# Common Cause Fault Rates for Pumps

Estimates Based on Licensee Event Reports at U.S. Commercial Nuclear Power Plants, January 1, 1972 Through September 30, 1980

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Prepared for U.S. Nuclear Regulatory Commission

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#### ABSTRACT

This report presents estimates of common cause fault rates and related quantities, based on Licensee Event Reports for pumps in nuclear reactors. The Licensee Event Report data base is described. For estimating rates, the binemial failure rate model is used, extended to allow for the substantial observed plant-to-plant variability, and for shocks that by their nature make all the pumps in a system inoperable. Every quantity is estimated by both a point estimate and a 90% interval. All rates are expressed per hour.

FIN No. A6283--Licensee Event Report Failure Rate Analysis Program

#### SUMMARY

This report presents estimates of common cause failure rates, common cause fault rates, and related quantities, based on Licensee Event Reports for pumps in nuclear reactors.

The data consist of 837 Licensee Event Reports, describing pump faults from January 1, 1972, through September 30, 1980. The term fault includes both failures and command faults. Both pump and fault are precisely defined in the body of the report.

Two kinds of fault are considered, failure to start on demand, and failure to operate after starting. The systems considered, their relevant exposure times, and their populations are described and tabulated. Imperfections in the data are also discussed.

Common cause faults are defined as faults that are synchronized by some external shock to the system under consideration. Both human errors and hardware failures may act as shocks. The report distinguishes between a nonlethal shock, which causes a random number of pumps to be inoperable, and a lethal shock, which by its nature causes all the pumps in the system to be inoperable.

Turbine-driven pumps have high fault rates, and so must be considered separately. Examination of the data also reveals substantial variability in the fault rates from plant to plant, and to a lesser degree from system to system, for presumably similar pumps. Therefore, the rates are assumed to vary and distributions are fitted to the data, both for the rate of individual faults (those not due to common cause), and also for the rate of common cause events when there are enough data. Other quantities of interest are then estimated, based on the binomial failure rate (BFR) model, extended to allow for lethal shocks.

Every quantity is estimated by both a point estimate and a 90% interval. Many of the intervals are quite wide, reflecting the observed

plant-to-plant variability. Because the numbers of demands are unknown, and the operating hours of most pumps are unknown, the only rates estimated are per exposure hour, normally calendar hour or critical hour.

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## COMMON CAUSE FAULT RATES FOR PUMPS: ESTIMATES BASED ON LICENSEE EVENT REPORTS AT U.S. COMMERCIAL NUCLEAR POWER PLANTS, JANUARY 1, 1972--SEPTEMBER 30, 1980

#### INTRODUCTION

Common cause faults are defined, for this report, as faults that are synchronized by some external shock to the system. The seriousness of having several pumps simultaneously inoperable due to a single cause makes it essential to estimate the rate of pumps becoming simultaneously inoperable. Therefore, this report presents estimates of common cause and individual fault rates and failure rates, for pumps in nuclear power plants.

The data are Licensee Event Reports. They are described and discussed in the first portion of this report. Two common cause aspects of the data are considered in detail: correctly classifying reported events as common cause events or not, and deciding which groups of pumps in a plant might be susceptible to simultaneous failure due to a common cause shock.

The binomial failure rate method is used to estimate the common cause rates and related quantities of interest. Every quantity of interest is estimated both by a point estimate and by a 90% interval. Many of the intervals are rather wide, reflecting the substantial plant-to-plant variability evident in the data. A section of the report discusses how to use binomial failure rate estimates in applications such as fault tree analyses.

All the basic methodology is described in the body of the report. Certain technical details not covered in the references are given in Appendix A. The required plant information, including exposure times and pump populations, is given in Appendix B. The estimates themselves are found in Appendix C. Appendix D consists of a listing of one-line summaries of all the data, and a separate listing of summaries of the reported common cause events.

#### THE DATA

#### Event Reports

The raw data consist of 837 Licensee Event Reports (LERs) of pumps at 68 U.S. commercial nuclear power plants, for the time period January 1, 1972, through September 30, 1980, as given by Trojovsky. They include reports from 44 pressurized water reactors (PWRs), i.e., those designed by Babcock & Wilcox, Combustion Engineering, and Westinghouse and 24 boiling water reactors (BWRs), i.e., those designed by General Electric Corporation. Events that occurred before a plant's initial criticality are not considered. Some errors and omissions in the data as originally published have been corrected.

One-line summaries of the data are presented in Appendix D. These summaries are also printed separately for different groups of pumps, accompanying the estimates in Appendix C. To facilitate checking for possible common cause, underscores are used to separate unrelated lines. Lines not so separated describe events that occurred at the same plant on the same date. Appendix C also contains some tabular summaries of the data, giving the total numbers of various kinds of faults.

Except for the common cause coding, the letter and number codes printed in the one-line summaries of Appendix C all have the same meanings as in Reference 1. The codes are briefly explained in a table in Appendix B. In the one-line summaries, the following information is given on each line:

<u>Vendor</u> This code tells whether the plant was designed by Babcock & Wilcox, Combustion Engineering, Westinghouse, or General Electric.

Plant This is a 3-character code identifying the plant.

<u>Control Number</u> This is the unique 6-digit identifier assigned to the LER. If a single LER refers to more than one pump or more than one date, the control number for this line has another character appended: an asterisk, or a letter A, B, C, etc.

Failure Date The month, day, and year are given.

System This code identifies the system to which the pumps belong, such as containment spray or high pressure coolant injection.

Component This tells whether the pump is motor driven, turbine driven, or diesel-driven.

Failure Mode and Cause These codes classify the kind of fault. For example the code for mode might mean does not start, while the code for cause might mean personnel error-maintenance.

Type This code tells whether the event is a failure or a command fault, whether it is an individual fault or caused by a common cause shock, and whether it is recurrent or not.

<u>Failure Number</u> This tells the number of pumps that were inoperable, or for a single pump, the number of times it was inoperable as reported by this line.

Activity This tells when the fault was discovered, for example, during normal operation or during maintenance.

<u>Event Classification</u> The likelihood of a kind of fault may depend on elapsed time or on the number of demands. This code classifies faults as time-related or demand-related, as described more fully in Reference 1.

Mode Description and Cause Description This is a very condensed narrative, from the LER.

## Definitions

The definitions given here follow Reference 1. A <u>pump</u> is defined as the pumping unit, together with its prime mover, coupling, and associated mechanical controls. Suction and discharge valves and strainers are not

considered part of the pump. Neither are electrical instrumentation and control elements. Suppose that the cooling system of the prime mover is served by a major plant cooling water system, such as the service water or component cooling water system. That portion of the prime mover cooling system that is downstream from the major cooling water system supply valve and upstream from the major cooling water system return valve is considered part of the prime mover. The prime mover of a motor-driven pump includes the motor and the junction where the power source enters the motor casing. It does not include components upstream from this junction, such as the motor control center, supply breaker, or power supply cables. The prime mover of a turbine-driven pump includes the turbine, the mechanical controls of the turbine governor, the trip-throttle valve, and the lube-oil systems used in operating the governor system or lubricating the bearings. Anything upstream from the trip-throttle valve or downstream from the turbine exhaust is considered outside the boundary of the turbine. The prime mover of a diesel-driven pump includes the diesel engine, the mechanical controls of the governor and of the overspeed trip mechanism, and the support systems: the fuel system, the air supply and exhaust system, the lube-oil system, and the starting system. Starting batteries are outside the boundary.

Failures are distinguished from command faults. A <u>failure</u> is an event in which the pump itself needs repair. A <u>command fault</u> is an event in which the pump does not fail, but it does not function as desired due to external inputs or lack of inputs. For example, if a pump is commanded to start, but it fails to function because its feeder breaker fails or an operator fails to vent its casing, then the pump has not failed; it would operate satisfactorily if power were available or the pump were full of liquid. The term <u>fault</u> is used to include both failures and command faults. This report presents estimated rates based both on all faults and on failures only. To avoid needless repetition, however, the explanatory text is given just once, and is expressed in terms of faults rather than failures. Unless the context clearly rules it out, any statement about faults should be understood to apply as well to any subset of faults, such as failures.

Five failure modes, defined below, are identified in the data. Both failures and command faults can involve any of the five modes. Leakage/ rupture describes a fault in which the pump is operational, but is removed from service because of excessive fluid or vapor leakage. Loss of function means that the pump was operating in a degraded condition, such as with low flow or low head. A pump does not continue to run if it is automatically or manually tripped off line to prevent damage to the pump. A pump does not start if it either fails to start on demand or else operates only briefly before tripping off line. The mode unavailable/not demanded is used for events when the pump was discovered in an inoperable condition. but it was not demanded either for operation or for a test. The codes for these five failure modes are given in Table B-4 of Appendix B. LERs describing other kinds of events are not considered in this report. For example, informational items, such as the failure to perform a test on schedule, are not considered. Neither are reports of maintenance repair, when an incipient failure was repaired before the pump had become inoperable. Because LERs normally do not mention taking a pump out of service for scheduled maintenance or inspection, when the time limit of the technical specification is not exceeded, such events are also not included in this report.

Rates for two groups of failure modes are presented in this report. The failure modes "does not start" and "unavailable/not demanded" are combined as <u>failure to start</u>, and this rate is estimated. The other three failure modes are combined as <u>failure to operate after starting</u>, and this rate is estimated. This is not a perfect grouping of the failure modes, because, for example, it is not clear whether an undemanded pump would have failed to start or tripped after running. However, no perfect grouping of the failure modes is possible, and the grouping used should be adequate.

## Systems, Exposure Times, and Populations

## Systems

The pumps belong to various systems, such as the auxiliary feedwater system or the containment spray system. The systems considered in this

report are listed in Table B-1 of Appendix B. Some systems are present only in PWRs or only in BWRs. Others are present in both types of reactors.

The pumps in the different systems also fall into three categories: running, alternating, and standby. Running pumps are those which are operated during the entire time of criticality. The only such pumps considered in this report are in the reactor coolant system of PWRs and the coolant recirculation system of BWRs. Alternating pumps are those which are normally operated part of the time. The system, such as component cooling water, is run continually, but only some of the pumps in the system are running at any one time. Standby pumps are intended for use only in an emergency. Except for periodic tests, they are normally not running.

The three categories of pumps characteristically show different kinds of faults. Reported faults in running pumps are virtually always failures to operate after starting. (There is only one reported failure to start in the nine years of data.) Standby pumps have somewhat more reported failures to start than failures to operate after starting. Alternating pumps have a behavior between the other two.

The systems considered in this report, and given in Table B-1, are those of Table 1 of Reference 1, except that service water pumps are left out. The term service water is vague, and its scope is not generally agreed on. This leads to both inconsistent counts of the pump populations based on plant drawings, and inconsistent reporting in the LERs. The texts of about half the LERs for service water pumps seem inconsistent with the population counts of Reference 1. Therefore, service water pumps are not considered in this report.

## Exposure Times

The number of calendar hours and the number of critical hours for each plant are given in Tables B-2 and B-3 of Appendix B. They are taken from Reference 1. Each time starts with the initial criticality of the plant and ends on September 30, 1980, except for Dresden 1, which began a lengthy

shutdown, and stopped submitting LERs, on October 31, 1978, and Three Mile Island 1 and 2, which were both shut down after the accident of March 28, 1979.

To estimate fault rates, it is necessary to know the relevant exposure times, the number of hours when the pumps might be reported inoperable. Some systems, such as the component cooling water system, are run both during criticality and during shutdown, and are required for safety at all times. Therefore, LERs would be submitted for faults that occur at any time, and the relevant exposure time for such a pump is the number of calendar hours for the plant. Other systems, such as the standby liquid control system in BWRs, are required only during criticality. So the relevant exposure time for such a pump is the number of critical hours for the plant.

To determine the relevant exposure time for each system, the LERs themselves were used. The power level of the plant is supposed to be shown on each LER. If this level was zero, and if the narrative does not state that the reactor was starting up or had just tripped, then the reported event was presumed to have taken place during shutdown. Based on this classification, a sample of LERs from each system was examined, to see what fraction of the LERs report events that occurred during shutdown. If more than 20% occurred during shutdown, the relevant time for that system was taken to be calendar hours. If fewer than 10% occurred during shutdown, the relevant time was taken to be critical hours. (The total number of shutdown hours for all the plants is about 30% of the total number of calendar hours.) Every system was classified in this way with the following exceptions.

Turbine-driven pumps can only be operated when the plant is producing steam. Therefore the turbine-driven high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) pumps in BWRs were taken to have the critical hours of the plant as the relevant exposure time. Because PWR auxiliary feedwater systems typically contain at least one turbine-driven pump, critical hours were also taken as the exposure time for all auxiliary feedwater pumps, whether turbine-driven or not (exactly 7 of the 35 faults

in motor-driven auxiliary feedwater pumps occurred during shutdown; to use critical hours rather than calendar hours raises the estimated fault rate somewhat, but greatly simplifies the common cause calculations, when the whole auxiliary feedwater system must be considered as a unit). Finally, for pumps that serve for both low pressure coolant injection (LPCI) and residual heat removal (RHR), the pump was defined as an LPCI pump if the reactor was critical and as an RHR pump if the reactor was shut down. The exposure time is then taken to be critical hours for LPCI pumps and shutdown hours for RHR pumps.

Table B-1 shows the exposure times used in this report for estimating fault rates.

Rates of failure to start are normally presented as rates per demand instead of rates per hour. However the number of demands is unknown. Those who can estimate the average number of demands per hour can convert the rates of this report. Variation in the number of demands may contribute to the substantial apparent plant-to-plant variability in the fault rates.

For alterating and standby pumps, rates of failure to operate after starting are normally presented in terms of operating hours. Unfortunately, the fraction of time when these pumps are operating is unknown. Again, the user must supply a conversion factor.

## Populations

The number of pumps in each system at each plant is given in Tables B-2 and B-3 of Appendix B. They are taken from Reference 1, and have been corrected in a few cases. The ultimate sources of the populations are the drawings in the individual plant Final Safety Analysis Report.

## Imperfections in the Data

Not all faults in a plant are reported in LERs, and the strictness of the reporting policy may vary from plant to plant. It is not known how much of the observed plant-to-plant variation is due to differences in reporting strictness.

There may be a few imaccuracies in the listed pump populations.

Two missing elements in the data are the number of demands on the pumps and the number of operating hours for the pumps. These numbers may vary greatly from plant to plant, and contribute to the apparent variability in the fault rate per hour; however, they are unknown. Therefore, fault rates per demand or per operating hour cannot be estimated.

Finally, the LERs sometimes provide incomplete information, especially concerning the cause of the failures. This may lead to incorrect classification of the event in the data base. A letter is often written to follow up the LER. This was read whenever a one-line description or event classification was questioned, and the coding of the event was changed if appropriate. To minimize the effect of possible misclassifications, every event involving more than one pump or involving a common cause fault was checked at least twice. The effect of data misclassification is discussed at the end of the next section. Also, an attempt is made in Appendix A to assess the effect of missing data, by using derivatives of the parameter estimates. Although it is beyond the scope of this report to estimate the number of events unreported in the LERs, the derivatives of Appendix A can be used to approximate the effect of any presumed rate of underreporting (see the Effect of Data Inaccuracies section).

#### COMMON CAUSE CLASSIFICATION

In order to estimate the rate of common cause faults, it is necessary to determine which events in the data base are common cause faults and which are not. The crucial question for each event is: "Was there some shock, external to the pump(s) under consideration, that caused or could have caused simultaneous faults?" Synchronization of the faults is essential, because the importance of common cause faults stems from the seriousness of having several pumps simultaneously inoperable.

For example, at Beaver Valley on April 11, 1980, two of the three residual heat removal (RHR) pumps could not develop adequate flow, because they were airbound. The shock was air getting into the water, so that it could pass through the pipes to the RHR pumps. At Turkey Point 3 on May 8, 1974, two of the three auxiliary feedwater pumps failed to start because their packing was too tight. The shock was the improper maintenance that they received. At St. Lucie 1 on May 16, 1977, all four reactor coolant pumps became inoperable when off-site power was lost. Here the shock was the loss of power.

Notice that in the first two examples, the number of inoperable pumps was random--an air leak or improper maintenance on the packing could potentially have affected a different number of pumps. The third shock, however, was lethal--by its very nature it caused all the pumps in the reactor coolant system to be inoperable. In a later section, it will be necessary to distinguish between lethal and nonlethal shocks.

Because most shocks affect a random number of pumps, there may be a shock causing exactly one pump to be inoperable. When the data are examined, it is usually possible to decide whether the single pump failed on its own, or because of some shock that could potentially have caused other pumps to fail. For example, air binding may affect one pump or several related pumps. Therefore all events involving air binding are coded as common cause. As another example, at Davis-Besse on September 15, 1978, a component cooling water pump tripped because the person responsible had not reopened a heat exchanger outlet valve. The shock in this case was

the person working with the valve positions. It could potentially have caused additional pumps to be inoperable (indeed, at Brunswick 2 on September 7, 1980, incorrect line-up of the stop-check valves did affect the RCIC pump and the HPCI pump simultaneously). Correct identification of common cause shocks as the causes of these single failures helps in estimating the rate at which shocks occur. If such events were ignored, then few common cause events would remain to be used, and the statistical uncertainties in the estimates would be much larger than necessary.

Faults due to personnel error are often coded as common cause. For a personnel error affecting only one pump to be coded as common cause, it must be plausible that in similar circumstances, e.g., at another time or at another plant, the person could make the same mistake affecting more than one pump at the same time. This is the case in the above example with an improper valve line-up. But it is not the case with all personnel errors. For example, inadequate lubrication would result in a high failure rate, but not in synchronized failures. As another example, at Davis Besse on May 28, 1978, an operator accidentally bumped a diesel generator control switch. This de-energized two electrical buses, so that the operating decay heat pump lost its power. There apparently was immediate annunciation of the problem, because power was restored within two minutes. Therefore it is very unlikely that the operator could have gone on to bump a second switch, so the event is not coded as common cause. As a final example, at Rancho Seco on February 18, 1977, it was noticed that the steam drive to the turbine-driven auxiliary feedwater pump was tripped. Nearly all PWRs have only one steam-driven auxiliary feedwater pump. Therefore, there would be no second pump that could potentially have been affected, so the event is not coded as common cause.

Multiple failures are coded as common cause only if they appear to be synchronized rather than coincidental. As a case in point, consider an event at Beaver Valley on December 15, 1976. Two pumps developed leaks in their lube oil coolers, caused by erosion from particles in the river cooling water. The leaks were discovered about 11 hours apart. If the particles were unusual, and caused essentially immediate failure, then the

failures were synchronized and should be classified as common cause. However, the word erosion suggests a gradual wearout, with no synchronization. It seems plausible that in the environment of dirty water the lube oil coolers have a high failure rate, but fail independently. Why then did the two fail on the same day, if presumably it takes months for the leaks to develop? A likely explanation is that when the plant personnel saw one leak they went looking for others. Therefore, the events are classified as two recurrent individual failures, rather than as one common cause event.

Suppose that all the pumps in a system, for example all the containment spray pumps, were inoperable due to common cause. Such an event is coded as a lethal shock only if the shock by its nature automatically made all the pumps inoperable. That is, under similar circumstances, even at a plant with a different number of pumps in the system, all the pumps would again be inoperable. The most common example in the pump data is loss of power to the reactor coolant pumps. A lethal shock can also occur when a person, through misunderstanding or forgetfulness, intentionally takes the same (wrong action repeatedly, rendering all the pumps inoperable. For example, at Robinson 2 on November 23, 1977, during a startup, the circuit breakers were found racked out for all three HPCI pumps and both containment spray pumps. Someone had tested the pumps for operability and then racked out the breakers again.

As can be seen, the coding of common cause events involves some judgement on the part of the coder. An inadvertent experience with diesel generator data, described by Atwood and Steverson, sheds some light on the importance of the coder's judgement. After all the estimates had been calculated, Atwood and Steverson reexamined the diesel generator data, and changed the common cause coding of eight faults, each involving one diesel generator. Two failures became common cause; five command faults became common cause command faults; and one common cause command fault became not common cause. So there was a net increase of six common cause faults, each involving only one diesel generator. This was in a data base of 369 LERs, with 25 events initially coded as common cause. Of the estimates that would be used in a fault tree, one of them,  $r_2$ , changed by almost 25%. This is about 5% of the length of the interval for  $r_2$ . The changes are

smaller for the other quantities that would be used directly in fault trees. This suggests that the coder's judgement has a noticeable but not overriding effect. There is no a priori reason to believe that pump data is more difficult or less difficult to code than diesel generator data, so the experience reported in Reference 2 is probably relevant for this report.

#### EXAMINING THE DATA FOR STRUCTURE

## The Scope of Common Cause Events

Nearly all of the common cause events in the data are restricted to a single system, for example, to the residual heat removal system or the component cooling water system. These events are also the ones of greatest interest in a probabilistic risk analysis, since the pumps in a single system back each other up.

There are, however, some reports of common cause events that involve more than one system. These events are shown in Table 1. Not shown in Table 1, or included in the pump data, are any events when a power supply to a pump was de-energized while the pump was not demanded. It would be cumbersome to try to present common cause fault rates for all the kinds of events suggested by Table 1. Most of the systems in Table 1 perform distinct functions, so their possible common cause connections are not of great interest, and are not considered further in this report. The pairs of systems that are considered are the HPCI and chemical and volume control (CVC) systems in PWRs, and the HPCI and RCIC systems in most BWRs. The HPCI and CVC systems in PWRs are considered together because they could both be used to mitigate a small-break loss-of-coolant accident. Rates are presented treating these two systems like all the other systems. Then in addition, rates are presented based only on the data from the two systems, with the two considered as a single pooled system. The other two systems that are pooled are the HPCI and RCIC systems in those BWRs (all but seven) having a single turbine-driven HPCI pump and a single turbine-driven RCIC pump. These two pumps often seem to be maintained together and tested together, so it is reasonable to treat them as a single system.

The events in Table 1 are coded in the data base as common cause only if they are common cause within the single system under consideration. For example, the incorrect substitute breaker event is coded as three nonlethal common cause events, one in each of the three systems, because it is plausible that more pumps might have been affected in each system. The event with the common valve is not coded as common cause, because the valve

TABLE 1. COMMON CAUSE EVENTS INVOLVING MORE THAN ONE SYSTEM

Plant	Control No.	Date	Systems	Description
0E1	014806	1/28/76	L, F, G	Incorrect substitute breakers were installed for one LPCI pump, one containment spray pump, and one HPCI pump.
OE2	011071	12/9/74	L, F	Common suction valve was closed for one LPCI pump and one containment spray pump.
R02	019793	11/23/77	Н, F	Breakers for all 3 HPCI pumps and both containment spray pumps were racked out.
SA1	017700	5/6/77	Н, G	Both HPCI pumps and one chemical and volume control pump were tagged out.
SA1	023232	11/27/78	G, L	One chemical and volume control pump and one RHR pump did not start, because of an electrical bus failure.
BF 1	000518	11/10/73	н, Q	The HPCI and RCIC pumps were inoperable until manually reset, because of improper trip logic.
BR2	032454	9/7/80	Н, Q	Stop-check valves were shut for both the HPCI and RCIC pumps (the RCIC pump tripped; the HPCI pump was not demanded).

failed internally, and it was not connected to more than one pump in a system. The case of the racked-out breakers is coded as two lethal shocks, one for HPCI and one for containment spray, because the personnel error by its nature affected all the pumps in each system.

In summary, common cause events are considered only within a single system, except that turbine-driven HPCI and RCIC pumps in BWRs are considered as a single system, and HPCI and CVC pumps in PWRs are considered both separately and as a single pooled system.

## Variability in the Fault Rates

Experienced engineers know, and the LERs confirm, that turbine-driven pumps have higher fault rates than motor-driven pumps. Therefore, systems with turbine-driven pumps must be treated separately. These are the HPCI and RCIC systems in all but five of the BWRs, and the auxiliary feedwater system in PWRs. The auxiliary feedwater system usually has one turbine-driven pump and two motor-driven pumps, although these numbers vary.

Because of this consideration, and those of the previous section, there are six groups of pumps for which fault rates are presented. These groups are listed in Table 2.

Within any of these groups of pumps, the fault rates show substantial plant-to-plant variability. There is also some variation in the rates from

TABLE 2. GROUPS OF PUMPS FOR WHICH FAULT RATES ARE ESTIMATED

Running Pumps:

Reactor coolant/recirculation pumps

Alternating Pumps:

PWR chemical and volume control (CVC) pumps BWR feed pumps that serve for HPCI (4 plants)

PWR poric acid transfer pumps Component cooling water pumps Residual heat removal (RHR) pumps

PWR Auxiliary Feedwater Pumps

BWR turbine-driven HPC1 and RCIC pumps (treated as one system)

Other Standby Pumps:

BWR low pressure core spray pumps

Containment spray pumps

PWR high pressure coolant injection (HPCI) pumps Low pressure coolant injection (LPCI) pumps

BWR standby liquid control pumps

PWR HPCI and CVC pumps (treated as one system)a

a. These two systems are pooled here, in addition to being considered separately above.

system to system. For example, the five systems classified as alternating show some apparent differences in their fault rates. But the plant-to-plant variability is dominant, as discussed below.

As a first step in estimating fault rates, the variability in the rates must be quantified. Suppose that the variability in some fault rate is to be modeled. The rate may be the rate of nonlethal common cause events, the rate of individual (i.e., not common cause) events, or if enough data are available the rate of lethal common cause events. The data sources are the different systems at the different plants, for example the five alternating systems at the 68 plants. To model the variation among the different plants and systems, assume that the rate has a two-parameter gamma distribution. A gamma distribution is used because it is a convenient distribution covering the range  $(0,\infty)$ . Some other distribution, such as lognormal, might work equally well. Based on the observed faults, find the maximum likelihood estimates of the two unknown parameters. This gives a gamma distribution that fits the data. An interval covering 90% of the fitted distribution is an approximate 90% interval for the fault rate. That is, the probability that such an interval will include a randomly chosen new fault rate (say, from a system at a plant not yet analyzed) is approximately 90%.

It is conceivable that the fault rate is strongly influenced by the type of plant (BWR or PWR), or by the system. For example, treating the alternating systems separately might result in five short tolerance intervals, covering different ranges, rather than one long tolerance interval. Although such a breakdown might conceivably help, in fact it does not. Therefore, system-specific rates are not given, except to the extent that single systems coincide with the groups given in Table 2.

Typically, most of the plants show no faults, while a few may show recurrent faults. This results in highly skewed fitted distributions, having a maximum at zero, a long flat tail to the right, and a 90% interval that is orders of magnitude wide. While such a distribution is not what a risk analyst desires, it does reflect the great variability in the data.

Occasionally a single plant or system has so many recurrent faults that it is an outlier, i.e., it is clearly different from the other plants. The most extreme example is the turbine-driven auxiliary feedwater pump at Arkansas 2. However, no outliers are so far out that they have to be excluded. For details, see the first section of Appendix A.

## ESTIMATING RATES USING AN EXTENDED BINOMIAL FAILURE RATE MODEL

## The Model

Let m be the number of pumps in a system at a plant. The model assumes that there are three possible kinds of fault:

- 1. Each pump can become inoperable individually, and has a constant fault rate  $\lambda$ .
- 2. A common cause shock can occur in the system, with constant occurrence rate μ. If a shock occurs, the pumps in the affected system are made inoperable independently of each other, each with probability p, so the total number of inoperable pumps is random. Vesely<sup>3</sup> calls this the binomial failure rate (BFR) model, because the number of inoperable pumps, given that a shock occurs, is a binomial(m, p) random variable. Estimators using this model are developed by Vesely<sup>3</sup> and Atwood.<sup>4,5</sup> These shocks are called nonlethal shocks, to distinguish them from the shocks defined below.
- 3. A <u>lethal shock</u> can occur in a system, with constant occurrence rate ω. A lethal shock, by its very nature, causes every pump in the affected system to be inoperable. The number of inoperable pumps is not random, but must equal m. Such events normally involve a procedural error or a personnel misunderstanding, or some hardware failure to the whole system, such as loss of offsite power.

Some quantities of interest are listed below. The notation for p,  $\lambda$ , and  $\mu$  agrees with Reference 4. The quantity  $\lambda_+$  is called  $\lambda_+'$  in that reference. The quantities are

fault rate for an individual pump, not counting faults due to common cause shocks

= rate of nonlethal shock occurrences

p = probability that a specific pump is inoperable, given that a nonlethal shock occurs

 $\lambda_+$  =  $\mu(1 - q^m)$  = rate of nonlethal shocks that cause at least one pump to be inoperable (rate of visible nonlethal shocks). Here, q = 1 - p

ω = rate of lethal shock occurrences

 $r_1$  =  $\lambda$  +  $\mu p$  +  $\omega$  = rate at which a specific pump becomes inoperable, either as an individual fault or due to a shock

 $r_k = \mu p^k + \omega$  = rate at which a specific set of k pumps becomes inoperable simultaneously (due to a shock)

 $\beta = [\mu p(1 - q^{m-1}) + \omega]/r_1 = long-term fraction of pump faults that occur in multiple faults; called the beta factor by Fleming.<sup>6</sup>$ 

The quantities  $r_1, r_2, \ldots$  are the relevant rates for fault tree analysis. For, if a cut set of a fault tree involves k pumps,  $k \ge 1$ , then the relevant rate is  $r_k$ , and the probability that the k pumps all fail in a short time t is  $r_k$ t plus terms of order  $t^2$ . The use of  $r_1$ ,  $r_2$ , etc., is discussed in the Application section, and in Appendix A. The expression given for ß ignores the time for discovery and repair of faults.

The basic binomial failure rate model, as defined in Reference 3, does not include lethal shocks. Including them has two advantages. First, it

models the data more accurately, if lethal shocks are observed, without making the model much more complicated. Second, inclusion of the lethal shock rate,  $\omega$ , puts a floor underneath the estimates of  $r_k$ , below which they cannot sink. The basic BFR method would estimate  $r_k$  as  $\mu p^k$ , for k>1. If p is small and k is large, then  $\mu p^k$  can be microscopic. Using  $r_k=\mu p^k+\omega$  keeps  $r_k$  up at a realistic level, because the Bayes estimate of  $\omega$  is always positive (even when the observed number of lethal shocks is zero).

#### Estimation

This section briefly describes the estimation procedure based on the above model. The Bayesian methods developed by  $Atwood^{4,5}$  are used, extended to allow for plant-to-plant variation and lethal shocks.

The point estimates given are Bayes means. The mean is used, rather than the mode or the median, because it is usually the largest of the three, and in fact often the only one of the three that is not virtually zero. The median is used for ß, because it is expensive and difficult to compute the mean. It should be realized that when the distribution has a large variance, then no single point—be it median, mean, or some other point—adequately identifies the location of the distribution. The interval estimates given are Bayes 90% intervals, with a 5% probability in each tail.

The use of Bayesian methods is unavoidable, because classical non-Bayesian methods do not give confidence intervals for complicated expressions such as  $\mathbf{r}_i$ , or even for simple expressions such as  $\mathbf{p}$  when the data are obtained from plants with different numbers of pumps. The Bayesian distributions used are either estimated directly from the data, to reflect the apparent variability in the parameters, or else are calculated in the usual way based on diffuse prior distributions. Therefore, the results obtained should not differ markedly from non-Bayesian results, if the latter were obtainable.

First, a gamma distribution is fitted to the observed individual faults of the pumps. This was described in Examining the Data for Structure and defines a distribution for the parameter  $\lambda$ . Similarly, if enough faults are observed, a gamma distribution is fitted to the observed nonlethal common cause events, giving a distribution for the parameter  $\lambda_+$ . For reactor coolant/recirculation pumps, there are enough observed lethal shocks so that a distribution for  $\omega$  can also be estimated.

Any variability in p, from plant to plant or shock to shock, is not estimated, because a method for doing this has not been developed. Therefore, standard Bayesian methods are used to get posterior distributions for p, and for  $\lambda_+$  and  $\omega$  when few or no common cause events occurred. For p, an approximately noninformative prior distribution is used, as described in Reference 5, pp. 16-17. For  $\lambda_+$  and  $\omega$ , a noninformative prior distribution is used, proportional to  $\lambda_+^{-1/2}$  or  $\omega^{-1/2}$ .

The quantities  $\mu$ ,  $\lambda$ ,  $\lambda_+$ , and  $\omega$  are treated as fundamental. The distributions of all the other quantities are obtained from the distributions of the four fundamental quantities, using the equations relating the parameters in the preceding section. Unfortunately, these equations involve m, the number of pumps in the system in question. Therefore, estimates of  $\mu$ ,  $\beta$ , and  $r_k$ ,  $1 \leq k \leq m$ , are found separately for each value of m. Then overall estimates are given, which do not depend on m, as follows. As a point estimate, the median of the point estimates is used (if the number of point estimates is even, the larger of the two possible medians is used). As a conservative interval, the smallest lower bound and the largest upper bound are used.

#### THE ESTIMATES

The estimates are given in Appendix C, for the six groups of pumps listed in Table 2.

Rates are estimated for two failure modes: "failure to start," based on LERs coded "does not start" and "unavailable/not demanded;" and "failure to operate after starting," based on LERs coded "leakage/rupture," "loss of function," and "does not continue to run." For running pumps, i.e., reactor coolant or recirculation pumps, only rates based on the second failure mode are given.

Depending on the application, command faults may or may not be of interest. Therefore, each set of estimates includes both estimates based on all faults and estimates based on failures only, with command faults excluded.

Every estimate is given as a triple of numbers, showing the lower limit, the point estimate, and the upper limit. The point estimate is the mean of the Bayes posterior distribution (for the beta factor, the median rather than the mean is shown). The upper and lower limits form a 90% interval. Application of the estimates is discussed in the next section.

Appendix C also contains summaries of the data used to produce the estimates, both tabular summaries and printouts of the one-line summaries of the LERs. A few comments precede each set of estimates.

#### DISCUSSION

## Application

All the rates given are per exposure hour. Many users will want rate of failure to start to be expressed as faults per demand, and rate of failure to operate after starting to be expressed as faults per operating hour. The numbers of demands on the pumps and the numbers of operating hours are not known, so the user must perform any conversion of the rates given here.

The uncertainty intervals should be used, not just the point estimates. Because of the great variability from one plant to another, many of the intervals are quite wide, so use of the point estimate alone would be overly naive. In some cases the lower bound is many orders of magnitude less than the point estimate. This happens when most of the plants or systems show no faults, but some of them show several faults. In such cases the distribution has a spike at zero and a very long flat tail. So the lower bound should be regarded as unknown, but essentially zero, and the point estimate should be thought of as a crude way to characterize a wide distribution.

Now consider the effect of delayed discovery of faults. Suppose that a pump becomes inoperable during a time interval t, but that the fault is not discovered until the pump is tested at the end of the time interval. Faults in the other pump(s) are also not discovered until the end of the time interval. If the interval is long enough, then a substantial portion of the simultaneous faults might not be common cause faults, but rather might be individual faults that were not discovered promptly.

A section of Appendix A gives the general method for using the estimated rates to estimate probabilities, for example, the probability that at least three out of four pumps become inoperable during a time period t. Using the general method, approximations can be found if t is not too large, such as

P(| specific pump inoperable) = r<sub>1</sub>t

and

P(k specific pumps inoperable)  $= (\lambda t)^k + r_k t$ 

for  $k \geq 2$ . These approximations are accurate to at least one significant digit if, in the first case,  $r_1t < 0.1$ , and in the second case if  $\lambda t < p/10$  and  $r_kt < 0.1$ . If t is too large for these approximations, then the more general methods of Appendix A should be used. For example, this would be necessary if turbine-driven pumps are under consideration,  $r_1$  is the upper end of the 90% interval, and t is 720 hours (1 month).

The formulas just given should look familiar to fault tree analysts. In particular, if k=2,  $r_2t$  is used in the way that  $\text{Br}_1t$  is often used by analysts. The formulas given here are more general than those obtained by the beta-factor method, because they recognize that systems can have more than two pumps. The ratio  $r_k/r_1$  would be a beta factor for k components, and the value given in this report as the beta factor is a compromise among these values.

It is instructive to compare the sizes of  $\lambda$  and  $r_2$ . For two specific pumps in time t, the probability that both pumps become inoperable because of a common cause shock is approximately  $r_2$ t. The probability that both become inoperable individually is approximately  $(\lambda t)^2$ . For various t, these probabilities may be compared. As an example, consider failures to start in standby pumps, counting all faults. The data contain 10 common cause events in which two or more pumps in the same system were simultaneously inoperable, and one event in which two pumps in a system were inoperable apparently by coincidence. Therefore we might ask what time period between demands, t, would make  $({}^{\lambda}t)^2/r_2t$  equal to 1/10. The answer, based on the point estimates in Appendix C, is

 $t = (1/10)(6.7E-7)/(3.1E-6)^2 = 6972 \text{ hr} = 290 \text{ days}.$ 

This is unrealistically large. If instead of the point estimates, we use the lower limit for  ${\bf r}_2$  and the upper limit for  ${\bf \lambda}$ , we get

 $t = (1/10)(2.7E-7)/(1.3E-5)^2 = 160 \text{ hr} = 6.7 \text{ days}.$ 

This is well under one month, so probably somewhat less than the actual average time between demands. (See Reference 1, pp 16-17.) Therefore, if we take into account the uncertainty in the estimates, this portion of the data is not inconsistent with the estimates given in Appendix C.

The beta factor is defined as the long-term fraction of pump faults that occur in multiple faults. However, to estimate it, with uncertainty bounds, the computer program uses a formula for  $\mathfrak B$  that assumes immediate discovery and repair of faults. Therefore the computed point estimates are low. The fact that medians are used rather than means may also make the point estimates low. For comparison, a simple direct estimate can be obtained by dividing the observed number of faults that occurred in multiple faults by the observed total number of faults. For failures to start in standby pumps, the direct estimate is 31/101=0.307, which hardly differs from the computed estimate of 0.297. For failures to operate in running pumps, the direct estimate is 38/109=0.349. This differs substantially from the computed estimate of 0.016, but is still far less than the computed upper bound of 0.850. In any case, this report recommends using  $r_2,\ r_3,\ \text{etc.}$ , rather than  $\mathfrak B$ .

## Diagnostic Checks

A diagnostic check looks for an indication that the data do not fit the assumed model. Three checks are considered here. Two are based on the internal consistency of the estimates, while the third is based on residuals. None of the checks shows strong evidence of lack of fit.

Consider the estimates for PWR HPCI and CVC pumps, pooled as one system. The estimated rates for two, three, and four simultaneous faults  $(r_2,\ r_3,\ and\ r_4,)$  are very slightly smaller when all faults are used than when only failures are counted. Of course the true rates based on all

faults cannot be smaller than the true rates based on only failures. The slight inconsistency arises because there are only three reported events involving more than one pump simultaneously. Because the rates are based on very little data, they can be somewhat inconsistent. The inconsistency is extremely small.

It is not uncommon for the estimate of the shock rate,  $\mu$ , to be larger when based on only failures than when based on all faults. It is impossible for the true value of  $\mu$  to be larger when only failures are considered than when all faults are considered. The estimates behave this way when a larger fraction of command faults than failures involve more than one pump simultaneously. It is quite possible that, with enough data, it would be better to estimate separate values of  $\mu$  and  $\mu$  for failures and for command faults. However, with the present amount of data, it is not conclusive that the data behavior represents anything more than random variation. In any case, the estimate of  $\mu$  is not used directly in fault trees. Therefore we do not pursue the matter further.

A final diagnostic check on the BFR assumptions is performed. The statistical details are given in Appendix A, but the idea of the check is as follows; if the BFR assumptions are correct, then the number of pumps affected by any (future) nonlethal shock is a binomial(m, p) random variable. Once p has been estimated, the observed numbers of affected pumps can be compared with the numbers predicted by the BFR assumptions. If they differ greatly, then the BFR assumptions should be questioned. The comparisons are performed by looking at the standardized residuals, defined as

(observed number - expected number)/standard deviation.

There is one residual for the number of common cause events involving exactly one pump, one residual for the common cause events involving exactly two pumps, etc. If the BFR assumptions are correct for the data set, then all the residuals should be small.

The largest standardized residual obtained in this way occurs when standby pumps are analyzed, based on failures to start, counting all faults. There are up to eight such pumps in a system. The standardized residuals corresponding to one through eight inoperable pumps are, respectively, -0.60, 1.19, -1.00, -0.42, -0.20, -0.09, -0.03, and -0.01. The largest absolute value is approximately 1.2. This means that no observed count is more than about 1.2 standard deviations from its estimated expected value. The residuals are even smaller in the other portions of the data. Therefore, this investigation finds no evidence of departure from the binomial distribution.

#### CONCLUSIONS

Estimates have been found for common cause fault rates, common cause failure rates, and related quantities. The estimates are based on Licensee Event Reports for pumps from January 1, 1972, through September 30, 1980. Because the LER data base may be incomplete, the estimates should be used with care. The numbers of demands and the operating hours are unknown for alternating and standby pumps. Therefore, all the rates presented are per exposure hour, usually critical hour or calendar hour. The user must perform any conversion to other units.

Every quantity has been estimated by both a point estimate and a 90% interval. The width of the intervals reflects both statistical uncertainty, due to the random nature of the data, and also the actual substantial variability in the fault rates from plant to plant or system to system.

How to use the estimates in applications has been discussed. Diagnostic checks showed no marked departure in the data from the assumptions of the model.

### REFERENCES

- 1. M. Trojovsky, Data Summaries of Licensee Event Reports of Pumps at U.S. Commercial Nuclear Power Plants, NUREG/CR-1205, Revision 1, EGG-EA-5524, January 1982.
- 2. C. L. Atwood and J. A. Steverson, <u>Common Cause Fault Rates for Diesel</u>
  <u>Generators: Estimates Based on Licensee Event Reports at U.S. Commercial Nuclear Power Plants</u>, 1976-1978, NUREG/CR-2099, EGG-FA-5359,
  Revision 1, 1982.
- 3. W. E. Vesely, "Estimating Common Cause Failure Probabilities in Reliability and Risk Analyses: Marshall-Olkin Specializations," in <u>Nuclear Systems Reliability Engineering and Risk Assessment</u>, ed. J. B. Fussell and G. R. Burdick, Philadelphia: Society for Industrial and Applied Mathematics, 1977, pp. 314-341.
- 4. C. L. Atwood, Estimators for the Binomial Failure Rate Common Cause Model, NUREG/CR-1401, EGG-EA-5112, April 1980.
- C. L. Atwood, "Estimating Common Cause Failure Rates for Pumps in Nuclear Reactors," Proceedings of the 1980 DOE Statistical Symposium, ed. T. Truett, D. Margolies, and R. W. Mensing, April 1981, pp. 15-26.
- K. N. Fleming, "A Reliability Model for Common Mode Failures in Redundant Safety Systems," <u>Proceedings of the Sixth Annual Pittsburgh Conference on Modeling and Simulation</u>, General Atomics Report GA-A13284, April 1975.

# APPENDIX A TECHNICAL DETAILS OF METHODOLOGY

# APPENDIX A TECHNICAL DETAILS OF METHODOLOGY

### Fitting a Gamma Distribution to the Data

Suppose that  $\lambda$  has a gamma(a, b) distribution, and that, given  $\lambda$ , the number of faults of a pump has a Poisson( $\lambda$ t) distribution. Then it is not hard to show that the unconditional distribution of the number of faults is negative binomial with parameters a and bt (see Johnson and Kotz<sup>A-1</sup>). Therefore, the maximum Tikelihood estimates of a and bt can be found numerically, based on the exposure times and observed failures for the pumps.

To illustrate this, consider the individual failures to operate after starting, for turbine-driven auxiliary feedwater pumps in PWRs. There are 44 PWRs, but the Turkey Point Units 3 and 4 share all their turbine-driven auxiliary feedwater pumps, so they are regarded as a single plant for this investigation. The parameter  $\lambda$  is considered to vary among the 43 plants, but not from pump to pump within a plant.

When a gamma distribution is fitted to the data, counting both failures and command faults, the estimated parameters are 0.395 and 1.140E-4, the estimated mean of the distribution is 4.504E-5, and the estimated 90% interval is  $(4.303E-8, \ ^1.879E-4)$ . The single turbine-driven pump at Arkansas 2 (AR2) had 7 faults in 7068 hours. If a and b were equal to their estimates, the probability of getting at least 7 faults in 7068 hours would be only 0.00064. Therefore, the probability that at least one of the 43 plants would be as extreme as this is approximately  $43 \times 0.00064 = 0.028$ . In fact AR2 is influencing the estimates of a and b, so this calculation makes AR2 look better than it is. Using estimates based on all the plants except AR2 gives  $43 \times 0.000015 = 0.0006$  as the probability of seeing a plant as extreme as AR2. Clearly, AR2 is an outlier.

If AR2 is excluded, and a gamma distribution is fitted to the remaining data, the estimated parameters are 0.682 and 4.249E-4, the estimated mean is 2.896E-5, and the estimated 90% interval is (4.557E-7, 9.951E-5).

That is, the mean shrinks by 36% (or by 9% of the length of the original interval), and the upper end point shrinks by 47%.

These changes are substantial. However it would be complicated to present a set of rates with AR2 included, another set with AR2 excluded, and another set based on AR2 only, leaving it to the reader to decide which set to use. Therefore, only one set is given, with AR2 included. This gives the conservative larger values. In Appendix C, where the estimates are given, there are some comments on how to adjust the estimates to remove the effect of AR2.

The above case was chosen to illustrate the method because it has the worst outlier problem. No other portion of the data has an outlier that is even close to as bad as AR2 in the above data.

### How to Obtain Probabilities from Rates

When using the model of this report, the key to evaluating probabilities is to condition on the number of nonlethal shocks. Let  $N_S$  be the number of nonlethal shocks, and  $N_L$  the number of lethal shocks. Consider any event involving the failure or survival of certain pumps in some time period t. Let P(A|B) denote the conditional probability of A, given B. The following decompositions hold:

$$P(\text{event}) = P(\text{event} \mid N_L > 0) P(N_L > 0) + P(\text{event} \mid N_L = 0) P(N_L = 0)$$

P(event | 
$$N_L = 0$$
) =  $\sum_{n=0}^{\infty}$  P(event |  $N_L = 0$ ,  $N_S = n$ ) P( $N_S = n$ ).

Normally only the first few terms in the sum need to be evaluated.

The model assumes independent shocks with a constant shock rate.

Therefore (Reference A-1, Ch. 4.1), the number of shocks in time t is a

Poisson random variable, with parameter equal to t times the shock rate. It follows that some of the above probabilities are easy:

$$P(N_L = 0) = e^{-\omega t}$$

$$P(N_1 > 0) = 1 - e^{-\omega t}$$

$$P(N_S = n) = e^{-\mu t} (\mu t)^n/n!$$

If t is small, these expressions can be approximated by even simpler ones.

The nontrivial term to evaluate is the conditional probability of the event under consideration, given that  $N_L=0$  and  $N_S=n$ . As a major step towards evaluating this, let q=1-p, and note that for any specific single pump

P(survival | 
$$N_L = 0$$
,  $N_S = n$ ) =  $q^n e^{-\lambda t}$ .

This expression is the probability that the pump survives all n shocks  $(q^n)$ , times the probability that it does not become inoperable individually  $(e^{-\lambda t})$ . Denote this expression by  $Q_n$ . To find  $P(\text{event } | \ N_L = 0, \ N_s = n)$ , use  $Q_n$  and the fact that, given a shock, the pumps behave independently.

As an example, suppose that a system has four pumps. What is the probability that at least three of the four become inoperable during some time period t? Given that  $N_L=0$  and  $N_S=n$ , the conditional probability that a specific pump survives is  $Q_n$ , so the conditional probability that at least three fail to survive is

P(exactly 3 fail | 
$$N_L = 0$$
,  $N_S = n$ ) + P(exactly 4 fail |  $N_L = 0$ ,  $N_S = n$ )

$$= {4 \choose 3}(1 - Q_n)^3 Q_n + (1 - Q_n)^4 = (1 - Q_n)^3 (1 + 3 Q_n).$$

Therefore, to obtain the desired probability, observe that  $P(\text{event} \mid N_{\text{L}} > 0) = 1$ , and substitute into the equation for P(event) at the beginning of this section. The answer is

$$(1 - e^{-\omega t}) + e^{-\omega t} \sum_{n} (1 - Q_{n})^{3} (1 + 3 Q_{n}) e^{-\mu t} (\mu t)^{n}/n!$$
.

Substitution of estimates for p,  $\mu$ ,  $\lambda$  and  $\omega$  yields an estimate of the desired probability. To obtain upper and lower uncertainty bounds on the probability is not so easy. Using the end points of the 90% intervals for p,  $\mu$ ,  $\lambda$  and  $\omega$  is conservative, since it is unlikely that the four parameters are all at their upper ends or all at their lower ends. In principle, a Bayes 90% interval can be found, based on the distributions of p,  $\lambda$ ,  $\lambda_+$ , and  $\omega$ . This is how the intervals for  $\beta$ ,  $r_1$ ,  $r_2$ , etc., are found in this report. To perform this operation, however, requires numerical integration.

The point estimate obtained by substituting the Bayes means into some complicated expression is not necessarily the same as the mean of the Bayes distribution of the expression. But it is simple, and credible.

When t is not large, simple approximations can be used. Each of the approximations given here is valid if  $\lambda t <<$  1,  $\mu t <<$  1, and  $\omega t <<$  1. They follow from the Taylor series expansion for  $e^{-X}$  and are

$$1 - e^{-\omega t} = \omega t$$

$$Q_n = q^n$$

$$1 - Q_n = (1 - q^n) + q^n \lambda t$$

$$\sum_{n=1}^{\infty} (1 - Q_n)^i Q_n^j P(N_S = n) \doteq (p + q\lambda t)^i q^j \mu t, \text{ for } i \geq 0 \text{ and } j \geq 0.$$

This leads to simple approximations of many probabilities. For each of the probabilities below, the first approximation is valid if  $\lambda t << 1$ ,  $\mu t << 1$ , and  $\omega t << 1$ . The second approximation for one specific pump is valid if in addition  $\mu << \lambda$  and  $\omega << \lambda$ . The second approximation is valid for k pumps if the first approximation is valid and in addition q $\lambda t << p$ .

P(1 specific pump fails) 
$$\stackrel{*}{=} \lambda t + p\mu t + \omega t \equiv r_1 t$$
 $\stackrel{*}{=} \lambda t$ 

P(k specific pumps fail) 
$$\stackrel{\text{d}}{=} (\lambda t)^k + (q\lambda t + p)^k \mu t + \omega t$$
  
 $\stackrel{\text{d}}{=} (\lambda t)^k + p^k \mu t + \omega t = (\lambda t)^k + r_k t \text{ for } k \ge 2$ 

P(at least k out of m pumps fail)

$$\stackrel{!}{=} {m \choose k} (\lambda t)^k + \mu t \sum_{i=k}^m {m \choose i} (q\lambda t + p)^i q^{m-i} + \omega t$$

$$\stackrel{!}{=} {m \choose k} (\lambda t)^k + \mu t \sum_{i=k}^m {m \choose i} p^i q^{m-i} + \omega t$$

$$for k > 1 .$$

## Diagnostic Check Based on Residuals

If the binomial failure rate (BFR) assumptions hold, then the number of pumps affected by an observable shock has a binominal(m, p) distribution, truncated because zero cannot be observed. Once p has been estimated, the correctness of this distributional assumption can be studied. The sample sizes in the pump data are much too small to allow standard

goodness of fit tests, but residuals can be used, essentially as described in Section 5 of Atwood. $^{\rm A-2}$ 

Suppose  $\mathbf{n}_{+}$  nonlethal shocks hit the systems with m pumps and cause at least one pump to become inoperable. Then define

$$z_{j} = {m \choose j} p^{j} q^{m-j}/(1 - q^{m})$$

for  $1 \leq j \leq m$ , with q = 1 - p. Let  $N_j$  be the number of shocks that affect exactly j pumps. Conditional on  $n_+$ ,  $N_j$  has mean  $E_j = n_+ z_j$  and variance  $V_j = n_+ z_j$   $(1 - z_j)$ . Now suppose that there are systems with various sizes  $m_i$ , and corresponding values  $n_+i$ ,  $N_ji$ ,  $E_{ji}$ , and  $V_{ji}$ . Then, conditional on the values of  $n_+i$ ,  $N_j = \sum N_ji$  has mean  $E_j = \sum E_{ji}$  and variance  $V_j = \sum V_{ji}$ . Here, the summations are over all i such that  $m_i \geq j$ . Substitution of the estimate of p gives  $\hat{E}_j$  and  $\hat{V}_j$ . Then for each j, a standardized residual can be constructed

$$v_{j} = \frac{(N_{j} \cdot - \hat{E}_{j} \cdot)}{\hat{V}_{j} \cdot \frac{1/2}{}}$$
.

Under the BFR assumptions, the  ${\rm U}_j$  values have a mean and variance of approximately 0 and 1. Any large value of  ${\rm U}_j$  indicates that the data do not satisfy the BFR assumptions.

# Effect of Data Inaccuracies

In the main body of this report, at the end of the Common Cause Classification section, there was a description of an actual experience suggesting the importance of data misclassification. Now let us investigate the effect of data inaccuracies more theoretically, by asking, "What effect does a small relative change in the data have on the estimates?" This effect can be approximated by the use of the relevant derivatives. Let  $\theta$  denote a parameter to be estimated  $(\lambda,\,\lambda_+,\,\omega,\,p,\,\mu,\,\beta,\,or\,an\,r_k)$ . Let x denote some quantity in the data  $(n_1,\,n_+,\,n_L,\,or\,v,\,all\,defined$ 

below). Relative change means the change in the quantity, divided by the value of the quantity. Then the rate of relative change in the estimate of  $\theta$  per relative change in x is

$$C(\Theta, x) = \frac{\partial \hat{\Theta}}{\partial x} \cdot \frac{x}{\hat{\Theta}} . \tag{A-1}$$

Approximate formulas will now be derived.

It is convenient during the derivation to work with maximum likelihood estimators rather than Bayes means. The difference between these two estimators is not important here, because the purpose is only to roughly approximate the effect of data inaccuracies. Suppose data are combined from systems with populations  $\mathbf{m_i}$  and times  $\mathbf{t_i}$ . Let  $\mathbf{n_{Ii}}$ ,  $\mathbf{n_{+i}}$ ,  $\mathbf{n_{Li}}$ , and  $\mathbf{s_i}$  denote the observed numbers of individual faults, nonlethal shocks, lethal shocks, and pumps made inoperable by nonlethal shocks. Then the maximum likelihood estimates satisfy

$$\hat{\lambda} = \frac{\sum n_{ij}}{\sum m_{ij}t_{ij}}$$

$$\hat{\lambda}_{+} = \frac{\sum n_{+i}}{\sum t_{i}}$$

$$\widehat{\omega} = \frac{\sum n_{Li}}{\sum t_i}$$

$$\sum s_{i} = \hat{p} \sum \frac{m_{i} n_{+i}}{1 - \hat{q}^{m_{i}}}$$
 (A-2)

Equation (A-2) requires knowledge of each separate  $m_i n_{+i}$ . However, it can be approximated by

$$\sum s_{i} = \frac{\hat{p} \sum m_{i} n_{+i}}{(1 - \hat{q}^{m})}$$

where m, generally not an integer, is the weighted average defined by

$$m = \frac{\sum m_{1}^{n} n_{+1}}{\sum n_{+1}}$$

where the sum is taken over all i such that  $m_i > 1$ . The terms with  $m_i = 1$  are not counted because they contain no information about p.

So now, if we define  $n_I = \sum n_{Ii}$ ,  $n_+ = \sum n_{+i}$ ,  $n_L = \sum n_{Li}$ , and  $v = \sum s_i / \sum m_i n_{+i}$ , and if m is as just defined, then the estimates satisfy

$$\hat{\lambda} = \frac{n_{I}}{\sum m_{i} t_{i}}$$

$$\hat{\lambda}_{+} = \frac{n_{+}}{\sum t_{i}}$$

$$\hat{\omega} = \frac{n_L}{\sum t_L}$$

$$\hat{p} = v (1 - \hat{q}^m)$$
.

Finally, the coefficients  $C(\theta, x)$  defined by Equation (A-1), can be approximated for  $\theta = \lambda$ ,  $\lambda_+$ ,  $\omega$ , p,  $\mu$ ,  $r_k$ , or  $\beta$ , and for  $x = n_1$ ,  $n_+$ ,  $n_L$ , or v. Formulas are given in Table A-1, and very rough approximate values are given in Table A-2. For these approximations it is assumed that  $r_1 = \lambda$ .

These coefficients are used as in the following example. Suppose that information is needed about the effect on the estimate  $r_1$  of increasing  $n_1$  and v by 10% and decreasing  $n_+$  by 5%. The relative change is

TABLE A-1. FURMULAS FOR  $C(\theta, x) = \frac{\partial \hat{\theta}}{\partial x} \cdot \frac{x}{\hat{\theta}}$ 

				×
Θ	_n_I_	n <sub>+</sub>	nL	v
λ	1	0	0	0
λ+	0	1	0	0
ω	0	0	1	0
P	0	0	0	$\frac{1 - q^m}{1 - q^m - m p q^{m-1}}$
и	0	1	0	1 - C(p,v)
$r_1$	$\frac{\lambda}{r_1}$	<u>ир</u> r <sub>1</sub>	$\frac{\omega}{r_1}$	<u>ир</u> r <sub>1</sub>
r <sub>k</sub> , k > 1	0	μp <sup>k</sup> r <sub>k</sub>	$\frac{\omega}{r_k}$	$\frac{\mu p^{k}}{r_{k}}$ [1 + (k - 1) C(p,v)]
β	$\frac{\lambda}{r_1}$	$\frac{D}{D+\omega}$ $\frac{\mu p}{r_1}$	$\frac{\omega}{D + \omega}$	$\frac{D + (m - 1)\mu p^2 q^{m-2} C(p, v)}{D + \omega} - C(r_1, v)$

### Notes:

- 1. Here, D denotes  $\mu p(1 q^{m-1})$ .
- 2. For typographical clarity, the hat is omitted from estimated quantities.

TABLE A-2. CRUDE APPROXIMATIONS FOR C(0, x)a

			x	
θ	n <sub>I</sub>	n <sub>+</sub>	nL	v
λ	1	0	0	0
λ+	0	1	0	0
ω	0	0	1	0
p	0	0	0	>1
μ	0	1	0	<0
rı	<b>±</b> 1	<b>±</b> 0	±0	≛0
k, k > 1	0	<1	<1	varies
β	± - 1	<1	<1	varies

a. This table shows, for example: If  $n_I$  increases by 10%,  $\beta$  will decrease by approximately 10%; if v increases by 5%, p will increase by more than 5%. For unusual data, the assumptions underlying the approximations may not be true. For very small data sets, small relative changes are impossible, so the table is irrelevant.

$$\frac{\Delta \hat{r}_1}{\hat{r}_1} = C(r_1, n_1) \times (0.1) + C(r_1, n_1) \times (-0.05) + C(r_1, v) \times (0.1)$$

Of course, the real difficulty is not in calculating derivatives, but in deciding how much inaccuracy might realistically be in the data. Inaccuracy due to misclassification of the reported events was addressed in the Common Cause Classification section of the main body of this report. To assess the amount of missing data (unreported events or overlooked reports) is beyond the scope of this report.

### References

- A-1. N. L. Johnson and S. Kotz, <u>Discrete Distributions</u>, New York: John Wiley & Sons, 1969, pp. 122-125.
- A-2. C. L. Atwood, Estimators for the Binomial Failure Rate Common Cause Model, NUREG/CR-1401, EGG-EA-5112, April 1980.

# APPENDIX B PLANT INFORMATION AND CODE DEFINITIONS

# APPENDIX B PLANT INFORMATION AND CODE DEFINITIONS

Table B-1 summarizes the systems of pumps considered in this report, and gives their codes and relevant exposure hours. Tables B-2 and B-3 give plant information: for each plant, its code, critical hours, calendar hours, and pump populations are shown. Table B-4 defines the codes used in the one-line data summaries.

TABLE B-1. SYSTEMS OF PUMPS, AND RELEVANT EXPOSURE HOURS

Code	Hours	Reactor Type	Descriptiona
Runnin	g Pumps		
K	Critical	Both	Reactor coolant/recirculation
Altern	ating Pumps		
G	Calendar	PWRs	Chemical and volume control (CVC)
Н	Critical	BWRs	Feed and HPCI (4 plants only)
Ι.	Critcal	PWRs	Boric acid transfer
J	Calendar	Both	Component cooling water
R	Shutdown	Both	Residual heat removal <sup>b</sup> (RHR)
Standb	y Pumps		
В	Critical	PWRs	Auxiliary feedwater
D	Calendar	BWRs	Low pressure core spray
F	Calendar	Both	Containment spray
Н	Calendar	Both	High pressure coolant injection (HPCI)
L	Critical	Both	Low pressure cooling injection <sup>b</sup> (LPCI)
Q	Critical	BWRs	Reactor core isolation cooling (RCIC)
U	Critical	BWRs	Standby liquid control

a. Terminology varies somewhat from plant to plant.

b. At most plants, the same pumps serve for LPCI during criticality and for RHR during shutdown.

TABLE B-2. PWR PLANT INFORMATION

					Running		Alter	nating			Standby		
Plant	Code	Vendor	Critical Hours	Calendar Hours	Reactor Clt K	CVC G	BAT	CCW	RHR <sup>b</sup>	Auxiliary Feed <sup>C</sup> B	Containment Spray F	HPC1	LPC I b
Arkansas 1 Crystal River 3 Davis-Besse 1 Oconee 1 Oconee 2	AR 1 CR 3 DB 1 OE 1 OE 2	B B B B	33594 17695 13042 45079 37558	53952 32544 26808 65328 60384	4 4 4 4	3 2 3 3	2 2 2 2 2 3	3 3 2 2	2 2 2 3 3	1M, 1T 1M, 1T 2T 1T	2 2 2 2 2 2	0q 0q 0q 0q	2 2 2 3 3 3
Oconee 3 Rancho Seco Three Mile Island 1 Three Mile Island 2	0E3 RS1 T11 T12	B B B	36816 29290 31732 3398	53232 52963 42192 8784	4 4 4	3 3 3 3	3 2 2 2	2 2 2 2	3 2 2 2	1T 1M, 1T 2M, 1T 2M, 1T	2 2 2 2	0q 0q 0q 0q	3 2 2 2
Arkansas 2 Calvert Cliffs 1 Calvert Cliffs 2 Fort Calhoun Millstone 2	AR2 CC1 CC2 FC1 M12	C C C C	7068 38451 26811 47570 30580	15984 52464 33624 62712 43464	4 4 4 4	3 3 3 3	2 2 2 2 2	3 3 3	2 2 2 2 2	1M, 1T 2T 2T 1M, 1T 2M, 1T	2 2 2 3 2	3 3 3 3	2 2 2 2 2
Maine Yankee Palisades St. Lucie 1	MY1 PA1 SL1	C C C	55878 38960 26228	69600 76704 38952	3 4 4	1 3 3	3 2 2	2 3 3	2 2 2	1M, 1T 1M, 1T 2M, 1T	3 3 2	3 2 3	2 2 2
Beaver Valley D. C. Coole 1 D. C. Coole 2 Haddam Neck Indian Point 2	BV1 DC1 DC2 HN1 1P2	M M M	13775 37510 16811 63506 37770	38520 49992 22464 76704 64536	3 4 4 4	3 3 3 3	2 2 2 2 2	3 3e 3e 3	2 2 2 2 2	2M, 1T 2M, 1T 2M, 1T 2T 2M, 1T	6 2 2 09 2	2 2 2 2 3	2 2 2 2 2
Indian Point 3 J. M. Farley 1 Kewaunee North Anna 1 North Anna 2	JF1 KE1 NA1 NA2	3 3 3 3 3	26443 16271 46125 15859 1724	39336 27576 57600 21840 2664	4 3 2 3 3	3 3 3 3	2 2 2 2 2	3 3 2 4 4	2 2 2 2 2 2	2M, 1T 2M, 1T 2M, 1T 2M, 1T 2M, 1T	2 2 2 6 6	3 0d 2 0d 0d	2 2 2 2 2 2
Prairie Island 1 Prairie Island 2 Point Beach 1 Point Beach 2 R. E. Ginna	PR1 PR2 PT1 PT2 RG1	2 2 2 3	46464 44184 62073 64363 58078	59904 50760 76704 73104 76704	2 2 2 2 2	3 3 3 3	2 2 2 2 2	2 2 2 2 2	2 2 2 2 2 2	2Mf, 1T 2Mf, 1T 2Mf, 1T 2Mf, 1T 2Mf, 1T	2 2 2 2 2 2	3h 3h 2 2 3	2 2 2 2 2

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TABLE B-2. (Continued)

					Running		Alter	nating				Standby		
Plant	Code	Vendor	Critical Hours	Calendar Hours	Reactor Clt K	CVC G	BAT	CCM	RHR <sup>b</sup>	Auxi1 Fee		Containment Spray F	HPC1	LPC1b
H. B. Robinson 2	R02	W	60180	76704	3	3	2	3	2	2M,	11	2	3	2
Salem 1	SAI	W	16488	33360	4	3	2	3	2	2M,		2	2	2
Sequoyah 1	SE1	W	542	2112	4	3	2	5	2	2M.		2	2	2
San Onofre 1	501	W	56392	76704	3	2	2	3	2	IM,		0.	3	2.
Surry 1	SUI	W	42519	72336	3	3h	2	4h	21	2M,	11	63	3	21
Surry 2	SU2	W	35584	66360	3	3h	2	4h	21	2M,	11	6j	3	21
Trojan	TRI	W	21998	42048	4	3	2	3	2	11,		2	4	2
Turkey Point 3	TU3	W	52956	69672	3	3	3	2	2	3Th		2	4	2
Turkey Point 4	TU4	W	46080	64056	3	3	3	2	2.	3Th		2	4	2.
Yankee Rowe	YR 1	W	53515	76704	4	3	- 1	2	21	37h 37h 17		0	3	31
Zion 1	211	W	42451	63864	4	3	2	5	2	2M,	11	3k	2	2
Zion 2	212	W	37666	59352	4	3	2	5	2	2M,		3k 3k	2	2

- a. Pumps are motor-driven unless otherwise noted.
- b. Unless otherwise noted, the same pumps are used for LPCI and RHR.
- c. The letters M, T, and D denote motor-driven, turbine-driven, and diesel-driven. For example 2M, 1T means that 2 motor-driven pumps and 1 turbine-driven pump are present.
- d. The HPCI and CVC pumps are shared. Population and faults are counted under CVC.
- e. The two units have five pumps: two per unit and one shared by either unit.
- f. A total of two motor-driven pumps is available for use by either unit.
- g. Containment spray is an integral part of LPCI. Population and faults are counted under LPCI.
- h. The two units share the same pumps.
- i. There are separate pumps for LPC1 and RHR.
- j. Two of the pumps can be driven by either a motor or a turbine (tandem prime movers).
- k. One pump is diesel-driven.

					Running	Alter	nating	Carried Control		Standby	-		
Plant	Code	Vendor	Critical Hours	Calendar Hours	Coolant Recirculation K	CCM	RHR <sup>b</sup>	Core Spray D	Containment Spray <sup>C</sup> F	HPC1 <sup>d</sup>	LPCI <sup>b</sup>	RC1C <sup>d</sup>	SLC
Browns Ferry 1	BF1	6	32634	62448	2	3	4	4	0	1	4	1	2
Browns Ferry 2	BF2	G	29788	54360	2	3	4	4	0		4	1	2
Browns Ferry 3	BF3	G	26961	36360	2	3	4	4	2	n	0	0	0
Big Rock Point	BPI	G	51445	76704	2	2	2	2	2	1	4	1	2
Brunswick 1	BR 1	G	22445	34896	2	3	4	2	U			1 12	
Brunswick 2	BR2	G	27176	48528	2	3	4	2	0	1	4	1	2
Cooper Station	CO1	G	45502	57936	2	4	4	2	0	1	4		2
Duane Arnold	DAT	G	35182	57216	2	3	4	2	0	1	4	1	2
Dresden 1	DR 1	6	39786	59904	4	3	2.	3	2	le .	3,6	0	0
Uresden 2	DR2	6	58693	76704	2	3	3f,g	2	0	1	4	0	
Dresden 3	DR3	G	56458	76704	2	3	3f,g	2	0	1	4 <sup>f</sup>	0	2
E. I. Hatch 1	ENT	G	39105	53064	2	3 .	4	2	. 0		4		2
E. I. Hatch 2	EN2	G	10147	19680	2	3	4	Z	0	1	7		2
J. A. Fitzpatrick	FP1	6	30779	51480	2	3	4	2	0	2h	7	0	2
Millstone 1	MII	6	58150	76704	2	2	4	2	0	3		U	-
Monticello	MOT	G	62706	76704	2	2	4	2	0	1,	4	1	2
Nine Mile Point 1	NM1	6	58566	76704	5	3	3	8	4	2h	3	0	- 2
Oyster Creek	00.1	G	55263	76704	5	2	3	8	4	3"	3	0	
Peach Bottom 2	PB2	6	40497	61728	2	2	4	4	0	1	4		- 2
Peach Bottom 3	PB3	G	40274	53928	2	2	4	4	0	1	4		
reach bottom 3	103		704.77								4.1		2
Pilgrim 1	P11	G	48238	72696	2	6,	4	2	C		4.5		2
Ouad-Cities 1	QC1	G	56398	76704	2	31 31	4	2	0		41	1	2
Quad-Dities 2	002	6	56912	73920	2	31	4	2	0		40		2
Vermont Yankee	VYI	6	57426	74712	2	3	4	2	0				

a. Pumps are motor-driven unless otherwise noted.

b. Unless otherwise noted, the same pumps are used for LPC1 and RHR.

c. At most plants, containment spray is an integral part of LPCI. A population O means that the population and faults are counted under LPCI.

d. HPCI and RCIC pumps are turbine-driven, except where inclosed by notes.

e. The emergency feed pump is counted as HPCI. It is motor-driven, and considered an alternating pump for this report.

f. There are separate pumps for LPCI and RHR.

g. Units 2 and 3 have a total of five RHR pumps: two per unit and one shared between units.

h. The main feed pumps serve as HPCI pumps. They are motor-driven, and alternating rather than slandby.

i. Units 1 and 2 have a total of five pumps: two per unit and one shared between units.

j. At each plant there are four motors, with each motor driving a gang of two pumps in series.

FAILURE MODE  CODE DESCRIPTION  A - LEAKAGE/RUPTURE B - DOES NOT START C - LOSS OF FUNCTION D - DOES NOT CONTINUE TO RUN	FAILURE CAUSE  OD - UNKNOWN OI - PERSONNEL (OPERATIONS) OZ - PERSONNEL (MAINTENANCE) O3 - PERSONNEL (TESTING) O4 - DESIGN ERROR O5 - FAB./CONSTRUCTION/O.C. O6 - PROCEDURAL DISCREPANCIES O7 - NORMAL WEAR O9 - EXCESSIVE WEAR O9 - FOREIGN MATERIAL CONTAMINATION II - EXTREME ENVIRONMENT II - EXTREME ENVIRONMENT II - EXTREME ENVIRONMENT	EVENT CLASSIFICATION  CODE DESCRIPTION  D - DEMAND T - TIME U - UNKNOWN
COMPONENT  CODE DESCRIPTION  PD - DIESEL-DRIVEN PUMP PM - MOTOR-DRIVEN PUMP PT - TURRINE-DRIVEN PUMP	13 - ELECTRICAL/MECHANICAL CONTROL MALFUNCTIONS 14 - FAILED INTERNALS 15 - SHAFT/COUPLING FAILURE 16 - LOSS OF PRESSURE BOUNDRY INTEGRETY 17 - IMPROPER CLEARANCES 18 - DRIVE TRAIN FAILURE 19 - SEAL/PACKING FAILURE 20 - MISALIGNMENTS 21 - BEARING FAILURE	
TYPE OF EVENT  CODE  COMMAND  FAILURE FAULT  DESCRIPTION  R T RECURRING, NOT COMMON CAUSE R T RECURRING, NOT COMMON CAUSE C U NONLETHAL COMMON CAUSE B V PECURRING NONLETHAL COMMON CAUSE L N LETHAL COMMON CAUSE M D PECURPING LETHAL COMMON CAUSE	NSSS VENDOR  CODE DESCRIPTION  B - BABCOCK & WILCOX C - COMPUSTION ENGINEERING G - GENERAL ELECTRIC W - WESTINGHOUSE	CODE DESCRIPTION  M - DUPING MAINTENANCE N - DURING NORMAL OPERATIONS R - DURING RECORDS REVIEW U - UNKNOWN

APPENDIX C ESTIMATED FAULT RATES

## APPENDIX C ESTIMATED FAULT RATES

This appendix contains six sections, corresponding to the six groups of pumps for which rates are estimated. The six groups, listed in Table 2 of the main body of this report, are

- 1. Running pumps
- 2. Alternating pumps
- 3. PWR auxiliary feedwater pumps
- 4. BWR turbine-driven HPCI and RCIC pumps
- 5. Other standby pumps
- 6. PWR HPCI and CVC pumps (treated as one system).

Each section contains some introductory remarks. Then, the estimated rates are presented (except for running pumps) for four sets of rates: failure to start, based on all faults; failure to start, based on failures only; failure to operate after starting, based on all faults; and failure to operate after starting, based on failures only. For running pumps, only rates of failure to start are estimated. Following the estimated rates are summaries of the data used: one summary for each of the two failure modes; and a listing of the one-line summaries of the relevant LERs.

### Running Pumps

The pumps considered are PWR reactor coolant pumps and BWR coolant recirculation pumps. The exposure times used are critical hours.

In all the data, there is only one reported failure to start. Therefore, rates are not estimated for failure to start, but only for failure to operate after starting.

All the nonlethal shocks were command faults rather than failures. Therefore, the quantities involving p cannot be estimated for failures.

There were eight lethal shocks, more than for any other system. They occurred at only five plants. This recurrence at certain plants leads to a very wide interval estimate for  $\omega$ , with the lower bound essentially zero. Of the eight lethal shocks, three were loss of power, and one was failure of the containment instrument air system. In many fault tree analyses, such hardware failures would be built into the fault tree explicitly, and so should not be counted a second time in the rates from this report. For possible use in such analyses, the rates are estimated excluding lethal shocks due to hardware failure.

In summary, rates are estimated for failure to operate after starting:

- 1. Based on all faults
- 2. Based on failures only
- Based on all faults, excluding lethal shocks due to hardware failure
- Based on failures only, excluding lethal shocks due to hardware failure.

Be sure to read the Application section in the main body of this report. The following printouts give the estimates and summaries of the relevant data.

RUNNING PUMPS - REACTOR COOLANT / RECTRCULATION

FAILURE TO OPERATE, GIVEN START

ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS

RATES ARE PER CRITICAL HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

P \* ( .371, .608, .816)

LAMBDA \* ( 1.7E-09, 1.3E-05, 5.8E-05)

LAMBDA \* ( 7.5E-13, 2.0E-06, 1.0E-05)

DMEGA \* ( 5.8E-34, 5.8E-06, 3.0E-05)

SYSTEM SHOCK RATE MU SPECIFIC COMPONENT BETA FACTOR

2 ( 9.1E-13, 2.4E-06, 1.3E-05) ( 1.8E-07, 2.0E-05, 9.5E-05) ( .000, .024, .850)

3 ( 8.2E-13, 2.2E-06, 1.1E-05) ( 1.8E-07, 2.0E-05, 9.4E-05) ( .000, .016, .800)

4 ( 7.8E-13, 2.1E-06, 1.1E-05) ( 1.8E-07, 2.0E-05, 9.4E-05) ( .000, .008, .753)

5 ( 7.6E-13, 2.0E-06, 1.1E-05) ( 1.8E-07, 2.0E-05, 9.4E-05) ( .000, .004, .724)

OVERALL ( 7.6E-13, 2.2E-06, 1.3E-05) ( 1.8E-07, 2.0E-05, 9.5E-05) ( .000, .016, .850)

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RUNNING PUMPS - REACTOR COOLANT / RECIRCULATION

FAILURE TO OPFRATE, GIVEN START

FAILURES ONLY, EXCLUDING COMMAND FAULTS

RATES ARE PER CRITICAL HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

LAMBOA . ( 1.0E-38, 5.7E-06, 2.1E-05)

LAMBOA . ( 5.3E-10. 1.3E-07. 5.2E-07)

GA \* ( 4.7E-08. 4.0E-07. 1.1E-06)

NO DATA WERE 19SERVED FOR ESTIMATING OTHER QUANTITIES

RUNNING PUMPS - REACTOR CODLANT / RECIRCULATION
FAILURE TO OPERATE, GIVEN START
LETHAL SHOCKS DUE TO HARDWARE FAILURE EXCLUDED
ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS
RATES ARE PER CRITICAL HOUR
TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)
LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

P = ( .371, .608, .816) LAMADA = ( 1.7E-09, 1.3E-05, 5.8E-05) CAMADA = ( 7.5E-13, 2.0E-06, 1.0E-05)

OVERALL ( 7.65-13, 2.25-06, 1.35-05) ( 1.85-07, 1.75-05, 7.85-05) ( .000, .016, .755) 1 .000, .016, .6541 1 .000. .000. 1 ( 7.6E-13, 2.0E-06, 1.1E-05) ( 1.8E-07, 1.7E-05, 7.8E-05) ( .000, .004, .533) 1 .000, .024, .7551 BETA FACTOR ( 7.8E-13, 2.1E-06, 1.1E-05) ( 1.8E-07, 1.7E-05, 7.8E-05) ( 9.1E-13, 2.4E-06, 1.3E-05) ( 1.8E-07, 1.7E-05, 7.8E-05) ( 8.2E-13, 2.2E-06, 1.1E-05) ( 1.8E-07, 1.7E-05, 7.8E-05) SPECIFIC COMPONENT

OVERALL ( 2.65-13, 3.55-06, 2.05-05) ( 1.55-13, 3.25-06, 1.75-05) ( 8.55-14, 5.16-05, 1.56-05) ( 4.86-14, 3.06-06, 1.46-05) ( 2.6E-13, 3.5E-06, 1.9E-05) ( 1.5E-13, 3.2E-06, 1.7E-05) ( 8.5E-14, 3.1E-36, 1.5E-05) ( 4.8E-14, 3.0E-06, 1.4E-05) 8 5 ( 2.7E-13, 3.5E-06, 1.9E-05) ( 1.5E-13, 3.2E-06, 1.7E-05) ( 8.7E-14, 3.1E-56, 1.5E-05) RATE FOR SET OF K SPECIFIC COMPONENTS ( 2.9E-13, 3.5E-06, 1.9E-05) ( 1.6E-13, 3.1E-06, 1.7E-05) ( 3.15-13, 3.65-06, 2.0E-05)

RUNNING PUMPS - REACTOR COOLANT / RECIRCULATION

FAILURE TO OPERATE, GIVEN START

LETHAL SHOCKS DUE TO HARDWARE FAILURE EXCLUDED

FAILURES ONLY, EXCLUDING COMMAND FAULTS

RATES ARE PER CRITICAL HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

LAMBOA . ( 1.0E-08. 5.2E-06. 2.1E-05)

LAMBOA . ( 5.3E-10, 1.3E-07, 5.2E-07)

OMEGA . ( 5.3E-10, 1.3E-07, 5.2E-07)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

ALL FAILURES 13 OPERATE, GIVEN START, IN REACTOR CODIANT / RECIRCULATION PUMPS

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CA II	33594	17695	13042	45079	37558	36816	29290	31732	3399	1068	38451	26811	47570	30580	55878	38960	26228	13775	37510	118311	63506	37770	25443	16271	46125	15859	1724	49494	44184	62073	64363	58078
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60180	15488	245	56395	42519	35584	86612	52966	46080	53515	42451	37665	32634	29788	19692	51445	22445	27175	45502	35182	39786	58693	56458	33105	10147	30779	59150	62706	58566	55263	40404	40274	48238	56398	56912	57426	1 1 1	2577618
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> E Z	PLANT	CONTROL	EVENT		0	MODE	Y	A	302	ACT CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
R	API	015609	081676	ĸ	PM	A19	R			N D	"O" RCP SEAL FAILED CREATING 25 GPM RCS LEAK	CAJSE OF SEAL FAILURE UNKN, OTHR FAILRS OC
											"C" RCP DUTER SEAL FAILED CREATING 5-6 GPM LEAK	ASSUMED NATURAL END-OF-LIFE SEAL FAILURE
											RCP *C* SEAL FAILED	REPLACED SEAL
											ALL 4 RCP'S TRIPPO DUE TO LOSS OF 13.8 KV POWER	REACTOR/TURBINE TRIP OCCURED AT 2243 HOUR
											RCP 1-2-2 STARTED WITH INCORRECT BKR ALIGNMENT	PERSONNEL ERROR
											RCP 1-1-2 TRIPPED, DUE TO LOW COMP COOL HZO FLOW	PERSONNEL MAINTENANCE LOOSENED WRONG CEVE
8	081	027335*	101579	K	PM	013	0			N U	LOSS OF OFFSITE POWER CAUSED LOSS OF ALL 4 RCPS	LOSS OF OFFSITE POWER-DUTPUT BRKR FAULT
В	081	027421	102379	K	PM	011			1	N D	RCP 1-1-1 SECURED DUE TO BAD SEALS	THERMAL SHOCK
B	081	027422	102579	K	PM	013	S		1	N D	RCP 2-2 TRIPPED	ALOWN FUSE IN INTERLOCK CONTROL CIRCUIT
8	091	027867	112679	K	PM	000			1	N U	RCP 1-2 TRIPPED DUE TO LOW DIL LEVEL ALARM	NO CAUSE GIVEN
8	DE 2	000699	012274	K	PM	019			1	N U	REAC COOLNT PMP RCP282 FAILD CAUSE NOT YET DETRAND	DISASMBLY SHOWD 1 CAPSCREW , SPIROL MISSING
C	CCI	013277	081075	ĸ	PH	A19			1	N U	118 RX COOLANT PUMP DEVELOPED 2.7 GPM LEAK	MOTH UPPER AND MIDDLE MECH SEALS FAILED
C	ccs	021059	070478	K	PM	A16	R		1	N T	CRACKED WELD DISCOVERED DN 218 REACTOR COOLANT PUM	CAUSE OF WELD CRACK IS UNKNOWN
c	CCZ	021844	071478	K	PM	002	R		ı	N D	RCP SEAL COOLING HEAT EXCHANGER WELD FAILED	PREVIOUS WELD REPAIR WAS INADEQUATE
C	FC1	013525	092075	K	PM	A00			1	N U	REACTOR COOLANT PUMP VAPOR SEALS LEAKED	CASSE NOT GIVEN
c	FCI	031635*	051680	K	PM	A16			3	TT	RCP'S 3A, B, 6C FOUND LEAKING BETWEEN CASING & COVER	CORROSION TO STUDS & DETERIORATED GASKETS
C	PAI	025614	020179	K	PM	000	S		1	N U	PRIMARY COOLANT PUMP INADVERTANTLY STOPPED	CAUSE NOT GIVEN
C	SLI	017833*	041577	K	PM	D13	L		4	N D	LOSS OF SEAL CLNG WTR TO RCPS - RCPS WERE SECURED	CONTAINMENT INST AIR SYSTEM FAILED
C	SLI	017935*	051677	K	PM	D13	N		4	N D	LOST AL. FOUR REACTOR COOLANT PUMPS	LOSS OF OFF-SITE POWER
W	B V 1	018241*	071977	K	PH	004	N		3	T D	LOAD REJECT. TEST FROM 50% PWRIPMPS TPIPPD UNDRERO	TURBINE CONTROL DESGN CONCEPTS
W	8 V 1	026984*	081979	K	PM	001	N		3	N D	ALL THREE RCPS TRIPPED ON UNDERFREQUENCY	OPERATOR ERROR
	HN1	019911	082177	К	PM	A19			1	N U	#2 RCP INDICATED SEAL FAILURE - SHUT DOWN	VIS INSP CONFMO SL FAILD - MODE SU-4M-AL
	IP?	018331	070277	K	PM	119			1	N U	NO. 23 RX COOLANT PUMP TRIPPED OFF-LINE MANUALLY	SFAL PACKAGE FAILED, TOT LKG 90,000 GAL
	NAI	021636	053078	K	PM	007			1	N T	RCP C REQUIRED TO BE SECURED	TEAK IN TOMES TABE OIL COOLES
	202	012680	050175	K	PM	A19			1	N U	REACTOR COOLANT PUMP LOST BOTH SHAFT SEALS	SEAL FAILURE - PUMP MODEL VIIO01-81

	PL			SYST	CO	M A	Ţ	F A	ACTIVI	CLA		
	N T	CONTROL	DATE	EM	P P	D S	E	I I	U T	5	MODE DESCRIPTION	CAUSE DESCRIPTION
1	4 SA1	022871*	102178	K	PM	A06		1	N	D	ALL THREE RCP SEALS FAILED	POSSIBLY TOO HIGH A DIFFERENTIAL PRESSURE
-	SA	029073	122779	K	PM	013	5	1	N	0	#12 RC PUMP TRIPPED	IF 4KV GROUP BUS WAS LOST
. 1	s 5 0 1	030015	011690	K	PH	016		1	N	U	FIRE STARTED ON RCP "A" FROM AN OIL LEAK	NO CAUSE GIVEN FOR OIL LIFT PUMP OIL LEAK
	1 501	010417	113073	K	PM	005		1	N	0	RCP 14 SHAFT FAILD AT 42% POWER	FILLET GROOVE ON SHFT INCORRECTLY MADE
	501	027758	121979	K	7 M	018		1	N	T	LA REACTOR COOLANT PUMP TRIPPED	GROUND FAULT IN PUMP MOTOR
	1 101	018991*	082177	K	PM	001	N	4	N	0	WER TO RCPS INADVERTENTLY DEENERGIZED	GE4 OUTPUT BRKR WAS TRIPPED PREMATURELY
1	212	016051*	091976	K	PM	001	U	2	N	0	TWO RCPS WERE INADVERTENTLY TRIPPED OFF-LINE	PERSONNEL MADE SWITCHING ERROR
	3 8F)	027159*	092679	K	PH	003	٧	2	N	D	A AND B RECIRCULATION PUMPS TRIPPED	TROUBLESHOOTING WRONG TERMINAL STOP
	9 F 1	027682*	112679	ĸ	PM	003	٧	2	N	0	BOTH RECIRC MG SETS SHUTDOWN DURING NORMAL OP.	PERSONNEL TESTING WRONG RELAYS
	S BF?	030311	020380	K	PM	003	T	1	Ŧ	0	24 REACTOR RECIRC PUMP ACCIDENTLY TRIPPED	MISTNIERPRETED PUMP LABEL ON TRIP BREAKER
	S BF2	030312	020380	K	PM	013	5	1	N	0	28 RECIRC PUMP TRIPPED	SPURIOUS SIGNAL, MG SET GEN STATOR TEMP
	G RF2	030360	020690	K	PH	003	1	1	N	0	28 RECIRC PUMP TRIPPED	WRING RELAY OPERATED
	G AFZ	031547	060790	K	PM	011	T	1	N	T	24 RECIRC PUMP TRIPPED ON HIGH STATOR TEMP ON MS	LOTSE CONNECTION DUE TO VIBRATION
	BF:	016269	103076	K	PM	006	S	1	N	T	38 RECIRC TRIPPO DUE TO BURND COLLECTR RING ON MG	CARBON BRUSH WORE TOO SHORT
	G BF	032542	090190	K	PM	000		1	N	U	"A" RECIRC PUMP TRIPPED	CAJSE UNKNOWN
	G BRI	019493	102577	K	PM	013	5	1	N	0	14 RECIRC TRIPPO DUE TO RECIRC MG SET TRIPPING	LO LUBE OIL PRESS. DUE TO CONTROL VALVE
	6 8P1	020209	122977	K	PM	002	5	1	N	D	RECIRC PMP 14 TRIPPD DUE TO MG SET TRIPPING	STRING ON MG BER GOT CAUGHT AND TRIPPED
	G BRI	025091	010479	K	PH	020	5	1	N	T	14 RECIRC PUMP TRIPPED DUE TO LOW LUBE DIL DY MG	MISSING LOCK NUT ON LO ADJ CAUSED DRIFT
	G BR	031149	050180	K	PM	013	5	1	N	T	IA RECIRC PUMP TRIPPED ON MG SET LOW LUBE OIL PRES	PRESS SW SET TOO HE WITH ERRATEC PRESSURE
	G BR	013619	080475	K	PM	404	R	1	N	0	AFTER SCRAM FROM PWR, 28 RX RECIRC PUMP LEAKED	HOT COOLANT REACHED SEALS, CRACKED SE FACE
	0.00	2 211590	082475	K	PM	404	R	1	N	D	AFTER SCRAM FROM PWR, 28 RX RECIRC PUMP LEAKED	HOT COOLANT REACHED SEALS. CRACKED SL FACE
	G BR	013620	090575	K	PM	A04	R	1	N	0	AFTER SCRAM FROM PWR, 28 RX RECTRC PUMP LEAKED	HOT COOLANT REACHED SEALS, CRACKED SE FACE
	G BR	013798	111475	K	PH	013	S	1	N	U	56% PWR R/X RECIRC 24 TRIPPDZA MG SET INOPERALE	NO PROBLEM FOUND WITH MG SET
	G BR	014947*	052776	K	PM	001	N	2	T	0	RECIRC PUMPS TRIPPO ON LOW L.O. PRESS	OPERATOR DED NOT FOLLOW EMERGNCY PROCEDRE
	G BR	0149474	052776	K	PM	019	R	1	N	0	28 RECIRC SEALS FAILD FOLLOWING RX SCRAM 30% PWR	NOT STATED AS TO REASON

Z	PLANT	CONTROL	EVENT	SYSTEM		MODE	Y		362	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
-	032	014946	053076	×	D M	013	5	1	,	1 T	RECIRC LOOP INOP. DUE TO ZA MG SET TRIP ON SVERCEN	DVERCURRENT RELAY "508" FAULTY
- 10		016397								0.1	RX IN RUN MUDE, ALARMS INDICATE 28 RECIRC PMP PROM	PUMP SEALS FAILED DUE TO THERMAL SHOCK
- 6		0277694								0 1	28 RECIRC PUMP TRIPPED	BLOWN FUSES DUE TO SHORT BRUSHES
- 29		0217698								4 D	28 RECIRC PUMP TRIPPED	BLOWN FUSES DUE TO SHORT BRUSHES
		0301944								0 4	28 RECTROULATION PUMP TRIPPED	FUSES BLOWN IN VOLT FEEDBACK CIRCUITRY
		0301948								N D	28 RECIRCULATION PUMP TRIPPED	FUSES BLOWN IN VOLT FEEDBACK CIRCUITRY
		0301745									24 REACTOR RECIRC PUMP TRIPPED	WIRE CONNECTED FOR TEST. CAUSED TRIP
		014302	020676							N U	RECIRC PMP "B" TRIPPD	UNCHOWN
			022776							N T	RR PUMP "B" DRIVE MOTOR TRIPPO TWICE TEMP. SWITCH	SWITCH TRIPPD DUE TO VIBRATION; TYPE DA438
		014360	111276							N T	"9" RECIRC PMP TRIPPO DUE TO FALSE OP.OF NOT-LIS	MOISTURE IN MODEL 4418C SWITCHILEAKY VLVE
		016604								N T	LEAK DEVELOPED FROM 'B' RECTRC SEAL	SEAL REPLACED
		027345	081474							UT	UNIDENTIFIED LKG TO DRYWELL EXCEEDED TS LMT. 5 GPM	LKG FRM RECICO PMP 8 SEALS, CORREN PROCTS
		010580	102877							N T	MAN RECIRC HAD SLIGHT DECREAS IN FLOW DUE TO M-G	VOLT. REG. FOR MG HAD OPEN IN TRANSFORME
		017705	043080			-				N T	"A" RECIRC PUMP MG SET TRIPPED ON UNDER VOLTAGE	SHORT IN PUMP MOTOR
		031167	052880							N U	*8 RECIRC PUMP SECURED DUE TO HITLOW LO ALARM	NO CAUSE FOUND FOR LOSS OF LUBE DEL LEVEL
		031422	101874						*	N T	"B"RECIRCULATION PUMP SEALS LEAKING	LEAKING MECHANICAL SEAL
		010808	080477							T D	"A" RECIRC PUMP DID NOT RUNBACK DURIN FEED SYS TST	OPERATOR TURNO OFF CONT.PUR TO "A" RECIRC
		018549	012780							N T	A RECERC PUMP TRIPPED WHILE AT POWER	GROUND IN CONTROL CIRCUIT
		030243	040376							N D	RECIDE PMP "A" TRIPPO DUE TO EXCITER OVERCURRENT	WATER LEAKAGE INTO CONTROL CABINET
		014486	063076							N U	LOSS OF "B" RECIRC PUMP LOSS OF POWER DURIN TRANSF	BUS 10200 FAILD TO TRANSFER TO RECER. PWR
		015236	022877							NT	RECIRC PUMP MG SET TRIPPED ON LOW DIL PRESSURE	FAILURE OF THE DRIVE TO THE OIL PUMP
		017329	030777							N T		RECTRE PUMP CONTROL CKT PROBLEM CAUSED SP
		017338	100577						Ţ	T D	B RECIRC MG SET INADVERTNYLY TRIPPD. LOST MAN PUMP	OPERATOR ERROR DURING TEST
		019296	082977							N U	PRIMARY LEAK OF 5.61GPM T-CH SPEC-5GPM	RECTROULATION PUMP "A" SEALS LEAKING
		002363								NI	RECIRC PUMP SEAL LEAKED EXCESSIVELY	NO CAUSE GIVEN - OTHER THAN LEAKY SEAL
	G NM1	002129	091972		PE	WT.	* *		r	14 1	***************************************	

				c					C			
> = Z -	P A N T	CONTROL	EVENT	THE PROPERTY	0010	M A USE	TYPE	F A I L	Y T Y	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
G	NM1	000455	101873	К	PH	A19	R	1	N	T	RX RECIRC PUMP 12 HAD SMALL SEAL LEAK	NT CAUSE GIVEN - OTHER THAN LEAKY SEAL
G	NM1	019586	110077	ĸ	PM	419	R	1	N	U	LEAK GT. SGPM FORCG POWR REDCTN #15 2C PUMP	SEAL FAILS RPLCD SEALS ON #11.#14 PMP ALS
G	OC 1	013530*	121275	K	PM	003	U	3	1	D	DEENERG 125V DC DIST CTR - LOSS OF 3 RECIRC PUMPS	PERSONNEL DID NOT FOLLOW PROCEDURES
G	oct	025518	032279	ĸ	PM	013	5	1	N	T	"C" RECERC PUMP KEPT TRIPPING	LOSS OF GENERATOR FIELD, FAILED POTENIOPET
G	oc1	031190	042980	K	PM	013	3 5	1	N	9	14 RECIRC PUMP TRIPPED WHEN MG LUBE OIL PUMP TRIP	CAUSE UNKNOWN WHY LUBE OIL PUMP TRIPPED
G	ocs	017540	101377	к	PM	013	T	1	N	T	ZA RECIRC PUMP M/G FAILED - LOST ZA RECIRC PUMP	LOASE TACH COUPLING - GENERATOR VIBRATION
G	305	025430	022379	К	PM	013	T	1	N	T	24 RECIRC PUMP TRIPPED	MG SET TACHOMETER COUPLING FAILD
G	ocs	032646	082980	K	PM	013	5	1	N	T	"A" RECIRCULATION PUMP MG FIELD BKR OPENED	FAILED CONTROL POWER TRANSFORMER

PAGE

### Alternating Pumps

The pumps considered are: PWR chemical and volume control pumps; BWR feed pumps that serve for HPCI (at four plants only); PWR boric acid transfer pumps; component cooling water pumps; and residual heat removal pumps. The exposure hours used for the different systems are listed in Table B-1.

The nonlethal common cause failures to operate after starting tend to cluster at a relatively small number of plants. This leads to a very wide interval for  $\lambda_{\perp}$ .

Rates are estimated for:

- 1. Failure to start, based on all faults
- 2. Failure to start, based on failures only
- 3. Failure to operate after starting, based on all faults
- 4. Failure to operate after starting, based on failure only.

Be sure to read the Application section in the main body of this report. The following computer printouts give the estimates and summaries of the relevant data.

ALTERNATING PUMPS: CCW. RHR, PWR CVC AND BAT, BWR MOTOR-OR HPCI FAILURE TO START ALL FAULTS - ROTH FAILURES AND COMMAND FAULTS PATES ARE PER EXPOSURE HOUR TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND) LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

P \* ( .109, .278, .473)

LAMBDA \* ( 7.0E-10, 2.3E-06, 1.0E-05)

LAMBDA \* ( 3.0E-12, 1.3E-06, 6.9E-06)

OMEGA \* ( 2.2E-10, 5.7E-08, 2.2E-07)

SYSTEM			SHOCK			SPECI	RATE FOR	NENT		BETA	FACTO	38
1	t	1.2F-11,	6.0E-06.	2.9E-051		2.8E-08.	3.7E-06.	1.4E-051				
2								1.26-051	•	.000,	.089,	.3941
3		5.25-12.	2.66-06.	1.3E-051	ŧ	2.4E-08,	2.98-06.	1.1E-051		.000,	.097.	.4751
4								1.18-051				
5	ŧ	4.0E-12.	1.96-06,	9.6E-061	1	2.4E-08,	2.8E-06.	1.18-051	-	.000,	.093,	.4441
6								1.18-051				
OVERALL	(	3.8E-12.	2.6F-06.	2.9E-051	- (	2.4E-08,	2.98-06,	1.4E-051	-	.000,	.093.	.4761

RATE FOR SET OF K SPECIFIC COMPONENTS

R2

R3

R4

2 (7.8E-11, 2.8F-07, 1.2E-06)
3 (1.3E-10, 2.3E-07, 1.0E-06) (7.2E-10, 1.2E-07, 4.3E-07)
4 (1.8E-10, 2.1E-07, 9.0E-07) (7.6E-10, 1.1E-07, 4.0E-07) (6.4E-10, 7.7E-98, 2.8E-07)
5 (2.2E-10, 2.0E-07, 8.4E-07) (7.7E-10, 1.1E-07, 3.9E-07) (6.2E-10, 7.5E-08, 2.7E-07)
6 (2.5E-10, 1.9E-07, 8.0E-07) (7.6E-10, 1.0E-07, 3.8E-07) (6.0E-10, 7.5E-08, 2.7E-07)

DVERALL (7.8E-11, 2.1E-07, 1.2E-06) (7.2E-10, 1.1E-07, 4.3E-07) (6.0E-10, 7.5E-08, 2.8E-07)

ALTERNATING PUMPS: CCW, RHR, PWR CVC AND BAT, BWR MOTOR-DR HPCI FAILURE TO START
FAILURES ONLY, EXCLUDING COMMAND FAULTS
RATES ARE PER EXPOSURE HOUR
TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LAMBDA - ( 1.1E-07, 5.5E-07, 1.3E-06)
LAMBDA - ( 1.2E-07, 4.0E-07, 8.0E-07)
GMEGA - ( 2.2E-10, 5.7E-08, 2.2E-07)

.0000 .004. .3401 .004, .097, .3561 1598. . 004. . 160. 1 .003. .079, .2931 DVEPALL ( 2.0E-07, 1.2F-04, 1.9E-04) ( 2.2E-07, 7.7E-07, 1.8E-06) ( .003, .094, .369) BETA FACTOR .000. .000. 3.1E-07, 8.3E-07, 1.6E-061 2.7E-07, 7.7E-07, 1.5E-061 ( 4.2E-07, 1.0E-06, 1.8E-06) 2.5E-07. 7.4E-07. 1.5E-061 2.3E-07, 7.2E-07, 1.5E-06) 2.2E-07. 7.1E-07. 1.5E-061 SPECIFIC COMPONENT 5.5E-07, 3.5E-04, 1.9E-041 3.4E-07. 1.8E-04, 9.8E-051 2.7E-07, 1.2E-04, 6.5E-051 2.4E-07, 8.9E-05, 4.9E-051 2.2E-07, 7.1F-05, 3.9E-051 3.36-051 2.0E-07, 5.9E-05.

( 3.0E-10, 6.0E-99, 2.2E-07) ( 3.0E-10. 6.0E-08. 2.2E-07) OVERALL ( 9.15-10, 8.05-08, 2.85-07) ( 4.05-10, 6.55-08, 2.35-07) ( 3.05-10, 6.05-09, 2.25-07) ( 3.0E-10, 6.0E-08, 2.7E-07) RATE FOR SET OF K SPECIFIC COMPONENTS ( 4.2E-10, 6.5E-08, 2.3E-07) 4.1E-10. 6.4E-08, 2.3E-071 4.0E-10, 6.4E-08, 2.3E-071 ( 4.5E-10, 6.6E-08, 2.3E-07) 1.35-09, 8.46-08, 2.66-071 1.1E-09, 8.0E-08, 2.6E-071 9.95-10. 7.85-08. 2.65-071 9.1E-10, 7.7E-08, 2.6E-071 1.9E-09, 9.1F-08, 2.8E-07) 64

ALTERNATING PUMPS: CCW, RHR, PWR CVC AND BAT, BWR MOTOR-DR HPCI FAILURE TO OPERATE, GIVEN START ALL FAULTS - ROTH FAILURES AND COMMAND FAULTS RATES ARE PER EXPOSURE HOUR TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND) LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

P \* ( .275, .415, .555)

LAMBDA \* ( 1.2F-10, 8.9E-06, 4.3E-05)

LAMBDA \* ( 1.1E-30, 4.4E-06, 2.3E-05)

OMEGA \* ( 2.2E-10, 5.7E-08, 2.2E-07)

SYSTEM			SHOCK RATE MU			SPECE	RATE FOR FIC COMPONENT	NENT		BET	A FACT	DR
1	1	2.8E-30,	1.1E-05.	5.8E-051	-	1.2E-07,	1.3E-05.	7.9E-051				
2	ţ	1.86-30,	6.9E-06.	3.6E-051	-	1.28-07.	1.26-05.	6.9E-051	t	.000.	.000,	.4501
3	(	1.5E-30.	5.6E-06,	3.0E-051	- (	1.2E-07,	1.16-05.	6.6E-051	t	.000,	.000.	.5001
4	(	1.36-30.	5.1E-06.	2.7E-051	t	1.2E-07,	1.16-05.	6.5E-051	-	.000,	.000,	.4451
5	1	1.25-30,	4.8F-06.	2.5E-051	(	1.2E-07.	1.18-05,	6.4E-051		.000,	.000,	. 3971
6	•	1.2E-30,	4.6E-06.	2.5E-051	(	1.2E-07,	1-18-05,	6.4E-051	•	.000,	.000+	.3151
DUC DALL		1 25-20	6 45-04.	5 9E-051		1.25-07.	1-16-05-	7-95-051		-000-	. 000.	-5001

ALTERNATING PUMPS: CCW, RHR, PWR CVC AND BAT, BWR MOTOR-DR HPCI FAILURE TO OPERATE, GIVEN START FAILURES ONLY, EXCLUDING COMMAND FAULTS RATES ARE PER EXPOSURE HOUR TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND) LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

P = ( .004, .246, .697)

LAMBDA = ( 2.9E-11, 7.0E-06, 3.5E-05)

LAMBDA = ( 2.0E-08, 1.7E-07, 4.4E-07)

OMEGA = ( 2.2E-10, 5.7E-08, 2.2E-07)

SYSTEM SHOCK
RATE

SYSTEM SIZE RATE FOR SPECIFIC COMPONENT BETA FACTOR

1 (7.2E-08, 7.5E-05, 3.8E-05) (1.1E-07, 7.2E-06, 5.4E-05)
2 (4.7E-08, 3.8E-05, 1.9E-05) (9.8E-08, 7.1E-06, 5.4E-05) (.000, .044, .560)
3 (3.9E-08, 2.5E-05, 1.3E-05) (9.8E-08, 7.1E-06, 5.4E-05) (.000, .044, .590)
4 (3.5E-08, 1.9E-05, 9.7E-06) (9.8E-08, 7.1E-06, 5.4E-05) (.000, .041, .593)
5 (3.2E-08, 1.5E-05, 7.8E-06) (9.8E-08, 7.1E-06, 5.4E-05) (.000, .038, .325)
6 (3.1E-08, 1.3E-05, 6.5E-06) (9.8E-08, 7.1E-06, 5.4E-05) (.000, .035, .629)

RATE FOR SET OF K SPECIFIC COMPONENTS

R2

R3

R4

2 (1.56-09, 8.46-08, 2.76-07)

3 (1.26-09, 8.06-08, 2.66-07) (5.36-10, 6.86-08, 2.46-07)

4 (1.06-09, 7.86-08, 2.66-07) (5.06-10, 6.86-08, 2.46-07) (3.76-10, 6.36-08, 2.36-07)

5 (9.66-10, 7.76-08, 2.66-07) (4.96-10, 6.86-08, 2.46-07) (3.76-10, 6.36-08, 2.36-07)

6 (9.06-10, 7.76-08, 2.66-07) (4.86-10, 6.76-08, 2.46-07) (3.66-10, 6.36-08, 2.36-07)

GVERALL ( 9.05-10, 7.85-08, 2.75-07) ( 4.85-10, 6.85-08, 2.45-07) ( 3.65-10, 6.35-08, 2.35-07)

ALL FAILURES TO START IN ALTERNATING PUMPS: CCM. RHR. PWR CVC AND BOR ACTO TR. BWR MOTOR-DK HPCI

AFFECTED BY LETHAL SHOCKS FAILRS/COM FLTS		,	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 1 0	0 1 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 4 0	0 / 0	0 / 0	0 1 0	0 1 0	0 / 0	0 / 0	0 / 0	0 / 0	0 1 0	0 / 0	0 1 0	0 / 0	0 1 0	0 / 0	0 1 0
FETTAS SHOCKS	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 1 0	0 1 0	0 1 0	0 / 0	0 / 0	0 / 0	0 1 0	0 / 0	0 / 0	0 / 0	0 1 0	0 / 0	0 / 0	0 / 0	0 1 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 1 0
NONLETHAL SHOCKS	1 / 0	0 / 5	1/1	0 / 1	0 / 0	0 / 0	0 / 0	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 1 0	0 / 0	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NUMBER OF MONLETHAL SHOCKS FAILRS/COM FLTS	110	0 / 1	1 / 1	1 /0	0 / 0	0 / 0	0 / 0	110	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 1 0	0 / 0	0 / 0	0 / 0	0 1 0	0 / 0	0 / 0	0 1 0	0 / 0	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 1 0
NUMBER OF INDIV. FAULTS FAILES/COM FLTS	0 / 0	0 / 0	+ 10	0 / 0	0 / 1	0 / 0	0 / 0	0 / 3	0 / 0	0 / 0	0 / 1	0 1 0	2 / 1	0 1 0	0 / 0	1 / 1	2 10	0 / 0	0 / 1	0 1 0	0 / 0	1 / 1	0 / 0	0 : 0	1 / 2	0 / 0	0 / 0	0 / 0	0 / 2	0 / 0	1 / 0	0 / 0	0 1 0
404	10	10	6	10	11	11	0	0	c	10	10	10	10	10	60	10	10	10	10	10	10	10	10	10	0	11	11	6	6	0	0	0	10
CALFND.	53952	32544	26808	65328	60384	53535	52968	42192	4679	15994	32464	33624	62712	43464	00969	76734	39352	38529	26665	52464	75704	64536	30336	27575	57690	21840	5992	20004	50760	76704	73104	76704	75704
HOURS.	33504	17695	13042	62055	37558	35816	23290	31732	3398	1068	39451	11892	47570	30580	55879	34960	26228	13775	37510	15811	63506	37770	53443	12251	46125	15859	1724	49494	44184	62029	54363	54078	60180
PLAYT	1 24	C 8 3	081	130	230	0£3	158	111	11.2	AR 2	1 23	233	FC 1	214	MYI	PAI	175	8 4 1	100	250	HN 1	201	163	1 40	KE 1	NAI	NA 2	1 00	6. a. a.	114	PT2	198	802

A. THIS COUNTS SHAPED PUMPS ONLY ONCE.

ALL FAILURES TO OPERATE, GIVEN START, IN ALTERNATING PUMPS! CCM, RHR, PWR CVC AND 838 ACID TR, BWR MOTOR-DR HPCI

PLANT	CRIII.	CALEND. HOURS	404	FAILRS	A LU	AULTS M FLTS	NON ET	MAL SHOCKS	NON	SHOP	D SHOCKS	FATLES	SHOCK COM FL	N-1	LETHA FAILRS	L CO	HOCKS H FLTS
	10800	K 3 0 K 3					0	0 /	0	-	0	0	0 /		0	`	•
AKI	33244	32566	2 2		0		0	2 /	0		,	0	0 /		0		
5 6 6	13043	26.01	0	,	3		0	1 2	0	-	2	0	0 /		0	_	0
190	13042	46338	10	1	0		0	0 /	0	,	0	0	0 /		0		
1 10	*1000	40360	2 -				0	0 /	0	10	0	0	0 1		0		0
2 30	31228	* 00 00	: :				0	0 /	0	1 0	0	0	0 /		0		0
06.3	36816	53236	11					0 1		1 0	0	c	0 /		0	-	0
N S I	29290	95998	> 1							1 0	2	0	0 /		0		0
111	31 732	42192	0 (	1						10	0	0	0 /		0		0
211	3368	8794	0 0	0 0	0 0		0 0	0 0		, 0	0	0	0 /		0	_	0
AP 2	1068	15984	10		>		,					•			•		
100	39451	52464	10	2	m .		0	1 /		, 0	7	0	0		0 0		
500	26811	33424	10	3 /	0		0	2 /				0	0		0		
E 2 3	47570	62712	10	0	,		0	0 /		, 0	0	0	0 /		0		0
	30580	63664	10	3 /	0		0	1 1		10	,	0	0 1		0		0
	55878	49600		-	0		0	0 /		1 0	0	c	0 /		0		0
1 1	38360	74704	10	-		0	0	0 /		1 0	0	0	0 /		0		0
	00000	20000		2			0	0 /		1 0	0	0	0 /		0		0
24.1	62292	30436						, ,		/ 1	1	0	0 /		0		0
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001	37510	26664	01	01			0 0			10	0	0	0 /		0		0
230	16811	55464	10	0			0										- 0
1 22	63506	76704	10	0	,	0	0	, 1		, 0	-	0	0 1		0		0
103	37770	46534	10	1.5		1	0	0 /		1 0	0	0			0		0
101	34663		10			0	0	0 /		. 0	0	0	-		0		0
			10			0	0	0 /		10	0	0			0		0
1 1	11261			, ,			0	0 /		1 0	0	0	-		0		0
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NAI	15854	~	11							10	0	0	0 /		0		0
NA.2	1724		11							. 0	0	0			0	•	0
100	40404		•	-				. ,			0	0	0 /		0	,	0
2 8 6	44184		0	0		0	0					•			0	-	0
p11	62073	76704	0	*	-	0	0	0 /		0	0						
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P.02	60183	16704	10	15		3	>			,							

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3	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	
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10	12	0	11	11	10	10	10	60	1.2	112	7	1	1	3	7	1	80	1	9	9	4	7	4	7	0	40	60	œ	¢	0	10	1	1	
33350	2112	74704	72336	66360	42048	21969	95059	76704	63864	26665	62448	54360	36360	76704	34836	48528	57936	57216	\$0665	76704	76704	\$3064	19680	51440	76704	76704	76704	76704	41728	53028	25696	76704	73920	
80	245	26895	61525	35584	816512	95466	46080	51515	15525	37666	32634	29788	25941	51448	55442	27176	45502	35182	39786	58693	56458	39105	10147	30779	59150	62706	59566	55263	26505	40274	48238	56333	56912	
15488		20																																

A. THIS COUNTS SHAPED PUMPS ONLY ONCE.

# ALL FAULTS IN ALTERNATING PUMPS: CCW, RHR, PWR CVC AND BOR ACID TR. BWR MOTOR-OR HPCI

									ě			
242	P L A N	CONTROL NUMBER	EVENT	SYST-WE	COMP	MODE	¥	Α.	ACK.	CLASS	MODE DESCRIPTION	CAUSE DESCREPTION
_		013015	070775	6	D M	801	c	1		I D	P36C M/U PUMP STARTED AND IMMED TRIPPED. PUMP FRZN	RAN WITH NO SUCTION. INCORRECT VLV LINE-UP
(797)		016195						- 3		T	P368 STOPPED DUE TO OVR-CURRENT AND LOSS OF PRESS	
	-	017938*						-		U	CHEM ADD PMPS 3A 6 3B FOUND INOP FOR PLANT S/U	CAUSE UNKN. PUMPS FLUSHED, RIND TO SERV
- 771	1000	01/430*									DISCOVO CHEM ADD PMPS 3A 6 38 INOP, PLANT AT POWER	PUSP BELIEVED AIRBOUND, VENT VLV INSTALED
750		021167	****					1			LOW FLOW EXISTED ON DECAY HEAT REMOVAL PUMP 1-A	PUMP SHAFT SHEARED, BEING EVALUATED
	-	022309*								0 1	CHEM ADD PUMPS FAILED TO DEVELOP DISCHARGE PRESS.	CAPIA AND 18 SECAME AIRBOUND
-	4.00	025927								4 U	CHEMICAL ADD PUMP FAILED TO PUMP (CAP-18)	CAJSE UNKNOW!
7795	90.000	019374						1		N D	MAKEUP PUMP 1-2 HAD DIE LEAK ON DIBD BRNG END PET	D-RING ON END PLATE DID NOT FORM ADEO SL
		020277	011678					1		1 1	DECAY HEAT PMP 1-1; FUSES IN BKR. START CKT.	POOR FUSE CONTACT IN CKT
		021570								N D	POWER LUST TO DECAY HEAT PUMP 1-2, DH FLOW LOST	PERSONNEL TRIPPED PS BUSSES TO PUMP ACCI.
	-	021859*								N D	POWER SUPPLY LOST 3 TIMES TO DECAY HEAT PUMP	2 PERSONNEL ERRORS
-		021858								1 1	HOSTZONTAL VIBRATION ON HPCI PUMP 1-1	PUMP WAS MISALIGNED DUE TO LOOSE MOUNTS
		021959						1		1 1	COMP COOLING WATER PUMP 1-1 HAD EXCESS. VIBRATION	FAILED AND IMP. CLEARANCES ON BEARINGS
		022690						1		N D	COMP. CAULING WATER PUMP 2 TRIPPED	PERSONNEL DID NOT REOPEN HX OUTLET VALVE
		0255254								1 0	HPI PUMP 1-1 FAILED TO DEVELOP SUFFICIANT RECIRC	HEAT TRACE UNABLE TO MAIN LINE ABOVE FREZ
-	7000	0255258								1 0	HPI PUMP 1-2 MAY NOT HAVE HAD SUFF. RECIRC	HEAT TRACE UNABLE TO MAIN LINE ABOVE FREZ
-	1000000	025603							- 1	N D	MAKE UP PUMP 1-1 DEVELOPED VIB AND DECRE PERFORM.	FORFIGN DEBRIS FAILED WEARING RING
-		027857	110879					1		N T	DHR PUMP 1 FAILED TO START	FAULTY SWITCH
		027859	111279	G	PH	805	5	1		1 0	HPI PUMP 1-1 FAILED TO START	FACTORY DEFECT IN CONTROL CIRCUIT WIRING
-		027918	120879	J	PM	813	3 5	- 1		N T	COMPONENT COOLING WATER PUMP #1 FAILED TO START	FATLED BREAKER ACLIS ON BUS CL
		031610	062380	G	PH	uoi	C	1		N D	HPI PUMP 1-1 BEARING THERMOCOUPLE WELLS BROKEN	ASSUMED TO BE STEPPED ON
В	DBI	032122	081380	8	PH	002	2 5	1		N D	DH PUMP 1-2 WAS STOPPED WHEN SUCTION VLV CLOSED	MAINTENANCE F'ILED TO DEFEAT INTERLOCK
	2000	0148060	012976	G	PH	802	2 U	1		1 0	HIGH PRESSURE INJECTION PUMP - INOPERABLE (1A)	INCORRECT SUBSTITUTE BREAKER INSTALLED
		031669						1		N T	BORIC ACID FRANSFER PUMP DECLARED INOP	FAILED MOTOR DIAPHRAM & VACUUM COMP VLV
8	OF 2	031916	071380	G	PM	021	1	1		N T	28 HPT PUMP REMOVED FROM SERVICE	MAD BEARING CAUSE NOT STATED

VEN	PLANT	CONTROL	EVENT	SYSTEM	0	MODE	×	FAIL	ACTIVITY	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
74		HUNDER		-			-		-	*	28 HPI PUMP DECLARED INOPERABLE, DEVELOPED HOT BEAR	MALEN PRESSURE DE MOTOR AGAINST UP REAR.
В	UES	033125	072680	G	PM	018	R	1	N	U		CAJSE NOT STATED
		032153								U	BORIC ACID TRANSFER PURP DECLARED INDICATOR	STRAINER WAS BLOCK
		032311	080580								BORIC ACID XFER PUMP UNABLE TO FORF DOWN COST	WORN WORM GEAR, BAD GASKET, & TORN OLL SEAL
-		032430						1		Ŧ	CON BURIC ACID STURAGE TARK	
		0327764						1-	N	U	CRAST PUMP FAILED IN PORT FROM COMMITTED	LOW DIL LEVEL IN PUMP, CAUSE NOT GIVEN
		0327768									CRACT DIMP DECLARED INDECADE	COUNTER NOT RESET
		014502						1		12	MOCT PARA TRIPPO DEF LINE WHEN AT 100% POWER	NO CAUSE COULD BE FOUND THRU TESTING
			082276								EXCESS LEAKAGE ON 8 PMP OF DECAY HEAT DURNG SEVENC	LEAK CAUSD BY STUFFING BOX GASKET
-	1000	016012									B DHR PUMP SEAL FOUND LEAKING	LEAKING SEAL REPLACED
		021744							- 11		LEAVACE ORSERVED ERON IA! DHR PUNP SEAL	SEAL WAS REPLACED
8	R 5 1	030263	011790	R	PM	Al				,	MANCHO DUMO 14 TRIPPED ON MANUAL ACTUATION	WRING LUG USED TO COHN FOR COL TO MTR WOG
8	TIL	011016	101074	G	PM	802	2		1	0	HARCUP PURP IC FALLED TO START - AUTOMATIC	WESTINGHSE ACB HAD DISLED TRIP LICH SPRNG
В	111	011015	101774	G	PM	813	3	1	1	D	MAKEUP PUMP 1C FAILED TO START - AUTOMATIC	LOSSE TERMINATION ON BRER RELEASE
8	TIL	012103	010375	5 G	P	81	3 5	1	1	0	HIGH PRESS INJ PUMP MU-PIC FAILED TO START "A" MAKEUP/PURIF PMP STARTED WITH IMPROPR VALV L/U	PMP FAILURE DUE TO INAD PROCEDRES/PERSCHL
8	TII	014220	021776	5 6	. P	80	5 C	1	1	0	"A" MAKEUP/PURIT PAP STARTED ON VECO TO CETE PR	MALFUNC TIME DELAY RELAY IN LOW L.O. CHT
8	TIL	020997*	031878	9 6	P	101	3 U	2	1	D	THE 1A 6 1C MAKEUP PMPS TRIPPED ON XFER TO SITE PR	FAILED LEAD INSIDE PUMP HOTOR
В	*11	025503	02177	9 6	, P!	01	8	1			HPI PUMP MU-P-1C TRIPPED ON GVERLOAD	RELAY IN ESFAS BURNED CONTACTS
c	CCI	012449	02167	5 .	) P	9 B1	3 5	1	1	0	NO 11 CCW FAILD TO START UPON SIS SIGNAL	PLUNGER PKG LKG TUTE & INDUS. PARTS SF194)
c	CCI	013189	08017	5 (	, P	4 41	9 R	1	ı	U	#13 CHARGING PUMP RELEASED GAS ACT TO AUX BLDS	PLUNGER PACKING LEAKED EXCESSIVELY
-		013389		5 (	; P	4 41	9 R	1	1	JU	#13 CHG PUMP RELEASED GAS ACT FROM UA-1 MAIN VEST	CAUSE FOR OPENING OF BKR. UNKNOWN
- 3		014754		6 (	5 P	4 DO	0 5	1	1	N U	\$13 CHARGN PUMP TRIPPO DUE TO BREAKER OPENING	
		013485								4 T	#12 CHARGING PUMP REMOVED FROM SERVICE	REPAIR SLOWLY INCREASING PACKING LEAK
		1 017688									#12 CHG PUMP S/D AND ISOLATED	EXCESSIVE PACKING LEAKAGE, PACKING FAILED
			-								*12 LPSI COULDN'T BE TRIPPE FROM CONTROL RM	MISSING SCREW IN TRIP ACT. LEVER ON BREKR
(	CC	1 020358	01737	0		H DO	2 1	1 1		N D	BLI LPSI PUMP WAS STOPPED WHILE IN RHR MODE	SPURIOUS RECIRC ACT SIG BY PERSONNEL TEST
(	CC	1 026235	0 90 67	9	GP	M DI	3	5 1		N T	#12 CHARGING PUMP TRIPPED ON LOW SUCITON PRESSURE	FAULTY PRESSURE INDICATING SWITCH
1	6.0	. 0.01.0										

									A			
1 KAK	P A N T	CONTROL	EVENT	Ė	COMP	MOSE	Y		NUM	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
C	CCI	0267188	080679	G	PM	A19		1	N	T	#11 CHARGING PUMP ISOLATED DUE TO LEAK	PACKING FAILED
¢	CCS	017049	012177	G	PM	C14		1	N	T	FLOW FROM #21 CHG PMP DECREASED TO ABOUT 39 GPM	INVEST REVEALED TWO DISCH VLVS BROKEN
C	CCZ	022604*	032478	P	PM	013	U	2		T	BOTH LPST PUMPS TRIPPED BY RAS SIGNAL	LEVEL INDICATOR FOUND TO BE OUT OF CAL.
c	ccs	022646*	101778	P	PM	C 0 6	U	2		0	BOTH 21 AND 22 LPST PUMPS LOST SUCTION	ATR LEAKED FROM PURIFICATION SYS TO SOC
C	ccz	023173*	121278	G	PM	A19		2		T	21 AND 22 CHARGING PUMPS HAD EX PRI PACKING LEAKS	PACKINGS REACHED EDL SIMULTANEOUSLY
C	FC1	000613	112073	J	PM	U04	R	2	-	1	COMPONENT COOLING WATER IMPELLER CRACKING	CAST IRON IMPELLERS CHANGED TO BRONZE
Ć	FC1	012513	040375	G	PH	809	5	1	1	1	CHARGING PUMP CH-1C FAILD TO START	DIRTY FIMING RELAY CONTACTS
C	FC1	032756	092680	G	PM	019	5	1		F	"A" CHARGING PUMP BECAME INOPERABLE	PACKING COOLING WATER PUMP FAILED
c	MIZ	014602	050276	G	PM	C19		1	1	1	"A"CHARGING PUMP NO FLOW ON AUTOMATIC START	GRISS PACKING LEAKS
C	MIZ	017374	121276	G	PM	000		1		1 1	"C" CHARGING PHP TAGGD OUT DUE TO EXCESSIVE MOTSE	UNKNOWN
C	M12	025576	031479	R	PM	C11	U	1		0	LPSI PUMP LOST SUCTION DURING S/D COOLING	PUMP BECAME ATRBOUND
C	H12	030796	031080	G	PM	A19		1		T	CHARGING PUMP PLACED OUT OF SERVICE	PACKING FAILED, NATURAL END OF LIFE
C	MY1	021039	030278	G	PM	002		1		T	14 CHARGING PMP STARTD FOR VIBRATH TESTHI TEMP.	LOCKH PIN NOT INSTILLD TO BEARING
C	PAL	000202	072773	J	PH	015	6	1	- (	J D	COMPNT COOLING PMP PSZC COUPLING FAILED	TEETH ON HUB STREPPED
C	PAL	014719	042175	G	PM	809		1	1	1.1	CHARGING PUMP P55-A WOULD NOT START PROPERLY	PLUGGED OIL FILTER
C	PAI	015311	072076	J	PM	DZO	)	1		U	CCW PMP P52-C INBORD BRNG FAIL? SHAFT METALLIZED	ETTHER HOT END ALIGHNT OR BRNG SLIPPAGE
C	PAI	021117	041778	G	PH	813	5	1		0 4	CHARGING PUMP P-558 WOULD NOT START	FAULTY CONTROL COIL IN CIRCUIT BREAKER
C	PAI	022913	103178	G	PM	A19	1	1		T	CHR PUMP P-55C TAKEN OUT OF SERVICE	LEAKING SEALS
C	SLI	0173744	022077	G	PH	000	) R	1	. 1	U	B CHG PMP SEAL LUBE WTR PMP FATLED DURING RIX SIU	MODEL SOLL, TYPE 102, STYLE CZOOV
c	SLI	0173948	022077	G	PM	000	2	1		N U	A CHG PMP SEAL LUBE WTR PMP FAILED DURING R/X S/U	MODEL SOLL TYPE 102 PART#78 15157
C	SLI	017393	022677	G	PM	coo	R	1	. 1	N J	DURING POWER OPS.A CHRONG PMP SEAL LUBE WIR FAILED	FATLD TO DELIVER SUFFICIENT FLOW
C	SLI	023658	090278	G	PM	A16	, R	1	. 1	1 1	CHR PUMP 14 FOUND TO HAVE SMALL CRACK IN BLOCK	CAUSE OF CRACK IS UNKNOWN
C	SLI	022649	100278	G	PM	813	3 5	1	. 1	0 P	18 CHARGING PUMP FAILED TO START	ELEC INTER READ O SUCTION PRESSURE
c	SLI	025595	031679	G	PM	416	, R	1	. 1	N T	1C CHARGING PUMP DEVELOPED CRACKED PUMP CASING	SUCTION CAVITATION & VIBRATION
C	SLI	032587A	082880	G	PH	A00	) R	1	. 1	H U	SEAL WATER LEAK DEVELOPED IN 18 CHR PUMP	CAUSE NOT STATED

P			500		, C			ACTIO	c		
V A E N N T	CONTROL	EVENT	TEM.	COMP	D S E	PE	I	1 1	5	MODE DESCRIPTION	CAUSE DESCREPTEON
c 51.1	0325870	082880	G	PM	800	S	1	N		14 CHR PUMP STARTED THEN APPARENTLY STOPPED	FATLED SEAL WATER PUMP
	015214									A RUPTURED SEAL WAS DISCOVERED ON 14 RHR PUMP	SEAL BOUND ON PUMP SHAFT CAUSING FAILURE
										IC CHARGNG PMP LEAKING AT SPEEDING. GEAR CASING	TUSE FAILURE OF L.O. COOLER
										18 CHARGNG PMP LEAKING AT GEAR CASING	TUSE FAILURE OF L.D. COOLER
	018348									18 CHARGING PUMP TRIPPED ON PHASE OVERCURRENT	PUMP SHAFT CRACKED AT BALANCE DRUM NUT
							1	N	T	18 CHARGN/SI PUMP HI REARING TEMP ALARM	PLUGGED DIL PUMP CHOLERS-WATER SIDE
										10 CHARGE/SI PMP HI BEARING TEMP ALARM PLGGO COOL	RIVER WATER STRAINERS TORN ALLOWING DERRI
										IC CHG PUMP TREPPED. NO BACK-UP WAS AVAILABLE	OPERATOR MADE IMPROPER ELEC LINE-UP
										A AND B RHR PUMPS WERE RUNNING WITH NO DISCH FLOW	PUMPS BECAME AIR BOUND WITH RCS DRAINED
	023145									1C CHARGING PUMP HAD LOW DISCHAGE PRESSURE	FAULTY ROTATING ELEMENT
w 8 v 1	026481	070379		PM	013	S	1	N	0	RHR PUMP WAS TRIPPED FROM CONT ISOLATION PHASE 8	POWER SUPPLY SWITCHING CAUSE VOLT SPIKE
w 9 V I	026841	081679	G	PM	002	c	1	1	0	IC CHARGING PUMP BECAME INOPERABLE	FAILED BEARING DUE TO A COOLING VLV SHLT
w av)	030552	013180	1	PM	013	S	1	N	T	BORIC ACID TRANSFER PUMP TRIPPED ON OVERLOAD	POSSIBLE FAULTY BLENDER CONTROLS. CH-P-28
w 8 V I	030879*	040880	R	PM	006	٧	2	N	0	RHR PUMPS BECAME AIRBOUND WHILE INCREASING FLOW	PRICEDURE REVISED TO VENT PUMPS
w 9 v 1	030880*	041180	R	PM	C11	٧	2	N	0	"A" AND "B" RHR PUMPS COULD NOT DEVELOP FLOW	PUMPS BECAME AIRBOUND
w BVI	031790	062990	1	PM	003	5	1	T	0	BORIC ACID TRANSFER PUMP TRIPPED	PERSONNEL TESTED BKR INCORRECTLY
w BVI	032789	091780	G	рн	002	U	1	1	0	IC HIGH HEAD CHARGING PUMP BEARING TEMP INCREASED	CHECK VALVES INSTAL BACKWARDS IN COOL HED
w BVI	032853	093080	T	PM	A19		1	N	T	ZA BORIC ACID PUMP DEVELOPED LEAK (CH-P-ZA)	WORN MECHANICAL SEAL, CRACK FOUND ON SHAFT
w oct	013078	070375	1	PH	C09		1	1	1	BOR ACID XFER PMP #2 FLOW 17.3 GPM, SPEC IS 20 SPM	BORIC ACID CRYSTALS IN VLVS & PIPES
w 001	013076	072075	ī	PM	C19	R	1	N	0	#1 BOR ACID XFER PMP COULD NOT MEET DESIGN FLOW	MECHANICAL SEAL FAILED
w oct	013443	082475	t	PM	419	R	1	N	0	#2 BOR ACID XFER PHP TAKEN DUT OF SERV, EXSV LKG	JOHN CRANE MECHANICAL SEAL FAILED
w pc	013410	092775	ŧ	PH	A19	R	1	N	0	#2 BOR ACTO XFER PMP TAKEN OUT OF SERV. EXSV LKG	JOHN CRANE MECHANICAL SEAL FAILED
. 001	013540	101775	1	PM	419	R	- 1	N	D	#1 BOR ACTO XFER PMP TAKEN OUT OF SERV, EXSV LKG	JOHN CRANE MECHANICAL SEAL FAILED
w nc:	013541	102075	1	PM	A15		1	N	0	#1 BOR ACTO XFER PMP TAKEN OUT OF SERV, CSNG SEPS	DAMAGE TO GASKET SEALING SURF ON CASING
w DC	017650	040777	G	PM	015	R	1	N	D	IN CENT CHG PUMP AMMIR PEGGED, PUMP DEENERGIZED	ARTKEN SHAFT-CLEAN BRK UNDR 11TH STG IPP

### ALL FAULTS IN ALTERNATING PUMPS: CCW, RHR, PHR CYC AND BOR ACID TR, BUR MOTOR-DR HPCI

							A			
P L A N T	CONTROL	EVENT	SYSTER	# C.	CATO	F	N I I	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
w 0C1	017670	041877	6 .	90 n	9	1	N	D	"H" CHARGN PMP HIGHER THAN NORMAL CASING TEMPERATE	RAG STUCK IN RECIRC LINE DURIN ROTOR REPL
w DC1	017769	051777	G	+ 0	58.	. 1	N	0	EAST CENT CHG PMP BRK BET 3RD & 4TH STG IMPELLERS	BREAK APPEARED TO BE A FATIGUE FAILURE
W 0C1	020067	122277	3 -		14.	1	1	0	WEST COMP COOL WIR PMP FAILD TO START (MANUAL)	WIRE BROKEN AT TERMINAL BLOCK HOT SID PAN
W DC1	020310	011678	10	0.6	e V	. 2	1	T	#2 BOR ACID XFER PHP DISCH PRESS LOWER THAN REOD	LEAKING MECH SHET SL. ATTRIB TO NOR WE AR
w 0C1	031911	070380	G P	8 0	10 7	1 5	-	0	TRAIN B CENTRIFUGAL CHR PUMP FAILED WHILE OPER.	SHAFT BROKE
W HNI	014163	012476	G P	M A	19	1	N	T	EXCESSIVE SEAL LEAKAGE ON 14 CENT CHARGING PUMP	OUTBO SEAL HAD "O" RING FAILURE
W HNI	015097	061776	R P	M D	06 (	1	N	0	R/X SHUTDOWN & REFUELING LOST PWR TO RHR PMP 2MIN	OVERLOADED 480V BUS PROCEDURES DEFICIENT
W HNI	016041	100176	I P	M D	21	- 1	N	T	14 BAT DEVELOPED LEAK IN CANNED ROTOR DUE TO BRIGS	WIPED BRNGS ALLWO ROTOR TO DROP & WEAR
W HNI	017426	030477	1 0	M D	09	1	N	T	14 BAT OVERHEATO & SEIZED DUE TO BEARING FATLURE	FOREIGN MATERIAL ENTERED MOTOR BEARING
W HN1	017569	040477	G P	M C	20	1	N	T	"A" CHONG PUMP INDICATIONS POINTED TO FAULTY OPS	DISASSY REVEALED CRKS UNDER PRESS RED SLV
W HN1	027687	042677	G P	M A	05	1		D	14 CHG PMP DEVELOPED SMALL WEEP ON SUCT MECH SEAL	SLIGHT POROSITY BINN SL SPLY PSG & SL SUR
W HNI	017698	042877	G P	M D	20	1	N	T	TA CHARGING PMP AXIAL MISALIGNANT OF MTR TO PUMP	EXCESS THRUST WIPED HOTOR SEARING RAN 20M
W IP7	J13170*	072275	G P	M A	19 8	1	N	0	2 CHG PMPS REMOVED FROM SERVICE	EXCSV PLUNGER SEAL LEAKAGE
W IPS	013299*	092775	G P	M A	19 6	1	N	0	2 CHG PMPS REMOVED FROM SERVICE	EXCSY PLNGR SEAL LKG VAR SPC 98GPM
W IP2	013300*	082775	G P	M A	19 6	1	N	0	2 CHG PMPS REMOVED FROM SERVICE	EX:SY PLNGR SEAL LKG - PSBLE DESIGN MOD
W IPZ	013432	090475	I P	H A	19 F	1	N	T	BOR ACD XFER PUMP # 21 REMOVED FROM SERVICE-TYPE 1	BELLOW SHAFT SEAL LKG - ONG FSP 10443-2
W IP2	013609	101475	I P	M A	19 8	1		T	BOR ACD XFER PUMP #22 REMOVED FROM SERVICE -TYPE 1	RELLOW SHAFT SEAL LKG - DWG FSP 10443-5
M Ibs	0137394	110575	G P	M A	16 R	1	1	0	MG. 23 CHG PUMP REMOVED FROM SERVICE	LEAKING HEAD GASKET - TYPE QX-300 QUNTPLX
W IP2	0137399	110575	G P	M A	19 6	1	N	0	MO. 22 CHG PUMP REMOVED FROM SERVICE	EXCSV PLNGR SEAL LKG - TYPE GX-300 QUNTPX
W IPS	013850	120375	G P	H A	16 F	1	N	0	NO. 21 CHG PUMP REMOVED FROM SERVICE	LKG HEAD GSKT - TYPE GX-300 QUINTUPLEX
W IP2	014003A	121875	G .	M A	16 A	1	N	0	NO. 21 CHG REMOVED FROM SERVICE	PIN HOLE LEAK IN FLUID HEAD
W IPZ	0140038	121879	G P	M A	16 F	1	N	D	NO. 23 CHG REMOVED FROM SERVICE	LARGE LEAK IN FLUID HEAD
4 I+2	014449	031276	I P	M A	19 6	1	N	T	BOR ACD XFER PUMP REMOVED FROM SERVICE	BELLOW SEAL LKG - CRACKED ROT SEAL SURFCE
W IP2	0187878	050777	J P	M B	13 5	1	1	0	#22 AUX COMP COOL WIR PMP FAILD TO START DURIN ST	DIRTY CONTACTS IPLANT IN COLO SHUTDOWN
W IP2	019236	052677	G P	M C	15	1	N	U	#22 CHG PUMP DEVELOPED LOUD NOISE - LOST DISCH PRS	FLUID DRIVE CPLNG FOUND GROKEN

#### ALL FAULTS IN ALTERNATING PUMPS: CCM, RHR, PUR CYC AND BOR ACED TR, BUR MOTOR-DR HPCI

									1		
YES-	PLANT	CONTROL	EVENT	SYSTEM	COECI	MODE	TYPE	F A I L	202	CLASSI	MODE DESCRIPTION CAUSE DESCRIPTION
×	IP2	019239	090977	1	PM	A19	8	1	1	4 1	#22 BOR ACID XFER PUMP REMOVED FROM SERVICE TYPE 1. BELLOWS SHAFT SEAL WAS LEAKING
W	IPZ	021333	050278	J	PM	800		1		U	NO. 22 AUX COMP COOLING PUMP FAILED TO START CAUSE UNKNOWN, FOUND DOING SI SYS TEST
W	102	022721	090878	1	PM	A19	R	1		1	NO. 22 BORIC ACID TRANS PUMP DECLARED INOPERABLE FAILED MECHANICAL SEAL
W	102	023580	121478	G	PM	A16	R	1	1	1 1	CH. PUMP #22 HAD LEAKAGE AT UND STUFF BOX GASKET FOUND CRACK IN FLUID HEAD AND CYL. WALL
W	192	025227	020679	1	PM	013	5	1	1	4 T	NO. 22 BORIC ACIC TRANSFER JMP BECAME INOPERABLE FAILED CONTROL TRANSFORMER
W	193	019265	092577	G	PM	A16	R	1	1	N U	#32 CHG PUMP DEVELOPED LEAK IN HEAD - TAKEN OFF-LY HAIR-LINE CRACK IN HEAD - 98 GPM, QX-3CO
W	193	019264	093077	G	PM	A19	P	1		u v	#33 CHG PUMP TAKEN OUT OF SERVICE EXCSV SEAL LEAKAGE - TYPE OX-300 QUINTPLX
¥	1 1 3	019262	100177	G	PM	A19	R	1	-	U	#31 CHG PUMP TAKEN DUT OF SERVICE EXCSV SEAL LEAKAGE - TYPE QX-300 QUINTPLX
	IP3	019283	100577	1	PM	A19	R	1	1	NU	#32 BOR ACTO XFER PUMP REMOVED FROM SERVICE LEAKING BELLOWS SHFT SL - CRANE, TYPE 1
×	193	019282	100677	1	PM	A16	R	1	1	U M	#32 BOR ACTO XFER PUMP REMOVED FROM SERVICE LEAKING SUCTION FLANGE GASKET - MOD 3196
٠	193	020122	121677	G	PH	A19	2	1		N U	#33 CHG PUMP REMOVED FROM SERVICE EXCSV SEAL LEAKAGE - 98GPM TYPE QX-300
	IP3	021359	041678	G	PM	Als	R	1		N U	#31 CHG PUMP REMOVED FROM SERVICE FX:SV SEAL LEAKAGE - QX-300 QUINTUPLEX
٧	IP3	022411	081578	R	PM	A19	)	1	. 1	N T	NO. 32 RHR PUMP SEAL FOUND LEAKING SEAL SURFACES FOUND WORN
,	IP3	022877	102778	6	PM	A14	R	1		N T	LEAKAGE DBSERVED FROM NO. 31 CHARING PUMP LEAK WAS FOUND IN PLUNGER
١	IP3	025232	020579	G	PH	A19	P	1	-	N T	# 32 CHARGING PUMP DISCOVERED LEAKING FAILED PLUNGER AND PACKING
. ,	IP3	026479	071579	1	PM	A19	R	1		N T	#32 BORIC ACID TRANSFER PUMP DEVELOPED LEAK MECHANICAL SEAL WAS REPAIRED
	KEI	010644	081974	j	PM	802	U	1		N D	COMP COOL PMP 14 DID NOT START PM ON 8/16/74 CTT BKR NOT RACKED IN FULLY
١	KFI	016686	122276	1	PH	000	)	1		N U	BOR ACID PUMP LA TRIPPED AND WOULD NOT RESTART BKR OVEDS TRIPPED, RESET - NO OTHE PROBLE
1	KEI	018882	081777	J	PM	81	3 5	1		H D	COMP COOL PMP WOULD NOT START AFTER PM WORK DONE TRIP ARM HITTING TRIP ROD; READJUSTED, LUBE
1	KEI	012311	100277	G	PM	016	R	1		N D	FLOW FROM OPERATING CHG PMP WAS LOST DURING OPERTY AROKEN BELT ON VARI-DRIVE UNIT
١	KE1	017643	110777	G	PM	016	3 R	1	. 1	N D	FLOW FROM OPERATING CHG PMP WAS LOST DURING OPER BROKEN BELT ON VARI-DRIVE UNIT
	KEI	020339	011578	J	PM	PI:	3 5	1		N 0	CC PUMP FAILD TO START DURIN FULL POWER OPERATEDY FAULTY STATIC TRIP DEVICE IN CKT BREAKER
1	KE	020338	011878	J	PM	800	)	1		N U	CC PUMP FAILD TO START DUE TO OVERCURRENT TRIP UNDER INVESTIGATION CAUSE NOT DETERMINED
,	KE	022237	080978	6	PH	C1:	3 5	1		N T	CCP OPERATED ONLY AT HIGH SPEED FAILED TRANSISTOR IN HAND CONTROL STATION
-	KEI	022540	091878	G	PH	A1	5	1		N T	LEAK DEVELOPED ON CCP BETWEEN DIS. PIPE AND BLOCK CRACK CAUSED BY OPERATING STRESS

## ALL FAULTS IN ALTERNATING PUMPS: CCW, RHR, PWR CVC AND BOR ACID TR. BWR 40TOR-DR HPCI

VEN	P L A N T	CONTROL	EVENT	F	0	MODE	Y	A 1	ACTIVITY	CLASSI	MODE DESCRIPTION	CAUSE DESCRIPTION
	KEI	030562	021180	G	PM	D1 3	5	1	N	r	CHARGING PUMP STOPPED WHEN CONTROL SW PLACED AUTO	STICKING CONTACT
		022033									CHP PUMP 1C BECAME INOPERABLE	IMPROPERLY ASSEMBLED SEAL ASSEMBLY
-	0.000							1	N	)	14618 OOS FOR MAINT, 1C FEEDER BRKR NOT RACKED IN	IMPROPER TAGOUT PROCEDURE
											CHARGING PUMP 1-CH-P-1A DID NOT FUNCTION	CAJSE NOT STATED
		018807									CHARGING PUMP FAILED	CAPSCREW FAILURE IN VARIDRIVE UNIT
	PRZ	030733	031280	G	PM	813	S	1	N	0	NO. 22 CHR PUMP MOTOR BKR KEPT TRIPPING	BREAKER FAILURE, BKR REPLACED
	PRZ	031631	061580	G	PM	813	S	1	N	0	NO. 23 CHR PUMP STARTED AND SOON SHUTDOWN	AIR LEAKS IN SPEED CONTROL UNIT
	PTI	015772*	030876	G	PM	018	R	2	N	T	CHARGING PUMPS "B" AND "C" FAILED	BROKEN VARIDRIVE BELTS - VARIBELT NO. 842
¥	PTI	016709	123076	G	PM	A19		1	N	T	C CHRGNG PMP DOS DUE TO PLUNGER LEAKAGE	PACKING WEAR AJAX IRON WORKS TYPE T-125
	P11	027043	091279	G	PM	015	R	1	U	0	THE 1-P28 CHR PUMP FOUND TO HAVE CRACKED CYL BLOCK	PRESSURE SPIKING FOLLOWING H2 SEPARATION
	PTZ	0172484	022176	G	PM	A19	R	1	N	T.	ZPZC CHARGING PUMP TAKEN OUT OF SERVICE	REPAIR PLUNGER LEAKAGE
	PTZ	0172488	022176	G	PM	018	R	1	N	0	2P28 CHARGING PUMP FAILED	BRIKEN VARIORIVE BELT - VARIBELT NO. 842
	PTZ	016154A	092076	G	PM	A19	R	1	N	T	H CHARGING PUMP TAKEN DUT OF SERVICE	REPAIR MINOR PLUNGER LEAKAGE
	PTZ	0161548	092076	G	PM	018	R	1	N	D	"8" CHARGING PUMP FAILED	BROKEN VARIORIVE BELT - VARIBELT MO. 842
	PTZ	020461A	022177	e	PM	A19	R	1	N	f	2P2C CHARGING PUMP TAKEN DUT OF SERVICE	REPAIR PLUNGER LEAKAGE
	PTZ	0204618	022177	G	PM	018	R	1	N	0	2928 CHARGING PUMP FAILED	BROKEN VARIORIVE BELT - VARIBELT NO. 842
	PT2	0207130	040677	G	PM	C04	R	1	U	T	CHR PUMP "C" DISCOVERED TO HAVE CYC BLOCK CRACK	PULSATIONS CAUSED CRACKING
	PT2	017722	042077	G	PM	C00		1	64	U	CHRGNG PMP UNABLE TO DELIVE SUFFERT FLOW	NOT YET DETERMINED INVESTIGATIONS CONT
	PT2	017839	051677	G	PM	B21		1	N	U	2P2B CHRGNG PMP OOS DUE FOR INSPECTION OF NOTSY BR	
		020713R										INSTILLTH OF PULSATION DAMPHERS PLANNED
	PTZ	0207130	030178	G	ри	C04	R	1	M	T	CHR PUMP "C" DISCOVERED TO HAVE A CYL BLOCK CRACK	
	PTZ	020974	031378	G	PM	018	R	1	N	T		BROKEN VARIDRIVE BELT
. 1	RGI	013996	011276	J	PM	015		1	N	T		DAMAGED COUPLING - LOOSE BOLTS, MOD DBZ 226
- 1	1 8 G I	018225	061977	G	PM	018					"C" CHARGING PUMP VARIDRIVE FOUND SMOKING	BELTS REPLACED - VARIDRIVE PART 84-2
,	RGI	025064	010479	G	PM	A16		1	N	T	"A" CHARGING PUMP FOUND LEAKING	BLICK REPLACED, HIGH HOOP STRESSES

### ALL FAULTS IN ALTERNATING PUMPS: CCW, RHR, PWR CVC AND BOR ACID TR, BWR MOTOR-DR HPCI

				5					0		
VEN	P A N T	CONTROL	EVENT	Y STEEL	COMP	MODE				LAS	MODE DESCRIPTION CAUSE DESCRIPTION
u	861	025065	010479	G	PM	C18	R	1	,	N T	18. CHARGING PUMP SPEED CONTROL NOT OPERATING PROP VARIORIVE BELT SLIPPING AT LOW SPEEDS
		000609	120473								BORIC ACID XFER PMP B SHAFT BROKE AT IMPELLER GENERIC DESIGN PROBLEM - TYPE GE-ZOK
- 7		000898	032074		PM	004	R	1		N D	BURIC ACID XFER PMP B BKR TRPD ON THERMAL OVED PUMP HAD BROKEN SHAFT - DESIGN PROBLEM
		010112	032074	I	PM	000	R	1	,	4 U	BORIC ACID XFER PMP B FOUND TRIPPED ON ROUTINE INS CAUSE UNKNOWN
W	RD2	010091	040674	1	PH	004	R	1	,	N D	BORIC ACID XFER PUMP A FAILED DURING NORMAL OPER SHAFT BROKE IN VICINITY OF IMPELLER
-7	100000	010476	080874	1	PM	004	R	1	,	0 1	BORIC ACID XFER PUMP B FAILED DURING 100% PWR OPS PUMP SHAFT BROKEN - DESIGN PROBLEM
		010519	081574	1	PM	004	R	1	1	10	BORIC ACID XFER PUMP B FAILED DURING PERIODIC TEST PUMP SHAFT FAILED - DESIGN PROBLEM
W	RUS	010803	097674	1	PM	004	R	1	. 1	N D	BORIC ACID XFER PUMP B FAILED DURING 100% PWR OPS PUMP SHAFT BROKE AT JUNCTURE WITH ROTOR
w	RIIZ	011088	120474	I	PH	021	R	1	-	U D	BORIC ACID XFER PUMP B FAILED AT PUMP-ROTOR END MAY BE CAUSED BY BEARING WEAR
W	R (1) 2	012078	011475	1	PM	004	R	1		N D	BORIC ACID XFER PMP A FAILED DURING 1002 PMR OPS PUMP SHAFT FAILED - DESIGN ERROR
W	R 02	012300	012675	J	PM	013	5	1	-	N D	OVERCURRENT TRIP OF "C" COMP. COOLN WTR AT 100% PW FAILD STATUS LITE; TRIED SEVERAL STARTS
W	802	012738	052175	1	PM	004	R	1		N 0	BORIC ACID XFER PMP B STOPPED SHORTLY AFTER START PUMP MOTOR SHAFT BROKEN - DESIGN PROBLEM
W	802	012975	062575	1	PM	004	R	1		N D	BORIC ACID XFER PMP A FAILED DURING NORMAL OPS PUMP SHAFT FAILED AT KEYWAY - DESIGN PROB
		014820	010276	1	PM	021	R	1		N T	BAT "8" FAILD DAMAGED ROTORSERIES G, MODL SE-204 FAILD REAR GRAPHITE BEARING
W	202	014830	041276	1	PM	002	T	1		N D	"B" BAT PUMP TRIPPO AT 100% PWR HEATER TRIPS SET AT 250 DEG F
W	ROZ	016206	101876	1	PM	018	R	1		N T	BAT "B" FAILD HI TEMP CUTOUT TRIPPD PUMP DEFECTIVE STATOR AND BEARINGS WORN
W	R02	016259	102976	1	PM	002	T	1		N D	BATP B TREPPED ON HE PUMP MOTOR TEMP CUTOUT HEAT TRACENG CERCUIT TEMP SET TOO HEGH
W	R112	017098	012477	1	PH	009	,	1		N D	BATP B TRIPPED ON HI MOTOR TEMP CUTOUT RECIRC LINE PLUGGED WITH SOLID BORIC ACID
W	ROZ	017099	013177	1	PM	DOS	S	1		N D	BATP B TRIPPED ON HE MOTOR TEMP CUTOUT TEMP CUTOUT SET TOO LOW FOR NORMAL OPS
W	802	018138*	060777	G	PM	C11	٧	2		N D	B & C CHENG PUMPS RUNNING - PSZR LVL STILL FALLING PUMP AIR BOUND - TYPE TX-150
W	R 32	017345	062277	G	PM	C11	V	1		N D	"C" CHENG PMP WOULD NOT CONTROL PSZR LEVEL PUMP WAS AIR BOUND - TYPE TX-150
	272	025815	040279	1	PM	015	,	- 1		N T	BORIC ACID TRANSFER PUMP KEPT TRIPPING, PUMP "A" BROKEN SHAFT, PUMP REPLACED
	SAI	0177008	050677	G	PM	U01	U	1		R D	BOTH SI PUMPS AND 1 CENTRIFUGAL CHG PMP TAGGED DUT PERSONNEL ERROR - NOT FOLLOWING PROCEDURE
	SAI	023232A	112778	G	PM	813	1	1	ı	N T	NO 11 CHR PUMP FAILED TO START DURING SI BUS FAILURE DUE TO OUTPUT TRANSF FAILEC
	SAI	0291194	042479	R	PH	006	· V	1		N D	OPERATING RHR PUMP TRIPPED OFF OF LINE INADEQUATE WORKING PROCEDURES

> EZ	P L A N T	CONTROL	EVENT	SE SE	COTA	MODE	TYPE	FAIL	AUM TO THE TOTAL THE TOTAL TO T	CLANNI	MODE DESCRIPTION	CAUSE DESCRIPTION
	CAI	0281198	050879	R	PM	006	v	1	,	0	Thekaling kuk bout ikirten out of come	INADEQUATE WORKING PROCEDURES
		026013						1		1	#13 CHULDIERI COOCINO MAICH	#13 COMPONENT COLLING WATER PUMP DP DEGRA
- 100		0291190						1		0	RHR PUMP LOST SUCTION	LOW LEVEL LIMIT WAS TOO LOW FOR RX WA LE
-	-	019000							,	ı T	MUKIH BUKIC IKANEK PHELO-ANI LATED TO STATE	PMP SELZO DUE TO ACCUMETN OF BORIC CRYSTL
		030728	031880					1	,	1 B	HIGH TEMP IND ON SOUTH CHR PUMP'S THRUST BEARING	LATRE COUPLING CAUSED BEARING TO BE WIFED
			111072					1	-	JU	EXCESSVE SEAL LEAKAGE ON "A" CHARGING PUMP	SEAL DAMAGED
-	-	000916	202000					1	,	T	MOTOR ON RHR PUMP 1-RH-P-1A BURST INTO FLAMES	INSUFFICIENT LUBRICATION TO LWR RAD BRAG
		010373						1	-	T	BORIC ACID TRANSFER PUMP KOTOR FAILED	GREASE ON STAT WHOGS CAUSED INSUL FAILURE
			020877					1	1	JT	CHRG WTR PMP 1-CC-P-ZA HAD TRIPPED ON THERMAL OVLD	MTR BRNGS ABRADED
	0.00	022641	100978	ı	PM	021		1	1	4 T	CHR PUMP COMP COOLING WATER PUMP TRIPPED ON OL	MOTOR BEARINGS FAILED DUE 100 CORROSION
		030258	012380					1	1	N D	FLOW WAS LOST FROM "A" BORIC ACID TRANSFER PUMP	SHAFT BROKE DUE TO PREVIOUS ASSEMBLY
-		013593	101575	1	PM	018		1		N T	"O" BORIC ACID TRANSFER PUMP MOTOR FAILED	BORIC ACID IN STATOR WINDINGS
		017055	011877					1		N U	BURIC ACID TRANSFER PUMP 1-CH-P-2D FAILED	MOTOR-TO-PUMP COUPLING WAS BROKEN
			111377	J	PH	807		1		N T	CHRG PMP COMP COOLING PMP 28 INOPERATIVE	NORMAL WEAR, PUMP REBUILT
		020813	030178					1		N T	BORIC ACID TRANS PMP 1-CH-P-2 TRIPD ON THEREL OVEL	OUTBOARD BRNG FAILING
		0140674	012576	1	PM	813	T	2		T D	COMP COOLING WIR PMPS DED NOT START AUTOMARTCALLY	SED CONT RATED AT TOO HE AMPACETY
										t D	B TRAIN CHARGING PUMPES DID NOT START	SEG CONT GATED AT TOO HE AMPACETY
		014566									OPERATING RHR PUMP LOST POWER	CKT SWITCHER SUPP ESF BUS INADY OPENED
	19. 10. 100	0191690									B RHR PUMP DID NOT START - AUTOMATIC	SEQUENCER CONTACTS OPER WITH TOO LOW CRNT
		018452	070177							N U	SOUTH CENTREGL CHRG PMP ROTOR FAILD	DETAILD ANALYSIS UNDERWAY
		018905	072877	J	PM	800	) T	1		T U	B COMP COOLING WIR PUMP FAILED TO START - AUTO	FXACT CAUSE UNKNOWN-REPLACED ALL SEONCES
W	TU3	000345	031973	J	PH	81	3 5	1		T D	34 COMP COOLING WATER PUMP FAILED TO START - AUTO	EMER LOAD SEGNCE RELAY CONT MALFUNCTIONED
	TU3	014880								N U	TAMONA TORNE ON CHARGE ONE DURNE NORMAL DES	CRACK IN CASING BETWEEN VALVCHMBR/STUFN B
		016258	101576	G	PH	82	1	-		N T	"38" CHRG PMP DOS DUE TO DAMAGE TO CONNECTENS ROD	INSUFCAT LUBRICIA TO CONN ROD BEARINGS
W	TU3	021010	031578	G	P	1 (1	1 8		ı	нт	"3A" CHRG PMP HAD CRACKD PMP CASING	HI CYCLIC STRESSES

1	P L A N T	CONTROL	EVENT DATE	SYSTEM	C	MODF	TYPE	FAN	ACTIVITY	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
-	TUE	026562						1	N	T	38 CHARGING PUMP REMOVED FROM SERVICE	FATLED PRIMARY AND SECONDARY PACKING
1	TU4	018127	041577	1	PH	809	R	1	N	T	UNITS 3 AND 4 OPERTNG ONLY 2 BORIC AC TRANFR OPERL	THRUST IMBALNCE DUE TO CRYSTAL BLOCKAGE
. 1	TU4	025305	012579	1	PM	002	T	1	N	T	4A BORIC ACID TRANSFER PUMP TRIPPED ON OVERLOAD	INSULATION NOT REINSTALLED, SOLIDIFICATION
	TU4	027106	081579	G	PH	A19		1	N	T	44 CHARGING PUMP REMOVED FROM SERVICE	SEAL FAILED
- 1	TU4	027242	082979	1	PM	011	r	1	N	T	4A BORIC ACTO TRANSFER PUMP TRIPPED ON OVERLOAD	SOLIDIFICATION OF BORON IN RECIRC LINE
	T ()4	027241	083079	1	PM	813	S	1	N	T	48 BORIC ACID TRANSFER PUMP FAILED TO START	MALFUNCTION OF LINE STARTED, DIRTY CONTACT
. 1	T () 4	027239	091179	G	PH	A19	R	1	N	T	4C CHARGING PUMP REMOVED FROM SERVICE	FATLED SEAL
	ZII	000317	091073	G	PM	813	5	1	N	T	THE 18 CHARGING PUMP WAS INOPERABLE-DID NOT START	FEEDER BRKR BRUSHHOLDER MISSING-VIBRATION
Н	BF	010171*	051374	R	PM	002	U	2	T	D	RHR PMPS TRIPPD DUE TO ISOLATION VALVES CLOSING	FAULTY RELAYS FOR FCV74-47 AND FCV74-77
1	881	016856	010577	R	PM	800		1	T	U	14 RHR FAILD TO STARTMANUAL START FAILD ALSO	NO CAUSE DETERMINED
	RR1	0131674	060177	R	PM	813	S	1	T	D	14 RHR DID NOT START ON AUTO-SIGNAL	STICKY CONTACTOR ON CONTROL SWITCH
	961	0191678	061877	R	PH	001	S	1	T	0	24 RHR TRIPPO DUE TO OPERATOR HITTING SWITCH	ACCIDENTAL BUMPING OF CONTROL ROOM SRITCH
. 3	RR2	025639*	040479	R	PM	813	U	5	T	T	RHR PUMPS 23 AND 2D WOULD NOT START FROM RTGS	POOR CONNECTIONS ON FUSES & FUSE BOX
	CO1	011261	121374	J	PM	018	R	1	N	T	18 CCW PMP MOTOR EXPERIENCO INSULATION FAULT-STATE	STATOR WINDINGS MEN. CLEARANCE; TEND TO SAG
	s cm	013063	070275	j	PM	018	R	1	N	T	14 CCW INSULATION BREAK IN STATOR	CODE. FINS HIT WINDINGS (SAGGING)
	s con	015715	081676	J	PM	021	R	1	N	T	REC PUMP "A" MOTOR MAKING NOISE BEARINGS FAILED	SER . NO. P4296075, 75HP . , 480VAC
	s con	017068	011077	J	PM	021	R	1	N	T	REC PUM MOTOR "A" NOISY BEARINGS RUNNING ROUGH	BEARINGS REPLACED
	. 0 4	012797	042375	R	PM	313	S	1	T	D	RHR PMP 2298 FAILD TO START	LOGIC RELAY E11-K708 DID NOT TRIP AS REO.
	G EN	014782	040976	R	PM	002	5	1	N	D	RHR PUMP E11-COOZC TRIPPED DURING FUNCTIONAL TEST	PUMP WAS WIRED INCORRECTLY
	G EN	026419	072579	R	PH	419		1	N	T	1C RHR PUMP HAD EXCESSIVE LEAK	MECHANICAL SEAL FAILURE
	G EN	030834	041580	R	PM	813	5	1	T	U	"D" RHR PUMP FAILED TO START ON LOCA SIGNAL	WIRF MISSING FROM TERMINAL NO.7 ON RELAY
	G FP	011055	121274	R	PM	818	S	1	T	D	RHR PMP 10P-30 FAILD TO STARTIREPLACED FAULTY BKR	SKR DC CHARGIN MOTOR BURNED OUT
	G MI	001051	032173	н	PM	021		1	N	U	COND BOOSTR "A" PUMP INBOARD BRNG FAILED	CAJSE NOT INDICATED
	G MI	0101594	051774	н	PM	019	R	1	N	U	FWCI COND BOOSTR "A" PUMP SEAL FAILED, SYS INOPERS	ING-RAND TYPE LOSH RECURING BRNG FAILR
	G MI	0101599	051774	Н	PM	821	R	1	N	IJ	FWCI COND BOOSTR "B" PUMP BRNG FAILED. SYS INOPERB	BRAG FAILURE ON ING-RAND TYPE 105H

### ALL FAULTS IN ALTERNATING PUMPS! CCW, RHR, PWR CVC AND BOR ACID TR, BWR MOTOR-DR HPCI

Zwz	P L A N T	CONTROL	EVENT	SYSTEM	COMP	MODE	TYPE	FAIL	ACTIVITY	CLASSI	MODE DESCRIPTION	CAUSE DESCRIPTION
G	NM1	012284	021275	11	PH	813	T	1	N	D	12 FEEDWATER PUMP FAILED TO START (HPCI COMPONENT)	LNKGE BET BOURDON TURE AND SWITCH DISCENN
6	NM1	013416	091375	н	PM	813	T	1	N	T	12 FEEDWATER PUMP FAILED TO START CHPCI COMPONENTS	OIL PMP HTR BRKR HAD LOOSE FUSE HOLDER
6	NMI	014245	021576	н	PH	013	T	1	U	0	LOSS OF #12 FEEDWATER PUMP (HPCI COMPONENT)	LAKEE BET BOURDON TUBE AND SWITCH DISCENN
(	NM1	015624	080976	н	PH	813	T	1		0	11 FEEDWATER PUMP FAILED TO START (HPCI COMPONENT)	AGASTAT FAILED TO FUNCTION PROPERLY
-	NM1	017284	102576	н	PM	A19		1	N	T	*12 FEED PMP TAKEN OUT OF SERVICE LEAKY SEAL STRNR	LEAKS IN SEAL STRAINE AND GEAR BOX
0	NM1	017431	040477	R	PM	006	U	1		U	WHILE LOWRNG RIX HED LEVEL FOR MAINTNEE ON VESSEL	SHUTDWN COOLNG PMP TRPPD DUE TO LOW SUCT
(	NMI	020253	012078	н	PM	813	T	1	N	0	LOST POWER TO 11 FEEDWATER PUMP AFTER LOSS OF PWR	RESERVE PWR BRKR FAILED TO CLOSE
(	NM1	032570	082280	н	PM	A07		1	-	T	*11 REACTOR FEEDPUMP HAD EXCESS SEAL HZO LEAKAGE	NORMAL WEAR TO SEAL
- (	001	013830A	121275	н	PM	D03	S	1	1	0	FEEDWATER PUMP TRIPPD DURING LOAD TEST OF BATTERY	PERSONNEL ERROR FOLLOWING PROCEDURES
. (	901	0258254	050277	H	PM	800		1		U	A FEED PUMP DID NOT OPERATE AFTER SCRAM	CAJSE NOT STATED
	001	0258258	050279	н	PM	813	U	2		4 D	BEC FEED PUMPS DID NOT OPERATE AFTER SCRAM	BUS DE-ENERGIZED
. (	P 8 3	010672	091874	R	PH	018		1	•	U	"8" RHR PUMP NOTOR EXPERIENCED SHORT TO GROUND	RANDOM INSULATION FAILURE
	P83	027446	102279	R	PM	018		1	1	4 T	34 RHR PUMP TRIPPED WHILE PROVIDING S/D COOLING	MOTOR FAN EXPERIENCED FATIGUE FAILURE
	PII	002247	100772	J	PM	013	U	1	1	J D	POWER CTR OVERCURRENT TRIP - LOSS OF CCW PUMP	LOADED PC SIMULTANEOUSLY VS SEQUENTIALLY
	PI	001043	041173	J	PH	013	T	1	t	J D	RECCW PUMP TREPPED BY 4809 MOTOR CONTROLLER	OVERLOAD RELAYS NOT FUNCTIONING PROPERLY
	PII	000044	091173	J	PM	013	T	1		4 D	RBCCW PUMP 202-C TRIPPED BY OVED RELAY IN MTR CONT	THERMAL HTR IN CONT NOT HE ENOUGH AMPRIGE
	, P11	000971*	032074		PM	813	S	2		0	"B" RBCCW PUMPS DID NOT AUTO START	PRESS SW MALFUNCTION-MECRO SW OUT OF ADJ
	PII	018410	032371	J	PM	013	T	1	1	0 0	"E" RBCCW PUMP INOPERABLE - BKR TRIPPED ON TVLD	OVERHEATING OF BLOCK TYPE OVLD RELAY

#### PWR Auxiliary Feedwater Pumps

The auxiliary feedwater systems contain both turbine-driven pumps and motor-driven pumps. There is also a diesel-driven pump at Trojan. The individual fault rates are estimated separately for the three kinds of pumps. Therefore, estimates of  $\lambda$ ,  $r_1$ , and  $\beta$  must be given separately for each of the three kinds of pumps. Common cause shocks, on the other hand, are assumed to affect all three kinds of pumps with equal likelihood. There are not enough data to show evidence contradicting this assumption. Therefore estimates of p,  $\lambda_+$ ,  $\omega$ ,  $\mu$ ,  $r_2$ , and  $r_3$  are given once for the entire system.

Because turbine-driven pumps cannot operate during shutdown, the exposure times used are critical hours. For the motor-driven pumps, seven of the 35 LERs seem to report events that occurred during shutdown. Therefore, the use of critical hours, rather than calendar hours, is somewhat conservative.

Each set of rates takes two pages. Rates are estimated for:

- 1. Failure to start, based on all faults
- 2. Failure to start, based on failures only
- 3. Failure to operate after starting, based on all faults
- 4. Failure to operate after starting, based on failures only.

The individual fault rate,  $\lambda$ , for turbine-driven pumps is shown below. Each rate is shown as a triple (lower bound, mean, upper bound). On the left are the estimated rates based on all the data. These numbers are taken directly from the four sets of estimates printed by the computer, printed on the following pages. On the right are the estimated rates based on all the data except that from Arkansas 2.

Based on all data	Excluding Arkansas 2						
(3.5E-8, 5.1E-5, 2.2E-4)	(6.2E-8, 4.2E-5, 1.7E-4)						
(1.1E-7, 2.1E-5, 7.9E-5)	(8.4E-8, 2.0E-5, 7.6E-4)						
(4.3E-8, 4.5E-5, 1.9E-4)	(4.6E-7, 2.9E-5, 1.0E-4)						
(3.0E-9, 3.7E-5, 1.7E-4)	(7.3E-8, 2.3E-5, 8.8E-5)						

If it is felt that the data from Arkansas 2 should not be used, then  $\lambda$  for turbine-drive pumps should be reduced as shown, and  $r_1$ , should be reduced correspondingly.

Be sure to read the Application section in the main body of this report. The following computer printouts give the estimates and summaries of the relevant data.

PWR AUXILIARY FEEDWATER PUMPS
FAILURE TO START
ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS
RATES ARE PER CRITICAL HOUR
TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)
LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

( 9.0E-07, 2.4E-06, 4.4E-06) ( 2.8E-07, 1.4E-05, 3.0E-05) OVERALL ( 4.8E-06, 1.1E-05, 3.0E-05) ( 9.0E-07, 2.7E-06, 4.9E-06) ( 2.8E-07, 1.4E-06, 3.0E-06) 83 RATE FOR SET OF K COMPONENTS ' 5.5E-06, 1.1E-05, 1.8E-C3! ( 1.1E-05, 2.7E-06, 4.9E-06) 1 4.8F-06, 9.0E-06, 1.5E-051 ( 7.9E-06, 1.7E-05, 3.0E-05) SYSTEM

\* ( 1.3F-09, 3.3E-07, 1.2E-06)

DMEGA

LAMBDA . ( 4.1E-06, 7.4E-06, 1.2E-05)

0 . ( .286. .478. .6651

INDIVIDUAL RATE RASED ON AGTOR-DRIVEN PUMPS ONLY LAMBDA . ( 1.8E-07, 1.3E-05, 4.4E-05)

SYSTEM SPECIFIC COMPONENT BETA FACTOR

1 (6.5E-06, 2.1E-05, 5.2E-05)

2 (4.6E-06, 1.7E-05, 5.0E-05) (.042, .204, .533)

3 (4.0E-06, 1.7E-05, 4.9E-05) (.040, .191, .487)

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OVERALL (4.0E-06, 1.8E-05, 5.2E-05) (.040, .204, .533)

INDIVIDUAL RATE BASED ON TURBINE-DRIVEN PUMPS ONLY
LAMBDA . ( 3.5E-08, 5.1E-05, 2.2E-04)

SYSTEM		SPECIF	IC COMPON	HENT		BETA	FACTO	)R
1	t	6.4E-06.	5.98-05,	2.3E-041				
2	ŧ	4.4E-06.	5.6E-05.	2.38-041	-	.010,	.113.	.5461
3	t	3.98-06,	5.5E-05,	2.3E-041	(	.009,	.102,	.5001
OVERALL	•	3.8E-06,	5.6E-05,	2.3E-041	1	.009.	.113,	.5461

INDIVIDUAL RATE BASED ON DIESEL-DRIVEN PUMP ONLY LAMBDA = ( 1.7E-04, 3.4E-04, 5.7E-04)

SYSTEM		SPECIF	FIC COMPON	BETA FACTOR					
1	(	1.7E-04,	3.5E-04,	5.8E-041					
2	-	1.75-04,	3.5F-04.	5.7E-041	•	.003.	.008,	.0191	
3	(	1.75-04.	3.5F-04,	5.7E-041	t	.003.	.007.	.016)	
OVERALL	ŧ	1.75-04.	3.5E-04,	5.8E-04)		.003,	.008.	.019)	

PWR AUXILIARY FEEDWATER PUMPS

FAILURE TO START

FAILURES ONLY, EXCLUDING COMMAND FAULTS

RATES ARE PER CRITICAL HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCEN? INTERVAL

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P · ( .097, .414, .769)

LAMBDA · ( 7.1E-07, 2.3E-06, 4.6E-06)

OMEGA · ( 1.3E-09, 3.3E-07, 1.2E-06)

SYSTEM SHOCK RATE RU R2

1 ( 1.5E-06, 1.0E-05, 2.8E-05)

2 ( 1.0F-06, 5.8E-06, 1.5E-05) ( 1.1E-07, 9.7E-07, 2.4E-06)

3 ( 9.1E-07, 4.4E-06, 1.1E-05) ( 7.5E-08, 8.9E-07, 2.3E-06) ( 1.7E-08, 6.4E-07, 1.9E-05)

OVERALL ( 9.1E-07, 5.8E-06, 2.8E-05) ( 7.5E-08, 9.7E-07, 2.4E-06) ( 1.7E-08, 6.4E-07, 1.9E-06)
```

INDIVIDUAL RATE BASED ON MOTOR-DRIVEN PJMPS ONLY LAMBDA . ( 1.9E-06, 3.9E-06, 6.5E-06)

SYSTEM		SPECI	RATE FOR		BETA FACTOR			
1	t	3.7E-06,	6.5E-06,	1.0E-051				
2	•	3.2E-06,	5.7F-06,	8.8F-06)	(	.022.	.148,	.3731
3	(	3.0E-06.	5.5E-06.	8.5E-061	ŧ	.026,	.136+	.318)
OVEPALL	-	3.0E-06.	5.7E-06,	1.0E-05)	(	.022,	.148,	. 3731

INDIVIDUAL RATE BASED ON TURBINE-DRIVEN PUMPS ONLY LAMBDA \* ( 1.15-07, 7.16-05) 7.96-051

8		.5081	1695.	. 5081
BETA FACTOR		.066	.050.	.066,
BETA		1 .004, .066, .5081	.005.	* 000 *
		~	**	-
ENT	8.26-051	( 1.6E-06, 2.3E-05, 8.1E-05)	( 1.4F-06, 2.2F-05, 8.1E-05) ( .005, .059, .469)	DVERALL ( 1.4E-06, 2.3E-05, 8.2E-05) ( .004, .066, .508)
SPECIFIC COMPONENT	2.4F-05,	2.36-05.	2.2F-05,	2.3E-05,
SPECIF	( 2.1E-06, 2.4F-05, 8.2E-05	1.65-06,	1.45-05,	1.48-06,
	-	_	~	-
SYSTEM	1	2	3	 OVERALL

INDIVIDUAL RATE RASED ON DIESEL-DRIVEN PUMP ONLY LAMBOA . ( 8.0E-06, 6.8E-05, 1.8E-04)

ACTOR		(101. **10. *100. )	( 9.5E-06, 7.0E-05, 1.8E-04) ( .002013, .092)	101. 101. 1001. 1.8E-041 ( .001014. 107)	
BETA FACTOR		. 001.	. 002.	100.	
		~	-	~	ř
ENT	1.86-041	1.86-04)	1.86-04)	1.85-041	
SPECIFIC COMPONENT	7.1F-05,	7.0F-05.	7.0E-05.	7.06-05.	200
SPECIF	1.16-05,	( 9.8E-06, 7.0E-05, 1.8E-04)	4.56-06+	0 KE-0A-	400 2006
	-	~	-		,
SYSTEM	-	2	3	1 1 1 0 0 0 0 0 0	JVERALL

PWR AUXILIARY FEEDWATER PUMPS

FAILURE TO OPERATE, GIVEN START

ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS

RATES ARE PER CRITICAL HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

```
P * ( .156, .371, .600)

LAMBDA * ( 3.3E-07, 5.6E-06, 1.6E-05)

OMEGA * ( 1.3E-09, 3.3E-07, 1.2E-06)

SYSTEM SIZE RATE FOR SET OF K COMPONENTS
RATE RATE RATE RATE

OVERALL ( 4.6E-07, 1.1E-05, 5.7E-05) ( 1.6E-07, 1.6E-06, 4.7E-06) ( 4.1E-08, 8.1E-07, 2.4E-06)

OVERALL ( 4.6E-07, 1.1E-05, 5.7E-05) ( 1.3E-07, 1.6E-06, 4.7E-06) ( 4.1E-08, 8.1E-07, 2.4E-06)
```

INDIVIDUAL RATE BASED ON MOTOR-DRIVEN PJMPS ONLY LAMBDA \* ( 5.1E-06, 9.7E-06, 1.5E-05)

SYSTEM		SPECI	RATE FOR		BET	FACT	)R	
1	t	7.6E-06.	1.6F-05.	2.8E-05)				
2	(	7.1E-06.	1.3E-05,	2.2E-05)	(	.015,	.076.	.270)
- 3	(	6.9E-06.	1.3E-05.	2.1E-05)	1	.016,	.100,	. 2591
OVERALL	t	6.9E-06.	1.3E-05,	2.88-051	t	.015.	.100,	. 2701

INDIVIDUAL RATE BASED ON TURBINE-DRIVEN PUMPS ONLY
LAMBDA = ( 4.3E-08, 4.5E-05, 1.9E-04)

SYSTEM		SPECI	RATE FOR FIC COMPON	NENT		вет	FACTO	)R
1	•	2.38-06,	5.18-05,	2.0E-041				
2	•	1.85-06.	4.9E-05,	2.0E-041	. (	.003,	.062,	. 4531
3	1	1.56-06,	4.8F-05,	1.98-041	t	.003,	.063,	.4851
OVERALL	•	1.58-06.	4.9F-05,	2.0E-041	-	.003.	.063.	.4851

INDIVIDUAL RATE BASED ON DIESEL-DRIVEN PUMP ONLY
LAMBDA - ( 7.6E-05, 2.0E-04, 3.8E-04)

SYSTEM		SPECT	RATE FOR	NENT		BETA	FACT	)R
1	•	8.1E-05.	2.18-04.	3.9E-041				
2	•	7.98-05,	2.1F-04,	3.9E-041	-	.001.	.006,	.0311
3	1	7.98-05.	2.1F-04,	3.9E-041	t	.001,	.006,	.0291
DVERALL	(	7.9F-05.	2.1E-04.	3.9E-041	-	.001,	.006.	.0311

POR AUXILIARY FEEDWATER PUMPS

FAILURE TO OPERATE, GIVEN START

FAILURES ONLY, EXCLUDING COMMAND FAULTS

RATES ARE PER CRITICAL HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

INDIVIDUAL RATE BASED ON MOTOR-DRIVEN PUMPS ONLY LAMBDA . ( 1.0E-06, 5.0E-06, 1.1E-05)

SYSTEM		SPECI	RATE FOR FIC COMPONENTS	NENT		BET	A FACT	OR.
1	ŧ	2.5E-06.	6.9E-06.	1.4E-051				
2	(	2.08-06.	6.2E-06,	1.36-051	t	.002,	.064,	.2931
3	-	1.88-06.	6. OF -06.	1.2E-051	1	.003,	.069.	.3081
OVERALL	1	1.8E-06,	6.2E-06,	1.46-051	(	.002,	.069,	.3081

INDIVIDUAL RATE BASED ON TURBINE-DRIVEN PUMPS ONLY LAMBDA = ( 3.0E-09, 3.7E-05, 1.7E-04)

SYSTEM		SPECI	RATE FOR FIC COMPO	NENT		BET	A FACT	OR
-1	-	1.28-06,	3.9E-05.	1.9E-041				
2	1	7.8F-07.	3.8F-05,	1.98-041	1	.000,	.033,	.4231
3	ŧ	6.2E-07,	3.8E-05,	1.96-04)	(	.001,	.034,	.488)
****								
OVERALL	1	6.2E-07.	3.8E-05,	1.9E-041	-	.000,	.034,	.4881

INDIVIDUAL RATE BASED ON DIESEL-DRIVEN PUMP ONLY
LAMBDA . ( 9.0E-06, 6.8E-05, 1.8E-04)

SYSTEM		SPECI	RATE FOR FIC COMPON	NENT		861	FACT	)R
1	(	9,98-06,	7.08-05,	1.88-041				
2	-	9.2E-06.	6.9E-05,	1.8E-041	1	.000,	.006,	.065)
3	-	9.0E-06.	6.9E-05,	1.8E-041	(	.000.	.006,	.0641
OVERALL	-	9.05-06.	6.9F-05,	1.8E-041	t	.000.	.006.	.0651

ALL FAILURES TO START IN PAR AUXILIARY FEEDWATER BUSES

32554	,			1
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	110	0 / 1	0 / 0	0 1 0
	0 / 0	0 / 0	0 / 0	0 / 0
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	0 / 1	1 / 0	0 / 0	0 1 0
	0 1 0	0 / 0	0 / 0	0 4 0
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	0 / 0	0 / 0	0 1 0	0 1 0
	0 / 0	0 / 0	0 / 0	0 1 0
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2 3 3 3 3 5	0 1 0	0 / 0	0 / 0	0 / 0
2 3 3 3 3	0 / 0	0 / 0	0 / 0	0 / 0
3 2 6 7 7 9 7 9 7 9 7 9 7 9 9 7 9 9 9 9 9 9	0 1 0	0 / 0	0 / 0	0 1 0
3 11/2	0 / 0	0 / 0	0 / 0	0 1 0
3 11/	0 1 0	0 / 0	0 / 0	0 / 0
10 2	0 / 0	0 / 0	0 1 0	0 1 0
	0 / 0	0 / 0	0 / 0	0 1 0
64536 3 0 7 1	0 1 0	0 / 0	0 / 0	0 / 0
39336 3 11 0	0 10	0 / 0	0 1 0	0 / 0
27576 3 2 1 3	0 / 1	2 / 0	0 / 0	0 / 0
57600 3 1 / 8	0 / 1	0 / 2	0 / 0	0 / 0
21840 3 010	0 / 0	0 / 0	0 / 0	0 / 0
2664 3 010	0 / 0	0 / 0	0 / 0	0 / 0
50004 3 2 / 1	0 1 0	0 / 0	0 / 0	0 / 0
50760 3 210	0 1 0	0 / 0	0 / 0	0 / 0
76704 3 0 / 1	0 1 0	0 / 0	0 1 0	0 1 0

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73104		76734	33360		76704	72336	66360	42048							1537087 7308416	
64363		60180	16488	542	56392	42519	35584	21998	52965	00077	40000	43461		. 1	1537087	
61.0	0.00	000	CA 1	1 1 1	501	SUI	502	101	103	4114			717		ALL	-

LL FAILURES TO OPERATE, GIVEN START, IN PWR AUXILIARY FEEDWATER PUMPS

NUMBER OF AFFECTED BY NUMBER OF AFFECTED BY AUNBER OF AFFECTED BY FAILRS/COM FLTS FAILRS/COM FLTS FAILRS/COM FLTS	000000000000000000000000000000000000000	0 1 0 0 1 0 0 1 0 0 1 0	11.0 01.0 01.0	010 010 010	010 010 010	010 010 010	10	0	0 /	010 010 010 010	-	/ 0	0 1 0 0 1 0 0 1 0 1 0	. 0	0 0	10	10	/ 0	10	0 1 0 0 1 0 0 1 0 0 1 0	011 015 010 010	010 010 010 010	0 1 0 0 1 0 0 1 0 1 0	10	10	010 010	10 010 010 01	11 011 01	
INDIA OF FAULTS	0 / 5	210	2 / 2	110	0 / 0	0 1 0	1 / 0	0 / 0	0 / 0	6 / 1	1 / 0	0 / 1	0 1 0	5 / 1	1 / 0	1 / 0	0 / 0	2 / 1	1 / 0	0 / 2	0 / 1	0 / 1	0 / 0	1/0	0 / 3	0 / 6	0 / 0	0 / 1	
404	2	2	2	1	14	-	2	3	3	2	~	2	2	3	2	2	3	3	3	3	2	9	3	3	3	3	3	3	
CALEND. HOURS	53952	32544	26808	65328	60384	53232	82958	42192	9 7 9 4	15994	52464	33624	62712	43484	69600	76704	38952	38520	49992	59422	76704	64536	39336	27575	57600	21840	2664	\$0665	The second second
CRIT.		17695	13042	45079	37558	36816	29290	31732	3398	7068	38451	26811	47570	30580	55879	39960	26228	13775	37510	15811	63506	37770	26443	16271	46125	15859	1724	45454	
LANT		C 0 3	081	DE 1	2 30	0.6.3	154	111	112	AR 2	100	200	FC 1	214	M 7.1	PA1	51.1	8 V 1	00.1	2 30	144	192	163	JF1	KE 1	NAN	NA 2	1 8 0	

PG1         58078         76704         3         0 / 0         0 / 1         0 / 0	012	64363	73104	9	0	_	0	10		0		0		10	0
1548   31360   3	PG1			3	0	-	0	0		0		0 1		0	0
15688         33360         3         0 / 1         0 / 0         0 / 0         0 / 0         0 / 0           55392         76704         2         1 / 0         0 / 0         0 / 0         0 / 0         0 / 0           42519         72316         3         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           21098         42048         2         1 / 4         0 / 0         0 / 0         0 / 0         0 / 0           52066         69672         3         1 / 4         0 / 0         0 / 0         0 / 0         0 / 0           45086         64056         3         0 / 1         0 / 0         0 / 0         0 / 0         0 / 0           45086         64056         3         0 / 1         0 / 0         0 / 0         0 / 0         0 / 0           42451         63864         3         2 / 1         0 / 0         0 / 0         0 / 0         0 / 0           42451         63864         3         2 / 1         0 / 0         0 / 0         0 / 0         0 / 0           42451         63864         3         2 / 1         0 / 0         0 / 0         0 / 0         0 / 0           42451         63864	R02			*	1	-	1	10		0		0 /		1 0	0
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42519 72336 3 0 7 0 0 7	201			2	1	-	0	0		0		0		10	0
\$52966 69672 3 1/7 4 0/7 0 0/7	SUL			9	0	-	0	0		0		10		0	0
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46080 64056 3 0/1 1 0/0 0/0 0/0 0/0 0/0 0/0 0/0 0/0 0	103			3	-		0	10		0		0		0	0
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		0000000	1111		2 110										

#### ALL FAULTS IN PWR AUXILIARY FEEDWATER PUMPS

v	PL			5754	CO	M O U	Ţ	F	2	014		
EN	N I	CONTROL	EVENT	E M	M P	D S	PE	I L	W 1	\$	MODE DESCRIPTION	CAUSE DESCRIPTION
8	AR1	026244	061679	8	PM	002		1	,	0	EMERGENCY FEED WATER PUMP PTB DEVELOPED A HOT BEAR	FAILTY INSTALLATION DURING PREV MAINTEN.
8	API	026491	062179	8	PT	801	U	1		0	EFW PUMP PTA KEPT TRIPPING ON OVERSPEED	WATER IN STEAM LINES DUE TO TRAPS ISOLATE
8	API	027885	120679	В	PT	C13		1	1	T	EFW PUMP PTA DID NOT DEVELOPE PROPER DELTA PRESS.	LOOSE LOCK NUT ON SPEED GOVENOR
8	ARI	031606	062480	В	PT	000		1		U	STEAM DRIVEN EFP STARTED THEN TRIPPED ON OVERSPEED	SPURIOUS-CAUSE UNKNOWN
8	AR1	031917	070680	8	PT	002		1	1	D	EMERGENCY FEEDWATER PUMP TREPPED ON OVERSPEED	PRIKEN STUD BOLTS ON GOV STEAM VALVE
8	CR3	017323	030177	8	PT	804	R	1		D	EFWP TRIPPO ON OVERSPEED WHILE START ON MAIN STEAM	SLOW GOWNE RESPONSE ON REMOTE START
θ	CR3	017657	041677	8	PT	804	R	1	1	0	EFWP TRIPPO WHILE ATTEMPTH TO START ON MAIN STEAM	NEW GOVNE SLOW RESPONSE WITH MAIN STEAM
8	CR3	018288	060277	8	PT	804	T	1	. 1	D	EFP-2 OVERSPEED TRIP ON INITIAL START	WATER IN STEAM SUPPLY PRYNTO THROTL CLCSN
В	CR3	019245	061677	В	PT	021	R	1	ħ	U	STM DRIVEN EFWP (EFP-2) IN RECIRC MODE, WAS S/D	FATLURE OF THE OUTBOARD PUMP BEARING
8	CP3	018564	071777	В	PŢ	804	Т	1	٨	D	EFP-2 OVERSPEED TRIP ON AUTOSTART	MODIFIED DRAIN SYS. GRYPASS AROUND IN. VLV
В	CR3	019803	112277	8	PT	D21	R	1	N	0	STM DRIVEN EFWP (EFP-2) TRPD AFTR RNNG APPX 10 414	1490,0180 BRNG FLR. ERRNEOUS SITEGLS LE VEL
В	091	017426	101677	8	19	004	8	1	1	0	GOVNR CLOSED ON AFP 1-2	VIRRATION CAUSING GOVNR TO CLOSE-DESIGN
8	081	019531	110877	B	PT	804	8	1	٨	0	GOVNE VALVE CLOSED DUE TO SURGING VIBRATIONS	NO FORCE TO HOLD GOVER OPENMOD. REQUISTO
8	081	017940	121177	8	PI	813	R	1	1	D	CONTROL OF AFP TURBINE LOST CONTROL AFPT 1-1	MECHANICAL BINDING OF GOVER
8	091	020218	122877	В	PŢ	C04	T	1	1	D	AFPT 1-2 SPEED CONTROL LOSTIWILL MODIFY RELAYS	FAILD RELAYS IN CONTROL CKT.; MODIFIED CSN
В	DRI	020271	010678	В	PT	C04	T	1	N	D	AFPT 1-1 LOSS OF SPEED CONTROL; RELAY FAILURES	SPEED CONT. CKT. MODIFIEDUPGRADED RELAY
8	081	027420	102279	8	PT	018		1	1	T	AUX FEED PUMP TURBINE BEARING HAD NO LUB OIL	LOOSE SIGHT GLASS
B	081	030051	010380	В	PT	C13	B	1	- 1	T	AUX FEED PUMP DECLARED INOPERABLE (NO. 1-1)	BURR ON HIGH SPEED STOP PIN, MISADJ CLUTCH
8	0.61	031186	050990	В	PT	009		1	1	T	EFW PUMP DECLARED INOP DUE TO NOISE FROM BEARING	BEARING FAILED DUE TO WATER IN OIL
В	DE 3	012877	043075	B	PT	802		1	1	0		PERSONL DID NOT VERIFY OPRBLTY AFTR MNINC
В	821	011151	103074	8	PM	801	C	1	N	0	AUX PMP SEAL RINGS FROZN TO BUSHNGS AND BSHN TO 54	
	TEE.		051975			-		1			MOTOR FOR AUX FEED PUMP P-318 TRIPPED OFF LINE	LOOSE LOCKNUT ON OVERCURRENT DELAY RELAY
1			021877					1		0		OPPRATE FAILO TO RESET TRIP WHEN P318 IST
	1100		071280						1			CAUSE UNKNOWN
C	ARZ	026488	071979	В	PT	B04	1	1	N	0	EFW PUMP 2P7A TRIPPED ON OVERSPEED	MOTSTURE IN STEAM LINE, NO TRAPS INSTALLED

## ALL FAULTS IN PWR AUXILIARY FEEDWATER PUMPS

PLANT		CONTROL	EVENT		COMP	CAUSE	TYPE	FANUL	CLASSI	MODE DESCRIPTION CAUSE DESCRIPTION
	-	034013	081879		DI	913	p	1	N T	EFW PUMP 2P7A TRIPPED ON OVERSPEED STICKING LINKAGE ON GOVENOR
			092379						N T	FFW PUMP 2PTA TRIPPED ON OVERSPEED, MOISTURE IN SL TRAPS NOT REMOVING MOISTURE IN STEAM LINE
		027125	123079						N T	FFW PUMP 2P7A TRIPPED ON OVERSPEED STEAM TRAP ISOLATED MOISTURE IN STEAM LIN
-	70-	028076							N D	BOTH TRAINS OF EFW PUMPS CAVITATED AFTER LOSS OF P FORCED FLOW STOPPED IN FW SYS OH WATER
		0310238							N D	BOTH TRAINS OF EFW PUMPS CAVITATED AFTER LOSS OF P FORCED FLOW STOPPED IN FW SYS OH WATER
-		031376							1 1	EMERGENCY FEED PUMP KEPT TRIPPING ON OVERSPEED MISADJUSTMENTS ON GOVENOR
		031381	052080						N U	EMERGENCY FEEDWATER PUMP TRIPPED ON OVERSPEED. 2P74 UNENOWN CAUSE
		031671	061080						N D	EMER FW PUMP 2974 WOULD NOT EXCEED 1000 RPM INCORRECT WIRING ON RAMP GEN AN EGM GOV.
		031674	062780	8	PT	000	R	1	N U	ENERGENCY FEEDWATER PUMP TRIPPED ON OVERSPEED UNKNOWN CAUSE, PUMP NO. 2P7A
	-	0320944	071780	8	PT	004	R	1	T D	EMERGENCY FEEDWATER PUMP 2PTA TRIPPED ON OVERSPEED BELIEVED TO BE DESIGN RELATED
		0320949							UT	EMERGENCY FEED PUMP 2PTA TRIPPED ON OVERSPEED BELIEVED TO BE DESIGN RELATED
CAR	2.5	0320940	082990	В	PT	004	R	1	UT	EMERGENCY FEED PUMP 2P7A TRIPPED ON OVERSPEED BELIEVED TO BE DESIGN RELATED
0 00	1	014753	050576	8	PT	005		1	N D	#12 AUX FD PMP S/D FOR REPAIR OF THTL TRIP LATCH TAPPET NUT INCORRECTLY SIZED PER PLANS
c cc	1	023310	110378	8	PT	813		1	T D	11 AUX FEED PUMP DECLARED INOPERABLE THROTTLE VALVE STUCK SHUT AFTER TEST TRIP
c cc	55	017456	031477	8	PT	U16	S	1	UU	#21 AUX FEED PUMP REMOVED FROM SERVICE REPAIR LEAK ON SERVICE WATER SUPPLY LINE
0 00	2	019692	111477	8	PT	809		1	N T	SI AFR LUB PRESS DANG TENT ALEMAN TENT ALE
c cc	2	017691	111677	8	PT	013		1	NU	ST AFM PLACED DOS BENDING GOVERNOR DESCRIPTION OF THE PROPERTY
c cc	02	025180	012779	8	PT	813	R	1	TT	THROTTLE ALA LOR ASS AND LEED LONG TO THE THROTTLE MAI SHALLINED
C F	01	000479	101073	8	PI	813	5	1	T D	APPT PW-10 PAICO TO START DONLING TEST
C M	12	018735	070377	8	PM	U09	R	1	N T	HZO IN "B" ADA FEED THROST SAME DIE
C M	12	018738	071277	8	PT	C13		1	1 1	STM OKIVEN AUX FO PAP FAILED TO TALL OR STEEL
C .M	12	021915	061978	В	PI	C 0 2	5	1	T D	AUX FEED FORF WOOLD NOT GO WOOLE NOT
C M	12	026283	061479	R	PM	009	R		N T	AUX FEED PUMP BECAME INOP DUE TO BEARING FAILURES PREVIOUS TEST WITH PUMP UNCOUPLED
CM	12	030387	011890					1	1 0	AUX FEED PUMP BECAME INDO DUE TO SEARTHS PACKING PACKING FAILED, NATURAL END OF LIFE
C M	12	030799	032180	8	PM	Als	1	1	N T	AUX FEED PURP LEAR EXCESSIVELY FROM GENTLY FROM

#### ALL FAULTS IN PWR AUXILIARY FEEDWATER PUMPS

	p			S		c			A C T			
٧	L			\$	C	MA	T	FAS	Ŷ	LA		
N -	1	CONTROL	DATE	H. W.	P 	DOSE	E	L	Y	5	MODE DESCRIPTION	CAUSE DESCRIPTION
С	H12	031946	071280	В	PT	007		1	T	t	AUX FEED PUMP TRIPPED PRIOR TO OVERSPEED SETPOINT	WEAR TO EMERGENCY TAPPET NUT
C	MY1	030992	040880	8	PM	000		1	T	U	AUX FEED PUMP P-25A REQUIRED TO BE SHUTDOWN	TIL FROM BEARING, COULD NOT BE DUPLICATED
C	PAI	002049	040272	8	PM	C21		1	N	T	FLOW FROM MTR DRVN AUX FD PUMP P-84 50 PRCT OF NOR	
C	SLI	016880	120876	8	PT	813	S	1	U	D	STEAM DRIVEN AUX FEED PUMP WOULD NOT START	TREP SOLENOID LATCH FAILED TO ENGAGE
¢	Stl	019503	081177	8	PŢ	800	R	1	T	U	C STEAM-DRIVEN AUX FEED PMP FAILD TO START	STAPTED ON 2ND TRY . PREVIOUS FAILE RPORTD
C	51.1	025363	020879	8	PT	813	R	1	T	U	AUX FEED PUMP 1C FAILED TO START	TREPPED OVERSPEED TREP, CAUSE UNKNOWN
¢	SLI	026469	061479	8	PT	818	R	1	T	T	AUX FEED PUMP 1C FAILED TO START	STEAM INLET VALVE FAILED TO OPEN
W	8 V I	015727	082576	8	PM	C04		. 1	T	D	34 AUX FEED PUMP VAPOR BOUND CAUSING LOSS OF DESCH	DESIGN DEF OF RECIRC LINE SIZE & ORIFICE
W	8 V I	017351	031077	B 1	PT	800		1	N	U	STEAM AFP FAILD TO START WHEN RIX TRIPPD 50% POWER	CAJSE UNDETERMINED
W	BAI	017561	040377	9 1	PŢ	015		1	1	T	LOUD NOISE DEVELOPED IN TURB DRIVEN AUX FEED PUMP	LOSSE COUPLING GUARD RUBBING ON COUPLING
W	8 V 1	020130	121577	8	PT	C13		1	N	T	STEAM AFP GOVENR FAILD TO MAINTAIN SPEED CONSTANT	MALFUNCTIONING GOVERNOR VALVE
W	941	025486	030579	9 1	PT	809		1	U	0	AUX FEED PUMP DECLARED INOPERABLE, TR VLV DIDONT CL	NUT AND WASHER DISCOVERED IN STEAM LINE
	-	015862	090676	8 8	PT	804	5	1	N	D	LIMIT SWITCHES ON LINKAGE ROTATED ON SHAFT	SET SCREWS DID NOT HOLD ARMS IN PLACE
W	DC1	016115	101376	8 1	PT	813	5	1	N	D	FAILD TO START FROM CONT. ROOM; TRIP LINKAGE STICKY	PANE THAT ENGAGES THROTTLE STOP VLVE STCK
		021939	071478			-	-		N	T	AUX FEED PUMP FAILED TO START ON START SIGNAL	SOLENDID THAT OP. TRIP THROTTLE, BURN OLT
		022673	100278	B (	1	C13	R	1	R	U	AUX FEED PUMP FAILED TO REACH RATED SPEED	GOVERNOR WAS REPLACED
		268220	110678	B 1	PT	813	5	1	Ť	T	AUX FEED PUMP FAILED TO START ON SURVEILLANCE TEST	FAILED ZEMOR DIODE IN OVERSPEED MONITOR
		025459	030679			-		1	T	T	AUX FEED PUMP TAKEN DOS DUE TO A HOT BEARING	BEARING FAILED, UNKNOWN CAUSE
		0302794				-		1	T	1	AUX FEED PUMP BECAME INOP, THROTTLE VALVE UNLATCHED	WEAR ON TWO MATING SURFACES ON LANKAGE
		0302798						1	N	T	AUX FEED PUMP FAILED TO START	BURNED OUT RESET COLL ON TRIP & THROTTLE
		030744				7.7	T	1	N	T	AUX FEED PUMP TRIPPED AND TET VALVE DIDN'T RESET	RESET SOLENOID DEFECTIVE, LINKAGE MISAD JU.
		031310				-		1	-		AUX FEED PUMP TRIP THRO VALVE LINKAGE UNLATCHED	CAUSE OF UNLATCHMENT UNKN, PUMP IN STANCBY
		015218*							N		AUX FEED PMPS WOULD NOT DEVELOP PROPER DISCH PRESS	BOTH PUMPS VAPOR BOUND - FAULTY CHK VLV
		025723						1			"A" AUX FEED PUMP FAILED TO REACH RATED FLOW	DERHEATED HED SUPPLY TO PUMP
H	IbS	010235	052274	8 5	M	P13	2	1	N	D	NO. 21 AUX FD PUMP FAILED TO START - AUTOMATIC	AUTO START CKT SWITCH HAD DIRTY CONTACTS

Zaz	PLANT	CONTROL	EVENT	SYSTEM		MODE	TYPE	FANIL	A CT	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
-		020022	121577	9	ом	018		1			#23 AFP OUS DUE TO SPARKING MOTORMOTOR REPLACED	WESTINGHOUSE ,4008HP, DWG 8610800
-			041277					1			ATTEMPT TO PUT #33 AUX FEED PUMP ON-LINE UNSUCSEL	SHAFT HAD SHEARED - MOD 3HMTA-9
		017877	120377								AFP TURBINE STARTED BUT FAILD TO REACH MAX SPEED	SIGNAL CONVERTER SSC-3405 FAILD
											AFPT FALLD TO START FOLLOWING R/X TRIP	TRIP/THROTTLE VALVE FOUND SHUT
		023443									AUX FEED PUMP DID NOT START	TRIP THROTLE VALVE TRIPPED, UNKNOWN CAUSE
		025438								1	AUX FEEDWATER PUMP FAILED TO START AFTER RX TRIP	MINT FLOW SPRING TENSION INSUFFICIANT
								-		200	AUX FEED PUMP TRIPPED ON OVERSPEED	MANUAL SPEED ADJUST LEFT MISADJUSTED
*	351	02/037	021680	8	DM	804	U	2		0.1	ASB AUX FEED PUMPS FAILED TO AUTO START	INADEQUATE DESIGN CHANGE CONTROL
		030559						1		10	AUX FEED PUMP DECLARED INOPERABLE, HOT THRUST BEAR.	MISPOSITIONED DILER ASSEMBLY, HE OIL LEVEL
		030560									WHILE STARTING AUX FEED PUMP THE TURBINE TRIPPED	TRIPPED. OVERSPEED DUE TO LIMIT SWITCH
			080174	A	PM	803	U	2		0 1	TWO AFP'S DID NOT START UNTIL THIRD ATTEMPT	DID ALLOW DIL PRESS TO BUILDUP
*	KEL	010040	102574	A	PM	813	5	1	-	N D	IA AFP DID NOT START AUTOMATICLY ON HI WTR LEVEL	A.O. SMITH RELAY BOUND UP MECHANICALLY
		012113						1		N U	24 AFP FAILO TO START AFTER R/X TRIP	UNDER INVESTIGATION
			012475								14 AFP FAILD TO START JPOWER SUPPLY FAILURE	BKR OPERATING HANDLE DID NOT CONTACT
-		012399									14 AFP FAILD TO START ON LO-LO SG LEVEL	RER GUIDE BAR"POSITION" NOTCH TOO SMALL
	NET.	0124224	101575	a	PM	813	5	1		N D	14 AFP FAILD TO START FOLLOWING A UNIT TRIP	DEFECTIVE M-S SMITCHES
	KEI	0134009	101575	R	PT	B13	5	1		N D	IC AFP FAILED TO START FOLLOWING UNIT TRIP	DEFECTIVE WESTINGHOUSE W-2 SWITCH
		013667*									AFP 14, 186 1C REDUCED FLOW DUE TO STARTUP STRATHES	PLUGGO BY RESIN BEADS FROM MAKEUP DEMIN
		013773									BKR 16201 OPENED CAUSING UNIT TRIP & INOP. 18 AFP	RER 16201 CLOSED MANUALLY
		014386	031276								AUX FO PUMP IN FAILED TO START ON BLACKOUT SEO STO	FAULTY LUBE OIL PRESSURE SWITCH
		016117									18 AFP FAILD TO START DUE TO STICKY ACTUAT. RELAY	WORN PLUNGER SHAFT, REPLACED RELAY
		025755	033079							N U	AUX FEED PUMP 1-FW-P-2 TRIP THROTTLE VLV CLOSED	SIGNAL FROM OVERSPEED TRIP
		027080						1		N T	AUX FEED PUMP BECAME INOPERABLE (1-FW-P-3)	LUSE OIL STRAINER WAS CLOGGED
	74.77.4	030102	011380					1		M T	AUX FEED PUMP TAKEN OUT OF SERVICE FOR INSPECTION	
- 7		030101	011480	A	PT	018	3	1		N T	AUX FEED PUMP 1-FM-P-Z DEVELOPED LEAK IN DIL COOL.	BLOWN GASKET

	¥EN	PLANT	CONTROL NUMBER	EVENT	SYSTEM	COMP	MODE	TYPE	FAUN	ACTIVITY -	MODE DESCRIPTION CAUSE DESCRIPTION
	w N	A 1	032635	090880	R	PT	013	R	1	NU	AUX FEED PUMP GOVERNOR VALVE FOUND TRIPPED GOVENOR TRIPPED ON OVERSPEED, CAUSE UNKNO.
	w P	8.1	010725	081374	В	PM	813	S	1	TC	AUX FEED PUMP 12 FAILED TO STAFT BREE FOR AUX LUBE DIL PUMP WAS OPENED
	w P	91	011230	121274	8	PM	009	5	1	N T	AUX FEED PUMP 12 DID NOT MAINTAIN NORMAL DISCH FLO SUCTION STAR CLOGGED WITH SILT
	W P	91	012411	032775	8	PI	809		1	N D	TURB DRYN AUX FD PMP FAIL TO REACH ACCPT DISCH PRS STICKY GOV CONT YLV LINKAGE - DIRTY
	W P	R 1	017791	050177	8	PT	806		1	N D	#11 TURB AUX FO PMP TRIPPO TWICE ON OVERSPEED LOW GOVERNR DIL LEVEL REVISED PROCEDURES
	W P	01	023041	122878	8	PI	013	U	1	1 0	NO. 11 AUX FD PUMP TRIPPED OFF-LINE AT END OF TEST STEAM SUPPLY VALVE TRIPPED ON OVERLOAD
	W P	8.5	019896	111077	В	PŢ	813		1	1.1	#22 TURB DRYN AUX FO PMP TRIPPED ON OVERSPEED LOSSE LINKAGE ON GOV TO PRESS COMPENSATOR
	W P	02	027527	110279	B	PT	813		1	T U	#22 AUX FEED PUMP FAILED TO START OVERSPEED TRIP VALVE FOUND TRIPPED
	M D	2 8	031455	052980	8	PI	002	T	1	N D	NO. 22 AUX FEED PUMP TRIPPED INADVERTANTLY TECH DROPPED INST ON TRIP THROTTLE LINKAG
	W D	82	032731	091480	В	PT	DOZ	T	1	N D	AUX FEED PUMP TRIP MECHANISM WAS TRIPPED WORKMAN ACCIDENTLY BUMPED TRIP MECHANISM
	W D	T L	0009644	040774	В	PM	C03	S	1	UT	"A" MTR DRIVEN AUX FD PUMP HAD INADEQUATE FLOW IN-LINE CONICAL STRAINER WAS PLUGGED
	W P	11	0009649	040774	8	PM	009	5	1	UT	"B" MTR ORIVEN AUX FD PUMP NO HAVE HAD INAD FLOW IN-LINE CONICAL STRAINER WAS PLUGGED
	W P	T 1	012531	041875	9	PI	419		1	UU	8 GALS LOW LEVE RAD. WTR LEAKD VIA STEAM-DR AUX FO SHAFT GLANDS LEAKD SHUT DISCHRG VALVE
	A 8	G1	000629*	121473	8	PM	C11	U	2	10	AUXILIARY FEED PUMPS A 6 8 LOST SUCTION ATR IN SUCTION HEADER
	W R	61	012115	010875	В	PT	913	5	1	T D	TURBINE-DRIVEN AUX FD PUMP FAILED TO START SUCSFLY LO LUBE DIL PRESS REGULATOR SETTING
	M R	0.2	000185	070973	8	PM	813	S	1	0 0	AFP "B" TRIPPO ON INITIAN OF MANUAL START AFP "B" TRIPPO ON INITIAN OF MANUAL START
	W R	02	011033	111974	В	PT	005	5	1	T D	STEAM DRIVEN AFW PUMP TRIPPED ON OVRSPD DRNG TEST WOODWARD GOVNE MAN STTG OUT OF ADJUSTMENT
	W R	0.2	013685	110275	8	PM	813	5	1	1 1	"A"AFP FAILD TO START ON SISES TARNISHED CONTACTS HIGH HUMIDITY MAY BE FACTOR FOR TAR. CONT
	W R	U2	020181	122277	8	PT	011	5	1	T D	AFPT TRIPPO DURIN TEST RUN; HI PUMP CASING TEMP. STEAM LEAKAGE BACK THRU VALVE V2-14C
	W R	0.2	022615	041178	8	PM	813	S	1	N D	"B" AFP FAILED TO START UPON LOSS OF MAIN FEED PRS WORN CKT BKR TRIP ARM
	W R	02	021317	041378	8	PM	813	5	1	N D	"B" AFP FAILD TO START FROM RIGB INST. TRIP COILS SETTINGS FOUND TO BE LOW
	W R	02	026362	060479	8	PM	818		1	N C	"A" AFW PUMP TRIPPED SHORTLY AFTER STARTING ROTOR BARS CRACKED IN MOTOR
	W S	A 1	016938	010877	8	PT	801	U	1	N D	#13 AUXILIARY FEEDWATER PUMP FAILED TO START PERSONNEL ERROR - TURB WAS MANUALLY TRIPD
	w S	11	022422	092478	9	PT	813		1	TU	AUX FEED PUMP FAILED TO START STEAM INLET VALVE OP SHEAR PIN WAS MISSED
10	w 5	A 1	0232320	112778	8	PM	800	5	1	N T	NO 12 AUX FEED PUMP FAILED TO AUTO START DURING ST NO CAUSE GIVEN. (STARTED MANUALLY)

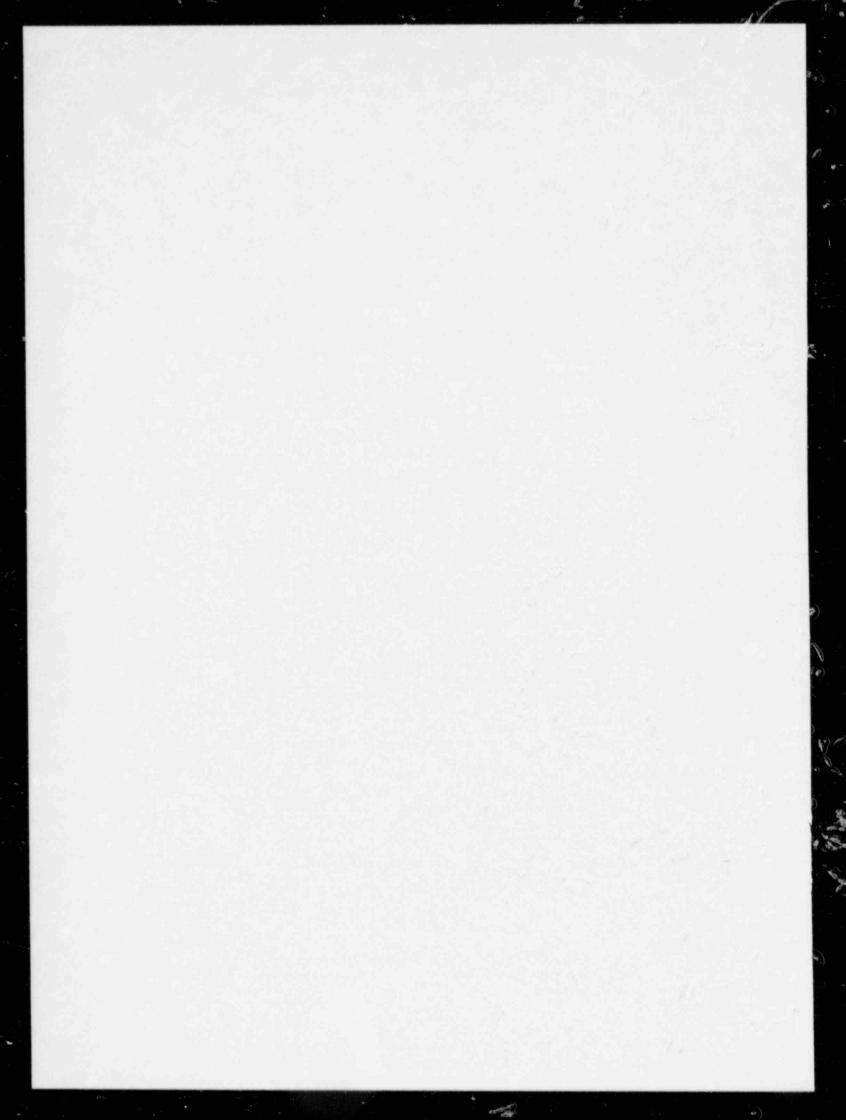
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****	P A N T	CONTROL	EVENT	T	COMP	M A U S E	TYPE	F N I U	TIVITY	CLASSI	MODE DESCRIPTION
	5 4 1	0232320	112778	В	PM	813	s	1	N	T	NO 13 AUX FEED PUMP FAILED TO START DURING ST
		023316	121378					1	N	U	NO 13 AUX FEED PUMP TRIPPED ON OVERSPEED
		027965	122679	R	PT	021		1	T	T	AUX FEED PUMP FAILED
		013977	121975	В	PD	806	T	1	N	0	DIESEL DRIVEN AUX FO PMP FAILED TO START - MANUAL
		013976	010476					1	N	0	DIESEL-DRYN AUX FO PUMP TRIPPED ON OVERSPEED
		014564	010976					1	T	D	DIESEL AFP OVERSPED WHEN MANUALY STARTED
		014145A						1	N	0	AUX FEED PUMPS FAILED TO START AUTOMATICALLY
			011676					1	N	0	AUX FEED PUMPS FAILED TO START AUTOMATICALLY
		***	312376					1	T	0	COLD STARTS OF DIESEL DRIVEN AUX FO PMPS UNSUCCSFL
		014251	032876					1		U	DIESEL DRIVEN AUX FD PUMP STARTED - TRIPPED. OVERSP
		014571	051276				*	- 7		0	STM DRIVEN AUX FD PUMP FAILED TO START
		014932	14/4/4/4/19							T	DIESEL-DRIVEN AUX FO PMP TRIPPED-HI HAKET WTR TEMP
		0166034								D	DIESEL-DRIVEN AUX FEED PUMP FAILED TO AUTO-START
		015996	090376							T	DIESEL-DRIVEN AUX FO PMP TRIPPED HI JAKET WTR TEMP
		0160038							-	T	TURBINE-DRIVEN AUX FO PUMP TRIPPED ON OVERSPEED
W	TRI	015339	100576						- 3		TURB-DRYN AUX FO PMP FAILED TO START - AUTOMATIC
W	121	016337	101976					- 2	- 12	0	DIESL AFP TRIPPO ON LOW L.O. PRESS
W	151	017574	032477					1		1 7	DSL DRYN AUX FD PUMP STARTED AND IMMED TRPD-485PD
W	101	020182	121777							0	STEAM DRIVEN AUX FEED PUMP INOPERABLE
w	161	020183	121777							1 0	AUX FEED PUMP FAILED TO START MANUALLY
W	181	032078	072080							1 0	
		032622	090380						- 1	r	AUX FEED PUMP FAILED TO START
W	103	010135A	050874	B	PI	806		2	- 1	0	
W	TUB	0101350	050874	8	PI	809	١.	1	. 1	1	
w	103	027583	100179	8	PI	809	9	1		T	
w	TUE	027658	110579	. 8	P1	B20		1	- 1	T	"A" AFW PUMP FAILED TO START

OVERSPEED TRIP MISADJUSTED SPEED CONTROL FOUND SET TOO HIGH BEARING FAILURE CAUSED BY LACK OF LUB. PRICEDURES INADEQ TO ENSURE SYS START L/U FORK SIGNAL LEAD TO GOV VIBRATED LOOSE GOVENE GAIN INCREASO TO IMPROVE RESPONSE MISLOGGING OF LIFTED LEAD IN AUTO-STA CKT MISLOGGING OF LIFTED LEAD IN AUTO-STA CKT L CONT CKT FOR L.O. PRESS S/D NEED REDESIGN P GOV MOD D 153-0054 REP W MOD T 153-0054 TRIPITHIL VLV NOT RESET-FAULTY IND LITE P TEMP SWITCH SET POINT SETTING DRIFTED LOW BLOWN FUSE IN THE AUTO-START CIRCUIT IP TEMP SWITCH SET POINT SETTING DRIFTED LOW FAILURE OF WOODWARD GOV SPO SENSOR CARC OPERATOR FAILED TO RESET TRP/THTL VALVE BRIKEN CRANKSHAFT ON DIESEL MICROSWICH IN SPD SENSING CKT OUT OF ADJ LIMIT SW FAILURE IN OVERSPEED TRIP CKT POOR PROCEDURE FAILED STARTING BATTERY PACKING TOO TIGHT DEFECTVE PROCEDURES FOREIGN MAT IN TURB REG VALVE/GOVERNOR WATER IN PNEU CONT OF PRESSURE CONTROL VL MISALIGN OF CONNECTORS ON PRESS CONT VLV

CAUSE DESCRIPTION

PAGE

>E2 -	PLANT	CONTROL NUMBE?	EVENT	SYSTEM	COMP	E CAUSE	TYPE	F A I L	NUN	CLASSI	MODE DESCRIPTION CAUSE DESCRIPTION
W	TU3	028094	112879	В	PT	800	R	1	- 1	U	"A" AFW PUMP FAILED TO START CAUSE UNKNOWN
w	103	032888	092680	8	PT	009	R	1	. N	T	"A" AUX FEED PUMP FAILED TO DELIVER REQUIRED FLOW WATER IN PNEUMATIC CONTROLS
w	TU4	000095*	061873	В	PT	802	U	3	N	0	AUTO START OF AUX FD PMPS DID NOT OCCUR ON SCRAM FUSES FOR AUTO-START LOGIC CKT NOT INSTLD
w	1114	030945	040780	В	PT	C13	S	1	1	T	"A" AUX FEEDWATER PUMP FAILED TO DELIVER REQUIRED FLIW. CONTROL CIRCUIT OUT OF CALIBRATION
w	211	010126	043074	8	PM	004	S	1	N	D	AUX FEED PMP 18 TRIPPD AFTR 30SEC, TRIPPD 2ND TIME PMP SUCTN LINE MODFLED TO PROVIDE VENTING
w	711	012080	051474	В	ÞΤ	800		1	1	0	AUX FEED PMP LA FAILD TO START RESET OVERSPO TRIP OVERSPO TRIP VALVE FOUND TO BE TRIPPO
W	711	010281	060674	R	PŢ	009	R	1	N	T	14 AUX FEED OVERSPO VALV TREPPO RESET THEN STARTED WATER HAMMER BROKE TURBEN EXHAUST HANGER
w	711	010718	071174	9	PT	802	U	1	U	0	AUX FO PUMP 14 FAILED TO START FROM CONT RM AUX FO L.O. PUMP PWR SUPPLY BKR WAS OPEN
w	711	010914	091974	8	PH	814		1	N	U	IC AUX FEED DOES NOT START PUMP INTERNALS DAMAGED CAJSE UNKNOWN UNDER INVESTIGATION
W	211	014269	030576	В	PŢ	809	R	1	N	0	14 AUX FEED PUMP FAILED TO START TURBINE WAS WATER BOUND
w	711	0153674	080876	В	PT	800		1	N	U	14 AUX FEED TRIPPD AFTR STRTD DUE TO OVERSPO TRIP PROBABLY STICKY SOVERNOR VALVE
w	711	0153678	080876	8	PM	C03		1	N	Ť	IC AUX FEED FAILD TO DEVELP FULL DISHEG HEAD PLUGGED SUCTION STRAINER
w	111	020112	120377	В	PT	813	Ţ	1	1	D	LA AUX FO PUMP WOULD NOT START STM FLO CONT VLV SOL STUCK IN ENERGZO POS
w	ZF:	020105	120877	8	PŢ	813	T	1	. 1	D	14 AUX FD PUMP WOULD NOT START STM FLO CONT VLV SOL STUCK IN ENERGZO POS
¥	Z I 1	027284	092579	8	PĦ	800		1	N	U	FOLLOWING RX TRIP 1C AFW PUMP STARTED THEN TRIPPED RESTARTED MANUALLY, CAUSE NOT STATED
W	212	0008938	021174	В	PM	011	9	- 1	U	0	AUX FO PUMP 28 HAD PREVIOUSLY FAILED APPARENTLY DAMAGED FROM AIR BINDING
w	212	000814	021574	8	PŤ	811	٧	1	- 1	0	ZA AUX FEED PUMP STARTED, BUT TRIPPED ON GVEPSPEED ALR WAS ASPIRATED INTO THE PUMP
W	212	0008934	021574	А	PM	C11	٧	1	N	0	2C AUX FD PUMP STARTED - DISCH PRESS DID NOT FISE AIR BINDING OF PUMP IMPELLER
W	712	168600	031274	8	PM	813	5	1	U	D	28 AUX FD PMP FAILED TO START OIL PRESS START INTLK SW WOULD NOT CLOSE
×	112	019997	120777	8	PM	800		1	N	U	28 AUX FFED PMP FAILD TO START NO APPARENT CAUSE FOR FAILURE



## BWR Turbine-Driven HPCI and RCIC Pumps

The HPCI and RCIC pumps are turbine-driven at most BWRs. Each of these plants has one pump for each system. Since the two pumps often seem to be tested together and maintained together, they are treated in this report as a single system. The exposure times used are critical hours.

Of the failures to start, all the common cause events were command faults rather than failures. Therefore, the quantities involving p cannot be estimated for failures.

Rates are estimated for:

- 1. Failure to start, based on all faults
- 2. Failure to start, based on failures only
- 3. Failure to operate after starting, based on all faults
- 4. Failure to operate after starting, based on failures only.

Be sure to read the Application section in the main body of this report. The following computer printouts give the estimates and summaries of the relevant data.

TURBINE-DRIVEN BWR HPCI/RCIC PUMPS

FAILURE TO START

ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS

RATES ARE PER CRITICAL HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POIN' ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT IN' 7AL

P • ( .001, .083, .281)

LAMBDA • ( 9.1E-06, 8.0E-05, 2.1E-04)

LAMBDA • ( 3.5E-08, 1.8E-05, 7.1E-05)

DMEGA • ( 2.3E-07, 1.9E-06, 5.0E-06)

SYSTEM SHOCK SPECIFIC COMPONENT BETA FACTOR

1 (6.3F-07, 3.8F-02, 1.4F-02) (1.8F-05, 9.9F-05, 2.4F-04)
2 (3.4F-07, 1.9F-02, 6.8F-03) (1.6F-05, 9.1F-05, 2.2F-04) (.004, .028, .148)

OVERALL (3.4F-07, 3.8F-02, 1.4F-02) (1.6F-05, 9.9F-05, 2.4F-04) (.004, .028, .148)

2 ( 3.3F-07, 2.7E-06, 7.4E-06)

OVERALL ( 3.3E-07, 2.7E-06, 7.4E-06)

TURGINE-DRIVEN BUR HPCI/RCIC PUMPS

FAILUPE TO START

FAILURES UNLY. EXCLUDING COMMAND FAULTS

RATES ARE PER CRITICAL HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER SOUNDS FORM 90 PERCENT INTERVAL

LAMBOA . ( 3.0F-07, 2.8E-05, 9.9E-05)

LAMADA . 1 2.5E-09. 6.4E-07. 2.5E-061

A \* 1 2.5E-09, 6.4E-07, 2.5E-061

NO DATA WERE DRSERVED FOR ESTIMATING OTHER QUANTITIES

BWR TURBINE-DRIVEN HPCI/RCIC PUMPS

FAILURE TO OPERATE, GIVEN START

ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS

RATES ARE PER CRITICAL HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

P • ( .002. .148, .470)

LAMBDA • ( 1.8E-05, 8.6E-05, 1.9E-04)

LAMBDA • ( 2.9E-06, 7.1E-06, 1.3E-05)

OMEGA • ( 2.5E-09, 6.4E-07, 2.5E-06)

SYSTEM SHOCK RATE SPECIFIC COMPONENT BETA FACTOR

1 (1.1E-05, 7.4E-03, 3.9E-03) ( 2.6F-05. 9.3E-05. 2.0E-04)
2 ( 7.2E-06, 3.7E-03, 2.0E-03) ( 2.3E-05. 9.0E-05. 2.0E-04) ( .000, .011. .074)

OVERALL ( 7.2E-06, 7.4E-03, 3.9E-03) ( 2.3E-05. 9.3E-05. 2.0E-04) ( .000. .011. .074)

SYSTEM SIZE RATE FOR BOTH COMPONENTS
R2
2 ( 2.9E-08, 1.3E-06, 3.7E-06)
----
DVERALL ( 2.9E-08, 1.3E-06, 3.7E-06)

TURBINE-DRIVEN BWR HPCI/RCIC PUMPS

FAILURE TO OPERATE, GIVEN START

FAILURES ONLY. EXCLUDING COMMAND FAULTS

RATES ARE PER CRITICAL HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

P = ( .006, .341, .863)

LAMBDA = ( 8.7E-06, 3.3E-05, 7.0E-05)

LAMBDA = ( 2.3E-07, 1.9E-06, 5.0E-06)

DMFGA = ( 2.5E-09, 6.4E-07, 2.5E-06)

SYSTEM SHOCK RATE FOR SPECIFIC COMPONENT BETA FACTOR

1 ( 6.0E-07, 6.0E-04, 2.9E-04) ( 1.1E-05, 3.6E-05, 7.3E-05)
2 ( 4.3E-07, 3.0E-04, 1.5E-04) ( 1.0E-05, 3.5E-05, 7.2E-05) ( .001, .024, .146)

OVERALL ( 4.3E-07, 6.0E-04, 2.9E-04) ( 1.0E-05, 3.6E-05, 7.3E-05) ( .001, .024, .146)

SYSTEM RATE FOR BOTH COMPONENTS
R2
2 (2.5E-OR, 1.1E-O6, 3.4E-O6)

DVERALL (2.5E-OR, 1.1E-O6, 3.4E-O6)

LETHAL SHOCKS ALL FAILURES TO START IN TURBINE-DRIVEN BUR HPCI AND RCIC PUMPS NUMBER OF NONLETHAL SHOCKS FAILRS/COM FLTS 1 0 101-0 1 0 1 0 CALEND. \$7936 \$7216 CR IT. 5 90 ENI F 10 2 HOM 96 1 89.2 0.4.1

ALL FAILURES TO OPERATE, GIVEN START, IN TURBINE-CRIVEN BUR HPCI AND RCIC PUMPS HOURS. 34360 34836 48528 57936 5392A 32634 29788 

DR 2 DR 3 5 P 1

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										A C			
× 5 7 7	PLANT	CONTROL	EVENT	- HELLINA	COMP	M DOE	TYPEI	F A I L	NC N	CLASS		MODE DESCRIPTION	CAUSE DESCRIPTION
G B	F1	000301	090473	14	PT	813	T	1		u D	STH S	UP VLV TO HPCI TURBINE, FCV-73-16, FAILED TO OP	LIMITORQUE DRIVE MOTOR-DAMAGED GEARS
G 8	FI	000368	091073	н	PT	813	T	1		D	HPCI	FARLED TO REACH RATED SPEED & FLO ON OK START	FLOW CONTROLLER MALFN-BAD CONNECTOR
G 8	F1	0005184	111073	н	PT	U13	N	1		N U	HPCI	INOPERABLE UNTIL MANUALLY RESET	TREP LOGIC IMPROP DESIGNED FOR LOSP
G 8	FI	0005188	111073	0	PT	U13	N	1		N U	RCIC	INOPERABLE UNTIL MANUALLY RESET	TRIP LOGIC IMPROP DESIGNED FOR LOSP
G 9	FI	000521	111573	0	PT	813	S	1		T O	RCIC	SYS FAILED TO OPER WHEN MANUALLY INITIATED	STEAM SUPPLY VLV WOULD NOT OPEN
G 8	IF I	000522	111573	н	PT	800	5	1		N U	HPCI	ISOLATED AND TRIPPED ON MANUAL INITIATION	NO APPARENT CAUSE
G B	FI	000655	122573	н	PT	C13	T	1		TT	HPCI	TURBINE FAILED TO REACH RATED SPEED & FLOW	GOVERNOR UNABLE TO PROPERLY SIGNAL CONTRL
G R	FI	000872	012674	н	PT	C13	7	1		1 0	HPCI	FLOW & TURBINE SPEED UNSTABLE	DEFECTVE PARTS IN EGM CONTROL BOX
6 8	F1	010019	031274	н		C13	T	1		7 7	129H	TURBINE FAILED TO REACH RATED SPEED AND FLOW	EGS BOX FAILED DUE TO DEFCTY TRANSISTOR
G 8	FI	000979	041374	н	PT	C13	Т	1		U T	HPCI	FAILED TO REACH RATED FLOW IN REQUIRED TIME	TWO DECTY ESISTORS IN GOV EGM CONTROL BOX
G 8	9F1	010122	050574	4	PT	800	2	1		N U	HPCI	SYSTEM ATTEMPTED TO START BUT TRIPPED	UNDETERMINED
G B	FI	010294	060974	н	PT	813	R	1		T D	HPCI	REOD SEVERAL MANUAL START ATTEMPTS FOR THERTY	MIL RELAY VALVE DID NOT OPEN FULLY
G R	F1	010422	062174	н	PT	813	R	1		U D	HPCI	TURBINE FAILED TO START MANUALLY	TURB STOP VLV PILOT PISTON WAS MALFUNCING
G 8	F1	010533	082074	Q	PI	804		1		N D	RCIC	FAILED TO START AFTER A REACTOR SCRAM	CONTROL COMPONENTS OUT OF CAL-WRONG LOCTH
G 8	3 F 1	010793	091874	н	PI	813	T	1		N D	HPCI	FAILD TO START DURIN SURVLINCE AT 95% POWER	CONTACTS IN AUX DIL PMP CERCUIT HUNG UP
G R	F1	010939	111574	0	PI	820		1		TT	RCIC	TRIPPED ON OVERSPEED DURING AUTO-INITIATION	REMOTE SERVO OUT OF ALIGNMENT W GOV LEVER
G R	FI	0159294	092176	н	PT	018	T	1		T T	HPCE	TRIPPED DURING TESTING	LEAKING STEAM DISCHARGE LINE RUPTURE DISK
G A	F1	0159298	092176	0	PT	813	T	1		T	RCIC	FAILED REQUIRED SURVEILLANCE TEST	GOVERNOR EG-R MALFUNCTIONED
G 8	IF1	019124	050277	Q	PI	C13	ŧ	1		T	2138	SYSTEM FAILED TO REACH RATED FLOW AND PRESS	THPPOPER SPEED REF VLTG TO EG-M CONT BCX
G B	FI	019126	050977	14	PT	813	T	1		T O	HPCI	TURB STM SUPPLY VLV, FCV-73-16, FAILED TO OPEN	LIMITORQUE ACTUATOR, MOD SMB-2, BROKN TEETH
G P	iF1	018122	051277	н	PT	813	1	1		T D	HPCI	AUX DIL PUMP FAILD TO START	DEFECTIVE PRESS. SWITCH
G 8	3FI	018540	080177	0	PT	C13	T	1		1 1	RCIC	TURB DIO NOT PRODUCE RATED FLOW IN REGO TIME	RAMP GEN AND SIGNAL CONVERTER OUT OF ADJ
G 8	FI	018691	080877	14	PT	013	T	1		TT	HPCI	TURBINE SPEED CONTROLLER WOULD NOT CONT TURB	POWER SUPPLY TO GOV FAILED-RESISTOR FAILD
G P	F1	027316	101079	н	PT	004	T	1		1 0	HPCI	TURBINE TRIPPED DUE TO RUPTURE DISK RUPTURE	REPLACING WITH IMPROVED RUPTURE DISK
G 8	3F1	027834	120379	H	PT	813		1		1 1	HPCI	STOP VALVE FAILED TO REMAIN OPEN	SPRING IN TRIP MECHANISM NOT COMPRESSED

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1 Zme	P L A N T	CONTROL	EVENT	SHAME	COKe	MODE	Ŷ	FANULM	Ť	CLASS	MODE DESCRIPTION	
G	8F1	030306	012780	н	PT	C11	T	1	U	D	HPCI PUMP TURBINE HAD CRACK ON COUP BEAR SUPP PED.	86
G	BF1	030887	040280	0	PT	018	T	1	T	D	RCIC TRIPPED DUE TO A HIGH RUPTURE DISC PRESSURF	TE
G	BF1	030977	040780	н	PT	018	T	1	T	0	HPCI PUMP TRIPPED DUE TO FAILED EXHUST RUP. DISC	TF
G	aF1	031403	060280	14	PI	013	R	1	T	T	HPCI PUMP FAILED DUE TO INADVERTANT TRIPPING	W
G	BF 2	010491	081174	14	PT	802	U	1	T	T	HPCI ISOLATION OCCURED DURING MANUAL HPCI START	E
G	9F2	010493	082374	0	PT	C13	T	1	U	T	RCIC FAILED TO REACH RATED FLOW	TI
G	352	010815	092474	14	PT	804	T	1	N	0	HPCI SYSTEM INOPERABLE DUE TO EXHAUST LINE FLOODED	\$1
G	BFZ	010816	100774	14	PT	804	T	1	N	0	FLOODED SYS. DUE TO LEAKING GLAND SEAL COND. GASKT	FI
G	BF2	010996	110474	14	PT	804	Ţ	1	N	0	HPCI INOPERABLE DUE TO FLOODED GLAND STEAM CONDEN.	RI
G	BFZ	011097	120374	н	PT	804	T	1	N	D	HPCI AUTO-ISOLATED AFTER AUTO-ACTUATION	N:
G	BF 2	012083	010775	Q	PT	813	T	1	T	T	RCIC SYSTEM FAILED TO OPERATE DURING A TEST	RI
G	8 6 2	012082	011675	0	PT	013	R	1	N	т	RCIC TURBINE TRIPPED DURING NORMAL OPERATION	M
		015936	090876	0	PT	C13	T	1	T	T	RCIC TURBINE GOV SPEED CONTROL FAILED TO RESPOND	ø
G	852	016907	111676	14	PT	813	5	1	T	D	HPCI TURBINE STEAM SUP VLV. FCV-73-16, FAILED TO DPN	L
G	BF2	021782	062778	14	PT	D03	C	1	T	0	DAMAGE SUBSTAINED TO HPCI PUMP AND REDUCTION GEARS	٧
G	BFZ	030417	021690	н	PT	C11	5	1	H	0	HPCI PUMP TUR HAD CRACK ON COUP BEAR SUPPORT PED.	81
G	BF2	030637	031080	н	PT	D18	T	1	1	D	HPCI PUMP TRIPPED DUE TO FAILED EXH RUPTURE DISC	T
G	BFZ	032259	081280	н	PT	018	T	1	Ţ	0	HPCI PUMP TRIPPED DUE TO FAILED EXH RUPTURE DISC	T
G	BF3	015055	082476	н	PT	818	S	1	T	0	RUPTURE DISK ON STM DISCH LINE FAILED ON HPCF S/U	C
G	8F 3	015937	082676	14	PT	813	T	1	7	T	HPCI TURBINE CYCLED ON START UP	GI
G	BF3	016056	092176	14	PT	C18	5	1	7	T	HPCI SHAFT DIL PMP PESS.LOW CAUSH ERRATIC TURBINE	L
G	BF3	016057	100176	0	PT	002	S	1	T	0	RCIC CONTROLLER FAILED TO CONTROL SPEED	91
G	953	019637	070577	н	PT	813	S	1	1	0	HPCI TURBINE STM SUP VLV.FCV-73-16.FAILED TO OPEN	T
		018892	083077	н	PT	C13	T	1	1	т	HPCI TURBINE SPEED CONTROLLER WOULD NOT CONT TURB	ŋ
		021839	070678					1	1	0	HPCI PUMP TRIPPED DURING SURVEILLANCE TEST	F
-												

BELIEVED TO BE CAUSED BY A WATER HAMMER TEFLON SHEET PORTION OF DISC FAILED TEFLON SHEET PORTION OF DISC FAILED WORN OVERSPEED TRIP PISTON EXHST RUPTURE DISK FLD-SOL VLV WIRED WANG TURRINE TACHOMETER CIRCUIT FAILED SUMP FLOCDING CAUSD HOTWELL PUMP FATLURE FLIDDED TURB. SUMP & HOTWELL PUMP RUPTURED GASKETS ON CONDENSER NO PROVISION FOR EXHAUST LINE DRAINAGE RESISTOR FAILED IN PWR SUP TO EGM CONTRLR MECH DYRSPD EMERG TAPPET NUT HAD ROTATED OPEN RESISTOR IN GOV PWR SUP ASSEMBLY LIMITORQUE SMB-2 TORQUE SW GEAR TIN BRIKE VALVE IN LUBE OIL LINE WAS NOT OPENED BELIEVED TO BE CAUSED BY WATER HAMMER TEFLON SHEET PORTION OF DISC FAILED TEFLON SHEET PORTION OF DISC FAILED CHK VLV IN EXHST LINE BINDING GROUNDED CONNECTOR ON GOV EGM BOX LEAKING UNION ON SUCTION OF OIL PUMP ARIKEN WIRE IN GOV SPEED SENSING CIRCUIT TORQUE SW GEAR ASSY, SMB-Z, REPLACED THEN RESISTOR IN GOVERNOR POWER SUPPLY FAILED RESISTOR IN POWER SUPPLY TO GOVEN.

CAUSE DESCRIPTION

## ALL FAULTS IN TURBINE-DRIVEN BWR HPCI AND RCIC PUMPS

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× × ×	P L A N T	CONTROL	EVENT		COEP	MODE		FAIL	707	T C L A		MODE DESCRIPTION	CAUSE DESCRIPTION
G 8	F3	023185	112478	0	PT	013		1		T T	RCIC	PUMP TRIPPED ON OVERSPEED	OIL LEAK ON ELEC-GOVENOR-REGULATOR
6 8	F3	031576	060990	0	PT	013		1		1 1	RCIC	TURBINE TRIPPED ON OVERSPEED	VOLTAGE SUPPRESSOR IN EGM BOX FAILED
G B	RI	015851	112176	14	PT	813	s	1	3	TT	HPCI	STM SUPPLY VLV, E41-FOOL, WOULD NOT OPEN	ARUSHES IN VALVE MOTOR WERE STICKING
		016858	120376	0	PT	813	5	1		T T	RCIC	STM ISOLATION VLV, E51-F007, FAILED TO OPEN	LOOSE WIRE ON VLV MOTOR OPEN CONTACTOR
		017272	093077					1		T U	RCIC	TURBINE TRIPPED ON HI EXHST PRESS DURING S/U	NO CAUSE GIVEN
	-	019679						1		1 0		TURBINE TRIP DUE DIL PMP TRIPISHORTED MOTOR	HE WATER IN HPCT ROOM DUE TO PMPING ROCMS
G B	RI	0198424	111077	0	PΓ	800	R	1	- 9	T U	RCIC	TURBINE TRIPPED DURING HANUAL START UP	NO CAUSE FOUND
	-	0198428								T U	RCIC	TURBINE TRIPPED ON HE EXST DURING MAN START	NO CAUSE FOUND
G B	21	020614	021378	0	PT	800	R	1		N U	RCIC	TURBINE TRIPPED ON OVERSPEED AFTER RX SCRAM	NO CAUSE DETERMINED FOR OVERSPEED
G 9	21	021090	041278	н	PT	C01		1		TT	TURB	NE CONT. VALVE WOULD NOT OPERATE DUE TO CORRO	EXCESSVE WTR IN ROOM(OCT.77) WAS CAUSE
		021253	042178	0	PI	010	S	1		T T	RCIC	TRIPPO DUE TO FALSE MECH. OVERSPEED INDICATIN	EGR ACTUATOR CORRODEDILEAKY VALVES
GR	21	022639	101478	0	PT	802	S	1		T D	RCIC	TURBINE STOP VALVE WOULD NOT RESET AFTER TRIP	EXCESSIVE PAINT AND DIRT ON TRIP LEVER
G B	RI	023061	111478	н	PT	009		1		T T	HPCI	EGR FAILED TO OPERATE PROPERLY	WATER IN HYDRAULIC FLUID CAUSED CORROSION
G B	RI	025090	010479	н	PT	C13		1		1 1	HPCI	TURBINE FAILED RESPONSE TEST	GOVENOR ASSEMBLY OUT OF ADJUSTMENT
G B	21	027037	091679	н	PT	U13	S	1	- 1	N T	HPCT	TURBINE NOTICED TO BE TRIPPED	SUCTION PRESSURE SWITCH FOUND OUT OF CAL
G 8	21	027232	092679	0	PT	DOZ		1	-	N D	RCIC	TURBINE TRIPPED	MEN WORKING ABOVE TRIP MECHANISM
G B	R 1	030195	012180	14	PT	D13	S	1		T T	HPCI	AUX LUBE OIL PUMP WOULD NOT RUN IN AUTO	LOOSE WIRE ON RIGH CONTROL SWITCH
G B	91	0307734	032480	н	PT	813	R	1	-	N T	HPCI	PUMP TRIPPED ON OVERSPEED WHILE STARTING	STROKE TIME FOR STOP VALVE WAS TO FAS?
G 8	21	0307738	040280	н	PT	813	R	1		T T	HPCI	PUMP TRIPPED ON OVERSPEED WHILE STARTING	STROKE TIME FOR STOP VALVE WAS TO FAST
GA	92	013325	041375	9	PT	018	T	1		N D	RCIC	TURBINE TRIPPED DUE TO HIGH EXHAUST PRESSURE	EXHAUST LINE CHECK VALVE STUCK SHUT
G B	22	013343	041475	н	PT	802	U	1		т о	HPCI	TURBINE STOP VALVE V8 FAILED TO OPEN FULLY	PERSONNEL ERROR-NEEDLE VLVS IMPRPR ADJST
G B	RZ	013379	041475	н	PT	813	S	1		TY	HPCI	TURBINE SUPPLY VALVE FOOL FAILED TO OPEN	VALVE MOTOR WINDINGS FAILED
		013626	090275	н	PT	813	S	1		T D	HPCI	STEAM ISQUATION VALVE FOOS FAILED TO OPERATE	AUXILIARY RELAY PLUNGER BROKE
GB	RZ	013514	100175	Q	PT	813	R	1		1 1	RCIC	TURBINE TRIPPED ON OVERSPEED DURING START	DRAIN DOWN OF CONTROL OIL FROM CONT VALVE
G A	22	013515	100375	0	PŢ	813	R	1		T T	RC IC	TURBINE TRIPPED ON OVERSPEED DURING START	DRAIN DOWN OF CONTROL DIL FROM CONT VALVE

G COL 018898 083177 H PT CL3 S I N T HPCI TURB STARTED BUT DID NOT ACCEL OR INJECT

GOVERNOR EG-R ACTUATOR FAILED TO OPERATE

# ALL FAULTS IN TURBINE-DRIVEN BUR HPCI AND RCIC PUMPS

Z#Z	PLANT	CONTROL	EVENT	METSAS	COEP	¥00€	TYPE	FAIL	1	CLASS		MODE DESCRIPTION	CAUSE DESCRIPTION
-				-	-	-		-			2010	INITIATED ON SCRAM BUT DID NOT RAMP UP SPEED	VITAL PWR FUSE BLOWN AND CONTACTOR OOS
G	COL		083177								*CIC	F ANT OF WER DISCOVE BLUING FRM HPCI CASE FLG	CASE NOT TOROD CORRECTLY BY MAINT PRINT
G	COI		011178					- 2		1 0	SIGNI	NE SPEED 74000RPM LED TO HPCI STEAM LINE ISO	DPIS 76677 READING HISSENSING LINE BACKEL
G	COL		020778									TURBINE FAILED TO RESPOND PROPERLY	RAMP GENERATOR MISALIGNED DUE TO DRIFT
G	001	021061	031178	Q	91	CI	3					INSINE LATER IN MESTIONS LINGUES	TURBINE STOP VALVE OPERATOR MALFUNCTIONED
G	001	026930	080979	Н	PF	813	3	-1		N T		PUMP PAILED IN START ON MOTO START START	THE INGMENT OF FOREIGN OBJECT ON THE WHEEL
100			031280							H D	1000	INKRINE BENDING LOGING CANADA	GOV CONT CKT SET HIGHER THAN DYRSPO TRIP
		010219										FAILED IN STAKE ADIOMATICALE.	HPCT STOP VALVE FAILED TO OPEN
G	DAL	0104244	062274	H	PŢ	81	3 5	1		T U	102.000	FAILED IN INJECT	PISTON IN MECH OVERSPO TRIP WAS UNDERSIZED
-		0104248								0 )	HPCI	FAILED TO INJECT WITHIN REQUIRED TIME TURBINE WOULD NOT RESPOND TO SPEED CHANGE SIG	
G	DAI	013576	102275	H	PT	C1:	3 5	1		T	HPCI	TURBINE WOULD NOT RESPOND TO SPEED CHARGE STO	HE SIGN POLS SETPOINTS WERE INCORRECT
G	041	016588	122076	н	PT	806	6 U	1		1 0		TURBINE TRIPPED ON FAST START WITH HE FLO 140	EXCESSIVE OPENING OF L.O. THROTLE VALVES
G	0 4 1	019127	092177	H	PT	CO	5 U	1		1 0		WOOLD HO! DETECT SOLITOR	IMPROPER ADJUSTMENT OF THIL SCREWS
G	DAI	019969	122077	H	PT	CO	2 T	1		1 0	HPCT	DISCH FLOW RATE DID NOT REACH REOD FLOW	
G	DAI	020178	122777	н	PŢ	CO	7 1	1		1 0		SYS DID NOT REACH REQD FLOW RATE OF 3000 GPM	THROTTLE ADJ SCREWS FOUND OUT OF ADJUST.
G	041	021565	051978	н	PI	C1	3	1		1 1	HPCI	PUMP DID NOT REACH RATED CAPACITY	
G	DAL	030456	030480	н	PI	CO	4	1		M D		BOOSTER PUMP SLPIT RING FOUND IN MAIN 4PCT P.	Medine 251 28582 0250 IN BOOZIER LOUL
G	DAI	031421	052480	H	PT	C1	3	1		T T	HPCI	INKRINE MOOFD AD! VENET WATER	LEAKING OIL SEAL ON TURBINE STOP VALVE
G	DAL	031884	071180	0	PT	81	0 5	- 1		1 1	RCEC	TRIP THROTTLE VALVE WOULD NOT DPEN ELECTRIC.	CHRODED CONTACTS ON HUTUR OF LINES SW.
G	DRZ	013460	092975	18	PT	CI	3	1		UT	HPCI	TURBINE FAILED TO TRIP AT DESIGN COOLANT LEVE	OBEN CKT IN COLF OF 1815 INTE SOCONOID AN
- 77		019931						1		1 0	HPCI	MOTOR SPEED CHGR FAILED TO BRING TURB GT 2800	LOSS OF PIN FROM MTR SPD CHNGR AND GEAR
		022551	093078					1		T T	HPCE	TRIPPED ON LOW SUCTION PRESSURE	INST DRIFT OF PRESSURE SWITCH
-		023340	010379	1	PT	80	0	1		t U	HPCI	PUMP FAILED TO START	CAJSE NOT STATED
			052072	н	PI	81	3 5	1		T U	HPCI	TURBINE FAILED TO START REMOTELY	BROKEN WIRE ON THE TURBINE RESET SOLONCID
		000055	060873	Н	PI	81	3 5			u u	HPCI	STEAM SUPPLY VALVE FAILED TO OPEN COMPLETELY	STEM OF THE VALVE WAS BENT
		000717										CONTROL VALVES FAILED TO OPEN	BURRS ON CYLINDER WALL AND PISTON
-3	000					100							

#### ALL FAULTS IN TURBINE-DRIVEN BWR HPCI AND RCIC PUMPS

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> w z -	PLANT	CONTROL	EVENT	STEM	4300	MODE	TYPE	FANIU	TIVETY		MODE DESCRIPTION	CAUSE DESCRIPTION
G	0 P 3	019911	121677	Н	PT	C13	S	1	1 0	HPCI	FLOW CONTRELE FAILD TO CONTROL MOTOR GEAR	HPCT INOPERABLEIFAILD PUR SUPPLY IN CONVT
G	EN1	012382	011075	Q	PT	802	S	1	N D		TURBINE TRIPPED DURING AUTO START AFTER SCRAM	The company and the second sec
G	EN1	012971	070575	0	PT	C13		1	N T		THE SPEED CONTROL MALFNOTHO SHAFT L.O. PUMP LO	The state of the s
G	EN1	013071	071375	0	PT	813	т	1	N T		TURBINE TRIPPED ON OVERSPEED AFTER RX SCRAM	ELEC DVERSPO INST CONTAINED MALEN XSISTOR
G I	EN1	013606	090675	0	PT	BDO		1	T U		TURBINE TRIPPED ON OVERSPEED	COMPONENT FAILURE - NO PROBLEM FOUND
G	ENI	013907	111575	0	PT	C13	R	1	N T	RCIC	MECHNEL OVERSPEED TRIP SETPOINT HIGH	RECALIBRATED MECHANICAL OVERSPEED
G	EN1	014773	022276	0	PT	811	T	1	N D	RCIC	TRIPPO ON MANUAL STARTTRIPPO BY MECH DYRSPO	
G	EN1	014789	042276	0	PT	COZ	U	1	T D		TURBINE SPEED WOULD NOT INCREASE	PERSONNEL CUT CABLE TO PUMP (DUR QUTAGE)
G	EN1	017333	030777	0	PT	020	R	1	1 1		INE SPEED INCREASED TO 5625 RPM IDIONT TRIP	OUT OF ADJUSTMAT TRIP LINKAGE ON MECH CS
G	ENI	019648	072777	0	PT	809	S	1	TT		NOT RESET RCIC TURBINE ; TRIP-THROTLE VALVE	DIRTY CONTACTS WOULD NOT ACTUATE VALVE
G I	N1	020023	092377	0	91	802	5	1	T D		TURBINE TRIP THROTTLE VALVE FAILD TO RETPEN	LOOSE BRUSH SPRING ON OPERATOR MOTOR
G	EN1	020153	120477	н	PT	C13	5	1	1 0		TURD GOVNOR STUCK, MANUALLY HAD TO FORCE GOVNE	DAMAGED ELEC. CONNECTOR ON FLEX CONDUIT
G I	ENI	025369	022779	н	PT	D13		1	TT	-24-24	PUMP REQUIRED TO BE SECURED DUE TO VIBRATION	ACTUATOR ON TURBINE CONTROL LOOP FAILEC
G	EN1	027818	120879	Q	PT	009	S	1	N T		TURBINE TRIPPED ON HIGH EXHUST PRESSURE	CLIGGED MANUAL CHECK VALVE
G I	EN1	031141	051380	н	PT	013	T	1	N D		FAILED TO START AFTER REACTOR SCRAM	SPUPIOUS HPCI HIGH STEAM FLOW SIGNAL
G I	N1	031265	051480	0	01	013	R	1	N U		PUMP TRIPPED ON MANUAL START	BELIEVED TO BE OVERSPEED TRIP, UNKN CAUSE
G I	ENI	031287	052090	н	PŢ	C13	5	1	1 1		TURBINE SPEED CONTROL FOUND ERRATIC	RAMP GEN IN EGM FOUND DEFECTIVE
G I	ENI	031601	061390	0	PI	013	S	1	N T		TURBINE TRIPPED FOLLOWING A REACTOR SCRAM	EGR AND LIMIT SW ON TRIP VALVE MALFUNCT.
G	N1	031658	062690	н	PT	013	T	1	NU		FAILED TO START AFTER REACTOR SCRAM	HI STEAM LINE FLOW SIS DUE TO TURBINE CON
G I	EN1	032130	072580	н	PT	C13		1	1 1		TURBINE FAILED TO TRIP AT OVERSPEED SETPOINT	WEAR TO TRIP DEVICE CAUSE SETPOINT DRIFT
G	N1	032720	091990	н	PT	000		1	TU		IG HPCI PUMP OP TEST, HPCI SYS ISOLATED	CAUSE UNKNOWN
G E	SNE	022023	072578	9	PI	813	S	1	T D		TURBINE FAILED TO START MANUALLY	SET POINT DRIFT OF GVERSPEED TREP
G F	N2	022753	110678	н	PT	802	U	1	T D		PUMP FAILED TO QUICK START	WIRE ON CONTROL CIRCUIT NOT RECONNECTED
G	EN2	025030	060379	н	PT	809		1	N T		PUMP FAILED TO START-TURBINE STOP FAILD TO DP	The state of the s
G f	N2	026035	060379					1	N T		PUMP FAILED TO RUN - RUPTURE DISC RUPTURED	DISCH CHK VLV DISC LOOSE - BLOCKED FLOW

# ALL FAULTS IN TURBINE-DRIVEN BWR HPCI AND RCIC PUMPS

Z S	P L A N	CONTROL	EVENT	SYSTEM	COTA	MODE!	TYPE	FANUL	ACTION TO I	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
-	EN 2	026149	060879	4	DT	018	5	1	T	3	HPCI PUMP BECAME INOPERABLE	VAS AND CONDENSATE PUMPS TRIPPED
- 0		026340	062779							0	RCIC CONDENSATE PUMP TRIPPED	PERSONNEL STEPPED ON MOTOR CONNECTING BOX
	-	027781	112979			-		1		D	HPCI PUMP AUX LUBE GIL PUMP TRIPPED	HPCT PUMP WAS BEING SECURED INCORRECTLY
	-	030234	013080			-		1			HPCI AUX LUBE DIL PUMP TRIPPED	TIME DELAY COIL IN BKR FAILED
-	-	030976	042280					1	1	U	RCIC TRIP THROTTLE VALVE TRIPPED	UNKNOWN
	-	031319	052190					1	N	0	RCIC PUMP TRIPPED TWO TIMES FOLLOWING SCRAM	TEST POT SPEED CONTROL USED INSTEAD OF AU
		012065	010275					1	1	U	RCIC PUMP DID NOT ACHIEVE RATED FLO ON INI TEST	PASSED SUBSEQ TESTS, CAUSE UNKNOWN
		012768	052275	c	PT	013	S	1	1	0	RCIC TURBINE TRIPPOSLOCAL TRIP LEVER ONLY PART ENG	READJUSTO TO FULLY ENGAGE
G	FP1	012769	052275	н	PT	016	5	1	1		HPCI TURBINE TRIPPO ON LOW OIL PRESS.	LEAKS CAUSD A LOW OIL LEVEL 65YS. PRESSUR
		013470	101175	н	PT	809	s	1	1	0	HPCI STEAM SUPPLY 23MOV14 FAILD TO OPEN ON SIGNAL	PAPER HAD FALLEN BETWEEN OPERATE CONTACTS
		013580	102975	н	PT	804	T	1	1	0	HPCI AUTO STARTO THEN ISOLATO ON HI STEAM FLOW	SNJBBER PINS WERE RELOCATED
G	FPI	014498	032176	0	PT	803	U	1	1	0	BOTH EXHAUST RUPTURE DISKS RUPTURD DURIN FLOW TEST	
		015062	061976	0	PT	C10		1	1	1	RCIC TURBINE WOULD NOT TRIP WHEN REQUIRED TO	RUSTY LINKAGE CAUSD BY STEAM LEAK
G	FPI	016375	110976	н	PT	804	T	1		0	HPCI STARTO THEN ISOLATED INEED STEAM SIGNAL SHUB	FLOW SNUBBERS ELIMINATED THE PROBLEM
G	FP1	017408	031477	0	PT	804	S	1	1	0	RCIC TURBINE TRIPPO DUE TO LOW OIL LEVEL	AUX. OIL SUMP INSTALLO PER VENDOR F.D.I.
G	FP1	317934	052177	Q	PΤ	811	S	1	1	0	RCIC TURBINE DAMAGED BY OVERSPEED	OIL LINE FAILURE-HI FREQUENCY VIBRATION
G	FPI	019169	092877	0	ΡŢ	813	5	1	- 1	T	13 MOVISE STEAM SUPPLY TO RCIC TURBINE WOLDAY TIPE	
G	FPI	019868	122877	Q	ρŢ	009		1	,	1	RCIC PUMP 13-P-1 S/D TO ALLOW CLNG OF CUND FILTER	CUND DIL FILTER CLOGGED
G	FPI	021143	041028	0	PT	009	5	1	- 1	0	LIMIT SWITCH MALFUNCT ON 13MOV131LOST SPEED CON	T DIST ON CONTACTS CAUSD LOSS OF CONTINUITY
G	MOI	002172	073172	н	PΤ	003	U	1	1	ru	HPCI TURBINE TRIPPO ON OVERSPEED FOLLOWING MAINT.	PLASTIC FRAGMENTS FOUND IN OIL INLET PLAT
G	MO1	001162	051873	н	PŢ	C13	S	1	- 1	U	EXCESSIVE STEAM FLOW TO HPCI ISOLATED HPCT FROM R	
G	M01	010267	052174	н	PT	813	5	1	1	0	HPCI TURB AUX OIL PUMP FAILED TO START	ACCEL RELAY AUX CONTACT ASSY DISLOCATED
G	HOL	013712	111875	0	PŢ	810	)	1		T	RCIC TURBINE FAILD ON FAST STARTISTEAM CONTROL VL	
G	MOI	014446	040576	0	PT	804	• 5	1		1 0	TURBINE TRIPPO ONCE ON HI EXHAUST LINE PRESSURE	RAISO TRIP SETPOINT FROM 25 TO 40 PSIG
6	M01	0154404	080276	0	PŢ	011	I	1		T	RCIC TURBINE TRIPPED ON OVERSPEED	STEAM VOID IN DISCH PIPING - VLV LEAKAGE

PASE

#### ALL FAULTS IN TURBINE-DRIVEN BUR HPCI AND RCIC PUMPS

1 K W K	PLANT	CONTROL	EVENT	NY STEEL	***************************************	CADSE	TYPE	302	ACT I VIANO	MODE DESCRIPTION CAUSE DESCRIPTION
G	H11	0154408	083076	Q P	T 0	11	T	1	TT	RCIC TURBONE TRIPPED ON OVERSPEED STEAM VOID IN DISCH PIPING - VLV LEAKAGE
G	MOI	019670	080577	н р	Y C	13 :	s	1	TT	GOVENOR CONTROL SYS. FAILD RESULTING IN LOSS OF DC FAILD RESISTOR
G	M01	026379	070279	н Р	T D	05		1	TT	HPCI GOVENOR END BEARING HAD HIGH TEMP AND VIBRA. WORN LUBE DIL PUMP DUE TO WRONG METAL USE
G	PRZ	000673	121273	H P	1 0	04	5	1	T D	DIL LINE FAILD IN TURBINE CONTROL SYSTEM SHEAR FAILURE IN THREADED PIPE SECT
G	P82	000641	122473	Q P	T 8	106	S	1	1 0	TURBINE TRIPPO ON 3 OCCASIONS, IMPROPR ADJUSTMENT LINKAGE BETWEEN TRIP VALVE AND 65 TRIP
G	PRZ	000933	032474	H P	T 8	13	T	1	T U	TURBINE CONT VALVE A0-16C FAILD TO OPEN POSITION OPEN CKT. CAUSD BY FAILD LOCAL SPEED POT.
G	P82	000989	041674	н р	T 8	113	S	1	TT	TURBINE ISOLATED UPON AUTO INITIATION; HI STEAM FL RAMP GENERATE OUT OF CAL GAVE HI FLOW IND
G	PRZ	010051	042774	H P	T B	104	S	1	T 0	TURBINE ISOLATED AFTE COLD QUICK START ON HE FLOW ARE ACCUMULATES IN HYD.CYL OF STOP VALVE
G	PBZ	010179	050774	9 P	T B	113	T	1	T U	OUTBOARD ISO. VALVE MOVIS-16 FAILD TO OPEN HOTOR FAILURE; REPLACED DURIN SHUTDOWN
G	P 8 2	015233	071976	H P	1 0	13	T	1	TT	TURBINE SPEED COULD NOT BE CONTROLLED FAILD ELECTRONIC PARTS IN SPEED CONT. SYS.
G	P82	016142	100576	0 P	T P	113	S	1	T U	RCIC TRIP THROTTLE VALV MOULONT RESET AFTR TRIPPIN GROUNDED WIRE ON TRIP SOLENOID
G	PB2	016779	122876	Q P	1 8	313	T	1	T D	STEAM SUPPLY ISO. VLVE MO-13-16 FAILD TO OPEN FAILD CLOSE TORQ SWITCH DAMAGD VLVE MOTOR
G	PB2	019187	092677	H P	TE	313		1	TT	HPCI INOPEROIL LEAK ON HPCI OIL CONTROL VALVE LEAKING DIAPHRAM; REPLACED WITH NEW DIAPH
G	PBS	020525	020778	H P	1 8	102	U	1	T D	TURBINE TRIPPO ON OVERSPEED; AUTO START TESTING MISCALIBRATION OF TURBINE SPEED CONTROL
G	P92	022284	090178	H P	T	118		1	1 1	AUX DIL PUMP FOR HPCI SYS FAILED TO START GROUND IN MOTOR
G	PA3	011037	112574	H P	TE	300		1	T U	OURIN 100 PERCENT ISOLATION TEST, HPCI ISOLATED BY A TRANSIENT CAUSE NOT IDENTIFIED
G	P83	014518	042976	H P	1	113	5	1	N D	HI STEAM FLOW TRIPPO HPCI TURBINE FOLLOWING SCRAM RAPID OPENING OF TURBINE STOP VALVE
G	P83	018416	072177	H P	1 (	13		1	T U	TURBINE SPEED CONTROL ERRATICIRCIC WAS OUT OF SERV BENT LIFT RODS IN TURBINE CONTROL VALVE
G	PB3	019716	093077	H P	1 (	13	S	1	T U	HPCI FLOW CONTRLER FC-3-23-108 DEFECTIVE CIRCUIT BOARD MODULE FAILD
G	P83	022080	080978	H P	T	13	5	1	N T	HPCI PUMP FAILED TO REACH RATE FLOW HISH AND LOW SPEED POTENTIOMETERS COC
G	P83	022852	110678	H P	T	013	R	1	N T	HPCI PUMP APPARENTLY TRIPPED ON OVERSPEED GOVENOR OUT OF CALIBRATION
G	PII	952229	123072	0 1	7 (	700		1	1 1	RCIC TURBINE DIL PRESS LOST WHILE OPERING IN TEST WORN GEARS IN DRVE TRAIN OF SHET L.O.PLMP
G	PII	001079	011673	H	PT I	806	5	1	1 0	HPCI TURBINE TRIPPED ON OVERSPEED DURING START FEST PROCEDURE USED WAS INADEQUATE
G	211	011041	110874	0 1	PT	000	5	1	T U	RCIC STEAM SUPPLY LINE ISOLATED DUE TO SPURTOUS S NO CAUSE IDENTIFIED
G	PII	013113	060875	0 1	T	800		1	T U	OVERSPEED TRIP OF TURBINE DURING STARTUP NO APPARENT CAUSE

V E Z	AN	CONTROL	EVENY	E	M	DEE	PE	IU	† S		MODE DESCRIPTION	CAUSE DESCRIPTION
	-		030578	-			-				THE STOP VALVE FAILD TO OPEN AFTE REACTIR SCRM	DIRTY DUPLEX DIL FILTER
		4	123078					1	T U	HPC1	PUMP TRIPPED IN FULL FLOW TEST	OIL FITTING LEAKED AND LOST LUBE DIL
		025165	021479					1	T U	HPCI	TURBINE TRIPPED DURING TEST	GASKET ON GLAND SEAL CONDENSER RUPTURED
-		025707	041579					1	T D	RCIO	CONDENSATE PUMP TRIPPED	BAD RELAY IN PUMP START LOGIC
		031557	053090						1 1	RCIO	TURBINE FLOW AND PRESSURE DID NOT MEET T.S.	AUTÓ FLOW CONTROL FOUND FAULTY
		000879	031074						1 1	RCIO	INOPERATIVE TURBINE STEAM INLET VALVE 1301-61	EXCESSIVE WEAR CAUSD CAN AND THE LEVEL
	-	010516	072074						1 0	HPC	SPEED CHANGE MOTOR ENOPER. CONT. POWR FUSES BL	SYS. IMPROPRIET TAKEN OUT OF SERVICE CANCEL
		015194	061776						1 0	SPE	D CHANGER MOTOR FAILD TO OPERATE	BOUND DUE TO INADEQUATE LUBRICATION
			102976	0	PT	C14		1	TU	OPE	RELTY SURVEILNC OF RCIC PMP COULDN'T MEET TECHS	DIRTY CONT LINGE STICKING DURING OPERATIN
-		0205964	012378	Q	PT	C09		1	T 1		PUMP TURBINE SPEED ERRATIC	DIRTY BALL AND TAPPET ASSEM. ON D.S. TRIP
		021437	050578	0	PT	009	R	1	T 1		PUMP REPEATERLY TRIPPED ON OVERSPEED TRIP	BALL AND TAPPET ASSEM BENT, REPLACED
		022190	080778	0	PT	013	R	1	1 (	RCE	TURBINE TRIFTED ON OVERSPEED TEST	CAUSE NOT DETERMINED
	-	002211	102172						T 1	1 HPC	I TURBINE STOP VALVE WOULD NOT OPEN	250 VDC BATTRY DISCHREDICHRER BKR TRIPPD
		010592	083174	н	PT	813	5	1	N 1	HPC	I WOULDN'T START BECAUSE VALVES WOULD NOT OPER.	255 VIC BATTER DESCRIPTION WHEN EMER OIL PAN
		012801	041875	н	PT	804		1	. 1	HPC	I TURBINE STOP VALV MOULDN'T OPEN DURNG ACT TEST	IMPROPER PINNING OF PILOT VLV LEVER ARM
		013085	072975	н	PT	C13		1	1	I TUR	BINE DRIVEN HPCI PUMP FLOW RATE INADEQUATE	HI PRESS DIL DISCHARGE LINE REPLACED
		013257	083075	1	PT	816	5	1	T		I SYS. INOPERABLE DUE TO BREAK IN HI PRESS OFL	WORN NUT IN OVERSPEED TRIP MECHANISM
		013258	093075	9 0	PT	013		1	T	RCI	C PMP TURBINE KEPT TRIPPING AT 3500 RPM	
G	902	014098	123175	5 0	PT	805		1	T		P THROTTL VLVE MECHANICAL OPERATOR WOLDN'T RESET	APPEARS TO BE A TURBINE PROBLEM
		017356	012877		PI	000	)	1	1		I FLOW DESIRED COULD NOT BE OBTAINED	22 200 110 201 100 201 201 201
		017257	020971					1	٢		BINE FAILD TO START DUE TO EXCSSV DIL PRESSURE	EMPROPER TENSION ON A SPRING - READJUSTED
G	oca	0205968	020678	9 0	P1	013	1		T		C PUMP TURBINE TRIPPED AT 3700 RPM	JA4 NUT ON ROD END BECAME LOOSE
								-	-	* 1197	TURBINE SPEED COULD NOT BE OBTAINED	281 1101 01 100 110

G OCZ 021790 061478 H PT C13 1 T T HPCI TURBINE SPEED COULD NOT BE OBTAINED

G WYL 030286 012880 H PT 813 1 T T HPCI PUMP GOVENOR VALVE WOULD NOT REOPEN

G VY1 030059 010380 H PT 013 1 T U HPCI PUMP TRIPPED AFTER STARTING

HI EXHUST PRESSURE OR AUTO ISOLATION

SHORT BETWEEN EGM & EGR ACT DR STUCK EER

#### ALL FAULTS IN TURBINE-DRIVEN BUR HPCI AND RCIC PUMPS

ZHZ	PLANT	CONTROL	EVENT	SYSTEM	COMP	MODE	TYPE	FANUL	WCLHANLY -	CHANNI				мо	DE	DESCRIPT	ton				c	AUSE DESCRIPTIO	·	
G	VY	030734	012680	н	PT	C13		1	T	T	HPCI	PUMP	WOUL	0 NO	<u>T</u> _	INCREASE	ABOVE	800	RPM	FATLE	FL	OW CONFROLLER		

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## Other Standby Pumps

The pumps considered are: BWR core spray pumps; containment spray pumps; PWR HCPI pumps; LPCI pumps; and BWR standby liquid control pumps. The exposure hours used for the different systems are listed in Table B-1.

The common cause failures to start were all command faults rather than failures. Therefore, quantities involving p cannot be estimated for failures.

Rates are estimated for

- 1. Failure to start, based on all faults
- 2. Failure to start, based on failures only
- 3. Failure to operate after starting, based on all faults
- 4. Failure to operate after starting, based on failures only.

Be sure to read the Application section in the main body of this report. The following computer printouts give the estimates and summaries of the relevant data.

STANDBY PUMPS: CONT SPR. LPCI, PWR HPCI, BWR CORE SPR. BWR ST LIG CONT ALL FAILURE TO START
ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS
RATES ARE PER EXPOSURE HOUR
TRIPLE OF NUMBERS SHOWS FLOWER BOUND, POINT ESTIMATE, UPPER ROUND)
LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

LAMBDA - ( 1.1E-09, 3.0E-06, 1.3E-05)
LAMBDA - ( 1.5E-06, 2.3E-06, 3.2E-06)
OMEGA - ( 1.3E-07, 4.1E-07, 8.3E-07)

α	.474	.5741	. 5921	1009.	.5821	.6001
BETA FACTOR	. 277.	. 334,	. 343,	.311.	. 569.	.311.
BETA	.040.	.050.	.048	.041.	.035.	.035,
	-	-	-	-	~	-
ENT	2.9E-06, 5.2E-06, 8.7E-06) ( 1.4E-06, 4.8E-06, 1.6E-05) ( .046, .277, .474)	( 2.3E-06, 3.9E-06, 6.4E-06) ( 1.2E-06, 4.5E-06, 1.5E-05) ( .050, .334, .574)	( 2.0E-06, 3.4E-06, 5.2E-06) ( 1.0E-06, 4.3E-06, 1.5E-05) ( .048, .343, .592)	1.8E-06, 2.8E-06, 4.2E-06) ( 9.1E-07, 4.2E-06, 1.5E-05) ( .041, .311, .600)	( 1.7E-06, 2.6E-06, 3.7E-06) ( 8.6E-07, 4.1E-06, 1.5E-05) ( .035, .269, .582)	DVERALL ( 1.76-06, 3.46-06, 8.76-06) ( 8.66-07, 4.36-06, 1.66-05) ( .035, .311, .600)
SPECIFIC COMPONENT	4.8E-06,	4.36-06.	4.3E-06.	4.2E-06,	4.1E-06.	4.36-06,
SPECIF	1.4E-06,	1.26-06,	1.06-06.	9.1E-07,	8.6E-07,	8.6E-07,
	-	-	-	-	~	~
	8.7E-061	6.48-061	5.2E-06)	4.2E-061	3.76-061	8.75-06)
A HOUSE	\$.2E-06,	3.96-06,	3.46-06,	2.8E-06,	2.6E-06,	3.4E-06,
	2.96-06,	2.36-06,	2.0E-06.	1.86-06,	1.75-06,	1.76-06,
	-	-	-	-	-	-
SYSTEM	2	3		•	80	DVERALL

			8.8E-071	8.55-071	8.56-073	8.6E-071
, a			4.4E-07.	4.46-37.	4.36-07.	4.4E-07.
			1.56-07.	1.46-07,	1.46-07,	1.46-07.
-			-	•	-	-
CCOMPONE		9.36-071	9.16-071	9.0E-071	9.0E-071	9.35-071
K SPECIFI		5.06-07.	4.96-07,	4.86-07,	4.3E-07.	4.96-07.
RATE FOR SET OF K SPECIFIC COMPONENTS		1.9E-07.	1.8E-07.	1.7E-07.	1.76-07.	1.76-07,
RATE	1.36-061	4E-07, 7.1E-07, 1.2E-06) ( 1.9E-07, 5.5E-07, 9.3E-07)	.1E-07, 6.7E-07, 1.1E-06) ( 1.8E-07, 4.9E-07, 9.1E-07) ( 1.5E-07, 4.4E-07, 8.6E-07)	.8E-07, 6.3E-07, 1.1E-06) ( 1.7E-07, 4.8E-07, 9.0E-07) ( 1.4E-07, 4.4E-07, 8.5E-07)	.7E-07, 6.2E-07, 1.1E-06) ( 1.7E-07, 4.3E-07, 9.0E-07) ( 1.4E-07, 4.3E-07, 8.5E-07)	7E-07, 6.7E-07, 1.3E-06) ( 1.7E-07, 4.9E-07, 9.3E-07) ( 1.4E-07, 4.4E-07, 8.6E-07)
24	.0E-07, 7.9E-07, 1.3E-061	7.1E-07,	6.7E-07,	6.38-07,	6.2E-07.	6.76-07,
	4.0E-07.	3.46-07,	3.16-07,	2.8E-07,	2.7E-07,	2.7E-07.
	-	-	-	-	-	-
SYSTEM	. 2		,	9	60	OVERALL

STANDBY PUMPS: CONT SPR, LPCI, PWR HPCI, BWR CORE SPR, BWR ST LIQ CONT FAILURE TO START

FAILURES ONLY, EXCLUDING COMMAND FAULTS

RATES ARE PER EXPOSURE HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT ENTERVAL

LAMBDA = ( 4.9E-17, 6.2E-07, 3.5E-06) LAMBDA = ( 2.3E-10, 5.9E-08, 2.3E-07) DMEGA = ( 2.3E-10, 5.9E-08, 2.3E-07)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

STANDBY PUMPS: CONT SPR, LPCI, PWR HPCI, BWR CORE SPR, BWR ST LIG CONT FAILURE TO OPERATE, GIVEN START ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS RATES ARE PER EXPOSURE HOUR TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER ROUNDS FORM 90 PERCENT INTERVAL

P = ( .034, .206, .449)

LAMBDA = ( 2.7E-08, 2.2E-06, 7.6E-06)

LAMBDA = ( 4.3E-07, 9.9E-07, 1.5E-06)

OMEGA = ( 2.1E-08, 1.8E-07, 4.6E-07)

OVERALL ( 5.25-07, 2.75-06, 1.46-05) ( 3.56-07, 2.76-06, 8.36-06) ( .017, .141, .558) ( .019, .131, .406) 1 .021, .149, .4981 1 .021. .151. .5291 1 .019. .141. .5521 ( .017, .129, .5581 BETA FACTOR ( 9.2E-07, 4.9E-06, 1.4E-05) ( 5.9E-07, 2.8E-06, 8.3E-06) ( 4.8E-07, 2.7E-06, 8.2E-06) ( 4.3E-07, 2.7E-06, 8.1E-06) ( 3.7E-07, 2.6E-06, 8.0E-06) ( 3.5E-07, 2.6E-06, 8.0E-06) SPECIFIC COMPONENT 7.4F-07, 3.5F-06, 9.2E-061 6.5E-07, 2.7E-36, 7.1E-061 ( 5.6E-07, 2.0E-06, 4.9E-06) ( 5.2E-07, 1.7E-06, 3.8E-06)

( 2.9E-08, 2.0E-07, 4.9E-07) ( 2.4E-08, 1.9E-07, 4.7E-07) ( 2.3E-08, 1.8E-07, 4.7E-07) ( 4.1E-08, 2.3E-07, 5.4E-07) ( 2.7E-08, 2.0E-07, 4.9E-07) ( 2.3E-08, 1.8E-07, 4.7E-07) OVERALL ( 4.1E-08, 2.05-0, 6.1E-07) ( 2.7E-08, 2.06-07, 4.9E-07) ( 2.3E-08, 1.8E-07, 4.7E-07) RATE FOR SET OF K SPECIFIC COMPONEN. ( 2.8E-08, 2.0E-07, 4.9E-07) ( 3.0E-08, 2.0E-07, 4.9E-07) ( 5.3E-08, 2.6E-07, 5.7E-07) ( 4.8E-08, 2.5E-07, 5.6E-07) ( 4.3E-08, 2.4E-07, 5.5E-07) ( 6.4E-08, 2.8E-07, 6.1E-07)

STANDBY PUMPS: CONT SPR, LPCI, PWR HPCI, BWR CORE SPR, BWR ST LIQ CONT FAILURE TO OPERATE, GIVEN START

FAILURES ONLY, EXCLUDING COMMAND FAULTS

RATES ARE PER EXPOSURE HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

P • ( .004, .246, .697)

LAMBDA • ( 1.8E-08, 2.0E-06, 7.4E-06)

LAMBDA • ( 2.1E-08, 1.8E-07, 4.6E-07)

DMEGA • ( 2.3E-10, 5.9E-08, 2.3E-07)

SYSTEM			SHOCK			SPECI	FIC COMPO	NENT		861	A FACT	DR
2	-	4.9F-08,	3.98-05,	2.0E-051	-	1.4E-07.	2.2E-06,	7.5E-061	ŧ	.001.	.045.	.4221
3	ţ	4.1E-08.	2.68-05.	1.38-051	-	1.2E-07,	2.2E-06.	7.5E-061	(	.001.	. 045.	.5001
4	t	3.6E-08.	2.0E-05.	1.08-051	ŧ	1.15-07.	2.2E-06.	7.5E-061	ŧ	.001,	.041,	.4731
. 6	•	3.26-08,	1.36-05,	6.8E-06)		1.0E-07,	2.18-06,	7.5E-061	t	.001,	.035,	.4741
8	•	3.0E-08,	9.9E-05.	5.1E-061	(	9.66-08.	2.18-06,	7.5E-061	ŧ	.000,	.032,	.4681
DVERALL	-	3.05-08.	2.0F-05.	2.0E-051	-	9.6E-08.	2.2E-06.	7.5E-061		.000,	.041.	.5001

RATE FJR SET OF K SPECIFIC COMPONENTS

R2

R3

R4

2 (1.6E-09, 8.8E-08, 2.8E-07)

4 (1.1E-09, 8.2E-08, 2.7E-07) (5.5E-10, 7.1E-08, 2.5E-07)

6 (9.4E-10, 8.0E-08, 2.7E-07) (5.0E-10, 7.0E-08, 2.5E-07) (3.8E-10, 6.6E-08, 2.4E-07)

8 (8.8E-10, 7.9F-08, 2.7E-07) (4.9E-10, 7.0E-08, 2.5E-07) (3.8E-10, 6.6E-09, 2.4E-07)

OVERALL (8.8E-10, 8.2E-08, 2.8E-07) (4.9E-10, 7.1E-08, 2.5E-07) (3.8E-10, 6.6E-09, 2.4E-07)

AFFECTED BY LETHAL SHOCKS FAILRS/COM FLTS ALL FAILURES TO START IN STANDBY PUMPS: CONT. SPRAY, LPCI, PUR HPCI. BUR CORE SPRAY, AND BUR ST. LIG. CONTROL AFFECTED BY NONLETHAL SHOCKS FAILES/COM FLTS NONLETHAL SHOCKS INDIV. FAULTS
FAILRS/COM FLTS 0 0 2 0 0 0 R 784 \$5464 

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VEN.	PLANT	CONTROL	EVENT	SYSTEM	0300	MODE	TYPE	FAUN	CLIAMALA	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
8 (	180	020274*	011278	F	PH	U01	N	2	N	D	BOTH CONT SPRAY PMPS INOPERABLE R/X IN MODE 4	PUMP CKT.BKRS. RE-ENERGIZED
8 1	181	021855	061878	F	PM	813	5	1	T	T	CONTAINMENT SPRAY PUMP FAILED TO START AUTOMATIC.	SFAS DUTPUT MODULE CAUSED FAILURE
8 (	180	030928	040680	F	PM	uoz		1	N	0	OIL SIGHT GLASS FOR CONT SPRAY PUMP 1-2 BROKE	BRIKEN BY CONTRUCTION PERSONNEL
B (	DE 1	0148064	012876	ι	PM	802	U	1	T	D	LOW PRESS INJECTION PUMP 1A - INOPERABLE	INCORRECT SUBSTITUTE BREAKER INSTALLED
8 1	130	0148068	012876	F	PH	802	U	1	t	0	REACTOR BUILDING SPRAY PUMP - INOPERABLE (14)	INCORRECT SUBSTITUTE BREAKER INSTALLED
В	OF 1	025915	041979	F	PM	A 05		1	T	D	18 RB SPRAY PUMP FOUND LEAKING AROUND VENT LINE	PLIG WAS SUPPOSED TO BE IN LOCATION OF VE
8	3E2	000577	111273	t	PH	801	U	1	1	0	LOW PRESSURE ENJECTION PUMP 28 FAILED TO START	BREAKER NOT RACKED IN PROPERLY
8	) E 2	011071A	120974	ι	PM	008	5	1	T	D	COMMON SUCTION VALVE FOR 1 LPCI AND 1 CONT SPRAY P	UMP FAILED TO OPEN - OPEN CKT IN 1 PHASE
8	DF 2	0110719	120974	F	PM	U0 8	S	1	t	D	COMMON SUCTION VALVE FOR 1 LPC1 AND 1 CONT SPRAY P	UMP FAILED TO OPEN - OPEN CKT IN 1 PHASE
8	OF 3	019484	090177	F	PM	004		1	Ţ	0	EXCESV NOIS DURNG VIBRIN TST OF 38 RIX BLONG SPRAY	DIL LEVEL IND IMPADPERLY POSITIONED
8	0.53	023435	122078	F	PM	014		1	T	T	REACTOR BUILDING SPRAY PUMP DECLARED INOPERABLE	HIGH VIBRATION DUE TO LOOSE IMPELLER
8	ne 3	023046	040479	F	PM	002		1	T	D	OIL DISCOVERED LEAKING FROM PUMP CASING, PUMP SEC.	BEARING CAP INSTALLED INCORRECTLY
В	R 5 1	016711	112376	F	PM	801	U	1	1	D	RX BLDG SPRAY PUMP FAILED TO START	BRKR WAS NOT RACKED IN CORRECTLY
9	P 5 1	025886	071979	L	PH	A19	R	1	Ţ	T	DHR PUMP "B" LEAKED IN EXCESS OF TECH SPEC	FATLED SEAL, SEAL SEPLACED
C	ccı	011272	117574	F	PM	C07		1	1	T	DURING TEST, CONTAIN SPRAY PMP #11 TOH DOS LOW	NORMAL WEAR OF PUMP INTERNALS
C	cci	015223	062176	F	PM	U12	R	1	N	Ŧ	NO 12 CONTAINMENT SPRAY PUMP WAS TAKEN OUT OF SERV	RE-AIR SMALL LEAK IN SEAL WER PIPE MIPPLE
C	CCI	019287	062277	F	PM	U12	R	1	N	T	NO 12 CONTAINMENT SPRAY PUMP WAS TAKEN OUT OF SERV	LEAKING SEAL ATR COOLER CASING FITTINGS
¢.	cez	027373	102779	Н	PH	019	1	1	N	T	HPSI PUMP "A" FAILED, REQUIRING SECSTING THE PUMP	MECHANICAL SEALS FAILED ON #22 HPCI PUPP
C	CCZ	0306784	022590	L	PM	000	)	1	U	U	LPSI PUMP 21 TAKEN OUT OF SERVICE FOR CORR. MAINT.	CAUSE NO' GIVEN
C.	CCS	0306788	022580	F	PH	002		1	U	U	CONT SPR PUMP 21 TAKEN DOS BY MISTAKE	MISUND' ASTANDING, SHO HAVE BEEN LPSI 21
C	FC1	025844	042079	F	PH	BOI	1	1	1	0	CONTAINMENT SPRAY PUMP FAILED TO START (SI-39)	SUPPLY BREAKER BOUND DUE TO PERSONNEL ER.
С	MIZ	031945	070380	н	PH	000	5 0	. 1	1	0	"A" HPCI PUMP SEIZED	PRILEDURE DED NOT REQUERE MEN FLOW VLV OP
C	MY)	002322	120272	. 14	PH	ROZ	2 1	1	1	0	HPST P-145 SUPPLIED BY "A" DG DID NOT START	GF JUNDING BLOCK NOT REMOVED FROM CKT BKR
C	MY]	027208	091879	F	P	1 00	3 (	1	1	0	"8" TRAIN CONTAINMENT SPRAY PUMP DIS PRESS DRIPPED	SUSTION VALVE WAS CLOSED
Ç	MY	027289	100379	F	P	81	3 !	5 1	1	T	"A" TRAIN CONTAINMENT SPRAY PUMP FAILED TO START	CONTACT BLOCK IN PUMP BER FAIL TO MADE UP

1 Zmc	PLANT	CONTROL	EVENT	SYSTEM	COMP	MODE	17961	FAIL	N U N	CLASS	MODE DESCRIPTION C	CAUSE DESCRIPTION
-	PAI	010659	071174	и	DM	004				0 1	HPS1 P66A TESTED UNSAT SHUTOFF HEAD NOT DEVELOPD STH STAG	
		013008	070975							1 0		GE IMPELLOR MOVED ON SHAFT
		013820	112275			10.00						ES NOT IN CORRECT POSITION
				-		200		- 10		1 0		RING CLEARANCE
		020132	121677					-		1 1	14 LHSI PUMP SHUTDOWN DUE TO HI VIBRATION ON SHAFT PUMP-TO-M	
	1	028105	091079			-		- ]		0		PLASTIC FIRE HOSE NOZZLE FOUND
		032628	090480			2.77	-	1	1	0		AS NOT REMOVED FROM SERVICE
		021329	040378					1	- 1	1 0	"A" HPSI PMP DEVELOPED UNUSUAL DRAG DURING MAINT INSPECTIO	IN DISCLSO CRKD WR RNGS & BSHNES
W	165	010282	051074	H	PM	809	U	2	- 1	T	#23 6 #21 HPSI PUMP STARTED ONLY DEVELOP 700# PRS BORIC ACI	TO LEAKAGE CAUSD SUCTION BLOCK AGE
×	165	012862	052275	L	PM	A16		1	- 1	1 0	RHR PMP #21 REMOVED FROM SERVICE TO REPAIR SEAL HT LEAKING SE	AL HEAT XCHER - PMP MODE 8X20 %
×	155	015920*	080576	Н	PM	C 0 3	N	3	1	0	ALL 3 SAFETY IMJ PUMPS RUN APPX 10 MIN W/O SUCTION CHY PUMP	SUCTION VLV (846) NOT OPEN
W	165	018789	052577	L	PM	A19		1	-1	T	#22 RHR PUMP REMOVED FROM SERVICE MECH SEAL	ASSY GSKT DETERATO AND LEAKED
W	IPZ	021706	060278	Н	PM	021		1		T	EXCESS OIL FROM ST FUMP NO. 22 THRUST BEARING THRUST CO	DLLAR AND SHOES FAILED. REPLACED
¥	I P 3	015945	011277	н	PM	813	5	1	1	0	#33 SI PMP FAILD TO START FROM SIS;PLANT TRIP 100% TO RELAY	IN START CKT FAILD MODEL 241 2PC
W	103	017878	040477	н	PM	C14		-1	-	1	NO. 31 SAFTY INJ PMP HAD GRAD DETERATN OF FLO DUPT WORN INTE	RNALS - HIGH HEAD TYPE JTCH
w	163	021036	032878	t	PM	A16		1	-		#31 RHR PUMP REMOVED FROM SERVICE GSCT BINN	GLND PLATE AND PMP CASING LKNG
w	JF1	*166550	091778	F	PM	001	U	2	- 3	0	BOTH CONTINT SPRAY PHP SUPPLY BREAKERS TAGGED THEN BOTH TRAT	NS REQUIRED BY TECH SPECS
W	KE1	019313	100777	F	PM	800	R	1	)	0	SPRAY PMP FAILD TO START DUE TO OVERCURRENT TREP START CUR	
w	KE1	019518	102477	F	PM	800	R	1		0	A CONTAINMT SPRAY PUMP FAILED TO START DURING ISTS CAUSE UNK	
W	KEI	020094	122377	F	PM	800	P	1	1	0	ICS PAR 18 FAILED TO START DURING OPERATIONAL TEST CAUSE UNK	
w	NAI	021665	060678	F	PM	809	S	1	1	0	CONT QUENCH SPAY PUMP 1-05-P-14 FAILED TO START RE SCREW FOU	Company - Control of the second - Control of the second of the control of the second of the control of the cont
w	NAI	021890	061578					7		- 7		PRING MOTOR SWITCH IN OFF POSI.
		017619	041177				-	- II		0	*12 SAFTY THE PRO ATTHREELER MOVED AXIALLY DY SHAFT ABNORMAL	and the contract of the contra
	La carran	026014	040879			-		- 5	7	U.		
											#11 SAFETY INJECTION PUMP FAILED TO START IN ASTO UNKNOWN C	
			041778								OPERATOR PLACED #22 RHR PUMP DOS - AUX OPER DESER CET BRER	
*	2.4.1	010049	0021/4		P.M	813		1	-	0	CONTAINMENT SPRAY PUMP 1914 DID NOT START PUMP BRKR	LATCH WAS NOT FULLY ENGAGED

									A		
-	PLANT	CONTROL	EVENT	SYSTEM	COMP	MOON	TYPE	FAIL	1	CLASS	MODE DESCRIPTION CAUSE DESCRIPTION
	PT	1 021 765*	063078	F	PM	813	T	1		d b	CONTAINMENT SPRAY PUMP 1-P148 DECLARED DOS POWER SUPPLY BKR WOULD NOT RACK IN
	e RG	1 001037	061173	н	PM	813	т	1	1	0	SAFETY INJECTION PUMP IC FAILED TO START BENT OPERATOR ARM ON THE CELL SWITCH
	e RG	1 010046	040674	н	PH	813	T	1	1	1 0	1C SAFETY INJECTION PUMP FAILED TO START MANJALLY PREMATURE CLOSING OF CB TRIP BAR
	W RG	1 010664	080774	н	PM	R13	T	1	1	0 1	10 SAFETY INJ PUMP FAILED TO START ON BUS 16 MAY BE FAULTY LOCKOUT INTERLOCK
											IC SAFETY THIS PUMP FAILED TO START ON BUS 16 REP WEAK SPRING AND TIGHTENED WERE IN CB
											IC SAFETY INJ PUNP FAILED TO START ON BUS 16 REP WEAK SPRING AND TIGHTENED WIRE IN CB
											IC SAFETY INJ PUMP FAILED TO START ON BUS 16 MECH BINDING ON LOCKOUT SCLENDED PLUNGER
	W PG	1 016716	010377	н	PM	813	T	1		1 0	10 SAFETY INJ PUMP FAILED TO START ON BUS 14 WEAK SPRING IN SECONDARY CONTACT ASSY
	W RG	1 018244	062977	14	PM	813	T	1	,	1 0	1C SAFETY INJ PUMP FAILED TO START ON BUS 14 NO APPARENT CAUSE FOR CB FAILURE
	W RG	1 021670	052978	F	PM	813	S	1	ŀ	TT	CSI PUMP FAILED TO START FAILED CIRCUIT BKR
	W R()	2 002067	050772	F	PH	814	, F	1	- 1	UU	THE OF THE CONTAINME SPRAY PMPS FOUND TO BE BENDING BURR ON IMPELLER GALLED THE SEAL RING
	w Rn	2 000184*	070973	14	PH	802	U	2	1	U D	SAFTY INJECTION PMPS "BMG"C" TRIPPD ON MANUAL STAR INSTANTAS TRIP SETTINGS WERE SET AT MIN.
	W 80	2 017585	032477	F	PM	UOZ	5	1	,	N D	CONTINT SPRAY PMP A NOT ON SVC DURING CRITICALITY PERSONNEL HAD REMOVED PUMP FROM SERVICE
	w 20	2 019793A	112377	н	PM	U01	N	3	-	N D	BREAKERS FOR ALL 3 SAFETY INJ PMPS FOUND RAKD OUT FAILURE TO RECOG TS LIMIT FOR GT 200 F OP
	w en	2 0197938	112377	F	PM	U01	N	2	-	N D	BREAKERS FOR BOTH CONT SPRAY PMPS FOUND RAKD OUT FAILURE TO RECOG TS LIMIT FOR GT 200 F OP
	w 80	2 022614*	100378	F	PM	006	U	2		T D	BOTH OF THE CONTAINMENT SPRAY PUMPS FOUND ATRBOUND PIMPS NOT VENTED AFTER SYSTEM REALIGNED
	W 80	2 026063	041479	14	PM	BOO	)	1		T U	"A" SI PUMP FAILED TO START CAUSE UNKNOWN
	W 80	2 032732	081180	н	PM	813	S	1		T T	'A' SI PUMP BER FAILED TO CLOSE HIGH RESISTANCE ALARM SWITCH CONTACT
	w 54	1 017700A	050677	н	PM	U01	U	2		R D	BOTH ST PUMPS AND 1 CENTRIFUGAL CHG PMP TAGGED JUT PERSONNEL ERROR - NOT FOLLOWING PROCEDURE
	w SA	1 0232328	112778	ι	PM	813	T	1		N T	NO ? RHR PUMP FAILED TO START DURING SI BUS FAILURE DUE TO DUTPUT TRANSF FAILED
	w 5 #	1 028005	112879	н	PH	814	R	1		N D	S. UMP FAILED, LOOSE LOCKNUTS FOUND, SHAFT BENT REVERSE ROTATION POSSIBLE CAUSE, #12 PUMP
	w 51	1 021521	051078	F	PM	DOS	,	1		T D	INSIDE RECIRC SPRAY PUMP RS-P-1A FAILED TO ROTATE FORFIGN MAT. BETWEEN IMPELL AND WEAR RING
	w 50	2 000519	111373	н	PM	802	2 U	1		U D	SAFETY INJICHG PUMP 2-CH-P-18 DED NOT START-MANUAL FUSES WERE NOT INSTALLED IN CONT CIRCUITS
	W TR	1 017572	030277	н	PM	813	3 T	1		N 0	ONE OF THO SAFETY INJ PUMPS FAILED TO START THPROPER ACTUATION OF DBA SEQ CONTACTS
	w 15	1 0191684	052877	н	PH	813	3 1	1		T D	B SAFETY INJ PUMP DID NOT START - AUTOMATIC SEQUENCER CONTACTS OPER WITH TOO LOW CANT

	P A N I	CONTROL	EVENT	SYSTEE	COMP	MODE	TYPE	FAIL	302	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
- 0	W TU	3 000780	020574	н	PM	813	5	1		0 1	3A SAFETY INJ PUMP FAILED TO START	INSUFFICIENT CHARGE ON BRKR CLSG SPRING
	e TU	3 010136	050374	н	PM	CII	U	1		4 D	SAFT INJ PMP STOPPD WHEN LOW RUN CURRNT/PRESS SEEM	ATR LEAKAGE INTO PUMP CASING
	W TU	3 025775	030279	н	PM	C17		1		1 U	38 ST PUMP FOUND TO BE RUBBING	CAUSE UNKNOWN, IMPELLERS MOVED
	W TU	4 019700	110977	F	PM	000		1		U	48 CONT SPRAY PMP INBOARD BRNG OVRHEATO	MODEL 3736 4X6-13DV 1450GPM AT 470 FT
	W YR	1 016649	121676	н	PM	A16		1	1	1	FI HPSI PMP SHAFT HOUSING SEAL LEARED	CUT IN GASKET BETWN HOUSNG/STUFFNG BOX
	W YR	1 016862	010777	Ł	PM	A07		1	. 1	1	PACKING GLND ON #1 LPST LEAKED EXCESSVELY	PACKN REACHD END OF LIFE REPLACD PACKING
	W YR	1 020071	122977	L	PM	D04		1	1	0	#3 LPSI OUTBRO SHFT PACKN GLAND OVERHEATD, PUMP S/D	INSUFCAT CLEARNCE BETWEEN SHFT/PACKM GLAD
	4 21	1 010081	042774	F	PM	806	U	1		0	18 CONTAINMENT SPRAY PUMP DID NOT START	BRCP RACKED IN TO WRONG POSITION
	W 21	1 013217	082575	F	PD	B13	5	1	,	1 1	CONTAINMENT SPRAY DIESEL FAILED TO START	DIESEL STARTING BATTERIES FAILED
	w 21	1 023442	122678	F	PD	018		1	. 1	1 1	CONTAINMENT SPRAY PUMP IC DEVELOPED HOSE RUPTURE	COOLING SYS HOSE ON DIESEL BROKE
	w ZI	2 010709	071274	F	PO	002	5	1	1	0	CONT SPRY INJ PMP 2C OPERATO 10% BELOW NORMAL HEAD	MAN CONT VALV NOT PROPERLY LOCKED
	1.7 #	966220 2	110878	F	PD	013		1		1 1	CONTAINMENT SPRY PUMP 2C DEVELOPED HOSE RUPTURE	COOLING SYS HOSE ON DIESEL BROKE
1	G AF	1 000713	011774	U	PM	A19		1		T	18 STRY LIQUID CONT PUMP FAILED SURVETLLANCE TEST	PACKING CH 1 OF 3 PUMP PLUNGERS FAILED
1	G BF	1 010377*	061874	0	PH	813	U	2	1	0	18 6 1C COR SPRA DIDNT START DURIN SURVLING TESTIN	BEST CONTACT ARM ON RELAY (MANUAL START)
	G BF	2 022085	080578	U	PH	C07		1	4	1	28 STANDBY LIQUID CONTROL PUMP FAILED TO REACH CAP	NORMAL WEAR TO VALVE, SEATING SURFACES
	G BF	3 015057	092376	ŧ	PH	813	5	1	1	U I	RHR PMP 3C FAILD TO START ON NORMAL POWER	OPEN CABLE IN RHR LOGIC
	G BF	3 032025	071480	ı	PM	013	5	1	1	0	3D RHR PUMP TRIPPED ON INSTANTANEOUS OVERCURRENT	POSSIBLE INCORRECT SETPOINT OF RELAY
	G B P	1 017025	082977	F	PD	B13	5	1	1	0	DIESEL FIRE PUMP FAILED TO START DURING REFUELING	2 SATTRY CABLES LOOSE; 8 BATTRY WAS DISCH
	G BR	1 019677	110577	L	PM	802	5	1	. 1	1	RHR 14 DES NUT START; COVER LOOSE & CONTACTS CORRO	CORRODED DUE TO WATER LEAKS
	G BR	1 025041	010979	t	PM	813	S	1	1	0	RHR PI'AP "D" WOULD NOT START	INTERNAL PROBLEMS IN CIRCUIT BER
	G BR	1 030408	021480	ı	PM	000		1		U	ID R'R PUMP TRIPPED IN TORUS COOLING MODE	CAJSE UNKNOWN, BKR RESET AND PUMP STARTED
- 1	G BR	2 017186	020777	D	PM	813	S	1		U	CORE SPRAY 28 FAILD TO STARTBKR CHARGIN SPRING	CHARG. SPRING MANUALLY CHARGED, BKR CLOSED
	G 38	2 019676	062277	L	PM	801	U	1	1	0	PHR ZA CHARGN MOTOR SWITCH IN OFF POSITION	PERSONEL LEFT SWITCH IN OFF POSITION
	G C	1 0200494	112177	U	PM	405		1	1	0	"B"SBLC PUMP STUFFING BX GLAND FOLLOWER BLEW GOT	MOVEMENT OF INSUFF CONTAINED GLAND FLWR
	G CO	1 0200498	117177	U	PM	C 0 5		1	1	0	"8"SBLC PUMP FAILED TO MEET REQD FLOW AT PRESSURE	3 IN LIEU OF 5 PKG RINGS INSTILLD BY MEGR

VEX.	PLANT	CONTROL NUMBER	EVENT	SYSTEM	COMP	CAUSE	TYPE	FAIL	EGZ.	CLASSI	MODE DESCRIPTION	CAUSE DESCRIPTION
G	cor	027957	122379	ι	PH	813	S		1 1	0	RHR PUMP "10" WOULD NOT OPERATE	BREAKER FAILURE
		030788	031080	U	PM	C07			1	Т	SEC PUMP 18 WOULD NOT PUMP REQUIRED FLOW RATE	LEAKING INTERNAL SUCTION AND DISCH VALVES
G	DAI	012848	061375	D	PM	809	S		1 1	0	CORE SPRAY PMP 2114 DID NOT START ON SIGNAL	DIRTY AUX CONTACTS ON 4KV CKT BKR
G	DRI	000427	092873	D	PM	019				1 1	14 CORE SPRAY PUMP INOPERABLE DUE TO SMOKING PKG	METALIC PKG SCORED SHFT SLV AND DISTORTED
G	DRI	017321	100477	D	PM	019	1		1	r u	B CORE SPRAY PUMP PACKING OVE HEATED, BEGAN SMKING	PUMP LAST PKD 11/16/76, LAST TSTD 9/20/77
G	DRZ	002284	030572	ι	PM	809	T		1	0	2C LPCT FAILD TO START DURING TEST	DIRTY CONTACTS IN 4KV ECCS BREAKERS
G	DRZ	015195	062576	ι	PM	819	1		1	C 1	2C LPCI FAILD TO START FOR MAINING TORUS WIR. TEMP	DIRTY SWITCH IN 4KV BKR FOR PUMP
G	DRZ	025953	041579	ι	PM	800	)		1	T U	ZA LPCI PUMP MOULD NOT START	CAJSE UNKNOWN
G	DR2	032415	081880	Ł	PH	A09	,		1	N T	ZA LPCI PUMP SEAL FOUND LEAKING	SEAL FAILED DUE TO DIRT ON SEALING SURF.
G	EN1	012973	070175	L	PM	813	s		1	1 0	RHR 18 AIR CKT BKR FAILD TO CLOSE	SLIPPO CAM IN LATCH ASY. OF ACB
G	ENI	021481	050678	D	PM	813	3 5		1	1 0	CORE SPRAY PUMP FAILED TO START (1A)	CONTROL SWITCH HAD BROKEN POSITION STOP
G	EN1	033578	090680	t	PM	002	2 5		1	T D	"D" RHR PUMP VIBRATED OUTSIDE ASME CODE	WRING REFERENCE DATA USED
G	FP1	017933	060677	U	PM	AIS	,		1	1 1	"B" STANDBY LIQUID CONTROL SYS PUMP PKG LEAKAGE	PACKING DEGRADED DUE TO AGE AND WEAR
6	FP1	022504	091578	L	PH	802	2 5		1	10	RHR PUMP 10-P-3C RENDERED INOPERABLE	CONTROL POWER FUSE HOLDER WAS BENT
0	FP1	027358	102079	t	PM	81	3 5		1	1 1	RHR PUMP "C" FAILED TO START PROPERLY	LIMIT SWITCH NOT ADJUSTED PROPERLY
(	MOI	002168	101172	U	PH	CO	5 0	1	1	T O	STBY LIQ CONT PUMP DIONT DEVELOP REQUIREAD	IMPROPER VENTING/FILL OF SUCTION LINE
i	NMI	002015	060172	D	PH	81	3 1		1	u o	CORE SPRAY PUMP FAILED TO START	C3 FAILED - LNKGE TO AUX SWITCH BINDING
(	NMI	002016	060172	0	PH	81	3 1		1	U D	CORE SPRAY PUMP FAILED TO START	CB FAILED - BURNED CONT RELAY CONTACTS
(	NMI	010746	091774	F	PH	co	5		1	T D	#122 CHIMNT SPRAY FLOW 2600GPM VS. 3000GPM	2x4 PIECE OF WOOD WEDGED IN EYE OF PUMP
	NH	013016	061875	U	PH	81	3 5	,	1	T D	11 STANDBY LIQ CONT PUMP WOULD NOT START	POWER BRKE TRIGGER WAS NOT LATCHED
	9 001	002253	080172	F	PF	81	3 1		1	U O	CONTAINMENT SPRAY PUMP FAILED TO START	DIRTY CONTACTS ON BRKR POSITION SWITCH
-	o nc	002305	080172	e u	P	81	3 (	3	2	U O	BRKR FOR 1 STBY LIO CONT PUMP RACKED DUT-OTHER PMP	WOULD NOT START - AUX CONT PREVENTED CPE
	a nc	000217	061873	5 F	P	1 81	3	Г	1	U D	CONTAINMENT SPRAY PUMP 51C DID NOT START	BRIKEN WIRE TO KEY LOCK SWITCH
	G OC	1 010834	101874	. F	P	1 81	3	r	1	T D	CONTAINMENT SPRAY PUMP 514 FAILED TO START	START CIRCUIT FAILURE - TIME DELAY RELAY
	G ac	012029	02117	5 F	P	4 80	0 1	2	1	T U	CONTAINMENT SPRAY PMP 514 FAILO TO START IN AUT)	UNDER INVESTIGATION

# ALL FAULTS IN STANDBY PUMPS: CONT. SPRAY, LPCI, PUR HPCI, BUR CORE SPRAY, BUR ST. LTG. CONTROL

	> E N	PLANT	CONTROL	EVENT	SYSTEM	COMP	MODE	TYPE	FANUL	ACTIVITY:	MODE DESCRIPTION	CAUSE DESCRIPTION
	G n	IC1	012330	030675	F	PM	813	T	1	T D	CONTAINMENT SPRAY PUMP 514 FAILED TO START IN AUTO	BRER TRIP BAR FAILED TO RESET ON PREV TRP
	G O	C 1	014576	042376	D	PM	419		1	NU	INBOARD SEAL ON CORE SPRAY NZOIB CRACKO 3GPM LEAK	CARRON ROTATNG WASHR CRACKD CAUSE UNKNWN
	G O	101	015477	111176	F	PM	813	T	1	1 0	CONTAINMENT SPRAY PUMP 510 DIO NOT START	CO TRIP LATCH FAILED TO RESET
4	G O	IC 1	023118A	112678	F	PM	813	T	1	1 0	CONTAINMENT SPRAY PUMP SIC FAILED TO START	EXCESS FRICTION IN POWER CIRCUIT BREAKERS
9	G D	Cl	0231188	120278	F	PM	813	Ţ	1	T D	CONTAINMENT SPRAY PUMP SIC FAILED TO START	EXCESS FRICTION IN POWER CIRCUIT BREAKERS
	G n	Cl	025827	041979	D	PM	813	S	1	1 0	CORE SPRAY PUMP FAILED TO START ON SIGNAL (MYDEA)	FUSE FAILURE
	G n	C1	027695	110379	0	PM	803	U	1	T D	CORE SPRAY BOOSTER PUMP DID NOT START, LOUSE FUSE	PERSONNEL MANIPULATING FUSE FOR TEST
	G P	92	021081	042978	L	PM	U01	U	2	N D	UNIT 2 "B". "D"RHR BLOCKED FOR 2 HRS.	OPERTR REMVO UNIT 2 INSTED OF UNIT 3 PMPS
	G P	83	012013	021675	U	PM	813	5	1	T D	STANDBY LIQUID CONTROL PUMP FAILED TO START	THE PHASE TRIP DEVICE MARGINALLY ADJUSTED
	G P	83	019831	111477	U	PM	407		1	NT	STORY LIQUID CONTROL PMP 38P40 OUT OF SERVICE	REPLACE PACKING PREVNTY MAINTENANCE
	G P	83	020273	011378	U	PM	813	5	1	1 1	STANDBY LIQUID CONT PUMP 3A DECLARED INOPERABLE	NE ACCUM DEPRESS - CHGING VALVE FAILED OF
	G P	11	012441	031975	D	PM	818		1	T U	"A" CORE SPRAY PUMP TRIPPED ON START	FAULTY MOTOR WINDINGS - INSULATION
	G P	11	017573	100977	D	PM	813	5	1	T D	CORE SPRAY PUMP P-2158 FAILED TO START	INCORRECT LOGIC CLSNG SCHEME FOR CIR BRKR
	G P	11	020884	032378	D	PM	813	5	1	T D	CORE SPRAY PUMP "A" DECLARED INOPERATIVE	LOSSE CONN ON SPRING CHARGING LIMIT SWICH
	G P	11	031177	051380	D	PH	813	T	1	1 0	CORE SPRAY PUMP P-2158 FAILED TO AUTO START	RKR 152-607 EXPERIENCED A TRIP FREE OP.
	G Q	CI	002210	101972	D	PM	813	S	1	1 0	18 CORE SPRAY PUMP FAILED TO START DURING TEST	IMP ADJ AUX CONT IN BREAKER NO. 1422
	G Q	Cl	014539	032576	U	PM	C14		1	TT	"B" SBLC SYS PUMP HAD DISCH PRESS FLUCTUATIONS	INTERNAL CHK VLVS WERE LEAKING
	G Q	Cl	016904	120276	t	PM	802	U	1	00	ATR LOCKO SUCT HEADR COMMON TO 14 RHR LOOP, DIFSE C	RHR SER WTR PMP HAD AIR LINE CONN TO CASE
	G Q	CZ	012799	041875	D	PM	813	S	1	T D	CORE SPRAY PUMP 28 FAILED TO AUTO START	LOSSE TERMINAL CONN ON CONT PANEL 902-33
	G V	41	015997	011877	L	PM	813	5	1	T 0	"D" RHR PUMP WOULD NOT START	A LOOSE LEAD IN A BREAKER CAUSED FAILURE

# PWR HPCI and CVC Pumps

For this analysis, the two systems are treated as a single pooled system. This allows for common cause shocks that affect both HPCI pumps and CVC pumps simultaneously. The two systems have already been treated separately, CVC with the alternating pumps and HPCI with the standby pumps. In these earlier analyses, the only common cause shocks considered were restricted to a single system. The exposure times used are calendar hours.

#### Rates are estimated for:

- 1. Failure to start, based on all faults
- 2. Failure to start, based on failures only
- 3. Failure to operate after starting, based on all faults
- 4. Failure to operate after starting, based on failures only.

Be sure to read the Application section in the main body of this report. The following computer printouts give the estimates and summaries of the relevant data.

PWR HPCI AND CVC PUMPS (POOLED)

FAILURE TO START

ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS

RATES ARE PER CALENDAR HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT (MTERVAL

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P • ( .140, .261, .395)

LAMBDA • ( 1.5E-08, 2.9E-06, 1.1E-05)

LAMBDA • ( 9.8E-07, 5.5E-06, 1.3E-05)

OMEGA • ( 8.8E-10, 2.2E-07, 8.6E-07)
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SYSTEM			SHOCK RATE MU			SPECI	RATE FOR FIC COMPO	NENT		851	A FACT	OR.
2	ŧ	2.18-06.	1.3F-05.	3.3E-051	-	1.4E-06,	6.3E-06.	1.56-051	-	.041,	.187.	.3581
3	(	1.7E-06,	1.0E-05,	2.5E-051	-	1.2E-06,	5.6E-06.	1.4E-051	ţ	.048,	. 252,	.4551
4	(	1.46-06.	8.4E-06.	2.1E-051	-	1.0E-06,	5.2E-06,	1.4E-051	(	.048,	. 266+	.4621
5	(	1.3E-06,	7.5E-06,	1.86-051	1	9.7E-07.	5.0E-06,	1.3E-051	-	.044,	.253.	.4511
6	1	1.2E-06.	6.9F-06,	1.7E-051	-	9.2E-07,	4.98-06,	1.3E-05)	-	.039,	. 228,	.4391
7	•	1.1E-06,	6.6E-06,	1.68-05)	1	8.9E-07,	4.8E-06.	1.3E-051	-	.033,	. 199,	.4231
OVEPALL	(	1.1E-06,	8.4E-06,	3.3E-05)	-	8.9E-07,	5.2E-06,	1.5E-051	(	.033,	. 252,	.4621

```
SYSTEM RATE FOR SET OF K SPECIFIC COMPONENTS

RATE FOR SE
```

FAILURE TO START
FAILURES ONLY, EXCLUDING COMMAND FAULTS
RATES ARE PER CALENDAR HOUR
TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)
LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

P \* ( .002, .146, .458)

LAMBDA \* ( 2.6E-07, 5.7E-07, 9.9E-07)

LAMBDA \* ( 4.9E-07, 1.6E-06, 3.2E-06)

OMEGA \* ( 8.8E-10, 2.2E-07, 8.6E-07)

8	.3921	1244.	. 4541	.4651	.4761	. 5001	. 5001
BETA FACTOR	( .010, .137, .392)	.182,	( .014, .200, .454)	( .015, .201, .455)	.1961	.190,	.1961
9514	.010.	.013,	.014.	.015,	.014,	.013,	.010.
	-	-		-	~	-	-
4ENT	1.3E-06, 6.6E-04, 3.7E-04) ( 8.2E-07, 1.6E-06, 2.8E-06)	( 7.0E-07, 1.4E-06, 2.4E-06) ( .013, .182, .442)	( 6.3E-07, 1.3E-06, 2.2E-06)	( 5.9E-07, 1.2E-06, 2.1E-06)	( 5.6E-07, 1.2E-06, 2.1E-06) ( .014, .196, .476)	( 5.4F-07, 1.2E-06, 2.0E-06) ( .013, .190, .500)	OVERALL ( 7.6E-07, 3.3E-04, 3.7E-04) ( 5.4E-07, 1.3E-06, 2.8E-06) ( .010, .196, .500)
SPECIFIC COMPONENT	1.66-06,	1.46-06,	1.36-06,	1.2E-06.	1.26-06,	1.2E-06,	1 . 3E -06,
SPECI	8.2E-07.	7.0E-07.	6.36-07,	5.9E-07.	5.66-07,	5.46-07,	5.4E-07.
	-		-	~	-	-	-
	3.7E-041	1.1E-06. 4.4E-04, 2.5E-04)	9.45-07, 3.3E-04, 1.9E-041	8.5E-07. 2.7E-04. 1.5E-041	1.2E-04)	( 7.5E-07, 1.9F-04, 1.1E-04)	3.76-041
SHOCK	6.66-04,	4.46-04,	3. 3E -04,	2.7E-04.	8.0E-07, 2.2E-04, 1.2E-04!	1.96-04.	3.3E-04,
	1.36-06,	1.16-06.	9.46-07.	8.58-07.	8.05-07,	7.56-07,	7.66-07,
	-	-	-	-	-	-	-
SYSTEM	2		4	5	9	7	 OVERALL

				8.9E-071	8.95-071	4.8E-071	8.86-071	8.96-071
	*			2.46-97,	2.46-07.	2.46-07.	2.46-37.	2.46-07.
				1.2E-09,	1.25-09,	1.2E-09,	1.2E-09.	1.26-09,
NTS				-	~	-	~	-
RATE FOR SET OF K SPECIFIC COMPONENTS			9.3E-071	4.4F-09, 3.2E-07, 1.0E-06) ( 1.7E-09, 2.6E-07, 9.2E-07) ( 1.2E-09, 2.4E-07, 8.9E-07)	( 3.9E-09, 3.1E-07, 1.0E-06) ( 1.6E-09, 2.5E-07, 9.2E-07) ( 1.2E-09, 2.4E-07, 8.9E-07)	3.65-09, 3.05-07, 1.05-06) ( 1.65-09, 2.55-07, 9.25-07) ( 1.25-09, 2.45-07, 4.85-07)	( 3.45-09, 3.05-07, 1.05-06) ( 1.56-09, 2.56-07, 9.16-07) ( 1.26-09, 2.46-07, 8.86-07)	DVERALL ( 3.45-09, 3.25-07, 1.16-06) ( 1.56-09, 2.56-07, 9.36-07) ( 1.26-09, 2.46-07, 8.96-07)
K SPECIFI	R3		2.5E-07.	2.6E-07,	2.56-07,	2.56-07.	2.5E-07,	2.5E-07,
OR SET OF			5.3E-09, 3.3E-07, 1.0E-06) ( 1.8E-09, 2.5E-07, 9.3E-07)	1.7E-09,	1.66-09.	1.66-09,	1.56-09,	1.56-09,
u.			~	-	-	-	-	_
RAT		1.16-06)	1.08-061	1.06-06)	1.08-061	1.0E-061	1.06-061	1.16-06)
	8.2	7.1E-09, 3.6F-07, 1.1E-06!	3.3E-07,	3.26-07,	3.16-07,	3.0E-07.	3.0F-07,	3.26-07,
		7.16-09.	5.38-09,	4.4F-09.	3.96-09,	3.68-09.	3.46-09.	3.46-09,
		-	-	-	-	-	-	-
SYSTEM	371C	2		3	3	\$	1	DVERALL

PWR HPCI AND CVC PUMPS (POOLED)

FAILURE TO OPERATE, GIVEN START

ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS

RATES ARE PER CALENDAR HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

```
P * ( .082, .189, .316)

LAMBDA * ( 7.1E-07, 1.0E-05, 2.9E-05)

LAMBDA * ( 7.3E-10, 1.2E-07, 4.7E-07)

OMEGA * ( 8.8E-10, 2.2E-07, 8.6E-07)
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SASTEM			SHOCK			SPECI	RATE FOR	NENT		861	A FACT	OR .
2	t	2.2E-09,	4.3E-07.	1.6E-06)	(	9.8E-07.	1.0E-05.	2.9E-051	-	.000,	.016.	.2411
3	(	1.6E-09,	3.1E-07,	1.28-061	•	9.6E-07,	1.0E-05.	2.9E-051	(	.000,	.016,	.2491
4	•	1.46-09,	2.5F-07.	9.6E-071	-	9.5E-07,	1.0E-05,	2.9E-051	(	.000,	.016.	.2501
5	ŧ	1.2E-09,	2.2E-07,	8.2E-071	(	9.5E-07.	1.0E-05,	2.9E-051	-	.000,	.016,	.2501
6	ŧ	1.16-09,	2.0E-07,	7.4E-071	-	9.4E-07,	1.06-05,	2.9E-051	- (	.000,	.016,	.2491
7	t	1.0E-09,	1.85-07,	6.8E-071	ŧ	9.4E-07,	1.0E-05,	2.9E-051	(	.000,	.016.	.2481
OVERALL	-	1.0E-09,	2.5E-07,	1.6E-061	•	9.4E-07,	1.08-05.	2.9E-051	-	.000,	.016,	.2501

```
RATE FOR SET OF K SPECIFIC COMPONENTS

R3

R4

2 (1.6F-09, 2.4E-07, 8.8E-07)

3 (1.4F-09, 2.3E-07, 8.7E-07) (9.8E-10, 2.3E-07, 8.6E-07)

4 (1.3E-09, 2.3E-07, 8.7E-07) (9.7E-10, 2.3E-07, 8.6E-07) (9.0E-10, 2.2E-07, 8.6E-07)

5 (1.2E-09, 2.3E-07, 8.7E-07) (9.6E-10, 2.3E-07, 8.6E-07) (9.0E-10, 2.2E-07, 8.6E-07)

6 (1.2E-09, 2.3E-07, 8.7E-07) (9.5E-10, 2.3E-07, 8.6E-07) (9.0E-10, 2.2E-07, 8.6E-07)

7 (1.2E-09, 2.3E-07, 8.7E-07) (9.5E-10, 2.3E-07, 8.6E-07) (9.0E-10, 2.2E-07, 8.6E-07)

OVERALL (1.2E-09, 2.3E-07, 8.8E-07) (9.5E-10, 2.3E-07, 8.6E-07) (9.0E-10, 2.2E-07, 8.6E-07)
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PWR HPCI AND CVC PUMPS (POOLED)

FAILURE TO OPERATE, GIVEN START

FAILURES ONLY, EXCLUDING COMMAND FAULTS

RATES ARE PER CALENDAR HOUR

TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

P = ( .001, .092, .299)

LAMBDA = ( 3.8E-07, 8.4E-06, 2.5E-05)

LAMBDA = ( 2.6E-07, 1.1E-06, 2.5E-06)

OMEGA = ( 8.8E-10, 2.2E-07, 8.6E-07)

SIZEM			RATE			SPECT	RATE FOR FIC COMPO	NENT		861	A FACT	JR
2	1	1.1E-06,	8.2E-04,	4.5E-041	ţ	i.1E-06,	9.28-06,	2.6E-051		.001,	.025,	.218)
3	1	8.5E-07.	5.5E-04.	3.0E-041	-	9.7E-07.	9.0E-06.	2.6E-051	(	.001,	.028,	.2681
4	ŧ	7.1F-07.	4.18-04,	2.2E-041	1	8.9E-07,	8.98-06,	2.6E-05)	1	:001,	.029,	.2951
5	(	6.3E-07,	3.3E-04,	1.8E-041	(	8.4E-07.	8.9E-06.	2.6E-051	-	.001,	.028,	+3091
. 6	(	5.7E-07.	2.7F-04,	1.5E-041	- (	8.16-07.	8.8E-06,	2.6E-051	-	.001,	.028,	.3151
7	. (	5.3E-07,	2.3E-04,	1.3E-041	ŧ	7.9E-07,	8.8E-06,	2.6E-051	-	.001,	.027,	.3201
OVERALL	. (	5.3E-07,	4.1F-04,	4.5E-041	- (	7.9E-07,	8.9E-06,	2.6E-051		.001,	.028,	.3201

RATE FOR SET OF K SPECIFIC COMPONENTS

R3

R4

2 ( 3.5E-09, 2.8E-07, 9.4E-07)

3 ( 2.7F-09, 2.7E-07, 9.2E-07) ( 1.2E-09, 2.3E-07, 8.7E-07)

4 ( 2.4E-09, 2.6E-07, 9.1E-07) ( 1.2E-09, 2.3E-07, 8.7E-07) ( 9.6E-10, 2.3E-07, 8.6E-07)

5 ( 2.2E-09, 2.6E-07, 9.0E-07) ( 1.1E-09, 2.3E-07, 8.7E-07) ( 9.6E-10, 2.3E-07, 8.6E-07)

6 ( 2.0E-09, 2.5E-07, 9.0E-07) ( 1.1E-09, 2.3E-07, 8.7E-07) ( 9.5E-10, 2.3E-07, 8.6E-07)

7 ( 1.9E-09, 2.5E-07, 9.0E-07) ( 1.1E-09, 2.3E-07, 8.7E-07) ( 9.5E-10, 2.3E-07, 8.6E-07)

ALL FAILURES TO START IN PUR HPCI AND CVC PUMPS

15   15   15   15   15   15   15   15	LANT	CRIT.	CALEND.	606	W 4 1	NO N	PER OF COMPLET	TS FA	NETHA IL RS/C	CHOCKS OH FLTS	FAILR	FOR SHOCKS	FATCR	AAL SHOCKS	u. 1	LETHA ATLRS	I COM	HOCKS
19744   3		33894	23052	3		0	0		1 /	0	1	0 /	0	0 /		0	0	
26.008		17695	32544	3		0	0		10	0	0	0 /	0	0 /		0		
6.387.3		13042	26808	2		0	. 1		1 /	1	1	1 /	0	0 /		0	0	
50 584         3         0 / 0         0	-	62055	65328	en		0	0		0	1	0	, 1	0	0 /		0	0 1	
93232         3         0 / 0         0 / 0         0 / 0         0 / 0           92988         3         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           9734         3         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           9734         3         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           5246         6         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           4346         6         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           52712         6         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           4346         6         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           52712         6         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           65716         7         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           75704         7         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           75704         7         0 / 0         0 / 0         0 / 0         0 /	-275	37558	60384	<b>6</b> 0		0	0		10	0	0	0 /	0	0 /		0	0	
\$2.59.8         3         0 f 0         0		35815	53232	6		0	0		1 0	0	0	0 /	0	0 1		0	0	
15   15   15   15   15   15   15   15		29290	\$2968	3		0	0		0	0	0	0 /	0	0 /		0	0	
9794         3         9794         3         9794         3         9794         3         9794		31732	45135	3		0			1	0	1	0 /	0	0 /		0	0	
15984         6         0 / 0         0 / 0         0 / 0           37644         6         0 / 0         0 / 0         0 / 0           37644         6         0 / 0         0 / 0         0 / 0           43464         6         0 / 1         0 / 0         0 / 0           62712         6         0 / 1         0 / 0         0 / 0           74764         6         0 / 1         0 / 0         0 / 0           74704         7         0 / 0         0 / 0         0 / 0           74704         7         0 / 0         0 / 0         0 / 0           74092         7         0 / 0         0 / 0         0 / 0           74093         7         0 / 0         0 / 0         0 / 0           74093         7         0 / 0         0 / 0         0 / 0           74093         7         0 / 0         0 / 0         0 / 0           74093         7         0 / 0         0 / 0         0 / 0           74093         7         0 / 0         0 / 0         0 / 0           74093         7         0 / 0         0 / 0         0 / 0           74093         7         0 / 0         0 / 0 <td></td> <td>3398</td> <td>9 7 8 4</td> <td>3</td> <td></td> <td>0</td> <td>0</td> <td></td> <td>0</td> <td>0</td> <td>0</td> <td>0 /</td> <td>0</td> <td>0 /</td> <td></td> <td>0</td> <td>0 /</td> <td></td>		3398	9 7 8 4	3		0	0		0	0	0	0 /	0	0 /		0	0 /	
37624         6         0 / 0         0 / 0         0 / 0           437624         6         0 / 0         0 / 0         0 / 0           62712         6         0 / 0         0 / 0         0 / 0           63702         6         0 / 0         0 / 0         0 / 0           76704         6         0 / 0         0 / 0         0 / 0         0 / 0           76704         7         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         7         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         7         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         7         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         7         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         7         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         7         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         0 / 0         0 / 0         0		1068	15984	9		0	0		0	0	0	0 /	0	0 ,		0	0	
33624         6         0 / 0         0 /		38451	52464	•		0	0		0	0	0	0 /	0	0 /		0	0	
43464         6         0 / 1         0 / 0         0 /	-	25811	33624	9		0	0		0	0	0	0 /	0	0 /		0	0	
43464         6         0 / 0         0 / 0         0 / 0           76704         5         1 / 1         0 / 0         0 / 0           76704         5         1 / 1         0 / 0         0 / 0           38520         5         0 / 0         0 / 0         0 / 0           4002         5         0 / 0         0 / 0         0 / 0           4003         5         0 / 0         0 / 0         0 / 0           4003         6         0 / 0         0 / 0         0 / 0           4003         7         0 / 0         0 / 0         0 / 0           4003         6         0 / 0         0 / 0         0 / 0           4003         6         0 / 0         0 / 0         0 / 0           4003         6         0 / 0         0 / 0         0 / 0           4004         7         0 / 0         0 / 0         0 / 0           4004         8         0 / 0         0 / 0         0 / 0           4004         9         0 / 0         0 / 0         0 / 0           4004         9         0 / 0         0 / 0         0 / 0           4004         0 / 0         0 / 0         0 / 0	-	47570	52712	0		0	1		0	0	0	0 /	0	0 /		0	0	
59600         4         0 / 0         0 / 1         0 / 0         0 / 0         0 / 0           38952         5         1 / 1         0 / 0         0 / 0         0 / 0         0 / 0           49952         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           49952         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           49952         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           2744         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           2744         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           2745         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           2756         6         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           2757         3         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           2750         6         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           2750         7         0 / 0         0 / 0         0 / 0<		30580	43464	•		0	0		10	0	0	0 /	0	0 /		0	0	
38956         5         1 / 1         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           38950         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           40922         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         6         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         7         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         0 / 0         0 / 0<		55878	69690	,		0	0		1 0	1	0	, 1	0	0 /		0		
3895         6         0 / 2         0 / 0         0 / 0         0 / 0           4993         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           7670         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           7670         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           7670         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           7670         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           7750         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           7750         6         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           7750         7500         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           7750         7500         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           7750         7500         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0		38960	76.704	2		***	1		0	0	0	0 /	0	0 /		0	0	
39520       5       0 7 0       0 7		26229	38088	9		0	2		1 0	0	0	0 /	0	0 /		0	0	
\$22454         \$5         \$0\$ f         \$		13775	34520	15		0	0		0	0	0	0 /	0	0 /		0	0	
22454         5         0 / 0         0 / 0         0 / 0         0 / 0           76704         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           84536         6         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           27576         3         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           21840         3         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           25904         6         1 / 0         0 / 0         0 / 0         0 / 0         0 / 0           26750         6         1 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0		37510	20004	2		0	0		0 /	0	0	0 /	0	0 /		0	0	
74704         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           04536         6         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           27576         3         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           21840         3         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           25750         6         1 / 0         0 / 0         0 / 0         0 / 0         0 / 0           26750         6         1 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         5         0 / 0         0 / 0         0 / 0         0 / 0         0           76704         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0           76704         5         0 / 0         0 / 0         0 / 0         0 / 0         0 / 0		15811	55428	6		0	0		0	0	0	0 /	0	0 /		0	0	
84536       6       0 / 0       0 / 1       0 / 0       0 / 0         27576       3       0 / 0       0 / 0       0 / 0       0 / 0         21840       3       0 / 0       0 / 0       0 / 0       0 / 0         2564       3       0 / 0       0 / 0       0 / 0       0 / 0         50760       6       1 / 0       0 / 0       0 / 0       0 / 0         7670       5       0 / 0       0 / 0       0 / 0       0 / 0         7670       5       0 / 0       0 / 0       0 / 0       0 / 0	1	93208	76704	w.		0	0		0	0	0	0 /	0	0 /		0	0	
27576       3       0 / 0       0 / 0       0 / 0       0 / 0         27576       3       0 / 0       0 / 0       0 / 0       0 / 0         21840       3       0 / 0       0 / 0       0 / 0       0 / 0         2564       3       0 / 0       0 / 0       0 / 0       0 / 0         59904       6       1 / 0       0 / 0       0 / 0       0 / 0         76704       5       0 / 0       0 / 0       0 / 0       0 / 0		37770	64536	•		0	0		10	1	0	1 2	c	0 /		0	0	
27576       3       0 f 0       0 f 0       0 f 0       0 f 0         21840       3       0 f 0       0 f 0       0 f 0       0 f 0         2564       3       0 f 0       0 f 0       0 f 0       0 f 0         59904       6       1 f 0       0 f 0       0 f 0       0 f 0         76704       5       0 f 0       0 f 0       0 f 0       0 f 0	-	25443	10336	9		0			10	0	0	0 /	0	0 /		0	0	
57600       5       0 t 0       0 t 0       0 t 0       0 t 0         21840       3       0 t 0       0 t 1       0 t 0       0 t 0         25904       6       1 t 0       0 t 0       0 t 0       0 t 0         50750       6       1 t 0       0 t 0       0 t 0       0 t 0         76704       5       0 t 0       0 t 0       0 t 0       0 t 0		16272	27576	3		0	0 .		10	9	0	0 /	0	0 /		0	0	
21840 3 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0		46125	57690	8		0	0		0 /	0	0	0 ,	0	0 /		0	0	
2664 3 0 7 0 0 0 7 0 0 0 7 0 0		15859	21840	3		0	0		0 /	1	0	1 1	0	0 /		0	0	
50904 6 1/0 0/0 0/0 0/0 0/0 0/0 0/0 0/1 0		1724	2664	3		0	0		0	0	0	0 /	0	0 /		0	0	
76704 5 010 010 010 010 010 01		46464	20006	9		1	0		10	0	0	0 /	0	0 /		0	0	
76704 5 010 010 010 010 010	-	46194	90708	9		0	2		10	0	0	0 /	0	0 /		0	0	
		62073	76704	2		0	0		0	0	0	0 /	0	0 /		0	0	

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CRIT.	33594	17695	13042	45079	37558	36816	29290	31732	3398	1068	39451	25811	47570	30580	55878	38960	25228	13775	37510	16811	63506	37770	26443	16271	46125	15857	1724	46464	44184	62073
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VEN	PLANT	CONTROL	EVENT	SYSTEM	COTP	MODE	TYPE	FANUL	ACTIVITY	CLASSI	MODE DESCRIPTION	CAUSE DESCRIPTION
8	ARI	013015	070775	G	PM	801	C	1	N	0	P36C M/U PUMP STARTED AND IMMED TRIPPED, PUMP FREN RAN WI	TH NO SUCTION, INCORRECT VLV LINE-UP
8	AR1	016195	100376	G	PH	008		1	N	T	P368 STOPPED DUE TO OVR-CURRENT AND LOSS OF PRESS EXCESS	IVE INTERNAL COMPONENT WEAR
8	031	019374	091777	G	PM	A19		1	N	D	MAKEUP PUMP 1-2 HAD OIL LEAK ON OTBO BRNG END PLT O-RING	ON END PLATE DID HOT FORM ADEO SL
В	081	021858	061678	G	PM	012		1	T	T	HORIZONTAL VIBRATION ON HPCI PUMP 1-1 PUMP W	AS MISALIGNED DUE TO LOOSE MOUNTS
В	031	0255254	010379	G	PM	C04	U	1	T	D	HPI PUMP 1-1 FAILED TO DEVELOP SUFFICIANT RECTRC HEAT T	RACE UNABLE TO MAIN LINE ABOVE FREE
9	DAI	0255259	010379	G	PM	U04	U	1	T	0	HPI PUMP 1-2 HAY NOT HAVE HAD SUFF. RECIRC HEAT T	RACE UNABLE TO MAIN LINE ABOVE FREZ
8	081	025603	032979	G	PM	C09		1	N	0	MAKE UP PUMP 1-1 DEVELOPED VIB AND DECRE PERFORM. FOREIG	N DEBRIS FAILED WEARING RING
В	081	027859	111279	G	PM	805	5	1	T	D	HPI PUMP 1-1 FAILED TO START FACTOR	Y DEFECT IN CONTROL CIRCUIT WIRING
8	091	031610	062380	G	PM	U01	C	1	N	D	HPI PUMP 1-1 BEARING THERMOCOUPLE WELLS BROKEN ASSUME	D TO BE STEPPED ON
8	0F1	0148060	012876	G	PM	802	U	1	T	D	HIGH PRESSURE INJECTION PUMP - INOPERABLE (14) INCORR	ECT SUBSTITUTE BREAKER INSTALLED
B	ne2	031916	071380	G	PM	021		1	N	T	28 HPI PUMP REMOVED FROM SERVICE 8AD BE	ARING CAUSE NOT STATED
8	OE2	033125	072680	G	PM	018	R	1	N	U	28 HPI PUMP DECLARED INOPERABLE, DEVELOPED HOT BEAR UPWARD	PRESSURE OF MOTOR AGAINST UP BEAR.
8	251	014502	032376	G	PM	000		1	N	U	HPCI P238A TRIPPO OFF LINE WHEN AT 100% POWER NO CAU	SE COULD BE FOUND THRU TESTING
8	TIL	011016	101074	G	PH	BCZ	S	1	T	0	MAKEUP PUMP IA TRIPPED ON MANUAL ACTUATION WRONG	LUG USED TO CONN FOR CBL TO MTR WOG
В	111	011015	101774	G	PM	813	S	1	Ţ	D	MAKEUP PUMP IC FAILED TO START - AUTOMATIC WESTIN	IGHSE ACB HAD DISLED TRIP LTCH SPRNG
В	111	012103	010375	G	PM	B13	S	1	T	0	HIGH PRESS INJ PUMP MU-PIC FAILED TO START LOOSE	TERMINATION ON BRKR RELEASE
8	TII	014220	021776	G	PM	806	C	1	T	0	"A" MAKEUP/PURIF PMP STARTED WITH IMPROPE VALV L/U PMP FA	ILURE DUE TO INAD PROCEDRES/PERSCHL
8	TII	020997*	031878	G	PM	D13	U	2	1	D	THE 14 6 1C MAKEUP PMPS TRIPPED ON XFER TO SITE PR MALFUN	C TIME DELAY RELAY IN LOW L.O. CKT
8	TIL	025503	021779	G	PM	018		1	Ţ	T	HPI PUMP MU-P-IC TRIPPED ON OVERLOAD FAILED	LEAD INSIDE PUMP MOTOR
C	CCL	013187	080175	G	PM	A19	R	1	U	U	*13 CHARGING PUMP RELEASED GAS ACT TO AUX BLDG PLINGE	R PKG LKG (UTEX INDUS. PART# SF154)
C	CCI	013389	091175	G	PM	A19	R	1	U	U	#13 CHG PUMP RELEASED GAS ACT FROM UA-1 MAIN VENT PLUNGE	R PACKING LEAKER EXCESSIVELY
C	001	014754	050476	G	PM	000	5	1	N	U	#13 CHARGN PUMP TRIPPD DUE TO BREAKER OPENING CAJSE	FOR OPENING OF BKR. UNKNOWN
C	CCI	018485	072977	G	PM	A19	R	1	N	T	#12 CHARGING PUMP REMOVED FROM SERVICE REPAIR	SLOWLY INCREASING PACKING LEAK
100		017698										TIVE PACKING LEAKAGE, PACKING FAILED
C	CCI	026718A	080679	G	PM	013	3 5	1	N	T	#12 CHARGING PUMP TRIPPED ON LOW SUCITON PRESSURE FAULTY	PRESSURE INDICATING SWITCH

VEN	PLANT	CONTROL	EVENT	SYSTEM	COMP	MODE	TYPE	FAIL	ACTIVITY	CLASSI	MODE DESCRIPTION	CAUSE DESCRIPTION
W	BVI	0167518	121576	G	PM	A14	R	1	N	T	18 CHARGNG PMP LEAKING AT GEAR CASING	THAF FAILURE OF L.O. COOLER
w	3 V 1	018348	070577	G	PM	015		1	N	U	18 CHARGING PUMP TREPPED ON PHASE OVERCURRENT	PUMP SHAFT CRACKED AT BALANCE DRUM NUT
w	8 V 1	021356A	041678	G	PM	009	5	1	N	T	18 CHARGN/SI PUMP HI BEARING TEMP ALARM	PLIGGED OIL PUMP COOLERS-WATER SIDE
W	8 1	0213568	041678	G	PM	009	5	1	N	T	IC CHARGE/SI PMP HI BEARING TEMP ALARM PLGGD COOL	RIVER WATER STRAINERS TORN ALLOWING DEBRI
W	8V1	021646	042178	G	PM	001	S	1	N	0	IC CHG PUMP TRIPPED, NO BACK-UP WAS AVAILABLE	OPERATOR MADE IMPROPER ELEC LINE-UP
W	8 V 1	028145	010379	G	PM	C14		1	N	T	1C CHARGING PUMP HAD LOW DISCHAGE PRESSURE	FAULTY ROTATING ELEMENT
w	BV1	026841	081679	G	PM	002	C	1	T	0	1C CHARGING PUMP BECAME INOPERABLE	FAILED BEARING DUE TO A COOLING VLV SHLT
W	8 V 1	032789	091780	G	PM	DOZ	U	1	T	0	10 HIGH HEAD CHARGING PUMP BEARING TEMP INCREASED	CHECK VALVES INSTAL BACKWARDS IN COOL F20
W	OCI	017650	040777	G	PM	015	R	1	N	0	IN CENT CHG PUMP AMMTR PEGGED, PUMP DEENERGIZED	BRIKEN SHAFT.CLEAN BRK UNDR 11TH STG IMP
W	DCI	017670	041877	G	PM	002	S	1	N	0	"W" CHARGN PMP HIGHER THAN NORMAL CASING TEMPERATE	RAG STUCK IN RECIRC LINE DURIN ROTOR REPL
W	DCI	017769	051777	G	PM	015	R	1	N	D	EAST CENT CHG PMP BRK BET 3RD & 4TH STG IMPELLERS	BREAK APPEARED TO BE A FATIGUE FAILURE
W	DCI	031811	070380	G	PM	015	R	1	N	0	TRAIN B CENTRIFUGAL CHR PUMP FAILED WHILE OPER.	SHAFT BROKE
W	HNI	014163	012476	G	PM	419		1	N	T	EXCESSIVE SEAL LEAKAGE ON 14 CENT CHARGING PIMP	OUTBD SEAL HAD "O" RING FAILURE
W	HN1	017569	040477	G	PM	C20		1	N	T	"A" CHONG PUMP INDICATIONS POINTED TO FAULTY OPS	DISASSY REVEALED CRKS UNDER PRESS RED SLV
м	HN1	017689	042677	G	PM	A05		1	M	0	14 CHG PMP DEVELOPED SMALL WEEP ON SUCT MECH SEAL	SLIGHT POROSITY BINN SL SPLY PSG & SL SUR
W	HNI	017638	042877	G	PM	020		1	N	T	14 CHARGING PMP AXIAL MISALIGNMAT OF MTR TO PUMP	EXCESS THRUST WIPED MOTOR BEARING RAN ZOM
×	HNI	021329	040378	н	PM	C14		1	H	U	"A" HPSI PMP DEVELOPED UNUSUAL DRAG DURING MAINT	INSPECTION DISCUSD CRKD WR RNGS & BSHNGS
	IPS	010282	051074	н	PH	809	U	2	N	T	#23 6 #21 HPSI PUMP STARTED ONLY DEVELOP 700# PRS	BORTC ACTO LEAKAGE CAUSO SUCTION BLOCKAGE
	IPZ	013170*	072275	G	PM	A19	R	1	N	0	Z CHG PMPS REMOVED FROM SERVICE	EXCSV PLUNGER SEAL LEAKAGE
¥	IPZ	013299*	082775	G	PM	A19	R	1	N	0	2 CHG PMPS REMOVED FROM SERVICE	EXCSV PLNGR SEAL LKG VAR SPD 98GPM
	192	013300*	082975	G	PH	419	R	1	N	0	2 CHG PMPS REMOVED FROM SERVICE	EXCSV PLNGR SEAL LKG - PSBLE DESIGN MOD
1	102	0137394	110575	G	PM	A16	P	1	N	0	NO. 23 CHG PUMP REMOVED FROM SERVICE	LEAKING HEAD GASKET - TYPE 0x-300 QUNTPLX
	IPZ	0137398	110575	G	PM	419	R	1	N	0	NO. 22 CHG PUMP REMOVED FROM SERVICE	EXCSV PLNGR SEAL LKG - TYPE QX-300 QUNTPX
	I P	013850	120375	G	PM	A16	P	1	N	0	NO. 21 CHG PUMP REMOVED FROM SERVICE	LEG HEAD GSKT - TYPE GX-300 QUINTUPLEX
	IP	0140034	121875	G	PM	A16	R	1	N	0	NO. 21 CHG REMOVED FROM SERVICE	PIN HOLE LEAK IN FLUID HEAD

1 Zmc	P L A N T	CONTROL	EVENT	SYSTEM	COMP	#00m	TYPE	FAIL	302	ACTIVITY -		MODE DESCRIPTION	CAUSE DESCRIPTION
w	IPZ	0140039	121875	G	PM	A1	6 R	1		N D	,	NO. 23 CHG REMOVED FROM SERVICE	LARGE LEAK IN FLUID HEAD
W	IPZ	015920*	080576	н	PM	CO:	3 N	3	1	T D	)	ALL 3 SAFETY INJ PUMPS RUN APPX 10 MIN W/O SUCTION	CMY PUMP SUCTION VLV (846) NOT OPEN
W	102	017236	052677	G	PM	C1:	5	1		N U	,	#22 CHG PUMP DEVELOPED LOUD NOISE - LOST DISCH PRS	FLUTD DRIVE CPLNG FOUND BROKEN
w	IPZ	021706	050278	н	PH	02	1	- 3	ı	T T		EXCESS GIL FROM SI PUMP NO. 22 THRUST BEARING	THRUST COLLAR AND SHOES FAILED, REPLACED
w	TPZ	023580	121478	G	PM	A10	6 R	1		нт		CH. PUMP #22 HAD LEAKAGE AROUND STUFF BOX GASKET	FOUND CRACK IN FLUID HEAD AND CYL. WALL
w	193	015944	011277	н	PM	81	3 5	1		N D	)	#33 SI PMP FAILD TO START FROM SISIPLANT TREP 100%	TO PELAY IN START CKT FAILD MODEL 2412PC
w	193	017878	040477	н	PM	C1	4	1	ı	R T		NO. 31 SAFTY INJ PMP HAD GRAD DETERATE OF FLO DUPT	MORN INTERNALS - HIGH HEAD TYPE JTCH
W	193	017265	092577	G	PM	Al	6 R	1	1	N U	,	#32 CHG PUMP DEVELOPED LEAK IN HEAD - TAKEN 1FF-LY	HATR-LINE CRACK IN HEAD - 98 GPM, 0X-3CO
w	193	019264	093077	G	PM	41	9 R	1		N U	1	#33 CHG PUMP TAKEN OUT OF SERVICE	EXESY SEAL LEAKAGE - TYPE QX-300 QUINTPLX
W	193	019262	100177	G	PM	A1	9 R	1	ı	N U	1	#31 CHG PUMP TAKEN OUT OF SERVICE	EXCSV SEAL LEAKAGE - TYPE QX-300 QUINTPLX
W	193	020122	121677	G	PM	A1	9 R	- 1	1	N U	,	#33 CHG PUNP REMOVED FROM SERVICE	EXTSV SEAL LEAKAGE - 98GPM TYPE QX-300
×	193	021359	041678	G	PM	A1	9 R	1	1	N U	,	#31 CHG PUMP REMOVED FROM SERVICE	EXCSV SEAL LEAKAGE - QX-300 QUINTUPLEX
W	193	022877	102778	G	PH	A1	4 R		1	N T	ř.	LEAKAGE OBSERVED FROM NO. 31 CHARING PUMP	LEAK WAS FOUND IN PLUNGER
W	193	025232	020579	G	PH	Al	9 R	1	ı	N T		# 32 CHARGING PUMP DISCOVERED LEAKING	FATLED PLUNGER AND PACKING
W	KEI	019311	100277	G	PM	01	8 R		1	N D	)	FLOW FROM OPERATING CHG PMP WAS LOST DURING OPERTN	BROKEN BELT ON VARI-DRIVE UNIT
W	KE1	019643	110777	G	PM	01	8 R	1	1	N 0	)	FLOW FROM OPERATING CHG PMP WAS LOST DURING THER	SROKEN BELT ON VARI-DRIVE UNIT
W	KE1	022237	080978	G	PM	C1	3 5		1	N T	r	CCP OPERATED ONLY AT HIGH SPEED	FAILED TRANSISTOR IN HAND CONTROL STATION
W	KF1	022540	091878	G	PM	A1	6	1	1	N T	r	LEAK DEVELOPED ON CCP BETWEEN DIS. PIPE AND BLOCK	CRACK CAUSED BY OPERATING STRESS
W	KEL	030562	021190	G	PM	D1	3 5	1	1	N I	1	CHARGING PUMP STOPPED WHEN CONTROL SW PLACED AUTO	STICKING CONTACT
w	NAI	022033	071778	G	PH	00	2		1	N 0	)	CHP PUMP IC BECAME INOPERABLE	THPROPERLY ASSEMBLED SEAL ASSEMBLY
W	NAI	025716	040879	G	PM	UO	1 U		1	N 0	)	LAGIB DOS FOR MAINT, 10 FEEDER BRKR NOT RACKED IN	IMPROPER TAGOUT PROCEDURE
w	NAL	027248	092879	G	PM	CO	0		1	T U	3	CHARGING PUMP 1-CH-P-1A DID NOT FUNCTION	CAJSE NOT STATED
W	PRI	017619	041177	н	PM	00	4	1	1	1 0	0	#12 SAFTY INJ PHP #7 IMPELLE MOVED AXIALLY ON SHAFT	ANNORMAL PRESSURE DISTRBTION ACROSS IMPLR
w	PRI	018907	062877	G	PM	01	3		1	N U	j	CHARGING PUMP FAILED	CAPSCREW FAILURE IN VARIORIVE UNIT
¥	PRI	026014	040879	н	PM	80	0		1	1 0	J	#11 SAFETY INJECTION PUMP FAILED TO START IN AUTO	UNKNOWN CAUSE, EVENT COULD NOT BE REPEATED

×+×	PLANT	CONTROL	EVENT	SYSTEM		CAUSE	TYPE	A N U	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
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W	P 2 2	030733	031280	G P	M	813	2	1	N D	NO. 22 CHR PUMP MOTOR BKR KEPT TRIPPING	BREAKER FAILURE, BKR REPLACED
W	565	031631	061580	G P	H	813	5	1	N D	NO. 23 CHR PUMP STARTED AND SOON SHUTDOWN	ATR LEAKS IN SPEED CONTROL UNIT
w	PTI	016772*	030876	G P	M	018	R	5	N T	CHARGING PUMPS "B" AND "C" FAILED	BROKEN VARIORIVE BELTS - VARIBELT NO. 842
W	PIL	016709	123076	G P	M	119		1	NT	C CHRGNG PMP DOS DUE TO PLUNGER LEAKAGE	PACKING WEAR AJAX IRON WORKS TYPE T-125
W	PTI	027043	091279	G P	M	C16	8	1	U D	THE 1-P28 CHR PUMP FOUND TO HAVE CRACKED CYL BLOCK	PRESSURE SPIKING FOLLOWING HE SEPARATION
w	PTZ	0172484	022176	G P	H	A19	R	1	N T	ZPZC CHARGING PUMP TAKEN OUT OF SERVICE	REPAIR PLUNGER LEAKAGE
W	PTZ	0172488	022176	G P	M	018	R	1	N D	2P2B CHARGING PUMP FAILED	BROKEN VARIDRIVE BELT - VARIBELT NO. 842
w	PTZ	0161544	092076	G P	H	A19	R	1	N T	"C" CHARGING PUMP TAKEN DUT OF SERVICE	REPAIR MINDR PLUNGER LEAKAGE
W	PTZ	0151548	092076	G P	H	018	R	1	N D	"B" CHARGING PUMP FAILED	BROKEN VARIORIVE BELT - VARIBELT NO. 842
w	PTZ	0204614	022177	G p	M	A19	R	t	N T	2P2C CHARGING PUMP TAKEN OUT OF SERVICE	REPAIR PLUNGER LEAKAGE
W	PTZ	0204618	022177	G P	M	018	R	1	N D	2P28 CHARGING PUMP FAILED	BROKEN VARIDRIVE BELT - VARIBELT NO. 942
W	PTZ	0207130	040677	G P	M	C04	R	1	UT	CHR PUMP "C" DISCOVERED TO HAVE CYC BLOCK CRACK	PULSATIONS CAUSED CRACKING
w	PTZ	017722	042077	G P	M	000		1	NU	CHRGNG PMP UNABLE TO DELIVE SUFFCHT FLOW	NOT YET DETERMINED INVESTIGATIONS CONT
W	PTZ	017839	051677	G 0	M	821		1	N U	2P2B CHRGNG PMP OOS DUE FOR INSPECTION OF NOISY AR	BRAG FOUND SERVICEABLE
W	PTZ	0207138	022878	G P	M	C04	R	1	H F	CHR PUMP "8" DICCOVERED TO HAVE A CYL BLOCK CRACK	INSTILLEN OF PULSATION DAMPNERS PLANNED
w	PTZ	0207130	030178	G F	M	C04	R	1	H T	CHR PUMP "C" DISCOVERED TO HAVE A CYL BLOCK CRACK	INSTLLTN OF PULSATION DAMPNERS PLANNED
W	212	020974	031378	GF	м	018	R	1	N T	A CHRGING PMP OOS TO REPLACE BELT	BROKEN VARIDRIVE BELT
W	RG1	001037	061173	H 5	M	813	T	1	T D	SAFETY INJECTION PUMP IC FAILED TO START	REST OPERATOR ARM ON THE CELL SWITCH
w	PG1	010046	040574	14 6	M	813	T	1	T D	IC SAFETY INJECTION PUMP FAILED TO START MANUALLY	PREMATURE CLUSING OF CB TRIP BAR
	861	010664	080774	H 1	M	813	T	1	1 0	1C SAFETY INJ PUMP FAILED TO START ON BUS 16	MAY BE FAULTY LOCKOUT INTERLOCK
W	RG1	012136A	020575	н г	M	813	T	1	T D	1C SAFETY INJ PUMP FAILED TO START ON BUS 15	REP WEAK SPRING AND TIGHTENED WIRE IN CR
¥	261	0121368	020675	H 1	M	813	T	1	T 0	1C SAFETY INJ PUMP FAILED TO START ON BUS 16	REP WEAK SPRING AND TIGHTENED WIRE IN CB
W	861	012397	021875	н (	PH	813	T	1	T D	1C SAFETY INJ PUMP FAILED TO START ON BUS 16	MECH BINDING ON LOCKOUT SOLENDED PLUNGER
	RGI	015716	010377	H 1	M	813	T	1	T . D	1C SAFFTY INJ PUMP FAILED TO START ON BUS 14	WERK SPRING IN SECONDARY CONTACT ASSY
										"C" CHARGING PUMP VARIDRIVE FOUND SMOKING	BFL'S REPLACED - VARIDRIVE PART 84-2

zwe	P L A N	CONTROL	EVENT	SYSTEM	COMP	MODE	1466-	f A N	CTIVITY	MODE DESCRIPTION CAUSE DESCRIPTION
W	861	019244	062977	н	PM	813	T	1	T	IC SAFETY INJ PUMP FAILED TO START ON BUS 14 NO APPARENT CAUSE FOR CB FAILURE
¥	RGI	025064	010479	G	PM	416		1	N	"A" CHARGING PUMP FOUND LEAKING BLOCK REPLACED, HIGH HOOP STRESSES
W	2G1	025065	010479	G	PM	C18	R	1	N	*8 CHARGING PUMP SPEED CONTROL NOT OPERATING PROP VARIORIVE BELT SLIPPING AT LOW SPEEDS
W	802	000184*	070973	н	PM	802	U	2	U	SAFTY INJECTION PMPS "B"E"C" TRIPPO ON MANUAL STAR INSTANTING TRIP SETTINGS WERE SET AT MIN.
H	902	018139*	060777	G	PM	C11	٧	2	N	B & C CHGNG PUMPS RUNNING - PSZR LYL STILL FALLING PUMP AIR BOUND - TYPE TX-150
W	803	019345	062277	G	PM	C11	٧	1	N	"C" CHGNG PMP WOULD NOT CONTROL PSZR LEVEL PUMP WAS AIR BOUND - TYPE TX-150
W	505	0197934	112377	н	PM	U01	N	3	N	BREAKERS FOR ALL 3 SAFETY IN PMPS FOUND RAKD OUT FAILURE TO RECOG TS LIMIT FOR GT 200 F OP
٧	RU3	026063	041479	H	PM	800		1	T	"A" SI PUMP FAILED TO START CAJSE UNKNOWN
W	802	032732	081190	Н	PM	813	S	1	T	"A" SI PUMP BKR FAILED TO CLOSE HIGH RESISTANCE ALARM SWITCH CONTACT
W	541	017700A	050677	н	PM	001	U	2	R	BOTH SI PUMPS AND 1 CENTRIFUGAL CHG PMP TAGGED DUT PERSONNEL ERROR - NOT FOLLOWING PROCEDURE
. *	SAL	0177008	050677	G	PM	001	U	1	R	BOTH ST PUMPS AND 1 CENTRIFUGAL CHG PMP TAGGED DUT PERSONNEL ERROR - NOT FOLLOWING PROCEDURE
¥	SAI	023232A	112778	G	PM	813	T	1	N	NO 11 CHR PUMP FAILED TO START DURING ST BUS FAILURE DUE TO OUTPUT TRANSF FAILED
W	SAI	023006	112879	H	PM	814	R	1	N	SI PUMP FAILED, LOOSE LOCKNUTS FOUND, SHAFT BENT REVERSE ROTATION POSSIBLE CAUSE, #12 PUPP
W	Sni	030728	031880	G	PM	021		1	N	HIGH TEMP IND ON SOUTH CHR PUMP'S THRUST BEARING LODSE COUPLING CAUSED BEARING TO BE WIFED
W	SUL	002022	111072	G	PM	419		1	U	EXCESSVE SEAL LEAKAGE ON "A" CHARGING PUMP SEAL DAMAGED
W	5112	000519	111373	Н	PM	802	U	1	U	SAFETY INJ/CHG PUMP 2-CH-P-18 DID NOT START-MANUAL FUSES WERE NOT INSTALLED IN CONT CIRCUITS
W	TRI	0140678	012576	G	PM	813	T	1	T	B TRAIN CHARGING PUMP(ST) DID NOT START SEQ CONT RATED AT TOO HE AMPACETY
W	TRE	017572	030277	н	PM	813	T	i	N	ONE OF TWO SAFETY INJ PUMPS FAILED TO START IMPROPER ACTUATION OF DBA SEQ CONTACTS
W	151	018168A	052877	н	PM	813	T	1	T	B SAFETY INJ PUMP DID NOT START + AUTOMATIC SEQUENCER CONTACTS OPER WITH TOO LOW CRNT
. 4	IRI	018452	070177	G	PM	014		1	N	SOUTH CENTREGE CHRG PMP ROTOR FAILD DETAILD ANALYSIS UNDERWAY
	1113	000780	020574	н	PM	813	S	1	N	3A SAFETY INJ PUMP FAILED TO START INSUFFICIENT CHARGE ON BRKR CLSG SPRING
W	TU3	010136	050374	14	PM	011	U	1	N	SAFT INJ PMP STOPPO WHEN LOW RUN CURRNT/PRESS SEEN ATR LEAKAGE INTO PUMP CASING
	1113	014880	021976	G	PM	A16	R	1	N	WATER LEAKING FROM 3A CHARGNG PMP DURNG NORMAL OPS CRACK IN CASING BETWEEN VALVCHMBR/STUFN B
	TU3	016258	101576	G	PM	821		1	N	"38" CHRG PMP DOS DUE TO DAMAGE TO CONNECTING ROD INSUFCRIT LUBRICTN TO CONN ROD BEARINGS
W	TU3	021010	031578	G	PM	C11	R	1	M	"3A" CHRG PMP HAD CRACKD PMP CASING HI CYCLIC STRESSES

¥E N	PLANT	CONTROL	EVENT	SYSTEM	COMP	KOOK	1 4 6 -	FANIUL	CHIVITY		MODE DESCRIPTION	CAUSE DESCRIPTION
w 1	TU3	025775	030279	14	PM	C17		1	M	J 31	S SI PUMP FOUND TO BE RUBBING	CAUSE UNKNOWN, IMPELLERS MOVED
w (	1113	026562	070179	G	PH	A19		1	N	1 3	B CHARGING PUMP REMOVED FROM SERVICE	FAILED PRIMARY AND SECONDARY PACKING
W 1	1114	027105	081579	G	PH	419		1	N	T 4	A CHARGING PUMP REMOVED FROM SERVICE	SEAL FAILED
w 1	1114	027239	091179	G	PH	A19	R	1	N	T 4	CHARGING PUMP REMOVED FROM SERVICE	FAILED SEAL
W 1	Y R 1	016649	121676	Н	PM	A16		1	T	1 #	HPST PMP SHAFT HOUSING SEAL LEAKED	CUT IN GASKET BETWN HOUSNG/STUFFNG BOX
W 2	711	000317	091073	G	PM	813	5	1	N	T T	HE 18 CHARGING PUMP WAS INOPERABLE-DID NOT START	FFEDER BRKR BRUSHHOLDER MISSING-VIBRATION

APPENDIX D
ONE-LINE DATA SUMMARIES

# APPENDIX D ONE-LINE DATA SUMMARIES

This appendix gives a listing of one-line summaries of all the LERs considered in this report. They are ordered by vendor, plant, and date. Following this, a second listing is given, of one-line summaries of the common cause events.

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Zm<	PLANT	CONTROL	EVENT		COMP	MODE	TYPE	FANDE	T C L AS	MODE DESCRIPTION	CAUSE DESCRIPTION
8 /	191	013015	070775	G	PM	801	c	1	N D	P36C M/U PUMP STARTED AND IMMED TRIPPED, PUMP FREN RAN	WITH NO SUCTION, INCORRECT VLV LINE-UP
8 /	RI	015609	081676	K	PH	A19	R	1	N D	"D" RCP SEAL FAILED CREATING 25 GPM RCS LEAK CAJS	E OF SEAL FAILURE UNKN, OTHE FAILES OC
B /	ARI	016195	100376	G	PH	008		1	N T	P368 STOPPED DUE TO OVR-CURRENT AND LOSS OF PRESS EXCE	SSIVE INTERNAL COMPONENT WEAR
8 /	491	020529	120377	К	PM	119	R	1	N T	"C" RCP DUTER SEAL FAILED CREATING 5-6 GPM LEAK ASSU	MED NATURAL END-OF-LIFE SEAL FAILURE
8 /	ARI	025244	061679	A	PH	DOZ		1	N D	EMERGENCY FEED WATER PUMP PTB DEVELOPED A HOT BEAR FAUL	TY INSTALLATION DURING PREV MAINTEN.
8	ARI	026491	062179	В	PT	801	U	1	N D	EFW PUMP PTA KEPT TRIPPING ON OVERSPEED WATE	R IN STEAM LINES DUE TO TRAPS ISOLATE
8	121	027885	120679	В	PT	C13		1	TT	EFW PUMP PTA DID NOT DEVELOPE PROPER DELTA PRESS. LOTS	E LOCK NUT ON SPEED GOVENOR
В	ARI	031027	051080	K	PM	A19	R	1	N U	RCP "C" SEAL FAILED REPL	ACED SEAL
8	ARI	031606	062480	B	PT	000		1	N U	STEAM DRIVEN EFP STARTED THEN TRIPPED ON OVERSPEED SPUR	EQUS-CAUSE UNKNOWN
8	AR1	031817	070680	8	PT	002		1	T D	EMERGENCY FEEDWATER PUMP TRIPPED ON OVERSPEED AROK	EN STUD BOLTS ON GOV STEAM VALVE
8 (	CR3	017323	030177	В	PT	804	R	1	N D	EFWP TRIPPO ON OVERSPEED WHILE START ON MAIN STEAM SLIW	GOVAR RESPONSE ON REMOTE START
8 (	CR3	017657	041677	8	PT	804	R	1	T D	EFWP TRIPPO WHILE ATTEMPTH TO START ON MAIN STEAM NEW	GOVNE SLOW RESPONSE WITH MAIN STEAM
8	CR3	017938*	052977	1	PM	800	٧	2	N U	CHEM ADD PMPS 3A 6 38 FOUND INOP FOR PLANT S/U CAUS	E UNKN, PUMPS FLUSHED, RIND TO SERV
8	CR3	019288	060277	В	PT	804	r	1	T D	EFP-2 OVERSPEED TRIP ON INITIAL START WATE	R IN STEAM SUPPLY PRENTO THROTE CLESN
8 (	CR3	018245	061677	8	PT	021	R	1	NU	STM DRIVEN EFWP (EFP-2) IN RECIRC MODE, WAS SID FAIL	URE OF THE OUTBOARD PUMP BEARING
8	CR3	018400*	070977	1	PM	C11	٧	2	N D	DISCOVO CHEM ADD PMPS 34 6 38 INOP, PLANT AT POWER PUMP	BELIEVED AIRBOUND, VENT VLV INSTALED
8	CP3	018564	071777	8	PT	804	T	1	N D	EFP-2 OVERSPEED TRIP ON AUTOSTART MODI	FIED DRAIN SYS. EBYPASS AROUND IN. VLV
8	CR3	019803	112277	B	PT	021	R	1	N D	STM DRIVEN EFWP (EFP-Z) TRPD AFTR RNNG APPX 10 414 1490	OTBD BRNG FLR, ERRNEOUS SITEGLS LEVEL
8	CR3	021167	042578	R	PM	C15		1	M 0	LOW FLOW EXISTED ON DECAY HEAT REMOVAL PHMP 1-A PUMP	SHAFT SHEARED, BEING EVALUATED
B	CR3	022309*	080278	I	PM	C11	٧	2	T 0	CHEM ADD PUMPS FAILED TO DEVELOP DISCHARGE PRESS. CAPI	A AND 18 BECAME AIRBOUND
8	CR3	025927	042379	ī	PM	coo	R	1	NU	CHEMICAL ADD PUMP FAILED TO PUMP (CAP-18) CAUS	E UNKNOWN
В	081	019374	091777	G	PM	A19		1	N D	MAKEUP PUMP 1-2 HAD OIL LEAK ON OTBD BRNG END PLT 0-21	NG ON FNO PLATE DID NOT FORM ADEQ SL
8 1	DAI	019426	101677	8	PT	004	8	1	T 0	GOVNE CLOSED ON AFP 1-2 VIBE	ATION CAUSING GOVNE TO CLOSE-DESIGN
8	081	017531	110877	B	PT	804	В	1	N D	GOVNE VALVE CLOSED DUE TO SURGING VIBRATIONS NO F	ORCE TO HOLD GOVER OPENMOD. REQUISTO
8	081	019712*	112977	K	PM	013	0	4	N 0	ALL 4 RCP'S TRIPPO DUE TO LOSS OF 13.8 KV POWER REAC	TOR/TURBINE TRIP OCCURED AT 2243 HOUR

1 Zm×	PLANT	CONTROL	EVENT	SYSTEM -	COTA	MODE	TYPE	FANUM	A CTIVITY	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
В	DAI	019940	121177	8	PT	813	R	1	1 1	D	CONTROL OF AFP TURBINE LOST CONTROL AFPT 1-1	METHANICAL BINDING OF GOVER
В	081	020218	122377	8	PT	C04	1	1	1 (	0	AFPT 1-2 SPEED CONTROL LOSTIWILL MODIFY RELAYS	FATLO RELAYS IN CONTROL CKT. MODIFIED DSN
8	081	020271	010678	8	PT	C 04	Ţ	1	N I	0	AFPT 1-1 LOSS OF SPEED CONTROL; RELAY FAILURES	SPEED CONT. CKT. MODIFIEDUPGRADED RELAY
8	081	020274*	011278	F	PM	U01	N	2	N I	D	BOTH CONT SPRAY PMPS INOPERABLE R/X IN MODE 4	PUMP CKT.8KRS. RE-ENERGIZED
8	DBI	020277	011678	R	PH	813	1	1	1	T	DECAY HEAT PMP 1-1; FUSES IN BKR. START CKT.	PRIN FUSE CONTACT IN CKT
8	081	021570	052878	R	PH	001	T	1	N I	D	POWER LOST TO DECAY HEAT PUMP 1-2.0H FLOW LOST	PERSONNEL TRIPPED PS BUSSES TO PUMP ACCI.
8	081	021859*	061578	P	PM	DOZ	T	2	N	D	POWER SUPPLY LOST 3 TIMES TO DECAY HEAT PUMP	2 PERSONNEL ERRORS
8	081	021853	061678	G	PM	012		1	1	T	HORIZONTAL VIBRATION ON HPCI PUMP 1-1	PUMP WAS MISALIGNED DUE TO LOOSE MOUNTS
8	081	021855	061878	F	PM	813	S	1	1	T	CONTAINMENT SPRAY PUMP FAILED TO START AUTOMATIC.	SFAS OUTPUT MODULE CAUSED FAILURE
8	081	021959	071078	J	PH	021		1	T	1	COMP COOLING WATER PUMP 1-1 HAD EXCESS. MIBRATION	FAILED AND IMP. CLEARANCES ON BEARINGS
8	081	055930	091578	J	PM	001	U	1	N	0	COMP. COOLING WATER PUMP 2 TRIPPED	PERSONNEL DID NOT REOPEN HX DUTLET VALVE
В	081	025525A	010379	G	PM	C 0 4	U	1	T	0	HPI PUMP 1-1 FAILED TO DEVELOP SUFFICIANT RECIRC	HEAT TRACE UNABLE TO MAIN LINE ABOVE FREZ
8	081	0255258	010379	G	24	U04	U	1	7 1	D	HPI PUMP 1-2 MAY NOT HAVE HAD SUFF. RECIRC	HEAT TRACE UNABLE TO MAIN LINE ABOVE FREZ
8	081	025139	011579	K	PM	801	U	1	N	0	RCP 1-2-2 STARTED WITH INCORRECT BKR ALIGNMENT	PERSONNEL ERROR
9	DB1	025526	022879	K	PM	DOS	5	1	N.	D	PCP 1-1-2 TRIPPED. DUE TO LOW COMP COOL HEO FLOW	PERSONNEL MAINTENANCE LOOSENED WRONG CEVE
8	DRI	025603	032979	G	PM	(09		1	N	0	MAKE UP PUMP 1-1 DEVELOPED VIB AND DECRE PERFORM.	FOREIGN DEBRIS FAILED WEARING RING
8	DBI	027335*	101579	K	PM	D13	0	4	N	U	LOSS OF OFFSITE POWER CAUSED LOSS OF ALL 4 RCPS	LOSS OF OFFSITE POWER-OUTPUT BRKE FAULT
		027420							T		AUX FEED PUMP TURBINE BEARING HAD NO LUB DIL	LOSSE SIGHT GLASS
		027421							N		RCP 1-1-1 SECURED DUE TO BAD SEALS	THERMAL SHOCK
- 1		027422	102579								RCP 2-2 TRIPPED	BLOWN FUSE IN INTERLOCK CONTROL CIRCUIT
		027857						1			DHR PUMP 1 FAILED TO START	FAULTY SWITCH
		027859				10.00				-	HPI PUMP 1-1 FAILED TO START	FACTORY DEFECT IN CONTROL CIRCUIT WIRING
		027867						1	N		RCP 1-2 TRIPPED DUE TO LOW DIL LEVEL ALARM	NO CAUSE GIVEN
		027918						10			COMPONENT COOLING WATER PUMP #1 FAILED TO START	FAILED BREAKER ACLIS ON BUS CL
8	081	030051	010380	B	PT	C13	8	1	1	1	AUX FEED PUMP DECLARED INOPERABLE (NO. 1-1)	BURR ON HIGH SPEED STOP PIN, MISADJ CLUTCH

>#21	PLANT	CONTROL	EVENT	SYSTEM	COMP	MODE	TYPE	FAIL	- MCZ	T C L A S S -	MODE DESCRIPTION	CAUSE DESCRIPTION
8	081	030928	040680	F	PM	U02		1		N D	OIL SIGHT GLASS FOR CONT SPRAY PUMP 1-2 BROKE	BROKEN BY CONTRUCTION PERSONNEL
8	081	031610	062380	G	PH	U01	C	1		0 10	HPT PUMP 1-1 SEARING THERMOCOUPLE WELLS BROKEN	ASSUMED TO BE STEPPED ON
В	091	032122	081380	R	PM	DOZ	S	1	1	N D	DH PUMP 1-2 WAS STOPPED WHEN SUCTION VLV CLOSED	MAINTENANCE FAILED TO DEFEAT INTERLOCK
8	0E 1	0148064	012876	t	PM	802	U	1		1 0	LOW PRESS INJECTION PUMP IA - INOPERABLE	INCORRECT SUBSTITUTE BREAKER INSTALLED
8	OFI	0148058	012876	F	PM	802	U	1		T D	REACTOR BUILDING SPRAY PUMP - INOPERABLE (14)	INCORRECT SUBSTITUTE BREAKER INSTALLED
В	DEI	0148060	012876	G	PM	802	U	1		1 0	HIGH PRESSURE INJECTION PUMP - INOPERABLE (1A)	INCORRECT SUBSTITUTE BREAKER INSTALLED
8	OEL	025915	041979	F	PM	405		1		T D	18 RB SPRAY PUMP FOUND LEAKING AROUAD VENT LINE	PLUG WAS SUPPOSED TO BE IN LOCATION OF VE
8	OFI	031186	050980	8	PŢ	009		1		1 1	EFW PUMP DECLARED INDP DUE TO NOISE FROM BEARING	BEARING FAILED DUE TO WATER IN OIL
8	OF1	031669	061880	Ĭ	PM	C14		1	-	N T	BORIC ACID TRANSFER PUMP DECLARED INOP	FATLED MOTOR, DIAPHRAN & VACUUM COMP VLV
8	DES	000577	111273	L	PM	801	U	1		T D	LOW PRESSURE INJECTION PUMP 28 FAILED TO START	BREAKER NOT RACKED IN PROPERLY
В	DES	000638	012274	K	PH	019	1	Ä	- 1	N U	REAC COOLNT PMP RCP282 FAILD CAUSE NOT YET DETRMND	DISASMBLY SHOWD 1 CAPSCREW , SPIROL MISSNG
8	0ES	011071A	120974	L	PM	U08	S	1		T D	COMMON SUCTION VALVE FOR 1 LPCI AND 1 CONT SPRAY P	UMP FAILED TO OPEN - OPEN CKT IN 1 PHASE
В	DES	0110713	120974	F	PM	008	5	1	+	1 0	COMMON SUCTION VALVE FOR 1 LPCI AND 1 CONT SPRAY P	UMP FAILED TO OPEN - OPEN CKT IN 1 PHASE
В	UE S	031916	071380	G	PM	021		1		N T	28 HPI PUMP REMOVED FROM SERVICE	BAD BEARING CAUSE NOT STATED
8	DE 2	033125	072690	G	PM	018	R	1	. 1	N U	28 HPI PUMP DECLARED INDPERABLE, DEVELOPED HOT SEAR	UPWARD PRESSURE OF MOTOR AGAINST UP BE AR.
В	OF2	032153	073080	I	PM	C00	) R	1		N U	BORIC ACID TRANSFER PUMP DECLARED INOPERABLE	CAJSE NOT STATED
В	DES	032311	080580	1	PM	C09	T	1		N T	BURIC ACID XFER PUMP UNABLE TO PUMP DOWN LOST	STRAINER WAS BLOCK
В	DE 2	032430	082280	I	PM	014		1		N T	CON BORIC ACID STORAGE TANK PUMP DECLARED INOPER.	WORM WORM GEAR, BAD GASKET, 6 TORN OIL SEAL
8	DES	0327764	092880	I	PM	000	)	1		NU	CHAST PUMP FAILED TO PUMP FROM CHAST TO LOST	LOW OIL LEVEL IN PUMP, CAUSE NOT GIVEN
8	DES	0327768	093080	Ī	PM	801	5	1		N D	CHAST PUMP DECLARED INOPERABLE	COUNTER NOT RESET
8	DE 3	012877	043075	8	PT	802	2	1		1 0	EMERGENCY FEED PMP INOPRBL DUE TO TIGHT PACKING GLM	PERSONL DID NOT VERIFY OPROLTY AFTR MNINC
8	DF3	019484	090177	F	PM	004				T D	EXCESV NOIS DURNG VIBRTH TST OF 38 R/X BLDNG SPRAY	
8	OE3	023435	122078	F	PH	014	•	1		1 1	REACTOR BUILDING SPRAY PUMP DECLARED INDPERABLE	HIGH VIBRATION DUE TO LOOSE IMPELLER
8	DE3	028046	040479	F	PH	DOZ	2	1		T D	OIL DISCOVERED LEAKING FROM PUMP CASING. PUMP SEC.	REARING CAP INSTALLED INCORRECTLY
8	851	011151	103074	8	PM	801	C	1		N D	AUX PMP SEAL RINGS FROZN TO BUSHNGS AND BSHY TO 54	OPERATE FAILD TO OPEN SUCTN VALV TO FEED

7	PLANT	CONTROL	EVENT	SYSTEM	1	M D D E	TYPE	MCZ.	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
	8 851	013184	051975	B P	M	013	S	1	TT	MOTOR FOR AUX FEED PUMP P-318 TRIPPED OFF LINE	LOGSE LOCKNUT ON OVERCURRENT DELAY RELAY
-	851	014502	032376	G P	М	000		1	N U	HPCI P238A TRIPPO OFF LINE WHEN AT 100% POWER	NO CAUSE COULD BE FOUND THRU TESTING
1	851	016012	082276	R P	M	A19	R	1	TT	EXCESS LEAKAGE ON B PMP OF DECAY HEAT DURNG SEVENC	LEAK CAUSO BY STUFFING BOX GASKET
1	8 RS1	016711	112376	F P	M	801	IJ	1	T D	RX BLOG SPRAY PUNP FAILED TO START	BRER WAS NOT RACKED IN CORRECTLY
	951	017233	021877	8 6	1	003	5	1	N D	STEAM DRIVE TO AUX FEED P318 TRIPPD P319 DOS	OPERATE FAILD TO RESET TREP WHEN P318 1ST
-	8 RS1	021744	062278	R P	М	A19	R	1	N T	B DHR PUMP SEAL FOUND LEAKING	LEAKING SEAL REPLACED
	8 RS1	026886	071979	LP	М	A19	R	1	TT	DHR PUMP 'B' LEAKED IN EXCESS OF TECH SPEC	FATLED SEAL, SEAL REPLACED
-	8 R S 1	030263	011780	P P	M	119		1	N T	LEAKAGE OBSERVED FROM "A" DHR PUMP SEAL	SEAL WAS REPLACED
-	RSI	031779	071280	8 P	T	800		1	T U	AUX FEED PUMP P-318 FAILED TO START	CAUSE UNKNOWN
-	3 111	011016	101074	G F	M	802	S	1	T D	MAKEUP PUMP 14 TRIPPED ON MANUAL ACTUATION	WRONG LUG USED TO CON'N FOR CBL TO MTR WOG
1	TII	011015	101774	G P	M	813	5	1	T 0	MAKEUP PUMP IC FAILED TO START - AUTOMATIC	WESTINGHSE ACB HAD DISLED TRIP LTCH SPRNG
-	111 E	012103	010375	G P	M	B13	5	1	T 0	HIGH PRESS INJ PUMP MU-PIC FAILED TO START	LOSSE TERMINATION ON BRKR RELEASE
1	3 111	014220	021776	G P	M	B06	C	1	1 0	"A" MAKEUP/PURIF PMP STARTED WITH IMPROPR VALV L/U	PMP FAILURE DUE TO INAD PROCEDRES/PERSCNL
	B T T 1	020997*	031878	G	M	013	U	2	T D	THE 14 & 10 MAKEUP PMPS TRIPPED ON XFER TO SITE PR	MALFUNC TIME DELAY RELAY IN LOW L.O. CKT
	B TII	025503	021779	GF	M	018		1	1 1	HPI PUMP MU-P-IC TRIPPED ON OVERLOAD	FATLED LEAD INSIDE PUMP MOTOR
	C ARZ	026488	071979	8 6	1	804	T	1	N D	EFW PUMP 2P7A TREPPED ON OVERSPEED	MOISTURE IN STEAM LINE, NO TRAPS INSTALLED
- 1	CARZ	*26913	081879	9 1	T	B13	R	1	N T	EFW PUMP 2P7A TRIPPED ON OVERSPEED	STECKING LINKAGE ON GOVENOR
-	C ARZ	027125	092379	8 6	7	B04	Ŧ	1	N T	EFW PUMP 2P7A TRIPPED ON OVERSPEED, MOISTURE IN SL	TRAPS NOT REMOVING MOISTURE IN STEAM LINE
	CARZ	028076	123079	3 1	T	804	T	1	N T	EFW PUMP ZP7A TRIPPED ON OVERSPEED	STEAM TRAP ISOLATED, MOISTURE IN STEAM LIN
1	C AR2	0310234	040780	8 5	M	C11	U	1	N D	BOTH TRAINS OF EFW PUMPS CAVITATED AFTER LOSS OF .	FORCED FLOW STOPPED IN FW SYS OH WATER
- 14	C ARZ	0310238	040790	B (	PT	C11	U	1	N D	BOTH TRAINS OF EFW PUMPS CAVITATED AFTER LOSS OF P	FORCED FLOW STOPPED IN FW SYS OH WATER
	C ARZ	031376	050680	8 6	PT	013	R	1	T T	EMERGENCY FEED PUMP KEPT TRIPPING ON OVERSPEED	MISADJUSTMENTS ON GOVENOR
	CARZ	031381	052080	R (	7	000	R	1	N U	EMERGENCY FEEDWATER PUMP TRIPPED ON OVERSPEED. 2P74	UNKNOWN CAUSE
	C ARZ	031671	061090	8 1	PT	cos	5	1	N D	EMER FW PUMP 2P7A WOULD NOT EXCEED 1000 RPM	INCORRECT WIRING ON RAMP GEN AN EGM GOV.
	C ARZ	031674	062780	3 1	b I	000	R	1	NU	EMERGENCY FEEDWATER PUMP TRIPPED ON OVERSPEED	UNKNOWN CAUSE, PUMP NO. 2P7A

				5						A C T		
v	L			ST	C	M A	T	F	N	VL		
E N	N T	CONTROL	EVENT	É M	70	D S	E	Ī	UM	† §	MODE DESCRIPTION	CAUSE DESCRIPTION
c	ARZ	0320944	071780	3	PT	004	R	1		T D	EMERGENCY FEEDWATER PUMP 2074 TRIPPED ON OVERSPEED	BELIEVED TO BE DESIGN RELATED
c	ARZ	0320948	080480	3	PT	004	R	1		U T	EMERGENCY FEED PUMP 2P74 TRIPPED ON OVERSPEED	EACTEVED TO BE DESIGN RELATED
c	AR2	0320940	082980	8	PŢ	004	R	1		u T	EMERGENCY FEED PUMP 2P7A TRIPPED ON OVERSPEED	BELIEVED TO BE DESIGN RELATED
c	CCI	011272	112574	F	PM	C07		1		t t	DURING TEST, CONTAIN SPRAY PMP #11 TOH OOS LOW	NORMAL WEAR OF PUMP INTERNALS
C	ccı	012449	021675	J	PM	813	S	1		T D	NO 11 CCW FAILD TO START UPON SIS SIGNAL	RELAY IN ESFAS BURNED CONTACTS
C	ccı	013189	080175	G	PM	A19	R	1		UU	#13 CHARGING PUMP RELEASED GAS ACT TO AUX BLOG	PLUNGER PKG LKG (UTEX INDUS. PARTS SF194)
C	ccı	013277	081075	K	PM	A19		1		N U	118 RX COOLANT PUMP DEVELOPED 2.7 GPM LEAK	BOTH UPPER AND MEDDLE MECH SEALS FAILED
C	CCI	013389	091175	G	PM	A19	R	1		UU	#13 CHG PUMP RELEASED GAS ACT FROM UA-1 MAIN VENT	PLUNGER PACKING LEAKED EXCESSIVELY
c	CCI	014754	050476	G	PH	000	S	1		N U	#13 CHARGN PUMP TRIPPD DUE TO BREAKER OPENING	CAUSE FOR OPENING OF BKR. UNKNOWN
C	ccı	014753	050576	В	PT	005		- 1	ı	N D	#12 AUX FO PMP S/D FOR REPAIR OF THTL TRIP LATCH	TAPPET NUT INCORRECTLY SIZED PER PLANS
C	CCI	015223	062176	F	PM	U12	R	1		N T	NO 12 CONTAINMENT SPRAY PUMP WAS TAKEN OUT OF SERV	REPAIR SMALL LEAK IN SEAL WER PIPE NIPPLE
0	CCI	018287	062277	F	PH	U12	R	1	ı	N T	NO 12 CONTAINMENT SPRAY PUMP WAS TAKEN OUT OF SERV	LEAKING SEAL WIR COOLER CASING FITTINGS
C	CCI	019485	072977	G	PM	A19	R	- 1	i :	N T	#12 CHARGING PUMP REMOVED FROM SERVICE	REPAIR SLOWLY INCREASING PACKING LEAK
0	CCI	019688	111377	G	PH	A19	R	. 1	1	N T	#12 CHG PUMP S/D AND ISOLATED	EXCESSIVE PACKING LEAKAGE, PACKING FAILED
	CCI	020358	012378	R	PH	C13	5	. 1	ı	N D	#12 LPSI COULDN'T BE TRIPPO FROM CONTROL RM	MISSING SCREW IN TRIP ACT. LEVER ON BREKR
(	CCI	023310	110378	В	PT	813	3		1	1 0	11 AUX FEED PUMP DECLARED INOPERABLE	THROTTLE VALVE STUCK SHUT AFTER TEST TRIP
(	cci	026235	050779	R	PH	003	3 U		1	N D	#11 LPSI PUMP WAS STOPPED WHILE IN RHR MODE	SPUPIOUS RECIRC ACT SIG BY PERSONNEL TEST
(	CCI	0267184	080679	G	PH	013	3 5		1	N T	#12 CHARGING PUMP TRIPPED ON LOW SUCITON PRESSURE	FAULTY PRESSURE INDICATING SWITCH
	001	0267188	080679	G	PN	A19	,		1	N T	#11 CHARGING PUMP ISOLATED DUE TO LEAK	PACKING FAILED
(	cca	017049	012177	G	P	C14			1	N T	FLOW FROM #21 CHG PMP DECREASED TO ABOUT 39 GPM	INVEST REVEALED TWO DISCH VLVS BROKEN
(	cca	017456	031477	В	PI	Ule	5 5		1	UU	#21 AUX FEED PUMP REMOVED FROM SERVICE	REPAIR LEAK ON SERVICE WATER SUPPLY LINE
(	c cc	017692	111477	8	PI	BO	9		1	N T	21 AFW LOW PRESS BRNG TEMP ALARM WIR IN CASING	RUST FROM TURBINE CASING CAUSD FAILURE
-	c cc	2 017691	111677	В	PI	01	3		1	N U	#21 AFW PLACED DOS BINDING GOVERNOR CONTROL KNOW	BENT PIN ON MAN. SPEED SETTING KNOB
-	c cc	2 021059	070478	K	P	1 41	6 R	1	1	N T	CRACKED WELD DISCOVERED ON 218 REACTOR COOLENT PUM	CAUSE OF WELD CRACK IS UNKNOWN
	c cc	2 021844	071478	K	P	00	2 8	1	1	N D	RCP SEAL COOLING HEAT EXCHANGER WELD FAILED	PREVIOUS WELD REPAIR WAS INADEQUATE

	YE 2		CONTROL	EVENT	SYSTEM	COER	MODE		FANULH	CHINA	MODE DESCRIPTION	CAUSE DESCRIPTION
	c cc	2 (	**00550	092478	R	PM	013	U	2	N T	BOTH LPSI PUMPS TRIPPED BY RAS SIGNAL	LEVEL INDICATOR FOUND TO BE OUT OF CAL.
- 1	0 00	2	022646*	101778	R	PH	C06	U	2	N D	BOTH 21 AND 22 LPSI PUMPS LOST SUCTION	ATR LEAKED FROM PURIFICATION SYS TO SOC
9	0 00	5.5	023173*	121278	G	PM	419		2	N T	21 AND 22 CHARGING PUMPS HAD EX PRI PACKING LEASS	PACKINGS REACHED EDL SIMULTANEOUSLY
1	0 0	2 (	025190	012779	8	PT	813	R	1	TT	THROTTLE VLV FOR #22 AUX FEED PUMP WOULD NOT RESET	ACRE THREAD OF TRAVELING NUT DISENGAGED
	c cc	2 (	027373	102779	н	PM	019		1	N T	HPSI PUMP "A" FAILED, REQUIRING SECURING THE PUMP	MECHANICAL SEALS FAILED ON #22 HPCI PUMP
	0 00	:2 1	0306784	022580	t	PM	000		1	UU	LPSI PUMP 21 TAKEN OUT OF SERVICE FOR CORR. MAINT.	CAUSE NOT GIVEN
	c c	2	0306788	022580	F	PM	002		1	UU	CONT SPR PUMP 21 TAKEN DOS BY MISTAKE	MISUNDERSTANDING, SHO HAVE BEEN LPSI 21
	C F	1 1	000479	101073	В	PŢ	813	5	1	T D	AFPT FW-10 FAILD TO START DURING TEST	BACKPRESSURE TREP DEVICE MALFUNCTIONED
1	C FC	1	000613	112073	J	PM	U04	R	2	UT	COMPONENT COOLING WATER IMPELLER CRACKING	CAST BRON IMPELLERS CHANGED TO BRONZE
	C F	1 (	012513	040375	G	PH	809	5	1	T. 7	CHARGING PUMP CH-1C FAILD TO START	DIRTY TIMING RELAY CONTACTS
. 1	C F	1	013525	092075	K	PM	A 00		1	N U	REACTOR COOLANT PUMP VAPOR SEALS LEAKED	CAUSE MOT GIVEN
	0,10	1	025844	042079	F	PM	801	U	1	T D	CONTAINMENT SPRAY PUMP FAILED TO START (SI-39)	SUPPLY BREAKER BOUND DUE TO PERSONNEL FR.
į	C FC	1	031635*	051680	K	PM	416		3	TT	RCP'S 34.8.6C FOUND LEAKING BETWEEN CASING & COVER	CORROSION TO STUDS & DETERTORATED GASKETS
	C FC	1	032766	092680	G	PH	019	5	1	N T	"A" CHARGING PUMP BECAME INGPERABLE	PACKING COOLING WATER PUMP FAILED
1	C M1	12	014602	050276	G	PM	C19		1	T T	"A"CHARGING PUMP NO FLOW ON AUTOMATIC START	GROSS PACKING LEAKS
	C #1	12	017374	121276	G	PM	000		1	NU	"C" CHARGING PMP TAGGD OUT DUE TO EXCESSIVE NOISE	UNKNOWN
	C MI	12 (	018735	070377	В	PH	009	R	-1	N F	HEO IN "B" AUX FEED THRUST BRNG GIL DAMAGO BRNG	HES ENTERED BRNG ALONG PURP SHAFT
	C MI	2	019738	071277	В	PŢ	C13		1	1.1	STE DRIVEN AUX FO PMP FAILED TO TRES ON OVERSPEED	HARGENED GREASE IN TRIP/THTL MLV
	C H1	12	021915	06197#	B	PF	C02	S	1	T 0	AUX FEED PUMP HOULD NOT GO ABOVE MIN 1400 RP	HAND SW. ON CONTROL BOARD MISALIGNED
	C M	12	025576	031479	R	PM	611	U	1	N D	LPST PUMP LOST SUCTION DURING SED COULING	PUMP SECAME AIRBOUND
	C M1	12	026283	061479	8	p 44	909	R	1	N T	AUX FEED PUMP BECAME INOP DUE TO FAILED BEARING	CONTAININATION OF OIL BY WATER
- 1	C MI	12	030387	011830	£	27	003		1	T D	AUX FEED PUMP BECAME INOP DUE TO BEAGING FAILURES	PREVIOUS TEST WITH PUMP UNCOUPLED
	C M	12	030796	031080	C	24	119		1	T	CHAPGING PUMP PLACED OUT OF SERVICE	PACKING FAILED NATURAL END OF LIFE
	C M	12	030799	032180	8	PH	A19		1	2.5	AUX FEED PUMP LEAK EXCESSIVELY FROM GLAND PACKING	PACKING FAILED, NATURAL END OF LIFE
	K M1	12	231945	070390	н	PH	004	C	1	T D	'A' HPCI PUMP SEIZED	PROCEDURE DID NOT REQUERE MIN FLOW VLV OF

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zme	PLANT	CONTROL	EVENT	COMP	# OC# 1	CAUSE	TYPE	A NU	TANS!	MODE DESCRIPTION	CAUSE DESCRIPTION
C	MIZ	331946	071290	8 P	T O	107		1	1 5	AUX FEED PUMP TRIPPED PRIOR TO OVERSPEED SETPOINT	WEAR TO EMERGENCY TAPPET NUT
C	MYI	002322	120272	14 P	H 8	102	U	1	T 0	MPSI P-145 SUPPLIED BY "A" DG DID NOT START	GROUNDING BLOCK NOT REMOVED FROM CKT BKR
c	MYI	021039	030278	G P	H 0	200		1	1 1	IA CHARGING PMP STARTD FOR VIBRATH TESTHI TEMP.	LOCKH PIN NOT INSTILLO TO BEARING
C	MYI	027208	091879	F P	H C	:03	U	1	T D	*B" TRAIN CONTAINMENT SPRAY PUMP DIS PRESS DROPPED	SUCTION VALVE WAS CLOSED
c	M71	027289	100379	F P	M 8	113	S	1	TT	"A" TRAIN CONTAINMENT SPRAY PUMP FAILED TO START	CONTACT BLOCK IN PUMP BER FAIL TO MADE UP
0	MYI	030992	040890	8 9	H D	000		1	T U	AUX FEED PUMP P-25A REQUIRED TO BE SHUTDOWN	OIL FROM BEARING, COULD NOT BE DUPLICATED
0	PAI	002049	040272	8 P	H (	21		1	N T	FLOW FROM MTR DRYN AUX FO PUMP P-BA 50 PRCT OF 408	HYDROSTATIC BEARING FAILED - NO PECINC
0	PAI	000202	072773	J P	M .	115		1	0 0	COMPNT COOLING PMP PSZC COUPLING FAILED	TEETH ON HUB STRIPPED
0	PAI	010659	071174	14 P	M (	:04		1	T D	HPSI PAGA TESTED UNSAT SHUTOFF HEAD NOT DEVELOPD	6TH STAGE IMPELLOR MOVED ON SHAFT
0	PAI	013008	070975	E P	H (	:01	U	1	1 0	LPST PUMP 678 NO FLOW, NO PRESSURE	TWO VALVES NOT IN CORRECT POSITION
- (	PA1	013820	112275	L P	M /	404		1	N D	LPSI PMP SEAL LEAKG PMP TYPE 8X21 AL, SER A-57393	IMPRPR ORING CLEARANCE
(	PAI	014719	042176	G P	M E	809		1	TT	CHARGING PUMP P55-A WOULD NOT START PROPERLY	PLUGGED DIL FILTER
(	PAI	015311	072076	J P	M T	020		1	N U	CCW PMP P52-C INBORD BRNG FAILD SHAFT METALLIZED	EITHER HOT END ALIGNNE OR BRNG SLIPPAGE
(	PAL	021117	041778	G F	M F	813	5	1	N D	CHARGING PUMP P-558 WOULD NOT START	FAULTY CONTROL COIL IN CIRCUIT BREAKER
1	PAI	022913	103178	G F	M	419		1	N T	CHR PUMP P-55C TAKEN OUT OF SERVICE	LEAKING SEALS
(	PAI	025614	020179	K 1	PM (	000	s	1	N U	PRIMARY COOLANT PUMP INADVERTANTLY STOPPED	CAUSE NOT GIVEN
(	SLI	016880	120876	B 1	T	313	S	1	U D	STEAM DRIVEN AUX FEED PUMP WOULD NOT START	TRIP SOLENDED LATCH FAILED TO ENGAGE
(	SLI	017394A	022077	G	M	000	R	1	N U	8 CHG PMP SEAL LUBE WIR PMP FAILED DURING R/X S/U	MODEL SOLL, TYPE 102, STYLE CZOOV
	SEI	0173948	022077	G	PH I	00	ă,	1	N U	A CHG PMP SEAL LUBE WTR PMP FAILED DURING R/X S/U	MODEL SOLL TYPE 102 PARTERS 15157
- 1	SLI	017393	022677	G F	PM	rjiv		1	N U	DURING POWER OPS, A CHRONG PMP SEAL LUBE WIR FAILED	FAILD TO DELIVER SUFFICIENT FLOW
	SLI	017833*	041577	K 1	PH			4	N D	LOSS OF SEAL CLNG WIR TO RCPS - RCPS WERE SECURED	CONTAINMENT INST AIR SYSTEM FAILED
-	SL	017935*	051677	K 1	M	150	N.	4	N D	LOST ALL FOUR REACTOR COOLANT PUMPS	LOSS OF OFF-SITE POWER
-	SLI	019503	081177	8	PT	800	8	1	1 0	C STEAM-DRIVEN AUX FEED PMP FAILD TO START	STARTED ON 2ND TRY . PREVIOUS FAILR RPORTO
-	SL	023658	090278	G	PH	A16	R	1	H T	CHR PUMP 14 FOUND TO HAVE SMALL CRACK IN BLOCK	CAJSE OF CRACK IS UNKNOWN
	SL	022649	100278	G	PM	813	S	1	N D	18 CHARGING PUMP FAILED TO START	ELEC INTER READ O SUCTION PRESSURE

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	V A E N T	CONTROL	EVENT	SYSTEM -	COMP	MODE	1 1	FAIL	NO.	TIVES	MODE DESCRIPTION	CAUSE DESCRIPTION
	C 2T	1 025363	020879	8	PT	813	3 5	1		T U	AUX FEED PUMP 1C FAILED TO START	TRIPPED OVERSPEED TRIP, CAUSE UNKNOWN
		1 025595										SUCTION CAVITATION & VIBRATION
	CSF	1 026469	061479	9	PT	818	9 8	1		TT	AUX FEED PUMP 1C FAILED TO START	STEAM INLET VALVE FAILED TO OPEN
	c sr	1 0325874	082880	G	PM	A00	) R	1		M U	SEAL WATER LEAK DEVELOPED IN 18 CHR PUMP	CAUSE NOT STATED
		1 0325870									14 CHR PUMP STARTED THEN APPARENTLY STOPPED	FATLED SEAL WATER PUMP
	# BV	015214	070876	R	PM	A19		1		N T	A RUPTURED SEAL WAS DISCOVERED ON 14 RHR PUMP	SEAL BOUND ON PUMP SHAFT CAUSING FAILURE
	W 8 V	015727	082576	8	o M	C04		1		T D	34 AUX FEED PUMP VAPOR BOUND CAUSING LOSS OF DISC+	DESIGN DEF OF RECIRC LINE SIZE & DOLETCE
	4 9 V	0157514	121576	G	PM	A14	R	1		N T	IC CHARGNG PMP LEAKING AT SPEEDING. GEAR CASING	TUSE FAILURE OF L.U. COOLER
											18 CHARGNG PMP LEAKING AT GEAR CASING	TUBE FAILURE OF L.O. COOLER
	# BV	017351	031077	B	PT	800	١.	1		N U	STEAM AFP FAILD TO START WHEN RIX TRIPPO SOT POWER	CAUSE UNDETERMINED
	# 9 V	017561	040377	R	PT	015		1		TT	LOUD NOISE DEVELOPED IN TURB DRIVEN AUX FEED PUMP	LOJSE COUPLING GUARD RUBBING ON COUPLING
-	e HV	018348	070577	G	PM	015		1	1	N U	18 CHARGING PUMP TRIPPED ON PHASE OVERCURRENT	PUMP SHAFT CRACKED AT BALANCE DRUM NUT
1	8 N	019241*	071977	K	PM	004	N	3		1 0	LOAD REJECT. TEST FROM SOE PURIPHPS TPIPPD UNDERRY	TURBINE CONTROL DESGN CONCEPTS
1	6 3V.	020130	121577	В	PT	C13		1	- 1	N T	STEAM AFP GOVENE FAILD TO MAINTAIN SPEED CONSTANT	MALFUNCTIONING GOVERNOR VALVE
- 1	( 8 V)	020132	121677	1	PM	020		1		TT	14 LHSI PUMP SHUTDOWN DUE TO HI VIBRATION ON SHAFT	PUMP-TO-MOTOR HISALIGNMENT
,	3 A I	0213564	041678	6	PM	009	S	1	. 1	4 T	18 CHARGNIST PUMP HE BEARING TEMP ALARM	PLUGGED DIL PUMP COOLERS-WATER SIDE
	( BV)	0213568	041678	G	PM	009	S	1	. !	N T	IC CHARGE/SI PMP HI BEARING TEMP ALARM PLGGD COOL	RIVER WATER STRAINERS FORM ALLOWING DE PRI
3	BAI	021646	042178	e	PM	001	S	1	- 3	4 D	IC CHG PUMP TRIPPED. NO BACK-UP WAS AVAILABLE	OPERATOR MADE IMPROPER ELEC LINE-UP
,	RVI	022396*	070478	R	PM	C11	٧	2	,	N D	A AND B PHR PUMPS WERE RUNNING WITH NO DISC4 FLOW	PUMPS BECAME AIR BOUND WITH RCS DRAINED
,	1 19 V 1	028145	010379	G	PH	C14		1	1	4 T	IC CHARGING PUMP HAD LOW DISCHAGE PRESSURE	FAULTY ROTATING ELEMENT
١	av1	025486	030579	8	pf	909		1	1	10	AUX FEED PUMP DECLARED INOPERABLE, TR VLV DIDONT CL	NUT AND WASHER DISCOVERED IN STEAM LINE
,	BAI	026481	070379	R	PH	013	2	1	*	1 0	RHR PUMP WAS TRIPPED FROM CONT ISOLATION PHASE B	POWER SUPPLY SWITCHING CAUSE VOLT SPIKE
*	8 V I	026841	081679	G	PM	002	C	1	1	0	1C CHARGING PUMP BECAME INOPERABLE	FAILED BEARING DUE TO A COOLING VLV SHLT
												OPERATOR ERROR
*	8 V I	028105	091079	L	PM	C09		1	. 1	0	LHSI PUMP FAILED TO REACH REQUIRED RECIRC FLOW	PIECES OF PLASTIC FIRE HOSE NOZZLE FOUND

ALL FAULTS CONSTDERED IN PUMPS

CAUSE DESCRIPTION	POSSIBLE FAULTY BLENDER CONTROLS, CH-P-28	PRICEDURE REVISED TO VENT PUMPS	PUMPS BECAME AIRBOUND	PERSONNEL TESTED BKR INCORRECTLY	CHECK VALVES INSTAL BACKWARDS IN COOL HZD	WORN MECHANICAL SEAL, CRACK FOUND ON SHAFT	BORIC ACID	MECHANICAL	JOHN CRANE MECHANICAL SEAL FAILED	JOHN CRANE MECHANICAL SEAL FAILED	JIN CRANE NECHANICAL SEAL FAILED	DAMAGE TO GASKET SEALING SURF ON CASING	SET SCREWS DID NOT HOLD ARMS IN PLACE		BROKEN SHAFT. CLEAN BRK UNDR 11TH STG IMP	RAS STUCK IN RECINC LINE DURIN ROTOR REPL	APEAK APPEARED TO BE A FATIGUE FAILURE	WIRE BROKEN AT TERMINAL BLOCK;HOT 5/D PAN	LEAKING MECH SHFT SL. ATTRIB TO NOR WEAR	SALENDED THAT OP. TRIP THROTTLE, BURN OLT	GOVERNOR WAS REPLACED	SHAFT BROKE	FAILEU ZEMOR DIODE IN OVERSPEED MONITOR	BEARING FAILED, UPKNOWN CAUSE	WEAR ON THO MATENG SURFACES ON LINKAGE
MODE DESCRIPTION	BORIC ACID TRANSFER PUMP TRIPPED ON OVERLOAD	RHR PUMP. BECAME AIRBOUND WHILE INCREASING FLOW	*A * AND *8 * RHR PUMPS COULD NOT DEVELOP FLOW	SORIC ACTO TRANSFER PUMP TRIPPED	IC HIGH HEAD CHARGING PUMP BEARING TEMP INCREASED	24 BORIC ACID PUMP DEVELOPED LEAK (CH-P-2A)	BOR ACTO XFER PMP #2 FLOW 17.3 GPM, SPEC IS 20 3PM	#1 BOR ACID XFER PMP COULD NOT MEET DESIGN FLOW	#2 BOR ACID MFER PMP TAKEN BUT OF SERV. EXSV LKG	#2 80R ACTO XFER PMP TAKEN DUT OF SERV, EXSV EKG		*1 BOR ACID KFER PMP TAKEN DUT OF SERV, CSNG SEPS		FAILD TO START FROM CONT. ROOM! TRIP LINKAGE STICKY	IN CENT CHG PUMP AMMTR PEGGED. PUMP DEENERGIZED	"M" CHARGN PMP HIGHER THAN NORMAL CASING IEMPERATR RAT STUCK IN RECIRC LINE DURIN ROTOR REPL	EAST CENT CHG PMP BRK BET 3RD & 4TH STG IMPELLERS	WEST COMP COOL WIR PMP FAILD TO START IMANUAL!	#2 BOR ACTO XFER PMP DISCH PRESS LOWER THAN REGO	AUX FEED PUMP FAILED TO START ON START SIGNAL	AUX FEED PUMP FAILED TO REACH RATED SPEED	TRAIN B CENTRIFUGAL CHR PUMP FAILED WHILE OPER.	AUX FEED PUMP FAILED TO START ON SURVEILLANCE TEST FAILED ZEMOR DIODE IN OVERSPEED MONITOR	AUX FEED PUMP TAKEN GOS DUE TO A HOT BEARING	AUX FEED PUMP BECAME INDP. THROTTLE VALVE UNLATCHED WEAR ON TWO MATENG SURFACES ON LINKAGE
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ושמיי	m	90	11	600	20	10	60	0	10	0	6	16	50	813	013	200	015	113	613	113	13	015	813	021	200
ושמנ	M 01	0	H C1		00 1	-	0	H C1	M A1	*	×	#	80	300		×			E	8 T	2 1 0	PM	1 4	10	1 4
EA.	۵.	8 0	0 0		E PR	N. d.	W d I	Nd I	0		4	0.	60	6.	9	9	9	0.	0	60	60	9	60		
NA I	180 I		0		c	0			92475		01775	02075		01376	040777	877	717.	22277	678	478	9278	70380	10678	5679	085
EVE	0131	040880	04118	062980	09178	0 33080	070375	077075	092	092775	101	102	070676	101	040	04187	05177	122	01167	97147	100	070	110	03067	91248
CONTROL	030552	030879*				6	013078	013076	013443	013410	0	0		016115	017650	017670	017769		0		0	03181	02289	02545	
ez-	8 v 1	8 W I	9 4 1		8 4 1	BVI	100	100	100	130	100	001	001	100	001	001	001	001	0.01	0.0	0.1	0.1	062	002	000
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>#12 I	PLANT	CONTROL NUMBER	EVENT	SYSTER	COMP	MODE	TYPE	FANIULM	ATTAC	MODE DESCRIPTION CAUSE DESCRIPTION
W	ocz	0302798					1	1	N T	AUX FEED PUMP FAILED TO START 90 NED OUT RESET COLL ON TRIP & THROTTLE
W	DCS	030744	032180	8	PT	813	T	1	H T	AUX FEED PUMP TRIPFED AND TET VALVE DIDN'T RESET RESET SOLENDED DEFECTIVE, LINKAGE MISADJU.
¥	DCZ	031310	052080	В	PT	U13		1	N U	AUX FEED PUMP TRIP THRO VALVE LINKAGE UNLATCHED CAUSE OF UNLATCHMENT UNKN, PUMP IN STANCBY
W	002	032628	090480	t.	PM	C06	U	1	T 0	EAST RHR PUMP WAS FOUND UNSTABLE ALL AIR WAS NOT REMOVED FROM SERVICE
W	HN1	014163	012476	G	PM	A19	F.	1	N T	EXCESSIVE SEAL LEAKAGE ON 14 CENT CHARGING PUMP OUTBO SEAL HAD "O" RING FAILURE
W	HNI	015097	061776	R	PM	006	U	1	N O	RIX SHUTDOWN & REFUELING LOST PWR TO RHR PMP2MIN OVERLOADED 480V BUS PROCEDURES DEFICIENT
W	<b>HN1</b>	015218*	070576	8	PT	C11	U	2	N T	AUX FEED PMPS WOULD NOT DEVELOP PROPER DESCH PRESS BOTH PUMPS VAPOR BOUND - FAULTY CHK VLV
W	HN1	015041	100176	1	PM	021		1	N T	14 BAT DEVELOPED LEAK IN CANNED ROTOR DUE TO BRYGS WIPED BRNGS ALLWO ROTOR TO DROP & WEAR
¥	HNI	017426	030477	1	PM	009		1	N T	14 BAT OVERHEATO & SEIZED DUE TO BEARING FAILURE FOREIGN MATERIAL ENTERED MOTOR BEARING
W	HN1	017559	040477	G	PM	C50		1	N T	"A" CHANG PUMP INDICATIONS POINTED TO FAULTY DPS DISASSY REVEALED CRKS UNDER PRESS RED SLV
W	HN1	017689	042677	G	PM	A05		1	M 0	14 CHG PMP DEVELOPED SMALL WEEP ON SUCT MECH SEAL SLIGHT POROSITY BINN SL SPLY PSG & SL SUR
W	HNI	017688	042877	G	PM	020		1	N T	LA CHARGING PMP AXIAL MISALIGNMNT OF MTR TO PUMP EXCESS THRUST WIPED MOTOR BEARING RAN 20M
W	481	018911	022177	K	PM	4.		1	N U	#2 RCP INDICATED SEAL FAILURE - SHUT DOWN WIS INSP CONFMD SL FAILD - MOD# SU-4M-AL
W	HNI	021329	040378	н	PM	C14		1	MU	"A" HPSE PMP DEVELOPED UNUSUAL DRAG DURING MAINT INSPECTION DISCLED CRED OR RINGS & BINNES
¥	<b>HN1</b>	025723	011879	B	PT	C11	S	1	1 0	"A" AUX FEED PUMP FAILED TO REACH RATED FLOW OVERHEATED HZG SUPPLY TO PUMP
W	102	010282	051074	н	PM	809	U	2	N T	#23 6 #21 HPST PUMP STARTED ONLY DEVELOP 700# PRS BORTC ACID LEAKAGE CAUSD SUCTION BLOCKAGE
w	102	010235	052274	8	PM	813	S	1	N D	NO. 21 AUX FO PUMP FAILED TO START - AUTOMATEC AUTO START CKT SHITCH HAD DIRTY CONTACTS
W	IbS	012862	052275	ι	PM	A16		1	N 0	RHR PMP #21 REMOVED FROM SERVICE TO REPAIR SEAL 4 LEAKING SEAL HEAT XCHGR - PMP MOD# 8X20 W
W	192	013170*	072275	G	PM	A17	R	1	N 0	2 CHG PMPS REMOVED FROM SERVICE EXCSV PLUNGER SEAL LEAKAGE
W	IPZ	013299*	082775	G	PM	419	R	1	N D	2 CHG PMPS REMOVED FROM SERVICE EXCSV PLNGR SEAL LKG VAR SPD 98GPM
W	1 P2	013300*	082975	G	PM	419	R	1	N 0	2 CHG PMPS REMOVED FROM SERVICE EXCSV PLNGR SEAL LKG - PSBLE DESIGN MOD
W	105	013432	090475	Ī	PH	A19	R	1	N 1	BOR ACD XFER PUMP # 21 REMOVED FROM SERVICE-TYPE 1 BELLOW SHAFT SEAL LKG - DWG FSP 10443-2
W	IPS	013609	101475	I	PM	A19	R	1	M I	BOR ACD XFER PUMP #22 REMOVED FROM SERVICE -TYPE 1 BELLOW SHAFT SEAL LKG - DWG FSP 10443-5
w	165	0137374	110575	G	PM	A16	R	1	N D	NO. 23 CHG PUMP REMOVED FROM SERVICE LEAKING HEAD GASKET - TYPE QX-300 QUNTPLX
w	192	0137399	110575	G	PM	A19	R	1	N D	NO. 22 CHG PUMP REMOVED FROM SERVICE EXCSV PLNGR SEAL LKG - TYPE QX-300 QUNTPX

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> x x .	P L A N T	CONTROL	EVENT	SYSTEM	COMP	MOOM!	1 P E	FANIU	James -	CLASS	MODE DESCRIPTION CAUSE DESCRIPTION
w	IPS	013850	120375	G	PH	A15	R	1	N	D	40. 21 CHG PUMP REMOVED FROM SERVICE LKS HEAD GSKT - TYPE GX-300 QUINTUPLEX
W	100	014003A	121875	G	PM	A16	R	1	N	0	40. 21 CHG REMOVED FROM SERVICE PTN HOLE LEAK IN FLUID HEAD
w	1 22	0140038	121875	G	PM	A15	R	1	N	D	NO. 23 CHG REMOVED FROM SERVICE LARGE LEAK IN FLUID HEAD
W	102	014449	031276	1	PM	A19	R	1	N	T	BOR ACD XFER PUMP REMOVED FROM SERVICE RELLOW SEAL LKG - CRACKED ROT SEAL SURFCE
W	102	015920*	080576	н	PM	C 0 3	N	3	T	0	ALL 3 SAFETY INJ PUMPS RUN APPX 10 MIN W/O SUCTION CMM PUMP SUCTION VLV (846) NOT OPEN
W	IPZ	0187878	050777	J	PM	813	5	1	T	D	22 AUX COMP COOL HTR PHP FAILD TO START DURIN ST DIRTY CONTACTS JPLANT IN COLD SHUTDOWN
W	102	018789	052577	L	PM	A19		1	N	T	PZZ RHR PUMP REMOVED FROM SERVICE MECH SEAL ASSY GSKT DETERATO AND LEAKED
W	IPZ	019236	052677	G	PM	C15		1	N	U	22 CHG PUMP DEVELOPED LOUD NOISE - LOST DISCH PRS FLUID DRIVE CPLNG FOUND BROKEN
W	IPS	019331	070277	K	PM	A19	1	1	N	U	NO. 23 RX COOLANT PUMP TRIPPED OFF-LINE MANUALLY SEAL PACKAGE FAILED, TOT LKG 90,000 GAL
W	IPZ	019239	090977	1	PM	A19	R	1	N	T	22 BOR ACID XFER PUMP REMOVED FROM SERVICE TYPE 1, BELLOWS SHAFT SEAL WAS LEAKING
W	192	020822	121577	8	PH	018	3	1	N	T	#23 AFP DOS DUE TO SPARKING MOTOR MOTOR REPLACED WESTINGHOUSE .4008HP, DWG 8610800
W	1 02	021333	050278	3	PH	800	)	1	1	U	NO. 22 AUX COMP COOLING PUMP FAILED TO START CAUSE UNKNOWN, FOUND DOING SI SYS TEST
W	IP2	021706	060278	н	PM	021		1	T	T	EXCESS OIL FROM SI PUMP NO. 22 THRUST BEARING THRUST COLLAR AND SHOES FAILED, REPLACED
W	IPZ	022721	090878	I	PM	A19	9 8	1	N	T	NO. 22 BORIC ACID TRANS PUMP DECLARED INOPERABLE FAILED MECHANICAL SEAL
W	IP2	023580	121478	G	PM	A16	R	1	H	T	CH. PUMP #22 HAD LEAKAGE AROUND STUFF BOX GASKET FOUND CRACK IN FLUID HEAD AND CYL. WALL
W	IPZ	025227	020679	I	PM	013	3 5	1	N	T	NO. 22 BORIC ACIC TRANSFER PUMP BECAME INOPERABLE FATLED CONTROL TRANSFORMER
¥	IP3	016944	011277	н	PM	813	3 5	1	N	0	833 SI PMP FAILD TO START FROM SISJPLANT TRIP 100% TO PELAY IN START CKT FAILD MODEL 2412PC
W	IP3	017978	040477	н	PM	C14	4	1	R	r	NO. 31 SAFTY INJ PMP HAD GRAD DETERATN OF FLO OUPT WORN INTERNALS - HIGH HEAD TYPE JTCH
*	103	017877	041277	В	PH	815	5	1	N	U	ATTEMPT TO PUT #33 AUX FEED P. " ON-LINE UNSUCSEL SHAFT HAD SHEARED - MOD 3HMTA-9
¥	IP3	019265	092577	G	PH	A16	5 R	1	N	U	#32 CHG PUMP DEVELOPED LEAK IN HEAD - TAKEN OFF-LY HATP-LINE CRACK IN HEAD - 98 GPM, QX-3CO
٧	I P 3	017264	093077	G	PM	A19	9 8	1	N	U	#33 CHG PUMP TAKEN OUT OF SERVICE FXCSV SEAL LEAKAGE - TYPE QX-300 QUINTPLX
	IP	019262	100177	G	PM	A1	9 R	1	N	U	#31 CHG PUMP TAKEN OUT OF SERVICE FXCSV SEAL LEAKAGE - TYPE QX-300 QUINTPLX
	IP:	017283	100577	1	PH	41	9 R	1	N	U	#32 BOR ACID XFER PUMP REMOVED FROM SERVICE LEAKING BELLOWS SHET SL - CRANE, TYPE 1
-	IP	019282	100677	1	PH	A1	6 R	1	N	U	#32 BOR ACID XFER PUMP REMOVED FROM SERVICE LEAKING SUCTION FLANGE GASKET - MOD 3196
,	IP:	020122	121671	G	PH	A1	9 R	1	N	U	#33 CHG PUMP REMOVED FROM SERVICE EXTSV SEAL LEAKAGE - 98GPM TYPE QX-300

> Z m Z	PLANT	CONTROL	EVENT		COMP	E CAUSE	TYPE	FAIL	302	CTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
W	IP3	021036	032878	t	PM	A16		1		N U	#31 RHR PUMP REMOVED FROM SERVICE	GSET BYWN GLND PLATE AND PMP CASING LKING
W	193	021359	041678	G	PH	A19	R	1	= 1	N U	#31 CHG PUMP REMOVED FROM SERVICE	EXCSV SEAL LEAKAGE - QX-300 QUINTUPLEX
W	IP3	022411	091578	R	PM	A19		1		N T	NO. 32 RHR PUMP SEAL FOUND LEAKING	SEAL SURFACES FOUND WORN
W	193	022877	102778	G	PM	A14	R	1	. 1	N T	LEAKAGE DBSERFED FROM NO. 31 CHARING PUMP	LEAK WAS FOUND IN PLUNGER
W	IP3	025232	020579	G	PH	A19	R	1		N T	# 32 CHARGING PUMP DISCOVERED LEAKING	FAILED PLUNGER AND PACKING
W	1 0 3	026479	071579	I	PH	419	R	1		N T	#32 BORIC ACED TRANSFER PUMP DEVELOPED LEAK	MECHANICAL SEAL WAS REPAIRED
W	JF1	019847	120377	8	PT	813	5	1	- 1	N D	AFP TURBINE STARTED BUT FAILD TO REACH MAX SPEED	STONAL CONVERTER SSC-3405 FAILD
W	JFI	020993	032578	8	PT	801	S	1		N D	AFPT FAILD TO START FOLLOWING RIX TRIP	TREP/THROTTLE VALVE FOUND SHUT
W	JF1	022633	090978	8	PT	813		1		T U	AUX FEED PUMP DED NOT START	TREP THROTLE VALVE TREPPED, UNKNOWN CAUSE
W	JF1	022631*	091778	F	PM	U01	U	2		N D	BOTH CONTMT SPRAY PMP SUPPLY BREAKERS TAGGED OPEN	BOTH TRAINS REQUIRED BY TECH SPECS
W	JF1	025438	011679	8	PT	813		1		N T	AUX FEEDWATER PUMP FAILED TO START AFTER RX TRIP	MINT FLOW SPRING TENSION INSUFFICIANT
W	JF1	027639	110379	8	PΤ	003	U	1		T D	AUX FEED PUMP TRIPPED ON OVERSPEED	MANUAL SPEED ADJUST LEFT MISADJUSTED
W	JF1	030322*	021480	8	PH	804	Ø	5		t D	AEB AUX FEED PUMPS FAILED TO AUTO START	THADEQUATE DESIGN CHANGE CONTROL
W	JF1	030559	021580	8	PT	002		1		T D	AUX FEED PUMP DECLARED INOPERABLE, HOT THRUST REAR.	MISPOSITIONED DILER ASSEMBLY, HI DIL LE VEL
W	JF1	030560	022280	8	PŢ	813	5	1		N T	WHILE STARTING AUX FEED PUMP THE TURBINE TRIPPED	TRIPPED OVERSPEED DUE TO LIMIT SWITCH
W	KE1	010646*	080174	R	PM	803	U	2		T D	TWO AFP'S DID NOT START UNTIL THIRD ATTEMPT	DES NOT ALLOW DEL PRESS TO BUILDUP
W	<b>K</b> €1	010644	081974	J	PM	802	U	1		N D	COMP COOL PMP 14 DID NOT START PM DN 8/16/74	CKT BKR NOT RACKED IN FULLY
W	KF1	010928	102574	8	PM	813	S	1		N D	14 AFP DID NOT START AUTOMATICLY ON HI WIR LEVEL	A.T. SMITH RELAY BOUND UP MECHANICALLY
W	KE1	012113	010475	8	PM	800		1		N U	24 AFP FAILD TO START AFTER R/X TRIP	UNDER INVESTIGATION
W	KE1	012110	012475	8	PH	804	T	1		M D	14 AFP FAILD TO START POWER SUPPLY FAILURE	BER OPERATING HANDLE DID NOT CONTACT
W	KE1	012399	020775	8	PM	804	1	1		N D	1A AFP FAILD TO START ON LO-LO SG LEVEL	BER GUIDE BAR"POSITION" NOTCH TOO SMALL
W	KEI	0134794	101575	8	PM	813	5	1		N D	14 AFP FAILD TO START FOLLOWING A UNIT TRIP	DEFECTIVE N-2 SWITCHES
W	KEL	0134998	101575	8	PT	813	S	1		N D	1C AFP FAILED TO START FOLLOWING UNIT TRIP	DEFECTIVE WESTINGHOUSE W-S SWITCH
W	KE1	013667*	110575	B	PH	C04	5	3	1	N D	AFP 14-186 1C REDUCED FLOW DUE TO STARTUP STRATURS	PLUGGO BY RESIN BEADS FROM MAKEUP DEMIN
W	KF1	013773	120475	8	PM	800	5	1		N U	SKR 16201 OPENED CAUSING UNIT TRIP & INOP. 19 AFP	948 16501 CLOSED MANUALLY

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P L A N T	CONTROL	EVENT		COMP	MOOM	TYPE	F A I L	MCM	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
W KE	014386	031276	R	PH	813	5	1		0 1	AUX FD PUMP 14 FAILED TO START ON BLACKOUT SED SIG	FAULTY LUBE DIL PRESSURE SWITCH
W KE	016117	092776	8	PM	813	5	1		T D	18 AFP FAILD TO START DUE TO STICKY ACTUAT. RELAY	WIRN PLUNGER SHAFT, REPLACED RELAY
W KE	1 016696	122276	t	FM	000	)	1		N U	BOR ACID PUMP IN TRIPPED AND WOULD NOT RESTART	AKE DVLDS TRIPPED, RESET - NO OTHE PROBLE
W KE	1 018882	081777	3	PM	B13	3 5	1		H D	COMP COOL PMP WOULD NOT START AFTER PM WORK DONE	TREP ARM HETTING TREP RODEREADJUSTED- LUBE
W KE	1 019311	100277	G	PH	018	9 8	1		N D	FLOW FROM OPERATING CHG PMP MAS LOST DURING OPERTN	BROKEN BELT ON VARI-DRIVE UNIT
. KE	019313	100777	F	PM	800	) 8	1		T 0	SPRAY PHP FAILD TO START DUE TO OVERCURRENT TRIP	START CURRENT G.T. SETPOINT; RAISED SETPT
W KE	1 019518	102477	F	PM	800	9 6	- 1		N D	A CONTAINMT SPRAY PUMP FAILED TO START DURING TETG	CAUSE UNKWN - BER WAS TRIPPED ON OVECURNT
W KE	1 019643	110777	G	PM	D16	8 8	1		N D	FLOW FROM OPERATING CHG PMP WAS LOST DURING THER	RROKEN BELT ON VARI-DRIVE UNIT
W KE	1 020094	122377	F	PM	800	0 8	1		T D	ICS PMP 18 FAILED TO START DURING OPERATIONAL TEST	CAUSE UNKNOWN - BRKR OPERTG ERRATICALLY
W KE	1 020339	011578	J	PM	813	3 5	1		N D	CC PUMP FAILD TO START DURIN FULL POWER OPERATION	FAULTY STATIC TRIP DEVICE IN CKT BREAKER
W KE	1 020338	011878	J	PH	800	0	1		N U	CC PUMP FAILD TO START DUE TO OVERCURRENT TRIP	UNDER INVESTIGATION CAUSE NOT DETERMINED
. KE	1 022237	080978	G	PM	CI	3 5	, 1	ı	N T	CCP OPERATED ONLY AT HIGH SPEED	FAILED TRANSESTOR IN HAND CONTROL STATION
. KE	1 022540	091878	G	PM	41	6	1	L	N T	LEAK DEVELOPED ON CCP BETWEEN DIS. PIPE AND BITCE	CRACK CAUSED BY OPERATING STRESS
W KE	1 030562	021180	6	PM	01	3	5 1	ı	N T	CHARGING PUMP STOPPED WHEN CONTROL SE PLACED AUTO	STICKING CONTACT
W NA	1 021636	053078	K	PM	DO	7	1	i	N T	RCP C REQUIRED TO BE SECURED	FAK IN LOWER LUBE DIL COOLER :
W NA	1 021665	060678	F	PH	80	9	5	1	T D	CONT QUENCH SPAY PUMP 1-QS-P-1A FAILED TO START RE	SCREW FOUND IN SUPPLY BKR (FOREIGN)
W NA	1 021890	061578	) F	PM	81	3	5	1	1 0	QUENCH SPRAY PUMP 1-QS-P-18 FAILED TO START	AKE CHR SPRING MOTOR SWITCH IN OFF POSI.
WNA	1 022033	071778	9 6	PH	00	2	1	1	N D	CHP PUMP IC BECAME INOPERABLE	IMPROPERLY ASSEMBLED SEAL ASSEMBLY
W N/	1 025755	033079	9 8	PI	01	3	R	1	N U	AUX FEED PUMP 1-FW-P-2 TRIP THROTTLE VLV CLOSED	SIGNAL FROM OVERSPEED TRIP
W N/	1 025716	040879	9 6	PH	1 00	1	U	1	N D	14618 DOS FOR MAINT, 1C FEEDER BRKR NOT RACKED IN	IMPROPER TAGOUT PROCEDURE
W N/	1 027080	090479	9 8	1 PF	1 00	9		1	N T	AUX FEED PUMP BECAME INOPERABLE (1-FW-P-3)	LUBE DIL STRAINER WAS CLOGGED
W N	1 027248	092879	9 6		4 00	0		1	T U	CHARGING PUMP 1-CH-P-1A DID NOT FUNCTION	CAUSE NOT STATED
W N	1 030102	011380	0 8	9 1	1 02	1		1	H T	AUX FEED PUMP TAKEN OUT OF SERVICE FOR INSPECTION	REARING HAD WIPED, DUE TO LACK OF OIL
W N	1 030101	01148	0 8	P 1	1 01	8		1	N T	AUX FEED PUMP 1-FW-P-2 DEVELOPED LEAK IN DIL COOL.	BLOWN GASKET
W N	1 032635	09089	0 8	3 P	1 01	3	R	1	N U	AUX FEED PUMP GOVERNOR VALVE FOUND TRIPPED	GOVENOR TRIPPED ON OVERSPEED, CAUSE UNK NO.

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zms.	P L A N T	CONTROL	EVENT	SYSTEM	1	MODE	Y	FANIU	YTY	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
w	PRI	010725	081374				5	1	T	D	AUX FEED PUMP 12 FAILED TO START	BRKR FOR AUX LUBE OIL PUMP WAS OPENED
W	PRI	011230	121274	8 1	М	09	5	1	N	T	AUX FEED PUMP 12 DED NOT MAINTAIN NORMAL DISCH FLO	SUCTION STAR CLOGGED WITH SILT
w	PRI	012411	032775	8	7	809		1	N	0	TURB DRYN AUX FO PMP FAIL TO REACH ACCPT DISCH PRS	STICKY GOV CONT VLV LINKAGE - DIRTY
w	921	017619	041177	H 1	PM	004		1	T	0	#12 SAFTY INJ PMP #7IMPELLR MOVED AXIALLY ON SHAFT	ASMIRMAL PRESSURE DISTRBTION ACROSS IMPLE
w	P 9 1	017791	050177	8 1	10	806		1	N	D	#11 TURB AUX FD PMP TRIPPO TWICE ON OVERSPEED	LOW GOVERNE OIL LEVEL REVISED PROCEDURES
w	PRI	019807	062877	G	PM	013		1	N.	U	CHARGING PUMP FAILED	CAPSCREW FAILURE IN VARIDRIVE UNIT
W	PP1	028041	122878	8	PŢ	013	U	1	T	0	NO. 11 AUX FO PUMP TRIPPED OFF-LINE AT END OF TEST	STEAM SUPPLY VALVE TRIPPED ON OVERLOAD
w	PRI	026014	040879	н 1	PM	800		1	T	U	#11 SAFETY INJECTION PUMP FAILED TO START IN AUTO	UNKNOWN CAUSE, EVENT COULD NOT BE REPEATED
w	PRZ	019896	111077	8	PT	813		1	T	T	#22 TURB DRVN AUX FO PMP TRIPPED ON OVERSPEED	LOSSE LINKAGE ON GOV TO PRESS COMPENSATOR
W	PRZ	021038	041778		PM	001	U	1	N	0	OPERATOR PLACED #22 PHR PUNP DOS - AUX OPER OPENED	CKT BRXR FOR # 21 RHR PUMP - PERSONNEL ER
W	PRZ	027527	110279	В	PT	B13		1	1	U	#22 AUX FEED PUMP FAILED TO START	OVERSPEED TRIP VALVE FOUND TRIPPED
W	PRZ	030733	031280	G	PM	813	5	1	N	0	NO. 22 CHR PUMP HOTOR BKR KEPT TRIPPING	RREAKER FAILURE, BKR REPLACED
w	992	031455	052980	8	PT	002	T	1	N	D	NO. 22 AUX FEED PUMP TRIPPED INADVERTANTLY	TECH DROPPED INST ON TRIP THROTTLE LINKAG
W	PRZ	031631	061590	G	PM	813	5	1	N	0	NO. 23 CHR PUMP STARTED AND SOON SHUTDOWN	ATR LEAKS IN SPEED CONTROL UNIT
W	PRZ	032731	091680	8	PI	002	T	1	N	D	AUX FEED PUMP TRIP MECHANISM WAS TRIPPED	WORKMAN ACCIDENTLY BUMPED TRIP MECHANISM
w	211	0009644	040774	8	PM	C09	5	1	U	T	"A" MTR DREVEN AUX FD PUMP HAD ENADEQUATE FLOW	IN-LINE CONICAL STRAINER WAS PLUGGED
W	PTI	0009648	040774	8	PM	U09	5	1	U	T	"B" MTR DRIVEN AUX FO PUMP WO HAVE HAD ENAD FLOW	IN-LINE CONICAL STRAINER WAS PLUGGED
w	PTI	010648	052174	F	PM	813	T	1	U	D	CONTAINMENT SPRAY PUMP 1P14A DID NOT START	PUTP BEKE LATCH WAS NOT FULLY ENGAGED
w	PTI	012531	041875	8	PT	A19		1	U	U	8 GALS LOW LEVE RAD. WTR LEAKD VIA STEAM-DR AUX FO	SHAFT GLANDS LEAKD SHUT DISCHEG VALVE
w	PTI	016772*	030876	G	PM	D18	R	2	N	T	CHARGING PUMPS ",B". AND "C" FAILED	BROKEN VARIORIVE BELTS - VARIBELT NO. 842
W	911	016709	123076	G	PM	A19		1	N	T	C CHRGNG PMP DOS DUE TO PLUNGER LEAKAGE	PACKING WEAR AJAX IRON WORKS TYPE T-125
W	PTI	021755*	053078	F	PM	813	T	1	N	0	CONTAINMENT SPRAY PUMP 1-P148 DECLARED DOS	POWER SUPPLY BKR WOULD NOT RACK IN
W	PT1	027043	091279	e	PM	016	R	1	U	0	THE 1-P28 CHR PUMP FOUND TO HAVE CRACKED CYL BLOCK	
W	P12	017248A	022176	G	PM	119	R	ı	N	T	ZPZC CHARGING PUMP TAKEN OUT OF SERVICE	REPAIR PLUNGER LEAKAGE
W	PTZ	0172498	022176	G	PM	018	R	1	N	0	2P28 CHARGING PUMP FAILED	BRIKEN VARIORIVE BELT - VARIBELT NO. 842

I Kmk	PLANT	CONTROL NUMBER	EVENT	SYSTEM :	COMP	KODE	TYPE	F A I L	NUM	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
W	PTZ	0161544					R	1		1.1	"C" CHARGING PUMP TAKEN OUT OF SERVICE	REPAIR MINOR PLUNGER LEAKAGE
W	PTZ	0161548	092076	G	PM	018	R	1		0	"B" CHARGING PUMP FAILED	BROKEN VARIORIVE BELT - VARIBELT NO. 842
W	912	0204614	022177	G	PM	419	R	1		1 1	2P2C CHARGING PUMP TAKEN OUT OF SERVICE	REPAIR PLUNGER LEAKAGE
W	P12	0204618	022177	G	PM	018	R	1		0	2P28 CHARGING PUMP FAILED	RRIKEN VARIORIVE BELT - VARIBELT NO. 842
W	PTZ	0207130	040677	G	PM	C04	R	1	t	T	CHR PUMP "C" DISCOVERED TO HAVE CYC BLOCK CRACK	PULSATIONS CAUSED CRACKING
W	PTZ	017722	042077	G	PM	000		1	N	U	CHRGNG PMP UNABLE TO DELIVE SUFFERT FLOW	NOT YET DETERMINED INVESTIGATIONS CONT
W	PTZ	017839	051677	G	PM	821		1	N	U	2P28 CHRGNG PMP OOS DUE FOR INSPECTION OF NOISY BR	
W	P12	0207139	022878	G	PM	C04	R	1		1	CHR PUMP "8" DICCOVERED TO HAVE A CYL BLOCK CRACK	INSTILLTN OF PULSATION DAMPNERS PLANNED
W	219	0207130	030178	G	PM	C04	R	1		1.1	CHR PUMP "C" DISCOVERED TO HAVE A CYL BLOCK CRACK	INSTILTE OF PULSATION DAMPNERS PLANNED
W	PTZ	020974	031378	G	PM	018	R	1		T	A CHRGING PMP DOS TO REPLACE BELT	BROKEN VARIDRIVE BELT
W	RG1	001037	061173	н	PM	813	T	1	- 1	0	SAFETY INJECTION PUMP IC FAILED TO START	BENT OPERATOR ARM ON THE CELL SWITCH
W	PG1	000629*	121473	8	PH	C11	U	2	- 1	0	AUXILIARY FEED PUMPS A 6 B LOST SUCTION	ATR IN SUCTION HEADER
W	RG1	010046	040674	н	PM	813	Ť	1	- 1	0	10 SAFETY INJECTION PUMP FAILED TO START MANUALLY	PREMATURE CLOSING OF CB TRIP BAR
											IC SAFETY INJ PUMP FAILED TO START ON BUS 16	MAY BE FAULTY LOCKOUT INTERLOCK
W	RGI	012115	010875	В	PT	813	S	1	1	0	TURBINE-DRIVEN AUX FD PUMP FAILED TO START SUCSFLY	LO LUBE OIL PRESS REGULATOR SETTING
W	PG1	0121364	020575	н	PM	813	T	1	- 1	0	1C SAFETY INJ PUMP FAILED TO START ON BUS 16	REP WEAK SPRING AND TIGHTENED WIRE IN CB
W	861	0121368	020675	н	PM	813	T	1	1	0	1C SAFETY INJ PUMP FAILED TO START ON BUS 16	REP WEAK SPRING AND TIGHTENED WIRE IN CH
W	861	012397	02.875	H	PM	813	T	1	- 1	0	IC SAFETY INJ PUMP FAILED TO START ON BUS 16	MECH BINDING ON LOCKOUT SOLENGED PLUNGER
W	PG1	013996	011276	J	PM	015		1		1	"B" COMPONENT COOLING WATER PUMP WAS NOISY	DAMAGED COUPLING - LOOSE BOLTS, MOD DBZ 226
W	861	016716	010377	н	PM	813	1	1	1	0	1C SAFETY INJ PUMP FAILED TO START ON BUS 14	WEAK SPRING IN SECONDARY CONTACT ASSY
W	9 G 1	018225	061977	G	PM	018	R	1		T	"C" CHARGING PUMP VARIDRIVE FOUND SMOKING	RELTS REPLACED - VARIDRIVE PART 84-2
W	RGI	018244	062977	н	PM	B13	T	1	1	0	1C SAFETY INJ PUMP FAILED TO START ON BUS 14	NO APPARENT CAUSE FOR CB FAILURE
W	RGI	021670	052978	F	PM	813	5	1	1	T	CSI PUMP FAILED TO START	FAILED CIRCUIT BKR
W	RGI	025064	010479	G	PH	A16		1	N	T	"A" CHARGING PUMP FOUND LEAKING	BLICK REPLACED, HIGH HOOP STRESSES
W	861	025065	010479	G	PM	C18	R	1		Т	*8 * CHARGING PUMP SPEED CONTROL NOT OPERATING PROP	VARIDRIVE BELT SLIPPING AT LOW SPEEDS

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2 mz	PLANT	CONTROL	EVENT	- MUTCHE	COMP	MODE	TYPE	FANULM	ACT-194551	MODE DESCRIPTION CAUSE DESCRIPTION
w 1	R (12	002067	060772	£	PM	814		1	U U	ONE OF THE CONTAINMT SPRAY PMPS FOUND TO BE BINDIG BURR ON IMPELLER GALLED THE SEAL RING
		000184*						2	0 0	SAFTY INJECTION PHPS "B"E"C" TRIPPO ON MANUAL STAR INSTANTAS TRIP SETTINGS WERE SET AT MIN.
	2012	000185	070973	В	PH	813	5	1	U D	AFP "B" TRIPPO ON INITIAN OF MANUAL START AFP "B" TRIPPO ON INITIAN OF MANUAL START
		000509	120473			-		1	UT	BORIC ACID XFER PMP B SHAFT BROKE AT IMPELLER GENERIC DESIGN PROBLEM - TYPE GE-ZOK
	900	000898	032074			-		1	N D	BORIC ACID XEER PMP B BKR TRPD ON THERMAL OVED PUMP HAD BROKEN SHAFT - DESIGN PROBLEM
		010112	032074					1	N U	BORIC ACID XFER PMP B FOUND TRIPPED ON ROUTINE THE CAUSE UNKNOWN
		010091	040674	ı	PH	004	R	1	N D	BORIC ACID XFER PUMP A FAILED DURING HORMAL OPER SHAFT BROKE IN VICINITY OF IMPELLER
	2112	010476	080874	1	PM	004	R	1	N D	BORIC ACID XFER PUMP B FAILED DURING 100% PHR OPS PUMP SHAFT BROKEN - DESIGN PROBLEM
		010519	081574	1	PM	004	R	1	T D	BORIC ACID XFER PUMP B FAILED DURING PERIODIC TEST PUMP SHAFT FAILED - DESIGN PROBLEM
		010803	092674					1	N D	BORIC ACID XFER PUMP B FAILED DURING 100% PWR OPS PUMP SHAFT BROKE AT JUNCTURE WITH ROTOR
		011033	111974	B	PI	002	S	1	T D	STEAM DRIVEN AFM PUMP TRIPPED ON OVERSPO DRNG TEST WOODWARD GOVNE MAN STIG OUT OF ADJUSTMENT
-		011088	120474					1	0 0	BORIC ACID XFER PUMP B FAILED AT PUMP-ROTOR END MAY BE CAUSED BY BEARING WEAR
		012078	011475					1	N D	BORIC ACID XFER PMP A FAILED DURING 100% PWR OPS PUMP SHAFT FAILED - DESIGN ERROR
-		012300	012675	- 7				1	N D	OVERCURRENT TRIP OF "C" COMP. COOLN WIR AT 100% PW FAILD STATUS LITE; TRIED SEVERAL STARTS
		012680	050175					1	N U	REACTOR COOLANT PUMP LOST BOTH SHAFT SEALS SEAL FAILURE - PUMP MODEL VILOO1-81
		012738	052175	ī	PM	004	R	1	N D	BORIC ACID XFER PMP B STOPPED SHORTLY AFTER START PHAP MOTOR SHAFT BROKEN - DESIGN PROBLEM
		012975	062575	1	PM	004	R	1	N D	BORIC ACID KEER PMP A FAILED DURING NORMAL OPS PUMP SHAFT FAILED AT KEYWAY - DESIGN PROB
		013685	110275	8	PM	813	5	1	T T	"A"AFP FAILD TO START ON SISES TARNISHED CONTACTS HIGH HUMIDITY MAY BE FACTOR FOR TAR. CONT
W	R112	014820	010276	1	PM	021	R	1	N T	BAT "B" FAILD DAMAGED ROTORSERIES G, MODL GF-ZOK FATLD REAR GRAPHITE BEARING
7		014830	041276	1	PM	DOZ	Т	1	N 0	"B" BAT PUMP TRIPPD AT 100% PWR HEATER TRIPS SET AT 250 DEG F
w	RN2	015205	121876	I	PM	018	R	1	N T	BAT "B" FAILD HE TEMP CUTOUT TREPPO PUMP DEFECTIVE STATOR AND BEARINGS WORN
w	202	016259	102976					1	N D	BATP B TRIPPED ON HI PUMP MOTOR FEMP CUTOUT HEAT TRACING CIRCUIT TEMP SET TOO HIGH
W	R () 2	017098	012477	1	PM	009		1	N D	BATP B TRIPPED ON HI MOTOR TEMP CUTOUT RECTRC LINE PLUGGED WITH SOLID BORIC ACID
W	ROZ	017099	013177	t	PM	002	S	1	N D	BATP B TRIPPED ON HI MOTOR TEMP CUTOUT TEMP CUTOUT SET TOO LOW FOR NORMAL OPS
w	202	017585	0 32 477	F	PM	U02	s	1	N D	CONTHT SPRAY PMP A NOT ON SVC DURING CRITICALITY PERSONNEL HAD REMOVED PUMP FROM SERVICE

-	PLANT	CONTROL	EVENT	SYSTER	COMP	CAUSE	TYPE	FAIL	MCZ	CHANGI	MODE DESCRIPTION CAUSE D	ESCRIPTION
	RO	2 018138*	060777	G	PM	C11	٧		2	N D	8 6 C CHGNG PUMPS RUNNING - PSIR LYL STILL FALLING PUMP AIR BOUND	- TYPE TX-150
	PD	2 019345	062277	G	PH	C11	٧		1	N D	"C" CHONG PMP WOULD NOT CONTROL PSZR LEVEL PUMP WAS AIR BO	UND - TYPE TX-150
1	e RO	2 019793A	112377	н	PM	1101	N		3	N D	BREAKERS FOR ALL 3 SAFETY INJ PMPS FOUND RAKO OUT FAILURE TO RECO	G TS LIMIT FOR GT 200 F OP
-	RO	2 0197938	112377	F	PM	U01	N		2	N D	BREAKERS FOR BOTH CONT SPRAY PMPS FOUND RAKD OUT FAILURE TO RECO	G TS LIMIT FOR GT 200 F OP
1	# RI3	2 020181	122277	В	PT	011	S		1	T O	AFPT TRIPPO DURIN TEST RUN; HI PUMP CASING TEMP. STEAM LEAKAGE B	ACK THRU VALVE VZ-14C
	RO	2 022615	041178	8	PH	813	S		1	N D	"B" AFP FAILED TO START UPON LOSS OF MAIN FEED PRS WORN CKT BKR TR	IP ARM
	# R()	2 021317	041378	В	PM	313	5		1	N D	"B" AFP FAILD TO START FROM RTGB 145T. TRIP COIL	S SETTINGS FOUND TO BE LOW
	4 90	2 022614*	100378	F	PH	006	U		2	T 0	BOTH OF THE CONTAINMENT SPRAY PUMPS FOUND AIRBOUND PUMPS NOT VENTE	D AFTER SYSTEM REALIGNED
	R R G	2 025816	040279	t	PM	015			1	N T	BORIC ACID TRANSFER PUMP KEPT TRIPPING, PUMP 'B' BROKEN SHAFT, PU	MP REPLACED
-)	4 90	2 026063	041479	н	PM	500	)		i	T U	"A" SI PUNP FAILED TO SYART CAJSE UNKNOWN	
4	. 80	2 026362	060479	8	PH	818			1	N D	"A" AFW PUMP TRIPPED SHORTLY AFTER STARTING ROTOR BARS CRAC	KED IN MOTOR
- 1	w RO	2 032732	081180	н	PH	813	5		1	T T	'A' SI PUMP BKR FAILED TO CLOSE HIGH RESISTANCE	ALARM SWITCH CONTACT
	W SA	1 016938	010877	8	PI	801	U	1	1	N D	#13 AUXILIARY FEEDWATER PUMP FAILED TO START PERSONNEL ERROR	- TURB WAS MANUALLY TRIPD
	W SA	1 017700A	050677	Н	PH	061	U	1	2	R D	BOTH SI PUMPS AND I CENTRIFUGAL CHG PMP TAGGED DUT PERSONNEL ERROR	- NOT FOLLOWING PROCEDURE
	w SA	1 0177008	050677	G	PH	U01	U	1	1	R D	BOTH SI PUMPS AND 1 CENTRIFUGAL CHG PMP TAGGED DUT PERSONNEL ERROR	- NOT FOLLOWING PROCEDURE
	W SA	1 027422	082478	8	PT	813	3		1	T U	AUX FEED PUMP FAILED TO START STEAM INLET VAL	VE OP SHEAR PIN WAS MISSED
	W SA	1 022871*	102178	K	9 14	A 06	5		1	N D	ALL THREE RCP SEALS FAILED POSSIBLY TOO HI	GH & DIFFERENTIAL PRESSURE
	W SA	1 0232324	112778	G	PH	813	3 1		1	N T	NO 11 CHR PUMP FAILED TO START DURING SI BUS FAILURE DUE	TO OUTPUT TRANSF FAILED
	W SA	1 0232328	112778	L	PH	813	3 1		1	N T	NO 12 RHR PUMP FAILED TO START DURING SI BUS FAILURE DUE	TO OUTPUT TRANSF FAILED
	W SA	1 0232320	112778	8	PH	800	) 5	5	1	N T	NO 12 AUX FEED PUMP FAILED TO AUTO START DURING ST NO CAUSE GIVEN.	(STARTED MANUALLY)
	W SA	1 0232320	112778	8	PH	813	3 5	S	1	N T	NO 13 AUX FEED PUMP FAILED TO START DURING ST OVERSPEED TRIP	MISADJUSTED
	W SA	1 023316	121378	8	PT	01	3 5	5	1	N U	NO 13 AUX FEED PUMP TRIPPED ON OVERSPEED SPEED CONTROL F	OUND SET TOO HIGH
	W 54	1 0281194	042479	R	P	1 000	5 1	1	1	N D	OPERATING RHR PUMP TRIPPED OFF OF LINE INADEQUATE WORK	ING PROCEDURES
	W SA	1 0281198	050879	P	P	000	5 1	1	1	N D	OPERATING RHR PUMP TRIPPED OFF OF LINE INADEQUATE WORK	ING PROCEDURES
	M 24	1 026013	060179	J	P	COS	5 8	2	1	R F	#13 COMPONENT COOLING WATER PUMP DP DEGRADING #13 COMPONENT C	COLLING WATER PUMP DP DEGRA

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> E Z	P L A N T	CONTROL	EVENT	SYSTEM	C 0 M P	MODE	TYPE	FAIL	3C2	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
_		029006	112070			014	0	,		N D	ST PUMP FAILED, LOOSE LOCKNUTS FOUND, SHAFT BENT	REVERSE ROTATION POSSIBLE CAUSE, #12 PUPP
	-	028073									\$12 RC PUMP TRIPPED	15 4KV GROUP BUS WAS LOST
270		028073								N D		LOW LEVEL LIMIT WAS TOO LOW FOR RX WA LE
	-									NT	NORTH BORIC TRANFR PMP(G-9A) FAILD TO START	PMP SEIZD DUE TO ACCUMETH OF BORIC CRYSTL
		018000								TT	AUX FEED PUMP FALLED	BEARING FAILURE CAUSED BY LACK OF LUB.
			122679					- 5		N U	FIRE STARTED ON RCP "A" FROM AN OIL LEAK	NO CAUSE GIVEN FOR DIL LIFT PUMP DIL LEAK
	-	030015	011680					- 7		N T		LOTSE COUPLING CAUSED BEARING TO BE WIPED
-	-	030728	031880								EXCESSVE SEAL LEAKAGE ON "A" CHARGING PUMP	SEAL DAMAGED
		005055	111072							0 0	RCP 1A SHAFT FAILD AT 42% POWER	FILLET GROOVE ON SHET INCORRECTLY MADE
		010417	113073					1		N D	MOTOR ON RHR PUMP 1-RH-P-14 BURST INTO FLAMES	INSUFFICIENT LUBRICATION TO LWR RAD BRNG
-		000916	012374					1		NT	BORIC ACID TRANSFER PUMP MOTOR FAILED	GREASE DN STAT WHOGS CAUSED INSUL FAILURE
- 00	0.000	010373	051274					1		N T	CHRG WTR PMP 1-CC-P-ZA HAD TRIPPED ON THERMAL OVLD	
	-	017137	020877					1		UT	INSIDE RECIRC SPRAY PUMP RS-P-14 FAILED TO ROTATE	FOREIGN MAT. BETWEEN IMPELL AND WEAR RING
M	SUI	021521	051078					1		TO	CHR PUMP COMP COOLING WATER PUMP TRIPPED ON OL	MOTOR BEARINGS FAILED DUE TOO CORROSION
w	501	022641	100978					1		N I		GROUND FAULT IN PUMP MOTOR
W	501	027758	121979					. 1		H T	IA REACTOR COOLANT PUMP TRIPPED FLOW WAS LOST FROM "A" BORIC ACID TRANSFER PUMP	SHAFT BROKE DUE TO PREVIOUS ASSEMBLY
W	201	030258	012380					1		N D	SAFETY INJ/CHG PUMP 2-CH-P-18 DID NOT START-MANUAL	
W	SUS	000519	111373					1		0 0		BORIC ACID IN STATOR WINDINGS
w	SUZ	013573	101575					1		N T	"D" BORIC ACID TRANSFER PUMP MOTOR FAILED	MOTOR-TO-PUMP COUPLING WAS BROKEN
¥	SUZ	017055	011877					1		NU	BORIC ACID TRANSFER PUMP 1-CH-P-ZD FAILED	MORNAL WEAR, PUMP REBUILT
W	5112	019742	111377	J	PM	807	,	- 1		N T	CHRG PHP COMP COOLING PMP 28 INDPERATIVE	
H	SUS	020813	030178	1	PM	DZI	l	1		N T	BORIC ACID TRANS PMP 1-CH-P-2 TRIPD ON THERML DVRL	PRICEDURES INADEQ TO ENSURE SYS START L/U
W	TRI	013977	121975	8	PO	806	r	1	l	N D	DIESEL DRIVEN AUX FD PMP FAILED TO START - MANUAL	FORK SIGNAL LEAD TO GOV VIBRATED LOOSE
W	161	013976	010476	8	PD	013	3 1	1	L	N D	DIESEL-DRYN AUX FD PUMP TRIPPED ON OVERSPEED	GOVENE GAIN INCREASO TO IMPROVE RESPONSE
-		014564	010976						l	1 0	DIESEL AFP OVERSPED WHEN MANUALY STARTED	MISLOGGING OF LIFTED LEAD IN AUTO-STA CKT
W	TPI	014145A	011676	8	PD	ROI	1 U	1	l	N D	AUX FEED PUMPS FAILED TO START AUTOMATICALLY	HISCORDING OF ETFICE CENT IN SOLD SIN ONL

	PLANT	CONTROL NUMBER	EVENT	SYSTEM	COMP	MODE	TYPE	FAIL	ACTIVITY	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
1	# TR	1 0141458	011676	8	PI	801	U	1	N	D	AUX FEED PUMPS FAILED TO START AUTOMATICALLY	MISLOGGING OF LIFTED LEAD IN AUTO-STA CKT
	M ES	1 014251	012376	8	PD	813	T	1	1	0	COLD STARTS OF DIESEL DRIVEN AUX FD PMPS UNSUCCSFL	
	W TR	1 0140574	012576	J	PM	813	T	2	T	0	COMP COOLING WIR PMPS DID NOT START AUTOMATICALLY	SEQ CONT RATED AT TOO HE AMPACETY
-	W TR	1 0140678	012576	G	PM	813	T	1	T	0	B TRAIN CHARGING PUMP(ST) DID NOT START	SED CONT RATED AT TOO HE AMPACETY
. 1	# TR	1 014566	031276	R	PM	013	S	1	1	D	OPERATING RHR PUMP LOST POWER	CKT SWITCHER SUPP ESF BUS INADY OPENED
	W TR	1 014571	032876	8	PD	813		1	N	U	DIESEL DRIVEN AUX FD PUMP STARTED - TRIPPED, TVERSP	
	W TR	1 014932	051276	8	PT	813	T	1	N	0	STM DRIVEN AUX FO PUMP FALLED TO START	TRIP/THTL VLV NOT RESET-FAULTY IND LITE
	W TR	1 016003A	090276	8	PD	013	T	1	N	T	DIESEL-DRIVEN AUX FO PMP TRIPPED-HI HAKET WTR TEMP	TEMP SWITCH SET POINT SETTING DRIFTED LOW
	W TR	1 015996	090376	8	PD	B13	S	1	N	0	DIESEL-DRIVEN AUX FEED PUMP FAILED TO AUTO-START	BLOWN FUSE IN THE AUTO-START CIRCUIT
	W TR	1 0160038	090976	8	PD	013	T	1	N	T	DIESEL-DRIVEN AUX FO PMP TRIPPED HI JAKET WTR TEMP	TEMP SWITCH SET POINT SETTING DRIFTED LOW
	W TR	1 016339	100576	B	PT	D13	T	1	1	1	TURBINE-DRIVEN AUX FO PUMP TRIPPED ON OVERSPEED	FAILURE OF WOODWARL GOV SPO SENSOR CARD
	W TR	1 016337	101976	8	PT	801	S	1	N	0	TURB-DRYN AUX FD PMP FAILED TO START - AUTOMATIC	OPERATOR FAILED TO RESET TRP/THTL VALVE
	M IS	1 017572	030277	н	PM	813	T	1	N	0	ONE OF TWO SAFETY INJ PUMPS FAILED TO START	IMPROPER ACTUATION OF DBA SEO CONTACTS
	M IS	1 017574	032477	8	b D	014		1	N	Ţ	DIESL AFP TRIPPO ON LOW L.O. PRESS	RROKEN CRANKSHAFT ON DIESEL
	M IS	1 0181684	052877	Н	PH	813	T	1	1	D	B SAFETY INJ PUMP DID NOT START - AUTOMATIC	SEQUENCER CONTACTS OPER WITH TOO LOW CRNT
	W TR	1 0191680	052877	R	PH	813	T	1	1	0	B RHR PUMP DID NOT START - AUTOMATIC	SEQUENCER CONTACTS OPER WITH TOO LOW CRNT
	W TR	1 018452	070177	G	PM	014		1	N	U	SOUTH CENTREGE CHRG PMP ROTOR FAILD	DETAILD ANALYSIS UNDERWAY
	M IS	1 019905	072877	J	PM	800	T	ı	1	U	B COMP COOLING WTR PUMP FAILED TO START - AUTO	EXACT CAUSE UNKNOWN-REPLACED ALL SEONCRS
	W TR	1 018991*	082177	K	PM	DOI	N	4	N	D	POWER TO RCPS INADVERTENTLY DEENERGIZED	GEN OUTPUT BRKR WAS TREPPED PREMATURELY
	W TR	1 020182	121777	B	PO	B13	1	1	U	0	DSL DRVN AUX FO PUMP STARTED AND IMMED TRPD-MRSPD	MICROSWICH IN SPO SENSING CRT OUT OF ADJ
	M IS	1 020183	121777	В	b 1	813	S	1	t	0	STEAM DRIVEN AUX FEED PUMP INOPERABLE	LIMIT SW FAILURE IN OVERSPEED TRIP CKT
		1 032078	072080	8	PT	806	5	1	t	0	AUX FEED PUMP FAILED TO START MANUALLY	POJR PROCEDURE
	M TR	1 032622	090380	B	P D	819	5	1	- 1	Т	AUX FEED PUMP FAILED TO START	FAILED STARTING BATTERY
	W TU	3 000345	031973	J	PM	813	5	1	1	D	34 COMP COOLING WATER PUMP FAILED TO START - AUTO	EMER LOAD SERNCE RELAY CONT MALFUNCTIONED
	W TI	3 000780	020574	H	PM	813	5	1		D	34 SAFETY INJ PUMP FAILED TO START	INSUFFICIENT CHARGE ON BRKR CLSG SPRINE

zak	PLANT	CONTROL	EVENT	SYSTEM	COMP	N A USE	TYPE	FAIL	303	CICLASS	MODE DESCREPTION	CAUSE DESCRIPTION
w	TU3	010136	050374	н	PH	C11	U	1		N D	SAFT INJ PMP STOPPO WHEN LOW RUN CURRNT/PRESS SEEN	ATR LEAKAGE INTO PUMP CASING
w	TU3	010135A	050874	8	PT	806	c	2		0 1	DURNG START TEST A & B AUX FEED FAILD TO START	PACKING TOO TIGHT DEFECTVE PROCEDURES
W	TU3	0101350	050874	8	PT	809		1		1 1	DURNG START TEST "C"AUX FEED FAILD TO START	FOREIGN MAT IN TURB REG VALVE/GOVERNOR
W	TU3	014880	021976	G	PH	A16	R	1		U	WATER LEAKING FROM 34 CHARGNG PMP DURNG NORMAL OPS	CRACK IN CASING BETWEEN VALVCHMBR/STUFN B
W	TU3	016258	101576	G	PM	821		1	. ,	N T	"38" CHRG PMP GOS DUE TO DAMAGE TO CONNECTING ROD	INSUFERT LUBRICTH TO CONN ROD BEARINGS
W	T113	021010	031578	G	PM	C11	R	1	. 1	1 1	"3A" CHRG PMP HAD CRACKD PMP CASING	HI CYCLIC STRESSES
W	TU3	025775	030279	н	РН	C17		- 1		4 U	38 SI PUMP FOUND TO BE RUBBING	CAJSE UNKNOWN, IMPELLERS MOVED
W	103	026562	070179	G	PM	A19		1		N T	38 CHARGING PUMP REMOVED FROM SERVICE	FATLED PRIMARY AND SECONDARY PACKING
W	103	027583	100179	8	PT	809	R	1		ГГ	"A" AFW PUMP FAILED TO START	WATER IN PNEU CONT OF PRESSURE CONTROL VL
W	TU3	027658	110579	В	PT	820	R	- 1		1 1	"A" AFW PUMP FAILED TO START	MISALIGN OF CONNECTORS ON PRESS CONT VLV
W	TU3	028094	112879	B	PI	800	R	1		T U	"A" AFW PUMP FAILED TO START	CAUSE UNKNOWN
W	TU3	032888	092680	8	PT	009	R	1	. 1	N T	"A" AUX FEED PUMP FAILED TO DELIVER REQUIRED FLOW	WATER IN PHEUMATIC CONTROLS
W	1114	000095*	061873	8	PT	802	U	1		N 0	AUTO START OF AUX FD PMPS DID NOT OCCUR ON SCRAM	FUSES FOR AUTO-START LOGIC CKT NOT INSILD
W	104	019127	041577	1	PM	809	R	1		N T	UNITS 3 AND 4 OPERING DNLY 2 BORIC AC TRANFR OPRAL	THRUST IMBALNCE DUE TO CRYSTAL BLOCKAGE
W	1114	019700	110977	F	PM	000		1	1	U N	48 CONT SPRAY PMP INBOARD BRNG DVRHEATD	MODEL 3736 4X6-13DV 1450GPM AT 470 FT
W	T134	025305	012579	1	PM	002	T	1	1	N T	44 BORIC ACID TRANSFER PUMP TRIPPED ON OVERLIAD	INSULATION NOT REINSTALLED, SOLIDIFICATION
W	104	027106	081579	G	PM	A19		1	1	1 P	4A CHARGING PUMP REMOVED FROM SERVICE	SEAL FAILED
W	T114	027242	082979	I	PM	011	T	1	1	N T	44 BORIC ACID TRANSFER PUMP TRIPPED ON OVERLOAD	SOLIDIFCATION OF BORON IN RECIRC LINE
W	TU4	027241	083079	t	PM	913	S	1		N T	48 BORIC ACID TRANSFER PUMP FAILED TO START	MALFUNCTION OF LINE STARTED. DIRTY CONTACT
W	1114	027239	091179	G	PM	A19	R	1	1	N T	4C CHARGING PUMP REMOVED FROM SERVICE	FATLED SEAL
W	TU4	030945	040780	8	PT	C13	5	1		1 1	"A" AUX FEEDWATER PUMP FAILED TO DELIVER REQUIRED	FLOW. CONTROL CERCUIT BUT OF CALIBRATION
W	YRI	016649	121676	Н	PM	A16		1	1	1 1	#1 HPST PMP SHAFT HOUSING SEAL LEAKED	CUT IN GASKET BETWN HOUSNG/STUFFNG BOX
W	YRI	016862	010777	t	PM	A07		1	1	T	PACKING GLND ON #1 LPSI LEAKED EXCESSVELY	PAIKN REACHD END OF LIFE REPLACE PACKING
W	YRI	020071	122977	t	PM	004		1		10	#3 LPST OUTBRO SHET PACKN GLAND OVERHEATD, PUNP S/O	INSUFCRT CLEARNCE BETHEEN SHFT/PACKH GLND
W	711	000317	091073	G	PM	813	5	1	. 1	N T	THE 18 CHARGING PUMP WAS INDPERABLE-DID NOT START	FFEDER BRKR BRUSHHOLDER MISSING-VIBRATION

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	p			SY		, c			I	C		
	VA			Ì	.03	MA	Y	AN	Ĭ	A		
3	N	NUMBER	DATE	H	P	E E	E	L M	Ÿ	3	MODE DESCRIPTION	CAUSE DESCRIPTION
				_						-	18 CONTAINMENT SPRAY PUMP DID NOT START	BRKR RACKED IN TO WRONG POSITION
		1 010081									AUX FEED PMP 18 TRIPPO AFTR 30SEC, TRIPPO 2ND TIME	PMP SUCTH LINE MODFIED TO PROVIDE VENTING
	w ZI	1 010126									AUX FEED PHP 1A FAILD TO START RESET OVERSPO TRIP	OVERSPO TRIP VALVE FOUND TO BE TRIPPO
	I S W	012080	051474	8	PT	800		1		D	14 AUX FEED OVERSPO VALV TRIPPO RESET THEN STARTED	
	13 M	1 010281	060674	8	PT	009	R	1	N	1	TA AUX FEED DAEKSAD ANTA LELLA KEREL LINER STATE	AUX FO L.O. PUMP PHR SUPPLY BKR WAS OPEN
	1 2 H	1 010718	071174	B	PŢ	802	U	1	U	D	AUX FO PUMP 1A FAILED TO START FROM CONT RM  1C AUX FEED DOES NOT START PUMP INTERNALS DAMAGED	
	T S W	1 010914	091974					1			*********	DIESEL STARTING BATTERIES FAILED
	w 21	1 013217	082575	F	PD	813	2	1	T		CONTRINENT STRAT DIESEL TREES TO THE	TURBINE WAS WATER BOUND
	w z t	1 014269	030576	B	PT	809	R	1	N		14 AUX FEED PUMP FAILED TO START	
	w 21	1 0153674	080876	8	PT	800		1			14 AUX FEED TRIPPO AFTR STRID DUE TO OVERSPO TRIP	PLUGGED SUCTION STRAINER
	w Z1	1 6153678	080876	8	PM	C09		1	N	T	IC AUX FEED FAILD TO DEVELP FULL DISHEG HEAD	STY FLO CONT VLV SOL STUCK IN ENERGZO POS
	13 W	1 020112	120377	8	PŢ	813	T	1	T	0	14 AUX FD PUMP WOULD NOT START	
	w 7 I	1 020105	120877	В	PT	813	T	1	T	0	14 AUX FO PUMP WOULD NOT START	ST4 FLO CONT VLV SOL STUCK IN ENERGED POS
	w z I	1 023442	122678	F	PO	018		1	T	T	CONTAINMENT SPRAY PUMP IC DEVELOPED HOSE RUPTURE	CHOLING SYS HOSE ON DIESEL BROKE
		1 027284						1	N	U	FOLLOWING RX TRIP IC AFM PUMP STARTED THEN TRIPPED	
								1	U	D	AUX FO PUMP 28 HAD PREVIOUSLY FAILED	APPARENTLY DAMAGED FROM AIR BINDING
	w 71	2 000814	021574	B	PT	811	٧	1	T	0	ZA AUX FEED PUMP STARTED, BUT TREPPED ON OVERSPEED	AIR WAS ASPIRATED INTO THE PUMP
		2 0008934							N	D	2C AUX FO PUMP STARTED - DISCH PRESS DID NOT RISE	ATR BINDING OF PUMP IMPELLER
		2 000 991	031274	R	PM	813	5	1	U	D	28 AUX FD PMP FAILED TO START	OIL PRESS START INTLK SW WOULD NOT CLOSE
	w 21	2 010709	071274	F	PD	C 02	5	1	T	D	CONT SPRY INJ PMP 2C OPERATO 10% BELOW NORMAL HEAD	MAN CONT VALV NOT PROPERLY LOCKED
	* * * *	2 010/04	001076	w	DM	001	11	,	N	D	TWO RCPS WERE INADVERTENTLY TRIPPED OFF-LINE	PERSONNEL MADE SWITCHING ERROR
										U		NO APPARENT CAUSE FOR FAILURE
		2 019997						1		1	CONTAINMENT SPRY PUMP 2C DEVELOPED HOSE RUPTURE	COOLING SYS HOSE ON DIESEL BROKE
		2 022996	110878		20	010			11	0	STH SUP VLV TO HPCI TURBINE, FCV-73-16, FAILED TO 09	LIMITORQUE DRIVE MOTOR-DAMAGED GEARS
	-	1 000301	040473	14	*1	n1:		1	0	0	HPCI FAILED TO REACH RATED SPEED & FLO ON OK START	FLOW CONTROLLER MALFN-BAD CONNECTOR
		1 000368										TRIP LOGIC IMPROP DESIGNED FOR LOSP
	G BF	1 0005184	111073	H	PI	013	N	. 1	N	U	HPCI INOPERABLE UNTIL MANUALLY RESET	

YES.	P L A N	CONTROL	EVENT	SYSTEM -	0	CAUSE	T Y P E -	FNU	CTIVITY		MODE DESCRIPTION	CAUSE DESCRIPTION
G	BF	0005188					N	1	N U	RCIC	INOPERABLE UNTIL MANUALLY RESET	TRIP LOGIC IMPROP DESIGNED FOR LOSP
6	RF	000521	111573	0 0	1 1	113	5	1	T D	RCIC	SYS FAILED TO OPER WHEN MANUALLY INITIATED	STEAM SUPPLY VLV WOULD NOT OPEN
G	BF	000522	111573	н Р	T 6	300	s	1	N U	HPCI	SOLATED AND TRIPPED ON MANUAL INITIATION	NO APPARENT CAUSE
6	8F	000655	122573	H P	T	13	T	1	1 1	HPCI	TURBINE FAILED TO REACH RATED SPEED & FLOW	GOVERNOR UNABLE TO PROPERLY SIGNAL CONTRL
G	BF	000713	011774	IJ P	M /	119		1	TT	18 51	BY LIQUID CONT PUMP FAILED SURVEILLANCE TEST	PACKING ON 1 OF 3 PUMP PLUNGERS FAILED
G	85	000872	012674	H P	T (	13	T	1	T D	HPCI	FLOW & TURBINE SPEED UNSTABLE	DEFECTVE PARTS IN EGM CONTROL BOX
G	BF	010018	031274	H P	T	13	T	1	1 1	HPCI	TURBINE FAILED TO REACH RATED SPEED AND FLOW	EG4 BOX FAILED DUE TO DEFCTY TRANSISTOR
G	BF	000978	041374	H P	1 (	13	T	1	UT	HPCI	FAILED TO REACH RATED FLOW IN REQUIRED TIME	TWO DECTY XSISTORS IN GOV EGM CONTROL BOX
G	AF)	010122	050574	H P	T F	300	R	1	N U	HPCI	SYSTEM ATTEMPTED TO START BUT TRIPPED	UNDFTERMINED
G	8F	010171*	051374	R P	M (	200	U	2	T D	RHR P	MPS TRIPPO DUE TO ISOLATION VALVES CLOSING	FAULTY RELAYS FOR FCV74-47 AND FCV74-77
0	BF	010294	0609.4	H P	1 1	313	R	1	T D	HPCI	REQD SEVERAL MANUAL START ATTEMPTS FOR OPERTM	OIL RELAY VALVE DID NOT OPEN FULLY
6	BF	010377*	061874	D P	M 8	313	U	2	1 0	18 6	1C COR SPRA DIONT START DURIN SURVLING TESTIN	BENT CONTACT ARM ON RELAY (MANUAL START)
6	BF:	010422	062174	14 8	T	313	R	1	U D	HPCI	TURBINE FAILED TO START MANUALLY	TURR STOP VLV PILOT PISTON WAS MALFUNCING
6	BF:	010533	082074	Q P	1	304	Т	1	N D	RCIC	FAILED TO START AFTER A REACTOR SCRAM	CONTROL COMPONENTS OUT OF CAL-WRONG LOCTN
6	BF	010793	091874	н	T	313	т	1	N D	HPCI	FAILD TO START DURIN SURVLINCE AT 95% POWER	CONTACTS IN AUX DIL PMP CIRCUIT HUNG UP
6	BF	010938	111574	Q P	T	320		1	1 1	RCIC	TRIPPED ON OVERSPEED DURING AUTO-INITIATION	REMOTE SERVO OUT OF ALIGNMENT W GOV LEVER
G	BF	0159294	092176	H P	T	018	T	1	1 1	HPCE	TRIPPED DURING TESTING	LEAKING STEAM DISCHARGE LINE RUPTURE DISK
6	8F	0159298	092176	0 9	1	913	T	1	1 1	RCIC	FAILED REQUIRED SURVEILLANCE TEST	GOVERNOR EG-R MALFUNCTIONED
6	aF	018124	050277	9 9	T	13	T	1	1 1	RCIC	SYSTEM FAILED TO REACH RATED FLOW AND PRESS	IMPROPER SPEED REF VLTG TO EG-M CONT BCX
0	BF	018126	050977	H P	T 8	313	T	1	T D	HPCI	TURB STM SUPPLY VLV.FCV-73-16, FAILED TO OPEN	LITITORQUE ACTUATOR, MOD SM8-2, BROKN TEETH
(	AF:	018122	051277	14 P	T !	313	T	1	T D	HPCI	AUX DIL PUMP FAILD TO START	DEFECTIVE PRESS. SWITCH
6	BF	019540	080177	0 0	1	13	T	1	1 1	RCIC	TURB DID NOT PRODUCE RATED FLOW IN REGO TIME	RAMP GEN AND SIGNAL CONVERTER OUT OF ACJ
	BF	018691	080877	H F	1	013	r	1	1.1	HPCT	TURBINE SPEED CONTROLLER WOULD NOT CONT TURR	POWER SUPPLY TO GOV FAILED-RESISTOR FAILD
6	BF	027159*	092679	KF	M (	003	٧	2	N D	A AND	8 RECIRCULATION PUMPS TRIPPED	TRIUBLESHOOTING WRONG TERMINAL STOP
(	9F	027316	101079	H F	1	004	T	1	T D	HPCI	TURBINE TRIPPED DUE TO RUPTURE DISK RUPTURE	REPLACING WITH IMPROVED RUPTURE DISK

Z W	PLANT	CONTROL	EVENT		0	MODE	TYPE	A T	302	A TIME LINE	CLASS	MODE DESCRIPTION	
-		027682*	112670		ом	003	v	,		N	0	BOTH RECERC MG SETS SHUTDOWN DURING NORMAL OP.	PERS
			120379					1			T	HPCI STOP VALVE FAILED TO REMAIN OPEN	2051
		027834	012780							U	0	HPCI PUMP TURBINE HAD CRACK ON COUP BEAR SUPP PED.	BELT
-		030306	040280									RCIC TRIPPED DUE TO A HIGH RUPTURE DISC PRESSURE	TEFE
		030887									0	HPCI PUMP TRIPPED DUE TO FAILED EXHUST RUP. DISC	TEF
		030977	040790								T	HPCI PUMP FAILED DUE TO INADVERTANT TRIPPING	MOSI
-7		031403	060280								T	HPCI ISDIATION OCCURED DURING MANUAL HPCI START	EX4
		010491	081174						١.			RCIC FAILED TO REACH RATED FLOW	TUR
		010493	082374								0	HPCL SYSTEM INOPERABLE DUE TO EXHAUST LINE FLOODED	C1141
- 7		010815	092474								0	FLOODED SYS. DUE TO LEAKING GLAND SEAL COND. GASKT	FL 1
G	BF2	010816	100774									HPCI INOPERABLE DUE TO FLOODED GLAND STEAM CONDEN.	8110
G	BF2	010996	110474								0	HPCI AUTO-ISOLATED AFTER AUTO-ACTUATION	NO
G	BF2	011097	120374								0	RCIC SYSTEM FAILED TO OPERATE DURING A TEST	RES
G	BF2	012083	010775						ī.,		1	RCIC TURBINE TRIPPED DURING NORMAL OPERATION	MEC
G	BF2	012082	011675						1			RCIC TURBINE GOV SPEED CONTROL FAILED TO RESPOND	MPF
G	SF2	015936	090876						7		T	HPCI TURBINE STEAM SU VLV. FCV-73-16, FAILED TO THE	LIT
G	BFS	016807	111676						1			DAMAGE SUBSTAINED TO HECT PUMP AND REDUCTION GEARS	VAL
G	BF	021782	062778	H	P	00	3	C	1	T	D	28 STANDBY LIQUID CONTROL PUMP FAILED TO REACH CAP	NOR
G	BF	2 022085	080578	U	1 0 1	1 00	7		1	T	T		MIS
6	AF:	030311	020380	K	P	1 00	3	T	1	T	D		SPU
0	BF.	2 030312	020380		P	9 01	3	5	1	N	0		487
- 0	BF	2 030360	020680		P	4 00	3	T	1	N	0	28 RECIRC PUMP TRIPPED	BEL
	BF:	2 030417	021680		1 P	r C1	1	5	1	H	0	HPCE PUMP TUR HAD CRACK ON COUP BEAR SUPPORT PED.	Att
-	BF	2 030637	031090	1	1 0	1 01	8	T	1	1	0		LOO
(	. BF	2 031547	060790	) 1	( P	M DI	1	T	1	N	T	ZA RECIRC PUMP TRIPPED ON HIGH STATOR TEMP ON MG	TEF
-	BF	2 032259	081280	) 1	4 P	1 01	9	T	à	1	0	HPCI SUMP TRIPPED DUE TO FAILED EXH RUPTURE DISC	

SONNEL TESTING WRONG RELAYS TING IN TRIP MECHANISM NOT COMPRESSED TEVED TO BE CAUSED BY A WATER HANNER LON SHEET PORTION OF DISC FAILED FLON SHEET PORTION OF DISC FAILED N OVERSPEED TRIP PISTON 4ST RUPTURE DISK FLO-SOL VLV WIRED WRNG RRINE TACHOMETER CIRCULT FAILED 49 FLOODING CAUSD HOTWELL PUMP FAILH DC INDED TURB. SUMP & HOTWELL PUMP THE D GASKETS ON CONDENSER PROVISION FOR EXHAUST LINE DRAINAGE STSTOR FAILED IN PUR SUP TO EGM CONTRLR CH OVESPO EMERG TAL SET NUT HAD ROTATED EN RESISTOR IN GOV PUR SUP ASSEMBL" MITORQUE SM8-2 TORQUE SW GEAR PIN BRCKE I VE IN LUBE OIL I THE WAS NOT OPENED RMAL WEAR TO VALVE, SEATING SURFACES SINTERPRETED PUMP LABEL ON TRIP BREAKER URIOUS SIGNAL. MG SET GEN STATOR TEMP THE RELAY OPERATED LIEVED TO BE CAUSED BY WATER HAMMER FLON SHEET PORTION OF DISC FAILED DISE CONNECTION DUE TO VIBRATION FLON SHEET PORTION OF DISC FAILED

CAUSE DESCRIPTION

, mar.	PLANT	CONTROL	EVENT	SYSTEM	0078	MOOR	Y		302	ACT CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
G	8F3	015095	082476	H 1	PT	818	S	1		0 1	RUPTURE DISK ON STM DISCH LINE FAILED ON HPCI STU	CHK VLV IN EXHST LINE SANSING
6	8F3	015937	082676	н 1	PT	813	T	1		T	HPCI TURBINE CYCLED ON START UP	GROUNDEL CONNECTOR ON GOV EGM BOX
6	BF3	016056	092176	H 1	PŢ	C18	S	1		1 1	HPCI SHAFT DIL PMP PESS-LOW CAUSH ERRATIC TURBINE	LEAKING UNION ON SUCTION OF DIL PUMP
6	BF3	015057	092376	1.	PM	813	5	1		U	RHR PMP 3C FAILD TO START ON NORMAL POWER	OPEN CABLE IN RHR LOGIC
G	BF3	016059	100176	0 1	1	COZ	S	1		T D	RCIC CONTROLLER FAILED TO CONTROL SPEED	BROKEN WIRE IN GOV SPEED SENSING CIRCUIT
G	BF3	016268	103076	K 1	M	006	S	1		N T	38 RECIRC TRIPPO DUE TO BURNO COLLECTR RING ON MG	CARBON BRUSH WORE TOO SHORT
6	BF3	018637	070577	H (	1	813	5	1		1 0	HPCI TURBINE STM SUP VLV.FCV-73-16, FAILED TO OPEN	TORQUE SW GEAR ASSY, SMB-2, REPLACED
G	BF3	018872	093077	H. 1	PT	013	T	1		1 1	HPCI TURBINE SPEED CONTROLLER WOULD NOT CONT TURB	OPEN RESISTOR IN GOVERNOR POWER SUPPLY
G	BF3	021839	070678	н 1	7	013	T	1		0.1	HPCI PUMP TRIPPED DURING SURVEILLANCE TEST	FAILED RESISTOR IN POWER SUPPLY TO GOVEN.
6	BF3	023185	112478	0 1	7	013		1		1 1	RCIC PUMP TRIPPED ON OVERSPEED	OIL LEAR UN ELEC-GOVENOR-REGULATOR
6	BF3	031576	069980	0 1	PŢ	013		1		TT	RCIC TURBINE TRIPPED ON OVERSPEED	VOLTAGE SUPPRESSOR IN FOR BOX FATIFO
6	8F3	032025	071480	1	PM	013	s	1		1 0	30 RHR PUMP TRIPPED ON INSTANTANEOUS OVERCURRENT	POSSIBLE INCORRECT SETPOINT OF RELAY
6	BF3	032542	090180	K 1	PM	000		1		U	"A" RECIRC PUMP TRIPPED	CAUSE UNKNOWN
G	801	019025	082977	F	D	813	5	1		T D	DIESEL FIRE PUMP FAILED TO START DURING REFUELING	Z MATTRY CABLES LOOSES B BATTRY WAS OTSCH
6	BRI	016861	112176	н	7	813	5	1		T	HPCI STM SUPPLY VLV, E41-FOOL, WOULD NOT OPEN	BRUSHES IN VALVE MOTOR WERE STICKING
G	681	015858	120376	0	PT	813	5	1		1 1	RCIC STH ISOLATION VLV, E51-FOOT, FAILED TO OPEN	LODSE WIRE ON VLV MOTOR OPEN CONTACTOR
6	3R1	016856	010577	R 1	PM	800		1		T U	14 RHR FAILD TO STARTMANUAL START FAILD ALSO	NO CAUSE DEFERMINED
G	391	0181674	060177	R 1	M	813	5	1		r D	14 RHR DED NOT START ON AUTO-SIGNAL	STICKY CONTACTOR ON CONTROL SWITCH
G	881	0181678	061877	R	M	001	S	1		10	24 RHR TRIPPO DUE TO OPERATOR HITTING SWITCH	ACCIDENTAL BUMPING OF CONTROL ROOM SWITCH
											RCIC TURBINE TRIPPED ON HI EXHST PRESS DURING S/U	NO CAUSE GIVEN
G	881	019493	102577	K F	M	013	5	1	-	N D	14 RECIRC TRIPPO DUE TO RECIRC MG SET TRIPPING	LO LUBE OIL PRESS. DUE TO CONTROL VALVE
G	881	017677	110577	L	РН	802	5	1		1 1	RHR 14 DED NO. START; COVER LOOSE & CONTACTS CORRO	CORRODED DUE TO WATER LEAKS
6	BRI										HPCI TURBINE TRIP DUE DIL PMP TRIPISHORTED MOTOR	HI WATER IN HPCT ROOM DUE TO PMPING ROOMS
G	881	0198424	111077	0 1	PT	800	R	1		T U	RCIC TURBINE TRIPPED DURING MANUAL START UP	NO CAUSE FOUND
G	881	0198428	111177	0 1	1	800	R	1		U	RCIC TURBINE TRIPPED ON HI EXST DURING MAN START	NO CAUSE FOUND

									A			
>EZ I	PLANT	CONTROL NUMBER	EVENT	SYSTEM	COTA	MOOM	TYPE	F A I L	- MCZ	CLASS	MODE DESCRIPTION	
G	881	020209	122977	ĸ	PM	002	S	1	N	D	RECIRC PMP 14 TRIPPD DUE TO MG SET TRIPPING	STRI
G	981	020614	021378	0	PT	800	R	1	N	U	RCIC TURBINE TRIPPED ON OVERSPEED AFTER RX SCRAM	NO C
G	BRI	021090	041278	H	PT	C01		1	1	t	TURBINE CONT. VALVE WOULD NOT OPERATE DUE TO CORRO	EXCE
-		021253	042178	q	PI	010	S	1	7	T	RCIC TRIPPO DUE TO FALSE MECH. OVERSPEED INDICATIN	EGR
175	70 TO 10	022699	101478	0	PI	802	5	1	T	0	RCIC TURBINE STOP VALVE WOULD NOT RESET AFTER TRES	EXCE
-0	-	023061	111478					1	1	T	HPCI EGR FAILED TO OPERATE PROPERLY	WATE
G	AP1	025090	010479					1	r	7	HPCI TURBINE FAILED RESPONSE TEST	GOVE
-		025091	010479					1	N	т	14 RECIRC PUMP TRIPPED DUE TO LOW LUBE OIL ON MG	MISS
		025041	010979	L	PM	813	S	1		0	RHR PUMP "D" MOULD NOT START	INTE
T		027037	091679	- 1					N	T	HPCI TURBINE NOTICED TO BE TRIPPED	SUCT
-20	2000	027232	092679	0	PT	002		1	N	0	RCIC TURBINE TRIPPED	MEN
		030195	012180	н	PT	013	5	1	1	r	HPCI AUX LUBE DIL PUMP WOULD NOT RUN IN AUTO	LOOS
7		030409	021480					1	T	U	TO RHR PUMP TRIPPED IN TORUS COOLING MODE	2113
G	991	0307734	032480	14	PT	813	R	1	N	T	HPCI PUMP TRIPPED ON OVERSPEED WHILE STARTING	STRO
		0307738								t	HPCI PUMP TRIPPED ON OVERSPEED WHILE STARTING	sten
		031149	050180						N	T	14 RECIRC PUMP TRIPPED ON M3 SET LOW LUBE OIL PRES	PRES
G	882	013325	041375	0	PT	019	T	1	N	D	RCIC TURBINE TRIPPED DUE TO HIGH EXHAUST PRESSURE	EX4A
	100000000000000000000000000000000000000	013343	041475						T	0	HPCI TURBINE STOP VALVE VB FAILED TO OPEN FULLY	PERS
-		013379	041475	н	PT	913	5	1	1	T	HPCI TURBINE SUPPLY VALVE FOOL FAILED TO OPEN	VALV
-		013617	080475	K	PH	A04	R	1	N	0	AFTER SCRAM FROM PWR, 28 RX RECIRC PUMP LEAKED	100
		013560	082475	ĸ	PM	A04	R	1	N	D	AFTER SCRAM FROM PWR, 28 RX RECIRC PUMP LEAKED	104
		013626	090275	14	PT	813	S	1	1	D	HPCI STEAM ISOLATION VALVE FOOS FAILED TO OPERATE	AUXI
-		013620	090575						N	0	AFTER SCRAM FROM PWR, 28 RX RECIRC PUMP LEAKED	401
		013514	100175						1	T	RCIC TURBINE TRIPPED ON OVERSPEED DURING START	0941
-3		013515	100375						1	T		DRAI

ING ON MG BKR GOT CAUGHT AND TRIPPED CAUSE DETERMINED FOR OVERSPEED ESSVE WIR IN ROOM(OCT. 77) WAS CAUSE ACTUATOR CORRODED; LEAKY VALVES ESSIVE PAINT AND DIRT ON TRIP LEVER FR IN HYDRAULIC FLUID CAUSED CORROS ION ENDR ASSEMBLY OUT OF ADJUSTMENT SING LOCK NUT ON LO ADA CAUSED DRIFT ERNAL PROBLEMS IN CIRCUIT BER TION PRESSURE SWITCH FOUND OUT OF CAL WORKING ABOVE TRIP MECHANISM SE WIRE ON RIGH CONTROL SWITCH SE UNKNOWN, BKR RESET AND PUMP STARTED ORE TIME FOR STOP VALVE WAS TO FAST THE TIME FOR STOP VALVE WAS TO FAST SS SW SET TOO HE WITH ERRATIC PRESSURE AUST LINE CHECK VALVE STUCK SHUT SONNEL ERROR-NEEDLE VLVS IMPRPR ADJST VE MOTOR WINDINGS FAILED COOLANT REACHED SEALS, CRACKED SL FACE COOLANT REACHED SEALS, CRACKED SL FACE ILIARY RELAY PLUNGER BROKE CODLANT REACHED SEALS, CRACKED SL FACE IN DOWN OF CONTROL OIL FROM CONT VALVE IN DOWN OF CONTROL DIL FROM CONT VALVE

CAUSE DESCRIPTION

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YEN-	PLANT	CONTROL NUMBER	EVENT	SYSTEM		CAUSE	TYPE	FANULM	CLASS	MODE DESCRIPTION CAUSE DESCRIPTION
G	BRZ	013516	100475	Q P	T	313	R	1	1 1	RCIC TURBINE TRIPPED ON OVERSPEED DURING START DOWN OF CONTROL OIL FROM CONT VALVE
G	882	013517	100975	Q P	1	813	R	1	1 1	RCIC TURBINE TRIPPED ON OVERSPEED DURING START DRAIN DOWN OF CONTROL OIL FROM CONT VALVE
G	882	013689	102775	Q P	T	814	T	1	UD	RCIC TURBINE TRIPPED BECAUSE OF HIGH EXHAUST PRESS CHE VLV FO40 JAMMED PARTIALLY CLOSED
G	882	013800	110375	Q P	1	313	R	1	1 1	RCIC TURBINE TRIPPED ON OVERSPEED DURING START ORAIN DOWN OF CONTROL OIL FROM CONT VALVE
G	882	013702	111075	0 P	1 (	313	R	1	1 1	RCIC TURBINE TRIPPED ON OVERSPEED DURING START DRAIN DOWN OF CONTROL GIL FROM CONT VALVE
G	BRZ	013798	111475	K P	M (	013	5	1	N U	56% PWR R/X RECIRC 24 TRIPPO24 MG SET INOPERBLE NO PROBLEM FOUND WITH MG SET
G	RR2	013799	111475	Q P	T	813	R	1	1 1	RCIC TURBINE TRIPPED ON OVERSPEED DURING START - ORAIN DOWN OF CONTROL DIL FROM CONT VALVE
G	882	013816	111875	Q P	1	813	S	1	1 1	RCIC TURBINE TRIPPED ON OVERSPEED DURING START BURNED OUT XSISTORS IN GOV VLV CONTROLLER
G	882	014646	020476	Q P	T	818	T	1	U 0	RCIC TURBINE TRIPPED ON HIGH EXHAUST PRESSURE DISCHARGE CHK VLV. FO40. DISC BLOCKING FLOW
G	BRZ	014947*	052776	K P	M (	001	N	2	T D	RECIRC PUMPS TRIPPO ON LOW L.O. PRESS OPERATOR DID NOT FOLLOW EMERGNCY PROCECRE
G	882	0149474	052776	K P	M 1	019	R	1	N 0	28 RECIRC SEALS FAILD FOLLOWING RX SCRAM 30% PWR NOT STATED AS TO REASON
G	822	014946	053076	K P	H (	013	5	1	N I	RECIRC LOOP INOP. DUE TO ZA MG SET TRIP ON OVERCORN OVERCURRENT RELAY "508" FAULTY
G	982	016260	110276	0 P	1	508	U	1	N 0	RCIC TURBINE TRIPPO ON HI EXHAUST PRESS FXHAUST STOP-CHECK VLV NOT OPENED
G	882	016397	110976	K P	M /	104	R	1	N 0	RX IN RUN MODE. ALARMS INDICATE 28 RECIRC PMP PROR PUMP SEALS FAILED DUE TO THERMAL SHOCK
G	882	017186	020777	0 P	M 1	813	5	1	TU	CORE SPRAY 28 FAILD TO START BKR CHARGIN SPRING CHARGE SPRING MANUALLY CHARGED, BKR CLOSED
G	885	017327	022377	0 P	T	913	5	1	N T	RCIC TURBINE STEAM INLET VALVE WOULD NOT OPEN VALVE OPERATOR FOR FO45 WAS BURNED UP
G	382	017535	040577	H P	T	811	T	1	N T	HPCI AUTO STARTED BUT THEN TRIPPED ON HI DELTA T RX BLOG HEAT WAS OFF-THEREFORE HI DELTA T
G	BRZ	019134	050777	Q P	T	301	U	1	N D	RCIC TURB. OVERSPED AFTE MANUAL START FOLLWY SCRAM OPERATOR DIDN'T CHECK MAN. SPEED SETTING
G	BRZ	019673	051477	H P	T 1	911	T	1	N T	HPCI TREPPED ON HIGH DEFFERENTIAL TEMPERATURE ISOL RX BLOG VENTLIN WAS ISOL-HE HPCE RM TEMP
G	882	018676	062277	£ 0	M E	108	U	1	T O	RHR ZA CHARGN MOTOR SWITCH IN OFF POSITION PERSONEL LEFT SWITCH IN OFF POSITION
G	882	019016	090477	H P	T. 1	813		1	N T	HPCE FAILED TO INJECT WATER ON RX SCRAM LOTSE FITTING IN CONT OIL LINE TO SERVE
G	882	020206	122777	H P	T	13	5	1	1 1	HPCI TURBINE SPEED COULD NOT BE CONTROLLED DEFECTIVE EGM UNIT-GROUND IN EGR ACT CCIL
G	882	022453	092478	0 9	T 1	800		1	T U	RCIC TURBINE TRIP AND THROTTLE VALVE TRIPPED TRIP THROTTLE COULD NOT BE RESET, UNKNOWN
.G	882	025377	030179	H P	T	13		1	TT	HPCI PUMP HAD SEVERE OSCILLATIONS WHEN ACCELERATIN SET SCREWS ON SPUR GEAR ON REF SPEED LOOS
G	BRZ	025639*	040479	B b	M .	813	U	2	1 1	RHR PUMPS 28 AND 20 WOULD NOT START FROM RTG8 POR CONNECTIONS ON FUSES & FUSE BOX

PLANT	CONTROL	EVENT		COM P	CAUSE		FAIL	TOT	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
G BR	026037	051879	14	PT	D13		1		T	HPCI PUMP TRIPPED ON OVERSPEED TOO SOON	ADJUSTING SCREW FOUND 5 TURNS OUT OF PES.
G 82	0277694	120679	K	рм	013	T	1		0 1	28 RECIRC PUMP TRIPPED	BLOWN FUSES DUE TO SHORT BRUSHES
G BR	0277698	121379	K	РМ	013	T	1		N D	28 RECIRC PUMP TRIPPED	BLOWN FUSES DUE TO SHORT BRUSHES
G 88	0301944	012380	K	PM	013	T	1		N D	28 RECIRCULATION PUMP TRIPPED	FUSES BLOWN IN VOLT FEEDBACK CIRCUITRY
6 88	0301949	021090	к	PM	013	T	1		N D	28 RECIRCULATION PUMP TRIPPED	FUSES BLOWN IN VOLT FEEDBACK CIRCUITRY
G 88	2 030526	022980	ĸ	PM	006	S	1		T D	ZA REACTOR RECIRC PUMP TRIPPED	WIRE CONNECTED FOR TEST, CAUSED TRIP
G BR	2 032454A	290780	0	PT	001	U	1		1 0	RCIC TURBINE TRIPPED ON HIGH EXHUST PRESSURE	INCORRECT VALVE LINE-UP
G BR	2 0324548	090780	н	PŢ	001	U	1		1 0	HPCI STOP-CHECK ALSO FOUND SHUT	PERSONNEL DIDNT VERIFY POSITN AFTER MAIMT
e co	010207	030874	н	PT	C13	S	1		7 0	TURBINE SPEED CONTROL PROBLEMS DURIN PUMP OFER TES	DIODE WEL IN SPEED REF. CKT. OF AMPLIFIER
g cn	010296	053074	Q	PT	813	5	1		T T	RCIC TRIPPED ON OVERSPEED DURING STARTUP TEST	FLOW CONTROLLER DRIFTED UPWARD 4 MA
e co	1 011261	121374	3	PM	018	R	1		N T	18 CCW PMP MOTOR EXPERIENCO INSULATION FAULT-STATE	STATOR WINDINGS MIN. CLEARANCESTEND TO SAG
g cn	012814	051275	0	PT	C13	s	1		T 0	RCIC FLOW WAS 375 VS 388 GPM FOR CORRSPHOG PRESSUR	FLOW INSTRUMENTS CALIBRATION WAS TOO LEW
G CO	1 013063	070275	1	PM	018	R	1		N T	14 CCW INSULATION BREAK IN STATOR	COOL. FINS HIT WINDINGS (SAGGING)
G CO	1 014304	012276	9	PŢ	C04	5	1		T	RCIC TURB. WOULD NOT RESPOND TO CONTROL INPUT	R-14 & R-15 IN PCB. ASSY FAILD FROM HEAT
6 00	1 014302	020676	ĸ	PM	000		1		N U	RECIRC PMP "8" TRIPPD	UMKNOWN
6 00	1 014350	022776	K	PH	004	5	1		N T	RR PUMP "B" DRIVE MOTOR TRIPPO TWICE TEMP. SWITCH	SWITCH TRIPPO DUE TO VIBRATION: TYPE DA438
G CO	1 015715	081676	J	PM	021	R	- 1		N T	REC PUMP "A" MOTOR MAKING NOISE BEARINGS FAILED	SER.NO.P4296075, 75HP., 480VAC
G CO	1 016604	111276	ĸ	PM	013	5	- 1		N T	"B" RECIRC PMP TRIPPO DUE TO FALSE OP. OF NBI-LIS	MOTSTURE IN MODEL 4418C SWITCHILEARY VIVE
e co	1 017068	011077	J	PM	021	R	- 1		N T	REC PUM MOTOR "A" NOISY BEARINGS RUNNING ROUGH	BEARINGS REPLACED
G C0	1 018898	083177	н	PT	C13	5	- 1		N T	HPCI TURB STARTED BUT DID NOT ACCEL OR INJECT	GOVERNOR EG-R ACTUATOR FAILED TO OPERATE
e co	1 019289	083177	0	51	C13	S	- 1		N T	RCIC INITIATED ON SCRAM BUT DID NOT RAMP UP SPEED	VITAL PUR FUSE BLOWN AND CONTACTOR DOS
6 00	1 0200494	112177	U	PM	A05		. 1		T D	"B"SBLC PUMP STUFFING BX SLAND FOLLOWER BLEW OUT	MOVEMENT OF INSUFF CONTAINED GLAND FLWR
G CO	1 0200498	112177	U	PM	C 0 5		3		1 0	MBMSBLC PUMP FAILED TO MEET REQD FLOW AT PRESSURE	3 IN LIEU OF 5 PKG RINGS ENSTLLD BY MFGR
6 00	1 020804	011178	н	PT	002	1	1	1	T D	SIGNIF AMT OF WER DISCOVO BLWING FRM HPCI CASE FLG	
G CO	1 020805	020778	H	PŢ	003	5	1	1	T D	TURBINE SPEED 74000RPM LED TO HPCI STEAM LINE TSO	DPIS 76677 READING HISSENSING LINE BACKEL

									A		
	PLANT	CONTROL	EVENT	STATUTE !	# OD#	CAUSE		302	TIVISS	MODE DESCRIPTION	CAUSE DESCRIPTION
		021061	031178	0 P	r c1	3 5		1	т т	PCIC TURBINE FAILED TO RESPOND PROPERLY	PAMP GENERATOR MISALIGNED DUE TO DRIFT
		025930	080979						N T	HPCI PUMP FAILED TO START ON AUTO START SIGNAL	TURBINE STOP VALVE OPERATOR MALFUNCTIONED
			091279					1	N T	LEAK DEVELOPED FROM *B* RECIRC SEAL	SEAL REPLACED
			122379	L P	M 81	3 5		1	N n	RHR PUMP "10" WOULD NOT OPERATE	BREAKER FAILURE
		030788	031080	U P	m co	7		1	1 1	SLC PUMP 18 WOULD NOT PUMP REQUIRED FLOW RATE	LEAKING INTERNAL SUCTION AND DISCH VALVES
			031290	Q P	1 00	9		1	H 0	RCIC TURBINE BLADING FOUND DAMAGED	IMPINGMENT OF FOREIGN OBJECT ON THE WHEEL
ì	DAI	010219	060474	0 0	T 80	6 0	1	1	T D	RCIC FAILED TO START AUTOMATICALLY	GOV CONT CKT SET HIGHER THAN OVERSPO TRIP
	G DAI	0104244	062274	н Р	F 81	3 5		1	T U	HPCI FAILED TO INJECT	HPCT STOP VALVE FAILED TO OPEN
	S DA1	0104248	062374	н Р	T 80	4		1	U D	HPCI FAILED TO INJECT WITHIN REQUIRED TIME	PISTON IN MECH OVRSPO TRIP WAS UNDERSIZED
. 1	G DA1	010580	081474	K P	M A1	9	-	1	U T	UNIDENTIFIED LKG TO DRYWELL EXCEEDED TS LMT. 5 GPM	LKG FRM RECIRC PMP B SEALS, CORRSN PROCTS
	G DAI	012797	042375	R P	M B1	3 5		1	T D	RHR PMP 2298 FAILD TO START	LOSIC RELAY ELL-KTOB DID NOT TRIP AS REQ.
	G DAI	012848	061375	D P	M 80	9 5		1	N D	CORE SPRAY PHP 2114 DID NOT START ON SIGNAL	DERTY AUX CONTACTS ON 4KV CKT BKR
- 3	G DAI	013576	102275	H P	T C1	3 5		1	TT	HPCI TURBINE WOULD NOT RESPOND TO SPEED CHANGE STG	HPCI SPEED CONTROLLER RELAY MALFUNCTIONED
	G DAI	016588	122076	H P	T 80	6 0	,	1	1 0	HPCI TURBINE TRIPPED ON FAST START WITH HI FLO IND	HI FLOW POIS SETPOINTS WERE INCORRECT
	G DA1	019127	092177	н Р	T co	6 1	1	1	1 0	HPCI WOULD NOT DEVELOP SUFFCHT RPM	EXCESSIVE OPENING OF L.O. THROTLE VALVES
	G DAI	019705	102877	K P	H CI	3 5		1	N T	"A" RECIRC HAD SLIGHT DECREAS IN FLOW DUE TO M-G	VOLT. REG. FOR MG HAD OPEN IN TRANSFORME
	G DAI	019968	122077	14 P	T CO	2 1		1	T D	HPCI DISCH FLOW RATE DID NOT REACH REOD FLOW	IMPROPER ADJUSTMENT OF THIL SCREWS
	G DAI	020178	122777	H P	T CO	7 1		1	T D	HPCI SYS DID NOT REACH REQD FLOW RATE OF 3000 GPM	WEAR TO TURBINE SHAFT DRIVEN OIL PUMP
	G DAI	021565	051978	н Р	T C1	3		1	TT	HPCI PUMP DID NOT REACH RATED CAPACITY	THROTTLE ADJ SCREWS FOUND OUT OF ADJUST.
	G DAI	030456	030480	н Р	r co	4		1	M D	HPCI BOOSTER PUMP SEPIT RING FOUND IN MAIN HPCI P.	WROUNG SET SREWS USED IN BOOSTER PUMP
	G DAI	031167	043080	K P	M D1	8		1	N T	"A" RECIRC PUMP MG SET TRIPPED ON UNDER VOLTAGE	SHORT IN PUMP MOTOR
	G DAI	031421	052480	H P	T C1	3		1	TT	HPCI TURBINE WOULD NOT REACH RATED SPEED	LEAKING OIL SEAL ON TURBINE STOP VALVE
	G DAI	031422	052880	K P	H D0	0 5	5	1	1 0	*8 * RECERC PUMP SECURED DUE TO HI/LOW LO ALARM	NO CAUSE FOUND FOR LOSS OF LUBE DEL LEVEL
	G DAI	031884	071180	0 P	T 81	0 5	5	1	TT	RCIC TRIP THROTTLE VALVE WOULD NOT OPEN ELECTRIC.	CORRODED CONTACTS ON MOTOR OF LIMIT SW.
	G DRI	000429	092873	0 P	M 01	9		1	UT	IA CORE SPRAY PUMP INOPERABLE DUE TO SMOKING PKG	METALIC PEG SCORED SHET SLY AND DISTORTED

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- 1			100477	-		019		,	T U	B CORE SPRAY PUMP PACKING OVE HEATED, BEGAN SMKING	PUSP LAST PKD 11/16/76, LAST TSTD 9/20/77
		019321	030572					-	TO	2C LPCI FAILD TO START DURING TEST	DIRTY CONTACTS IN 4KV ECCS BREAKERS
		002284	101874					-	NT		LEAKING MECHANICAL SEAL
		010808	092975						UT	HPCI TURBINE FAILED TO TRIP AT DESIGN COOLANT LEVE	OPEN CKT IN COIL OF TRIP THTL SOLONOID VA
		013460	062576					1	N D	2C LPCI FAILD TO START FOR MAINTING TORUS WTR. TEMP	DIRTY SWITCH IN 4KV BKR FOR PUMP
		015195	091077					,	T D	HPCI MOTOR SPEED CHGR FAILED TO BRING TURB GT 2800	LOSS OF PEN FROM MER SPO CHNGR AND GEAR
		018931	093078					1	1 1	HPCI TRIPPED ON LUW SUCTION PRESSURE	INST DRIFT OF PRESSURE SWITCH
-		023340	010379			37,777,00		,	T ()	HPCI PUMP FAILED TO START	CASSE NOT STATED
		025953	041579					1	T 0	ZA LPCI PUMP WOULD NOT START	CAUSE UNKNOWN
		032415	081880	-				1	NI	ZA LPCI PUMP SEAL FOUND LEAKING	SEAL FAILED DUE TO DIRT ON SEALING SURF.
		002288	052072					1	T U	HPCI TURBINE FAILED TO START REMOTELY	BROKEN WIRE ON THE TURBINE RESET SOLUNCIO
		000055	060873						u u	HPCI STEAM SUPPLY VALVE FAILED TO OPEN COMPLETELY	STEM OF THE VALVE WAS BENT
	M. 11 M.	000717	011774					1	T D	HPCI CONTROL VALVES FAILED TO OPEN	BURRS ON CYLINDER WALL AND PISTON
-		019549	080477					1	T 0	THE TAX HAT DIMETER DIRECT CON CASE LEL	OPERATOR TURNO OFF CONT.PWR TO "A" RECIRC
		019911	121677					-	T D	TO TOUR TO TOUR TO TOUR TOUR TOUR TOUR T	HPCI INOPERABLE; FAILD PWR SUPPLY IN CONVI
		012382	011075						N D	TARTE CALL CALL OF THE TARE CALL THE COLUMN	WERING ERROR ON THE TURBINE GOVERNOR
-		012973	070175						1 0	RHR 18 ATR CKT BKR FAILD TO CLOSE	SLIPPO CAM IN LATCH ASY. OF ACE
	-	012971	070575						N T	TURBINE SPEED CONTROL MALFNCTHO SHAFT L.O. PUMP LT	MUSH DRIVE GEARS (UPPR & LWR BU MINGS).
		013071	071375						NI	RCIC TURBINE TRIPPED ON OVERSPEED AFTER RX SCRAM	ELEC OVERSPO INST CONTAINED HALFN XSISTOR
		013606	090675						T 0	THE PARTY OF THE P	COMPONENT FAILURE - NO PROBLEM FOUND
		013907	111575					1	N T	RCIC MECHNEL OVERSPEED TRIP SETPOINT HIGH	RECALIBRATED MECHANICAL OVERSPEED
	-	014773	022276					-	N O	TOTAL TOTAL BY HELD DAY HELD DANGED	VIRRATION CAUSO VALVE TO UNLATCH ON S/U
		014782	040976							TOTAL TRANSPORT OF THE PROPERTY OF THE TEST	PUMP WAS WIRED INCORRECTLY
- 20		014789									PERSONNEL CUT CABLE TO PUMP (DUR OUTAGE)
- 77		017333								TURBINE SPEED INCREASED TO 5625 RPM IDIONT TRIP	OUT OF ADJUSTANT TRIP LINKAGE ON MECH CS
0	C 44 7	011323	23010	-			-	-		************************	

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1 Zme	P A N T	CONTROL	EVENT	SYSTEM	COER	MODE	TYPE	FAIL	Y	CLASSI	MODE DESCRIPTION	CAUSE DESCRIPTION
G	ENI	018648	072777	0	PT	809	5	1	T	t	COULD NOT RESET RCIC TURBINE ; TRIP-THROTLE VALVE	DIRTY CONTACTS WOULD NOT ACTUATE VALVE
G	ENI	020023	092377	0	PT	802	5	1	T	0	RCIC TURBINE TRIP THROTTLE VALVE FAILD TO RESPEN	LOSSE BRUSH SPRING ON OPERATOR MOTOR
G	EN1	020153	120477	н	PT	C13	5	1	T	0	HPCI TURD GOVNOR STUCK, MANUALLY HAD TO FORCE GOVNR	DATAGED ELEC. CONNECTOR ON FLEX CONDUIT
G	ENI	021481	050678	D	PM	813	S	1	T	D	CORE SPRAY PUMP FAILED TO START (1A)	CONTROL SWITCH HAD BROKEN POSITION STOP
G	ENI	025369	022779	н	PT	013		1	T	T	HPCT PUMP REQUIRED TO BE SECURED DUE TO VERRATION	ACTUATOR ON TURBINE CONTROL LOOP FAILED
G	EN1	026417	072579	R	PM	A19		1	N	T	1C RHR PUMP HAD EXCESSIVE LEAK	MECHANICAL SEAL FAILURE
G	ENI	027818	120879	0	PT	009	5	1	N	T	RCIC TURBINE TRIPPED ON HIGH EXHUST PRESSURE	CLIGGED MANUAL CHECK VALVE
G	ENI	030243	012780	K	PM	013	5	1	N	T	"A" RECIRC PUMP TRIPPED WHILE AT POWER	GROUND IN CONTROL CIRCUIT
G	E 41	031141	051380	н	PT	013	T	1	N	0	HPCI FAILED TO START AFTER REACTOR SCRAM	SPURIOUS HPCI HIGH STEAM FLOW SIGNAL
G	ENI	031265	051480	0	PT	013	R	1	N	U	RCIC PUMP TRIPPED ON MANUAL START	BELIEVED TO BE OVERSPEED TRIP, UNKN CAUSE
G	ENI	031287	052080	н	PŢ	C13	5	1	T	Ť	HPCI TURBINE SPEED CONTROL FOUND ERRATIC	RAMP GEN IN EGM FOUND DEFECTIVE
G	ENI	031601	061390	Q	PT	013	5	1	N	T	RCIC TURBINE TRIPPED FOLLOWING A REACTOR SCRAM	EGR AND LIMIT SW ON TRIP VALVE MALFUNCT.
G	€N1	031658	062680	н	PŢ	013	T	1	N	U	HPCI FAILED TO START AFTER REACTOR SCRAM	HI STEAM LINE FLOW SIG DUE TO TURBINE CON
G	EN1	032130	072580	н	PT	C13		1	T	T	HPCI TURBINE FAILED TO TRIP AT OVERSPEED SETPOINT	WEAR TO TRIP DEVICE CAUSE SETPOINT DRIFT
G	ENI	033578	090680	L	PH	002	5	1	T	D	"D" RHR PUMP VIBRATED OUTSIDE ASME CODE	WRING REFERENCE DATA USED
G	ENI	032720	091980	н	PŢ	000		1	T	U	DURING HPCI PUMP OP TEST. HPCI SYS ISOLATED	CATSE UNKNOWN
G	ENZ	022023	072578	0	PI	813	5	1	T	0	RCIC TURBINE FAILED TO START MANUALLY	SET POINT DRIFT OF OVERSPEED TRIP
G	ENZ	022753	110678	н	PT	802	U	1	T	0	HPCI PUMP FAILED TO QUICK START	WIRE ON CONTROL CIRCUIT NOT RECONNECTED
G	ENS	026030	060379	н	PT	809	N	1	N	T	HPCI PUMP FAILED TO START-TURBINE STOP FAILD TO DP	WATER CONTAM DIL - SEAL LINE LEAKING
G	ENZ	026035	060379	0	PI	012	5	1	N	Ŧ	RCIC PUMP FAILED TO RUN - RUPTURE DISC RUPTURED	DISCH CHK ATA DIZC FOOZE - BFOCKED LFOR
G	ENS	026149	060879	H	PT	010	5	1	T	0	HPCI PUMP BECAME INOPERABLE	VAC AND CONDENSATE PUMPS TREPPED
G	EN5	026340	062779	0	PT	002	5	1	N	0	RCIC CONDENSATE PUMP TRIPPED	PERSONNEL STEPPED ON MOTOR CONNECTING BOX
G	ENZ	027781	112979	н	PT	DOI	2	1	T	0	HPCI PUMP AUX LUBE DIL PUMP TRIPPED	HPCI PUMP WAS BEING SECURED INCORRECTLY
		030234	013080			-					HPCI AUX LUBE OIL PUMP TRIPPED	TIME DELAY COLL IN BKR FAILED
6	EN2	030834	041580	R	PM	813	S	1	T	U	OF RHR PUMP FAILED TO START ON LOCA SIGNAL	WIRE MISSING FROM TERMINAL NG.7 ON RELAY

PLANT	CONTROL	EVENT	SYSTEM	MODE	1 4 6 5	FAUL	ACT I VIASS	MODE DESCRIPTION	CAUSE DESCRIPTION
C EN2	030976	042280	0 21	000		1	1 0	RCIC TRIP THROTTLE VALVE TRIPPED	UNKNOWN
	031319	052180				1	N D	RCIC PUMP TRIPPED THO TIMES FOLLOWING SCRAM	TEST POT SPEED CONTROL USED INSTEAD OF AU
		121274				1	T 0	RHR PMP 10P-30 FAILD TO STARTIREPLACED FAULTY BER	BER DE CHARGIN HOTOR BURNED OUT
	012065	010275		-		1	1 1	RCIC PUMP DID NOT ACHIEVE RATED FLO CH INI TEST	PASSED SUBSEQ TESTS, CAUSE UNKNOWN
	012769	052275	42 227			1	T 0	RCIC TURBINE TRIPPOJLOCAL TRIP LEVER ONLY PART ENG	READJUSTO TO FULLY ENGAGE
	012769	052275					T 1	HPCI TURBINE TRIPPD ON LOW DIL PRESS.	LEAKS CAUSD A LOW DIL LEVEL ESYS. PRESSUR
	013470	101175					1 0	HPCI STEAM SUPPLY 23MOV14 FAILD TO OPEN ON SIGNAL	PAPER HAD FALLEN BETWEEN OPERATE CONTACTS
	013580	102975		-	- 77		T 0		SHIBBER PINS WERE RELOCATED
3 1 1 1 3	014488	032176						BOTH EXHAUST RUPTURE DISKS RUPTURD DURIN FLOW TEST	MANUAL EXHAUST VALVE FULLY CLOSED
	014486	040376						RECIRC PMP "A" TRIPPD DUE TO EXCITER OVERCUREENT	WATER LEAKAGE INTO COMTROL CABINET
	015062	061976			-		T 1	PCIC TURBINE WOULD NOT TRIP WHEN REQUIRED TO	RUSTY LINKAGE CAUSD BY STEAM LEAR
	015236			-		1	N U	LOSS OF "B" RECIRC PUMP LOSS OF POWER DURIN TRANSF	BUS 10200 FAILD TO TRANSFER TO RECER. PWR
	016375	110976						THE PARTY OF THE P	FLOW SNUBBERS ELIMINATED THE PROBLEM
	017329	022877						The state of the s	FAILURE OF THE DRIVE TO THE DIL PUMP
	017338	030777							RECTRE PUMP CONTROL CKT PROBLEM CAUSED SP
	017408	031477							AUR. OIL SUMP INSTALLD PER VENDOR F.D.I.
	017934	052177				- 3			OIL LINE FAILURE-HI FREQUENCY VIBRATION
	017933	060677				1	7 1		PACKING DEGRADED DUE TO AGE AND WEAR
	019169	092877				1	T 1	13 MOVIST STEAM SUPPLY TO RCIC TURBINE WOLDAT OPEN	TORG SWITCH RESET SO VALV WOULD OPERATE
	019296	100577					T (	B RECIPC MG SET INADVERTNILY TRIPPD. LOST "B" PUMP	DERATOR ERROR DURING TEST
	017869	122877					N 1	RCIC PUMP 13-P-1 S/D TO ALLOW CLNG OF CUND FILTER	CUND DIL FILTER CLOGGED
	021143	041078				1	1 (	LIMIT SWITCH MALFUNCT ON 13MOV131LOST SPEED CONT	DIRT ON CONTACTS CAUSD LOSS OF CONTINUITY
	022504	091578					T (		CONTROL POWER FUSE HOLDER WAS BENT
	027358	102079					T 1	RHR PUMP "C" FAILED TO START PROPERLY	LIMIT SWITCH NOT ADJUSTED PROPERLY
	002363						N I		RECTROULATION PUMP "A" SEALS LEAKING
	000.303			-					

P L A R N T	CONTROL NUMBER	EVENT	SYSTEM	M D D E	TYPE	F A I L	NO.	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
G 411									COND BOOSTR "A" PUMP INBOARD BRNG FAILED	CAJSE NOT INDICATED
									FHCI COND BOOSTR "A" PUMP SEAL FAILED, SYS INTPERS	
									FWCI COND BOOSTR "8" PUMP BRNG FAILED, SYS INDPERB	
									HPCI TURBINE TRIPPO ON OVERSPEED FOLLOWING MAINT.	
									STRY LIQ CONT PUMP DIDNT DEVELOP REQD HEAD	IMPROPER VENTING/FILL OF SUCTION LINE
	001162								EXCESSIVE STEAM FLOW TO HPCI ISOLATED HPCT FROM RX	EXCESSIVE STEAM FLOW TO HPCI ISOLATED FPC
	010267								HPCI TURB AUX OIL PUMP FAILED TO START	ACCEL RELAY AUX CONTACT ASSY DISLOCATED
G M01	013712	111875	Q P	F 810	)	1	1	1 1	RCIC TURBINE FAILD ON FAST START; STEAM CONTROL VLV	CORROSION AND CRUD ON VALV STEM AND PIVOT
									TURBINE TRIPPO ONCE ON HI EXHAUST LINE PRESSURE	RAISD TRIP SETPOINT FROM 25 TO 40 PSIG
	015440A									STEAM VOID IN DESCH PIPING - VLV LEAKAGE
G MOI	0154408	083076	Q P	T D1	1 1	1	1	1 1	RCIC TURBINE TRIPPED ON OVERSPEED	STEAM VOID IN DISCH PIPING - VLV LEAKAGE
G MOI	018670	080577	н Р	T C1	3 5	1	1	1 1	GOVENOR CONTROL SYS. FAILD RESULTING IN LOSS OF DC	FAILD RESISTOR
6 401	026379	070279	н Р	T DO	5	1		т	HPCI GOVENOR END BEARING HAD HIGH TEMP AND VIBRA.	WORN LUBE DIL PUMP DUE TO WRONG METAL USE
G NMI	002015	060172	D P	M 81	3 1	1	1	0 0	CORE SPRAY PUMP FAILED TO START	CS FAILED - LNKGE TO AUX SWITCH BINDING
G NM1	002016	060172	0 9	M 81	3 1	1	1	0 0	CORE SPRAY PUMP FAILED TO START	CB FAILED - BURNED CONT RELAY CONTACTS
G NM1	002129	091972	K P	M A1	Q R	1	,	N T	RECIRC PUMP SEAL LEAKED EXCESSIVELY	NO CAUSE GIVEN - OTHER THAN LEAKY SEAL
G NMI	000455	101873	K P	H A1	9 8	1	,	N T	RX RECIRC PUMP 12 HAD SMALL SEAL LEAK	NO CAUSE GIVEN - OTHER THAN LEAKY SEAL
G NM	010746	091774	F P	M CO!	5	1		T D	BIZZ CHTMNT SPRAY FLOW ZOOGPH VS. 3000GPM	2X4 PIECE OF WOOD WEDGED IN EYE OF PUMP
G NMI	012284	021275	н Р	M 81	3 1	1		N 0	12 FEEDWATER PUMP FAILED TO START (HPCI COMPONENT)	LNIGE BET BOURDON TUBE AND SWITCH DISCENN
G MMI	011016	061875	UP	H B1	3 5	1	1	T D	11 STANDBY LIQ CONT PUMP WOULD NOT START	POWER BRKR TRIGGER WAS NOT LATCHED
G NH1	013416	091375	н Р	M 81	3 1	1		N T	12 FEEDWATER PUMP FAILED TO START CHPC1 COMPONENTS	OIL PMP MIR BRKR HAD LOOSE FUSE HOLDER
G NMI	014245	021576	н Р	M 01	3 1	1	-	U D	LOSS OF #12 FEEDWATER PUMP (HPCI COMPONENT)	LNEGE BET BOURDON TUBE AND SWITCH DISCENN
G NM1	015624	080976	H P	M 81	3 1	1	-	N D	11 FEEDWATER PUMP FAILED TO START (HPCI COMPONENT)	AGASTAT FAILED TO FUNCTION PROPERLY
G NM	017284	102576	H P	M A1	9	1	,	N T	\$12 FEED PMP TAKEN OUT OF SERVICE LEAKY SEAL STRAR	LEAKS IN SEAL STRAINE AND GEAR BOX
G NM1	017431	040477	N P	M DO	5 U	1	-	N U	WHILE LOWRNG RIX HED LEVEL FOR MAINTNEE ON VESSEL	SHUTOWN COOLING PMP TRPPD DUE TO LOW SUCT

2 m×	PLANT	CONTROL	EVENT	SYSTER	ODE	KODE	TYPE	F N I U	ACTIVITY	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
G N	m1	019586	110677	ĸ	PM	A19	R	1		U	LEAK GT. SGPM FORCD POWR REDCTN #15 RC PUMP	SEAL FAILD RPLCD SEALS ON #11.#14 PMP ALS
			012078	н	PM	813	1	- 1		0	LOST POWER TO 11 FEEDWATER PUMP AFTER LOSS OF PWR	RESERVE PUR BRKR FAILED TO CLOSE
G 1	IM1	032570	082280	н	PM	407		1	,	1.1	DIT REACTOR FEEDPUMP HAD EXCESS SEAL HED LEAKAGE	MORMAL WEAR TO SEAL
G 1	101	002253	080172	F	PM	813	1	1	1	0	CONTAINMENT SPRAY PUMP FAILED TO START	DIRTY CONTACTS ON BRKR POSITION SWITCH
6 1	1C 1	002305*	080172	U	PH	813	U	2	1	J D	BRKR FOR 1 STBY LIQ CONT PUMP RACKED DUT-OTHER PAP	WOJLD NOT START - AUX CONT PREVENTED OPE
		000217	061873						1	0 0	CONTAINMENT SPRAY PUMP SIC DID NOT START	BRIKEN WIRE TO KEY LOCK SWITCH
G (	OC 1	010834	101874	F	PM	813	1	1	1	T D	CONTAINMENT SPRAY PUMP 51A FAILED TO START	START CIRCUIT FAILURE - TIME DELAY RELAY
6 (	101	012029	021175	F	PM	800	) R	1	1	U	CONTAINMENT SPRAY PMP SIA FAILD TO START IN AUTO	UNDER INVESTIGATION
6 (	101	012330	030675	F	PH	813	1	1	1	T D	CONTAINMENT SPRAY PUMP SIA FAILED TO START IN AUTO	BRER TRIP BAR FAILED TO RESET ON PREV TRP
G (	101	013830*	121275	ĸ	PM	003	U	3	1	0 1	DEENERG 125V DC DIST CTR - LOSS OF 3 RECIRC PUMPS	PERSONNEL DED NOT FOLLOW PROCEDURES
6 1	301	013830A	121275	н	PM	DO:	5	1	1	r D	FEEDWATER PUMP TRIPPD DURING LOAD TEST OF BATTERY	PERSONNEL ERROR FOLLOWING PROCEDURES
		014576								N U	INBOARD SEAL ON CORE SPRAY MZOIB CRACKO 3GP4 LEAK	CARBON ROTATNE WASHR CRACKO CAUSE UNKNIN
G I	100	015477	111176	F	PH	813	1	1	1	0 1	CONTAINMENT SPRAY PUMP 510 DID NOT START	CB TRIP LATCH FAILED TO RESET
		023118A										EXCESS FRICTION IN POWER CIRCUIT BREAKERS
G I	101	0231198	120278	F	PM	813	1	1	1	1 0	CONTAINMENT SPRAY FUMP SIC FAILED TO START	EXCESS FRICTION IN POWER CIRCUIT BREAKERS
6	101	025518	032279	к	PH	01	3 5	1		N T	*C * RECERC PUMP KEPT TREPPING	LOSS OF GENERATOR FIELD, FAILED POTENTOPET
G	100	025827	041979	D	PM	81	5	1	1	7 0	CORE SPRAY PUMP FAILED TO START ON SIGNAL 1470141	FUSE FAILURE
G	100	0258254	056279	н	PM	80	9	1	1	UF	A FEED PUMP DED NOT OPERATE AFTER SCRAM	CAISE NOT STATED
G	nc 1	0258258	050279	н	PH	91	3 1	) 2	1	N 0	BEC FEED PUMPS DED NOT OPERATE AFTER SCRAM	BUS DE-ENERGIZED
G	oc 1	027695	110379	D	PH	80	3 (	1		1 0	CORE SPRAY BOOSTER PUMP DID NOT START, LOOSE FUSE	PERSONNEL MANIPULATING FUSE FOR TEST
G	PB2	000673	121273	н	PT	00	. :	1	1	1 0	DIL LINE FAILD IN TURBINE CONTROL SYSTEM	SHEAR FAILURE IN THREADED PIPE SECT
G	289	000641	122473	0	PT	80	5 5	5 1	1	1 0	TURBINE TRIPPO ON 3 OCCASIONS, IMPROPR ADJUST SENT	LINKAGE BETWEEN TRIP VALVE AND OS TRIP
G	P82	000933	032474	н	PT	81	3 1	1		T U	TURBINE CONT VALVE AU-16C FAILD TO OPEN POSTFION	OPEN CKT. CAUSD BY FAILD LOCAL SPEED PCT.
G	P82	000989	041674	н	PT	81	3 5	5 1		1 1	INKBINE IZAFNICA OLAN MOIO THEITERS	
G	P82	010051	042774	н	**	80	4 5	5 1		T D	TURBINE ISOLATED AFTE COLD QUICK START ON HE FLOW	ATR ACCUMULATES IN HYD.CYL OF STOP VALVE

Y Y	PANT	CONTROL	EVENT	SAN COMP.		EDDE -	TYPE	NUP	ACTIVITY Y	MODE DESCRIPTION	CA-JE DESCRIPTION
3	299	610179	050774	0 0	1	81	2	1	1 0	OUTBOARD ISC. VALVE HOVE? 10 FAILD TO GPEN	MOTOR FAILURE PREPLACED DURIN SHUTDOWN
G	PR7	015233	071976	н р	T.	113	-	1	1 1	TURBINE SPEED COMES NO . BE CONTROLLED	FATLD ELECTRONIC PARTS IN SPEED CONT.SYS.
G	992	015142	100576	Q P	1	813	5	1	TU	RCIC TRIP THROTTLE VALV MOVEDNI RESET AFTR TRIPPIA	GROUNDED WIRE ON TRIP SOLENDID
NI.		015779	122876	0 P	1	813	1	1	. 3	STEAM SUPPLY ISD. THE MO-23-15 FAILD TO GREN	PATED CLOSE TORO SHITCH DAMAGE VEVE MOTOR
6	982	219187	092677	H P	1	813		1	1 1	HPCI SNOPEROIL LEAK ON HPCI OIL CONTROL VALVE	LEAKING DIAPHRAMS REPLACED WITH NEW DIAPH
G	277	020525	020776	H .	* *	802	U	1	1.0	TURDINE TRIPPO ON OVERSPEED; AUTO STAPT (ESTING	MISCALIBRATION OF TURBINE SPEED CONTROL
G	289	121001	042978	2	*	U01	U	2	N P	UNIT 2 MB#, METRHR BLOCKED FOR 2 HRS.	OPERTS RENED UNIT & ENSTED OF UNIT 3 PERS
G	P82	022284	090173	4 9	T	818		3	TT	AUX OI PUMP FOR HPCI SYS FAILED TO START	GROUND IN MOTOR
G	P83	010672	091874	R P	М	018		1	N U	"B" KHR PUMP TOTOR EXPERIENCED SHORT TO GROUND	RANDOM INSULATION FAILURE
8	P83	011017	112574	H 9	т	800		1	T U	DURIN 100 PERCENT ISOLATION TEST, HPCI ISOLATED BY	A TRANSIENT CAUSE NOT IDENTIFIED
9	PR3	012013	021675	UP	· K	813	5	1	T D	STANCAY LIQUID CONTROL PUMP FAILED TO START	BAS PHASE TRIP DEVEST MARGINALLY ADJUSTED
G	P83	014518	042976	H P	7	813	S	1	N D	HI STELD FLOW TRIPPO HPCI TURBINE FOLLOWING SCRAN	RAPTO OFENING OF TURBLUF STOP VALVE
G	P93	018416	072177	н Р	1	C13		1	TU	TURBING SPEED CONTROL ERRATIC JRCIC WAS OUT OF SERV	BENT LIFT ROOS IN TURBINE CONTROL VALVE
G	P 8 3	019716	093077	н.	T	C13	s	1	T U	HPCI FLOW CONTRLER FC-3-23-108 DEFECTIVE	CIRCUIT BOATO TOUGHE FAILE
G	P 8 3	019831	111477	UF	M	A07		1	N T	STORY LIQUID CONTROL PMP 38P40 OUT OF SERVICE	TEPLATE FACKING PREVNTY MAINTENANCE
G	P 5 3	020273	011378	U	M	813	S	1	1 1	STANOBY LIQUID CONT PUMP 34 DECLARED INOPERABLE	ME ALCUM DEPRESS - CHEING TALVE FAILED OF
G	p.mg	028600	080978	н г	PT	C13	S	1	N T	HPCI PUMP FAILED TO REACH RASS FLOW	HIGH AND LOW SPEED POTENTIONETERS OOC
G	PP3	022852	110679	H F	PŢ	D13	R	1	N T	HPCI PUMP APPARENTLY TRIPPED ON OVERSPEED	GOVENER DUT OF CALIBRATION
ü	PR3	27446	102274	R F	M	018		1	N T	THE TRIPPES WHILE PROVIDING SID COOLING	"TOR FAN EXPERIENCED FATAGUE FAILURE
G	P I 1	002247	100772	J :	M	013	U		0 0	POWER CTR GEREST TRIP - LOSS OF CCW PUMP	LOADED PC SIMULTANEGUSLY VS SEQUENTIALLY
G	PII	002229	12 072	9 6	7	007		1	1 7	RCIC TURBINE OF PRESS LOST WHILE OPERING IN TEST	WORR GEARS IN TRUE TRAIN OF SHET L.O.PLMP
G	PII	001079	011677	H 1	PT	500	S	1	10	HPCI TURBINE TRIPPED ON OVERSPEED DURING START	TEST PROCEDURE USED WAS INADEQUATE
G	PII	001043	0417	J	7	013	T	1	U D	RECCW PUMP TREPPED BY 480Y MOTOR CONTROLLER	OVERLOAD RELAT: NOT FUNCTIONING PROPERLY
G	PII	000054	021173	1 1	M	013	τ	31	N D	RECCH PUMP 202-E TRIPPED BY OVLD RELAY IN MTR CONT	THERMAL HTR IN CONT NOT HE ENOUGH AMPRAGE
G	PII	000971*	032074	3 1	PM	813	S	,	T D	MBE RACCH PUMPS DID NOT AUTO START	PRESS SW MALFUNCTION-MICRO SW OUT OF ADJ

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								Å	Annual Control of the	
	P			S C	H 1		F	Ic		
ě	A	CONTROL	EVENT	T O	0 1	J Y	A P	1 4		
N	ı	NUMBER	DATE	E M	E	E	1	* 3	MODE DESCRIPTION	CAUSE DESCRIPTION
G	PII	011041	110874	Q P	1 00	0 5	1	TU	RCIC STEAM SUPPLY LINE SOULATED DUE TO SPURTOUS S	NO CAUSE IDENTIFIED
G	PII	012441	031975	0 9	M 81	8	1	TU	"A" CORE SPRAY PUMP TRIPPED ON START	FAULTY HOTOR WINDIMATE - INSULATION
G	PII	013113	060875	0 P	T 80	0	1	T U	OVERSPEED TRIP OF TURBINE DURING STARTUP	NO APPARENT CAUSE
G	PII	018410	032377	J P	M D1	3 T	1	UD	"E" RECCY PUMP INOPERABLE - BKR TRIPPED ON THE	OVERHEATING OF BLOCK TYPE OVED RELAY
G	P I 1	017593	100977	D P	M 81	3 5	-1	T D	CORE SPRAY PUMP P-2158 FAILED TO START	INCORRECT LOGIC CLING SCHEME FOR CIR BRKR
G	P11	020675	030578	н Р	1 80	9 5	1	N T	TURBINE STOP VALVE FAILD TO OPEN AFTE REACTOR SCR.	DIRTY DUPLEX DIL FILTER
G	PII	020884	032378	D P	M B1	3 5	1	1 0	CORE SPRAY PUMP "A" DECLARED INOPERATIVE	LODSE CONN ON SPRING CHARGING LIMIT SWICH
G	PII	023395	123078	H P	1 01	g	1	T U	HPCI PUMP TRIPPED IN FULL FLOW TEST	OIL FITTING LEAKED AND LOST LUBE OIL
G	PII	025165	021479	Н Р	10.	3 5	1	T U	HPCI TURBINE TRIPPED DURING TEST	CASKET ON GLAND SEAL CONDENSER RUPTURE U
G	PII	025707	041579	Q P	T DI	3 \$	1	T D	RCIC CONDENSATE PUMP TRIPPED	BAD RELAY IN PUMP START LUGIC
G	PII	031177	051380	D P	M 81	3 1	1	1 0	CORE SPRAY PUMP P-2158 FALLED TO AUTO START	BCR 152-607 EXPERIENCED A TRIP FREE OP.
G	211	031557	053080	9 P	T Cl	3 S	1	TI	RCIC TURBINE FLOW AND PRESSURE DID NOT MEET T.S.	AUTO FLOW CONTROL FOUND FAULTY
S	901	002210	101972	D P	M B1	3 5	1	T D	18 CORE SPRAY PUMP FAILED TO START DURING TEST	IMP ADJ AUX CONT IN BREAKER NO. 1422
G	QCI	000879	031074	0 0	T 81	3 5	. 1	TT	RCIC INOPERATIVE; TURBINE STEAM INLET VALVE 1301-6	EXCESSIVE WEAR CAUSD CAM AND TRIP LEVER
G	001	010516	072074	H P	r co	1 U	1	T D	HPCI SPEED CHANGE MOTOR INOPER. CONT. POWE FUSES BE	SYS. IMPROPRLY TAKEN OUT OF SERVICE EARLER
G	QCE	014539	032576	U P	M C1	4	1	1.1	"8" SBLC SYS PUMP HAD DISCH PRESS FLUCTUATIONS	INTERNAL CHK VLVS WERE LEAKING
G	901	015194	061776	H P	T C1	3	1	T D	SPEED CHANGER MOTOR FAILD TO OPERATE	ABUND DUE TO INADEQUALE LUBRICATION
G	901	016457	102976	Q P	T C1	4	1	TU	OPERBLTY SURVEILNC OF RCIC PMP COULDNY MEET TECH	5 5 STAGES WERE SEVERLY DAMAGED
G	901	016904	120276	L P	M 80	2 0	1	UD	ATR LOCKO SUCT HEADR COMMON TO LA RHR LOOP, DIES!	RAR SER WER PHP HAD AIR LINE GONN TO CASE
G	901	020596A	012378	Q P	T CO	9	1	1.1	RCIC PUMP TURBINE SPEED ERRATIC	DIRTY CONT LINES STICKING DURING OPERATION
G	901	021437	050578	9 9	T DO	9 R	1	1.1	RCIC PUMP REPEATEDLY TRIPPED ON OVERSPEED TRIP	DIRTY BALL AND TAPPET ASSEM. ON O.S. TRIP
6	001	022190	080778	Q P	T DI	3 8	1	1 0	RCIC TURBINE TRIPPED ON OVERSPEED TEST	BALL AND TAPPET ASSEM BENT, REPLACED
G	201	031190	042980	K P	M D1	3 5	1	N 0	14 RECIRC PUMP TRIPPED WHEN MG LUBE DIL PUMP TRIP	CAJSE UNKNOWN WHY LUBE OIL PUMP TRIPPED
G	QCZ	115500	102172	н Р	T 80	0	1	TU	HPCI TURBINE STOP VALVE WOULD NOT OPEN	CAJSE NOT DETERMINED
G	902	010592	083174	н Р	T 81	3 5	1	N 0	HPCI WOULDN'T START BECAUSE VALVES WOULD NOT OPER.	250 VDC BATTRY DISCHROD; CHRGR BKR TRIPFD

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>===	PLANT	CONTROL	EVENT	SYSTEM	COMP	MODE	TYPE	FAIL	ZOZ	CLASS	MODE DESCRIPTION	CAUSE DESCRIPTION
G 0	230	012799	041875	D	PM	813	S	1		0.1	CORE SPRAY PUMP 28 FAILED TO AUTO START	LODSE TERMINAL CONN ON CONT PANEL 902-33
G C	cz	012801	041875	н	PT	804		1		10	HPCI TURBINE STOP VALV WOULDN'T OPEN DURNG ACT TEST	AUX DIL PMP AUTO TRIPPO WHEN EMER DIL PAN
G C	Soc	0130.5	072975	н	PT	C13		1		T U	TURBINE DRIVEN HPCI PUMP FLOW RATE INADEQUATE	IMPROPER PINNING OF PILOT VLV LEVER ARP
G C	cz	013257	083075	Н	PT	816	S	1		T U	HPCI SYS. INOPERABLE DUE TO BREAK IN HI PRESS OIL	HI PRESS DIL DISCHARGE LINE REPLACED
G Q	200	013258	083075	2	PT	013		1		1 1	RCIC PMP TURBINE KEPT TRIPPING AT 3500 RPM	WORM NUT IN UVERSPEED TRIP MECHANISM
G C	cz	014098	123175	0	PT	805		1		T D	TRIP THROTTL VLVE MECHANICAL OPERATOR WOLDNE RESET	REPLACEMENT TAPPET LONGER THAN ORIGINAL
G	Soci	017356	012877	н	PT	000		1		T U	HPCI FLOW DESIRED COULD NOT BE OBTAINED	APPEARS TO BE A TURBINE PROBLEM
G	200	017257	020977	Н	PT	809	5	1		1 1	TURBINE FAILD TO START DUE TO EXCSSY WL PRESSURE	DIRT CLOGGO DRIFICE CONTROLING DIL PRESS.
G Q	200	017540	101377	K	PH	013	T	1	- 1	N T	24 RECIRC PUMP M/G FAILED - LOST 24 RECIRC PUMP	LOOSE TACH COUPLING - GENERATOR VIBRATION
G	200	0205968	020678	0	PT	013		1		T U	RCIC PUMP TURBINE TRIPPED AT 3700 RPM	TMPROPER TENSION ON A SPRING - READJUSTED
G C	CS	021790	061478	Н	PT	C13		1		T T	HPCI TURBINE SPEED COULD NOT SE OBTAINED	JAM NUT ON ROD END BECAME LOOSE
G	CS	025430	022379	K	PM	013	T	1	- 1	N T	ZA RECIRC PUMP TRIPPED	MS SET TACHOMETER COUPLING FAILD
6 0	102	032646	082980	K	PH	D13	S	1		N T	"A" RECIRCULATION PUMP MG FIELD BKR OPENED	FAILED CONTROL POWER TRANSFORMER
G	/Y1	016997	011877	t	PM	813	S	1		T D	"D" RHR PUMP WOULD NOT START	A LOOSE LEAD IN A BREAKER CAUSED FAILURE
G V	//1	030058	010390	н	PT	013	١.	1		T U	HPCI PUMP TRIPPED AFTER STARTING	HI FXHUST PRESSURE OR AUTO ISOLATION
G I	/Y1	030286	012880	Н	PI	813		1		T	HPCI PUMP GOVENOR VALVE WOULD NOT REOPEN	SHORT BETWEEN EGM & EGR ACT OR STUCK EGR
G 1	111	030734	032680	н	PT	C13		1		T	HPCI PUMP WOULD NOT INCREASE ABOVE 800 RPM	FATLED FLOW CONINULLER

>421	PLANT	CONTROL	EVENT	STATES :	COMP	MODE	TYPE !	FAUR	ACTIVITY	MODE DESCRIPTION CAUSE DESCRIPTION
8	481	013015	070775	G	PM	B01	c	1	N C	P36C M/U PUMP STARTED AND IMMED TRIPPED, PUMP FREN RAN WITH NO SUCTION INCORRECT VLV LINE-UP
			052179	1				1	N E	EFW PUMP PTA KEPT TRIPPING ON OVERSPEED WATER IN STEAM LINES DUE TO TRAPS ISOLATE
-	-	017938+		-		-	-	2	N I	CHEM ADD PHPS 3A 6 38 FOUND INDP FOR PLANT S/U CAUSE UNKN, PUMPS FLUSHED, RTND TO SERV
		018400*			Lance	76.75		2	N I	DISCOVO CHEM ADD PMPS 34 & 38 INDP, PLANT AT POWER PUMP BELIEVED AIRBOUND, VENT VLV INSTALED
		022309*					-	T.	1.1	CHEM ADD PUMPS FAILED TO DEVELOP DISCHARGE PRESS. CAPIA AND 18 BECAME ALREOUND
		019426	101677			1		1	1.1	GOVNE CLOSED ON AFP 1-2 VIRENTION CAUSING GOVNE TO CLOSE-DESIGN
8	DAI	017531	1:0877	8	PT	804	В	1	N I	GOVNE VALVE CLOSED DUE TO SURGING VIBRATIONS NO FORCE TO HOLD GOVNE OPENMOD. REQUISTO
8	081	0197120	112977	K	PM	013	-0	4	N I	ALL 4 RCP+S TRIPPO DUE TO LOSS OF 13.8 KV POWER REACTOR/TURBINE TRIP OCCURED AT 2243.HCUR
8	081	020274*	011278	F	PH	U01	N	2	N I	BOTH CONT SPRAY PMPS INOPERABLE RIX IN MODE 4 PUMP CKT.BKRS. RE-ENERGIZED
8	081	022690	091578	J	PM	001	U	1	N I	COMP. COOLING WATER PUMP 2 TRIPPED PERSONNEL DID NOT REOPEN HX DUTLET VALVE
В	081	0255254	010379	G	PM	C04	U	1	T .	HPI PUMP 1-1 FAILED TO DEVELOP SUFFICIANT RECIRC HEAT TRACE UNABLE TO MAIN LINE ABOVE FREZ
8	081	0255258	010379	G	PM	U04	U	1	1	HPI PUMP 1-2 MAY NOT HAVE HAD SUFF. RECIRC HEAT TRACE UNABLE TO MAIN LINE ABOVE FREZ
8	081	025139	011579	K	PM	801	U	1	N	RCP 1-2-2 STARTED WITH INCORRECT BKR ALIGNMENT PERSONNEL ERROR
8	081	027335*	101579	K	PH	013	0	4	N	LOSS OF OFFSITE POWER CAUSED LOSS OF ALL 4 RCPS LOSS OF OFFSITE POWER-DUTPUT BRKR FAULT
8	091	031610	062380	G	PM	U01	C	1	N	HPI PUMP 1-1 BEARING THERMOCOUPLE WELLS BROKEN ASSUMED TO BE STEPPED ON
8	ne i	0148064	012876		PH	802	U	1	7	LOW PRESS INJECTION PUMP 1A - INCPERABLE INCORRECT SUBSTITUTE BREAKER INSTALLED
8	of 1	0148068	012876	F	PM	802	U	1	T	REACTOR BUILDING SPRAY PUMP - INOPERABLE (1A) INCORRECT SUBSTITUTE BREAKER INSTALLED
8	OF 1	0148060	012876	G	PM	802	U	1	1	HIGH PRESSURE INJECTION PUMP - INOPERABLE (1A) INCORRECT SUBSTITUTE BREAKER INSTALLED
8	DES	000577	111273	L	PH	801	U	1	T	LOW PRESSURE INJECTION PUMP 28 FAILED TO START BREAKER NOT RACKED IN PROPERLY
8	RSI	011151	103074	8	PH	801	c	1	N	AUX PMP SEAL RINGS FROZN TO BUSHNGS AND BSHN TO SH OPERATR FAILD TO OPEN SUCTN VALV TO FEED
8	RSI	016711	112376	F	PM	801	U	1	T	RX BLOG SPRAY PUMP FAILED TO START BRKR WAS NOT RACKED IN CORRECTLY
8	TI	014220	021776	G	PM	806	C	1	T	"A" MAKEUP/PURIF PMP STARTED WITH IMPROPR VALV L/U PMP FAILURE DUE TO INAD PROCEDRES/PERSCHL
	TI	020997	031878	G	PM	D1:	U	2	T	THE 14 & 10 MAKEUP PMPS TRIPPED ON XFER TO STIE PR MALFUNC TIME DELAY RELAY IN LOW L.O. CHT
(	ARZ	0310234	040760	В	PM	C11	U	1	N	BOTH TRAINS OF EFW PUMPS CAVITATED AFTER LOSS OF P FORCED FLOW STOPPED IN FW SYS OH WATER
(	ARZ	0310238	040790	A	PT	C11	U	1	N	BOTH TRAINS OF EFW PUMPS CAVITATED AFTER LOSS OF P FORCED FLOW STOPPED IN FW SYS OH WATER

	0			S					ACT	c		
1 Zmc	A N T	CONTROL	EVENT	STEM	COMP	MODE	T P E	FAIL	YITY	INNE	MODE DESCRIPTION	CAUSE DESCRIPTION
C	CCI	026235	050779	R	PM	D03	U	1	N	D	#11 LPST PUMP WAS STOPPED WHILE IN RHR MODE	SPURIOUS RECIRC ACT SEG BY PERSONNEL TEST
C	CCS	022604*	092478	P	PH	013	U	2	N	T	BOTH LPST PUMPS TRIPPED BY RAS SIGNAL	LEVEL INDICATOR FOUND TO BE OUT OF CAL.
c	CCS	022646*	101778	R	PM	C 06	U	2	N	D	BOTH 21 AND 22 LPST PUMPS LOST SUCTION	ATR LEAKED FROM PURIFICATION SYS TO SOC
C	FC1	025844	042079	F	PM	801	U	1	T	D	CONTAINMENT SPRAY PUMP FAILED TO START (SI-38)	SUPPLY BREAKER BOUND DUE TO PERSONNEL ER.
C	WIS	025576	031479	P	PM	C11	U	1	N	0	LPSI PUMP LOST SUCTION DURING S/D COOLING	PUTP BECAME AIRBOUND
c	MIZ	031945	070380	н	PM	006	C	1	T	D	"A" HPCI PUMP SEIZED	PROCEDURE DID NOT REQUIRE MIN FLOW VLV OP
C	MYI	002322	120272	H	PM	802	U	1	1	D	HPSI P-145 SUPPLIED BY "A" DG DID NOT START	GROUNDING BLOCK NOT REMOVED FROM CKT BKR
c	MYI	027208	091879	F	PM	C03	U	1	T	D	*8 TRAIN CONTAINMENT SPRAY PUMP DIS PRESS DROPPED	SUCTION VALVE WAS CLOSED
C	PAI	013009	070975	L	PM	001	U	1	T	D	LPSI PUMP 678 NO FLOW. NO PRESSURE	TWO VALVES NOT IN CORRECT POSITION
C	SLI	017933*	041577	K	PM	D13	L	4	N	D	LOSS OF SEAL CLNG WTR TO RCPS - RCPS WERE SECURED	CONTAINMENT INST AIR SYSTEM FAILED
C	Stl	017935*	051677	K	PM	D13	N	-4	N	D	LOST ALL FOUR REACTOR COOLANT PUMPS	LOSS OF OFF-SITE POWER
W	9 V 1	018241*	071977	K	PM	004	N	3	T	D	LOAD REJECT. TEST FROM 50% PWR;PMPS TPEPPD UNDRERO	TURBINE CONTROL DESGN CONCEPTS
W	8 V 1	022396*	090478	R	PM	C11	٧	2	N	D	A AND B RHR PUMPS WERE RUNNING WITH NO DISCH FLOW	PUMPS BECAME AIR BOUND WITH RCS DRAINED
W	8 V I	026841	081679	G	PM	002	c	1	t	0	1C CHARGING PUMP BECAME INOPERABLE	FATLED BEARING DUE TO A COOLING VLV SHLT
W	3 V I	025984*	081979	K	PM	001	N	3	N	0	ALL THREE RCPS TRIPPED ON UNDERFREQUENCY	OPERATOR ERROR
W	8 V 1	030879*	040880	R	PM	C06	٧	2	N	0	RHR PUMPS BECAME AIRBOUND WHILE INCREASING FLOW	PRICEDURE REVISED TO VENT PUMPS
W	8 V I	030880*	041180	R	PM	C11	٧	2	N	D	"A" AND "B" RHR PUMPS COULD NOT DEVELOP FLOW	PUMPS BECAME AIRBOUND
	8 V I	032789	091780	G	PM	002	U	1	Ţ	0	1C HIGH HEAD CHARGING PUMP BEARING TEMP INCREASED	CHECK VALVES INSTAL BACKWARDS IN COOL HED
W	DCS	032628	090480	t	PM	C06	U	1	T	0	EAST RHR PUMP WAS FOUND UNSTABLE	ALL AIR WAS NOT REMOVED FROM SERVICE
W	HNI	015097	061776	R	PM	006	U	1	H	D	R/X SHUTDOWN & REFUELING LOST PWR TO RHR PMP24TH	OVERLOADED 480V BUS PROCEDURES DEFICIENT
M	HNI	015218*	070576	8	PT	C11	U	2	N	T	AUX FEED PMPS WOULD NOT DEVELOP PROPER DISCH PRESS	BOTH PUMPS VAPOR BOUND - FAULTY CHK VL V
W	IPS	010282	051074	н	PM	809	U	2	N	T	#23 6 #21 HPSI PUMP STARTED ONLY DEVELOP 700# PRS	BORIC ACID LEAKAGE CAUSD SUCTION BLOCK AGE
W	IPS	015920*	080576	н	PM	C03	1/4	3	1	0	ALL 3 SAFETY INJ PUMPS RUN APPX 10 MIN W/O SUCTION	CMM PUMP SUCTION VLV (846) NOT OPEN
W	1F1	022631*	091778	F	PM	U01	U	2	N	D	BOTH CONTMT SPRAY PMP SUPPLY BREAKERS TAGGED THEY	BOTH TRAINS REQUIRED BY TECH SPECS
W	JF1	027639	110379	R	PI	003	U	1	T	0	AUX FEED PUMP TRIPPED ON QVERSPEED	MANUAL SPEED ADJUST LEFT MISADJUSTED

									A		
-	PLANT	CONTROL	EVENT	SYSTEE	COED	MODE	TYPE	FANULM	CHASSI	MODE DESCRIPTION	CAUSE DESCRIPTION
. 1	JF1	030322*	021480	В	PM	804	U	2	1 0	AGB AUX FEED PUMPS FAILED TO AUTO START	INADEQUATE DESIGN CHANGE CONTROL
1	KE1	010646*	080174	8	PH	803	U	2	T D	TWO AFP'S DID NOT START UNTIL THIRD ATTEMPT	DID NOT ALLOW DIL PRESS TO BUILDUP
,	KE1	010644	081974	J	PM	802	U	1	N 0	COMP COOL PHP 14 DID NOT START PM ON 8/16/74	CKT BER NOT RACKED IN FULLY
-	. NAI	025716	040879	G	PM	U01	U	1	N D	14618 OOS FOR MAINT, 1C FEEDER BRKR NOT RACKED IN	TMPROPER TAGOUT PROCEDURE
1	PRI	028041	122878	8	PT	013	U	1	T D	NO. 11 AUX FD PUMP TRIPPED OFF-LINE AT END OF TEST	STEAM SUPPLY VALVE TRIPPED ON OVERLOAD
- 1	PRZ	021038	041778	t	PM	U01	U	1	N D	OPERATOR PLACED #22 RHR PUMP DOS - AUX OPER OPENED	CKT BRKR FOR # 21 RHR PUMP - PERSONNEL ER
1	RG1	000629*	121473	8	PM	C11	U	2	1 0	AUXILIARY FEED PUMPS A & B LOST SUCTION	ATR IN SUCTION HEADER
1	ROS	000184*	070973	н	PM	802	U	2	UD	SAFTY INJECTION PHPS "8"5"C" TRIPPO ON MANUAL STAR	INSTANTAS TRIP SETTINGS WERE SET AT MIN.
,	# R02	018138*	060777	G	PM	C11	٧	2	N D	B & C CHGNG PUMPS RUNNING - PSZR LVL STILL FALLING	PUMP AIR BOUND - TYPE TX-150
	R R TIZ	019345	062277	G	PM	C11	٧	1	N D	"C" CHGNG PMP WOULD NOT CONTROL PSZR LEVEL	PUSP WAS AIR BOUND - TYPE TX-150
	# RO2	019793A	112377	н	PH	U01	N	3	N D	BREAKERS FOR ALL 3 SAFETY INJ PMPS FOUND RACD OUT	FAILURE TO RECOG TS LIMIT FOR GT 200 F OP
1	# ROZ	0197938	112377	F	PH	U01	N	2	N 0	BREAKERS FOR BOTH CONT SPRAY PMPS FOUND RAKD OUT	FATLURE TO RECOG TS LIMIT FOR GT 200 F OP
	W ROZ	022614*	100378	F	PM	006	U	2	1 0	BOTH OF THE CONTAINMENT SPRAY PUMPS FOUND ATRBOUND	PURPS NOT VENTED AFTER SYSTEM REALIGNED
	W SAI	016938	010877	8	PT	B01	U	1	N D	#13 AUXILIARY FEEDWATER PUMP FAILED TO START	PERSONNEL ERROR - TURB WAS MANUALLY TRIPD
	W SAI	0177004	050677	н	PM	U01	U	2	R D	BOTH SI PUMPS AND 1 CENTRIFUGAL CHG PMP TAGGED JUT	PERSONNEL ERROR - NOT FOLLOWING PROCEDURE
	W SAI	0177008	050677	G	PM	U01	U	1,	R D	BOTH SI PUMPS AND 1 CENTRIFUGAL CHG PMP TAGGED DUT	PERSONNEL ERROR - NOT FOLLOWING PROCEDURE
	W SAI	0281194	042479	R	PM	006	٧	1	N D	OPERATING RHR PUMP TRIPPED OFF OF LINE	INADEQUATE WORKING PROCEDURES
	W SAI	0231198	050879	P	PM	006	٧	1	N D	OPERATING RHR PUMP TRIPPED OFF OF LINE	THADEQUATE WORKING PROCEDURES
	W SAI	0291190	063080	R	PM	C04	U	1	N D	RHR PUMP LOST SUCTION	LOW LEVEL LIMIT WAS TOO LOW FOR RX WA LE
	w SUZ	000519	111373	н	PM	802	U	1	UD	SAFETY INJ/CHG PUMP 2-CH-P-18 DED NOT START-MANUAL	FUSES WERE NOT INSTALLED IN CONT CIRCUITS
	W TR	014145A	011676	8	PD	801	U	1	N D	AUX FEED PUMPS FAILED TO START AUTOMATICALLY	MISLOGGING OF LIFTED LEAD IN AUTO-STA CKT
	W TR	0141458	011676	В	PT	801	U	1	N D	AUX FEED PUMPS FAILED TO START AUTOMATICALLY	MISLOGGING OF LIFTED LEAD IN AUTO-STA CKT
	W TR	018991*	082177	K	PM	001	N	4	N D	POWER TO RCPS INADVERTENTLY DEEMERGIZED	GEN OUTPUT BRKR WAS TRIPPED PREMATURELY
	w TU:	010136	050374	н	PM	C11	U	1	N D	SAFT INJ PHP STOPPO WHEN LOW RUN CURRNT/PRESS SEEN	AIR LEAKAGE INTO PUMP CASING
	w TU	3 010135A	050874	8	PI	806	c	2	T D	DURNG START TEST A & B AUX FEED FAILD TO START	PACKING TOO TIGHT DEFECTVE PROCEDURES

	PLAN	CONTROL	EVENT	2757	100	MOOM	TY	FA	ACTIVITY	CILAR		
1	T	NUMBER	DATE	H	P	E E	Ē	L	Ý	\$	MODE DESCRIPTION	CAUSE DESCRIPTION
. 3	1 14	000095*	061873	В	PI	802	U	3	N	0	AUTO START OF AUX FO PMPS DID NOT OCCUR ON SCRAM	FUSES FOR AUTO-START LOGIC CKT NOT INSTLD
1	711	010081	042774	F	PM	806	U	1	U	D	18 CONTAINMENT SPRAY PUMP DID NOT START	BRKR RACKED IN TO WRONG POSITION
1	211	010718	071174	В	PT	802	U	1	U	0	AUX FD PUMP 14 FAILED TO START FROM CONT RM	AUX FD L.O. PUMP PWR SUPPLY BKR WAS OPEN
1	113	0008938	021174	В	PM	011	8	1	U	D	AUX FD PUMP 28 HAD PREVIOUSLY FAILED	APPARENTLY DAMAGED FROM AIR BINDING
1	212	000814	021574	B	PT	811	٧	1	T	D	24 AUX FEED PUMP STARTED, BUT TRIPPED ON OVERSPEED	ATR WAS ASPIRATED INTO THE PUMP
. 1	212	000893A	021574	8	PM	C11	٧	1	N	0	2C AUX FD PUMP STARTED - DISCH PRESS DID NOT RISE	ATR BINDING OF PUMP IMPELLER
1	212	016051*	091976	K	PM	001	U	2	N	0	TWO RCPS WERE INADVERTENTLY TRIPPED OFF-LINE	PERSONNEL MADE SWITCHING ERROR
(	8F1	0005184	111073	н	PT	U13	N	1	N	U	HPCI INOPERABLE UNTIL MANUALLY RESET	TREP LOGIC IMPROP DESIGNED FOR LOSP
-	8F1	0005188	111073	0	PT	U13	N	1	H	U	RCIC INOPERABLE UNTIL MANUALLY RESET	TRIP LOGIC IMPROP DESIGNED FOR LOSP
(	8F1	010171*	051374	R	PM	DOS	U	2	1	D	RHR PMPS TRIPPD DUE TO ISOLATION VALVES CLOSING	FAJLTY RELAYS FOR FCV74-47 AND FCV74-77
(	BF1	010377*	061874	0	PM	813	U	2	1	D	18 6 1C COR SPRA DIDNT START DURIN SURVLENC TESTIN	BENT CONTACT ARM ON RELAY (MANUAL START)
(	8F1	027159*	092679	K	PM	003	٧	2	N	0	A AND B RECIRCULATION PUMPS TRIPPED	TROUBLESHOOTING WRONG TERMINAL STOP
(	8F1	027682*	112679	K	PM	003	٧	2	N	0	BOTH RECIRC MG SETS SHUTDOWN DURING NORMAL OP.	PERSONNEL TESTING WRONG RELAYS
(	BF2	010491	081174	н	PT	802	U	1	T	T	HPCI ISOLATION OCCURED DURING MANUAL HPCI START	EX4ST RUPTURE DISK FLD-SOL VLV WIRED WRNG
1	8F2	021782	062778	н	PŢ	003	C	1	1	D	DAMAGE SUBSTAINED TO HPCI PUMP AND REDUCTION GEARS	VALVE IN LUBE OIL LINE WAS NOT OPENED
(	BRZ	013343	041475	н	PT	802	U	1	Ŧ	0	HPCI TURBINE STOP VALVE V8 FAILED TO OPEN FULLY	PERSONNEL ERROR-NEEDLE VLVS IMPRPR ADJST
-	882	014947*	052776	K	PM	001	N	2	T	D	RECIRC PUMPS TRIPPD ON LOW L.O. PRESS	OPERATOR DED NOT FOLLOW EMERGNCY PROCECRE
(	BRZ	016260	110276	Q	PT	802	U	1	N	D	RCIC TURBINE TRIPPO ON HE EXHAUST PRESS	EXHAUST STOP-CHECK VLV NOT OPENED
(	BRZ	018134	050777	0	PT	801	U	1	N	0	RCEC TURB. OVERSPED AFTR MANUAL START FOLLWY SCRAM	OPERATOR DIDN'T CHECK MAN. SPEED SETTING
(	882	018676	062277	L	PM	801	U	1	T	D	RHR ZA CHARGN MOTOR SWITCH IN OFF POSITION	PERSONEL LEFT SWITCH IN OFF POSTTION
- (	8 8 2	025639*	040479	R	PM	813	U	2	T	t	RHR PUMPS 28 AND 20 WOULD NOT START FROM RTGB	POOR CONNECTIONS ON FUSES & FUSE BOX
(	BRZ	0324544	090780	0	PT	001	U	1	1	0	RCIC TURBINE TRIPPED ON HIGH EXHUST PRESSURE	INCORRECT VALVE LINE-UP
(	882	0324548	090780	н	PT	U01	U	1	т	0	HPCI STOP-CHECK ALSO FOUND SHUT	PERSONNEL DIONT VERIFY POSITH AFTER MAINT
(	DAL	010217	060474	Q	PT	806	U	1	T	0	RCIC FAILED TO START AUTOMATICALLY	GOV CONT CKT SET HIGHER THAN GURSPO TRIP
(	DAL	016588	122076	н	PT	806	U	1	T	0	HPC! TURBINE TRIPPED ON FAST START WITH HE FLO IND	HT FLOW POIS SETPOINTS WERE INCORRECT

Zme	PLANT	CONTROL	EVENT	NA NA ME	0020	MODE	TYPE	FAIL	ACTUALY	CLANO	MODE DESCRIPTION	CAUSE DESCRIPTION
G	DAL	019127	092177	н	PT	C 0 6	U	1	1	0	HPCI WOULD NOT DEVELOP SUFFCHT RPM	EXCESSIVE OPENING OF L.O. THROTLE VALVES
G	DR3	018549	080477	ĸ	PH	C03	U	1	1	0	"A" RECIRC PUMP DID NOT RUNBACK DURIN FEED SYS TST	OPERATOR TURNO OFF CONT.PWR TO "A" RECIRC
G	EN1	014789	042276	0	PT	COS	U	1	1	0	RCIC TURBINE SPEED WOULD NOT INCREASE	PERSONNEL CUT CABLE TO PUMP (DUR OUTAGE)
G	EN2	022753	110678	н	PI	802	U	1	. 1	0	HPCI PUMP FAILED TO QUICK START	WIRE ON CONTROL CIRCUIT NOT RECONNECTED
G	FP1	014488	032176	0	PT	803	U	-1	1	0	BOTH EXHAUST RUPTURE DISKS RUPTURD DURIN FLOW TEST	MAMUAL EXHAUST VALVE FULLY CLOSED
G	MO1	002172	073172	н	PT	809	U	1	-1	U	HPCI TURBINE TRIPPD ON OVERSPEED FOLLOWING MAINT.	PLASTIC FRAGMENTS FOUND IN OIL INLET PERT
G	HOL	002168	101172	U	PH	C06	· U	1	1	D	STRY LIO CONT PUMP DIDNT DEVELOP REOD HEAD	IMPROPER VENTING/FILL OF SUCTION LINE
G	NM1	017431	040477	R	PH	006	U	- 1		U	WHILE LOWRING RIX HEO LEVEL FOR MAINTINGE ON VESSEL	SHUTDWN COOLNG PHP TRPPD DUE TO LOW SUCT
6	001	002305*	080172	U	PH	813	U	2	-	0	BRKR FOR 1 STRY LIQ CONT PUMP RACKED OUT-OTHER PMP	WOULD NOT START - AUX CONT PREVENTED CPE
6	001	013830*	121275	K	PM	003	U	3	-1	0	DEENERG 1254 DC DIST CTR - LOSS OF 3 RECIRC PUMPS	PERSONNEL DID NOT FOLLOW PROCEDURES
0	001	0258258	050279	H	PM	813	U	2		0	BEC FEED PUMPS DID NOT OPERATE AFTER SCRAM	BUS DE-ENERGIZED
0	001	027695	110379	D	PM	803	3 U	1	1	D	CORE SPRAY BOOSTER PUMP DID NOT START, LOOSE FUSE	PERSONNEL MANIPULATING FUSE FOR TEST
6	P82	020525	020778	н	PI	802	2 0	1		D	TURBINE TRIPPO ON OVERSPEED; AUTO START TESTING	MISCALIBRATION OF TURBINE SPEED CONTROL
0	P82	021081	042978	L	PM	uo:	U	2	-	N D	UNIT 2 "B", "D"RHR BLOCKED FOR 2 HRS.	OPERIR REMYD UNIT 2 INSTED OF UNIT 3 PPPS
(	PII	002247	100772	J	PH	013	3 (	1	. 1	0 0	POWER CTR OVERCURRENT TRIP - LOSS OF CCW PUTP	LOADED PC SIMULTANEOUSLY VS SEQUENTIALLY
(	901	010516	072074	H	PI	COI	1 0	1		0	HPCI SPEED CHANGE MOTOR INOPER. CONT. POWR FUSES BL	SYS. IMPROPRLY TAKEN DUT OF SERVICE EARLER
(	001	016904	120276	L	PH	802	2 (	1	- 1	0	AIR LUCKO SUCT HEADR COMMON TO 14 RHR LOOP.DIESL C	RAS SER MER PMP HAD ATR LINE CONN TO CASE

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