FAULT TREE ANALYSIS

FOR

AMMONIUM NITRATE (AN) EXPLOSION

WITHIN THE

CHEMICAL PROCESS CELL

REV. 1

BY

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1.0 Introduction

A probabilistic fault tree analysis (FTA) was conducted to estimate the average annual frequency of explosion of ammonium nitrate (AN) contained in the chemical process cell (CPC) at the Defense Waste Processing Facility (DWPF) at the Savannah River Site (SRS). This frequency is estimated to be 1.7×10^{-5} yr^{-1}.

As discussed in this report, several design changes have been implemented in the CPC to reduce the likelihood of AN formation and explosion. Major equipment changes include ammonia removal by three scrubbers, new scrubber pump, three scrub solution control valves, scrub solution PH analyzers and slurry mix evaporator condensate tank (SMECT) cooling coils. Major equipment changes for hydrogen dilution and removal include larger blowers, upgrading chillers, larger formic acid vent condenser, nitrogen vaporizers and new purge air compressors.

This report summarizes the FTA conducted for this study. Topics discussed in this report are:

- Conduct of the FTA study (Section 2)
- Simplified CPC system description (Section 3)
- Sources of AN within the CPC (Section 4)
- Control schemes considered in the FTA (Section 5)
- Fault tree generation -- general assumptions (Section 6)
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2.0 Conduct of the FTA Study

During the summer of 1993, a completed set of chemical process cell (CPC) draft fault trees were generated for fire/explosion of ammonium nitrate (AN) within the CPC. Various fires were considered as ignitors of AN.

From a narrative description, a top level fault tree was generated. The top level fault tree was reviewed by BNI/BNISO and WSRC personnel. Appropriate changes were made to the top level fault trees. Detailed fault trees were generated to include control system failures, human error and interlock failures.

The fault trees were generated by first examining the Chapter 9 SAR fault trees. All estimates regarding human error probabilities were obtained directly from Chapter 9, ref (1). The SAR fault trees were modified to incorporate new or modified interlocks since completion of Chapter 9. In addition, the scope of this FTA study is different; we assume in this study that deposition of AN in CPC tank vent lines has occurred. Chapter 9 modeled the causes of deposition and failure to clean vent lines.

To be consistent with the SPC fault trees, ref (2) and (3), new failure modes were incorporated in the fault trees that were not included in the Chapter 9 SAR fault trees, i.e.,

- Interlocks can be bypassed with probability 1.0×10^{-3}
- Cooling coils and heat exchangers can be fouled
- Hanford connectors can leak (a cause of failure for air purge to CPC process vessels)
- Certain types of control system failures can be ameliorated by the operator opening bypass valves -- hence it is assumed that these operating procedures are in place.

During the course of the review of the detailed fault trees, leaking Hanford connectors were excluded from consideration.

A probabilistic fault tree analysis was then performed to obtain frequencies of the various fires. A preliminary list of dominant

failure modes were generated. A number of issues were raised regarding these fault trees.

Further review by WSRC personnel established that hydrogen fires alone cannot cause an AN explosion and that certain types of benzene fires involving precipitate hydrolysis aqueous (PHA) are not possible. Sustained fires are needed to heat the AN to the assumed ignition temperature of 135°C. Confinement is also necessary for AN to explode. In addition, it was established that the ammonia concentrations could not reach the LEL and ammonia fires were excluded from further consideration.

A new fault tree study was started in December of 1993 and completed in April, 1994 (called the "Rev. 0" FTA study). A new narrative description regarding AN decomposition was generated. This narrative description included hydrogen deflagrations as possible causes of AN decomposition and involves a more complicated sequence of events than for hydrogen fires. In addition, the Rev. 0 study modeled how AN deposition and decomposition can occur on the PVV heater. AN is not normally deposited on the heater when the heater is in operation. For this scenario, the heater must turn off, the CPC vessels must continue to generate both NH_3 and NO_x for an adequate amount of time to allow for a sufficient amount of AN deposition on the heater and then the operator must erroneously turn the heater on to ignite the AN. This study also recommended further design changes (i.e., alarms, interlocks and bypass valves) and implementation of new procedures to prevent and mitigate formation of AN on the PVV heater. Specifically, the inclusion of interlocks that would cease NH_3 generation in the SRAT, SME and RCT by shutting off steam and provide adequate cooling to these vessels in the event of low PVV heater outlet temperature or low PVV heater current was recommended. It was further recommended that manual bypass valves be installed in parallel with the SRAT, SME and RCT cooling water return valves which close upon loss of the DCS.

However, this scenario is not considered in this revision of the FTA report because it was discovered during the tests of AN deposit samples from the IDMS runs that these deposits of AN would not rapidly decompose or explode even if they were heated to temperatures in excess of 600°C, ref (7). The 600°C is considerably higher than 230°C, the operating temperature of the sheath of heating elements in the PVV heater, and more than the 590°C, the maximum temperature of the sheath of the heating

elements, assuming zero air flow across the heater, ref (11). For completeness, the engineering CALC-NOTE in the appendix of this report includes the FTA with the PVV heater scenario.

This study is a revision of the Rev. 0 report. The Rev. 0 report underwent a peer review. Comments from this peer review were incorporated in this report. In addition to excluding the PVV heater scenario, new estimates regarding pump ignition source failure rates were made. As described in section 8.1, ignition source failure rates are important risk drivers.

3.0 Simplified CPC System Description

The CPC contains the melter feed preparation system. The first step in the melter feed preparation operation is nitric acid adjustment of the sludge. This operation takes place in the sludge receipt and adjustment tank (SRAT). The aqueous product of the acid hydrolysis in the salt process cell (SPC), the PHA, is then blended with the sludge. The SRAT product is then transferred to the slurry mix evaporator (SME) where it is blended with a frit-water slurry. The resulting slurry, the SME product, is then sampled and analyzed to determine its acceptability and processability.

The PHA, bottoms from the precipitate reactor (PR) located in the SPC, will contain various aromatic organics including soluble benzene and phenylboric acid (PBA). The amount of benzene in the precipitate reactor bottoms tank (PRBT) vapor space is determined by the vapor-liquid equilibrium in the tank and is thus dependent upon the temperature of the PHA material. All soluble benzene and the benzene fraction of PBA decomposition products will vaporize and exit the SRAT to the process vessel vent system (PVVS) upon addition of the PHA to the SRAT's boiling contents.

Once the slurry is determined to be acceptable and processable, it is transferred to the melter feed tank (MFT) and slowly fed to the melter. See figure 1 for a simple schematic of the CPC and PVVS.

Hydrogen will be generated during the melter feed preparation in the CPC by two means: radiolysis and catalysis. Catalysis refers to the decomposition of formic acid catalyzed by noble metals. Hydrogen generation from catalysis increases as temperature increases.

As described in Section 4.0, both hydrogen and benzene are flammables and can ignite AN under certain conditions.

The sequence of steps conducted for the SRAT, SME, PRBT and MFT during the operational cycle and their duration are shown respectively in tables 7, 8, 9 and 10.

4.0 Sources of Ammonium Nitrate (AN) within the CPC

Ammonium nitrate (NH_4NO_3) may form and accumulate in the melter feed preparation system and the process vessel vent system (PVVS). Figure 1 shows the vent line locations where AN can deposit within the CPC. AN is formed by the reaction of gaseous ammonia (NH_3) with nitrogen dioxide or nitric acid fumes. Ammonia is formed by a catalyzed reaction between formic acid and nitrate ions. NH_3 is also present in the PHA. AN is a solid which can deposit in off-gas system piping and equipment and cause blockage. AN is explosive under the right conditions.

To limit the formation of AN, packed bed scrubbers are provided to remove ammonia in the vent gas. A scrubber is located at the exit of the SRAT condenser, SME condenser, and the RCT/MFT vent line. The scrubbers are designed to reduce the ammonia concentration to less than 10 ppm. The small amount of ammonia remaining in the treated vent gas may react to form AN. There is no direct means to verify the required scrubbing efficiency is being met. As a result, the off-gas lines and equipment where AN might form need to be periodically flushed with water to remove possible ammonium nitrate deposits.

Some organic compounds in the PHA are vaporized into the SRAT off-gas stream. The high-boiler organic compounds can condense and build up in the SRAT condenser and off-gas lines. Ammonium nitrate mixed with hydrocarbons increases the potential for explosion and the explosive force generated. Certain organic compounds also increase its sensitivity to explosion. Studies indicate that organic accumulation will be insignificant with the nitric acid and late wash flowsheets.

5.0 Control Schemes Considered in the FTA

An important step in the FTA was to identify the hardware elements that comprise important feedback loops that perform important functions such as achieving air purge flow and achieving adequate cooling. The hardware elements comprising these negative feedback loops are listed in table 1. Failure of control elements comprising these control loops can cause insufficient purge flow or cause insufficient cooling and are initiating events considered in the FTA.

The next step in the FTA was to list the interlocks that could ameliorate the effect of these failures. As described in section 4, hardware elements that comprise these interlocks are shown in table 2. Credit in the FTA was given to both software and hardwired interlocks. It is important to note that the FTA considered only the relevant interlock actions listed in table 2 -- not all actions listed there are included in the FTA. It is important to note the PRBT and MFT do not have off-gas analyzers as do the SRAT and SME. It is basically for this reason that fires have higher frequency of occurrence in the PRBT and MFT than they do in the SRAT and SME.

During fault tree construction, particular emphasis was addressed to identifying common cause initiating events, i.e, failure modes that cause system upset conditions and simultaneously fail mitigative system features such as interlocks. For example, the PRBT or MFT temperature sensor failing low would cause high temperature and result in failure to turn off the PRBT or MFT agitators -- this dependency is evident when examining interlocks 2 and 20. As described in section 9, these failure modes are dominant risk contributors.

6.0 Fault Tree Generation -- General Assumptions

In this section, we list the assumptions that are used to generate the fault tree shown in Appendix A. Sheets 1, 2, 6, 11, 16 and 17 show the top level events considered in the FTA and represent the scenarios considered in the FTA. The FTA addressed the following type of generic scenario involving AN explosion within the CPC:

- Deflagrations or fires which ignite AN contained in vessel vent lines.

For this scenario, we assume that sensitized AN is present all the time and that either a hydrogen deflagration or benzene fire is required to ignite the AN.

As described in section 2.0, deposition of AN on the PVV heater is not considered since the usual heater temperature prevents deposition on the heater during normal operation.

6.1 Explosion of AN Contained in CPC Vessel Vent Lines

We assume that an explosion of AN in the CPC tank vent lines when the following conditions occur. These conditions are inputs to top level AND gates (refer to sheet 1, logic gates CP-01-01 and CP-01-03).

- Sufficient AN forms in CPC tank vent lines (assumed to be true)
- The AN is sensitized by impurities (e.g., organics and chlorides) in CPC tank vent lines (assumed to be true)
- High temperature (>135°C) is the mechanism to initiate the AN explosion. High temperatures are caused by **sustained** fires or deflagrations involving benzene, hydrogen or a combination of benzene and hydrogen
- CPC tank vent lines (6" dia and smaller) provide sufficient confinement for the AN to explode (assumed to be true).

No credit is taken for air inleakage to dilute hydrogen because there is no means to ensure the inleakage flow is high enough to dilute the hydrogen to safe levels.

We assume that ammonia concentrations will always stay below the LEL within the melter feed preparation process. Hence ammonia fires are not considered as heat sources to ignite the AN.

Fires in the PVVH are not considered because the 10" dia header is assumed to be too large to sufficiently confine the AN to explode. Below, we discuss the fires/deflagrations involving either benzene, hydrogen or a combination that can cause the AN to decompose. In addition we list the applicable interlocks given in table 2 that would ameliorate the effect of upset conditions for the scenarios described below.

For the following discussion, location numbers refer to locations in the simplified block diagram shown in figure 1.

6.1.1 SRAT Hydrogen Deflagration (Sheet 2)

For this scenario, a hydrogen deflagration in the SRAT causes an AN explosion downstream of SRAT condenser (location 1). Any of the following conditions cause hydrogen to reach an explosive concentration (4%):

- Insufficient SRAT purge gas flow (Sheet 3)
- Excessive formic acid added to PR (Sheet 4)
- High noble metal concentration in the sludge received from the tank farm (Sheet 5).

It is assumed that high nitric acid addition would not cause a substantial increase in hydrogen generation and is not considered in the FTA.

It is also assumed that the formic acid addition line to the SRAT, SME and MFT will be modified to prevent accidental addition due to operator error. Therefore, excessive formic acid addition to the SRAT, SME or MFT was not considered as a credible scenario in this FTA report.

SRAT ignition sources include the sample pump, transfer pump, agitator and static charge.

Mitigators include (1) backup purge air compressor and (2) backup nitrogen for purge air. SRAT gas analyzer would alarm at high LFL at about 2.5%, stop the steam, stop PHA addition, and turn on the cooling water. The PHA is sampled prior to transfer from the PR and the PRBT. Applicable interlocks are 3, 4, 5, 6, 7, 8, 9 and 10.

6.1.2 SME Hydrogen Deflagration

In this scenario, a hydrogen deflagration in the SME causes an AN explosion downstream of the SME condenser (location 4).

It is assumed that this scenario is similar to the SRAT hydrogen deflagration. Applicable interlocks are 10, 11, 12, 13, 14, 15, 16 and 17.

6.1.3 PRBT Benzene/Hydrogen Deflagration (Sheet 6)

For this scenario, a hydrogen and benzene deflagration in the PRBT causes an AN explosion in the mercury transfer header (location 10). It is assumed that any one of the following conditions would result in the formation of an explosive benzene/hydrogen mixture:

- Insufficient PRBT purge gas flow (Sheet 7)
- Insufficient cooling water heat removal (Sheet 9).

For both the PRBT and the MFT, the cooling coils are assumed to provide cooling when the vessels are at low liquid level. Hence the agitator operating at a low level resulting in insufficient heat removal is not considered in the FTA.

PRBT ignition sources include the sample pump, transfer pump, agitator and static charge.

Mitigators include (1) backup purge air compressor, (2) backup nitrogen for purge air and (3) redundant flowmeters and controllers on purge supply line. It will take 17.9 hours for a hydrogen/ benzene mixture to build up to LFL based on the hydrogen generation rate by radiolysis in ref (10), 0.008 scfm, and by catalysis in ref (9), 0.0019 scfm. During this time, it is assumed that repair

of failed components can take place (e.g., repairing a failed compressor) to restore either the main purge system or the backup nitrogen supply. It is assumed that the mean repair time of repairing either the main or backup purge system is eight hours and that the repair rate is constant, i.e., exponentially distributed. The probability of no repair in 17.9 hours is $e^{-17.9/8} = 0.11$. Applicable interlocks are 1, 2 and 10.

6.1.4 MFT Hydrogen Deflagration (Sheet 11)

For this scenario, a hydrogen deflagration in the MFT causes an AN explosion in vent line (location 10 in figure 1) or mercury transfer header. It is assumed that any one of the following conditions will result in an explosive concentration of hydrogen (4%) in the MFT:

- Insufficient MFT purge gas flow (Sheet 12)
- Insufficient cooling water heat removal (Sheet 14).

Excessive formic acid addition to PR is not considered due to its low probability of occurrence, i.e., numerous transfer and sampling errors from the PR, PRBT, SRAT and SME would have to occur.

MFT ignition sources include the sample pump, two feed pumps, agitator and static charge.

Mitigators include (1) backup purge air compressor and (2) backup nitrogen for purge air. As with the PRBT, there are redundant flowmeters and controllers on purge supply line. It will take 2.6 hours for the hydrogen concentration to build up to LFL based on the hydrogen generation rate by radiolysis in ref (10), 0.0078 scfm, and by catalysis in ref (9), 0.060 scfm. During this time, it is assumed that repair of failed components can take place to restore either the main purge system or the backup nitrogen supply. The probability of no repair in 2.6 hours is $e^{-2.6/8} = 0.72$. Applicable interlocks are 10, 19 and 20.

6.1.5 PRBT Internal Benzene Fire (Sheet 16)

An extended fire in PRBT causes AN explosion in mercury transfer header. The sequence of events is:

- Large quantity of benzene is accidentally drained from the precipitate reactor condensate decanter (PRCD) into the PR. The PHA and benzene are erroneously transferred from PR to PRBT (Sheet 33).

- If the PRBT agitator is not running, a separate benzene layer forms in the PRBT (Sheet 33).

- The PRBT vapor space is above LFL and catches fire. The benzene layer supplies fuel for a sustained fire.

- Ignition sources include the agitator, sample pump, transfer pump and static charge.

Mitigators include (1) PHA is sampled in PR prior to transfer and (2) the PRBT agitator is normally running.

Assumption:

- A prolonged fire is necessary to decompose AN to explosion. This can only occur if a large quantity of benzene is present as a separate layer.

6.1.6 SRAT Benzene Fire

This fire is not considered because it will have lower probability than PRBT benzene fire.

6.1.7 PRBT External Benzene Fire (Sheet 17)

An extended fire in the CPC causes AN explosion in mercury transfer header or CPC tank vent lines. The sequence of events is:

- Large quantity of benzene is accidentally drained from the PRCD into the PR. The PHA and benzene are transferred from the PR (Sheet 33).

- The jumper to the PRBT leaks and the PHA and benzene accumulate in the CPC trench and sump (Sheet 17).

- The benzene floats on top and ignites, causing a fire that heats the vent lines above it.

- Ignition sources include the sump pump and static charge.

Mitigators include a low level PRCD alarm, sampling and transfer procedures.

7.0 Min Cut Set Generation

Once the fault tree is generated, the next step is to generate the min cut sets. Min cut sets, called the system modes of failure, are combinations of basic events that cause the Top Event to occur. For this study, min cut sets describes scenarios by which sustained fires or deflagrations can occur within the CPC to decompose AN contained in various vent lines identified in figure 1. Two conditions are required for fire or deflagration to occur:

- Formation of an explosive concentration (benzene and/or hydrogen concentration between the LEL and UEL and oxygen concentration above MOC [assumed to be true])

- Ignition source present.

The computer code FTAP was used to find the min cut sets. There are a total of 1,313 min cut sets. A cutoff value of 1×10^{-19}/yr was used for eliminating min cut sets in FTAP. The number of min cut sets according to order is shown in table 11. Order refers to the number of basic events in a min cut set.

8.0 Data for the Fault Tree Basic Events

Basic events, representing the limit of resolution in the fault tree, appear as circles at the bottom of the fault tree and include events such as:

- Equipment failure
- Human error
- Environmental or operational conditions.

For this study, there are a total of 226 basic events, 159 are pure enabling events and 67 are initiating events.

The basic events are coded according to an eight digit scheme. The first digit represents the system code as listed in table 3. Digits 2 and 3 represent the component type and are displayed in table 4. Digits 4, 5, 6 and 7 are used for identification of the component or event described by the basic event. Digit 8 represents the failure mode and is listed in table 5.

To compute the Top Event occurrence frequency, we must compute the frequency of occurrence for the min cut sets. To do this, we first must identify two types of basic events that are contained in the min cut sets:

- Initiating events
- Enabling events.

Initiating events, i.e., deviation events, cause a perturbation in a system variable and causes the Top Event to occur if mitigation of the initiating event does not occur. Enabling events permit the initiating event to cause system failure and are of two type for this study:

- Pre-existing conditions required for fire or explosion to occur
- Mitigative failures, e.g., interlock failure, operator fails to respond to an alarm.

In general we compute the frequency of occurrence for initiating events and given the occurrence of the initiating event, the probability that an enabling condition is present or that an enabling event occurs. The later conditional probability is called enabling event unavailability. For this study, enabling event unavailability is given by either (1) a probability per demand or (2) the product of the failure rate and fault duration time (FDT).

We can estimate the failure frequency, unconditional probability of failure per unit time, of an initiating event by λ, the failure rate, the conditional probability of failure per unit time. The failure rates used in this study are listed in tables 4 and 5.

As described in sections 6.1.3 and 6.1.4, a mean repair time of 8 hours was assumed to restore failed components within the purge systems of either the PRBT or MFT. For these special cases, the probability of no repair within eight hours is assumed to be $e^{-\tau/8}$ where τ is the time to build up to an explosive concentration. τ is 17.9 hours for the PRBT and 2.6 hours for the MFT. In this case, the effective initiating event frequency for component failures which fail these purge systems in excess of a specified outage time are the product of the following two terms:

$$\lambda \ e^{-\tau/8}$$

In general, the fail high failure mode for control elements such as sensors and controllers was assigned a factor of 0.1 lower failure rate than for the fail low failure mode -- this same treatment of failure rates is recommended in ref (4). In general, there are more failure causes for the fail low mode than for the fail high failure mode.

For this study, there were two generic types of enabling events:

1) Equipment failure

2) Human error.

Equipment failure can occur at the time of the demand (e.g., a relay failure) or prior to the demand (e.g., an analyzer failure). In the first case, failure rates on demand, λ_d, are given in tables 4 and 5. In addition, human error probability estimates are given on per demand basis. In the second case, a failure rate must be

specified as well as an inspection interval θ. Component failures in this case are detected at a fixed interval θ. It is assumed that at the end of this interval that the component is repaired or that system operation is not permitted until repair takes place. If $\lambda \theta < .1$, then a good estimate for the average time-integrated average component unavailability, i.e.,

$$< \frac{\lambda \theta}{2}$$

This expression assumes that the probability of the occurrence of an initiating event is equally likely in the time interval $[0,\theta]$.

It is important to note how the failure rates and fault duration times for basic events are coded in Appendix A. The first number is either a failure rate given in terms of time units or no units indicating the failure rate is per demand. The second number is referred to as the fault duration time. If the FDT contains an asterisk, the event is a pure enabling event, otherwise the event can be initiating and/or enabling.

For pure enabling events, the enabling event unavailability is obtained by taking the product of the failure rate and the FDT. For probabilities per demand, the FDT is one with no time units. Otherwise, time units are specified. For latent failures, such as an analyzer failure, the FDT is generally one half the cycle time corresponding to the average time a failure can occur until its failure can be repaired or ameliorated. In this case, the enabling event unavailability is estimated to be $\lambda\theta/2$, the expression given above.

For initiating events that can also function as enabling events, (e.g. pump ignition sources), the enabling event unavailability is computed as FDT/(FDT + MTBF) where MTBF is the mean time between failures and is given by $1/\lambda$. For this study, MTBF >> FDT. The enabling event unavailability can be approximated by $\lambda \times$ FDT. A FDT of 1.0 with no units is interpreted by IMPORTANCE as 1.0 hour.

There are two important failure modes whose failure rates and probabilities are important risk drivers:

- Ignition source probability/failure frequency for agitators or pumps

- Gas chromatograph failure rate.

We discuss assignment of these failure rates/probabilities below.

8.1 Agitator and Pump Ignition Source Probabilities

Chapter 9 of the SAR, ref (1), assigned a pure probability for pump and agitator ignition sources as 0.03 which was taken from the Dupont data base, ref (4). Reviewing this data base, the estimate was taken from another source, ref (5). The assignment of this probability in ref (5) was subjective. Ten Managers were asked to give their best estimate of an ignition source probability and their estimates were pooled. Furthermore, the problem of assigning a pure probability is that it is not a frequency and does not distinguish between a pump which operates all the time and a pump that works for only a small fraction of time. We assume that when a pump does not operate, it cannot be an ignition source.

However, ref (6) assigned an ignition source failure rate to pumps as 1.6×10^{-5} hr^{-1} and this failure rate was used in this study for both pumps and agitators. Furthermore, ref (6) reduced this failure rate by a factor of 0.01 due to the fact that pumps considered in that study are fully submersed. For CPC pumps, the impellers are fully submersed when they pump but portions of the shaft are not. For this reason, we assume that this reduction factor, R(A), for CPC pumps to be 0.1 instead of 0.01. In this study, we further reduce the pump ignition source failure rate due to the fact that CPC pumps are constructed of Hastelloy steel, denoted by reduction factor R(B). It is more likely that Hastelloy steel pumps will gall and trip due to overcurrent than carbon steel pumps, ref (12). The basis of assigning CPC pump ignition source frequencies in this report is given below by the following product of three terms:

failure frequency for all pump failure modes	x	reduction factor since pump inlet is submersed	x	reduction factor for Hastelloy steel
λ (pump ignition source)	x	R(A)	x	R(B)

1.6×10^{-5} hr^{-1} x 0.1 x 0.1 = 1.6×10^{-7} hr^{-1} $\approx$ 1.4×10^{-3} yr^{-1}.

In this study, we assume that the agitator ignition source frequency λ is the same as for pumps. However, CPC vessel agitators are fully submersed in liquid. Hence we assume that R(A) is 0.01 for agitators and use the same expression above to estimate the CPC agitator ignition source frequency as 1.4×10^{-4} yr^{-1}. The ignition source failure rate is further reduced by the fractional amount of time the pump or agitator is working during the operating cycle. Cycle operating times are given in tables 7, 8, 9 and 10 for the SRAT, SME, PRBT and MFT pumps and agitators. It is assumed that either a pump or agitator could run for half of an operating cycle before destruction or before its circuit breaker trips due to high current. Hence, the FDT for pump/agitator ignition sources for the SRAT, SME and MFT is assumed to be 48 hours and 22 hours for the PRBT. The FDT is important when we compute the enabling probability for the pump ignition source. The occurrence of the pump ignition source can be either enabling or initiating depending whether the condition occurs before or after the occurrence of the explosive concentration.

8.2 Gas Chromatograph Failure Rate

The failure rate for a gas chromatograph is assumed to be 3.0×10^{-5} hr^{-1}. Gas chromatographs are used to analyze the off gases from the SRAT and SME. There have been operational problems with these gas chromatographs -- peak drift and condensation forming in the sample supply lines. The analysis assumes that these problems are rectified and that the generic failure rate is applicable with no adjustment required.

9.0 Fault Tree Quantification

The computer code IMPORTANCE was used to conduct the probabilistic calculations. The details and meaning of these calculations are discussed in ref (8). The output of IMPORTANCE is shown in appendix B. The following information is given:

- Options and basic event data used (pages B-1 through B-4)
- The top event occurrence frequency (page B-5)
- Initiating event importance (pages B-6 and B-7)
- Enabling event importance (pages B-8, B-9, B-10 and B-11)
- Min cut set importance (pages B-12 through B-22).

Importance measures are weighting functions that have value between 0 and 1. They are conditional probabilities that a set of min cut sets have occurred given the occurrence of the top event. If the set of min cut sets is a single min cut set, then min cut set importance is computed; if the set of min cut sets are those that contain a specified initiating event, then initiating event importance is computed; if the set of min cut sets are those that contain a specified enabling event, then enabling event importance is computed. The fault tree contains basic events that are descriptor events -- their first digit is denoted by #. These events are coded as enabling events with probability one. Descriptor events define a particular scenario, i.e., fire or deflagration, analyzed in the min cut set and gives the capability of determining the percentage contribution of each scenario by its enabling event importance.

The CALC-NOTE shows all the inputs and outputs to FTAP and IMPORTANCE computer codes plus a QA verification of all the basic event data used. The top event occurrence frequency was computed to be 1.7×10^{-5} yr^{-1}. The frequency and probabilistic importance of various deflagrations or fires is given in table 6. We see that benzene/hydrogen deflagrations or fires due to loss of cooling in the MFT and PRBT dominate probabilistically. Loss of cooling occurs if either the (1) PRBT temperature sensor TE-3211A or the MFT temperature sensor TE-3248A fails low or (2) if the DCS fails. The importance analysis presented in Appendix B indicates that

these single failures which cause loss of cooling dominate probabilistically. Failure of the temperature sensors would cause an increase in temperature and result in failure to turn off the agitators. In addition, a DCS failure would cause the cooling water valves to the PRBT and MFT to close and would result in failure to turn off the PRBT and MFT agitators.

We see that an acceptable frequency is attained for the CPC design described in this report if the design goal is 1.0×10^{-4} yr^{-1}.

9.1 Explosive Concentration Frequency

Another fault tree run was conducted to assume that ignition sources exist all the time. The frequency of an explosive concentration is given in the last column in table 6. We see that the explosive concentration frequency is orders of magnitude higher than that of deflagrations. Thus, it can be seen that the assignment of ignition source probabilities is an important risk driver. To further illustrate this point, another IMPORTANCE run was conducted by reducing the ignition source FDT from 44 hours to 0.5 hours. This means that a pump or agitator can run only for one hour until it destroys itself or its circuit breaker trips due to overcurrent. The new top event occurrence frequency for AN explosion is calculated to be 9.2×10^{-6} yr^{-1} -- resulting in a reduction factor of 1.9.

9.2 Redundant PRBT and MFT Temperature Sensor Study

For information, another fault tree run was conducted by assuming that redundant temperature sensors to the PRBT and MFT are installed. See fault tree sheets 19 and 31 in Appendix A. In addition, it was assumed that both softwired and hardwired interlocks exist to shut off the PRBT and MFT agitators. It is further assumed that the highest of the two temperature signals is taken (i.e. a voting logic) to activate these interlocks which shuts off the agitators. Incorporating these modifications would mean that there is no single failure would result in loss of cooling to the PRBT and MFT. The new top event occurrence frequency is computed to be 6.7×10^{-7} yr^{-1} -- resulting in a reduction factor of 26. The procedure by which the computer codes FTAP and IMPORTANCE were modified to perform this run is discussed in the engineering CALC-NOTE.

10.0 Conclusions, Recommendations and Results

Major design changes in the CPC have occurred since the problem of AN formation within the melter feed preparation process was discovered. The FTA showed that many of these changes were necessary to achieve an acceptable frequency of AN explosion within the CPC.

The analysis presented in section 9.1 illustrated that the top event occurrence frequency is a very sensitive function of both the ignition source failure rates and fault duration times. However, it is felt that the assignment of these failure rates and FDTs in this report are based on conservative assumptions which implies that the final frequency computed is conservative.

Also as described in section 6.1.1, it is assumed that the formic acid addition lines to the SRAT, SME and MFT will be modified to prevent accidental addition due to operator error. Therefore, excessive formic acid addition to the SRAT, SME or MFT was not considered as a credible scenario in this FTA report.

11.0 References

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12.0 Acronym List

AN	Ammonium nitrate (NH_4NO_3)
BNI/BNISO	Bechtel National, Inc. / Site Office
CPC	Chemical process cell
DCS	Distributed control system
DWPF	Defense Waste Processing Facility
FAVC	Formic acid vent condenser
FDT	Fault duration time
FTA	Fault tree analysis
HEME	High efficiency mist eliminator
IDMS	Integrated DWPF Melter System
LEL	Lower explosive limit
LFL	Lower flammability limit
MFT	Melter feed tank
MOC	Minimum oxidant concentration
MTBF	Mean time between failures
MWWT	Mercury water wash tank
PBA	Phenylboric acid
PHA	Precipitate hydrolysis aqueous
ppm	Parts per million
PR	Precipitate reactor

PRCD	Precipitate reactor condensate decanter
PRBT	Precipitate reactor bottoms tank
PVVH	Process vessel vent header
PVVS	Process vessel vent system
QA	Quality assurance
RCT	Recycle collection tank
SAR	Safety Analysis Report
scfm	Standard cubic feet per minute
SCR	Silicon controlled rectifier
SME	Slurry mix evaporator
SMECT	SME condensate tank
SPC	Salt process cell
SRS	Savannah River Site
SRTC	Savannah River Technical Center
SRAT	Sludge receipt and adjustment tank
UEL	Upper explosive limit
WSRC	Westinghouse Savannah River Company

TABLES

LIST OF TABLES

TABLE 1

HARDWARE ELEMENTS COMPRISING CPC NEGATIVE FEEDBACK LOOPS

LOOP DESCRIPTION (P&ID)	SENSOR	CONTROLLER	OTHER CONTROL ELEMENTS
PRBT AIR PURGE FLOW (W754021)	FE-3215* FE-3218	FC-3216A	FIT-3215, FY-3218, FIT-3218, DCS, XS-3216, FY-3216, FCV-3216
		FIC-3216B	FIT-3215, FY-3218, FIT-3218, FY-3216A, FX-3216B, XS-3216, FY-3216, FCV-3216
SRAT AIR PURGE FLOW (W750186)	FE-3034*	FC-3034A	FIT-3034, DCS, XS-3034, FY-3034, FCV-3034
		FIC-3034B	FIT-3034, FX-3034B XS-3034, FY-3034, FCV-3034
SME AIR PURGE FLOW (W750312)	FE-8856*	FC-8856A	FIT-8856, DCS, XS-8856, FY-8856, FCV-8856
		FIC-8856B	FIT-8856, FX-8856B, XS-8856, FY-8856, FCV-8856
MFT AIR PURGE FLOW (W750313)	FE-0682* FE-0684	FC-0683A	FIT-0682, FIT-0684, FY-(NO LOOP NO.), DCS, XS-0683, FY-0683, FCV-0683
		FIC-0683B	FIT-0682, FIT-0684, FY-0683A, FX-0683B, XS-0683, FY-0683, FCV-0683
PRBT COOLING WATER FLOW (W754021)	TE-3211A*	TSL-3211 TSH-3211	HCV-3212, DCS
MFT COOLING WATER FLOW (W750235)	TE-3248A*	TSL-3248 TSH-3248	HCV-3252, DCS

* COMMON CAUSE INITIATING EVENT

TABLE 2

HARDWARE AND SOFTWARE ELEMENTS COMPRISING CPC INTERLOCKS

INTERLOCK TRIP CONDITION (P&ID/CLD)	INTER-LOCK NUMBER	SENSOR	INTERMEDIATE CONTROL ELEMENTS	FUNCTION (FINAL CONTROL ELEMENT)
PRBT LEVEL LOW (W754022/W767936)	1	BUBBLER	LT-4063, LY-4063 LSL-4063 DCS	SHUT OFF PRBT AGITATOR
PRBT TEMPERATURE HIGH (W754021/W767938)	2	TE-3211A	TSH-3211 DCS	OPEN PRBT COOLING WATER VALVE (HCV-3212)
PRBT TEMPERATURE HIGH HIGH (W754021/W767936)	2a	TE-3211A	TSHH-3211 DCS	SHUT OFF PRBT AGITATOR
SRAT AIR PURGE FLOW LOW (W750186/W766963)	3	FE-3034	FIT-3034 FSL-3034 DCS	CLOSE SRAT STEAM SUPPLY VALVE (FCV-3000) OPEN SRAT COOLING WATER VALVE (HCV-3010) STOP PRBT TRANSFER PUMP CLOSE FORMIC ACID ADDITION VALVE (FCV-2045) CLOSE NITRIC ACID ADDITION VALVE (FCV-0716)
SRAT AIR PURGE FLOW LOW LOW (W750186/W766901)	4	FE-3034	FIT-3034 FSLL-3034 RELAY CR2	CLOSE SRAT STEAM SUPPLY VALVE (FCV-3000) OPEN SRAT COOLING WATER VALVE (HCV-3010) STOP PRBT TRANSFER PUMP CLOSE FORMIC ACID ADDITION VALVE (FCV-2045) CLOSE NITRIC ACID ADDITION VALVE (FCV-0716)
SRAT OFF-GAS %LFL HIGH (W750483/W766963)	5	AE-8795 AE-8796	AIT-8795, AY-8795A AIT-8796, AY-8796A AY-8795A, AY-8795B AY-8795D, ASH-8795 DCS	CLOSE SRAT STEAM SUPPLY VALVE (FCV-3000) OPEN SRAT COOLING WATER VALVE (HCV-3010) STOP PRBT TRANSFER PUMP CLOSE FORMIC ACID ADDITION VALVE (FCV-2045) CLOSE NITRIC ACID ADDITION VALVE (FCV-0716)

INTERLOCK TRIP CONDITION (P&ID/CLD)	INTER-LOCK NUMBER	SENSOR	INTERMEDIATE CONTROL ELEMENTS	FUNCTION (FINAL CONTROL ELEMENT)
SRAT OFF-GAS %LFL HIGH HIGH (W750483/W766901)	6	AE-8795 AE-8796	AIT-8795, AY-8795A AIT-8796, AY-8796A AY-8795D AX-8795, ASHH-8795 RELAY CR10	CLOSE SRAT STEAM SUPPLY VALVE (FCV-3000) OPEN SRAT COOLING WATER VALVE (HCV-3010) STOP PRBT TRANSFER PUMP CLOSE FORMIC ACID ADDITION VALVE (FCV-2045) CLOSE NITRIC ACID ADDITION VALVE (FCV-0716)
SRAT GAS CHROMATOGRAPH #1 [OR #2] N_2 LOW (W750483/W766963)	7	AE-8795 AE-8796	AIT-8795, AY-8795B [AIT-8796, AY-8796B] ASL-8795B [ASL-8796B] DCS	CLOSE SRAT STEAM SUPPLY VALVE (FCV-3000) OPEN SRAT COOLING WATER VALVE (HCV-3010) STOP PRBT TRANSFER PUMP CLOSE FORMIC ACID ADDITION VALVE (FCV-2045) CLOSE NITRIC ACID ADDITION VALVE (FCV-3119) CLOSE NITRIC ACID ADDITION VALVE (FCV-0716)
SRAT GAS CHROMATOGRAPH #1 [OR #2] N_2 LOW LOW (W750483/W766901)	8	AE-8795 AE-8796	AIT-8795, AY-8795B [AIT-8796, AY-8796B] ASLL-8795B [ASLL-8796B] RELAY CR8 [RELAY CR7]	CLOSE SRAT STEAM SUPPLY VALVE (FCV-3000) OPEN SRAT COOLING WATER VALVE (HCV-3010) STOP PRBT TRANSFER PUMP CLOSE FORMIC ACID ADDITION VALVE (FCV-2045) CLOSE NITRIC ACID ADDITION VALVE (FCV-0716)
SRAT OFF-GAS SAMPLE PUMP FLOW LOW OR SRAT GAS CHROMATOGRAPH #1 [OR #2] FLOW LOW (W750483/W766901)	9	FISL-8799 FISL-8801 [FISL-8802]	CR13 CR14 [CR15]	CLOSE SRAT STEAM SUPPLY VALVE (FCV-3000) OPEN SRAT COOLING WATER VALVE (HCV-3010) STOP PRBT TRANSFER PUMP CLOSE FORMIC ACID ADDITION VALVE (FCV-2045) CLOSE NITRIC ACID ADDITION VALVE (FCV-0716)
BACKUP CPC PURGE SYSTEM FLOW HIGH (W751548/W766963)	10	FE-0961	FIT-0961 FSH-0961 DCS	CLOSE SRAT STEAM SUPPLY VALVE (FCV-3000) OPEN SRAT COOLING WATER VALVE (HCV-3010) CLOSE SME STEAM SUPPLY VALVE (FCV-3080) OPEN SME COOLING WATER VALVE (HCV-3089)
SME AIR PURGE FLOW LOW (W750312/W766983)	11	FE-8856	FIT-8856 FSL-8856 DCS	CLOSE SME STEAM SUPPLY VALVE (FCV-3080) OPEN SME COOLING WATER VALVE (HCV-3089) STOP PFSFT PUMP/INITIATE FLUSH CLOSE FORMIC ACID ADDITION VALVE (FCV-2044) CLOSE CDC ISOLATION VALVE (MOV-4066) CLOSE NITRIC ACID ADDITION VALVE (FCV-3119)

INTERLOCK TRIP CONDITION (P&ID/CLD)	INTER-LOCK NUMBER	SENSOR	INTERMEDIATE CONTROL ELEMENTS	FUNCTION (FINAL CONTROL ELEMENT)
SME AIR PURGE FLOW LOW LOW (W750312/W766901)	12	FE-8856	FIT-8856 FSLL-8856 RELAY CR4	CLOSE SME STEAM SUPPLY VALVE (FCV-3080) OPEN SME COOLING WATER VALVE (HCV-3089) STOP PFSFT PUMP/INITIATE FLUSH CLOSE FORMIC ACID ADDITION VALVE (FCV-2044) CLOSE CDC ISOLATION VALVE (MOV-4066) CLOSE NITRIC ACID ADDITION VALVE (FCV-3119)
SME OFF-GAS %LFL HIGH (W750308/W766963)	13	AE-8797 AE-8798	AIT-8797, AY-8797A AIT-8798, AY-8798A AY-8797A, AY-8797B AY-8797D, ASH-8797 DCS	CLOSE SME STEAM SUPPLY VALVE (FCV-3080) OPEN SME COOLING WATER VALVE (HCV-3089) STOP PFSFT PUMP/INITIATE FLUSH CLOSE FORMIC ACID ADDITION VALVE (FCV-2044) CLOSE CDC ISOLATION VALVE (MOV-4066) CLOSE NITRIC ACID ADDITION VALVE (FCV-3119)
SME OFF-GAS %LFL HIGH HIGH (W750308/W766901)	14	AE-8797 AE-8798	AIT-8797, AY-8797A AIT-8798, AY-8798A AY-8797D AX-8797, ASHH-8797 RELAY CR9	CLOSE SME STEAM SUPPLY VALVE (FCV-3080) OPEN SME COOLING WATER VALVE (HCV-3089) STOP PFSFT PUMP/INITIATE FLUSH CLOSE FORMIC ACID ADDITION VALVE (FCV-2044) CLOSE CDC ISOLATION VALVE (MOV-4066) CLOSE NITRIC ACID ADDITION VALVE (FCV-3119)
SME GAS CHROMATOGRAPH #1 [OR #2] N_2 LOW (W750308/W766963)	15	AE-8797 AE-8798	AIT-8797, AY-8797B [AIT-8798, AY-8798B] ASL-8797B [ASL-8798B] DCS	CLOSE SME STEAM SUPPLY VALVE (FCV-3080) OPEN SME COOLING WATER VALVE (HCV-3089) STOP PFSFT PUMP/INITIATE FLUSH CLOSE FORMIC ACID ADDITION VALVE (FCV-2044) CLOSE CDC ISOLATION VALVE (MOV-4066) CLOSE NITRIC ACID ADDITION VALVE (FCV-3119)
SME GAS CHROMATOGRAPH #1 [OR #2] N_2 LOW LOW (W750308/W766901)	16	AE-8797 AE-8798	AIT-8797, AY-8797B [AIT-8798, AY-8798B] ASLL-8797B [ASLL-8798B] RELAY CR6 [RELAY CR5]	CLOSE SME STEAM SUPPLY VALVE (FCV-3080) OPEN SME COOLING WATER VALVE (HCV-3089) STOP PFSFT PUMP/INITIATE FLUSH CLOSE FORMIC ACID ADDITION VALVE (FCV-2044) CLOSE CDC ISOLATION VALVE (MOV-4066) CLOSE NITRIC ACID ADDITION VALVE (FCV-3119)

INTERLOCK TRIP CONDITION (P&ID/CLD)	INTER-LOCK NUMBER	SENSOR	INTERMEDIATE CONTROL ELEMENTS	FUNCTION (FINAL CONTROL ELEMENT)
SME OFF-GAS SAMPLE PUMP FLOW LOW OR SME GAS CHROMATOGRAPH #1 [OR #2] FLOW LOW (W750308/W766901)	17	FISL-8800 FISL-8803 [FISL-8804]	CR16 CR17 [CR18]	CLOSE SME STEAM SUPPLY VALVE (FCV-3080) OPEN SME COOLING WATER VALVE (HCV-3089) STOP PFSFT PUMP/INITIATE FLUSH CLOSE FORMIC ACID ADDITION VALVE (FCV-2044) CLOSE CDC ISOLATION VALVE (MOV-4066) CLOSE NITRIC ACID ADDITION VALVE (FCV-3119)
MFT LEVEL LOW LOW (W750104/W767448)	18	LE-3182	LT-3182, LY-3182 LSLL-3182A DCS	SHUT OFF MFT AGITATOR
MFT TEMPERATURE HIGH (W750235/W766261)	19	TE-3248A	TSH-3248 DCS	OPEN MFT COOLING WATER VALVE (HCV-3252)
MFT TEMPERATURE HIGH HIGH HIGH (W750235/W766232)	20	TE-3248A	TSHH-3248B DCS	SHUT OFF MFT AGITATOR

TABLE 3

SYSTEM CODE (1ST DIGIT)

ABBR.	SYSTEM
0	CO_2 purge (backup)
1	CO_2 purge (primary)
2	Air purge
3	N_2 purge
4	SME
5	SRAT
6	PRBT
7	MFT
8	OE
9	PR
A	OECT
B	PRFT
C	Scrubber
D	PVVH
E	Process chilled water
F	Process cooling water
G	Steam
H	Normal power
I	Formic acid addition
J	PCCS
K	SCVC
L	FAVC
M	Instrument air
N	Emergency power
O	Cooling tower water
P	Organic waste storage tank
Q	Low point pump pit
R	Ventilation (vitrification building)
S	Melter offgas system
T	Ventilation (LPPT)
U	Melter
V	CPC (general)
W	CPC sump
X	DCS
#	Scenario descriptor event

TABLE 4

COMPONENT CODES WITH FAILURE RATES (2ND AND 3RD DIGIT)

COMPONENT CODE	COMPONENT	AVERAGE FAILURE RATE*		(REF,PAGE)	COMMENTS REGARDING FAILURE MODES
AG	Agitator	1.0 E-3	Y	See Table 5	Agitator ignition source
		5.7 E-5	H	(duPont,34)	Fails to run (assume same failure rate as pump)
AI	Analyzer	3.4 E-4	H	(duPont,4)	Announced/inactive
		3.4 E-5	H		Unannounced/inactive
AL	Alarm	3.0 E-6	H		Inactive/not generated
BA	Battery	1.4 E-6	H	(duPont,7)	Dead
BL	Blower	7.6 E-5	H	(duPont,7)	Fails to run
BS	BUS AC	1.0 E-8	H	(IREP,127)	
BS	BUS DC				
CB	Circuit Breaker	3.0 E-3	D	(IREP,127)	Fails to transfer
CD	Condenser (Vent)	6.9 E-6	H	(duPont,33)	
CH	Chiller	6.9 E-6	H	(duPont,33)	Reactor cooler
CL	Control Logic (Solid State)	3.0 E-6	H	(IREP,128)	Inactive
CN	Controller	2.1 E-4	H	(duPont,11)	Inactive
		2.1 E-5	H		Inactive/solid state controller
CP	Computer (Digital)	2.0 E-5	H	SRP Data	Inactive
		2.0 E-6	H	Assumed (Factor of 10 reduction)	Inactive for greater than 17.9 hours
CV	Check Valve	1.2 E-6	H	(duPont,48)	Leakage
		1.0 E-4	D	(duPont,48)	Fails to open
DA	Damper Isolation	2.0 E-5	H	(OREDA,279)	Inadvertantly closes
		3.0 E-3	D		Failure to close on demand
DC	Ditch Covers				
DG	Diesel Generator	1.0 E-2	D	(Chap 9, 9.A.1-82)	DG fails to start (loss of backup power)
		0.19	C		2nd DG fails to start given 1st DG fails to start

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COM-PONENT CODE	COMPONENT	AVERAGE FAILURE RATE*		(REF,PAGE)	COMMENTS REGARDING FAILURE MODES
DO	Detector Optical	1.5 E-5	H	(duPont,38)	
DP	Dip Tube	1.3 E-6	H		Leaks
DT	Detector Thermistor	1.5 E-5	H	(duPont,38)	
FL	Flange	1.3 E-6	H	SRP Data	Leaks
FR	Filter	1.0 E-6	H	(duPont,14)	Plugged
FU	Fuse	1.0 E-6	H	SRP Data	Opens prematurely
GC	Gas Chromatograph	3.0 E-5	H		Generates no output
		0.01	D	(Chap 9, CALC note,43)	SRAT GC miscalibrated
HC	Hanford Connector	1.3 E-6	H	SRP Data	Leaks/installed incorrectly
HE	Heater				
HX	Heat Exchanger	1.5 E-5	H	(duPont,33)	Fouled
		5.2 E-7	H	(Chap 9, 9.A.2-57)	Inadequate process cooling water heat removal (calculation)
IA	Instrument Alarm Flow				
IC	Instrument Connections				
IN	Inverter	1.0 E-4	H	(IREP,128)	
IP	I/P Transducer	6.4 E-5	H	(duPont,43)	
IT	Interlock	1.0 E-4	D	(duPont,23)	
		1.0 E-3	D	SRP Data	Bypassed
LOSP	Offsite Power	0.33	Y	SRP Data	Loss of power to normal load centers
LS	Limit Switch	1.0 E-4	D	(IREP,127)	Fails to open/close
		1.2 E-6	H	(duPont,40)	Transfers open/close
LV	Vent Lines				
N2	Nitrogen Supply	1.0 E-5	H	FTA	Loss of supply
NZ	Nozzle	2.7 E-7	H	(OREDA,99)	Plugged
PC	Compressor	5.0 E-3	D	(Chap 9, 9.A.1-81)	Fails to start, fails to run
		5.0 E-5	H		Fails to run
		2.3 E-4	D	(Chap 9, 9.A.1-81)	Unavailable due to maintenance
PE	Panel Electrical	3.0 E-6	H	(IREP,128)	

COMPONENT CODE	COMPONENT	AVERAGE FAILURE RATE*	(REF,PAGE)	COMMENTS REGARDING FAILURE MODES
PI	Pipe	9.0 E-9 H	(IREP,129)	Plug/rupture
	Steam Coil	6.0 E-6 H	(duPont,36)	
PP	Pump	5.7 E-5 H	(duPont,34)	Fails to run
		3.0 E-3 D	(IREP,126)	Fails to start
		1.0 E-2 Y	See Table 5	Ignition source
PT	Seal Pot	1.0 E-2 D		Dry
RE	Rectifier	1.0 E-6 H	(IREP,128)	Loss of function
RT	Rotameter	3.0 E-6 H		Plugged
RY	Relay	3.0 E-6 H	(IREP,128)	Transfer open
		1.0 E-3 D	(Chap 9, 9.A.1-103)	Fails to open/close on demand
SC	SCR Controller	5.0 E-5 H	(Dexter/Perkins)	Off
		5.0 E-6 H		
SE	Seal (Gaskets)	2.5 E-5 H	(WASH1400)	Leakage
SF	Sensor Flow	3.0 E-5 H	(duPont,15)	Inactive
SL	Sensor Level	3.0 E-5 H	(duPont,23)	Inactive
SP	Pressure Sensor	3.4 E-4 H	(duPont,31)	Inactive
ST	Sensor Temperature	3.3 E-5 H	(duPont,42)	Inactive
SW	Switch	3.0 E-5 H	(IREP,129)	Inactive
TA	Temperature Alarm	1.9 E-4 H	(duPont,)	Inactive
TI	Agastat Relay	3.3 E-5 H	(duPont,42)	Inactive
TK	Tank	7.3 E-10H	(duPont,37)	Rupture
		1.0 E-8 H	(Chap 9, 9.4.1-106)	Leaks
TL	Totalizer	2.0 E-5 H	(duPont, 21)	Assume same failure rate as summer
TM	Thermistor, Probe	8.0 E-6 H	FRADA	Inactive
TW	Cooling Tower	5.3 E-2 Y	(Chap 9, 9.A.2-72)	Inadequate heat removal
VA	Valve Gate	3.0 E-3 D	(IREP,126)	Fails to open/close
		8.3 E-6 H		
VB	Butterfly Valve	2.3 E-5 H	(duPont,48)	
VD	Drain Valve	1.2 E-6 H	(duPont,47)	Leakage (Large leakage reduced by a factor of 10)

COM-PONENT CODE	COMPONENT	AVERAGE FAILURE RATE*	(REF,PAGE)	COMMENTS REGARDING FAILURE MODES
VF	Fire Water Valve	2.4 E-2 D	(OREDA,97)	Fails to open
VG	Valve Globe			
VI	Pressure Control Valve	1.6 E-5 H	(duPont,49)	Low flow
VK	Block Valve	3.0 E-3 D	(IREP,126)	Fails to open/close
		8.3 E-5 H		
VL	Flow Control Valve	6.2 E-5 H	(duPont,48)	Stick open (fails to close)
		2.2 E-6 H		Fails closed
		3.0 E-3 D	(IREP,126)	Failure to open (NC) or close (NO) on demand
		1.0 E-3 D	(Chap 9, 9.A.1-84)	Failure to open (NO) or close (NC) on demand
		1.0 E-5 H	(Chap 9, 9.A.1-83)	Fails closed/open
		2.0 E-6 H	(duPont,48)	Leakage
VM	Motor Operated Valve	3.0 E-3 D	(IREP,126)	Fails to open/close
		1.0 E-7 H	(IREP,126)	Failure to remain open
VO	Valve Pilot			
VP	Valve Plug			
VP	Vaporizer	3.0 E-4 H	(Chap 9, 9.A.1-108)	Fails to supply adequate purge
VS	Valve Solenoid	1.0 E-3 D	(duPont,52)	Fails to open
		5.0 E-7 H	(Chap 9, 9.A.1-103)	Transfers closed
VT	Needle Valve			
VX	Check Valve	1.0 E-4 D	(IREP,126)	Fails to open per demand
VY	Valve Pressure Relief	2.0 E-9 H	(duPont,51)	Fails open
VZ	Strainer Valve	2.8 E-7 H		Plugged
XM	Transmitter	3.0 E-6 H		Inactive/fails high or low

*H denotes per hour
Y denotes per year
D denotes per demand
C denotes conditional probability

TABLE 5

FAILURE MODE CODES WITH FAILURE RATES (8TH DIGIT)

CODE	FAILURE MODE	FAILURE RATE*	(REF,PAGE)	APPLICABLE COMPONENT
A	Does Not Start			
B	Open Circuit			
C	Closed Valve	2.2 E-6 H	(duPont,49)	Control valve
D	Does Not Open			
E	Engaged			
F	Loss of function			
G	Disengaged			
H	Heat Exchanger Fouled			
I	Ignition Source	1.1 E-6 H	(duPont,19)	Motor
		1.6 E-5 H	SRP	Pump (1)
		1.6 E-5 H	SRP	Agitator (1)
		1.6 E-6 H	Assumed	Agitator with Hg Seals (1)
		3.0 E-4 H	Assumed	Blower
		1.1 E-5 H	Assumed	Heater
		1.0 E-9 H	Assumed	Static Charge
J	Short Across			
K	Does Not close			
L	Leakage	4.0 E-7 H	(duPont,28)	Pipe
M	Exceeds Limit			
N	No input			
O	Open Valve	6.2 E-5 H	(duPont,49)	Control valve

(1) Pump and (agitator) ignition source failure rate is reduced by a factor of .1 (.01) if inlet and outlet are partially (totally) submersed and by a factor of 0.1 if constructed of Hastelloy stainless steel

CODE	FAILURE MODE	FAILURE RATE*	(REF,PAGE)	APPLICABLE COMPONENT
P	Plugged	6.0 E-6 H	(duPont,30)	Process piping
Q	Shortage to Power			
R	Rupture	6.0 E-6 H	(duPont,37,38)	Process piping
S	Short to Ground			
T	Operator Error	1.0 E-2 D		Following an accident
	(Omission)	1.3 E-2 D	(Chap 9--CALC note,31)	Fails to follow normal operating procedure
		2.7 E-4 D	(Chap 9--CALC note,32)	Failure to respond to an alarm
		2.7 E-5 D	Assumed (Factor of 10 reduction)	Failure to respond to an alarm after long time delay
		6.9 E-5 D	(Chap 9--CALC note,31)	Sampling and analysis error SRP procedures
		0.01 D	(Chap 9--CALC note,43)	SRAT gas chromatograph miscalibrated
U	Operator Error (Commission)	1.0 E-5 H		During normal operation, random human error/no independent check of error
		1.0 E-7 H		With independent check of error
		1.3 E-3 D	(Chap 9--CALC Note,32)	Inadvertently opens/closes valves starts/stops pumps (selection error per opportunity)
V	Does Not Run			
W	Does Not Actuate			

CODE	FAILURE MODE	FAILURE RATE*	(REF,PAGE)	APPLICABLE COMPONENT
X	Maintenance Fault	3.8 E-2 D	(Chap 9--CALC note,32)	Failure to open valve after maintenance--Product of two probabilities: 1) .48, failure to use written maintenance procedure, PM- 2) .081, operator fails to perform independent check, VM- (PM- and VM- are codes used in Chap 9)
Y	Fails Low			
Z	Fails High			
1	Inadvertently Actuates			
2	Works as Intended			
3	Conditional Event			
4	Expected Event	1.0 / Y	Chap 9	Routine maintenance
		2.0 / Y	(Chap 9, 9.A.1-80)	PRCD valve operated
5	Unexpected Event (Fault Condition)			
6	No Repair			

*H denotes per hour
D denotes per demand
Y denotes per year

TABLE 6

FREQUENCIES/IMPORTANCE RANKINGS OF VARIOUS FIRES WITHIN THE CPC

Top Event Frequency (AN Explosion) = 1.74×10^{-5} yr^{-1}

RANK	SYSTEM	FIRE	CAUSE	ANNUAL FREQUENCY YR-1	IMPORTANCE %	EXPLOSIVE CONCENTRATION FREQUENCY YR-1
1	MFT	HYDROGEN	LOSS OF COOLING	1.5×10^{-5}	84.4	0.470
2	PRBT	BENZENE\ HYDROGEN	LOSS OF COOLING	2.1×10^{-6}	12.1	0.470
3	MFT	HYDROGEN	INSUFFICIENT PURGE	6.0×10^{-7}	3.46	1.94×10^{-2}
4	PRBT	HYDROGEN	INSUFFICIENT PURGE	8.3×10^{-9}	4.79×10^{-2}	2.95×10^{-3}
5	SRAT	HYDROGEN	INSUFFICIENT PURGE	7.7×10^{-9}	4.41×10^{-2}	3.05×10^{-3}
6	SRAT	HYDROGEN	HIGH FORMIC ACID CONCENTRATION	3.1×10^{-12}	1.78×10^{-5}	4.02×10^{-6}
7	SRAT	HYDROGEN	HIGH NOBLE METAL CONCENTRATION	2.8×10^{-12}	1.59×10^{-5}	3.28×10^{-6}

Note: Assume that SME and SRAT have identical frequencies

TABLE 7

SRAT DURATION TIMES

SRAT OPERATION	DURATION OF OPERATION	DURATION TIME OF OPERATION		
		AGITATOR	TRANSFER PUMP	SAMPLE PUMP
Transfer sludge from LPPP	2 hours	2 hours		
Sample and wait for results	22 hours	22 hours		2-3 hours
Heat to 93°C and add nitric acid	4 hours	4 hours		
PHA addition	23 hours	23 hours		
Cool and sample	4 hours	4 hours		2-3 hours
Wait for sample results	32 hours	32 hours		
Transfer to SME	1 hour	1 hour	1 hour	

TABLE 8

SME DURATION TIMES

SME OPERATION	DURATION OF OPERATION	DURATION TIME OF OPERATION		
		AGITATOR	TRANSFER PUMP	SAMPLE PUMP
Receive transfer from SRAT	1 hour	1 hour		
Receive transfer from CDC	12 hours	12 hours		
Heat to boiling and concentrate	9 hours	9 hours		
Add process frit from PFSFT	1 hour	1 hour		
Concentrate	6 hours	6 hours		
Receive transfers from CDC	12 hours	12 hours		
Heat to boiling and concentrate	9 hours	9 hours		
Cool and sample	4 hours	4 hours		2-3 hours
Wait for sample results	46 hours	46 hours		
Transfer to MFT	1 hour	1 hour	1 hour	

TABLE 9

PRBT DURATION TIMES

AGITATOR WILL RUN 100% OF THE TIME

TRANSFER PUMP WILL RUN 23 HOURS (DURING TRANSFER TO SRAT)

SAMPLE PUMP WILL RUN 4-6 HOURS PER SME CYCLE

TABLE 10

MFT DURATION TIMES

AGITATOR WILL RUN 100% OF THE TIME

FEED PUMPS WILL RUN 95% OF THE TIME

SAMPLE PUMP WILL RUN 2-3 HOURS PER SME CYCLE

TABLE 11

REFERENCE TABLE FOR MIN CUT SETS

ORDER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NO. OF MIN CUT SETS	0	0	0	0	0	0	0	0	4	79	294	328	364	198	46

TOTAL NO. OF MIN CUT SETS = 1313

F:\CPC94\REPORT\TABLES\TABLE11 6/13/94 12:37pm

FIGURES

LIST OF FIGURES

Figure 1 -- CHEMICAL PROCESS CELL
BLOCK FLOW DIAGRAM

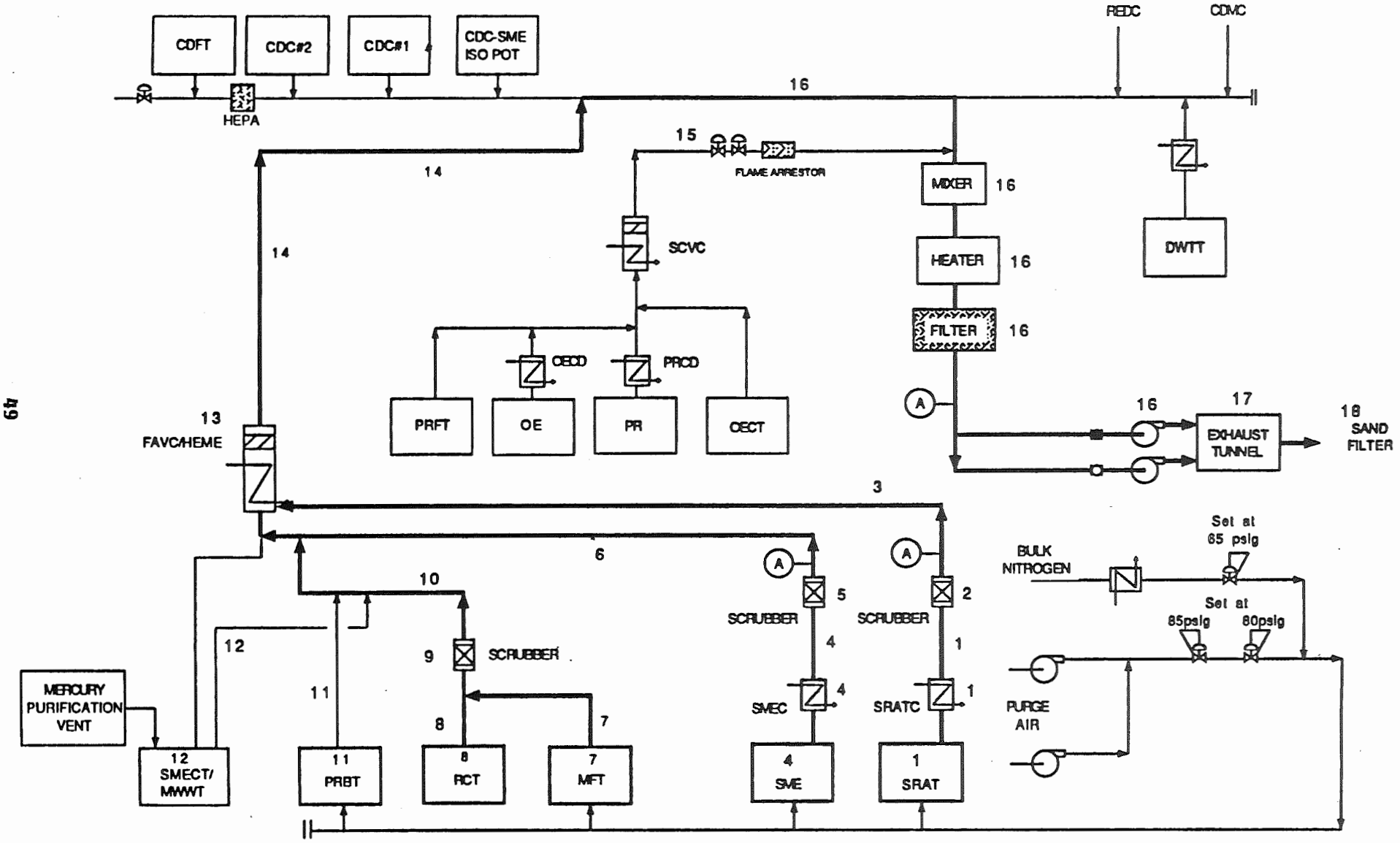


FIGURE 1 (CONT.)

AMMONIUM NITRATE LOCATION NODES

ITEM	NH_4NO_3 LOCATION
1	SRAT system (includes SRAT condenser, piping between SRAT and SRAT scrubber)
2	SRAT scrubber
3	Piping between SRAT scrubber and FAVC
4	SME system (includes SME condenser, piping between SME and SME scrubber)
5	SME scrubber
6	Piping between SME scrubber and FAVC
7	MFT system
8	RCT system
9	RCT/MFT scrubber
10	Piping between RCT/MFT scrubber and FAVC
11	PRBT system
12	SMECT system
13	FAVC/FAVC HEME
14	Piping between FAVC and PVVH
15	Piping from PR to PVVH
16	PVVS (includes PVVH, PVV air mixer, PVV heater, PVVF, PVV blower)
17	Exhaust tunnel
18	Sand filter

APPENDIX A

CHEMICAL PROCESS CELL

AMMONIUM NITRATE EXPLOSION

FAULT TREES

CPC FAULT TREE TITLE SHEET LIST

SHEET #	TITLE	SUBTITLE
1	TOP EVENT DEFINITION	AMMONIUM NITRATE EXPLOSION WITHIN THE CPC
2	SRAT HYDROGEN FIRE	ALL CAUSES
3	SRAT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW
4	SRAT HYDROGEN DEFLAGRATION	EXCESSIVE FORMIC ACID CONCENTRATION IN PHA
5	SRAT HYDROGEN DEFLAGRATION	HIGH NOBEL METAL CONCENTRATION IN SLUDGE
6	PRBT BENZENE/HYDROGEN DEFLAGRATION	ALL CAUSES
7	PRBT BENZENE/HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 17.9 HOURS
8		INTENTIONALLY BLANK
9	PRBT BENZENE/HYDROGEN DEFLAGRATION	INSUFFICIENT PRBT COOLING WATER HEAT REMOVAL
10	SRAT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW SRAT LOW FLOW INTERLOCKS FAIL
11	MFT HYDROGEN DEFLAGRATION	ALL CAUSES
12	MFT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 2.6 HOURS
13		INTENTIONALLY BLANK
14	MFT HYDROGEN DEFLAGRATION	INSUFFICIENT COOLING WATER FLOW
15		INTENTIONALLY BLANK
16	INTERNAL PRBT BENZENE FIRE	
17	CPC SUMP/TRENCH BENZENE FIRE	
18	MFT HYDROGEN DEFLAGRATION	INSUFFICIENT MFT COOLING WATER HEAT REMOVAL

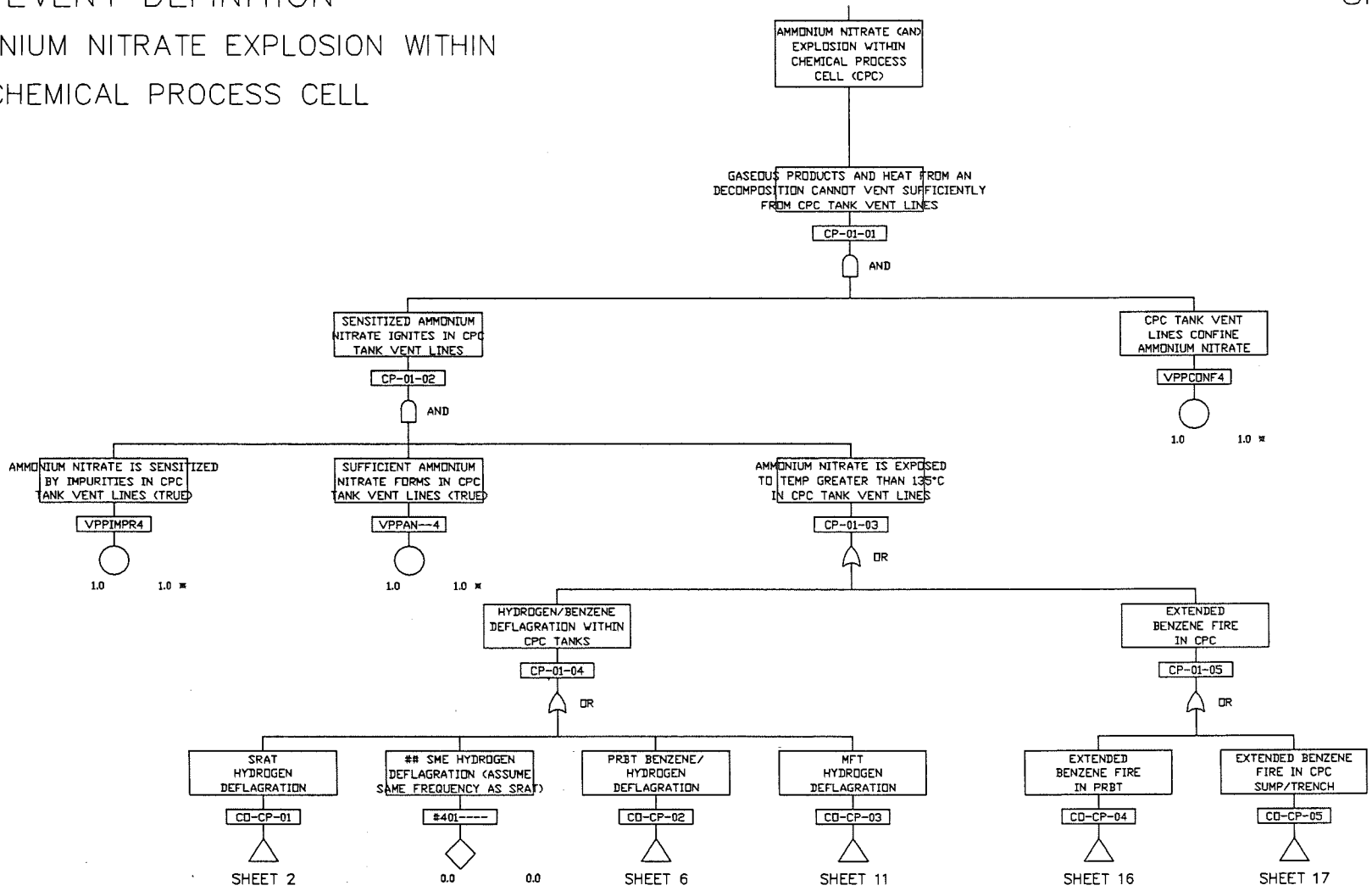
SHEET #	TITLE	SUBTITLE
19	PRBT BENZENE/HYDROGEN DEFLAGRATION	INSUFFICIENT PRBT COOLING WATER HEAT REMOVAL
20	MFT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 2.6 HOURS
21	PRBT BENZENE/HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW FOR GREATER THAN 17.9 HOURS
22	SRAT HYDROGEN DEFLAGRATION	EXCESSIVE FORMIC ACID CONCENTRATION IN PHA FROM PR
23	SRAT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW
24	SRAT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW SRAT AIR PURGE LOW INTERLOCK FAILURE
25	SRAT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW SRAT OFFGAS HIGH % LFL INTERLOCK FAILURE
26	SRAT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW SRAT OFFGAS % LFL INTERLOCK FAILURE
27	SRAT HYDROGEN DEFLAGRATION	EXCESSIVE FORMIC ACID CONCENTRATION IN PHA FROM PR
28	SRAT HYDROGEN DEFLAGRATION	HIGH NOBLE METAL CONCENTRATION IN SLUDGE
29	MFT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 2.6 HOURS
30	MFT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 2.6 HOURS
31	MFT HYDROGEN DEFLAGRATION	INSUFFICIENT MFT COOLING WATER HEAT REMOVAL
32	SRAT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW
33	INTERNAL BENZENE FIRE	LARGE BENZENE LAYER FORMS IN PRBT
34	MFT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 2.6 HOURS
35	SRAT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW GAS CHROMATOGRAPH LOW N2 CONCENTRATION INTERLOCK FAILURE
36	SRAT HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW GAS CHROMATOGRAPH LOW N2 CONCENTRATION INTERLOCK FAILURE
37	LOSS OF CPC PRIMARY AIR PURGE SYSTEM	HARDWARE FAILURES ONLY

SHEET #	TITLE	SUBTITLE
38	LOSS OF CPC PRIMARY AIR PURGE SYSTEM	ALL CAUSES
39	LOSS OF N2 BACKUP PURGE SYSTEM	HARDWARE FAILURES ONLY
40	LOSS OF N2 BACKUP PURGE SYSTEM	ALL CAUSES
41	INADEQUATE PROCESS COOLING WATER HEAT REMOVAL	INITIATING EVENT LOGIC
42	PRBT BENZENE/HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 17.9 HOURS
43	PRBT HYDROGEN/BENZENE DEFLAGRATION	INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 17.9 HOURS
44	PRBT BENZENE/HYDROGEN DEFLAGRATION	INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 17.9 HOURS

TOP EVENT DEFINITION

AMMONIUM NITRATE EXPLOSION WITHIN THE CHEMICAL PROCESS CELL

SHEET 1



A-4

# DENOTES SCENARIO DESCRIPTOR EVENT

* DENOTES ENABLING EVENT

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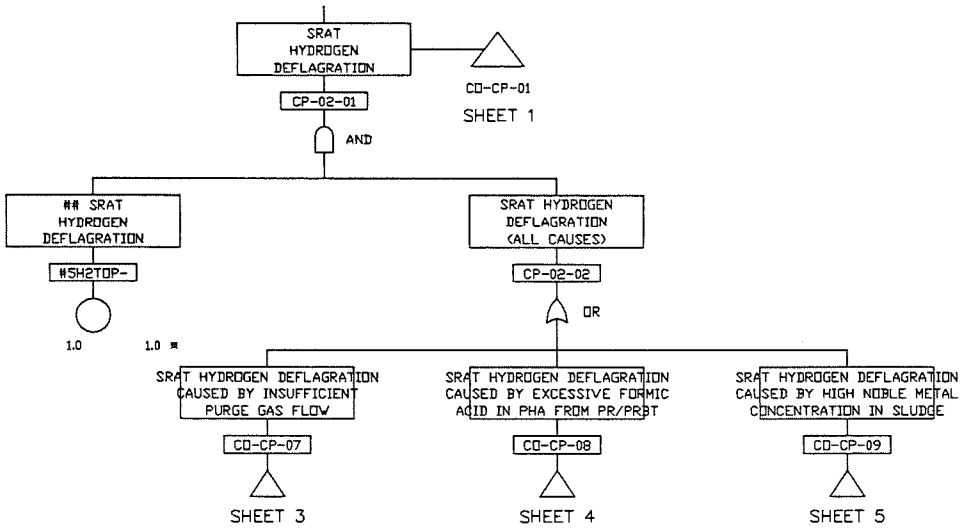
SRAT HYDROGEN FIRE

ALL CAUSES

SHEET 2



A-5

# DENOTES SCENARIO DESCRIPTOR EVENT

* DENOTES ENABLING EVENT

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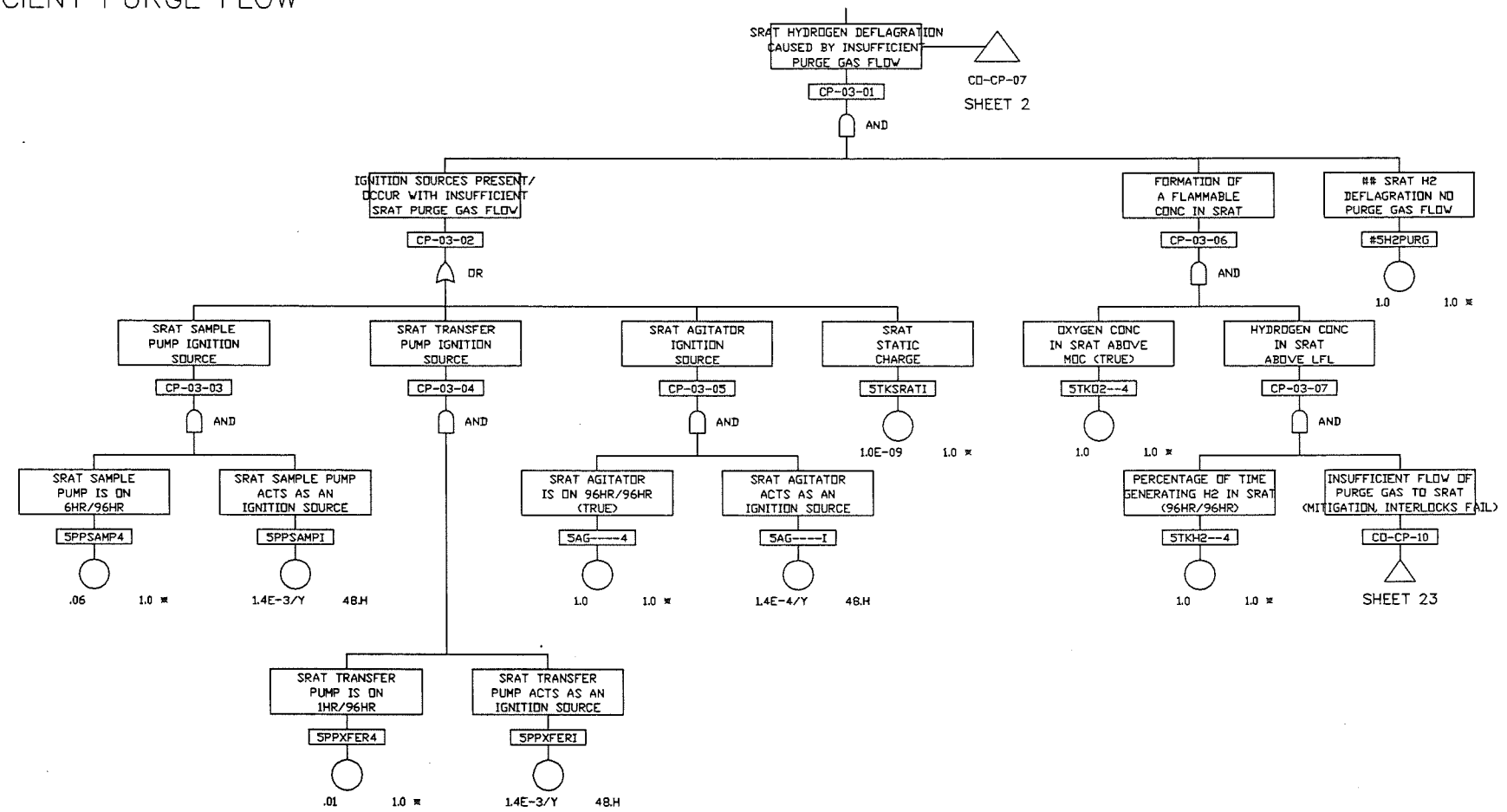
SRAT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW

SHEET 3



# DENOTES SCENARIO DESCRIPTOR EVENT

* DENOTES ENABLING EVENT

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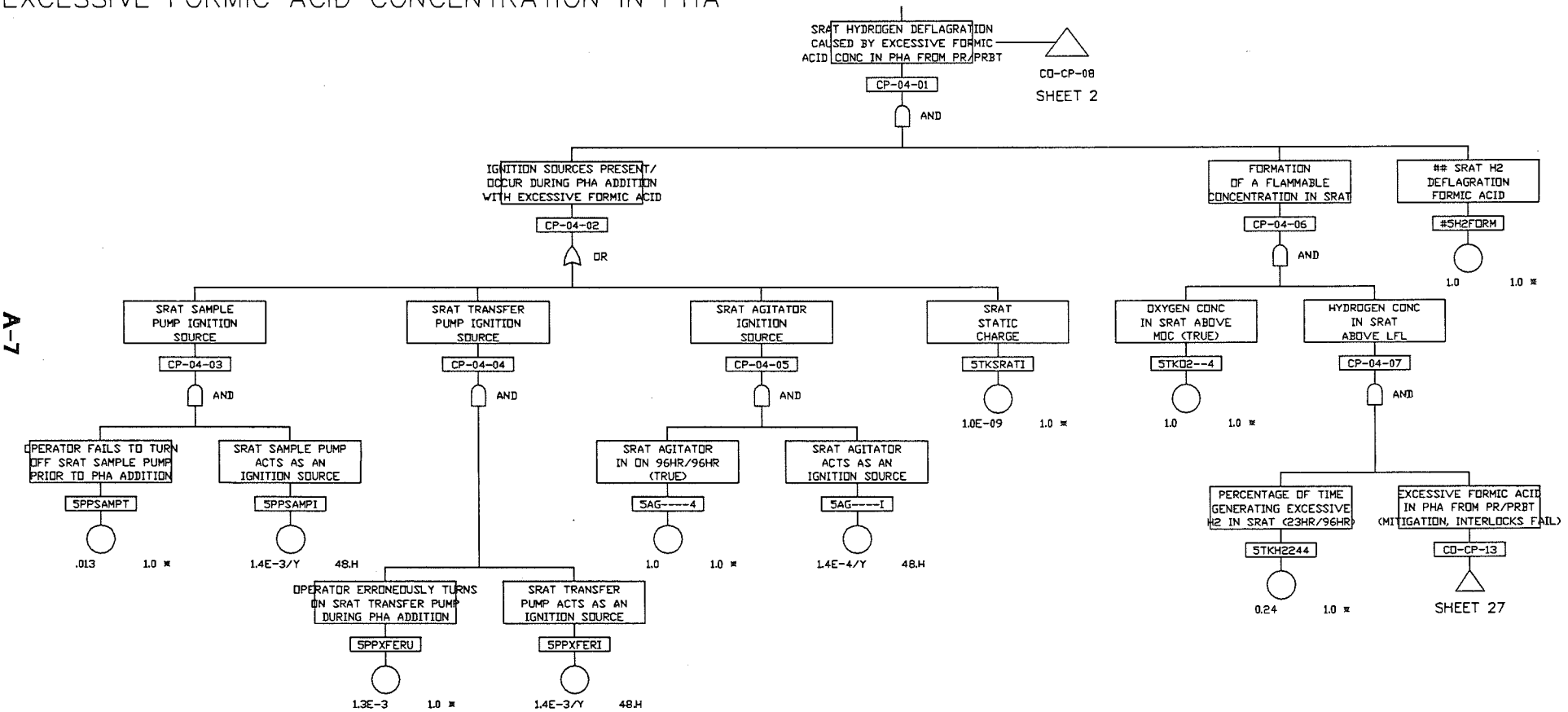
SRAT HYDROGEN DEFLAGRATION

EXCESSIVE FORMIC ACID CONCENTRATION IN PHA

SHEET 4



A-7

# DENOTES SCENARIO DESCRIPTOR EVENT

* DENOTES ENABLING EVENT

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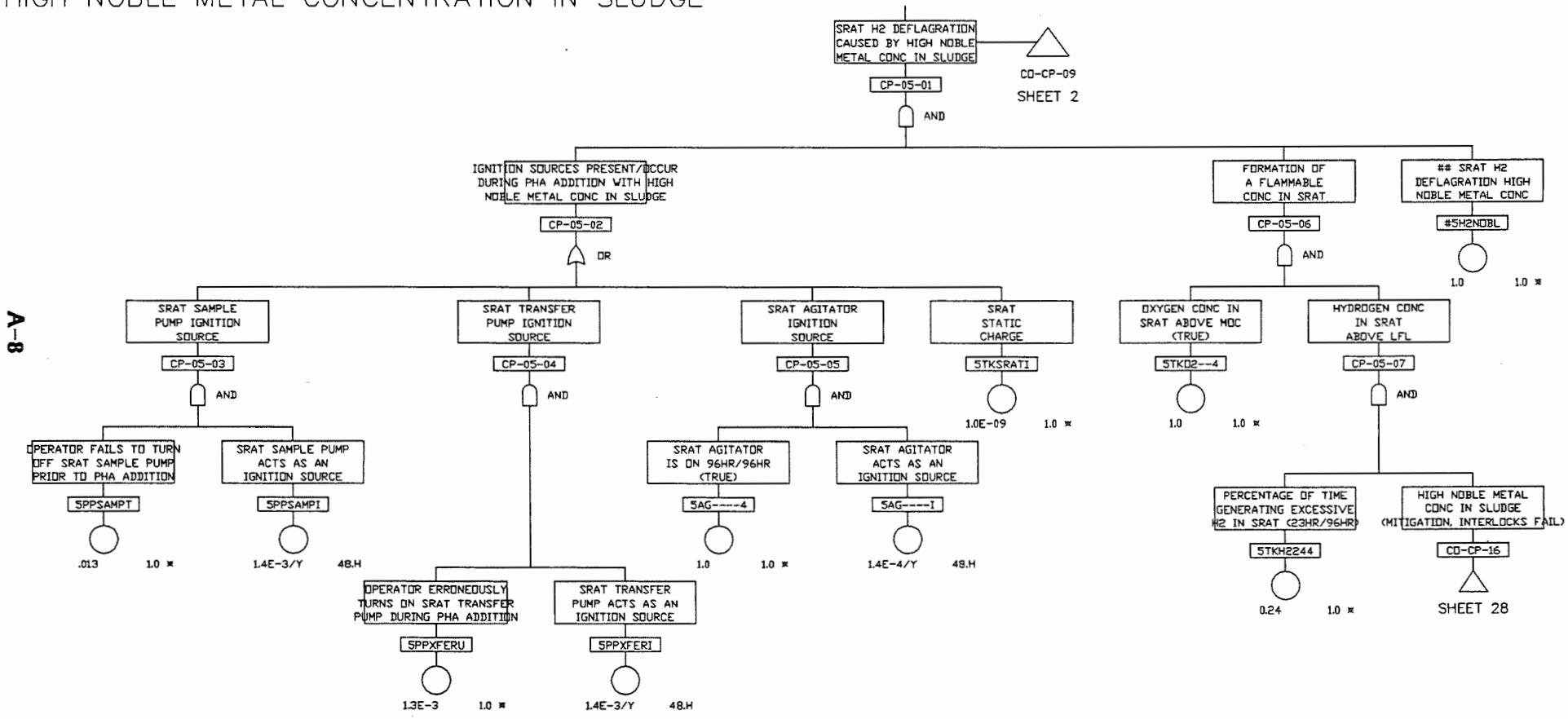
SRAT HYDROGEN DEFLAGRATION

SHEET 5

HIGH NOBLE METAL CONCENTRATION IN SLUDGE



A-8

# DENOTES SCENARIO DESCRIPTOR EVENT

* DENOTES ENABLING EVENT

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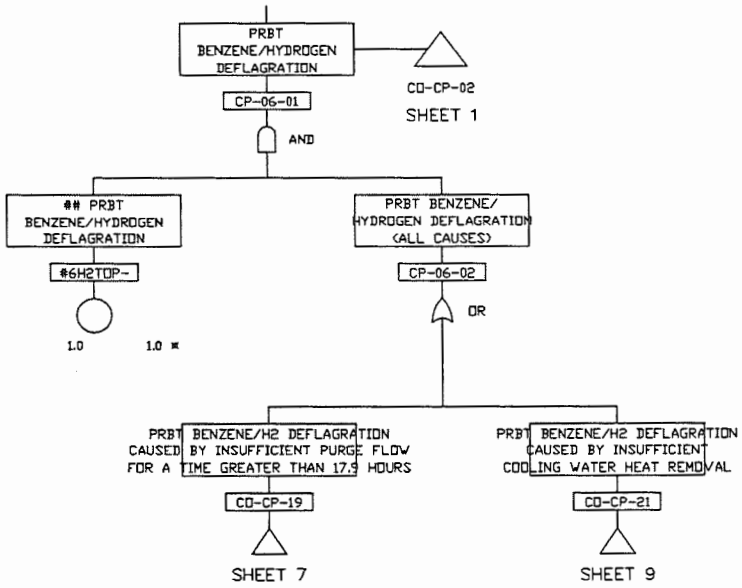
PRBT BENZENE/HYDROGEN DEFLAGRATION

SHEET 6

ALL CAUSES



A-9

# DENOTES SCENARIO DESCRIPTOR EVENT

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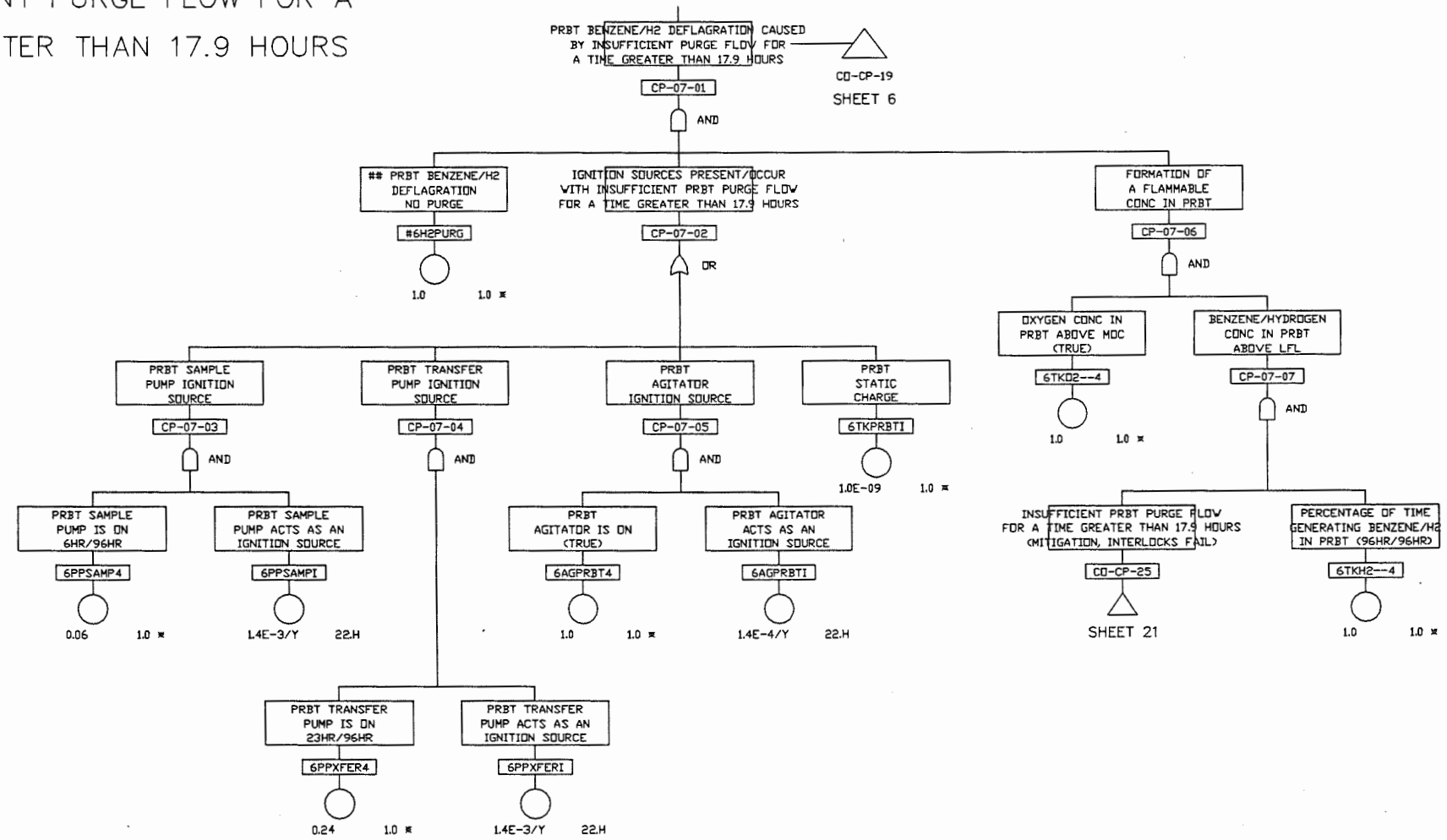
PRBT BENZENE/HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 17.9 HOURS

SHEET 7



A-10

# DENOTES SCENARIO DESCRIPTOR EVENT

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SHEET 8

A-11

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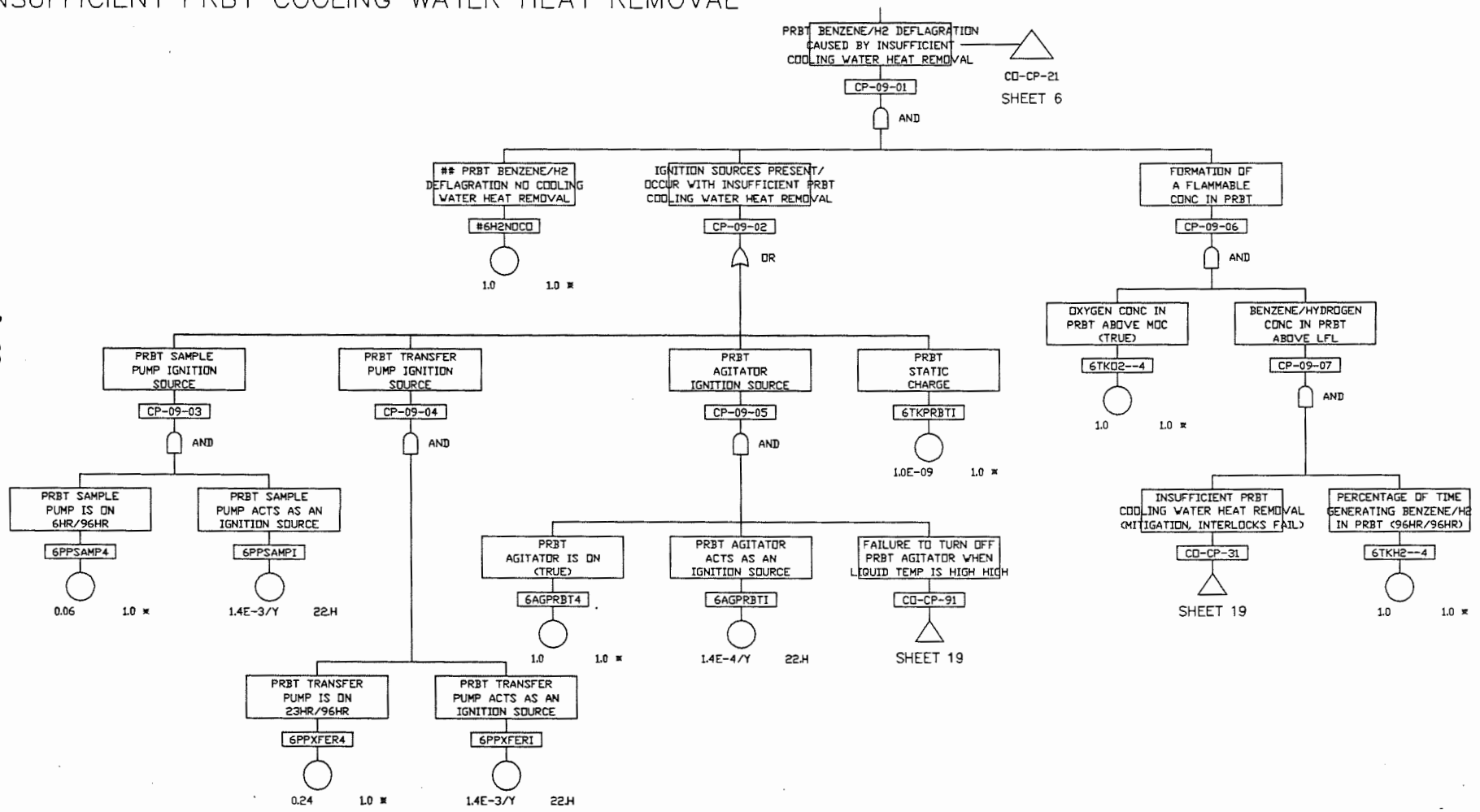
PRBT BENZENE/HYDROGEN DEFLAGRATION

SHEET 9

INSUFFICIENT PRBT COOLING WATER HEAT REMOVAL



A-12

# DENOTES SCENARIO DESCRIPTOR EVENT

* DENOTES ENABLING EVENT

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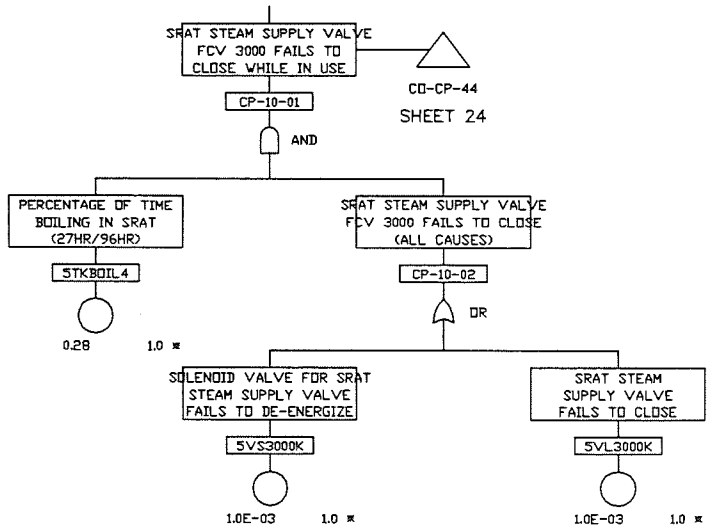
SRAT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW

SRAT AIR PURGE LOW FLOW INTERLOCKS FAIL



* DENOTES ENABLING EVENT

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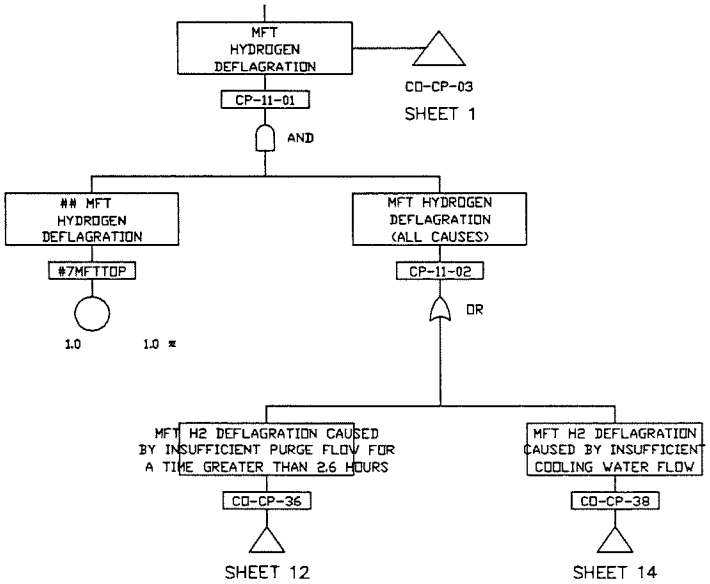
MFT HYDROGEN DEFLAGRATION

ALL CAUSES

SHEET 11



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* DENOTES ENABLING EVENT

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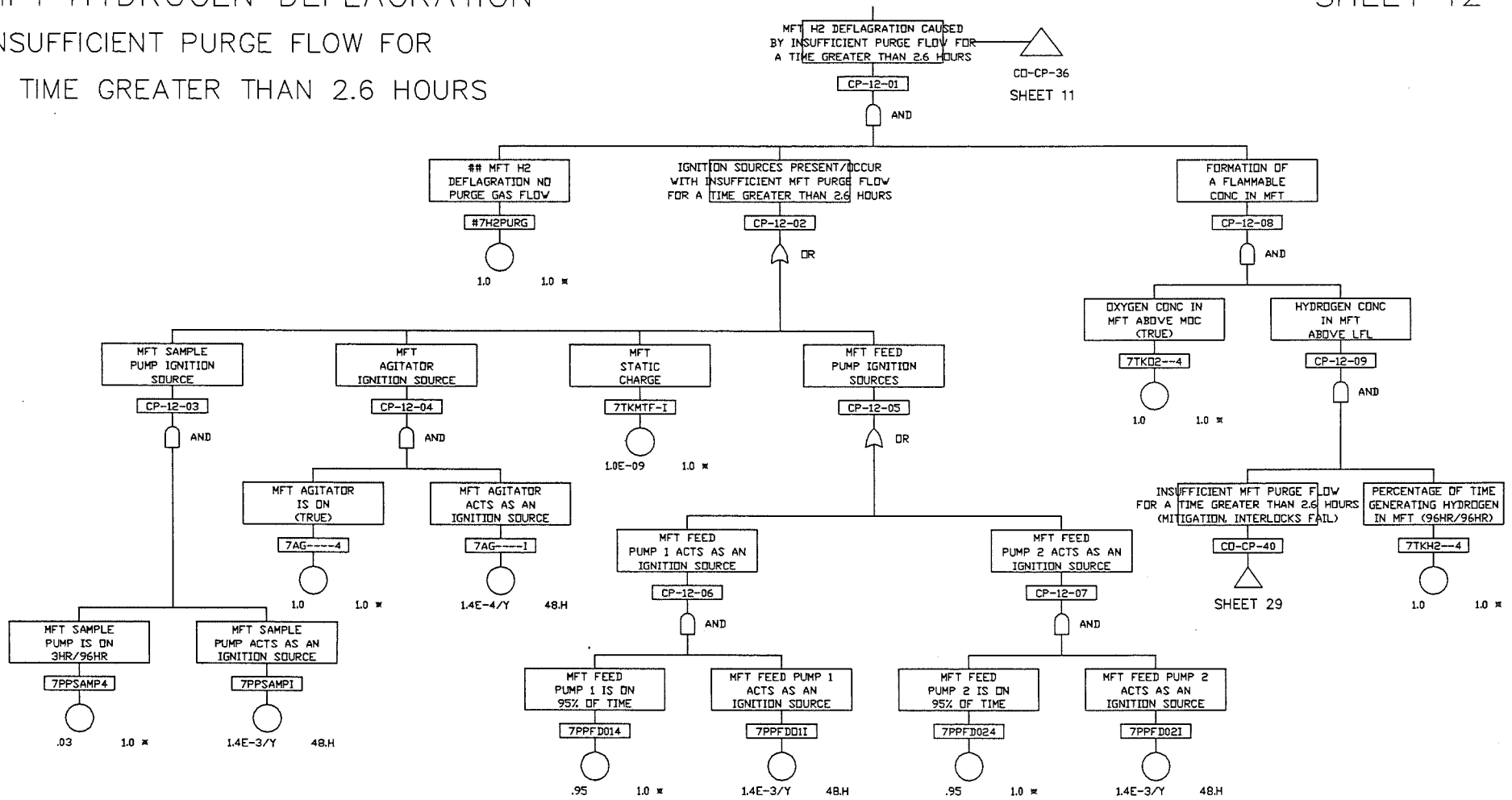
MFT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 2.6 HOURS

SHEET 12



A-15

# DENOTES SCENARIO DESCRIPTOR EVENT

* DENOTES ENABLING EVENT

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SHEET 13

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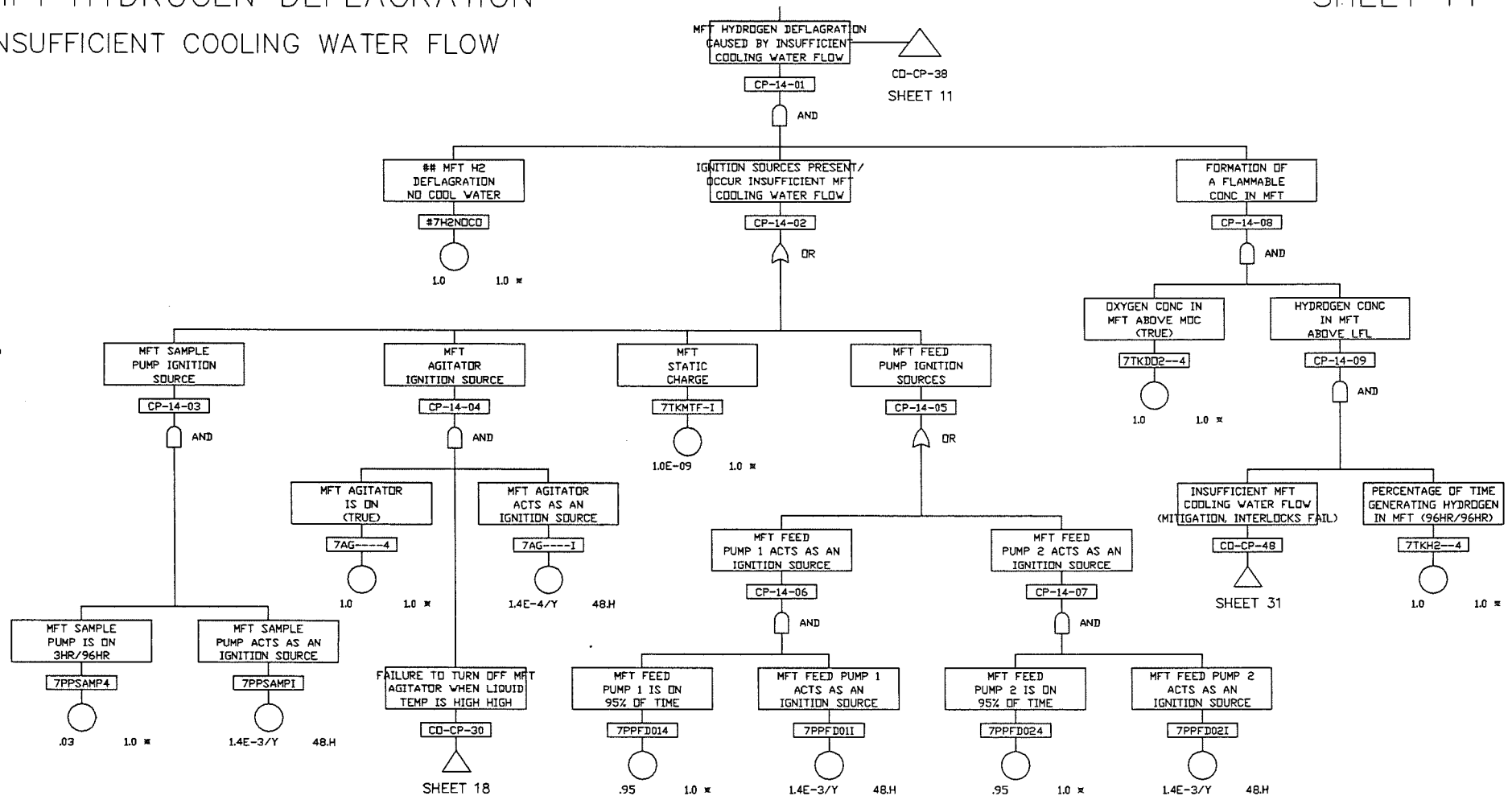
MFT HYDROGEN DEFLAGRATION

INSUFFICIENT COOLING WATER FLOW

SHEET 14



A-17

# DENOTES SCENARIO DESCRIPTOR EVENT

* DENOTES ENABLING EVENT

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SHEET 15

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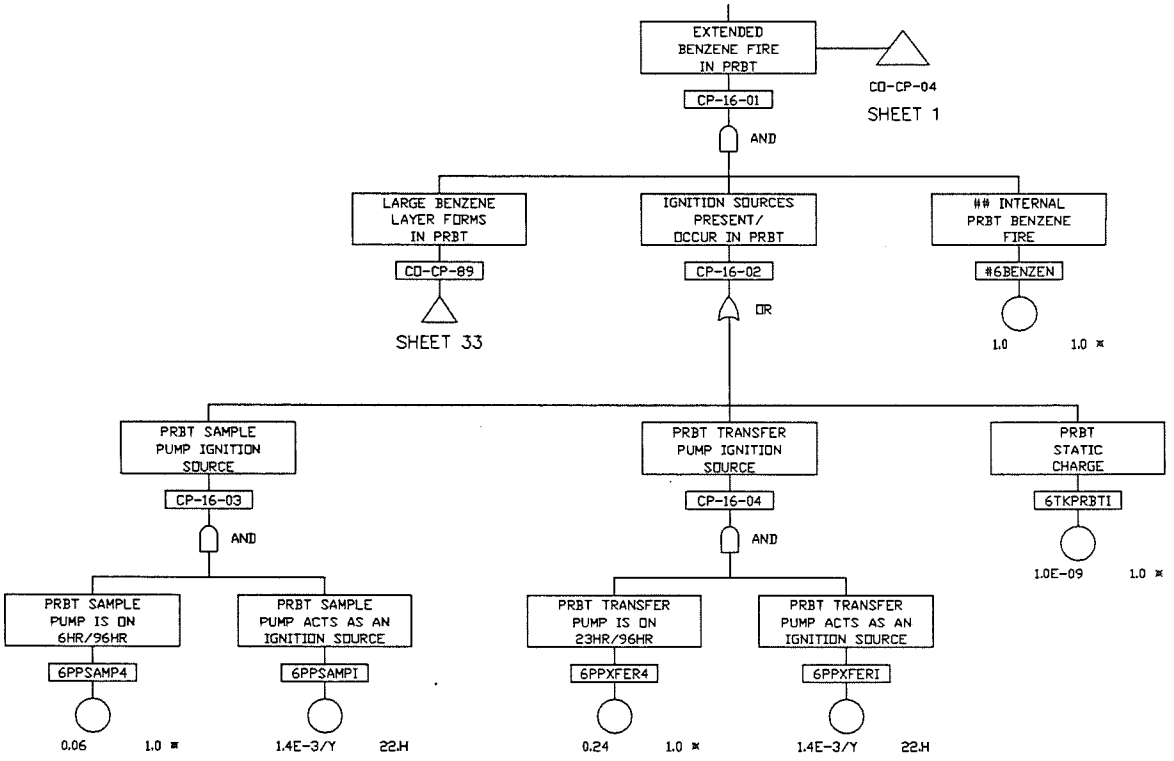
INTERNAL PRBT BENZENE FIRE

SHEET 16



# DENOTES SCENARIO DESCRIPTOR EVENT

* DENOTES ENABLING EVENT

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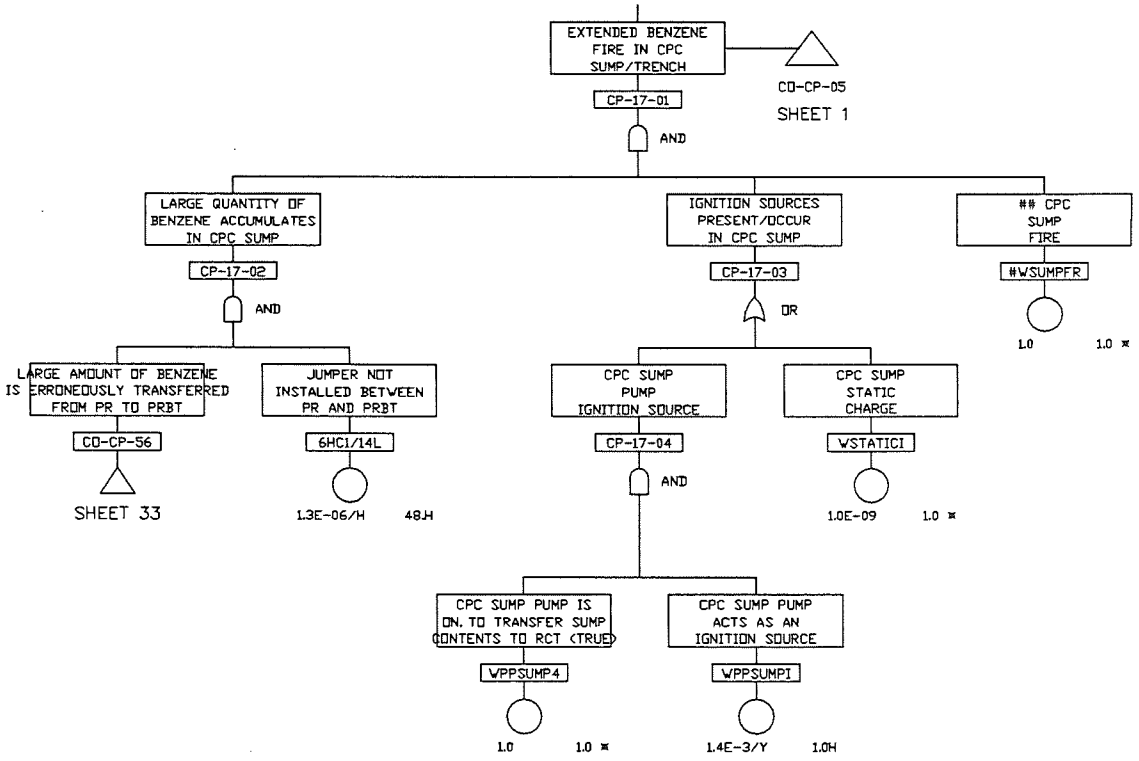
CPC SUMP/TRENCH BENZENE FIRE

SHEET 17



A-20

# DENOTES SCENARIO DESCRIPTOR EVENT

* DENOTES ENABLING EVENT

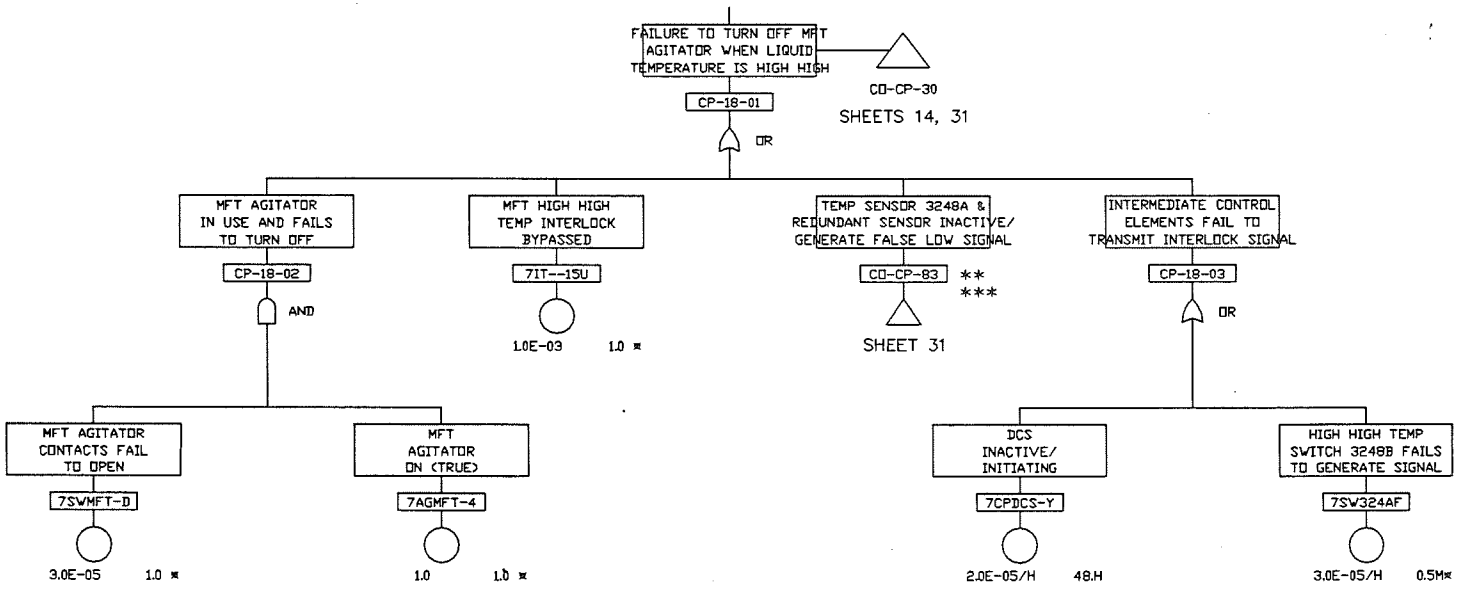
06-10-94 10:45
F:\CPC94\FTREE\ACAD\CPC17

MFT HYDROGEN DEFLAGRATION

INSUFFICIENT MFT COOLING

WATER HEAT REMOVAL

SHEET 18



A-21

* DENOTES ENABLING EVENT

** COMMON CAUSE INITIATING EVENT

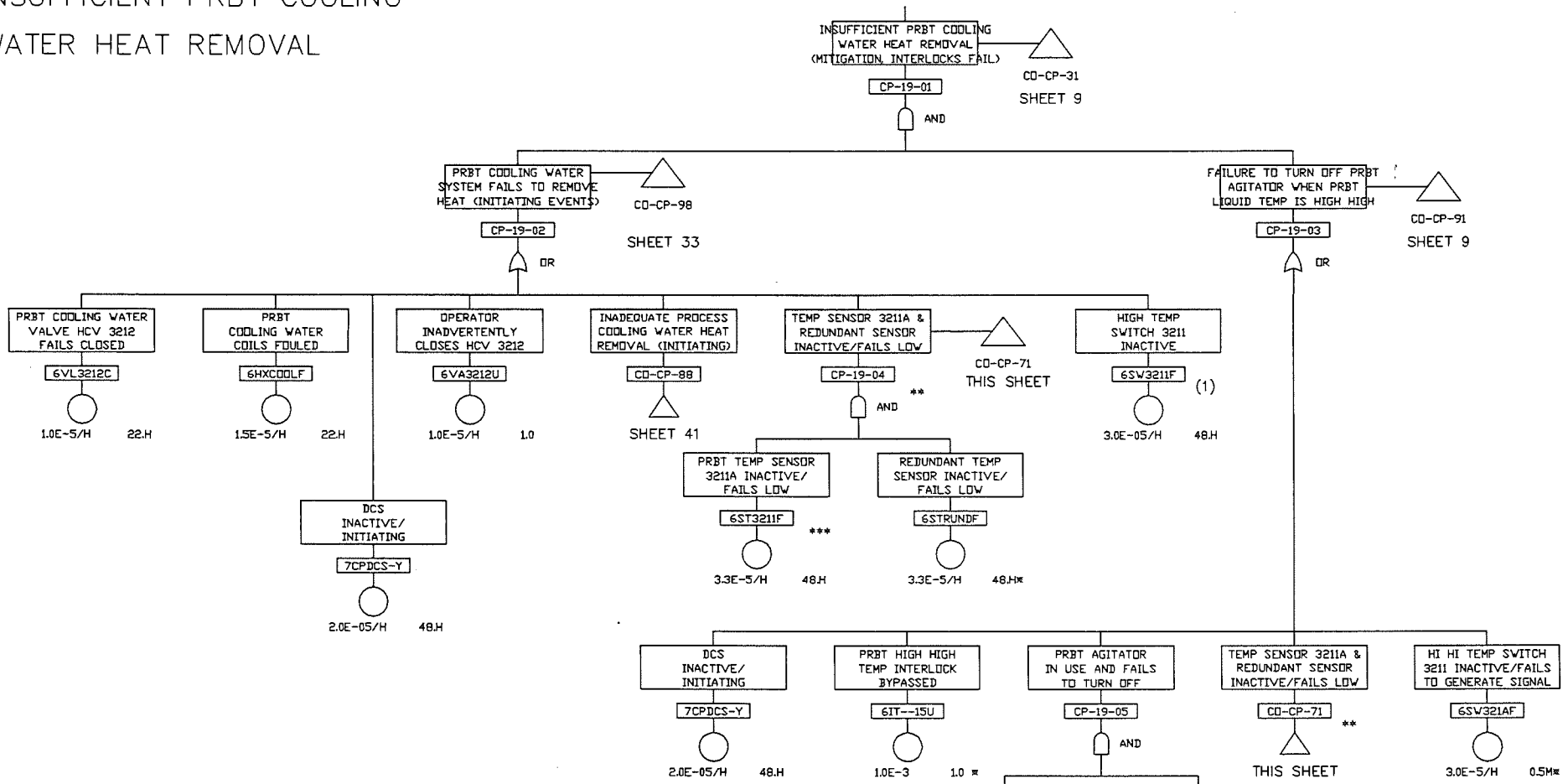
*** REDUNDANT TEMPERATURE SENSOR SENSITIVITY STUDY

06-17-94 10:03
F:\CPC94\FTREE\ACAD\CPC18

PRBT BENZENE/HYDROGEN DEFLAGRATION

SHEET 19

INSUFFICIENT PRBT COOLING WATER HEAT REMOVAL



(1) SWITCH CYCLES OPEN/CLOSED--FAILURE IS INITIATING

* DENOTES ENABLING EVENT

** REDUNDANT TEMPERATURE SENSOR SENSITIVITY STUDY

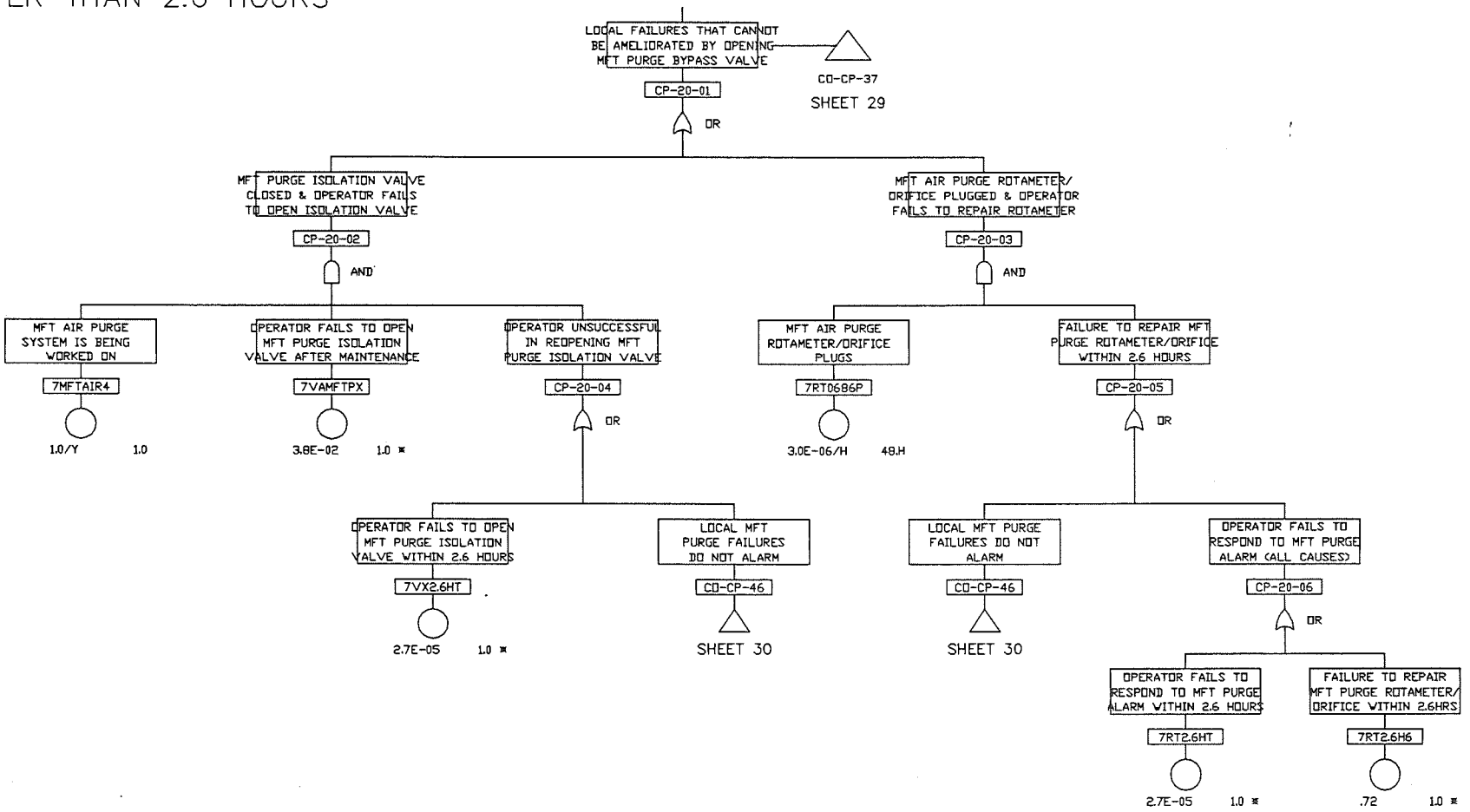
*** COMMON CAUSE INITIATING EVENT

06-17-94 10:05
F:\CPC94\FTREE\ACAD\CPC19

MFT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 2.6 HOURS

SHEET 20



06-17-94 10:07
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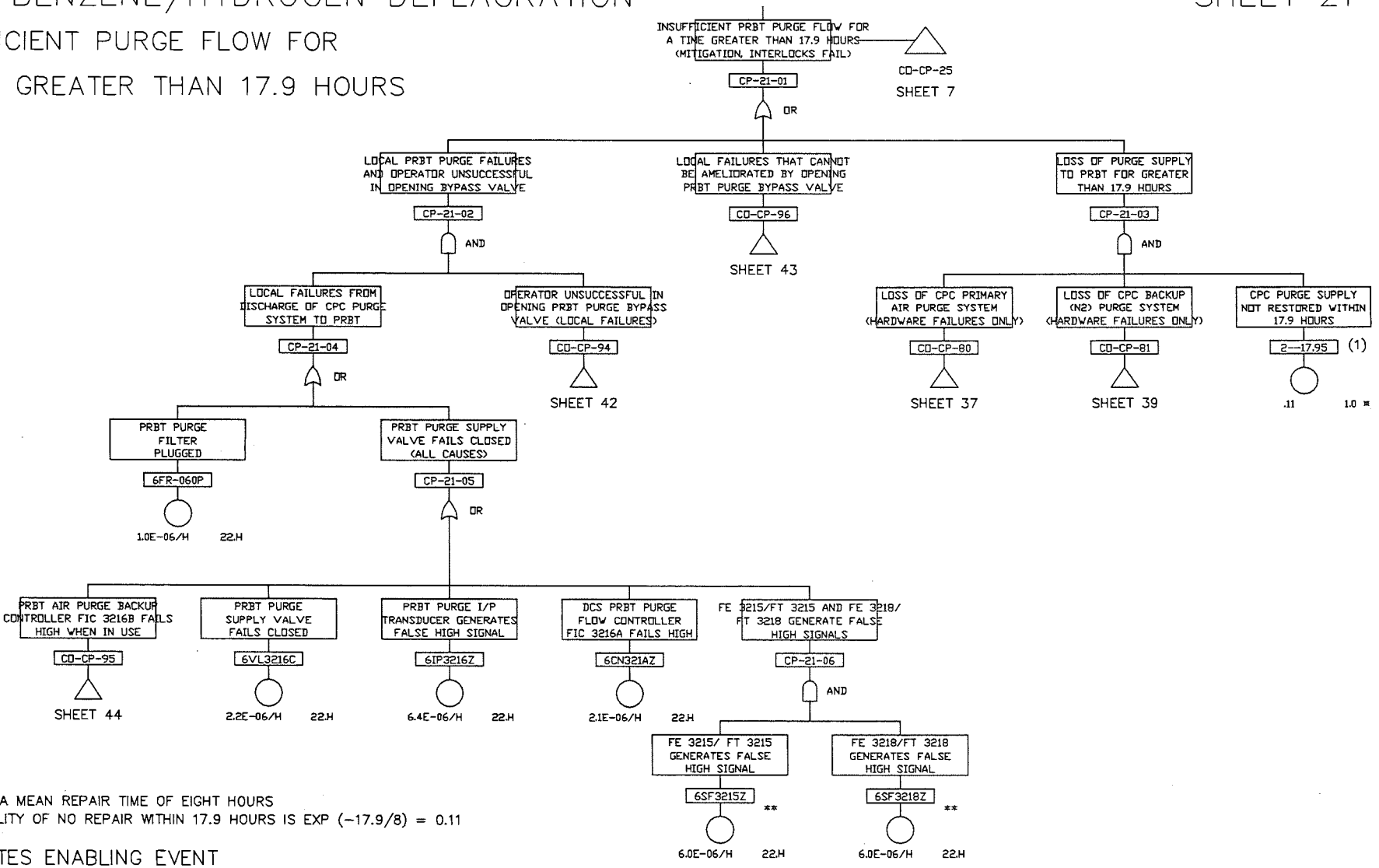
PRBT BENZENE/HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 17.9 HOURS



1) ASSUME A MEAN REPAIR TIME OF EIGHT HOURS
   PROBABILITY OF NO REPAIR WITHIN 17.9 HOURS IS EXP (−17.9/8) = 0.11

* DENOTES ENABLING EVENT

** COMMON CAUSE INITIATING EVENT (SHEET 42)

05-25-94 17:05
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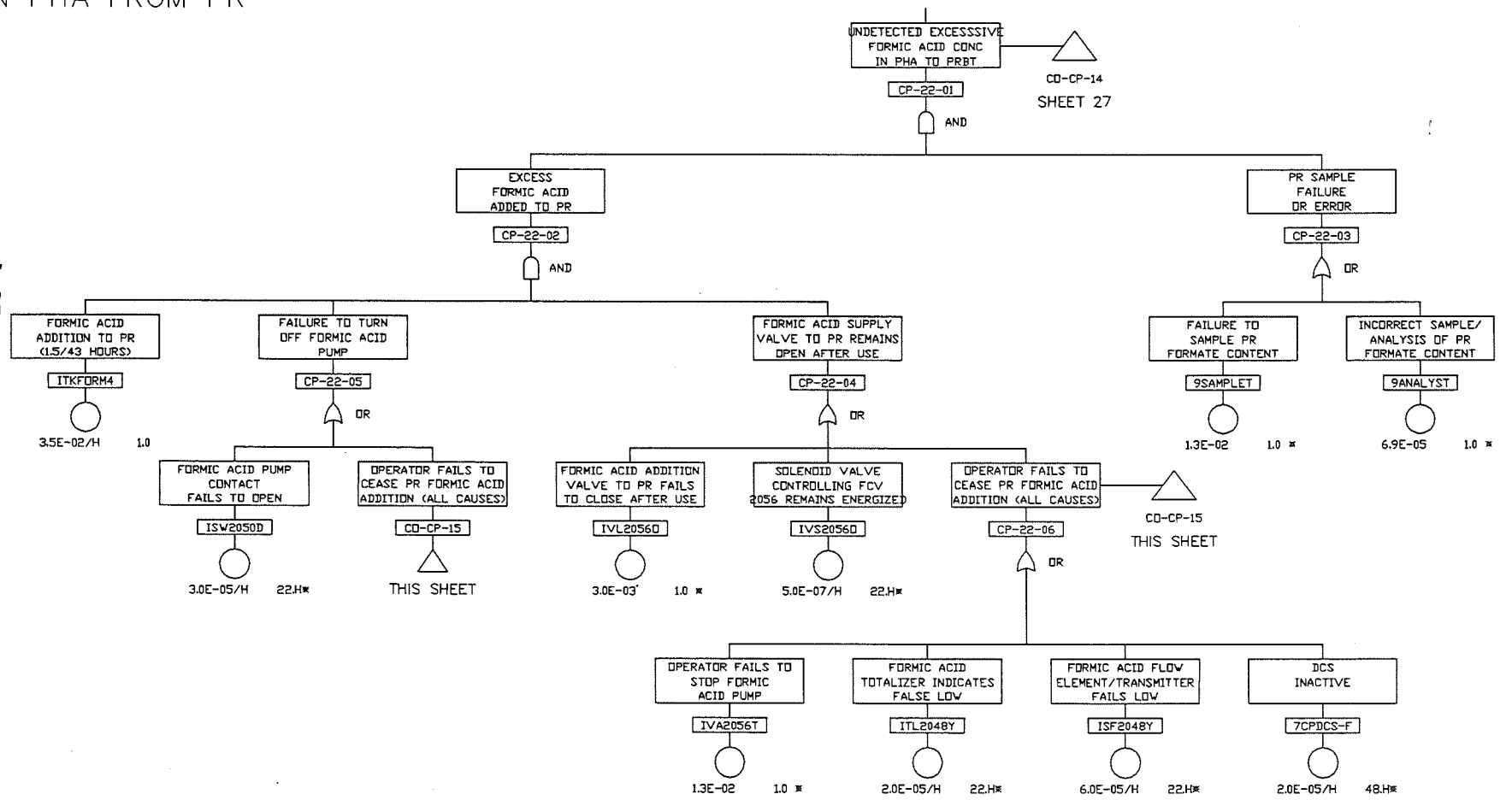
SRAT HYDROGEN DEFLAGRATION

EXCESSIVE FORMIC ACID CONCENTRATION IN PHA FROM PR

SHEET 22



A-25

* DENOTES ENABLING EVENT

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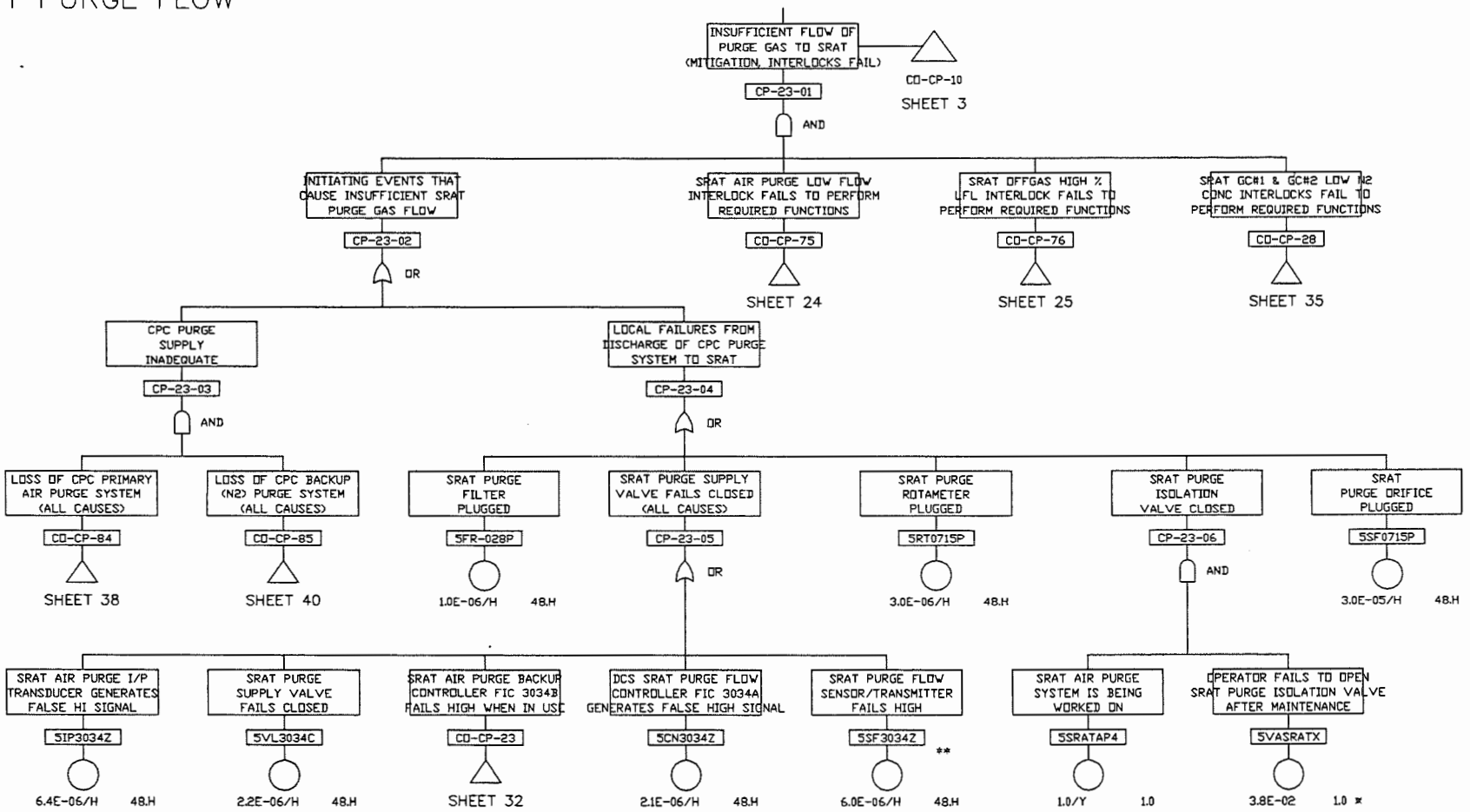
F:\CPC94\FTREE\ACAD\CPC22

SRAT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW

SHEET 23



A-26

* DENOTES ENABLING EVENT

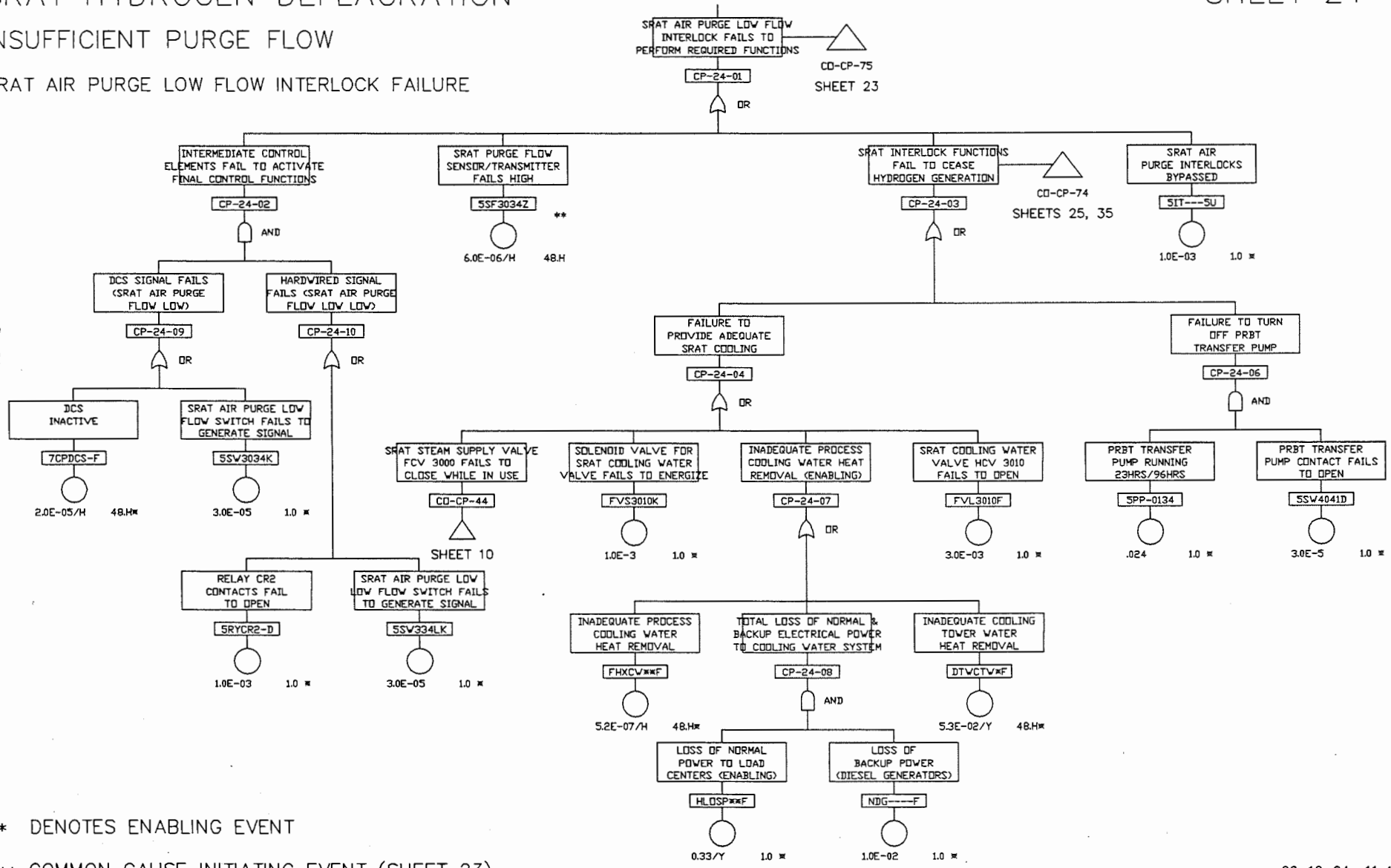
** COMMON CAUSE INITIATING EVENT (SHEET 24)

06-17-94 10:13
F:\CPC94\FTREE\ACAD\CPC23

SRAT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW

SRAT AIR PURGE LOW FLOW INTERLOCK FAILURE



A-27

* DENOTES ENABLING EVENT

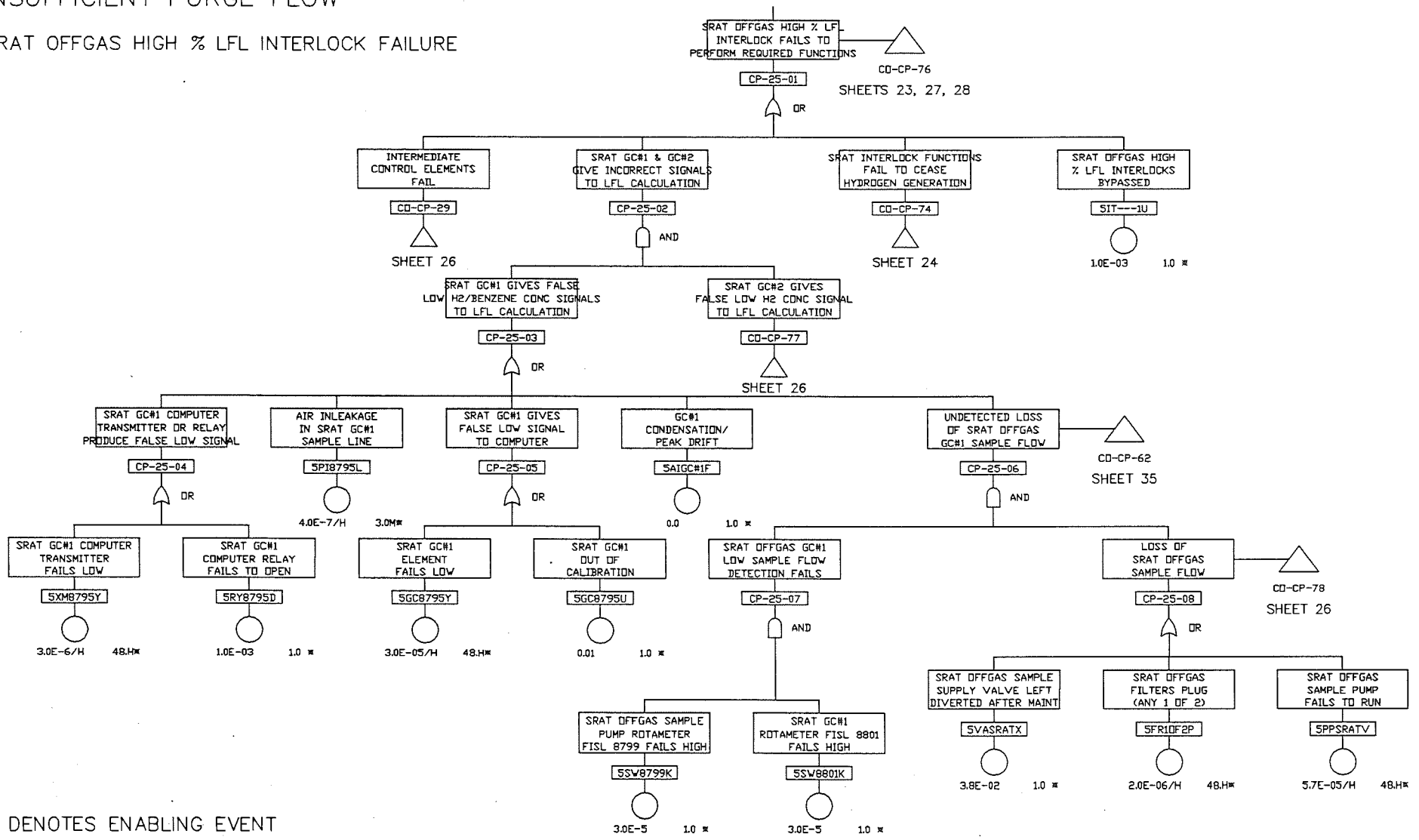
** COMMON CAUSE INITIATING EVENT (SHEET 23)

06-10-94 11:43
F:\CPC94\FTREE\ACAD\CPC24

SRAT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW

SRAT OFFGAS HIGH % LFL INTERLOCK FAILURE



A-28

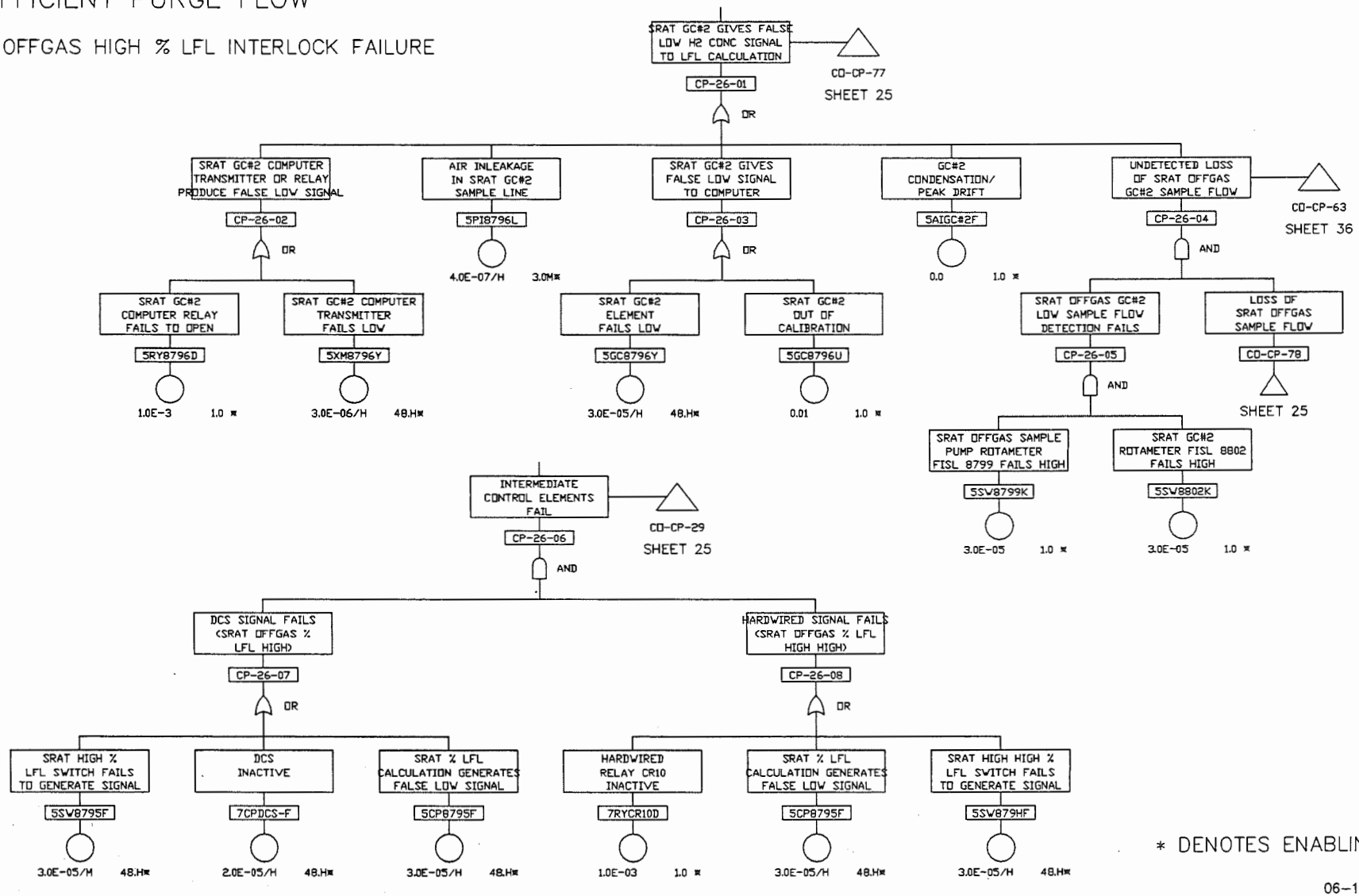
* DENOTES ENABLING EVENT

06-10-94 10:57
F:\CPC94\FTREE\ACAD\CPC25

SRAT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW

SRAT OFFGAS HIGH % LFL INTERLOCK FAILURE



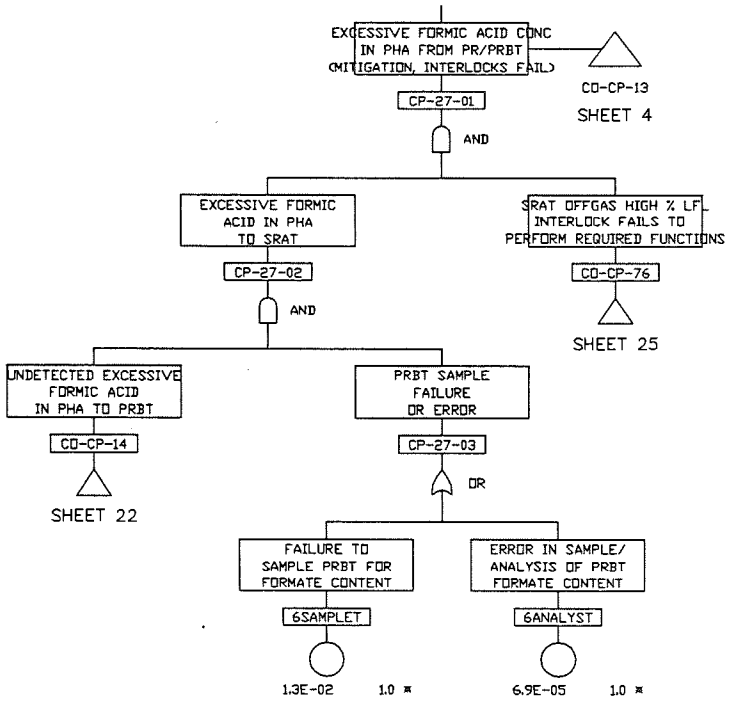
* DENOTES ENABLING EVENT

06-10-94 11:45
F:\CPC94\FTREE\ACAD\CPC26

SRAT HYDROGEN DEFLAGRATION

EXCESSIVE FORMIC ACID CONCENTRATION IN PHA FROM PR

SHEET 27



A-30

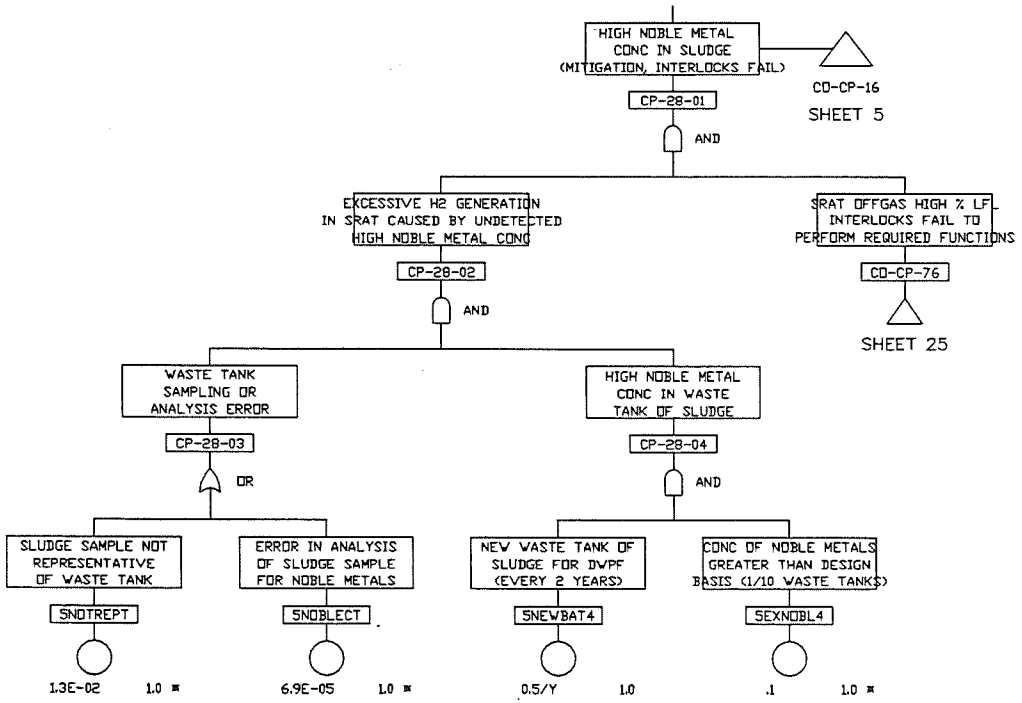
* DENOTES ENABLING EVENT

02-15-94 12:45
F:\CPC94\FTREE\ACAD\CPC27

SRAT HYDROGEN DEFLAGRATION

HIGH NOBLE METAL CONCENTRATION IN SLUDGE

SHEET 28



A-31

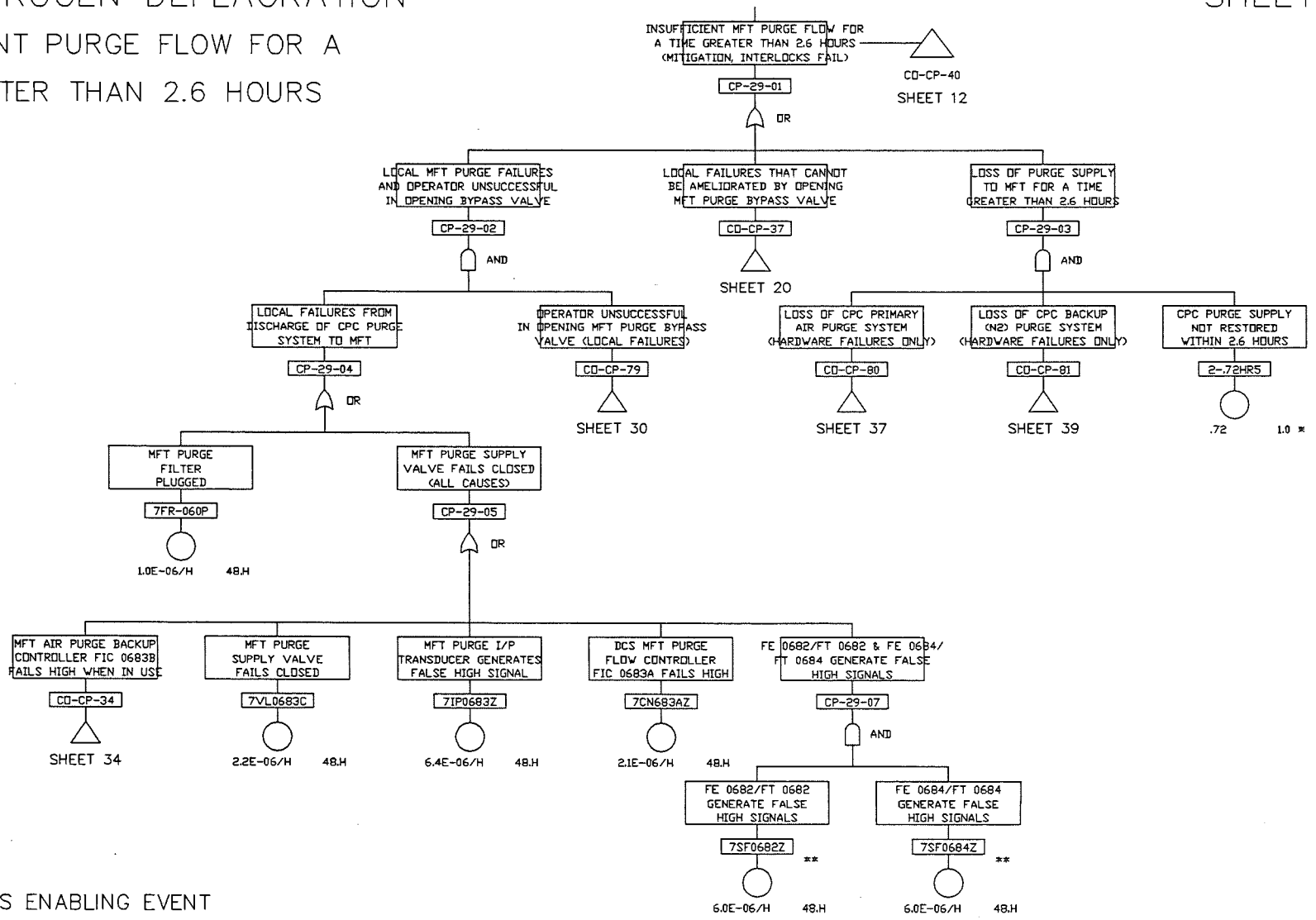
* DENOTES ENABLING EVENT

06-03-94 10:20
F:\CPC94\FTREE\ACAD\CPC28

MFT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 2.6 HOURS

SHEET 29



A-32

* DENOTES ENABLING EVENT

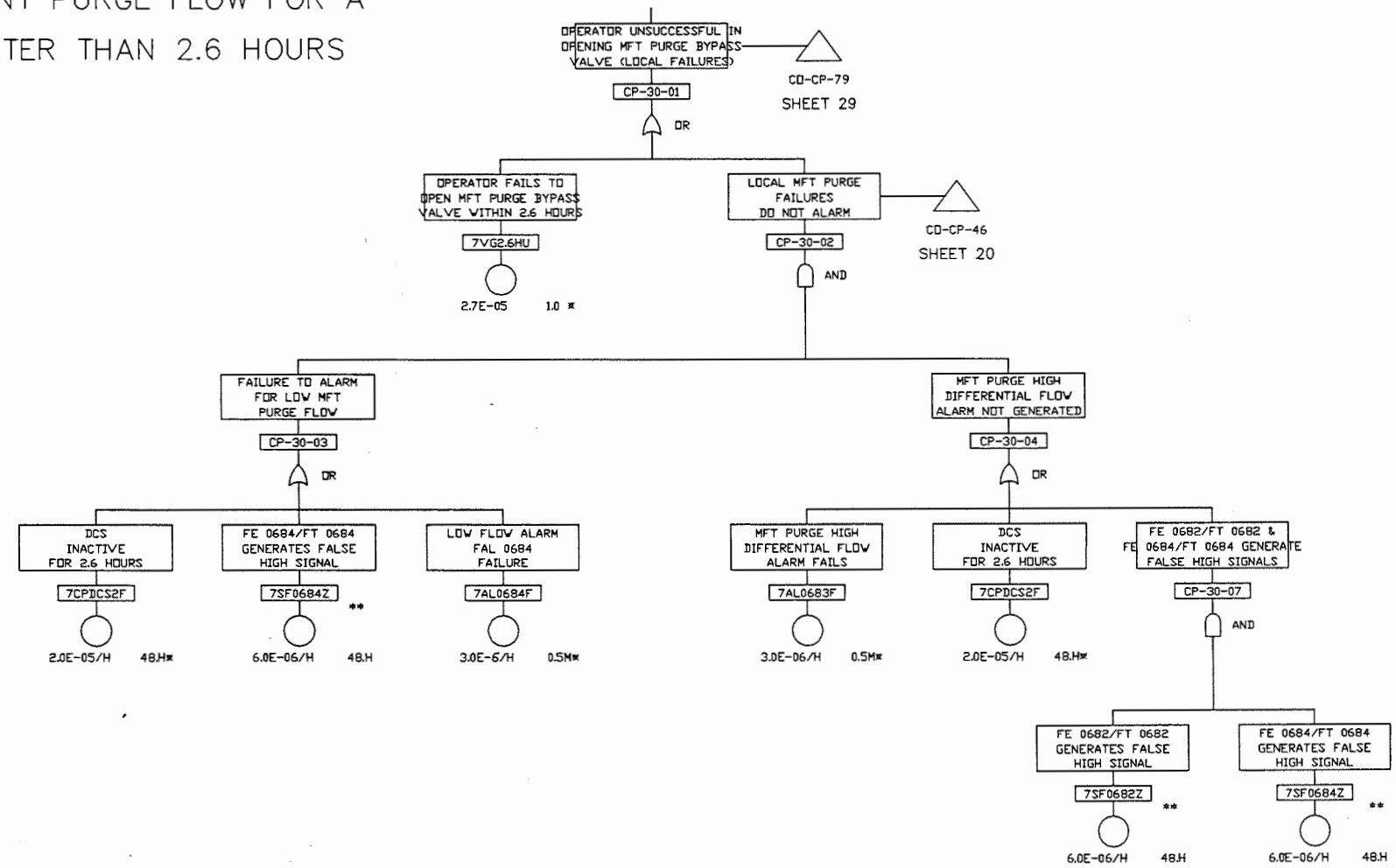
** COMMON CAUSE INITIATING EVENT (SHEET 30)

05-25-94 17:18
F:\CPC94\FTREE\ACAD\CPC29

MFT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 2.6 HOURS

SHEET 30



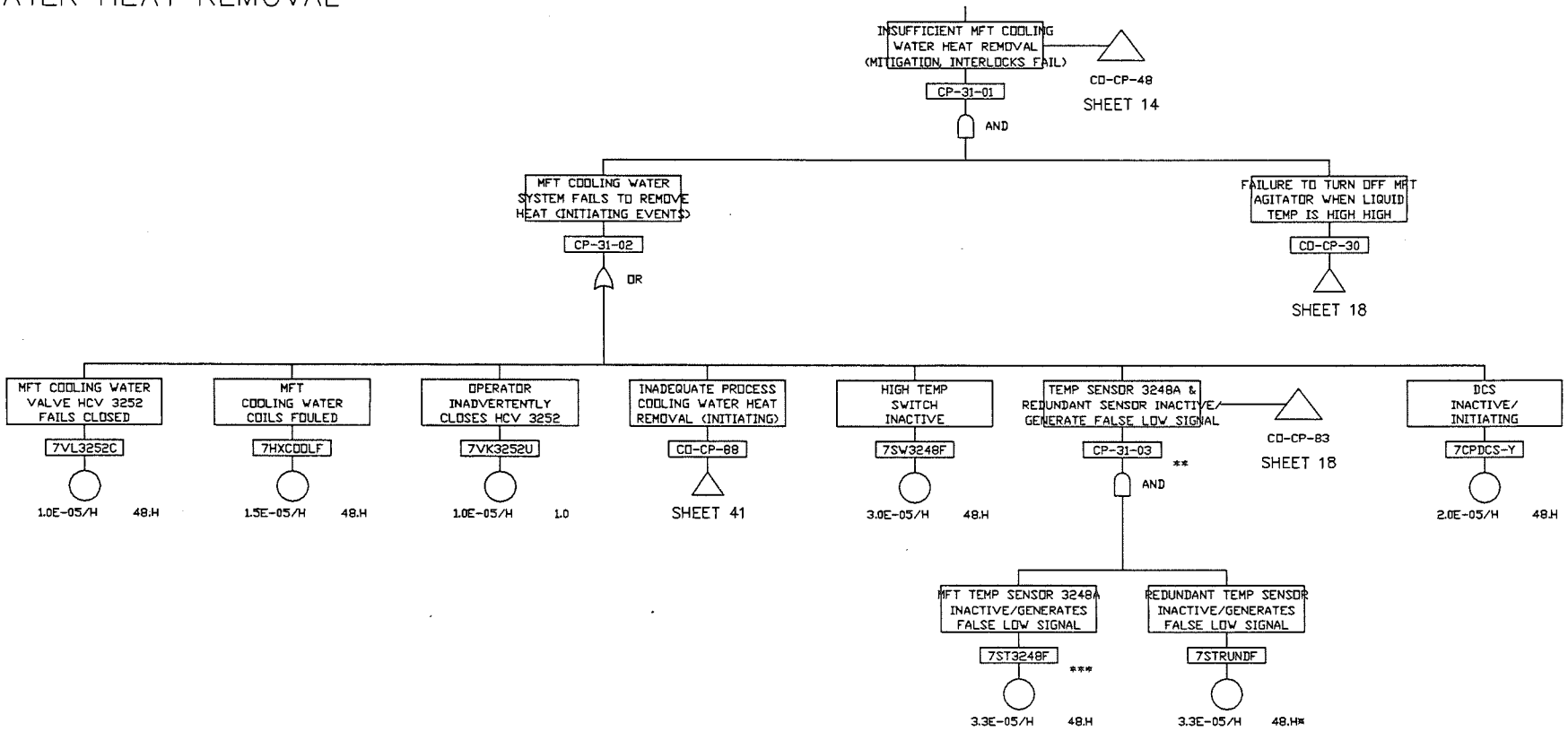
* DENOTES ENABLING EVENT

** DENOTES COMMON CAUSE INITIATING EVENT (SHEET 29)

05-27-94 13:48
F:\CPC94\FTREE\ACAD\CPC30

MFT HYDROGEN DEFLAGRATION

INSUFFICIENT MFT COOLING WATER HEAT REMOVAL



* DENOTES ENABLING EVENT

** REDUNDANT TEMPERATURE SENSOR SENSITIVITY STUDY

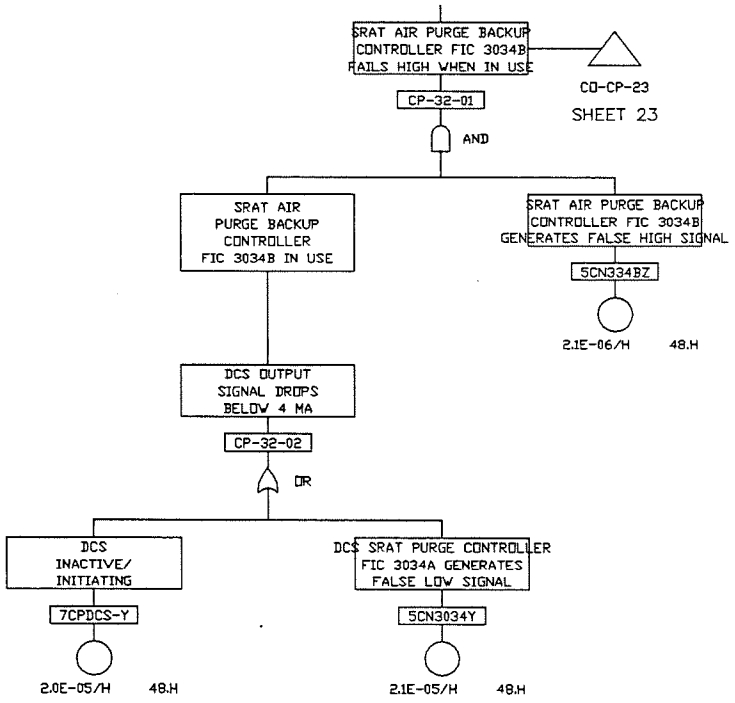
*** COMMON CAUSE INITIATING EVENT

06-13-94 09:57
F:\CPC94\FTREE\ACAD\CPC31

SRAT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW

SHEET 32



A-35

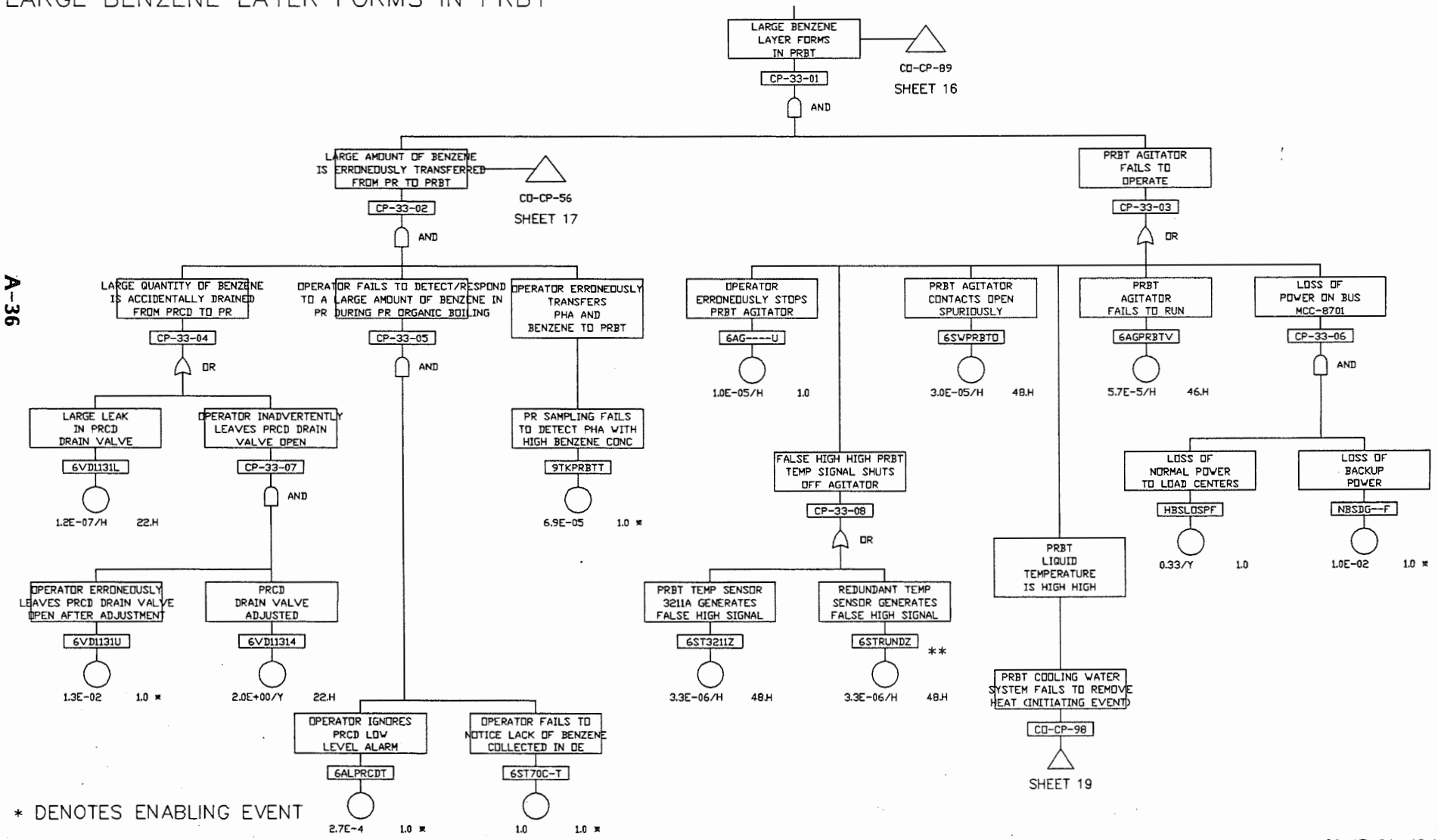
* DENOTES ENABLING EVENT

05-27-94 13:50
F:\CPC94\FTREE\ACAD\CPC32

INTERNAL BENZENE FIRE

LARGE BENZENE LAYER FORMS IN PRBT

SHEET 33



A-36

* DENOTES ENABLING EVENT

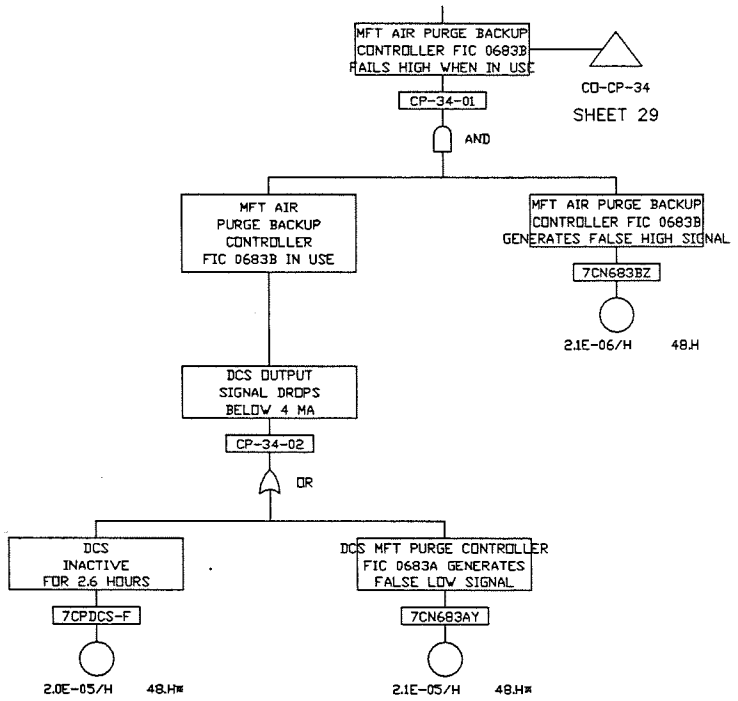
** REDUNDANT TEMPERATURE SENSOR SENSITIVITY STUDY

06-17-94 10:16
F:\CPC94\FTREE\ACAD\CPC33

MFT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 2.6 HOURS

SHEET 34



A-37

* DENOTES ENABLING EVENT

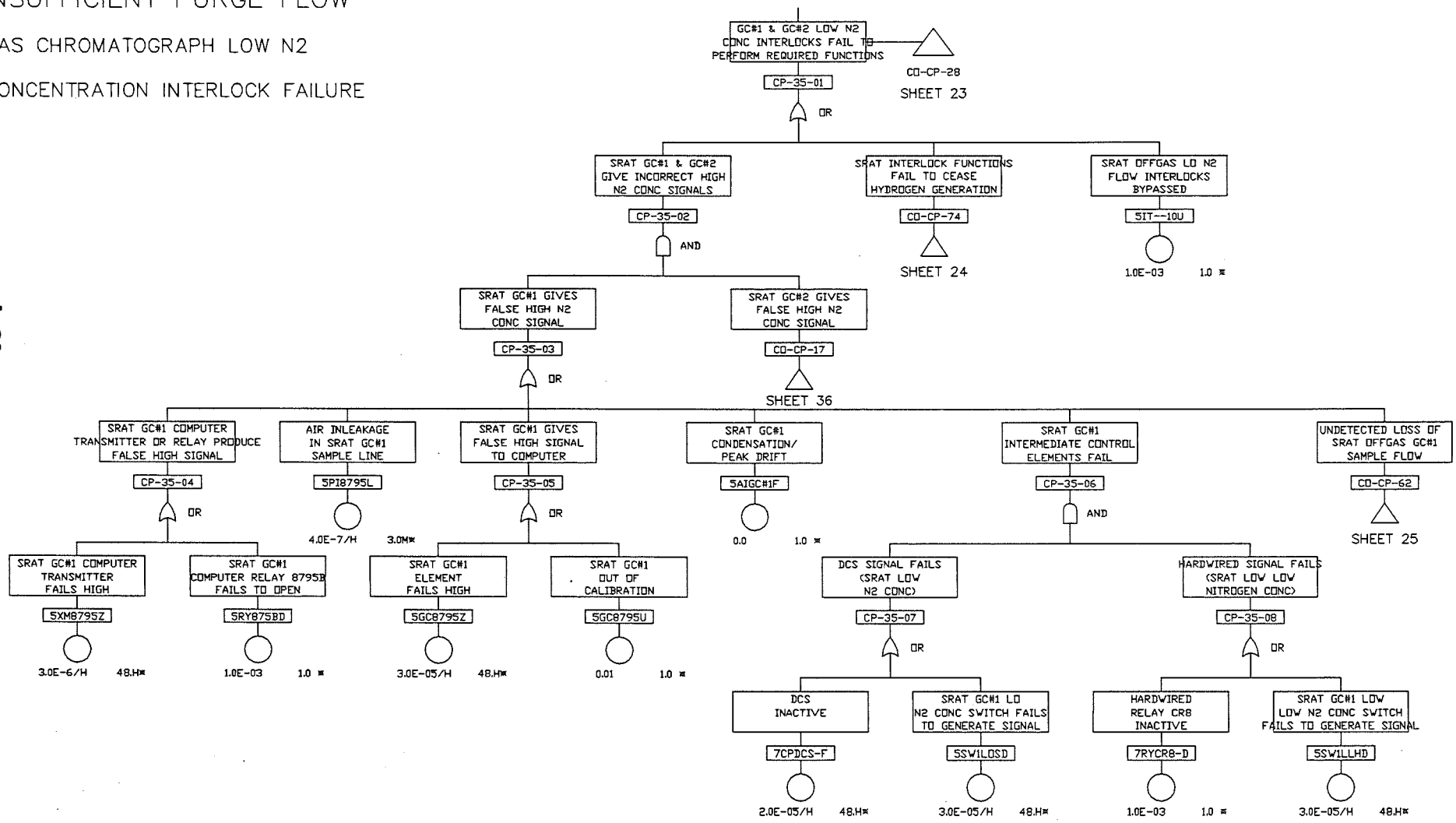
05-27-94 13:57
F:\CPC94\FTREE\ACAD\CPC34

SRAT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW

GAS CHROMATOGRAPH LOW N2

CONCENTRATION INTERLOCK FAILURE



* DENOTES ENABLING EVENT

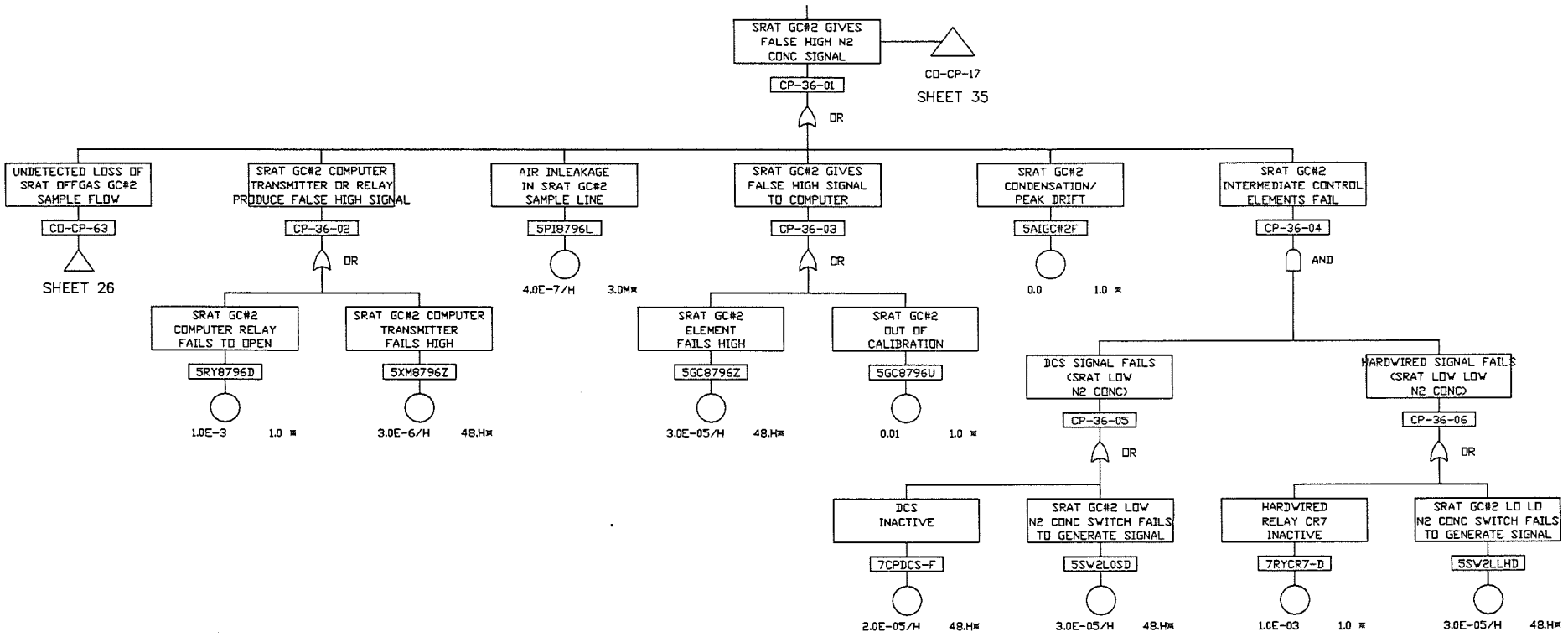
05-24-94 17:04
F:\CPC94\FTREE\ACAD\CPC35

SRAT HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW

GAS CHROMATOGRAPH LOW N2 CONCENTRATION INTERLOCK FAILURE

SHEET 36



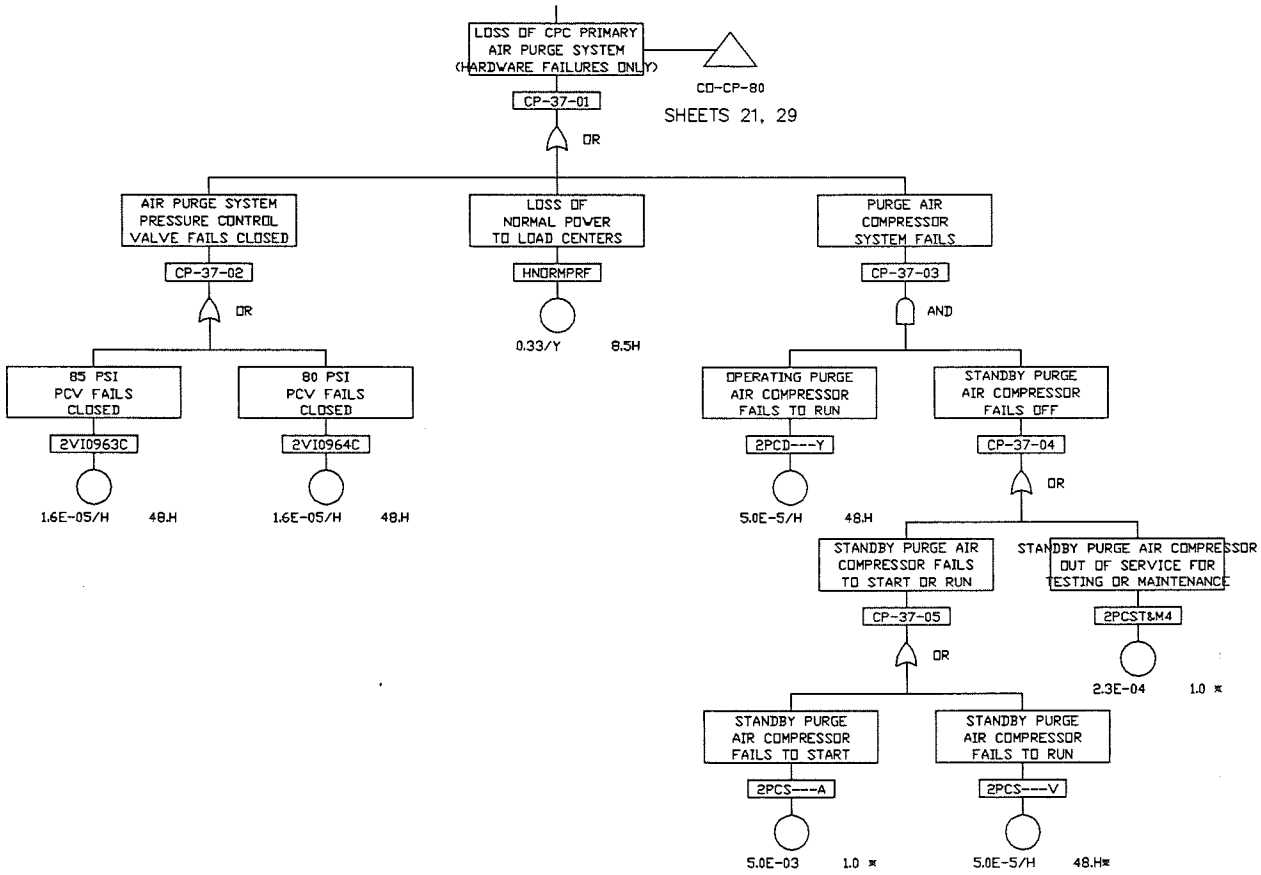
A-39

* DENOTES ENABLING EVENT

05-27-94 14:00
F:\CPC94\FTREE\ACAD\CPC36

LOSS OF CPC PRIMARY AIR PURGE SYSTEM

HARDWARE FAILURES ONLY

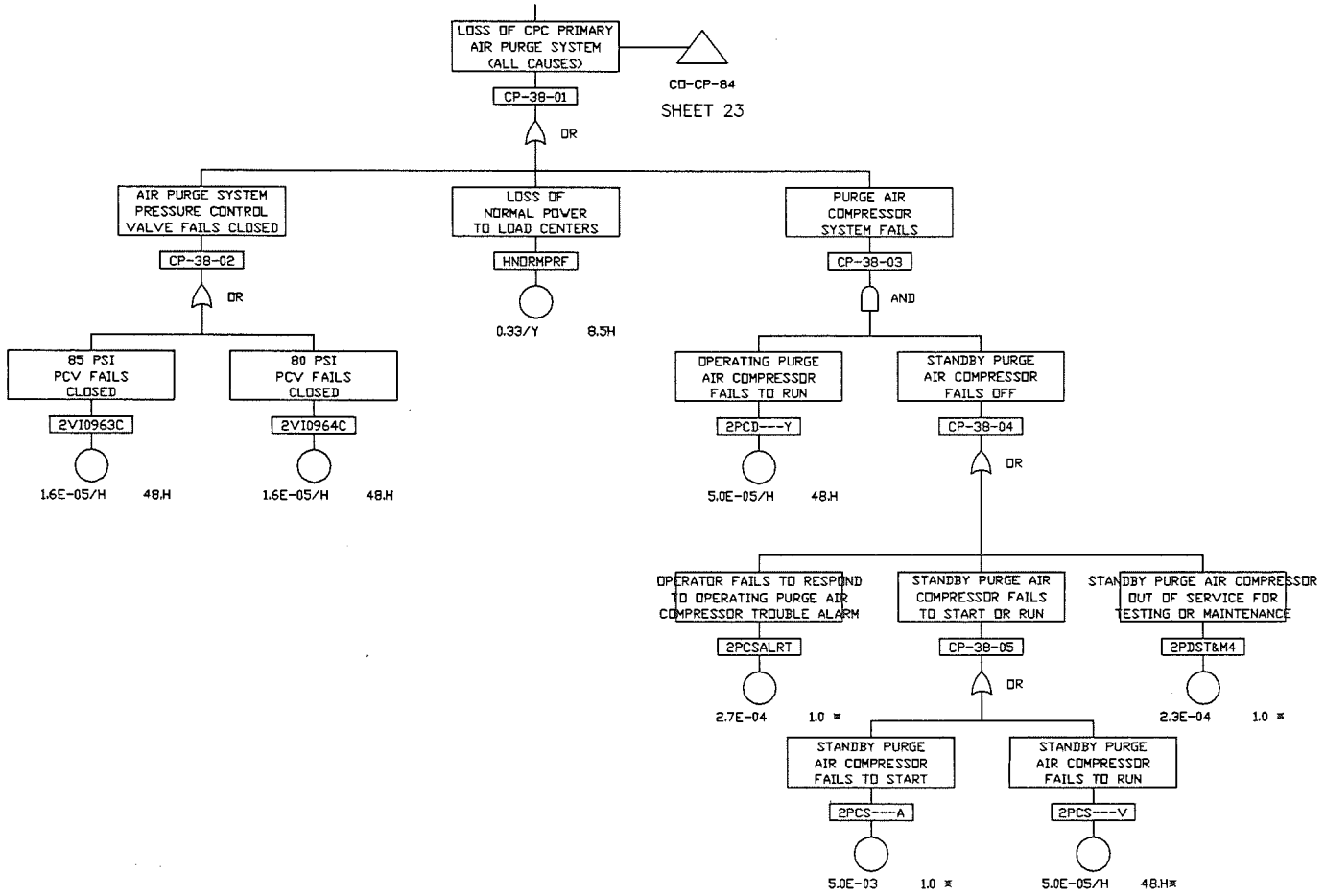


* DENOTES ENABLING EVENT

06-03-94 10:27
F:\CPC94\FTREE\ACAD\CPC37

LOSS OF CPC PRIMARY AIR PURGE SYSTEM

ALL CAUSES



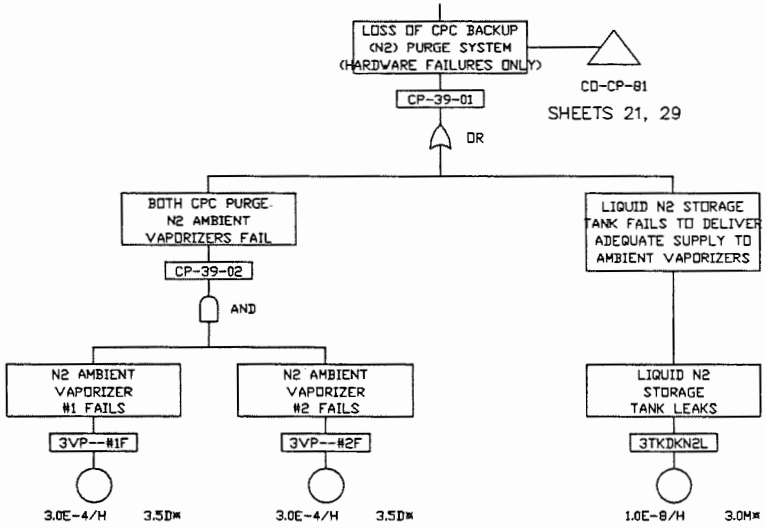
* DENOTES ENABLING EVENT

06-10-94 11:12
F:\CPC94\FTREE\ACAD\CPC38

LOSS OF N2 BACKUP PURGE SYSTEM

HARDWARE FAILURES ONLY

SHEET 39



A-42

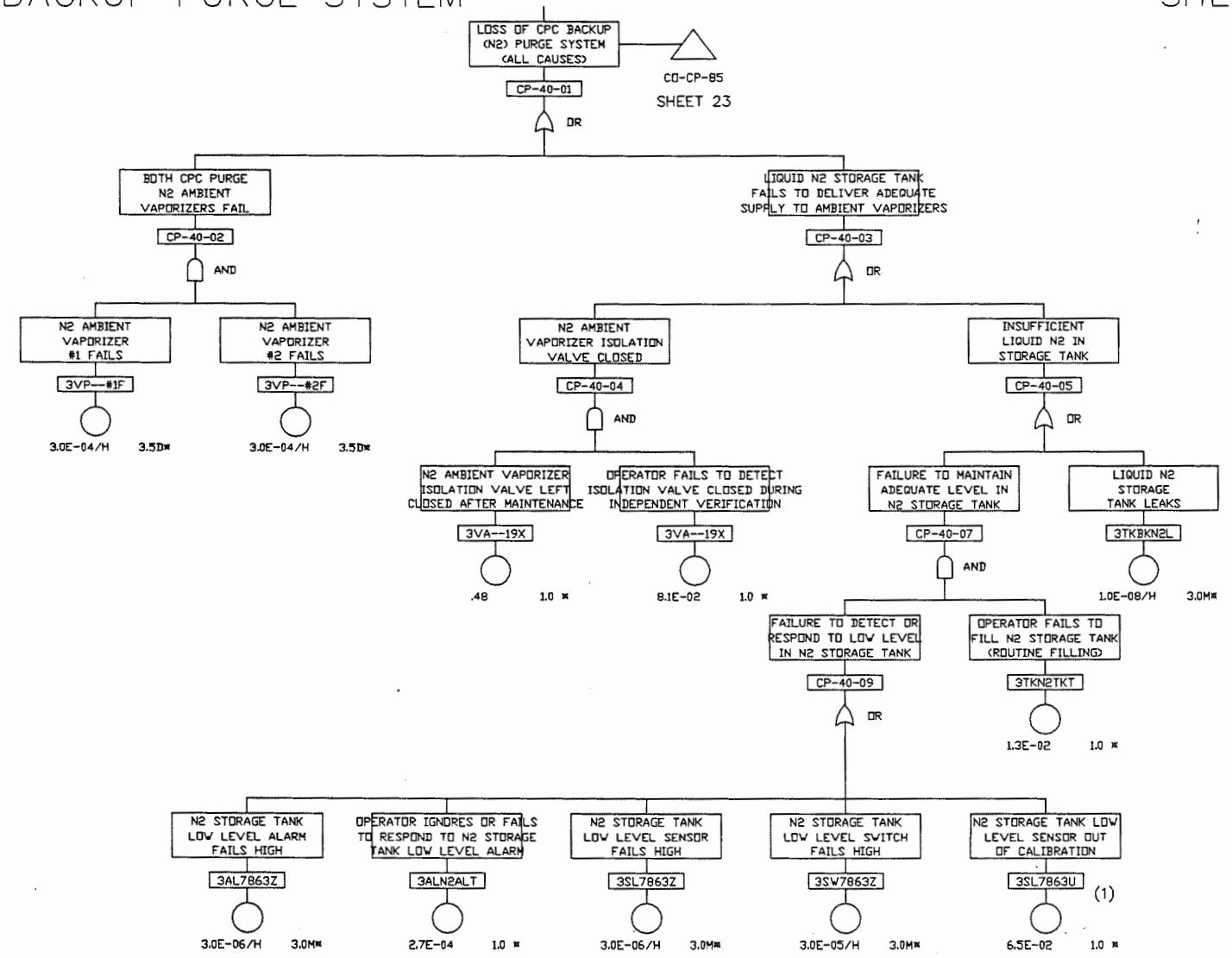
* DENOTES ENABLING EVENT

02-15-94 16:39
F:\CPC94\FTREE\ACAD\CPC39

LOSS OF N2 BACKUP PURGE SYSTEM

SHEET 40

ALL CAUSES



A-43

(1) CHAP 9 SAR, 9.A.2-46

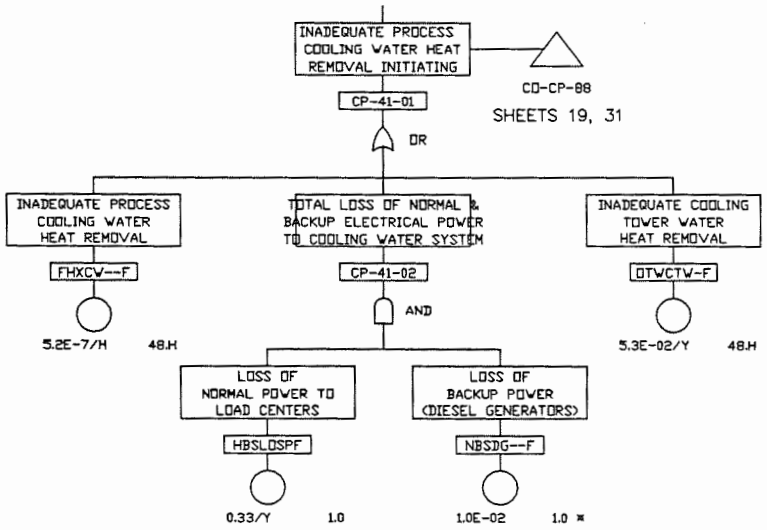
* DENOTES ENABLING EVENT

06-17-94 10:19
F:\CPC94\FTREE\ACAD\CPC40

INADEQUATE PROCESS COOLING WATER HEAT REMOVAL

INITIATING EVENT LOGIC

SHEET 41



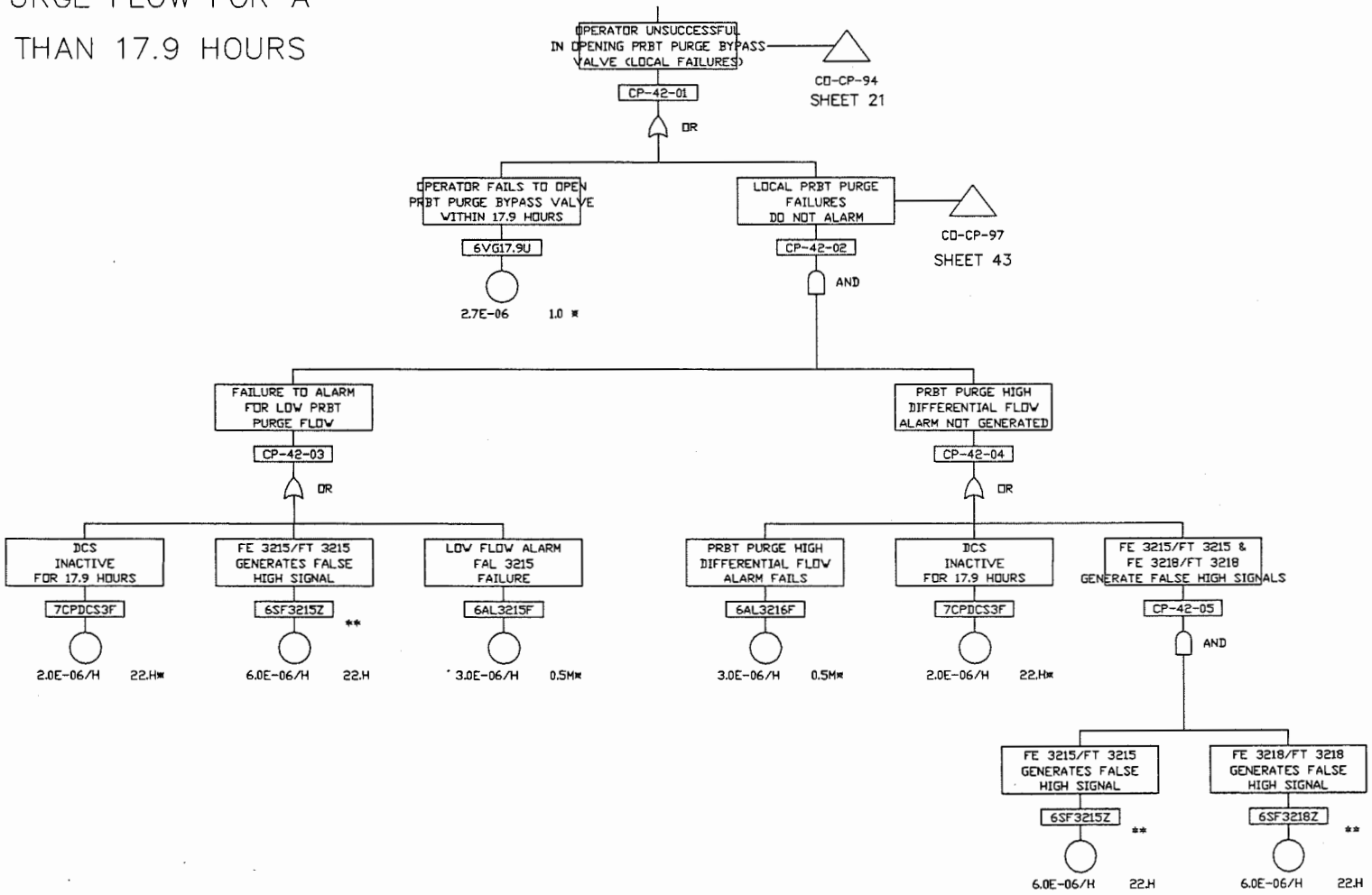
* DENOTES ENABLING EVENT

06-10-94 11:21
F:\CPC94\FTREE\ACAD\CPC41

PRBT BENZENE/HYDROGEN DEFLAGRATION

SHEET 42

INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 17.9 HOURS



A-45

* DENOTES ENABLING EVENT

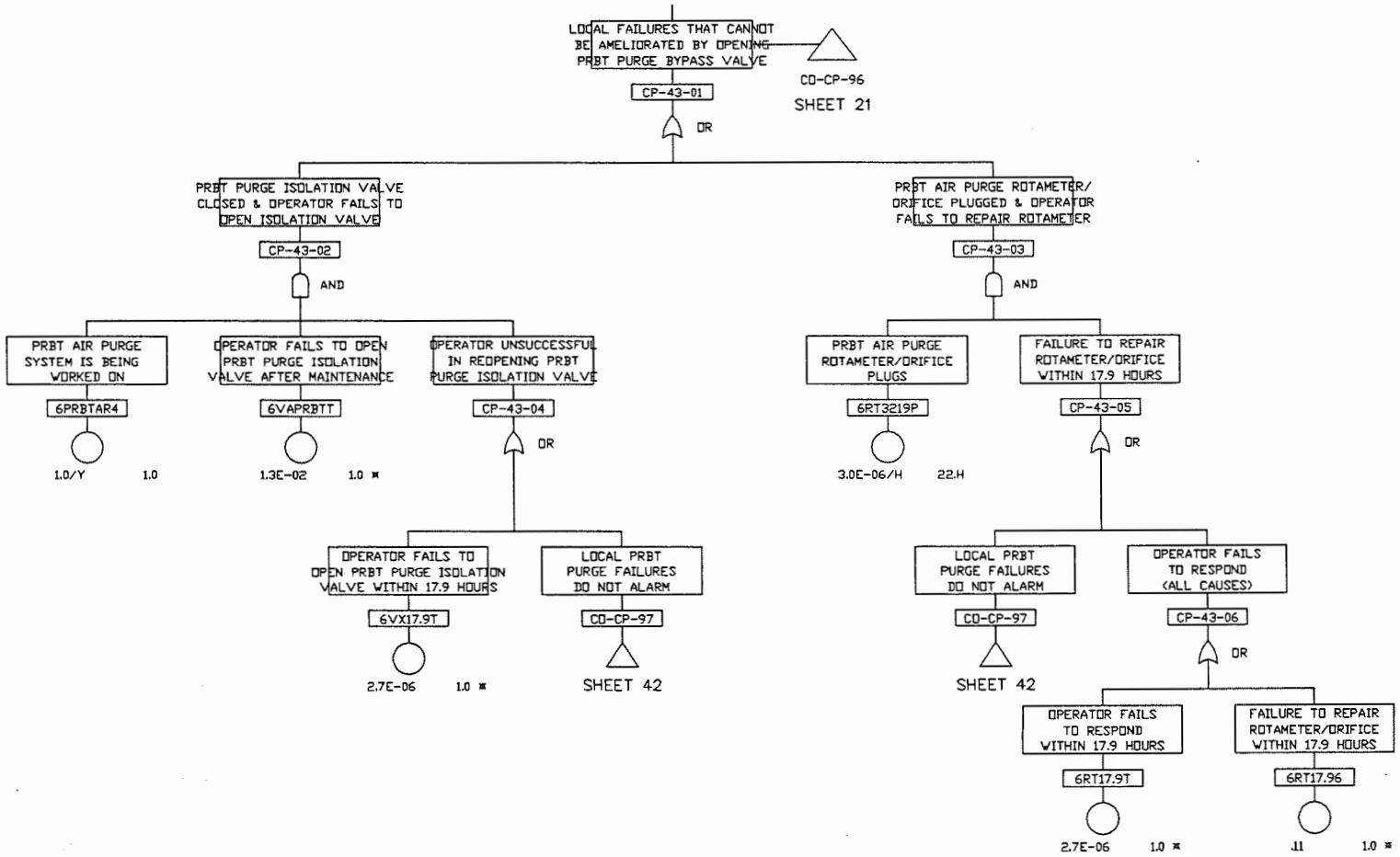
** DENOTES COMMON CAUSE INITIATING EVENT (SHEET 29)

05-27-94 14:13
F:\CPC94\FTREE\ACAD\CPC42

PRBT BENZENE\HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 17.9 HOURS

SHEET 43



A-46

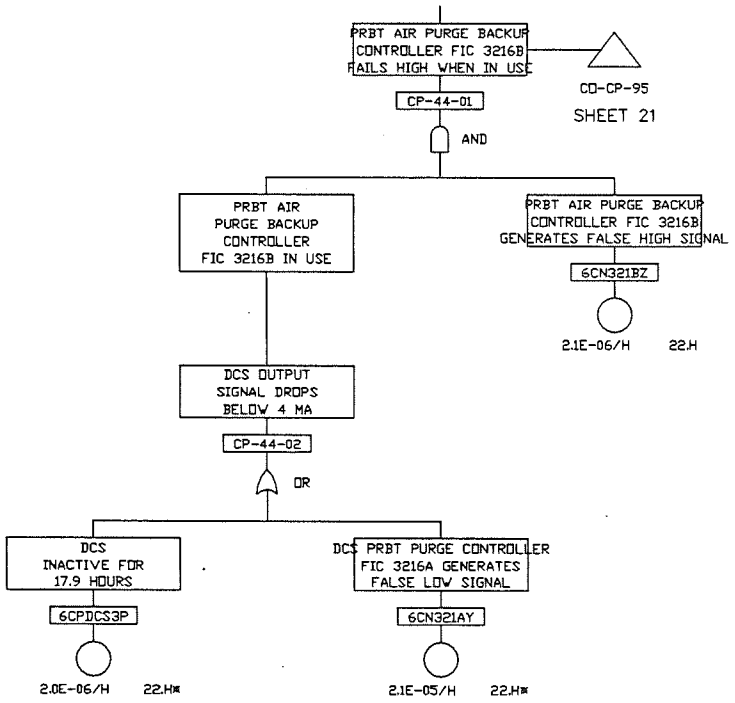
* DENOTES ENABLING EVENT

06-10-94 11:22
F:\CPC94\FTREE\ACAD\CPC43

PRBT BENZENE/HYDROGEN DEFLAGRATION

INSUFFICIENT PURGE FLOW FOR A TIME GREATER THAN 17.9 HOURS

SHEET 44



A-47

* DENOTES ENABLING EVENT

05-27-94 14:21
F:\CPC94\FTREE\ACAD\CPC44

APPENDIX B

IMPORTANCE OUTPUT

FOR

CHEMICAL PROCESS CELL

AMMONIUM NITRATE EXPLOSION

** TIME AND DATE OF RUN -- 13:18:28 JUN 10, 1994
INPUT FILE NAME : BIG .II

****

CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC

****

INPUT DATA OPTION 1
FAILURE RATE AND MEAN FAULT DURATION GIVEN IN TERMS OF REAL TIME

STEADY STATE CALCULATIONS

EXPECTED NUMBER OFFAILURES CALCULATED FOR TIME = , 1.00Y 30.00Y

****

** BASIC EVENT OPTIONS USED **

BIRNBAUM	CRITICA-LITY	UPGRADING FUNCTION	FUSSELL-VESELY	INITIATOR (BARLOW-PROSCHAN)	ENABLER (CONTRIB-UTORY)	STRUCTURAL
NO	NO	NO	NO	YES	YES	NO

****

** MIN CUT SET OPTIONS USED **

INITIATOR (BARLOW-PROSCHAN)	FUSSELL-VESELY
YES	NO

****

INFORMATION ON DETAILED CUT SET OUTPUT -- NM =100 AND FACTOR =1.000E-03

** BASIC EVENT DATA **

FAILURE RATE	MEAN FAULT DURATION		NAME	ENABLER	DESCRIPTION
	0.00E+00	CONSTP	#401----	*	## SME H2 DEFLAG (ASSUME SAME FREQ AS SRAT)
1.000E+00/HOUR	1.00E+00	HOURS	#5H2FORM	*	## SRAT H2 DEFLAGRATION FORMIC ACID
1.000E+00/HOUR	1.00E+00	HOURS	#5H2NOBL	*	## SRAT H2 DEFLAGRATION HIGH NOBLE METAL CONC
1.000E+00/HOUR	1.00E+00	HOURS	#5H2PURG	*	## SRAT H2 DEFLAGRATION NO PURGE GAS FLOW
1.000E+00/HOUR	1.00E+00	HOURS	#5H2TOP-	*	## SRAT HYDROGEN DEFLAGRATION
1.000E+00/HOUR	1.00E+00	HOURS	#6BENZEN	*	## INTERNAL PRBT BENZENE FIRE
1.000E+00/HOUR	1.00E+00	HOURS	#6H2NOCO	*	## PRBT BENZENE/H2 DEFLAG NO COOL H2O HEAT REMOV
1.000E+00/HOUR	1.00E+00	HOURS	#6H2PURG	*	## PRBT BENZENE/H2 DEFLAGRATION NO PURGE
1.000E+00/HOUR	1.00E+00	HOURS	#6H2TOP-	*	## PRBT HYDROGEN DEFLAGRATION
1.000E+00/HOUR	1.00E+00	HOURS	#7H2NOCO	*	## MFT H2 DEFLAGRATION NO COOL WATER
1.000E+00/HOUR	1.00E+00	HOURS	#7H2PURG	*	## MFT H2 DEFLAGRATION NO PURGE GAS FLOW
1.000E+00/HOUR	1.00E+00	HOURS	#7MFTTOP	*	## MFT HYDROGEN DEFLAGRATION
1.000E+00/HOUR	1.00E+00	HOURS	#WSUMPFR	*	## CPC SUMP FIRE
1.100E-01/HOUR	1.00E+00	HOURS	2--17.95	*	CPC PURGE SUPPLY NOT RESTORED WITHIN 17.9 HOURS
7.200E-01/HOUR	1.00E+00	HOURS	2-.72HR5	*	CPC PURGE SUPPLY NOT RESTORED WITHIN 12 HOURS
5.000E-05/HOUR	4.80E+01	HOURS	2PCD---Y		OPERATING PURGE AIR COMPRESSOR FAILS TO RUN
5.000E-03/HOUR	1.00E+00	HOURS	2PCS---A	*	STANDBY PURGE AIR COMPRESSOR FAILS TO START
5.000E-05/HOUR	4.80E+01	HOURS	2PCS---V	*	STANDBY PURGE AIR COMPRESSOR FAILS TO RUN
2.700E-04/HOUR	1.00E+00	HOURS	2PCSALRT	*	OP FAILS TO RESP TO OP PRGE AIR COMPRESSR TRBL A
2.300E-04/HOUR	1.00E+00	HOURS	2PCST&M4	*	STANDBY PRGE AIR COMPRESSR OUT OF SERVICE/TEST O
2.300E-04/HOUR	1.00E+00	HOURS	2PDST&M4	*	STANDBY PRGE AIR COMPRESSR OUT OF SERVICE/TEST O
1.600E-05/HOUR	4.80E+01	HOURS	2VI0963C		85 PSI PCV FAILS CLOSED
1.600E-05/HOUR	4.80E+01	HOURS	2VI0964C		80 PSI PCV FAILS CLOSED
3.000E-06/HOUR	3.00E+00	MONTHS	3AL7863Z	*	N2 STORAGE TANK LOW LEVEL ALARM FAILS HIGH

2.700E-04/HOUR	1.00E+00 HOURS	3ALN2ALT	*	OP IGNORES/FAILS RESP TO N2 STORAGE TNK LO LVL A
6.500E-02/HOUR	1.00E+00 HOURS	3SL7863U	*	N2 STORAGE TNK LO LEVEL SENSOR OUT CALIBRATION
3.000E-06/HOUR	3.00E+00 MONTHS	3SL7863Z	*	N2 STORAGE TANK LO LEVEL SENSOR FAILS HI
3.000E-05/HOUR	3.00E+00 MONTHS	3SW7863Z	*	N2 STORAGE TANK LO LEVEL FAILS HI
1.000E-08/HOUR	3.00E+00 MONTHS	3TKBKN2L	*	LIQUID N2 STORAGE TANK LEAKS
1.000E-08/HOUR	3.00E+00 MONTHS	3TKDKN2L	*	LIQUID N2 STORAGE TANK LEAKS
1.300E-02/HOUR	1.00E+00 HOURS	3TKN2TKT	*	OP FAILS TO FILL N2 STORAGE TNK(ROUTINE FILL)
8.100E-02/HOUR	1.00E+00 HOURS	3VA--19U	*	OP NO DETECT ISO VLV CLOSED DURING INDPNDNT VERI
4.800E-01/HOUR	1.00E+00 HOURS	3VA--19X	*	N2 AMBIENT VPRIZR ISO VLV LEFT CLOSED AFTER MAIN
3.000E-04/HOUR	3.50E+00 DAYS	3VP--#1F	*	N2 AMBIENT VAPORIZER #1 FAILS
3.000E-04/HOUR	3.50E+00 DAYS	3VP--#2F	*	N2 AMBIENT VAPORIZER #2 FAILS
1.000E+00/HOUR	1.00E+00 HOURS	5AG----4	*	SRAT AGITATOR IS ON 96HR/96HR (TRUE)
1.400E-04/YEAR	4.80E+01 HOURS	5AG----I		SRAT AGITATOR ACTS AS AN IGNITION SOURCE
	1.00E+00 CONSTP	5AIGC#1F	*	SRAT GC#1 CONDENSATION/PEAK DRIFT
	1.00E+00 CONSTP	5AIGC#2F	*	SRAT GC#2 CONDENSATION/PEAK DRIFT
2.100E-05/HOUR	4.80E+01 HOURS	5CN3034Y		DCS SRAT PRGE FIC 3034A GENS FALSE LO SIGNAL
2.100E-06/HOUR	4.80E+01 HOURS	5CN3034Z		DCS SRAT PURGE FLOW CTRLR FIC 3034 GEN FALSE HI
2.100E-06/HOUR	4.80E+01 HOURS	5CN334BZ		SRAT AIR PRGE BACKUP FIC 3034B GENS FALSE HI SIG
3.000E-05/HOUR	4.80E+01 HOURS	5CP8795F	*	SRAT % LFL CALC GENS FALSE LO SIGNAL
1.000E-01/HOUR	1.00E+00 HOURS	5EXNOBL4	*	CONC OF NOBLE METALS>DESIGN BASIS(1/10 WASTE TNK
1.000E-06/HOUR	4.80E+01 HOURS	5FR-028P		SRAT PURGE FILTER PLUGGED
2.000E-06/HOUR	4.80E+01 HOURS	5FR1OF2P	*	SRAT OFFGAS FILTERS PLUG (ANY 1 OF 2)
1.000E-02/HOUR	1.00E+00 HOURS	5GC8795U	*	SRAT GC#1 OUT OF CALIBRATION
3.000E-05/HOUR	4.80E+01 HOURS	5GC8795Y	*	SRAT GC#1 COMPUTER ELEMENT FAILS LOW (LEL)
3.000E-05/HOUR	4.80E+01 HOURS	5GC8795Z	*	SRAT GC #1 ELEMENT FAILS HI
1.000E-02/HOUR	1.00E+00 HOURS	5GC8796U	*	SRAT GC#2 OUT OF CALIBRATION
3.000E-05/HOUR	4.80E+01 HOURS	5GC8796Y	*	SRAT GC#2 ELEMENT FAILS LOW
3.000E-05/HOUR	4.80E+01 HOURS	5GC8796Z	*	SRAT GC#2 ELEMENT FAILS HIGH
6.400E-06/HOUR	4.80E+01 HOURS	5IP3034Z		SRAT AIR PURGE I/P XDUCER GEN FALSE HI SIGNAL
1.000E-03/HOUR	1.00E+00 HOURS	5IT---1U	*	SRAT OFFGAS HIGH % LFL INTERLOCKS BYPASSED
1.000E-03/HOUR	1.00E+00 HOURS	5IT---5U	*	SRAT AIR PURGE INTERLOCKS BYPASSED
1.000E-03/HOUR	1.00E+00 HOURS	5IT--10U	*	SRAT OFFGAS LO N2 FLOW INTERLOCKS BYPASSED
5.000E-01/YEAR	1.00E+00 HOURS	5NEWBAT4		NEW WASTE TNK OF SLDG FOR DWPF(EVERY 2YRS)
6.900E-05/HOUR	1.00E+00 HOURS	5NOBLECT	*	ERR IN ANALYSIS OF SLDG SMPL FOR NOBLE METALS
1.300E-02/HOUR	1.00E+00 HOURS	5NOTREPT	*	SLUDGE SAMPLE NOT REPRESENT OF WASTE TANK
4.000E-07/HOUR	3.00E+00 MONTHS	5PI8795L	*	AIR INLEAKAGE IN SRAT GC#1 SAMPLE LINE
4.000E-07/HOUR	3.00E+00 MONTHS	5PI8796L	*	AIR INLEAKAGE IN SRAT GC#2 SAMPLE LINE
2.400E-02/HOUR	1.00E+00 HOURS	5PP-0134	*	PRBT XFER PP RUNS 23HR/96HR
6.000E-02/HOUR	1.00E+00 HOURS	5PPSAMP4	*	SRAT SAMPLE PUMP IS ON 6HR/96HR
1.400E-03/YEAR	4.80E+01 HOURS	5PPSAMPI		SRAT SAMPLE PP ACTS AS AN IGNITION SOURCE
1.300E-02/HOUR	1.00E+00 HOURS	5PPSAMPT	*	OP FAILS TURN OFF SRAT SMPL PP PRIOR PHA ADD'N
5.700E-05/HOUR	4.80E+01 HOURS	5PPSRATV	*	SRAT OFFGAS SAMPLE PUMP FAILS TO RUN
1.000E-02/HOUR	1.00E+00 HOURS	5PPXFER4	*	SRAT XFER PP IS ON 1HR/96HR
1.400E-03/YEAR	4.80E+01 HOURS	5PPXFERI		SRAT XFER PP ACTS AS AN IGNITION SOURCE
1.300E-03/HOUR	1.00E+00 HOURS	5PPXFERU	*	OP ERRS TURNS ON SRAT XFER PP DUR PHA ADD'N
3.000E-06/HOUR	4.80E+01 HOURS	5RT0715P		SRAT PURGE ROTAMETER PLUGGED
1.000E-03/HOUR	1.00E+00 HOURS	5RY875BD	*	SRAT GC#1 COMPUTER RELAY 8795B FAILS TO OPEN
1.000E-03/HOUR	1.00E+00 HOURS	5RY8795D	*	SRAT GC#1 COMPUTER RELAY FAILS TO OPEN
1.000E-03/HOUR	1.00E+00 HOURS	5RY8796D	*	SRAT GC#2 COMPUTER RELAY FAILS TO OPEN
1.000E-03/HOUR	1.00E+00 HOURS	5RYCR2-D	*	RELAY CR2 CONTACTS FAIL TO OPEN
3.000E-05/HOUR	4.80E+01 HOURS	5SF0715P		SRAT PURGE ORIFICE PLUGGED
6.000E-06/HOUR	4.80E+01 HOURS	5SF3034Z		SRAT PURGE FLOW SENSOR/XMITTER FAILS HIGH
1.000E+00/YEAR	1.00E+00 HOURS	5SRATAP4		SRAT AIR PURGE SYSTEM IS BEING WORKED ON
3.000E-05/HOUR	4.80E+01 HOURS	5SW1LLHD	*	SRAT GC#1 LO LO N2 CONC SWITCH FAILS TO GENERATE
3.000E-05/HOUR	4.80E+01 HOURS	5SW1LOSD	*	SRAT GC#1 LO N2 CONC SWITCH FAILS TO GENERATE SI
3.000E-05/HOUR	4.80E+01 HOURS	5SW2LOSD	*	SRAT GC#2 LO N2 CONC SW FAILS TO GEN SIGNAL
3.000E-05/HOUR	4.80E+01 HOURS	5SW2LLHD	*	SRAT GC#2 LO LO N2 CONC SW FAILS TO GEN SIGNAL
3.000E-05/HOUR	1.00E+00 HOURS	5SW3034K	*	SRAT AIR PURGE LO FLOW SW FAILS TO GEN SIGNAL
3.000E-05/HOUR	1.00E+00 HOURS	5SW334LK	*	SRAT AIR PURGE LO LO FLOW SW FAILS GEN SIGNAL
3.000E-05/HOUR	1.00E+00 HOURS	5SW4041D	*	PRBT TRANSFER PUMP CONTACT FAILS TO OPEN
3.000E-05/HOUR	4.80E+01 HOURS	5SW8795F	*	SRAT HI % LFL SW FAILS TO GEN SIGNAL
3.000E-05/HOUR	1.00E+00 HOURS	5SW8799K	*	SRAT OFFGAS SAMPLE PP ROTAMTR FISL 8799 FAILS HI
3.000E-05/HOUR	4.80E+01 HOURS	5SW879HF	*	SRAT HI HI % LFL SW FAILS TO GEN SIGNAL
3.000E-05/HOUR	1.00E+00 HOURS	5SW8801K	*	SRAT GC#1 ROTAMETER FISL 8801 FAILS HIGH
3.000E-05/HOUR	1.00E+00 HOURS	5SW8802K	*	SRAT GC#2 ROTAMTR FISL 8802 FAILS HI
2.800E-01/HOUR	1.00E+00 HOURS	5TKBOIL4	*	% OF TIME BOILING IN SRAT 27HR/96HR
1.000E+00/HOUR	1.00E+00 HOURS	5TKH2--4	*	% OF TIME GEN H2 IN SRAT (96HR/96HR)
2.400E-01/HOUR	1.00E+00 HOURS	5TKH2244	*	% TIME GEN EXCESS H2 IN SRAT (23HR/96HR)
1.000E+00/HOUR	1.00E+00 HOURS	5TKO2--4	*	OXYGEN CONC IN SRAT ABOVE MOC (TRUE)
1.000E-09/HOUR	1.00E+00 HOURS	5TKSRATI	*	SRAT STATIC CHARGE
3.800E-02/HOUR	1.00E+00 HOURS	5VASRATU	*	OP FAILS OPEN SRAT PURGE ISO VLV AFTER MAINT.
3.800E-02/HOUR	1.00E+00 HOURS	5VASRATX	*	SRAT OFFGAS SAMPLE SUPPLY VLV LEFT DIVERT AFTER
1.000E-03/HOUR	1.00E+00 HOURS	5VL3000K	*	SRAT STEAM SUPPLY VALVE FAILS TO CLOSE
2.200E-06/HOUR	4.80E+01 HOURS	5VL3034C		SRAT PURGE SUPPLY VALVE FAILS CLOSED
1.000E-03/HOUR	1.00E+00 HOURS	5VS3000K	*	SV FOR SRAT STEAM SUPPLY VALVE FAILS TO DE-ENERG
3.000E-06/HOUR	4.80E+01 HOURS	5XM8795Y	*	SRAT GC#2 COMPUTER INDICATION XMITTER FAILS LOW
3.000E-06/HOUR	4.80E+01 HOURS	5XM8795Z	*	SRAT GC#1 COMPUTER XMITTER FAILS HIGH

3.000E-06/HOUR	4.80E+01 HOURS	5XM8796Y	*	SRAT GC#2 COMPUTER XMITTER FAILS LOW
3.000E-06/HOUR	4.80E+01 HOURS	5XM8796Z	*	SRAT GC#2 COMPUTER XMITTER FAILS HIGH
1.000E-05/HOUR	1.00E+00 HOURS	6AG----U		OP ERRONEOUSLY STOPS PRBT AGITATOR
1.000E+00/HOUR	1.00E+00 HOURS	6AGPRBT4	*	PRBT AGITATOR IS ON (TRUE)
1.400E-04/YEAR	2.20E+01 HOURS	6AGPRBTI		PRBT AGITATOR ACTS AS AN IGNITION SOURCE
5.700E-05/HOUR	4.60E+01 HOURS	6AGPRBTV		PRBT AGITATOR FAILS TO RUN
3.000E-06/HOUR	5.00E-01 MONTHS	6AL3215F	*	LOW FLOW ALARM FAL 3215 FAILURE
3.000E-06/HOUR	5.00E-01 MONTHS	6AL3216F	*	PRBT PURGE FLOW DEV ALARM NOT GENERATED
2.700E-04/HOUR	1.00E+00 HOURS	6ALPRCDT	*	OPERATOR IGNORES PRCD LOW LEVEL ALARM
6.900E-05/HOUR	1.00E+00 HOURS	6ANALYST	*	ERROR IN SAMPLE/ANALYSIS OF PRBT FORMATE CONTENT
2.100E-05/HOUR	2.20E+01 HOURS	6CN321AY	*	DCS PRBT PRGE FIC 3216A GENS FALSE LO SIGNAL
2.100E-06/HOUR	2.20E+01 HOURS	6CN321AZ		DSC PRBT PURGE CONTROLLER FIC 3216A FAILS HIGH
2.100E-06/HOUR	2.20E+01 HOURS	6CN321BZ		PRBT AIR PRGE BACKUP FIC 3216B GENS FALSE HI SIG
2.000E-06/HOUR	2.20E+01 HOURS	6CPDCS3P	*	DCS INACTIVE FOR 17.9 HOURS
1.000E-06/HOUR	2.20E+01 HOURS	6FR-060P		PRBT PURGE FILTER PLUGGED
1.300E-06/HOUR	4.80E+01 HOURS	6HC1/14L		JUMPER NOT INSTALLED BETWEEN PR AND PRBT
1.500E-05/HOUR	2.20E+01 HOURS	6HXCOOLF		PRBT COOLING WATER COILS FOULED
6.400E-06/HOUR	2.20E+01 HOURS	6IP3216Z		PRBT PURGE I/P TRANSDUCER GENERATES FALSE HIGH S
1.000E-03/HOUR	1.00E+00 HOURS	6IT--15U	*	PRBT HI HI TEMP INTERLOCK BYPASSED
6.000E-02/HOUR	1.00E+00 HOURS	6PPSAMP4	*	PRBT SAMPLE PUMP IS ON 6HR/96HR
1.400E-03/YEAR	2.20E+01 HOURS	6PPSAMPI		PRBT SAMPLE PUMP ACTS AS AN IGNITION SOURCE
2.400E-01/HOUR	1.00E+00 HOURS	6PPXFER4	*	PRBT TRANSFER PUMP IS ON 23HR/96HR
1.400E-03/YEAR	2.20E+01 HOURS	6PPXFERI		PRBT TRANSFER PUMP ACTS AS AN IGNITION SOURCE
1.000E+00/YEAR	1.00E+00 HOURS	6PRBTAR4		PRBT AIR PURGE SYSTEM IS BEING WORKED ON
1.100E-01/HOUR	1.00E+00 HOURS	6RT17.96	*	FAIL TO REPAIR ROTAMTR/ORIFICE IN 17.9 HRS
2.700E-06/HOUR	1.00E+00 HOURS	6RT17.9T	*	OP FAILS TO RESPOND IN 17.9 HRS
3.000E-06/HOUR	2.20E+01 HOURS	6RT3219P		PRBT AIR PURGE RTM/ORF PLUGS
1.300E-02/HOUR	1.00E+00 HOURS	6SAMPLET	*	FAILURE TO SAMPLE PRBT FOR FORMATE CONTENT
6.000E-06/HOUR	2.20E+01 HOURS	6SF3215Z		FE 3215/FT 3215 GENERATES FALSE HI SIGNAL
6.000E-06/HOUR	2.20E+01 HOURS	6SF3218Z		FE 3218/FT 3218 GENERATES FALSE HI SIGNAL
3.300E-05/HOUR	4.80E+01 HOURS	6ST3211F		PRBT TEMP SENSOR 3211A INACTIVE/FAILS LOW
3.300E-06/HOUR	4.80E+01 HOURS	6ST3211Z		PRBT TEMP SENSOR 3211A GENERATES FALSE HI SIGNAL
1.000E+00/HOUR	1.00E+00 HOURS	6ST70C-T	*	OP FAILS TO NOTE LACK OF BENZENE COLLCTD IN OE
3.300E-05/HOUR	4.80E+01 HOURS	6STRUNDF	*	REDUNDANT TEMP SENSOR INACTIVE/FAILS LOW
3.300E-06/HOUR	4.80E+01 HOURS	6STRUNDZ		REDUND TEMP SENSOR GENS FALSE HI SIGNAL
3.000E-05/HOUR	4.80E+01 HOURS	6SW3211F		HI TEMP SW 3211 INACTIVE
3.000E-05/HOUR	5.00E-01 MONTHS	6SW321AF	*	HI HI TEMP SW 3211 INACTV/FAILS GEN SIGNAL
3.000E-05/HOUR	1.00E+00 HOURS	6SWPRBTD	*	PRBT AGITATOR CONTACTS FAIL TO OPEN
3.000E-05/HOUR	4.80E+01 HOURS	6SWPRBTO		PRBT AGITATOR CONTACTS OPEN SPURIOUSLY
1.000E+00/HOUR	1.00E+00 HOURS	6TKH2--4	*	% TIME GEN BENZENE/H2 IN PRBT (96HR/96HR)
1.000E+00/HOUR	1.00E+00 HOURS	6TKO2--4	*	OXYGEN CONC IN PRBT ABOVE MOC (TRUE)
1.000E-09/HOUR	1.00E+00 HOURS	6TKPRBTI	*	PRBT STATIC CHARGE
1.000E-05/HOUR	1.00E+00 HOURS	6VA3212U		OPERATOR INADVERTENTLY CLOSES HCV 3212
1.300E-02/HOUR	1.00E+00 HOURS	6VAPRBTT	*	OP FAILS OPEN PRBT PRGE ISO VLV AFTER MAINT.
2.000E+00/YEAR	2.20E+01 HOURS	6VD11314		PRCD DRAIN VALVE ADJUSTED
1.200E-07/HOUR	2.20E+01 HOURS	6VD1131L		LARGE LEAK IN PRCD DRAIN VALVE
1.300E-02/HOUR	1.00E+00 HOURS	6VD1131U	*	OP ERRS LEAVES PRCD DRAIN VLV OPEN AFTER ADJUSTM
2.700E-06/HOUR	1.00E+00 HOURS	6VG17.9U	*	OP FAILS OPEN PRBT PRGE BYPASS VLV IN 17.9 HRS
1.000E-05/HOUR	2.20E+01 HOURS	6VL3212C		PRBT COOL WATER VALVE HCV 3212 FAILS CLOSED
2.200E-06/HOUR	2.20E+01 HOURS	6VL3216C		PRBT PURGE SUPPLY VALVE FAILS CLOSED
2.700E-06/HOUR	1.00E+00 HOURS	6VX17.9T	*	OP FAILS OPEN PRBT PURGE ISO VLV IN 17.9 HRS
1.000E+00/HOUR	1.00E+00 HOURS	7AG----4	*	MFT AGITATOR IS ON (TRUE)
1.400E-04/YEAR	4.80E+01 HOURS	7AG----I		MFT AGITATOR ACTS AS AN IGNITION SOURCE
1.000E+00/HOUR	1.00E+00 HOURS	7AGMFT-4	*	MFT AGITATOR ON (TRUE)
3.000E-06/HOUR	5.00E-01 MONTHS	7AL06B3F	*	MFT PURGE FLOW DEV ALARM NOT GENERATED
3.000E-06/HOUR	5.00E-01 MONTHS	7AL0684F	*	LOW FLOW ALARM FAL 0684 FAILURE
2.100E-05/HOUR	4.80E+01 HOURS	7CN683AY	*	DCS MFT PRGE FIC 0683A GENS FALSE LO SIGNAL
2.100E-06/HOUR	4.80E+01 HOURS	7CN6B3AZ		DCS MFT PURGE FLOW CTRLR FIC 06B3A FAILS HI
2.100E-06/HOUR	4.80E+01 HOURS	7CN683BZ		MFT AIR PRGE BACKUP FIC 0683B GENS FALSE HI SIGN
2.000E-05/HOUR	4.80E+01 HOURS	7CPDCS-F	*	DCS INACTIVE
2.000E-05/HOUR	4.80E+01 HOURS	7CPDCS-Y		DCS INACTIVE/INITIATING
2.000E-05/HOUR	4.80E+01 HOURS	7CPDCS2F	*	DCS INACTIVE FOR 2.6 HOURS
2.000E-06/HOUR	2.20E+01 HOURS	7CPDCS3F	*	DCS INACTIVE FOR 17.9 HOURS
1.000E-06/HOUR	4.80E+01 HOURS	7FR-060P		MFT PURGE FILTER PLUGGED
1.500E-05/HOUR	4.80E+01 HOURS	7HXCOOLF		MFT COOLING WATER COILS FOULED
6.400E-06/HOUR	4.80E+01 HOURS	7IP0683Z		MFT PURGE I/P XDUCER GENERATES FALSE HIGH SIGNAL
1.000E-03/HOUR	1.00E+00 HOURS	7IT--15U	*	MFT HI HI TEMP INTERLOCK BYPASSED
1.000E+00/YEAR	1.00E+00 HOURS	7MFTAIR4		MFT AIR PURGE SYSTEM IS BEING WORKED ON
9.500E-01/HOUR	1.00E+00 HOURS	7PPFD014	*	MFT FEED PUMP 1 IS ON 95%
1.400E-03/YEAR	4.80E+01 HOURS	7PPFD01I		MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
9.500E-01/HOUR	1.00E+00 HOURS	7PPFD024	*	MFT FEED PUMP 2 IS ON 95%
1.400E-03/YEAR	4.80E+01 HOURS	7PPFD02I		MFT FEED PUMP 2 ACTS AS AN IGNITION SOURCE
1.400E-03/YEAR	4.80E+01 HOURS	7PPFD01I		MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
3.000E-02/HOUR	1.00E+00 HOURS	7PPSAMP4	*	MFT SAMPLE PUMP IS ON 3HR/96HR
1.400E-03/YEAR	4.80E+01 HOURS	7PPSAMPI		MFT SAMPLE PUMP ACTS AS AN IGNITION SOURCE
3.000E-06/HOUR	4.80E+01 HOURS	7RT0686P		MFT AIR PURGE ROTAMETER/ORIFICE PLUGS
7.200E-01/HOUR	1.00E+00 HOURS	7RT2.6H6	*	FAIL TO REPAIR MFT PURGE ROTAMETER/ORIFICE IN 2.

2.700E-05/HOUR	1.00E+00 HOURS	7RT2.6HT	*	OP FAILS RESPOND TO MFT PURGE ALARM IN 2.6HR
1.000E-03/HOUR	1.00E+00 HOURS	7RYCR10D	*	HARDWIRED RELAY CR10 INACTIVE
1.000E-03/HOUR	1.00E+00 HOURS	7RYCR7-D	*	HARDWIRED RELAY CR7 INACTIVE
1.000E-03/HOUR	1.00E+00 HOURS	7RYCR8-D	*	HARDWIRED RELAY CR8 INACTIVE
6.000E-06/HOUR	4.80E+01 HOURS	7SF0682Z		FE 0682/FT 0682 GENERATE FALSE HIGH SIGNALS
6.000E-06/HOUR	4.80E+01 HOURS	7SF0684Z		FE 0684/FT 0684 GENERATES FALSE HI SIGNAL
3.300E-05/HOUR	4.80E+01 HOURS	7ST3248F		MFT TEMP SENSOR 3248A INACTIVE/GENERATES FALSE L
3.300E-05/HOUR	4.80E+01 HOURS	7STRUNDF	*	REDUNDANT TEMP SENSOR INACTIVE/GENERATES FALSE L
3.000E-05/HOUR	4.80E+01 HOURS	7SW3248F		HI TEMP SW INACTIVE
3.000E-05/HOUR	5.00E-01 MONTHS	7SW324AF	*	HI HI TEMP SW 3248B FAILS TO GEN SIG
3.000E-05/HOUR	1.00E+00 HOURS	7SWMFT-D	*	MFT AGITATOR CONTACTS FAIL TO OPEN
1.000E+00/HOUR	1.00E+00 HOURS	7TKDO2--	*	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
1.000E+00/HOUR	1.00E+00 HOURS	7TKH2--4	*	% OF TIME GEN H2 IN MFT (96HR/96HR)
1.000E-09/HOUR	1.00E+00 HOURS	7TKMTF-I	*	MFT STATIC CHARGE
1.000E+00/HOUR	1.00E+00 HOURS	7TKO2--4	*	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
3.800E-02/HOUR	1.00E+00 HOURS	7VAMFTPU	*	OP FAILS OPEN MFT PURGE ISO VLV AFTER MAINT.
2.700E-05/HOUR	1.00E+00 HOURS	7VG2.6HU	*	OP FAILS OPEN MFT PURGE BYPASS VLV IN 2.6 HRS
1.000E-05/HOUR	1.00E+00 HOURS	7VK3252U		OPERATOR INADVERTENTLY CLOSES HCV 3252
2.200E-06/HOUR	4.80E+01 HOURS	7VL0683C		MFT PURGE SUPPLY VALVE FAILS CLOSED
1.000E-05/HOUR	4.80E+01 HOURS	7VL3252C		MFT COOLING WATER VALVE HCV 3252 FAILS CLOSED
2.700E-05/HOUR	1.00E+00 HOURS	7VX2.6HT	*	OP FAILS OPEN MFT PURGE ISO VLV IN 2.6HR
6.900E-05/HOUR	1.00E+00 HOURS	9ANALYST	*	INCORRECT SAMPLE ANALYSIS OF PR FORMATE CONTENT
1.300E-02/HOUR	1.00E+00 HOURS	9SAMPLET	*	FAILURE TO SAMPLE PR FORMATE CONTENT
6.900E-05/HOUR	1.00E+00 HOURS	9TKPRBTT	*	PR SAMPLING FAILS TO DETECT PHA WITH HI BENZENE
5.300E-02/YEAR	4.80E+01 HOURS	DTWCTW*F	*	INADEQUATE COOLING TOWER WATER HEAT REMOVAL
5.200E-07/HOUR	4.80E+01 HOURS	FHXCW**F	*	INADEQUATE PROCESS COOLING WATER HEAT REMOVAL
5.200E-07/HOUR	4.80E+01 HOURS	FHXCW--F		INADEQUATE PROCESS COOLING WATER HEAT REMOVAL
3.000E-03/HOUR	1.00E+00 HOURS	FVL3010F	*	SRAT COOL H2O VLV HCV 3010 FAILS TO OPEN
1.000E-03/HOUR	1.00E+00 HOURS	FVS3010K	*	SV FOR SRAT COOL H2O VLV FAILS TO ENERGIZE
3.300E-01/YEAR	1.00E+00 HOURS	HBSLOSPF		LOSS OF NORMAL POWER TO LOAD CENTERS
3.300E-01/YEAR	1.00E+00 HOURS	HLOSP**F	*	LOSS NORM POWR TO LOAD CNTRS/ENABLING
3.300E-01/YEAR	8.50E+00 HOURS	HNORMPRF		LOSS OF NORMAL POWER TO LOAD CENTERS
6.000E-05/HOUR	2.20E+01 HOURS	ISF2048Y	*	FORMIC ACID FLOW ELEMENT/XMITTER FAILS LOW
3.000E-05/HOUR	2.20E+01 HOURS	ISW2050D	*	FORMIC ACID PP CONTACT FAILS TO OPEN
3.500E-02/HOUR	1.00E+00 HOURS	ITKFORM4		FORMIC ACID ADD'N TO PR (1.5/43 HRS)
2.000E-05/HOUR	2.20E+01 HOURS	ITL2048Y	*	FORMIC ACID TOTALIZER INDICATES FALSE LOW
1.300E-02/HOUR	1.00E+00 HOURS	IVA2056U	*	OP FAILS TO STOP FORMIC ACID PP
3.000E-03/HOUR	1.00E+00 HOURS	IVG2056O	*	FORMIC ACID ADDITION VALVE TO PR FAILS OPEN
5.000E-07/HOUR	2.20E+01 HOURS	IVS2056O	*	SV CONTROLLING FCV 2056 REMAINS ENERGIZED
1.000E-02/HOUR	1.00E+00 HOURS	NBSDG--F	*	LOSS OF BACKUP POWER (DIESEL GENERATORS)
1.000E-02/HOUR	1.00E+00 HOURS	NDG----F	*	LOSS OF BACKUP POWER (DIESEL GENERATORS)
5.300E-02/YEAR	4.80E+01 HOURS	OTWCTW-F		INADEQUATE COOLING TOWER WATER HEAT REMOVAL
1.000E+00/HOUR	1.00E+00 HOURS	VPPAN--4	*	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
1.000E+00/HOUR	1.00E+00 HOURS	VPPCONF4	*	CPC TANK VENT LINES CONFINE AN
1.000E+00/HOUR	1.00E+00 HOURS	VPPIMPR4	*	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE
1.000E+00/HOUR	1.00E+00 HOURS	WPPSUMP4	*	CPC SUMP PP ON TO XFER SUMP CONTENTS TO RCT/TRUE
1.400E-03/YEAR	1.00E+00 HOURS	WPPSUMPI		CPC PUMP PP ACTS AS AN IGNITION SOURCE
1.000E-09/HOUR	1.00E+00 HOURS	WSTATICI	*	CPC SUMP STATIC CHARGE

STEADY STATE SYSTEM CHARACTERISTICS

TOP EVENT RATE (PER HOUR) = 1.98289E-09 TOP EVENT RATE (PER YEAR) = 1.73702E-05

MEAN TIME TO SYSTEM FAILURE = 5.04313E+08 HOURS 5.75700E+04 YEARS

MEAN TIME TO SYSTEM REPAIR = 2.28941E+01 HOURS 9.53921E-01 DAYS

TOP EVENT PROBABILITY = 4.53966E-08

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

INITIATOR (BARLOW-PROSCHAN) MEASURE OF BASIC EVENTIMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

TOP EVENT PROBABILITY = 4.53966E-08

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

RANK	BASIC EVENT	IMPORTANCE	FAILURE RATE	MEAN FAULT DURATION	BASIC EVENT DESCRIPTION
1	7ST3248F I	2.588E-01	3.300E-05 HOURS	48.000 HOURS	MFT TEMP SENSOR 3248A INACTIVE/GENERATES FALSE L
2	7PPFD02I I	2.051E-01	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 2 ACTS AS AN IGNITION SOURCE
3	7PPFD01I I	1.971E-01	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
4	7CPDCS-Y I	1.711E-01	2.000E-05 HOURS	48.000 HOURS	DCS INACTIVE/INITIATING
5	6PPXFERI I	4.981E-02	1.400E-03 YEARS	22.000 HOURS	PRBT TRANSFER PUMP ACTS AS AN IGNITION SOURCE
6	6ST3211F I	2.339E-02	3.300E-05 HOURS	48.000 HOURS	PR8T TEMP SENSOR 3211A INACTIVE/FAILS LOW
7	7AG----I I	2.159E-02	1.400E-04 YEARS	48.000 HOURS	MFT AGITATOR ACTS AS AN IGNITION SOURCE
8	6AGPRBTI I	2.074E-02	1.400E-04 YEARS	22.000 HOURS	PRBT AGITATOR ACTS AS AN IGNITION SOURCE
9	7RT0686P I	1.699E-02	3.000E-06 HOURS	48.000 HOURS	MFT AIR PURGE ROTAMETER/ORIFICE PLUGS
10	6PPSAMPI I	1.245E-02	1.400E-03 YEARS	22.000 HOURS	PRBT SAMPLE PUMP ACTS AS AN IGNITION SOURCE
11	7PPFD01I I	8.065E-03	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
12	7PPSAMPI I	6.482E-03	1.400E-03 YEARS	48.000 HOURS	MFT SAMPLE PUMP ACTS AS AN IGNITION SOURCE
13	7SW3248F I	2.783E-03	3.000E-05 HOURS	48.000 HOURS	HI TEMP SW INACTIVE
14	7HXCOOLF I	1.393E-03	1.500E-05 HOURS	48.000 HOURS	MFT COOLING WATER COILS FOULED
15	7VK3252U I	9.291E-04	1.000E-05 HOURS	1.000 HOURS	OPERATOR INADVERTENTLY CLOSES HCV 3252
15	7VL3252C I	9.287E-04	1.000E-05 HOURS	48.000 HOURS	MFT COOLING WATER VALVE HCV 3252 FAILS CLOSED
16	OTWCTW-F I	6.128E-04	5.300E-02 YEARS	48.000 HOURS	INADEQUATE COOLING TOWER WATER HEAT REMOVAL
17	6SW3211F I	2.515E-04	3.000E-05 HOURS	48.000 HOURS	HI TEMP SW 3211 INACTIVE
18	6RT3219P I	2.343E-04	3.000E-06 HOURS	22.000 HOURS	PRBT AIR PURGE RTM/ORF PLUGS
19	HNORMPRF I	1.468E-04	3.300E-01 YEARS	8.500 HOURS	LOSS OF NORMAL POWER TO LOAD CENTERS
20	6HXCOOLF I	1.259E-04	1.500E-05 HOURS	22.000 HOURS	PRBT COOLING WATER COILS FOULED
21	5AG----I I	1.245E-04	1.400E-04 YEARS	48.000 HOURS	SRAT AGITATOR ACTS AS AN IGNITION SOURCE
22	5SF0715P I	9.637E-05	3.000E-05 HOURS	48.000 HOURS	SRAT PURGE ORIFICE PLUGGED
23	6VA3212U I	8.396E-05	1.000E-05 HOURS	1.000 HOURS	OPERATOR INADVERTENTLY CLOSES HCV 3212
23	6VL3212C I	8.395E-05	1.000E-05 HOURS	22.000 HOURS	PRBT COOL WATER VALVE HCV 3212 FAILS CLOSED
24	5PPSAMPI I	7.472E-05	1.400E-03 YEARS	48.000 HOURS	SRAT SAMPLE PP ACTS AS AN IGNITION SOURCE
25	5SF3034Z I	6.272E-05	6.000E-06 HOURS	48.000 HOURS	SRAT PURGE FLOW SENSOR/XMITTER FAILS HIGH
26	2VI0964C I	6.231E-05	1.600E-05 HOURS	48.000 HOURS	80 PSI PCV FAILS CLOSED
26	2VI0963C I	6.231E-05	1.600E-05 HOURS	48.000 HOURS	85 PSI PCV FAILS CLOSED
27	FHXCW--F I	5.268E-05	5.200E-07 HOURS	48.000 HOURS	INADEQUATE PROCESS COOLING WATER HEAT REMOVAL
28	7IP0683Z I	4.967E-05	6.400E-06 HOURS	48.000 HOURS	MFT PURGE I/P XDUCER GENERATES FALSE HIGH SIGNAL
29	HBSLOSPF I	3.816E-05	3.300E-01 YEARS	1.000 HOURS	LOSS OF NORMAL POWER TO LOAD CENTERS
30	7MFTAIR4 I	3.367E-05	1.000E+00 YEARS	1.000 HOURS	MFT AIR PURGE SYSTEM IS BEING WORKED ON
31	5IP3034Z I	2.058E-05	6.400E-06 HOURS	48.000 HOURS	SRAT AIR PURGE I/P XDUCER GEN FALSE HI SIGNAL
32	7VL0683C I	1.708E-05	2.200E-06 HOURS	48.000 HOURS	MFT PURGE SUPPLY VALVE FAILS CLOSED
33	7CN683AZ I	1.630E-05	2.100E-06 HOURS	48.000 HOURS	DCS MFT PURGE FLOW CTRLR FIC 0683A FAILS HI
34	5SRATAP4 I	1.394E-05	1.000E+00 YEARS	1.000 HOURS	SRAT AIR PURGE SYSTEM IS BEING WORKED ON
35	7SF0684Z I	1.360E-05	6.000E-06 HOURS	48.000 HOURS	FE 0684/FT 0684 GENERATES FALSE HI SIGNAL

I DENOTES INITIATING EVENT

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

INITIATOR (BARLOW-PROSCHAN) MEASURE OF BASIC EVENTIMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

TOP EVENT PROBABILITY = 4.53966E-08

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

RANK	BASIC EVENT	IMPORTANCE	FAILURE RATE	MEAN FAULT DURATION	BASIC EVENT DESCRIPTION
36	7SF0682Z I	1.356E-05	6.000E-06 HOURS	48.000 HOURS	FE 0682/FT 0682 GENERATE FALSE HIGH SIGNALS
37	5PPXFERI I	1.245E-05	1.400E-03 YEARS	48.000 HOURS	SRAT XFER PP ACTS AS AN IGNITION SOURCE
38	5RT0715P I	9.649E-06	3.000E-06 HOURS	48.000 HOURS	SRAT PURGE ROTAMETER PLUGGED
39	7FR-060P I	7.763E-06	1.000E-06 HOURS	48.000 HOURS	MFT PURGE FILTER PLUGGED
40	5VL3034C I	7.076E-06	2.200E-06 HOURS	48.000 HOURS	SRAT PURGE SUPPLY VALVE FAILS CLOSED
41	5CN3034Z I	6.755E-06	2.100E-06 HOURS	48.000 HOURS	DCS SRAT PURGE FLOW CTRLR FIC 3034 GEN FALSE HI
42	5FR-028P I	3.217E-06	1.000E-06 HOURS	48.000 HOURS	SRAT PURGE FILTER PLUGGED
43	2PCD---Y I	1.483E-06	5.000E-05 HOURS	48.000 HOURS	OPERATING PURGE AIR COMPRESSOR FAILS TO RUN
44	6SF3215Z I	5.631E-07	6.000E-06 HOURS	22.000 HOURS	FE 3215/FT 3215 GENERATES FALSE HI SIGNAL

45	6SF3218Z	I	5.620E-07	6.000E-06	HOURS	22.000 HOURS FE 3218/FT 3218 GENERATES FALSE HI SIGNAL
46	6IP3216Z	I	2.180E-07	6.400E-06	HOURS	22.000 HOURS PRBT PURGE I/P TRANSDUCER GENERATES FALSE HIGH S
47	ITKFORM4	I	1.744E-07	3.500E-02	HOURS	1.000 HOURS FORMIC ACID ADD'N TO PR (1.5/43 HRS)
48	5NEWBAT4	I	1.561E-07	5.000E-01	YEARS	1.000 HOURS NEW WASTE TNK OF SLDG FOR DWPF(EVERY 2YRS)
49	6VL3216C	I	7.482E-08	2.200E-06	HOURS	22.000 HOURS PRBT PURGE SUPPLY VALVE FAILS CLOSED
50	6CN321AZ	I	7.142E-08	2.100E-06	HOURS	22.000 HOURS DSC PRBT PURGE CONTROLLER FIC 3216A FAILS HIGH
51	6PRBTAR4	I	4.801E-08	1.000E+00	YEARS	1.000 HOURS PRBT AIR PURGE SYSTEM IS BEING WORKED ON
52	6FR-060P	I	3.395E-08	1.000E-06	HOURS	22.000 HOURS PRBT PURGE FILTER PLUGGED
53	7CN683BZ	I	3.198E-08	2.100E-06	HOURS	48.000 HOURS MFT AIR PRGE BACKUP FIC 0683B GENS FALSE HI SIGN
54	5CN334BZ	I	1.303E-08	2.100E-06	HOURS	48.000 HOURS SRAT AIR PRGE BACKUP FIC 3034B GENS FALSE HI SIG
55	5CN3034Y	I	6.676E-09	2.100E-05	HOURS	48.000 HOURS DCS SRAT PRGE FIC 3034A GENS FALSE LO SIGNAL

I DENOTES INITIATING EVENT

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

ENABLER (SEQUENTIAL CONTRIBUTORY) BASIC EVENT IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

TOP EVENT PROBABILITY = 4.53966E-08

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

RANK	BASIC EVENT	IMPORTANCE	FAILURE RATE	MEAN FAULT DURATION	BASIC EVENT DESCRIPTION
1	VPPAN--4	1.000E+00	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
1	VPPCONF4	1.000E+00	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
1	VPPIMPR4	1.000E+00	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE
2	#7MFTTOP	8.781E-01	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
2	7TKH2--4	8.781E-01	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
3	#7H2NOCO	8.435E-01	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
3	7TKO2--	8.435E-01	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
4	7PPFD014	4.109E-01	9.500E-01 HOURS	1.000 HOURS	MFT FEED PUMP 1 IS ON 95%
4	7PPFD024	4.109E-01	9.500E-01 HOURS	1.000 HOURS	MFT FEED PUMP 2 IS ON 95%
5	7ST3248F I	2.588E-01	3.300E-05 HOURS	48.000 HOURS	MFT TEMP SENSOR 3248A INACTIVE/GENERATES FALSE L
6	7PPFD02I I	2.055E-01	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 2 ACTS AS AN IGNITION SOURCE
7	7PPFD01I I	1.974E-01	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
8	7CPDCS-Y I	1.878E-01	2.000E-05 HOURS	48.000 HOURS	DCS INACTIVE/INITIATING
9	#6H2TOP-	1.214E-01	1.000E+00 HOURS	1.000 HOURS	## PRBT HYDROGEN DEFLAGRATION
9	6TKH2--4	1.214E-01	1.000E+00 HOURS	1.000 HOURS	% TIME GEN BENZENE/H2 IN PRBT (96HR/96HR)
9	6TKO2--4	1.214E-01	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN PRBT ABOVE MOC (TRUE)
10	#6H2NOCO	1.209E-01	1.000E+00 HOURS	1.000 HOURS	## PRBT BENZENE/H2 DEFLAG NO COOL H2O HEAT REMOV
11	6PPXFER4	7.282E-02	2.400E-01 HOURS	1.000 HOURS	PRBT TRANSFER PUMP IS ON 23HR/96HR
12	6ST3211F I	5.099E-02	3.300E-05 HOURS	48.000 HOURS	PRBT TEMP SENSOR 3211A INACTIVE/FAILS LOW
13	7AG----4	4.326E-02	1.000E+00 HOURS	1.000 HOURS	MFT AGITATOR IS ON (TRUE)
14	7TKO2--4	3.463E-02	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
14	#7H2PURG	3.463E-02	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO PURGE GAS FLOW
15	7RT2.6H6	3.392E-02	7.200E-01 HOURS	1.000 HOURS	FAIL TO REPAIR MFT PURGE ROTAMETER/ORIFICE IN 2.
16	6AGPRBT4	3.034E-02	1.000E+00 HOURS	1.000 HOURS	PRBT AGITATOR IS ON (TRUE)
17	6PPXFERI I	2.302E-02	1.400E-03 YEARS	22.000 HOURS	PRBT TRANSFER PUMP ACTS AS AN IGNITION SOURCE
18	7AG----I I	2.163E-02	1.400E-04 YEARS	48.000 HOURS	MFT AGITATOR ACTS AS AN IGNITION SOURCE
19	6PPSAMP4	1.820E-02	6.000E-02 HOURS	1.000 HOURS	PRBT SAMPLE PUMP IS ON 6HR/96HR
20	7RT0686P I	1.697E-02	3.000E-06 HOURS	48.000 HOURS	MFT AIR PURGE ROTAMETER/ORIFICE PLUGS
21	7PPSAMP4	1.298E-02	3.000E-02 HOURS	1.000 HOURS	MFT SAMPLE PUMP IS ON 3HR/96HR
22	7SW324AF	1.133E-02	3.000E-05 HOURS	.500 MONTHS	HI HI TEMP SW 3248B FAILS TO GEN SIG
23	6AGPRBTI I	9.583E-03	1.400E-04 YEARS	22.000 HOURS	PRBT AGITATOR ACTS AS AN IGNITION SOURCE
24	7PPFD01I I	8.133E-03	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
25	7PPSAMPI I	6.498E-03	1.400E-03 YEARS	48.000 HOURS	MFT SAMPLE PUMP ACTS AS AN IGNITION SOURCE
26	6PPSAMPI I	5.757E-03	1.400E-03 YEARS	22.000 HOURS	PRBT SAMPLE PUMP ACTS AS AN IGNITION SOURCE
27	7SW3248F I	2.781E-03	3.000E-05 HOURS	48.000 HOURS	HI TEMP SW INACTIVE
28	7HXCOOLF I	1.391E-03	1.500E-05 HOURS	48.000 HOURS	MFT COOLING WATER COILS FOULED
29	6SW321AF	1.356E-03	3.000E-05 HOURS	.500 MONTHS	HI HI TEMP SW 3211 INACTV/FAILS GEN SIGNAL
30	7IT--15U	1.049E-03	1.000E-03 HOURS	1.000 HOURS	MFT HI HI TEMP INTERLOCK BYPASSED

I DENOTES INITIATING EVENT WHICH CAN FUNCTION AS AN ENABLING EVENT

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

ENABLER (SEQUENTIAL CONTRIBUTORY) BASIC EVENT IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

TOP EVENT PROBABILITY = 4.53966E-0B

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

RANK	BASIC EVENT	IMPORTANCE	FAILURE RATE	MEAN FAULT DURATION	BASIC EVENT DESCRIPTION
31	7VL3252C I	9.278E-04	1.000E-05 HOURS	48.000 HOURS	MFT COOLING WATER VALVE HCV 3252 FAILS CLOSED
32	OTWCTW-F I	6.721E-04	5.300E-02 YEARS	48.000 HOURS	INADEQUATE COOLING TOWER WATER HEAT REMOVAL
33	6SW3211F I	5.482E-04	3.000E-05 HOURS	48.000 HOURS	HI TEMP SW 3211 INACTIVE
34	#6H2PURG	4.789E-04	1.000E+00 HOURS	1.000 HOURS	## PRBT BENZENE/H2 DEFLAGRATION NO PURGE
35	6RT17.96	4.682E-04	1.100E-01 HOURS	1.000 HOURS	FAIL TO REPAIR ROTAMTR/ORIFICE IN 17.9 HRS
36	#5H2TOP-	4.417E-04	1.000E+00 HOURS	1.000 HOURS	## SRAT HYDROGEN DEFLAGRATION
36	5TKO2--4	4.417E-04	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN SRAT ABOVE MOC (TRUE)
36	#5H2PURG	4.414E-04	1.000E+00 HOURS	1.000 HOURS	## SRAT H2 DEFLAGRATION NO PURGE GAS FLOW
36	5TKH2--4	4.414E-04	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN SRAT (96HR/96HR)

37	2-.72HR5	4.049E-04	7.200E-01	HOURS	1.000 HOURS	CPC PURGE SUPPLY NOT RESTORED WITHIN 12 HOURS
38	3VP--#1F	3.995E-04	3.000E-04	HOURS	3.500 DAYS	N2 AMBIENT VAPORIZER #1 FAILS
38	3VP--#2F	3.995E-04	3.000E-04	HOURS	3.500 DAYS	N2 AMBIENT VAPORIZER #2 FAILS
39	5AG----4	2.598E-04	1.000E+00	HOURS	1.000 HOURS	SRAT AGITATOR IS ON 96HR/96HR (TRUE)
40	7CPDCS2F	2.550E-04	2.000E-05	HOURS	48.000 HOURS	DCS INACTIVE FOR 2.6 HOURS
41	6RT3219P I	2.341E-04	3.000E-06	HOURS	22.000 HOURS	PRBT AIR PURGE RTM/ORF PLUGS
42	FVL3010F	2.176E-04	3.000E-03	HOURS	1.000 HOURS	SRAT COOL H2O VLV HCV 3010 FAILS TO OPEN
43	5PPSAMP4	1.557E-04	6.000E-02	HOURS	1.000 HOURS	SRAT SAMPLE PUMP IS ON 6HR/96HR
44	5AG----I I	1.350E-04	1.400E-04	YEARS	48.000 HOURS	SRAT AGITATOR ACTS AS AN IGNITION SOURCE
45	6HXCOOLF I	1.258E-04	1.500E-05	HOURS	22.000 HOURS	PRBT COOLING WATER COILS FOULED
46	6IT--15U	1.256E-04	1.000E-03	HOURS	1.000 HOURS	PRBT HI HI TEMP INTERLOCK BYPASSED
47	5SF0715P I	9.621E-05	3.000E-05	HOURS	48.000 HOURS	SRAT PURGE ORIFICE PLUGGED
48	5AIGC#2F	8.679E-05			1.000E+00	SRAT GC#2 CONDENSATION/PEAK DRIFT
49	6VL3212C I	8.386E-05	1.000E-05	HOURS	22.000 HOURS	PRBT COOL WATER VALVE HCV 3212 FAILS CLOSED
50	5PPSAMPI I	8.101E-05	1.400E-03	YEARS	48.000 HOURS	SRAT SAMPLE PP ACTS AS AN IGNITION SOURCE
51	5GC8795U	8.069E-05	1.000E-02	HOURS	1.000 HOURS	SRAT GC#1 OUT OF CALIBRATION
52	FVS3010K	7.254E-05	1.000E-03	HOURS	1.000 HOURS	SV FOR SRAT COOL H2O VLV FAILS TO ENERGIZE
53	2VI0963C I	6.327E-05	1.600E-05	HOURS	48.000 HOURS	85 PSI PCV FAILS CLOSED
53	2VI0964C I	6.327E-05	1.600E-05	HOURS	48.000 HOURS	80 PSI PCV FAILS CLOSED
54	5SF3034Z I	6.250E-05	6.000E-06	HOURS	48.000 HOURS	SRAT PURGE FLOW SENSOR/XMITTER FAILS HIGH
55	FHXCW--F I	5.778E-05	5.200E-07	HOURS	48.000 HOURS	INADEQUATE PROCESS COOLING WATER HEAT REMOVAL
56	7IP0683Z I	4.968E-05	6.400E-06	HOURS	48.000 HOURS	MFT PURGE I/P XDUCER GENERATES FALSE HIGH SIGNAL
57	5TKBOIL4	4.063E-05	2.800E-01	HOURS	1.000 HOURS	% OF TIME BOILING IN SRAT 27HR/96HR
58	NBSDG--F	3.903E-05	1.000E-02	HOURS	1.000 HOURS	LOSS OF BACKUP POWER (DIESEL GENERATORS)
59	7VAMFTPU	3.437E-05	3.800E-02	HOURS	1.000 HOURS	OP FAILS OPEN MFT PURGE ISO VLV AFTER MAINT.
60	7AGMFT-4	3.148E-05	1.000E+00	HOURS	1.000 HOURS	MFT AGITATOR ON (TRUE)
60	7SWMFT-D	3.147E-05	3.000E-05	HOURS	1.000 HOURS	MFT AGITATOR CONTACTS FAIL TO OPEN
61	7TKMTF-I	2.820E-05	1.000E-09	HOURS	1.000 HOURS	MFT STATIC CHARGE
62	6TKPRBTI	2.726E-05	1.000E-09	HOURS	1.000 HOURS	PRBT STATIC CHARGE

I DENOTES INITIATING EVENT WHICH CAN FUNCTION AS AN ENABLING EVENT

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

ENABLER (SEQUENTIAL CONTRIBUTORY) BASIC EVENT IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

TOP EVENT PROBABILITY = 4.53966E-08

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

RANK	BASIC EVENT	IMPORTANCE	FAILURE RATE	MEAN FAULT DURATION	BASIC EVENT DESCRIPTION
63	7SF0684Z I	2.721E-05	6.000E-06 HOURS	48.000 HOURS	FE 0684/FT 0684 GENERATES FALSE HI SIGNAL
64	7SF0682Z I	2.713E-05	6.000E-06 HOURS	48.000 HOURS	FE 0682/FT 0682 GENERATE FALSE HIGH SIGNALS
65	HNORMPRF I	2.639E-05	3.300E-01 YEARS	8.500 HOURS	LOSS OF NORMAL POWER TO LOAD CENTERS
66	5PPXFER4	2.595E-05	1.000E-02 HOURS	1.000 HOURS	SRAT XFER PP IS ON 1HR/96HR
67	DTWCTW*F	2.106E-05	5.300E-02 YEARS	48.000 HOURS	INADEQUATE COOLING TOWER WATER HEAT REMOVAL
68	5IP3034Z I	2.055E-05	6.400E-06 HOURS	48.000 HOURS	SRAT AIR PURGE I/P XDUCER GEN FALSE HI SIGNAL
69	5VL3000K	2.031E-05	1.000E-03 HOURS	1.000 HOURS	SRAT STEAM SUPPLY VALVE FAILS TO CLOSE
69	5VS3000K	2.031E-05	1.000E-03 HOURS	1.000 HOURS	SV FOR SRAT STEAM SUPPLY VALVE FAILS TO DE-ENERG
70	7VK3252U I	1.934E-05	1.000E-05 HOURS	1.000 HOURS	OPERATOR INADVERTENTLY CLOSES HCV 3252
71	7VL0683C I	1.708E-05	2.200E-06 HOURS	48.000 HOURS	MFT PURGE SUPPLY VALVE FAILS CLOSED
72	7CN683AZ I	1.631E-05	2.100E-06 HOURS	48.000 HOURS	DCS MFT PURGE FLOW CTRLR FIC 0683A FAILS HI
73	5VASRATU	1.424E-05	3.800E-02 HOURS	1.000 HOURS	OP FAILS OPEN SRAT PURGE ISO VLV AFTER MAINT.
74	3VA--19X	1.363E-05	4.800E-01 HOURS	1.000 HOURS	N2 AMBIENT VPRIZR ISO VLV LEFT CLOSED AFTER MAIN
74	3VA--19U	1.363E-05	8.100E-02 HOURS	1.000 HOURS	OP NO DETECT ISO VLV CLOSED DURING INDPNDNT VERI
75	3TKDKN2L	1.358E-05	1.000E-08 HOURS	3.000 MONTHS	LIQUID N2 STORAGE TANK LEAKS
76	5PPXFERI I	1.350E-05	1.400E-03 YEARS	48.000 HOURS	SRAT XFER PP ACTS AS AN IGNITION SOURCE
77	5RT0715P I	9.633E-06	3.000E-06 HOURS	48.000 HOURS	SRAT PURGE ROTAMETER PLUGGED
78	2--17.95	7.951E-06	1.100E-01 HOURS	1.000 HOURS	CPC PURGE SUPPLY NOT RESTORED WITHIN 17.9 HOURS
79	7FR-060P I	7.765E-06	1.000E-06 HOURS	48.000 HOURS	MFT PURGE FILTER PLUGGED
80	5VL3034C I	7.065E-06	2.200E-06 HOURS	48.000 HOURS	SRAT PURGE SUPPLY VALVE FAILS CLOSED
81	5PI8795L	6.966E-06	4.000E-07 HOURS	3.000 MONTHS	AIR INLEAKAGE IN SRAT GC#1 SAMPLE LINE
82	5CN3034Z I	6.744E-06	2.100E-06 HOURS	48.000 HOURS	DCS SRAT PURGE FLOW CTRLR FIC 3034 GEN FALSE HI
83	7VG2.6HU	4.962E-06	2.700E-05 HOURS	1.000 HOURS	OP FAILS OPEN MFT PURGE BYPASS VLV IN 2.6 HRS
84	6VA3212U I	3.812E-06	1.000E-05 HOURS	1.000 HOURS	OPERATOR INADVERTENTLY CLOSES HCV 3212
85	6SWPRBTD	3.764E-06	3.000E-05 HOURS	1.000 HOURS	PRBT AGITATOR CONTACTS FAIL TO OPEN
86	5FR-028P I	3.211E-06	1.000E-06 HOURS	48.000 HOURS	SRAT PURGE FILTER PLUGGED
87	2PCS---A	1.958E-06	5.000E-03 HOURS	1.000 HOURS	STANDBY PURGE AIR COMPRESSOR FAILS TO START
88	FHXCW**F	1.809E-06	5.200E-07 HOURS	48.000 HOURS	INADEQUATE PROCESS COOLING WATER HEAT REMOVAL
89	2PCD---Y I	1.506E-06	5.000E-05 HOURS	48.000 HOURS	OPERATING PURGE AIR COMPRESSOR FAILS TO RUN
90	7RT2.6HT	1.272E-06	2.700E-05 HOURS	1.000 HOURS	OP FAILS RESPOND TO MFT PURGE ALARM IN 2.6HR
91	6SF3215Z I	1.126E-06	6.000E-06 HOURS	22.000 HOURS	FE 3215/FT 3215 GENERATES FALSE HI SIGNAL
92	6SF3218Z I	1.124E-06	6.000E-06 HOURS	22.000 HOURS	FE 3218/FT 3218 GENERATES FALSE HI SIGNAL

93	7CPDCS3F	9.660E-07	2.000E-06	HOURS	22.000	HOURS DCS INACTIVE FOR 17.9 HOURS
94	2PCS---V	9.392E-07	5.000E-05	HOURS	48.000	HOURS STANDBY PURGE AIR COMPRESSOR FAILS TO RUN
94	7VX2.6HT	9.389E-07	2.700E-05	HOURS	1.000	HOURS OP FAILS OPEN MFT PURGE ISO VLV IN 2.6HR
95	HBSLOSPF I	8.726E-07	3.300E-01	YEARS	1.000	HOURS LOSS OF NORMAL POWER TO LOAD CENTERS
96	5GC8796U	8.636E-07	1.000E-02	HOURS	1.000	HOURS SRAT GC#2 OUT OF CALIBRATION
97	5IT---5U	7.047E-07	1.000E-03	HOURS	1.000	HOURS SRAT AIR PURGE INTERLOCKS BYPASSED

I DENOTES INITIATING EVENT WHICH CAN FUNCTION AS AN ENABLING EVENT

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

ENABLER (SEQUENTIAL CONTRIBUTORY) BASIC EVENT IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

TOP EVENT PROBABILITY = 4.53966E-08

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

RANK	BASIC EVENT	IMPORTANCE	FAILURE RATE	MEAN FAULT DURATION	BASIC EVENT DESCRIPTION
98	7MFTAIR4 I	7.016E-07	1.000E+00 YEARS	1.000 HOURS	MFT AIR PURGE SYSTEM IS BEING WORKED ON
99	3TKN2TKT	6.469E-07	1.300E-02 HOURS	1.000 HOURS	OP FAILS TO FILL N2 STORAGE TNK(ROUTINE FILL)
100	7AL0683F	4.252E-07	3.000E-06 HOURS	.500 MONTHS	MFT PURGE FLOW DEV ALARM NOT GENERATED
101	5TKH2244	3.373E-07	2.400E-01 HOURS	1.000 HOURS	% TIME GEN EXCESS H2 IN SRAT (23HR/96HR)
102	7AL0684F	3.072E-07	3.000E-06 HOURS	.500 MONTHS	LOW FLOW ALARM FAL 0684 FAILURE
103	3SL7863U	2.950E-07	6.500E-02 HOURS	1.000 HOURS	N2 STORAGE TNK LO LEVEL SENSOR OUT CALIBRATION
104	3SW7863Z	2.941E-07	3.000E-05 HOURS	3.000 MONTHS	N2 STORAGE TANK LO LEVEL FAILS HI
105	5SRATAP4 I	2.903E-07	1.000E+00 YEARS	1.000 HOURS	SRAT AIR PURGE SYSTEM IS BEING WORKED ON
106	6IP3216Z I	2.185E-07	6.400E-06 HOURS	22.000 HOURS	PRBT PURGE I/P TRANSDUCER GENERATES FALSE HIGH S
107	#5H2FORM	1.780E-07	1.000E+00 HOURS	1.000 HOURS	## SRAT H2 DEFLAGRATION FORMIC ACID
107	9SAMPLET	1.780E-07	1.300E-02 HOURS	1.000 HOURS	FAILURE TO SAMPLE PR FORMATE CONTENT
107	6SAMPLET	1.780E-07	1.300E-02 HOURS	1.000 HOURS	FAILURE TO SAMPLE PRBT FOR FORMATE CONTENT
108	5TKSRATI	1.725E-07	1.000E-09 HOURS	1.000 HOURS	SRAT STATIC CHARGE
109	IVA2056U	1.596E-07	1.300E-02 HOURS	1.000 HOURS	OP FAILS TO STOP FORMIC ACID PP
110	#5H2NOBL	1.594E-07	1.000E+00 HOURS	1.000 HOURS	## SRAT H2 DEFLAGRATION HIGH NOBLE METAL CONC
110	5NOTREPT	1.594E-07	1.300E-02 HOURS	1.000 HOURS	SLUDGE SAMPLE NOT REPRESENT OF WASTE TANK
110	5EXNOBL4	1.594E-07	1.000E-01 HOURS	1.000 HOURS	CONC OF NOBLE METALS>DESIGN BASIS(1/10 WASTE TNK
111	2PCST&M4	8.696E-08	2.300E-04 HOURS	1.000 HOURS	STANDBY PRGE AIR COMPRESSR OUT OF SERVICE/TEST O
112	5RY8796D	8.612E-08	1.000E-03 HOURS	1.000 HOURS	SRAT GC#2 COMPUTER RELAY FAILS TO OPEN
113	6VL3216C I	7.495E-08	2.200E-06 HOURS	22.000 HOURS	PRBT PURGE SUPPLY VALVE FAILS CLOSED
114	5PI8796L	7.440E-08	4.000E-07 HOURS	3.000 MONTHS	AIR INLEAKAGE IN SRAT GC#2 SAMPLE LINE
115	6CN321AZ I	7.155E-08	2.100E-06 HOURS	22.000 HOURS	DSC PRBT PURGE CONTROLLER FIC 3216A FAILS HIGH
116	5CP8795F	6.381E-08	3.000E-05 HOURS	48.000 HOURS	SRAT % LFL CALC GENS FALSE LO SIGNAL
117	5GC8795Y	6.372E-08	3.000E-05 HOURS	48.000 HOURS	SRAT GC#1 COMPUTER ELEMENT FAILS LOW (LEL)
118	5GC8795Z	5.727E-08	3.000E-05 HOURS	48.000 HOURS	SRAT GC #1 ELEMENT FAILS HI
119	6VAPRBTT	5.019E-08	1.300E-02 HOURS	1.000 HOURS	OP FAILS OPEN PRBT PRGE ISO VLV AFTER MAINT.
120	5PP-0134	4.985E-08	2.400E-02 HOURS	1.000 HOURS	PRBT XFER PP RUNS 23HR/96HR
120	5SW4041D	4.985E-08	3.000E-05 HOURS	1.000 HOURS	PRBT TRANSFER PUMP CONTACT FAILS TO OPEN
121	6VG17.9U	4.481E-08	2.700E-06 HOURS	1.000 HOURS	OP FAILS OPEN PRBT PRGE BYPASS VLV IN 17.9 HRS
122	5IT---1U	4.235E-08	1.000E-03 HOURS	1.000 HOURS	SRAT OFFGAS HIGH % LFL INTERLOCKS BYPASSED
122	5RY8795D	4.235E-08	1.000E-03 HOURS	1.000 HOURS	SRAT GC#1 COMPUTER RELAY FAILS TO OPEN
123	5RY875BD	3.964E-08	1.000E-03 HOURS	1.000 HOURS	SRAT GC#1 COMPUTER RELAY 8795B FAILS TO OPEN
123	5IT--10U	3.964E-08	1.000E-03 HOURS	1.000 HOURS	SRAT OFFGAS LO N2 FLOW INTERLOCKS BYPASSED
124	7CPDCS-F	3.831E-08	2.000E-05 HOURS	48.000 HOURS	DCS INACTIVE
125	6FR-060P I	3.395E-08	1.000E-06 HOURS	22.000 HOURS	PRBT PURGE FILTER PLUGGED
126	7CN683AY	3.276E-08	2.100E-05 HOURS	48.000 HOURS	DCS MFT PRGE FIC 0683A GENS FALSE LO SIGNAL
127	7CN683BZ I	3.198E-08	2.100E-06 HOURS	48.000 HOURS	MFT AIR PRGE BACKUP FIC 0683B GENS FALSE HI SIGN
128	5PPSAMPT	2.906E-08	1.300E-02 HOURS	1.000 HOURS	OP FAILS TURN OFF SRAT SMPL PP PRIOR PHA ADD'N

I DENOTES INITIATING EVENT WHICH CAN FUNCTION AS AN ENABLING EVENT

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

ENABLER (SEQUENTIAL CONTRIBUTORY) BASIC EVENT IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

TOP EVENT PROBABILITY = 4.53966E-08

MISSION TIME 1.000E+00Y 3.000E+01Y
EXPECT NO OF SYSTEM FAIL 1.737E-05 5.211E-04

RANK	BASIC EVENT	IMPORTANCE	FAILURE RATE	MEAN FAULT DURATION	BASIC EVENT DESCRIPTION
129	3SL7863Z	2.865E-08	3.000E-06 HOURS	3.000 MONTHS	N2 STORAGE TANK LO LEVEL SENSOR FAILS HI

129	3AL7863Z	2.865E-08	3.000E-06 HOURS	3.000 MONTHS	N2 STORAGE TANK LOW LEVEL ALARM FAILS HIGH
130	6AL3216F	2.759E-08	3.000E-06 HOURS	.500 MONTHS	PRBT PURGE FLOW DEV ALARM NOT GENERATED
131	5CN334BZ I	2.607E-08	2.100E-06 HOURS	48.000 HOURS	SRAT AIR PRGE BACKUP FIC 3034B GENS FALSE HI SIG
132	NDG----F	2.565E-08	1.000E-02 HOURS	1.000 HOURS	LOSS OF BACKUP POWER (DIESEL GENERATORS)
132	HLOSP**F	2.565E-08	3.300E-01 YEARS	1.000 HOURS	LOSS NORM POWR TO LOAD CNTRS/ENABLING
133	6AL3215F	2.432E-08	3.000E-06 HOURS	.500 MONTHS	LOW FLOW ALARM FAL 3215 FAILURE
134	5CN3034Y I	1.335E-08	2.100E-05 HOURS	48.000 HOURS	DCS SRAT PRGE FIC 3034A GENS FALSE LO SIGNAL
135	6RT17.9T	1.149E-08	2.700E-06 HOURS	1.000 HOURS	OP FAILS TO RESPOND IN 17.9 HRS
136	ISF2048Y	9.295E-09	6.000E-05 HOURS	22.000 HOURS	FORMIC ACID FLOW ELEMENT/XMITTER FAILS LOW
137	3TKBKN2L	5.951E-09	1.000E-08 HOURS	3.000 MONTHS	LIQUID N2 STORAGE TANK LEAKS
138	5XM8795Z	5.641E-09	3.000E-06 HOURS	48.000 HOURS	SRAT GC#1 COMPUTER XMITTER FAILS HIGH
139	5XM8795Y	4.005E-09	3.000E-06 HOURS	48.000 HOURS	SRAT GC#2 COMPUTER INDICATION XMITTER FAILS LOW
140	ITKFORM4 I	3.633E-09	3.500E-02 HOURS	1.000 HOURS	FORMIC ACID ADD'N TO PR (1.5/43 HRS)
141	5NEWBAT4 I	3.252E-09	5.000E-01 YEARS	1.000 HOURS	NEW WASTE TNK OF SLDG FOR DWPF(EVERY 2YRS)
142	2PCSALRT	2.832E-09	2.700E-04 HOURS	1.000 HOURS	OP FAILS TO RESP TO OP PRGE AIR COMPRESSR TRBL A
143	ITL2048Y	2.383E-09	2.000E-05 HOURS	22.000 HOURS	FORMIC ACID TOTALIZER INDICATES FALSE LOW
144	2PDST&M4	2.312E-09	2.300E-04 HOURS	1.000 HOURS	STANDBY PRGE AIR COMPRESSR OUT OF SERVICE/TEST O
145	6PRBTAR4 I	2.182E-09	1.000E+00 YEARS	1.000 HOURS	PRBT AIR PURGE SYSTEM IS BEING WORKED ON
146	6VX17.9T	1.782E-09	2.700E-06 HOURS	1.000 HOURS	OP FAILS OPEN PRBT PURGE ISO VLV IN 17.9 HRS
147	3ALN2ALT	4.168E-10	2.700E-04 HOURS	1.000 HOURS	OP IGNORES/FAILS RESP TO N2 STORAGE TNK LO LVL A
148	5RYCR2-D	3.560E-10	1.000E-03 HOURS	1.000 HOURS	RELAY CR2 CONTACTS FAIL TO OPEN
149	5GC8796Z	1.925E-10	3.000E-05 HOURS	48.000 HOURS	SRAT GC#2 ELEMENT FAILS HIGH
150	5GC8796Y	9.624E-11	3.000E-05 HOURS	48.000 HOURS	SRAT GC#2 ELEMENT FAILS LOW

I DENOTES INITIATING EVENT WHICH CAN FUNCTION AS AN ENABLING EVENT

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INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

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GROUP RANK	CUMULATIVE IMPORTANCE	RESIDUAL IMPORTANCE
1	4.841E-01	5.159E-01
2	7.776E-01	2.224E-01
3	8.222E-01	1.778E-01
4	8.492E-01	1.508E-01
5	8.747E-01	1.253E-01
6	8.933E-01	1.067E-01
7	9.092E-01	9.082E-02
8	9.250E-01	7.497E-02
9	9.405E-01	5.952E-02
10	9.517E-01	4.826E-02
11	9.629E-01	3.711E-02
12	9.705E-01	2.946E-02
13	9.773E-01	2.270E-02
14	9.819E-01	1.807E-02
15	9.867E-01	1.332E-02
16	9.883E-01	1.165E-02
17	9.907E-01	9.280E-03
18	9.923E-01	7.697E-03
19	9.928E-01	7.196E-03
20	9.938E-01	6.238E-03
21	9.942E-01	5.801E-03
22	9.950E-01	4.995E-03
23	9.953E-01	4.714E-03
24	9.955E-01	4.464E-03
25	9.960E-01	4.025E-03
26	9.962E-01	3.843E-03
27	9.963E-01	3.705E-03
28	9.964E-01	3.580E-03
29	9.965E-01	3.463E-03
30	9.968E-01	3.243E-03
31	9.969E-01	3.134E-03
32	9.970E-01	3.042E-03
33	9.970E-01	2.954E-03
34	9.971E-01	2.871E-03
35	9.972E-01	2.796E-03
36	9.973E-01	2.721E-03
37	9.974E-01	2.647E-03
38	9.975E-01	2.501E-03
39	9.976E-01	2.430E-03
40	9.976E-01	2.361E-03
41	9.977E-01	2.304E-03
42	9.978E-01	2.196E-03
43	9.979E-01	2.089E-03
44	9.980E-01	2.039E-03
45	9.980E-01	1.991E-03
46	9.981E-01	1.944E-03
47	9.981E-01	1.899E-03
48	9.981E-01	1.854E-03
49	9.982E-01	1.765E-03
50	9.983E-01	1.723E-03
51	9.983E-01	1.681E-03
52	9.984E-01	1.599E-03
53	9.984E-01	1.558E-03
54	9.985E-01	1.520E-03
55	9.985E-01	1.483E-03
56	9.986E-01	1.408E-03
57	9.986E-01	1.371E-03
58	9.987E-01	1.337E-03
59	9.987E-01	1.309E-03
60	9.987E-01	1.284E-03
61	9.987E-01	1.261E-03
62	9.988E-01	1.238E-03
63	9.988E-01	1.215E-03
64	9.988E-01	1.193E-03
65	9.988E-01	1.172E-03
66	9.988E-01	1.150E-03
67	9.989E-01	1.131E-03
68	9.989E-01	1.112E-03
69	9.989E-01	1.093E-03
70	9.989E-01	1.076E-03

71	9.990E-01	1.043E-03
72	9.990E-01	1.027E-03
73	9.990E-01	1.011E-03
74	9.990E-01	9.959E-04
75	9.990E-01	9.804E-04

INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

MISSION TIME 1.000E+00Y 3.000E+01Y
EXPECT NO OF SYSTEM FAIL 1.737E-05 5.211E-04
TOP EVENT PROBABILITY = 4.53966E-08

RANK IMPORTANCE

1 2.421E-01 CUT SET 6 MEAN TIME TO OCCURRENCE = 2.08341E+09 HOURS 2.37833E+05 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.484109/ 5.159E-01

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2NOCO	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7PPFD014	9.500E-01 HOURS	1.000 HOURS	MFT FEED PUMP 1 IS ON 95%
7PPFD01I I	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
7ST3248F I	3.300E-05 HOURS	48.000 HOURS	MFT TEMP SENSOR 3248A INACTIVE/GENERATES FALSE L
7TKD02--	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

1 2.420E-01 CUT SET 5 MEAN TIME TO OCCURRENCE = 2.08352E+09 HOURS 2.37845E+05 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.484109/ 5.159E-01

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2NOCO	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7PPFD024	9.500E-01 HOURS	1.000 HOURS	MFT FEED PUMP 2 IS ON 95%
7PPFD02I I	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 2 ACTS AS AN IGNITION SOURCE
7ST3248F I	3.300E-05 HOURS	48.000 HOURS	MFT TEMP SENSOR 3248A INACTIVE/GENERATES FALSE L
7TKD02--	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

I DENOTES INITIATING EVENT

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

MISSION TIME 1.000E+00Y 3.000E+01Y
EXPECT NO OF SYSTEM FAIL 1.737E-05 5.211E-04
TOP EVENT PROBABILITY = 4.53966E-08

RANK IMPORTANCE

2 1.467E-01 CUT SET 8 MEAN TIME TO OCCURRENCE = 3.43656E+09 HOURS 3.92302E+05 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.777600/ 2.224E-01

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2NOCO	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7CPDCS-Y I	2.000E-05 HOURS	48.000 HOURS	DCS INACTIVE/INITIATING
7PPFD014	9.500E-01 HOURS	1.000 HOURS	MFT FEED PUMP 1 IS ON 95%
7PPFD01I I	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
7TKD02--	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

2 1.467E-01 CUT SET 7 MEAN TIME TO OCCURRENCE = 3.43675E+09 HOURS 3.92323E+05 YEARS
GROUP RANK CUMULATIVE/RESIDUAL

.777600/ 2.224E-01

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2NOCO	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7CPDCS-Y I	2.000E-05 HOURS	48.000 HOURS	DCS INACTIVE/INITIATING
7PPFD024	9.500E-01 HOURS	1.000 HOURS	MFT FEED PUMP 2 IS ON 95%
7PPFD02I I	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 2 ACTS AS AN IGNITION SOURCE
7TKD02--	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

I DENOTES INITIATING EVENT

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

TOP EVENT PROBABILITY = 4.53966E-08

RANK IMPORTANCE

3 4.460E-02 CUT SET 9 MEAN TIME TO OCCURRENCE = 1.13078E+10 HOURS 1.29084E+06 YEARS

GROUP RANK CUMULATIVE/RESIDUAL
.822198/ 1.778E-01

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#6H2NOCO	1.000E+00 HOURS	1.000 HOURS	## PRBT BENZENE/H2 DEFLAG NO COOL H2O HEAT REMOV
#6H2TOP-	1.000E+00 HOURS	1.000 HOURS	## PRBT HYDROGEN DEFLAGRATION
6PPXFER4	2.400E-01 HOURS	1.000 HOURS	PRBT TRANSFER PUMP IS ON 23HR/96HR
6PPXFERI I	1.400E-03 YEARS	22.000 HOURS	PRBT TRANSFER PUMP ACTS AS AN IGNITION SOURCE
6ST3211F I	3.300E-05 HOURS	48.000 HOURS	PRBT TEMP SENSOR 3211A INACTIVE/FAILS LOW
6TKH2--4	1.000E+00 HOURS	1.000 HOURS	% TIME GEN BENZENE/H2 IN PRBT (96HR/96HR)
6TKO2--4	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN PRBT ABOVE MOC (TRUE)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

4 2.704E-02 CUT SET 11 MEAN TIME TO OCCURRENCE = 1.86501E+10 HOURS 2.12900E+06 YEARS

GROUP RANK CUMULATIVE/RESIDUAL
.849239/ 1.508E-01

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#6H2NOCO	1.000E+00 HOURS	1.000 HOURS	## PRBT BENZENE/H2 DEFLAG NO COOL H2O HEAT REMOV
#6H2TOP-	1.000E+00 HOURS	1.000 HOURS	## PRBT HYDROGEN DEFLAGRATION
6PPXFER4	2.400E-01 HOURS	1.000 HOURS	PRBT TRANSFER PUMP IS ON 23HR/96HR
6PPXFERI I	1.400E-03 YEARS	22.000 HOURS	PRBT TRANSFER PUMP ACTS AS AN IGNITION SOURCE
6TKH2--4	1.000E+00 HOURS	1.000 HOURS	% TIME GEN BENZENE/H2 IN PRBT (96HR/96HR)
6TKO2--4	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN PRBT ABOVE MOC (TRUE)
7CPDCS-Y I	2.000E-05 HOURS	48.000 HOURS	DCS INACTIVE/INITIATING
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

I DENOTES INITIATING EVENT

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

TOP EVENT PROBABILITY = 4.53966E-08

RANK IMPORTANCE

5 2.548E-02 CUT SET 10 MEAN TIME TO OCCURRENCE = 1.97934E+10 HOURS 2.25952E+06 YEARS

GROUP RANK CUMULATIVE/RESIDUAL
.874718/ 1.253E-01

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2NOCO	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7AG----4	1.000E+00 HOURS	1.000 HOURS	MFT AGITATOR IS ON (TRUE)
7AG----I I	1.400E-04 YEARS	48.000 HOURS	MFT AGITATOR ACTS AS AN IGNITION SOURCE
7ST3248F I	3.300E-05 HOURS	48.000 HOURS	MFT TEMP SENSOR 3248A INACTIVE/GENERATES FALSE L
7TKDO2--	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

6 1.858E-02 CUT SET 14 MEAN TIME TO OCCURRENCE = 2.71386E+10 HOURS 3.09801E+06 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.893301/ 1.067E-01

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#6H2NOCO	1.000E+00 HOURS	1.000 HOURS	## PRBT BENZENE/H2 DEFLAG NO COOL H2O HEAT REMOV
#6H2TOP-	1.000E+00 HOURS	1.000 HOURS	## PRBT HYDROGEN DEFLAGRATION
6AGPRBT4	1.000E+00 HOURS	1.000 HOURS	PRBT AGITATOR IS ON (TRUE)
6AGPRBTI I	1.400E-04 YEARS	22.000 HOURS	PRBT AGITATOR ACTS AS AN IGNITION SOURCE
6ST3211F I	3.300E-05 HOURS	48.000 HOURS	PRBT TEMP SENSOR 3211A INACTIVE/FAILS LOW
6TKH2--4	1.000E+00 HOURS	1.000 HOURS	% TIME GEN BENZENE/H2 IN PRBT (96HR/96HR)
6TKO2--4	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN PRBT ABOVE MOC (TRUE)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

I DENOTES INITIATING EVENT
1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

TOP EVENT PROBABILITY = 4.53966E-08

RANK IMPORTANCE

7 1.587E-02 CUT SET 85 MEAN TIME TO OCCURRENCE = 3.17684E+10 HOURS 3.62653E+06 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.909176/ 9.082E-02

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2PURG	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO PURGE GAS FLOW
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7PPFD014	9.500E-01 HOURS	1.000 HOURS	MFT FEED PUMP 1 IS ON 95%
7PPFD01I I	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
7RT0686P I	3.000E-06 HOURS	48.000 HOURS	MFT AIR PURGE ROTAMETER/ORIFICE PLUGS
7RT2.6H6	7.200E-01 HOURS	1.000 HOURS	FAIL TO REPAIR MFT PURGE ROTAMETER/ORIFICE IN 2.
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
7TKO2--4	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

8 1.585E-02 CUT SET 84 MEAN TIME TO OCCURRENCE = 3.18094E+10 HOURS 3.63120E+06 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.925030/ 7.497E-02

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2PURG	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO PURGE GAS FLOW
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7PPFD024	9.500E-01 HOURS	1.000 HOURS	MFT FEED PUMP 2 IS ON 95%
7PPFD02I I	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 2 ACTS AS AN IGNITION SOURCE
7RT0686P I	3.000E-06 HOURS	48.000 HOURS	MFT AIR PURGE ROTAMETER/ORIFICE PLUGS
7RT2.6H6	7.200E-01 HOURS	1.000 HOURS	FAIL TO REPAIR MFT PURGE ROTAMETER/ORIFICE IN 2.
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
7TKO2--4	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

TOP EVENT PROBABILITY = 4.53966E-08

RANK IMPORTANCE

9 1.545E-02 CUT SET 12 MEAN TIME TO OCCURRENCE = 3.26490E+10 HOURS 3.72705E+06 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.940476/ 5.952E-02

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2NOCO	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7AG----4	1.000E+00 HOURS	1.000 HOURS	MFT AGITATOR IS ON (TRUE)
7AG----I I	1.400E-04 YEARS	48.000 HOURS	MFT AGITATOR ACTS AS AN IGNITION SOURCE
7CPDCS-Y I	2.000E-05 HOURS	48.000 HOURS	DCS INACTIVE/INITIATING
7TKD02--	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

10 1.127E-02 CUT SET 17 MEAN TIME TO OCCURRENCE = 4.47600E+10 HOURS 5.10959E+06 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.951743/ 4.826E-02

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#6H2NOCO	1.000E+00 HOURS	1.000 HOURS	## PRBT BENZENE/H2 DEFLAG NO COOL H2O HEAT REMOV
#6H2TOP-	1.000E+00 HOURS	1.000 HOURS	## PRBT HYDROGEN DEFLAGRATION
6AGPRBT4	1.000E+00 HOURS	1.000 HOURS	PRBT AGITATOR IS ON (TRUE)
6AGPRBTI I	1.400E-04 YEARS	22.000 HOURS	PRBT AGITATOR ACTS AS AN IGNITION SOURCE
6TKH2--4	1.000E+00 HOURS	1.000 HOURS	% TIME GEN BENZENE/H2 IN PRBT (96HR/96HR)
6TKO2--4	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN PRBT ABOVE MOC (TRUE)
7CPDCS-Y I	2.000E-05 HOURS	48.000 HOURS	DCS INACTIVE/INITIATING
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

I DENOTES INITIATING EVENT
1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

TOP EVENT PROBABILITY = 4.53966E-08

RANK IMPORTANCE

11 1.115E-02 CUT SET 15 MEAN TIME TO OCCURRENCE = 4.52312E+10 HOURS 5.16338E+06 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.962893/ 3.711E-02

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#6H2NOCO	1.000E+00 HOURS	1.000 HOURS	## PRBT BENZENE/H2 DEFLAG NO COOL H2O HEAT REMOV
#6H2TOP-	1.000E+00 HOURS	1.000 HOURS	## PRBT HYDROGEN DEFLAGRATION
6PPSAMP4	6.000E-02 HOURS	1.000 HOURS	PRBT SAMPLE PUMP IS ON 6HR/96HR
6PPSAMPI I	1.400E-03 YEARS	22.000 HOURS	PRBT SAMPLE PUMP ACTS AS AN IGNITION SOURCE
6ST3211F I	3.300E-05 HOURS	48.000 HOURS	PRBT TEMP SENSOR 3211A INACTIVE/FAILS LOW
6TKH2--4	1.000E+00 HOURS	1.000 HOURS	% TIME GEN BENZENE/H2 IN PRBT (96HR/96HR)
6TKO2--4	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN PRBT ABOVE MOC (TRUE)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

12 7.644E-03 CUT SET 13 MEAN TIME TO OCCURRENCE = 6.59785E+10 HOURS 7.53179E+06 YEARS

GROUP RANK CUMULATIVE/RESIDUAL
.970537/ 2.946E-02

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2NOCO	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7PPSAMP4	3.000E-02 HOURS	1.000 HOURS	MFT SAMPLE PUMP IS ON 3HR/96HR
7PPSAMPI I	1.400E-03 YEARS	48.000 HOURS	MFT SAMPLE PUMP ACTS AS AN IGNITION SOURCE
7ST3248F I	3.300E-05 HOURS	48.000 HOURS	MFT TEMP SENSOR 3248A INACTIVE/GENERATES FALSE L
7TKDO2--	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

I DENOTES INITIATING EVENT

INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

TOP EVENT PROBABILITY = 4.53966E-08

RANK IMPORTANCE

13 6.760E-03 CUT SET 18 MEAN TIME TO OCCURRENCE = 7.46003E+10 HOURS 8.51602E+06 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.977297/ 2.270E-02

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#6H2NOCO	1.000E+00 HOURS	1.000 HOURS	## PRBT BENZENE/H2 DEFLAG NO COOL H2O HEAT REMOV
#6H2TOP-	1.000E+00 HOURS	1.000 HOURS	## PRBT HYDROGEN DEFLAGRATION
6PPSAMP4	6.000E-02 HOURS	1.000 HOURS	PRBT SAMPLE PUMP IS ON 6HR/96HR
6PPSAMPI I	1.400E-03 YEARS	22.000 HOURS	PRBT SAMPLE PUMP ACTS AS AN IGNITION SOURCE
6TKH2--4	1.000E+00 HOURS	1.000 HOURS	% TIME GEN BENZENE/H2 IN PRBT (96HR/96HR)
6TKO2--4	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN PRBT ABOVE MOC (TRUE)
7CPDCS-Y I	2.000E-05 HOURS	48.000 HOURS	DCS INACTIVE/INITIATING
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

14 4.634E-03 CUT SET 16 MEAN TIME TO OCCURRENCE = 1.08831E+11 HOURS 1.24236E+07 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.981931/ 1.807E-02

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2NOCO	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7CPDCS-Y I	2.000E-05 HOURS	48.000 HOURS	DCS INACTIVE/INITIATING
7PPSAMP4	3.000E-02 HOURS	1.000 HOURS	MFT SAMPLE PUMP IS ON 3HR/96HR
7PPSAMPI I	1.400E-03 YEARS	48.000 HOURS	MFT SAMPLE PUMP ACTS AS AN IGNITION SOURCE
7TKDO2--	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

I DENOTES INITIATING EVENT

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

TOP EVENT PROBABILITY = 4.53966E-08

RANK IMPORTANCE

15 2.373E-03 CUT SET 86 MEAN TIME TO OCCURRENCE = 2.12495E+11 HOURS 2.42574E+07 YEARS
GROUP RANK CUMULATIVE/RESIDUAL

.986677/ 1.332E-02

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2NOCO	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7PPFD014	9.500E-01 HOURS	1.000 HOURS	MFT FEED PUMP 1 IS ON 95%
7PPFD01I I	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
7SW3248F I	3.000E-05 HOURS	48.000 HOURS	HI TEMP SW INACTIVE
7SW324AF	3.000E-05 HOURS	.500 MONTHS	HI HI TEMP SW 3248B FAILS TO GEN SIG
7TKDO2--	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

15 2.373E-03 CUT SET 87 MEAN TIME TO OCCURRENCE = 2.12506E+11 HOURS 2.42587E+07 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.986677/ 1.332E-02

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2NOCO	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7PPFD024	9.500E-01 HOURS	1.000 HOURS	MFT FEED PUMP 2 IS ON 95%
7PPFD02I I	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 2 ACTS AS AN IGNITION SOURCE
7SW3248F I	3.000E-05 HOURS	48.000 HOURS	HI TEMP SW INACTIVE
7SW324AF	3.000E-05 HOURS	.500 MONTHS	HI HI TEMP SW 3248B FAILS TO GEN SIG
7TKDO2--	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

I DENOTES INITIATING EVENT

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

TOP EVENT PROBABILITY = 4.53966E-08

RANK IMPORTANCE

16 1.669E-03 CUT SET 90 MEAN TIME TO OCCURRENCE = 3.02188E+11 HOURS 3.44963E+07 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.988346/ 1.165E-02

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2PURG	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO PURGE GAS FLOW
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7AG----4	1.000E+00 HOURS	1.000 HOURS	MFT AGITATOR IS ON (TRUE)
7AG----I I	1.400E-04 YEARS	48.000 HOURS	MFT AGITATOR ACTS AS AN IGNITION SOURCE
7RT0686P I	3.000E-06 HOURS	48.000 HOURS	MFT AIR PURGE ROTAMETER/ORIFICE PLUGS
7RT2.6H6	7.200E-01 HOURS	1.000 HOURS	FAIL TO REPAIR MFT PURGE ROTAMETER/ORIFICE IN 2.
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
7TKO2--4	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

17 1.187E-03 CUT SET 88 MEAN TIME TO OCCURRENCE = 4.24837E+11 HOURS 4.84974E+07 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.990720/ 9.280E-03

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2NOCO	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7HXCOOLF I	1.500E-05 HOURS	48.000 HOURS	MFT COOLING WATER COILS FOULED
7PPFD014	9.500E-01 HOURS	1.000 HOURS	MFT FEED PUMP 1 IS ON 95%
7PPFD01I I	1.400E-03 YEARS	48.000 HOURS	MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
7SW324AF	3.000E-05 HOURS	.500 MONTHS	HI HI TEMP SW 3248B FAILS TO GEN SIG
7TKDO2--	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE

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      VPPCONF4        1.000E+00 HOURS          1.000 HOURS     CPC TANK VENT LINES CONFINE AN
      VPPIMPR4        1.000E+00 HOURS          1.000 HOURS     AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

  I DENOTES INITIATING EVENT
1 ********************          CPC FTA --  EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC          **********

        INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

 STEADY STATE CALCULATIONS

   MISSION TIME             1.000E+00Y 3.000E+01Y
   EXPECT NO OF SYSTEM FAIL  1.737E-05  5.211E-04
 TOP EVENT PROBABILITY =  4.53966E-08

 RANK  IMPORTANCE


   17 1.187E-03  CUT SET     89 MEAN TIME TO OCCURRENCE =  4.24860E+11 HOURS 4.85000E+07 YEARS
                                GROUP RANK CUMULATIVE/RESIDUAL
                                           .990720/ 9.280E-03
      BASIC EVENT       FAILURE RATE       MEAN FAUL DURATION       BASIC EVENT DESCRIPTION

      #7H2NOCO        1.000E+00 HOURS          1.000 HOURS     ## MFT H2 DEFLAGRATION NO COOL WATER
      #7MFTTOP        1.000E+00 HOURS          1.000 HOURS     ## MFT HYDROGEN DEFLAGRATION
      7HXCOOLF I      1.500E-05 HOURS         48.000 HOURS     MFT COOLING WATER COILS FOULED
      7PPFD024        9.500E-01 HOURS          1.000 HOURS     MFT FEED PUMP 2 IS ON 95%
      7PPFD02I I      1.400E-03 YEARS         48.000 HOURS     MFT FEED PUMP 2 ACTS AS AN IGNITION SOURCE
      7SW324AF        3.000E-05 HOURS           .500 MONTHS    HI HI TEMP SW 3248B FAILS TO GEN SIG
      7TKDO2--        1.000E+00 HOURS          1.000 HOURS     OXYGEN CONC IN MFT ABOVE MOC (TRUE)
      7TKH2--4        1.000E+00 HOURS          1.000 HOURS     % OF TIME GEN H2 IN MFT (96HR/96HR)
      VPPAN--4        1.000E+00 HOURS          1.000 HOURS     SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
      VPPCONF4        1.000E+00 HOURS          1.000 HOURS     CPC TANK VENT LINES CONFINE AN
      VPPIMPR4        1.000E+00 HOURS          1.000 HOURS     AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

   18 7.915E-04  CUT SET     91 MEAN TIME TO OCCURRENCE =  6.37179E+11 HOURS 7.27374E+07 YEARS
                                GROUP RANK CUMULATIVE/RESIDUAL
                                           .992303/ 7.697E-03
      BASIC EVENT       FAILURE RATE       MEAN FAUL DURATION       BASIC EVENT DESCRIPTION

      #7H2NOCO        1.000E+00 HOURS          1.000 HOURS     ## MFT H2 DEFLAGRATION NO COOL WATER
      #7MFTTOP        1.000E+00 HOURS          1.000 HOURS     ## MFT HYDROGEN DEFLAGRATION
      7PPFD014        9.500E-01 HOURS          1.000 HOURS     MFT FEED PUMP 1 IS ON 95%
      7PPFD01I I      1.400E-03 YEARS         48.000 HOURS     MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
      7SW324AF        3.000E-05 HOURS           .500 MONTHS    HI HI TEMP SW 3248B FAILS TO GEN SIG
      7TKDO2--        1.000E+00 HOURS          1.000 HOURS     OXYGEN CONC IN MFT ABOVE MOC (TRUE)
      7TKH2--4        1.000E+00 HOURS          1.000 HOURS     % OF TIME GEN H2 IN MFT (96HR/96HR)
      7VL3252C I      1.000E-05 HOURS         48.000 HOURS     MFT COOLING WATER VALVE HCV 3252 FAILS CLOSED
      VPPAN--4        1.000E+00 HOURS          1.000 HOURS     SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
      VPPCONF4        1.000E+00 HOURS          1.000 HOURS     CPC TANK VENT LINES CONFINE AN
      VPPIMPR4        1.000E+00 HOURS          1.000 HOURS     AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

  I DENOTES INITIATING EVENT
1 ********************          CPC FTA --  EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC          **********

        INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

 STEADY STATE CALCULATIONS

   MISSION TIME             1.000E+00Y 3.000E+01Y
   EXPECT NO OF SYSTEM FAIL  1.737E-05  5.211E-04
 TOP EVENT PROBABILITY =  4.53966E-08

 RANK  IMPORTANCE


   18 7.914E-04  CUT SET     92 MEAN TIME TO OCCURRENCE =  6.37213E+11 HOURS 7.27412E+07 YEARS
                                GROUP RANK CUMULATIVE/RESIDUAL
                                           .992303/ 7.697E-03
      BASIC EVENT       FAILURE RATE       MEAN FAUL DURATION       BASIC EVENT DESCRIPTION

      #7H2NOCO        1.000E+00 HOURS          1.000 HOURS     ## MFT H2 DEFLAGRATION NO COOL WATER
      #7MFTTOP        1.000E+00 HOURS          1.000 HOURS     ## MFT HYDROGEN DEFLAGRATION
      7PPFD024        9.500E-01 HOURS          1.000 HOURS     MFT FEED PUMP 2 IS ON 95%
      7PPFD02I I      1.400E-03 YEARS         48.000 HOURS     MFT FEED PUMP 2 ACTS AS AN IGNITION SOURCE
      7SW324AF        3.000E-05 HOURS           .500 MONTHS    HI HI TEMP SW 3248B FAILS TO GEN SIG
      7TKDO2--        1.000E+00 HOURS          1.000 HOURS     OXYGEN CONC IN MFT ABOVE MOC (TRUE)
      7TKH2--4        1.000E+00 HOURS          1.000 HOURS     % OF TIME GEN H2 IN MFT (96HR/96HR)
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      7VL3252C I      1.000E-05 HOURS          48.000 HOURS     MFT COOLING WATER VALVE HCV 3252 FAILS CLOSED
      VPPAN--4        1.000E+00 HOURS           1.000 HOURS     SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
      VPPCONF4        1.000E+00 HOURS           1.000 HOURS     CPC TANK VENT LINES CONFINE AN
      VPPIMPR4        1.000E+00 HOURS           1.000 HOURS     AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

  19 5.007E-04  CUT SET     93 MEAN TIME TO OCCURRENCE =  1.00730E+12 HOURS 1.14989E+08 YEARS
                                    GROUP RANK CUMULATIVE/RESIDUAL
                                                .992804/ 7.196E-03
      BASIC EVENT       FAILURE RATE       MEAN FAUL DURATION       BASIC EVENT DESCRIPTION

      #7H2PURG        1.000E+00 HOURS           1.000 HOURS     ## MFT H2 DEFLAGRATION NO PURGE GAS FLOW
      #7MFTTOP        1.000E+00 HOURS           1.000 HOURS     ## MFT HYDROGEN DEFLAGRATION
      7PPSAMP4        3.000E-02 HOURS           1.000 HOURS     MFT SAMPLE PUMP IS ON 3HR/96HR
      7PPSAMPI I      1.400E-03 YEARS          48.000 HOURS     MFT SAMPLE PUMP ACTS AS AN IGNITION SOURCE
      7RT0686P I      3.000E-06 HOURS          48.000 HOURS     MFT AIR PURGE ROTAMETER/ORIFICE PLUGS
      7RT2.6H6        7.200E-01 HOURS           1.000 HOURS     FAIL TO REPAIR MFT PURGE ROTAMETER/ORIFICE IN 2.
      7TKH2--4        1.000E+00 HOURS           1.000 HOURS     % OF TIME GEN H2 IN MFT (96HR/96HR)
      7TKO2--4        1.000E+00 HOURS           1.000 HOURS     OXYGEN CONC IN MFT ABOVE MOC (TRUE)
      VPPAN--4        1.000E+00 HOURS           1.000 HOURS     SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
      VPPCONF4        1.000E+00 HOURS           1.000 HOURS     CPC TANK VENT LINES CONFINE AN
      VPPIMPR4        1.000E+00 HOURS           1.000 HOURS     AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

  I DENOTES INITIATING EVENT
1 ********************          CPC FTA --  EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC          **********************

         INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

 STEADY STATE CALCULATIONS

   MISSION TIME              1.000E+00Y 3.000E+01Y
   EXPECT NO OF SYSTEM FAIL  1.737E-05  5.211E-04
 TOP EVENT PROBABILITY =  4.53966E-08

 RANK  IMPORTANCE


  20 4.789E-04  CUT SET     94 MEAN TIME TO OCCURRENCE =  1.05305E+12 HOURS 1.20211E+08 YEARS
                                    GROUP RANK CUMULATIVE/RESIDUAL
                                                .993762/ 6.238E-03
      BASIC EVENT       FAILURE RATE       MEAN FAUL DURATION       BASIC EVENT DESCRIPTION

      #7H2NOCO        1.000E+00 HOURS           1.000 HOURS     ## MFT H2 DEFLAGRATION NO COOL WATER
      #7MFTTOP        1.000E+00 HOURS           1.000 HOURS     ## MFT HYDROGEN DEFLAGRATION
      7PPFD014        9.500E-01 HOURS           1.000 HOURS     MFT FEED PUMP 1 IS ON 95%
      7PPFD01I I      1.400E-03 YEARS          48.000 HOURS     MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
      7SW324AF        3.000E-05 HOURS            .500 MONTHS    HI HI TEMP SW 3248B FAILS TO GEN SIG
      7TKD02--        1.000E+00 HOURS           1.000 HOURS     OXYGEN CONC IN MFT ABOVE MOC (TRUE)
      7TKH2--4        1.000E+00 HOURS           1.000 HOURS     % OF TIME GEN H2 IN MFT (96HR/96HR)
      OTWCTW-F I      5.300E-02 YEARS          48.000 HOURS     INADEQUATE COOLING TOWER WATER HEAT REMOVAL
      VPPAN--4        1.000E+00 HOURS           1.000 HOURS     SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
      VPPCONF4        1.000E+00 HOURS           1.000 HOURS     CPC TANK VENT LINES CONFINE AN
      VPPIMPR4        1.000E+00 HOURS           1.000 HOURS     AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

  20 4.789E-04  CUT SET     95 MEAN TIME TO OCCURRENCE =  1.05310E+12 HOURS 1.20217E+08 YEARS
                                    GROUP RANK CUMULATIVE/RESIDUAL
                                                .993762/ 6.238E-03
      BASIC EVENT       FAILURE RATE       MEAN FAUL DURATION       BASIC EVENT DESCRIPTION

      #7H2NOCO        1.000E+00 HOURS           1.000 HOURS     ## MFT H2 DEFLAGRATION NO COOL WATER
      #7MFTTOP        1.000E+00 HOURS           1.000 HOURS     ## MFT HYDROGEN DEFLAGRATION
      7PPFD024        9.500E-01 HOURS           1.000 HOURS     MFT FEED PUMP 2 IS ON 95%
      7PPFD02I I      1.400E-03 YEARS          48.000 HOURS     MFT FEED PUMP 2 ACTS AS AN IGNITION SOURCE
      7SW324AF        3.000E-05 HOURS            .500 MONTHS    HI HI TEMP SW 3248B FAILS TO GEN SIG
      7TKD02--        1.000E+00 HOURS           1.000 HOURS     OXYGEN CONC IN MFT ABOVE MOC (TRUE)
      7TKH2--4        1.000E+00 HOURS           1.000 HOURS     % OF TIME GEN H2 IN MFT (96HR/96HR)
      OTWCTW-F I      5.300E-02 YEARS          48.000 HOURS     INADEQUATE COOLING TOWER WATER HEAT REMOVAL
      VPPAN--4        1.000E+00 HOURS           1.000 HOURS     SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
      VPPCONF4        1.000E+00 HOURS           1.000 HOURS     CPC TANK VENT LINES CONFINE AN
      VPPIMPR4        1.000E+00 HOURS           1.000 HOURS     AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

  I DENOTES INITIATING EVENT
1 ********************          CPC FTA --  EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC          **********************

         INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

 STEADY STATE CALCULATIONS
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  MISSION TIME              1.000E+00Y 3.000E+01Y
  EXPECT NO OF SYSTEM FAIL  1.737E-05  5.211E-04
TOP EVENT PROBABILITY =  4.53966E-08

RANK  IMPORTANCE


  21 4.376E-04  CUT SET     96 MEAN TIME TO OCCURRENCE =  1.15243E+12 HOURS 1.31556E+08 YEARS
                                    GROUP RANK CUMULATIVE/RESIDUAL
                                                .994199/ 5.801E-03
       BASIC EVENT       FAILURE RATE       MEAN FAUL DURATION       BASIC EVENT DESCRIPTION

       #6H2NOCO        1.000E+00 HOURS          1.000 HOURS     ## PRBT BENZENE/H2 DEFLAG NO COOL H2O HEAT REMOV
       #6H2TOP-        1.000E+00 HOURS          1.000 HOURS     ## PRBT HYDROGEN DEFLAGRATION
       6PPXFER4        2.400E-01 HOURS          1.000 HOURS     PRBT TRANSFER PUMP IS ON 23HR/96HR
       6PPXFERI I      1.400E-03 YEARS         22.000 HOURS     PRBT TRANSFER PUMP ACTS AS AN IGNITION SOURCE
       6SW3211F I      3.000E-05 HOURS         48.000 HOURS     HI TEMP SW 3211 INACTIVE
       6SW321AF        3.000E-05 HOURS           .500 MONTHS    HI HI TEMP SW 3211 INACTV/FAILS GEN SIGNAL
       6TKH2--4        1.000E+00 HOURS          1.000 HOURS     % TIME GEN BENZENE/H2 IN PRBT (96HR/96HR)
       6TKO2--4        1.000E+00 HOURS          1.000 HOURS     OXYGEN CONC IN PRBT ABOVE MOC (TRUE)
       VPPAN--4        1.000E+00 HOURS          1.000 HOURS     SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
       VPPCONF4        1.000E+00 HOURS          1.000 HOURS     CPC TANK VENT LINES CONFINE AN
       VPPIMPR4        1.000E+00 HOURS          1.000 HOURS     AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

  22 4.030E-04  CUT SET    138 MEAN TIME TO OCCURRENCE =  1.25135E+12 HOURS 1.42849E+08 YEARS
                                    GROUP RANK CUMULATIVE/RESIDUAL
                                                .995005/ 4.995E-03
       BASIC EVENT       FAILURE RATE       MEAN FAUL DURATION       BASIC EVENT DESCRIPTION

       #7H2NOCO        1.000E+00 HOURS          1.000 HOURS     ## MFT H2 DEFLAGRATION NO COOL WATER
       #7MFTTOP        1.000E+00 HOURS          1.000 HOURS     ## MFT HYDROGEN DEFLAGRATION
       7PPFD014        9.500E-01 HOURS          1.000 HOURS     MFT FEED PUMP 1 IS ON 95%
       7PPFD01I I      1.400E-03 YEARS         48.000 HOURS     MFT FEED PUMP 1 ACTS AS AN IGNITION SOURCE
       7SW324AF        3.000E-05 HOURS           .500 MONTHS    HI HI TEMP SW 3248B FAILS TO GEN SIG
       7TKD02--        1.000E+00 HOURS          1.000 HOURS     OXYGEN CONC IN MFT ABOVE MOC (TRUE)
       7TKH2--4        1.000E+00 HOURS          1.000 HOURS     % OF TIME GEN H2 IN MFT (96HR/96HR)
       7VK3252U I      1.000E-05 HOURS          1.000 HOURS     OPERATOR INADVERTENTLY CLOSES HCV 3252
       VPPAN--4        1.000E+00 HOURS          1.000 HOURS     SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
       VPPCONF4        1.000E+00 HOURS          1.000 HOURS     CPC TANK VENT LINES CONFINE AN
       VPPIMPR4        1.000E+00 HOURS          1.000 HOURS     AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

  I DENOTES INITIATING EVENT
1 ********************              CPC FTA --  EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC          **********************

          INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

  MISSION TIME              1.000E+00Y 3.000E+01Y
  EXPECT NO OF SYSTEM FAIL  1.737E-05  5.211E-04
TOP EVENT PROBABILITY =  4.53966E-08

RANK  IMPORTANCE


  22 4.030E-04  CUT SET    139 MEAN TIME TO OCCURRENCE =  1.25148E+12 HOURS 1.42863E+08 YEARS
                                    GROUP RANK CUMULATIVE/RESIDUAL
                                                .995005/ 4.995E-03
       BASIC EVENT       FAILURE RATE       MEAN FAUL DURATION       BASIC EVENT DESCRIPTION

       #7H2NOCO        1.000E+00 HOURS          1.000 HOURS     ## MFT H2 DEFLAGRATION NO COOL WATER
       #7MFTTOP        1.000E+00 HOURS          1.000 HOURS     ## MFT HYDROGEN DEFLAGRATION
       7PPFD024        9.500E-01 HOURS          1.000 HOURS     MFT FEED PUMP 2 IS ON 95%
       7PPFD02I I      1.400E-03 YEARS         48.000 HOURS     MFT FEED PUMP 2 ACTS AS AN IGNITION SOURCE
       7SW324AF        3.000E-05 HOURS           .500 MONTHS    HI HI TEMP SW 3248B FAILS TO GEN SIG
       7TKD02--        1.000E+00 HOURS          1.000 HOURS     OXYGEN CONC IN MFT ABOVE MOC (TRUE)
       7TKH2--4        1.000E+00 HOURS          1.000 HOURS     % OF TIME GEN H2 IN MFT (96HR/96HR)
       7VK3252U I      1.000E-05 HOURS          1.000 HOURS     OPERATOR INADVERTENTLY CLOSES HCV 3252
       VPPAN--4        1.000E+00 HOURS          1.000 HOURS     SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
       VPPCONF4        1.000E+00 HOURS          1.000 HOURS     CPC TANK VENT LINES CONFINE AN
       VPPIMPR4        1.000E+00 HOURS          1.000 HOURS     AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

  23 2.805E-04  CUT SET    100 MEAN TIME TO OCCURRENCE =  1.79799E+12 HOURS 2.05249E+08 YEARS
                                    GROUP RANK CUMULATIVE/RESIDUAL
                                                .995286/ 4.714E-03
       BASIC EVENT       FAILURE RATE       MEAN FAUL DURATION       BASIC EVENT DESCRIPTION
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#6H2PURG	1.000E+00 HOURS	1.000 HOURS	## PRBT BENZENE/H2 DEFLAGRATION NO PURGE
#6H2TOP-	1.000E+00 HOURS	1.000 HOURS	## PRBT HYDROGEN DEFLAGRATION
6PPXFER4	2.400E-01 HOURS	1.000 HOURS	PRBT TRANSFER PUMP IS ON 23HR/96HR
6PPXFERI I	1.400E-03 YEARS	22.000 HOURS	PRBT TRANSFER PUMP ACTS AS AN IGNITION SOURCE
6RT17.96	1.100E-01 HOURS	1.000 HOURS	FAIL TO REPAIR ROTAMTR/ORIFICE IN 17.9 HRS
6RT3219P I	3.000E-06 HOURS	22.000 HOURS	PRBT AIR PURGE RTM/ORF PLUGS
6TKH2--4	1.000E+00 HOURS	1.000 HOURS	% TIME GEN BENZENE/H2 IN PRBT (96HR/96HR)
6TKO2--4	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN PRBT ABOVE MOC (TRUE)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

I DENOTES INITIATING EVENT

1 ********** CPC FTA -- EXPLOSION OF AMMONIUM NITRATE WITHIN THE CPC **********

INITIATOR (BARLOW-PROSCHAN) MEASURE OF CUT SET IMPORTANCE (MEASURE OF INTERVAL RELIABILITY)

STEADY STATE CALCULATIONS

MISSION TIME	1.000E+00Y	3.000E+01Y
EXPECT NO OF SYSTEM FAIL	1.737E-05	5.211E-04

TOP EVENT PROBABILITY = 4.53966E-08

RANK IMPORTANCE

24 2.498E-04 CUT SET 97 MEAN TIME TO OCCURRENCE = 2.01880E+12 HOURS 2.30457E+08 YEARS
GROUP RANK CUMULATIVE/RESIDUAL
.995536/ 4.464E-03

BASIC EVENT	FAILURE RATE	MEAN FAUL DURATION	BASIC EVENT DESCRIPTION
#7H2NOCO	1.000E+00 HOURS	1.000 HOURS	## MFT H2 DEFLAGRATION NO COOL WATER
#7MFTTOP	1.000E+00 HOURS	1.000 HOURS	## MFT HYDROGEN DEFLAGRATION
7AG----4	1.000E+00 HOURS	1.000 HOURS	MFT AGITATOR IS ON (TRUE)
7AG----I I	1.400E-04 YEARS	48.000 HOURS	MFT AGITATOR ACTS AS AN IGNITION SOURCE
7SW3248F I	3.000E-05 HOURS	48.000 HOURS	HI TEMP SW INACTIVE
7SW324AF	3.000E-05 HOURS	.500 MONTHS	HI HI TEMP SW 3248B FAILS TO GEN SIG
7TKDO2--	1.000E+00 HOURS	1.000 HOURS	OXYGEN CONC IN MFT ABOVE MOC (TRUE)
7TKH2--4	1.000E+00 HOURS	1.000 HOURS	% OF TIME GEN H2 IN MFT (96HR/96HR)
VPPAN--4	1.000E+00 HOURS	1.000 HOURS	SUFF AN FORMS IN CPC TNK VNT LNS/TRUE
VPPCONF4	1.000E+00 HOURS	1.000 HOURS	CPC TANK VENT LINES CONFINE AN
VPPIMPR4	1.000E+00 HOURS	1.000 HOURS	AN SENSITIZED BY IMPURES IN CPC TNK VNT LNS/TRUE

I DENOTES INITIATING EVENT