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Common Cause Fault Rates for Valves

Estimates Based on Licensee Event Reports at U.S. Commercial Nuclear Power Plants, 1976-1980

Prepared by J. A. Steverson, C. L. Atwood

EG&G Idaho, Inc.

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ABSTRACT

This report presents estimates of common cause fault rates and related quantities, based on Licensee Event Reports for valves in nuclear reactors. The Licensee Event Report data base is described. For estimating rates, the binomial 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 valves in a system inoperable. Every quantity is estimated by both a point estimate and a 90% interval.

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

SUMMARY

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

The data consist of 600 reports describing valve faults from 1976 through 1980. Coding the data is discussed; an event is coded common cause if faults were synchronized by an external shock to the system, causing several valves to fail simultaneously. Single faults are also coded common cause if the potential existed for other valves to fail simultaneously. Imperfections in the data are also discussed; the most important ones are reports with the number of failed valves not stated, inexact populations of valves, and miscoding of the data due to subjectivity.

Different types of valves, such as air-operated valves, check valves, and safety valves, are treated separately. Each type of valve has its own major failure modes. Separate rates are estimated for each of these modes. The binomial failure rate method is used to estimate the common cause rates and related quantities of interest. Every estimated quantity is estimated by both a point estimate and by a 90% interval. Many of the intervals are rather wide, reflecting the observed plant-to-plant variability.

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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 valves simultaneously inoperable due to a single cause makes it essential to estimate the rate of valves becoming simultaneously inoperable. Therefore, this report presents estimates of common cause and individual fault rates and failure rates for valves 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 valves 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. 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 valve 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 the reported common cause events, and a separate listing of all the data.

THE DATA

Event Reports

The raw data are 600 Licensee Event Reports (LERs), describing valve faults in U.S. nuclear power plants. The LERs, summarized by Miller et al.,[1] describe events occurring between January 1, 1976, and December 31, 1980. They include reports from 44 pressurized water reactors (PWRs), i.e., those designed by Babcock and Wilcox, Combustion Engineering, and Westinghouse, and 22 boiling water reactors (BWRs), i.e., those designed by General Electric. Events that occurred before a plant's initial criticality date are not considered.

The pertinent information from each LER is coded into a one-line summary. These one-line summaries are grouped and listed with the respective failure rates in Appendix C. To aid in checking for possible common cause events, underscores are used to separate unrelated events. 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. In Appendix D, a list of only common cause events precedes a list of all one-line summaries.

Definitions

The definitions given here follow Reference 1. A valve is defined as the valve body and all its internal parts, the valve operator (motor, solenoid, handwheel, etc.), and any attached functional accessories, such as limit and torque switches, that are needed to make the entire assembly function. Although supply systems to the valve operator (such as electrical, air, or hydraulic) are considered outside the bounds of the component, failures involving them are included. Such failures are considered command faults to the valve assembly.

A failure is an event in which the valve itself needs repair in order to perform as designed. A command fault is an event in which the valve does not fail, but it does not function as desired due to external inputs

or lack of inputs. For example, suppose a valve is commanded to operate, but it fails to function because it receives no power due to a failure of its electrical breaker. Then the valve has not failed; it would have operated satisfactorily if power were available. A second example is when someone lines up a valve in the wrong position. The term fault is used to include both failures and command faults. Appendix C presents estimated rates based both on all faults and on failures only. To avoid needless repetition, however, the explanatory text is given just once. Because there is no convenient verb corresponding to all kinds of faults, statements are often expressed in terms of failures. Unless the context clearly rules it out, any statement about failures or faults should be understood to apply to both.

Seven failure modes identified in the data are defined here. The presence of a demand is not implied by any of the failure modes; if a valve was found to be inoperable or improperly lined up, then the event is counted as a fault, regardless of whether or not the valve was required at the time. The letter following each mode name is the code used in the one-line summaries. Failure to open (A) or failure to close (B) is reported when a valve fails to open fully or close fully when commanded to do so. Failure to close includes safety/relief valves failing to reseat. Internal leakage (C) results when there is measurable leakage past the valve seat, even though the indications show that the valve is closed. This definition assumes that the valve is repairable by cleaning and resurfacing the valve seat and disk. Reverse leakage (E) is a mode used to describe internal leakage through a check valve. It is a separate and distinct mode, applying only to check valves, and is not considered part of the internal leakage mode.

Some control valves such as pressure, level, or flow are not "open" or "close" oriented, but are designed to constantly change positions during operation. Other valves are required to open or close within rigid time constraints for systems to operate properly. Many LERs do not specifically state how a valve fails, but state only, ". . . valve failed to operate during testing." Thus, failure to operate as required (F) is used whenever (a) a valve failed to meet specific requirements such as closing or opening

times, (b) a valve lost the ability to control system parameters, or (c) the LER failed to provide sufficient information concerning the event.

The plugged (failure to remain open) (G) mode is used if any event stopped or limited flow through a normally open valve. A valve is coded plugged if, for example, a valve disk separated from the stem and fell into the closed position, or if the air supply to an air-operated valve fails, allowing the valve to drift closed.

Improper valve configuration (V) is a mode consisting entirely of events caused by human factors resulting in valves not being in the position required by applicable plant conditions. They usually involve personnel failing to close a valve or closing the wrong valve during a valve line-up procedure. All events in this mode are considered command faults, not valve failures.

Populations

As reported in Reference 1, correct valve populations are difficult to obtain. They are usually taken from plant drawings or from the text of Preliminary or Final Safety Analysis Reports, so inaccuracies may be present because the available copy of a drawing is poor, or because changes were made in a plant design and are not shown on the plan. For example, no motor-operated valves are shown in the drawing for the residual heat removal/low pressure coolant injection system at FitzPatrick; yet eight LERs report failures of such valves. In such a case, the population is counted as zero; the reported faults are shown in the one-line summaries of the data, but they are not counted in the tabular summaries of the data, and they are not used in estimates. If a drawing shows several systems as a composite system, as is common for the PWR engineered safety features systems, then Reference 1 gives only the composite population. Rates for damper valves, solenoid-operated valves and hydraulically operated valves are not estimated because their populations are unknown. Tables B-1 and B-2 of Appendix B present populations for the types of valves that were considered: air-operated, motor-operated, manually operated, check, safety, and relief valves.

Exposure Times and Estimated Demands

Except for safety and relief valves, the hours used to estimate fault rates are calendar hours. The starting date is the plant's initial criticality date or January 1, 1976, whichever came later. The ending date is December 31, 1980, except for Three Mile Island Units 1 and 2, which were both shut down following the accident of March 28, 1979. The number of calendar hours is listed for each plant in Tables B-1 and B-2 of Appendix B.

For PWR safety valves and BWR relief valves, fault rates for failure to open and failure to close are estimated using test and operational demands. These valves are required to be tested at least once every 5 years. One test demand is used in the rate estimates for the safety and relief valves in those plants that achieved initial criticality prior to January 1, 1976 and remained operational for the full 5-year period covered by this report. No test demands are assumed for plants that achieved initial criticality after January 1, 1976.

Since only one test demand is assumed for safety or relief valves, operational demands are added to the test demand to estimate failure rates for these valves. An operational demand is considered to be a plant pressure transient sufficient to raise system pressure above the setpoint of the safety or relief valve. Because it was beyond the scope of Reference 1 to obtain a 5-year pressure history for each plant, the number of operational demands was estimated for each plant. Miller et al., pp. 14-15, discuss the necessary assumptions and how estimates of the number of operational demands were obtained. Tables B-1 and B-2 of Appendix B also contain these estimates.

Imperfections in the Data

An important deficiency in the data is the imperfect population counts, as discussed in the section "Populations." Also, a detailed data analysis is impossible because the populations are only given for large systems.

Second, the LER reporting policies may vary from plant to plant. The basic concept of the LERs was to implement a systematic way of identifying risk-significant events that have occurred at U.S. commercial nuclear power plants. LERs, therefore, notify the NRC of "reportable occurrences" at the power plants, by Revision 4 of Regulatory Guide 1.16.[2] Three possible reasons for the reporting variations are: (a) the general wording of the reportable occurrence section of Regulatory Guide 1.16 could be misinterpreted, (b) the implementation of the Regulatory Guide may differ among plants, and (c) the importance assigned to the Regulatory Guide by the management of the individual plants may also differ. Appendix A of Reference 1 contains a detailed discussion of this LER concept and reporting variability.

A final major imperfection in the data is lack of precise detail in the LERs. The reports are often so vaguely worded that the type of valve, number of failed valves, failure mode, or failure cause is uncertain. These four cases are considered separately here.

Type of Valve

As stated in Reference 1, many LERs do not specify the valve type, but do make it clear that the valve is operated remotely. Since motor-operated valves are the most common type, Miller et al., believe that most of the failures of remotely operated valves are actually failures of motor-operated valves. In this report, LERs for remotely operated valves are pooled with those for motor-operated valves, and estimates are given on the basis of the pooled data. These estimates are upper bounds on what would be found for motor-operated valves if more complete information were available. Conversely, the estimates given for air-operated valves may be lower than estimates based on perfect classification of the data, because some of the remotely operated valves may really be air-operated.

The importance of this pooling is suggested by a scan of the one-line summaries of the data: there are 600 lines, with 313 coded motor-operated, 109 coded remotely operated, and 22 coded air-operated.

Number of Failed Valves

Some LERs contain phrases such as "many containment valves," "several isolation valves," or just the plural "valves." Therefore, in Reference 1 the following values were arbitrarily assigned as the number of failed valves, based on key words used in the LERs:

Key Word	Code	Number Assigned
Valves	V	2
Some	A	3
Various	B	3
Lineup wrong	L	2
Several	S	3
Other	Z	≥ 2

"Other" refers to phrases that did not contain any of the above key words, phrases such as "all containment motor-operated valves" or "a series of valves." Numbers were assigned according to the information in the phrase. The codes are printed in the list of one-liners in Appendixes C and D next to the assigned failure numbers when applicable.

This has a slight effect on the estimates of the rates of individual (i.e., not common cause) faults. Of the hundreds of LERs reporting individual faults, five do not state the exact number of failed valves. For these five events, numbers are assigned as described above.

For common cause faults, no arbitrarily assigned numbers of valves are used in the estimates. A common cause event involving an unknown number of valves contributes to the estimate of the rate of common cause events, but it is not used to help estimate the average number of valves per event (for details, see Appendix A). Of the 37 common cause events involving more than one valve, the exact number of valves is uncertain in 12 of the events.

Failure Mode

As mentioned in an earlier section, the mode failure to operate as required is used to include LERs that do not clearly identify the nature of the failure. This is not a serious problem for this report, because only generic fault rates are given here. For motor-operated, air-operated, and manually operated valves, the three modes failure to open, failure to close, and failure to operate as required are combined, and a single rate is estimated for such failures. For other types of valves, the failure mode can always be inferred from the LER.

Failure Cause

The cause of failure is not always clear. Sometimes the cause was unknown to the person who wrote the LER, and sometimes the cause is obscured by a vaguely written narrative. This lack of clarity introduces errors in the classification of events as common cause or not. The possible seriousness of such misclassification is discussed in the following section.

CLASSIFYING COMMON CAUSE EVENTS

To estimate common cause fault rates, it is necessary to determine which events in the data set are common cause faults and which are not. The critical question for each event is: "Was there some shock, external to the valve or valves, that caused or could have caused simultaneous failures or faults?" Synchronization of the faults is essential, because the importance of common cause faults stems from the seriousness of having several valves failing simultaneously.

Because shocks affect a random number of valves, there may be a shock causing exactly one valve to fail. When the data are examined, it is usually possible to decide whether the single valve failed on its own or from some shock that could potentially have caused other valves to fail. Correct identification of common cause shocks as the causes of these single failures helps in estimating the shock rate. 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.

On February 20, 1976, for example, one discharge valve in the containment spray system at Kewaunee failed to open because the valve had been manually torqued down too tightly. And at Oconee 1, on December 4, 1978, a valve in the containment spray system failed to operate when tested because the breaker to the valve was not racked in properly. Both examples involve command faults imputed to personnel action. They are coded common cause faults, as personnel errors often are. For a personnel error affecting only one valve to be coded 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 valve at the same time. In this report, 61 one-valve events are coded as common cause.

Faults caused by design errors are rarely coded as common cause because there usually is no mechanism to synchronize the faults. Rather, design errors normally contribute to a high individual failure rate, often leading to recurrent failures.

As can be seen, the coding of common cause events involves some judgment on the part of the coder. An inadvertent experience with diesel generator data, described by Atwood and Steverson,[3] sheds some light on the importance of the coder's judgment. 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 simply a command fault. 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 judgment has a noticeable but not overriding effect.

It is conceivable that a person, through misunderstanding or forgetfulness, might intentionally take the same (wrong) action repeatedly, rendering all the valves of a certain type in a certain system either inoperable or incorrectly positioned. This would be an example of a lethal shock, a shock that by its nature automatically causes all the valves of a given type in a system to fail. No such events occur in the data for this report. This may be partly because most of the valves are only grouped very crudely, into major systems with large populations. However, even though no such events are observed, the model allows for their occurrence. This causes the estimated fault rates to be conservative, as described in the section "Estimating Rates Using an Extended Binomial Failure Rate Model."

EXAMINING THE DATA FOR STRUCTURE

Common Cause Systems

It is necessary to form groups of valves, or "common cause systems" such that all the valves within a group are susceptible to simultaneous failure due to a common cause. For example, valves that are serviced together and that perform similar functions and have similar mechanisms could form a common cause system. A system must not be so small that a single shock could affect valves in more than one group.

The valves of one type in a functional system of a plant form such a group. For example, air-operated valves in the engineered safety features (ESF) system all perform similar functions, and the procedures for maintaining and servicing them are normally similar. Their functions, operating environment, and maintenance procedures are different from those of, say, check valves in the auxiliary feedwater system.

Therefore, it is extremely unlikely that a single common cause shock could affect valves of different types, or valves in different systems. And, in fact, no such events occur in the LERs under consideration. On the other hand, valves of the same type in the same plant-system may fail simultaneously because of a single shock. At Rancho Seco, for example, on November 11, 1977, an operator misread the control indications of two high pressure coolant injection (HPCI) motor-operated valves, and therefore mispositioned both valves. At Yankee Rowe on February 1, 1980, three remotely operated HPCI valves were found inoperable because the time delay relays were simultaneously wired improperly when replacements were installed. At Beaver Valley 1 on May 21, 1980, remotely operated valves in the residual heat removal system failed to close because the process control signal was deenergized. And on February 1, 1980, remotely operated control valves in the auxiliary feedwater system of Joseph M. Farley 1 failed to open because contacts in a circuit breaker of the control circuit were misaligned.

Therefore, each common cause system is defined for this report as all the valves of a particular type in a particular functional system of a plant. The populations of the common cause systems are given in Tables B-1 and B-2 of Appendix B.

This grouping of valves into common cause systems is probably too coarse. In particular, there may be few or no shocks that can simultaneously affect all the valves of one type in the entire ESF system. At the very least, it would be desirable to divide the ESF system into HPCI, LPCI (low pressure coolant injection), and containment spray, since none of the reported common cause events involves more than one of these three systems. Perhaps an even finer decomposition would be useful. However, only composite populations are available at many plants, so the common cause systems used are the best that are now possible.

Variability in the Fault Rates

Whenever possible, it is desirable to pool similar data, to obtain the most precise fault rate estimates possible. Examples are pooling the data from plants of similar design, or from similar valves in different systems. Therefore, this report presents generic rates. The different types of valves are treated separately because their mechanisms and functions differ greatly. For each type of valve, fault rates are estimated for failure modes that are intended to be those of greatest interest in applications.

Thus, air-operated, manually operated, and remote/motor-operated valves have rates estimated for failure to open, close, or operate; failure to remain open, or plugged; and improper valve configuration or lineup. Rates are also estimated for internal leakage in air-operated valves, but not in remote/motor-operated or manually operated valves. Internal leakage in the two latter types of valves is considered inconsequential as far as risk to safety is concerned. For check valves, the modes failure to open and failure to remain open, or plugged, are combined, as are failure to close and reverse leakage. Rates are estimated for three failure modes in

safety valves and relief valves: failure to open, failure to close, and internal leakage. Table 1 contains a list of the valve types and their associated failure modes.

TABLE 1. TYPES OF VALVES AND ASSOCIATED FAILURE MODES

Air-Operated Valves
Failure to open, close, or operate
Internal leakage
Failure to remain open (plugged)
Improper valve configuration
Check Valves
Failure to open or failure to remain open (plugged)
Failure to close or reverse leakage
Remote/Motor-Operated Valves
Failure to open, close, or operate
Failure to remain open (plugged)
Improper valve configuration
Manually Operated Valves
Failure to open, close, or operate
Failure to remain open (plugged)
Improper valve configuration
PWR Safety Valves
Failure to open
Failure to close
Internal leakage
BWR Relief Valves
Failure to open
Failure to close
Internal leakage

For any of these types of valves and failure modes, the fault rates show substantial plant-to-plant variability. There are also variations in the rates among systems, 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 that of individual (i.e., not common cause) events or, if enough data are available, the rate of common cause events. The data sources are the different common cause systems at the different plants, corresponding to any one of the valve types and failure modes listed in Table 1. 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. On the basis of 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%.

Typically, most of the plants show no faults, although 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. Although such a distribution is not what a risk analyst desires, it does reflect the great variability in the data.

ESTIMATING RATES USING AN EXTENDED BINOMIAL FAILURE RATE MODEL

The Model

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

1. Each valve can fail individually, and has a constant fault rate λ.

2. A common cause shock can occur in the system, with constant occurrence rate μ. If a shock occurs, the valves in the affected system fail independently of each other, each with probability p, so the total number of failed valves is random. Vesely[4] calls this the binomial failure rate (BFR) model, because the number of failed valves, given that a shock occurs, is a binomial(m, p) random variable. Estimators using this model are developed by Vesely[4] and Atwood.[5,6] These shocks are called nonlethal shocks, to distinguish them from the shocks defined below.

3. A lethal shock can occur in a system, with constant occurrence rate ω. A lethal shock, by its very nature, causes every valve in the affected system to fail. The number of failed valves is not random, but must equal m. No such events occur in the valve LERs. However, the model includes them, for reasons discussed below.

Some quantities of interest are listed below. The notations for p, λ, and μ agree with Reference 5. The quantity λ_+ is called λ'_+ in that reference. The quantities are

λ = fault rate for an individual valve, not counting faults due to common cause shocks

μ	=	rate of nonlethal shock occurrences
p	=	probability that a specific valve is inoperable, given that a nonlethal shock occurs
$\lambda_+ = \mu(1 - q^m)$	=	rate of nonlethal shocks that cause at least one valve 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 valve becomes inoperable, either as an individual fault or due to a shock
$r_k = \mu p^k + \omega$ for $k \geq 2$	=	rate at which a specific set of k valves becomes inoperable simultaneously (due to a shock)
$\beta = [\mu p(1 - q^{m-1}) + \omega]/r_1$	=	long-term fraction of valve faults that occur in multiple faults; called the beta factor by Fleming.[7]

The quantities r_1, r_2, . . . are the relevant rates for fault tree analysis. For, if a cut set of a fault tree involves k valves, $k \geq 1$, then the relevant rate is r_k, and the probability that the k valves 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 section "Application," and in Appendix A. The expression given for β ignores the time for discovery and repair of faults.

The basic binomial failure rate model, as defined in Reference 4, does not include lethal shocks. Lethal shocks are included here in order to put

a floor underneath the estimates of r_k, below which they cannot sink. The basic BFR method would estimate r_k as μp^k, for $k > 1$. If p is small and k is large, then μp^k can be microscopic. Using $r_k = \mu p^k + \omega$ maintains r_k at a realistic level, because the Bayes estimate of ω is always positive (even when the observed number of lethal shocks is zero). Therefore, the postulated lethal shocks act as a surrogate for other possible model inaccuracies.

Estimation

This section briefly describes the estimation procedure based on the above model. The Bayesian methods developed by Atwood[5,6] 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 β, because the computer code has not been programmed to calculate the mean. It should be realized that when the distribution has a large variance, 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 r_1, or even for simple expressions such as p when the data are obtained from plants with different numbers of valves. The Bayesian distributions used are either estimated directly from the data, to reflect the apparent variability in the parameters, or are calculated in the usual way on the basis of 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 valves. This was described in the section "Variability in

the Fault Rates," and defines a distribution for the parameter λ. Similarly, if enough faults are observed, a gamma distribution is fitted to the observed nonlethal common cause events, giving a distribution for the parameter λ_+. Only motor-operated valves have enough common cause faults to allow plant-to-plant variability to be fitted for λ_+.

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 ω, and for λ_+ when few or no common cause events occurred. For p, an approximately noninformative prior distribution is used, as described in Reference 6, pp. 16-17. For λ_+ and ω, a noninformative prior distribution is used, proportional to $\lambda_+^{-1/2}$ or $\omega^{-1/2}$.

The quantities p, λ, λ_+, and ω 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 valves in the system in question. Therefore, estimates of μ, β, and r_k, $1 \leq k \leq m$, are found separately for each value of m. Then, overall estimates that do not depend on m are given, 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.

DISCUSSION

Application

The uncertainty intervals for the rates 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; therefore, 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 valve becomes inoperable during a time interval t, but that the fault is not discovered until the valve is tested at the end of the time interval. Faults in the other valve(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.

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

$$P(1 \text{ specific valve inoperable}) = r_1 t$$

and

$$P(k \text{ specific valves inoperable}) = (\lambda t)^k + r_k t$$

for $k \geq 2$. These approximations are accurate to at least one significant digit if, in the first case, $r_1 t < 0.1$, and in the second case, if $\lambda t < p/10$ and $r_k t < 0.1$. If t is too large for these approximations, then the more general methods of Appendix A should be used.

The formulas just given should look familiar to fault tree analysts. In particular, if $k = 2$, $r_2 t$ is used in the way that $\beta r_1 t$ 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 valves. The ratio r_k/r_1 would be a beta factor for k components, and the value given in this report as <u>the</u> beta factor is a compromise among these values.

The beta factor is defined as the long-term fraction of valve faults that occur in multiple faults. However, to estimate it, with uncertainty bounds, the computer program uses a formula for β 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 open, close, or operate in air-operated valves, the direct estimate is 2/18 = 0.111, which differs little from the computed estimate of 0.165. For failures to open in BWR relief valves, the direct estimate is 12/42 = 0.286. This differs substantially from the computed estimate of 0.095, but is still less than the computed upper bound of 0.493. In any case, this report recommends using r_2, r_3, etc., rather than β.

Diagnostic Checks

A diagnostic check on the BFR assumptions is considered. 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 valves affected by any (future) nonlethal shock is a binomial(m, p) random variable. Once p has been estimated, the observed numbers of affected valves 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 valve, one residual for the common cause events involving exactly two valves, 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 improper lineups of remote/motor-operated valves are analyzed. For this analysis, events are considered only if the exact number of incorrect valves is reported. There are 17 such events, occurring in systems with up to 50 valves. The standardized residuals corresponding to one through ten inproperly lined up valves are, respectively, -0.85, 1.79, -1.12, -0.57, -0.29, -0.14, -0.07, -0.03, -0.01, and -0.01. The standardized residuals corresponding to more than ten valves are all equal to zero, to two decimal places. The largest absolute value is approximately 1.8. This means that no observed count is more than 1.8 standard deviations from its estimated expected value. The residuals are even smaller for other kinds of valves or faults. Therefore, this investigation finds no strong evidence of departure from the binomial distribution.

In the above case, the pattern of residuals shows that there are more faults than expected involving two valves at a time, and fewer than expected involving other numbers of valves. The discrepancies are not statistically significant, but the pattern might be altered if the exact number of improper valves were reported in every case. In particular, it may be that events involving more than two valves are less likely to have the number of valves reported; this would partially account for the pattern.

THE ESTIMATES

The estimates for the 18 classes of valves and failure modes listed in Table 1 are given in Appendix C.

Depending on the application, command faults may or may not be of interest. Therefore, most of the estimated rates include both estimates based on all faults and estimates based on failures only, with command faults excluded. However, when a valve failed due to an improper lineup, the event was always coded as a command fault; the valve itself did not fail. Thus, estimates based only on command faults are presented for rates involving improper valve configuration.

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.

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 valves from January 1, 1976, through December 31, 1980. Because the LER data base may be incomplete, the estimates should be used with care. The rates presented are per calendar hour for all systems except safety and relief valves, where estimated demands are used for failure to open and failure to close. 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. C. F. Miller et al., Data Summaries of Licensee Event Reports of Valves at U.S. Commercial Nuclear Power Plants from January 1, 1976 to December 31, 1980, EGG-EA-5816, April 1982.

2. "Reporting of Operating Information--Appendix A Technical Specifications," U.S. Nuclear Regulatory Commission Regulatory Guide 1.16, Revision 4, August 1975.

3. C. L. Atwood and J. A. Steverson, Common Cause Fault Rates for diesel Generators: Estimates Based on Licensee Event Reports at U.S. Commercial Nuclear Power Plants, 1976-1978, NUREG/CR-2099, EGG-EA-5359, Revision 1, 1982.

4. W. E. Vesely, "Estimating Common Cause Failure Probabilities in Reliability and Risk Analyses: Marshall-Olkin Specializations," in Nuclear Systems Reliability Engineering and Risk Assessment, J. B. Fussel and G. R. Burdick (eds.), Philadelphia: Society for Industrial and Applied Mathematics, 1977, pp. 314-341.

5. C. L. Atwood, Estimators for the Binomial Failure Rate Common Cause Model, NUREG/CR-1401, EGG-EA-5112, April 1980.

6. C. L. Atwood, "Estimating Common Cause Failure Rates for Pumps in Nuclear Reactors," Proceedings of the 1980 DOE Statistical Symposium, T. Truett, D. Margolies, and R. W. Mensing (eds.), April 1981, pp. 15-26.

7. K. N. Fleming, "A Reliability Model for Common Mode Failures in Redundant Safety Systems," Proceedings of the Sixth Annual Pittsburgh Conference on Modeling and Simulation, 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 λ has a gamma (a, b) distribution, and that, given λ, the number of faults of a valve has a Poisson (λt) 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[A-1]). Therefore, the maximum likelihood estimates of a and bt can be found numerically, based on the exposure times and observed failures for the valves.

To illustrate this, consider the individual failures to open, close, or operate, for remote/motor-operated valves, counting failures only. There are 181 systems at the various plants, for example, the auxiliary feedwater system at Davis-Besse 1, the HPCI and LPCI systems at Crystal River 3 (combined as a single system for lack of more detailed population information), and the core spray system at Quad-Cities 2. When a gamma distribution is fitted to the 253 reported failures from these 181 plant-systems, the estimated parameters are 0.811 and 3.233E-6, the estimated mean of the distribution is 2.623E-6, and the estimated 90% interval is (7.500E-8, 8.465E-6).

A check is routinely made for outliers, but no plant-system is so far out in the tail of the fitted distribution that it should be called an outlier. The estimated mean and 90% interval given above are used in Appendix C as the mean and interval for λ.

This example is typical of all the portions of the data, except that the estimates are usually based on far fewer reported faults. If so few faults are reported that a gamma distribution cannot be estimated (that is, the estimation program finds no evidence of variability in λ), then a posterior Bayes distribution for λ is used, obtained in the usual way from a noninformative prior distribution and the reported data.

An LER may neglect to report the exact number of failed valves. If the LER reports individual faults, they are included in the data used for fitting a gamma distribution to λ, with the number of valves assigned as described in the section "Number of Failed Valves" in the main body of this report. On the other hand, if the LER describes a common cause event, then it is included in the data used for fitting a gamma distribution for λ_+ (because a shock is known to have occurred), but it is not included in the data used for estimating P (because the number of affected valves is unknown). It is not certain what effect this has on the estimates. If reports are more likely not to specify the number of valves when this number is large, then the procedure followed will tend to underestimate P. However, the procedure seems better than making up numbers whenever the counts are unknown.

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 be the number of lethal shocks. Consider any event involving the failure or survival of certain valves in some time period t. Let $P(A|B)$ denote the conditional probability of A, given B. The following decompositions hold:

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

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

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:

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

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

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

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 toward evaluating this, let $q = 1 - p$, and note that for any specific single valve

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

This expression is the probability that the valve 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(event $\mid N_L = 0$, $N_S = n$), use Q_n and the fact that, given a shock, the valves behave independently.

As an example, suppose that a system has four valves. 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 valve survives is Q_n, so the conditional probability that at least three fail to survive is

$$P(\text{exactly 3 fail} \mid N_L = 0, N_S = n) + P(\text{exactly 4 fail} \mid N_L = 0, N_S = n)$$

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

Therefore, to obtain the desired probability, observe that $P(\text{event} \mid N_L > 0) = 1$, 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, μ, λ, and ω 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, μ, λ, and ω 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, λ, λ_+, and ω. This is how the intervals for β, 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 $\lambda t \ll 1$, $\mu t \ll 1$, and $\omega t \ll 1$. They follow from the Taylor series expansion for e^{-x} and are

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

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

$$e^{-\mu t} \doteq 1$$

$$Q_n \doteq q^n$$

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

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

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 valve is valid if, in addition, $\mu << \lambda$ and $\omega << \lambda$. The second approximation is valid for k valves if the first approximation is valid and, in addition, $q\lambda t << p$.

$$P(1 \text{ specific valve fails}) \doteq \lambda t + p\mu t + \omega t \equiv r_1 t$$
$$\doteq \lambda t$$

$$P(k \text{ specific valves fail}) \doteq (\lambda t)^k + (q\lambda t + p)^k \mu t + \omega t$$
$$\doteq (\lambda t)^k + p^k \mu t + \omega t \equiv (\lambda t)^k + r_k t \quad \text{for } k \geq 2$$

P(at least k out of m valves fail)

$$\doteq \binom{m}{k}(\lambda t)^k + \mu t \sum_{i=k}^{m} \binom{m}{i}(q\lambda t + p)^i q^{m-i} + \omega t$$
$$\doteq \binom{m}{k}(\lambda t)^k + \mu t \sum_{i=k}^{m} \binom{m}{i} p^i q^{m-i} + \omega t$$
$$\text{for } k \geq 1 .$$

Diagnostic Check Based on Residuals

If the binomial failure rate (BFR) assumptions hold, then the number of valves 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 valve 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.[A-2]

Suppose n_+ nonlethal shocks hit the systems with m valves and cause at least one valve to become inoperable. Then define

$$z_j = \binom{m}{j} p^j q^{m-j} / (1 - q^m)$$

for $1 \leq j \leq m$, with $q = 1 - p$. Let N_j be the number of shocks that affect exactly j valves. 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}, $N_{j\cdot} = \sum N_{ji}$ has mean $E_{j\cdot} = \sum E_{ji}$ and variance $V_{j\cdot} = \sum V_{ji}$. Here, the summations are over all i, such that $m_i \geq j$. Substitution of the estimate of p gives $\hat{E}_{j\cdot}$ and $\hat{V}_{j\cdot}$. Then, for each j, a standardized residual can be constructed

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

Under the BFR assumptions, the U_j values have a mean and variance of approximately 0 and 1. Any large value of 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 Classifying Common Cause Events 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 θ denote a parameter to be estimated (λ, λ_+, ω, p, μ, β, or an r_k). Let x denote some quantity in the data (n_I, 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 θ per relative change in x is

$$C(\theta, x) = \frac{\partial \hat{\theta}}{\partial x} \cdot \frac{x}{\hat{\theta}} . \qquad \text{(A-1)}$$

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 m_i and times t_i. Let n_{Ii}, n_{+i}, n_{Li}, and s_i denote the observed numbers of individual faults, nonlethal shocks, lethal shocks, and valves made inoperable by nonlethal shocks. Then, the maximum likelihood estimates satisfy

$$\hat{\lambda} = \frac{n_{Ii}}{m_i t_i}$$

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

$$\hat{\omega} = \frac{n_{Li}}{t_i}$$

$$\sum s_i = \hat{p} \sum \frac{m_i \, n_{+i}}{m_i} \cdot \frac{}{1 - \hat{q}} \qquad \text{(A-2)}$$

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

$$\sum s_i \doteq \frac{p \sum m_i n_{+i}}{(1 - q^m)}$$

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

$$m = \frac{\sum m_i n_{+i}}{\sum n_{+i}}$$

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

$$\hat{\lambda} = \frac{n_I}{m_i t_i}$$

$$\hat{\lambda}_+ = \frac{n_+}{t_i}$$

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

$$\hat{p} \doteq v\,(1 - \hat{d}^m) \quad .$$

Finally, the coefficients $C(\theta, x)$ defined by Equation (A-1), can be approximated for $\theta = \lambda$, λ_+, ω, p, u, r_k, or β, and for $x = n_I$, 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 $\hat{r}_1 \doteq \lambda$.

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_I and v by 10% and decreasing n_+ by 5%. The relative change is

$$\frac{\Delta \hat{r}_1}{\hat{r}_1} \doteq C(r_1, n_I) \times (0.1) + C(r_1, n_+) \times (-0.05) + C(r_1, v) \times (0.1) \quad .$$

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 section "Classifying Common Cause Events," in 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.

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

	x			
θ	n_1	n_+	n_L	v
λ	1	0	0	0
λ_+	0	1	0	0
ω	0	0	1	0
P	0	0	0	$\frac{1 - q^m}{1 - q^m - m\,p\,q^{m-1}}$
μ	0	1	0	$1 - C(p,v)$
r_1	$\frac{\lambda}{r_1}$	$\frac{\mu p}{r_1}$	$\frac{\omega}{r_1}$	$\frac{\mu p}{r_1}$
r_k, $k > 1$	0	$\frac{\mu p^k}{r_k}$	$\frac{\omega}{r_k}$	$\frac{\mu p^k}{r_k}[1 + (k - 1)\,C(p,v)]$
β	$\frac{\lambda}{r_1}$	$\frac{D}{D + \omega}$	$\frac{\mu p}{r_1}$	$\frac{\omega}{D + \omega}$ $\frac{D + (m - 1)\mu p^2}{D + \omega}$ $q^{m-2}\,C(p,v) - C(r_1,v)$

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 $C(\theta,x)$[a]

	x			
θ	n_I	n_+	n_L	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
r_1	$\pm$1	$\pm$0	$\pm$0	$\pm$0
r_k, k > 1	0	<1	<1	Varies
β	$\pm$ -1	<1	<1	Varies

a. This table shows, for example: if n_I increases by 10%, $\hat{\beta}$ will decrease by approximately 10%; if v increases by 5%, $\hat{p}$ 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.

References

A-1. N. L. Johnson and S. Kotz, Discrete Distributions, 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

TABLE B-1. PWR PLANT DATA

Plant Name	Code	Vend	Calendar Hours	Valve Population[a]									
				Auxiliary Feedwater				ESF[b]					
				Air	Check	Motor	Manual	Air	Check	Motor	Manual	Safety[c]	Safety Demands
Arkansas Nuclear One 1	AR1	B	43800	2	5	10	-	-	4,12, 8	2, 6,10	16,17, 6	2	10
Crystal River 3	CR3	B	34704	1	13	6	15	-	4,23	6,16	7,12	2	13
Davis-Besse 1	DB1	B	28944	-	11	2	18	-,14	2,26	4,17	6, -	2	12
Oconee 1	OE1	B	43800	3	9	9	14	-, 1, -	-,13, 7	2,12,29	5,39,17	2	19
Oconee 2	OE2	B	43800	3	9	9	14	-, 1, -	-,14, 7	2,12,28	5,40,18	2	9
Oconee 3	OE3	B	43800	3	9	9	14	-, 1, 4	-,14, 7	2,12,23	5,41,15	2	11
Rancho Seco	RS1	B	43800	-	12	2	12	-	14,20	8,20	29,33	2	7
Three Mile Island 1	TI1	B	28368	3	11	4	10	-	8,19	10,17	7, 8	2	1
Three Mile Island 2	TI2	B	8736	2	10	7	9	-, 2	12,19	27, 8	18,32	2	1
Arkansas Nuclear One 2	AR2	C	18120	4	16	14	7	-, 2	13,30	13,36	21,14	3	19
Calvert Cliffs 1	CC1	C	43800	2	8	-	10	4	45	31	39	2	17
Calvert Cliffs 2	CC2	C	35784	2	8	-	10	4	45	31	39	2	8
Fort Calhoun	FC1	C	43800	5	4	1	10	32	45	5	45	2	8
Millstone 2	MI2	C	43800	7	4	3	25	4	47	30	36	2	23
Maine Yankee	MY1	C	43800	3	8	-	15	22	49	35	72	3	13
Palisades	PA1	C	43800	4	6	-	8	2	21	15	31	3	20
St. Lucie 1	SL1	C	41112	4	9	3	16	2, 1	10,30	4,30	16,27	3	14
Beaver Valley 1	BV1	W	40656	-	6	9	17	-, 3, -	4,22,14	10,15,15	-,19, 2	3	49
D. C. Cook 1	DC1	W	43800	5	12	10	32	-,25	10,34	10,43	13,46	3	17
D. C. Cook 2	DC2	W	24600	5	12	10	32	-,25	10,34	10,43	13,46	3	10
Haddam Neck	HN1	W	43800	4	8	-	19	-	27	28	46	3	10
Indian Point 2	IP2	W	43800	4	18	8	20	-	36	52	53	3	33
Indian Point 3	IP3	W	41472	4	23	8	24	4	45	58	52	3	25
Joseph M. Farley 1	JF1	W	29712	8	21	11	42	-, -, 3	5,28, 5	10,27,20	16,20,16	3	29
Kewaunee	KE1	W	43800	-	11	4	9	-	13,19	8,29	14,27	2	17
North Anna 1	NA1	W	23976	3	6	3	24	-, 3, -	5,22,14	8,25,12	6, 6, 6	3	12
North Anna 2	NA2	W	4872	3	6	3	24	-, 3, -	5,22,14	8,25,12	6, 6, 6	3	7
Prairie Island 1	PR1	W	43800	4	11	3	9	2, -	5,23	23,28	11,22	2	12
Prairie Island 2	PR2	W	43800	4	11	3	9	2, -	5,23	23,28	11,22	2	12
Point Beach 1	PT1	W	43800	3	16	11	21	2, 2	10,21	4,27	15,38	2	6
Point Beach 2	PT2	W	43800	3	16	11	21	2, 2	10,21	4,27	15,38	2	5
R. E. Ginna 1	RG1	W	43800	7	12	3	22	-	21	44	42	2	4

TABLE B-1. (continued)

Plant Name	Code	Vend	Calendar Hours	Valve Population[a]									
				Auxiliary Feedwater				ESF[b]					
				Air	Check	Motor	Manual	Air	Check	Motor	Manual	Safety[c]	Safety Demands
H. B. Robinson 2	RO2	W	43800	3	10	8	20	8	25	29	57	3	21
Salem 1	SA1	W	35496	14	17	-	28	-, 4	6,32	7,32	16,41	3	17
Sequoyah 1	SE1	W	4320	10	21	3	25	10,85	8,42	3,10	7,78	3	11
San Onofre 1	SO1	W	43800	7	12	3	27	-	18	23	12	2	9
Surry 1	SU1	W	43800	-	16	6	20	-, 3	7,25	10,39	9,27	3	14
Surry 2	SU2	W	43800	-	16	6	20	-, 3	7,25	10,39	9,27	3	14
Trojan	TR1	W	43800	-	15	11	26	-	6,22	10,20	13,19	3	19
Turkey Point 3	TU3	W	43800	6	7	-	17	2	34	50	40	3	21
Turkey Point 4	TU4	W	43800	6	7	-	17	2	34	50	40	3	26
Yankee Rowe	YR1	W	43800	-	4	8	10	2	17	20	26	3	8
Zion 1	ZI1	W	43800	8	7	17	8	-, 4	12,50	9,56	22,42	3	26
Zion 2	ZI2	W	43800	8	7	17	8	-, 4	12,50	9,56	22,42	3	26

a. A dash indicates that no valves of the type under consideration are shown in the available drawings.

b. Due to composite drawings, separate populations are not always available for the Containment Spray, High-Pressure Coolant Injection (HPCI), and Low-Pressure Coolant Injection (LPCI) systems. If three numbers are shown, they are the populations of the three systems, respectively. If two numbers are shown, the first is the Containment Spray population, and the second is the population of the pooled HPCI and LPCI systems. If only one number is shown, it is the total population of the three systems.

c. The populations are for safety valves that tap off the pressurizer.

TABLE B-2. BWR PLANT DATA

Plant Name	Code	Vend	Calendar Hours	Valve Population[a]													
				Core Spray				HPCI				LPCI					
				Air	Check	Motor	Manual	Air	Check	Motor	Manual	Air	Check	Motor	Manual	Relief[b]	Relief Demands
Browns Ferry 1	BF1	G	43800	-	12	12	17	-	12	11	6	-	11	40	15	11	70
Browns Ferry 2	BF2	G	43800	-	12	12	17	-	12	11	6	-	11	40	15	11	63
Browns Ferry 3	BF3	G	38496	-	12	12	17	-	12	11	6	-	11	40	15	11	53
Brunswick 1	BR1	G	37032	-	10	10	12	-	10	13	4	4	18	49	25	9	49
Brunswick 2	BR2	G	43800	-	10	10	12	-	10	13	4	4	18	49	25	9	72
Cooper Station	CO1	G	43800	-	6	10	4	-	-	10	1	7	6	37	-	8	22
Dresden 2	DR2	G	43800	-	2	10	14	-	12	13	12	-	10	28	18	5	35
Dresden 3	DR3	G	43800	-	2	10	14	-	12	13	12	-	10	28	18	5	29
Duane Arnold	DA1	G	43800	2	2	10	4	-	3	7	2	8	16	50	28	6	29
Edwin I. Hatch 1	EN1	G	43800	2	12	10	12	1	11	13	4	10	21	45	24	9	74
Edwin I. Hatch 2	EN2	G	21816	4	6	10	9	1	12	14	4	10	12	43	30	11	20
FitzPatrick	FP1	G	43800	2	2	10	4	-	1	8	-	7	5	-	29	9	37
Millstone 1	MI1	G	43800	2	-	10	8	4	9	-	35	2	-	24	28	3	24
Monticello	MO1	G	43800	-	8	8	14	-	8	12	4	7	17	27	34	4	26
Peach Bottom 2	PB2	G	43800	-	18	14	18	3	11	12	10	2	21	32	30	11	26
Peach Bottom 3	PB3	G	43800	-	18	14	18	3	11	12	10	2	21	32	30	11	35
Pilgram 1	PI1	G	43800	-	-	8	2	-	1	7	1	5	8	32	27	3	40
Quad-Cities 1	QC1	G	43800	-	2	10	8	5	14	15	11	1	10	32	20	5	33
Quad-Cities 2	QC2	G	43800	-	2	10	8	5	14	15	11	1	10	32	20	5	32
Vermont Yankee	VY1	G	43800	-	8	10	11	-	11	11	6	-	16	35	34	4	18

				Core Spray				ESF[c]				
				Air	Check	Motor	Manual	Air	Check	Motor	Manual	Relief[b]
Nine Mile Point 1	NM1	G	43800	1	13	12	8	4,8	10,2	4, 5	12,8	6
Oyster Creek	OC1	G	43800	-	14	14	7	-,7	6,5	10,18	-,8	4

a. A dash indicates that no valves of the type under consideration are shown in the available drawings.

b. The populations are for relief valves that tap off the main steam header.

c. The first number is the Containment Spray population, and the second is the population of the pooled High-Pressure Coolant Injection (HPCI) and Low-Pressure Coolant Injection systems.

TABLE B-3. CODES USED IN VALVE LER ONE-LINE DESCRIPTIONS

FAILURE MODE

CODE	DESCRIPTION
A	FAILED TO OPEN
B	FAILED TO CLOSE
C	INTERNAL LEAKAGE
E	REVERSE LEAKAGE (CHECK VALVES)
F	FAILED TO OPERATE AS REQUIRED
G	PLUGGED (FAILS TO REMAIN OPEN)
V	IMPROPER VALVE CONFIGURATION

COMPONENT

CODE	DESCRIPTION
MV	MOTOR OPERATED VALVE (ELEC.)
AV	PNEUMATIC OPERATED VALVE
RM	REMOTE OPERATED VALVE
XV	MANUAL OPERATED VALVE
CV	CHECK VALVE
RV	RELIEF/SAFETY VALVE

TYPE OF EVENT

CODE		
FAILURE	COMMAND FAULT	DESCRIPTION
	S	NONRECURRING, NOT COMMON CAUSE
R	T	RECURRING, NOT COMMON CAUSE
C	U	NONLETHAL COMMON CAUSE
B	V	RECURRING NONLETHAL COMMON CAUSE
L	N	LETHAL COMMON CAUSE
M	O	RECURRING LETHAL COMMON CAUSE

FAILURE CAUSE

CODE	DESCRIPTION
00	UNKNOWN
01	PERSONNEL (OPERATION)
02	PERSONNEL (MAINTENANCE)
03	PERSONNEL (TESTING)
04	DESIGN ERROR
05	FABRICATION/CONSTRUCTION/QUALITY CONTROL
06	PROCEDURAL DISCREPANCY
07	NORMAL WEAR
08	EXCESSIVE WEAR
09	CORROSION
10	FOREIGN MATERIAL CONTAMINATION
11	EXCISSIVE VIBRATION
12	MECH. CONTROL/PARTS; FAILED/OUT OF ADJUST.
13	SEAL/GASKET FAILURE/PROBLEM
14	PACKING FAILURE/PROBLEM
15	BELLOWS/BOOT FAILURE/PROBLEM
16	ELECTRICAL INPUT FAILURE/PROBLEM
17	BEARING/BUSHING FAILURE/PROBLEM
18	WELD FAILURE
19	LACK OF LUBRICATION
20	ELECTRIC MOTOR OPERATOR FAILURE/PROBLEM
21	SOLENOID FAILURE/PROBLEM
22	LEAKING/RUPTURE DIAPHRAGM
23	TORQUE SWITCH FAILURE/PROBLEM
24	FAILURE OF COMPONENT SUPPLY SYSTEM
25	SEAT/DISC FAILURE/PROBLEM
26	LIMIT SWITCH FAILURE/PROBLEM
27	PILOT VALVE FAILURE/PROBLEM

NUMERICAL KEY WORDS

CODE	DESCRIPTION	NUMBER ASSIGNED
V	VALVES	2
A	SOME	3
B	VARIOUS	3
S	SEVERAL	3
Z	OTHER	>1
BLANK	NUMBER GIVEN IN LER	

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
M	MAINTENANCE
N	NORMAL OPERATION
R	RECORDS REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR

CODE	DESCRIPTION
B	BABCOCK & WILCOX
C	COMBUSTION ENGINEERING
W	WESTINGHOUSE
G	GENERAL ELECTRIC

TABLE B-3. (continued)

SYSTEMS

CODE	PWR	CODE	BWR
A	-	A	- AUTOMATIC DEPRESSURIZATION
B	- AUXILIARY FEED	B	-
C	- CONTAINMENT ISOLATION (INCL PENETRATIONS)	C	- CONTAINMENT ISOLATION (INCL PENETRATIONS)
D	-	D	- LOW PRESSURE CORE SPRAY
E	-	E	-
F	- CONTAINMENT SPRAY INJECTION	F	- CONTAINMENT SPRAY INJECTION
G	- CHEMICAL VOLUME CONTROL (MAKE-UP & BORON)	G	- STANDBY LIQUID CONTROL (BORON)
H	- HIGH PRESSURE COOLANT INJECTION	H	- HIGH PRESSURE COOLANT INJECTION
I	-	I	-
J	- COMPONENT COOLING WATER	J	- COMPONENT COOLING WATER
K	- REACTOR COOLANT	K	- REACTOR COOLANT RECIRC
L	- LOW PRESSURE COOLANT INJECTION (RHR)	L	- LOW PRESSURE COOLANT INJECTION (RHR)
M	-	M	- CONTROL ROD DRIVE HYDRAULIC (SCRAM)
N	- NONSAFETY-RELATED	N	- NONSAFETY-RELATED
P	- SYSTEM UNKNOWN/NOT APPLICABLE	P	- SYSTEM UNKNOWN/NOT APPLICABLE
Q	-	Q	- REACTOR CORE ISOLATION COOLING
R	- CONTAINMENT FAN COOLING SYSTEM	R	-
S	- SERVICE WATER	S	- SERVICE WATER
T	-	T	-
U	- CONDENSATE AND FEED	U	- CONDENSATE AND FEED
V	-	V	-
W	- MAIN STEAM	W	- MAIN STEAM
X	- REACTOR PROTECTION (PPS)	X	- REACTOR PROTECTION (PPS)
Y	- CONTAINMENT AIR/EFFLUENT& PURIF./SAMPLE.	Y	- CONTAINMENT AIR/EFFLUENT& PURIF./SAMPLE.
Z	- FAILED FUEL ELEMENT DETECTION	Z	-

APPENDIX C
ESTIMATED FAULT RATES

APPENDIX C
ESTIMATED FAULT RATES

This appendix presents estimated fault rates for each type of valve and failure mode listed in Table 1 of the main text. One-line summaries for each group of valves accompany the associated rates. To facilitate checking for possible common cause events, underscores are used to separate unrelated lines. Lines not so separated describe events that occurred at the same plant on the same date. This appendix 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 here and in Appendix D all have the same meanings as in Reference 1 from the main text. The codes are briefly explained in a table in Appendix B. In the one-line summaries, the following information is given on each line:

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

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

Control Number This is the unique six-digit identifier assigned to the LER. If a single LER refers to more than one valve 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 valves belong, such as containment spray, high pressure coolant injection, etc.

Component This tells whether the valves are air-operated, remote/motor-operated, or manually operated, or check, safety, or relief valves.

Failure Mode and Cause These codes classify the kind of fault. For example, the code for failure mode might mean "does not open," whereas 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.

Failure Number This tells the number of valves that failed or, for a single valve, the number of times it failed as reported by this line.

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

Mode Description and Cause Description These are very condensed narratives from the LER.

Air-Operated Valves

There are 22 LERs involving air-operated valves. Eighteen of the events are coded failure to open, failure to close, or failure to operate. These are pooled into an estimated rate for failure to open, close, or operate. Rates are also presented for the modes internal leakage, failure to remain open (plugged), and improper valve configuration. No common cause events occurred in internal leakage or in failure to remain open, so most quantities cannot be estimated. Those that are estimated remain the same for all faults and for failures only; thus, they are presented only once. Rates are estimated for common cause command faults involving improper valve configuration; any event involving improper valve lineup is considered a common cause event and a command fault rather than a failure. One event in this failure mode was observed. Rates for each failure mode are presented first, followed by a summary table of faults in all modes and a listing of one-line descriptions of the LERs.

AIR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

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

ESTIMATES ARE BASED ON DATA WITH M = 1, 2, 3, 4, 5, 6, 7, 8, 10, 14, 22, 25, 32, 85
THEY ARE SHOWN FOR FEWER VALUES OF M

P = (.002, .160, .490)

LAMBDA = (1.9E-11, 1.3E-06, 6.5E-06)

$LAMBDA_+$ = (4.4E-08, 3.7E-07, 9.7E-07)

OMEGA = (4.9E-10, 1.2E-07, 4.8E-07)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
1	(2.4E-07, 2.8E-04, 1.4E-04)	(1.7E-07, 1.8E-06, 8.9E-06)	
2	(1.5E-07, 1.4E-04, 7.3E-05)	(1.1E-07, 1.7E-06, 8.7E-06)	(.003, .165, .503)
3	(1.1E-07, 9.2E-05, 4.8E-05)	(8.7E-08, 1.6E-06, 8.7E-06)	(.003, .197, .595)
4	(9.8E-08, 6.9E-05, 3.6E-05)	(7.3E-08, 1.6E-06, 8.7E-06)	(.003, .206, .615)
7	(7.7E-08, 4.0E-05, 2.1E-05)	(5.3E-08, 1.5E-06, 8.6E-06)	(.002, .196, .694)
8	(7.3E-08, 3.5E-05, 1.8E-05)	(5.0E-08, 1.5E-06, 8.6E-06)	(.002, .191, .702)
10	(6.8E-08, 2.8E-05, 1.5E-05)	(4.5E-08, 1.5E-06, 8.6E-06)	(.002, .182, .731)
32	(5.4E-08, 8.9E-06, 4.8E-06)	(3.4E-08, 1.5E-06, 8.6E-06)	(.001, .156, .839)
85	(4.9E-08, 3.6E-06, 2.1E-06)	(3.2E-08, 1.5E-06, 8.6E-06)	(.001, .151, .843)
OVERALL	(4.9E-08, 4.0E-05, 1.4E-04)	(3.2E-08, 1.5E-06, 8.9E-06)	(.001, .191, .863)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
2	(2.2E-09, 1.6E-07, 5.3E-07)		
3	(1.7E-09, 1.5E-07, 5.2E-07)	(8.0E-10, 1.3E-07, 4.9E-07)	
4	(1.5E-09, 1.5E-07, 5.2E-07)	(7.7E-10, 1.3E-07, 4.9E-07)	(6.1E-10, 1.3E-07, 4.8E-07)
7	(1.2E-09, 1.5E-07, 5.1E-07)	(7.3E-10, 1.3E-07, 4.9E-07)	(6.0E-10, 1.3E-07, 4.8E-07)
8	(1.2E-09, 1.5E-07, 5.1E-07)	(7.2E-10, 1.3E-07, 4.9E-07)	(6.0E-10, 1.3E-07, 4.8E-07)
10	(1.2E-09, 1.4E-07, 5.1E-07)	(7.2E-10, 1.3E-07, 4.9E-07)	(6.0E-10, 1.3E-07, 4.8E-07)
32	(1.1E-09, 1.4E-07, 5.1E-07)	(7.1E-10, 1.3E-07, 4.9E-07)	(6.0E-10, 1.3E-07, 4.8E-07)
85	(1.1E-09, 1.4E-07, 5.1E-07)	(7.1E-10, 1.3E-07, 4.9E-07)	(6.0E-10, 1.3E-07, 4.8E-07)
OVERALL	(1.1E-09, 1.5E-07, 5.3E-07)	(7.1E-10, 1.3E-07, 4.9E-07)	(6.0E-10, 1.3E-07, 4.8E-07)

AIR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

FAILURES ONLY

RATES ARE PER CALENDAR HOUR

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

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

LAMBDA = (8.3E-12, 4.8E-07, 2.3E-06)

LAMBDA$_t$ = (4.9E-10, 1.2E-07, 4.8E-07)

OMEGA = (4.9E-10, 1.2E-07, 4.8E-07)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

AIR OPERATED VALVES - INTERNAL LEAKAGE

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

LAMBDA = (2.2E-13, 1.8E-07, 9.2E-07)

LAMBDA$_+$ = (4.9E-10, 1.2E-07, 4.8E-07)

OMEGA = (4.9E-10, 1.2E-07, 4.8E-07)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

AIR OPERATED VALVES - FAILURE TO REMAIN OPEN (PLUGGED)
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

λ = (1.0E-10, 2.6E-08, 9.9E-08)
λ^{+} = (4.9E-10, 1.7E-07, 4.8E-07)
ω = (4.9E-10, 1.2E-07, 4.8E-07)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

AIR OPERATED VALVES - IMPROPER VALVE CONFIGURATION

COMMON CAUSE COMMAND FAULTS ONLY

RATES ARE PER CALENDAR HOUR

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

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

ESTIMATES ARE BASED ON DATA WITH M = 1, 2, 3, 4, 5, 6, 7, 8, 10, 14, 22, 25, 32, 85
THEY ARE SHOWN FOR FEWER VALUES OF M

P = (.157, .586, .934)

$LAMBDA_+$ = (4.4E-08, 3.7E-07, 9.7E-07)

$OMEGA_+$ = (4.9E-10, 1.2E-07, 4.8E-07)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
1	(7.3E-08, 1.0E-06, 2.9E-06)	(8.9E-08, 6.2E-07, 1.2E-06)	
2	(5.6E-08, 6.4E-07, 1.7E-06)	(6.7E-08, 5.2E-07, 9.6E-07)	(.351, .684, .941)
3	(5.1E-08, 5.3E-07, 1.4E-06)	(5.7E-08, 4.9E-07, 9.1E-07)	(.252, .532, .651)
4	(4.9E-08, 4.8E-07, 1.2E-06)	(5.2E-08, 4.8E-07, 9.0E-07)	(.154, .422, .642)
7	(4.6E-08, 4.2E-07, 1.1E-06)	(4.5E-08, 4.7E-07, 8.9E-07)	(.102, .267, .656)
8	(4.6E-08, 4.1E-07, 1.1E-06)	(4.4E-08, 4.7E-07, 8.9E-07)	(.098, .258, .657)
10	(4.5E-08, 4.0E-07, 1.0E-06)	(4.3E-08, 4.7E-07, 8.9E-07)	(.094, .249, .650)
32	(4.4E-08, 3.8E-07, 9.8E-07)	(4.0E-08, 4.7E-07, 8.9E-07)	(.088, .241, .556)
85	(4.4E-08, 3.7E-07, 9.8E-07)	(3.9E-08, 4.7E-07, 8.9E-07)	(.088, .241, .545)
OVERALL	(4.4E-08, 4.2E-07, 2.9E-06)	(3.9E-08, 4.7E-07, 1.2E-06)	(.088, .267, .941)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
2	(2.4E-08, 2.9E-07, 7.9E-07)		
3	(2.0E-08, 2.8E-07, 7.8E-07)	(7.9E-09, 2.4E-07, 7.1E-07)	
4	(1.7E-08, 2.8E-07, 7.7E-07)	(7.3E-09, 2.4E-07, 7.0E-07)	(4.1E-09, 2.1E-07, 6.6E-07)
7	(1.5E-08, 2.8E-07, 7.7E-07)	(6.8E-09, 2.4E-07, 7.0E-07)	(3.9E-09, 2.1E-07, 6.6E-07)
8	(1.5E-08, 2.8E-07, 7.7E-07)	(6.7E-09, 2.4E-07, 7.0E-07)	(3.9E-09, 2.1E-07, 6.6E-07)
10	(1.5E-08, 2.7E-07, 7.7E-07)	(6.7E-09, 2.4E-07, 7.0E-07)	(3.9E-09, 2.1E-07, 6.6E-07)
32	(1.4E-08, 2.7E-07, 7.7E-07)	(6.6E-09, 2.4E-07, 7.0E-07)	(3.9E-09, 2.1E-07, 6.6E-07)
85	(1.4E-08, 2.7E-07, 7.7E-07)	(6.6E-09, 2.4E-07, 7.0E-07)	(3.9E-09, 2.1E-07, 6.6E-07)
OVERALL	(1.4E-08, 2.8E-07, 7.9E-07)	(6.6E-09, 2.4E-07, 7.1E-07)	(3.7E-09, 2.1E-07, 6.6E-07)

AIR-OPERATED VALVES

PLANT	HOURS	POP	NUMBER OF INDIV. FAULTS FAILRS/COM FLTS	NUMBER OF NONLETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY NONLETHAL SHOCKS FAILRS/COM FLTS	NUMBER OF LETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY LETHAL SHOCKS FAILRS/COM FLTS
AR1	43800	2	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CR3	34704	1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DB1	28944	14	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DE1	43800	4	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DE2	43800	4	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DE3	43800	8	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TI1	28368	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TI2	8736	4	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0
AR2	18120	6	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CC1	43800	6	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CC2	35784	6	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0
FC1	43800	37	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
MI2	43800	6	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MY1	43800	25	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PA1	43800	6	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0
SL1	41112	7	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BV1	40656	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DC1	43800	30	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DC2	24600	30	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
HN1	43800	4	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP2	43800	4	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP3	41472	8	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
JF1	29712	11	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NA1	23976	6	0 / 1	0 / 1	0 / 2	0 / 0	0 / 0
NA2	4872	6	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR1	43800	6	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR2	43800	6	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PT1	43800	7	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PT2	43800	7	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RG1	43800	7	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0

RD2	43800	11	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SA1	35496	18	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SE1	4320	105	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SD1	43800	7	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU1	43800	3	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU2	43800	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TU3	43800	8	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TU4	43800	8	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
YR1	43800	2	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI1	43800	12	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI2	43800	12	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BR1	37032	4	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BR2	43800	4	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CO1	43800	7	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DA1	43800	10	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
EN1	43800	13	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
EN2	21816	15	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
FP1	43800	9	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MI1	43800	8	0 / 4	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MO1	43800	7	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NM1	43800	13	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
OC1	43800	7	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PB2	43800	5	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PB3	43800	5	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PI1	43800	5	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
QC1	43800	6	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
QC2	43800	6	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
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ALL	2211720	587	11 / 11	0 / 2	0 / 3	0 / 0	0 / 0	0 / 0	0 / 0

AIR-OPERATED VALVES

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	AR1	020607	011378	B	AV	A23			1		T	VALVE CV-2667 FAILED TO OPEN REMOTELY	TORQUE SWITCH DEFECTIVE
B	DB1	030931	041080	I	AV	A12			1		N	DHR COOLER OUTLET VLV WOULD NOT OPEN COMPLETELY	RADIUS ARM OUT OF ADJUSTMENT
B	DE3	020064	010378	L	AV	F12			1		T	VALVE 3LP-14 FAILED TO CYCLE MANUALLY	MECH PARTS LOOSE+OUT OF ALIGN
B	TI2	021277	040478	I	AV	A24	S		1		T	RHR AOV (MS-V83&) FAILED TO OPEN DURING TEST	FAILURE OF SOLENOID OPERATED PILOT VALVE
C	CC2	033265	111080	O	AV	B24	S		1		N	SI-661-CV FAILED TO CLOSE	SOLENOID AIR VLV CONTROLLING AIR FAILED
C	FC1	022469	092178	B	AV	A24	U		1		T	VAL YCV-1045 FAILED TO OPEN(AUX.FD.PMP.STM.INL.)	INSTRUMENT AIR SUPPLY TO VAL CLOSED
C	MI2	027976*	122879	O	AV	F00			2		T	HPSI INJ.VLVS. 2-SI-6166626 OVERTRAVELLED 3%	NO CAUSE FOUND FOR FAILURE
C	PA1	020231	010878	O	AV	A24	S		1		U	VALVE CV-3025 FAILED IN CLOSED POSITION	WATER IN AIR LINE TO VALVE OPERATOR
W	DC2	022838A	101078	B	AV	C00			1		U	PNEUMATIC TEST VALVE LEAKED THRU	UNKNOWN
W	JF1	031513	052880	L	AV	B12			1		T	1A RHR HEAT EXCH DISCHARGE VLV FAILED TO CLOSE	CAP SCREW CONNECT STEM AND OP CAME OUT
W	NA1	020872	031478	H	AV	F16	S		1		N	LET DOWN TRIP VALVE OUTSIDE ISOLATION CLOSED SPUR	SHORT IN VALVE CIRCUIT CAUSED VLV TO SHUT
W	NA1	021506	051478	B	AV	V06	U		2		T	AUX FEEDWATER VALS PCV-F2-159A,-159B IMP.LINEUP	CHECKOFF SHEET DOES NOT LIST NORM VAL POS
W	SA1	022422	082478	B	AV	A12			1		T	AUX FEED PUMP STEAM VLV (1MS132) FAILED TO OPEN	STEM WAS FOUND DISENGAGED FROM ACTUATOR
W	SU1	030321	020680	I	AV	B24	S		1		N	HCV-1852A DELAYED IN CLOSING WHILE RECIRC ACCUMU.	RELIEVED TO BE MOISTURE IN AIR LINES
W	YR1	033661	122780	I	AV	F27	R		1		N	SI-PR-59 VLV CONTROLLED PRESSURE TOO HIGH	SETPOINT DRIFT OF REGULATING PILOT
W	ZI1	016047A	091676	I	AV	C25			1		N	NITROGEN VALVE (1HCV-SI943) LEAKED THRU	LEAKING SEAT OF AO PLUG VALVE
G	MI1	014290	021276	H	AV	F24	T		1		N	1 OF 2 FEEDWTR.REG.VLVS LOCK.IN THE AS IS POSITION	FAILURE IN 3 WAY PRESSURE REGULATOR
G	MI1	018414	071377	H	AV	F24	T		1		U	"B" FEEDWTR.REG.VLV EXPERIENCED CONTROL PROBLEMS	FAILURE CAUSED BY DIA.FAIL.IN SUP.SYS.VLV
G	MI1	018625*	080677	H	AV	F24	T		2V		N	FEEDWTR.REG.VLVS. LOCKED UP "AS IS"	LOSS OF INSTRUMENT AIR PRESS.CAUSED FAIL.
G	NM1	033594	121680	I	AV	F24	S		1		N	#11 FEEDWATER FLOW CONTROL VLV POSITIONER UNIT HAD	//EXCESS AIR VENTING FROM IT. PARTS REPL/
G	PB3	014035	010776	H	AV	C25			1		T	HPCI EXHAUST LINE DRAIN VLV AO-5248 -EXCESS.LEAK.	POOR MATING BETWEEN PLUG & SEATING SURF.
G	QC1	018106	041277	L	AV	B24	S		1		T	DRAIN VALVE FAILED TO CLOSE/COMMAND FAULT	AIR SUPPLY SV FAILED/AIR WOULDNT VENT OFF

Check Valves

Fifty LERs involve faults of check valves. The majority of events are coded either failure to close or reverse leakage. In both modes, backflow results. If the backflow is extensive, the event is coded failed to close; otherwise, it is coded reverse leakage. It is often difficult to determine from the LER how extensive the backflow was; for this reason, and because the consequence is the same, i.e., backflow results, the two modes are combined to estimate one rate. Similarly, the modes failure to open and failure to remain open are combined. The consequence of either mode is the same: the valve is closed when it is required to be open and allowing flow.

Rates are not estimated in check valves for failure to operate or improper valve configuration. Any LERs involving these modes, however, are incluced in the summary table of faults and in the listing of one-line descriptions.

CHECK VALVES - FAILURE TO OPEN OR REMAIN OPEN (PLUGGED)

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

ESTIMATES ARE BASED ON DATA WITH M = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 25, 26, 27, 28, 30, 32, 34, 36, 42, 45, 47, 49, 50

THEY ARE SHOWN FOR FEWER VALUES OF M

P = (.035, .203, .440)

LAMBDA = (5.6E-09, 2.5E-08, 5.4E-08)

$LAMBDA^{+}$ = (2.5E-08, 2.1E-07, 5.5E-07)

OMEGA = (2.8E-10, 7.0E-08, 2.7E-07)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
1	(1.1E-07, 2.2E-06, 6.9E-06)	(7.3E-08, 3.1E-07, 6.9E-07)	
2	(6.7E-08, 1.2E-06, 3.5E-06)	(5.2E-08, 2.1E-07, 4.8E-07)	(.056, .310, .525)
3	(5.2E-08, 8.2E-07, 2.4E-06)	(4.2E-08, 1.8E-07, 4.3E-07)	(.074, .401, .608)
4	(4.4E-08, 6.5E-07, 1.9E-06)	(3.7E-08, 1.7E-07, 4.0E-07)	(.079, .436, .637)
18	(2.8E-08, 2.7E-07, 7.1E-07)	(2.5E-08, 1.4E-07, 3.6E-07)	(.019, .341, .740)
19	(2.7E-08, 2.7E-07, 7.0E-07)	(2.5E-08, 1.4E-07, 3.6E-07)	(.018, .337, .741)
26	(2.6E-08, 2.5E-07, 6.4E-07)	(2.4E-08, 1.4E-07, 3.6E-07)	(.015, .323, .737)
34	(2.6E-08, 2.4E-07, 6.1E-07)	(2.4E-08, 1.4E-07, 3.6E-07)	(.013, .316, .731)
50	(2.5E-08, 2.2E-07, 5.8E-07)	(2.4E-08, 1.4E-07, 3.6E-07)	(.012, .310, .719)
OVERALL	(2.5E-08, 2.7E-07, 6.9E-06)	(2.4E-08, 1.4E-07, 6.9E-07)	(.012, .337, .741)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
2	(2.3E-09, 9.5E-08, 3.0E-07)		
3	(1.6E-09, 9.0E-08, 3.0E-07)	(5.3E-10, 7.6E-08, 2.8E-07)	
4	(1.3E-09, 8.7E-08, 2.9E-07)	(4.9E-10, 7.5E-08, 2.8E-07)	(3.5E-10, 7.2E-08, 2.7E-07)
18	(8.7E-10, 8.2E-08, 2.9E-07)	(4.4E-10, 7.4E-08, 2.8E-07)	(3.4E-10, 7.2E-08, 2.7E-07)
19	(8.7E-10, 8.2E-08, 2.9E-07)	(4.4E-10, 7.4E-08, 2.8E-07)	(3.4E-10, 7.2E-08, 2.7E-07)
26	(8.5E-10, 8.2E-08, 2.9E-07)	(4.3E-10, 7.4E-08, 2.7E-07)	(3.4E-10, 7.2E-08, 2.7E-07)
34	(8.5E-10, 8.2E-08, 2.9E-07)	(4.3E-10, 7.4E-08, 2.7E-07)	(3.4E-10, 7.2E-08, 2.7E-07)
50	(8.4E-10, 8.2E-08, 2.9E-07)	(4.3E-10, 7.4E-08, 2.7E-07)	(3.4E-10, 7.2E-08, 2.7E-07)
OVERALL	(8.4E-10, 8.2E-08, 3.0E-07)	(4.3E-10, 7.4E-08, 2.8E-07)	(3.4E-10, 7.2E-08, 2.7E-07)

CHECK VALVES - FAILURE TO OPEN OR TO REMAIN OPEN (PLUGGED)

FAILURES ONLY

RATES ARE PER CALENDAR HOUR

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

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

ESTIMATES ARE BASED ON DATA WITH M = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 25, 26, 27, 28, 30, 32, 34, 36, 42, 45, 47, 49, 50

THEY ARE SHOWN FOR FEWER VALUES OF M

P = (.035, .203, .440)

$LAMBDA$ = (5.6E-09, 2.5E-08, 5.4E-08)

$LAMBDA_+$ = (2.5E-08, 2.1E-07, 5.5E-07)

$OMEGA$ = (2.8E-10, 7.0E-08, 2.7E-07)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
1	(1.1E-07, 2.2E-06, 6.9E-06)	(7.3E-08, 3.1E-07, 6.9E-07)	
2	(6.7E-08, 1.2E-06, 3.5E-06)	(5.2E-08, 2.1E-07, 4.8E-07)	(.056, .310, .525)
3	(5.2E-08, 8.2E-07, 2.4E-06)	(4.2E-08, 1.8E-07, 4.3E-07)	(.074, .401, .609)
4	(4.4E-08, 6.5E-07, 1.9E-06)	(3.7E-08, 1.7E-07, 4.0E-07)	(.079, .436, .637)
18	(2.8E-08, 2.7E-07, 7.1E-07)	(2.5E-08, 1.4E-07, 3.6E-07)	(.019, .341, .740)
19	(2.7E-08, 2.7E-07, 7.0E-07)	(2.5E-08, 1.4E-07, 3.6E-07)	(.018, .337, .741)
26	(2.6E-08, 2.5E-07, 6.4E-07)	(2.4E-08, 1.4E-07, 3.6E-07)	(.015, .323, .737)
34	(2.6E-08, 2.4E-07, 6.1E-07)	(2.4E-08, 1.4E-07, 3.6E-07)	(.013, .316, .731)
50	(2.5E-08, 2.2E-07, 5.8E-07)	(2.4E-08, 1.4E-07, 3.6E-07)	(.012, .310, .719)
OVERALL	(2.5E-08, 2.7E-07, 6.9E-06)	(2.4E-08, 1.4E-07, 6.9E-07)	(.012, .337, .741)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
2	(2.3E-09, 9.5E-08, 3.0E-07)		
3	(1.6E-09, 9.0E-08, 3.0E-07)	(5.3E-10, 7.6E-08, 2.8E-07)	
4	(1.3E-09, 8.7E-08, 2.9E-07)	(4.9E-10, 7.5E-08, 2.8E-07)	(3.5E-10, 7.2E-08, 2.7E-07)
18	(8.7E-10, 8.2E-08, 2.9E-07)	(4.4E-10, 7.4E-08, 2.8E-07)	(3.4E-10, 7.2E-08, 2.7E-07)
19	(8.7E-10, 8.2E-08, 2.9E-07)	(4.4E-10, 7.4E-08, 2.8E-07)	(3.4E-10, 7.2E-08, 2.7E-07)
26	(8.5E-10, 8.2E-08, 2.9E-07)	(4.3E-10, 7.4E-08, 2.7E-07)	(3.4E-10, 7.2E-08, 2.7E-07)
34	(8.5E-10, 8.2E-08, 2.9E-07)	(4.3E-10, 7.4E-08, 2.7E-07)	(3.4E-10, 7.2E-08, 2.7E-07)
50	(8.4E-10, 8.2E-08, 2.9E-07)	(4.3E-10, 7.4E-08, 2.7E-07)	(3.4E-10, 7.2E-08, 2.7E-07)
OVERALL	(8.4E-10, 8.2E-08, 3.0E-07)	(4.3E-10, 7.4E-08, 2.8E-07)	(3.4E-10, 7.2E-08, 2.7E-07)

CHECK VALVES - FAILURE TO CLOSE / REVERSE LEAKAGE

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

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THEY ARE SHOWN FOR FEWER VALUES OF M

P = (.002, .187, .567)

LAMBDA = (2.6E-09, 5.6E-07, 2.1E-06)

$LAMBDA_+$ = (2.5E-08, 2.1E-07, 5.5E-07)

OMEGA = (2.8E-10, 7.0E-08, 2.7E-07)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT Ri	BETA FACTOR
1	(1.2E-07, 1.6E-04, 7.6E-05)	(1.3E-07, 8.4E-07, 2.4E-06)	
2	(7.2E-08, 7.9E-05, 3.8E-05)	(9.1E-08, 7.4E-07, 2.3E-06)	(.003, .129, .484)
3	(5.8E-08, 5.3E-05, 2.6E-05)	(7.5E-08, 7.1E-07, 2.3E-06)	(.004, .144, .546)
4	(5.0E-08, 4.0E-05, 1.9E-05)	(6.6E-08, 7.0E-07, 2.3E-06)	(.004, .143, .576
18	(3.2E-08, 9.0E-06, 4.4E-06)	(4.4E-08, 6.7E-07, 2.2E-06)	(.001, .104, .687)
19	(3.2E-08, 8.5E-06, 4.2E-06)	(4.4E-08, 6.7E-07, 2.2E-06)	(.001, .103, .688)
26	(3.1E-08, 6.3E-06, 3.1E-06)	(4.2E-08, 6.7E-07, 2.2E-06)	(.001, .100, .693)
34	(3.0E-08, 4.8E-06, 2.4E-06)	(4.2E-08, 6.7E-07, 2.2E-06)	(.001, .098, .692)
50	(2.8E-08, 3.3E-06, 1.7E-06)	(4.1E-08, 6.7E-07, 2.2E-06)	(.001, .096, .690)
OVERALL	(2.8E-08, 9.0E-06, 7.6E-05)	(4.1E-08, 6.7E-07, 2.4E-06)	(.001, .104, .693)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
2	(1.4E-09, 9.5E-08, 3.1E-07)		
3	(1.1E-09, 9.0E-08, 3.0E-07)	(5.1E-10, 7.8E-08, 2.8E-07)	
4	(9.6E-10, 8.8E-08, 3.0E-07)	(4.9E-10, 7.8E-08, 2.8E-07)	(3.8E-10, 7.4E-08, 2.8E-07)
18	(7.1E-10, 8.5E-08, 3.0E-07)	(4.5E-10, 7.7E-08, 2.8E-07)	(3.7E-10, 7.4E-08, 2.8E-07)
19	(7.1E-10, 8.5E-08, 3.0E-07)	(4.5E-10, 7.7E-08, 2.8E-07)	(3.7E-10, 7.4E-08, 2.8E-07)
26	(7.0E-10, 8.5E-08, 3.0E-07)	(4.5E-10, 7.7E-08, 2.8E-07)	(3.7E-10, 7.4E-08, 2.8E-07)
34	(6.9E-10, 8.5E-08, 3.0E-07)	(4.5E-10, 7.7E-08, 2.8E-07)	(3.7E-10, 7.4E-08, 2.8E-07)
50	(6.9E-10, 8.5E-08, 3.0E-07)	(4.5E-10, 7.7E-08, 2.8E-07)	(3.7E-10, 7.4E-08, 2.8E-07)
OVERALL	(6.9E-10, 8.5E-08, 3.1E-07)	(4.5E-10, 7.7E-08, 2.8E-07)	(3.7E-10, 7.4E-08, 2.8E-07)

CHECK VALVES - FAILURE TO CLOSE / REVERSE LEAKAGE

FAILURES ONLY

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LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

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THEY ARE SHOWN FOR FEWER VALUES OF M

P = (.002, .187, .567)

LAMBDA = (2.6E-09, 5.6E-07, 2.1E-06)

$LAMBDA_+$ = (2.5E-08, 2.1E-07, 5.5E-07)

OMEGA = (2.8E-10, 7.0E-08, 2.7E-07)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
1	(1.2E-07, 1.6E-04, 7.6E-05)	(1.3E-07, 8.4E-07, 2.4E-06)	
2	(7.2E-08, 7.9E-05, 3.8E-05)	(9.1E-08, 7.4E-07, 2.3E-06)	(.003, .129, .484)
3	(5.8E-08, 5.3E-05, 2.6E-05)	(7.5E-08, 7.1E-07, 2.3E-06)	(.004, .144, .546)
4	(5.0E-08, 4.0E-05, 1.9E-05)	(6.6E-08, 7.0E-07, 2.3E-06)	(.004, .143, .576)
18	(3.2E-08, 9.0E-06, 4.4E-06)	(4.4E-08, 6.7E-07, 2.2E-06)	(.001, .104, .687)
19	(3.2E-08, 8.5E-06, 4.2E-06)	(4.4E-08, 6.7E-07, 2.2E-06)	(.001, .103, .688)
26	(3.1E-08, 6.3E-06, 3.1E-06)	(4.2E-08, 6.7E-07, 2.2E-06)	(.001, .100, .693)
34	(3.0E-08, 4.8E-06, 2.4E-06)	(4.2E-08, 6.7E-07, 2.2E-06)	(.001, .098, .692)
50	(2.8E-08, 3.3E-06, 1.7E-06)	(4.1E-08, 6.7E-07, 2.2E-06)	(.001, .096, .690)
OVERALL	(2.8E-08, 9.0E-06, 7.6E-05)	(4.1E-08, 6.7E-07, 2.4E-06)	(.001, .104, .693)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
2	(1.4E-09, 9.5E-08, 3.1E-07)		
3	(1.1E-09, 9.0E-08, 3.0E-07)	(5.1E-10, 7.8E-08, 2.8E-07)	
4	(9.6E-10, 8.8E-08, 3.0E-07)	(4.9E-10, 7.8E-08, 2.8E-07)	(3.8E-10, 7.4E-08, 2.8E-07)
18	(7.1E-10, 8.5E-08, 3.0E-07)	(4.5E-10, 7.7E-08, 2.8E-07)	(3.7E-10, 7.4E-08, 2.8E-07)
19	(7.1E-10, 8.5E-08, 3.0E-07)	(4.5E-10, 7.7E-08, 2.8E-07)	(3.7E-10, 7.4E-08, 2.8E-07)
26	(7.0E-10, 8.5E-08, 3.0E-07)	(4.5E-10, 7.7E-08, 2.8E-07)	(3.7E-10, 7.4E-08, 2.8E-07)
34	(6.9E-10, 8.5E-08, 3.0E-07)	(4.5E-10, 7.7E-08, 2.8E-07)	(3.7E-10, 7.4E-08, 2.8E-07)
50	(6.9E-10, 8.5E-08, 3.0E-07)	(4.5E-10, 7.7E-08, 2.8E-07)	(3.7E-10, 7.4E-08, 2.8E-07)
OVERALL	(6.9E-10, 8.5E-08, 3.1E-07)	(4.5E-10, 7.7E-08, 2.8E-07)	(3.7E-10, 7.4E-08, 2.8E-07)

CHECK VALVES

PLANT	HOURS	POP	NUMBER OF INDIV. FAULTS FAILRS/COM FLTS	NUMBER OF NONLETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY NONLETHAL SHOCKS FAILRS/COM FLTS	NUMBER OF LETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY LETHAL SHOCKS FAILRS/COM FLTS
AR1	43800	29	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CR3	34704	40	1 / 0	0 / 1	0 / 1	0 / 0	0 / 0
OB1	28944	39	3 / 0	0 / 0	0 / 0	0 / 0	0 / 0
OE1	43800	29	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
OE2	43800	30	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
OE3	43800	30	1 / 0	0 / 1	0 / 2	0 / 0	0 / 0
RS1	43800	56	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TI1	28368	38	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TI2	8736	41	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
AR2	18120	59	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CC1	43800	53	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CC2	35784	53	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
FC1	43800	49	0 / 0	1 / 0	1 / 0	0 / 0	0 / 0
MI2	43800	51	3 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MY1	43800	57	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PA1	43800	27	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SL1	41112	49	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BV1	40656	46	3 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DC1	43800	56	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DC2	24600	56	1 / 0	1 / 0	2 / 0	0 / 0	0 / 0
HN1	43800	35	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP2	43800	54	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP3	41472	68	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
JF1	29712	59	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
KE1	43800	43	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NA1	23976	47	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NA2	4872	47	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR1	43800	39	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR2	43800	39	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PT1	43800	47	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0

PT2	43800	47	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RG1	43800	33	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RO2	43800	35	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SA1	35496	55	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SE1	4320	71	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SO1	43800	30	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU1	43800	48	3 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU2	43800	48	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TR1	43800	43	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TU3	43800	41	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TU4	43800	41	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
YR1	43800	21	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI1	43800	69	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI2	43800	69	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF1	43800	35	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF2	43800	35	3 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF3	38496	35	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BR1	37032	38	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BR2	43800	38	2 / 0	0 / 1	0 / 1	0 / 0	0 / 0
CO1	43800	12	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DA1	43800	21	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DR2	43800	24	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DR3	43800	24	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
EN1	43800	44	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
EN2	21816	30	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
FP1	43800	8	4 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MI1	43800	9	4 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MO1	43800	33	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NM1	43800	25	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
OC1	43800	25	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PB2	43800	50	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PB3	43800	50	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PI1	43800	9	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
QC1	43800	26	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
QC2	43800	26	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
VY1	43800	35	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
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ALL	2600616	2649	57 / 0	2 / 3	3 / 4	0 / 0	0 / 0

CHECK VALVES

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	CR3	025631	032179	G	CV	V00		U	1	M		MAKEUP PMP 3-C DISCHG STOP CHK VLV MUV-2 IMPROPERL	POSITIONED--CAUSE UNKNOWN
B	CR3	031894A	072880	H	CV	B00			1	T		CK VLV CFV-79 FAILED ALOWING BACKFLOW INTO N2 SYS	CAUSE NOT GIVEN FOR FAILED CHECK VALVE
B	D81	0209898	031678	B	CV	E00			2	T		CHECK VLVS AF39&72 LEAKED INTERNALLY	CAUSE OF REVERSE LEAKAGE NOT GIVEN
B	D81	032832	100880	H	CV	E25			1	T		GROSS BACK LEAKAGE DISCOVERED THROUGH CF30	DISK DISENGAGED FROM VALVE BODY
B	OE1	031621	061880	H	CV	E00			1	N		BACKLEAKAGE DISCOVED THROUGH 'B' HPI LINE CHECK VL	NO CAUSE GIVEN
B	OE3	016209	110176	H	CV	V01		U	2	M		IMP.LINEUP VALS 3HP-152 + 3HP-153 CLOSED S.B.OPEN	PERSONNEL ERROR
B	OE3	031086	042380	L	CV	B00			1	N		CHECK VLV FAILED TO RESEAT AFTER TEST	NO CAUSE GIVEN FOR VLV FAILURE IN ECCS SY
C	CC2	022246*	090778	H	CV	E00			2V	N		#2186228 SI.TANK OUTLET CHECK VLVS LEAKING	CAUSE OF REVERSE LEAKAGE NOT GIVEN
C	FC1	022972	110178	B	CV	E05		C	1	R		AUX FEED CHECK VALVE FOUND INSTALLED WRONG	CONSTRUCTION ERROR
C	MI2	017620	040777	H	CV	E00		R	1	N		INT LEAK OF CV BETW INJECT TK 4 AND PRI COOLANT	CAUSE UNKNOWN
C	MI2	018740	072177	H	CV	E00		R	1	N		S.I.HEADER CHECK VLV. 2-SI-648 LEAKING INTERNALLY	NO CAUSE GIVEN
C	MI2	018971	081677	H	CV	E00		R	1	N		INT LEAK OF CV BETW INJECT TK 4 AND PRI COOLANT	CAUSE UNKNOWN
W	BV1	025486	030579	B	CV	F12			1	N		1C S/G STM SUP CHECK VLV INOPERABLE	NUT AND WASHER ON CHECK VLV WAS MISSING
W	BV1	028105	091079	L	CV	G10			1	T		1A LHSI PUMP RECIRC CHK VLV HAD FLOW RESTRICTION	FOREIGN MATERIAL LODGED IN CHECK VLV
W	BV1	032895	100180	H	CV	B12		R	1	T		SI PUMP(CH-P-2A) DISCHR CHECK DID NOT RESEAT	ANTI-ROTATION DEVICES BINDING
W	DC2	020978	031878	B	CV	B00			1	N		AUX FEED SYS CHECK VALVE FROM S/G 1 STUCK OPEN	UNKNOWN (VALVE 2-FW138-1)ATWOOD & MORRILL
W	DC2	023030*	112178	F	CV	A05		C	2	N		CHK.VLVS.CTS-127E&W TO THE LOWER CONT.SPRAY NOZZL-	-ES INSTALLED BACKWARDS//FABRICATION ERR.
W	HN1	015218	070576	B	CV	E00			1	N		CHECK VALVE IN FEED LINE HAD REVERSE LEAKAGE	NO CAUSE GIVEN FOR REVERSE LEAKAGE
W	HN1	018777	080177	B	CV	E00			1	T		CHECK VALVE ON AUX FEED PUMP LEAKING INTERNALY	UNKNOWN
W	IP2	021653	052378	H	CV	E12			1	T		4 IN SWING CV D.S.OF PUMP 22 LEAKING INTERNALY	TWO HANGER BRACKET BOLTS MISSING
W	KE1	031613	062480	L	CV	B00			1	N		RHR SUCTION CHECK VLV FAILED TO CLOSE	CYCLING OF PUMPS SEATED CHECK VALVE
W	NA2	032572	090580	G	CV	B09			1	T		2-SI-70(BORON INJ RECIRC LINE) LEAKED EXCESSIVELY	CORROSION ALLOW SPRING TO DROP OFF PLUG
W	RG1	018247	071377	H	CV	E00			1	N		SI PUMP 1A CHECK VALVE REVERSE FLOW TO RWST	UNKNOWN/ VELAN 3 INCH 1500 PSIG CHECK VAL
W	RO2	014822	012876	H	CV	E00			1	N		B ACCUMULATOR CHECK VALVE 875E LEAKED THRU	REASON NOT STATED
W	RO2	019351	081777	B	CV	E05			1	T		DISCH CK VAL FOR AUX FEED PUMP,C STM GEN FAILED	CK VAL HAS BURR ON HINGE JOINT,OPEN POSIT

CHECK VALVES

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
W	SA1	033529	121480	H	CV	B00			1	T		VALVE 11SJ139 WAS FOUND TO BE COCKED OPEN	NO CAUSE GIVEN FOR LIFT CHECK VALVE FAIL
W	SE1	033789	092780	H	CV	B05			1	T		CHECK VLV 63-635 STUCK IN OPEN POSITION	INTERFERENCE BETWN DISC WELD AND VLV BODY
W	SU1	015522*	070276	H	CV	200			2	T		TWO CHECK VLV (1-SI-128/130) LEAKED THRU	UNKNOWN
W	SU1	030005	010880	B	CV	B00			1	N		CHECK VLV 1-FW-89 (DISCH AUX FP) FAILED TO CLOSE	CAUSE UNKNOWN
W	SU2	019744	110877	H	CV	E00			1	N		CHECK VALVE 2-SI-127 LEAKING THRU	UNKNOWN
W	ZI1	015162*	062376	H	CV	E00			2V	N		LEAKAGE THRU CHECK VALVES/ACCUMULATOR OVERFILL	UNKNOWN/DARLING 10 INCH TYPE 10-C48Z
G	BF2	021094	032578	H	CV	B04			1	M		CHECK VLV.2-73-603,IN HIGH-PRESS.CI.SYS,FOUND OPEN	DIMEN.ERR. IN VLV. INTERFERENCE CLEARANCE
G	BF2	032409	083080	L	CV	E00	R		1	T		CHECK VLV BETWEEN B&D HEAT EXCHANGERS LEAKING	NO CAUSE STATED "VALVE REPAIRED"
G	BF2	032703	091180	H	CV	E10			1	T		HPCI CV 2-73-609 FAILED LOCAL LEAK RATE TEST	BUILDUP OF RESIDUAL MATERIAL COCKED DISC
G	BF3	016055	082476	H	CV	A00			1	T		CHECK VALVE IN HPCI TURB.EXH.LINE WAS BINDING	CAUSE OF CHECK VLV BINDING NOT STATED
G	BR1	018128	052077	H	CV	F04			1	T		HPCI STM.LINE EXH.CHECK VLV E41-F049 DETER.FAILED	VLV OSCIL.CAUSED DSC HINGE FAIL;IMP.DESGN
G	BR2	023033	111178	L	CV	B04			1	N		RHR CHECK VALVE E11-F031 WILL NOT FULLY SEAT	DESIGN ERROR/VLV.DOESN'T WORK ON LOW DP.
G	BR2	0324548	090780	H	CV	V01	U		1	T		HPCI MANUAL STOP CHECK FOUND LOCKED CLOSED	PERSONNEL ERROR VLV WAS REQ OPEN
G	BR2	033238	111280	L	CV	E00			1	N		28 RHR PUMP DISCHRGE CHECK VLV FAILED TO RESEAT	--FULLY,REVERSE LEAKAGE/NO DETAILS GIVEN
G	DR2	014420	032976	H	CV	E25			1	T		HPCI VALVE 2-2301-45 LEAKING INTERNALY	CORROSION, PITTING OF LOWER SEATING AREA
G	DR3	016163	100776	L	CV	E10			1	T		ISOLATION CHECK VALVE 3-1501-258 LEAKING INTERNALY	DIRT AND SMALL SCRATCHES ON VALVE SEAT
G	DR3	016454	110176	L	CV	E10			1	T		ISOLATION CHECK VALVE 3-205-2-7 LEAKING INTERNALY	DIRT IN SEATING AREA & ON DISK PIVOT PIN
G	EN2	033508	120980	F	CV	E00	R		1	T		VENT PURGE OUTLET ISO VLV 2T48-F318 LEAKED	CAUSE UNKNOWN
G	FP1	016176	101476	L	CV	E25			1	N		CHECK VALVE 428 LEAKING INTERNALY	NORMAL WEAR ON VALVE SEAT
G	FP1	020570	030278	L	CV	B00			1	N		A RHR PUMP CHECK VALVE STUCK OPEN	CAUSE UNKNOWN
G	FP1	023358	122478	L	CV	B00			1	N		RHR LOOP CHECK VALVE FAILED TO CLOSE	NO REASON FOUND FOR STICKING,REASSEMBLED
G	FP1	026343	063079	L	CV	F25			1	T		REVERSE ROTATION OF RHR PUMP WAS NOTED DURING TEST	DISCH CHECK VALVE DISC NOT ATTACHED
G	MI1	0207228	032078	U	CV	E00			4	T		FEED WTR.CK.(1-FW-9A,9B,10A,10B)LEAK.EXCESS OF T.S	CAUSE OF LEAKAGE NOT GIVEN
G	MI1	0304738	022080	D	CV	E25	R		1	N		CORE SPRAY CHECK VLV LEAKING THRU	SEAT PROBLEM
G	MO1	022808	102078	H	CV	E10	R		1	T		HPCI-9 TURB EXT LINE CHECK VALVE LEAKING INTERNALY	ACCUMULATED DIRT ON SEATING SURFACES

CHECK VALVES

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	M01	030707	022380	H	CV	E25		R	1	T		ANCHOR 16-INCH SWING CHECK VLV LEAKING THRU(TEST)	LOOSE SEAT RING
G	P82	022916	102178	H	CV	E12			1	N		CHECK VALVE 2-23-131 LEAKING INTERNALY, GLAND SEAL	INTERNALS OF CHECK VALVE WORN OUT
G	P83	014033	010776	H	CV	E25			1	T		HPCI EXHAUST LINE CHECK VLV 23-65-EXCESSIVE LEAK.	POOR MATING BETWEEN FLAPPER & SEATING SUR
G	QC1	014059	010576	H	CV	E13			1	T		HPCI EXHAUST CHECK VLV. LEAKING INTERNALLY	DEFECT.GASKET BETWEEN VLV.SEAT AND BODY
G	QC2	020943	030578	L	CV	E10			1	T		REVERSE FLOW THRU CHECK VALVE 2-220-67A / TESTING	DIRT ACCUMULATED IN VALVE INTERNALS
G	VY1	032650	090480	L	CV	E12			1	T		D RHR-SW PUMP DISCHARGE CHECK DID NOT SEAT	DEGRADATION OF VLV INTERNALS

Remote/Motor-Operated Valves

Motor-operated and remotely operated valves are treated as one type of valve. (The section in the main text "Imperfections in the Data" discusses this decision.) Of the 600 LERs used in this analysis, 422 events are reports of remote/motor-operated valve faults. The majority of these events, 393 LERs, are coded as failures to open, failures to close, or failures to operate. These are pooled into an estimated rate for failure to open, close, or operate. The remaining LERs are coded as failures to remain open (plugged), or improper valve configuration. Rates are given for all faults and for failures only, in the modes failure to open, close, or operate, and failure to remain open (plugged). Events involving improper valve configuration, however, are always coded as common cause events and as command faults, rather than failures. Therefore, quantities for this failure mode are presented only for common cause command faults. The estimated rates, summary tables of faults, and listings of one-line descriptions are presented separately for the three failure modes.

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

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

ESTIMATES ARE BASED ON DATA WITH K = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 23, 24, 25, 27, 28, 29, 30, 31, 32, 35, 36, 37, 39, 40, 43, 44, 45, 49, 50, 52, 56, 58

THEY ARE SHOWN FOR FEWER VALUES OF M

P = (.016, .026, .038)

LAMBDA = (1.1E-07, 3.8E-06, 1.2E-05)

$LAMBDA_+$ = (1.1E-11, 6.0E-06, 3.1E-05)

OMEGA = (2.8E-10, 7.1E-08, 2.7E-07)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
1	(4.5E-10, 2.5E-04, 1.3E-03)	(4.0E-07, 9.9E-06, 3.6E-05)	
2	(2.3E-10, 1.3E-04, 6.4E-04)	(3.5E-07, 7.0E-06, 2.3E-05)	(.000, .019, .043)
3	(1.5E-10, 8.6E-05, 4.4E-04)	(3.2E-07, 6.0E-06, 1.9E-05)	(.000, .026, .074)
4	(1.2E-10, 6.5E-05, 3.3E-04)	(3.1E-07, 5.5E-06, 1.7E-05)	(.000, .029, .101)
24	(2.5E-11, 1.4E-05, 6.9E-05)	(2.5E-07, 4.2E-06, 1.4E-05)	(.000, .032, .332)
25	(2.4E-11, 1.3E-05, 6.7E-05)	(2.5E-07, 4.2E-06, 1.4E-05)	(.000, .032, .336)
30	(2.1E-11, 1.2E-05, 5.9E-05)	(2.5E-07, 4.2E-06, 1.4E-05)	(.000, .031, .349)
44	(1.7E-11, 9.2E-06, 4.7E-05)	(2.4E-07, 4.1E-06, 1.3E-05)	(.000, .030, .353)
58	(1.5E-11, 8.0E-06, 4.1E-05)	(2.4E-07, 4.1E-06, 1.3E-05)	(.000, .029, .335)
OVERALL	(1.5E-11, 1.4E-05, 1.3E-03)	(2.4E-07, 4.2E-06, 3.6E-05)	(.000, .030, .353)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
2	(1.1E-09, 1.5E-07, 5.5E-07)		
3	(1.6E-09, 1.2E-07, 4.4E-07)	(3.5E-10, 7.3E-08, 2.8E-07)	
4	(1.8E-09, 1.1E-07, 3.8E-07)	(3.3E-10, 7.2E-08, 2.8E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
24	(7.7E-10, 8.0E-08, 2.9E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
25	(7.6E-10, 8.0E-08, 2.9E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
30	(7.0E-10, 7.9E-08, 2.9E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
44	(6.0E-10, 7.7E-08, 2.8E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
58	(5.6E-10, 7.7E-08, 2.8E-07)	(2.9E-10, 7.1E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
OVERALL	(5.6E-10, 8.0E-08, 5.5E-07)	(2.9E-10, 7.2E-08, 2.8E-07)	(2.8E-10, 7.1E-08, 2.7E-07)

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

FAILURES ONLY

RATES ARE PER CALENDAR HOUR

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

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

ESTIMATES ARE BASED ON DATA WITH M = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 23, 24, 25, 27, 28, 29, 30, 31, 32, 35, 36, 37, 39, 40, 43, 44, 45, 49, 50, 52, 56, 58

THEY ARE SHOWN FOR FEWER VALUES OF M

P = (.008, .019, .032)

LAMBDA = (7.5E-08, 2.6E-06, 8.5E-06)

$LAMBDA_+$ = (4.1E-23, 3.4E-06, 2.0E-05)

OMEGA = (2.8E-10, 7.1E-08, 2.7E-07)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
1	(2.4E-21, 2.2E-04, 1.2E-03)	(1.4E-07, 6.1E-06, 2.4E-05)	
2	(1.2E-21, 1.1E-04, 6.0E-04)	(1.3E-07, 4.4E-06, 1.6E-05)	(.000, .017, .046)
3	(8.0E-22, 7.4E-05, 4.0E-04)	(1.3E-07, 3.9E-06, 1.3E-05)	(.000, .022, .075)
4	(6.0E-22, 5.6E-05, 3.0E-04)	(1.3E-07, 3.6E-06, 1.3E-05)	(.000, .023, .100)
24	(1.2E-22, 1.1E-05, 6.0E-05)	(1.3E-07, 2.9E-06, 1.0E-05)	(.000, .022, .338)
25	(1.2E-22, 1.1E-05, 5.8E-05)	(1.3E-07, 2.9E-06, 1.0E-05)	(.000, .022, .343)
30	(1.0E-22, 9.1E-06, 5.1E-05)	(1.3E-07, 2.8E-06, 1.0E-05)	(.000, .023, .364)
44	(7.8E-23, 6.9E-06, 3.9E-05)	(1.3E-07, 2.8E-06, 1.0E-05)	(.000, .024, .392)
58	(6.6E-23, 5.8E-06, 3.2E-05)	(1.3E-07, 2.8E-06, 9.8E-06)	(.000, .025, .396)
OVERALL	(6.6E-23, 1.1E-05, 1.2E-03)	(1.3E-07, 2.9E-06, 2.4E-05)	(.000, .023, .396)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
2	(1.6E-10, 1.0E-07, 4.2E-07)		
3	(3.8E-10, 9.3E-08, 3.6E-07)	(3.0E-10, 7.2E-08, 2.7E-07)	
4	(5.0E-10, 8.8E-08, 3.3E-07)	(3.0E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
24	(4.3E-10, 7.5E-08, 2.8E-07)	(2.8E-10, 7.1E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
25	(4.2E-10, 7.5E-08, 2.8E-07)	(2.8E-10, 7.1E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
30	(4.1E-10, 7.4E-08, 2.8E-07)	(2.8E-10, 7.1E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
44	(3.8E-10, 7.4E-08, 2.8E-07)	(2.8E-10, 7.1E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
58	(3.7E-10, 7.3E-08, 2.8E-07)	(2.8E-10, 7.1E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
OVERALL	(1.6E-10, 7.5E-08, 4.2E-07)	(2.8E-10, 7.1E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

PLANT	HOURS	POP	NUMBER OF INDIV. FAULTS FAILRS/COM FLTS	NUMBER OF NONLETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY NONLETHAL SHOCKS FAILRS/COM FLTS	NUMBER OF LETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY LETHAL SHOCKS FAILRS/COM FLTS
AR1	43800	28	3 / 0	1 / 1	1 / 1	0 / 0	0 / 0
CR3	34704	28	14 / 6	0 / 0	0 / 0	0 / 0	0 / 0
DB1	28944	23	7 / 0	4 / 0	4 / 0	0 / 0	0 / 0
DE1	43800	52	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DE2	43800	51	5 / 1	0 / 0	0 / 0	0 / 0	0 / 0
DE3	43800	46	4 / 1	0 / 0	0 / 0	0 / 0	0 / 0
RS1	43800	30	6 / 0	0 / 1	0 / 1	0 / 0	0 / 0
TI1	28368	31	1 / 1	0 / 0	0 / 0	0 / 0	0 / 0
TI2	8736	42	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
AR2	18120	63	4 / 6	0 / 0	0 / 0	0 / 0	0 / 0
CC1	43800	31	3 / 1	0 / 0	0 / 0	0 / 0	0 / 0
CC2	35784	31	1 / 1	0 / 0	0 / 0	0 / 0	0 / 0
FC1	43800	6	0 / 3	0 / 1	0 / 1	0 / 0	0 / 0
MI2	43800	33	2 / 1	0 / 0	0 / 0	0 / 0	0 / 0
MY1	43800	35	4 / 0	0 / 1	0 / 1	0 / 0	0 / 0
PA1	43800	15	0 / 2	0 / 0	0 / 0	0 / 0	0 / 0
SL1	41112	37	4 / 3	0 / 0	0 / 0	0 / 0	0 / 0
BV1	40656	49	3 / 1	0 / 1	0 / 2	0 / 0	0 / 0
DC1	43800	63	3 / 3	0 / 1	0 / 3	0 / 0	0 / 0
DC2	24600	63	4 / 1	0 / 0	0 / 0	0 / 0	0 / 0
HN1	43800	28	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP2	43800	60	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP3	41472	60	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
JF1	29712	68	3 / 2	0 / 2	0 / 5	0 / 0	0 / 0
KE1	43800	41	6 / 0	2 / 0	2 / 0	0 / 0	0 / 0
NA1	23976	48	8 / 4	0 / 0	0 / 0	0 / 0	0 / 0
NA2	4872	48	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR1	43800	54	3 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR2	43800	54	2 / 1	0 / 0	0 / 0	0 / 0	0 / 0
PT1	43800	42	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0

PT2	43800	42	3 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RG1	43800	47	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RO2	43800	37	7 / 2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SA1	35496	39	3 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SE1	4320	16	1 / 1	1 / 0	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SO1	43800	26	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU1	43800	55	0 / 1	1 / 0	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU2	43800	55	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TR1	43800	41	3 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TU3	43800	50	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TU4	43800	50	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
YR1	43800	28	1 / 0	0 / 1	0 / 3	0 / 0	0 / 0	0 / 0	0 / 0
ZI1	43800	82	3 / 4	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI2	43800	82	3 / 2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF1	43800	63	5 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF2	43800	63	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF3	38496	63	4 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BR1	37032	72	6 / 4	1 / 1	1 / 1	0 / 0	0 / 0	0 / 0	0 / 0
BR2	43800	72	5 / 1	0 / 1	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0
CO1	43800	57	12 / 3	1 / 0	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DA1	43800	67	5 / 0	1 / 0	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DR2	43800	51	13 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DR3	43800	51	5 / 9	0 / 1	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0
EN1	43800	68	7 / 4	1 / 1	1 / 1	0 / 0	0 / 0	0 / 0	0 / 0
EN2	21816	67	10 / 4	3 / 3	5 / 5	0 / 0	0 / 0	0 / 0	0 / 0
FP1	43800	18	14 / 1	1 / 0	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MI1	43800	34	2 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MO1	43800	47	6 / 3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NM1	43800	21	1 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
OC1	43800	42	2 / 6	0 / 2	0 / 3	0 / 0	0 / 0	0 / 0	0 / 0
PB2	43800	58	5 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PB3	43800	58	7 / 2	2 / 0	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PI1	43800	47	6 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
QC1	43800	57	6 / 1	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
QC2	43800	57	7 / 5	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
VY1	43800	56	2 / 1	2 / 0	4 / 0	0 / 0	0 / 0	0 / 0	0 / 0
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ALL	2600616	3105	253 /100	19 / 18	24 / 29	0 / 0	0 / 0	0 / 0	0 / 0

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	AR1	022339	072078	G	RM	F23			1	T		SODIUM THIOSULFATE BLOCK VLV CV-2411 FAIL. TO OPER	TORQUE SETTING OUT OF ADJ; DRY PACKING
B	AR1	027473	100879	F	RM	F16	U		1	T		CV1616 FAILED IN THE ES POSITION	CONT FUSE BLEW BECAUSE OF GROUND WIRE
B	AR1	030864	040680	B	RM	F02	C		1	T		EMER. FW SUPPLY VALVE FAILED TO FULLY OPEN(CV-2667	LOOSE BOLTS SECURING ACT TO VALVE BODY
B	AR1	030926	040780	H	MV	A20			1	N		CV-U227 FAILED TO OPEN ON MAN HPI (HPI VLV LOOP B)	MAN ENGAGING LEVER FOUND STUCK IN ENG POS
B	AR1	032533	090680	G	MV	B23			1	N		RCS MAKE UP BLOCK VLV(CV-1234) FAILED TO FULL CLOS	TORQUE SWITCH SETTING TOO LOW
B	CR3	017168A	020377	L	MV	A20	R		1	N		DECAY HEAT VLV DHV-4 WOULD NOT OPEN REMOTE ACTUATN	MTR. OPERATOR WOULDN'T OVERCOME VLV. DRAG
B	CR3	017168B	020377	L	MV	A20	R		1	N		DECAY HEAT VLV DHV-41 WOULDN'T OPEN REMOTE ACTUATN	MTR. OPERATOR WOULDN'I OVERCOME VLV. DRAG
B	CR3	018561	071577	L	MV	A23	R		1	T		VLV DHV-41 WOULD NOT OPEN FROM CONTROL ROOM	CAUSED BY SHIFT IN TORQUE SWITCH SETTING
B	CR3	018562	071577	L	MV	A00	R		1	T		DECAY HEAT VLV DHV-4 WOULD NOT OPEN FROM CONT.ROOM	CAUSE OF FAILURE UNKNOWN
B	CR3	018566	072977	H	MV	A12			1	T		HPI VLV MUV-25 FAILED TO OPEN AUTOMATICALLY	MECH.BINDING OF THE REVERSING INTERLOCKS
B	CR3	019010	082777	L	MV	B23			1	N		CORE FLOOD DR.VLV FOR B CORE FL.TK.WOULDN'T CLOSE	DRIFT OF TORQUE SWTCH SETTING;VLV CFV-12
B	CR3	019013	083177	L	RM	B00			1	N		CORE FLOOD SAMP.ISO.VLV CFV-11 WOULDN'T CLOSE	CAUSE OF FAILURE UNKNOWN
B	CR3	021775	062178	L	RM	A00	R		1	N		DECAY HEAT REMOV.VLV DHV-111 WOULD NOT OPEN REMOT.	CAUSE OF EVENT IS UNDETERMINED
B	CR3	022359	090778	L	RM	B23			1	T		CORE FLOOD VALVE CFV-15 FAILED TO CLOSE ON TEST	FAULTY TORQUE SWITCH
B	CR3	0230958	100478	L	RM	F16	T		1	T		FLOW CONTROL VALVE DHV-110 FAILED TO CONTROL FLOW	NO SIGNAL FROM FLOW CONTROLLER
B	CR3	025547*	030479	L	RM	A00	R		2	N		DECAY HEAT REMOVAL VLVS DHV-364 COULD NOT BE OPENE	D REMOTELY--CAUSE UNKNOWN
B	CR3	025936	040479	L	RM	F00	R		1	T		THROTTLE VLV HDV-110 WOULD NOT CONTROL FLOW IN AUT	NO CAUSE FOUND
B	CR3	025925	042479	L	RM	A12	R		1	N		DECAY HEAT REMOVAL VLV DHV-4 FAILED TO OPEN REMOTE	WASHER BINDING AT STEM NUT INTERFACE
B	CR3	030369	020680	L	RM	F16	T		1	T		'A' DECAY HEAT PMP DISCH THROTTLE DIDN'T CONTROL	IN AUTO. LOOSE WIRES ON SELECTOR SWITCH
B	CR3	033760	080680	L	RM	F24	T		1	T		DHV-110 WOULD NOT CONTROL FLOW IN AUTOMATIC	AIR IN THE CONTROLLER SENSING LINE
B	CR3	032554	082780	L	MV	F24	T		1	T		DHV-111('B' DECAY HEAT PMP DISCH THROTTLE) DID NOT	// CONTROL IN AUTO. AIR IN SENSING LINES
B	CR3	032555A	090380	L	MV	F20	R		1	T		DHV-110 DID NOT OPERATE AS REQUIRE (FIFTH OCCUR)	ELECTRICAL SHORT FOUND IN MOTOR
B	CR3	032555B	090580	L	RM	F16	S		1	T		MUV-23 FAILED TO OPERATE, NO POWER	FAILED CONTROL TRANSFORMER
B	CR3	032682	091680	L	MV	F16	T		1	T		DHV-111('B' DH PMP DISCHR THROTTLE) DID NOT OPER.	HIGH ALARM SWITCH DID NOT OPERATE
B	DB1	020989A	031678	B	MV	A26			1	T		AUX.FDPMP.1-1 STOP VLV AF3870 FAILED TO OPEN	LIMIT SWTCH ON VLV MTR NOT ADJUSTED PROP.

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	DB1	021957	071678	L	MV	A12			1		N	DECAY HEAT COOL.1-2 OUTLET VLV DH-14A WOLDN'T OPEN	ACTUATOR ARM HAD BECOME MISALIGNED
B	DB1	025402	011779	L	MV	B20			1		N	CORE FLOOD TANK 1-2 ISO VLV CFIA WOULD NOT CLOSE	LOOSE SET SCREW IN MOTOR OPERATOR
B	DB1	025521	022079	B	MV	B23			1		T	AFW VLV AF3869 COULD NOT BE CLOSED REMOTELY	FAULTY TORQUE SWITCH IN MOTOR OPERATOR
B	DB1	026605	032079	L	MV	B10			1		T	DECAY HEAT REMOV CONT ISO VLV DH 2735 FAILED TO CL	OSE--BUILDUP OF BORIC ACID ON VALVE STEM
B	DB1	026597	070479	B	MV	F20			1		T	AFW VLV AF 3870 WOULD NOT OPERATE REMOTELY	INTERNAL SHORT CIRCUIT IN MOTOR WINDING
B	DB1	030872	041880	L	RM	B12			1		N	DH62 WAS DISCOVER OPEN	REMOTE OPERATOR OUT OF ADJUSTMENT
B	DB1	031898	071080	L	RM	F02	C		1		N	DH COOLER 1-2 DISCH CONTROL VLV OPERATED ERRATIC	SFAS CH 2 DEENERGIZED FOR MAINTENANCE
B	DB1	031906A	072480	L	RM	F02	B		1		N	DH 12 CLOSED	PERSONNEL SHORTED FUSE CLIP IN CONTROL PC
B	DB1	031906B	072480	L	RM	F06	B		1		N	DH 11 CLOSED	INADEQUATE RESTORATION PROCEDURE
B	DB1	031906C	080380	L	RM	F02	B		1		N	DH 11 CLOSED	MAIN. SPEC. REMOVED BISTABLE
B	DE1	030598	030680	L	MV	A26			1		T	DHR COOLER 1B OUTLET VLV 1LP-14 FAILED TO OPEN	OUT OF ADJUSTMENT LIMIT SWITCH
B	DE2	016201	101476	L	MV	A16	S		1		T	VLV LPSW-5 COULD NOT BE OPENED REMOTELY	DIRTY ELEC.CONTACT IN MOTOR CONTROL CENTR
B	DE2	017541	040577	F	MV	B12	R		1		T	VALVE 2LP-21 FAILED TO CLOSE	LOOSE SET SCREW ON PINION GEAR OF MTR SET
B	DE2	027795*	120979	H	MV	A02			2V		M	HPI SUCTION VLV FROM BWST RENDERED INOPERABLE	PERSONNEL SHOULD HAVE BEEN DOING UNIT 1'S
B	DE2	031735	062580	F	MV	A02	R		1		U	2LP21 FAILED TO OPEN,SET SCREW LOOSE ON MOTOR PIN.	PREVIOUS REPAIR WORK OR VIB. AND AGE
B	DE2	032690	091680	F	MV	A20	R		1		T	2LP21 FAILED TO OPEN	LOOSE SET SCREW ON MOTOR OPERATOR PINION
B	DE3	014927	050476	L	RM	B23			1		T	VALVE 3CS-5 WOULD NOT CLOSE REMOTELY	TORQUE SWITCH FAILURE
B	DE3	020592	020378	F	MV	A23			1		T	VALVE BS-1 FAILED TO OPEN	TORQUE SWITCH FAILURE
B	DE3	020593	020778	F	MV	F12			1		T	VALVE BS-2 FAILED IN INTERMEDIATE POSITION	VALVE STEM FAILURE
B	DE3	021047	032078	H	MV	A16	S		1		T	VALVE HP-24 FAILED TO OPEN	DIRT ON VAL OPER CONTACTS
B	DE3	027368	101979	L	MV	F02			1		T	LPI VLV 3HP-410 OPENED FULL WHEN ATTEMPTING CLOSE	MOTOR MISWIRED
B	RS1	014306	020778	L	MV	A14			1		T	RHR MOV FAILED TO OPEN DURING TESTING(HV-26106)	TIGHT PACKING /POSS STICKING SEAT
B	RS1	016558*	111176	L	MV	A23	R		2		T	TWO DECAY HEAT MOVS FAILED TO OPEN FOR MONTH TEST	TORQUE SWITCHS NEEDED RESET/TESTED WEEKLY
B	RS1	019536	100177	L	MV	F20	R		1		N	BWS ISOL VALVE FAILED TO OPERATE (SFV-25003)	LIMITORQUE OPERATOR(SMB)FAILED(EXCESS OP)
B	RS1	019798	111977	H	MV	F00			1		T	HPI INJECTION ISOLATION VALVE FAILED TO CYCLE/TEST	UNKNOWN

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	RS1	030143	010980	H	RM	F16		U	1		U	POWER TO MU TANK ISO VLV SFV-23508 WAS NOT RESTORE	PERSONNEL ERROR
B	RS1	030725	032280	L	MV	B20		R	1		N	SFV-25003 (BWST ISO TO DHR SUCTION) FAILED TO CLO.	FAILED CLUTCH IN MOTOR OPERATOR
B	TI1	017343	030977	F	MV	B23			1		T	MO SPRAY PUMP SUCTION VALVE FAILED TO CLOSE/TEST	GREASE IN SPRING PREVENTED TORQUE SW OPER
B	TI1	025505	011279	H	MV	A16		S	1		T	HPI DH-V-5B DID NOT OPEN FROM MID POSITION	MOTOR BREAK DID NOT RELEASE
C	AR2	023481	122078	B	MV	A16		T	1		N	FLOW CONTROL VLV 2CV-1025-1 FAILED TO OPERATE	LOOSE MOTOR POWER CONNECTION
C	AR2	026245A	051479	B	MV	B16		T	1		N	SUP VLV 2CV-1039-2 WOULD NOT RESPOND TO SIGNAL	BLOWN FUSE IN VLV CONTROL CIRCUITRY
C	AR2	026248	060379	B	MV	B26		R	1		N	EMER FEED WTR CONT VLV 2CV-1036-1 WOULD NOT SHUT	LIMIT SWITCH WAS OUT OF ADJUSTMENT
C	AR2	026243A	060979	B	MV	B16		T	1		N	EMER FEED WTR CONT VLV 2CV-1038-1 WOULD NOT SHUT	LOOSE WIRE ON THE HANDSWITCH
C	AR2	026543A	070679	B	MV	B00		R	1		N	EMER FEED WTR CONT VLV 2CV-1038 WOULD NOT SHUT	NO REASON FOUND FOR FAILURE
C	AR2	026896	082679	H	MV	A20			1		N	SAFETY INJECTION TANK MAKEUP VLV 2CV-5064 FA SHUT	SPRING TENS ON VLV OPER GATE OUT OF ADJ
C	AR2	031672	060580	B	MV	A16		T	1		N	EF WTR SUP. VLV (2CV-1075) FAIL. TO OPEN ON DEMAND	LOOSE CONNECTOR AT VLV OPERATOR
C	AR2	031823	070780	B	MV	A20		R	1		N	EF VALVE 2CV-1075-1 FAILED TO OPEN FROM CONTROL RM	LOOSE BRUSH CONNECTION
C	AR2	032447	081280	F	MV	F16		S	1		T	CONTAINMENT SUMP RECIRC VLV 2CV-5048-2 FAILED	FOREIGN MAT. IN VLV OPERATOR SW CONTACTS
C	AR2	033375	112980	H	RM	B16		S	1		M	HPCI VLV 2CV-5056 FAILED TO CLOSE	BELIEVED TO BE CONTROL CIRCUIT FUSE FAIL.
C	CC1	014465	030576	H	MV	F16		S	1		N	HPSI LP.ISO.VLV 1-MO[illegible]616 WOULD NOT OPER. REMOTELY	BLOWN CONTROL CIRCUIT FUSE CAUSED FAILURE
C	CC1	016403	111776	H	MV	A23		R	1		T	AUX.HI.PRESS.LP.ISO.VLV SI-617 FAILED TO OPEN	DEFECTIVE TORQUE SWITCH;BURNED CONTACTS
C	CC1	027170	092479	H	MV	A20		R	1		T	AUX HIGH PRESS LOOP ISO VLV SI-617 FAILED TO OPEN	VLV MOTOR WAS SINGLE PHASING IN OPEN DIR
C	CC1	030214	010480	H	RM	F23			1		N	12A HPSI STOP VLV WOULD NOT THROTTLE	LOOSE LEADS ON TORQUE SWITCH
C	CC2	018881	082577	F	RM	F16		S	1		N	#21 CONT.SPRAY SYS.HDR.ISO.VLV(2-SI-4150-CV) OOS	VLV PLACE.OUT OF SERV.DUE TO FAIL.RESIST.
C	CC2	019740	111577	H	MV	A26			1		N	MOV-627,AUX HI PRESS HDR STP LP 118,WOULDN'T OPEN	OPEN LIMIT SWITCH CONTS. WERE DIRTY
C	FC1	014561	041476	H	RM	B16		S	1		T	HCV-383-4 FAILED TO CLOSE ON TEST	BINDING CONTACT IN BREAKER TO VALVE
C	FC1	023139	112478	L	RM	F16		U	1		T	PC-1058 WAS NOT OPERATING	VALVE CLOSING RELAY NOT REWIRED AFT MAINT
C	FC1	025590	032179	H	MV	A16		S	1		N	LOOP SAFETY INJECT. VLV HCV-311 FAILED TO OPEN	INTERLOCK SWITCH BINDING IN CONT CIRCUITRY
C	FC1	030212	011780	H	RM	B16		S	1		T	CONT. SUMP RECIRC VLV HCV-383-4 FAILED TO CLOSE	AUX INTERLOCK FOUND BINDING
C	MI2	014461	030976	B	RM	A16		S	1		M	AUX.FEEDPMP.STM.INLET VLV.CYCLED;WOULD NOT REOPEN	FAILURE OF VALVE OPERATING CIRCUIT

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
C	MI2	015338	072476	B	MV	A20			1		N	INLET STEAM TRIVALVE WOULD NOT OPEN	VALVE OPERATOR SPINDLE FAILED
C	MI2	033586	121080	H	MV	F23			1		T	HPSI INJECTION MOV-2-SI-616 OVERTRAVELLED 1/4 INCH	OPERATOR SENSITIVE TO TORQUE SWITCH
C	MY1	020758	020277	H	RM	F16	U	T	1		M	VALVE SL-P-3 FAILED TO OPERATE	WIRES DISCONNECTED (CAUSE UNKNOWN)
C	MY1	025490A	030779	H	MV	F23			1		T	"A" TRAIN HPSI PMP SUCT.VLV FAILED TO OPERATE	IMPROPER TORQUE SWITCH SETTING
C	MY1	0254908	030779	F	MV	F23			1		T	"A" TRAIN SCAT OUTLET VLV FAILED TO OPERATE	IMPROPER TORQUE SWITCH SETTING
C	MY1	030991	040880	L	MV	F00	R		1		T	LPSI LOOP HEADER STOP VALVE FAILED TO OPERATE	NO CAUSE FOUND (VLV IN LOOP #3)(LSI-M-31)
C	MY1	031389	050680	L	MV	F20	R		1		T	LPSI LOOP 3 HEADER STOP VLV FAILED TO OPERATE	BROKEN WELD ON COUPLING ON LSI-M-31
C	PA1	018274	061577	H	MV	A16	T		1		T	MOV-3011 FAILED TO OPEN	CONTACT FOR "SEAL-IN" CKT ON RELAY FAILED
C	PA1	025184	012679	H	RM	F16	S		1		N	SI TANK T82D VENT VLV OPENED WHEN PRESSURIZING TNK	SHORT BETWEEN FILL AND VNT VLV CIR(CV305)
C	SL1	015002	052176	B	MV	A16	T		1		N	MO AUX FEED PUMP STEAM SUPPLY VALVE FAILED TO OPEN	NO SIGNAL TO VALVE/COMMAND FAULT/ELECT
C	SL1	015507	070976	B	MV	A16	T		1		T	AUX FEED PUMP STEAM INLET VALVE FAILED TO OPEN	COMMAND/H2O IN CONTROL CIRCUIT/POOR DES
C	SL1	016880	120876	B	MV	A16	T		1		T	AUX FEED PUMP STEAM INLET VALVE FAILED TO OPEN	COMMAND/H2O IN CONTROL CIRCUIT/DESIGN
C	SL1	019505	081777	F	RM	A00			1		T	CONTAINMENT SPRAY VALVE FAILED TO OPEN/TESTING	UNKNOWN/ LOCKED OPEN HANDWHEEL
C	SL1	019509	092577	F	RM	A00			1		T	CONT.SPRAY HDR.ISO.VLV FCV-07-1B NOT FULLY OPEN	UNKNOWN (CONT.SPRAY VLV.STICKING)
C	SL1	020639	020978	B	MV	B20			1		T	AUX FEED PUMP VALVE (MV-09-11) FAILED TO CLOSE	MOV MOTOR WINDING PARTIALLY SHORTED
C	SL1	023141	112178	H	MV	A23			1		T	MOV 07-1B IN 1B ECCS TRAIN FAILED TO OPEN ON TEST	TORQUE SW FAULTY,REPLACED SWITCH
W	BV1	016356	102576	H	MV	B16	S		1		N	DRAIN VALVE ON ACCUMULATOR 1C FAILED TO SHUT	NO PWR/THERMAL OVERLOAD OF LINESTARTER
W	BV1	018725	072877	B	RM	A23			1		T	AUX. FEEDWATER CONT VLV WOULD NOT OPEN ELETRIC.	BINDING TORQUE SWITCH
W	BV1	022135	080178	L	RM	B10			1		T	1B LOW HEAD SAFETY INJECTION PMP.HEAD.ISO.NOT CLOS	VLV FAIL.TO CLOSE DUE TO BORIC CRY.IN PAK
W	BV1	028146	060979	L	MV	F23			1		M	1B LHSI PUMP SUCTION VLV FOUND TO BE INOPERABLE	MTR OPERATOR TORQUE SWITCH WAS FAILED
W	BV1	031210*	052180	L	RM	B16	U		2V		T	RHR ISOL VLVS FAILED TO CLOSE	DEENERGIZED PROCESS CONTROL SIGNAL
W	DC1	016367	110176	L	MV	F12			1		T	RHR VALVE FAILED TO CYCLE DURING TESTING	PACKING GLAND WAS TOO TIGHT
W	DC1	020694	020878	B	MV	B16	S		1		N	AUX FEED MOV FAILED TO CLOSE	COMMAND/LOOSE ELEC CONNECTION/CONTROL
W	DC1	021011*	032278	H	MV	F16	U		3		N	POWER FOUND OFF TO 3 ECCS VALVES	3 BREAKERS FOUND TRIPPED ON MCC
W	DC1	023114	112878	B	MV	B16	S		1		N	AFW THROTTLE VLV. WOULD NOT CLOSE ELECTRICALLY	BROKEN LEAD ON MTR OPERATOR

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	SUB CODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
W	DC1	025045B	010679	B	MV	B20		R	1	M		AFW VLV FMO-231 WOULD NOT CLOSE	BROKEN WIRE IN MOTOR OPERATOR
W	DC1	025380	022379	B	MV	B16		T	1	T		AFW DISCHG VLV FMO-212 WOULD NOT CLOSE	LOOSE CONNECTION IN HOT SHUTDOWN PANEL
W	DC1	025378	030379	B	MV	B20		R	1	N		AUX FEED VLV FMO-212 WOULD NOT SHUT FROM CONT **	BROKEN WIRE IN VLV'S OPERATOR
W	DC2	022069	071978	L	MV	F00			1	T		RHR PUMP SUCTION MOV FAILED TO CYCLE/TIME-WISE	UNKNOWN WHY CYCLE TIME EXCEEDED
W	DC2	025045A	010679	B	MV	B20		R	2	M		AFW VLVS FMO-2326222 WOULD NOT CLOSE	BROKEN WIRES IN MOTOR OPERATORS
W	DC2	027930	121779	F	MV	A23			1	N		CONTAIN SPRAY PMP DISCHG VLV IMO-220 FAILED TO OPN	FAILURE CAUSED BY TORQ SWTCH BINDING
W	DC2	030740	032580	B	MV	F16	S		1	T		AUX FEED VLV FMO-221 (#2 SG) DID NOT OPERATE	ARMATURE LEAD PULL OFF OF VLV OP MOTOR
W	IP2	0187878	050777	F	RM	F23			1	T		VALVE 8228 DID NOT OPERATE PROPERLY	TORQUE SWITCH MALFUNCTION
W	IP2	026367	062679	B	RM	B00			1	T		SHUTOFF VLV PCV-1310B(STM.SUP.TO #22 AFW PMP) WOUL	D NOT SHUT--NO CAUSE FOUND
W	JF1	022633*	090978	B	RM	F16	U		3	T		CONTROL WAS LOST ON FLOW CONT.VLVS 3228A,B,&C	DEFECTIVE RELAY IN TDAFP CONTROL CIRCUIT.
W	JF1	025436	012379	G	MV	F00			1	T		BIT INLET VLV Q1E21V0168 FAILED TO OPERATE ELEC.	NO CAUSE FOUND FOR FAILURE
W	JF1	030326*	020180	B	RM	A24	U		2V	T		CONTROL VLVS FOR 'A' AUX FEED TRAIN DIDN'T AUTO OP	//EN. CONTACTS MISALIGNED IN CONTROL CIR
W	JF1	030614	030380	F	MV	A00			1	T		CS-MOV-8820B,DISCH TO CONT SP HDR,DID NOT OPEN	CAUSE UNKNOWN (AFFECTED THE B TRAIN)
W	JF1	033005	102080	H	MV	A26			1	T		VALVE 1-CVC-MOV-1150(RWST SUPPLY TO CHR PUMPS)FAI	/LED TO OPEN. LIMIT SWITCH NEEDED ADJ.
W	JF1	033572	112880	L	RM	F16	S		1	T		LOOP SUCTION VLV FOR 'A' TRAIN RHR CLOSED	DIRTY CONTACTS IN PRESSURE TRANSMITTER
W	JF1	033672	122580	L	RM	F16	S		1	M		RHR LOOP B SUCTION VLV WENT CLOSED WHEN REQ OPEN	IMPROPER SIGNAL TO VLV DUE TO SHORT/MAINT
W	KE1	013963	010876	H	MV	F12			1	T		VALVE SI-28 DID NOT OPERATE	SCREW HOLDING TRIP LEVER BACKED OUT
W	KE1	014240	022076	F	RM	A01	C		1	T		VALVE ICS-58 FAILED TO OPEN(CONT.SPRAY DISCH. VLV)	VALVE MANUALLY TORQUED DOWN TOO TIGHT
W	KE1	019312	100377	F	MV	F02	C		1	M		MAINT.MAN DEENERGIZED 2 SW VLVS,WHEN ONLY ALLOW.T-	-O DEENER.1 VLV//PERSONNEL ERROR
W	KE1	020788	030278	H	MV	A00	R		1	T		CNTNMNT SUMP ISO VAL WOULD NOT FULLY OPEN	CAUSE UNKNOWN
W	KE1	021077	040478	H	MV	A14	R		1	T		CNTNMNT SUMP ISO VAL WOULD NOT FULLY OPEN	VAL PACKING AT END OF USEFUL LIFE
W	KE1	026136	053079	L	RM	A00			1	N		RHR LOW HEAD INJECT VLV SI-302A FAILED TO OPEN	NO CAUSE FOUND FOR FAILURE
W	KE1	030654	030380	L	MV	A23			1	T		DURING CONT SUMP RECIRC TEST,SI-351 DID NOT OPEN	TORQUE SWITCH OUT OF ADJUSTMENT
W	KE1	030693	031080	B	RM	B00			1	T		AUX FEED PUMP DISCH CROSSCONNECT VLV FAIL TO CLOSE	NO CAUSE FOUND FOR FAILURE OF AFW 10B
W	NA1	021150	042878	H	RM	B00			1	N		STEAM DUMP VAL 408E STUCK OPEN FOLL. TRIP	CAUSE NOT GIVEN

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
W	NA1	022269	081778	L	MV	A14			1		T	VALVE MOV-18608 FAILED TO OPEN DURING TEST	DRY VALVE PACKING CAUSED LIM SW TO TRIP
W	NA1	025767	030679	L	RM	F00			1		N	RHR DISCHG VLV MOV-17208 INADVERTANTLY OPENED	CAUSE NOT STATED
W	NA1	025862	041679	L	MV	B26			1		T	RHR ISO.VLV MOV-1701 FAILED TO CLOSE AUTOMATICALLY	MISALIGNED LIMIT SWITCH CONTACT
W	NA1	025859	043079	H	RM	A14			1		N	SAFETY INJECTION VLV MOV-18568 FAILED TO OPEN	VLV STUCK DUE TO DRIED PACKING
W	NA1	025974	051179	L	RM	A00			1		T	LOW HEAD SI PMP DISCHG.VLV.MOV-1863A FAILED TO OPN	CAUSE OF EVENT UNKNOWN
W	NA1	030111	011880	F	RM	A16	T		1		N	MOV-RS-100A FAILED TO OPEN (COMMAND FAULT)	CLOSED SIGNAL TO VALVE (PERSONNEL ERROR)
W	NA1	030333	012980	F	RM	A16	T		1		N	MOV-RS-100B FAILED TO OPEN (COMMAND FAULT)	CLOSED SIGNAL TO VALVE (PERSONNEL ERROR)
W	NA1	031697	062380	L	RM	A16	S		1		T	RECIRC VLV MOV-18638 FAILED TO REOPEN	DEFECTIVE ELECTRICLE SWITCH IN CON ROOM
W	NA1	036209A	122980	F	MV	F16	S		1		T	MOV-SW-105C FAILED TO OPERATE DURING TEST	LOOSE LEAD ON BREAKER/CONTROLLER
W	NA1	036209B	122980	F	MV	F10			1		T	MOV-SW-108A FAILED TO OPERATE DURING TEST	WATER IN VLV OPERATOR MOTOR
W	NA1	036209C	122980	F	MV	F00			1		T	MOV-RS-101A FAILED TO OPERATE DURING TEST	CAUSE UNKNOWN
W	PR1	014758	051376	L	MV	A23	R		1		T	MOV FAILED TO OPEN DURING TEST (MV-32065)	TORQUE SW PROBLEM/ADJUSTED IT(LIMITORQUE)
W	PR1	018341	061877	B	MV	F20			1		N	AUX FEED PUMP DISCHARGE VALVE FAILED TO OPERATE	OPEN LEAD IN OPERATOR/LIMITORQUE SMB-000
W	PR1	026266	041079	H	MV	A00			1		T	MV-32067 HPSI VLV TO RX VESSEL FAILED TO OPEN	NO CAUSE COULD BE FOUND
W	PR2	016284A	102576	H	RM	B00			1		T	HOT LEG SAMPLE LOOP VLV CV-31607 FAILED TO CLOSE	UNKNOWN/RETEST WAS OK
W	PR2	019284	100477	H	MV	A00			1		T	SAFETY INJ PUMP SUPPLY VLV MV-32183 FAILED TO OPEN	UNKNOWN/ STEM WAS LUBRICATED/NEXT TRY OK
W	PR2	020125	122377	B	MV	A16	S		1		T	#22 TURB.DRIVEN AFW PUMP STM.SUP.VLV.FAILED TO OP-	-EN//MOTOR LEAD GROUNDED TO JUNCTION BOX
W	PT1	013945	010876	B	MV	F20			1		T	MOV-4020 AUX FEED PUMP DISCHARGE FAILED STUCK/TEST	VALVE OPERATOR RING WORN/GEAR REPLACED
W	PT2	014348	031576	F	MV	A03	R		1		T	CONTAINMENT SPRAY 2MOV-8608 FAILED TO OPEN / TEST	PERSONNEL ERROR/TERMINAL SLIDER OPEN
W	PT2	015186	070176	B	MV	A23	R		1		T	MOV-2MS-2019/STEAM TO AUX FEED PUMP FAILED TO OPEN	TORQUE SW SETPOINT CAUSED TIGHT CLOSING
W	PT2	017035	012777	F	MV	F16	T		1		N	CONT.SPRAY PMP.DISCHG.VLV.2-8608 INOPERABLE	VALVE OPERATOR BREAKER WAS OPEN
W	PT2	021766	061678	F	MV	F23			1		T	CONT SPRAY VALVE(MOV) FAILED TO OPERATE FOR TEST	SMB-00 LIMITORQUE SW FAULTY/REPLACED
W	RG1	025265	020679	L	MV	A00			1		T	CNTMT RECIRC SUMP OUTLET MOV-851B FAILED TO OPEN	FLEX OF LONG EXT MIGHT HAVE CAUSED OVERTC
W	RO2	015570	081776	B	MV	A20	P		1		T	VALVE V2-16A FAILED TO OPEN	LIMITORQUE OPER FAILED TO OPEN VALVE
W	RO2	017540	032677	B	RM	A00			1		N	VALVE V2-14A FAILED TO OPEN	INCREASE IN TENSION BETWEEN SEATING SURF.

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
W	RO2	019350	081677	B	MV	A20		R	1		N	VALVE V2-16B FAILED TO OPEN AS REQUIRED	LIMITORQUE VALVE OPERATOR FAILED
W	RO2	019352	081777	B	MV	A20		R	1		N	VALVE V2-16A FAILED TO OPEN	LIMITORQUE VALVE OPERATOR FAILED
W	RO2	019667	102677	L	MV	A20			1		N	RHR VALVE 759B FAILED TO OPEN	MOTOR WINDINGS WERE SHORTED
W	RO2	020053	120377	L	MV	A16		S	1		T	RHR VALVE 744B FAILED TO OPEN	CIRCUIT THERMAL OVERLOAD DEVICE TRIPPED
W	RO2	022626	122177	B	MV	A12		R	1		T	AUX FEED PUMP DISCH VAL, V2-16A FAILED TO OPEN	EXCESS SEATING PRESS CAUSED BY OVERHEAT
W	RO2	020322	011178	L	MV	F20			1		T	VALVE RHR-744B FAILED TO FUNCTION PROPERLY	OIL LEAKED INTO MOTOR (GASKET FAILED)
W	RO2	027067	090579	B	MV	A16	T		1		N	AFW ISO.VLV AFW-V2-16A FAILED TO OPEN	OPERATOR POWER SUPPLY BREAKER WAS TRIPPED
W	SA1	016939*	011077	H	MV	F20			2		N	MTR.BRKRS.TO VLVS 1SJ1&2 TRIPPED WHEN VLVS WERE O-	PENED//BOTH MTR.OPERATORS HAD FAILED
W	SA1	021910	052378	H	MV	A20			1		T	MOV 1SJ1 (HPIS) FAILED TO OPEN DURING TEST	WINDING FAILED/INCORRECT MOTOR SIZE/PERSN
W	SE1	033818A	092280	L	MV	F26			1		U	1-FCV-70-156 FAILED TO OPERATE	LIMIT SW REQUIRED ADJUSTMENT
W	SE1	032973*	100580	B	RM	F01	C		2		T	AUX FEEDWATER VLVS LCV-3-1746173 WOULD NOT HAVE OP	//ER IN AUTO. PRESS SWITCH LEFT ISOLATED
W	SE1	033298	111980	F	MV	A16		S	1		T	CNTMT SUMP VLV TO CNTMNT SPRAY PMP DID NOT OPEN	INTER LIMIT SW ON FCV7421 FAILED ICV72-2(
W	SO1	020609	013078	F	RM	B00			1		T	CONT SPRAY VLV (CV-517) FAILED TO CLOSE FOR TEST	UNKNOWN/POSSIBLE LUBRICATION PROBLEM
W	SO1	021207	041878	H	MV	F12			1		T	MOV-850C FAILED TO OPEN IN REQUIRED TIME / TESTING	SHAFT DISTORTED/PROB DUE TO EXCESS TORQUE
W	SU1	014871	031876	B	MV	A16		S	1		N	AUX.FEEDWTR.PUMP DISC.VLV.MOV-FW-151A FAILED TO O-	-PEN//TIMING RELAY FAILURE
W	SU1	021802	062278	L	MV	A02		C	1		T	MOV-RH-100 FAILED TO OPEN	MAINT ERROR/STEM WAS NOT ENGAGED TO DISC
W	SU2	015526	061576	L	MV	F12			1		T	LPIS MOV-28628 FAILED TO OPERATE FROM CONSOLE	THERMAL OVERLOAD DUE TO VALVE PLUG BIND
W	TR1	016250A	102876	H	MV	A23			1		N	RWST SUCTION VALVE(MO-112E)FAILED TO OPEN/DEMAND	TORQUE SW SET TOO LOW/VAL WOULDNT UNSEAT
W	TR1	016250B	102876	H	MV	A16		S	1		N	RWST SUCTION VALVE (MO-112D) FAILED TO OPEN/DEMAND	BREAKER SUPPLYING POWER FAILED/COMMAND
W	TR1	020325	112777	B	MV	F20			1		N	AUX FEED VLV (CV-300482) FAILED TO OPERATE	MOTOR OPER FAILED/WATER CAME THRU GASKET
W	TR1	020516	010478	H	MV	A19			1		T	MOV-88807A FAILED TO OPEN DURING TESTING	VALVE STEM LACKED LUBRICATION
W	YR1	019495	102477	H	RM	F00			1		N	REGULATOR VALVE FAILED TO OPER.(CONTROL PRESSURE)	UNKNOWN / SETPOINT DRIFT / ADJUSTED VLV
W	YR1	030141*	020180	H	RM	F16	U		3		T	SI ACCUMULATOR N2 VLV SI-TV-604,605,606 DIDN'T OP.	IMPROPER WIRING OF TIME DELAY RELAYS
W	ZI1	017154	012177	F	MV	A19			1		T	CONTAINMENT SPRAY 1MOV-C50002 FAILED TO OPEN	STEM STICKING DUE TO LUBRICATION PROBLEM
W	ZI1	017040	012677	H	MV	A16	T		1		T	VALVE 1MOV-SI8808A FAILED TO OPEN	COMMAND/AUX CONTACTS IN CONTL CKT STUCK

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
W	ZI1	017223	012877	H	MV	A16		T	1	T		VALVE 1MOV-SI8808B FAILED TO OPEN	COMMAND/AUX CONTACTS,CONTROL CKT,STUCK
W	ZI1	017251	012877	H	MV	A16		T	1	T		VALVE 1MOV-SI8800C FAILED TO OPEN/COMMAND	AUX CONTACTS IN CONTROL CIRCUIT STUCK
W	ZI1	021337	042178	L	MV	A00			1	T		RHR 1MOV-87008 FAILED TO OPEN DURING TESTING	UNKNOWN/SOMETHING CAUSED THERMALS TO OPEN
W	ZI1	021397	050378	F	MV	A19			1	T		CONTAINMENT SPRAY VALVE 1MOV-CS0002 FAILED TO OPEN	LACK OF LUBRICATION
W	ZI1	033533	121580	L	RM	B16	S		1	T		RHR MINI FLOW VLV(1FIC-610A) WOULD NOT HAVE CLOSED	FAILED MICRO SWITCH
W	ZI2	014253	021376	H	MV	A16		T	1	T		2B SI PMP.SUC.VLV 2MOV-SI8923B FAILED TO OPEN	DIRTY CONT.ON CKT.BRKR.TO MTR.OPERATOR
W	ZI2	017861	051977	H	MV	A20			1	N		VALVE 2MOV-SI8800D FAILED TO OPEN	LIMITORQUE MOTOR OPERATOR FAILURE
W	ZI2	018212	060477	L	MV	A16	S		1	T		RHR VALVE(2MOV-RH87008) FAILED TO OPEN DURING TEST	COMMAND/AUX CONTACTS STUCK IN MCC
W	ZI2	026750	071879	L	MV	A26			1	T		2MOV-SI8811A FAILED TO STROKE OPEN(RECIRC FROM SU/	IMP TO RHR SUCTION). LIMIT SWITCH FAILURE
W	ZI2	031245	042980	F	MV	A23			1	T		2B CONT SPRAY PUMP STOP VLV FAILED TO OPEN	FAILED TORQUE SWITCH
G	BF1	017594A	032177	L	MV	B08			1	T		VLV FCV 74-52 WOULD NOT GO COMPLETELY CLOSED	WORN BRNG.ASS,LOCKNUT,YOKE&NUT,GASKETS
G	BF1	017594B	032177	L	MV	B20			1	T		VLV FCV 74-52 WOULD NOT CLOSE;MTR TRIP,THERMAL O.L	MOTOR SHAFT WAS BENT
G	BF1	018126	050977	H	MV	A20			1	T		HPCI TURB.STM.SUP.ISO.VLV. FCV 1-73-16 FAIL.TO OPN	BROKEN TEETH ON MTR PINION&CLUTCH GEAR
G	BF1	027620	101779	H	MV	A26			1	T		FCV-73-27 WOULD NOT OPEN-HPCI INOPERABLE	DIRTY CONTACTS ON OPER. LIMIT SWITCH
G	BF1	030712	031380	L	MV	B16	S		1	T		RHR INJECT VLV 74-67 FAILED TO CLOSE DURING TEST	LIMIT SW IN ISOLATION LOGIC FAILED
G	BF1	032742	092480	L	MV	F20			1	N		RHR TORUS VLV FCV-74-71 FOUND TO BE INOPERABLE	GROUNDED MOTOR(3.9HP,SMBZ,LIMITORQUE)
G	BF2	016807	111676	H	MV	A23		R	1	T		HPCI TURB.STM.SUP.VLV 2-FCV-73-16 FAILED TO OPEN	TOR.SWT.GEAR ASS.PIN FOR VLV OPER.SHEARED
G	BF2	025015	011379	H	MV	A26		R	1	T		HPCI INOPERABLE-FCV-73-16 FAILED TO OPEN	MECH FAILURE OF OPERATOR LIMIT SWITCH
G	BF3	018637	070577	H	MV	A23		R	1	T		HPCI TURB.STM.SUP. 3-FCV-73-16 FAILED TO OPEN	TOR.SWTH.GEAR ASS.SHEARED;CAUS.OVLD ON MT
G	BF3	020524	021378	L	MV	F12		R	1	T		VLV FCV.3-74-52 WAS FOUND INOPERABLE	UPPER BRNG.LOCKNUT STRIPPED FROM NOR. POS
G	BF3	021245	042878	L	MV	F12		R	1	T		VLV FCV 3-74-52 WAS FOUND INOPERABLE	UP.BRNG.LOCKNUT STRIPPED FROM NOR.POSITIO
G	BF3	030363	020580	L	MV	F26		R	1	T		RHR VLV FCV 74-73 FAILED TO OPERATE DURING TEST	LIMIT SW IN ACTUATOR ASSEMBLY FAILED
G	BR1	016402	111976	L	MV	F16		U	1	N		RHR INJECTION VALVE(E11-F015A) FAILED TO OPERATE	UNDERSIZED BKR/DESIGN PROBLEM(ROOT)
G	BR1	016861	112176	H	MV	A20		R	1	T		E41-F001(HPCI STM.SUP.VLV) WOULD NOT OPEN	BRUSHES ON VLV MOTOR WERE STICKIN
G	BR1	017081	011977	H	MV	B20		R	1	T		HPCI STM.SUP.VLV E41-F003 WOULD NOT CLOSE	DIRTY COMMUTATOR IN VLV OPERATOR

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	BR1	017600	021077	D	MV	A16		S	1		N	CORE SPRAY VALVE FAILED TO OPEN AT REQUIRED PRESS	SETPOINT ON CONTROLLING INST DRIFTED HI
G	BR1	017290	030177	H	MV	B12			1		T	HPCI MIN. FLOW VLV E41-F012 FAILED TO CLOSE	ANTI-ROT. KEY SET SCREW HAD UNSCREWED
G	BR1	017330	030677	L	MV	A00			1		T	RHR PMP 1D TORUS SUC.VLV E11-F004D WOULD NOT OPEN	CAUSE OF FAILURE UNKNOWN
G	BR1	019677	110577	L	MV	A02		C	1		N	RHR VALVE E11-F004A FAILED TO OPEN(MOTOR PROBLEM)	PERSONNEL ERROR/COVER LEFT LOOSE/WATER LK
G	BR1	019824	120377	L	MV	B20			1		U	VALVE E11-F040 FAILED IN OPEN POSITION	MOTOR FOUND TO BE OPEN(UNDETERMINED WHY)
G	BR1	022092B	072878	L	MV	A16		T	1		U	VALVE F068B FAILED TO OPEN	BLOWN FUSE
G	BR1	022092A	080278	L	MV	A16		T	1		U	VALVE F068B FAILED TO OPEN	BLOWN FUSE/FOUND GRND WIRE IN LOGIC CKT
G	BR1	022218	080878	H	MV	A00			1		N	HPCI FEED INJ VALVE E41-F006 FAILED TO OPEN AUTO	UNKNOWN/TESTING COULDNT DUPLICATE FAILURE
G	BR1	030638	031480	H	RM	B16		S	1		T	HPCI TORUS SUCTION VLV E41-F041 FAILED TO CLOSE	RTGB CONTROL SW FAILED
G	BR2	014618	031076	H	RM	A26			1		T	VALVE 2-E41-PV-1219D FAILED TO OPEN DURING TEST	LIMIT SW WAS OUT OF ADJUSTMENT
G	BR2	020240	010478	H	MV	F26			1		T	CLOSING TIME ON E41-F002 EXCEED. TS LIMIT (HPCI)	LIMIT SWITCH(OPEN) OUT OF ADJUSTMENT
G	BR2	020913	040378	L	MV	A20			1		N	SHUTDOWN COOL.OUTB.SUC.VLV E11-F008 WOULDN'T OPEN	ELECTRO-MECHANICAL BRAKE ON VLV.OP.FAILED
G	BR2	021663	060378	L	MV	A00			1		N	RHR VLV E11-F009 WOULD NOT OPEN FROM CONTROL ROOM	CAUSE OF VLV NOT OPENING, NOT GIVEN
G	BR2	023034	111278	L	MV	A16		U	1		N	RHR VLV E11-F008 WOULD NOT OPEN AT REQ. SETPOINT	FAIL. OF RX.STM.DOME HIGH PRESS.SWITCH
G	BR2	026521	072179	H	MV	F20			1		T	HPCI STEAM ISOLATION VALVE F001 INOPERABLE	PINION GEAR INSTALLED BACKWARD ON OP SHAF
G	BR2	030412	021480	L	RM	A16		S	1		N	VLV E11-F049 FROM RHR TO RADWASTE FAILED TO OPEN	COMMAND FAULT,RELAY FAILED IN LOGIC CKT
G	C01	014359	012476	L	MV	F20		R	1		N	VLV RHR-MO-34A WOULD NOT OPERATE BY MTR.OPERATOR	SHEARED WOODRUFF KEY.IN MTR.OPERATOR
G	C01	015717	081076	D	MV	F20			1		T	VALVE CS-MO-12B WOULD NOT OPERATE	TRIPPER PIN IN OPERATOR DISLODGED
G	C01	016008	090776	D	MV	A20			1		T	VALVE CNS-MV-12B FAILED TO OPEN	THE REPAIR CLUTCH AND COMPONENTS FAILED
G	C01	016658	102876	L	RM	A16		S	1		T	VALVE RHR MO-17 FAILED TO OPEN	BROKEN RELAY COIL KEEPER LODGED IN CONT.
G	C01	017301	021977	L	MV	B12		R	1		N	MOTOR OPERATED VALVE RHR-MO-34 WOULD NOT CLOSE	SHEARED KEY BETWEEN VALVE AND OPERATOR
G	C01	018004	042077	D	MV	F20			1		T	CORE SPRAY PUMP VALVE INOPERATIVE,MOTOR RUNS	MOTOR GEAR SET SCREW ON VAL OPER LOOSE
G	C01	020343	011378	L	MV	B16		S	1		T	RHR INJ BLOCK VALVE FAILED TO CLOSE DURING TEST	DIRTY CONTACTS ON RELAY&WIRING ERROR
G	C01	0208068	020778	H	RM	B16		T	1		T	HPCI VALVE FAILED TO CLOSE DURING TEST	NO SIGNAL FROM DP SWITCH
G	C01	023049	091878	L	MV	A20			1		N	VALVE RHR-MO-66B FAILED TO OPEN	SET SCREW ON VALVE OPERATOR LOOSTENED

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	CO1	026068	032179	D	MV	A20			1	T		CS-MO-11A CORE SPRAY VALVE FAILED TO OPEN	WORN SET CLUTCH COLLAR ON OPERATOR
G	CO1	027749	110979	D	MV	A20	R		1	T		CS VALVE CS-MO-12A WOULD NOT OPEN	WORN WORM SET CLUTCH COLLAR ON OPERATOR
G	CO1	031544	051680	L	RM	F26	C		1	T		RHR VLV MO-57 FAIL TO CLOSE IN REQUIRED TIME	LIMIT SW SET WRONG(PERSONNEL ERROR)
G	CO1	032114	062980	L	MV	B12			1	N		RHR-MO-57 FAILED TO CLOSE	STEM BACKED OUT OF DISC JAMMING VLV
G	CO1	032211	081380	L	MV	F20	R		1	T		RHR-MO-34B FAILED TO OPERATE	KEY BETWEEN MOTOR SHAFT AND PINION FAILED
G	CO1	033825	111780	L	MV	F05	R		1	N		RHR-MO-34A WOULD NOT OPERATE--KEY CONNECTING MOTOR	PINION GEAR AND SHAFT MADE OF WRONG MATER
G	CO1	033709	121680	L	RM	A23			1	T		RHR-MO-25B WOULD NOT OPEN	CLOSING TORQ SWTCH.SET TOO CLOSE TO REQ.
G	DA1	017043	021177	D	MV	F05			1	T		CLUTCH HOUSING FOR MOV 2115 FRACTURED DUR. TEST	MATERIAL TOO BRITTLE
G	DA1	017312	021977	H	RM	F03	C		1	N		CONTACT BLOCK FOUND INSTALLED IN VALVE CIRCUIT	PERSONNEL ERROR,FAILED TO REMOVE AFTER TS
G	DA1	019963	112377	H	MV	B00			1	T		HPCI INJECTION VALVE MOV 2312 FAILED TO CLOSE	CAUSE UNKNOWN
G	DA1	019967	121577	L	MV	A20			1	N		RHR CROSS TIE VALVE FAILED TO OPEN	FRACTURED TEETH ON WORM AND WORM GEAR
G	DA1	027096	091879	L	MV	A20			1	T		RHR MINIMUM FLOW VALVE WOULD NOT OPEN	OPERATOR WORM GEAR WAS STRIPPED
G	DA1	028004	091979	D	MV	F02			1	N		"A" CORE SPRAY MINIMUM FLOW VALVE WOULD NOT CLOSE	LEVER ON OPERATOR MOVED TO NEUTRAL POSITI
G	DR2	014330	031376	H	RM	A16	S		1	T		HPCI STEAM SUPPLY VALVE 2-2301-4 FAILED TO OPEN	DIRTY CONTACTS IN BREAKER SUPPLYING VALVE
G	DR2	015748	061076	D	RM	B19	R		1	T		VALVE MO2-1402-48 FAILED TO CLOSE AGAINST PUMP HED	INADAQUATE LUBRICATION OF VALVE STEM
G	DR2	015378	071176	D	MV	F26			1	T		CORE SPRAY INJECTION VAL MO2-1402-24B FAILED	BROKEN LIMIT SWITCH CONTACT BLOCK
G	DR2	016453	111376	H	MV	F12	R		1	T		HPCI INJECTION VALVE MO2-2301-8 FAILED	VALVE STEM SHEARED
G	DR2	017182	021777	L	MV	A26			1	T		LPCI CROSS-TIE VALVE MO2-1501-32B FAILED TO OPEN	LIMIT SWITCH OPENED BEFORE VALVE OFF SEAT
G	DR2	018508	080277	H	MV	A23	R		1	T		HPCI VALVE 2-2301-8 FAILED TO OPEN	SUSPECT PROBLEM WITH TORQUE SWITCH
G	DR2	018934	081577	L	MV	A00			1	T		SUCTION VALVE MO-2-1501-5A FAILED TO OPEN	CAUSE UNKNOWN
G	DR2	018985	091077	H	MV	A04			1	T		HPCI VALVE 2-2301-8 FAILED TO OPEN,VAL DAMAGED	OVER SIZED MTR OPERATORS OVERSTRESS STEM
G	DR2	022776	101378	D	PM	B19	R		1	T		THE 2-1402-48 FLOW TEST VALVE FAILED TO CLOSE	VALVE STEM NOT ADEQUATELY LUBRICATED
G	DR2	022775	101878	L	RM	B19			1	T		LPCI SUCTION VALVE MO-1501-5C FAILED TO CLOSE	VALVE STEM NOT ADEQUATELY LUBRICATED
G	DR2	025246	011179	L	MV	B20			1	T		LPCI FLOW TEST VALVE FAILED TO CLOSE WHEN ACTUATED	BROKEN PINION GEAR ON OP MOTOR SHAFT
G	DR2	025248	012479	L	MV	B00			1	T		LPCI MIN FLOW VALVE FAILED TO CLOSE COMPLETELY	CAUSE UNKNOWN

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	DR2	031264	051280	H	RM	B14			1		N	HPCI ISOL VLV FAILED TO CLOSE	STEAM CAUSED PACKING TO SWELL(PERSONNEL):
G	DR2	032749	101180	H	MV	A23		R	1		N	HPCI STEAM SUPPLY VLV FAILED TO OPEN	TORQUE SW CONTACTS STUCK OPEN REPLACED
G	DR3	014750	051076	D	MV	B16		U	1		T	MO 3-1402-25B TRIPPED WHILE BEING CLOSED	WRONG SIZE OVERLOAD HEATER
G	DR3	016695	101276	L	MV	A16		S	1		T	VALVE 3-1501-27A FAILED TO OPEN ELECTRICALLY	LOOSE TERMINAL IN VALVE CONTROL CIRCUIT
G	DR3	016474*	111976	H	MV	F16		S	2V		U	HPCI VLVS FAILED TO OPERATE (CYCLING)	DESIGN ERROR IN LOGIC CIRCUIT
G	DR3	018936	081177	L	MV	A19			1		N	VALVE MO-3-1501-20B FAILED TO OPEN	VALVE STEM NOT ADEQUATELY LUBRICATED
G	DR3	019996	121677	L	MV	A00		R	1		N	LPCI HX DISCH VALVE MO3-1501-3A FAILED TO OPEN	CAUSE UNKNOWN
G	DR3	020602	020778	L	MV	A00		R	1		T	VALVE MO-3-1501-5C FAILED TO OPEN	CAUSE UNKNOWN
G	DR3	021679	060678	F	MV	F23			1		N	VALVE MO3-1501-28B FAILED WHILE BEING CYCLED	DEFECTIVE SHAFT PIN ON TORQUE SWITCH
G	DR3	022561	092278	L	MV	B16		S	1		T	LPCI VALVE 3-1501-20A FAILED TO CLOSE ON TESTING	STUCK CONTACTOR IN MCC
G	DR3	022591	092278	L	MV	F00			1		N	LPCI HX VALVE MO3-1501-3A FAILED TO OPERATE	CAUSE UNKNOWN
G	DR3	027260	092379	L	MV	A16		S	1		T	LPCI MOV 3-1501-3A WOULD NOT OPEN REMOTELY	SLIDEWIRE ON POSITION CONTROLLER GOT OFF
G	DR3	030246	012280	L	MV	B16		S	1		T	LPCI VLV MO-3-1501-11B FAILED TO CLOSE	PROBLEMS WITH VLVS SUPPLY BREAKER
G	DR3	030528	030680	L	MV	A16		S	1		T	LPCI VLV MO-3-1501-22A FAILED TO OPEN DURING TEST	LOOSE WIRE IN MCC SUPPLYING PWR TO VLV
G	DR3	033668	121980	F	MV	B16		S	1		N	DRYWELL SPRAY HEADER ISO-VLV WOULD NOT CLOSE	STUCK PLUNG.ON CLOS.COIL OF VLV MOTOR ARM
G	DR3	033713	122380	L	RM	B16		S	1		T	SHUTDOWN COOL.SYS.INBOARD ISO.VLV DID NOT CLOSE	PROBLEMS IN VLV CONTROL CIRCUITRY
G	EN1	014785	040776	L	MV	F20			1		M	VALVE E11-F047A FAILED TO OPERATE ELECTRICALY	A MOTOR WINDING FAILURE OCCURRED
G	EN1	014792	050176	H	MV	A26		R	1		N	HPCI DISCHARGE VALVE E41-F006 FAILED TO OPEN	FAILURE OF A SNAP LOCK LIMIT SWITCH
G	EN1	015555	061576	H	MV	A00		R	1		N	HPIC VALVE E41-F006 DID NOT FULLY OPEN	CAUSE UNKNOWN
G	EN1	018191	060477	L	RM	F02		C	1		T	LPCI VALVE E11-F017B CYCLE TIME OUTSIDE T.S.	VALVE STEM PACKED TOO TIGHTLY/PERSONNEL
G	EN1	022113	070278	L	MV	A16		S	1		T	RHR MOV E11-F024A FAILED TO OPEN	DIRT IN INTERLOCK ON BREAKER CAUSED BIND
G	EN1	025019	011979	H	MV	F20			1		T	HPCI INJECTION VALVE FAILED TO OPERATE	MOTOR BURNED UP
G	EN1	026631	072679	L	MV	F16		U	1		M	RHR OUTBOARD ISOLATION VALVE MADE INOPERABLE	NO PWR AVAILABLE TO VLV (PERSON.ERROR)
G	EN1	030031	010580	L	MV	F00		R	1		T	RHR VLV 1E11-F008 FAILED TO OPER IN REQ TIME	CAUSE UNKNOWN AT PRESENT
G	EN1	031143	042980	L	MV	A20		R	1		T	MOV 1E11-F016A FAILED TO OPEN DURING TEST	KEY BETWEEN MOTOR SHAFT AND PINION FAILED

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	EN1	031281	052580	L	MV	A16		S	1	T		RHR VALVE 1E11-F006B FAILED TO OPEN	FAULTY AUX CONTACT BLOCK (COMMAND FAULT)
G	EN1	0317698	071180	L	MV	F16		S	1	N		LPCI INJECTION VLV LOST POWER(INVERTER OVERHEATED)	LOSS OF POWER(PERSONNEL)SEE 31769A
G	EN1	032190	080880	L	MV	A20			1	T		RHR VLV 1E11-F015A FAILED TO OPEN ON TEST	MOTOR WINDINGS AND ROTOR FOUND BURNED
G	EN1	032667	091980	H	RM	B16		S	1	T		HPCI MIN FLOW VLV 1E41-F012 FAILED TO CLOSE (TEST)	NO PWR TO VLV, CONTACTOR WAS BINDING
G	EN2	022024*	071778	L	MV	F16		U	2V	N		RHR VALVES HAD POWER LOST TO THEM	BREAKER TRIPPED DUE TO BLOWN FUSES
G	EN2	022500*	091078	L	RM	B04			2	N		RHR VALVES 2E11-F003A,F047A FAILED TO CLOSE	VALVE GATES SAG+BIND IN FULL OPEN POSIT
G	EN2	022486*	092678	L	RM	F12			2	T		RESTRICTED FLOW THROUGH RHR SYSTEM CONTROL VALVES	DAMAGED CAVITROL TRIMS IN VALVES
G	EN2	022675	102778	H	MV	F20			1	T		HPCI VALVE 2E41-F001 FAILED TO OPERATE	FAILURE OF MOTOR SHUNT FIELD INSULATION
G	EN2	022753*	110678	H	RM	F16		U	2V	T		HPCI CONTROL VALVES FAILED TO OPERATE	WIRE LEFT OFF BY MAINT PERSONNEL
G	EN2	026148	060979	H	MV	F20			1	T		HPCI SUCTION VALVE EXCEEDED OPERATING TIME	LOOSE CONNECTION IN SHUNT FIELD CIRCUIT
G	EN2	026422	070779	H	MV	F16		S	1	[illegible]		HPCI STEAM SUPPLY ISOLATION VALVE FAILED TO OPERAT	MOTOR OPERATED 12 TIMES IN 5 HRS
G	EN2	026639	073079	H	MV	B20		R	1	N		HPCI SUCT FROM SUPP CHAMBER FAILED TO CLOSE	BURNED MOTOR-PINION KEY HAD SLIPPED ON SH
G	EN2	027321	101579	H	MV	A20		R	1	T		HPCI SUCT FROM SUPP CHAMBER FAILED TO OPEN	MOTOR WINDING FAILURE
G	EN2	030178	013080	H	RM	B16		T	1	T		HPCI MIN FLOW VLV 2E41-F012 FAILED TO CLOSE	FAILED FLOW SW CONTROLLING VLV
G	EN2	030975	042180	H	RM	F16		T	1	T		MIN FLOW CONT VLV 2E41-F012 FAILED TO OPER	FLOW SW PROVIDING SIGNAL TO VLV FAILED
G	EN2	033764	050780	L	MV	B20		C	1	T		2E41-F006 INBOARD ISO.VLV FAILED TO CLOSE	WATER SHORTED OUT MOTOR OPERATOR WINDINGS
G	EN2	031318*	051480	L	MV	F26		C	2	N		RHR VLVS 2E11-F004D & F006D FAILED TO OPERATE	LOOSE & BROKEN LIMIT SWITCHS
G	EN2	031431A	053080	L	MV	A20		B	2	T		TORUS SUCTION VLVS 2E41-F041&42 FAILED TO OPEN	VALVE MOTORS SHORTED OUT(STEAM LEAK)
G	EN2	031555	060480	H	RM	A16		S	1	N		HPCI VLV 2E41-F003 COULD NOT BE OPENED	LOGIC CKT FAILED TO RESET
G	EN2	031842	071180	H	MV	A20		R	1	N		HPCI INJ VLV 2E41-F006 FAILED TO OPEN	MOTOR WINDING FAILURE,POSS.EXCEED.DUTY CY
G	EN2	032135	072480	H	RM	F16		U	1	N		HPCI VLV 2E41-F002 CLOSED WHEN REQUIRED OPEN	INADVERTANT SIGNAL, OPERATOR BUMPED RELAY
G	EN2	033210A	110480	L	RM	B23			1	T		2E11-F007A(RHR MINIMUM FLOW VLV) LEAKED DUE TO NOT	//BEING CLOSED. TORQUE SWITCHES ADJUSTED
G	FP1	015058	042076	H	MV	A20			1	T		HPCI TORUS SUCTION VALVE FAILED TO OPEN	SHORT IN OPERATOR MOTOR
G	FP1	015237	070376	L	MV	A20			1	T		RHR VALVE 10 MOV 25A FAILED TO OPEN	SUSPECT OPEN CIRCUIT IN MOTOR WINDINGS
G	FP1	016269	102676	L	MV	A20			1	T		RHR SYSTEM VALVE 10-MOV-24A WOULD NOT OPEN	VALVE MOTOR OPERATOR BURNED OUT

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	FP1	016497	111976	H	MV	A20			1		N	HPCI VALVE 23-MOV-57 FAILED TO OPEN	FAILURE OF VALVE MOTOR WINDINGS
G	FP1	017956	061177	H	MV	A00			1		T	VALVE 23 MOV 58 FAILED TO OPEN ON TEST SIGNAL	CAUSE UNKNOWN
G	FP1	021142	100477	L	MV	A23			1		T	LPCI MOV 25A FAILED TO OPEN ON TEST	LOW TORQUE SWITCH SETTING
G	FP1	019310	100877	H	MV	B23			1		T	HPCI STEAM ISOL VALVE FAILED TO CLOSE ELECTRICALLY	TORQUE SWITCH NEEDED ADJUSTMENT
G	FP1	021022	040678	L	MV	A16	S		1		N	RHR ISOLATION VALVE 10MOV18 INOPERABLE (CLOSED)	CONTROLLER AUXILIARY CONTACT FAILURE
G	FP1	021023	040878	H	MV	F12			1		T	VALVE 23MOV14 SEPERATED FROM OPERATOR	FAILURE OF MECHANICAL FASTENERS
G	FP1	021225	042978	H	MV	A23			1		N	HPCI 23-MOV-15 WOULD NOT OPEN	TORQUE SWITCH WAS RESET
G	FP1	021227	050878	D	MV	F02	C		1		M	POWER REMOVED FROM CORE SPRAY VALVE MOTOR	PERSONNEL ERROR
G	FP1	021712	062978	H	MV	B16	S		1		T	HPCI VALVE 23-MOV-15 FAILED TO CLOSE	DEFECTIVE TEMP SWITCH(NO SIGNAL TO CLOSE)
G	FP1	021924	072278	D	MV	B20			1		T	OUTBOARD INJECTION VALVE 14-MOV-11B FAILED TO CLOS	OPERATOR SHAFT KEY SHEARED
G	FP1	022329	090378	D	MV	A04			1		T	CORE SPRAY INJECTION VALVE 14-MOV-12B FAIL TO OPEN	DESIGN ERROR, DIFFERENTIAL PRESS.TOO HIGH
G	FP1	026344	062779	L	MV	A23			1		T	B LOOP LPCI INJECTION VALVE DID NOT OPEN	TORQUE SWITCH FAILURE
G	FP1	027006	090679	H	MV	A20			1		T	HPCI CONDENSATE STORAGE TANK SUCTION VALVE FAILED	MOTOR FAILURE
G	FP1	027872	122179	D	MV	A20			1		T	CS ISOLATION VALVE WOULD NOT REOPEN AFTER CLOSURE	MOTOR PINION GEAR LOOSE ON SHAFT
G	FP1	030081	010880	D	MV	F00			1		R	CORE SPRAY INJ VLV FAILED TO OPERATE PROPERLY	CAUSE NOT KNOWN
G	FP1	033799	010980	D	MV	A02			1		T	CORE SPRAY INJ VLV 14-MOV-12B FAILED TO OPEN	PERSONNEL ERROR IN ADJ LIMIT & TORQUE SW
G	FP1	030974	041080	H	MV	B20			1		T	HPCI MIN FLOW VLV FAILED TO CLOSE	COCKED BRUSH HOLDER ON DRIVE MOTOR
G	FP1	031016	041580	L	MV	A26			1		N	RHR VLV 10-MOV-67 FAILED TO OPEN	TORQUE BYPASS LIMIT SW SET IMPROPERLY
G	FP1	032007	041880	L	MV	B07			1		T	RHR VLV 10-MOV-67 FAILED TO FULLY CLOSE	"NORMAL WEAR & TEAR",SEAT,DISC,PACKING
G	FP1	032919	101180	L	MV	B02			1		N	CONT ISOL VLV 10-MOV-57 FAILED TO CLOSE	PERSONNEL ACCIDENTALLY DISENGAGED CLUTCH
G	FP1	033410	120880	H	MV	F23			1		T	HPCI STEAM SUPPLY VALVE FAILED TO OPERATE	TORQUE SWITCH FAILURE
G	MI1	016689	121876	L	MV	B23			1		T	CONDENSATE RETURN VAL 1-IC-4 FAILED TO CLOSE	TORQUE SW SET INCORRECTLY
G	MI1	019326	101277	F	RM	A00			1		N	TORUS SPRAY VLV FAILED TO OPEN ON SIGNAL	CAUSE OF OCCURRENCE IS UNKNOWN
G	MI1	027674	111579	L	MV	F16	S		1		T	LPCI INBOARD ISOLATION VALVE INOPERABLE	ELECTRICAL FAILURE IN MOTOR CONTROLLER
G	MO1	015026	060376	H	MV	B23			1		T	HPCI STM LINE ISO VAL FAILED TO CLOSE	TORQUE SW SETTING DRIFTED TOO LOW

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	MO1	015708	090276	F	MV	B12		R	1		N	VALVE MO-2008 FAILED TO OPEN	STEM CLAMP SET SCREWS SHEARED
G	MO1	018094	053077	L	MV	A16		T	1		T	"B" RHR INJECTION VALVE FAILED TO OPEN (MO-2013)	CONTACTOR IN CONT.CIRCUITRY DID NOT CLOSE
G	MO1	018955	082877	L	MV	A16		T	1		T	"B" RHR INJECTION VALVE FAILED TO OPEN (MO-2013)	CONTACTOR IN CONT.CIRCUITRY DID NOT CLOSE
G	MO1	019050	090977	F	MV	F04		R	1		N	VALVE MO 2009 FAILED TO OPERATE PROPERLY	SET CLAMP SCREWS UNDERSIZED
G	MO1	019158	092377	F	MV	F12		R	1		M	VALVE MO-2008 FOUND FAILED DURING MAINTENANCE	SEAT RING THREADS STRIPPED
G	MO1	023389	112178	L	MV	F16		S	1		N	MO-2014 LPCI "A" ADMISSION VALVE INOPERABLE	BLOWN FUSE IN CONTROL POWER CIRCUIT
G	MO1	026492	070879	L	MV	A26			1		N	TORUS COOLING INJECTION VLV MOTOR OPERATOR FAILED	LIMIT SWITCH DID NOT DEENERGIZE MOTOR
G	MO1	032221	072980	H	MV	F20			1		T	HPCI STEAM SUPPLY VLV FAILED TO OPERATE	FAILED MOTOR WINDINGS
G	NM1	014666	051576	L	MV	A20			1		M	SHUTDOWN COOL SYST ISO VALVE 38-02 FAIL TO OPEN	OPEN MOTOR WINDINGS
G	NM1	018299	063077	H	RM	F16		S	1		T	NO.12 INLET INSIDE IV-B(40-01)FAIL TO OPERATE	FAILURE OF ELECT CONTACTOR (CLOSING)
G	OC1	014413	040176	F	MV	A16		S	1		T	TORUS SPRAY VLV V-21-15 FAILED TO OPEN ON AUTO.SIG	MOTOR CONT.(MTR.BRKR. FAILED TO OPERATE)
G	OC1	015375	082076	F	MV	A16		S	1		T	VLV V-21-18 FAILED TO OPEN ON AUTO START SIGNAL	DEFECT.SWITCH IN VLV.MOTOR CONTROL
G	OC1	016486	111176	F	RM	A00			1		T	VALVE V-21-5 FAILED TO OPEN/CKT BRKR TRIPPED	CAUSE UNKNOWN / VLV OPENED HARD MANUALLY
G	OC1	016479	120176	D	MV	A16		T	1		T	CORE SPRAY ISO.VLV V-20-15 FAILED TO OPEN ON SIGNL	INTERMIT.GRND.SHRT.IN VLV.MTR.OPER.PWR.FE
G	OC1	017472	032377	D	MV	B16		T	1		T	CORE SPRAY ISO.VLV V-20-15 INOPERABLE IN OPEN POS.	VLV.MTR. OPERATOR BREAKER TRIPPED
G	OC1	018623*	072777	D	MV	A16		V	2		T	CORE SPRAY ISO.VLVS V-20-40 & V-20-15 FAILED TO F-	-ULLY OPEN//IMP.CKT.BRKR.OVERLOAD SETTING
G	OC1	019080	090877	D	MV	B16		T	1		T	CORE SPRAY ISO.VLV. V-20-15 FAILED TO CLOSE	DEFECTIVE CKT.BRKR. TO MOTOR
G	OC1	022576	091478	L	MV	A23			1		T	VALVE V-14-37 WOULD NOT OPEN,BKR TRIPPED	SET SCREW ON TORQUE SW LOOSTENED,SET DRFT
G	OC1	023144	120478	F	MV	A16		U	1		T	CONT SPRAY VALVE V-21-78 FAILED TO OPEN ON TESTING	BREAKER TO VALVE NOT RACKED IN PROPERLY
G	OC1	026709	080779	D	MV	F16		T	1		T	CORE SPRAY ISOLATION VALVE V-20-15 INOPERABLE	INADVERTENT VALVE CLOSE SIGNAL DURING OPE
G	PB2	013992	010776	L	MV	A20			1		T	MO-10-25B RHR INJECTION VLV FAILED TO OPEN	MOTOR ON VLV OVERHEATED AND DAMAGED WNDNG
G	PB2	013990	011576	L	MV	A20			1		T	RHR INJECTION VALVE MO-10-25A FAILED TO OPEN	MTR SHAFT TO PINION GEAR KEY SHEARED
G	PB2	015142	061876	L	MV	F12			1		T	RHR SD COOL SUCT ISO VAL MO-2-10-18 FAIL TO STROKE	VALVE STEM BENT
G	PB2	016390	110976	D	MV	B20			1		T	CORE SPRAY VALVE MO-26A FAILED TO CLOSE	MTR OPER GEAR TRAIN FAILED
G	PB2	019094	091377	H	MV	F16		S	1		T	HPCI TURB EXHAUST VAL MTR DAMAGED	SHORT IN VAL CONTROL CIRCUIT

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	PB2	026944	090579	L	RM	F02			1	N	BKR FOR 'A' RHR LOOP INJ VLV(MO-25A) OPENED	SWITCH HIT BY SCAFFOLDING/PERSONNEL ERROR
G	PB3	014C32	010576	D	MV	A16	S		1	N	MO-3-14-128(B CORE SPR.LP.INJ.VLV) FAILED TO OPEN	PROBLEM WITH MAGNET.TRIP DEVICE MTR. BRKR
G	PB3	014475	021776	L	MV	A16	S		1	U	RHR INJ. VLV.MO-10-25A FAILED TO FULLY OPEN	BROKEN WIRE TO OPENING TORQUE SWITCH
G	PB3	014471	030176	L	MV	B12	R		1	N	B RHR OUTBOARD INJECTION VLV MO-1548 FAIL.TO CLOSE	VLV DISC SEPARATED FROM VLV STEM
G	PB3	016476	112376	D	MV	B23			1	T	CORE SPR.B FULL FL.TST.RET.VLV FAILED TO CLOSE	TORQUE SWITCH SETTING WAS TOO LOW
G	PB3	018884	090277	H	MV	A09			1	T	HPCI SYS.VLV MO-3-23-41 FAILED TO FULLY OPEN	CORRODED VLV STEM DUE TO VLV PACKING LEAK
G	PB3	023062	111678	L	MV	A20	R		1	T	RHR VALVE MO154B FAILED TO OPEN ON TESTING	MOTOR & SEVERAL OPERATOR PARTS REPLACED
G	PB3	026763	010879	L	MV	F00			1	N	VALVE OPERATOR FAILURE ON MO16A CAUSED LOSS OF RHR	NO CAUSE GIVEN. RELEASE RATE EXCEEDED
G	PB3	031104	042180	L	MV	A05	R		1	T	LPCI VLV MO-3-10-25B FAILED TO OPEN ON TEST	WALWORTH 23-INCH IMPROPER INTERNAL CLEAR?
G	PB3	031740	060880	F	MV	B05	C		1	T	CONT SPRAY VLV MO-3-10-26B FAILED TO CLOSE	STEM LOCKING NUT NOT STAKED BACKED OUT
G	PB3	032270	080680	L	MV	A17			1	T	LPCI VLV MO-3-10-25A FAILED TO OPEN DURING TEST	THRUST BEARING IN LIMITORQUE OPER FAILED
G	PB3	033292	112480	H	RM	F23			1	T	HPCI VLV MO-3-23-1 KEPT DRIVING CLOSED ONCE AND //	FAILED TO CLOSE ANOTHER TIME. TORQUE SW.
G	PI1	018325	062077	L	MV	B12	R		1	N	VALVE MO-1001-36A FAILED TO CLOSE,RHR PUMP OPERAT	KEY WHICH PREVENTS STEM ROTATION SHEARED
G	PI1	019669	110477	L	MV	F20			1	N	MTR OPER FOR VAL MO-1001-18B OVERLOADED,BURNED OUT	WORN GEARS ALLOWED MTR TO RUN AFT VLV CL?
G	PI1	026427	062779	L	MV	F00	R		1	T	RHR VALVE 1001-36A INOPERABLE	CAUSE UNKNOWN
G	PI1	026760	072579	L	MV	A12	R		1	N	RHR VALVE MOV-1001-36B INOPERABLE	VALVE STEM GUIDE KEY SHEARED
G	PI1	027177	091979	L	MV	F12	R		1	T	RHR MOV-1001-36B FAILED TO OPERATE	ALLEN SCREW LOOSENED, STEM GUIDE SLIPPED
G	PI1	031177	051380	D	RM	A16	S		1	T	CORE SPRAY VLV 1402-24B FAILED TO OPEN	DIRTY CONTACT IN LOGIC CIRCUIT
G	PI1	032578	082580	D	RM	A19			1	T	MO 1400-24A FAILED TO OPEN(CORE SPRAY SYSTEM)	VLV LUBRICATED AND SUCCESSFULLY OPERATED
G	QC1	015257	070176	F	MV	F12			1	U	LOOP SPRAY VALVE FAILED TO OPERATE(MO-1-1001-23-B)	LOOSE BOLTS HOLDING OPERATOR TO VALVE
G	QC1	016162	090276	F	MV	B20			1	T	MOV FAILED TO CLOSE DURING TESTING(MO-1-1001-26-A)	EXCESS GREASE/COMPACTION/HYDRAULIC LOCK
G	QC1	019489	093077	D	MV	F05			1	T	CORE SPRAY VALVE 1-1402-25B FAILED TO OPERATE	CRACKED YOKE/PROB SINCE INSTALLATION
G	QC1	020264	111877	H	MV	A23			1	T	HPCI MOV 1-2301-4 FAILED TO OPEN DURING TESTING	MOV HAD DEFECTIVE TORQUE SWITCH
G	QC1	021436	050478	H	MV	B23			1	T	HPCI PMP SUCTION VLV MO-1-2301-6 WOULD NOT CLOSE	VLV.TORQUE SWITCH WAS WORN OUT
G	QC1	030440	020680	L	MV	F16	S		1	T	LPCI VLV MO-1-1001-36A FAILED TO OPERATE	POWER TRANSFORMER BURNED OUT(COMMAND)

REMOTE/MOTOR OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	QC1	030965	041080	L	MV	A23			1	T		LPCI MO-1-1001-36B FAILED TO OPEN ON TESTING	TORQUE SWITCH NEEDED ADJUSTMENT
G	QC2	019759	111477	D	MV	A08			1	T		CORE SPRAY MOV 2-1402-24B FAILED TO OPEN / TEST	STEM AND BONNET BADLY GALLED
G	QC2	021128	040478	L	RM	F16	S		1	N		VLV FOR FILL WTR TO LPCI DISCHARGE PIPE FAILED	NO POWER TO VLV,FUSE FAILED
G	QC2	025429	021179	L	MV	B16	S		1	T		RHR SUCTION ISOLATION VALVE FAILED TO CLOSE	STICKING CONTACTS IN CIRCUIT BREAKER
G	QC2	026557	071279	L	MV	A16	S		1	T		LPCI MOV THERMAL OVERLOAD TRIPPED	PROBABLE CAUSE-LOOSE CONNECTORS AT BREAKE
G	QC2	027100	090579	L	MV	F12			1	T		DRYWELL SPRAY VALVE TRIPPED BREAKER WHEN OPERATED	BROKEN BOLT IN VALVE MOTOR OPERATOR
G	QC2	027551	102679	L	RM	F00			1	T		2 C RHR PUMP SUCTION VLV MO2-100-7C BKR TRIPPED	NO APPARENT CAUSE FOUND
G	QC2	031189	042880	L	MV	B16	S		1	T		LPCI MOV 2-1001-36A FAILED TO CLOSE DURING TEST	PROBLEM IN CKT BRKR SUPPLYING PWR TO VLV
G	QC2	032779	091480	D	MV	A23			1	T		MO-2-1402-3A WOULD NOT OPEN (CORE SPRAY)	TEMPORARY STICKING OF TORQUE SWITCH
G	QC2	032967	101080	F	MV	A23			1	T		MO-2-1001-29A FAILED TO OPEN INITIALLY	DISC TO TIGHT,TORQUE SWITCH ADJUSTED
G	QC2	032968	101080	L	MV	A26			1	T		MO-2-1001-34A FAILED TO OPEN FULLY	LIMIT SWITCHES OUT OF ADJUSTMENT
G	QC2	033451	120380	H	MV	F20			1	N		HPCI INJECTION VLV MO-2-2301-8 FOUND INOPERABLE	SHORT IN MOTOR OPERATOR
G	QC2	033744	123080	L	MV	A16	S		1	N		RHR VLV MO-2-1001-34A FAILED TO OPEN	CORRODED CONTACTS IN AUX CONTACTOR
G	VY1	014230*	021776	L	MV	F01	C		2	N		RHR VLVS. 25A&B WOULD NOT STROKE ELECTRICALLY	PERSON.ERROR(MUST STRO.VLVS.MANUALLY 1ST)
G	VY1	014584*	051076	L	MV	A14	C		2	T		TWO 24 INCH MOVS (RHR-27A/B) FAILED TO OPEN / TEST	PACKING MAINTENANCE PROBLEM
G	VY1	015855	092076	L	MV	A00			1	T		LPCI MOV (RHR-25B) FAILED TO OPEN DURING TESTING	UNKNOWN/WALWORTH AND LIMITORQUE INVESTIG.
G	VY1	030837	040180	L	MV	A20			1	T		LPCI VLV 2-53B WOULDNT FULLY OPEN DURING TEST	LOOSE PINION GEAR ON LIMITORQUE OPERATOR
G	VY1	032649	093080	H	RM	F16	S		1	N		V23-19 HPCI PUMP DISCHARGE VLV LOST CONTROL POWER	OVERLOAD RELAY HAD TRIPPED NO CAUSE

REMOTE/MOTOR OPERATED VALVES - FAILURE TO REMAIN OPEN (PLUGGED)

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

ESTIMATES ARE BASED ON DATA WITH M = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 23, 24, 25, 27, 28, 29, 30, 31, 32, 35, 36, 37, 39, 40, 43, 44, 45, 49, 50, 52, 56, 58

THEY ARE SHOWN FOR FEWER VALUES OF M

P = (.000, .050, .169)

LAMBDA = (3.6E-21, 5.3E-08, 3.1E-07)

$LAMBDA_+$ = (8.2E-08, 3.6E-07, 7.9E-07)

OMEGA = (2.8E-10, 7.1E-08, 2.7E-07)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
1	(1.2E-06, 1.3E-03, 6.6E-04)	(1.5E-07, 4.8E-07, 1.4E-06)	
2	(6.2E-07, 6.4E-04, 3.3E-04)	(8.4E-08, 3.1E-07, 1.0E-06)	(.028, .219, .330)
3	(4.4E-07, 4.2E-04, 2.2E-04)	(5.8E-08, 2.5E-07, 8.9E-07)	(.035, .301, .452)
4	(3.5E-07, 3.2E-04, 1.6E-04)	(4.3E-08, 2.2E-07, 8.3E-07)	(.038, .366, .530)
24	(1.3E-07, 5.3E-05, 2.8E-05)	(7.8E-09, 1.5E-07, 7.2E-07)	(.034, .668, .828)
25	(1.3E-07, 5.1E-05, 2.7E-05)	(7.6E-09, 1.5E-07, 7.1E-07)	(.034, .670, .832)
30	(1.3E-07, 4.3E-05, 2.2E-05)	(6.9E-09, 1.5E-07, 7.1E-07)	(.032, .676, .853)
44	(1.1E-07, 2.9E-05, 1.5E-05)	(5.8E-09, 1.5E-07, 7.1E-07)	(.028, .675, .890)
58	(1.1E-07, 2.2E-05, 1.2E-05)	(5.1E-09, 1.4E-07, 7.1E-07)	(.026, .669, .912)
OVERALL	(1.1E-07, 5.3E-05, 6.6E-04)	(5.1E-09, 1.5E-07, 1.4E-06)	(.026, .669, .912)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
2	(7.1E-10, 8.1E-08, 2.9E-07)		
3	(5.8E-10, 7.8E-08, 2.8E-07)	(3.1E-10, 7.2E-08, 2.8E-07)	
4	(5.2E-10, 7.7E-08, 2.8E-07)	(3.1E-10, 7.2E-08, 2.7E-07)	(2.9E-10, 7.1E-08, 2.7E-07)
24	(3.7E-10, 7.4E-08, 2.8E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
25	(3.7E-10, 7.4E-08, 2.8E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
30	(3.6E-10, 7.4E-08, 2.8E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
44	(3.6E-10, 7.3E-08, 2.8E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
58	(3.6E-10, 7.3E-08, 2.8E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
OVERALL	(3.6E-10, 7.4E-08, 2.9E-07)	(2.9E-10, 7.2E-08, 2.8E-07)	(2.8E-10, 7.1E-08, 2.7E-07)

REMOTE/MOTOR OPERATED VALVES - FAILURE TO REMAIN OPEN (PLUGGED)
FAILURES ONLY
RATES ARE PER CALENDAR HOUR
TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)
LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

LAMBDA = (3.9E-18, 8.4E-09, 4.8E-08)
LAMBDA$_+$ = (2.8E-10, 7.1E-08, 2.7E-07)
OMEGA = (2.8E-10, 7.1E-08, 2.7E-07)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

REMOTE/MOTOR OPERATED VALVES - PLUGGED (FAILED TO REMAIN OPEN)

PLANT	HOURS	POP	NUMBER OF INDIV. FAULTS FAILRS/COM FLTS	NUMBER OF NONLETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY NONLETHAL SHOCKS FAILRS/COM FLTS	NUMBER OF LETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY LETHAL SHOCKS FAILRS/COM FLTS
AR1	43800	28	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CR3	34704	28	1 / 1	0 / 0	0 / 0	0 / 0	0 / 0
DR1	24944	22	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
DE1	43800	52	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DF2	43800	51	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DF3	43800	46	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RS1	43800	30	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TI1	28368	31	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TI2	8736	42	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
AR2	18120	63	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CC1	43800	31	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CC2	35784	31	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
FC1	43800	6	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MI2	43800	33	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MY1	43800	35	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PA1	43800	15	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0
SL1	41112	37	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PV1	40656	49	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DC1	43800	63	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DC2	24600	63	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
HN1	43800	28	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP2	43800	60	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP3	41472	66	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
JF1	29712	68	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
KF1	43800	41	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NA1	23976	48	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NA2	4872	48	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR1	43800	54	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR2	43800	54	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PT1	43800	42	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0

PT2	43800	42	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PG1	43800	47	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PD2	43800	37	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SA1	35496	39	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SE1	4320	16	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SD1	43800	26	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU1	43800	55	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU2	43800	55	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TR1	43800	41	0 / 1	0 / 1	0 / 2	0 / 0	0 / 0
TU3	43800	50	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TU4	43800	50	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
YR1	43800	28	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI1	43800	82	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI2	43800	82	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF1	43800	63	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF2	43800	63	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF3	39496	63	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BR1	37032	72	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BR2	43800	72	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CO1	43800	57	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DA1	43800	67	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DR2	43800	51	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DR3	43800	51	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
EN1	43800	68	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0
EN2	21816	67	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
FP1	43800	18	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MI1	43800	34	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MO1	43800	47	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NM1	43800	21	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
OC1	43800	42	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR2	43800	58	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR3	43800	58	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PI1	43800	47	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
QC1	43800	57	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0
QC2	43800	57	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
VY1	43800	56	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
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ALL	2609616	3104	1 / 5	0 / 2	0 / 3	0 / 0	0 / 0

REMOTE/MOTOR-OPERATED VALVES - FAILURE TO REMAIN OPEN (PLUGGED)

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	CR3	022361	081978	L	RM	G16		T	1		N	DHV-3 WEN CLOSED WHEN REQUIRED TO REMAIN OPEN	LOSS OF 120 VOLT AC VITAL BUS(INVERTER)
B	CR3	030667	030680	L	RM	G00			1		N	DECAY HEAT SUCTION ISO VLV DHV-3 CLOSED INADVERTEN	//TLY. NO CAUSE COULD BE FOUND
B	D81	032122	081380	L	RM	G16		V	1		N	DECAY HEAT ISO VLV DH-11 BEGAN CLOSING,STOPPED PMP	PERSONNEL FAILED TO BLOCK AUTO CLOS.SIGNL
C	PA1	020230	122377	H	MV	G16		T	1		T	MOV-3011(HPCI ISO.VLV) FAILED TO REMAIN OPEN	BAD SWITCH CAUSED CLOSING CONT.TO STICK
W	TR1	014504	022176	L	MV	G16		S	1		N	RHR VLV CLOSED WHEN IT WAS REQUIRED TO REMAIN OPEN	VOLT.FLUC.ON INSTRUMENT AC BUS
W	TR1	021068*	032078	L	MV	G16		U	2V		T	DEENERGIZING PROTECTION SYS CAUSED RHR VALVES TO--	--CLOSE//PROCEDURAL DEFICIENCY
G	EN1	015564	072076	L	RM	G16		S	1		T	RHR FLOW VALVE E11-F0078 FAILED TO STAY OPEN	DEFECTIVE SWITCH SUPPLYING SIGNAL TO VALV
G	QC1	018459	061177	H	RM	G16		S	1		T	HPCI PUMP INLET VALVE WOULD NOT STAY OPEN/TESTING	MALFUNCTION IN LOCAL VALVE CONT STAT CIRC

REMOTE/MOTOR OPERATED VALVES - IMPROPER VALVE CONFIGURATION

COMMON CAUSE COMMAND FAULTS ONLY

RATES ARE PER CALENDAR HOUR

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

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

ESTIMATES ARE BASED ON DATA WITH M = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 23, 24, 25, 27, 28, 29, 30, 31, 32, 35, 36, 37, 39, 40, 43, 44, 45, 49, 50, 52, 56, 58

THEY ARE SHOWN FOR FEWER VALUES OF M

P = (.019, .037, .058)

$LAMBDA_+$ = (1.8E-09, 3.1E-06, 1.3E-05)

OMEGA = (2.8E-10, 7.1E-08, 2.7E-07)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
1	(5.1E-08, 9.6E-05, 4.1E-04)	(3.4E-09, 3.3E-06, 1.3E-05)	
2	(2.6E-08, 4.9E-05, 2.1E-04)	(2.6E-09, 1.7E-06, 6.9E-06)	(.039, .061, .085)
3	(1.8E-08, 3.3E-05, 1.4E-04)	(2.4E-09, 1.2E-06, 4.7E-06)	(.067, .103, .145)
4	(1.3E-08, 2.5E-05, 1.1E-04)	(2.3E-09, 9.6E-07, 3.6E-06)	(.093, .142, .197)
24	(3.2E-09, 5.7E-06, 2.5E-05)	(3.1E-09, 3.4E-07, 9.4E-07)	(.378, .464, .516)
25	(3.1E-09, 5.6E-06, 2.4E-05)	(3.2E-09, 3.3E-07, 9.2E-07)	(.382, .467, .520)
30	(2.8E-09, 5.0E-06, 2.1E-05)	(3.2E-09, 3.1E-07, 8.4E-07)	(.380, .478, .540)
44	(2.3E-09, 4.1E-06, 1.8E-05)	(3.8E-09, 2.9E-07, 7.3E-07)	(.310, .470, .572)
58	(2.1E-09, 3.7E-06, 1.6E-05)	(4.0E-09, 2.7E-07, 6.8E-07)	(.244, .434, .584)
OVERALL	(2.1E-09, 5.7E-06, 4.1E-04)	(2.3E-09, 3.4E-07, 1.3E-05)	(.039, .464, .584)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
2	(4.1E-09, 1.3E-07, 4.1E-07)		
3	(3.3E-09, 1.1E-07, 3.6E-07)	(3.6E-10, 7.3E-08, 2.8E-07)	
4	(2.6E-09, 1.0E-07, 3.3E-07)	(3.4E-10, 7.3E-08, 2.8E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
24	(7.1E-10, 7.9E-08, 2.8E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
25	(6.9E-10, 7.9E-08, 2.8E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
30	(6.5E-10, 7.8E-08, 2.8E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
44	(5.8E-10, 7.7E-08, 2.8E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
58	(5.5E-10, 7.6E-08, 2.8E-07)	(2.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.1E-08, 2.7E-07)
OVERALL	(5.5E-10, 7.9E-08, 4.1E-07)	(2.9E-10, 7.2E-08, 2.8E-07)	(2.8E-10, 7.1E-08, 2.7E-07)

REMOTE/MOTOR OPERATED VALVES - IMPROPER VALVE CONFIGURATION

PLANT	HOURS	POP	NUMBER OF INDIV. FAULTS FAILRS/COM FLTS	NUMBER OF NONLETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY NONLETHAL SHOCKS FAILRS/COM FLTS	NUMBER OF LETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY LETHAL SHOCKS FAILRS/COM FLTS
AR1	43800	28	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CR3	34704	28	0 / 0	0 / 3	0 / 6	0 / 0	0 / 0
DR1	28944	22	0 / 0	0 / 1	0 / 2	0 / 0	0 / 0
DE1	43800	52	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DE2	43800	51	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DE3	43800	46	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PS1	43800	30	0 / 0	0 / 1	0 / 2	0 / 0	0 / 0
TI1	28368	31	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TI2	8736	42	0 / 0	0 / 1	0 / 2	0 / 0	0 / 0
AP2	19120	63	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
CC1	43800	31	0 / 0	0 / 2	0 / 3	0 / 0	0 / 0
CC2	35784	31	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
FC1	43800	6	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MI2	43800	33	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MY1	43800	35	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PA1	43800	15	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
SL1	41112	37	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BV1	40656	49	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
DC1	43800	63	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
DC2	24600	63	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
HN1	43800	28	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP2	43800	60	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP3	41472	66	0 / 0	0 / 1	0 / 2	0 / 0	0 / 0
JF1	29712	68	0 / 0	0 / 2	0 / 3	0 / 0	0 / 0
KF1	43800	41	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NA1	23976	48	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
NA2	4872	48	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR1	43800	54	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR2	43800	54	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PT1	43800	42	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0

PI2	43800	42	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
RG1	43800	47	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RO2	43800	37	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SA1	35496	39	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SE1	4320	16	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SO1	43800	26	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU1	43800	55	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU2	43800	55	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TP1	43800	41	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TU3	43800	50	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TU4	43800	50	0 / 0	0 / 1	0 / 2	0 / 0	0 / 0
YP1	43800	28	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI1	43800	82	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI2	43800	82	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF1	43800	63	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF2	43800	63	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF3	38496	63	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BR1	37C32	72	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
BR2	43800	72	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CO1	43800	57	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DA1	43800	67	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DR2	43800	51	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DR3	43800	51	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
EN1	43800	68	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
EN2	21816	67	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
FP1	43800	18	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MI1	43800	34	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MO1	43800	47	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NM1	43800	21	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
OC1	43800	42	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PA2	43800	58	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PA3	43800	58	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PI1	43800	47	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
QC1	43800	57	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
QC2	43800	57	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
VY1	43800	56	0 / 0	0 / 1	0 / 2	0 / 0	0 / 0
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ALL	2600616	3104	0 / 0	0 / 21	0 / 32	0 / 0	0 / 0

REMOTE/MOTOR OPERATED VALVES - IMPROPER VALVE CONFIGURATION

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	CR3	017322R	030777	H	RM	V01	U		2L	M		"B" LOOP OF HPI SYS. ISOL.CONT.TO T.S.FOR MAINTENC	PERSONNEL ERROR
B	CR3	017658	042177	G	RM	V01	V		2	N		SUCT.VLVS CAV-38646 FROM BORIC ACID STOR.TANK.SHUT	T.S.VIO./PERSONNEL ERROR/IMP.VLV LINEUP
B	CR3	023237	103078	G	RM	V01	V		2	N		CONC.BORIC ACID TK.DISC.VLVS.CAV38643 CLOSED;TS VI	PERSONNEL ERROR;IMPROPER VALVE LINEUP
B	D81	025520	030679	H	RM	V01	U		2	N		BORATED WTR STOR TANK ISO VLVS DH7A678 CLOSED WHEN	REQUIRED OPEN--PERSONNEL ERROR
B	RS1	019666	111177	H	MV	V04	U		2	T		VALVE LINE-UP INCORRECT//NEW VALVES WERE INSTALLED	--WITH OPEN/CLOSE INDICATION ATYPICAL
B	TI2	027456A	032879	B	RM	V00	U		2L	N		AUX FEEDWATER BLOCK VLVS DISCOVERED CLOSED	NO CONCLUSIVE CAUSE COULD BE FOUND
C	AR2	031374	040880	F	RM	V03	V		4	T		"A" TRAIN CONT. SPRAY ACCIDENTALLY INITIATED	PERSONNEL ERROR DURING TESTING
C	CC1	025619	041179	H	MV	V06	U		1	T		SI HDR ISO VLV SI-656 SHUT WHEN REQUIRED OPEN	DEFECTIVE PROCEDURES
C	CC1	026785	082879	L	MV	V01	U		2	T		SI-4145-MOV OPEN REQ SHUT,SI-4143-MOV SHUT REQ OPN	OPERATIONS PERSONNEL ERROR
C	PA1	032224	091980	H	RM	V03	U		1	N		CV-3031 WAS CLOSED AND THEN IMMEDIATELY OPENED	OPERATOR FAILED TO RELATE TEST REQUIRE.
W	BV1	027663	112779	H	MV	V01	U		1	M		HHSI PMP SUC VLV CH-115D ISO FOR MAINT WHEN REQ OP	PERSONNEL ERROR--2ND VLV ALSO SHUT
W	DC1	016648	121776	F	MV	V01	U		1	T		CONTAINMENT SPRAY PUMP SUCTION VALVE FOUND CLOSED	PERSONNEL LEFT VALVE SHUT AFTER A TEST
W	IP3	014604	042976	F	RM	V03	U		2L	T		INCRT.VLV LINUP FOR TEST,CNTMNT SPRY ACCID.TURN ON	PERSONNEL ERROR
W	JF1	020993	032578	B	MV	V02	U		2	N		TDAFP & TDAFP RECIRC BYPASS ISO VLVS OPEN	PERSONNEL ERROR
W	JF1	022629	091878	L	RM	V06	U		1	T		RHR PUMP SUCTION VLV 8701A CLOSED WHEN REQ. OPEN	INADEQUATE PROCEDURES
W	NA1	027593	110679	L	RM	V02	U		1	N		RHR INLET VLV MOV-1701 SHUT WHEN REQ. OPEN	MAINTENANCE PERSONNEL ERROR
W	PI2	018572	072877	H	MV	V01	U		1	N		MOV FOUND IN INTERMEDIATE POSITION/SINCE PREV TEST	PERSONNEL FAILED TO ASSURE FULLY OPEN
W	TU4	019421	091377	L	RM	V01	U		2	T		TWO VALVES INADVERTANTLY OPENED/RWST LEVEL DECREAS	PERSONNEL ERROR/POSSIBLE PROCEDURE PROBLE
G	BP1	029036	121979	L	MV	V01	U		1	N		RHR TORUS SUCTION VALVE FOUND SHUT	OPERATOR ERROR-FORGOT TO OPEN VALVE
G	QC2	021561	052178	D	RM	V01	U		1	N		ZA CORE SPRAY SUC.VLV. NO 2-1402-3A CLOSED WHEN R-	-EQUIRED TO BE OPEN//PERSONNEL ERROR
G	VY1	016997	011877	L	RM	V03	U		2L	T		"B" RHR PMP DISCH.VLVS. SHUT WHEN REQ. TO BE OPEN	PERSONNEL ERROR

Manually Operated Valves

Rates are estimated for three failure modes in manually operated valves: failure to open, close, or operate; failure to remain open (plugged); and improper valve configuration. Twenty-six LERs involve manually operated valves. Of these, 22 are reports of faults due to improper valve lineup and 4 are reports of failures to open, close, or operate. Any LER involving improper valve configuration is coded as a common cause event and as a command fault, rather than a failure. Therefore, the rates estimated in this mode are for common cause command faults. No LERs involve faults due to plugged valves or valves unable to remain open, so most quantities cannot be estimated for this mode. Summary tables of all the faults and brief one-line descriptions of the LERs follow the estimated rates.

MANUALLY OPERATED VALVES - FAILURE TO OPEN, CLOSE, OR OPERATE
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

LAMBDA = (1.2E-08, 3.3E-08, 6.1E-08)
LAMBDA$_t$ = (2.7E-10, 7.0E-08, 2.7E-07)
OMEGA = (2.7E-10, 7.0E-08, 2.7E-07)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

MANUALLY OPERATED VALVES - FAILURE TO REMAIN OPEN (PLUGGED)
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

λ = (1.4E-11, 3.6E-09, 1.4E-08)
λ_+ = (2.7E-10, 7.0E-08, 2.7E-07)
ω = (2.7E-10, 7.0E-08, 2.7E-07)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

MANUALLY OPERATED VALVES - IMPROPER VALVE CONFIGURATION

COMMON CAUSE COMMAND FAULTS ONLY

RATES ARE PER CALENDAR HOUR

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

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

ESTIMATES ARE BASED ON DATA WITH M = 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 38, 39, 40, 41, 42, 45, 46, 52, 53, 57, 72, 78

THEY ARE SHOWN FOR FEWER VALUES OF M

P = (.005, .016, .031)

$LAMBDA_+$ = (4.5E-11, 3.1E-06, 1.5E-05)

OMEGA = (2.7E-10, 7.0E-08, 2.7E-07)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
1	(3.1E-07, 2.5E-04, 1.2E-03)	(1.5E-10, 3.2E-06, 1.5E-05)	
2	(1.6E-09, 1.3E-04, 6.0E-04)	(1.3E-10, 1.7E-06, 7.7E-06)	(.024, .041, .060)
4	(7.9E-10, 6.5E-05, 3.1E-04)	(1.4E-10, 9.2E-07, 4.0E-06)	(.053, .090, .136)
25	(1.5E-10, 1.2E-05, 5.6E-05)	(9.4E-10, 2.9E-07, 8.5E-07)	(.266, .404, .495)
26	(1.5E-10, 1.1E-05, 5.4E-05)	(8.8E-10, 2.8E-07, 8.3E-07)	(.274, .413, .502)
36	(1.1E-10, 8.7E-06, 4.1E-05)	(1.3E-09, 2.5E-07, 6.8E-07)	(.337, .477, .556)
46	(9.6E-11, 7.2E-06, 3.4E-05)	(1.5E-09, 2.3E-07, 6.0E-07)	(.377, .514, .593)
78	(7.0E-11, 5.1E-06, 2.4E-05)	(2.0E-09, 2.1E-07, 4.9E-07)	(.365, .563, .668)
OVERALL	(7.0E-11, 1.2E-05, 1.2E-03)	(1.3E-10, 2.9E-07, 1.5E-05)	(.024, .413, .668)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
2	(1.6E-09, 9.5E-09, 3.2E-07)		
4	(1.0E-09, 8.2E-08, 2.9E-07)	(2.9E-10, 7.0E-08, 2.7E-07)	(2.7E-10, 7.0E-08, 2.7E-07)
25	(4.0E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.0E-08, 2.7E-07)	(2.7E-10, 7.0E-08, 2.7E-07)
26	(3.9E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.0E-08, 2.7E-07)	(2.7E-10, 7.0E-08, 2.7E-07)
36	(3.7E-10, 7.2E-08, 2.7E-07)	(2.8E-10, 7.0E-08, 2.7E-07)	(2.7E-10, 7.0E-08, 2.7E-07)
46	(3.5E-10, 7.1E-08, 2.7E-07)	(2.8E-10, 7.0E-08, 2.7E-07)	(2.7E-10, 7.0E-08, 2.7E-07)
78	(3.3E-10, 7.1E-08, 2.7E-07)	(2.7E-10, 7.0E-08, 2.7E-07)	(2.7E-10, 7.0E-08, 2.7E-07)
OVERALL	(3.3E-10, 7.2E-08, 3.2E-07)	(2.7E-10, 7.0E-08, 2.7E-07)	(2.7E-10, 7.0E-08, 2.7E-07)

MANUALLY OPERATED VALVES

PLANT	HOURS	POP	NUMBER OF INDIV. FAULTS FAILRS/COM FLTS	NUMBER OF NONLETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY NONLETHAL SHOCKS FAILRS/COM FLTS	NUMBER OF LETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY LETHAL SHOCKS FAILRS/COM FLTS
AR1	43800	39	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
CR3	34704	34	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
OB1	28944	24	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
OE1	43800	75	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
OE2	43800	77	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
OE3	43800	75	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RS1	43800	74	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TI1	28368	25	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TI2	8736	59	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
AR2	18120	42	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CC1	43800	49	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CC2	35784	49	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
FC1	43800	55	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MI2	43800	61	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
MY1	43800	87	1 / 0	0 / 2	0 / 4	0 / 0	0 / 0
PA1	43800	39	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
SL1	41112	59	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BV1	40656	38	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DC1	43800	91	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DC2	24600	91	0 / 0	0 / 2	0 / 2	0 / 0	0 / 0
HN1	43800	65	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP2	43800	73	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP3	41472	76	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
JF1	29712	94	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
KE1	43800	50	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NA1	23976	42	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NA2	4872	42	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR1	43800	42	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR2	43800	42	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
PT1	43800	74	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0

PT2	43800	74	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RG1	43800	64	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RO2	43800	77	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SA1	35496	85	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SE1	4320	110	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SO1	43800	39	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU1	43800	56	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU2	43800	56	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TR1	43800	58	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
TU3	43800	57	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TU4	43800	57	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
YR1	43800	56	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI1	43800	72	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI2	43800	72	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF1	43800	38	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
BF2	43800	38	0 / 0	0 / 2	0 / 2	0 / 0	0 / 0
BF3	38496	38	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BR1	37032	41	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
BR2	43800	41	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
CO1	43800	5	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
DA1	43800	34	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DR2	43800	44	0 / 0	0 / 1	0 / 2	0 / 0	0 / 0
DR3	43800	44	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
EN1	43800	40	0 / 0	0 / 4	0 / 7	0 / 0	0 / 0
EN2	21816	43	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
FP1	43800	33	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MI1	43800	71	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MO1	43800	52	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NM1	43800	28	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
OC1	43800	15	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PB2	43800	58	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PB3	43800	58	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PI1	43800	30	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
QC1	43800	39	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
QC2	43800	39	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
VY1	43800	51	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
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ALL	2600616	3536	6 / 0	0 / 22	0 / 28	0 / 0	0 / 0

MANUALLY OPERATED VALVES

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	AR1	015207	061276	H	XV	V06		U	1	N		VALVE SF-22 WAS NOT CLOSED(A SPILL RESULTED)	PROCEDURES WERE INADEQUATE
B	CR3	023095A	100478	I	XV	V03		U	1	T		ISOL VALVE TO FLOW CONTROLLER SHUT(SEE 023095)	PERSONNEL ERROR/VALVE REQUIRED TO BE OPEN
B	OE1	014808	041376	H	XV	F12			1	N		FLOOD TANK 1A NITROGEN ADD VLV FAILED OPEN	VAL STEM SEPERATED FROM DISK
B	OE2	019970	120877	F	XV	V01		U	1	N		ISO.VLV.TO CHAN.3 RB PRESS.TRANS.SHUT BY MISTAKE	PERSONNEL ERROR
C	MI2	031945	070380	O	XV	V06		U	1	T		HPSI PUMP MINIMUM FLOW VLV WAS SHUT	DEFECTIVE PROCEDURES,CAUSED PUMP SEIZURE
C	MY1	026274	060779	O	XV	A12			1	N		CS-14 "B" TRAIN SPRAY HEADER ISO.VLV WOULD NOT OPN	REMOTE LINKAGE DISCONNECT FROM HANDWHEEL
C	MY1	030804	031980	O	XV	V01		U	2	N		RHR VLVS RH-8 AND RH-10 FOUND OPENED AND UNLOCKED	PERSONNEL ERROR
C	MY1	031390	050780	O	XV	V03		U	2L	U		COOLING WATER IMPROP LINED UP TO S-CHARGING PUMP	PERSONNEL ERROR (SEPARATION NOT MAINTAIN)
C	PA1	032156	071980	O	XV	V03		U	1	N		INST. EQ. VLV NOT CLOSE AFTER CALIBRATION	PERSONNEL ERROR WHEN CAL. HPSI FLOW IND.
W	DC2	021079	041678	I	XV	V01		U	1	N		HANDWHEEL CAME OFF RHR VALVE POSITIONING IT WRONG	PERSONNEL FAILED TO REPOSITION THE VALVE
W	DC2	022838	101078	B	XV	V01		U	1	T		AUX FEED VALVE FOUND UNLOCKED & OPEN/WRONG LINE-UP	PERSONNEL ERROR
W	IP3	030696	031580	O	XV	A08			1	T		VC ISO VLV 869B(ISO SPRAY PUMP FROM CONT SPRAY HDR	DION'T OPEN.KEY FAILURE IN YOKE NUT BUSH.
W	PR2	017889	051977	B	XV	V06		U	1	U		PUMP INLET VALVE FOUND NEARLY SHUT/AUX FEED INLET	POSITION REQUIREMENT WILL GO ON CHECKLIST
W	TR1	019580	101677	I	XV	V01		U	1	N		RHR DISCHARGE VLV (87288) FOUND LOCKED CLOSED	PERSONNEL ERROR/IMPROPER VALVE LINEUP
G	BF1	016053	092376	O	XV	V02		U	1	U		VALVE FOUND CLOSED TO PRESSURE SWITCH	PERSONNEL ERROR
G	BF2	016199	100776	H	XV	V03		U	1	T		EQUALIZER VALVE ON FLOW INSTRUMENT FOUND OPEN	PERSONNEL ERROR
G	BF2	021782	062778	H	XV	V01		U	1	T		VALVE LEFT SHUT IN LUB OIL LINE TO HPCI PUMP	PERSONNEL ERROR IN VALVE LINE UP
G	BR1	030407	021480	H	XV	V01		V	1	T		MANUAL ISOL VLV LOW SIDE OF 1E41LS15A FOUND CLOSED	PERSONNEL ERROR (WHEN UNDETERMINED)
G	BR2	014647	020576	L	XV	V03		U	1	M		PRESS SW FOUND ISOLATED AFTER TESTING	PERSONNEL ERROR
G	CO1	020806A	020778	H	XV	V03		V	1	T		ISOLATION VALVE TO DPIS-76 FOUND CLOSED(SEE020806)	PERSONNEL ERROR
G	DA1	015991	092876	H	XV	C00			1	T		HPCI TURB STM LINE HI FLO EQUALIZING VALVE LEAKS	CAUSE UNKNOWN
G	DR2	021158	042878	L	XV	V01		U	2L	N		VALVES IN LPCI & CORE SPRAY LINED UP IMPROPERLY	OPERATING PERSONNEL ERROR
G	EN1	017096	011777	L	XV	V03		U	1	U		PRESS SW FOUND VALVED OUT WHEN REQUIRED OPEN	PERSONNEL ERROR
G	EN1	031157	051080	L	XV	V03		U	2	N		TWO COOLING WTR VLVS TO PUMPS A & B FOUND CLOSED	PERSONNEL ERROR
G	EN1	031521	062280	L	XV	V01		U	2	T		RHR MIN FLOW VLVS E11-F0188 & D FOUND CLOSED	PERSONNEL ERROR

MANUALLY OPERATED VALVES

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	EN1	0317694	071180	L	XV	V01		U	2L	N	COOLING WATER VLV SECURED WHEN REQUIRED OPEN	PERSONNEL ERROR
G	M01	023390	112478	[illegible]	XV	C25			1	N	HPCI DRAIN VALVE CV-2043 LEAKING THRU INTERNALLY	INTERNAL PARTS NEED REPLACEMENT
G	VY1	019854	110177	D	XV	F08			1	T	MANIFOLD BYPASS VALVE FAILED TO OPERATE	GALLED THREADS/STEM SEIZED

PWR Safety and BWR Relief Valves

There are 9 LERs on PWR safety valves and 71 LERs on BWR relief valves. For both types of valves, rates are estimated for failure to open, failure to close, and internal leakage. No common cause events were reported for safety valves or for failures to close in relief valves, so most quantities cannot be estimated in these cases. Although rates are not estimated for failure to operate or improper valve lineup, events involving these modes are included in the summary tables of faults and in the one-line descriptions.

PWR SAFETY VALVES - FAILURE TO OPEN
ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS
RATES ARE PER ESTIMATED DEMAND
TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)
LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

LAMBDA = (1.1E-05, 4.4E-03, 1.8E-02)
LAMBDA$_+$ = (3.0E-06, 7.5E-04, 2.9E-03)
OMEGA = (3.0E-06, 7.5E-04, 2.9E-03)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

PWR SAFETY VALVES - FAILURE TO CLOSE

ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS

RATES ARE PER ESTIMATED DEMAND

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

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

LAMBDA = (1.1E-06, 2.8E-04, 1.1E-03)

LAMBDA$_+$ = (3.0E-06, 7.5E-04, 2.9E-03)

OMEGA = (3.0E-06, 7.5E-04, 2.9E-03)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

PWR SAFETY VALVES - INTERNAL LEAKAGE

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

LAMBDA = (1.2E-20, 1.2E-06, 7.0E-06)

LAMBDA = (1.2E-09, 3.0E-07, 1.1E-06)

OMEGA^{+} = (1.2E-09, 3.0E-07, 1.1E-06)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

PWR SAFETY VALVES

PLANT	HOURS	POP	NUMBER OF INDIV. FAULTS FAILRS/COM FLTS	NUMBER OF NONLETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY NONLETHAL SHOCKS FAILRS/COM FLTS	NUMBER OF LETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY LETHAL SHOCKS FAILRS/COM FLTS
AR1	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CR3	34704	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DB1	28944	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DE1	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DE2	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DE3	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RS1	43800	2	3 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TI1	28368	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TI2	8736	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
AR2	18120	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CC1	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
CC2	35784	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
FC1	43800	2	1 / 0	0 / 1	0 / 2	0 / 0	0 / 0
MI2	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MY1	43800	3	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PA1	43800	3	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SL1	41112	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BV1	40656	3	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DC1	43800	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DC2	24600	3	0 / 0	0 / 1	0 / 1	0 / 0	0 / 0
HN1	43800	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP2	43800	3	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
IP3	41472	3	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
JF1	29712	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
KE1	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NA1	23976	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
NA2	4872	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR1	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PR2	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PT1	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0

PT2	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RG1	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RD2	43800	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SA1	35496	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SE1	4320	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SO1	43800	2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU1	43800	3	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
SU2	43800	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TR1	43800	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TU3	43800	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
TU4	43800	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
YR1	43800	2	2 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI1	43800	3	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
ZI2	43800	3	0 / 0	0 / 1	0 / 2	0 / 0	0 / 0
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ALL	1671072	111	14 / 0	0 / 3	0 / 5	0 / 0	0 / 0

PWR SAFETY VALVES

WEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	RS1	0217468	061178	K	RV	C00			3	T		2 SAFETY,1 ELECTRO RV LEAKING THRU DURING TESTING	UNKNOWN/2 REPLACED,1 REBUILT
C	FC1	019551	102677	K	RV	A00	R		1	M		VALVE RC-142 RELIEF PRESSURE OUT SPEC HIGH	COULD NOT BE DETERMINED
C	FC1	023171	122078	K	RV	V06	U		2	M		TWO PRESS OP RELIEF VALVES OPENED WHEN REQ CLOSED	TECH PULLED FUSES,DEFECTIVE PROCEDURES
C	MY1	022141	081578	K	RV	A00			1	M		PRESSURIZER RV PR-S-13 SETPOINT OUT OF SPEC	CAUSE UNKNOWN,SETPOINT ADJUSTED
C	PA1	0273658	101279	K	RV	A12			1	T		RV1039(PZR RELIEF VLV) SET PRESSURE FOUND HIGH	ALIGNMENT PIN FOUND MISPOSITION
W	BV1	033542*	121880	K	RV	F00	R		2V	U		PLANT SHUT DOWN TO REPAIR PZR SAFETY VLVS	CAUSE NOT GIVEN
W	OC2	022581	092278	K	RV	V01	U		1	T		PRESSURIZER RV OPENED WHEN REQUIRED TO BE CLOSED	PERSONNEL ERROR
W	IP2	018788A	051377	K	RV	A00	R		1	T		RV PCV-468 DID NOT OPEN AT SETPOINT PRESSURE	SET POINT DRIFT
W	IP2	018788B	051377	K	RV	C25			1	T		INTERNAL LEAKAGE PAST VALVE PCV-466	EXCESSIVE VALVE SEAT WEAR
W	IP3	033011A	101780	K	RV	C25			1	T		PCV-466 WOULD NOT RELEASE AT SET PRESSURE & LEAKED	VALVE SEAT AND DISK HAD GROOVES
W	SU1	0168828	111376	K	RV	A00	R		1	T		PRESS SAFETY VLV (SV15518) OPENED AT HI PRESS	UNKNOWN/ "SETPOINT DRIFT" UP
W	YR1	018419*	062777	K	RV	A00			2	T		PRESSURIZER SAFETY VALVES (101/102) FAILED TO OPEN	UNKNOWN/SETPOINT DRIFTED HIGH/DRESSER INC
W	ZI2	031625	061880	K	RV	V06	U		2	N		IMPROPER VLV LINE UP MADE PORVS INOPERABLE	PROCEDURE CHANGED TO BLOCK THE VLVS OPEN

BWR RELIEF VALVES - FAILURE TO OPEN

ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS

RATES ARE PER ESTIMATED DEMAND

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

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

P = (.079, .256, .471)

LAMBDA = (1.8E-05, 1.9E-02, 7.7E-02)

$LAMBDA_+$ = (1.1E-06, 4.8E-03, 2.1E-02)

OMEGA = (2.4E-06, 6.1E-04, 2.4E-03)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
3	(2.0E-06, 1.1E-02, 4.6E-02)	(5.1E-04, 2.1E-02, 8.2E-02)	(.002, .095, .493)
4	(1.7E-06, 8.7E-03, 3.8E-02)	(5.0E-04, 2.1E-02, 8.1E-02)	(.002, .095, .501)
5	(1.5E-06, 7.6E-03, 3.3E-02)	(5.0E-04, 2.1E-02, 8.1E-02)	(.002, .091, .500)
6	(1.4E-06, 7.0E-03, 3.0E-02)	(5.0E-04, 2.1E-02, 8.1E-02)	(.002, .085, .496)
8	(1.3E-06, 6.2E-03, 2.7E-02)	(5.0E-04, 2.1E-02, 8.1E-02)	(.002, .071, .482)
9	(1.2E-06, 5.9E-03, 2.6E-02)	(4.9E-04, 2.1E-02, 8.1E-02)	(.002, .066, .471)
11	(1.2E-06, 5.6E-03, 2.5E-02)	(4.9E-04, 2.0E-02, 8.1E-02)	(.001, .056, .446)
OVERALL	(1.2E-06, 7.0E-03, 4.6E-02)	(4.9E-04, 2.1E-02, 8.2E-02)	(.001, .085, .501)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
3	(2.5E-05, 1.2E-03, 4.0E-03)	(9.9E-06, 8.0E-04, 2.8E-03)	
4	(2.3E-05, 1.1E-03, 3.8E-03)	(8.9E-06, 7.8E-04, 2.7E-03)	(4.6E-06, 6.8E-04, 2.5E-03)
5	(2.2E-05, 1.1E-03, 3.6E-03)	(8.3E-06, 7.7E-04, 2.7E-03)	(4.4E-06, 6.7E-04, 2.5E-03)
6	(2.1E-05, 1.0E-03, 3.6E-03)	(8.0E-06, 7.6E-04, 2.7E-03)	(4.3E-06, 6.7E-04, 2.5E-03)
8	(1.9E-05, 1.0E-03, 3.5E-03)	(7.6E-06, 7.6E-04, 2.7E-03)	(4.2E-06, 6.7E-04, 2.5E-03)
9	(1.9E-05, 1.0E-03, 3.5E-03)	(7.4E-06, 7.5E-04, 2.7E-03)	(4.2E-06, 6.7E-04, 2.5E-03)
11	(1.8E-05, 1.0E-03, 3.4E-03)	(7.3E-06, 7.5E-04, 2.7E-03)	(4.2E-06, 6.7E-04, 2.5E-03)
OVERALL	(1.8E-05, 1.0E-03, 4.0E-03)	(7.3E-06, 7.6E-04, 2.8E-03)	(4.2E-06, 6.7E-04, 2.5E-03)

AWR RELIEF VALVES - FAILURE TO OPEN

FAILURES ONLY

RATES ARE PER ESTIMATED DEMAND

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

LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

P = (.079, .256, .471)

LAMBDA = (3.2E-06, 1.4E-02, 6.4E-02)

LAMBDA$_+$ = (1.3E-03, 4.3E-03, 8.6E-03)

OMEGA = (2.4E-06, 6.1E-04, 2.4E-03)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
3	(2.2E-03, 9.5E-03, 2.3E-02)	(1.4E-03, 1.7E-02, 7.0E-02)	(.008, .158, .520)
4	(1.9E-03, 7.9E-03, 1.9E-02)	(1.2E-03, 1.7E-02, 7.0E-02)	(.008, .158, .529)
5	(1.8E-03, 6.9E-03, 1.6E-02)	(1.1E-03, 1.6E-02, 7.0E-02)	(.007, .147, .532)
6	(1.7E-03, 6.3E-03, 1.4E-02)	(1.0E-03, 1.6E-02, 7.0E-02)	(.006, .133, .534)
8	(1.5E-03, 5.5E-03, 1.2E-02)	(9.5E-04, 1.6E-02, 7.0E-02)	(.004, .108, .528)
9	(1.5E-03, 5.3E-03, 1.1E-02)	(9.2E-04, 1.6E-02, 7.0E-02)	(.003, .098, .522)
11	(1.5E-03, 5.0E-03, 1.1E-02)	(8.8E-04, 1.6E-02, 7.0E-02)	(.002, .083, .504)
OVERALL	(1.5E-03, 6.3E-03, 2.3E-02)	(8.8E-04, 1.6E-02, 7.0E-02)	(.002, .133, .534)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
3	(7.6E-05, 1.1E-03, 3.1E-03)	(1.2E-05, 7.8E-04, 2.6E-03)	
4	(5.8E-05, 1.1E-03, 3.0E-03)	(1.0E-05, 7.6E-04, 2.6E-03)	(4.7E-06, 6.7E-04, 2.4E-03)
5	(4.8E-05, 1.0E-03, 2.9E-03)	(9.4E-06, 7.5E-04, 2.5E-03)	(4.5E-06, 6.7E-04, 2.4E-03)
6	(4.3E-05, 1.0E-03, 2.9E-03)	(8.9E-06, 7.5E-04, 2.5E-03)	(4.4E-06, 6.7E-04, 2.4E-03)
8	(3.7E-05, 9.8E-04, 2.9E-03)	(8.4E-06, 7.4E-04, 2.5E-03)	(4.3E-06, 6.6E-04, 2.4E-03)
9	(3.5E-05, 9.8E-04, 2.9E-03)	(8.2E-06, 7.4E-04, 2.5E-03)	(4.3E-06, 6.6E-04, 2.4E-03)
11	(3.2E-05, 9.7E-04, 2.9E-03)	(8.0E-06, 7.4E-04, 2.5E-03)	(4.2E-06, 6.6E-04, 2.4E-03)
OVERALL	(3.2E-05, 1.0E-03, 3.1E-03)	(8.0E-06, 7.5E-04, 2.6E-03)	(4.2E-06, 6.7E-04, 2.4E-03)

BWR RELIEF VALVES - FAILURE TO CLOSE
ALL FAULTS - BOTH FAILURES AND COMMAND FAULTS
RATES ARE PER ESTIMATED DEMAND
TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)
LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

LAMBDA = (2.2E-03, 3.3E-03, 4.5E-03)
$LAMBDA_+$ = (2.4E-06, 6.1E-04, 2.4E-03)
OMEGA = (2.4E-06, 6.1E-04, 2.4E-03)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

BWR RELIEF VALVES - FAILURE TO CLOSE
FAILURES ONLY
RATES ARE PER ESTIMATED DEMAND
TRIPLE OF NUMBERS SHOWS (LOWER BOUND, POINT ESTIMATE, UPPER BOUND)
LOWER AND UPPER BOUNDS FORM 90 PERCENT INTERVAL

LAMBDA = (2.1E-03, 3.1E-03, 4.4E-03)
LAMBDA' = (2.4E-06, 6.1E-04, 2.4E-03)
OMEGA = (2.4E-06, 6.1E-04, 2.4E-03)

NO DATA WERE OBSERVED FOR ESTIMATING OTHER QUANTITIES

BWR RELIEF VALVES - INTERNAL LEAKAGE

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 = (.002, .159, .498)

LAMBDA = (7.1E-20, 2.7E-06, 1.6E-05)

LAMBDA$_+$ = (1.9E-07, 1.6E-06, 4.2E-06)

OMEGA = (2.1E-09, 5.4E-07, 2.1E-06)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
3	(4.9E-07, 4.2E-04, 2.2E-04)	(2.9E-07, 3.9E-06, 2.0E-05)	(.010, .416, .832)
4	(4.2E-07, 3.1E-04, 1.6E-04)	(2.4E-07, 3.8E-06, 2.0E-05)	(.010, .471, .852)
5	(3.8E-07, 2.5E-04, 1.3E-04)	(2.3E-07, 3.7E-06, 2.0E-05)	(.009, .497, .877)
6	(3.5E-07, 2.1E-04, 1.1E-04)	(1.8E-07, 3.6E-06, 2.0E-05)	(.009, .508, .901)
8	(3.2E-07, 1.6E-04, 8.2E-05)	(1.5E-07, 3.6E-06, 2.0E-05)	(.008, .508, .941)
9	(3.1E-07, 1.4E-04, 7.3E-05)	(1.4E-07, 3.6E-06, 2.0E-05)	(.007, .502, .957)
11	(2.9E-07, 1.1E-04, 6.0E-05)	(1.2E-07, 3.6E-06, 2.0E-05)	(.006, .490, .984)
OVERALL	(2.9E-07, 2.1E-04, 2.2E-04)	(1.2E-07, 3.6E-06, 2.0E-05)	(.006, .497, .984)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
3	(7.3E-09, 6.6E-07, 2.3E-06)	(3.4E-09, 5.8E-07, 2.1E-06)	
4	(6.4E-09, 6.5E-07, 2.2E-06)	(3.3E-09, 5.8E-07, 2.1E-06)	(2.6E-09, 5.6E-07, 2.1E-06)
5	(5.9E-09, 6.4E-07, 2.2E-06)	(3.2E-09, 5.8E-07, 2.1E-06)	(2.6E-09, 5.6E-07, 2.1E-06)
6	(5.6E-09, 6.3E-07, 2.2E-06)	(3.2E-09, 5.7E-07, 2.1E-06)	(2.6E-09, 5.6E-07, 2.1E-06)
8	(5.2E-09, 6.3E-07, 2.2E-06)	(3.1E-09, 5.7E-07, 2.1E-06)	(2.6E-09, 5.5E-07, 2.1E-06)
9	(5.1E-09, 6.3E-07, 2.2E-06)	(3.1E-09, 5.7E-07, 2.1E-06)	(2.6E-09, 5.5E-07, 2.1E-06)
11	(4.9E-09, 6.2E-07, 2.2E-06)	(3.1E-09, 5.7E-07, 2.1E-06)	(2.6E-09, 5.5E-07, 2.1E-06)
OVERALL	(4.9E-09, 6.3E-07, 2.3E-06)	(3.1E-09, 5.7E-07, 2.1E-06)	(2.6E-09, 5.6E-07, 2.1E-06)

BWR RELIEF VALVES - INTERNAL LEAKAGE

FAILURES ONLY

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, .159, .488)

LAMBDA = (7.1E-20, 2.7E-06, 1.6E-05)

LAMBDA$_+$ = (1.9E-07, 1.6E-06, 4.2E-06)

OMEGA = (2.1E-09, 5.4E-07, 2.1E-06)

SYSTEM SIZE M	SHOCK RATE MU	RATE FOR SPECIFIC COMPONENT R1	BETA FACTOR
3	(4.9E-07, 4.2E-04, 2.2E-04)	(2.7E-07, 3.9E-06, 2.0E-05)	(.010, .416, .632)
4	(4.2E-07, 3.1E-04, 1.6E-04)	(2.1E-07, 3.8E-06, 2.0E-05)	(.010, .471, .652)
5	(3.8E-07, 2.5E-04, 1.3E-04)	(1.9E-07, 3.7E-06, 2.0E-05)	(.009, .497, .677)
6	(3.5E-07, 2.1E-04, 1.1E-04)	(1.6E-07, 3.6E-06, 2.0E-05)	(.009, .508, .701)
8	(3.2E-07, 1.6E-04, 8.2E-05)	(1.3E-07, 3.6E-06, 2.0E-05)	(.008, .508, .741)
9	(3.1E-07, 1.4E-04, 7.3E-05)	(1.2E-07, 3.6E-06, 2.0E-05)	(.007, .502, .757)
11	(2.9E-07, 1.1E-04, 6.0E-05)	(1.1E-07, 3.6E-06, 2.0E-05)	(.006, .490, .784)
OVERALL	(2.9E-07, 2.1E-04, 2.2E-04)	(1.1E-07, 3.6E-06, 2.0E-05)	(.006, .497, .784)

SYSTEM SIZE M	RATE FOR SET OF K SPECIFIC COMPONENTS R2	R3	R4
3	(7.3E-09, 6.6E-07, 2.3E-06)	(3.4E-09, 5.8E-07, 2.1E-06)	
4	(6.4E-09, 6.5E-07, 2.2E-06)	(3.3E-09, 5.8E-07, 2.1E-06)	(2.6E-09, 5.6E-07, 2.1E-06)
5	(5.9E-09, 6.4E-07, 2.2E-06)	(3.2E-09, 5.8E-07, 2.1E-06)	(2.6E-09, 5.6E-07, 2.1E-06)
6	(5.6E-09, 6.3E-07, 2.2E-06)	(3.2E-09, 5.7E-07, 2.1E-06)	(2.6E-09, 5.6E-07, 2.1E-06)
8	(5.2E-09, 6.3E-07, 2.2E-06)	(3.1E-09, 5.7E-07, 2.1E-06)	(2.6E-09, 5.5E-07, 2.1E-06)
9	(5.1E-09, 6.3E-07, 2.2E-06)	(3.1E-09, 5.7E-07, 2.1E-06)	(2.6E-09, 5.5E-07, 2.1E-06)
11	(4.9E-09, 6.2E-07, 2.2E-06)	(3.1E-09, 5.7E-07, 2.1E-06)	(2.6E-09, 5.5E-07, 2.1E-06)
OVERALL	(4.9E-09, 6.3E-07, 2.3E-06)	(3.1E-09, 5.7E-07, 2.1E-06)	(2.6E-09, 5.6E-07, 2.1E-06)

BWR RELIEF VALVES

PLANT	HOURS	POP	NUMBER OF INDIV. FAULTS FAILRS/COM FLTS	NUMBER OF NONLETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY NONLETHAL SHOCKS FAILRS/COM FLTS	NUMBER OF LETHAL SHOCKS FAILRS/COM FLTS	VALVES AFFECTED BY LETHAL SHOCKS FAILRS/COM FLTS
BF1	43800	11	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF2	43800	11	7 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BF3	38496	11	10 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BR1	37032	9	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0
BR2	43800	9	3 / 2	0 / 0	0 / 0	0 / 0	0 / 0
CO1	43800	8	1 / 0	1 / 0	1 / 0	0 / 0	0 / 0
DA1	43800	6	20 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DR2	43800	5	5 / 0	0 / 0	0 / 0	0 / 0	0 / 0
DR3	43800	5	7 / 0	1 / 0	1 / 0	0 / 0	0 / 0
EN1	43800	9	10 / 0	0 / 0	0 / 0	0 / 0	0 / 0
EN2	21816	11	17 / 0	1 / 0	3 / 0	0 / 0	0 / 0
FP1	43800	9	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MI1	43800	3	3 / 0	0 / 0	0 / 0	0 / 0	0 / 0
MO1	43800	4	1 / 1	0 / 0	0 / 0	0 / 0	0 / 0
NM1	43800	6	0 / 3	0 / 0	0 / 0	0 / 0	0 / 0
OC1	43800	4	2 / 1	1 / 0	1 / 0	0 / 0	0 / 0
PB2	43800	11	3 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PB3	43800	11	2 / 1	0 / 0	0 / 0	0 / 0	0 / 0
PI1	43800	3	6 / 2	0 / 0	0 / 0	0 / 0	0 / 0
QC1	43800	5	5 / 3	0 / 0	0 / 0	0 / 0	0 / 0
QC2	43800	5	8 / 2	0 / 0	0 / 0	0 / 0	0 / 0
VY1	43800	4	3 / 0	1 / 0	3 / 0	0 / 0	0 / 0
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ALL	929544	160	113 / 15	5 / 0	9 / 0	0 / 0	0 / 0

BWR RELIEF VALVES

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	BF1	017525	042177	K	RV	B27		R	1	N		MN.STM.SAFE.RELIEF VLV. FAILED TO RESEAT	SEVERE STM.CUTS ON PILOT DISC
G	BF2	020380	020578	K	RV	B00		R	1	N		RELIEF VALVE 2-1-41 OPENED AND FAILED TO RESEAT	CAUSE OF MALFUNCTION UNKNOWN
G	BF2	020469	021378	K	RV	B00		R	1	N		RELIEF VALVE 2-1-5 OPENED AND FAILED TO RESEAT	CAUSE OF MALFUNCTION UNKNOWN
G	BF2	032705*	092980	K	RV	F00		R	5	T		5 MS RELIEF VLVS FAILED TO ACTUATE AT PROPER PRESS	NO CAUSE STATED SET PRESS WAS RESET
G	BF3	020923	041578	K	RV	B00		R	1	N		RELIEF [illegible]-1-31 FAILED TO RESEAT AT PROPER PRESSURE	CAUSE OF MALFUNCTION IS NOT KNOWN
G	BF3	022126A	081778	K	RV	B00		R	1	N		A MAIN STM RELIEF VLV DID NOT CLOSE AFTER LIFTING	CAUSE OF FAILURE NOT GIVEN
G	BF3	033640*	121080	K	RV	F00		R	8	T		8 MS RVS FAILED TO ACTUATE AT REQUIRED PRESS(TEST)	CAUSE NOT PRECISELY KNOWN(RESET ADJUSTMT)
G	BR1	020771	031378	K	RV	B27		R	1	N		RELIEF VLV B21-F013F FAILED TO RESEAT AT REQ.PRESS	DEFECTIVE PILOT VLV/PILOT REPLACED
G	BR2	018697	071577	K	RV	B16		S	1	N		SAFETY REL.VLV B21-F013B STUCK OPEN;AFTER MAN.OPEN	GRND. ON SOLENOID ASS. FOR REMOTE ACTUATR
G	BR2	025638A	032079	K	RV	A27		R	2	T		2B21-F013H&013B SET POINTS FOUND DRIFTED HIGH	SETPOINT DRIFT OF PILOT VALVES
G	BR2	026626	071779	K	RV	F27			1	N		SAFETY RELIEF VALVE F013E LIFTED & RESET-SPURIOUS	EXCESSIVE PILOT VALVE ASSEMBLY LEAKAGE
G	BR2	032662	091080	K	RV	A16		S	1	T		ADS RV 2-B21-F013E FAILED TO ACTUATE AS REQUIRED	BROKEN WIRE IN SOLENOID COIL(COMMAND FLT)
G	CO1	014936	051476	K	RV	A27			1	M		MAIN STEAM SAFETY RELIEF VALVE MALFUNCTIONING	CRACK IN BELLOWS TO BASE WELD
G	CO1	015873	081376	K	RV	A02		C	1	R		SETPOINT OF MS-RV-71E ADJUSTED INCORRECTLY	INCORRECT MAINTENANCE PROCEDURE
G	DA1	014445*	033176	K	RV	C27			6	T		SIX RELIEF VALVES LEAKING INTERNALY	EXCESS STEAM CUTTING ON PILOT VALVE SEAT
G	DA1	017631*	032877	K	RV	A27			6	T		6 MAIN STEAM RV DID NOT LIFT AT PROPER PRESSURE	FAILURE OF PILOT VALVE TO OPERATE
G	DA1	021169*	040378	K	RV	A00			4	T		SETPOINTS OUT OF SPEC ON 1 SAFTEY+3 RELIEF VALVES	CAUSE UNKNOWN
G	DA1	030530*	031080	K	RV	F00		R	3	T		3 TARGET ROCK RELIEF VLVS FOUND WITH BAD SETPOINTS	CAUSE UNKNOWN
G	DA1	033106	111080	K	RV	B27			1	N		RELIEF VLV PSV-4405 FAILED TO CLOSE/SCRAMMED PLANT	PILOT VLV PROBLEM OF UNKNOWN NATURE
G	DR2	014747	052576	K	RV	B27			1	T		DURING BLOWDOWN TEST VALVE 203-3A REMAINED OPEN	EXCESS LEAKAGE ON PILOT STAGE OF VALVE
G	DR2	019985	120977	K	RV	A00		R	1	T		ELECTROMATIC RELIEF VALVE 3B FAILED TO OPEN	CAUSE UNKNOWN
G	DR2	033323	112480	K	RV	F00			1	N		2A SAFETY RV VLV NOT OPERABLE IN SAFETY MODE	CAUSE UNKNOWN AT THIS TIME
G	DR3	018378A	061177	K	RV	C02		B	1	N		ELECTROMATIC RELIEF VALVE 203-3D LEAKING INTERNALY	PILOT PIN ADJUSTED INCORRECTLY
G	DR3	018378B	061177	K	RV	C10		R	1	N		ELECTROMATIC RELIEF VALVE 203-3E LEAKING INTERNALY	DIRT UNDER VALVE SEAT
G	DR3	018377	061277	K	RV	C27		R	1	T		ELECTROMATIC RELIEF VALVE 203-3D LEAKING INTERNALY	DEFECTIVE PILOT VALVE STEM

BWR RELIEF VALVES

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	DR3	018376	061377	K	RV	A10		R	1		T	SOLENOID OPERATING LEVER FOR 203-3C STICKING	RUST BUILDUP ON GUIDE PINS
G	DR3	030967A	042580	K	RV	A12		R	1		N	3A TARGET ROCK ADS RELIEF FAILED TO OPEN	AIR ACTUATOR IMPROPERLY BOLTED TO VLV
G	DR3	030967B	042580	K	RV	A27		R	3		N	3B,3C,3E ADS ELECTROMATIC RELIEFS FAILED TO OPEN	VARIOUS PILOT VALVE PROBLEMS
G	EN1	016841	120976	K	RV	B00		R	1		T	RELIEF VALVE WOULD NOT RESEAT	CAUSE UNKNOWN
G	EN1	017110	010977	K	RV	B27		R	1		N	RELIEF VALVE B21-F013G OPENED AND STUCK OPEN	GROSS LEAKAGE OF PILOT+2ND STAGE ASSEMBLY
G	EN1	017189	020177	K	RV	B00		R	1		N	RELIEF VALVE B21-F013G OPENED AND STUCK OPEN	CAUSE UNKNOWN,VALVE TO BE TESTED
G	EN1	018649	080977	K	RV	A00			1		N	SAFETY RV 1C FAILED TO OPEN AT HIGH REACTOR PRESS.	CAUSE UNKNOWN
G	EN1	020019*	100677	K	RV	A00		R	4		N	FOUR RELIEF VALVES FAILED TO OPEN FOLLOWING SCRAM	CAUSE UNKNOWN,VALVES BEING EXAMINED
G	EN1	021723*	060978	K	RV	A12		R	2		T	TWO RELIEF VALVES FAILED BENCH CHECK	PROBLEMS WITH PLUNGERS AND SPRINGS
G	EN2	025467*	021479	K	RV	A27			2		R	2 SAFETY RELIEF VALVES FAILED TO OPEN AS REQUIRED	SCUFFING OF PILOT DISCS AND SEATS
G	EN2	025875*	050879	K	RV	F05	C		3		M	AIR OPERATORS FOR THREE SRV'S IMPROPERLY INSTALLED	IMPROPERLY INSTALLED BY WYLE LAB
G	EN2	033426A	112680	K	RV	F27		R	8		T	OUT OF THE VLVS 2821-5013A-M,8 VLVS FAILED	PILOT SEAT LEAKAGE
G	EN2	033426B	112680	K	RV	A00		R	7		T	OUT OF THE VLVS 2821-5013A-M,7 VLVS SET PRESSURE W	AS TOO HIGH// CAUSE UNKNOWN
G	MI1	018156	061877	K	RV	C27			1		N	RV DISCH TEMP HIGH/VLV LEAKING STM INTERNALLY	COLLAPSED FILTER,STM CUTTING OF PLT SEATS
G	MI1	020698B	031078	K	RV	C27		R	1		T	RELIEF VALVE LEAKING THROUGH	LEAKAGE IN PILOT VALVE / STEAM CUT
G	MI1	025313	022679	K	RV	B27		R	1		N	SRV LIFTED PREMATURELY & FAILED TO RESEAT	PILOT DISC STEAM CUT
G	MO1	015100	061476	K	RV	A24	S		1		T	SAFETY RELIEF VLV 2-71A FAILED TO ACTUATE	AIR LEAK IN AIR SUPPLY SYSTEM
G	MO1	025804	031579	K	RV	F06			1		T	OPENING DELAY TIME OF 'A' SRV IN EXCESS OF ASSUMED	PROCEDURE DID NOT HAVE INSULATION INSPEC
G	NM1	017401*	030977	K	RV	A16	S		3		N	3 OUT OF 6 ADS RELIEF VLVS WOULD NOT HAVE OPERATE-	-D IF NEEDED//RESET SWITCH FAILURE
G	OC1	018671	080277	K	RV	A12			1		T	ELECTROMATIC RV C FAILED TO OPEN	ACTUATOR PLATE BOUND AGAINST A RIVET
G	OC1	027195	091779	K	RV	A16	S		1		T	ELECTROMATIC RV WOULD NOT HAVE OPENED	HIGH PRESSURE MICROSWITCH WAS DEFECTIVE
G	OC1	030047A	010580	K	RV	A05	C		1		T	ELECTROMATIC RV"D" FAILED TO OPEN DURING TEST	RETAINER RING BACKED OUT, GRUB SCREW GONE
G	OC1	032048	071680	K	RV	A06			1		T	ELECTROMATIC RV"D" FAILED TO OPEN DURING TEST	PROCEDURES FAILED TO DESCRIBE ADJUSTMENT
G	PB2	015085	062976	K	RV	B27		R	1		N	MAIN STEAM RV FAILED IN OPEN POSITION	PILOT VALVE SEAT LEAKAGE
G	PB2	016333	111476	K	RV	B10		R	1		N	MAIN STM RV 71F FAILED IN OPEN POSITION	DIRT UNDER PILOT DISK AND SEAT

BWR RELIEF VALVES

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	PB2	016676A	010677	K	RV	B27		R	1		N	MAIN STM RV 71E FAILED OPEN	EXCESSIVE PILOT SEAT LEAKAGE
G	PB3	015153	071276	K	RV	B27		R	1		N	71B MAIN STEAM RELIEF VALVE FAILED OPEN	FAILURE DUE TO PILOT VLV SEAT LEAKAGE
G	PB3	015228	072076	K	RV	B27		R	1		N	MAIN STEAM RELIEF VLV 71G FAILED OPEN	FAILURE DUE TO PILOT VLV SEAT LEAKAGE
G	PB3	025311	022579	K	RV	F16		S	1		N	RELIEF VALVE RV-71L FAILED TO OPERATE	FUSES BLOWN, SHORT TO GROUND
G	PI1	017674	051077	K	RV	A24		S	1		N	RV 203-3C DID NOT OPEN FROM REMOTE CONTROL SWITCH	DETERT OF THE REMOTE AIR ACTUATOR DIAPH
G	PI1	019736	111477	K	RV	A24		S	1		T	RELIEF/SAFETY VALVE 203-3B COULD NOT BE MAN OPENED	FAIL OF 3-WAY SOLENOID VAL TO PORT PROPER
G	PI1	019859	111577	K	RV	C27		R	1		N	RELIEF VALVE 203-3B DETERMINED TO BE LEAKING	FIRST+SECOND STAGE OF PILOT VALVE LEAKING
G	PI1	019756	111777	K	RV	C27		R	1		N	RELIEF VALVE 203-3D DETERMINED TO BE LEAKING	FIRST STAGE OF PILOT VLV SEAT LEAKING
G	PI1	022757	100978	K	RV	B27		R	1		N	RV-203-3C FAILED TO RESEAT AT PROPER PRESSURE	EXCESSIVE PILOT SEAT LEAKAGE
G	PI1	031759	072580	K	RV	A21		R	1		T	RV 203-3D FAILED TO OPEN DURING TEST/LOCKTITE IN	THE VLVS SOLENOID ASSEMBLY REPLACED SAME
G	PI1	032273	080180	K	RV	A00		R	1		U	RV 203-3D DID NOT OPEN GIVEN MANUAL OPEN SIGNAL	NO CAUSE COULD BE DISCOVERED BY FACT REP
G	PI1	032812	100180	K	RV	B12			1		N	*D* RELIEF VLV STUCK OPEN DURING SHUTDOWN	MAIN PISTON SCORED
G	QC1	016472*	110176	K	RV	A13			2		T	ELECTROMATIC RELIEF VALVES FAILED TO OPEN/TESTING	EXCESSIVE INTERNAL STEAM LEAKAGE
G	QC1	020532	032077	K	RV	A12			1		T	MAIN STEAM ELECTROMATIC RELIEF FAILED TO OPEN/TEST	INTERNAL PARTS FOUND LOOSE AND MISSING
G	QC1	020425	111677	K	RV	A16		S	1		N	RELIEF VALVE 1-203-3B FAILED TO OPEN ON DEMAND	COMMAND/WIRE TIE IN ELECT CONTACTOR
G	QC1	020636	020678	K	RV	A12			1		T	ELECTROMATIC RELIEF 1-203-3E FAILED TO OPEN / TEST	WORN INTERNAL PARTS/VALVE WAS REPLACED
G	QC1	021408	042478	K	RV	A18			1		T	ELECTROMATIC RV 1-203-3C FAILED TO OPERATE / TEST	WELD FAILURE BETWEEN BODY AND CAGE/VIBRAT
G	QC1	026560	071779	K	RV	F16		S	1		T	RELIEF VALVE FAILED TO OPERATE	PRESSURE SWITCH WIRE NOT CONNECTED
G	QC1	031359	051180	K	RV	A16		S	1		T	RV 1-203-3B FAILED TO OPEN DURING TEST	DIRT ON CONTACTS OF HOLD-IN COIL SWITCH
G	QC2	016473*	110176	K	RV	A09		R	2		T	TWO ELECTROMATIC RELIEFS FAILED TO OPEN ON TESTING	INTERNAL BINDING DUE TO CORROSION PROBLEM
G	QC2	020533	032377	K	RV	A12		R	1		T	ELECTROMATIC RELIEF FAILED TO OPEN DURING TESTING	LOOSE INTERNAL PARTS BOUND/EXCESS VIBRAT
G	QC2	019223	092377	K	RV	A12		R	1		T	ELECTROMATIC RELIEF FAILED TO OPEN DURING TESTING	RINGS CUT GROOVES IN DISC GUIDE/STEAM CUT
G	QC2	019745	110677	K	RV	B27			1		N	RELIEF VALVE 2-203-3B FAILED TO RESEAT	PILOT VALVE WAS STEAM CUT AND ERODED
G	QC2	020245	011478	K	RV	F16		S	1		T	RELIEF VALVE FAILED TO OPERATE AS REQUIRED	PRESSURE CONTROL SWITCH SETPOINT DRIFT
G	QC2	022815	092978	K	RV	A24		S	1		T	RV 2-203-3A FAILED TO OPEN(MANUAL) / COMMAND	AIRLINE TO MANUAL AIR OPERATOR BROKE

BWR RELIEF VALVES

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	QC2	031100	042080	K	RV	A27		R	1	1	T	RV 2-203-3C FAILED TO OPERATE DURING TEST	EXCESS CLEARANCE,PLUNGER TO PILOT VL STEP
G	QC2	033138	101780	K	RV	A25		R	1	1	U	RELIEF VLV 2-203-3C FAILED TO OPEN	LEAKAGE BETWEEN MAIN DISC AND DISC GUIDE
G	QC2	033525	120380	K	RV	A12		R	1	1	N	ELECTROMATIC RELIEF 2-203-3D FAILED TO OPEN	STEAM LEAKAGE RETAINER PLUG TO MAIN DISK
G	VY1	015184*	070676	K	RV	A22		C	3	1	T	3 TARGET ROCK RVS FAILED TO OPERATE(SIGNAL/MANUAL)	DIAPHRAGM IN AIR OPERATORS FAILED/HEAT
G	VY1	020910	041278	K	RV	A00			1	1	R	RV (67HH13) SET TOO HIGH	SETPOINT DRIFT/RESET TO LOWER LIFT PRESS
G	VY1	025152	012379	K	RV	A00		R	1	1	T	STEAM VLV SAFETY FOUND TO HAVE TOO HIGH SETPOINT	SETPOINT DRIFT
G	VY1	032985	100780	K	RV	A00		R	1	1	T	MAIN-STEAM RELIEF VLV S/N67HH12 SET POINT 3# TO HI	SETPOINT DRIFT

APPENDIX D

ONE-LINE DESCRIPTIONS OF ALL RELEVANT VALVE LERS

COMMON CAUSE EVENTS

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	AR1	015207	061276	G	XV	V06	U		1		N	VALVE SF-22 WAS NOT CLOSED(A SPILL RESULTED)	PROCEDURES WERE INADEQUATE
B	AR1	027473	100879	F	RM	F16	U		1		T	CV1616 FAILED IN THE ES POSITION	CONT FUSE BLEW BECAUSE OF GROUND WIRE
B	AR1	030864	040680	B	RM	F02	C		1		T	EMER. FW SUPPLY VALVE FAILED TO FULLY OPEN(CV-2667	LOOSE BOLTS SECURING ACT TO VALVE BODY
B	CR3	017322B	030777	H	RM	V01	U		2L	M		"B" LOOP OF HPI SYS. ISOL.CONT.TO T.S.FOR MAINTENC	PERSONNEL ERROR
B	CR3	017658	042177	G	RM	V01	V		2		N	SUCT.VLVS CAV-38646 FROM BORIC ACID STOR.TANK.SHUT	T.S.VIO./PERSONNEL ERROR/IMP.VLV LINEUP
B	CR3	023095A	100478	L	XV	V03	U		1		T	ISOL VALVE TO FLOW CONTROLLER SHUT(SEE 023095)	PERSONNEL ERROR/VALVE REQUIRED TO BE OPEN
B	CR3	023237	103078	G	RM	V01	V		2		N	CONC.BORIC ACID TK.DISC.VLVS.CAV38643 CLOSED;TS VI	PERSONNEL ERROR;IMPROPER VALVE LINEUP
B	CR3	025631	032179	G	CV	V00	U		1		M	MAKEUP PMP 3-C DISCHG STOP CHK VLV MUV-2 IMPROPERL	POSITIONED--CAUSE UNKNOWN
B	DB1	025520	030679	H	RM	V01	U		2		N	BORATED WTR STOR TANK ISO VLVS DH7A&7B CLOSED WHEN	REQUIRED OPEN--PERSONNEL ERROR
B	DB1	031898	071080	L	RM	F02	C		1		N	DH COOLER 1-2 DISCH CONTROL VLV OPERATED ERRATIC	SFAS CH 2 DEENERGIZED FOR MAINTENANCE
B	DB1	031906A	072480	L	RM	F02	B		1		N	DH 12 CLOSED	PERSONNEL SHORTED FUSE CLIP IN CONTROL PC
B	DB1	031906B	072480	L	RM	F06	B		1		N	DH 11 CLOSED	INADEQUATE RESTORATION PROCEDURE
B	DB1	031906C	080380	L	RM	F02	B		1		N	DH 11 CLOSED	MAIN. SPEC. REMOVED BISTABLE
B	DB1	032122	081380	L	RM	G16	V		1		N	DECAY HEAT ISO VLV DH-11 BEGAN CLOSING,STOPPED PMP	PERSONNEL FAILED TO BLOCK AUTO CLOS.SIGNL
B	DE2	019970	120877	F	XV	V01	U		1		N	ISO.VLV.TO CHAN.3 RB PRESS.TRANS.SHUT BY MISTAKE	PERSONNEL ERROR
B	DE3	016209	110176	H	CV	V01	U		2		M	IMP.LINEUP VALS 3HP-152 + 3HP-153 CLOSED S.B.OPEN	PERSONNEL ERROR
B	RS1	019666	111177	H	MV	V04	U		2		T	VALVE LINE-UP INCORRECT//NEW VALVES WERE INSTALLED	--WITH OPEN/CLOSE INDICATION ATYPICAL
B	RS1	030143	010980	H	RM	F16	U		1		U	POWER TO MU TANK ISO VLV SFV-23508 WAS NOT RESTORE	PERSONNEL ERROR
B	TI2	027656A	032879	B	RM	V00	U		2L		N	AUX FEEDWATER BLOCK VLVS DISCOVERED CLOSED	NO CONCLUSIVE CAUSE COULD BE FOUND
C	AR2	031374	040880	F	RM	V03	V		1		T	"A" TRAIN CONT. SPRAY ACCIDENTALLY INITIATED	PERSONNEL ERROR DURING TESTING
C	CC1	025619	041179	H	MV	V06	U		1		T	SI HDR ISO VLV SI-656 SHUT WHEN REQUIRED OPEN	DEFECTIVE PROCEDURES
C	CC1	026785	082879	L	MV	V01	U		2		T	SI-4145-MOV OPEN REQ SHUT,SI-4143-MOV SHUT REQ OPN	OPERATIONS PERSONNEL ERROR
C	FC1	022469	092178	B	AV	A24	U		1		T	VAL YCV-1045 FAILED TO OPEN(AUX.FD.PMP.STM.INL.)	INSTRUMENT AIR SUPPLY TO VAL CLOSED
C	FC1	022972	110178	B	CV	E05	C		1		R	AUX FEED CHECK VALVE FOUND INSTALLED WRONG	CONSTRUCTION ERROR
C	FC1	023139	112478	L	RM	F16	U		1		T	PC-105B WAS NOT OPERATING	VALVE CLOSING RELAY NOT REWIRED AFT MAINT

COMMON CAUSE EVENTS

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
C	FC1	023171	122078	K	RV	V06	U	2		M		TWO PRESS OP RELIEF VALVES OPENED WHEN REQ CLOSED	TECH PULLED FUSES,DEFECTIVE PROCEDURES
C	MI2	031945	070380	H	XV	V06	U	1		T		HPSI PUMP MINIMUM FLOW VLV WAS SHUT	DEFECTIVE PROCEDURES,CAUSED PUMP SEIZURE
C	MY1	020758	020277	H	RM	F16	U	1		M		VALVE SL-P-3 FAILED TO OPERATE	WIRES DISCONNECTED (CAUSE UNKNOWN)
C	MY1	030804	031980	L	XV	V01	U	2		N		RHR VLVS RH-8 AND RH-10 FOUND OPENED AND UNLOCKED	PERSONNEL ERROR
C	MY1	031390	050780	H	XV	V03	U	2L		U		COOLING WATER IMPROP LINED UP TO S-CHARGING PUMP	PERSONNEL ERROR (SEPARATION NOT MAINTAIN)
C	PA1	032156	071980	H	XV	V03	U	1		N		INST. EQ. VLV NOT CLOSE AFTER CALIBRATION	PERSONNEL ERROR WHEN CAL. HPSI FLOW IND.
C	PA1	032224	081980	H	RM	V03	U	1		N		CV-3031 WAS CLOSED AND THEN IMMEDIATELY OPENED	OPERATOR FAILED TO RELATE TEST REQUIRE.
W	BV1	027663	112779	H	MV	V01	U	1		M		HHSI PMP SUC VLV CH-1150 ISO FOR MAINT WHEN REQ OP	PERSONNEL ERROR--2ND VLV ALSO SHUT
W	BV1	031210*	052180	L	RM	B16	U	2V		T		RHR ISOL VLVS FAILED TO CLOSE	DEENERGIZED PROCESS CONTROL SIGNAL
W	DC1	016648	121776	F	MV	V01	U	1		T		CONTAINMENT SPRAY PUMP SUCTION VALVE FOUND CLOSED	PERSONNEL LEFT VALVE SHUT AFTER A TEST
W	DC1	021011*	032278	H	MV	F16	U	3		N		POWER FOUND OFF TO 3 ECCS VALVES	3 BREAKERS FOUND TRIPPED ON MCC
W	DC2	021079	041678	L	XV	V01	U	1		N		HANDWHEEL CAME OFF RHR VALVE POSITIONING IT WRONG	PERSONNEL FAILED TO REPOSITION THE VALVE
W	DC2	022581	092278	K	RV	V01	U	1		T		PRESSURIZER RV OPENED WHEN REQUIRED TO BE CLOSED	PERSONNEL ERROR
W	DC2	0228388	101078	B	XV	V01	U	1		T		AUX FEED VALVE FOUND UNLOCKED & OPEN/WRONG LINE-UP	PERSONNEL ERROR
W	DC2	023030*	112178	F	CV	A05	C	2		N		CHK.VLVS.CTS-127E&W TO THE LOWER CONT.SPRAY NOZZL-	-ES INSTALLED BACKWARDS//FABRICATION ERR.
W	IP3	014604	042976	F	RM	V03	U	2L		T		INCRT.VLV LINUP FOR TEST,CNTMNT SPRY ACCID.TURN ON	PERSONNEL ERROR
W	JF1	020993	032578	B	MV	V02	U	2		N		MDAFP & TDAFP RECIRC BYPASS ISO VLVS OPEN	PERSONNEL ERROR
W	JF1	022633*	090978	B	RM	F16	U	3		T		CONTROL WAS LOST ON FLOW CONT.VLVS 3228A,B,&C	DEFECTIVE RELAY IN TDAFP CONTROL CIRCUIT.
W	JF1	022629	091878	L	RM	V06	U	1		T		RHR PUMP SUCTION VLV 8701A CLOSED WHEN REQ. OPEN	INADEQUATE PROCEDURES
W	JF1	030326*	020180	B	RM	A24	U	2V		T		CONTROL VLVS FOR 'A' AUX FEED TRAIN DIDN'T AUTO OP	//EN. CONTACTS MISALIGNED IN CONTROL CIR
W	KE1	014240	022076	F	RM	A01	C	1		T		VALVE ICS-5B FAILED TO OPEN(CONT.SPRAY DISCH. VLV)	VALVE MANUALLY TORQUED DOWN TOO TIGHT
W	KE1	019312	100377	F	MV	F02	C	1		M		MAINT.MAN DEENERGIZED 2 SW VLVS,WHEN ONLY ALLOW.T-	-O DEENER.1 VLV//PERSONNEL ERROR
W	NA1	021506	051478	B	AV	V06	U	2		T		AUX FEEDWATER VALS PCV-F2-159A,-159B IMP.LINEUP	CHECKOFF SHEET DOES NOT LIST NORM VAL POS
W	NA1	027593	110679	L	RM	V02	U	1		N		RHR INLET VLV MOV-1701 SHUT WHEN REQ. OPEN	MAINTENANCE PERSONNEL ERROR
W	PR2	017889	051977	B	XV	V06	U	1		U		PUMP INLET VALVE FOUND NEARLY SHUT/AUX FEED INLET	POSITION REQUIREMENT WILL GO ON CHECKLIST

COMMON CAUSE EVENTS

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
W	PT2	018572	072877	H	MV	V01	U	1	N	MOV FOUND IN INTERMEDIATE POSITION/SINCE PREV TEST	PERSONNEL FAILED TO ASSURE FULLY OPEN
W	SE1	032973*	100580	B	RM	F01	C	2	T	AUX FEEDWATER VLVS LCV-3-174&173 WOULD NOT HAVE OP	//ER IN AUTO. PRESS SWITCH LEFT ISOLATED
W	SU1	021802	062278	L	MV	A02	C	1	T	MOV-RH-100 FAILED TO OPEN	MAINT ERROR/STEM WAS NOT ENGAGED TO DISC
W	TR1	019580	101677	L	XV	V01	U	1	N	RHR DISCHARGE VLV (87288) FOUND LOCKED CLOSED	PERSONNEL ERROR/IMPROPER VALVE LINEUP
W	TR1	021068*	032078	L	MV	C36	U	2V	T	DEENERGIZING PROTECTION SYS CAUSED RHR VALVES TO--	--CLOSE//PROCEDURAL DEFICIENCY
W	TU4	019421	091377	L	RM	V01	U	2	T	TWO VALVES INADVERTANTLY OPENED/RWST LEVEL DECREAS	PERSONNEL ERROR/POSSIBLE PROCEDURE PROBLE
W	YR1	030141*	020180	H	RM	F16	U	3	T	SI ACCUMULATOR N2 VLV SI-TV-604,605,606 DIDN'T OP.	IMPROPER WIRING OF TIME DELAY RELAYS
W	ZI2	031625	061880	K	RV	V06	U	2	N	IMPROPER VLV LINE UP MADE PORVS INOPERABLE	PROCEDURE CHANGED TO BLOCK THE VLVS OPEN
G	BF1	016053	092376	D	XV	V02	U	1	U	VALVE FOUND CLOSED TO PRESSURE SWITCH	PERSONNEL ERROR
G	BF2	016199	100776	H	XV	V03	U	1	T	EQUALIZER VALVE ON FLOW INSTRUMENT FOUND OPEN	PERSONNEL ERROR
G	BF2	021782	062778	H	XV	V01	U	1	T	VALVE LEFT SHUT IN LUB OIL LINE TO HPCI PUMP	PERSONNEL ERROR IN VALVE LINE UP
G	BR1	016402	111976	L	MV	F16	U	1	N	RHR INJECTION VALVE(E11-F015A) FAILED TO OPERATE	UNDERSIZED BKR/DESIGN PROBLEM(ROOT)
G	BR1	019677	110577	L	MV	A02	C	1	N	RHR VALVE E11-F004A FAILED TO OPEN(MOTOR PROBLEM)	PERSONNEL ERROR/COVER LEFT LOOSE/WATER LK
G	BR1	028036	121979	L	MV	V01	U	1	N	RHR TORUS SUCTION VALVE FOUND SHUT	OPERATOR ERROR-FORGOT TO OPEN VALVE
G	BR1	030407	021480	H	XV	V01	V	1	T	MANUAL ISOL VLV LOW SIDE OF 1E41L515A FOUND CLOSED	PERSONNEL ERROR (WHEN UNDETERMINED)
G	BR2	014647	020576	L	XV	V03	U	1	N	PRESS SW FOUND ISOLATED AFTER TESTING	PERSONNEL ERROR
G	BR2	023034	111278	L	MV	A16	U	1	N	RHR VLV E11-F008 WOULD NOT OPEN AT REQ. SETPOINT	FAIL. OF RX.STM.DOME HIGH PRESS.SWITCH
G	BR2	0324548	090780	H	CV	V01	U	1	T	HPCI MANUAL STOP CHECK FOUND LOCKED CLOSED	PERSONNEL ERROR VLV WAS REQ OPEN
G	CO1	015873	081376	W	RV	A02	C	1	R	SETPOINT OF MS-RV-71E ADJUSTED INCORRECTLY	INCORRECT MAINTENANCE PROCEDURE
G	CO1	020806A	020778	H	XV	V03	V	1	T	ISOLATION VALVE TO DPIS-76 FOUND CLOSED(SEE020806)	PERSONNEL ERROR
G	CO1	031544	051680	L	RM	F26	C	1	T	RHR VLV MO-57 FAIL TO CLOSE IN REQUIRED TIME	LIMIT SW SET WRONG(PERSONNEL ERROR)
G	DA1	017312	021977	H	RM	F03	C	1	N	CONTACT BLOCK FOUND INSTALLED IN VALVE CIRCUIT	PERSONNEL ERROR,FAILED TO REMOVE AFTER TS
G	DR2	021158	042878	L	XV	V01	U	2L	N	VALVES IN LPCI & CORE SPRAY LINED UP IMPROPERLY	OPERATING PERSONNEL ERROR
G	DR3	014750	051076	D	MV	B16	U	1	T	MO 3-1402-25B TRIPPED WHILE BEING CLOSED	WRONG SIZE OVERLOAD HEATER
G	DR3	018378A	061177	W	RV	C02	B	1	N	ELECTROMATIC RELIEF VALVE 203-3D LEAKING INTERNALY	PILOT PIN ADJUSTED INCORRECTLY

COMMON CAUSE EVENTS

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	EN1	017096	011777	L	XV	V03	U	1	U	PRESS SW FOUND VALVED OUT WHEN REQUIRED OPEN	PERSONNEL ERROR
G	EN1	018191	060477	L	RM	F02	C	1	T	LPCI VALVE E11-F0178 CYCLE TIME OUTSIDE T.S.	VALVE STEM PACKED TOO TIGHTLY/PERSONNEL
G	EN1	026631	072679	L	MV	F16	U	1	M	RHR OUTBOARD ISOLATION VALVE MADE INOPERABLE	NO PWR AVAILABLE TO VLV (PERSON.ERROR)
G	EN1	031157	051080	L	XV	V03	U	2	N	TWO COOLING WTR VLVS TO PUMPS A & B FOUND CLOSED	PERSONNEL ERROR
G	EN1	031521	062280	L	XV	V01	U	2	T	RHR MIN FLOW VLVS E11-F0188 & D FOUND CLOSED	PERSONNEL ERROR
G	EN1	031769A	071180	L	XV	V01	U	2L	N	COOLING WATER VLV SECURED WHEN REQUIRED OPEN	PERSONNEL ERROR
G	EN2	022024*	071778	L	MV	F16	U	2V	N	RHR VALVES HAD POWER LOST TO THEM	BREAKER TRIPPED DUE TO BLOWN FUSES
G	EN2	022753*	110678	H	RM	F16	U	2V	T	HPCI CONTROL VALVES FAILED TO OPERATE	WIRE LEFT OFF BY MAINT PERSONNEL
G	EN2	025875*	050879	W	RV	F05	C	3	M	AIR OPERATORS FOR THREE SRV'S IMPROPERLY INSTALLED	IMPROPERLY INSTALLED BY WYLE LAB
G	EN2	033764	050780	L	MV	B20	C	1	T	2E41-F006 INBOARD ISO.VLV FAILED TO CLOSE	WATER SHORTED OUT MOTOR OPERATOR WINDINGS
G	EN2	031318*	051480	L	MV	F26	C	2	N	RHR VLVS 2E11-F004D E F006D FAILED TO OPERATE	LOOSE & BROKEN LIMIT SWITCHS
G	EN2	031431A	053080	L	MV	A20	B	2	T	TORUS SUCTION VLVS 2E41-F041&42 FAILED TO OPEN	VALVE MOTORS SHORTED OUT(STEAM LEAK)
G	EN2	032135	072480	H	RM	F16	U	1	N	HPCI VLV 2E41-F002 CLOSED WHEN REQUIRED OPEN	INADVERTANT SIGNAL, OPERATOR BUMPED RELAY
G	FP1	021227	050878	D	MV	F02	C	1	M	POWER REMOVED FROM CORE SPRAY VALVE MOTOR	PERSONNEL ERROR
G	OC1	018623*	072777	D	MV	A16	V	2	T	CORE SPRAY ISO.VLVS V-20-40 & V-20-15 FAILED TO F-	-ULLY OPEN//IMP.CKT.BRKR.OVERLOAD SETTING
G	OC1	023144	120478	F	MV	A16	U	1	T	CONT SPRAY VALVE V-21-78 FAILED TO OPEN ON TESTING	BREAKER TO VALVE NOT RACKED IN PROPERLY
G	OC1	030047A	010580	W	RV	A05	C	1	T	ELECTROMATIC RV-08 FAILED TO OPEN DURING TEST	RETAINER RING BACKED OUT, GRUB SCREW GONE
G	PB3	031104	042180	L	MV	A05	B	1	T	LPCI VLV MO-3-10-25B FAILED TO OPEN ON TEST	WALWORTH 23-INCH IMPROPER INTERNAL CLEARN
G	PB3	031740	060880	F	MV	B05	C	1	T	CONT SPRAY VLV MO-3-10-26B FAILED TO CLOSE	STEM LOCKING NUT NOT STAKED BACKED OUT
G	QC2	021561	052178	D	RM	V01	U	1	N	2A CORE SPRAY SUC.VLV. MO 2-1402-3A CLOSED WHEN R-	-EQUIRED TO BE OPEN//PERSONNEL ERROR
G	VY1	014230*	021776	L	MV	F01	C	2	N	RHR VLVS. 25A&B WOULD NOT STROKE ELECTRICALLY	PERSON.ERROR(MUST STRO.VLVS.MANUALLY 1ST)
G	VY1	014584*	051076	L	MV	A14	C	2	T	TWO 24 INCH MOVS (RHR-27A/B) FAILED TO OPEN / TEST	PACKING MAINTENANCE PROBLEM
G	VY1	015184*	070676	A	RV	A22	C	3	T	3 TARGET ROCK RVS FAILED TO OPERATE(SIGNAL/MANUAL)	DIAPHRAGM IN AIR OPERATORS FAILED/HEAT
G	VY1	016997	011877	L	RM	V03	U	2L	T	"B" RHR PMP DISCH.VLVS. SHUT WHEN REQ. TO BE OPEN	PERSONNEL ERROR

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	AR1	015207	061276	G	XV	V06		U	1	N		VALVE SF-22 WAS NOT CLOSED(A SPILL RESULTED)	PROCEDURES WERE INADEQUATE
B	AR1	020607	011378	B	AV	A23			1	T		VALVE CV-2667 FAILED TO OPEN REMOTELY	TORQUE SWITCH DEFECTIVE
B	AR1	022339	072078	G	RM	F23			1	T		SODIUM THIOSULFATE BLOCK VLV CV-2411 FAIL. TO OPER	TORQUE SETTING OUT OF ADJ; DRY PACKING
B	AR1	027473	100879	F	RM	F16		U	1	T		CV1616 FAILED IN THE ES POSITION	CONT FUSE BLEW BECAUSE OF GROUND WIRE
B	AR1	030864	040680	B	RM	F02		C	1	T		EMER. FW SUPPLY VALVE FAILED TO FULLY OPEN(CV-2667	LOOSE BOLTS SECURING ACT TO VALVE BODY
B	AR1	030926	040780	H	MV	A20			1	N		CV-U227 FAILED TO OPEN ON MAN HPI (HPI VLV LOOP B)	MAN ENGAGING LEVER FOUND STUCK IN ENG POS
B	AR1	032533	090680	G	MV	B23			1	N		RCS MAKE UP BLOCK VLV(CV-1234) FAILED TO FULL CLOS	TORQUE SWITCH SETTING TOO LOW
B	CR3	017168A	020377	L	MV	A20		R	1	N		DECAY HEAT VLV DHV-4 WOULD NOT OPEN REMOTE ACTUATN	MTR. OPERATOR WOULDN'T OVERCOME VLV. DRAG
B	CR3	0171688	020377	L	MV	A20		R	1	N		DECAY HEAT VLV DHV-41 WOULDN'T OPEN REMOTE ACTUATN	MTR. OPERATOR WOULDN'T OVERCOME VLV. DRAG
B	CR3	0173228	030777	H	RM	V01		U	2L	M		"B" LOOP OF HPI SYS. ISOL.CONT.TO T.S.FOR MAINTENC	PERSONNEL ERROR
B	CR3	017658	042177	G	RM	V01		V	2	N		SUCT.VLVS CAV-38&46 FROM BORIC ACID STOR.TANK.SHUT	T.S.VIO./PERSONNEL ERROR/IMP.VLV LINEUP
B	CR3	018561	071577	L	MV	A23		R	1	T		VLV DHV-41 WOULD NOT OPEN FROM CONTROL ROOM	CAUSED BY SHIFT IN TORQUE SWITCH SETTING
B	CR3	018562	071577	L	MV	A00		R	1	T		DECAY HEAT VLV DHV-4 WOULD NOT OPEN FROM CONT.ROOM	CAUSE OF FAILURE UNKNOWN
B	CR3	018566	072977	H	MV	A12			1	T		HPI VLV MUV-25 FAILED TO OPEN AUTOMATICALLY	MECH.BINDING OF THE REVERSING INTERLOCKS
B	CR3	019010	082777	L	MV	B23			1	N		CORE FLOOD DR.VLV FOR B CORE FL.TK.WOULDN'T CLOSE	DRIFT OF TORQUE SWTCH SETTING;VLV CFV-12
B	CR3	019013	083177	L	RM	B00			1	N		CORE FLOOD SAMP.ISO.VLV CFV-11 WOULDN'T CLOSE	CAUSE OF FAILURE UNKNOWN
B	CR3	021775	062178	L	RM	A00		R	1	N		DECAY HEAT REMOV.VLV DHV-111 WOULD NOT OPEN REMOT.	CAUSE OF EVENT IS UNDETERMINED
B	CR3	022361	081978	L	RM	G16		T	1	N		DHV-3 WENT CLOSED WHEN REQUIRED TO REMAIN OPEN	LOSS OF 120 VOLT AC VITAL BUS(INVERTER)
B	CR3	022359	090778	L	RM	B23			1	T		CORE FLOOD VALVE CFV-15 FAILED TO CLOSE ON TEST	FAULTY TORQUE SWITCH
B	CR3	023095A	100478	L	XV	V03		U	1	T		ISOL VALVE TO FLOW CONTROLLER SHUT(SEE 023095)	PERSONNEL ERROR/VALVE REQUIRED TO BE OPEN
B	CR3	0230958	100478	L	RM	F16		T	1	T		FLOW CONTROL VALVE DHV-110 FAILED TO CONTROL FLOW	NO SIGNAL FROM FLOW CONTROLLER
B	CR3	023237	103078	G	RM	V01		V	2	N		CONC.BORIC ACID TK.DISC.VLVS.CAV38&43 CLOSED;TS VI	PERSONNEL ERROR;IMPROPER VALVE LINEUP
B	CR3	0255479	033479	L	RM	A00		R	2	N		DECAY HEAT REMOVAL VLVS DHV-3&4 COULD NOT BE OPENE	D REMOTELY--CAUSE UNKNOWN
B	CR3	025631	032179	G	CV	V00		U	1	M		MAKEUP PMP 3-C DISCHG STOP CHK VLV MUV-2 IMPROPERL	POSITIONED--CAUSE UNKNOWN
B	CR3	025936	040479	L	RM	F00		R	1	T		THROTTLE VLV HDV-110 WOULD NOT CONTROL FLOW IN AUT	NO CAUSE FOUND

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	CR3	025925	042479	L	RM	A12		R	1		N	DECAY HEAT REMOVAL VLV DHV-4 FAILED TO OPEN REMOTE	WASHER BINDING AT STEM NUT INTERFACE
B	CR3	030369	020680	L	RM	F16		T	1		T	'A' DECAY HEAT PMP DISCH THROTTLE DIDN'T CONTROL	IN AUTO. LOOSE WIRES ON SELECTOR SWITCH
B	CR3	030667	030680	L	RM	G00			1		N	DECAY HEAT SUCTION ISO VLV DHV-3 CLOSED INADVERTEN	//TLY. NO CAUSE COULD BE FOUND
B	CR3	031894A	072880	H	CV	B00			1		T	CK VLV CFV-79 FAILED ALOWING BACKFLOW INTO N2 SYS	CAUSE NOT GIVEN FOR FAILED CHECK VALVE
B	CR3	033760	080680	L	RM	F24		T	1		T	DHV-110 WOULD NOT CONTROL FLOW IN AUTOMATIC	AIR IN THE CONTROLLER SENSING LINE
B	CR3	032554	082780	L	MV	F24		T	1		T	DHV-111('B' DECAY HEAT PMP DISCH THROTTLE) DID NOT	// CONTROL IN AUTO. WTR IN SENSING LINES
B	CR3	032555A	090380	L	MV	F20		R	1		T	DHV-110 DID NOT OPERATE AS REQUIRE (FIFTH OCCUR)	ELECTRICAL SHORT FOUND IN MOTOR
B	CR3	032555B	090580	L	RM	F16		S	1		T	MUV-23 FAILED TO OPERATE, NO POWER	FAILED CONTROL TRANSFORMER
B	CR3	032682	091680	L	MV	F16		T	1		T	DHV-111('B' DH PMP DISCHR THROTTLE) DID NOT OPER.	HIGH ALARM SWITCH DID NOT OPERATE
B	DB1	020989A	031678	B	MV	A26			1		T	AUX.FDPMP.1-1 STOP VLV AF3870 FAILED TO OPEN	LIMIT SWTCH ON VLV MTR NOT ADJUSTED PROP.
B	DB1	0209898	031678	B	CV	E00			2		T	CHECK VLVS AF39&72 LEAKED INTERNALLY	CAUSE OF REVERSE LEAKAGE NOT GIVEN
B	DB1	021957	071678	L	MV	A12			1		N	DECAY HEAT COOL.1-2 OUTLET VLV DH-14A WOLDN'T OPEN	ACTUATOR ARM HAD BECOME MISALIGNED
B	DB1	025402	011779	L	MV	B20			1		N	CORE FLOOD TANK 1-2 ISO VLV CFIA WOULD NOT CLOSE	LOOSE SET SCREW IN MOTOR OPERATOR
B	DB1	025521	022079	B	MV	B23			1		T	AFW VLV AF3869 COULD NOT BE CLOSED REMOTELY	FAULTY TORQUE SWITCH IN MOTOR OPERATOR
B	DB1	025520	030679	H	RM	V01		U	2		N	BORATED WTR STOR TANK ISO VLVS DH7A&7B CLOSED WHEN	REQUIRED OPEN--PERSONNEL ERROR
B	DB1	026602	032079	L	MV	B10			1		T	DECAY HEAT REMOV CONT ISO VLV DH 2735 FAILED TO CL	OSE--BUILDUP OF BORIC ACID ON VALVE STEM
B	DB1	026597	070479	B	MV	F20			1		T	AFW VLV AF 3870 WOULD NOT OPERATE REMOTELY	INTERNAL SHORT CIRCUIT IN MOTOR WINDING
B	DB1	030931	041080	L	MV	A12			1		N	DHR COOLER OUTLET VLV WOULD NOT OPEN COMPLETELY	RADIUS ARM OUT OF ADJUSTMENT
B	DB1	030872	041880	L	RM	B12			1		N	DH62 WAS DISCOVER OPEN	REMOTE OPERATOR OUT OF ADJUSTMENT
B	DB1	031898	071080	L	RM	F02		C	1		N	DH COOLER 1-2 DISCH CONTROL VLV OPERATED ERRATIC	SFAS CH 2 DEENERGIZED FOR MAINTENANCE
B	DB1	031906A	072480	L	RM	F02		B	1		N	DH 12 CLOSED	PERSONNEL SHORTED FUSE CLIP IN CONTROL PC
B	DB1	0319068	072480	L	RM	F06		B	1		N	DH 11 CLOSED	INADEQUATE RESTORATION PROCEDURE
B	DB1	031906C	080380	L	RM	F02		B	1		N	DH 11 CLOSED	MAIN. SPEC. REMOVED BISTABLE
B	DB1	032122	081380	L	RM	G16		V	1		N	DECAY HEAT ISO VLV DH-11 BEGAN CLOSING,STOPPED PMP	PERSONNEL FAILED TO BLOCK AUTO CLOS.SIGNL
B	DB1	032832	100880	H	CV	E25			1		T	GROSS BACK LEAKAGE DISCOVERED THROUGH CF30	DISK DISENGAGED FROM VALVE BODY

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	OE1	014808	041376	H	XV	F12			1	N		FLOOD TANK 1A NITROGEN ADD VLV FAILED OPEN	VAL STEM SEPERATED FROM DISK
B	OE1	030598	030680	L	MV	A26			1	T		DHR COOLER 1B OUTLET VLV 1LP-14 FAILED TO OPEN	OUT OF ADJUSTMENT LIMIT SWITCH
B	OE1	031621	061880	H	CV	E00			1	N		BACKLEAKAGE DISCOVED THROUGH "B" HPI LINE CHECK VL	NO CAUSE GIVEN
B	OE2	016201	101476	L	MV	A16	S		1	T		VLV LPSW-5 COULD NOT BE OPENED REMOTELY	DIRTY ELEC.CONTACT IN MOTOR CONTROL CENTR
B	OE2	017541	040577	F	MV	B12	R		1	T		VALVE 2LP-21 FAILED TO CLOSE	LOOSE SET SCREW ON PINION GEAR OF MTR SET
B	OE2	019970	120877	F	XV	V01	U		1	N		ISO.VLV.TO CHAN.3 RB PRESS.TRANS.SHUT BY MISTAKE	PERSONNEL ERROR
B	OE2	027795*	120979	H	MV	A02			2V	M		HPI SUCTION VLV FROM BWST RENDERED INOPERABLE	PERSONNEL SHOULD HAVE BEEN DOING UNIT 1'S
B	OE2	031735	062580	F	MV	A02	R		1	U		2LP21 FAILED TO OPEN,SET SCREW LOOSE ON MOTOR PIN.	PREVIOUS REPAIR WORK OR VIB. AND AGE
B	OE2	032690	091680	F	MV	A20	R		1	T		2LP21 FAILED TO OPEN	LOOSE SET SCREW ON MOTOR OPERATOR PINION
B	OE3	014927	050476	L	RM	R23			1	T		VALVE 3CS-5 WOULD NOT CLOSE REMOTELY	TORQUE SWITCH FAILURE
B	OE3	016209	110176	H	CV	V01	U		2	M		IMP.LINEUP VALS 3HP-152 + 3HP-153 CLOSED S.B.OPEN	PERSONNEL ERROR
B	OE3	020064	010378	L	AV	F12			1	T		VALVE 3LP-14 FAILED TO CYCLE MANUALLY	MECH PARTS LOOSE+OUT OF ALIGN
B	OE3	020592	020378	F	MV	A23			1	T		VALVE BS-3 FAILED TO OPEN	TORQUE SWITCH FAILURE
B	OE3	020593	020778	F	MV	F12			1	T		VALVE BS-2 FAILED IN INTERMEDIATE POSITION	VALVE STEM FAILURE
B	OE3	021047	032078	H	MV	A16	S		1	T		VALVE HP-24 FAILED TO OPEN	DIRT ON VAL OPER CONTACTS
B	OE3	027368	101979	L	MV	F02			1	T		LPI VLV 3HP-410 OPENED FULL WHEN ATTEMPTING CLOSE	MOTOR MISWIRED
B	OE3	031086	042380	L	CV	B00			1	N		CHECK VLV FAILED TO RESEAT AFTER TEST	NO CAUSE GIVEN FOR VLV FAILURE IN ECCS SY
B	RS1	014306	020776	L	MV	A14			1	T		RHR MOV FAILED TO OPEN DURING TESTING(HV-26106)	TIGHT PACKING /POSS STICKING SEAT
B	RS1	016558*	111176	L	MV	A23	R		2	T		TWO DECAY HEAT MOVS FAILED TO OPEN FOR MONTH TEST	TORQUE SWITCHS NEEDED RESET/TESTED WEEKLY
B	RS1	019536	100177	L	MV	F20	R		1	N		BWS ISOL VALVE FAILED TO OPERATE (SFV-25003)	LIMITORQUE OPERATOR(SM8)FAILED(EXCESS OP)
B	RS1	019666	111177	H	MV	V04	U		2	T		VALVE LINE-UP INCORRECT//NEW VALVES WERE INSTALLED	--WITH OPEN/CLOSE INDICATION ATYPICAL
B	RS1	019798	111977	H	MV	F00			1	T		HPI INJECTION ISOLATION VALVE FAILED TO CYCLE/TEST	UNKNOWN
B	RS1	0217468	061178	K	RV	C00			3	T		2 SAFETY,1 ELECTRO RV LEAKING THRU DURING TESTING	UNKNOWN/2 REPLACED,1 REBUILT
B	RS1	030143	010980	H	RM	F16	U		1	U		POWER TO MU TANK ISO VLV SFV-23508 WAS NOT RESTORE	PERSONNEL ERROR
B	RS1	030725	032280	L	MV	B20	R		1	N		SFV-25003 (BWST ISO TO DHR SUCTION) FAILED TO CLO.	FAILED CLUTCH IN MOTOR OPERATOR

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
B	TI1	017343	030977	F	MV	B23			1	T	MD SPRAY PUMP SUCTION VALVE FAILED TO CLOSE/TEST	GREASE IN SPRING PREVENTED TORQUE SW OPER
B	TI1	025505	011279	H	MV	A16	S		1	T	HPI DH-V-58 DID NOT OPEN FROM MID POSITION	MOTOR BREAK DID NOT RELEASE
B	TI2	021277	040478	L	AV	A24	S		1	T	RHR AOV (NS-V838) FAILED TO OPEN DURING TEST	FAILURE OF SOLENOID OPERATED PILOT VALVE
B	TI2	027456A	032879	B	RM	V00	U		2L	N	AUX FEEDWATER BLOCK VLVS DISCOVERED CLOSED	NO CONCLUSIVE CAUSE COULD BE FOUND
C	AR2	023481	122078	B	MV	A16	T		1	N	FLOW CONTROL VLV 2CV-1025-1 FAILED TO OPERATE	LOOSE MOTOR POWER CONNECTION
C	AR2	026245A	051479	B	MV	B16	T		1	N	SUP VLV 2CV-1039-2 WOULD NOT RESPOND TO SIGNAL	BLOWN FUSE IN VLV CONTROL CIRCUITRY
C	AR2	026248	060379	B	MV	B26	R		1	N	EMER FEED WTR CONT VLV 2CV-1036-1 WOULD NOT SHUT	LIMIT SWITCH WAS OUT OF ADJUSTMENT
C	AR2	026243A	060979	B	MV	B16	T		1	N	EMER FEED WTR CONT VLV 2CV-1038-1 WOULD NOT SHUT	LOOSE WIRE ON THE HANDSWITCH
C	AR2	026543A	070679	B	MV	B00	R		1	N	EMER FEED WTR CONT VLV 2CV-1038 WOULD NOT SHUT	NO REASON FOUND FOR FAILURE
C	AR2	026896	082679	H	MV	A20			1	N	SAFETY INJECTION TANK MAKEUP VLV 2CV-5064 FA SHUT	SPRING TENS ON VLV OPER GATE OUT OF ADJ
C	AR2	031374	040880	F	RM	V03	V		1	T	'A' TRAIN CONT. SPRAY ACCIDENTALLY INITIATED	PERSONNEL ERROR DURING TESTING
C	AR2	031672	060580	B	MV	A16	T		1	N	EF WTR SUP. VLV (2CV-1075) FAIL. TO OPEN ON DEMAND	LOOSE CONNECTOR AT VLV OPERATOR
C	AR2	031823	070780	B	MV	A20	R		1	N	EF VALVE 2CV-1075-1 FAILED TO OPEN FROM CONTROL RM	LOOSE BRUSH CONNECTION
C	AR2	032447	081280	F	MV	F16	S		1	T	CONTAINMENT SUMP RECIRC VLV 2OV-5648-2 FAILED	FOREIGN MAT. IN VLV OPERATOR SW CONTACTS
C	AR2	033375	112980	H	RM	B16	S		1	M	HPCI VLV 2CV-5056 FAILED TO CLOSE	BELIEVED TO BE CONTROL CIRCUIT FUSE FAIL.
C	CC1	014465	030576	H	MV	F16	S		1	N	HPSI LP.ISO.VLV 1-MOV-616 WOULD NOT OPER. REMOTELY	BLOWN CONTROL CIRCUIT FUSE CAUSED FAILURE
C	CC1	016403	111776	H	MV	A23	R		1	T	AUX.HI.PRESS.LP.ISO.VLV SI-617 FAILED TO OPEN	DEFECTIVE TORQUE SWITCH;BURNED CONTACTS
C	CC1	025619	041179	H	MV	V06	U		1	T	SI HDR ISO VLV SI-656 SHUT WHEN REQUIRED OPEN	DEFECTIVE PROCEDURES
C	CC1	026785	082879	L	MV	V01	U		2	T	SI-4145-MOV OPEN REQ SHUT,SI-4143-MOV SHUT REQ OPN	OPERATIONS PERSONNEL ERROR
C	CC1	027170	092479	H	MV	A20	R		1	T	AUX HIGH PRESS LOOP ISO VLV SI-617 FAILED TO OPEN	VLV MOTOR WAS SINGLE PHASING IN OPEN DIR
C	CC1	030214	010480	H	RM	F23			1	N	12A HPSI STOP VLV WOULD NOT THROTTLE	LOOSE LEADS ON TORQUE SWITCH
C	CC2	018881	082577	F	RM	F16	S		1	N	#21 CONT.SPRAY SYS.HDR.ISO.VLV(2-SI-4150-CV) OOS	VLV PLACE.OUT OF SERV.DUE TO FAIL.RESIST.
C	CC2	019740	111577	H	MV	A26			1	N	MOV-627,AUX HI PRESS HDR STP LP 118,WOULDN'T OPEN	OPEN LIMIT SWITCH CONTS. WERE DIRTY
C	CC2	022246*	090778	H	CV	E00			2V	N	#2186228 SI.TANK OUTLET CHECK VLVS LEAKING	CAUSE OF REVERSE LEAKAGE NOT GIVEN
C	CC2	033265	111080	H	AV	B24	S		1	N	SI-661-CV FAILED TO CLOSE	SOLENOID AIR VLV CONTROLLING AIR FAILED

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
C	FC1	014561	041476	H	RM	B16		S	1	T		HCV-383-4 FAILED TO CLOSE ON TEST	BINDING CONTACT IN BREAKER TO VALVE
C	FC1	019551	102677	K	RV	A00		R	1	M		VALVE PC-142 RELIEF PRESSURE OUT SPEC HIGH	COULD NOT BE DETERMINED
C	FC1	022469	092178	B	AV	A24		U	1	T		VAL YCV-1045 FAILED TO OPEN(AUX.FD.PMP.STM.INL.)	INSTRUMENT AIR SUPPLY TO VAL CLOSED
C	FC1	022972	110178	B	CV	E05		C	1	R		AUX FEED CHECK VALVE FOUND INSTALLED WRONG	CONSTRUCTION ERROR
C	FC1	023139	112478	L	RM	F16		U	1	T		PC-1058 WAS NOT OPERATING	VALVE CLOSING RELAY NOT REWIRED AFT MAINT
C	FC1	023171	122078	K	RV	V06		U	2	M		TWO PRESS OP RELIEF VALVES OPENED WHEN REQ CLOSED	TECH PULLED FUSES,DEFECTIVE PROCEDURES
C	FC1	025590	032179	H	MV	A16		S	1	N		LOOP SAFETY INJECT. VLV HCV-311 FAILED TO OPEN	INTERLOCK SWTCH BINDING IN CONT CIRCUITRY
C	FC1	030212	011780	H	RM	B16		S	1	T		CONT.SUMP RECIRC VLV HCV-383-4 FAILED TO CLOSE	AUX INTERLOCK FOUND BINDING
C	MI2	014461	030976	B	RM	A16		S	1	M		AUX.FEEDPMP.STM.INLET VLV.CYCLED;WOULD NOT REOPEN	FAILURE OF VALVE OPERATING CIRCUIT
C	MI2	015338	072476	B	MV	A20			1	N		INLET STEAM TRIVALVE WOULD NOT OPEN	VALVE OPERATOR SPINDLE FAILED
C	MI2	017620	040777	H	CV	E00		R	1	N		INT LEAK OF CV BETW INJECT TK 4 AND PRI COOLANT	CAUSE UNKNOWN
C	MI2	018740	072177	H	CV	E00		R	1	N		S.I.HEADER CHECK VLV. 2-SI-648 LEAKING INTERNALLY	NO CAUSE GIVEN
C	MI2	018971	081677	H	CV	E00		R	1	N		INT LEAK OF CV BETW INJECT TK 4 AND PRI COOLANT	CAUSE UNKNOWN
C	MI2	027976*	122879	H	AV	F00			2	T		HPSI INJ.VLVS. 2-SI-616&626 OVERTRAVELLED 3%	NO CAUSE FOUND FOR FAILURE
C	MI2	028075*	122879	H	RM	C00		R	2	N		SI TANK #1 FILL VLV AND/OR DRAIN VLV LEAKING INTER	NALLY--NO CAUSE FOR LEAKAGE GIVEN
C	MI2	031945	070380	H	XV	V06		U	1	T		HPSI PUMP MINIMUM FLOW VLV WAS SHUT	DEFECTIVE PROCEDURES,CAUSED PUMP SEIZURE
C	MI2	033586	121080	H	MV	F23			1	T		HPSI INJECTION MOV-2-SI-616 OVERTRAVELLED 1/4 INCH	OPERATOR SENSITIVE TO TORQUE SWITCH
C	MY1	020758	020277	H	RM	F16		U	1	M		VALVE SL-P-3 FAILED TO OPERATE	WIRES DISCONNECTED (CAUSE UNKNOWN)
C	MY1	022141	081578	K	RV	A00			1	M		PRESSURIZER RV PR-S-13 SETPOINT OUT OF SPEC	CAUSE UNKNOWN,SETPOINT ADJUSTED
C	MY1	025490A	030779	H	MV	F23			1	T		"A" TRAIN HPSI PMP SUCT.VLV FAILED TO OPERATE	IMPROPER TORQUE SWITCH SETTING
C	MY1	025490B	030779	F	MV	F23			1	T		"A" TRAIN SCAT OUTLET VLV FAILED TO OPERATE	IMPROPER TORQUE SWITCH SETTING
C	MY1	026274	060779	F	XV	A12			1	N		CS-14 "B" TRAIN SPRAY HEADER ISO.VLV WOULD NOT OPN	REMOTE LINKAGE DISCONNECT FROM HANDWHEEL
C	MY1	030804	031980	L	XV	V01		U	2	N		RHR VLVS RH-8 AND RH-10 FOUND OPENED AND UNLOCKED	PERSONNEL ERROR
C	MY1	030991	040880	L	MV	F00		R	1	T		LPSI LOOP HEADER STOP VALVE FAILED TO OPERATE	NO CAUSE FOUND (VLV IN LOOP #3)(LSI-M-31)
C	MY1	031389	050680	L	MV	F20		R	1	T		LPSI LOOP 3 HEADER STOP VLV FAILED TO OPERATE	BROKEN WELD ON COUPLING ON LSI-M-31

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
C	MY1	031390	050780	H	XV	V03		U	2L		U	COOLING WATER IMPROP LINED UP TO S-CHARGING PUMP	PERSONNEL ERROR (SEPARATION NOT MAINTAIN)
C	PA1	018274	061577	H	MV	A16		T	1		T	MOV-3011 FAILED TO OPEN	CONTACT FOR "SEAL-IN" CKT ON RELAY FAILED
C	PA1	020230	122377	H	MV	G16		T	1		T	MOV-3011(HPCI ISO.VLV) FAILED TO REMAIN OPEN	BAD SWITCH CAUSED CLOSING CONT.TO STICK
C	PA1	020231	010878	L	AV	A24		S	1		U	VALVE CV-3025 FAILED IN CLOSED POSITION	WATER IN AIR LINE TO VALVE OPERATOR
C	PA1	025184	012679	H	RM	F16		S	1		N	SI TANK T82D VENT VLV OPENED WHEN PRESSURIZING TNK	SHORT BETWEEN FILL AND VNT VLV CIR(CV3053
C	PA1	0273658	101279	K	RV	A12			1		T	RV1039(PZR RELIEF VLV) SET PRESSURE FOUND HIGH	ALIGNMENT PIN FOUND MISPOSITION
C	PA1	032156	071980	H	XV	V03		U	1		N	INST. EQ. VLV NOT CLOSE AFTER CALIBRATION	PERSONNEL ERROR WHEN CAL. HPSI FLOW IND.
C	PA1	032224	081980	H	RM	V03		U	1		N	CV-3031 WAS CLOSED AND THEN IMMEDIATELY OPENED	OPERATOR FAILED TO RELATE TEST REQUIRE.
C	SL1	015002	052176	B	MV	A16		T	1		N	NO AUX FEED PUMP STEAM SUPPLY VALVE FAILED TO OPEN	NO SIGNAL TO VALVE/COMMAND FAULT/EL[illegible]
C	SL1	015507	070976	B	MV	A16		T	1		T	AUX FEED PUMP STEAM INLET VALVE FAILED TO OPEN	COMMAND/H2O IN CONTROL CIRCUIT/POOR DES
C	SL1	016880	120876	B	MV	A16		T	1		T	AUX FEED PUMP STEAM INLET VALVE FAILED TO OPEN	COMMAND/H2O IN CONTROL CIRCUIT/DESIGN
C	SL1	019504	081777	F	RM	A00			1		T	CONTAINMENT SPRAY VALVE FAILED TO OPEN/TESTING	UNKNOWN/ LOCKED OPEN HANDWHEEL
C	SL1	019509	092577	F	RM	A00			1		T	CONT.SPRAY HDR.ISO.VLV FCV-07-1B NOT FULLY OPEN	UNKNOWN (CONT.SPRAY VLV.STICKING)
C	SL1	020639	020978	B	MV	B20			1		T	AUX FEED PUMP VALVE (MV-09-11) FAILED TO CLOSE	MOV MOTOR WINDING PARTIALLY SHORTED
C	SL1	023141	112178	H	MV	A23			1		T	MOV 07-1B IN 1B ECCS TRAIN FAILED TO OPEN ON TEST	TORQUE SW FAULTY,REPLACED SWITCH
W	BV1	016356	102576	H	MV	B16		S	1		N	DRAIN VALVE ON ACCUMULATOR 1C FAILED TO SHUT	NO PWR/THERMAL OVERLOAD OF LINESTARTER
W	BV1	018725	072877	B	RM	A23			1		T	AUX. FEEDWATER CONT VLV WOULD NOT OPEN ELETRIC.	BINDING TORQUE SWITCH
W	BV1	022135	080178	L	RM	B10			1		T	1B LOW HEAD SAFETY INJECTION PMP.HEAD.ISO.NOT CLOS	VLV FAIL.TO CLOSE DUE TO BORIC CRY.IN PAK
W	BV1	025486	030579	B	CV	F12			1		N	1C S/G STM SUP CHECK VLV INOPERABLE	NUT AND WASHER ON CHECK VLV WAS MISSING
W	BV1	028146	060979	L	MV	F23			1		M	1B LHSI PUMP SUCTION VLV FOUND TO BE INOPERABLE	MTR OPERATOR TORQUE SWITCH WAS FAILED
W	BV1	028105	091079	L	CV	G10			1		T	1A LHSI PUMP RECIRC CHK VLV HAD FLOW RESTRICTION	FOREIGN MATERIAL LODGED IN CHECK VLV
W	BV1	027663	112779	H	MV	V01		U	1		M	HHSI PMP SUC VLV CH-115D ISO FOR MAINT WHEN REQ OP	PERSONNEL ERROR--2ND VLV ALSO SHUT
W	BV1	031210*	052180	L	RM	B16		U	2V		T	RHR ISOL VLVS FAILED TO CLOSE	DEENERGIZED PROCESS CONTROL SIGNAL
W	BV1	032895	100180	H	CV	B12		R	1		T	SI PUMP(CH-P-2A) DISCHR CHECK DID NOT RESEAT	ANTI-ROTATION DEVICES BINDING
W	BV1	033542*	121880	K	RV	F00		R	2V		U	PLANT SHUT DOWN TO REPAIR PZR SAFETY VLVS	CAUSE NOT GIVEN

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
W	DC1	016367	110176	L	MV	F12			1	T		RHR VALVE FAILED TO CYCLE DURING TESTING	PACKING GLAND WAS TOO TIGHT
W	DC1	016648	121776	F	MV	V01	U		1	T		CONTAINMENT SPRAY PUMP SUCTION VALVE FOUND CLOSED	PERSONNEL LEFT VALVE SHUT AFTER A TEST
W	DC1	020694	020878	B	MV	B16	S		1	N		AUX FEED MOV FAILED TO CLOSE	COMMAND/LOOSE ELEC CONNECTION/CONTROL
W	DC1	021011*	032278	H	MV	F16	U		3	N		POWER FOUND OFF TO 3 ECCS VALVES	3 BREAKERS FOUND TRIPPED ON MCC
W	DC1	023114	112878	B	MV	B16	S		1	N		AFW THROTTLE VLV. WOULD NOT CLOSE ELECTRICALLY	BROKEN LEAD ON MTR OPERATOR
W	DC1	025045B	010679	B	MV	B20	R		1	M		AFW VLV FMO-231 WOULD NOT CLOSE	BROKEN WIRE IN MOTOR OPERATOR
W	DC1	025380	022379	B	MV	B16	T		1	T		AFW DISCHG VLV FMO-212 WOULD NOT CLOSE	LOOSE CONNECTION IN HOT SHUTDOWN PANEL
W	DC1	025378	030379	B	MV	B20	R		1	N		AUX FEED VLV FMO-212 WOULD NOT SHUT FROM CONT RM	BROKEN WIRE IN VLV'S OPERATOR
W	DC2	020978	031878	B	CV	B00			1	N		AUX FEED SYS CHECK VALVE FROM S/G 1 STUCK OPEN	UNKNOWN (VALVE 2-FW138-1)ATWOOD & MORRILL
W	DC2	021079	041678	L	XV	V01	U		1	N		HANDWHEEL CAME OFF RHR VALVE POSITIONING IT WRONG	PERSONNEL FAILED TO REPOSITION THE VALVE
W	DC2	022069	071978	L	MV	F00			1	T		RHR PUMP SUCTION MOV FAILED TO CYCLE/TIME-WISE	UNKNOWN WHY CYCLE TIME EXCEEDED
W	DC2	022581	092278	K	RV	V01	U		1	T		PRESSURIZER RV OPENED WHEN REQUIRED TO BE CLOSED	PERSONNEL ERROR
W	DC2	022838A	101078	B	AV	C00			1	U		PNEUMATIC TEST VALVE LEAKED THRU	UNKNOWN
W	DC2	022838B	101078	B	XV	V01	U		1	T		AUX FEED VALVE FOUND UNLOCKED & OPEN/WRONG LINE-UP	PERSONNEL ERROR
W	DC2	023030*	112178	F	CV	A05	C		2	N		CHK.VLVS.CTS-127E&W TO THE LOWER CONT.SPRAY NOZZL-	-ES INSTALLED BACKWARDS//FABRICATION ERR.
W	DC2	025045A	010679	B	MV	B20	R		2	M		AFW VLVS FMO-2326222 WOULD NOT CLOSE	BROKEN WIRES IN MOTOR OPERATORS
W	DC2	027930	121779	F	MV	A23			1	N		CONTAIN SPRAY PMP DISCHG VLV IMO-220 FAILED TO OPN	FAILURE CAUSED BY TORQ SWTCH BINDING
W	DC2	030740	032580	B	MV	F16	S		1	T		AUX FEED VLV FMO-221 (#2 SG) DID NOT OPERATE	ARMATURE LEAD PULL OFF OF VLV OP MOTOR
W	DC2	031630	061380	B	RM	C00			1	N		FRV-225 LEAKED ENOUGH TO HINDER WELDING DOWNSTREAM	NO CAUSE GIVEN. MINOR LEAKAGE
W	HN1	015218	070576	B	CV	E00			1	N		CHECK VALVE IN FEED LINE HAD REVERSE LEAKAGE	NO CAUSE GIVEN FOR REVERSE LEAKAGE
W	HN1	018777	080177	B	CV	E00			1	T		CHECK VALVE ON AUX FEED PUMP LEAKING INTERNALY	UNKNOWN
W	IP2	018787B	050777	F	RM	F23			1	T		VALVE 8228 DID NOT OPERATE PROPERLY	TORQUE SWITCH MALFUNCTION
W	IP2	018788A	051377	K	RV	A00	R		1	T		RV PCV-468 DID NOT OPEN AT SETPOINT PRESSURE	SET POINT DRIFT
W	IP2	018788B	051377	K	RV	C25			1	T		INTERNAL LEAKAGE PAST VALVE PCV-466	EXCESSIVE VALVE SEAT WEAR
W	IP2	021653	052378	H	CV	E12			1	T		4 IN SWING CV D.S.OF PUMP 22 LEAKING INTERNALY	TWO HANGER BRACKET BOLTS MISSING

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
W	IP2	026367	062679	B	RM	B00			1	T		SHUTOFF VLV PCV-1310B(STM.SUP.TO #22 AFW PMP) WOUL	D NOT SHUT--NO CAUSE FOUND
W	IP3	014604	042976	F	RM	V03	U		2L	T		INCRT.VLV LINUP FOR TEST,CNTMNT SPRY ACCID.TURN ON	PERSONNEL ERROR
W	IP3	030696	031580	F	XV	A08			1	T		VC ISO VLV 869B(ISO SPRAY PUMP FROM CONT SPRAY HDR	DIDN'T OPEN.KEY FAILURE IN YOKE NUT BUSH.
W	IP3	033011A	101780	X	RV	C25			1	T		PCV-466 WOULD NOT RELEASE AT SET PRESSURE & LEAKED	VALVE SEAT AND DISK HAD GROOVES
W	JF1	020993	032578	B	MV	V02	U		2	N		MDAFP & TDAFP RECIRC BYPASS ISO VLVS OPEN	PERSONNEL ERROR
W	JF1	022633*	090978	B	RM	F16	U		3	T		CONTROL WAS LOST ON FLOW CONT.VLVS 3228A,B,&C	DEFECTIVE RELAY IN TDAFP CONTROL CIRCUIT.
W	JF1	022629	091878	L	RM	V06	U		1	T		RHR PUMP SUCTION VLV 8701A CLOSED WHEN REQ. OPEN	INADEQUATE PROCEDURES
W	JF1	025436	012379	G	MV	F00			1	T		BIT INLET VLV Q1E21V0168 FAILED TO OPERATE ELEC.	NO CAUSE FOUND FOR FAILURE
W	JF1	030326*	020180	B	RM	A24	U		2V	T		CONTROL VLVS FOR 'A' AUX FEED TRAIN DIDN'T AUTO OP	//EN. CONTACTS MISALIGNED IN CONTROL CIR
W	JF1	030614	030380	F	MV	A00			1	T		CS-MOV-8820B,DISCH TO CONT SP HDR,DID NOT OPEN	CAUSE UNKNOWN (AFFECTED THE B TRAIN)
W	JF1	031513	052880	L	MV	B12			1	T		1A RHR HEAT EXCH DISCHARGE VLV FAILED TO CLOSE	CAP SCREW CONNECT STEM AND OP CAME OUT
W	JF1	033005	102080	H	MV	A26			1	T		VALVE 1-CVC-MOV-115D(RWST SUPPLY TO CHR PUMPS)FAI/	/LED TO OPEN. LIMIT SWITCH NEEDED ADJ.
W	JF1	033572	112880	L	RM	F16	S		1	T		LOOP SUCTION VLV FOR 'A' TRAIN RHR CLOSED	DIRTY CONTACTS IN PRESSURE TRANSMITTER
W	JF1	033672	122580	L	RM	F16	S		1	M		RHR LOOP B SUCTION VLV WENT CLOSED WHEN REQ OPEN	IMPROPER SIGNAL TO VLV DUE TO SHORT/MAINT
W	KE1	013963	010876	H	MV	F12			1	T		VALVE SI-2B DID NOT OPERATE	SCREW HOLDING TRIP LEVER BACKED OUT
W	KE1	014240	022076	F	RM	A01	C		1	T		VALVE ICS-5B FAILED TO OPEN(CONT.SPRAY DISCH. VLV)	VALVE MANUALLY TORQUED DOWN TOO TIGHT
W	KE1	019312	100377	F	MV	F02	C		1	M		MAINT.MAN DEENERGIZED 2 SW VLVS,WHEN ONLY ALLOW.T-	-O DEFNER.1 VLV//PERSONNEL ERROR
W	KE1	020788	030278	H	MV	A00	R		1	T		CNTNMNT SUMP ISO VAL WOULD NOT FULLY OPEN	CAUSE UNKNOWN
W	KE1	021077	040478	H	MV	A14	R		1	T		CNTNMNT SUMP ISO VAL WOULD NOT FULLY OPEN	VAL PACKING AT END OF USEFULL LIFE
W	KE1	026136	053079	L	RM	A00			1	N		RHR LOW HEAD INJECT VLV SI-302A FAILED TO OPEN	NO CAUSE FOUND FOR FAILURE
W	KE1	030654	030380	L	MV	A23			1	T		DURING CONT SUMP RECIRC TEST,SI-351 DID NOT OPEN	TORQUE SWITCH OUT OF ADJUSTMENT
W	KE1	030693	031080	B	RM	B00			1	T		AUX FEED PUMP DISCH CROSSCONNECT VLV FAIL TO CLOSE	NO CAUSE FOUND FOR FAILURE OF AFW 108
W	KE1	031613	062480	L	CV	B00			1	N		RHR SUCTION CHECK VLV FAILED TO CLOSE	CYCLING OF PUMPS SEATED CHECK VALVE
W	NA1	020872	031478	G	AV	F16	S		1	N		LET DOWN TRIP VALVE OUTSIDE ISOLATION CLOSED SPUR	SHORT IN VALVE CIRCUIT CAUSED VLV TO SHUT
W	NA1	021150	042878	H	RM	B00			1	N		STEAM DUMP VAL 408E STUCK OPEN FOLL. TRIP	CAUSE NOT GIVEN

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
W	NA1	021506	051478	B	AV	V06		U	2		T	AUX FEEDWATER VALS PCV-F2-159A,-159B IMP.LINEUP	CHECKOFF SHEET DOES NOT LIST NORM VAL POS
W	NA1	022269	081778	L	MV	A14			1		T	VALVE MOV-1860B FAILED TO OPEN DURING TEST	DRY VALVE PACKING CAUSED LIM SW TO TRIP
W	NA1	025767	030679	L	RM	F00			1		N	RHR DISCHG VLV MOV-1720B INADVERTANTLY OPENED	CAUSE NOT STATED
W	NA1	025862	041679	L	MV	B26			1		T	RHR ISO.VLV MOV-1701 FAILED TO CLOSE AUTOMATICALLY	MISALIGNED LIMIT SWITCH CONTACT
W	NA1	025859	043079	H	RM	A14			1		N	SAFETY INJECTION VLV MOV-1856B FAILED TO OPEN	VLV STUCK DUE TO DRIED PACKING
W	NA1	025974	051179	L	RM	A00			1		T	LOW HEAD SI PMP DISCHG.VLV.MOV-1863A FAILED TO OPN	CAUSE OF EVENT UNKNOWN
W	NA1	027593	110679	L	RM	V02		U	1		N	RHR INLET VLV MOV-1701 SHUT WHEN REQ. OPEN	MAINTENANCE PERSONNEL ERROR
W	NA1	030111	011880	F	RM	A16		T	1		N	MOV-RS-100A FAILED TO OPEN (COMMAND FAULT)	CLOSED SIGNAL TO VALVE (PERSONNEL ERROR)
W	NA1	030333	012980	F	RM	A16		T	1		N	MOV-RS-100B FAILED TO OPEN (COMMAND FAULT)	CLOSED SIGNAL TO VALVE (PERSONNEL ERROR)
W	NA1	031697	062380	L	RM	A16		S	1		T	RECIRC VLV MOV-1863B FAILED TO REOPEN	DEFECTIVE ELECTRICLE SWITCH IN CON ROOM
W	NA1	036209A	122980	F	MV	F16		S	1		T	MOV-SW-105C FAILED TO OPERATE DURING TEST	LOOSE LEAD ON BREAKER/CONTROLLER
W	NA1	036209B	122980	F	MV	F10			1		T	MOV-SW-108A FAILED TO OPERATE DURING TEST	WATER IN VLV OPERATOR MOTOR
W	NA1	036209C	122980	F	MV	F00			1		T	MOV-RS-101A FAILED TO OPERATE DURING TEST	CAUSE UNKNOWN
W	NA2	032572	090580	G	CV	B09			1		T	2-SI-70(BORON INJ RECIRC LINE) LEAKED EXCESSIVELY	CORROSION ALLOW SPRING TO DROP OFF PLUG
W	PR1	014758	051376	L	MV	A23		R	1		T	MOV FAILED TO OPEN DURING TEST (MV-32065)	TORQUE SW PROBLEM/ADJUSTED IT(LIMITORQUE)
W	PR1	018341	061877	B	MV	F20			1		N	AUX FEED PUMP DISCHARGE VALVE FAILED TO OPERATE	OPEN LEAD IN OPERATOR/LIMITORQUE SMB-000
W	PR1	026266	041079	H	MV	A00			1		T	MV-32067 HPSI VLV TO RX VESSEL FAILED TO OPEN	NO CAUSE COULD BE FOUND
W	PR2	016284A	102576	H	RM	B00			1		T	HOT LEG SAMPLE LOOP VLV CV-31807 FAILED TO CLOSE	UNKNOWN/RETEST WAS OK
W	PR2	017889	051977	B	XV	V06		U	1		U	PUMP INLET VALVE FOUND NEARLY SHUT/AUX FEED INLET	POSITION REQUIREMENT WILL GO ON CHECKLIST
W	PR2	019284	100477	H	MV	A00			1		T	SAFETY INJ PUMP SUPPLY VLV MV-32183 FAILED TO OPEN	UNKNOWN/ STEM WAS LUBRICATED/NEXT TRY OK
W	PR2	020125	122377	B	MV	A16		S	1		T	#22 TURB.DRIVEN AFW PUMP STM.SUP.VLV.FAILED TO OP-	-EN//MOTOR LEAD GROUNDED TO JUNCTION BOX
W	PT1	013945	010876	B	MV	F20			1		T	MOV-4020 AUX FEED PUMP DISCHARGE FAILED STUCK/TEST	VALVE OPERATOR RING WORN/GEAR REPLACED
W	PT2	014348	031576	F	MV	A03		R	1		T	CONTAINMENT SPRAY 2MOV-8808 FAILED TO OPEN / TEST	PERSONNEL ERROR/TERMINAL SLIDER OPEN
W	PT2	015186	070176	B	MV	A23		R	1		T	MOV-2MS-2019/STEAM TO AUX FEED PUMP FAILED TO OPEN	TORQUE SW SETPOINT CAUSED TIGHT CLOSING
W	PT2	017035	012777	F	MV	F16		T	1		N	CONT.SPRAY PMP.DISCHG.VLV.2-8808 INOPERABLE	VALVE OPERATOR BREAKER WAS OPEN

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
W	PT2	018572	072877	H	MV	V01		U	1	N		MOV FOUND IN INTERMEDIATE POSITION/SINCE PREV TEST	PERSONNEL FAILED TO ASSURE FULLY OPEN
W	PT2	021766	061678	F	MV	F23			1	T		CONT SPRAY VALVE(MOV) FAILED TO OPERATE FOR TEST	SMB-00 LIMITORQUE SW FAULTY/REPLACED
W	RG1	018247	071377	H	CV	E00			1	N		SI PUMP 1A CHECK VALVE REVERSE FLOW TO RWST	UNKNOWN/ VELAN 3 INCH 1500 PSIG CHECK VAL
W	RG1	025265	020679	L	MV	A00			1	T		CNTMT RECIRC SUMP OUTLET MOV-8518 FAILED TO OPEN	FLEX OF LONG EXT MIGHT HAVE CAUSED OVERTO
W	RO2	014822	012876	H	CV	E00			1	N		B ACCUMULATOR CHECK VALVE 875E LEAKED THRU	REASON NOT STATED
W	RO2	015570	081776	B	MV	A20		R	1	T		VALVE V2-16A FAILED TO OPEN	LIMITORQUE OPER FAILED TO OPEN VALVE
W	RO2	017540	032677	B	RM	A00			1	N		VALVE V2-14A FAILED TO OPEN	INCREASE IN TENSION BETWEEN SEATING SURF.
W	RO2	019350	081677	B	MV	A20		R	1	N		VALVE V2-16B FAILED TO OPEN AS REQUIRED	LIMITORQUE VALVE OPERATOR FAILED
W	RO2	019351	081777	B	CV	E05			1	T		DISCH CK VAL FOR AUX FEED PUMP,C STM GEN FAILED	CK VAL HAS BURR ON HINGE JOINT,OPEN POSIT
W	RO2	019352	081777	B	MV	A20		R	1	N		VALVE V2-16A FAILED TO OPEN	LIMITORQUE VALVE OPERATOR FAILED
W	RO2	019667	102677	L	MV	A20			1	N		RHR VALVE 7598 FAILED TO OPEN	MOTOR WINDINGS WERE SHORTED
W	RO2	020053	120377	L	MV	A16	S		1	T		RHR VALVE 7448 FAILED TO OPEN	CIRCUIT THERMAL OVERLOAD DEVICE TRIPPED
W	RO2	022626	122177	B	MV	A12		R	1	T		AUX FEED PUMP DISCH VAL,V2-16A FAILED TO OPEN	EXCESS SEATING PRESS CAUSED BY OVERHEAT
W	RO2	020181	122277	B	RM	C19			1	N		VALVE V2-14C LEAKING INTERNALLY / NOT SHUT FULLY	INSUFFICIENT VALVE STEM LUBRICATION
W	RO2	020322	011178	L	MV	F20			1	T		VALVE RHR-7448 FAILED TO FUNCTION PROPERLY	OIL LEAKED INTO MOTOR (GASKET FAILED)
W	RO2	027067	090579	B	MV	A16		T	1	N		AFW ISO.VLV AFW-V2-16A FAILED TO OPEN	OPERATOR POWER SUPPLY BREAKER WAS TRIPPED
W	SA1	016939*	011077	H	MV	F20			2	N		MTR.BRKRS.TO VLVS 1SJ162 TRIPPED WHEN VLVS WERE O-	PENED//BOTH MTR.OPERATORS HAD FAILED
W	SA1	021910	052378	H	MV	A20			1	T		MOV 1SJ1 (HPIS) FAILED TO OPEN DURING TEST	WINDING FAILED/INCORRECT MOTOR SIZE/PERSN
W	SA1	022422	082478	B	AV	A12			1	T		AUX FEED PUMP STEAM VLV (1MS132) FAILED TO OPEN	STEM WAS FOUND DISENGAGED FROM ACTUATOR
W	SA1	033529	121480	H	CV	B00			1	T		VALVE 11SJ139 WAS FOUND TO BE COCKED OPEN	NO CAUSE GIVEN FOR LIFT CHECK VALVE FAIL
W	SE1	033818A	092280	L	MV	F26			1	U		1-FCV-70-156 FAILED TO OPERATE	LIMIT SW REQUIRED ADJUSTMENT
W	SE1	033789	092780	H	CV	B05			1	T		CHECK VLV 63-635 STUCK IN OPEN POSITION	INTERFERENCE BETWN DISC WELD AND VLV BODY
W	SE1	032973*	100580	B	RM	F01	C		2	T		AUX FEEDWATER VLVS LCV-3-1746173 WOULD NOT HAVE OP	//ER IN AUTO. PRESS SWITCH LEFT ISOLATED
W	SE1	033298	111980	F	MV	A16	S		1	T		CNTMT SUMP VLV TO CNTMNT SPRAY PMP DID NOT OPEN	INTER LIMIT SW ON FCV7421 FAILED ICV72-2C
W	SO1	020609	013078	F	RM	B00			1	T		CONT SPRAY VLV (CV-517) FAILED TO CLOSE FOR TEST	UNKNOWN/POSSIBLE LUBRICATION PROBLEM

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
W	SO1	021207	041878	H	MV	F12			1	T		MOV-850C FAILED TO OPEN IN REQUIRED TIME / TESTING	SHAFT DISTORTED/PROB DUE TO EXCESS TORQUE
W	SU1	014871	031876	B	MV	A16	S		1	N		AUX.FEEDWTR.PUMP DISC.VLV.MOV-FW-151A FAILED TO O-	-PEN//TIMING RELAY FAILURE
W	SU1	015522*	070276	H	CV	E00			2	T		TWO CHECK VLV (1-SI-128/130) LEAKED THRU	UNKNOWN
W	SU1	0168828	111376	K	RV	A00	R		1	T		PRESS SAFETY VLV (SV15518) OPENED AT HI PRESS	UNKNOWN/ "SETPOINT DRIFT" UP
W	SU1	021802	062278	L	MV	A02	C		1	T		MOV-RH-100 FAILED TO OPEN	MAINT ERROR/STEM WAS NOT ENGAGED TO DISC
W	SU1	030005	010880	B	CV	B00			1	N		CHECK VLV 1-FW-89 (DISCH AUX FP) FAILED TO CLOSE	CAUSE UNKNOWN
W	SU1	030321	020680	H	AV	B24	S		1	N		HCV-1852A DELAYED IN CLOSING WHILE RECIRC ACCUMU.	BELIEVED TO BE MOISTURE IN AIR LINES
W	SU2	015526	061576	L	MV	F12			1	T		LPIS MOV-28628 FAILED TO OPERATE FROM CONSOLE	THERMAL OVERLOAD DUE TO VALVE PLUG BIND
W	SU2	019744	110877	H	CV	E00			1	N		CHECK VALVE 2-SI-127 LEAKING THRU	UNKNOWN
W	TR1	014504	022176	L	MV	G16	S		1	N		RHR VLV CLOSED WHEN IT WAS REQUIRED TO REMAIN OPEN	VOLT.FLUC.ON INSTRUMENT AC BUS
W	TR1	016250A	102876	H	MV	A23			1	N		RWST SUCTION VALVE(MO-112E)FAILED TO OPEN/DEMAND	TORQUE SW SET TOO LOW/VAL WOULDNT UNSEAT
W	TR1	0162508	102876	H	MV	A16	S		1	N		RWST SUCTION VALVE (MO-112D) FAILED TO OPEN/DEMAND	BREAKER SUPPLYING POWER FAILED/COMMAND
W	TR1	019580	101677	L	XV	V01	U		1	N		RHR DISCHARGE VLV (8728B) FOUND LOCKED CLOSED	PERSONNEL ERROR/IMPROPER VALVE LINEUP
W	TR1	020325	112777	B	MV	F20			1	N		AUX FEED VLV (CV-300482) FAILED TO OPERATE	MOTOR OPER FAILED/WATER CAME THRU GASKET
W	TR1	020516	010478	H	MV	A19			1	T		MOV-88807A FAILED TO OPEN DURING TESTING	VALVE STEM LACKED LUBRICATION
W	TR1	021068*	032078	L	MV	G16	U		2V	T		DEENERGIZING PROTECTION SYS CAUSED RHR VALVES TO--	--CLOSE//PROCEDURAL DEFICIENCY
W	TU4	019421	091377	L	RM	V01	U		2	T		TWO VALVES INADVERTANTLY OPENED/RWST LEVEL DECREAS	PERSONNEL ERROR/POSSIBLE PROCEDURE PROBLP
W	YR1	018419*	062777	K	RV	A00			2	T		PRESSURIZER SAFETY VALVES (181/182) FAILED TO OPEN	UNKNOWN/SETPOINT DRIFTED HIGH/DRESSER INC
W	YR1	019495	102477	H	RM	F00			1	N		REGULATOR VALVE FAILED TO OPER.(CONTROL PRESSURE)	UNKNOWN / SETPOINT DRIFT / ADJUSTED VLV
W	YR1	030141*	020180	H	RM	F16	U		3	T		SI ACCUMULATOR N2 VLV SI-TV-604,605,606 DIDN'T OP.	IMPROPER WIRING OF TIME DELAY RELAYS
W	YR1	033661	122780	H	AV	F27	R		1	N		SI-PR-59 VLV CONTROLLED PRESSURE TOO HIGH	SETPOINT DRIFT OF REGULATING PILOT
W	ZI1	015162*	062376	H	CV	E00			2V	N		LEAKAGE THRU CHECK VALVES/ACCUMULATOR OVERFILL	UNKNOWN/DARLING 10 INCH TYPE 10-C48Z
W	ZI1	016047A	091676	H	AV	C25			1	N		NITROGEN VALVE (1HCV-SI943) LEAKED THRU	LEAKING SEAT OF AO PLUG VALVE
W	ZI1	017154	012177	F	MV	A19			1	T		CONTAINMENT SPRAY 1MOV-C50002 FAILED TO OPEN	STEM STICKING DUE TO LUBRICATION PROBLEM
W	ZI1	017040	012677	H	MV	A16	T		1	T		VALVE 1MOV-SI8808A FAILED TO OPEN	COMMAND/AUX CONTACTS IN CONTL CKT STUCK

ALL VALVE LERS USED

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W	ZI1	017223	012877	H	MV	A16		T	1	T		VALVE 1MOV-SI88088 FAILED TO OPEN	COMMAND/AUX CONTACTS,CONTROL CKT,STUCK
W	ZI1	017251	012877	H	MV	A16		T	1	T		VALVE 1MOV-SI8800C FAILED TO OPEN/COMMAND	AUX CONTACTS IN CONTROL CIRCUIT STUCK
W	ZI1	021337	042178	L	MV	A00			1	T		RHR 1MOV-87008 FAILED TO OPEN DURING TESTING	UNKNOWN/SOMETHING CAUSED THERMALS TO OPEN
W	ZI1	021397	050378	F	MV	A19			1	T		CONTAINMENT SPRAY VALVE 1MOV-CS0002 FAILED TO OPEN	LACK OF LUBRICATION
W	ZI1	033533	121580	L	RM	B16		S	1	T		RHR MINI FLOW VLV(1FIC-610A) WOULD NOT HAVE CLOSED	FAILED MICRO SWITCH
W	ZI2	014253	021376	H	MV	A16		T	1	T		2B SI PMP.SUC.VLV 2MOV-SI8923B FAILED TO OPEN	DIRTY CONT.ON CKT.BRKR.TO MTR.OPERATOR
W	ZI2	017861	051977	H	MV	A20			1	N		VALVE 2MOV-SI8800D FAILED TO OPEN	LIMITORQUE MOTOR OPERATOR FAILURE
W	ZI2	018212	060477	L	MV	A16		S	1	T		RHR VALVE(2MOV-RH87008) FAILED TO OPEN DURING TEST	COMMAND/AUX CONTACTS STUCK IN MCC
W	ZI2	026750	071879	L	MV	A26			1	T		2MOV-SI8811A FAILED TO STROKE OPEN(RECIRC FROM SU/	IMP TO RHR SUCTION). LIMIT SWITCH FAILURE
W	ZI2	031245	042980	F	MV	A23			1	T		2A CONT SPRAY PUMP STOP VLV FAILED TO OPEN	FAILED TORQUE SWITCH
W	ZI2	031625	061880	K	RV	V06		U	2	N		IMPROPER VLV LINE UP MADE PORVS INOPERABLE	PROCEDURE CHANGED TO BLOCK THE VLVS OPEN
G	BF1	016053	092376	D	RV	V02		U	1	U		VALVE FOUND CLOSED TO PRESSURE SWITCH	PERSONNEL ERROR
G	BF1	017594A	032177	L	MV	B08			1	T		VLV FCV 74-52 WOULD NOT GO COMPLETELY CLOSED	WORN BRNG.ASS,LOCKNUT,YOKE&NUT,GASKETS
G	BF1	017594B	032177	L	MV	B20			1	T		VLV FCV 74-52 WOULD NOT CLOSE;MTR TRIP,THERMAL O.L	MOTOR SHAFT WAS BENT
G	BF1	017525	042177	W	RV	B27		R	1	N		MN.STM.SAFE.RELIEF VLV. FAILED TO RESEAT	SEVERE STM.CUTS ON PILOT DISC
G	BF1	018126	050977	H	MV	A20			1	T		HPCI TURB.STM.SUP.ISO.VLV. FCV 1-73-16 FAIL.TO OPN	BROKEN TEETH ON MTR PINION&CLUTCH GEAR
G	BF1	027620	101779	H	MV	A26			1	T		FCV-73-27 WOULD NOT OPEN-HPCI INOPERABLE	DIRTY CONTACTS ON OPER. LIMIT SWITCH
G	BF1	030712	031380	L	MV	B16		S	1	T		RHR INJECT VLV 74-67 FAILED TO CLOSE DURING TEST	LIMIT SH IN ISOLATION LOGIC FAILED
G	BF1	032742	092480	L	MV	F20			1	N		RHR TORUS VLV FCV-74-71 FOUND TO BE INOPERABLE	GROUNDED MOTOR(3.9HP,SMBZ,LIMITORQUE)
G	BF2	016199	100776	H	XV	V03		U	1	T		EQUALIZER VALVE ON FLOW INSTRUMENT FOUND OPEN	PERSONNEL ERROR
G	BF2	016807	111676	H	MV	A23		R	1	T		HPCI TURB.STM.SUP.VLV 2-FCV-73-16 FAILED TO OPEN	TOR.SWT.GEAR ASS.PIN FOR VLV OPER.SHEARED
G	BF2	020380	020578	W	RV	B00		R	1	N		RELIEF VALVE 2-1-41 OPENED AND FAILED TO RESEAT	CAUSE OF MALFUNCTION UNKNOWN
G	BF2	020469	021378	W	RV	B00		R	1	N		RELIEF VALVE 2-1-5 OPENED AND FAILED TO RESEAT	CAUSE OF MALFUNCTION UNKNOWN
G	BF2	021094	032578	H	CV	B04			1	M		CHECK VLV.2-73-603,IN HIGH-PRESS.CI.SYS,FOUND OPEN	DIMEN.ERR. IN VLV. INTERFERENCE CLEARANCE
G	BF2	021782	062778	H	XV	V01		U	1	T		VALVE LEFT SHUT IN LUB OIL LINE TO HPCI PUMP	PERSONNEL ERROR IN VALVE LINE UP

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	BF2	025015	011379	H	MV	A26		R	1	T		HPCI INOPERABLE-FCV-73-16 FAILED TO OPEN	MECH FAILURE OF OPERATOR LIMIT SWITCH
G	BF2	032409	083080	L	CV	E00		R	1	T		CHECK VLV BETWEEN B&O HEAT EXCHANGERS LEAKING	NO CAUSE STATED "VALVE REPAIRED"
G	BF2	032703	091180	H	CV	E10			1	T		HPCI CV 2-73-609 FAILED LOCAL LEAK RATE TEST	BUILDUP OF RESIDUAL MATERIAL COCKED DISC
G	BF2	032705*	092980	W	RV	F00		R	5	T		5 MS RELIEF VLVS FAILED TO ACTUATE AT PROPER PRESS	NO CAUSE STATED SET PRESS WAS RESET
G	BF3	016055	082476	H	CV	A00			1	T		CHECK VALVE IN HPCI TURB.EXH.LINE WAS BINDING	CAUSE OF CHECK VLV BINDING NOT STATED
G	BF3	018637	070577	H	MV	A23		R	1	T		HPCI TURB.STM.SUP. 3-FCV-73-16 FAILED TO OPEN	TOR.SWTH.GEAR ASS.SHEARED;CAUS.OVLD ON MT
G	BF3	020524	021378	L	MV	F12		R	1	T		VLV FCV.3-74-52 WAS FOUND INOPERABLE	UPPER BRNG.LOCKNUT STRIPPED FROM NOR. POS
G	BF3	020923	041578	W	RV	B00		R	1	N		RELIEF 3-1-31 FAILED TO RESEAT AT PROPER PRESSURE	CAUSE OF MALFUNCTION IS NOT KNOWN
G	BF3	021245	042878	L	MV	F12		R	1	T		VLV FCV 3-74-52 WAS FOUND INOPERABLE	UP.BRNG.LOCKNUT STRIPPED FROM NOR.POSITIN
G	BF3	022126A	081778	W	RV	B00		R	1	N		A MAIN STM RELIEF VLV DID NOT CLOSE AFTER LIFTING	CAUSE OF FAILURE NOT GIVEN
G	BF3	030363	020580	L	MV	F26		R	1	T		RHR VLV FCV 74-73 FAILED TO OPERATE DURING TEST	LIMIT SW IN ACTUATOR ASSEMBLY FAILED
G	BF3	033640*	121080	W	RV	F00		R	8	T		8 MS RVS FAILED TO ACTUATE AT REQUIRED PRESS(TEST)	CAUSE NOT PRECISELY KNOWN(RESET ADJUSTMT)
G	BR1	016402	111976	L	MV	F16		U	1	N		RHR INJECTION VALVE(E11-F015A) FAILED TO OPERATE	UNDERSIZED BKR/DESIGN PROBLEM(ROOT)
G	BR1	016861	112176	H	MV	A20		R	1	T		E41-F001(HPCI STM.SUP.VLV) WOULD NOT OPEN	BRUSHES ON VLV MOTOR WERE STICKIN
G	BR1	017081	011977	H	MV	B20		R	1	T		HPCI STM.SUP.VLV E41-F003 WOULD NOT CLOSE	DIRTY COMMUTATOR IN VLV OPERATOR
G	BR1	017600	021077	D	MV	A16		S	1	N		CORE SPRAY VALVE FAILED TO OPEN AT REQUIRED PRESS	SETPOINT ON CONTROLLING INST DRIFTED HI
G	BR1	017290	030177	H	MV	B12			1	T		HPCI MIN. FLOW VLV E41-F012 FAILED TO CLOSE	ANTI-ROT. KEY SET SCREW HAD UNSCREWED
G	BR1	017330	030677	L	MV	A00			1	T		RHR PMP 1D TORUS SUC.VLV E11-F004D WOULD NOT OPEN	CAUSE OF FAILURE UNKNOWN
G	BR1	018128	052077	H	CV	F04			1	T		HPCI STM.LINE EXH.CHECK VLV E41-F049 DETER.FAILED	VLV OSCIL.CAUSED DSC HINGE FAIL;IMP.DESGN
G	BR1	019387	102577	D	MV	C20			1	N		B CORE SPRAY LOOP FULL FLOW TST.VLV E21-F015B LEAK	VLV OPER. HAD STRIPPED OPERATING GEARS
G	BR1	019677	110577	L	MV	A02		C	1	N		RHR VALVE E11-F004A FAILED TO OPEN(MOTOR PROBLEM)	PERSONNEL ERROR/COVER LEFT LOOSE/WATER LK
G	BR1	019824	120377	L	MV	B20			1	U		VALVE E11-F040 FAILED IN OPEN POSITION	MOTOR FOUND TO BE OPEN(UNDETERMINED WHY)
G	BR1	020771	031378	W	RV	B27		R	1	N		RELIEF VLV B21-F013F FAILED TO RESEAT AT REQ.PRESS	DEFECTIVE PILOT VLV/PILOT REPLACED
G	BR1	0220928	072878	L	MV	A16		T	1	U		VALVE F068B FAILED TO OPEN	BLOWN FUSE
G	BR1	022092A	080278	L	MV	A16		T	1	U		VALVE F068B FAILED TO OPEN	BLOWN FUSE/FOUND GRND WIRE IN LOGIC CKT

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	BR1	022218	080878	H	MV	A00			1	N		HPCI FEED INJ VALVE E41-F006 FAILED TO OPEN AUTO	UNKNOWN/TESTING COULDNT DUPLICATE FAILURE
G	BR1	028036	121979	L	MV	V01	U		1	N		RHR TORUS SUCTION VALVE FOUND SHUT	OPERATOR ERROR-FORGOT TO OPEN VALVE
G	BR1	030407	021480	H	XV	V01	V		1	T		MANUAL ISOL VLV LOW SIDE OF 1E41LS15A FOUND CLOSED	PERSONNEL ERROR (WHEN UNDETERMINED)
G	BR1	030638	031480	H	RM	B16	S		1	T		HPCI TORUS SUCTION VLV E41-F041 FAILED TO CLOSE	RTGB CONTROL SW FAILED
G	BR2	014647	020576	L	XV	V03	U		1	N		PRESS SW FOUND ISOLATED AFTER TESTING	PERSONNEL ERROR
G	BR2	014618	031076	H	RM	A26			1	T		VALVE 2-E41-PV-1219D FAILED TO OPEN DURING TEST	LIMIT SW WAS OUT OF ADJUSTMENT
G	BR2	018697	071577	W	RV	B16	S		1	N		SAFETY REL.VLV B21-F0133 STUCK OPEN;AFTER MAN.OPEN	GRND. ON SOLENOID ASS. FOR REMOTE ACTUATR
G	BR2	019023*	090677	L	MV	C00			2	N		RHR TORUS COOL.RETRN.LN.ISOS.E11-F0248&288 LEAKING	VLVS FAILED TO SEAT PROPERLY/UNKNOWN
G	BR2	020240	010478	H	MV	F26			1	T		CLOSING TIME ON E41-F002 EXCEED. TS LIMIT (HPCI)	LIMIT SWITCH(OPEN) OUT OF ADJUSTMENT
G	BR2	020913	040378	L	MV	A20			1	N		SHUTDOWN COOL.OUTB.SUC.VLV E11-F008 WOULDN*T OPEN	ELECTRO-MECHANICAL BRAKE ON VLV.OP.FAILED
G	BR2	021663	060378	L	MV	A00			1	N		RHR VLV E11-F009 WOULD NOT OPEN FROM CONTROL ROOM	CAUSE OF VLV NOT OPENING, NOT GIVEN
G	BR2	023033	111178	L	CV	B04			1	N		RHR CHECK VALVE E11-F031 WILL NOT FULLY SEAT	DESIGN ERROR/VLV.DOESN*T WORK ON LOW DP.
G	BR2	023034	111278	L	MV	A16	U		1	N		RHR VLV E11-F008 WOULD NOT OPEN AT REQ. SETPOINT	FAIL. OF RX.STM.DOME HIGH PRESS.SWITCH
G	BR2	025638A	032079	W	RV	A27	R		2	T		2B21-F013H&0138 SET POINTS FOUND DRIFTED HIGH	SETPOINT DRIFT OF PILOT VALVES
G	BR2	026626	071779	W	RV	F27			1	N		SAFETY RELIEF VALVE 2013E LIFTED & RESET-SPURIOUS	EXCESSIVE PILOT VALVE ASSEMBLY LEAKAGE
G	BR2	026521	072179	H	MV	F20			1	T		HPCI STEAM ISOLATION VALVE F001 INOPERABLE	PINION GEAR INSTALLED BACKWARD ON OP SHAF
G	BR2	030412	021480	L	RM	A16	S		1	N		VLV E11-F049 FROM RHR TO RADWASTE FAILED TO OPEN	COMMAND FAULT,RELAY FAILED IN LOGIC CKT
G	BR2	0324548	090780	H	CV	V01	U		1	T		HPCI MANUAL STOP CHECK FOUND LOCKED CLOSED	PERSONNEL ERROR VLV WAS REQ OPEN
G	BR2	032662	091080	A	RV	A16	S		1	T		ADS RV 2-B21-F013E FAILED TO ACTUATE AS REQUIRED	BROKEN WIRE IN SOLENOID COIL(COMMAND FLT)
G	BR2	033238	111280	L	CV	E00			1	N		2B RHR PUMP DISCHRGE CHECK VLV FAILED TO RESEAT	--FULLY,REVERSE LEAKAGE/NO DETAILS GIVEN
G	CO1	014359	012476	L	MV	F20	R		1	N		VLV RHR-MO-34A WOULD NOT OPERATE BY MTR.OPERATOR	SHEARED WOODRUFF KEY.IN MTR.OPERATOR
G	CO1	014936	051476	W	RV	A27			1	M		MAIN STEAM SAFETY RELIEF VALVE MALFUNCTIONING	CRACK IN BELLOWS TO BASE WELD
G	CO1	015717	081076	D	MV	F20			1	T		VALVE CS-MO-12B WOULD NOT OPERATE	TRIPPER PIN IN OPERATOR DISLODGED
G	CO1	015873	081376	W	RV	A02	C		1	R		SETPOINT OF MS-RV-71E ADJUSTED INCORRECTLY	INCORRECT MAINTENANCE PROCEDURE
G	CO1	016008	090776	D	MV	A20			1	T		VALVE CNS-MV-12B FAILED TO OPEN	THE REPAIR CLUTCH AND COMPONENTS FAILED

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	C01	016658	102876	L	RM	A16	S		1	T		VALVE RHR MO-17 FAILED TO OPEN	BROKEN RELAY COIL KEEPER LODGED IN CONT.
G	C01	017301	021977	L	MV	B12	R		1	N		MOTOR OPERATED VALVE RHR-MO-34 WOULD NOT CLOSE	SHEARED KEY BETWEEN VALVE AND OPERATOR
G	C01	018004	042077	D	MV	F20			1	T		CORE SPRAY PUMP VALVE INOPERATIVE,MOTOR RUNS	MOTOR GEAR SET SCREW ON VAL OPER LOOSE
G	C01	020343	011378	L	MV	B16	S		1	T		RHR INJ BLOCK VALVE FAILED TO CLOSE DURING TEST	DIRTY CONTACTS ON RELAY&WIRING ERROR
G	C01	020806A	020778	H	XV	V03	V		1	T		ISOLATION VALVE TO DPIS-76 FOUND CLOSED(SEE020806)	PERSONNEL ERROR
G	C01	020806B	020778	H	PM	B16	T		1	T		HPCI VALVE FAILED TO CLOSE DURING TEST	NO SIGNAL FROM DP SWITCH
G	C01	023049	091878	L	MV	A20			1	N		VALVE RHR-MO-66B FAILED TO OPEN	SET SCREW ON VALVE OPERATOR LOOSTENED
G	C01	026068	032179	D	MV	A20			1	T		CS-MO-11A CORE SPRAY VALVE FAILED TO OPEN	WORN SET CLUTCH COLLAR ON OPERATOR
G	C01	027749	110979	D	MV	A20	R		1	T		CS VALVE CS-MO-12A WOULD NOT OPEN	WORN WORM SET CLUTCH COLLAR ON OPERATOR
G	C01	031544	051680	L	RM	F26	C		1	T		RHR VLV MO-57 FAIL TO CLOSE IN REQUIRED TIME	LIMIT SW SET WRONG(PERSONNEL ERROR)
G	C01	032114	062980	L	MV	B12			1	N		RHR-MO-57 FAILED TO CLOSE	STEM BACKED OUT OF DISC JAMMING VLV
G	C01	032211	081380	L	MV	F20	R		1	T		RHR-MO-34B FAILED TO OPERATE	KEY BETWEEN MOTOR SHAFT AND PINION FAILED
G	C01	033825	111780	L	MV	F05	R		1	N		RHR-MO-34A WOULD NOT OPERATE--KEY CONNECTING MOTOR	PINION GEAR AND SHAFT MADE OF WRONG MATER
G	C01	033709	121680	L	RM	A23			1	T		RHR-MO-25B WOULD NOT OPEN	CLOSING TORQ.SWTCH.SET TOO CLOSE TO REQ.
G	DA1	014445*	033176	W	RV	C27			6	T		SIX RELIEF VALVES LEAKING INTERNALY	EXCESS STEAM CUTTING ON PILOT VALVE SEAT
G	DA1	015991	092876	H	XV	C00			1	T		HPCI TURB STM LINE HI FLO EQUALIZING VALVE LEAKS	CAUSE UNKNOWN
G	DA1	017043	021177	D	MV	F05			1	T		CLUTCH HOUSING FOR MOV 2115 FRACTURED DUR. TEST	MATERIAL TOO BRITTLE
G	DA1	017312	021977	H	RM	F03	C		1	N		CONTACT BLOCK FOUND INSTALLED IN VALVE CIRCUIT	PERSONNEL ERROR,FAILED TO REMOVE AFTER TS
G	DA1	017631*	032877	W	RV	A27			6	T		6 MAIN STEAM RV DID NOT LIFT AT PROPER PRESSURE	FAILURE OF PILOT VALVE TO OPERATE
G	DA1	019963	112377	H	MV	B00			1	T		HPCI INJECTION VALVE MOV 2312 FAILED TO CLOSE	CAUSE UNKNOWN
G	DA1	019967	121577	L	MV	A20			1	N		RHR CROSS TIE VALVE FAILED TO OPEN	FRACTURED TEETH ON WORM AND WORM GEAR
G	DA1	021169*	040378	W	RV	A00			4	T		SETPOINTS OUT OF SPEC ON 1 SAFTEY+3 RELIEF VALVES	CAUSE UNKNOWN
G	DA1	027096	091879	L	MV	A20			1	T		RHR MINIMUM FLOW VALVE WOULD NOT OPEN	OPERATOR WORM GEAR WAS STRIPPED
G	DA1	028004	091979	D	MV	F02			1	N		"A" CORE SPRAY MINIMUM FLOW VALVE WOULD NOT CLOSE	LEVER ON OPERATOR MOVED TO NEUTRAL POSITI
G	DA1	030530*	031080	A	RV	F00	R		3	T		3 TARGET ROCK RELIEF VLVS FOUND WITH BAD SETPOINTS	CAUSE UNKNOWN

ALL VALVE LERS USED

GEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	DA1	033106	111080	A	RV	B27			1		N	RELIEF VLV PSV-4405 FAILED TO CLOSE/SCRAMMED PLANT	PILOT VLV PROBLEM OF UNKNOWN NATURE
G	DR2	014330	031376	H	RM	A16		S	1		T	HPCI STEAM SUPPLY VALVE 2-2301-4 FAILED TO OPEN	DIRTY CONTACTS IN BREAKER SUPPLYING VALVE
G	DR2	014420	032976	H	CV	E25			1		T	HPCI VALVE 2-2301-45 LEAKING INTERNALY	CORROSION, PITTING OF LOWER SEATING AREA
G	DR2	014747	052576	A	RV	B27			1		T	DURING BLOWDOWN TEST VALVE 203-3A REMAINED OPEN	EXCESS LEAKAGE ON PILOT STAGE OF VALVE
G	DR2	015748	061076	D	RM	B19		R	1		T	VALVE MO2-1402-4D FAILED TO CLOSE AGAINST PUMP HED	INADAQUATE LUBRICATION OF VALVE STEM
G	DR2	015378	071176	D	MV	F26			1		T	CORE SPRAY INJECTION VAL MO2-1402-24B FAILED	BROKEN LIMIT SWITCH CONTACT BLOCK
G	DR2	016453	111376	H	MV	F12		R	1		T	HPCI INJECTION VALVE MO2-2301-8 FAILED	VALVE STEM SHEARED
G	DR2	017182	021777	L	MV	A26			1		T	LPCI CROSS-TIE VALVE MO2-1501-32B FAILED TO OPEN	LIMIT SWITCH OPENED BEFORE VALVE OFF SEAT
G	DR2	018508	080277	H	MV	A23		R	1		T	HPCI VALVE 2-2301-8 FAILED TO OPEN	SUSPECT PROBLEM WITH TORQUE SWITCH
G	DR2	018934	081577	L	MV	A00			1		T	SUCTION VALVE MO-2-1501-5A FAILED TO OPEN	CAUSE UNKNOWN
G	DR2	018985	091077	H	MV	A04			1		T	HPCI VALVE 2-2301-8 FAILED TO OPEN, VAL DAMAGED	OVER SIZED MTR OPERATORS OVERSTRESS STEM
G	DR2	019985	120977	W	RV	A00		R	1		T	ELECTROMATIC RELIEF VALVE 3B FAILED TO OPEN	CAUSE UNKNOWN
G	DR2	021158	042878	L	XV	V01		U	2L		N	VALVES IN LPCI & CORE SPRAY LINED UP IMPROPERLY	OPERATING PERSONNEL ERROR
G	DR2	022776	101378	D	RM	B19		R	1		T	THE 2-1402-4B FLOW TEST VALVE FAILED TO CLOSE	VALVE STEM NOT ADEQUATELY LUBRICATED
G	DR2	022775	101878	L	RM	B19			1		T	LPCI SUCTION VALVE MO-1501-5C FAILED TO CLOSE	VALVE STEM NOT ADEQUATELY LUBRICATED
G	DR2	025246	011179	L	MV	B20			1		T	LPCI FLOW TEST VALVE FAILED TO CLOSE WHEN ACTUATED	BROKEN PINION GEAR ON OP MOTOR SHAFT
G	DR2	025248	012679	L	MV	B00			1		T	LPCI MIN FLOW VALVE FAILED TO CLOSE COMPLETELY	CAUSE UNKNOWN
G	DR2	031264	051280	H	RM	B14			1		N	HPCI ISOL VLV FAILED TO CLOSE	STEAM CAUSED PACKING TO SWELL(PERSONNEL?)
G	DR2	032749	101180	H	MV	A23		R	1		N	HPCI STEAM SUPPLY VLV FAILED TO OPEN	TORQUE SW CONTACTS STUCK OPEN REPLACED
G	DR2	033323	112480	A	RV	F00			1		N	2A SAFETY RV VLV NOT OPERABLE IN SAFETY MODE	CAUSE UNKNOWN AT THIS TIME
G	DR3	016150	051076	D	MV	B16		U	1		T	MO 3-1402-25B TRIPPED WHILE BEING CLOSED	WRONG SIZE OVERLOAD HEATER
G	DR3	016163	100776	L	CV	E10			1		T	ISOLATION CHECK VALVE 3-1501-25B LEAKING INTERNALY	DIRT AND SMALL SCRATCHES ON VALVE SEAT
G	DR3	016695	101276	L	MV	A16		S	1		T	VALVE 3-1501-27A FAILED TO OPEN ELECTRICALLY	LOOSE TERMINAL IN VALVE CONTROL CIRCUIT
G	DR3	016454	110176	L	CV	E10			1		T	ISOLATION CHECK VALVE 3-205-2-7 LEAKING INTERNALY	DIRT IN SEATING AREA & ON DISK PIVOT PIN
G	DR3	016474*	111976	H	MV	F16		S	2V		U	HPCI VLVS FAILED TO OPERATE (CYCLING)	DESIGN ERROR IN LOGIC CIRCUIT

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	DR3	018378A	061177	W	RV	C02		B	1	N	ELECTROMATIC RELIEF VALVE 203-3D LEAKING INTERNALY	PILOT PIN ADJUSTED INCORRECTLY
G	DR3	018378B	061177	W	RV	C10		R	1	N	ELECTROMATIC RELIEF VALVE 203-3E LEAKING INTERNALY	DIRT UNDER VALVE SEAT
G	DR3	018377	061277	W	RV	C27			1	T	ELECTROMATIC RELIEF VALVE 203-3D LEAKING INTERNALY	DEFECTIVE PILOT VALVE STEM
G	DR3	018376	061377	W	RV	A10		R	1	T	SOLENOID OPERATING LEVER FOR 203-3C STICKING	RUST BUILDUP ON GUIDE PINS
G	DR3	018936	081177	L	MV	A19			1	N	VALVE MO-3-1501-20B FAILED TO OPEN	VALVE STEM NOT ADEQUATELY LUBRICATED
G	DR3	019996	121677	L	MV	A00		R	1	N	LPCI HX DISCH VALVE MO3-1501-3A FAILED TO OPEN	CAUSE UNKNOWN
G	DR3	020602	020778	L	MV	A00		R	1	T	VALVE MO-3-1501-5C FAILED TO OPEN	CAUSE UNKNOWN
G	DR3	021679	060678	F	MV	F23			1	N	VALVE MO3-1501-28B FAILED WHILE BEING CYCLED	DEFECTIVE SHAFT PIN ON TORQUE SWITCH
G	DR3	022561	092278	L	MV	B16	S		1	T	LPCI VALVE 3-1501-20A FAILED TO CLOSE ON TESTING	STUCK CONTACTOR IN MCC
G	DR3	022591	092278	L	MV	F00			1	N	LPCI HX VALVE MO3-1501-3A FAILED TO OPERATE	CAUSE UNKNOWN
G	DR3	027260	092379	L	MV	A16	S		1	T	LPCI MOV 3-1501-3A WOULD NOT OPEN REMOTELY	SLIDEWIRE ON POSITION CONTROLLER GOT OFF
G	DR3	030246	012280	L	MV	B16	S		1	T	LPCI VLV MO-3-1501-11B FAILED TO CLOSE	PROBLEMS WITH VLVS SUPPLY BREAKER
G	DR3	030528	030680	L	MV	A16	S		1	T	LPCI VLV MO-3-1501-22A FAILED TO OPEN DURING TEST	LOOSE WIRE IN MCC SUPPLYING PWR TO VLV
G	DR3	030878	040280	H	MV	C25			1	T	HPCI SUCTION VLV MO-3-2301-35 FOUND LEAKING THRU	NORMAL SEAT DISC DETERIORATION
G	DR3	030967A	042580	A	RV	A12		R	1	N	3A TARGET ROCK ADS RELIEF FAILED TO OPEN	AIR ACTUATOR IMPROPERLY BOLTED TO VLV
G	DR3	030967B	042580	A	RV	A27		R	3	N	3B,3C,3E ADS ELECTROMATIC RELIEFS FAILED TO OPEN	VARIOUS PILOT VALVE PROBLEMS
G	DR3	033668	121980	F	MV	B16	S		1	N	DRYWELL SPRAY HEADER ISO.VLV WOULD NOT CLOSE	STUCK PLUNG.ON CLOS.COIL OF VLV MOTOR BRK
G	DR3	033713	122380	L	RM	B16	S		1	T	SHUTDOWN COOL.SYS.INBOARD ISO.VLV DID NOT CLOSE	PROBLEMS IN VLV CONTROL CIRCUITRY
G	EN1	014785	040776	L	MV	F20			1	M	VALVE E11-F047A FAILED TO OPERATE ELECTRICALY	A MOTOR WINDING FAILURE OCCURRED
G	EN1	014792	050176	H	MV	A26		R	1	N	HPCI DISCHARGE VALVE E41-F006 FAILED TO OPEN	FAILURE OF A SNAP LOCK LIMIT SWITCH
G	EN1	015555	061576	H	MV	A00		R	1	N	HPIC VALVE E41-F006 DID NOT FULLY OPEN	CAUSE UNKNOWN
G	EN1	015564	072076	L	RM	G16	S		1	T	RHR FLOW VALVE E11-F007B FAILED TO STAY OPEN	DEFECTIVE SWITCH SUPPLYING SIGNAL TO VALV
G	EN1	016841	120976	A	RV	B00		R	1	T	RELIEF VALVE WOULD NOT RESEAT	CAUSE UNKNOWN
G	EN1	017110	010977	A	RV	B27		R	1	N	RELIEF VALVE B21-F013G OPENED AND STUCK OPEN	GROSS LEAKAGE OF PILOT+2ND STAGE ASSEMBLY
G	EN1	017096	011777	L	XV	V03		U	1	U	PRESS SW FOUND VALVED OUT WHEN REQUIRED OPEN	PERSONNEL ERROR

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	EN1	017189	020177	A	RV	B00		F	1		N	RELIEF VALVE B21-F013G OPENED AND STUCK OPEN	CAUSE UNKNOWN.VALVE TO BE TESTED
G	EN1	018191	060477	L	RM	F02		C	1		T	LPCI VALVE E11-F017B CYCLE TIME OUTSIDE T.S.	VALVE STEM PACKED TOO TIGHTLY/PERSONNEL
G	EN1	018649	080977	W	RV	A00			1		N	SAFETY RV 1C FAILED TO OPEN AT HIGH REACTOR PRESS.	CAUSE UNKNOWN
G	EN1	020019*	100677	A	RV	A00		R	4		N	FOUR RELIEF VALVES FAILED TO OPEN FOLLOWING SCRAM	CAUSE UNKNOWN.VALVES BEING EXAMINED
G	EN1	021723*	060978	A	RV	A12		R	2		T	TWO RELIEF VALVES FAILED BENCH CHECK	PROBLEMS WITH PLUNGERS AND SPRINGS
G	EN1	022113	070278	L	MV	A16		S	1		T	RHR MOV E11-F024A FAILED TO OPEN	DIRT IN INTERLOCK ON BREAKER CAUSED BIND
G	EN1	025019	011979	H	MV	F20			1		T	HPCI INJECTION VALVE FAILED TO OPERATE	MOTOR BURNED UP
G	EN1	026631	072679	L	MV	F16	U		1		M	RHR OUTBOARD ISOLATION VALVE MADE INOPERABLE	NO PWR AVAILABLE TO VLV (PERSON.ERROR)
G	EN1	030031	010580	L	MV	F00		R	1		T	RHR VLV 1E11-F008 FAILED TO OPER IN REQ TIME	CAUSE UNKNOWN AT PRESENT
G	EN1	030954	042580	L	MV	C00		R	1		T	MOV E11-F015A STARTED LEAKING THRU AFTER TESTING	NO CAUSE STATED
G	EN1	031143	042980	L	MV	A20		R	1		T	MOV 1E11-F016A FAILED TO OPEN DURING TEST	KEY BETWEEN MOTOR SHAFT AND PINION FAILED
G	EN1	031157	051080	L	XV	V03		U	2		N	TWO COOLING WTR VLVS TO PUMPS A & B FOUND CLOSED	PERSONNEL ERROR
G	EN1	031267	052480	L	MV	C00			1		R	RHR INJECTION VLV LEAKING THRU	NO CAUSE STATED
G	EN1	031281	052580	L	MV	A16		S	1		T	RHR VALVE 1E11-F006B FAILED TO OPEN	FAULTY AUX CONTACT BLOCK (COMMAND FAULT)
G	EN1	031521	062280	L	XV	V01		U	2		T	RHR MIN FLOW VLVS E11-F018B & D FOUND CLOSED	PERSONNEL ERROR
G	EN1	031769A	071180	L	XV	V01		U	2L		N	COOLING WATER VLV SECURED WHEN REQUIRED OPEN	PERSONNEL ERROR
G	EN1	031769B	071180	L	MV	F16		S	1		N	LPCI INJECTION VLV LOST POWER(INVERTER OVERHEATED)	LOSS OF POWER(PERSONNEL)SEE 31769A
G	EN1	032190	080880	L	MV	A20			1		T	RHR VLV 1E11-F015A FAILED TO OPEN ON TEST	MOTOR WINDINGS AND ROTOR FOUND BURNED
G	EN1	032667	091980	H	RM	B16		S	1		T	HPCI MIN FLOW VLV 1E41-F012 FAILED TO CLOSE (TEST)	NO PWR TO VLV. CONTACTOR WAS BINDING
G	EN1	033579	121280	L	RM	C25		R	1		N	RHR VLV 1E11-F015B LEAKING THRU	SEAT GALLED,DISC CRACKED
G	EN2	022024*	071778	L	MV	F16		U	2V		N	RHR VALVES HAD POWER LOST TO THEM	BREAKER TRIPPED DUE TO BLOWN FUSES
G	EN2	022500*	091078	L	RM	B04			2		N	RHR VALVES 2E11-F003A,F047A FAILED TO CLOSE	VALVE GATES SAG+BIND IN FULL OPEN POSIT
G	EN2	022486*	092678	L	RM	F12			2		T	RESTRICTED FLOW THROUGH RHR SYSTEM CONTROL VALVES	DAMAGED CAVITROL TRIMS IN VALVES
G	EN2	022675	102778	H	MV	F20			1		T	HPCI VALVE 2E41-F001 FAILED TO OPERATE	FAILURE OF MOTOR SHUNT FIELD INSULATION
G	EN2	022753*	110678	H	RM	F16		U	2V		T	HPCI CONTROL VALVES FAILED TO OPERATE	WIRE LEFT OFF BY MAINT PERSONNEL

ALL VALVE LERs USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	ENZ	025467*	021479	W	RV	A27			2		R	2 SAFETY RELIEF VALVES FAILED TO OPEN AS REQUIRED	SCUFFING OF PILOT DISCS AND SEATS
G	ENZ	025875*	050879	W	RV	F05	C		3		M	AIR OPERATORS FOR THREE SRV'S IMPROPERLY INSTALLED	IMPROPERLY INSTALLED BY WYLE LAB
G	ENZ	026148	060979	H	MV	F20			1		T	HPCI SUCTION VALVE EXCEEDED OPERATING TIME	LOOSE CONNECTION IN SHUNT FIELD CIRCUIT
G	ENZ	026422	070779	H	MV	F16	S		1		T	HPCI STEAM SUPPLY ISOLATION VALVE FAILED TO OPERAT	MOTOR OPERATED 12 TIMES IN 5 HRS
G	ENZ	026639	073079	H	MV	B20	R		1		N	HPCI SUCT FROM SUPP CHAMBER FAILED TO CLOSE	BURNED MOTOR-PINION KEY HAD SLIPPED ON SH
G	ENZ	027321	101579	H	MV	A20	R		1		T	HPCI SUCT FROM SUPP CHAMBER FAILED TO OPEN	MOTOR WINDING FAILURE
G	ENZ	030178	013080	H	RM	B16	T		1		T	HPCI MIN FLOW VLV 2E41-F012 FAILED TO CLOSE	FAILED FLOW SW CONTROLLING VLV
G	ENZ	030975	042180	H	RM	F16	T		1		T	MIN FLOW CONT VLV 2E41-F012 FAILED TO OPER	FLOW SW PROVIDING SIGNAL TO VLV FAILED
G	ENZ	033764	050780	L	MV	B20	C		1		T	2E41-F006 INBOARD ISO.VLV FAILED TO CLOSE	WATER SHORTED OUT MOTOR OPERATOR WINDINGS
G	ENZ	031318*	051480	L	MV	F26	C		2		N	RHR VLVS 2E11-F004D & F006D FAILED TO OPERATE	LOOSE & BROKEN LIMIT SWITCHS
G	ENZ	031431A	053080	L	MV	A20	B		2		T	TORUS SUCTION VLVS 2E41-F041&42 FAILED TO OPEN	VALVE MOTORS SHORTED OUT(STEAM LEAK)
G	ENZ	031555	060480	H	RM	A16	S		1		N	HPCI VLV 2E41-F003 COULD NOT BE OPENED	LOGIC CKT FAILED TO RESET
G	ENZ	031842	071180	H	MV	A20	R		1		N	HPCI INJ VLV 2E41-F006 FAILED TO OPEN	MOTOR WINDING FAILURE,POSS.EXCEED.DUTY CY
G	ENZ	032135	072480	H	RM	F16	U		1		N	HPCI VLV 2E41-F002 CLOSED WHEN REQUIRED OPEN	INADVERTANT SIGNAL, OPERATOR BUMPED RELAY
G	ENZ	033210A	110480	L	RM	B23			1		T	2E11-F007A(RHR MINIMUM FLOW VLV) LEAKED DUE TO NOT	//BEING CLOSED. TORQUE SWITCHES ADJUSTED
G	ENZ	033426A	112680	A	RV	F27	R		8		T	OUT OF THE VLVS 2821-5013A-M,8 VLVS FAILED	PILOT SEAT LEAKAGE
G	ENZ	033426B	112680	A	RV	A00	R		7		T	OUT OF THE VLVS 2821-5013A-M,7 VLVS SET PRESSURE W	AS TOO HIGH// CAUSE UNKNOWN
G	ENZ	033508	120980	F	CV	E00	R		1		T	VENT PURGE OUTLET ISO VLV 2T48-F318 LEAKED	CAUSE UNKNOWN
G	FP1	015058	042076	H	MV	A20			1		T	HPCI TORUS SUCTION VALVE FAILED TO OPEN	SHORT IN OPERATOR MOTOR
G	FP1	015237	070376	L	MV	A20			1		T	RHR VALVE 10 MOV 25A FAILED TO OPEN	SUSPECT OPEN CIRCUIT IN MOTOR WINDINGS
G	FP1	016176	101476	L	CV	E25			1		N	CHECK VALVE 42B LEAKING INTERNALY	NORMAL WEAR ON VALVE SEAT
G	FP1	016269	102676	L	MV	A20			1		T	RHR SYSTEM VALVE 10-MOV-24A WOULD NOT OPEN	VALVE MOTOR OPERATOR BURNED OUT
G	FP1	016497	111976	H	MV	A20			1		N	HPCI VALVE 23-MOV-57 FAILED TO OPEN	FAILURE OF VALVE MOTOR WINDINGS
G	FP1	017956	061177	H	MV	A00			1		T	VALVE 23 MOV 58 FAILED TO OPEN ON TEST SIGNAL	CAUSE UNKNOWN
G	FP1	021142	100477	L	MV	A23			1		T	LPCI MOV 25A FAILED TO OPEN ON TEST	LOW TORQUE SWITCH SETTING

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	FP1	019310	100877	H	MV	B23			1		T	HPCI STEAM ISOL VALVE FAILED TO CLOSE ELECTRICALLY	TORQUE SWITCH NEEDED ADJUSTMENT
G	FP1	020570	030278	L	CV	B00			1		N	A RHR PUMP CHECK VALVE STUCK OPEN	CAUSE UNKNOWN
G	FP1	021022	040678	L	MV	A16		S	1		N	RHR ISOLATION VALVE 10MOV18 INOPERABLE (CLOSED)	CONTROLLER AUXILIARY CONTACT FAILURE
G	FP1	021023	040878	H	MV	F12			1		T	VALVE 23MOV14 SEPERATED FROM OPERATOR	FAILURE OF MECHANICAL FASTENERS
G	FP1	021225	042978	H	MV	A23			1		N	HPCI 23-MOV-15 WOULD NOT OPEN	TORQUE SWITCH WAS RESET
G	FP1	021227	050878	D	MV	F02	C		1		M	POWER REMOVED FROM CORE SPRAY VALVE MOTOR	PERSONNEL ERROR
G	FP1	021712	062978	H	MV	B16		S	1		T	HPCI VALVE 23-MOV-15 FAILED TO CLOSE	DEFECTIVE TEMP SWITCH(NO SIGNAL TO CLOSE)
G	FP1	021924	072278	D	MV	B20			1		T	OUTBOARD INJECTION VALVE 14-MOV-118 FAILED TO CLOS	OPERATOR SHAFT KEY SHEARED
G	FP1	022329	090378	D	MV	A04			1		T	CORE SPRAY INJECTION VALVE 14-MOV-128 FAIL TO OPEN	DESIGN ERROR, DIFFERENTIAL PRESS.TOO HIGH
G	FP1	023358	122478	L	CV	B00			1		N	RHR LOOP CHECK VALVE FAILED TO CLOSE	NO REASON FOUND FOR STICKING,REASSEMBLED
G	FP1	026344	062779	L	MV	A23			1		T	B LOOP LPCI INJECTION VALVE DID NOT OPEN	TORQUE SWITCH FAILURE
G	FP1	026343	063079	L	CV	F25			1		T	REVERSE ROTATION OF RHR PUMP WAS NOTED DURING TEST	DISCH CHECK VALVE DISC NOT ATTACHED
G	FP1	027006	090679	H	MV	A20			1		T	HPCI CONDENSATE STORAGE TANK SUCTION VALVE FAILED	MOTOR FAILURE
G	FP1	027872	122179	D	MV	A20			1		T	CS ISOLATION VALVE WOULD NOT REOPEN AFTER CLOSURE	MOTOR PINION GEAR LOOSE ON SHAFT
G	FP1	030081	010880	D	MV	F00			1		R	CORE SPRAY INJ VLV FAILED TO OPERATE PROPERLY	CAUSE NOT KNOWN
G	FP1	033799	010980	D	MV	A02			1		T	CORE SPRAY INJ VLV 14-MOV-128 FAILED TO OPEN	PERSONNEL ERROR IN ADJ LIMIT & TORQUE SW
G	FP1	030974	041080	H	MV	B20			1		T	HPCI MIN FLOW VLV FAILED TO CLOSE	COCKED BRUSH HOLDER ON DRIVE MOTOR
G	FP1	031016	041580	L	MV	A26			1		N	RHR VLV 10-MOV-67 FAILED TO OPEN	TORQUE BYPASS LIMIT SW SET IMPROPERLY
G	FP1	032007	041880	L	MV	B07			1		T	RHR VLV 10-MOV-67 FAILED TO FULLY CLOSE	"NORMAL WEAR & TEAR", SEAT, DISC, PACKING
G	FP1	032919	101180	L	MV	B02			1		N	CONT ISOL VLV 10-MOV-57 FAILED TO CLOSE	PERSONNEL ACCIDENTALLY DISENGAGED CLUTCH
G	FP1	033419	120880	H	MV	F23			1		T	HPCI STEAM SUPPLY VALVE FAILED TO OPERATE	TORQUE SWITCH FAILURE
G	MI1	014290	021276	U	AV	F24	T		1		N	1 OF 2 FEEDWTR.REG.VLVS LOCK.IN THE AS IS POSITION	FAILURE IN 3 WAY PRESSURE REGULATOR
G	MI1	016689	121876	L	MV	B23			1		T	CONDENSATE RETURN VAL 1-IC-4 FAILED TO CLOSE	TORQUE SW SET INCORRECTLY
G	MI1	018156	061877	W	RV	C27			1		N	RV DISCH TEMP HIGH/VLV LEAKING STM INTERNALLY	COLLAPSED FILTER,STM CUTTING OF PLT SEATS
G	MI1	018414	071377	U	AV	F24	T		1		U	"B" FEEDWTR.REG.VLV EXPERIENCED CONTROL PROBLEMS	FAILURE CAUSED BY DIA.FAIL.IN SUP.SYS.VLV

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	MI1	018625*	080677	U	AV	F24		T		2V	N	FEEDWTR.REG.VLVS. LOCKED UP "AS IS"	LOSS OF INSTRUMENT AIR PRESS.CAUSED FAIL.
G	MI1	019326	101277	F	RM	A00			1	N		TORUS SPRAY VLV FAILED TO OPEN ON SIGNAL	CAUSE OF OCCURRENCE IS UNKNOWN
G	MI1	0206988	031078	K	RV	C27		R	1	T		RELIEF VALVE LEAKING THROUGH	LEAKAGE IN PILOT VALVE / STEAM CUT
G	MI1	0207228	032078	U	CV	E00			4	T		FEED WTR.CK.(1-FW-9A,9B,10A,10B)LEAK.EXCESS OF T.S	CAUSE OF LEAKAGE NOT GIVEN
G	MI1	025313	022679	W	RV	B27		R	1	N		SRV LIFTED PREMATURELY & FAILED TO RESEAT	PILOT DISC STEAM CUT
G	MI1	027674	111579	L	MV	F16		S	1	T		LPCI INBOARD ISOLATION VALVE INOPERABLE	ELECTRICAL FAILURE IN MOTOR CONTROLLER
G	MI1	030473A	022080	D	RM	C25		R	1	N		CORE SPRAY INJ VALVE LEAKING THRU	SEAT PROBLEM
G	MI1	0304738	022080	D	CV	E25		R	1	N		CORE SPRAY CHECK VLV LEAKING THRU	SEAT PROBLEM
G	MO1	015026	060376	H	MV	B23			1	T		HPCI STM LINE ISO VAL FAILED TO CLOSE	TORQUE SW SETTING DRIFTED TOO LOW
G	MO1	015100	061476	K	RV	A24		S	1	T		SAFETY RELIEF VLV 2-71A FAILED TO ACTUATE	AIR LEAK IN AIR SUPPLY SYSTEM
G	MO1	015708	090276	F	MV	B12		R	1	N		VALVE MO-2008 FAILED TO OPEN	STEM CLAMP SET SCREWS SHEARED
G	MO1	018094	053077	L	MV	A16		T	1	T		"B" RHR INJECTION VALVE FAILED TO OPEN (MO-2013)	CONTACTOR IN CONT.CIRCUITRY DID NOT CLOSE
G	MO1	018955	082877	L	MV	A16		T	1	T		"B" RHR INJECTION VALVE FAILED TO OPEN (MO-2013)	CONTACTOR IN CONT.CIRCUITRY DID NOT CLOSE
G	MO1	019050	090977	F	MV	F04		R	1	N		VALVE MO 2009 FAILED TO OPERATE PROPERLY	SET CLAMP SCREWS UNDERSIZED
G	MO1	019158	092377	F	MV	F12		R	1	M		VALVE MO-2008 FOUND FAILED DURING MAINTENANCE	SEAT RING THREADS STRIPPED
G	MO1	022808	102078	H	CV	E10		R	1	T		HPCI-9 TURB EXT LINE CHECK VALVE LEAKING INTERNALY	ACCUMULATED DIRT ON SEATING SURFACES
G	MO1	023389	112178	L	MV	F16		S	1	N		MO-2014 LPCI "A" ADMISSION VALVE INOPERABLE	BLOWN FUSE IN CONTROL POWER CIRCUIT
G	MO1	023390	112478	H	XV	C25			1	N		HPCI DRAIN VALVE CV-2043 LEAKING THRU INTERNALLY	INTERNAL PARTS NEED REPLACEMENT
G	MO1	025804	031579	W	RV	F06			1	T		OPENING DELAY TIME OF 'A' SRV IN EXCESS OF ASSUMED	PROCEDURE DID NOT HAVE INSULATION INSPEC
G	MO1	026492	070879	L	MV	A26			1	N		TORUS COOLING INJECTION VLV MOTOR OPERATOR FAILED	LIMIT SWITCH DID NOT DEENERGIZE MOTOR
G	MO1	030707	022380	H	CV	E25		R	1	T		ANCHOR 16-INCH SWING CHECK VLV LEAKING THRU(TEST)	LOOSE SEAT RING
G	MO1	032221	072980	H	MV	F20			1	T		HPCI STEAM SUPPLY VLV FAILED TO OPERATE	FAILED MOTOR WINDINGS
G	NM1	014666	051576	L	MV	A20			1	M		SHUTDOWN COOL SYST ISO VALVE 38-02 FAIL TO OPEN	OPEN MOTOR WINDINGS
G	NM1	017401*	030977	A	RV	A16		S	3	N		3 OUT OF 6 ADS RELIEF VLVS WOULD NOT HAVE OPERATE-	-D IF NEEDED//RESET SWITCH FAILURE
G	NM1	018299	063077	H	RM	F16		S	1	T		NO.12 INLET INSIDE IV-8(40-01)FAIL TO OPERATE	FAILURE OF ELECT CONTACTOR (CLOSING)

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	NM1	033594	121680	U	AV	F24		S	1	N		#11 FEEDWATER FLOW CONTROL VLV POSITIONER UNIT HAD	//EXCESS AIR VENTING FROM IT. PARTS REPLA
G	OC1	014413	040176	F	MV	A16		S	1	T		TORUS SPRAY VLV V-21-15 FAILED TO OPEN ON AUTO.SIG	MOTOR CONT.(MTR.BRKR. FAILED TO OPERATE)
G	OC1	015375	082076	F	MV	A16		S	1	T		VLV V-21-18 FAILED TO OPEN ON AUTO START SIGNAL	DEFECT.SWTCH IN VLV.MOTOR CONTROL
G	OC1	016486	111176	F	RM	A00			1	T		VALVE V-21-5 FAILED TO OPEN/CKT BRKR TRIPPED	CAUSE UNKNOWN / VLV OPENED HAND MANUALLY
G	OC1	016479	120176	D	MV	A16		T	1	T		CORE SPRAY ISO.VLV V-20-15 FAILED TO OPEN ON SIGNL	INTERMIT.GRND.SHRT.IN VLV.MTR.OPER.PWR.FD
G	OC1	017472	032377	D	MV	B16		T	1	T		CORE SPRAY ISO.VLV V-20-15 INOPERABLE IN OPEN POS.	VLV.MTR. OPERATOR BREAKER TRIPPED
G	OC1	018623*	072777	D	MV	A16		V	2	T		CORE SPRAY ISO.VLVS V-20-40 & V-20-15 FAILED TO F-	-ULLY OPEN//IMP.CKT.BRKR.OVERLOAD SETTING
G	OC1	018671	080277	A	RV	A12			1	T		ELECTROMATIC RV C FAILED TO OPEN	ACTUATOR PLATE BOUND AGAINST A RIVET
G	OC1	019080	090877	D	MV	B16		T	1	T		CORE SPRAY ISO.VLV. V-20-15 FAILED TO CLOSE	DEFECTIVE CKT.BRKR. TO MOTOR
G	OC1	022576	091478	L	MV	A23			1	T		VALVE V-14-37 WOULD NOT OPEN,BKR TRIPPED	SET SCREW ON TORQUE SW LOOSTENED,SET DRFT
G	OC1	023144	120478	F	MV	A16		U	1	T		CONT SPRAY VALVE V-21-78 FAILED TO OPEN ON TESTING	BREAKER TO VALVE NOT RACKED IN PROPERLY
G	OC1	026709	080779	D	MV	F16		T	1	T		CORE SPRAY ISOLATION VALVE V-20-15 INOPERABLE	INADVERTENT VALVE CLOSE SIGNAL DURING OPE
G	OC1	027195	091779	W	RV	A16		S	1	T		ELECTROMATIC RV WOULD NOT HAVE OPENED	HIGH PRESSURE MICROSWITCH WAS DEFECTIVE
G	OC1	030047A	010580	W	RV	A05		C	1	T		ELECTROMATIC RV"D" FAILED TO OPEN DURING TEST	RETAINER RING BACKED OUT, GRUB SCREW GONE
G	OC1	032048	071680	A	RV	A06			1	T		ELECTROMATIC RV"D" FAILED TO OPEN DURING TEST	PROCEDURES FAILED TO DESCRIBE ADJUSTMENT
G	PB2	013992	010776	L	MV	A20			1	T		MO-10-25B RHR INJECTION VLV FAILED TO OPEN	MOTOR ON VLV OVERHEATED AND DAMAGED WNDNG
G	PB2	013990	011576	L	MV	A20			1	T		RHR INJECTION VALVE MO-10-25A FAILED TO OPEN	MTR SHAFT TO PINION GEAR KEY SHEARED
G	PB2	015142	061876	L	MV	F12			1	T		RHR SD COOL SUCT ISO VAL MO-2-10-18 FAIL TO STROKE	VALVE STEM BENT
G	PB2	015085	062976	W	RV	B27		R	1	N		MAIN STEAM RV FAILED IN OPEN POSITION	PILOT VALVE SEAT LEAKAGE
G	PB2	016390	110976	D	MV	B20			1	T		CORE SPRAY VALVE MO-26A FAILED TO CLOSE	MTR OPER GEAR TRAIN FAILED
G	PB2	016333	111476	W	RV	B10		R	1	N		MAIN STM RV 71F FAILED IN OPEN POSITION	DIRT UNDER PILOT DISK AND SEAT
G	PB2	016676A	010677	W	RV	B27		R	1	N		MAIN STM RV 71E FAILED OPEN	EXCESSIVE PILOT SEAT LEAKAGE
G	PB2	019094	091377	H	MV	F16		S	1	T		HPCI TURB EXHAUST VAL MTR DAMAGED	SHORT IN VAL CONTROL CIRCUIT
G	PB2	022916	102178	H	CV	E12			1	N		CHECK VALVE 2-23-131 LEAKING INTERNALY, GLAND SEAL	INTERNALS OF CHECK VALVE WORN OUT
G	PB2	026944	090579	L	RM	F02			1	N		BKR FOR "A" RHR LOOP INJ VLV(MO-25A) OPENED	SWITCH HIT BY SCAFFOLDING/PERSONNEL ERROR

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	P83	014032	010576	D	MV	A16		S	1		N	MO-3-14-128(B CORE SPR.LP.INJ.VLV) FAILED TO OPEN	PROBLEM WITH MAGNET.TRIP DEVICE MTR. BRKR
G	P83	014033	010776	H	CV	E25			1		T	HPCI EXHAUST LINE CHECK VLV 23-65-EXCESSIVE LEAK.	POOR MATING BETWEEN FLAPPER & SEATING SUR
G	P83	014035	010776	H	AV	C25			1		T	HPCI EXHAUST LINE DRAIN VLV AO-5248 -EXCESS.LEAK.	POOR MATING BETWEEN PLUG & SEATING SURF.
G	P83	014475	021776	L	MV	A16		S	1		U	RHR INJ. VLV.MO-10-25A FAILED TO FULLY OPEN	BROKEN WIRE TO OPENING TORQUE SWITCH
G	P83	014471	030176	L	MV	B12		R	1		N	B RHR OUTBOARD INJECTION VLV MO-154B FAIL.TO CLOSE	VLV DISC SEPARATED FROM VLV STEM
G	P83	015153	071276	W	RV	B27		R	1		N	718 MAIN STEAM RELIEF VALVE FAILED OPEN	FAILURE DUE TO PILOT VLV SEAT LEAKAGE
G	P83	015228	072076	W	RV	B27		R	1		N	MAIN STEAM RELIEF VLV 71G FAILED OPEN	FAILURE DUE TO PILOT VLV SEAT LEAKAGE
G	P83	016476	112376	D	MV	B23			1		T	CORE SPR.B FULL FL.TST.RET.VLV FAILED TO CLOSE	TORQUE SWITCH SETTING WAS TOO LOW
G	P83	018884	090277	H	MV	A09			1		T	HPCI SYS.VLV MO-3-23-41 FAILED TO FULLY OPEN	CORRODED VLV STEM DUE TO VLV PACKING LEAK
G	P83	023062	111678	L	MV	A20		R	1		T	RHR VALVE MO1548 FAILED TO OPEN ON TESTING	MOTOR & SEVERAL OPERATOR PARTS REPLACED
G	P83	026763	010879	L	MV	F00			1		N	VALVE OPERATOR FAILURE ON MO16A CAUSED LOSS OF RHR	NO CAUSE GIVEN. RELEASE RATE EXCEEDED
G	P83	025311	022579	W	RV	F16		S	1		N	RELIEF VALVE RV-71L FAILED TO OPERATE	FUSES BLOWN, SHORT TO GROUND
G	P83	031104	042180	L	MV	A05		B	1		T	LPCI VLV MO-3-10-25B FAILED TO OPEN ON TEST	WALWORTH 23-INCH IMPROPER INTERNAL CLEARA
G	P83	031740	060880	F	MV	B05		C	1		T	CONT SPRAY VLV MO-3-10-26B FAILED TO CLOSE	STEM LOCKING NUT NOT STAKED BACKED OUT
G	P83	032270	080680	L	MV	A17			1		T	LPCI VLV MO-3-10-25A FAILED TO OPEN DURING TEST	THRUST BEARING IN LIMITORQUE OPER FAILED
G	P83	033292	112480	H	RM	F23			1		T	HPCI VLV MO-3-23-1 KEPT DRIVING CLOSED ONCE AND //	FAILED TO CLOSE ANOTHER TIME. TORQUE SW.
G	PI1	017674	051077	W	RV	A24		S	1		N	RV 203-3C DID NOT OPEN FROM REMOTE CONTROL SWITCH	DETERI OF THE REMOTE AIR ACTUATOR DIAPH
G	PI1	018325	062077	L	MV	B12		R	1		N	VALVE MO-1001-36A FAILED TO CLOSE.RHR PUMP OPERAT	KEY WHICH PREVENTS STEM ROTATION SHEARED
G	PI1	019669	110477	L	MV	F20			1		N	MTR OPER FOR VAL MO-1001-18B OVERLOADED,BURNED OUT	WORN GEARS ALLOWED MTR TO RUN AFT VLV CLS
G	PI1	019736	111477	W	RV	A24		S	1		T	RELIEF/SAFETY VALVE 203-3B COULD NOT BE MAN OPENED	FAIL OF 3-WAY SOLENOID VAL TO PORT PROPER
G	PI1	019859	111577	W	RV	C27		R	1		N	RELIEF VALVE 203-3B DETERMINED TO BE LEAKING	FIRST+SECOND STAGE OF PILOT VALVE LEAKING
G	PI1	019756	111777	W	RV	C27		R	1		N	RELIEF VALVE 203-3D DETERMINED TO BE LEAKING	FIRST STAGE OF PILOT VLV SEAT LEAKING
G	PI1	022757	100978	W	RV	B27		R	1		N	RV-203-3C FAILED TO RESEAT AT PROPER PRESSURE	EXCESSIVE PILOT SEAT LEAKAGE
G	PI1	026427	062779	L	MV	F00		R	1		T	RHR VALVE 1001-36A INOPERABLE	CAUSE UNKNOWN
G	PI1	026760	072579	L	MV	A12		R	1		N	RHR VALVE MOV-1001-36B INOPERABLE	VALVE STEM GUIDE KEY SHEARED

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	PI1	027177	091979	L	MV	F12		R	1		T	RHR MOV-1001-36B FAILED TO OPERATE	ALLEN SCREW LOOSENED, STEM GUIDE SLIPPED
G	PI1	031177	051380	D	RM	A16		S	1		T	CORE SPRAY VLV 1400-24B FAILED TO OPEN	DIRTY CONTACT IN LOGIC CIRCUIT
G	PI1	031759	072580	A	RV	A21		R	1		T	RV 203-3D FAILED TO OPEN DURING TEST/LOCKTITE IN	THE VLVS SOLENOID ASSEMBLY REPLACED SAME
G	PI1	032273	080180	A	RV	A00		R	1		U	RV 203-3D DID NOT OPEN GIVEN MANUAL OPEN SIGNAL	NO CAUSE COULD BE DISCOVERED BY FACT REP
G	PI1	032578	082580	D	RM	A19			1		T	MO 1400-24A FAILED TO OPEN(CORE SPRAY SYSTEM)	VLV LUBRICATED AND SUCCESSFULLY OPERATED
G	PI1	032812	100180	A	RV	B12			1		N	"D" RELIEF VLV STUCK OPEN DURING SHUTDOWN	MAIN PISTON SCORED
G	QC1	014059	010576	H	CV	E13			1		T	HPCI EXHAUST CHECK VLV. LEAKING INTERNALLY	DEFECT.GASKET BETWEEN VLV.SEAT AND BODY
G	QC1	014057	011476	L	MV	C23		R	1		T	VALVE MO-1-1001-37A FAILED LEAKRATE TEST	TORQUE SW OUT OF ADJUSTMENT/LIMITORQUE
G	QC1	015257	070176	F	MV	F12			1		U	LOOP SPRAY VALVE FAILED TO OPERATE(MO-1-1001-23-B)	LOOSE BOLTS HOLDING OPERATOR TO VALVE
G	QC1	016162	090276	F	MV	B20			1		T	MOV FAILED TO CLOSE DURING TESTING(MO-1-1001-26-A)	EXCESS GREASE/COMPACTION/HYDRAULIC LOCK
G	QC1	016472*	110176	A	RV	A13			2		T	ELECTROMATIC RELIEF VALVES FAILED TO OPEN/TESTING	EXCESSIVE INTERNAL STEAM LEAKAGE
G	QC1	0205318	032077	F	MV	C25			2M		T	EXCESS LEAKAGE THRU SPRAY VALVES DURING TEST	IMPROPER SEATING OF VALVE
G	QC1	020532	032077	A	RV	A12			3		T	MAIN STEAM ELECTROMATIC RELIEF FAILED TO OPEN/TEST	INTERNAL PARTS FOUND LOOSE AND MISSING
G	QC1	018106	041277	F	AV	B24	S		1		T	DRAIN VALVE FAILED TO CLOSE/COMMAND FAULT	AIR SUPPLY SV FAILED/AIR WOULDNT VENT OFF
G	QC1	018459	061177	H	RM	G16	S		1		T	HPCI PUMP INLET VALVE WOULD NOT STAY OPEN/TESTING	MALFUNCTION IN LOCAL VALVE CONT STAT CIRC
G	QC1	019489	093077	D	MV	F05			1		T	CORE SPRAY VALVE 1-1402-25B FAILED TO OPERATE	CRACKED YOKE/PROB SINCE INSTALLATION
G	QC1	020425	111677	A	RV	A16	S		1		N	RELIEF VALVE 1-203-3B FAILED TO OPEN ON DEMAND	COMMAND/WIRE TIE IN ELECT CONTACTOR
G	QC1	020264	111877	H	MV	A23			1		T	HPCI MOV 1-2301-4 FAILED TO OPEN DURING TESTING	MOV HAD DEFECTIVE TORQUE SWITCH
G	QC1	020636	020678	A	RV	A12			1		T	ELECTROMATIC RELIEF 1-203-3E FAILED TO OPEN / TEST	WORN INTERNAL PARTS/VALVE WAS REPLACED
G	QC1	021408	042478	A	RV	A18			1		T	ELECTROMATIC RV 1-203-3C FAILED TO OPERATE / TEST	WELD FAILURE BETWEEN BODY AND CAGE/VIBRAT
G	QC1	021436	050478	H	MV	B23			1		T	HPCI PMP SUCTION VLV MO-1-2301-6 WOULD NOT CLOSE	VLV.TORQUE SWITCH WAS WORN OUT
G	QC1	026560	071779	W	RV	F16	S		1		T	RELIEF VALVE FAILED TO OPERATE	PRESSURE SWITCH WIRE NOT CONNECTED
G	QC1	030440	020680	L	MV	F16	S		1		T	LPCI VLV MO-1-1001-36A FAILED TO OPERATE	POWER TRANSFORMER BURNED OUT(COMMAND)
G	QC1	030965	041080	L	MV	A23			1		T	LPCI MO-1-1001-36B FAILED TO OPEN ON TESTING	TORQUE SWITCH NEEDED ADJUSTMENT
G	QC1	031359	051180	A	RV	A16	S		1		T	RV 1-203-3B FAILED TO OPEN DURING TEST	DIRT ON CONTACTS OF HOLD-IN COIL SWITCH

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	QC2	016473*	110176	A	RV	A09		R	2		T	TWO ELECTROMATIC RELIEFS FAILED TO OPEN ON TESTING	INTERNAL BINDING DUE TO CORROSION PROBLEM
G	QC2	020533	032377	A	RV	A12		R	1		T	ELECTROMATIC RELIEF FAILED TO OPEN DURING TESTING	LOOSE INTERNAL PARTS BOUND/EXCESS VIBRAT
G	QC2	019223	092377	A	RV	A12		R	1		T	ELECTROMATIC RELIEF FAILED TO OPEN DURING TESTING	RINGS CUT GROOVES IN DISC GUIDE/STEAM CUT
G	QC2	019745	110677	W	RV	B27			1		N	RELIEF VALVE 2-203-3B FAILED TO RESEAT	PILOT VALVE WAS STEAM CUT AND ERODED
G	QC2	019759	111477	D	MV	A08			1		T	CORE SPRAY MOV 2-1402-24B FAILED TO OPEN / TEST	STEM AND BONNET BADLY GALLED
G	QC2	020245	011478	W	RV	F16	S		1		T	RELIEF VALVE FAILED TO OPERATE AS REQUIRED	PRESSURE CONTROL SWITCH SETPOINT DRIFT
G	QC2	020943	030578	L	CV	E10			1		T	REVERSE FLOW THRU CHECK VALVE 2-220-67A / TESTING	DIRT ACCUMULATED IN VALVE INTERNALS
G	QC2	021128	040478	L	RM	F16	S		1		N	VLV FOR FILL WTR TO LPCI DISCHARGE PIPE FAILED	NO POWER TO VLV,FUSE FAILED
G	QC2	021561	052178	D	RM	V01	U		1		N	2A CORE SPRAY SUC.VLV. MO 2-1402-3A CLOSED WHEN R-	-EQUIRED TO BE OPEN//PERSONNEL ERROR
G	QC2	022815	092978	W	RV	A24	S		1		T	RV 2-203-3A FAILED TO OPEN(MANUAL) / COMMAND	AIRLINE TO MANUAL AIR OPERATOR BROKE
G	QC2	025429	021179	L	MV	B16	S		1		T	RHR SUCTION ISOLATION VALVE FAILED TO CLOSE	STICKING CONTACTS IN CIRCUIT BREAKER
G	QC2	026557	071279	L	MV	A16	S		1		T	LPCI MOV THERMAL OVERLOAD TRIPPED	PROBABLE CAUSE-LOOSE CONNECTORS AT BREAKE
G	QC2	027100	090579	L	MV	F12			1		T	DRYWELL SPRAY VALVE TRIPPED BREAKER WHEN OPERATED	BROKEN BOLT IN VALVE MOTOR OPERATOR
G	QC2	027551	102679	L	RM	F00			1		T	2 C RHR PUMP SUCTION VLV MO2-100-7C BKR TRIPPED	NO APPARENT CAUSE FOUND
G	QC2	028115	020480	L	MV	C25			1		T	LEAKAGE THRU MO-2-1001-36B DURING TEST	VARIOUS SEAT/DISC PROBLEMS;WARP,CORROSION
G	QC2	031100	042080	A	RV	A27		R	1		T	RV 2-203-3C FAILED TO OPERATE DURING TEST	EXCESS CLEARANCE PLUNGER TO PILOT VL STEP
G	QC2	031189	042880	L	MV	B16	S		1		T	LPCI MOV 2-1001-36A FAILED TO CLOSE DURING TEST	PROBLEM IN CKT BRKR SUPPLYING PWR TO VLV
G	QC2	032779	091480	D	MV	A23			1		T	MO-2-1402-3A WOULD NOT OPEN (CORE SPRAY)	TEMPORARY STICKING OF TORQUE SWITCH
G	QC2	032967	101080	F	MV	A23			1		T	MO-2-1001-29A FAILED TO OPEN INITIALLY	DISC TO TIGHT,TORQUE SWITCH ADJUSTED
G	QC2	032968	101080	L	MV	A26			1		T	MO-2-1001-34A FAILED TO OPEN FULLY	LIMIT SWITCHES OUT OF ADJUSTMENT
G	QC2	033138	101780	A	RV	A25		R	1		U	RELIEF VLV 2-203-3C FAILED TO OPEN	LEAKAGE BETWEEN MAIN DISC AND DISC GUIDE
G	QC2	033451	120380	H	MV	F20			1		N	HPCI INJECTION VLV MO-2-2301-8 FOUND INOPERABLE	SHORT IN MOTOR OPERATOR
G	QC2	033525	120380	A	RV	A12		R	1		N	ELECTROMATIC RELIEF 2-203-3D FAILED TO OPEN	STEAM LEAKAGE RETAINER PLUG TO MAIN DISK
G	QC2	033744	123080	L	MV	A16	S		1		N	RHR VLV MO-2-1001-34A FAILED TO OPEN	CORRODED CONTACTS IN AUX CONTACTOR
G	VY1	014230*	021776	L	MV	F01	C		2		N	RHR VLVS. 25A&B WOULD NOT STROKE ELECTRICALLY	PERSON.ERROR(MUST STRO.VLVS.MANUALLY 1ST)

ALL VALVE LERS USED

VEN	PLANT	CONTROL NUMBER	EVENT DATE	SYSTEM	COMP	MODE	CAUSE	TYPE	FAIL	NUM	ACTIVITY	MODE DESCRIPTION	CAUSE DESCRIPTION
G	VY1	014584*	051076	L	MV	A14	C		2	T		TWO 24 INCH MOVS (RHR-27A/B) FAILED TO OPEN / TEST	PACKING MAINTENANCE PROBLEM
G	VY1	015184*	070676	A	RV	A22	C		3	T		3 TARGET ROCK RVS FAILED TO OPERATE(SIGNAL/MANUAL)	DIAPHRAGM IN AIR OPERATORS FAILED/HEAT
G	VY1	015855	092076	L	MV	A00			1	T		LPCI MOV (RHR-25B) FAILED TO OPEN DURING TESTING	UNKNOWN/WALWORTH AND LIMITORQUE INVESTIG.
G	VY1	016997	011877	L	RM	V03	U		2L	T		"B" RHR PMP DISCH.VLVS. SHUT WHEN REQ. TO BE OPEN	PERSONNEL ERROR
G	VY1	019854	110177	D	XV	F08			1	T		MANIFOLD BYPASS VALVE FAILED TO OPERATE	GALLED THREADS/STEM SEIZED
G	VY1	020910	041278	K	RV	A00			1	R		RV (67HH13) SET TOO HIGH	SETPOINT DRIFT/RESET TO LOWER LIFT PRESS
G	VY1	025152	012379	W	RV	A00	R		1	T		STEAM VLV SAFETY FOUND TO HAVE TOO HIGH SETPOINT	SETPOINT DRIFT
G	VY1	030837	040180	L	MV	A20			1	T		LPCI VLV 2-53B WOULDNT FULLY OPEN DURING TEST	LOOSE PINION GEAR ON LIMITORQUE OPERATOR
G	VY1	032650	090480	L	CV	E12			1	T		D RHR-SW PUMP DISCHARGE CHECK DID NOT SEAT	DEGRADATION OF VLV INTERNALS
G	VY1	032649	093080	H	RM	F16	S		1	N		923-19 HPCI PUMP DISCHARGE VLV LOST CONTROL POWER	OVERLOAD RELAY HAD TRIPPED NO CAUSE
G	VY1	032985	100780	W	RV	A00	R		1	T		MAIN-STEAM RELIEF VLV S/N67HH12 SET POINT 3# TO HI	SETPOINT DRIFT

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This report presents estimates of common cause fault rates and related quantities, based on Licensee Event Reports for valves in nuclear reactors. The Licensee Event Report data base is described. For estimating rates, the binomial 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 valves in a system inoperable. Every quantity is estimated by both a point estimate and a 90 percent interval.

17. KEY WORDS AND DOCUMENT ANALYSIS

17a. DESCRIPTORS

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