Attachment 4

North Anna Power Station Units 1 and 2
Emergency Diesel Generator
Preventive Maintenance Inspection Outage

PROBABILISTIC SAFETY ASSESSMENT

August 1995

VIRGINIA ELECTRIC AND POWER COMPANY

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1.0 INTRODUCTION

This report was prepared to document the feasibility of a 14-day outage on-line (Modes 1, 2, 3 and 4) for preventive maintenance and inspection of each emergency diesel generator (EDG) once every 18 months. The alternate A.C. diesel generator (AAC DG) recently installed at North Anna is assumed to be operable during the performance of this EDG preventive maintenance and inspection. It has been determined that the increase in risk associated with performance of the 18-month diesel preventive maintenance and inspection on-line is acceptably small. Based on this conclusion, a request for revised North Anna Power Station Technical Specifications associated with EDG outage time is being proposed. This report is being prepared to serve as an attachment to the licensing package.

Section 2 presents background information on the reason for the request and a summary description of the relevant systems including a description of the AAC DG. Section 3 contains a discussion of the PSA analysis performed. Section 4 presents a discussion of acceptable risk increases. Implementation requirements are provided in Section 5. Section 6 contains conclusions. References are provided as footnotes.

2.0 BACKGROUND INFORMATION

The EDGs installed at North Anna Power Station were manufactured by Fairbanks-Morse. The manufacturer recommends that an extensive inspection of these diesels be performed every 18 months. Currently, this maintenance is performed during shutdown conditions as required by Technical Specifications. Because the inspections require at least ten days to complete, a significant burden is placed on the maintenance crews to perform this work along with the many other tasks that must be performed during an outage.

Virginia Power has determined that the substantial benefits of performing this maintenance on-line justify the negligible increase in risk for at-power conditions because of the decrease in risk achieved due:

- to installation of the AAC DG,
- to improved maintenance quality resulting from focused resources on the EDG maintenance, and
- to less EDG unavailability during shutdown (i.e., Modes 5 and 6) which lowers shutdown risk.

The following sections provide a description of the generators and the power distribution system. This background information is important because it provides an understanding of the various sources of A.C. power and of the path to the emergency bus.

2.1 Emergency Diesel Generator

The Emergency Generator (EG) System provides a reliable source of emergency electric power to Engineered Safeguards Features(ESFs) and other essential loads in the event of a Loss of Off-site Power (LOOP)[1]. The EG System consists of two 100-percent capacity Emergency Diesel Generator (EDG) sets in each unit. Each EDG independently powers a train of safety-related equipment, thereby providing redundancy in the event of loss of an EDG. Each EDG in a unit will automatically start when a safety injection signal from its associated train is present. Each EDG in a unit will automatically start with a pre-set time delay upon sensing either undervoltage or degraded voltage on its associated 4kV bus or an improper 4kV supply breaker lineup. Then, an EDG output breaker closes, and loads connect sequentially to the emergency bus if the residual voltage on the bus is less than 30 percent, a degraded or undervoltage exists, the 4kV buses are aligned properly, the EDG volts are greater than 95 percent, and the EDG output breaker lock-out and EDG differential breaker relay are reset. Each EDG is initiated automatically or manually and consists of a diesel engine, governor, generator with excitation system, controls, battery and charger, and the following subsystems: starting air, fuel oil, scavenging air and exhaust, lubricating oil, jacket cooling, and air cooling.

The diesel engine provides sufficient mechanical power to drive a generator with a 2,000 hr/yr rating of not less than 3,000kW, both mounted on a sub-base. The governor is furnished with an adjustable speed droop, load limit, and remote speed control for 125V dc operation

The EG System may be operated from the Main Control Room or from the Diesel Generator Rooms. Control circuits are provided for local and remote operation of the engine, generator and generator output breakers. The engine initiation signals are provided from the Emergency Electrical Power (EE) System (under/degraded voltage) and the Reactor Protection System (RPS) safety injection signal.

The generator and exciter provide a 2000 hr/yr capacity of 3,000 Kw at 4160V, 60 cycles. The generator uses a brushless exciter and rectifier assembly to provide excitation to the main generator field. Space heaters are provided for insulation protection.

The EDG battery and battery charger provide power for flashing the generator field, powering the dc fuel oil pump, powering the speed control motor, operating the air starting solenoids, and providing power for EDG control circuits voltage regulation and protective relays.

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[1]The information in this section is taken from the SDBD document "Emergency Diesel Generator System, North Anna Power Station," SDBD-NAPS-EG, Rev. 1, Section 3.1, 12/31/93

The starting air subsystem for each EDG consists of two independent, separate trains of equipment and piping that deliver compressed air to the diesel engine. Either train is capable of starting the engine without outside electric power.

Each starting air train has an air receiver (tank) that stores a sufficient vol'me of compressed air to provide five diesel engine starts without recharge. Each air receiver is kept charged by an electric motor-driven air compressor powered from the Emergency Electrical Power (EE) System. Each compressor has a small diesel engine backup drive that can be manually connected in the event of loss of electric power.

The fuel oil (FO) subsystem consists of underground fuel storage tanks, fuel transfer pumps, and engine delivery and injection components. The fuel oil is stored in two safety-related underground fuel oil storage tanks (one per unit) which contain sufficient capacity to provide continuous operation of one EDG in each unit at full load for 7 days. The underground fuel oil storage tanks are filled from the aboveground non-safety-related FO System which provides fuel oil for all site needs. For each EDG, one ready fuel oil transfer pump takes suction from one of the two underground fuel oil storage tanks, and one standby fuel oil transfer pump takes suction from the other tank. Either transfer pump fills and maintains the proper level of the day tank required for diesel generator operation. The day tank has sufficient capacity to support a fully loaded engine for at least 3 hours.

The scavenging air and exhaust subsystem provides pressurized air to the diesel engine cylinders for combustion, and aids in exhausting the combustion gases.

The lubricating oil (LO) subsystem consists of an engine-driven pump, full-flow filter, cooler, strainer, immersion heater, motor-driven prelube pump, and a standby circulating pump. This subsystem provides cleaned and cooled lube oil to the diesel engine and its components during operation.

The air-cooling subsystem consists of an engine-driven pump, a three-way mixing valve, radiators, and aircoolers (aftercooler). This subsystem removes heat from the combustion air in the scavenging air and exhaust subsystem. A three-way mixing valve controls the flow through the radiators. During EDG operation, an engine-driven air cooling pump circulates cooling water through the radiators for cooling and then to the aftercoolers in the scavenging air and exhaust subsystem. Cooling water is also circulated through the radiator fan gear box cooler. The radiator fan assembly provides forced air flow over the radiators in both the jacket cooling and air cooling subsystems by drawing ambient air into the Diesel Generator Room, over the radiator fins, and exhausting through the roof.

2.2 Emergency Electrical Power System

The Emergency Electrical Power (EE) System provides a highly reliable power source to Class 1E loads and certain non-Class 1E loads during all plant conditions[2]. Figures 1 and 2 show one line diagrams of the emergency buses for Unit 1 and Unit 2 respectively. The EE System consists of two redundant power distribution systems. One system is referred to as the train A (orange; H) system. The other system is referred to as the train B (purple; J) system. Each EE System train consists of a 4160V switchgear, two 480V load centers, and 480V MCCs, which supply power to motors, motor-operated valves (MOVs), heaters, lighting, and other loads, which are required to be powered during normal and design basis event plant operating conditions.

Each train is normally energized continuously from the switchyard external grid system. This preferred power supply is available from the reserve station service transformers (RSSTs) via the transfer buses. Upon loss of the switchyard "preferred power supply," each EE System train is supplied by a "standby power supply," which consists of an on-site EDG. There are a total of four EDGs at North Anna, two per unit. Each 100-percent capacity EDG is connected to its assigned train and is available to pick up load within 10 seconds after receipt of a start signal. The Class 1E loads are loaded onto the EDGs sequentially.

An additional supply source for the Unit 1H bus is the connection from the 1H bus to the 1B bus. The 1B bus may be energized in the startup or shutdown mode from RSST B (Figure 1). In addition, if the main generator breaker is open, the 1H bus may be supplied through the main transformer, the unit station service transformer, and the 1B bus tie. In a similar manner, the 1J bus may be supplied from the 2B bus. However, the only source of supply to the 2B bus, except for when Unit 2 is operating, is from RSST B.

An additional off-site source of Unit 2 normal station service power can be made available in 8 hours by removing the isolated bus duct disconnect links, backfeeding through the main transformers, and utilizing the normal station service transformers. The 2B bus then can serve as an alternative power source to power the emergency bus 1J for Unit 1. To minimize low-voltage effects on equipment during an EE System emergency bus transfer from the off-site source to the diesel generators, the 4.16kV Class 1E bus is divided into two sections: the normal Class 1E bus section and the stub bus section, which are connected via the stub bus tie breaker. The stub bus section supplies the component cooling and residual heat removal loads, which are not immediately required during an accident condition. These loads on the stub

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[2]The information in this section is taken from the SDBD document "Emergency Power System, North Anna Power Station," SDBD-NAPS-EP, Rev. 1, Section 3.1, 12/31/93

bus are disconnected due to undervoltage on the bus, i.e., during transfer from the off-site to the on-site source, and may be reconnected either manually or automatically. In addition, when a containment depressurization actuation (CDA) signal occurs, the stub bus tie breaker is tripped and locked out.

For Unit 2, either 4160V emergency bus may be connected to the emergency bus of the opposite train, by an administratively controlled bus tie breaker. This connection permits Class 1E equipment of one train to be powered by its opposite train emergency bus, which can get its power from either the RSST or EDG. Unit 1 does not have this emergency bus tie breaker installed.

2.3 Alternate A.C. Diesel

The AAC DG is a Caterpillar 3612, four cycle, turbocharged, after-cooled, diesel engine. The AAC DG engine will operate at 900 RPM, 4640 horsepower, to produce 3300 electrical kilowatts on a continuous basis. In addition, the engine will be capable of a "2000" hour rating of 3640 kilowatts.

The fuel oil system consists of a day tank sized to allow diesel operation for up to four hours without replenishment. The fill system for the diesel engine day tank utilizes the auxiliary boiler fuel transfer pump with a supply line routed from the Auxiliary Boiler Building to the Alternate A.C. (AAC) Building. Filling of the day tank is an automatic process with pump and valve activation based on tank level. Additionally, a gravity fed bypass of the pump is available.

The AAC DG can be started by local operator action or by receiving an auto start signal following the simultaneous loss of the D or E and F transfer buses. This logic will prevent unnecessary diesel starts when a single emergency bus is lost (one RSST) on a unit, while providing a diesel start when the potential exists for a station blackout (i.e., loss of both emergency buses on a unit). After it has started, the diesel will be available for manual loading onto the desired transfer bus and subsequent emergency bus as shown in Figure 1 and Figure 2 for Unit 1 and Unit 2 respectively.

Based on the train specific (loads powered from H buses only or J buses only) nature of some common systems, especially instrument air, it is desirable to power a H and a J bus in order to deal with a station blackout. Therefore, if the H EDG is providing power to the non-blacked out unit, then the AAC DG will, if possible, power the J bus on the blacked out unit. It is possible that an operator can power a J bus on both the blacked out and non-blacked out unit. Then the operator will have to take appropriate actions to restore power to an air compressor or to perform necessary actions without compressed air.

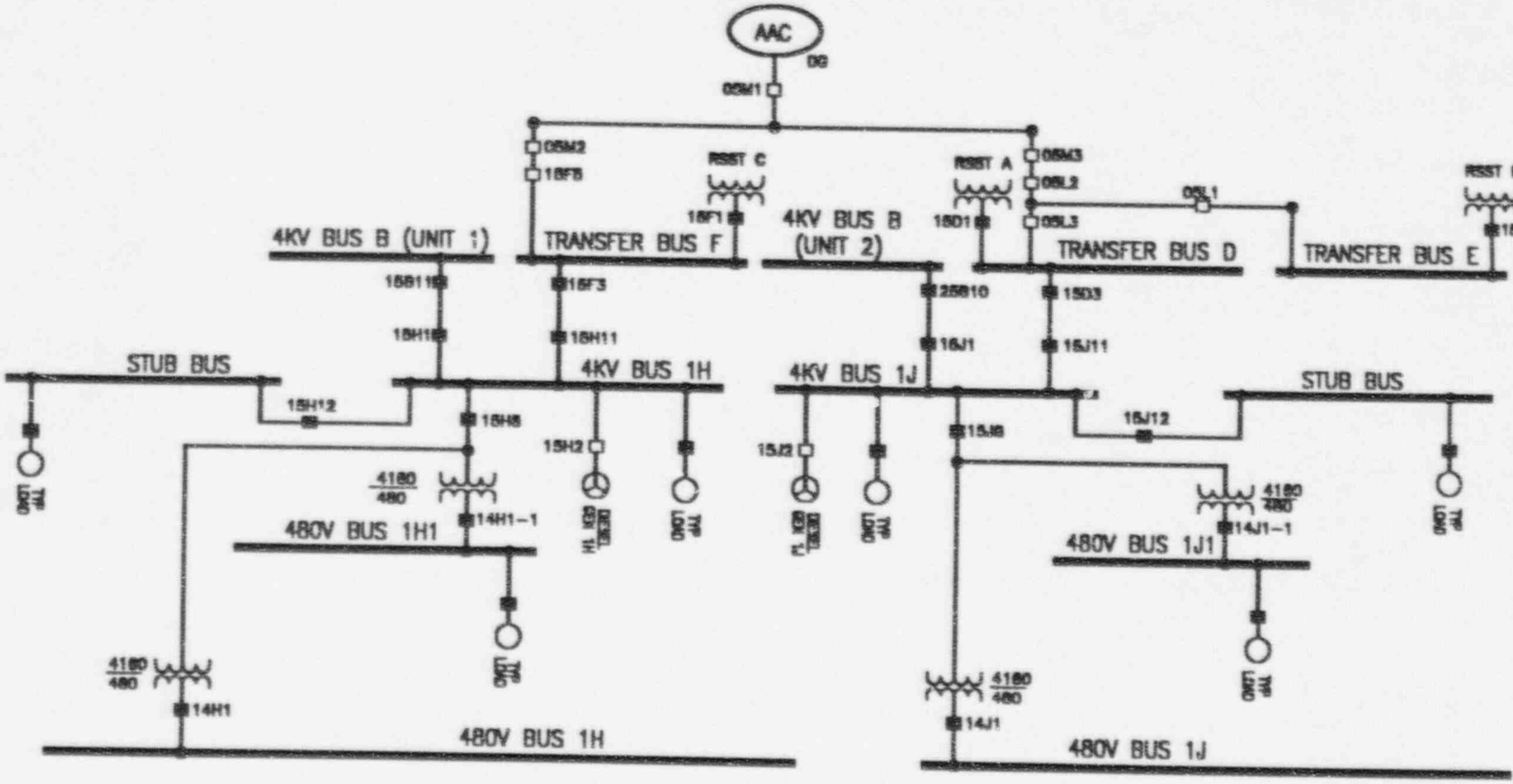

Figure 1 - Power Supply to 1H and 1J Emergency Buses

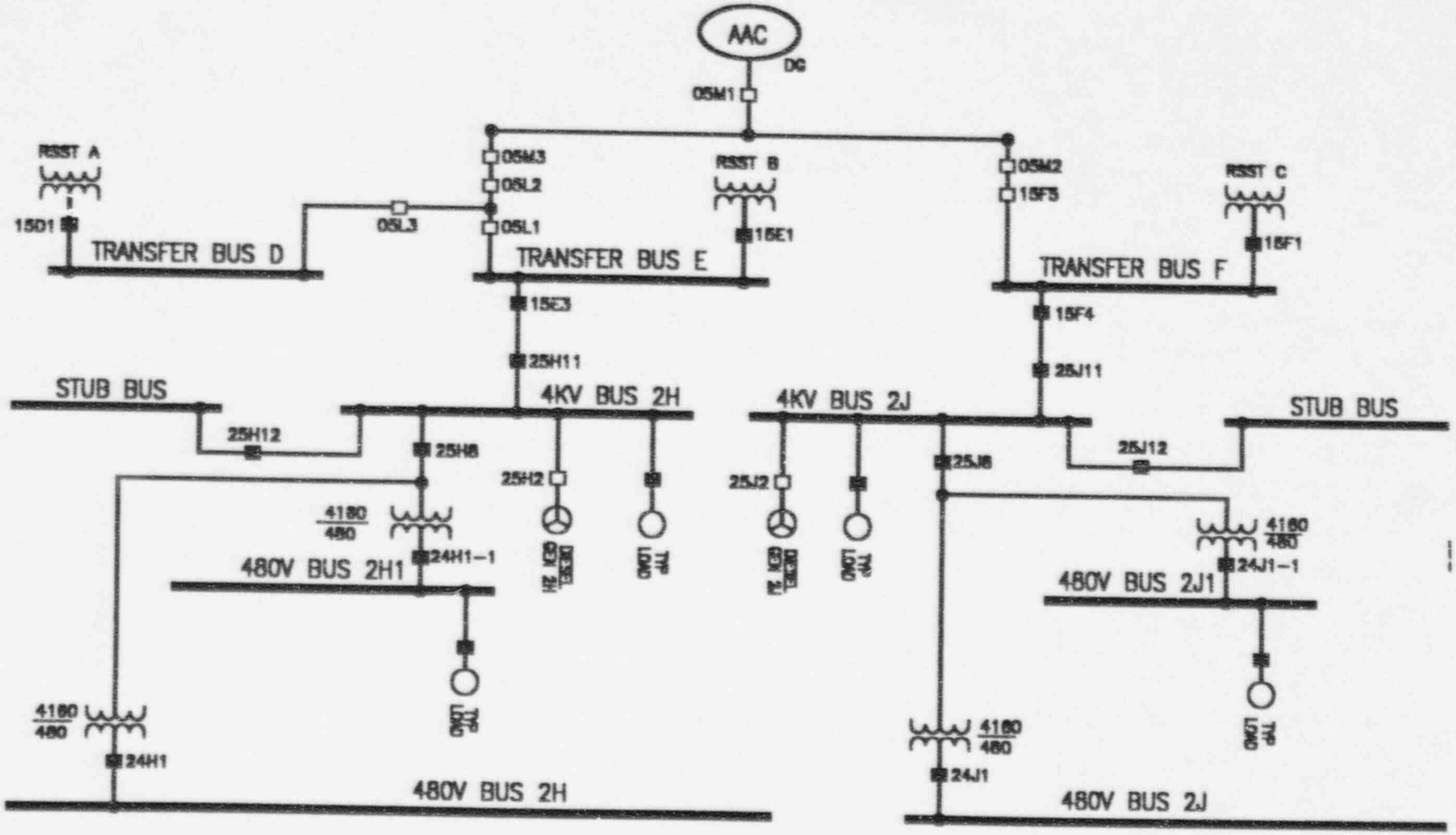

Figure 2 - Power Supply to the 2H and 2J Emergency Buses

Before Station Blackout (SBO) modifications were made the normal off-site feeder breakers from the transfer buses to the emergency buses (15D3, 15E3, 15F3 and 15F4) were tripped and blocked from closing following a loss of off-site power, a RSST differential trip, a pilot wire trip or a trip of their associated main transfer bus breaker (15D1, 15E1 or 15F1). These non-safety related breakers, however, must be closed during a SBO with any or all of the mentioned conditions present. This has been accomplished by adding a "NORMAL/AAC" switch on the AAC breaker control panel for each breaker (15D3, 15E3, 15F3, 15F4). In the "AAC" position, this switch will bypass/defeat the trip and close interlocks stated above. Once the transfer bus breaker is closed, the associated emergency bus breaker may be closed and the desired emergency bus energized. The ability to close these breakers with 15D1, 15E1, and 15F1 open has been proven during start up testing.

The existing electrical separation requirements which pertain to circuits related to the D and E versus the F transfer bus system and its feeders have been maintained. The new switchgear provides isolation of the AAC source from the normally energized transfer buses. This arrangement also minimizes the increase in exposure of the energized transfer buses during normal operation by maintaining them in their associated Switchgear Room.

Diesel control panels are provided in the AAC Building. Three panels are provided by the diesel manufacturer and contain the controls required for manual diesel operation, and the operation of its support equipment as well as recording parameter variation with time. General annunciation is provided remotely in the Control Room to indicate diesel trouble/diesel tripped/diesel running/RSST A paralleled with RSST B/bus OL and breaker 15F5 alarms. Specific problem annunciation is provided locally to enhance troubleshooting efforts.

A bus relaying panel is located adjacent to the diesel generator monitoring panel. This panel is supplied by the switchgear manufacturer. The panel contains the generator protection relaying. There is also a control panel installed adjacent to the diesel generator control panels which provides remote control of the new AAC system breakers. These breakers were added to provide the electrical connection between the transfer bus and the AAC DG.

2.4 Description of EDG Preventive Maintenance Inspection

Once every 18 months each of the EDG undergoes preventive maintenance and inspection appropriate for diesels used for this class of standby service. This maintenance involves disassembly of the major subsystems in order to clean and inspect components. A list of the components which are included follows:

Inspection Covers and Exhaust Manifold
Crankshaft Coupler Pointer Check
Crank Leak Check
Fuel Injection Timing Check
Inspection of Fuel Oil Pump Shaft Seal
Inspection of Governor and Fuel Pump Drive
Inspection of Lube Oil Pump and Coolant Pump Drive Gears
Inspection of Upper Torsional Dampers
Inspection of Lower Torsional Dampers
Inspection of Lube Oil Internal Piping
Inspection of Pistons, Rings, and Cylinder Liners
Inspection of Blower Flexible Drive, Timing Gears and Spring Packs
Inspection of Timing Chain, Sprocket and Sprocket Bearing
Measuring Lower Crankshaft Strain on Cylinders No. 11 and 12
Upper and Lower Main and Connecting Rod Bearing Inspection
Inspection of Vertical Drive Shaft Gears and Coupling
Checking Crankshaft Thrust Bearing Clearance
Checking Torque of Crankshaft Coupling Bolts
Fuel Injection Nozzle Opening Pressure Check and Seal Leakage Check
Air-Start Check Valve and Distributor Inspection
Inspection of Cooling Water Side of Lube Oil Cooler
Engine Block Coolant Hydrostatic Test
Cleaning and Inspection of Crankcase Assembly and Cleaning Oil separator/Breather
Lube Oil System Maintenance
Fuel Oil Day Tank Foot Valve Strainer Maintenance
Changing Oil in Woodward EG-B10 Governor
Blower Lobe and Housing Clearances
Blower Inlet Air Filter Inspection
Installing Exhaust Manifold and Engine Inspection Covers
Cleaning Standby Lube Oil Heater
Refilling Engine Sump (If Drained)

Historically, this maintenance has been performed during refueling outages (i.e., Modes 5 and 6) when Technical Specifications require only one EDG to be operable. A review of the maintenance records, by station personnel, shows that the above list of activities requires about fourteen days to complete in the worst case. On average it takes about ten days to perform this work (i.e., with no unplanned additional activities).

Two crews work to support the EDG maintenance. Obviously, this represents a cost that will be incurred regardless of when the diesel is maintained. However, if the EDG inspection can be performed when the unit is on-line, the crews doing this maintenance can work on other outage activities during refueling operations. So, more of the outage work can be performed by Virginia Power personnel. This action represents a cost savings because there are fewer contractor personnel required. In addition it is estimated that one day of critical outage time can be realized using this approach.

3.0 PSA ANALYSIS

The PSA analysis was performed with a model of North Anna that represents the current operation of the station. The IPEEE model was upgraded and enhanced, including use of the newest version of NUPRA[3]. Each stage of the development is summarized below.

- Upgrade, enhance and solve the IPEEE model using the latest version of NUPRA.(EDG-TM)
- Update the plant specific EDG unavailability data used in the IPE to account for operating practices during the last five years. (NO-AAC)
- Add the AAC DG to the current model with the updated data. (95JUNE)
- Increase the maintenance unavailability of the EDG to represent the single 14-day outage per 18 months for each EDG. (EDG-AOT)
- Run a sensitivity case with EDG unavailability extended beyond the 14-day window. (BOUNDING)

3.1 Comparison to IPE model

The North Anna IPE model was submitted to NRC in December 1992[4]. A request for additional information (RAI) was received and the response was submitted on April 28, 1995[5]. The IPEEE model, submitted in June 1994[6], is similar to the IPE model but

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[3]"NUPRA 2.2 Users Manual," NUS Corporation, March 1994.

[4]"North Anna Power Station Units 1 and 2 Response to Generic Letter 88-20 and Supplement 1, Individual Plant Examination (IPE) for Severe Accident vulnerabilities," Letter from W.L.Stewart to USNRC, Serial No. 92-774, December 1992 with Final Report as Enclosure.

[5]"North Anna Power Station Units 1 and 2 Individual Plant Examination (IPE), Request for Additional Information," Letter from M.L. Bowling to USNRC, Serial No. 94-740A with enclosure.

incorporates plant changes and model enhancements since the IPE model was completed. Two minor hardware modifications thought to have significance to prevention of core damage were added to the model. They were a tie-in to the bearing cooling system to create an alternate supply of cooling water to the emergency switchgear room chillers and the capability to use fire water as a backup supply to the charging pump lube oil heat exchangers. The PSA model was solved with these modifications included and the result was a slightly lower overall CDF.

Some model enhancements and event tree structure changes were also made to the IPE model. The model enhancements were made to take advantage of increased computing capability and reduce manual iterations. The primary event tree changes include developed fault trees for equipment from the unaffected unit. The trees affected by this change are loss of seal cooling (T4), loss of service water (T6), and loss of emergency room switchgear cooling, (T8). Table 3.1 summarizes the event trees used in each model.

There are significantly more event trees listed for the IPEEE than the IPE. The number of accident initiators remains the same in both models. The original event trees were split into smaller trees with less sequences to improve the utility of the two trees. For example, by splitting the large LOCA tree into two the number of sequences on each page is cut in half and therefore is much easier to read. The accident sequence structure did not change for most accident initiators. However, as mentioned above the structure of the T4, T6 and T8 trees were changed. Each of these trees is discussed below.

The T4 tree modification involves an alternate interpretation of the seal LOCA model. In the IPE, successful depressurization was assumed to avoid a seal LOCA. Following the IPE solution, it was evident that this depressurization assumption did not significantly affect overall CDF, and a more conservative approach could be adopted. Therefore, for the IPEEE, the depressurization function was assigned a value of 1.0. The impact of this change is that core damage can only be avoided if the loss of seal cooling is mitigated using the core cooling recovery strategy given in the emergency response guidelines. The T4 contribution to core damage frequency doubles, relative to the IPE, to ~2E-8/yr. Hence the change is not significant but represents consistent seal LOCA modeling among the event trees.

The loss of service water tree (T6) was changed more substantially. Given the loss of service water there is a loss of RC pump seal cooling and ESGR cooling. Either of these lead to core damage by causing a seal LOCA unless a different heat sink can be found. Fortunately, another heat sink is available for each component. The use of

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[6]"Individual Plant Examination Of Non-Seismic External Events and Fires, North Anna Power Station, Units 1 and 2," Final Report Volumes 1 and 2, April 1994.

these alternate heat sinks was developed to support the large service water pipe restoration project at North Anna and are now part of the plant design. As a result, the revised loss of service water event tree does not consider the state of the seals but instead considers the probability of recovering the lost heat sink. The T6 contribution to core damage increases to ~5E-7/yr as compared to 4E-9/yr reported for the IPE. While the difference is about two orders of magnitude it should be noted that the absolute value is still quite small at about 0.9% of total core damage frequency.

The final tree with structural changes is the loss of emergency switchgear room cooling event tree (T8). Once the event occurs it is not an issue of depressurization as much as it is one of needing to provide alternate RC pump seal cooling before it is lost. Since the T8 initiating event affects only one unit, the equipment on the unaffected unit is available to mitigate the loss of seal cooling. Therefore, the tree has been structured to use HVAC from the unaffected unit to cool the affected unit. There are two ways to accomplish this goal: use fans to blow cool air into the affected ESGR or cross connect the seal cooling equipment from the unaffected unit. If the first action fails but the unaffected unit HVAC still functions, it is possible to use charging and component cooling from the unaffected unit to supply seal injection and seal cooling to the affected unit. As a result of these changes the loss of ESGR cooling initiating event contributes ~6E-7/yr to CDF as opposed to ~7E-6/yr using the IPE model.

The core damage frequency was nearly the same for both solutions. The IPE core damage frequency is 6.8E-5/yr while the IPEEE core damage frequency was 6.3E-5/yr. The differences in the results between the two solutions were reviewed and found to be non-significant based on a comparison of the cut sets for each function. Some of the IPEEE event trees were used in the analysis of fires as reported in the Non-Seismic IPEEE final report[7].

The PSA software used by Virginia Power has evolved as PC hardware capabilities have improved. One significant advancement is that NUPRA now allows batch mode solution of the entire PSA model. Therefore, the first step in the analysis of extended allowed outage time was to convert the model to the most recent version of NUPRA. This conversion must show that the results with the new code version are the same as the previous results or that any differences are understood. The EDG-TM run served this purpose.

The differences between the IPEEE and the EDG-TM are attributable to several factors including: the function truncation limits were set at 1E-9 versus 1E-10; undeveloped

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[7]"Individual Plant Examination Of Non-Seismic External Events and Fires, North Anna Power Station, Units 1 and 2," Final Report Volumes 1 and 2, April 1994.

transfers from the earlier models were deleted; and two new functions were added to the T1 event tree, providing status of the Unit 1 and Unit 2 EDGs, to facilitate development of the AAC model. The core damage frequency for the IPEEE model is 6.3E-5/yr while the EDG-TM model yields a core damage frequency of 5.7E-5/yr.

3.2 Revised EDG Unavailability Data

In addition to conversion to the latest version of NUPRA, the EDG test and maintenance unavailability is updated with recent plant specific data. Improvements in EDG preventive and corrective maintenance practices have lowered the EDG unavailability. A more accurate EDG unavailability is desirable not only to lower SBO and total CDF results, but also to provide faithful risk ranking for applications such as the 10 CFR 50.65 maintenance rule. The North Anna IPE data analysis methods were used to revise the EDG unavailability estimate. Plant records for the 1990 through 1994 interval indicate an average EDG unavailability of 97.30 hours per EDG per calendar year. This EDG unavailability applies to plant operation in Modes 1 to 4, and is felt to conservatively estimate at-power EDG unavailability (Modes 1 and 2 only). Critical-hours from NUREG-0020 were used to estimate EDG exposure for at-power operation. For the 1990 to 1994 interval, the average unit (or EDG) critical-hour exposure is 7601.66 cr-hrs per calendar year. Combining the 1990-1994 EDG unavailability with the EDG exposure yields an unavailability probability of 1.28E-2. This can be expressed in terms of hours as 112.2 hours/critical-year or in terms of days as 4.7 days/critical-year or 4.1 days per calendar year.

The PSA model includes components from Unit 2 systems that can be cross-connected to Unit 1 requiring consideration of opposite unit diesel unavailability. Furthermore, the opposite unit EDG unavailability must include all modes of operation since the unaffected unit may be down when the affected unit is at power. This is accomplished by determining how many hours of diesel unavailability there are when the unit is in Modes 3 to 6 and adding that to the diesel unavailability during Modes 1 and 2.

Based on a review of available data and discussions with plant personnel it was concluded that the total unavailability per diesel is conservatively estimated to have been 23 days per fuel cycle during 1990 to 1994. Converting 23 days of diesel unavailability every 18 months to a 12 month basis results in 23 * (12/18) = 15.3 days per calendar year. Adding this to the 4.7 days per critical year of unavailability during Modes 1 and 2 results in a total of 20 days per critical year or an unavailability of 5.48E-2. This is equivalent to 17.3 outage days per calendar year.

The use of this data bounds the expected conditions for the revised operating strategy. If the EDG maintenance is performed on-line there will be 14 days of opposite unit EDG preventive maintenance and inspection outage plus normal EDG unavailability. However, the EDG unavailability during opposite unit shutdown will decrease to 3 or 4 days. Thus, the total days of EDG unavailability should be about the same for either operating strategy.

The impact of the changes in EDG unavailability models can be seen through the reduction in CDF from the EDG-TM model (5.7E-5) to the NO-AAC model (5.4E-5). (A summary of all of the results is shown in Table 3.2). Hence the increased availability of the diesels reduces core damage frequency ~3E-6/yr.

3.3 AAC DG TM

The AAC DG manufacturer recommends a major tear down maintenance inspection, similar to the 18 month preventive maintenance and inspection of the EDG, but only once every ten years. The AAC DG is not required to be operable by Technical Specifications but is required to have a high availability to meet the SBO Rule Guidelines. There is no readily available operating history to use as a basis for the AAC DG test and maintenance unavailability. It is reasonable to estimate the AAC DG unavailability with that used for the Unit 2 EDG TM unavailability when Unit 1 is operating. This is conservative to the North Anna IPE generic industry data for EDG unavailability by a factor of two.

3.4 AAC DG Base Case

The AAC DG, recently installed to meet the requirements of the station blackout rule, is now fully operational. This diesel represents an independent source of emergency power that can feed any one of the four 4160V emergency buses at North Anna. Therefore, it is postulated that this AAC DG can serve as a replacement to the EDG during the preventive maintenance and inspection outage if it is performed on-line.

The 95JUNE model provides the positive impact of the AAC DG when it is available. In other words this model provides the estimated core damage frequency given that the AAC DG is available and the EDGs continue to experience the same number of hours of maintenance unavailability.

It should be noted that this diesel can not serve as a replacement for an EDG for all initiating events because the AAC DG is loaded manually. The need to load the diesel manually is a design feature which is intended to reduce common mode failures as required by the station blackout rule. It is assumed that it takes one hour to start and load the AAC DG. One hour is conservatively chosen since it is the longest time permitted by the station blackout rule.

A human factors viewpoint is used to evaluate the PSA initiating events to determine which events occur so rapidly that there is insufficient time to load the AAC DG. Several initiating events proceed to core damage in less than one hour without power available including: Large LOCA (A); Medium LOCA (S1); Reactor Vessel Rupture (Rx); Interfacing system LOCA; and ATWS (Th). The assumption that AAC DG cannot mitigate core damage for these initiating events is executed by special PSA model logic.

The AAC DG is potentially available for any emergency bus for the remaining initiating events. The PSA model is structured so that only one emergency bus can be powered from the AAC DG. Furthermore, if either of the Unit 2 diesels is failed the AAC DG is assumed to only provide power to Unit 2. This approach conservatively models electric power recovery at Unit 1.

The above restrictions are incorporated by revising certain aspects of the station and unit blackout models. Each of these are discussed below in some detail. The significant changes to the EDG-TM model include common cause modeling and the addition of the AAC DG system model.

The addition of the fifth diesel to the PSA model complicates the EDG common cause model. First, the criterion for the purchase and installation of the AAC DG was to minimize common cause failures between this fifth diesel and the other EDGs. Second, the PSA model considers only one unit, so the station impact of a five or four diesel common cause failure is not straightforward. Third, the IPE utilizes the multiple greek letter method for EDG common cause failures, and this 11 fault model could become unwieldy with an additional diesel. The 95JUNE PSA solution chose to simplify the EDG common cause model in a conservative manner, reducing the 11 fault model to a 3 fault model. Two faults are unchanged, the Unit 1 two EDG fault for 1H and 1J diesels, and the Unit 2 two EDG fault for the 2H and 2J diesels. The remaining two EDG common cause faults and all the three EDG common cause faults are combined with the four EDG common cause fault. This approach is conservative and allocates the common cause failures among the two units.
The system model for the AAC DG is similar to EDG model. It considers the typical electrical equipment failures that prevent the transfer of electrical energy to each of the three transfer buses. These failures include breaker failures, maintenance unavailability, AAC DG fail-to-start and fail-to-run. The fault tree resulting from the system model is shown in Appendix A.

The addition of the AAC DG reduces core damage by requiring three failures, instead of two, to fail both 4160 V electrical buses after a loss of off-site power. The 95JUNE model represents the current plant hardware configuration, and with the addition of the AAC DG, the core damage frequency is reduced by ~1.3E-5/yr to 4.1E-5/yr compared to the NO-AAC model shown in Table 3.2.

3.5 Extended EDG Unavailability

For the EDG-AOT model, the EDG unavailability is increased to reflect the assumption of a single, fourteen day maintenance outage once every eighteen months for each EDG. Actually, the 95JUNE model data is applied to the EDG-AOT model, except for the Unit 1 EDG maintenance unavailability basic events. The 14 day preventive maintenance and inspection outage time is added to the existing unavailability to determine the impact of the proposed EDG Technical Specifications changes. A 14 day outage performed once every 18 months is equivalent to 9.3 outage days, or 224 hours, per calendar year. Adding this unavailability to the 97.30 hour plant data unavailability of yields a total unavailability of about 321.3 hours. Combining this 321.3 hour unavailability with the 7601.66 cr-hrs per calendar year exposure produces a new unavailability probability of 4.23E-2.

The EDG-AOT model solution yields a core damage frequency of 4.2E-5/yr. The 95JUNE model CDF of 4.1E-5/yr is the base case against which the difference of 1E-6/yr from the EDG-AOT case represents an acceptably small increase.

3.6 BOUNDING Model

A final model was created to study the effects of EDG unavailability on CDF. This model is named "BOUNDING", and represents a sensitivity study on EDG unavailability. The maintenance unavailability was set equal to 40 days per calendar year for all five diesels. The resulting CDF is 4.7E-5/yr.

3.7 Results

Each of the five cases produced reasonable results. A summary of the cases is shown in Table 3.2. The CDF contribution from the each initiating event is shown in Table 3.3. Table 3.3 is a listing of core damage frequency sorted by accident group and accident type. The fault trees which have been changed since the IPEEE model was created are included in Appendix A. The event trees for the 95JUNE model are included in Attachment B. The results show that the electrical transient accident initiators are sensitive to the inclusion of the AAC DG and to varying the EDG unavailability. Other accident initiators are less sensitive to the AAC DG and EDG unavailability.

The LOCA transients shown in Table 3.3 contribute the same to core damage frequency with and without the AAC DG in operation as shown by the subtotal for the "NO-AAC", "95JUNE" and "EDG-AOT" cases. Also, the EDG unavailability does not impact the contribution of this initiating event group. The same conclusion can be drawn for the general transient group of initiating events. The electrical transients are impacted by both the AAC DG and the increased EDG unavailability. The inclusion of the AAC DG results in a significant reduction in CDF of ~1.3E-5/yr (i.e.,"NO-AAC" - "95JUNE"). This reduction is entirely from the electrical transients subgroup.

Thus, the initiating event groups with the largest contribution are the those involving loss of electrical power and include the T1 and T1EE trees. These trees have in common the loss of off-site power as an initiating event. This fact makes the diesel generator arrangement important. In the other trees, a coincident loss of off-site power must occur before any diesel dependencies are realized. Unless the initiating event involves a loss of off-site power there is only a small impact from the extended EDG unavailability on the contribution of that initiating event group to core damage frequency.

The T1EE event tree represents the loss of off-site power and failure of the EDGs on Unit 1; or in other words a unit blackout. This event tree is the largest contributor to core damage until the AAC DG is added to the model. The AAC DG decreases the contribution of this initiating event group from about 22% to about 14%. When the extended diesel generator unavailability is added the contribution increases only slightly to about 16%. The change in core damage frequency is ~1E-6/yr due to this extended EDG unavailability. This represents an average annual increase but, it actually occurs over two separate fourteen day intervals; one for the 1H diesel and one for the 1J diesel. Thus, it is concluded that the AAC DG is an adequate source of replacement power for an EDG for the limited outage required to perform the 18-month inspection.

The PSA models assume that other risk significant equipment is unavailable on an average annual basis. However, it is important that on-line maintenance be performed in an integrated fashion so that all risk significant components are considered. This important consideration is ensured by the administrative controls in place for performing on-line maintenance. These controls are based on a list of risk significant equipment which was developed from the North Anna PSA model. The controls involve scheduling of on-line maintenance. Scheduling of equipment for on-line maintenance is to be performed in a way that minimizes simultaneous outages of risk significant equipment. Special emphasis is given to limiting on-line maintenance when the electrical distribution system is at less than full capacity.

Table 3.1 - Comparison of Event Trees Between The IPE and the IPEEE		
Event Tree	**IPE**	**IPEEE**
Large LOCA	A	A,AD2
Vessel Rupture	Rx	Rx
Medium LOCA	S1	S1,S1D1
Small LOCA	S2	S2,S2D1
Loss of Off-site Power	T1,T1Tr,T1A	T1,T1Q,T1QFW, T1Hv,T1EG, T1EGQ
Transient - Loss of MFW	T2,T2Tr	T2,T2HV
Transient - MFW Recoverable	T2A,T2ATr	T2A,T2AHv
Transient - MFW Available	T3,T3Tr	T3,T3Hv
Loss of RCP Seal Cooling	T4	T4
Loss of Emergency Power DC Bus 1-I	T5A	T5A,T5AQ
Loss of Emergency Power DC Bus 1-III	T5B	T5B,T5BQ
Loss of Service Water	T6	T6
Steam Generator Tube Rupture	T7	T7,T7D1
Loss of ESGR Cooling	T8	T8
Loss of Emergency Power - Bus 1H	T9A,T9ATr	T9A,T9AQ,T9AHv
Loss of Emergency Power - Bus 1J	T9B,T9BTr	T9B,T9AQ,T9BHv
ATWS	TH,TL	TH,THMFW,TL
Interfacing System LOCA	VX	VX

Table 3.2 - Summary Of Results

Model Name	AAC DG Yes/No	Outage Days Per Calendar Year			CDF /yr
		Unit 1 EDG	Unit 2 EDG	AAC DG	
IPE	No	5.5	31.7	N/A	6.8E-5
IPEEE	No	5.5	31.7	N/A	6.3E-5
EDG-TM	No	5.5	31.7	N/A	5.7E-5
NO-AAC	No	4.1	17.3	17.3	5.4E-5
95JUNE	Yes	4.1	17.3	17.3	4.1E-5
EDG-AOT	Yes	13.4	17.3	17.3	4.2E-5
BOUNDING	Yes	40.0	40.0	40.0	4.7E-5

Table 3.3 Core Damage Frequency For Each Accident Group For Each North Anna PSA Model								
Accident Group	Accident Type	BOUNDING	EDG-AOT	95JUNE	NO-AAC	EDG-TM	94 Jan (IPEEE)	92 Dec (IPE)
LOCA Transients	S2	9.87E-6	9.86E-6	9.86E-6	9.89E-6	9.90E-6	9.84E-6	1.01E-5
	T7	7.58E-6	7.57E-6	7.57E-6	7.59E-6	7.60E-6	7.34E-6	7.02E-6
	S1	6.76E-6	6.75E-6	6.75E-6	6.75E-6	6.75E-6	6.73E-6	6.64E-6
	A	4.06E-6	4.06E-6	4.06E-6	4.06E-6	4.06E-6	4.48E-6	4.09E-6
	Vx	1.60E-6	1.60E-6	1.60E-6	1.60E-6	1.60E-6	1.60E-6	1.60E-6
	Rx	2.67E-7	2.67E-7	2.67E-7	2.67E-7	2.67E-7	2.67E-7	2.68E-7
	T4	2.43E-8	2.43E-8	2.43E-8	2.43E-8	2.43E-8	2.43E-8	1.07E-8
	Subtotal	3.02E-5	3.01E-5	3.01E-5	3.02E-5	3.02E-5	3.03E-5	2.97E-5

Table 3.3 Core Damage Frequency For Each Accident Group For Each North Anna PSA Model								
Accident Group	**Accident Type**	**BOUNDING**	**EDG-AOT**	**95JUNE**	**NO-AAC**	**EDG-TM**	**94 Jan (IPEEE)**	**92 Dec (IPE)**
Electrical Transients	T1EE	8.83E-6	6.53E-6	5.85E-6	1.17E-5	1.32E-5	1.80E-5	7.98E-6
	T1	4.14E-6	2.19E-6	1.67E-6	7.82E-6	8.76E-6	9.89E-6	4.60E-6
	T9AHv	2.66E-7	2.13E-7	2.01E-7	3.87E-7	4.37E-7	2.26E-7	3.26E-6
	T9B	2.17E-7	1.62E-7	1.47E-7	3.25E-7	3.54E-7	3.38E-7	5.81E-7
	T9A	1.59E-7	1.17E-7	1.06E-7	2.40E-7	3.42E-7	2.50E-7	4.15E-7
	T1Hv	2.58E-7	1.04E-7	7.70E-8	7.53E-7	1.15E-6	1.50E-6	7.27E-6
	T9BHv	7.01E-8	7.01E-8	7.01E-8	7.03E-8	7.10E-8	7.48E-9	6.78E-8
	T5A	2.35E-8	2.04E-8	1.96E-8	2.95E-8	3.10E-8	2.95E-8	1.11E-7
	T5B	1.77E-8	1.77E-8	1.77E-8	1.81E-8	1.84E-8	3.52E-8	1.09E-7
	Sub-total	1.40E-5	9.42E-6	8.16E-6	2.13E-5	2.44E-5	3.03E-5	2.44E-5

Table 3.3 Core Damage Frequency For Each Accident Group For Each North Anna PSA Model								
Accident Group	Accident Type	BOUNDING	EDG-AOT	95JUNE	NO-AAC	EDG-TM	94 Jan (IPEEE)	92 Dec (IPE)
General Transients	T8	6.53E-7	6.17E-7	6.17E-7	7.04E-7	7.90E-7	5.67E-7	6.56E-6
	T6	5.39E-7	5.39E-7	5.39E-7	5.39E-7	5.39E-7	5.39E-7	4.52E-9
	TH	4.24E-7	4.24E-7	4.24E-7	4.24E-7	4.24E-7	4.25E-7	4.20E-7
	T3Hv	3.92E-7	3.92E-7	3.92E-7	3.97E-7	4.06E-7	1.19E-7	4.06E-6
	T2	3.45E-7	3.45E-7	3.45E-7	3.45E-7	3.45E-7	3.28E-7	8.86E-7
	T2AHv	1.57E-7	1.57E-7	1.57E-7	1.59E-7	1.61E-7	3.94E-8	1.65E-6
	T3	1.68E-8	1.59E-8	1.59E-8	1.96E-8	2.05E-8	2.09E-8	7.61E-8
	T2A	1.45E-8	1.42E-8	1.42E-8	1.54E-8	1.57E-8	1.51E-8	6.11E-8
	T2Hv	1.39E-8	1.39E-8	1.39E-8	1.39E-8	1.39E-8	2.80E-9	1.44E-7
	TL	4.23E-10	4.23E-10	4.23E-10	4.23E-10	4.23E-10	4.23E-10	0.0
	Sub-total	2.54E-6	2.52E-6	2.52E-6	2.62E-6	2.72E-6	2.06E-6	1.39E-5
Grand Total		4.67E-5	4.21E-5	4.08E-5	5.42E-5	5.72E-5	6.27E-5	6.79E-5

4.0 ACCEPTABLE RISK INCREASES

Virginia Power has determined what constitutes an acceptable risk increase for the proposed Technical Specifications changes. This determination was based on a review of existing documents and the selection of the guidelines most applicable to North Anna Power Station. The pertinent documents are summarized below.

The EPRI PSA applications guide discusses the concept of a permanent modification which is essentially what is proposed herein. The modification is to the Technical Specifications not the plant hardware. The EPRI document states that a permanent risk increase can be determined as a percentage of the base CDF. The calculation for North Anna follows assuming that the base case is the IPE model submitted previously for NRC review.

$$\log(\Delta_{CDF}) = -0.5 * \log(CDF_{baseline}) - 1$$

For North Anna the baseline core damage frequency ($CDF_{baseline}$)is 6.8E-5/yr. So, the acceptable risk increase (Δ_{CDF}) is given as

$$\log(\Delta_{CDF}) = -0.5 * \log(6.8E-5) - 1$$

Evaluating by reducing the right-hand-side and making both sides an exponent of base 10 gives

$$\Delta_{CDF} = 12.1$$

Hence based on the above formula, a 12.1% increase in core damage frequency could be justified for a permanent increase. This increase is comparable to the contribution from the largest initiating event categories. It is larger than the largest contribution from any sequence.

The Brookhaven NUREG/CR study of risk based technical specification development does not discuss risk increases in general but does treat the subject of Allowed Outage Time increases. The document discusses when a sensitivity analysis can be used in lieu of re-solving the model. One of the criteria it gives for the acceptability of sensitivity analysis is if the overall equation has minimal cut sets for the down component that have "a non-negligible contribution, i.e., have a contribution greater than 1%."[8] A complementary statement to this is that those cut sets which contribute less than 1.0% have a negligible contribution. Therefore, another possible

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[8]"Handbook of Methods for Risk-Based Methods for Analyses of Technical Specifications," NUREG/CR-6141, page 3-8, December 1994.

acceptable risk increase criterion is 1.0% of the base core damage frequency which for North Anna would be 6.8E-7/yr using the IPE as the base model.

The use of 1.0% of core damage frequency as the cutoff value is similar to the types of cutoffs that have been chosen in other applications. For example, the reporting guidelines for the individual plant examination require core damage sequences greater than 1E-7 per year and within the upper 95 percent of the total core damage frequency to be reported. The NUMARC guidelines for the maintenance rule define risk significant components in several possible ways[9]. One way is the use of the core damage frequency contribution. Cut sets that account for about 90% of the overall core damage frequency, with appropriate eliminations, should be used as input to risk determination. Since a cut set can appear in only one sequence this is the same as a sequence requirement and is obviously less restrictive than the 1% number discussed above.

Finally, consider that the screening cutoff for the IPEEE, including FIVE, is 1E-6/yr[10]. This is comparable with the 6.8E-7/yr representing 1% of the core damage frequency as indicated by the North Anna IPE.

As a result of the above discussion it is clear that the use of something on the order of 1% as an acceptable risk increase is within the bounds used by NRC and its contractors for PSA applications. It is also clear that it is more conservative than some of the measures discussed. Based on this review of industry experience, 1E-6/yr has been adopted by Virginia Power as the figure of merit for use in the evaluation of the extended EDG outage.

5.0 IMPLEMENTATION REQUIREMENTS

An implementation plan is necessary to ensure that analysis assumptions are properly incorporated into station operating procedures. The plan presented below has two components: equipment required to be operable during the extended EDG maintenance outage and other safety related equipment potentially available for on-line maintenance.

The off-site power sources and other (i.e., both units) EDGs must be operable during the EDG extended outage when the inspection and maintenance is performed during

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[9]"Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," March 1993.

[10]"Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities - Final Report," NUREG-1407, page 4, June 1991.

operation in Modes 1,2,3 or 4. Additionally, the AAC DG must be operable as defined in the Technical Requirements Manual. Operability includes the EDG set and several subsystems, such as the fuel transfer system, in a manner similar to the EDGs. Surveillance requirements have been defined for these AAC DG subsystems and some specific components. The AAC DG operability items are listed in Table 5.1. In addition to these operability requirements in Table 5 the AAC DG must be tested within 14 prior to removal of an EDG for its preventive maintenance inspection outage. During this testing the AAC DG must be aligned to the transfer bus associated with the emergency bus powered by the EDG to be inspected.

A procedure must be written to address the use of the AAC DG for each of the EDGs. The procedure must address the controls for starting the diesel and individual breaker position for providing power to each bus. The procedure should include an equipment load list with priorities for the order in which equipment are loaded onto the bus.

Performance of additional on-line maintenance concurrent with EDG preventive maintenance during the fourteen day extended outage is governed by existing on-line maintenance administrative controls which rely on a list of risk significant equipment developed from the North Anna PSA model. The administrative controls currently require that only one functional equipment group, FEG, (i.e., all of the subcomponents which must function in order for a major piece of equipment to function) be unavailable for planned maintenance at the same time.

If two or more risk important FEGs for a unit are to be unavailable additional administrative controls may be required. However, during the extended EDG outage if two or more FEGs are to be unavailable at the same time, for any reason, a contingency plan outlining compensatory actions should be developed.

The performance of this inspection outage during modes 3 and 4 has not been specifically analyzed. The at-power PSA model is not appropriate for these conditions. NUREG/CR-5994[11] considered the effect of EDG maintenance on core damage frequency during various modes of operation. The study concludes that EDG maintenance in shutdown modes prior to an outage should be avoided because decay heat generation is highest and steam to power the turbine driven auxiliary feedwater pumps may not be available.

The administrative controls currently in place preclude on-line maintenance to FEGs on systems important to PSA safety and components important to plant reliability during planned transients. So, this type of maintenance would not be started during a planned evolution into Modes 3 or 4. However, if a unit is forced to enter into these

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[11]"Emergency Diesel Generator: Maintenance and Failure Unavailability, and Their Risk Impacts," NUREG/CR-5994, Chapter 5, November 1994.

modes while the EDG maintenance is in progress, the increase in core damage frequency resulting solely from changing modes does not require continued cooldown as long as sufficient secondary heat removal capability exists. Sufficient secondary heat removal capability exists if there are at least two sources of feedwater available. The main feedwater system, the auxiliary feedwater system or a combination of the two could be used for this purpose. The operability assumptions related to the EDG outage (items 1,2 and 4 above) must also continue to be met. If at least two sources of feedwater cannot supply their respective steam generators the unit should be brought to cold shutdown.

Table 5.1
Alternate A.C. Diesel Operability Requirements

1.	Verify that the volume of fuel oil in the day tank is greater than or equal to 850 gallons.	
2.	Verify that the volume of fuel oil in the above ground fuel oil storage tank is greater than or equal to 45,000.	
3.	Verify that a fuel oil transfer pump can be started and transfers fuel from the storage system to the day tank, or verify gravity feed flow to the day tank is > 4 gpm, or verify gravity feed flow is sufficient to maintain the day tank level while the AAC DG is loaded > 3250 kw.	
4.	Verify that the AAC DG can start and accelerate to synchronous speed (900 rpm) with generator voltage and frequency at 4300 ± 100 volts and 60 ± 1.2 Hz. Subsequently, verifying the generator is synchronized, gradually loaded to an indicated 3250-3350 kw and operates for at least 60 minutes.	
5.	Verify that the AAC DG total battery terminal voltage is greater than or equal to 126 volts on a float charge before initiating Surveillance Requirement 4.8.1.1.2.f when operating in Modes 1,2,3 or 4.	
6.	Verify that the starting air tank is > 275 psig.	
7.	Verifying that the following A.C. electrical buses are OPERABLE:	
	a.	4160 v bus OM
	b.	4160 v bus OL
	c.	480 v bus OM1
	d.	480 v bus OM1-1

6.0 CONCLUSIONS

Virginia Power has performed an analysis of extended EDG outages. The analysis included an update of the existing PSA model in order to keep it current with the configuration of the plant. A base case was run with and without the AAC DG model activated assuming the current average annual unavailability for the EDGs. The core damage frequency for the case without the AAC DG is 5.4E-5/yr while the base case CDF with the AAC DG included is 4.1E-5/yr as reported in Table 3.2. When the unavailability of each EDG is increased to include a single 14-day outage once every 18 months the core damage frequency increases to 4.2E-5/yr. A sensitivity analysis performed with even larger assumed EDG unavailability shows that the increase in CDF is still much less than the decrease resulting from the addition of the AAC DG. The decrease in core damage frequency associated with adding the AAC DG is 1.3E-5/yr while the increase in CDF resulting from the increased EDG unavailability is 1E-6/yr. This increase in CDF is small and meets the criterion for acceptable risk increase identified for this project.

The PSA analysis found that the increase in CDF with the additional EDG unavailability is small. The analysis considered operation in Modes 1 and 2. Administrative procedures preclude performance of the EDG inspection outage coincident with a planned transient. Continued performance of the inspection outage during unplanned entrance into Modes 3 and 4 was evaluated and found to be acceptable as long as secondary heat removal capability could be demonstrated.

With the EDG maintenance performed on-line it is not expected to be necessary to have an EDG in extended maintenance during shutdown conditions. Hence, any increase in risk associated with the inspection performed on-line is partially offset by the reduced risk of core damage during shutdown. Thus, the overall CDF increase is less than the 1E-6/yr identified above because the units will typically have both diesels in operation for most of the outage. This means that both EDG's will have higher availability during loss of off-site power events at shutdown, which will improve residual heat removal system availability in these events. In the past, one diesel was declared inoperable for about half of an outage. Therefore, for half of the outage decay heat removal during loss of off-site power events is highly dependent upon a single RHR pump; the redundant RHR pump is available only if powered by the AAC DG.

A shutdown PSA has not been performed for North Anna. However, a shutdown PSA analysis was performed for Surry Power Station that is documented in NUREG/CR-6144[12]. The Surry shutdown PSA found only reduced inventory plant operational

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[12] "Evaluation of Potential Severe Accidents During Low Power and Shutdown Operations at Surry, Unit 1 - Analysis of Core Damage Frequency from Internal Events During Mid-Loop Operations,"

states were significant contributors to core damage frequency. The study also found that "maintenance unavailability was the dominant cause of equipment unavailability" during the reduced inventory states. In this study the EDGs were defined to be part of the minimum equipment list for reduced inventory situations so they were assigned no maintenance unavailability.

The above shutdown PSA model was used along with a full power PSA model to look specifically at the impact of EDG maintenance at power and during shutdown. The results of the comparison are reported in NUREG/CR-5994[13] prepared by Brookhaven National Laboratory. This study shows that the change in CDF due to an EDG being in maintenance is the same as or more significant during most shutdown operational configurations than when the EDG maintenance is performed at power. While this conclusion indicates that EDG maintenance at power is risk beneficial it should be remembered that Surry has only three diesels and that the North Anna model presented herein takes credit for five diesels. The impact of the AAC DG at shutdown could change the results of the Brookhaven study. Nevertheless, this study confirms that some shutdown risk is averted by doing the maintenance at power.

Based on these results Virginia Power concludes that it is acceptable to conduct the 18 month EDG preventive maintenance and inspection during any mode, and during mode changes, as long as the inspection is performed in a single 14-day EDG outage once every eighteen months and the AAC DG is operable during this time. Restrictions on the operability of other equipment are also defined. The 1E-6/yr increase in CDF calculated as a result of the increased EDG unavailability meets the criterion for acceptable risk increase defined for this project.

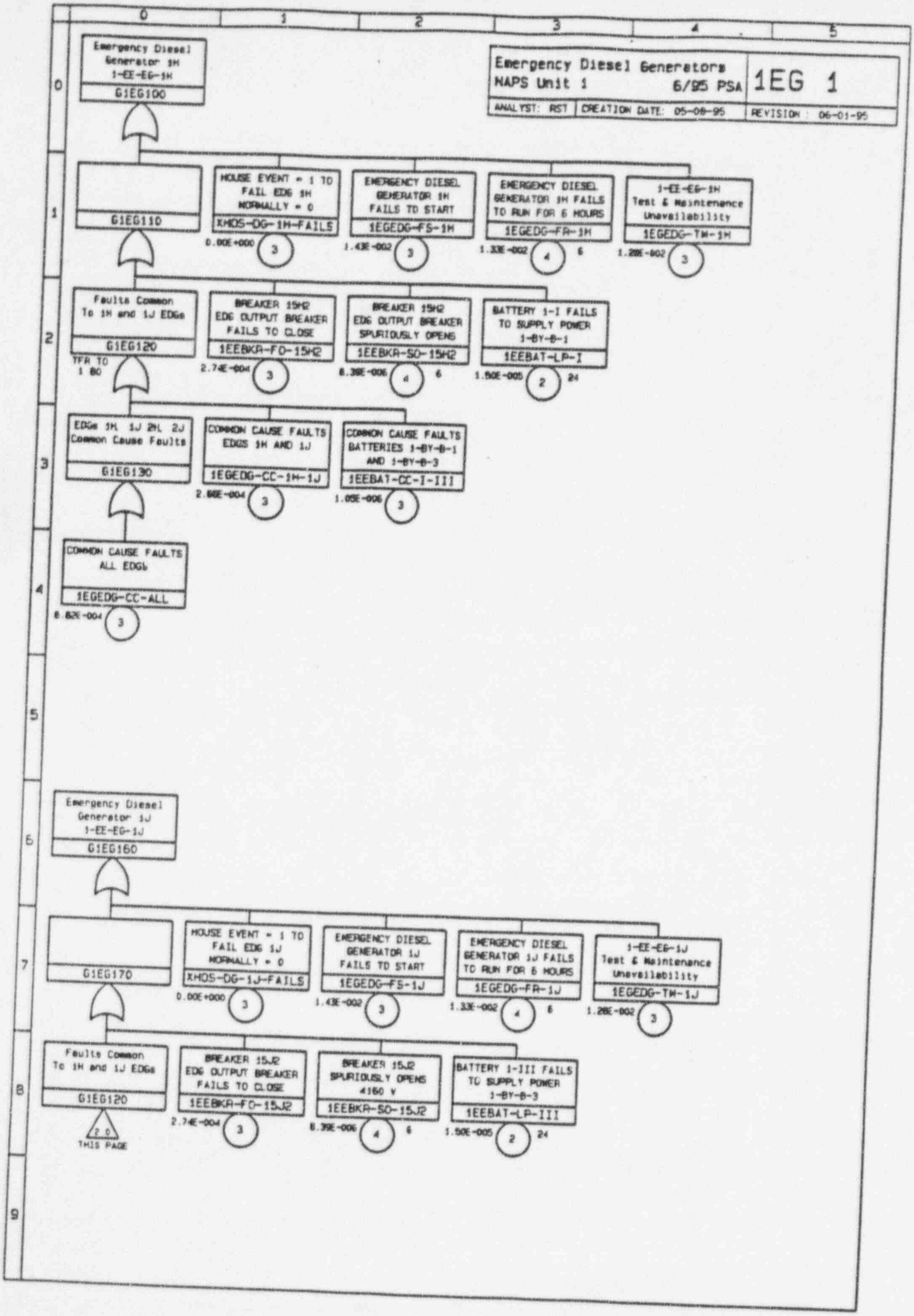
NUREG/CR-6144, Executive Summary, pp xxxii-xxxiii, June 1994.

[13]"Emergency Diesel Generator: Maintenance and Failure Unavailability, and Their Risk Impacts," NUREG/CR-5994, Chapter 5, November 1994.

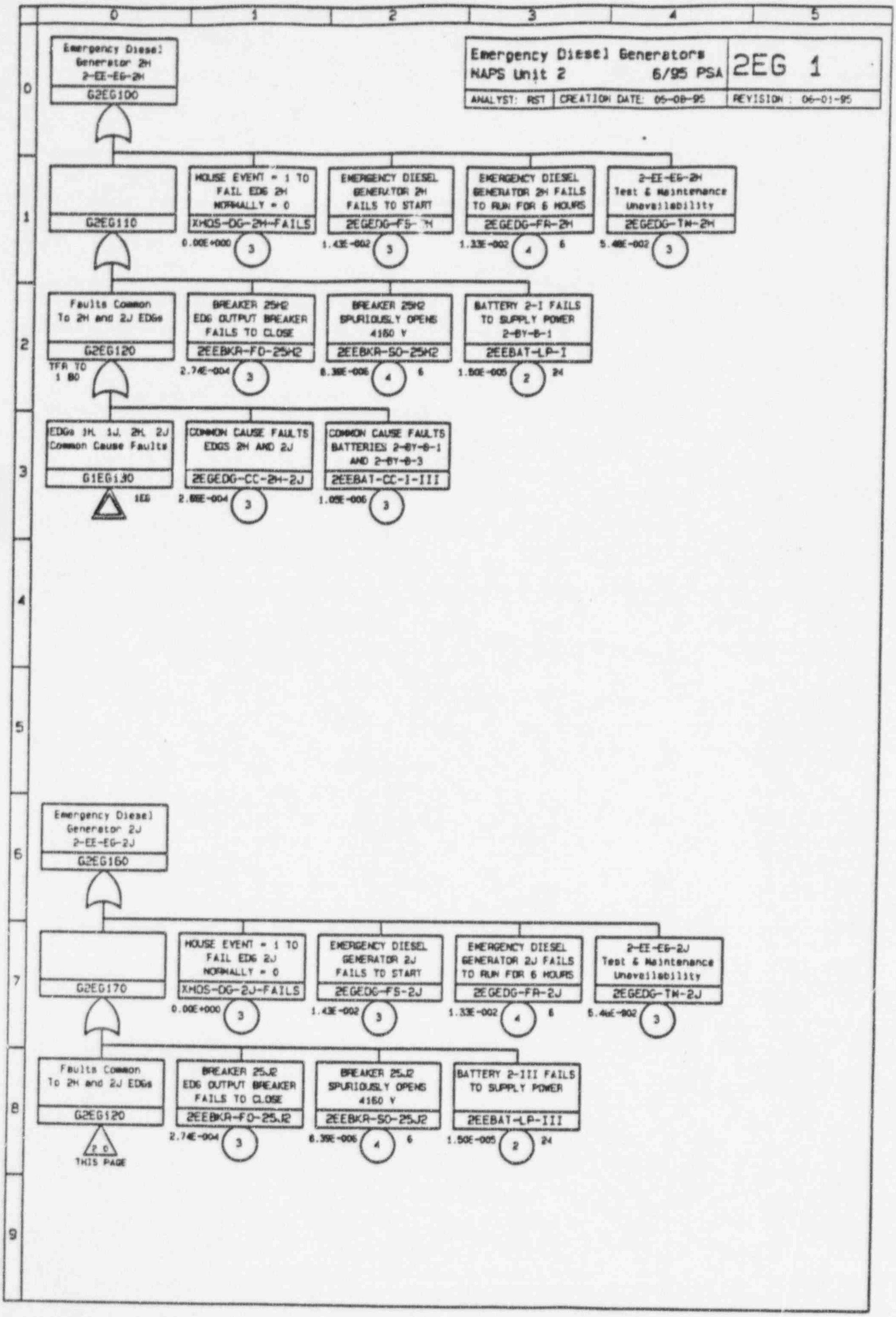
APPENDIX A
Fault Trees

The following fault trees are contained in this Appendix.

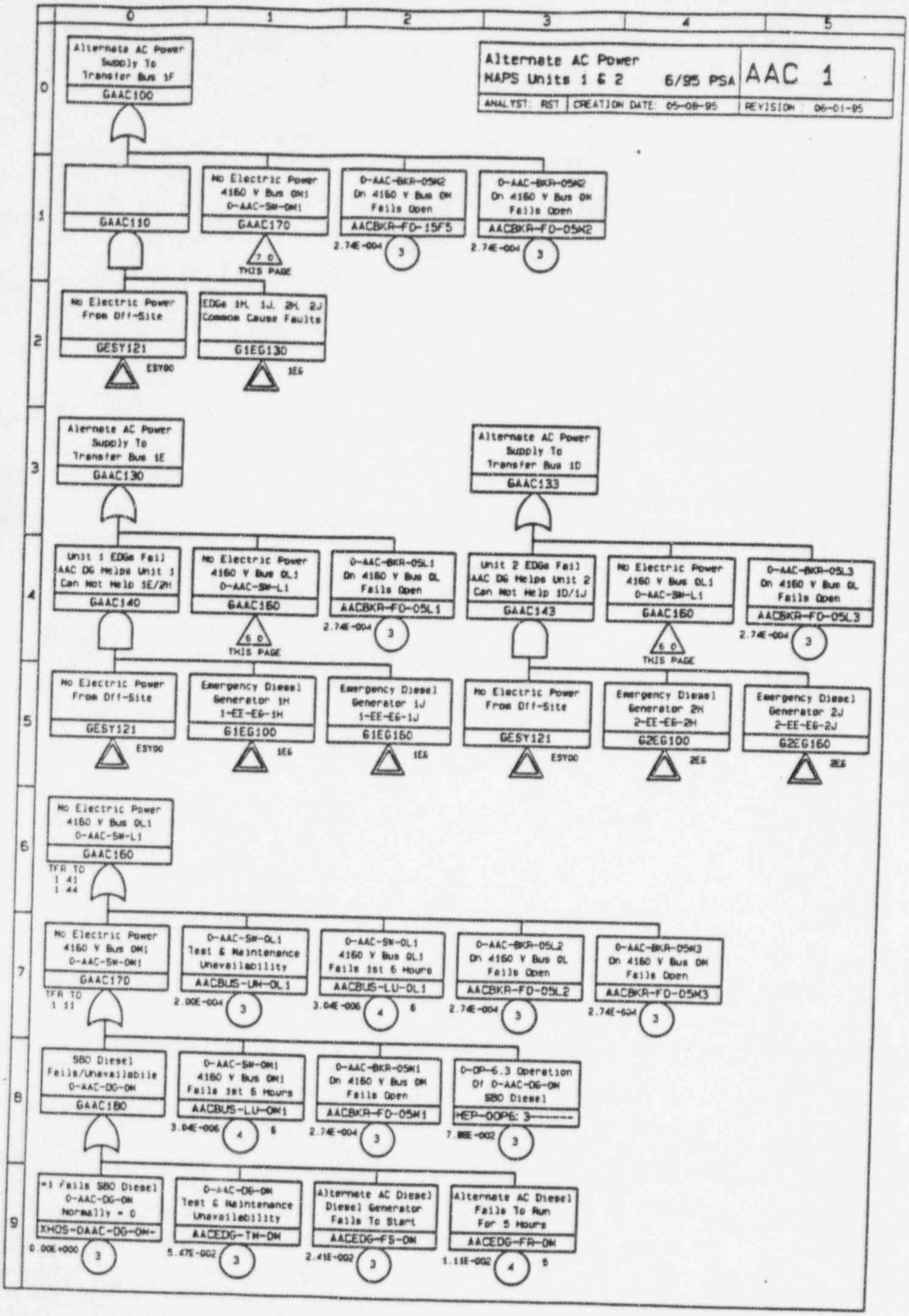
ID	Name	Description
1EG	1EG	Emergency Diesel Generators Unit 1 6/95 PSA, 1 p.
2EG	2EG	Emergency Diesel Generators Unit 2 6/95 PSA, 1 p.
AAC	0AAC	Alternate AC Power Units 1 & 2 6/95 PSA, 1 p.
DAM	DAM	Disallowed Maintenance Unit 1 6/95 PSA, 19 pp.
E1H	E1H00	1H Emergency Electric Power Unit 1 6/95 PSA, 15 pp.
E1J	E1J00	1J Emergency Electric Power Unit 1 6/95 PSA, 12 pp.
E2H	E2H00	2H Emergency Electric Power Unit 2 6/95 PSA, 13 pp.
E2J	E2J00	2J Emergency Electric Power Unit 2 6/95 PSA, 12 pp.
ESY	ESY00	Switchyard Buses Units 1 & 2 6/95 PSA, 14 pp.
FFT	FFT	Functional Fault Tree Unit 1 6/95 PSA, 6 pp.
LR1	LR100	Low Head Safety Recirculation Unit 1 6/95 PSA, 10 pp.
T9A	IET9A	T9A Loss of 1H 4160 Elect Pwr Unit 1 6/95 PSA, 1 p.
T9B	IET9A	T9A Loss of 1J 4160 Elect Pwr Unit 1 6/95 PSA, 1 p.



1EG.LGC NUPRA 2.2 VAPWR



2EG LGC NUPRA 2.2 VAPWR

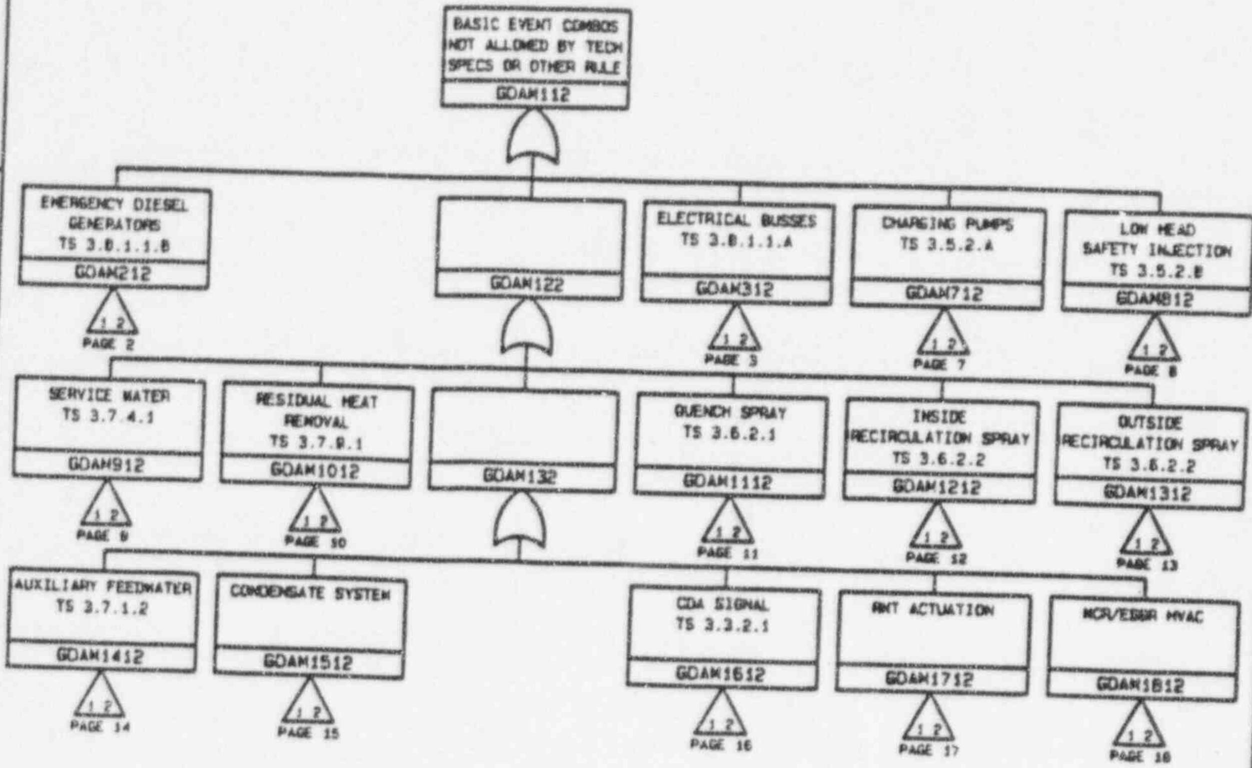


OAAC.LGC NUPRA 2.2 VAPWR

Disallowed Maintenance
NAPS Unit 1 6/95 PSA

DAM 1

ANALYST: RST | CREATION DATE: 06-22-92 | REVISION: 06-01-95

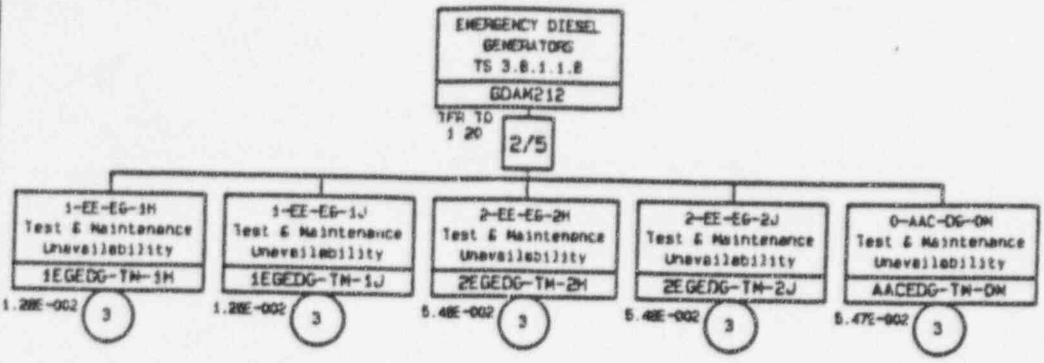


DAM.LGC NUPRA 2.2 VAPWR

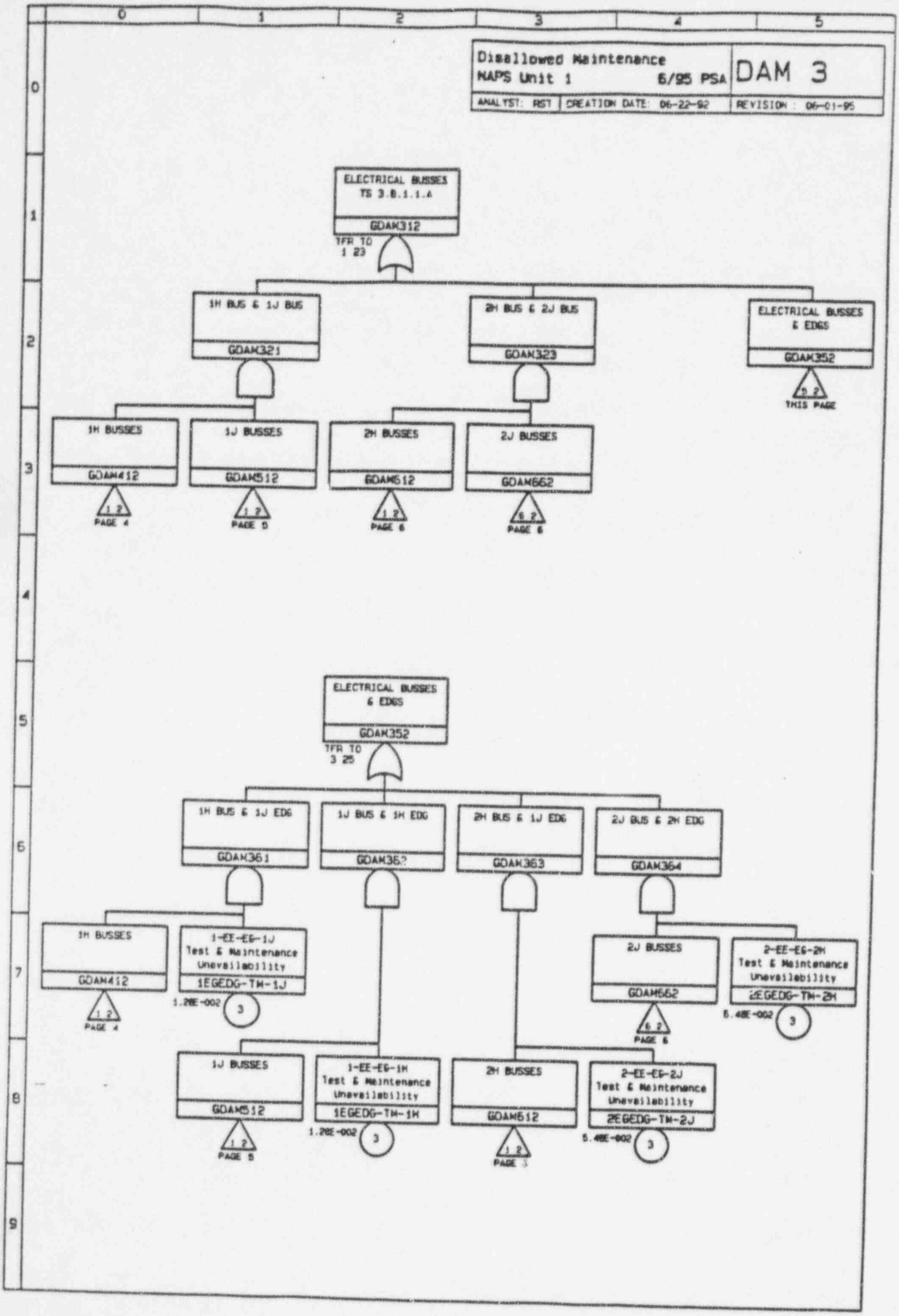
Disallowed Maintenance
NAPS Unit 1 6/95 PSA

DAM 2

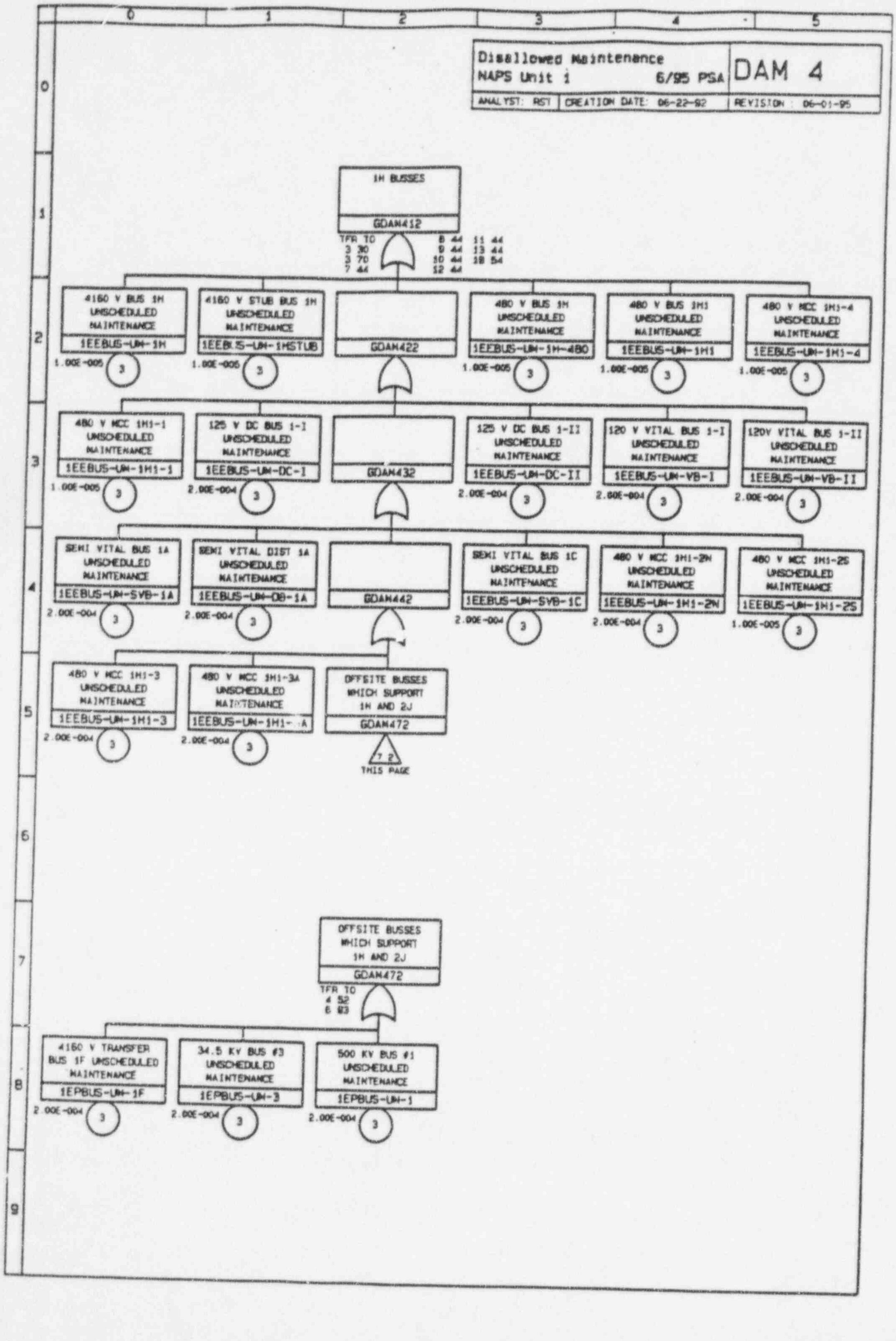
ANALYST: RST | CREATION DATE: 06-22-92 | REVISION: 06-01-95



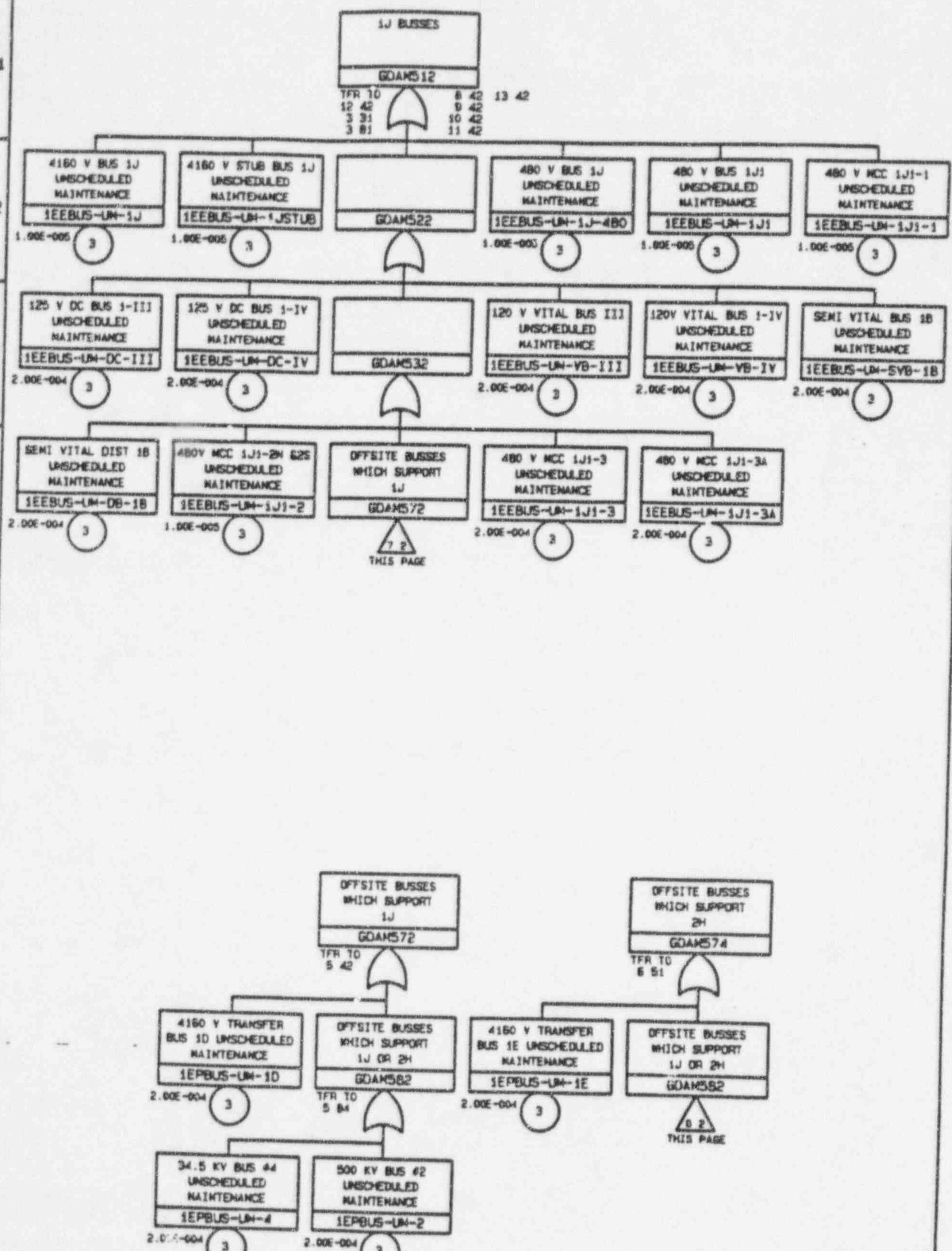
DAM.LGC NUPRA 2.2 VAPWD



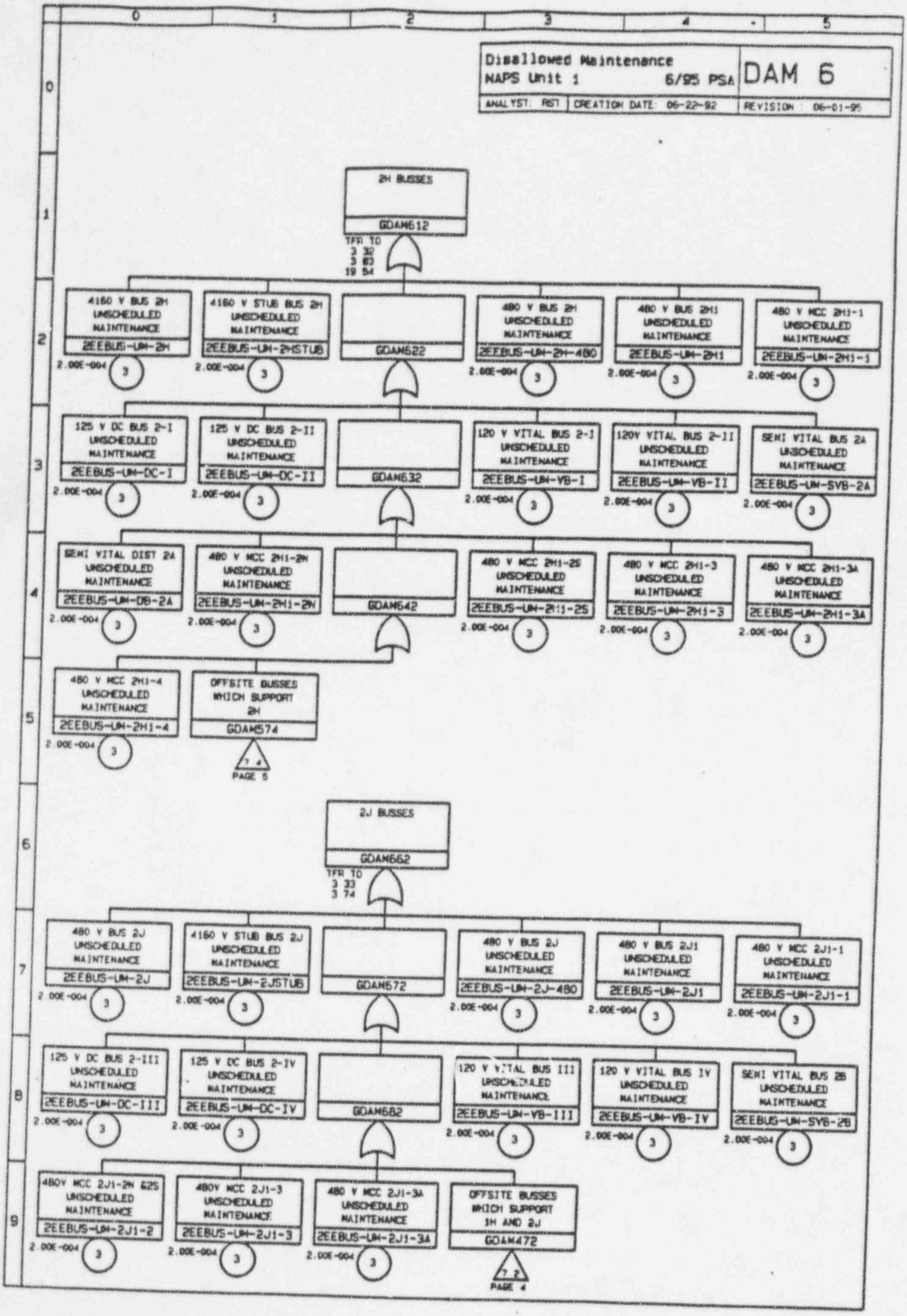
Disallowed Maintenance
NAPS Unit 1
6/95 PSA
DAM 3
ANALYST: RST
CREATION DATE: 06-22-92
REVISION: 06-01-95
ELECTRICAL BUSSES
TS 3.8.1.1.A
GDAM312
TFR TO
1 23
1H BUS & 1J BUS
GDAM321
2H BUS & 2J BUS
GDAM323
ELECTRICAL BUSSES
& EDGS
GDAM352
THIS PAGE
1H BUSSES
GDAM412
PAGE 4
1J BUSSES
GDAM512
PAGE 5
2H BUSSES
GDAM612
PAGE 6
2J BUSSES
GDAM662
PAGE 6
ELECTRICAL BUSSES
& EDGS
GDAM352
TFR TO
3 25
1H BUS & 1J EDG
GDAM361
1J BUS & 1H EDG
GDAM362
2H BUS & 1J EDG
GDAM363
2J BUS & 2H EDG
GDAM364
1H BUSSES
GDAM412
PAGE 4
1-EE-EG-1J
Test & Maintenance
Unavailability
1EGEDG-TM-1J
1.28E-002
2J BUSSES
GDAM662
PAGE 6
2-EE-EG-2H
Test & Maintenance
Unavailability
2EGEDG-TM-2H
5.48E-002
1J BUSSES
GDAM512
PAGE 5
1-EE-EG-1H
Test & Maintenance
Unavailability
1EGEDG-TM-1H
1.28E-002
2H BUSSES
GDAM612
PAGE 3
2-EE-EG-2J
Test & Maintenance
Unavailability
2EGEDG-TM-2J
5.48E-002
DAM.LGC
NUPRA 2.2
VAPWR


0
1
2
3
4
5
Disallowed Maintenance
NAPS Unit 1 6/95 PSA
DAM 4
ANALYST: RST
CREATION DATE: 06-22-92
REVISION: 06-01-95
1H BUSSES
GDAM412
TFR TO
3 30
3 70
7 44
8 44
9 44
10 44
12 44
11 44
13 44
18 54
4160 V BUS 1H UNSCHEDULED MAINTENANCE
1EEBUS-UM-1H
1.00E-005
4160 V STUB BUS 1H UNSCHEDULED MAINTENANCE
1EEBUS-UM-1HSTUB
1.00E-005
GDAM422
480 V BUS 1H UNSCHEDULED MAINTENANCE
1EEBUS-UM-1H-480
1.00E-005
480 V BUS 1H1 UNSCHEDULED MAINTENANCE
1EEBUS-UM-1H1
1.00E-005
480 V MCC 1H1-4 UNSCHEDULED MAINTENANCE
1EEBUS-UM-1H1-4
1.00E-005
480 V MCC 1H1-1 UNSCHEDULED MAINTENANCE
1EEBUS-UM-1H1-1
1.00E-005
125 V DC BUS 1-I UNSCHEDULED MAINTENANCE
1EEBUS-UM-DC-I
2.00E-004
GDAM432
125 V DC BUS 1-II UNSCHEDULED MAINTENANCE
1EEBUS-UM-DC-II
2.00E-004
120 V VITAL BUS 1-I UNSCHEDULED MAINTENANCE
1EEBUS-UM-VB-I
2.00E-004
120V VITAL BUS 1-II UNSCHEDULED MAINTENANCE
1EEBUS-UM-VB-II
2.00E-004
SEMI VITAL BUS 1A UNSCHEDULED MAINTENANCE
1EEBUS-UM-SVB-1A
2.00E-004
SEMI VITAL DIST 1A UNSCHEDULED MAINTENANCE
1EEBUS-UM-DB-1A
2.00E-004
GDAM442
SEMI VITAL BUS 1C UNSCHEDULED MAINTENANCE
1EEBUS-UM-SVB-1C
2.00E-004
480 V MCC 1H1-2N UNSCHEDULED MAINTENANCE
1EEBUS-UM-1H1-2N
2.00E-004
480 V MCC 1H1-2S UNSCHEDULED MAINTENANCE
1EEBUS-UM-1H1-2S
1.00E-005
480 V MCC 1H1-3 UNSCHEDULED MAINTENANCE
1EEBUS-UM-1H1-3
2.00E-004
480 V MCC 1H1-3A UNSCHEDULED MAINTENANCE
1EEBUS-UM-1H1-3A
2.00E-004
OFFSITE BUSSES WHICH SUPPORT 1H AND 2J
GDAM472
7 2
THIS PAGE
OFFSITE BUSSES WHICH SUPPORT 1H AND 2J
GDAM472
TFR TO
4 52
6 83
4160 V TRANSFER BUS 1F UNSCHEDULED MAINTENANCE
1EPBUS-UM-1F
2.00E-004
34.5 KV BUS #3 UNSCHEDULED MAINTENANCE
1EPBUS-UM-3
2.00E-004
500 KV BUS #1 UNSCHEDULED MAINTENANCE
1EPBUS-UM-1
2.00E-004
DAM_LGC NUPRA 2.2 VAPWD

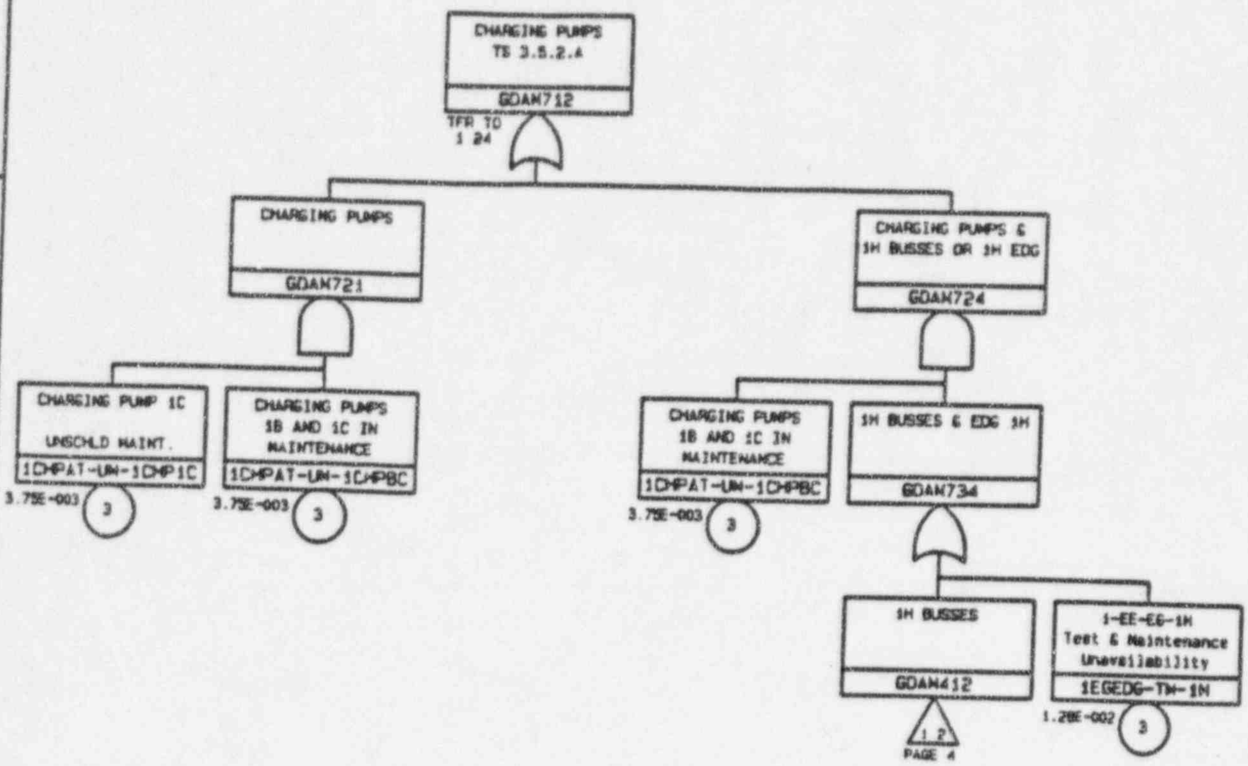
Disallowed Maintenance MAPS Unit 1 6/95 PSA	DAM 5
ANALYST: RST | CREATION DATE: 06-22-92	REVISION: 06-01-95



DAM.LGC NUPRA 2.2 VAPWR

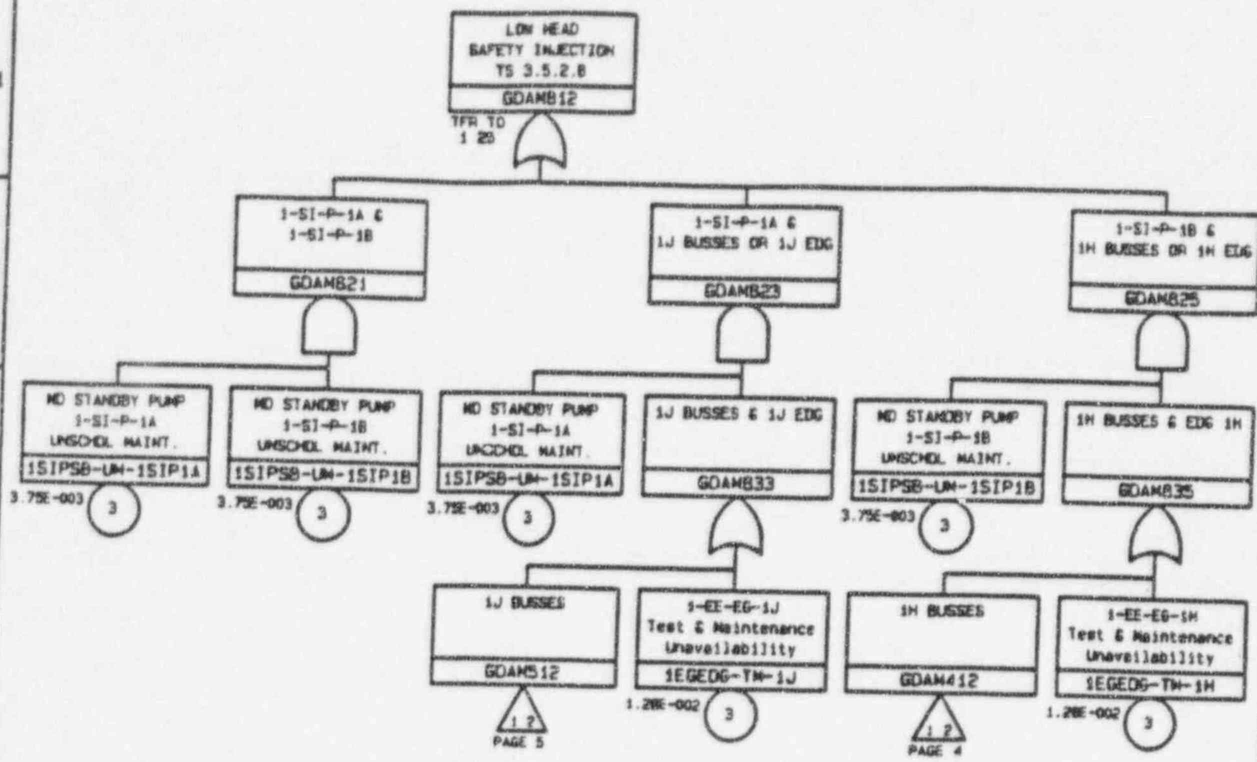

Disallowed Maintenance
NAPS Unit 1 6/95 PSA
DAM 6
ANALYST: RST
CREATION DATE: 06-22-92
REVISION: 06-01-95
2H BUSSES
GDAM612
TFR TO 3 32 3 83 19 54
4160 V BUS 2H UNSCHEDULED MAINTENANCE
2EEBUS-UM-2H
4160 V STUB BUS 2H UNSCHEDULED MAINTENANCE
2EEBUS-UM-2HSTUB
GDAM622
480 V BUS 2H UNSCHEDULED MAINTENANCE
2EEBUS-UM-2H-480
480 V BUS 2H1 UNSCHEDULED MAINTENANCE
2EEBUS-UM-2H1
480 V MCC 2H1-1 UNSCHEDULED MAINTENANCE
2EEBUS-UM-2H1-1
125 V DC BUS 2-I UNSCHEDULED MAINTENANCE
2EEBUS-UM-DC-I
125 V DC BUS 2-II UNSCHEDULED MAINTENANCE
2EEBUS-UM-DC-II
GDAM632
120 V VITAL BUS 2-I UNSCHEDULED MAINTENANCE
2EEBUS-UM-VB-I
120V VITAL BUS 2-II UNSCHEDULED MAINTENANCE
2EEBUS-UM-VB-II
SEMI VITAL BUS 2A UNSCHEDULED MAINTENANCE
2EEBUS-UM-SVB-2A
SEMI VITAL DIST 2A UNSCHEDULED MAINTENANCE
2EEBUS-UM-DB-2A
480 V MCC 2H1-2N UNSCHEDULED MAINTENANCE
2EEBUS-UM-2H1-2N
GDAM642
480 V MCC 2H1-2S UNSCHEDULED MAINTENANCE
2EEBUS-UM-2H1-2S
480 V MCC 2H1-3 UNSCHEDULED MAINTENANCE
2EEBUS-UM-2H1-3
480 V MCC 2H1-3A UNSCHEDULED MAINTENANCE
2EEBUS-UM-2H1-3A
480 V MCC 2H1-4 UNSCHEDULED MAINTENANCE
2EEBUS-UM-2H1-4
OFFSITE BUSSES WHICH SUPPORT 2H
GDAM574
7 4
PAGE 5
2J BUSSES
GDAM662
TFR TO 3 33 3 74
480 V BUS 2J UNSCHEDULED MAINTENANCE
2EEBUS-UM-2J
4160 V STUB BUS 2J UNSCHEDULED MAINTENANCE
2EEBUS-UM-2JSTUB
GDAM672
480 V BUS 2J UNSCHEDULED MAINTENANCE
2EEBUS-UM-2J-480
480 V BUS 2J1 UNSCHEDULED MAINTENANCE
2EEBUS-UM-2J1
480 V MCC 2J1-1 UNSCHEDULED MAINTENANCE
2EEBUS-UM-2J1-1
125 V DC BUS 2-III UNSCHEDULED MAINTENANCE
2EEBUS-UM-DC-III
125 V DC BUS 2-IV UNSCHEDULED MAINTENANCE
2EEBUS-UM-DC-IV
GDAM682
120 V VITAL BUS III UNSCHEDULED MAINTENANCE
2EEBUS-UM-VB-III
120 V VITAL BUS IV UNSCHEDULED MAINTENANCE
2EEBUS-UM-VB-IV
SEMI VITAL BUS 2B UNSCHEDULED MAINTENANCE
2EEBUS-UM-SVB-2B
480V MCC 2J1-2N &2S UNSCHEDULED MAINTENANCE
2EEBUS-UM-2J1-2
480V MCC 2J1-3 UNSCHEDULED MAINTENANCE
2EEBUS-UM-2J1-3
480 V MCC 2J1-3A UNSCHEDULED MAINTENANCE
2EEBUS-UM-2J1-3A
OFFSITE BUSSES WHICH SUPPORT 1H AND 2J
GDAM472
7 2
PAGE 4
2.00E-004

Disallowed Maintenance MAPS Unit 1 6/95 PSA	DAM 7
ANALYST: RST | CREATION DATE: 06-22-92	REVISION : 06-01-95

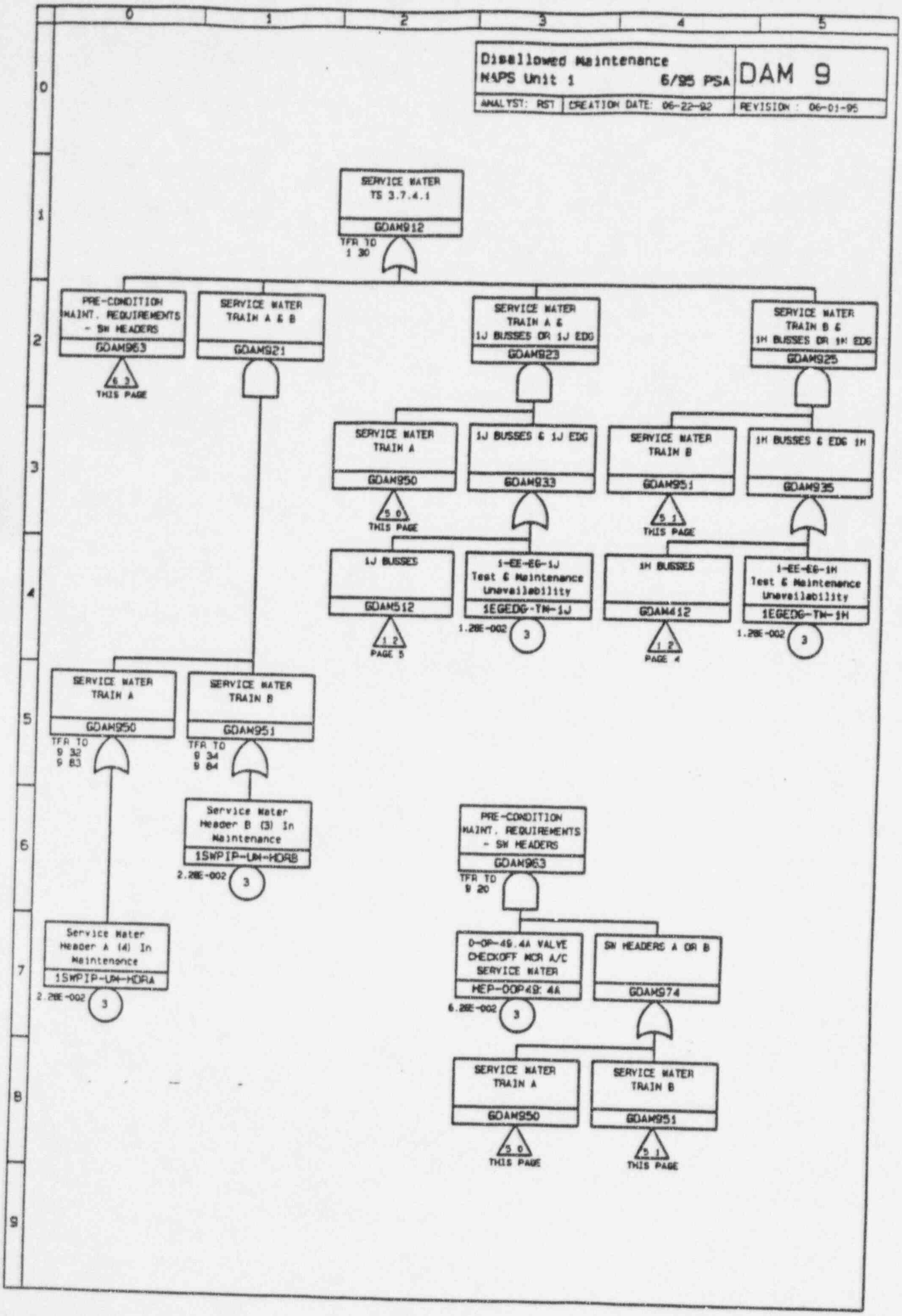


DAM.LGC NUPRA 2.2 VAPWR

Disallowed Maintenance NAPS Unit 1 6/95 PSA	DAM 8
ANALYST: RST | CREATION DATE: 06-22-92	REVISION : 06-01-95

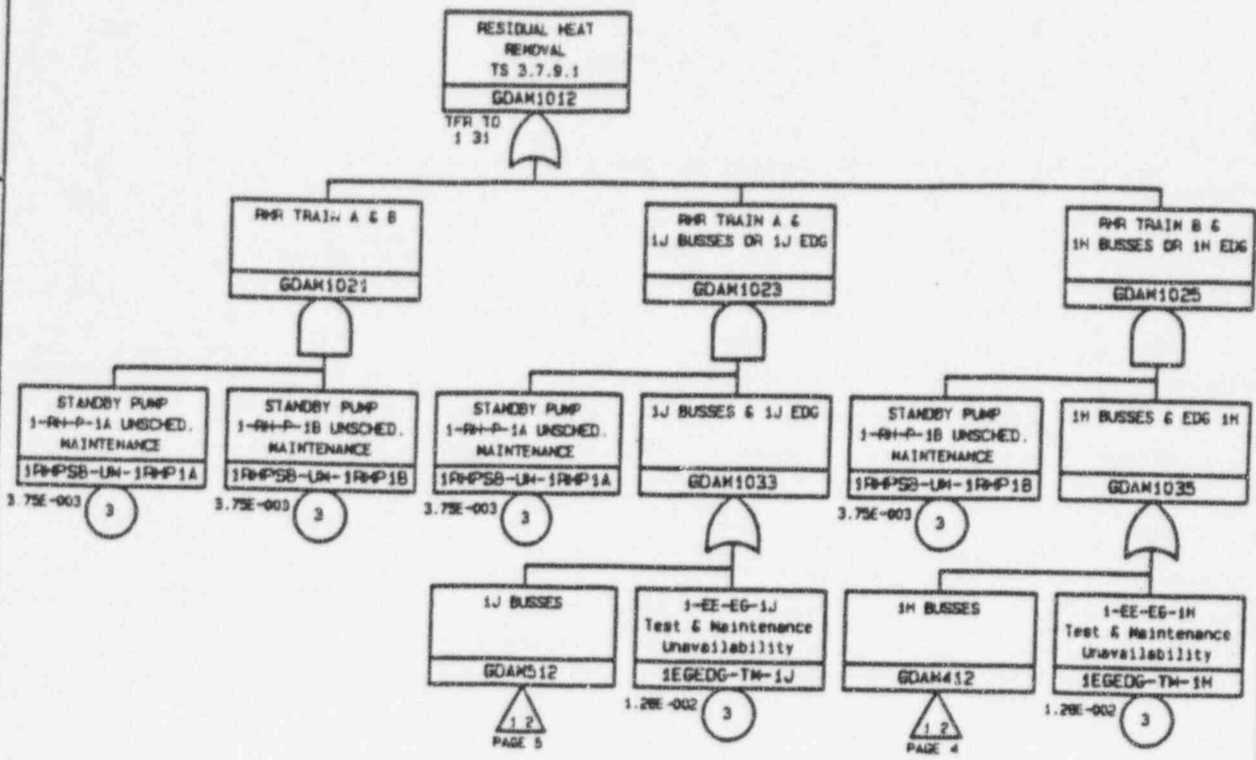


DAM.LGC NUPRA 2.2 VAPWR

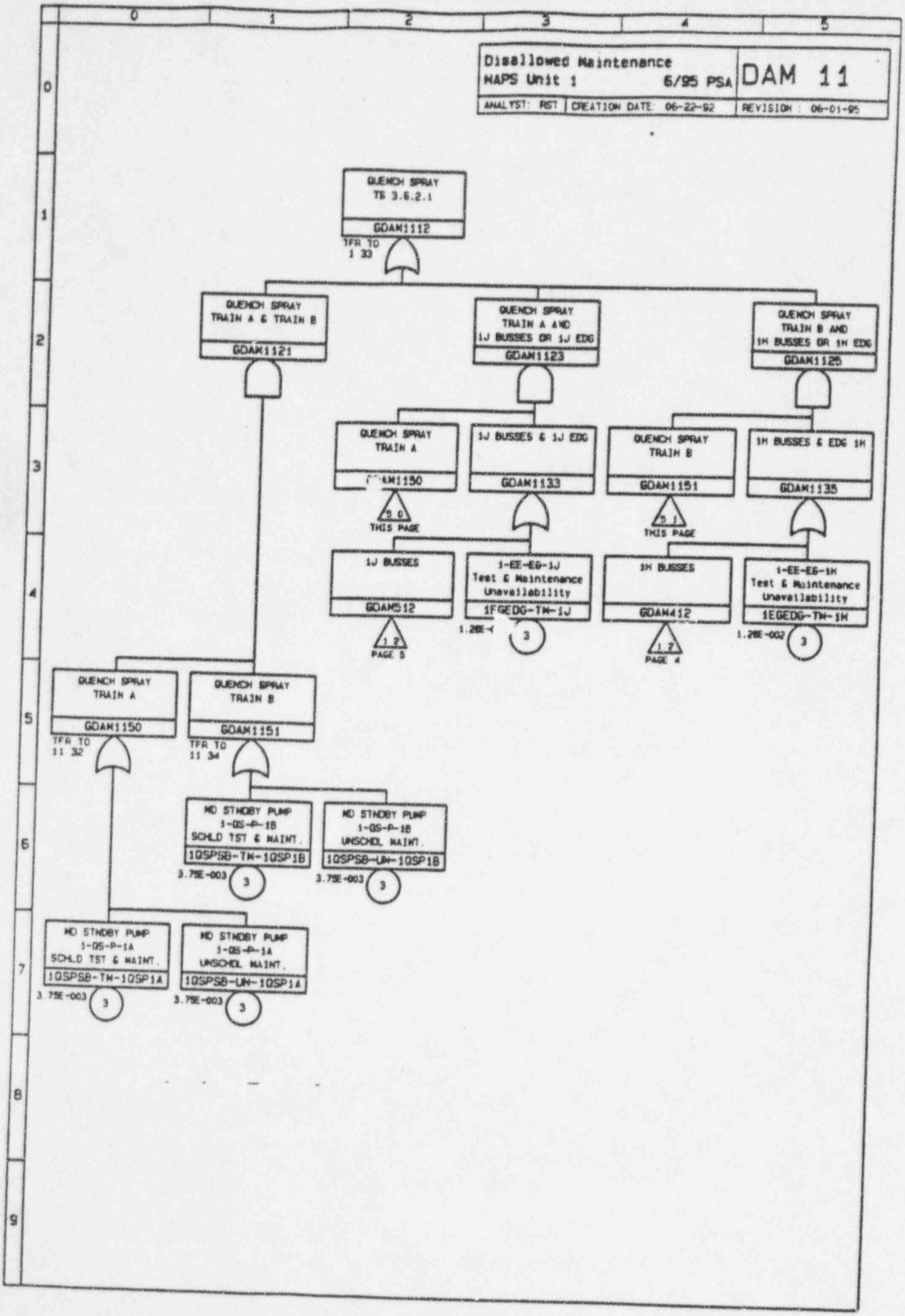


DAM.LGC NUPRA 2.2 VAPWR

Disallowed Maintenance NAPS Unit 1 6/95 PSA	DAM 10
ANALYST: RST | CREATION DATE: 06-22-92	REVISION : 06-01-95

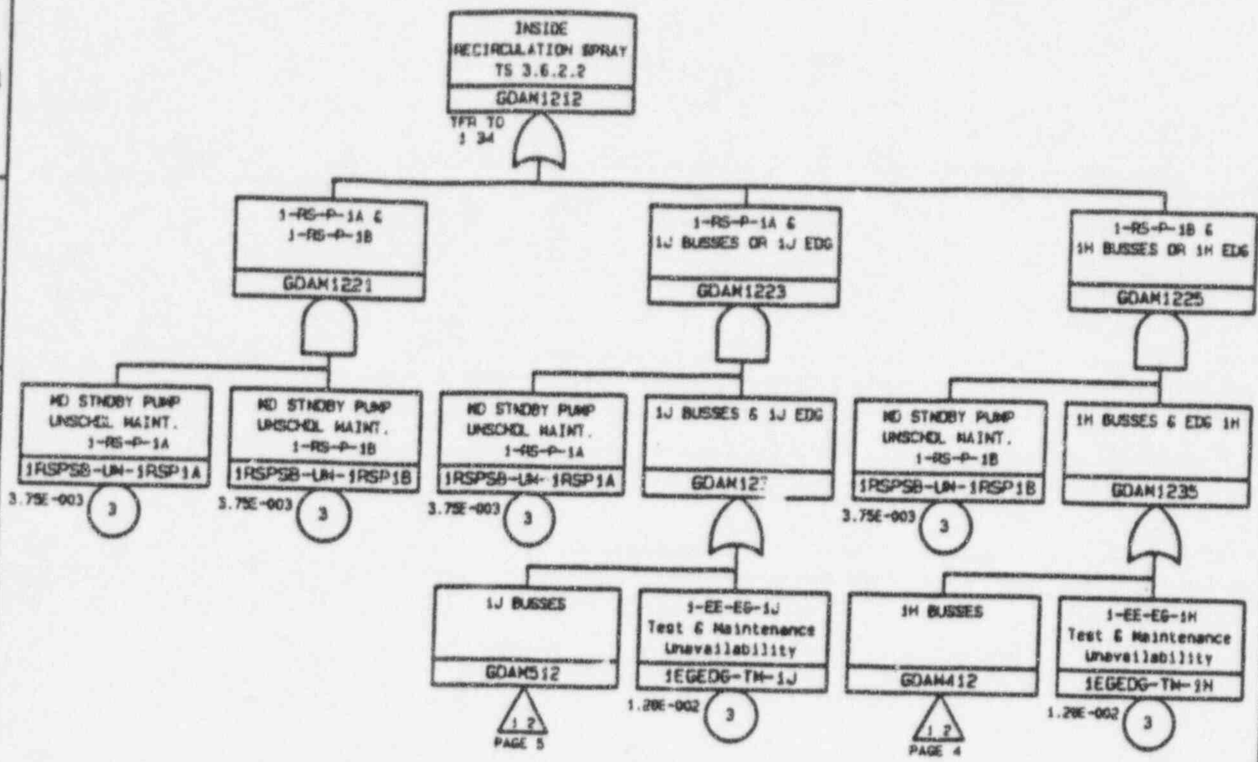


DAM.LGC NAPRA 2.2 VAPWR



DAM.LGC NUPRA 2.2 VAPWR

Disallowed Maintenance NAPS Unit 1 6/95 PSA		DAM 12
ANALYST: RST	CREATION DATE: 06-22-92	REVISION: 06-01-95

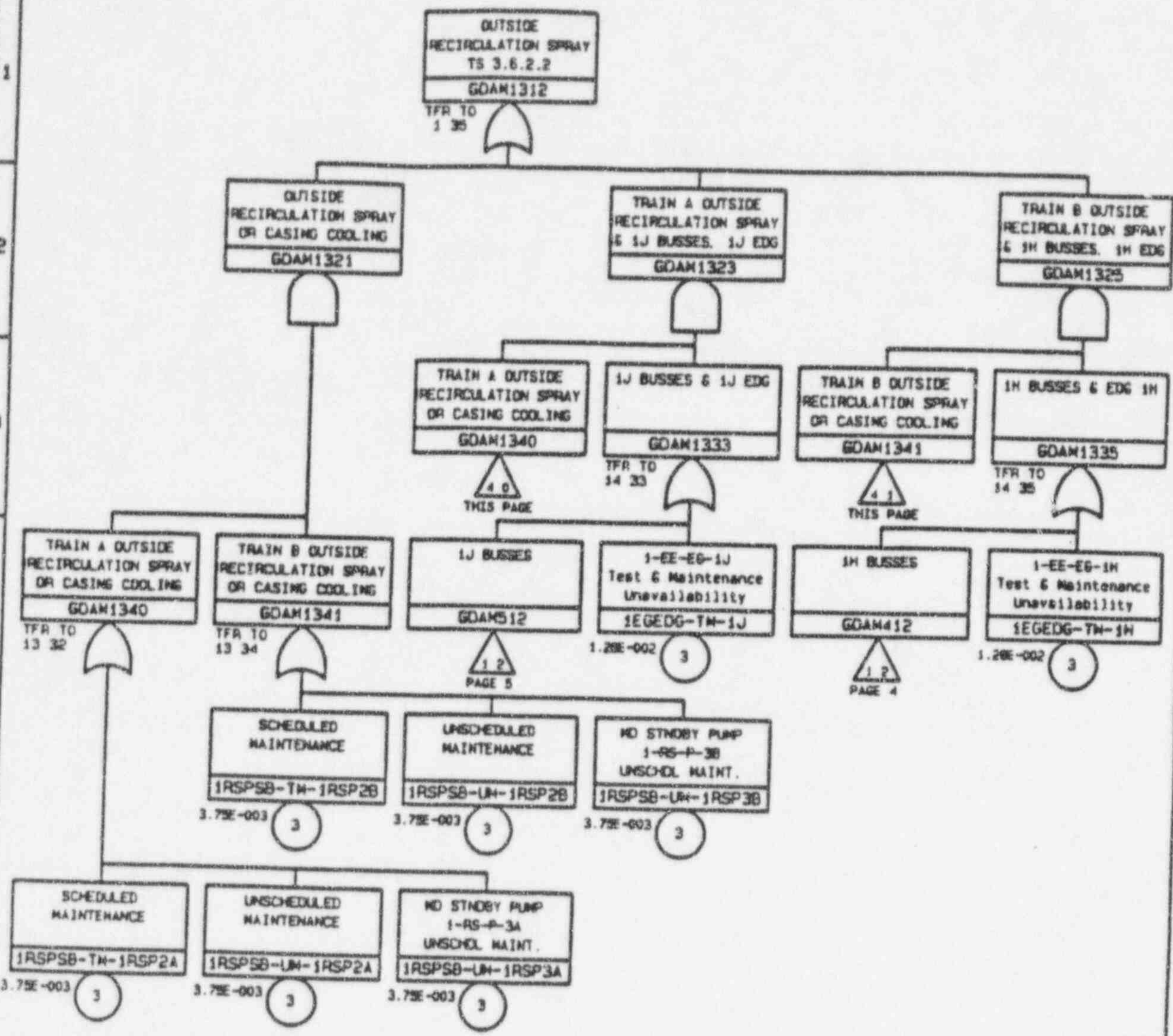


DAM.LOC NUPRA 2.2 VAPWR

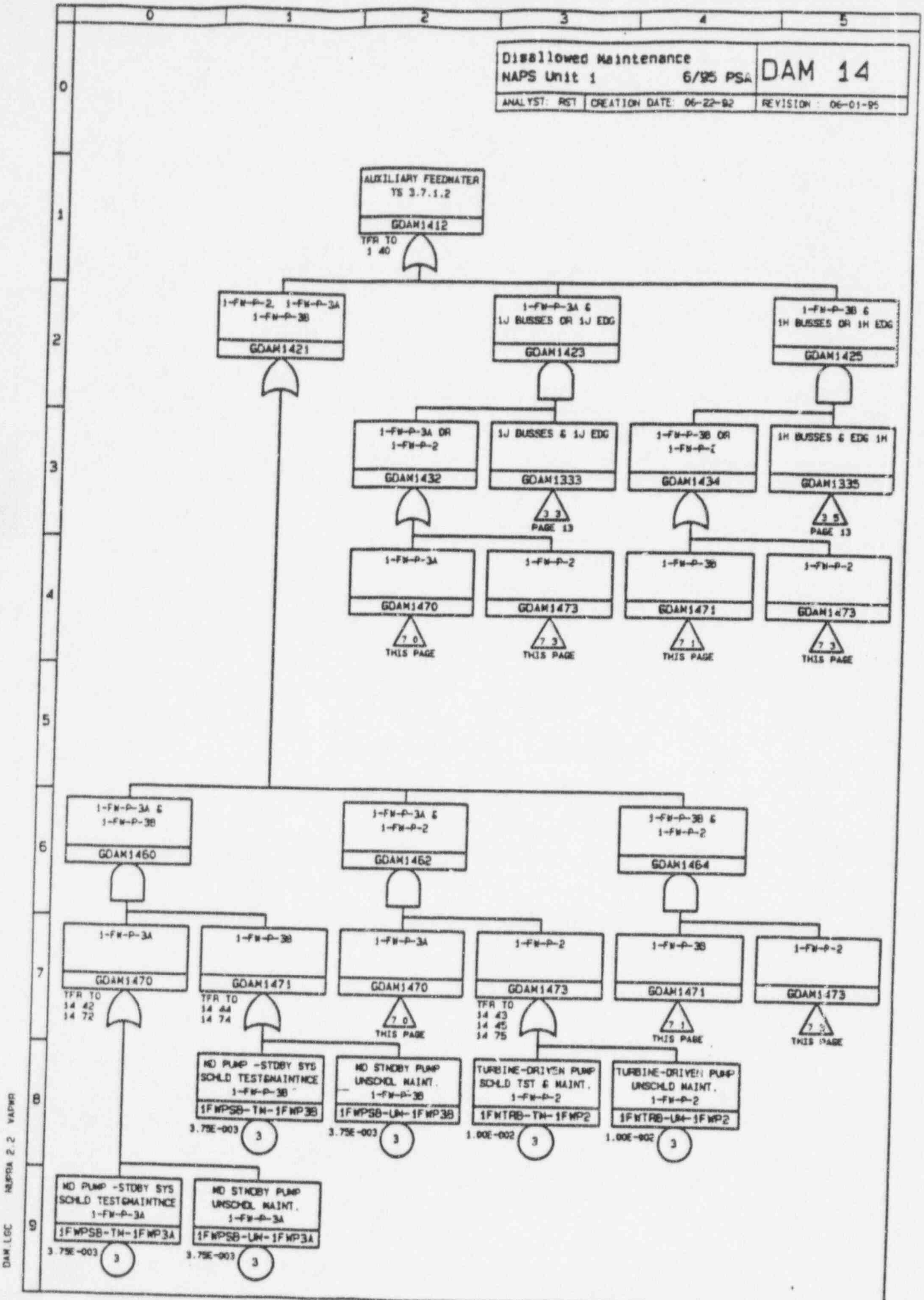
Disallowed Maintenance
NAPS Unit 1 6/95 PSA

DAM 13

ANALYST: RST | CREATION DATE: 06-22-92 | REVISION: 06-01-95

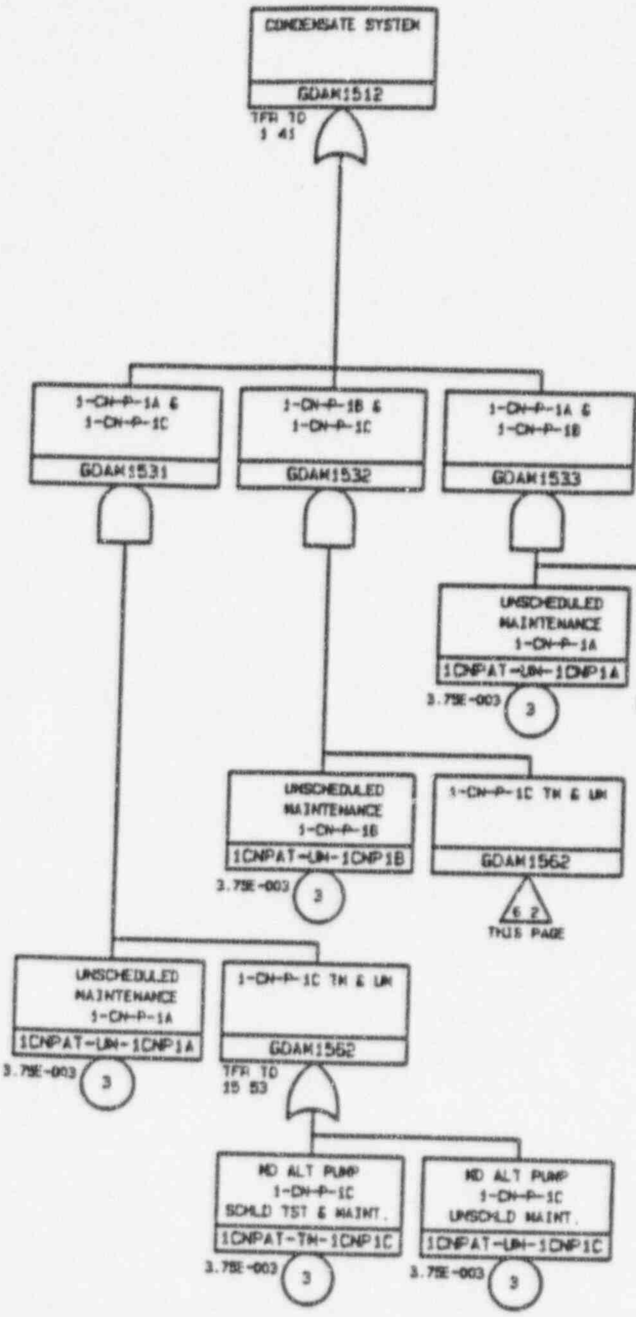


DAM.LGC NUPRA 2.2 VAPWR



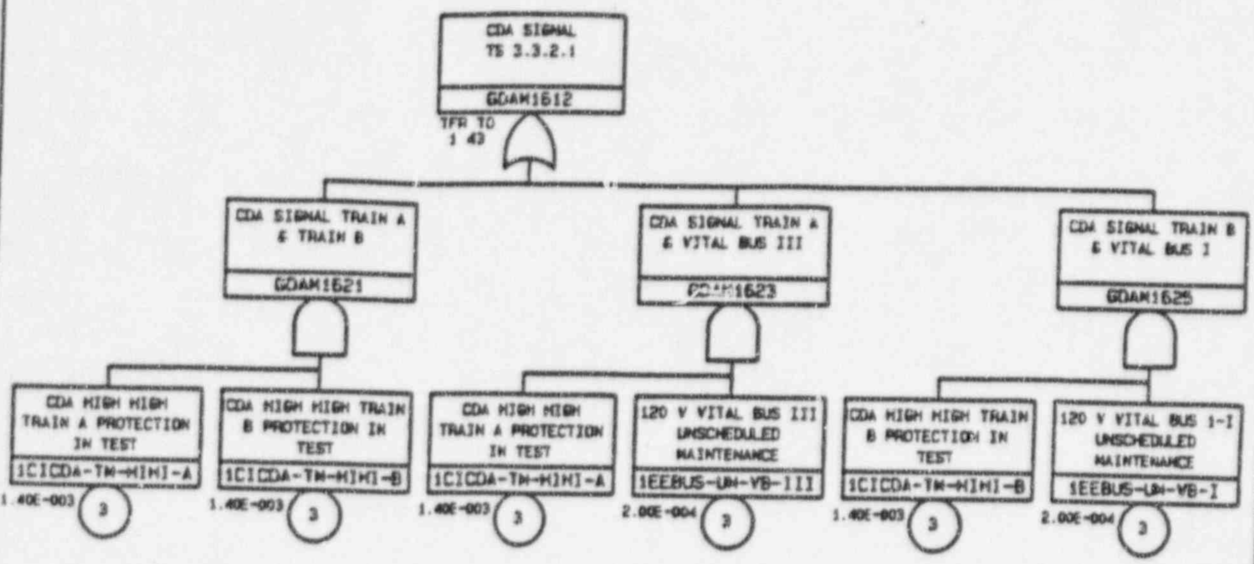
Disallowed Maintenance
NAPS Unit 1 6/95 PSA
DAM 14
ANALYST: RST
CREATION DATE: 06-22-92
REVISION: 06-01-95
AUXILIARY FEEDWATER TS 3.7.1.2
GDAM1412
TFR TO 1 40
1-FW-P-2, 1-FW-P-3A 1-FW-P-3B
GDAM1421
1-FW-P-3A & 1J BUSSES OR 1J EDG
GDAM1423
1-FW-P-3B & 1H BUSSES OR 1H EDG
GDAM1425
1-FW-P-3A OR 1-FW-P-2
GDAM1432
1J BUSSES & 1J EDG
GDAM1333
PAGE 13
1-FW-P-3B OR 1-FW-P-Z
GDAM1434
1H BUSSES & EDG 1H
GDAM1335
PAGE 13
1-FW-P-3A
GDAM1470
THIS PAGE
1-FW-P-2
GDAM1473
THIS PAGE
1-FW-P-3B
GDAM1471
THIS PAGE
1-FW-P-2
GDAM1473
THIS PAGE
1-FW-P-3A & 1-FW-P-3B
GDAM1460
1-FW-P-3A & 1-FW-P-2
GDAM1462
1-FW-P-3B & 1-FW-P-2
GDAM1464
1-FW-P-3A
GDAM1470
TFR TO 14 42 14 72
1-FW-P-3B
GDAM1471
TFR TO 14 44 14 74
1-FW-P-3A
GDAM1470
THIS PAGE
1-FW-P-2
GDAM1473
TFR TO 14 43 14 45 14 75
1-FW-P-3B
GDAM1471
THIS PAGE
1-FW-P-2
GDAM1473
THIS PAGE
MD PUMP -STDBY SYS SCHLD TEST&MAINTNCE 1-FW-P-3B
1FWPSB-TM-1FWP3B
3.75E-003
MD STNDBY PUMP UNSCHDL MAINT. 1-FW-P-3B
1FWPSB-UM-1FWP3B
3.75E-003
TURBINE-DRIVEN PUMP SCHLD TST & MAINT. 1-FW-P-2
1FWTRB-TM-1FWP2
1.00E-002
TURBINE-DRIVEN PUMP UNSCHLD MAINT. 1-FW-P-2
1FWTRB-UM-1FWP2
1.00E-002
MD PUMP -STDBY SYS SCHLD TEST&MAINTNCE 1-FW-P-3A
1FWPSB-TM-1FWP3A
3.75E-003
MD STNDBY PUMP UNSCHDL MAINT. 1-FW-P-3A
1FWPSB-UM-1FWP3A
3.75E-003
DAM.LGC NUPRA 2.2 VAPWR

Disallowed Maintenance NAPS Unit 1 6/95 PSA	DAM 15
ANALYST: RST | CREATION DATE: 06-22-92	REVISION: 06-01-95



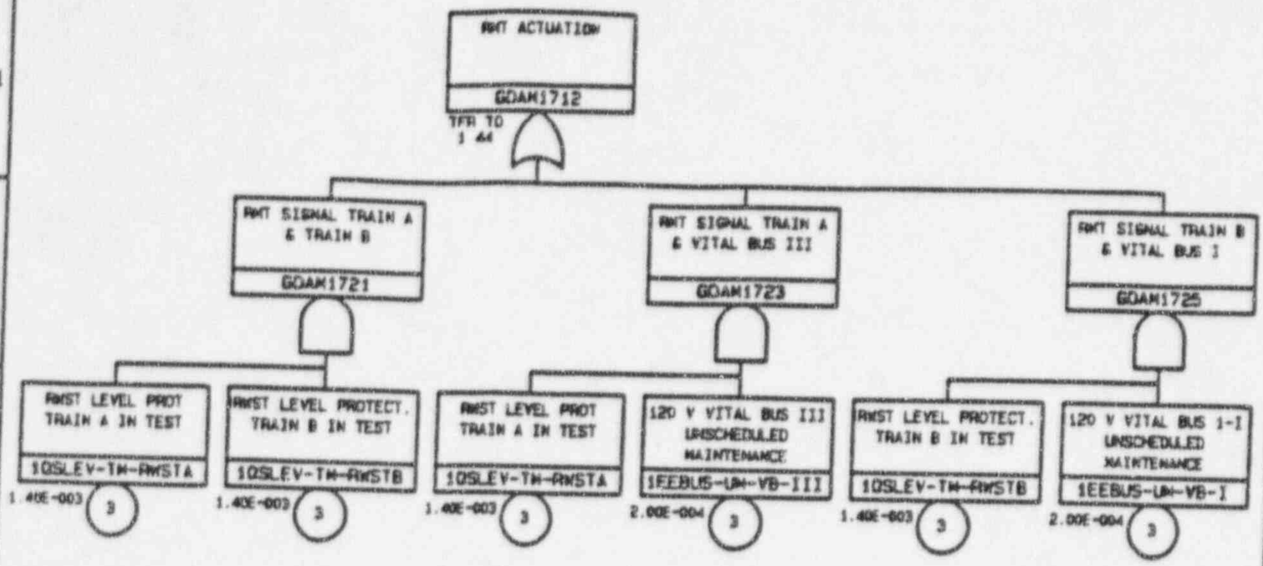
DAM.LGC NUPRA 2.2 VAPWO

Disallowed Maintenance NAPS Unit 1 6/95 PSA	DAM 16
ANALYST: RST | CREATION DATE: 06-22-92	REVISION: 06-01-95



DAM.LGC NUPRA 2.2 VAPWR

Disallowed Maintenance NAPS Unit 1 6/95 PSA	DAM 17
ANALYST: RST | CREATION DATE: 06-22-92	REVISION : 06-01-95

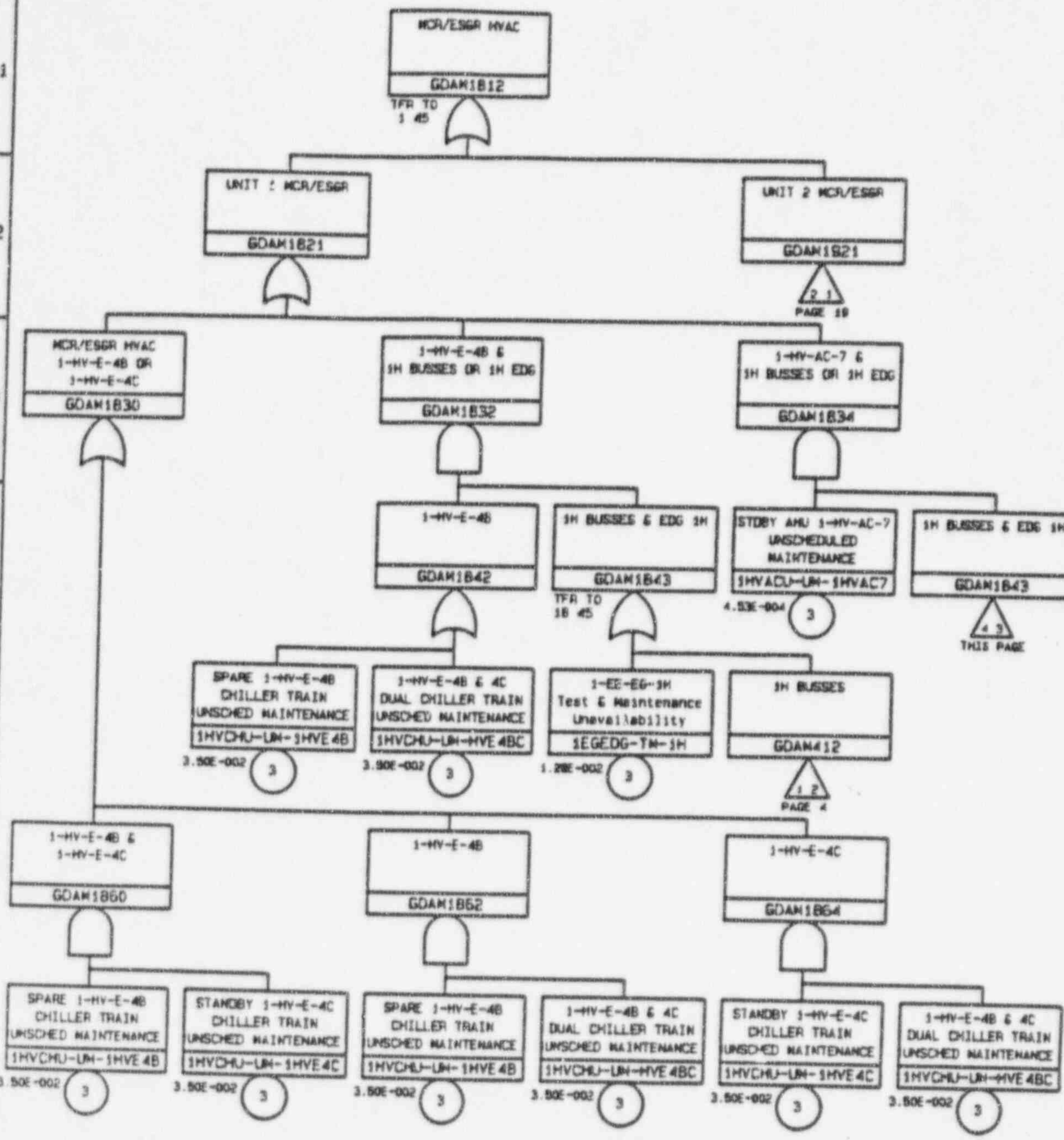


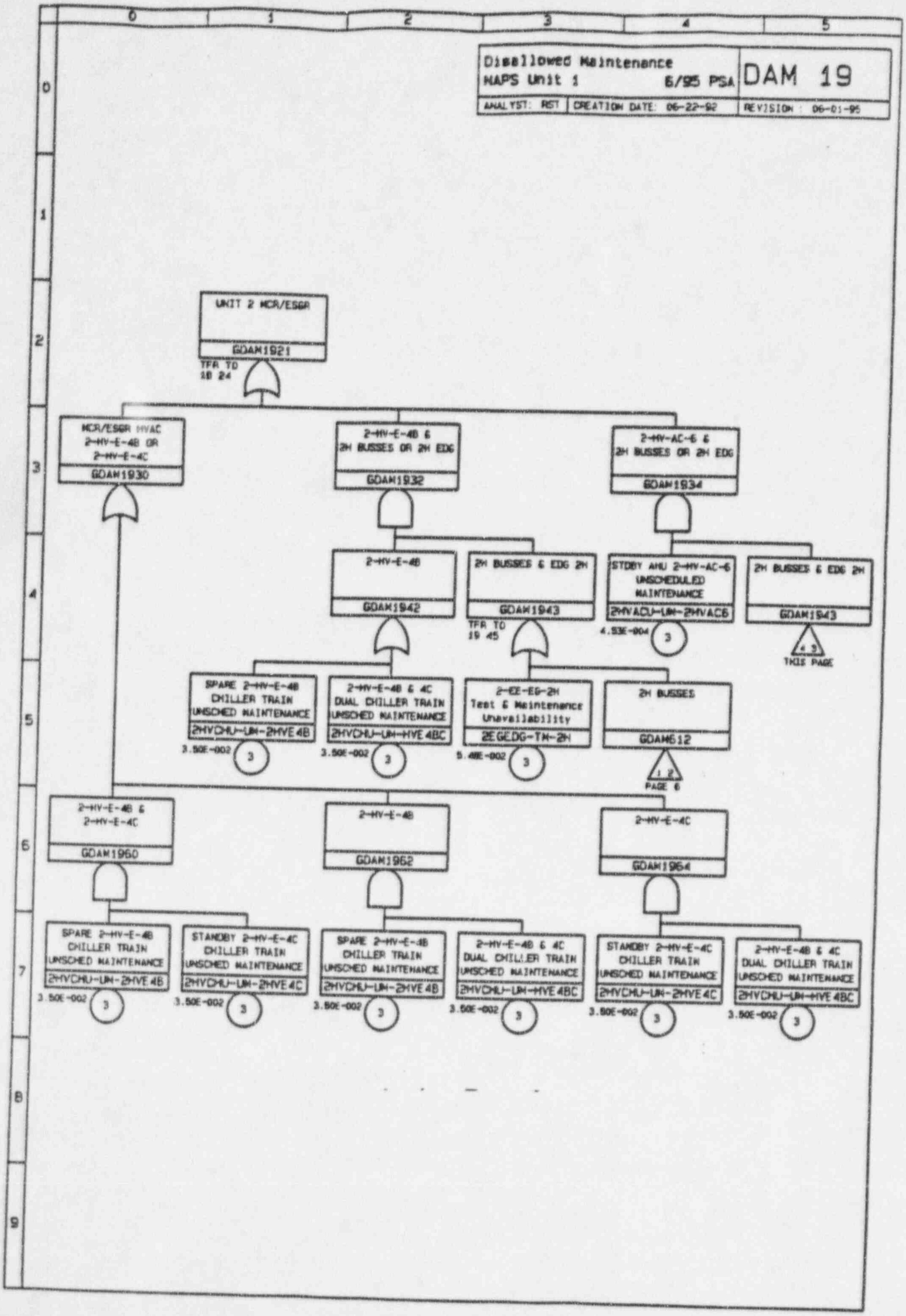
DAM.LGC NUPRA 2.2 VAPOR

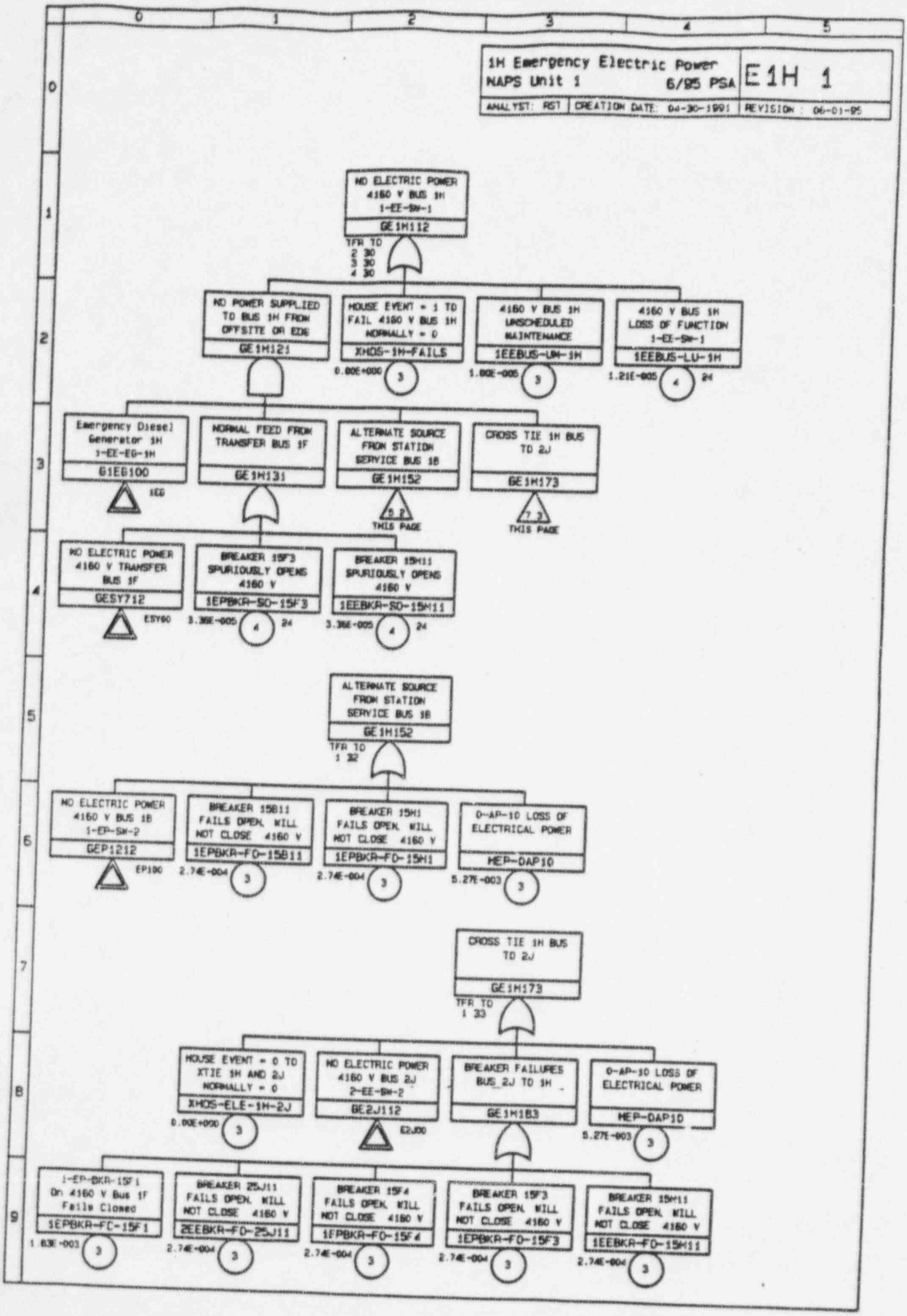
Disallowed Maintenance
NAPS Unit 1 6/95 PSA

DAM 18

ANALYST: RST | CREATION DATE: 06-22-92 | REVISION: 06-01-95



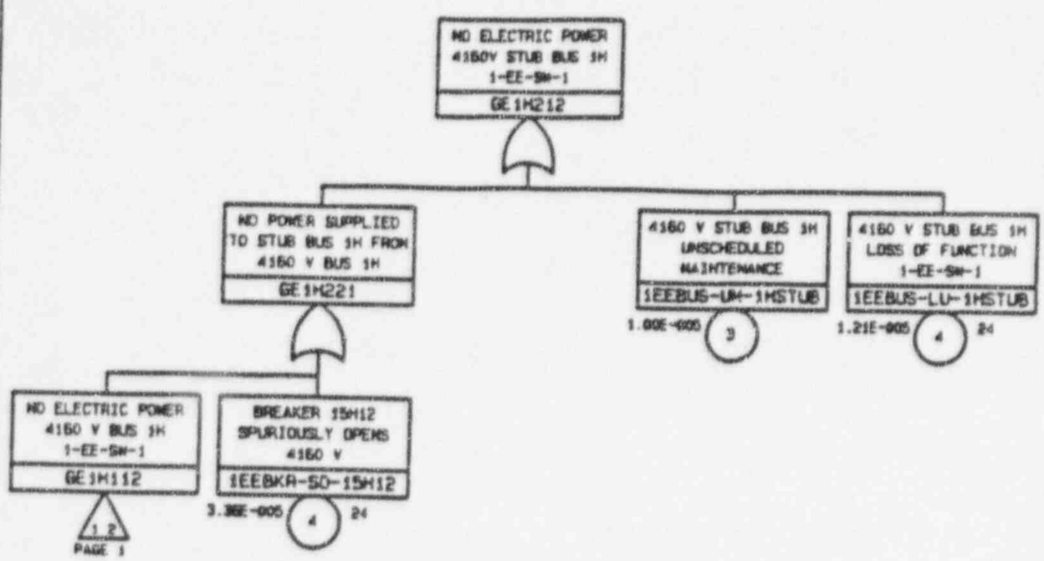

Disallowed Maintenance
MAPS Unit 1
6/95 PSA
DAM 19
ANALYST: RST
CREATION DATE: 06-22-92
REVISION : 06-01-95
UNIT 2 MCR/ESGR
GDAM1921
TFR TO 18 24
MCR/ESGR HVAC 2-HV-E-4B OR 2-HV-E-4C
GDAM1930
2-HV-E-4B & 2H BUSSES OR 2H EDG
GDAM1932
2-HV-AC-6 & 2H BUSSES OR 2H EDG
GDAM1934
2-HV-E-4B
GDAM1942
2H BUSSES & EDG 2H
GDAM1943
TFR TO 19 45
STDBY AHU 2-HV-AC-6 UNSCHEDULED MAINTENANCE
2HVACU-UM-2HVAC6
4.53E-004
2H BUSSES & EDG 2H
GDAM1943
THIS PAGE
SPARE 2-HV-E-4B CHILLER TRAIN UNSCHED MAINTENANCE
2HVCHU-UM-2HVE4B
3.50E-002
2-HV-E-4B & 4C DUAL CHILLER TRAIN UNSCHED MAINTENANCE
2HVCHU-UM-HVE4BC
3.50E-002
2-EE-EG-2H Test & Maintenance Unavailability
2EGEDG-TM-2H
5.48E-002
2H BUSSES
GDAM612
PAGE 6
2-HV-E-4B & 2-HV-E-4C
GDAM1960
2-HV-E-4B
GDAM1962
2-HV-E-4C
GDAM1964
SPARE 2-HV-E-4B CHILLER TRAIN UNSCHED MAINTENANCE
2HVCHU-UM-2HVE4B
3.50E-002
STANDBY 2-HV-E-4C CHILLER TRAIN UNSCHED MAINTENANCE
2HVCHU-UM-2HVE4C
3.50E-002
SPARE 2-HV-E-4B CHILLER TRAIN UNSCHED MAINTENANCE
2HVCHU-UM-2HVE4B
3.50E-002
2-HV-E-4B & 4C DUAL CHILLER TRAIN UNSCHED MAINTENANCE
2HVCHU-UM-HVE4BC
3.50E-002
STANDBY 2-HV-E-4C CHILLER TRAIN UNSCHED MAINTENANCE
2HVCHU-UM-2HVE4C
3.50E-002
2-HV-E-4B & 4C DUAL CHILLER TRAIN UNSCHED MAINTENANCE
2HVCHU-UM-HVE4BC
3.50E-002


1H Emergency Electric Power
NAPS Unit 1 6/95 PSA
E1H 1
ANALYST: RST
CREATION DATE: 04-30-1991
REVISION : 06-01-95
NO ELECTRIC POWER 4160 V BUS 1H 1-EE-SW-1
GE1H112
TFR TO 2 30 3 30 4 30
NO POWER SUPPLIED TO BUS 1H FROM OFFSITE OR EDG
GE1H121
HOUSE EVENT = 1 TO FAIL 4160 V BUS 1H NORMALLY = 0
XHOS-1H-FAILS
0.00E+000
4160 V BUS 1H UNSCHEDULED MAINTENANCE
1EEBUS-UM-1H
1.00E-005
4160 V BUS 1H LOSS OF FUNCTION 1-EE-SW-1
1EEBUS-LU-1H
1.21E-005
Emergency Diesel Generator 1H 1-EE-EG-1H
G1EG100
1EG
NORMAL FEED FROM TRANSFER BUS 1F
GE1H131
ALTERNATE SOURCE FROM STATION SERVICE BUS 1B
GE1H152
5 2 THIS PAGE
CROSS TIE 1H BUS TO 2J
GE1H173
7 3 THIS PAGE
NO ELECTRIC POWER 4160 V TRANSFER BUS 1F
GESY712
ESY00
BREAKER 15F3 SPURIOUSLY OPENS 4160 V
1EPBKR-SO-15F3
3.36E-005
BREAKER 15H11 SPURIOUSLY OPENS 4160 V
1EEBKR-SO-15H11
3.36E-005
ALTERNATE SOURCE FROM STATION SERVICE BUS 1B
GE1H152
TFR TO 1 32
NO ELECTRIC POWER 4160 V BUS 1B 1-EP-SW-2
GEP1212
EP100
BREAKER 15B11 FAILS OPEN, WILL NOT CLOSE 4160 V
1EPBKR-FO-15B11
2.74E-004
BREAKER 15H1 FAILS OPEN, WILL NOT CLOSE 4160 V
1EPBKR-FO-15H1
2.74E-004
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-OAP10
5.27E-003
CROSS TIE 1H BUS TO 2J
GE1H173
TFR TO 1 33
HOUSE EVENT = 0 TO XTIE 1H AND 2J NORMALLY = 0
XHOS-ELE-1H-2J
0.00E+000
NO ELECTRIC POWER 4160 V BUS 2J 2-EE-SW-2
GE2J112
E2J00
BREAKER FAILURES BUS 2J TO 1H
GE1H183
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-OAP10
5.27E-003
1-EP-BKR-15F1 On 4160 V Bus 1F Fails Closed
1EPBKR-FC-15F1
1.63E-003
BREAKER 25J11 FAILS OPEN, WILL NOT CLOSE 4160 V
2EEBKR-FO-25J11
2.74E-004
BREAKER 15F4 FAILS OPEN, WILL NOT CLOSE 4160 V
1EPBKR-FO-15F4
2.74E-004
BREAKER 15F3 FAILS OPEN, WILL NOT CLOSE 4160 V
1EPBKR-FO-15F3
2.74E-004
BREAKER 15H11 FAILS OPEN, WILL NOT CLOSE 4160 V
1EEBKR-FO-15H11
2.74E-004

1H Emergency Electric Power
NAPS Unit 1 6/95 PSA

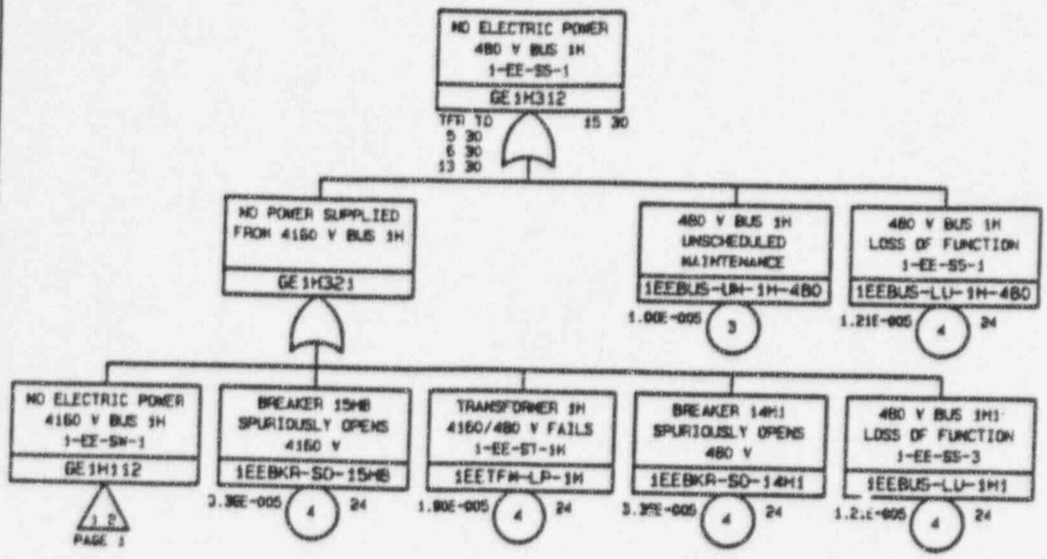
E1H 2

ANALYST: RST | CREATION DATE: 04-30-1991 | REVISION: 06-01-95

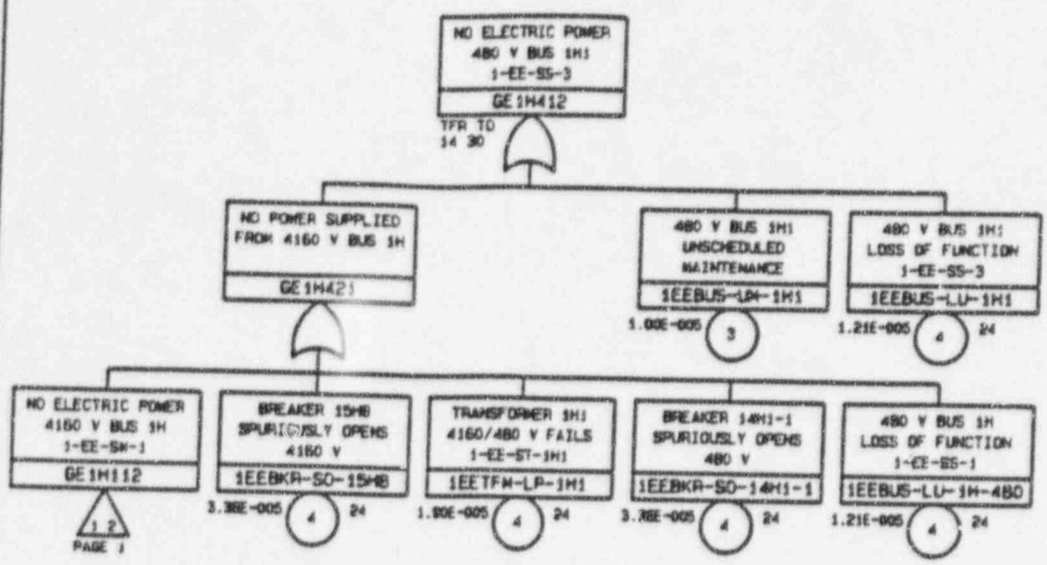


E1H00 LGC NUPRA 2.2 VAPWR

1H Emergency Electric Power NAPS Unit 1 6/95 PSA	E1H 3
ANALYST: RST | CREATION DATE: 04-30-1991	REVISION: 06-01-95

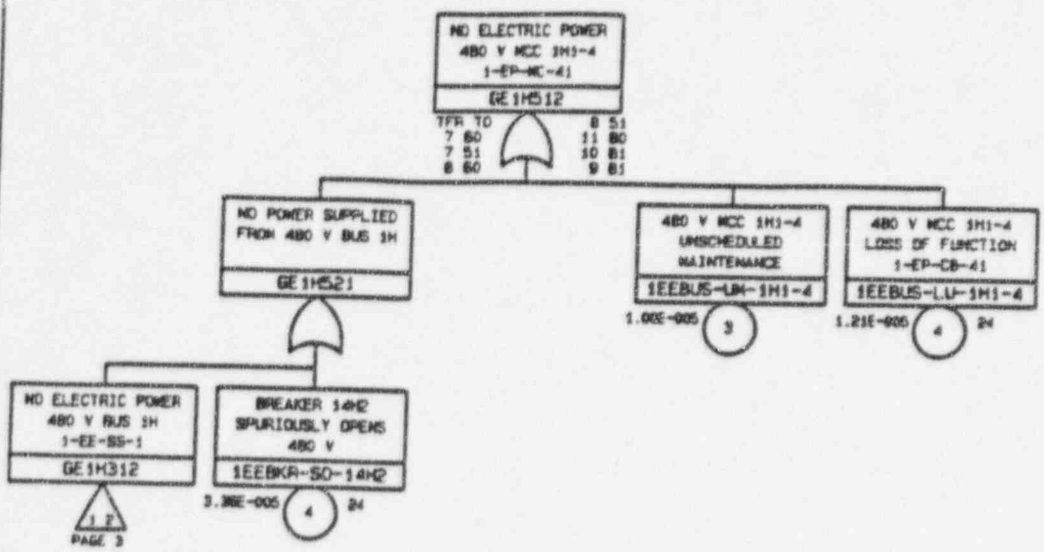


1H Emergency Electric Power MAPS Unit 1 6/95 PSA	E1H 4
ANALYST: RST | CREATION DATE: 04-30-1991	REVISION : 06-01-95



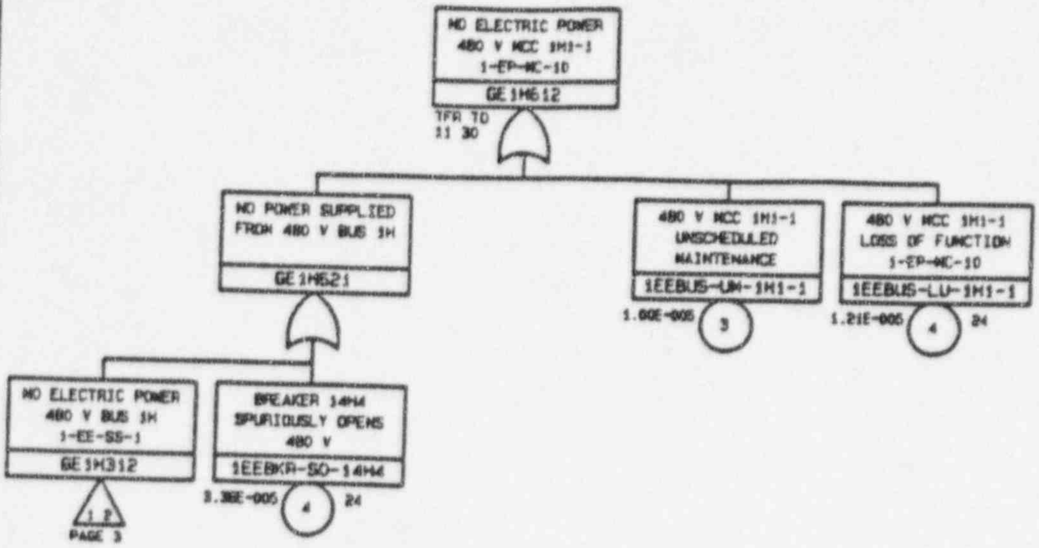
E1H00.LGC NUFPS 2.2 VAPWR

1H Emergency Electric Power NAPS Unit 1 6/95 PSA	E1H 5
ANALYST: RST | CREATION DATE: 04-30-1991	REVISION : 06-01-95

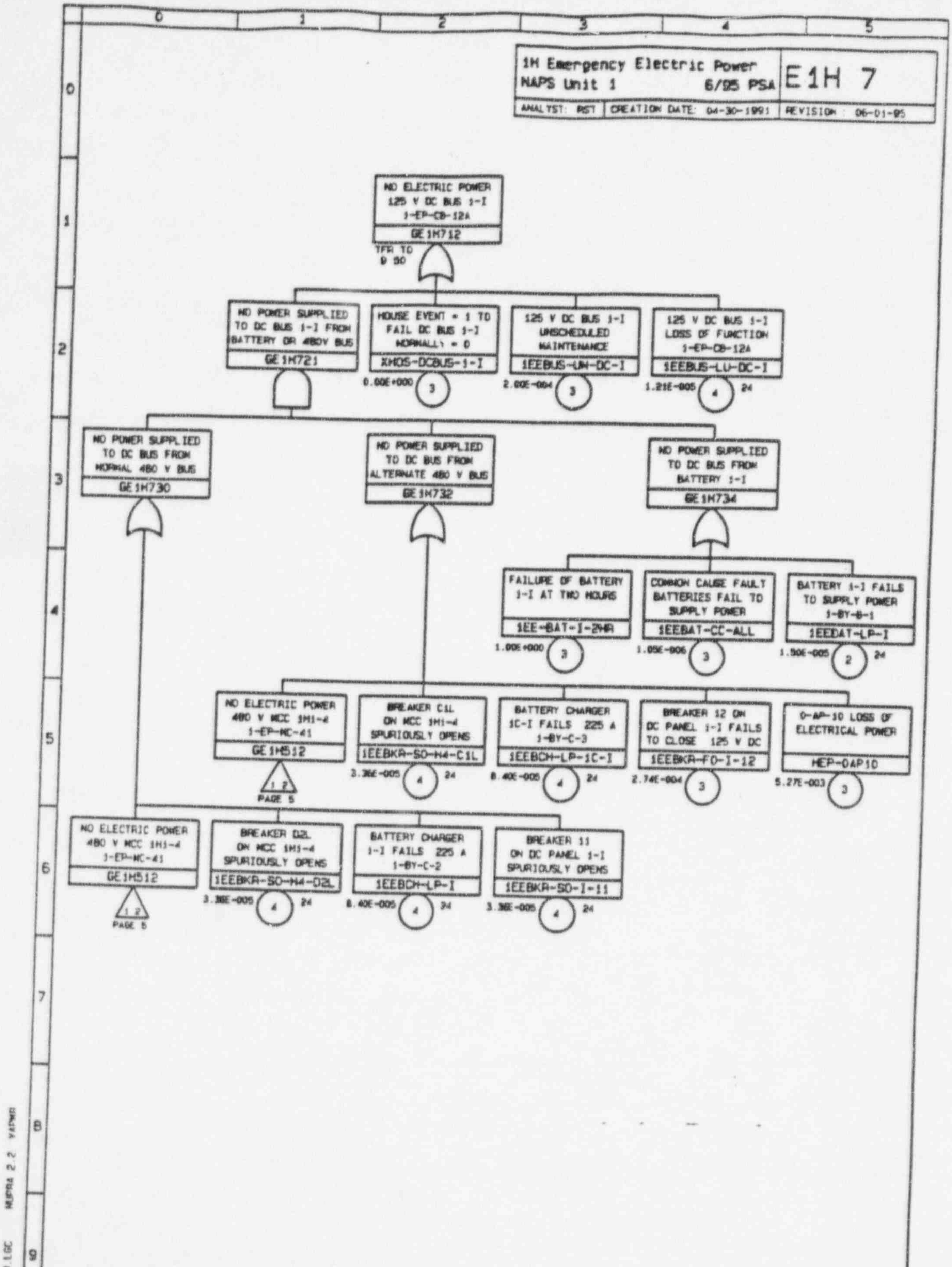


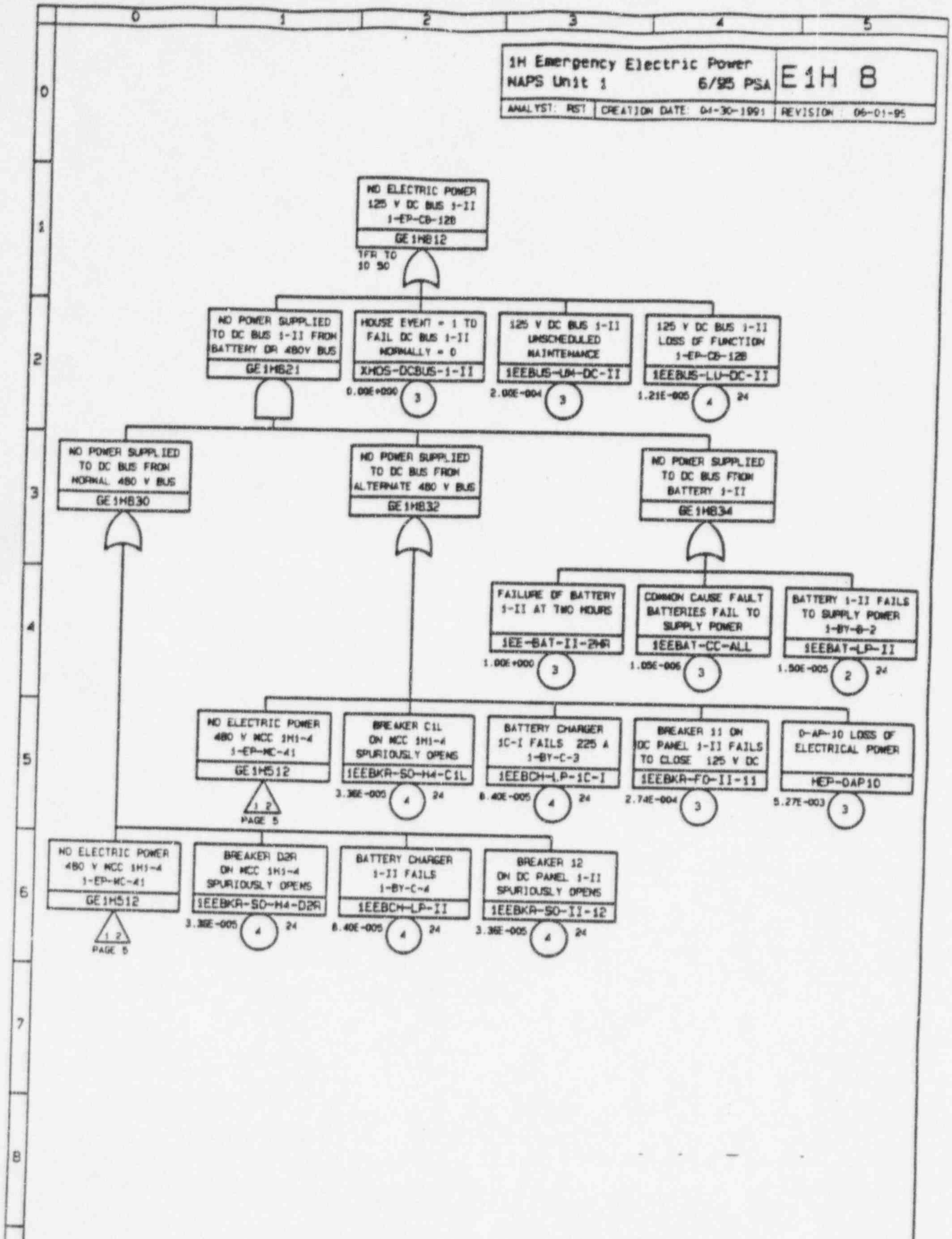
E1H00.LGC NUPRA 2.2

1H Emergency Electric Power NAPS Unit 1 6/95 PSA	E1H 6
ANALYST: RST | CREATION DATE: 04-30-1991	REVISION: 06-01-95

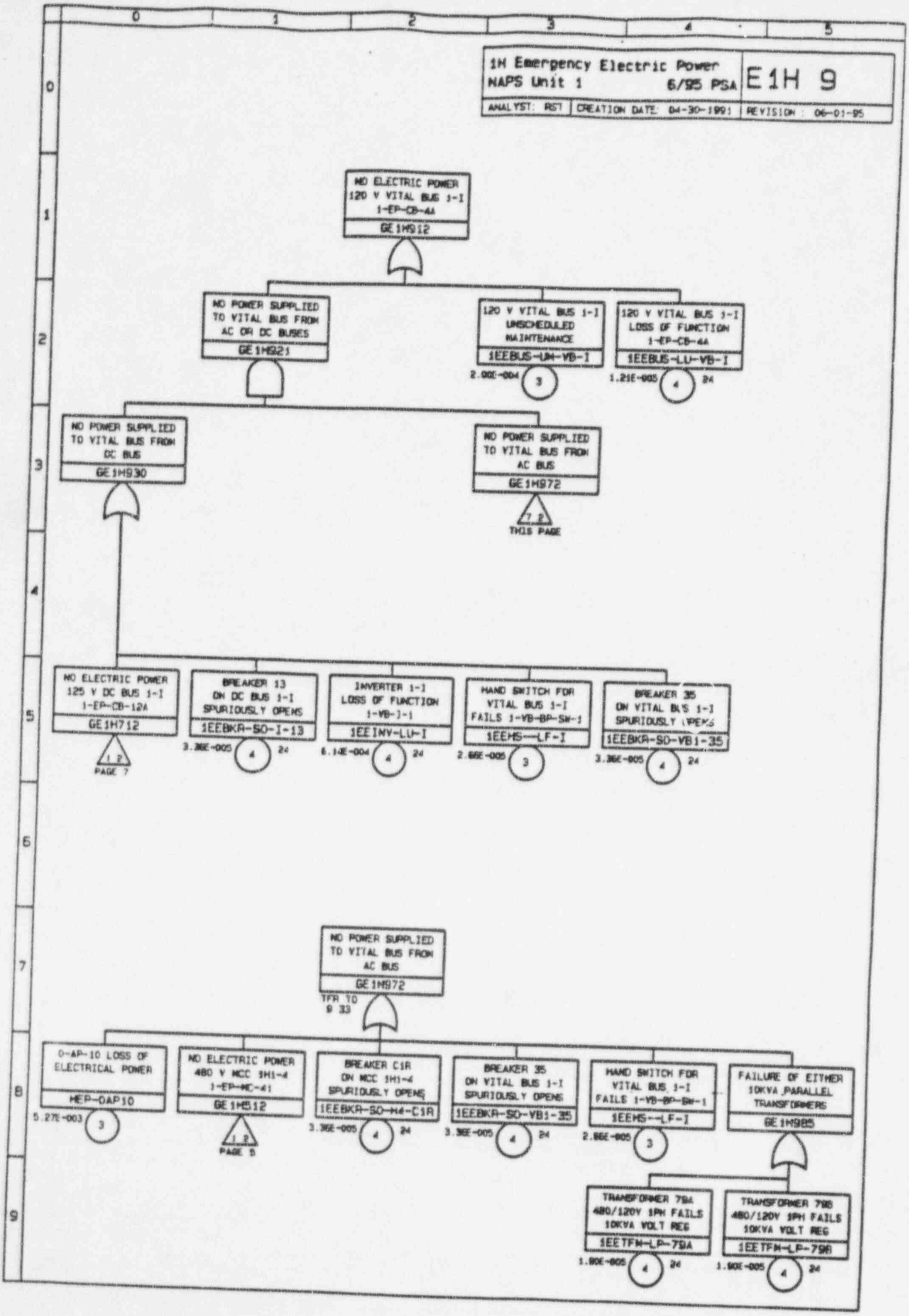


E1H00.LGC NUPRA 2.2 VAPWR

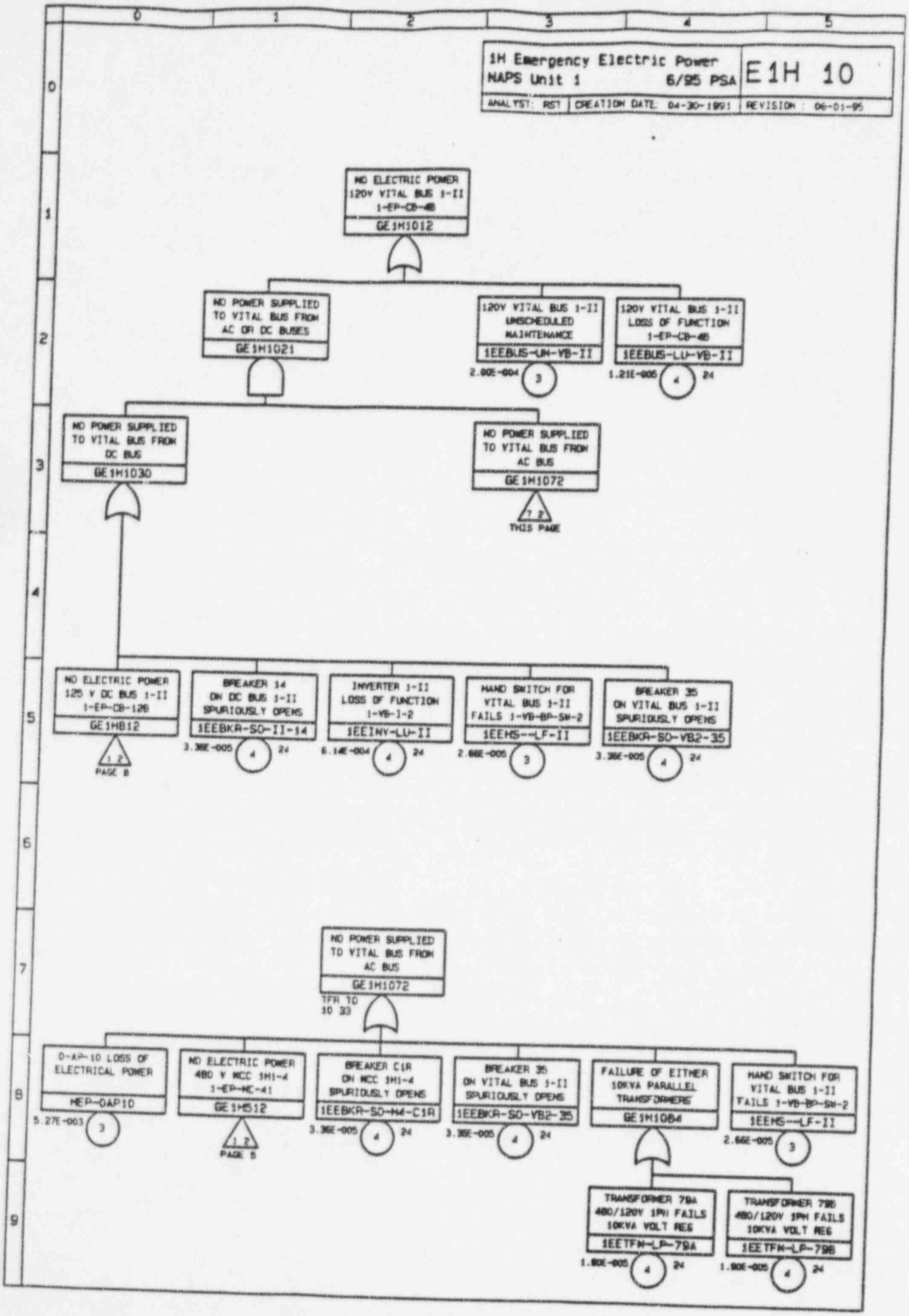

1H Emergency Electric Power
NAPS Unit 1 6/95 PSA
E1H 7
ANALYST: RST
CREATION DATE: 04-30-1991
REVISION : 06-01-95
NO ELECTRIC POWER 125 V DC BUS 1-I 1-EP-CB-12A
GE1H712
TFR TO D 50
NO POWER SUPPLIED TO DC BUS 1-I FROM BATTERY OR 480V BUS
GE1H721
HOUSE EVENT = 1 TO FAIL DC BUS 1-I NORMALLY = 0
XHOS-DCBUS-1-I
0.00E+000
125 V DC BUS 1-I UNSCHEDULED MAINTENANCE
1EEBUS-UM-DC-I
2.00E-004
125 V DC BUS 1-I LOSS OF FUNCTION 1-EP-CB-12A
1EEBUS-LU-DC-I
1.21E-005
NO POWER SUPPLIED TO DC BUS FROM NORMAL 480 V BUS
GE1H730
NO POWER SUPPLIED TO DC BUS FROM ALTERNATE 480 V BUS
GE1H732
NO POWER SUPPLIED TO DC BUS FROM BATTERY 1-I
GE1H734
FAILURE OF BATTERY 1-I AT TWO HOURS
1EE-BAT-I-2HR
1.00E+000
COMMON CAUSE FAULT BATTERIES FAIL TO SUPPLY POWER
1EEBAT-CC-ALL
1.05E-006
BATTERY 1-I FAILS TO SUPPLY POWER 1-BY-B-1
1EEBAT-LP-I
1.50E-005
NO ELECTRIC POWER 480 V MCC 1H1-4 1-EP-MC-41
GE1H512
PAGE 5
BREAKER C1L ON MCC 1H1-4 SPURIOUSLY OPENS
1EEBKR-SO-H4-C1L
3.36E-005
BATTERY CHARGER 1C-I FAILS 225 A 1-BY-C-3
1EEBCH-LP-1C-I
8.40E-005
BREAKER 12 ON DC PANEL 1-I FAILS TO CLOSE 125 V DC
1EEBKR-FO-I-12
2.74E-004
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-OAP10
5.27E-003
NO ELECTRIC POWER 480 V MCC 1H1-4 1-EP-MC-41
GE1H512
PAGE 5
BREAKER D2L ON MCC 1H1-4 SPURIOUSLY OPENS
1EEBKR-SO-H4-D2L
3.36E-005
BATTERY CHARGER 1-I FAILS 225 A 1-BY-C-2
1EEBCH-LP-I
8.40E-005
BREAKER 11 ON DC PANEL 1-I SPURIOUSLY OPENS
1EEBKR-SO-I-11
3.36E-005
E1H00.LGC NUPRA 2.2 YAPWR

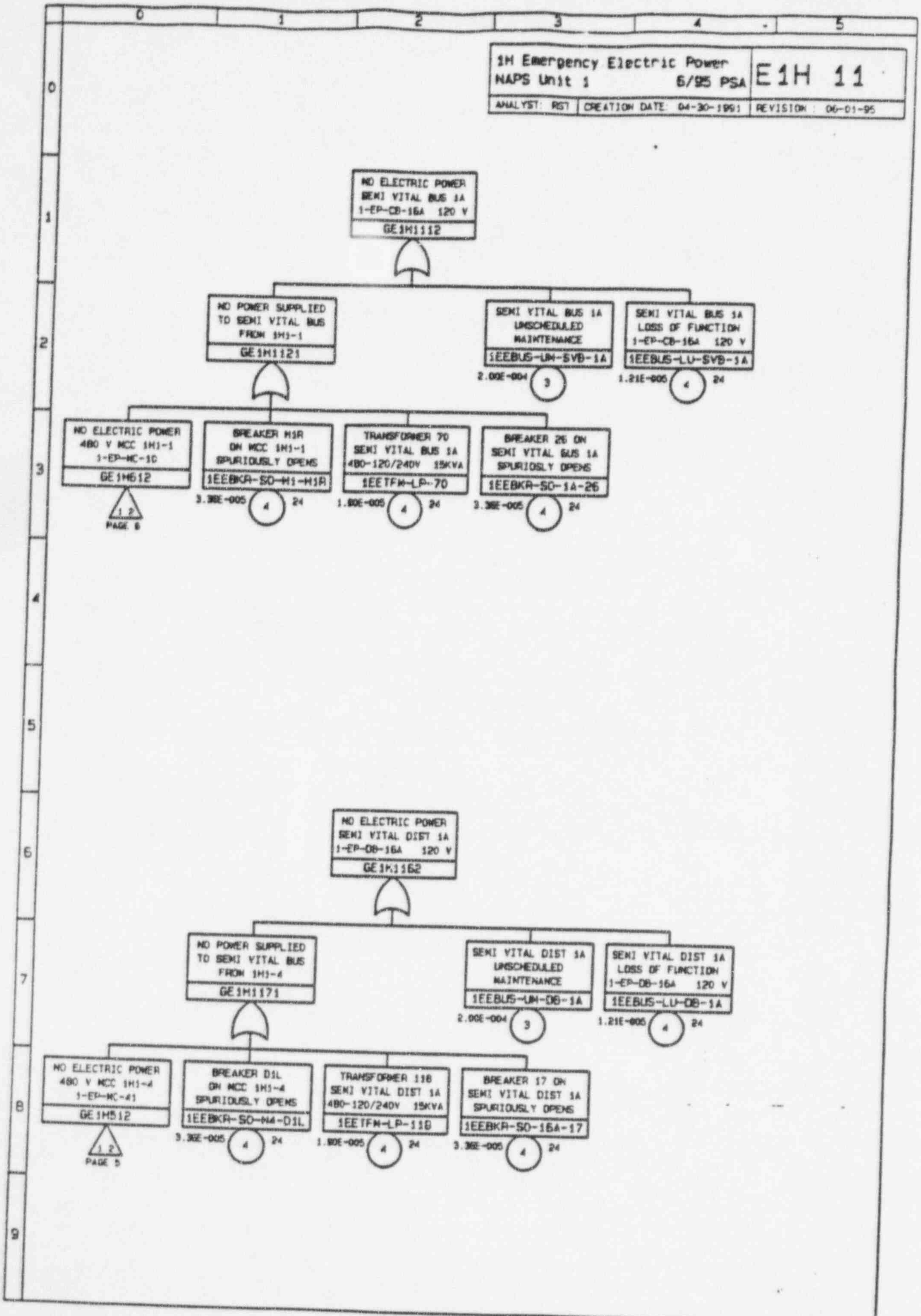


1H Emergency Electric Power
NAPS Unit 1 6/95 PSA
E1H 8
ANALYST: RST
CREATION DATE: 04-30-1991
REVISION 06-01-95
NO ELECTRIC POWER 125 V DC BUS 1-II 1-EP-CB-12B
GE1H812
TFR TO 10 S0
NO POWER SUPPLIED TO DC BUS 1-II FROM BATTERY OR 480V BUS
GE1H821
HOUSE EVENT = 1 TO FAIL DC BUS 1-II NORMALLY = 0
XHOS-DCBUS-1-II
0.00E+000
125 V DC BUS 1-II UNSCHEDULED MAINTENANCE
1EEBUS-UM-DC-II
2.00E-004
125 V DC BUS 1-II LOSS OF FUNCTION 1-EP-CB-12B
1EEBUS-LU-DC-II
1.21E-005
NO POWER SUPPLIED TO DC BUS FROM NORMAL 480 V BUS
GE1H830
NO POWER SUPPLIED TO DC BUS FROM ALTERNATE 480 V BUS
GE1H832
NO POWER SUPPLIED TO DC BUS FROM BATTERY 1-II
GE1H834
FAILURE OF BATTERY 1-II AT TWO HOURS
1EE-BAT-II-2HR
1.00E+000
COMMON CAUSE FAULT BATTERIES FAIL TO SUPPLY POWER
1EEBAT-CC-ALL
1.05E-006
BATTERY 1-II FAILS TO SUPPLY POWER 1-BY-B-2
1EEBAT-LP-II
1.50E-005
NO ELECTRIC POWER 480 V MCC 1H1-4 1-EP-MC-41
GE1H512
PAGE 5
BREAKER C1L ON MCC 1H1-4 SPURIOUSLY OPENS
1EEBKR-SO-H4-C1L
3.36E-005
BATTERY CHARGER 1C-I FAILS 225 A 1-BY-C-3
1EEBCH-LP-1C-I
8.40E-005
BREAKER 11 ON DC PANEL 1-II FAILS TO CLOSE 125 V DC
1EEBKR-FO-II-11
2.74E-004
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-0AP10
5.27E-003
NO ELECTRIC POWER 480 V MCC 1H1-4 1-EP-MC-41
GE1H512
PAGE 5
BREAKER D2R ON MCC 1H1-4 SPURIOUSLY OPENS
1EEBKR-SO-H4-D2R
3.36E-005
BATTERY CHARGER 1-II FAILS 1-BY-C-4
1EEBCH-LP-II
8.40E-005
BREAKER 12 ON DC PANEL 1-II SPURIOUSLY OPENS
1EEBKR-SO-II-12
3.36E-005
E1H00.LGC NUPRA 2.2 VAPWR

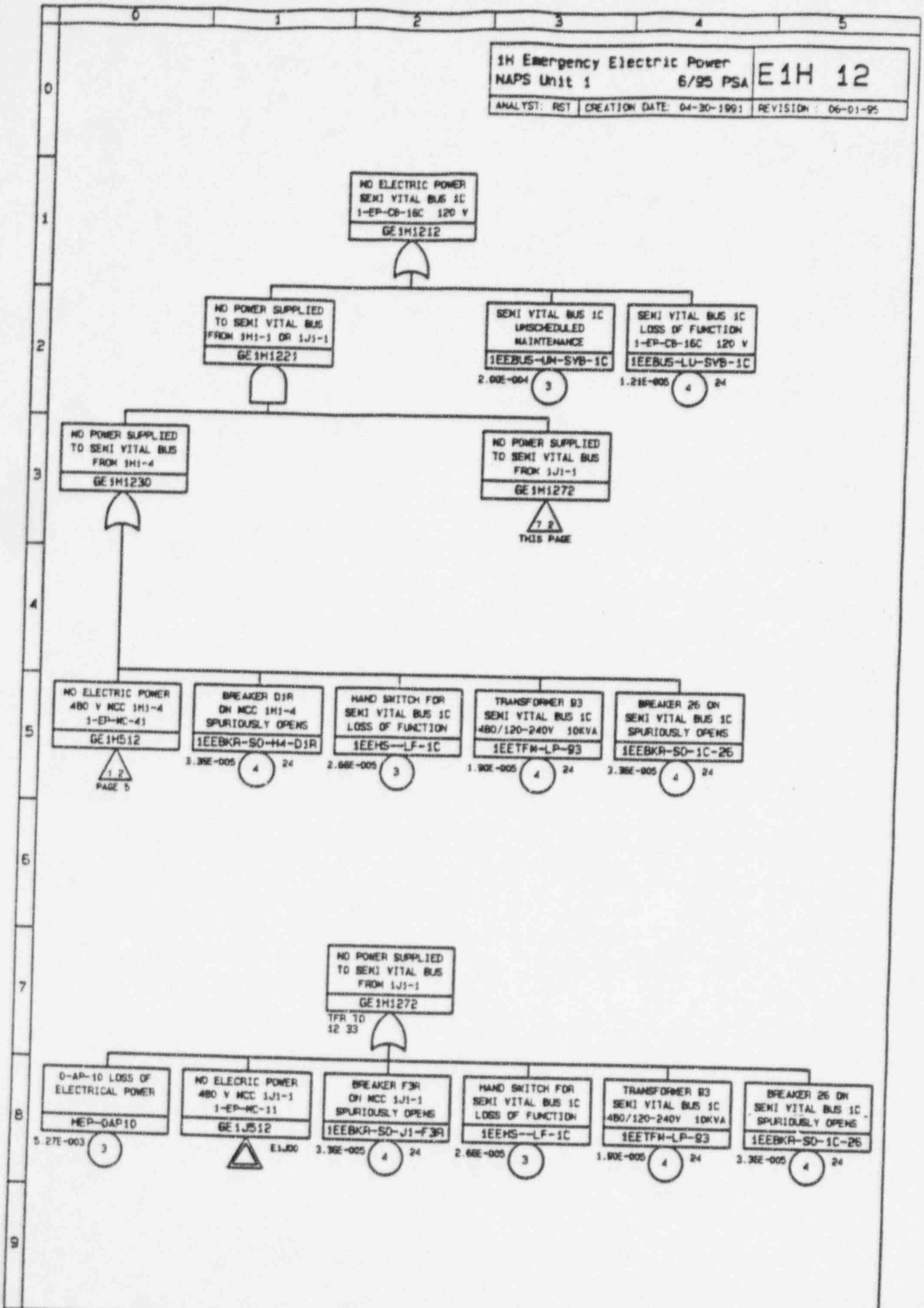


1H Emergency Electric Power
NAPS Unit 1
6/95 PSA
E1H 9
ANALYST: RST
CREATION DATE: 04-30-1991
REVISION : 06-01-95
NO ELECTRIC POWER 120 V VITAL BUS 1-I 1-EP-CB-4A
GE1H912
NO POWER SUPPLIED TO VITAL BUS FROM AC OR DC BUSES
GE1H921
120 V VITAL BUS 1-I UNSCHEDULED MAINTENANCE
1EEBUS-UM-VB-I
2.00E-004
120 V VITAL BUS 1-I LOSS OF FUNCTION 1-EP-CB-4A
1EEBUS-LU-VB-I
1.21E-005
NO POWER SUPPLIED TO VITAL BUS FROM DC BUS
GE1H930
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE1H972
THIS PAGE
NO ELECTRIC POWER 125 V DC BUS 1-I 1-EP-CB-12A
GE1H712
PAGE 7
BREAKER 13 ON DC BUS 1-I SPURIOUSLY OPENS
1EEBKA-SO-I-13
3.36E-005
INVERTER 1-I LOSS OF FUNCTION 1-VB-I-1
1EEINV-LU-I
6.14E-004
HAND SWITCH FOR VITAL BUS 1-I FAILS 1-VB-BP-SW-1
1EEHS--LF-I
2.66E-005
BREAKER 35 ON VITAL BUS 1-I SPURIOUSLY OPENS
1EEBKA-SO-VB1-35
3.36E-005
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE1H972
TFR TO 9 33
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-0AP10
5.27E-003
NO ELECTRIC POWER 480 V MCC 1H1-4 1-EP-MC-41
GE1H512
PAGE 5
BREAKER C1R ON MCC 1H1-4 SPURIOUSLY OPENS
1EEBKA-SO-H4-C1R
3.36E-005
BREAKER 35 ON VITAL BUS 1-I SPURIOUSLY OPENS
1EEBKA-SO-VB1-35
3.36E-005
HAND SWITCH FOR VITAL BUS 1-I FAILS 1-VB-BP-SW-1
1EEHS--LF-I
2.66E-005
FAILURE OF EITHER 10KVA PARALLEL TRANSFORMERS
GE1H985
TRANSFORMER 79A 480/120V 1PH FAILS 10KVA VOLT REG
1EETFM-LP-79A
1.90E-005
TRANSFORMER 79B 480/120V 1PH FAILS 10KVA VOLT REG
1EETFM-LP-79B
1.90E-005


1H Emergency Electric Power
NAPS Unit 1 6/95 PSA
E1H 10
ANALYST: RST
CREATION DATE: 04-30-1991
REVISION: 06-01-95
NO ELECTRIC POWER 120V VITAL BUS 1-II 1-EP-CB-4B
GE1H1012
NO POWER SUPPLIED TO VITAL BUS FROM AC OR DC BUSES
GE1H1021
120V VITAL BUS 1-II UNSCHEDULED MAINTENANCE
1EEBUS-UM-VB-II
2.00E-004
120V VITAL BUS 1-II LOSS OF FUNCTION 1-EP-CB-4B
1EEBUS-LU-VB-II
1.21E-005
NO POWER SUPPLIED TO VITAL BUS FROM DC BUS
GE1H1030
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE1H1072
THIS PAGE
NO ELECTRIC POWER 125 V DC BUS 1-II 1-EP-CB-12B
GE1HB12
PAGE 8
BREAKER 14 ON DC BUS 1-II SPURIOUSLY OPENS
1EEBKR-SO-II-14
3.36E-005
INVERTER 1-II LOSS OF FUNCTION 1-VB-I-2
1EEINV-LU-II
6.14E-004
HAND SWITCH FOR VITAL BUS 1-II FAILS 1-VB-BP-SW-2
1EEHS--LF-II
2.66E-005
BREAKER 35 ON VITAL BUS 1-II SPURIOUSLY OPENS
1EEBKR-SO-VB2-35
3.36E-005
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE1H1072
TFR TO 10 33
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-0AP10
5.27E-003
NO ELECTRIC POWER 480 V MCC 1H1-4 1-EP-MC-41
GE1H512
PAGE 5
BREAKER C1R ON MCC 1H1-4 SPURIOUSLY OPENS
1EEBKR-SO-H4-C1R
3.36E-005
BREAKER 35 ON VITAL BUS 1-II SPURIOUSLY OPENS
1EEBKR-SO-VB2-35
3.36E-005
FAILURE OF EITHER 10KVA PARALLEL TRANSFORMERS
GE1H1084
HAND SWITCH FOR VITAL BUS 1-II FAILS 1-VB-BP-SW-2
1EEHS--LF-II
2.66E-005
TRANSFORMER 79A 480/120V 1PH FAILS 10KVA VOLT REG
1EETFN-LP-79A
1.90E-005
TRANSFORMER 79B 480/120V 1PH FAILS 10KVA VOLT REG
1EETFN-LP-79B
1.90E-005
E1H00.LGC NUPRA 2.2 VAPWR

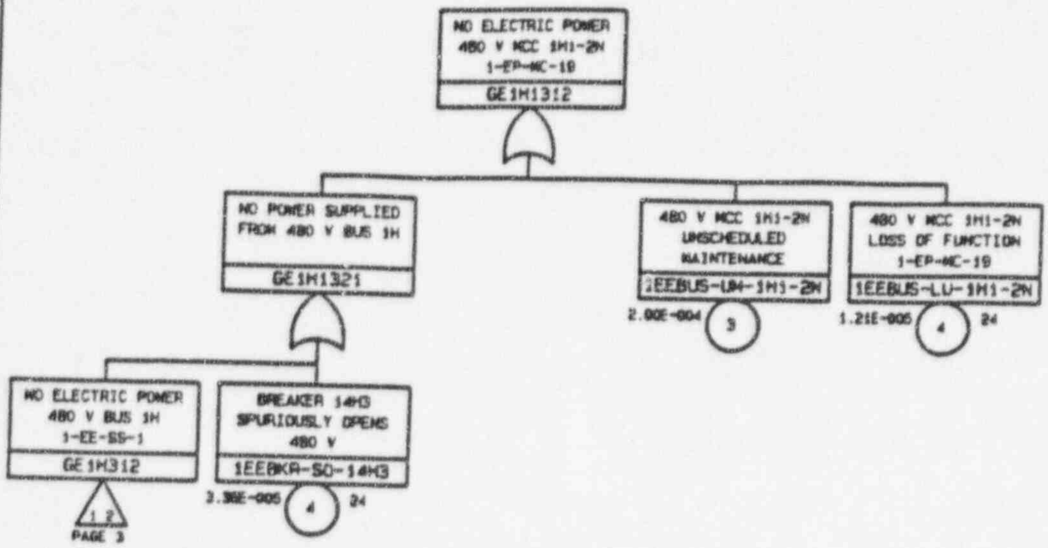


1H Emergency Electric Power
NAPS Unit 1 6/95 PSA
E1H 11
ANALYST: RST
CREATION DATE: 04-30-1991
REVISION : 06-01-95
NO ELECTRIC POWER SEMI VITAL BUS 1A 1-EP-CB-16A 120 V
GE1H1112
NO POWER SUPPLIED TO SEMI VITAL BUS FROM 1H1-1
GE1H1121
SEMI VITAL BUS 1A UNSCHEDULED MAINTENANCE
1EEBUS-UM-SVB-1A
2.00E-004
SEMI VITAL BUS 1A LOSS OF FUNCTION 1-EP-CB-16A 120 V
1EEBUS-LU-SVB-1A
1.21E-005
NO ELECTRIC POWER 480 V MCC 1H1-1 1-EP-MC-10
GE1H612
PAGE 6
BREAKER H1R ON MCC 1H1-1 SPURIOUSLY OPENS
1EEBKR-SO-H1-H1R
3.36E-005
TRANSFORMER 70 SEMI VITAL BUS 1A 480-120/240V 15KVA
1EETFM-LP-70
1.80E-005
BREAKER 26 ON SEMI VITAL BUS 1A SPURIOSLY OPENS
1EEBKR-SO-1A-26
3.36E-005
NO ELECTRIC POWER SEMI VITAL DIST 1A 1-EP-DB-16A 120 V
GE1K1162
NO POWER SUPPLIED TO SEMI VITAL BUS FROM 1H1-4
GE1H1171
SEMI VITAL DIST 1A UNSCHEDULED MAINTENANCE
1EEBUS-UM-DB-1A
2.00E-004
SEMI VITAL DIST 1A LOSS OF FUNCTION 1-EP-DB-16A 120 V
1EEBUS-LU-DB-1A
1.21E-005
NO ELECTRIC POWER 480 V MCC 1H1-4 1-EP-MC-41
GE1H512
PAGE 5
BREAKER D1L ON MCC 1H1-4 SPURIOUSLY OPENS
1EEBKR-SO-H4-D1L
3.36E-005
TRANSFORMER 11B SEMI VITAL DIST 1A 480-120/240V 15KVA
1EETFM-LP-11B
1.80E-005
BREAKER 17 ON SEMI VITAL DIST 1A SPURIOUSLY OPENS
1EEBKR-SO-16A-17
3.36E-005
E1H00.LGC NUPRA 2.2 VAPWR



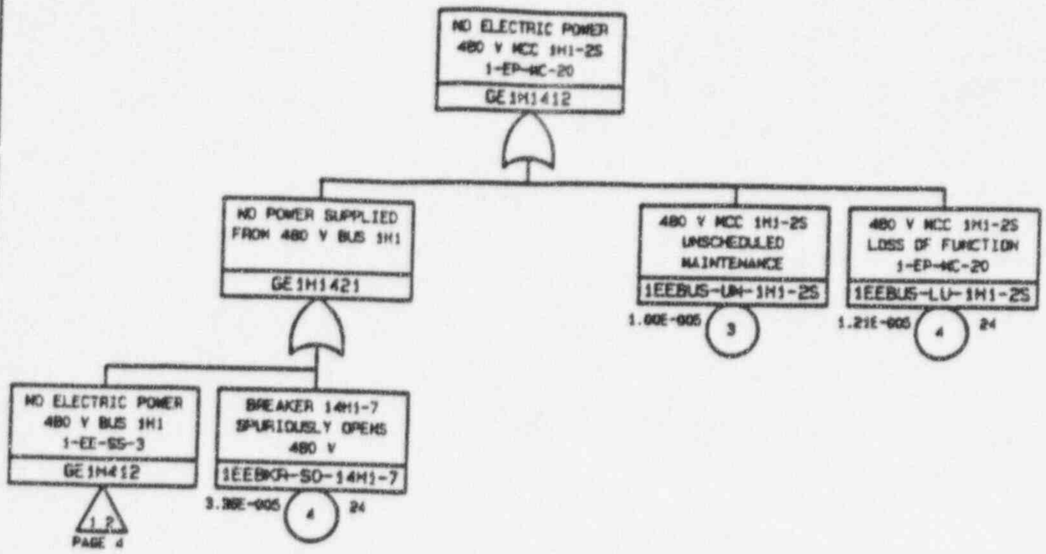
1H Emergency Electric Power
NAPS Unit 1 6/95 PSA
E1H 12
ANALYST: RST
CREATION DATE: 04-30-1991
REVISION: 06-01-95
NO ELECTRIC POWER SEMI VITAL BUS 1C 1-EP-CB-16C 120 V
GE1H1212
NO POWER SUPPLIED TO SEMI VITAL BUS FROM 1H1-1 OR 1J1-1
GE1H1221
SEMI VITAL BUS 1C UNSCHEDULED MAINTENANCE
1EEBUS-UM-SVB-1C
2.00E-004
3
SEMI VITAL BUS 1C LOSS OF FUNCTION 1-EP-CB-16C 120 V
1EEBUS-LU-SVB-1C
1.21E-005
4
24
NO POWER SUPPLIED TO SEMI VITAL BUS FROM 1H1-4
GE1H1230
NO POWER SUPPLIED TO SEMI VITAL BUS FROM 1J1-1
GE1H1272
7 2
THIS PAGE
NO ELECTRIC POWER 480 V MCC 1H1-4 1-EP-MC-41
GE1H512
1 2
PAGE 5
BREAKER D1R ON MCC 1H1-4 SPURIOUSLY OPENS
1EEBKR-SO-H4-D1R
3.36E-005
4
24
HAND SWITCH FOR SEMI VITAL BUS 1C LOSS OF FUNCTION
1EEHS--LF-1C
2.66E-005
3
TRANSFORMER 93 SEMI VITAL BUS 1C 480/120-240V 10KVA
1EETFM-LP-93
1.90E-005
4
24
BREAKER 26 ON SEMI VITAL BUS 1C SPURIOUSLY OPENS
1EEBKR-SO-1C-26
3.36E-005
4
24
NO POWER SUPPLIED TO SEMI VITAL BUS FROM 1J1-1
GE1H1272
TFR TO 12 33
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-0AP10
5.27E-003
3
NO ELECRIC POWER 480 V MCC 1J1-1 1-EP-MC-11
GE1J512
E1J00
BREAKER F3R ON MCC 1J1-1 SPURIOUSLY OPENS
1EEBKR-SO-J1-F3R
3.36E-005
4
24
HAND SWITCH FOR SEMI VITAL BUS 1C LOSS OF FUNCTION
1EEHS--LF-1C
2.66E-005
3
TRANSFORMER 93 SEMI VITAL BUS 1C 480/120-240V 10KVA
1EETFM-LP-93
1.90E-005
4
24
BREAKER 26 ON SEMI VITAL BUS 1C SPURIOUSLY OPENS
1EEBKR-SO-1C-26
3.36E-005
4
24
E1H00.LGC NUPRA 2.2 VAPWR

1H Emergency Electric Power MAPS Unit 1 6/95 PSA	E1H 13
ANALYST: RST | CREATION DATE: 04-30-1991	REVISION: 06-01-95

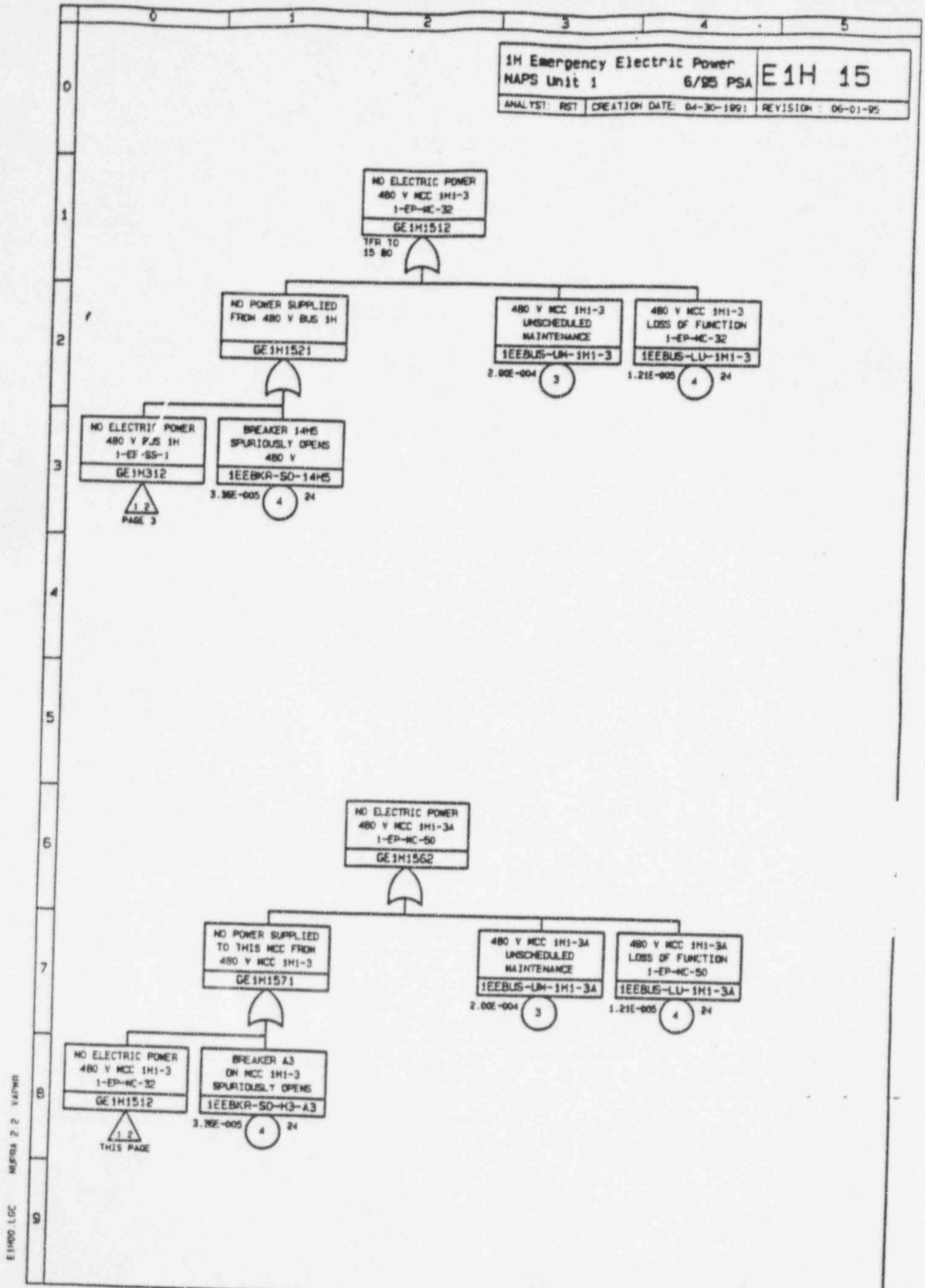


E1H00.LGC NUPRA 2.2 VAPWR

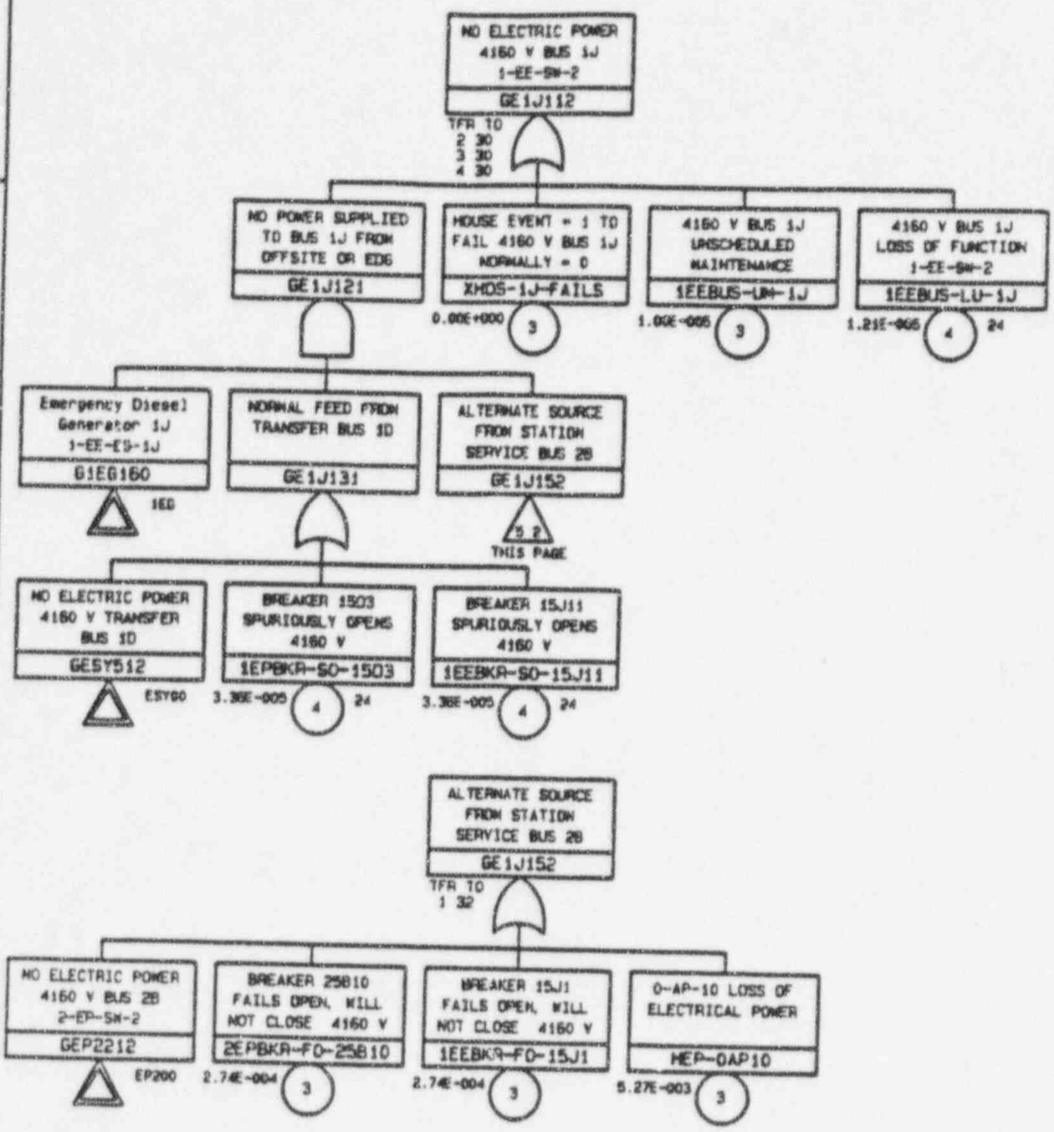
1H Emergency Electric Power NAPS Unit 1 6/95 PSA	E1H 14
ANALYST: RST | CREATION DATE: 04-30-1991	REVISION : 06-01-95



E1H00.LGC NUPRA 2.2 Version

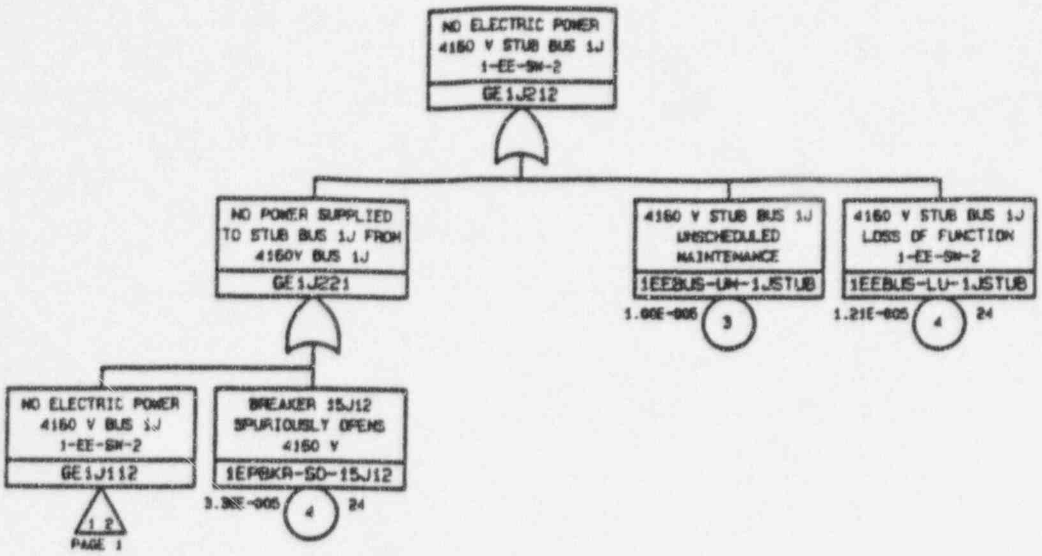

1H Emergency Electric Power
NAPS Unit 1 6/95 PSA
E1H 15
ANALYST: RST
CREATION DATE: 04-30-1991
REVISION: 06-01-95
NO ELECTRIC POWER 480 V MCC 1H1-3 1-EP-MC-32
GE1H1512
TFR TO 15 B0
NO POWER SUPPLIED FROM 480 V BUS 1H
GE1H1521
480 V MCC 1H1-3 UNSCHEDULED MAINTENANCE
1EEBUS-UM-1H1-3
2.00E-004
480 V MCC 1H1-3 LOSS OF FUNCTION 1-EP-MC-32
1EEBUS-LU-1H1-3
1.21E-005
NO ELECTRIC POWER 480 V BUS 1H 1-EP-SS-1
GE1H312
PAGE 3
BREAKER 14H5 SPURIOUSLY OPENS 480 V
1EEBKR-SO-14H5
3.36E-005
NO ELECTRIC POWER 480 V MCC 1H1-3A 1-EP-MC-50
GE1H1562
NO POWER SUPPLIED TO THIS MCC FROM 480 V MCC 1H1-3
GE1H1571
480 V MCC 1H1-3A UNSCHEDULED MAINTENANCE
1EEBUS-UM-1H1-3A
2.00E-004
480 V MCC 1H1-3A LOSS OF FUNCTION 1-EP-MC-50
1EEBUS-LU-1H1-3A
1.21E-005
NO ELECTRIC POWER 480 V MCC 1H1-3 1-EP-MC-32
GE1H1512
THIS PAGE
BREAKER A3 ON MCC 1H1-3 SPURIOUSLY OPENS
1EEBKR-SO-H3-A3
3.36E-005
E1H00.LGC NUPRA 2.2 VAPWR

1J Emergency Electric Power NAPS Unit 1 6/95 PSA	E1J 1
ANALYST: RST	CREATION DATE: 05-24-1991	REVISION: 06-01-95

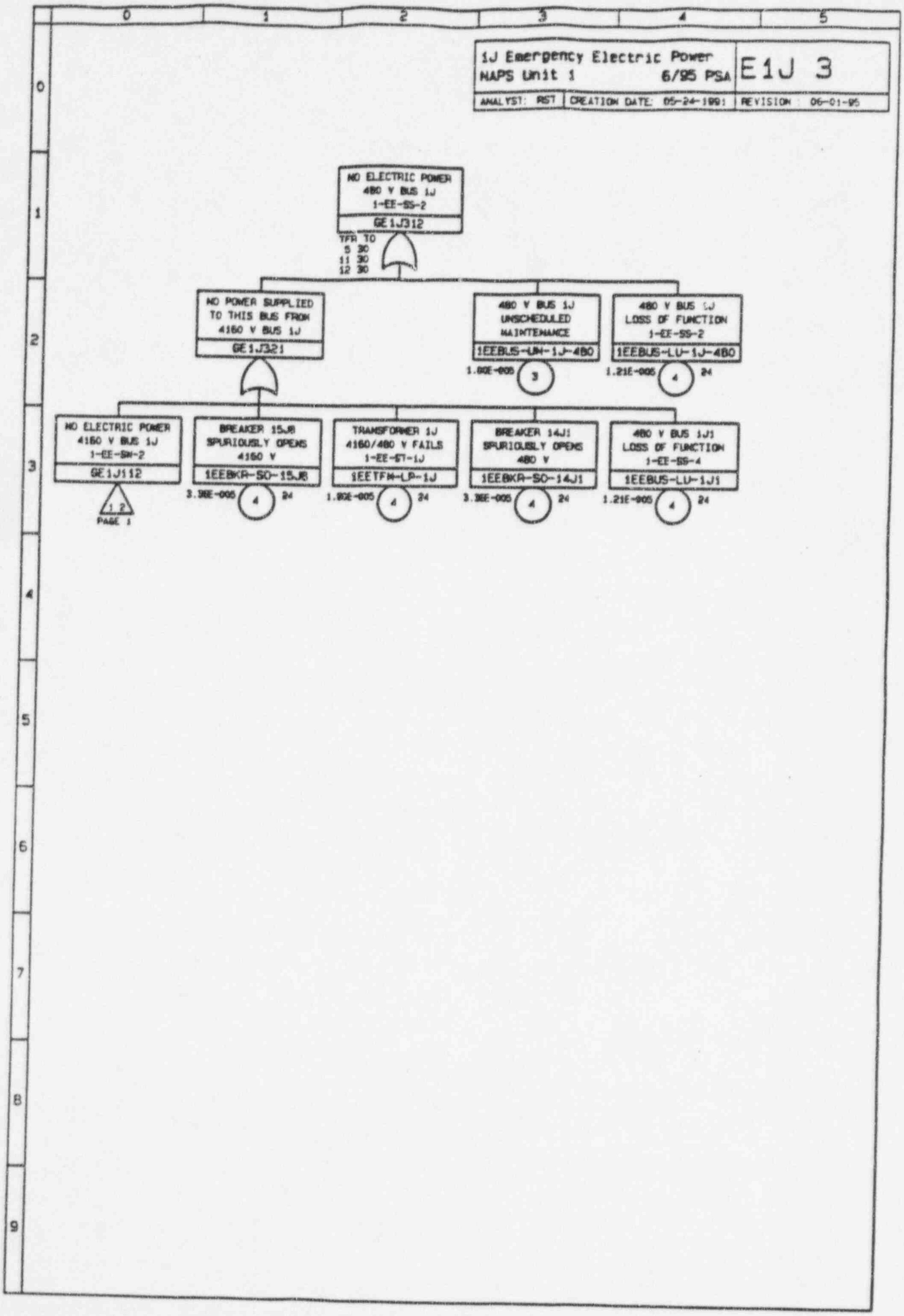


E1J00.LGC NUPRA 2.2 VAPWR

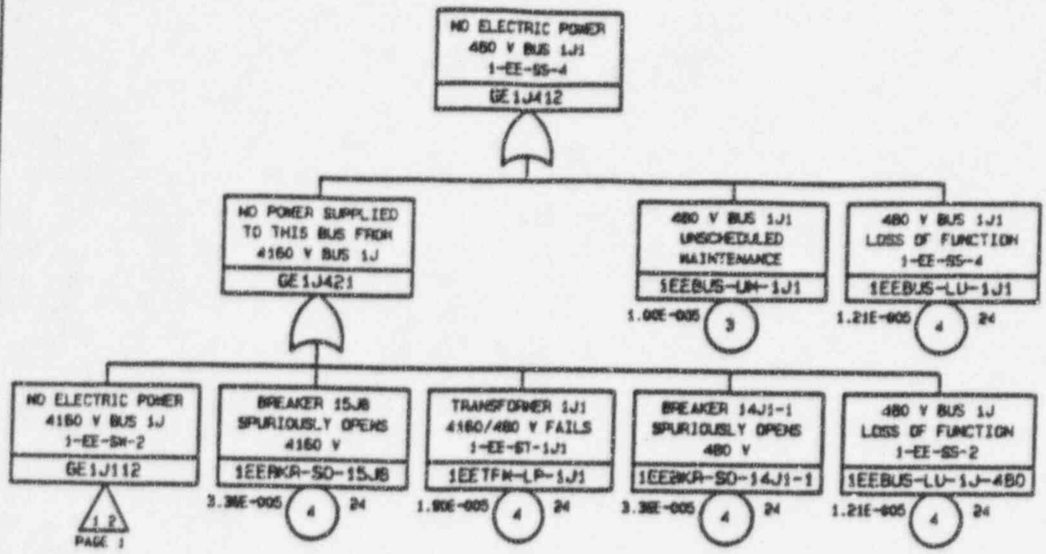
1J Emergency Electric Power NAPS Unit 1 6/95 PSA	E1J 2
ANALYST: RST | CREATION DATE: 05-24-1991	REVISION: 06-01-95



E1J00.LGC NUPRA 2.2 VAPWR

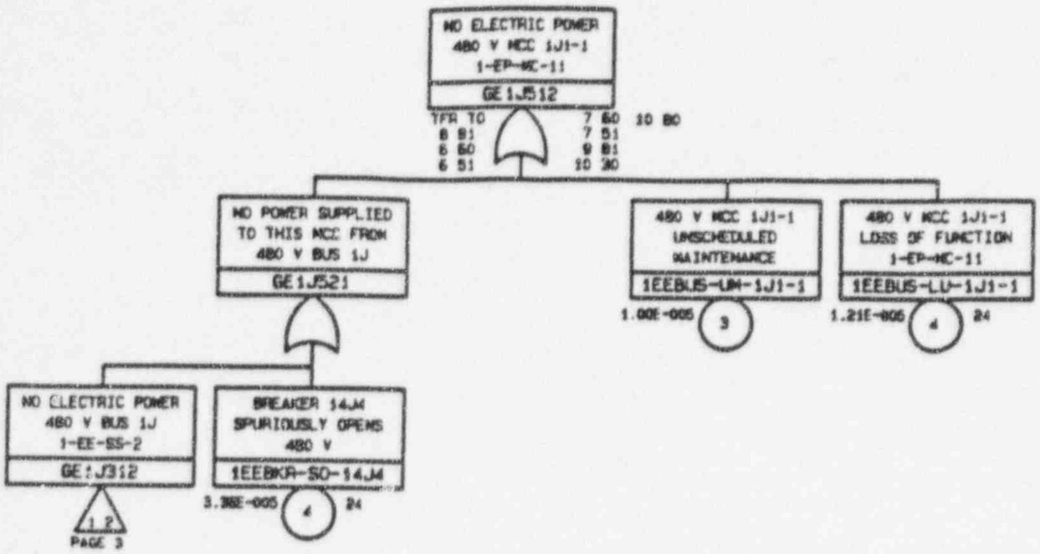

1J Emergency Electric Power
NAPS Unit 1 6/95 PSA
E1J 3
ANALYST: RST
CREATION DATE: 05-24-1991
REVISION : 06-01-95
NO ELECTRIC POWER 480 V BUS 1J 1-EE-SS-2
GE1J312
TFR TO
5 30
11 30
12 30
NO POWER SUPPLIED TO THIS BUS FROM 4160 V BUS 1J
GE1J321
480 V BUS 1J UNSCHEDULED MAINTENANCE
1EEBUS-UM-1J-480
1.80E-005
3
480 V BUS 1J LOSS OF FUNCTION 1-EE-SS-2
1EEBUS-LU-1J-480
1.21E-005
4
24
NO ELECTRIC POWER 4160 V BUS 1J 1-EE-SH-2
GE1J112
1 2
PAGE 1
BREAKER 15J8 SPURIOUSLY OPENS 4160 V
1EEBKR-SO-15J8
3.38E-005
4
24
TRANSFORMER 1J 4160/480 V FAILS 1-EE-ST-1J
1EETFM-LP-1J
1.80E-005
4
24
BREAKER 14J1 SPURIOUSLY OPENS 480 V
1EEBKR-SO-14J1
3.38E-005
4
24
480 V BUS 1J1 LOSS OF FUNCTION 1-EE-SS-4
1EEBUS-LU-1J1
1.21E-005
4
24
E1J00.LGC
NUPRA 2.2
VAPWR

1J Emergency Electric Power NAPS Unit 1 6/95 PSA	E1J 4
ANALYST: RST | CREATION DATE: 05-24-1991	REVISION: 06-01-95



E1J60.LGC NUPRA 2.2 VAPWS

1J Emergency Electric Power NAPS Unit 1 6/95 PSA	E1J 5
ANALYST: RST | CREATION DATE: 05-24-1991	REVISION : 06-01-95

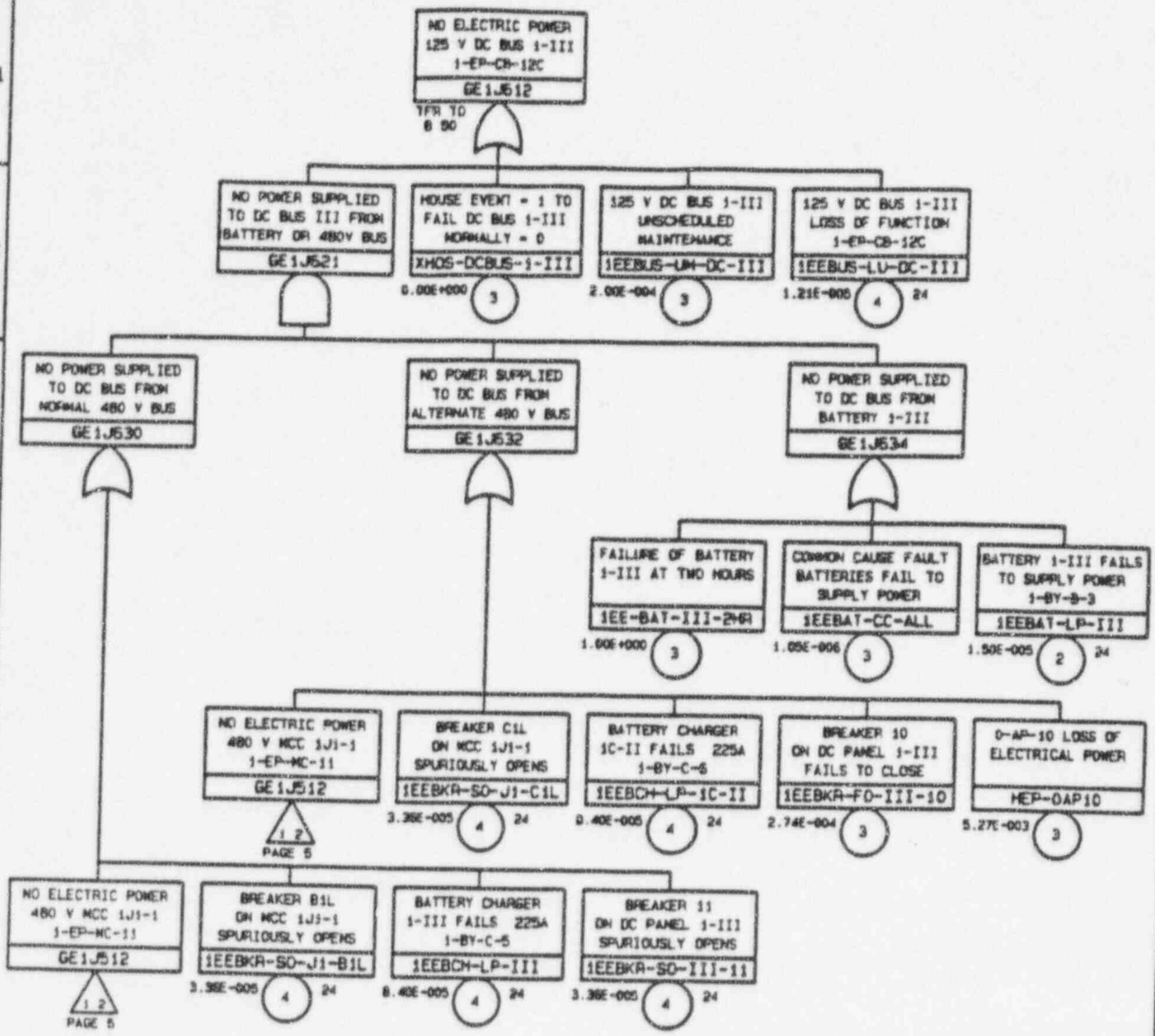


E1J00.LGC NUPRA 2.2 VAPWR

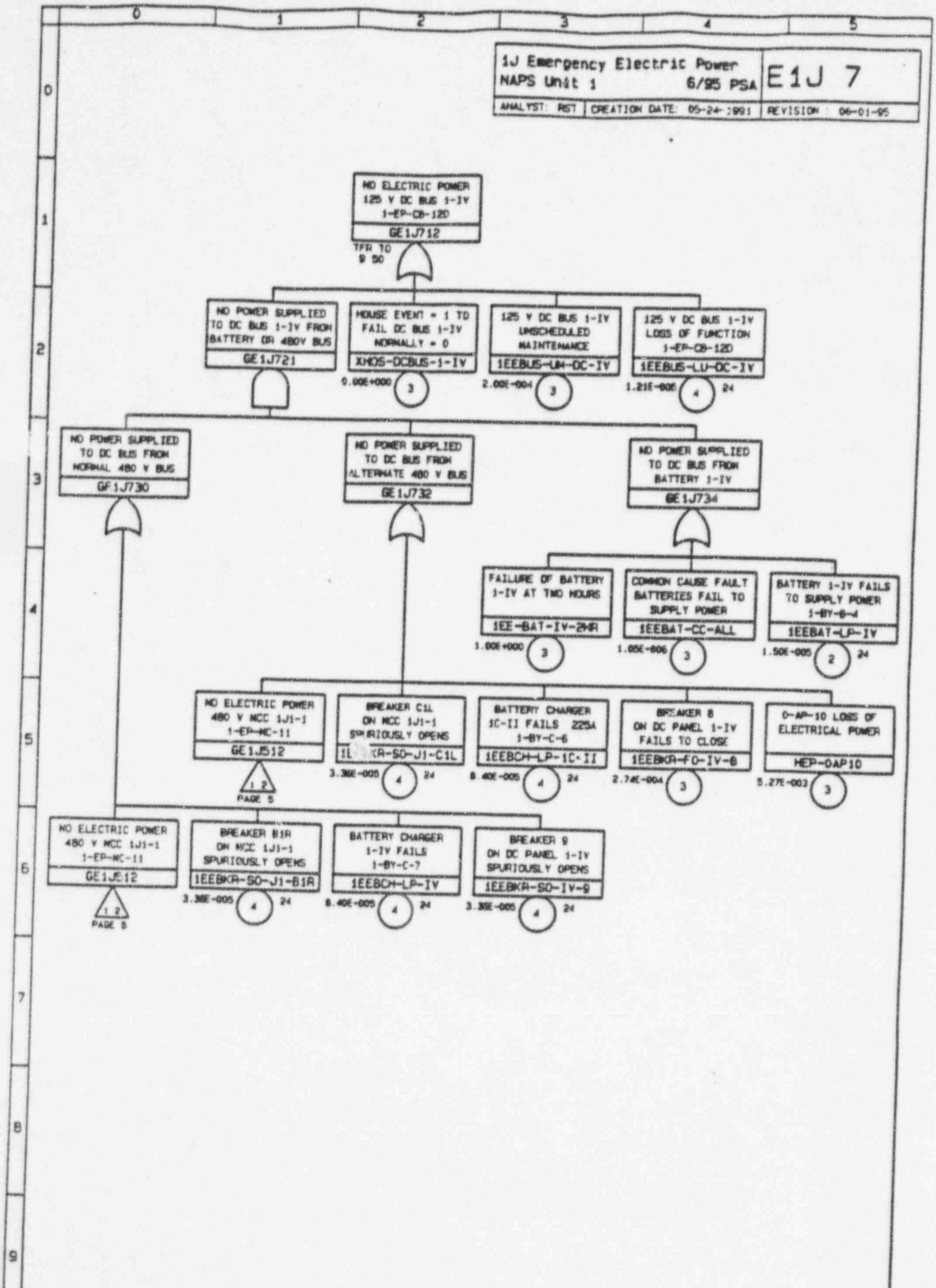
1J Emergency Electric Power
NAPS Unit 1 6/95 PSA

E1J 6

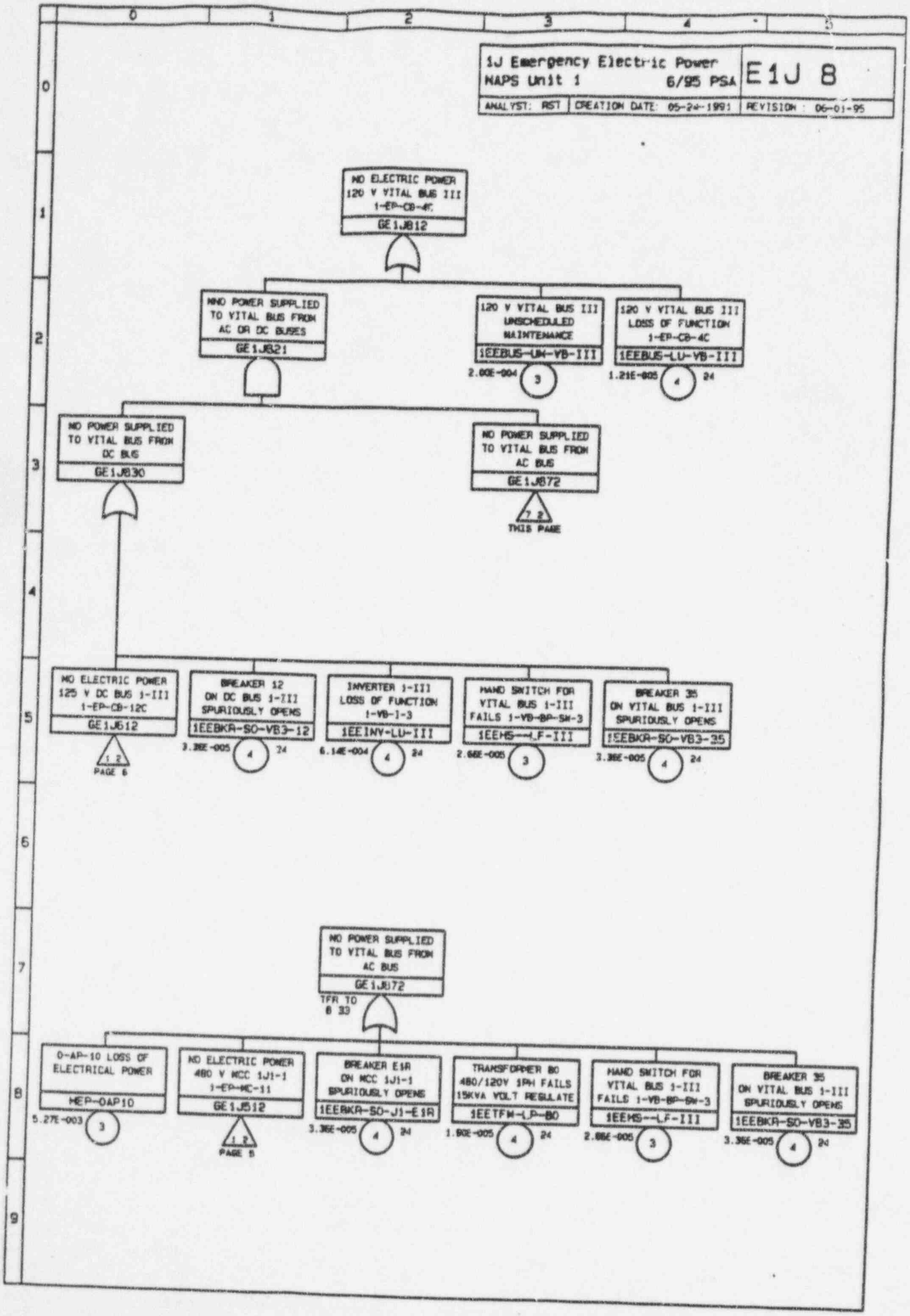
ANALYST: RST | CREATION DATE: 05-24-1991 | REVISION: 06-01-95

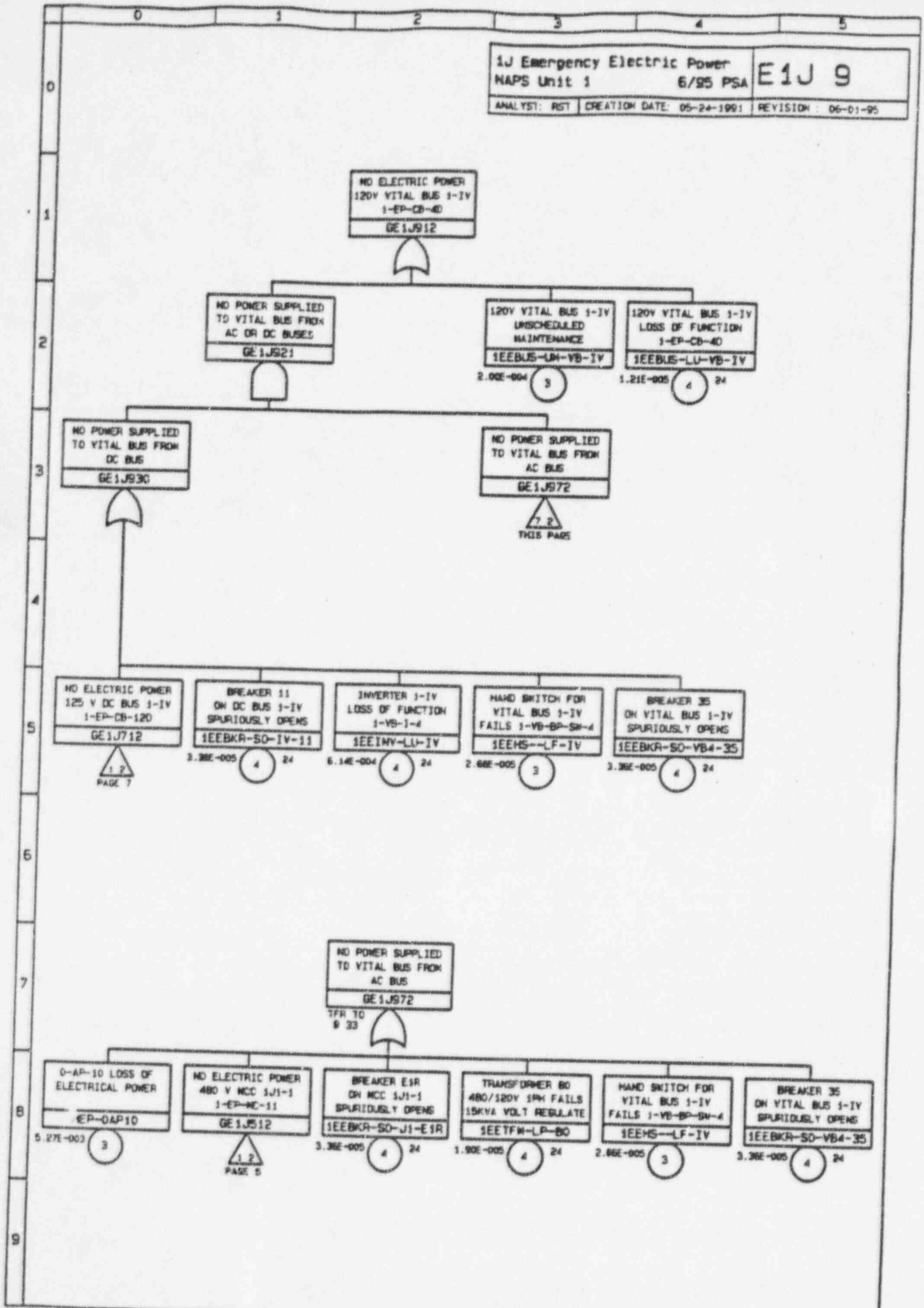


E1J00.LGC NUPRA 2.2 VAPWR

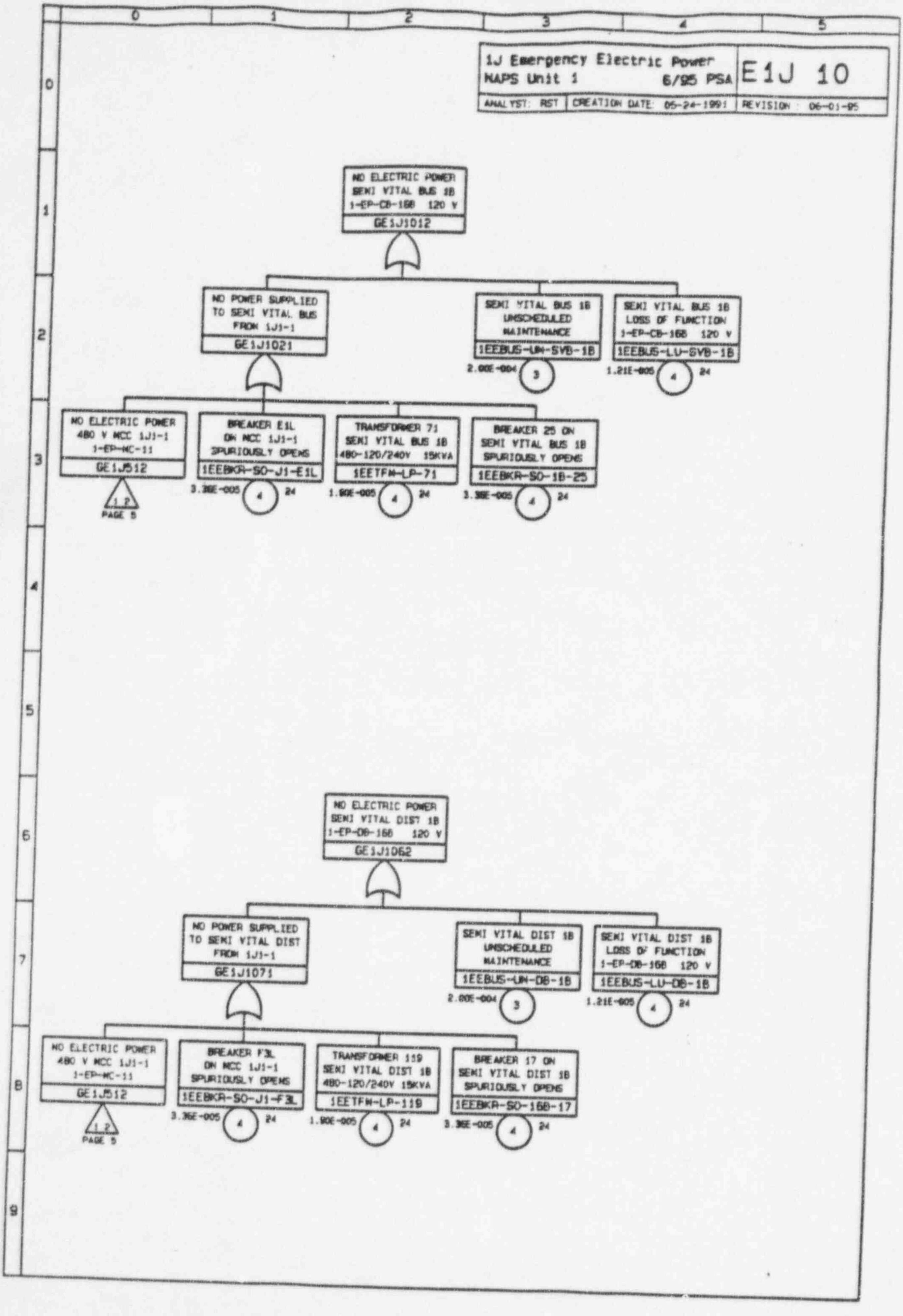


1J Emergency Electric Power
NAPS Unit 1 6/95 PSA
E1J 7
ANALYST: RST
CREATION DATE: 05-24-1991
REVISION : 06-01-95
NO ELECTRIC POWER 125 V DC BUS 1-IV 1-EP-CB-12D
GE1J712
TFR TO 9 50
NO POWER SUPPLIED TO DC BUS 1-IV FROM BATTERY OR 480V BUS
GE1J721
HOUSE EVENT = 1 TO FAIL DC BUS 1-IV NORMALLY = 0
XHOS-DCBUS-1-IV
0.00E+000
125 V DC BUS 1-IV UNSCHEDULED MAINTENANCE
1EEBUS-UM-DC-IV
2.00E-004
125 V DC BUS 1-IV LOSS OF FUNCTION 1-EP-CB-12D
1EEBUS-LU-DC-IV
1.21E-006
24
NO POWER SUPPLIED TO DC BUS FROM NORMAL 480 V BUS
GE1J730
NO POWER SUPPLIED TO DC BUS FROM ALTERNATE 480 V BUS
GE1J732
NO POWER SUPPLIED TO DC BUS FROM BATTERY 1-IV
GE1J734
FAILURE OF BATTERY 1-IV AT TWO HOURS
1EE-BAT-IV-2HR
1.00E+000
COMMON CAUSE FAULT BATTERIES FAIL TO SUPPLY POWER
1EEBAT-CC-ALL
1.05E-006
BATTERY 1-IV FAILS TO SUPPLY POWER 1-BY-B-4
1EEBAT-LP-IV
1.50E-005
24
NO ELECTRIC POWER 480 V MCC 1J1-1 1-EP-MC-11
GE1J512
PAGE 5
BREAKER C1L ON MCC 1J1-1 SPURIOUSLY OPENS
1EEBKA-SO-J1-C1L
3.36E-005
24
BATTERY CHARGER 1C-II FAILS 225A 1-BY-C-6
1EEBCH-LP-1C-II
8.40E-005
24
BREAKER 8 ON DC PANEL 1-IV FAILS TO CLOSE
1EEBKA-FO-IV-8
2.74E-004
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-0AP10
5.27E-003
NO ELECTRIC POWER 480 V MCC 1J1-1 1-EP-MC-11
GE1J512
PAGE 5
BREAKER B1R ON MCC 1J1-1 SPURIOUSLY OPENS
1EEBKA-SO-J1-B1R
3.36E-005
24
BATTERY CHARGER 1-IV FAILS 1-BY-C-7
1EEBCH-LP-IV
8.40E-005
24
BREAKER 9 ON DC PANEL 1-IV SPURIOUSLY OPENS
1EEBKA-SO-IV-9
3.36E-005
24
E1J00.LGC
NUPRA 2.2


1J Emergency Electric Power
NAPS Unit 1 6/95 PSA
E1J 8
ANALYST: RST
CREATION DATE: 05-24-1991
REVISION: 06-01-95
NO ELECTRIC POWER 120 V VITAL BUS III 1-EP-CB-4C
GE1J812
NNO POWER SUPPLIED TO VITAL BUS FROM AC OR DC BUSES
GE1J821
120 V VITAL BUS III UNSCHEDULED MAINTENANCE
1EEBUS-UM-VB-III
2.00E-004
3
120 V VITAL BUS III LOSS OF FUNCTION 1-EP-CB-4C
1EEBUS-LU-VB-III
1.21E-005
4
24
NO POWER SUPPLIED TO VITAL BUS FROM DC BUS
GE1J830
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE1J872
7 2
THIS PAGE
NO ELECTRIC POWER 125 V DC BUS 1-III 1-EP-CB-12C
GE1J612
1 2
PAGE 6
BREAKER 12 ON DC BUS 1-III SPURIOUSLY OPENS
1EEBKR-SO-VB3-12
3.36E-005
4
24
INVERTER 1-III LOSS OF FUNCTION 1-VB-I-3
1EEINV-LU-III
6.14E-004
4
24
HAND SWITCH FOR VITAL BUS 1-III FAILS 1-VB-BP-SW-3
1EEHS--LF-III
2.66E-005
3
BREAKER 35 ON VITAL BUS 1-III SPURIOUSLY OPENS
1EEBKR-SO-VB3-35
3.36E-005
4
24
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE1J872
TFR TO 8 33
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-0AP10
5.27E-003
3
NO ELECTRIC POWER 480 V MCC 1J1-1 1-EP-MC-11
GE1J512
1 2
PAGE 5
BREAKER E1R ON MCC 1J1-1 SPURIOUSLY OPENS
1EEBKR-SO-J1-E1R
3.36E-005
4
24
TRANSFORMER 80 480/120V 1PH FAILS 15KVA VOLT REGULATE
1EETFM-LP-80
1.90E-005
4
24
HAND SWITCH FOR VITAL BUS 1-III FAILS 1-VB-BP-SW-3
1EEHS--LF-III
2.66E-005
3
BREAKER 35 ON VITAL BUS 1-III SPURIOUSLY OPENS
1EEBKR-SO-VB3-35
3.36E-005
4
24
E1J00.GC NUPRA 2.2 VAPWR

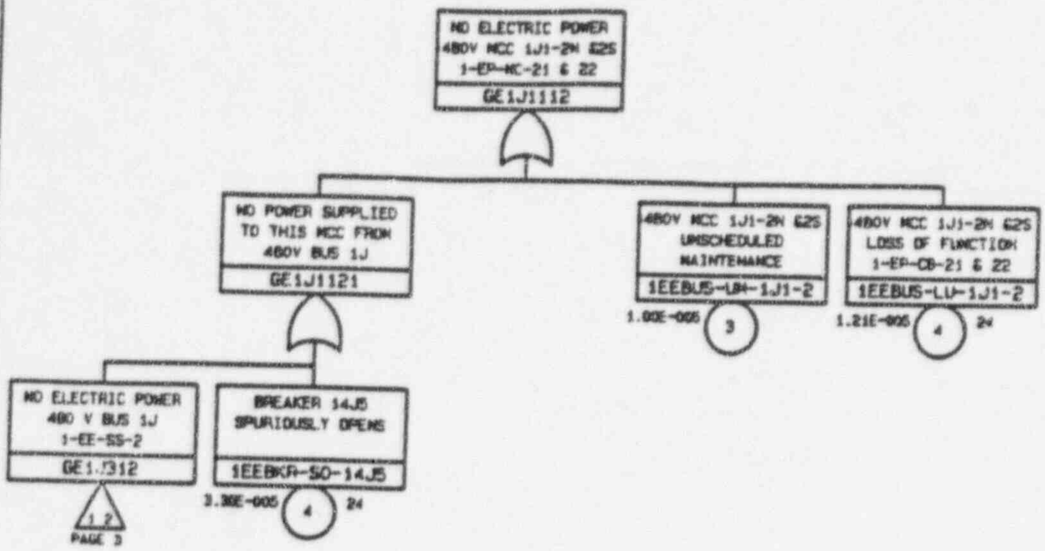


1J Emergency Electric Power
NAPS Unit 1 6/95 PSA
E1J 9
ANALYST: RST
CREATION DATE: 05-24-1991
REVISION: 06-01-95
NO ELECTRIC POWER 120V VITAL BUS 1-IV 1-EP-CB-4D
GE1J912
NO POWER SUPPLIED TO VITAL BUS FROM AC OR DC BUSES
GE1J921
120V VITAL BUS 1-IV UNSCHEDULED MAINTENANCE
1EEBUS-UM-VB-IV
2.00E-004
120V VITAL BUS 1-IV LOSS OF FUNCTION 1-EP-CB-4D
1EEBUS-LU-VB-IV
1.21E-005
NO POWER SUPPLIED TO VITAL BUS FROM DC BUS
GE1J930
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE1J972
THIS PAGE
NO ELECTRIC POWER 125 V DC BUS 1-IV 1-EP-CB-12D
GE1J712
PAGE 7
BREAKER 11 ON DC BUS 1-IV SPURIOUSLY OPENS
1EEBKR-SO-IV-11
3.36E-005
INVERTER 1-IV LOSS OF FUNCTION 1-VB-I-4
1EEINV-LU-IV
6.14E-004
HAND SWITCH FOR VITAL BUS 1-IV FAILS 1-VB-BP-SW-4
1EEHS--LF-IV
2.66E-005
BREAKER 35 ON VITAL BUS 1-IV SPURIOUSLY OPENS
1EEBKR-SO-VB4-35
3.36E-005
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE1J972
TFR TO 9 33
0-AP-10 LOSS OF ELECTRICAL POWER
EP-0AP10
5.27E-003
NO ELECTRIC POWER 480 V MCC 1J1-1 1-EP-MC-11
GE1J512
PAGE 5
BREAKER E1R ON MCC 1J1-1 SPURIOUSLY OPENS
1EEBKR-SO-J1-E1R
3.36E-005
TRANSFORMER B0 480/120V 1PH FAILS 15KVA VOLT REGULATE
1EETFM-LP-B0
1.90E-005
HAND SWITCH FOR VITAL BUS 1-IV FAILS 1-VB-BP-SW-4
1EEHS--LF-IV
2.66E-005
BREAKER 35 ON VITAL BUS 1-IV SPURIOUSLY OPENS
1EEBKR-SO-VB4-35
3.36E-005
E1J00.LGC
NUPRA 2.2



E1J00.LGC NUPRA 2.2 VAPWD

1J Emergency Electric Power NAPS Unit 1 6/95 PSA	E1J 11
ANALYST: RST | CREATION DATE: 05-24-1991	REVISION : 06-01-95

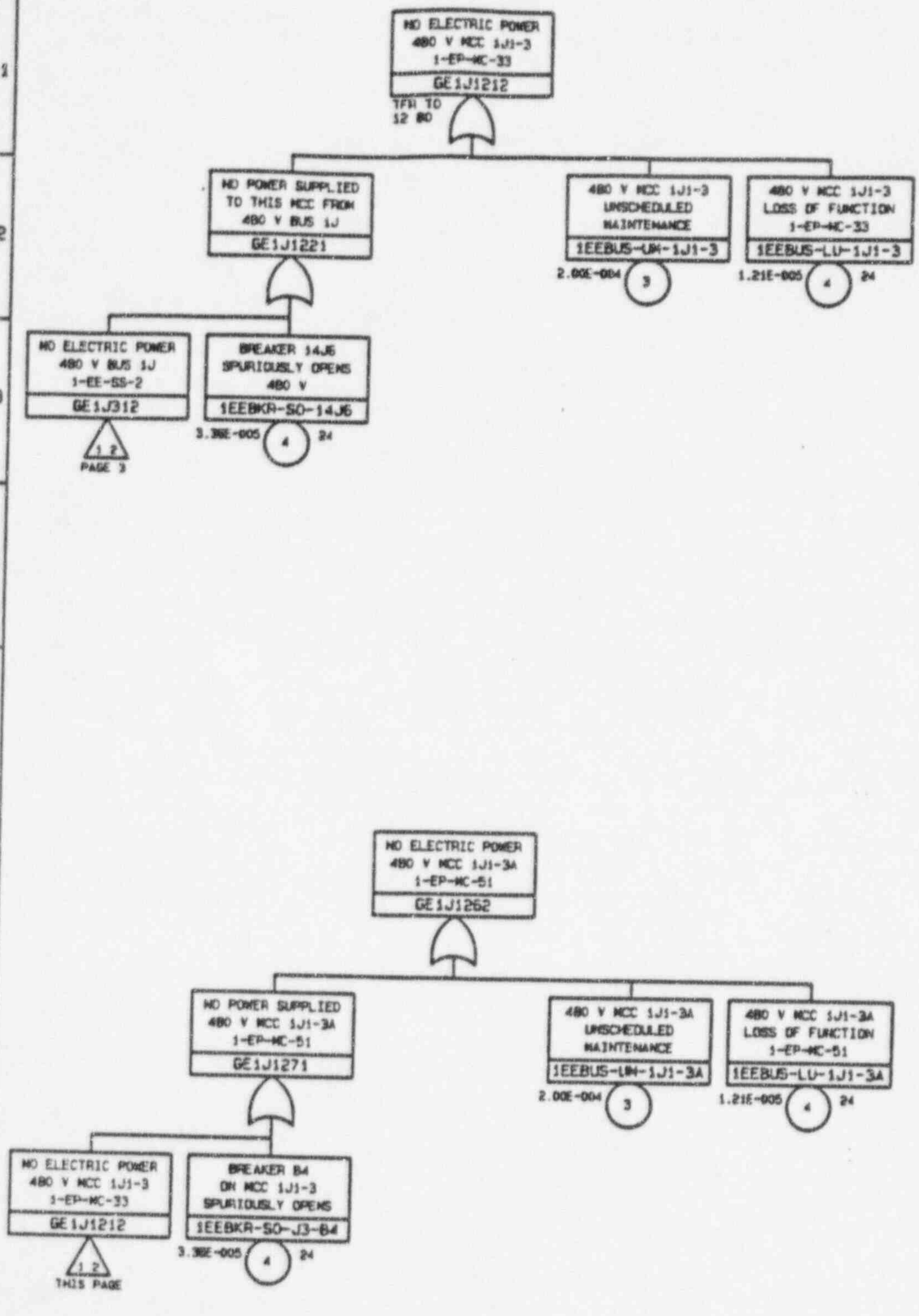


E1J00.LGC NUPRA 2.2 VAPWR

1J Emergency Electric Power
NAPS Unit 1 6/95 PSA

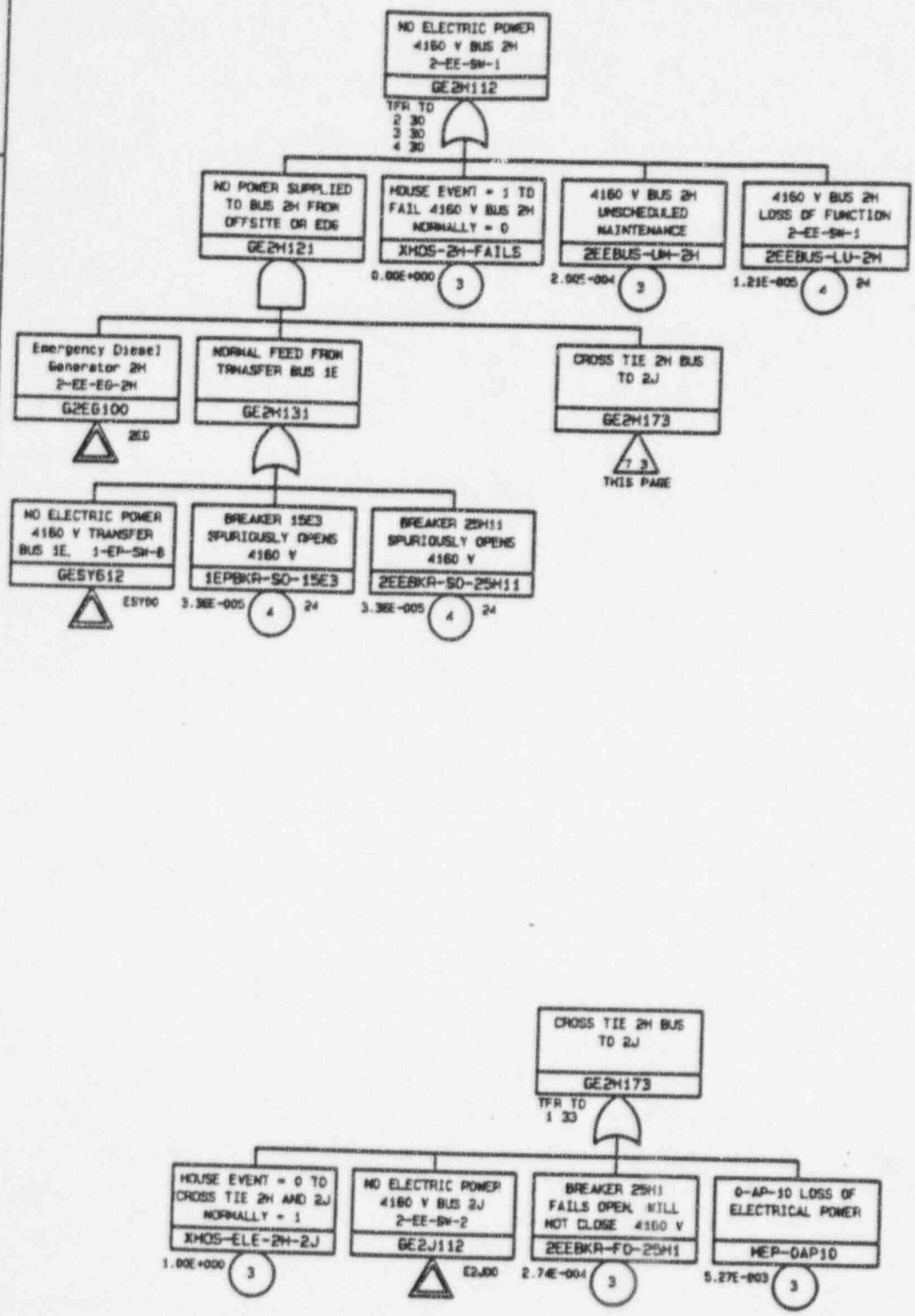
E1J 12

ANALYST: RST | CREATION DATE: 05-24-1991 | REVISION: 06-01-95



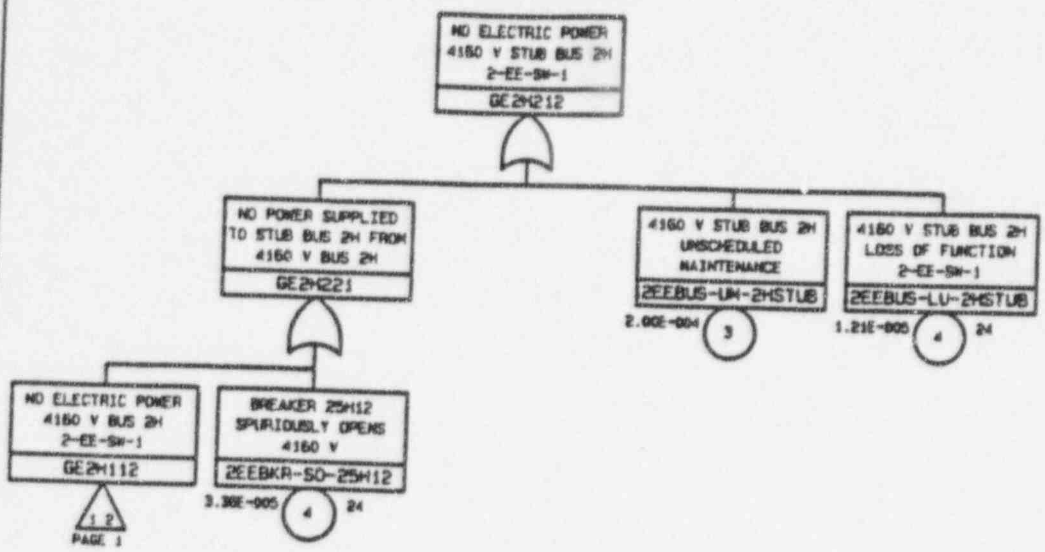
E1J00.LGC NUPRA 2.2 VAPWR

2H Emergency Electric Power MAPS Unit 2 6/95 PSA	E2H 1
ANALYST: RST | CREATION DATE: 05-27-1991	REVISION : 06-01-95



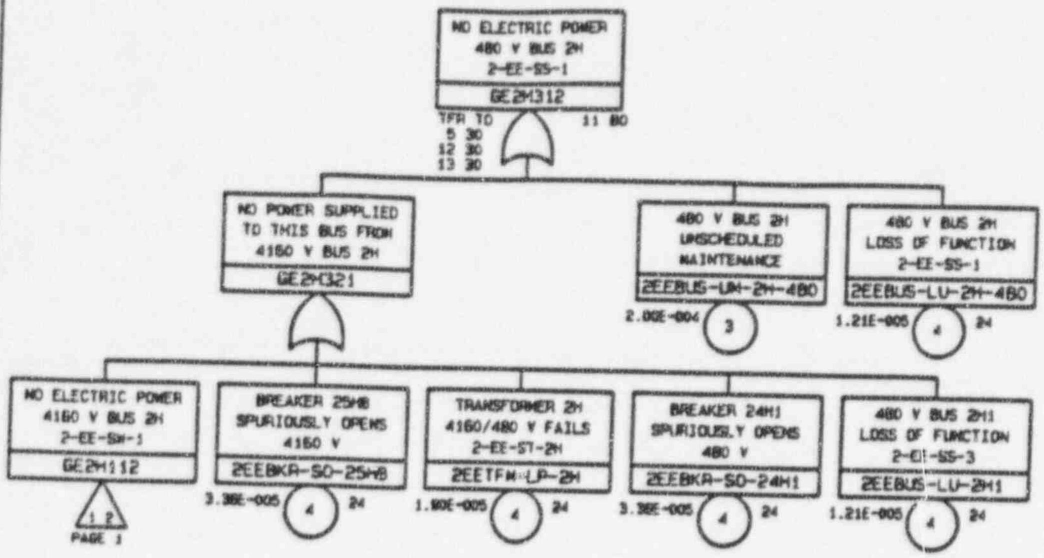
E2H00.LGC NUPRA 2.2

2H Emergency Electric Power NAPS Unit 2 6/95 PSA	E2H 2
ANALYST: RST | CREATION DATE: 05-27-1991	REVISION: 06-01-95



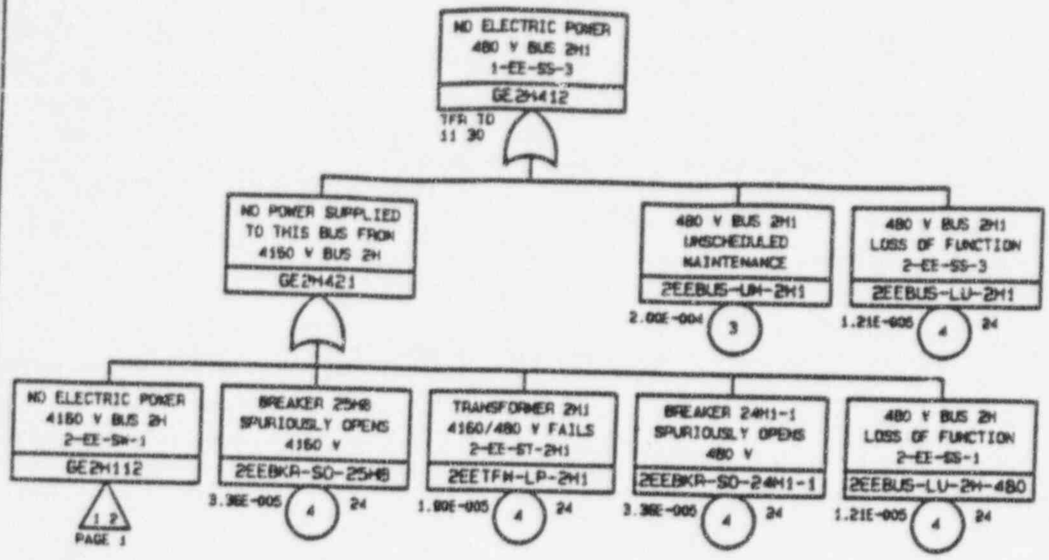
E2H00.LSC NUPRA 2.2 VAPWR

2H Emergency Electric Power NAPS Unit 2 6/95 PSA	E2H 3
ANALYST: RST | CREATION DATE: 05-27-1991	REVISION : 06-01-95



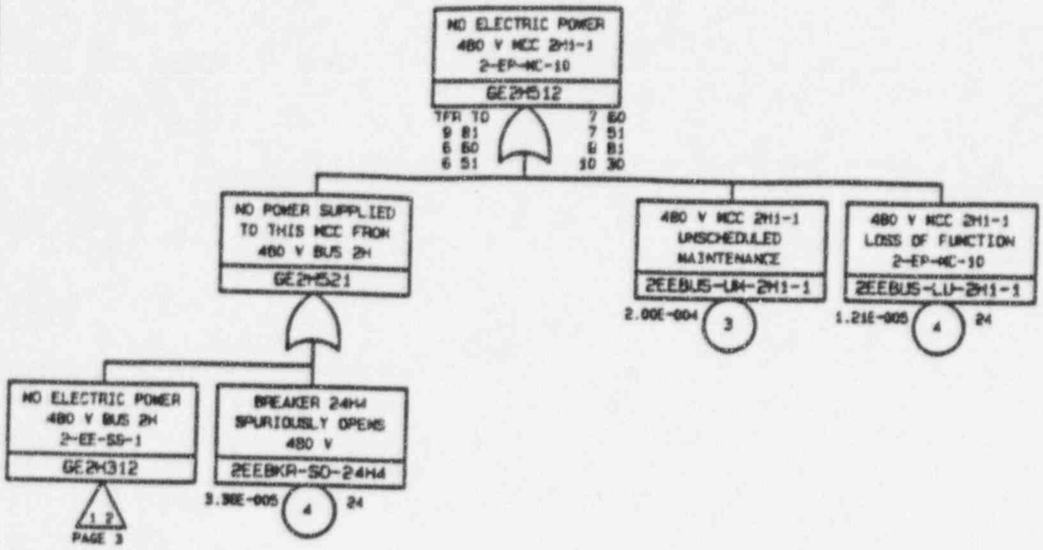
E2H00.LGC NUPRA 2.2 VAPWD

2H Emergency Electric Power NAPS Unit 2 6/95 PSA	E2H 4
ANALYST: RST | CREATION DATE: 05-27-1991	REVISION: 06-01-95



E2H00.LGC NUPRA 2.2 VAPWR

2H Emergency Electric Power NAPS Unit 2 6/95 PSA	E2H 5
ANALYST: RST | CREATION DATE: 05-27-1991	REVISION : 06-01-95

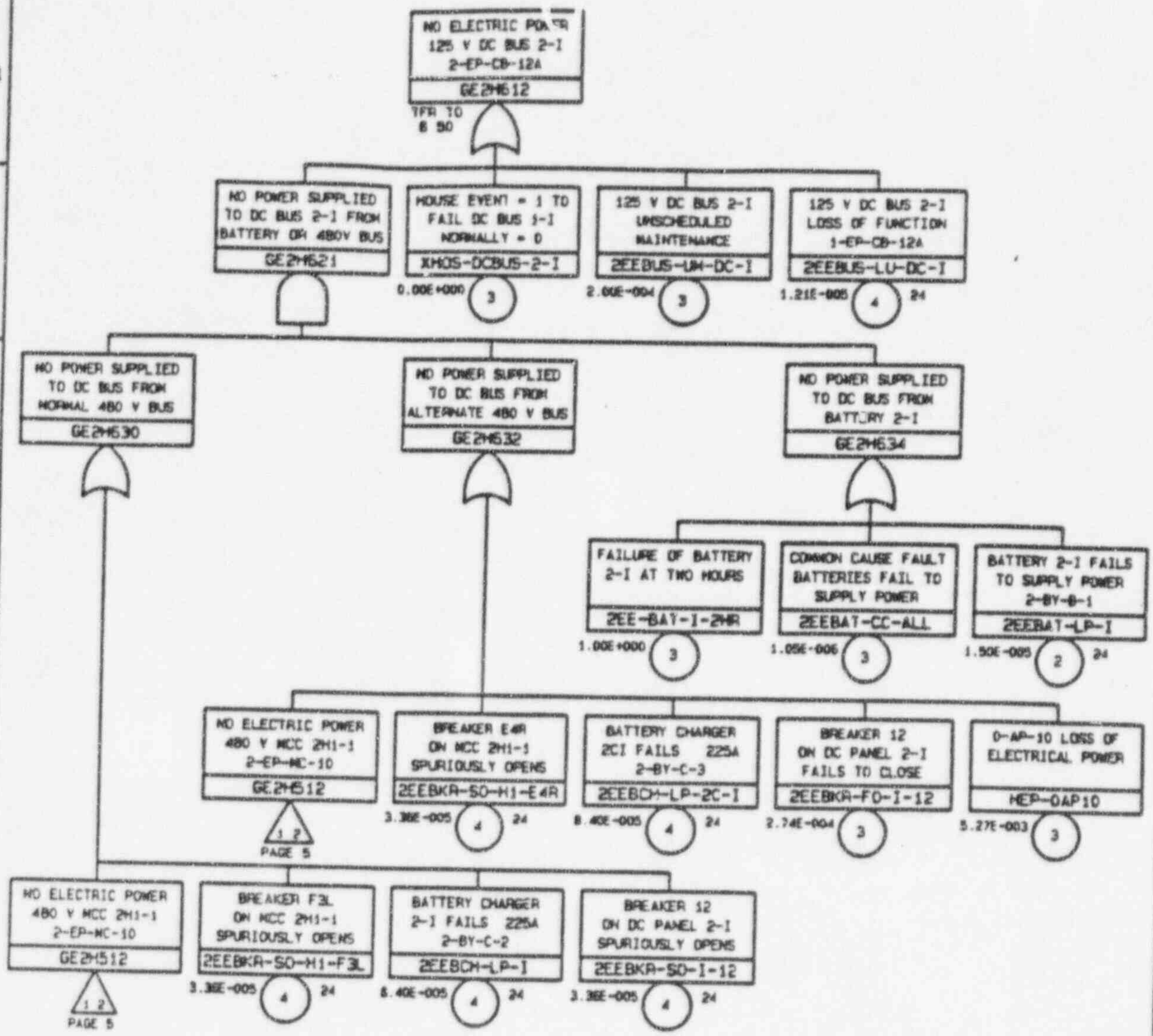


E2H00.LGC NUFRA 2.2 VAPWR

2: Emergency Electric Power
NAPS Unit 2 6/95 PSA

E2H 6

ANALYST: RST | CREATION DATE: 05-27-1991 | REVISION: 06-01-95

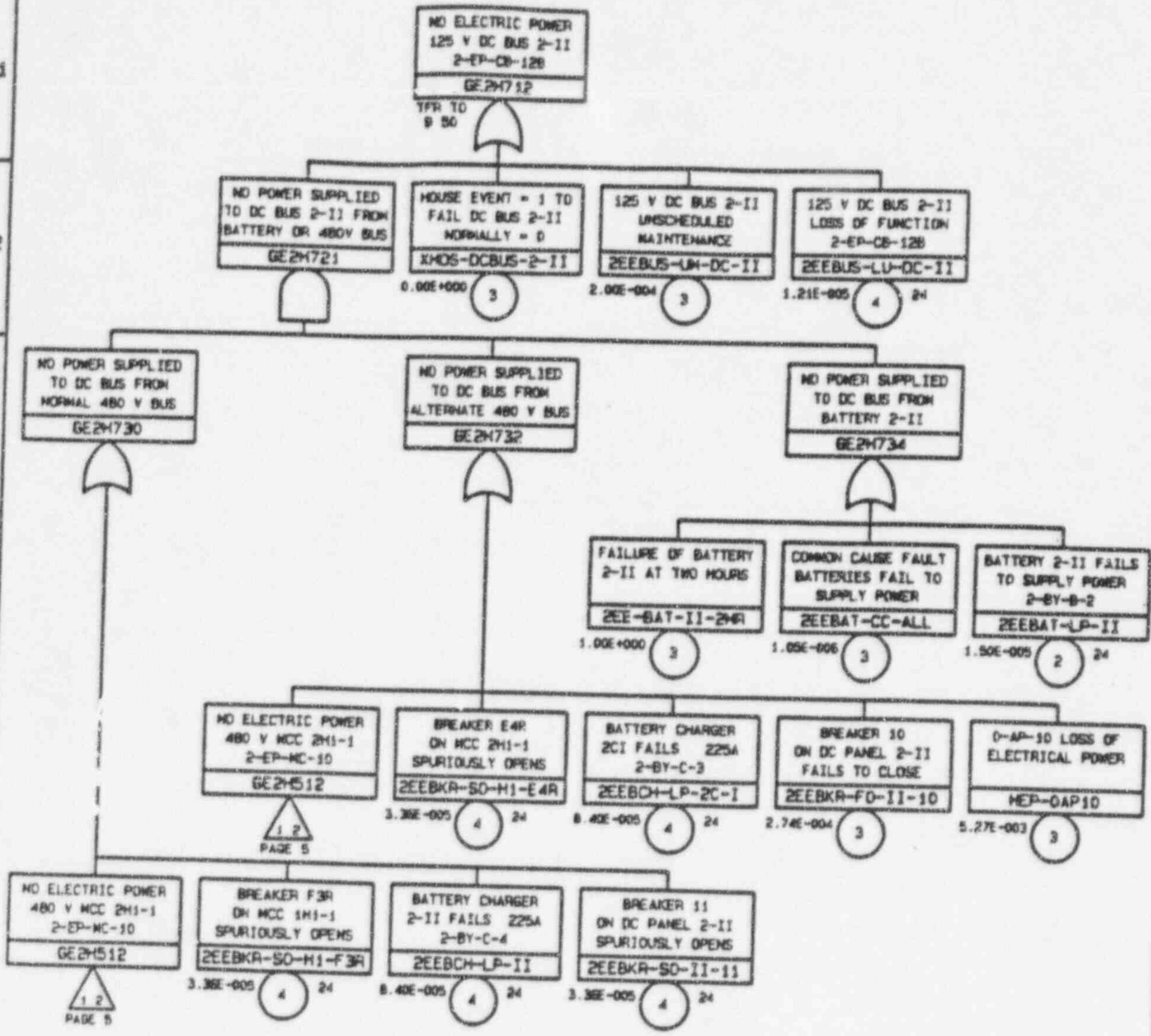


E2H00.LGC NUPRA 2.2 VAPWR

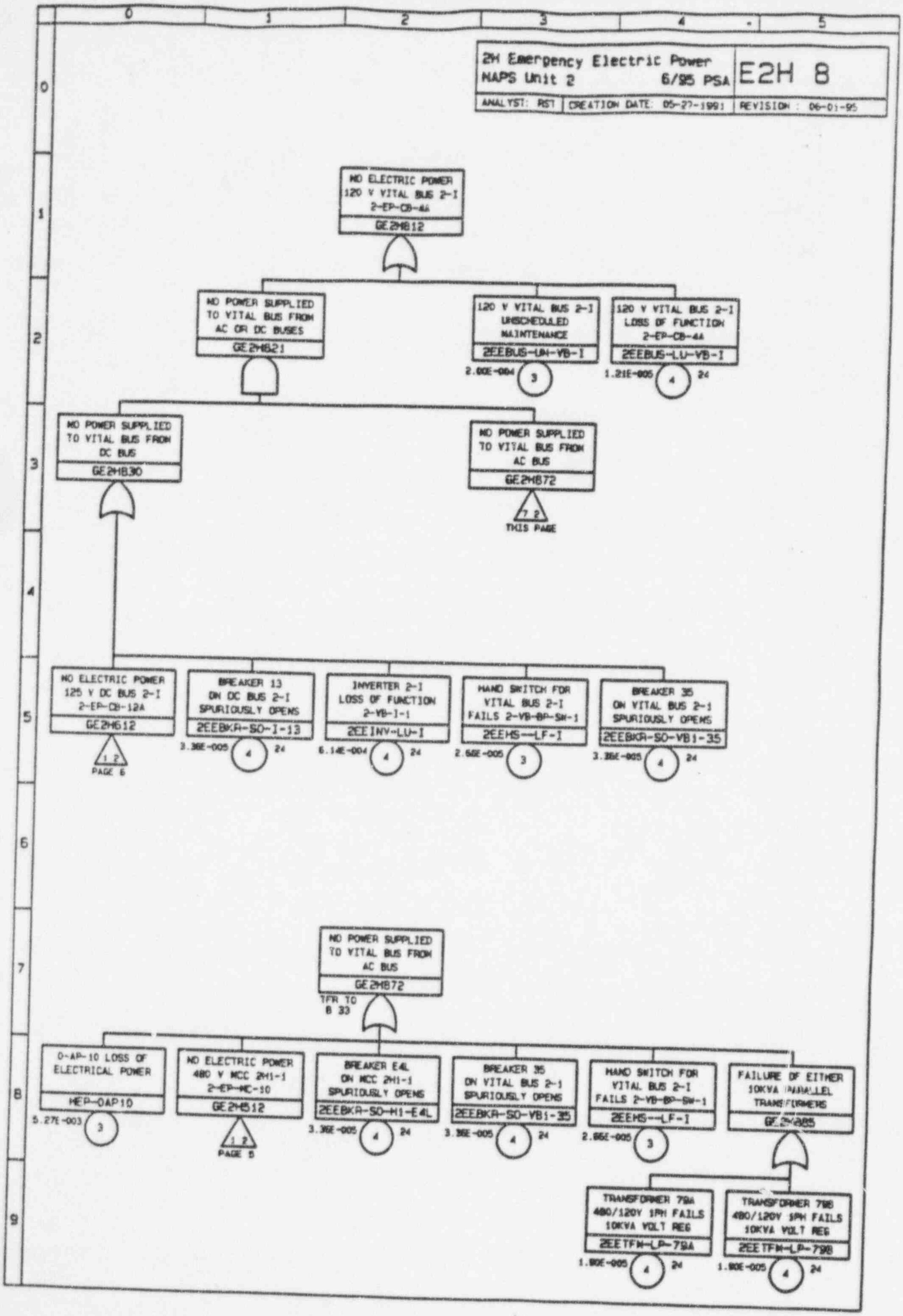
2H Emergency Electric Power
NAPS Unit 2 6/95 PSA

E2H 7

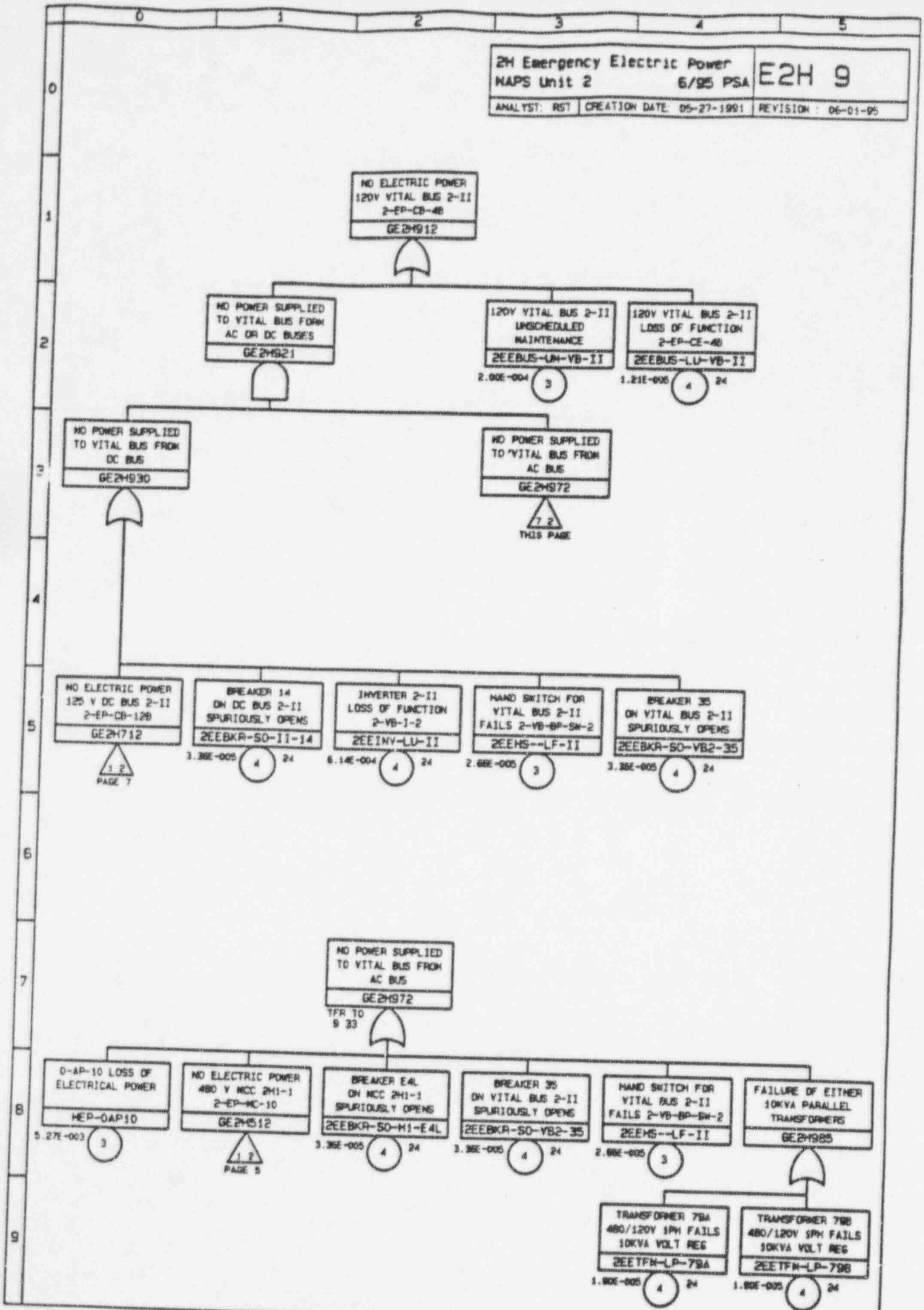
ANALYST: RST | CREATION DATE: 05-27-1991 | REVISION: 06-01-95



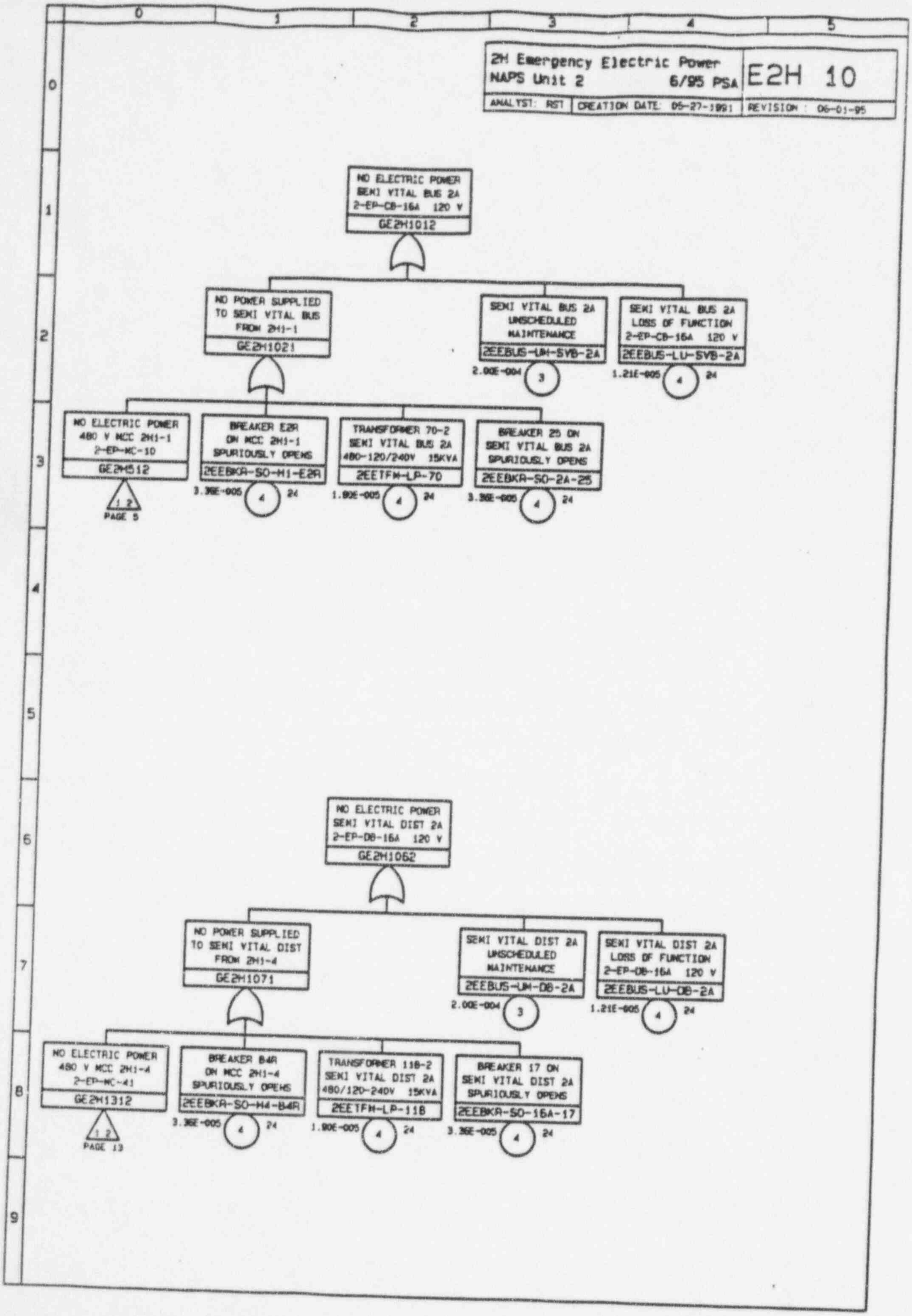
E2H00.LGC NUPRA 2.2 VAPWR



2H Emergency Electric Power
NAPS Unit 2 6/95 PSA
E2H 8
ANALYST: RST
CREATION DATE: 05-27-1991
REVISION : 06-01-95
NO ELECTRIC POWER 120 V VITAL BUS 2-I 2-EP-CB-4A
GE2HB12
NO POWER SUPPLIED TO VITAL BUS FROM AC OR DC BUSES
GE2HB21
120 V VITAL BUS 2-I UNSCHEDULED MAINTENANCE
2EEBUS-UM-VB-I
2.00E-004 3
120 V VITAL BUS 2-I LOSS OF FUNCTION 2-EP-CB-4A
2EEBUS-LU-VB-I
1.21E-005 4 24
NO POWER SUPPLIED TO VITAL BUS FROM DC BUS
GE2HB30
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE2HB72
7 2
THIS PAGE
NO ELECTRIC POWER 125 V DC BUS 2-I 2-EP-CB-12A
GE2H612
1 2
PAGE 6
BREAKER 13 ON DC BUS 2-I SPURIOUSLY OPENS
2EEBKR-SO-I-13
3.36E-005 4 24
INVERTER 2-I LOSS OF FUNCTION 2-VB-I-1
2EEINV-LU-I
6.14E-004 4 24
HAND SWITCH FOR VITAL BUS 2-I FAILS 2-VB-BP-SW-1
2EEHS--LF-I
2.56E-005 3
BREAKER 35 ON VITAL BUS 2-1 SPURIOUSLY OPENS
2EEBKR-SO-VB1-35
3.36E-005 4 24
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE2HB72
TFR TO B 33
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-0AP10
5.27E-003 3
NO ELECTRIC POWER 480 V MCC 2H1-1 2-EP-MC-10
GE2H512
1 2
PAGE 5
BREAKER E4L ON MCC 2H1-1 SPURIOUSLY OPENS
2EEBKR-SO-H1-E4L
3.36E-005 4 24
BREAKER 35 ON VITAL BUS 2-1 SPURIOUSLY OPENS
2EEBKR-SO-VB1-35
3.36E-005 4 24
HAND SWITCH FOR VITAL BUS 2-I FAILS 2-VB-BP-SW-1
2EEHS--LF-I
2.56E-005 3
FAILURE OF EITHER 10KVA PARALLEL TRANSFORMERS
GE2HB85
TRANSFORMER 79A 480/120V 1PH FAILS 10KVA VOLT REG
2EETFM-LP-79A
1.90E-005 4 24
TRANSFORMER 79B 480/120V 1PH FAILS 10KVA VOLT REG
2EETFM-LP-79B
1.90E-005 4 24

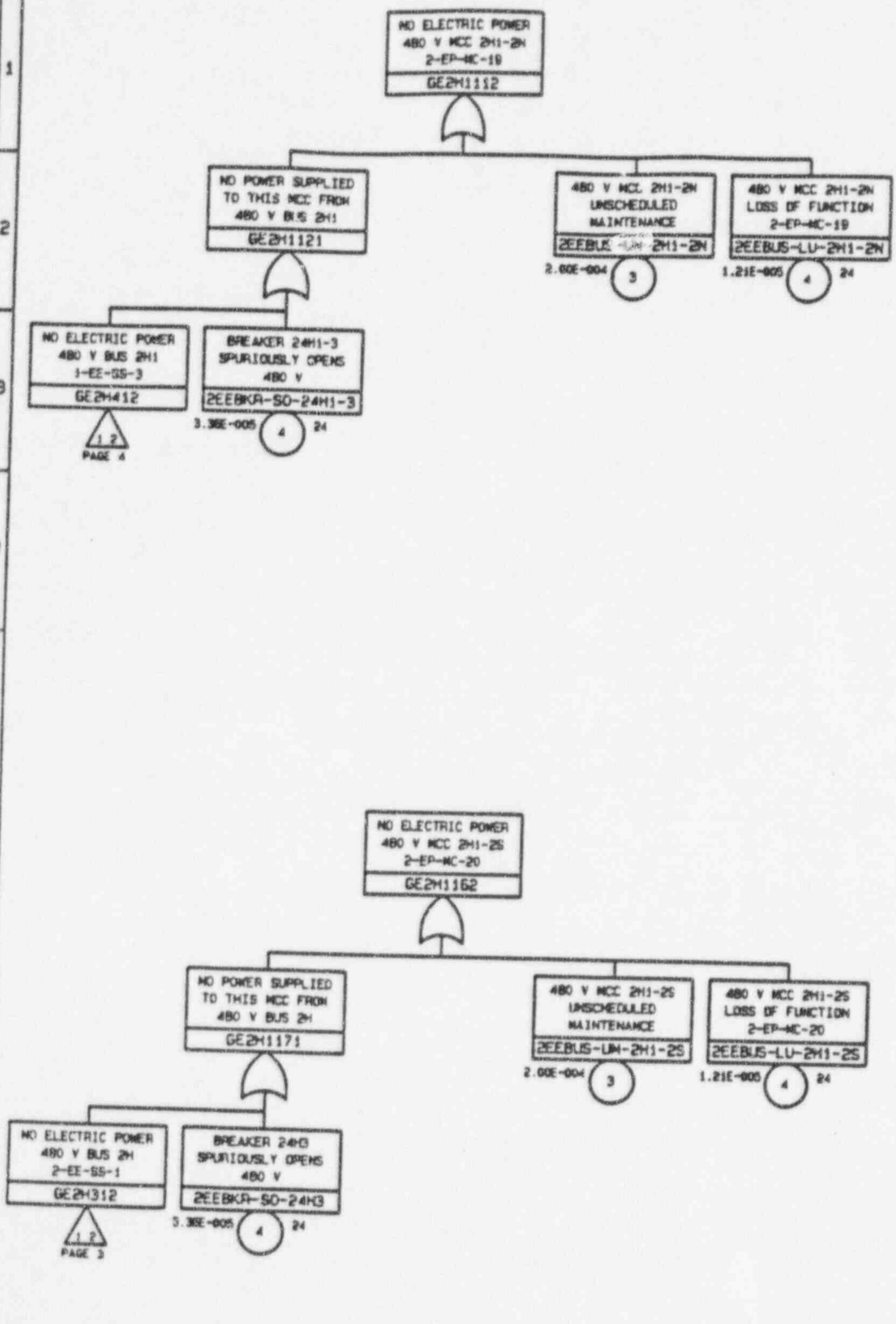


E2H00.LGC NUPRA 2.2 VAPWR

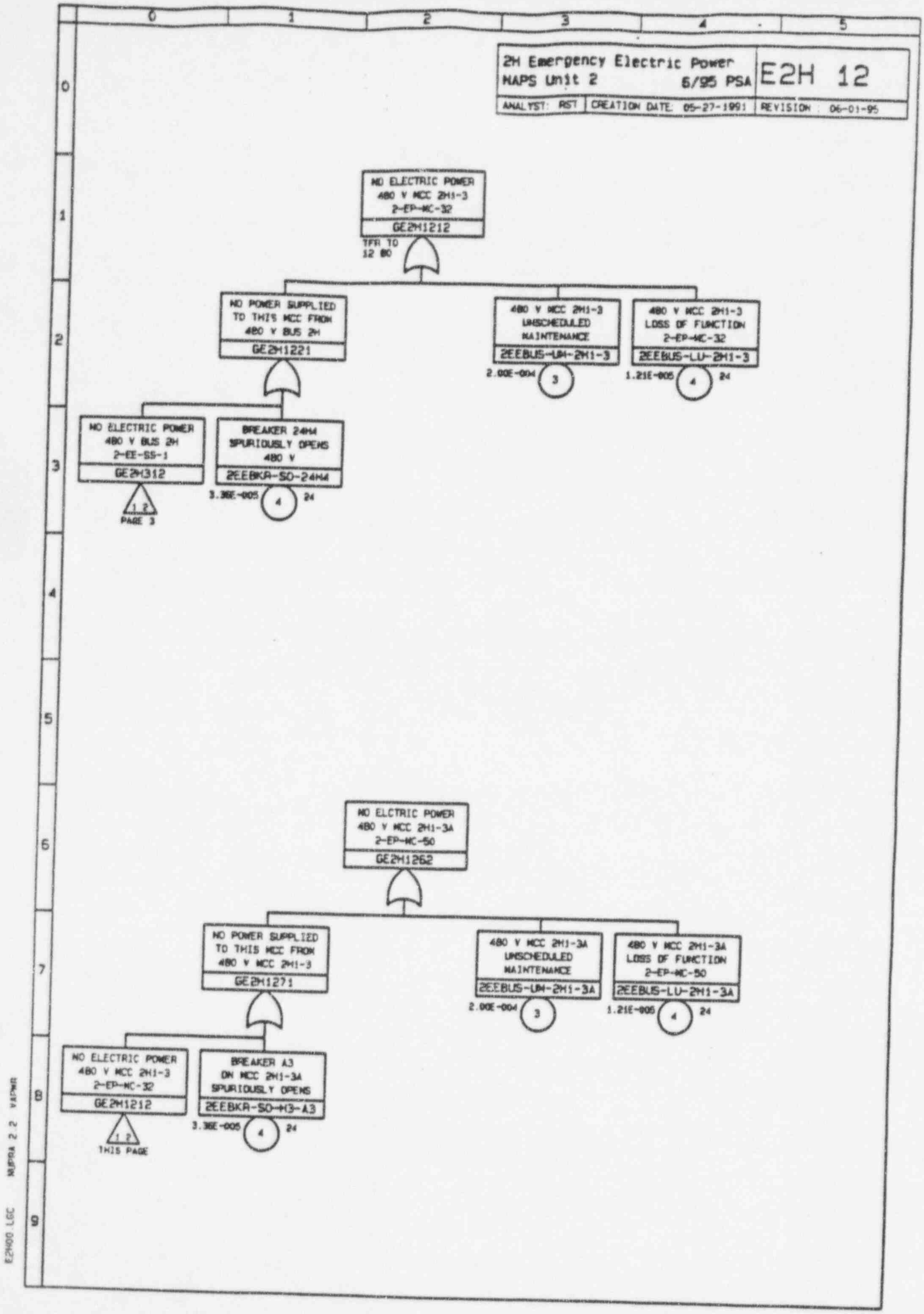


2H Emergency Electric Power
NAPS Unit 2 6/95 PSA
E2H 10
ANALYST: RST
CREATION DATE: 05-27-1991
REVISION: 06-01-95
NO ELECTRIC POWER SEMI VITAL BUS 2A 2-EP-CB-16A 120 V
GE2H1012
NO POWER SUPPLIED TO SEMI VITAL BUS FROM 2H1-1
GE2H1021
SEMI VITAL BUS 2A UNSCHEDULED MAINTENANCE
2EEBUS-UM-SVB-2A
2.00E-004
SEMI VITAL BUS 2A LOSS OF FUNCTION 2-EP-CB-16A 120 V
2EEBUS-LU-SVB-2A
1.21E-005
NO ELECTRIC POWER 480 V MCC 2H1-1 2-EP-MC-10
GE2M512
PAGE 5
BREAKER E2R ON MCC 2H1-1 SPURIOUSLY OPENS
2EEBKR-SO-H1-E2R
3.36E-005
TRANSFORMER 70-2 SEMI VITAL BUS 2A 480-120/240V 15KVA
2EETFM-LP-70
1.90E-005
BREAKER 25 ON SEMI VITAL BUS 2A SPURIOUSLY OPENS
2EEBKR-SO-2A-25
3.36E-005
NO ELECTRIC POWER SEMI VITAL DIST 2A 2-EP-DB-16A 120 V
GE2H1062
NO POWER SUPPLIED TO SEMI VITAL DIST FROM 2H1-4
GE2H1071
SEMI VITAL DIST 2A UNSCHEDULED MAINTENANCE
2EEBUS-UM-DB-2A
2.00E-004
SEMI VITAL DIST 2A LOSS OF FUNCTION 2-EP-DB-16A 120 V
2EEBUS-LU-DB-2A
1.21E-005
NO ELECTRIC POWER 480 V MCC 2H1-4 2-EP-MC-41
GE2H1312
PAGE 13
BREAKER B4R ON MCC 2H1-4 SPURIOUSLY OPENS
2EEBKR-SO-H4-B4R
3.36E-005
TRANSFORMER 118-2 SEMI VITAL DIST 2A 480/120-240V 15KVA
2EETFM-LP-118
1.90E-005
BREAKER 17 ON SEMI VITAL DIST 2A SPURIOUSLY OPENS
2EEBKR-SO-16A-17
3.36E-005
E2H00.LGC
NUPRA 2.2 VAPWR

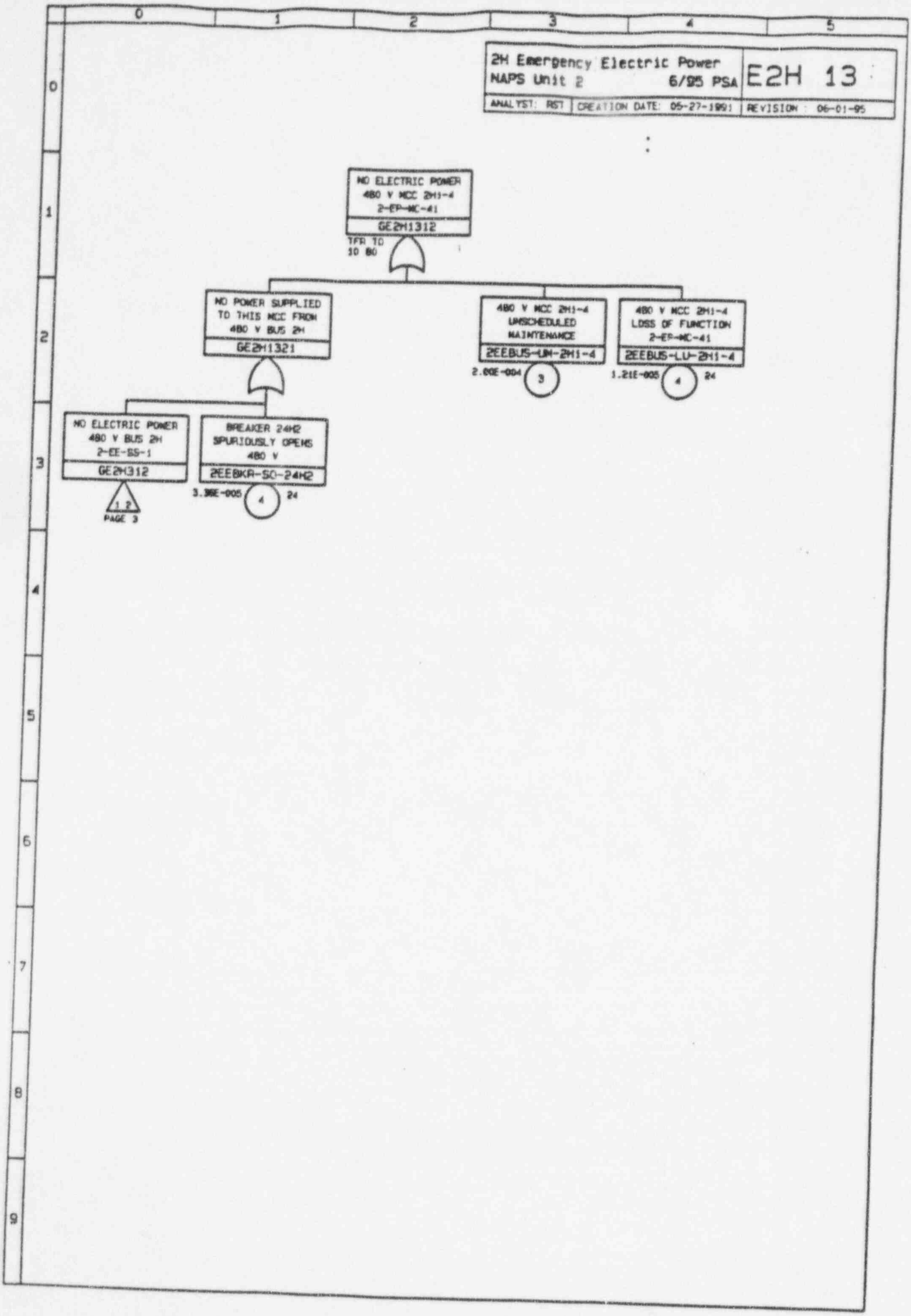
2H Emergency Electric Power NAPS Unit 2 6/95 PSA	E2H 11
ANALYST: RST CREATION DATE: 05-27-1991	REVISION: 06-01-95



E2H00.LGC NUPRA 2.2 VAPWD



2H Emergency Electric Power
NAPS Unit 2 6/95 PSA
E2H 12
ANALYST: RST
CREATION DATE: 05-27-1991
REVISION: 06-01-95
NO ELECTRIC POWER 480 V MCC 2H1-3 2-EP-MC-32
GE2H1212
TFR TO 12 80
NO POWER SUPPLIED TO THIS MCC FROM 480 V BUS 2H
GE2H1221
480 V MCC 2H1-3 UNSCHEDULED MAINTENANCE
2EEBUS-UM-2H1-3
2.00E-004
3
480 V MCC 2H1-3 LOSS OF FUNCTION 2-EP-MC-32
2EEBUS-LU-2H1-3
1.21E-005
4
24
NO ELECTRIC POWER 480 V BUS 2H 2-EE-SS-1
GE2H312
1 2
PAGE 3
BREAKER 24H4 SPURIOUSLY OPENS 480 V
2EEBKR-SO-24H4
3.36E-005
4
24
NO ELCTRIC POWER 480 V MCC 2H1-3A 2-EP-MC-50
GE2H1262
NO POWER SUPPLIED TO THIS MCC FROM 480 V MCC 2H1-3
GE2H1271
480 V MCC 2H1-3A UNSCHEDULED MAINTENANCE
2EEBUS-UM-2H1-3A
2.00E-004
3
480 V MCC 2H1-3A LOSS OF FUNCTION 2-EP-MC-50
2EEBUS-LU-2H1-3A
1.21E-005
4
24
NO ELECTRIC POWER 480 V MCC 2H1-3 2-EP-MC-32
GE2H1212
1 2
THIS PAGE
BREAKER A3 ON MCC 2H1-3A SPURIOUSLY OPENS
2EEBKR-SO-H3-A3
3.36E-005
4
24
E2H00.LGC
NUPRA 2.2

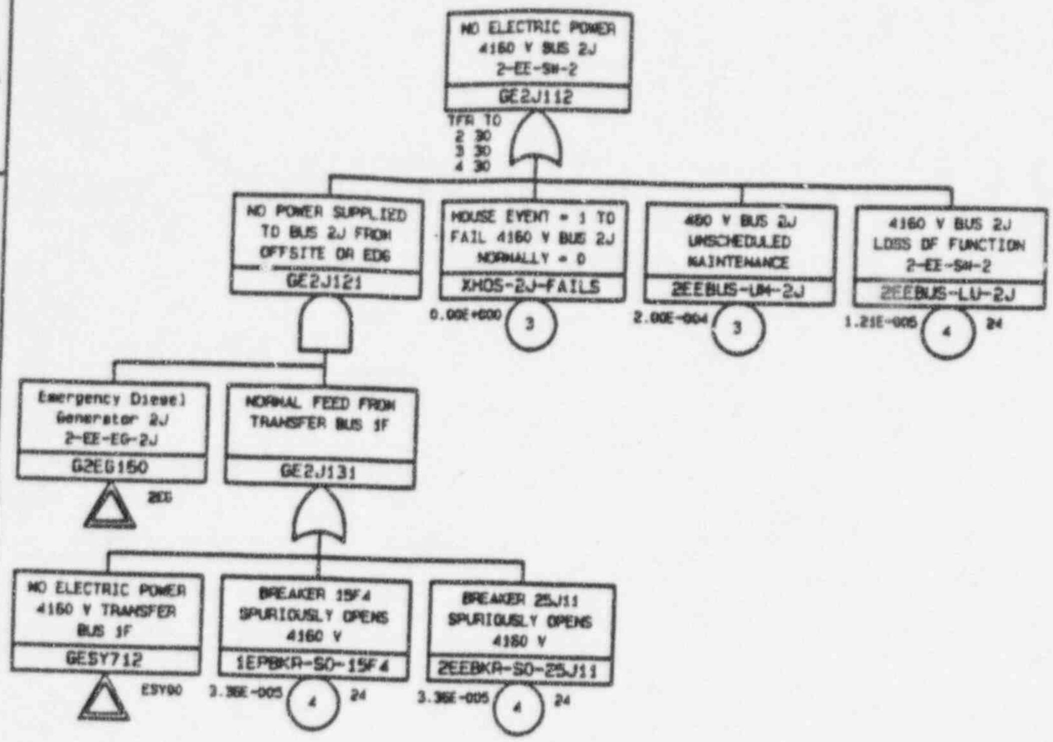


E2H00.LGC NUPRA 2.2 VAPWR

2J Emergency Electric Power
NAPS Unit 2 6/95 PSA

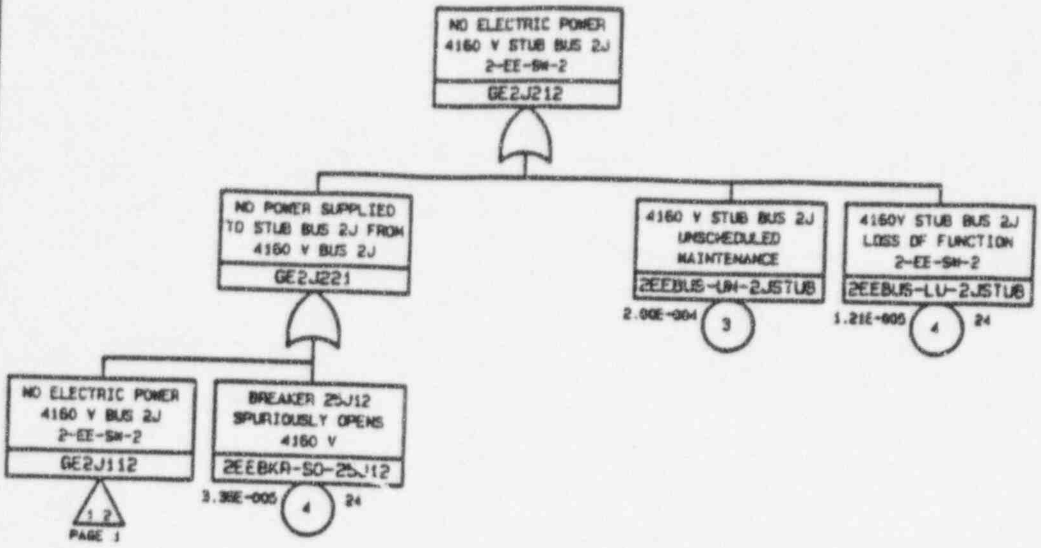
E2J 1

ANALYST: RST | CREATION DATE: 05-27-1991 | REVISION: 06-01-95



E2J00.LGC NUPRA 2.2 VAPWR

2J Emergency Electric Power NAPS Unit 2 6/95 PSA		E2J 2
ANALYST: RST	CREATION DATE: 05-27-1991	REVISION: 06-01-95

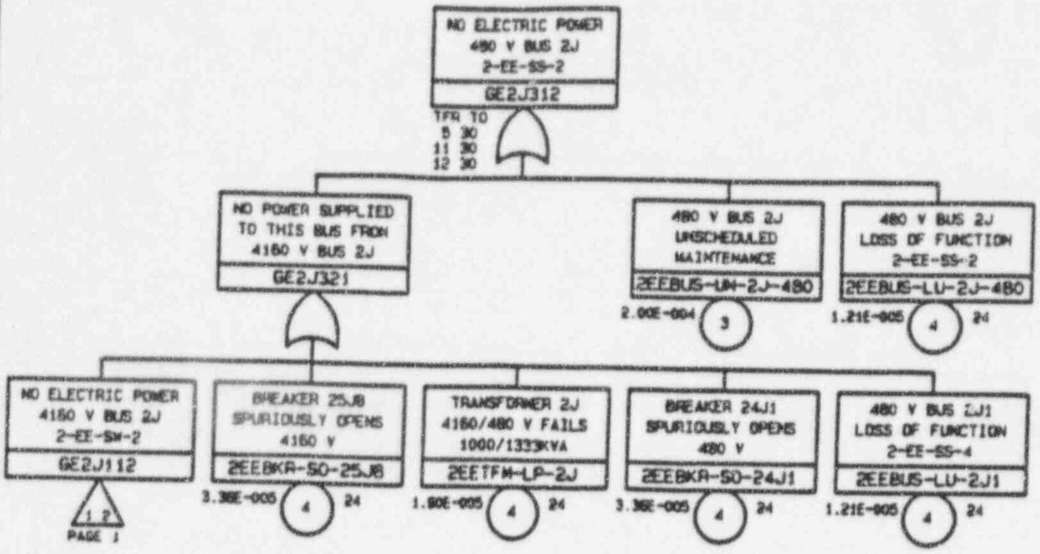


E2J00.1SC NUPRA 2.2 YAPWR

2J Emergency Electric Power
MAPS Unit 2 6/95 PSA

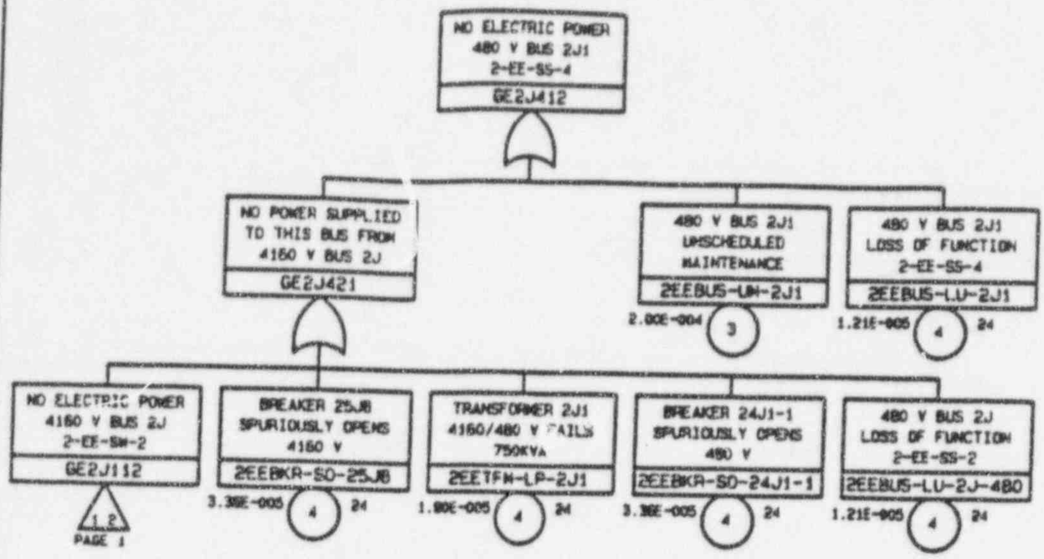
E2J 3

ANALYST: RST | CREATION DATE: 05-27-1991 | REVISION: 06-01-95



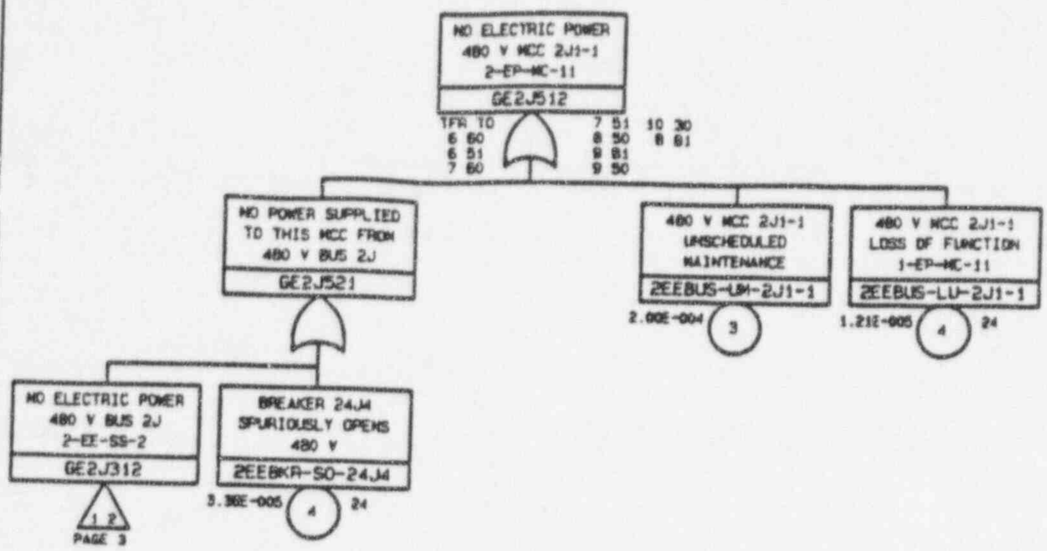
E2J00.LGC NUPRA 2.2 VAPWR

2J Emergency Electric Power NAPS Unit 2 6/95 PSA	E2J 4
ANALYST: RST | CREATION DATE: 05-27-1991	REVISION : 06-01-95

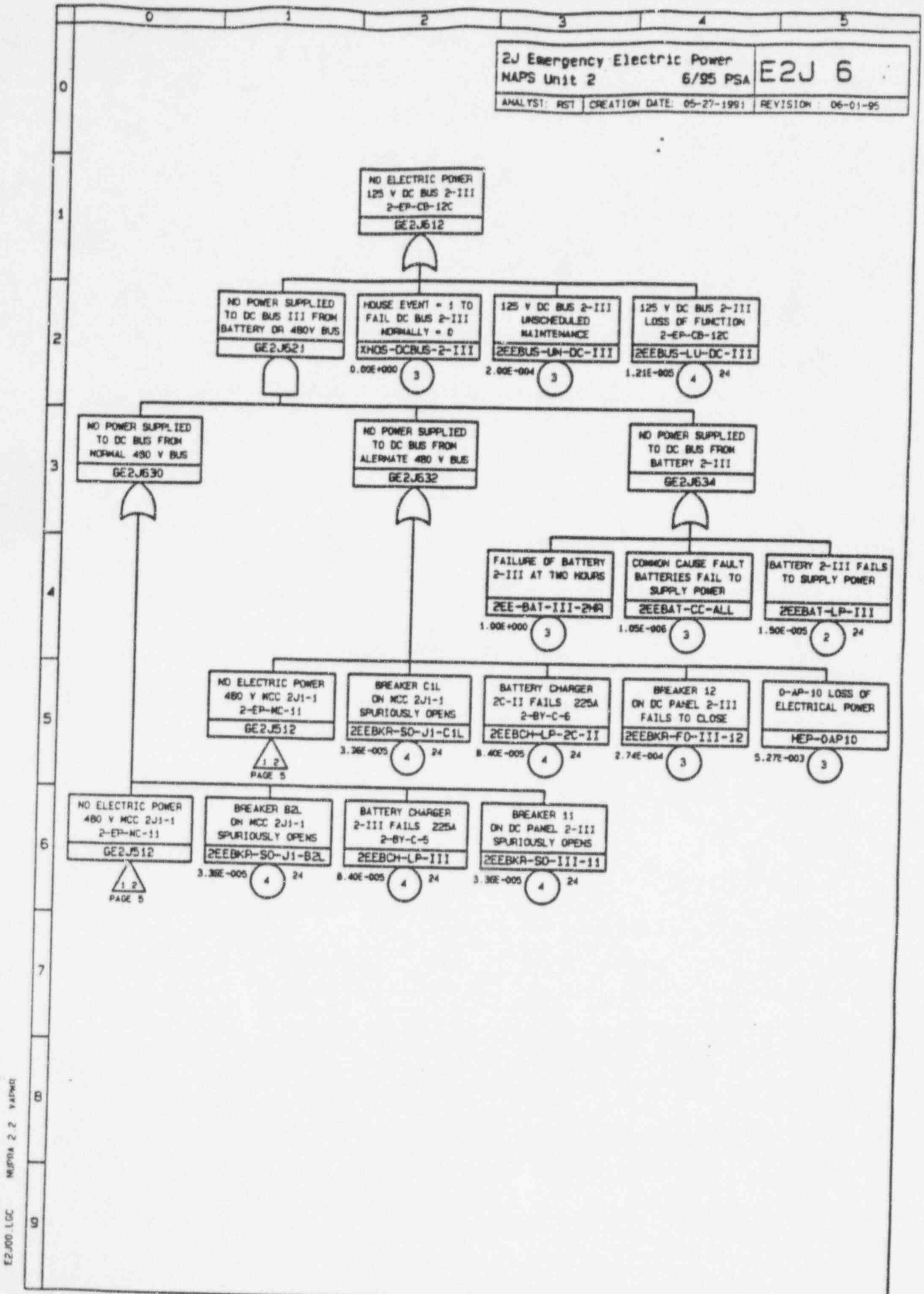


E2J00.LGC NUPRA 2.2 VAPWR

2J Emergency Electric Power NAPS Unit 2 6/95 PSA		E2J 5
ANALYST: RST	CREATION DATE: 05-27-1991	REVISION: 06-01-95



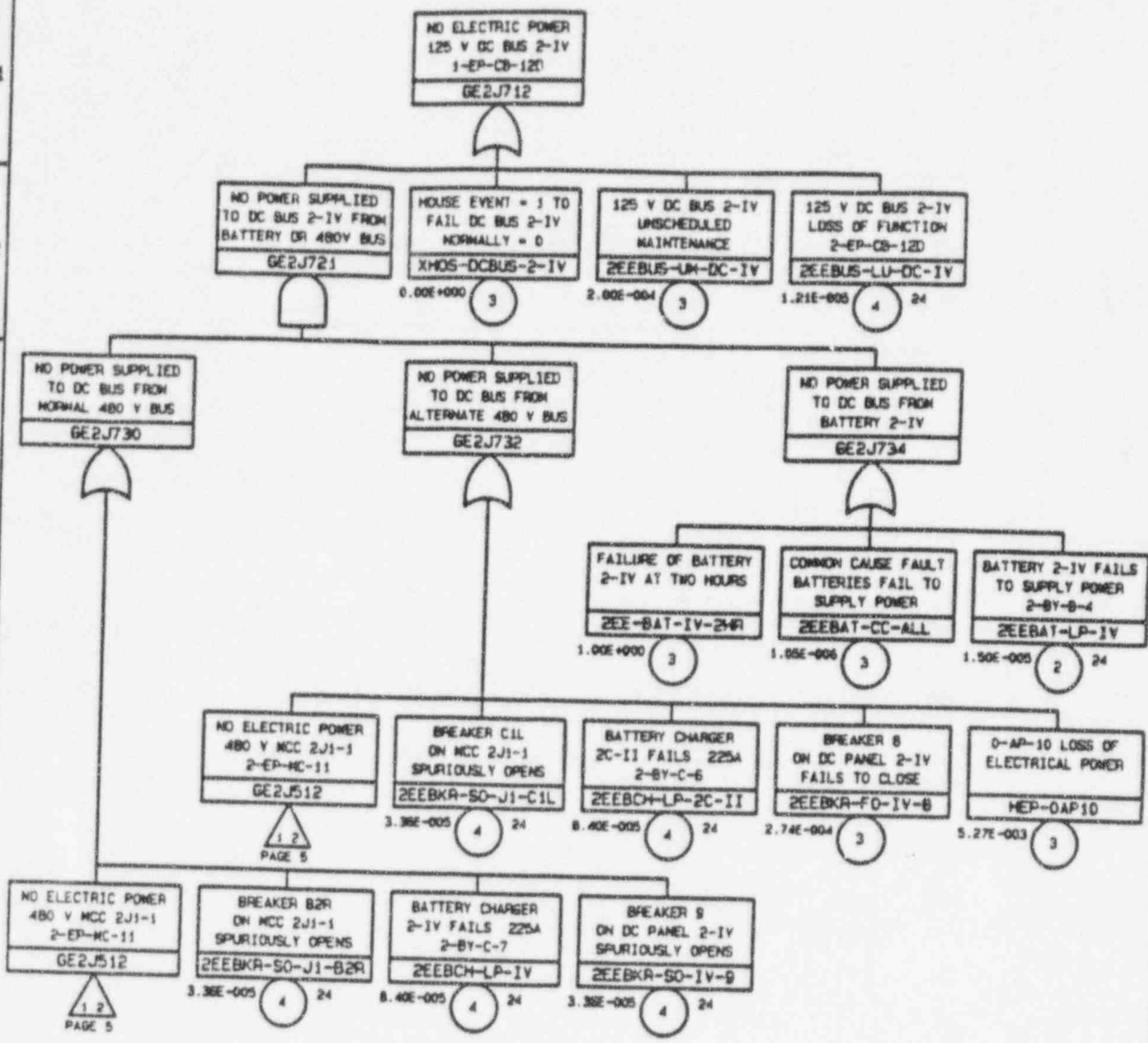
E2J00.LGC NUPRA 2.2 VAPWR


2J Emergency Electric Power
NAPS Unit 2 6/95 PSA
E2J 6
ANALYST: RST
CREATION DATE: 05-27-1991
REVISION: 06-01-95
NO ELECTRIC POWER 125 V DC BUS 2-III 2-EP-CB-12C
GE2J612
NO POWER SUPPLIED TO DC BUS III FROM BATTERY OR 480V BUS
GE2J621
HOUSE EVENT = 1 TO FAIL DC BUS 2-III NORMALLY = 0
XHOS-DCBUS-2-III
0.00E+000
125 V DC BUS 2-III UNSCHEDULED MAINTENANCE
2EEBUS-UM-DC-III
2.00E-004
125 V DC BUS 2-III LOSS OF FUNCTION 2-EP-CB-12C
2EEBUS-LU-DC-III
1.21E-005
NO POWER SUPPLIED TO DC BUS FROM NORMAL 480 V BUS
GE2J630
NO POWER SUPPLIED TO DC BUS FROM ALERNATE 480 V BUS
GE2J632
NO POWER SUPPLIED TO DC BUS FROM BATTERY 2-III
GE2J634
FAILURE OF BATTERY 2-III AT TWO HOURS
2EE-BAT-III-2HR
1.00E+000
COMMON CAUSE FAULT BATTERIES FAIL TO SUPPLY POWER
2EEBAT-CC-ALL
1.05E-006
BATTERY 2-III FAILS TO SUPPLY POWER
2EEBAT-LP-III
1.50E-005
NO ELECTRIC POWER 480 V MCC 2J1-1 2-EP-MC-11
GE2J512
PAGE 5
BREAKER C1L ON MCC 2J1-1 SPURIOUSLY OPENS
2EEBKR-SO-J1-C1L
3.36E-005
BATTERY CHARGER 2C-II FAILS 225A 2-BY-C-6
2EEBCH-LP-2C-II
8.40E-005
BREAKER 12 ON DC PANEL 2-III FAILS TO CLOSE
2EEBKR-FO-III-12
2.74E-004
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-0AP10
5.27E-003
NO ELECTRIC POWER 480 V MCC 2J1-1 2-EP-MC-11
GE2J512
PAGE 5
BREAKER B2L ON MCC 2J1-1 SPURIOUSLY OPENS
2EEBKR-SO-J1-B2L
3.36E-005
BATTERY CHARGER 2-III FAILS 225A 2-BY-C-5
2EEBCH-LP-III
8.40E-005
BREAKER 11 ON DC PANEL 2-III SPURIOUSLY OPENS
2EEBKR-SO-III-11
3.36E-005
E2J00.LGC NUPRA 2.2 VAPWR

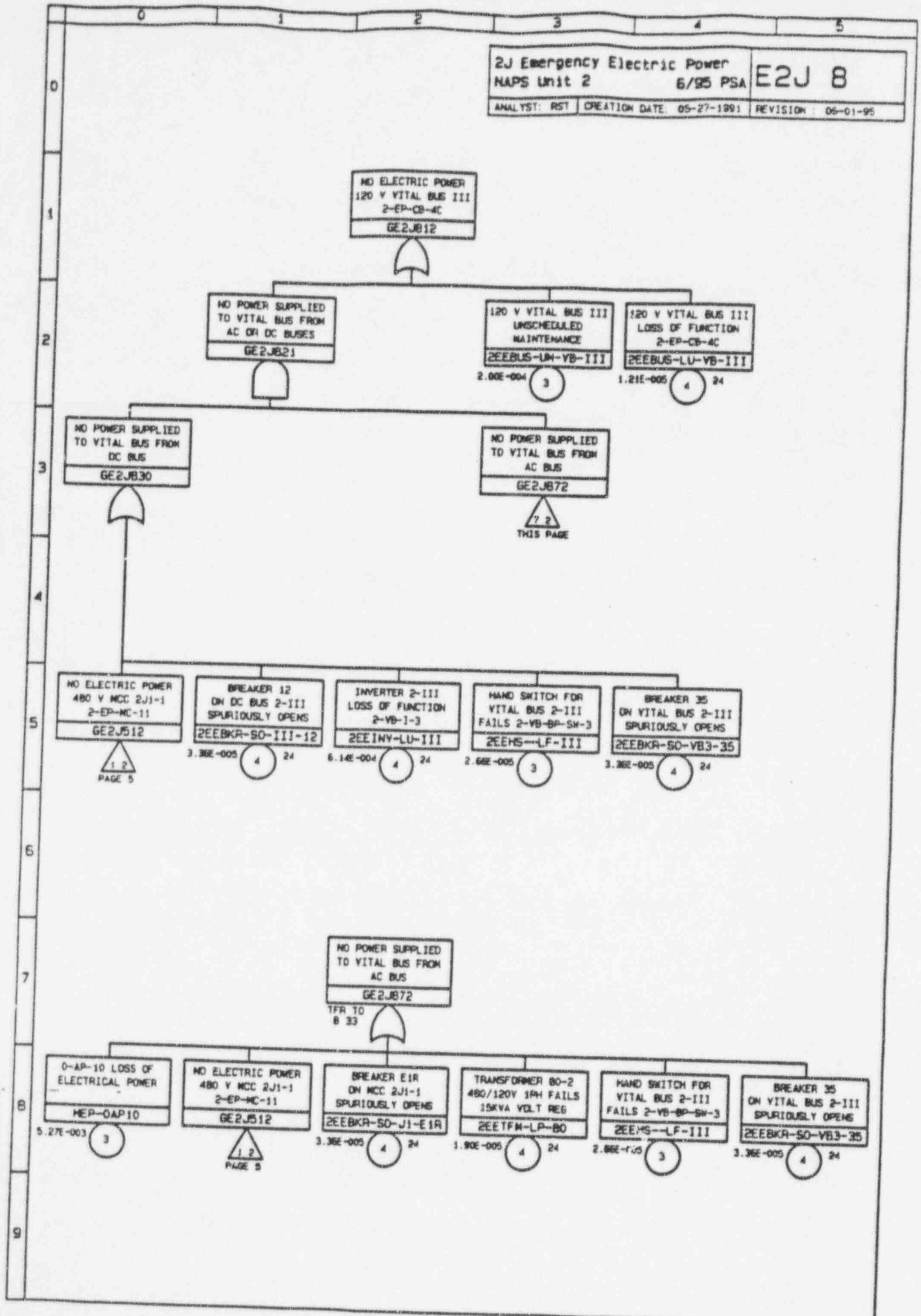
2J Emergency Electric Power
NAPS Unit 2 6/95 PSA

E2J 7

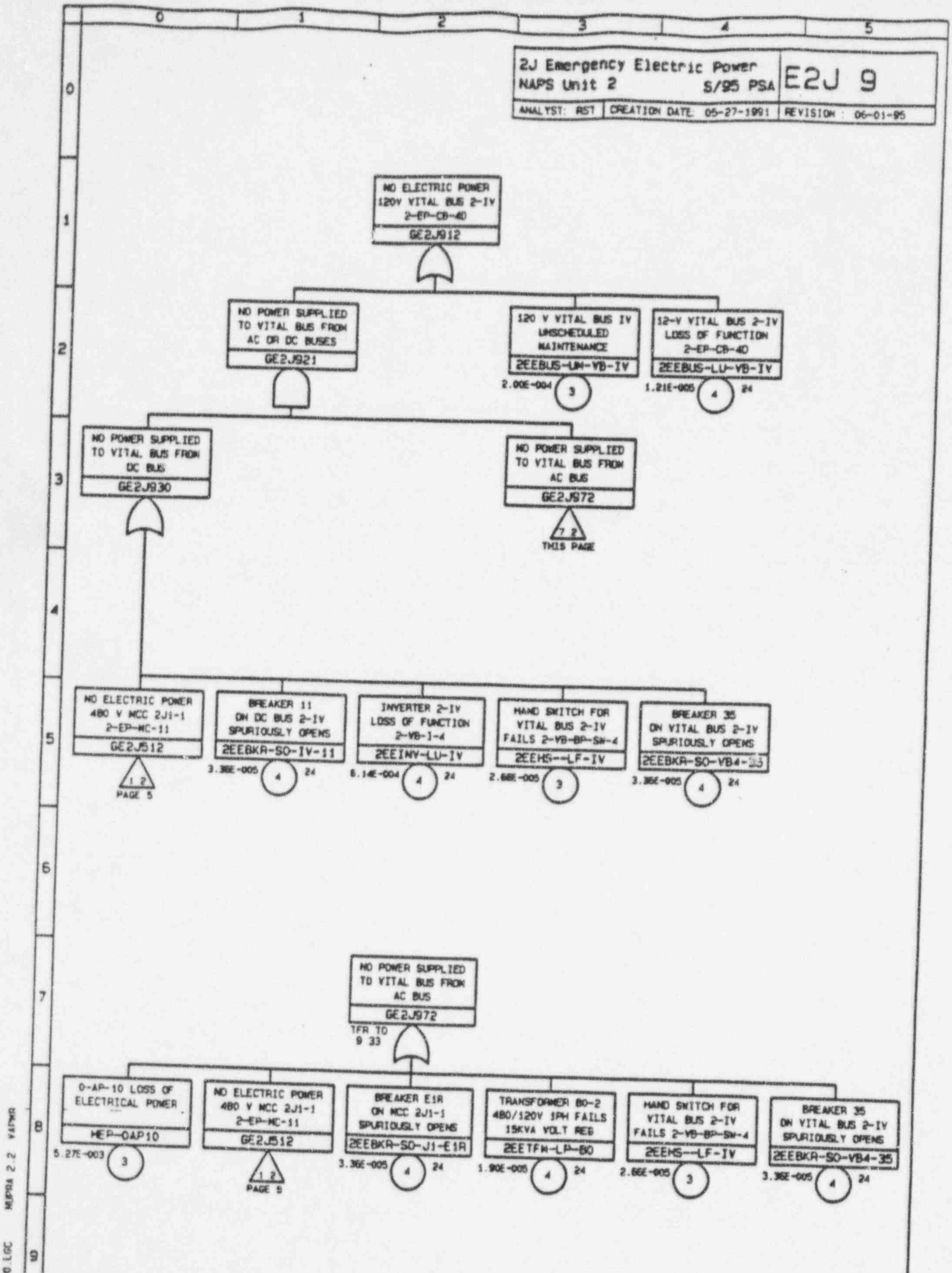
ANALYST: RST | CREATION DATE: 05-27-1991 | REVISION: 06-01-95



E2J00.LGC NUPRA 2.2 VAPWR



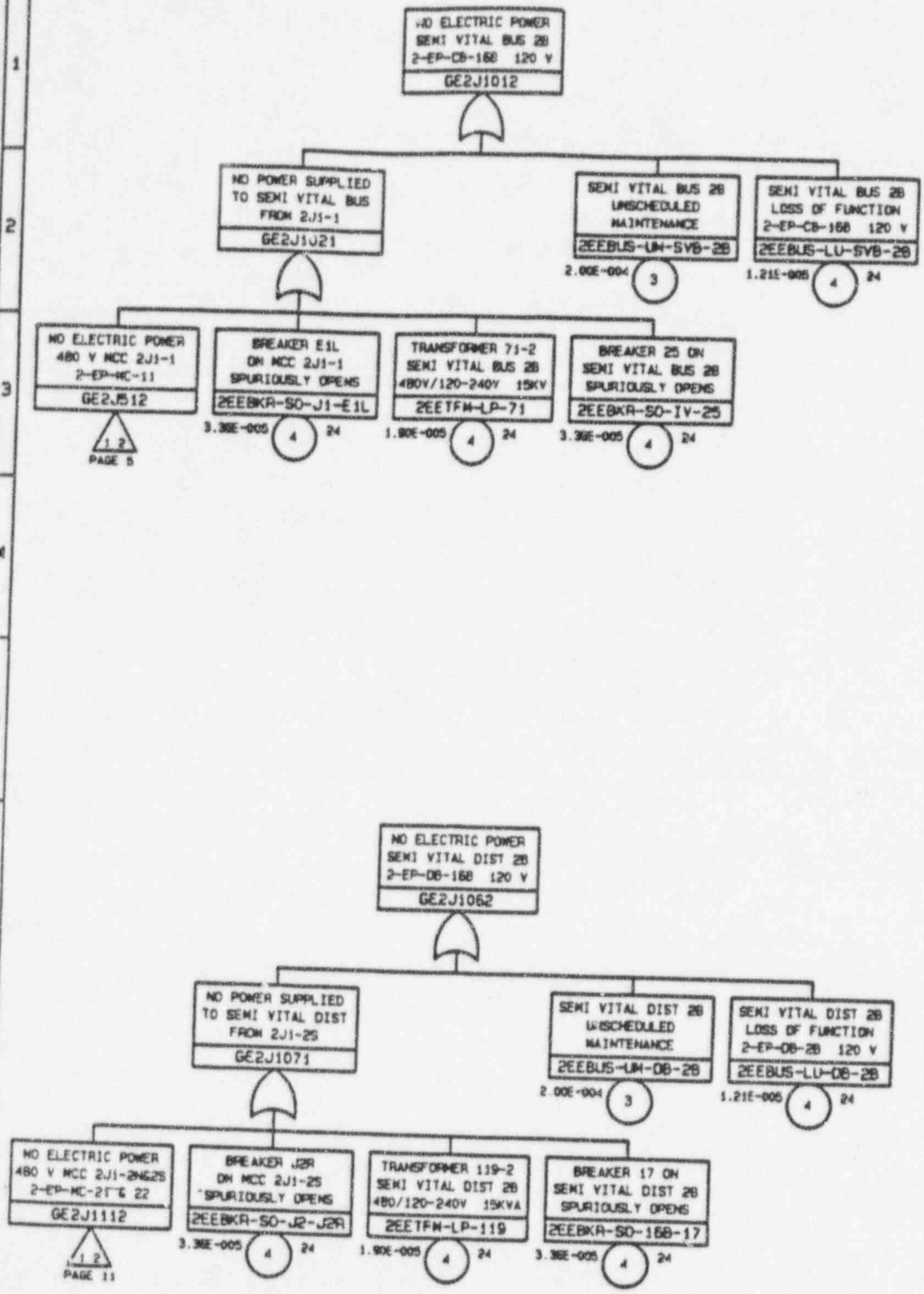
0 1 2 3 4 5
2J Emergency Electric Power
NAPS Unit 2 6/95 PSA
E2J 8
ANALYST: RST
CREATION DATE: 05-27-1991
REVISION: 06-01-95
NO ELECTRIC POWER 120 V VITAL BUS III 2-EP-CB-4C
GE2J812
NO POWER SUPPLIED TO VITAL BUS FROM AC OR DC BUSES
GE2J821
120 V VITAL BUS III UNSCHEDULED MAINTENANCE
2EEBUS-UM-VB-III
2.00E-004 3
120 V VITAL BUS III LOSS OF FUNCTION 2-EP-CB-4C
2EEBUS-LU-VB-III
1.21E-005 4 24
NO POWER SUPPLIED TO VITAL BUS FROM DC BUS
GE2J830
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE2J872
7 2
THIS PAGE
NO ELECTRIC POWER 480 V MCC 2J1-1 2-EP-MC-11
GE2J512
1 2
PAGE 5
BREAKER 12 ON DC BUS 2-III SPURIOUSLY OPENS
2EEBKR-SO-III-12
3.36E-005 4 24
INVERTER 2-III LOSS OF FUNCTION 2-VB-I-3
2EEINV-LU-III
6.14E-004 4 24
HAND SWITCH FOR VITAL BUS 2-III FAILS 2-VB-BP-SW-3
2EEHS--LF-III
2.66E-005 3
BREAKER 35 ON VITAL BUS 2-III SPURIOUSLY OPENS
2EEBKR-SO-VB3-35
3.36E-005 4 24
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE2J872
TFR TO 8 33
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-0AP10
5.27E-003 3
NO ELECTRIC POWER 480 V MCC 2J1-1 2-EP-MC-11
GE2J512
1 2
PAGE 5
BREAKER E1R ON MCC 2J1-1 SPURIOUSLY OPENS
2EEBKR-SO-J1-E1R
3.36E-005 4 24
TRANSFORMER 80-2 480/120V 1PH FAILS 15KVA VOLT REG
2EETFM-LP-80
1.90E-005 4 24
HAND SWITCH FOR VITAL BUS 2-III FAILS 2-VB-BP-SW-3
2EEHS--LF-III
2.66E-005 3
BREAKER 35 ON VITAL BUS 2-III SPURIOUSLY OPENS
2EEBKR-SO-VB3-35
3.36E-005 4 24
E2J00.LGC NUPRA 2.2 YAPWR


2J Emergency Electric Power
NAPS Unit 2 5/95 PSA
E2J 9
ANALYST: RST
CREATION DATE: 05-27-1991
REVISION : 06-01-95
NO ELECTRIC POWER 120V VITAL BUS 2-IV 2-EP-CB-4D
GE2J912
NO POWER SUPPLIED TO VITAL BUS FROM AC OR DC BUSES
GE2J921
120 V VITAL BUS IV UNSCHEDULED MAINTENANCE
2EEBUS-UM-VB-IV
2.00E-004
3
12-V VITAL BUS 2-IV LOSS OF FUNCTION 2-EP-CB-4D
2EEBUS-LU-VB-IV
1.21E-005
4
24
NO POWER SUPPLIED TO VITAL BUS FROM DC BUS
GE2J930
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE2J972
7 2
THIS PAGE
NO ELECTRIC POWER 480 V MCC 2J1-1 2-EP-MC-11
GE2J512
1 2
PAGE 5
BREAKER 11 ON DC BUS 2-IV SPURIOUSLY OPENS
2EEBKR-SO-IV-11
3.36E-005
4
24
INVERTER 2-IV LOSS OF FUNCTION 2-VB-1-4
2EEINV-LU-IV
6.14E-004
4
24
HAND SWITCH FOR VITAL BUS 2-IV FAILS 2-VB-BP-SW-4
2EEHS--LF-IV
2.66E-005
3
BREAKER 35 ON VITAL BUS 2-IV SPURIOUSLY OPENS
2EEBKR-SO-VB4-35
3.36E-005
4
24
NO POWER SUPPLIED TO VITAL BUS FROM AC BUS
GE2J972
TFR TO 9 33
0-AP-10 LOSS OF ELECTRICAL POWER
HEP-OAP10
5.27E-003
3
NO ELECTRIC POWER 480 V MCC 2J1-1 2-EP-MC-11
GE2J512
1 2
PAGE 5
BREAKER E1R ON MCC 2J1-1 SPURIOUSLY OPENS
2EEBKR-SO-J1-E1R
3.36E-005
4
24
TRANSFORMER 80-2 480/120V 1PH FAILS 15KVA VOLT REG
2EETFM-LP-80
1.90E-005
4
24
HAND SWITCH FOR VITAL BUS 2-IV FAILS 2-VB-BP-SW-4
2EEHS--LF-IV
2.66E-005
3
BREAKER 35 ON VITAL BUS 2-IV SPURIOUSLY OPENS
2EEBKR-SO-VB4-35
3.36E-005
4
24
E2J00.LGC NUPRA 2.2 VIATWR

2J Emergency Electric Power
NAPS Unit 2 6/95 PSA

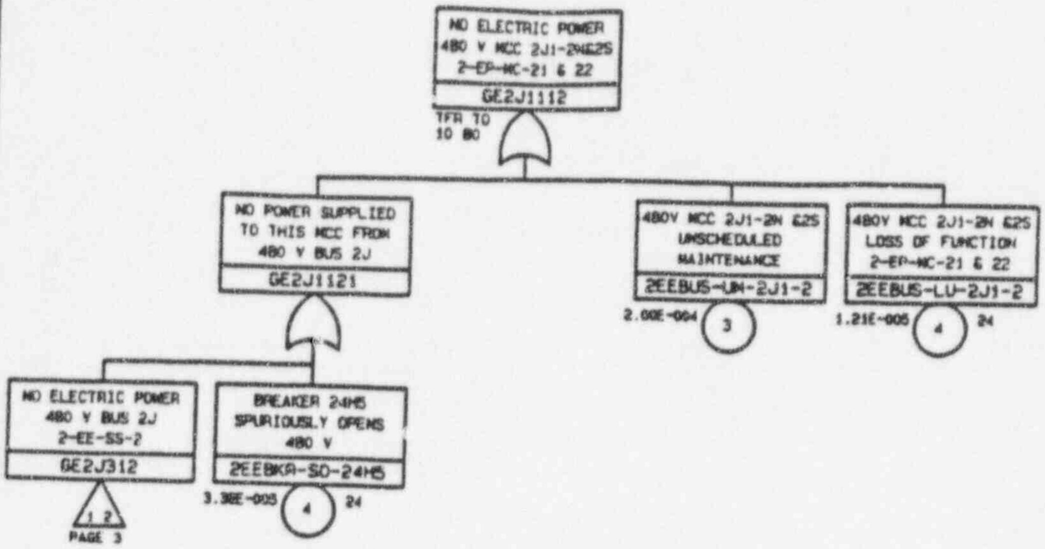
E2J 10

ANALYST: RST | CREATION DATE: 05-27-1991 | REVISION : 06-01-95



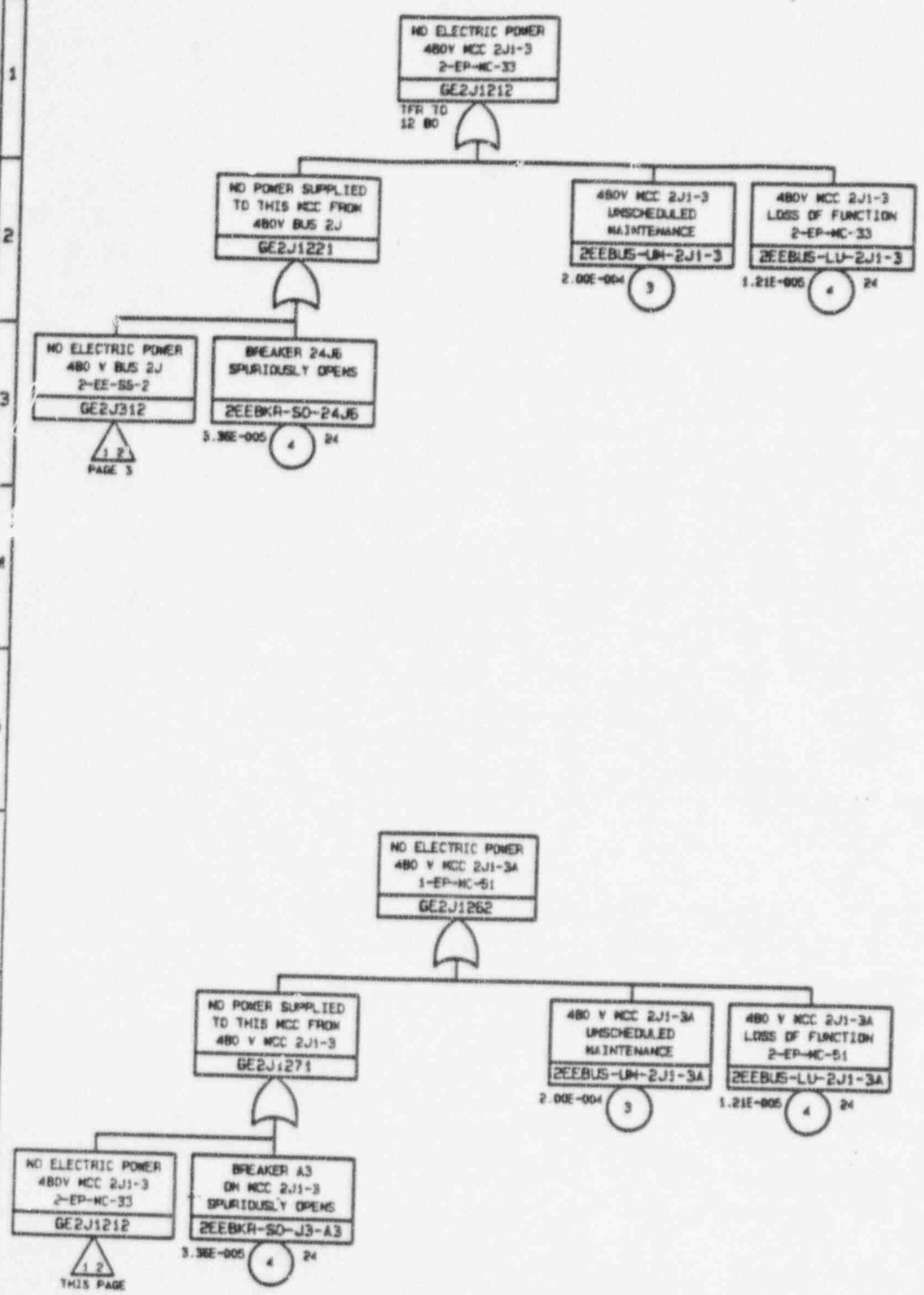
E2J00.LGC NUPRA 2.2 VAPWR

2J Emergency Electric Power NAPS Unit 2 6/95 PSA		E2J 11
ANALYST: RST	CREATION DATE: 05-27-1991	REVISION : 06-01-95



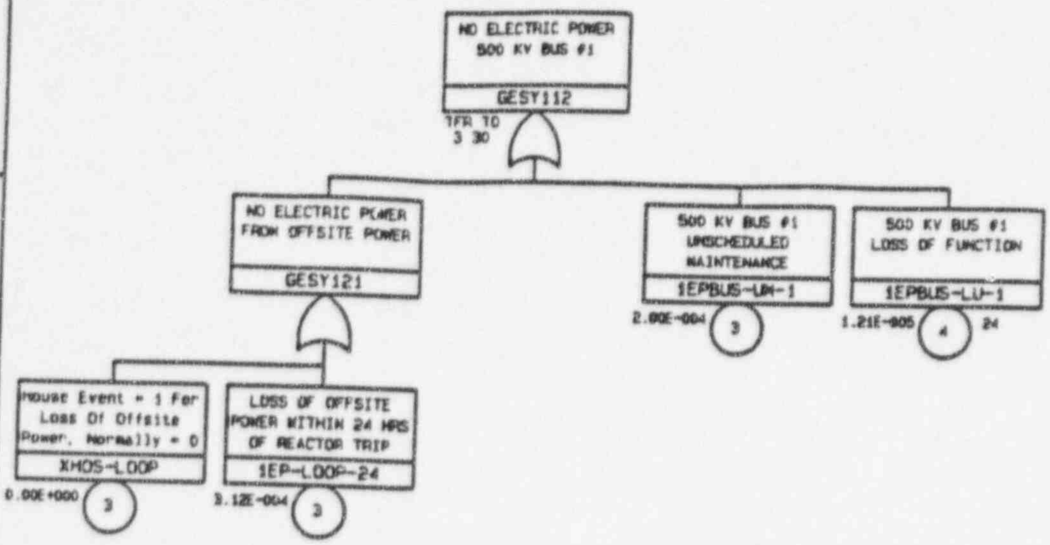
E2J00.LGC NUPRA 2.2 VAPWR

2J Emergency Electric Power MAPS Unit 2 6/95 PSA	E2J 12
ANALYST: RST | CREATION DATE: 05-27-1991	REVISION : 06-01-95



E2J00 LGC NUPRA 2.2 VAPWD

Switchyard Electrical Buses NAPS Units 1 & 2 6/95 PSA	ESY 1
ANALYST: RST / CREATION DATE: 03-10-1991	REVISION: 06-01-95

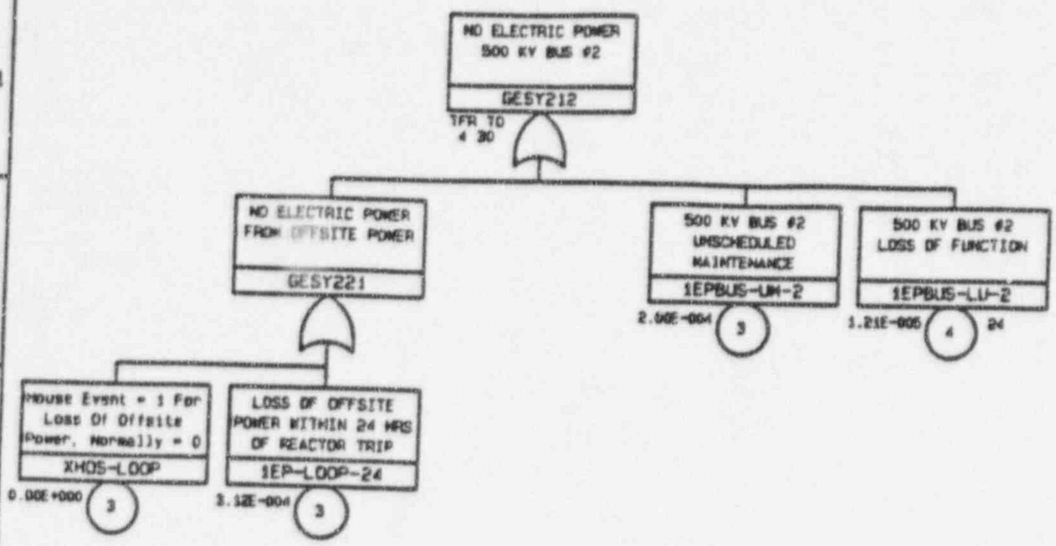


ESY00.LGC NUPRA 2.2 VAFWD

Switchyard Electrical Buses
NAPS Units 1 & 2 6/95 PSA

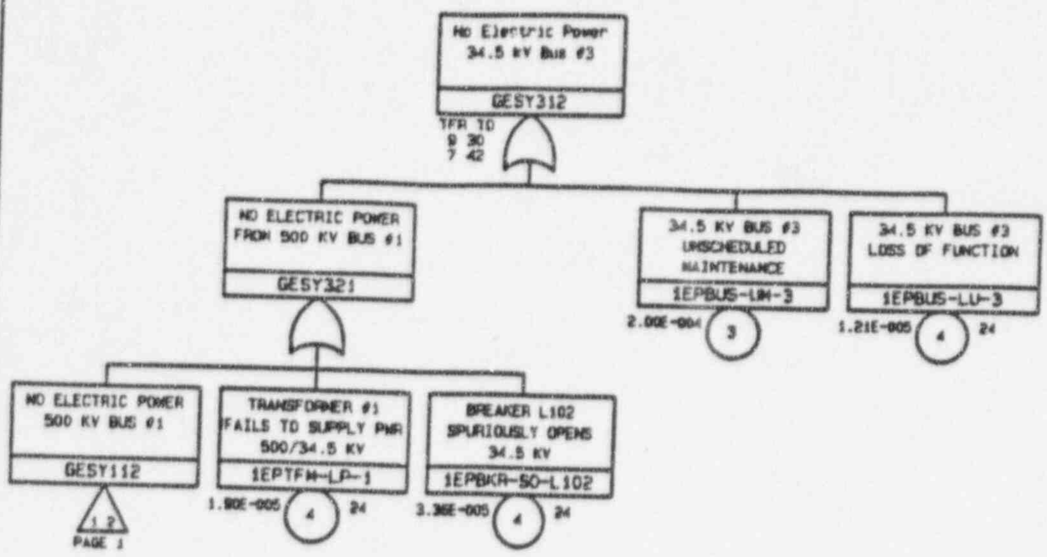
ESY 2

ANALYST: RST | CREATION DATE: 03-10-1991 | REVISION : 06-01-95

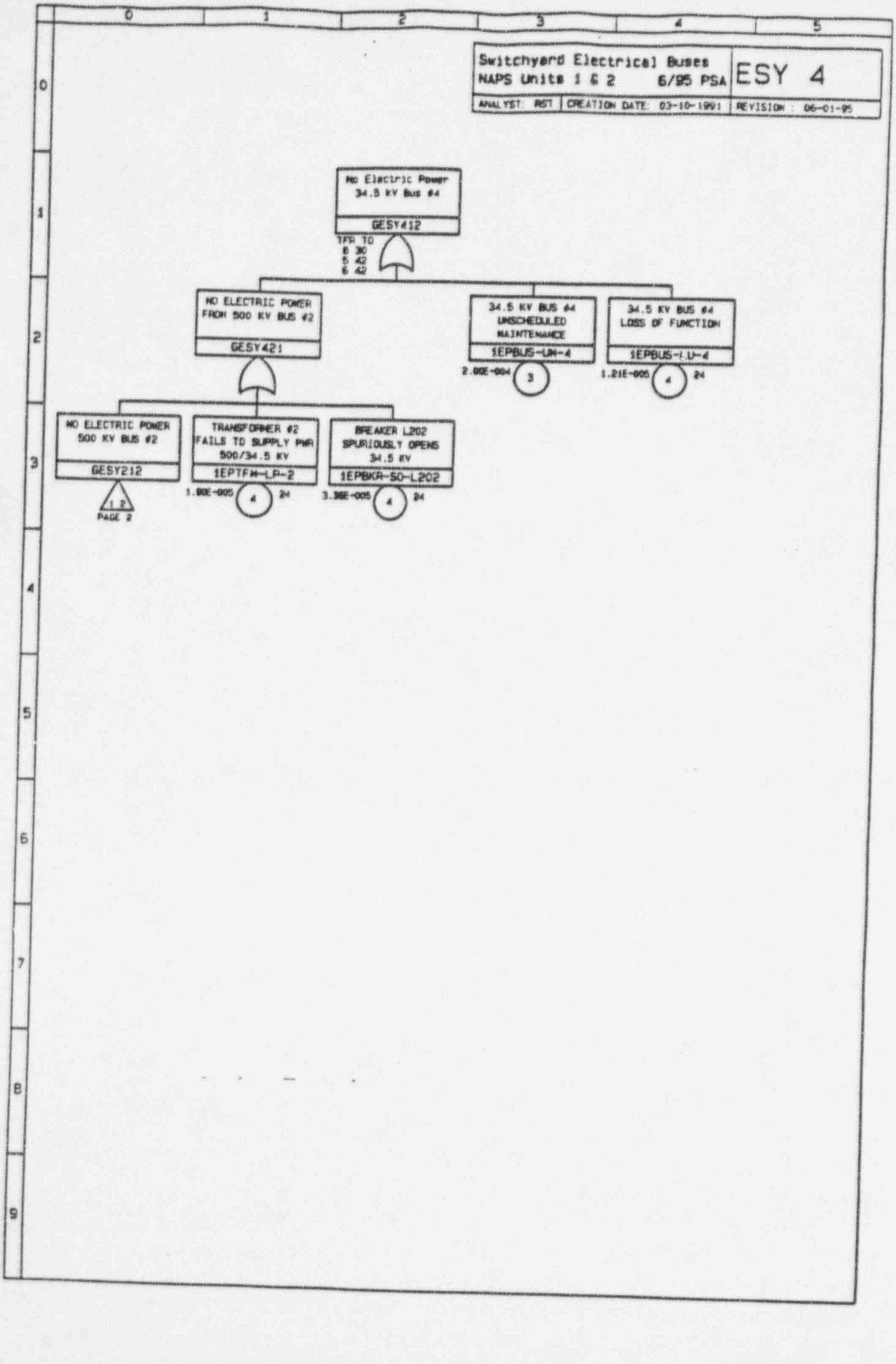


ESY00.LGC NUPRA 2.2 VAPNR

Switchyard Electrical Buses NAPS Units 1 & 2 6/95 PSA	ESY 3
ANALYST: RST · CREATION DATE: 03-10-1991	REVISION: 06-01-95



ESY00.LGC NUFRM 2.2 YAPWR

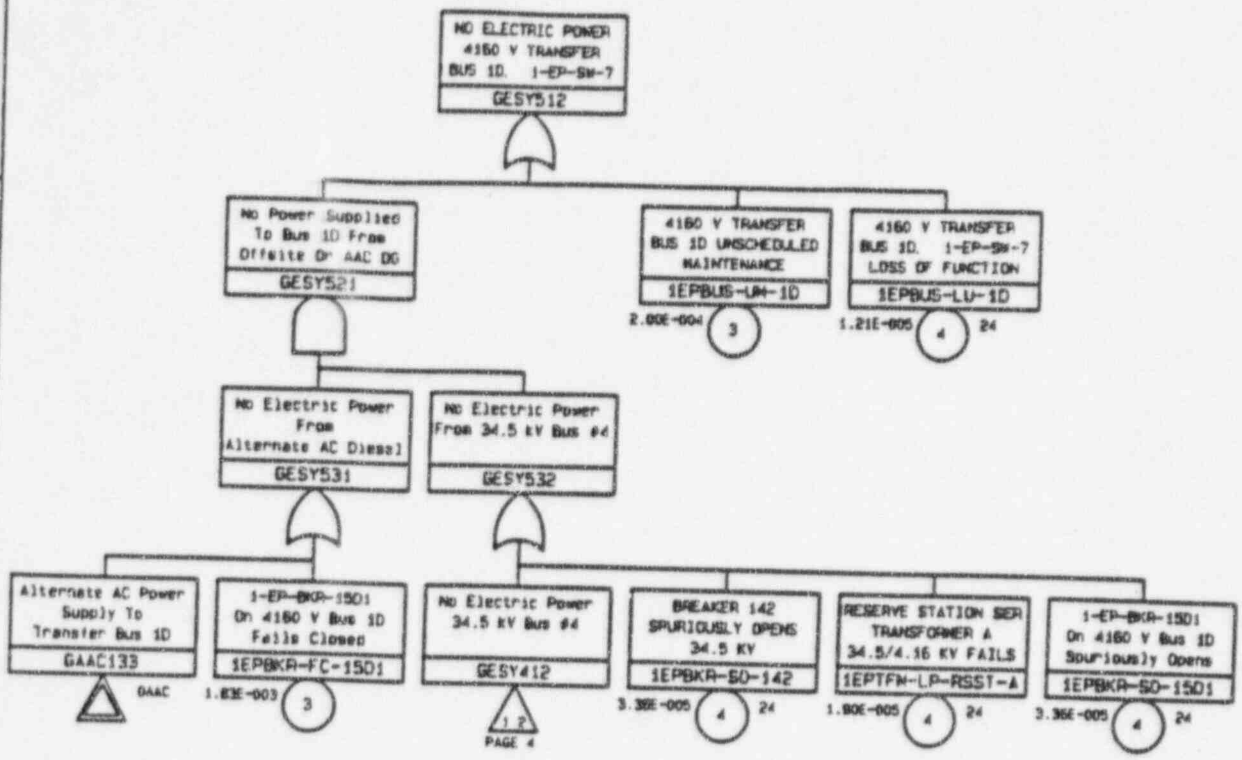


Switchyard Electrical Buses
NAPS Units 1 & 2 6/95 PSA
ESY 4
ANALYST: RST
CREATION DATE: 03-10-1991
REVISION: 06-01-95
No Electric Power 34.5 KV Bus #4
GESY412
TFR TO
8 30
5 42
6 42
NO ELECTRIC POWER FROM 500 KV BUS #2
GESY421
34.5 KV BUS #4 UNSCHEDULED MAINTENANCE
1EPBUS-UM-4
2.00E-004
3
34.5 KV BUS #4 LOSS OF FUNCTION
1EPBUS-LU-4
1.21E-005
4
24
NO ELECTRIC POWER 500 KV BUS #2
GESY212
1 2
PAGE 2
TRANSFORMER #2 FAILS TO SUPPLY PWR 500/34.5 KV
1EPTFM-LP-2
1.80E-005
4
24
BREAKER L202 SPURIOUSLY OPENS 34.5 KV
1EPBKR-SO-L202
3.36E-005
4
24
ESY00.LGC
NUPRA 2.2
VAPWR

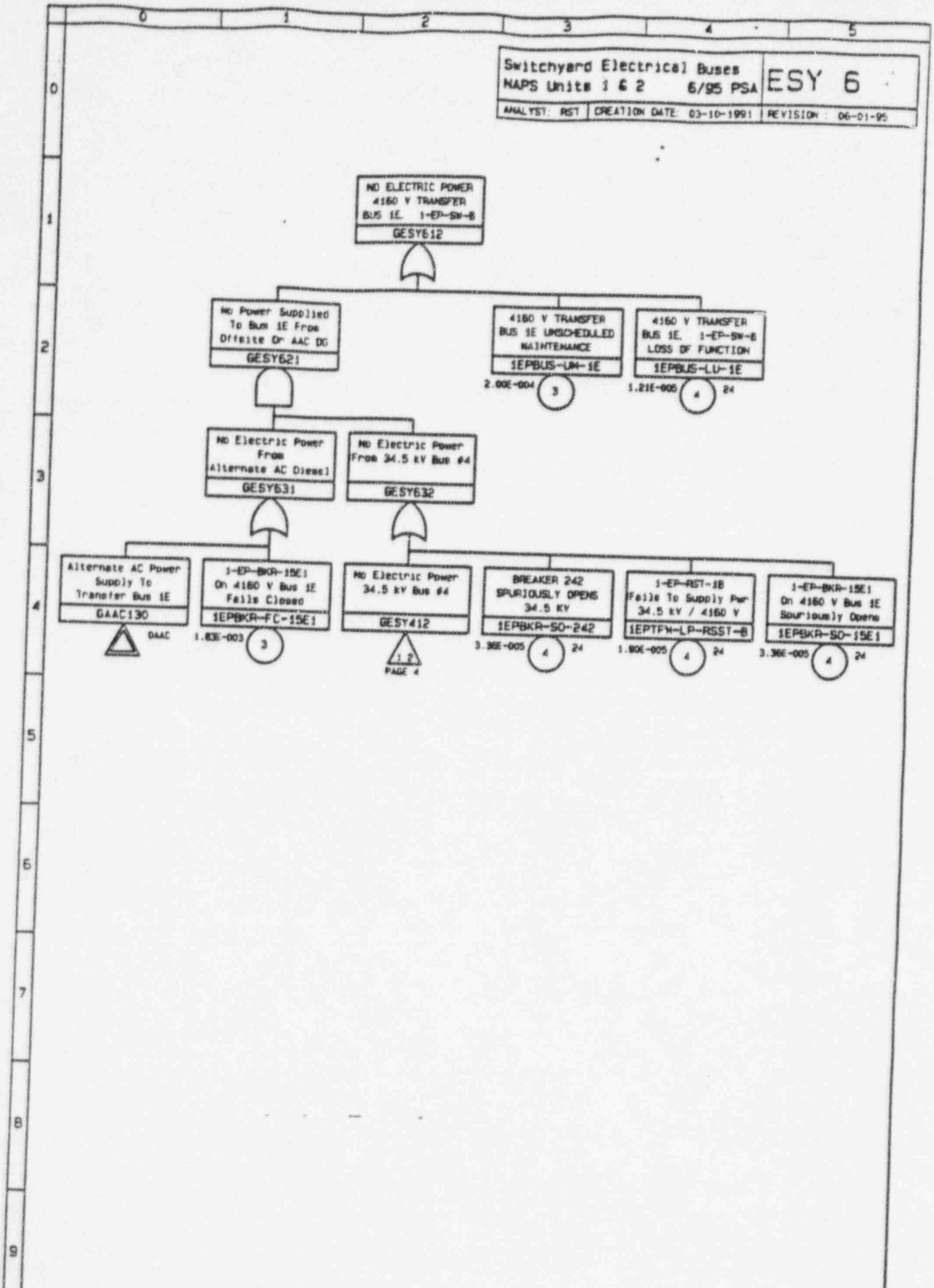
Switchyard Electrical Buses
NAPS Units 1 & 2 6/95 PSA

ESY 5

ANALYST: RST | CREATION DATE: 03-10-1991 | REVISION: 06-01-95



ES100.LGC NUPRA 2.2 VAPWR

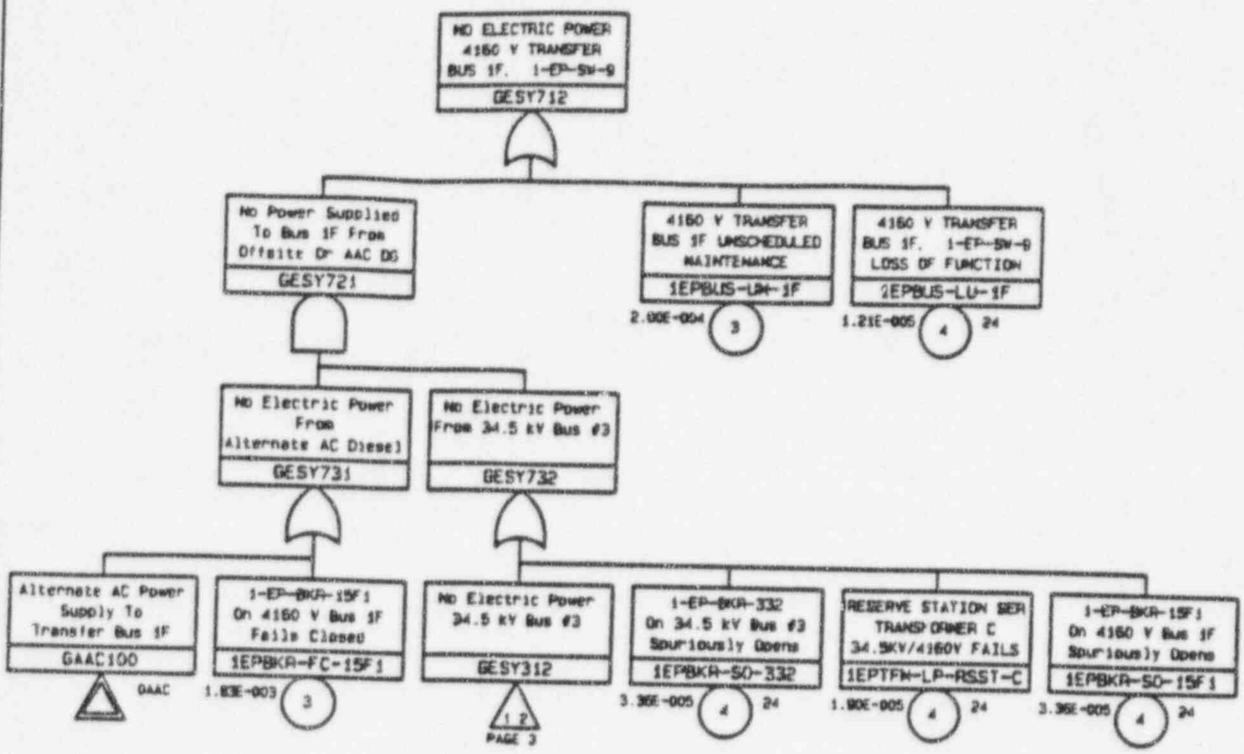


ESY00.1GC NUPRA 2.2

Switchyard Electrical Buses
NAPS Units 1 & 2 6/95 PSA

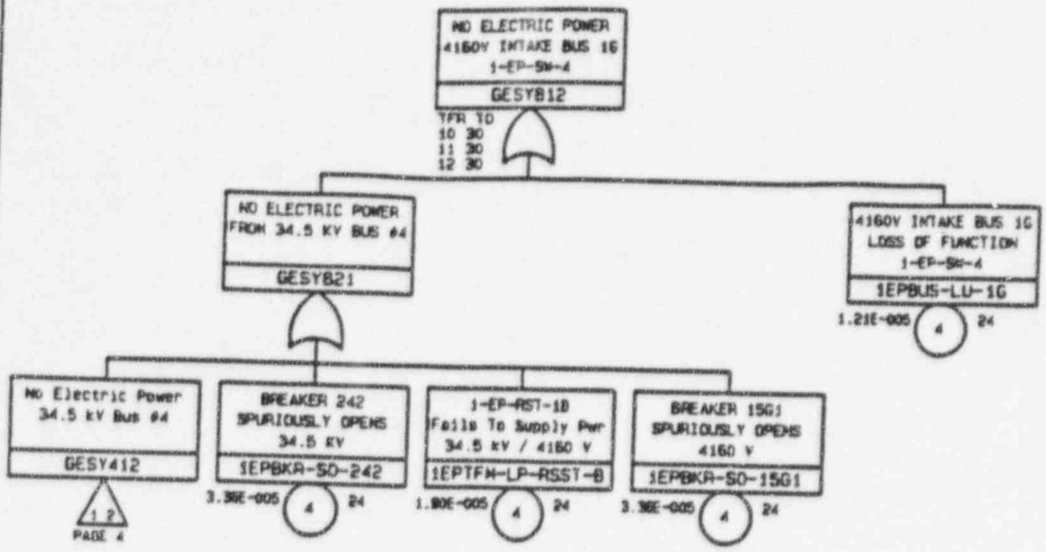
ESY 7

ANALYST: RST | CREATION DATE: 03-10-1991 | REVISION: 06-01-95



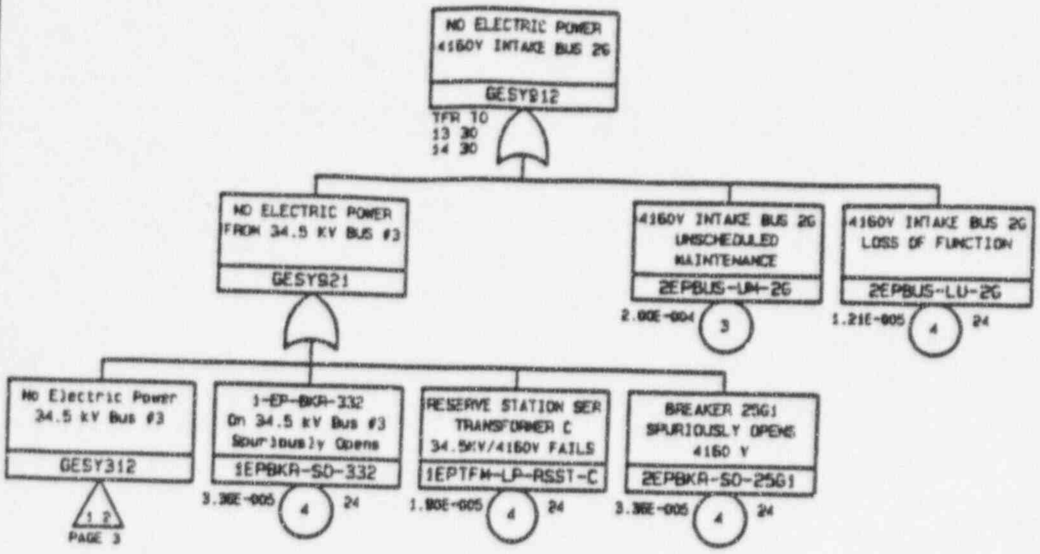
ESY00.LGC NUPRA 2.2 VAPWR

Switchyard Electrical Buses NAPS Units 1 & 2 6/95 PSA	ESY 8
ANALYST: RST | CREATION DATE: 03-10-1991	REVISION : 06-01-95



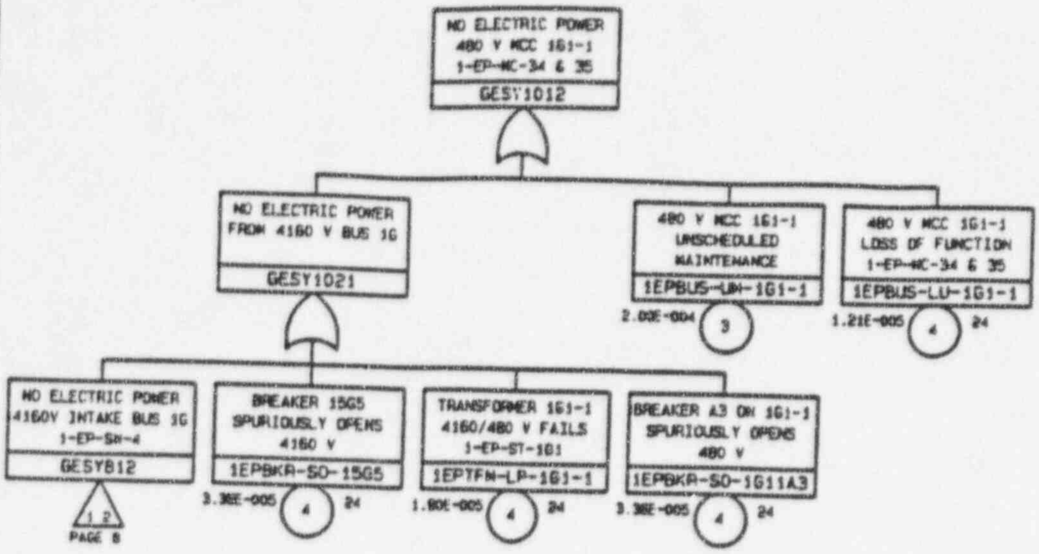
ESY00.LGC NUPRA 2.2 VAPWR

Switchyard Electrical Buses NAPS Units 1 & 2 6/95 PSA	ESY 9
ANALYST: RST · CREATION DATE: 03-10-1991	REVISION : 06-01-95



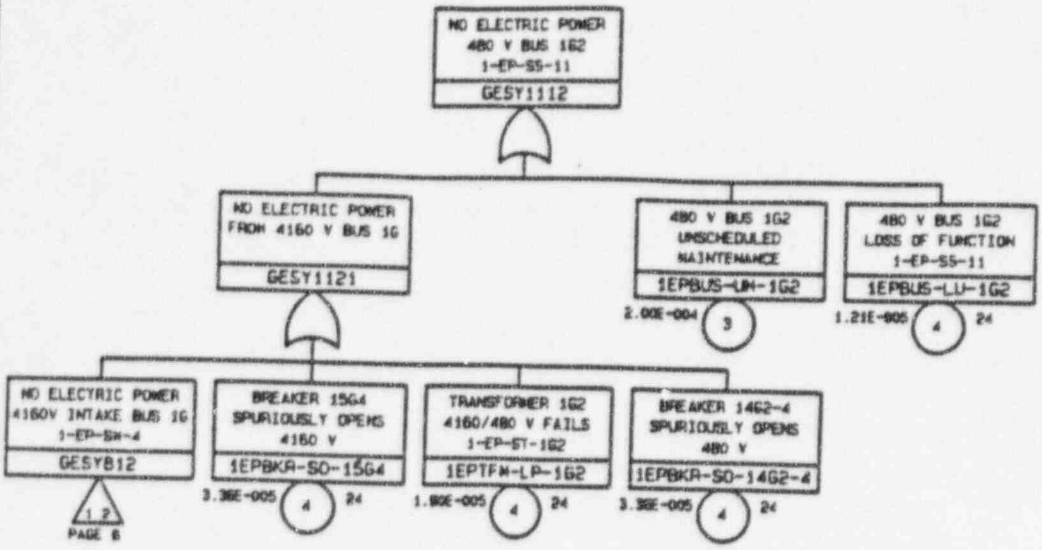
ESY00.LGC NUPRA 2.2 YAPWR

Switchyard Electrical Buses NAPS Units 1 & 2 6/95 PSA	ESY 10
ANALYST: RST | CREATION DATE: 03-10-1991	REVISION : 06-01-95



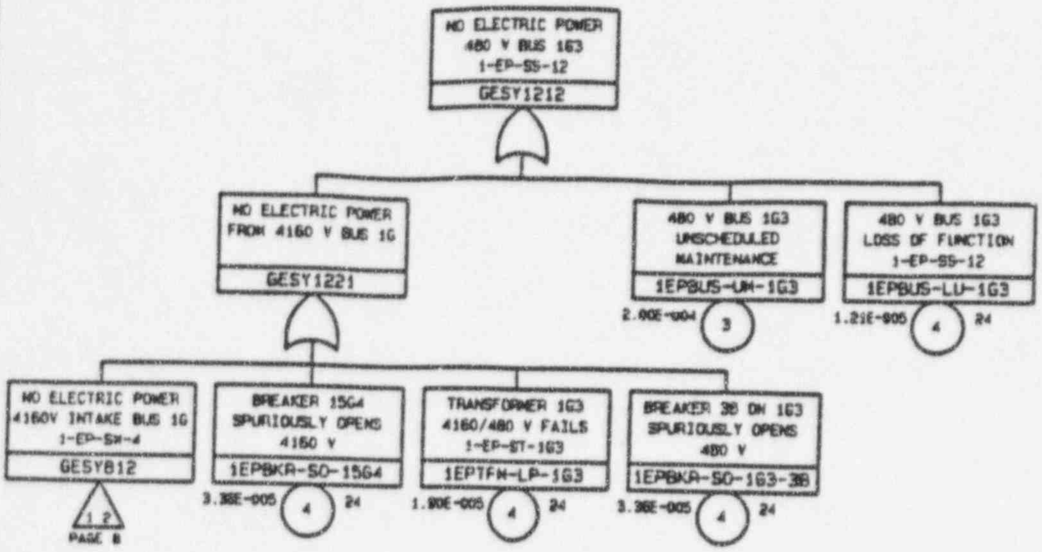
ESY00.LGC NUPRA 2.2 VAPWR

Switchyard Electrical Buses NAPS Units 1 & 2 6/95 PSA	ESY 11
ANALYST: RST | CREATION DATE: 03-10-1991	REVISION : 06-01-95



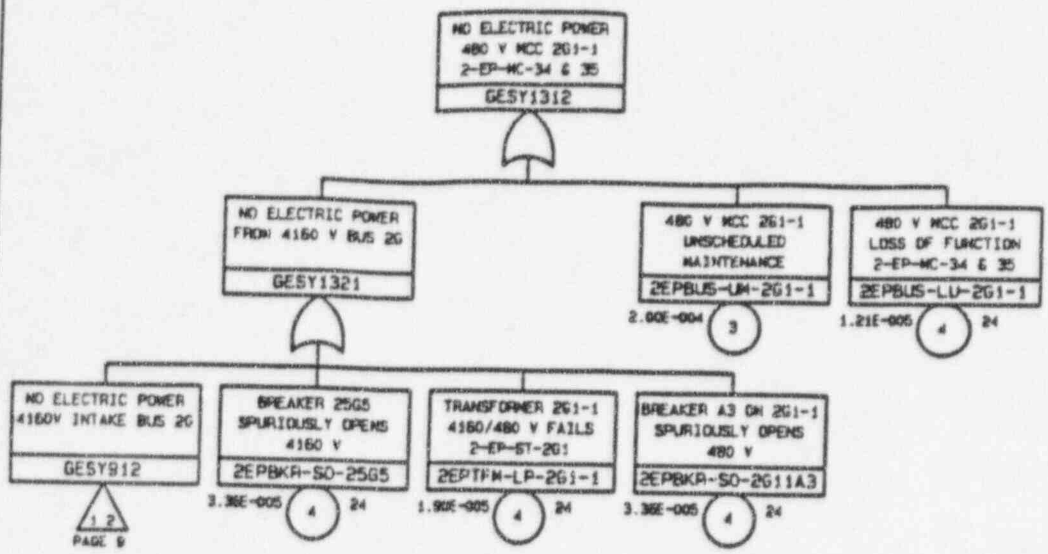
ESY00.LGC NUPRA 2.2 VAPWR

Switchyard Electrical Buses NAPS Units 1 & 2 6/95 PSA	ESY 12
ANALYST: RST | CREATION DATE: 03-10-1991	REVISION: 06-01-95



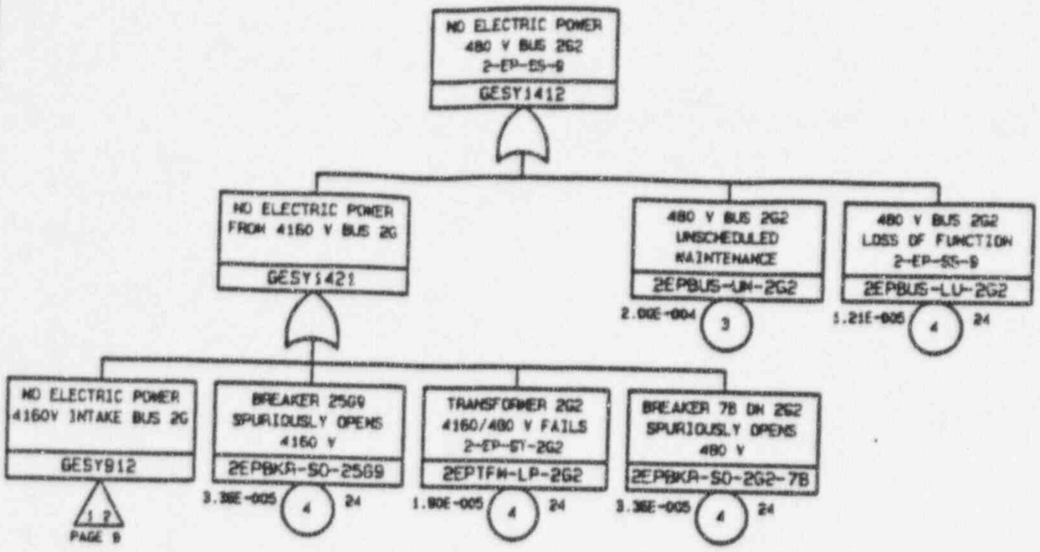
ESY00.LGC NUPRA 2.2 VASMO

Switchyard Electrical Buses NAPS Units 1 & 2 6/95 PSA	ESY 13
ANALYST: RST | CREATION DATE: 03-10-1991	REVISION: 06-01-95

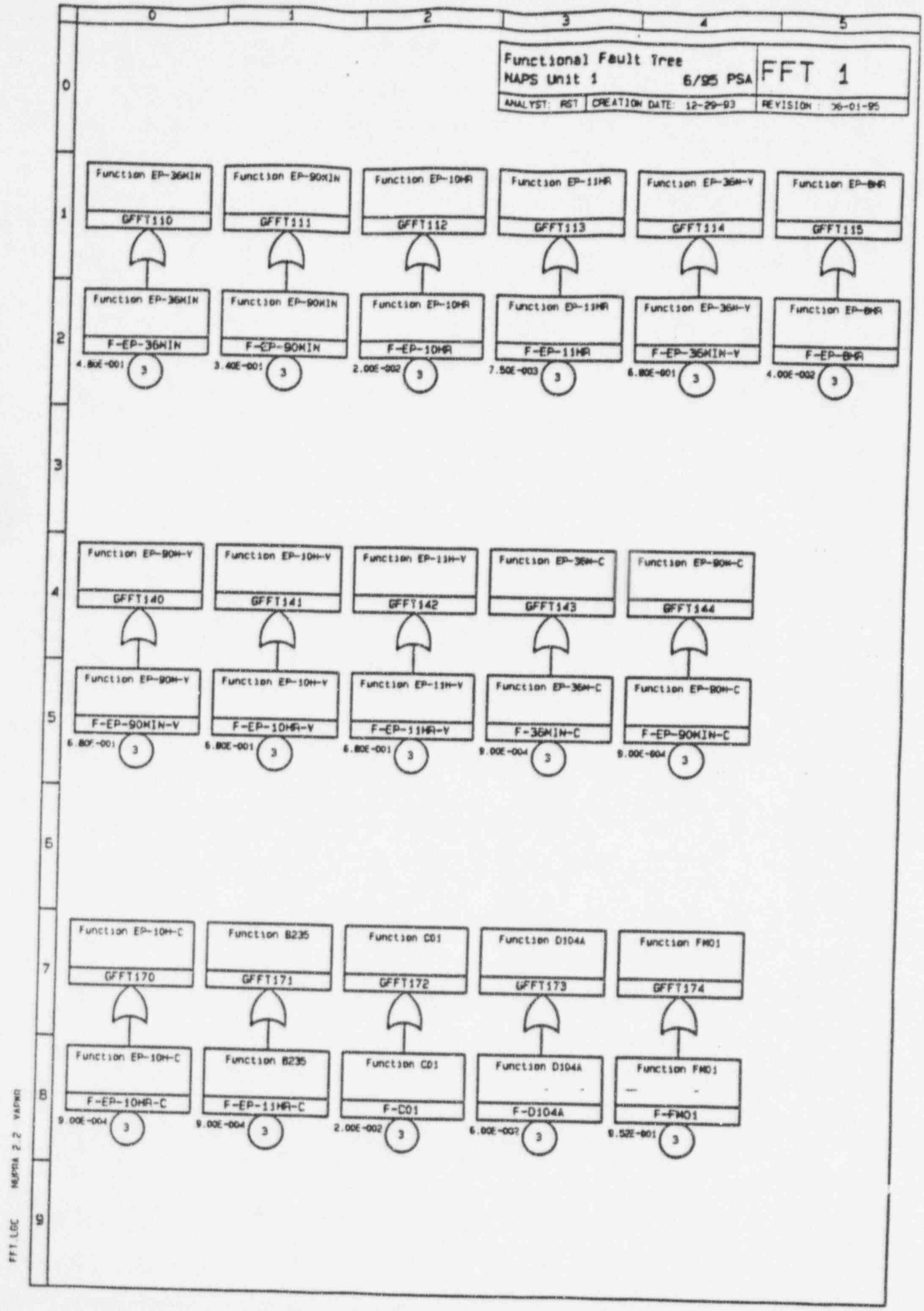


ES100.LGC NUPRA 2.2 VAPWR

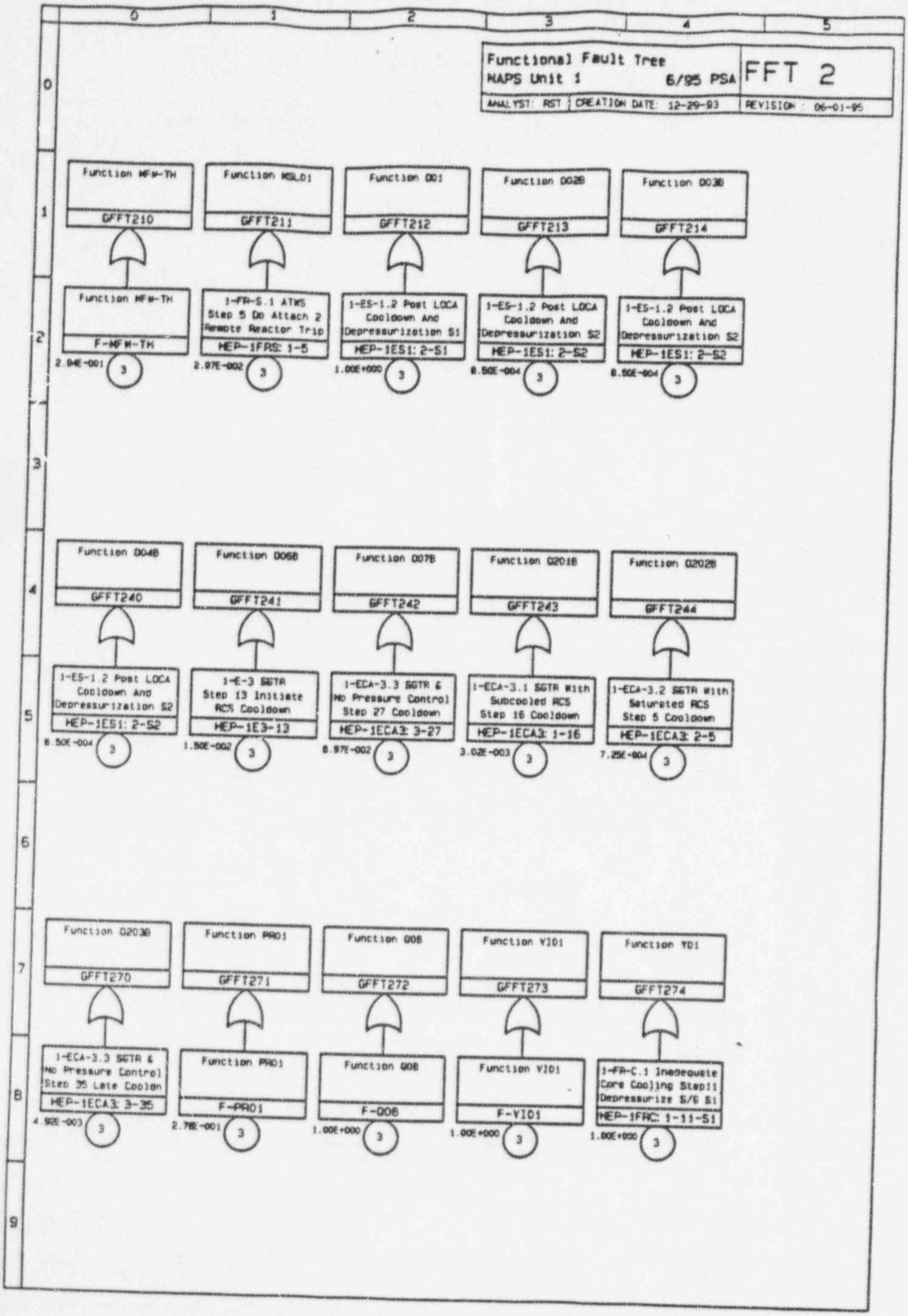
Switchyard Electrical Buses NAPS Units 1 & 2 6/95 PSA	ESY 14
ANALYST: RST | CREATION DATE: 03-10-1991	REVISION : 06-01-95



ES100.LGC NUPRA 2.2 VAPWR

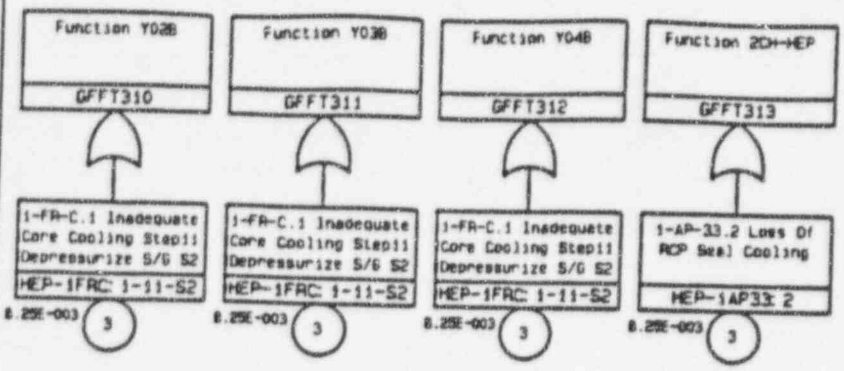


Functional Fault Tree
NAPS Unit 1 6/95 PSA
FFT 1
ANALYST: RST
CREATION DATE: 12-29-93
REVISION: 06-01-95
Function EP-36MIN
GFFT110
Function EP-36MIN
F-EP-36MIN
4.80E-001
3
Function EP-90MIN
GFFT111
Function EP-90MIN
F-EP-90MIN
3.40E-001
3
Function EP-10HR
GFFT112
Function EP-10HR
F-EP-10HR
2.00E-002
3
Function EP-11HR
GFFT113
Function EP-11HR
F-EP-11HR
7.50E-003
3
Function EP-36M-V
GFFT114
Function EP-36M-V
F-EP-36MIN-V
6.80E-001
3
Function EP-BHR
GFFT115
Function EP-BHR
F-EP-BHR
4.00E-002
3
Function EP-90M-V
GFFT140
Function EP-90M-V
F-EP-90MIN-V
6.80E-001
3
Function EP-10H-V
GFFT141
Function EP-10H-V
F-EP-10HR-V
6.80E-001
3
Function EP-11H-V
GFFT142
Function EP-11H-V
F-EP-11HR-V
6.80E-001
3
Function EP-36M-C
GFFT143
Function EP-36M-C
F-36MIN-C
9.00E-004
3
Function EP-90M-C
GFFT144
Function EP-90M-C
F-EP-90MIN-C
9.00E-004
3
Function EP-10H-C
GFFT170
Function EP-10H-C
F-EP-10HR-C
9.00E-004
3
Function B235
GFFT171
Function B235
F-EP-11HR-C
9.00E-004
3
Function C01
GFFT172
Function C01
F-C01
2.00E-002
3
Function D104A
GFFT173
Function D104A
F-D104A
6.00E-002
3
Function FM01
GFFT174
Function FM01
F-FM01
9.52E-001
3
FFT1.LGC NUPRA 2.2 VAPWR

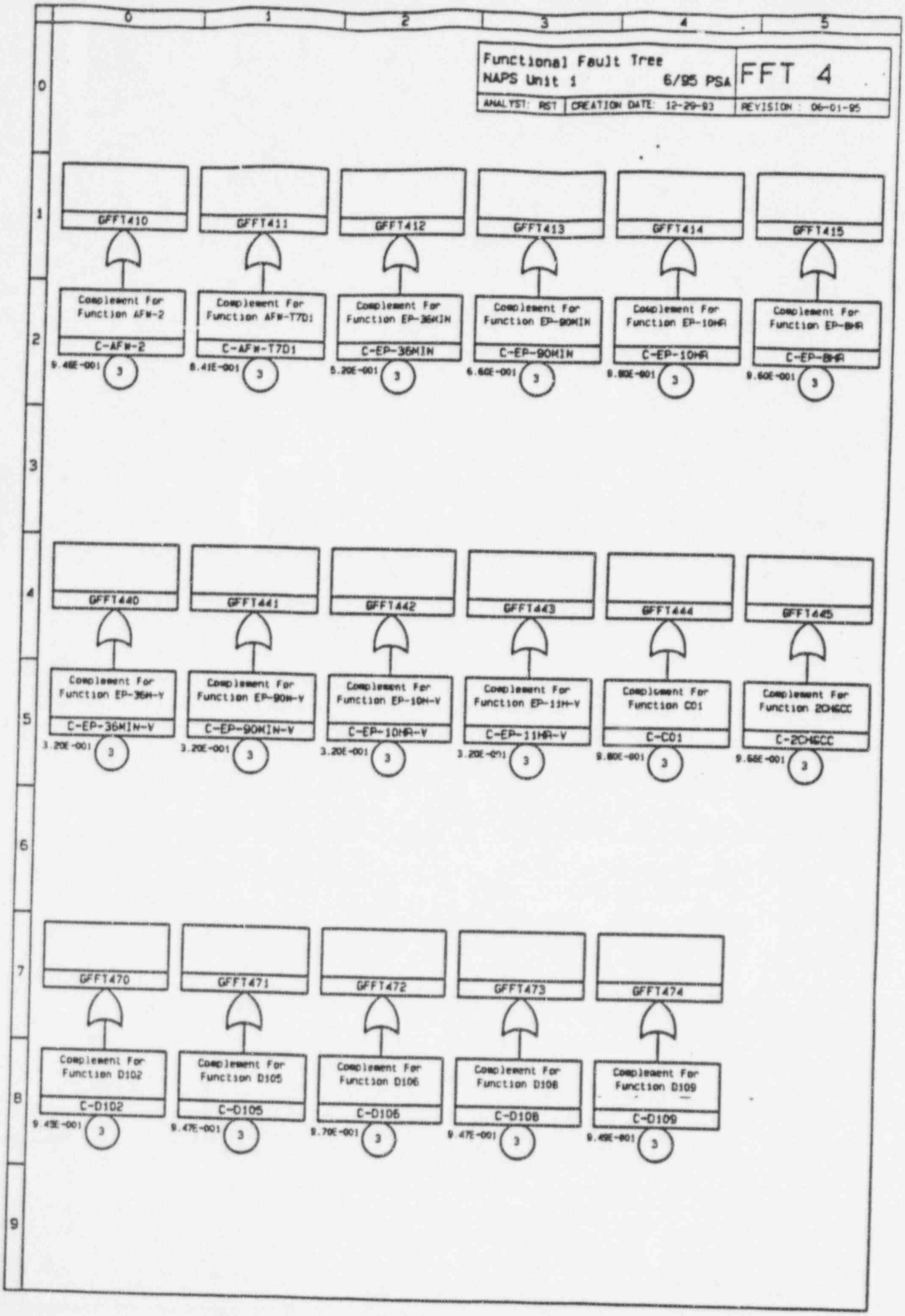


FFT.LGC NUPRA 2.2 VAPWR

Functional Fault Tree NAPS Unit 1 6/95 PSA		FFT 3
ANALYST: RST	CREATION DATE: 12-29-93	REVISION: 06-01-95



FFT.LGC NUPRA 2.2 VAPWR

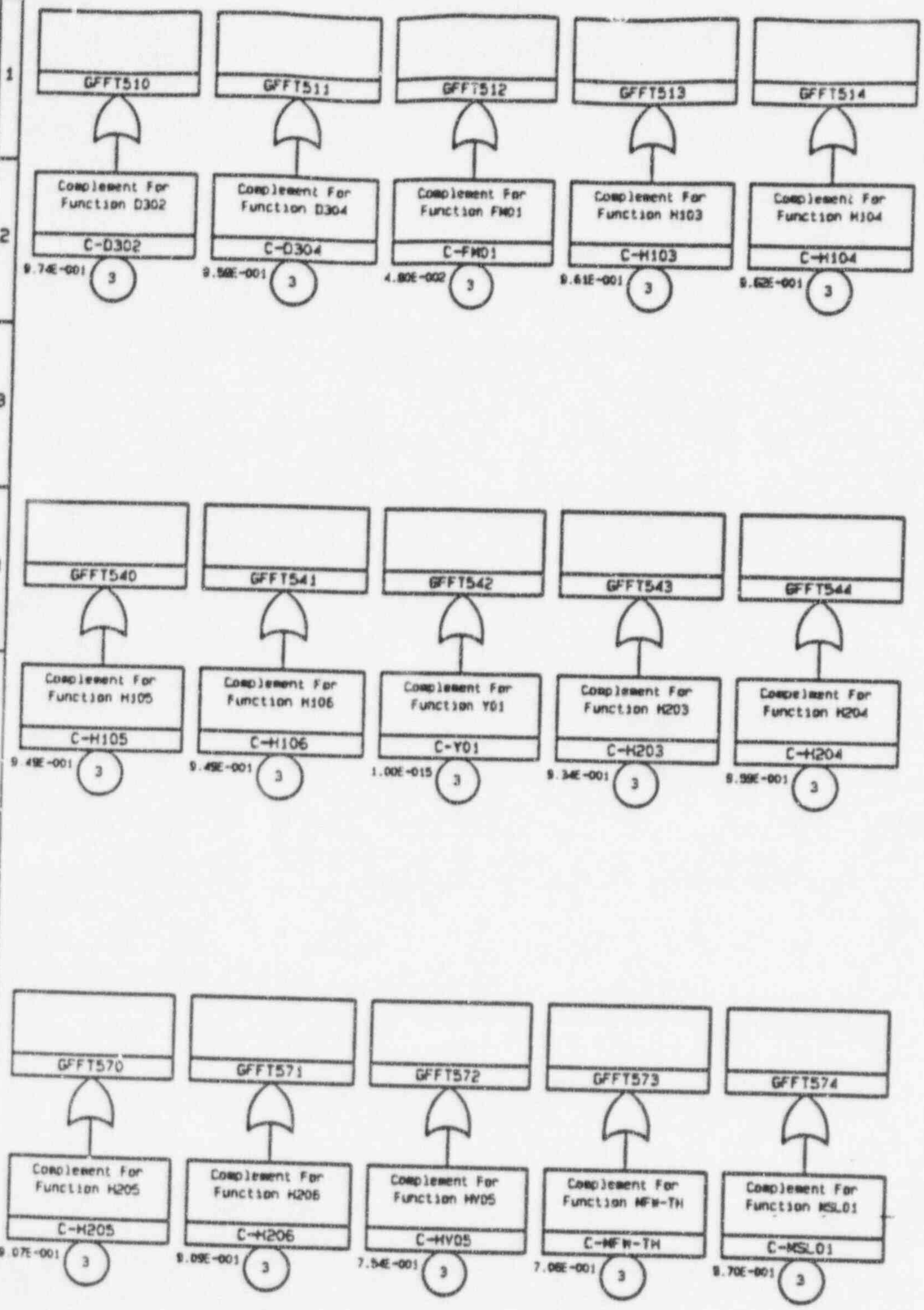


FFT.LGC NEPRA 2.2 VAPWD

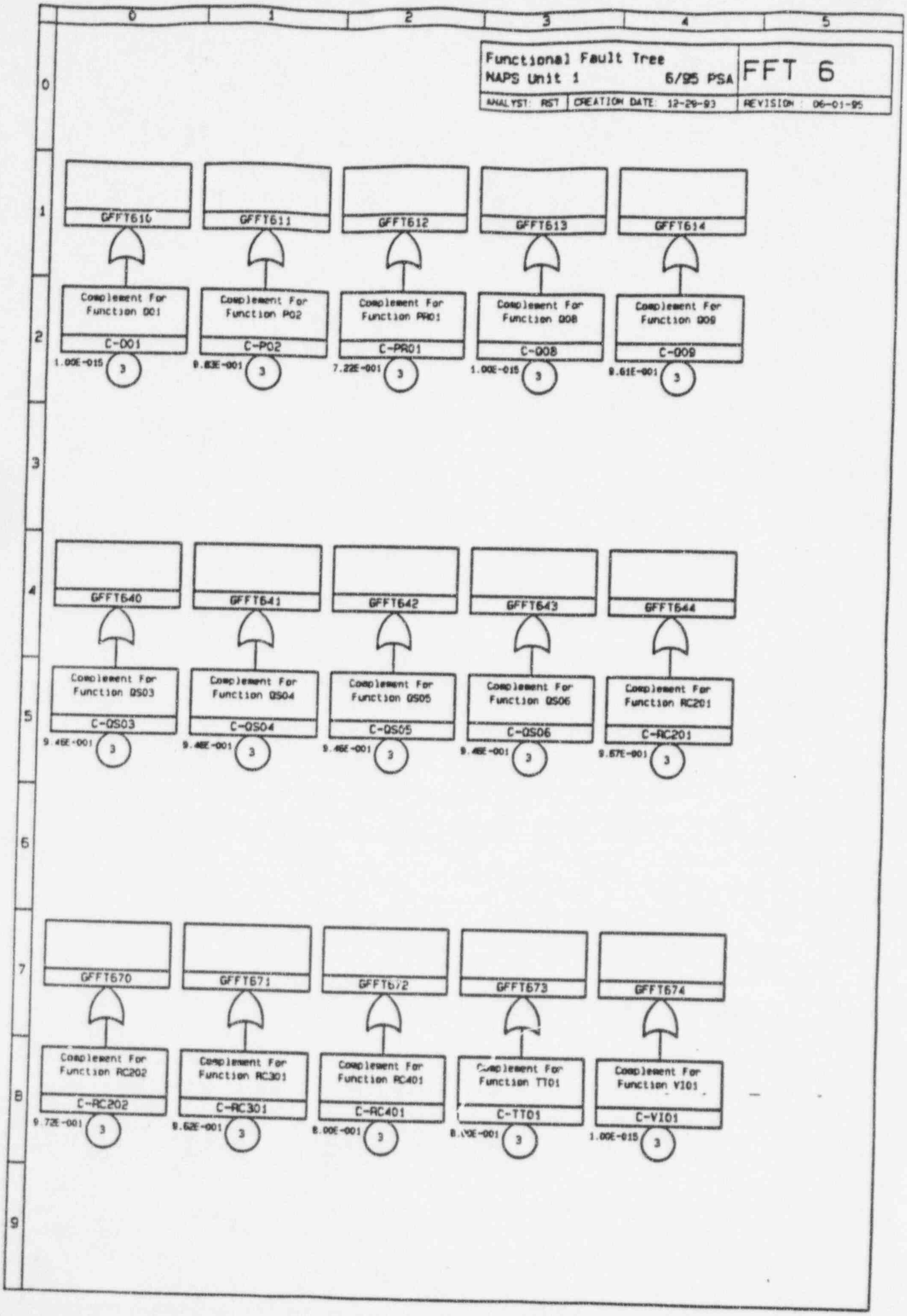
Functional Fault Tree
NAPS Unit 1 6/95 PSA

FFT 5

ANALYST: RST | CREATION DATE: 12-29-93 | REVISION: 06-01-95



FFT.LGC NUPRA 2.2 VAPWR

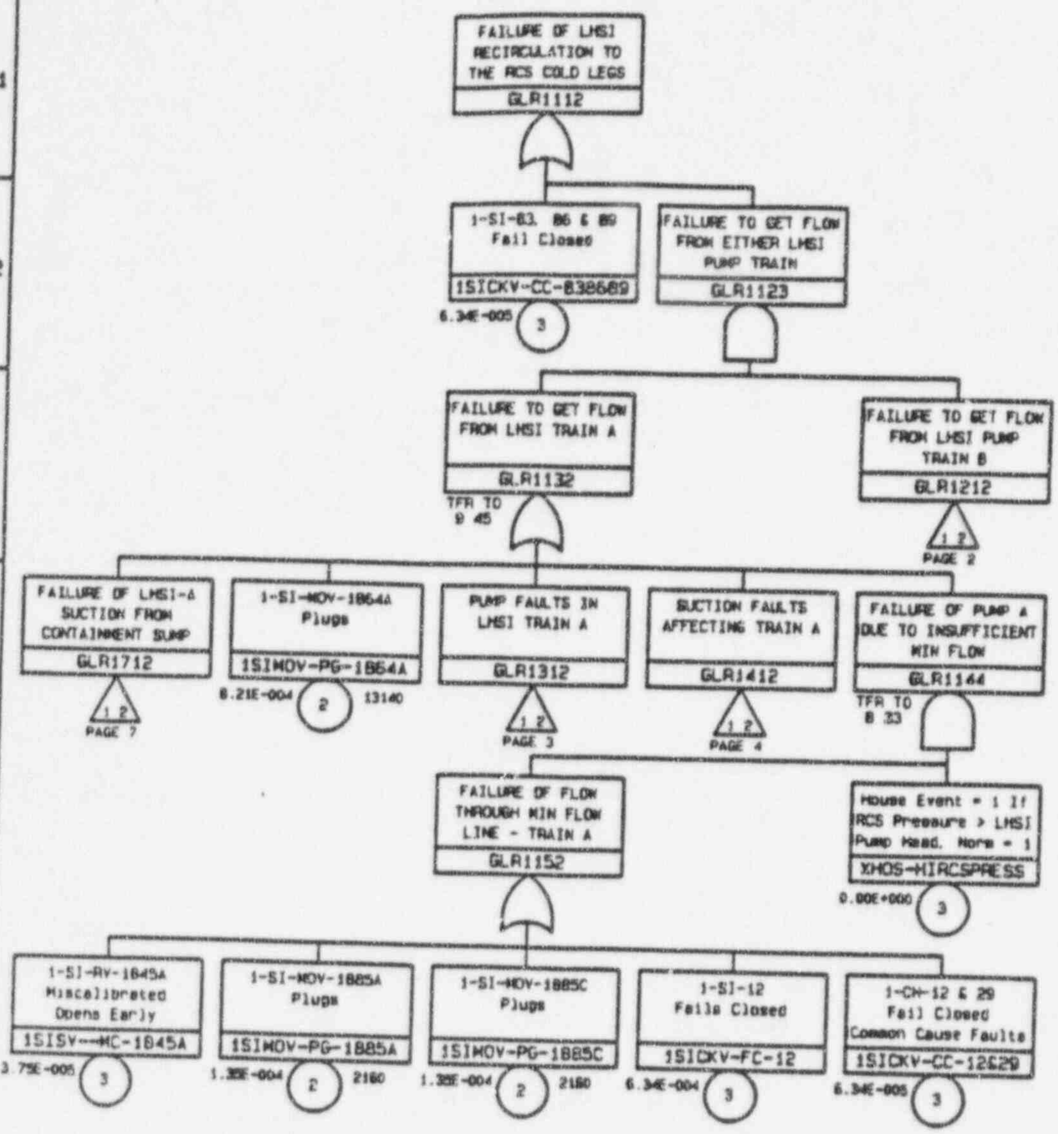


Functional Fault Tree
NAPS Unit 1 6/95 PSA
FFT 6
ANALYST: RST
CREATION DATE: 12-29-93
REVISION: 06-01-95
GFFT610
Complement For Function D01
C-D01
1.00E-015
3
GFFT611
Complement For Function P02
C-P02
9.83E-001
3
GFFT612
Complement For Function PR01
C-PR01
7.22E-001
3
GFFT613
Complement For Function D08
C-D08
1.00E-015
3
GFFT614
Complement For Function D09
C-D09
9.61E-001
3
GFFT640
Complement For Function QS03
C-QS03
9.46E-001
3
GFFT641
Complement For Function QS04
C-QS04
9.46E-001
3
GFFT642
Complement For Function QS05
C-QS05
9.46E-001
3
GFFT643
Complement For Function QS06
C-QS06
9.46E-001
3
GFFT644
Complement For Function RC201
C-RC201
9.67E-001
3
GFFT670
Complement For Function RC202
C-RC202
9.72E-001
3
GFFT671
Complement For Function RC301
C-RC301
9.62E-001
3
GFFT672
Complement For Function RC401
C-RC401
8.00E-001
3
GFFT673
Complement For Function TT01
C-TT01
3
GFFT674
Complement For Function VI01
C-VI01
1.00E-015
3

Low Head Safety Recirculation
NAPS Unit 1 6/95 PSA

LR1 1

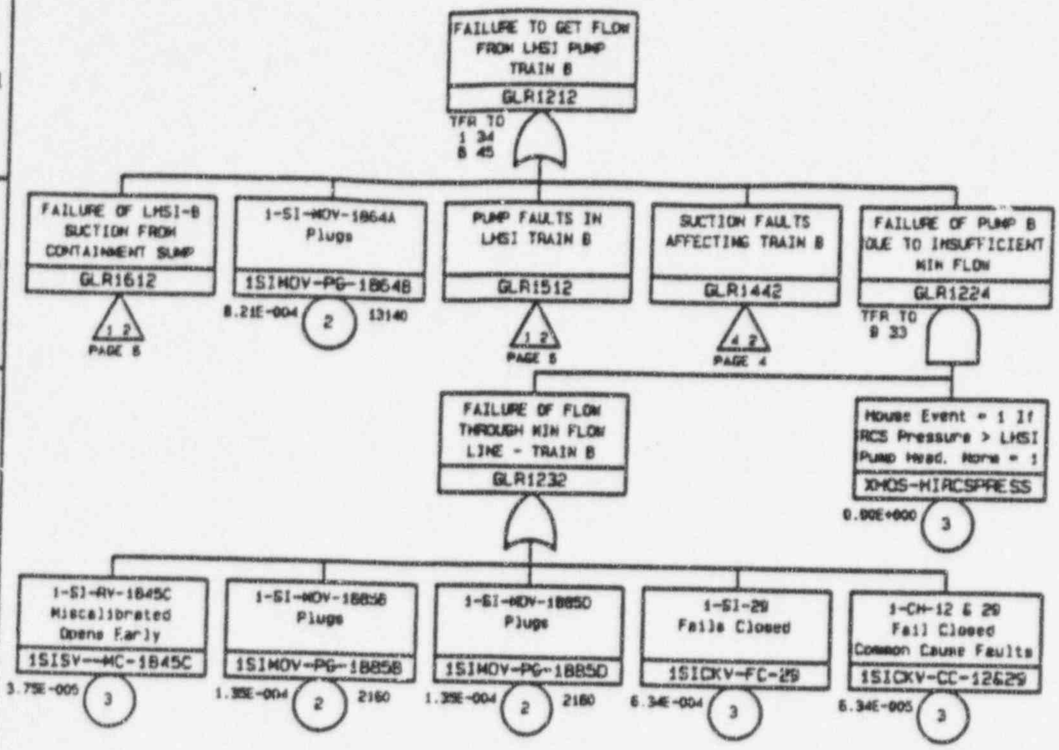
ANALYST: RST | CREATION DATE: 06-28-199. | REVISION: 06-01-95



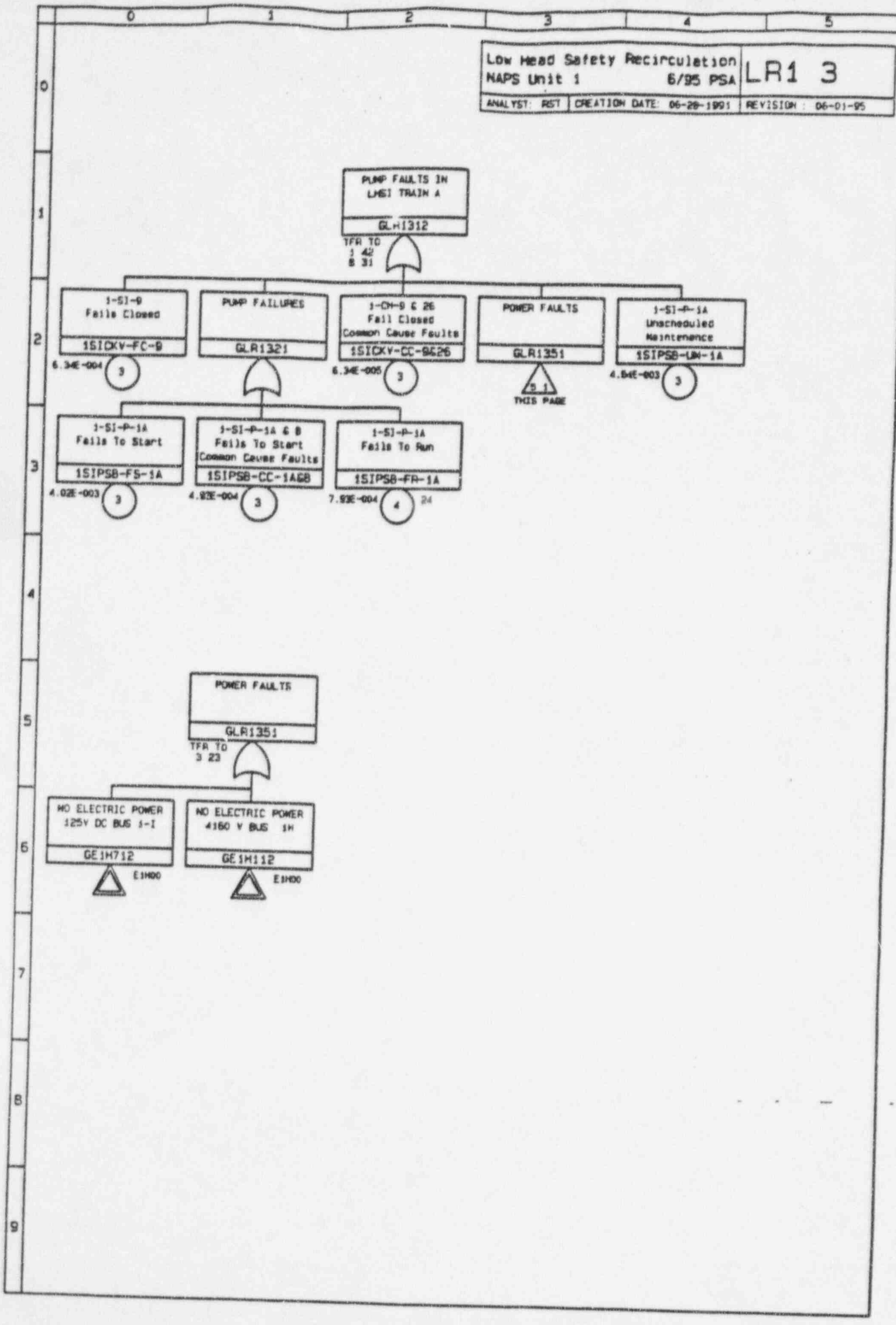
Low Head Safety Recirculation
NAPS Unit 1 6/95 PSA

LR1 2

ANALYST: RST | CREATION DATE: 06-28-1991 | REVISION: 06-01-95

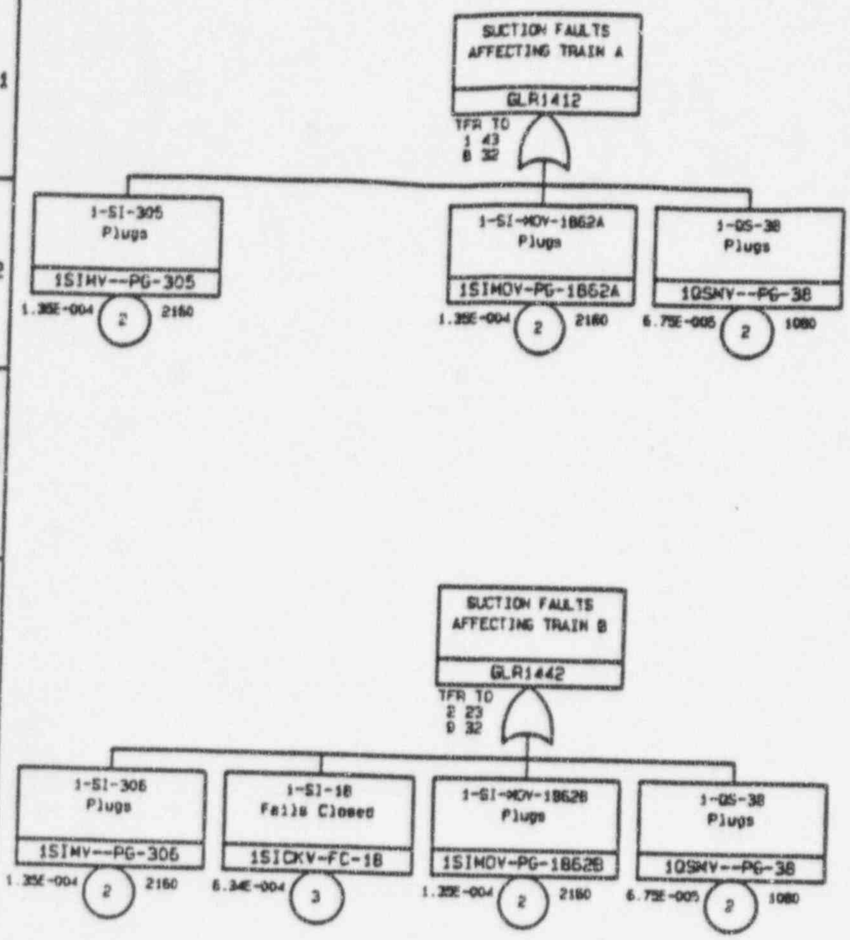


LR100.LGC NUPRA 2.2 VAPWR



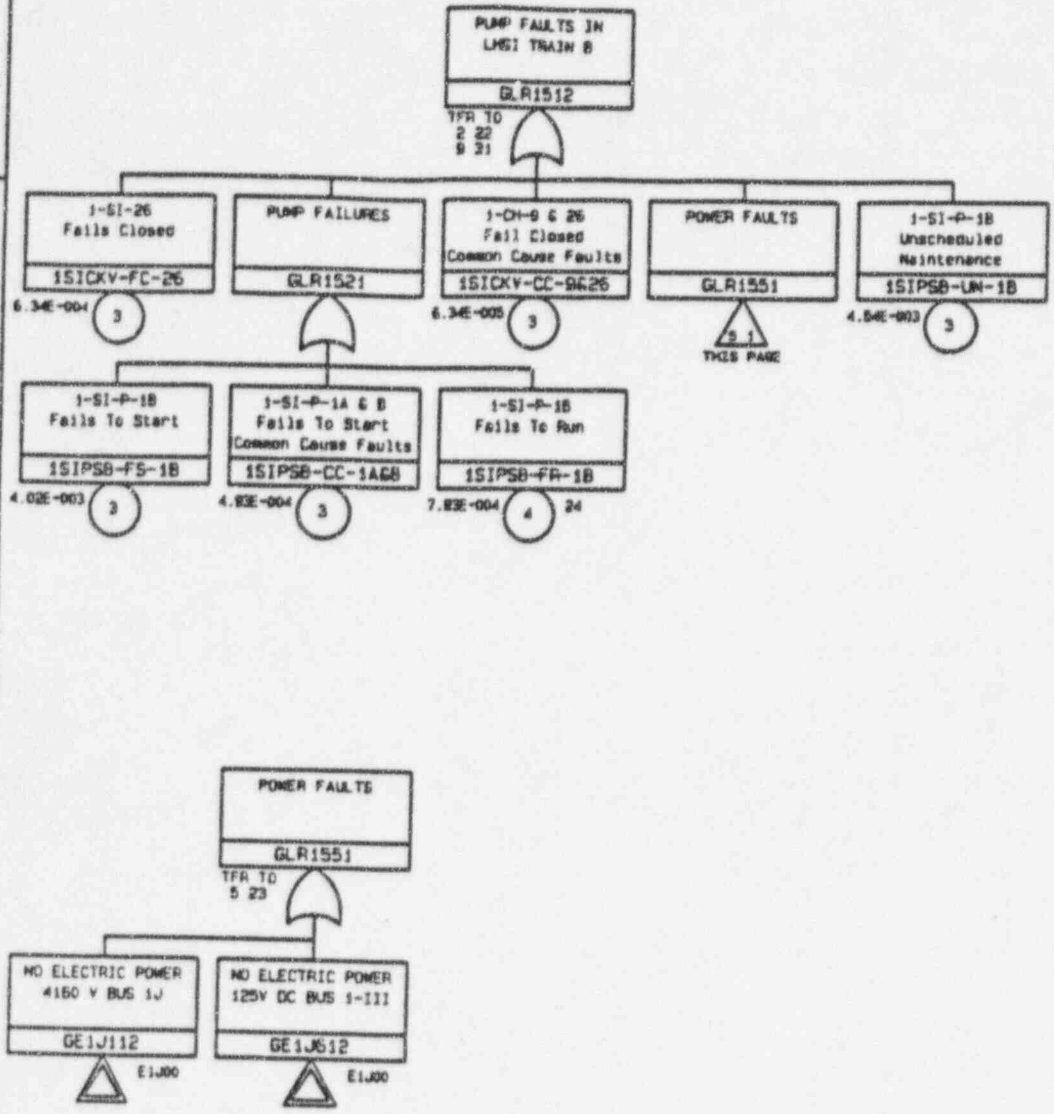
Low Head Safety Recirculation
NAPS Unit 1 6/95 PSA
LR1 3
ANALYST: RST
CREATION DATE: 06-28-1991
REVISION : 06-01-95
PUMP FAULTS IN LHSI TRAIN A
GLH1312
TFR TO 1 42 8 31
1-SI-9 Fails Closed
1SICKV-FC-9
6.34E-004
PUMP FAILURES
GLR1321
1-CH-9 & 26 Fail Closed Common Cause Faults
1SICKV-CC-9&26
6.34E-005
POWER FAULTS
GLR1351
THIS PAGE
1-SI-P-1A Unscheduled Maintenance
1SIPSB-UM-1A
4.84E-003
1-SI-P-1A Fails To Start
1SIPSB-FS-1A
4.02E-003
1-SI-P-1A & B Fails To Start Common Cause Faults
1SIPSB-CC-1A&B
4.92E-004
1-SI-P-1A Fails To Run
1SIPSB-FR-1A
7.93E-004
24
POWER FAULTS
GLR1351
TFR TO 3 23
NO ELECTRIC POWER 125V DC BUS 1-I
GE1H712
E1H00
NO ELECTRIC POWER 4160 V BUS 1H
GE1H112
E1H00
LR100.LGC NUPRA 2.2 VaPWR

Low Head Safety Recirculation NAPS Unit 1 6/95 PSA		LR1 4
ANALYST: RST	CREATION DATE: 06-28-1991	REVISION: 06-01-95

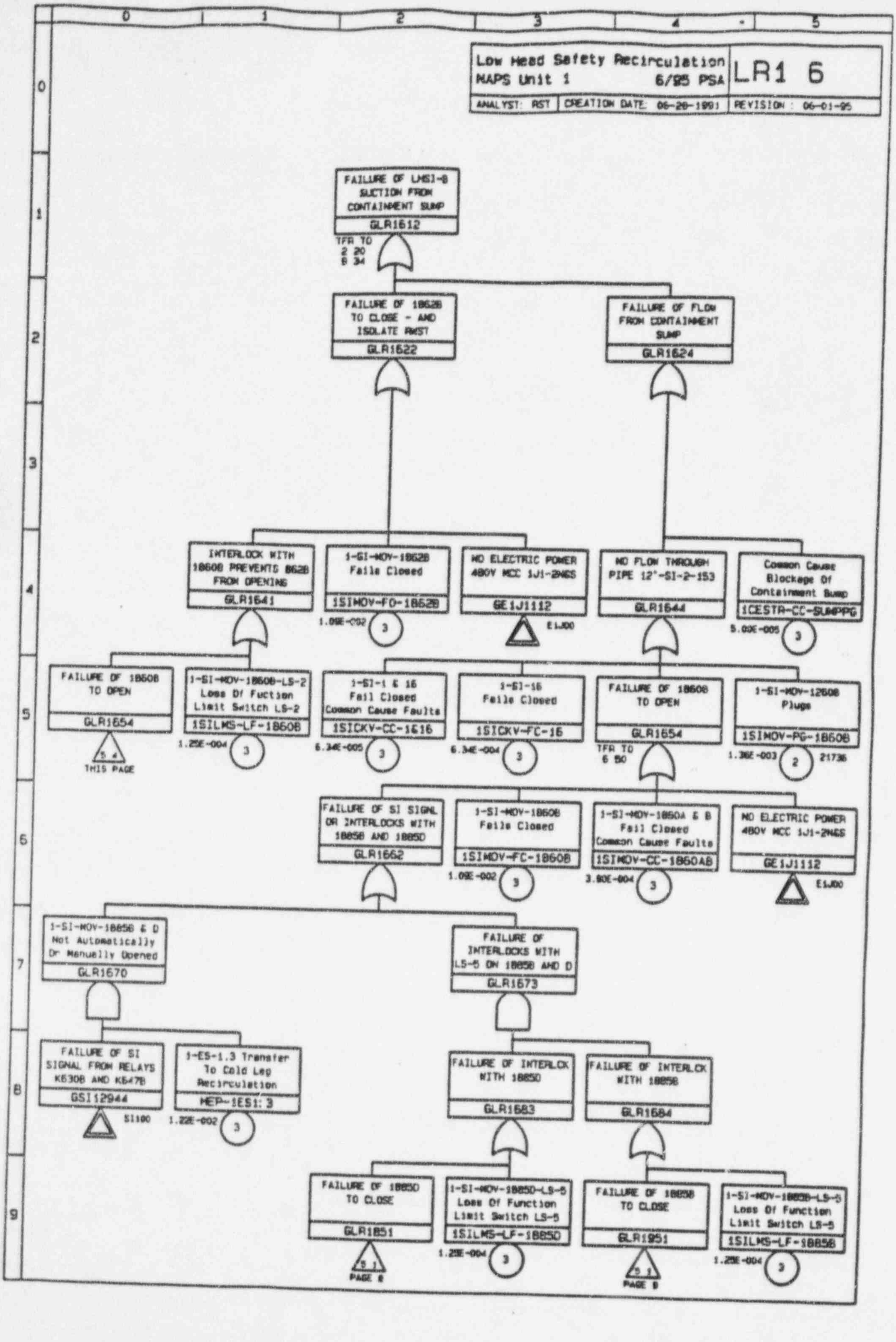


LR100.LGC NUPRA 2.2 VAPWR

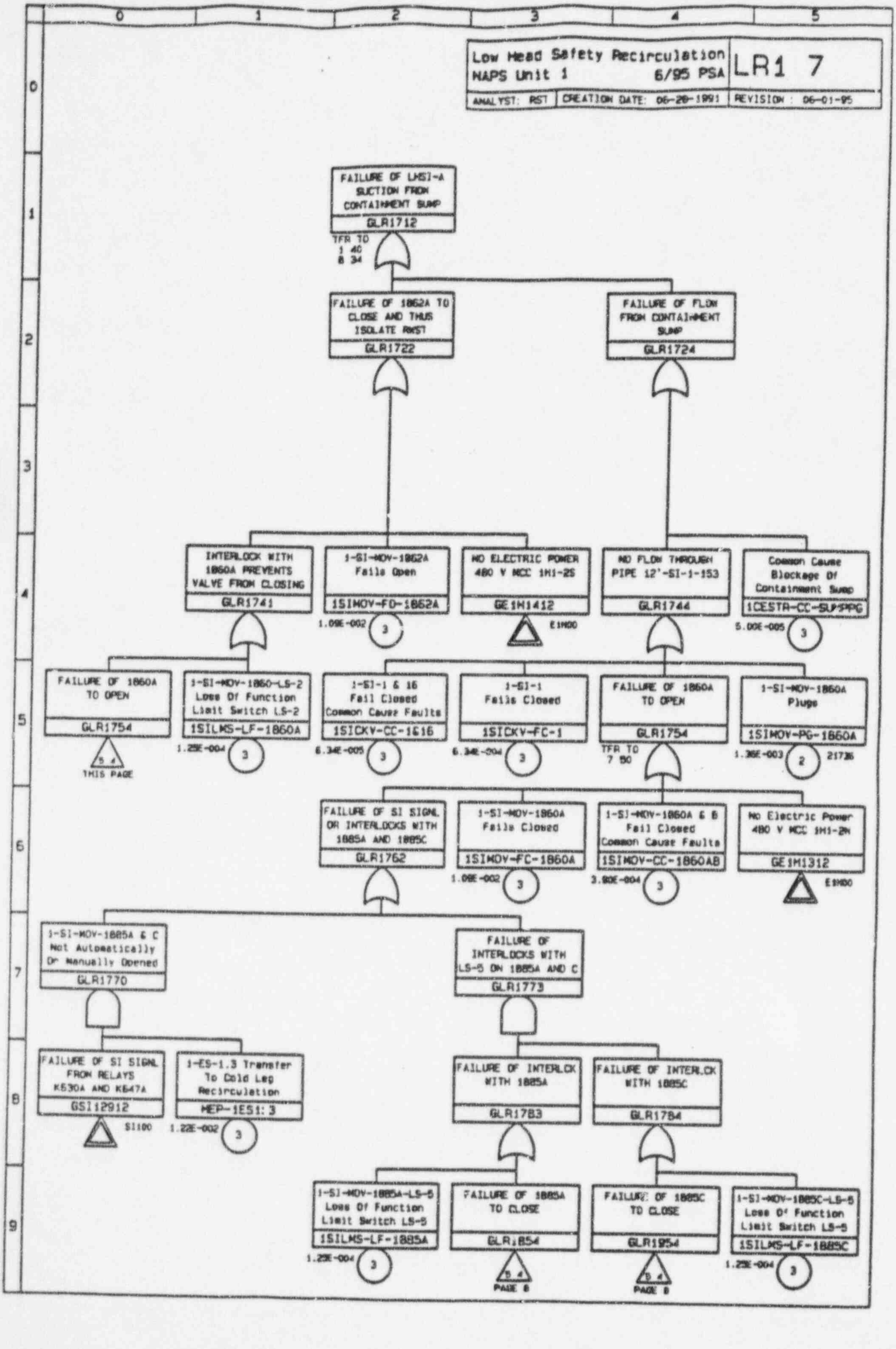
Low Head Safety Recirculation NAPS Unit 1 6/95 PSA	LR1 5
ANALYST: RST / CREATION DATE: 06-28-1991	REVISION: 06-01-95

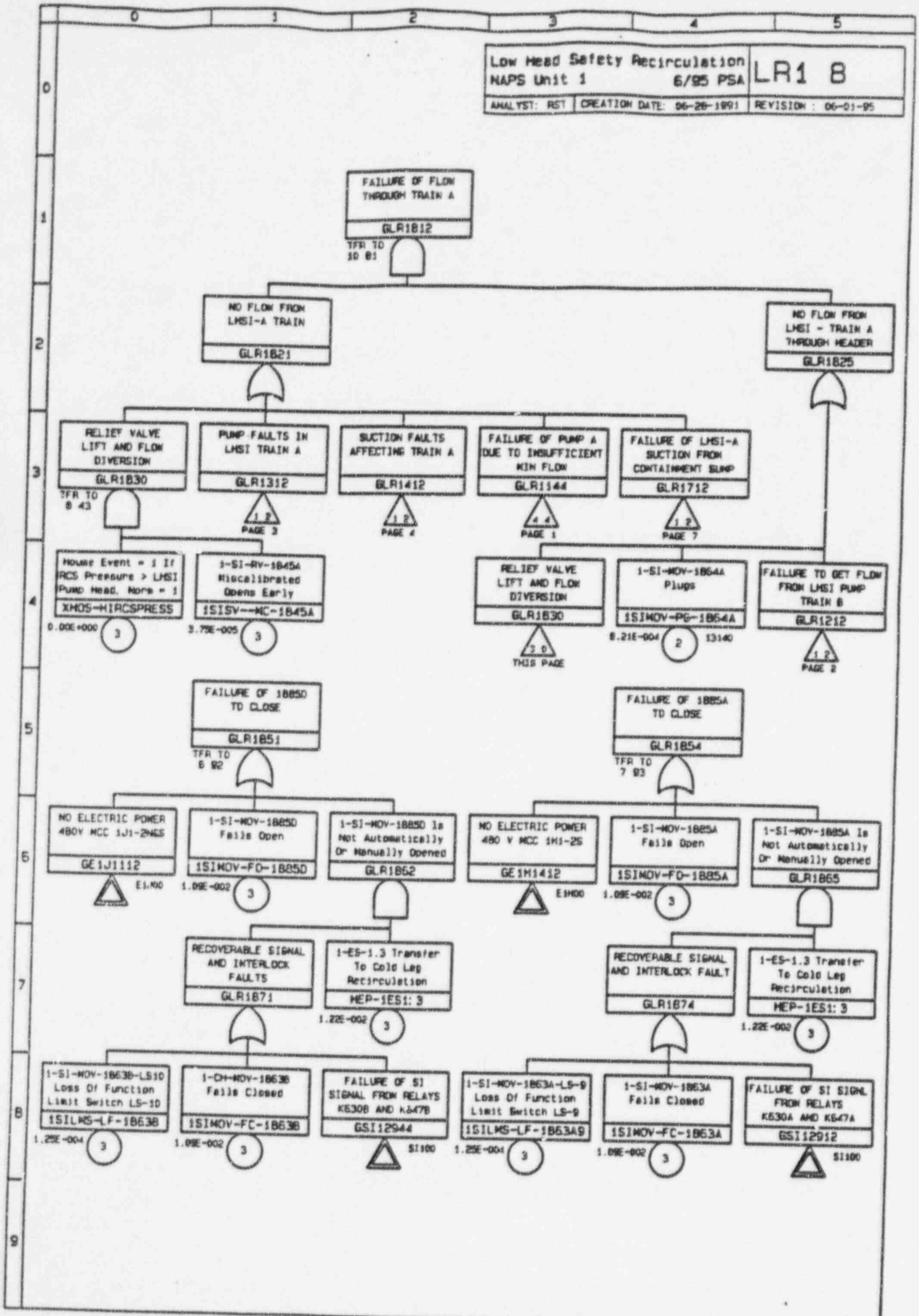


LR100.LGC NUPRA 2.2 VAFWR



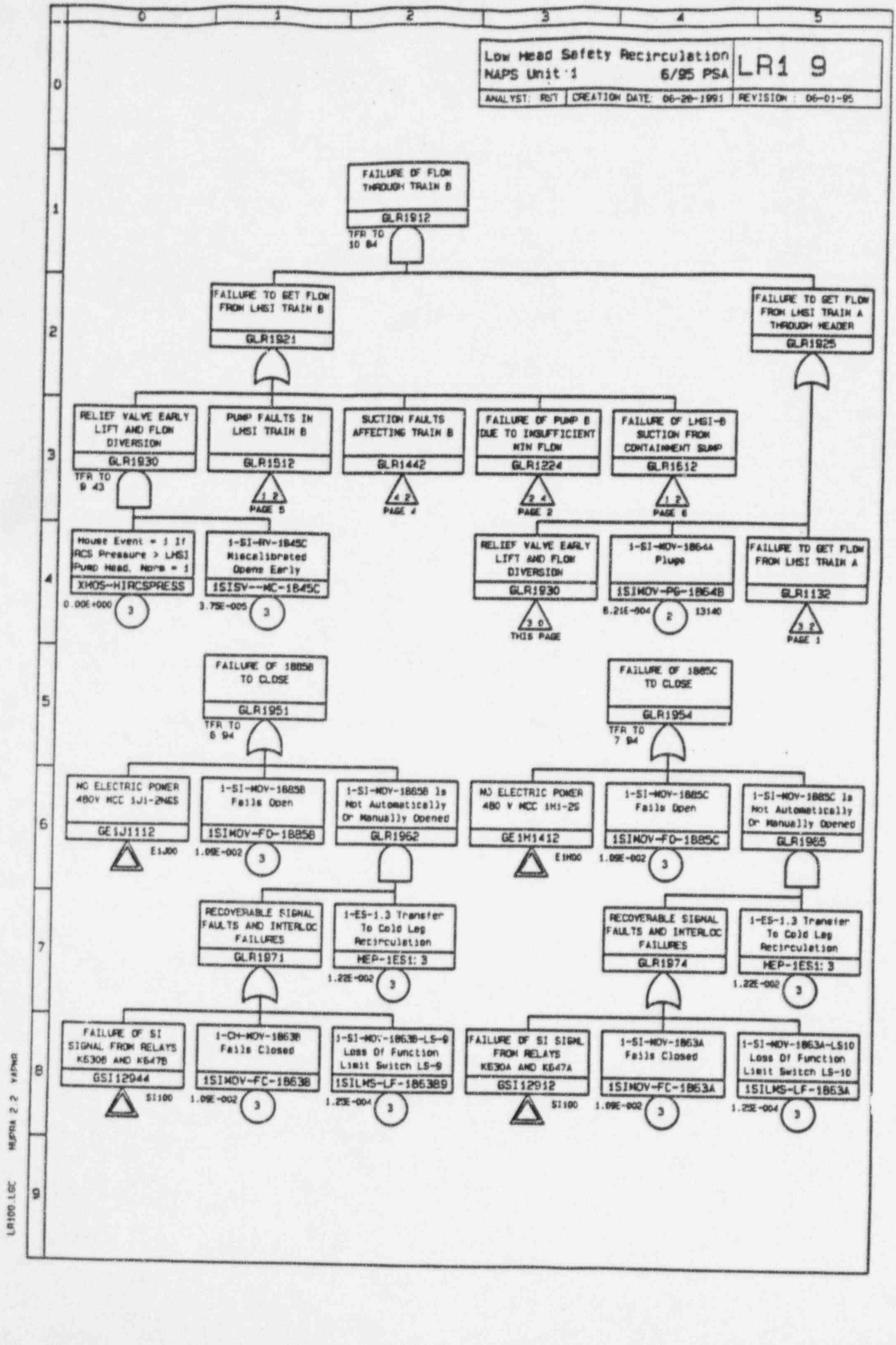
Low Head Safety Recirculation
MAPS Unit 1 6/95 PSA
LR1 6
ANALYST: RST
CREATION DATE: 06-28-1991
REVISION : 06-01-95
FAILURE OF LHSI-B SUCTION FROM CONTAINMENT SUMP
GLR1612
TFR TO 2 20 8 34
FAILURE OF 1862B TO CLOSE - AND ISOLATE RWST
GLR1622
FAILURE OF FLOW FROM CONTAINMENT SUMP
GLR1624
INTERLOCK WITH 1860B PREVENTS 862B FROM OPENING
GLR1641
1-SI-MOV-1862B Fails Closed
1SIMOV-FO-1862B
NO ELECTRIC POWER 480V MCC 1J1-2N6S
GE1J1112
E1J00
NO FLOW THROUGH PIPE 12"-SI-2-153
GLR1644
Common Cause Blockage Of Containment Sump
1CESTR-CC-SUMPPG
5.00E-005
FAILURE OF 1860B TO OPEN
GLR1654
THIS PAGE
1-SI-MOV-1860B-LS-2 Loss Of Fuction Limit Switch LS-2
1SILMS-LF-1860B
1.25E-004
1-SI-1 & 16 Fail Closed Common Cause Faults
1SICKV-CC-1&16
6.34E-005
1-SI-16 Fails Closed
1SICKV-FC-16
6.34E-004
FAILURE OF 1860B TO OPEN
GLR1654
TFR TO 6 50
1-SI-MOV-1260B Plugs
1SIMOV-PG-1860B
1.36E-003
21736
FAILURE OF SI SIGNL OR INTERLOCKS WITH 1885B AND 1885D
GLR1662
1-SI-MOV-1860B Fails Closed
1SIMOV-FC-1860B
1.09E-002
1-SI-MOV-1860A & B Fail Closed Common Cause Faults
1SIMOV-CC-1860AB
3.90E-004
NO ELECTRIC POWER 480V MCC 1J1-2N6S
GE1J1112
E1J00
1-SI-MOV-1885B & D Not Automatically Or Manually Opened
GLR1670
FAILURE OF INTERLOCKS WITH LS-5 ON 1885B AND D
GLR1673
FAILURE OF SI SIGNAL FROM RELAYS K630B AND K647B
GSI12944
SI100
1-ES-1.3 Transfer To Cold Leg Recirculation
HEP-1ES1:3
1.22E-002
FAILURE OF INTERLCK WITH 1885D
GLR1683
FAILURE OF INTERLCK WITH 1885B
GLR1684
FAILURE OF 1885D TO CLOSE
GLR1851
PAGE 8
1-SI-MOV-1885D-LS-5 Loss Of Function Limit Switch LS-5
1SILMS-LF-1885D
1.25E-004
FAILURE OF 1885B TO CLOSE
GLR1951
PAGE 8
1-SI-MOV-1885B-LS-5 Loss Of Function Limit Switch LS-5
1SILMS-LF-1885B
1.25E-004
LR100.LGC NUPRA 2.2 VAPWR

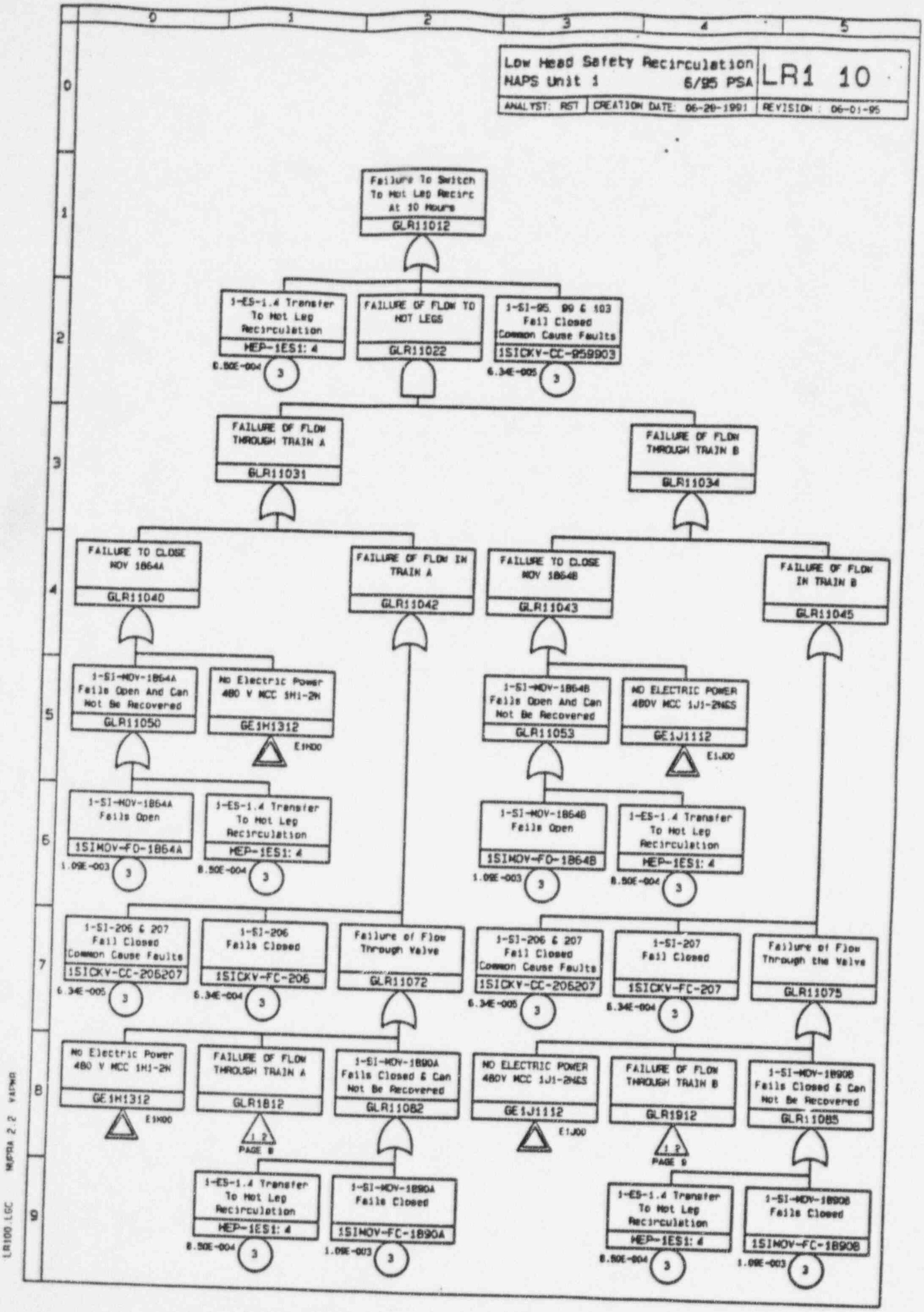

Low Head Safety Recirculation
NAPS Unit 1 6/95 PSA
LR1 7
ANALYST: RST
CREATION DATE: 06-28-1991
REVISION: 06-01-95
FAILURE OF LHSI-A SUCTION FROM CONTAINMENT SUMP
GLR1712
TFR TO 1 40 8 34
FAILURE OF 1862A TO CLOSE AND THUS ISOLATE RWST
GLR1722
FAILURE OF FLOW FROM CONTAINMENT SUMP
GLR1724
INTERLOCK WITH 1860A PREVENTS VALVE FROM CLOSING
GLR1741
1-SI-MOV-1862A Fails Open
1SIMOV-FO-1862A
1.09E-002
NO ELECTRIC POWER 480 V MCC 1H1-2S
GE1H1412
E1H00
NO FLOW THROUGH PIPE 12'-SI-1-153
GLR1744
Common Cause Blockage Of Containment Sump
1CESTR-CC-SUMPPG
5.00E-005
FAILURE OF 1860A TO OPEN
GLR1754
THIS PAGE
1-SI-MOV-1860-LS-2 Loss Of Function Limit Switch LS-2
1SILMS-LF-1860A
1.25E-004
1-SI-1 & 16 Fail Closed Common Cause Faults
1SICKV-CC-1&16
6.34E-005
1-SI-1 Fails Closed
1SICKV-FC-1
6.34E-004
FAILURE OF 1860A TO OPEN
GLR1754
TFR TO 7 50
1-SI-MOV-1860A Plugs
1SIMOV-PG-1860A
1.36E-003
FAILURE OF SI SIGNL OR INTERLOCKS WITH 1885A AND 1885C
GLR1762
1-SI-MOV-1860A Fails Closed
1SIMOV-FC-1860A
1.09E-002
1-SI-MOV-1860A & B Fail Closed Common Cause Faults
1SIMOV-CC-1860AB
3.90E-004
No Electric Power 480 V MCC 1H1-2N
GE1H1312
E1H00
1-SI-MOV-1885A & C Not Automatically Or Manually Opened
GLR1770
FAILURE OF INTERLOCKS WITH LS-5 ON 1885A AND C
GLR1773
FAILURE OF SI SIGNL FROM RELAYS K630A AND K647A
GSI12912
SI100
1-ES-1.3 Transfer To Cold Leg Recirculation
HEP-1ES1:3
1.22E-002
FAILURE OF INTERLCK WITH 1885A
GLR1783
FAILURE OF INTERLCK WITH 1885C
GLR1784
1-SI-MOV-1885A-LS-5 Loss Of Function Limit Switch LS-5
1SILMS-LF-1885A
1.25E-004
FAILURE OF 1885A TO CLOSE
GLR1854
PAGE 8
FAILURE OF 1885C TO CLOSE
GLR1954
PAGE 8
1-SI-MOV-1885C-LS-5 Loss Of Function Limit Switch LS-5
1SILMS-LF-1885C
1.25E-004

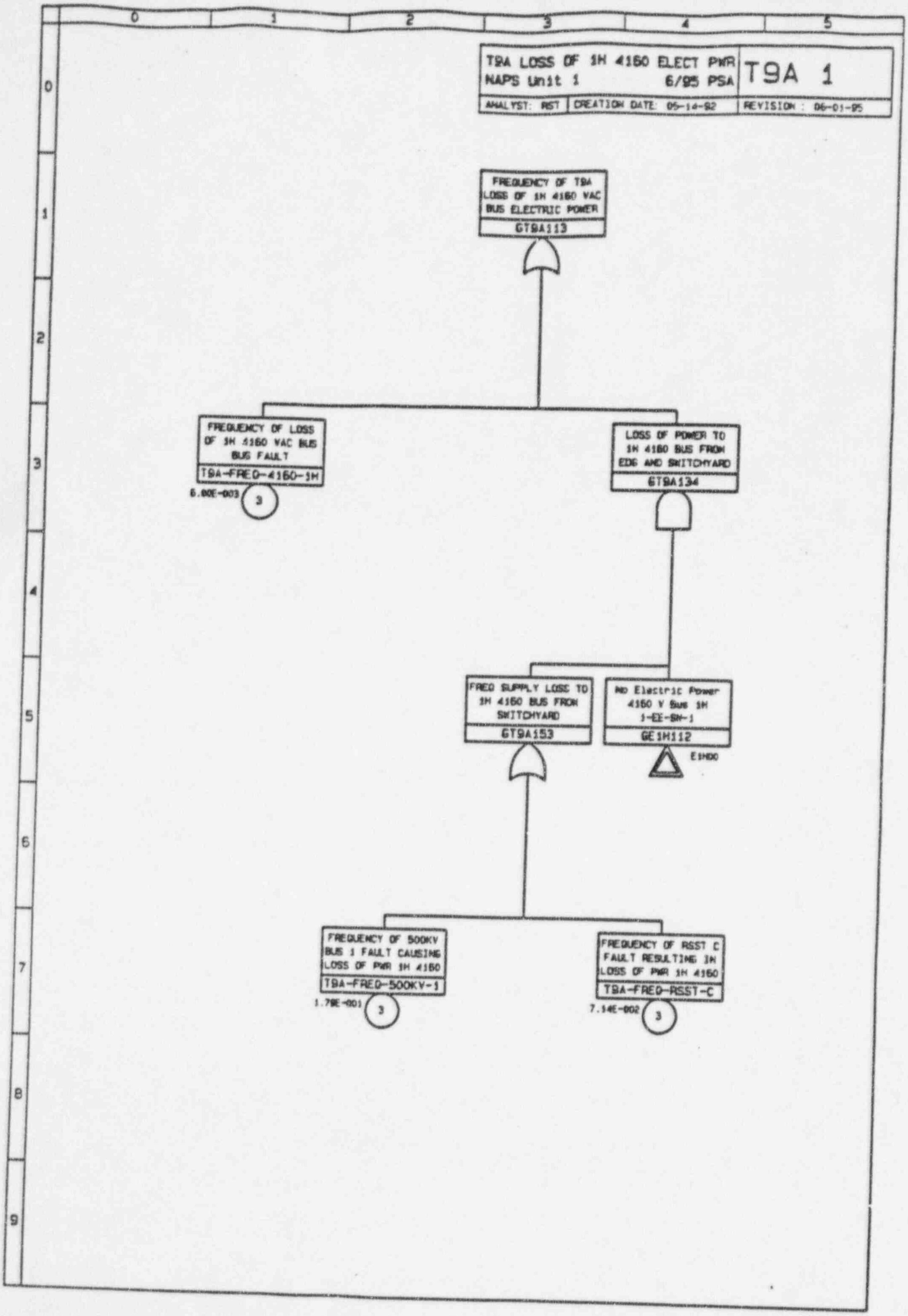


Low Head Safety Recirculation
NAPS Unit 1 6/95 PSA
LR1 8
ANALYST: RST
CREATION DATE: 06-28-1991
REVISION: 06-01-95
FAILURE OF FLOW THROUGH TRAIN A
GLR1812
TFR TO 10 81
NO FLOW FROM LHSI-A TRAIN
GLR1821
NO FLOW FROM LHSI - TRAIN A THROUGH HEADER
GLR1825
RELIEF VALVE LIFT AND FLOW DIVERSION
GLR1830
TFR TO 8 43
PUMP FAULTS IN LHSI TRAIN A
GLR1312
PAGE 3
SUCTION FAULTS AFFECTING TRAIN A
GLR1412
PAGE 4
FAILURE OF PUMP A DUE TO INSUFFICIENT MIN FLOW
GLR1144
PAGE 1
FAILURE OF LHSI-A SUCTION FROM CONTAINMENT SUMP
GLR1712
PAGE 7
House Event = 1 If RCS Pressure > LHSI Pump Head, Nore = 1
XHOS-HIRCSPRESS
0.00E+000
1-SI-RV-1845A Miscalibrated Opens Early
1SISV--MC-1845A
3.75E-005
RELIEF VALVE LIFT AND FLOW DIVERSION
GLR1830
THIS PAGE
1-SI-MOV-1864A Plugs
1SIMOV-PG-1864A
8.21E-004
13140
FAILURE TO GET FLOW FROM LHSI PUMP TRAIN B
GLR1212
PAGE 2
FAILURE OF 1885D TO CLOSE
GLR1851
TFR TO 6 92
FAILURE OF 1885A TO CLOSE
GLR1854
TFR TO 7 93
NO ELECTRIC POWER 480V MCC 1J1-2NES
GE1J1112
E1J00
1-SI-MOV-1885D Fails Open
1SIMOV-FO-1885D
1.09E-002
1-SI-MOV-1885D Is Not Automatically Or Manually Opened
GLR1862
NO ELECTRIC POWER 480 V MCC 1H1-2S
GE1H1412
E1H00
1-SI-MOV-1885A Fails Open
1SIMOV-FO-1885A
1.09E-002
1-SI-MOV-1885A Is Not Automatically Or Manually Opened
GLR1865
RECOVERABLE SIGNAL AND INTERLOCK FAULTS
GLR1871
1-ES-1.3 Transfer To Cold Leg Recirculation
HEP-1ES1: 3
1.22E-002
RECOVERABLE SIGNAL AND INTERLOCK FAULT
GLR1874
1-ES-1.3 Transfer To Cold Leg Recirculation
HEP-1ES1: 3
1.22E-002
1-SI-MOV-1863B-LS10 Loss Of Function Limit Switch LS-10
1SILMS-LF-1863B
1.25E-004
1-CH-MOV-1863B Fails Closed
1SIMOV-FC-1863B
1.09E-002
FAILURE OF SI SIGNAL FROM RELAYS K630B AND K647B
GSI12944
SI100
1-SI-MOV-1863A-LS-9 Loss Of Function Limit Switch LS-9
1SILMS-LF-1863A9
1.25E-004
1-SI-MOV-1863A Fails Closed
1SIMOV-FC-1863A
1.09E-002
FAILURE OF SI SIGNL FROM RELAYS K630A AND K647A
GSI12912
SI100

LR100.LGC

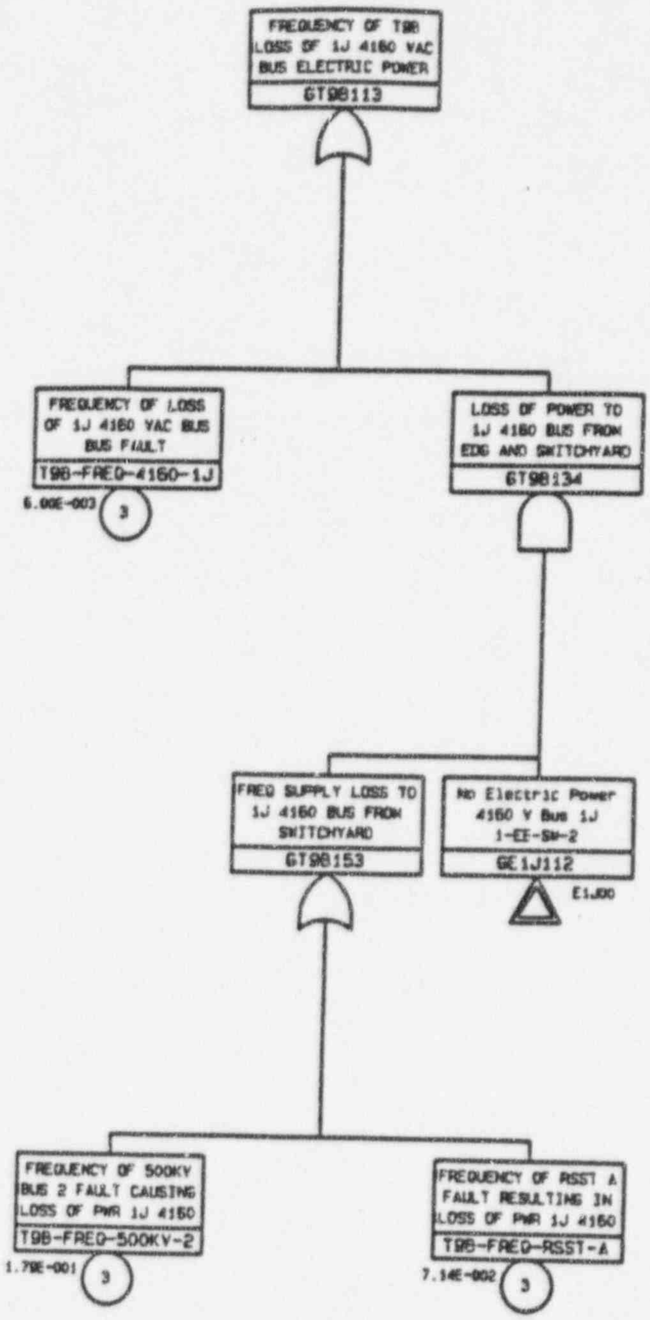

Low Head Safety Recirculation
NAPS Unit 1 6/95 PSA
LR1 9
ANALYST: RST
CREATION DATE: 06-28-1991
REVISION: 06-01-95
FAILURE OF FLOW THROUGH TRAIN B
GLR1912
TFR TO 10 B4
FAILURE TO GET FLOW FROM LHSI TRAIN B
GLR1921
FAILURE TO GET FLOW FROM LHSI TRAIN A THROUGH HEADER
GLR1925
RELIEF VALVE EARLY LIFT AND FLOW DIVERSION
GLR1930
TFR TO 9 43
PUMP FAULTS IN LHSI TRAIN B
GLR1512
PAGE 5
SUCTION FAULTS AFFECTING TRAIN B
GLR1442
PAGE 4
FAILURE OF PUMP B DUE TO INSUFFICIENT MIN FLOW
GLR1224
PAGE 2
FAILURE OF LHSI-B SUCTION FROM CONTAINMENT SUMP
GLR1612
PAGE 6
House Event = 1 If RCS Pressure > LHSI Pump Head, Norm = 1
XHOS-HIRCSPRESS
0.00E+000
1-SI-RV-1845C Miscalibrated Opens Early
1SISV--MC-1845C
3.75E-005
RELIEF VALVE EARLY LIFT AND FLOW DIVERSION
GLR1930
THIS PAGE
1-SI-MOV-1864A Plugs
1SIMOV-PG-1864B
8.21E-004
13140
FAILURE TO GET FLOW FROM LHSI TRAIN A
GLR1132
PAGE 1
FAILURE OF 1885B TO CLOSE
GLR1951
TFR TO 8 94
FAILURE OF 1885C TO CLOSE
GLR1954
TFR TO 7 94
NO ELECTRIC POWER 480V MCC 1J1-2NES
GE1J1112
E1J00
1-SI-MOV-1885B Fails Open
1SIMOV-FO-1885B
1.09E-002
1-SI-MOV-1885B Is Not Automatically Or Manually Opened
GLR1962
NO ELECTRIC POWER 480 V MCC 1H1-2S
GE1H1412
E1H00
1-SI-MOV-1885C Fails Open
1SIMOV-FO-1885C
1.09E-002
1-SI-MOV-1885C Is Not Automatically Or Manually Opened
GLR1965
RECOVERABLE SIGNAL FAULTS AND INTERLOC FAILURES
GLR1971
1-ES-1.3 Transfer To Cold Leg Recirculation
HEP-1ES1: 3
1.22E-002
RECOVERABLE SIGNAL FAULTS AND INTERLOC FAILURES
GLR1974
1-ES-1.3 Transfer To Cold Leg Recirculation
HEP-1ES1: 3
1.22E-002
FAILURE OF SI SIGNAL FROM RELAYS K630B AND K647B
GSI12944
SI100
1-CH-MOV-1863B Fails Closed
1SIMOV-FC-1863B
1.09E-002
1-SI-MOV-1863B-LS-9 Loss Of Function Limit Switch LS-9
1SILMS-LF-186389
1.25E-004
FAILURE OF SI SIGNAL FROM RELAYS K630A AND K647A
GSI12912
SI100
1-SI-MOV-1863A Fails Closed
1SIMOV-FC-1863A
1.09E-002
1-SI-MOV-1863A-LS10 Loss Of Function Limit Switch LS-10
1SILMS-LF-1863A
1.25E-004
LR100.LGC
NUPRA 2.2


Low Head Safety Recirculation
NAPS Unit 1 6/95 PSA
LR1 10
ANALYST: RST
CREATION DATE: 06-28-1991
REVISION : 06-01-95
Failure To Switch To Hot Leg Recirc At 10 Hours
GLR11012
1-ES-1.4 Transfer To Hot Leg Recirculation
HEP-1ES1: 4
8.50E-004
FAILURE OF FLOW TO HOT LEGS
GLR11022
1-SI-95, 99 & 103 Fail Closed Common Cause Faults
1SICKV-CC-959903
6.34E-005
FAILURE OF FLOW THROUGH TRAIN A
GLR11031
FAILURE OF FLOW THROUGH TRAIN B
GLR11034
FAILURE TO CLOSE MOV 1864A
GLR11040
FAILURE OF FLOW IN TRAIN A
GLR11042
FAILURE TO CLOSE MOV 1864B
GLR11043
FAILURE OF FLOW IN TRAIN B
GLR11045
1-SI-MOV-1864A Fails Open And Can Not Be Recovered
GLR11050
No Electric Power 480 V MCC 1H1-2N
GE1H1312
E1H00
1-SI-MOV-1864B Fails Open And Can Not Be Recovered
GLR11053
NO ELECTRIC POWER 480V MCC 1J1-2NES
GE1J1112
E1J00
1-SI-MOV-1864A Fails Open
1SIMOV-FO-1864A
1.09E-003
1-ES-1.4 Transfer To Hot Leg Recirculation
HEP-1ES1: 4
8.50E-004
1-SI-MOV-1864B Fails Open
1SIMOV-FO-1864B
1.09E-003
1-ES-1.4 Transfer To Hot Leg Recirculation
HEP-1ES1: 4
8.50E-004
1-SI-206 & 207 Fail Closed Common Cause Faults
1SICKV-CC-206207
6.34E-005
1-SI-206 Fails Closed
1SICKV-FC-206
6.34E-004
Failure of Flow Through Valve
GLR11072
1-SI-206 & 207 Fail Closed Common Cause Faults
1SICKV-CC-206207
6.34E-005
1-SI-207 Fail Closed
1SICKV-FC-207
6.34E-004
Failure of Flow Through the Valve
GLR11075
No Electric Power 480 V MCC 1H1-2N
GE1H1312
E1H00
FAILURE OF FLOW THROUGH TRAIN A
GLR1812
PAGE 8
1-SI-MOV-1890A Fails Closed & Can Not Be Recovered
GLR11082
NO ELECTRIC POWER 480V MCC 1J1-2NES
GE1J1112
E1J00
FAILURE OF FLOW THROUGH TRAIN B
GLR1912
PAGE 9
1-SI-MOV-1890B Fails Closed & Can Not Be Recovered
GLR11085
1-ES-1.4 Transfer To Hot Leg Recirculation
HEP-1ES1: 4
8.50E-004
1-SI-MOV-1890A Fails Closed
1SIMOV-FC-1890A
1.09E-003
1-ES-1.4 Transfer To Hot Leg Recirculation
HEP-1ES1: 4
8.50E-004
1-SI-MOV-1890B Fails Closed
1SIMOV-FC-1890B
1.09E-003
LR100.LGC NUPRA 2.2 VAPWR



IET9A.LGC NUPRA 2.2 VAPWO

T9B LOSS OF 1J 4160 ELECT PWR NAPS Unit 1 6/95 PSA	T9B 1
ANALYST: RST | CREATION DATE: 06-22-92	REVISION : 06-01-95

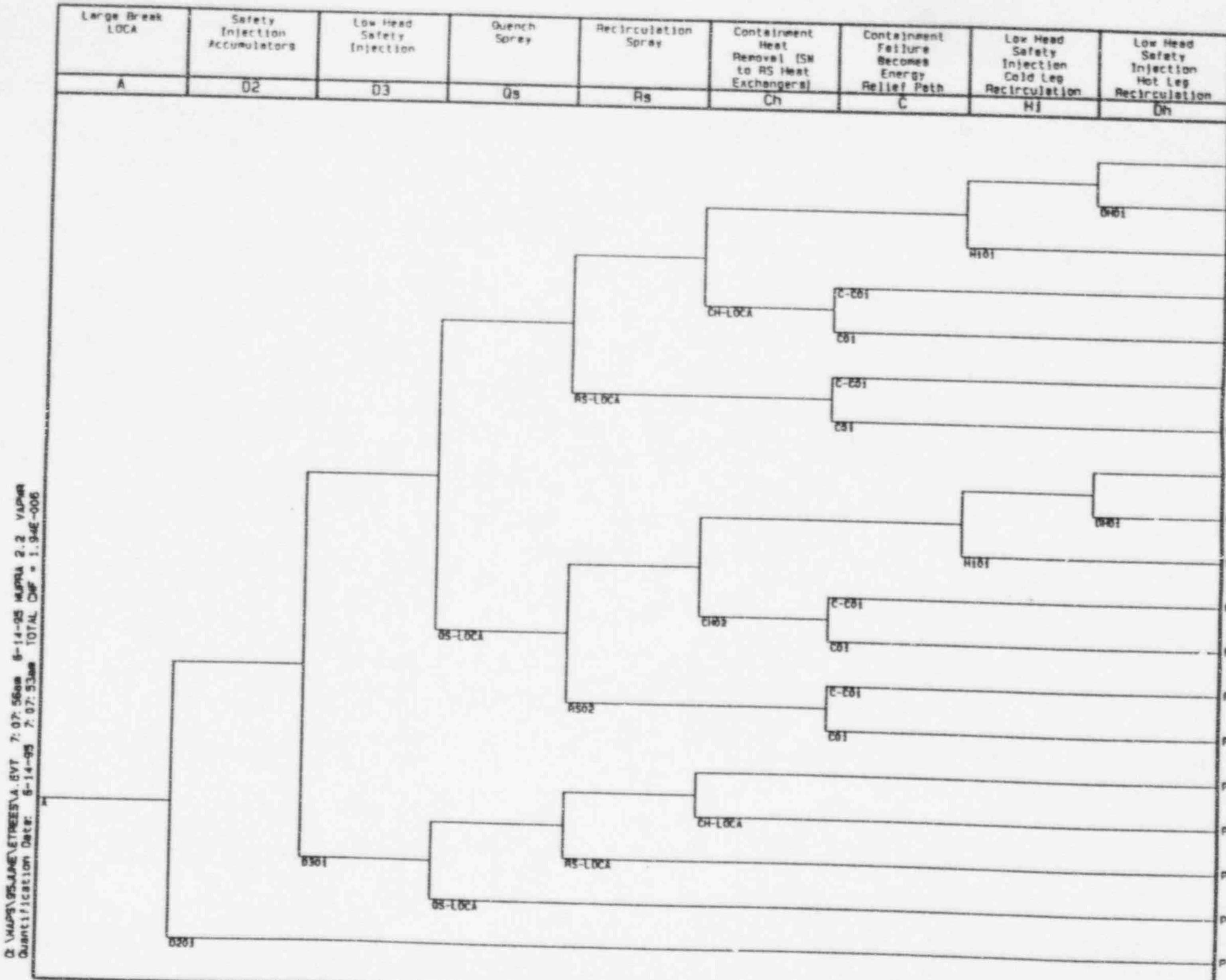


IET9B 1.0 NUSTRA 2.2 VAPWR

APPENDIX B
Event Trees

A:	Large Break Loss of Coolant Accident (LOCA)
AD2:	Large Break Loss of Coolant Accident (LOCA) & Accumulators Fail To Inject
Rx:	Reactor Vessel Rupture
S1:	Medium Break Loss Of Coolant Accident
S1D1:	Medium Break Loss Of Coolant Accident (LOCA) Without High Head Safety Injection
S2:	Small Break Loss Of Coolant Accident (LOCA)
S2D1:	Small Break Loss Of Coolant Accident (LOCA) Without High Head Safety Injection
T1:	Loss Of Off-site Power
T1EE:	Unit 1 Station Blackout Loss Of Off-site Power & Failure of Unit 1 Emergency Diesel Generators And Alternate AC Diesel
T1EEQ:	Station Blackout (Loss Of Off-site Power & Failure of Diesels to Supply Power) And Pressurizer PORV Fails Open
T1Hv:	Loss Of Off-site Power & Loss Of Emergency Switchgear Room Cooling
T1Q:	Loss Of Off-site Power & Pressurizer PORV Fails Open
T1QAFW:	Loss Of Off-site Power & Pressurizer PORV Fails Open & Auxiliary Feedwater Fails
T2:	Loss Of Main Feedwater
T2A:	Recoverable Loss Of Main Feedwater
T2AHv:	Recoverable Loss Of Main Feedwater & Loss Of Emergency Switchgear Room Cooling
T2Hv:	Loss Of Main Feedwater & Loss Of Emergency Switchgear Room Cooling
T3:	Transients With Main Feedwater
T3Hv:	Transients With Main Feedwater & Without Emergency Switchgear Room Cooling
T4:	Loss Of Reactor Coolant Pump Seal Cooling
T5A:	Loss Of Emergency Power DC Bus 1-I
T5AQ:	Loss Of Emergency Power DC Bus 1-I & Pressurizer PORV Fails Open
T5B:	Loss Of Emergency Power DC Bus 1-III

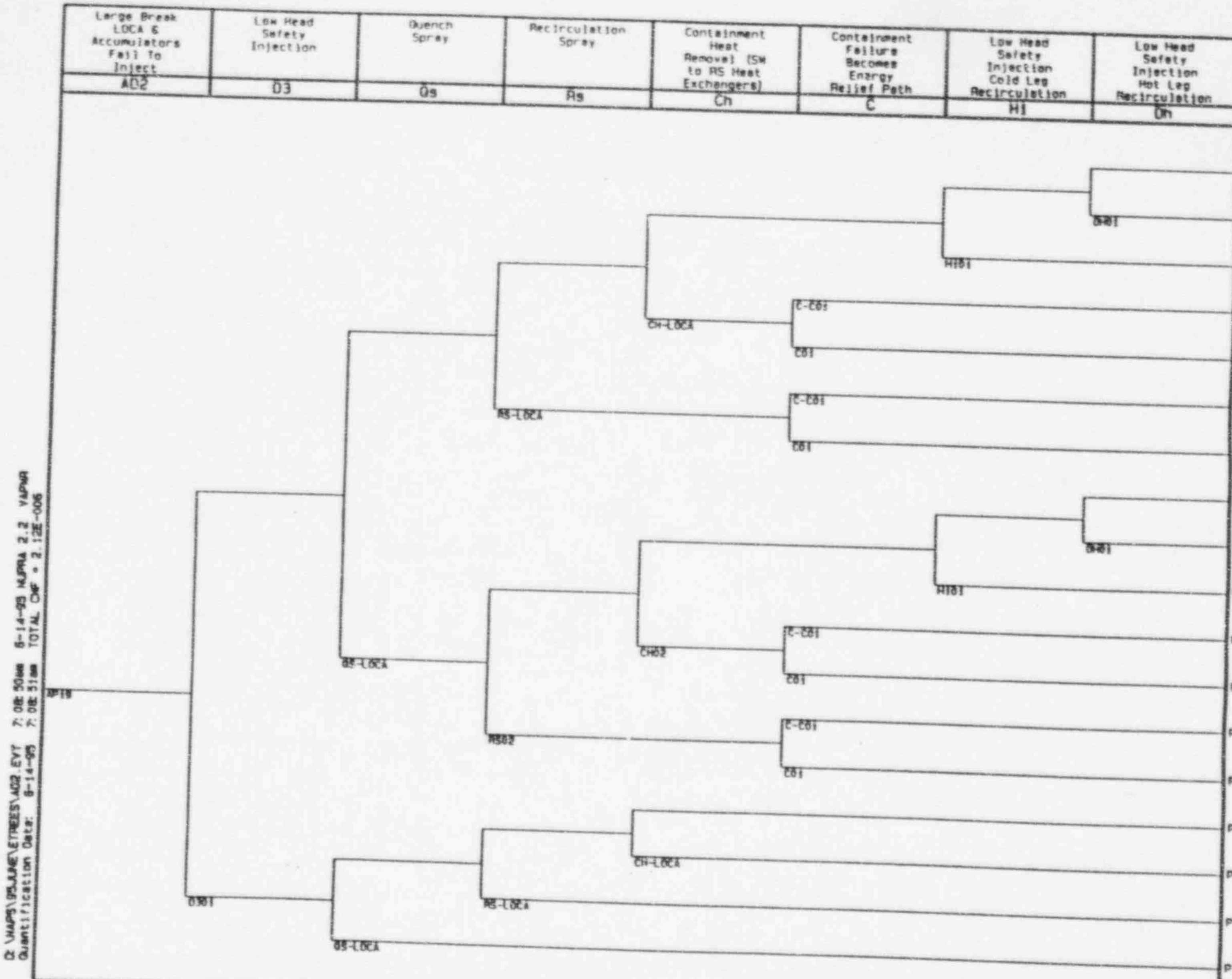
T5BQ:	Loss Of Emergency Power DC Bus 1-III & Pressurizer PORV Fails Open
T6:	Loss Of Service Water
T7:	Steam Generator Tube Rupture
T7D1:	Steam Generator Tube Rupture Without High Head Safety Injection
T8:	Loss Of Emergency Switchgear Room Cooling
T9A:	Loss Of Emergency Power 4160 V Bus 1H
T9AHv:	Loss Of Emergency Power 4160 V Bus 1H & Loss Of Emergency Switchgear Room Cooling
T9AQ:	Loss Of Emergency Power 4160 V Bus 1H & Pressurizer PORV Fails Open
T9B:	Loss Of Emergency Power 4160 V Bus 1H
T9BHv:	Loss Of Emergency Power 4160 V Bus 1H & Loss Of Emergency Switchgear Room Cooling
T9BQ:	Loss Of Emergency Power 4160 V Bus 1H & Pressurizer PORV Fails Open
TH:	Anticipated Transient Without a Scram (ATWS) When Greater Than 40% Reactor Power
THMFW:	Anticipated Transient Without a Scram (ATWS) When Greater Than 40% Reactor Power & No Main Feedwater
TL:	Anticipated Transient Without a Scram (ATWS) When Greater Than 40% Reactor Power
Vx:	Interfacing System LOCA



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY
P01	A	OK	
P02	ADh	12	4.93E-07
P03	AHi	13	8.25E-07
P04	ACh	OK	
P05	AChC	1	1.58E-08
P06	ARs	OK	
P07	ARsC	2	4.29E-09
P08	AQs	OK	
P09	AQsDh	12	1.09E-09
P10	AQsHi	13	1.55E-10
P11	AQsCh	OK	
P12	AQsChC	1	0.00E+00
P13	AQsRs	OK	
P14	AQsRsC	2	0.00E+00
P15	AD3	13	5.96E-07
P16	AD3Ch	13	0.00E+00
P17	AD3Rs	13	0.00E+00
P18	AD3Qs	13	4.89E-10
P19	AD2	TR	2.12E-06 AD2

North Anna Probabilistic Safety Assessment
June 1995

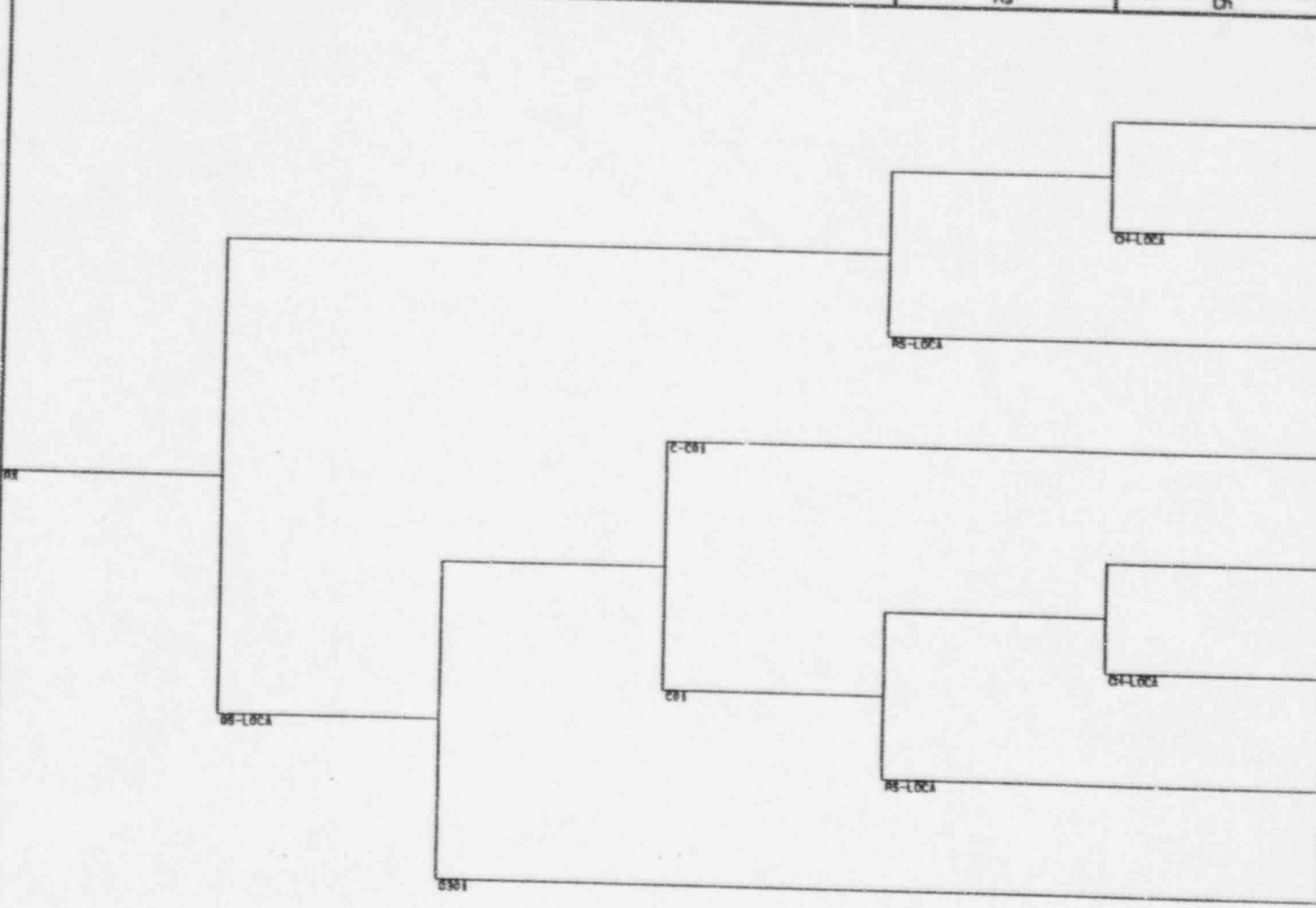
A: Large Break Loss of Coolant Accident (LOCA)



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY
P01	AD2	12	2.12E-08
P02	AD2Dh	12	1.78E-09
P03	AD2H1	13	8.15E-10
P04	AD2Ch	OK	
P05	AD2ChC	1	0.00E+00
P06	AD2Rs	OK	
P07	AD2RsC	2	0.00E+00
P08	AD2Qs	OK	
P09	AD2QsDh	12	0.00E+00
P10	AD2QsH1	13	0.00E+00
P11	AD2QsCh	OK	
P12	AD2QsChC	1	0.00E+00
P13	AD2QsRs	OK	
P14	AD2QsRsC	2	0.00E+00
P15	AD2D3	13	1.85E-09
P16	AD2D3Ch	13	0.00E+00
P17	AD2D3Rs	13	0.00E+00
P18	AD2D3Qs	13	0.00E+00

A D2: Large Break Loss Of Coolant Accident (LOCA) & Accumulators Fail To Inject

Reactor Vessel Rupture	Quench Spray	Low Head Safety Injection	Containment Failure Becomes Energy Relief Path	Recirculation Spray	Containment Heat Removal (SW to RS Heat Exchangers)
RX	Qs	O3	C	Rs	Ch

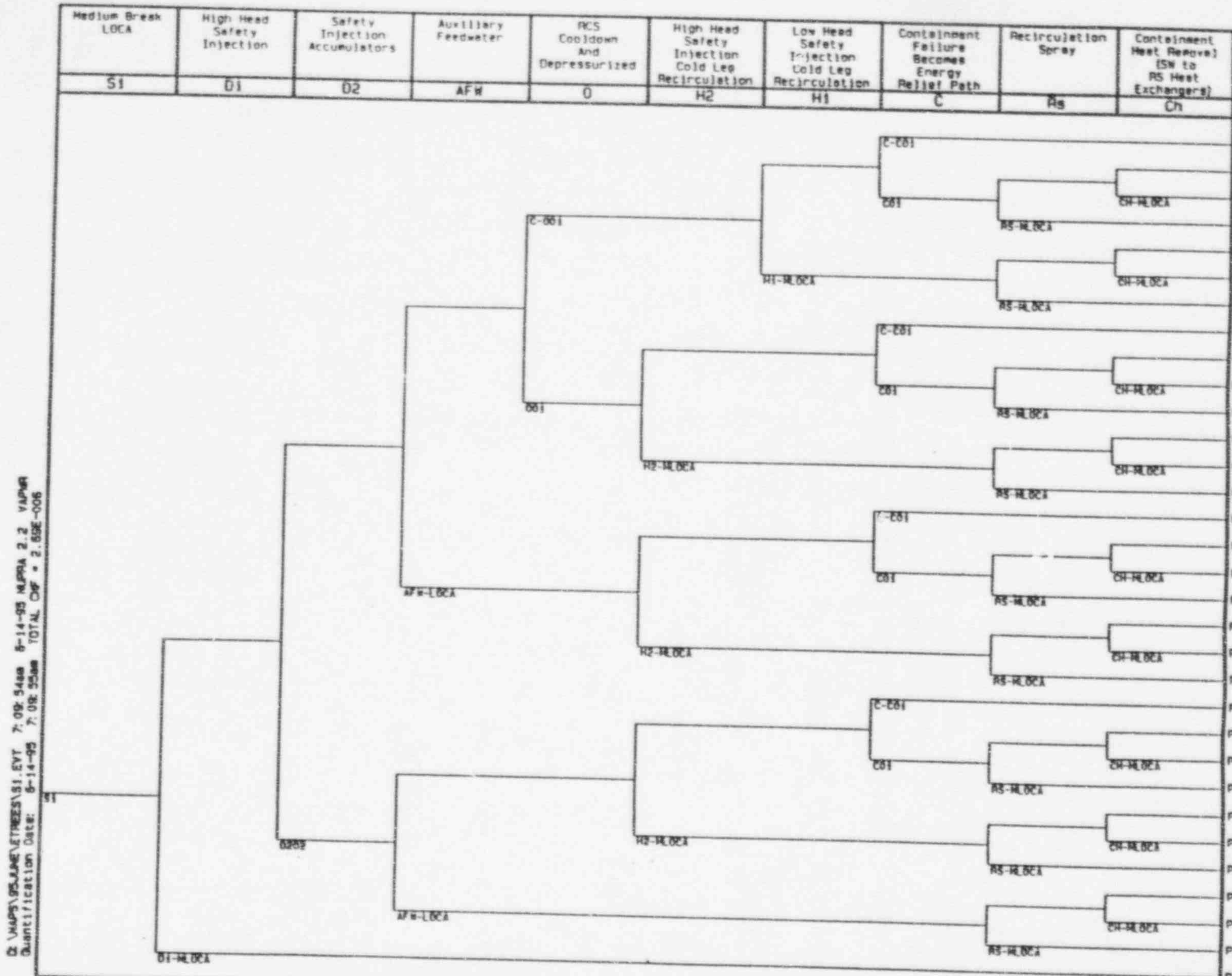


SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY
P01	RX	12	2.66E-07
P02	RXCh	12	4.16E-10
P03	RXRs	13	0.00E+00
P04	RXQs	12	4.12E-10
P05	RXQsC	12	0.00E+00
P06	RXQsCCh	1	0.00E+00
P07	RXQsCRs	2	0.00E+00
P08	RXQsO3	13	0.00E+00

C:\NAPS\95JUNE\ETREES\RX.EVT 7:09:36am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:09:37am TOTAL CMF = 2.67E-007

North Anne Probabilistic Safety Assessment
June 1995

RX: Reactor Vessel Rupture



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY
P01	S1	OK	
P02	S1C	OK	
P03	S1CCh	1	0.00E+00
P04	S1CRs	2	0.00E+00
P05	S1H1	21	0.00E+00
P06	S1H1Ch	22	0.00E+00
P07	S1H1Rs	23	0.00E+00
P08	S1O	OK	
P09	S1OC	OK	
P10	S1OCCh	1	3.17E-08
P11	S1OCRs	2	7.50E-09
P12	S1OH2	21	2.60E-09
P13	S1OH2Ch	22	1.38E-09
P14	S1OH2Rs	23	5.03E-08
P15	S1AFW	OK	
P16	S1AFWC	OK	
P17	S1AFWCCh	1	0.00E+00
P18	S1AFWCRs	2	0.00E+00
P19	S1AFWH2	21	0.00E+00
P20	S1AFWH2Ch	22	0.00E+00
P21	S1AFWH2Rs	23	0.00E+00
P22	S1D2	OK	
P23	S1D2C	OK	
P24	S1D2CCh	1	0.00E+00
P25	S1D2CRs	2	0.00E+00
P26	S1D2H2	21	0.00E+00
P27	S1D2H2Ch	22	0.00E+00
P28	S1D2H2Rs	23	0.00E+00
P29	S1D2AFW	21	0.00E+00
P30	S1D2AFWCh	22	0.00E+00
P31	S1D2AFWRs	23	0.00E+00
P32	S1D1	1R	4.01E-06 S1D1

North Anna Probabilistic Safety Assessment
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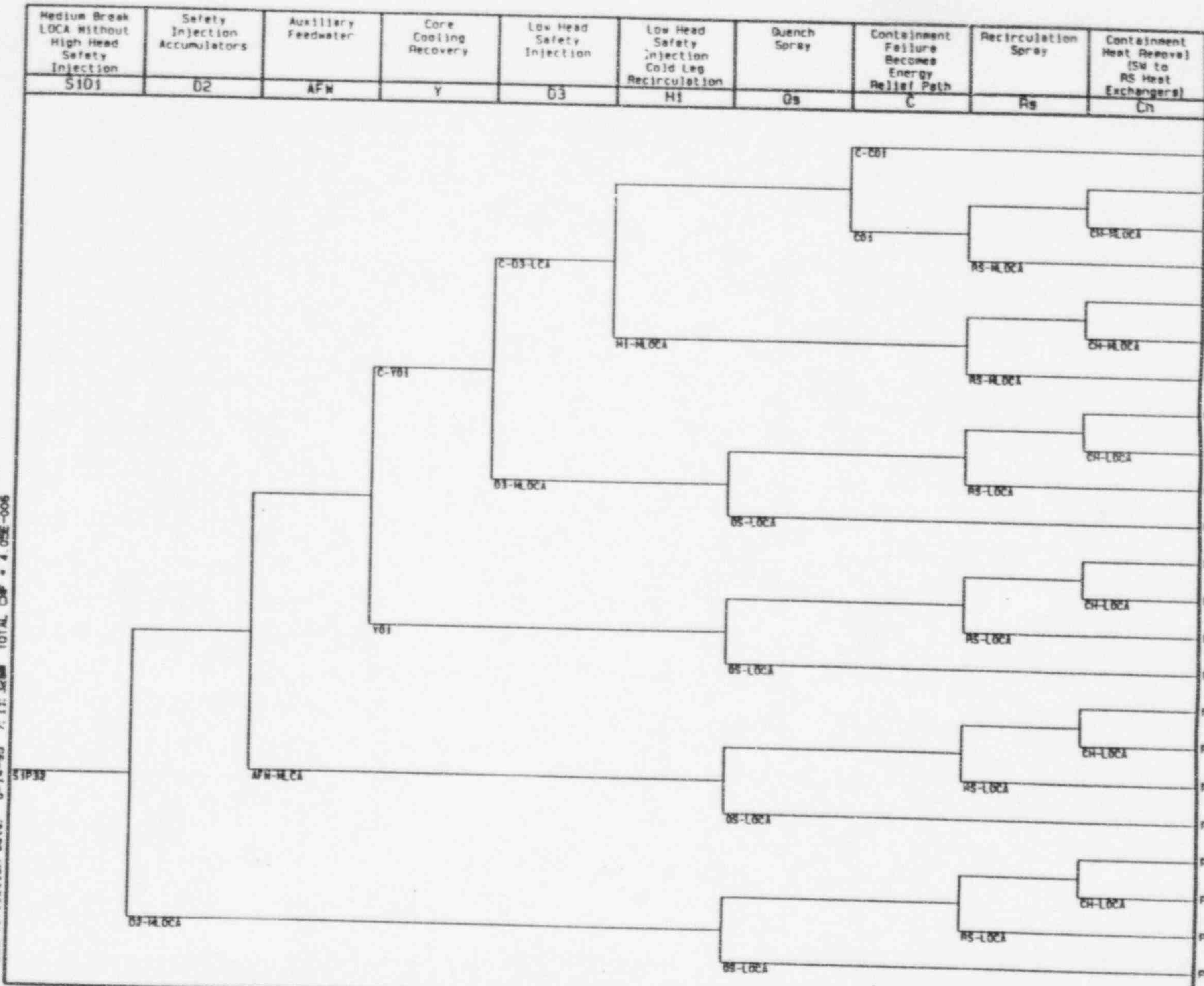
S1: Medium Break Loss Of Coolant Accident

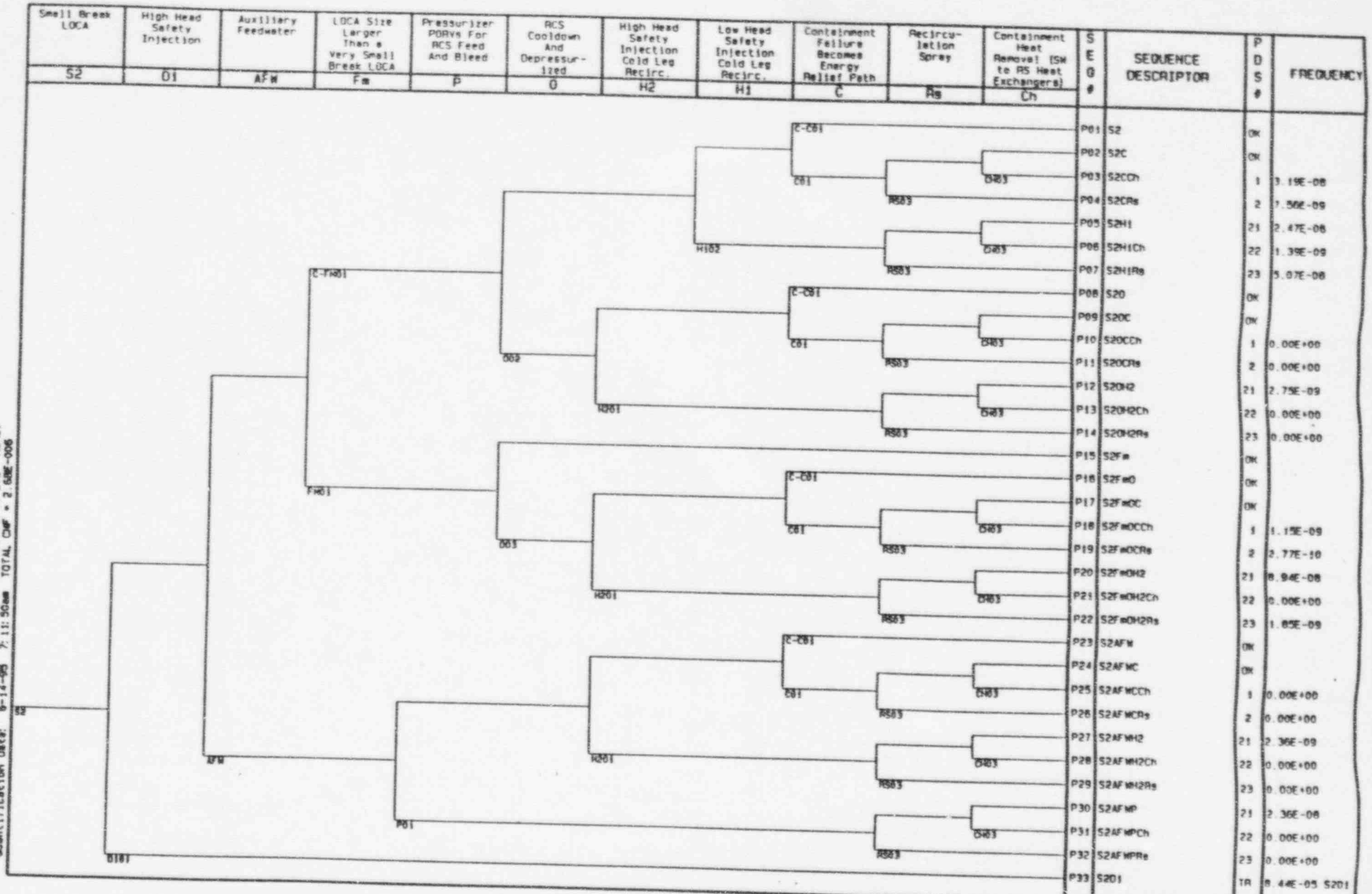
C:\NAPS\95JUNE\ETREES\S1D1.EVT 7:11:32am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:11:32am TOTAL CMF = 4.05E-006



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY
P01	S1D1	OK	
P02	S1D1C	OK	
P03	S1D1CCh	1	0.00E+00
P04	S1D1CRs	2	0.00E+00
P05	S1D1H1	21	0.00E+00
P06	S1D1H1Ch	22	0.00E+00
P07	S1D1H1Rs	23	0.00E+00
P08	S1D1D3	21	0.00E+00
P09	S1D1D3Ch	22	0.00E+00
P10	S1D1D3Rs	23	0.00E+00
P11	S1D1D3Qs	23	0.00E+00
P12	S1D1Y	21	4.01E-08
P13	S1D1YCh	22	5.38E-09
P14	S1D1YRs	23	1.29E-09
P15	S1D1YQs	23	9.84E-09
P16	S1D1AFW	21	5.61E-09
P17	S1D1AFWCh	22	0.00E+00
P18	S1D1AFWRs	23	0.00E+00
P19	S1D1AFWQs	23	2.75E-10
P20	S1D1D2	21	2.16E-08
P21	S1D1D2Ch	22	0.00E+00
P22	S1D1D2Rs	23	0.00E+00
P23	S1D1D2Qs	23	0.00E+00

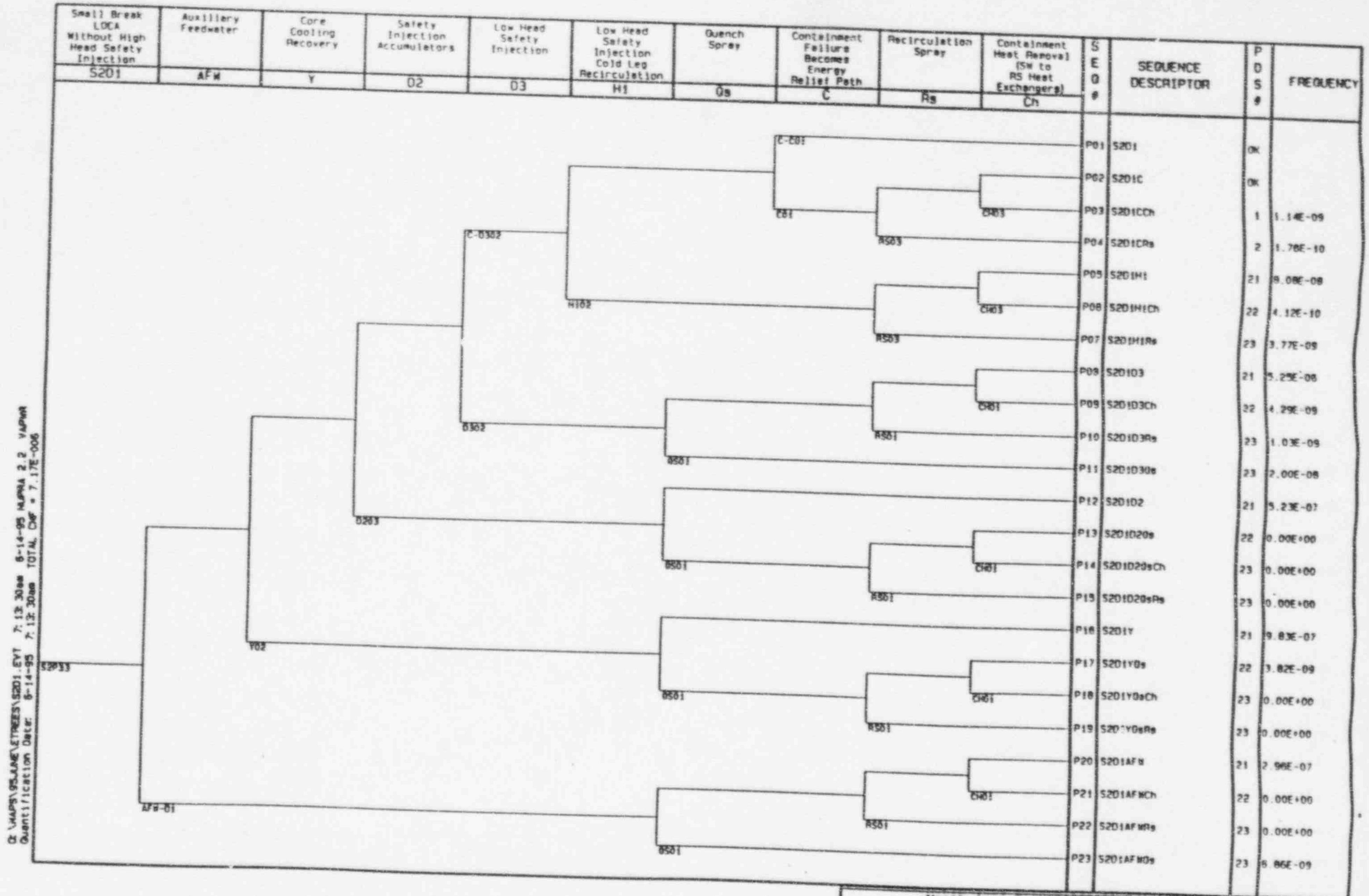
North Anna Probabilistic Safety Assessment
June 1995

S1 D1: Medium Break Loss Of Coolant Accident (LOCA) Without High Head Safety Injection



North Anna Probabilistic Safety Assessment
June 1995

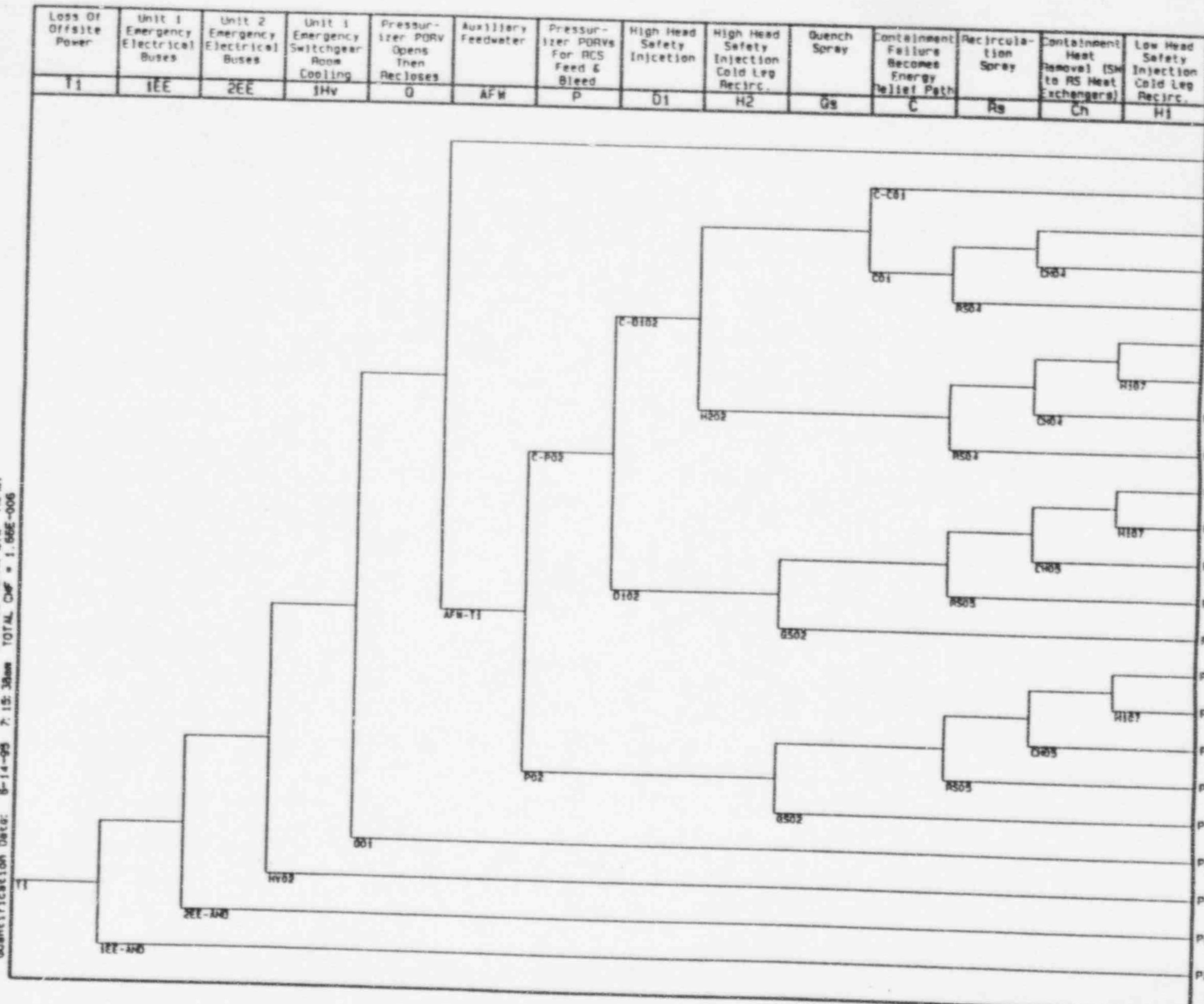
S2: Small Break Loss Of Coolent Accident (LOCA)



North Anna Probabilistic Safety Assessment
June 1995

S2 D1: Small Break Loss Of Coolant Accident (LOCA) Without High Head Safety Injection

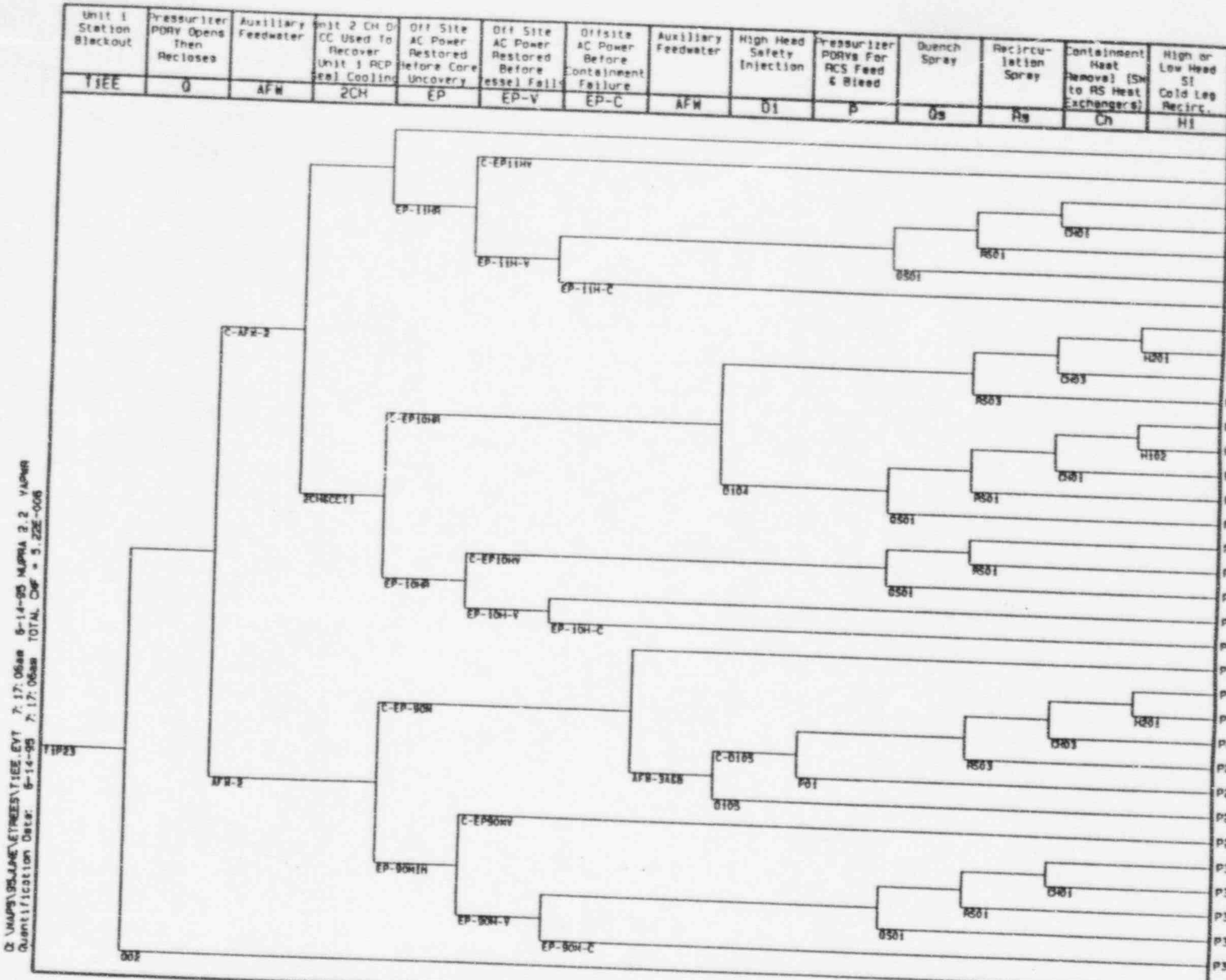
Q:\NAPS\95JUNE\ETREES\T1.EVT 7:15:38am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:15:38am TOTAL CMF = 1.66E-006



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY
P01	T1	OK	
P02	T1AFW	OK	
P03	T1AFWC	OK	
P04	T1AFWCCh	1	0.00E+00
P05	T1AFWCRs	2	0.00E+00
P06	T1AFWH2	21	1.51E-06
P07	T1AFWH2H1	21	6.04E-08
P08	T1AFWH2Ch	22	0.00E+00
P09	T1AFWH2Rs	23	3.36E-10
P10	T1AFWD1	20	7.55E-07
P11	T1AFWD1H1	21	1.16E-09
P12	T1AFWD1Ch	22	0.00E+00
P13	T1AFWD1Rs	23	1.28E-10
P14	T1AFWD1Qs	23	3.13E-08
P15	T1AFWP	8	7.46E-07
P16	T1AFWPH1	9	6.21E-09
P17	T1AFWPCh	10	0.00E+00
P18	T1AFWPRs	11	0.00E+00
P19	T1AFWPQs	11	4.88E-08
P20	T1Q	TR	1.37E-06 T1Q
P21	T11Hv	TR	2.06E-04 T1HV
P22	T12EE	TR	6.02E-05 2580
P23	T11EE	TR	1.30E-04 T1EE

North Anna Probabilistic Safety Assessment
June 1995

T1: Loss Of Offsite Power



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY
P01	T1EE	OK	
P02	T1EEEP	3	5.58E-08
P03	T1EEEPEP-V	4	1.41E-07
P04	T1EEEPEP-VCh	5	0.00E+00
P05	T1EEEPEP-VRs	6	0.00E+00
P06	T1EEEPEP-VQs	6	0.00E+00
P07	T1EEEPEP-VEP-C	7	0.00E+00
P08	T1EE2CH	OK	
P09	T1EE2CHH1	15	4.47E-07
P10	T1EE2CHCh	18	1.48E-07
P11	T1EE2CHRs	17	8.86E-08
P12	T1EE2CHD1	14	2.12E-08
P13	T1EE2CHD1H1	15	7.31E-10
P14	T1EE2CHD1Ch	18	0.00E+00
P15	T1EE2CHD1Rs	17	0.00E+00
P16	T1EE2CHD1Qs	17	1.74E-09
P17	T1EE2CHEP	16	6.27E-07
P18	T1EE2CHEPRs	17	2.28E-10
P19	T1EE2CHEPQs	17	1.75E-09
P20	T1EE2CHEPEP-V	18	1.34E-08
P21	T1EE2CHEPEP-VEP-C	19	1.18E-09
P22	T1EEAFW	OK	
P23	T1EEAFWAFW	OK	
P24	T1EEAFWAFWH1	15	0.00E+00
P25	T1EEAFWAFWCh	18	0.00E+00
P26	T1EEAFWAFWRs	17	0.00E+00
P27	T1EEAFWAFWP	3	0.00E+00
P28	T1EEAFWAFWD1	3	1.24E-09
P29	T1EEAFWEP	3	7.52E-07
P30	T1EEAFWEPEP-V	4	1.60E-08
P31	T1EEAFWEPEP-VCh	5	1.81E-09
P32	T1EEAFWEPEP-VRs	6	4.36E-10
P33	T1EEAFWEPEP-VQs	6	3.06E-09
P34	T1EEAFWEPEP-VEP-C	7	1.05E-09
P35	T1EEQ	TR	1.30E-08T1EEQ

North Anna Probabilistic Safety Assessment
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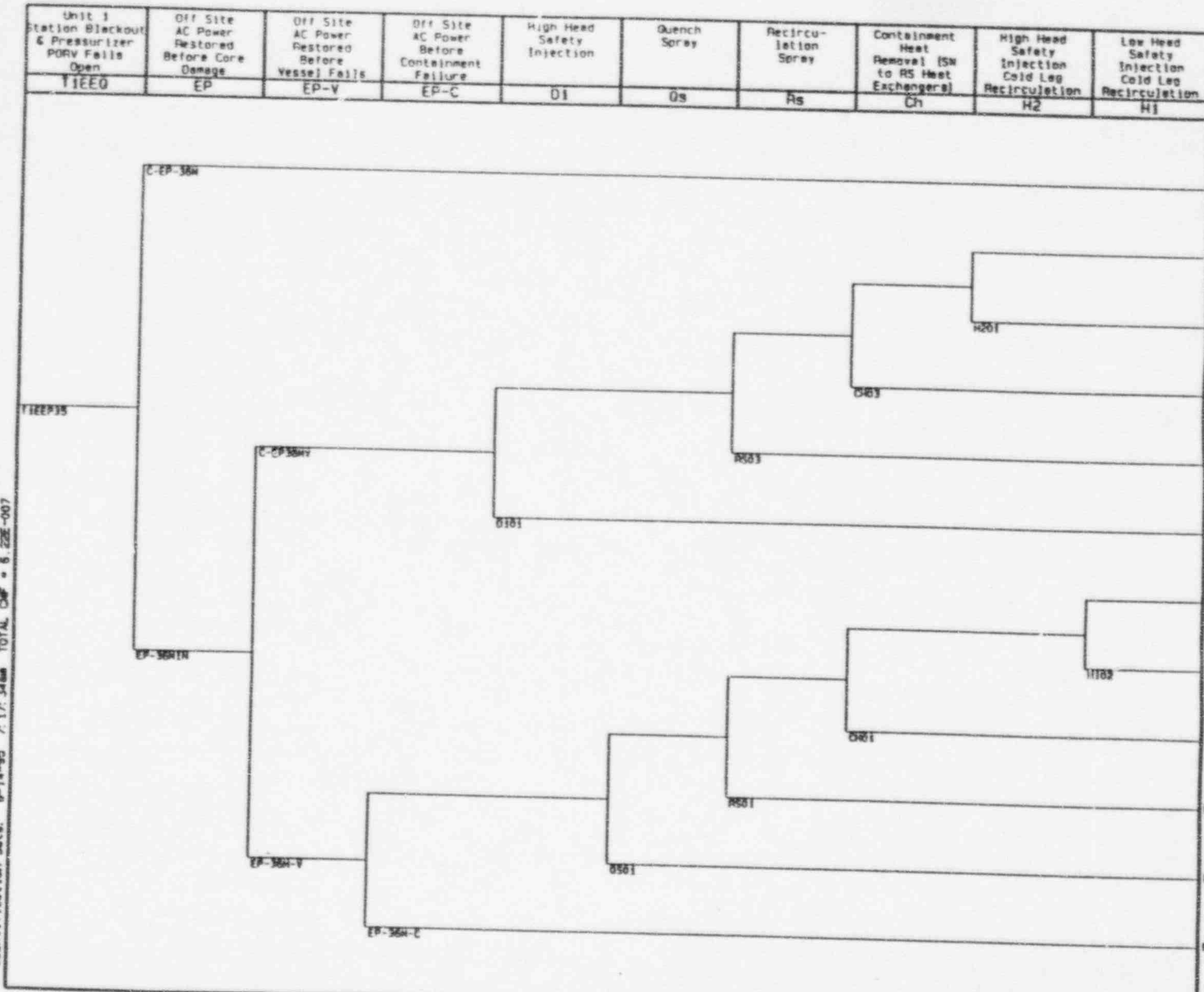
T1EE: Unit 1 Station Blackout
Loss of Offsite Power & Failure of Unit 1
Emergency Diesel Generators And Alternate AC Diesel



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY
P01	T1EEQ	1R	6.73E-07 52
P02	T1EEQEP	14	1.99E-07
P03	T1EEQEPH2	15	0.00E+00
P04	T1EEQEPCh	16	0.00E+00
P05	T1EEQEPRs	17	0.00E+00
P06	T1EEQEPD1	14	0.00E+00
P07	T1EEQEPEP-V	15	4.22E-07
P08	T1EEQEPEP-VH1	16	0.00E+00
P09	T1EEQEPEP-VCh	17	0.00E+00
P10	T1EEQEPEP-VRs	17	0.00E+00
P11	T1EEQEPEP-VQs	18	2.61E-10
P12	T1EEQEPEP-VEP-C	19	2.95E-10

North Anna Probabilistic Safety Assessment
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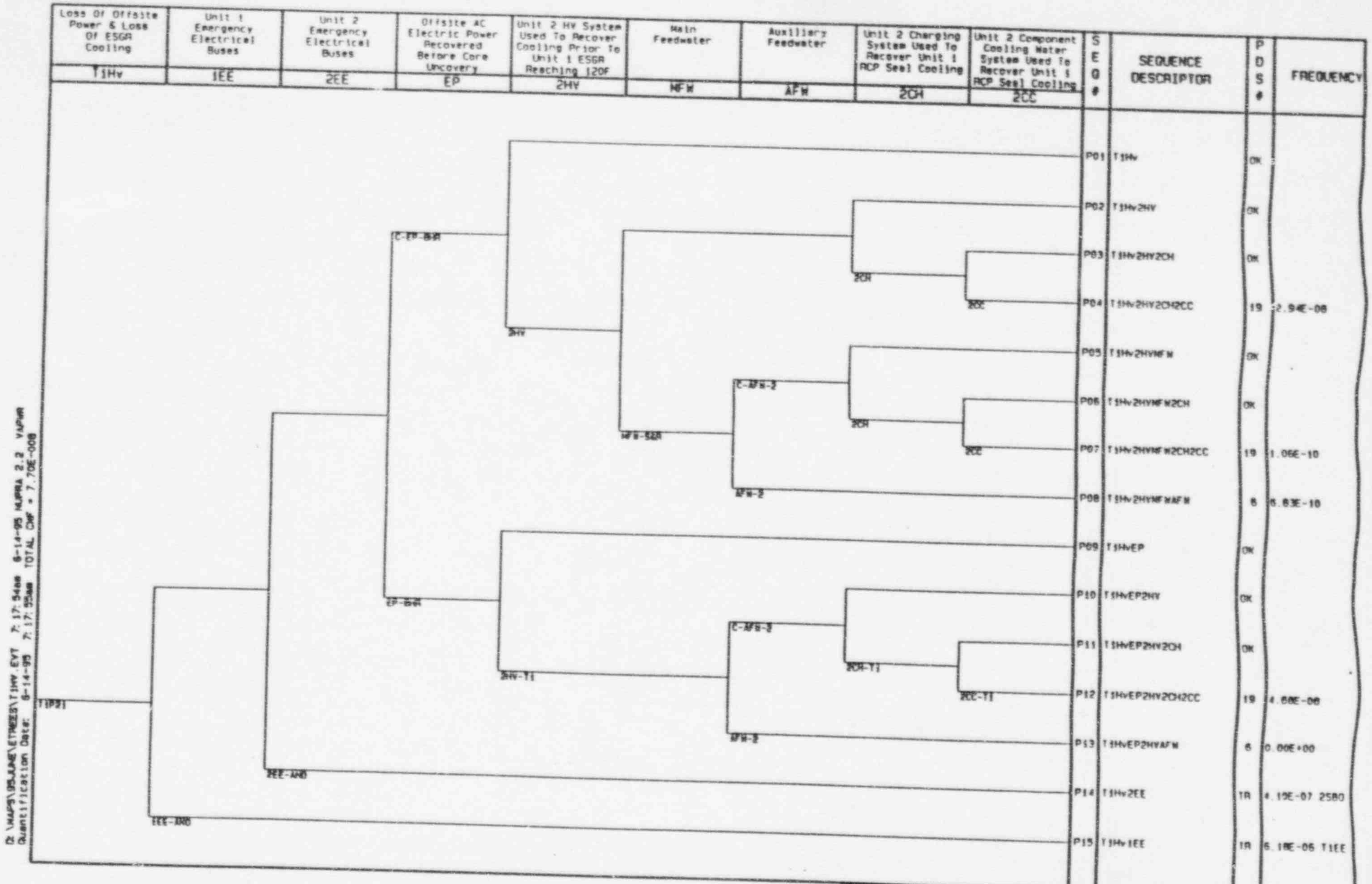
T1 EE Q: Station Blackout (Loss of Off-site Power & Failure of Diesels to Supply Power) And Pressurizer PORV Fails Open

Q:\NAPS\95JUNE\ETREES\T1EEQ.EVT 7:17:34am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:17:34am TOTAL CMF = 6.22E-007

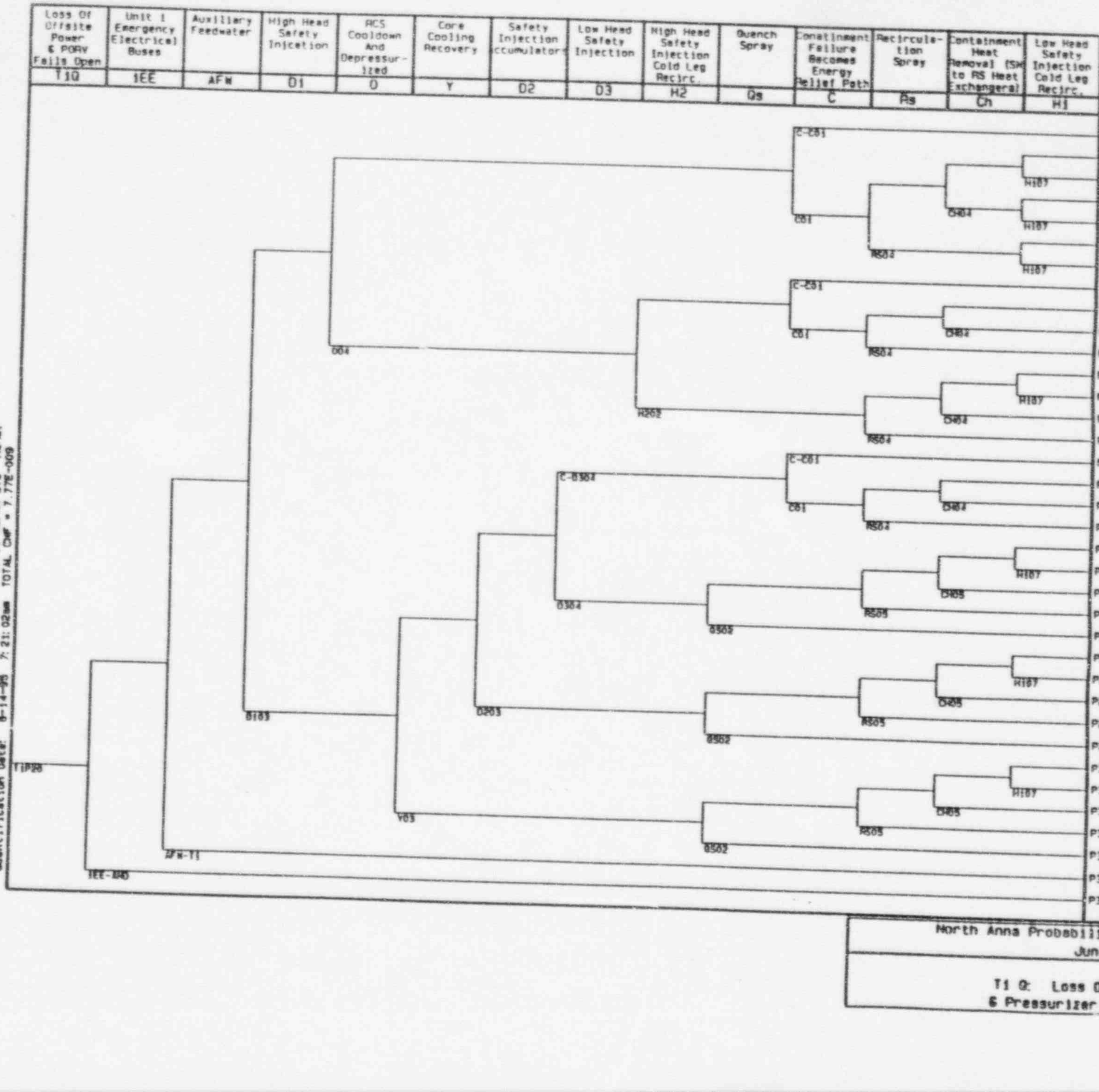


North Anna Probabilistic Safety Assessment

June 1995

T1 Hv: Loss Of Offsite Power & Loss Of Emergency Switchgear Room Cooling

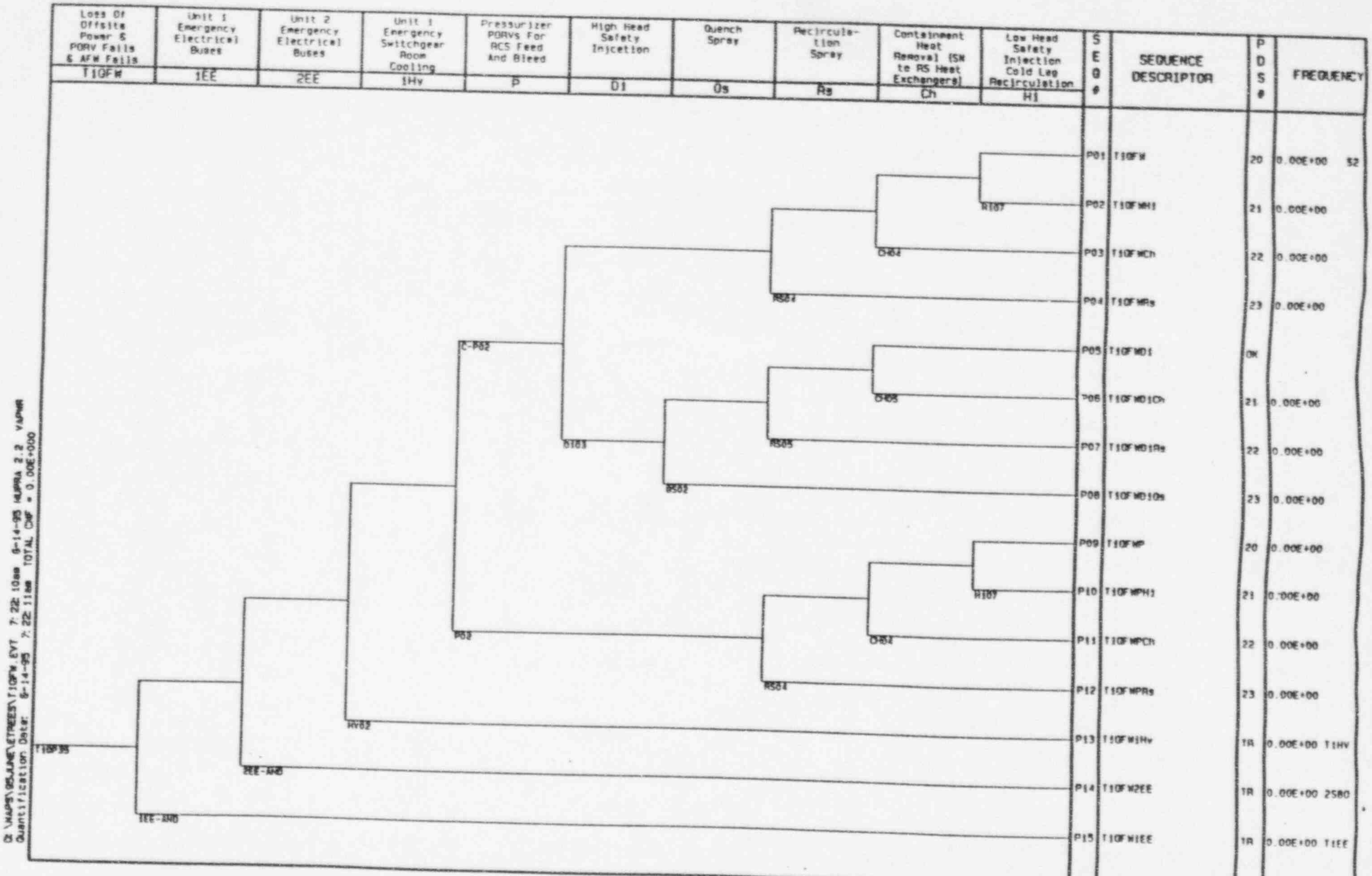
Q:\VAPS\95JUNE\ETREES\T1Q.EVT 7:21:02am 6-14-95 MUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:21:02am TOTAL CMF = 7.77E-009



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY	
P01	T1Q	TR	1.34E-08	S2
P02	T1QC	TR	2.38E-08	S2
P03	T1QCH1	21	0.00E+00	
P04	T1QCCh	1	0.00E+00	
P05	T1QCChH1	22	0.00E+00	
P06	T1QCRs	2	0.00E+00	
P07	T1QCRsH1	23	0.00E+00	
P08	T1QO	OK		
P09	T1QOC	OK		
P10	T1QOCCh	1	0.00E+00	
P11	T1QOCRs	2	0.00E+00	
P12	T1QOH2	21	0.00E+00	
P13	T1QOH2H1	21	0.00E+00	
P14	T1QOH2Ch	22	0.00E+00	
P15	T1QOH2Rs	23	0.00E+00	
P16	T1QD1	OK		
P17	T1QD1C	OK		
P18	T1QD1CCh	1	0.00E+00	
P19	T1QD1CRs	2	0.00E+00	
P20	T1QD1D3	20	7.77E-09	
P21	T1QD1D3H1	21	0.00E+00	
P22	T1QD1D3Ch	22	0.00E+00	
P23	T1QD1D3Rs	23	0.00E+00	
P24	T1QD1D3Qs	23	0.00E+00	
P25	T1QD1D2	20	0.00E+00	
P26	T1QD1D2H1	21	0.00E+00	
P27	T1QD1D2Ch	22	0.00E+00	
P28	T1QD1D2Rs	23	0.00E+00	
P29	T1QD1D2Qs	23	0.00E+00	
P30	T1QD1Y	20	0.00E+00	
P31	T1QD1YH1	21	0.00E+00	
P32	T1QD1YCh	22	0.00E+00	
P33	T1QD1YRs	23	0.00E+00	
P34	T1QD1YQs	23	0.00E+00	
P35	T1QAFW	TR	0.00E+00	T1OFW
P36	T1Q1EE	TR	6.97E-09	T1EE

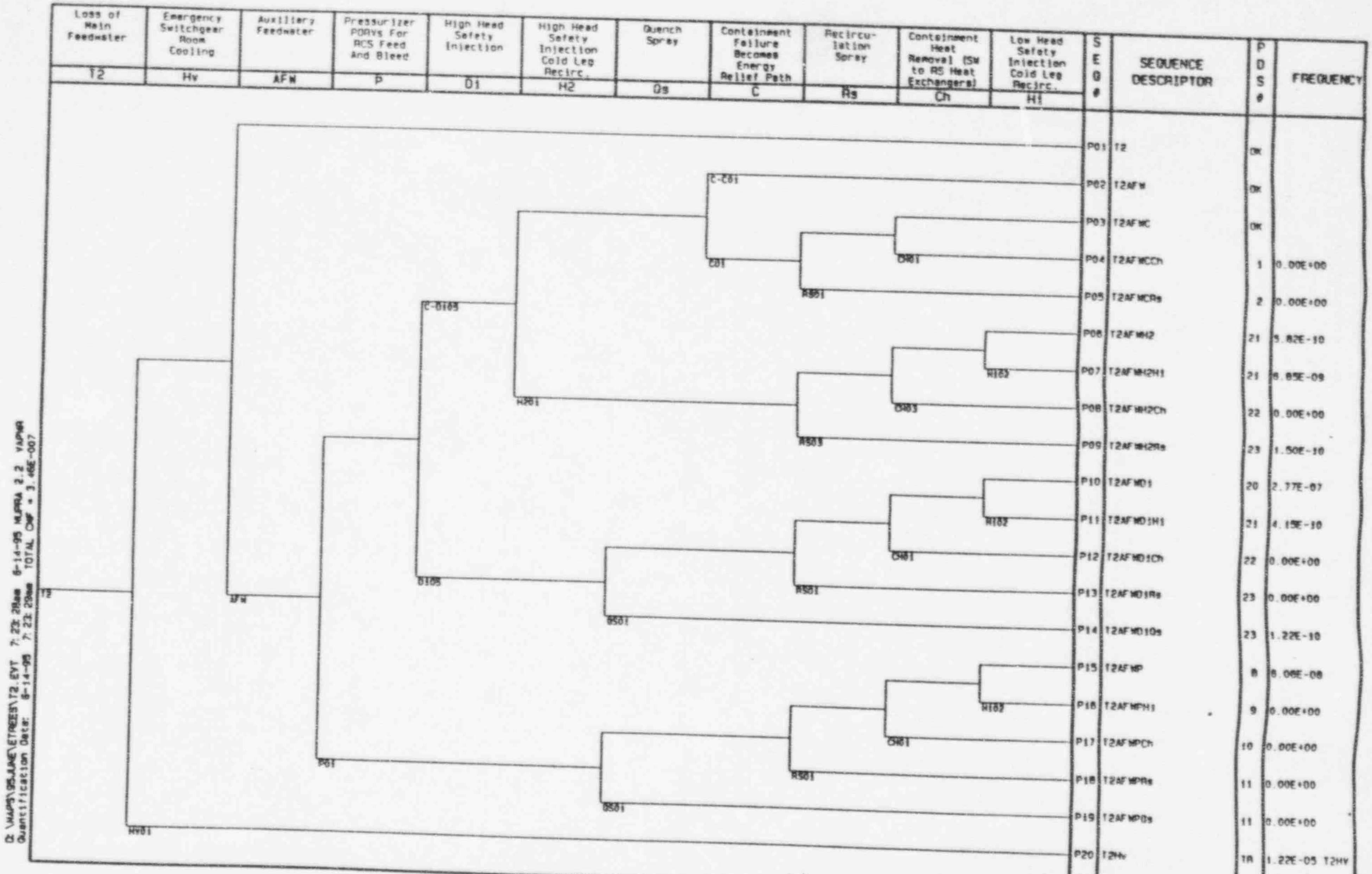
North Anna Probabilistic Safety Assessment
June 1995

T1 Q: Loss Of Offsite Power & Pressurizer PORV Fails Open



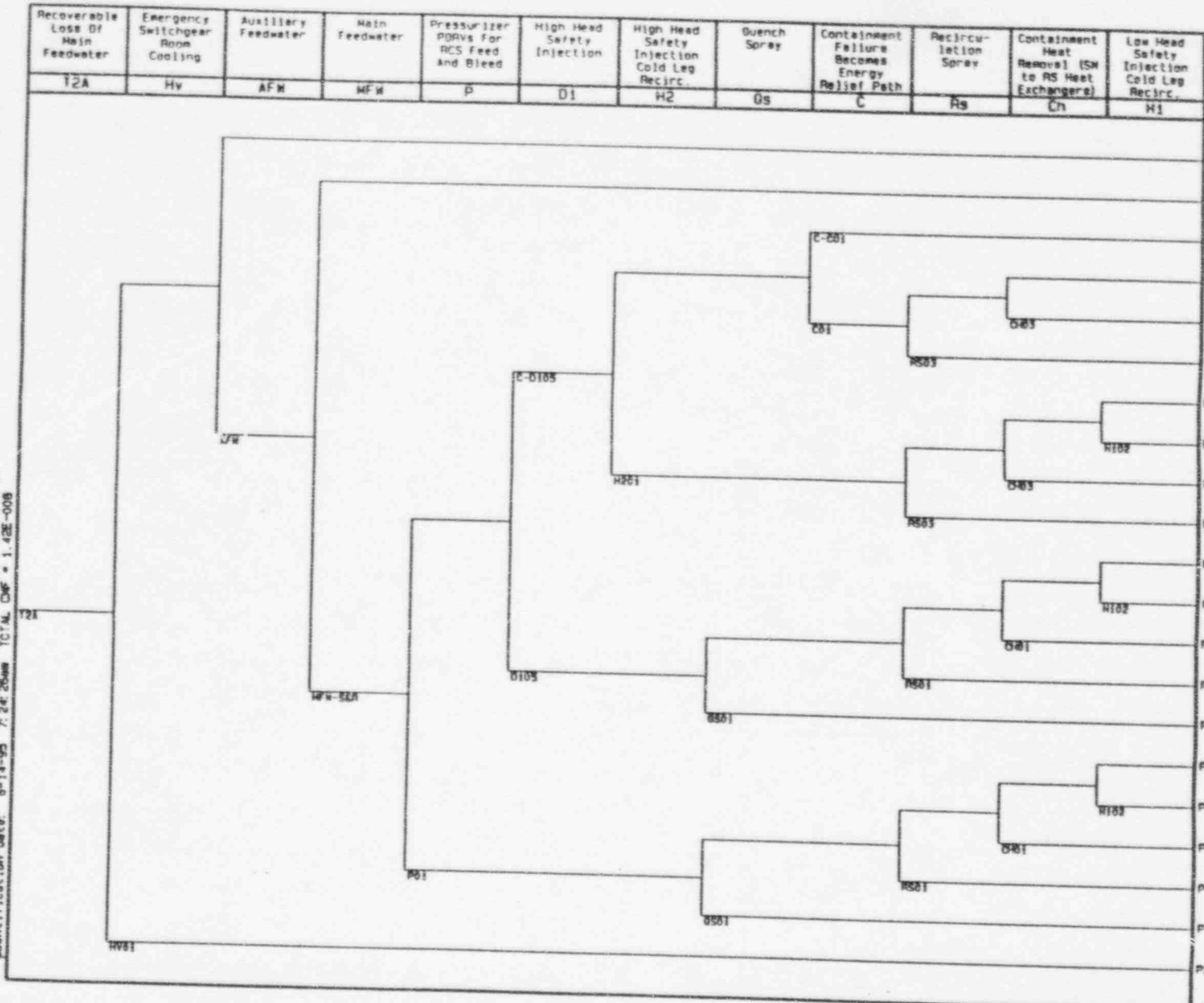
North Anna Probabilistic Safety Assessment
June 1995

T1 Q AFW: Loss Of Offsite Power
& Pressurizer PORV Fails Open & Auxiliary Feedwater Fails



North Anna Probabilistic Safety Assessment
June 1995

T2: Loss of Main Feedwater



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY
P01	T2A	OK	
P02	T2AAFW	OK	
P03	T2AAFWMFW	OK	
P04	T2AAFWMFWC	OK	
P05	T2AAFWMFWCCh	1	0.00E+00
P06	T2AAFWMFWCRs	2	0.00E+00
P07	T2AAFWMFWH2	21	0.00E+00
P08	T2AAFWMFWH2H1	21	0.00E+00
P09	T2AAFWMFWH2Ch	22	0.00E+00
P10	T2AAFWMFWH2Rs	23	0.00E+00
P11	T2AAFWMFWD1	20	1.29E-08
P12	T2AAFWMFWD1H1	21	0.00E+00
P13	T2AAFWMFWD1Ch	22	0.00E+00
P14	T2AAFWMFWD1Rs	23	0.00E+00
P15	T2AAFWMFWD1Qs	23	0.00E+00
P16	T2AAFWMFWP	8	1.33E-09
P17	T2AAFWMFWPH1	9	0.00E+00
P18	T2AAFWMFWPCh	10	0.00E+00
P19	T2AAFWMFWPRs	11	0.00E+00
P20	T2AAFWMFWPQs	11	0.00E+00
P21	T2AHv	1R	1.35E-04T2AHV

D:\NAPS\95JUNE\ETREES\T2A.EVT 7:24:26am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:24:26am TOTAL CDF = 1.42E-008

North Anna Probabilistic Safety Assessment
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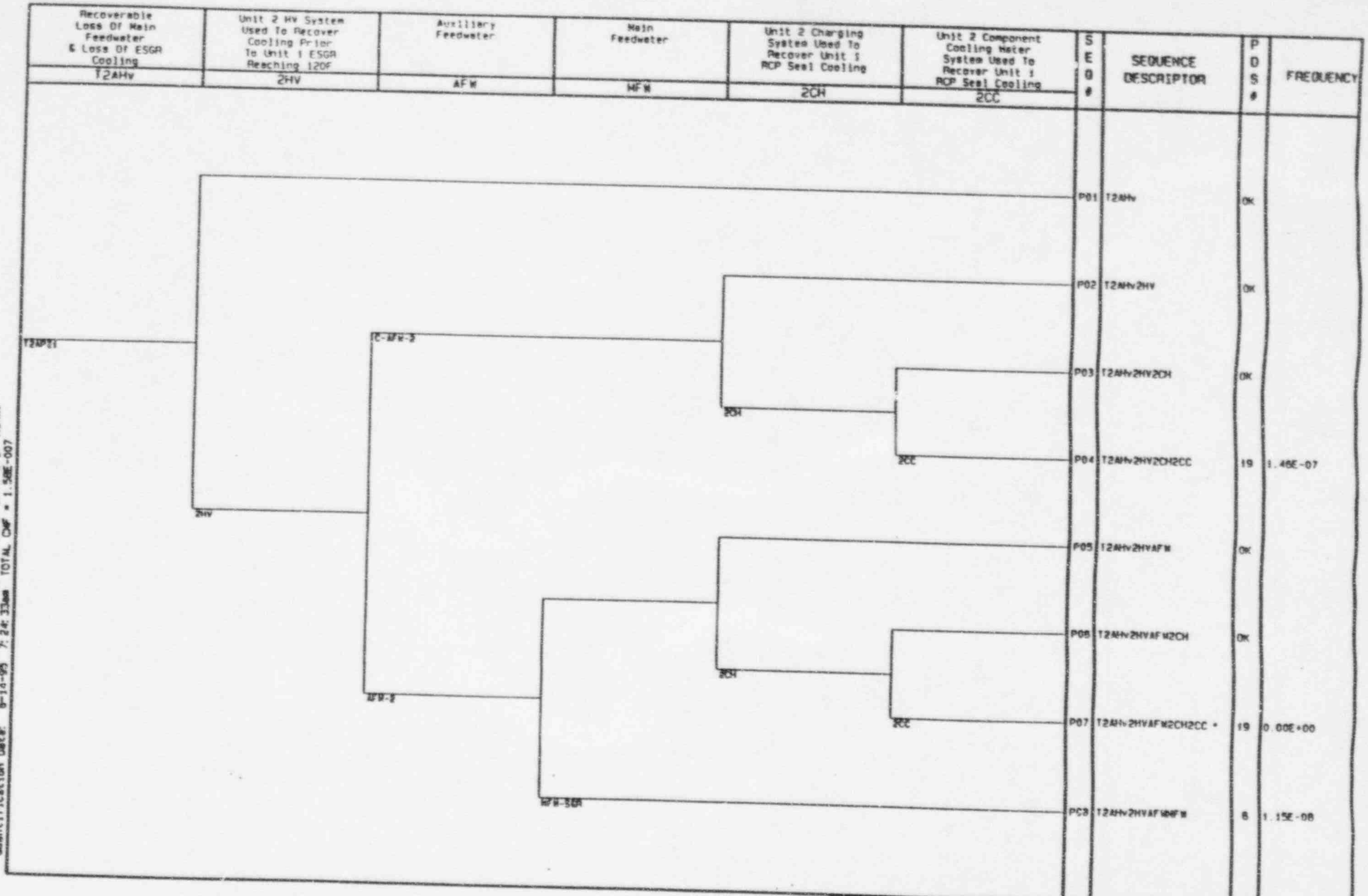
T2A: Recoverable Loss Of Main Feedwater



Q:\NAPS\95JUNE\ETREES\T2AHV.EVT 7:24:32am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:24:33am TOTAL CMF = 1.58E-007

North Anna Probabilistic Safety Assessment
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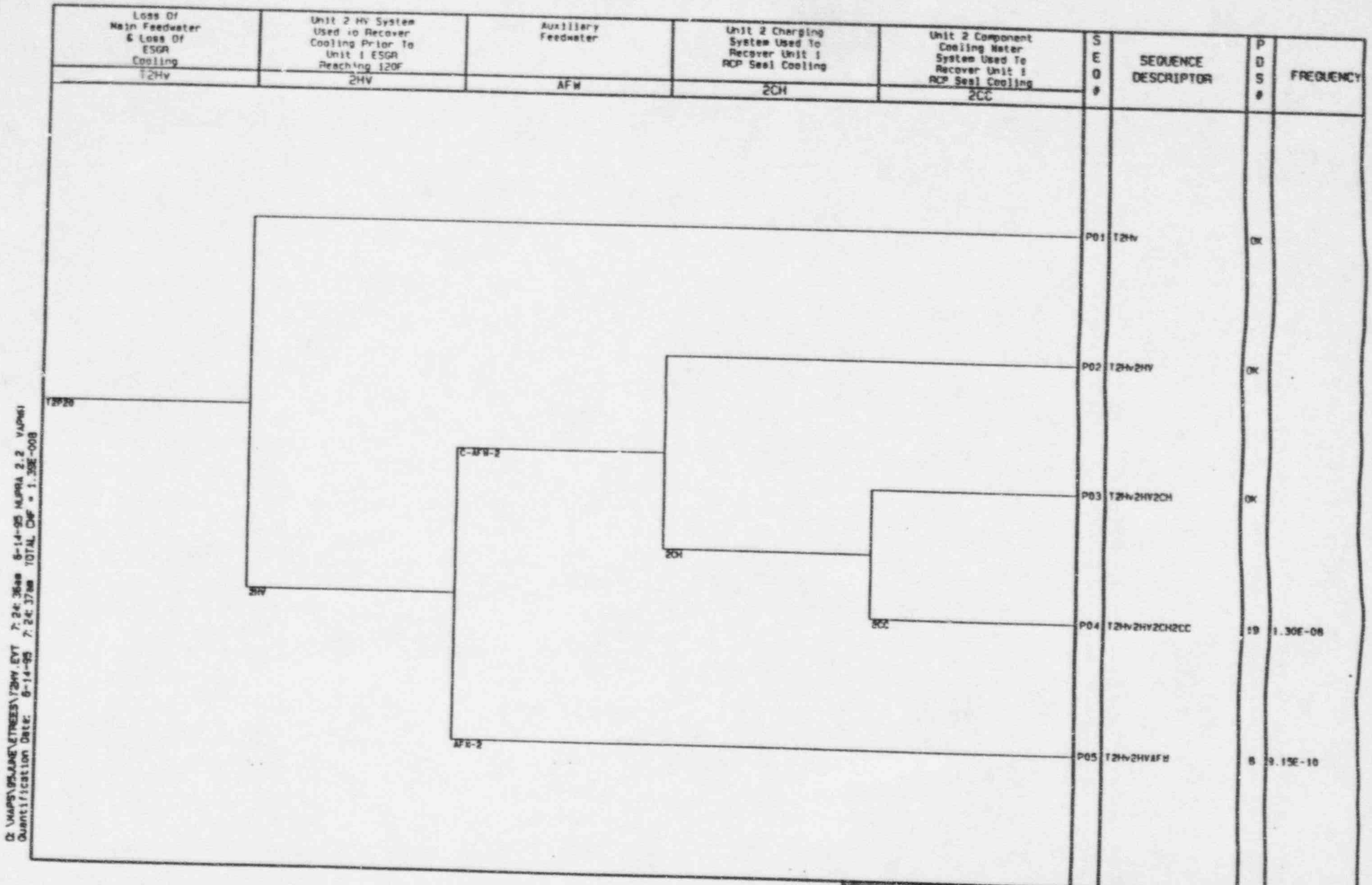
T2A Hv: Recoverable Loss Of Main Feedwater
& Loss Of Emergency Switchgear Room Cooling



North Anna Probabilistic Safety Assessment
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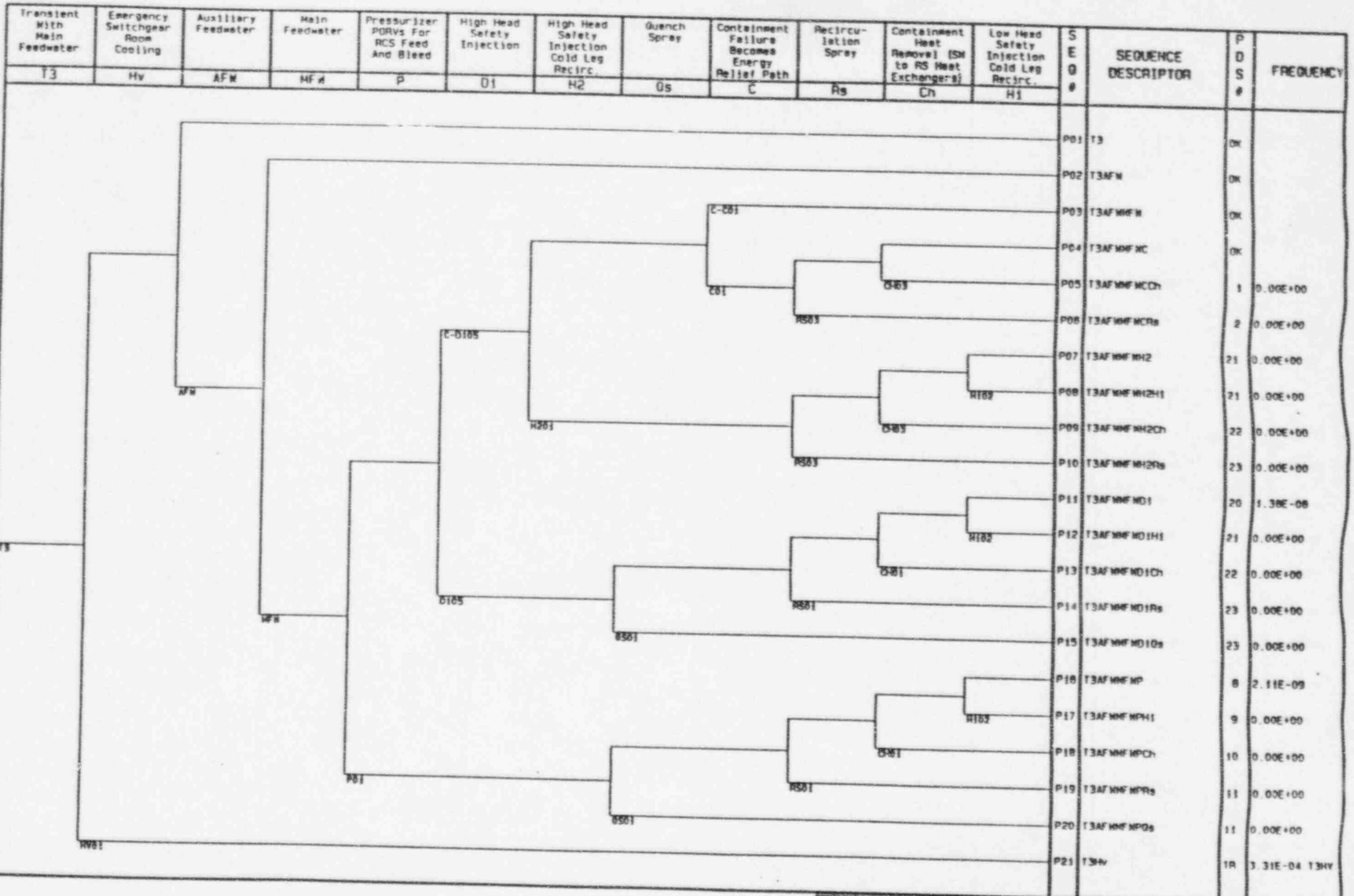
T2 Hv: Loss Of Main Feedwater
& Loss Of Emergency Switchgear Room Cooling



C:\NAPS\95JUNE\ETREES\T3.EVT 7:25:34am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:25:34am TOTAL CMF = 1.35E-008

North Anna Probabilistic Safety Assessment
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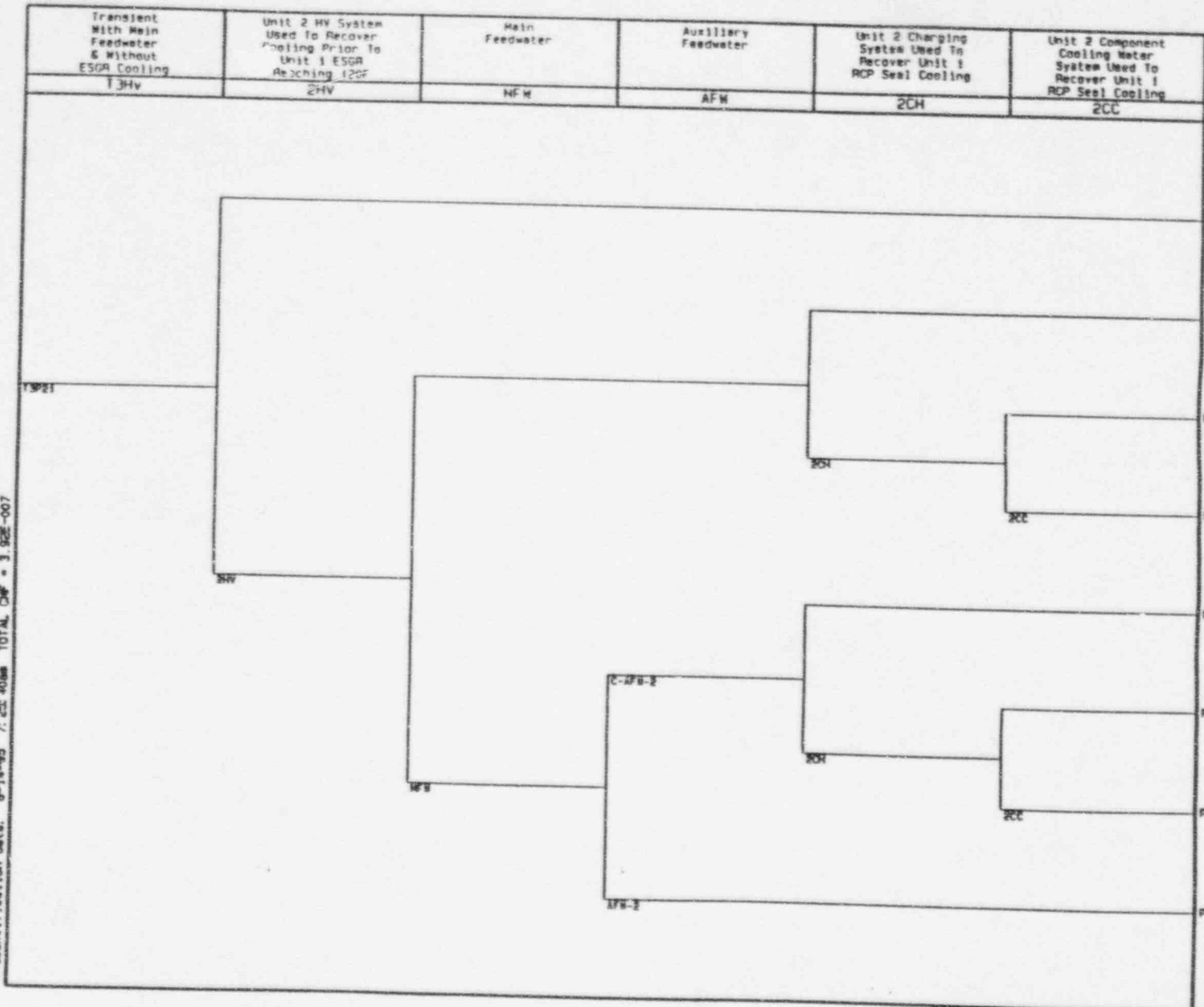
T3: Transients With Main Feedwater

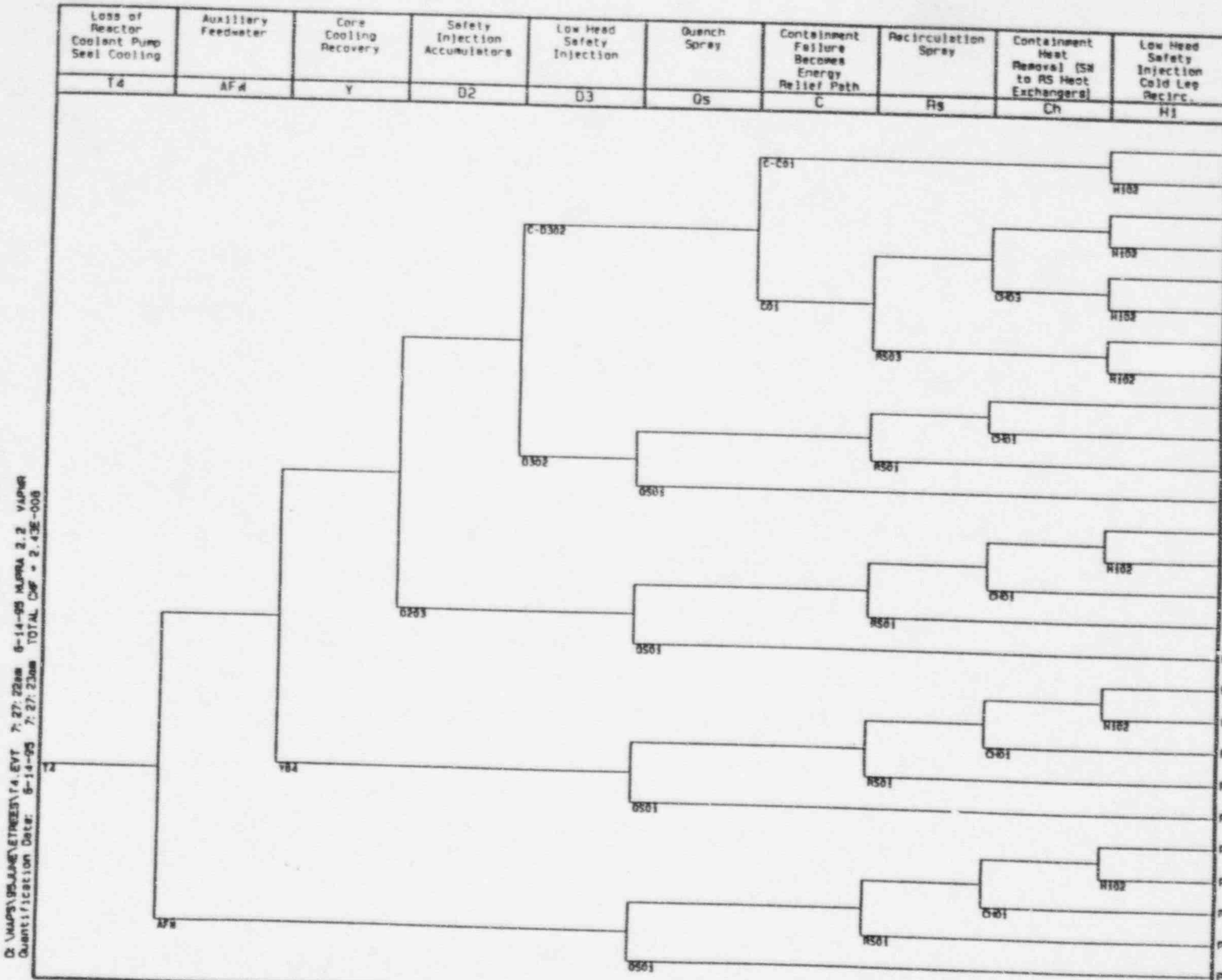


SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY
P01	T3Hv	OK	
P02	T3Hv2HV	OK	
P03	T3Hv2HV2CH	OK	
P04	T3Hv2HV2CH2CC	19	8.76E-09
P05	T3Hv2HVMFW	OK	
P06	T3Hv2HVMFW2CH	OK	
P07	T3Hv2HVMFW2CH2CC	19	3.54E-07
P08	T3Hv2HVMFWAFW	6	2.89E-08

D:\NAPS\95JUNE\ETREES\T3HV.EYT 7:25:40am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:25:40am TOTAL CMF = 3.92E-007

North Anna Probabilistic Safety Assessment
June 1995

T3 Hv: Transient With Main Feedwater
& Without Emergency Switchgear Room Cooling



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY
P01	T4	OK	
P02	T4H1	21	2.24E-10
P03	T4C	OK	
P04	T4CH1	21	0.00E+00
P05	T4CCh	1	0.00E+00
P06	T4CChH1	22	0.00E+00
P07	T4CRs	2	0.00E+00
P08	T4CRsH1	23	0.00E+00
P09	T4D3	21	1.45E-08
P10	T4D3Ch	22	0.00E+00
P11	T4D3Rs	23	0.00E+00
P12	T4D3Qs	23	0.00E+00
P13	T4D2	20	3.76E-09
P14	T4D2H1	21	0.00E+00
P15	T4D2Ch	22	0.00E+00
P16	T4D2Rs	23	0.00E+00
P17	T4D2Qs	23	0.00E+00
P18	T4Y	20	5.80E-09
P19	T4YH1	21	0.00E+00
P20	T4YCh	22	0.00E+00
P21	T4YRs	23	0.00E+00
P22	T4YQs	23	0.00E+00
P23	T4AFW	8	0.00E+00
P24	T4AFWH1	9	0.00E+00
P25	T4AFWCh	10	0.00E+00
P26	T4AFWRs	11	0.00E+00
P27	T4AFWQs	11	0.00E+00

North Anna Probabilistic Safety Assessment
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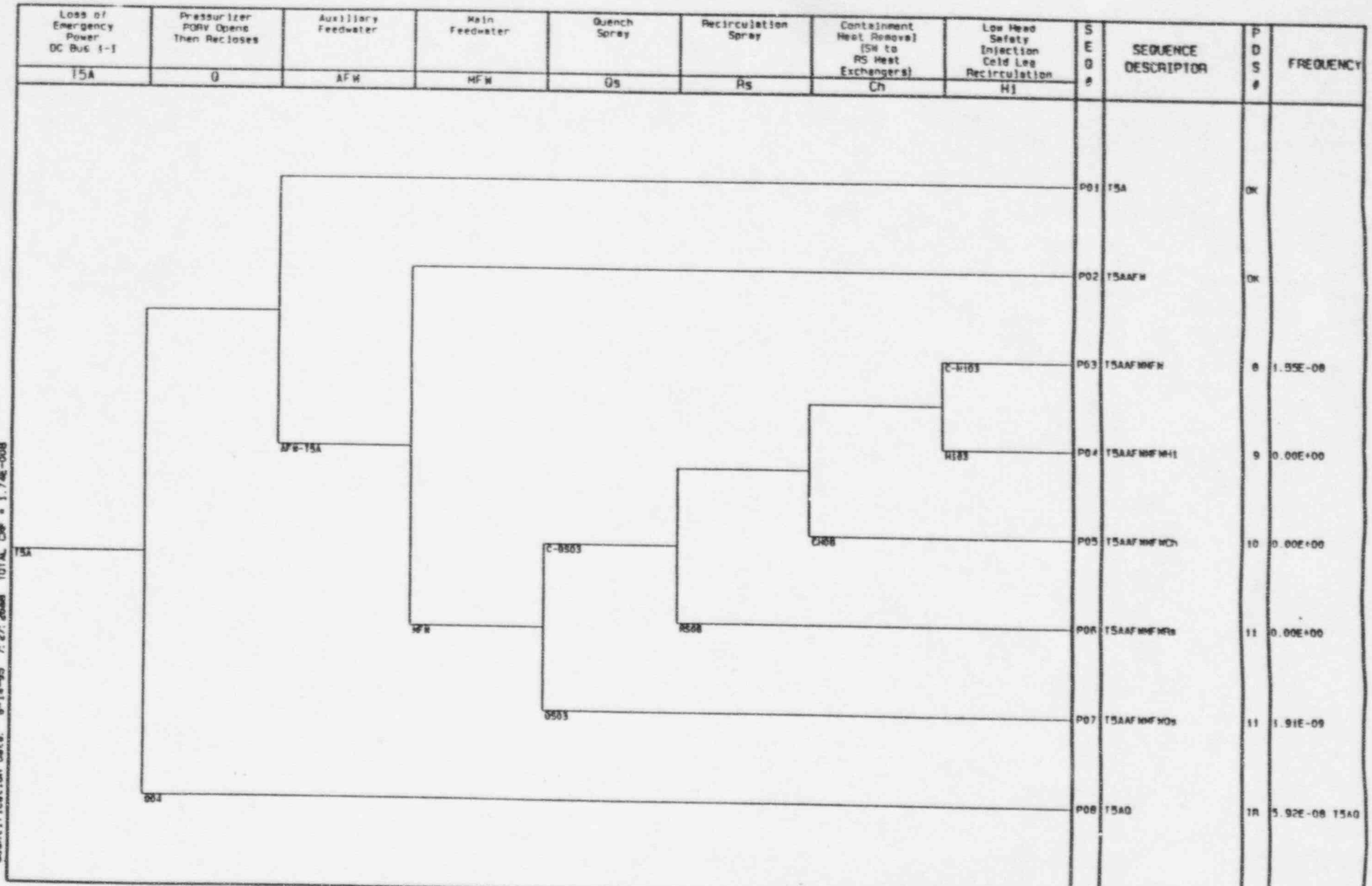
T4: Loss of Reactor Coolant Pump Seal Cooling

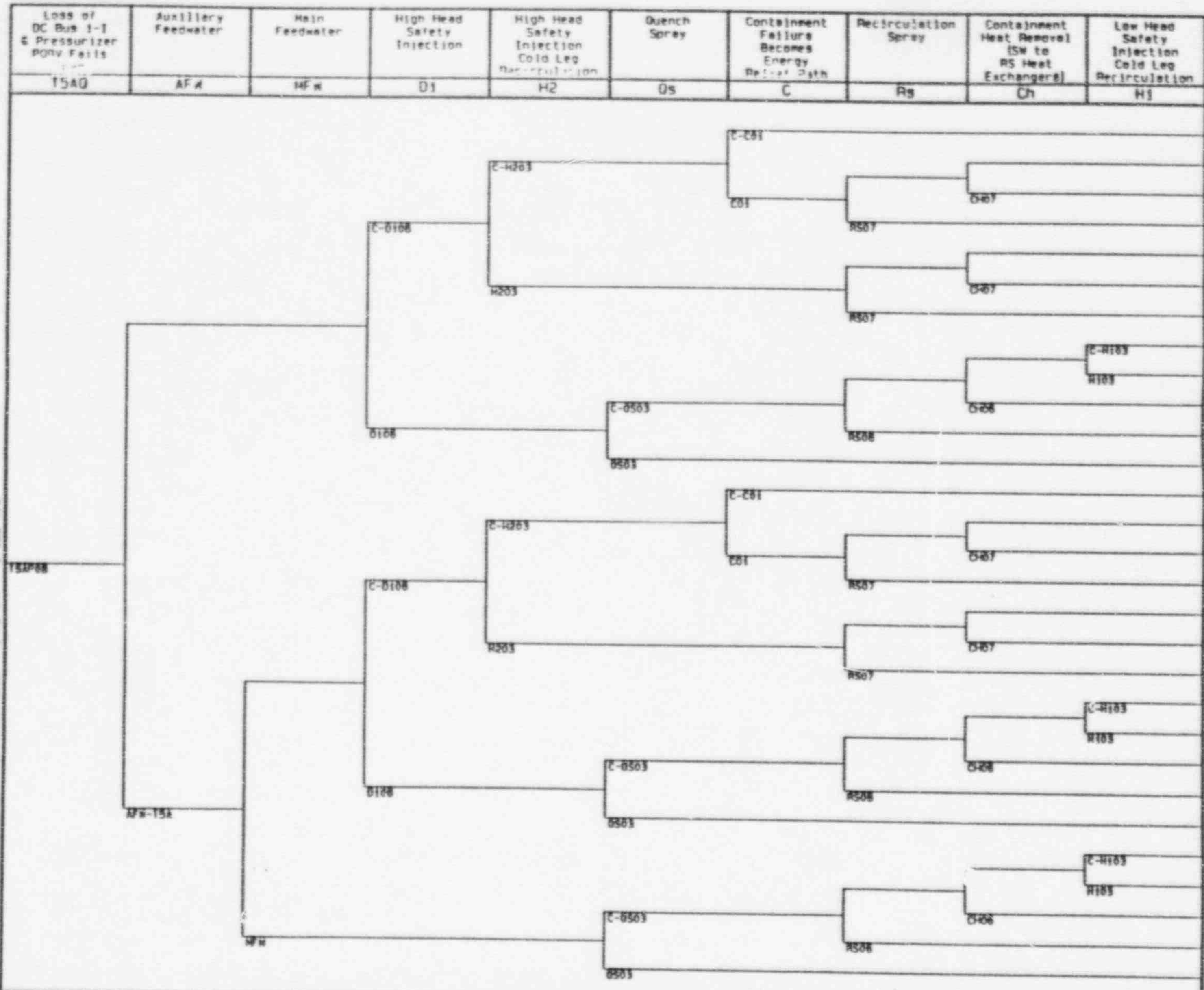
C: \NAPS\95JUNE\ETREES\T5A.EVT   7: 27: 25am   6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95   7: 27: 26am   TOTAL CMF = 1.74E-008



North Anna Probabilistic Safety Assessment
June 1995

T5A: Loss Of Emergency Power DC Bus 1-I

Q:\VAPPS\95JUNE\ETREES\T5AQ.EVT 7:27:36am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:27:36am TOTAL CHF = 2.23E-009



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY	
P01	T5AQ	1R	5.26E-08	S2
P02	T5AQC	1R	1.07E-09	S2
P03	T5AQCCh	1	0.00E+00	
P04	T5AQCRs	2	0.00E+00	
P05	T5AQH2	21	1.25E-09	
P06	T5AQH2Ch	22	0.00E+00	
P07	T5AQH2Rs	23	0.00E+00	
P08	T5AQD1	20	9.78E-10	
P09	T5AQD1H1	21	0.00E+00	
P10	T5AQD1Ch	22	0.00E+00	
P11	T5AQD1Rs	23	0.00E+00	
P12	T5AQD1Qs	23	0.00E+00	
P13	T5AQAFW	1R	0.00E+00	S2
P14	T5AQAFWC	1R	0.00E+00	S2
P15	T5AQAFWCCh	1	0.00E+00	
P16	T5AQAFWCRs	2	0.00E+00	
P17	T5AQAFWH2	21	0.00E+00	
P18	T5AQAFWH2Ch	22	0.00E+00	
P19	T5AQAFWH2Rs	23	0.00E+00	
P20	T5AQAFWD1	20	0.00E+00	
P21	T5AQAFWD1H1	21	0.00E+00	
P22	T5AQAFWD1Ch	22	0.00E+00	
P23	T5AQAFWD1Rs	23	0.00E+00	
P24	T5AQAFWD1Qs	23	0.00E+00	
P25	T5AQAFWMFW	20	0.00E+00	
P26	T5AQAFWMFWH1	21	0.00E+00	
P27	T5AQAFWMFWCh	22	0.00E+00	
P28	T5AQAFWMFWRs	23	0.00E+00	
P29	T5AQAFWMFWQs	23	0.00E+00	

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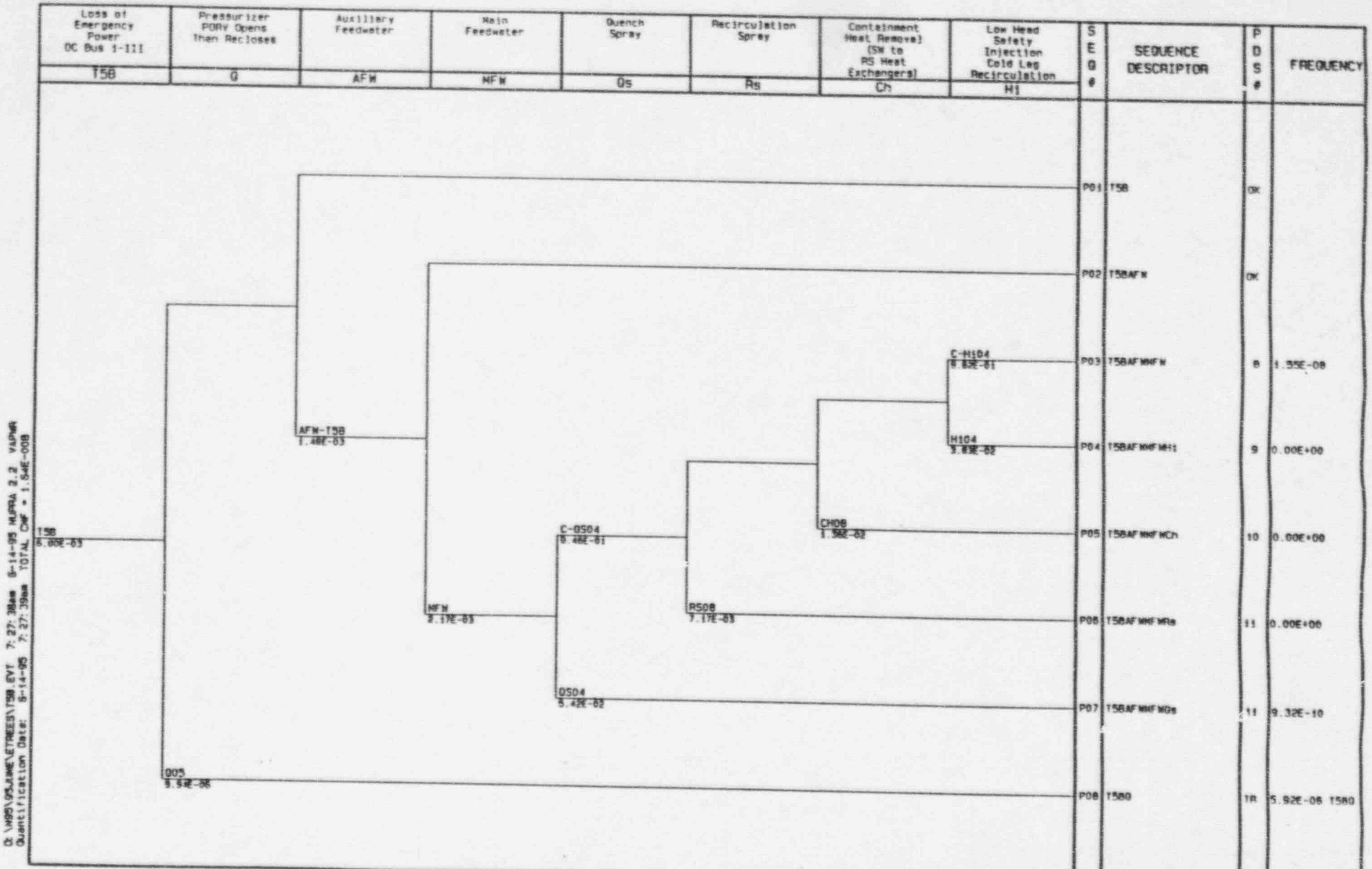
T5A Q: Loss Of Emergency Power DC Bus 1-I & Pressurizer PORV Fails Open



North Anna Probabilistic Safety Assessment
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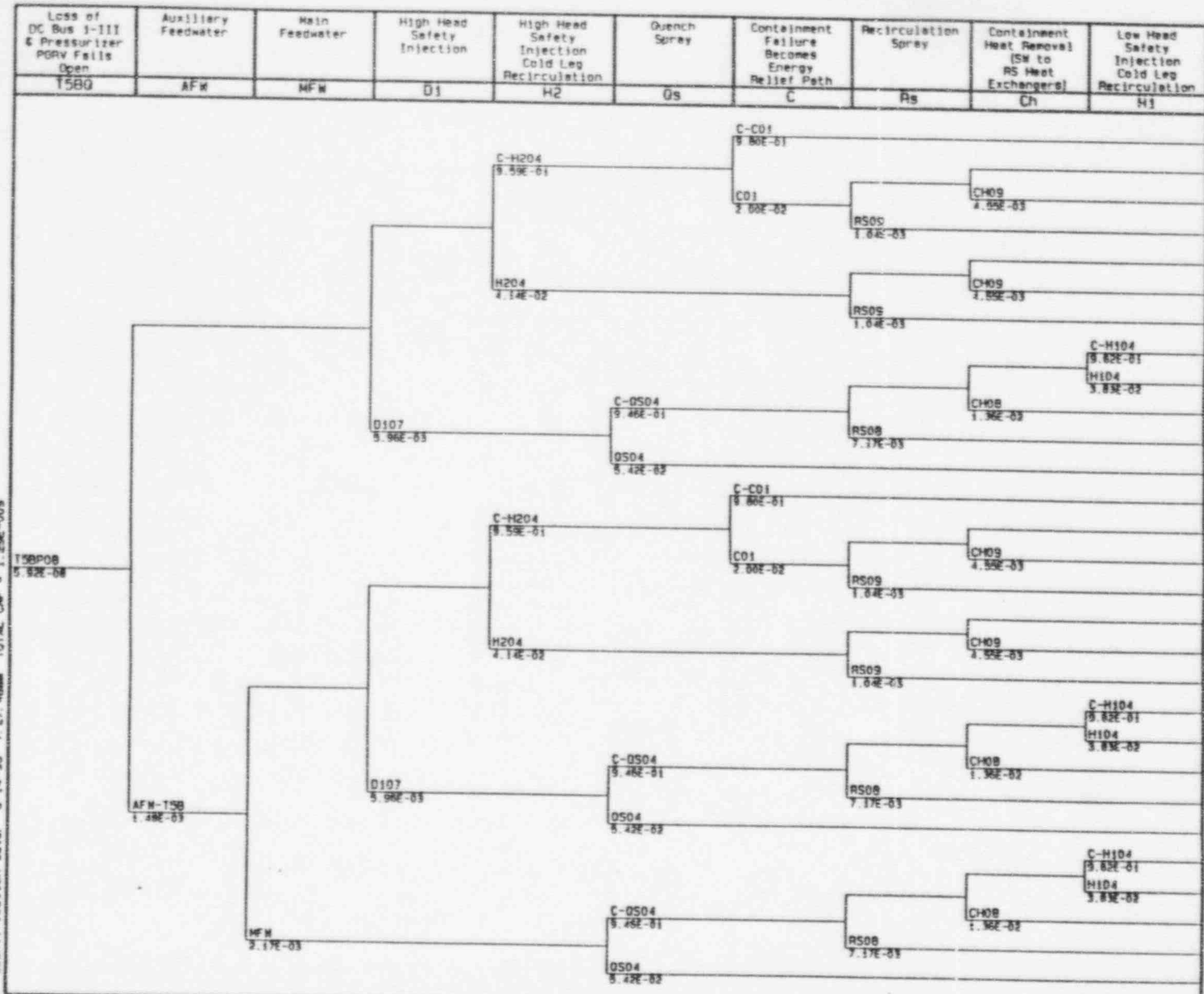
T5B: Loss Of Emergency Power DC Bus 1-III

Q:\H95\95JUNE\ETREES\T5BQ.EVT 7:27:48am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:27:48am TOTAL CMF = 1.29E-009



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY	
P01	T5BQ	TR	5.57E-08	52
P02	T5BQC	TR	1.14E-09	52
P03	T5BQCCh	1	0.00E+00	
P04	T5BQCRs	2	0.00E+00	
P05	T5BQH2	21	1.29E-09	
P06	T5BQH2Ch	22	0.00E+00	
P07	T5BQH2Rs	23	0.00E+00	
P08	T5BQD1	20	0.00E+00	
P09	T5BQD1H1	21	0.00E+00	
P10	T5BQD1Ch	22	0.00E+00	
P11	T5BQD1Rs	23	0.00E+00	
P12	T5BQD1Qs	23	0.00E+00	
P13	T5BQAFW	TR	0.00E+00	52
P14	T5BQAFWC	TR	0.00E+00	52
P15	T5BQAFWCCh	1	0.00E+00	
P16	T5BQAFWCRs	2	0.00E+00	
P17	T5BQAFWH2	21	0.00E+00	
P18	T5BQAFWH2Ch	22	0.00E+00	
P19	T5BQAFWH2Rs	23	0.00E+00	
P20	T5BQAFWD1	20	0.00E+00	
P21	T5BQAFWD1H1	21	0.00E+00	
P22	T5BQAFWD1Ch	22	0.00E+00	
P23	T5BQAFWD1Rs	23	0.00E+00	
P24	T5BQAFWD1Qs	23	0.00E+00	
P25	T5BQAFWMFW	20	0.00E+00	
P26	T5BQAFWMFWH1	21	0.00E+00	
P27	T5BQAFWMFWCh	22	0.00E+00	
P28	T5BQAFWMFWRs	23	0.00E+00	
P29	T5BQAFWMFWQs	23	0.00E+00	

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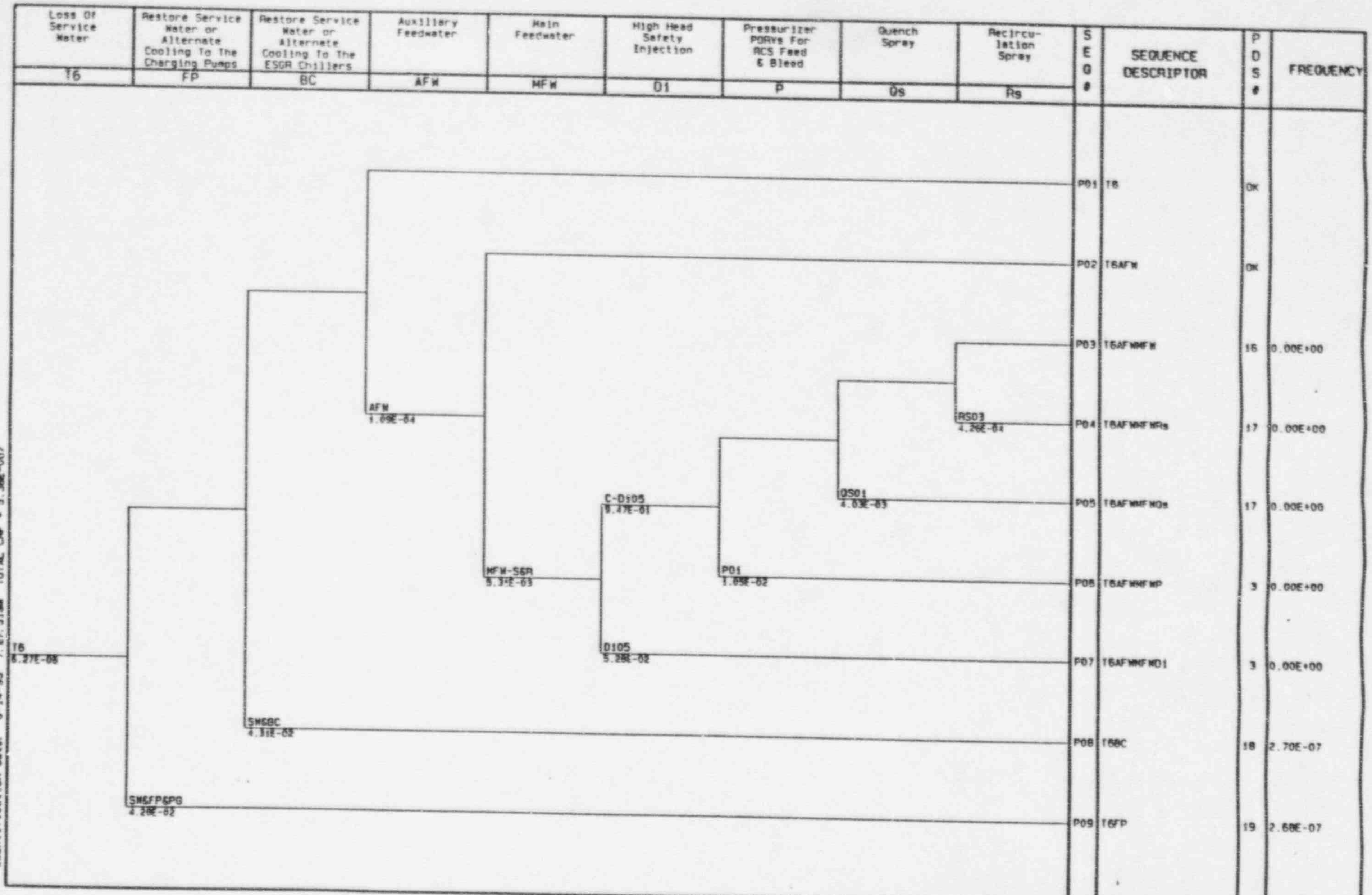
T5B Q: Loss Of Emergency Power DC Bus 1-III & Pressurizer PORV Fails Open

D:\W95\95JUNE\ETREES\T6.EVT 7:27:50am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:27:51am TOTAL CMF = 5.30E-007



North Anna Probabilistic Safety Assessment
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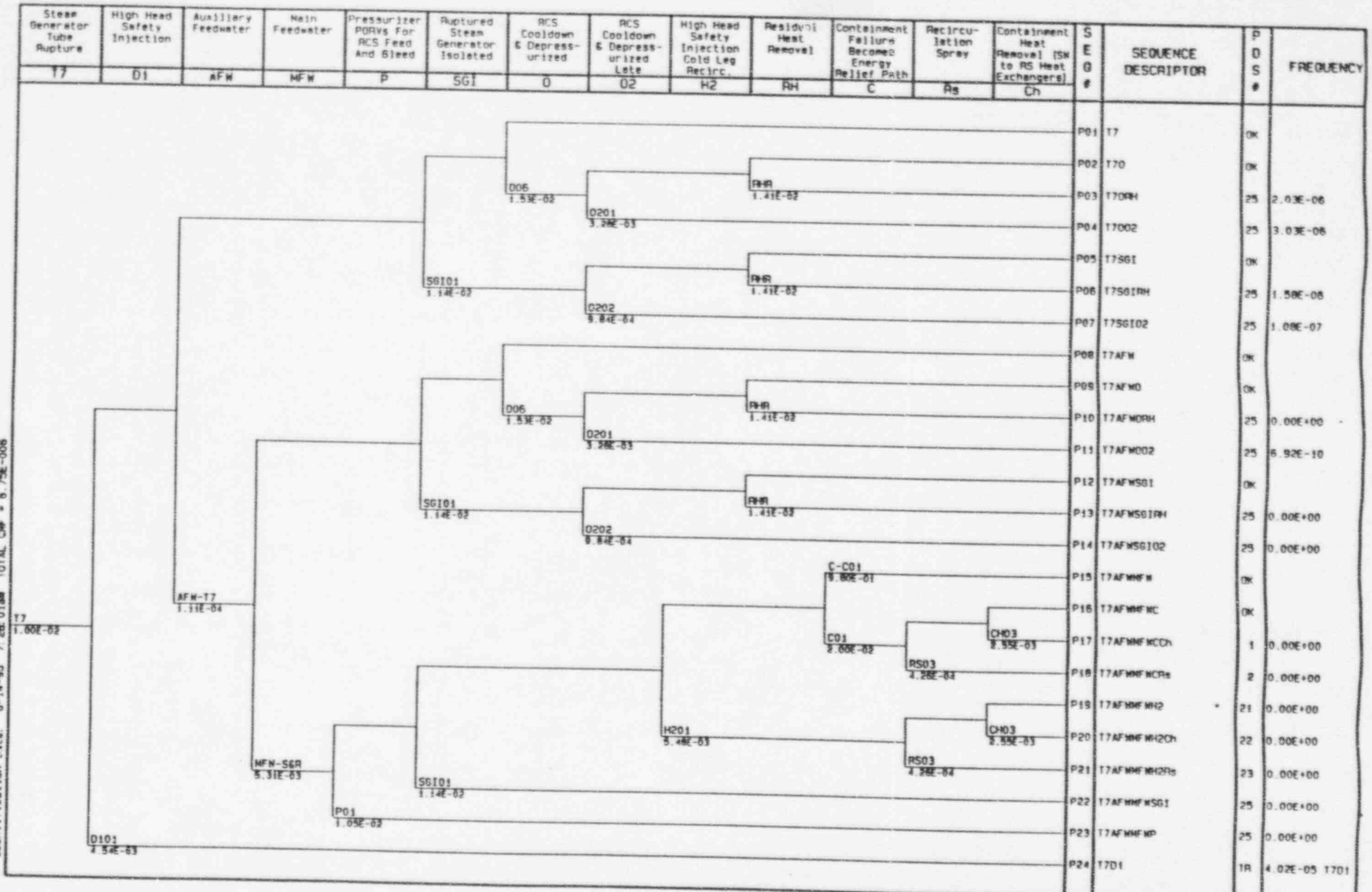
T6: Loss Of Service Water

D:\N95\95JUNE\ETREES\T7.EVT 7:28:00am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:28:01am TOTAL CMF = 6.75E-006



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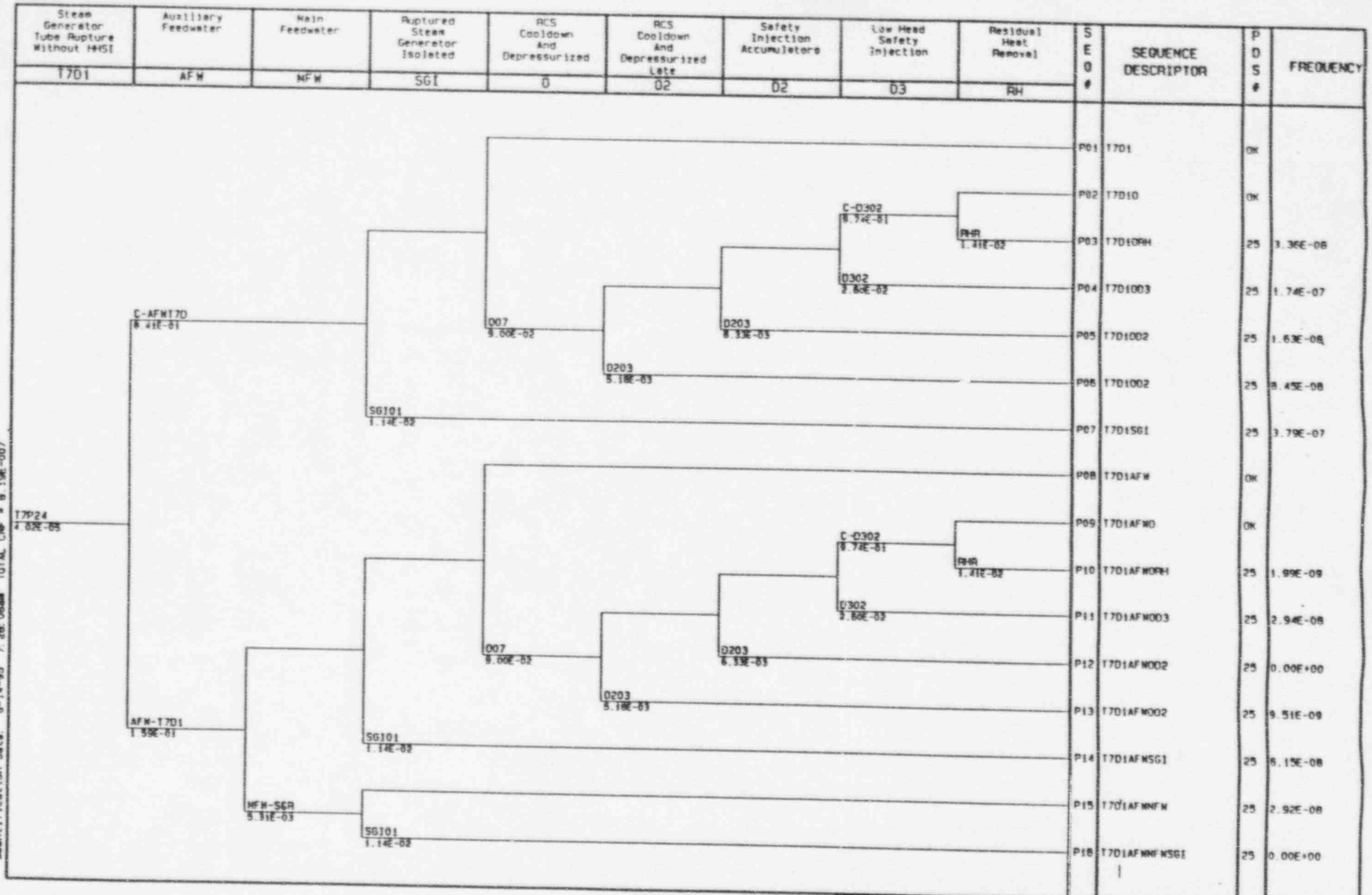
T7: Steam Generator Tube Rupture

D:\W95\95JUNE\ETREES\T7D1.EVT 7:28:06am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:28:06am TOTAL CMF = 8.19E-007



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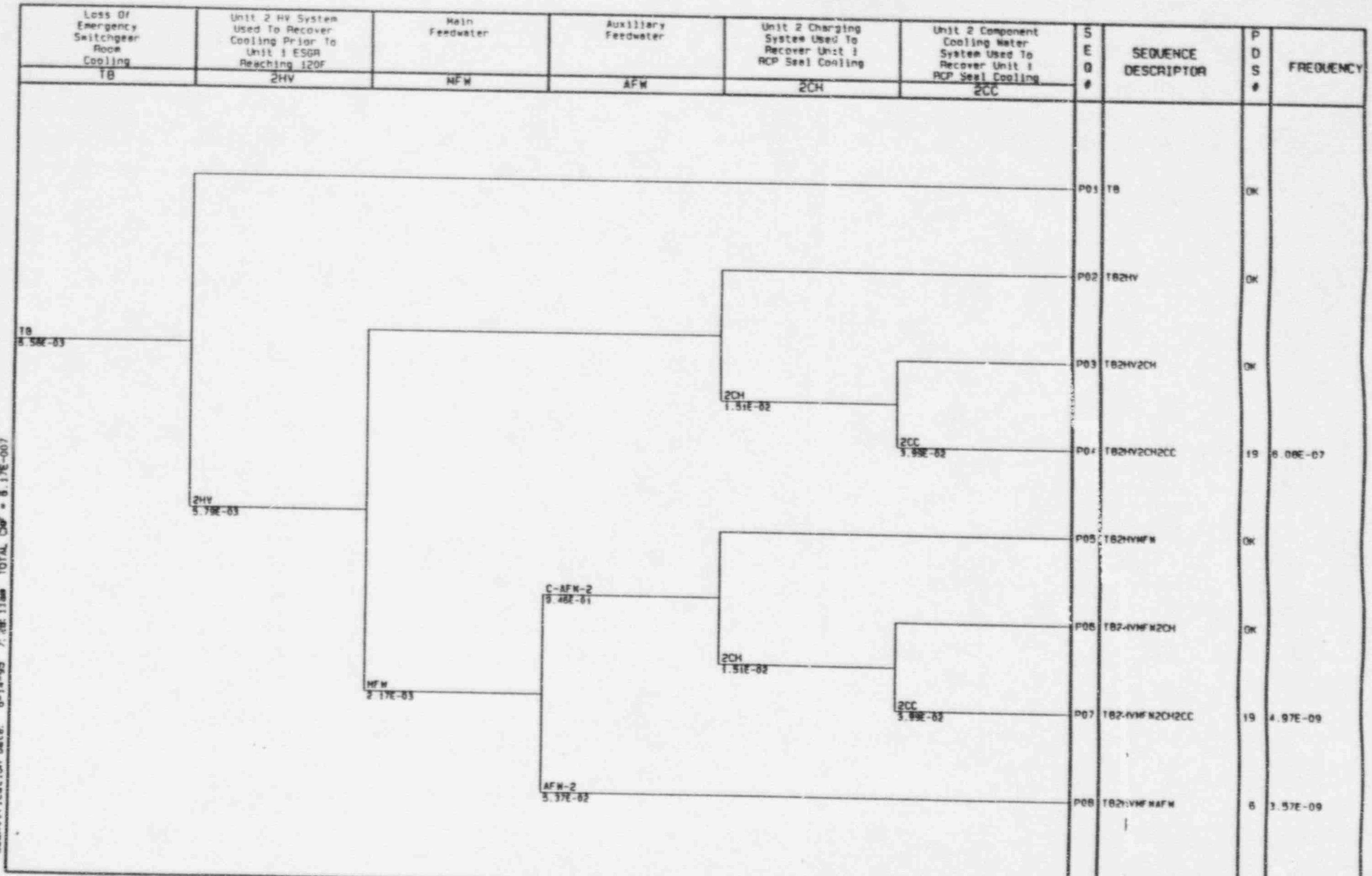
T7 D1: Steam Generator Tube Rupture Without High Head Safety Injection



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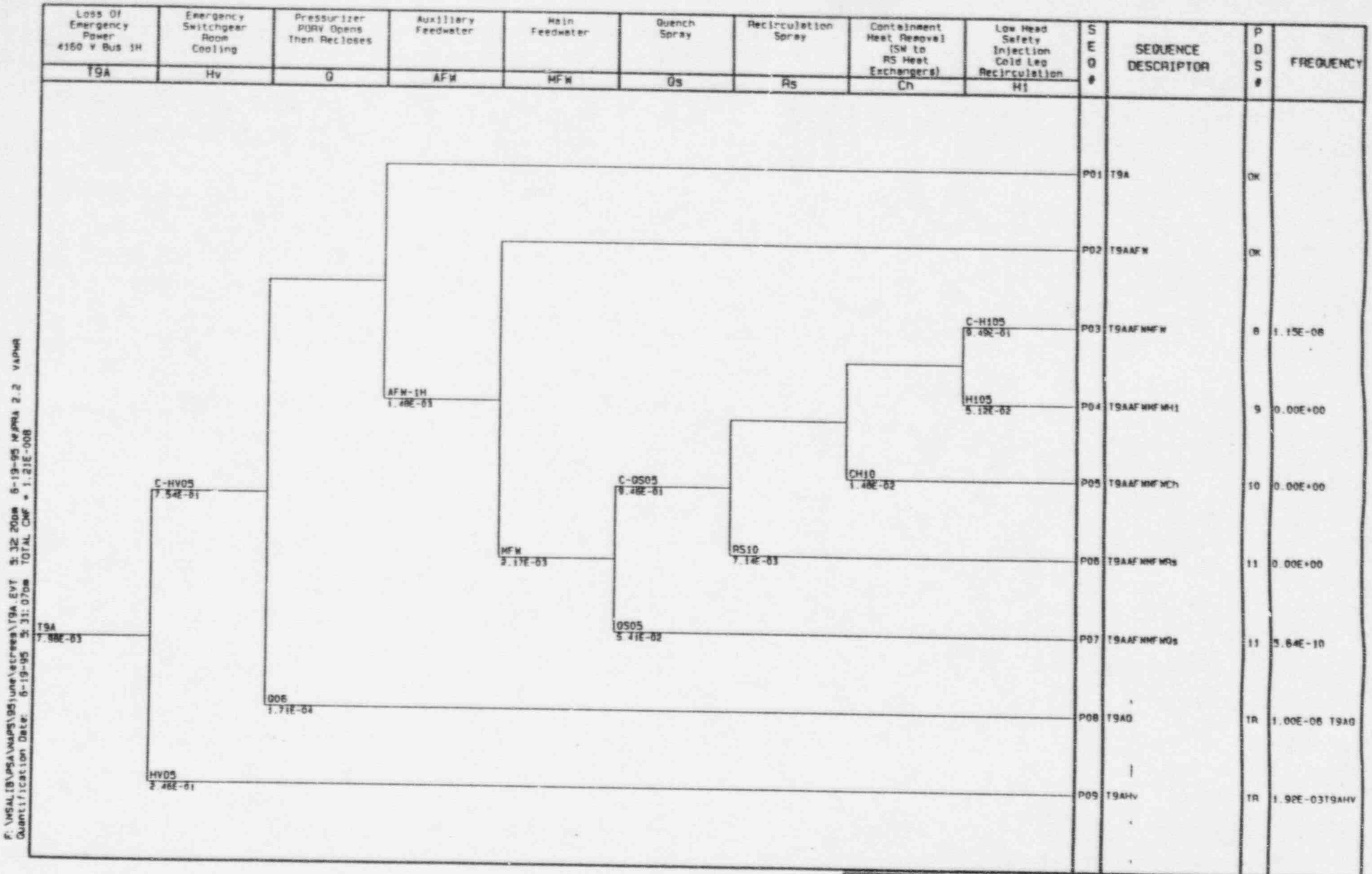
TB: Loss Of Emergency Switchgear Room Cooling

C:\W95\ETREES\TB.EVT 7:28:10am 6-14-95 NUPRA 2.2 VAPWR
Quantification Date: 6-14-95 7:28:11am TOTAL CMF = 6.17E-007



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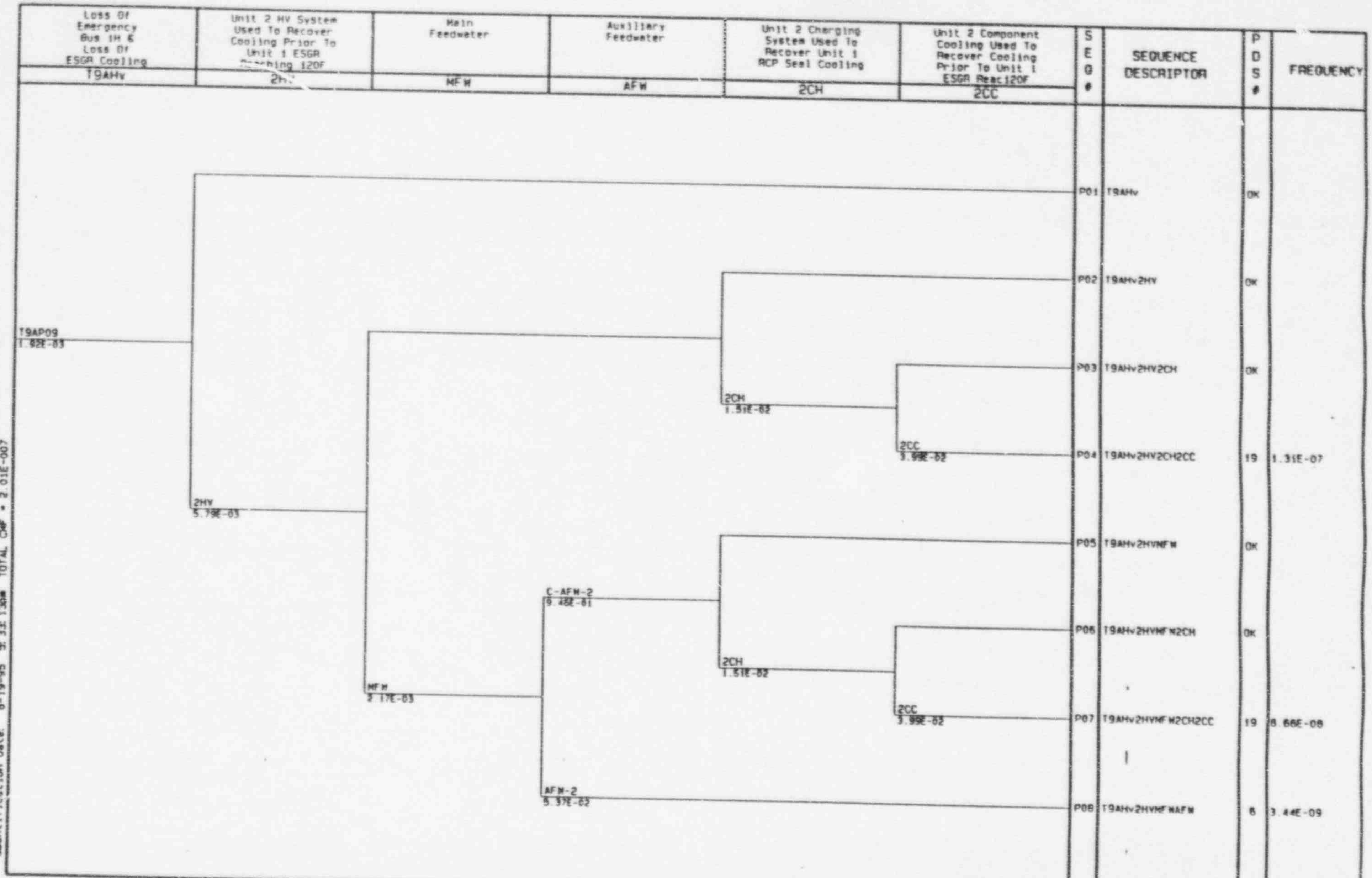
T9A: Loss Of Emergency Power 4160 V Bus 1H



F:\HSALIB\PSA\NAPS\95june\etrees\T9AHV.EVT 9:33:12am 6-19-95 NUPRA 2.2 VAPWR
Quantification Date: 6-19-95 9:33:13am TOTAL CMF = 2.01E-007

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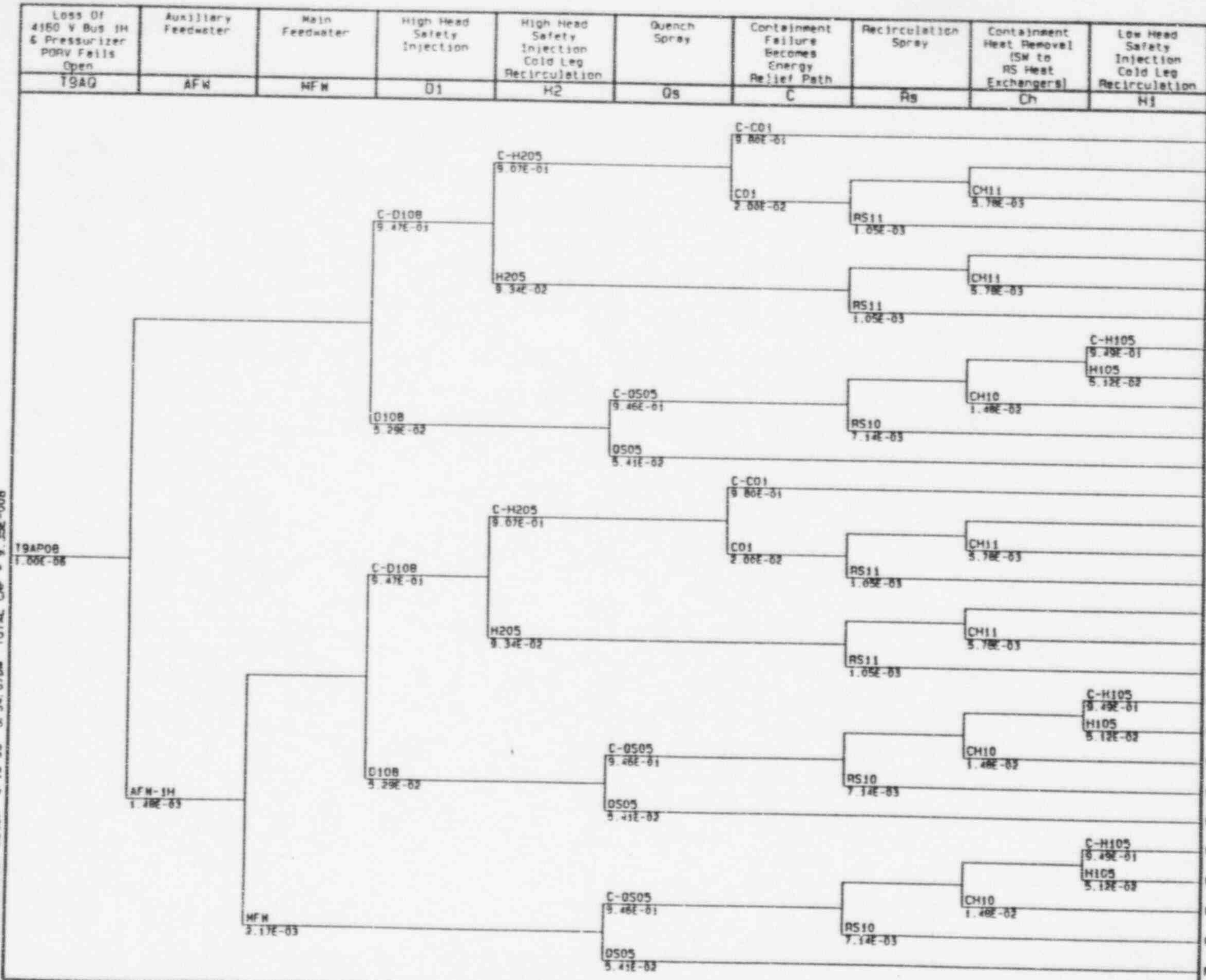
T9A Hv: Loss Of Emergency Power 4160 V Bus 1H
& Loss Of Emergency Switchgear Room Cooling

F:\HSALIB\PSA\NAPS\95june\etrees\T9AQ.EVT 5:34:06pm 6-19-95 NUPRA 2.2 VAPWR
Quantification Date: 6-19-95 5:34:07pm TOTAL CMF = 9.35E-008



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY	
P01	T9AQ	1R	8.45E-07	52
P02	T9AQC	1R	1.67E-08	52
P03	T9AQCCh	1	0.00E+00	
P04	T9AQCRs	2	0.00E+00	
P05	T9AQH2	21	5.13E-08	
P06	T9AQH2Ch	22	0.00E+00	
P07	T9AQH2Rs	23	0.00E+00	
P08	T9AQD1	20	4.02E-08	
P09	T9AQD1H1	21	4.38E-10	
P10	T9AQD1Ch	22	3.75E-10	
P11	T9AQD1Rs	23	0.00E+00	
P12	T9AQD1Qs	23	1.15E-09	
P13	T9AQAFW	1R	4.79E-10	52
P14	T9AQAFWC	1R	0.00E+00	52
P15	T9AQAFWCCh	1	0.00E+00	
P16	T9AQAFWCRs	2	0.00E+00	
P17	T9AQAFWH2	21	0.00E+00	
P18	T9AQAFWH2Ch	22	0.00E+00	
P19	T9AQAFWH2Rs	23	0.00E+00	
P20	T9AQAFWD1	20	0.00E+00	
P21	T9AQAFWD1H1	21	0.00E+00	
P22	T9AQAFWD1Ch	22	0.00E+00	
P23	T9AQAFWD1Rs	23	0.00E+00	
P24	T9AQAFWD1Qs	23	0.00E+00	
P25	T9AQAFWMFW	20	0.00E+00	
P26	T9AQAFWMFWH1	21	0.00E+00	
P27	T9AQAFWMFWCh	22	0.00E+00	
P28	T9AQAFWMFWRs	23	0.00E+00	
P29	T9AQAFWMFWQs	23	0.00E+00	

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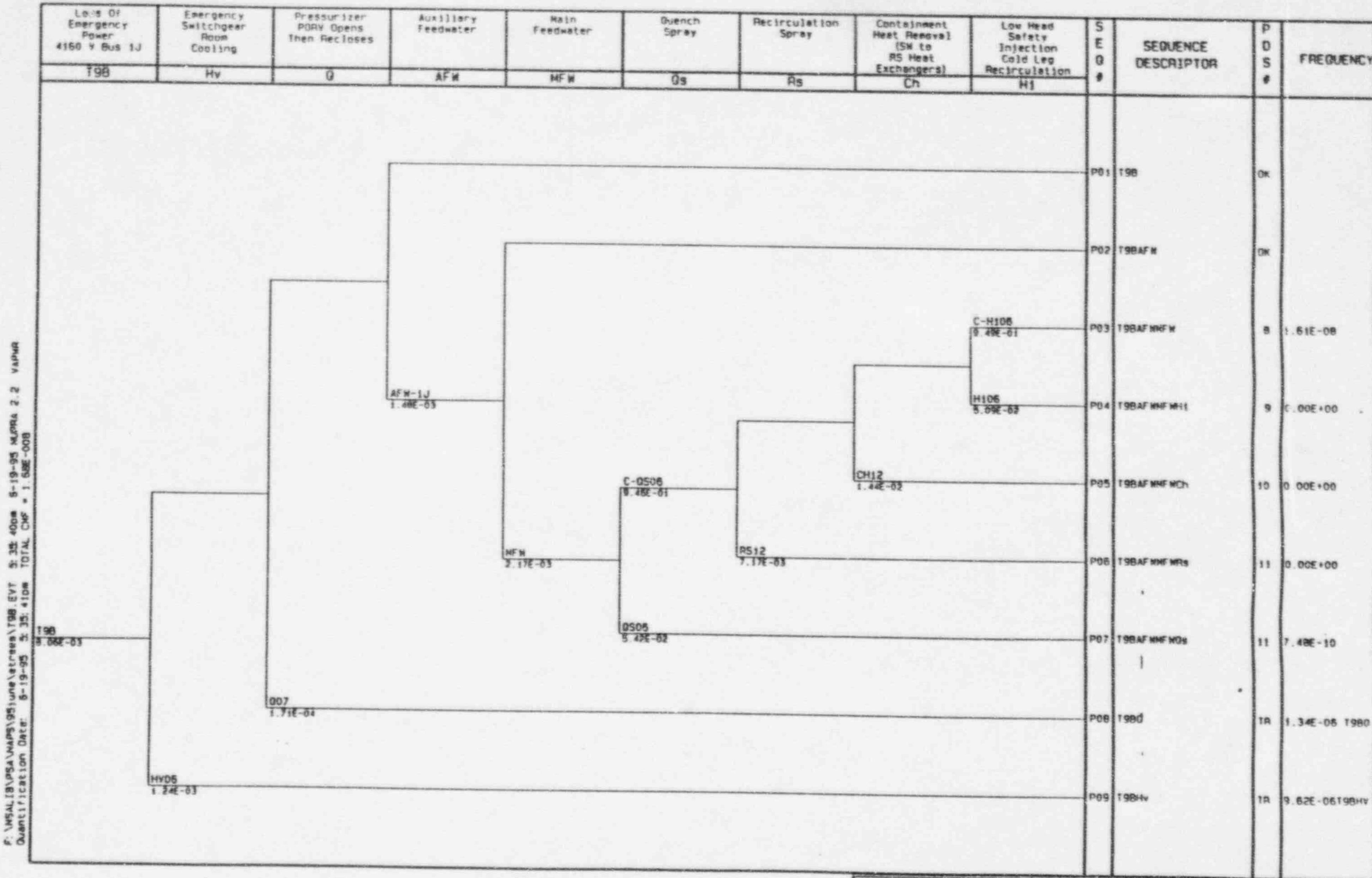
T9A Q: Loss Of Emergency Power 4160 V Bus 1H & Pressurizer PORV Fails Open



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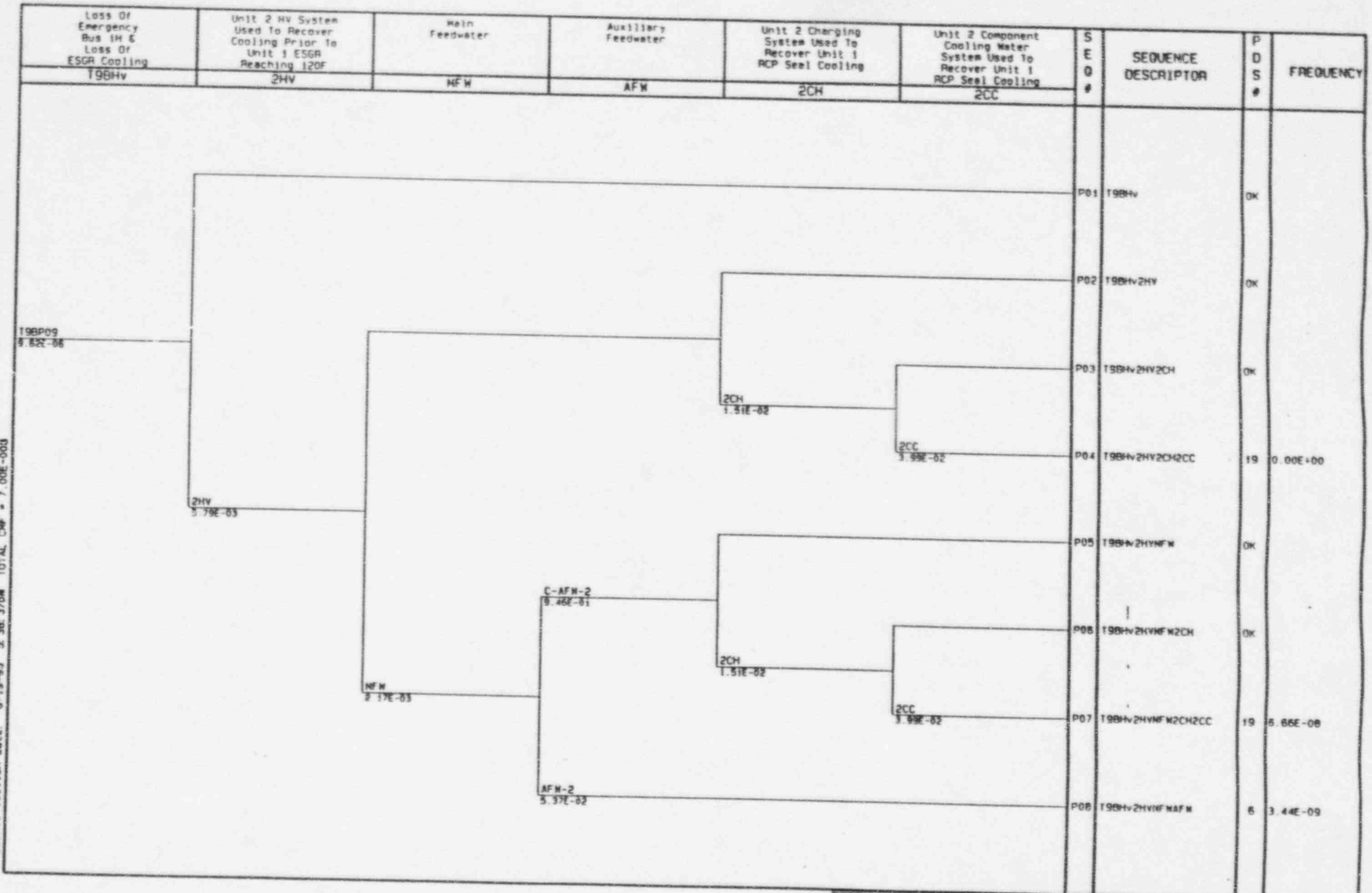
T9B: Loss Of Emergency Power 4160 V Bus 1J



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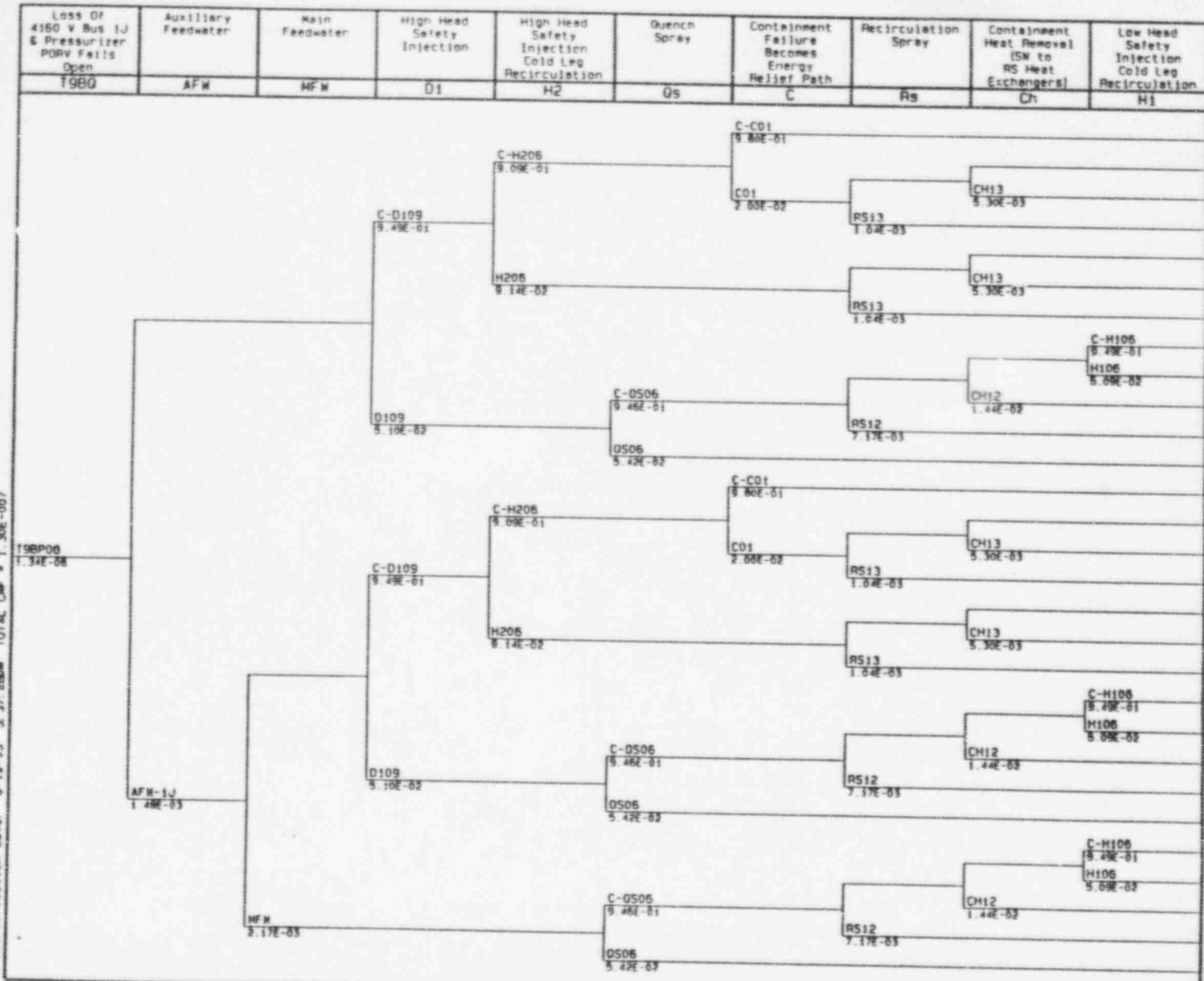
T98 Hv: Loss Of Emergency Power 4160 V Bus 1J & Loss Of Emergency Switchgear Room Cooling

F:\NSALIB\PSA\NAPS\95june\etrees\T98HV.EVT 5:38:38pm 6-19-95 NUPRA 2.2 V.PWR
Quantification Date: 6-19-95 5:38:37pm TOTAL CMF = 7.00E-008

F:\WSALIB\PSA\NAPS\95june\etrees\T98Q.EVT 5:37:28pm 6-19-95 NUPRA 2.2 VAPWA
Quantification Date: 6-19-95 5:37:28pm TOTAL CMF = 1.30E-007



SEQ #	SEQUENCE DESCRIPTOR	PDS #	FREQUENCY	
P01	T98Q	1R	1.13E-08	S2
P02	T98QC	1R	2.22E-08	S2
P03	T98QCCh	1	0.00E+00	
P04	T98QCRs	2	0.00E+00	
P05	T98QH2	21	7.26E-08	
P06	T98QH2Ch	22	0.00E+00	
P07	T98QH2Rs	23	0.00E+00	
P08	T98QD1	20	5.41E-08	
P09	T98QD1H1	21	1.40E-09	
P10	T98QD1Ch	22	0.00E+00	
P11	T98QD1Rs	23	0.00E+00	
P12	T98QD1Qs	23	2.10E-09	
P13	T98QAFW	1R	6.36E-10	S2
P14	T98QAFWC	1R	0.00E+00	S2
P15	T98QAFWCCh	1	0.00E+00	
P16	T98QAFWCRs	2	0.00E+00	
P17	T98QAFWH2	21	0.00E+00	
P18	T98QAFWH2Ch	22	0.00E+00	
P19	T98QAFWH2Rs	23	0.00E+00	
P20	T98QAFWD1	20	0.00E+00	
P21	T98QAFWD1H1	21	0.00E+00	
P22	T98QAFWD1Ch	22	0.00E+00	
P23	T98QAFWD1Rs	[illegible]	0.00E+00	
P24	T98QAFWD1Qs	23	0.00E+00	
P25	T98QAFWMFW	20	0.00E+00	
P26	T98QAFWMFWH1	21	0.00E+00	
P27	T98QAFWMFWCh	22	0.00E+00	
P28	T98QAFWMFWRs	23	0.00E+00	
P29	T98QAFWMFWQs	23	0.00E+00	

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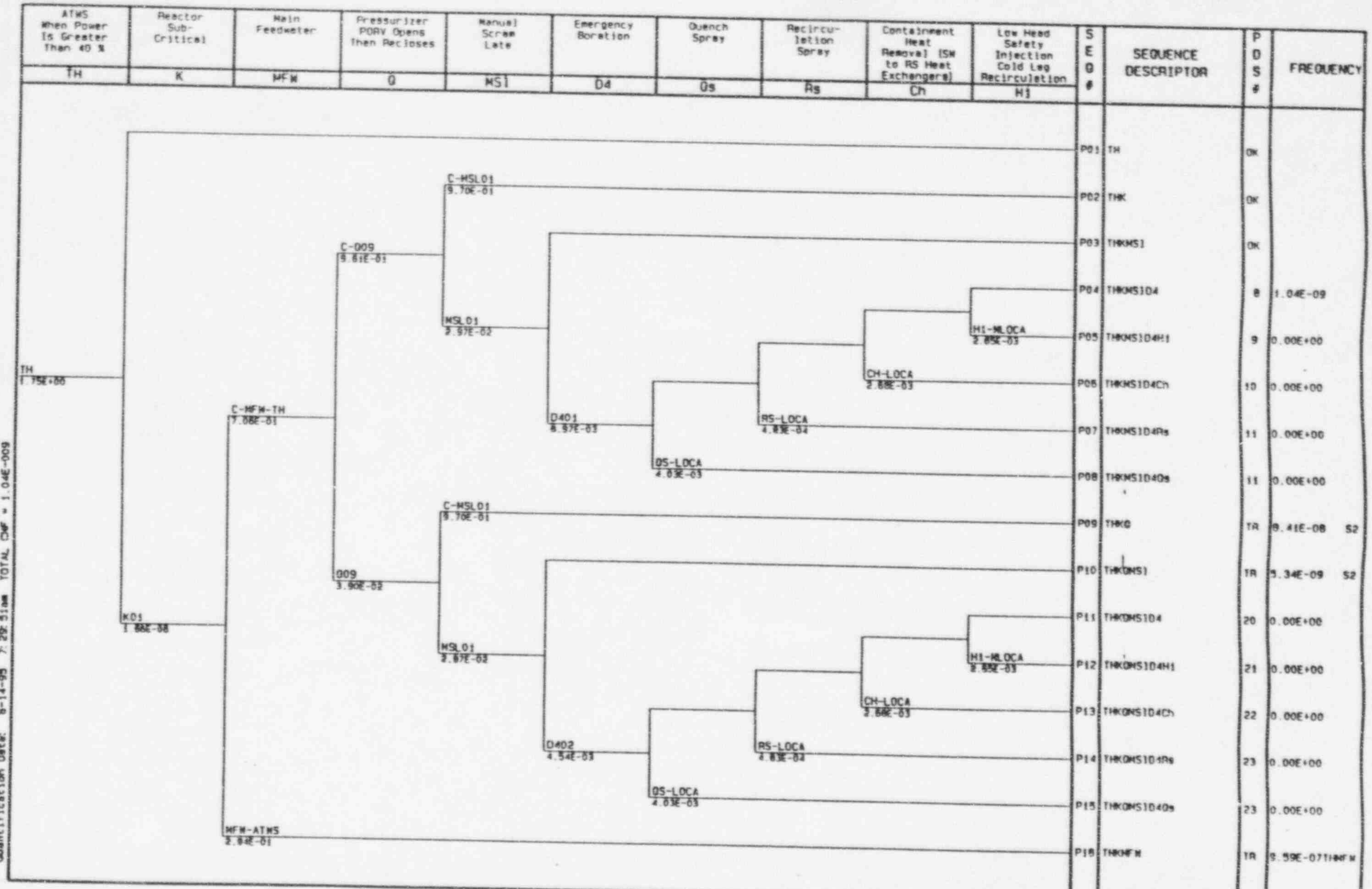
T98 Q: Loss Of Emergency Power 4160 V Bus 1J & Pressurizer PORV Fails Open



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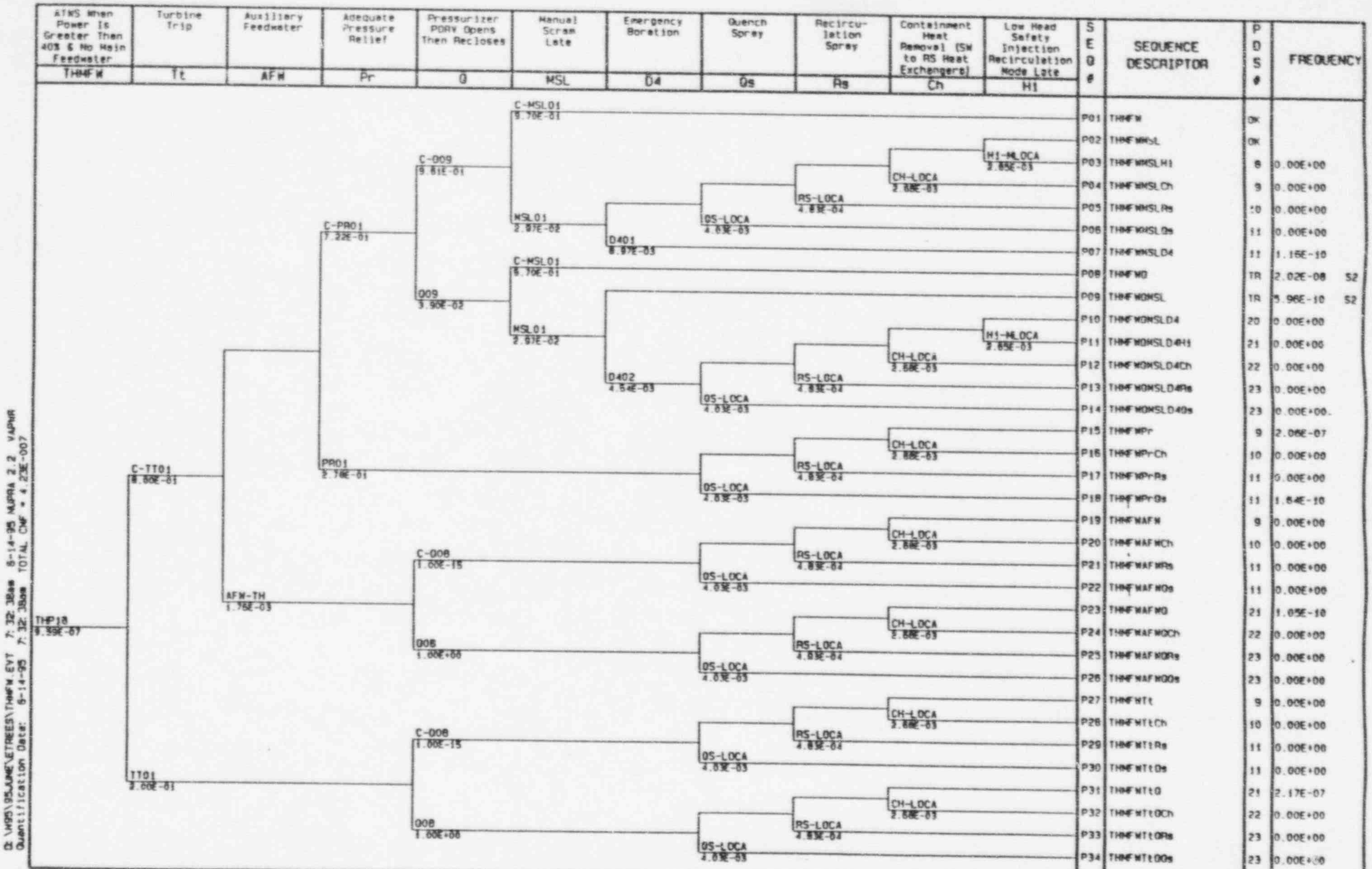
TH: Anticipated Transient Without a Scram (ATWS) When Greater Than 40% Reactor Power



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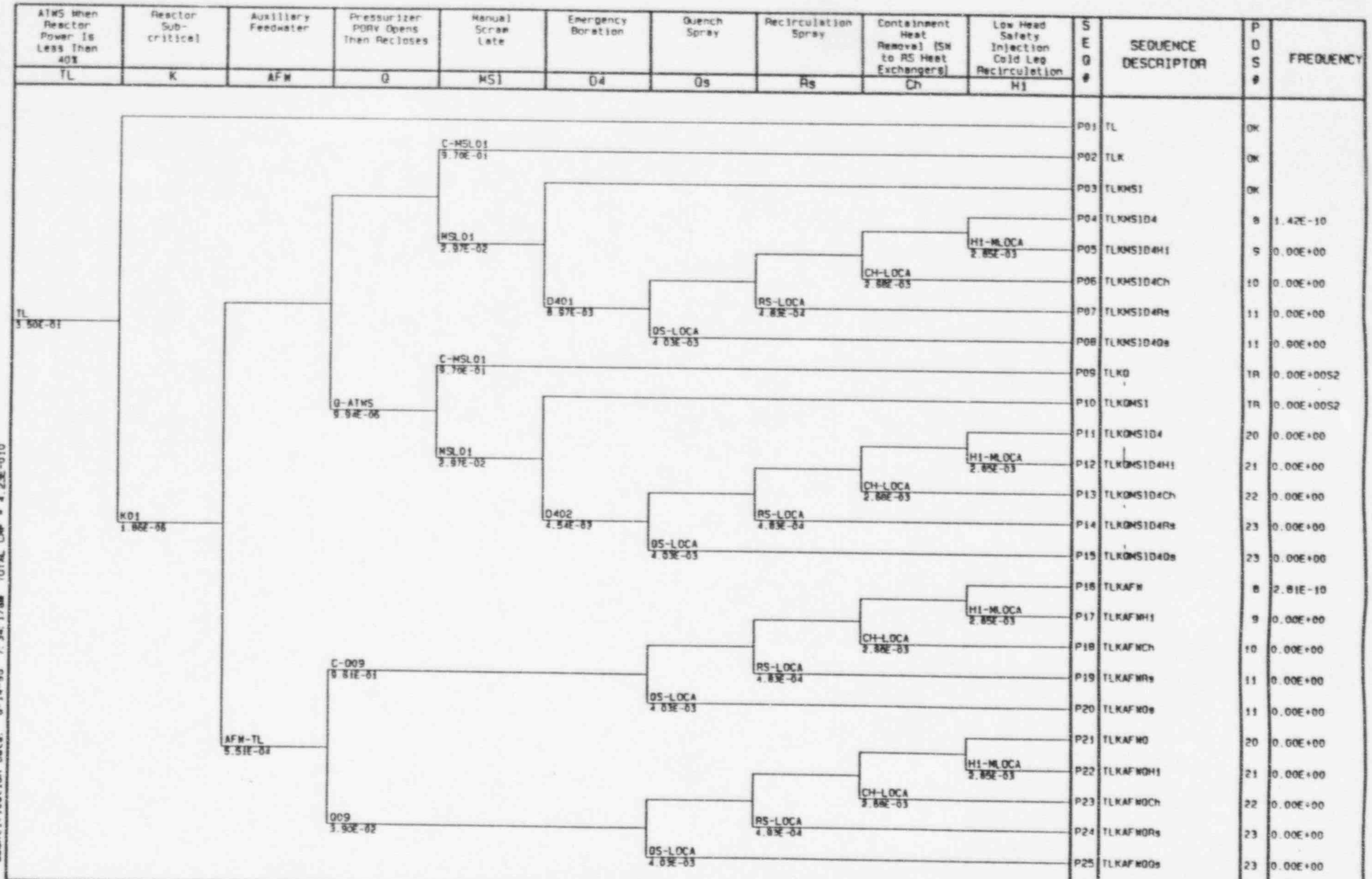
TH MFW: Anticipated Transient Without A Scram (ATWS) When Greater Than 40% Reactor Power & No Main Feedwater

Q:\W95\95JUNE\ETREES\TL.EVT 7:34:16am 8-14-95 MUPRA 2.2 VAPMA
Quantification Date: 8-14-95 7:34:17am TOTAL CMF = 4.23E-010



North Anna Probabilistic Safety Assessment
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TL: Anticipated Transient Without Scram
When Reactor Power Is Less Than 40%