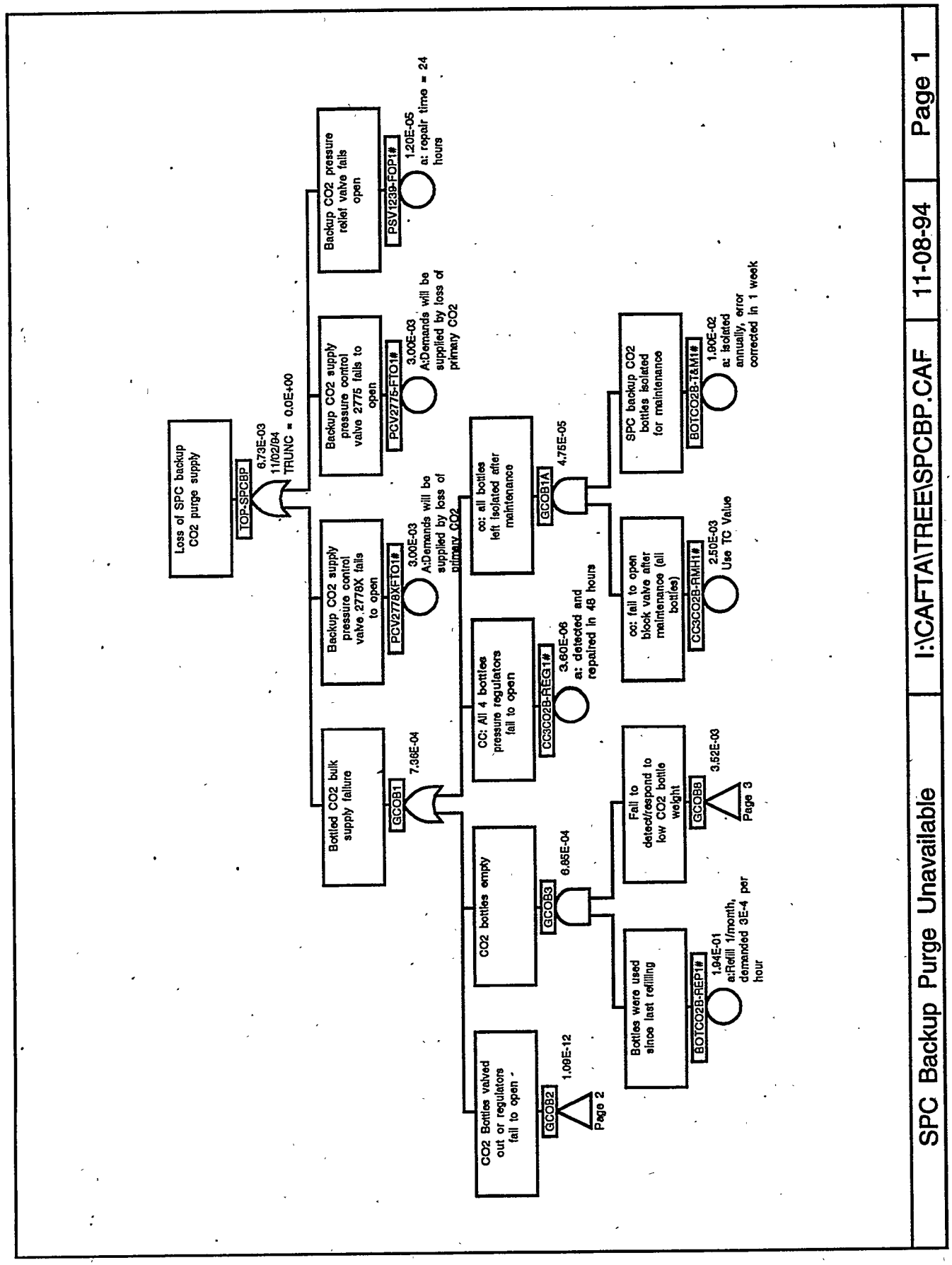
Modified top event frequency = (top event frequency) x (risk achievement worth).

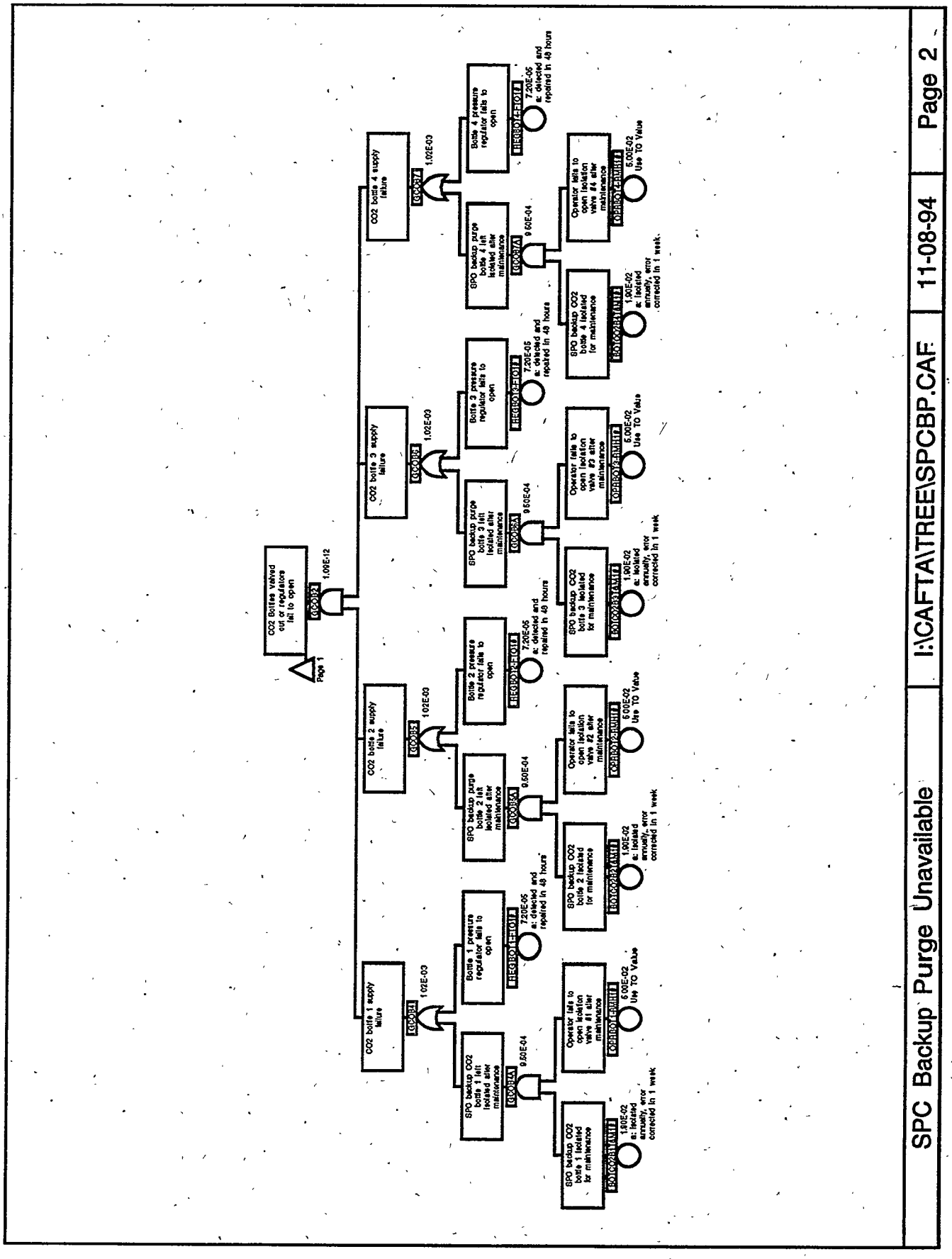
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
TC-7605XFLO1+-I	CO2 heater temperature controller fails low	3.00E-05/H	1.81E+00
TC-7606XFLO1+-I	Heater low temp cutoff valve controller fails low	3.00E-05/H	1.81E+00
TSH7605XFCL1+-I	High temperature cutout switch for CO2 heater fails closed	1.00E-06/H	1.02E+00
PSH4033XFCL1+-I	CO2 tank high pressure switch fails closed	1.00E-06/H	1.02E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

SPC Backup Purge Unavailable


SPC Backup Purge Unavailable
I:\CAFTA\TREE\SPCBP.CAF
11-08-94
Page 1
Loss of SPC backup CO2 purge supply
TOP-SPCBP
6.73E-03
11/02/94
TRUNC = 0.0E+00
Backup CO2 supply pressure control valve 2775 fails to open
PCV2775-FTO1#
3.00E-03
A:Demands will be supplied by loss of primary CO2
Backup CO2 pressure relief valve fails open
PSV1239-FOP1#
1.20E-05
a: repair time = 24 hours
Backup CO2 supply pressure control valve .2778X fails to open
PCV2778XFTO1#
3.00E-03
A:Demands will be supplied by loss of primary CO2
Bottled CO2 bulk supply failure
GCOB1
7.36E-04
CC: All 4 bottles pressure regulators fail to open
CC3CO2B-REG1#
3.60E-06
a: detected and repaired in 48 hours
cc: all bottles left isolated after maintenance
GCOB1A
4.75E-05
SPC backup CO2 bottles isolated for maintenance
BOTCO2B-T&M1#
1.90E-02
a: isolated annually, error corrected in 1 week
cc: fail to open block valve after maintenance (all bottles)
CC3CO2B-RMH1#
2.50E-03
Use TC Value
CO2 bottles empty
GCOB3
6.85E-04
Fail to detect/respond to low CO2 bottle weight
GCOB8
3.52E-03
Page 3
Bottles were used since last refilling
BOTCO2B-REP1#
1.94E-01
a:Refill 1/month, demanded 3E-4 per hour
CO2 Bottles valved out or regulators fail to open
GCOB2
1.08E-12
Page 2


SPC Backup Purge Unavailable
I:\CAFTA\TREE\SPCBP.CAF
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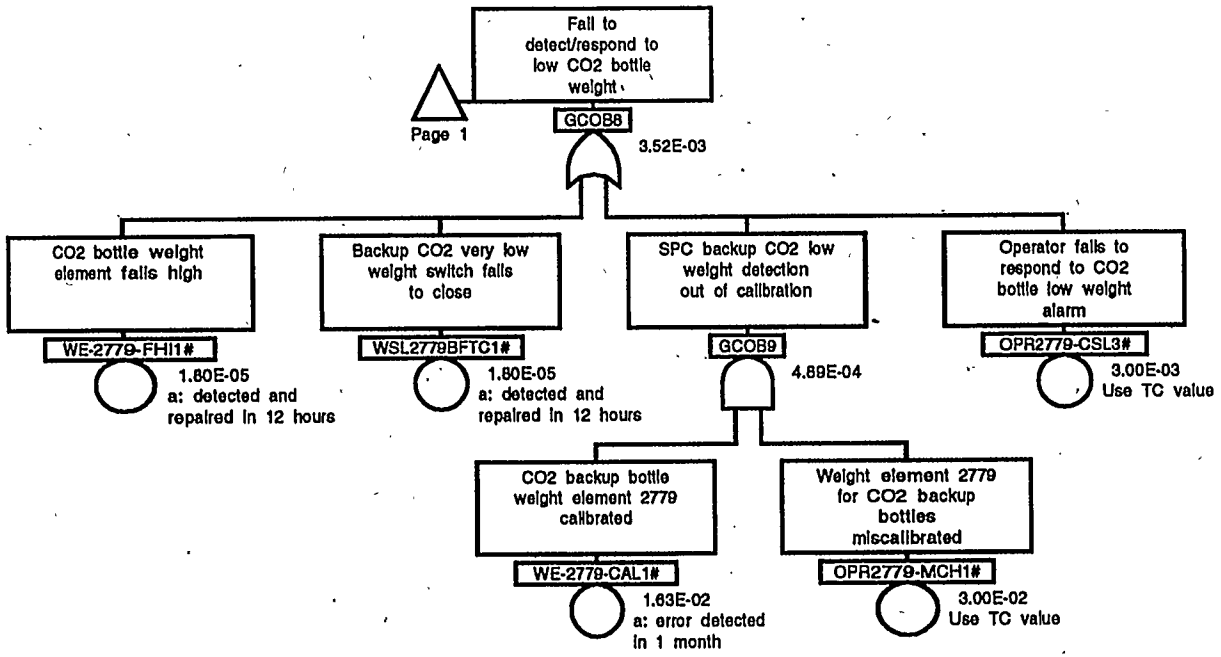
Page 2
CO2 Bottles valved out or regulators fail to open
1.00E-12
Page 1
CO2 bottle 1 supply failure
1.02E-03
CO2 bottle 2 supply failure
1.02E-03
CO2 bottle 3 supply failure
1.02E-03
CO2 bottle 4 supply failure
1.02E-03
Bottle 1 pressure regulator fails to open
7.20E-05
a: detected and repaired in 48 hours
Bottle 2 pressure regulator fails to open
7.20E-05
a: detected and repaired in 48 hours
Bottle 3 pressure regulator fails to open
7.20E-05
a: detected and repaired in 48 hours
Bottle 4 pressure regulator fails to open
7.20E-05
a: detected and repaired in 48 hours
SPO backup purge bottle 1 left isolated after maintenance
9.50E-04
SPO backup purge bottle 2 left isolated after maintenance
9.50E-04
SPO backup purge bottle 3 left isolated after maintenance
9.50E-04
SPO backup purge bottle 4 left isolated after maintenance
9.50E-04
Operator fails to open isolation valve #1 after maintenance
6.00E-02
Use TO Value
Operator fails to open isolation valve #2 after maintenance
6.00E-02
Use TO Value
Operator fails to open isolation valve #3 after maintenance
6.00E-02
Use TO Value
Operator fails to open isolation valve #4 after maintenance
6.00E-02
Use TO Value
SPO backup CO2 bottle 1 isolated for maintenance
1.90E-02
a: Isolated annually, error corrected in 1 week
SPO backup CO2 bottle 2 isolated for maintenance
1.90E-02
a: Isolated annually, error corrected in 1 week
SPO backup CO2 bottle 3 isolated for maintenance
1.90E-02
a: Isolated annually, error corrected in 1 week
SPO backup CO2 bottle 4 isolated for maintenance
1.90E-02
a: Isolated annually, error corrected in 1 week



SPC Backup Purge Unavailable	I:\CAFTA\TREE\SPCBP.CAF	11-08-94	Page 3

Cutsets for I:\CAFTA\CUT\SPCBP.CSR 11/08/94 12:13 AM

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	TOP-SPCBP					6.73E-03
1.	PCV2778XFTO1#	Backup CO2 supply pressure control valve 2778X fails to open	1	1N 3.0E-03N	3.00E-03N	3.00E-03
2.	PCV2775-FTO1#	Backup CO2 supply pressure control valve 2775 fails to open	1	1N 3.0E-03N	3.00E-03N	3.00E-03
3.	BOTCO2B-REP1#	Bottles were used since last refilling	3	1M 3.0E-04H	1.94E-01	5.83E-04
	OPR2779-CSL3#	Operator fails to respond to CO2 bottle low weight alarm	1	1N 3.0E-03N	3.00E-03N	
4.	BOTCO2B-REP1#	Bottles were used since last refilling	3	1M 3.0E-04H	1.94E-01	9.50E-05
	OPR2779-MCH1#	Weight element 2779 for CO2 backup bottles miscalibrated	1	1N 3.0E-02N	3.00E-02N	
	WE-2779-CAL1#	CO2 backup bottle weight element 2779 calibrated	3	1M 2.0E-01Y	1.63E-02	
5.	BOTCO2B-T&M1#	SPC backup CO2 bottles isolated for maintenance	3	7D 1Y	1.90E-02	4.75E-05
	CC3CO2B-RMH1#	cc: fail to open block valve after maintenance (all bottles)	1	1N 2.5E-03N	2.50E-03N	
6.	PSV1239-FOP1#	Backup CO2 pressure relief valve fails open	3	24H 5.0E-07H	1.20E-05	1.20E-05
7.	CC3CO2B-REG1#	CC: All 4 bottles pressure regulators fail to open	5	48H 1.5E-07H	3.60E-06	3.60E-06
8.	BOTCO2B-REP1#	Bottles were used since last refilling.	3	1M 3.0E-04H	1.94E-01	3.50E-06
	WE-2779-FHI1#	CO2 bottle weight element fails high	5	12H 3.0E-06H	1.80E-05	
9.	BOTCO2B-REP1#	Bottles were used since last refilling	3	1M 3.0E-04H	1.94E-01	3.50E-06
	WSL2779BFTC1#	Backup CO2 very low weight switch fails to close	5	12H 3.0E-06H	1.80E-05	
10.	BOTCO2B1T&M1#	SPC backup CO2 bottle 1 isolated for maintenance	3	7D 1Y	1.90E-02	8.14E-13
	BOTCO2B2T&M1#	SPC backup CO2 bottle 2 isolated for maintenance	3	7D 1Y	1.90E-02	
	BOTCO2B3T&M1#	SPC backup CO2 bottle 3 isolated for maintenance	3	7D 1Y	1.90E-02	

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	BOTCO2B4T&M1#	SPC backup CO2 bottle 4 isolated for maintenance	3	7D 1Y	1.90E-02	
	OPRBOT1-RMH1#	Operator fails to open isolation valve #1 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT2-RMH1#	Operator fails to open isolation valve #2 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT3-RMH1#	Operator fails to open isolation valve #3 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT4-RMH1#	Operator fails to open isolation valve #4 after maintenance	1	1N 5.0E-02N	5.00E-02N	
11.	BOTCO2B1T&M1#	SPC backup CO2 bottle 1 isolated for maintenance	3	7D 1Y	1.90E-02	6.17E-14
	BOTCO2B3T&M1#	SPC backup CO2 bottle 3 isolated for maintenance	3	7D 1Y	1.90E-02	
	BOTCO2B4T&M1#	SPC backup CO2 bottle 4 isolated for maintenance	3	7D 1Y	1.90E-02	
	OPRBOT1-RMH1#	Operator fails to open isolation valve #1 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT3-RMH1#	Operator fails to open isolation valve #3 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT4-RMH1#	Operator fails to open isolation valve #4 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT2-FTO1#	Bottle 2 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
12.	BOTCO2B1T&M1#	SPC backup CO2 bottle 1 isolated for maintenance	3	7D 1Y	1.90E-02	6.17E-14
	BOTCO2B2T&M1#	SPC backup CO2 bottle 2 isolated for maintenance	3	7D 1Y	1.90E-02	
	BOTCO2B4T&M1#	SPC backup CO2 bottle 4 isolated for maintenance	3	7D 1Y	1.90E-02	
	OPRBOT1-RMH1#	Operator fails to open isolation valve #1 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT2-RMH1#	Operator fails to open isolation valve #2 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT4-RMH1#	Operator fails to open isolation valve #4 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT3-FTO1#	Bottle 3 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
13.	BOTCO2B2T&M1#	SPC backup CO2 bottle 2 isolated for maintenance	3	7D 1Y	1.90E-02	6.17E-14
	BOTCO2B3T&M1#	SPC backup CO2 bottle 3 isolated for maintenance	3	7D 1Y	1.90E-02	
	BOTCO2B4T&M1#	SPC backup CO2 bottle 4 isolated for maintenance	3	7D 1Y	1.90E-02	

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	OPRBOT2-RMH1#	Operator fails to open isolation valve #2 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT3-RMH1#	Operator fails to open isolation valve #3 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT4-RMH1#	Operator fails to open isolation valve #4 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT1-FTO1#	Bottle 1 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
14.	BOTCO2B1T&M1#	SPC backup CO2 bottle 1 isolated for maintenance	3	7D 1Y	1.90E-02	6.17E-14
	BOTCO2B2T&M1#	SPC backup CO2 bottle 2 isolated for maintenance	3	7D 1Y	1.90E-02	
	BOTCO2B3T&M1#	SPC backup CO2 bottle 3 isolated for maintenance	3	7D 1Y	1.90E-02	
	OPRBOT1-RMH1#	Operator fails to open isolation valve #1 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT2-RMH1#	Operator fails to open isolation valve #2 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT3-RMH1#	Operator fails to open isolation valve #3 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT4-FTO1#	Bottle 4 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
15.	BOTCO2B2T&M1#	SPC backup CO2 bottle 2 isolated for maintenance	3	7D 1Y	1.90E-02	4.68E-15
	BOTCO2B4T&M1#	SPC backup CO2 bottle 4 isolated for maintenance	3	7D 1Y	1.90E-02	
	OPRBOT2-RMH1#	Operator fails to open isolation valve #2 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT4-RMH1#	Operator fails to open isolation valve #4 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT1-FTO1#	Bottle 1 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT3-FTO1#	Bottle 3 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
16.	BOTCO2B1T&M1#	SPC backup CO2 bottle 1 isolated for maintenance	3	7D 1Y	1.90E-02	4.68E-15
	BOTCO2B3T&M1#	SPC backup CO2 bottle 3 isolated for maintenance	3	7D 1Y	1.90E-02	
	OPRBOT1-RMH1#	Operator fails to open isolation valve #1 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT3-RMH1#	Operator fails to open isolation valve #3 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT2-FTO1#	Bottle 2 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	REGBOT4-FTO1#	Bottle 4 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
17.	BOTCO2B2T&M1#	SPC backup CO2 bottle 2 isolated for maintenance	3	7D 1Y	1.90E-02	4.68E-15
	BOTCO2B3T&M1#	SPC backup CO2 bottle 3 isolated for maintenance	3	7D 1Y	1.90E-02	
	OPRBOT2-RMH1#	Operator fails to open isolation valve #2 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT3-RMH1#	Operator fails to open isolation valve #3 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT1-FTO1#	Bottle 1 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT4-FTO1#	Bottle 4 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
18.	BOTCO2B3T&M1#	SPC backup CO2 bottle 3 isolated for maintenance	3	7D 1Y	1.90E-02	4.68E-15
	BOTCO2B4T&M1#	SPC backup CO2 bottle 4 isolated for maintenance	3	7D 1Y	1.90E-02	
	OPRBOT3-RMH1#	Operator fails to open isolation valve #3 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT4-RMH1#	Operator fails to open isolation valve #4 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT1-FTO1#	Bottle 1 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT2-FTO1#	Bottle 2 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
19.	BOTCO2B1T&M1#	SPC backup CO2 bottle 1 isolated for maintenance	3	7D 1Y	1.90E-02	4.68E-15
	BOTCO2B2T&M1#	SPC backup CO2 bottle 2 isolated for maintenance	3	7D 1Y	1.90E-02	
	OPRBOT1-RMH1#	Operator fails to open isolation valve #1 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	OPRBOT2-RMH1#	Operator fails to open isolation valve #2 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT3-FTO1#	Bottle 3 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT4-FTO1#	Bottle 4 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
20.	BOTCO2B1T&M1#	SPC backup CO2 bottle 1 isolated for maintenance	3	7D 1Y	1.90E-02	4.68E-15
	BOTCO2B4T&M1#	SPC backup CO2 bottle 4 isolated for maintenance	3	7D 1Y	1.90E-02	
	OPRBOT1-RMH1#	Operator fails to open isolation valve #1 after maintenance	1	1N 5.0E-02N	5.00E-02N	

Cutsets for I:\CAFTA\CUT\SPCBP.CSR 11/08/94 12:13 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	OPRBOT4-RMH1#	Operator fails to open isolation valve #4 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT2-FTO1#	Bottle 2 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT3-FTO1#	Bottle 3 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
21.	BOTCO2B2T&M1#	SPC backup CO2 bottle 2 isolated for maintenance	3	7D 1Y	1.90E-02	3.54E-16
	OPRBOT2-RMH1#	Operator fails to open isolation valve #2 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT1-FTO1#	Bottle 1 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT3-FTO1#	Bottle 3 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT4-FTO1#	Bottle 4 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
22.	BOTCO2B3T&M1#	SPC backup CO2 bottle 3 isolated for maintenance	3	7D 1Y	1.90E-02	3.54E-16
	OPRBOT3-RMH1#	Operator fails to open isolation valve #3 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT1-FTO1#	Bottle 1 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT2-FTO1#	Bottle 2 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT4-FTO1#	Bottle 4 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
23.	BOTCO2B4T&M1#	SPC backup CO2 bottle 4 isolated for maintenance	3	7D 1Y	1.90E-02	3.54E-16
	OPRBOT4-RMH1#	Operator fails to open isolation valve #4 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT1-FTO1#	Bottle 1 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT2-FTO1#	Bottle 2 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT3-FTO1#	Bottle 3 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
24.	BOTCO2B1T&M1#	SPC backup CO2 bottle 1 isolated for maintenance	3	7D 1Y	1.90E-02	3.54E-16
	OPRBOT1-RMH1#	Operator fails to open isolation valve #1 after maintenance	1	1N 5.0E-02N	5.00E-02N	
	REGBOT2-FTO1#	Bottle 2 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT3-FTO1#	Bottle 3 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	REGBOT4-FTO1#	Bottle 4 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
25.	REGBOT1-FTO1#	Bottle 1 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	2.69E-17
	REGBOT2-FTO1#	Bottle 2 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT3-FTO1#	Bottle 3 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	
	REGBOT4-FTO1#	Bottle 4 pressure regulator fails to open	5	48H 3.0E-06H	7.20E-05	

Loss of SPC backup CO2 purge supply Top Event Probability: 6.22E-03

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
PSV1239-FOP1#	Backup CO2 pressure relief valve fails open	1.20E-05	1.61E+02
CC3CO2B-REG1#	CC: All 4 bottles pressure regulators fail to open	3.60E-06	1.61E+02
PCV2778XFTO1#	Backup CO2 pressure control valve 2778X fails to open	3.00E-03	1.61E+02
PCV2775-FTO1#	Backup CO2 pressure control valve 2775 fails to open	3.00E-03	1.61E+02
WSL2779BFTC1#	Backup CO2 very low weight switch fails to close	1.80E-05	8.53E+00
WE-2779-FHI1#	CO2 bottle weight element fails high	1.80E-05	8.53E+00
OPR2779-CSL3#	Operator fails to respond to CO2 bottle low weight alarm	3.00E-03	8.50E+00
CC3CO2B-RMH1#	cc: fail to open block valve after maintenance (all bottles)	2.50E-03	4.03E+00
BOTCO2B-REP1#	Bottles were used since last refilling	4.71E-02	1.54E+00
BOTCO2B-T&M1#	SPC backup CO2 bottles isolated for maintenance	1.90E-02	1.39E+00
WE-2779-CAL1#	CO2 backup bottle weight element 2779 calibrated	1.63E-02	1.22E+00
OPR2779-MCH1#	Weight element 2779 for CO2 backup bottles miscalibrated	3.00E-02	1.12E+00

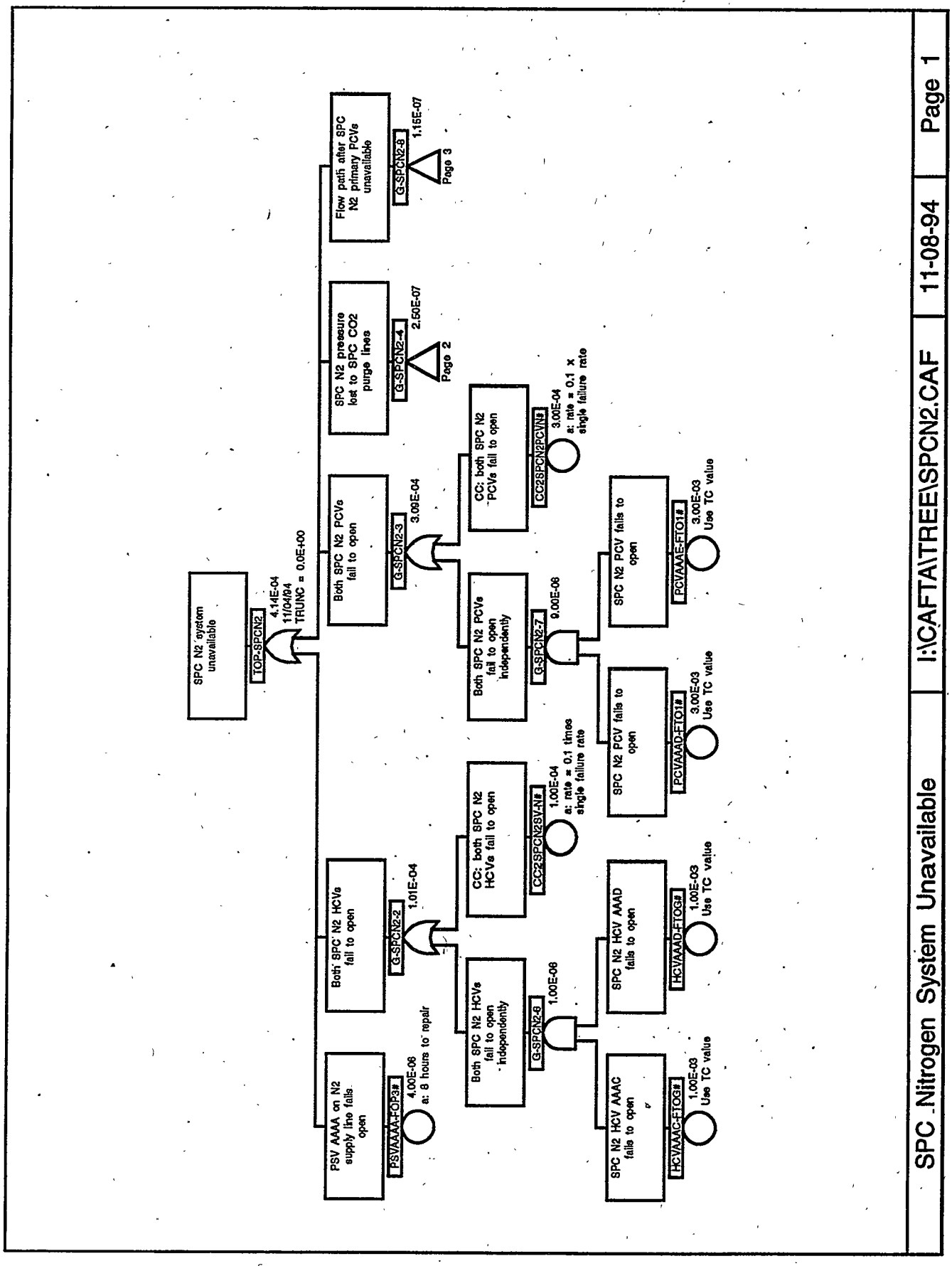
Modified top event frequency = (top event frequency) x (risk achievement worth).

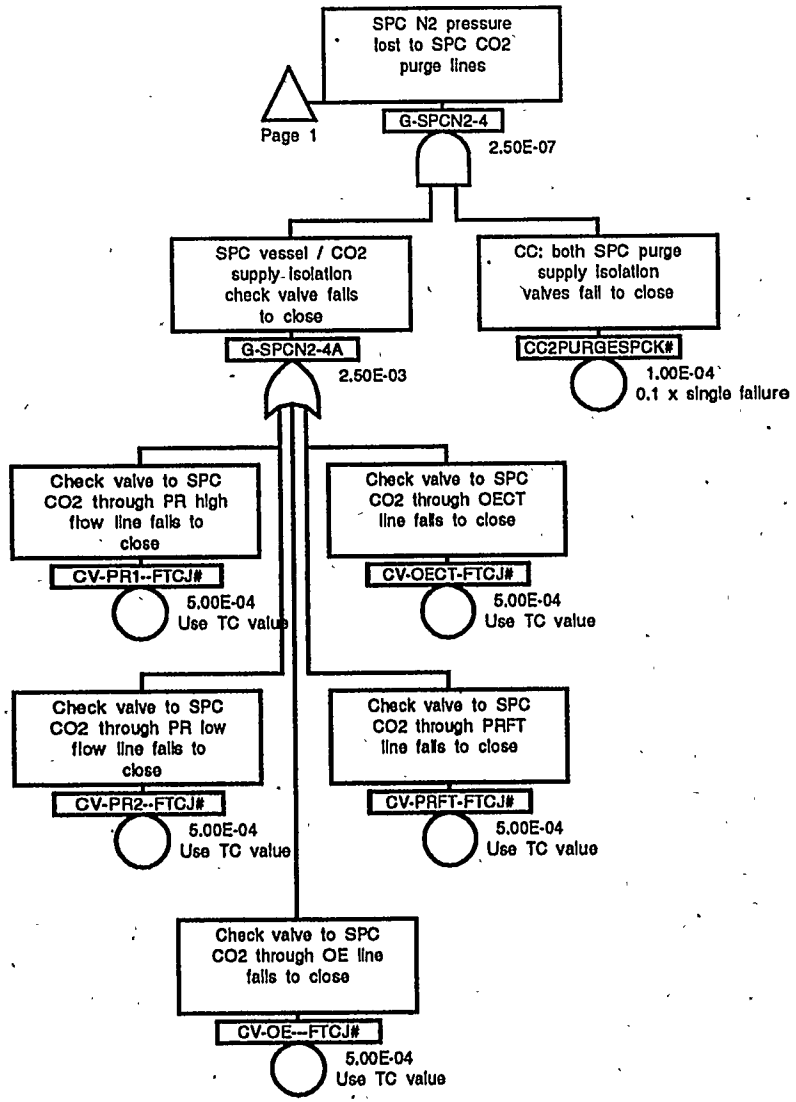
Risk Reduction Worth

Basic Event Name	Description	Prob/Freq	RedW
PCV2775-FTO1#	Backup CO2 pressure control valve 2775 fails to open	3.00E-03	1.93E+00
PCV2778XFTO1#	Backup CO2 pressure control valve 2778X fails to open	3.00E-03	1.93E+00
BOTCO2B-REP1#	Bottles were used since last refilling	4.71E-02	1.03E+00
OPR2779-CSL3#	Operator fails to respond to CO2 bottle low weight alarm	3.00E-03	1.02E+00

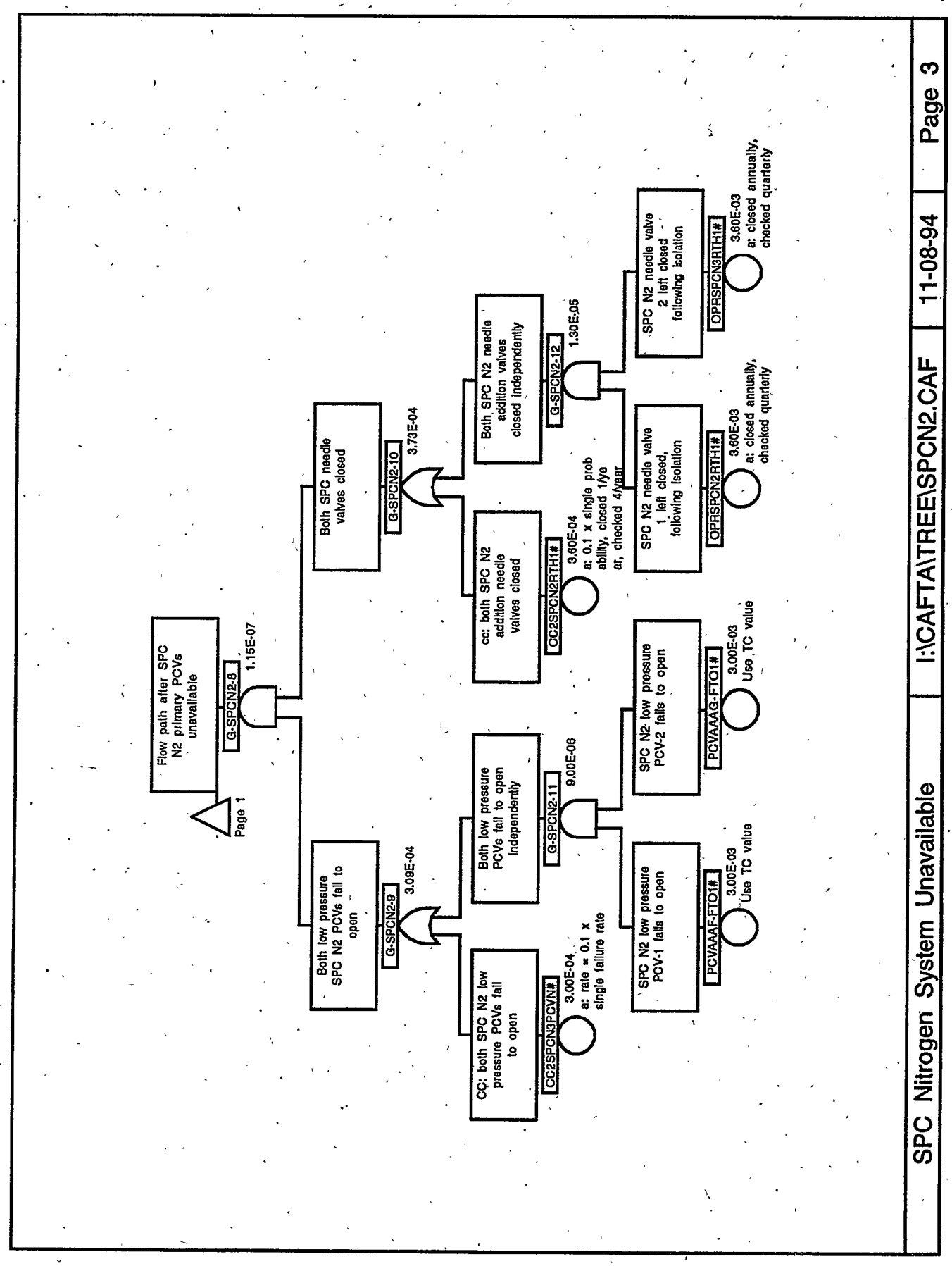
Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

SPC Nitrogen Purge Unavailable


SPC N2 system unavailable
TOP-SPCN2
4.14E-04
11/04/94
TRUNC = 0.0E+00
Both SPC N2 PCVs fail to open
G-SPCN2-3
3.09E-04
SPC N2 pressure lost to SPC CO2 purge lines
G-SPCN2-4
2.50E-07
Page 2
Flow path after SPC N2 primary PCVs unavailable
G-SPCN2-8
1.15E-07
Page 3
CC: both SPC N2 PCVs fail to open
CC2SPCN2PCVN#
3.00E-04
a: rate = 0.1 x single failure rate
Both SPC N2 PCVs fail to open independently
G-SPCN2-7
9.00E-06
SPC N2 PCV fails to open
PCVAAAE-FTO1#
3.00E-03
Use TC value
SPC N2 PCV fails to open
PCVAAAD-FTO1#
3.00E-03
Use TC value
Both SPC N2 HCVs fail to open
G-SPCN2-2
1.01E-04
CC: both SPC N2 HCVs fail to open
CC2SPCN2SVN#
1.00E-04
a: rate = 0.1 times single failure rate
SPC N2 HCV AAAD fails to open
HCVAAAD-FTO1#
1.00E-03
Use TC value
Both SPC N2 HCVs fail to open independently
G-SPCN2-6
1.00E-06
SPC N2 HCV AAAC fails to open
HCVAAAC-FTO1#
1.00E-03
Use TC value
PSV AAAA on N2 supply line fails open
PSVAAAA-FOP3#
4.00E-06
a: 8 hours to repair
SPC_Nitrogen System Unavailable
I:\CAFTA\TREE\SPCN2.CAF
11-08-94
Page 1



SPC Nitrogen System Unavailable	I:\CAFTA\TREE\SPCN2.CAF	11-08-94	Page 2


SPC Nitrogen System Unavailable
I:\CAFTA\TREE\SPCN2.CAF
11-08-94
Page 3
Flow path after SPC N2 primary PCVs unavailable
G-SPCN2-8
1.15E-07
Page 1
Both SPC needle valves closed
G-SPCN2-10
3.73E-04
Both low pressure SPC N2 PCVs fail to open
G-SPCN2-9
3.09E-04
Both low pressure PCVs fail to open independently
G-SPCN2-11
9.00E-08
CC: both SPC N2 low pressure PCVs fail to open
CC2SPCN3PCVN#
3.00E-04
a: rate = 0.1 x single failure rate
SPC N2 low pressure PCV-1 fails to open
PCVAAAF-FTO1#
3.00E-03
Use TC value
SPC N2 low pressure PCV-2 fails to open
PCVAAAG-FTO1#
3.00E-03
Use TC value
cc: both SPC N2 addition needle valves closed
CC2SPCN2RTH1#
3.60E-04
a: 0.1 x single prob ability, closed 1/ye ar, checked 4/year
Both SPC N2 needle addition valves closed independently
G-SPCN2-12
1.30E-05
SPC N2 needle valve 1 left closed, following isolation
OPRSPCN2RTH1#
3.60E-03
a: closed annually, checked quarterly
SPC N2 needle valve 2 left closed - following isolation
OPRSPCN3RTH1#
3.60E-03
a: closed annually, checked quarterly

Cutsets for I:\CAFTA\CUT\SPCN2.CSR 11/08/94 12:15 AM

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	TOP-SPCN2					4.14E-04
1.	CC2SPCN2PCVN#	CC: both SPC N2 PCVs fail to open	1	1N 3.0E-04N	3.00E-04N	3.00E-04
2.	CC2SPCN2SV-N#	CC: both SPC N2 HCVs fail to open	1	1N 1.0E-04N	1.00E-04N	1.00E-04
3.	PCVAAAD-FTO1#	SPC N2 PCV fails to open	1	1N 3.0E-03N	3.00E-03N	9.00E-06
	PCVAAAE-FTO1#	SPC N2 PCV fails to open	1	1N 3.0E-03N	3.00E-03N	
4.	PSVAAAA-FOP3#	PSV AAAA on N2 supply line fails open	3	8H 5.0E-07H	4.00E-06	4.00E-06
5.	HCVAAAC-FTOG#	SPC N2 HCV AAAC fails to open	1	1N 1.0E-03N	1.00E-03N	1.00E-06
	HCVAAAD-FTOG#	SPC N2 HCV AAAD fails to open	1	1N 1.0E-03N	1.00E-03N	
6.	CC2SPCN2RTH1#	cc: both SPC N2 addition needle valves closed	1	.12N 3.0E-03N	3.60E-04N	1.08E-07
	CC2SPCN3PCVN#	CC: both SPC N2 low pressure PCVs fail to open	1	1N 3.0E-04N	3.00E-04N	
7.	CC2PURGESPCK#	CC: both SPC purge supply isolation valves fail to close	1	1N 1.0E-04N	1.00E-04N	5.00E-08
	CV-OE---FTCJ#	Check valve to SPC CO2 through OE line fails to close	1	1N 5.0E-04N	5.00E-04N	
8.	CC2PURGESPCK#	CC: both SPC purge supply isolation valves fail to close	1	1N 1.0E-04N	1.00E-04N	5.00E-08
	CV-PR1--FTCJ#	Check valve to SPC CO2 through PR high flow line fails to close	1	1N 5.0E-04N	5.00E-04N	
9.	CC2PURGESPCK#	CC: both SPC purge supply isolation valves fail to close	1	1N 1.0E-04N	1.00E-04N	5.00E-08
	CV-PRFT-FTCJ#	Check valve to SPC CO2 through PRFT line fails to close	1	1N 5.0E-04N	5.00E-04N	
10.	CC2PURGESPCK#	CC: both SPC purge supply isolation valves fail to close	1	1N 1.0E-04N	1.00E-04N	5.00E-08
	CV-PR2--FTCJ#	Check valve to SPC CO2 through PR low flow line fails to close	1	1N 5.0E-04N	5.00E-04N	
11.	CC2PURGESPCK#	CC: both SPC purge supply isolation valves fail to close	1	1N 1.0E-04N	1.00E-04N	5.00E-08

Cutsets for I:\CAFTA\CUT\SPCN2.CSR 11/08/94 12:15 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	CV-OECT-FTCJ#	Check valve to SPC CO2 through OECT line fails to close	1	1N 5.0E-04N	5.00E-04N	
12.	CC2SPCN3PCVN#	CC: both SPC N2 low pressure PCVs fail to open	1	1N 3.0E-04N	3.00E-04N	3.89E-09
	OPRSPCN2RTH1#	SPC N2 needle valve 1 left closed, following isolation	1	.12N 3.0E-02N	3.60E-03N	
	OPRSPCN3RTH1#	SPC N2 needle valve 2 left closed following isolation	1	.12N 3.0E-02N	3.60E-03N	
13.	CC2SPCN2RTH1#	cc: both SPC N2 addition needle valves closed	1	.12N 3.0E-03N	3.60E-04N	3.24E-09
	PCVAAAF-FTO1#	SPC N2 low pressure PCV-1 fails to open	1	1N 3.0E-03N	3.00E-03N	
	PCVAAAG-FTO1#	SPC N2 low pressure PCV-2 fails to open	1	1N 3.0E-03N	3.00E-03N	
14.	OPRSPCN2RTH1#	SPC N2 needle valve 1 left closed, following isolation	1	.12N 3.0E-02N	3.60E-03N	1.17E-10
	OPRSPCN3RTH1#	SPC N2 needle valve 2 left closed following isolation	1	.12N 3.0E-02N	3.60E-03N	
	PCVAAAF-FTO1#	SPC N2 low pressure PCV-1 fails to open	1	1N 3.0E-03N	3.00E-03N	
	PCVAAAG-FTO1#	SPC N2 low pressure PCV-2 fails to open	1	1N 3.0E-03N	3.00E-03N	

SPC N2 system unavailable Top Event Probability: 4.14E-04

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
PSVAAAA-FOP3#	PSV AAAA on N2 supply line fails open	4.00E-06	2.41E+03
CC2SPCN2SV-N#	CC: both SPC N2 HCVs fail to open	1.00E-04	2.41E+03
CC2SPCN2PCVN#	CC: both SPC N2 PCVs fail to open	3.00E-04	2.41E+03
PCVAAAE-FTO1#	SPC N2 PCV fails to open	3.00E-03	8.22E+00
PCVAAAD-FTO1#	SPC N2 PCV fails to open	3.00E-03	8.22E+00
CC2PURGESPCK#	CC: both SPC purge supply isolation valves fail to close	1.00E-04	7.02E+00
HCVAAAC-FTOG#	SPC N2 HCV AAAC fails to open	1.00E-03	3.41E+00
HCVAAAD-FTOG#	SPC N2 HCV AAAD fails to open	1.00E-03	3.41E+00
CC2SPCN3PCVN#	CC: both SPC N2 low pressure PCVs fail to open	3.00E-04	1.90E+00
CC2SPCN2RTH1#	cc: both SPC N2 addition needle valves closed	3.60E-04	1.75E+00
CV-PR2--FTCJ#	Check valve to SPC CO2 through PR fails to close	5.00E-04	1.24E+00
CV-OECT-FTCJ#	Check valve to SPC CO2 through OECT line fails to close	5.00E-04	1.24E+00
CV-PRFT-FTCJ#	Check valve to SPC CO2 through PRFT line fails to close	5.00E-04	1.24E+00
CV-OE---FTCJ#	Check valve to SPC CO2 through OE line fails to close	5.00E-04	1.24E+00
CV-PR1--FTCJ#	Check valve to SPC CO2 through PR high flow fails to close	5.00E-04	1.24E+00

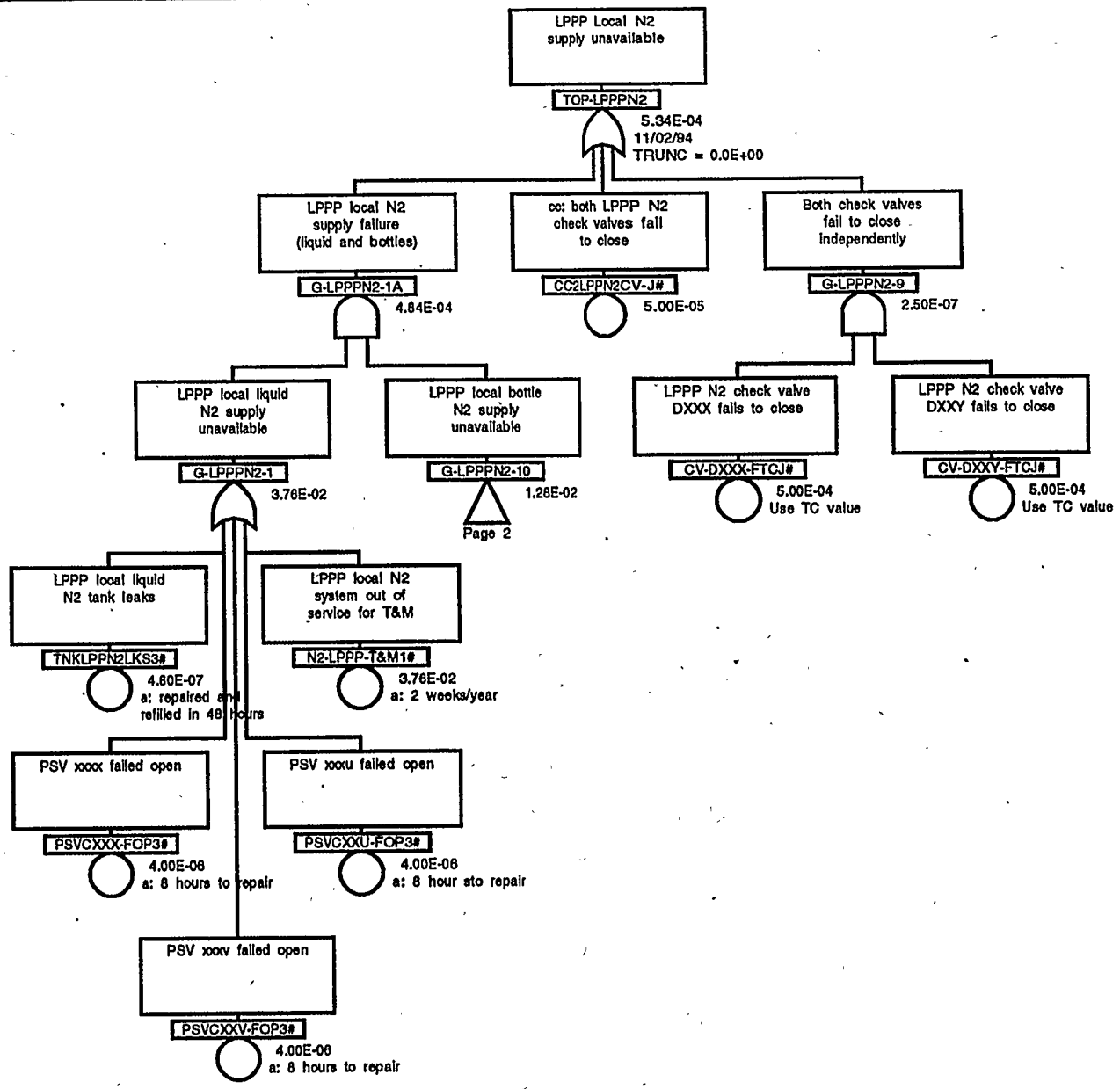
Modified top event frequency = (top event frequency) x (risk achievement worth).

Risk Reduction Worth

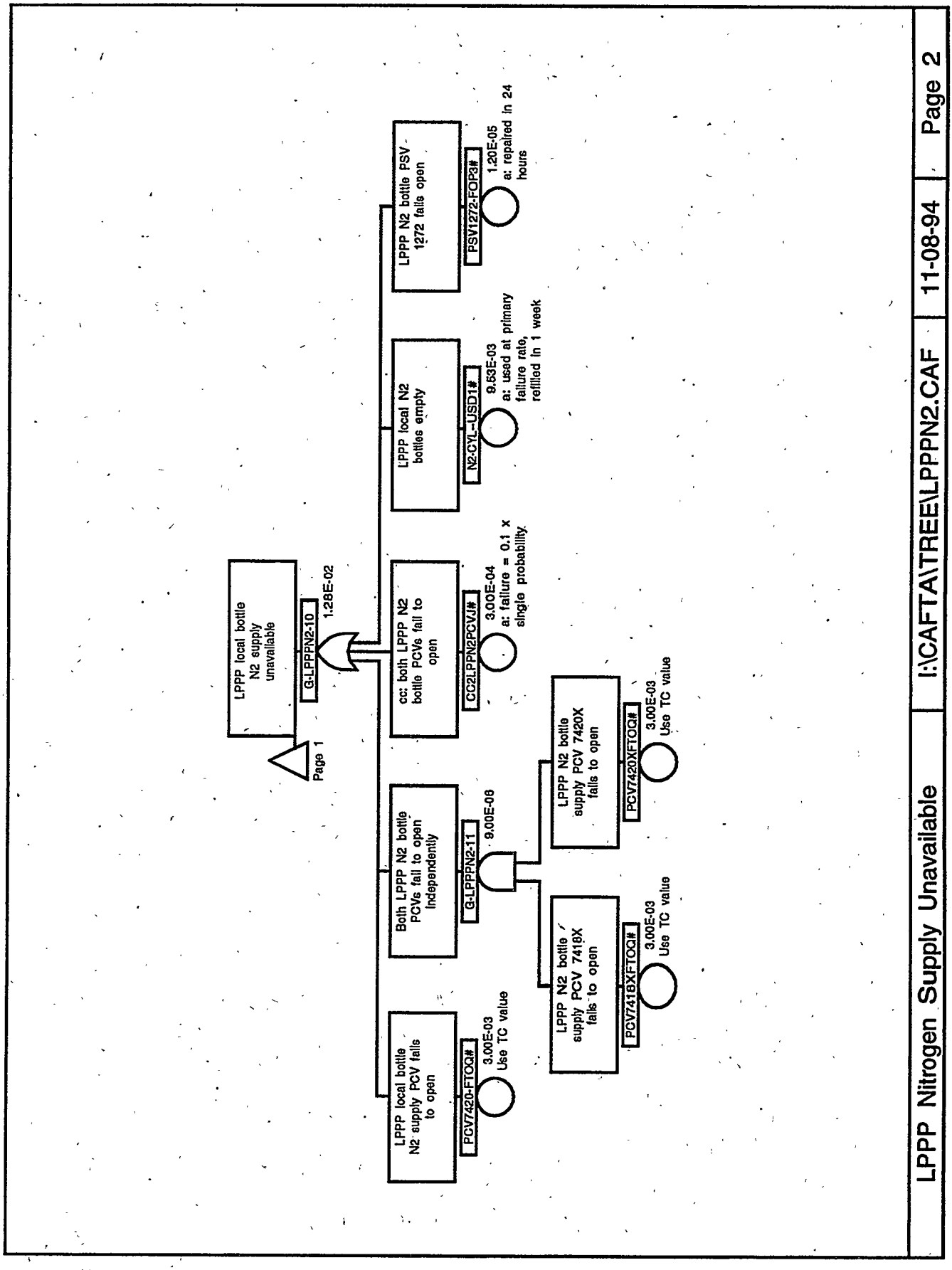
Basic Event Name	Description	Prob/Freq	RedW
CC2SPCN2PCVN#	CC: both SPC N2 PCVs fail to open	3.00E-04	3.62E+00
CC2SPCN2SV-N#	CC: both SPC N2 HCVs fail to open	1.00E-04	1.32E+00
PCVAAAE-FTO1#	SPC N2 PCV fails to open	3.00E-03	1.02E+00
PCVAAAD-FTO1#	SPC N2 PCV fails to open	3.00E-03	1.02E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

LPPP Nitrogen Purge Unavailable



LPPP Nitrogen Supply Unavailable	I:\CAFTA\TREE\LPPPN2.CAF	11-08-94	Page 1


LPPP Nitrogen Supply Unavailable
I:\CAFTA\TREE\LPPPN2.CAF
11-08-94
Page 2
LPPP local bottle N2 supply unavailable
G-LPPPN2-10
1.28E-02
Page 1
cc: both LPPP N2 bottle PCVs fail to open
CC2LPPN2PCVJ#
3.00E-04
a: failure = 0.1 x single probability
LPPP local N2 bottles empty
N2-CYL-USD1#
9.53E-03
a: used at primary failure rate, refilled in 1 week
LPPP N2 bottle PSV 1272 fails open
PSV1272-FOP3#
1.20E-05
a: repaired in 24 hours
Both LPPP N2 bottle PCVs fail to open independently
G-LPPPN2-11
9.00E-06
LPPP local bottle N2 supply PCV fails to open
PCV7420-FTOQ#
3.00E-03
Use TC value
LPPP N2 bottle supply PCV 7418X fails to open
PCV7418XFTOQ#
3.00E-03
Use TC value
LPPP N2 bottle supply PCV 7420X fails to open
PCV7420XFTOQ#
3.00E-03
Use TC value

Cutsets for I:\CAFTA\CUT\LPPPN2.CSR 11/08/94 12:16 AM

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	TOP-LPPPN2					5.34E-04
1.	N2-CYL--USD1#	LPPP local N2 bottles empty	5	7D 1Y	9.53E-03	3.59E-04
	N2-LPPP-T&M1#	LPPP local N2 system out of service for T&M	3	14D 1Y	3.76E-02	
2.	N2-LPPP-T&M1#	LPPP local N2 system out of service for T&M	3	14D 1Y	3.76E-02	1.13E-04
	PCV7420-FTOQ#	LPPP local bottle N2 supply PCV fails to open	1	1N 3.0E-03N	3.00E-03N	
3.	CC2LPPN2CV-J#	cc: both LPPP N2 check valves fail to close	1	1N 5.0E-05N	5.00E-05N	5.00E-05
4.	CC2LPPN2PCVJ#	cc: both LPPP N2 bottle PCVs fail to open	1	1N 3.0E-04N	3.00E-04N	1.13E-05
	N2-LPPP-T&M1#	LPPP local N2 system out of service for T&M	3	14D 1Y	3.76E-02	
5.	N2-LPPP-T&M1#	LPPP local N2 system out of service for T&M	3	14D 1Y	3.76E-02	4.52E-07
	PSV1272-FOP3#	LPPP N2 bottle PSV 1272 fails open	3	24H 5.0E-07H	1.20E-05	
6.	N2-LPPP-T&M1#	LPPP local N2 system out of service for T&M	3	14D 1Y	3.76E-02	3.39E-07
	PCV7418XFTOQ#	LPPP N2 bottle supply PCV 7418X fails to open	1	1N 3.0E-03N	3.00E-03N	
	PCV7420XFTOQ#	LPPP N2 bottle supply PCV 7420X fails to open	1	1N 3.0E-03N	3.00E-03N	
7.	CV-DXXX-FTCJ#	LPPP N2 check valve DXXX fails to close	1	1N 5.0E-04N	5.00E-04N	2.50E-07
	CV-DXXY-FTCJ#	LPPP N2 check valve DXXY fails to close	1	1N 5.0E-04N	5.00E-04N	
8.	N2-CYL--USD1#	LPPP local N2 bottles empty	5	7D 1Y	9.53E-03	3.81E-08
	PSVCXXV-FOP3#	PSV xxxv failed open	3	8H 5.0E-07H	4.00E-06	
9.	N2-CYL--USD1#	LPPP local N2 bottles empty	5	7D 1Y	9.53E-03	3.81E-08
	PSVCXXX-FOP3#	PSV xxxx failed open	3	8H 5.0E-07H	4.00E-06	

Cutsets for I:\CAFTA\CUT\LPPPN2.CSR 11/08/94 12:16 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
10.	N2-CYL--USD1#	LPPP local N2 bottles empty	5	7D 1Y	9.53E-03	3.81E-08
	PSVCXXU-FOP3#	PSV xxxu failed open	3	8H 5.0E-07H	4.00E-06	
11.	PCV7420-FTOQ#	LPPP local bottle N2 supply PCV fails to open	1	1N 3.0E-03N	3.00E-03N	1.20E-08
	PSVCXXX-FOP3#	PSV xxxx failed open	3	8H 5.0E-07H	4.00E-06	
12.	PCV7420-FTOQ#	LPPP local bottle N2 supply PCV fails to open	1	1N 3.0E-03N	3.00E-03N	1.20E-08
	PSVCXXU-FOP3#	PSV xxxu failed open	3	8H 5.0E-07H	4.00E-06	
13.	PCV7420-FTOQ#	LPPP local bottle N2 supply PCV fails to open	1	1N 3.0E-03N	3.00E-03N	1.20E-08
	PSVCXXV-FOP3#	PSV xxxv failed open	3	8H 5.0E-07H	4.00E-06	
14.	N2-CYL--USD1#	LPPP local N2 bottles empty	5	7D 1Y	9.53E-03	4.57E-09
	TNKLPPN2LKS3#	LPPP local liquid N2 tank leaks	3	48H 1.0E-08H	4.80E-07	
15.	PCV7420-FTOQ#	LPPP local bottle N2 supply PCV fails to open	1	1N 3.0E-03N	3.00E-03N	1.44E-09
	TNKLPPN2LKS3#	LPPP local liquid N2 tank leaks	3	48H 1.0E-08H	4.80E-07	
16.	CC2LPPN2PCVJ#	cc: both LPPP N2 bottle PCVs fail to open	1	1N 3.0E-04N	3.00E-04N	1.20E-09
	PSVCXXV-FOP3#	PSV xxxv failed open	3	8H 5.0E-07H	4.00E-06	
17.	CC2LPPN2PCVJ#	cc: both LPPP N2 bottle PCVs fail to open	1	1N 3.0E-04N	3.00E-04N	1.20E-09
	PSVCXXX-FOP3#	PSV xxxx failed open	3	8H 5.0E-07H	4.00E-06	
18.	CC2LPPN2PCVJ#	cc: both LPPP N2 bottle PCVs fail to open	1	1N 3.0E-04N	3.00E-04N	1.20E-09
	PSVCXXU-FOP3#	PSV xxxu failed open	3	8H 5.0E-07H	4.00E-06	
19.	CC2LPPN2PCVJ#	cc: both LPPP N2 bottle PCVs fail to open	1	1N 3.0E-04N	3.00E-04N	1.44E-10

Set No.	Event Name	Description	C	B.E. Prob	Calc. Result	Cutset Prob
	TNKLPPN2LKS3#	LPPP local liquid N2 tank leaks	3	48H 1.0E-08H	4.80E-07	
20.	PSV1272-FOP3#	LPPP N2 bottle PSV 1272 fails open	3	24H 5.0E-07H	1.20E-05	4.80E-11
	PSVCXXV-FOP3#	PSV xxxv failed open	3	8H 5.0E-07H	4.00E-06	
21.	PSV1272-FOP3#	LPPP N2 bottle PSV 1272 fails open	3	24H 5.0E-07H	1.20E-05	4.80E-11
	PSVCXXX-FOP3#	PSV xxxx failed open	3	8H 5.0E-07H	4.00E-06	
22.	PSV1272-FOP3#	LPPP N2 bottle PSV 1272 fails open	3	24H 5.0E-07H	1.20E-05	4.80E-11
	PSVCXXU-FOP3#	PSV xxxu failed open	3	8H 5.0E-07H	4.00E-06	
23.	PCV7418XFTOQ#	LPPP N2 bottle supply PCV 7418X fails to open	1	1N 3.0E-03N	3.00E-03N	3.60E-11
	PCV7420XFTOQ#	LPPP N2 bottle supply PCV 7420X fails to open	1	1N 3.0E-03N	3.00E-03N	
	PSVCXXV-FOP3#	PSV xxxv failed open	3	8H 5.0E-07H	4.00E-06	
24.	PCV7418XFTOQ#	LPPP N2 bottle supply PCV 7418X fails to open	1	1N 3.0E-03N	3.00E-03N	3.60E-11
	PCV7420XFTOQ#	LPPP N2 bottle supply PCV 7420X fails to open	1	1N 3.0E-03N	3.00E-03N	
	PSVCXXX-FOP3#	PSV xxxx failed open	3	8H 5.0E-07H	4.00E-06	
25.	PCV7418XFTOQ#	LPPP N2 bottle supply PCV 7418X fails to open	1	1N 3.0E-03N	3.00E-03N	3.60E-11
	PCV7420XFTOQ#	LPPP N2 bottle supply PCV 7420X fails to open	1	1N 3.0E-03N	3.00E-03N	
	PSVCXXU-FOP3#	PSV xxxu failed open	3	8H 5.0E-07H	4.00E-06	

LPPP Local N2 supply unavailable Top Event Probability: 5.34E-04

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
CC2LPPN2CV-J#	cc: both LPPP N2 check valves fail to close	5.00E-05	1.87E+03
PSV1272-FOP3#	LPPP N2 bottle PSV 1272 fails open	1.20E-05	7.15E+01
CC2LPPN2PCVJ#	cc: both LPPP N2 bottle PCVs fail to open	3.00E-04	7.15E+01
PCV7420-FTOQ#	LPPP local bottle N2 supply PCV fails to open	3.00E-03	7.13E+01
N2-CYL--USD1#	LPPP local N2 bottles empty	9.53E-03	7.08E+01
TNKLPPN2LKS3#	LPPP local liquid N2 tank leaks	4.80E-07	2.50E+01
PSVCXXX-FOP3#	PSV xxxx failed open	4.00E-06	2.50E+01
PSVCXXV-FOP3#	PSV xxxv failed open	4.00E-06	2.50E+01
PSVCXXU-FOP3#	PSV xxxu failed open	4.00E-06	2.50E+01
N2-LPPP-T&M1#	LPPP local N2 system out of service for T&M	3.76E-02	2.41E+01
CV-DXXX-FTCJ#	LPPP N2 check valve DXXX fails to close	5.00E-04	1.94E+00
CV-DXXY-FTCJ#	LPPP N2 check valve DXXY fails to close	5.00E-04	1.94E+00
PCV7418XFTOQ#	LPPP N2 bottle supply PCV 7418X fails to open	3.00E-03	1.21E+00
PCV7420XFTOQ#	LPPP N2 bottle supply PCV 7420X fails to open	3.00E-03	1.21E+00

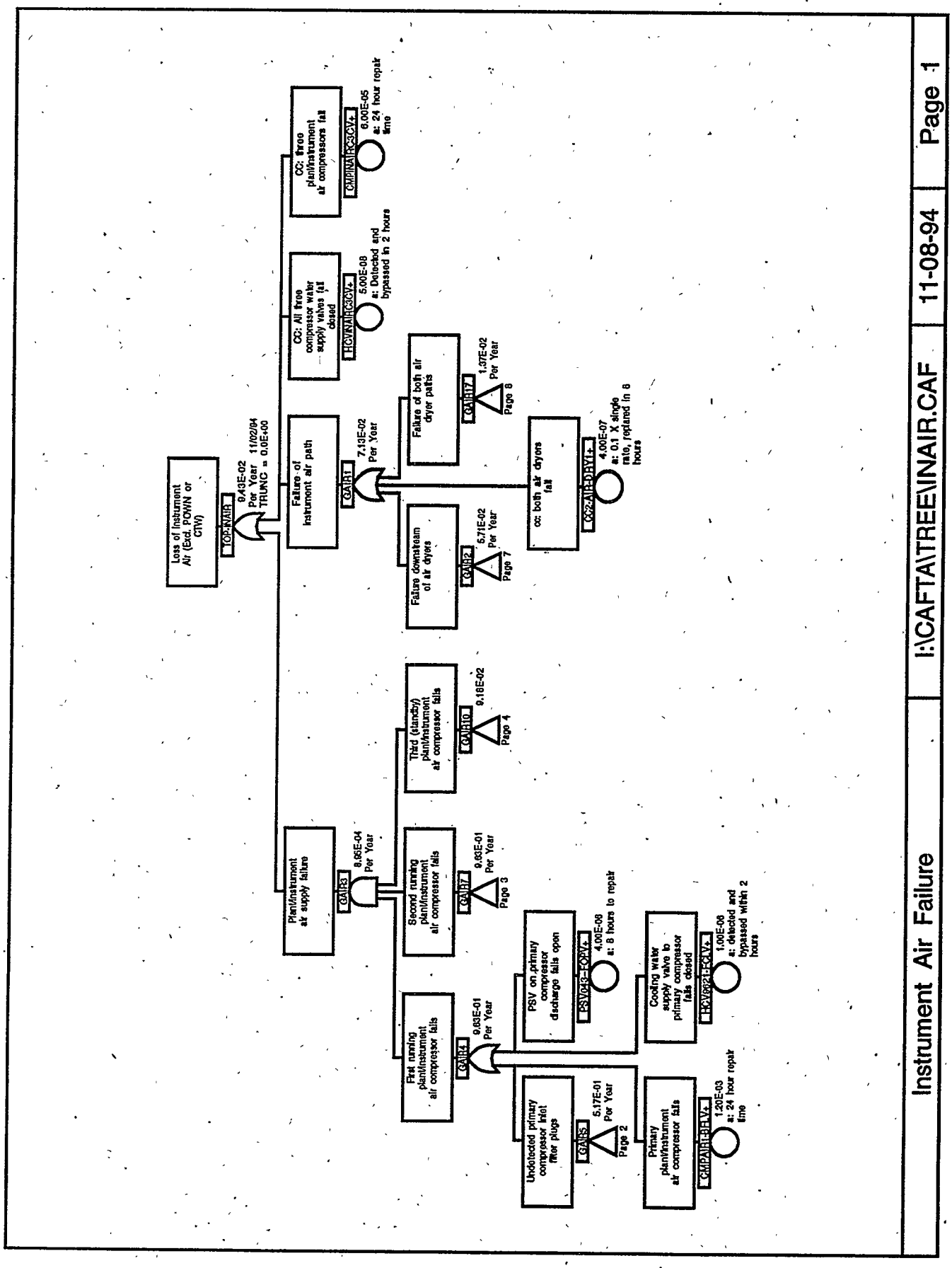
Modified top event frequency = (top event frequency) x (risk achievement worth).

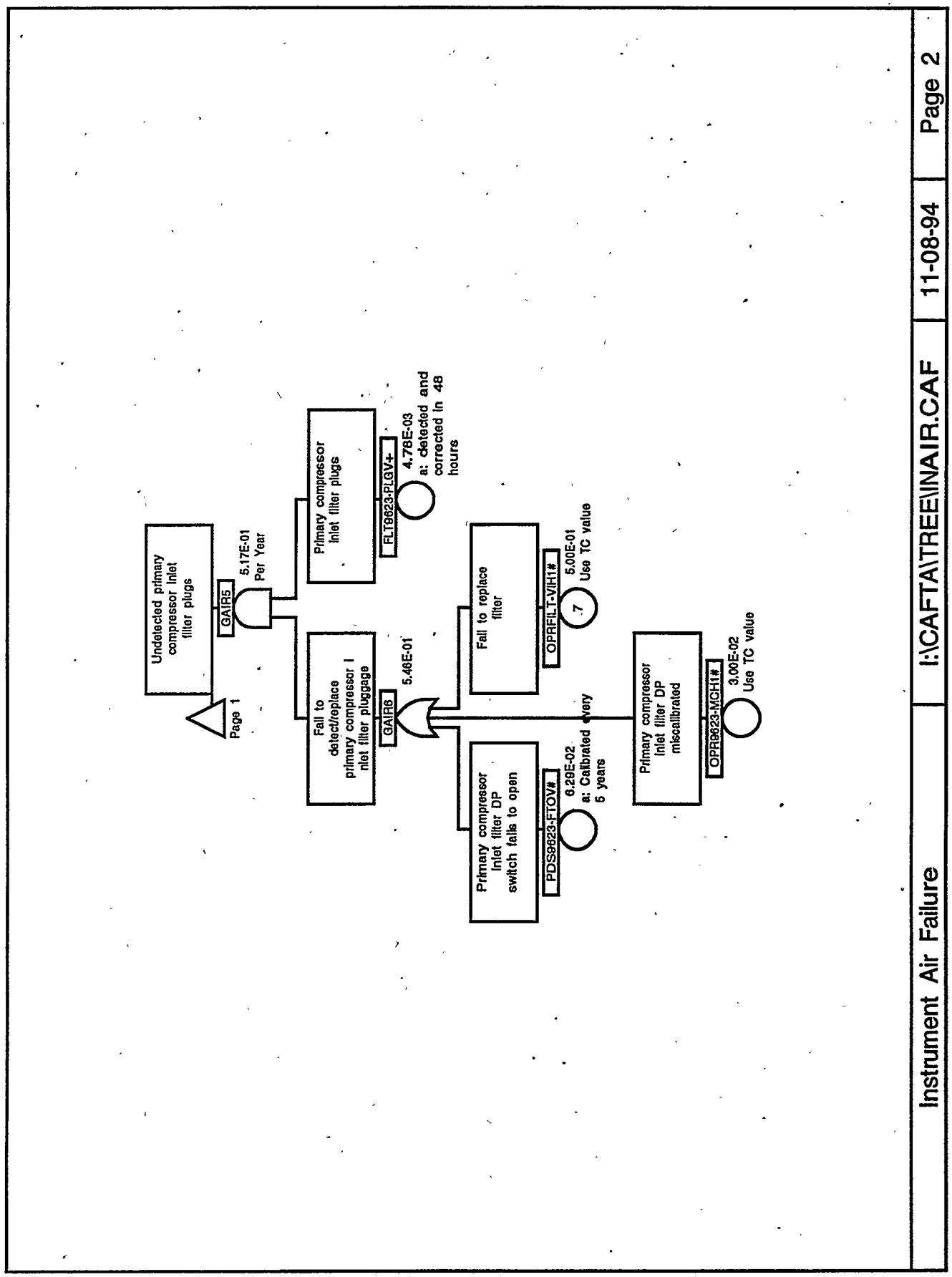
Risk Reduction Worth

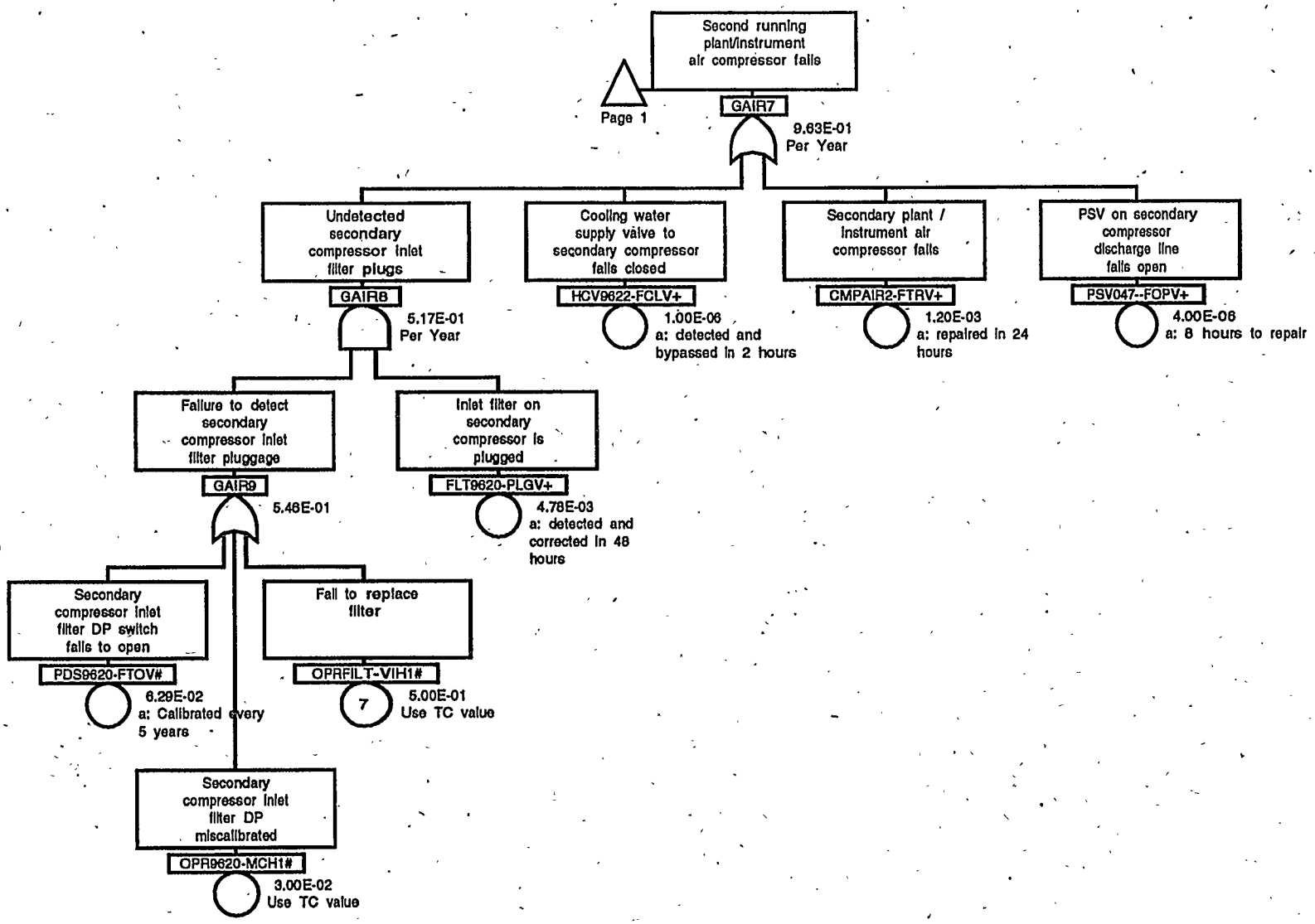
Basic Event Name	Description	Prob/Freq	RedW
N2-LPPP-T&M1#	LPPP local N2 system out of service for T&M	3.76E-02	1.06E+01
N2-CYL--USD1#	LPPP local N2 bottles empty	9.53E-03	3.05E+00
PCV7420-FTOQ#	LPPP local bottle N2 supply PCV fails to open	3.00E-03	1.27E+00
CC2LPPN2CV-J#	cc: both LPPP N2 check valves fail to close	5.00E-05	1.10E+00
CC2LPPN2PCVJ#	cc: both LPPP N2 bottle PCVs fail to open	3.00E-04	1.02E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

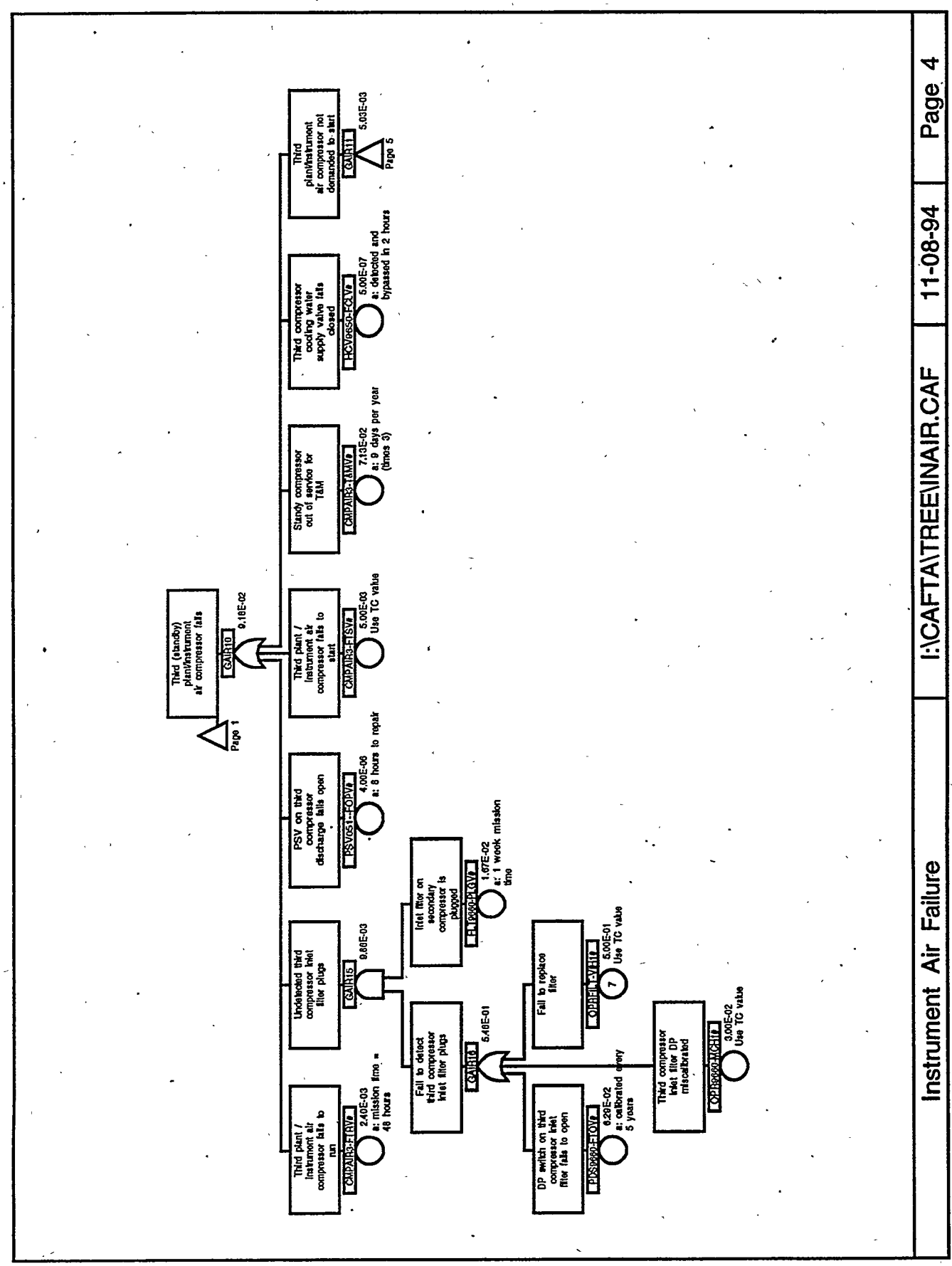
Instrument Air Failure

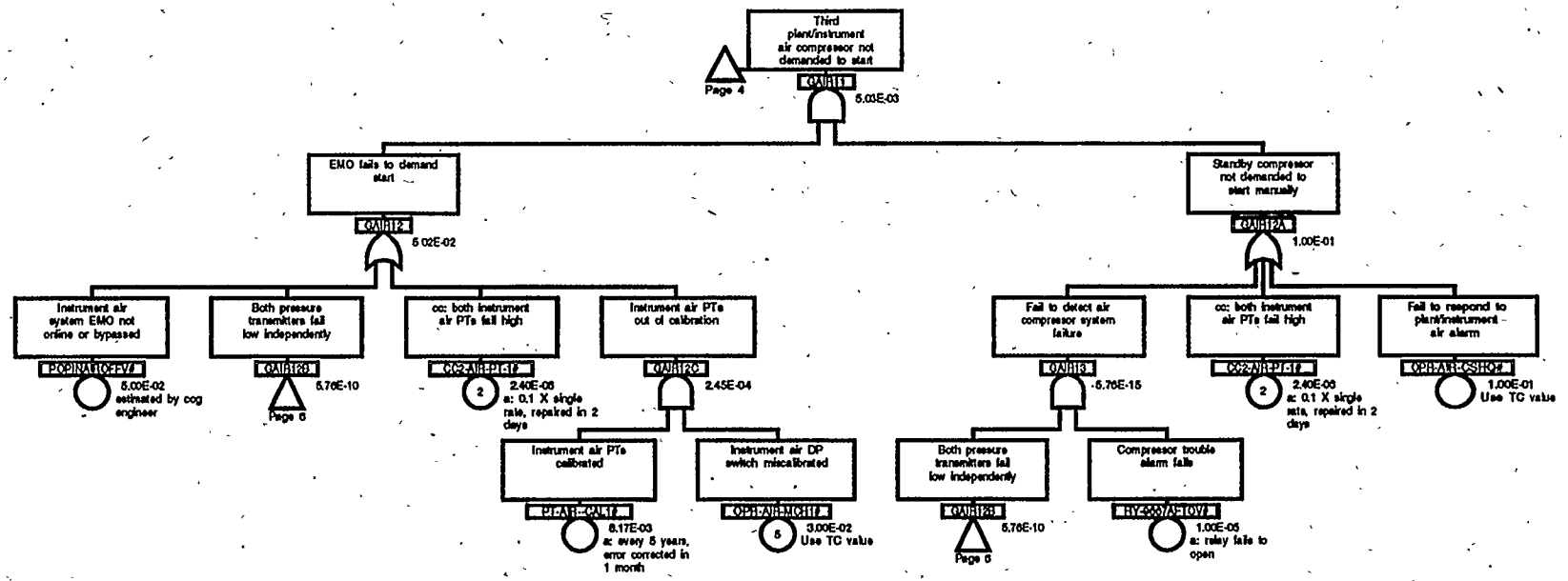

Instrument Air Failure
I:\CAFTA\TREE\INAIR.CAF
11-08-94
Page 1
Loss of Instrument Air (Excl. POWN or CIW)
TOP-INAIR
9.43E-02 Per Year 11/02/94 TRUNC = 0.0E+00
Failure of instrument air path
GAIR1
7.18E-02 Per Year
CC: three plant/instrument air compressors fail
CMPINAIR-3CCF
6.00E-05 a: 24 hour repair time
CC: All three compressor water supply valves fail closed
HCVINAIR-3CCF
5.00E-08 a: Detected and bypassed in 2 hours
Failure of both air dryer paths
GAIR17
1.37E-02 Per Year Page 8
Failure downsteam of air dryers
GAIR2
5.71E-02 Per Year Page 7
cc: both air dryers fail
CC2-AIR-DRYF
4.00E-07 a: 0.1 X single rate, replaced in 8 hours
Plant/instrument air supply failure
GAIR3
8.65E-04 Per Year
Third (standby) plant/instrument air compressor fails
GAIR10
9.18E-02 Page 4
Second running plant/instrument air compressor fails
GAIR7
9.63E-01 Per Year Page 3
First running plant/instrument air compressor fails
GAIR4
9.63E-01 Per Year
PSV on primary compressor discharge fails open
PSV0945-FOPN
4.00E-06 a: 8 hours to repair
Cooling water supply valve to primary compressor fails closed
HCV0921-FCPN
1.00E-06 a: detected and bypassed within 2 hours
Undetected primary compressor inlet filter plugs
GAIR5
5.17E-01 Per Year Page 2
Primary plant/instrument air compressor fails
CMPAIR-1FHPN
1.20E-03 a: 24 hour repair time


Undetected primary compressor Inlet filter plugs
GAIR5
5.17E-01
Per Year
Primary compressor Inlet filter plugs
FLT9623-PLGV+
4.78E-03
a: detected and corrected in 48 hours
Page 1
Fail to detect/replace primary compressor I nlet filter pluggage
GAIR6
5.46E-01
Fail to replace filter
OPRFILT-VIH1#
.7
5.00E-01
Use TC value
Primary compressor Inlet filter DP switch fails to open
PDS9623-FTOV#
6.29E-02
a: Calbrated every 5 years
Primary compressor Inlet filter DP miscalibrated
OPR9623-MCH1#
3.00E-02
Use TC value
Instrument Air Failure
I:\CAFTA\TREE\INAIR.CAF
11-08-94
Page 2

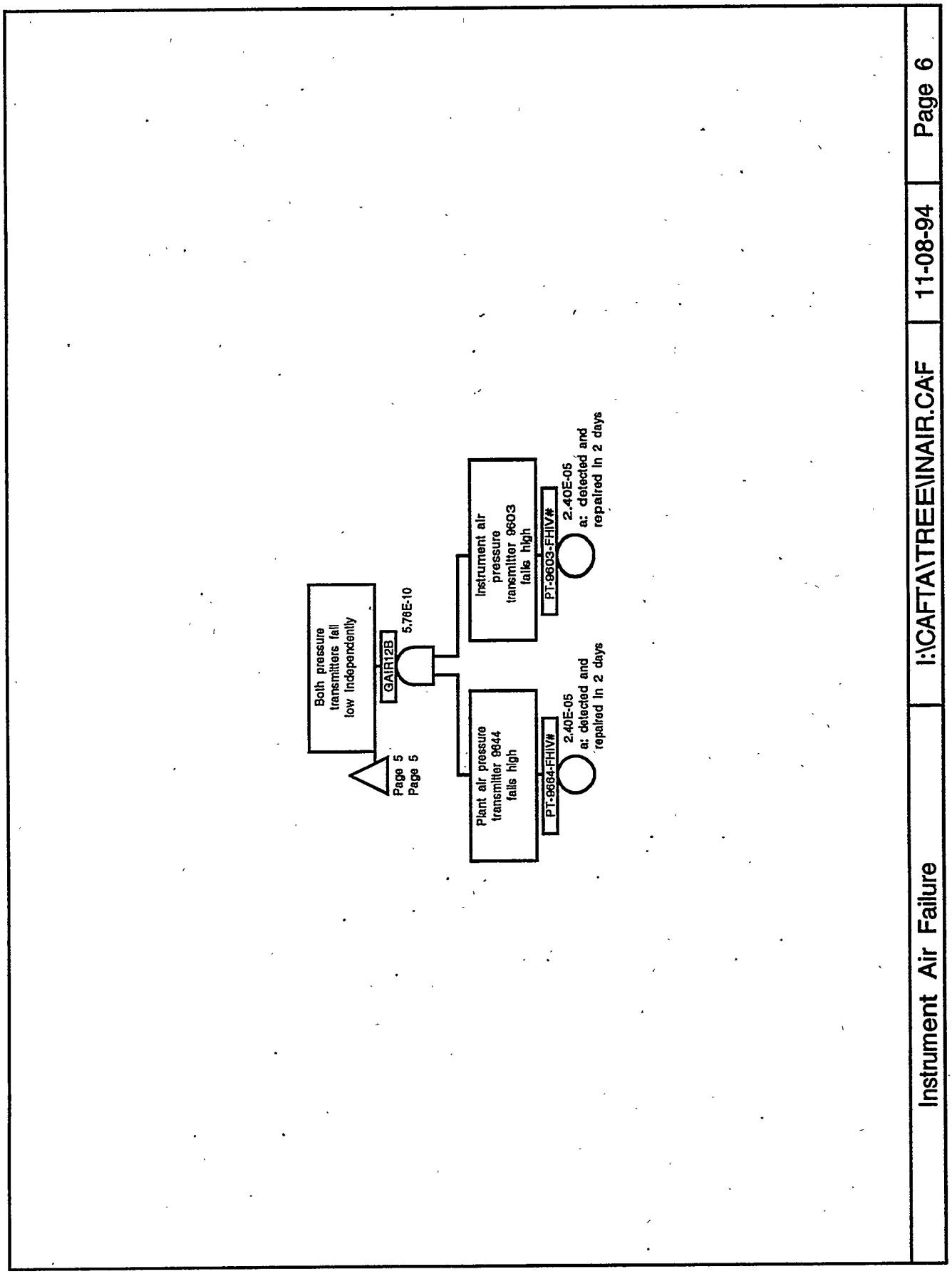


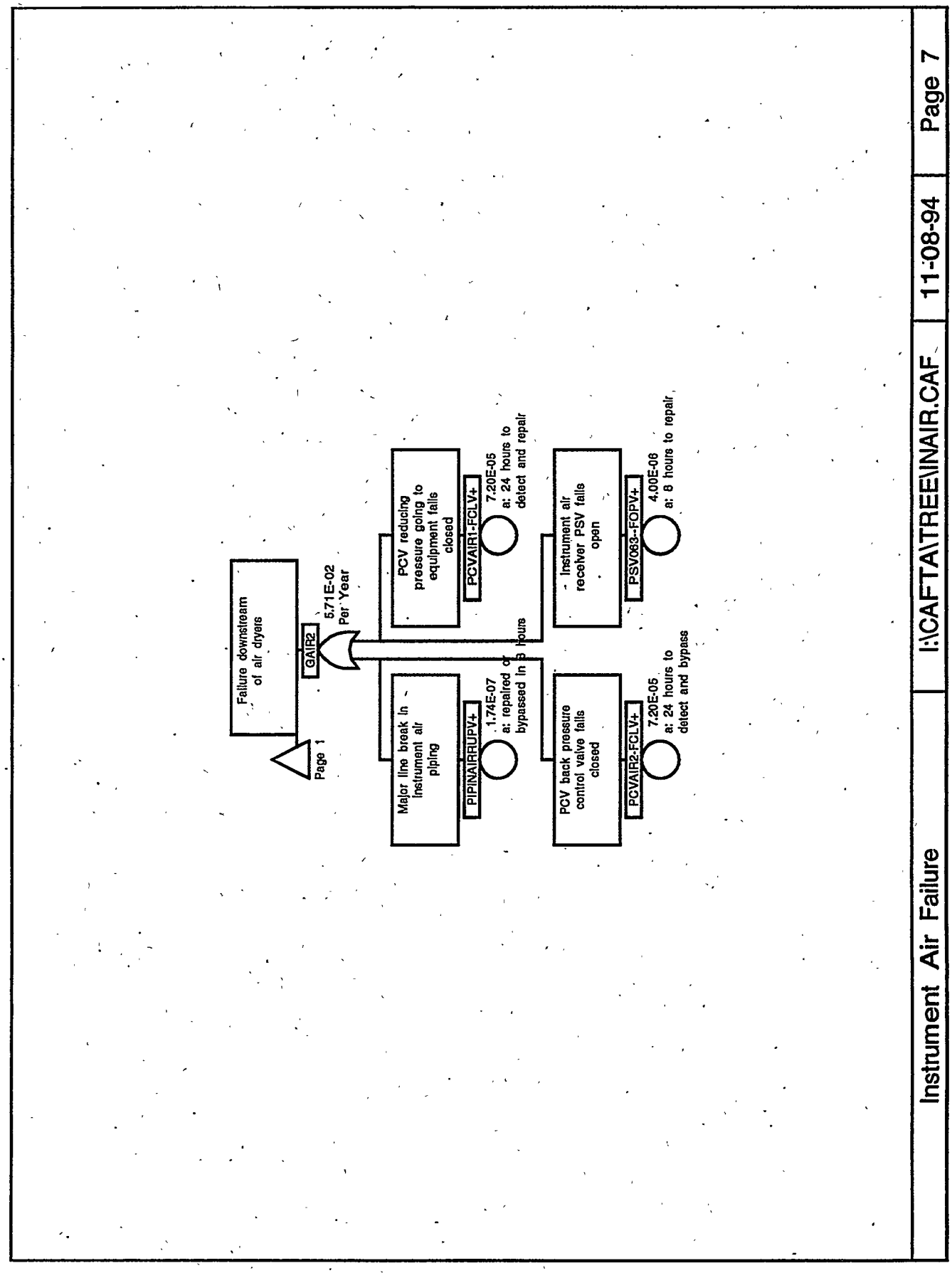
Instrument Air Failure	I:\CAFTA\TREE\INAIR.CAF	11-08-94	Page 3

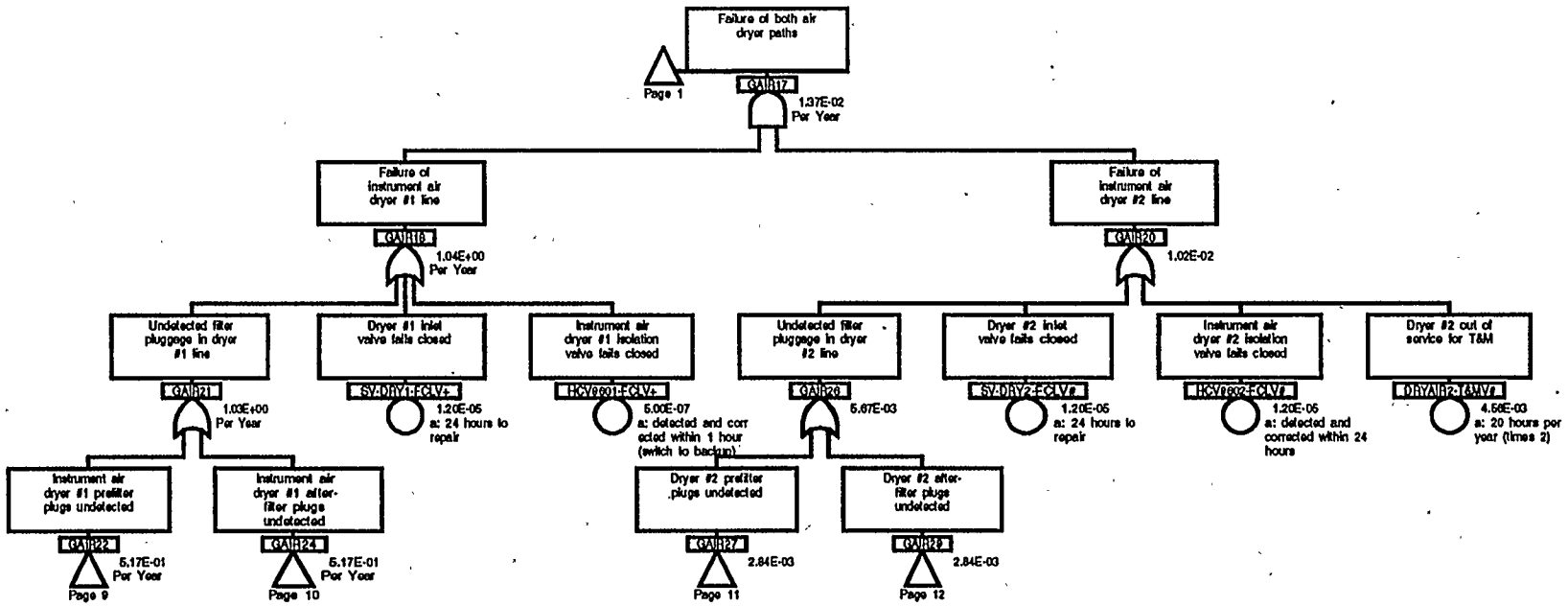

Third (standby) plant/instrument air compressor fails
GAIR10
9.18E-02
Page 1
Third plant / instrument air compressor fails to run
CMPAIR3-FTRVP
2.40E-03
a: mission time = 48 hours
Undetected third compressor inlet filter plugs
GAIN15
9.86E-03
Fail to detect third compressor inlet filter plugs
GAIR16
5.46E-01
DP switch on third compressor inlet filter fails to open
PDSB660-FOVP
6.29E-02
a: calibrated every 5 years
Fail to replace filter
OPRELTY-H16
5.00E-01
Use TC value
7
Third compressor inlet filter DP miscalibrated
LOPB660-MCH16
3.00E-02
Use TC value
Inlet filter on secondary compressor is plugged
FILB660-PLGVP
1.97E-02
a: 1 week mission time
PSV on third compressor discharge fails open
PSVG61-FOPVP
4.00E-06
a: 8 hours to repair
Third plant / instrument air compressor fails to start
CMPAIR3-FTSVP
5.00E-03
Use TC value
Standy compressor out of service for T&M
CMPAIR3-TMVP
7.13E-02
a: 9 days per year (tmos 3)
Third compressor cooling water supply valve fails closed
HCVG650-FCVP
5.00E-07
a: detected and bypassed in 2 hours
Third plant/instrument air compressor not demanded to start
GAIR11
5.03E-03
Page 5
Instrument Air Failure
I:\CAFTA\TREE\INAIR.CAF
11-08-94
Page 4



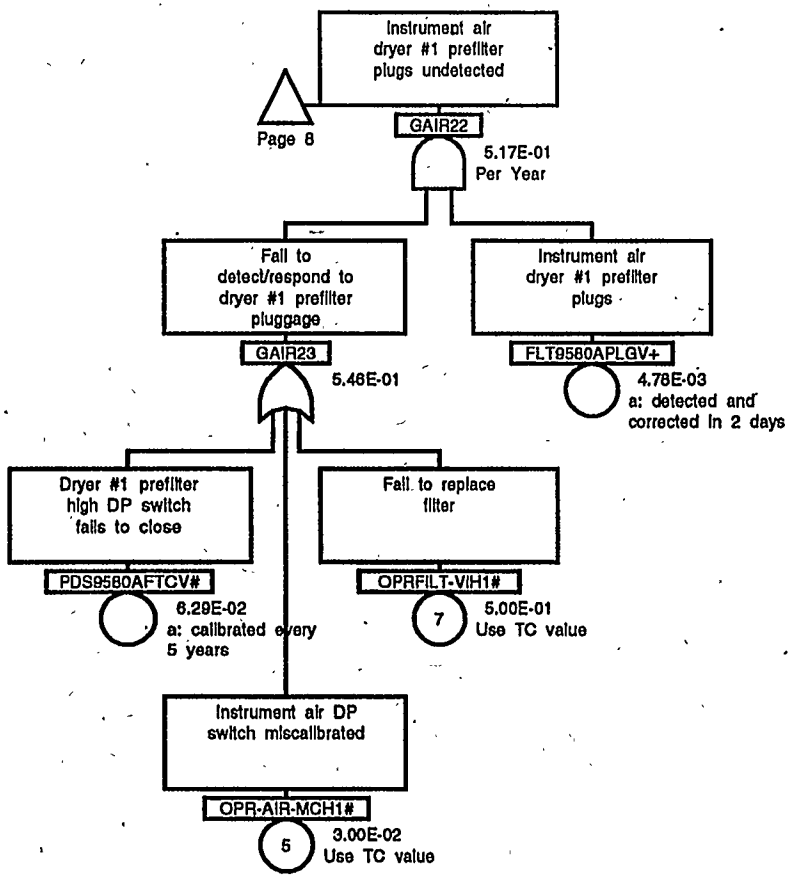
Instrument Air Failure	I:\CAFTA\TREE\INAIR.CAF	11-08-94	Page 5

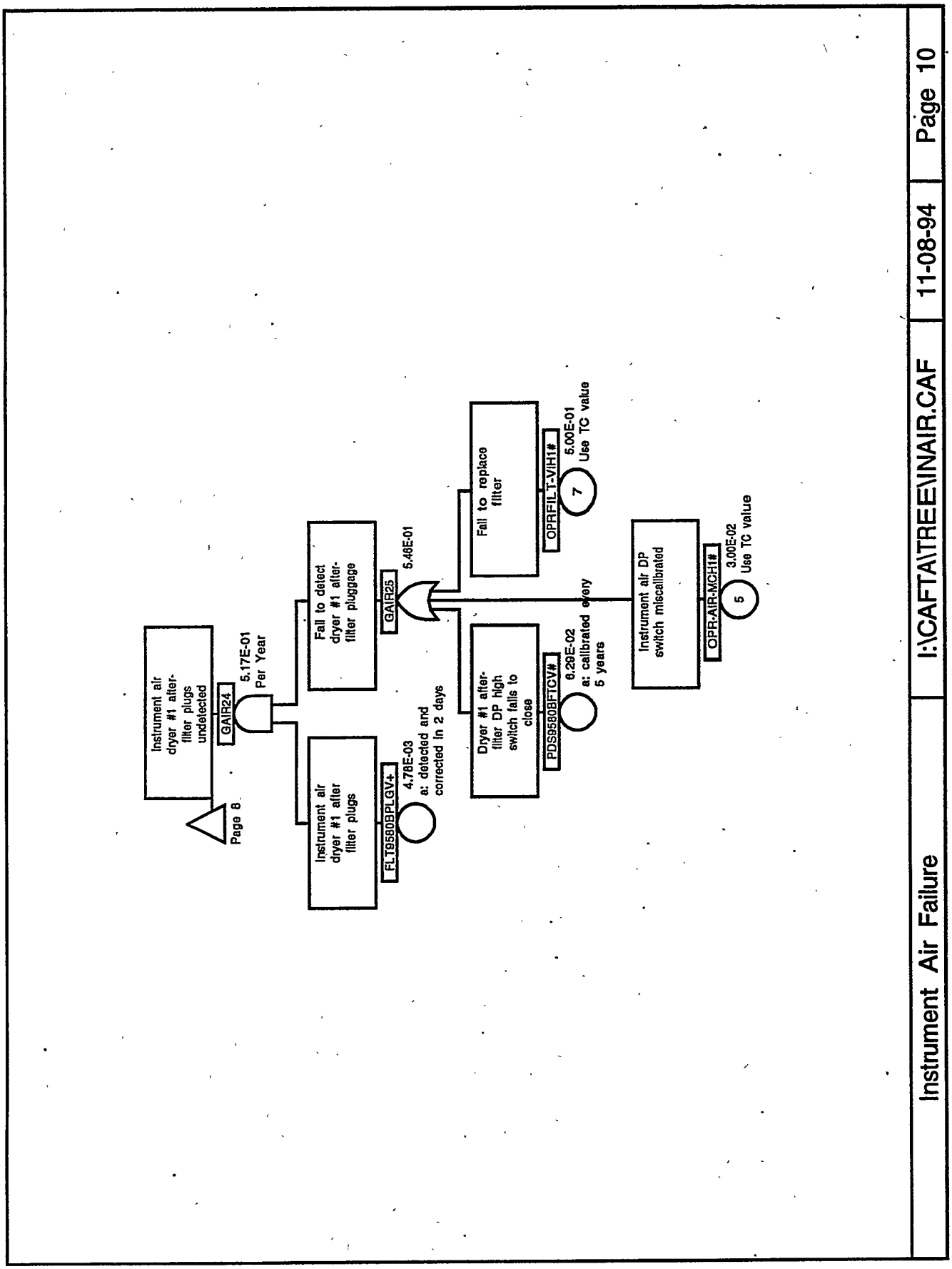

Instrument Air Failure
I:\CAFTA\TREE\INAIR.CAF
11-08-94
Page 6
Both pressure transmitters fail low independently
Page 5
Page 5
GAIR12B
5.78E-10
Plant air pressure transmitter 9844 fails high
PT-9684-FHIV#
2.40E-05
a: detected and repaired in 2 days
Instrument air pressure transmitter 9603 fails high
PT-9603-FHIV#
2.40E-05
a: detected and repaired in 2 days


Instrument Air Failure
I:\CAFTA\TREE\INAIR.CAF
11-08-94
Page 7
Failure downstream of air dryers
GAIR2
5.71E-02
Per Year
Page 1
Major line break in instrument air piping
PIPINAIRRUPV+
1.74E-07
a: repaired or bypassed in 8 hours
PCV reducing pressure going to equipment fails closed
PCVAIR1-FCLV+
7.20E-05
a: 24 hours to detect and repair
PCV back pressure control valve fails closed
PCVAIR2-FCLV+
7.20E-05
a: 24 hours to detect and bypass
Instrument air receiver PSV fails open
PSV063--FOPV+
4.00E-06
a: 8 hours to repair



Instrument Air Failure	I:\CAFTA\TREE\INAIR.CAF	11-08-94	Page 8


Instrument air dryer #1 prefilter plugs undetected
Page 8
GAIR22
5.17E-01
Per Year
Fail to detect/respond to dryer #1 prefilter pluggage
Instrument air dryer #1 prefilter plugs
GAIR23
5.46E-01
FLT9580APLGV+
4.78E-03
a: detected and corrected in 2 days
Dryer #1 prefilter high DP switch fails to close
Fail to replace filter
PDS9580AFTCV#
6.29E-02
a: calibrated every 5 years
OPRFILT-VIH1#
7
5.00E-01
Use TC value
Instrument air DP switch miscalibrated
OPR-AIR-MCH1#
5
3.00E-02
Use TC value


Instrument air dryer #1 after-filter plugs undetected
GAIR24
5.17E-01
Per Year
Page 8
Instrument air dryer #1 after filter plugs
FLT9580BPLGV+
4.78E-03
a: detected and corrected in 2 days
Fail to detect dryer #1 after-filter pluggage
GAIR25
5.46E-01
Dryer #1 after-filter DP high switch fails to close
PDS9580BFTCV#
6.29E-02
a: calibrated every 5 years
Fail to replace filter
OPRFILT-VIH1#
7
5.00E-01
Use TC value
Instrument air DP switch miscalibrated
OPR-AIR-MCH1#
5
3.00E-02
Use TC value
Instrument Air Failure
I:\CAFTA\TREE\INAIR.CAF
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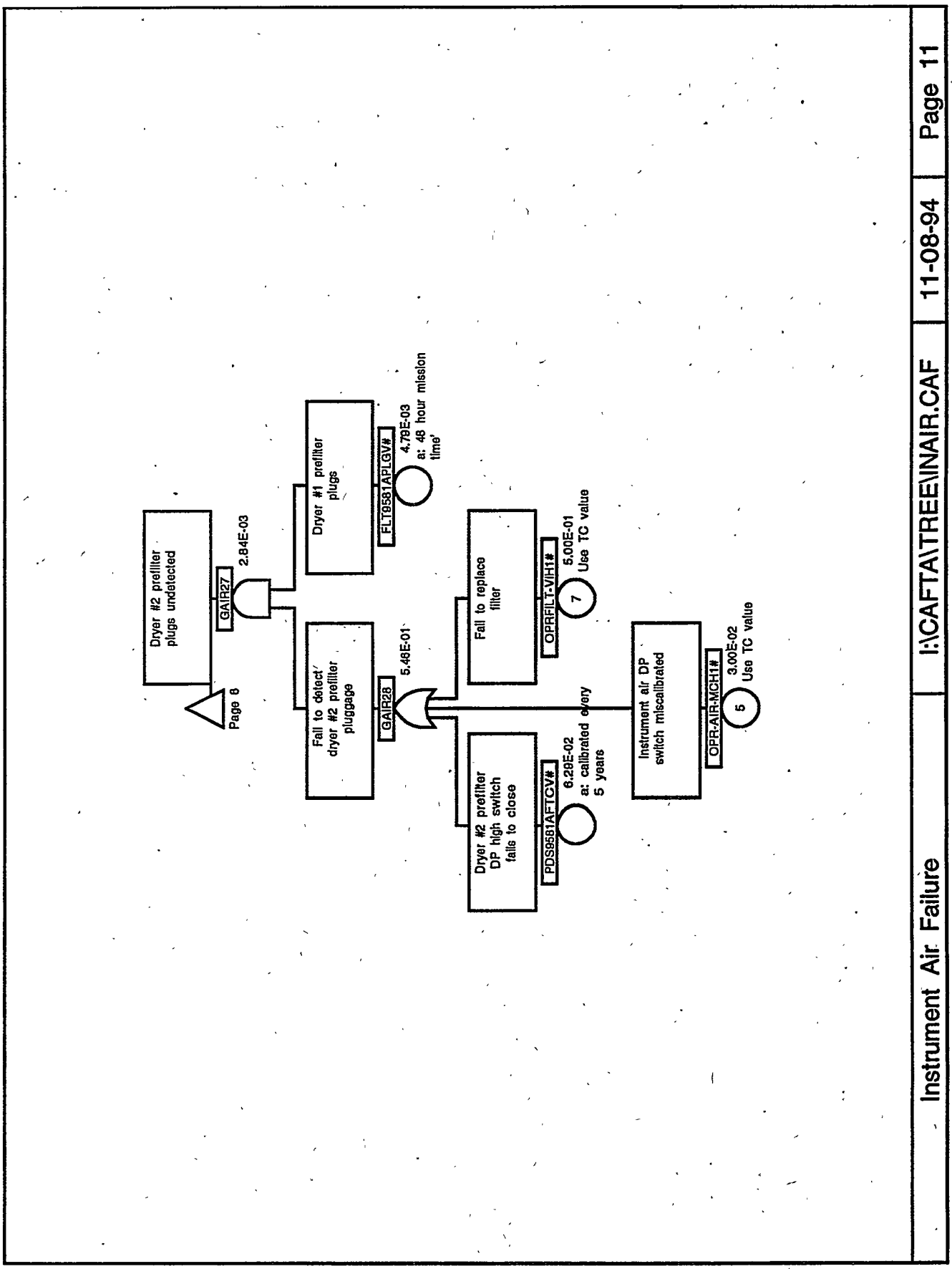
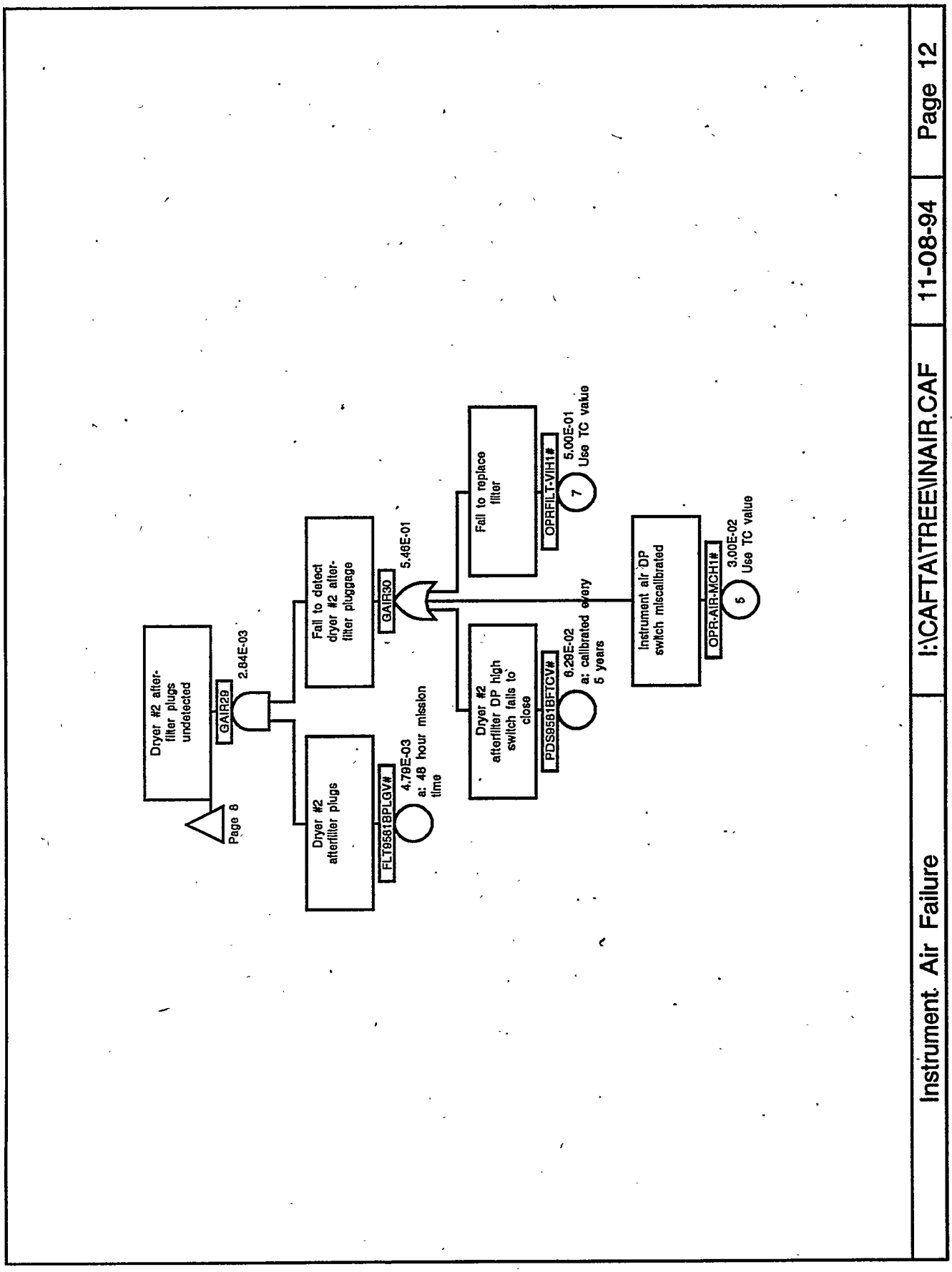

Instrument Air Failure
I:\CAFTA\TREE\INAIR.CAF
11-08-94
Page 11
Dryer #2 prefilter plugs undetected
GAIR27
2.84E-03
Dryer #1 prefilter plugs
FLT9581APLGV#
4.79E-03
a: 48 hour mission time
Page 8
Fail to detect dryer #2 prefilter pluggage
GAIR28
5.46E-01
Fail to replace filter
OPRFILT-VIH1#
7
5.00E-01
Use TC value
Dryer #2 prefilter DP high switch fails to close
PDS9581AFTCV#
8.29E-02
a: calibrated every 5 years
Instrument air DP switch miscalibrated
OPR-AIR-MCH1#
5
3.00E-02
Use TC value


Instrument Air Failure
I:\CAFTA\TREE\INAIR.CAF
11-08-94
Page 12
Dryer #2 after-filter plugs undetected
GAIR29
2.84E-03
Page 8
Fail to detect dryer #2 after-filter pluggage
GAIR30
5.46E-01
Dryer #2 afterfilter plugs
FLT95B1BPLGV#
4.79E-03
a: 48 hour mission time
Fail to replace filter
OPRFILT-VIH1#
7
5.00E-01
Use TC value
Dryer #2 afterfilter DP high switch fails to close
PDS95B1BFTCV#
6.29E-02
a: calibrated every 5 years
Instrument air DP switch miscalibrated
OPR-AIR-MCH1#
6
3.00E-02
Use TC value

Cutsets for I:\CAFTA\CUT\INAIR.CSR 11/08/94 12:17 AM

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	TOP-INAIR					9.43E-02
1.	PCVAIR2-FCLV+	PCV back pressure control valve fails closed	4	24H 3.0E-06H	7.20E-05	2.63E-02
2.	PCVAIR1-FCLV+	PCV reducing pressure going to equipment fails closed	4	24H 3.0E-06H	7.20E-05	2.63E-02
3.	CMPINAIRC3CV+	CC: three plant/instrument air compressors fail	4	24H 2.5E-06H	6.00E-05	2.19E-02
4.	PSV063--FOPV+	Instrument air receiver PSV fails open	4	8H 5.0E-07H	4.00E-06	4.38E-03
5.	FLT9580APLGV+	Instrument air dryer #1 prefilter plugs	4	48H 1.0E-04H	4.78E-03	2.09E-03
	FLT9581BPLGV#	Dryer #2 afterfilter plugs	3	48H 1.0E-04H	4.79E-03	
	OPRFILT-VIH1#	Fail to replace filter	1	1N 5.0E-01N	5.00E-01N	
6.	FLT9580APLGV+	Instrument air dryer #1 prefilter plugs	4	48H 1.0E-04H	4.78E-03	2.09E-03
	FLT9581APLGV#	Dryer #1 prefilter plugs	3	48H 1.0E-04H	4.79E-03	
	OPRFILT-VIH1#	Fail to replace filter	1	1N 5.0E-01N	5.00E-01N	
7.	FLT9580BPLGV+	Instrument air dryer #1 after filter plugs	4	48H 1.0E-04H	4.78E-03	2.09E-03
	FLT9581APLGV#	Dryer #1 prefilter plugs	3	48H 1.0E-04H	4.79E-03	
	OPRFILT-VIH1#	Fail to replace filter	1	1N 5.0E-01N	5.00E-01N	
8.	FLT9580BPLGV+	Instrument air dryer #1 after filter plugs	4	48H 1.0E-04H	4.78E-03	2.09E-03
	FLT9581BPLGV#	Dryer #2 afterfilter plugs	3	48H 1.0E-04H	4.79E-03	
	OPRFILT-VIH1#	Fail to replace filter	1	1N 5.0E-01N	5.00E-01N	
9.	DRYAIR2-T&MV#	Dryer #2 out of service for T&M	3	40H 1Y	4.56E-03	1.99E-03
	FLT9580BPLGV+	Instrument air dryer #1 after filter plugs	4	48H 1.0E-04H	4.78E-03	
	OPRFILT-VIH1#	Fail to replace filter	1	1N 5.0E-01N	5.00E-01N	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq.(/yr)
10.	DRYAIR2-T&MV#	Dryer #2 out of service for T&M	3	40H 1Y	4.56E-03	1.99E-03
	FLT9580APLGV+	Instrument air dryer #1 prefilter plugs	4	48H 1.0E-04H	4.78E-03	
	OPRFILT-VIH1#	Fail to replace filter	1	1N 5.0E-01N	5.00E-01N	
11.	CC2-AIR-DRY1+	cc: both air dryers fail	4	8H 5.0E-08H	4.00E-07	4.38E-04
12.	CMPAIR3-T&MV#	Standy compressor out of service for T&M	3	27D 1Y	7.13E-02	2.97E-04
	FLT9620-PLGV+	Inlet filter on secondary compressor is plugged	4	48H 1.0E-04H	4.78E-03	
	FLT9623-PLGV+	Primary compressor inlet filter plugs	4	48H 1.0E-04H	4.78E-03	
	OPRFILT-VIH1#	Fail to replace filter	1	1N 5.0E-01N	5.00E-01N	
13.	DRYAIR2-T&MV#	Dryer #2 out of service for T&M	3	40H 1Y	4.56E-03	2.50E-04
	FLT9580BPLGV+	Instrument air dryer #1 after filter plugs	4	48H 1.0E-04H	4.78E-03	
	PDS9580BFTCV#	Dryer #1 after-filter DP high switch fails to close	5	5Y 3.0E-06H	6.29E-02	
14.	DRYAIR2-T&MV#	Dryer #2 out of service for T&M	3	40H 1Y	4.56E-03	2.50E-04
	FLT9580APLGV+	Instrument air dryer #1 prefilter plugs	4	48H 1.0E-04H	4.78E-03	
	PDS9580AFTCV#	Dryer #1 prefilter high DP switch fails to close	5	5Y 3.0E-06H	6.29E-02	
15.	HCVINAIRC3CV+	CC: All three compressor water supply valves fail closed	4	2H 2.5E-08H	5.00E-08	2.19E-04
16.	PIPINAIRRUPV+	Major line break in instrument air piping	4	8H 2.18E-08H	1.74E-07	1.91E-04
17.	FLT9580BPLGV+	Instrument air dryer #1 after filter plugs	4	48H 1.0E-04H	4.78E-03	1.25E-04
	FLT9581APLGV#	Dryer #1 prefilter plugs	3	48H 1.0E-04H	4.79E-03	
	OPR-AIR-MCH1#	Instrument air DP switch miscalibrated	1	1N 3.0E-02N	3.00E-02N	

Cutsets for I:\CAFTA\CUT\INAIR.CSR 11/08/94 12:17 AM (CONT.)

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
18.	FLT9580BPLGV+	Instrument air dryer #1 after filter plugs	4	48H 1.0E-04H	4.78E-03	1.25E-04
	FLT9581BPLGV#	Dryer #2 afterfilter plugs	3	48H 1.0E-04H	4.79E-03	
	OPR-AIR-MCH1#	Instrument air DP switch miscalibrated	1	1N 3.0E-02N	3.00E-02N	
19.	FLT9580APLGV+	Instrument air dryer #1 prefilter plugs	4	48H 1.0E-04H	4.78E-03	1.25E-04
	FLT9581APLGV#	Dryer #1 prefilter plugs	3	48H 1.0E-04H	4.79E-03	
	OPR-AIR-MCH1#	Instrument air DP switch miscalibrated	1	1N 3.0E-02N	3.00E-02N	
20.	FLT9580APLGV+	Instrument air dryer #1 prefilter plugs	4	48H 1.0E-04H	4.78E-03	1.25E-04
	FLT9581BPLGV#	Dryer #2 afterfilter plugs	3	48H 1.0E-04H	4.79E-03	
	OPR-AIR-MCH1#	Instrument air DP switch miscalibrated	1	1N 3.0E-02N	3.00E-02N	
21.	DRYAIR2-T&MV#	Dryer #2 out of service for T&M	3	40H 1Y	4.56E-03	1.19E-04
	FLT9580APLGV+	Instrument air dryer #1 prefilter plugs	4	48H 1.0E-04H	4.78E-03	
	OPR-AIR-MCH1#	Instrument air DP switch miscalibrated	1	1N 3.0E-02N	3.00E-02N	
22.	DRYAIR2-T&MV#	Dryer #2 out of service for T&M	3	40H 1Y	4.56E-03	1.19E-04
	FLT9580BPLGV+	Instrument air dryer #1 after filter plugs	4	48H 1.0E-04H	4.78E-03	
	OPR-AIR-MCH1#	Instrument air DP switch miscalibrated	1	1N 3.0E-02N	3.00E-02N	
23.	CMPAIR2-FTRV+	Secondary plant / instrument air compressor fails	4	24H 5.0E-05H	1.20E-03	1.12E-04
	CMPAIR3-T&MV#	Standy compressor out of service for T&M	3	27D 1Y	7.13E-02	
	FLT9623-PLGV+	Primary compressor inlet filter plugs	4	48H 1.0E-04H	4.78E-03	
	OPRFILT-VIH1#	Fail to replace filter	1	1N 5.0E-01N	5.00E-01N	
24.	CMPAIR1-BFLV+	Primary plant/instrument air compressor fails	4	24H 5.0E-05H	1.20E-03	1.12E-04
	CMPAIR3-T&MV#	Standy compressor out of service for T&M	3	27D 1Y	7.13E-02	

Set No.	Event Name	Description	C	B.E. Input	Calc. Result	Cutset Freq. (/yr)
	FLT9620-PLGV+	Inlet filter on secondary compressor is plugged	4	48H 1.0E-04H	4.78E-03	
	OPRFILT-VIH1#	Fail to replace filter	1	1N 5.0E-01N	5.00E-01N	
25.	CMPAIR1-BFLV+	Primary plant/instrument air compressor fails	4	24H 5.0E-05H	1.20E-03	7.48E-05
	CMPAIR2-FTRV+	Secondary plant / instrument air compressor fails	4	24H 5.0E-05H	1.20E-03	
	CMPAIR3-T&MV#	Standy compressor out of service for T&M	3	27D 1Y	7.13E-02	

Loss of Instrument Air (Excl. POWN or CTW) Top Event Frequency: 9.43E-02/YR

Risk Achievement Worth

Basic Event Name	Description	Prob/Freq	AchW
HCVINAIRC3CV+-I	CC: All three compressor water supply valves fail closed	2.50E-08/H	9.29E+04
PIPINAIRRUPV+-I	Major line break in instrument air piping	2.18E-08/H	9.29E+04
CC2-AIR-DRY1+-I	cc: both air dryers fail	5.00E-08/H	9.29E+04
PSV063--FOPV+-I	Instrument air receiver PSV fails open	5.00E-07/H	9.29E+04
PCVAIR1-FCLV+-I	PCV reducing pressure going to equipment fails closed	3.00E-06/H	9.29E+04
PCVAIR2-FCLV+-I	PCV back pressure control valve fails closed	3.00E-06/H	9.29E+04
CMPINAIRC3CV+-I	CC: three plant/instrument air compressors fail	2.50E-06/H	9.29E+04
HCV9601-FCLV+-I	Instrument air dryer #1 isolation valve fails closed	5.00E-07/H	9.50E+02
SV-DRY1-FCLV+-I	Dryer #1 inlet valve fails closed	5.00E-07/H	9.50E+02
FLT9580APLGV+-I	Instrument air dryer #1 prefilter plugs	9.95E-05/H	7.26E+02
FLT9580BPLGV+-I	Instrument air dryer #1 after filter plugs	9.95E-05/H	7.26E+02
HCV9621-FCLV+-IC	Cooling water valve to primary compressor fails closed	5.00E-07/H	3.82E+01
HCV9622-FCLV+-IC	Cooling water valve to secondary compressor fails closed	5.00E-07/H	3.82E+01
PSV043--FOPV+-IC	PSV on primary compressor discharge fails open	5.00E-07/H	3.82E+01
PSV047--FOPV+-IC	PSV on secondary compressor discharge line fails open	5.00E-07/H	3.82E+01
CMPAIR1-BFLV+-IC	Primary plant/instrument air compressor fails	4.99E-05/H	3.82E+01
CMPAIR2-FTRV+-IC	Secondary plant / instrument air compressor fails	4.99E-05/H	3.82E+01
FLT9623-PLGV+-IC	Primary compressor inlet filter plugs	9.95E-05/H	3.08E+01
FLT9620-PLGV+-IC	Inlet filter on secondary compressor is plugged	9.95E-05/H	3.08E+01
SV-DRY2-FCLV#	Dryer #2 inlet valve fails closed	1.20E-05	1.21E+01
HCV9602-FCLV#	Instrument air dryer #2 isolation valve fails closed	1.20E-05	1.21E+01
DRYAIR2-T&MV#	Dryer #2 out of service for T&M	4.56E-03	1.20E+01
FLT9581BPLGV#	Dryer #2 afterfilter plugs	4.79E-03	1.09E+01
FLT9581APLGV#	Dryer #1 prefilter plugs	4.79E-03	1.09E+01
OPR-AIR-MCH1#	Instrument air DP switch miscalibrated	3.00E-02	1.25E+00
OPRFILT-VIH1#	Fail to replace filter	5.00E-01	1.14E+00
HCV9650-FCLV#	Third compressor cooling water supply valve fails closed	5.00E-07	1.10E+00
CC2-AIR-PT-1#	cc: both instrument air PTs fail high	2.40E-06	1.10E+00
PSV051--FOPV#	PSV on third compressor discharge fails open	4.00E-06	1.10E+00
CMPAIR3-FTRV#	Third plant / instrument air compressor fails to run	2.40E-03	1.10E+00
CMPAIR3-FTSV#	Third plant / instrument air compressor fails to start	5.00E-03	1.10E+00
CMPAIR3-T&MV#	Standy compressor out of service for T&M	7.13E-02	1.09E+00
FLT9660-PLGV#	Inlet filter on secondary compressor is plugged	1.67E-02	1.08E+00
PDS9580BFTCV#	Dryer #1 after-filter DP high switch fails to close	6.29E-02	1.04E+00
PDS9580AFTCV#	Dryer #1 prefilter high DP switch fails to close	6.29E-02	1.04E+00

Modified top event frequency = (top event frequency) x (risk achievement worth).

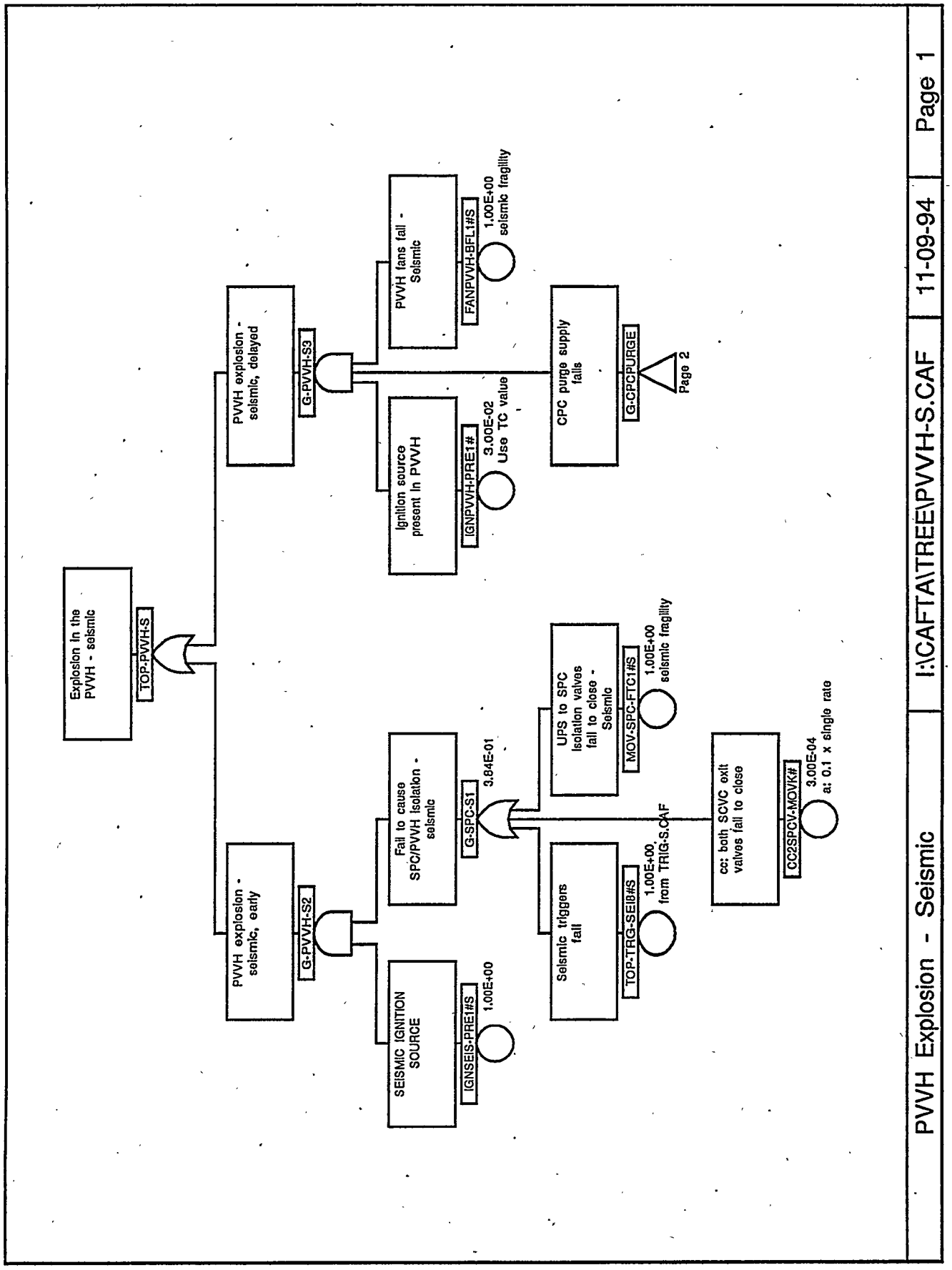
Risk Reduction Worth

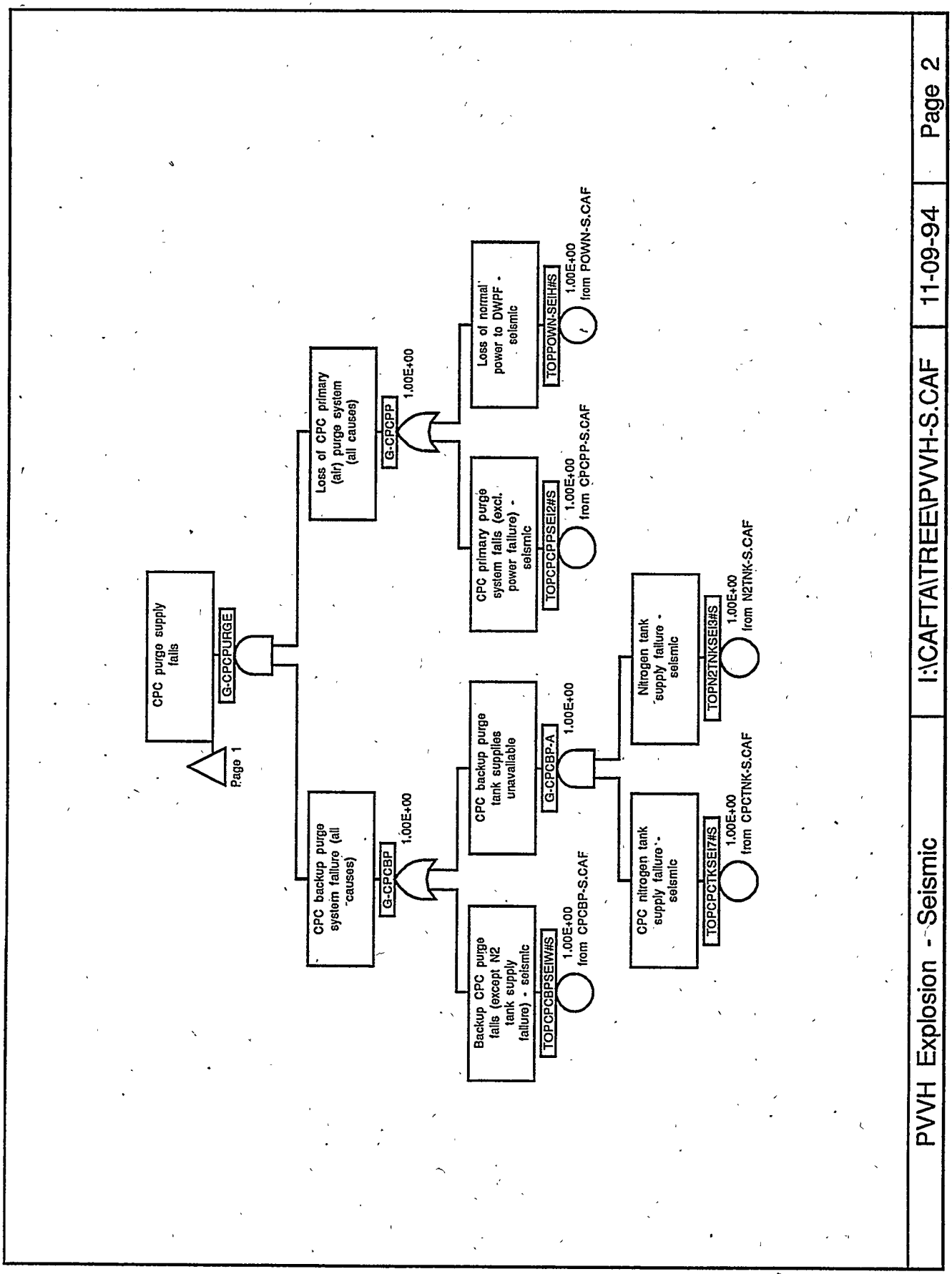
Basic Event Name	Description	Prob/Freq	RedW
PCVAIR1-FCLV+-I	PCV reducing pressure going to equipment fails closed	3.00E-06/H	1.39E+00
PCVAIR2-FCLV+-I	PCV back pressure control valve fails closed	3.00E-06/H	1.39E+00
CMPINAIRC3CV+-I	CC: three plant/instrument air compressors fail	2.50E-06/H	1.30E+00
OPRFILT-VIH1#	Fail to replace filter	5.00E-01	1.16E+00
FLT9580BPLGV+-I	Instrument air dryer #1 after filter plugs	9.95E-05/H	1.08E+00
FLT9580APLGV+-I	Instrument air dryer #1 prefilter plugs	9.95E-05/H	1.08E+00
DRYAIR2-T&MV#	Dryer #2 out of service for T&M	4.56E-03	1.05E+00
FLT9581APLGV#	Dryer #1 prefilter plugs	4.79E-03	1.05E+00
FLT9581BPLGV#	Dryer #2 afterfilter plugs	4.79E-03	1.05E+00
PSV063--FOPV+-I	Instrument air receiver PSV fails open	5.00E-07/H	1.05E+00

Note: Events that make less than 1% difference to the importance factor are not included.
Modified top event frequency = (top event frequency) / (risk reduction worth).

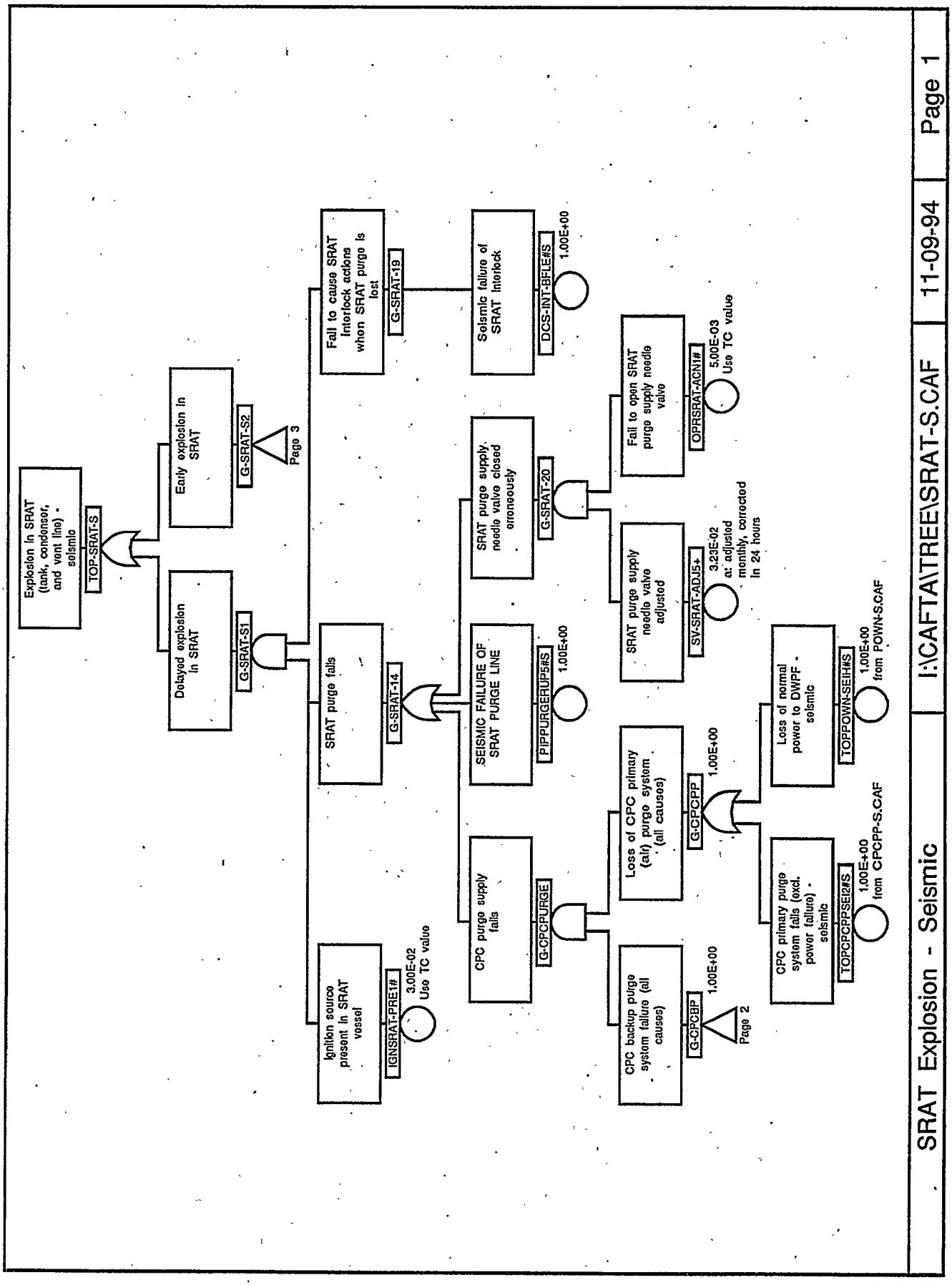
Attachment 7
Seismic Initiator Accident Fault Trees

PVVH Explosion - Seismic


Explosion in the PVVH - seismic
TOP-PVVH-S
PVVH explosion - seismic, delayed
G-PVVH-S3
PVVH fans fail - Seismic
FANPVVH-BFL1#S
1.00E+00
seismic fragility
Ignition source present in PVVH
IGNPVVH-PRE1#
3.00E-02
Use TC value
CPC purge supply fails
G-CPCPURGE
Page 2
PVVH explosion - seismic, early
G-PVVH-S2
Fail to cause SPC/PVVH isolation - seismic
G-SPC-S1
3.84E-01
UPS to SPC isolation valves fail to close - Seismic
MOV-SPC-FTC1#S
1.00E+00
seismic fragility
SEISMIC IGNITION SOURCE
IGNSEIS-PRE1#S
1.00E+00
Seismic triggers fail
TOP-TRG-SEI8#S
1.00E+00
from TRIG-S.CAF
cc: both SCVC exit valves fail to close
CC2SPCV-MOVK#
3.00E-04
a: 0.1 x single rate
PVVH Explosion - Seismic
I:\CAFTA\TREE\PVVH-S.CAF
11-09-94
Page 1


CPC purge supply fails
G-CPCPURGE
Page 1
CPC backup purge system failure (all causes)
G-CPCBP
1.00E+00
Loss of CPC primary (air) purge system (all causes)
G-CPCPP
1.00E+00
CPC backup purge tank supplies unavailable
G-CPCBP-A
1.00E+00
CPC primary purge system fails (excl. power failure) - seismic
TOPCPCPPSEI2#S
1.00E+00
from CPCPP-S.CAF
Loss of normal power to DWPF - seismic
TOPPOWN-SEIH#S
1.00E+00
from POWN-S.CAF
Backup CPC purge fails (except N2 tank supply failure) - seismic
TOPCPCBPSEIW#S
1.00E+00
from CPCBP-S.CAF
CPC nitrogen tank supply failure - seismic
TOPCPCTKSEI7#S
1.00E+00
from CPCTNK-S.CAF
Nitrogen tank supply failure - seismic
TOPN2TNKSEI9#S
1.00E+00
from N2TNK-S.CAF
PVVH Explosion - Seismic
I:\CAFTA\TREE\PVVH-S.CAF
11-09-94
Page 2

SRAT Explosion - Seismic


Explosion in SRAT (tank, condensor, and vent line) - seismic
TOP-SRAT-S
Delayed explosion in SRAT
G-SRAT-S1
Early explosion in SRAT
G-SRAT-S2
Page 3
Fail to cause SRAT interlock actions when SRAT purge is lost
G-SRAT-19
Seismic failure of SRAT interlock
DCS-INT-BFLE#S
1.00E+00
SRAT purge fails
G-SRAT-14
SRAT purge supply needle valve closed erroneously
G-SRAT-20
Fail to open SRAT purge supply needle valve
OPRSRAT-ACN1#
5.00E-03
Use TC value
Ignition source present in SRAT vessel
IGNSRAT-PRE1#
3.00E-02
Use TC value
SEISMIC FAILURE OF SRAT PURGE LINE
PIPPURGERUP5#S
1.00E+00
SRAT purge supply needle valve adjusted
SV-SRAT-ADJ5+
3.23E-02
a: adjusted monthly, corrected in 24 hours
CPC purge supply fails
G-CPCPURGE
Loss of CPC primary (air) purge system (all causes)
G-CPCPP
1.00E+00
CPC backup purge system failure (all causes)
G-CPCBP
1.00E+00
Page 2
CPC primary purge system fails (excl. power failure) - seismic
TOPCPCPPSEI2#S
1.00E+00
from CPCPP-S.CAF
Loss of normal power to DWPF - seismic
TOPPOWN-SEIH#S
1.00E+00
from POWN-S.CAF
SRAT Explosion - Seismic
I:\CAFTA\TREE\SRAT-S.CAF
11-09-94
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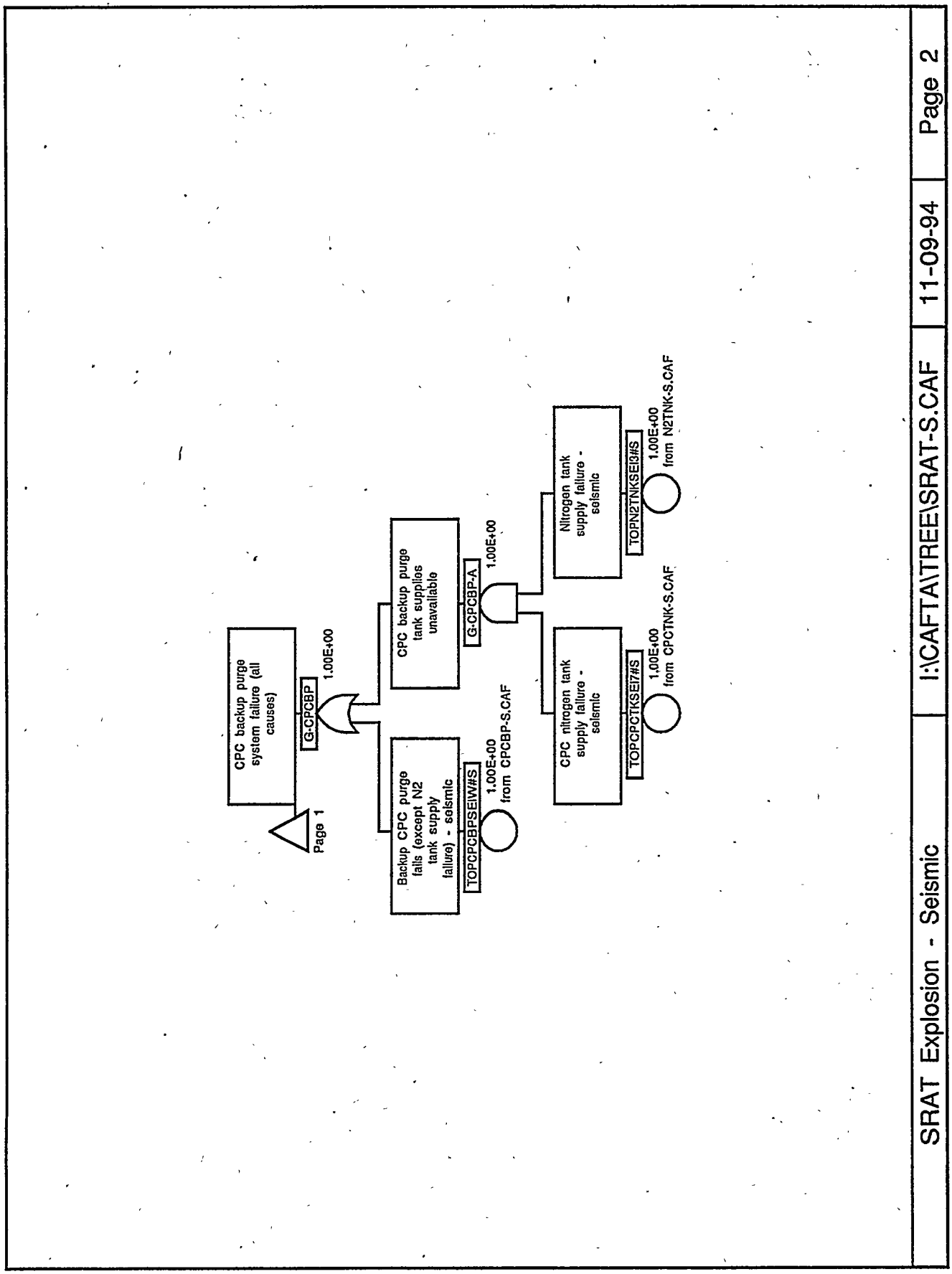
CPC backup purge system failure (all causes)
G-CPCBP
1.00E+00
Page 1
Backup CPC purge fails (except N2 tank supply failure) - seismic
TOPCPCBPSEIW#S
1.00E+00
from CPCBP-S.CAF
CPC backup purge tank supplies unavailable
G-CPCBP-A
1.00E+00
CPC nitrogen tank supply failure - seismic
TOPCPCTKSEI7#S
1.00E+00
from CPCTNK-S.CAF
Nitrogen tank supply failure - seismic
TOPN2TNKSEI3#S
1.00E+00
from N2TNK-S.CAF
SRAT Explosion - Seismic
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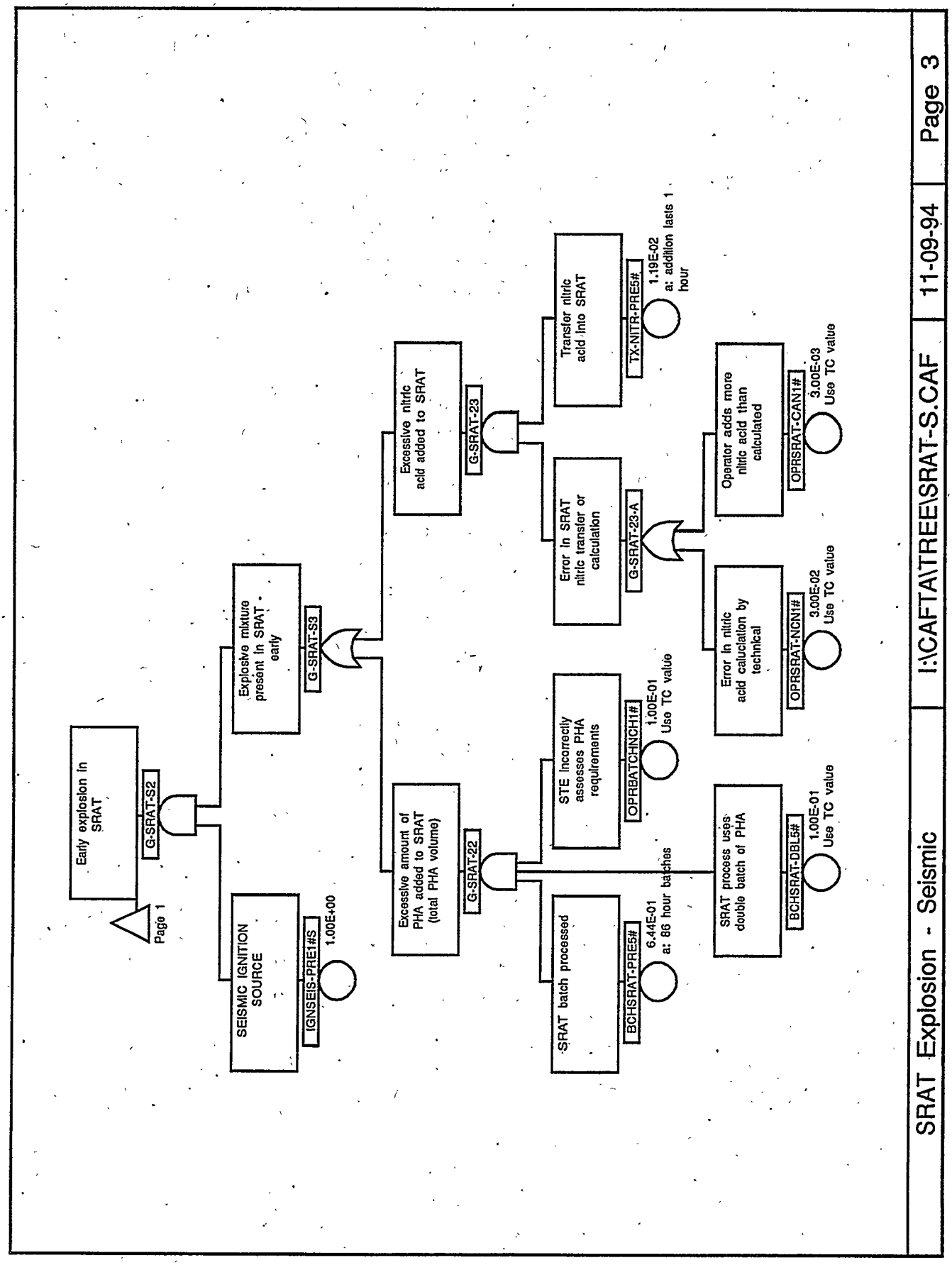
11-09-94
Page 2


Early explosion in SRAT
G-SRAT-S2
Page 1
SEISMIC IGNITION SOURCE
IGNSEIS-PRE1#S
1.00E+00
Explosive mixture present in SRAT - early
G-SRAT-S3
Excessive amount of PHA added to SRAT (total PHA volume)
G-SRAT-22
SRAT batch processed
BCHSRAT-PRE5#
6.44E-01
a: 86 hour batches
STE incorrectly assesses PHA requirements
OPRBATCHNCH1#
1.00E-01
Use TC value
SRAT process uses double batch of PHA
BCHSRAT-DBL5#
1.00E-01
Use TC value
Excessive nitric acid added to SRAT
G-SRAT-23
Error in SRAT nitric transfer or calculation
G-SRAT-23-A
Error in nitric acid calculation by technical
OPRSRAT-NCN1#
3.00E-02
Use TC value
Transfer nitric acid into SRAT
TX-NITR-PRE5#
1.19E-02
a: addition lasts 1 hour
Operator adds more nitric acid than calculated
OPRSRAT-CAN1#
3.00E-03
Use TC value
SRAT Explosion - Seismic
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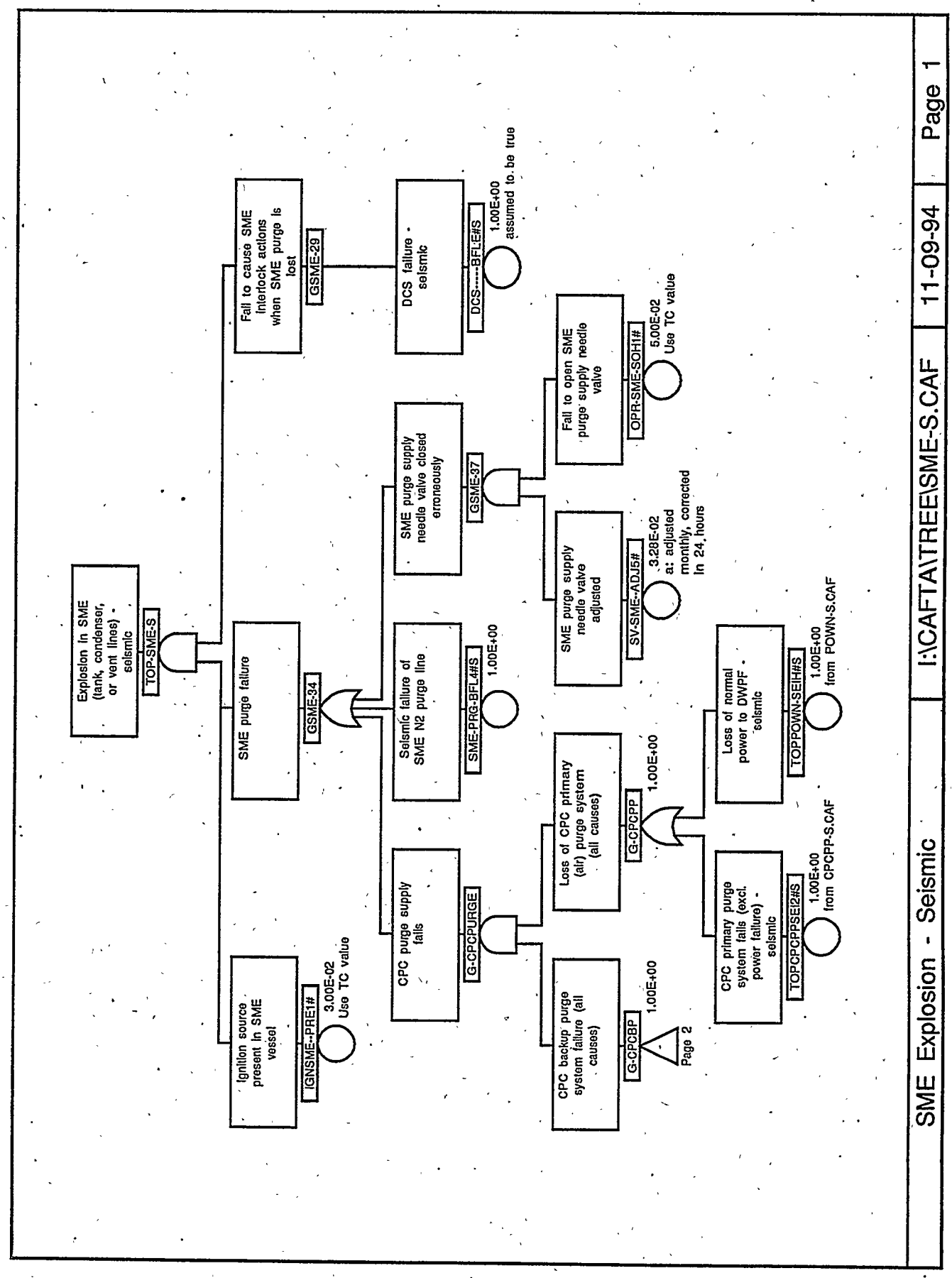
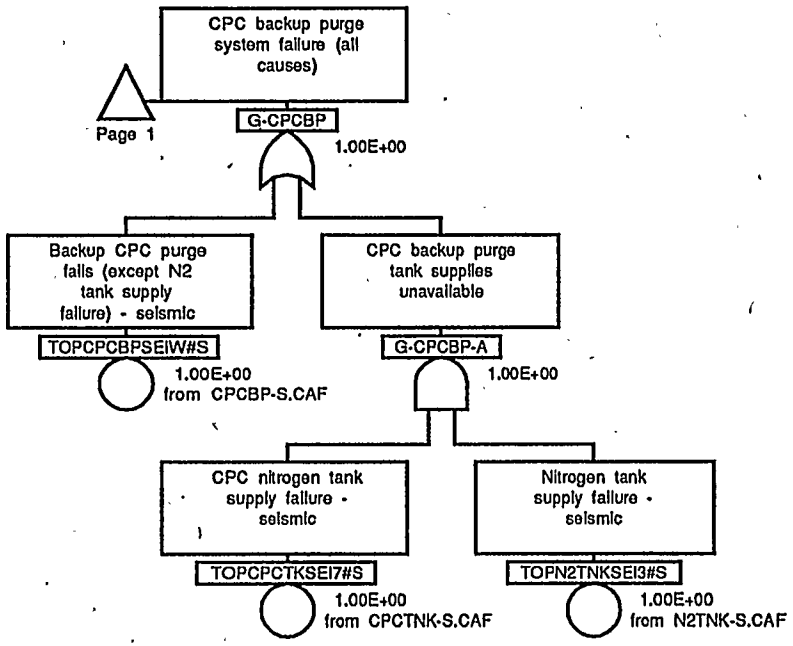
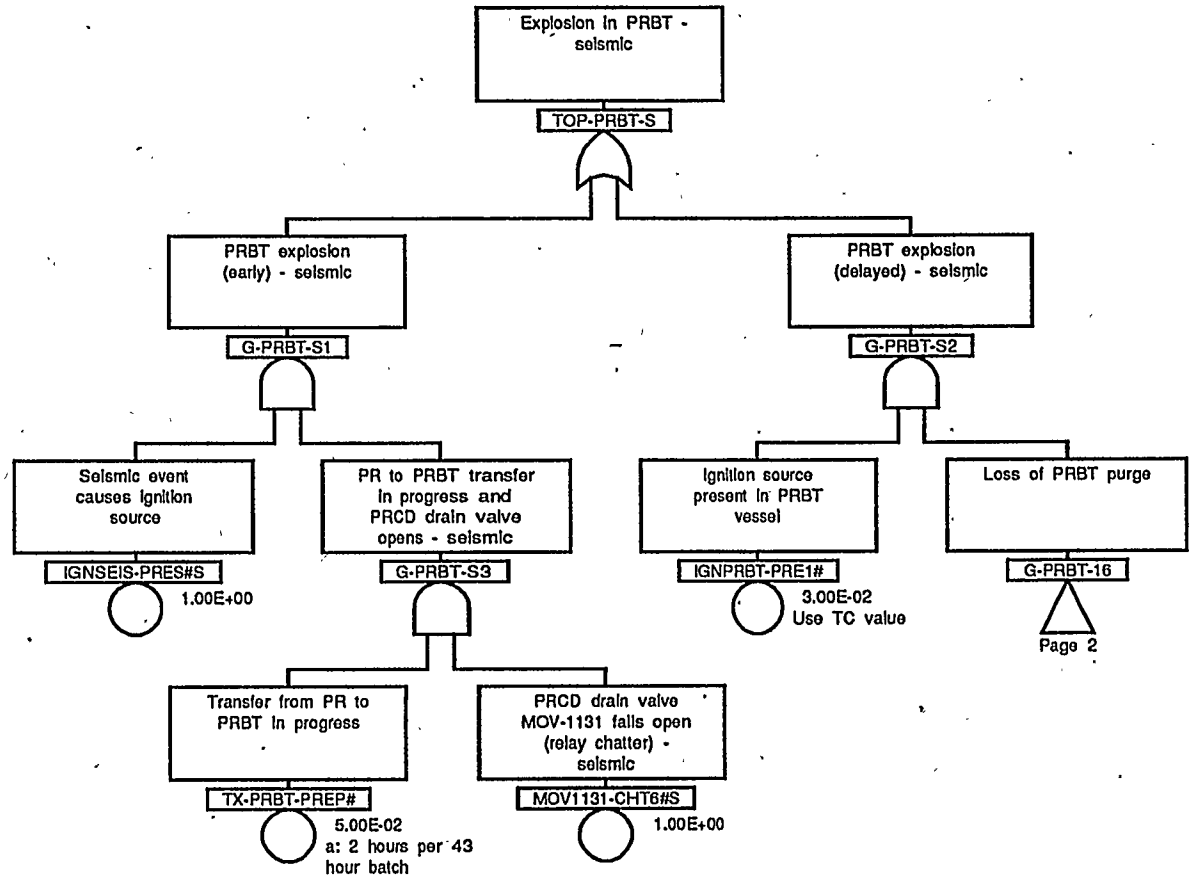
SME Explosion - Seismic


Explosion in SME (tank, condenser, or vent lines) - seismic
TOP-SME-S
SME purge failure
GSME-34
Ignition source present in SME vessel
IGNSME--PRE1#
3.00E-02
Use TC value
CPC purge supply fails
G-CPCPURGE
CPC backup purge system failure (all causes)
G-CPCBP
1.00E+00
Page 2
Loss of CPC primary (air) purge system (all causes)
G-CPCPP
1.00E+00
Seismic failure of SME N2 purge line
SME-PRG-BFL4#S
1.00E+00
CPC primary purge system fails (excl. power failure) - seismic
TOPCPCPPSEI2#S
1.00E+00
from CPCPP-S.CAF
Loss of normal power to DWPF - seismic
TOPPOWN-SEIH#S
1.00E+00
from POWN-S.CAF
SME purge supply needle valve closed erroneously
GSME-37
SME purge supply needle valve adjusted
SV-SME-ADJ5#
3.28E-02
a: adjusted monthly, corrected in 24 hours
Fail to open SME purge supply needle valve
OPR-SME-SOH1#
5.00E-02
Use TC value
Fail to cause SME interlock actions when SME purge is lost
GSME-29
DCS failure - seismic
DCS----BFLE#S
1.00E+00
assumed to be true
SME Explosion - Seismic
I:\CAFTA\TREE\SME-S.CAF
11-09-94
Page 1

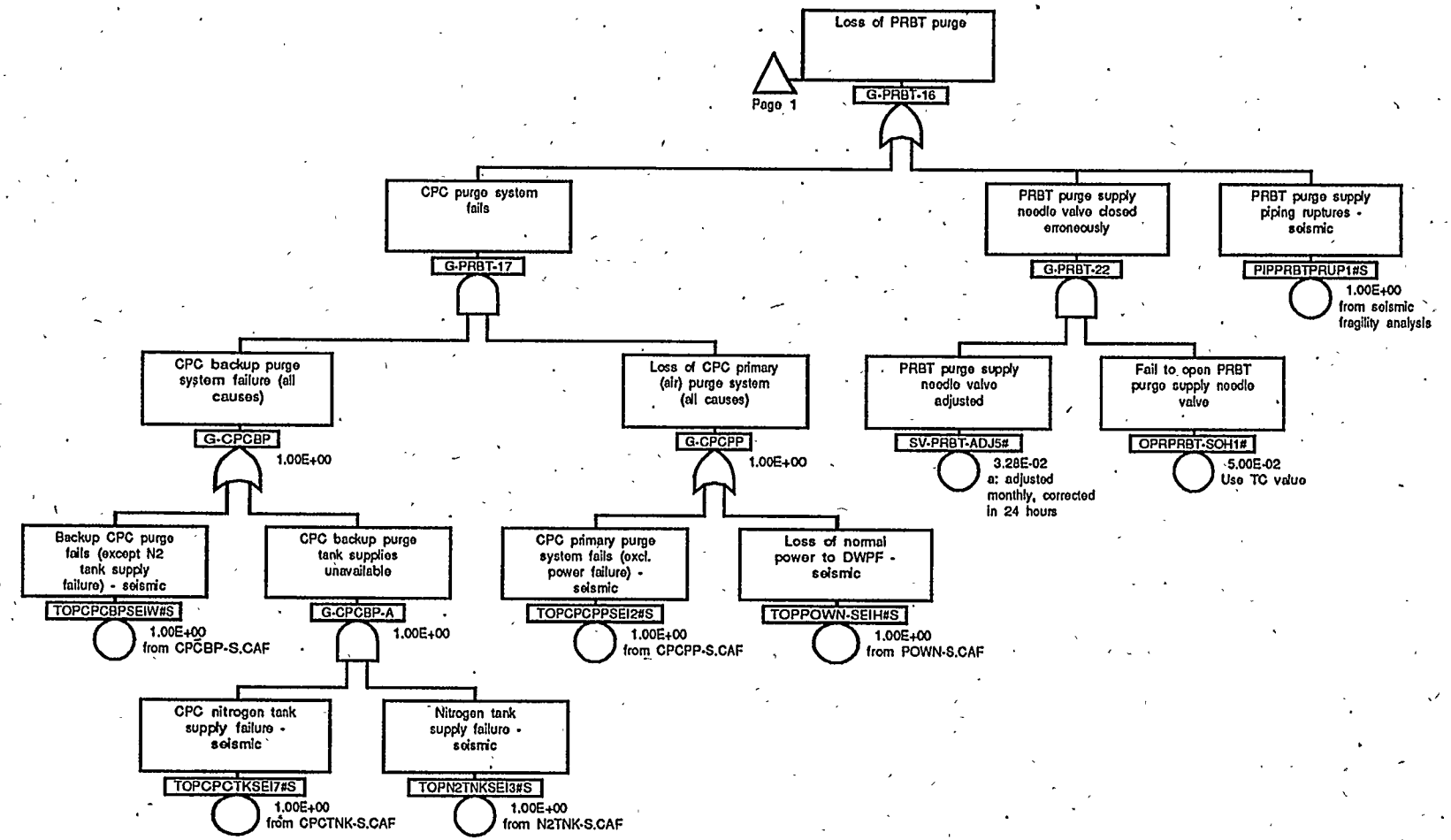


SME Explosion - Seismic	I:\CAFTA\TREE\SME-S.CAF	11-09-94	Page 2

PRBT Explosion - Seismic

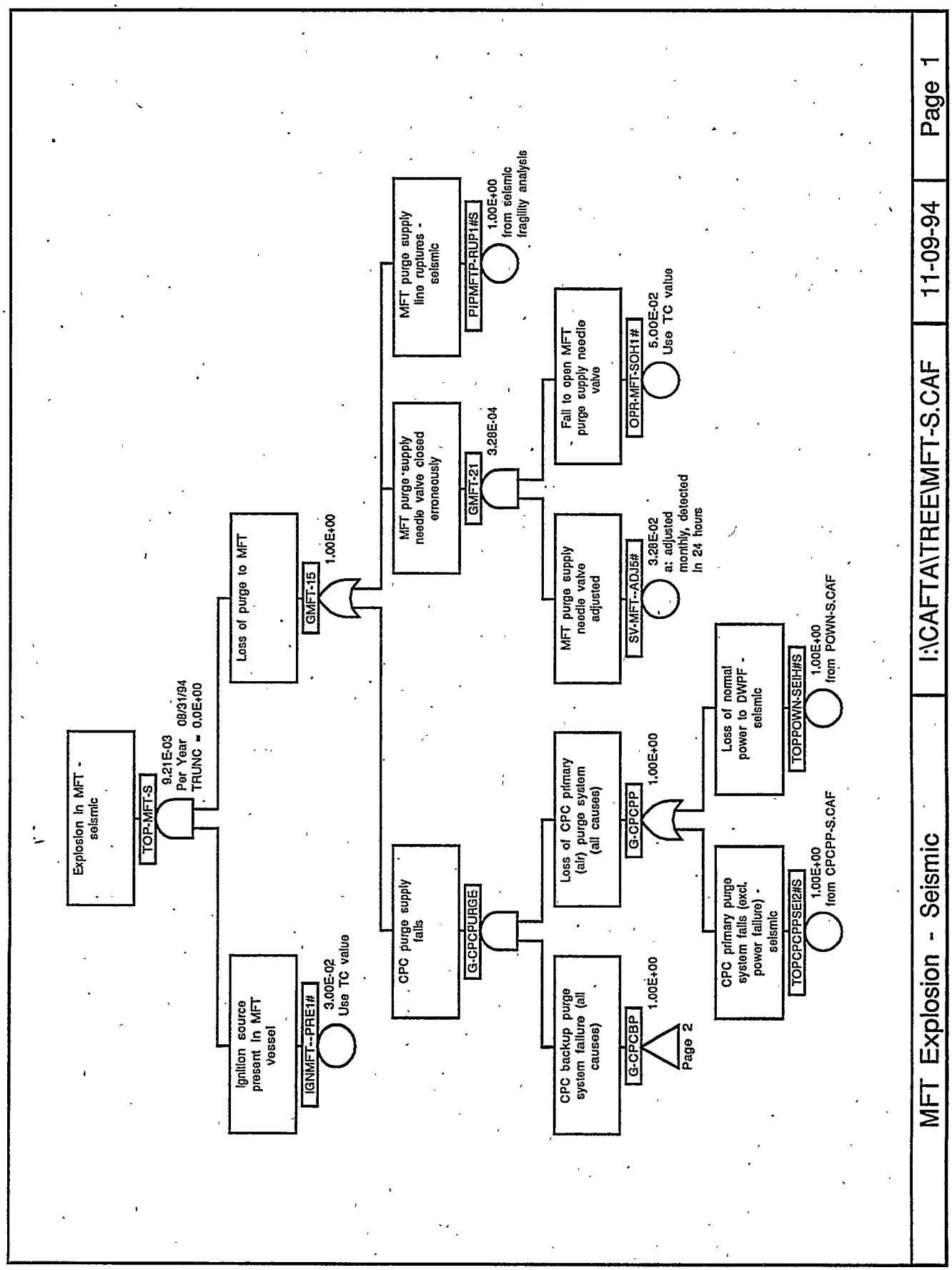


PRBT Explosion - Seismic	I:\CAFTA\TREE\PRBT-S.CAF	11-09-94	Page 1



PRBT Explosion - Seismic	I:\CAFTA\TREE\PRBT-S.CAF	11-09-94	Page 2

MFT Explosion - Seismic


Explosion in MFT - seismic
TOP-MFT-S
9.21E-03 Per Year 08/31/94 TRUNC = 0.0E+00
Loss of purge to MFT
GMFT-15
1.00E+00
MFT purge supply line ruptures - seismic
PIPMFTP-RUP1#S
1.00E+00 from seismic fragility analysis
MFT purge supply needle valve closed erroneously
GMFT-21
3.28E-04
Fail to open MFT purge supply needle valve
OPR-MFT-SOH1#
5.00E-02 Use TC value
Ignition source present in MFT vessel
IGNMFT--PRE1#
3.00E-02 Use TC value
CPC purge supply fails
G-CPCPURGE
Loss of CPC primary (air) purge system (all causes)
G-CPCPP
1.00E+00
MFT purge supply needle valve adjusted
SV-MFT--ADJ5#
3.28E-02 a: adjusted monthly, detected in 24 hours
CPC backup purge system failure (all causes)
G-CPCBP
1.00E+00
Page 2
Loss of normal power to DWPF - seismic
TOPPOWN-SEIH#S
1.00E+00 from POWN-S.CAF
CPC primary purge system fails (excl. power failure) - seismic
TOPCPCPPSEI2#S
1.00E+00 from CPCPP-S.CAF
MFT Explosion - Seismic
I:\CAFTA\TREE\MFT-S.CAF
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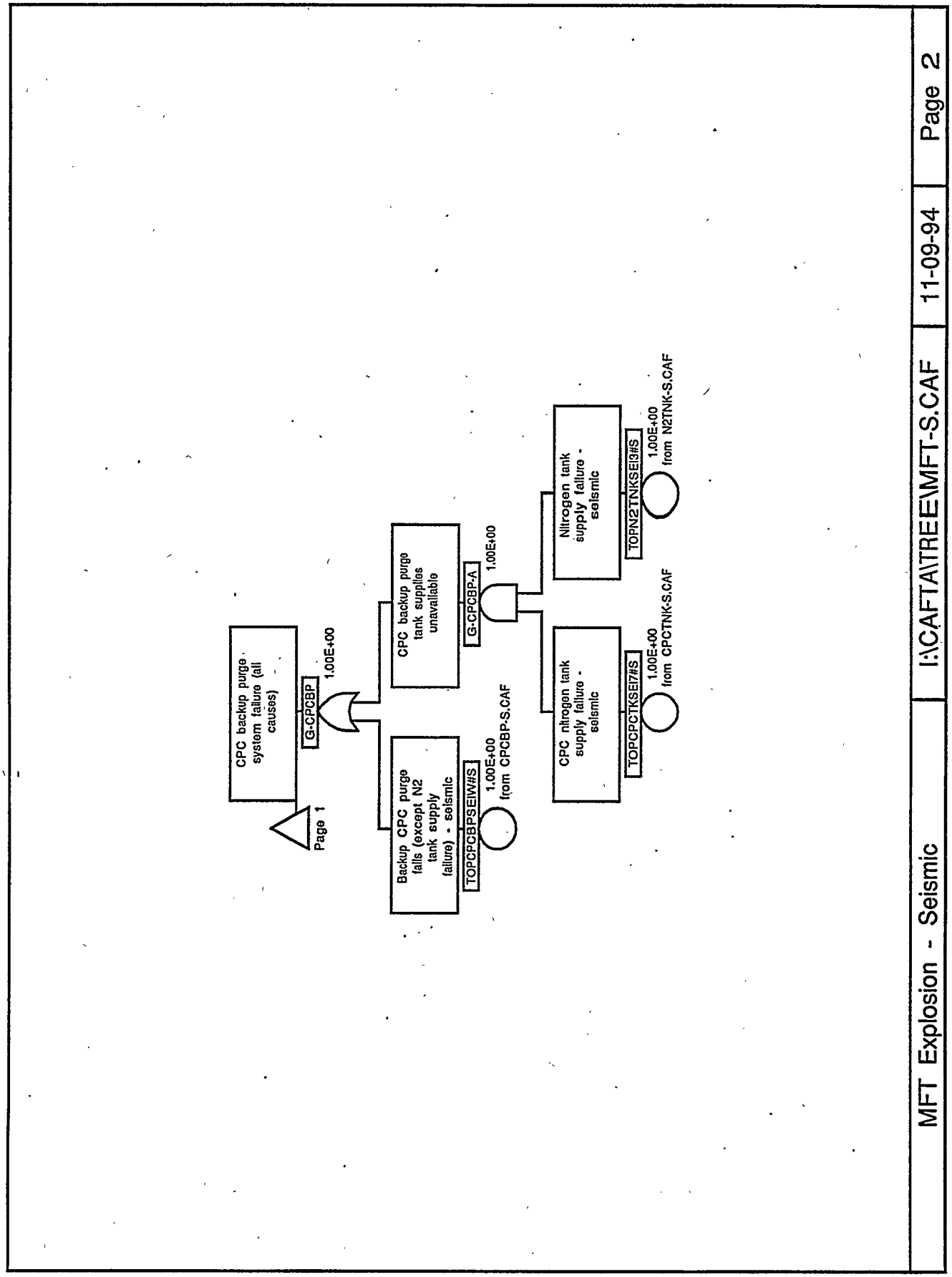
Page 1


CPC backup purge system failure (all causes)
G-CPCBP
1.00E+00
Page 1
Backup CPC purge falls (except N2 tank supply failure) - seismic
TOPCPCBPSEIW#S
1.00E+00
from CPCBP-S.CAF
CPC backup purge tank supplies unavailable
G-CPCBP-A
1.00E+00
CPC nitrogen tank supply failure - seismic
TOPCPCTKSEI7#S
1.00E+00
from CPCTNK-S.CAF
Nitrogen tank supply failure - seismic
TOPN2TNKSEI3#S
1.00E+00
from N2TNK-S.CAF
MFT Explosion - Seismic
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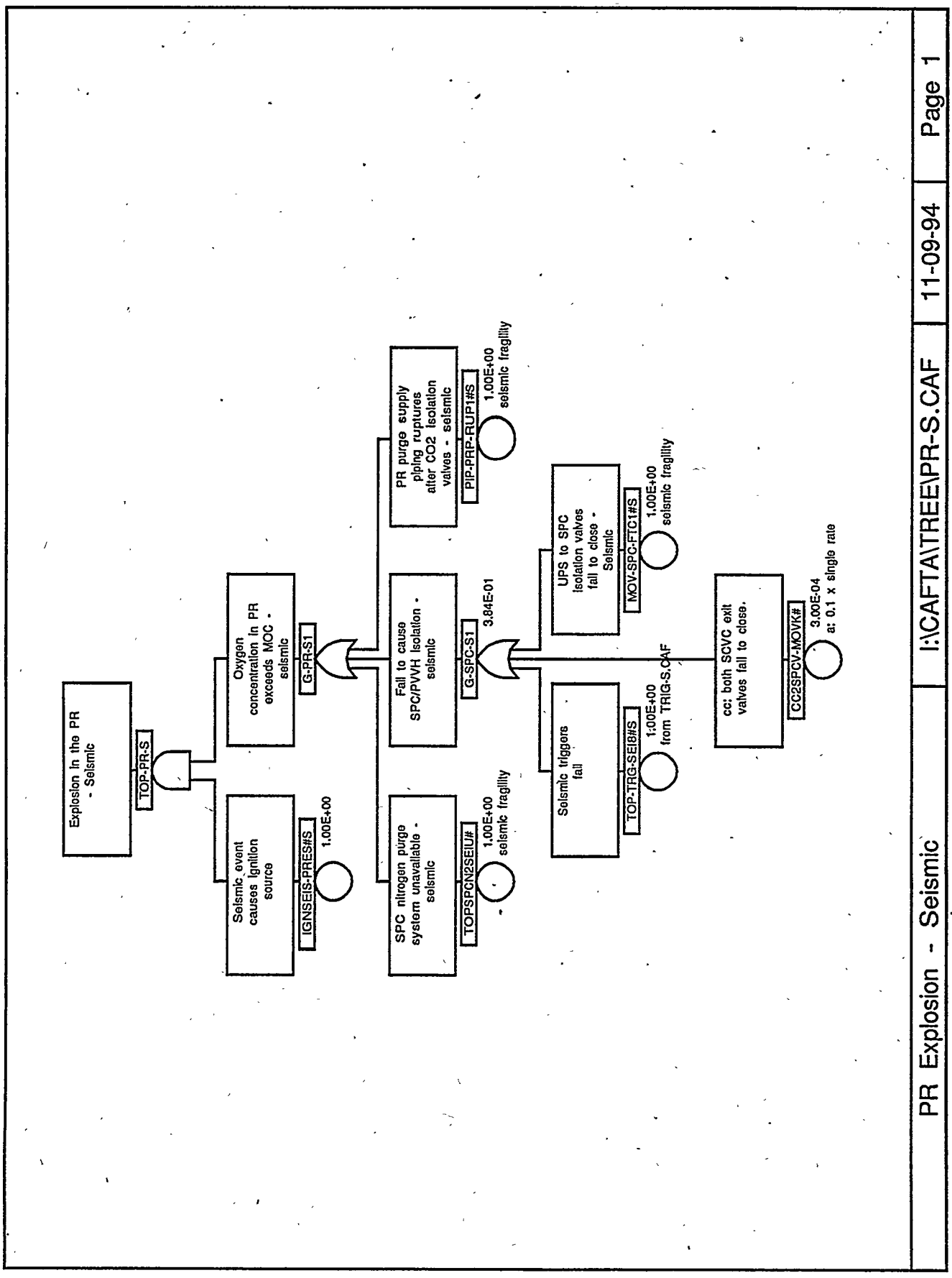
PR Explosion - Seismic


Explosion in the PR - Seismic
TOP-PR-S
Seismic event causes ignition source
IGNSEIS-PRES#S
1.00E+00
Oxygen concentration in PR exceeds MOC - seismic
G-PR-S1
SPC nitrogen purge system unavailable - seismic
TOPSPGN2SEIU#
1.00E+00
seismic fragility
Fail to cause SPC/PVVH isolation - seismic
G-SPC-S1
3.84E-01
PR purge supply piping ruptures after CO2 isolation valves - seismic
PIP-PRP-RUP1#S
1.00E+00
seismic fragility
Seismic triggers fail
TOP-TRG-SEI8#S
1.00E+00
from TRIG-S.CAF
UPS to SPC isolation valves fail to close - Seismic
MOV-SPC-FTC1#S
1.00E+00
seismic fragility
cc: both SCVC exit valves fail to close.
CC2SPCV-MOVK#
3.00E-04
a: 0.1 x single rate
PR Explosion - Seismic
I:\CAFTA\TREE\PR-S.CAF
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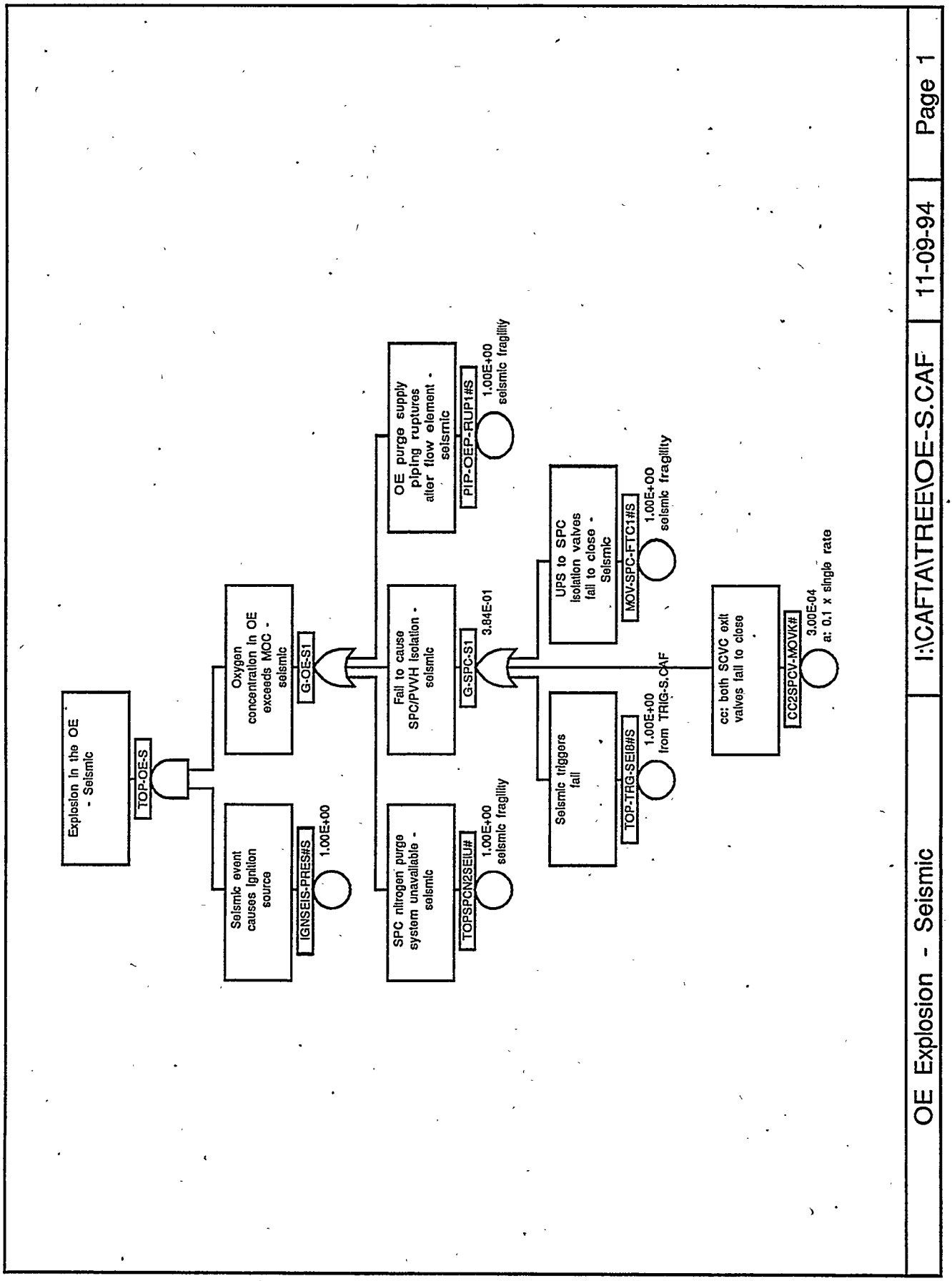
Page 1

OE Explosion - Seismic


Explosion in the OE - Seismic
TOP-OE-S
Seismic event causes ignition source
IGNSEIS-PRES#S
1.00E+00
Oxygen concentration in OE exceeds MOC - seismic
G-OE-S1
SPC nitrogen purge system unavailable - seismic
TOPSPCN2SEIU#
1.00E+00
seismic fragility
Fail to cause SPC/PVVH isolation - seismic
G-SPC-S1
3.84E-01
OE purge supply piping ruptures after flow element - seismic
PIP-OEP-RUP1#S
1.00E+00
seismic fragility
Seismic triggers fail
TOP-TRG-SEI8#S
1.00E+00
from TRIG-S.CAF
UPS to SPC isolation valves fail to close - Seismic
MOV-SPC-FTC1#S
1.00E+00
seismic fragility
cc: both SCVC exit valves fail to close
CC2SPCV-MOVK#
3.00E-04
a: 0.1 x single rate
OE Explosion - Seismic
I:\CAFTA\TREE\OE-S.CAF
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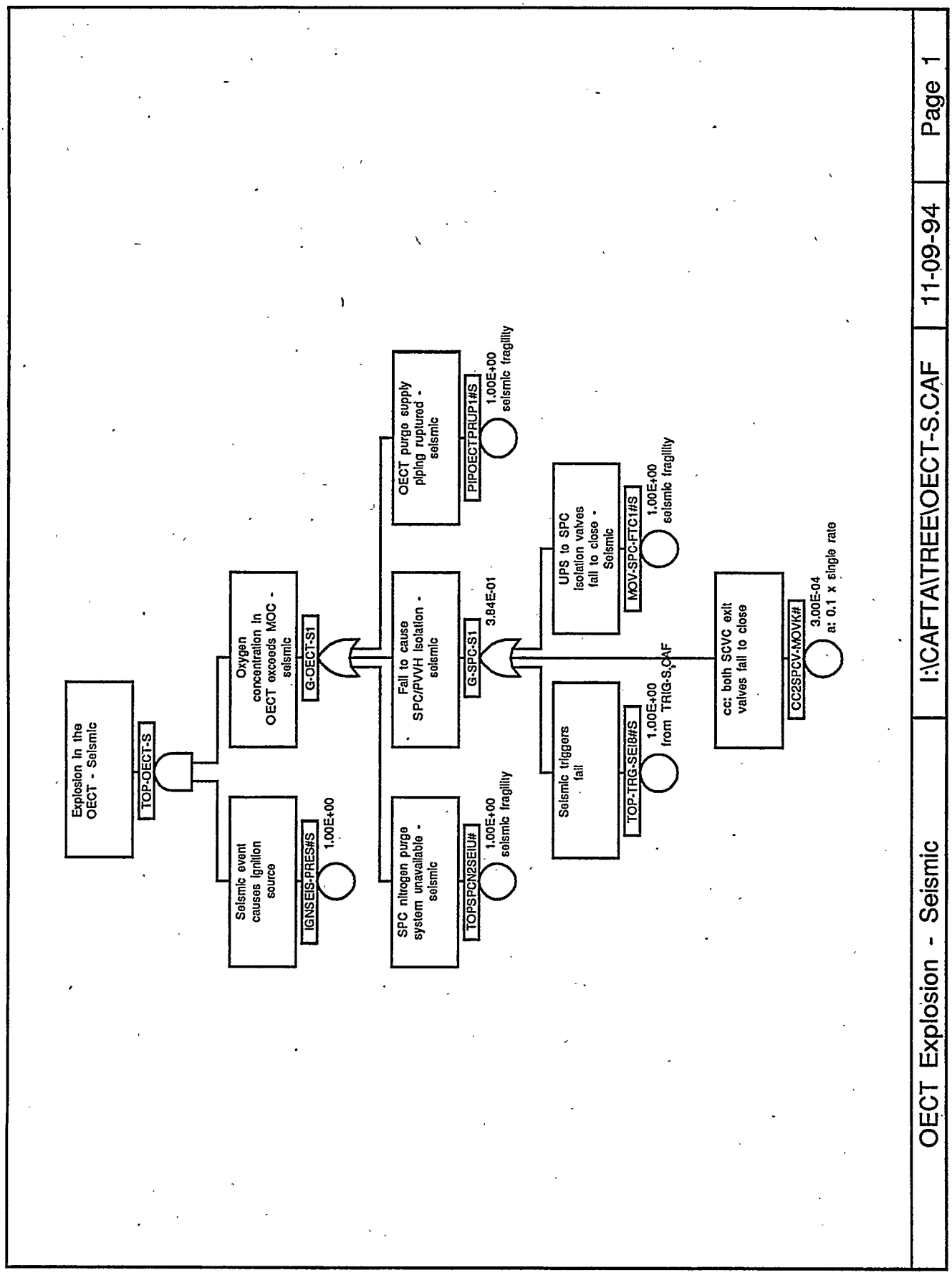
Page 1

OECT Explosion - Seismic


Explosion in the OECT - Seismic
TOP-OECT-S
Seismic event causes ignition source
IGNSEIS-PRES#S
1.00E+00
Oxygen concentration in OECT exceeds MOC - seismic
G-OECT-S1
SPC nitrogen purge system unavailable - seismic
TOPSPCN2SEIU#
1.00E+00
seismic fragility
Fail to cause SPC/PVVH isolation - seismic
G-SPC-S1
3.84E-01
OECT purge supply piping ruptured - seismic
PIPOECTPRUP1#S
1.00E+00
seismic fragility
Seismic triggers fail
TOP-TRG-SEI8#S
1.00E+00
from TRIG-S.CAF
UPS to SPC isolation valves fail to close - Seismic
MOV-SPC-FTC1#S
1.00E+00
seismic fragility
cc: both SCVC exit valves fail to close
CC2SPCV-MOVK#
3.00E-04
a: 0.1 x single rate
OECT Explosion - Seismic
I:\CAFTA\TREE\OECT-S.CAF
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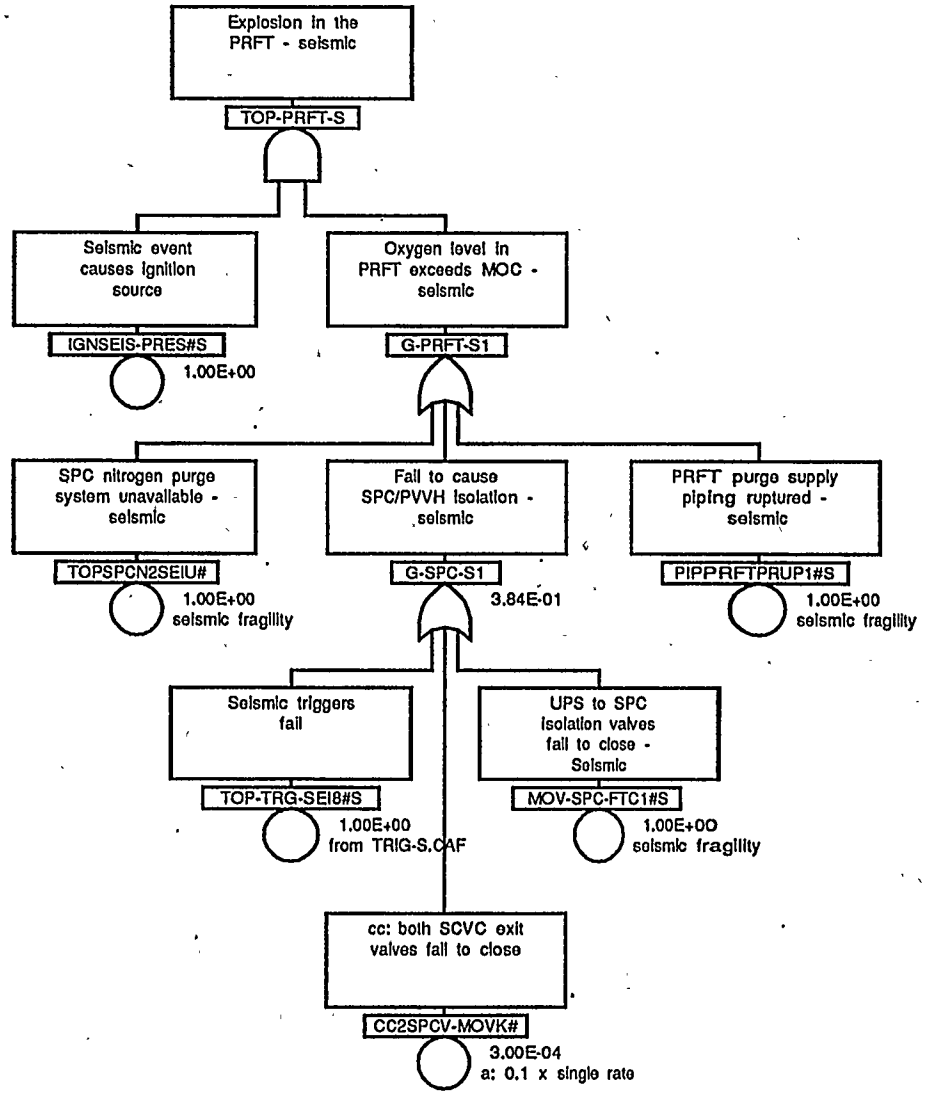
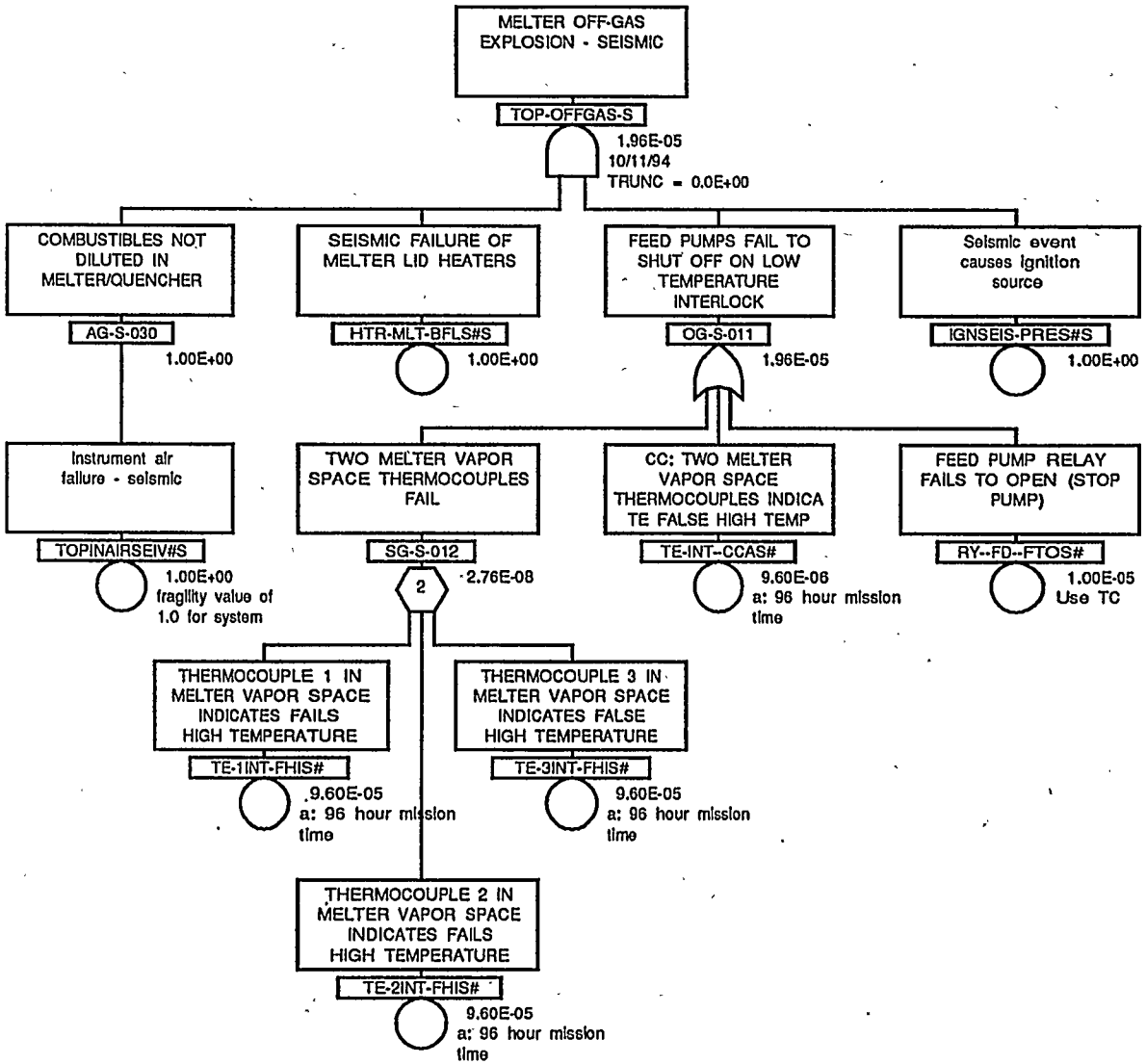
Page 1

PRFT Explosion - Seismic



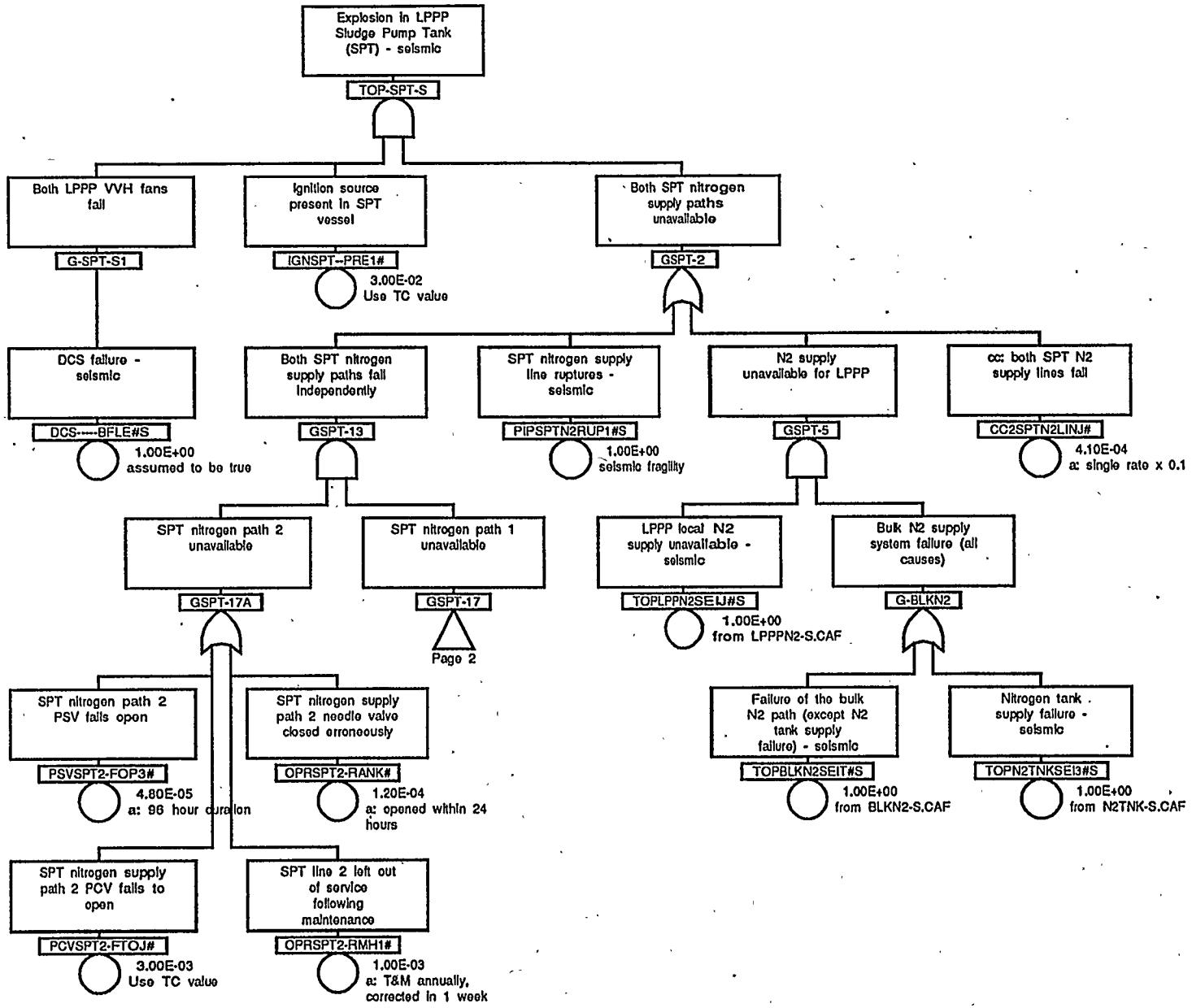
PRFT Explosion - Seismic	I:\CAFTA\TREE\PRFT-S.CAF	11-09-94	Page 1

Melter Offgas Explosion

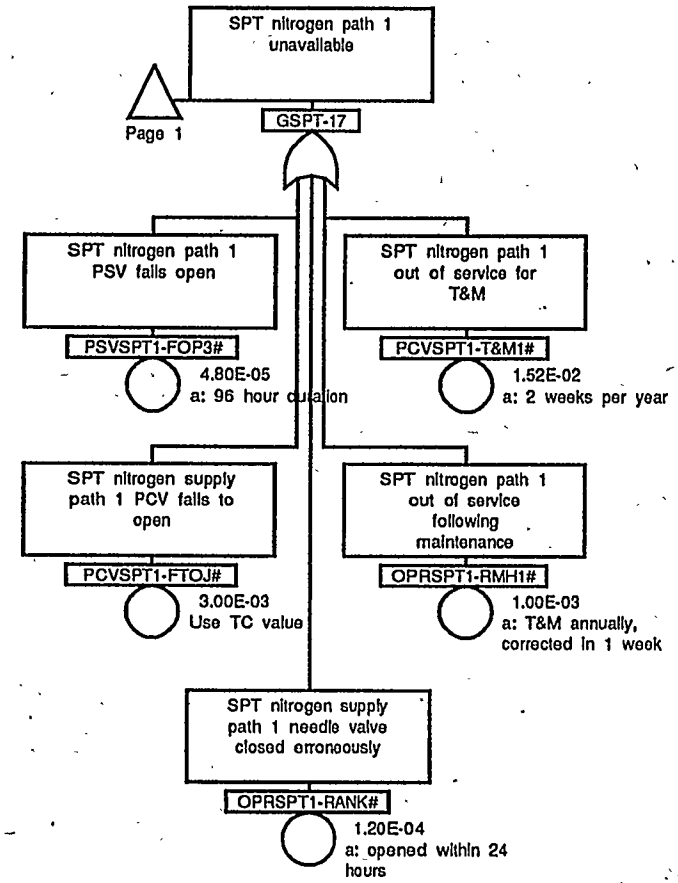


Melter Off-gas Explosion - Seismic	I:\CAFTA\TREE\OFFGAS-S.CAF	11-09-94	Page 1

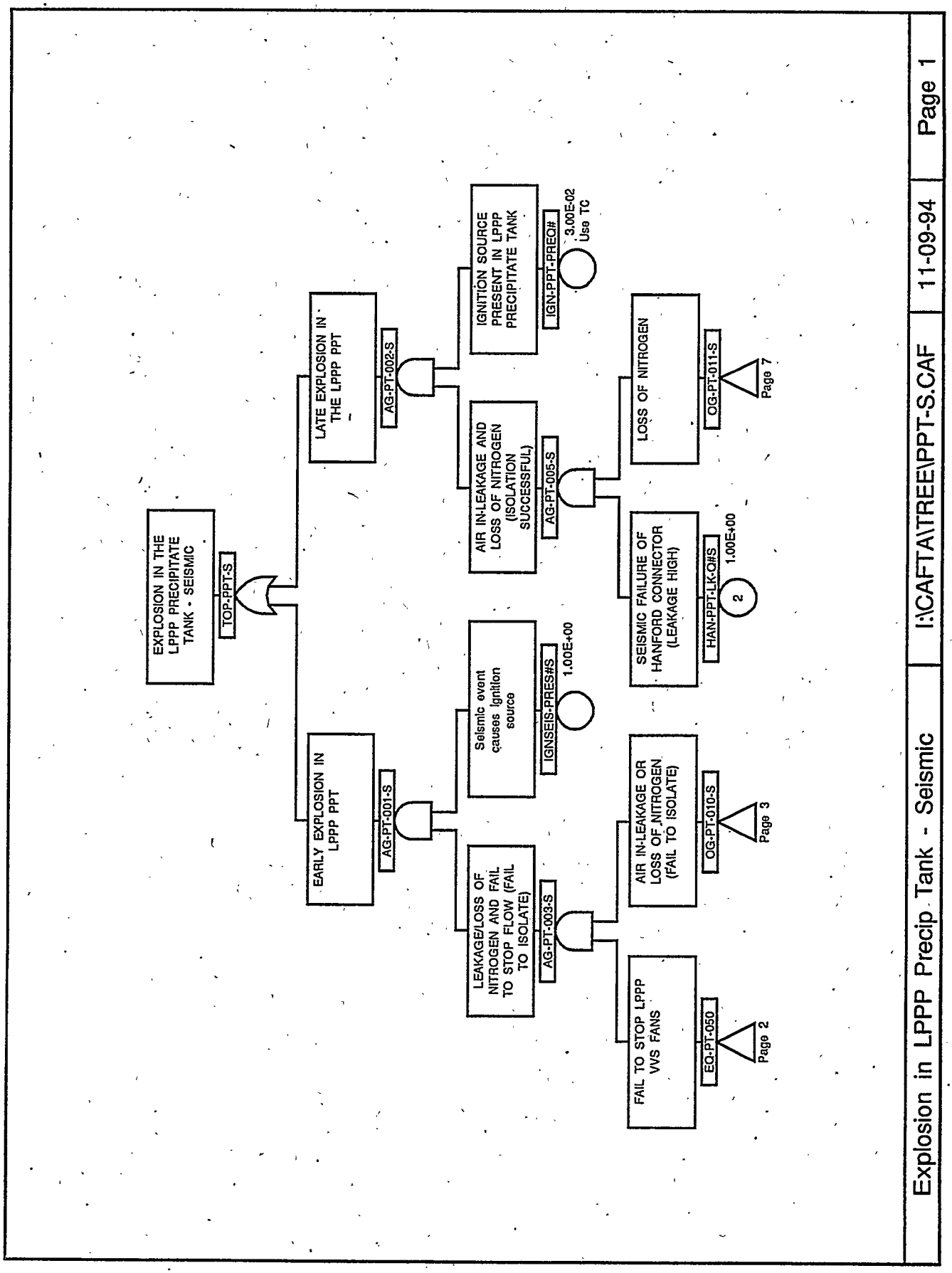
LPPP Sludge Pump Tank Explosion - Seismic



SPT Explosion - Seismic	I:\CAFTA\TREE\SPT-S.CAF	11-09-94	Page 1


SPT nitrogen path 1 unavailable
Page 1
GSPT-17
SPT nitrogen path 1 PSV fails open
PSVSPT1-FOP3#
4.80E-05
a: 96 hour duration
SPT nitrogen path 1 out of service for T&M
PCVSPT1-T&M1#
1.52E-02
a: 2 weeks per year
SPT nitrogen supply path 1 PCV fails to open
PCVSPT1-FTOJ#
3.00E-03
Use TC value
SPT nitrogen path 1 out of service following maintenance
OPRSPT1-RMH1#
1.00E-03
a: T&M annually, corrected in 1 week
SPT nitrogen supply path 1 needle valve closed erroneously
OPRSPT1-RANK#
1.20E-04
a: opened within 24 hours

LPPP PPT Explosion - Seismic


EXPLOSION IN THE LPPP PRECIPITATE TANK - SEISMIC
TOP-PPT-S
LATE EXPLOSION IN THE LPPP PPT
AG-PT-002-S
IGNITION SOURCE PRESENT IN LPPP PRECIPITATE TANK
IGN-PPT-PREQ#
3.00E-02
Use TC
AIR IN-LEAKAGE AND LOSS OF NITROGEN (ISOLATION SUCCESSFUL)
AG-PT-005-S
LOSS OF NITROGEN
OG-PT-011-S
Page 7
SEISMIC FAILURE OF HANFORD CONNECTOR (LEAKAGE HIGH)
HAN-PPT-LK-O#S
2
1.00E+00
EARLY EXPLOSION IN LPPP PPT
AG-PT-001-S
Seismic event causes ignition source
IGNSEIS-PRES#S
1.00E+00
LEAKAGE/LOSS OF NITROGEN AND FAIL TO STOP FLOW (FAIL TO ISOLATE)
AG-PT-003-S
AIR IN-LEAKAGE OR LOSS OF NITROGEN (FAIL TO ISOLATE)
OG-PT-010-S
Page 3
FAIL TO STOP LPPP VVS FANS
EQ-PT-050
Page 2
Explosion in LPPP Precip Tank - Seismic
I:\CAFTA\TREE\PPT-S.CAF
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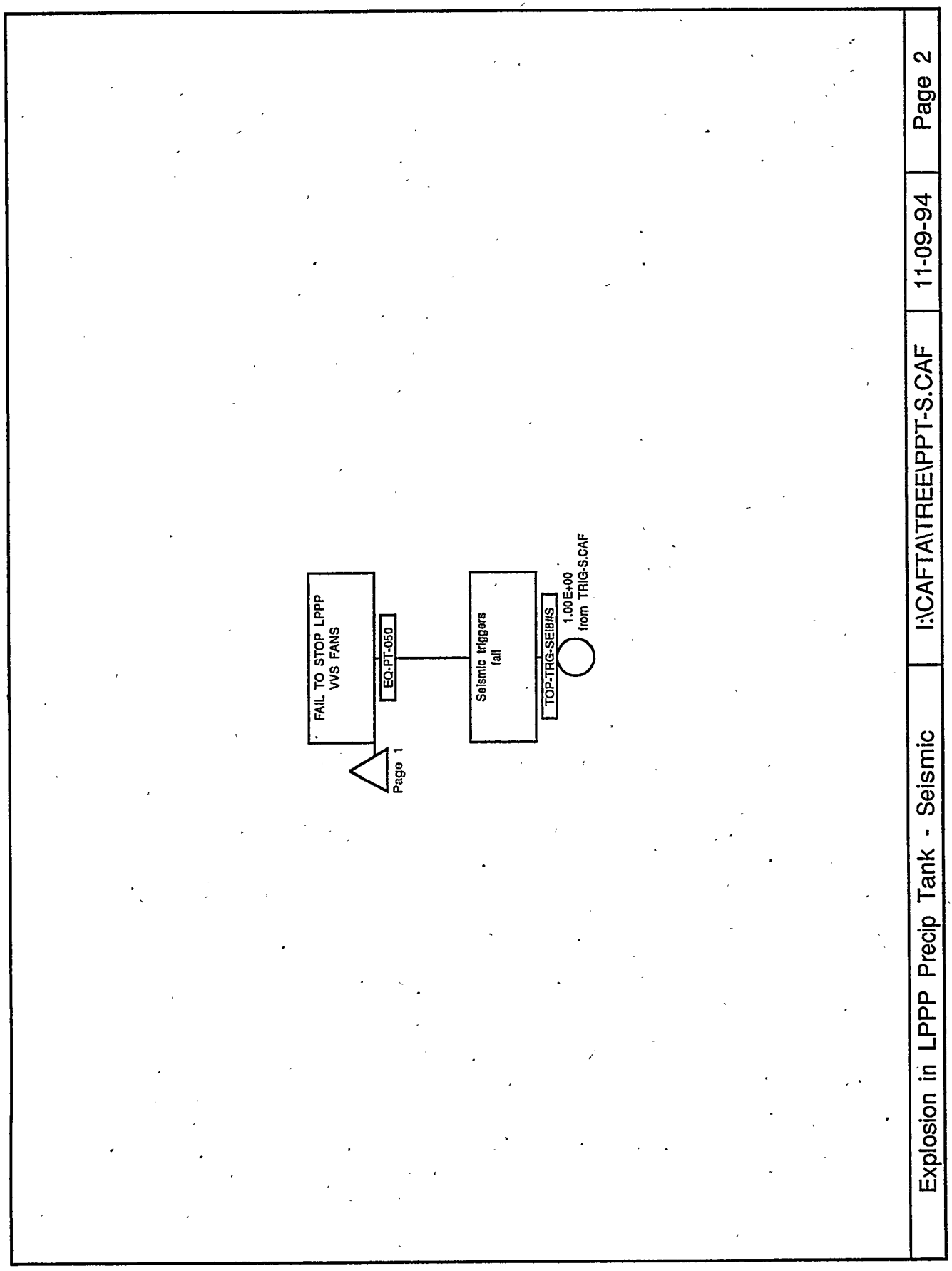
Page 1


FAIL TO STOP LPPP VVS FANS
EQ-PT-050
Page 1
Seismic triggers fail
TOP-TRG-SEI8#S
1.00E+00
from TRIG-S.CAF
Explosion in LPPP Precip Tank - Seismic
I:\CAFTA\TREE\PPT-S.CAF
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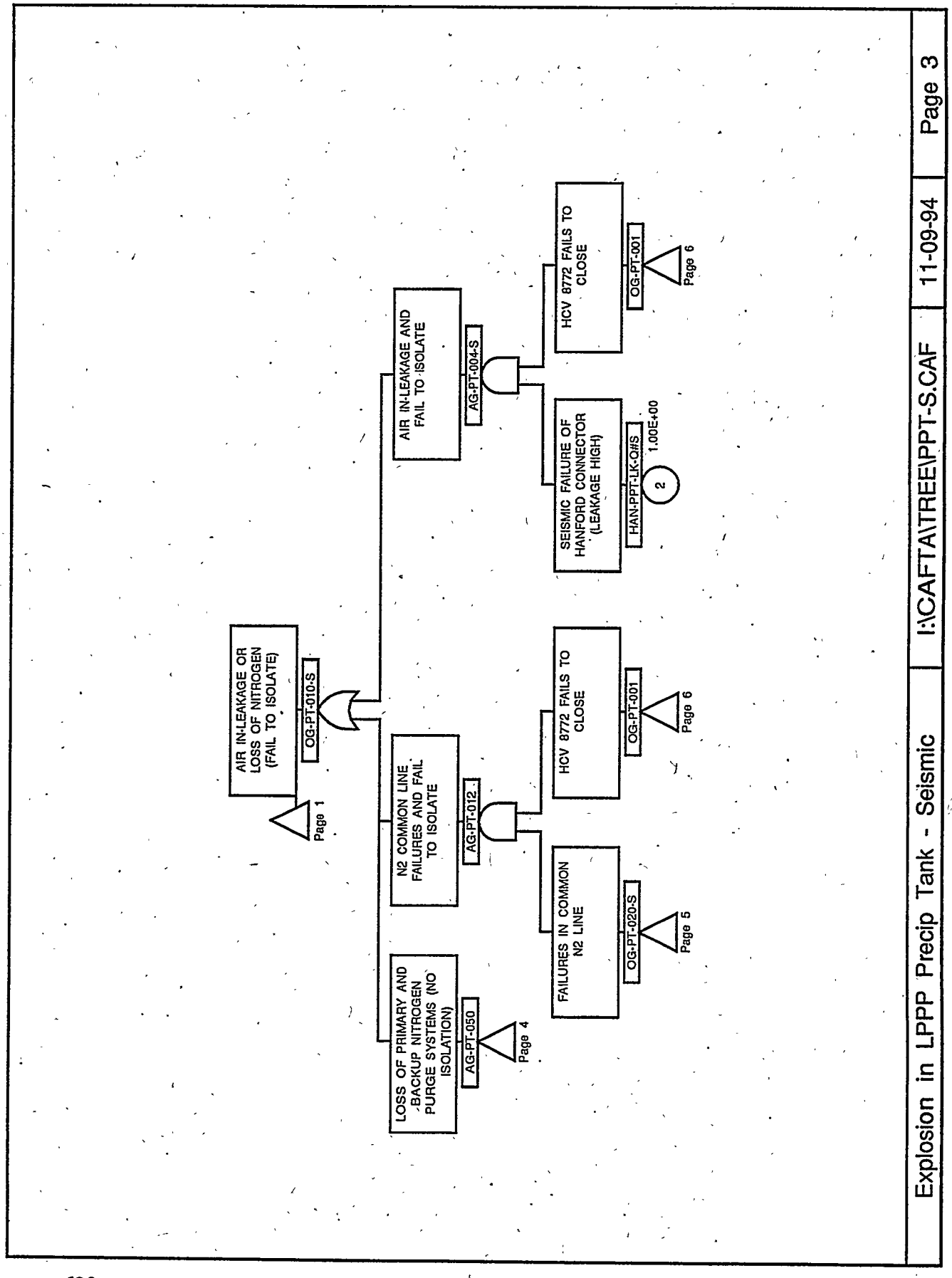
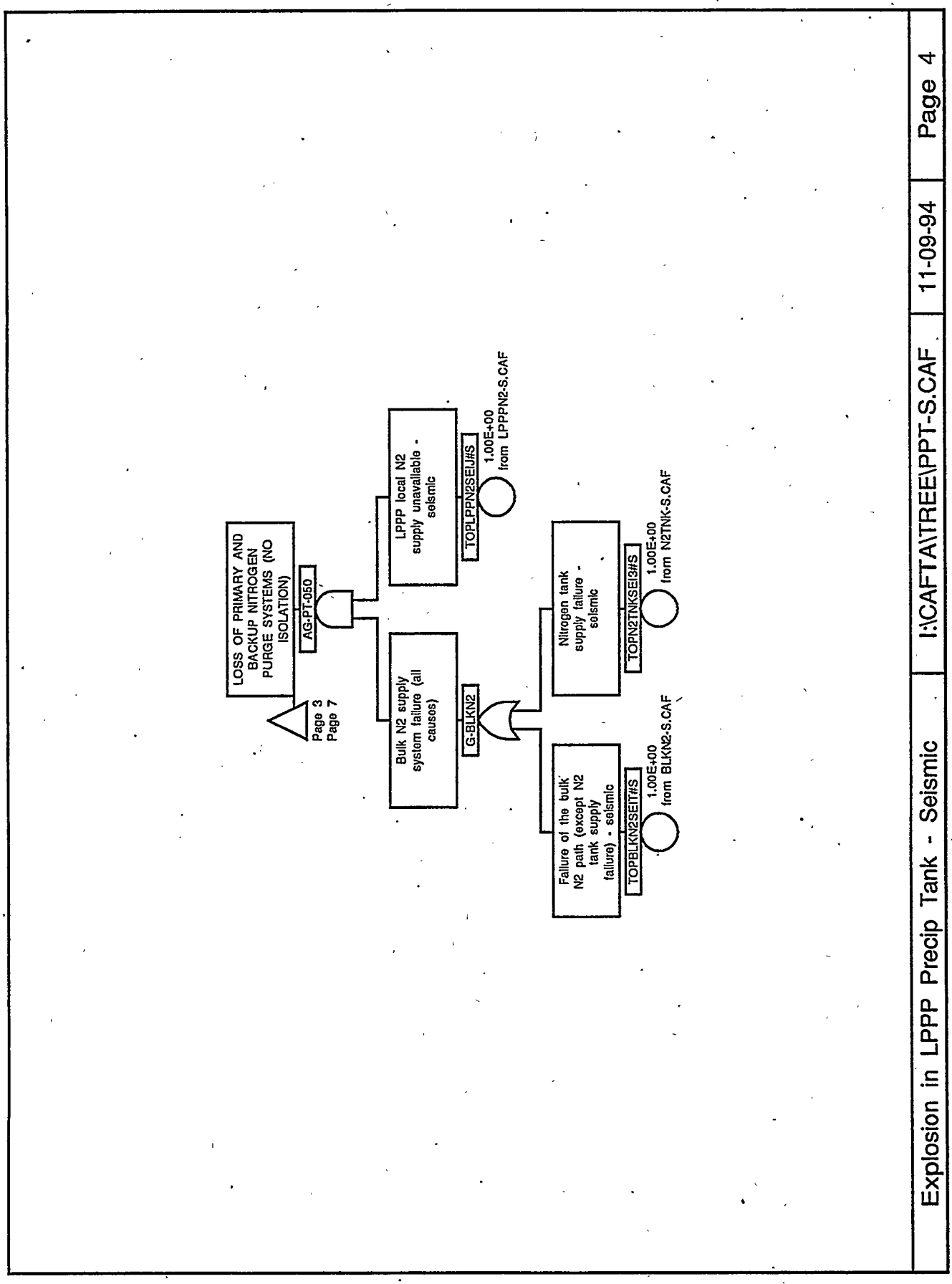
Page 2


Explosion in LPPP Precip Tank - Seismic
I:\CAFTA\TREE\PPT-S.CAF
11-09-94
Page 3
AIR IN-LEAKAGE OR LOSS OF NITROGEN (FAIL TO ISOLATE)
OG-PT-010-S
Page 1
LOSS OF PRIMARY AND BACKUP NITROGEN PURGE SYSTEMS (NO ISOLATION)
AG-PT-050
Page 4
N2 COMMON LINE FAILURES AND FAIL TO ISOLATE
AG-PT-012
FAILURES IN COMMON N2 LINE
OG-PT-020-S
Page 5
HCV 8772 FAILS TO CLOSE
OG-PT-001
Page 6
AIR IN-LEAKAGE AND FAIL TO ISOLATE
AG-PT-004-S
HCV 8772 FAILS TO CLOSE
OG-PT-001
Page 6
SEISMIC FAILURE OF HANFORD CONNECTOR (LEAKAGE HIGH)
HAN-PPT-LK-O#S
2
1.00E+00


LOSS OF PRIMARY AND BACKUP NITROGEN PURGE SYSTEMS (NO ISOLATION)
AG-PT-050
Page 3
Page 7
Bulk N2 supply system failure (all causes)
G-BLKN2
LPPP local N2 supply unavailable - seismic
TOPLPPN2SEIJ#S
1.00E+00
from LPPPN2-S.CAF
Nitrogen tank supply failure - seismic
TOPN2TNKSEI3#S
1.00E+00
from N2TNK-S.CAF
Failure of the bulk N2 path (except N2 tank supply failure) - seismic
TOPBLKN2SEIT#S
1.00E+00
from BLKN2-S.CAF
Explosion in LPPP Precip Tank - Seismic
I:\CAFTA\TREE\PPT-S.CAF
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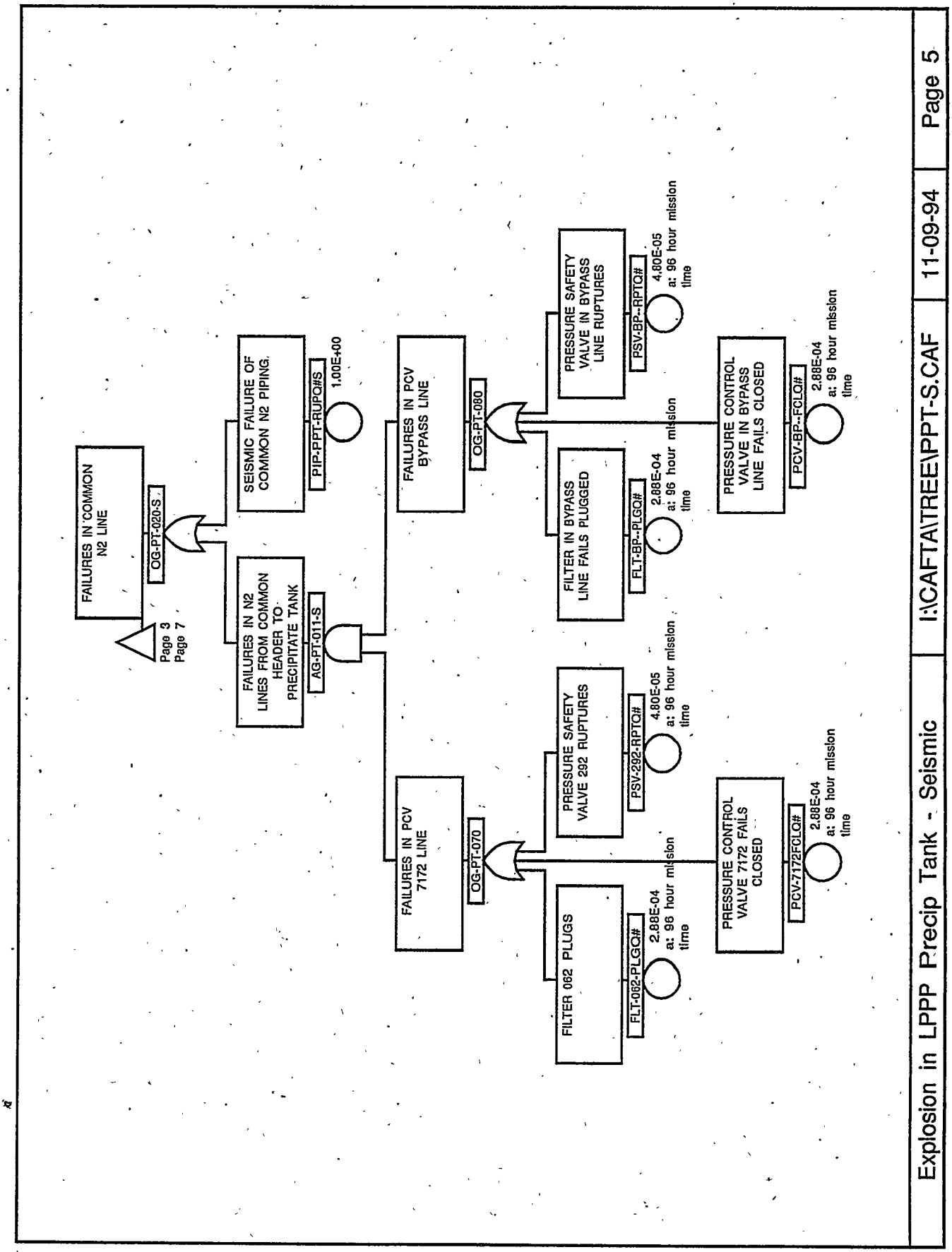
Explosion in LPPP Precip Tank - Seismic
I:\CAFTA\TREE\PPT-S.CAF
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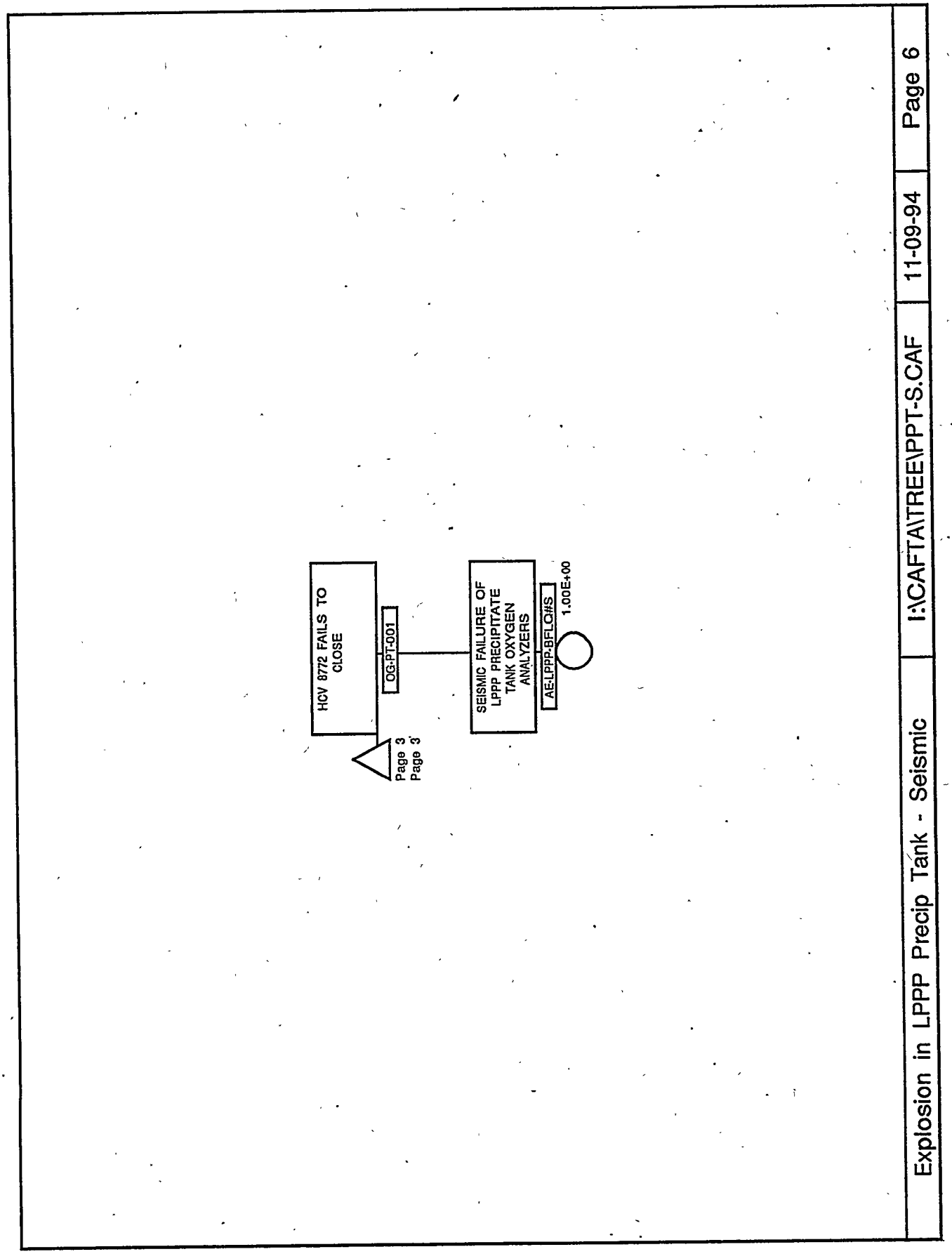
Page 5
FAILURES IN COMMON N2 LINE
OG-PT-020-S
Page 3
Page 7
SEISMIC FAILURE OF COMMON N2 PIPING
PIP-PPT-RUPO#S
1.00E+00
FAILURES IN N2 LINES FROM COMMON HEADER TO PRECIPITATE TANK
AG-PT-011-S
FAILURES IN PCV BYPASS LINE
OG-PT-080
PRESSURE SAFETY VALVE IN BYPASS LINE RUPTURES
PSV-BP--RPTO#
4.80E-05
a: 96 hour mission time
FILTER IN BYPASS LINE FAILS PLUGGED
FLT-BP--PLGO#
2.88E-04
a: 96 hour mission time
PRESSURE CONTROL VALVE IN BYPASS LINE FAILS CLOSED
PCV-BP--FCLO#
2.88E-04
a: 96 hour mission time
FAILURES IN PCV 7172 LINE
OG-PT-070
PRESSURE SAFETY VALVE 292 RUPTURES
PSV-292-RPTO#
4.80E-05
a: 96 hour mission time
FILTER 062 PLUGS
FLT-062-PLGO#
2.88E-04
a: 96 hour mission time
PRESSURE CONTROL VALVE 7172 FAILS CLOSED
PCV-7172FCLO#
2.88E-04
a: 96 hour mission time


HCV 8772 FAILS TO CLOSE
OG-PT-001
Page 3
Page 3'
SEISMIC FAILURE OF LPPP PRECIPITATE TANK OXYGEN ANALYZERS
AE-LPPP-BFLO#S
1.00E+00
Explosion in LPPP Precip Tank - Seismic
I:\CAFTA\TREE\PPT-S.CAF
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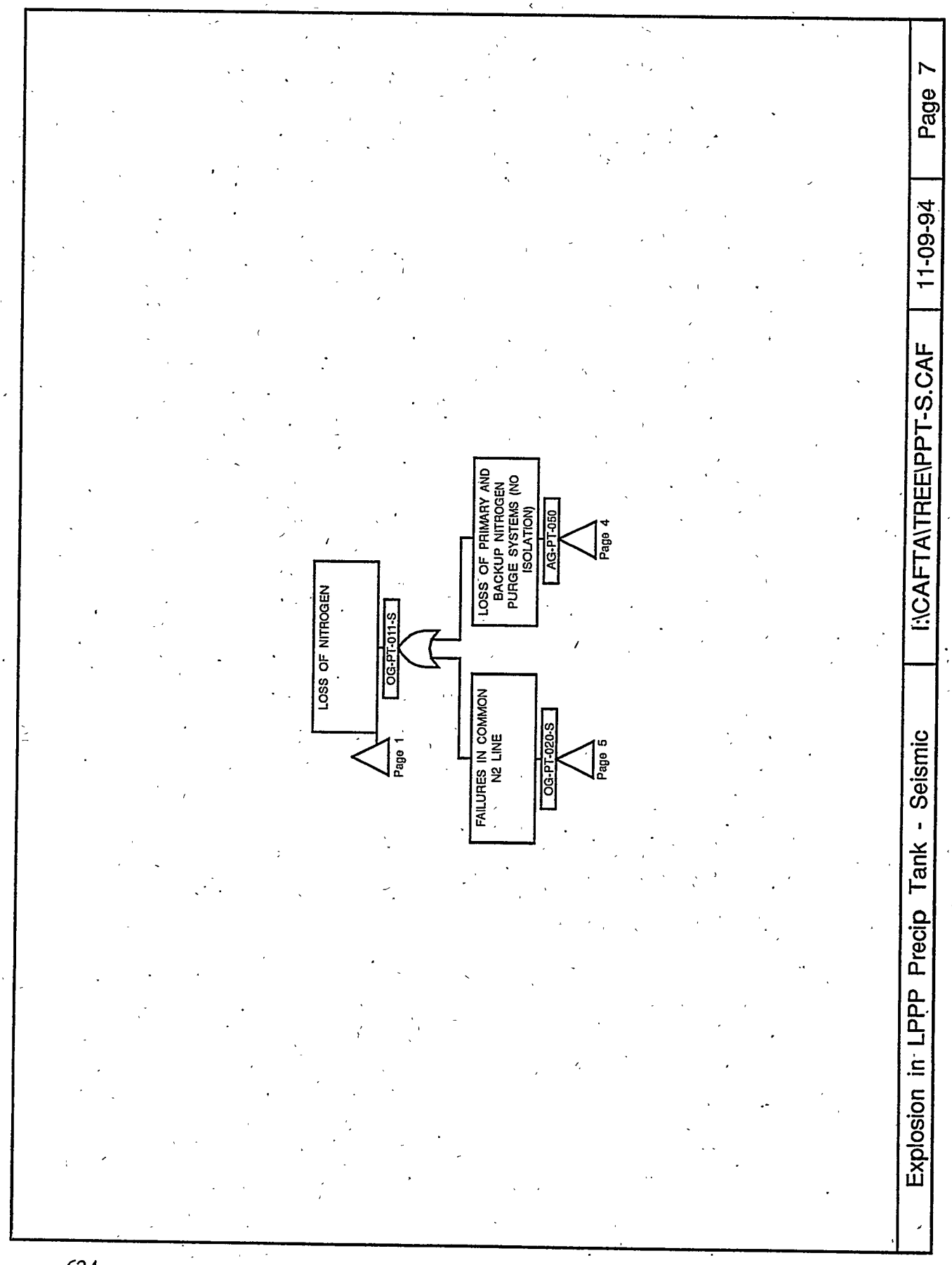
Page 6


LOSS OF NITROGEN
OG-PT-011-S
Page 1
LOSS OF PRIMARY AND BACKUP NITROGEN PURGE SYSTEMS (NO ISOLATION)
AG-PT-050
Page 4
FAILURES IN COMMON N2 LINE
OG-PT-020-S
Page 5
Explosion in LPPP Precip Tank - Seismic
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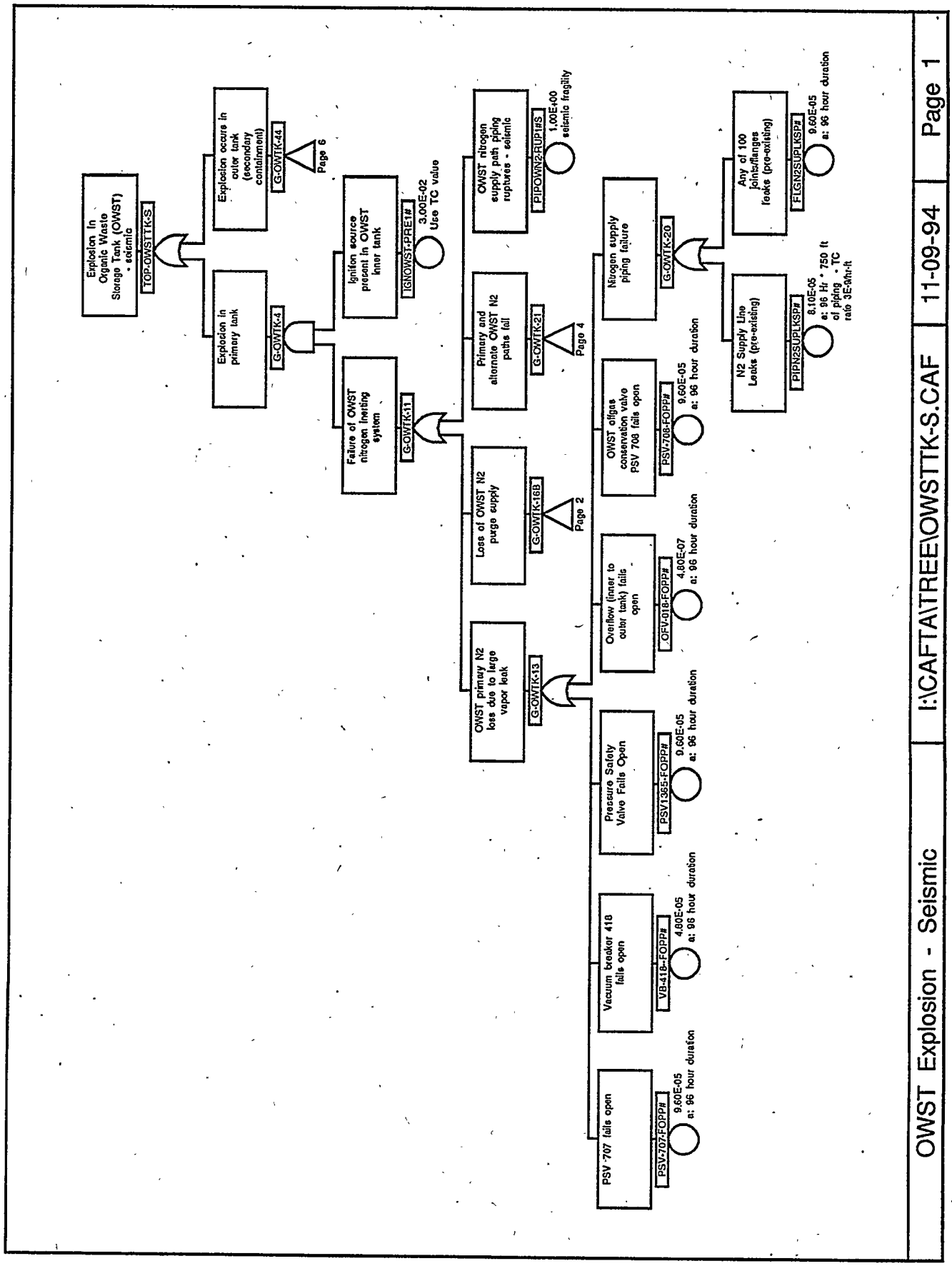
OWST Explosion - Seismic


Explosion in Organic Waste Storage Tank (OWST) - seismic
TOP-OWSTTK-S
Explosion in primary tank
G-OWTK-4
Explosion occurs in outer tank (secondary containment)
G-OWTK-44
Page 6
Failure of OWST nitrogen inerting system
G-OWTK-11
Ignition source present in OWST inner tank
IGNOWST-PRET#
3.00E-02
Use TC value
Primary and alternate OWST N2 paths fail
G-OWTK-21
Page 4
OWST nitrogen supply path piping ruptures - seismic
PIPOWN2RUP1#S
1.00E-00
seismic fragility
Loss of OWST N2 purge supply
G-OWTK-16B
Page 2
OWST primary N2 loss due to large vapor leak
G-OWTK-13
Overflow (inner to outer tank) fails open
OFV-418-FOPP#
4.80E-07
a: 96 hour duration
OWST offgas conservation valve PSV 708 fails open
PSV-708-FOPP#
9.60E-05
a: 96 hour duration
Nitrogen supply piping failure
G-OWTK-20
Any of 100 joints/flanges leaks (pre-existing)
FLGN2SUPLKSP#
9.60E-05
a: 96 hour duration
N2 Supply Line Leaks (pre-existing)
PIPN2SUPLKSP#
8.10E-05
a: 96 Hr * 750 ft of piping * TC rate 3E-6/hr-ft
Pressure Safety Valve Fails Open
PSV1365-FOPP#
9.60E-05
a: 96 hour duration
Vacuum breaker 418 fails open
VB-418-FOPP#
4.80E-05
a: 96 hour duration
PSV 707 fails open
PSV-707-FOPP#
9.60E-05
a: 96 hour duration
OWST Explosion - Seismic
I:\CAFTA\TREE\OWSTTK-S.CAF
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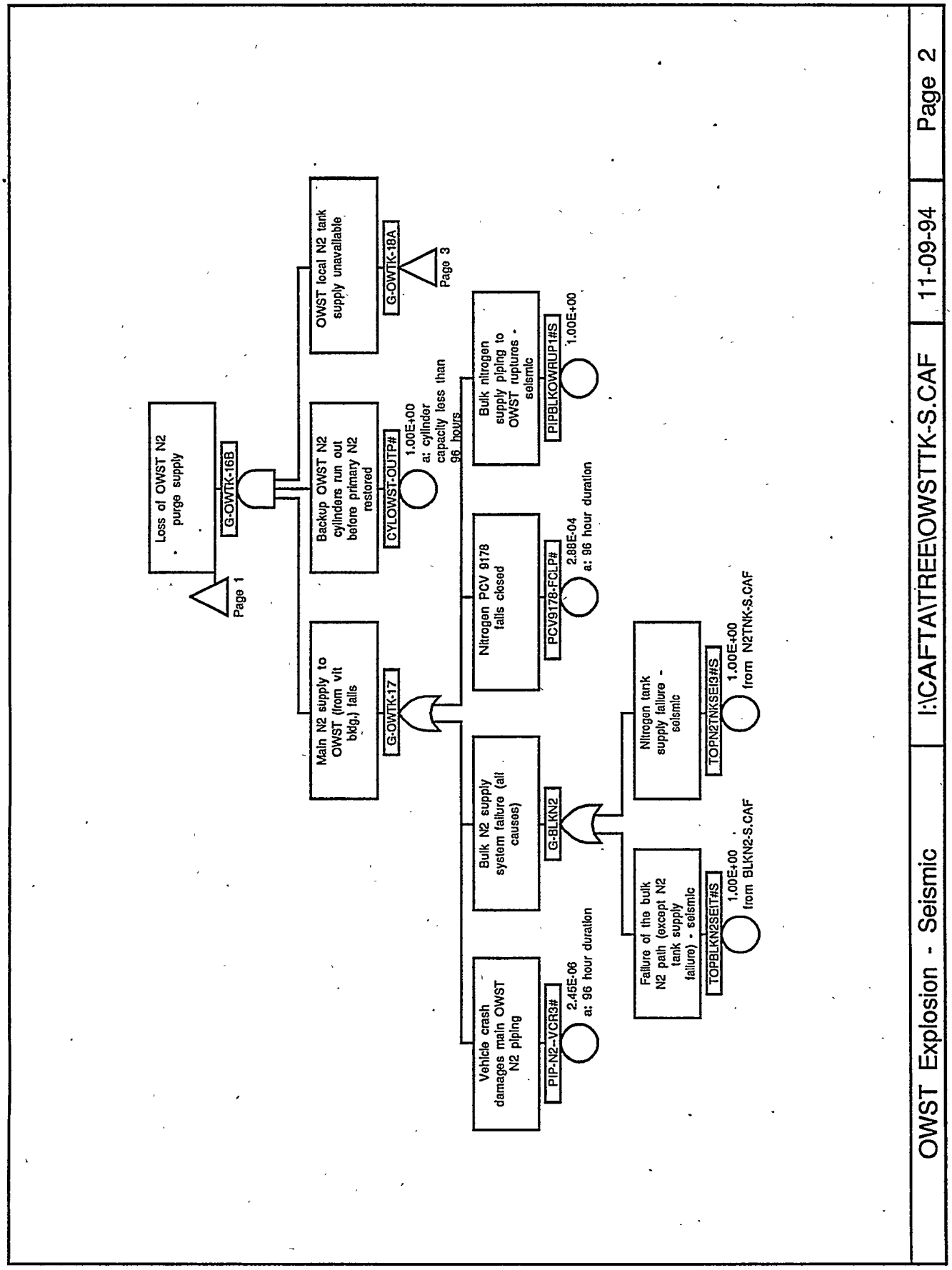
Page 1


Loss of OWST N2 purge supply
G-OWTK-16B
Page 1
Backup OWST N2 cylinders run out before primary N2 restored
CYLOWST-OUTP#
1.00E+00
a: cylinder capacity less than 96 hours
OWST local N2 tank supply unavailable
G-OWTK-18A
Page 3
Main N2 supply to OWST (from vit bldg.) fails
G-OWTK-17
Nitrogen PCV 9178 falls closed
PCV9178-FCLP#
2.88E-04
a: 96 hour duration
Bulk nitrogen supply piping to OWST ruptures - seismic
PIPBLKOWRUP1#S
1.00E+00
Bulk N2 supply system failure (all causes)
G-BLKN2
Vehicle crash damages main OWST N2 piping
PIP-N2--VCR3#
2.45E-06
a: 96 hour duration
Failure of the bulk N2 path (except N2 tank supply failure) - seismic
TOPBLKN2SEIT#S
1.00E+00
from BLKN2-S.CAF
Nitrogen tank supply failure - seismic
TOPN2TNKSEI3#S
1.00E+00
from N2TNK-S.CAF
OWST Explosion - Seismic
I:\CAFTA\TREE\OWSTTK-S.CAF
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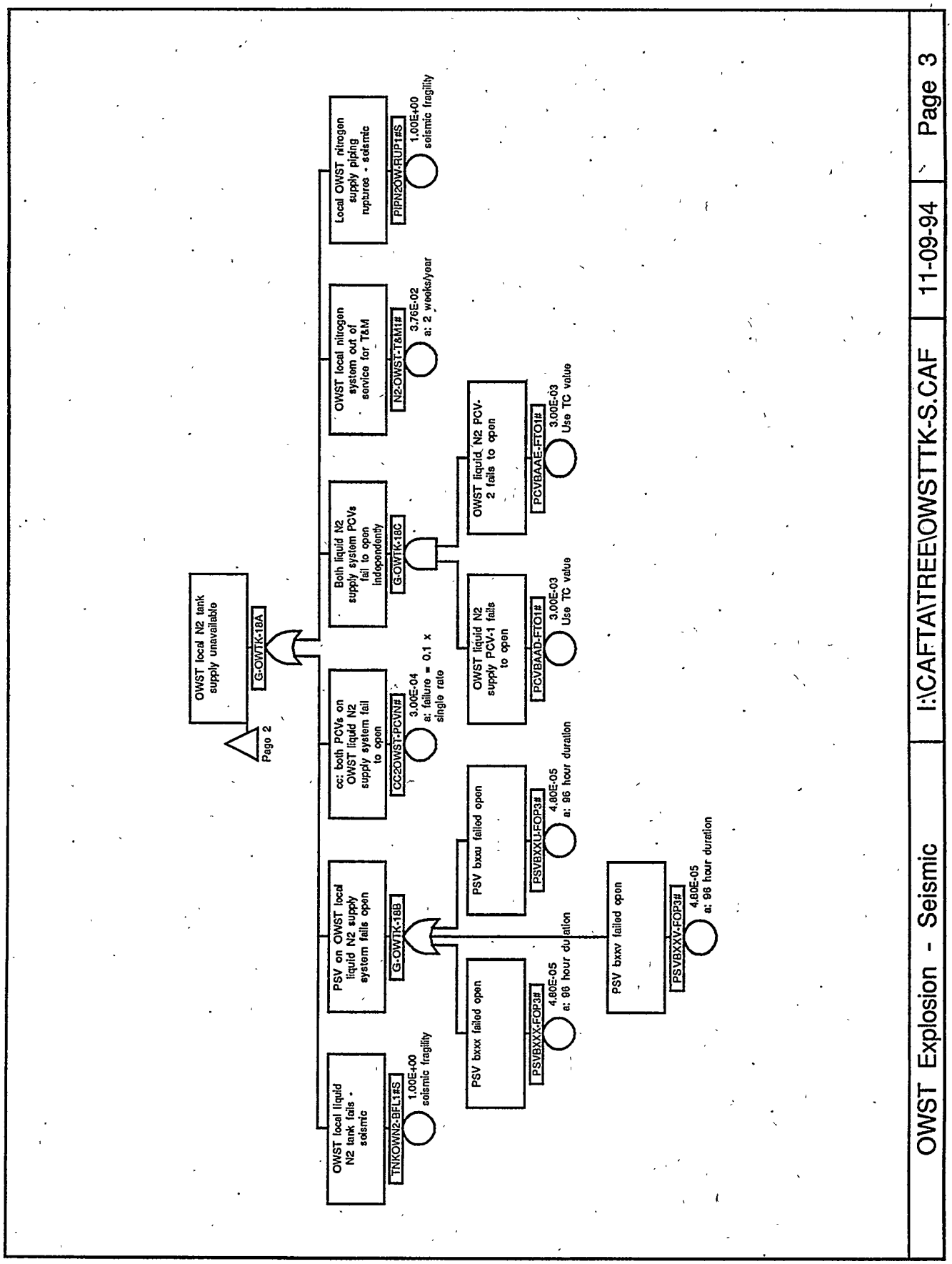
OWST Explosion - Seismic
I:\CAFTA\TREE\OWSTTK-S.CAF
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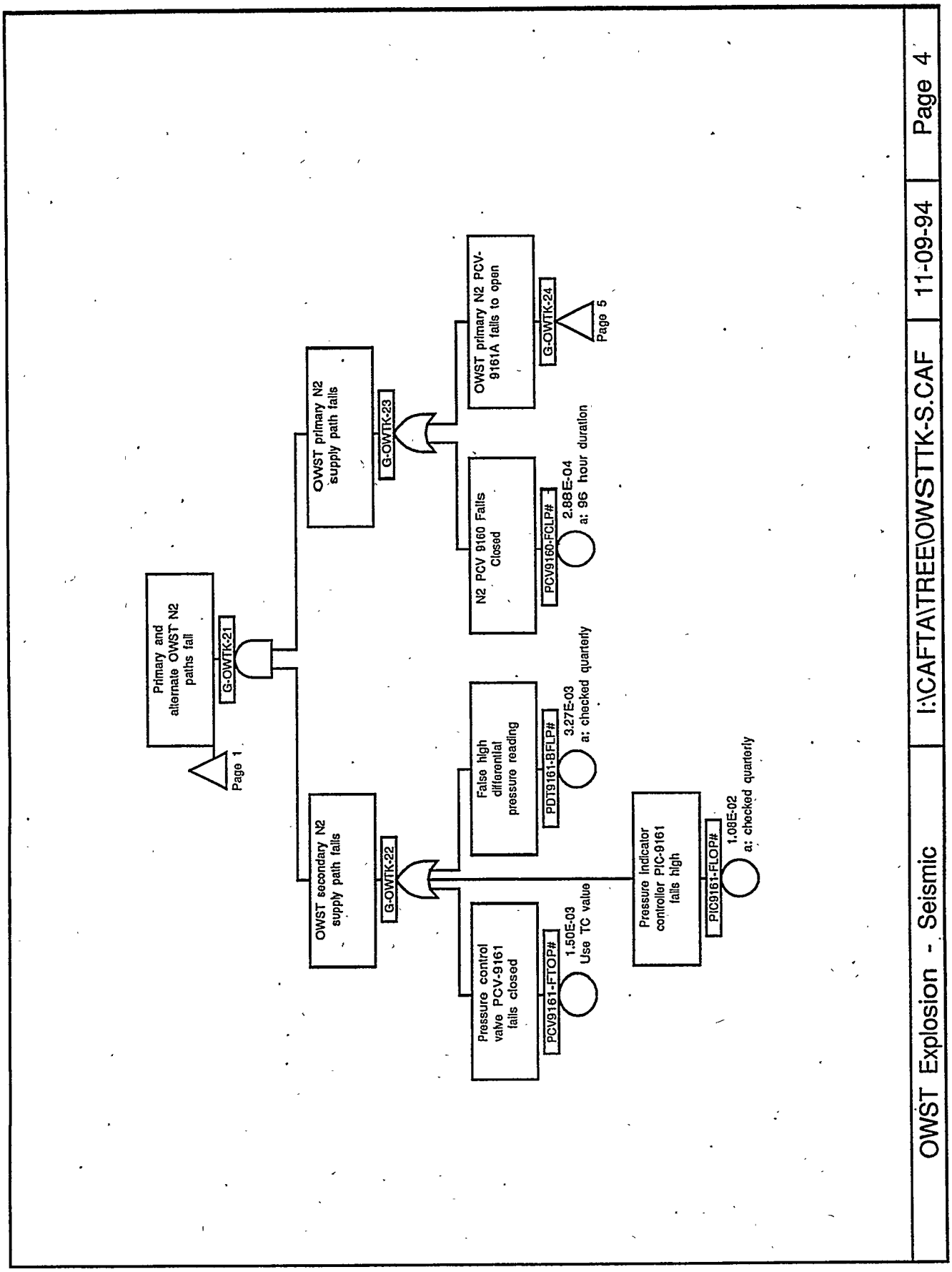
Page 3
OWST local N2 tank supply unavailable
G-OWTK-18A
Page 2
Both liquid N2 supply system PCVs fail to open independently
G-OWTK-18C
OWST local nitrogen system out of service for T&M
N2-OWST-T&M1#
3.76E-02
a: 2 weeks/year
Local OWST nitrogen supply piping ruptures - seismic
PIPN2OW-RUP1#S
1.00E+00
seismic fragility
OWST liquid N2 PCV-2 fails to open
PCVBAAE-FTO1#
3.00E-03
Use TC value
OWST liquid N2 supply PCV-1 fails to open
PCVBAAD-FTO1#
3.00E-03
Use TC value
cc: both PCVs on OWST liquid N2 supply system fail to open
CC2OWST-PCVN#
3.00E-04
a: failure = 0.1 x single rate
PSV on OWST local liquid N2 supply system fails open
G-OWTK-18B
PSV bxxu failed open
PSVBXXU-FOP3#
4.80E-05
a: 96 hour duration
PSV bxxx failed open
PSVBXXX-FOP3#
4.80E-05
a: 96 hour duration
PSV bxxv failed open
PSVBXXV-FOP3#
4.80E-05
a: 96 hour duration
OWST local liquid N2 tank fails - seismic
TNKOWN2-BFL1#S
1.00E+00
seismic fragility


Primary and alternate OWST N2 paths fail
G-OWTK-21
Page 1
OWST secondary N2 supply path fails
G-OWTK-22
Pressure control valve PCV-9161 fails closed
PCV9161-FTOP#
1.50E-03
Use TC value
False high differential pressure reading
PDT9161-BFLP#
3.27E-03
a: checked quarterly
Pressure Indicator controller PIC-9161 fails high
PIC9161-FLOP#
1.08E-02
a: checked quarterly
OWST primary N2 supply path fails
G-OWTK-23
N2 PCV 9160 Fails Closed
PCV9160-FCLP#
2.88E-04
a: 96 hour duration
OWST primary N2 PCV-9161A fails to open
G-OWTK-24
Page 5
OWST Explosion - Seismic
I:\CAFTA\TREE\OWSTTK-S.CAF
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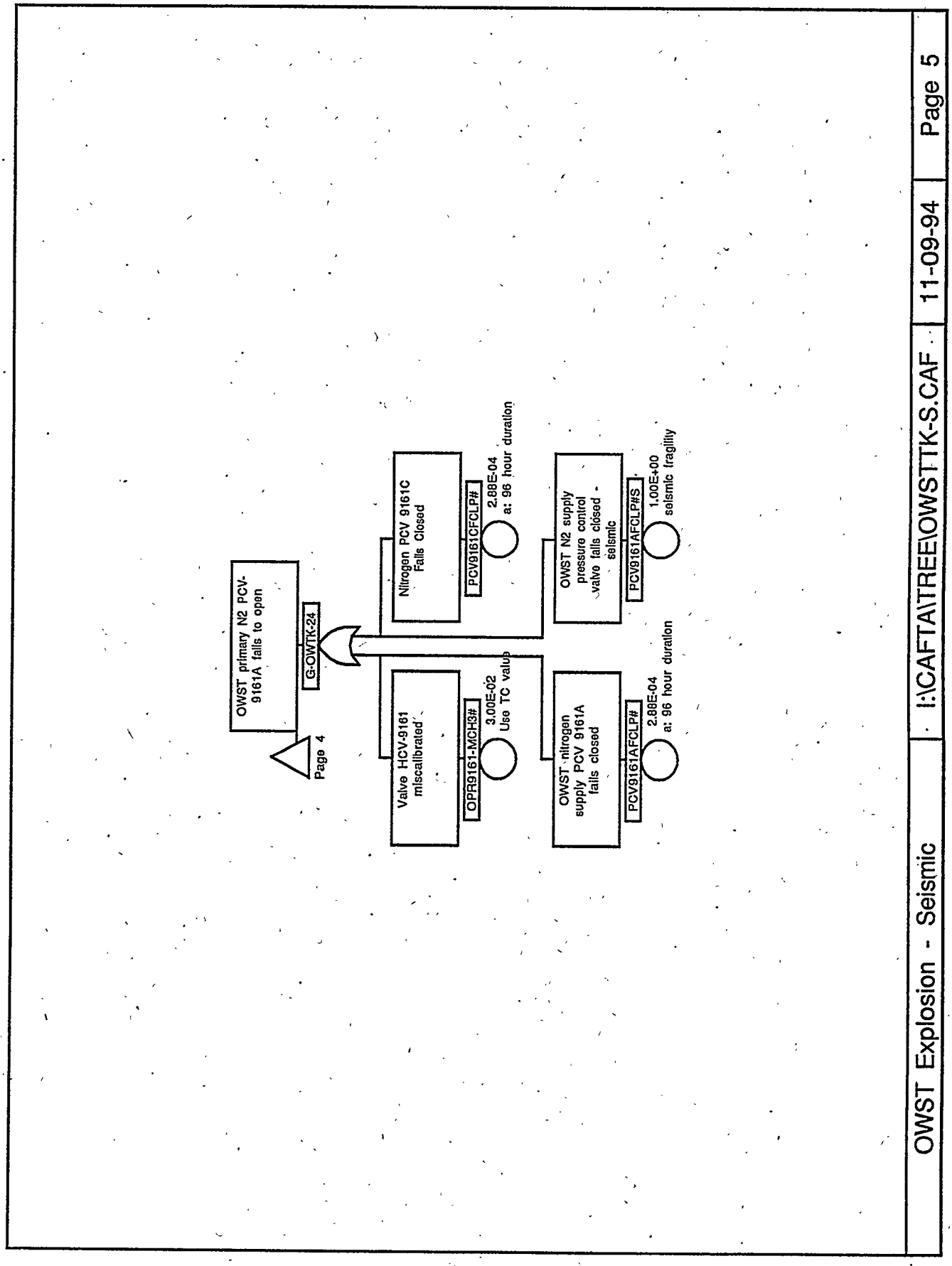
OWST primary N2 PCV-9161A falls to open
G-OWTK-24
Page 4
Valve HCV-9161 miscalibrated
OPR9161-MCH3#
3.00E-02
Use TC value
Nitrogen PCV 9161C Falls Closed
PCV9161CFCLP#
2.88E-04
a: 96 hour duration
OWST nitrogen supply PCV 9161A falls closed
PCV9161AFCLP#
2.88E-04
a: 96 hour duration
OWST N2 supply pressure control valve falls closed - seismic
PCV9161AFCLP#S
1.00E+00
seismic fragility
OWST Explosion - Seismic
I:\CAFTA\TREE\OWSTTK-S.CAF
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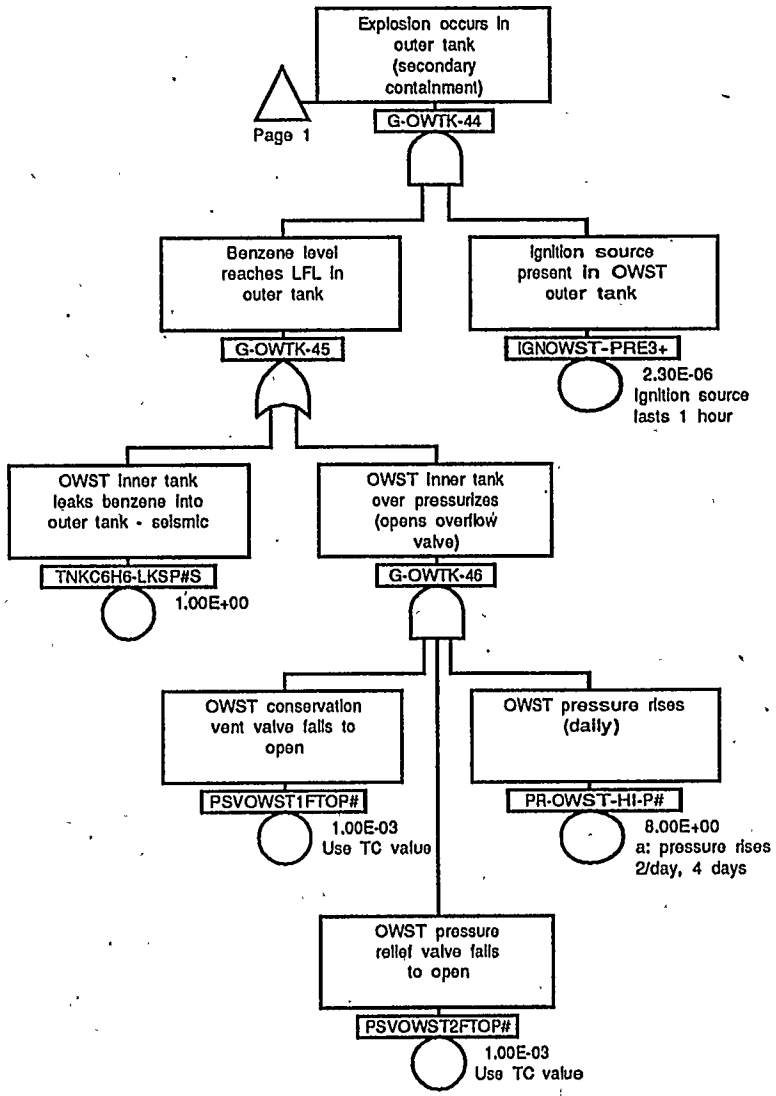
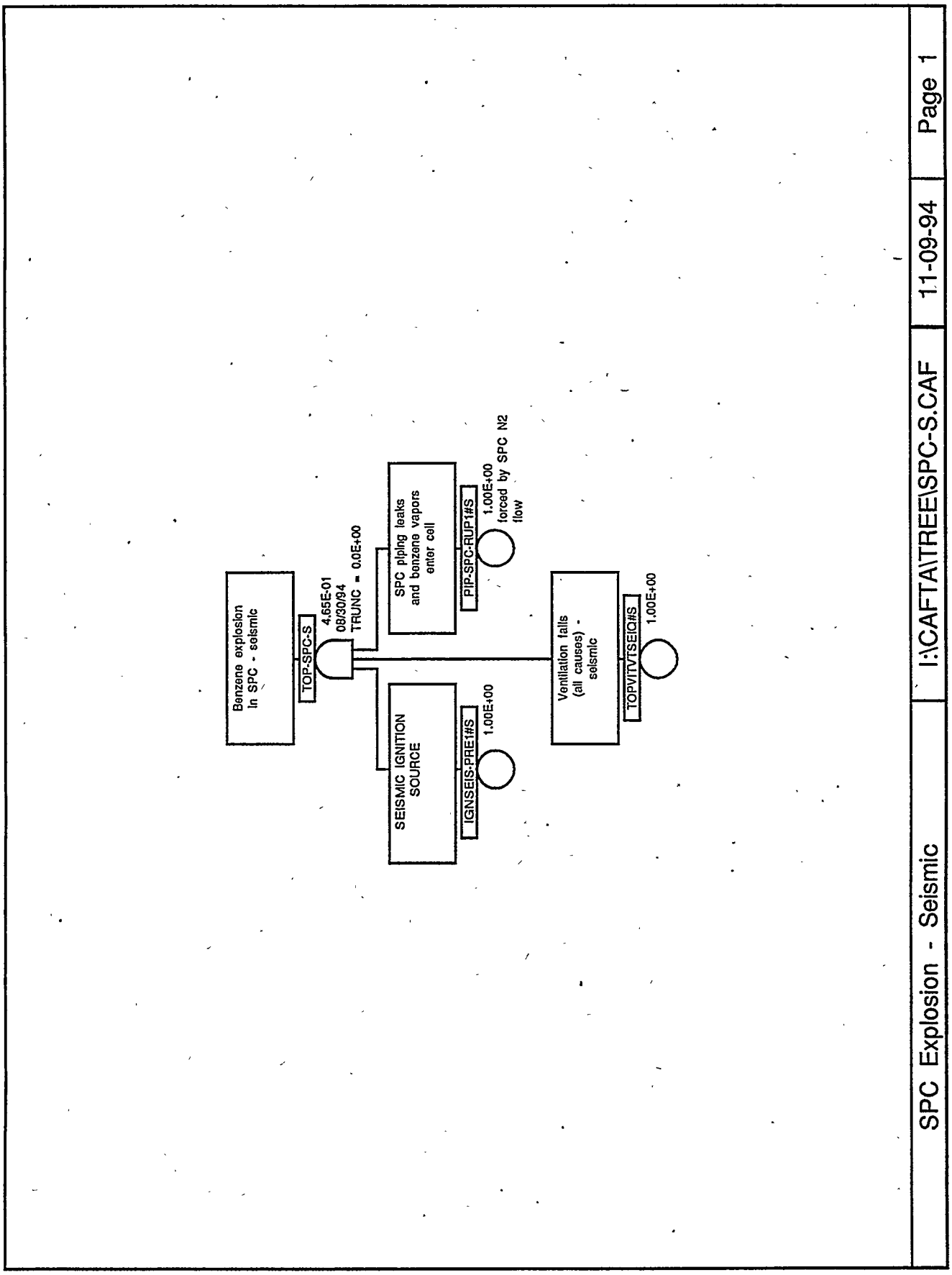


OWST Explosion - Seismic	I:\CAFTA\TREE\OWSTTK-S.CAF	11-09-94	Page 6

SPC Explosion - Seismic


Benzene explosion in SPC - seismic
TOP-SPC-S
4.65E-01
08/30/94
TRUNC = 0.0E+00
SEISMIC IGNITION SOURCE
IGNSEIS-PRE1#S
1.00E+00
SPC piping leaks and benzene vapors enter cell
PIP-SPC-RUP1#S
1.00E+00
forced by SPC N2 flow
Ventilation fails (all causes) - seismic
TOPVITVTSEIO#S
1.00E+00
SPC Explosion - Seismic
I:\CAFTA\TREE\SPC-S.CAF
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Attachment 8

DWPF Basic Event Importance Factors

The top event frequency (or probability) for each fault tree is a function of the failure frequency and failure probabilities of the various basic events in the tree. While some of these basic events contribute significantly to the top event frequency, others have less impact on that value. The relative significance of a basic event may be assessed using an importance analysis, a systematic reevaluation of the top event frequency based on independent change of individual events. Results of an importance analysis are typically expressed through presentation of importance measures, numeric rankings that represent each component's impact on the top event. A variety of importance measures may be calculated to express different perspectives of component significance. For purposes of the DWPF analysis, the Risk Reduction Worth and Risk Achievement Worth measures were chosen to provide information most relevant to facility maintenance and improvement goals.

The Risk Reduction Worth measure is defined as the decrease in risk if the basic event is assumed to be optimized (assumed to never fail). Mathmatically, it is the ratio of the original, nominal top event value (P_{top}) to the reduced top event value resulting from optimization of the basic event being evaluated (P_0).

$$RedW = P_{top} / P_0$$

In the case in which the basic event is an initiating event, the failure is expressed as a frequency of occurrence per hour (/H). Optimization of such an event is represented by a failure frequency of 0 occurrences per hour. In the case in which the basic event is an enabling event, the failure is expressed as a probability of occurrence and optimization is represented as a probability of 0.0. Consideration of the Risk Reduction Worth measure offers insight into the level of potential risk reduction available through improvement of individual components. Events that display a large Risk Reduction Worth value are most significant in contributing to the top event value. Those events with a Risk Reduction Worth value near 1.0 contribute less significantly, on an individual basis, to the top event value.

In the unique situation in which a single event must occur in each of the failure combinations (cutsets) that lead to top event occurrence, such as the presence of the ignition source in explosion fault trees, a very high risk reduction worth value will occur indicating that optimization, elimination of that event, would result in elimination of top event occurrence ($P_0 \rightarrow 0 \Rightarrow RedW \rightarrow \infty$). For this special case; the Risk Reduction Worth is defined, by convention, to be $1/P_{top}$.

The Risk Achievement Worth measure is defined as the increase in risk if the basic event is considered to assume the least optimum configuration. It is expressed as the ratio of the increased top event value that results from increased failure potential of the selected basic event (P_1) to the original, nominal top event value (P_{top}).

$$AchW = P_1 / P_{top}$$

As previously stated, initiating basic events are expressed as a frequency of occurrence (/H) and reliability reduction of such events is represented by assignment of a high frequency, 1.0 /H. Enabling basic events are expressed as probabilities of failure and reliability reduction is represented as certainty of failure, an assigned value of 1.0. Consideration of the Risk Achievement Worth measure provides insight into the significance of assuring performance of individual components. Basic events that display a large value of Risk Achievement Worth contribute most significantly to the top event value. A Risk Achievement Worth value near 1.0 indicates that failure of that component has little impact on the top event.

Two importance ranking tables are included for each DWPF fault tree. The first presents a list of the fault tree basic events in order of descending Risk Achievement Worth value, the second is ordered according to descending Risk Reduction Worth value. In each, the basic event is described and the associated frequency for initiator events or probability for enabling events is included. Due to the method used for fault tree development, it is common for a given event to contribute both in an initiating capacity and in an enabling capacity. For ease of interpretation, these contributions have been combined. Components that function as both initiators and as enablers are identified in the importance ranking tables by a "-C" at the end of the basic event name and the importance measures associated with these components include both aspects of performance.

It should be noted that the importance measure of each event is an independent, non-cumulative representation. It is not appropriate to consider the rankings in a summary manner as representation of the combined effect of multiple basic event value modifications. The impact of multiple event changes can only be determined through full reevaluation of the top event value.

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