



FORM EG&G 398  
(Rev. 11-79)

8005070 712

## INTERIM REPORT

Accession No. \_\_\_\_\_

Report No. EGG-EA-5079

**Contract Program or Project Title:**

LER Failure Rate Analysis Program

**Subject of this Document:**

Extraction of Control Rod and Drive Mechanism Failure Data from Licensee Event Reports (LERs) for Use in Risk Assessments

**Type of Document:**

Data Summary Report

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**Date of Document:**

January 1980

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This document was prepared primarily for preliminary or internal use. It has not received full review and approval. Since there may be substantive changes, this document should not be considered final.

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Prepared for the  
U.S. Nuclear Regulatory Commission  
Washington, D.C.  
Under DOE Contract No. DE-AC07-76ID01570  
NRC FIN No. A6276

## INTERIM REPORT

# NRC Research and Technical Assistance Report

## FOREWORD

This report is one in a series summarizing the statistics of Licensee Event Reports (LERs) as recorded by the U.S. Nuclear Regulatory Commission. The goal of the report is twofold: (a) to summarize the data for risk and statistical analyses, and (b) to obtain gross constant failure rate estimations and gross categorizations of the failures.

Because subjective judgments had to be made regarding population sizes and pertinence of recorded events, and because some component failure may not be recorded in the LERs, the component failure rates estimated in this report should be interpreted as being only tentative gross indicators of the true failure rates. The analyst himself must validate the applicability of the LER-derived failure rates for his own particular use. Furthermore, because LER reporting requirements can differ from plant to plant, comparisons of plant-to-plant failure rates should be interpreted with care; a higher failure rate may simply be due to stricter reporting requirements. As more data are collected and more analyses are performed in the future, improved failure rate estimations will be produced.

The failure rates given in the report are only one of many kinds of information presented. The tables and discussions give important information on failure classifications, according to failure modes, failure causes, and systems affected. Gross time trends are examined. Human errors are identified as are common-cause failures and recurring failures. Each LER analyzed is presented in a useful, summarized form, and all evaluations are presented such that you can modify the authors' calculations or perform your own evaluations if you so desire.

William E. Vesely  
Project Manager  
November 16, 1979

January 1980

DATA SUMMARIES OF LICENSEE EVENT REPORTS OF CONTROL  
RODS AND DRIVE MECHANISMS AT U.S. COMMERCIAL NUCLEAR  
POWER PLANTS FROM JANUARY 1, 1972 TO APRIL 30, 1978

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This is an informal report intended for use as a preliminary or working document

NRC Research and Technical  
Assistance Report

Prepared for the  
U.S. Nuclear Regulatory Commission  
Under DOE Contract No. DE-AC07-76ID01570  
FIN No. A6038

 **EG&G** Idaho

#### ACKNOWLEDGMENTS

The authors express their sincere appreciation to the following people for their assistance in making this report possible:

Q. R. Decker for his assistance in performing the necessary computer work associated with the project.

J. A. Johnston for her conscientious and timely efforts in the typing of this report which helped greatly to meet our required time schedule.

NRC Research and Technical  
Assistance Report

## ABSTRACT

This report describes the creation and summarization of a computer data file compiled from Licensee Event Reports for control rods and drive mechanisms in commercial nuclear power plants for the period January 1, 1972 to April 30, 1978. In addition, analyses of the data file were made, primarily to obtain gross failure breakdowns and categorizations.

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## DEFINITIONS

1. Component - A component is the largest entity of hardware for which data are most generally collected and expected to be available (for example, pump with motor, valve with operator, amplifier, pressure transmitter). It is generally an off-the-shelf item procured by the system designer as a basic building block for his system. It should be distinguished from seals, materials, nuts, bolts, and other piece parts from which the component is made.
2. System - A system is a collection of components arranged to provide a desired function (for example, containment spray system, residual heat removal system, high pressure coolant injection system).
3. Fault - A fault is any undesired state of a component or system. A fault does not necessarily require failure (for example, a valve might be closed when it should be open because of another component or human error - a "command fault").
4. Failure - A failure is a subset of a fault and represents an irreversible state of a component such that it must be repaired in order for it to provide its design function. Failures are sometimes classified as primary or secondary failures. However, in classifying failures for this report, no distinction has been made between the two classifications.
  - a. A primary failure is the so called "random failure" found in the literature. It results from no external cause.
  - b. A secondary failure results when the component is subject to conditions which exceed its design envelope (for example, excessive voltage, pressure, shock, vibration, temperature).

5. Common Cause Failure - Common cause failures are two or more redundant component failures due to a single cause. The common cause events that cause multiple failures are usually secondary events or events which exceed the design envelope of the component. Human errors are a special type of command fault that are considered common cause for multiple failures, that is, other types of command faults are not considered common cause.
6. Failure Mode - The description of the manner in which a component ceases to perform its intended function.
7. Failure Mechanism - The identified cause which prevented the component from performing its intended function.
8. Demand Failure Rate - The probability (per demand) that a component will fail to operate upon demand when required to start, change state, or function.
9. Standby Failure Rate - The probability (per hour) of failure for those components which are normally dormant or in a standby state until tested or required to operate.
10. Operating Failure Rate - The probability (per hour) of failure for those operating components required to operate or function for a period of time.
11. Conservative - As used in this report, conservative is used in respect to reactor safety. (Any quantity labeled as "conservative" implies that the failure rate estimated using the "conservative" quantity will be higher than the actual failure rate.)

ACRONYMS

NRC Nuclear Regulatory Commission

LER Licensee Event Report

PWR Pressurized water reactor

BWR Boiling water reactor

CRDM Control rod and drive mechanism

FSAR Final Safety Analysis Report

NSSS Nuclear Steam Supply System

Q.C. Quality Control

DATA SUMMARIES OF LICENSEE EVENT REPORTS OF  
CONTROL RODS AND DRIVE MECHANISMS AT  
U.S. COMMERCIAL NUCLEAR POWER PLANTS  
FROM JANUARY 1, 1972 TO APRIL 30, 1978

INTRODUCTION

This report describes an evaluation of Licensee Event Reports (LERs) pertaining to control rods and drive mechanisms (CRDMs) and was performed in support of the U.S. Nuclear Regulatory Commission's (NRC's) Probabilistic Analysis Staff. The purpose of this study was to extract CRDM data from the LERs, to put the data in a form suitable for future statistical analyses, to summarize and categorize the data, and to estimate failure rates that can be used as a comparison with other failure rates used in nuclear plant risk assessments. These failure rates were estimated for both failures and faults; that is, failures plus command faults.

The NRC LER file was searched for all LERs pertaining to control rod and drive mechanism events from January 1, 1972 to April 30, 1978. LERs for the following four plants are not included because these plants are considered atypical: (a) Peach Bottom 1, (b) Fort St. Vrain, (c) LaCrosse, and (d) Humboldt Bay.<sup>a</sup> The LERs were then qualitatively examined and pertinent information concerning the LER was coded into a one-line description (one-liner). The coded one-liner was then stored in a computer-based data file for future use. The coded one-liner provides input for statistical and reliability summarizations of LERs concerning CRDMs. The computer-based data file has the capability to search, collate, retrieve, update, and display the coded one-liners by almost any item of data contained in the original LER, for example, plant name, Nuclear Steam System Supply (NSSS) vendor, event date, failure mode, or failure mechanism.

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a. Peach Bottom 1 and Fort St. Vrain are high-temperature gas reactors, while LaCrosse and Humboldt Bay have small megawatt ratings.

As one type of summarization, the faults in the one-line LERs were used to estimate LER-based failure rates ("LER rates" for short), calculated in units of per hour or per demand, for CRDMs of each operating nuclear power plant considered in this report, with the exceptions of Indian Point 1, Palisades, and Yankee Rowe, which have an older design cruciform-shaped control rod. Failure rates were estimated for most of the failure modes identified in this report. It should be noted that not all faults within a particular failure mode had to exhibit exactly the same failure characteristics. For example, the failure mode "failure to insert during normal shutdown" contains faults characterized by control rods moving in partially then stopping, as well as by control rods failing to move at all. Further discussion of LER rate evaluations and failure mode descriptions will be presented in the Description of the LER Analyses and Evaluation Methodology section.

For probabilistic assessments such as gross risk and reliability evaluations, the LER rates, as well as the one-liners, can be useful. However, when using the LER rates the analyst must be careful in the application. These LER rates may not be representative of the current failure rates associated with CRDMs because of possible differences in rod failure definitions which were applied to the problem being analyzed.

The LER summarization is described in the Description of the LER Analyses and Evaluation Methodology section. Included in the section are the definitions, ground rules, coding schemes, and assumptions used to bound the summarization. The Summary of Results section presents the results of the data summarization. Appendix A gives an explanation of the criteria for LER reporting. Appendix B describes the methods used to estimate the LER failure rates. Appendix C is a listing of the plants for which operating licenses were issued with standard technical specifications. Appendix D is a computer listing of the additional information contained in the computer-based data file but not shown in the listing of one-line LERs. Appendixes E through AF contain the computer printouts of specific types of one-liners and the gross estimates of LER rates.

## DESCRIPTION OF THE LER ANALYSIS AND EVALUATION METHODOLOGY

LERs used in this report are those submitted to the NRC during the period January 1, 1972 through April 30, 1978. The NRC LER file was computer-searched for all LERs pertaining to CRDMs. Due to the specific nature of the component and the fact that it is contained in only one system, the reactivity control system, it is felt that the majority of the LERs containing CRDM faults were used in the preparation of this report. All information considered pertinent was extracted from the CRDM LERs and encoded into the one-liner data base. The following is a summary of the CRDM LERs used in this report.

Total number of NRC LERs on CRDMs	237
LERs excluded [atypical plants (23), prior to initial criticality and other reasons (38)]	<u>61</u>
Remaining LERs	176
Additional one-liners created (due to two or more separate events being reported under one LER)	<u>23</u>
Total number of one-liners	199

Since many of the one-liners contain multiple faults, these 199 one-liners represent 504 faults and six technical specification violations.

### Component Definition

For this report, the CRDM is defined as the control rod, the drive mechanism [electric for pressurized water reactors (PWRs) or hydraulic for boiling water reactors (BWRs)], the housing containing the drive mechanism, and all parts connecting the control rod to the drive mechanism. Cables or piping external to the drive mechanism housing were not considered as part of the CRDM.



## LER Coding

After defining the bounds for the CRDMs, the LERs received from NRC were coded into a one-line data record and stored in a computer-based data file. The various data fields (15) within each data record provide a means for sorting the coded one-line LERs. These coded one-line descriptions will be used for subsequent statistical analyses of the data. The data fields within each one-line LER were coded according to the rationale described below. It should be noted that some sort fields described in the following sections are not listed in the one-liner computer printout due to lack of space. This additional information is cross-referenced by the control number and provided in Appendix D.

### Control Number

To identify each one-liner within the data base and also to provide a cross-reference with the actual LER submitted to NRC, the unique six-digit control number assigned to the LER by NRC was entered into this field. In some instances, an LER may contain several faults, exhibiting different failure modes, listed in the narrative summary. To accommodate this situation, an alphabetic character was added to the six-digit number, thus traceability of each one-liner back to the original LER was maintained. In the case where the LER reported more than one fault exhibiting the same failure mode in the summary description, an asterisk (\*), indicating multiple CRDM failures, was used to flag the coded one-line LER in the data base. The control number field can be used as a sort field, but it is intended for data record identification within the data base and not a sorting key.

### Plant

A three-character alphanumeric field is used to store the code for the plant name identified in the LER; for example, Zion 1 is coded Z11. The coding used to identify the licensed operating plants is

displayed in the Plant Information Table, Appendix E. The plant field can be used as a sort key.

#### Vendor

To identify LERs with the four NSSS vendors considered in this report, a one-character field was used. The four NSSS vendors are Babcock & Wilcox, Combustion Engineering, Westinghouse, and General Electric (BWR). The coding is displayed in Appendix F. The vendor field can be used as a sort key.

#### System

All CRDMs are contained in the reactivity control system. This system is identified by the letter M. The system field can be used as a sort key.

#### Component Type

The code CD is used to identify the CRDM component. Presently, this field contains only one code, therefore, sorting is not necessary. This field can be used as a sort key if the CRDM data were to be combined with other component data.

#### Failure Mode

A single-character field is used to identify the mode of component failure. From the LERs, 12 failure modes were identified for CRDMs.

The coding of failure modes is as follows:

<u>Code</u>	<u>Failure Mode</u>
B	Failure to insert during normal shutdown
C	Failure to bottom during scram
D	Failure to insert to at least 96% during scram

<u>Code</u>	<u>Failure Mode</u>
E	Rod fails to move during power changes or testing
F	Rod fails to withdraw from fully inserted position
G	Dropped rod (PWR)
H	Uncoupled rod/overtravel condition (BWR)
I	Improper rod movement
J	External leakage/rupture
K	Does not operate properly (specific mode not identifiable)
L	Maintenance/replacement required
T	Technical specification violations (non-failures)

The following is a discussion of the individual CRDM failure modes. Code letters are indicated in parentheses.

Failure to insert during normal shutdown (B) - the failure of a control rod to drive into the full insertion position while performing a normal shutdown of the reactor. This implies that the reactor is critical and an operator "demanded" the rods to drive in for the purpose of going subcritical. The safety implications of this mode are considered less than some other modes as the rods are designed to be disengaged from the driving mechanism and dropped into the core (that is, scrambled) independent of the driving mechanism.

Failure to bottom during scram (C) - the failure of a control rod to insert fully into the core while attempting to shut down the reactor by scram. This implies that the reactor is critical, that the control rod has the ability to be dropped (some part-length control rods do not drop on a scram but can only be driven in or out), that an operator or control system "demanded" the control

rod to scram, and that the rod does insert to at least six inches from the "bottom." "Bottom," for this definition, means between 96% inserted and the fully inserted rod position. If a rod reaches the 96% inserted position, it is considered to have done its job in terms of adding enough negative reactivity to the core to place the reactor in a safe condition.

Failure to insert to at least 96% during scram (D) - the failure of a control rod to drop to at least the 96% inserted position while attempting to shut down the reactor by scram. As compared with Mode C, this mode is more important from a safety aspect because of the greater severity of the failure. This was the definition used by EPRI<sup>1</sup> in analyzing their single rod failure rates; for many problems this definition of failure may be conservative. Mode D combined with Mode C above would give the full set of faults for rods failing to insert during scram. Because of the sparsity of data, failure to insert is not broken into modes finer than either Mode C or Mode D.

Rod fails to move during power changes/testing (E) - the failure of a control rod to move either in or out of the core while adjusting the reactor power level or testing the control rod for movement. Starting conditions normally are with the reactor critical and at power, and the operator "demands" the control rods to move to adjust power or to test that the rods are moveable over a small range of their travel. This mode would cover most of the faults which occur during rod motion tests required by technical specifications.

Rod fails to withdraw from fully inserted position (F) - the failure of a control rod to withdraw from the full insert position when demanded. This mode is a subset of a category "Rods fail to move when driven" as are modes B and E, but is broken out separately because it does not have the safety implications of Modes B or E. Mode F is of interest when calculating plant unavailability or down time.

Dropped rod (PWR) (G) - the failure of a PWR control rod to remain in position. In the case of a PWR, this means the control rod becomes unlatched and drops by gravity into the core usually to the fully inserted position (bottom). One effect of this type of fault could be flux tilts which could cause uneven power generation and core thermal problems. The dropped rod mode is applicable to PWRs since the control rod drives are usually mounted above the core as opposed to BWR control rod drives which are mounted below the core. A dropped BWR control rod would fall out of the core rather than into it. Due to the seriousness of such an event, the BWR CRDM design and operation is such that this type of event is improbable.

Uncoupled rod/overtravel condition (BWR) (H) - the failure of a BWR control rod to be physically attached to its drive mechanism. The BWR CRDM design is such that during withdrawal an uncoupled control rod's position may be independent of its drive mechanism. Upon withdrawal of the drive mechanism, the uncoupled control rod usually follows the drive mechanism out but, in some instances, it may bind and stop at some intermediate position in the core. If the reactor were critical and the uncoupled control rod drifted from such an intermediate position, a power transient could result. The "overtravel condition" refers to the normal way in which a control rod is found to be uncoupled. When the drive mechanism is fully withdrawn, if the control rod is not physically coupled, the drive mechanism can overtravel (that is, move a few inches beyond full out position).

Improper rod movement (I) - the inadvertent insertion or withdrawal of a control rod by means of the drive mechanism when the drive mechanism is being commanded by forces external to the mechanism. These external forces may either be human or hardware faults which are outside the bounds of the component. By definition, all Mode I failures are command faults. Human faults may include operator, design, fabrication, construction, quality control, or procedural errors. The hardware faults might be failures in any system that

interfaces with the CRDM. Some examples of events which fall into the Mode I category and their reported causes are as follows:

<u>Event</u>	<u>Cause</u>
Improper movement of Rod 7-4 caused high SUR scram.	Procedure for conducting test was inadequate.
Operated with Rod 6-6 lower than remainder of Group 6 rods.	Personnel error (operating).
Improper rod movement caused inadvertent criticality.	Personnel error (testing); interlocks were jumped.
Rod moved without operator action.	Probable cause, noise spikes in timer circuit.

Since this mode is somewhat specialized in that all the faults are command faults, the number of CRDMs effected by the command fault is considered unimportant. What is important for Mode I is how many times the CRDMs are commanded improperly, not the number of CRDMs which are commanded improperly. Therefore, all analysis performed on Mode I considered each one-liner as one fault.

External leakage/rupture (J) - the failure of the CRDM housing to contain the primary coolant within the boundaries of the primary system.

Does not operate properly (K) - any fault of a CRDM which is not described specifically enough to assign the fault to one of the other modes.

Maintenance/replacement required (L) - This is a unique category in that component conditions are identified and repaired or replaced before the CRDM has a chance to fail during operation. In the normal coding of a one-liner, the mode is identified and then the problem which caused the fault is listed. For the one-liners coded Mode L, a problem is identified which would probably cause some operational fault, but rather than speculate as to the

failure mode the problem would have caused, had the CRDM operated with the problem, Mode L is specified. In some cases, it is not clear whether the problem would have failed the CRDM, but the parts involved with the problem were repaired or replaced anyway.

Technical specification violation (T) - this mode does not involve actual faults of the CRDM but instead concerns human failure to perform the required tests on the CRDMs or human failure to operate the CRDMs in accordance with the technical specifications. One-liners, coded with this mode, are considered non-failures and are, therefore, left out of all CRDM failure rate estimates.

The number of plant events coded with Mode T could be used as a measure of the proficiency of plant personnel in adhering to procedures, testing schedules, and instructions dictated by the plants' technical specifications.

A listing of the failure mode codes and a brief description of the failure modes are contained in Appendix F. The failure mode field can be used as a sort key.

#### Failure Mechanism

The failure mechanism, or reported cause of failure, code is a two-digit number following the alphabetic failure mode code. The failure mechanism codes are, in general, self-explanatory and are listed below.

- 00 UNKNOWN
- 01 PERSONNEL (OPERATION)
- 02 PERSONNEL (MAINTENANCE)
- 03 PERSONNEL (TESTING)
- 04 DESIGN ERROR
- 05 FAB./CONSTRUCTION/Q.C.

- 06 PROCEDURAL DISCREPANCY
- 07 NORMAL WEAR
- 08 EXCESSIVE WEAR
- 09 CORROSION
- 10 FOREIGN MATERIAL CONTAMINATION
- 11 EXCESSIVE VIBRATION
- 12 CRDM MOTOR FAILURE
- 13 SEAL FAILURE
- 14 FAILED/MISALIGNED INTERNALS
- 15 CLUTCH FAILURE
- 16 BRAKE FAILURE
- 17 BEARING/BUSHING FAILURE/PROBLEM
- 18 FILTER/STRAINER PLUGGED
- 19 BINDING/SEIZURE
- 20 FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
- 21 CONTROL CIRCUIT FAILURE/PROBLEM
- 22 FASTENER FAILURE/PROBLEM
- 23 WELD FAILURE
- 24 LUBRICATION PROBLEM

Many of the LERs failed to report a cause for the CRDM fault. Unknown (00) was used to code the failure mechanism in such cases.

Faults involving personnel are covered in codes 01-06. Operational errors are primarily associated with failure Mode I (improper rod movement). All Mode I faults are considered command faults. However, some failures are directly caused by personnel (for example, maintenance personnel are a principal cause of failures).

Normal wear (07) was used for end of normal service life, etc., while excessive wear implies a shorter than normal component life. It



should be noted that normal wear failures do not occur in the constant failure rate portion of the failure rate versus time curve. Therefore, some analysts may wish to exclude these failures from the estimations. Galling was included in excessive wear.

Two of the failure mechanisms are directly related to command faults. Failure/fault of component supply system (20) and control circuit failure/problem (21) are two mechanisms used in conjunction with command faults. These codes are used to show that the CRDM could not function because it had no source of power, electrical or mechanical, to command the CRDM to function. If the CRDM is not commanded to move, it is not considered to be a CRDM failure but a command fault.

The above mechanism list, restructured below, groups the mechanisms into the logical categories which were considered during the development of the mechanisms. This restructured list should provide some insight into the rationale used in evaluating the LERs.

<u>Categories</u>	<u>Mechanisms Used</u>
1. Mechanisms not stated or unknown	00--Unknown
2. Human originated mechanisms	01--Personnel (Operations) 02--Personnel (Maintenance) 03--Personnel (Testing) 04--Design Error 05--Fab./Construction/Q.C. 06--Procedural Discrepancy
3. General mechanisms existing independent of component type	07--Normal Wear 08--Excessive Wear 09--Corrosion 10--Foreign Material Contamination 11--Excessive Vibration
4. General mechanisms related to the specific component type	14--Failed/Misaligned Internals 19--Binding/Seizure 22--Fastener Failure/Problem 23--Weld Failure 24--Lubrication Problem

<u>Categories</u>	<u>Mechanisms Used</u>
5. Mechanisms related to specific parts within the component type	12--CRDM Motor Failure 13--Seal Failure 15--Clutch Failure 16--Brake Failure 17--Bearing/Bushing Failure/Problem 18--Filter/Strainer Plugged
6. General "command fault" mechanisms	20--Failure/Fault of Component Supply System 21--Control Circuit Failure/Problem

### Type of Failure

The "type of failure" code is a single alphabetic character field and is listed below.

B--RECURRING COMMON CAUSE FAILURES

C--COMMON CAUSE FAILURES

R--RECURRING FAILURES

S--COMMAND FAULT

T--RECURRING COMMAND FAULTS

A common cause failure (C) is defined, for purposes of this report, as a failure of two or more CRDMs resulting from a single identifiable causal event such as fire, flood, or poor maintenance. These failures should occur in approximately the same time period. Some events were coded as common cause even though only one failure resulted. These events were considered to be "common cause candidates" because of the failure cause, and were coded as common cause to aid in future common cause studies. Recurring failures (R) are failures of a specific CRDM or failures involving different CRDMs, but in either case, each failure is usually caused by the same precise failure mechanism. Two examples of a recurring type of failure could be (a) CRDM #20 fails to scram in February and another LER reports the same rod failing to scram in March (both causes listed as unknown) and (b) CRDM #13 fails to withdraw due to an embrittled shaft connecting pin in April and in another LER for

June; CRDM #14 failed to scram, again due to an embrittled shaft connecting pin. Such recurring failures are identified by screening all the LERs submitted by one plant and finding two or more LERs with the same precise failure mechanism. Occasionally, two LERs will be exactly the same except for the failure mechanism (for example, one may state, "cause unknown" and the next may state, "corrosion"). In such cases these LERs were coded as recurring. It was assumed that the cause for the first failure had not been investigated thoroughly enough (that is, the problem was not fixed after the first LER). One other method of having a LER coded as recurring is for that one LER to state, "this is a recurring failure" or "three previous failures have been reported on this component." A command fault (S) is a failure of the CRDM to be COMMANDED to function due to a fault in another component or by human error (for example, open scram breakers to the CRDMs or technician fails to correctly line up valves properly in a subsystem to the BWR CRDMs). The recurring common cause failures (B) code is used to describe a failure as being both a common cause and a recurring failure (for example, CRDMs failing due to a common cause in January and CRDMs failing again due to the same common cause in March). The recurring command fault (T) code was used to describe a failure as both a command fault and recurring. The "type of failure" field can be used as a sort key.

#### Event Date

A six-digit field was used to record the date of the event. The format for the date field is in the following order:

Month - - - two digits  
Day - - - - two digits  
Year - - - two digits.

This is the date on which the fault reported was discovered and may not be the actual date on which the fault occurred. The month, day, and year can be used as sort keys.

### Failure Mode Description

The LER narrative summary of the failure mode was condensed into a 50-character alphanumeric field. This field provides a short, concise description of the failure mode. This is not a sort field.

### Failure Mechanism Description

A 41-character alphanumeric field is used to provide a narrative description of the failure mechanism. This field provides a short, concise description of the failure mechanism. This is not a sort field.

### Activity Resulting in Discovery

A single-character code is used to indicate the activity resulting in the discovery of the fault. This field is not listed in the one-liner due to line size restrictions, but it is contained in Appendix D. The codes and descriptions are displayed in Appendix F. This field can be used as a sort key.

### Manufacturer

A four-character field is used to record the manufacturer of the failed component. This field is not listed in the one-liner due to page-size restrictions, but it is contained in Appendix D. This field is available to provide sorts of LERs by manufacturer. The codes for the various manufacturers were taken from Exhibit J of the "Instructions for Preparation of Data Entry Sheets for Licensee Event Report (LER) File"<sup>2</sup>.

### Number of Failures

As mentioned earlier in the discussion of the control number field, more than one fault is sometimes reported in an LER. When this type of LER is encountered, the number of faults is placed in this two-digit field. If only one fault is reported, this field is left blank. A few

plants reported groups of rods failing. The number of rods in the failed group was obtained from the Final Safety Analysis Report (FSAR) for that plant. Core changes could vary the rod configurations, therefore, these group numbers are only best estimates. The field can be used as a sort key.

### Failure Classification

In an attempt to extract additional information from the original LER, each CRDM fault was examined to determine whether the cause of the failure was time related or demand related. For the time related failures, as the standby time or operating time increases, the chance of this kind of failure occurring would increase. For the demand related failures, the chance of demand related failures would increase as the demands or cycling of the component increases and not directly as the time increases. As an example, a CRDM that failed due to corrosion would be classified as a "time related" failure, while a CRDM failure that resulted from a binding or seizure of internal parts would be considered a "demand related" failure. Most of the LERs, however, did not provide enough information to make a clear time or demand determination. The "Unknown" classification was used for any failure mechanism which could not be specifically classified. Faults, which are due to human errors occurring during operation, testing, or maintenance of the CRDM, were classified as "demand related" faults, since the probability of this kind of fault increases as the number of human interactions with the component increases. All command faults were classified as "demand related" because the fault occurred when a "demand" was placed on the component. It should be recognized that in assuming a demand failure classification for all command faults, this classification applies only to the commanded component, the CRDM. No attempt was made to classify the fault which caused the improper CRDM command. The "Not Applicable" classification was used for the technical specification violations (non-failures).

Since many subjective judgments were made to facilitate classification, the reader should be careful when using this information.

## LER Rate Estimates

LER rates pertaining to CRDMs were estimated for selected failure modes or combinations of failure modes. The computational formulas used for estimating the LER rates are discussed in Appendix B. CRDM LER rates were estimated for selected failure modes for

1. Each licensed operating plant
2. Each NSSS
3. All PWRs and all BWRs
4. The aggregate population.

Two different time periods were used in the estimates. The entire period covered by this report, January 1, 1972 through April 30, 1978, and a second period, January 1, 1976 through April 30, 1978. Separate estimates were done for this second time period to coincide with improved LER reporting changes which went into effect on January 1, 1976 (see Appendix A).

The LER rate estimates are linked closely with the functions that a component can perform. The failure modes are, in turn, closely related to these functions. Two major functions that the CRDM performs are shutdown and control of the reactor. LER rates are estimated for failure modes involving both of these functions.

The first step of the process is selecting the failure modes for LER rate estimates. Each selected failure mode is then evaluated to determine whether a failure per demand or a failure per hour LER rate estimate is appropriate. The following is a list of the type of LER rate estimates performed for each selected failure mode.

<u>Selected CRDM Failure Modes</u>	<u>Type of LER Rate Estimate</u>
(B) Failure to insert during normal shutdown	Failure per demand
(C&D) Failure to bottom during scram and failure to insert to at least 96% during scram	Failure per demand
(D) Failure to insert to at least 90% during scram	Failure per demand
(E) Rod fails to move during power changes/testing	Failure per demand
(G) Dropped rod (PWR)	Failure per hour
(H) Uncoupled rod/overtravel condition (BWR)	Failure per hour
(I) Improper rod movement	Failure per hour

Demand LER rates, in units of failures per demand, are estimated for failure modes that are demand related. These are failure modes involving failure of the CRDM to move to a desired position when required (for example, failure to insert during normal shutdown is a failure per demand). During the time the reactor is critical, awaiting a demand, the CRDM may be considered to be in a standby condition. Therefore, whenever a demand LER rate is estimated, a standby LER rate, in units of failures per hour, is also estimated.

Due to the fact that a CRDM may be considered to be in a standby condition when not demanded, a standby LER rate, in units of failures per hour, is estimated for all failure modes that are not demand related (for example, a dropped rod in a PWR is not considered a demand related fault).

The time required to complete CRDM demands is considered insignificant when compared with the total number of hours that the CRDM is in the standby condition. Therefore, no deduction was taken from the total number of standby hours to account for these demands.

Data necessary to estimate CRDM failure rates from LERs for selected failure modes were collected from the sources given in the following sections. The data obtained were critical hours of operation for each plant, demands experienced by the CRDMs for each plant, CRDM populations for each plant, and the number of CRDM faults reported in LERs for each plant. Indian Point 1, Palisades, and Yankee Rowe plants were excluded from all failure rate estimates since they have cruciform-shaped control rods, whereas later PWRs have control rod clusters. The three plants containing cruciform-shaped control rods experienced a much larger percentage of failures than those containing control rod clusters. This condition would unfairly bias the LER rate estimates made for PWR plants. (For statistical data concerning these three plants, see Reference 1, pages 2-15 through 2-19.)

#### Time

The hours used in the standby LER rate estimates were the total hours during which each plant reported being critical (that is, critical hours). The number of critical hours for each licensed operating plant was obtained from either the NRC "Gray Book"<sup>3</sup>, the "Nuclear Power Plant Operating Experiences"<sup>4,5,6,7</sup>, or "The Operating History of U.S. Central Station Nuclear Power Plants"<sup>8</sup> for the years 1972 through April 30, 1978. In some cases, it was necessary to use a combination of these sources to obtain the critical hours of operation for a particular plant.

It is recognized that power is supplied to the CRDMs for longer than the critical hours, such as for start-up checkouts and some testing periods. These additional hours are not incorporated into the calculations, because they are difficult to determine, and are believed to represent only a very small fraction of the total critical hours.



## Demands

To obtain an estimate of the number of demands experienced by CRDMs, information was gathered based on both testing and operational demands.

Testing Demands. Typical testing frequencies for CRDMs, as specified in technical specifications for each of the reactor types, are as follows:

	<u>PWR</u>	<u>BWR</u>
Test for control rod movement	≤31 days	≤7 days
Test for scram ability (drop times)	≤18 months	10% of rods ≤120 days on rotating basis

It was assumed that testing was done at the minimal frequency as specified by the technical specification requirements. Consequently, the number of testing demands for rod motion in each plant were assumed to be the plant's total yearly critical hours divided by an average number of hours per month for the PWR reactors, or an average number of hours per week for the BWR reactors. This testing frequency assumption will result in conservative per demand failure rates (higher than actual) compared to when testing is performed at a frequency greater than minimally required by technical specifications. To the order of magnitude precisions of concern here, variations in testing frequencies will generally have small effects. The failure rate data are given such that the analyst can insert his own testing frequency and calculate modified failure rates if the difference is significant.

For scram testing, it was assumed that all tests would be scheduled to coincide with scheduled outages. Since all scheduled outages are reported by each plant, the number of scheduled outages are assumed to contain all the scram tests. With regard to the potential conservatism of this testing frequency assumption, the same comments apply as in the previous paragraph.

Operational Demands. The NRC "Gray Book"<sup>3</sup> and the "Nuclear Power Plant Operating Experiences"<sup>4,5,6,7</sup> give the number of (a) normal shutdowns, (b) manual scrams, and (c) automatic scrams for each plant by month. This information was not available for 1972, however, so the average number of demands in 1973 through 1977 was assumed for 1972. For the partial year, 1978, the data for February were not available. No operational demands were assumed for February unless it could be determined from either the January or March operating history that a shutdown had occurred in February.

It should be noted that the actual number of operational demands is larger than the number of demands assumed due to transients and fuel and poison burnup requiring rod motion. These additional demands are not on the entire rod population, however, but only on the controlling rod bank, therefore, no attempt was made to account for them.

#### CRDM Population

The CRDM population for each licensed operating plant examined was obtained from the plant description section of "Nuclear Power Experience"<sup>9</sup>.

Nearly all the plants contain part-length rods which are used to balance the neutron flux in the core. These part-length rods were considered as part of the entire CRDM population with one exception. In the Westinghouse design, FSARs indicated that part-length rods are not designed to drop on a scram. Therefore, they were left out of the population for estimates involving failure to scram.

#### Faults

The faults used to estimate component LER rates are divided into failures and command faults. Component LER rates were estimated using both failure and command fault data extracted from the one-liners stored in the computer-based data file. It should be noted that the rate estimates performed for CRDMs assumed each fault was an individual

random event, when in fact some of the faults are common mode events. The common mode events are worthy of mention in that they present a greater potential for serious accidents than do most events involving only a single rod.

Five common mode events involving failures to scram were identified from the LERs and are listed below:

8-29-72	Palisades 1	4 rods failed to insert during scram-- degradation of lubrication of spline surfaces
11-20-73	Nine Mile Island 1	11 rods failed to insert fully during scram--leakage past stop pistons
11-26-73	Nine Mile Island 1	15 rods failed to insert fully during scram--leakage past stop pistons
11-2-74	Dresden 2	96 rods failed to insert fully during scram--leakage past seals
7-9-77	Dresden 2	46 rods failed to insert fully during scram--worn stop piston seals

Table 1 gives the number of faults, population, demands, and time used for each plant for the selected modes used to estimate LER rates. If the analyst has more precise information on any of the quantities, he may modify the values used and reestimate the LER rates using these more precise data.

Not all one-liners pertain to actual failures or command faults. These non-failures (that is, technical specification violations) were not used in the LER rate estimates and are not counted in Table 1. The individual one-liners which account for the faults, listed in Table 1, are presented at the beginning of the individual appendixes which contain the LER rate estimations (see Appendixes U through AF).

TABLE 1. SUMMARY OF

Nuclear Steam Supply System	Plant	Control Rod Drive Mechanism	Critical Hours		Failure to Insert to at Least 96% During Scram						Failure to In During Normal S			
			Population <sup>e</sup>	72-78 <sup>f</sup>	76-78 <sup>g</sup>	Demands		Failures		Faults		Demands		Failures
						72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78
Babcock & Wilcox	AR1	69	20009	12946	15	8	0	0	0	0	17	9	0	
	CR3	69	7430	7430	15	15	0	0	0	0	22	22	0	
	DB1	57	4129	4129	7	7	0	0	0	0	6	6	0	
	OE1	69	30392	13620	64	17	0	0	0	0	43	17	0	
	OE2	69	21755	13196	17	6	0	0	0	0	39	21	0	
	OE3	69	22921	15777	18	10	0	0	0	0	32	18	0	
	RS1	69	14543	12642	12	10	0	0	0	0	21	15	0	
	TI1	69	24929	14916	7	2	0	0	0	0	16	7	0	
	TI2	69	342	342	4	4	0	0	0	0	0	0	0	
Totals		609	146450	94998	159	79	0	0	0	0	196	115	0	

Nuclear Steam Supply System	Plant	Control Rod Drive Mechanism	Critical Hours		Failure to Insert Fully During Scram						Failure to Move on Non-Scram D			
			Population <sup>e</sup>	72-78 <sup>f</sup>	76-78 <sup>g</sup>	Demands		Failures		Faults		Demands		Failures
						72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78
Babcock & Wilcox	AR1	69	20009	12946	15	8	0	0	0	0	44	26	0	
	CR3	69	7430	7430	15	15	0	0	0	0	32	32	1	
	DB1	57	4129	4129	7	7	0	0	0	0	12	11	0	
	OE1	69	30392	13620	64	17	0	0	0	0	85	36	0	
	OE2	69	21755	13196	17	6	0	0	0	0	69	39	0	
	OE3	69	22921	15777	18	10	0	0	0	0	63	40	0	
	RS1	69	14543	12642	12	10	0	0	0	0	41	32	0	
	TI1	69	24929	14916	7	2	0	0	0	0	50	28	0	
	TI2	69	342	342	4	4	0	0	0	0	1	1	0	
Totals		609	146450	94998	159	79	0	0	0	0	397	245	1	

- a. All faults involving Improper Rod Movement are considered command faults, thus they were categorized as either person
- b. Estimates were performed on failures (primary and secondary) and on faults (command faults and failures). In those c
- c. Includes only personnel command faults.
- d. Includes both personnel and hardware command faults.
- e. Populations in parentheses for Westinghouse nuclear steam supply system exclude part length control rods, which were
- f. Covers time period January 1, 1972 through April 30, 1978.
- g. Covers time period January 1, 1976 through April 30, 1978.
- h. Estimates for plants with standard and non-standard technical specifications were only performed for the period after

ALL DATA USED IN LER RATE ESTIMATES

Plant	Rod Fails to Move During Power Changes/Testing												Dropped Rod (PWR)				Uncoupled Rod/Overtravel Condition (BWR)				Improper Rod Movement <sup>a</sup>			
	Faults <sup>b</sup>		Demands		Failures		Faults		Failures		Faults		Failures		Faults		Faults <sup>c</sup>		Faults <sup>d</sup>					
	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78				
0			27	17	0	0	0	0	0	0	0	9	9			1	0	1						
0			10	10	1	1	30	30	1	1	21	21			1	1	1							
0			6	5	0	0	0	0	0	0	0	0	0			0	0	0						
0			42	19	0	0	0	0	0	0	0	0	0			2	0	2						
0			30	18	0	0	0	0	2	2	23	14			1	0	1							
0			31	22	0	0	0	0	1	1	19	19			1	0	1							
0			20	17	0	0	0	0	0	0	0	0			1	1	1							
0			34	21	0	0	0	0	1	0	1	0			1	0	1							
0			1	1	0	0	0	0	0	0	0	0			0	0	0							
			201	130	1	1	30	30	5	4	73	63			8	2	8							

Plant	Properly Demands				Aggregate of All CRDM Faults for Plants with Standard Technical Specifications <sup>h</sup>				Aggregate of All CRDM Faults for Plants with Non-Standard Technical Specifications <sup>h</sup>				Aggregate of All CRDM Faults for Plants Considered in These Estimates					
	Faults		Failures		Faults		Failures		Faults		Failures		Faults		Failures		Faults	
	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
0	0	0	0	0	10	9			0	9	0	0	10	9				
0	30	30	1	1	22	22	3	53			3	3	53	53				
0	0	0	0	0	0	0	0	0			0	0	0	0				
0	0	0	0	0	2	0					0	0	0	0	2	0		
0	0	0	2	2	24	14					2	14	2	2	24	14		
0	0	0	1	1	20	19					1	19	1	1	20	19		
0	0	0	0	0	1	1					0	1	0	0	1	1		
0	0	0	1	0	2	0					0	0	2	0	4	0		
0	0	0	0	0	0	0	0	0					0	0	0	0		
	30	30	5	4	81	65	3	53			3	43	8	6	114	96		

caused or a combination of personnel and hardware caused faults.

cases where no command faults occurred for a failure mode, no estimate was performed.

not used for estimates involving scrams in Westinghouse plants.

the implementation of the standard technical specifications, January 1, 1976.

TABLE 1. (co

Nuclear Steam Supply System	Plant	Control Rod Drive Mechanism Population <sup>e</sup>	Critical Hours		Failure to Insert to at Least 96% During Scram						Failure to Insert During Normal Shutdown					
			72-78 <sup>f</sup>	76-78 <sup>g</sup>	Demands		Failures		Faults		Demands		Failures		Faults <sup>j</sup>	
					72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
Combustion Engineering	CC1	85	20739	15903	28	18	0	0	0	0	21	14	0	0		
	CC2	85	9162	9162	11	11	0	0	0	0	13	13	0	0		
	FC1	49	32123	16130	29	10	0	0	0	0	19	6	0	0		
	MI2	81	14906	13567	41	41	0	0	0	0	7	7	0	0		
	MY1	85	40408	18606	31	9	0	0	0	0	33	9	0	0		
	SL1	81	9903	9903	23	23	0	0	0	0	5	5	0	0		
Totals		466	127241	83271	163	112	0	0	0	0	98	54	0	0		

Nuclear Steam Supply System	Plant	Control Rod Drive Mechanism Population <sup>e</sup>	Critical Hours		Failure to Insert Fully During Scram						Failure to Move Properly on Non-Scram Demands					
			72-78 <sup>f</sup>	76-78 <sup>g</sup>	Demands		Failures		Faults		Demands		Failures		Faults	
					72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
Combustion Engineering	CC1	85	20739	15903	28	18	0	0	0	0	49	36	0	0	0	0
	CC2	85	9162	9162	11	11	0	0	0	0	26	26	0	0	1	1
	FC1	49	32123	16130	29	10	0	0	0	0	63	29	0	0	0	0
	MI2	81	14906	13567	41	41	0	0	0	0	27	26	0	0	0	0
	MY1	85	40408	18606	31	9	0	0	0	0	88	35	0	0	0	0
	SL1	81	9903	9903	23	23	0	0	0	0	20	20	0	0	1	1
Totals		466	127241	83271	163	112	0	0	0	0	273	172	0	0	2	2

- a. All faults involving Improper Rod Movement are considered command faults, thus they were categorized as either personnel caused or a
- b. Estimates were performed on failures (primary and secondary) and on faults (command faults and failures). In those cases where no co
- c. Includes only personnel command faults.
- d. Includes both personnel and hardware command faults.
- e. Populations in parentheses for Westinghouse nuclear steam supply system exclude part length control rods, which were not used for est
- f. Covers time period January 1, 1972 through April 30, 1978.
- g. Covers time period January 1, 1976 through April 30, 1978.
- h. Estimates for plants with standard and non-standard technical specifications were only performed for the period after the implementat

(inued)

Rod Fails to Move During Power Changes/Testing						Dropped Rod (PWR)				Uncoupled Rod/Overtravel Condition (BWR)				Improper Rod Movement <sup>a</sup>			
Demands		Failures		Faults		Failures		Faults		Failures		Faults		Faults <sup>c</sup>		Faults <sup>d</sup>	
72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
28	22	0	0	0	0	3	3	6	6					0	0	0	
13	13	0	0	1	1	2	2	5	5					0	0	0	
44	23	0	0	0	0	1	0	1	0					1	0	1	
20	19	0	0	0	0	0	0	1	1					0	0	0	
55	26	0	0	0	0	0	0	0	0					0	0	0	
15	15	0	0	1	1	3	3	5	5					0	0	0	
175	118	0	0	2	2	9	8	18	17					1	0	1	

Faults Involving Rod Motion when No Motion is Desired				Aggregate of All CRDM Faults for Plants with Standard Technical Specifications <sup>h</sup>				Aggregate of All CRDM Faults for Plants with Non-Standard Technical Specifications <sup>h</sup>				Aggregate of All CRDM Faults for Plants Considered in These Estimates			
Failures		Faults		Failures		Faults		Failures		Faults		Failures		Faults	
72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
3	3	6	6		3		6					3	3	6	6
2	2	5	5		2		6					2	2	6	6
1	0	2	0					0		0		1	0	2	0
0	0	1	1		0		1					0	0	1	1
0	0	0	0					0		0		0	0	0	0
3	3	5	5		3		6					3	3	6	6
9	8	19	17		8		19	0		0		9	8	21	19

combination of personnel and hardware caused faults.

and faults occurred for a failure mode, no estimate was performed.

cases involving scrams in Westinghouse plants.

of the standard technical specifications, January 1, 1976.

Nuclear Steam Supply System	Plant	Control Rod Drive Mechanism Population <sup>e</sup>	Critical Hours		Failure to Insert to at Least 96% During Scram						Failure to Inse During Normal Sh			
			72-78 <sup>c</sup>	76-78 <sup>k</sup>	Demands		Failures		Faults		Demands		Failures	
					72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
General Electric	BF1	185	15553	10793	47	22	0	0	1	0	14	0	1	0
	BF2	185	12326	11809	30	22	0	0	1	1	2	1	0	0
	BF3	185	11545	11545	30	30	0	0	0	0	0	0	0	0
	BP1	32	38622	13379	3	2	0	0	1	0	17	6	0	0
	BR1	137	7544	7544	20	20	0	0	0	0	11	11	0	0
	BR2	137	14576	13226	58	42	0	0	0	0	19	6	0	0
	CO1	137	27641	16617	44	14	0	0	0	0	4	1	0	0
	DA1	89	22487	15031	24	17	0	0	0	0	26	16	0	0
	DR1	80	35600	15801	15	11	0	0	0	0	40	14	1	1
	DR2	177	39390	16103	39	14	3	0	3	0	48	8	0	0
	DR3	177	41057	17226	39	9	0	0	0	0	40	14	0	0
	EN1	137	23634	15876	78	44	0	0	0	0	27	17	0	0
	FP1	137	18189	15348	30	24	0	0	0	0	18	12	0	0
	MI1	145	39560	17024	40	17	0	0	0	0	64	12	0	0
	MO1	121	44190	18126	20	8	1	0	1	0	34	11	0	0
	NM1	129	41084	16060	61	9	0	0	1	1	29	7	0	0
	OC1	137	42170	16142	22	4	0	0	0	0	19	2	0	0
	PB2	185	24563	13776	46	16	0	0	0	0	23	10	0	0
	PB3	185	22737	14885	17	11	2	2	5	5	23	17	0	0
	PI1	145	31756	13412	54	19	1	1	1	1	16	2	0	0
QC1	177	37446	15547	48	21	0	0	0	0	64	21	0	0	
QC2	177	39780	16750	56	18	0	0	0	0	45	14	0	0	
VY1	89	39826	17311	38	12	0	0	0	0	31	6	0	0	
Totals		3285	671276	340281	859	406	7	3	14	8	614	208	2	1



E 1. (continued)

Port Shutdown	Rod Fails to Move During Power Changes/Testing								Dropped Rod (PWR)				Uncoupled Rod/Overtravel Condition (BWR)				Improper Rod Movement <sup>a</sup>			
	Faults <sup>b</sup>		Demands		Failures		Faults		Failures		Faults		Failures		Faults		Faults <sup>c</sup>		Faults <sup>d</sup>	
	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
		93	64	0	0	0	0					0	0			0	0	0		
		73	70	0	0	0	0					0	0			0	0	0		
		69	69	0	0	0	0					0	0			0	0	0		
		230	80	1	1	1	1					0	0			0	0	0		
		45	45	0	0	0	0					0	0			1	1	1		
		87	79	0	0	0	0					3	2			0	0	0		
		165	99	0	0	0	0					1	1			0	0	0		
		134	95	0	0	0	0					0	0			0	0	3		
		212	94	0	0	0	0					4	0			0	0	0		
		234	96	0	0	0	0					17	10			2	1	2		
		244	103	0	0	0	0					0	0			0	0	0		
		141	95	0	0	0	0					0	0			0	0	0		
		108	91	0	0	0	0					0	0			0	0	0		
		235	101	0	0	0	0					1	0			1	1	1		
		263	108	0	0	0	0					0	0			1	1	1		
		245	96	0	0	0	0					0	0			0	0	0		
		251	96	0	0	0	0					0	0			0	0	0		
		146	82	0	0	0	0					0	0			0	0	0		
		135	89	0	0	0	0					0	0			0	0	0		
		189	80	0	0	0	0					1	1			0	0	1		
		223	93	0	0	0	0					0	0			3	1	3		
		237	100	0	0	0	0					0	0			0	0	0		
		237	103	0	0	0	0					0	0			1	0	1		
		3996	2028	1	1	1	1					27	14			9	5	13		

TABLE 1. (conti

Nuclear Steam Supply System	Plant	Control Rod Drive Mechanism Population <sup>e</sup>	Critical Hours		Failure to Insert Fully During Scram						Failure to Move Properly on Non-Scram Demands					
			72-78 <sup>f</sup>	76-78 <sup>g</sup>	Demands		Failures		Faults		Demands		Failures		Faults	
					72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
General	BF1	185	15553	10793	47	22	0	0	1	0	107	64	1	0	1	0
Electric	BF2	185	12326	11809	30	22	0	0	1	1	75	71	0	0	0	0
	BF3	185	11545	11545	30	30	0	0	0	0	69	69	0	0	0	0
	BP1	32	38622	13379	3	2	0	0	1	0	274	86	1	1	1	1
	BR1	137	7544	7544	20	20	0	0	0	0	56	56	0	0	0	0
	BR2	137	14576	13226	58	42	0	0	0	0	106	85	0	0	0	0
	CO1	137	27641	16617	44	14	0	0	0	0	169	100	0	0	0	0
	DA1	89	22487	15981	24	17	4	0	4	0	160	111	0	0	0	0
	DR1	80	35600	15801	15	11	0	0	0	0	252	108	1	1	1	1
	DR2	177	39390	16103	39	14	142	46	142	46	282	104	0	0	0	0
	DR3	177	41057	17226	39	9	0	0	0	0	284	117	0	0	0	0
	EN1	137	23634	15876	78	44	0	0	0	0	168	112	0	0	0	0
	FP1	137	18189	15348	30	24	0	0	0	0	126	103	0	0	0	0
	MI1	145	39560	17024	40	17	0	0	0	0	299	113	0	0	0	0
	MO1	121	44190	18126	20	8	1	0	1	0	297	119	0	0	0	0
	NM1	129	41084	16060	61	9	26	0	27	1	274	103	0	0	0	0
	OC1	137	42170	16142	22	4	0	0	0	0	270	98	0	0	0	0
	PB2	185	24563	13776	46	16	2	2	2	2	169	92	0	0	0	0
	PB3	185	22732	14885	17	11	2	2	5	5	158	106	0	0	0	0
	PI1	145	31756	13412	54	19	1	1	1	1	205	82	0	0	0	0
	QC1	177	37446	15547	48	21	0	0	0	0	287	114	0	0	0	0
	QC2	177	39780	16750	56	18	0	0	0	0	282	114	0	0	0	0
	VY1	89	39826	17311	38	12	0	0	0	0	268	109	0	0	0	0
Totals		3285	671276	340281	859	406	178	51	185	56	4610	2236	3	2	3	2

- a. All faults involving Improper Rod Movement are considered command faults, thus they were categorized as either personnel caused or a c
- b. Estimates were performed on failures (primary and secondary) and on faults (command faults and failures). In those cases where no com
- c. Includes only personnel command faults.
- d. Includes both personnel and hardware command faults.
- e. Populations in parentheses for Westinghouse nuclear steam supply system exclude part length control rods, which were not used for estim
- f. Covers time period January 1, 1972 through April 30, 1978.
- g. Covers time period January 1, 1976 through April 1978.
- h. Estimates for plants with standard and non-standard technical specifications were only performed for the period after the implementati

ed)

Faults Involving Rod Motion when No Motion is Desired				Aggregate of All CRDM Faults for Plants with Standard Technical Specifications <sup>h</sup>				Aggregate of All CRDM Faults for Plants with Non-Standard Technical Specifications <sup>h</sup>				Aggregate of All CRDM Faults for Plants Considered in These Estimates			
Failures		Faults		Failures		Faults		Failures		Faults		Failures		Faults	
72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
0	0	0	0					0	0	1	0	2	0		
0	0	0	0					0	1	0	0	1	1		
0	0	0	0					0	0	0	0	0	0		
0	0	0	0					5	5	26	5	27	5		
0	0	1	1		0		1			0	0	1	1		
3	2	3	2		2		2			3	2	3	2		
1	1	1	1					1	1	1	1	1	1		
0	0	3	0					0	0	4	0	7	0		
4	0	4	0					1	1	7	1	7	1		
17	10	19	11					56	57	159	*	165	57		
0	0	0	0					0	0	18	0	18	0		
0	0	0	0					0	0	0	0	0	0		
0	0	0	0					0	0	0	0	0	0		
1	0	2	1					0	1	1	0	2	1		
0	0	1	1					0	1	1	0	2	1		
0	0	0	0					3	4	29	3	30	4		
0	0	0	0					0	0	0	0	0	0		
0	0	0	0					2	2	2	2	2	2		
0	0	0	0					2	5	2	2	5	5		
1	1	2	1					2	2	3	2	4	2		
0	0	3	1					0	1	1	0	4	1		
0	0	0	0					0	0	0	0	0	0		
0	0	1	0					0	0	0	0	1	0		
7	14	40	19		2		3	72	81	258	74	282	84		

nation of personnel and hardware caused faults.

faults occurred for a failure mode, no estimate was performed.

s involving scrams in Westinghouse plants.

f the standard technical specifications, January 1, 1976.

Nuclear Steam Supply System	Plant	Control Rod Drive Mechanism Population <sup>e</sup>	Critical Hours		Failure to Insert to at Least 96% During Scram						Failure to Inse During Normal Shut			
			72-78 <sup>f</sup>	76-78 <sup>g</sup>	Demands		Failures		Faults		Demands		Failures	
					72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
Westinghouse	BV1	53 (48)	9106	9106	82	82	0	0	0	0	19	19	0	0
	DC1	53 (53)	22795	16401	33	20	0	0	0	0	27	20	0	0
	DC2	53 (53)	770	770	7	7	0	0	0	0	3	3	0	0
	HN1	45 (45)	45574	18030	23	12	0	0	0	0	24	7	0	0
	IP2	61 (53)	21387	10995	128	35	0	0	0	0	29	10	0	0
	IP3	61 (53)	11694	11694	19	19	0	0	0	0	6	6	0	0
	JF1	53 (48)	3079	3079	13	13	0	0	0	0	2	2	0	0
	KE1	33 (29)	28727	16994	66	17	0	0	0	0	26	6	0	0
	NA1	53 (48)	410	410	6	6	0	0	0	0	0	0	0	0
	PR1	37 (37)	28913	16859	45	13	0	0	0	0	21	9	0	0
	PR2	37 (37)	25020	17531	36	13	0	0	0	0	8	4	0	0
	PT1	37 (37)	44738	18041	17	5	0	0	0	0	35	12	0	0
	PT2	37 (37)	45215	17964	25	6	0	0	0	0	37	17	0	0
	RG1	33 (29)	40932	14639	20	3	0	0	0	0	41	19	0	0
	RO2	41 (41)	43928	16245	80	22	1	1	1	1	46	13	0	0
	SA1	53 (53)	4368	4368	17	17	0	0	0	0	8	8	0	0
	SO1	45 (45)	41777	14325	24	13	0	0	0	0	25	12	0	0
	SU1	53 (48)	31984	15487	84	19	0	0	0	0	30	11	0	0
	SU2	53 (48)	28790	13160	62	15	0	0	0	0	21	11	0	0
	TR1	61 (53)	12539	12539	28	28	0	0	0	0	10	10	0	0
	TU3	53 (45)	36992	15712	81	19	2	0	2	0	52	17	0	0
	TU4	53 (45)	29791	14145	74	28	0	0	0	0	44	16	0	0
	ZI1	53 (53)	26612	15178	51	19	0	0	0	0	20	5	0	0
	ZI2	53 (53)	21735	13657	89	29	0	0	0	0	23	8	0	0
Totals		1164 (1091)	606876	307329	1110	460	3	1	3	1	557	245	0	0

E 1. (continued)

t down		Rod Fails to Move During Power Changes/Testing						Dropped Rod (PWR)				Uncoupled Rod/Overtravel Condition (BWR)				Improper Rod Movement <sup>a</sup>					
		Faults <sup>b</sup>		Demands		Failures		Faults		Failures		Faults		Failures		Faults		Failures <sup>c</sup>		Faults <sup>d</sup>	
72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
		13	13	0	0	0	0	0	0	0	0					0	0	0			
		31	22	0	0	0	0	0	0	0	0					0	0	0			
		1	1	0	0	0	0	0	0	0	0					0	0	0			
		63	24	0	0	0	0	0	0	0	0					0	0	0			
		29	14	0	0	0	0	1	1	1	1					0	0	0			
		16	16	1	1	1	1	0	0	0	0					0	0	0			
		4	4	0	0	0	0	0	0	0	0					0	0	0			
		39	24	0	0	0	0	0	0	0	0					0	0	0			
		1	1	0	0	0	0	0	0	0	0					0	0	0			
		40	23	0	0	0	0	0	0	0	0					0	0	0			
		34	24	0	0	0	0	0	0	0	0					0	0	0			
		61	25	0	0	0	0	0	0	0	0					1	0	1			
		62	25	0	0	0	0	0	0	0	0					0	0	0			
		56	19	0	0	3	2	0	0	9	7					0	0	0			
		60	21	0	0	0	0	0	0	3	0					2	0	2			
		6	6	0	0	0	0	0	0	0	0					0	0	0			
		57	20	0	0	0	0	0	0	0	0					0	0	0			
		44	21	0	0	0	0	0	0	1	1					0	0	0			
		40	17	0	0	0	0	0	0	0	0					0	0	0			
		17	17	0	0	13	13	0	0	0	0					0	0	0			
		51	21	0	0	0	0	0	0	0	0					0	0	0			
		41	19	0	0	0	0	0	0	0	0					1	0	1			
		37	21	0	0	0	0	0	0	0	0					0	0	0			
		30	19	0	0	0	0	0	0	0	0					0	0	0			
		833	487	1	1	17	16	1	1	14	9					4	0	4			

TABLE 1. (cont)

Nuclear Steam Supply System	Plant	Control Rod Drive Mechanism Population <sup>e</sup>	Critical Hours		Failure to Insert Fully During Scram						Failure to Move Properly on Non-Scram Demands					
			72-78 <sup>f</sup>	76-78 <sup>g</sup>	Demands		Failures		Faults		Demands		Failures		Faults	
					72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
Westinghouse	BV1	53 (48)	9106	9106	82	82	0	0	0	0	32	32	0	0	0	0
	DC1	53 (53)	22795	16401	33	20	0	0	0	0	58	42	0	0	0	0
	DC2	53 (53)	770	770	7	7	0	0	0	0	4	4	0	0	0	0
	HN1	45 (45)	45574	18030	23	12	0	0	0	0	87	31	0	0	0	0
	IP2	61 (53)	21387	10995	128	35	0	0	0	0	58	24	0	0	0	0
	IP3	61 (53)	11694	11694	19	19	0	0	0	0	22	22	1	1	1	1
	JF1	53 (48)	3079	3079	13	13	0	0	0	0	6	6	0	0	0	0
	KE1	33 (29)	28727	16994	66	17	0	0	0	0	65	30	0	0	0	0
	NA1	53 (48)	410	410	6	6	0	0	0	0	1	1	0	0	0	0
	PR1	37 (37)	28913	16859	45	13	0	0	0	0	61	32	0	0	0	0
	PR2	37 (37)	25020	17531	36	13	0	0	0	0	42	28	0	0	0	0
	PT1	37 (37)	44738	18041	17	5	0	0	0	0	96	37	0	0	0	0
	PT2	37 (37)	45215	17964	25	6	0	0	0	0	99	42	0	0	0	0
	RG1	33 (29)	40932	14639	20	3	0	0	0	0	97	38	0	0	3	2
	RO2	41 (41)	43928	16245	80	22	1	1	1	1	106	34	0	0	0	0
	SA1	53 (53)	4368	4368	17	17	0	0	0	0	14	14	0	0	0	0
	SO1	45 (45)	41777	14325	24	13	0	0	0	0	82	32	0	0	0	0
	SU1	53 (48)	31984	15487	84	19	0	0	0	0	74	32	0	0	0	7
	SU2	53 (48)	28790	13160	62	15	0	0	0	0	61	28	0	0	0	0
	TR1	61 (53)	12539	12539	28	28	0	0	0	0	27	27	0	0	13	13
	TU3	53 (45)	36992	15712	81	19	2	0	2	0	103	38	0	0	0	0
	TU4	53 (45)	29791	14145	74	28	0	0	0	0	85	35	0	0	0	0
	ZI1	53 (53)	26612	15178	51	19	0	0	0	0	57	26	0	0	0	0
	ZI2	53 (53)	21735	13657	89	29	0	0	0	0	53	27	0	0	0	0
Totals		1164 (1091)	606876	307329	1110	460	3	1	3	1	1390	662	1	1	17	16

- a. All faults involving Improper Rod Movement are considered command faults, thus they were categorized as either personnel caused or a
- b. Estimates were performed on failures (primary and secondary) and on faults (command faults and failures). In those cases where no c
- c. Includes only personnel command faults.
- d. Includes both personnel and hardware command faults.
- e. Populations in parentheses for Westinghouse nuclear steam supply system exclude part length control rods, which were not used for es
- f. Covers time period January 1, 1972 through April 30, 1978.
- g. Covers time period January 1, 1976 through April 30, 1978.
- h. Estimates for plants with stand ard and non-standard technical specifications were only performed for the period after the implementa

ed)

Faults Involving Rod Motion when No Motion is Desired				Aggregate of All CRDM Faults for Plants with Standard Technical Specifications <sup>h</sup>				Aggregate of All CRDM Faults for Plants with Non-Standard Technical Specifications <sup>h</sup>				Aggregate of All CRDM Faults for Plants Considered in These Estimates			
Failures		Faults		Failures		Faults		Failures		Faults		Failures		Faults	
72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78	72-78	76-78
0	0	0	0		0		0					0	0	0	0
0	0	0	0		1		1					1	1	1	1
0	0	0	0		0		0					0	0	0	0
0	0	0	0					1		1		1	1	1	1
1	1	1	1					1		1		1	1	1	1
0	0	0	0					1		1		1	1	1	1
0	0	0	0		0		0					0	0	0	0
0	0	0	0					0		0		0	0	0	0
0	0	0	0		0		0					0	0	0	0
0	0	0	0					0		0		0	0	0	0
0	0	1	0					0		0		0	0	1	0
0	0	0	0					0		0		0	0	0	0
0	0	9	7					0		9		0	0	13	9
0	0	5	0					3		3		4	3	9	3
0	0	0	0		0		0					0	0	0	0
0	0	0	0					0		0		0	0	0	0
0	0	1	1					0		1		1	0	2	1
0	0	0	0					0		0		0	0	0	0
0	0	0	0		0		16					0	0	16	16
0	0	0	0					0		0		2	0	2	0
0	0	1	0					0		0		0	0	1	0
0	0	0	0					0		0		0	0	0	0
0	0	0	0					0		0		1	0	1	0
1	1	18	9		1		17		6		16	12	7	49	33

ination of personnel and hardware caused faults.

nd faults occurred for a failure mode, no estimate was performed.

ees involving scrams in Westinghouse plants.

of the standard technical specifications, January 1, 1976.

## SUMMARY OF RESULTS

This section presents comments on major items of interest: (a) summary statistics on data base sorts, (b) one-liners sorted into areas of interest, (c) LER rates, and (d) scatter plots on LER rates. Due to the magnitude of the task, no attempt was made to present all possible statistics or LER rates. Specific items of interest to a reader may not be provided in this report. In these cases, more extensive data base sorts can be made from the coded one-liners. Tables 2 through 12 and Appendixes D through AF should, however, contain sufficient detail to satisfy the needs of many readers and illustrate the usefulness of the data base as a tool for the analyst.

### Summary Statistics

Summary statistics, as presented here, are a numerical tabulation of faults grouped by areas of potential interest (that is, year, vendor, failure modes, failure mechanisms, etc.). Nine descriptive statistical tables are presented (see Tables 2 through 10). These tables are described below. Each table shows figures for two time intervals (1972 through 1978 and 1976 through 1978). The conclusions drawn on these tables are based on the time interval 1972 through 1978. The figures for 1976 through 1978 are provided so the reader can compare the effects of the changes in reporting requirements which went into effect on January 1, 1976.

### NSSS

Table 2 lists the number of faults for each NSSS. General Electric designed plants (BWRs) accounted for 56% of the individual component faults. The Dresden 2 plant accounted for over 50% of the component faults in these plants. The major contributors to Dresden's failures occurred on November 2, 1974 and on July 9, 1977. In 1974 Dresden had 96 control rods which did not fully insert on scram (93 of the 96 rods inserted to position 02, while three of the 96 rods stopped before reaching position 02). In 1977 Dresden again, in one incident, had



TABLE 2. NUMBER OF FAULTS LISTED BY NSSS

	Number of Plants <sup>a</sup>	Failures				Command Faults				Total Faults			
		1972 to 1978		1976 to 1978		1972 to 1978		1976 to 1978		1972 to 1978		1976 to 1978	
		Number of Failures	Percent of Failures	Number of Failures	Percent of Failures	Number of Faults	Percent of Faults	Number of Faults	Percent of Faults	Number of Faults	Percent of Faults	Number of Faults	Percent of Faults
General Electric	23	258	80	74	71	24	13	10	7	282	56	84	34
Babcock & Wilcox	10	15	5	6	6	106	58	90	64	121	24	96	39
Westinghouse	25	14	4	7	7	37	20	26	19	51	10	33	14
Combustion Engineering	7	34	11	17	16	16	9	14	10	50	10	31	13
	55	321		104		183		140		504		244	

a. Number of licensed plants summarized in this report as of April 30, 1978.

46 control rods which failed to fully insert on scram (all 46 rods stopped at position 02). In both of the above cases, it appeared that the problem was associated with the stop piston seals. These two incidents are part of the common mode problem discussed previously. Another point of interest in this table is the 106 component command faults experienced by Babcock & Wilcox designed plants. The majority of these command faults (64%) were attributed to the controlling rod group dropping during power operations. These faults resulted from problems associated with the group control circuitry.

#### Failure Mode

Table 3 lists the number of faults and technical specification violations (non-failures) for each failure mode considered in this report. Failure Mode "C" accounts for 53% of all CRDM failures. Within Mode "C", Dresden 2 accounts for 83% of the failures.<sup>a</sup> The high number of command faults (49%) shown for failure Mode "C" is attributed to the problems associated with Babcock & Wilcox plants controlling rod groups<sup>a</sup>. All of the failures attributed to PWR rods failing to insert during normal shutdown were in the three plants with cruciform-shaped control rods. These rod designs are typical of early PWR plants. They were replaced by a rod cluster design in the later plants.

The majority of the faults (94%) associated with control rods failing to insert on scram were reported by BWR plants due to a generic problem involving leakage past the stop piston seals. Four different BWR plants have reported this problem: Dresden 2, Nine Mile Point 1, Duane Arnold, and Monticello 1. The majority of the PWR failures to insert during scrams (75%) were attributed to the three plants with cruciform-shaped control rods.

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a. See Summary of Results Section, NSSS, pages 29 and 30.

TABLE 3. NUMBER OF FAULTS LISTED BY FAILURE MODE

	Failures				Command Faults				Total Faults				Technical Specification Violations (non failures)	
	1972 to 1978		1976 to 1978		1972 to 1978		1976 to 1978		1972 to 1978		1976 to 1978		1972 to 1978	1976 to 1978
	Number of Failures	Percent of Failures	Number of Failures	Percent of Failures	Number of Faults	Percent of Faults	Number of Faults	Percent of Faults	Number of Faults	Percent of Faults	Number of Faults	Percent of Faults		
(B) Failure to insert during normal shutdown	7	2	1	1	0	--	0	--	7	1	1	0		
(C) Failure to bottom during scram	171	53	48	46	0	--	0	--	171	34	48	20		
(D) Failure to insert to at least 96% during scram	19	6	4	4	7	4	5	4	26	5	9	4		
(E) Rod fails to move during power change/testing	12	4	7	7	47	26	46	33	59	12	53	22		
(F) Rod fails to withdraw from fully inserted position	7	2	0	--	0	--	0	--	7	1	0	--		
(G) Dropped rod (PWR)	19	6	13	13	90	49	76	54	109	22	89	36		
(H) Uncoupled rod/ overtravel condition (BWR)	27	8	14	13	0	--	0	--	27	5	14	6		
(I) Improper rod movement	0	--	0	--	29	16	10	7	29	6	10	4		
(J) External leakage/rupture	7	2	5	5	3	3	0	--	10	2	5	2		
(K) Does not operate properly (specific mode not identifiable)	37	12	4	4	7	4	3	2	44	9	7	3		

TABLE 3. (continued)

	Failures				Command Faults				Total Faults				Technical Specification Violations (non failures)	
	1972 to 1978		1976 to 1978		1972 to 1978		1976 to 1978		1972 to 1978		1976 to 1978		1972 to 1978	1976 to 1978
	Number of Failures	Percent of Failures	Number of Failures	Percent of Failures	Number of Faults	Percent of Faults	Number of Faults	Percent of Faults	Number of Faults	Percent of Faults	Number of Faults	Percent of Faults		
(L) Maintenance/ replacement required	15	5	8	8	0	--	0	--	15	3	8	3		
(T) Technical specification violation (non-failure)	--	--	--	--	--	--	--	--	--	--	--	--	6	3
	321		104		183		140		504		244		6	3

Rods failing to move during power changes or testing were all PWR faults with the exception of one fault experienced by Big Rock Point 1, a BWR plant. Again, the three plants with cruciform-shaped control rods accounted for a significant percentage (15%) of the PWR plant faults. All faults associated with failure Mode "F" (rod fails to withdraw from fully inserted position) occurred in BWR plants.

Of the faults attributed to the uncoupled or overtravel condition in BWRs, 56% were caused by problems associated with inner filters at Dresden 2 and Brunswick 2. Dresden 2 reported that their problems were caused by improper maintenance. The problem first appeared in 1973 and it was thought to be corrected in 1977 by having an outside group come in to oversee quality control of maintenance.

#### Failure Mechanism

Table 4 lists the number of faults categorized for each failure mechanism considered in this report. The high number of faults shown for mechanisms "13" and "21" (38% and 26%) (seal failures and control circuit failures, respectively) are due to a large number of failures in a few plants<sup>a</sup>.

The next largest number of faults (15%) had to be classified as "unknown." The number of faults in this category indicates a problem in reporting methods. An example of this is the faults associated with BWR uncoupled or overtravelled rods. When a fault occurs, these rods are fully inserted and disarmed until plant conditions allow investigating the cause of the fault. Most of the LERs which report this type of fault state that the cause is unknown or under investigation and that a followup report will be submitted which will state the cause of the fault. Usually there was no followup LER found for these faults. Another cause for the large number of unknown mechanisms is that many times a fault will occur which cannot be duplicated or any cause found

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a. See Summary of Results Section, NSSS, pages 29 and 30.

TABLE 4. NUMBER OF FAULTS LISTED BY FAILURE MECHANISM

Code	Description	Failures				Command Faults				Total Faults			
		1972 to 1978		1976 to 1978		1972 to 1978		1976 to 1978		1972 to 1978		1976 to 1978	
		Number of Failures	Percent of Failures	Number of Failures	Percent of Failures	Number of Faults	Percent of Faults	Number of Faults	Percent of Faults	Number of Faults	Percent of Faults	Number of Faults	Percent of Faults
00	Unknown	63	20	25	24	11	6	0	--	74	15	25	10
01	Personnel (operations)	0	--	0	--	16	9	9	6	16	3	9	4
02	Personnel (maintenance)	5	2	1	1	3	2	1	1	8	2	2	1
03	Personnel (testing)	0	--	0	--	5	3	3	2	5	1	3	1
04	Design Error	1	0	1	1	0	--	0	--	1	0	1	0
05	Fabrication/Construction/Q.C.	3	1	0	--	2	1	0	--	5	1	0	--
06	Procedural Discrepancies	0	--	0	--	7	4	1	1	7	1	1	0
07	Normal Wear	0	--	0	--	--	--	--	--	0	--	0	--
08	Excessive Wear	1	0	0	--	--	--	--	--	1	0	0	--
09	Corrosion	0	--	0	--	--	--	--	--	0	--	0	--
10	Foreign Material Contamination	6	2	1	1	--	--	--	--	6	1	1	0
11	Excessive Vibration	0	--	0	--	--	--	--	--	0	--	0	--
12	CRDM Motor Failure	5	2	4	4	--	--	--	--	5	1	4	2
13	Seal Failure	191	60	49	47	--	--	--	--	191	38	49	20
14	Failed/Misaligned Internals	2	1	0	--	--	--	--	--	2	0	0	--
15	Clutch Failure	6	2	0	--	--	--	--	--	6	1	0	--
16	Brake Failure	9	3	4	4	--	--	--	--	9	2	4	2
17	Bearing Failure	3	1	3	3	--	--	--	--	3	1	3	1
18	Filter/Stainer; Plugged Problem	14	4	12	12	--	--	--	--	14	3	12	5
19	Binding/Seizure	1	0	1	1	--	--	--	--	1	0	1	0
20	Failure/Fault of Component Supply System	0	--	0	--	7	4	1	1	7	1	1	0
21	Control Circuit Failure/Problem	0	--	0	--	132	72	125	89	132	26	125	51
22	Fastener Failure/Problem	3	1	0	--	--	--	--	--	3	1	0	--
23	Weld Failure	4	1	3	3	--	--	--	--	4	1	3	1
24	Lubrication Problem	4	1	0	--	--	--	--	--	4	1	0	--
		321		104		183		140		504		244	

for it. An example of this is a dropped rod which is relatched and operates properly from that point on.

The brake failure and clutch failure mechanisms are all attributed to the Palisades plant with the exception of one clutch failure reported by the Fort Calhoun plant.

Type of Failure

In evaluating the LERs it became evident that certain LERs could be categorized into specific types of failure such as recurring, common cause, command faults, recurring common cause, or recurring command faults. Table 5 lists the number of times each type of failure occurs. The number of faults recorded on these one-liners is not presented here, but can be obtained in Appendixes N through R. As an example, in November 1973, at Nine Mile Point 1, 11 CRDMs did not fully insert on scram. Six days later, another LER from Nine Mile Point 1 reported the same fault for 15 CRDMs. Both of these LERs were coded as recurring common cause and are counted as two of the total number of recurring

TABLE 5. NUMBER OF ONE-LINERS CODED AS TO TYPE OF FAILURE

	One-Liners			
	1972 to 1978		1976 to 1978	
	Number	Percent	Number	Percent
R Recurring Failures	49	25	26	27
S Command Faults	44	22	19	19
T Recurring Command Faults	29	15	24	24
C Common Cause	12	6	6	6
B Recurring Common Cause	30	15	12	12
One-liners with no specific Type of Failure	35	18	11	11
	199		98	

common cause occurrences listed in Table 5. Each one-liner represents an occurrence.

The largest number of one-liners is in the recurring category. It is interesting to note that approximately 50% of the one-liners coded as recurring are due to unknown causes. The common cause and recurring common cause one-liners are dominated by BWR plant problems (88%). The problems associated with rod drive inner filters and stop piston seals, discussed in previous sections, account for the majority (62%) of the one-liners in these categories. Approximately 45% of the one-liners coded as either command faults or recurring command faults are attributed to personnel (that is, personnel operations, maintenance, testing, procedural, design, fabrication, construction, or quality control errors).

#### Improper Rod Movements

Table 6 gives a breakdown of the number of improper rod movement occurrences by failure mechanism. All of these occurrences are considered to be command faults. Eighty-six percent of the occurrences were attributed to personnel errors, while only 14% were attributed to hardware problems. The two occurrences attributed to an unknown cause appeared to be hardware problems, and were included in the 14%.

#### Time and Demand Related Occurrences

An attempt was made to classify the CRDM one-liners as to whether they were time or demand related. Table 7 reflects this classification. Only 56% of the one-liners could be classified: 10% as a function of time, 43% as a function of demand, and 3% as not applicable. Insufficient information was provided in the balance of the LERs to classify the one-liners.

#### Activity Resulting in Discovery

Table 8 lists the number of one-liners classified as to the activity resulting in the discovery of the fault. It should be noted that



TABLE 6. NUMBER OF IMPROPER ROD MOVEMENT FAULTS LISTED BY FAILURE MECHANISM

Cause of Improper Rod Movement	Number of Violations			
	1972 to 1978		1976 to 1978	
	Number	Percent	Number	Percent
Operational Error	12	41	6	60
Procedural Discrepancy	7	24	1	10
Testing Error	5	17	3	30
Maintenance Error	1	3	0	0
Component Supply System Problem	1	3	0	0
Control Circuit Problem	1	3	0	0
Unknown <sup>a</sup>	2	7	0	0
	29		10	

a. These "unknown" failures appear to be Component Supply System problems.

the activity resulting in the discovery of the fault is in no way related to when the CRDM fault occurred. It only describes the activity in progress which resulted in the fault being detected. The largest percentage (42%) of the faults were discovered during normal operation/surveillance.

#### Year

Table 9 lists the number of faults for each year covered in this report. Since new plants came on-line each year, the data were normalized using CRDM-HOURS. These CRDM-HOURS were obtained by multiplying the sum of each plant's critical hours times the total CRDM population for each year. These critical hours and CRDM populations were obtained using References 3 through 9.

TABLE 7. NUMBER OF ONE-LINERS LISTED BY  
"CLASSIFICATION OF FAILURE"<sup>a</sup>

<u>Classification</u>	<u>Number of One-Liners</u>			
	<u>1972 to 1978</u>		<u>1976 to 1978</u>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Not Applicable <sup>b</sup>	6	3	3	3
Time	20	10	7	7
Demand	86	43	48	49
Unknown <sup>a</sup>	<u>87</u>	44	<u>40</u>	41
	199		98	

a. Due to the limited LER narrative describing most faults, many of the numbers in the "Time" and "Demand" classifications were subjectively determined. This, coupled with the large number in the "Unknown" category, makes the usefulness of these numbers questionable.

b. Non-failures (technical specification violations) comprise the "Not Applicable" group.

If the total faults per CRDM-HOUR is used as a guide, there is no apparent gross time behaviors except perhaps for the years 1974 and 1976. In 1974, Dresden 2 reported one occurrence in which 96 CRDMs failed to fully insert during a scram. Excluding this one occurrence from the 1974 data would have resulted in the total faults per CRDM-HOUR calculation being of the same order-of-magnitude as the other years. Due to the large number of component faults involved in some of the individual occurrences, care must be taken when the total number of faults are used in a trend analysis. During 1976, there were fewer faults reported in proportion to the CRDM-HOURS. During 1976, a change in reporting techniques and criteria was incorporated (see Appendix A). This might have influenced the number of faults which were reported during 1976.

TABLE 8. ACTIVITY RESULTING IN DISCOVERY  
REPORTED IN EACH OF THE ONE-LINERS

	<u>1972 to 1978</u>		<u>1976 to 1978</u>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
N Normal Operation/Surveillance	84	42	51	52
T Testing	40	20	20	20
D Demand on CRPM	33	17	15	15
M Maintenance	15	8	7	7
R Records Review	2	1	1	1
U Unknown (not stated in LER)	<u>25</u>	13	<u>4</u>	4
	199		98	

Manufacturer

Table 10 lists the number of one-liners attributed to manufacturers. These numbers should not immediately be related to the quality of a manufacturer's product but may, in fact, relate more to the quantity of the manufacturer's product in the operating plants. Table 10 is not attempting to link faults with manufacturers, but provides the reader with a starting point if an analysis of faults versus manufacturers is desired. Since the one-liners (Appendix G) do not contain the manufacturer, the starting point for further analysis would be the data in Appendix D. Appendix D contains the control number and the manufacturer's code for each one-liner. Cross-referencing the control numbers of interest in Appendix D with Appendix G will link the information contained in the one-liners to the manufacturer.

TABLE 9. NUMBER OF FAULTS LISTED BY YEAR

<u>Year</u>	<u>Critical Hours</u>	<u>Total CRDM Population</u>	<u>Failures</u>	<u>Command Faults</u>	<u>Total Faults Per CRDM-HOUR</u>
1972	122192	2096	16	4	7.8E-08
1973	164085	2942	36	7	8.9E-08
1974	219517	4102	126	7	1.5E-07
1975	318188	4426	39	25	4.5E-08
1976	330392	5068	17	36	3.2E-08
1977	392311	5242	77	81	7.7E-08
1978 <sup>a</sup>	134220	5549	10	23	4.4E-08
			321	183	

a. Year 1978 only covers failures through April 30, 1978.

TABLE 10. MANUFACTURER REPORTED IN EACH OF THE ONE-LINERS

Manufacturer <sup>a</sup> Code	Manufacturer Name	One-Liners Containing Failures				One-Liners Containing Command Faults			
		1972 to 1978		1976 to 1978		1972 to 1978		1976 to 1978	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
B015	Babcock & Wilcox Company	1	1	1	2	2	3	1	2
C490	Combustion Engineering, Corp.	14	12	9	17	7	10	7	16
C720	Crouse-Hinds	0	--	0	--	2	3	2	5
D150	Diamond Power Specialty Corp.	6	5	4	8	6	8	6	14
G080	General Electric Co.	27	23	25	48	8	11	8	19
P314	Power-Mate	2	2	2	4	6	8	6	14

TABLE 10. (continued)

Manufacturer <sup>a</sup> Code	Manufacturer Name	One-Liners Containing Failures				One-Liners Containing Command Faults			
		1972 to 1978		1976 to 1978		1972 to 1978		1976 to 1978	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
W120	Westinghouse Electric Corp.	6	5	5	10	11	15	6	14
ZZZZ	Not given in LER	64	53	6	12	31	42	6	14
		120		52		73		43	14

a. Manufacturer's codes are taken from Reference 2.

## One-Liners Sorted into Areas of Interest

Selected sorts of the CRDM data file are presented in Appendixes H through S. These appendixes are presented in three major sections: (a) personnel-related faults, (b) all the "types of failures," and (c) "time" and "demand" related faults. A sort of all technical specification violations is also presented in Appendix T. Appendix G provides a complete listing of the CRDM data file. These sorts provide more than just the numerical tabulations presented in the summary statistics tables. They provide the majority of the information available on the data file concerning a specific category of faults.

### Personnel-Related

To obtain sorts of personnel-related faults, failure mechanism codes 01 through 06 were sorted individually. These six sets of one-liners could be very useful as a basis for an analysis of personnel performance in commercial nuclear plants. Some subsets of each set could show how personnel perform compared by vendors, plants, or years. Such subsets can be produced by sorting on the failure mechanism as well as a specific vendor or, if the sets are not too large, the subsets may be easily identified from the set.

### Type of Failure

The five "type of failure" codes (B, C, R, S, T) were sorted individually. This grouped all the one-liners which were typed as "recurring common cause failures" (B) as well as the four other types of failure. Subsets of sorts could assist an analyst in identifying possible problem areas with a particular component. Problems such as "why does this component seem to have recurring problems" or "why did both of these components fail at the same time" can be identified and a more detailed search for answers begun. Generic trends may emerge from these sorts. In the course of many days of coding and different individuals performing the coding, generic problems may not become evident until a sort is done on the complete component data file.

### Failure Classification

The two classifications of interest, "time related" faults and "demand related" faults are presented in Appendix S. Ideally, all faults should be placed under one of these categories. Due to lack of more specific information in many of the LERs, however, 44% of the one-liners are categorized as "unknown." The remaining one-liners are classified as "not applicable" as they are not faults but technical specification violations. Any one-liner which has a "D" in the column headed "CLASS" in Appendix S is a "demand related" fault, while the remaining one-liners which have a "T" in the "CLASS" column are "time related" faults.

These few examples should point out some of the potentials of the one-liners in the component data file. All the example sorts were done by sorting on only one code per sort. To extract more specific failures, two or more codes could be sorted on. It would be possible, for instance, to find all CRDMs failing to scram in Combustion Engineering plants during 1974 which were caused by defective clutch assemblies. As an analytical tool, the component data file should prove useful for future investigations.

### LER Rates

LER rates were estimated for selected failure modes and groups of failure modes. Based upon the function the CRDM is required to perform in a selected failure mode, either a demand or a standby LER rate is estimated. Standby estimates were performed as it was assumed, for this report, that the CRDM was in a standby condition while awaiting either a demand to control or a demand to scram the reactor. The actual time required for demands was considered insignificant in relation to the non-demand period. Therefore, critical hours were used for standby hours in all standby estimates. The results of a demand estimate includes a standby LER rate in addition to the demand LER rate. In general, four estimates could be performed on each selected failure mode or group of modes. The estimates were subdivided by year,



January 1, 1972 through April 30, 1978 or January 1, 1976 through April 30, 1978. The latter time period corresponding to a change in LER reporting requirements. In both of these time periods, the estimates could be further subdivided into estimates performed on failures alone or on both failures and command faults. Table 11 presents a list of all the CRDM estimates performed and provides the appendix which contains the complete set of data, both input and results, for each of the selected failure modes or groups of modes estimated.

Each appendix contains a sort of all the one-liners used to extract the number of faults for the selected failure mode or modes and the results of the actual LER rate estimates performed. One needs only to select from the one-line sort the proper time period and whether a fault is a failure or a command fault to extract the failure data that are used in each estimate. The results of each estimate are in the form of computer output divided into the four NSSS vendors and a summary sheet. Each page of vendor information provides additional data used in the estimate; namely, the plant name, the critical hours, the CRDM population (and demands if a demand estimate is performed, as well as the rates estimated for each plant of the vendor type). These data used for each LER rate estimate are also summarized in Table 1. The summary sheet for each estimate provides LER rate estimations for each of the four vendors as well as for BWR and PWR classifications and an overall LER rate estimation for the aggregate of all CRDM faults for all plants used in the estimate. It should be remembered that all plants which were placed in the data file were not used in the LER rate estimates. Indian Point 1, Palisades, and Yankee Rowe faults were excluded from all estimates since the control rods of these plants are of an earlier cruciform-shaped design which tend to experience a greater number of failures.

All LER rate estimations are either mean values or, in the case where no faults are reported by a plant or vendor, the number provided is the upper 95% confidence bound and is flagged with an asterisk (\*). The mean values which appear on the summary sheet are accompanied by error factors. The upper error factor, if multiplied by the mean,

TABLE 11. LISTING OF LER RATE ESTIMATES PERFORMED ON SELECTED FAILURE MODES

Appendix	Title of Appendix	Mode or Modes	Type of Estimate Performed <sup>a</sup>	LER Rate Estimates Performed			
				1972 to 1978 Failures	1976 to 1978 Faults <sup>b</sup>	1972 to 1978 Failures	1976 to 1978 Faults <sup>b</sup>
U	Failure to insert to at least 96% during scram	D	DEMAND	X	X	X	X
V	Failure to insert during normal shutdown	B	DEMAND	X	--	X	--
W	Rod fails to move during power changes/testing	E	DEMAND	X	X	X	X
X	Dropped Rod (PWR)	G	STANDBY	X	X	X	X
Y	Uncoupled rod/ overtravel condition (BWR)	H	STANDBY	X	--	X	--
Z	Improper rod movement	I	STANDBY	--	X <sup>c</sup>	--	X <sup>c</sup>
AA	Failure to insert fully during scram	C,D	DEMAND	X	X	X	X
AB	Failure to move properly on non-scram demands	B,E	DEMAND	X	X	X	X

TABLE 11. (continued)

Appendix	Title of Appendix	Mode or Modes	Type of Estimate Performed <sup>a</sup>	LER Rate Estimates Performed			
				1974 to 1978 Failures	1976 to 1978 Faults <sup>b</sup>	1972 to 1978 Failures	1976 to 1978 Faults <sup>b</sup>
AC	Faults involving rod motion when no motion is desired	G,H,I	STANDBY	X	X	X	X
AD	Aggregate of all CRDM faults for plants with standard tech. specs.	G,C,D, E,F,G, H,I,J, K,L	STANDBY	--	--	X	X
AE	Aggregate of all CRDM faults for plants with non-standard tech. specs.	B,C,D, E,F,G, H,I,J, K,L	STANDBY	--	--	X	X
AF	Aggregate of all CRDM faults for all plants considered in these estimates	B,C,D, E,F,G, H,I,J, K,L	STANDBY	X	X	X	X

a. Standby LER rates in units of failures per hour are based on critical hours and are included in the demand estimates also.

b. Faults include both failures and command faults.

c. Improper rod movements were all command faults but were subdivided into personnel errors or hardware faults. Estimates were performed on personnel alone and personnel plus hardware for 1972 to 1978. Only personnel faults were encountered in the 1976 to 1978 data.

provides the upper 95% confidence bound. The lower error factor, divided into the mean, provides the lower 5% confidence bound.

Table 12 provides a summary of the CRDM LER rate estimations presented in Appendixes U through AF. The WASH-1400<sup>10</sup> failure rate for CRDMs is provided in the notes for Table 12, for comparison purposes. Since the failure definitions are not necessarily the same, care must be taken in drawing any conclusions from these comparisons.

TABLE 12. SUMMARY OF C

	Mode D Failure to Insert to at Least 96% <sup>c</sup> During Scram		Mode B Failure to Insert During Normal Normal Shutdown <sup>c</sup>		Mode E Rod Fails to Move During Power Changes/Testing <sup>c</sup>		Mode G Dropped Rod (PWR) <sup>c</sup>	Mode H Uncoupled/ Overtravelled Rod (BWR) <sup>c</sup>	Mode I Improper Rod Movement <sup>c</sup>	Mode C & D Failure to Insert Fully <sup>c</sup> During Scram	
	$\lambda_d^e$	$\lambda_s^e$	$\lambda_d^e$	$\lambda_s^e$	$\lambda_d^e$	$\lambda_s^e$	$\lambda_s^e$	$\lambda_s^e$	$\lambda_s^e$	$\lambda_d^e$	$\lambda_s^e$
Babcock & Wilcox	5.6E-4 <sup>f</sup> (5.6E-4) <sup>f</sup>	4.6E-7 <sup>f</sup> (4.6E-7) <sup>f</sup>	3.8E-4 <sup>f</sup>	4.6E-7 <sup>f</sup>	1.1E-4 (3.4E-3)	1.5E-7 (4.6E-6)	6.1E-7 (9.7E-6)	--	3.1E-7 <sup>g</sup>	5.6E-4 <sup>f</sup> (5.6E-4) <sup>f</sup>	4.6E-7 (4.6E-7)
Combustion Engineering	3.4E-4 <sup>f</sup> (3.4E-4) <sup>f</sup>	4.7E-7 <sup>f</sup> (4.7E-7) <sup>f</sup>	6.9E-4 <sup>f</sup>	4.7E-7 <sup>f</sup>	3.3E-4 <sup>f</sup> (2.2E-4)	4.7E-7 <sup>f</sup> (3.1E-7)	1.2E-6 (2.7E-6)	--	4.7E-7 <sup>f,g</sup>	3.4E-4 <sup>f</sup> (3.4E-4) <sup>f</sup>	4.7E-7 (4.7E-7)
Westinghouse	4.6E-5 (4.6E-5)	7.4E-8 (7.4E-8)	2.6E-4 <sup>f</sup>	2.1E-7 <sup>f</sup>	5.1E-5 (8.2E-4)	7.0E-8 (1.1E-6)	7.0E-8 (6.3E-7)	--	2.1E-7 <sup>f,g</sup>	4.6E-5 (4.6E-5)	7.4E-8 (7.4E-8)
PWR	2.8E-5 (2.8E-5)	3.8E-8 (3.8E-8)	1.3E-4 <sup>f</sup>	1.1E-7	5.3E-5 (1.3E-3)	7.3E-8 (1.8E-6)	4.8E-7 (3.3E-6)	--	7.3E-8 <sup>g</sup>	2.8E-5 (2.8E-5)	3.8E-8 (3.8E-8)
General Electric (BWR)	4.9E-5 (1.3E-4)	6.2E-8 (1.7E-7)	3.4E-5	2.1E-8	3.5E-6 (3.5E-6)	2.1E-8 (2.1E-8)	--	2.9E-7	1.0E-7 <sup>g</sup>	8.4E-4 (9.2E-4)	1.1E-6 (1.2E-6)
Overall	4.1E-5 (9.3E-5)	5.4E-8 (1.2E-7)	1.9E-5	1.3E-8	9.2E-6 (1.5E-4)	4.0E-8 (6.5E-7)	4.8E-7 (3.3E-6)	2.9E-7	9.3E-8 <sup>g</sup>	5.4E-4 (5.9E-4)	7.0E-7 (7.6E-7)

SUMMARY OF CRDM LER RATES  
(1972 through 1978)

	Mode D Failure to Insert to at Least 96% <sup>c</sup> During Scram		Mode B Failure to Insert During Normal Normal Shutdown <sup>c</sup>		Mode E Rod Fails to Move During Power Changes/Testing <sup>c</sup>		Mode G Dropped Rod (PWR) <sup>c</sup>	Mode H Uncoupled/ Overtravelled Rod (BWR) <sup>c</sup>	Mode I Improper Rod Movement <sup>c</sup>	Mode C & D Failure to Insert Fully <sup>c</sup> During Scram	
	$\lambda_d^e$	$\lambda_s^e$	$\lambda_d^e$	$\lambda_s^e$	$\lambda_d^e$	$\lambda_s^e$	$\lambda_s^e$	$\lambda_s^e$	$\lambda_s^e$	$\lambda_d^e$	$\lambda_s^e$
Babcock & Wilcox	2.8E-4 <sup>f</sup> (2.8E-4) <sup>f</sup>	3.0E-7 <sup>f</sup> (3.0E-7) <sup>f</sup>	1.2E-4 <sup>f</sup>	3.0E-7 <sup>f</sup>	7.2E-5 (2.2E-3)	9.9E-8 (3.0E-6)	5.0E-7 (7.3E-6)	--	8.0E-7 <sup>g</sup> 8.0E-7 <sup>h</sup>	2.8E-4 <sup>f</sup> (2.8E-4) <sup>f</sup>	3.0E-7 (3.0E-7)
Combustion Engineering	2.4E-4 <sup>f</sup> (2.4E-4) <sup>f</sup>	3.1E-7 <sup>f</sup> (3.1E-7) <sup>f</sup>	3.9E-4 <sup>f</sup>	3.1E-7 <sup>f</sup>	2.3E-4 <sup>f</sup> (1.5E-4)	3.1E-7 <sup>f</sup> (2.1E-7)	9.4E-7 (1.9E-6)	--	1.0E-7 <sup>g</sup> 1.0E-7 <sup>h</sup>	2.4E-4 <sup>f</sup> (2.4E-4) <sup>f</sup>	3.1E-7 (3.1E-7)
Westinghouse	5.9E-5 (5.9E-5)	1.2E-7 <sup>f</sup> (1.2E-7)	1.2E-4 <sup>f</sup>	1.1E-7 <sup>f</sup>	2.6E-5 (4.5E-4)	3.6E-8 (6.2E-7)	3.6E-8 (5.1E-7)	--	1.4E-7 <sup>g</sup> 1.4E-7 <sup>h</sup>	5.9E-5 (5.9E-5)	1.2E-7 (1.2E-7)
PWR	4.0E-5 <sup>f</sup> (4.0E-5)	6.6E-8 (6.6E-8)	6.4E-5 <sup>f</sup>	6.3E-8 <sup>f</sup>	3.1E-5 (7.6E-4)	4.2E-8 (1.0E-6)	3.2E-7 (2.2E-6)	--	2.8E-7 <sup>g</sup> 2.8E-7 <sup>h</sup>	4.0E-5 (4.0E-5)	6.6E-8 (6.6E-8)

RDM LER RATES

Mode B & E Failure to Move Properly on Non-Scram Demands <sup>c</sup>		Mode G, H, I Faults Involving Rod Motion when No Motion is Desired <sup>c</sup>	All Modes Aggregate of All CRDM Faults for Plants with Standard Technical Specifications <sup>c,d</sup>	All Modes Aggregate of All CRDM Faults for Plants with Non-standard Technical Specifications <sup>c</sup>	All Modes Aggregate of All CRDM Faults for All Plants Considered in These Estimates <sup>c</sup>
$\lambda_d^e$	$\lambda_s^e$	$\lambda_s^e$	$\lambda_s^e$	$\lambda_s^e$	$\lambda_s^e$
6.0E-5 (1.8E-3)	1.5E-7 (4.6E-6)	6.1E-7 (1.0E-5)	3.9E-6 (6.9E-5)	5.2E-7 (7.5E-6)	9.2E-7 (1.5E-5)
2.2E-4 <sup>f</sup> (1.5E-4)	4.7E-7 <sup>f</sup> (3.1E-7)	1.2E-6 (2.7E-6)	2.0E-6 (4.7E-6)	1.3E-6 <sup>f</sup> (1.3E-6) <sup>f</sup>	1.2E-6 (3.0E-6)
3.2E-5 (5.1E-4)	7.0E-8 (1.1E-6)	7.0E-8 (6.3E-7)	3.9E-7 (6.6E-6)	5.1E-7 1.4E-6	4.9E-7 (2.3E-6)
3.3E-5 (7.8E-4)	7.3E-8 (1.8E-6)	4.8E-7 (3.3E-6)	1.6E-6 (1.2E-5)	4.5E-7 3.0E-6	7.7E-7 (5.4E-6)
6.3E-6 (6.3E-6)	4.2E-8 (4.2E-8)	2.9E-7 (3.9E-7)	7.0E-7 (1.1E-6)	1.6E-6 1.8E-6	1.5E-6 (1.7E-6)
1.1E-5 (1.3E-4)	5.3E-8 (6.6E-7)	3.6E-7 (1.5E-6)	1.4E-6 (9.0E-6)	1.2E-6 2.1E-6	1.3E-6 (3.1E-6)

Mode B & E Failure to Move Properly on Non-Scram Demands <sup>c</sup>		Mode G, H, I Faults Involving Rod Motion when No Motion is Desired <sup>c</sup>	All Modes Aggregate of All CRDM Faults for All Plants Considered in These Estimates <sup>c</sup>
$\lambda_d^e$	$\lambda_s^e$	$\lambda_s^e$	$\lambda_s^e$
3.7E-5 (1.1E-3)	9.9E-8 (3.0E-6)	5.0E-7 (8.1E-6)	8.0E-7 (1.1E-5)
1.4E-4 <sup>f</sup> (9.6E-5)	3.1E-7 <sup>f</sup> (2.1E-7)	9.4E-7 (2.0E-6)	9.4E-7 (2.2E-6)
1.6E-5 (2.7E-4)	3.6E-8 (6.2E-7)	3.6E-8 (6.5E-7)	4.3E-7 (1.8E-6)
1.8E-5 (4.4E-4)	4.2E-8 (1.0E-6)	3.2E-7 (2.5E-6)	6.1E-7 (3.9E-6)

TABLE 12.

	SUMMARY OF (1972 (cc							
	Mode D Failure to Insert to at Least 96% During Scram <sup>c</sup>		Mode B Failure to Insert During Normal Normal Shutdown <sup>c</sup>		Mode E Rod Fails to Move During Power <sup>c</sup> Changes/Testing		Mode G Dropped Rod (PWR) <sup>c</sup>	Mode H Uncouple Overtrave Rod (BWR)
	$\lambda_d^e$	$\lambda_s^e$	$\lambda_d^e$	$\lambda_s^e$	$\lambda_d^e$	$\lambda_s^e$	$\lambda_s^e$	$\lambda_s^e$
General Electric (BWR)	5.4E-5 (1.1E-4)	7.5E-8 (1.5E-7)	2.3E-5	2.2E-8	1.8E-6 (1.8E-6)	1.1E-8 (1.1E-8)	-- --	2.9E- --
Overall	4.9E-5 (8.4E-5)	7.2E-8 (1.2E-7)	1.5E-5	1.4E-8	4.9E-6 (8.1E-5)	2.1E-8 (3.6E-7)	3.2E-7 (2.2E-6)	2.9E-

a. WASH-1400<sup>7</sup> failure rate--Scram Rod, Failure to Insert  $\lambda_d = 1.0E-4$ .

b. Confidence bounds associated with these Licensee Event Report (LER) rates can be found in Appendix

c. LER rates not in parentheses include only failures, except for all rates shown in Mode I, which are

d. Any calculation which was made on all modes, excludes Mode T since these LERs were considered non-

e.  $\lambda_d$  is a demand rate;  $\lambda_s$  is a standby hourly rate based on critical hours.

f. Denotes upper 95% confidence bound.

g. Denotes LER rates based on personnel errors only.

h. Denotes LER rates based on personnel and hardware faults.

(continued)

CRDM LER RATES  
through 1978)  
(continued)

d/ lled c)	Mode I Improper Rod Movement	Mode C & D Failure to Insert Fully During Scram		Mode B & E Failure to Move Properly on Non-Scram Demands <sup>c</sup>		Mode G, H, I Faults Involving Rod Motion when No Motion is Desired <sup>c</sup>	All Modes Aggregate of All CRDM Faults for All Plants Considered in These Estimates <sup>c</sup>
	$\lambda_s^e$	$\lambda_d^e$	$\lambda_s^e$	$\lambda_d^e$	$\lambda_s^e$	$\lambda_s^e$	$\lambda_s^e$
7	9.7E-8 <sup>g</sup>	1.4E-3	1.9E-6	4.7E-6	3.2E-8	2.9E-7	2.8E-6
	1.4E-7 <sup>h</sup>	(1.4E-3)	(2.0E-6)	(4.7E-6)	(3.2E-8)	(4.3E-7)	(3.0E-6)
7	1.6E-7 <sup>g</sup>	8.9E-4	1.3E-6	6.6E-6	3.6E-8	3.0E-7	2.0E-6
	1.9E-7 <sup>h</sup>	(9.2E-4)	(1.4E-6)	(6.9E-5)	(3.7E-7)	(1.1E-6)	(3.3E-6)

es U through AF.

all command faults. LER rates in parentheses include both failures and command faults.

failures for the purposes of this report.



### Scatter Plots

Due to the large variations in the number of faults reported by various plants within an NSSS vendor, we felt that plotting the specific plant LER rates associated with various CRDM failure modes would best illustrate these plant variations. Figures 1 through 5 reproduce these plots.

For each of the plots, specific plant LER rates for each selected CRDM failure mode are grouped by NSSS vendor. This grouping provides four plots for each of the selected failure modes, one for each group of plants classified by NSSS vendor. A pound sign (#) immediately following the plant code indicates that there were no failures reported for that plant. The failure rate given for the plant is the mean failure rate of the NSSS vendor of which the plant is a member. All plant LER rates that were used to generate these plots included command faults, and covered the time interval of January 1, 1972 through April 30, 1978.

It should be noted that the statistical and reliability summarizations presented in this report are only a few of the possible examples of the analyses that can be performed. The primary purpose of this task is not to perform comprehensive reliability statistical analyses, but to code the LERs onto a data file from which further statistical analyses can be performed.

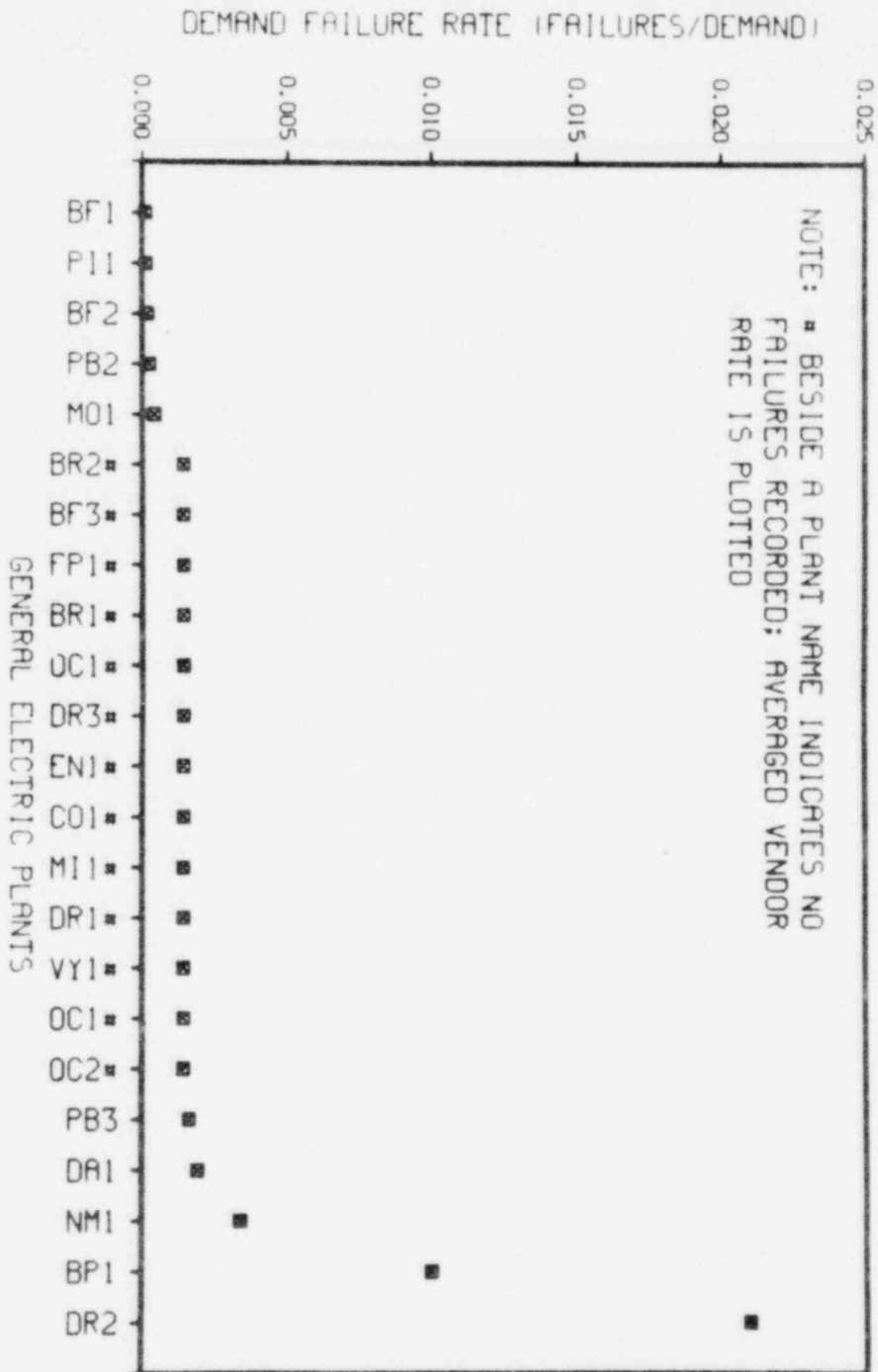


Figure 1a. Scatter plot of demand LER rates for "failure to insert fully during scram," command faults included, January 1, 1972 to April 30, 1978, General Electric plants.

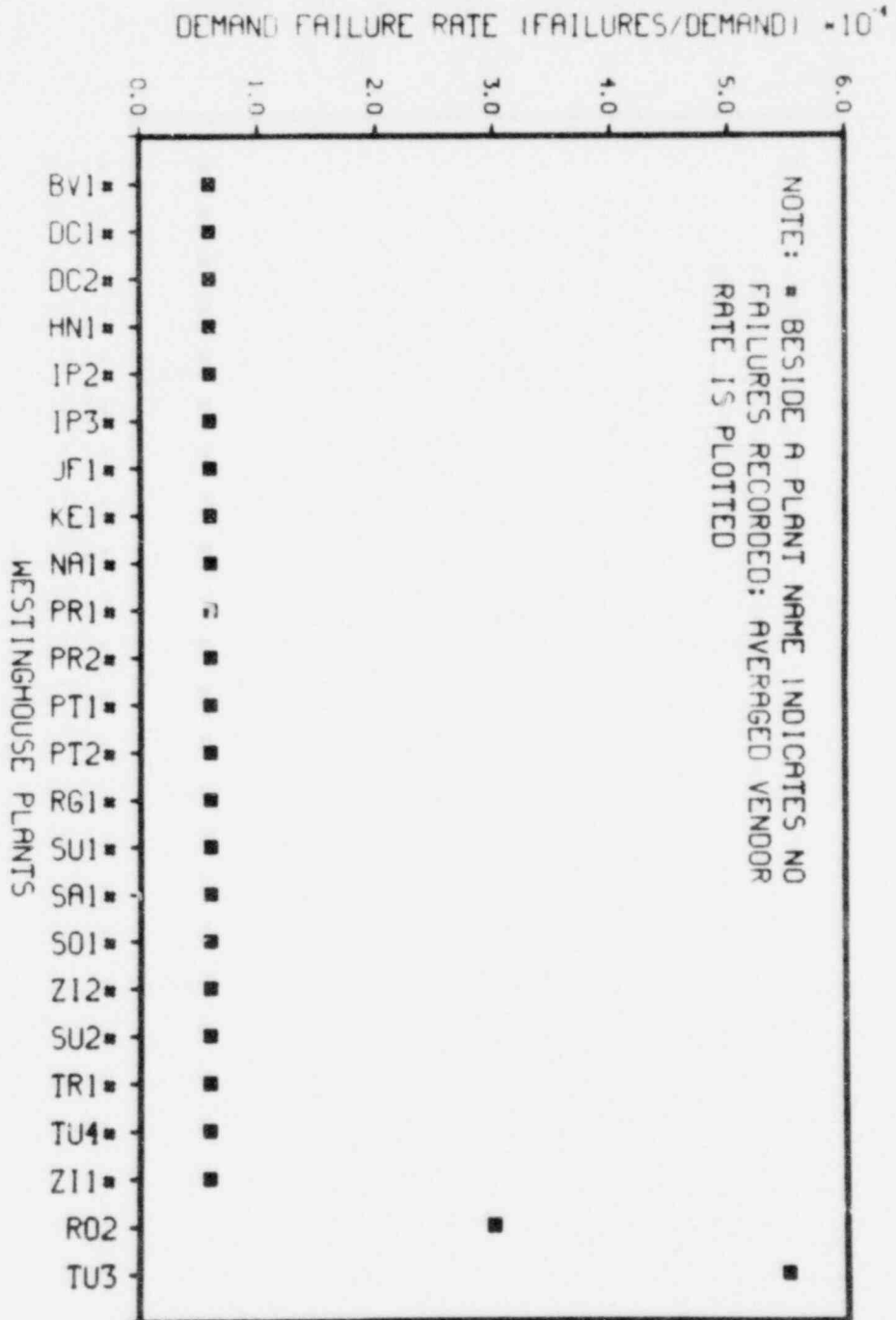


Figure 1b. Scatter plot of demand LER rates for "failure to insert fully during scram," "command faults included, January 1, 1972 to April 30, 1978, Westinghouse plants.

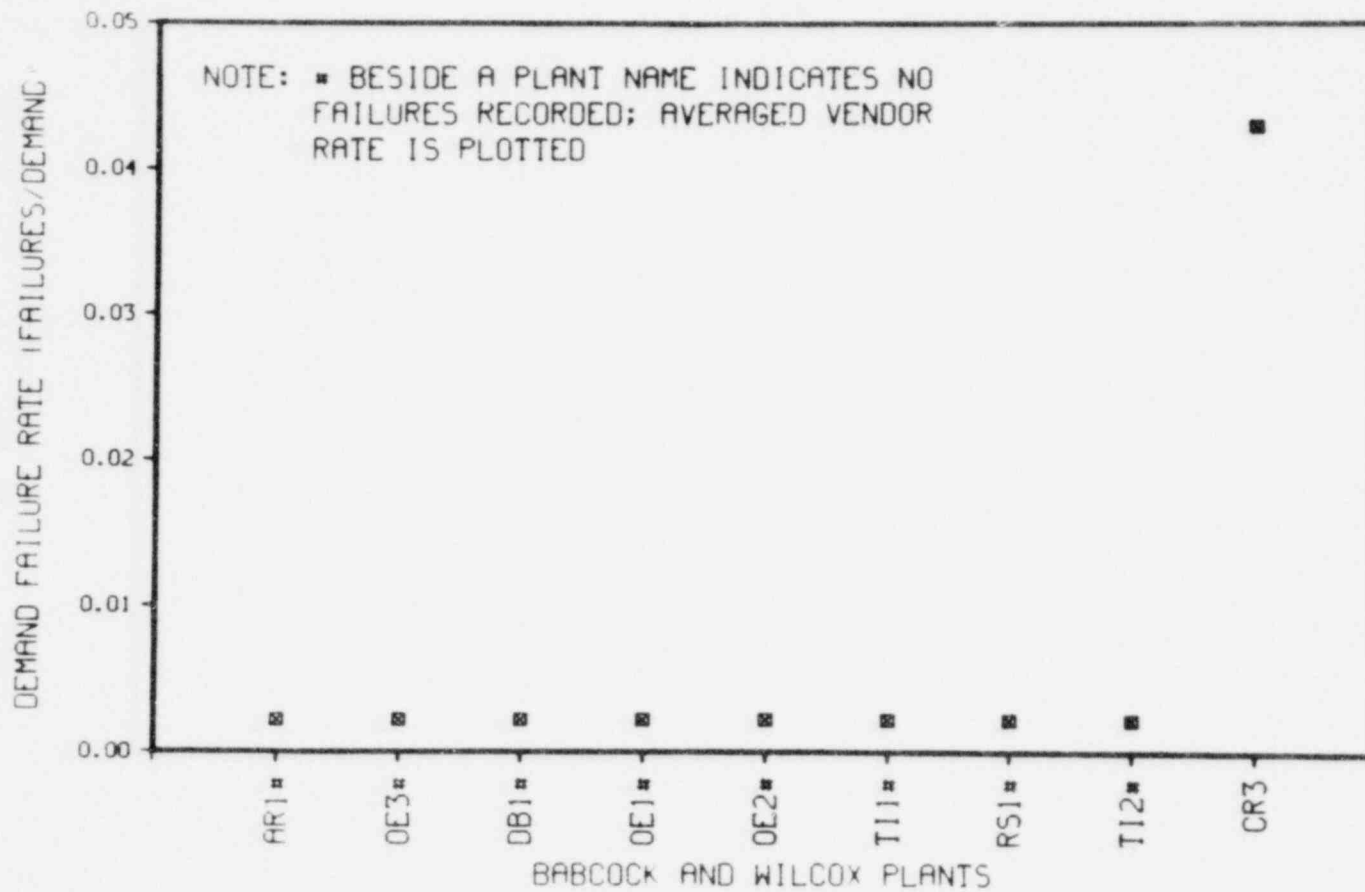


Figure 2a. Scatter plot of demand LER rates for "rod fails to move during power changes/testing," command faults included, January 1, 1972 to April 30, 1978, Babcock & Wilcox plants.

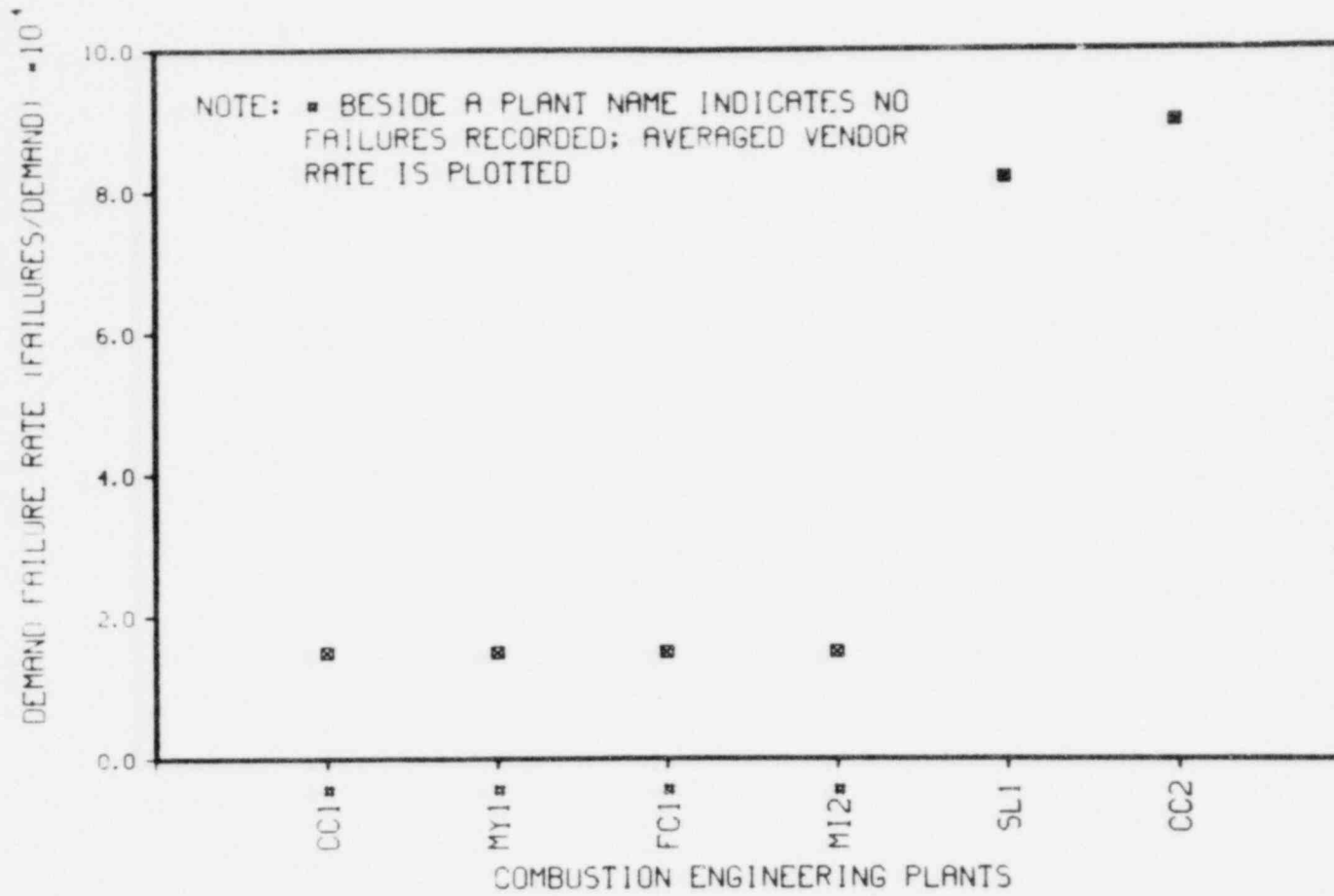


Figure 2b. Scatter plot of demand LER rates for "rod fails to move during power changes/testing," command faults included, January 1, 1972 to April 30, 1978, Combustion Engineering plants.

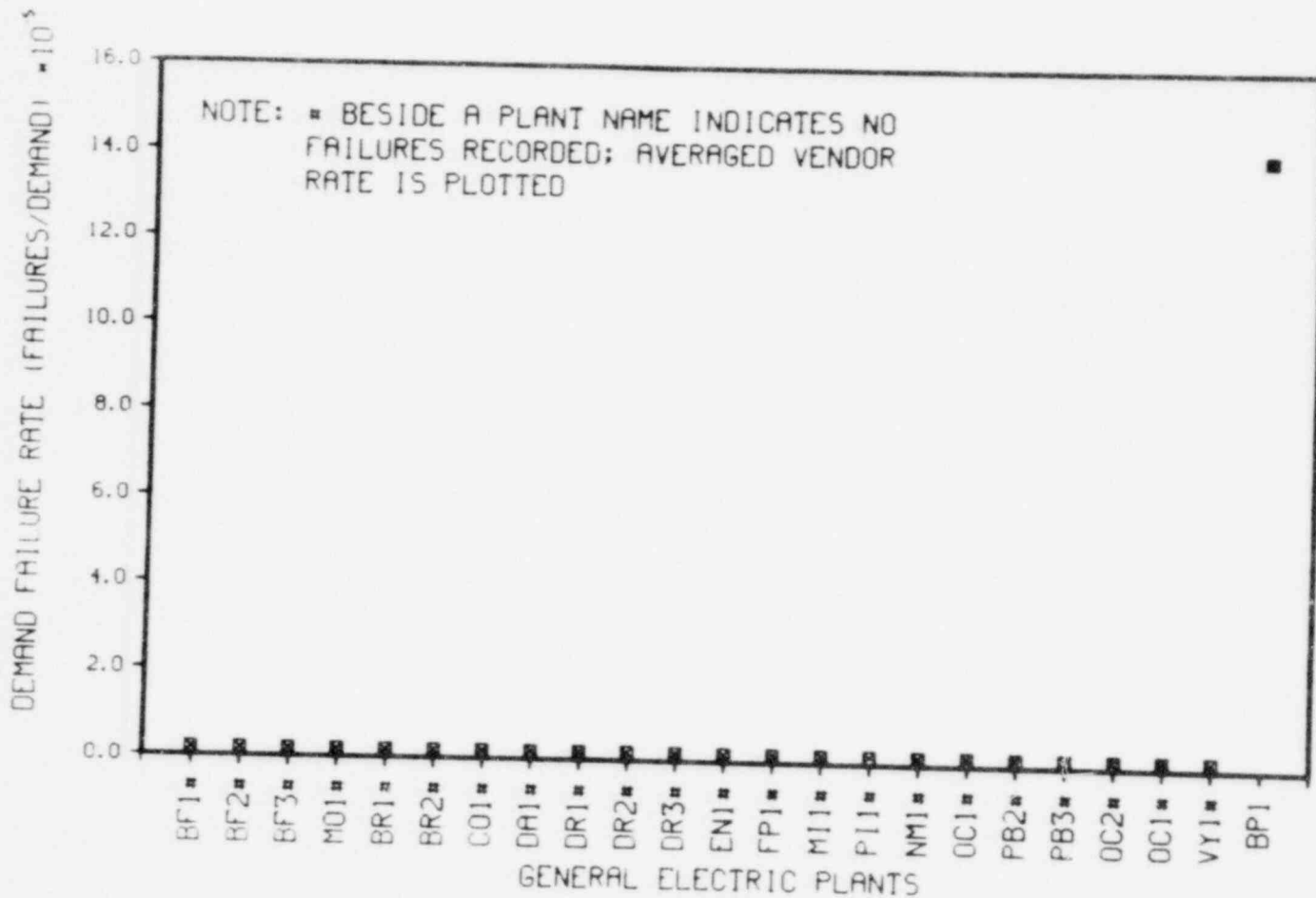


Figure 2c. Scatter plot of demand LER rates for "rod fails to move during power changes/testing," command faults included, January 1, 1972 to April 30, 1978, General Electric plants.

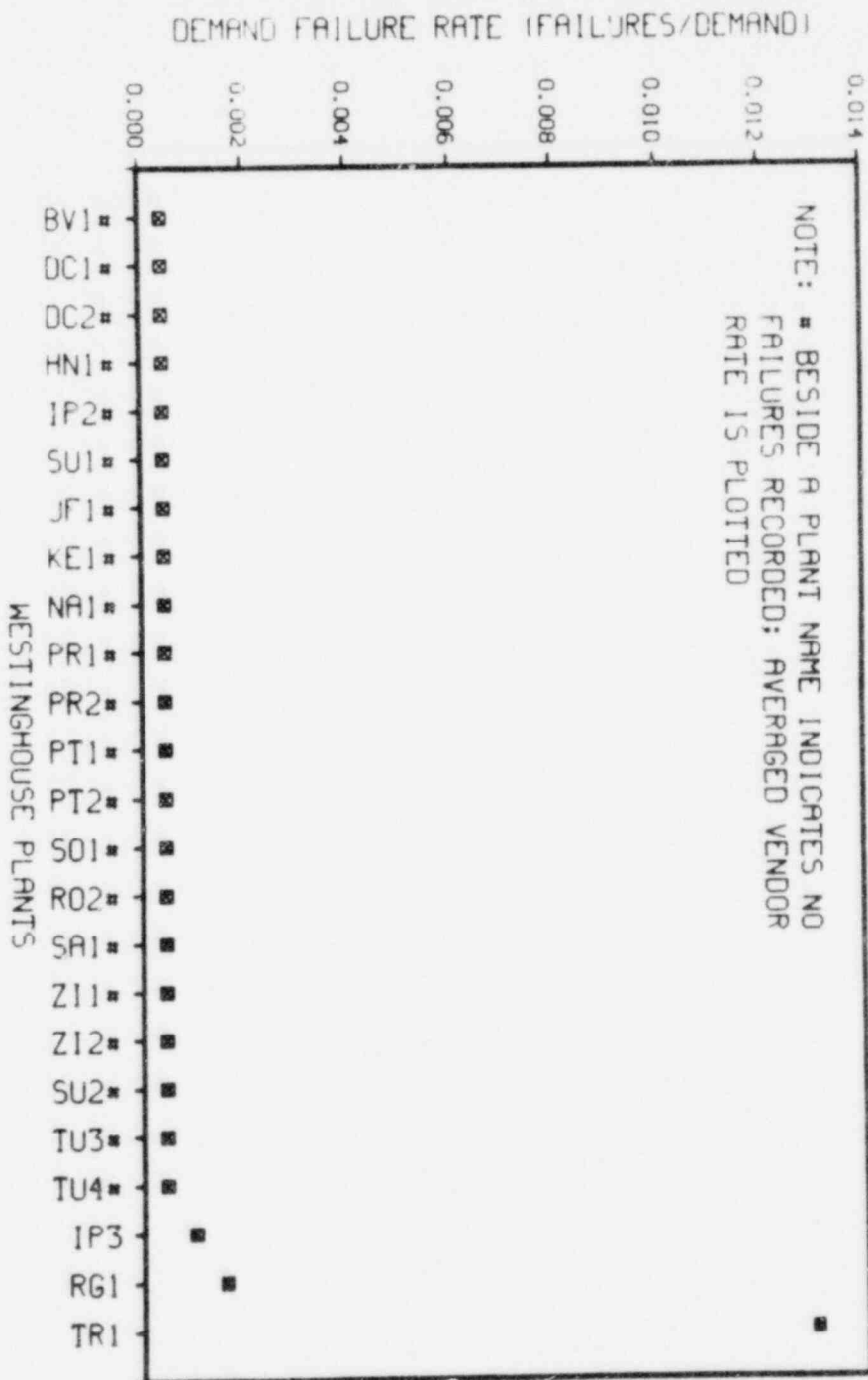


Figure 2d. Scatter plot of demand LER rates for "rod fails to move during power changes/testing," command faults included, January 1, 1972 to April 30, 1978, Westinghouse plants.

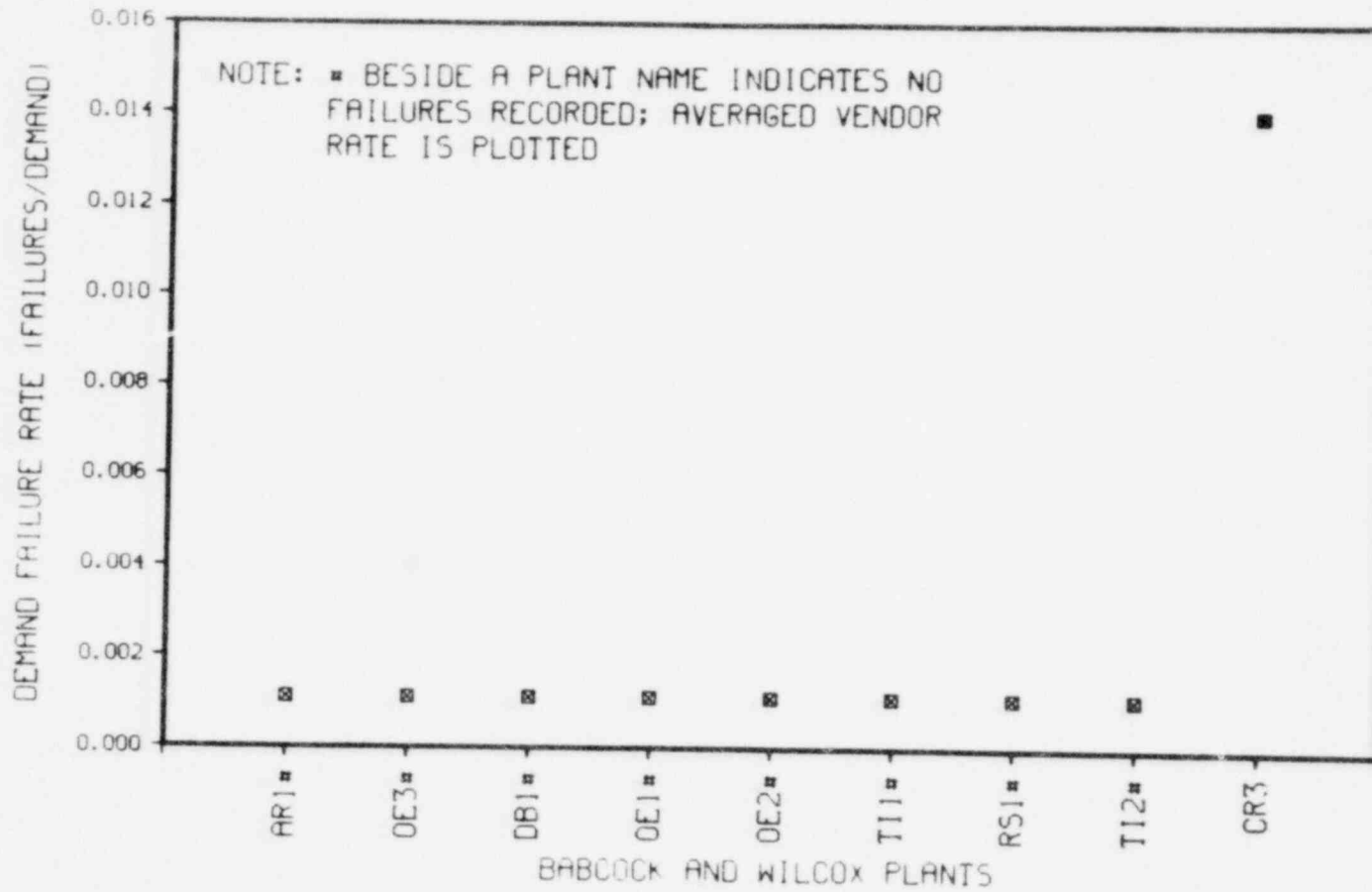


Figure 3a. Scatter plot of demand LER rates for "failure to move properly on non-scrum demands," command faults included, January 1, 1972 to April 30, 1978, Babcock & Wilcox plants.



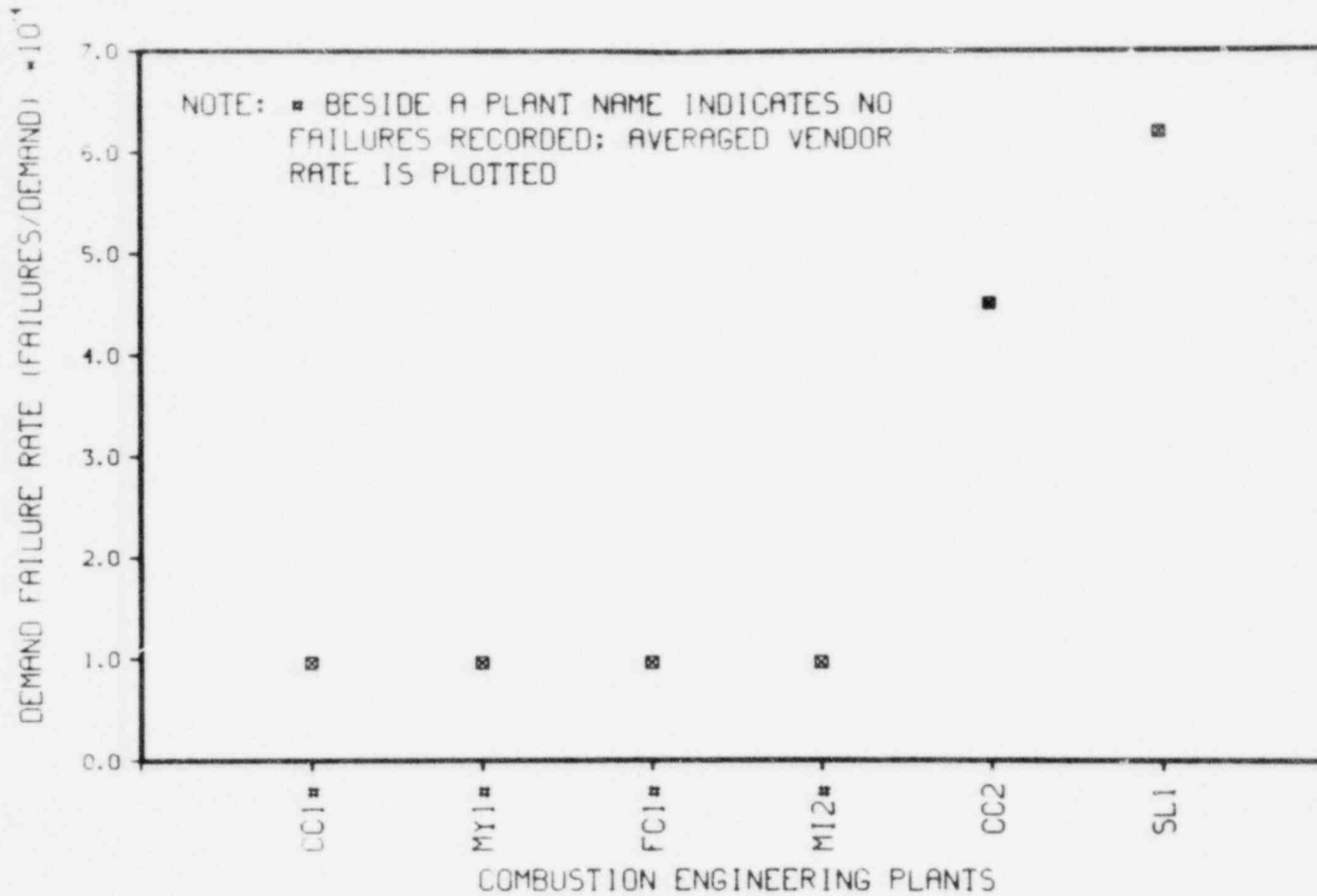


Figure 3b. Scatter plot of demand LER rates for "failure to move properly on non-scrum demands," command faults included, January 1, 1972 to April 30, 1978, Combustion Engineering plants.

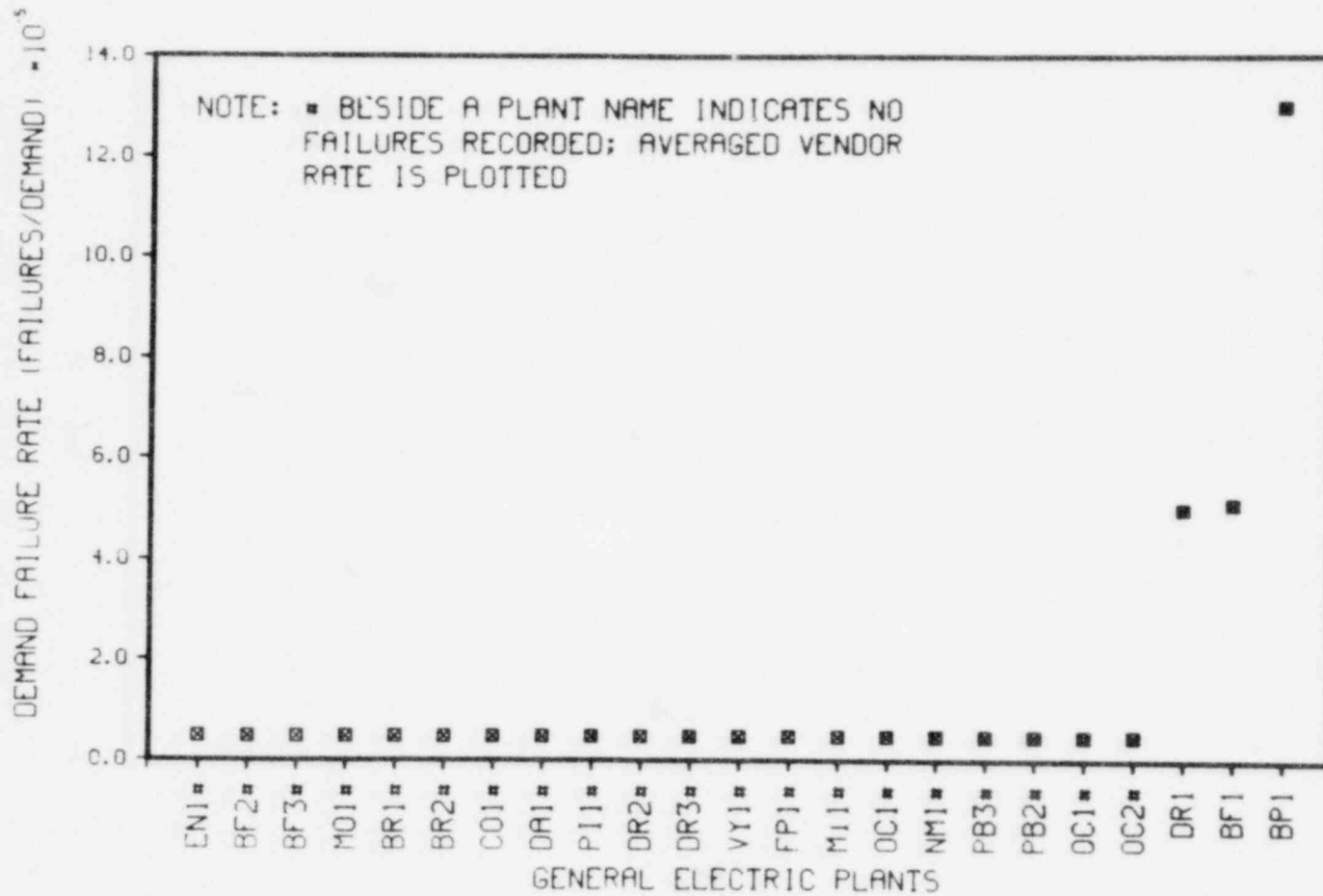


Figure 3c. Scatter plot of demand LER rates for "failure to move properly on non-scrum demands," command faults included, January 1, 1972 to April 30, 1978, General Electric plants.

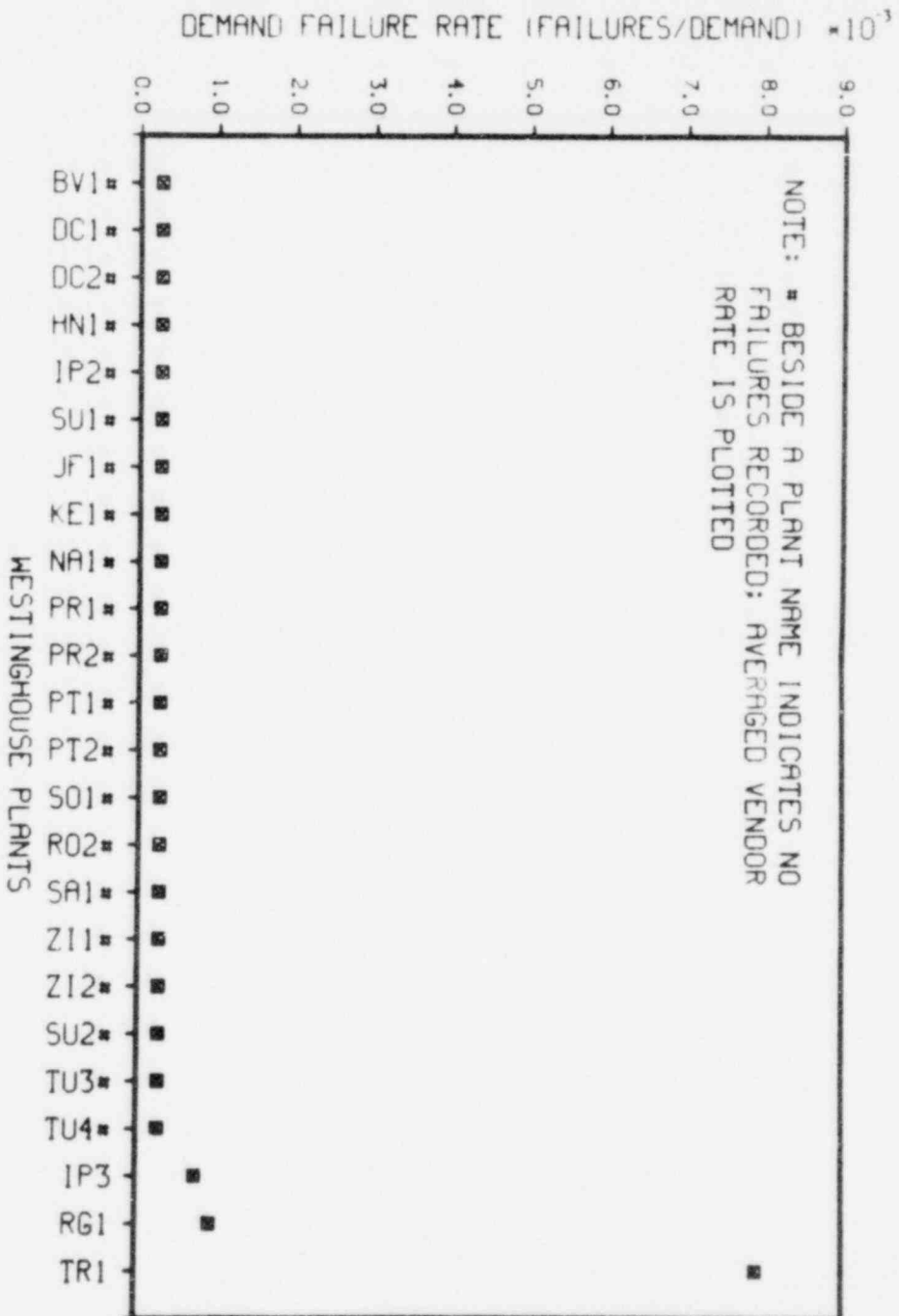


Figure 3d. Scatter plot of demand LER rates for "failure to move properly on non-scrum demands," command faults included, January 1, 1972 to April 30, 1978, Westinghouse plants.

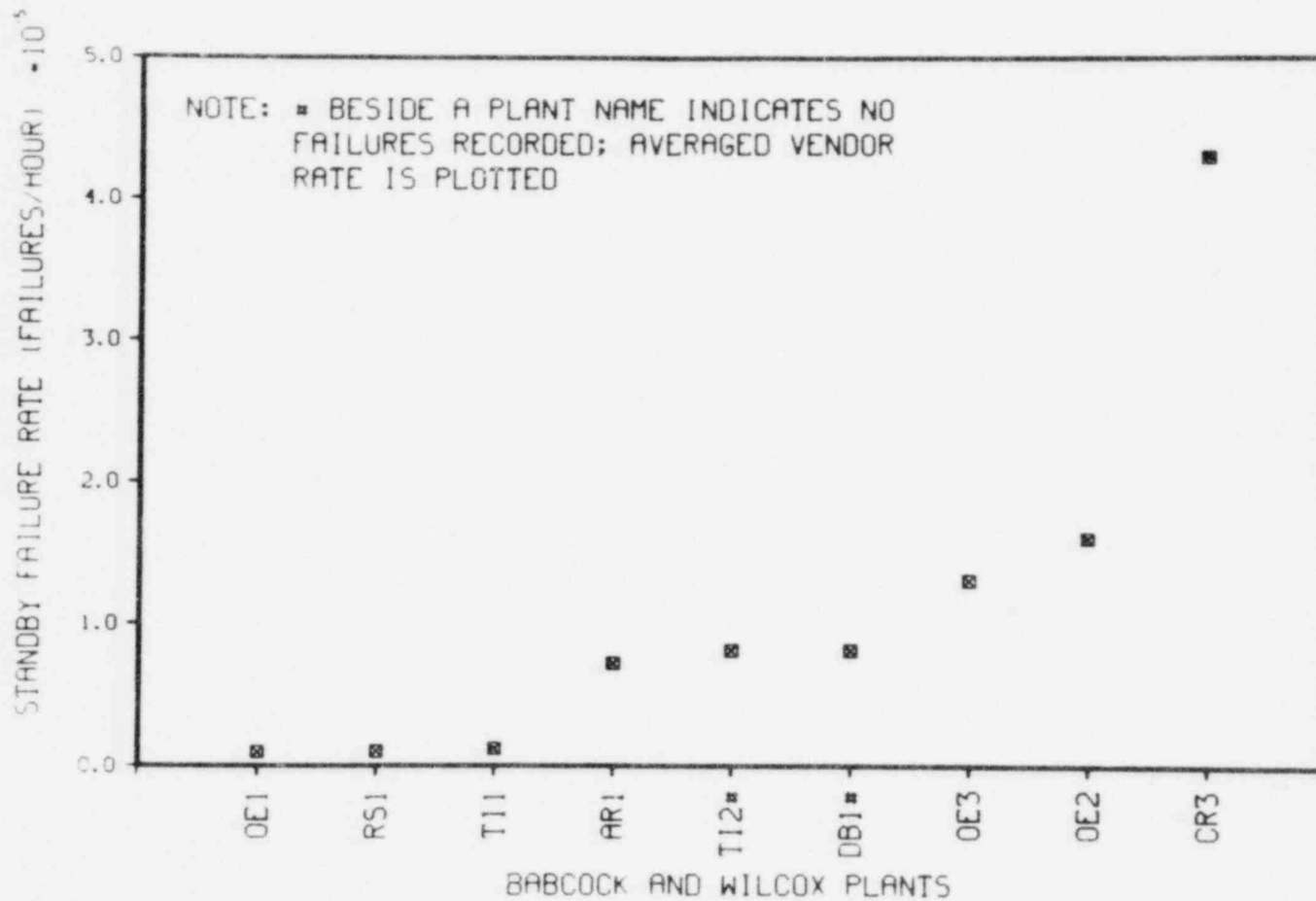


Figure 4a. Scatter plot of standby LER rates for "faults involving rod motion when no motion is desired," command faults included, January 1, 1972 to April 30, 1978, Babcock & Wilcox.

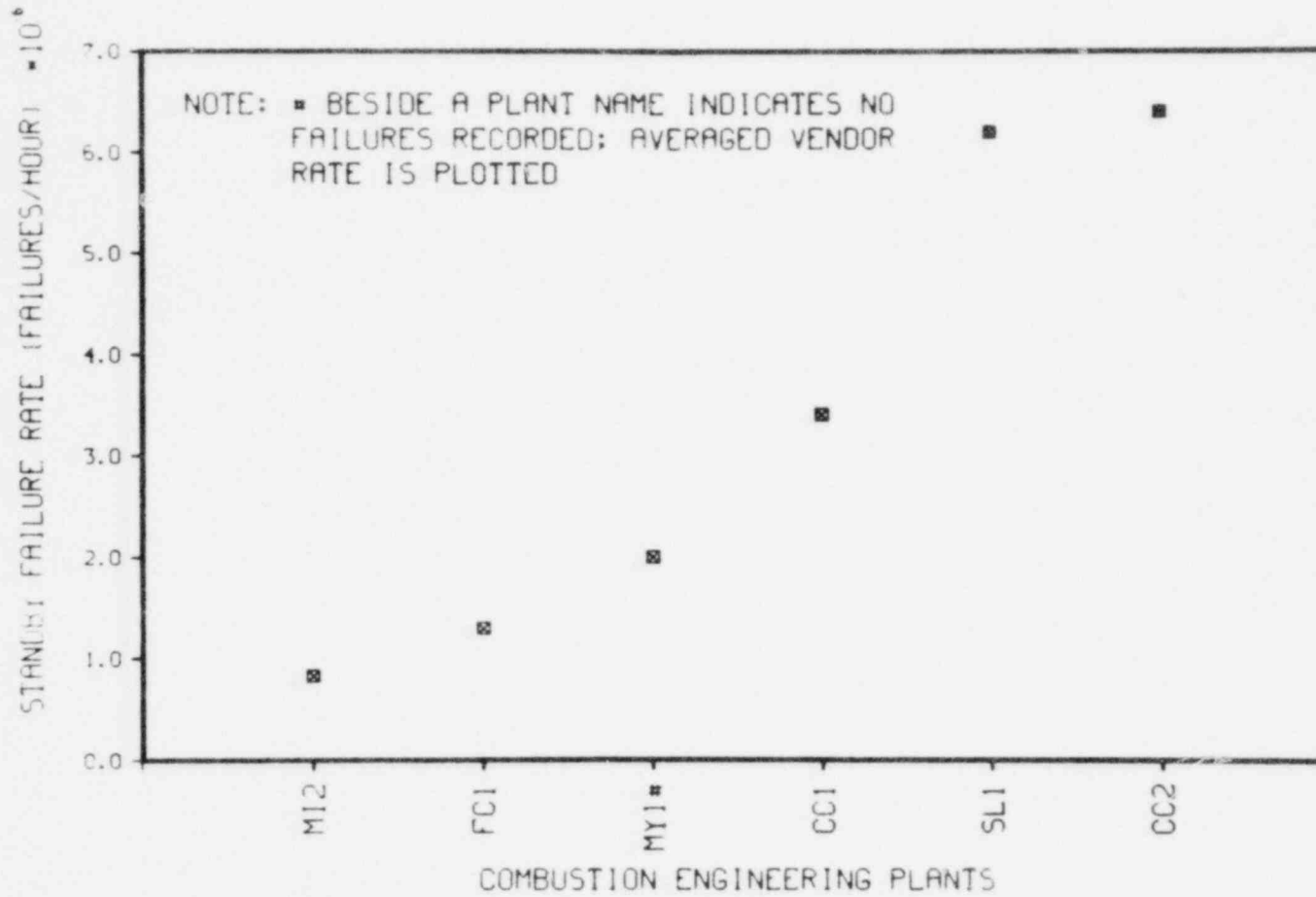


Figure 4b. Scatter plot of standby LER rates for "faults involving rod motion when no motion is desired," command faults included, January 1, 1972 to April 30, 1978, Combustion Engineering plants.

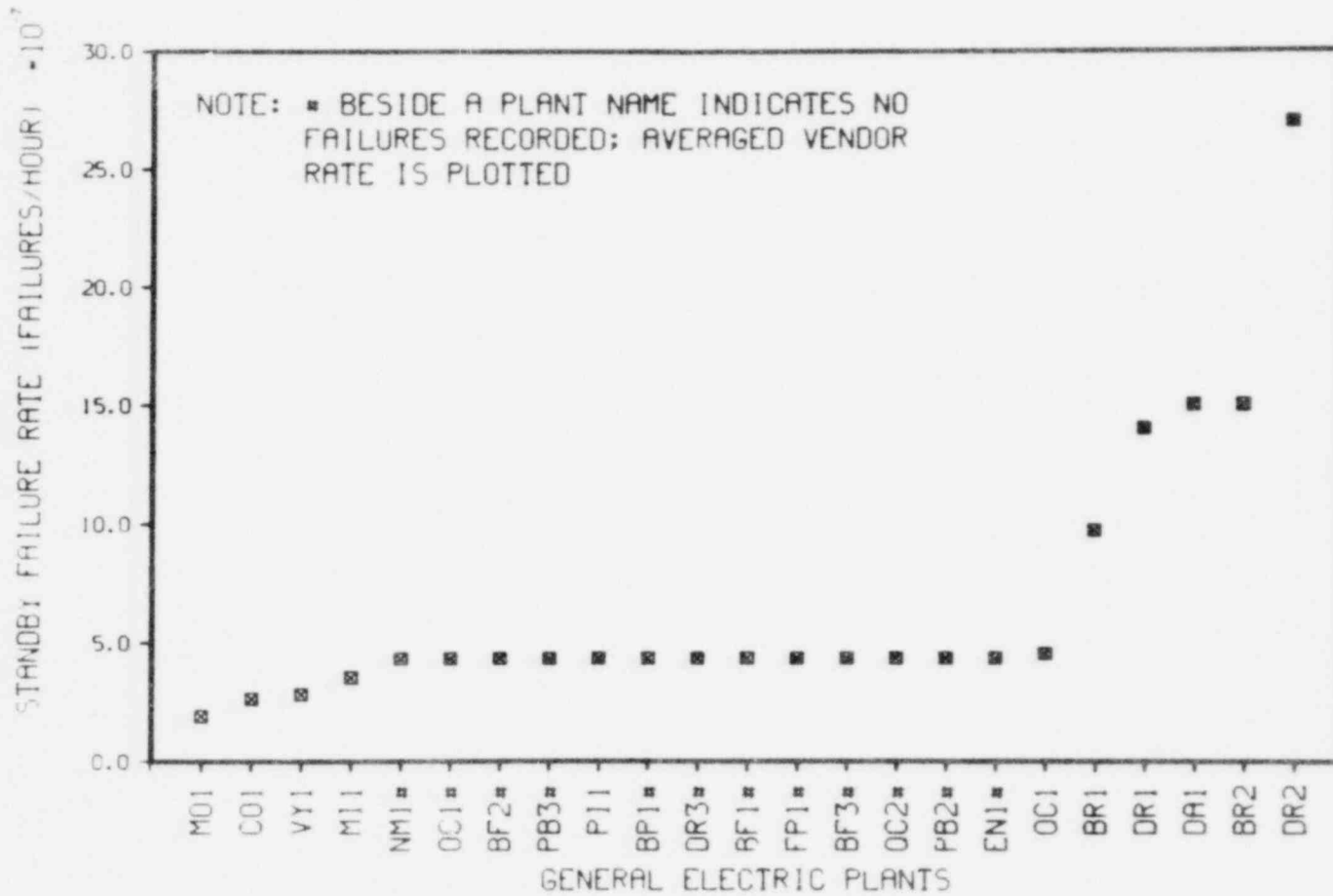
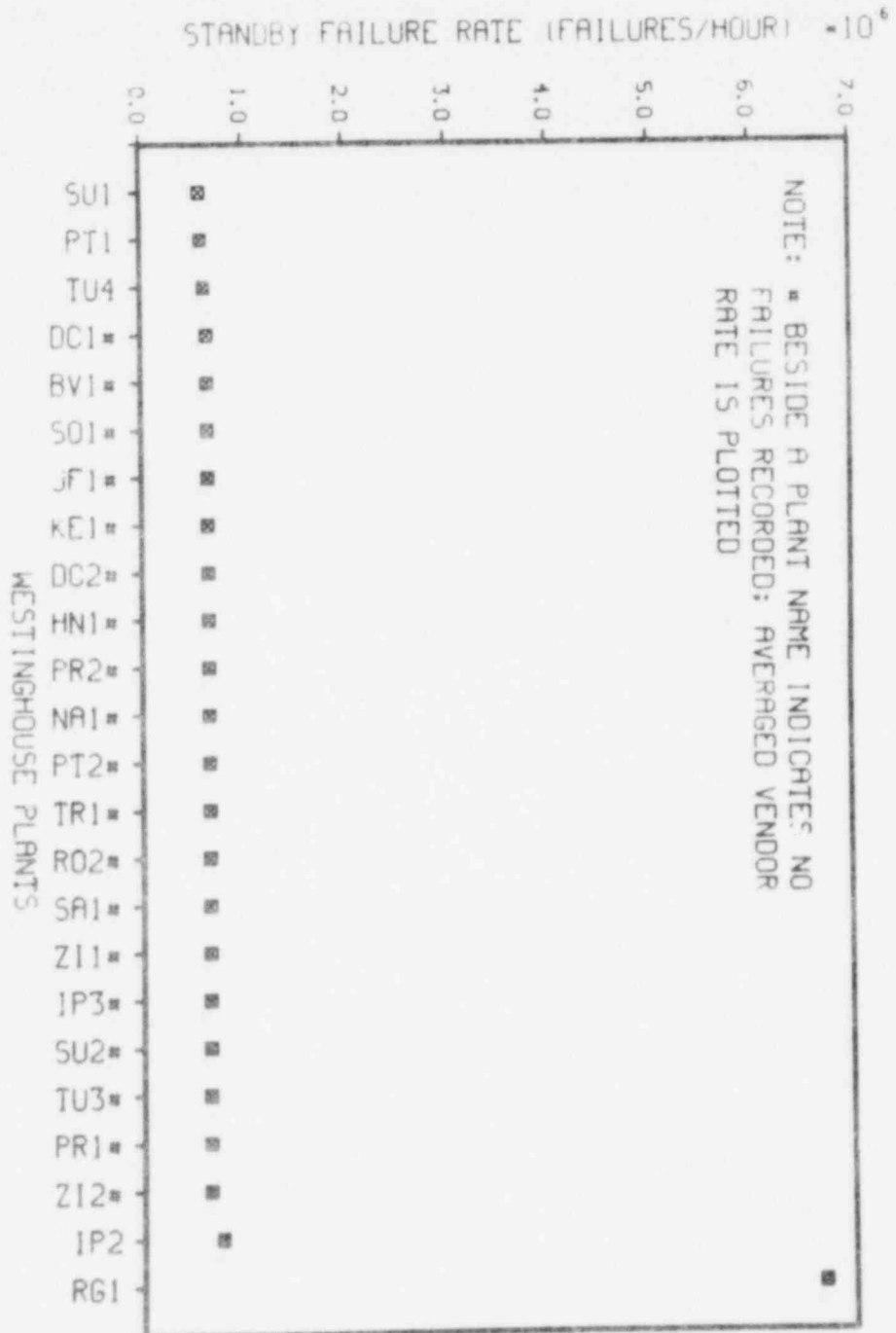


Figure 4c. Scatter plot of standby LER rates for "faults involving rod motion when no motion is desired," command faults included, January 1, 1972 to April 30, 1978, General Electric plants.

Figure 4d. Scatter plot of standby LER rates for "faults involving rod motion when no motion is desired," command faults included, January 1, 1972 to April 30, 1978, Westinghouse plants.



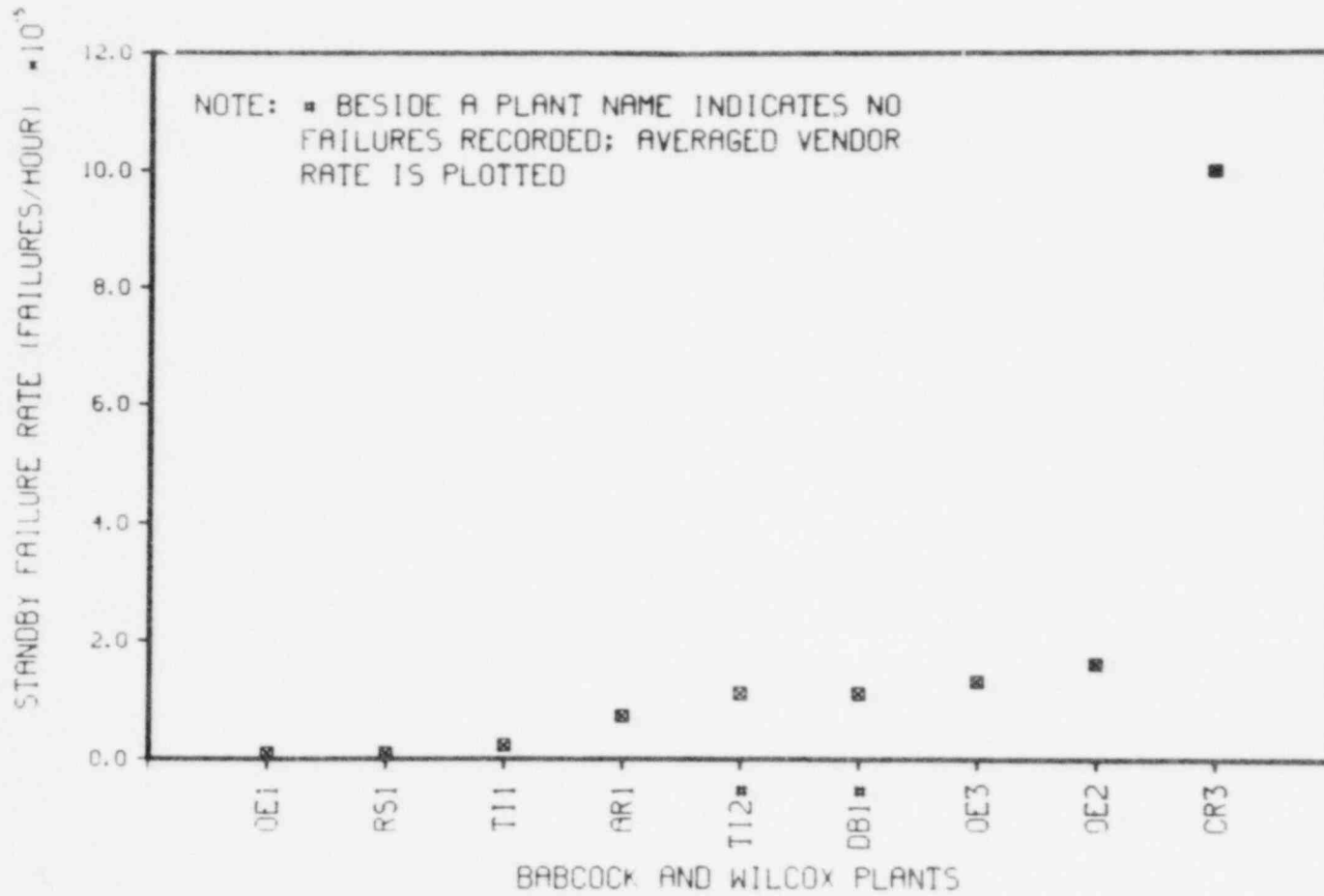


Figure 5a. Scatter plot of standby LER rates for "aggregate of all CRDM faults," command faults included, January 1, 1972 to April 30, 1978, Babcock & Wilcox plants.



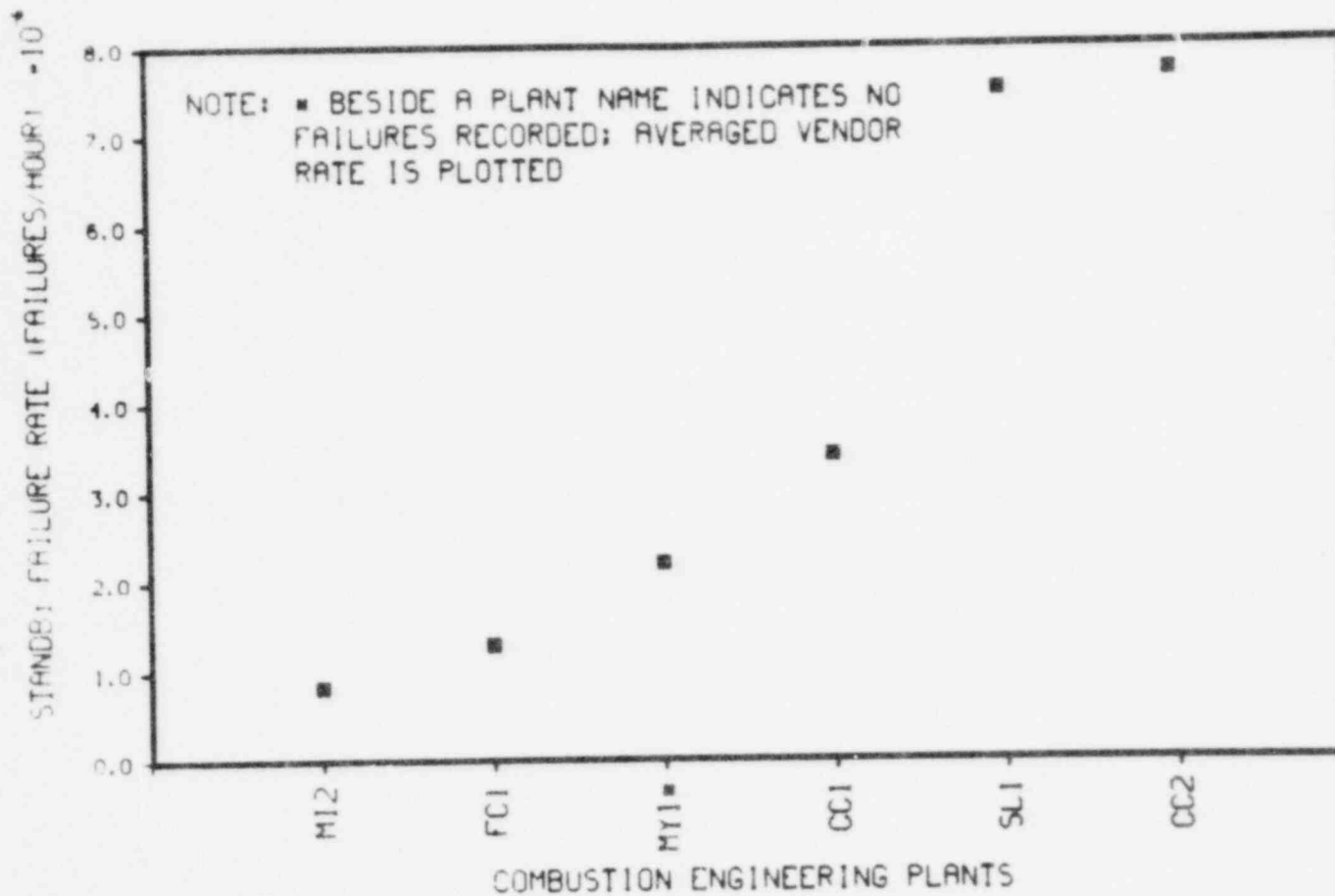


Figure 5b. Scatter plot of standby LER rates for "aggregate of all CRDM faults," command faults included, January 1, 1972 to April 30, 1978, Combustion Engineering plants.

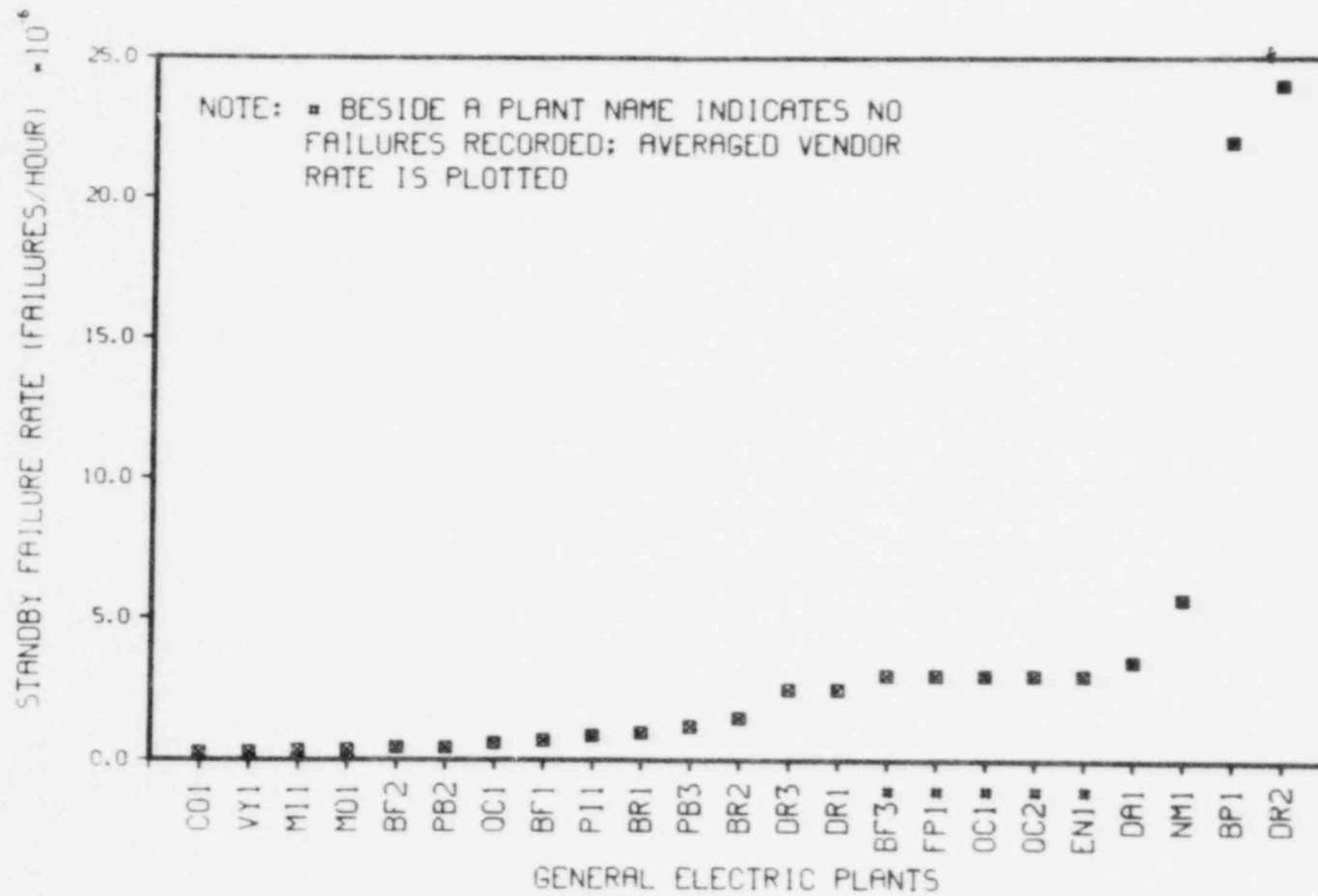


Figure 5c. Scatter plot of standby LER rates for "aggregate of all CRDM faults," command faults included, January 1, 1972 to April 30, 1978, General Electric plants.

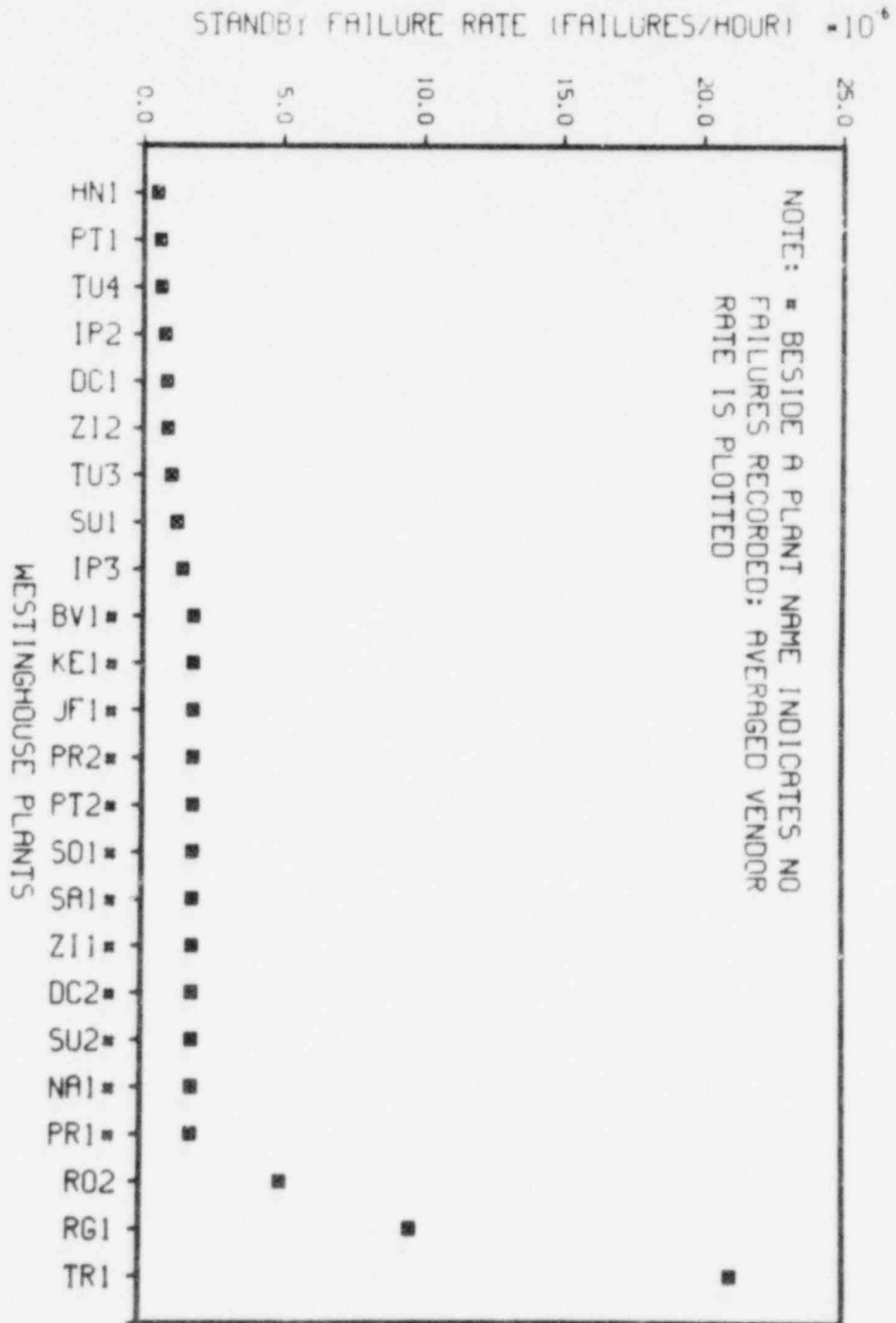


Figure 5d. Scatter plot of standby LER rates for "aggregate of all CRDM faults," "command faults included," January 1, 1972 to April 30, 1978, Westinghouse plants.

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APPENDIX A

CRITERIA FOR LER REPORTING

## APPENDIX A

### CRITERIA FOR LER REPORTING

There are generally two criteria used by the utilities to determine reporting requirements for failures. These are (a) Technical Specifications for each individual plant and (b) Regulatory Guide 1.16. Variation exists in the reporting requirements for individual plants. For example, generally, the Technical Specifications for plants licensed prior to January 1, 1976 were independently written by each specific plant without any planned uniformity between plants. All plants licensed after this date used standardized technical specifications which helped create more uniform reporting. Also, there have been changes made in the rules which govern LER reporting, to ensure greater uniformity. These changed reporting rules, and the standardized Technical Specifications, are expected to result in more uniform LER reporting since January 1, 1976.

The above "mechanistic" causes for LER reporting variations are explainable and expected. However, there are further reporting variations. These variations are caused by differences in interpretation of the rules for submitting incident reports. Also, variation is caused by the difficulty of determining the extent of safety and non-safety systems, and therefore, by the questions of what failures are or are not required to be reported. Finally, variation can be caused by the degree of importance assigned to the LER reports by management of the individual utilities. Variations in quantity and quality of LERs have been shown to exist between similar plants where one would expect a more uniform reporting. These variations have been attributed to the reasons mentioned above.

The one thing that seems to have most hindered the development of uniform reporting is the lack of agreement of what is intended by an LER. Many people feel that the LERs are intended to highlight problem areas. And many of these same people do not feel that these uses are compatible with the need to determine failure rate information.

APPENDIX B

LER RATE ESTIMATES

## APPENDIX B

### LER RATE ESTIMATES

To estimate the LER failure rates for components, the following well-known statistical methods for Type I censored data with replacement were used (see Reference B-1).

The general methods for estimating failure rates on an hourly basis and a demand basis are:

$$\hat{\lambda}(\text{hourly}) = \frac{N}{T} \quad (\text{B-1})$$

$$\hat{\lambda}(\text{demand}) = \frac{N}{D} \quad (\text{B-2})$$

where

- = estimated failure rate
- N = numbers of reported component failures
- T = total time accrued by all components
- D = total number of demands of all components.

The general computational formulas, Equations (B-1) and (B-2) may be applied to particular situations. The failure rate for a component in a particular plant is estimated by setting

$$N = N_i$$

$$T = T_i$$

$$D = D_i$$

where

- $N_i$  = the number of component failures in plant  $i$



$T_i$  = the total accrued hours of all like components in plant i

$D_i$  = total accrued number of demands on all like components in plant i.

In a similar manner, failure rates may be estimated for components manufactured by a particular vendor for components in a particular plant type (for example, PWR or BWR) or for components present in all plants.

Confidence limits for hourly failure rates were based on the assumption that the underlying component failure distributions are exponential, so, the resulting LER data are representable by a Poisson process. In demand evaluations, N is binomially distributed. However, since probability of failure is small and the number of demands is large, the Poisson distribution may be used to approximate this variable. The generalized formulas for estimating 90% confidence limits on the failure rates are

$$\frac{\chi_{0.05}^2 (2N)}{2T} \leq \hat{\lambda}(\text{hourly}) \leq \frac{\chi_{0.95}^2 (2N+2)}{2T} \quad (\text{B-3})$$

and

$$\frac{\chi_{0.05}^2 (2N)}{2D} \leq \hat{\lambda}(\text{demand}) \leq \frac{\chi_{0.95}^2 (2N+2)}{2D} \quad (\text{B-4})$$

where

$\chi_{0.05}^2 (2N)$  = the chi-square variate at 0.05 cumulative probability with 2N degrees of freedom

$\chi_{0.95}^2 (2N+2)$  = the chi-square variate at 0.95 cumulative probability with (2N+2) degrees of freedom.

In this work, when no failures were observed, an upper 95% confidence limit for the failure rate was estimated by

$$\lambda(\text{hourly}) = \frac{\chi_{0.95}^2 (2)}{2T} \quad (\text{B-5})$$

or by

$$\hat{\lambda}(\text{demand}) = \frac{\chi_{0.95}^2(2)}{2D} \quad (\text{B-6})$$

depending on whether time data or demand data were involved.

In estimating the above confidence limits, it was assumed that all components in the sample have exactly the same true failure rate. No effort was made to account for possible variations arising from the mixture of populations having different true failure rates. For further discussion of the assumptions and limitations of these confidence limits, see Reference B-1.

#### REFERENCE

B-1. L. J. Bain, Statistical Analysis of Reliability and Life-Testing Models, New York: Marcell Dekker, Inc., 1978, p. 157.

APPENDIX C

FACILITY OPERATING LICENSES ISSUED WITH  
STANDARD TECHNICAL SPECIFICATIONS

## APPENDIX C

FACILITY OPERATING LICENSES ISSUED WITH  
STANDARD TECHNICAL SPECIFICATIONS

<u>Facility</u>	<u>Vendor</u>	<u>Issue Date</u>
Crystal River Unit 3	B	December 3, 1976
Davis-Besse Unit 1	B	April 22, 1977
Three Mile Island Unit 2	B	February 8, 1978
Arkansas Unit 2 <sup>a</sup>	C	July 18, 1978
Calvert Cliffs Unit 1 (STS Conversion)	C	February 11, 1977
Calvert Cliffs Unit 2	C	August 13, 1976
Millstone Unit 2	C	August 1, 1975
St. Lucie Unit 1	C	March 1, 1976
Brunswick Unit 1	G	September 8, 1976
Brunswick Unit 2 (STS Conversion)	G	November 23, 1977
Hatch Unit 2 <sup>a</sup>	G	June 13, 1978
Beaver Valley Unit 1	W	January 30, 1976
D. C. Cook Unit 1	W	October 15, 1974
D. C. Cook Unit 2	W	December 23, 1977
Joseph Farley Unit 1	W	June 25, 1977
North Anna Unit 1	W	November 16, 1977
Salem Unit 1	W	August 13, 1976
Trojan	W	November 21, 1975
Yankee Rowe (STS Retrofit)	W	January 1, 1977

a. These plants were not included in this report.

APPENDIX D

ADDITIONAL ONE-LINER INFORMATION

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 ADDITIONAL ONE-LINER INFORMATION  
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<u>CONTROL</u>	<u>VENDOR</u>	<u>PLANT</u>	<u>FAIL DATE</u>	<u>FAIL NUP</u>	<u>MANUFACTURER</u>	<u>OB TIME</u>
010504	B	AR1	080974		ZZZZ	T
012154	B	AR1	011475		ZZZZ	U
021314*	B	AR1	042478	09	D150	N
016844	B	CR3	122276		D150	T
018405	B	CR3	040477		D150	N
018403	B	CR3	040677		D150	N
017943	B	CR3	042777		D150	N
017944*	B	CR3	042777	02	D150	N
017941*	B	CR3	051377	09	D150	N
017937*	B	CR3	060177	29	D150	D
019429*	B	CR3	101677	09	D150	T
020781	B	CR3	030678		B015	M
002093	B	IP1	032272		ZZZZ	N
002312	B	IP1	040872		ZZZZ	M
002096	B	IP1	061772		ZZZZ	D
002010	B	IP1	123072		ZZZZ	D
002327	B	IP1	123072		ZZZZ	T
000800	B	IP1	020874		ZZZZ	D
010329	B	IP1	070774		ZZZZ	T
000417	B	LF1	100573		ZZZZ	U

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 ADDITIONAL ONE-LINER INFORMATION  
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<u>CONTRL</u>	<u>VENDOR</u>	<u>PLANT</u>	<u>FAIL DATE</u>	<u>FAIL NUM</u>	<u>MANUFACTURER</u>	<u>DB TIME</u>
C12286	B	CE1	010375		B015	U
C12293	B	CE2	011575		ZZZZ	U
C13202*	B	CE2	082575	09	ZZZZ	N
C14813	B	CE2	022676		ZZZZ	N
C20154	B	CE2	122977		D150	N
C20865*	B	CE2	030178	12	ZZZZ	T
C12298	B	CE3	020975		ZZZZ	N
C14818*	B	CE3	042276	09	ZZZZ	N
C15010*	B	CE3	060976	09	ZZZZ	N
C20641	B	CE3	021078		D150	T
C16011	B	RS1	100776		B015	N
0180.3	B	RS1	042277		D150	R
C12144	B	TI1	021075		ZZZZ	N
C13557	B	TI1	102175		ZZZZ	R
C13684A	B	TI1	111275		D150	N
013684B	B	TI1	111275		D150	N
C13735	B	TI1	111475		ZZZZ	M
C16741	C	CC1	121276		C490	T
C17710	C	CC1	042277		C490	T
C19689A	C	CC1	111277		F314	N

ADDITIONAL ONE-LINER INFORMATION

<u>CONTROL</u>	<u>VENDOR</u>	<u>PLANT</u>	<u>FAIL DATE</u>	<u>FAIL NUM</u>	<u>MANUFACTURER</u>	<u>OB TIME</u>
C196898	C	CC1	111277		P314	N
C19781	C	CC1	120377		C490	N
C20171	C	CC1	010278		F314	N
C18300A	C	CC2	070577		P314	N
C18300B	C	CC2	070777		P314	N
C19279	C	CC2	100277		F314	N
C19693	C	CC2	111177		C490	N
C20228	C	CC2	C12178		F314	N
C20561	C	CC2	C21578		P314	T
C00233	C	FC1	C80873		ZZZZ	T
C00406	C	FC1	C81773		ZZZZ	U
C16030	C	M12	C92276		ZZZZ	N
CC2051	C	PA1	C12872		ZZZZ	U
CC2053	C	PA1	C20372		ZZZZ	U
C02040	C	PA1	C60272		ZZZZ	U
C02042*	C	PA1	C82972	04	ZZZZ	U
C02045	C	PA1	102372		ZZZZ	T
C02046	C	PA1	112672		ZZZZ	U
C00267	C	PA1	C80873		ZZZZ	U
C12586	C	PA1	C32975		ZZZZ	N
						T



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 ADDITIONAL CPE-LINER INFORMATION  
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<u>CUNTRLL</u>	<u>VENDOR</u>	<u>PLANT</u>	<u>FAIL DATE</u>	<u>FAIL NLP</u>	<u>MANUFACTURER</u>	<u>OB TIME</u>
013007	C	PA1	071375		C490	D
013074	C	PA1	072775		C490	D
013075	C	PA1	072775		C490	D
013154	C	PA1	081775		ZZZZ	N
013224	C	PA1	083075		C490	N
013239	C	PA1	090575		C490	N
014237*	C	PA1	030476	C3	C490	M
016376	C	PA1	082676		ZZZZ	D
015757A	C	PA1	082776		ZZZZ	D
045757B	C	PA1	082776		ZZZZ	D
016394	C	PA1	091376		C490	U
016710	C	PA1	010377		C490	U
016924	C	PA1	011777		C490	N
016925	C	PA1	011777		C490	N
021116	C	PA1	041578		C490	T
021115	C	PA1	042078		ZZZZ	D
014999	C	SL1	052576		C490	T
014508	C	SL1	071076		C490	N
017200	C	SL1	020477		C490	N
018060	C	SL1	052777		C490	N

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 ADDITIONAL ONE-LINER INFORMATION  
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<u>CONTROL</u>	<u>VENDOR</u>	<u>PLANT</u>	<u>FAIL DATE</u>	<u>FAIL NUP</u>	<u>MANUFACTURER</u>	<u>OB TIME</u>
C19576A	C	SL1	102877		C490	N
C19576B	C	SL1	102877		C490	N
C00512	G	BF1	100473		ZZZZ	D
C00512A	G	BF1	100473		ZZZZ	N
C15392	G	BF2	061976		G080	N
C00903*	G	BP1	032374	06	ZZZZ	U
C10032	G	BP1	033174		ZZZZ	M
C10078*	G	BP1	050474	06	ZZZZ	T
C10391A	G	BP1	060474		ZZZZ	T
C10391B	G	BP1	060574		ZZZZ	T
012197	G	BP1	011775		ZZZZ	T
C12209*	G	BP1	011875	04	ZZZZ	T
013157	G	BP1	072575		ZZZZ	D
C13723	G	BP1	111375		ZZZZ	N
C18924*	G	BP1	082377	03	G080	T
C19682	G	BP1	103077		ZZZZ	M
019725	G	BP1	111177		G080	N
C20934	G	BP1	032078		G080	N
C16935	G	BR1	C10977		G080	N
C13629	G	BR2	C92575		G080	T

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 ADDITIONAL ONE-LINER INFORMATION  
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<u>CONTROL</u>	<u>VENDOR</u>	<u>PLANT</u>	<u>FAIL DATE</u>	<u>FAIL NUM</u>	<u>MANUFACTURER</u>	<u>OB TIME</u>
C20838A	G	BR2	033178		G080	T
C20838E	G	BR2	033178		G080	T
C19583	G	CG1	092977		G080	T
C10428	G	DA1	070274		ZZZZ	N
C10517	G	DA1	071674		ZZZZ	N
C10691	G	DA1	090674		ZZZZ	M
C13158A	G	DA1	081475		ZZZZ	D
C13158B	G	DA1	081475		ZZZZ	D
C13465A	G	DA1	092975		ZZZZ	D
C13465B	G	DA1	092975		ZZZZ	D
C10290	G	DR1	041074		ZZZZ	U
C10183	G	DR1	041274		ZZZZ	D
010430A	G	DR1	070474		ZZZZ	N
010430B	G	DR1	070474		ZZZZ	N
010430C	G	DR1	070474		ZZZZ	N
C10429	G	DR1	071474		ZZZZ	N
018286	C	DR1	061577		G080	N
C00284	G	DR2	021973		ZZZZ	N
C00285	G	DR2	021973		ZZZZ	N
C00286	G	DR2	021973		ZZZZ	N

ADDITIONAL CNE-LINER INFORMATION

<u>CONTROL</u>	<u>VENDOR</u>	<u>PLANT</u>	<u>FAIL DATE</u>	<u>FAIL NUM</u>	<u>MANUFACTURER</u>	<u>OP TIME</u>
000884	G	DR2	031474		ZZZZ	T
010314	G	DR2	061574		ZZZZ	N
010751	G	DR2	102374		ZZZZ	N
010904	G	DR2	110274		ZZZZ	N
010945*	G	DR2	110274	93	ZZZZ	D
010945A	G	DR2	110274	03	ZZZZ	D
012217	G	DR2	012575		ZZZZ	M
012846*	G	DR2	061175	04	ZZZZ	T
014529	G	DR2	041376		G080	T
017177A	G	DR2	121276		G080	T
017177B	G	DR2	121276		G080	T
016907A	G	DR2	122876		G080	N
016907B	G	DR2	122876		G080	N
017515	G	DR2	040277		G080	N
017516	G	DR2	040277		G080	N
01P182	G	DR2	060577		G080	N
01F450*	G	DR2	070977	46	G080	N
018933A	G	DR2	080277		G080	T
018933B	G	DR2	080277		G080	T
019652	G	DR2	110277		G080	T

ADDITIONAL CNE-LINER INFORMATION

<u>CONTROL</u>	<u>VENDOR</u>	<u>PLANT</u>	<u>FAIL DATE</u>	<u>FAIL NUM</u>	<u>MANUFACTURER</u>	<u>OB TIME</u>
C12349*	G	DR3	030275	06	ZZZZ	T
C12343*	G	DR3	031675	08	ZZZZ	T
C12920*	G	DR3	062675	04	G080	M
CCC205	G	MI1	072473		ZZZZ	U
C16343	G	MI1	111276		G080	T
002116	G	MO1	052372		ZZZZ	D
C17363	G	MO1	022377		ZZZZ	N
CCC508*	G	NM1	112073	11	ZZZZ	D
CCC588*	G	NM1	112673	15	ZZZZ	D
017671*	G	NM1	031077	03	G080	M
C19404	G	NM1	102677		G080	D
C16763A	G	PB2	010277		G080	D
C16763B	G	PB2	010277		G080	D
C14724A	G	PB3	050876		G080	C
C14724B	G	PB3	052576		G080	D
C19091A	G	PB3	092577		G080	D
C19091P	G	PB3	092577		G080	D
C19091C	G	PB3	092577		G080	D
CCC076A	G	PI1	030973		ZZZZ	U
CCC076B	G	PI1	030973		ZZZZ	U

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 ADDITIONAL ONE-LINER INFORMATION  
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<u>CONTROL</u>	<u>VENDOR</u>	<u>PLANT</u>	<u>FAIL DATE</u>	<u>FAIL NUM</u>	<u>MANUFACTURER</u>	<u>DB TIME</u>
C17773	G	PI1	050277		G080	U
C18700	G	PI1	080677		G080	D
C00350	G	QC1	092173		ZZZZ	N
C10859	G	QC1	101174		ZZZZ	U
C12663	G	QC1	050375		ZZZZ	N
C15380	G	QC1	070976		ZZZZ	M
C00477	G	VY1	110773		ZZZZ	T
C10161	G	VY1	041474		ZZZZ	N
C14550	W	CC1	051176		W120	N
C19894	W	HN1	110377		W120	M
C18071	W	IP2	052677		W120	N
C16551	W	IP3	111876		W120	N
C10649	W	PT1	052974		ZZZZ	N
C12311A	W	RG1	030575		W120	N
C12311B	W	RG1	030575		W120	N
C12542	W	RG1	041075		W120	U
C13394	W	RG1	091775		W120	T
C14596*	W	RG1	041676	02	W120	N
C15098*	W	RG1	070476	02	W120	N
C15328*	W	RG1	080476	02	W120	N

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 ADDITIONAL CHE-LINER INFORMATION  
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<u>CONTROL</u>	<u>VENDOR</u>	<u>PLANT</u>	<u>FAIL DATE</u>	<u>FAIL NUF</u>	<u>MANUFACTURER</u>	<u>QB TIME</u>
C16644	W	RG1	121776		C720	N
C19595	W	RG1	111677		W120	N
C19596	W	RG1	111877		W120	N
CC2072*	W	RO2	062072	03	ZZZZ	U
C10293	W	RO2	052674		ZZZZ	M
C11114A	W	RO2	121174		ZZZZ	N
C11114B	W	RO2	121174		ZZZZ	N
C19342	W	RO2	042477		ZZZZ	D
C20552*	W	RO2	021776	02	W120	M
C13696	W	SU1	102575		W120	M
C18875	W	SU1	081877		C720	N
C14500*	W	TR1	040476	03	W120	N
C18906*	W	TR1	082177	13	W120	U
CC1026	W	TU3	060873		ZZZZ	U
CCC308	W	TU3	081873		ZZZZ	T
CC0283	W	TU4	081573		ZZZZ	T
CC2077	W	YR1	101872		ZZZZ	U
CC2115	W	YR1	110372		ZZZZ	M
CC0729	W	ZI2	011774		ZZZZ	L

APPENDIX E

PLANT INFORMATION



PLANT INFORMATION  
-----  
(BABCOCK & WILCOX)

CODE	PLANT	A&E	MEGA WATT RATING	CRITICAL DATE
AR1	ARKANSAS 1	BECHTEL	0850	08/06/74
CR1	CRYSTAL RIVER 2	GILBT ASSOC	0825	01/14/77
CB1	DAVIS-BESSE 1	BECHTEL	0906	09/10/77
IP1	INDIAN POINT 1	UTILITY	0265	08/02/62
OE1	OCONEE 1	CPC/BECHTEL	0887	04/19/73
OE2	OCONEE 2	DPC/BECHTEL	0887	11/11/73
OE3	OCONEE 3	DPC/BECHTEL	0887	09/05/74
RS1	RANCHO SECO	BECHTEL	0917	09/16/74
TI1	THREE MILE ISLAND 1	GILBT ASSOC	0819	06/05/74
TI2	THREE MILE ISLAND 2	BURNS&RDE	0906	03/28/78

PLANT INFORMATION  
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(COMBUSTION ENGINEERING)

CODE	PLANT	A&E	MEGA WATT RATING	CRITICAL DATE
CC1	CALVERT CLIFFS 1	BECHTEL	0845	10/07/74
CC2	CALVERT CLIFFS 2	BECHTEL	0845	11/30/76
FC1	FORT CALHOUN	GIBBS&HILL	0457	08/06/73
M12	MILLSTONE 2	BECHTEL	0830	10/17/75
MY1	MAINE YANKEE	SEW	0790	10/23/72
PA1	PALISADES	BECHTEL	0805	05/24/71
SL1	ST. LUCIE 1	EBASCO	0802	04/22/76

PLANT INFORMATION  
(GENERAL ELECTRIC)

<u>CODE</u>	<u>PLANT</u>	<u>A&amp;E</u>	<u>MEGA WATT RATING</u>	<u>CRITICAL DATE</u>
BF1	BROWNS FERRY 1	TVA	1065	08/17/73
BF2	BROWNS FERRY 2	TVA	1065	07/20/74
BF3	BROWNS FERRY 3	TVA	1065	08/08/76
BP1	BIG ROCK POINT 1	BECHTEL	0072	09/27/62
BR1	BRUNSWICK 1	UNITED ENG	0821	10/08/76
BR2	BRUNSWICK 2	UNITED ENG	0821	03/20/75
CC1	COOPER STATION	BURNS&ROE	0778	02/21/74
DA1	DUANE ARNOLD	BECHTEL	0538	03/23/74
DR1	DRESDEN 1	BECHTEL	0200	10/15/59
DR2	DRESDEN 2	SARGENT/LUN	0794	01/07/70
DR3	DRESDEN 3	SARGENT/LUN	0794	01/31/71
EN1	HATCH 1	SSI	0786	09/12/74
EN2	HATCH 2	SSI	0795	07/01/78
FP1	FITZPATRICK	SEW	0821	11/17/74
MI1	MILLSTONE 1	EBASCO	0660	10/26/70
MO1	MONTECELLO	BECHTEL	0545	12/10/70
NP1	NINE MILE POINT 1	UTILITY	0610	09/05/69
OC1	OYSTER CREEK	BURNS&ROE	0650	05/03/69
PB2	PEACH BOTTOM 2	BECHTEL	1065	09/16/73
PB3	PEACH BOTTOM 3	BECHTEL	1065	08/07/74
P11	PILGRIM 1	BECHTEL	0655	06/16/72
QC1	QUAD CITIES 1	SARGENT/LUN	0789	10/18/71
QC2	QUAD CITIES 2	SARGENT/LUN	0789	04/26/72
VY1	VERMONT YANKEE	EBASCO	0514	03/24/72

PLANT INFORMATION  
 -----  
 (WESTINGHOUSE)

CODE -----	PLANT -----	A&E ---	MEGA WATT RATING -----	CRITICAL DATE -----
BV1	BEAVER VALLEY 1	S&W	0852	05/10/76
DC1	COCK 1	AEP	1054	01/18/75
DC2	COOK 2	AEP	1060	03/17/78
HN1	HADDAM NECK	S&W	0575	07/24/67
IP2	INDIAN POINT 2	UE&C	0873	05/22/73
IP3	INDIAN POINT 3	UE&C	0873	04/06/76
JF1	FARLEY 1	BECHTEL/SSI	0829	08/09/77
KE1	KEWAUNEE	PIONEER	0535	03/07/74
NA1	NORTH ANNA 1	S&W	0934	04/05/78
PA1	PRAIRIE ISLAND 1	PIONEER	0530	12/01/73
PF2	PRAIRIE ISLAND 2	PIONEER	0530	12/17/74
PT1	POINT BEACH 1	BECHTEL	0497	11/02/70
PT2	POINT BEACH 2	BECHTEL	0497	05/30/72
RG1	GINNA	GILBERT	0490	11/08/69
RC2	ROBINSON 2	EBASCO	0700	09/20/70
SA1	SALEM 1	PSE&G	1090	12/11/76
SC1	SAN ONOFRE 1	BECHTEL	0430	06/14/67
SU1	SURRY 1	S&W	0822	07/01/72
SU2	SURRY 2	S&W	0822	03/07/73
TR1	TRICJAN	BECHTEL	1130	12/15/75
TU3	TURKEY POINT 3	BECHTEL	0693	10/20/72
TU4	TURKEY POINT 4	BECHTEL	0693	06/11/73
YR1	YANKEE-ROWE	BECHTEL	0693	06/11/73
ZI1	ZICN 1	S&W	0175	08/19/60
ZI2	ZICN 2	SARGENT/LUN	1040	06/19/73
		SARGENT/LUN	1040	12/24/73

APPENDIX F

CODES

FAILURE MODE CODES

CODE	DESCRIPTION
A	- FAILURE TO INSERT DURING NORMAL S/D
B	- FAILURE TO EJECT DURING SCRAM
C	- FAIL TO INSERT TC AT LEAST 90% DURING SCRAM
D	- ROD FAILS TO MOVE DURING POWER CHANGES/ TESTING
E	- ROD FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	- UNCOUPLED ROD/COVERTRAVEL CONDITION (BWR)
G	- IMPROPER ROD MOVEMENT
H	- EXTERNAL LEAKAGE/RUPTURE
I	- DEVICES NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
J	- MAINTENANCE REPLACEMENT REQUIRED
K	- TECHNICAL SPECIFICATION VIOLATION (NON-FAILURES)

COMPONENT CODE

CODE	DESCRIPTION
CC	- CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CODE	DESCRIPTION
B	- RECURRING COMMON CAUSE FAILURES
C	- COMMON CAUSE FAILURES
D	- RECURRING FAILURES
E	- COMMON FAILS
F	- RECURRING COMMON FAULTS

FAILURE MECHANISM CODES

CODE	DESCRIPTION
CC	- UNKNOWN
CL	- PERSONNEL (OPERATIONS)
CM	- PERSONNEL (MAINTENANCE)
CN	- PERSONNEL (TESTING)
CP	- DESIGN ERROR
CQ	- FAB/CONSTRUCTION/C.C.
CR	- PROCEDURAL DISCREPANCIES
CS	- NORMAL WEAR
CT	- EXCESSIVE WEAR
CU	- CORROSION
CV	- FOREIGN MATERIAL CONTAMINATION
CL	- EXCESSIVE VIBRATION
LN	- MOTOR FAILURE
LU	- SEAL FAILURE
LV	- TIGHTENING/LOOSE INTERNALS
LW	- CLOTH FAILURE
LX	- GASKET FAILURE
LY	- BEARING FAILURE
LZ	- FILTER/STRAINER PLUGGED
MA	- BINDING/SEIZURE
MB	- FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
MC	- CONTROL CIRCUIT FAILURE/PROBLEM
MD	- FASTENER FAILURE/PROBLEM
ME	- WELD FAILURE
MF	- LUBRICATION PROBLEM

SYSTEM CODE

CODE	DESCRIPTION
	PWR
	---
M	- REACTIVITY CONTROL SYSTEM
	BWR
	---
M	- REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	- DEMAND
T	- TIME
U	- UNKNOWN
N	- NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	- DEMAND ON COMPONENT
M	- MAINTENANCE
N	- NORMAL OPERATION/SURVEILLANCE
R	- RECORD REVIEW
T	- TESTING
U	- UNKNOWN

NSSS VENDOR CODES

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

APPENDIX G

ONE-LINER DESCRIPTION OF ALL CRDM LERS

FAILURE MODE CODES

CODE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/D
B	FAILURE TO EJECT DURING SCRAM
C	FAIL TO INSERT TO AT LEAST 90% DURING SCRAM
D	RCD FAILS TO MOVE DURING POWER CHANGES/ TESTING
E	RCD FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	CRIPPED ROD (PAR)
G	UNCOUPLED ROD/OVERTRAVEL CONDITION (BWR)
H	IMPROPER ROD MOVEMENT
I	EXTERNAL LEAKAGE/RUPTURE
J	CCES NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
K	MAINTENANCE/REPLACEMENT REQUIRED
L	TECHNICAL SPECIFICATION VIOLATION (NCR-FAILURES)

COMPONENT CODE

CODE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CODE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMON FAULT
F	RECURRING COMMON FAULTS

FAILURE MECHANISM CODES

CODE	DESCRIPTION
CC	UNKNOWN
CC01	PERSONNEL (OPERATIONS)
CC02	PERSONNEL (MAINTENANCE)
CC03	PERSONNEL (TESTING)
CC04	DESIGN ERROR
CC05	LAB./CONSTRUCTION/C.C.
CC06	PROCEDURAL DISCREPANCIES
CC07	NORMAL WEAR
CC08	EXCESSIVE WEAR
CC09	CORROSION
CC10	FOREIGN MATERIAL CONTAMINATION
CC11	EXCESSIVE VIBRATION
CC12	CRDM MOTOR FAILURE
CC13	SEAL FAILURE
CC14	TRAPPED/MISALIGNED INTERNALS
CC15	CLUTCH FAILURE
CC16	BRAKE FAILURE
CC17	BEARING FAILURE
CC18	FILTER/STRAINER PLUGGED
CC19	BINDING/SEIZURE
CC20	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
CC21	CONTROL CIRCUIT FAILURE/PROBLEM
CC22	SYSTEM FAILURE/PROBLEM
CC23	WELD FAILURE
CC24	LUBRICATION PROBLEM

SYSTEM CODE

CODE	DESCRIPTION
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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

ONE-LINER DESCRIPTION OF ALL CROM LER'S

Y	P	CONT. NO.	FAIL DATE	S.P.	FAIL CODE	Y	C	F	FAILURE MODE	FAILURE MECHANISM
B	AF1	C1C5C4	080974	M	CC	IC6	S	D	IMPROVEMENT OF ROD 7-4 CAUSED HI S/U RATE TRIP PROCEDURE FOR COND. TEST WAS INADEQUATE	
B	AF1	C12154	011475	M	CC	TC4	N		ERROR IN HOT-ZERO PWR EJECTED ROD WORTH CALC	DESIGN ERROR
B	AF1	421314*	042478	M	CD	G21	T	D	GROUP 7 CONTROL RODS DROPPED DURING PWR OPERATION	FAILURE OF A GATE DRIVE CIRCUIT
B	CR3	C16844	122276	M	CD	T03	N		TECH SPEC VIOLATION/CRO BKR CLOSED, DETECTORS COS	PERSONNEL ERROR WHILE TESTING
B	CR3	C16402	040477	M	CC	E12	P	D	ROD 6 GR 7 WOULD NOT MOVE WHEN REDUCING PWR	CROM STATOR FAILED / FUSE BLEW
B	CR3	416403	040677	M	CD	G12	P	D	IN MODE 1, ROD 3 GR 2 DROPPED INTO CORE	FAILURE OF CROM STATOR CAUSED ROD TO DROP
B	CR3	C17543	042777	M	CD	I01	S	D	ROD GROUP 6 EXCEEDED ITS INSERTION LIMIT (T.S.)	PERSONNEL ERROR(COMMAND FAULT)
B	CR3	017544*	042777	M	CD	G21	T	D	IN MODE 1, ROD GRP 1 DROPPED INTO CORE	POSSIBLE GROUNDED SHIELD TO 24VLT PRG
B	CR3	017541*	051377	M	CD	G21	T	D	IN MODE 1, CRUPL 7 DROPPED INTO CORE	POSSIBLE DESIGN ERROR,GATE DRIVE MEL.CKT.
B	CR3	017537*	060477	M	CC	E21	S	D	CRD SYS. FAILED TO POSIT. REG.RODS ON AUTO DEMAND	LOOSE CONNEX. ON CRD PROG.PRINT.CKT.CARD
B	CR3	019429*	101677	M	CC	G21	T	D	IN MODE 1,DURING TEST SP-110 GRP. 7 DROPP INTO CORE	RANDOM INTERMITTENT POWER INTERRUPTIONS
B	CR3	026781	030678	M	CC	L00	U		17 LOOSE PARTS IDENT AS COUPL66SPID ASSEM ROD B-47	CAUSE OF LOOSE PARTS UNDETERMINED
B	IP1	022093	032272	M	CC	E00	S	U	ROD 12 STUCK AT 19 INCH POSITION FOLLOWING SCRAM	CAUSE UNKNOWN
B	IP1	022312	040872	M	CD	E14	R	T	ROD 13 FAILED TO MOVE DURING WITHDRAWL FOR INSPEC.	EMBRITTLLED SHAFT CONNECTING PIN BROKE
B	IP1	022096	061772	M	CC	D14	R	T	ROD 14 STUCK 36 INCHES OUT OF THE CORE ON SCRAM	EMBRITTLLED SPIRAL PIN CONNECT. SEAL SHAFT
B	IP1	022010	123072	M	CD	B00	F	U	ROD 20 REMAINED AT 36*5 INCH POST.DURING ROD INSEN	CAUSE NOT DETERMINED
B	IP1	022327	123072	M	CC	B00	F	U	ROD 20 WOULD NOT INSERT COMPLETELY DURING TEST	CAUSE NOT DETERMINED
B	IP1	026600	020674	M	CC	B05	B	D	ROD 6 GR A DID NOT INSERT DURING A FAST INSERTION	ID TAGS PUT ON TOO TIGHT/OPEN MTR WINDINGS
B	IP1	010329	070774	M	CC	B05	B	D	ROD 16 GR A DID NOT INSERT DURING A FAST INSERTION	ID TAGS PUT ON TOO TIGHT/OPEN MTR WINDINGS
B	CE1	026417	100573	M	CC	I01	S	D	TECH SPEC ROD WITHDRAWL LIMITS WERE EXCEEDED	PERSONNEL ERROR



ONE-LINER DESCRIPTION OF ALL CROM LER'S

VE N	P L A N T	CCN1-NO.	FAIL DATE	S Y M S	C E M S P	FAIL CODE	T Y P E	C L A S S	F A I L V	FAILURE MODE	FAILURE MECHANISM
B	CE1	012286	010375	M	CD	IO6	S	D		RODS WERE MOVED WITHOUT CALCULATING Q POWER WORTH	VENDOR/PERSONNEL PROCEDURES PROBLEM
B	CE2	012293	011575	M	CD	*C1	S	D		IMPROPER ROD MOVEMENT CAUSED OVERLAP PROBLEM	PERSONNEL ERROR
B	CE2	013202*	082575	M	CD	G00	S	D	09	GR7 RODS DROPPED CAUSING LOSS OF REQUIRED OVERLAP	NO PROBLEM FOUND/PROBABLE COMMAND FAULT
B	CE2	014813	022676	M	CD	G04	R	T		DROPPED CONT.ROD CAUSED RX.QUAD.TILT TO EX.TECH SP	SHRT. DUE TO DETER EPOXY IN STAT.WNDGS.
B	CE2	020194	122977	M	CD	G12	R	T		CR4GR6 DROPPED WHILE BEING WITHDRAWN	SHRT. DUE TO O-RING FAIL., IN STAT.WNDGS.
B	CE2	020865*	030178	M	CD	G21	S	D	12	CONTROL ROD GROUP 5 DROPPED DURING PERFORM. TEST	MOMENTARY LOSS OF POWER, REASON UNKNOWN
B	CE3	012498	020975	M	CD	IO1	S	D		IMPROPER ROD MOVEMENT CAUSED OVERLAP PROBLEM	PERSONNEL ERROR/WRONG ROD POS MONITORED
B	CE3	014818*	042276	M	CD	G21	T	D	09	GROUP 7 RODS DROPPED AT 95% POWER	A FAILED GATE DRIVE CIRCUIT
B	CE3	015010*	060976	M	CD	G21	T	D	09	GROUP 7 RODS DROPPED	TWO PWR. SUPPLIES FAILED (FUSE, TRANSISTOR)
B	CE3	020641	021078	M	CD	G12	R	T		CR3GR4 DROPPED DURING 20% RPS BREAKER TEST	SHRT. DUE TO O-RING FAIL., IN STAT.WNDGS.
B	RS1	016011	100776	M	CD	IO1	S	D		RODS IN POSITION TO GIVE 41% DELTA K/K SHUTDOWN	PERSONNEL ERROR DURING COLD SHUTDOWN
B	RS1	016013	042277	M	CD	TC2	N			TECH SPEC VIOLATION/VERIFICATION CHECKS NOT DONE--	--ON COMPLETION OF MAINT//PERSONNEL ERROR
B	TI1	012144	021075	M	CD	IO1	S	D		OPERATED WITH ROD 6/6 LOWER THAN REST OF GROUP 6	PERSONNEL ERROR
B	TI1	013557	102175	M	CD	TC3	N			TECH SPEC VIOLATION/TEST NOT PERFORMED PROPERLY	PERSONNEL ERROR
B	TI1	013844*	111275	M	CD	G12	U			ROD 4 OF GR 7 DROPPED INTO CORE DURING FULL PWR OP	FAILED STATOR WNDG CAUSED ROD 4 TO DROP
B	TI1	013848*	111275	M	CD	K00	U			ROD 5 OF GR7 MISALIGNED MORE THAN 9 IN., INOPERABLE	NO CAUSE STATED FOR FAILURE
B	TI1	013735	111475	M	CD	J02	S	D		VENT FOUND OPEN ON CROM/GAS VENTED TO RX BUILDING	PERSONNEL ERROR/FAILED TO FOLLOW PROCED.
C	CC1	016741	121276	M	CD	G00	A	U		ROD 27 SLIPPED TO 77 INCH. DURING MOVEMENT TESTS	UNDETERMINED ( SEE LER 019689 )
C	CC1	017710	042277	M	CD	G00	R	U		ROD 34 SLIPPED TO 34 INCH. DURING MOVEMENT TESTS	UNDETERMINED ( SEE LER 019689 )
C	CC1	019689*	111277	M	CD	G21	T	D		WHILE AT 55 PWR AT 2104AM CIA 54 DROP TO FULL-IN	15-VLT PWR.SUP.IN COIL PWR.PROG.DRIFT LOW

ONE-LINER DESCRIPTION OF ALL CROM LER'S

PLANT	YR	QNT. NO.	FAIL DATE	SYM	CD	FAIL CODE	FAILURE MODE	FAILURE MECHANISM
C	CC1	0196896	111277	M	CD	G21	WHILE AT SS FWR AT 11114M CEA 54 DROP, TO FULL-IN	15-VLT PWR. SUP. IN COIL PWR. PROG. DRIFT LOW
C	CC1	015781	120377	M	CC	G00	RCD 1 DROPPED WHILE PULLING GROUP 5	UNKNOWN
C	CC1	026171	010278	M	CD	G21	WHILE AT SS PWR CEA 32 DROPPED TO FULLY INSERTED	CEA 15-VLT PWR. SUP. FAILED
C	CC2	018300A	070577	M	CD	G21	WHILE OPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTENT FAIL. OF 15VDC POWER SUPPLY
C	CC2	018300R	070777	M	CD	G21	WHILE OPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTENT FAIL. OF 15VDC POWER SUPPLY
C	CC2	015279	100277	M	CD	G21	DURING FULL PWR. OPS. CEA 37 DROPPED TO FULLY INS.	15 VLT PWR SUPPLY FAILED LOW
C	CC2	015653	111177	M	CD	E21	CEA 36 WOULD NOT MOVE THEN DROPPED WHILE AT SS PWR	DEFECT. TIMER MOD. IN COIL PWR PROGRAMMER
C	CC2	020228	012178	M	CD	G00	RCD 1 DROPPED DURING POWER REDUCTION	UNKNOWN
C	CC2	020261	021578	M	CD	G00	RCD 33 DROPPED DURING MONTHLY EXER. TESTS	UNKNOWN
C	FC1	000233	080673	M	CD	I06	R005 WITHDRAWN WHICH REDUCED S/D MARGIN TO < 2.4	PROCEDURE BASED ON WRONG R00 WORTH CURVES
C	FC1	000466	081773	M	CD	G15	CEA 35 DROPPED TO ITS LOWER HARD STOP	CLUTCH COIL FAILED
C	PI2	016030	092276	M	CD	G21	DURING CEA PARALLEL OPS. CEA 49 DROPPED INTO CORE	BLOWN FUSE IN PARALLELING CIRCUIT
C	PA1	002051	012872	M	CD	E16	RCC 35 COULD NOT BE WITHDRAWN BEYOND 107.2 INCHES	IMPROP. OPER. OF MTR PACKAGE BRAKE
C	PA1	002053	020372	M	CD	J05	STEAM LEAK THROUGH DRIVE PACKAGE OF CROM NO. 17	IMPROPER ASSEM. OF FLANGE CAUSED SEAL FAIL
C	PA1	002040	060272	M	CD	D15	RCD 5 DID NOT DROP INTO CORE ON DIFF. SCRAM SIG.	DEFECTIVE CLUTCH ASSEMBLY
C	PA1	002042*	082972	M	CD	D24	R004 4 R005 FAILED TO DRCP DURING CROM TRIP TESTING	DEGRADATION OF LUB. ON SPLINE SURFACES
C	PA1	002045	102372	M	CD	J22	PRI. WATER LEAKAGE THROUGH SEAL ON CROM NO. 19	LOOSE SET SCREW DAMAGED SEAL ASSEMBLY
C	PA1	002046	112672	M	CD	E16	R00 26 COULD NOT BE WITHDRAWN TO FULL OUT POSITION	SHORT IN MOTOR BRAKE WIRE
C	PA1	000267	080673	M	CD	G15	R00 9 WAS FULLY INSERTED WHEN REQUIRED TO BE WITHDR	SHORT IN CLUTCH COIL CAUSE RCD9 TO INSERT
C	PA1	012556	032975	M	CD	D00	R0030 FAILED TO DROP DURING CROM TOR. ER00 DRP TEST	CAUSE UNDER INVESTIGATION

ONE-LINER DESCRIPTION OF ALL CRDM LER'S

<u>V E N</u>	<u>P L A N T</u>	<u>C N T . N U .</u>	<u>F A I L</u> <u>D A T E</u>	<u>S Y S</u>	<u>C O M P</u>	<u>F A I L</u> <u>C O D E</u>	<u>T Y P E</u>	<u>C L A S S</u>	<u>F A I L</u> <u>N O</u>	<u>F A I L U R E</u> <u>M O D E</u>	<u>F A I L U R E</u> <u>M E C H A N I S M</u>
C	PA1	013007	071375	M	CD	B16	U			ROD37 WOULD NOT INSERT DURING ROD EXERCISING	ROT. ELEMENT OF BRAKE ASSEM. WAS LOOSE
C	PA1	013074	072775	M	CD	E16	R	T		CRDM14 WOULD NOT INSERT OR WITHDRAW	BRAKE LINING PARTICLES BETWEEN COIL&SHAFT
C	PA1	013075	072775	M	CD	E16	R	T		CRDM33 COULD WITHDRAW BUT WOULD NOT INSERT	BRAKE LINING PARTICLES BETWEEN COIL&SHAFT
C	PA1	013154	081775	M	CD	G15	R	U		ROD19 DROPPED INTO CORE DURING STEADY STATE OPER.	SHORT IN CLUTCH COIL CAUSED ROD19 TO DROP
C	PA1	013224	083075	M	CD	G15	R	U		ROD11 DROPPED INTO CORE DURING 80% PWR. OPERATION	SHORT IN CLUTCH COIL CAUSED ROD11 TO DROP
C	PA1	013239	090575	M	CD	G15	R	U		ROD16 DROPPED INTO CORE DURING 80% PWR. OPERATION	SHORT IN CLUTCH COIL CAUSED ROD16 TO DROP
C	PA1	014237*	030476	M	CD	L17	C	T	03	SEVERAL CRDM INNER CLUTCH BEARINGS FOUND FAILED	BEARING FAILURES DUE TO OVERHEATING
C	PA1	016376	082676	M	CD	E16	K	U		CRDM39 FAILED TO WITHDRAW DURING PWR ESCALATION	MOTOR/BRAKE ASSEMBLY PROBLEMS
C	PA1	015757A	082776	M	CD	E16	K	U		ROD 37 FAILED TO MOVE WITH ITS GROUP	MOTOR/BRAKE ASSEMBLY PROBLEMS
C	PA1	015757b	082776	M	CD	E16	K	U		ROD 37 FAILED TO MOVE WITH ITS GROUP	MOTOR/BRAKE ASSEMBLY PROBLEMS
C	PA1	016354	091376	M	CD	J13	K	U		ROD 13 DECLARED INOPERABLE DUE TO LEAKAGE	SEAL FAILURE
C	PA1	016710	010377	M	CD	J13	R	U		ROD 4 DECLARED INOPERABLE DUE TO LEAKAGE	SEAL FAILURE
C	PA1	016924	011777	M	CD	I01	T	D		IMPROPER ROD MOVEMENT CAUSED DISPLACEMENT PROBLEM	PERSONNEL ERROR/FAILED TO SELECT AUTO
C	PA1	016925	011777	M	CD	I01	T	D		IMPROPER ROD MOVEMENT CAUSED DISPLACEMENT PROBLEM	PERSONNEL ERROR/WRONG SWITCH POSITION
C	PA1	021116	041578	M	CD	I03	S	D		IMPROPER ROD MOVEMENT/OUT-OF-SEQUENCE PROBLEM	PERSONNEL ERROR
C	PA1	021115	042078	M	CD	E16	R	U		CRDM 38 BECAME MISALIGNED DURING PWR ESCALATION	MOTOR/BRAKE ASSEMBLY PROBLEMS
C	SL1	014999	052576	M	CD	E21	S	D		REGULATING RCD 59 IMPROVABLE BECAUSE OF CEA MOD.PAL	FAILURE IN RAISE/LOWER CKT OF THE MODULE
C	SL1	01550F	071076	M	CD	G21	T	D		CEA 50 DROPPED WITH RX. CRIT. AT 0.01% PWR.	FAILURE OF 15 VOLT POWER SUPPLY
C	SL1	017200	020477	M	CD	G00	R	U		CEA #50 DROPPED WHILE AT POWER	THE CAUSE IS UNKNOWN
C	SL1	01E060	052777	M	CD	G21	T	D		CEA 39 DROPPED WITH PLANT OPERATING AT POWER	FAULTY INSERTION TIMER

ONE-LINE DESCRIPTION OF ALL CRDM LER'S

PLANT	CONT. NO.	FAIL DATE	SYSTEM	COMPONENT	FAIL CODE	TYPE	CLASS	FALB	FAILURE MODE	FAILURE MECHANISM
C SL1	C19576A	102877	M	CD	G00	R	U		CEA #56 DROPPED FOR NO APPARENT REASON	CAUSE UNKNOWN, POSS. PROB. PWR. SUP. 6TIME MOD
C SL1	C19576B	102877	M	CD	G00	R	U		CEA #56 DROPPED FOR NO APPARENT REASON	CAUSE UNKNOWN, POSS. PROB. PWR. SUP. 6TIME MOD
G BF1	000512	100473	M	CD	F18		T		ROD 26-55 DRIVE FAILED TO INSERT WHILE AT POWER	ROD DRIVE SYS HAD A DIRTY STRAINER
G BF1	000512A	100473	M	CD	D20	S	D		ROD 54-27 WAS VALVED OUT WHILE FULLY WITHDRAWN	NO SUPPLY AVAILABLE TO SCRAM ROD (PERSONL)
G EF2	015392	061976	M	CD	D20	S	D		ROD 30-31 INCAPABLE OF SCRAM/HCU VALVES SHUT	COMMAND FAULT/PERSONNEL ERROR
C BP1	000903*	032374	M	CD	K00	B	U	06	6 CRDM WITHDRAWAL TINES WERE LESS THAN TECH. SPEC.	CAUSE UNDER INVESTIGATION
G BP1	010032	033174	M	CD	L08	R	T		DURING INSPEC ROD ROLLER MISSING, ROD BLADE C-D	EXCESSIVE WEAR OF SOFT PINS
C BP1	010076*	050474	M	CD	K00	B	U	06	6 CRDM WITHDRAWAL TINES WERE LESS THAN TECH. SPEC.	UNKNOWN/POSSIBLE DESIGN DEFICIENCY
G BP1	010391A	060474	M	CD	F10	K	T		ROD C4 FAILED TO MOVE DURING PRE-STARTUP TEST	ROD BLADE ROLLER WEDGED IN DIXIE CUP
G BP1	010391B	060574	M	CD	F10	K	T		ROD B5 WOULD NOT MOVE FROM FULL INSERTED	BOLT OR CAP SCREW WEDGED IN DIXIE CUP
G BP1	012197	011775	M	CD	F10	R	T		SEMI-ANL CRD TEST - ROD B4 STUCK FULLY INSERTED	1-INCH BOLT WITH NUT LODGED IN THIMBLE
G BP1	012209*	011875	M	CD	K00	B	U	04	4 CRDM WITHDRAWAL TINES WERE LESS THAN TECH. SPEC.	CAUSE UNKNOWN
G BP1	013157	072575	M	CD	F10	R	T		ROD E4 WOULD NOT WITHDRAW PROPERLY	POSSIBLY LODGED BY SMALL OBJECT IN INTERN
G BP1	013723	111375	M	CD	D01	S	D		ROD INCAPABLE OF SCRAM/ACCUMULATOR VALVED OUT	PERSONNEL ERROR (INSTRUCTIONS REVISED)
G BP1	016924*	062377	M	CD	K00	B	U	03	3 CRDM WITHDRAWAL TINES WERE LESS THAN TECH. SPEC.	CAUSE UNKNOWN
G BP1	016662	103077	M	CD	T06		N		MODE SW LEFT IN RUN WITH ROD DRIVE REMOVAL/T.S.	MAINT PROCEDURE REVISED
G BP1	019725	111177	M	CD	E00	R	U		UNABLE TO WITHDRAW ROD B4 FROM POS 5 TO 6	UNKNOWN/POSSIBLY A FOREIGN OBJ. BINDING IT
G BP1	020934	032078	M	CD	J13		T		LEAKAGE FROM ROD F3 DRIVE FLANGE	O-RING SEAL FAILURE
G ER1	016935	010977	M	CD	I01	S	D		OPERATOR PULLED RODS TO NOTCH 48 INSTEAD OF 24	PERSONNEL ERROR/MINIMIZER FAILED TO BLOCK
G BR2	013629	052575	M	CD	H1P		T		ROD 26-07 DRIFT FROM FULL INSERT TO FULL WITHDRAW	FOREIGN MATTER IN CRD COLLET PISTON AREA

ONE-LINER DESCRIPTION OF ALL CRDM LER'S

<u>V</u>	<u>E</u>	<u>N</u>	<u>P</u>	<u>L</u>	<u>A</u>	<u>N</u>	<u>T</u>	<u>C</u>	<u>O</u>	<u>N</u>	<u>T</u>	<u>C</u>	<u>F</u>	<u>A</u>	<u>I</u>	<u>L</u>	<u>B</u>	<u>F</u>	<u>A</u>	<u>I</u>	<u>L</u>	<u>M</u>	<u>O</u>	<u>D</u>	<u>E</u>	<u>M</u>	<u>E</u>	<u>C</u>	<u>H</u>	<u>A</u>	<u>N</u>	<u>I</u>	<u>S</u>			
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G	BR2	C2C82PA	033178	M	CD	H18	C	D																												
G	BR2	C2C82PB	033178	M	CD	H18	C	D																												
G	CO1	019583	092977	M	CD	H02	C	D																												
G	DA1	010428	070274	M	CD	IC0	T	D																												
G	DA1	010517	071874	M	CD	IC0	T	D																												
G	DA1	010691	090874	M	CD	I21	T	D																												
G	DA1	013158A	081475	M	CD	C13	B	U																												
G	DA1	013158B	081475	M	CD	C13	B	U																												
G	DA1	013465A	092975	M	CD	C13	B	U																												
G	DA1	013465B	092975	M	CD	C13	B	U																												
G	DR1	010290	041074	M	CD	F22		U																												
G	DR1	010183	041274	M	CD	F10		T																												
G	DR1	010430A	070474	M	CD	H00	B	U																												
G	DR1	010430B	070474	M	CD	H00	B	U																												
C	DR1	010430C	070474	M	CD	H00	B	U																												
G	DR1	010429	071474	M	CD	H00	B	U																												
C	DR1	018286	061577	M	CD	B10		I																												
G	DR2	000284	021973	M	CD	H02	B	D																												
G	DR2	000285	021973	M	CD	H02	B	D																												
G	DR2	000286	021973	M	CD	H02	B	D																												

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 ONE-LINER DESCRIPTION OF ALL CRDM LER'S  
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VEN	FLANT	CONT. NO.	FAIL DATE	SY	CONF	FAIL CODE	TYPE	CLASS	FAIL #	FAILURE MODE	FAILURE MECHANISM
G DR2	000884	J31474	M CD	HCC	R U					CRD B-11 UNCOUPLED DURING SCRAM TEST	TO BE DETERMINED
G DR2	C10314	J61574	M CD	HCC	R U					CRD L-9 UNCOUPLED WHILE BEING WITHDRAWN	FAILURE MECHANISM NOT KNOWN
G DR2	C10751	102374	M CD	H00	R U					CRD P-12 UNCOUPLED WHILE BEING WITHDRAWN	FAILURE MECHANISM NOT KNOWN
G DR2	C10904	110274	F CD	HCC	R U					CRD N-10 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	FAILURE MECHANISM NOT KNOWN
G DR2	C10945*	110274	M CD	C13	C L	93				93 RODS INSERTED TO POS.02 FOLLOWING SCRAM	PROB. CAUSE EXCES. LEAK. PAST SEALS OF CRD
G DR2	C10945*	110274	F CD	D13	C U	03				3 CRDS FAILED TO GO TO POS 02 OR BELOW ON SCRAM	PROBABLE EXCESSIVE LEAKAGE PAST SEALS
G DR2	C12217	01257*	F CD	IC4	S D					2 ADJ CONTROL RODS WITHDRAWN DURING REFUELING	DEFECTIVE TEMPORARY PROCEDURE
G DR2	C12846*	061175	M CD	K20	S D	04				DURING SCRAM TEST, 4 DRVS. DID NOT MEET 5% SCR. TIM.	HIGH PRESS. IN SCRAM VLV. HEADER
G DR2	C14129	041376	M CD	IG3	T D					RODS EXERCISED/WX VESSEL OPEN/PERSONNEL IN AREA	PERSONNEL FAILED TO EVACUATE AREA
G DR2	C17177A	121276	F CD	H1F	B L					CRD F-5 UNCOUPLED FOLLOWING 50% CORE SCRAM TESTING	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	C17177B	121276	M CD	H1P	B L					CRD F-5 UNCOUPLED FOLLOWING SCRAM & WITHDRAWL	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	C16907A	122876	M CD	H1F	B U					CRD J-11 UNCOUPLED DURING ROUTINE S/U AT POS.48	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	C16907B	122876	F CD	H1P	B U					CRD J-11 UNCOUPLED AFTER INSERT.&WITHDRAW.TC POS.48	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	017515	040277	M CD	H1B	B U					CRD L-5 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	017516	040277	M CD	H1P	B U					CRD H-8 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	018182	060577	F CD	H1B	B L					CRD L-5 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	018450*	070977	M CD	C13	C U	46				46 CRDS FAILED TO FULLY INSERT FOLLOWING A SCRAM	WORN OR DETERIORATED STOP PISTON SEALS
G DR2	018933A	080277	M CD	H1B	B L					CRD F-5 UNCOUPLED WHEN WITHDRAWN AFTER SCRAM TEST	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	018933B	080277	M CD	H1B	B L					CRD H-7 UNCOUPLED WHEN WITHDRAWN AFTER SCRAM TEST	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	019652	110277	F CD	H1B	B U					CRD H-5 UNCOUPLED DURING FUNCTIONAL TEST	LOOSEMED INNER FILTER CAUSED UNCOUPLING

ONE-LINER DESCRIPTION OF ALL GROM LER'S

VEN	PLANT	CONT. NO.	FAIL DATE	SYS	CCM P	FAIL CODE	TYPE	CLASS	F	L	B	FAILURE MODE		FAILURE MECHANISM	
G DB3	C12349*	030275	M	CD	K13	C	U	06				DURING CRD SCRM TST 6 CRDS FAIL. 5% & 20% INSERT TIME	DETERIORATION OF CRD DRIVE SEALS		
G DB3	C12343*	031675	M	CD	K13	C	U	08				DURING CRD SCRM TST 8 CRDS INSERT TIME EXC. TECH. SP	DETERIORATION OF CRD DRIVE SEALS		
G DB3	C12920*	062675	M	CD	L00	C	U	04				CRACKS IN COLLET HOLDING OF 4 CRDS FOUND PERF. MAINT	CAUSE NOT DEFINITELY DETERMINED		
G MI1	000205	072473	M	CD	H00		U					CONT. ROD 18-35 WENT TO OVERTRAVEL POSITION	PROB. POSSIBLY DUE TO COUPLING "PUD		
G MI1	016343	111276	M	CD	I03	S	D					IMPROPER ROD MOVEMENTS CAUSED INADVERTANT CRITICAL	PERSONNEL SELECTED WRONG RODS DURING TEST		
G MO1	002116	052372	M	CD	D13		U					1 CONT. ROD DID NOT FULLY INSERT DURING SCRAM	EXCESS LEAK. ACROSS STOP PISTON SEALS		
G MO1	017363	022377	M	CD	I06	S	D					IMPROPER ROD MOVEMENT RESULTED IN HIGH SUR SCRAM	DEFECTIVE PROCEDURES ON START-UP ROD SEQ.		
G NM1	000508*	112073	M	CD	C13	B	U	11	11			CONT. RODS DID NOT FULLY INSERT DURING SCRAM	EXCESS LEAK. ACROSS STOP PISTON SEALS		
G NM1	000568*	112673	M	CD	C13	B	U	15	15			CONT. RODS DID NOT FULLY INSERT DURING SCRAM	EXCESS LEAK. ACROSS STOP PISTON SEALS		
G NM1	017671*	031077	M	CD	L00	C	U	03				FOUND LINEAR INDICAT. ON 3 COLLET RETAINER TUBES	CAUSE UNDER INVESTIGATION		
G NM1	019404	102677	M	CD	DC2	S	D					CRD 26-51 FAILED TO INSERT WHEN RX WAS SCRAMMED	ACCUM. FOR CRD HAD IMPROP. VLV LINEUP		
G PB2	C16763A	010277	M	CD	C00	R	L					ROD 30-27 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED		
G PB2	C16763B	010277	M	CD	C00	R	U					ROD 54-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED		
G PB3	C14724*	050876	M	CD	D00	R	U					ROD 10-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED		
G PB3	C14724*	052576	M	CD	D00	R	L					ROD 10-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED		
G PB3	C19091A	092577	M	CD	LC1	S	D					ROD 02-27 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES		
G PB3	C19091B	092577	M	CD	CG1	S	D					ROD 14-15 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES		
G PB3	C19091C	092577	M	CD	DC1	S	D					ROD 18-03 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES		
G PI1	000076A	030973	M	CD	I20	S	D					ROD 34-15 MOVED FROM 6IN. WITHDRAWN TO FULL-IN	MOVE. DUE TO HI. PRES. IN COOL. WTR. LINE		
G PI1	000076B	030973	M	CD	K05		D					ROD 34-15 INTERFERE WITH FUEL ELE. CHN. 1" FR. FULL-IN	UNCHAMFERED EDGE INTERFERES WITH FUEL CHN.		

ONE-LINER DESCRIPTION OF ALL CROM LER'S

VEN	PLANT	CONT. NO.	FAIL DATE	SY	COMP	FAIL CODE	TYPE	CLASS	FAILURE	FAILURE MODE	FAILURE MECHANISM
G	PI1	C17773	050277	M	CD	H00	L			ROD 48-29 WAS WITHDRAWN BEYOND THE FULL OUT POSIT.	CAUSE UNDER INVEST. NEW LER TO BE SUBMIT.
G	PI1	C18700	080677	M	CD	D00	L			ROD 34-11 REMAINED FULL OUT WHEN RX WAS SCRAMMED	CAUSE UNDER INVEST. NEW LER TO BE SUBMIT.
G	CC1	000350	092173	M	CD	I01	S	D		IMPROPER ROD MOVEMENT/HEAT GENERATION RATE EXCEED	PERSONNEL ERROR/WRONG ROD SELECTED
G	CC1	010859	101174	M	CD	F13	D			ROD N-11 JUMPED FULLY INSERTED	FAIL. CAUSED BY BROKEN SEAL ON STOP PISTN
G	CC1	C12863	050375	M	CD	I06	S	D		IMPROPER ROD WITHDRAWAL DURING REFUELING	INADEQUATE PROCEDURES
G	CC1	019380	070978	M	CD	I01	S	D		IMPROPER ROD MOVEMENT/2 PULLED SIMULTANEDUSLY	PERSONNEL ERROR
G	VY1	C00477	110773	M	CD	I03	S	D		IMPROPER ROD MOVEMENT CAUSED INADVERTAN CRITICALTY	PERSONNEL ERRORS/INTERLOCKS JUMPERED/TOOT
G	VY1	C10161	041474	M	CD	T01	M			TECH SPEC VIOLATION/FAILED TO EXERCISE RODS	PERSONNEL ERROR/OVERSIGHT ON WEEKLY TEST
W	DC1	C14550	051176	M	CD	K15	R	L		1 OR 2 ROD FINGERS STUCK / SEPARATED FROM SPIDER	ROD FINGERS BROKE WHEN FREEING RCCA E-3
W	HN1	019854	110377	M	CD	L23	P	L		RCC SPIDER ASSEMBLY VANE FOUND SEPAR FROM RCC HLB	CAUSED BY FAULTY BRAZE JOINT
W	IP2	C18071	052677	M	CD	G00	U			ROD F-2 BANK D DROPPED DURING STARTUP	CAUSE UNKNOWN
W	IP3	C18551	111876	M	CD	E00	L			ROD D-8 BANK B BECAME MISALIGNED DURING NORMAL OPS	CAUSE UNKNOWN
W	PI1	C10849	052974	M	CD	I01	S	D		IMPROPER ROD MOVEMENT/PART-LENGTH RODS INSERTED TO	--82X //PERSONNEL ERROR
W	RG1	C12311A	030575	M	CD	G21	T	D		B BANK GR2 RCC G5 DROPPED	WTR IN CAB GRND CONT PWR FOR STATN GRIP.
W	RG1	C12311B	030575	M	CD	G21	T	D		B BANK GR2 RCC G-9 DROPPED	WTR IN CAB. GRND CONT.PWR.FOR STATN GRIP.
W	RG1	C12542	041075	M	CD	J05	S	D		LEAK IN CANPY SEC K-7 CAP ON CRD ROD TRAVL HOUSING	CAUSED BY IMPR.TORQ&MACH.DEFECT IN CAP
W	RG1	C13354	051775	M	CD	E21	S	D		ROD G-5 BANK B DID NOT MOVE WITH BANK DURING TEST	OPEN CNT IN CABLE OR COIL. G-5 LIFT COIL
W	RG1	01456*	041876	M	CD	G21	T	D	02	B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	FAILURE OF 4 P.C. CARDS POSSIBLE CAUSE
W	RG1	015098*	070476	M	CD	G21	T	D	02	B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	STATIONARY COIL CIRCUITRY FAILURE
W	RG1	015328*	080476	M	CD	G21	T	D	02	E BANK GROUP 2 RODS G-3 AND G-11 PARTIALLY DROPPED	STATIONARY COIL CIRCUITRY FAILURE



ONE-LINER DESCRIPTION OF ALL CRDM LER'S

PLANT	CONT. NO.	FAIL DATE	SYS	COMP	FAIL CODE	TYPE	CLASS	FAIL	FAILURE MODE	FAILURE MECHANISM
W RG1	C18644	121776	M	CD	G21	T	D		ROD F-12 DROPPED DURING OPER. AT REDUCED LOAD	FAILURE OF STATIONARY HOLD COIL CIRCUITRY
W RG1	C19599	111677	M	CD	E21	T	D		RCD CONTROL URGENT FAIL. ROD STOP ALARM LIT	RANDOM FAILURE OF 2 DEFECTIVE P.C. CARDS
W RG1	C19596	111877	M	CD	F21	T	D		RCD CONTROL URGENT FAILURE ROD ALARM LIT	STATIONARY REGULAT. FAIL. IN 1BD PWR.CAB.
W RC2	CC2072*	062072	M	CD	G21	S	D	03	3 RODS (BANK D-GROUP 2) DROPPED INTO THE CORE	MULTIPLEXING THYRISTOR FAILURE PWR CAB2BD
W RD2	010293	052674	M	CD	I02	S	D		KCC ASSEMBLY INADVERTANTLY REMOVED DURING REFUEL	PERSONNEL ERROR
W RC2	C11114A	121174	M	CD	K00		U		PART LENGTH ROD CONT. SYS FAILED WHILE AT POWER	CAUSE OF FAILURE NOT STATED
W RC2	C11114B	121174	M	CD	I06	S	D		RODS NOT INSERTED(S/D) WHEN PART-LENGTH ROD INOPER	PROCEDURES HAD 5 PARAGRAPHS DELETED
W RD2	019342	042477	M	CD	000		U		RCD N-9 DID NOT INSERT ON REACTOR TRIP	CAUSE IS UNKNOWN
W RC2	020152*	021776	M	CD	J23	T	D	02	PINHOLE LEAKS ON 2 SEAL WELDS (D-4 AND G-7)	APPARENTLY THE RESULT OF WELD DEGRADATION
W SU1	C13696	102575	M	CD	L02		D		INADVERT. BENT CRD SHAFT DURING CRANE OPERATION	PERSONNEL ERROR
W SU1	C1867*	081877	M	CD	G21	S	D		ROD J-13(SHUTDOWN BANK A)DROPPED DURING NORM. OPER	LOSS OF PWR TO STATION. GRIP COIL OF CRDM
W TR1	C14500*	040476	M	CD	K21	T	D	03	ALL DIGITAL RCD POSITION INDIC. WAS LOST, 3 TIMES	FAILURES OF ELEC.COMP. DUE TO OVERHEATING
W TR1	C18906*	082177	M	CD	E21	S	D	13	LOSS OF ROD CONTROL AFFECTING 13 OF PLANTS 53 RODS	FAILURE OF SUPERVISORY BUFFER MEM. CARD
W TU3	CC1026	060873	M	CD	000	R	U		RCC H-8 STUCK AT 225 STEPS AFTER ROD DROP SIGNAL	NO CAUSE DETERMINED
W TU3	CC0308	081873	M	CD	000	R	U		RCC J-5 FAILED TO DROP AFTER RX TRIP BRKRS OPENED	NO CAUSE DETERMINED
W TU4	CC0283	081573	M	CD	I03	S	D		RCD TEST CONDUCTED WHICH TECH SPECS DONT ALLOW	PERSONNEL ERROR
W YR1	CC2077	101872	M	CD	000		U		RCD 19 FAILED TO DROP COMPLETELY INTO THE CORE	REASON NOT KNOWN
W YP1	CC2115	110372	M	CD	L22		U		UNABLE TO REINSERT ROD 5-18 AFTER INSPECTION	MISALIGN. SHRD.TUBE & SHRD.TUBE BOLT
W Z12	CC0729	011774	M	CD	J23		U		LEAK.BETWN CRD LATCH HOUSNG & ROD TRVL HOUSN CRDM14	CRACK IN CANOPY SEAL WELD BETWN HOUSINGS

APPENDIX H

ONE-LINERS ATTRIBUTED TO PERSONNEL (OPERATIONS)

FAILURE MODE CODES

CCDE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/C
B	FAILURE TO BOTTOM DURING SCRAM
C	FAIL TO INSERT AT LEAST 90% DURING SCRAM
D	RCD FAILS TO MOVE DURING POWER CHANGES/TESTING
F	RCD FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
G	CRIPPED ROD (PWR)
H	UNCOUPLED ROD/COVER TRAVEL CONDITION (BWR)
I	IMPROPER ROD MOVEMENT
J	EXTERNAL LEAKAGE/RUPTURE
K	ROD NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
L	MAINTENANCE REPLACEMENT REQUIRED
M	TECHNICAL SPECIFICATION VIOLATION (NON-FAILURE)

COMPONENT CODE

CCDE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CCDE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMAND FAULT
F	RECURRING COMMAND FAULTS

FAILURE MECHANISM CODES

CCDE	DESCRIPTION
CC	UNKNOWN
C1	PERSONNEL (OPERATIONS)
C2	PERSONNEL (MAINTENANCE)
C3	PERSONNEL (TESTING)
C4	DESIGN ERROR
C5	LAB/CONSTRUCTION/C.C.
C6	PROCEDURAL DISCREPANCIES
C7	NORMAL WEAR
C8	EXCESSIVE WEAR
C9	CORROSION
10	EXTRANEOUS MATERIAL CONTAMINATION
11	EXCESSIVE VIBRATION
12	CRDM MOTOR FAILURE
13	SEAL FAILURE
14	TRAPPED/MISALIGNED INTERNALS
15	CLUTCH FAILURE
16	BEARING FAILURE
17	BEARING FAILURE
18	FILTER/STRAINER PLUGGED
19	BINDING/STIZZURE
20	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
21	CONTROL CIRCUIT FAILURE/PROBLEM
22	FASTENER FAILURE/PROBLEM
23	WELD FAILURE
24	LUBRICATION PROBLEM

SYSTEM CODE

CCDE	DESCRIPTION
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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



APPENDIX I

ONE-LINERS ATTRIBUTED TO PERSONNEL (MAINTENANCE)

FAILURE MODE CODES

CODE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/D
B	FAILURE TO EJECT DURING SCRAM
C	FAIL TO INSERT TO AT LEAST 90% DURING SCRAM
D	RCC FAILS TO MOVE DURING POWER CHANGES/TESTING
E	RCC FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	CRAPPED ROD (PAR)
G	UNCOUPLED ROD/CONTROL TRAVEL CONDITION (BWR)
H	IMPROPER ROD MOVEMENT
I	EXTERNAL LEAKAGE/RUPTURE
J	RODS NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
K	MAINTENANCE/REPLACEMENT REQUIRED
L	TECHNICAL SPECIFICATION VIOLATION (MCR-FAILURES)

COMPONENT CODE

CODE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CODE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMON FAULT
T	RECURRING COMMON FAULTS

FAILURE MECHANISM CODES

CODE	DESCRIPTION
U	UNKNOWN
P	PERSONNEL (OPERATIONS)
M	PERSONNEL (MAINTENANCE)
T	PERSONNEL (TESTING)
D	DESIGN ERROR
F	FINISH/CONSTRUCTION/C.C.
P	PROCEDURAL DISCREPANCIES
N	NORMAL WEAR
R	EXCESSIVE WEAR
C	CORROSION
F	FOREIGN MATERIAL CONTAMINATION
V	EXCESSIVE VIBRATION
M	ARM MOTOR FAILURE
M	MISALIGNMENT
M	MISALIGNED INTERNALS
C	CLUTCH FAILURE
B	BRAKE FAILURE
B	BEARING FAILURE
F	FILTER/STRAINER PLUGGED
B	BINDING/SEIZURE
F	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
C	CONTROL CIRCUIT FAILURE/PROBLEM
F	FASTENER FAILURE/PROBLEM
W	WELD FAILURE
L	LUBRICATION PROBLEM

SYSTEM CODE

CODE	DESCRIPTION
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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

ONE-LINERS ATTRIBUTED TO PERSONNEL (MAINTENANCE)

<u>PLANT</u>	<u>CONT. NO.</u>	<u>FAIL DATE</u>	<u>TIME</u>	<u>COMP</u>	<u>FAIL CODE</u>	<u>TYPE</u>	<u>CLASS</u>	<u>FAIL</u>	<u>FAILURE MODE</u>	<u>FAILURE MECHANISM</u>
B RS1	048013	042277	M	LD	TC2	N			TECH SPEC VIOLATION/VERIFICATION CHECKS NOT DON	--ON COMPLETION OF MAINT//PERSONNEL ERROR
B TI1	013735	111475	M	CD	J02	S	D		VENT FOUND OPEN ON CRDM/GAS VENTED TO RX BUILDING	PERSONNEL ERROR/FAILED TO FOLLOW PROCED.
G CC1	019583	047977	M	CD	H02	C	D		UNCOUPLING ROD AND SPUD FINGERS BENT	IMPROPER ASSEMBLY BY MAINTAINANCE PERSON
G DK2	000284	021973	M	CD	H02	P	D		CRD L-11 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP. INSTAL. OF FILTER DAMAGE RETAIN. SPR
G DK2	000285	021973	M	CD	H02	P	D		CRD K-8 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP. INSTAL. OF FILTER DAMAGE RETAIN. SPR
G DK2	000286	021973	M	CD	H02	B	D		CRD B-6 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP. INSTAL. OF FILTER DAMAGE RETAIN. SPR
G NP1	019404	102677	M	CD	DC2	S	D		CRD 26-91 FAILED TO INSERT WHEN RX WAS SCRAMMED	ACCUM. FOR CRD HAD IMPROP. VLV LINEUP
M RL2	010293	052674	M	CD	IC2	S	D		RCC ASSEMBLY INADVERTANTLY REMOVED DURING REFUEL	PERSONNEL ERROR
M SL1	013696	107575	M	CD	LC2	S	D		INADVERT. BENT CRD SHAFT DURING CRANE OPERATION	PERSONNEL ERROR

APPENDIX J

ONE-LINERS ATTRIBUTED TO PERSONNEL (TESTING)



## FAILURE MODE CODES

CODE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/C
B	FAILURE TO BOTTOM DURING SCRAM
C	FAIL TO INSERT TC AT LEAST 90% DURING SCRAM
D	REC FAILS TO MOVE DURING POWER CHANGES/TESTING
E	REC FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	CRIPPLED ROD (PWR)
G	UNCOLPRED ROD/COVER TRAVEL CONDITION (BWR)
H	IMPROPER ROD MOVEMENT
I	EXTERNAL LEAKAGE/rupture
J	CCS NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
K	MAINTENANCE/REPLACEMENT REQUIREMENT
L	TECHNICAL SPECIFICATION VIOLATION (TCN-FAILURES)

## COMPONENT CODE

CODE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY

## TYPE OF FAILURE CODES

CODE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMAND FAULT
F	RECURRING COMMAND FAULTS

## FAILURE MECHANISM CODES

CODE	DESCRIPTION
CC	UNKNOWN
CC1	PERSONNEL (OPERATIONS)
CC2	PERSONNEL (MAINTENANCE)
CC3	PERSONNEL (TESTING)
CC4	DESIGN ERROR
CC5	LAB./CONSTRUCTION/C.C.
CC6	PROCEDURAL DISCREPANCIES
CC7	NORMAL WEAR
CC8	EXCESSIVE WEAR
CC9	CRACKS
CC10	CONTAMINATION
CC11	EXCESSIVE VIBRATION
CC12	ROTOR MOTOR FAILURE
CC13	VALVE FAILURE
CC14	WORN/MISALIGNED INTERNALS
CC15	FLUID FAILURE
CC16	SPARK FAILURE
CC17	PLUGGING FAILURE PLUGGED
CC18	FILTER/STRAINER
CC19	LOADING/SIZING
CC20	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
CC21	CONTROL CIRCUIT FAILURE/PROBLEM
CC22	FASTENER FAILURE/PROBLEM
CC23	WELD FAILURE
CC24	LUBRICATION PROBLEM

## SYSTEM CODE

CODE	DESCRIPTION
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

## FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

## ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

## NSSS VENDOR CODES

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

LINE-LINERS ATTRIBUTED TO PERSONNEL (TESTING)

VEHICLE	CONT. NO.	FAIL. DATE	FAIL. TYPE	FAIL. CODE	Y/N	FAIL. CODE	Y/N	FAIL. CODE	Y/N	FAILURE MODE	FAILURE MECHANISM
B 063	016P44	122276	M	CO	TC3	K				TECH SPEC VIOLATION/CRD BARS CLOSED, DETECTORS GOO	PERSONNEL ERROR WHILE TESTING
B 111	013557	102175	M	CO	TC3	N				TECH SPEC VIOLATION/TEST NOT PERFORMED PROPERLY	PERSONNEL ERROR
C 041	021116	041576	M	CO	IC3	S	C			IMPROPER ROD MOVEMENT/OUT-OF-SEQUENCE PROBLEM	PERSONNEL ERROR
G 062	014520	041376	M	CO	IC3	I	D			RODS EXERCISED/RX VESSEL OPEN/PERSONNEL IN AREA	PERSONNEL FAILED TO EVACUATE AREA
G 011	016343	111276	M	CO	IC3	I	D			IMPROPER ROD MOVEMENT CAUSED INADVERTANT CRITICAL	PERSONNEL SELECTED WRONG RODS DURING TEST
G 041	000477	440773	M	CO	IC3	S	D			IMPROPER ROD MOVEMENT CAUSED INADVERTANT CRITICALTY	PERSONNEL ERRORS/INTERLOCKS JUMPERED/TEST
M 104	000243	061573	M	CO	IC3	S	D			ROD TEST CONDUCTED WHICH TECH SPECS DONT ALLOW	PERSONNEL ERROR

APPENDIX K

ONE-LINERS ATTRIBUTED TO DESIGN ERROR

FAILURE MODE CODES

CCDE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/D
B	FAILURE TO INSERT DURING SCRAM
C	FAIL TO INSERT TC AT LEAST 90% DURING SCRAM
D	PCC FAIL TO MOVE DURING POWER CHANGES/TESTING
E	PCC FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	CR/PPC ROD (PWR)
G	UNCOUPLE ROD/CONTROL ROD TRAVEL CONDITION (BWR)
H	IMPROPER ROD MOVEMENT
I	EXTERNAL LEAKAGE/RUPTURE
J	CCES NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
K	MAINTENANCE/REPLACEMENT REQUIRED
L	TECHNICAL SPECIFICATION VIOLATION (MCH-FAILURES)

COMPONENT CODE

CCDE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CCDE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMON FAULT
F	RECURRING COMMAND FAULTS

FAILURE MECHANISM CODES

CCDE	DESCRIPTION
CC	UNKNOWN
C1	PERSONNEL (OPERATIONS)
C2	PERSONNEL (MAINTENANCE)
C3	PERSONNEL (TESTING)
C4	DESIGN ERROR
C5	FAB/CONSTRUCTION/C.C.
C6	PROCEDURAL DISCREPANCIES
C7	NORMAL WEAR
C8	EXCESSIVE WEAR
C9	CORROSION
C10	FOREIGN MATERIAL CONTAMINATION
C11	EXCESSIVE VIBRATION
C12	CRON MOTOR FAILURE
C13	SEAL FAILURE
C14	FAILED/MISALIGNED INTERNALS
C15	CLUTCH FAILURE
C16	BEARING FAILURE
C17	FILTER/STRAINER PLUGGED
C18	BINDING/SEIZURE
C19	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
C20	CONTROL CIRCUIT FAILURE/PROBLEM
C21	FASTENER FAILURE/PROBLEM
C22	WELD FAILURE
C23	LUBRICATION PROBLEM

SYSTEM CODE

CCDE	DESCRIPTION
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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

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 ONE-LINES ATTRIBUTED TO DESIGN ERROR  
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PLANT	CONT. NO.	FAIL. CASE	SYMBOL	CODE	FAILURE MODE	FAILURE MECHANISM
B 451	C12154	U11475	M CC TC4	N	ERROR IN HOT ZERO PAR-EJECTED ROD WORTH CALC	DESIGN ERROR
B 452	C14813	022676	P CC GU4	R T	CRIPPED CONT. ROD CAUSED RX-WARD TILT TO EX-TECH SP SHRT. DUE TO DETER EPOXY IN STAT. WNDGS.	

APPENDIX L

ONE-LINERS ATTRIBUTED TO FABRICATION, CONSTRUCTION, Q.C.



ONE-LINERS ATTRIBUTED TO FABRICATION, CONSTRUCTION, Q.C.

REF	PLANT	COMP. NO.	FAIL DATE	UNIT	DEF	FAIL CODE	TRIP	CLASS	LIFE	FAILURE MODE	FAILURE MECHANISM
R	IP1	000000	020674	M	CD	PC5	B	D		KCD 6 GR A DID NOT INSERT DURING A FAST INSERTION	ID TAGS PUT ON TOO TIGHT/OPEN MTR WINDINGS
B	YP1	C10329	070774	M	CD	PC5	B	D		KCD 16 GR A DID NOT INSERT DURING A FAST INSERTION	ID TAGS PUT ON TOO TIGHT/OPEN MTR WINDINGS
C	PA1	002053	020372	M	CD	JCS	S	D		STEAM LEAK THROUGH CRIVE PACKAGE OF CRDM NO. 17	IMPROPER ASSEM. OF FLANGE CAUSED SEAL FAIL
C	PI1	000076F	030973	M	CD	KCS		D		RCD 34-15 INTERFER WITH FUEL ELE. CHN. 1" FR. FUL-IN UNCHAMFERED EDGE INTERFERS WITH FUEL CHN.	
M	RG1	012542	041075	M	CD	JCS	S	D		LEAK IN CANPY SEC K-7 CAP ON CRD ROD TRAVL HOUSING CAUSED BY IMPR. TORQUEMACH. DEFECT IN CAP	



APPENDIX M

ONE-LINERS ATTRIBUTED TO PROCEDURAL DISCREPANCIES

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FAILURE MODE CODES

CCDE	DESCRIPTION
A	- FAILURE TO INSERT DURING NORMAL S/D
B	- FAILURE TO EJECT DURING SCRAM
C	- FAIL TO INSERT TC AT LEAST 90% DURING SCRAM
D	- RCD FAILS TO MOVE DURING POWER CHANGES/ TESTING
E	- RCD FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	- CRIPPED ROD (PWR)
G	- UNCOUPLED ROD/EXTRAVEL CONDITION (BWR)
H	- IMPROPER ROD MOVEMENT
I	- EXTERNAL LEAKAGE/RIPTURE
J	- DECS NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
K	- MAINTENANCE/REPLACEMENT REQUIRED
L	- TECHNICAL SPECIFICATION VIOLATION (NON-FAILURES)

COMPONENT CODE

CCDE	DESCRIPTION
CC	- CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CCDE	DESCRIPTION
B	- RECURRING COMMON CAUSE FAILURES
C	- COMMON CAUSE FAILURES
D	- RECURRING FAILURES
E	- COMMON FAULT
F	- RECURRING COMMON FAULTS

FAILURE MECHANISM CODES

CCDE	DESCRIPTION
CC	- UNKNOWN
C1	- PERSONNEL (OPERATIONS)
C2	- PERSONNEL (MAINTENANCE)
C3	- PERSONNEL (TESTING)
C4	- DESIGN ERROR
C5	- FAB./CONSTRUCTION/C.C.
C6	- PROCEDURAL DISCREPANCIES
C7	- NORMAL WEAR
C8	- EXCESSIVE WEAR
C9	- CORROSION
C10	- FOREIGN MATERIAL CONTAMINATION
C11	- EXCESSIVE VIBRATION
C12	- CRDM MOTOR FAILURE
C13	- SEAL FAILURE
C14	- FAILED/MISALIGNED INTERNALS
C15	- CLUTCH FAILURE
C16	- BRAKE FAILURE
C17	- BEARING FAILURE
C18	- FILTER/STRAINER PLUGGED
C19	- BINDING/SEIZURE
C20	- FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
C21	- CONTROL CIRCUIT FAILURE/PROBLEM
C22	- FASTENER FAILURE/PROBLEM
C23	- WELD FAILURE
C24	- LUBRICATION PROBLEM

SYSTEM CODE

CCDE	DESCRIPTION
	- PWR
M	- REACTIVITY CONTROL SYSTEM
	- BWR
M	- REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	- DEMAND
T	- TIME
U	- UNKNOWN
N	- NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CCDE	DESCRIPTION
D	- DEMAND ON COMPONENT
M	- MAINTENANCE
N	- NORMAL OPERATION/SURVEILLANCE
R	- RECORD REVIEW
T	- TESTING
U	- UNKNOWN

NSSS VENDOR CODES

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



APPENDIX N

ONE-LINERS OF RECURRING COMMON CAUSE CRDM FAULTS

FAILURE MODE CODES

<u>CCDE</u>	<u>DESCRIPTION</u>
A	FAILURE TO INSERT DURING NORMAL S/D
B	FAILURE TO REMOVE DURING SCRAM
C	FAIL TO INSERT IC AT LEAST 90% DURING SCRAM
D	RCD FAILING TO MOVE DURING POWER CHANGES/TESTING
E	RCD FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	CRIPPED ROD (PWR)
G	IMPROPER ROD/COVER TRAVEL CONDITION (BWR)
H	INTERNAL LEAKAGE/rupture
I	RODS NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
J	MAINTENANCE/REPLACEMENT REQUIRED
K	TECHNICAL SPECIFICATION VIOLATION (MCM-FAILURES)

COMPONENT CODE

<u>CCDE</u>	<u>DESCRIPTION</u>
CC	CONTROL RCD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

<u>CCDE</u>	<u>DESCRIPTION</u>
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMON FAULTS
F	RECURRING COMMON FAULTS

FAILURE MECHANISM CODES

<u>CCDE</u>	<u>DESCRIPTION</u>
CC	UNKNOWN
C1	PERSONNEL (OPERATIONS)
C2	PERSONNEL (MAINTENANCE)
C3	PERSONNEL (TESTING)
C4	DESIGN ERROR
C5	FAB./CONSTRUCTION/C.C.
C6	PROCEDURAL DISCREPANCIES
C7	NORMAL WEAR
C8	EXCESSIVE WEAR
C9	CORROSION
C10	FOREIGN MATERIAL CONTAMINATION
C11	EXCESSIVE VIBRATION
C12	CRDM MOTOR FAILURE
C13	SEAL FAILURE
C14	FAILED/MISALIGNED INTERNALS
C15	CLUTCH FAILURE
C16	BEARING FAILURE
C17	BEARING FAILURE
C18	FILTER/STRAINER PLUGGED
C19	BINDING/SEIZURE
C20	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
C21	CONTROL CIRCUIT FAILURE/PROBLEM
C22	FASTENER FAILURE/PROBLEM
C23	WELD FAILURE
C24	LUBRICATION PROBLEM

SYSTEM CODE

<u>CCDE</u>	<u>DESCRIPTION</u>
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

<u>CODE</u>	<u>DESCRIPTION</u>
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

<u>CCDE</u>	<u>DESCRIPTION</u>
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

<u>CODE</u>	<u>DESCRIPTION</u>
B	BABCOCK & WILCOX
C	COMBUSTION ENGINEERING
G	GENERAL ELECTRIC
M	WESTINGHOUSE

ONE-LINERS OF RECURRING COMMON CAUSE CROM FAILTS

VEH	UNIT	COMP. NO.	FAIL DATE	TYPE	PLC	FAIL CODE	TYPE	CLASS	FAIL	FAILURE MODE	FAILURE MECHANISM
B	IP1	000000	020674	M	CD	BC5	R	D		ROD 6 GR A DID NOT INSERT DURING A FAST INSERTION	ID TAGS PUT ON TOO TIGHT/OPEN MTR WINDINGS
B	IP1	010329	070774	M	CD	BC5	R	D		ROD 16 GR A DID NOT INSERT DURING A FAST INSERTION	ID TAGS PUT ON TOO TIGHT/OPEN MTR WINDINGS
G	BP1	000903*	032374	M	CD	K00	P	U	06	6 CROM WITHDRAWAL TAPES WERE LESS THAN TECH. SPEC.	CAUSE UNDER INVESTIGATION
G	BP1	010078*	010474	M	CD	K00	B	U	06	6 CROM WITHDRAWAL TAPES WERE LESS THAN TECH. SPEC.	UNKNOWN/POSSIBLE DESIGN DEFICIENCY
G	BP1	012209*	011675	M	CD	K00	B	U	04	4 CROM WITHDRAWAL TAPES WERE LESS THAN TECH. SPEC.	CAUSE UNKNOWN
G	EP1	016924*	012377	M	CD	K00	B	U	03	3 CROM WITHDRAWAL TAPES WERE LESS THAN TECH. SPEC.	CAUSE UNKNOWN
G	DA1	013158A	011475	M	CD	C13	R	L		ROD 22-23 DID NOT FULLY INSERT FOLLOWING SCRAM	WORN OR LEAKING PISTON SEAL RINGS IN CROM
G	DA1	013158B	011475	M	CD	C13	B	U		ROD 30-27 DID NOT FULLY INSERT FOLLOWING SCRAM	WORN OR LEAKING PISTON SEAL RINGS IN CROM
G	DA1	013465A	042975	M	CD	C13	B	U		ROD 22-23 DID NOT FULLY INSERT FOLLOWING SCRAM	WORN OR LEAKING PISTON SEAL RINGS IN CROM
G	DA1	013465B	042975	M	CD	C13	R	L		ROD 30-27 DID NOT FULLY INSERT FOLLOWING SCRAM	WORN OR LEAKING PISTON SEAL RINGS IN CROM
G	DK1	010430A	070474	M	CD	H00	B	L		ROD 04 MOVEMENT COULD NOT BE DETER. ON NUC. INSTRU.	UNDETERMINED
G	DR1	010430E	070474	M	CD	H00	B	L		ROD 45 MOVEMENT COULD NOT BE DETER. ON NUC. INSTRU.	UNDETERMINED
G	DK1	010430F	070474	M	CD	H00	B	U		ROD 010 MOVEMENT COULD NOT BE DETER. ON NUC. INSTRU.	UNDETERMINED
G	DR1	010429	071474	M	CD	H00	B	L		ROD A7 MOVEMENT COULD NOT BE DETER. ON NUC. INSTRU.	UNDETERMINED
G	DR2	000284	021973	M	CD	HC2	B	D		CRD L-11 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP. INSTAL. OF FILTER DAMAGE RETAIN. SPR
G	DR2	000285	021973	M	CD	HC2	B	D		CRD K-8 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP. INSTAL. OF FILTER DAMAGE RETAIN. SPR
G	DR2	000286	021973	M	CD	HC2	B	D		CRD R-6 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP. INSTAL. OF FILTER DAMAGE RETAIN. SPR
G	DR2	017177A	121276	M	CD	H1P	R	L		CRD F-5 UNCOUPLED FOLLOWING SOX CORE SCRAM TESTING	LOOSENED INNER FILTER CAUSED UNCOUPLING
G	DR2	017177B	121276	M	CD	H1P	B	L		CRD F-5 UNCOUPLED FOLLOWING SCRAM & WITHDRAWAL	LOOSENED INNER FILTER CAUSED UNCOUPLING
G	DR2	016907A	122676	M	CD	H1P	B	U		CRD J-11 UNCOUPLED DURING ROUTINE S/O AT POS. 48	LOOSENED INNER FILTER CAUSED UNCOUPLING

UNE-LINERS OF RECURRING COMMON CAUSE CROM FAULTS

VENT M T	UNIT NO.	FAIL DATE	SYS	COMP	FAIL CODE	TYPE	CLASS NO.	FAIL NO.	FAILURE MODE	FAILURE MECHANISM
G DR2	C16907R	122876	M	CD	H18	B	U		CRD J-11 UNCOUPLED AFTER INSERT.&WITHDRAW.TC PG548	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	C17515	040277	F	CD	H18	B	U		CRD L-5 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	C17516	040277	M	CD	H18	P	U		CRD H-8 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	C18182	060577	M	CD	H18	P	U		CRD L-5 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	C18933*	060277	F	CD	H18	P	U		CRD F-5 UNCOUPLED WHEN WITHDRAWN AFTER SCRAM TEST	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	C18933a	060277	F	CD	H18	B	U		CRD H-7 UNCOUPLED WHEN WITHDRAWN AFTER SCRAM TEST	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G DR2	C19612	110277	F	CD	H18	B	U		CRD H-5 UNCOUPLED DURING FUNCTIONAL TEST	LOOSEMED INNER FILTER CAUSED UNCOUPLING
G AP1	C00504*	112073	M	CD	C13	B	U	11	11 CONT. RODS DID NOT FULLY INSERT DURING SCRAM	EXCESS LEAK. ACROSS STOP PISTON SEALS
G AP1	C00504*	112673	F	CD	C13	P	L	15	15 CONT. RODS DID NOT FULLY INSERT DURING SCRAM	EXCESS LEAK. ACROSS STOP PISTON SEALS
WR2	G20512*	021778	M	CD	J23	B	T	02	FINHOLE LEAKS ON 2 SEAL WELDS (D-4 AND G-7)	APPARENTLY THE RESULT OF WELD DEGRADATION

APPENDIX O

ONE-LINERS OF COMMON CAUSE CRDM FAULTS



FAILURE MODE CODES

CCDE	DESCRIPTION
A	- FAILURE TO INSERT DURING NORMAL S/D
B	- FAILURE TO EJECT DURING SCRAM
C	- FAIL TO INSERT TO AT LEAST 90% DURING SCRAM
D	- RCC FAILS TO MOVE DURING POWER CHANGES/ TESTING
F	- RCC FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
G	- CRIPPED ROD (PWR)
H	- UNCOUPLED ROD/CONTROL TRAVEL CONDITION (BWR)
I	- IMPROPER ROD MOVEMENT
J	- EXTERNAL LEAKAGE/RUPTURE
K	- ECCS NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
L	- MAINTENANCE/REPLACEMENT REQUIRED
M	- TECHNICAL SPECIFICATION VIOLATION (NON-FAILURES)

COMPONENT CODE

CCDE	DESCRIPTION
CC	- CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CCDE	DESCRIPTION
R	- RECURRING COMMON CAUSE FAILURES
S	- COMMON CAUSE FAILURES
T	- RECURRING FAILURES
U	- COMMON FAULT
V	- RECURRING COMMON FAULTS

FAILURE MECHANISM CODES

CCDE	DESCRIPTION
CC	- UNKNOWN
C1	- PERSONNEL (OPERATIONS)
C2	- PERSONNEL (MAINTENANCE)
C3	- PERSONNEL (TESTING)
C4	- DESIGN ERROR
C5	- FAB/CONSTRUCTION/G.C.
C6	- PROCEDURAL DISCREPANCIES
C7	- NORMAL WEAR
C8	- EXCESSIVE WEAR
C9	- CORROSION
I0	- FOREIGN MATERIAL CONTAMINATION
I1	- EXCESSIVE VIBRATION
I2	- CRM MOTOR FAILURE
I3	- SEAL FAILURE
I4	- FAILED/MISALIGNED INTERNALS
I5	- CLUTCH FAILURE
I6	- BRANCH FAILURE
I7	- BRACING FAILURE
I8	- FILTER/STRAINER PLUGGED
I9	- BINDING/SEIZURE
I10	- FAULT OF COMPONENT SUPPLY SYSTEM
I11	- CONTROL CIRCUIT FAILURE/PROBLEM
I12	- FASTER FAILURE/PROBLEM
I13	- WELD FAILURE
I14	- LUBRICATION PROBLEM

SYSTEM CODE

CCDE	DESCRIPTION
	PWR
M	- REACTIVITY CONTROL SYSTEM
	BWR
P	- REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CCDE	DESCRIPTION
D	- DEMAND
V	- VIBRATION
U	- UNKNOWN
N	- NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CCDE	DESCRIPTION
D	- DEMAND ON COMPONENT
M	- MAINTENANCE
N	- NORMAL OPERATION/SURVEILLANCE
R	- RECORD REVIEW
T	- TESTING
U	- UNKNOWN

NSSS VENDOR CODES

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

ONE-LINERS OF COMMON CAUSE CRDM FAULTS

<u>V</u>	<u>F</u>	<u>C</u>	<u>S</u>	<u>C</u>	<u>F</u>	<u>T</u>	<u>C</u>	<u>F</u>	<u>F</u>	<u>F</u>
<u>E</u>	<u>L</u>	<u>O</u>	<u>O</u>	<u>M</u>	<u>A</u>	<u>P</u>	<u>L</u>	<u>A</u>	<u>A</u>	<u>A</u>
<u>N</u>	<u>A</u>	<u>N</u>	<u>S</u>	<u>S</u>	<u>I</u>	<u>E</u>	<u>S</u>	<u>L</u>	<u>I</u>	<u>I</u>
<u>T</u>	<u>N</u>	<u>T</u>	<u>S</u>	<u>F</u>	<u>C</u>	<u>S</u>	<u>S</u>	<u>L</u>	<u>I</u>	<u>I</u>
<u>CON</u>	<u>CONT</u>	<u>NO</u>	<u>FAIL</u>	<u>SY</u>	<u>FAIL</u>	<u>TYPE</u>	<u>CLASS</u>	<u>MODE</u>	<u>MECHANISM</u>	<u>MECHANISM</u>
<u>NO.</u>	<u>NO.</u>	<u>.</u>	<u>LATE</u>	<u>M</u>	<u>CC</u>	<u>CC</u>	<u>S</u>	<u></u>	<u></u>	<u></u>
C PA1	002042*	082977	M CD	024	C T	04	4	RODS FAILED TO DRCP DURING CRDM TRIP TESTING	DEGRADATION OF LUB. ON SPLINE SURFACES	
C PA1	014237*	030476	M CD	L17	C T	03		SEVERAL CRDM INNER CLUTCH BEARINGS FOUND FAILED	BEARING FAILURES DUE TO OVERHEATING	
G BR2	020838A	033178	M CD	H18	C D			ROD 22-19 UNCOUPLED FROM DRIVE MECHANISM	ROD DRIVE MECH. INNER FILTER CAME LOOSE	
G BR2	020838B	033178	M CD	H18	C D			ROD 26-29 UNCOUPLED FROM DRIVE MECHANISM	ROD DRIVE MECH. INNER FILTER CAME LOOSE	
G CC1	019583	092977	M CD	H02	C D			UNCOUPLING ROD AND SPUD FINGERS BENT	IMPROPER ASSEMBLY BY MAINTAINANCE PERSON	
C CR2	010945*	110274	M CD	013	C L	93	93	RODS INSERTED TO POS.02 FOLLOWING SCRAM	PROB. CAUSE EXCES. LEAK. PAST SEALS OF CRD	
C CR2	010945A	110274	M CD	013	C U	03	3	CRDS FAILED TO GO TO POS 02 OR BELOW ON SCRAM	PROBABLE EXCESSIVE LEAKAGE PAST SEALS	
G CR2	01F450*	070577	M CD	013	C U	46	46	CRDS FAILED TO FULLY INSERT FOLLOWING A SCRAM	WORN OR DETERIORATED STOP PISTON SEALS	
G CR3	012344*	030275	M CD	K13	C L	06		DURING CRD SCRM TST 6 CRDS FAIL.5%620% INSERT TIME	DETERIORATION OF CRD.DRIVE SEALS	
C CR3	012343*	031675	M CD	K13	C U	08		DURING CRD SCRM TST 8 CRDS INSERT.TIME EXC.TECH.SP	DETERIORATION OF CRD DRIVE SEALS	
G CR3	012920*	062675	M CD	L00	C U	04		CRACKS IN COLLET HOLDSNG OF 4 CRDS FOUND PERF.MAINT	CAUSE NOT DEFINITELY DETERMINED	
G NM1	017671*	031077	M CD	L00	C U	03		FOUND LINEAR INDICAT. ON 3 COLLET RETAINER TUBES	CAUSE UNDER INVESTIGATION	

APPENDIX P

ONE-LINERS OF RECURRING CRDM FAULTS

FAILURE MODE CODES

CODE	DESCRIPTION
A	- FAILURE TO INSERT DURING NORMAL S/D
B	- FAILURE TO SUBSTOM DURING SCRAM
C	- FAIL TO INSERT TC AT LEAST 90% DURING SCRAM
D	- RCC FAILS TO MOVE DURING POWER CHANGES/TESTING
F	- RCC FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
G	- CRIPPED ROD (PWR)
H	- UNCOUPLED ROD/CONTROL TRAVEL CONDITION (BWR)
I	- IMPROPER ROD MOVEMENT
J	- EXTERNAL LEAKAGE/CRACK
K	- ECCS NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
L	- MAINTENANCE/REPLACEMENT REQUIRED
M	- TECHNICAL SPECIFICATION VIOLATION (NON-FAILURES)

COMPONENT CODE

CODE	DESCRIPTION
CC	- CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CODE	DESCRIPTION
B	- RECURRING COMMON CAUSE FAILURES
C	- COMMON CAUSE FAILURES
R	- RECURRING FAILURES
S	- COMMON FAULT
T	- RECURRING COMMON FAULTS

FAILURE MECHANISM CODES

CODE	DESCRIPTION
CC	- UNKNOWN
OP	- PERSONNEL (OPERATIONS)
MA	- PERSONNEL (MAINTENANCE)
TE	- PERSONNEL (TESTING)
DE	- DESIGN ERROR
CC	- FAB./CONSTRUCTION/C.C.
PR	- PROCEDURAL DISCREPANCIES
NO	- NORMAL WEAR
EX	- EXCESSIVE WEAR
CR	- CORROSION
CM	- CREOSOTE MATERIAL CONTAMINATION
CV	- EXCESSIVE VIBRATION
CM	- MOTOR FAILURE
SE	- SEAL FAILURE
MI	- MISALIGNED INTERNALS
CL	- CLUTCH FAILURE
BR	- BRAKE FAILURE
BE	- BEARING FAILURE
FS	- FILTER/STRAINER PLUGGED
BI	- BINDING/SEIZURE
FS	- FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
CC	- CONTROL CIRCUIT FAILURE/PROBLEM
FA	- FASTENER FAILURE/PROBLEM
WE	- WELD FAILURE
LI	- LUBRICATION PROBLEM

SYSTEM CODE

CODE	DESCRIPTION
	PWR
M	- REACTIVITY CONTROL SYSTEM
	BWR
M	- REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	- DEMAND
T	- TIME
U	- UNKNOWN
N	- NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	- DEMAND ON COMPONENT
M	- MAINTENANCE
N	- NORMAL OPERATION/SURVEILLANCE
R	- RECORD REVIEW
T	- TESTING
U	- UNKNOWN

NSSS VENDOR CODES

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

CNE-LINERS OF RECURRING CRDM FAULTS

<u>VEN</u>	<u>PLANT</u>	<u>CCNT.NO.</u>	<u>FAIL DATE</u>	<u>SYS</u>	<u>COMP</u>	<u>FAIL CODE</u>	<u>TYPE</u>	<u>CLASS</u>	<u>FAIL #</u>	<u>FAILURE MODE</u>	<u>FAILURE MECHANISM</u>
B	CR3	018405	040477	M	CD	E12	R	D		RCD 6 GR 7 WOULD NOT MOVE WHEN REDUCING PWR	CRDM STATOR FAILED / FUSE BLEW
B	CR3	018403	040677	M	CD	G12	R	D		IN MODE 1, RCD 3 GR 2 DROPPED INTO CORE	FAILURE OF CRDM STATOR CAUSED ROD TO DROP
B	IP1	002093	032272	M	CD	D00	P	L		RCD 12 STUCK AT 19 INCH POSITION FOLLOWING SCRAM	CAUSE UNKNOWN
B	IP1	002312	040872	M	CD	E14	F	T		RCD 13 FAILED TO MOVE DURING WITHDRAWL FOR INSPEC.	EMBRITTLED SHAFT CONNECTING PIN BROKE
B	IP1	002096	061772	M	CD	D14	R	T		ROD 14 STUCK 36 INCHES OUT OF THE CORE ON SCRAM	EMBRITTLED SPIRAL PIN CONNECT. SEAL SHAFT
B	IP1	002010	123072	M	CD	R00	R	U		RCD 20 REMAINED AT 26.5 INCH POST. DURING ROD INSER	CAUSE NOT DETERMINED
B	IP1	002327	123072	M	CD	B00	R	U		RCD 20 WOULD NOT INSERT COMPLETELY DURING TEST	CAUSE NOT DETERMINED
B	CE2	014813	022676	M	CD	G04	P	T		DROPPED CONT.ROD CAUSED RX.QUAD.TILT TO EX.TECH SP	SHRT. DUE TO DETER EPOXY IN STAT.WNDGS.
B	CE2	020154	122977	M	CD	G12	R	T		CR4GR6 DROPPED WHILE BEING WITHDRAWN	SHRT. DUE TO O-RING FAIL. IN STAT.WNDGS.
B	GE3	020641	021078	M	CD	G12	R	T		CR3GR4 DROPPED DURING AN RPS BREAKER TEST	SHRT. DUE TO O-RING FAIL. IN STAT.WNDGS.
C	CC1	016741	121276	M	CD	G00	R	L		ROD 27 SLIPPED TO 77 INCH. DURING MOVEMENT TESTS	UNDETERMINED ( SEE LER 019689 )
C	CC1	017710	042277	M	CD	G00	R	U		ROD 34 SLIPPED TO 34 INCH. DURING MOVEMENT TESTS	UNDETERMINED ( SEE LER 019689 )
C	CC1	019781	120377	M	CD	G00	R	U		RCD 1 DROPPED WHILE PULLING GROUP 5	UNKNOWN
C	CC2	020228	012178	M	CD	G00	R	L		RCD 1 DROPPED DURING POWER REDUCTION	UNKNOWN
C	CC2	020561	021578	M	CD	G00	R	L		ROD 33 DROPPED DURING MONTHLY EXER. TESTS	UNKNOWN
C	PA1	002040	060272	M	CD	D15	R	U		RCD 5 DID NOT DROP INTO CORE ON DIFF. SCRAM SIG.	DEFECTIVE CLUTCH ASSEMBLY
C	PA1	000267	060673	M	CD	G15	R	U		ROD 9 WAS FULLY INSERTED WHEN REQUIRED TO BE WITHDR	SHORT IN CLUTCH COIL CAUSE ROD9 TO INSERT
C	PA1	013074	072775	M	CD	E16	R	T		CRDM14 WOULD NOT INSERT OR WITHDRAW	BRAKE LINING PARTICLES BETWEEN COIL&SHAFT
C	PA1	013075	072775	M	CD	E16	R	T		CRDM33 COULD WITHDRAW BUT WOULD NOT INSERT	BRAKE LINING PARTICLES BETWEEN COIL&SHAFT
C	PA1	013154	061775	M	CD	G15	R	U		RCD19 DROPPED INTO CORE DURING STEADY STATE OPER.	SHORT IN CLUTCH COIL CAUSED ROD19 TO DROP

ONE-LINERS OF RECURRING CROM FAULTS

VENT	PLANT	CGNT.NJ.	FAIL DATE	SYS	COMP	FAIL CODE	TYPE	CLASS	FAIL #	FAILURE MODE	FAILURE MECHANISM
C	PA1	013224	083075	M	CD	G15	R	U		ROD11 DROPPED INTO CORE DURING 80% PWR. OPERATION	SHORT IN CLUTCH COIL CAUSED ROD11 TO DROP
C	PA1	013239	090575	M	CD	G15	R	U		ROD16 DROPPED INTO CORE DURING 80% PWR. OPERATION	SHORT IN CLUTCH COIL CAUSED ROD16 TO DROP
C	PA1	016376	082676	M	CD	E16	R	U		CRD39 FAILED TO WITHDRAW DURING PWR ESCALATION	MOTOR/BRAKE ASSEMBLY PROBLEMS
C	PA1	015757A	082776	M	CD	E16	R	U		ROD 37 FAILED TO MOVE WITH ITS GROUP	MOTOR/BRAKE ASSEMBLY PROBLEMS
C	PA1	015757B	082776	M	CD	E16	R	U		ROD 37 FAILED TO MOVE WITH ITS GROUP	MOTOR/BRAKE ASSEMBLY PROBLEMS
C	PA1	016394	091376	M	CD	J13	R	U		ROD 13 DECLARED INOPERABLE DUE TO LEAKAGE	SEAL FAILURE
C	PA1	016710	010377	M	CD	J13	R	U		ROD 4 DECLARED INOPERABLE DUE TO LEAKAGE	SEAL FAILURE
C	PA1	021115	042078	M	CD	E16	R	U		CROM 38 BECAME MISALIGNED DURING PWR ESCALATION	MOTOR/BRAKE ASSEMBLY PROBLEMS
C	SL1	017200	020477	M	CD	G00	R	U		CEA #60 DROPPED WHILE AT POWER	THE CAUSE IS UNKNOWN
C	SL1	019576A	102877	M	CD	G00	R	U		CEA #56 DROPPED FOR NO APPARENT REASON	CAUSE UNKNOWN, POSS. PROB. PWR. SUP. & TIME. MOD
C	SL1	019576B	102877	M	CD	G00	R	U		CEA #56 DROPPED FOR NO APPARENT REASON	CAUSE UNKNOWN, POSS. PROB. PWR. SUP. & TIME. MOD
C	BP1	010032	033174	M	CD	L08	R	T		DURING INSPEC ROD ROLLER MISSING, ROD BLADE C-6	EXCESSIVE WEAR OF SOFT PINS
G	BP1	010391A	060474	M	CD	F10	R	T		ROD C4 FAILED TO MOVE DURING PRE-STARTUP TEST	ROD BLADE ROLLER WEDGED IN DIXIE CUP
G	BP1	010391B	060574	M	CD	F10	R	T		ROD B5 WOULD NOT MOVE FROM FULL INSERTED	BOLT OR CAP SCREW WEDGED IN DIXIE CUP
G	BP1	012197	011775	M	CD	F10	R	T		SEMI-ANL CRD TEST - ROD B4 STUCK FULLY INSERTED	1-INCH BOLT WITH NUT LODGED IN THIMBLE
G	BP1	013157	072575	M	CD	F10	R	T		ROD E4 WOULD NOT WITHDRAW PROPERLY	POSSIBLY LODGED BY SMALL OBJECT IN INTERN
G	BP1	014725	111177	M	CD	E00	R	U		UNABLE TO WITHDRAW ROD B4 FROM POS 5 TO 6	UNKNOWN/POSSIBLY A FOREIGN OBJ. BINDING IT
C	DR2	000884	031474	M	CD	H00	R	U		CRD P-11 UNCOUPLED DURING SCRAM TEST	TO BE DETERMINED
C	DR2	010314	061574	M	CD	H00	R	U		CRD L-9 UNCOUPLED WHILE BEING WITHDRAWN	FAILURE MECHANISM NOT KNOWN
C	DR2	010751	102374	M	CD	H00	R	U		CRD P-12 UNCOUPLED WHILE BEING WITHDRAWN	FAILURE MECHANISM NOT KNOWN

ONE-LINERS OF RECURRING CRDM FAULTS

PLANT	CONT. NO.	FAIL DATE	SY S	COMP	FAIL CODE	TYPE	CLASS	FAILURE MODE	FAILURE MECHANISM
G DA2	C10904	110274	M	CD	H00	R	U	CRD N-10 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	FAILURE MECHANISM NOT KNOWN
G PB2	C16763A	010277	M	CD	000	R	U	ROD 30-27 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G PB2	C16763B	010277	M	CD	000	R	U	ROD 54-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G PB3	C14724A	050676	M	CD	000	R	U	ROD 10-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G PB3	C14724B	052576	M	CD	000	R	U	ROD 10-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
W DC1	014550	051176	M	CD	K19	R	U	1 CR 2 ROD FINGERS STUCK / SEPARATED FROM SPIDER	ROD FINGERS BROKE WHEN FREEING ROCA E-3
W HN1	C19894	110377	M	CD	L23	P	L	RCC SPADER ASSEMBLY VANE FOUND SEPAR FROM RCC HUB	CAUSED BY FAULTY BRAZE JOINT
W TU2	001076	060873	M	CD	000	R	U	RCC H-8 STUCK AT 225 STEPS AFTER ROD DROP SIGNAL	NO CAUSE DETERMINED
W TU3	000308	061873	M	CD	000	R	U	RCC J-5 FAILED TO DROP AFTER RX TRIP BRKRS OPENED	NO CAUSE DETERMINED

APPENDIX Q

ONE-LINERS OF COMMAND CRDM FAULTS



FAILURE MODE CODES		FAILURE MECHANISM CODES		FAILURE CLASSIFICATION CODES	
CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/D	CC	UNKNOWN	D	DEMAND
B	FAILURE TO INSERT DURING SCRAM	CD	PERSONNEL (OPERATIONS)	T	TIME
C	FAIL TO INSERT AT LEAST 90% DURING SCRAM	CM	PERSONNEL (MAINTENANCE)	U	UNKNOWN
D	POWER CHANGES/TESTING	CU	PERSONNEL (TESTING)	N	NOT APPLICABLE
F	POWER FAILS TO WITHDRAW	CE	DESIGN ERROR		
G	ROD FULLY INSERTED POSITION	CS	FAB/CONSTRUCTION/C.C.	-----	
H	CRIPPED ROD (PWR)	CCF	PROCEDURAL DISCREPANCIES		
I	ROD/COVER TRAVEL CONDITION (BWR)	CG	NORMAL WEAR	ACTIVITY RESULTING IN DISCOVERY	
J	ROD MOVEMENT	CB	EXCESSIVE WEAR		
K	EXTERNAL LEAKAGE/LEPTURE	CO	CONTAMINATION		
L	ROD NOT OPERATE PROPERLY	CI	MATERIAL CONTAMINATION		
M	ROD NOT IDENTIFIABLE	CCM	EXCESSIVE VIBRATION		
N	REPAIR/REPLACEMENT REQUIRED	CCD	SCRAM FAILURE		
O	REPLACEMENT REQUIRED	CCM	SCRAM FAILURE		
P	REPLACEMENT REQUIRED	CCM	MISALIGNED INTERNALS		
Q	REPLACEMENT REQUIRED	CCM	CLUTCH FAILURE		
R	REPLACEMENT REQUIRED	CCM	BEARING FAILURE		
S	REPLACEMENT REQUIRED	CCM	BEARING FAILURE		
T	REPLACEMENT REQUIRED	CCM	FILTER/STRAINER PLUGGED		
U	REPLACEMENT REQUIRED	CCM	BINDING/SEIZURE		
V	REPLACEMENT REQUIRED	CCM	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM		
W	REPLACEMENT REQUIRED	CCM	CONTROL CIRCUIT FAILURE/PROBLEM		
X	REPLACEMENT REQUIRED	CCM	FASTENER FAILURE/PROBLEM		
Y	REPLACEMENT REQUIRED	CCM	WELD FAILURE		
Z	REPLACEMENT REQUIRED	CCM	LUBRICATION PROBLEM		
-----		-----		-----	
COMPONENT CODE		SYSTEM CODE		NSSS VENDOR CODES	
CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY			B	BABCOCK & WILCOX
-----				C	COMBUSTION ENGINEERING
TYPE OF FAILURE CODES		SYSTEM CODE		G	GENERAL ELECTRIC
CODE	DESCRIPTION	CODE	DESCRIPTION	M	WESTINGHOUSE
B	RECURRING COMMON CAUSE FAILURES		PWR		
C	COMMON CAUSE FAILURES	M	REACTIVITY CONTROL SYSTEM		
D	RECURRING FAILURES		BWR		
E	COMMAND FAIL	M	REACTIVITY CONTROL SYSTEM		
F	RECURRING COMMAND FAILURES				

ONE-LINERS OF COMMAND CRDM FAULTS

Y E A R	P L A N T	C L O S I N G N O.	F A I L D A T E	S Y S T E M	C O M P O N E N T	F A I L C O D E	T Y P E	C L A S S I F I C A T I O N	F A I L M O D E	F A I L U R E M E C H A N I S M
B	AR1	016504	080974	M	CD	106	S	D	IMPROP.MOVEMENT OF ROD 7-4 CAUSED HI S/D RATE TRIP	PROCEDURE FOR COND. TEST WAS INADEQUATE
B	CF3	017943	042777	M	CD	101	S	D	ROD GROUP 6 EXCEEDED ITS INSERTION LIMIT (T.S.)	PERSONNEL ERROR(COMMAND FAULT)
B	CR3	017937*	060177	M	CD	E21	S	D 29	CRD SYS. FAILED TO POSIT. REG.RODS ON AUTO DEMAND	LOOSE CONNec. ON CRD PROG.PRINT.CKT.CARD
B	CE1	000417	100573	M	CD	101	S	D	TECH SPEC ROD WITHDRAWL LIMITS WERE EXCEEDED	PERSONNEL ERROR
B	CE1	012266	010275	M	CD	106	S	D	RODS WERE MOVED WITHOUT CALCULATING D POWER WORTH	VENDOR/PERSONNEL PROCEDURES PROBLEM
B	CE2	012293	011575	M	CD	101	S	D	IMPROPER ROD MOVEMENT CAUSED OVERLAP PROBLEM	PERSONNEL ERROR
B	UF2	013202*	082575	M	CD	G00	S	D 09	GR7 RODS DROPPED CAUSING LOSS OF REQUIRED OVERLAP	NO PROBLEM FOUND/PROBABLE COMMAND FAULT
B	CE2	020665*	030178	M	CD	G21	S	D 12	CONTROL ROD GROUP 5 DROPPED DURING PERFORM. TEST	MOMENTARY LOSS OF POWER, REASON UNKNOWN
B	CE3	012298	020975	M	CD	101	S	D	IMPROPER ROD MOVEMENT CAUSED OVERLAP PROBLEM	PERSONNEL ERROR/WRONG ROD POS MONITORED
B	RS1	016011	100776	M	CD	101	S	D	RODS IN POSITION TO GIVE <1% DELTA K/K SHUTDOWN	PERSONNEL ERROR DURING COLD SHUTDOWN
B	T11	012144	021075	M	CD	101	S	D	OPERATED WITH ROD 6/6 LOWER THAN REST OF GROUP 6	PERSONNEL ERROR
B	T11	012735	111475	M	CD	J02	S	D	VENT FOUND OPEN ON CRDM/GAS VENTED TO RX BUILDING	PERSONNEL ERROR/FAILED TO FOLLOW PROCED.
C	CC2	019693	111177	M	CD	E21	S	D	CEA 36 WOULD NOT MOVE THEN DROPPED WHILE AT SS PWR	DEFECT, TIMER MOD. IN COIL PWR PROGRAMMER
C	FC1	000233	080873	M	CD	106	S	D	RODS WITHDRAWN WHICH REDUCED S/D MARGIN TO < 2.4	PROCEDURE BASED ON WRONG ROD WORTH CURVES
C	MT2	016030	092276	M	CD	G21	S	D	DURING CEA PARALLEL OPS., CEA 49 DROPPED INTO CORE	BLOWN FUSE IN PARALLELING CIRCUIT
C	PA1	002053	020372	M	CD	J05	S	D	STEAM LEAK THROUGH DRIVE PACKAGE OF CRDM NO. 17	IMPROPER ASSEN.OF FLANGE CAUSED SEAL FAIL
C	PA1	021116	041578	M	CD	103	S	D	IMPROPER ROD MOVEMENT/OUT-OF-SEQUENCE PROBLEM	PERSONNEL ERROR
C	SL1	014955	052576	M	CD	E21	S	D	REGULATING ROD 59 IMPROVABLE BECAUSE OF CEA MOD.PAL	FAILURE IN RAISE/LOWER CKT OF THE MODULE
G	BF1	000512A	100473	M	CD	D20	S	D	ROD 54-27 WAS VALVED OUT WHILE FULLY WITHDRAWN	NO SUPPLY AVAILABLE TO SCRAM ROD(PERSONL)
G	BF2	015392	061976	M	CD	D20	S	D	ROD 30-31 INCAPABLE OF SCRAM/HCU VALVES SHUT	COMMAND FAULT/PERSONNEL ERROR

ONE-LINERS OF COMMAND CRM FAULTS

PLANT	CCAT.NO.	FAIL DATE	SU Y P	C	FAIL CODE	Y A I P S L	FAILURE MODE	FAILURE MECHANISM	
G	BPI 013723	111375	M	CD	001	S	D	ROD INCAPABLE OF SCRAM/ACCUMULATOR VALVED OUT	PERSONNEL ERROR/INSTRUCTIONS REVISED)
G	BPI 016935	010977	M	CD	101	S	D	OPERATOR PULLED RODS TO NUTCH 48 INSTEAD OF 24	PERSONNEL ERROR/MINIMIZER FAILED TO BLOCK
G	DP2 012217	012575	M	CD	106	S	D	2 ROD CONTROL RODS WITHDRAWN DURING REFUELING	DEFECTIVE TEMPORARY PROCEDURE
G	ER2 012846*	061175	M	CD	K20	S	D	04 DURING SCRAM TEST, 4 DRVS. DID NOT MEET 5% SCR. TIM. HIGH PRESS. IN SCRAM VLV. HEADER	ACCUM. FOR CRD HAD IMPROP. VLV LINEUP
G	PI1 016343	111276	M	CD	103	S	D	IMPROPER ROD MOVEMENTS CAUSED INADVERTANT CRITICAL	PERSONNEL SELECTED WRONG RODS DURING TEST
G	PG1 017243	022377	M	CD	106	S	D	IMPROPER ROD MOVEMENT RESULTED IN HIGH SUR SCRAM	DEFECTIVE PROCEDURES ON START-UP ROD SEQ.
G	NH1 016404	102677	M	CD	PC2	S	D	CRD 26-51 FAILED TO INSERT WHEN RX WAS SCRAMMED	
G	PB3 015051A	092577	M	CD	UC1	S	D	ROD 02-27 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G	PB3 015051P	092577	M	CD	UC1	S	D	ROD 14-15 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G	PB3 015051C	092577	M	CD	CC1	S	D	ROD 18-03 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G	PI1 00676A	030973	M	CD	120	S	D	ROD 34-15 MOVED FROM 6IN. WITHDRAWN TO FULL-IN	MOVE. DUE TO HI.PRES. IN COOL. WTR. LINE
G	CCI 000350	092173	M	CD	101	S	D	IMPROPER ROD MOVEMENT/HEAT GENERATION RATE EXCEED	PERSONNEL ERROR/WRONG ROD SELECTED
G	CCI 012663	050375	M	CD	106	S	D	IMPROPER ROD WITHDRAWL DURING REFUELING	INADEQUATE PROCEDURES
C	CCI 01538C	070976	M	CD	101	S	D	IMPROPER ROD MOVEMENT/2 PULLED SIMULTANEOUSLY	PERSONNEL ERROR
G	VY1 006477	110773	M	CD	103	S	D	IMPROPER ROD MOVEMENT CAUSED INADVERTANT CRITICALLY	PERSONNEL ERRORS/INTERLOCKS JUMPERED/TEST
M	FT1 010649	052574	M	CD	101	S	D	IMPROPER ROD MOVEMENT/PART-LENGTH RODS INSERTED TO	--02Z //PERSONNEL ERROR
M	RG1 012542	041075	M	CD	J05	S	D	LEAK IN CANPY SEC K-7 CAP ON CRD ROD TRAVL HOUSING	CAUSED BY IMPR.TORCHMACH.DEFECTY IN CAP
M	RG1 013354	091775	M	CD	F21	S	D	ROD G-5 BANK B DID NOT MOVE WITH BANK DURING TEST	OPEN CKT IN CABLE OR COIL# G-5 LIFT COIL
M	RO2 002072*	062072	M	CD	G21	S	D	03 3 RODS (BANK E-GROUP 2) DROPPED INTO THE CORE	MULTIPLYING THYRISTOR FAILURE PWR CAB28D
M	RC2 010243	052674	M	CD	102	S	D	PCC ASSEMBLY INADVERTANTLY REMOVED DURING REFUEL	PERSONNEL ERROR

CNE-LINERS OF COMMAND CRDM FAULTS

<u>V</u>	<u>P</u> <u>PLANT</u>	<u>CLNT. NO.</u>	<u>FAIL</u> <u>DATE</u>	<u>S</u> <u>Y S</u>	<u>C</u> <u>OMP</u>	<u>FAIL</u> <u>CODE</u>	<u>T</u> <u>TYPE</u>	<u>C</u> <u>LA</u>	<u>F</u> <u>AILS</u>	<u>FAILURE MODE</u>	<u>FAILURE MECHANISM</u>
W	PC2	0111146	121174	M	CD	106	S	D		RODS NOT IMSEYED(S/D) WHEN PART-LENGTH ROD INOPER PROCEDURES HAD 5 PARAGRAPHS DELETED	
W	SL1	018875	091877	M	CD	621	S	D		ROD J-13 (SHUTDOWN BANK A) DROPPED DURING NORM. OPER LOSS OF PWR VO STATION. GRIP COIL OF CRDM	
W	TR1	018906*	062177	M	CD	E21	S	D	13	LOSS OF ROD CONTROL AFFECTING 13 OF PLANTS 53 RODS FAILURE OF SUPERVISORY BUFFER MEM. CARD	
W	TU4	000263	061573	M	CD	103	S	D		ROD TEST CONCLCTED WHICH TECH SPECS DONT ALLOW	PERSONNEL ERROR

APPENDIX R

ONE-LINERS OF RECURRING COMMAND CRDM FAULTS

FAILURE MODE CODES

CCDE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/C
B	FAILURE TO RECTIFY DURING SCRAM
C	FAIL TO INSERT TC AT LEAST 90% DURING SCRAM
D	REC FAILS TO MOVE DURING POWER CHANGES/ TESTING
E	REC FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	CRIPPED ROD (PWR)
G	UNCOUPLED ROD/COVER TRAVEL CONDITION (BWR)
H	IMPROPER ROD MOVEMENT
I	EXTERNAL LEAKAGE/RLPTURE
J	RODS NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
K	MAINTENANCE/REPLACEMENT REQUIRED
L	TECHNICAL SPECIFICATION VIOLATION (MCM-FAILURES)

COMPONENT CODE

CCDE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CCDE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMON FAILS
F	RECURRING COMMON FAULTS

FAILURE MECHANISM CODES

CCDE	DESCRIPTION
CC	UNKNOWN
CD	PERSONNEL (OPERATIONS)
CE	PERSONNEL (MAINTENANCE)
CF	PERSONNEL (TESTING)
CG	DESIGN ERROR
CH	FAB./CONSTRUCTION/C.C.
CI	PROCEDURAL DISCREPANCIES
CJ	NORMAL WEAR
CK	EXCESSIVE WEAR
CL	CORROSION
CM	FOREIGN MATERIAL CONTAMINATION
CN	EXCESSIVE VIBRATION
CO	CRDM MOTOR FAILURE
CP	SEAL FAILURE
CQ	FAILURE/MISALIGNED INTERNALS
CR	CLUTCH FAILURE
CS	BEARING FAILURE
CT	BEARING FAILURE
CU	FILTER/STRAINER PLUGGED
CV	BINDING/SEIZURE
CW	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
CX	CONTROL CIRCUIT FAILURE/PROBLEM
CY	FASTENER FAILURE/PROBLEM
CZ	WELD FAILURE
AA	LUBRICATION PROBLEM

SYSTEM CODE

CCDE	DESCRIPTION
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE DESCRIPTION

D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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

ONE-LINERS OF RECURRING COMMAND GROUP FAILURES

EVENT	FLAKY	CONT. NO.	FAIL DATE	SYM	CD	FAIL CODE	TYPE	CLASS	FAILURE MODE	FAILURE MECHANISM
B	AF1	021314*	042478	M	CD	G21	T	D 09	GROUP 7 CONTROL RODS DROPPED DURING PWR OPERATION	FAILURE OF A GATE DRIVE CIRCUIT
B	CR3	017944*	042777	M	CD	G21	T	D 02	IN MODE 1, ROD GRP 7 DROPPED INTO CORE	POSSIBLE GROUNDED SHIELD TO 24VLT PRG
B	CR3	017941*	051377	M	CD	G21	T	D 09	IN MODE 1, GROUP 7 DROPPED INTO CORE	POSSIBLE DESIGN ERROR, GATE DRIVE REL. CKT.
B	CR3	019429*	101677	M	CD	G21	T	D 09	IN MODE 1, DURING TEST SP-110 GRP. 7 DROP INTO CORE	RANDOM INTERMITTENT POWER INTERRUPTIONS
B	CE3	014618*	042276	M	CD	G21	T	D 09	GROUP 7 RODS DROPPED AT 95% POWER	A FAILED GATE DRIVE CIRCUIT
B	CE3	015010*	060976	M	CD	G21	T	D 09	GROUP 7 RODS DROPPED	TWO PWR. SUPPLIES FAILED (FUSE, TRANSISTOR)
C	CC1	019689A	111277	M	CD	G21	T	D	WHILE AT SS PWR AT 3:04AM CEA 54 DRGP. TO FULL-IN	15-VLT PWR. SUP. IN COIL PWR. PRG. DRIFT LOW
C	CC1	019689B	111277	M	CD	G21	T	D	WHILE AT SS PWR AT 11:14AM CEA 54 DRGP. TO FULL-IN	15-VLT PWR. SUP. IN COIL PWR. PRG. DRIFT LOW
C	CC1	020191	010278	M	CD	G21	T	D	WHILE AT SS PWR CEA 32 DROPPED TO FULLY INSERTED	CEA 15-VLT PWR. SUP. FAILED
C	CC2	016300A	070577	M	CD	G21	T	D	WHILE OPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTEN FAIL. OF 15VDC POWER SUPPLY
C	CC2	016300B	070777	M	CD	G21	T	D	WHILE OPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTEN FAIL. OF 15VDC POWER SUPPLY
C	CC2	019279	100277	M	CD	G21	T	D	DURING FULL PWR. OPS. CEA 37 DROPPED TO FULLY INS.	15 VLT PWR SUPPLY FAILED LOW
C	FA1	016924	011777	M	CD	I01	T	D	IMPROPER ROD MOVEMENT CAUSED DISPLACEMENT PROBLEM	PERSONNEL ERROR/FAILED TO SELECT AUTO
C	FA1	016925	011777	M	CD	I01	T	D	IMPROPER ROD MOVEMENT CAUSED DISPLACEMENT PROBLEM	PERSONNEL ERROR/WRONG SWITCH POSITION
C	SL1	015508	071076	M	CD	G21	T	D	CEA 50 DROPPED WITH RX. CRIT. AT 0.01% PWR.	FAILURE OF 15 VOLT POWER SUPPLY
C	SL1	018060	052777	M	CD	G21	T	D	CEA 39 DROPPED WITH PLANT OPERATING AT POWER	FAULTY INSERTION TIMER
G	DA1	010428	070274	M	CD	I00	T	D	ROD 18-27 WITHDREW WITHOUT WITHDRAWL SIGNAL APPLIED	EXACT CAUSE NOT STATED
G	DA1	010517	071674	M	CD	I00	T	D	ROD 06-23 WITHDREW WITHOUT WITHDRAWL SIGNAL APPLIED	CAUSE UNKNOWN, BEING INVESTIGATED
G	DA1	010691	090674	M	CD	I21	T	D	ROD MOVED WITHOUT OPERATOR ACTION IN 2 INSTANCES	PROB. CAUSE, NOISE SPIKES IN RMCS OR TIMER
G	DR2	014529	041376	M	CD	I03	T	D	RODS EXERCISED/RX V. SSEL OPEN/PERSONNEL IN AREA	PERSONNEL FAILED TO EVACUATE AREA

CHE-LINERS OF RECURRING COMMAND CRDM FAULTS

VEN	PLANT	CENT. NO.	FAIL DATE	SYST	COMP	FAIL CODE	TYPE	CLASS	FAIL #	FAILURE MODE	FAILURE MECHANISM
W	RG1	C12311A	J30575	M	CD	G21	T	D		B BANK GR2 RCC G5 DROPPED	WTR IN CAB GRND CONT PWR FOR STATN GRIP.
W	RG1	C12311B	C30575	M	CD	G21	T	D		B BANK GR2 RCC G-9 DROPPED	WTR IN CAB. GRND CONT. PWR. FOR STATN GRIP.
W	RG1	C14596*	041676	M	CD	G21	T	D	02	B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	FAILURE OF 4 P.C. CARDS POSSIBLE CAUSE
W	RG1	C15098*	070476	M	CD	G21	T	D	02	B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	STATIONARY COIL CIRCUITRY FAILURE
W	RG1	C15328*	080476	M	CD	G21	T	D	02	D BANK GROUP 2 RODS G-3 AND G-11 PARTIALLY DROPPED	STATIONARY COIL CIRCUITRY FAILURE
W	RG1	C16644	121776	M	CD	G21	T	D		ROD F-12 DROPPED DURING OPER. AT REDUCED LOAD	FAILURE OF STATIONARY HOLD COIL CIRCUITRY
W	RG1	C19595	111677	M	CD	E21	T	D		ROD CONTROL URGENT FAIL. ROD STOP ALARM LIT	RANDOM FAILURE OF 2 DEFECTIVE P.C. CARDS
W	RG1	C19596	111677	M	CD	E21	T	D		ROD CONTROL URGENT FAILURE ROD ALARM LIT	STATIONARY REGULAT. FAIL. IN 180 PWR. CAB.
W	TR1	C14500*	040476	M	CD	K21	T	D	03	ALL DIGITAL ROD POSITION INDIC. WAS LOST, 3 TIMES	FAILURES OF ELEC. COMP. DUE TO OVERHEATING



APPENDIX S

ONE-LINERS OF "DEMAND RELATED" AND "TIME RELATED"  
FAILURE CLASSIFICATION

## APPENDIX S

### ONE-LINERS OF "DEMAND RELATED" AND "TIME RELATED" FAILURE CLASSIFICATION

There are two classifications of interest; (a) time related and (b) demand related faults. Any one-liner which has a "D" in the column headed "CLASS" is a "demand related" fault, and the one-liners which have a "T" in the "CLASS" column are "time related" faults.

FAILURE MODE CODES

FAILURE MECHANISM CODES

FAILURE CLASSIFICATION CODES

CCDE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/C
B	FAILURE TO INSERT DURING SCRAM
C	FAIL TO INSERT AT LEAST 92% DURING SCRAM
D	REC FAILS TO MOVE DURING POWER CHANGES/TESTING
E	REC FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	COUPLER ROD (PAR)
G	COUPLER ROD/CONTROL TRAVEL CONDITION (BWR)
H	INTERNAL LEAKAGE/RUPTURE
I	INTERNAL LEAKAGE/RUPTURE
J	INTERNAL LEAKAGE/RUPTURE
K	INTERNAL LEAKAGE/RUPTURE
L	INTERNAL LEAKAGE/RUPTURE
M	INTERNAL LEAKAGE/RUPTURE
N	INTERNAL LEAKAGE/RUPTURE
O	INTERNAL LEAKAGE/RUPTURE
P	INTERNAL LEAKAGE/RUPTURE
Q	INTERNAL LEAKAGE/RUPTURE
R	INTERNAL LEAKAGE/RUPTURE
S	INTERNAL LEAKAGE/RUPTURE
T	INTERNAL LEAKAGE/RUPTURE
U	INTERNAL LEAKAGE/RUPTURE
V	INTERNAL LEAKAGE/RUPTURE
W	INTERNAL LEAKAGE/RUPTURE
X	INTERNAL LEAKAGE/RUPTURE
Y	INTERNAL LEAKAGE/RUPTURE
Z	INTERNAL LEAKAGE/RUPTURE

CCDE	DESCRIPTION
00	UNKNOWN
01	PERSONNEL (OPERATIONS)
02	PERSONNEL (MAINTENANCE)
03	PERSONNEL (TESTING)
04	DESIGN ERROR
05	FABR/CONSTRUCTION/C.C.
06	PROCEDURAL DISCREPANCIES
07	NORMAL WEAR
08	ABNORMAL WEAR
09	CONTAMINATION
10	EXCESSIVE VIBRATION
11	COMP MOTOR FAILURE
12	SEAL FAILURE
13	MISALIGNED INTERNALS
14	CLUTCH FAILURE
15	BEARING FAILURE
16	BEARING FAILURE
17	FILTER/STRAINER PLUGGED
18	BINDING/SEIZURE
19	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
20	CONTROL CIRCUIT FAILURE/PROBLEM
21	FASTENER FAILURE/PROBLEM
22	WELD FAILURE
23	WELD FAILURE
24	LUBRICATION PROBLEM

CCDE	DESCRIPTION
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

COMPONENT CODE

CCDE	DESCRIPTION
CE	CONTROL ROD DRIVE ASSEMBLY

ACTIVITY RESULTING IN DISCOVERY

CCDE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

TYPE OF FAILURE CODES

CCDE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMON FAULT
F	RECURRING COMMON FAULTS

SYSTEM CODE

CCDE	DESCRIPTION
P	REACTIVITY CONTROL SYSTEM
M	REACTIVITY CONTROL SYSTEM
P	REACTIVITY CONTROL SYSTEM

NSSS VENDOR CODES

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

ONE-LINERS OF "DEMAND RELATED" AND "TIME RELATED" FAILURE CLASSIFICATION

PLANT	CONT. NO.	FAIL DATE	SY S	C C P	FAIL CODE	T T F	C L S S	F A I L R	FAILURE MODE	FAILURE MECHANISM
B AF1	010504	080974	M	CD	706	S	D		IMPROP. MOVEMENT OF ROD 7-4 CAUSED HI S/D RATE TRIP	PROCEDURE FOR COND. TEST WAS INADEQUATE
B AF1	021314*	042478	M	CD	G21	T	D	09	GROUP 7 CONTROL RODS DROPPED DURING PWR OPERATION	FAILURE OF A GATE DRIVE CIRCUIT
B CP3	018405	040477	M	CC	E12	R	D		FCC 6 GR 7 WOULD NOT MOVE WHEN REDUCING PWR	CROM STATOR FAILED / FUSE BLEW
B CK3	018403	040677	M	CD	G12	R	D		IN MODE 1, ROD 3 GR 2 DROPPED INTO CORE	FAILURE OF CROM STATOR CAUSED ROD TO DROP
B CK3	017943	042777	M	CD	IC1	S	D		ROD GROUP 6 EXCEEDED ITS INSERTION LIMIT (I.S.)	PERSONNEL ERROR (COMMAND FAULT)
B CK3	017944*	042777	M	CD	G21	T	D	02	IN MODE 1, ROD GRP 7 DROPPED INTO CORE	POSSIBLE GROUNDED SHIELD TO 24VLT PROG
B CK3	017941*	051377	M	CD	G21	T	D	09	IN MODE 1, GROUP 7 DROPPED INTO CORE	POSSIBLE DESIGN ERROR, GATE DRIVE REL. CKT.
B CK3	017937*	060177	M	CD	E21	S	D	29	CRD SYS. FAILED TO POSIT. REG. RODS ON AUTO DEMAND	LOOSE CONNec. ON CRD PROG. PRINT. CKT. CARD
B CP3	019429*	101677	M	CD	G21	T	D	09	IN MODE 1, DURING TEST SP-110 GRP. 7 DROP INTO CORE	RANDOM INTERMITTENT POWER INTERRUPTIONS
B IP1	000600	020674	M	CD	BC5	B	D		ROD 6 GR A DID NOT INSERT DURING A FAST INSERTION	ID TAGS PUT ON TOO TIGHT/OPEN MTR WINDINGS
B IP1	010329	070774	M	CD	P05	B	D		FCC 16 GR A DID NOT INSERT DURING A FAST INSERTION	ID TAGS PUT ON TOO TIGHT/OPEN MTR WINDINGS
B DE1	000417	100573	M	CD	IC1	S	D		TECH SPEC ROD WITHDRAWL LIMITS WERE EXCEEDED	PERSONNEL ERROR
B CE1	012286	010375	M	CD	I06	S	D		RODS WERE MOVED WITHOUT CALCULATING D POWER WORTH	VENDOR/PERSONNEL PROCEDURES PROBLEM
B CE2	012293	011575	M	CD	IC1	S	D		IMPROPER ROD MOVEMENT CAUSED OVERLAP PROBLEM	PERSONNEL ERROR
B CE2	013202*	082575	M	CD	G00	S	D	09	GR7 RODS DROPPED CAUSING LOSS OF REQUIRED OVERLAP	NO PROBLEM FOUND/PROBABLE COMMAND FAULT
B CE2	020865*	030178	M	CD	G21	S	D	12	CONTROL ROD GROUP 5 DROPPED DURING PERFORM. TEST	MOMENTARY LOSS OF POWER, REASON UNKNOWN
B CE3	012298	020975	M	CD	IC1	S	D		IMPROPER ROD MOVEMENT CAUSED OVERLAP PROBLEM	PERSONNEL ERROR/WRONG ROD POS MONITORED
B CE3	014818*	042276	M	CD	G21	T	D	09	GROUP 7 RODS DROPPED AT 95% POWER	A FAILED GATE DRIVE CIRCUIT
B CE3	015010*	060976	M	CD	G21	T	D	09	GROUP 7 RODS DROPPED	TWO PWR. SUPPLIES FAILED (FUSE, TRANSISTOR)
B RS1	016011	100776	M	CD	IC1	S	D		RODS IN POSITION TO GIVE 4% DELTA K/K SHUTDOWN	PERSONNEL ERROR DURING COLD SHUTDOWN
E T11	012144	021075	M	CC	IC1	S	D		OPERATED WITH ROD 6/8 LOWER THAN REST OF GROUP 6	PERSONNEL ERROR
B T11	013735	111475	M	CD	J02	S	D		VENT FOUND OPEN ON CRDM/GAS VENTED TO RX BUILDING	PERSONNEL ERROR/FAILED TO FOLLOW PROCED.
C CC1	019689A	111277	M	CD	G21	T	D		WHILE AT SS PWR AT 3:04AM CEA 54 DROP TO FULL-IN	15-VLT PWR. SUP. IN COIL PWR. PROG. DRIFT LOW
C CC1	019689B	111277	M	CD	G21	T	D		WHILE AT SS PWR AT 11:14AM CEA 54 DROP TO FULL-IN	15-VLT PWR. SUP. IN COIL PWR. PROG. DRIFT LOW
C CC1	020171	010278	M	CD	G21	T	D		WHILE AT SS PWR CEA 32 DROPPED TO FULLY INSERTED	CEA 15-VLT PWR. SUP. FAILED
C CC2	018300A	070577	M	CD	G21	T	D		WHILE OPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTEN FAIL. OF 15VDC POWER SUPPLY
C CC2	018300B	070777	M	CD	G21	T	D		WHILE OPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTEN FAIL. OF 15VDC POWER SUPPLY
C CC2	019279	100277	M	CD	G21	T	D		DURING FULL PWR. OPS. CEA 37 DROPPED TO FULLY INS.	15 VLT PWR SUPPLY FAILED LOW
C CC2	019693	111177	M	CD	F21	S	D		CEA 36 WOULD NOT MOVE THEN DROPPED WHILE AT SS PWR	DEFECT. TIMER MOD. IN COIL PWR PROGRAMMER
C FC1	000233	060873	M	CD	IC6	S	D		RODS WITHDRAWN WHICH REDUCED S/D MARGIN TO < 2.4	PROCEDURE BASED ON WRONG ROD WORTH CURVES

ONE-LINERS OF "DEMAND RELATED" AND "TIME RELATED" FAILURE CLASSIFICATION

VE N	PLANT	CONT. NO.	FAIL DATE	SY S	COMP	FAIL CODE	TYPE	CLASS	FAILURE MODE	FAILURE MECHANISM
C	MI2	C16030	092276	M	CD	G21	S	D	DURING CEA PARALLEL OPS., CEA 49 DROPPED INTO CORE	BLOWN FUSE IN PARALLELING CIRCUIT
C	PA1	C02059	020372	M	CD	J05	S	D	STEAM LEAK THROUGH DRIVE PACKAGE OF CRDM NO. 17	IMPROPER ASSEM. OF FLANGE CAUSED SEAL FAIL
C	PA1	C16924	011777	M	CD	I01	T	D	IMPROPER ROD MOVEMENT CAUSED DISPLACEMENT PROBLEM	PERSONNEL ERROR/FAILED TO SELECT AUTO
C	PA1	C16925	011777	M	CD	I01	T	D	IMPROPER ROD MOVEMENT CAUSED DISPLACEMENT PROBLEM	PERSONNEL ERROR/WRONG SWITCH POSITION
C	PA1	C21116	041578	M	CD	I03	S	D	IMPROPER ROD MOVEMENT/OUT-OF-SEQUENCE PROBLEM	PERSONNEL ERROR
C	SL1	C14959	052576	M	CD	E21	S	D	REGULATING ROD 59 IMMOVABLE BECAUSE OF CEA MOD. MAL	FAILURE IN RAISE/LOWER CKT OF THE MODULE
C	SL1	C15509	071076	M	CD	G21	T	D	CEA 50 DROPPED WITH RX. CRIT. AT 0.01% PWR.	FAILURE OF 15 VOLT POWER SUPPLY
C	SL1	C18046	052777	M	CD	G21	T	D	CEA 39 DROPPED WITH PLANT OPERATING AT POWER	FAULTY INSERTION TIMER
G	BF1	C00512A	100473	M	CD	D20	S	D	ROD 54-27 WAS VALVED OUT WHILE FULLY WITHDRAWN	NO SUPPLY AVAILABLE TO SCRAM ROD (PERSONNEL)
G	BF2	C15392	061976	M	CD	D20	S	D	ROD 30-31 INCAPABLE OF SCRAM/HCU VALVES SHUT	COMMAND FAULT/PERSONNEL ERROR
G	BP1	C13723	111375	M	CD	D01	S	D	ROD INCAPABLE OF SCRAM/ACCUMULATOR VALVED OUT	PERSONNEL ERROR (INSTRUCTIONS REVISED)
G	BR1	C16935	010977	M	CD	I01	S	D	OPERATOR PULLED RODS TO NOTCH 48 INSTEAD OF 24	PERSONNEL ERROR/MINIMIZER FAILED TO BLOCK
C	BR2	C20838A	033178	M	CD	H18	C	D	ROD 22-19 UNCOUPLED FROM DRIVE MECHANISM	ROD DRIVE MECH. INNER FILTER CAME LOOSE
G	BR2	C20838B	033178	M	CD	H18	C	D	ROD 26-39 UNCOUPLED FROM DRIVE MECHANISM	ROD DRIVE MECH. INNER FILTER CAME LOOSE
C	CC1	C19583	092977	M	CD	H02	C	D	UNCOUPLING ROD AND SPUD FINGERS BENT	IMPROPER ASSEMBLY BY MAINTAINANCE PERSON
C	DA1	C10428	070274	M	CD	I00	T	D	ROD 18-27 WITHDREW WITHOUT WITHDRAWAL SIGNAL APPLIED	EXACT CAUSE NOT STATED
G	DA1	C10517	071674	M	CD	I00	T	D	ROD 06-23 WITHDREW WITHOUT WITHDRAWAL SIGNAL APPLIED	CAUSE UNKNOWN, BEING INVESTIGATED
G	DA1	C10691	090674	M	CD	I21	T	D	ROD MOVED WITHOUT OPERATOR ACTION IN 2 INSTANCES	PROB. CAUSE, NOISE SPIKES IN RMCS OR TIMER
G	DF2	C00284	021973	M	CD	H02	B	D	CRD L-11 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP. INSTAL. OF FILTER DAMAGE RETAIN. SPR
G	DF2	C00285	021973	M	CD	H02	B	D	CRD K-8 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP. INSTAL. OF FILTER DAMAGE RETAIN. SPR
G	DF2	C00286	021973	M	CD	H02	B	D	CRD B-6 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP. INSTAL. OF FILTER DAMAGE RETAIN. SPR
G	DF2	C12217	012575	M	CD	I06	S	D	2 ADJ CONTROL RODS WITHDRAWN DURING REFUELING	DEFECTIVE TEMPORARY PROCEDURE
G	DR2	C12846*	061175	M	CD	K20	S	D	04 DURING SCRAM TEST, 4 DRVS. DID NOT MEET 5% SCR. TIM.	HIGH PRESS. IN SCRAM VLV. HEADER
G	DR2	C14529	041376	M	CD	I03	T	D	RODS EXERCISED/RX VESSEL OPEN/PERSONNEL IN AREA	PERSONNEL FAILED TO EVACUATE AREA
G	MI1	C16343	111276	M	CD	I03	S	D	IMPROPER ROD MOVEMENTS CAUSED INADVERTANT CRITICAL	PERSONNEL SELECTED WRONG RODS DURING TEST
G	MC1	C17363	022377	M	CD	I06	S	D	IMPROPER MOVEMENT RESULTED IN HIGH SUR SCRAM	DEFECTIVE PROCEDURES ON START-UP ROD SEQ.
G	NR1	C19404	102677	M	CD	D02	S	D	CRD 26-51 FAILED TO INSERT WHEN RX WAS SCRAMMED	ACCUM. FOR CRD HAD IMPROP. VLV LINEUP
C	PE3	C19091A	092577	M	CD	D01	S	D	ROD 02-27 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G	FB3	C19091B	092577	M	CD	D01	S	D	ROD 14-15 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G	FB3	C19091C	092577	M	CD	D01	S	D	ROD 18-03 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES

ONE-LINERS OF "DEMAND RELATED" AND "TIME RELATED" FAILURE CLASSIFICATION

PLANT	UNIT	FAIL DATE	SY S	CD	FAIL CODE	TYPE	CLASS	FAILURE MODE	FAILURE MECHANISM
G	P11	030973	M	CD	I20	S	D	ROD 34-15 MOVED FROM 6IN. WITHDRAWN TO FULL-IN	MOVE. DUE TO HI.PRES. IN COOL. WTR. LINE
G	P11	030973	M	CD	K05		D	ROD 34-15 INTERFER WITH FUEL ELE.CHN. 1" FR.FUL-IN	UNCHAMFERED EDGE INTERFERS WITH FUEL CHN.
G	CC1	042173	M	CD	IC1	S	D	IMPROPER ROD MOVEMENT/HEAT GENERATION RATE EXCEED	PERSONNEL ERROR/WRONG ROD SELECTED
G	CC1	101174	M	CD	F13		E	ROD N-11 JAMMED FULLY INSERTED	FAIL. CAUSED BY BROKEN SEAL ON STOP PISTN
G	CC1	050375	M	CD	IC6	S	D	IMPROPER ROD WITHDRAWL DURING REFUELING	INADEQUATE PROCEDURES
G	CC1	070976	M	CD	IC1	S	D	IMPROPER ROD MEVEMENT/2 PULLED SIMULTANEOUSLY	PERSONNEL ERROR
G	VY1	110773	M	CD	IO3	S	D	IMPROPER ROD MOVEMENT CAUSED INADVERTAN CRITICALTY	PERSONNEL ERRORS/INTERLOCKS JUMPERED/TEST
W	PT4	052974	M	CD	IC1	S	D	IMPROPER ROD MOVEMENT/PART-LENGTH RODS INSERTED TO	--82% //PERSONNEL ERROR
W	RC1	030575	M	CD	G21	T	D	B BANK GR2 RCC G5 DROPPED	WTR IN CAB GRND CONT PWR FOR STATN GRIP.
W	RC1	030575	M	CD	G21	T	D	B BANK GR2 RCC G-9 DROPPED	WTR IN CAB. GRND CONT.PWR.FOR STATN GRIP.
W	RG1	041075	M	CD	J05	S	D	LEAK IN CANPY SEC K-7 CAP ON CRD ROD TRAVL HOUSING	CAUSED BY IMPR.TORQ6MACH.DEFECT IN CAP
W	RG1	091775	M	CD	E21	S	D	ROD G-5 BANK B DID NOT MOVE WITH BANK DURING TEST	OPEN CKT IN CABLE OR COIL, G-5 LIFT COIL
W	RG1	041676	M	CD	G21	T	D	02 B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	FAILURE OF 4 P.C. CARDS POSSIBLE CAUSE
W	RG1	170476	M	CD	G21	T	D	02 B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	STATIONARY COIL CIRCUITRY FAILURE
W	RG1	060476	M	CD	G21	T	D	02 D BANK GROUP 2 RODS G-3 AND G-11 PARTIALLY DROPPED	STATIONARY COIL CIRCUITRY FAILURE
W	RG1	121776	M	CD	G21	T	D	ROD F-12 DROPPED DURING OPER. AT REDUCED LOAD	FAILURE OF STATIONARY HOLD COIL CIRCUITRY
W	RG1	019595	M	CD	E21	T	D	ROD CONTROL URGENT FAIL. ROD STOP ALARM LIT	RANDOM FAILURE OF 2 DEFECTIVE P.C. CARDS
W	RG1	019596	M	CD	E21	T	D	ROD CONTROL URGENT FAILURE ROD ALARM LIT	STATIONARY REGULAT. FAIL. IN 180 PWR.CAB.
W	RD2	062072	M	CD	G21	S	D	03 2 RODS (BANK D-GROUP 2) DROPPED INTO THE CORE	MULTIPLEXING THYRISTOR FAILURE PWR CAB280
W	RD2	052674	M	CD	IC2	S	D	RCC ASSEMBLY INADVERTANTLY REMOVED DURING REFUEL	PERSONNEL ERROR
W	RD2	121174	M	CD	IO6	S	D	RODS NOT INSERTED(S/D) WHEN PART-LENGTH ROD INOPER	PROCEDURES HAD 5 PARAGRAPHS DELETED
W	SL1	102575	M	CD	LC2		D	INADVERT. BENT CRD SHAFT DURING CRANE OPERATION	PERSONNEL ERROR
W	SL1	061877	M	CD	G21	S	D	ROD J-13(SHUTDOWN BANK A)DROPPED DURING NORM. OPER	LOSS OF PWR TO STATION. GRIP COIL OF CRDM
W	TR1	040476	M	CD	K21	T	D	03 ALL DIGITAL ROD POSITION INDIC. WAS LOST, 3 TIMES	FAILURES OF ELEC.COMP. DUE TO OVERHEATING
W	TR1	062177	M	CD	E21	S	D	13 LOSS OF ROD CONTROL AFFECTING 13 OF PLANTS 53 RODS	FAILURE OF SUPERVISORY BUFFER MEM. CARD
W	TU4	081573	M	CD	IO3	S	D	ROD TEST CONDUCTED WHICH TECH SPECS DONT ALLOW	PERSONNEL ERROR
B	IP1	040872	M	CD	F14	R	T	ROD 13 FAILED TO MOVE DURING WITHDRAWL FOR INSPEC.	EMBRITTLLED SHAFT CONNECTING PIN BROKE
B	IP1	061772	M	CD	F14	R	T	ROD 14 STUCK 36 INCHES OUT OF THE CORE ON SCRAM	EMBRITTLLED SPIRAL PIN CONNECT. SEAL SHAFT
B	CE2	022676	M	CD	G04	R	T	DROPPED CONT.ROD CAUSED RX.QUAD.TILT TO EX.TECH SP	SHRT. DUE TO DETER EPOXY IN STAT.WNDGS.
B	CE2	122977	M	CD	G12	R	T	CR4GR6 DROPPED WHILE BEING WITHDRAWN	SHRT. DUE TO O-RING FAIL. IN STAT.WNDGS.
B	CE3	021078	M	CD	G12	R	T	CR3GR4 DROPPED DURING AN RPS BREAKER TEST	SHRT. DUE TO O-RING FAIL. IN STAT.WNDGS.

ONE-LINERS OF "DEMAND RELATED" AND "TIME RELATED" FAILURE CLASSIFICATION

VEN	PLANT	CONT. NO.	FAIL DATE	SYS	COMP	FAIL CODE	TYPE	CLASS	FAIL	FAILURE MODE	FAILURE MECHANISM
C	PA1	002042*	082972	M	CD	D24	C	T	04	4 RODS FAILED TO DRCP DURING CRDM TRIP TESTING	DEGRADATION OF LUB. ON SPLINE SURFACES
C	PA1	013074	072775	M	CD	E16	R	T		CRDM14 WOULD NOT INSERT OR WITHDRAW	BRAKE LINING PARTICLES BETWEEN COIL&SHAFT
C	PA1	013075	072775	M	CD	E16	R	T		CRDM33 COULD WITHDRAW BUT WOULD NOT INSERT	BRAKE LINING PARTICLES BETWEEN COIL&SHAFT
C	FA1	014237*	030476	M	CD	L17	C	T	03	SEVERAL CRDM INNER CLUTCH BEARINGS FOUND FAILED	BEARING FAILURES DUE TO OVERHEATING
G	BP1	000512	100473	M	CD	B18		T		RCD 26-55 DRIVE FAILED TO INSERT WHILE AT POWER	RCD DRIVE SYS HAD A DIRTY STRAINER
G	BP1	010032	033174	M	CD	L08	K	T		DURING INSPEC ROD ROLLER MISSING, ROD BLADE C-6	EXCESSIVE WEAR OF SOFT PINS
G	BP1	010351A	060474	M	CD	F10	R	T		RCD C4 FAILED TO MOVE DURING PRE-STARTUP TEST	RCD BLADE ROLLER WEDGED IN DIXIE CUP
C	BP1	010351B	060574	M	CD	F10	R	T		RCD B5 WOULD NOT MOVE FROM FULL INSERTED	BOLT OR CAP SCREW WEDGED IN DIXIE CUP
G	BP1	012197	011775	M	CD	F10	R	T		SEMI-ANL CRD TEST - ROD B4 STUCK FULLY INSERTED	1-INCH BOLT WITH NUT LODGED IN THIMBLE
C	BP1	013157	072575	M	CD	F10	R	T		RCD E4 WOULD NOT WITHDRAW PROPERLY	POSSIBLY LODGED BY SMALL OBJECT IN INTERN
G	BP1	020934	032078	M	CD	J13		T		LEAKAGE FROM RCD F3 DRIVE FLANGE	O-RING SEAL FAILURE
G	BR2	013629	092575	M	CD	H18		T		RCD 26-07 DRIFT FROM FULL INSERT TO FULL WITHDRAW	FOREIGN MATTER IN CRD COLLET PISTON AREA
G	DR1	010183	041274	M	CD	F10		T		CRD B-2 WOULD NOT FUNCTION WHEN GIVEN WITHDRAW SIG	HI CRUD LVL BELIEVED TO BE RESPONSIBLE
G	DR1	018286	061577	M	CD	B10		T		CRD G-9 INSERTED TO 00 THEN DRIFTED TO POSITION 12	PROB. CAUSE OF MALFUNC. WAS FOR. MAT. CONTAM.
W	R02	020552*	021778	M	CD	J23	R	T	02	PINHOLE LEAKS ON 2 SEAL WELDS (D-4 AND G-7)	APPARENTLY THE RESULT OF WELD DEGRADATION

APPENDIX T

ONE-LINERS OF TECHNICAL SPECIFICATION VIOLATIONS (NON-FAILURES)



FAILURE MODE CODES

CODE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/D
B	FAILURE TO INSERT DURING SCRAM
C	FAIL TO INSERT TO AT LEAST 90% DURING SCRAM
E	RCD FAILS TO MOVE DURING POWER CHANGES/TESTING
F	RCD FAILS TO MOVE FROM FULLY INSERTED POSITION
G	CREEPED RCD (PWR)
H	UNCOUPLED RCD/CONTROL TRAVEL CONDITION (BWR)
I	IMPROPER RCD MOVEMENT
J	EXTERNAL LEAKAGE/CRACK
K	CCES NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
L	MAINTENANCE/REPLACEMENT REQUIRED (TECHNICAL SPECIFICATION VIOLATION (MCH-FAILURES))

COMPONENT CODE

CODE	DESCRIPTION
CC	CONTROL RCD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CODE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
R	RECURRING FAILURES
S	COMMAND FAULT
T	RECURRING COMMAND FAULTS

FAILURE MECHANISM CODES

CODE	DESCRIPTION
CO	UNKNOWN
CC	PERSONNEL (OPERATIONS)
CC	PERSONNEL (MAINTENANCE)
CC	PERSONNEL (TESTING)
CC	DESIGN ERROR
CC	LAB./CONSTRUCTION/C.C.
CC	PROCEDURAL DISCREPANCIES
CC	NORMAL WEAR
CC	EXCESSIVE WEAR
CC	CORROSION
CC	EXCESSIVE MATERIAL CONTAMINATION
CC	EXCESSIVE VIBRATION
CC	COM MOTOR FAILURE
CC	SEAL FAILURE
CC	WELD/MISALIGNED INTERNALS
CC	CLUTCH FAILURE
CC	SPRING FAILURE
CC	BEARING FAILURE
CC	FILTER/STRAINER PLUGGED
CC	BINDING/SEIZURE
CC	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
CC	CONTROL CIRCUIT FAILURE/PROBLEM
CC	FASTENER FAILURE/PROBLEM
CC	WELD FAILURE
CC	LUBRICATION PROBLEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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

SYSTEM CODE

CODE	DESCRIPTION
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

ONE-LINERS OF TECHNICAL SPECIFICATION VIOLATIONS (NGN-FAILURES)

VENT	PLANT	CONT. NO.	FAIL DATE	SY S	COMP	FAIL CODE	TYPE	CLASS	FAIL #	FAILURE MODE	FAILURE MECHANISM
B	AR1	C12154	011475	M	CD	T04	N			ERROR IN HOT, ZERO PWR, EJECTED ROD WORTH CALC	DESIGN ERROR
B	CR3	C16644	122276	M	CD	T03	N			TECH SPEC VIOLATION/CRD BKRS CLOSED, DETECTORS OOS	PERSONNEL ERROR WHILE TESTING
B	RS1	C18013	042277	M	CD	T02	N			TECH SPEC VIOLATION/VERIFICATION CHECKS NOT DONE--	--ON COMPLETION OF MAINT//PERSONNEL ERROR
B	T11	C13517	102175	M	CD	T03	N			TECH SPEC VIOLATION/TEST NOT PERFORMED PROPERLY	PERSONNEL ERROR
G	BP1	019662	103077	M	CD	T06	N			MODE SW LEFT IN RUN WITH ROD DRIVE REMOVAL/T.S.	MAINT PROCEDURE REVISED
G	VY1	010161	041474	M	CD	T01	N			TECH SPEC VIOLATION/FAILED TO EXERCISE RODS	PERSONNEL ERROR/OVERSIGHT ON WEEKLY TEST

APPENDIX U

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAM

FAILURE MODE CODES

CODE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/D
B	FAILURE TO INSERT DURING SCRAM
C	FAILURE TO INSERT AT LEAST 90% DURING SCRAM
D	POWER CHANGES/TESTING
E	FROM FULLY INSERTED POSITION
F	CRAPPED ROD (PWR)
G	UNCOMPLETED ROD/CONTROL TRAVEL CONDITION (BWR)
H	IMPROPER ROD MOVEMENT
I	EXTERNAL LEAKAGE/RUPTURE
J	DOES NOT OPERATE PROPERLY
K	(SPECIFIC MODE NOT IDENTIFIABLE)
L	MAINTENANCE/REPLACEMENT REQUIRED
M	TECHNICAL SPECIFICATION VIOLATION (NON-FAILURES)

COMPONENT CODE

CODE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CODE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMAND FAULTS
F	RECURRING COMMAND FAULTS

FAILURE MECHANISM CODES

CODE	DESCRIPTION
CC	UNKNOWN
DD	PERSONNEL (OPERATIONS)
EE	PERSONNEL (MAINTENANCE)
FF	PERSONNEL (TESTING)
GG	DESIGN ERROR
HH	CONSTRUCTION/C.C.
II	PROCEDURAL DISCREPANCIES
JJ	NORMAL WEAR
KK	EXCESSIVE WEAR
LL	CORROSION
MM	OVERHEAT
NN	EXCESSIVE MATERIAL CONTAMINATION
OO	EXCESSIVE VIBRATION
PP	CRON MOTOR FAILURE
QQ	SEAL FAILURE
RR	MISALIGNED INTERNALS
SS	CLUTCH FAILURE
TT	SLAKE FAILURE
UU	BEARING FAILURE
VV	FILTER/STRAINER PLUGGED
WW	BINDING/SEIZURE
XX	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
YY	CONTROL CIRCUIT FAILURE/PROBLEM
ZZ	FASTENER FAILURE/PROBLEM
AA	WELD FAILURE
BB	LUBRICATION PROBLEM

SYSTEM CODE

CODE	DESCRIPTION
	PWR
	BWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/
	SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAM

<u>VFN</u>	<u>PLANT</u>	<u>CONT. NO.</u>	<u>FAIL DATE</u>	<u>DAY</u>	<u>CLAS</u>	<u>FAIL CODE</u>	<u>TYPE</u>	<u>CLASS</u>	<u>FAILURE MODE</u>	<u>FAILURE MECHANISM</u>
G	BF1	00512A	100473	M	CD	D20	S	D	RCD 54-27 WAS VALVED OUT WHILE FULLY WITHDRAWN	NO SUPPLY AVAILABLE TO SCRAM ROD(PERSONL)
G	BF2	015392	061976	F	CD	D20	S	D	RCD 30-31 INCAPABLE OF SCRAM/HCU VALVES SHUT	COMMAND FAULT/PERSONNEL ERROR
G	BF1	013723	111375	M	CD	D01	S	D	RCD INCAPABLE OF SCRAM/ACCUMULATOR VALVED OUT	PERSONNEL ERROR(INSTRUCTIONS REVISED)
G	DR2	010949A	110274	M	CD	D13	C	L G3	3 CRDS FAILED TO GO TO POS 02 DR BELOW ON SCRAM	PROBABLE EXCESSIVE LEAKAGE PAST SEALS
G	FC1	002116	052372	F	CD	D13	L		1 CONT. ROD DID NOT FULLY INSERT DURING SCRAM	EXCESS. LEAK. ACROSS STOP PISTON SEALS
G	NM1	019404	102677	M	CD	D02	S	D	CRD 26-51 FAILED TO INSERT WHEN RX WAS SCRAMMED	ACCUM. FOR CRD HAD INPROP. VLV LINEUP
G	PB3	014724A	050676	F	CD	D00	R	U	RCD 10-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G	PB3	014724B	052576	M	CD	D00	R	U	RCD 10-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G	PB3	019091A	052577	M	CD	D01	S	D	RCD 02-27 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G	PB3	019091B	052577	M	CD	D01	S	D	RCD 14-15 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G	PB3	019091C	052577	M	CD	D01	S	D	RCD 16-03 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G	PI1	016700	060677	M	CD	D00	L		RCD 34-11 REMAINED FULL OUT WHEN RX WAS SCRAMMED	CAUSE UNDER INVEST. NEW LER TO BE SUBMIT.
M	RC2	019342	042477	M	CD	D00	L		RCD N-9 DID NOT INSERT ON REACTOR TRIP	CAUSE IS UNKNOWN
M	TU3	001026	060673	M	CD	D00	R	L	RCD N-8 STUCK AT 225 STEPS AFTER ROD DROP SIGNAL	NO CAUSE DETERMINED
M	TU3	000308	061673	M	CD	D00	R	L	RCD J-5 FAILED TO DROP AFTER RX TRIP BRKRS OPENED	NO CAUSE DETERMINED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAM; 1/1/76 THRU 4/30/78

BAFCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AR1	12946.0	69	8	0	893274.0	552	3.4E-06*	5.4E-03*
CK3	7430.0	69	15	0	512670.0	1035	5.8E-06*	2.9E-03*
DE1	4129.0	57	7	0	235353.0	399	1.3E-05*	7.5E-03*
DE1	13620.0	69	17	0	939780.0	1173	3.2E-06*	2.6E-03*
DE2	13196.0	69	6	0	910524.0	414	3.3E-06*	7.2E-03*
DE3	15777.0	69	10	0	1088613.0	690	2.8E-06*	4.3E-03*
RS1	12642.0	69	10	0	872298.0	640	3.4E-06*	4.3E-03*
TI1	14916.0	69	2	0	1029204.0	138	2.9E-06*	2.2E-02*
TI2	342.0	69	4	0	23596.0	276	1.3E-04*	1.1E-02*
TOTALS				0	6505314.0	5367		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAM; 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	15903.0	85	18	0	1351755.0	1530	2.2E-06*	2.0E-03*
CC2	9162.0	85	11	0	778770.0	935	3.8E-06*	3.2E-03*
FC1	16130.0	49	10	0	790370.0	490	3.8E-06*	6.1E-03*
MI2	13567.0	61	41	0	1098927.0	3321	2.7E-06*	9.0E-04*
MY1	18606.0	85	9	0	1581510.0	765	1.9E-06*	3.9E-03*
SL1	9903.0	61	23	0	802143.0	1863	3.7E-06*	1.6E-03*
TOTALS				0	6403475.0	8904		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAM; 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	OPIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	10793.0	185	22	0	1996705.0	4070	1.5E-06*	7.4E-04*
BF2	11809.0	185	22	0	2184665.0	4070	1.4E-06*	7.4E-04*
BF3	11545.0	185	30	0	2135825.0	5550	1.4E-06*	5.4E-04*
BP1	13379.0	32	2	0	428128.0	64	7.0E-06*	4.7E-02*
BP1	7544.0	137	20	0	1033528.0	2740	2.9E-06*	1.1E-03*
BP2	13226.0	137	42	0	1811962.0	5754	1.7E-06*	5.2E-04*
CL1	16617.0	137	14	0	2276529.0	1918	1.3E-06*	1.6E-03*
CA1	15981.0	89	17	0	1422309.0	1513	2.1E-06*	2.0E-03*
DF1	15801.0	60	11	0	1264080.0	880	2.4E-06*	3.4E-03*
DF2	16103.0	177	14	0	2850231.0	2478	1.1E-06*	1.2E-03*
DK3	17226.0	177	9	0	3049002.0	1593	9.8E-07*	1.9E-03*
EN1	15876.0	137	44	0	2175012.0	6028	1.4E-06*	5.0E-04*
FP1	15348.0	137	24	0	2102676.0	3288	1.4E-06*	9.1E-04*
MI1	17024.0	145	17	0	2468480.0	2465	1.2E-06*	1.2E-03*
MC1	18126.0	121	8	0	2193246.0	968	1.4E-06*	3.1E-03*
NP1	16060.0	129	9	0	2071740.0	1161	1.4E-06*	2.6E-03*
OC1	16142.0	137	4	0	2211454.0	548	1.4E-06*	5.5E-03*
PE2	13776.0	185	16	0	2548560.0	2960	1.2E-06*	1.0E-03*
PB3	14685.0	185	11	2	2753725.0	2035	7.3E-07	9.8E-04
PI1	13412.0	145	19	1	1944740.0	2755	5.1E-07	3.6E-04
QC1	15547.0	177	21	0	2751819.0	3717	1.1E-06*	8.1E-04*
QC2	16750.0	177	18	0	2964750.0	3186	1.0E-06*	9.4E-04*
VY1	17311.0	89	12	0	1540679.0	1068	1.9E-06*	2.8E-03*
			TOTALS	3	48179845.0	60809		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 90% DURING SCRAM; 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT. HRS.	POPULATION	DEMANDS	FALLTS	POP. HOURS	POP. DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BV1	9106.0	48	82	0	437088.0	3956	6.9E-06*	7.6E-04*
CC1	16401.0	53	20	0	869253.0	2060	3.4E-06*	2.8E-03*
LC2	770.0	53	7	0	40810.0	371	7.3E-05*	8.1E-03*
HN1	18030.0	45	12	0	811350.0	540	3.7E-06*	5.5E-03*
IP2	10995.0	53	35	0	582735.0	1855	5.1E-06*	1.6E-03*
IP3	11694.0	53	15	0	619782.0	1007	4.8E-06*	3.0E-03*
JF1	3079.0	48	13	0	147792.0	624	2.0E-05*	4.8E-03*
KE1	16994.0	29	17	0	492826.0	493	6.1E-06*	6.1E-03*
NA1	410.0	48	6	0	19680.0	288	1.5E-04*	1.0E-02*
PR1	16859.0	37	13	0	623783.0	481	4.8E-06*	6.2E-03*
PR2	17531.0	37	13	0	648647.0	481	4.6E-06*	6.2E-03*
PT1	18041.0	37	5	0	667517.0	185	4.5E-06*	1.6E-02*
PT2	17964.0	37	6	0	664668.0	222	4.5E-06*	1.3E-02*
RC1	14639.0	29	3	0	424531.0	87	7.1E-06*	3.4E-02*
RD2	16245.0	41	22	1	666045.0	902	1.5E-06	1.1E-03
SA1	4368.0	53	17	0	231504.0	901	1.3E-05*	3.3E-03*
SD1	14325.0	45	13	0	644625.0	585	4.6E-06*	5.1E-03*
SL1	15487.0	48	19	0	743376.0	912	4.0E-06*	3.3E-03*
SL2	13160.0	48	15	0	631680.0	720	4.7E-06*	4.2E-03*
TR1	12539.0	53	28	0	664567.0	1484	4.5E-06*	2.0E-03*
FU3	15712.0	45	19	0	707040.0	855	4.2E-06*	3.5E-03*
TL4	14145.0	45	28	0	636525.0	1260	4.7E-06*	2.4E-03*
ZI1	15178.0	53	19	0	804434.0	1007	3.7E-06*	3.0E-03*
ZI2	13657.0	53	25	0	723821.0	1537	4.1E-06*	1.9E-03*
			TOTALS	1	13504079.0	21793		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



FAILURE TO INSERT IJ AT LEAST 96% DURING SCRAM; 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
BAB.EWIL.	4.6E-07*	5.6E-04*
COMB.ENG.	4.7E-07*	3.4E-04*
	2.6	2.6
GEN.ELEC.	6.2E-08	4.9E-05
	3.7	3.7
	4.7	4.7
WESTINGH.	7.4E-08	4.6E-05
	19.5	19.5
	4.7	4.7
PWR'S	3.8E-08	2.8E-05
	19.5	19.5
	2.3	2.3
OVERALL	5.4E-08	4.1E-05
	2.9	2.9

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAP (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

BAECJCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AF1	12946.0	69	8	0	893274.0	552	3.4E-06*	5.4E-03*
CR3	7430.0	69	15	0	512670.0	1035	5.8E-06*	2.9E-03*
DP1	4129.0	57	7	0	235353.0	399	1.3E-05*	7.5E-03*
DE1	13620.0	69	17	0	939780.0	1173	3.2E-06*	2.6E-03*
DE2	13196.0	69	6	0	910524.0	414	3.3E-06*	7.2E-03*
DE3	15777.0	69	10	0	1088613.0	690	2.8E-06*	4.3E-03*
FS1	12642.0	69	10	0	872298.0	690	3.4E-06*	4.3E-03*
T11	14916.0	69	2	0	1029204.0	138	2.9E-06*	2.2E-02*
T12	342.0	69	4	0	23598.0	276	1.3E-04*	1.1E-02*
TOTALS				0	6505314.0	5367		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAP (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	15903.0	85	18	0	1351755.0	1530	2.2E-06*	2.0E-03*
CC2	9162.0	85	11	0	778770.0	935	3.8E-06*	3.2E-03*
FC1	16130.0	49	10	0	790370.0	490	3.8E-06*	6.1E-03*
MT2	13567.0	81	41	0	1098927.0	3321	2.7E-06*	9.0E-04*
MY1	18606.0	85	5	0	1581510.0	765	1.9E-06*	3.9E-03*
SL1	9903.0	81	23	0	802143.0	1863	3.7E-06*	1.6E-03*
TOTALS				0	6403475.0	8904		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAM (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	10793.0	185	22	0	1996705.0	4070	1.5E-06*	7.4E-04*
BF2	11809.0	185	22	1	2184665.0	4070	4.6E-07	2.5E-04
BF3	11545.0	185	30	0	2135825.0	5550	1.4E-06*	5.4E-04*
BF1	13379.0	32	2	0	428128.0	64	7.0E-06*	4.7E-02*
BF1	7544.0	137	20	0	1033528.0	2740	2.9E-06*	1.1E-03*
BF2	13226.0	137	42	0	1811962.0	5754	1.7E-06*	5.2E-04*
CC1	16617.0	137	14	0	2276529.0	1918	1.3E-06*	1.6E-03*
DA1	15981.0	89	17	0	1422309.0	1513	2.1E-06*	2.0E-03*
DF1	15601.0	80	11	0	1264080.0	880	2.4E-06*	3.4E-03*
DR2	16103.0	177	14	0	2850231.0	2478	1.1E-06*	1.2E-03*
DF3	17226.0	177	9	0	3049002.0	1593	9.8E-07*	1.9E-03*
EA1	15876.0	137	44	0	2175012.0	6028	1.4E-06*	5.0E-04*
FP1	15348.0	137	24	0	2102676.0	3288	1.4E-06*	9.1E-04*
MI1	17024.0	145	17	0	2468480.0	2465	1.2E-06*	1.2E-03*
ME1	18126.0	121	8	0	2193246.0	968	1.4E-06*	3.1E-03*
NF1	16060.0	129	9	1	2071740.0	1161	4.8E-07	8.6E-04
UC1	16142.0	137	4	0	2211454.0	548	1.4E-06*	5.5E-03*
PE2	13776.0	185	16	0	2548560.0	2960	1.2E-06*	1.0E-03*
PB3	14885.0	185	11	5	2753725.0	2035	1.8E-06	2.5E-03
PI1	13412.0	145	19	1	1944740.0	2755	5.1E-07	3.6E-04
QC1	15547.0	177	21	0	2751819.0	3717	1.1E-06*	8.1E-04*
QC2	16750.0	177	18	0	2964750.0	3186	1.0E-06*	9.4E-04*
VY1	17311.0	89	12	0	1540679.0	1068	1.9E-06*	2.8E-03*
TOTALS				8	48179845.0	60809		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAP (COMPAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BV1	9106.0	48	82	0	437088.0	3936	6.9E-06*	7.6E-04*
DC1	16401.0	53	20	0	869253.0	1060	3.4E-06*	2.8E-03*
DC2	770.0	53	7	0	40810.0	371	7.3E-05*	8.1E-03*
HN1	18030.0	45	12	0	811350.0	540	3.7E-06*	5.5E-03*
IF2	10995.0	53	35	0	582735.0	1855	5.1E-06*	1.6E-03*
IP3	11694.0	53	15	0	619782.0	1007	4.8E-06*	3.0E-03*
JF1	3079.0	48	13	0	147792.0	624	2.0E-05*	4.8E-03*
KE1	16994.0	29	17	0	492826.0	493	6.1E-06*	6.1E-03*
NA1	410.0	48	6	0	19680.0	288	1.5E-04*	1.0E-02*
PP1	16859.0	37	13	0	623783.0	481	4.8E-06*	6.2E-03*
PR2	17531.0	37	13	0	648647.0	481	4.6E-06*	6.2E-03*
PT1	18041.0	37	5	0	667517.0	185	4.5E-06*	1.6E-02*
PI2	17964.0	37	6	0	664668.0	222	4.5E-06*	1.3E-02*
RG1	14639.0	29	3	0	424531.0	87	7.1E-06*	3.4E-02*
RC2	16245.0	41	22	1	666045.0	902	1.5E-06	1.1E-03
SA1	4368.0	53	17	0	231504.0	901	1.3E-05*	3.3E-03*
SC1	14325.0	45	13	0	644625.0	585	4.6E-06*	5.1E-03*
SC1	15487.0	48	15	0	743376.0	912	4.0E-06*	3.3E-03*
SC2	13160.0	48	15	0	631680.0	720	4.7E-06*	4.2E-03*
TR1	12539.0	53	26	0	664567.0	1484	4.5E-06*	2.0E-03*
TL3	15712.0	45	15	0	707040.0	855	4.2E-06*	3.5E-03*
TU4	14145.0	45	28	0	636525.0	1260	4.7E-06*	2.4E-03*
ZI1	15178.0	53	19	0	804434.0	1007	3.7E-06*	3.0E-03*
ZI2	13657.0	53	29	0	723821.0	1537	4.1E-06*	1.9E-03*
			TOTALS	1	13504079.0	21793		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAP (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
BAB. & WIL.	4.6E-07*	5.6E-04*
COMB. ENG.	4.7E-07*	3.4E-04*
	1.8	1.8
GEN. ELEC.	1.7E-07	1.3E-04
	2.0	2.0
	4.7	4.7
WESTINGH.	7.4E-08	4.6E-05
	19.5	19.5
	4.7	4.7
PWR'S	3.8E-08	2.8E-05
	19.5	19.5
	1.7	1.7
OVERALL	1.2E-07	9.3E-05
	1.9	1.9

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAM; 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AF1	20009.0	69	15	0	1380621.0	1035	2.2E-06*	2.9E-03*
CR3	7430.0	69	15	0	512670.0	1035	5.8E-06*	2.9E-03*
DE1	4129.0	57	7	0	235353.0	399	1.3E-05*	7.5E-03*
DE1	30392.0	69	64	0	2097048.0	4416	1.4E-06*	6.8E-04*
DE2	21755.0	69	17	0	1501095.0	1173	2.0E-06*	2.6E-03*
DE3	22921.0	69	18	0	1581549.0	1242	1.9E-06*	2.4E-03*
RS1	14543.0	69	12	0	1003467.0	828	3.0E-06*	3.6E-03*
TJ1	24929.0	69	7	0	1720101.0	483	1.7E-06*	6.2E-03*
TJ2	342.0	69	4	0	23598.0	276	1.3E-04*	1.1E-02*
TOTALS				0	10055502.0	10887		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAM; 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	20739.0	85	28	0	1762815.0	2380	1.7E-06*	1.3E-03*
CC2	9162.0	85	11	0	778770.0	935	3.8E-06*	3.2E-03*
FC1	32123.0	49	29	0	1574027.0	1421	1.9E-06*	2.1E-03*
M12	14906.0	81	41	0	1207386.0	3321	2.5E-06*	9.0E-04*
MY1	40408.0	85	31	0	3434680.0	2635	8.7E-07*	1.1E-03*
SL1	9903.0	81	23	0	802143.0	1863	3.7E-06*	1.6E-03*
TOTALS				0	9559821.0	12555		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAM; 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CKTT.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	15553.0	185	47	0	2877305.0	8695	1.0E-06*	3.4E-04*
LF2	12326.0	185	30	0	2280310.0	5550	1.3E-06*	5.4E-04*
BF3	11545.0	185	30	0	2135825.0	5550	1.4E-06*	5.4E-04*
BP1	38622.0	32	3	0	1235904.0	96	2.4E-06*	3.1E-02*
BR1	7544.0	137	20	0	1033528.0	2740	2.9E-06*	1.1E-03*
BR2	14576.0	137	58	0	1996912.0	7946	1.5E-06*	3.8E-04*
CD1	27641.0	137	44	0	3786817.0	6028	7.9E-07*	5.0E-04*
CP1	22487.0	89	24	0	2001343.0	2136	1.5E-06*	1.4E-03*
DK1	35600.0	80	15	0	2848000.0	1200	1.1E-06*	2.5E-03*
DR2	39390.0	177	35	3	6972030.0	6903	4.3E-07	4.3E-04
DP3	41057.0	177	35	0	7267089.0	6903	4.1E-07*	4.3E-04*
EN1	23634.0	137	78	0	3237858.0	10686	9.3E-07*	2.8E-04*
FP1	18189.0	137	30	0	2491893.0	4110	1.2E-06*	7.3E-04*
MI1	39560.0	145	40	0	5736200.0	5800	5.2E-07*	5.2E-04*
MO1	44190.0	121	20	1	5346990.0	2420	1.9E-07	4.1E-04
NP1	41084.0	129	61	0	5299836.0	7869	5.7E-07*	3.8E-04*
OC1	42170.0	137	22	0	5777290.0	3014	5.2E-07*	9.9E-04*
PP2	24563.0	185	46	0	4544155.0	8510	6.6E-07*	3.5E-04*
PE3	22737.0	185	17	2	4206345.0	3145	4.8E-07	6.4E-04
PI1	31756.0	145	54	1	4604620.0	7830	2.2E-07	1.3E-04
QC1	37446.0	177	48	0	6627942.0	8496	4.5E-07*	3.5E-04*
QC2	39780.0	177	56	0	7041060.0	9912	4.3E-07*	3.0E-04*
VY1	39826.0	89	38	0	3544514.0	3382	8.5E-07*	8.9E-04*
			TOTALS	7	92893766.0	128921		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAM; 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CYCL.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOURLY RATE	DEMAND RATE
BV1	9106.0	48	82	0	437088.0	3936	6.9E-06*	7.6E-04*
DC1	22795.0	53	33	0	1208135.0	1749	2.5E-06*	1.7E-03*
DC2	770.0	53	7	0	40810.0	371	7.3E-05*	8.1E-03*
HM1	45574.0	45	23	0	2050830.0	1035	1.5E-06*	2.9E-03*
IP2	21387.0	53	128	0	1133511.0	6784	2.6E-06*	4.4E-04*
IP3	11694.0	53	19	0	619782.0	1007	4.8E-06*	3.0E-03*
JF1	3079.0	48	13	0	147792.0	624	2.0E-05*	4.8E-03*
KE1	28727.0	29	66	0	833083.0	1914	3.6E-06*	1.6E-03*
NA1	410.0	48	6	0	19680.0	288	1.5E-04*	1.0E-02*
PF1	28913.0	37	45	0	1069781.0	1665	2.8E-06*	1.8E-03*
PK2	25020.0	37	36	0	925740.0	1332	3.2E-06*	2.2E-03*
PI1	44738.0	37	17	0	1655306.0	629	1.8E-06*	4.8E-03*
PT2	45215.0	37	25	0	1672955.0	925	1.8E-06*	3.2E-03*
RG1	40932.0	29	20	0	1187028.0	580	2.5E-06*	5.2E-03*
RO2	43928.0	41	80	1	1801048.0	3280	5.6E-07	3.0E-04
SA1	4368.0	53	17	0	231504.0	901	1.3E-05*	3.3E-03*
SL1	41777.0	45	24	0	1879965.0	1080	1.6E-06*	2.8E-03*
SL1	31984.0	48	84	0	1535232.0	4032	2.0E-06*	7.4E-04*
SL2	28790.0	48	62	0	1381920.0	2976	2.2E-06*	1.0E-03*
TF1	12539.0	53	28	0	664567.0	1484	4.5E-06*	2.0E-03*
TL3	34592.0	45	81	2	1664640.0	3645	1.2E-06	5.5E-04
TL4	29791.0	45	74	0	1340595.0	3330	2.2E-06*	9.0E-04*
Z11	26612.0	53	51	0	1410436.0	2703	2.1E-06*	1.1E-03*
Z12	21735.0	53	89	0	1151955.0	4717	2.6E-06*	6.4E-04*
			TOTALS	3	26063383.0	50987		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



FAILURE TO INSERT TO AT LEAST 90% DURING SCRAM; 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
BAB.6WIL.	3.0E-07*	2.8E-04*
CUMB.ENG.	3.1E-07*	2.4E-04*
	1.9	1.9
GEN.ELEC.	7.5E-08	5.4E-05
	2.1	2.1
	2.6	2.6
WESTINGH.	1.2E-07	5.9E-05
	3.7	3.7
	2.6	2.6
PWR'S	6.6E-08	4.0E-05
	3.7	3.7
	1.7	1.7
OVERALL	7.2E-08	4.9E-05
	1.8	1.8

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TC AT LEAST 96% DURING SCRAM (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

BABCOCK & WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AP1	20009.0	69	15	0	1380621.0	1035	2.2E-06*	2.9E-03*
CP3	7430.0	69	15	0	512670.0	1035	5.8E-06*	2.9E-03*
DE1	4129.0	57	7	0	235353.0	399	1.3E-05*	7.5E-03*
DE1	30392.0	69	64	0	2097048.0	4416	1.4E-06*	6.8E-04*
DE2	21755.0	69	17	0	1501095.0	1173	2.0E-06*	2.6E-03*
DE3	22921.0	69	18	0	1581549.0	1242	1.9E-06*	2.4E-03*
RS1	14543.0	69	12	0	1003467.0	828	3.0E-06*	3.6E-03*
T11	24929.0	69	7	0	1720101.0	483	1.7E-06*	6.2E-03*
T12	342.0	69	4	0	23598.0	276	1.3E-04*	1.1E-02*
TOTALS				0	10055502.0	10887		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TC AT LEAST 96% DURING SCRAM (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	20739.0	85	28	0	1762815.0	2380	1.7E-06*	1.3E-03*
CC2	9162.0	85	11	0	778770.0	935	3.8E-06*	3.2E-03*
FC1	32123.0	49	25	0	1574027.0	1421	1.9E-06*	2.1E-03*
M12	14906.0	81	41	0	1207386.0	3321	2.5E-06*	9.0E-04*
MY1	40408.0	85	31	0	3434680.0	2635	8.7E-07*	1.1E-03*
SL1	9903.0	81	23	0	802143.0	1863	3.7E-06*	1.6E-03*
TOTALS				0	9559821.0	12555		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAM (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	15553.0	185	47	1	2877305.0	8695	3.5E-07	1.2E-04
BF2	12326.0	185	30	1	2280310.0	5550	4.4E-07	1.8E-04
BF3	11545.0	185	30	0	2135825.0	5550	1.4E-06*	5.4E-04*
BP1	38622.0	32	3	1	1235904.0	96	8.1E-07	1.0E-02
BR1	7544.0	137	20	0	1033528.0	2740	2.9E-06*	1.1E-03*
BR2	14576.0	137	58	0	1996912.0	7946	1.5E-06*	3.8E-04*
CC1	27641.0	137	44	0	3786817.0	6028	7.9E-07*	5.0E-04*
DA1	22487.0	89	24	0	2001343.0	2136	1.5E-06*	1.4E-03*
DF1	35600.0	80	15	0	2848000.0	1200	1.1E-06*	2.5E-03*
DF2	39390.0	177	35	3	6972030.0	6903	4.3E-07	4.3E-04
DF3	41057.0	177	35	0	7267089.0	6903	4.1E-07*	4.3E-04*
EN1	23634.0	137	78	0	3237858.0	10686	9.3E-07*	2.8E-04*
FP1	18189.0	137	30	0	2491893.0	4110	1.2E-06*	7.3E-04*
M11	39560.0	145	40	0	5736200.0	5800	5.2E-07*	5.2E-04*
MC1	44190.0	121	20	1	5346990.0	2420	1.9E-07	4.1E-04
NM1	41084.0	129	61	1	5299836.0	7869	1.9E-07	1.3E-04
OC1	42170.0	137	22	0	5777290.0	3014	5.2E-07*	9.9E-04*
PE2	24563.0	185	46	0	4544155.0	8510	6.6E-07*	3.5E-04*
PP3	22737.0	185	17	5	4206345.0	3145	1.2E-06	1.6E-03
PT1	31756.0	145	54	1	4604620.0	7830	2.2E-07	1.3E-04
QC1	37446.0	177	48	0	6627942.0	8496	4.5E-07*	3.5E-04*
WC2	39780.0	177	56	0	7041060.0	9912	4.3E-07*	3.0E-04*
VY1	39826.0	65	38	0	3544514.0	3382	8.5E-07*	8.9E-04*
			TOTALS	14	92893766.0	128921		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FATLURE TO INSERT TC AT LEAST 96% DURING SCRAM (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOOR RATE	DEMAND RATE
BB1	9106.0	48	82	0	437088.0	3936	6.9E-06*	7.6E-04*
CC1	22795.0	53	33	0	1208135.0	1749	2.5E-06*	1.7E-03*
CC2	770.0	53	7	0	40810.0	371	7.3E-05*	8.1E-03*
HA1	45574.0	45	23	0	2050830.0	1035	1.5E-06*	2.9E-03*
IF2	21387.0	53	128	0	1133511.0	6784	2.6E-06*	4.4E-04*
IP3	11694.0	53	15	0	619782.0	1007	4.8E-06*	3.0E-03*
JF1	3079.0	48	12	0	147792.0	624	2.0E-05*	4.8E-03*
KE1	28727.0	29	66	0	833083.0	1914	3.6E-06*	1.6E-03*
NA1	410.0	48	6	0	19680.0	288	1.5E-04*	1.0E-02*
PP1	28913.0	37	45	0	1069781.0	1665	2.8E-06*	1.8E-03*
PR2	25020.0	37	36	0	925740.0	1332	3.2E-06*	2.2E-03*
PT1	44738.0	37	17	0	1655306.0	629	1.8E-06*	4.8E-03*
PT2	45215.0	37	25	0	1672955.0	925	1.8E-06*	3.2E-03*
RC1	40952.0	29	20	0	1187028.0	580	2.5E-06*	5.2E-03*
RL2	43928.0	41	80	1	1801048.0	3280	5.6E-07	3.0E-04
SA1	4368.0	53	17	0	231504.0	901	1.3E-05*	3.3E-03*
SC1	41777.0	45	24	0	1879965.0	1080	1.6E-06*	2.8E-03*
SL1	31984.0	48	84	0	1535232.0	4032	2.0E-06*	7.4E-04*
SU2	28790.0	48	62	0	1381920.0	2976	2.2E-06*	1.0E-03*
TR1	12539.0	53	28	0	664567.0	1484	4.5E-06*	2.0E-03*
TL3	36992.0	45	81	2	1664640.0	3645	1.2E-06	5.5E-04
TL4	29791.0	45	74	0	1340595.0	3330	2.2E-06*	9.0E-04*
Z11	26612.0	53	51	0	1410436.0	2703	2.1E-06*	1.1E-03*
Z12	21735.0	53	89	0	1151955.0	4717	2.6E-06*	6.4E-04*
TOTALS				3	26063383.0	50987		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT TO AT LEAST 96% DURING SCRAM (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
BAB.EWIL.	3.0E-07*	2.8E-04*
CUMB.ENG.	3.1E-07*	2.4E-04*
	1.6	1.6
GEN.ELEC.	1.5E-07	1.1E-04
	1.7	1.7
	2.6	2.6
WESTINGH.	1.2E-07	5.9E-05
	3.7	3.7
	2.6	2.6
PWR'S	6.6E-08	4.0E-05
	3.7	3.7
	1.5	1.5
OVERALL	1.2E-07	8.4E-05
	1.6	1.6

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

APPENDIX V

FAILURE TO INSERT DURING NORMAL SHUTDOWN

## FAILURE MODE CODES

CCDE	DESCRIPTION
A	- FAILURE TO INSERT DURING NORMAL S/C
B	- FAILURE TO RECTIFY DURING SCRAM
C	- FAIL TO INSERT TO AT LEAST 90% DURING SCRAM
E	- RCC FAILS TO MOVE DURING POWER CHANGES/TESTING
F	- RCC FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
G	- CRIPPED ROD (PWR)
H	- UNCOUPLED ROD/OVERTRAVEL CONDITION (BWR)
I	- IMPROPER ROD MOVEMENT
J	- EXTERNAL LEAKAGE/RUPTURE
K	- CCS NOT OPERATE PROPERLY
L	- (SPECIFIC MODE NOT IDENTIFIABLE)
M	- MAINTENANCE/REPLACEMENT REQUIRED
N	- TECHNICAL SPECIFICATION VIOLATION (NCR-FAILURES)

## COMPONENT CODE

CCDE	DESCRIPTION
CC	- CONTROL ROD DRIVE ASSEMBLY

## TYPE OF FAILURE CODES

CLDE	DESCRIPTION
B	- RECURRING COMMON CAUSE FAILURES
C	- COMMON CAUSE FAILURES
D	- RECURRING FAILURES
E	- COMMON FAILS
F	- RECURRING COMMAND FAULTS

## FAILURE MECHANISM CODES

CCDE	DESCRIPTION
CC	- UNKNOWN
CC1	- PERSONNEL (OPERATIONS)
CC2	- PERSONNEL (MAINTENANCE)
CC3	- PERSONNEL (TESTING)
CC4	- DESIGN ERROR
CC5	- FAB./CONSTRUCTION/Q.C.
CC6	- PROCEDURAL DISCREPANCIES
CC7	- NORMAL WEAR
CC8	- EXCESSIVE WEAR
CC9	- CORROSION
CC10	- EXCESSIVE MATERIAL CONTAMINATION
CC11	- EXCESSIVE VIBRATION
CC12	- ROOM MOTOR FAILURE
CC13	- SEAL FAILURE
CC14	- MILED/MISALIGNED INTERNALS
CC15	- CLUTCH FAILURE
CC16	- BRAKE FAILURE
CC17	- BEARING FAILURE
CC18	- FILTER/STRAINER PLUGGED
CC19	- BINDING/SEIZURE
CC20	- FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
CC21	- CONTROL CIRCUIT FAILURE/PROBLEM
CC22	- FASTENER FAILURE/PROBLEM
CC23	- WELD FAILURE
CC24	- LUBRICATION PROBLEM

## SYSTEM CODE

CCDE	DESCRIPTION
	PWR
	BWR
M	- REACTIVITY CONTROL SYSTEM
	BWR
	PWR
M	- REACTIVITY CONTROL SYSTEM

## FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	- DEMAND
V	- TIME
U	- UNKNOWN
N	- NOT APPLICABLE

## ACTIVITY RESULTING IN DISCOVERY

CCDE	DESCRIPTION
D	- DEMAND ON COMPONENT
M	- MAINTENANCE
N	- NORMAL OPERATION/SURVEILLANCE
R	- RECORD REVIEW
T	- TESTING
U	- UNKNOWN

## NSSS VENDOR CODES

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

FAILURE TO INSERT DURING NORMAL SHUTDOWN

<u>VENT</u>	<u>PLANT</u>	<u>CNT.NO.</u>	<u>FAIL DATE</u>	<u>SYM</u>	<u>FAIL CODE</u>	<u>TYPE</u>	<u>CLAIM</u>	<u>FAILURE MODE</u>	<u>FAILURE MECHANISM</u>
G	BF1	000512	100473	M CD	B18	T		RCD 26-55 DRIVE FAILED TO INSERT WHILE AT POWER	ROD DRIVE SYS HAD A DIRTY STRAINER
G	DR1	018286	041577	M CD	B10	T		CRD G-9 INSERTED TO 00 THEN DRIFTED TO POSITION 12 PROB.CAUSE OF MALFUNC.WAS FOR.MAT.CONTAM.	



FAILURE TO INSERT DURING NORMAL SHUTDOWNS 1/1/76 THRU 4/30/78

BAFCJCKEWILCCX

PLANT	CRIT.PRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AK1	12946.0	69	5	0	893274.0	621	3.4E-06*	4.8E-03*
CF3	7430.0	69	22	0	512670.0	1518	5.8E-06*	2.0E-03*
CE1	4129.0	57	6	0	235353.0	342	1.3E-05*	8.8E-03*
CF1	13620.0	69	17	0	939780.0	1173	3.2E-06*	2.6E-03*
DE2	13196.0	69	21	0	910524.0	1449	3.3E-06*	2.1E-03*
DE3	15777.0	69	18	0	1088613.0	1242	2.8E-06*	2.4E-03*
RS1	12642.0	69	15	0	872298.0	1035	3.4E-06*	2.9E-03*
TI1	14916.0	69	7	0	1029204.0	483	2.9E-06*	6.2E-03*
TI2	342.0	69	0	0	23598.0	0	1.3E-04*	0. *
TOTALS				0	6505314.0	7863		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT DURING NORMAL SHUTDOWNS 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.PRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	15903.0	85	14	0	1351755.0	1190	2.2E-06*	2.5E-03*
CC2	9162.0	85	13	0	778770.0	1105	3.8E-06*	2.7E-03*
FC1	16130.0	49	6	0	790370.0	294	3.8E-06*	1.0E-02*
MJ2	13567.0	81	7	0	1098927.0	567	2.7E-06*	5.3E-03*
MY1	18606.0	85	5	0	1581510.0	765	1.9E-06*	3.9E-03*
SL1	9903.0	81	5	0	802143.0	405	3.7E-06*	7.4E-03*
TOTALS				0	6403475.0	4326		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT DURING NORMAL SHUTDOWNS 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	10793.0	185	0	0	1996705.0	0	1.5E-06*	0. *
BF2	11809.0	185	1	0	2184665.0	185	1.4E-06*	1.6E-02*
BF3	11545.0	185	0	0	2135825.0	0	1.4E-06*	0. *
BP1	13379.0	32	6	0	428128.0	192	7.0E-06*	1.6E-02*
BF1	7544.0	137	11	0	1033528.0	1507	2.9E-06*	2.0E-03*
BK2	13226.0	137	6	0	1811962.0	822	1.7E-06*	3.6E-03*
CU1	16617.0	137	1	0	2276529.0	137	1.3E-06*	2.2E-02*
DA1	15981.0	89	16	0	1422309.0	1424	2.1E-06*	2.1E-03*
DK1	15801.0	80	14	1	1264080.0	1120	7.9E-07	8.9E-04
DF2	16103.0	177	8	0	2850231.0	1416	1.1E-06*	2.1E-03*
DF3	17226.0	177	14	0	3049002.0	2478	9.8E-07*	1.2E-03*
EM1	15876.0	137	17	0	2175012.0	2329	1.4E-06*	1.3E-03*
FP1	15348.0	137	12	0	2102676.0	1644	1.4E-06*	1.8E-03*
MI1	17024.0	145	12	0	2468480.0	1740	1.2E-06*	1.7E-03*
MO1	18126.0	121	11	0	2193246.0	1331	1.4E-06*	2.3E-03*
NP1	16060.0	129	7	0	2071740.0	903	1.4E-06*	3.3E-03*
OC1	16142.0	137	2	0	2211454.0	274	1.4E-06*	1.1E-02*
PE2	13776.0	185	10	0	2548560.0	1850	1.2E-06*	1.6E-03*
PB3	14885.0	185	17	0	2753725.0	3145	1.1E-06*	9.5E-04*
PT1	13412.0	145	2	0	1944740.0	290	1.5E-06*	1.0E-02*
QC1	15547.0	177	21	0	2751819.0	3717	1.1E-06*	8.1E-04*
QC2	16750.0	177	14	0	2964750.0	2478	1.0E-06*	1.2E-03*
VY1	17311.0	89	6	0	1540679.0	534	1.9E-06*	5.6E-03*
TOTALS				1	48179845.0	29516		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT DURING NORMAL SHUTDOWN: 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
EV1	9166.0	53	19	0	482618.0	1007	6.2E-06*	3.0E-03*
DC1	16401.0	53	20	0	869253.0	1060	3.4E-06*	2.8E-03*
CC2	770.0	53	3	0	40810.0	159	7.3E-05*	1.9E-02*
HM1	18030.0	45	7	0	811350.0	315	3.7E-06*	9.5E-03*
IF2	10595.0	61	10	0	670695.0	610	4.5E-06*	4.9E-03*
IF3	11694.0	61	6	0	713334.0	366	4.2E-06*	8.2E-03*
JF1	3079.0	53	2	0	163187.0	106	1.8E-05*	2.8E-02*
KF1	16994.0	33	6	0	560802.0	198	5.3E-06*	1.5E-02*
NA1	410.0	53	0	0	21730.0	0	1.4E-04*	0. *
PF1	16859.0	37	9	0	623783.0	333	4.8E-06*	9.0E-03*
FP2	17531.0	37	4	0	648647.0	148	4.6E-06*	2.0E-02*
PT1	18041.0	37	12	0	667517.0	444	4.5E-06*	6.7E-03*
PT2	17964.0	37	17	0	664668.0	629	4.5E-06*	4.8E-03*
RC1	14639.0	33	19	0	483087.0	627	6.2E-06*	4.8E-03*
PC2	16245.0	41	13	0	666045.0	533	4.5E-06*	5.6E-03*
SA1	4368.0	53	6	0	231504.0	424	1.3E-05*	7.1E-03*
SL1	14325.0	45	12	0	644625.0	540	4.6E-06*	5.5E-03*
JL1	15487.0	53	11	0	820811.0	583	3.6E-06*	5.1E-03*
SL2	13160.0	53	11	0	697480.0	583	4.3E-06*	5.1E-03*
TF1	12539.0	61	10	0	764879.0	610	3.9E-06*	4.9E-03*
TL3	15712.0	53	17	0	832736.0	901	3.6E-06*	3.3E-03*
TL4	14145.0	53	16	0	749685.0	848	4.0E-06*	3.5E-03*
Z11	15176.0	53	5	0	804434.0	265	3.7E-06*	1.1E-02*
Z12	13657.0	53	8	0	723821.0	424	4.1E-06*	7.1E-03*
TOTALS				0	14357501.0	11713		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT DURING NORMAL SHUTDOWN; 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
EAB.6WIL.	4.6E-07*	3.8E-04*
COME.ENG.	4.7E-07*	6.9E-04*
	4.7	4.7
GEN.ELEC.	2.1E-08	3.4E-05
	19.5	19.5
WESTINGH.	2.1E-07*	2.6E-04*
FWR'S	1.1E-07*	1.3E-04*
	4.7	4.7
OVERALL	1.3E-08	1.9E-05
	19.5	19.5

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT DURING NORMAL SHUTDOWN; 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AR1	20009.0	69	17	0	1380621.0	1173	2.2E-06*	2.6E-03*
CF3	7430.0	69	22	0	512670.0	1518	5.8E-06*	2.0E-03*
GE1	4129.0	57	6	0	235353.0	342	1.3E-05*	8.8E-03*
GE1	30392.0	69	43	0	2097048.0	2967	1.4E-06*	1.0E-03*
GE2	21755.0	69	35	0	1501095.0	2691	2.0E-06*	1.1E-03*
GE3	22921.0	69	32	0	1581549.0	2208	1.9E-06*	1.4E-03*
RS1	14543.0	69	21	0	1003467.0	1449	3.0E-06*	2.1E-03*
TI1	24929.0	69	16	0	1720101.0	1104	1.7E-06*	2.7E-03*
TI2	342.0	69	0	0	23598.0	0	1.3E-04*	0. *
TOTALS				0	10055502.0	13452		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT DURING NORMAL SHUTDOWN; 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	0739.0	85	21	0	1762815.0	1785	1.7E-06*	1.7E-03*
CC2	9162.0	85	13	0	778770.0	1105	3.8E-06*	2.7E-03*
FL1	32123.0	49	15	0	1574027.0	931	1.9E-06*	3.2E-03*
M12	14906.0	81	7	0	1207386.0	567	2.5E-06*	5.3E-03*
MY1	40408.0	85	33	0	3434680.0	2805	8.7E-07*	1.1E-03*
SL1	9903.0	81	5	0	802143.0	405	3.7E-06*	7.4E-03*
TOTALS				0	9559821.0	7598		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT DURING NORMAL SHUTDOWNS 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	15553.0	185	14	1	2877305.0	2590	3.5E-07	3.9E-04
BF2	12326.0	185	2	0	2280310.0	370	1.3E-06*	8.1E-03*
BF3	11545.0	185	0	0	2135825.0	0	1.4E-06*	0. *
BP1	38622.0	32	17	0	1235904.0	544	2.4E-06*	5.5E-03*
BR1	7544.0	137	11	0	1033528.0	1507	2.9E-06*	2.0E-03*
BR2	14576.0	137	15	0	1996912.0	2603	1.5E-06*	1.2E-03*
CC1	27641.0	137	4	0	3786817.0	548	7.9E-07*	5.5E-03*
CA1	22487.0	89	26	0	2001343.0	2314	1.5E-06*	1.3E-03*
CF1	35600.0	80	40	1	2848000.0	3200	3.5E-07	3.1E-04
DF2	39390.0	177	48	0	6972030.0	5000	4.3E-07*	3.5E-04*
DF3	41057.0	177	40	0	7267089.0	7080	4.1E-07*	4.2E-04*
EA1	23634.0	137	27	0	3237858.0	3699	9.3E-07*	8.1E-04*
FF1	18189.0	137	18	0	2491893.0	2466	1.2E-06*	1.2E-03*
MI1	39560.0	145	64	0	5736200.0	9280	5.2E-07*	3.2E-04*
MC1	44190.0	121	34	0	5346990.0	4114	5.6E-07*	7.3E-04*
NM1	41084.0	129	25	0	5299836.0	3741	5.7E-07*	8.0E-04*
OC1	42170.0	137	15	0	5777290.0	2603	5.2E-07*	1.2E-03*
PB2	24563.0	185	23	0	4544155.0	4255	6.6E-07*	7.0E-04*
PB3	22737.0	185	23	0	4206345.0	4255	7.1E-07*	7.0E-04*
PI1	31756.0	145	16	0	4604620.0	2320	6.5E-07*	1.3E-03*
QC1	37446.0	177	64	0	6627942.0	11328	4.5E-07*	2.6E-04*
QC2	39780.0	177	45	0	7041060.0	7965	4.3E-07*	3.8E-04*
VY1	39826.0	89	31	0	3544514.0	2759	8.5E-07*	1.1E-03*
TOTALS				2	92893766.0	88037		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT DURING NORMAL SHUTDOWN; 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BV1	9106.0	53	19	0	482618.0	1007	6.2E-06*	3.0E-03*
DC1	22795.0	53	27	0	1208135.0	1431	2.5E-06*	2.1E-03*
DC2	770.0	53	3	0	40810.0	159	7.3E-05*	1.9E-02*
HR1	45574.0	45	24	0	2050830.0	1080	1.5E-06*	2.8E-03*
IF2	21387.0	61	29	0	1304607.0	1769	2.3E-06*	1.7E-03*
IP3	11694.0	61	6	0	713334.0	366	4.2E-06*	8.2E-03*
JF1	3079.0	53	2	0	163187.0	106	1.8E-05*	2.8E-02*
KE1	28727.0	33	26	0	947991.0	858	3.2E-06*	3.5E-03*
NA1	410.0	53	0	0	21730.0	0	1.4E-04*	0. *
PR1	28913.0	37	21	0	1069781.0	777	2.8E-06*	3.9E-03*
PR2	25020.0	37	6	0	925740.0	296	3.2E-06*	1.0E-02*
PT1	44738.0	37	35	0	1655306.0	1295	1.8E-06*	2.3E-03*
PT2	45215.0	37	37	0	1672955.0	1369	1.8E-06*	2.2E-03*
RG1	40952.0	33	41	0	1350756.0	1353	2.2E-06*	2.2E-03*
RC2	42228.0	41	46	0	1801048.0	1886	1.7E-06*	1.6E-03*
SA1	4368.0	53	8	0	231504.0	424	1.3E-05*	7.1E-03*
SC1	41777.0	45	25	0	1879965.0	1125	1.6E-06*	2.7E-03*
SL1	31984.0	53	30	0	1695152.0	1590	1.8E-06*	1.9E-03*
SL2	28790.0	53	21	0	1525870.0	1113	2.0E-06*	2.7E-03*
TR1	12539.0	61	10	0	764879.0	610	3.9E-06*	4.9E-03*
TU3	36992.0	53	52	0	1960576.0	2756	1.5E-06*	1.1E-03*
TL4	29791.0	53	44	0	1578923.0	2332	1.9E-06*	1.3E-03*
ZI1	26612.0	53	20	0	1410436.0	1060	2.1E-06*	2.8E-03*
ZI2	21735.0	53	23	0	1151955.0	1219	2.6E-06*	2.5E-03*
			TOTALS	0	27608088.0	25981		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT DURING NORMAL SHUTDOWN; 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOOR RATE	DEMAND RATE
BAB. & WIL.	3.0E-07*	2.2E-04*
COME. ENG.	3.1E-07*	3.9E-04*
	3.1	3.1
GEN. ELEC.	2.2E-08	2.3E-05
	5.6	5.6
WESTINGH.	1.1E-07*	1.2E-04*
PWR'S	6.3E-08*	6.4E-05*
	3.1	3.1
OVERALL	1.4E-08	1.5E-05
	5.6	5.6

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



APPENDIX W

ROD FAILS TO MOVE DURING POWER CHANGE/TESTING



ROD FAILS TO MOVE DURING POWER CHANGES/TESTING

VEN	PLANT	CONT. NO.	FAIL DATE	SY S	COMP	FAIL CODE	TYPE	CLASS	FAIL #	FAILURE MODE	FAILURE MECHANISM
B	CR3	018409	040477	M	CD	E12	R	D		ROD 6 GR 7 WOULD NOT MOVE WHEN REDUCING PWR	CRDM STATOR FAILED / FUSE BLEW
B	CR3	017937*	060177	M	CD	E21	S	D	29	CRD SYS. FAILED TO POSIT. REG. RODS ON AUTO DEMAND	LOOSE CONNec. ON CRD PROG. PRINT. CKT. CARD
C	LC2	019693	111177	M	CD	E21	S	D		CEA 36 WOULD NOT MOVE THEN DROPPED WHILE AT SS PWR DEFECT. TIMER MOD. IN COIL PWR PROGRAMMER	
C	SL1	014999	052576	M	CD	E21	S	D		REGULATING ROD 59 IMMOVABLE BECAUSE OF CEA MOD. MAL FAILURE IN RAISE/LOWER CKT OF THE MODULE	
G	BP1	019725	111177	M	CD	E00	R	L		UNABLE TO WITHDRAW ROD B4 FROM POS 5 TO 6	UNKNOWN/POSSIBLY A FOREIGN OBJ. BINDING IT
W	IP3	016551	111876	M	CD	E00	U			ROD D-8 BANK B BECAME MISALIGNED DURING NORMAL OPS	CAUSE UNKNOWN
W	RG1	013394	091775	M	CD	E21	S	D		ROD G-5 BANK B DID NOT MOVE WITH BANK DURING TEST	OPEN CKT IN CABLE OR COIL, G-5 LIFT COIL
W	RG1	019595	111677	M	CD	E21	T	D		ROD CONTROL URGENT FAIL. ROD STOP ALARM LIT	RANDOM FAILURE OF 2 DEFECTIVE P.C. CARDS
W	RG1	019596	111677	M	CD	E21	T	D		ROD CONTROL URGENT FAILURE ROD ALARM LIT	STATIONARY REGULAT. FAIL. IN 1BD PWR. CAB.
W	TR1	018906*	082177	M	CD	E21	S	D	13	LOSS OF ROD CONTROL AFFECTING 13 OF PLANTS 53 RODS	FAILURE OF SUPERVISORY BUFFER MEM. CARD

ROD FAILS TO MOVE DURING POWER CHANGES/TESTING; 1/1/76 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AR1	12946.0	69	17	0	893274.0	1173	3.4E-06*	2.6E-03*
CB3	7430.0	69	10	1	512670.0	690	2.0E-06	1.4E-03
DB1	4129.0	57	5	0	235353.0	285	1.3E-05*	1.1E-02*
DE1	13620.0	69	19	0	939780.0	1311	3.2E-06*	2.3E-03*
DE2	13196.0	69	18	0	910524.0	1242	3.3E-06*	2.4E-03*
DE3	15777.0	69	22	0	1088613.0	1518	2.8E-06*	2.0E-03*
RS1	12642.0	69	17	0	872298.0	1173	3.4E-06*	2.6E-03*
TI1	14916.0	69	21	0	1029204.0	1449	2.9E-06*	2.1E-03*
TI2	342.0	69	1	0	23598.0	69	1.3E-04*	4.3E-02*
TOTALS				1	6505314.0	8910		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

ROD FAILS TO MOVE DURING POWER CHANGES/TESTING; 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	15903.0	85	22	0	1351755.0	1870	2.2E-06*	1.6E-03*
CC2	9162.0	85	12	0	778770.0	1105	3.8E-06*	2.7E-03*
FC1	16130.0	49	23	0	790370.0	1127	3.8E-06*	2.7E-03*
MI2	13567.0	81	19	0	1098927.0	1539	2.7E-06*	1.9E-03*
MY1	18606.0	85	26	0	1581510.0	2210	1.9E-06*	1.4E-03*
SL1	9903.0	81	15	0	802143.0	1215	3.7E-06*	2.5E-03*
TOTALS				0	6403475.0	9066		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

ROD FAILS TO MOVE DURING POWER CHANGES/TESTING; 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	10793.0	185	64	0	1996705.0	11840	1.5E-06*	2.5E-04*
BF2	11809.0	185	70	0	2184665.0	12950	1.4E-06*	2.3E-04*
BF3	11545.0	185	69	0	2135825.0	12765	1.4E-06*	2.3E-04*
BP1	13379.0	32	80	1	428128.0	2560	2.3E-06	3.9E-04
BR1	7544.0	137	45	0	1033528.0	6165	2.9E-06*	4.9E-04*
BR2	13226.0	137	75	0	1811962.0	10823	1.7E-06*	2.8E-04*
CC1	16617.0	137	99	0	2276529.0	13563	1.3E-06*	2.2E-04*
DA1	15981.0	89	95	0	1422309.0	8455	2.1E-06*	3.5E-04*
DR1	15801.0	80	94	0	1264080.0	7520	2.4E-06*	4.0E-04*
DR2	16103.0	177	98	0	2850231.0	16992	1.1E-06*	1.8E-04*
DR3	17226.0	177	102	0	3049002.0	18231	9.8E-07*	1.6E-04*
EN1	15876.0	137	95	0	2175012.0	13015	1.4E-06*	2.3E-04*
FP1	15348.0	137	91	0	2102676.0	12467	1.4E-06*	2.4E-04*
MI1	17024.0	145	101	0	2468480.0	14645	1.2E-06*	2.0E-04*
MC1	18126.0	121	108	0	2193246.0	13068	1.4E-06*	2.3E-04*
NP1	16060.0	129	96	0	2071740.0	12384	1.4E-06*	2.4E-04*
QC1	16142.0	137	96	0	2211454.0	13152	1.4E-06*	2.3E-04*
PE2	13776.0	185	82	0	2548560.0	15170	1.2E-06*	2.0E-04*
PB3	14885.0	185	89	0	2753725.0	16465	1.1E-06*	1.8E-04*
P11	13412.0	145	80	0	1944740.0	11600	1.5E-06*	2.6E-04*
QC1	15547.0	177	93	0	2751819.0	16461	1.1E-06*	1.8E-04*
QC2	16750.0	177	100	0	2964750.0	17700	1.0E-06*	1.7E-04*
VY1	17311.0	89	103	0	1540679.0	9167	1.9E-06*	3.3E-04*
			TOTALS	1	48179845.0	287158		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

ROD FAILS TO MOVE DURING POWER CHANGES/TESTING; 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.PRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOURLY RATE	DEMAND RATE
PV1	9106.0	53	13	0	482618.0	689	6.2E-06*	4.3E-03*
DC1	16401.0	53	22	0	869253.0	1166	3.4E-06*	2.6E-03*
DC2	770.0	53	1	0	40810.0	53	7.3E-05*	5.7E-02*
HN1	18030.0	45	24	0	811350.0	1080	3.7E-06*	2.8E-03*
IP2	10995.0	61	14	0	670695.0	854	4.5E-06*	3.5E-03*
IP3	11694.0	61	16	1	713334.0	976	1.4E-06	1.0E-03
JF1	3079.0	53	4	0	163187.0	212	1.8E-05*	1.4E-02*
KE1	16994.0	33	24	0	560802.0	792	5.3E-06*	3.8E-03*
NA1	410.0	53	1	0	21730.0	53	1.4E-04*	5.7E-02*
PF1	16859.0	37	23	0	623783.0	851	4.8E-06*	3.5E-03*
PR2	17531.0	37	24	0	648647.0	888	4.6E-06*	3.4E-03*
PT1	18041.0	37	25	0	667517.0	925	4.5E-06*	3.2E-03*
PT2	17964.0	37	25	0	664668.0	925	4.5E-06*	3.2E-03*
RG1	14639.0	33	19	0	483087.0	627	6.2E-06*	4.8E-03*
RO2	16245.0	41	21	0	666045.0	861	4.5E-06*	3.5E-03*
SA1	4368.0	53	6	0	231504.0	318	1.3E-05*	9.4E-03*
SD1	14325.0	45	20	0	644625.0	900	4.6E-06*	3.3E-03*
SL1	15487.0	53	21	0	820811.0	1113	3.6E-06*	2.7E-03*
SL2	13160.0	53	17	0	697480.0	901	4.3E-06*	3.3E-03*
TR1	12539.0	61	17	0	764879.0	1037	3.9E-06*	2.9E-03*
TL3	15712.0	53	21	0	832736.0	1113	3.6E-06*	2.7E-03*
TL4	14145.0	53	19	0	749685.0	1007	4.0E-06*	3.0E-03*
TL1	15178.0	53	21	0	804434.0	1113	3.7E-06*	2.7E-03*
ZI2	13657.0	53	19	0	723821.0	1007	4.1E-06*	3.0E-03*
			TOTALS	1	14357501.0	19461		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

ROD FAILS TO MOVE DURING POWER CHANGES/TESTING; 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOOR RATE	DEMAND RATE
	4.7	4.7
BAB.EWIL.	1.5E-07	1.1E-04
	19.5	19.5
COMP.ENG.	4.7E-07*	3.3E-04*
	4.7	4.7
GEN.FLEC.	2.1E-08	3.5E-06
	19.5	19.5
	4.7	4.7
WESTINGH.	7.0E-08	5.1E-05
	19.5	19.5
	3.1	3.1
PWR'S	7.3E-08	5.3E-05
	5.6	5.6
	2.6	2.6
OVERALL	4.0E-08	9.2E-06
	3.7	3.7

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

RCD FAILS TO MOVE DURING POWER CHANGES/TESTING (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AF1	12946.0	69	17	0	893274.0	1173	3.4E-06*	2.6E-03*
CR3	7430.0	69	10	30	512670.0	690	5.9E-05	4.3E-02
CB1	4129.0	57	5	0	235353.0	285	1.3E-05*	1.1E-02*
CE1	13620.0	69	19	0	939780.0	1311	3.2E-06*	2.3E-03*
CE2	13196.0	69	18	0	910524.0	1242	3.3E-06*	2.4E-03*
CE3	15777.0	69	22	0	1088613.0	1518	2.8E-06*	2.0E-03*
PS1	12642.0	69	17	0	872298.0	1173	3.4E-06*	2.6E-03*
TII	14916.0	69	21	0	1029204.0	1449	2.9E-06*	2.1E-03*
TI2	342.0	69	1	0	23598.0	69	1.3E-04*	4.3E-02*
TOTALS				30	6505314.0	8910		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

RCD FAILS TO MOVE DURING POWER CHANGES/TESTING (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	15903.0	85	22	0	1351755.0	1870	2.2E-06*	1.6E-03*
CC2	9162.0	85	13	1	778770.0	1105	1.3E-06	9.0E-04
FC1	16130.0	49	23	0	790370.0	1127	3.8E-06*	2.7E-03*
M12	13567.0	81	15	0	1098927.0	1539	2.7E-06*	1.9E-03*
MY1	18606.0	85	26	0	1581510.0	2210	1.9E-06*	1.4E-03*
SL1	9903.0	81	15	1	802143.0	1215	1.2E-06	8.2E-04
TOTALS				2	6403475.0	9066		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



RED FAILS TO MOVE DURING POWER CHANGES/TESTING (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.FRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	10793.0	185	64	0	1996705.0	11840	1.5E-06*	2.5E-04*
BF2	11809.0	185	70	0	2184665.0	12950	1.4E-06*	2.3E-04*
BF3	11545.0	185	69	0	2135825.0	12765	1.4E-06*	2.3E-04*
BP1	13379.0	32	80	1	428128.0	2560	2.3E-06	3.9E-04
BR1	7544.0	137	45	0	1033528.0	6165	2.9E-06*	4.9E-04*
BR2	13226.0	137	79	0	1811962.0	10823	1.7E-06*	2.8E-04*
CC1	16617.0	137	99	0	2276529.0	13563	1.3E-06*	2.2E-04*
JA1	15981.0	89	55	0	1422309.0	8455	2.1E-06*	3.5E-04*
DR1	15801.0	80	94	0	1264080.0	7520	2.4E-06*	4.0E-04*
DR2	16103.0	177	96	0	2850231.0	16992	1.1E-06*	1.8E-04*
DR3	17226.0	177	103	0	3049002.0	18231	9.8E-07*	1.6E-04*
EN1	15876.0	137	95	0	2175012.0	13015	1.4E-06*	2.3E-04*
FP1	15348.0	137	91	0	2102676.0	12467	1.4E-06*	2.4E-04*
MI1	17024.0	145	101	0	2468480.0	14645	1.2E-06*	2.0E-04*
MD1	18126.0	121	108	0	2193246.0	13068	1.4E-06*	2.3E-04*
NM1	16060.0	129	96	0	2071740.0	12384	1.4E-06*	2.4E-04*
OC1	16142.0	137	96	0	2211454.0	13152	1.4E-06*	2.3E-04*
PE2	13776.0	185	62	0	2548560.0	15170	1.2E-06*	2.0E-04*
PB3	14885.0	185	89	0	2753725.0	16465	1.1E-06*	1.8E-04*
PI1	13412.0	145	80	0	1944740.0	11600	1.5E-06*	2.6E-04*
QC1	15547.0	177	93	0	2751819.0	16461	1.1E-06*	1.8E-04*
CC2	16750.0	177	100	0	2964750.0	17700	1.0E-06*	1.7E-04*
VY1	17311.0	89	103	0	1540679.0	9167	1.9E-06*	3.3E-04*
			TOTALS	1	48179845.0	287158		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

ROD FAILS TO MOVE DURING POWER CHANGES/TESTING (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BV1	9106.0	53	13	0	482616.0	689	6.2E-06*	4.3E-03*
DC1	16401.0	53	22	0	869253.0	1166	3.4E-06*	2.6E-03*
DC2	770.0	53	1	0	40810.0	53	7.3E-05*	5.7E-02*
HN1	18030.0	45	24	0	811350.0	1080	3.7E-06*	2.8E-03*
IP2	10995.0	61	14	0	670695.0	854	4.5E-06*	3.5E-03*
IP3	11694.0	61	16	1	713334.0	976	1.4E-06	1.0E-03
JF1	3079.0	53	4	0	163187.0	212	1.8E-05*	1.4E-02*
KE1	16994.0	32	24	0	560802.0	792	5.3E-06*	3.8E-03*
NA1	410.0	53	1	0	21730.0	53	1.4E-04*	5.7E-02*
PR1	16859.0	37	23	0	623783.0	851	4.8E-06*	3.5E-03*
PR2	17531.0	37	24	0	648647.0	888	4.6E-06*	3.4E-03*
PT1	18041.0	37	25	0	667517.0	925	4.5E-06*	3.2E-03*
PT2	17964.0	37	25	0	664668.0	925	4.5E-06*	3.2E-03*
RG1	14639.0	33	19	2	483087.0	627	4.1E-06	3.2E-03
RC2	16245.0	41	21	0	666045.0	861	4.5E-06*	3.5E-03*
SA1	4368.0	53	6	0	231504.0	318	1.3E-05*	9.4E-03*
SC1	14325.0	45	20	0	644625.0	900	4.6E-06*	3.3E-03*
SL1	15487.0	53	21	0	820811.0	1113	3.6E-06*	2.7E-03*
SL2	13160.0	53	17	0	697480.0	901	4.3E-06*	3.3E-03*
IF1	12539.0	61	17	13	764879.0	1037	1.7E-05	1.3E-02
TU3	15712.0	53	21	0	832736.0	1113	3.6E-06*	2.7E-03*
TL4	14145.0	53	19	0	749685.0	1007	4.0E-06*	3.0E-03*
ZI1	15178.0	53	21	0	804434.0	1113	3.7E-06*	2.7E-03*
ZI2	13657.0	53	19	0	723821.0	1007	4.1E-06*	3.0E-03*
TOTALS				16	14357501.0	19461		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

ROD FAILS TO MOVE DURING POWER CHANGES/TESTING (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUP RATE	DEMAND RATE
	1.4	1.4
BAB.6WIL.	4.6E-06	3.4E-03
	1.4	1.4
	3.1	3.1
COMP.ENG.	3.1E-07	2.2E-04
	5.6	5.6
	4.7	4.7
GEN. ELEC.	2.1E-08	3.5E-06
	19.5	19.5
	1.5	1.5
WESTINGH.	1.1E-06	8.2E-04
	1.6	1.6
	1.3	1.3
PWR'S	1.8E-06	1.3E-03
	1.3	1.3
	1.3	1.3
OVERALL	6.5E-07	1.5E-04
	1.3	1.3

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

RCD FAILS TO MOVE DURING POWER CHANGES/TESTING; 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AR1	20009.0	69	27	0	1380621.0	1863	2.2E-06*	1.6E-03*
CR3	7430.0	69	10	1	512670.0	690	2.0E-06	1.4E-03
DB1	4129.0	57	6	0	235353.0	342	1.3E-05*	8.8E-03*
DE1	30392.0	69	42	0	2097048.0	2898	1.4E-06*	1.0E-03*
DE2	21755.0	69	30	0	1501095.0	2070	2.0E-06*	1.4E-03*
DE3	22921.0	69	31	0	1581549.0	2139	1.9E-06*	1.4E-03*
RS1	14543.0	69	20	0	1003467.0	1380	3.0E-06*	2.2E-03*
TI1	24929.0	69	34	0	1720101.0	2346	1.7E-06*	1.3E-03*
TI2	342.0	69	1	0	23598.0	69	1.3E-04*	4.3E-02*
TOTALS				1	10055502.0	13797		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

RCD FAILS TO MOVE DURING POWER CHANGES/TESTING; 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	20739.0	85	28	0	1762815.0	2380	1.7E-06*	1.3E-03*
CC2	9162.0	85	13	0	778770.0	1105	3.8E-06*	2.7E-03*
FC1	32123.0	49	44	0	1574027.0	2156	1.9E-06*	1.4E-03*
M12	14906.0	81	20	0	1207386.0	1620	2.5E-06*	1.8E-03*
MY1	40408.0	85	55	0	3434680.0	4675	8.7E-07*	6.4E-04*
SL1	9903.0	81	15	0	802143.0	1215	3.7E-06*	2.5E-03*
TOTALS				0	9559821.0	13151		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

ROD FAILS TO MOVE DURING POWER CHANGES/TESTING; 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	15553.0	185	93	0	2877305.0	17205	1.0E-06*	1.7E-04*
BF2	12326.0	185	73	0	2280310.0	13505	1.3E-06*	2.2E-04*
BF3	11545.0	185	69	0	2135825.0	12765	1.4E-06*	2.3E-04*
BP1	38622.0	32	230	1	1235904.0	7360	8.1E-07	1.4E-04
BR1	7544.0	137	45	0	1033528.0	6165	2.9E-06*	4.9E-04*
BR2	14576.0	137	87	0	1996912.0	11919	1.5E-06*	2.5E-04*
CL1	27641.0	137	165	0	3786817.0	22605	7.9E-07*	1.3E-04*
DA1	22487.0	89	134	0	2001343.0	11926	1.5E-06*	2.5E-04*
DR1	35600.0	80	212	0	2848000.0	16960	1.1E-06*	1.8E-04*
DK2	39390.0	177	234	0	6972030.0	41418	4.3E-07*	7.2E-05*
LF3	41057.0	177	244	0	7267089.0	43188	4.1E-07*	6.9E-05*
EN1	23634.0	137	141	0	3237858.0	19317	9.3E-07*	1.6E-04*
FP1	18189.0	137	108	0	2491893.0	14796	1.2E-06*	2.0E-04*
MI1	39560.0	145	235	0	5736200.0	34075	5.2E-07*	8.8E-05*
MO1	44190.0	121	263	0	5346990.0	31823	5.6E-07*	9.4E-05*
NP1	41084.0	129	245	0	5299836.0	31605	5.7E-07*	9.5E-05*
OC1	42170.0	137	251	0	5777290.0	34387	5.2E-07*	8.7E-05*
PB2	24563.0	185	146	0	4544155.0	27010	6.6E-07*	1.1E-04*
PB3	22737.0	185	125	0	4206345.0	24975	7.1E-07*	1.2E-04*
PI1	31756.0	145	189	0	4604620.0	27405	6.5E-07*	1.1E-04*
QC1	37446.0	177	223	0	6627942.0	39471	4.5E-07*	7.6E-05*
QC2	39780.0	177	237	0	7041060.0	41949	4.3E-07*	7.1E-05*
VY1	39826.0	89	237	0	3544514.0	21093	8.5E-07*	1.4E-04*
TOTALS				1	92893766.0	552922		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAILURES RECORDED

ROD FAILS TO MOVE DURING POWER CHANGES/TESTING; 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BV1	9106.0	53	13	0	482618.0	689	6.2E-06*	4.3E-03*
DC1	22795.0	53	31	0	1208135.0	1643	2.5E-06*	1.8E-03*
DC2	770.0	53	1	0	40810.0	53	7.3E-05*	5.7E-02*
HN1	45574.0	45	62	0	2050830.0	2835	1.5E-06*	1.1E-03*
IF2	21387.0	61	29	0	1304607.0	1769	2.3E-06*	1.7E-03*
IP3	11694.0	61	16	1	713334.0	976	1.4E-06	1.0E-03
JF1	3079.0	53	4	0	163187.0	212	1.8E-05*	1.4E-02*
KE1	28727.0	33	39	0	947991.0	1287	3.2E-06*	2.3E-03*
NA1	410.0	53	1	0	21730.0	53	1.4E-04*	5.7E-02*
PR1	28913.0	37	40	0	1069781.0	1480	2.8E-06*	2.0E-03*
PR2	25020.0	37	34	0	925740.0	1258	3.2E-06*	2.4E-03*
PT1	44738.0	37	61	0	1655306.0	2257	1.8E-06*	1.3E-03*
PT2	45215.0	37	62	0	1672955.0	2294	1.8E-06*	1.3E-03*
RG1	40932.0	32	56	0	1350756.0	1848	2.2E-06*	1.6E-03*
RG2	43928.0	41	60	0	1801048.0	2460	1.7E-06*	1.2E-03*
SA1	4368.0	53	6	0	231504.0	318	1.3E-05*	9.4E-03*
SC1	41777.0	45	57	0	1879965.0	2565	1.6E-06*	1.2E-03*
SU1	31984.0	53	44	0	1695152.0	2332	1.8E-06*	1.3E-03*
SU2	28790.0	53	40	0	1525870.0	2120	2.0E-06*	1.4E-03*
TR1	12539.0	61	17	0	764879.0	1037	3.9E-06*	2.9E-03*
TU3	36992.0	53	51	0	1960576.0	2703	1.5E-06*	1.1E-03*
TU4	29791.0	53	41	0	1578923.0	2173	1.9E-06*	1.4E-03*
Z11	26612.0	53	37	0	1410436.0	1961	2.1E-06*	1.5E-03*
Z12	21735.0	53	30	0	1151955.0	1590	2.6E-06*	1.9E-03*
TOTALS				1	27608088.0	27013		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

RCC FAILS TO MOVE DURING POWER CHANGES/TESTING; 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
	4.7	4.7
BAB.6WIL.	9.9E-08	7.2E-05
	19.5	19.5
COPE.ENG.	3.1E-07*	2.3E-04*
	4.7	4.7
GEN.FLEC.	1.1E-08	1.8E-06
	19.5	19.5
	4.7	4.7
WESTINGH.	3.6E-08	2.6E-05
	19.5	19.5
	3.1	3.1
PWR'IS	4.2E-08	3.1E-05
	5.6	5.6
	2.6	2.6
CVEFALL	2.1E-08	4.9E-06
	3.7	3.7

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAILTS RECORDED

RDD FAILS TO MOVE DURING POWER CHANGES/TESTING (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AF1	20009.0	69	27	0	1380621.0	1863	2.2E-06*	1.6E-03*
CK3	7430.0	69	10	30	512670.0	690	5.9E-05	4.3E-02
DE1	4129.0	57	6	0	235353.0	342	1.3E-05*	8.8E-03*
DE1	30392.0	69	42	0	2097048.0	2898	1.4E-06*	1.0E-03*
DE2	21755.0	69	30	0	1501095.0	2070	2.0E-06*	1.4E-03*
DE3	22921.0	69	31	0	1581549.0	2139	1.9E-06*	1.4E-03*
KS1	14543.0	69	20	0	1003467.0	1380	3.0E-06*	2.2E-03*
TI1	24929.0	69	34	0	1720101.0	2346	1.7E-06*	1.3E-03*
TI2	342.0	69	1	0	23598.0	69	1.3E-04*	4.3E-02*
TOTALS				30	10055502.0	13797		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

RDD FAILS TO MOVE DURING POWER CHANGES/TESTING (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	20739.0	85	28	0	1762815.0	2380	1.7E-06*	1.3E-03*
CC2	9162.0	85	13	1	778770.0	1105	1.3E-06	9.0E-04
FC1	32123.0	49	44	0	1574027.0	2156	1.9E-06*	1.4E-03*
MI2	14906.0	81	20	0	1207386.0	1620	2.5E-06*	1.8E-03*
MY1	40408.0	65	55	0	3434680.0	4675	8.7E-07*	6.4E-04*
SL1	9903.0	81	15	1	802143.0	1215	1.2E-06	8.2E-04
TOTALS				2	9559821.0	13151		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



RCC FAILS TO MOVE DURING POWER CHANGES/TESTING (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	PDP.HOURS	PDP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	15553.0	185	93	0	2877305.0	17205	1.0E-06*	1.7E-04*
BF2	12326.0	185	73	0	2280310.0	13505	1.3E-06*	2.2E-04*
BF3	11545.0	185	69	0	2135825.0	12765	1.4E-06*	2.3E-04*
BP1	38622.0	32	230	1	1235904.0	7360	8.1E-07	1.4E-04
BR1	7544.0	137	45	0	1033528.0	6165	2.9E-06*	4.9E-04*
BR2	14576.0	137	87	0	1996912.0	11919	1.5E-06*	2.5E-04*
CC1	27641.0	137	165	0	3786817.0	22605	7.9E-07*	1.3E-04*
DA1	22487.0	89	134	0	2001343.0	11926	1.3E-06*	2.5E-04*
DF1	35600.0	80	212	0	2848000.0	16960	1.1E-06*	1.8E-04*
DK2	39390.0	177	234	0	6972030.0	41418	4.3E-07*	7.2E-05*
DR3	41057.0	177	244	0	7267089.0	43188	4.1E-07*	6.9E-05*
EN1	23634.0	137	141	0	3237858.0	19317	9.3E-07*	1.6E-04*
FP1	18189.0	137	106	0	2491893.0	14796	1.2E-06*	2.0E-04*
M11	39560.0	145	235	0	5736200.0	34075	5.2E-07*	8.8E-05*
MC1	44190.0	121	263	0	5346990.0	31823	5.6E-07*	9.4E-05*
NM1	41084.0	129	245	0	5299836.0	31605	5.7E-07*	9.5E-05*
OC1	42170.0	137	251	0	5777290.0	34387	5.2E-07*	8.7E-05*
PE2	24563.0	185	146	0	4544155.0	27010	6.6E-07*	1.1E-04*
PE3	22737.0	185	135	0	4206345.0	24975	7.1E-07*	1.2E-04*
F11	31756.0	145	189	0	4604620.0	27405	6.5E-07*	1.1E-04*
QC1	37446.0	177	223	0	6627942.0	39471	4.5E-07*	7.6E-05*
QC2	39780.0	177	237	0	7041060.0	41949	4.3E-07*	7.1E-05*
WY1	39826.0	89	237	0	3544514.0	21093	8.5E-07*	1.4E-04*
			TOTALS	1	92893766.0	552922		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

RCC FAILS TO MOVE DURING POWER CHANGES/TESTING (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BV1	9106.0	53	13	0	482618.0	689	6.2E-06*	4.3E-03*
CC1	22795.0	53	31	0	1208135.0	1643	2.5E-06*	1.8E-03*
CC2	770.0	53	1	0	40810.0	53	7.3E-05*	5.7E-02*
HN1	45574.0	45	62	0	2050830.0	2835	1.5E-06*	1.1E-03*
IF2	21387.0	61	29	0	1304607.0	1769	2.3E-06*	1.7E-03*
IF3	11694.0	61	16	1	713334.0	976	1.4E-06	1.0E-03
JF1	3079.0	53	4	0	163187.0	212	1.8E-05*	1.4E-02*
KE1	28727.0	33	39	0	947991.0	1287	3.2E-06*	2.3E-03*
NA1	410.0	53	1	0	21730.0	53	1.4E-04*	5.7E-02*
PR1	28913.0	37	40	0	1069781.0	1480	2.8E-06*	2.0E-03*
PR2	25020.0	37	34	0	925740.0	1258	3.2E-06*	2.4E-03*
PT1	44738.0	37	61	0	1655306.0	2257	1.8E-06*	1.3E-03*
PT2	45215.0	37	62	0	1672955.0	2294	1.8E-06*	1.3E-03*
RC1	40932.0	33	56	3	1350756.0	1848	2.2E-06	1.6E-03
RC2	43928.0	41	60	0	1801048.0	2460	1.7E-06*	1.2E-03*
SA1	4368.0	53	6	0	231504.0	318	1.3E-05*	9.4E-03*
SD1	41777.0	45	57	0	1879965.0	2565	1.6E-06*	1.2E-03*
SL1	31984.0	53	44	0	1695152.0	2332	1.8E-06*	1.3E-03*
SL2	28790.0	53	40	0	1525870.0	2120	2.0E-06*	1.4E-03*
TR1	12539.0	61	17	13	764879.0	1037	1.7E-05	1.3E-02
TL3	36992.0	53	51	0	1960576.0	2703	1.5E-06*	1.1E-03*
TU4	29791.0	53	41	0	1578923.0	2173	1.9E-06*	1.4E-03*
ZI1	26612.0	53	37	0	1410436.0	1961	2.1E-06*	1.5E-03*
ZI2	21735.0	53	30	0	1151955.0	1590	2.6E-06*	1.9E-03*
TOTALS				17	2760808.0	37913		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

RCD FAILS TO MOVE DURING POWER CHANGES/TESTING (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
	1.4	1.4
BAB.6WIL.	3.0E-06	2.2E-03
	1.4	1.4
	3.1	3.1
COME.ENG.	2.1E-07	1.5E-04
	5.6	5.6
	4.7	4.7
GEN.ELEC.	1.1E-08	1.8E-06
	19.5	19.5
	1.5	1.5
WESTINGH.	6.2E-07	4.5E-04
	1.6	1.6
	1.3	1.3
PWR'IS	1.0E-06	7.6E-04
	1.3	1.3
	1.3	1.3
OVERALL	3.6E-07	8.1E-05
	1.3	1.3

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

APPENDIX X

DROPPED ROD (PWR)

FAILURE MODE CODES

CODE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/D
B	FAILURE TO INSERT DURING SCRAM
C	FAIL TO INSERT TO AT LEAST 90% DURING SCRAM
D	RCD FAILS TO MOVE DURING POWER CHANGES/ TESTING
E	RCD FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	CRIPPED ROD (PAR)
G	INCOMPLETE ROD/COVERTRAVEL CONDITION (BWR)
H	IMPROPER ROD MOVEMENT
I	EXTERNAL LEAKAGE/RUPTURE
J	CCES NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
K	MAINTENANCE/REPLACEMENT REQUIRED
L	TECHNICAL SPECIFICATION VIOLATION (NON-FAILURES)

COMPONENT CODE

CODE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CODE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMON FAULT
F	RECURRING COMMON FAULTS

FAILURE MECHANISM CODES

CODE	DESCRIPTION
CC	UNKNOWN
CC01	PERSONNEL (OPERATIONS)
CC02	PERSONNEL (MAINTENANCE)
CC03	PERSONNEL (TESTING)
CC04	DESIGN ERROR
CC05	FAB./CONSTRUCTION/G.C.
CC06	PROCEDURAL DISCREPANCIES
CC07	NORMAL WEAR
CC08	EXCESSIVE WEAR
CC09	CORROSION
CC10	EXCESSIVE MATERIAL CONTAMINATION
CC11	EXCESSIVE VIBRATION
CC12	COMMON MOTOR FAILURE
CC13	MISALIGNMENT
CC14	SCALE FAILURE
CC15	SHAKE/MISALIGNED INTERNALS
CC16	CLUTCH FAILURE
CC17	PAKE FAILURE
CC18	PARING FAILURE
CC19	FILTRING/STRAINER PLUGGED
CC20	INDUING/SEIZURE
CC21	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
CC22	CONTROL CIRCUIT FAILURE/PROBLEM
CC23	WASTER FAILURE/PROBLEM
CC24	WILD FAILURE
CC25	LUBRICATION PROBLEM

SYSTEM CODE

CODE	DESCRIPTION
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/ SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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

DROPPED ROD (PWR)

V E N	P L A N T	CONT. NO.	FAIL DATE	S Y S	C O M P	FAIL CODE	T Y P E	C L A S S	F A I L R E A S E	FAILURE MODE	FAILURE MECHANISM
B	AR1	021314*	042478	M	CD	G21	T	D	09	GROUP 7 CONTROL RODS DROPPED DURING PWR OPERATION	FAILURE OF A GATE DRIVE CIRCUIT
B	CR3	018403	040677	M	CD	G12	R	D		IN MODE 1, ROD 3 GR 2 DROPPED INTO CORE	FAILURE OF CROM STATOR CAUSED ROD TO DROP
B	CR3	017944*	042777	M	CD	G21	T	D	02	IN MODE 1, ROD GRP 7 DROPPED INTO CORE	POSSIBLE GROUNDED SHIELD TO 24VLT PROG
B	CR3	017941*	051377	M	CD	G21	T	D	09	IN MODE 1, GROUP 7 DROPPED INTO CORE	POSSIBLE DESIGN ERROR, GATE DRIVE REL. CKT.
B	CR3	049424*	101677	M	CD	G21	T	D	09	IN MODE 1, DURING TEST SP-110 GRP. 7 DROP INTO CORE	RANDOM INTERMITTENT POWER INTERRUPTIONS
B	DE2	013202*	062575	M	CD	G00	S	D	09	GR7 RODS DROPPED CAUSING LOSS OF REQUIRED OVERLAP	NO PROBLEM FOUND/PROBABLE COMMAND FAULT
B	DE2	014913	022676	M	CD	G04	R	T		DROPPED CONT. ROD CAUSED RX. QUAD. TILT TO EX. TECH SP	SHRT. DUE TO DETER. EPOXY IN STAT. WNDGS.
B	DE2	020154	122977	M	CD	G12	R	T		CR4GR6 DROPPED WHILE BEING WITHDRAWN	SHRT. DUE TO O-RING FAIL. IN STAT. WNDGS.
B	DE2	020665*	030178	M	CD	G21	S	D	12	CONTROL ROD GROUP 5 DROPPED DURING PERFORM. TEST	MOMENTARY LOSS OF POWER, REASON UNKNOWN
B	DE3	014618*	042276	M	CD	G21	T	D	09	GROUP 7 RODS DROPPED AT 95% POWER	A FAILED GATE DRIVE CIRCUIT
B	DE3	015010*	060976	M	CD	G21	T	D	09	GROUP 7 RODS DROPPED	TWO PWR. SUPPLIES FAILED (FUSE, TRANSISTOR)
B	DE3	020641	021078	M	CD	G12	R	T		CR3GR4 DROPPED DURING AN RPS BREAKER TEST	SHRT. DUE TO O-RING FAIL. IN STAT. WNDGS.
B	TI1	013684A	111275	M	CD	G12				ROD 4 OF GR 7 DROPPED INTO CORE DURING FULL PWR OP	FAILED STATOR WNDG CAUSED ROD 4 TO DROP
C	CC1	016741	121276	M	CD	G00	R	L		ROD 27 SLIPPED TO 77 INCH. DURING MOVEMENT TESTS	UNDETERMINED (SEE LER 019689)
C	CC1	017710	042277	M	CD	G00	R	L		ROD 34 SLIPPED TO 34 INCH. DURING MOVEMENT TESTS	UNDETERMINED (SEE LER 019689)
C	CC1	019689A	111277	M	CD	G21	T	D		WHILE AT 55 PWR AT 2404AM CEA 54 DROP. TO FULL-IN	15-VLT PWR. SUP. IN COIL PWR. PROG. DRIFT LOW
C	CC1	019689B	111277	M	CD	G21	T	D		WHILE AT 55 PWR AT 11414AM CEA 54 DROP. TO FULL-IN	15-VLT PWR. SUP. IN COIL PWR. PROG. DRIFT LOW
C	CC1	019781	120377	M	CD	G00	R	L		ROD 1 DROPPED WHILE PULLING GROUP 5	UNKNOWN
C	CC1	020171	010778	M	CD	G21	T	D		WHILE AT 55 PWR CEA 32 DROPPED TO FULLY INSERTED	CEA 15-VLT PWR. SUP. FAILED
L	CC2	018300A	070577	M	CD	G21	T	D		WHILE OPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTENT FAIL. OF 15VDC POWER SUPPLY

DROPPED ROD (PWR)

<u>V</u> <u>E</u> <u>N</u>	<u>F</u> <u>L</u> <u>A</u> <u>N</u> <u>T</u>	<u>C</u> <u>O</u> <u>N</u> <u>T</u> <u>N</u> <u>U</u> <u>.</u>	<u>F</u> <u>A</u> <u>I</u> <u>L</u> <u>D</u> <u>A</u> <u>T</u> <u>E</u>	<u>S</u> <u>C</u> <u>S</u> <u>S</u> <u>P</u>	<u>F</u> <u>A</u> <u>I</u> <u>L</u> <u>C</u> <u>O</u> <u>D</u> <u>E</u>	<u>T</u> <u>T</u> <u>P</u> <u>E</u>	<u>C</u> <u>L</u> <u>A</u> <u>S</u> <u>S</u>	<u>F</u> <u>A</u> <u>I</u> <u>L</u> <u>M</u>	<u>F</u> <u>A</u> <u>I</u> <u>L</u> <u>M</u> <u>O</u> <u>D</u> <u>E</u>	<u>F</u> <u>A</u> <u>I</u> <u>L</u> <u>M</u> <u>E</u> <u>C</u> <u>H</u> <u>A</u> <u>N</u> <u>I</u> <u>S</u> <u>M</u>
C	CC2	018300P	070777	M	CD	G21	T	D	WHILE OPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTEN FAIL. OF 15VDC POWER SUPPLY
C	CC2	019279	100277	M	CD	G21	T	D	DURING FULL PWR. OPS. CEA 37 DROPPED TO FULLY INS.	15 VLT PWR SUPPLY FAILED LOW
C	CC2	020228	012178	M	CD	G00	R	U	ROD 1 DROPPED DURING POWER REDUCTION	UNKNOWN
C	CC2	020561	021578	M	CD	G00	R	L	ROD 33 DROPPED DURING MONTHLY EXER. TESTS	UNKNOWN
C	FC1	000406	081773	M	CD	G15		U	CEA 35 DROPPED TO ITS LOWER HARD STOP	CLUTCH COIL FAILED
C	MI2	016030	092276	M	CD	G21	S	D	DURING CEA PARALLEL OPS. CEA 49 DROPPED INTO CORE	BLOWN FUSE IN PARALLELING CIRCUIT
C	SL1	015508	071076	M	CD	G21	T	D	CEA 50 DROPPED WITH RX. CRIT. AT 0.01X PWR.	FAILURE OF 15 VOLT POWER SUPPLY
C	SL1	017200	020477	M	CD	G00	R	L	CEA #60 DROPPED WHILE AT POWER	THE CAUSE IS UNKNOWN
C	SL1	018060	052777	M	CD	G21	T	D	CEA 39 DROPPED WITH PLANT OPERATING AT POWER	FAULTY INSERTION TIMER
C	SL1	019276A	102877	M	CD	G00	R	L	CEA #56 DROPPED FOR NO APPARENT REASON	CAUSE UNKNOWN, POSS. PROB. PWR. SUP. & TIME. MOD
C	SL1	019576H	102877	M	CD	G00	R	L	CEA #56 DROPPED FOR NO APPARENT REASON	CAUSE UNKNOWN, POSS. PROB. PWR. SUP. & TIME. MOD
W	IP2	018071	052677	M	CD	G00		U	ROD F-2 BANK D DROPPED DURING STARTUP	CAUSE UNKNOWN
W	RG1	012311A	030575	M	CD	G21	T	D	B BANK GR2 RCC G5 DROPPED	WTR IN CAB GRND CONT PWR FOR STATN GRIP.
W	RG1	012311P	030575	M	CD	G21	T	D	B BANK GR2 RCC G-9 DROPPED	WTR IN CAB. GRND CONT. PWR. FOR STATN GRIP.
W	RG1	014596*	041676	M	CD	G21	T	D 02	B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	FAILURE OF 4 P.C. CARDS POSSIBLE CAUSE
W	RG1	015098*	070476	M	CD	G21	T	D 02	B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	STATIONARY COIL CIRCUITRY FAILURE
W	RG1	015328*	080476	M	CD	G21	T	D 02	L BANK GROUP 2 RODS G-3 AND G-11 PARTIALLY DROPPED	STATIONARY COIL CIRCUITRY FAILURE
W	RG1	016644	121776	M	CD	G21	T	D	ROD F-12 DROPPED DURING OPER. AT REDUCED LOAD	FAILURE OF STATIONARY HOLD COIL CIRCUITRY
W	RO2	002072*	062072	M	CD	G21	S	D 03	3 RODS (BANK C-GROUP 2) DROPPED INTO THE CORE	MULTIPLEXING THYRISTOR FAILURE PWR CAB2BD
W	SL1	018875	061877	M	CD	G21	S	D	ROD J-13 (SHUTDOWN BANK A) DROPPED DURING NORM. OPER	LOSS OF PWR TO STATION. GRIP COIL OF CROM

CROPPED ROI (PWR); 1/1/76 THRU 4/30/78

BABCJCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	PDP.HOURS	STANDBY HOUR RATE
AR1	12946.0	69	0	893274.0	3.4E-06*
CR3	7430.0	69	1	512670.0	2.0E-06
DB1	4129.0	57	0	235353.0	1.3E-05*
DE1	13520.0	69	0	939780.0	3.2E-06*
DE2	13196.0	69	2	910524.0	2.2E-06
DE3	15777.0	69	1	1088613.0	9.2E-07
RS1	12642.0	69	0	872298.0	3.4E-06*
TI1	14916.0	69	0	1029204.0	2.9E-06*
TI2	342.0	69	0	23598.0	1.3E-04*
TOTALS			4	6505314.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



DROPPED ROD (PWR); 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	15903.0	85	3	1351755.0	2.2E-06
CC2	9162.0	85	2	778770.0	2.6E-06
FC1	16130.0	49	0	790370.0	3.8E-06*
MI2	13567.0	81	0	1098927.0	2.7E-06*
MY1	18606.0	85	0	1581510.0	1.9E-06*
SL1	9903.0	81	3	802143.0	3.7E-06
TOTALS			8	6403475.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

DROPPED ROD (PWR) 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BV1	9106.0	53	0	482618.0	6.2E-06*
DC1	16401.0	53	0	869253.0	3.4E-06*
DC2	770.0	53	0	40810.0	7.3E-05*
HN1	18030.0	45	0	811350.0	3.7E-06*
IP2	10995.0	61	1	670695.0	1.5E-06
IP3	11694.0	61	0	713334.0	4.2E-06*
JF1	3079.0	53	0	163187.0	1.8E-05*
KF1	16994.0	33	0	560802.0	5.3E-06*
NA1	410.0	53	0	21730.0	1.4E-04*
PR1	16859.0	37	0	623783.0	4.8E-06*
PR2	17531.0	37	0	648647.0	4.6E-06*
PT1	18041.0	37	0	667517.0	4.5E-06*
PT2	17964.0	37	0	664668.0	4.5E-06*
RG1	14639.0	33	0	483087.0	6.2E-06*
KD2	16245.0	41	0	666045.0	4.5E-06*
SAL	4368.0	53	0	231504.0	1.3E-05*
SD1	14325.0	45	0	644625.0	4.6E-06*
SU1	15487.0	53	0	820811.0	3.6E-06*
SU2	13160.0	53	0	697480.0	4.3E-06*
TP1	12539.0	61	0	764879.0	3.9E-06*
TU3	15712.0	53	0	832736.0	3.6E-06*
TU4	14145.0	53	0	749685.0	4.0E-06*
ZI1	15178.0	53	0	804434.0	3.7E-06*
ZI2	13657.0	53	0	723821.0	4.1E-06*
			TOTALS	1	14357501.0

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

CROPPED FOR (PWR); 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	2.3
BAB.&WIL.	6.1E-07
	2.9
	1.8
COMB.ENG.	1.2E-06
	2.0
GEN.&ELEC.	0.
	4.7
WESTINGH.	7.0E-08
	19.5
	1.6
PWR'S	4.8E-07
	1.7
	1.6
OVERALL	4.8E-07
	1.7

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

DROPPEL ROD (PWR) (COMMON FAULTS INCLUDED); 1/1/76 THRU 4/30/76

BABCOCK&WILCOX

PLANT	OPIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
AR1	12946.0	69	9	893274.0	1.0E-05
CR3	7430.0	69	21	512670.0	4.1E-05
DB1	4129.0	57	0	235353.0	1.3E-05*
DE1	13620.0	69	0	939780.0	3.2E-06*
DE2	13196.0	69	14	910524.0	1.5E-05
DE3	15777.0	69	19	1088613.0	1.7E-05
RS1	12642.0	69	0	872298.0	3.4E-06*
TI1	14916.0	69	0	1029204.0	2.9E-06*
TI2	342.0	69	0	23598.0	1.3E-04*
TOTALS			63	6505314.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

DROPPED ROD (PWR) (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	15903.0	85	6	1351755.0	4.4E-06
CC2	9162.0	85	5	778770.0	6.4E-06
FC1	16130.0	49	0	790370.0	3.8E-06*
MI2	13567.0	81	1	1098927.0	9.1E-07
MY1	18606.0	85	0	1581510.0	1.9E-06*
SL1	9903.0	81	5	802143.0	6.2E-06
TOTALS			17	6403475.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

DROPPED ROD (PWR) (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BV1	9106.0	53	0	482618.0	6.2E-06*
CC1	16401.0	53	0	869253.0	3.4E-06*
DC2	770.0	53	0	40810.0	7.3E-05*
HN1	18030.0	45	0	811350.0	3.7E-06*
IP2	10995.0	61	1	670695.0	1.5E-06
IP3	11694.0	61	0	713334.0	4.2E-06*
JF1	3079.0	53	0	163187.0	1.8E-05*
KE1	16994.0	23	0	560802.0	5.3E-06*
NA1	410.0	53	0	21730.0	1.4E-04*
PR1	16859.0	27	0	623783.0	4.8E-06*
PR2	17531.0	27	0	648647.0	4.6E-06*
PT1	18041.0	27	0	667517.0	4.5E-06*
PT2	17964.0	27	0	664668.0	4.5E-06*
RG1	14639.0	23	7	483087.0	1.4E-05
RC2	16245.0	41	0	666045.0	4.5E-06*
SA1	4368.0	53	0	231504.0	1.3E-05*
SD1	14325.0	45	0	644625.0	4.6E-06*
SU1	15487.0	53	1	820811.0	1.2E-06
SU2	13160.0	53	0	697480.0	4.3E-06*
TR1	12539.0	61	0	764879.0	3.9E-06*
TU3	15712.0	53	0	632736.0	3.6E-06*
TU4	14145.0	53	0	749685.0	4.0E-06*
ZI1	15178.0	53	0	804434.0	3.7E-06*
ZI2	13657.0	53	0	723821.0	4.1E-06*
		TOTALS	9	14357501.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

DROPPED ROD (PWR) (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	1.2
EAB. SWIL.	9.7E-06
	1.2
	1.5
COMB. ENG.	2.7E-06
	1.6
CEN. ELEC.	0.
	1.7
WESTINGH.	6.3E-07
	1.9
	1.2
PWR'S	3.3E-06
	1.2
	1.2
OVERALL	3.3E-06
	1.2

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

CREFFED RUC (PWR); 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
AR1	20009.0	69	0	1380621.0	2.2E-06*
CR3	7430.0	69	1	512670.0	2.0E-06
DB1	4129.0	57	0	235353.0	1.3E-05*
DE1	30392.0	69	0	2097048.0	1.4E-06*
DE2	21755.0	69	2	1501095.0	1.3E-06
DE3	22921.0	69	1	1581549.0	6.3E-07
RS1	14543.0	69	0	1003467.0	3.0E-06*
TI1	24929.0	69	1	1720101.0	5.8E-07
TI2	342.0	69	0	23598.0	1.3E-04*
TOTALS			5	10055502.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



DROPPED ROD (PWR); 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	20739.0	85	3	1762815.0	1.7E-06
CC2	9162.0	85	2	778770.0	2.6E-06
FC1	32123.0	49	1	1574027.0	6.4E-07
MI2	14906.0	81	0	1207386.0	2.5E-06*
MY1	40408.0	85	0	3434680.0	8.7E-07*
SL1	9903.0	81	3	802143.0	3.7E-06
TOTALS			9	9559821.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

DROPPED ROL (PWR); 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BV1	9106.0	53	0	482618.0	6.2E-06*
DC1	22795.0	53	0	1208135.0	2.5E-06*
DC2	770.0	53	0	40810.0	7.3E-05*
HN1	45574.0	45	0	2050830.0	1.5E-06*
IP2	21387.0	61	1	1304607.0	7.7E-07
IP3	11694.0	61	0	713334.0	4.2E-06*
JF1	3079.0	53	0	163187.0	1.8E-05*
KE1	28727.0	33	0	947991.0	3.2E-06*
NA1	410.0	53	0	21730.0	1.4E-04*
PR1	28913.0	37	0	1069701.0	2.8E-06*
PR2	25020.0	37	0	925740.0	3.2E-06*
PT1	44738.0	37	0	1655306.0	1.8E-06*
PT2	45215.0	37	0	1672955.0	1.8E-06*
RG1	40932.0	33	0	1350756.0	2.2E-06*
RO2	43926.0	41	0	1801048.0	1.7E-06*
SA1	4368.0	53	0	231504.0	1.3E-05*
SO1	41777.0	45	0	1879965.0	1.6E-06*
SU1	31984.0	53	0	1695152.0	1.8E-06*
SU2	28790.0	53	0	1525870.0	2.0E-06*
TR1	12539.0	61	0	764879.0	3.9E-06*
TL3	36992.0	53	0	1960576.0	1.5E-06*
TU4	29791.0	53	0	1578923.0	1.9E-06*
ZI1	26612.0	53	0	1410436.0	2.1E-06*
ZI2	21735.0	53	0	1151955.0	2.6E-06*
TOTALS			1	27608088.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

DROPPED ROC (PWR): 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	2.1
EAB.&WIL.	5.0E-07
	2.5
	1.7
COMB.ENG.	9.4E-07
	1.9
CEN.ELEC.	0.
	4.7
WESTINGH.	3.6E-08
	19.5
	1.5
FWK'S	3.2E-07
	1.6
	1.5
OVERALL	3.2E-07
	1.6

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

DROPPED RCD (PWR) (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
AP1	20009.0	69	9	1380621.0	6.5E-06
CR3	7430.0	69	21	512670.0	4.1E-05
DB1	4129.0	57	0	235353.0	1.3E-05*
DE1	30392.0	69	0	2097048.0	1.4E-06*
DE2	21755.0	69	23	1501095.0	1.5E-05
DE3	22921.0	69	19	1581549.0	1.2E-05
PS1	14543.0	69	0	1003467.0	3.0E-06*
TI1	24929.0	69	1	1720101.0	5.8E-07
TI2	342.0	69	0	23598.0	1.3E-04*
TOTALS			73	10055502.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

DROPPED RED (PWR) (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	20739.0	85	6	1762815.0	3.4E-06
CC2	9162.0	85	5	778770.0	6.4E-06
FC1	32123.0	49	1	1574027.0	6.4E-07
MI2	14906.0	81	1	1207386.0	8.3E-07
MY1	40408.0	85	0	3434680.0	8.7E-07*
SL1	9903.0	81	5	802143.0	6.2E-06
TOTALS			18	9559821.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

DROPPED ALO (PWR) (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	PCP.HOURS	STANDBY HOUR RATE
PV1	9106.0	53	0	482618.0	6.2E-06*
DC1	22795.0	53	0	1208135.0	2.5E-06*
DC2	770.0	53	0	40810.0	7.3E-05*
HN1	45574.0	45	0	2050830.0	1.5E-06*
IP2	21387.0	61	1	1304607.0	7.7E-07
IP3	11694.0	61	0	713334.0	4.2E-06*
JF1	3079.0	53	0	163187.0	1.8E-05*
KE1	28727.0	33	0	947951.0	3.2E-06*
NA1	410.0	53	0	21730.0	1.4E-04*
PR1	28913.0	37	0	1069781.0	2.8E-06*
PR2	25020.0	37	0	925740.0	3.2E-06*
PT1	44738.0	37	0	1655306.0	1.8E-06*
PT2	45215.0	37	0	1672955.0	1.8E-06*
RG1	40932.0	33	9	1350756.0	6.7E-06
RD2	43928.0	41	3	1801048.0	1.7E-06
SA1	4368.0	53	0	231504.0	1.3E-05*
SD1	41777.0	45	0	1879965.0	1.6E-06*
SU1	31984.0	53	1	1695152.0	5.9E-07
SU2	28790.0	53	0	1525870.0	2.0E-06*
TR1	12539.0	61	0	764879.0	3.9E-06*
TU3	36992.0	53	0	1960576.0	1.5E-06*
TU4	29791.0	53	0	1578923.0	1.9E-06*
ZI1	26612.0	53	0	1410436.0	2.1E-06*
ZI2	21735.0	53	0	1151955.0	2.6E-06*
		TOTALS	14	27608088.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

DROPPED RCD (PWR) (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	1.2
EAB.&WIL.	7.3E-06
	1.2
	1.5
COMB.ENG.	1.9E-06
	1.5
CEN.ELEC.	0.
	1.6
WESTINGH.	5.2E-07
	1.7
	1.2
PWR'S	2.2E-06
	1.2
	1.2
OVERALL	2.2E-06
	1.2

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

APPENDIX Y

UNCOUPLED ROD/OVERTRAVEL CONDITION (BWR)



FAILURE MODE CODES

CODE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/D
B	FAILURE TO INSERT DURING SCRAM
C	FAIL TO INSERT AT LEAST 90% DURING SCRAM
D	RCC FAILS TO MOVE DURING POWER CHANGES/ TESTING
E	RCC FAILS TO WITHSTAND PREM FULLY INSERTED POSITION
F	CRIPPED ROD (PART)
G	UNCOUPLE ROD/COVER TRAVEL CONDITION (BWR)
H	EXCESSIVE ROD MOVEMENT
I	EXTERNAL LEAKAGE/rupture
J	RODS NOT OPERATE PROPERLY
K	SPECIFIC MODE NOT IDENTIFIABLE)
L	MAINTENANCE/REPLACEMENT REQUIRED
M	TECHNICAL SPECIFICATION VIOLATION (NON-FAILURES)

COMPONENT CODE

CODE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CODE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMAND FALLT
F	RECURRING COMMAND FAULTS

FAILURE MECHANISM CODES

CODE	DESCRIPTION
CC	UNKNOWN
CI	PERSONNEL (OPERATIONS)
CJ	PERSONNEL (MAINTENANCE)
CK	PERSONNEL (TESTING)
CL	DESIGN ERROR
CM	FABRICATION/CONSTRUCTION/C.C.
CN	PROCEDURAL DISCREPANCIES
CO	NORMAL WEAR
CP	ABNORMAL WEAR
CQ	CONTAMINATION
CR	EXCESSIVE VIBRATION
CS	COM MOTOR FAILURE
CT	SCAL FAILURE
CU	MISALIGNED INTERNALS
CV	CLUTCH FAILURE
CW	BEARING FAILURE
CX	BEARING FAILURE
CY	FILTERING/STRAINER PLUGGED
CZ	BINDING/SEIZURE
CC	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
CD	CONTROL CIRCUIT FAILURE/PROBLEM
CE	ASTENER FAILURE/PROBLEM
CF	WELD FAILURE
CG	LUBRICATION PROBLEM

SYSTEM CODE

CODE	DESCRIPTION
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIRE
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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

UNCOUPLED ROD/OVERTRAVEL CONDITION (BWR)

VE N	P L A N T	CONT.NO.	FAIL DATE	S Y S	C O M P	FAIL CODE	T Y P E	C L A S S	F A I L #	FAILURE MODE	FAILURE MECHANISM
G	BR2	013629	092575	M	CD	H18		I		ROD 26-07 DRIFT FROM FULL INSERT TO FULL WITHDRAW	FOREIGN MATTER IN CRD COLLET PISTON AREA
G	BR2	020838A	033178	M	CD	H18	C	D		ROD 22-19 UNCOUPLED FROM DRIVE MECHANISM	ROD DRIVE MECH. INNER FILTER CAME LOOSE
G	BR2	020838B	033178	F	CD	H18	C	D		ROD 26-39 UNCOUPLED FROM DRIVE MECHANISM	ROD DRIVE MECH. INNER FILTER CAME LOOSE
G	CC1	019583	092977	M	CD	H02	C	D		UNCOUPLING ROD AND SPUD FINGERS BENT	IMPROPER ASSEMBLY BY MAINTAINANCE PERSON
G	DR1	010430A	070474	M	CD	H00	B	U		ROD 04 MOVEMENT COULD NOT BE DETER. ON NUC.INSTRU.	UNDETERMINED
G	DR1	010430B	070474	F	CD	H00	B	L		ROD A5 MOVEMENT COULD NOT BE DETER. ON NUC.INSTRU.	UNDETERMINED
G	DR1	010430C	070474	F	CD	H00	B	U		ROD D10 MOVEMENT COULD NOT BE DETER.ON NUC.INSTRU.	UNDETERMINED
G	DR1	010429	071474	M	CD	H00	B	U		ROD A7 MOVEMENT COULD NOT BE DETER. ON NUC.INSTRU.	UNDETERMINED
G	DR2	000284	021973	F	CD	H02	B	D		CRD L-11 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP.INSTAL. OF FILTER DAMAGE RETAIN.SPR
G	DR2	000285	021973	M	CD	H02	B	D		CRD K-8 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP.INSTAL. OF FILTER DAMAGE RETAIN.SPR
G	DR2	000286	021973	M	CD	H02	B	D		CRD B-6 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP.INSTAL. OF FILTER DAMAGE RETAIN.SPR
G	DR2	000884	031474	M	CD	H00	R	U		CRD H-11 UNCOUPLED DURING SCRAM TEST	TO BE DETERMINED
G	DR2	010314	061574	M	CD	H00	R	U		CRD L-9 UNCOUPLED WHILE BEING WITHDRAWN	FAILURE MECHANISM NOT KNOWN
C	DR2	010751	102374	M	CD	H00	R	L		CRD P-12 UNCOUPLED WHILE BEING WITHDRAWN	FAILURE MECHANISM NOT KNOWN
G	DR2	010904	110274	M	CD	H00	R	U		CRD N-10 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	FAILURE MECHANISM NOT KNOWN
G	DR2	017177A	121276	M	CD	H18	B	L		CRD F-5 UNCOUPLED FOLLOWING 50% CORE SCRAM TESTING	LOOSENER INNER FILTER CAUSED UNCOUPLING
G	DR2	017177B	121276	M	CD	H18	B	U		CRD F-5 UNCOUPLED FOLLOWING SCRAM & WITHDRAWL	LOOSENER INNER FILTER CAUSED UNCOUPLING
G	DR2	016907A	122876	M	CD	H18	B	U		CRD J-11 UNCOUPLED DURING ROUTINE S/U AT POS.48	LOOSENER INNER FILTER CAUSED UNCOUPLING
G	DR2	016907b	122876	M	CD	H18	B	U		CRD J-11 UNCOUPLED AFTER INSERT.&WITHDRAW.TO POS48	LOOSENER INNER FILTER CAUSED UNCOUPLING
G	DR2	017515	040277	F	CD	H18	B	U		CRD L-5 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	LOOSENER INNER FILTER CAUSED UNCOUPLING
G	DR2	017516	040277	M	CD	H18	B	U		CRD H-8 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	LOOSENER INNER FILTER CAUSED UNCOUPLING
G	DR2	018182	060577	F	CD	H18	B	L		CRD L-5 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	LOOSENER INNER FILTER CAUSED UNCOUPLING
G	DR2	018933A	080277	F	CD	H18	B	U		CRD F-5 UNCOUPLED WHEN WITHDRAWN AFTER SCRAM TEST	LOOSENER INNER FILTER CAUSED UNCOUPLING
G	DR2	018933B	080277	M	CD	H18	B	U		CRD H-7 UNCOUPLED WHEN WITHDRAWN AFTER SCRAM TEST	LOOSENER INNER FILTER CAUSED UNCOUPLING
G	DR2	019652	110277	F	CD	H18	B	L		CRD H-5 UNCOUPLED DURING FUNCTIONAL TEST	LOOSENER INNER FILTER CAUSED UNCOUPLING
C	PI1	000205	072473	F	CD	H00		U		CENT. ROD 18-35 WENT TO OVERTRAVEL POSITION	PROB. POSSIBLY DUE TO COUPLING SPUD
C	PI1	017773	050277	F	CD	H00		U		ROD 46-39 WAS WITHDRAWN BEYOND THE FULL OUT POSIT. CAUSE UNDER INVEST. NEW LER TO BE SUBMIT.	

UNCOUPLED/OVERTRAVELLED ROD (BWR); 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	PDP.HOURS	STANDBY HOUR RATE
BF1	10793.0	185	0	1996705.0	1.5E-06*
BF2	11809.0	185	0	2184665.0	1.4E-06*
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	13379.0	32	0	428128.0	7.0E-06*
BR1	7544.0	137	0	1033528.0	2.9E-06*
BR2	13226.0	137	2	1811962.0	1.1E-06
CC1	16617.0	137	1	2276529.0	4.4E-07
DA1	15981.0	89	0	1422309.0	2.1E-06*
DR1	15801.0	80	0	1264080.0	2.4E-06*
DR2	16103.0	177	10	2850231.0	3.5E-06
DR3	17226.0	177	0	3049002.0	9.8E-07*
EN1	15876.0	137	0	2175012.0	1.4E-06*
FP1	15348.0	137	0	2102676.0	1.4E-06*
MI1	17024.0	145	0	2468480.0	1.2E-06*
MC1	18126.0	121	0	2193246.0	1.4E-06*
NM1	16060.0	129	0	2071740.0	1.4E-06*
OC1	16142.0	137	0	2211454.0	1.4E-06*
PB2	13776.0	185	0	2548560.0	1.2E-06*
PB3	14885.0	185	0	2753725.0	1.1E-06*
PI1	13412.0	145	1	1944740.0	5.1E-07
QC1	15547.0	177	0	2751819.0	1.1E-06*
QC2	16750.0	177	0	2964750.0	1.0E-06*
VY1	17311.0	89	0	1540679.0	1.9E-06*
TOTALS			14	48179845.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

UNCOUPLED/OVERTRAVELLED ROD (BWR); 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
EAB.&WIL.	0.
COMB.ENG.	0.
	1.6
GEN.ELEC.	2.9E-07
	1.7
WESTINGH.	0.
PWR'S	0. *
	1.6
OVERALL	2.9E-07
	1.7

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

UNCOUPLED/OVERTRAVELLED ROD (BWR); 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BF1	15553.0	185	0	2877305.0	1.0E-06*
BF2	12326.0	185	0	2280310.0	1.3E-06*
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	38622.0	32	0	1235904.0	2.4E-06*
BR1	7544.0	137	0	1033528.0	2.9E-06*
BR2	14576.0	137	3	1996912.0	1.5E-06
CO1	27641.0	137	1	3786817.0	2.6E-07
DA1	22487.0	89	0	2001343.0	1.5E-06*
DR1	35600.0	80	4	2848000.0	1.4E-06
DR2	39390.0	177	17	6972030.0	2.4E-06
DR3	41057.0	177	0	7267089.0	4.1E-07*
EN1	23634.0	137	0	3237858.0	9.3E-07*
FP1	18189.0	137	0	2491893.0	1.2E-06*
MI1	39560.0	145	1	5736200.0	1.7E-07
MO1	44190.0	121	0	5346990.0	5.6E-07*
NM1	41084.0	129	0	5299836.0	5.7E-07*
OC1	42170.0	137	0	5777290.0	5.2E-07*
PB2	24563.0	185	0	4544155.0	6.6E-07*
PB3	22737.0	185	0	206345.0	7.1E-07*
PI1	31756.0	145	1	4605000.0	2.2E-07
QC1	37446.0	177	0	6627942.0	4.5E-07*
QC2	39780.0	177	0	7041060.0	4.3E-07*
VY1	39826.0	89	0	3544514.0	8.5E-07*
TOTALS			27	92093766.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

UNCOUPLED/OVERTRAVELLED RCD (BWR); 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
EAE. EWIL.	0.
COMB. ENG.	0.
	1.4
GEN. ELEC.	2.9E-07
	1.4
WESTINGH.	0.
FWR'S	0. *
	1.4
OVERALL	2.9E-07
	1.4

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

APPENDIX Z

IMPROPER ROD MOVEMENT

FAILURE MODE CODES

<u>CCDE</u>	<u>DESCRIPTION</u>
A	FAILURE TO INSERT DURING NORMAL S/D
B	FAILURE TO INSERT DURING SCRAM
C	FAILURE TO INSERT AT LEAST 90% DURING SCRAM
D	POWER CHANGES/ TESTING
E	POWER CHANGES/ TESTING
F	POWER CHANGES/ TESTING
G	POWER CHANGES/ TESTING
H	POWER CHANGES/ TESTING
I	POWER CHANGES/ TESTING
J	POWER CHANGES/ TESTING
K	POWER CHANGES/ TESTING
L	POWER CHANGES/ TESTING
M	POWER CHANGES/ TESTING
N	POWER CHANGES/ TESTING
O	POWER CHANGES/ TESTING
P	POWER CHANGES/ TESTING
Q	POWER CHANGES/ TESTING
R	POWER CHANGES/ TESTING
S	POWER CHANGES/ TESTING
T	POWER CHANGES/ TESTING
U	POWER CHANGES/ TESTING
V	POWER CHANGES/ TESTING
W	POWER CHANGES/ TESTING
X	POWER CHANGES/ TESTING
Y	POWER CHANGES/ TESTING
Z	POWER CHANGES/ TESTING

COMPONENT CODE

<u>CCDE</u>	<u>DESCRIPTION</u>
CC	CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

<u>CCDE</u>	<u>DESCRIPTION</u>
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMON CAUSE FAILURES
F	RECURRING COMMON CAUSE FAILURES

FAILURE MECHANISM CODES

<u>CCDE</u>	<u>DESCRIPTION</u>
CC	UNKNOWN
CD	PERSONNEL (OPERATIONS)
CE	PERSONNEL (MAINTENANCE)
CF	PERSONNEL (TESTING)
CG	DESIGN ERROR
CH	FACTORY/CONSTRUCTION/C.C.
CI	PROCEDURAL DISCREPANCIES
CJ	EXCESSIVE WEAR
CK	EXCESSIVE WEAR
CL	EXCESSIVE WEAR
CM	EXCESSIVE WEAR
CN	EXCESSIVE WEAR
CO	EXCESSIVE WEAR
CP	EXCESSIVE WEAR
CQ	EXCESSIVE WEAR
CR	EXCESSIVE WEAR
CS	EXCESSIVE WEAR
CT	EXCESSIVE WEAR
CU	EXCESSIVE WEAR
CV	EXCESSIVE WEAR
CW	EXCESSIVE WEAR
CX	EXCESSIVE WEAR
CY	EXCESSIVE WEAR
CZ	EXCESSIVE WEAR

SYSTEM CODE

<u>CCDE</u>	<u>DESCRIPTION</u>
M	REACTIVITY CONTROL SYSTEM
N	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

<u>CODE</u>	<u>DESCRIPTION</u>
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

<u>CODE</u>	<u>DESCRIPTION</u>
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

<u>CODE</u>	<u>DESCRIPTION</u>
B	BABCOCK & WILCOX
C	COMBUSTION ENGINEERING
G	GENERAL ELECTRIC
W	WESTINGHOUSE



IMPROPER ROD MOVEMENT

PLANT	CCNT-NO.	FAIL DATE	S P	C	FAIL CODE	FAILURE MODE	FAILURE MECHANISM	
B AR1	C1C5C4	060974	M	CD	IC6	S	D	IMPROP. MOVEMENT OF ROD 7-4 CAUSED HI S/U RATE TRIP PROCEDURE FOR COND. TEST WAS INADEQUATE
B CR3	017643	042177	M	CD	IC1	S	C	ROD GROUP 6 EXCEEDED ITS INSERTION LIMIT (T.S.) PERSONNEL ERROR(COMMAND FAULT)
B CE1	00C417	100573	M	CD	IC1	S	D	TECH SPEC ROD WITHDRAWAL LIMITS WERE EXCEEDED PERSONNEL ERROR
B CE1	012266	010375	M	CD	IC6	S	D	RODS WERE MOVED WITHOUT CALCULATING O POWER WORTH VENDOR/PERSONNEL PROCEDURES PROBLEM
B CE2	012293	011575	M	CD	IC1	S	C	IMPROPER ROD MOVEMENT CAUSED OVERLAP PROBLEM PERSONNEL ERROR
B CE3	012258	020575	M	CD	IC1	S	D	IMPROPER ROD MOVEMENT CAUSED OVERLAP PROBLEM PERSONNEL ERROR/WRONG ROD POS MONITORED
B BS1	016C11	100776	M	CD	IC1	S	D	RODS IN POSITION TO GIVE <1% DELTA K/K SHUTDOWN PERSONNEL ERROR DURING COLD SHUTDOWN
B T11	C12144	021075	M	CD	IC1	S	D	OPERATED WITH ROD 6/6 LOWER THAN REST OF GROUP 6 PERSONNEL ERROR
C FC1	00C233	080873	M	CD	IC6	S	D	RODS WITHDRAWN WHICH REDUCED S/D MARGIN TO < 2.4 PROCEDURE BASED ON WRONG ROD WORTH CURVES
G BR1	016925	010977	M	CD	IC1	S	D	OPERATOR PULLED RODS TO NOTCH 48 INSTEAD OF 24 PERSONNEL ERROR/MINIMIZER FAILED TO BLOCK
G CA1	C10428	070274	M	CD	IC0	T	D	KOD 18-27 WITHDREW WITHOUT WITHDRAWAL SIGNAL APPLIED EXACT CAUSE NOT STATED
G DA1	C10517	071674	M	CD	IC0	T	D	RCD 06-23 WITHDREW WITHOUT WITHDRAWAL SIGNAL APPLIED CAUSE UNKNOWN, BEING INVESTIGATED
G DA1	010691	090674	M	CD	IC1	T	D	ROD MOVED WITHOUT OPERATOR ACTION IN 2 INSTANCES PROB. CAUSE, NOISE SPIKES IN RACS OR TIMER DEFECTIVE TEMPORARY PROCEDURE
G DR2	C12217	012575	M	CD	IC6	S	D	2 ADJ CONTROL RODS WITHDRAWN DURING REFUELING
G DR2	014529	041376	M	CD	IC3	T	D	RODS EXERCISED/RX VESSEL CPEM/PERSONNEL IN AREA PERSONNEL FAILED TO EVACUATE AREA
G N11	C16343	111276	M	CD	IC3	S	D	IMPROPER ROD MOVEMENTS CAUSED INADVERTANT CRITICAL PERSONNEL SELECTED WRONG RODS DURING TEST
G MC1	017363	022377	M	CD	IC6	S	C	IMPROPER ROD MOVEMENT RESULTED IN HIGH SUR SCRAM DEFECTIVE PROCEDURES ON START-UP ROD SEQ.
G P11	00C076A	030973	M	CD	IC0	S	D	RCD 34-15 MOVED FROM 6IN. WITHDRAWN TO FULL-IN MOVE. DUE TO HI-PRES. IN COOL. WTR. LINE
G GC1	00C35C	092173	M	CD	IC1	S	D	IMPROPER ROD MOVEMENT/HEAT GENERATION RATE EXCEED PERSONNEL ERROR/WRONG ROD SELECTED
G GC1	012663	050375	M	CD	IC6	S	D	IMPROPER ROD WITHDRAWL DURING REFUELING INADEQUATE PROCEDURES
G GC1	0153FC	070576	M	CD	IC1	S	D	IMPROPER ROD MOVEMENT/2 PULLED SIMULTANEOUSLY PERSONNEL ERROR
G VY1	00C477	110773	M	CD	IC3	S	D	IMPROPER ROD MOVEMENT CAUSED INADVERTANT CRITICALITY PERSONNEL ERRORS/INTERLOCKS JUMPER/F/TEST
N PT1	010649	052974	M	CD	IC1	S	D	IMPROPER ROD MOVEMENT/PART-LENGTH RODS INSERTED TO --82 //PERSONNEL ERROR
N RC2	C16292	052674	M	CD	IC2	S	D	RCC ASSEMBLY INADVERTANTLY REMOVED DURING REFUEL PERSONNEL ERROR
N RC2	0111148	121174	M	CD	IC6	S	D	RODS NOT INSERTED(S/D), WHEN PART-LENGTH ROD INOPER PROCEDURES HAD 5 PARAGRAPHS DELETED
N T04	00C263	081573	M	CD	IC3	S	C	ROD TEST CONDUCTED WHICH TECH SPECS DONT ALLOW PERSONNEL ERROR

IMPROPER ROD MOVEMENT (PERSONNEL); 1/1/76 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
AR1	12946.0	69	0	893274.0	3.4E-06*
CR3	7430.0	69	1	512670.0	2.0E-06
DB1	4129.0	57	0	235353.0	1.3E-05*
DE1	13620.0	69	0	939780.0	3.2E-06*
DE2	13196.0	69	0	910524.0	3.3E-06*
DE3	15777.0	69	0	1088613.0	2.8E-06*
RS1	12642.0	69	1	872298.0	1.1E-06
TI1	14916.0	69	0	1029204.0	2.9E-06*
TI2	342.0	69	0	23598.0	1.3E-04*
			TOTALS	-----	
				2	6505314.0

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER ROD MOVEMENT (PERSONNEL); 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	15903.0	85	0	1351755.0	2.2E-06*
CC2	9162.0	85	0	778770.0	3.8E-06*
FC1	16130.0	49	0	790370.0	3.8E-06*
MI2	13567.0	81	0	1098927.0	2.7E-06*
MY1	18606.0	85	0	1581510.0	1.9E-06*
SL1	9903.0	81	0	802143.0	3.7E-06*
		TOTALS	0	6403475.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER ROD MOVEMENT (PERSONNEL); 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HP	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BF1	10793.0	185	0	1996705.0	1.5E-06*
BF2	11809.0	185	0	2184665.0	1.4E-06*
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	13379.0	32	0	428128.0	7.0E-06*
BR1	7544.0	137	1	1033528.0	9.7E-07
BR2	13226.0	137	0	1811962.0	1.7E-06*
CC1	16617.0	137	0	2276529.0	1.3E-06*
DA1	15981.0	89	0	1422309.0	2.1E-06*
DR1	15801.0	80	0	1264080.0	2.4E-06*
DR2	16103.0	177	1	2850231.0	3.5E-07
DR3	17226.0	177	0	3049002.0	9.8E-07*
EN1	15876.0	137	0	2175012.0	1.4E-06*
FP1	15348.0	137	0	2102676.0	1.4E-06*
MI1	17024.0	145	1	2468480.0	4.1E-07
MO1	18126.0	121	1	2193246.0	4.6E-07
NM1	16060.0	129	0	2071740.0	1.4E-06*
JC1	16142.0	137	0	2211454.0	1.4E-06*
PB2	13776.0	185	0	2548560.0	1.2E-06*
PB3	14885.0	185	0	2753725.0	1.1E-06*
PI1	13412.0	145	0	1944740.0	1.5E-06*
QC1	15547.0	177	1	2751819.0	3.6E-07
QC2	16750.0	177	0	2964750.0	1.0E-06*
VY1	17311.0	89	0	1540679.0	1.9E-06*
		<b>TOTALS</b>	<b>5</b>	<b>48179845.0</b>	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER RGD MOVEMENT (PERSONNEL); 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BV1	9106.0	53	0	482618.0	6.2E-06*
DC1	16401.0	53	0	869253.0	3.4E-06*
DC2	770.0	53	0	40810.0	7.3E-05*
HN1	18030.0	45	0	811350.0	3.7E-06*
IP2	10995.0	61	0	670695.0	4.5E-06*
IP3	11694.0	61	0	713334.0	4.2E-06*
JF1	3079.0	53	0	163187.0	1.8E-05*
KE1	16994.0	23	0	560802.0	5.3E-06*
NA1	410.0	53	0	21730.0	1.4E-04*
PR1	16859.0	27	0	623783.0	4.8E-06*
PR2	17531.0	27	0	648647.0	4.6E-06*
PT1	18041.0	27	0	667517.0	4.5E-06*
PT2	17964.0	27	0	664668.0	4.5E-06*
RG1	14639.0	23	0	483087.0	6.2E-06*
RO2	16245.0	41	0	666045.0	4.5E-06*
SA1	4368.0	53	0	231504.0	1.3E-05*
SD1	14325.0	45	0	644625.0	4.6E-06*
SU1	15487.0	53	0	820811.0	3.6E-06*
SU2	13160.0	53	0	697480.0	4.3E-06*
TR1	12539.0	61	0	764879.0	3.9E-06*
TU3	15712.0	53	0	832736.0	3.6E-06*
TU4	14145.0	53	0	749685.0	4.0E-06*
ZI1	15178.0	53	0	804434.0	3.7E-06*
ZI2	13657.0	53	0	723821.0	4.1E-06*
		TOTALS	0	14357501.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER ROD MOVEMENT (PERSONNEL) 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	3.1
EAB.&WIL.	3.1E-07
	5.6
COMB.ENG.	4.7E-07*
	2.1
GEN.ELEC.	1.0E-07
	2.5
WESTINGH.	2.1E-07*
	3.1
FWR'S	7.3E-08
	5.6
	1.9
OVERALL	9.3E-08
	2.1

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER ROD MOVEMENT (PERSONNEL); 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
AR1	20009.0	69	1	1380621.0	7.2E-07
CR3	7430.0	69	1	512670.0	2.0E-06
DB1	4129.0	57	0	235353.0	1.3E-05*
DE1	30392.0	69	2	2097048.0	9.5E-07
DE2	21755.0	69	1	1501095.0	6.7E-07
DE3	22921.0	69	1	1581549.0	6.3E-07
RS1	14543.0	69	1	1003467.0	1.0E-06
TI1	24929.0	69	1	1720101.0	5.8E-07
TI2	342.0	69	0	23598.0	1.3E-04*
TOTALS			8	10055502.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER ROD MOVEMENT (PERSONNEL); 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	20739.0	85	0	1762815.0	1.7E-06*
CC2	9162.0	85	0	778770.0	3.8E-06*
FC1	32123.0	49	1	1574027.0	6.4E-07
MI2	14906.0	81	0	1207386.0	2.5E-06*
MY1	40408.0	85	0	3434680.0	8.7E-07*
SL1	9903.0	81	0	802143.0	3.7E-06*
TOTALS			1	9559821.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



IMPROPER ROD MOVEMENT (PERSONNEL); 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BF1	15553.C	185	0	2877305.0	1.0E-06*
BF2	12326.C	185	0	2280310.0	1.3E-06*
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	38622.C	32	0	1235904.0	2.4E-06*
BR1	7544.0	137	1	1033528.0	9.7E-07
BR2	14576.C	137	0	1996912.0	1.5E-06*
CO1	27641.C	137	0	3786817.0	7.9E-07*
DA1	22487.0	89	0	2001343.0	1.5E-06*
DR1	35600.C	80	0	2848000.0	1.1E-06*
DR2	39390.0	177	2	6972030.0	2.9E-07
DR3	41057.0	177	0	7267089.0	4.1E-07*
EN1	23634.0	137	0	3237858.0	9.3E-07*
FP1	18189.C	137	0	2491893.0	1.2E-06*
MI1	39560.0	145	1	5736200.0	1.7E-07
MO1	44190.C	121	1	5346990.0	1.9E-07
NM1	41084.0	129	0	5299836.0	5.7E-07*
OC1	42170.0	137	0	5777290.0	5.2E-07*
PB2	24563.0	185	0	4544155.0	6.6E-07*
PB3	22737.C	185	0	4206345.0	7.1E-07*
PI1	31756.C	145	0	4604620.0	6.5E-07*
QC1	37446.0	177	3	6627942.0	4.5E-07
QC2	39780.C	177	0	7041060.0	4.3E-07*
VY1	39826.0	89	1	3544514.0	2.8E-07
			TOTALS	9	92893766.0

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER RCD MOVEMENT (PERSONNEL); 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BV1	9106.0	53	0	482618.0	6.2E-06*
DC1	22795.0	53	0	1208135.0	2.5E-06*
DC2	770.0	53	0	40810.0	7.3E-05*
HN1	45574.0	45	0	2050830.0	1.5E-06*
IP2	21387.0	61	0	1304607.0	2.3E-06*
IP3	11694.0	61	0	713334.0	4.2E-06*
JF1	3079.0	53	0	163187.0	1.8E-05*
KE1	28727.0	23	0	947991.0	3.2E-06*
NA1	410.0	53	0	21730.0	1.4E-04*
PR1	28913.0	27	0	1069781.0	2.8E-06*
PR2	25020.0	27	0	925740.0	3.2E-06*
PT1	44738.0	27	1	1655306.0	6.0E-07
PT2	45215.0	27	0	1672955.0	1.8E-06*
RG1	40932.0	23	0	1350756.0	2.2E-06*
RC2	43928.0	41	2	1801048.0	1.1E-06
SA1	4368.0	53	0	231504.0	1.3E-05*
SO1	41777.0	45	0	1879965.0	1.6E-06*
SU1	31984.0	53	0	1695152.0	1.8E-06*
SU2	28790.0	53	0	1525870.0	2.0E-06*
TR1	12539.0	61	0	764879.0	3.9E-06*
TU3	36992.0	53	0	1960576.0	1.5E-06*
TU4	29791.0	53	1	1578923.0	6.3E-07
ZI1	26612.0	53	0	1410436.0	2.1E-06*
ZI2	21735.0	53	0	1151955.0	2.6E-06*
TOTALS			4	27608088.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER ROD MOVEMENT (PERSONNEL); 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	1.8
6.0.6WIL.	8.0E-07
	2.0
	4.7
COMB.ENG.	1.0E-07
	19.5
	1.7
CEN.ELEC.	9.7E-08
	1.9
	2.3
WESTINGH.	1.4E-07
	2.9
	1.6
PWR'S	2.8E-07
	1.7
	1.4
OVERALL	1.6E-07
	1.5

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER ROD MOVEMENT (PERSONNEL & HARDWARE) 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
AR1	20009.0	69	1	1380621.0	7.2E-07
CR3	7430.0	69	1	512670.0	2.0E-06
DB1	4129.0	57	0	235353.0	1.3E-05*
DE1	30392.0	69	2	2097048.0	9.5E-07
DE2	21755.0	69	1	1501095.0	6.7E-07
DE3	22921.0	69	1	1581549.0	6.3E-07
RS1	14543.0	69	1	1003467.0	1.0E-06
TI1	24929.0	69	1	1720101.0	5.8E-07
TI2	342.0	69	0	23598.0	1.3E-04*
TOTALS			8	10055502.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER ROD MOVEMENT (PERSONNEL & HARDWARE); 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	20739.0	E5	0	1762815.0	1.7E-06*
CC2	9162.0	E5	0	778770.0	3.8E-06*
FC1	32123.0	49	1	1574027.0	6.4E-07
MI2	14906.0	E1	0	1207386.0	2.5E-06*
MY1	40408.0	E5	0	3434680.0	8.7E-07*
SL1	9903.0	E1	0	802143.0	3.7E-06*
TOTALS			1	9559821.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER WCD MOVEMENT (PERSONNEL & HARDWARE); 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	PCP.HOURS	STANDBY HOUR RATE
BF1	15553.0	185	0	2877305.0	1.0E-06*
BF2	12326.0	185	0	2280310.0	1.3E-06*
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	38622.0	22	0	1235904.0	2.4E-06*
BR1	7544.0	137	1	1033528.0	9.7E-07
BR2	14576.0	137	0	1996912.0	1.5E-06*
CO1	27641.0	137	0	3786817.0	7.9E-07*
DAL	22487.0	89	3	2001343.0	1.5E-06
DR1	35600.0	80	0	2848000.0	1.1E-06*
DR2	39390.0	177	2	6972030.0	2.9E-07
DR3	41057.0	177	0	7267089.0	4.1E-07*
EN1	23634.0	137	0	3237858.0	9.3E-07*
FP1	18189.0	137	0	2491893.0	1.2E-06*
MI1	39560.0	145	1	5736200.0	1.7E-07
MO1	44190.0	121	1	5346990.0	1.9E-07
NM1	41084.0	129	0	5299836.0	5.7E-07*
OC1	42170.0	137	0	5777290.0	5.2E-07*
PB2	24563.0	185	0	4544155.0	6.6E-07*
PB3	22737.0	185	0	4206345.0	7.1E-07*
PI1	31756.0	145	1	4604620.0	2.2E-07
QC1	37446.0	177	3	6627942.0	4.5E-07
QC2	39780.0	177	0	7041060.0	4.3E-07*
VY1	39826.0	89	1	3544514.0	2.8E-07
TOTALS			13	92893766.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER ROD MOVEMENT (PERSONNEL & HARDWARE); 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
EV1	9106.0	53	0	482618.0	6.2E-06*
DC1	22795.0	53	0	1208135.0	2.5E-06*
DC2	770.0	53	0	40810.0	7.3E-05*
HN1	45574.0	45	0	2050830.0	1.5E-06*
IP2	21387.0	61	0	1304607.0	2.3E-06*
IP3	11694.0	61	0	713334.0	4.2E-06*
JF1	3079.0	53	0	163187.0	1.8E-05*
KE1	28727.0	33	0	947991.0	3.2E-06*
NA1	410.0	53	0	21730.0	1.4E-04*
PR1	28913.0	37	0	1069781.0	2.8E-06*
PR2	25020.0	37	0	925740.0	3.2E-06*
PT1	44738.0	37	1	1655306.0	6.0E-07
PT2	45215.0	37	0	1672955.0	1.8E-06*
RG1	40932.0	33	0	1350756.0	2.2E-06*
RD2	43928.0	41	2	1801048.0	1.1E-06
SA1	4368.0	53	0	231504.0	1.3E-05*
SO1	41777.0	45	0	1879965.0	1.6E-06*
SU1	31984.0	53	0	1695152.0	1.8E-06*
SU2	28790.0	53	0	1525870.0	2.0E-06*
TR1	12539.0	61	0	764879.0	3.9E-06*
TU3	36992.0	53	0	1960576.0	1.5E-06*
TU4	29791.0	53	1	1578923.0	6.3E-07
ZI1	26612.0	53	0	1410436.0	2.1E-06*
ZI2	21735.0	53	0	1151955.0	2.6E-06*
TOTALS			4	27608088.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

IMPROPER ROD MOVEMENT (PERSONNEL & HARDWARE); 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	1.8
EAB.&WIL.	8.0E-07
	2.0
	4.7
COMB.ENG.	1.0E-07
	19.5
	1.6
GEN.ELEC.	1.4E-07
	1.7
	2.3
WESTINGH.	1.4E-07
	2.9
	1.6
PWR'S	2.8E-07
	1.7
	1.4
OVERALL	1.9E-07
	1.4

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



APPENDIX AA

FAILURE TO INSERT FULLY DURING SCRAM

FAILURE MODE CODES

CCDE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/C
B	FAILURE TO INSERT DURING SCRAM
C	FAIL TO INSERT TO AT LEAST 90% DURING SCRAM
D	RCD FAILS TO MOVE DURING POWER CHANGES/TESTING
E	RCD FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	CRIPPED ROD (PWR)
G	INCOMPLETE ROD/ROTRAVEL CONDITION (BWR)
H	IMPROPER ROD MOVEMENT
I	EXTERNAL LEAKAGE/RUPTURE
J	CCES NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
K	MAINTENANCE/REPLACEMENT REQUIRED
L	TECHNICAL SPECIFICATION VIOLATION (ACN-FAILURES)

COMPONENT CODE

CCDE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CCDE	DESCRIPTION
R	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
F	RECURRING FAILURES
T	COMMAND FAULT
U	RECURRING COMMAND FAULTS

FAILURE MECHANISM CODES

CCDE	DESCRIPTION
CC	UNKNOWN
CC	PERSONNEL (OPERATIONS)
CC	PERSONNEL (MAINTENANCE)
CC	PERSONNEL (TESTING)
CC	DESIGN ERROR
CC	PROC./CONSTRUCTION/G.C. DISCREPANCIES
CC	NORMAL WEAR
CC	EXCESSIVE WEAR
CC	EXCESSIVE MATERIAL CONTAMINATION
CC	EXCESSIVE VIBRATION
CC	CORD MOTOR FAILURE
CC	SEAL FAILURE
CC	CLUTCH/MISALIGNED INTERNALS
CC	CLUTCH FAILURE
CC	PAKE FAILURE
CC	BRKNG FAILURE
CC	FILTER/STRAINER PLUGGED
CC	INDUING/SEIZURE
CC	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
CC	CONTROL CIRCUIT FAILURE/PROBLEM
CC	FASTER FAILURE/PROBLEM
CC	WELD FAILURE
CC	LUBRICATION PROBLEM

SYSTEM CODE

CCDE	DESCRIPTION
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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

FAILURE TO INSERT FULLY DURING SCRAM

VEN	PLANT	CCNT.NO.	FAIL DATE	SYS	COMP	FAIL CODE	TYPE	CLASS	FAIL #	FAILURE MODE	FAILURE MECHANISM
G	BF1	000517A	100473	M	CD	D20	S	D		RCD 54-27 WAS VALVED OUT WHILE FULLY WITHDRAWN	NO SUPPLY AVAILABLE TO SCRAM ROD(PERSONL)
G	BF2	015392	061976	M	CD	D20	S	D		RCD 30-31 INCAPABLE OF SCRAM/HCU VALVES SHUT	COMMAND FAULT/PERSONNEL ERROR
G	BP1	013723	111375	M	CD	DC1	S	D		RCD INCAPABLE OF SCRAM/ACCUMULATOR VALVED OUT	PERSONNEL ERROR(INSTRUCTIONS REVISED)
G	DA1	013158A	081475	M	CD	C13	B	U		RCD 22-23 DID NOT FULLY INSERT FOLLOWING SCRAM	WORN OR LEAKING PISTON SEAL RINGS IN CRDM
G	DA1	013158B	081475	M	CD	C13	B	U		RCD 30-27 DID NOT FULLY INSERT FOLLOWING SCRAM	WORN OR LEAKING PISTON SEAL RINGS IN CRDM
G	DA1	013465A	092975	M	CD	C13	B	U		RCD 22-23 DID NOT FULLY INSERT FOLLOWING SCRAM	WORN OR LEAKING PISTON SEAL RINGS IN CRDM
G	DA1	013465B	092975	M	CD	C13	B	U		RCD 30-27 DID NOT FULLY INSERT FOLLOWING SCRAM	WORN OR LEAKING PISTON SEAL RINGS IN CRDM
G	DR2	010945*	110274	M	CD	C13	C	U	93	93 RODS INSERTED TO POS.02 FOLLOWING SCRAM	PROB. CAUSE EXCES-LEAK. PAST SEALS OF CRD
G	DR2	010945A	110274	M	CD	D13	C	U	03	3 CRDS FAILED TO GO TO POS 02 OR BELOW ON SCRAM	PROBABLE EXCESSIVE LEAKAGE PAST SEALS
G	DR2	018450*	070977	M	CD	C13	C	L	46	46 CRDS FAILED TO FULLY INSERT FOLLOWING A SCRAM	WORN OR DETERIORATED STOP PISTON SEALS
G	MO1	002116	052372	M	CD	D13		L		1 CONT. ROD DID NOT FULLY INSERT DURING SCRAM	EXCESS. LEAK. ACROSS STOP PISTON SEALS
G	NM1	000508*	112073	M	CD	C13	B	U	11	11 CONT. RODS DID NOT FULLY INSERT DURING SCRAM	EXCESS LEAK. ACROSS STOP PISTON SEALS
G	NM1	000588*	112673	M	CD	C13	B	U	15	15 CONT. RODS DID NOT FULLY INSERT DURING SCRAM	EXCESS LEAK. ACROSS STOP PISTON SEALS
G	NM1	0194C4	102677	M	CD	DC2	S	D		CRD 26-51 FAILED TO INSERT WHEN RX WAS SCRAMMED	ACCUM. FOR CRD HAD IMPROP. VLV LINEUP
G	PB2	016763A	010277	M	CD	CC0	R	L		RCD 30-27 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G	PB2	016763B	010277	M	CD	CC0	R	L		RCD 54-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G	PB3	014724A	050876	M	CD	DC0	R	U		RCD 10-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G	PB3	014724B	052576	M	CD	DC0	R	L		RCD 10-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G	PB3	019091A	092577	M	CD	DC1	S	D		RCD 02-27 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G	PB3	019091B	092577	M	CD	DC1	S	D		RCD 14-15 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G	PB3	019091C	092577	M	CD	DC1	S	D		RCD 18-03 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G	FI1	018700	060677	M	CD	DC0		U		RCD 34-11 REMAINED FULL OUT WHEN RX WAS SCRAMMED	CAUSE UNDER INVEST. NEW LER TO BE SUBMIT.
M	RC2	019342	042477	M	CD	DC0		L		RCD N-9 DID NOT INSERT ON REACTOR TRIP	CAUSE IS UNKNOWN
M	TL3	001026	060873	M	CD	DC0	R	U		RCC H-B STUCK AT 225 STEPS AFTER ROD DROP SIGNAL	NO CAUSE DETERMINED
M	TL3	000308	061873	M	CD	DC0	R	L		RCC J-5 FAILED TO DROP AFTER RX TRIP BRKRS OPENED	NO CAUSE DETERMINED

FAILURE TO INSERT FULLY DURING SCRAM; 1/1/76 THRU 4/30/78

BAPCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AR1	12946.0	69	8	0	893274.0	552	3.4E-06*	5.4E-03*
CR3	7430.0	69	15	0	512670.0	1035	5.8E-06*	2.9E-03*
DB1	4129.0	57	7	0	235353.0	399	1.3E-05*	7.5E-03*
DE1	13620.0	69	17	0	939780.0	1173	3.2E-06*	2.6E-03*
DE2	13196.0	69	6	0	910524.0	414	3.3E-06*	7.2E-03*
DE3	15777.0	69	10	0	1088613.0	690	2.8E-06*	4.3E-03*
RL1	12642.0	69	10	0	872298.0	690	3.4E-06*	4.3E-03*
TI1	14916.0	69	2	0	1029204.0	138	2.9E-06*	2.2E-02*
TI2	342.0	69	4	0	23598.0	276	1.3E-04*	1.1E-02*
TOTALS				0	6505314.0	5367		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAM; 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	15903.0	85	18	0	1351755.0	1530	2.2E-06*	2.2E-03*
CC2	9162.0	85	11	0	778770.0	935	3.8E-06*	3.2E-03*
FC1	16130.0	49	10	0	790370.0	490	3.8E-06*	6.1E-03*
MI2	13567.0	81	41	0	1098927.0	3321	2.7E-06*	9.0E-04*
MY1	18606.0	85	5	0	1581510.0	765	1.9E-06*	3.9E-03*
SL1	9903.0	81	23	0	802143.0	1863	3.7E-06*	1.6E-03*
TOTALS				0	6403475.0	8904		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAM; 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.CFMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	10793.0	185	22	0	1996705.0	4070	1.5E-06*	7.4E-04*
BF2	11809.0	185	22	0	2184665.0	4070	1.4E-06*	7.4E-04*
BF3	11545.0	185	30	0	2135825.0	5550	1.4E-06*	5.4E-04*
BF1	13379.0	32	2	0	428128.0	64	7.0E-06*	4.7E-02*
BK1	7544.0	137	20	0	1033528.0	2740	2.9E-06*	1.1E-03*
BK2	13226.0	137	42	0	1811962.0	5754	1.7E-06*	5.2E-04*
CC1	16617.0	137	14	0	2276529.0	1918	1.3E-06*	1.6E-03*
CA1	15981.0	89	17	0	1422309.0	1513	2.1E-06*	2.0E-03*
WA1	15801.0	80	11	0	1264080.0	880	2.4E-06*	3.4E-03*
DF2	16103.0	177	14	46	2850231.0	2478	1.6E-05	1.9E-02
UK3	17226.0	177	9	0	3049002.0	1593	9.8E-07*	1.9E-03*
EN1	15876.0	137	44	0	2175012.0	6028	1.4E-06*	5.0E-04*
FP1	15348.0	137	24	0	2102676.0	3288	1.4E-06*	9.1E-04*
MI1	17024.0	145	17	0	2468480.0	2465	1.2E-06*	1.2E-03*
MC1	18126.0	121	8	0	2193246.0	968	1.4E-06*	3.1E-03*
NP1	16060.0	129	9	0	2071740.0	1161	1.4E-06*	2.6E-03*
OC1	16142.0	137	4	0	2211454.0	548	1.4E-06*	5.5E-03*
PF2	13776.0	185	16	2	2548560.0	2960	7.8E-07	6.8E-04
PF3	14885.0	185	11	2	2753725.0	2035	7.3E-07	9.8E-04
PI1	13412.0	145	19	1	1944740.0	2755	5.1E-07	3.6E-04
QC1	15547.0	177	21	0	2751000.0	3717	1.1E-06*	8.1E-04*
QC2	16750.0	177	18	0	2964750.0	3186	1.0E-06*	0.5E-04*
VY1	17311.0	89	12	0	1540679.0	1068	1.9E-06*	2.8E-03*
TOTALS				51	48179845.0	60809		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAM; 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BV1	9106.0	48	82	0	437088.0	3936	6.9E-06*	7.6E-04*
DC1	16401.0	53	20	0	869253.0	1060	3.4E-06*	2.8E-03*
DC2	770.0	53	7	0	40810.0	371	7.3E-05*	8.1E-03*
HN1	18030.0	45	12	0	811350.0	540	3.7E-06*	5.5E-03*
IP2	10995.0	53	35	0	582735.0	1855	5.1E-06*	1.6E-03*
IP3	11694.0	53	19	0	619782.0	1007	4.8E-06*	3.0E-03*
JF1	3079.0	48	13	0	147792.0	624	2.0E-05*	4.8E-03*
KE1	16994.0	29	17	0	492826.0	493	6.1E-06*	6.1E-03*
NA1	410.0	48	6	0	19680.0	288	1.5E-04*	1.0E-02*
PF1	16859.0	37	13	0	623783.0	481	4.8E-06*	6.2E-03*
PK2	17531.0	37	13	0	648647.0	481	4.6E-06*	6.2E-03*
PT1	18041.0	37	5	0	667517.0	185	4.5E-06*	1.6E-02*
PT2	17964.0	37	6	0	664666.0	222	4.5E-06*	1.3E-02*
RG1	14639.0	29	3	0	424531.0	87	7.1E-06*	3.4E-02*
RD2	16245.0	41	22	1	666045.0	902	1.5E-06	1.1E-03
SA1	4368.0	53	17	0	231504.0	901	1.3E-05*	3.3E-03*
SL1	14325.0	45	13	0	644625.0	585	4.6E-06*	5.1E-03*
SL1	15487.0	48	19	0	743376.0	912	4.0E-06*	3.3E-03*
SL2	13160.0	48	15	0	631680.0	720	4.7E-06*	4.2E-03*
TR1	12539.0	53	28	0	664567.0	1484	4.5E-06*	2.0E-03*
TL3	15712.0	45	19	0	707040.0	855	4.2E-06*	3.5E-03*
TL4	14145.0	45	28	0	636525.0	1260	4.7E-06*	2.4E-03*
ZI1	15178.0	53	19	0	804434.0	1007	3.7E-06*	3.0E-03*
ZI2	13657.0	53	29	0	723821.0	1537	4.1E-06*	1.9E-03*
TOTALS				1	13504079.0	21793		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAM; 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
BAB.6WIL.	4.6E-07*	5.6E-04*
COMB.ENG.	4.7E-07*	3.4E-04*
	1.3	1.3
GEN.ELEC.	1.1E-06	8.4E-04
	1.3	1.3
	4.7	4.7
WESTINGH.	7.4E-08	4.6E-05
	19.5	19.5
	4.7	4.7
PWR'S	3.8E-08	2.8E-05
	19.5	19.5
	1.3	1.3
OVERALL	7.0E-07	5.4E-04
	1.3	1.3

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAP (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AR1	12946.0	69	8	0	893274.0	552	3.4E-06*	5.4E-03*
CK3	7430.0	69	15	0	512670.0	1035	5.8E-06*	2.9E-03*
DB1	4129.0	57	7	0	235353.0	399	1.3E-05*	7.5E-03*
JE1	13620.0	69	17	0	939780.0	1173	3.2E-06*	2.6E-03*
DE2	13196.0	69	6	0	910524.0	414	3.3E-06*	7.2E-03*
DE3	15777.0	69	10	0	1088613.0	690	2.8E-06*	4.3E-03*
RS1	12642.0	69	10	0	872298.0	690	3.4E-06*	4.3E-03*
T11	14916.0	69	2	0	1029204.0	138	2.9E-06*	2.2E-02*
T12	342.0	69	4	0	23598.0	276	1.3E-04*	1.1E-02*
TOTALS				0	6505314.0	5367		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAP (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.PRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	15903.0	85	18	0	1351755.0	1530	2.2E-06*	2.0E-03*
CC2	9162.0	65	11	0	778770.0	935	3.8E-06*	3.2E-03*
FC1	16130.0	49	10	0	790370.0	490	3.8E-06*	6.1E-03*
MI2	13567.0	81	41	0	1098927.0	3321	2.7E-06*	9.0E-04*
MY1	18606.0	85	9	0	1581510.0	765	1.9E-06*	3.9E-03*
SL1	9903.0	81	23	0	802143.0	1863	3.7E-06*	1.6E-03*
TOTALS				0	6403475.0	8904		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



FAILURE TO INSERT FULLY DURING SCRAM (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	20793.0	185	22	0	1996705.0	4070	1.5E-06*	7.4E-04*
BF2	11809.0	185	22	1	2184665.0	4070	4.6E-07	2.5E-04
BF3	11545.0	185	30	0	2135825.0	5550	1.4E-06*	5.4E-04*
BP1	13379.0	32	2	0	428128.0	64	7.0E-06*	4.7E-02*
BR1	7544.0	137	20	0	1033528.0	2740	2.9E-06*	1.1E-03*
BR2	13226.0	137	42	0	1811962.0	5754	1.7E-06*	5.2E-04*
CL1	16617.0	137	14	0	2276529.0	1918	1.3E-06*	1.6E-03*
DA1	15981.0	89	17	0	1422309.0	1513	2.1E-06*	2.0E-03*
DR1	15801.0	80	11	0	1254080.0	880	2.4E-06*	3.4E-03*
DR2	16103.0	177	14	46	2850231.0	2478	1.6E-05	1.9E-02
DF3	17226.0	177	9	0	3049002.0	1593	9.8E-07*	1.9E-03*
EM1	15876.0	137	44	0	2175012.0	6028	1.4E-06*	5.0E-04*
FP1	15348.0	137	24	0	2102676.0	3288	1.4E-06*	9.1E-04*
MI1	17024.0	145	17	0	2468480.0	2465	1.2E-06*	1.2E-03*
MO1	18126.0	121	8	0	2193246.0	968	1.4E-06*	3.1E-03*
NM1	16060.0	129	9	1	2071740.0	1161	4.8E-07	8.6E-04
OC1	16142.0	137	4	0	2211454.0	548	1.4E-06*	5.5E-03*
PB2	13776.0	185	16	2	2518500.0	2960	7.8E-07	6.8E-04
PB3	14885.0	185	11	5	2753000.0	2035	1.8E-06	2.5E-03
PI1	13412.0	145	19	1	1944740.0	2755	5.1E-07	3.6E-04
QC1	15547.0	177	21	0	2751819.0	3717	1.1E-06*	8.1E-04*
QC2	16750.0	177	18	0	2964750.0	3186	1.0E-06*	9.4E-04*
VY1	17311.0	89	12	0	1540679.0	1068	1.9E-06*	2.8E-03*
			TOTALS	56	48179845.0	60809		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAP (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BV1	9106.0	48	82	0	437088.0	3936	6.9E-06*	7.6E-04*
DC1	16401.0	53	20	0	869253.0	1060	3.4E-06*	2.8E-03*
DC2	770.0	53	7	0	40810.0	371	7.3E-05*	8.1E-03*
HM1	18030.0	45	12	0	811350.0	540	3.7E-06*	5.5E-03*
IP2	10995.0	53	35	0	582735.0	1855	5.1E-06*	1.6E-03*
IP3	11694.0	53	19	0	619782.0	1007	4.8E-06*	3.0E-03*
JF1	3079.0	48	13	0	147792.0	624	2.0E-05*	4.8E-03*
KE1	16994.0	29	17	0	492826.0	493	6.1E-06*	6.1E-03*
NA1	410.0	48	6	0	19680.0	288	1.5E-04*	1.0E-02*
PR1	16859.0	37	13	0	623783.0	481	4.8E-06*	6.2E-03*
PR2	17531.0	37	13	0	648647.0	481	4.6E-06*	6.2E-03*
PT1	18041.0	37	5	0	667517.0	185	4.5E-06*	1.6E-02*
PT2	17964.0	37	6	0	664668.0	222	4.5E-06*	1.3E-02*
RG1	14639.0	29	3	0	424531.0	87	7.1E-06*	3.4E-02*
RG2	16245.0	41	22	1	666045.0	902	1.5E-06	1.1E-03
SA1	4368.0	53	17	0	231504.0	901	1.3E-05*	3.3E-03*
SC1	14325.0	45	13	0	644625.0	585	4.6E-06*	5.1E-03*
SU1	15487.0	48	19	0	743376.0	912	4.0E-06*	3.3E-03*
SU2	13160.0	48	15	0	631680.0	720	4.7E-06*	4.2E-03*
TR1	12539.0	53	28	0	664567.0	1484	4.5E-06*	2.0E-03*
TU3	15712.0	45	19	0	707040.0	855	4.2E-06*	3.5E-03*
TU4	14145.0	45	28	0	636525.0	1260	4.7E-06*	2.4E-03*
ZI1	15178.0	53	19	0	804434.0	1007	3.7E-06*	3.0E-03*
ZI2	15177.0	53	29	0	723821.0	1537	4.1E-06*	1.9E-03*
TOTALS				1	13504079.0	21793		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY CURING SCRAP (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
BAB.6WIL.	4.6E-07*	5.6E-04*
COMB.ENG.	4.7E-07*	3.4E-04*
	1.2	1.2
GEN.FLEC.	1.2E-06	9.2E-04
	1.3	1.3
	4.7	4.7
WESTINGH.	7.4E-08	4.6E-05
	19.5	19.5
	4.7	4.7
PWR'S	3.8E-08	2.8E-05
	19.5	19.5
	1.2	1.2
OVERALL	7.6E-07	5.9E-04
	1.3	1.3

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAM; 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AF1	20009.0	69	15	0	1380621.0	1035	2.2E-06*	2.9E-03*
CP3	7430.0	69	15	0	512670.0	1035	5.8E-06*	2.9E-03*
DE1	4129.0	57	7	0	235353.0	399	1.3E-05*	7.5E-03*
GE1	30392.0	69	64	0	2097048.0	4416	1.4E-06*	6.8E-04*
DE2	21755.0	69	17	0	1501095.0	1173	2.0E-06*	2.6E-03*
GE3	22921.0	69	18	0	1581549.0	1242	1.9E-06*	2.4E-03*
RS1	14543.0	69	12	0	1003467.0	828	3.0E-06*	3.6E-03*
T11	24929.0	69	7	0	1720101.0	483	1.7E-06*	6.2E-03*
T12	342.0	69	4	0	23598.0	276	1.3E-04*	1.1E-02*
TOTALS				0	10055502.0	10887		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAM; 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	20739.0	85	28	0	1762815.0	2380	1.7E-06*	1.3E-03*
CC2	9162.0	85	11	0	778770.0	935	3.8E-06*	3.2E-03*
FC1	32123.0	49	29	0	1574027.0	1421	1.9E-06*	2.1E-03*
M12	14906.0	81	41	0	1207386.0	3321	2.5E-06*	9.0E-04*
MY1	40408.0	85	31	0	3434680.0	2635	8.7E-07*	1.1E-03*
SL1	9903.0	81	23	0	802143.0	1863	3.7E-06*	1.6E-03*
TOTALS				0	9559821.0	12555		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAMS 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	15553.0	185	47	0	2877305.0	8695	1.0E-06*	3.4E-04*
BF2	12326.0	185	30	0	2280310.0	5550	1.3E-06*	5.4E-04*
BF3	11545.0	185	30	0	2135825.0	5550	1.4E-06*	5.4E-04*
BF1	38622.0	32	3	0	1235904.0	96	2.4E-06*	3.1E-02*
BR1	7544.0	137	20	0	1033528.0	2740	2.9E-06*	1.1E-03*
BR2	14576.0	137	58	0	1946912.0	7946	1.5E-06*	3.8E-04*
CC1	27641.0	137	44	0	3786817.0	6028	7.9E-07*	5.0E-04*
DA1	22487.0	89	24	4	2001343.0	2136	2.0E-06	1.9E-03
DF1	35600.0	80	15	0	2848000.0	1200	1.1E-06*	2.5E-03*
DA2	39390.0	177	39	142	6972030.0	6903	2.0E-05	2.1E-02
DF3	41057.0	177	39	0	7267089.0	6903	4.1E-07*	4.3E-04*
EN1	23634.0	137	78	0	3237858.0	10686	9.3E-07*	2.8E-04*
FP1	18189.0	137	30	0	2491893.0	4110	1.2E-06*	7.3E-04*
MI1	39560.0	145	40	0	5736200.0	5800	5.2E-07*	5.2E-04*
NU1	44190.0	121	20	1	5346990.0	2420	1.9E-07	4.1E-04
NM1	41084.0	129	61	26	5299836.0	7869	4.9E-06	3.3E-03
OC1	42170.0	137	22	0	5777290.0	3014	5.2E-07*	9.9E-04*
PB2	24563.0	185	46	2	4544155.0	8510	4.4E-07	2.4E-04
PB3	22737.0	185	17	2	4206345.0	3145	4.8E-07	6.4E-04
PI1	31756.0	145	54	1	4604620.0	7830	2.2E-07	1.3E-04
QC1	37446.0	177	48	0	6627942.0	8496	4.5E-07*	3.5E-04*
QC2	39780.0	177	56	0	7041060.0	9912	4.3E-07*	3.0E-04*
VY1	39826.0	89	38	0	3544514.0	3382	8.5E-07*	8.9E-04*
TOTALS				178	92893766.0	128921		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FALLTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAM; 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BV1	9106.0	48	82	0	437088.0	3936	6.9E-06*	7.6E-04*
DC1	22795.0	53	33	0	1208135.0	1749	2.5E-06*	1.7E-03*
DC2	770.0	53	7	0	40810.0	371	7.3E-05*	8.1E-03*
HN1	45574.0	45	23	0	2050830.0	1035	1.5E-06*	2.9E-03*
IP2	21387.0	53	128	0	1133511.0	6784	2.6E-06*	4.4E-04*
IP3	11694.0	53	19	0	619782.0	1007	4.8E-06*	3.0E-03*
JF1	3079.0	48	13	0	147792.0	624	2.0E-05*	4.8E-03*
KE1	28727.0	29	66	0	833083.0	1914	3.6E-06*	1.6E-03*
NA1	410.0	48	6	0	19680.0	288	1.5E-04*	1.0E-02*
PR1	28913.0	37	45	0	1069781.0	1665	2.8E-06*	1.8E-03*
PR2	25020.0	37	36	0	925740.0	1332	3.2E-06*	2.2E-03*
PT1	44738.0	37	17	0	1655306.0	629	1.8E-06*	4.8E-03*
PT2	45215.0	37	25	0	1672955.0	925	1.8E-06*	3.2E-03*
RG1	40932.0	29	20	0	1187028.0	580	2.5E-06*	5.2E-03*
RC2	43928.0	41	80	1	1801048.0	3280	5.6E-07	3.0E-04
SA1	4368.0	53	17	0	231504.0	901	1.3E-05*	3.3E-03*
SG1	41777.0	45	24	0	1879965.0	1080	1.6E-06*	2.8E-03*
SL1	31984.0	48	84	0	1535232.0	4032	2.0E-06*	7.4E-04*
SL2	28790.0	48	62	0	1381920.0	2976	2.2E-06*	1.0E-03*
TR1	22539.0	53	28	0	664567.0	1484	4.5E-06*	2.0E-03*
TL3	36992.0	45	81	2	1664640.0	3645	1.2E-06	5.5E-04
TL4	29791.0	45	74	0	1340595.0	3330	2.2E-06*	9.0E-04*
ZI1	26612.0	53	51	0	1410436.0	2703	2.1E-06*	1.1E-03*
ZI2	21735.0	53	85	0	1151955.0	4717	2.6E-06*	6.4E-04*
TOTALS				3	26063383.0	50987		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAM; 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
BAB.FWIL.	3.0E-07*	2.8E-04*
COMP.ENG.	3.1E-07*	2.4E-04*
	1.1	1.1
GEN.ELEC.	1.9E-06	1.4E-03
	1.1	1.1
	2.6	2.6
WESTINGH.	1.2E-07	5.9E-05
	3.7	3.7
	2.6	2.6
PWR'S	6.6E-08	4.0E-05
	3.7	3.7
	1.1	1.1
OVERALL	1.3E-06	8.9E-04
	1.1	1.1

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAM (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AF1	20009.0	69	15	0	1380621.0	1035	2.2E-06*	2.9E-03*
CR3	7430.0	69	15	0	512670.0	1035	5.8E-06*	2.9E-03*
DE1	4129.0	57	7	0	235353.0	399	1.3E-05*	7.5E-03*
DE1	30392.0	69	64	0	2097048.0	4416	1.4E-06*	6.8E-04*
DE2	21755.0	69	17	0	1501095.0	1173	2.0E-06*	2.6E-03*
DE3	22921.0	69	18	0	1581549.0	1242	1.9E-06*	2.4E-03*
RS1	14543.0	69	12	0	1003467.0	828	3.0E-06*	3.6E-03*
TI1	24929.0	69	7	0	1720101.0	483	1.7E-06*	6.2E-03*
TI2	342.0	69	4	0	23598.0	276	1.3E-04*	1.1E-02*
TOTALS				0	10055502.0	10887		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAM (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	20739.0	85	28	0	1762815.0	2380	1.7E-06*	1.3E-03*
CC2	9162.0	85	11	0	778770.0	935	3.8E-06*	3.2E-03*
FC1	32123.0	49	29	0	1574027.0	1421	1.9E-06*	2.1E-03*
MI2	14906.0	81	41	0	1207386.0	3321	2.5E-06*	9.0E-04*
MY1	40408.0	85	31	0	3434680.0	2635	8.7E-07*	1.1E-03*
SL1	9903.0	81	23	0	802143.0	1863	3.7E-06*	1.6E-03*
TOTALS				0	9559821.0	12555		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



FAILURE TO INSERT FULLY DURING SCRAM (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	15553.0	185	47	1	2377305.0	8695	3.5E-07	1.2E-04
BF2	12326.0	185	30	1	2280310.0	5550	4.4E-07	1.8E-04
BF3	11545.0	185	30	0	2135825.0	5550	1.4E-06*	5.4E-04*
BF1	38622.0	32	3	1	1235904.0	96	8.1E-07	1.0E-02
BR1	7544.0	137	20	0	1033528.0	2740	2.9E-06*	1.1E-03*
BR2	14576.0	137	58	0	1996912.0	7946	1.5E-06*	3.8E-04*
CC1	27641.0	137	44	0	3786817.0	6028	7.9E-07*	5.0E-04*
DA1	22487.0	89	24	4	2001343.0	2136	2.0E-06	1.9E-03
DF1	35600.0	80	15	0	2848000.0	1200	1.1E-06*	2.5E-03*
DR2	39390.0	177	39	142	6972030.0	6903	2.0E-05	2.1E-02
DK3	41057.0	177	39	0	7267089.0	6903	4.1E-07*	4.3E-04*
EM1	23634.0	137	78	0	3237858.0	10686	9.3E-07*	2.8E-04*
FP1	18189.0	137	30	0	2491893.0	4110	1.2E-06*	7.3E-04*
MI1	39560.0	145	40	0	5736200.0	5800	5.2E-07*	5.2E-04*
MC1	44190.0	121	20	1	5346990.0	2420	1.9E-07	4.1E-04
MM1	41084.0	129	61	27	5299836.0	7869	5.1E-06	3.4E-03
OC1	42170.0	137	22	0	5777290.0	3014	5.2E-07*	9.9E-04*
PB2	24563.0	185	46	2	4544155.0	8510	4.4E-07	2.4E-04
PB3	22737.0	185	17	5	4206345.0	3145	1.2E-06	1.6E-03
PI1	31756.0	145	54	1	4604620.0	7830	2.2E-07	1.3E-04
QC1	37446.0	177	48	0	6627942.0	8496	4.5E-07*	3.5E-04*
QC2	39780.0	177	56	0	7041060.0	9912	4.3E-07*	3.0E-04*
VY1	39826.0	89	38	0	3544514.0	3382	8.5E-07*	8.9E-04*
TOTALS				185	92893766.0	128921		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAM (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BV1	9106.0	48	82	0	437088.0	3936	6.9E-06	7.6E-04*
DC1	22795.0	53	33	0	1208135.0	1749	2.5E-06	1.7E-03*
DC2	770.0	53	7	0	40810.0	371	7.3E-05*	1.7E-03*
HM1	45574.0	45	23	0	2050830.0	1035	1.5E-06*	2.9E-03*
IP2	21387.0	53	126	0	1133511.0	6784	2.6E-06*	4.4E-04*
IP3	11694.0	53	19	0	619782.0	1007	4.8E-06*	3.0E-03*
JF1	3079.0	48	13	0	147792.0	624	2.0E-05*	4.8E-03*
KE1	28727.0	29	66	0	833083.0	1914	3.6E-06*	1.6E-03*
NA1	410.0	48	6	0	19680.0	288	1.5E-04*	1.0E-02*
PR1	2013.0	37	45	0	1069781.0	1665	2.8E-06*	1.8E-03*
PF2	25020.0	37	36	0	925740.0	1332	3.2E-06*	2.2E-03*
PT1	44738.0	37	17	0	1655306.0	629	1.8E-06*	4.8E-03*
PT2	45215.0	37	25	0	1672955.0	925	1.8E-06*	3.2E-03*
RG1	40932.0	29	20	0	1187028.0	580	2.5E-06*	5.2E-03*
RD2	43928.0	41	80	1	1801048.0	3280	5.6E-07	3.0E-04
SA1	4368.0	53	17	0	231504.0	901	1.3E-05*	3.3E-03*
SC1	41777.0	45	24	0	1879965.0	1080	1.6E-06*	2.8E-03*
SL1	31984.0	48	84	0	1535232.0	4032	2.0E-06*	7.4E-04*
SU2	28790.0	48	62	0	1381920.0	2976	2.2E-06*	1.0E-03*
TR1	12539.0	53	28	0	664567.0	1484	4.5E-06*	2.0E-03*
TL3	36992.0	45	81	2	1664640.0	3645	1.2E-06	5.5E-04
TL4	29791.0	45	74	0	1340595.0	3330	2.2E-06*	9.0E-04*
ZI1	26612.0	53	51	0	1410436.0	2703	2.1E-06*	1.1E-03*
ZI2	21735.0	53	89	0	1151955.0	4717	2.6E-06*	6.4E-04*
TOTALS				3	26063383.0	50987		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO INSERT FULLY DURING SCRAM (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
BAB. & WIL.	3.0E-07*	2.8E-04*
COMB. ENG.	3.1E-07*	2.4E-04*
	1.1	1.1
GEN. ELEC.	2.0E-06	1.4E-03
	1.1	1.1
	2.6	2.6
WESTINGH.	1.2E-07	5.9E-05
	3.7	3.7
	2.6	2.6
PWR'S	6.6E-08	4.0E-05
	3.7	3.7
	1.1	1.1
OVERALL	1.4E-06	9.2E-04
	1.1	1.1

\* DENOTES LOWER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

APPENDIX AB

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS

FAILURE MODE CODES

<u>CCDE</u>	<u>DESCRIPTION</u>
A	- FAILURE TO INSERT DURING NORMAL S/D
B	- FAILURE TO EXTRACT DURING SCRAM
C	- FAIL TO INSERT TO AT LEAST 90% DURING SCRAM
D	- RCC FAILS TO MOVE DURING POWER CHANGES/TESTING
E	- RCC FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	- CRIPPED ROD (PWR)
G	- UNCOUPLED ROD/CONTROL TRAVEL CONDITION (BWR)
H	- IMPROPER ROD MOVEMENT
I	- EXTERNAL LEAKAGE/RIPTURE
J	- DEVICES NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
K	- MAINTENANCE/REPLACEMENT REQUIRED (TECHNICAL SPECIFICATION VIOLATION (MCR-FAILURES))

COMPONENT CODE

<u>CCDE</u>	<u>DESCRIPTION</u>
CC	- CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

<u>CCDE</u>	<u>DESCRIPTION</u>
B	- RECURRING COMMON CAUSE FAILURES
C	- COMMON CAUSE FAILURES
D	- RECURRING FAILURES
E	- COMMON FAULT
F	- RECURRING COMMON FAULTS

FAILURE MECHANISM CODES

<u>CCDE</u>	<u>DESCRIPTION</u>
CO	- UNKNOWN
CP	- PERSONNEL (OPERATIONS)
CN	- PERSONNEL (MAINTENANCE)
CR	- PERSONNEL (TESTING)
CS	- DESIGN ERROR
CC	- FAB./CONSTRUCTION/G.C.
CD	- PROCEDURAL DISCREPANCIES
CE	- NORMAL WEAR
CF	- EXCESSIVE WEAR
CG	- CORROSION
CH	- REMOVAL MATERIAL CONTAMINATION
CI	- EXCESSIVE VIBRATION
CJ	- COMMON MOTOR FAILURE
CK	- SEAL FAILURE
CL	- GLEET/MISALIGNED INTERNALS
CM	- CLUTCH FAILURE
CN	- BRAKE FAILURE
CO	- BEARING FAILURE
CP	- FILTER/STRAINER PLUGGED
CQ	- BINDING/SEIZURE
CR	- FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
CS	- CONTROL CIRCUIT FAILURE/PROBLEM
CT	- FASTENER FAILURE/PROBLEM
CU	- WELD FAILURE
CV	- LUBRICATION PROBLEM

SYSTEM CODE

<u>CCDE</u>	<u>DESCRIPTION</u>
	PWR
M	- REACTIVITY CONTROL SYSTEM
	BWR
M	- REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

<u>CCDE</u>	<u>DESCRIPTION</u>
D	- DEMAND
T	- TIME
U	- UNKNOWN
N	- NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

<u>CCDE</u>	<u>DESCRIPTION</u>
D	- DEMAND ON COMPONENT
M	- MAINTENANCE
N	- NORMAL OPERATION/SURVEILLANCE
R	- RECORD REVIEW
T	- TESTING
U	- UNKNOWN

NSSS VENDOR CODES

<u>CCDE</u>	<u>DESCRIPTION</u>
B	- BABCOCK & WILCOX
C	- COMBUSTION ENGINEERING
G	- GENERAL ELECTRIC
W	- WESTINGHOUSE

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS

PLANT	CCNT.NO.	FAIL DATE	MO	CD	ERR	TYPE	CLASS	FAILURE MODE	FAILURE MECHANISM
B CR3 C18405	040477	M CD E12	R D					ROD 6 GR 7 WOULD NOT MOVE WHEN REDUCING PWR	CRDM STATOR FAILED / FUSE BLEW
B CR3 C17927*	060177	M CD E21	S D 29				CRD SYS. FAILED TO POSIT. REG.RODS ON AUTO DEMAND	LOOSE CONNec. ON CRD PROG.PRINT.CKT.CARD	
C CC2 C19693	111177	M CD E21	S D				CEA 36 WOULD NOT MOVE THEN DROPPED WHILE AT SS PWR	DEFECT. TIMER MOD. IN COIL PWR PROGRAMMER	
C 5L1 014999	052576	M CD E21	S D				REGULATING ROD 59 IMMOVABLE BECAUSE OF CEA ROD.MAL	FAILURE IN RAISE/LOWER CKT OF THE MODULE	
E BF1 000512	100473	M CD E18	T				ROD 26-55 DRIVE FAILED TO INSERT WHILE AT POWER	ROD DRIVE SYS HAD A DIRTY STRAINER	
G BP1 019725	111177	M CD E00	R L				UNABLE TO WITHDRAW ROD 64 FROM POS 5 TO 6	UNKNOWN/POSSIBLY A FOREIGN OBJ.BINDING IT	
G DR1 018286	061577	M CD B10	T				CRD G-9 INSERTED TO 00 THEN DRIFTED TO POSITION 12	PROB.CAUSE OF MALFUNC.WAS FOR.MAT.CONTAM.	
H IP3 016551	111676	M CD E00	L				ROD D-8 BANK B BECAME MISALIGNED DURING NORMAL EPS	CAUSE UNKNOWN	
W RG1 013394	091775	M CD E21	S D				ROD G-5 BANK B DID NOT MOVE WITH BANK DURING TEST	OPEN CKT IN CABLE DR COIL, G-5 LIFT COIL	
W RG1 019*95	111677	M CD E21	T D				ROD CONTROL URGENT FAIL. ROD STOP ALARM LIT	RANDOM FAILURE OF 2 DEFECTIVE P.C. CARDS	
W RG1 019596	111677	M CD E21	T D				ROD CONTROL URGENT FAILURE ROD ALARM LIT	STATIONARY REGULAT. FAIL. IN 180 PWR.CAB.	
W TR1 018906*	082177	M CD E21	S D 13				LOSS OF ROD CONTROL AFFECTING 13 OF PLANTS 53 RODS	FAILURE OF SUPERVISORY BUFFER MEM. CARD	

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS; 1/1/76 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AR1	12946.0	69	26	0	893274.0	1794	3.4E-06*	1.7E-03*
CR3	7430.0	69	32	1	512670.0	2208	2.0E-06	4.5E-04
DE1	4129.0	57	11	0	235353.0	627	1.3E-05*	4.8E-03*
DE1	13620.0	69	36	0	939780.0	2484	3.2E-06*	1.2E-03*
DE2	13196.0	69	35	0	910524.0	2691	3.3E-06*	1.1E-03*
DE3	15777.0	69	40	0	1088613.0	2760	2.8E-06*	1.1E-03*
RS1	12642.0	69	32	0	872298.0	2208	3.4E-06*	1.4E-03*
T11	14916.0	69	26	0	1029204.0	1932	2.9E-06*	1.6E-03*
T12	342.0	69	1	0	23598.0	69	1.3E-04*	4.3E-02*
TOTALS				1	6505314.0	16773		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS; 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	15903.0	85	36	0	1351755.0	3060	2.2E-06*	9.8E-04*
CC2	9162.0	85	26	0	778770.0	2210	3.8E-06*	1.4E-03*
FC1	16130.0	49	25	0	790370.0	1421	3.8E-06*	2.1E-03*
M12	13567.0	81	26	0	1098927.0	2106	2.7E-06*	1.4E-03*
MY1	18606.0	85	35	0	1581510.0	2975	1.9E-06*	1.0E-03*
SL1	9903.0	81	20	0	802143.0	1620	3.7E-06*	1.8E-03*
TOTALS				0	6403475.0	13392		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS; 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	10793.0	185	64	0	1996705.0	11840	1.5E-06*	2.5E-04*
BF2	11809.0	185	71	0	2184665.0	13135	1.4E-06*	2.3E-04*
BF3	11545.0	185	69	0	2135825.0	12765	1.4E-06*	2.3E-04*
BF1	13379.0	32	86	1	428128.0	2752	2.3E-06	3.6E-04
BR1	7544.0	137	56	0	1033528.0	7672	2.9E-06*	3.9E-04*
BR2	13226.0	137	85	0	1811962.0	11645	1.7E-06*	2.6E-04*
CC1	16617.0	137	100	0	2276529.0	13700	1.3E-06*	2.2E-04*
CA1	15981.0	89	111	0	1422309.0	9879	2.1E-06*	3.0E-04*
DF1	15801.0	80	108	1	1264080.0	8640	7.9E-07	1.2E-04
DF2	16103.0	177	104	0	2850231.0	18408	1.1E-06*	1.6E-04*
DF3	17226.0	177	117	0	3049002.0	20709	9.8E-07*	1.4E-04*
EN1	15876.0	137	112	0	2175012.0	15344	1.4E-06*	2.0E-04*
FF1	15348.0	137	103	0	2102676.0	14111	1.4E-06*	2.1E-04*
MI1	17024.0	145	113	0	2468480.0	16385	1.2E-06*	1.8E-04*
MC1	18126.0	121	119	0	2193246.0	14399	1.4E-06*	2.1E-04*
NP1	16060.0	129	103	0	2071740.0	13287	1.4E-06*	2.3E-04*
OC1	16142.0	137	98	0	2211454.0	13426	1.4E-06*	2.2E-04*
PB2	13776.0	185	92	0	2548560.0	17020	1.2E-06*	1.8E-04*
PB3	14885.0	185	106	0	2753725.0	19610	1.1E-06*	1.5E-04*
PI1	13412.0	145	82	0	1944740.0	11890	1.5E-06*	2.5E-04*
QC1	15547.0	177	114	0	2751819.0	20178	1.1E-06*	1.5E-04*
QC2	16750.0	177	114	0	2964750.0	20178	1.0E-06*	1.5E-04*
VY1	17311.0	89	109	0	1540679.0	9701	1.9E-06*	3.1E-04*
TOTALS				2	48179845.0	315000		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS; 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AV1	9106.0	53	32	0	482618.0	1696	6.2E-06*	1.8E-03*
DC1	16401.0	53	42	0	869253.0	2226	3.4E-06*	1.3E-03*
DC2	770.0	53	4	0	40810.0	212	7.3E-05*	1.4E-02*
HA1	18030.0	45	31	0	811350.0	1395	3.7E-06*	2.1E-03*
IP2	10995.0	61	24	0	670695.0	1464	4.5E-06*	2.0E-03*
IP3	11694.0	61	22	1	713334.0	1342	1.4E-06	7.5E-04
JF1	3079.0	52	6	0	163187.0	318	1.8E-05*	9.4E-03*
KE1	16994.0	23	30	0	560802.0	990	5.3E-06*	3.0E-03*
NA1	410.0	53	1	0	21730.0	53	1.4E-04*	5.7E-02*
PR1	16859.0	37	32	0	623783.0	1184	4.8E-06*	2.5E-03*
PR2	17531.0	37	28	0	648647.0	1036	4.6E-06*	2.9E-03*
PT1	18041.0	37	37	0	667517.0	1369	4.5E-06*	2.2E-03*
PT2	17964.0	37	42	0	664668.0	1554	4.5E-06*	1.9E-03*
RC1	14639.0	33	38	0	483087.0	1254	4.2E-06*	2.4E-03*
RC2	16245.0	41	34	0	666045.0	1394	4.5E-06*	2.1E-03*
SA1	4368.0	52	14	0	231504.0	742	1.3E-05*	4.0E-03*
SC1	14325.0	45	32	0	644625.0	1440	4.6E-06*	2.1E-03*
SL1	15487.0	53	32	0	820811.0	1696	3.6E-06*	1.8E-03*
SL2	13160.0	52	28	0	697480.0	1484	4.3E-06*	2.0E-03*
TF1	12539.0	61	27	0	764879.0	1647	3.9E-06*	1.8E-03*
TL3	15712.0	53	38	0	832736.0	2014	3.6E-06*	1.5E-03*
TL4	14145.0	53	35	0	749685.0	1855	4.0E-06*	1.6E-03*
ZI1	15178.0	53	26	0	804434.0	1378	3.7E-06*	2.2E-03*
ZI2	13657.0	52	27	0	723821.0	1431	4.1E-06*	2.1E-03*
			TOTALS	1	14357501.0	31174		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS; 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
	4.7	4.7
DAB. & WIL.	1.5E-07	6.0E-05
	19.5	19.5
CCPE. ENG.	4.7E-07*	2.2E-04*
	3.1	3.1
GEN. ELEC.	4.2E-08	6.3E-06
	5.6	5.6
	4.7	4.7
WESTINGH.	7.0E-08	3.2E-05
	19.5	19.5
	3.1	3.1
PWR'S	7.3E-08	3.3E-05
	5.6	5.6
	2.3	2.3
OVERALL	5.3E-08	1.1E-05
	2.9	2.9

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

BABCOCK & WILCOX

PLANT	CRIT. HRS.	POPULATION	DEMANDS	FALLTS	POP. HOURS	POP. DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AK1	12946.0	69	26	0	893274.0	1794	3.4E-06*	1.7E-03*
CR3	7430.0	69	32	20	512670.0	2208	5.9E-05	1.4E-02
DE1	4129.0	57	11	0	235353.0	627	1.3E-05*	4.8E-03*
UE1	13620.0	69	36	0	939780.0	2484	3.2E-06*	1.2E-03*
UE2	13196.0	69	35	0	910524.0	2691	3.3E-06*	1.1E-03*
CE3	15777.0	69	40	0	1088613.0	2760	2.8E-06*	1.1E-03*
RS1	12642.0	69	32	0	872298.0	2208	3.4E-06*	1.4E-03*
T11	14916.0	69	26	0	1029204.0	1932	2.9E-06*	1.6E-03*
T12	342.0	69	1	0	23598.0	69	1.3E-04*	4.3E-02*
TOTALS				30	6505314.0	16773		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT. HRS.	POPULATION	DEMANDS	FALLTS	POP. HOURS	POP. DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	15903.0	85	36	0	1351755.0	3060	2.2E-06*	9.8E-04*
CC2	9162.0	85	26	1	778770.0	2210	1.3E-06	4.5E-04
FC1	16130.0	49	29	0	790370.0	1421	3.8E-06*	2.1E-03*
MI2	13567.0	81	26	0	1098927.0	2106	2.7E-06*	1.4E-03*
MY1	18606.0	85	35	0	1581510.0	2975	1.9E-06*	1.0E-03*
SL1	9903.0	81	20	1	802143.0	1620	1.2E-06	6.2E-04
TOTALS				2	6403475.0	13392		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	10793.0	185	64	0	1996705.0	11840	1.5E-06*	2.5E-04*
BF2	11809.0	185	71	0	2184665.0	13135	1.4E-06*	2.3E-04*
BF3	11545.0	185	69	0	2135825.0	12765	1.4E-06*	2.3E-04*
BF1	13379.0	32	86	1	428128.0	2752	2.3E-06	3.6E-04
BR1	7544.0	137	56	0	1033528.0	7672	2.9E-06*	3.9E-04*
BR2	13226.0	137	85	0	1811962.0	11645	1.7E-06*	2.6E-04*
CC1	16617.0	137	100	0	2276529.0	13700	1.3E-06*	2.2E-04*
DA1	15981.0	89	111	0	1422309.0	9879	2.1E-06*	3.0E-04*
DF1	15801.0	80	106	1	1264080.0	8640	7.9E-07	1.2E-04
DF2	16103.0	177	104	0	2850231.0	18408	1.1E-06*	1.6E-04*
DF3	17226.0	177	117	0	3049002.0	20709	9.8E-07*	1.4E-04*
EN1	15876.0	137	112	0	2175012.0	15344	1.4E-06*	2.0E-04*
FP1	15348.0	137	103	0	2102676.0	14111	1.4E-06*	2.1E-04*
MI1	17024.0	145	112	0	2468480.0	16385	1.2E-06*	1.8E-04*
MG1	18126.0	121	119	0	2193240.0	14399	1.4E-06*	2.1E-04*
NP1	16060.0	129	103	0	2071740.0	13287	1.4E-06*	2.3E-04*
OC1	16142.0	137	98	0	2211454.0	13426	1.4E-06*	2.2E-04*
PE2	13776.0	185	92	0	2548560.0	17020	1.2E-06*	1.8E-04*
PE3	14885.0	185	106	0	2753725.0	19610	1.1E-06*	1.5E-04*
PI1	13412.0	145	82	0	1944740.0	11890	1.5E-06*	2.5E-04*
QC1	15547.0	177	114	0	2751819.0	20178	1.1E-06*	1.5E-04*
QC2	16750.0	177	114	0	2964750.0	20178	1.0E-06*	1.5E-04*
VY1	17311.0	89	109	0	1540679.0	9701	1.9E-06*	3.1E-04*
TOTALS				2	48179845.0	316674		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAP DEMANDS (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BV1	9106.0	53	32	0	482618.0	1696	6.2E-06*	1.8E-03*
DC1	16401.0	53	42	0	869253.0	2226	3.4E-06*	1.3E-03*
DC2	770.0	53	4	0	40810.0	212	7.3E-05*	1.4E-02*
HM1	18030.0	45	31	0	811350.0	1395	3.7E-06*	2.1E-03*
IP2	10995.0	61	24	0	670695.0	1464	4.5E-06*	2.0E-03*
IP3	11694.0	61	22	1	713334.0	1342	1.4E-06	7.5E-04
JF1	3079.0	53	6	0	163187.0	318	1.8E-05*	9.4E-03*
KE1	16994.0	33	30	0	560802.0	990	5.3E-06*	3.0E-03*
MA1	410.0	53	1	0	21730.0	53	1.4E-04*	5.7E-02*
PK1	16859.0	37	32	0	623783.0	1184	4.8E-06*	2.5E-03*
PR2	17531.0	37	28	0	648647.0	1036	4.6E-06*	2.9E-03*
PT1	19041.0	37	37	0	667517.0	1369	4.5E-06*	2.2E-03*
PT2	17964.0	37	42	0	664668.0	1554	4.5E-06*	1.9E-03*
RG1	14639.0	33	38	2	483087.0	1254	4.1E-06	1.6E-03
RC2	16245.0	41	34	0	666045.0	1394	4.5E-06*	2.1E-03*
SA1	4368.0	53	14	0	231504.0	742	1.3E-05*	4.0E-03*
SC1	14325.0	45	32	0	644625.0	1440	4.6E-06*	2.1E-03*
SU1	15487.0	53	32	0	820811.0	1696	3.6E-06*	1.8E-03*
SL2	13160.0	53	28	0	697490.0	1484	4.3E-06*	2.0E-03*
TR1	12539.0	61	27	13	764879.0	1647	1.7E-05	7.9E-03
TC3	15712.0	53	38	0	832736.0	2014	3.6E-06*	1.5E-03*
TL4	14145.0	53	38	0	749685.0	1855	4.0E-06*	1.6E-03*
Z11	15178.0	53	26	0	804434.0	1378	3.7E-06*	2.2E-03*
Z12	13657.0	53	27	0	723821.0	1431	4.1E-06*	2.1E-03*
TOTALS				16	14357501.0	31174		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOOR RATE	DEMAND RATE
	1.4	1.4
PAB. & WIL.	4.6E-06	1.8E-03
	1.4	1.4
	3.1	3.1
COMB. ENG.	3.1E-07	1.5E-04
	5.6	5.6
	3.1	3.1
GEN. ELEC.	4.2E-08	6.3E-06
	5.6	5.6
	1.5	1.5
WESTINGH.	1.1E-06	5.1E-04
	1.6	1.6
	1.3	1.3
PWR'S	1.8E-06	7.8E-04
	1.3	1.3
	1.3	1.3
OVERALL	6.6E-07	1.3E-04
	1.3	1.3

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAILTS RECORDED

FAILURE TO MOVE PROPERLY IN NON-SCRAM DEMANDS; 1/1/72 THRU 4/30/78

BABCOCKWILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AP1	20009.0	69	44	0	1380621.0	3036	2.2E-06*	9.9E-04*
CK3	7430.0	69	32	1	512670.0	2208	2.0E-06	4.5E-04
DE1	4129.0	57	12	0	235353.0	684	1.3E-05*	4.4E-03*
DE1	30392.0	69	85	0	2097048.0	5865	1.4E-06*	5.1E-04*
DE2	21755.0	69	69	0	1501095.0	4761	2.0E-06*	6.3E-04*
DE3	22921.0	69	63	0	1581549.0	4347	1.9E-06*	6.9E-04*
RS1	14543.0	69	41	0	1003407.0	2829	3.0E-06*	1.1E-03*
TI1	24929.0	69	50	0	1720101.0	3450	1.7E-06*	8.7E-04*
TI2	342.0	69	1	0	23598.0	69	1.3E-04*	4.3E-02*
TOTALS				1	10055502.0	27249		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY IN NON-SCRAM DEMANDS; 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	20739.0	85	49	0	1762815.0	4165	1.7E-06*	7.2E-04*
CC2	9162.0	85	26	0	778770.0	2210	3.8E-06*	1.4E-03*
FC1	32123.0	49	63	0	1574027.0	3087	1.9E-06*	9.7E-04*
MI2	14906.0	81	27	0	1207386.0	2187	2.5E-06*	2.4E-03*
MY1	40406.0	85	86	0	3434680.0	7480	8.7E-07*	4.0E-04*
SL1	9903.0	81	20	0	802143.0	1620	3.7E-06*	1.8E-03*
TOTALS				0	9559821.0	20749		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS; 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	15553.0	185	107	1	2877305.0	19795	3.5E-07	5.1E-05
BF2	12326.0	185	75	0	2280310.0	13875	1.3E-06*	2.2E-04*
BF3	11545.0	185	69	0	2135825.0	12765	1.4E-06*	2.3E-04*
BP1	38622.0	32	247	1	1235904.0	7904	8.1E-07	1.3E-04
BR1	7544.0	137	56	0	1033528.0	7672	2.9E-06*	3.9E-04*
BK2	14576.0	137	106	0	1996912.0	14522	1.5E-06*	2.1E-04*
CD1	27641.0	137	169	0	3786817.0	23153	7.9E-07*	1.3E-04*
DA1	22487.0	89	160	0	2001343.0	14240	1.5E-06*	2.1E-04*
DF1	35600.0	80	252	1	2848000.0	20160	3.5E-07	5.0E-05
DR2	39390.0	177	282	0	6972030.0	49914	4.3E-07*	6.0E-05*
DF3	41057.0	177	284	0	7267089.0	50268	4.1E-07*	6.0E-05*
EN1	23634.0	137	168	0	3237858.0	23016	9.3E-07*	1.3E-04*
FP1	18189.0	137	126	0	2491893.0	17262	1.2E-06*	1.7E-04*
MI1	39560.0	145	299	0	5736200.0	43355	5.2E-07*	6.9E-05*
MD1	44190.0	121	297	0	5346990.0	35937	5.6E-07*	8.3E-05*
NP1	41084.0	129	274	0	5299836.0	35346	5.7E-07*	8.5E-05*
OC1	42170.0	137	270	0	5777290.0	36990	5.2E-07*	8.1E-05*
PE2	24563.0	185	169	0	4544155.0	31265	6.6E-07*	9.6E-05*
PB3	22737.0	185	158	0	4206345.0	29230	7.1E-07*	1.0E-04*
PI1	31756.0	145	205	0	4604620.0	29725	6.5E-07*	1.0E-04*
QC1	37446.0	177	287	0	6627942.0	50799	4.5E-07*	5.9E-05*
QC2	39780.0	177	282	0	7041060.0	49914	4.3E-07*	6.0E-05*
VY1	39826.0	89	266	0	3544514.0	23852	8.5E-07*	1.3E-04*
TOTALS				3	92893766.0	640959		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FALLTS RECORDED



FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS; 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HCLR RATE	DEMAND RATE
EV1	9106.0	53	32	0	482618.0	1696	6.2E-06*	1.8E-03*
DC1	22795.0	53	58	0	1208135.0	3074	2.5E-06*	9.7E-04*
DC2	770.0	53	4	0	40810.0	212	7.3E-05*	1.4E-02*
HN1	45574.0	45	87	0	2050830.0	3915	1.5E-06*	7.7E-04*
IP2	21387.0	61	58	0	1304607.0	3538	2.3E-06*	8.5E-04*
IF3	11694.0	61	22	1	713334.0	1342	1.4E-06	7.5E-04
JF1	3079.0	53	8	0	163187.0	318	1.8E-05*	9.4E-03*
KE1	28727.0	33	65	0	947991.0	2145	3.2E-06*	1.4E-03*
KA1	410.0	53	1	0	21730.0	53	1.4E-04*	5.7E-02*
PR1	28913.0	37	61	0	1069781.0	2257	2.8E-06*	1.3E-03*
FR2	25020.0	37	42	0	925740.0	1554	3.2E-06*	1.9E-03*
PT1	44738.0	37	98	0	1655306.0	3552	1.8E-06*	8.4E-04*
PT2	45215.0	37	99	0	1672955.0	3663	1.8E-06*	8.2E-04*
RG1	40932.0	33	97	0	135076.0	3201	2.2E-06*	9.4E-04*
RC2	43928.0	41	108	0	1801048.0	4346	1.7E-06*	6.9E-04*
SA1	4368.0	53	14	0	231504.0	742	1.3E-05*	4.0E-03*
SC1	41777.0	45	82	0	1879965.0	3690	1.6E-06*	8.1E-04*
SU1	31984.0	53	74	0	1695152.0	3922	1.8E-06*	7.6E-04*
SU2	28790.0	53	61	0	1525870.0	3233	2.0E-06*	9.3E-04*
TR1	12539.0	61	27	0	764879.0	1647	3.9E-06*	1.8E-03*
TL3	36992.0	53	103	0	1960576.0	5459	1.5E-06*	5.5E-04*
TU4	29791.0	53	85	0	1578923.0	4505	1.9E-06*	6.6E-04*
ZI1	26612.0	53	57	0	1410436.0	3021	2.1E-06*	9.9E-04*
ZI2	21735.0	53	53	0	1151955.0	2809	2.6E-06*	1.1E-03*
TOTALS				1	27608088.0	63894		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY IN NON-SCRAM DEMANDS; 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
	4.7	4.7
BAB.EWIL.	9.9E-08	3.7E-05
	19.5	19.5
COPE.ENG.	3.1E-07*	1.4E-04*
	2.6	2.6
GEN.ELEC.	3.2E-08	4.7E-06
	3.7	3.7
	4.7	4.7
WESTINGH.	3.6E-08	1.6E-05
	19.5	19.5
	3.1	3.1
PWR'S	4.2E-08	1.8E-05
	5.6	5.6
	2.1	2.1
OVERALL	3.6E-08	6.6E-06
	2.5	2.5

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

BABCOCK & WILCOX

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
AP1	20009.0	69	44	0	1380621.0	3036	2.2E-06*	9.9E-04*
CR3	7430.0	69	32	30	512670.0	2208	5.9E-05	1.4E-02
DE1	4129.0	57	12	0	235353.0	684	1.3E-05*	4.4E-03*
DE1	30392.0	69	85	0	2097048.0	5865	1.4E-06*	5.1E-04*
DE2	21755.0	69	69	0	2501095.0	4761	2.0E-06*	6.3E-04*
DE3	22921.0	69	63	0	1581549.0	4347	1.9E-06*	6.9E-04*
RS1	14543.0	69	41	0	1003467.0	2829	3.0E-06*	1.1E-03*
T11	24929.0	69	50	0	1720101.0	3450	1.7E-06*	8.7E-04*
T12	342.0	69	1	0	23598.0	69	1.3E-04*	4.3E-02*
TOTALS				30	10055502.0	27249		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
CC1	20739.0	85	49	0	1762815.0	4165	1.7E-06*	7.2E-04*
CC2	9162.0	85	26	1	778770.0	2210	1.3E-06	4.5E-04
FC1	37123.0	49	63	0	1574027.0	3087	1.9E-06*	9.7E-04*
MI2	14906.0	81	27	0	1207386.0	2187	2.5E-06*	1.4E-03*
MY1	40408.0	85	88	0	3434680.0	7480	8.7E-07*	4.0E-04*
SL1	9903.0	81	20	1	802143.0	1620	1.2E-06	6.2E-04
TOTALS				2	9559821.0	20749		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAP DEMANDS (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	OPIT.HRS.	POPULATION	DEMANDS	FAULTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
BF1	15553.0	185	107	1	2377305.0	19795	3.5E-07	5.1E-05
BF2	12326.0	185	75	0	2280310.0	13875	1.3E-06*	2.2E-04*
BF3	11545.0	185	69	0	2135825.0	12765	1.4E-06*	2.3E-04*
BP1	38622.0	32	247	1	1235904.0	7904	8.1E-07	1.3E-04
BR1	7544.0	137	56	0	1033528.0	7672	2.9E-06*	3.9E-04*
BR2	14576.0	137	106	0	1996912.0	14522	1.5E-06*	2.1E-04*
CC1	27641.0	137	169	0	3786817.0	23153	7.9E-07*	1.3E-04*
DA1	22487.0	89	160	0	2001343.0	14240	1.5E-06*	2.1E-04*
DF1	35600.0	80	252	1	2848000.0	20160	3.5E-07	5.0E-05
DR2	39390.0	177	282	0	6972030.0	49914	4.3E-07*	6.0E-05*
DR3	41057.0	177	284	0	7267089.0	50268	4.1E-07*	6.0E-05*
EN1	23634.0	137	168	0	3237858.0	23016	9.3E-07*	1.3E-04*
FF1	18189.0	137	126	0	2491893.0	17262	1.2E-06*	1.7E-04*
MI1	39560.0	145	299	0	5736200.0	43355	5.2E-07*	6.9E-05*
ML1	44190.0	121	297	0	5346990.0	35937	5.6E-07*	8.3E-05*
NP1	41084.0	129	274	0	5299836.0	35346	5.7E-07*	8.5E-05*
OC1	42170.0	137	270	0	5777290.0	36990	5.2E-07*	8.1E-05*
PB2	24563.0	185	169	0	4544155.0	31265	6.6E-07*	9.6E-05*
PB3	22737.0	185	158	0	4206345.0	29230	7.1E-07*	2.0E-04*
PI1	31756.0	145	205	0	4604620.0	29725	6.5E-07*	1.0E-04*
QC1	37446.0	177	287	0	6627942.0	50799	4.5E-07*	5.9E-05*
QC2	39780.0	177	282	0	7041060.0	49914	4.3E-07*	6.0E-05*
VY1	39826.0	89	268	0	3544514.0	23852	8.5E-07*	1.3E-04*
TOTALS				3	92893766.0	640959		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAP DEMANDS (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	DEMANDS	FALLTS	POP.HOURS	POP.DEMANDS	STANDBY HOUR RATE	DEMAND RATE
RV1	9106.0	53	32	0	482618.0	1696	6.2E-06*	1.8E-03*
DC1	22795.0	53	58	0	1208135.0	3074	2.5E-06*	9.7E-04*
DC2	770.0	53	4	0	40810.0	212	7.3E-05*	1.4E-02*
HM1	45574.0	45	87	0	2050830.0	3915	1.5E-06*	7.7E-04*
IP2	21387.0	61	58	0	1304607.0	3538	2.3E-06*	8.5E-04*
IP3	11694.0	61	22	1	713334.0	1342	1.4E-06	7.5E-04
JF1	3079.0	53	6	0	163187.0	318	1.8E-05*	9.4E-03*
KE1	28727.0	33	65	0	947991.0	2145	3.2E-06*	1.4E-03*
MA1	410.0	53	1	0	21730.0	53	1.4E-04*	5.7E-02*
PF1	28913.0	37	61	0	1069781.0	2257	2.8E-06*	1.3E-03*
PK2	25020.0	37	42	0	925740.0	1554	3.2E-06*	1.9E-03*
PT1	44738.0	37	96	0	1655306.0	3552	1.8E-06*	8.4E-04*
PT2	45215.0	37	99	0	1672955.0	3663	1.8E-06*	8.2E-04*
RG1	40932.0	33	97	3	1350756.0	3201	2.2E-06	9.4E-04
RL2	43928.0	41	106	0	1801048.0	4346	1.7E-06*	6.9E-04*
SA1	4368.0	53	14	0	231504.0	742	1.3E-05*	4.0E-03*
SC1	41777.0	45	82	0	1879965.0	3690	1.6E-06*	8.1E-04*
SL1	31984.0	53	74	0	1695152.0	3922	1.8E-06*	7.6E-04*
SL2	28790.0	53	61	0	1525870.0	3233	2.0E-06*	9.3E-04*
TP1	12539.0	61	27	13	764879.0	1647	1.7E-05	7.9E-03
TL3	36992.0	53	103	0	1960576.0	5459	1.5E-06*	5.5E-04*
TL4	29791.0	53	85	0	1578923.0	4505	1.9E-06*	6.6E-04*
Z11	26612.0	53	57	0	1410436.0	3021	2.1E-06*	9.9E-04*
Z12	21735.0	53	53	0	1151955.0	2809	2.6E-06*	1.1E-03*
TOTALS				17	27608088.0	63894		

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURE TO MOVE PROPERLY ON NON-SCRAM DEMANDS (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE	DEMAND RATE
	1.4	1.4
BAB.&WIL.	3.0E-06	1.1E-03
	1.4	1.4
	3.1	3.1
COMB.ENG.	2.1E-07	9.6E-05
	5.6	5.6
	2.6	2.6
GEN.ELEC.	3.2E-08	4.7E-06
	3.7	3.7
	1.5	1.5
WESTINGH.	6.2E-07	2.7E-04
	1.6	1.6
	1.3	1.3
PWR'S	1.0E-06	4.4E-04
	1.3	1.3
	1.3	1.3
OVERALL	3.7E-07	6.9E-05
	1.3	1.3

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

APPENDIX AC

FAULTS INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED

FAILURE MODE CODES

CCDE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/D
B	FAILURE TO BOTTOM DURING SCRAM
C	FAILURE TO INSURE AT LEAST 90% DURING SCRAM
D	FAILURE TO MOVE DURING
E	POWER CHANGES/TESTING
F	FAILURE TO WITHDRAW
G	FAILURE TO FULLY INSERTED POSITION
H	CRACKED ROD (DWR)
I	CRACKED ROD COVER TRAVEL CONDITION (BWR)
J	CRACKED ROD MOVEMENT
K	CRACKED LEAKAGE PROTECT
L	CRACKED NOT OPERATE PROPERLY
M	CRACKED MORE NOT IDENTIFIABLE
N	CRACKED PLACEMENT REQUIREMENT
O	CRACKED SPECIALIZATION REQUIREMENT
P	CRACKED FAILURE

COMPONENT CODE

CCDE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CCDE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
D	RECURRING FAILURES
E	COMMON FAULT
F	RECURRING COMMON FAULTS

FAILURE MECHANISM CODES

CCDE	DESCRIPTION
CO	UNKNOWN
C1	PERSONNEL (OPERATIONS)
C2	PERSONNEL (MAINTENANCE)
C3	PERSONNEL (TESTING)
C4	DESIGN ERROR
C5	FACTORY CONSTRUCTION/C.C.
C6	PROCEDURAL DISCREPANCIES
C7	NORMAL WEAR
C8	EXCESSIVE WEAR
C9	CONTAMINATION
C10	EXCESSIVE MATERIAL CONTAMINATION
C11	EXCESSIVE VIBRATION
C12	COMMON MOTOR FAILURE
C13	VALVE FAILURE
C14	VALVE MISALIGNED INTERNALS
C15	VALVE H FAILURE
C16	VALVE FAILURE
C17	VALVE FAILURE PLUGGED
C18	VALVE FAILURE
C19	VALVE FAILURE
C20	VALVE FAILURE
C21	VALVE FAILURE
C22	VALVE FAILURE
C23	VALVE FAILURE
C24	VALVE FAILURE
C25	VALVE FAILURE
C26	VALVE FAILURE
C27	VALVE FAILURE
C28	VALVE FAILURE
C29	VALVE FAILURE
C30	VALVE FAILURE
C31	VALVE FAILURE
C32	VALVE FAILURE
C33	VALVE FAILURE
C34	VALVE FAILURE
C35	VALVE FAILURE
C36	VALVE FAILURE
C37	VALVE FAILURE
C38	VALVE FAILURE
C39	VALVE FAILURE
C40	VALVE FAILURE
C41	VALVE FAILURE
C42	VALVE FAILURE
C43	VALVE FAILURE
C44	VALVE FAILURE
C45	VALVE FAILURE
C46	VALVE FAILURE
C47	VALVE FAILURE
C48	VALVE FAILURE
C49	VALVE FAILURE
C50	VALVE FAILURE
C51	VALVE FAILURE
C52	VALVE FAILURE
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C54	VALVE FAILURE
C55	VALVE FAILURE
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C58	VALVE FAILURE
C59	VALVE FAILURE
C60	VALVE FAILURE
C61	VALVE FAILURE
C62	VALVE FAILURE
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C64	VALVE FAILURE
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C66	VALVE FAILURE
C67	VALVE FAILURE
C68	VALVE FAILURE
C69	VALVE FAILURE
C70	VALVE FAILURE
C71	VALVE FAILURE
C72	VALVE FAILURE
C73	VALVE FAILURE
C74	VALVE FAILURE
C75	VALVE FAILURE
C76	VALVE FAILURE
C77	VALVE FAILURE
C78	VALVE FAILURE
C79	VALVE FAILURE
C80	VALVE FAILURE
C81	VALVE FAILURE
C82	VALVE FAILURE
C83	VALVE FAILURE
C84	VALVE FAILURE
C85	VALVE FAILURE
C86	VALVE FAILURE
C87	VALVE FAILURE
C88	VALVE FAILURE
C89	VALVE FAILURE
C90	VALVE FAILURE
C91	VALVE FAILURE
C92	VALVE FAILURE
C93	VALVE FAILURE
C94	VALVE FAILURE
C95	VALVE FAILURE
C96	VALVE FAILURE
C97	VALVE FAILURE
C98	VALVE FAILURE
C99	VALVE FAILURE
C00	VALVE FAILURE

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIME
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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

CCDE	DESCRIPTION
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM



-----FAULTS INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED-----

P L V E K	A C N T	CCNT-NO.	FAIL DATE	SYM P	SC P	FAIL CODE	UNIT	TYPE	FAILURE MODE	FAILURE MECHANISM
B	AP1	010504	060974	M	CD	106	S	D	IMPROP. MOVEMENT OF ROD 7-4 CAUSED HI S/U RATE TRIP PROCEDURE FOR COND. TEST WAS INADEQUATE	
B	AP1	021310*	042478	M	CD	621	T	D	GROUP 7 CONTROL RODS DROPPED DURING PWR OPERATION	FAILURE OF A GATE DRIVE CIRCUIT
B	CR3	018403	040677	M	CC	612	R	C	IN MODE 1, ROD 3 GR 2 DROPPED INTO CORE	FAILURE OF CROM STATOR CAUSED ROD TO DROP
B	CR3	017943	042777	M	CD	101	S	D	ROD GROUP 6 EXCEEDED ITS INSERTION LIMIT (T.S.)	PERSONNEL ERROR (COMMAND FAULT)
B	CR3	017944*	042777	M	CD	621	T	D	IN MODE 1, GROUP 7 DROPPED INTO CORE	POSSIBLE GROUNDED SHIELD TO 24VLT PROG
B	CP3	017941*	051377	M	CC	621	T	D	IN MODE 1, DURING TEST SP-110 GRP. 7 DROP INTO CORE	POSSIBLE DESIGN ERROR/GATE DRIVE REL-CAT.
B	CR3	019429*	161677	M	CD	621	T	D	IN MODE 1, DURING TEST SP-110 GRP. 7 DROP INTO CORE	RANDOM INTERMITTENT POWER INTERRUPTIONS
B	CE1	000417	100573	M	CD	101	S	D	TECH SPEC ROD WITHDRAWAL LIMITS WERE EXCEEDED	PERSONNEL ERROR
B	CE1	012286	010375	M	CD	106	S	D	RODS WERE MOVED WITHOUT CALCULATING G POWER WORTH	VENDOR/PERSONNEL PROCEDURES PROBLEM
B	CE2	012293	011575	M	CD	101	S	D	IMPROPER ROD MOVEMENT CAUSED OVERLAP PROBLEM	PERSONNEL ERROR
B	DE2	013202*	062575	M	CD	600	S	D	GR7 RODS DROPPED CAUSING LOSS OF REQUIRED OVERLAP	NO PROBLEM FOUND/PROBABLE COMMAND FAULT
B	CE2	014813	022676	M	CC	604	R	T	DROPPED CONT. ROD CAUSED RA. QUAD. TILT TO EX. TECH SP	SHRT. DUE TO D-RING FAIL. IN STAT. WMDGS.
B	CE2	020154	122577	M	CD	612	R	T	CR3GR6 DROPPED WHILE BEING WITHDRAWN	SHRT. DUE TO D-RING FAIL. IN STAT. WMDGS.
B	CE2	020665*	030178	M	CC	621	S	D	CONTROL ROD GROUP 5 DROPPED DURING PERFORM. TEST	MOMENTARY LOSS OF POWER, REASON UNKNOWN
B	CE3	012298	020975	M	CD	101	S	D	IMPROPER ROD MOVEMENT CAUSED OVERLAP PROBLEM	PERSONNEL ERROR/WRONG ROD POS MONITORED
B	CE2	014818*	042276	M	CD	621	T	D	GROUP 7 RODS DROPPED AT 95% POWER	A FAILED GATE DRIVE CIRCUIT
B	CE3	015610*	060976	M	CD	621	T	D	GROUP 7 RODS DROPPED	TWO PWR. SUPPLIES FAILED (FUSE, TRANSISTOR)
B	CE3	020661	021078	M	CD	612	R	T	CR3GR4 DROPPED DURING AN RPS BREAKER TEST	SHRT. DUE TO D-RING FAIL. IN STAT. WMDGS.
B	RS1	016011	100776	M	CD	101	S	D	RODS IN POSITION TO GIVE <14 DELTA K/K SHUTDOWN	PERSONNEL ERROR DURING COLD SHUTDOWN
B	TI1	012144	021075	M	CD	101	S	D	OPERATED WITH ROD 6/6 LOWER THAN REST OF GROUP 6	PERSONNEL ERROR
B	TI1	013684	111275	M	CC	612	U		ROD 4 OF GR 7 DROPPED INTO CORE DURING FULL PWR OP	FAILED STATOR WMDG CAUSED ROC 4 TO DROP
C	CC1	016741	121276	M	CD	600	R	U	ROD 27 SLIPPED TO 77 INCH. DURING MOVEMENT TESTS	UNDETERMINED (SEE LER 019689)
C	CC1	017710	042277	M	CD	600	R	U	ROD 34 SLIPPED TO 34 INCH. DURING MOVEMENT TESTS	UNDETERMINED (SEE LER 019689)
C	CC1	015689A	111277	M	CD	621	Y	D	WHILE AT SS PWR AT 2:04AM CEA 54 DROPPED TO FULL-IM	15-VLT PWR. SUP. IN COIL PWR. PROG. DRAIFT LOW
C	CC1	015689B	111277	M	CD	621	Y	D	WHILE AT SS PWR AT 11:14AM CEA 54 DROPPED TO FULL-IM	15-VLT PWR. SUP. IN COIL PWR. PROG. DRAIFT LOW
C	CC1	015781	120377	M	CD	600	R	L	ROD 1 DROPPED WHILE PULLING GROUP 5	UNKNOWN
C	CC1	020171	010278	M	CD	621	T	D	WHILE AT SS PWR CEA 32 DROPPED TO FULLY INSERTED	CEA 15-VLT PWR. SUP. FAILED
C	CC2	018300A	070377	M	CD	621	T	D	WHILE OPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTENT FAIL. OF 15VDC POWER SUPPLY
C	CC2	018300R	070777	M	CD	621	T	D	WHILE OPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTENT FAIL. OF 15VDC POWER SUPPLY
C	CC2	019279	160277	M	CD	621	T	D	DURING FULL PWR. UPS. CEA 37 DROPPED TO FULLY INS.	15 VLT PWR SUPPLY FAILED LOW
C	CC2	020228	012178	M	CC	600	R	U	ROD 1 DROPPED DURING POWER REDUCTION	UNKNOWN

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 FAULTS INVOLVING ROD MOTIION WHEN NO MOTION IS DESIRED  
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Y E A R	F L A N T	C O N T. N O.	F A I L D A T E	S Y S	C O M P	F A I L C O D E	T Y P E	C L A S S	F A I L M	F A I L M O D E	F A I L M E C H A N I S M
C	CC2	020561	021578	M	CD	G00	R	L		ROD 33 DROPPED DURING MONTHLY EXER. TESTS	UNKNOWN
C	FC1	000233	080873	M	CD	I06	S	D		RODS WITHDRAWN WHICH REDUCED S/D MARGIN TO < 2.4	PROCEDURE BASED ON WRONG ROD WORTH CURVES
C	FC1	000406	0F1773	M	CD	G15		L		CEA 35 DROPPED TO ITS LOWER HARD STOP	CLUTCH COIL FAILED
C	#12	010030	092276	M	CD	G21	S	D		DURING CEA PARALLEL OPS., CEA 49 DROPPED INTO CORE	BLOWN FUSE IN PARALLELING CIRCUIT
C	SL1	015509	071078	M	CD	G21	T	D		CEA 50 DROPPED WITH RX. CRIT. AT 0.01X PWR.	FAILURE OF 15 VOLT POWER SUPPLY
C	SL1	017200	020477	M	CD	G00	R	L		CEA #60 DROPPED WHILE AT POWER	THE CAUSE IS UNKNOWN
C	SL1	018060	052777	M	CD	G21	T	D		CEA 39 DROPPED WITH PLANT OPERATING AT POWER	FAULTY INSERTION TIMER
C	SL1	019576A	102877	M	CD	G00	R	L		CEA #56 DROPPED FOR NO APPARENT REASON	CAUSE UNKNOWN, POSS. PROB. PWR. SUP. & TIME. MOD
C	SL1	019576B	102877	M	CD	G00	R	L		CEA #56 DROPPED FOR NO APPARENT REASON	CAUSE UNKNOWN, POSS. PROB. PWR. SUP. & TIME. MOD
G	BR1	014935	010977	M	CD	I01	S	D		OPERATOR PULLED RODS TO NOTCH 48 INSTEAD OF 24	PERSONNEL ERROR/MINIMIZER FAILED TO BLOCK
G	BR2	013629	092975	M	CD	H18		T		ROD 26-07 DRIFT FROM FULL INSERT TO FULL WITHDRAW	FOREIGN MATTER IN CRD COLLET PISTON AREA
G	BR2	020838A	033178	M	CD	H18	C	D		ROD 22-19 UNCOUPLED FROM DRIVE MECHANISM	ROD DRIVE MECH. INNER FILTER CAME LOOSE
G	BR2	020838B	033178	M	CD	H18	C	D		ROD 26-39 UNCOUPLED FROM DRIVE MECHANISM	ROD DRIVE MECH. INNER FILTER CAME LOOSE
G	CO1	019583	092977	M	CD	H02	C	D		UNCOUPLING ROD AND SPUD FINGERS BENT	IMPROPER ASSEMBLY BY MAINTAINANCE PERSON
G	CA1	010428	070274	M	CD	I00	T	D		ROD 18-27 WITHDREW WITHOUT WITHDRAWL SIGNAL APPLIED	EXACT CAUSE NOT STATED
G	CA1	010517	071674	M	CD	I00	T	D		ROD 06-23 WITHDREW WITHOUT WITHDRAWL SIGNAL APPLIED	CAUSE UNKNOWN, BEING INVESTIGATED
G	CA1	010691	090674	M	CD	I21	T	D		ROD MOVED WITHOUT OPERATOR ACTION IN 2 INSTANCES	PROB. CAUSE, NOISE SPIKES IN RMCS OR TIMER
G	CR1	010430A	070474	M	CD	H00	B	L		ROD 04 MOVEMENT COULD NOT BE DETER. ON NUC. INSTRU.	UNDETERMINED
G	CR1	010430B	070474	M	CD	H00	B	L		ROD A5 MOVEMENT COULD NOT BE DETER. ON NUC. INSTRU.	UNDETERMINED
G	CR1	010430C	070474	M	CD	H00	B	L		ROD D10 MOVEMENT COULD NOT BE DETER. ON NUC. INSTRU.	UNDETERMINED
G	CR1	010429	071474	M	CD	H00	B	L		ROD A7 MOVEMENT COULD NOT BE DETER. ON NUC. INSTRU.	UNDETERMINED
G	DR2	000284	021973	M	CD	H02	B	D		CRD L-11 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP. INSTAL. OF FILTER DAMAGE RETAIN. SPR
G	DR2	000285	021973	M	CD	H02	B	D		CRD K-8 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP. INSTAL. OF FILTER DAMAGE RETAIN. SPR
G	DR2	000286	021973	M	CD	H02	B	D		CRD B-6 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP. INSTAL. OF FILTER DAMAGE RETAIN. SPR
G	DR2	000884	031474	M	CD	H00	R	L		CRD B-11 UNCOUPLED DURING SCRAM TEST	TO BE DETERMINED
G	DR2	010314	061574	M	CD	H00	R	L		CRD L-9 UNCOUPLED WHILE BEING WITHDRAWN	FAILURE MECHANISM NOT KNOWN
G	DR2	010751	102374	M	CD	H00	R	L		CRD P-12 UNCOUPLED WHILE BEING WITHDRAWN	FAILURE MECHANISM NOT KNOWN
G	DR2	010904	110274	M	CD	H00	R	L		CRD N-10 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	FAILURE MECHANISM NOT KNOWN
G	DR2	012217	012575	M	CD	I06	S	D		2 ADJ CONTROL RODS WITHDRAWN DURING REFUELING	DEFECTIVE TEMPORARY PROCEDURE

FAULTS INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED

PLANT	CONT. NO.	FAIL DATE	SY S	COMP	FAIL CODE	TYPE	CLASS	FAIL #	FAILURE MODE	FAILURE MECHANISM
G DR2	C14529	041376	M	CD	I03	T	C		RODS EXERCISED/RX VESSEL OPEN/PERSONNEL IN AREA	PERSONNEL FAILED TO EVACUATE AREA
G DR2	C17177A	121276	M	CD	H18	B	U		CRD F-5 UNCOUPLED FOLLOWING 50% CORE SCRAM TESTING	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C17177B	121276	M	CD	H18	B	L		CRD F-5 UNCOUPLED FOLLOWING SCRAM & WITHDRAWL	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C16907A	122876	M	CD	H18	B	L		CRD J-11 UNCOUPLED DURING ROUTINE S/U AT POS.48	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C16907B	122876	M	CD	H18	B	U		CRD J-11 UNCOUPLED AFTER INSERT.&WITHDRAW TO POS48	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C17515	040277	M	CD	H18	B	L		CRD L-5 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C17516	040277	M	CD	H18	B	U		CRD H-8 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C181F2	0c0577	M	CD	H18	B	L		CRD L-5 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C18433A	090277	M	CD	H18	B	U		CRD F-5 UNCOUPLED WHEN WITHDRAWN AFTER SCRAM TEST	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C18433B	060277	M	CD	H18	B	U		CRD H-7 UNCOUPLED WHEN WITHDRAWN AFTER SCRAM TEST	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C19652	110277	M	CD	H18	B	L		CRD H-5 UNCOUPLED DURING FUNCTIONAL TEST	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G MI1	C00205	072473	M	CD	H00		U		CONT. ROD 18-35 WENT TO OVERTRAVEL POSITION	PROB. POSSIBLY DUE TO COUPLING SPUD
G MI1	C18343	111276	M	CD	I03	S	D		IMPROPER ROD MOVEMENTS CAUSED INADVERTANT CRITICAL	PERSONNEL SELECTED WRONG RODS DURING TEST
G MI1	C17363	022377	M	CD	I06	S	D		IMPROPER ROD MOVEMENT RESULTED IN HIGH SUR SCRAM	DEFECTIVE PROCEDURES ON START-UP ROD SEQ.
G PI1	C00076A	050973	M	CD	I20	S	D		ROD 34-15 MOVED FROM 6IN. WITHDRAWN TO FULL-IN	MOVE. DUE TO HI.PRES. IN COOL. WTR. LINE
G PI1	C17773	050277	M	CD	H00		L		ROD 46-39 WAS WITHDRAWN BEYOND THE FULL OUT POSIT.	CAUSE UNDER INVEST. NEW LER TO BE SUBMIT.
G GC1	C00350	092173	M	CD	I01	S	D		IMPROPER ROD MOVEMENT/HEAT GENERATION RATE EXCEED	PERSONNEL ERROR/WRONG ROD SELECTED
G GC1	C12663	050375	M	CD	I06	S	D		IMPROPER ROD WITHDRAWL DURING REFUELING	INADEQUATE PROCEDURES
G GC1	C15380	070976	M	CD	I01	S	D		IMPROPER ROD MOVEMENT/2 PULLED SIMULTANEOUSLY	PERSONNEL ERROR
G VY1	C00477	110773	M	CD	I03	S	D		IMPROPER ROD MOVEMENT CAUSED INADVERTANT CRITICALTY	PERSONNEL ERRORS/INTERLOCKS JUMPERED/TEST
W JF2	C18071	052677	M	CD	G00		U		ROD F-2 BANK C DROPPED DURING STARTUP	CAUSE UNKNOWN
W PT1	C10649	052974	M	CD	I01	S	D		IMPROPER ROD MOVEMENT/PART-LENGTH RODS INSERTED TO	--82% //PERSONNEL ERROR
W RC1	C12311A	030575	M	CD	G21	T	D		B BANK GR2 RCC G5 DROPPED	WTR IN CAB GRND CONT PWR FOR STATN GRIP.
W RC1	C12311B	030575	M	CD	G21	T	D		B BANK GR2 RCC G-9 DROPPED	WTR IN CAB. GRND CONT.PWR.FOR STATN GRIP.
W RC1	C14556*	041676	M	CD	G21	T	D	02	B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	FAILURE OF 4 P.C. CARDS POSSIBLE CAUSE
W RC1	C15058*	070476	M	CD	G21	T	D	02	B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	STATIONARY COIL CIRCUITRY FAILURE
W RC1	C15328*	060476	M	CD	G21	T	D	02	D BANK GROUP 2 RODS G-3 AND G-11 PARTIALLY CROPPED	STATIONARY COIL CIRCUITRY FAILURE
W RC1	C16044	121776	M	CD	G21	T	D		ROD F-12 DROPPED DURING OPER. AT REDUCED LOAD	FAILURE OF STATIONARY HOLD COIL CIRCUITRY
W RC2	C02072*	062072	M	CD	G21	S	D	03	3 RODS (BANK D-GROUP 2) DROPPED INTO THE CORE	MULTIPLEXING THYRISTOR FAILURE PWR CAB280
W RC2	C10293	052674	M	CD	I02	S	D		RCC ASSEMBLY INADVERTANTLY REMOVED DURING REFUEL	PERSONNEL ERROR
W RC2	C11114B	121174	M	CD	I06	S	D		RODS NOT INSERTED(S/D) WHEN PART-LENGTH ROD INOPER	PROCEDURES HAD 5 PARAGRAPHS DELETED
W SU1	C18875	081877	M	CD	G21	S	D		ROD J-13(SHUTDOWN BANK A)DROPPED DURING NORM. OPER	LOSS OF PWR TO STATION. GRIP COIL OF CROM
W TL4	C002E3	081573	M	CD	I03	S	D		ROD TEST CONDUCTED WHICH TECH SPECS DONT ALLOW	PERSONNEL ERROR

FAILURES INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED; 1/1/76 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	PCP.HOURS	STANDBY HOUR RATE
AR1	12946.C	69	0	893274.0	3.4E-06*
CR3	7430.C	69	1	512670.0	4.0E-06
DB1	4129.C	57	0	235353.0	1.3E-05*
DE1	13620.C	69	0	939780.0	3.2E-06*
DE2	13296.C	69	2	910524.0	2.2E-06
DE3	15777.C	69	1	1088613.0	9.2E-07
RS1	12642.C	69	0	872298.0	3.4E-06*
YI1	14916.C	69	0	1029204.0	2.9E-06*
YI2	342.C	69	0	23598.0	1.3E-04*
TOTALS			4	6505314.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURES INVOLVING ROD ACTION WHEN NO ACTION IS DESIRED; 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	COET.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	15903.0	85	3	1351755.0	2.2E-06
CC2	9162.0	85	2	778770.0	2.6E-06
FC1	16130.0	49	0	790370.0	3.8E-06*
MI2	13567.0	81	0	1098927.0	2.7E-06*
MY1	18606.0	85	0	1581510.0	1.9E-06*
SL1	9903.0	81	3	802143.0	3.7E-06
			TOTALS	8	6403475.0

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURES INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED; 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	PCP.HOURS	STANDBY HOUR RATE
BF1	10793.0	185	0	1996705.0	1.5E-06*
BF2	11809.0	185	0	2184665.0	1.4E-06*
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	13379.0	32	0	428128.0	7.0E-06*
BR1	7544.0	137	0	1033528.0	2.9E-06*
BR2	13226.0	137	2	1811962.0	1.1E-06
CO1	16617.0	137	1	2276529.0	4.4E-07
CA1	15981.0	89	0	1422309.0	2.1E-06*
DR1	15801.0	80	0	1264080.0	2.4E-06*
DR2	16103.0	177	10	2850231.0	3.5E-06
DR3	17226.0	177	0	3049002.0	9.8E-07*
EN1	15876.0	137	0	2175012.0	1.4E-06*
FP1	15348.0	137	0	2102676.0	1.4E-06*
MI1	17024.0	145	0	2468480.0	1.2E-06*
MO1	18126.0	121	0	2193246.0	1.4E-06*
NM1	16060.0	129	0	2071740.0	1.4E-06*
OC1	16142.0	137	0	2211454.0	1.4E-06*
PB2	13776.0	185	0	2548560.0	1.2E-06*
PB3	14885.0	185	0	2753725.0	1.1E-06*
PI1	13412.0	145	1	1944740.0	5.1E-07
QC1	15547.0	177	0	2751819.0	1.1E-06*
QC2	16750.0	177	0	2964750.0	1.0E-06*
VY1	17311.0	89	0	1540679.0	1.9E-06*
		TOTALS	14	48179845.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURES INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED; 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BV1	9106.C	53	0	482618.0	6.2E-06*
CC1	16401.C	53	0	669253.0	3.4E-06*
CC2	770.C	53	0	40810.0	7.3E-05*
HN1	18030.C	45	0	811350.0	3.7E-06*
IP2	10995.0	61	1	670695.0	1.5E-06
IP3	11694.C	61	0	713334.0	4.2E-06*
JF1	3079.C	53	0	163187.0	1.8E-05*
KE1	16994.C	33	0	560802.0	5.3E-06*
NA1	410.C	53	0	21730.0	1.4E-04*
PR1	16859.0	37	0	623783.0	4.8E-06*
PR2	17531.C	37	0	648647.0	4.6E-06*
PT1	18041.C	37	0	667517.0	4.5E-06*
PT2	17964.C	37	0	664668.0	4.5E-06*
RG1	14639.C	33	0	483087.0	6.2E-06*
RD2	16245.C	41	0	666045.0	4.5E-06*
SA1	4368.C	53	0	231504.0	1.3E-05*
SO1	14325.C	45	0	644625.0	4.6E-06*
SU1	15487.0	53	0	820811.0	3.6E-06*
SU2	13160.C	53	0	697460.0	4.3E-06*
TR1	12539.0	61	0	764879.0	3.9E-06*
TU3	15712.C	53	0	832736.0	3.6E-06*
TU4	14145.C	53	0	749685.0	4.0E-06*
ZI1	15178.0	53	0	804434.0	3.7E-06*
ZI2	13657.C	53	0	723821.0	4.1E-06*
			TOTALS	1	14357501.0

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURES INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED; 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	2.3
EAB.GWIL.	6.1E-07
	2.9
	1.8
COMB.ENG.	1.2E-06
	2.0
	1.6
GEN.ELEC.	2.9E-07
	1.7
	4.7
WESTINGH.	7.0E-08
	19.5
	1.6
FWR'S	4.8E-07
	1.7
	1.4
OVERALL	3.6E-07
	1.4

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



FAULTS INVOLVING RUD MOTION WHEN NO MOTION IS DESIRED (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

B&B COCKSWILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDEY HOUR RATE
AP1	12946.0	69	9	893274.0	1.0E-05
CR3	7430.0	69	22	512670.0	4.3E-05
DB1	4129.0	57	0	235353.0	1.3E-05*
OE1	13620.0	69	0	939780.0	3.2E-06*
OE2	13196.0	69	14	910524.0	1.5E-05
OE3	15777.0	69	19	1088613.0	1.7E-05
RS1	12642.0	69	1	872298.0	1.1E-06
TI1	14916.0	69	0	1029204.0	2.9E-06*
TI2	342.0	69	0	23598.0	1.3E-04*
			TOTALS	65	6505314.0

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAULTS INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	15903.0	85	6	1351755.0	4.4E-06
CC2	9162.0	85	5	778770.0	6.4E-06
FC1	16130.0	49	0	790370.0	3.8E-06*
MI2	13567.0	81	1	1098927.0	9.1E-07
MY1	18606.0	85	0	1581510.0	1.9E-06*
SL1	9903.0	81	5	802143.0	6.2E-06
TOTALS			17	6403475.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FALLTS INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED (COMMAND FAULTS INCLUDED) 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BF1	10793.0	185	0	1996705.0	1.5E-06*
BF2	11809.0	185	0	2184665.0	1.4E-06*
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	13379.0	32	0	428128.0	7.0E-06*
BR1	7544.0	137	1	1033528.0	9.7E-07
BR2	13226.0	137	2	1811962.0	1.1E-06
CC1	16617.0	137	1	2276529.0	4.4E-07
DA1	15981.0	89	0	1422309.0	2.1E-06*
DR1	15801.0	80	0	1264080.0	2.4E-06*
DR2	16103.0	177	11	2850231.0	3.9E-06
DR3	17226.0	177	0	3049002.0	9.8E-07*
EM1	15876.0	137	0	2175012.0	1.4E-06*
FP1	15348.0	137	0	2102676.0	1.4E-06*
FI1	17024.0	145	1	2468480.0	4.1E-07
MD1	18126.0	121	1	2193246.0	4.6E-07
NM1	16060.0	129	0	2071740.0	1.4E-06*
OC1	16142.0	137	0	2211454.0	1.4E-06*
PB2	13776.0	185	0	2548560.0	1.2E-06*
PB3	14885.0	185	0	2753725.0	1.1E-06*
PI1	13412.0	145	1	1944740.0	5.1E-07
QC1	15547.0	177	1	2751819.0	3.6E-07
QC2	16750.0	177	0	2964750.0	1.0E-06*
VY1	17311.0	89	0	1540679.0	1.9E-06*
			TOTALS	19	48179845.0

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FALLTS INVOLVING POD MOTION WHEN NO MOTION IS DESIRED (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOOR RATE
BV1	9106.0	53	0	482618.0	6.2E-06*
DC1	16401.0	53	0	869253.0	3.4E-06*
DC2	770.0	53	0	40810.0	7.3E-05*
HN1	18030.0	45	0	811350.0	3.7E-06*
IP2	10995.0	61	1	670695.0	1.5E-06
IP3	11694.0	61	0	713324.0	4.2E-06*
JF1	3079.0	53	0	163187.0	1.8E-05*
KE1	16994.0	23	0	560802.0	5.3E-06*
NA1	410.0	53	0	21730.0	1.4E-04*
PR1	16859.0	27	0	623783.0	4.8E-06*
PR2	17531.0	27	0	648647.0	4.6E-06*
PT1	18041.0	27	0	667517.0	4.5E-06*
PT2	17964.0	27	0	664668.0	4.5E-06*
RG1	14639.0	23	7	483087.0	1.4E-05
RC2	16245.0	41	0	666045.0	4.5E-06*
SA1	4368.0	53	0	231504.0	1.3E-05*
SO1	14325.0	45	0	644625.0	4.6E-06*
SU1	15487.0	53	1	820811.0	1.2E-06
SU2	13160.0	53	0	697480.0	4.3E-06*
TR1	12539.0	61	0	764879.0	3.9E-06*
TU3	15712.0	53	0	832736.0	3.6E-06*
TU4	14145.0	53	0	749685.0	4.0E-06*
ZI1	15178.0	53	0	804434.0	3.7E-06*
ZI2	13657.0	53	0	723821.0	4.1E-06*
TOTALS			9	14357501.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAULTS INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	1.2
EAB.6WIL.	1.0E-05
	1.2
	1.5
COMB.ENG.	2.7E-06
	1.6
	1.5
GEN.ELEC.	3.9E-07
	1.5
	1.7
WESTINGH.	6.3E-07
	1.9
	1.2
FWR'S	3.3E-06
	1.2
	1.2
OVERALL	1.5E-06
	1.2

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURES INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED; 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
AR1	20009.C	69	0	1380621.0	2.2E-06*
CR3	7430.C	69	1	512670.0	2.0E-06
DB1	4129.C	57	0	235353.0	1.3E-05*
GE1	30392.C	69	0	2097048.0	1.4E-06*
GE2	21755.C	69	2	1501099.0	1.3E-06
OE3	22921.C	69	1	1581549.0	6.3E-07
RS1	14543.C	69	0	1003467.0	3.0E-06*
TI1	24929.C	69	1	1720101.0	5.8E-07
TI2	342.C	69	0	23598.0	1.3E-04*
TOTALS			5	10055502.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURES INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED; 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	20739.C	85	3	1762815.0	1.7E-06
CC2	9162.C	85	2	778770.0	2.6E-06
FC1	32123.C	49	1	1574027.0	6.4E-07
MI2	14906.C	81	0	1207386.0	2.5E-06*
MY1	40408.0	85	0	3434680.0	8.7E-07*
SL1	9903.C	81	3	802143.0	3.7E-06
TOTALS			9	9559821.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURES INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED; 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	PCP.HOURS	STANDBY HOUR RATE
BF1	15553.0	185	0	2877305.0	1.0E-06*
BF2	12326.0	185	0	2280310.0	1.3E-06*
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	38622.0	82	0	1235904.0	2.4E-06*
BR1	7544.0	187	0	1033528.0	2.9E-06*
BR2	14576.0	187	3	1996912.0	1.5E-06
CC1	27641.0	187	1	3786817.0	2.6E-07
DA1	22487.0	89	0	2001343.0	1.5E-06*
CR1	35600.0	180	4	2848000.0	1.4E-06
DR2	39390.0	177	17	6972030.0	2.4E-06
DR3	41057.0	177	0	7267089.0	4.1E-07*
EN1	23634.0	187	0	3237858.0	9.3E-07*
FP1	18189.0	187	0	2491893.0	1.2E-06*
MI1	39560.0	145	1	5736200.0	1.7E-07
MO1	44190.0	121	0	5346990.0	5.6E-07*
NM1	41084.0	129	0	5299836.0	5.7E-07*
OC1	42170.0	137	0	5777290.0	5.2E-07*
PB2	24563.0	185	0	4544155.0	6.6E-07*
PB3	22737.0	185	0	4206345.0	7.1E-07*
PI1	31756.0	145	1	4604620.0	2.2E-07
QC1	37446.0	177	0	6627942.0	4.5E-07*
QC2	39780.0	177	0	7041060.0	4.3E-07*
VY1	39826.0	89	0	3544514.0	8.5E-07*
TOTALS			27	92893766.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



FAILURES INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED; 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BV1	9106.C	53	0	482618.0	6.2E-06*
DC1	22795.C	53	0	1208135.0	2.5E-06*
DC2	770.C	53	0	40810.0	7.3E-05*
HN1	45574.C	45	0	2050830.0	1.5E-06*
IP2	21387.C	61	1	1304607.C	7.7E-07
IP3	11694.C	61	0	713334.0	4.2E-06*
JF1	3079.C	53	0	163187.0	1.8E-05*
KE1	28727.0	53	0	947991.0	3.2E-06*
NA1	410.C	53	0	21730.0	1.4E-04*
PR1	28913.0	57	0	1069781.0	2.8E-06*
PR2	25020.0	57	0	925740.0	3.2E-06*
PT1	44738.C	57	0	1655306.0	1.8E-06*
PT2	45215.C	57	0	1672955.0	1.8E-06*
RG1	40932.C	53	0	1350756.0	2.2E-06*
RD2	43928.C	41	0	1801048.0	1.7E-06*
SA1	4368.C	53	0	231504.0	1.3E-05*
SO1	41777.C	45	0	1879965.0	1.6E-06*
SU1	31984.C	53	0	1695152.0	1.8E-06*
SU2	28790.C	53	0	1525870.0	2.0E-06*
TR1	12539.C	61	0	764879.0	3.9E-06*
TL3	36992.C	53	0	1960576.0	1.5E-06*
TL4	29791.0	53	0	1578923.0	1.9E-06*
ZI1	26612.C	53	0	1410436.C	2.1E-06*
ZI2	21735.C	53	0	1151955.0	2.6E-06*
		TOTALS	1	27608088.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAILURES INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED; 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	2.1
EAB.6WIL.	5.0E-07
	2.5
	1.7
COMB.ENG.	9.4E-07
	1.9
	1.4
GEN.ELEC.	2.9E-07
	1.4
	4.7
WESTINGH.	3.6E-08
	19.5
	1.5
FWR'S	3.2E-07
	1.6
	1.3
OVERALL	3.0E-07
	1.3

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAILTS RECORDED

FAULTS INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	PCP.HOURS	STANDBY HOUR RATE
AR1	20009.0	69	10	1380621.0	7.2E-06
CR3	7430.0	69	22	512670.0	4.3E-05
DB1	4129.0	57	0	235353.0	1.3E-05*
DE1	30392.0	69	2	2097048.0	9.5E-07
DE2	21755.0	69	24	1501095.0	1.6E-05
DE3	22921.0	69	20	1581549.0	1.3E-05
RS1	14543.0	69	1	1003467.0	1.0E-06
TI1	24929.0	69	2	1720101.0	1.2E-06
TI2	342.0	69	0	23598.0	1.3E-04*
			TOTALS	81	10055502.0

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FAULTS INVOLVING ROC ACTION WHEN NO ACTION IS DESIRED (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	20739.C	85	6	1762815.0	3.4E-06
CC2	9162.0	85	5	778770.0	6.4E-06
FC1	32123.0	49	2	1574027.0	1.3E-06
MI2	14906.C	81	1	1207386.0	8.3E-07
MY1	40408.C	85	0	3434680.0	8.7E-07*
SL1	8903.C	81	5	802143.0	6.2E-06
			<b>TOTALS</b>	<b>19</b>	<b>9559821.0</b>

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FALLTS INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED(COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	PDP.HOURS	STANDBY HOUR RATE
BF1	15553.C	185	0	2877305.0	1.0E-06*
BF2	12326.C	185	0	2280310.0	1.3E-06*
BF3	11545.C	185	0	2135825.0	1.4E-06*
BP1	38622.C	32	0	1235904.0	2.4E-06*
BR1	7544.C	127	1	1033528.0	9.7E-07
BR2	14576.C	127	3	1996912.0	1.5E-06
CO1	27641.0	127	1	3786817.0	2.6E-07
CA1	22487.C	189	3	2001343.0	1.5E-06
DP1	35600.C	180	4	2848000.0	1.4E-06
DR2	39390.C	177	19	6972030.0	2.7E-06
DR3	41057.0	177	0	7267089.0	4.1E-07*
EM1	23634.C	127	0	3237858.0	9.3E-07*
FP1	18189.C	127	0	2491893.0	1.2E-06*
MI1	39560.C	145	2	5736200.0	3.5E-07
MO1	44190.C	121	1	5346990.0	1.9E-07
NM1	41084.C	129	0	5299836.0	5.7E-07*
CC1	42170.C	127	0	5777290.0	5.2E-07*
PB2	24563.C	185	0	4544155.0	6.6E-07*
PB3	22737.C	185	0	4206345.0	7.1E-07*
PI1	31756.C	145	2	4604620.0	4.3E-07
QC1	37446.C	177	3	6627942.0	4.5E-07
QC2	39780.0	177	0	7041060.0	4.3E-07*
VY1	39826.C	89	1	3544514.0	2.8E-07
		TOTALS	40	92893766.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FALLTS INVOLVING ROD MOTION WHEN NO MOTION IS DESIRED (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BV1	9106.C	53	0	482618.0	6.2E-06*
DC1	22795.C	53	0	1208135.0	2.5E-06*
DC2	770.C	53	0	40810.0	7.3E-05*
HN1	45574.C	45	0	2050830.0	1.5E-06*
IP2	21387.C	61	1	1304607.0	7.7E-07
IP3	11694.C	61	0	713334.0	4.2E-06*
JF1	3079.C	53	0	163187.0	1.8E-05*
KE1	28727.C	33	0	947991.0	3.2E-06*
NA1	410.C	53	0	21730.0	1.4E-04*
PR1	24913.C	37	0	1069781.0	2.8E-06*
PR2	25020.C	37	0	925740.0	3.2E-06*
PT1	44738.C	37	1	1655306.0	6.0E-07
PT2	45215.C	37	0	1672955.0	1.8E-06*
RG1	40932.0	33	9	1350756.0	6.7E-06
RD2	43928.C	41	5	1801048.0	2.8E-06
SA1	4368.C	53	0	231504.0	1.3E-05*
SO1	41777.C	45	0	1879965.0	1.6E-06*
SU1	31984.0	53	1	1695152.0	5.9E-07
SU2	28790.C	53	0	1525870.0	2.0E-06*
TR1	12539.C	61	0	764879.0	3.9E-06*
TU3	26992.C	53	1	1960576.0	1.5E-06*
TU4	29791.C	53	1	1578923.0	6.3E-07
ZI1	26612.C	53	0	1410436.0	2.1E-06*
ZI2	21735.C	53	0	1151955.0	2.6E-06*
TOTALS			18	27608088.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

FALTS INVOLVING ROD MOTI<sup>ON</sup> WHEN NO MOTION IS DESIRED (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	1.2
EAB.6WIL.	8.1E-06
	1.2
	1.5
COMB.ENG.	2.0E-06
	1.5
	1.3
CEN.ELEC.	4.3E-07
	1.3
	1.5
WESTINGH.	6.5E-07
	1.5
	1.2
FWR'S	2.5E-06
	1.2
	1.1
OVERALL	1.1E-06
	1.1

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

APPENDIX AD

AGGREGATE OF ALL CRDM FAULTS FOR PLANTS WITH  
STANDARD TECHNICAL SPECIFICATIONS



FAILURE MODE CODES

CCDE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/C
B	FAILURE TO BCT TOP DURING SCRAM
C	FAIL TO INSERT TC AT LEAST 90% DURING SCRAM
D	RCC FAILS TO MOVE DURING POWER CHANGES/TESTING
E	RCC FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
F	CLIPPED ROD (PNR)
G	EXCESSIVE ROD/CONTROL TRAVEL CONDITION (BWR)
H	IMPROPER ROD MOVEMENT
I	EXTERNAL LEAKAGE/KLPTURF
J	RODS NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
K	MAINTENANCE/REPLACEMENT REQUIRED
L	TECHNICAL SPECIFICATION VIOLATION (NON-FAILURES)

COMPONENT CODE

CCDE	DESCRIPTION
CC	CONTROL ROD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CCDE	DESCRIPTION
E	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
R	RECURRING FAILURES
F	COMMON FAULT
T	RECURRING COMMON FAULTS

FAILURE MECHANISM CODES

CCDE	DESCRIPTION
CC	UNKNOWN
OP	PERSONNEL (OPERATIONS)
MA	PERSONNEL (MAINTENANCE)
TE	PERSONNEL (TESTING)
DE	DESIGN ERROR
AB	MANUFACTURING/CONSTRUCTION/C.C.
PD	PROCEDURAL DISCREPANCIES
NR	NORMAL WEAR
EX	EXCESSIVE WEAR
CR	CORROSION
CM	CREAKING MATERIAL CONTAMINATION
CV	EXCESSIVE VIBRATION
RM	ROOM MOTOR FAILURE
SA	SAFETY FAILURE
MI	MISALIGNED INTERNALS
LU	LUBRICATION FAILURE
BR	BRAKE FAILURE
ST	STARTING FAILURE
IL	FILTER/STRAINER PLUGGED
IN	INDICATING/SEIZURE
CS	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
CT	CONTROL CIRCUIT FAILURE/PROBLEM
WA	WATER PUMP FAILURE/PROBLEM
WE	WELD FAILURE
LB	LUBRICATION PROBLEM

SYSTEM CODE

CCDE	DESCRIPTION
	PWR
P	REACTIVITY CONTROL SYSTEM
	BWR
P	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CCDE	DESCRIPTION
D	DEMAND
T	TIRE
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CCDE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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

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 AGGREGATE OF ALL CRDM FAULTS FOR PLANTS WITH STAND. TECH. SPECS.  
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PLANT	CCNT. NO.	FAIL DATE	SYS	COMP	FAIL CODE	TYPE	CLASS	FAIL	FAILURE MODE	FAILURE MECHANISM
B CR3	C18405	040477	M	CD	E12	R	D		RCD 6 GR 7 WOULD NOT MOVE WHEN REDUCING PWR	CRDM STATOR FAILED / FUSE BLEW
B CR3	C18403	040677	M	CD	G12	R	D		IN MODE 1, FCC 3 GR 2 DROPPED INTO CORE	FAILURE OF CRDM STATOR CAUSED WCD TO DROP
B CR3	C17943	042777	M	CD	IC1	S	D		RCD GROUP 6 EXCEEDED ITS INSERTION LIMIT (T.S.)	PERSONNEL ERROR (COMMAND FAULT)
B CR3	C17944*	042777	M	CD	G21	T	D	02	IN MODE 1, RCD GRP 7 DROPPED INTO CORE	POSSIBLE GROUNDED SHIELD TO 24VLT PROG
B CR3	C17941*	051377	M	CD	G21	T	D	09	IN MODE 1, GROUP 7 DROPPED INTO CORE	POSSIBLE DESIGN ERROR, GATE DRIVE REL. CKT.
B CR3	C17937*	060177	M	CD	E21	S	D	29	CRD SYS. FAILED TO POSIT. REG. RCDs ON AUTO DEMAND	LOOSE CONNec. ON CRD PROG. PRINT. CKT. CARD
B CR3	C19429*	101677	M	CD	G21	T	D	09	IN MODE 1, DURING TEST SP-110 GRP. 7 DROP INTO CORE	RANDOM INTERMITTENT POWER INTERRUPTIONS
B CR3	C207E1	030678	M	CD	L00			U	17 LOOSE PARTS IDENT AS COUPLG6SPID ASSEM RCD B-47	CAUSE OF LOOSE PARTS UNDETERMINED
C CC1	C16741	121276	M	CC	G00	R	L		RCD 27 SLIPPED TO 77 INCH. DURING MOVEMENT TESTS	UNDETERMINED ( SEE LER 019689 )
C CC1	C17710	042277	M	CC	G00	R	L		RCD 34 SLIPPED TO 34 INCH. DURING MOVEMENT TESTS	UNDETERMINED ( SEE LER 019689 )
C CC1	C19689A	111277	M	CC	G21	T	D		WHILE AT SS PWR AT 2404AM CEA 54 DROP TO FULL-IN	15-VLT PWR. SUP. IN COIL PWR. PROG. DRIFT LOW
C CC1	C19689B	111277	M	CC	G21	T	D		WHILE AT SS PWR AT 11:14AM CEA 54 DROP TO FULL-IN	15-VLT PWR. SUP. IN COIL PWR. PROG. DRIFT LOW
C CC1	C197F1	120377	M	CC	G00	R	L		RCD 1 DROPPED WHILE PULLING GROUP 5	UNKNOWN
C CC1	C20171	010278	M	CC	G21	T	D		WHILE AT SS PWR CEA 32 DROPPED TO FULLY INSERTED	CEA 15-VLT PWR. SUP. FAILED
C CC2	C18300A	070577	M	CC	G21	T	D		WHILE GPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTEN FAIL. OF 15VDC POWER SUPPLY
C CC2	C18300B	070777	M	CC	G21	T	D		WHILE CFER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTEN FAIL. OF 15VDC POWER SUPPLY
C CC2	C19279	100277	M	CC	G21	T	D		DURING FULL PWR. OPS. CEA 37 DROPPED TO FULLY INS.	15 VLT PWR SUPPLY FAILED LOW
C CC2	C19693	111177	M	CC	E21	S	D		CEA 36 WOULD NOT MOVE THEN DROPPED WHILE AT SS PWR	DEFECT. TIMER MOD. IN COIL PWR PROGRAMMER
C CC2	C20228	012178	M	CC	G00	R	L		RCD 1 DROPPED DURING POWER REDUCTION	UNKNOWN
C CC2	C20561	021578	M	CC	G00	R	L		RCD 33 DROPPED DURING MONTHLY EXER. TESTS	UNKNOWN

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 AGGREGATE OF ALL CRDM FAILTS FOR PLANTS WITH STAND.TECH.SPECS.  
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VE N	PL ANT Y	CONT.NU.	FAIL DATE	S Y S	C O M P	FAIL CODE	T Y P E	C L A S S	F A I L R	FAILURE MODE	FAILURE MECHANISM
C	M12	C16030	092276	M	CD	G21	S	D		DURING CEA PARALLEL OPS., CEA 49 DROPPED INTO CORE	BLOWN FUSE IN PARALLELING CIRCUIT
C	SL1	C14999	052576	M	CD	E21	S	D		REGULATING RCD 59 IMMOVABLE BECAUSE OF CEA MOD.MAL	FAILURE IN RAISE/LOWER CKT OF THE MODULE
C	SL1	C15508	071076	M	CD	G21	T	D		CEA 50 DROPPED WITH RX. CRIT. AT 0.01% PWR.	FAILURE OF 15 VOLT POWER SUPPLY
C	SL1	C17200	020477	M	CD	G00	R	L		CEA #60 DROPPED WHILE AT POWER	THE CAUSE IS UNKNOWN
C	SL1	C18066	052777	M	CD	G21	T	D		CEA 39 DROPPED WITH PLANT OPERATING AT POWER	FAULTY INSERTION TIMER
C	SL1	C19576A	102877	M	CD	G00	R	L		CEA #56 DROPPED FOR NO APPARENT REASON	CAUSE UNKNOWN, POSS. PROB. PWR. SUP. ETIME. MOD
C	SL1	C19576B	102877	M	CD	G00	R	L		CEA #56 DROPPED FOR NO APPARENT REASON	CAUSE UNKNOWN, POSS. PROB. PWR. SUP. ETIME. MOD
C	BR1	C16935	010977	M	CD	I01	S	D		OPERATOR PULLED RODS TO NOTCH 48 INSTEAD OF 24	PERSONNEL ERROR/MINIMIZER FAILED TO BLOCK
C	BR2	C20636A	033178	M	CD	H1P	C	D		RCD 22-19 UNCOUPLED FROM DRIVE MECHANISM	ROD DRIVE MECH. INNER FILTER CAME LOOSE
C	BR2	C20636B	033178	M	CD	H1B	C	D		RCD 26-39 UNCOUPLED FROM DRIVE MECHANISM	ROD DRIVE MECH. INNER FILTER CAME LOOSE
N	DC1	C14550	051176	M	CD	K19	R	L		1 OR 2 RCD FINGERS STUCK / SEPARATED FROM SPIDER	ROD FINGERS BROKE WHEN FREEING RCD E-3
	TR1	C14500*	040476	M	CD	K21	T	D	03	ALL DIGITAL RCD POSITION INDIC. WAS LOST, 3 TIMES	FAILURES OF ELEC.COMP. DUE TO OVERHEATING
N	TR1	C18906*	062177	M	CD	E21	S	D	13	LOSS OF RCD CONTROL AFFECTING 13 OF PLANTS 53 RCDs	FAILURE OF SUPERVISORY BUFFER MEM. CARD

AGGREGATE OF ALL CRDM FAILURES FOR PLANTS WITH STAND.TECH.SPECS.; 1/1/76 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CR3	7430.0	69	3	512670.0	5.9E-06
DB1	4129.0	57	0	235353.0	1.3E-05*
T12	342.0	69	0	23598.0	1.3E-04*
TOTALS			3	771621.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAILURES FOR PLANTS WITH STAND.TECH.SPECS.; 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	15903.0	65	3	1351755.0	2.2E-06
CC2	9162.0	65	2	778770.0	2.6E-06
M12	13567.0	61	0	1098927.0	2.7E-06*
SL1	9903.0	61	3	802143.0	3.7E-06
TOTALS			8	4031595.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAILURES FOR PLANTS WITH STAND.TECH.SPECS.; 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BR1	7544.0	137	0	1033528.0	2.9E-06*
BR2	13226.0	137	2	1811962.0	1.1E-06
		TOTALS	2	2845490.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAILURES FOR PLANTS WITH STAND.TECH.SPECS.; 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BV1	9106.0	53	0	482618.0	6.2E-06*
DC1	16401.0	53	1	869253.0	1.2E-06
DC2	770.0	53	0	40810.0	7.3E-05*
JF1	3079.0	53	0	163187.0	1.8E-05*
NA1	410.0	53	0	21730.0	1.4E-04*
SA1	4368.0	53	0	231504.0	1.3E-05*
TR1	12539.0	61	0	764879.0	3.9E-06*
		TOTALS	1	2573981.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CSDM FAILURES FOR PLANTS WITH STAND. TECH. SPECS. 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	2.6
EAB.&WIL.	3.9E-06
	3.7
	1.8
COMB.ENG.	2.0E-06
	2.0
	3.1
GEN.ELEC.	7.0E-07
	5.6
	4.7
WESTINGH.	3.9E-07
	19.5
	1.6
FNR'S	1.6E-06
	1.7
	1.6
OVERALL	1.4E-06
	1.7

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAILTS RECORDED

AGGREGATE OF ALL CRDM FAULTS FOR PLANTS WITH STAND.TECH.SPECS. (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CR3	7430.0	69	53	512670.0	1.0E-04
GB1	4129.0	57	0	235353.0	1.3E-05*
TI2	342.0	69	0	23598.0	1.3E-04*
TOTALS			53	771621.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAULTS FOR PLANTS WITH STAND.TECH.SPECS. (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	15903.0	85	6	1351755.0	4.4E-06
CC2	9162.0	85	6	778770.0	7.7E-06
MI2	13567.0	81	1	1098927.0	9.1E-07
SL1	9903.0	81	6	802143.0	7.5E-06
TOTALS			19	4031595.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAULTS FOR PLANTS WITH STAND.TECH.SPECS. (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BR1	7544.0	137	1	1033528.0	9.7E-07
BR2	13226.0	137	2	1811962.0	1.1E-06
TOTALS			3	2845490.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CPM FAULTS FOR PLANTS WITH STAND.TECH.SPECS. (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BV1	9106.0	53	0	482618.0	6.2E-06*
DC1	16401.0	53	1	869253.0	1.2E-06
DC2	770.0	53	0	40810.0	7.3E-05*
JF1	3079.0	53	0	163187.0	1.8E-05*
NA1	410.0	53	0	21730.0	1.4E-04*
SA1	4368.0	53	0	231504.0	1.3E-05*
TR1	12539.0	61	16	764879.0	2.1E-05
TOTALS			17	2573981.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



AGGREGATE OF ALL CRDM FAULTS FOR PLANTS WITH STAND.TECH.SPECS. (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/76

FINAL STATISTICS

	STANDBY HOURLY RATE
	1.3
EAB.6WIL.	6.9E-05
	1.3
	1.5
COMB.ENG.	4.7E-06
	1.5
	2.6
CEN.ELEC.	1.1E-06
	3.7
	1.5
WESTINGH.	6.6E-06
	1.6
	1.2
FWR'S	1.2E-05
	1.2
	1.2
OVERALL	9.0E-06
	1.2

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

APPENDIX AE

AGGREGATE OF ALL CRDM FAULTS FOR PLANTS WITH  
NON-STANDARD TECHNICAL SPECIFICATIONS

FAILURE MODE CODES

CCDE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/C
A	FAILURE TO INSERT DURING SCRAM
A	FAIL TO INSERT TC AT LEAST 90% DURING SCRAM
F	RCD FAILS TO MOVE DURING POWER CHANGES/TESTING
F	RCD FAILS TO WITHDRAW FROM FULLY INSERTED POSITION
C	CRIPPED ROD (PWR)
C	INCORRECT RCD/COVER TRAVEL CONDITION (BWR)
C	IMPROPER ROD MOVEMENT
C	EXTERNAL LEAKAGE/CRACKURE
C	CVES NOT OPERATE PROPERLY (SPECIFIC MODE NOT IDENTIFIABLE)
M	MAINTENANCE/REPLACEMENT REQUIRED
M	TECHNICAL SPECIFICATION VIOLATION (MCM-FAILURES)

COMPONENT CODE

CCDE	DESCRIPTION
CC	CONTROL RCD DRIVE ASSEMBLY

TYPE OF FAILURE CODES

CLCE	DESCRIPTION
B	RECURRING COMMON CAUSE FAILURES
C	COMMON CAUSE FAILURES
R	RECURRING FAILURES
M	COMMON FAULTS
M	RECURRING COMMAND FAULTS

FAILURE MECHANISM CODES

CCDE	DESCRIPTION
CC	UNKNOWN
C1	PERSONNEL (OPERATIONS)
C2	PERSONNEL (MAINTENANCE)
C3	PERSONNEL (TESTING)
C4	DESIGN ERROR
C5	FAB./CONSTRUCTION/C.C.
C6	PROCEDURAL DISCREPANCIES
C7	NORMAL WEAR
C8	EXCESSIVE WEAR
C9	CORROSION
C10	EXCESSIVE MATERIAL CONTAMINATION
C11	EXCESSIVE VIBRATION
C12	CDRM MOTOR FAILURE
C13	SEAL FAILURE
C14	WALLED/MISALIGNED INTERNALS
C15	CLUTCH FAILURE
C16	BEARING FAILURE
C17	BEARING FAILURE
C18	FILTER/STRAINER PLUGGED
C19	BINDING/SEIZURE
C20	FAILURE/FAULT OF COMPONENT SUPPLY SYSTEM
C21	CONTROL CIRCUIT FAILURE/PROBLEM
C22	FASTENER FAILURE/PROBLEM
C23	WELD FAILURE
C24	LUBRICATION PROBLEM

SYSTEM CODE

CCDE	DESCRIPTION
	PWR
M	REACTIVITY CONTROL SYSTEM
	BWR
M	REACTIVITY CONTROL SYSTEM

FAILURE CLASSIFICATION CODES

CODE	DESCRIPTION
D	DEMAND
T	TIRE
U	UNKNOWN
N	NOT APPLICABLE

ACTIVITY RESULTING IN DISCOVERY

CODE	DESCRIPTION
D	DEMAND ON COMPONENT
M	MAINTENANCE
N	NORMAL OPERATION/SURVEILLANCE
R	RECORD REVIEW
T	TESTING
U	UNKNOWN

NSSS VENDOR CODES

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

AGGREGATE OF ALL CROM FAULTS FOR PLANTS WITH NON-STAND. TECH. SPECS.

PLANT	CENT. NO.	FAIL DATE	SYST	COMP	FAIL CODE	TYPE	CLASS	FAULT	FAILURE MODE	FAILURE MECHANISM
E AP1	C21314*	042478	M	CD	G21	T	D	09	GROUP 7 CONTROL RODS DROPPED DURING PWR OPERATION	FAILURE OF A GATE DRIVE CIRCUIT
B CE2	C14013	022676	M	CD	GC4	R	T		DROPPED CONT. ROD CAUSED RX QUAD. TILT TO EX. TECH SP	SHRT. DUE TO DETER EPOXY IN STAT. WNDGS.
B CE2	C2C154	122977	M	CD	G12	R	T		CR4GR6 DROPPED WHILE BEING WITHDRAWN	SHRT. DUE TO O-RING FAIL. IN STAT. WNDGS.
B CE2	C26865*	030178	M	CD	G21	S	D	12	CONTROL ROD (GROUP 5) DROPPED DURING PERFORM. TEST	MOMENTARY LOSS OF POWER, REASON UNKNOWN
B CE2	C14818*	042276	M	CD	G21	T	D	09	GROUP 7 RODS DROPPED AT 95% POWER	A FAILED GATE DRIVE CIRCUIT
B CE3	C15010*	060976	M	CD	G21	T	D	09	GROUP 7 RODS DROPPED	TWO PWR. SUPPLIES FAILED (FUSE, TRANSISTOR)
B CE3	C20641	021078	M	CD	G12	R	T		CR3GR4 DROPPED DURING AN RPS BREAKER TEST	SHRT. DUE TO O-RING FAIL. IN STAT. WNDGS.
B RS1	C16011	100776	M	CD	IO1	S	D		RODS IN POSITION TO GIVE <1% DELTA K/K SHUTDOWN	PERSONNEL ERROR DURING COLD SHUTDOWN
G BF2	C15352	061976	M	CD	D20	S	D		ROD 30-31 INCAPABLE OF SCRAM/HCU VALVES SHUT	COMMAND FAULT/PERSONNEL ERROR
G BF1	C18924*	082377	M	CD	KCC	B	L	03	3 CROM WITHDRAWAL TINES WERE LESS THAN TECH. SPEC.	CAUSE UNKNOWN
G BF1	C19725	111177	M	CD	ECC	R	L		UNABLE TO WITHDRAW ROD B4 FROM POS 5 TO 6	UNKNOWN/POSSIBLY A FOREIGN OBJ. BINDING IT
G BF1	C20924	032078	M	CD	J13	T			LEAKAGE FROM ROD F3 DRIVE FLANGE	O-RING SEAL FAILURE
G CC4	C16583	052977	M	CD	H02	C	D		UNCOUPLING ROD AND SPUD FINGERS BENT	IMPROPER ASSEMBLY BY MAINTAINANCE PERSON
G DR1	016266	061577	M	CD	B10	T			CRD G-9 INSERTED TO OD THEN DRIFTED TO POSITION 12	PROB. CAUSE OF MALFUNC. WAS FOR. MAT. CONTAM.
G DR2	C14529	041376	M	CD	IO3	T	D		RODS EXERCISED/RX VESSEL OPEN/PERSONNEL IN AREA	PERSONNEL FAILED TO EVACUATE AREA
G DR2	C17177A	121276	M	CD	H18	B	L		CRD F-5 UNCCPLED FOLLOWING 50% CORE SCRAM TESTING	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C17177B	121276	M	CD	H18	B	L		CRD F-5 UNCCPLED FOLLOWING SCRAM & WITHDRAWL	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C169C7A	122676	M	CD	H18	B	L		CRD J-11 UNCCPLED DURING ROUTINE S/U AT POS. 48	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C169C7B	122676	M	CD	H18	B	L		CRD J-11 UNCCPLED AFTER INSERT. & WITHDRAW. TO POS. 48	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C17515	040277	M	CD	H18	B	L		CRD L-5 UNCCPLED WHEN WITHDRAWN DURING STARTUP	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C17516	040277	M	CD	H18	B	L		CRD H-8 UNCCPLED WHEN WITHDRAWN DURING STARTUP	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C16182	060577	M	CD	H18	B	L		CRD L-5 UNCCPLED WHEN WITHDRAWN DURING STARTUP	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C18450*	070977	M	CD	C13	C	L	46	46 CRODS FAILED TO FULLY INSERT FOLLOWING A SCRAM	WORN OR DETERIORATED STOP PISTON SEALS
G DR2	C16933A	060277	M	CD	H18	B	L		CRD F-5 UNCCPLED WHEN WITHDRAWN AFTER SCRAM TEST	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C16933B	060277	M	CD	H18	B	L		CRD H-7 UNCCPLED WHEN WITHDRAWN AFTER SCRAM TEST	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G DR2	C19652	110277	M	CD	H18	B	L		CRD H-5 UNCCPLED DURING FUNCTIONAL TEST	LOOSENEED INNER FILTER CAUSED UNCOUPLING
G PI1	C16343	111276	M	CD	IO3	S	D		IMPROPER ROD MOVEMENTS CAUSED INADVERTANT CRITICAL	PERSONNEL SELECTED WRONG RODS DURING TEST
G PG1	017363	022377	M	CD	IO6	S	D		IMPROPER ROD MOVEMENT RESULTED IN HIGH SUR SCRAM	DEFECTIVE PROCEDURES ON START-UP ROD SEQ.
G NP1	017671*	031077	M	CD	LOO	C	L	C3	FOUND LINEAR INDICAT. ON 3 COLLET RETAINER TUBES	CAUSE UNDER INVESTIGATION
G NP1	019404	162677	M	CD	DC2	S	D		CRD 26-51 FAILED TO INSERT WHEN RX WAS SCRAMMED	ACCUM. FOR CRD HAD IMPROP. VLV LINEUP

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 AGGREGATE OF ALL CROM FAILTS FOR PLANTS WITH NON-STAND.TECH.SPECS.  
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PLANT	CENT.NO.	FAIL DATE	TIME	CODE	FAIL CODE	TYPE	CLASS	FAILURE MODE	FAILURE MECHANISM
G PB2	C16763A	010277	M	CD	CCO	R	L	ROD 30-27 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G PB2	C16763B	010277	M	CD	CCO	R	L	ROD 54-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G PB3	C14724A	050676	M	CD	CCO	R	L	ROD 10-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G PB3	C14724B	052576	M	CD	CCO	R	L	ROD 10-23 DID NOT FULLY INSERT ON AUTO-SCRAM SIGNAL	SPECIFIC CAUSE NOT DETERMINED
G PB3	C19091A	092577	M	CD	DC1	S	D	ROD 02-27 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G PB3	C19091B	092577	M	CD	DC1	S	D	ROD 14-15 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G PB3	C19091C	092577	M	CD	DC1	S	D	ROD 18-03 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G PI1	C17773	050277	M	CD	H00		L	ROD 46-39 WAS WITHDRAWN BEYOND THE FULL OUT POSIT.	CAUSE UNDER INVEST. NEW LER TO BE SUBMIT.
G PI1	C18700	080677	M	CD	DCO		L	ROD 34-11 REMAINED FULL OUT WHEN RX WAS SCRAMMED	CAUSE UNDER INVEST. NEW LER TO BE SUBMIT.
G GC1	C15380	070976	M	CD	IC1	S	D	IMPROPER ROD MEVEMENT/2 PULLED SIMULTANEOUSLY	PERSONNEL ERROR
W HN1	C19894	110377	M	CD	L23	R	L	RCC SPIDER ASSEMBLY VANE FOUND SEPAR FROM RCC HLB	CAUSED BY FAULTY BRAZE JOINT
W IP2	C16071	052677	M	CD	GCC		L	ROD F-2 BANK D DROPPED DURING STARTUP	CAUSE UNKNOWN
W IP3	C16551	111876	M	CD	FCO		L	ROD D-8 BANK B BECAME MISALIGNED DURING NORMAL OPS	CAUSE UNKNOWN
W RC1	C14596*	041676	M	CD	G21	T	C 02	B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	FAILURE OF 4 P.C. CARDS POSSIBLE CAUSE
W RC1	C15098*	070476	M	CD	G21	T	C 02	B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	STATIONARY COIL CIRCUITRY FAILURE
W RC1	C15328*	080476	M	CD	G21	T	C 02	C BANK GROUP 2 RODS G-3 AND G-11 PARTIALLY DROPPED	STATIONARY COIL CIRCUITRY FAILURE
W RC1	C16644	121776	M	CD	G21	T	C	ROD F-12 DROPPED DURING OPER. AT REDUCED LOAD	FAILURE OF STATIONARY HOLD COIL CIRCUITRY
W RC1	C19595	111677	M	CD	E21	T	C	ROD CONTROL URGENT FAIL. ROD STOP ALARM LIT	RANDOM FAILURE OF 2 DEFECTIVE P.C. CARDS
W RC1	C19596	111877	M	CD	E21	T	C	ROD CONTROL URGENT FAILURE ROD ALARM LIT	STATIONARY REGULAT. FAIL. IN 1BD PWR.CAB.
W RU2	C19342	042477	M	CD	DCO		L	ROD N-9 DID NOT INSERT ON REACTOR TRIP	CAUSE IS UNKNOWN
W RC2	C20552*	021776	M	CD	J23	B	T 02	PINHOLE LEAKS ON 2 SEAL WELDS (D-4 AND G-7)	APPARENTLY THE RESULT OF WELD DEGRADATION
W SL1	C16677	081877	M	CD	G21	S	D	ROD J-13(SHLTCCWN BANK A)DROPPED DURING NORM. OPER	LOSS OF PWR TO STATION. GRIP COIL OF CROM

AGGREGATE OF ALL CRDM FAILURES FOR PLANTS WITH NON-STAND.TECH.SPECS.; 1/1/76 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
AR1	12946.0	69	0	893274.0	3.4E-06*
OE1	13620.0	69	0	939780.0	3.2E-06*
OE2	13196.0	69	2	910524.0	2.2E-06
OE3	15777.0	69	1	1088613.0	9.2E-07
RS1	12642.0	69	0	872298.0	3.4E-06*
TI1	14916.0	69	0	1029204.0	2.9E-06*
TOTALS			2	5733693.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAILURES FOR PLANTS WITH NON-STAND.TECH.SPECS.; 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
FC1	16130.0	49	0	790370.0	3.8E-06*
MY1	18606.0	85	0	1581510.0	1.9E-06*
TOTALS			0	2371880.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAILURES FOR PLANTS WITH NON-STAND. TECH. SPECS. 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BF1	10793.0	185	0	1996705.0	1.5E-06*
BF2	11809.0	185	0	2184665.0	1.4E-06*
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	13379.0	32	5	428128.0	1.2E-05
CO1	16617.0	137	1	2276529.0	4.4E-07
DA1	15981.0	89	0	1422309.0	2.1E-06*
DR1	15801.0	80	1	1264080.0	7.9E-07
DR2	16103.0	177	56	2850231.0	2.0E-05
DR3	17226.0	177	0	3049002.0	9.8E-07*
EN1	15876.0	137	0	2175012.0	1.4E-06*
FP1	15348.0	137	0	2102676.0	1.4E-06*
MI1	17024.0	145	0	2468480.0	1.2E-06*
MO1	18126.0	121	0	2193246.0	1.4E-06*
NM1	16060.0	129	3	2071740.0	1.4E-06
OC1	16142.0	137	0	2211454.0	1.4E-06*
PB2	13776.0	185	2	2548560.0	7.8E-07
PB3	14885.0	185	2	2753725.0	7.3E-07
PI1	13412.0	145	2	1944740.0	1.0E-06
QC1	15547.0	177	0	2751819.0	1.1E-06*
QC2	16750.0	177	0	2964750.0	1.0E-06*
VY1	17311.0	89	0	1540679.0	1.9E-06*
TOTALS			72	45334355.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAILURES FOR PLANTS WITH NON-STAND.TECH.SPECS.; 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
FN1	18030.0	45	1	811350.0	1.2E-06
TP2	10995.0	61	1	670695.0	1.5E-06
IP3	11694.0	61	1	713334.0	1.4E-06
KE1	16994.0	33	0	560802.0	5.3E-06*
PR1	16859.0	37	0	623783.0	4.8E-06*
PR2	17531.0	37	0	648647.0	4.6E-06*
PT1	18041.0	37	0	667517.0	4.5E-06*
PT2	17964.0	37	0	664668.0	4.5E-06*
RG1	14639.0	23	0	483087.0	6.2E-06*
RD2	16245.0	41	3	666045.0	4.5E-06
SD1	14325.0	45	0	644625.0	4.6E-06*
SU1	15487.0	53	0	820811.0	3.6E-06*
SU2	13160.0	53	0	697480.0	4.3E-06*
TU3	15712.0	53	0	832736.0	3.6E-06*
TU4	14145.0	53	0	749685.0	4.0E-06*
Z11	15178.0	53	0	804434.0	3.7E-06*
Z12	13657.0	53	0	723821.0	4.1E-06*
TOTALS			6	11783520.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



AGGREGATE OF ALL CRDM FAILURES FOR PLANTS WITH NON-STAND. TECH. SPECS.: 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	2.6
EAB. & WIL.	5.2E-07
	3.7
COMB. ENG.	1.3E-06*
	1.2
CEN. ELEC.	1.6E-06
	1.2
	2.0
WESTINGH.	5.1E-07
	2.3
	1.7
FWR'S	4.5E-07
	1.9
	1.2
OVERALL	1.2E-06
	1.2

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAULTS FOR PLANTS WITH NON-STAND.TECH.SPECS. (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
AR1	12946.0	69	9	893274.0	1.0E-05
DE1	13620.0	69	0	939780.0	3.2E-06*
DE2	13196.0	69	14	910524.0	1.5E-05
DE3	15777.0	69	19	1088613.0	1.7E-05
RS1	12642.0	69	1	872298.0	1.1E-06
T11	14916.0	69	0	1029204.0	2.9E-06*
TOTALS			43	5733693.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAULTS FOR PLANTS WITH NON-STAND.TECH.SPECS. (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
FC1	16130.0	69	0	790370.0	3.8E-06*
MY1	18606.0	65	0	1581510.0	1.9E-06*
TOTALS			0	2371880.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CROM FAULTS FOR PLANTS WITH NON-STAND. TECH. SPECS. (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT. HRS.	POPULATION	FAULTS	POP. HOURS	STANDBY HOUR RATE
BF1	10793.0	185	0	1996705.0	1.5E-06*
BF2	11809.0	185	1	2184665.0	4.6E-07
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	13379.0	32	5	428128.0	1.2E-05
CO1	16617.0	137	1	2276529.0	4.4E-07
DA1	15981.0	89	0	1422309.0	2.1E-06*
DR1	15801.0	80	1	1264080.0	7.9E-07
DR2	16103.0	177	57	2850231.0	2.0E-05
DR3	17226.0	177	0	3049002.0	9.8E-07*
EN1	15876.0	137	0	2175012.0	1.4E-06*
FP1	15348.0	137	0	2102676.0	1.4E-06*
MI1	17024.0	145	1	2468480.0	4.1E-07
MO1	18126.0	121	1	2193246.0	4.6E-07
NM1	16060.0	129	4	2071740.0	1.9E-06
OC1	16142.0	137	0	2211454.0	1.4E-06*
PB2	13776.0	185	2	2548560.0	7.8E-07
PB3	14885.0	185	5	2753725.0	1.8E-06
PI1	13412.0	145	2	1944740.0	1.0E-06
QC1	15547.0	177	1	2751819.0	3.6E-07
QC2	16750.0	177	0	2964750.0	1.0E-06*
VY1	17311.0	89	0	1540679.0	1.9E-06*
TOTALS			81	45334355.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CROM FAULTS FOR PLANTS WITH NON-STAND.TECH.SPECS. (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	PCP.HOURS	STANDBY HOUR RATE
HNI	18030.C	45	1	811350.0	1.2E-06
IP2	10995.C	61	1	670695.0	1.5E-06
IP3	11694.C	61	1	713334.0	1.4E-06
KE1	16994.C	33	0	560802.0	5.3E-06*
PR1	16859.C	37	0	623783.0	4.8E-06*
FR2	17531.0	37	0	648647.0	4.6E-06*
PT1	18041.0	37	0	667517.0	4.5E-06*
PI2	17964.0	37	0	664668.0	4.5E-06*
RG1	14639.C	33	9	483087.0	1.9E-05
RO2	16245.C	41	3	666045.0	4.5E-06
SC1	14325.C	45	0	644625.0	4.6E-06*
SU1	15487.C	53	1	820811.0	1.2E-06
SU2	13160.0	53	0	697480.0	4.3E-06*
TU3	15712.0	53	0	832736.0	3.6E-06*
TL4	14145.0	53	0	749665.0	4.0E-06*
ZI1	15178.0	53	0	804434.0	3.7E-06*
ZI2	13657.0	53	0	723821.0	4.1E-06*
TOTALS			16	11783520.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAULTS FOR PLANTS WITH NON-STAND.TECH.SPECS. (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	1.3
EAB.6WIL.	7.5E-06
	1.3
COMB.ENG.	1.3E-06*
	1.2
GEN.ELEC.	1.8E-06
	1.2
	1.5
WESTINGH.	1.4E-05
	1.6
	1.2
PWR'S	3.0E-06
	1.3
	1.2
OVERALL	2.1E-06
	1.2

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

APPENDIX AF

AGGREGATE OF ALL CRDM FAULTS



FAILURE MODE CODES		FAILURE MECHANISM CODES		FAILURE CLASSIFICATION CODES	
CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION
A	FAILURE TO INSERT DURING NORMAL S/D	00	UNKNOWN	D	DEMAND
B	FAILURE TO INSERT DURING SCRAM	01	PERSONNEL (OPERATIONS)	E	TIME
C	FAILURE TO INSERT AT LEAST 90% DURING SCRAM	02	PERSONNEL (MAINTENANCE)	U	UNKNOWN
D	RCC FAILS TO MOVE DURING	03	PERSONNEL (TESTING)	N	NOT APPLICABLE
E	POWER CHANGES/TESTING	04	DESIGN ERROR		
F	RCC FAILS TO WITHDRAW	05	LABOR/CONSTRUCTION/C.C		
G	RCC FULLY INSERTED POSITION	06	PROCEDURAL DISCREPANCIES		
H	CRIPPED RCC (PWR)	07	NORMAL WEAR		
I	CRIPPED RCC (BWR)	08	EXCESSIVE WEAR		
J	EXCESSIVE ROD TRAVEL CONDITION (BWR)	09	CONTAMINATION		
K	EXCESSIVE ROD MOVEMENT	10	SYSTEM VIBRATION		
L	INTERNAL LEAKAGE/REPTURE	11	ROOM MOTOR FAILURE		
M	RCC NOT OPERATE PROPERLY	12	VALVE FAILURE		
N	EXCESSIVE ROD TRAVEL	13	MISALIGNED INTERNALS		
O	MAINTENANCE/REPLACEMENT (FIABLE)	14	CLUSTER FAILURE		
P	TECHNICAL SPECIFICATION VIOLATION	15	PLUGGED		
Q	(NON-FAILURES)	16	FAILURE		
		17	STRAY WIRE		
		18	INDENTURE		
		19	FAILURE		
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AGGREGATE OF ALL CROM FAILS

UNIT	CCNT	FAIL	SY	CD	ICB	SD	DESCRIPTION	FAILURE MODE	FAILURE MECHANISM
B AP1	010504	060974	M	CD	ICB	SD	IMPROP. MOVEMENT OF ROD 7-4 CAUSED HI S/U RATE TARP PROCEDURE FOR COND. TEST WAS INADEQUATE		
B AP1	021314*	042478	M	CD	G21	T D 09	GROUP 7 CONTROL RODS DROPPED DURING PWR OPERATION		FAILURE OF A GATE DRIVE CIRCUIT
B CP3	018405	040477	M	CD	E12	R D	ROD 6 GR 7 WOULD NOT MOVE WHEN REDUCING PWR		CROM STATOR FAILED / FUSE BLEW
B CR3	016403	040677	M	CD	G12	R D	IN MODE 1, ROD 3 GR 2 DROPPED INTO CORE		FAILURE OF CROM STATOR CAUSED ROD TO DROP
B CR3	017943	042777	M	CD	I01	S D	ROD GROUP 6 EXCEEDED ITS INSERTION LIMIT (T.S.)		PERSONNEL ERROR (COMMAND FAULT)
B CR3	017944*	042777	M	CD	G21	T D 02	IN MODE 1, ROD GRP 7 DROPPED INTO CORE		POSSIBLE GROUNDED SHIELD TO 24VLT PROG
B CR3	017943*	051377	M	CD	G21	T D 09	IN MODE 1, GRGUP 7 DROPPED INTO CORE		POSSIBLE DESIGN ERROR, GATE DRIVE REL. CKT.
B CR3	017937*	060177	M	CD	E21	S D 29	CRO SYS. FAILED TO POSIT. REG. RODS ON AUTO DEMAND		LOOSE CONNEX. ON CRO PROG. PRINT. CKT. CARD
B CR3	019429*	161677	M	CC	G21	T D 09	IN MODE 1, DOLKING TEST SP-110 GRP. 7 DROP INTO CORE		RANDOM INTERMITTENT POWER INTERRUPTIONS
B CR3	020781	030678	M	CD	LC0	U	LOOSE PARTS IDENT AS COUPLER SPID ASSEM ROD B-47		CAUSE OF LOOSE PARTS UNDETERMINED
B CE1	000417	100573	M	CD	IC1	S D	TECH SPEC ROD WITHDRAWAL LIMITS WERE EXCEEDED		PERSONNEL ERROR
B CE1	012286	010375	M	CC	I06	S D	RODS WERE MOVED WITHOUT CALCULATING O POWER WORTH		VENDOR/PERSONNEL PROCEDURES PROBLEM
B CE2	012293	011375	M	CD	I01	S D	IMPROPER ROD MOVEMENT CAUSED OVERLAP PROBLEM		PERSONNEL ERROR
B CE2	013202*	062575	M	CD	G00	S D 09	GR7 RODS DROFFED CAUSING LOSS OF REQUIRED OVERLAP		NO PROBLEM FOUND/PROBABLE COMMAND FAULT
B CE2	014813	022676	M	CD	G04	R T	DROPPED CONT. ROD CAUSED AX. QUAD. TILT TO EX. TECH SP		SHRT. DUE TO O-RING FAIL. IN STAT. WNDGS.
B CE2	020154	122977	M	CD	G12	R T	CR4GR6 DROPPED WHILE BEING WITHDRAWN		SHRT. DUE TO O-RING FAIL. IN STAT. WNDGS.
B CE2	020855*	030178	M	CD	G21	S D 12	CONTROL ROD GROUP 5 DROPPED DURING PERFORM. TEST		MOMENTARY LOSS OF POWER, REASON UNKNOWN
B CE3	012298	020975	M	CD	I01	S D	IMPROPER ROD MOVEMENT CAUSED OVERLAP PROBLEM		PERSONNEL ERROR/WRONG R/D POS MONITORED
B CE3	014818*	042276	M	CD	G21	T D 09	GROUP 7 RODS DROPPED AT 95% POWER		A FAILED GATE DRIVE CIRCUIT
B CE3	019010*	060976	M	CD	G21	T D 09	GROUP 7 RODS DROPPED		TWO PWR. SUPPLIES FAILED (FUSE, TRANSISTOR)
B CE3	020641	021078	M	CD	G12	R T	CR3GR4 DROPPED DURING AN RPS BREAKER TEST		SHRT. DUE TO O-RING FAIL. IN STAT. WNDGS.
B RS1	016011	100776	M	CD	IC1	S D	RODS IN POSITION TO GIVE SIX DELTA K/K SHUTDOWN		PERSONNEL ERROR DURING COLD SHUTDOWN
B Y11	012144	021075	M	CD	IC1	S D	OPERATED WITH ROD 6/6 LOWER THAN REST OF GROUP 6		PERSONNEL ERROR
B Y11	013684A	111275	M	CD	G12	U	ROD 4 OF GR 7 DROPPED INTO CORE DURING FULL PWR OP		FAILED STATOR WNDG CAUSED ROD 4 TO DROP
B Y11	013684B	111275	M	CD	K00	U	ROD 5 OF GR7 MISALIGNED MORE THAN 9 IN. INOPERABLE		NO CAUSE STATED FOR FAILURE
B Y11	013735	111475	M	CC	J02	S D	VENT FOUND OPEN ON CROM/GAS VENTED TO RX BUILDING		PERSONNEL ERROR/FAILED TO FOLLOW PROCED.
C CC1	016741	121276	M	CD	G00	R U	KCD 27 SLIPPED TO 77 INCH. DURING MOVEMENT TESTS		UNDETERMINED (SEE LER 019689)
C CC1	017710	042277	M	CD	G00	R U	KCD 34 SLIPPED TO 34 INCH. DURING MOVEMENT TESTS		UNDETERMINED (SEE LER 019689)
C CC1	019689A	111277	M	CD	G21	T D	WHILE AT 55 FWR AT 2104AM CEA 54 DROP. TO FULL-IN		15-VLT PWR. SUP. IN COIL PWR. PROG. DRIFT LOW
C CC1	019689B	111277	M	CD	G21	T D	WHILE AT 55 FWR AT 1114AM CEA 54 DROP. TO FULL-IN		15-VLT PWR. SUP. IN COIL PWR. PROG. DRIFT LOW

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 AGGREGATE OF ALL CROM FAULTS  
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PLANT	CONT. NO.	FAIL DATE	TIME	CD	FAIL CODE	TYPE	FAIL #	FAILURE MODE	FAILURE MECHANISM
C	CC1 015791	120377	M	CD	G00	R	L	ROD 1 DROPPED WHILE PULLING GROUP 5	UNKNOWN
C	CC1 020171	010278	M	CD	G21	T	D	WHILE AT SS PWR CEA 32 DROPPED TO FULLY INSERTED	CEA 15-VLT PWR.SUP. FAILED
C	CC2 018300A	070577	M	CD	G21	T	D	WHILE OPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTEN FAIL. OF 15VDC POWER SUPPLY
C	CC2 018300B	070777	M	CD	G21	T	D	WHILE OPER. AT FULL PWR. CEA 30 SLIPPED PARTIALLY	INTERMITTEN FAIL. OF 15VDC POWER SUPPLY
C	CC2 015279	100277	M	CD	G21	T	D	DURING FULL PWR. OPS. CEA 37 DROPPED TO FULLY INS.	15 VLT PWR SUPPLY FAILED LOW
C	CC2 019693	111177	M	CD	E21	S	D	CEA 36 WOULD NOT MOVE THEN DROPPED WHILE AT SS PWR	DEFECT. TIMER MOD. IN COIL PWR PROGRAMMER
C	CL2 020228	012178	M	CD	G00	R	U	ROD 1 DROPPED DURING POWER REDUCTION	UNKNOWN
C	CC2 020561	021578	M	CD	G00	R	U	ROD 33 DROPPED DURING MONTHLY EXER. TESTS	UNKNOWN
C	FC1 000233	060873	M	CD	I06	S	D	RODS WITHDRAWN WHICH REDUCED S/D MARGIN TO < 2.4	PROCEDURE BASED ON WRONG ROD WORTH CURVES
C	FC1 000406	081773	M	CD	G15		U	CEA 35 DROPPED TO ITS LOWER HARD STOP	CLUTCH COIL FAILED
C	M12 016030	092276	M	CD	G21	S	D	DURING CEA PARALLEL OPS. CEA 49 DROPPED INTO CORE	BLOWN FUSE IN PARALLELING CIRCUIT
C	SL1 014999	052576	M	CD	E21	S	D	REGULATING ROD 59 IMMOVABLE BECAUSE OF CEA MOD.MAL	FAILURE IN RAISE/LOWER CKT OF THE MODULE
C	SL1 015508	071076	M	CD	G21	T	D	CEA 50 DROPPED WITH RX. CRIT. AT 0.01R PWR.	FAILURE OF 15 VOLT POWER SUPPLY
C	SL1 017200	020477	M	CD	G00	R	U	CEA #60 DROPPED WHILE AT POWER	THE CAUSE IS UNKNOWN
C	SL1 018060	052777	M	CD	G21	T	D	CEA 39 DROPPED WITH PLANT OPERATING AT POWER	FAULTY INSERTION TIMER
C	SL1 019576A	102877	M	CD	G00	R	U	CEA #56 DROPPED FOR NO APPARENT REASON	CAUSE UNKNOWN, POSS. PROB. PWR. SUP. & TIME. MOD
C	SL1 019576B	102877	M	CD	G00	R	U	CEA #56 DROPPED FOR NO APPARENT REASON	CAUSE UNKNOWN, POSS. PROB. PWR. SUP. & TIME. MOD
G	BF1 000512	100473	M	CD	B18		T	ROD 26-55 DRIVE FAILED TO INSERT WHILE AT POWER	ROD DRIVE SYS HAD A DIRTY STRAINER
G	BF1 000512A	100473	M	CD	D20	S	D	ROD 54-27 WAS VALVED OUT WHILE FULLY WITHDRAWN	NO SUPPLY AVAILABLE TO SCRAM ROD(PERSONL)
G	BF2 015392	061976	M	CD	D20	S	D	ROD 30-31 INCAPABLE OF SCRAM/HCU VALVES SHUT	COMMAND FAULT/PERSONNEL ERROR
G	BP1 000903*	032374	M	CD	K00	B	U 06	6 CROM WITHDRAWAL TINES WERE LESS THAN TECH. SPEC.	CAUSE UNDER INVESTIGATION
G	BP1 010032	033174	M	CD	L08	R	T	DURING INSPEC ROD ROLLER MISSING, ROD BLADE C-6	EXCESSIVE WEAR OF SOFT PINS
G	BP1 010078*	050474	M	CD	K00	B	U 06	6 CROM WITHDRAWAL TINES WERE LESS THAN TECH. SPEC.	UNKNOWN/POSSIBLE DESIGN DEFICIENCY
G	BP1 010391A	060474	M	CD	F10	R	T	ROD C4 FAILED TO MOVE DURING PRE-STARTUP TEST	ROD BLADE ROLLER WEDGED IN DIXIE CUP
G	BP1 010391B	060574	M	CD	F10	R	T	ROD B5 WOULD NOT MOVE FROM FULL INSERTED	BOLT OR CAP SCREW WEDGED IN DIXIE CUP
G	BP1 012197	011775	M	CD	F10	R	T	SEMI-ANL CRD TEST - ROD B4 STUCK FULLY INSERTED	1-INCH BOLT WITH NUT LODGED IN THIMBLE
G	BP1 012209*	011875	M	CD	K00	B	U 04	4 CROM WITHDRAWAL TINES WERE LESS THAN TECH. SPEC.	CAUSE UNKNOWN
G	BP1 013157	072575	M	CD	F10	R	T	ROD E4 WOULD NOT WITHDRAW PROPERLY	POSSIBLY LODGED BY SMALL OBJECT IN INTERN
G	BP1 013723	111375	M	CD	D01	S	D	ROD INCAPABLE OF SCRAM/ACCUMULATOR VALVED OUT	PERSONNEL ERROR(INSTRUCTIONS REVISED)
G	BP1 018924*	082377	M	CD	K00	B	U 03	3 CROM WITHDRAWAL TINES WERE LESS THAN TECH. SPEC.	CAUSE UNKNOWN

AGGREGATE OF ALL CRDM FAULTS

VE N	PLANT	CENT.NO.	FAIL DATE	SYS	COMP	FAIL CODE	TYPE	CLASS	FAIL #	FAILURE MODE	FAILURE MECHANISM
G	BP1	019725	111177	M	CD	E00	R	C		UNABLE TO WITHDRAW ROD B4 FROM POS 5 TO 6	UNKNOWN/POSSIBLY A FOREIGN OBJ.BINDING IT
G	BP1	020934	032078	M	CD	J13		T		LEAKAGE FROM ROD F3 DRIVE FLANGE	O-RING SEAL FAILURE
G	BR1	016935	010977	M	CD	I01	S	D		OPERATOR PULLED RODS TO NOTCH 48 INSTEAD OF 24	PERSONNEL ERROR/MINIMIZER FAILED TO BLOCK
G	BR2	013629	052575	M	CD	H18		T		ROD 26-07 DRIFT FROM FULL INSERT TO FULL WITHDRAW	FOREIGN MATTER IN CRD COLLET PISTON AREA
G	BR2	020838A	033178	M	CD	H1P	C	D		ROD 22-19 UNCOUPLED FROM DRIVE MECHANISM	ROD DRIVE MECH. INNER FILTER CAME LOOSE
G	BR2	020838B	033178	M	CD	H18	C	D		ROD 26-39 UNCOUPLED FROM DRIVE MECHANISM	ROD DRIVE MECH. INNER FILTER CAME LOOSE
G	CO1	019583	052977	M	CD	H02	C	D		UNCOUPLING ROD AND SPUD FINGERS BENT	IMPROPER ASSEMBLY BY MAINTAINANCE PERSON
G	DA1	010428	070274	M	CD	I00	T	D		ROD 18-27 WITHDREW WITHOUT WITHDRAWL SIGNAL APPLID	EXACT CAUSE NOT STATED
G	DA1	010517	071674	M	CD	I00	T	D		ROD 06-23 WITHDREW WITHOUT WITHDRAWL SIGNAL APPLID	CAUSE UNKNOWN, BEING INVESTIGATED
G	DA1	010851	050674	M	CD	I21	T	D		ROD MOVED WITHOUT OPERATOR ACTION IN 2 INSTANCES	PROB. CAUSE, NOISE SPIKES IN RWCS OR TIMER
G	DA1	013158A	081475	M	CD	C13	B	C		ROD 22-23 DID NOT FULLY INSERT FOLLOWING SCRAM	WORN OR LEAKING PISTON SEAL RINGS IN CRDM
G	DA1	013158B	081475	M	CD	C13	B	U		ROD 30-27 DID NOT FULLY INSERT FOLLOWING SCRAM	WORN OR LEAKING PISTON SEAL RINGS IN CRDM
G	DA1	013465A	092975	M	CD	C13	B	C		ROD 22-23 DID NOT FULLY INSERT FOLLOWING SCRAM	WORN OR LEAKING PISTON SEAL RINGS IN CRDM
G	DA1	013465B	092975	M	CD	C13	B	U		ROD 30-27 DID NOT FULLY INSERT FOLLOWING SCRAM	WORN OR LEAKING PISTON SEAL RINGS IN CRDM
G	DR1	010290	041074	M	CD	F22		L		CONTROL ROD BLADE F-1 WOULD NOT MOVE FROM FULL IN	CAP SCREW WAS LODGED IN GUIDE TUBE
G	DR1	010183	041274	M	CD	F10		T		CRD B-2 WOULD NOT FUNCTION WHEN GIVEN WITHDRAW SIG	HI CRUD LVL BELIEVED TO BE RESPONSIBLE
G	DR1	010430A	070474	M	CD	H00	B	U		ROD D4 MOVEMENT COULD NOT BE DETER. ON NUC.INSTRU.	UNDETERMINED
G	DR1	010430B	070474	M	CD	H00	B	U		ROD A5 MOVEMENT COULD NOT BE DETER. ON NUC.INSTRU.	UNDETERMINED
G	DR1	010430C	070474	M	CD	H00	B	U		ROD D10 MOVEMENT COULD NOT BE DETER.ON NUC.INSTRU.	UNDETERMINED
G	DR1	010429	071474	M	CD	H00	B	U		ROD A7 MOVEMENT COULD NOT BE DETER. ON NUC.INSTRU.	UNDETERMINED
G	DR1	018286	061577	M	CD	B10		T		CRD G-9 INSERTED TO 00 THEN DRIFTED TO POSITION 12	PROB.CAUSE OF MALFUNC.WAS FOR.MAT.CONTAM.
G	DR2	000284	021973	M	CD	H02	B	D		CRD L-11 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP.INSTAL. OF FILTER DAMAGE RETAIN.SPR
G	DR2	000285	021973	M	CD	H02	B	D		CRD K-8 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP.INSTAL. OF FILTER DAMAGE RETAIN.SPR
G	DR2	000286	021973	M	CD	H02	B	D		CRD B-6 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	IMPRP.INSTAL. OF FILTER DAMAGE RETAIN.SPR
G	DR2	000884	031474	M	CD	H00	R	U		CRD B-11 UNCOUPLED DURING SCRAM TEST	TO BE DETERMINED
G	DR2	010314	061574	M	CD	H00	R	U		CRD L-9 UNCOUPLED WHILE BEING WITHDRAWN	FAILURE MECHANISM NOT KNOWN
G	DR2	010751	102374	M	CD	H00	R	C		CRD P-12 UNCOUPLED WHILE BEING WITHDRAWN	FAILURE MECHANISM NOT KNOWN
G	DR2	010504	110274	M	CD	H00	P	U		CRD N-10 UNCOUPLED WHEN WITHDRAWN DURING STARTUP	FAILURE MECHANISM NOT KNOWN
G	DR2	010945*	110274	M	CD	C13	C	U	93	93 RODS INSERTED TO POS.02 FOLLOWING SCRAM	PROB. CAUSE EXCES.LEAK. PAST SEALS OF CRD
G	DR2	010945A	110274	M	CD	C13	C	L	03	3 CRDS FAILED TO GO TO POS 02 OR BELOW ON SCRAM	PROBABLE EXCESSIVE LEAKAGE PAST SEALS



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 AGGREGATE OF ALL CROM FAULTS  
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PLANT	CENT. NO.	FAIL DATE	SYS	COMP	FAIL CODE	TYPE	CLASS	FAILURE MODE	FAILURE MECHANISM
G PB3	0190916	092577	M CD	LC1	S D			ROD 14-15 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G PB3	0190910	092577	M CD	DC1	S D			ROD 18-03 FAILED TO FAST SCRAM WHEN REQUIRED TO	FAILURE DUE TO CLOSED CHG. WATER VALVES
G P11	000076A	030973	M CD	I20	S D			ROD 34-15 MOVED FROM 6IN. WITHDRAWN TO FULL-IN	MOVE. DUE TO HI-PRES. IN COOL. WTR. LINE
G P11	000076B	030973	M CD	K05	D			ROD 34-15 INTERFER WITH FUEL ELE.CHN. 1" FR.FUL-IN	UNCHAMFERED EDGE INTERFERS WITH FUEL CHN.
G P11	017773	050277	M CD	H00	U			ROD 46-39 WAS WITHDRAWN BEYOND THE FULL OUT POSIT.	CAUSE UNDER INVEST. NEW LER TO BE SUBMIT.
G P11	018700	080677	M CD	D00	U			ROD 34-11 REMAINED FULL OUT WHEN RX WAS SCRAMMED	CAUSE UNDER INVEST. NEW LER TO BE SUBMIT.
G GC1	000350	092173	M CD	I01	S D			IMPROPER ROD MOVEMENT/HEAT GENERATION RATE EXCEED	PERSONNEL ERROR/WRONG ROD SELECTED
G CC1	010859	101174	M CD	F13	D			ROD N-11 JAMMED FULLY INSERTED	FAIL. CAUSED BY BROKEN SEAL ON STOP PISTN
G GC1	012663	050375	M CD	I06	S D			IMPROPER ROD WITHDRAWL DURING REFUELING	INADEQUATE PROCEDURES
G GC1	015380	070976	M CD	IC1	S D			IMPROPER ROD MEVEMENT/2 PULLED SIMULTANEGUSLY	PERSONNEL ERROR
G VY1	000477	110773	M CD	IC3	S D			IMPROPER ROD MOVEMENT CAUSED INADVERTAN CRITICALTY	PERSONNEL ERRORS/INTERLOCKS JUMPERED/TEST
W CC1	014550	051176	M CD	K19	R U			1 OR 2 ROD FINGERS STUCK / SEPARATED FROM SPIDER	ROD FINGERS BROKE WHEN FREEING RCCA E-3
W HN1	015894	110377	M CD	L23	R U			RCC SPIDER ASSEMBLY VANE FOUND SEPAR FROM RCC HLB	CAUSED BY FAULTY BRAZE JOINT
W IP2	018071	052677	M CD	G00	U			ROD F-2 BANK D DROPPED DURING STARTUP	CAUSE UNKNOWN
W IP3	016551	111876	M CD	E00	U			RCC D-8 BANK B BECAPE MISALIGNED DURING NORMAL OPS	CAUSE UNKNOWN
W PT1	010649	052974	M CD	I01	S D			IMPROPER ROD MOVEMENT/PART-LENGTH RODS INSERTED TO	--82% //PERSONNEL ERROR
W RG1	012311A	030575	M CD	G21	T D			B BANK GR2 RCC G5 DROPPED	WTR IN CAB GRND CONT PWR FOR STATN GRIP.
W RG1	012311B	030575	M CD	G21	T D			B BANK GR2 RCC G-9 DROPPED	WTR IN CAB. GRND CONT PWR.FOR STATN GRIP.
W RG1	012542	041075	M CD	J05	S D			LEAK IN CANPY SEC K-7 CAP ON CRD ROD TRAVL HOUSING	CAUSED BY IMPR.TORQUE/DEFECT IN CAP
W RG1	013394	091775	M CD	E21	S D			ROD G-5 BANK B DID NOT MOVE WITH BANK DURING TEST	OPEN CKT IN CABLE OR COIL, G-5 LIFT COIL
W RG1	014596*	041676	M CD	G21	T D 02			B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	FAILURE OF 4 P.C. CARDS POSSIBLE CAUSE
W RG1	015098*	070476	M CD	G21	T D 02			B BANK GROUP 2 RODS G-5 AND G-9 DROPPED	STATIONARY COIL CIRCUITRY FAILURE
W RG1	015329*	080476	M CD	G21	T D 02			C BANK GROUP 2 RODS G-3 AND G-11 PARTIALLY DROPPED	STATIONARY COIL CIRCUITRY FAILURE
W RG1	016644	121776	M CD	G21	T D			ROD F-12 DROPPED DURING OPER. AT REDUCED LOAD	FAILURE OF STATIONARY HOLD COIL CIRCUITRY
W RG1	019595	111677	M CD	E21	T D			ROD CONTROL URGENT FAIL. ROD STOP ALARM LIT	RANDOM FAILURE OF 2 DEFECTIVE P.C. CARDS
W RG1	019596	111877	M CD	E21	T D			ROD CONTROL URGENT FAILURE ROD ALARM LIT	STATIONARY REGULAT. FAIL. IN 1BD PWR.CAB.
W RG2	002072*	062072	M CD	G21	S D 03			3 RODS (BANK C-GROUP 2) DROPPED INTO THE CORE	MULTIPLEXING THYRISTOR FAILURE PWR CAB2BD
W RC2	010293	052674	M CD	I02	S D			RCC ASSEMBLY INADVERTANTLY REMOVED DURING REFUEL	PERSONNEL ERROR
W RC2	011114A	121174	M CD	K00	U			PART LENGTH ROD CONT. SYS FAILED WHILE AT POWER	CAUSE OF FAILURE NOT STATED
W RG2	011114B	121174	M CD	I06	S D			RODS NOT INSERTED(S/D) WHEN PART-LENGTH ROD INOPER	PROCEDURES HAD 5 PARAGRAPHS DELETED

AGGREGATE OF ALL CRDM FAULTS

<u>VEN</u>	<u>PLANT</u>	<u>CONT.NO.</u>	<u>FAIL DATE</u>	<u>SYS</u>	<u>COMP</u>	<u>FAIL CODE</u>	<u>TYPE</u>	<u>CLASS</u>	<u>FAIL</u>	<u>FAILURE MODE</u>	<u>FAILURE MECHANISM</u>
W	RC2	C19342	042477	M	CD	000	U			ROD N-9 DID NOT INSERT ON REACTOR TRIP	CAUSE IS UNKNOWN
W	KL2	020552*	021778	M	CC	J23	B T 02			PINHOLE LEAKS ON 2 SEAL WELDS (D-4 AND G-7)	APPARENTLY THE RESULT OF WELD DEGRADATION
W	SL1	013696	102575	M	CD	L02	D			INADVERT. BENT CRD SHAFT DURING CRANE OPERATION	PERSONNEL ERROR
W	SL1	C18875	081877	M	CC	G21	S D			ROD J-13(SHUTDOWN BANK A)DROPPED DURING NORM. OPER	LOSS OF PWR TO STATION. GRIP COIL OF CRDM
W	TR1	014500*	040476	M	CD	K21	T D C3			ALL DIGITAL ROD POSITION INDIC. WAS LOST, 3 TIMES	FAILURES OF ELEC.COMP. DUE TO OVERHEATING
W	TR1	C18906*	082177	M	CD	E21	S D 13			LOSS OF ROD CONTROL AFFECTING 13 OF PLANTS 53 RODS	FAILURE OF SUPERVISORY BUFFER MEM. CARD
W	TL3	001026	060973	M	CD	000	R U			RCC H-8 STUCK AT 225 STEPS AFTER ROD DROP SIGNAL	NO CAUSE DETERMINED
W	TL3	000308	081873	M	CD	000	R U			RCC J-5 FAILED TO DROP AFTER RX TRIP BRKKS OPENED	NO CAUSE DETERMINED
W	TL4	000283	081573	M	CD	I03	S D			ROD TEST CONDUCTED WHICH TECH SPECS DONT ALLOW	PERSONNEL ERROR
W	Z12	000729	011774	M	CD	J23	L			LEAK.BETWN CFD LATCH HOUSNG 6ROD TRVL HOUSN CRDM14	CRACK IN CANOPY SEAL WELD BETWN HOUSINGS

AGGREGATE OF ALL CRDM FAILURES; 1/1/76 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	PDP.HOURS	STANDBY HOUR RATE
AR1	12946.0	69	0	893274.0	3.4E-06*
CR3	7430.0	69	3	512670.0	5.9E-06
DP1	4129.0	57	0	235353.0	1.3E-05*
DE1	13620.0	69	0	939760.0	3.2E-06*
DE2	13196.0	69	2	910524.0	2.2E-06
DE3	15777.0	69	1	1088613.0	9.2E-07
RS1	12642.0	69	0	872298.0	3.4E-06*
T11	14916.0	69	0	1029204.0	2.9E-06*
T12	342.0	69	0	23598.0	1.3E-04*
TOTALS			6	6505314.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAILURES; 1/1/76 THRU 4/30/78  
 COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	15903.0	85	3	1351755.0	2.2E-06
CC2	9162.0	85	2	778770.0	2.6E-06
FC1	16130.0	49	0	790370.0	3.8E-06*
MI2	13567.0	81	0	1098927.0	2.7E-06*
MY1	18606.0	85	0	1581510.0	1.9E-06*
SL1	9903.0	81	3	802143.0	3.7E-06
		TOTALS	8	6403475.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



AGGREGATE OF ALL CRDP FAILURES: 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BF1	10793.0	185	0	1996705.0	1.5E-06*
BF2	11809.0	185	0	2184665.0	1.4E-06*
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	13379.0	32	5	428128.0	1.2E-05
BR1	7544.0	137	0	1033528.0	2.9E-06*
BR2	13226.0	137	2	1811962.0	1.1E-06
CO1	16617.0	137	1	2276529.0	4.4E-07
CA1	15981.0	89	0	1422309.0	2.1E-06*
CR1	15801.0	80	1	1264080.0	7.9E-07
DR2	16103.0	177	56	2850231.0	2.0E-05
DR3	17226.0	177	0	3049002.0	9.8E-07*
EM1	15876.0	137	0	2175012.0	1.4E-06*
FP1	15348.0	137	0	2102676.0	1.4E-06*
MI1	17024.0	145	0	2468480.0	1.2E-06*
MO1	18126.0	121	0	2193246.0	1.4E-06*
NM1	16060.0	129	3	2071740.0	1.4E-06
OC1	16142.0	137	0	2211454.0	1.4E-06*
PB2	13776.0	185	2	2548560.0	7.8E-07
PB3	14885.0	185	2	2753725.0	7.3E-07
PI1	13412.0	145	2	1944740.0	1.0E-06
QC1	15547.0	177	0	2751819.0	1.1E-06*
QC2	16750.0	177	0	2964750.0	1.0E-06*
VY1	17311.0	89	0	1540679.0	1.9E-06*
			TOTALS	74	48179845.0

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDP FAILURES; 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BV1	9106.0	53	0	482618.0	6.2E-06*
DC1	16401.0	53	1	869253.0	1.2E-06
DC2	770.0	53	0	40810.0	7.3E-05*
HN1	18030.0	45	1	811350.0	1.2E-06
JP2	10995.0	61	1	670695.0	1.5E-06
IP3	11694.0	61	1	713334.0	1.4E-06
JF1	1079.0	53	0	163187.0	1.8E-05*
KF1	16994.0	33	0	560802.0	5.3E-06*
NA1	410.0	53	0	21730.0	1.4E-04*
PP1	16859.0	37	0	623783.0	4.8E-06*
PR2	17531.0	37	0	648647.0	4.6E-06*
PT1	18041.0	37	0	667517.0	4.5E-06*
PT2	17964.0	37	0	664668.0	4.5E-06*
RG1	14639.0	33	0	483087.0	6.2E-06*
RD2	16245.0	41	3	666045.0	4.5E-06
SA1	4368.0	53	0	231504.0	1.3E-05*
SO1	14325.0	45	0	644625.0	4.6E-06*
SU1	15487.0	53	0	820811.0	3.6E-06*
SU2	13160.0	53	0	697480.0	4.3E-06*
TR1	12539.0	61	0	764879.0	3.9E-06*
TU3	15712.0	53	0	832736.0	3.6E-06*
TU4	14145.0	53	0	749685.0	4.0E-06*
ZI1	15178.0	53	0	804434.0	3.7E-06*
ZI2	13657.0	53	0	723821.0	4.1E-06*
TOTALS			7	14357501.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAILURES; 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOOR RATE
	2.0
EAB.6WIL.	9.2E-07
	2.3
	1.8
COMB.ENG.	1.2E-06
	2.0
	1.2
GEN.ELEC.	1.5E-06
	1.2
	1.9
WESTINGH.	4.9E-07
	2.1
	1.4
FWR'S	7.7E-07
	1.5
	1.2
OVERALL	1.3E-06
	1.2

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDP FAULTS (COMPAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
AR1	12946.0	69	9	893274.0	1.0E-05
CR3	7430.0	69	53	512670.0	1.0E-04
DB1	4129.0	57	0	235353.0	1.3E-05*
DE1	13620.0	69	0	939780.0	3.2E-06*
DE2	13196.0	69	14	910524.0	1.5E-05
DE3	15777.0	69	19	1088613.0	1.7E-05
RS1	12642.0	69	1	872298.0	1.1E-06
T11	14916.0	69	0	1029204.0	2.9E-06*
TJ2	342.0	69	0	23598.0	1.3E-04*
			TOTALS	6505314.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRCP FAULTS (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	PCP.HOURS	STANDBY HOUR RATE
CC1	15903.0	85	6	1351755.0	4.4E-06
CC2	9162.0	85	6	778770.0	7.7E-06
FC1	16130.0	49	0	790370.0	3.8E-06*
MI2	13567.0	81	1	1098927.0	9.1E-07
MY1	18606.0	85	0	1581510.0	1.9E-06*
SL1	9903.0	81	6	802143.0	7.5E-06
TOTALS			19	6403475.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDP FAULTS (COMMAND FAULTS INCLUDED) 1/1/76 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	PDP.HOURS	STANDBY HOUR RATE
BF1	10793.C	185	0	1996705.0	1.5E-06*
BF2	11809.C	185	1	2184665.0	4.6E-07
BF3	11545.C	185	0	2135825.0	1.4E-06*
BP1	13379.C	32	5	428128.0	1.2E-05
BR1	7544.C	137	1	1033528.0	9.7E-07
BR2	13226.C	137	2	1811962.0	1.1E-06
CO1	16617.0	137	1	2276529.0	4.4E-07
DA1	15981.0	89	0	1422309.0	2.1E-06*
DF1	15801.0	80	1	1264080.0	7.9E-07
DR2	16103.C	177	57	2850231.0	2.0E-05
DR3	17226.C	177	0	3049002.0	9.8E-07*
EN1	15876.C	137	0	2175012.0	1.4E-06*
FP1	15348.C	137	0	2102676.0	1.4E-06*
M11	17024.C	145	1	2468480.0	4.1E-07
MO1	18126.0	121	1	2193246.0	4.6E-07
NM1	16060.C	129	4	2071740.0	1.9E-06
OC1	16142.0	137	0	2211454.0	1.4E-06*
PB2	13776.C	185	2	2548560.0	7.8E-07
PB3	14885.0	185	5	2753725.0	1.7E-06
PI1	13412.C	145	2	1944740.0	1.0E-06
QC1	15547.0	177	1	2751819.0	3.6E-07
QC2	16750.0	177	0	2964750.0	1.0E-06*
VY1	17311.C	89	0	1540679.0	1.9E-06*
TOTALS			84	43179845.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDP FAULTS (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BV1	9106.0	53	0	482618.0	6.2E-06*
CC1	16401.0	53	1	869253.0	1.2E-06
DC2	770.0	53	0	40810.0	7.3E-05*
HN1	18030.0	45	1	811350.0	1.2E-06
YP2	10995.0	61	1	670695.0	1.5E-06
IP3	11694.0	61	1	713334.0	1.4E-06
JF1	3079.0	53	0	163187.0	1.8E-05*
KE1	16994.0	33	0	560802.0	5.3E-06*
NA1	410.0	53	0	21730.0	1.4E-04*
PR1	16859.0	37	0	623783.0	4.8E-06*
PR2	17531.0	37	0	648647.0	4.6E-06*
PT1	18041.0	37	0	667517.0	4.5E-06*
PT2	17964.0	37	0	664668.0	4.5E-06*
PG1	14639.0	33	9	483087.0	1.9E-05
RD2	16245.0	41	3	666045.0	4.5E-06
SA1	4368.0	53	0	231504.0	1.3E-05*
SD1	14325.0	45	0	644625.0	4.6E-06*
SU1	15487.0	53	1	820811.0	1.2E-06
SU2	13160.0	53	0	697480.0	4.3E-06*
TR1	12539.0	61	16	764679.0	2.1E-05
TU3	15712.0	53	0	832736.0	3.6E-06*
TU4	14145.0	53	0	749685.0	4.0E-06*
Z11	15176.0	53	0	804434.0	3.7E-06*
ZI2	13657.0	53	0	723821.0	4.1E-06*
			TOTALS	33	14357501.0

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAULTS (COMMAND FAULTS INCLUDED); 1/1/76 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	1.2
EAB.&WIL.	1.5E-05
	1.2
	1.5
COMB.ENG.	3.0E-06
	1.5
	1.2
CEN.ELEC.	1.7E-06
	1.2
	1.3
WESTINGH.	2.3E-06
	1.4
	1.1
FWR'S	5.4E-06
	1.2
	1.1
OVERALL	3.1E-06
	1.1

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



AGGREGATE OF ALL CRDM FAILURES: 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RAYL.
AR1	20009.0	69	0	1380621.0	2.2E-06*
CR3	7430.0	69	3	512670.0	5.9E-06
DB1	4129.0	57	0	235353.0	1.3E-05*
DE1	30392.0	69	0	2097048.0	1.4E-06*
DE2	21755.0	69	2	1501095.0	1.3E-06
DE3	22921.0	69	1	1581549.0	6.3E-07
RS1	14543.0	69	0	1003467.0	3.0E-06*
TI1	24929.0	69	2	1720101.0	1.2E-06
TI2	342.0	69	0	23598.0	1.3E-04*
TOTALS			8	10055502.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAILURES; 1/1/72 THRU 4/30/78  
 COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	20739.0	85	3	1762815.0	1.7E-06
CC2	9162.0	85	2	778770.0	2.6E-06
FC1	32123.0	49	1	1574027.0	6.4E-07
MI2	14906.0	81	0	1207386.0	2.5E-06*
MY1	40408.0	85	0	3434680.0	8.7E-07*
SL1	9903.0	81	3	802143.0	3.7E-06
TOTALS			9	9559821.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CPDM FAILURES; 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BF1	15553.0	185	1	2877305.0	3.5E-07
BF2	12326.0	185	0	2280310.0	1.3E-06*
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	28622.0	32	26	1235904.0	2.1E-05
BR1	7544.0	137	0	1033528.0	2.9E-06*
BR2	14576.0	137	3	1996912.0	1.5E-06
CD1	27641.0	137	1	3786817.0	2.6E-07
DA1	22487.0	89	4	2001343.0	2.0E-06
DR1	25600.0	80	7	2848000.0	2.5E-06
DR2	29390.0	177	159	6972030.0	2.3E-05
DR3	41057.0	177	18	7267089.0	2.5E-06
EN1	23634.0	137	0	3237858.0	9.3E-07*
FP1	18189.0	137	0	2491893.0	1.2E-06*
MI1	39560.0	145	1	5736200.0	1.7E-07
MO1	44190.0	121	1	5346990.0	1.9E-07
NM1	41084.0	129	29	5299836.0	5.5E-06
OC1	42170.0	137	0	5777290.0	5.7E-07*
PB2	24563.0	185	2	4544155.0	4.4E-07
PB3	22737.0	185	2	4206345.0	4.8E-07
PI1	31756.0	145	3	4604620.0	6.5E-07
QC1	37446.0	177	1	6627942.0	1.5E-07
QC2	39780.0	177	0	7041060.0	4.3E-07*
VY1	39826.0	89	0	3544514.0	8.5E-07*
TOTALS			258	92893766.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAILURES; 1/1/72 THRU 4/30/78

WESTINGHOUSE

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HJUR RATE
BV1	9106.0	53	0	482618.0	6.2E-06*
DC1	22795.0	53	1	1208135.0	8.3E-07
DC2	770.0	53	0	40810.0	7.3E-05*
HN1	45574.0	45	1	2050830.0	4.9E-07
IP2	21387.0	61	1	1304607.0	7.7E-07
IP3	11694.0	61	1	713334.0	1.4E-06
JF1	3079.0	53	0	163187.0	1.8E-05*
KE1	28727.0	33	0	947991.0	3.2E-06*
NA1	410.0	53	0	21730.0	1.4E-04*
PR1	28913.0	37	0	1069781.0	2.8E-06*
PR2	25020.0	37	0	925740.0	3.2E-06*
PT1	44738.0	37	0	1655306.0	1.8E-06*
PT2	45215.0	37	0	1672955.0	1.8E-06*
RG1	40932.0	33	0	1350756.0	2.2E-06*
RO2	43928.0	41	4	1801048.0	2.2E-06
SA1	4368.0	53	0	231504.0	1.3E-05*
SO1	41777.0	45	0	1879965.0	1.6E-06*
SU1	31984.0	53	1	1695152.0	5.9E-07
SU2	28790.0	53	0	1525870.0	2.0E-06*
TR1	12539.0	61	0	764879.0	3.9E-06*
TL3	36992.0	53	2	1960576.0	1.0E-06
TL4	29791.0	53	0	1578923.0	1.9E-06*
ZI1	26612.0	53	0	1410436.0	2.1E-06*
ZI2	21735.0	53	1	1151955.0	8.7E-07
			TOTALS	12	27606088.0

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAILURES; 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	1.8
EAB.&WIL.	8.0E-07
	2.0
	1.7
COMB.ENG.	9.4E-07
	1.9
	1.1
GEN.ELEC.	2.8E-06
	1.1
	1.6
WESTINGH.	4.3E-07
	1.7
	1.4
FWR'S	6.1E-07
	1.4
	1.1
OVERALL	2.0E-06
	1.1

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDP FAULTS (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

BABCOCK&WILCOX

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
AR1	20009.0	69	10	1380621.0	7.2E-06
CR3	7430.0	69	53	512670.0	1.0E-04
DP1	4129.0	57	0	235353.0	1.3E-05*
DE1	30392.0	69	2	2097048.0	9.5E-07
DE2	21755.0	69	24	1501095.0	1.6E-05
DE3	22921.0	69	20	1581549.0	1.3E-05
RS1	14543.0	69	1	1003467.0	1.0E-06
TI1	24929.0	69	4	1720101.0	2.3E-06
TI2	342.0	69	0	23598.0	1.3E-04*
TOTALS			114	10055502.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAULTS (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

COMBUSTION ENGINEERING

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
CC1	20739.0	85	6	1762815.0	3.4E-06
CC2	9162.0	85	6	778770.0	7.7E-06
FC1	32123.0	49	2	1574027.0	1.3E-06
MI2	14906.0	81	1	1207386.0	8.3E-07
MY1	40408.0	85	0	3434680.0	8.7E-07*
SL1	9903.0	81	6	802143.0	7.5E-06
			<u>21</u>	<u>9559821.0</u>	
		TOTALS			

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDM FAULTS (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

GENERAL ELECTRIC

PLANT	CRIT.HRS.	POPULATION	FAULTS	POP.HOURS	STANDBY HOUR RATE
BF1	15553.0	185	2	2877305.0	7.0E-07
BF2	12326.0	185	1	2280310.0	4.4E-07
BF3	11545.0	185	0	2135825.0	1.4E-06*
BP1	38622.0	32	27	1235904.0	2.2E-05
BR1	7544.0	137	1	1033528.0	9.7E-07
BR2	14576.0	137	3	1996912.0	1.5E-06
CG1	27641.0	137	1	3786817.0	2.6E-07
DA1	22487.0	89	7	2001343.0	3.5E-06
DR1	35600.0	80	7	2848000.0	2.5E-06
DR2	29390.0	177	165	6972030.0	2.4E-05
DR3	41057.0	177	18	7267089.0	2.5E-06
EN1	23634.0	137	0	3237858.0	9.3E-07*
FP1	18189.0	137	0	2491893.0	1.2E-06*
MI1	39560.0	145	2	5736200.0	3.5E-07
MO1	44190.0	121	2	5346990.0	3.7E-07
NM1	41084.0	129	30	5299836.0	5.7E-06
OC1	42170.0	137	0	5777290.0	5.2E-07*
PB2	24563.0	185	2	4544155.0	4.4E-07
PB3	22737.0	185	5	4206345.0	1.2E-06
PI1	31756.0	145	4	4604620.0	8.7E-07
QC1	37446.0	177	4	6627942.0	6.0E-07
QC2	39780.0	177	0	7041060.0	4.3E-07*
VY1	39826.0	89	1	3544514.0	2.8E-07
TOTALS			282	92893766.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED



AGGREGATE OF ALL CKDP FAULTS (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78  
 WESTINGHOUSE

PLANT	CFIT.HRS.	POPULATION	FAULTS	PDP.HOURS	STANDBY HOOR RATE
PV1	9106.0	53	0	482618.0	6.2E-06*
DC1	22795.0	53	1	1208135.0	8.3E-07
CC2	770.0	53	0	40810.0	7.3E-05*
HN1	45574.0	45	1	2050830.0	4.9E-07
IP2	21387.0	61	1	1304607.0	7.7E-07
IP3	11694.0	61	1	713334.0	1.4E-06
JF1	3079.0	53	0	163187.0	1.8E-05*
KE1	28727.0	33	0	947991.0	3.2E-06*
NA1	410.0	53	0	21730.0	1.4E-04*
PR1	28913.0	37	0	1069781.0	2.8E-06*
PR2	25020.0	37	0	925740.0	3.2E-06*
PT1	44738.0	37	1	1655306.0	6.0E-07
PT2	45215.0	37	0	1672955.0	1.8E-06*
RG1	40932.0	33	13	1350756.0	9.6E-06
RO2	43928.0	41	9	1801048.0	5.0E-06
SA1	4368.0	53	0	231504.0	1.3E-05*
SO1	41777.0	45	0	1879965.0	1.6E-06*
SU1	31984.0	53	2	1695152.0	1.2E-06
SU2	28790.0	53	0	1525870.0	2.0E-06*
TR1	12539.0	61	16	764879.0	2.1E-05
TU3	36992.0	53	2	1960576.0	1.0E-06
TU4	29791.0	53	1	1578923.0	6.3E-07
ZI1	26612.0	53	0	1410436.0	2.1E-06*
ZI2	21735.0	53	1	1151955.0	8.7E-07
TOTALS		49	49	27608088.0	

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED

AGGREGATE OF ALL CRDP FAULTS (COMMAND FAULTS INCLUDED); 1/1/72 THRU 4/30/78

FINAL STATISTICS

	STANDBY HOUR RATE
	1.2
EAB.&WIL.	1.1E-05
	1.2
	1.4
COMB.ENG.	2.2E-06
	1.5
	1.1
CEN.ELEC.	3.0E-06
	1.1
	1.3
WESTINGH.	1.8E-06
	1.3
	1.1
FWR'S	3.9E-06
	1.1
	1.1
OVERALL	3.3E-06
	1.1

\* DENOTES UPPER 95 PERCENT CONFIDENCE BOUND WHEN NO FAULTS RECORDED