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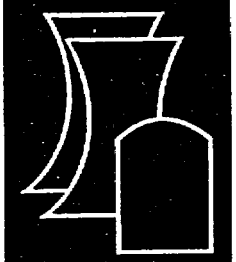

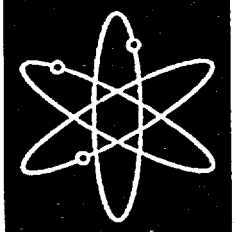

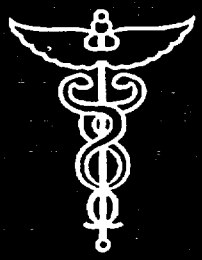

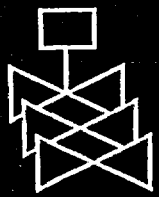

Component Performance Study — Motor-Driven Pumps, 1987–1998

Commercial Power Reactors

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Component Performance Study — Motor-Driven Pumps, 1987–1998

Commercial Power Reactors

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ABSTRACT

This report documents an analysis of the performance of safety-related motor-driven pump assemblies (pump, motor, and circuit breaker subcomponents) used in the pressurized water reactor (PWR) and in the boiling water reactor (BWR) risk-important systems in U.S. commercial power reactor plants.

A risk-based analysis of operating data and an engineering analysis of trends and patterns were done to provide insights into the performance of motor-driven pump components on an industry basis, and the results were compared with data used by plant-specific probabilistic risk assessments. The engineering analysis of selected risk-important systems used data from the 1987-1995 period. Failure probability estimates used combined engineered safety features data (1987-1998) and surveillance test data (1987-1995).

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EXECUTIVE SUMMARY

This study provides the performance evaluation based on industry experience during the 1987 through 1998 period for motor-driven pumps (MDPs) in the pressurized water reactor (PWR) and in the boiling water reactor (BWR) risk-important (RI) systems. The objectives of component performance studies are (1) to determine the reliability of risk-important components and compare the results with estimates in probabilistic risk assessments (PRAs) and individual plant examinations (IPEs) and (2) to review the operational data from an engineering perspective to determine trends and patterns and gain insights into component performance.

MDP failure and estimated demand data was obtained from two databases. The Nuclear Plant Reliability Data System (NPRDS) provided data on component failures and surveillance test frequencies for the 1987-1995 period. The Sequence Coding and Search System (SCSS) provided engineering safety features (ESF) failure and demand data for the 1987-1998 period and some surveillance test failure data for the 1987-1995 period reported in Licensee Event Reports (LERs).

For the PWR and BWR RI systems, the MDP probability of failure on demand estimates were based on the combined ESF and surveillance test data failures and demands from SCSS and NPRDS data sources, except for the PWR residual heat removal and nuclear service water systems and the BWR residual heat removal system. For these exceptions the surveillance test data was used because the ESF data was sparse.

The MDP probability of failure on demand estimates were consistent with the generic values from NUREG/CR-4550 (used as an input to NUREG-1150), with two exceptions. The values for the BWR reactor building closed cooling water system were lower than the generic values and the mean value for the high pressure core spray system was higher.than the generic values. Table ES-A lists the MDP probability of failure on demand estimates developed for the RI systems selected for this study and the NUREG/CR-4550 values.

The yearly trend analysis of the MDP probability of failure on demand showed no trend for PWR and BWR RI systems, except for the PWR high pressure injection (HPI) system. The HPI system showed an increasing trend through the 1987-1995 period. The end point of the trend is still within the expected range of the generic values in NUREG/CR-4550.

TABLE ES-A
MDP PROBABILITY OF FAILURE ON DEMAND (1987-1998)

	LOWER BOUND	MEAN	UPPER BOUND
NUREG/CR-4550	**1.1E-3**	**3E-3**	**1.1E-2**
PWR RI SYSTEMS			
Auxiliary Feedwater (AFW)	1.2E-3	1.8E-3	2.4E-3
High Pressure Injection (HPI)	9.5E-5	3.0E-3	9.6E-3
Component Cooling Water (CCW)	8.8E-7	1.4E-3	5.8E-3
Containment Spray (CS)	8.9E-5	2.1E-3	6.5E-3
Chemical and Volume Control (CVCS)	9.9E-4	2.0E-3	3.4E-3
Nuclear Service Water (NSW)	1.5E-4	2.1E-3	5.8E-3
Residual Heat Removal (RHR)	2.0E-4	1.7E-3	4.5E-3
BWR RI SYSTEMS			
High Pressure Core Spray (HPCS)	2.5E-8	1.2E-2	6.1E-2
Low Pressure Core Spray (LPCS)	2.5E-4	1.5E-3	3.6E-3
Reactor Building Closed Cooling (RBCC)	4.2E-5	3.5E-4	9.2E-4
Essential Service Water (ESW)	1.5E-3	3.4E-3	5.9E-3
Residual Heat Removal (RHR)	5.1E-4	1.2E-3	2.2E-3

The MDP mean probabilities of failure on demand used in plant-specific IPE studies were compared with the results of this study. The PWR IPE mean values were generally consistent with the results of this study and NUREG/CR-4550. The IPE mean values for BWR RI systems were also consistent with the results of this study and NUREG/CR-4550, except for the RHR and RBCC systems. Sixty percent of the IPE mean values for the BWR RHR system were higher than the RHR system value range estimated in this study. Most (approximately 89%) of the IPE mean values for the RBCC system were higher than the RBCC system value range estimated in this study.

Figure ES-1(AFW system) is indicative of the systems where there was general agreement between the sampled IPEs and our analysis of operating experience. Figures ES-2 and ES-3 show BWR RHR and RBCC systems noted above, respectively.

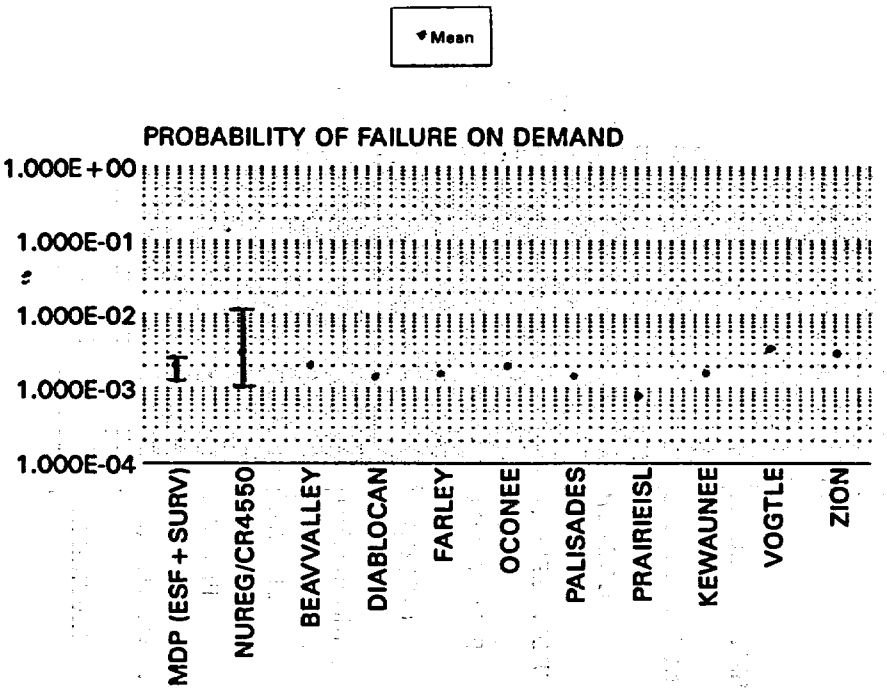


FIGURE ES-1
PWR AFW SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs

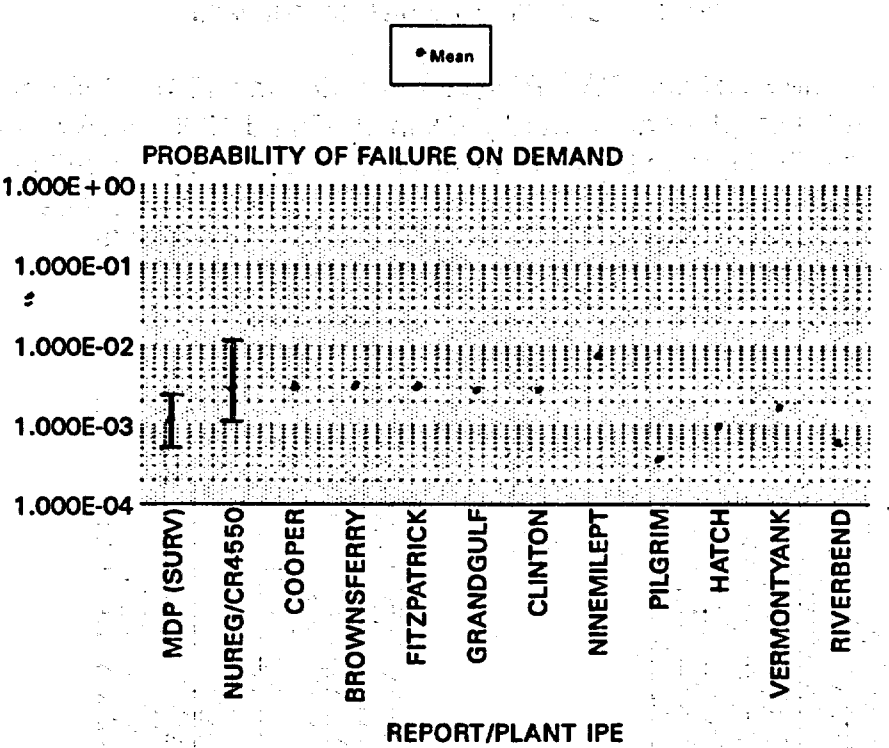


FIGURE ES-2
BWR RHR SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs

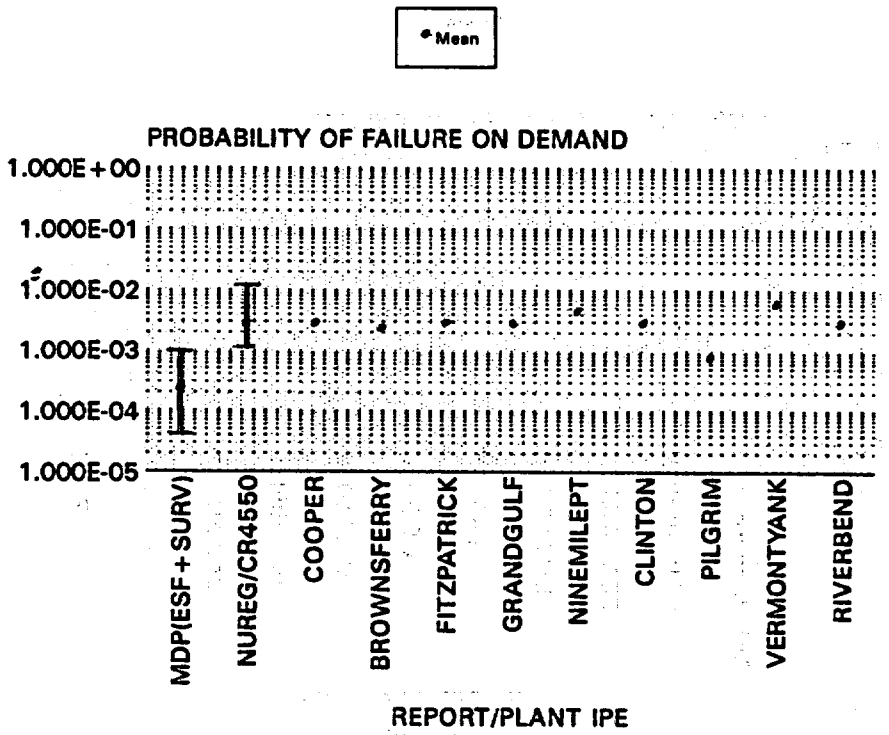


FIGURE ES-3
BWR RBCC SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND
COMPARISON WITH VALUES USED IN IPEs

Failure trends for the PWR and BWR RI systems during the 1987-1995 period were relatively constant, except for an upward peak in 1992 and 1993 for PWRs and in 1993 for BWRs. Figure ES-4 shows the MDP failure trends for the 1987-1995 period.

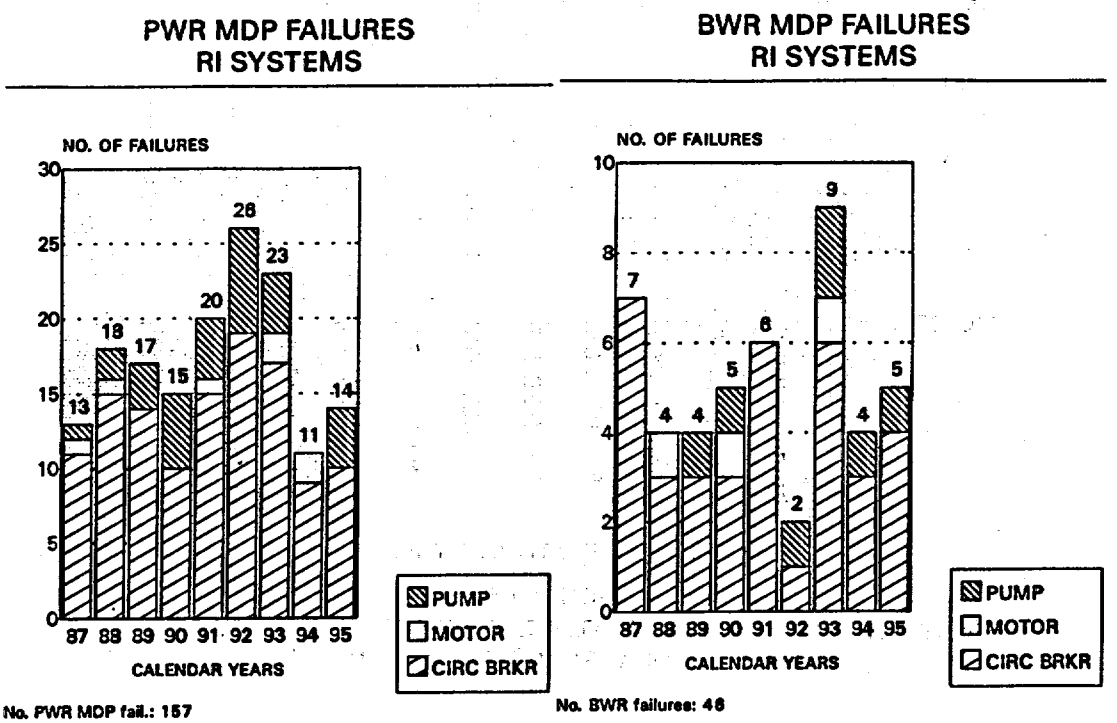


FIGURE ES-4
MDP FAILURE TRENDS

Failure rates, as a function of component-years, varied slightly among the PWR and BWR plant age groups (three groups, of approximately equal size, from older to newer plants by commercial operations date). For PWRs and BWRs, the review of plant age groups did not show evidence of an increase in failure rates for any of the plant age groups due to aging mechanisms.

The evaluation of MDP subcomponent failure patterns demonstrated that circuit breakers were significant contributors to the MDP failures in both PWR and BWR RI systems (greater than 75%).

Failures of MDP assemblies in PWR RI systems were mainly attributed to unknown causes (43%) because a root cause analysis was generally not performed on the predominant failed subcomponent (circuit breaker). Age/wear and maintenance/procedural deficiencies together accounted for the bulk of the balance (43%). For BWR RI systems, age/wear was the predominant cause (43%), while unknown causes and maintenance/procedural deficiencies together accounted for the bulk of the balance (46%). Figure ES-5 shows the MDP assembly failure causes for PWR and BWR RI systems.

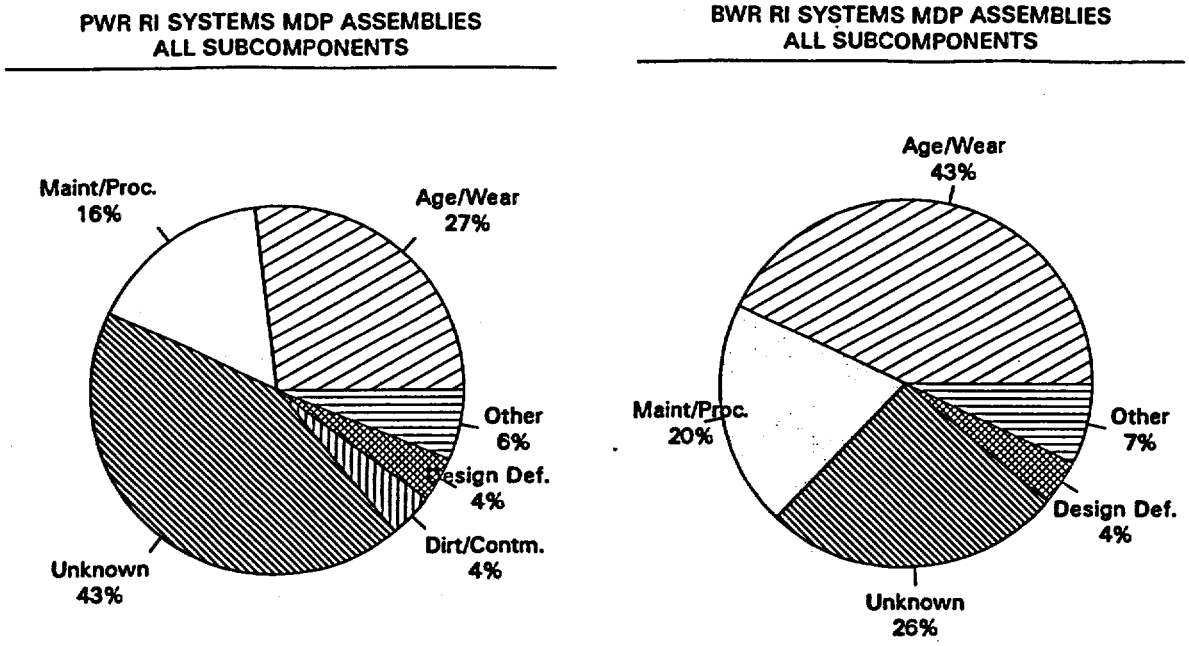


FIGURE ES-5
MDP ASSEMBLY FAILURE CAUSES

FOREWORD

This report provides information relevant to the performance of motor-driven pumps (MDPs). It summarizes the failure and event data used in the analysis and evaluation. The results, including failure probabilities and engineering insights, are intended to support several risk-informed regulatory activities. This includes providing information to enhance plant inspections of risk-important systems and information used to support staff technical reviews.

Findings and conclusions from the analysis of MDPs, which are based on 1987-1998 operating experience, are presented in the Executive Summary and Section 5. The results of risk-based analysis and engineering analysis are presented in Sections 3 and 4, respectively. Information to support risk-informed regulatory activities and engineering analysis related to MDPs is summarized in Table F-1. This table provides a condensed index of risk-important data and data for engineering insights in the text discussions, tables, figures, and appendices.

The application of results is intended on an industry-wide basis for MDPs. Plant-specific application may require a more detailed review of the relevant Licensee Event Reports (LERs) and in-plant validation of plant-specific Nuclear Plant Reliability Data System (NPRDS) failure history data cited in this report. Factors such as design and application of specific MDPs, test and maintenance practices, availability, and response to regulatory initiatives would need to be considered in light of specific information provided in LER and NPRDS failure records. Other documents such as plant specifications, logs, reports, and inspection reports should be reviewed during plant inspections to supplement the information contained in this report.

In addition, a review of recent LERs and plant-specific information in NPRDS or the Equipment Information Exchange (EPIX) may yield indications of whether performance has undergone a significant change since the last year of this report. A search of the LER database can be conducted through the NRC's Sequence Coding and Search System (SCSS) to identify the MDP events that occurred after the period covered by this report. SCSS is accessible by NRC staff from the SCSS home page (http://scss.ornl.gov/) or in the Public Document Room (PDR). Nuclear industry organizations and the general public can obtain information from the SCSS on a cost recovery basis by contacting the Oak Ridge National Laboratory directly. NPRDS archival data (through 1996) and EPIX failure data is proprietary information that can be obtained from the EPIX database through the Institute of Nuclear Power Operations (INPO).

Table F-1

Summary of Risk-Important Information and Engineering Analysis For MDPs

1.	Risk-based analysis of operational data - calculation results	Section 3.1
2.	MDP probability of failure on demand	Table A, Appendix I
3.	Comparison with IPEs	Section 3.2, Figures 3 - 15,
4.	Failure trend analysis	Section 4.1, Figures 16, Appendix III
5.	Component trends in time	Section 4.2, Figures 17 and 18, Appendix II
6.	Failures of subcomponents and their causes	Section 4.3, Figures 19 - 21, Appendix III
7.	Related issues - Information Notices	Section 4.4, Table B
8.	Data source inputs for failures and demands	Appendix IV

ACKNOWLEDGMENTS

We thank our colleague Dr. Dale M. Rasmuson for his technical assistance in reviewing and presenting the statistical data.

ACRONYMS

AFW	auxiliary feedwater system
AOV	air-operated valve
ASME	American Society of Mechanical Engineers
BWR	boiling water reactor
CCW	component cooling water system
CS	containment spray system
CVCS	chemical and volume control system
EPIX	Equipment Performance and Information Exchange
ESF	engineered safety features
ESW	essential service water system
HPCS	high pressure core spray system
HPI	high pressure safety injection system
INEEL	Idaho National Engineering and Environmental Laboratory
INPO	The Institute of Nuclear Power Operations
IPE	individual plant examination
LER	Licensee Event Report
LPCI	low pressure core injection system
LPCS	low pressure core spray system
LPI	low pressure injection system
MDP	motor-driven pump
MOV	motor-operated valve
NPRDS	Nuclear Plant Reliability Data System
NRC	United States Nuclear Regulatory Commission
NSW	nuclear service water system
ORNL	Oak Ridge National Laboratory
PRA	probabilistic risk assessment
PWR	pressurized water reactor
RBCC	reactor building closed cooling water system
RHR	residual heat removal system
RI	risk-important
SCSS	Sequence Coding and Search System
TDP	turbine-driven pump

COMPONENT PERFORMANCE STUDY — MOTOR-DRIVEN PUMPS, 1987–1998

1. INTRODUCTION

1.1 Purpose

This study provides the performance evaluation of motor-driven pump (MDP) assemblies in the pressurized water reactors (PWR) and in the boiling water reactors (BWR) risk-important (RI) systems during the period 1987 through 1998. The objectives of this study are (1) to determine the reliability of MDP assemblies and compare the results with estimates in probabilistic risk assessments (PRAs) and individual plant examinations (IPEs) and (2) to review the operational data from an engineering perspective to determine trends and patterns and gain insights into component performance.

An engineering analysis of the factors affecting component reliability was performed to determine trends and patterns in the MDP operating data for the 1987-1995 period. This study was based on the operating history of MDPs for these safety-related, RI systems. The reliability parameters calculated in this study are the probability of failure to start on demand and failure rate per standby hours (standby failure rate). Supplemental failure and demand data for 1996-1998 from operational events (engineered safety features actuations reported in Licensee Event Reports) was added to the 1987-1995 data for estimating the MDP probabilities of failure on demand.

1.2 Background

The U.S. Nuclear Regulatory Commission (NRC) PRA Policy Statement directs the staff to increase the use of probabilistic risk assessment (PRA) technology in all regulatory matters. Accordingly, the Office of Nuclear Regulatory Research (RES), Division of Risk Analysis and Application (DRAA), monitors and reports on the functional reliability of risk-important systems in commercial nuclear power plants. The approach is to compare estimates from PRAs to actual operating experience.

Over the past decade, the NRC has issued several studies applicable to MDP risk-important systems, MDP components or their subcomponent failures, failure on demand probabilities, and trends and patterns:

- AEOD/S98-02 (INEEL/EXT-95-00133), "High Pressure Core Spray System Reliability, 1987-1993," dated May 1998 (Ref. 1), documented an analysis of the performance of the BWR HPCS system during the period 1987-1993. Both a risk-based analysis and an engineering analysis of trends and patterns were done, using HPCS system operational events data (reported by LERs), to provide insights into the performance of the HPCS system throughout the industry and at a plant-specific level.

- NUREG/CR-5500, Vol. 1, "Reliability Study: Auxiliary/Emergency Feedwater System, 1987-1995," dated August 1998 (Ref. 2), documented an analysis of the performance of the PWR AFW system during the period 1987-1995. Both a risk-based analysis and an engineering analysis of trends and patterns were done, using AFW system operational events data (reported by LERs), to provide insights into the performance of the AFW system throughout the industry and at a plant-specific level.

- NUREG/CR-5500 (INEEL/EXT-99-00373, "High Pressure Safety Injection System Reliability, 1987-1997 (DRAFT)," dated May 1999 (Ref. 3), documented an analysis of the performance of the PWR HPI system during the period 1987-1997. Both a risk-based analysis and an engineering analysis of trends and patterns were done, using HPI system operational events data (reported by LERs), to provide insights into the performance of the HPI system throughout the industry and at a plant-specific level.

1.3 Overall Study Structure

This study has four sections:

(1) Section 1 is the introduction.

(2) Section 2 describes the scope of the study, risk-important systems, the MDP assembly and its subcomponent boundaries, and the methodology used for operational data collection and analysis.

(3) Section 3 provides the risk-based analysis of operational data, the calculation results for estimating MDP probabilities of failure on demand and standby failure rate, the contingency test analysis for the data population, and the comparison of MDP probability values with those in IPEs and other sources.

(4) Section 4 provides the engineering analyses (failure trend analysis, component trends in time, failure of subcomponents and their causes, and a brief discussion of NRC regulatory initiatives related to MDPs.

The appendices provide related data used in this study and evaluation results. Appendix I gives the estimated probabilities of failure on demand and calculated standby failure rates. Appendix II contains tables of data used to plot the component trends in time and for evaluating aging effects on MDPs. Appendix III gives data used for engineering analysis and for insights into failure trends and patterns. Appendix IV provides operational data inputs for reported failures and estimated demands from the NPRDS database and LERs (SCSS database).

2. SCOPE OF STUDY

2.1 Risk-Important Systems and Components

The PWR risk important (RI) systems that use the MDPs are the auxiliary/emergency feedwater (AFW) system, the component cooling water (CCW) system, the containment spray (CS) system, the chemical and volume control system (CVCS), the residual heat removal/low pressure injection (RHR) system, the nuclear service water (NSW) system, and the high pressure safety injection/safety injection (HPI) system. For this study, the HPI system includes intermediate head safety injection pumps or charging/high head safety injection pumps. The CVCS system includes charging pumps for plants that also have intermediate head safety injection pumps in the HPI system.

The BWR RI systems that use MDPs are the essential service water (ESW) system, the high pressure core spray (HPCS) system, the low pressure core spray (LPCS) system, the reactor building closed cooling water (RBCC) system, and the residual heat removal/low pressure core injection (RHR) system. The HPCS system, with a single MDP train is used in newer BWR plants as a replacement for the high pressure coolant injection (HPCI) system that used a turbine-driven pump (TDP) train.

2.2 MDP Assembly Description and Boundaries

For this study, a MDP assembly consists of pump, motor-driver, and circuit breaker subcomponents. The pumps are all centrifugal, but some types have horizontal single stage and multiple stages, and some types have vertical single stage or multiple stages. The motors are medium or large AC horizontal or vertical motors, as required to accommodate the pump type and supply the required rated horsepower.

The component boundaries are the MDP assembly with the subcomponents (described above) that are supplied as part of the MDP assembly. For most plants, the AFW system MDP assembly includes a speed increaser which is treated as a subcomponent.

2.3 DATA COLLECTION

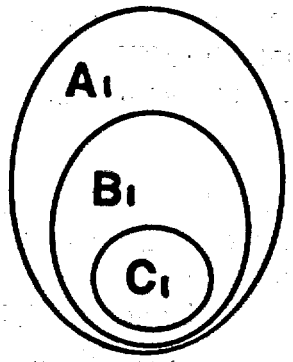
Data collection and reporting for the NPRDS were terminated at the end of 1996. Furthermore, the 1996 failure data reported in NPRDS was not as consistent as for the 1987-1995 period (the industry was transitioning for the termination of NPRDS). The Institute for Nuclear Power Operations (INPO) has recently implemented a new component database called Equipment Performance and Information Exchange (EPIX). This system, that is intended to replace the NPRDS system, yields additional information, such as demands. In its present stage of development, the EPIX system was not sufficiently mature to provide a complete data source for the 1996-1998 period for this study. Where applicable in the development of probability of failure on demand estimates for this study, the SCSS database ESF failure and demand data (reported in LERs) were used from the 1996-1998 period.

The NPRDS database was used to obtain the number of MDP assembly subcomponents and the estimated testing frequency for each subcomponent in each plant. The number and testing frequency of Application Coded pump subcomponents were compared with the number and testing frequency of Application Coded motor driver and circuit breaker subcomponents for each MDP assembly. This was done for each RI system in PWRs and BWRs for each plant. This comparison was made to ensure that the number of MDP assemblies was correct for each plant, as each assembly has one pump, one motor, and one circuit breaker. The values developed in Appendix IV were also used in developing the other appendices.

The term "Application Coded" refers to risk-important components or subcomponents that are functionally designated within a specific system by the NPRDS. An example using the PWR RHR system MDP subcomponents that were separately Application Coded in NPRDS is as follows:

COMP. ASSY	SUBCOMP.	REACTOR TYPE	RI SYSTEM	APPLICATION CODE DESCRIP.
MDP	Pump	PWR	RHR	RHR Motor Driven Pump
MDP	Motor	PWR	RHR	RHR Motor Driver
MDP	Circuit Breaker	PWR	RHR	RHR Circuit Breaker

A detailed review and evaluation was performed of the LERs and the NPRDS failure histories to determine the total number of MDP failures used for this study. Only "complete" (i.e., catastrophic) failures were included in the failure count. For MDP pump and motor subcomponents, the NPRDS "fail to start" (FS) and "fail to run" (FR) failure modes were both included for estimating probability of failure on demand. Because these failure modes occurred in a relatively short period, these pump and motor subcomponent failure modes were considered as equivalent to "fail to start." For the MDP circuit breaker subcomponent, the "failure to close" (FC) and "failure to operate as required" (OR) failure modes were used. Figure 1 illustrates the relationship between various NPRDS database failure data subsets.



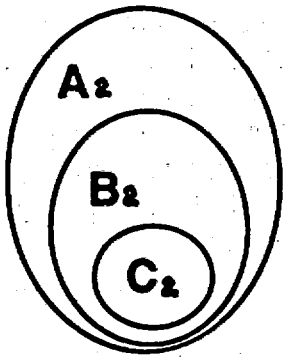
A_1 All MDP assembly subcomponent failures as "complete"/catastrophic failure category (1987-1995)

B_1 Subset - MDP failures for risk-important systems

C_1 Subset - MDP failures occurring during surveillance tests

FIGURE 1
NPRDS DATABASE MDP FAILURES

The SCSS database was used to determine the number of MDP failures, reported in LERs, that occurred during surveillance tests or that were associated with an engineered safety features (ESF) actuation. The NPRDS database was used to obtain the number of surveillance test failures for each MDP subcomponent. Surveillance test failures reported in LERs were excluded from the NPRDS failure counts, but included in the LER failure counts. This was done to prevent a "double count" of failures. Figure 2 illustrates the relationship between various SCSS database failure data subsets that were reported by LERs.



A_2 All MDP assembly failures (1987-1998)

B_2 Subset - MDP failures for risk-important systems

C_2 Subset - MDP failures associated with ESFs or occurring during surveillance tests

FIGURE 2
SCSS DATABASE MDP FAILURES

MDP failures that occurred during surveillance testing were directly linked with surveillance test demands to ensure that surveillance test probability of failure on demand estimates were valid. Similarly, ESF failures were linked with ESF demands to estimate ESF probability of failure on demand. For most plant RI systems, there are multiple MDP trains. These other, redundant MDPs, which might have been actuated during pre-test or post-test system train alignment, were not included in the surveillance test failure counts used in this study.

When it was analytically determined that the ESF failures and demands were in the same population as the surveillance test failures and demands, the total number of demands was the sum of the ESF demands and the surveillance test demands. Otherwise, surveillance test demands (and associated failures) of the larger population were used to calculate the MDP unreliability because the ESF data was determined to be relatively sparse for component performance evaluation.

The first step in estimating ESF demands was to identify ESF actuations and then determine which component types and how many components of each type were actuated by ESF demands. Other demands that may have occurred during plant operation, startup, or shutdown but did not result in ESF actuations were not included in the ESF demand determination, nor were any associated failures included. However, inadvertent and spurious demands and manual actuations associated with an ESF (e.g., a reactor trip) were considered ESF demands. The SCSS database was used for the PWR and BWR RI systems for LERs that were coded as "ESF Actuations" and those coded as "SCRAMS and Shutdowns." The full text of each LER was reviewed to determine whether the selected systems were actuated, the number and type of trains (e.g., for AFW, the turbine-driven pump train(s) and/or the motor-driven pump train(s) actuated by the ESF), and the best estimate of the number of each MDP actuated based on the plant-specific train configuration].

The second step in estimating the total number of demands was to use NPRDS testing frequencies as the basis for surveillance test demands. This was done for the NPRDS Application Coded, functionally designated MDP assembly subcomponents in the RI systems (see Section 2.1 for the description of the MDP assembly). The NPRDS testing frequency was reviewed for each subcomponent of the MDP assembly (i.e., pump, motor driver, and circuit breaker). When the NPRDS reported testing frequency differed among the subcomponents, an estimate was made for the MDP assembly testing frequency that included the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI Inservice Testing interval requirements (as required by the Technical Specifications), the system, and the subcomponent function in the MDP assembly. When no

frequency was given by NPRDS, a minimum frequency of once per quarter was used. Demands associated with a surveillance test that occurred during train alignment and return to the "as found" condition of a system/train were not included in the total number of demands, nor were corollary failures included in the failure count. Although the Technical Specifications generally require a full flow test once per refueling cycle, no additional demands were included because the surveillance test frequencies used in this study (e.g., monthly or quarterly) were assumed to envelop these refueling cycle demands.

The total number of demands for the MDPs in a specific system was the sum of ESF MDP demands and surveillance test demands, where the latter is the sum of the products of the MDPs and their estimated testing frequencies over the 9-year period (1987-1995) and the former (ESFs) covers the 12-year period (1987-1998). However, this method is applicable when the ESF data and surveillance test data are determined by statistical methods to be in the same population (see Section 4.1 for contingency tests).

The probability of failure on demand for MDPs was estimated by dividing total MDP failures by total MDP demands [(ESF failures + surveillance test failures) ÷ (ESF demands + surveillance test demands)] as long as the ESF data and surveillance test data were determined to be in the same population.

2.4 Operational Data Analysis

A contingency test analysis was performed to *reject* or to *not reject* the hypothesis that failure and demand data from surveillance testing of Application Coded MDPs were in the same population as ESF failure and demand data. The analysis used surveillance test data for the MDPs in the PWR and BWR RI systems during the 1987-1995 period and ESF data from the 1987-1998 period..

The approximate method for contingency test tables (chi-square, 1 degree of freedom, 0.95 quantile), was used for the *reject/not reject* hypothesis that the ESF and surveillance test data are from the same population ($\chi^2 < 3.84$). The contingency test table provides a short-cut method of computing chi-square using the following 2X2 table and formula:

$\chi^2 = \frac{n(ad-bc)^2}{k}k$, where $n = a+b+c+d$ and $k = (a+b)(c+d)(a+c)(b+d)$

	ESFs	SURVEILLANCE TEST	TOTAL
NO. of FAILURES	*a*	*b*	*(a + b)*
NO. of SUCCESSES	*c*	*d*	*(c + d)*
TOTAL (DEMANDS)	*(a + c)*	*(b + d)*	*n*

Alternate Method (formula to correct for continuity): $\chi^2 = \frac{n(|ad-bc| - n/2)^2}{k}$

Bayes Method

The Bayes method (Ref. 4), as applied for MDPs by plant system, assumes that the probability of failure on demand varies from plant to plant according to a beta distribution. The parameters for this distribution were estimated from the pooled data by maximum likelihood. For each plant RI system, this distribution was used as a Bayes prior distribution and updated with the plant-specific system failure data.

Standby Failure Rate

The average standby failure rate (λ) for MDPs in each system is based on the data for the 9-year period (1987-1995), using the following equation:

$$\lambda = \frac{f}{(nc)(coy)(8760)}, \text{ failures per component-hour}$$

where f = the number of failures during the period
nc = the number of MDPs in each plant for the system
coy = the actual number of calendar operating years during the 9-year period
8760 = the number of hours in a calendar year

3. RISK-BASED ANALYSIS

This section provides the risk-based analysis of operational data, the estimated MDP probabilities of failure on demand and estimated standby failure rate, the contingency test analysis for the data population, and the comparison of MDP probability values with those in IPEs and other sources.

3.1 Calculation Results

Appendix I provides tables applicable to the MDP probability of failure on demand by the selected RI systems in the PWR and BWR plants. The results of the contingency test analysis for ESFs and surveillance test data in the same population are as follows:

PWR RI SYSTEM	HYPOTHESIS	BWR RI SYSTEM	HYPOTHESIS
HPI	Not Rejected	HPCS	Not Rejected
AFW	Not Rejected	RBCC	Not Rejected
RHR/LPI	Rejected	ESW	Not Rejected
CVCS	Not Rejected	LPCS	Not Rejected
CS	Not Rejected	RHR/LPCI	Rejected
CCW	Not Rejected		
NSW	Rejected		

For the PWR and BWR plants, during the 1987-1995 period, the contingency test rejected the hypothesis that the ESF failures and demands were in the same population as the surveillance test failures and demands for MDPs in RHR systems (see Section 4.1). The reason for this disparity appears to be the sparseness of ESF data, since most RHR functions are performed during shutdown and have few ESF actuations. For the PWR NSW system, the rejection is also due to relatively sparse data, since ESF actuation signals do not constitute a demand of a running NSW system. As stated earlier, the more extensive surveillance test data (1987-1995) was used for probability of failure on demand estimates for these systems.

For the balance of PWR and BWR RI systems, the contingency tests did not reject the hypothesis that the ESF failures and demands were in the same population as the surveillance test failures and demands (see Section 4.1). Therefore, the Bayes 90-percent intervals used for this study used ESF data from 1987-1998 and surveillance test data from 1987-1995.

The failure probabilities used in PRAs are presently provided in terms of probability of failure on demand and probability of failure per operating hour. In this study, probability of failure on demand was used for MDPs because data was available to match failures with demands. Data on run times from LERs and NPRDS was not available to compare with generic failure to run

data. The generic failure probability on demand values used in this study are from NUREG/CR-4550 (Ref. 5), which was an input to NUREG-1150.

Table A shows the MDP probability of failure on demand values for the 1987-1998 period for the selected RI systems.

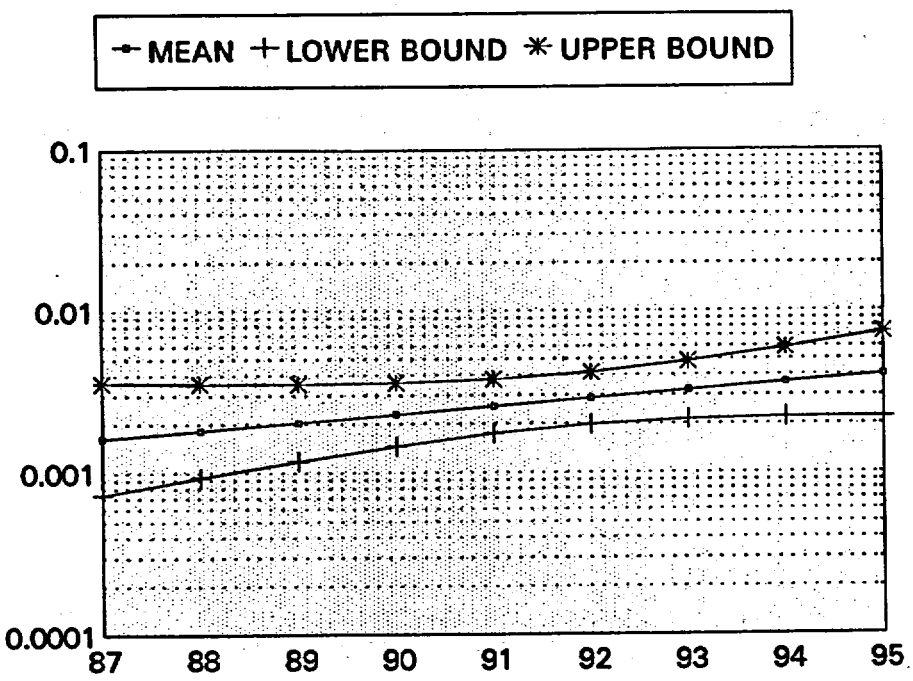
TABLE A
MDP PROBABILITY OF FAILURE ON DEMAND (1987-1998)

	LOWER BOUND	MEAN	UPPER BOUND
NUREG/CR-4550	**1.1E-3**	**3E-3**	**1.1E-2**
PWR RI SYSTEMS			
Auxiliary Feedwater (AFW)	1.2E-3	1.8E-3	2.4E-3
High Pressure Injection (HPI)	9.5E-5	3.0E-3	9.6E-3
Component Cooling Water (CCW)	8.8E-7	1.4E-3	5.8E-3
Containment Spray (CS)	8.9E-5	2.1E-3	6.5E-3
Chemical and Volume Control (CVCS)	9.9E-4	2.0E-3	3.4E-3
Nuclear Service Water (NSW)	1.5E-4	2.1E-3	5.8E-3
Residual Heat Removal (RHR)	2.0E-4	1.7E-3	4.5E-3
BWR RI SYSTEMS			
High Pressure Core Spray (HPCS)	2.5E-8	1.2E-2	6.1E-2
Low Pressure Core Spray (LPCS)	2.5E-4	1.5E-3	3.6E-3
Reactor Building Closed Cooling (RBCC)	4.2E-5	3.5E-4	9.2E-4
Essential Service Water (ESW)	1.5E-3	3.4E-3	5.9E-3
Residual Heat Removal (RHR)	5.1E-4	1.2E-3	2.2E-3

The results shown in Table A indicated that the Bayes 90-percent interval probabilities of failure on demand were generally consistent with the generic NUREG/CR-4550 values referenced in this study, except the BWR RBCC system value was lower and the mean value and upper bound value for the HPCS system was higher.

Appendix I gives calculated standby failure rates for the selected PWR and BWR RI systems.

The MDP yearly trend analysis for probability of failure on demand showed no trend for PWR and BWR RI systems, except for the PWR HPI system. The HPI system showed an increasing trend through the 1987-1995 period (see Figure 3, below). The end point of the trend is still within the expected range of the generic values in NUREG/CR-4550.

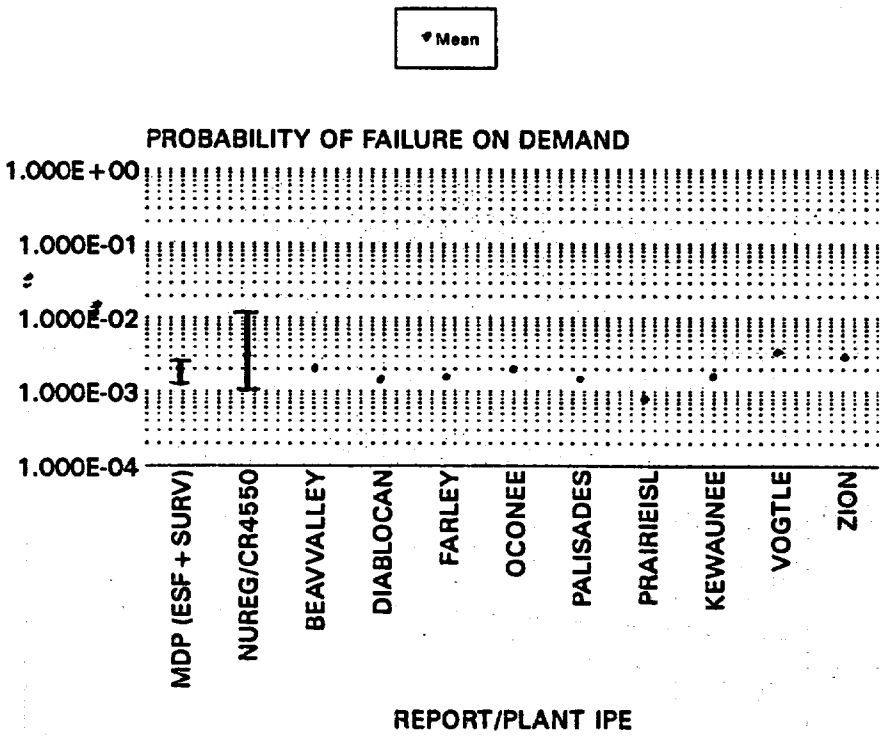


PWR HPI PROBABILITY OF FAILURE ON DEMAND
YEARLY TREND - 1987-1995
FIGURE 3

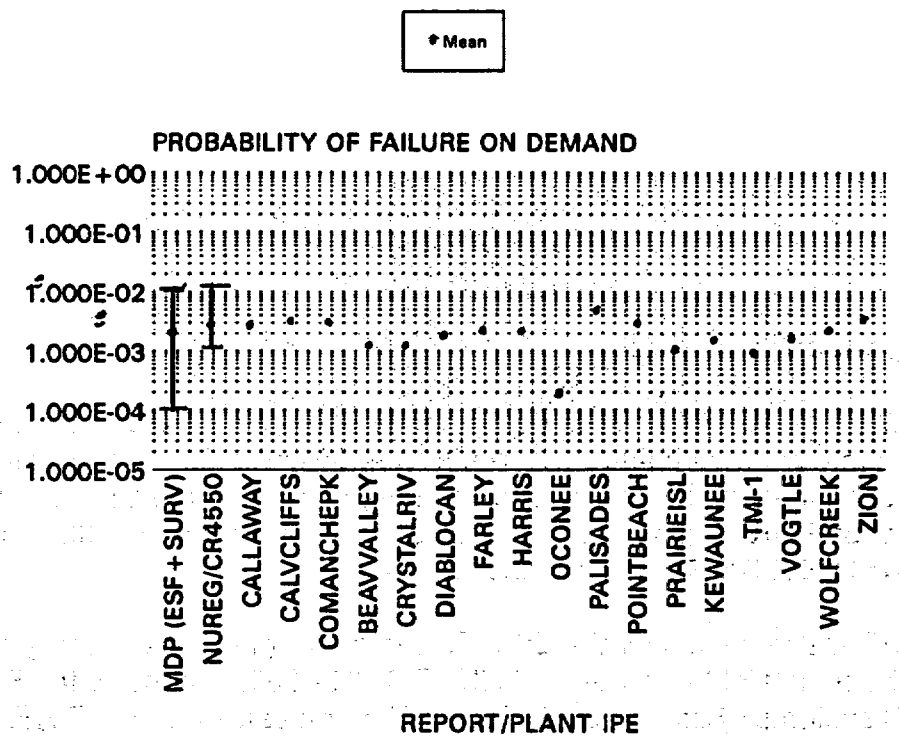
3.2 Comparison With IPEs

The MDP failure probabilities on demand developed for the PWR and BWR RI systems were compared with a selected group of plant-specific individual plant examinations (IPEs), as shown in Figures 4 through 15. The IPE mean values for PWR plants were generally consistent with the results of this study and the NUREG/CR-4550 generic values.

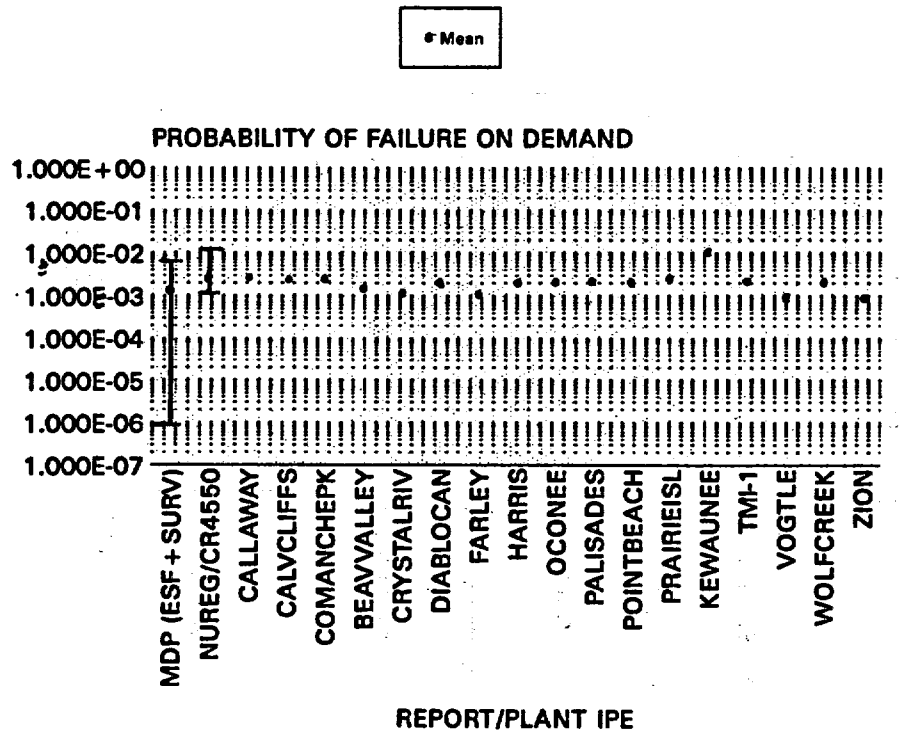
The IPE mean values for the BWR RI systems were also generally consistent with the results of this study and NUREG/CR-4550, except for the RHR and RBCC systems. Sixty percent of the IPE mean values for the BWR RHR system were higher than the RHR system value range estimated in this study. Most (89%) of the IPE mean values for the RBCC system were higher than the RBCC system value range estimated in this study.



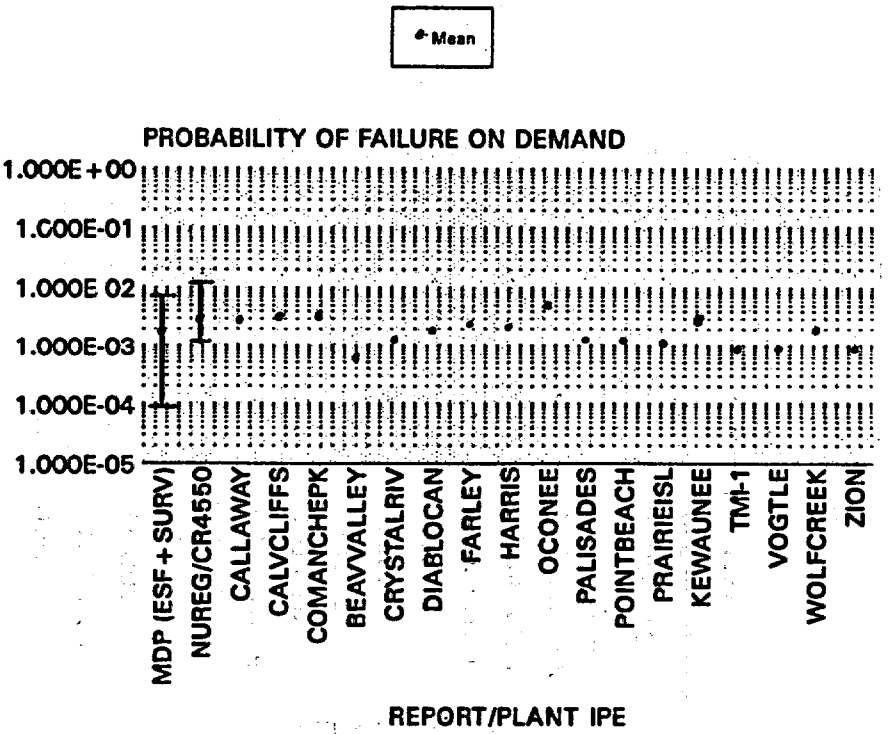
PWR AFW SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs
FIGURE 4



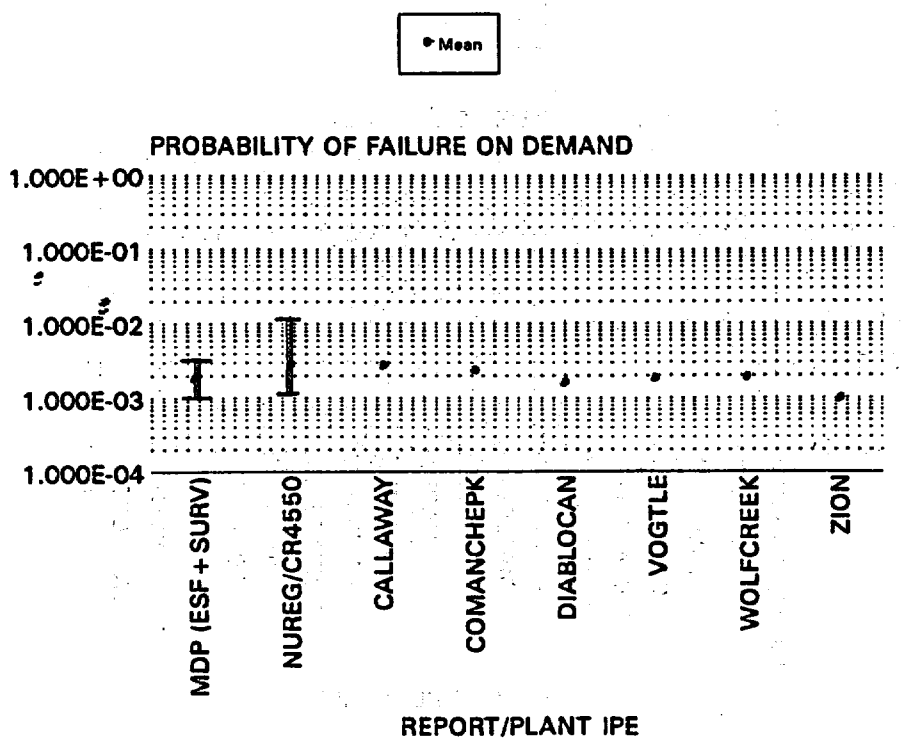
PWR HPI SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs
FIGURE 5



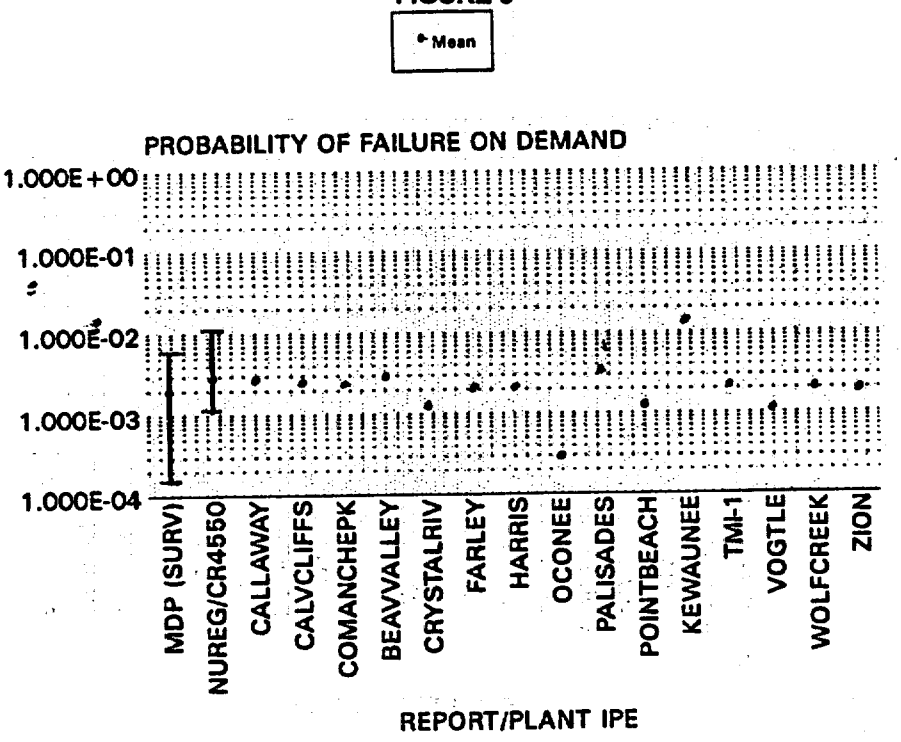
PWR CCW SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs
FIGURE 6



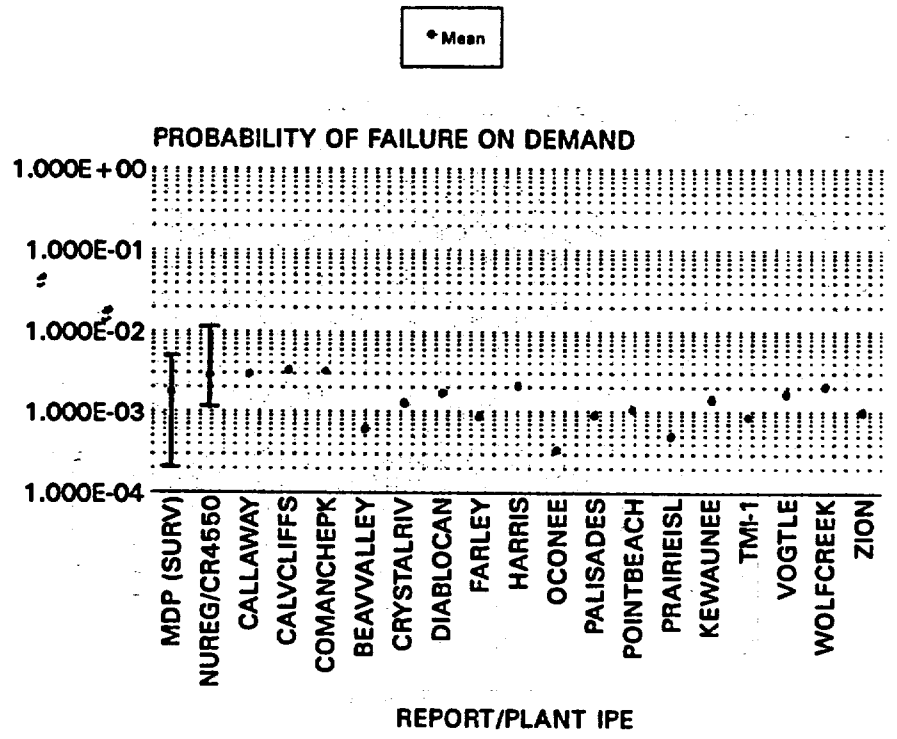
PWR CS SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs
FIGURE 7



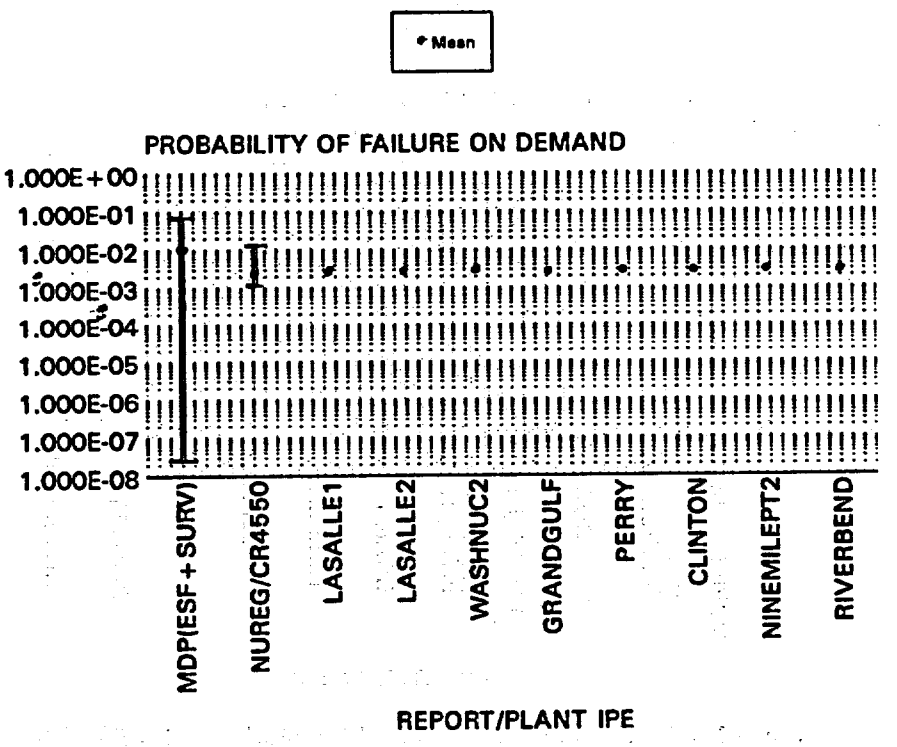
PWR CVCS SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs
FIGURE 8



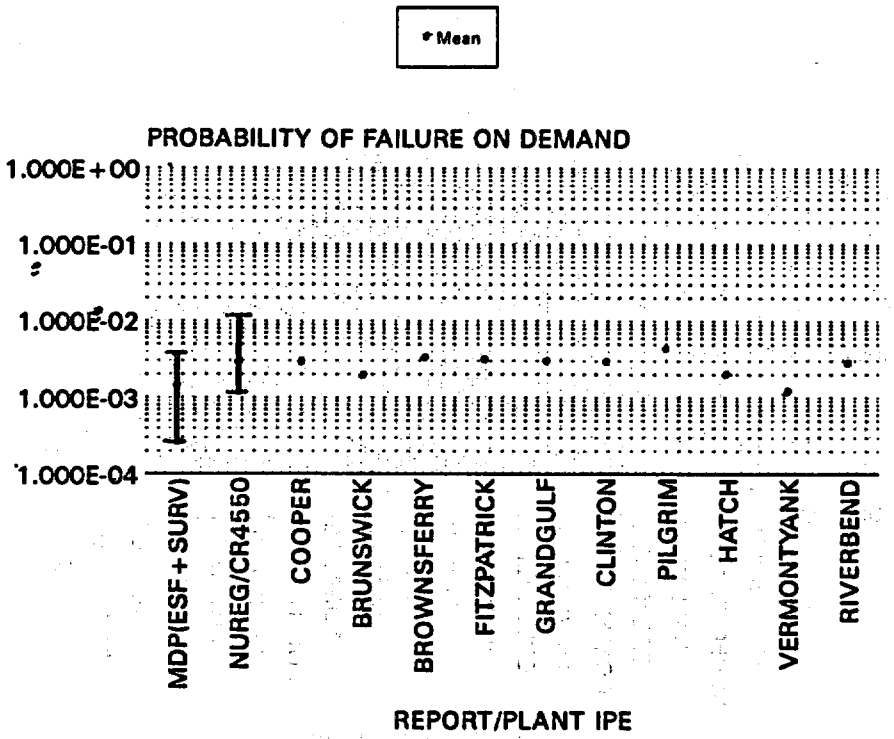
PWR NSW SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs
FIGURE 9



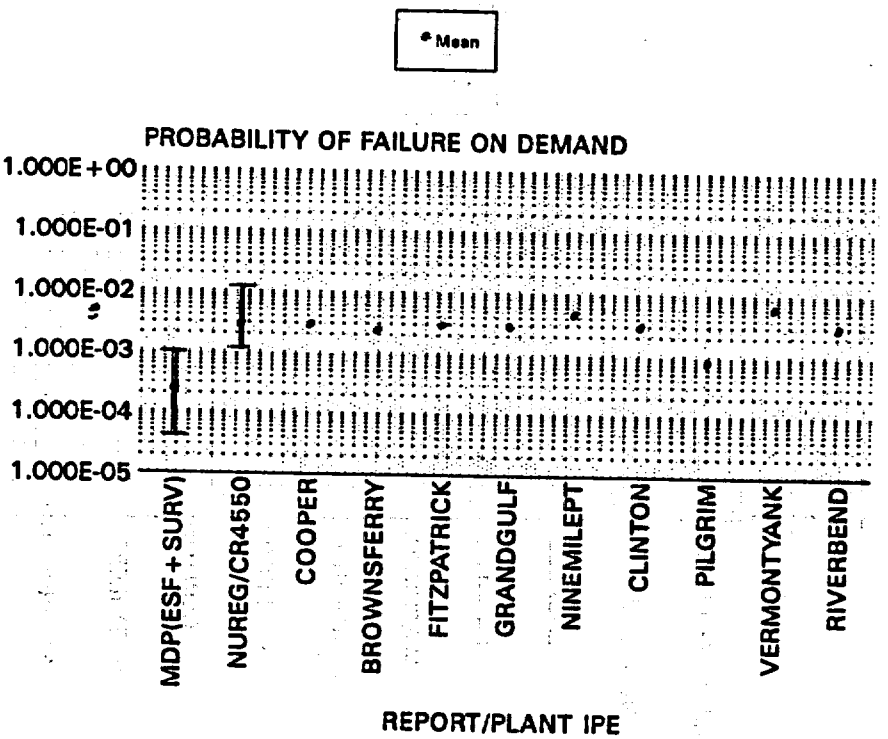
PWR RHR SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs
FIGURE 10



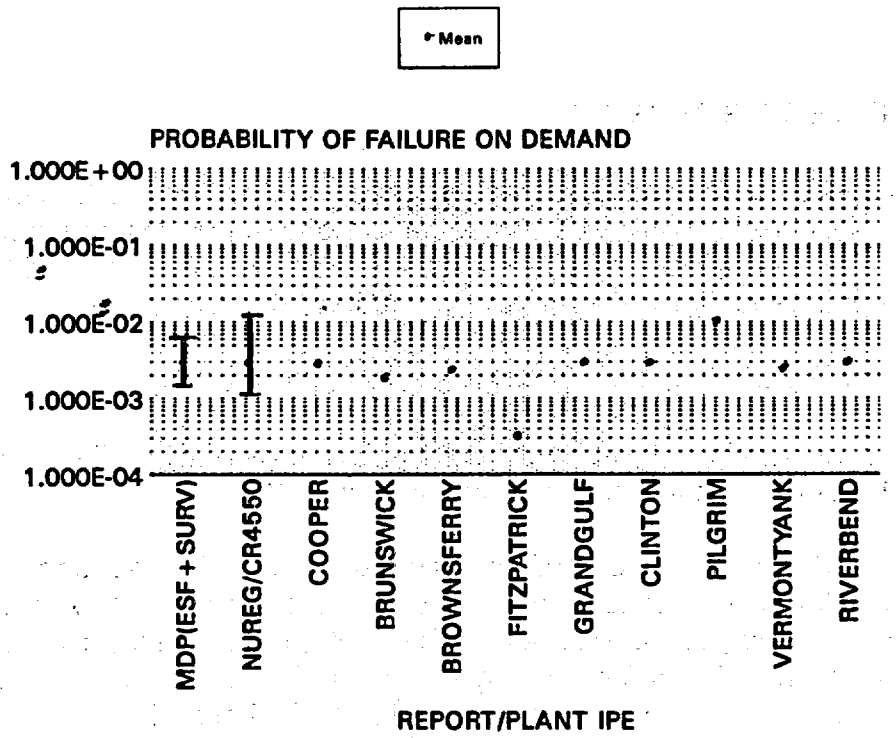
BWR HPCS SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs
FIGURE 11



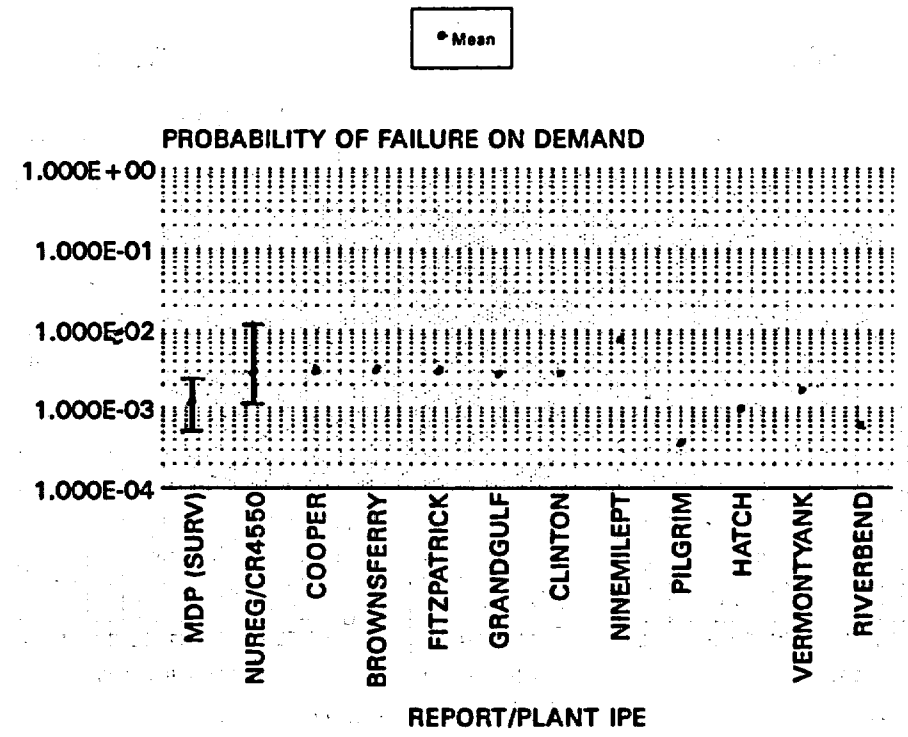
BWR LPCS SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs
FIGURE 12



BWR RBCC SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs
FIGURE 13



BWR ESW SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs
FIGURE 14



BWR RHR SYSTEM MDP PROBABILITY OF FAILURE ON DEMAND COMPARISON WITH VALUES USED IN IPEs
FIGURE 15

4. ENGINEERING ANALYSIS

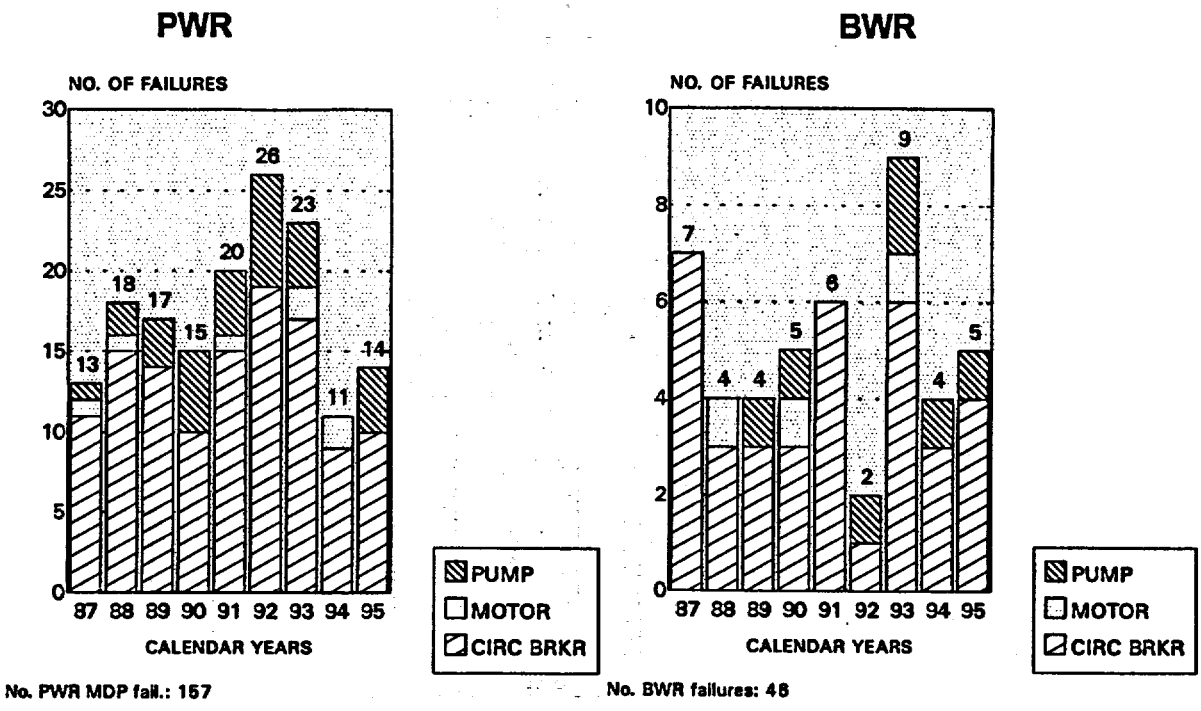
This section contains the engineering analyses including failure trend analysis, component trends in time, failure characteristics and their causes, a brief discussion and a listing of NRC regulatory initiatives related to MDPs, and engineering insights from the various analyses.

4.1 Failure Trend Analysis

Appendix III gives data for trending MDP failures. MDP failure trends during the 1987-1995 period are illustrated in Figure 16.

As stated in Section 2.3, NPRDS failure data for 1996 was reported inconsistently by licensees and, therefore, was determined to be insufficient for trending purposes. Without NPRDS data, LER data from 1996 through 1998 was insufficient for trending purposes. Therefore, NPRDS and LER failure data was used for trending the 1987-1995 period.

Failure trends of MDPs for the PWR and BWR RI systems during the 1987-1995 period were relatively constant, except for an upward peak in 1992 and 1993 for PWRs and in 1993 for BWRs.



PWR AND BWR MDP FAILURE TRENDS
FIGURE 16

4.2 Component Trends in Time

Methodology

The initial assumption made in this study is that the rate of failure events over time (λ) is constant. Several methods were used to check this assumption to determine if any significant age-related increase in λ occurred among older plants. An increase in λ due to aging could only occur if the following conditions were present:

1. There was an increase in λ over time (a nonconstant failure rate that was increasing), and

2. λ was higher for the older plants, and

3. the dominant contributor to failure was due to age/wear mechanisms.

When individual failure events are arranged in chronological order, a cumulative plot helps to show whether λ is constant throughout the period.

This study used an average failure rate, λ_{AVE}, equal to the total number of MDP failures (ESF and surveillance test) for the 1987-1995 period, divided by the cumulative number of MDP component-years of operation during the period. Failure data from the 1996-1998 period was not included since it was limited to ESF and sparse surveillance test data reported in LERs.

The cumulative number of failures were plotted against the number of MDP component-years since the beginning of the study period (i.e., 1987) and compared with λ_{AVE}. This was done for PWRs and BWRs for combined plant age groups (all PWR and BWR plants) and individually for plant age groups A, B, and C. These groups comprise 109 plants used as a basis for all component studies. There were 73 PWR plants and 36 BWR plants with MDPs. The following table defines the plant age groups and gives the number of PWR and BWR plants in each group:

PLT AGE GROUP	COMMERCIAL OPERATION DATE	TOTAL NUMBER OF PLANTS	NUMBER OF PWR PLANTS	NUMBER OF BWR PLANTS
A	12/31/74 and Earlier	36	24	12
B	01/01/75 through 03/31/84	37	25	12
C	04/01/84 and later	36	24	12

The assumption (i.e., the null hypothesis) that λ_{AVE} is constant during the study period for each plant age group and for the combined plant age groups was evaluated. The failure rates (λ_{AVE}) are the slope of the plots for each plant age group. Plant age groups were compared to determine whether there was any indication of plant aging (e.g., a higher slope for the older plant age groups than for the newer plant age groups). A statistical test for the null hypothesis is the Laplace test. For this test, $L/2$ is defined as the midpoint of the cumulative number of component-years during the 1987-1995 period. If λ is constant, about half of the events should occur before $L/2$ and half afterwards. The criterion for not rejecting the null hypothesis is that the statistic U is approximately normal for a number of failures ≥ 3 (U is within $\pm$ 1.645 for the 0.95th and 0.05th quantiles of the standard distribution). With a nonconstant failure rate (rejected null hypothesis) that is increasing (U >+1.645), there may be aging. The formula for the U statistic is :

$$U = \frac{\overline{T} - L/2}{L\sqrt{1/12n}}$$ where n = no. of failures, Ti = interval between failures in component-years, and $\overline{T} = \Sigma Ti / n$

The mean time between failures was provided for information, using the reciprocal of the λ_{AVE} applicable to each PWR and BWR plant age group and to combined plant age groups.

Results

Appendix II provides tables applicable to component trends in time evaluations for MDPs. These analyses were performed to determine whether the failure rates were constant over time and whether the failure rates between older and newer plant age groups increased as an indication of possible aging. A comparison of plots of cumulative MDP failures over time to the applicable average failure rate ($\lambda_{AVE.}$) plots for PWRs and BWRs indicated the following:

PWRs (see Figure 17) - For the PWR RI systems, a review of plant age groups did not show evidence of an increase in λ for any of the plant age groups due to aging mechanisms.

- For plant age group A, the assumed hypothesis that the failure rate was constant was not rejected. The value of U at the 10-percent significance level was + 0.17 (very close to zero) and did not show any evidence of a nonconstant failure rate.

- For plant age group B, the hypothesis of a constant failure rate was also not rejected. The value of U at the 10-percent significance level was + 0.30 (also very close to zero) and did not show any evidence of a nonconstant failure rate.

- For plant age group C, the hypothesis of a constant failure rate was also not rejected. The value of U at the 10-percent significance level was - 0.85 and did not show evidence of a nonconstant failure rate.

- When the average failure rates were compared among the plant age groups, plant age effects were assumed to be reflected by highest average failure rates for the older plant age group A, ranging to the lowest average failure rate for plant age group C. However, the $\lambda_{AVE.}$ for B (0.019) was slightly higher than for A (0.017), and that both rates were slightly higher than for C (0.012). Therefore, there was no evidence that failure rates increased as a function of plant age.

- When the causes of PWR MDP assembly failures were reviewed, unknown causes accounted for 43%, followed by age/wear causes (27%) and maintenance/procedural deficiencies (16%)(see Figure 20). Therefore, age/wear mechanisms were not the predominant cause of failure.

BWRs (see Figure 18) - For the BWR RI system MDPs, the review of plant age groups did not show evidence of an increase in λ for any of the plant age groups due to aging mechanisms.

- For the plant age group A, the hypothesis of a constant failure rate was not rejected. The value of U at the 10-percent significance level was - 1.585 (close to -1.645 and decreasing), and did not show any evidence of a nonconstant failure rate.

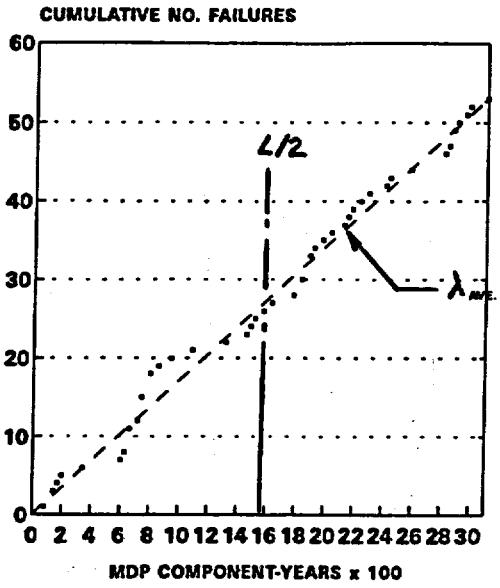
- For plant age group B, the hypothesis of a constant failure rate was also not rejected. The value of U at the 10-percent significance level was + 0.97 (<+1.645) and did not show any evidence of a nonconstant failure rate.

- For plant age group C, the hypothesis was not rejected either. The value of U at the 10-percent significance level was + 0.29 (close to zero) and did not show any evidence of a nonconstant failure rate.

- When the average failure rates were compared among the plant age groups, plant age effects were assumed to be reflected by highest average failure rates for the older plant age group A, ranging to the lowest average failure rate for plant age group C. Plant age group A (0.010) was slightly lower than for B (0.012) and C (0.012). Therefore, there was no evidence that failure rates increased as a function of plant age.

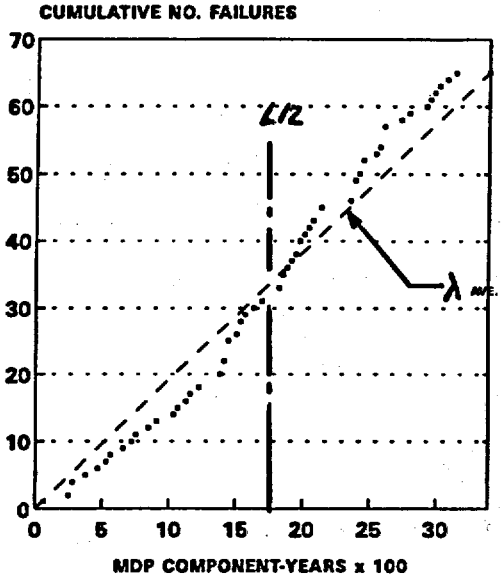
- When the causes of BWR MDP assembly failures were reviewed, age/wear (43%), unknown (26%), and maintenance/procedural deficiencies (20%) were found to be the most significant causes. Therefore, age/wear mechanisms were the predominant cause of MDP failures (see Figure 20).

PWR PLANT AGE GRP 'A
PWR RI SYSTEMS



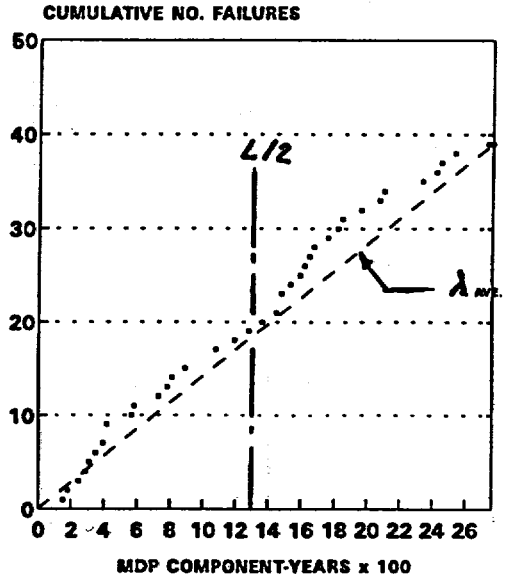
PERIOD: 1987-1995
No. fail.: 53

PWR PLANT AGE GRP 'B
PWR RI SYSTEMS



PERIOD: 1987-1995
No. fail.: 65

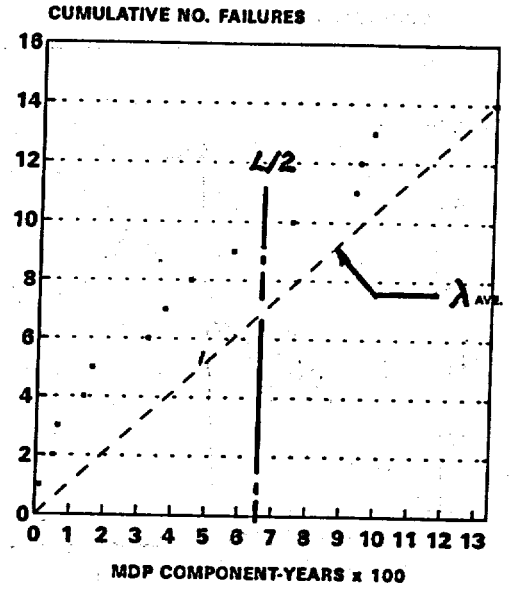
PWR PLANT AGE GRP 'C
PWR RI SYSTEMS



PERIOD: 1987-1995
No. fail.: 39

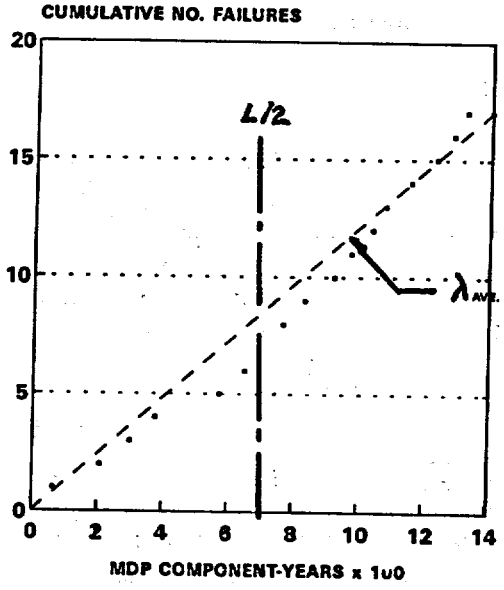
PWR RI SYSTEMS MDP COMPONENT TRENDS IN TIME
FIGURE 17

BWR PLANT AGE GRP A
BWR RI SYSTEMS



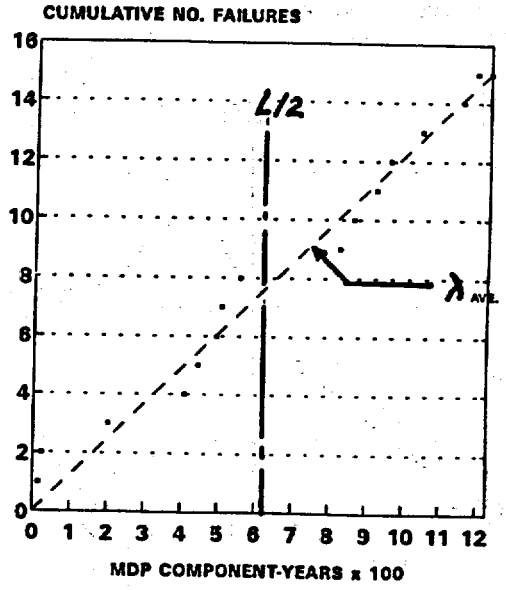
PERIOD: 1987-1995
No. fail.: 14

BWR PLANT AGE GRP B
BWR RI SYSTEMS



PERIOD: 1987-1995
No. fail.: 17

BWR PLANT AGE GRP C
BWR RI SYSTEMS



PERIOD: 1987-1995
No. fail.: 15

BWR RI SYSTEMS MDP COMPONENT TRENDS IN TIME
FIGURE 18

4.3 Failure of Subcomponents and Their Causes

Methodology

The MDP assembly failures and causes were identified on a subcomponent level in the NPRDS database. LER reported failures in the SCSS database and the LER narrative provided sufficient information to identify the failed subcomponents and causes and to group these failures using the NPRDS categories. The apportionments were done to obtain insights into the predominant subcomponent failures and their causes by reactor type (PWR and BWR).

The subcomponents were also grouped by PWR and BWR and the causes of failure were calculated as percentages. The cause categories of failure used are similar to those defined in NPRDS.

The failure cause categories used in this study were as follows:

Age/wear (AW)
Design deficiency (DD)
Unknown (UK)
Out-of-adjustment (OA)
Dirt/contamination/corrosion (DC)
Manufacturing defect (MF)
Maintenance/procedural deficiencies (MP)
Mechanical linkage (ML)

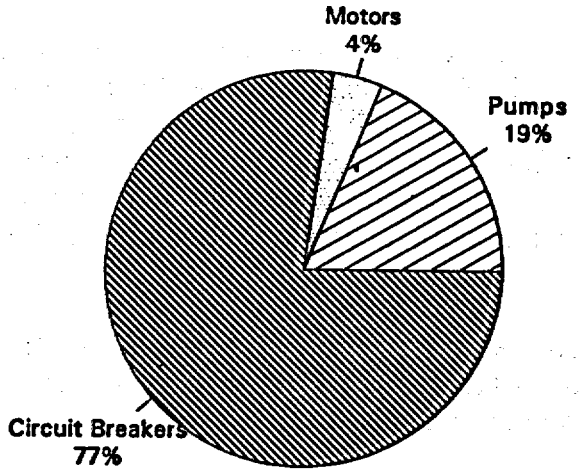
Results

Figure 19 shows the MDP subcomponent failure apportionment for the PWR and BWR RI systems. For both PWRs and BWRs, the evaluation of MDP subcomponent failure patterns determined that circuit breaker failures accounted for greater than three-quarters of all MDP subcomponent failures. Pumps failures were less significant and motor failures were considered not significant (less than 10%).

Failure causes for all MDP assemblies are illustrated in Figures 20 and 21. For the PWR RI systems, the causes were mainly due to unknown (43%), age/wear (27%),and maintenance/procedural deficiencies (16%). For the BWR RI systems, the causes were mainly due to age/wear (43%), unknown (26%), and maintenance/procedural deficiencies (20%).

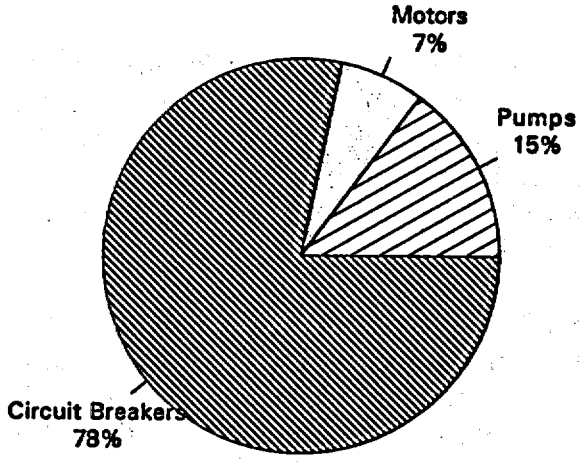
For lack of a root cause analysis, failures to many MDP subcomponents, particularly circuit breakers, were attributed to unknown causes.

PWR RI SYSTEM MDPs



No. failures: 157

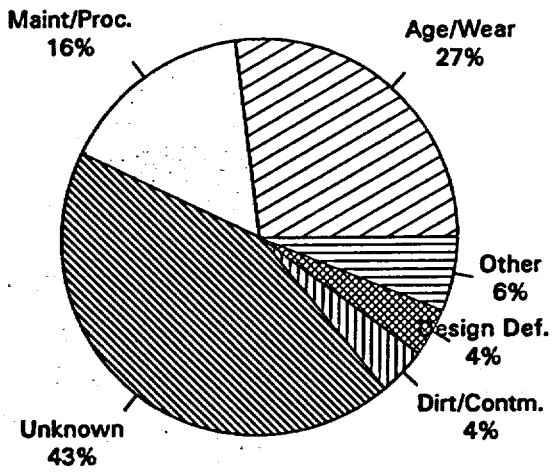
BWR RI SYSTEM MDPs



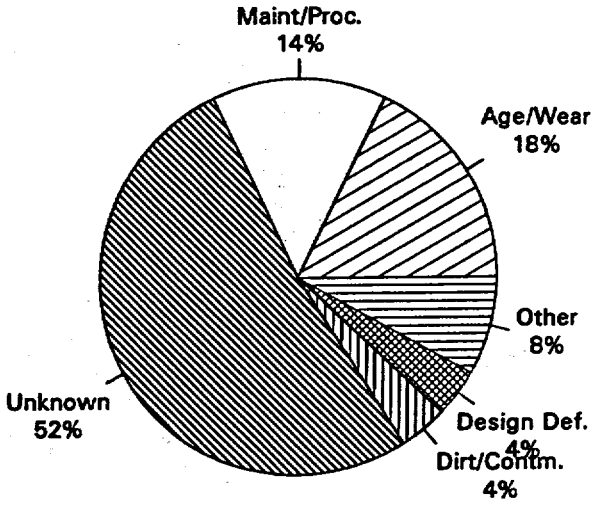
No. failures: 46

MDP SUBCOMPONENT FAILURE APPORTIONMENT
FIGURE 19

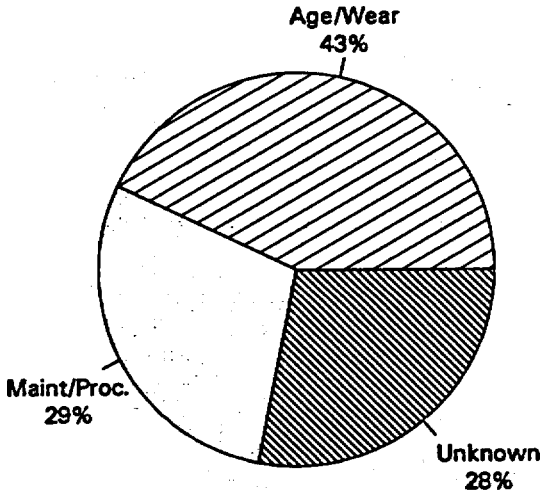
PWR RI SYSTEMS MDP ASSEMBLIES
ALL SUBCOMPONENTS



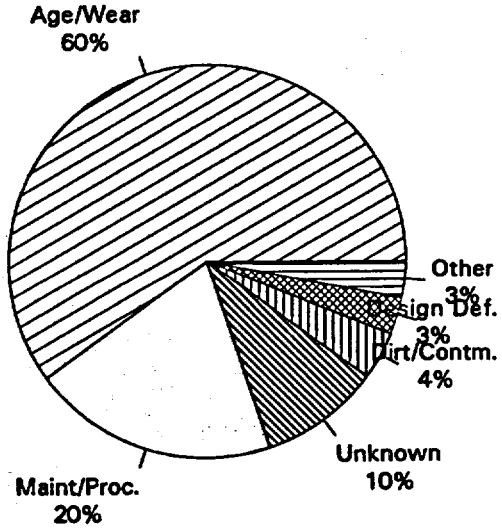
PWR RI SYSTEMS MDP ASSEMBLIES
CIRCUIT BREAKER SUBCOMPONENT



PWR RI SYSTEMS MDP ASSEMBLIES
MOTOR DRIVER SUBCOMPONENT

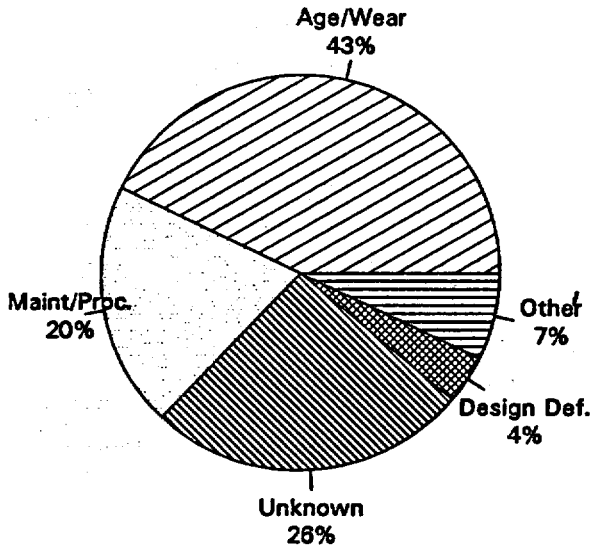


PWR RI SYSTEMS MDP ASSEMBLIES
PUMP SUBCOMPONENT

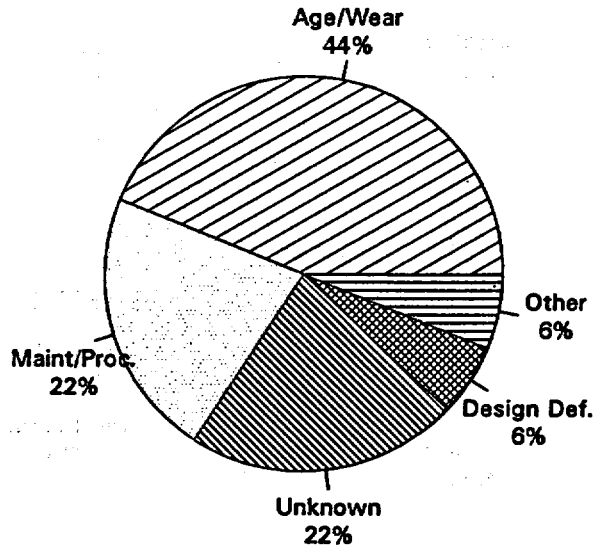


PWR RI SYSTEMS MDP FAILURE CAUSES
FIGURE 20

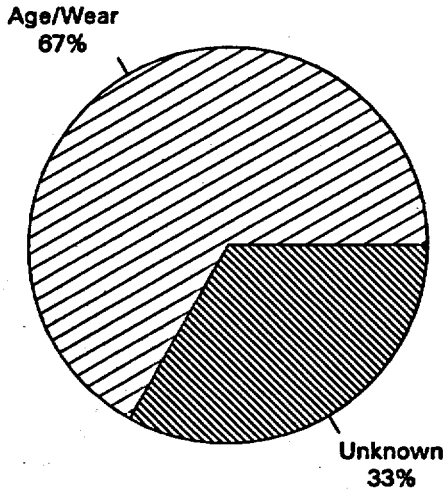
BWR RI SYSTEMS MDP ASSEMBLIES
ALL SUBCOMPONENTS



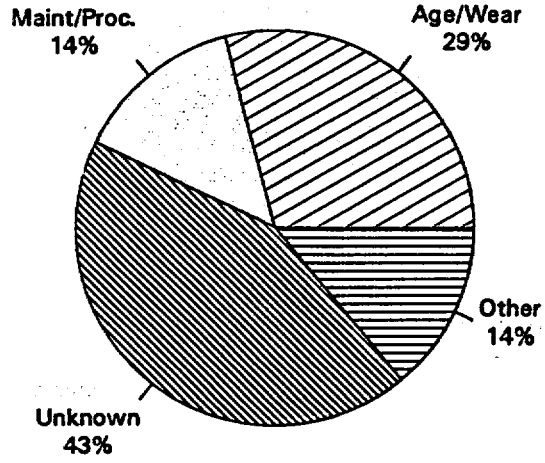
BWR RI SYSTEMS MDP ASSEMBLIES
CIRCUIT BREAKER SUBCOMPONENT



BWR RI SYSTEMS MDP ASSEMBLIES
MOTOR DRIVER SUBCOMPONENT



BWR RI SYSTEMS MDP ASSEMBLIES
PUMP SUBCOMPONENT



BWR RI SYSTEMS MDP FAILURE CAUSES
FIGURE 21

4.4 Related Issues - Information Notices

The review of NRC regulatory initiatives related to MDP assemblies and their subcomponents included Generic Letters, Circulars, Bulletins, and Information Notices (INs). This review determined that only the 12 INs listed in Table B were directly applicable to MDP assemblies and their subcomponents during the 1987-1998 period. INs that identified system interactions with MDPs or potential MDP failures due to system alignment or procedures were excluded. The review of the listed INs did not identify any catastrophic failures associated with ESF demands or surveillance testing used in this study.

TABLE B
NRC INFORMATION NOTICES (INs) CONCERNING MDP ASSEMBLIES (1986-1998)

IN 87-30	Cracking of Surge Ring Brackets in Large General Electric Company Electric Motors, July 2, 1987.
IN 87-51	Failure of Low Pressure Safety Injection Pump Due to Seal Problems, October 13,1987.
IN 88-12	Overgreasing of Electric Motor Bearings, April 12, 1988.
IN 88-54	Failure of Circuit Breaker Following Installation of Amtector Direct Trip Attachment, July 28, 1988.
IN 89-08	Pump Damage Caused by Low-Flow Operations, January 26, 1989.
IN 91-07	Maintenance Deficiency Associated with General Electric Horizontal Custom 8000 Induction Motors, February 4, 1991.
IN 93-08	Failure of Residual Heat Removal Pump Bearings Due to High Thrust Loading, February 1, 1993.
IN 94-45	Potential Common-Cause Failure Mechanism for Large Vertical Pumps, June 17, 1994.
IN 94-76	Recent Failures of Charging/Safety Injection Pump Shafts, October 26, 1994.
IN 97-52	Inadvertent Loss of Capability for Emergency Core Cooling System Motors, July 17, 1997.
IN 97-90	Use of Nonconservative Acceptance Criteria in Safety-Related Pump Surveillance Tests, December 30, 1997.
IN 98-38	Metal-Clad Circuit Breaker Maintenance Issues Identified by NRC Inspections, October 15, 1998.

5. SUMMARY OF RESULTS

5.1 Failure Probabilities

For the PWR and BWR RI systems, the MDP probability of failure on demand estimates were based on the failures and demands in the combined ESF and surveillance test data from SCSS and NPRDS data sources, except for the PWR residual heat removal and nuclear service water systems and the BWR residual heat removal system. For these exceptions the surveillance test data was used. The MDP probability of failure on demand estimates were consistent with the generic values from NUREG/CR-4550, which was used as an input to NUREG-1150, except that the value for the BWR reactor building closed cooling water system was lower and the mean and upper bound values for the high pressure core spray system were higher.

The yearly trend analysis for the MDP probability of failure on demand showed no trend for PWR and BWR RI systems, except for the PWR high pressure injection (HPI) system. The HPI system showed a slightly increasing trend through the 1987-1995 period, but this was evaluated as not significant.

The MDP mean probabilities of failure on demand from plant-specific IPE studies were compared with the results of this study. The PWR IPE mean values were generally consistent with the results of this study and NUREG/CR-4550. The IPE mean values for BWR RI systems were also consistent with the results of this study and NUREG/CR-4550, except for the RHR and RBCC systems. Sixty percent of the IPE mean values for the BWR RHR system were higher than the RHR system value range estimated in this study. Most (approximately 89%) of the IPE mean values for the RBCC system were higher than the RBCC system value range estimated in this study. Although the higher values are not considered significant, this study does not support plant-specific system values when the mean values are lower than the system lower bounds values developed in this study.

5.2 Engineering Insights

The engineering insights gained from this study are as follows:

- Failure trends for the PWR and BWR RI systems during the 1987-1995 period were relatively constant, except for an upward peak in 1992 and 1993 for PWRs and in 1993 for BWRs.

- Failure rates, as a function of component-years, varied slightly among the PWR and BWR plant age groups (three groups, of approximately equal size, from older to newer plants by commercial operations date). For PWRs, the review of plant age groups did not show evidence of an increase in failure rates for any of the plant age groups due to aging mechanisms. For BWRs, the review of plant age groups did not show clear evidence of an increase in failure rates for any of the plant age groups due to aging mechanisms.

- The evaluation of MDP subcomponent failure patterns demonstrated that circuit breaker failures were significant contributors to MDP failures in both PWR and BWR RI systems (greater than 75%).

- Failure causes for MDP assemblies in PWR RI systems were mainly due to unknown causes (43%) because a root cause analysis was generally not performed on the predominant failed subcomponent (circuit breaker). Age/wear and maintenance/procedural deficiencies together accounted for the bulk of the balance of failures (43%). For BWR RI systems, age/wear was the predominant cause (43%), while unknown causes and maintenance/procedural deficiencies together accounted for the bulk of the balance (46%).

6. REFERENCES

1. AEOD/S98-02 (INEEL/EXT-95-00133), "High-Pressure Core Spray System Reliability, 1987-1993," May 1998.

2. NUREG/CR-5500, "Reliability Study: Auxiliary/Emergency Feedwater System, 1987-1995," Vol. 1, August 1998.

3. NUREG/CR-5500 (INEEL/EXT-99-00373), "High Pressure Safety Injection System Reliability, 1987-1997 (DRAFT)," May 1999.

4. Martz, Harry F., and Ray A. Waller, "Bayesian Reliability Analysis," Malabar, FL: Krieger, Section 7.6, 1991.

5. NUREG/CR-4550, SAND86-2084, "Analysis of Core Damage Frequency: Internal Events Methodology," Vol. 1, Rev.1, January 1990.

APPENDIX I

FAILURE PROBABILITIES

MDP ASSEMBLY

APPENDIX I - MDP ASSEMBLY FAILURE PROBABILITIES

APPENDIX I - TABLE I
PWR RI SYSTEM MDP ASSEMBLIES
PROBABILITY OF FAILURE ON DEMAND

	NO. FAIL.	NO. DEMANDS	PROBABILITY OF FAILURE ON DEMAND 90% CONFID. INTERVALS PLCB	PHAT	PUCB	BAYES 90% INTERVALS PLO	MEAN	PUP
AFW	22	12329	1.2E-3	1.8E-3	2.5E-3	1.2E-3	1.8E-3	2.5E-3
HPI	34	12720	2.0E-3	2.8E-3	3.6E-3	9.5E-5	3.0E-3	9.6E-3
CCW	18	13414	8.1E-4	1.3E-3	1.9E-3	8.8E-7	1.4E-3	5.8E-3
CS	24	11830	1.4E-3	2.0E-3	2.8E-3	8.9E-5	2.1E-3	6.5E-3
CVCS	7	3611	9.1E-4	1.9E-3	3.6E-3	9.9E-4	2.0E-3	3.4E-3
NSW	30	14608	1.5E-3	2.1E-3	2.8E-3	1.5E-4	2.1E-3	5.8E-3
RHR	20	11736	1.1E-3	1.7E-3	2.5E-3	2.0E-4	1.7E-3	4.5E-3

NOTES:

1. For the 1987-1995 period, the contingency test accepted the hypothesis that the ESF failures and demands were in the same population as the surveillance test failures and demands for the AFW, HPI, CCW, and CVCS systems. Since the contingency test for the 1996-1998 ESF data was also accepted, the probability of failure on demand data combined the surveillance test data for 1987-1995 with ESF data for 1987-1998.

2. For the 1987-1995 period, the contingency test rejected the hypothesis that the ESF failures and demands were in the same population as the surveillance test failures and demands for the NSW and RHR systems. The surveillance test data (1987-1995) was used for estimating the probability of failure on demand for these systems.

3. The 90% confidence intervals (chi-square) are provided for information. The Bayes 90% intervals are used in this study for RI system estimated probability of failure on demand.

4. Average standby failure rates (λ, failures per component-hour), based on 1987-1995 failure data for the combined ESF and surveillance tests for the PWR RI systems, are provided for information, as follows:

   AFW: λ_L = 1.5E-6; λ = 2.2E-6; λ_U = 3.2E-6.
   HPI: λ_L = 1.9E-6; λ = 2.6E-6; λ_U = 3.4E-6.
   CCW: λ_L = 6.7E-7; λ = 1.0E-6; λ_U = 1.6E-6.
   CS: λ_L = 1.4E-6; λ = 2.0E-6; λ_U = 2.8E-6.
   CVCS: λ_L = 7.0E-7; λ = 1.5E-6; λ_U = 2.8E-6.
   NSW: λ_L = 1.5E-6; λ = 2.0E-6; λ_U = 2.7E-6.
   RHR: λ_L = 1.2E-6; λ = 1.8E-6; λ_U = 2.5E-6.

APPENDIX I - TABLE II
BWR RI SYSTEMS MDP ASSEMBLIES
PROBABILITY OF FAILURE ON DEMAND

SYSTEM	NO. FAIL.	NO. DEMANDS	PROBABILITY OF FAILURE ON DEMAND 90% CONFID. INTERVALS PLCB	PHAT	PUCB	BAYES 90% INTERVALS PLO	MEAN	PUP
HPCS	4	457	3.0E-3	8.8E-3	2.0E-2	2.5E-8	1.2E-2	6.1E-2
LPCS	8	5466	7.3E-4	1.5E-3	2.6E-3	2.5E-4	1.5E-3	3.6E-3
RBCC	1	4136	1.2E-5	2.4E-4	1.1E-3	4.2E-5	3.5E-4	9.2E-4
ESW	22	6671	2.2E-3	3.3E-3	4.7E-3	1.5E-3	3.4E-3	5.9E-3
RHR	10	8299	6.5E-4	1.2E-3	2.0E-3	5.1E-4	1.2E-3	2.2E-3

NOTES:

1. For the 1987-1995 period, the contingency test accepted the hypothesis that the ESF failures and demands were in the same population as the surveillance test failures and demands for the HPCS, LPCS, RBCC, and ESW systems. Since the contingency test for the 1996-1998 ESF data was also accepted, the probability of failure on demand data combined the surveillance test data for 1987-1995 with ESF data for 1987-1998.

4. For the 1987-1995 period, the contingency test rejected the hypothesis that the ESF failures and demands were in the same population as the surveillance test failures and demands for the RHR system. The surveillance test data (1987-1995) was used for estimating the probability of failure on demand for these systems.

5. The 90% confidence intervals (chi-square) are provided for information. The Bayes 90% intervals are used in this study for RI system estimated probability of failure on demand.

4. Average standby failure rates (λ, failures per componenent-hour), based on 1987-1995 failure data for the combined ESF and surveillance tests for the BWR RI systems, are provided for information, as follows:

HPCS: λ_L = 2.3E-6; λ = 6.6E-6; λ_U = 1.5E-5.
LPCS: λ_L = 5.6E-7; λ = 1.1E-6; λ_U = 2.1E-6.
RBCC: λ_L = 7.0E-9; λ = 1.4E-7; λ_U = 6.4E-7.
ESW: λ_L = 1.4E-6; λ = 2.1E-6; λ_U = 3.0E-6.
RHR: λ_L = 5.6E-7; λ = 1.1E-6; λ_U = 1.8E-6.

APPENDIX II

MDP ASSEMBLY

COMPONENT TRENDS IN TIME

APPENDIX II
MDP ASSEMBLY COMPONENT TRENDS IN TIME

APPENDIX II - TABLE I
PWR RI SYSTEMS MDP ASSEMBLY FAILURES VERSUS COMPONENT-YEARS
ALL PLANT AGE GROUPS
ESF AND SURVEILLANCE TEST FAILURES

EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS
1/87	0	77	1/90	1	3039	1/93	1	6264
2/87	1	154	2/90	2	3128	2/93	1	6355
3/87	1	231	3/90	2	3216	3/93	3	6445
4/87	0	307	4/90	0	3304	4/93	5	6535
5/87	2	384	5/90	0	3392	5/93	1	6625
6/87	1	461	6/90	1	3481	6/93	3	6715
7/87	1	537	7/90	0	3569	7/93	0	6805
8/87	1	614	8/90	2	3657	8/93	2	6895
9/87	2	691	9/90	2	3745	9/93	1	6985
10/87	1	768	10/90	4	3834	10/93	1	7076
11/87	0	845	11/90	0	3922	11/93	3	7166
12/87	3	922	12/90	1	4010	12/93	2	7256
1/88	0	1005	1/91	4	4101	1/94	2	7345
2/88	0	1087	2/91	1	4192	2/94	0	7436
3/88	2	1170	3/91	1	4282	3/94	1	7526
4/88	0	1253	4/91	2	4372	4/94	0	7617
5/88	2	1336	5/91	2	4462	5/94	1	7707
6/88	2	1419	6/91	1	4552	6/94	1	7797
7/88	0	1502	7/91	1	4642	7/94	0	7887
8/88	1	1585	8/91	1	4732	8/94	0	7977
9/88	2	1668	9/91	1	4822	9/94	2	8067
10/88	2	1751	10/91	2	4912	10/94	1	8158
11/88	6	1834	11/91	3	5002	11/94	1	8248
12/88	1	1917	12/91	1	5092	12/94	2	8338
1/89	1	2002	1/92	1	5183	1/95	1	8428
2/89	3	2087	2/92	3	5274	2/95	3	8518
3/89	1	2173	3/92	4	5364	3/95	1	8608
4/89	3	2260	4/92	3	5454	4/95	4	8699
5/89	2	2346	5/92	2	5544	5/95	1	8789
6/89	2	2432	6/92	4	5634	6/95	0	8879
7/89	0	2518	7/92	2	5724	7/95	1	8969
8/89	0	2604	8/92	3	5814	8/95	1	9059
9/89	2	2690	9/92	2	5904	9/95	0	9149
10/89	1	2779	10/92	1	5994	10/95	0	9240
11/89	0	2865	11/92	1	6084	11/95	1	9330
12/89	2	2951	12/92	0	6174	12/95	1	9420
Totals:							157	

NOTES:

1. $\lambda_{AVE.} = \frac{157}{9420}$ = 0.017 failures per component-year (1987-1995).
2. The mean time between failures = 1/0.017 = 59 component-years.
3. This table is for information only. Tables II, III, and IV are used for evaluation and go with Figure 17 in the text.

APPENDIX II - TABLE II
PWR RI SYSTEMS MDP ASSEMBLY FAILURES VERSUS COMPONENT-YEARS
PLANT AGE GROUPS A
ESF AND SURVEILLANCE TEST FAILURES

EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS
1/87	0	29	1/90	0	1064	1/93	0	2099
2/87	0	58	2/90	1	1092	2/93	1	2128
3/87	1	81	3/90	0	1121	3/93	1	2156
4/87	0	115	4/90	0	1150	4/93	1	2185
5/87	2	144	5/90	0	1179	5/93	0	2214
6/87	1	172	6/90	0	1208	6/93	1	2242
7/87	1	201	7/90	0	1236	7/93	0	2271
8/87	0	230	8/90	0	1265	8/93	1	2300
9/87	0	259	9/90	0	1294	9/93	0	2329
10/87	0	288	10/90	1	1322	10/93	0	2358
11/87	0	316	11/90	0	1351	11/93	0	2386
12/87	1	345	12/90	0	1380	12/93	1	2415
1/88	0	374	1/91	0	1409	1/94	1	2444
2/88	0	402	2/91	0	1438	2/94	0	2472
3/88	0	431	3/91	1	1466	3/94	0	2501
4/88	0	460	4/91	1	1495	4/94	0	2530
5/88	0	489	5/91	1	1524	5/94	0	2559
6/88	0	518	6/91	0	1552 - *L/2*	6/94	1	2588
7/88	0	546	7/91	1	1581	7/94	0	2616
8/88	0	575	8/91	0	1610	8/94	0	2645
9/88	1	604	9/91	1	1639	9/94	0	2674
10/88	1	632	10/91	0	1668	10/94	0	2702
11/88	3	661	11/91	0	1696	11/94	0	2731
12/88	0	690	12/91	0	1725	12/94	0	2760
1/89	1	719	1/92	0	1754	1/95	0	2789
2/89	3	748	2/92	1	1782	2/95	2	2818
3/89	0	776	3/92	0	1811	3/95	1	2846
4/89	3	805	4/92	2	1840	4/95	2	2875
5/89	0	834	5/92	0	1869	5/95	1	2904
6/89	1	862	6/92	3	1898	6/95	0	2932
7/89	0	891	7/92	1	1926	7/95	1	2961
8/89	0	920	8/92	0	1955	8/95	1	2990
9/89	1	949	9/92	1	1984	9/95	0	3019
10/89	0	978	10/92	0	2012	10/95	0	3048
11/89	0	1006	11/92	1	2041	11/95	0	3076
12/89	0	1035	12/92	0	2070	12/95	1	3105
Totals:							53	

NOTES:

1. $\lambda_{AVE.} = \frac{53}{3105} = 0.017$ failures per component-year (1987-1995).
2. The mean time between failures = 1/0.017 = 59 component-years.
3. Failures are for the PWR RI systems in plant age group A.
4. *L/2* indicates the midpoint of the cumulative MDP-years for the 1987-1995 period, for use in the Laplace test (see text).
5. See Figure 17 in the text.

APPENDIX II - TABLE III
PWR RI SYSTEMS MDP ASSEMBLY FAILURES VERSUS COMPONENT-YEARS
PLANT AGE GROUPS B
ESF AND SURVEILLANCE TEST FAILURES

EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS
1/87	0	31	1/90	1	1162	1/93	0	2293
2/87	1	63	2/90	0	1194	2/93	0	2325
3/87	0	94	3/90	1	1225	3/93	1	2356
4/87	0	126	4/90	0	1257	4/93	3	2388
5/87	0	157	5/90	0	1288	5/93	1	2419
6/87	0	188	6/90	0	1319	6/93	2	2450
7/87	0	220	7/90	0	1351	7/93	0	2482
8/87	1	251	8/90	2	1382	8/93	0	2513
9/87	2	283	9/90	2	1414	9/93	1	2545
10/87	0	314	10/90	3	1445	10/93	1	2576
11/87	0	346	11/90	0	1477	11/93	3	2608
12/87	1	377	12/90	1	1508	12/93	0	2639
1/88	0	408	1/91	2	1539	1/94	0	2670
2/88	0	440	2/91	1	1571	2/94	0	2702
3/88	1	471	3/91	0	1602	3/94	1	2733
4/88	0	503	4/91	1	1634	4/94	0	2765
5/88	1	534	5/91	0	1665	5/94	1	2796
6/88	1	565	6/91	1	1696 - *L/2*	6/94	0	2827
7/88	0	597	7/91	0	1728	7/94	0	2859
8/88	0	628	8/91	0	1759	8/94	0	2890
9/88	1	660	9/91	0	1791	9/94	1	2922
10/88	0	691	10/91	2	1822	10/94	1	2953
11/88	1	723	11/91	2	1854	11/94	1	2984
12/88	1	754	12/91	1	1885	12/94	1	3016
1/89	0	785	1/92	1	1916	1/95	0	3047
2/89	0	817	2/92	1	1948	2/95	1	3079
3/89	1	848	3/92	2	1979	3/95	0	3110
4/89	0	880	4/92	1	2011	4/95	1	3142
5/89	1	911	5/92	1	2042	5/95	0	3173
6/89	0	942	6/92	1	2073	6/95	0	3204
7/89	0	974	7/92	0	2105	7/95	0	3236
8/89	0	1005	8/92	2	2136	8/95	0	3267
9/89	1	1037	9/92	0	2168	9/95	0	3299
10/89	1	1068	10/92	0	2199	10/95	0	3330
11/89	0	1100	11/92	0	2231	11/95	0	3362
12/89	1	1131	12/92	0	2262	12/95	0	3393
Totals:							65	

NOTES:

1. $\lambda_{AVE.} = \frac{65}{3393} = 0.019$ failures per component-year (1987-1995).
2. The mean time between failures = 1/0.019 = 53 component-years.
3. Failures are for the PWR RI systems in plant age group B.
4. *L/2* indicates the midpoint of the cumulative MDP-years for the 1987-1995 period, for use in the Laplace test (see text).
5. See Figure 17 in the text.

APPENDIX II - TABLE IV
PWR RI SYSTEMS MDP ASSEMBLY FAILURES VERSUS COMPONENT-YEARS
PLANT AGE GROUPS C
ESF and SURVEILLANCE TEST FAILURES

EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS
1/87	0	15	1/90	0	758	1/93	1	1762
2/87	0	31	2/901	1	784	2/93	0	1791
3/87	0	47	3/90	1	811	3/93	1	1820
4/87	0	62	4/90	0	837	4/93	1	1848
5/87	0	77	5/90	0	864	5/93	0	1876
6/87	0	92	6/90	1	891	6/93	0	1905
7/87	0	107	7/90	0	917	7/93	0	1934
8/87	0	122	8/90	0	944	8/93	1	1962
9/87	0	137	9/90	0	970	9/93	0	1991
10/87	1	152	10/90	0	997	10/93	0	2019
11/87	0	167	11/90	0	1023	11/93	0	2048
12/87	1	182	12/90	0	1050	12/93	1	2076
1/88	0	203	1/91	2	1078	1/94	1	2104
2/88	0	224	2/91	0	1107	2/94	0	2133
3/88	1	246	3/91	0	1136	3/94	0	2162
4/88	0	267	4/91	0	1164	4/94	0	2190
5/88	1	288	5/91	1	1192	5/94	0	2218
6/88	1	310	6/91	0	1221	6/94	0	2247
7/88	0	331	7/91	0	1250	7/94	0	2276
8/88	1	352	8/91	1	1278	8/94	0	2304
9/88	0	373	9/91	0	1306	9/94	1	2333
10/88	1	394	10/91	0	1335	10/94	0	2361
11/88	2	416	11/91	1	1364 - *L/2*	11/94	0	2390
12/88	0	437	12/91	0	1392	12/94	1	2418
1/89	0	462	1/92	0	1421	1/95	1	2446
2/89	0	486	2/92	1	1449	2/95	0	2475
3/89	0	511	3/92	2	1478	3/95	0	2504
4/89	0	536	4/92	0	1506	4/95	1	2532
5/89	1	560	5/92	1	1534	5/95	0	2561
6/89	1	584	6/92	0	1563	6/95	0	2589
7/89	0	609	7/92	1	1592	7/95	0	2618
8/89	0	634	8/92	1	1620	8/95	0	2646
9/89	0	658	9/92	1	1648	9/95	0	2675
10/89	0	682	10/92	1	1677	10/95	0	2703
11/89	0	707	11/92	0	1706	11/95	1	2732
12/89	1	731	12/92	0	1734	12/95	0	2760
Totals:							39	

NOTES:

1. $\lambda_{AVE.} = \frac{39}{2760} = 0.014$ failures per component-year 1987-1995).
2. The mean time between failures = 1/0.014 = 71 component-years.
3. Failures are for the PWR RI systems in plant age group C.
4. *L/2* indicates the midpoint of the cumulative MDP-years for the 1987-1995 period, for use in the Laplace test (see text).
5. See Figure 17 in the text.

APPENDIX II - TABLE V
BWR RI SYSTEMS MDP ASSEMBLY FAILURES VERSUS COMPONENT-YEARS
ALL PLANT AGE GROUPS
ESF AND SURVEILLANCE TEST FAILURES

EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT MATE	NO. FAIL.	CUMULATIVE TDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS
1/87	0	33	1/90	0	1311	1/93	0	2666
2/87	2	66	2/90	0	1248	2/93	0	2703
3/87	1	99	3/90	0	1386	3/93	3	2741
4/87	1	132	4/90	0	1423	4/93	1	2779
5/87	2	165	5/90	1	1461	5/93	0	2816
6/87	0	198	6/90	0	1499	6/93	1	2854
7/87	0	231	7/90	0	1536	7/93	1	2892
8/87	0	264	8/90	2	1574	8/93	1	2929
9/87	0	297	9/90	0	1611	9/93	0	2967
10/87	0	330	10/90	1	1649	10/93	0	3005
11/87	1	363	11/90	0	1686	11/93	2	3042
12/87	0	396	12/90	1	1724	12/93	0	3080
1/88	1	432	1/91	1	1762	1/94	0	3118
2/88	0	469	2/91	1	1799	2/94	1	3155
3/88	0	505	3/91	0	1837	3/94	0	3193
4/88	1	542	4/91	0	1875	4/94	0	3231
5/88	0	578	5/91	1	1912	5/94	1	3268
6/88	0	614	6/91	0	1950	6/94	0	3306
7/88	0	651	7/91	0	1988	7/94	0	3344
8/88	0	687	8/91	0	2025	8/94	0	3381
9/88	0	724	9/91	0	2063	9/94	1	3419
10/88	0	760	10/91	0	2101	10/94	0	3457
11/88	2	797	11/91	2	2138	11/94	1	3494
12/88	0	833	12/91	1	2176	12/94	0	3532
1/89	0	870	1/92	0	2214	1/95	0	3570
2/89	1	906	2/92	0	2251	2/95	0	3607
3/89	0	943	3/92	0	2289	3/95	1	3645
4/89	0	980	4/92	1	2327	4/95	0	3683
5/89	1	1016	5/92	0	2364	5/95	0	3720
6/89	1	1053	6/92	0	2402	6/95	2	3758
7/89	0	1090	7/92	0	2440	7/95	0	3796
8/89	0	1126	8/92	0	2477	8/95	0	3833
9/89	0	1163	9/92	0	2515	9/95	1	3871
10/89	0	1200	10/92	0	2553	10/95	1	3909
11/89	0	1236	11/92	1	2590	11/95	0	3946
12/89	1	1273	12/92	0	2628	12/95	0	3984
Totals:							46	

NOTES:

1. $\lambda_{AVE.} = \frac{46}{3984} = 0.012$ failures per component-year 1987-1995).
2. The mean time between failures = 1/0.012 = 83 component-years.
3. This table is for information only. Tables VI, VII, and VIII are used for evaluation go with Figure 18 in the text.

APPENDIX II - TABLE VI
BWR RI SYSTEMS MDP ASSEMBLY FAILURES VERSUS COMPONENT-YEARS
PLANT AGE GROUP A
ESF AND SURVEILLANCE TEST FAILURES

EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS
1/87	0	12	1/90	0	459	1/93	0	906
2/87	1	25	2/90	0	472	2/93	0	919
3/87	0	37	3/90	0	484	3/93	1	931
4/87	1	50	4/90	0	497	4/93	1	944
5/87	1	62	5/90	0	509	5/93	0	956
6/87	0	74	6/90	0	521	6/93	0	968
7/87	0	87	7/90	0	534	7/93	1	981
8/87	0	99	8/90	0	546	8/93	0	993
9/87	0	112	9/90	0	559	9/93	0	1006
10/87	0	124	10/90	1	571	10/93	0	1018
11/87	1	136	11/90	0	584	11/93	0	1031
12/87	0	149	12/90	0	596	12/93	0	1043
1/88	1	161	1/91	0	608	1/94	0	1055
2/88	0	174	2/91	0	621	2/94	0	1068
3/88	0	186	3/91	0	633	3/94	0	1080
4/88	0	199	4/91	0	646	4/94	0	1093
5/88	0	211	5/91	0	658	5/94	0	1105
6/88	0	223	6/91	0	670 - *L/2*	6/94	0	1117
7/88	0	236	7/91	0	683	7/94	0	1130
8/88	0	248	8/91	0	695	8/94	0	1142
9/88	0	261	9/91	0	708	9/94	0	1155
10/88	0	273	10/91	0	720	10/94	0	1167
11/88	0	286	11/91	0	732	11/94	0	1180
12/88	0	298	12/91	1	745	12/94	0	1192
1/89	0	310	1/92	0	757	1/95	0	1204
2/89	1	323	2/92	0	770	2/95	0	1217
3/89	0	335	3/92	0	782	3/95	0	1229
4/89	0	348	4/92	0	795	4/95	0	1242
5/89	0	360	5/92	0	807	5/95	0	1254
6/89	1	372	6/92	0	819	6/95	0	1266
7/89	0	385	7/92	0	832	7/95	0	1279
8/89	0	397	8/92	0	844	8/95	0	1291
9/89	0	410	9/92	0	857	9/95	0	1304
10/89	0	422	10/92	0	869	10/95	0	1316
11/89	0	434	11/92	0	882	11/95	0	1329
12/89	1	447	12/92	0	894	12/95	1	1341
Totals:							14	

NOTES:

1. $\lambda_{AVE.} = \frac{14}{1341} = 0.010$ failures per component-year (1987-1995).
2. The mean time between failures = 1/0.010 = 100 component-year.
3. Failures are for BWR RI systems only in plant age group A.
4. *L/2* indicates the midpoint of the cumulative MDP-years for the 1987-1995 period, for use in the Laplace test (see text).
5. See Figure 18 in text.

APPENDIX II - TABLE VII

BWR RI SYSTEMS MDP ASSEMBLY FAILURES VERSUS COMPONENT-YEARS

PLANT AGE GROUP B

ESF AND SURVEILLANCE TEST FAILURES

EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS
1/87	0	13	1/90	0	481	1/93	0	949
2/87	0	26	2/90	0	494	2/93	0	962
3/87	0	39	3/90	0	507	3/93	1	975
4/87	0	52	4/90	0	520	4/93	0	988
5/87	1	65	5/90	0	533	5/93	0	1001
6/87	0	78	6/90	0	546	6/93	0	1014
7/87	0	91	7/90	0	559	7/93	0	1027
8/87	0	104	8/90	1	572	8/93	1	1040
9/87	0	117	9/90	0	585	9/93	0	1053
10/87	0	130	10/90	0	598	10/93	0	1066
11/87	0	143	11/90	0	611	11/93	1	1079
12/87	0	156	12/90	0	624	12/93	0	1092
1/88	0	169	1/91	0	637	1/94	0	1105
2/88	0	182	2/91	1	650	2/94	0	1118
3/88	0	195	3/91	0	663	3/94	0	1131
4/88	1	208	4/91	0	676	4/94	0	1144
5/88	0	221	5/91	0	689	5/94	1	1157
6/88	0	234	6/91	0	702 - L/2	6/94	0	1170
7/88	0	247	7/91	0	715	7/94	0	1183
8/88	0	260	8/91	0	728	8/94	0	1196
9/88	0	273	9/91	0	741	9/94	0	1209
10/88	0	286	10/91	0	754	10/94	0	1222
11/88	1	299	11/91	2	767	11/94	1	1235
12/88	0	312	12/91	0	780	12/94	0	1248
1/89	0	325	1/92	0	793	1/95	0	1261
2/89	0	338	2/92	0	806	2/95	0	1274
3/89	0	351	3/92	0	819	3/95	1	1287
4/89	0	364	4/92	1	832	4/95	0	1300
5/89	1	377	5/92	0	845	5/95	0	1313
6/89	0	390	6/92	0	858	6/95	1	1326
7/89	0	403	7/92	0	871	7/95	0	1339
8/89	0	416	8/92	0	884	8/95	0	1352
9/89	0	429	9/92	0	897	9/95	0	1365
10/89	0	442	10/92	0	910	10/95	0	1378
11/89	0	455	11/92	1	923	11/95	0	1391
12/89	0	468	12/92	0	936	12/95	0	1404
Totals:							17	

NOTES:

1. $\lambda_{AVE.} = \frac{17}{1404} = 0.012$ failures per component-year (1987-1995).
2. The mean time between failures = 1/0.012 = 83 component-years.
3. Failures are for BWR RI systems only in plant age group B.
4. *L/2* indicates the midpoint of the cumulative MDP-years for the 1987-1995 period, for use in the Laplace test (see text).
5. See Figure 18 in the text.

APPENDIX II - TABLE VIII

BWR RI SYSTEMS MDP ASSEMBLY FAILURES VERSUS COMPONENT-YEARS

PLANT AGE GROUP C

ESF AND SURVEILLANCE TEST FAILURES

EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MDP-YEARS
1/87	0	8	1/90	0	360	1/93	0	800
2/87	1	15	2/90	0	372	2/93	0	812
3/87	1	23	3/90	0	384	3/93	1	825
4/87	0	30	4/90	0	397	4/93	0	837
5/87	0	38	5/90	1	409	5/93	0	849
6/87	0	46	6/90	0	421	6/93	1	862
7/87	0	53	7/90	0	433	7/93	0	874
8/87	0	61	8/90	1	445	8/93	0	886
9/87	0	68	9/90	0	457	9/93	0	898
10/87	0	76	10/90	0	470	10/93	0	911
11/87	0	83	11/90	0	482	11/93	1	923
12/87	0	91	12/90	1	494	12/93	0	935
1/88	0	101	1/91	1	506	1/94	0	947
2/88	0	111	2/91	0	518	2/94	1	960
3/88	0	121	3/91	0	531	3/94	0	972
4/88	0	132	4/91	0	543	4/94	0	984
5/88	0	142	5/91	1	555	5/94	0	996
6/88	0	152	6/91	0	568	6/94	0	1008
7/88	0	162	7/91	0	580	7/94	0	1021
8/88	0	172	8/91	0	592	8/94	0	1033
9/88	0	182	9/91	0	604	9/94	1	1045
10/88	0	193	10/91	0	616 - L/2	10/94	0	1058
11/88	1	203	11/91	0	629	11/94	0	1070
12/88	0	213	12/91	0	641	12/94	0	1082
1/89	0	224	1/92	0	653	1/95	0	1094
2/89	0	236	2/92	0	666	2/95	0	1106
3/89	0	247	3/92	0	678	3/95	0	1119
4/89	0	258	4/92	0	690	4/95	0	1131
5/89	0	269	5/92	0	702	5/95	0	1143
6/89	0	281	6/92	0	714	6/95	1	1156
7/89	0	292	7/92	0	727	7/95	0	1168
8/89	0	303	8/92	0	739	8/95	0	1180
9/89	0	314	9/92	0	751	9/95	1	1192
10/89	0	326	10/92	0	764	10/95	0	1204
11/89	0	337	11/92	0	776	11/95	0	1217
12/89	0	348	12/92	0	788	12/95	0	1229
Totals:							15	

NOTES:

1. $\lambda_{AVE.} = \frac{15}{1229} = 0.012$ failures per component-year (1987-1995).
2. The mean time between failures = 1/0.012 = 83 component-years.
3. Failures are for BWR RI systems only in plant age group C.
4. *L/2* indicates the midpoint of the cumulative MDP-years for the 1987-1995 period, for use in the Laplace test (see text).
5. See Figure 18 in the text.

APPENDIX III

MDP ASSEMBLY

ENGINEERING INSIGHTS

APPENDIX III
MDP ASSEMBLY - ENGINEERING INSIGHTS

APPENDIX III - TABLE I
PWR SYSTEM - FAILURES AND FAILURE FRACTIONS FOR MDP ASSEMBLIES AND SUBCOMPONENTS

PUMPS	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	1	2	3	4	4	7	4	0	4	29
No. ESF Failures:	0	0	0	1	0	0	0	0	0	1
Total No. Failures:	1	2	3	5	4	7	4	0	4	30
No. Pumps:	----------1082----------									
Failure Fraction	.001	.002	.003	.005	.004	.006	.004	0	.004	
Ave. Failure Fraction	----------.003----------									

MOTORS	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	1	1	0	0	1	0	2	2	0	7
No. ESF Failures:	0	0	0	0	0	0	0	0	0	0
Total No. Failures:	1	1	0	0	1	0	2	2	0	7
No. Motors:	----------1082----------									
Failure Fraction	.001	.001	0	0	.001	0	.002	.002	0	
Ave. Failure Fraction	----------.001----------									

CIRCUIT BREAKERS	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	9	14	14	10	15	19	17	9	9	116
No. ESF Failures:	2	1	0	0	0	0	0	0	1	4
Total No. Failures:	11	15	14	10	15	19	17	9	10	120
No. Circuit Breakers	----------1082----------									
Failure Fraction	.010	.014	.013	.009	.014	.018	.016	.008	.009	
Ave. Failure Fraction	----------.012----------									

MDP ASSY (Includes above subcomponents)	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	11	17	17	14	20	26	23	11	13	152
No. ESF Failures:	2	1	0	1	0	0	0	0	1	5
Total No. Failures:	13	18	17	15	20	26	23	11	14	157
No. MDP Assys:	----------1082----------									
Failure Fraction	.012	.017	.016	.014	.018	.024	.021	.010	.013	
Ave. Failure Fraction	----------.016----------									

Note: See Figure 16 in the text

APPENDIX III - TABLE II
BWR SYSTEMS - FAILURES AND FAILURE FRACTION FOR MDP ASSEMBLIES AND SUBCOMPONENTS

PUMPS	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv.Test Failures:	0	0	1	1	0	1	2	1	1	7
No. ESF Failures:	0	0	0	0	0	0	0	0	0	0
Total No. Failures:	0	0	1	1	0	1	2	1	1	7
No. Pumps:	----------452----------									
Failure Fraction:	0	0	.002	.002	0	.002	.004	.002	.002	
Ave. Failure Fraction:	----------.002----------									

MOTORS	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	0	0	0	1	0	0	1	0	0	2
No. ESF Failures:	0	1	0	0	0	0	0	0	0	1
Total No. Failures:	0	1	0	1	0	0	1	0	0	3
No. Motor Drivers:	----------452----------									
Failure Fraction:	0	.002	0	.002	0	0	.002	0	0	
Ave. Failure Fraction:	----------.001----------									

CIRCUIT BREAKERS	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	7	3	3	2	6	1	6	3	4	35
No. ESF Failures:	0	0	0	1	0	0	0	0	0	1
Total No. Failures:	7	3	3	3	6	1	6	3	4	36
No. Circuit Breakers	----------452----------									
Failure Fraction:	.015	.007	.007	.007	.013	.002	.013	.007	.009	
Ave. Failure Fraction:	----------.009----------									

MDP ASSYs	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	7	3	4	4	6	2	9	4	5	44
No. ESF Failures:	0	1	0	1	0	0	0	0	0	2
Total No. Failures:	7	4	4	5	6	2	9	4	5	46
No. MDP Assys:	----------452----------									
Failure Fraction:	.015	.009	.009	.011	.013	.004	.020	.009	.011	
Ave. Failure Fraction:	----------.011----------									

NOTE: See Figure 16 in the text.

APPENDIX III - TABLE III
PWR RI SYSTEM MDP ASSEMBLY AND SUBCOMPONENTS
FAILURE CAUSE APPORTIONMENT

FAILURE CAUSE	CIRC. BRKRS No. Fail.	CIRC. BRKRS %	MOTOR DRIVERS No. Fail.	MOTOR DRIVERS %	PUMPS No. Fail.	PUMPS %	MDP ASSEMBLIES Fail.	MDP ASSEMBLIES %
Age/Wear/Fat.	22	18	3	43	18	60	43	27
Maint./Proc.	17	14	2	29	6	20	25	16
Unknown	62	52	2	28	3	10	67	43
Dirt/Contam.	5	4	0	0	1	4	6	4
Design Defic.	5	4	0	0	1	3	6	4
Other	9	8	0	0	3	3	10	6
Totals:	120	77	7	4	30	19	157	100

NOTE: See Figures 10 and 11 in text.

APPENDIX III - TABLE IV
BWR RI SYSTEM MDP ASSEMBLY AND SUBCOMPONENTS
FAILURE CAUSE APPORTIONMENT

FAILURE CAUSE	CIRC. BRKRS No. Fail.	CIRC. BRKRS %	MOTOR DRIVERS No. Fail.	MOTOR DRIVERS %	PUMPS No. Fail.	PUMPS %	MDP ASSEMBLIES Fail.	MDP ASSEMBLIES %
Age/Wear/Fat.	16	44	2	67	2	29	20	43
Maint./Proc.	8	22	0	0	1	14	9	20
Unknown	8	22	1	33	3	43	12	26
Dirt/Contam.	0	0	0	0	0	0	0	0
Design Defic.	2	6	0	0	0	0	2	4
Other	2	6	0	0	1	14	3	7
Totals:	36	78	3	7	7	15	46	100

NOTE: See Figures 10 and 12 in text.

APPENDIX IV

DATA SOURCE INPUT FOR REPORTED FAILURES AND ESTIMATED DEMANDS

MDP ASSEMBLIES

ABBREVIATIONS USED IN APPENDIX IV - TABLES I, II, AND IIA

Column Headings:

APPL CODE — Application Coded (YES. All MDPs used in study are Application Coded)

PLT ID NO. — Numerical identifier assigned to each selected plant used with NPRDS failure histories. When source is from LERs, a 3-digit docket number is used.

DATA SRC — Data surce, either as NPRDS failure history (FHIS) or as a 5-digit LER number, as applicable.

PLT AGE — Plant age group (A, B, or C). The plants are grouped by the dates of their commercial license:

A - 12/31/74 and earlier B - 1/1/75 through 3/31/86 C - 4/1/86 and later

PLT SYS — The selected risk-important (RI) system in which the component failed (see text list of acronyms for system abbreviations).

NO. FAIL — Number of same subcomponents failed.with same failure mode, system, date, etc.

DISC DATE — For NPRDS failures, this is the discovery date,and for LERs, the event date, given by month and year only (e.g., 0189 is January 1989).

SUB COMP — Subcomponent of the MDP assembly (PMP- pump, MOT - motor driver, and CB - MDP assembly circuit breaker)

ESF/SURV. — Failure associated with engineered safety features actuation or surveillance testing.

FAIL MODE — Failure modes used are as follows:

Failure to start (FS) - pump; pump motor
Failure to run (FR) - pump; pump motor
Failure to close (FC) - MDP circuit breaker
Failure to operate as required (both fail to open and fail to close)(OR) - MDP circuit breaker

FAIL CAUS — Failure causes are as follows:

Age/wear (AW)
Design deficiency (DD)
Unknown (UK)
Out of adjustment (OA)
Maintenance/procedural deficiency (MP)
Dirt/contamination/corrosion (DC)
Manufacturing defect (MF)
Debris/foreign material (DF)
Mechanical linkage (ML)

ABBREVIATIONS USED IN APPENDIX IV - TABLES V AND VI

Column Headings:

PLT ID NO.	Numerical identifier assigned to each selected plant used with NPRDS failure histories. When source is from LERs, a 3-digit docket number is used.
PLT SYS	The selected risk-important (RI) system in which the component failed (see text list of acronyms for system abbreviations).
NO. MDPs/ SYS	Number of Application Coded MDPs in each RI system.
SURV TST FREQ/YR	The frequency of surveillance tests per year.
DEMAND/YR	The number of MDP surveillance test demands per year per specific RI system at the surveillance test frequency
NO. YRS/ PERIOD	The number of commercial years of operation during the nine-year (1987-1995).
SYS TOT MDP-DEM	The total number of MDP-demands per RI system during the nine-period. When there are two or more surveillance test frequencies listed for a specific RI system, only the cumulative total of the system MDP-demands is listed.

APPENDIX IV
MDP ASSEMBLY - DATA SOURCE INPUT FOR REPORTED FAILURES AND ESTIMATED DEMANDS - TABLES

APPENDIX IV - TABLE I
PWR MDP ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
FAILURES

ITEM NO.	APPL CODE	PLT ID NO.	DATA SRC	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	ESF/ SURV	FAIL MODE	FAIL CAUS
1	YES	48	FHIS	B	CCW	1	0287	CB	SURV	FC	UK
2	YES	32	FHIS	A	RHR	1	0387	CB	SURV	FC	UK
3	YES	16	FHIS	A	NSW	1	0587	CB	SURV	FC	MP
4	YES	10	FHIS	A	NSW	1	0587	PMP	SURV	FS	DC
5	YES	282	87009	A	HPI	1	0687	CB	SURV	FC	MP
6	YES	6	FHIS	A	AFW	1	0787	CB	SURV	FC	UK
7	YES	54	FHIS	B	NSW	1	0887	CB	SURV	FC	UK
8	YES	346	87011	B	NSW	1	0987	CB	ESF	FC	MP
9	YES	317	87013	B	HPI	1	0987	CB	ESF	FC	MP
10	YES	88	FHIS	C	AFW	1	1087	MOT	SURV	FS	UK
11	YES	24	FHIS	C	AFW	1	1287	CB	SURV	FC	UK
12	YES	49	FHIS	B	RHR	1	1287	CB	SURV	FC	UK
13	YES	244	87008	A	RHR	1	1287	CB	SURV	FC	DD
14	YES	58	FHIS	B	CS	1	0388	CB	SURV	FC	UK
15	YES	87	FHIS	C	HPI	1	0388	CB	SURV	FC	UK
16	YES	31	FHIS	B	RHR	1	0588	CB	SURV	FC	UK
17	YES	498	88032	C	AFW	1	0588	PMP	SURV	FR	DD
18	YES	400	88013	C	NSW	1	0688	CB	ESF	FC	UK
19	YES	311	88012	B	CVCS	1	0688	CB	SURV	FC	UK
20	YES	98	FHIS	C	CS	1	0888	CB	SURV	FC	UK
21	YES	13	FHIS	A	CCW	1	0988	CB	SURV	FC	UK
22	YES	82	FHIS	B	RHR	1	0988	CB	SURV	FC	UK
23	YES	27	FHIS	A	RHR	1	1088	CB	SURV	FC	UK
24	YES	89	FHIS	C	CS	1	1088	CB	SURV	FC	UK
25	YES	98	FHIS	C	CS	1	1188	MOT	SURV	FS	UK
26	YES	27	FHIS	A	NSW	1	1188	PMP	SURV	FS	AW
27	YES	30	FHIS	A	CS	1	1188	CB	SURV	FC	UK
28	YES	30	FHIS	A	HPI	1	1188	CB	SURV	FC	UK
29	YES	83	FHIS	B	AFW	1	1188	CB	SURV	FC	DF

APPENDIX IV - TABLE I (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
FAILURES

ITEM NO.	APPL CODE	PLT ID NO.	DATA SRC	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	ESF/ SURV	FAIL MODE	FAIL CAUS
30	YES	103	FHIS	C	NSW	1	1188	CB	SURV	FC	UK
31	YES	61	FHIS	B	CS	1	1288	CB	SURV	FC	UK
32	YES	30	FHIS	A	CS	1	0189	PMP	SURV	FS	AW
33	YES	41	FHIS	A	AFW	1	0289	PMP	SURV	FS	MP
34	YES	27	FHIS	A	AFW	1	0289	CB	SURV	FC	UK
35	YES	27	FHIS	A	CS	1	0289	CB	SURV	FC	UK
36	YES	61	FHIS	B	CS	1	0389	CB	SURV	FC	UK
37	YES	206	89018	A	CS	1	0489	CB	SURV	FC	AW
38	YES	21	FHIS	A	RHR	1	0489	CB	SURV	FC	UK
39	YES	30	FHIS	A	HPI	1	0489	CB	SURV	FC	UK
40	YES	46	FHIS	B	CVCS	1	0589	CB	SURV	FC	UK
41	YES	87	FHIS	C	CCW	1	0589	CB	SURV	OR	UK
42	YES	91	FHIS	C	RHR	1	0689	PMP	SURV	FS	MP
43	YES	40	FHIS	A	CVCS	1	0689	CB	SURV	FC	UK
44	YES	45	FHIS	A	RHR	1	0989	CB	SURV	FC	MP
45	YES	83	FHIS	B	NSW	1	0989	CB	SURV	FC	UK
46	YES	66	FHIS	B	CCW	1	1089	CB	SURV	FC	AW
47	YES	58	FHIS	B	CS	1	1289	CB	SURV	FC	AW
48	YES	97	FHIS	C	AFW	1	1289	CB	SURV	FC	DC
49	YES	72	FHIS	B	CS	1	0190	CB	SURV	FC	AW
50	YES	106	FHIS	C	CCW	1	0290	CB	SURV	OR	UK
51	YES	255	90002	A	HPI	1	0290	PMP	ESF	FR	UK
52	YES	23	FHIS	B	NSW	1	0390	PMP	SURV	FS	AW
53	YES	107	FHIS	C	HPI	1	0390	CB	SURV	FC	UK
54	YES	91	FHIS	C	CCW	1	0690	CB	SURV	FC	MP
55	YES	44	FHIS	B	NSW	1	0890	PMP	SURV	FS	AW
56	YES	66	FHIS	B	NSW	1	0890	CB	SURV	FC	UK
57	YES	54	FHIS	B	CCW	1	0990	CB	SURV	OR	UK
58	YES	82	FHIS	B	CS	1	0990	CB	SURV	FC	DC

APPENDIX IV - TABLE I (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
FAILURES

ITEM NO.	APPL CODE	PLT ID NO.	DATA SRC	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	ESF/ SURV	FAIL MODE	FAIL CAUS
59	YES	23	FHIS	B	NSW	1	1090	PMP	SURV	FS	AW
60	YES	19	FHIS	A	AFW	1	1090	CB	SURV	OR	UK
61	YES	46	FHIS	B	AFW	1	1090	CB	SURV	FC	UK
62	YES	82	FHIS	B	NSW	1	1090	CB	SURV	FC	DC
63	YES	23	FHIS	B	NSW	1	1290	PMP	SURV	FS	AW
64	YES	49	FHIS	B	HPI	1	0191	PMP	SURV	FS	AW
65	YES	93	FHIS	C	NSW	1	0191	PMP	SURV	FS	AW
66	YES	83	FHIS	B	NSW	1	0191	CB	SURV	FC	MP
67	YES	95	FHIS	C	CVCS	1	0191	CB	SURV	FC	AW
68	YES	59	FHIS	B	CS	1	0291	CB	SURV	FC	DC
69	YES	32	FHIS	A	RHR	1	0391	CB	SURV	FC	DC
70	YES	6	FHIS	A	HPI	1	0491	CB	SURV	FC	UK
71	YES	23	FHIS	B	HPI	1	0491	CB	SURV	FC	UK
72	YES	85	FHIS	C	AFW	1	0591	MOT	SURV	FS	AW
73	YES	255	91016	A	CS	1	0591	CB	SURV	FC	MP
74	YES	64	FHIS	B	NSW	1	0691	CB	SURV	FC	UK
75	YES	11	FHIS	A	HPI	1	0791	CB	SURV	OR	UK
76	YES	87	FHIS	C	NSW	1	0891	PMP	SURV	FS	AW
77	YES	33	FHIS	A	HPI	1	0991	PMP	SURV	FS	MP
78	YES	59	FHIS	B	NSW	1	1091	CB	SURV	FC	UK
79	YES	82	FHIS	B	RHR	1	1091	CB	SURV	FC	MP
80	YES	49	FHIS	B	AFW	1	1191	CB	SURV	OR	UK
81	YES	49	FHIS	B	HPI	1	1191	CB	SURV	FC	UK
82	YES	108	FHIS	C	HPI	1	1191	CB	SURV	OR	UK
83	YES	75	FHIS	B	CCW	1	1291	CB	SURV	FC	AW
84	YES	47	FHIS	B	CVCS	1	0192	CB	SURV	FC	UK
85	YES	23	FHIS	B	NSW	1	0292	PMP	SURV	FS	AW
86	YES	21	FHIS	A	RHR	1	0292	CB	SURV	FC	UK
87	YES	93	FHIS	C	NSW	1	0292	CB	SURV	FC	DD

APPENDIX IV - TABLE I (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
FAILURES

ITEM NO.	APPL CODE	PLT ID NO.	DATA SRC	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	ESF/ SURV	FAIL MODE	FAIL CAUS
88	YES	47	FHIS	B	CVCS	1	0392	CB	SURV	FC	UK
89	YES	82	FHIS	B	RHR	1	0392	CB	SURV	FC	AW
90	YES	93	FHIS	C	NSW	1	0392	CB	SURV	FC	DD
91	YES	98	FHIS	C	HPI	1	0392	CB	SURV	FC	UK
92	YES	13	FHIS	A	HPI	1	0492	CB	SURV	FC	UK
93	YES	30	FHIS	A	HPI	1	0492	CB	SURV	FC	UK
94	YES	54	FHIS	B	AFW	1	0492	CB	SURV	FC	UK
95	YES	59	FHIS	B	HPI	1	0592	CB	SURV	FC	UK
96	YES	87	FHIS	C	CS	1	0592	CB	SURV	FC	UK
97	YES	27	FHIS	A	NSW	1	0692	PMP	SURV	FS	AW
98	YES	29	FHIS	A	NSW	1	0692	PMP	SURV	FS	AW
99	YES	43	FHIS	A	HPI	1	0692	PMP	SURV	FS	AW
100	YES	55	FHIS	B	RHR	1	0692	CB	SURV	FC	MF
101	YES	261	92014	A	HPI	1	0792	CB	SURV	FC	UK
102	YES	107	FHIS	C	RHR	1	0792	CB	SURV	FC	UK
103	YES	99	FHIS	C	CCW	1	0892	PMP	SURV	FS	AW
104	YES	327	92014	B	HPI	1	0892	CB	SURV	FC	UK
105	YES	344	92024	B	CVCS	1	0892	PMP	SURV	FR	MP
106	YES	301	92003	A	CS	1	0992	PMP	SURV	FS	MP
107	YES	530	92003	C	RHR	1	0992	CB	SURV	FC	MP
108	YES	98	FHIS	C	CS	1	1092	CB	SURV	FC	DD
109	YES	10	FHIS	A	HPI	1	1192	CB	SURV	FC	UK
110	YES	85	FHIS	C	HPI	1	0193	CB	SURV	OR	MF
111	YES	6	FHIS	A	AFW	1	0293	PMP	SURV	FR	UK
112	YES	13	FHIS	A	CCW	1	0393	CB	SURV	FC	UK
113	YES	76	FHIS	B	HPI	1	0393	CB	SURV	FC	AW
114	YES	89	FHIS	C	RHR	1	0393	MOT	SURV	OR	AW
115	YES	19	FHIS	A	HPI	1	0493	MOT	SURV	FR	MP

APPENDIX IV - TABLE I (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
FAILURES

ITEM NO.	APPL CODE	PLT ID NO.	DATA SRC	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	ESF/ SURV	FAIL MODE	FAIL CAUS
116	YES	48	FHIS	B	RHR	1	0493	CB	SURV	FC	AW
117	YES	59	FHIS	B	CCW	1	0493	CB	SURV	FC	AW
118	YES	76	FHIS	B	AFW	1	0493	CB	SURV	OR	OA
119	YES	95	FHIS	C	NSW	1	0493	PMP	SURV	FR	AW
120	YES	54	FHIS	B	CCW	1	0593	CB	SURV	OR	UK
121	YES	6	FHIS	A	NSW	1	0693	CB	SURV	FC	MP
122	YES	59	FHIS	B	CCW	1	0693	CB	SURV	FC	MP
123	YES	60	FHIS	B	HPI	1	0693	CB	SURV	FC	MP
124	YES	261	93009	A	NSW	1	0893	PMP	SURV	FS	AW
125	YES	85	FHIS	C	CS	1	0893	CB	SURV	FC	UK
126	YES	48	FHIS	B	CS	1	0993	CB	SURV	FC	MP
127	YES	72	FHIS	B	CCW	1	1093	CB	SURV	FC	UK
128	YES	48	FHIS	B	CCW	1	1193	CB	SURV	FC	MP
129	YES	66	FHIS	B	NSW	1	1193	CB	SURV	FC	AW
130	YES	72	FHIS	B	NSW	1	1193	CB	SURV	FC	AW
131	YES	16	FHIS	A	HPI	1	1293	PMP	SURV	FR	AW
132	YES	104	FHIS	C	RHR	1	1293	CB	SURV	OR	AW
133	YES	16	FHIS	A	NSW	1	0194	CB	SURV	OR	AW
134	YES	93	FHIS	C	AFW	1	0194	CB	SURV	OR	OA
135	YES	82	FHIS	B	AFW	1	0394	CB	SURV	FC	AW
136	YES	74	FHIS	B	AFW	1	0594	CB	SURV	FC	AW
137	YES	244	94008	A	HPI	1	0694	MOT	SURV	FS	AW
138	YES	59	FHIS	B	RHR	1	0994	CB	SURV	FC	OA
139	YES	79	FHIS	C	HPI	1	0994	CB	SURV	FC	ML
140	YES	31	FHIS	B	AFW	1	1094	CB	SURV	FC	OA
141	YES	31	FHIS	B	CCW	1	1194	CB	SURV	FC	DD

APPENDIX IV - TABLE I (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
FAILURES

ITEM NO.	APPL CODE	PLT ID NO.	DATA SRC	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	ESF/ SURV	FAIL MODE	FAIL CAUS
142	YES	46	FHIS	B	AFW	1	1294	MOT	SURV	FR	MP
143	YES	51	FHIS	C	CS	1	1294	CB	SURV	FC	OA
144	YES	79	FHIS	C	HPI	1	0195	CB	SURV	FC	AW
145	YES	247	95004	A	RHR	1	0295	CB	ESF	FC	UK
146	YES	247	95008	A	CS	1	0295	CB	SURV	FC	MP
147	YES	58	FHIS	B	CS	1	0295	PMP	SURV	FS	MP
148	YES	30	FHIS	A	NSW	1	0395	CB	SURV	FC	AW
149	YES	305	95006	A	HPI	1	0495	PMP	SURV	FS	AW
150	YES	41	FHIS	A	HPI	1	0495	PMP	SURV	FR	UK
151	YES	54	FHIS	B	CCW	1	0495	CB	SURV	FO	AW
152	YES	88	FHIS	C	CS	1	0495	CB	SURV	FC	MP
153	YES	35	FHIS	A	AFW	1	0595	CB	SURV	FC	UK
154	YES	13	FHIS	A	HPI	1	0795	PMP	SURV	FR	DF
155	YES	10	FHIS	A	HPI	1	0895	CB	SURV	FC	AW
156	YES	99	FHIS	C	CCW	1	1195	CB	SURV	FC	AW
157	YES	41	FHIS	A	NSW	1	1295	CB	SURV	FC	AW

Totals: 157

APPENDIX IV - TABLE I A
PWR MDP ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
ESF FAILURES (1996-1998)

ITEM NO.	APPL CODE	PLT ID NO.	DATA SRC	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	ESF/ SURV	FAIL MODE	FAIL CAUS
1	YES	400	96018	C	NSW	1	0996	PMP	ESF	FR	MP
2	YES	247	97010	A	AFW	1	0597	CB	ESF	FC	MP

Totals: 2

APPENDIX IV - TABLE II
BWR MDP ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
FAILURES

ITEM NO.	APPL CODE	PLT ID NO.	DATA SRC	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	ESF/ SURV	FAIL MODE	FAIL CAUS
1	YES	388	87004	C	RHR	1	0287	CB	SURV	FC	AW
2	YES	37	FHIS	A	LPCS	1	0287	CB	SURV	FC	UK
3	YES	81	FHIS	C	RHR	1	0387	CB	SURV	FC	AW
4	YES	5	FHIS	A	ESW	1	0487	CB	SURV	FC	AW
5	YES	34	FHIS	A	LPCS	1	0587	CB	SURV	FC	MP
6	YES	53	FHIS	B	ESW	1	0587	CB	SURV	FC	AW
7	YES	37	FHIS	A	RHR	1	1187	CB	SURV	FC	MP
8	YES	298	88003	A	RHR	1	0188	MOT	ESF	FS	UK
9	YES	25	FHIS	B	ESW	1	0488	CB	SURV	FC	AW
10	YES	15	FHIS	B	ESW	1	1188	CB	SURV	FC	UK
11	YES	101	FHIS	C	LPCS	1	1188	CB	SURV	FC	AW
12	YES	9	FHIS	A	RHR	1	0289	CB	SURV	FC	MP
13	YES	77	FHIS	B	ESW	1	0589	CB	SURV	FC	AW
14	YES	3	FHIS	A	LPCS	1	0689	CB	SURV	FC	AW
15	YES	12	FHIS	A	ESW	1	1289	PMP	SURV	FS	MP
16	YES	102	FHIS	C	ESW	1	0590	PMP	SURV	FS	UK
17	YES	77	FHIS	B	ESW	1	0890	CB	SURV	FC	MP
18	YES	102	FHIS	C	RHR	1	0890	CB	SURV	FC	UK
19	YES	259	90016	A	ESW	1	1090	CB	ESF	FC	MP
20	YES	69	FHIS	C	RBCC	1	1290	MOT	SURV	FS	AW
21	YES	81	FHIS	C	ESW	1	0191	CB	SURV	FC	AW
22	YES	77	FHIS	B	HPCS	1	0291	CB	SURV	FC	AW
23	YES	63	FHIS	C	RHR	1	0591	CB	SURV	FC	UK
24	YES	50	FHIS	B	ESW	2	1191	CB	SURV	FC	MP
25	YES	12	FHIS	A	LPCS	1	1291	CB	SURV	FC	AW
26	YES	50	FHIS	B	ESW	1	0492	PMP	SURV	FS	UK
27	YES	77	FHIS	B	HPCS	1	1192	CB	SURV	OR	MP
28	YES	416	93003	C	ESW	1	0393	MOT	SURV	FR	AW

APPENDIX IV - TABLE II (CONTINUED)
BWR MDP ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
FAILURES

ITEM NO.	APPL CODE	PLT ID NO.	DATA SRC	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	ESF/ SURV	FAIL MODE	FAIL CAUS
29	YES	7	FHIS	A	ESW	1	0393	CB	SURV	FC	DD
30	YES	52	FHIS	B	ESW	1	0393	CB	SURV	FC	UK
31	YES	37	FHIS	A	ESW	1	0493	CB	SURV	FC	DC
32	YES	458	93013	C	HPCS	1	0693	CB	SURV	OR	UK
33	YES	12	FHIS	A	LPCS	1	0793	CB	SURV	FC	OA
34	YES	25	FHIS	B	ESW	1	0893	PMP	SURV	FR	AW
35	YES	53	FHIS	B	RHR	1	1193	CB	SURV	FO	MF
36	NO	102	FHIS	C	RHR	1	1193	PMP	SURV	FR	UK
37	YES	101	FHIS	C	ESW	1	0294	PMP	SURV	FR	AW
38	YES	26	FHIS	B	LPCS	1	0594	CB	SURV	OR	AW
39	YES	90	FHIS	C	RHR	1	0994	CB	SURV	FO	AW
40	YES	50	FHIS	B	RHR	1	1194	CB	SURV	FC	AW
41	NO	56	FHIS	B	ESW	1	0395	CB	SURV	FC	AW
42	YES	458	95005	C	HPCS	1	0695	CB	SURV	OR	UK
43	YES	56	FHIS	B	ESW	1	0695	CB	SURV	OR	AW
44	YES	81	FHIS	C	LPCS	1	0995	CB	SURV	FC	DD
45	YES	4	FHIS	A	ESW	1	1095	PMP	SURV	FR	MF

Totals: 46

Note: There were no BWR ESF failures during the 1996-1998 period.

APPENDIX IV - TABLE III
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
1	206	89012	AFW	0589	1	1	1
2	206	89019	AFW	0789	1	1	1
3	206	89023	AFW	0989	1	1	1
4	206	89012	AFW	0589	1	1	1
5	206	89019	AFW	0789	1	1	1
6	206	89023	AFW	0989	1	1	1
7	206	90011	AFW	0590	1	1	1
8	206	91010	AFW	0591	1	1	1
9	206	91017	AFW	1091	1	1	1
10	213	95016	HPI	0795	1	2	2
11	213	95016	CVCS	0795	1	2	2
12	244	88003	AFW	0388	1	2	2
13	244	88005	AFW	0688	1	2	2
14	244	88005	HPI	0688	1	3	3
15	244	89003	HPI	0589	1	1	1
16	244	89004	AFW	0689	1	2	2
17	244	90006	HPI	0590	1	3	3
18	244	90007	AFW	0590	1	2	2
19	244	90010	AFW	0690	1	2	2
20	244	90012	AFW	0990	1	2	2
21	244	90013	AFW	1290	1	2	2
22	244	90018	AFW	1290	1	2	2
23	244	90019	AFW	1290	1	2	2
24	244	92002	AFW	0292	1	2	2
25	244	92003	AFW	0292	1	2	2
26	244	93006	AFW	1193	1	2	2
27	244	94007	AFW	0494	1	2	2
28	244	95003	RHR	0495	1	1	1
29	244	95008	AFW	0895	1	2	2
30	247	88001	HPI	0188	1	3	3
31	247	88019	AFW	1188	1	2	2
32	247	91001	AFW	0191	1	2	2
33	247	91001	HPI	0191	1	3	3
34	247	91006	NSW	0391	1	1	1
35	247	91006	CCW	0391	1	1	1
36	247	91010	NSW	0691	1	1	1
37	247	92002	HPI	0192	1	3	3
38	247	92007	AFW	0492	1	2	2
39	247	94003	CCW	1194	1	2	2
40	247	95001	AFW	0195	1	2	2
41	247	95010	CCW	0395	1	2	2
42	247	95011	NSW	0495	1	2	2
43	247	95012	CCW	0595	2	1	2
44	247	95015	AFW	0695	1	2	2
45	250	87011	NSW	0387	1	1	1
46	250	87021	HPI	0787	1	3	3
47	250	87023	HPI	0987	1	3	3
48	250	89011	HPI	0689	1	3	3
49	250	90007	CCW	0490	1	1	1

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
50	250	90008	CS	0490	1	1	1
51	250	90008	HPI	0490	1	3	3
52	250	91008	CCW	0891	1	1	1
53	250	94002	HPI	0594	1	3	3
54	251	87002	CCW	0187	1	1	1
55	251	87011	CCW	0687	1	1	1
56	251	87012	CCW	0787	1	1	1
57	251	87016	NSW	0787	1	1	1
58	251	87026	CCW	1187	1	1	1
59	251	89002	HPI	0489	1	2	2
60	251	89011	HPI	0989	1	3	3
61	251	90006	CCW	0790	1	1	1
62	251	90007	CCW	0790	1	1	1
63	251	92004	HPI	0392	1	3	3
64	255	87029	AFW	0987	1	2	2
65	255	87032	HPI	0987	1	1	1
66	255	88006	AFW	0388	1	1	1
67	255	89020	AFW	0889	1	1	1
68	255	89025	HPI	1189	1	2	2
69	255	90001	AFW	0190	1	1	1
70	255	90002	AFW	0290	1	1	1
71	255	90002	HPI	0290	1	1	1
72	255	90003	AFW	0390	1	1	1
73	255	90014	AFW	0890	1	1	1
74	255	92034	AFW	0792	1	2	2
75	255	92035	AFW	0792	1	1	1
76	255	92037	AFW	0892	1	2	2
77	255	92039	AFW	1092	1	1	1
78	255	94002	CS	0193	1	1	1
79	255	95001	HPI	0395	1	1	1
80	255	95001	NSW	0395	1	1	1
81	255	95001	RHR	0395	1	1	1
82	255	95005	CCW	0795	1	1	1
83	255	95005	HPI	0795	1	1	1
84	261	87018	AFW	0687	1	2	2
85	261	89004	HPI	0289	1	2	2
86	261	91011	AFW	0891	1	2	2
87	261	92017	HPI	0892	1	2	2
88	261	94016	AFW	0894	1	2	2
89	266	87005	HPI	1187	1	2	2
90	266	89006	AFW	0589	1	2	2
91	266	91008	AFW	0691	1	2	2
92	266	91008	HPI	0691	1	2	2
93	266	93007	NSW	0793	1	3	3
94	266	94009	NSW	0994	1	3	3
95	269	88009	AFW	0788	1	2	2
96	269	89001	AFW	0189	1	2	2
97	269	89001	HPI	0189	1	1	1

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
98	269	89002	AFW	0189	1	2	2
99	269	89002	HPI	0189	1	1	1
100	269	91006	HPI	0591	1	1	1
101	269	91011	AFW	1091	1	2	2
102	269	92004	AFW	0592	1	2	2
103	269	92015	AFW	1092	1	2	2
104	269	93008	AFW	0893	1	2	2
105	269	93008	HPI	0893	1	1	1
106	269	93010	AFW	1193	1	2	2
107	269	93010	HPI	1193	1	1	1
108	269	94002	AFW	0294	1	2	2
109	269	94002	HPI	0294	1	1	1
110	270	87001	HPI	0187	1	1	1
111	270	87002	HPI	0387	1	1	1
112	270	89002	HPI	0289	1	1	1
113	270	89003	HPI	0289	1	1	1
114	270	89004	AFW	0489	1	2	2
115	270	92004	AFW	1092	1	2	2
116	270	92004	HPI	1092	1	1	1
117	270	93001	AFW	0493	1	2	2
118	270	93007	HPI	1093	1	1	1
119	270	94002	AFW	0494	1	2	2
120	270	94002	HPI	0494	1	1	1
121	270	94004	NSW	1094	1	2	2
122	270	94005	AFW	1294	1	2	2
123	270	95002	HPI	0495	1	1	1
124	272	89007	AFW	0289	1	2	2
125	272	89024	CVCS	0689	1	2	2
126	272	89024	HPI	0689	1	2	2
127	272	89027	AFW	0689	1	2	2
128	272	91007	AFW	0291	1	2	2
129	272	91022	AFW	0691	1	1	1
130	272	91024	AFW	0691	1	2	2
131	272	91027	AFW	0891	1	1	1
132	272	91027	HPI	0891	1	1	1
133	272	93013	AFW	0793	1	2	2
134	272	94007	CVCS	0494	2	2	4
135	272	94007	HPI	0494	2	2	4
136	272	94011	AFW	0794	1	2	2
137	275	87004	AFW	0387	1	2	2
138	275	87006	AFW	0587	1	2	2
139	275	87023	AFW	1287	1	2	2
140	275	87024	AFW	1287	1	2	2
141	275	88002	AFW	0188	1	2	2
142	275	88025	AFW	0888	1	2	2
143	275	89009	AFW	1089	1	2	2
144	275	89009	CVCS	1089	1	2	2
145	275	89009	HPI	1089	1	2	2
146	275	90002	AFW	0290	1	2	2
147	275	90014	AFW	1290	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
148	275	90017	AFW	1290	1	2	2
149	275	90017	CVCS	1290	1	2	2
150	275	90017	HPI	1290	1	2	2
151	275	91002	AFW	0291	1	2	2
152	275	91007	AFW	0491	1	2	2
153	275	91009	AFW	0591	1	2	2
154	275	91009	CVCS	0591	1	2	2
155	275	91009	HPI	0591	1	2	2
156	275	91011	AFW	0791	1	1	1
157	275	92002	AFW	0392	1	2	2
158	275	92004	AFW	0492	1	2	2
159	275	93011	AFW	1293	1	2	2
160	275	94020	AFW	1294	1	2	2
161	275	95009	AFW	0995	1	2	2
162	275	95014	CCW	1095	1	2	2
163	275	95015	AFW	1195	1	2	2
164	275	95017	AFW	1295	1	2	2
165	280	87023	HPI	0987	1	1	1
166	280	87024	HPI	0987	1	2	2
167	280	88003	AFW	0288	1	2	2
168	280	88029	HPI	0888	1	1	1
169	280	90004	AFW	0590	1	2	2
170	280	90018	HPI	1290	1	2	2
171	280	92001	AFW	0192	1	2	2
172	280	93001	AFW	0193	1	2	2
173	280	93001	HPI	0193	2	1	2
174	280	93002	AFW	0293	1	2	2
175	280	94006	AFW	0594	1	2	2
176	280	95001	AFW	0195	2	2	4
177	280	95003	AFW	0495	1	2	2
178	281	88004	HPI	0388	1	1	1
179	281	88010	AFW	0588	1	2	2
180	281	88010	HPI	0588	1	1	1
181	281	89003	HPI	0989	1	1	1
182	281	89010	AFW	0989	1	2	2
183	281	90003	AFW	0590	1	2	2
184	281	90004	AFW	0890	1	2	2
185	281	91007	CCW	0891	1	2	2
186	281	91007	HPI	0891	1	1	1
187	281	91011	AFW	1291	1	2	2
188	281	92009	AFW	0792	1	2	2
189	281	93003	AFW	0893	1	2	2
190	281	93004	AFW	0893	1	2	2
191	281	93005	AFW	0893	1	2	2
192	281	93006	AFW	1193	1	2	2
193	281	95004	AFW	0595	1	2	2
194	281	95005	AFW	0595	1	2	2
195	281	95006	AFW	0695	1	2	2
196	281	95007	AFW	1195	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
197	282	87004	HPI	0387	1	1	1
198	282	87020	CCW	1087	1	1	1
199	282	89005	AFW	0589	1	1	1
200	282	90007	CCW	0590	1	1	1
201	282	90009	CCW	0890	1	1	1
202	282	93009	HPI	0793	1	1	1
203	282	94001	CCW	0394	1	1	1
204	282	94006	HPI	0994	1	1	1
205	282	94012	HPI	1294	1	1	1
206	285	87036	AFW	1187	1	2	2
207	285	88015	CCW	0688	1	1	1
208	285	88031	CCW	1088	1	1	1
209	285	90026	AFW	1190	1	1	1
210	285	92023	AFW	0792	1	2	2
211	285	92023	HPI	0792	1	3	3
212	285	93009	HPI	0593	1	3	3
213	285	93011	AFW	0693	1	1	1
214	285	93015	HPI	1193	1	1	1
215	285	93018	AFW	1293	1	1	1
216	285	94001	CCW	0294	1	2	2
217	285	94001	HPI	0294	1	3	3
218	286	87001	AFW	0187	1	2	2
219	286	87002	HPI	0287	1	3	3
220	286	87004	HPI	0487	1	3	3
221	286	87010	HPI	0987	1	3	3
222	286	88006	AFW	1088	1	2	2
223	286	90004	AFW	0690	1	2	2
224	286	89015	AFW	1089	1	2	2
225	286	91004	AFW	0391	1	2	2
226	286	92013	AFW	0992	1	2	2
227	286	95012	AFW	0695	1	2	2
228	287	89002	HPI	0389	1	1	1
229	287	89004	HPI	0889	1	1	1
230	287	90002	HPI	0390	1	1	1
231	287	90003	HPI	1190	1	1	1
232	287	91007	AFW	0791	1	2	2
233	287	91007	HPI	0791	1	1	1
234	287	92001	AFW	0192	1	2	2
235	287	92003	AFW	0692	1	2	2
236	287	93001	AFW	0193	1	2	2
237	287	94002	AFW	0894	1	2	2
238	287	94003	AFW	0894	1	2	2
239	289	88004	AFW	0888	1	2	2
240	289	89001	HPI	1089	1	1	1
241	289	90006	HPI	0790	1	1	1
242	289	91007	AFW	1191	1	2	2
243	295	87005	AFW	0287	1	1	1
244	295	87009	CVCS	0487	1	2	2
245	295	87009	HPI	0487	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
246	295	88021	CCW	1188	1	1	1
247	295	88024	AFW	1188	1	1	1
248	295	89009	AFW	0689	1	1	1
249	295	90006	AFW	0290	1	1	1
250	295	90020	AFW	0990	1	1	1
251	295	91008	CVCS	0591	1	2	2
252	295	91005	HPI	0591	1	2	2
253	295	91016	CVCS	1191	1	1	1
254	295	92003	NSW	0492	1	1	1
255	295	92003	CCW	0492	1	1	1
256	295	92006	NSW	0492	1	1	1
257	295	92006	CCW	0492	1	1	1
258	295	92007	CCW	0592	1	2	2
259	295	92019	CVCS	1092	1	1	1
260	295	92019	HPI	1092	1	1	1
261	295	92019	NSW	1092	1	1	1
262	295	92019	CCW	1092	1	1	1
263	295	92021	AFW	1092	1	1	1
264	295	92024	RHR	1292	1	1	1
265	295	93010	RHR	1193	1	1	1
266	295	94005	AFW	0494	1	2	2
267	295	94015	CCW	0994	1	1	1
268	295	95022	CCW	1195	1	1	1
269	295	95022	CVCS	1195	1	1	1
270	295	95022	NSW	1195	1	1	1
271	295	95022	RHR	1195	1	1	1
272	301	87002	AFW	0887	1	2	2
273	301	88001	HPI	0488	1	2	2
274	301	90001	AFW	0490	1	1	1
275	301	90002	AFW	1090	1	1	1
276	301	95001	NSW	0295	1	3	3
277	301	95004	AFW	1095	1	1	1
278	302	87011	HPI	0787	1	1	1
279	302	87027	RHR	1087	1	1	1
280	302	87030	RHR	1187	1	1	1
281	302	87030	HPI	1187	1	3	3
282	302	88002	AFW	0188	1	1	1
283	302	88021	HPI	1088	1	3	3
284	302	89003	AFW	0189	1	1	1
285	302	89022	AFW	0689	1	1	1
286	302	89023	AFW	0689	1	1	1
287	302	90016	AFW	1090	1	1	1
288	302	91003	AFW	0491	1	1	1
289	302	91014	AFW	1191	1	1	1
290	302	91016	AFW	1191	1	1	1
291	302	91018	AFW	1291	1	1	1
292	302	91018	HPI	1291	1	1	1
293	302	92001	AFW	0392	1	1	1
294	302	92015	AFW	0792	1	1	1
295	302	92027	AFW	1292	1	1	1
296	304	87006	HPI	0787	1	1	1

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
297	304	87007	AFW	0887	2	1	2
298	304	88012	CVCS	1288	1	2	2
299	304	88012	HPI	1288	1	2	2
300	304	88014	AFW	1288	1	1	1
301	304	92002	CS	0592	1	1	1
302	305	87005	AFW	0487	1	2	2
303	305	87008	AFW	0687	1	2	2
304	305	87009	AFW	0787	1	2	2
305	305	88001	AFW	0388	1	2	2
306	305	88002	HPI	0388	1	1	1
307	305	88004	AFW	0488	1	2	2
308	305	88006	AFW	0588	1	2	2
309	305	88012	AFW	0988	1	2	2
310	305	89016	AFW	1289	1	2	2
311	305	90012	AFW	1190	1	1	1
312	305	91010	AFW	1091	1	2	2
313	305	92017	AFW	0992	1	2	2
314	305	93001	AFW	0193	1	2	2
315	305	93013	AFW	0693	1	2	2
316	306	90004	AFW	0990	1	1	1
317	306	90006	CCW	0990	1	1	1
318	306	92001	AFW	0292	1	1	1
319	306	92003	AFW	0392	1	1	1
320	306	94002	AFW	0794	1	1	1
321	306	95004	CCW	0995	1	1	1
322	306	95004	HPI	0995	1	1	1
323	309	88011	HPI	1288	1	2	2
324	309	89001	AFW	0189	1	2	2
325	309	94008	AFW	0594	1	2	2
326	311	88014	CVCS	0688	1	2	2
327	311	88014	HPI	0688	1	2	2
328	311	88024	AFW	1188	1	2	2
329	311	89005	CVCS	0389	1	2	2
330	311	89005	HPI	0389	1	2	2
331	311	90017	AFW	0590	1	1	1
332	311	90029	AFW	0690	1	2	2
333	311	90037	CVCS	0990	1	1	1
334	311	90037	HPI	0990	1	1	1
335	311	91009	AFW	0691	1	1	1
336	311	91012	AFW	0891	1	1	1
337	311	91012	HPI	0891	1	1	1
338	311	92001	AFW	0192	1	1	1
339	311	92014	AFW	0992	1	2	2
340	311	93002	AFW	0193	1	2	2
341	311	93005	AFW	0393	1	2	2
342	311	93009	AFW	0693	1	2	2
343	311	94008	AFW	0694	1	2	2
344	313	87002	AFW	0587	1	1	1
345	313	87003	AFW	0887	1	1	1

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
346	313	87004	AFW	0887	1	1	1
347	313	87005	AFW	0887	1	1	1
348	313	88019	AFW	1288	1	1	1
349	313	89002	AFW	0189	1	1	1
350	313	89002	HPI	0189	1	1	1
351	313	89020	AFW	0589	1	1	1
352	313	89041	AFW	1289	1	1	1
353	313	89048	AFW	1289	1	1	1
354	313	90017	RHR	1290	1	1	1
355	313	91003	AFW	0491	1	1	1
356	313	91005	AFW	0591	1	1	1
357	313	92003	AFW	0492	1	1	1
358	313	94002	AFW	0494	1	1	1
359	313	94002	HPI	0494	1	1	1
360	313	95004	AFW	0495	1	1	1
361	315	87008	AFW	0687	1	2	2
362	315	87021	AFW	1087	1	2	2
363	315	88001	AFW	0188	1	2	2
364	315	88011	AFW	1088	1	2	2
365	315	88013	AFW	1188	1	2	2
366	315	89001	AFW	0189	1	2	2
367	315	89003	AFW	0389	1	2	2
368	315	91004	AFW	0591	1	2	2
369	315	95003	AFW	0795	1	2	2
370	315	95005	AFW	0795	1	2	2
371	316	87004	AFW	0687	1	2	2
372	316	87005	AFW	0687	1	2	2
373	316	87007	AFW	0787	1	2	2
374	316	87008	AFW	0787	1	2	2
375	316	89014	AFW	0889	1	2	2
376	316	90004	AFW	0690	1	2	2
377	316	90012	AFW	1290	1	2	2
378	316	90013	AFW	1290	1	2	2
379	316	91004	AFW	0391	1	2	2
380	316	91006	AFW	0891	1	2	2
381	316	91010	AFW	1191	1	2	2
382	316	93007	AFW	0893	1	2	2
383	316	94001	AFW	0294	1	2	2
384	316	94005	AFW	0894	1	2	2
385	316	94008	AFW	1294	1	2	2
386	316	95005	AFW	0895	1	2	2
387	316	95008	NSW	0995	1	1	1
388	317	87013	HPI	0987	1	1	1
389	317	87015	AFW	1187	1	1	1
390	317	88009	AFW	0888	1	1	1
391	317	88012	AFW	1188	1	1	1
392	317	91003	AFW	1091	1	1	1
393	317	91008	AFW	1291	1	1	1
394	317	95002	AFW	0695	1	1	1
395	317	95005	AFW	1195	1	1	1
396	317	95006	AFW	1195	1	1	1

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
397	318	87006	AFW	0987	1	2	2
398	318	87007	AFW	1087	1	2	2
399	318	87008	AFW	1187	1	1	1
400	318	87009	AFW	1287	1	1	1
401	318	88002	AFW	0188	1	2	2
402	318	88004	AFW	0488	1	2	2
403	318	91004	AFW	0591	1	1	1
404	318	92007	AFW	0992	1	1	1
405	318	94001	AFW	0194	1	1	1
406	318	94002	CS	0394	1	1	1
407	318	95002	AFW	0195	1	1	1
408	323	87003	AFW	0387	1	2	2
409	323	87003	CVCS	0387	1	2	2
410	323	87003	HPI	0387	1	2	2
411	323	87004	AFW	0487	1	2	2
412	323	87004	CVCS	0487	1	2	2
413	323	87004	HPI	0487	1	2	2
414	323	87013	AFW	0787	1	2	2
415	323	87016	AFW	0787	1	2	2
416	323	87016	CVCS	0787	1	2	2
417	323	87016	HPI	0787	1	2	2
418	323	87024	AFW	1187	1	2	2
419	323	88002	AFW	0388	1	2	2
420	323	88008	AFW	0788	1	2	2
421	323	88008	CVCS	0788	1	2	2
422	323	88008	HPI	0788	1	2	2
423	323	88018	AFW	1188	1	2	2
424	323	89007	AFW	0789	1	2	2
425	323	89008	AFW	0889	1	2	2
426	323	89010	AFW	1089	1	2	2
427	323	93001	AFW	0193	1	2	2
428	323	94012	AFW	1294	1	2	2
429	323	95002	AFW	0995	1	2	2
430	327	88045	AFW	1188	1	2	2
431	327	88047	AFW	1288	1	2	2
432	327	89003	AFW	0289	1	1	1
433	327	89005	AFW	0289	1	2	2
434	327	89035	AFW	1289	1	2	2
435	327	90009	AFW	0590	1	2	2
436	327	90021	AFW	0990	1	2	2
437	327	90030	AFW	1190	1	2	2
438	327	92011	CVCS	0492	1	2	2
439	327	92011	HPI	0492	1	2	2
440	327	92017	CVCS	0892	1	1	1
441	327	92018	AFW	1092	1	2	2
442	327	92027	AFW	1292	1	2	2
443	327	94011	AFW	0794	1	2	2
444	327	94014	AFW	1194	1	2	2
445	327	95008	AFW	0695	1	2	2
446	328	88023	AFW	0588	1	1	1
447	328	88024	AFW	0588	1	2	2
448	328	88027	AFW	0688	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
449	328	88028	AFW	0688	2	2	4
450	328	89008	AFW	0789	1	2	2
451	328	90008	AFW	0490	1	2	2
452	328	91001	AFW	0191	1	2	2
453	328	91006	AFW	1191	1	2	2
454	328	92011	CVCS	0892	1	1	1
455	328	92011	HPI	0892	1	2	2
456	328	95007	AFW	1295	1	2	2
457	334	88003	AFW	0288	1	1	1
458	334	88007	AFW	0688	1	2	2
459	334	88007	HPI	0688	1	2	2
460	334	88008	AFW	0688	1	2	2
461	334	88009	AFW	0688	1	2	2
462	334	88014	AFW	0988	1	1	1
463	334	88015	NSW	0988	1	1	1
464	334	89001	AFW	0189	1	2	2
465	334	89002	AFW	0289	1	2	2
466	334	89005	NSW	0489	1	1	1
467	334	89007	AFW	0589	1	1	1
468	334	89007	HPI	0589	1	2	2
469	334	90007	AFW	0390	1	2	2
470	334	90018	NSW	1290	1	1	1
471	334	91022	AFW	0791	1	2	2
472	334	91023	AFW	0791	1	2	2
473	334	91029	AFW	1191	1	2	2
474	334	91031	NSW	1191	1	1	1
475	334	92009	AFW	1092	1	2	2
476	334	92010	NSW	1092	1	1	1
477	334	93002	NSW	0293	1	1	1
478	334	93013	AFW	1093	1	2	2
479	334	93013	CCW	1093	1	2	2
480	334	93013	HPI	1093	1	1	1
481	334	94005	AFW	0694	1	2	2
482	334	94005	HPI	0691	1	1	1
483	334	94007	NSW	0694	1	1	1
484	334	95003	HPI	0295	1	1	1
485	335	87010	HPI	0487	1	2	2
486	335	87013	AFW	0687	1	2	2
487	335	87017	AFW	1287	1	2	2
488	335	88001	HPI	0288	1	1	1
489	335	88003	AFW	0388	1	2	2
490	335	88008	AFW	0988	1	2	2
491	335	88004	AFW	0688	1	2	2
492	335	91003	AFW	0591	1	2	2
493	335	91005	AFW	0791	1	1	1
494	335	91006	AFW	0991	1	1	1
495	335	94001	AFW	0194	1	2	2
496	335	94009	HPI	1194	1	2	2
497	335	94010	HPI	1194	1	1	1
498	335	95010	AFW	1195	1	1	1
499	336	87012	AFW	1187	1	1	1
500	336	90015	HPI	0990	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
501	336	94010	HPI	0594	1	1	1
502	336	94023	HPI	0794	1	1	1
503	336	95005	CS	0295	1	1	1
504	338	87017	HPI	0787	1	2	2
505	338	87020	AFW	1187	1	2	2
506	338	88002	AFW	0188	1	2	2
507	338	88005	AFW	0188	1	2	2
508	338	88020	AFW	0888	1	2	2
509	338	89005	AFW	0289	1	2	2
510	338	89006	CCW	0389	1	1	1
511	338	89017	AFW	1289	1	2	2
512	338	89017	HPI	1289	1	2	2
513	338	91015	HPI	0791	1	1	1
514	338	93010	NSW	0393	1	1	1
515	338	94005	AFW	0994	1	2	2
516	339	88002	HPI	0788	1	1	1
517	339	90003	AFW	0890	1	2	2
518	339	90010	AFW	1190	1	2	2
519	339	91009	HPI	0991	1	2	2
520	339	92007	HPI	0892	1	2	2
521	339	93002	AFW	0493	1	2	2
522	339	93003	AFW	0493	1	2	2
523	344	89006	AFW	0489	1	2	2
524	346	87011	NSW	0987	1	1	1
525	346	89017	CS	1189	1	1	1
526	346	90010	RHR	0590	1	1	1
527	348	87002	AFW	0187	1	2	2
528	348	87003	AFW	0187	1	2	2
529	348	87004	AFW	0187	1	2	2
530	348	87010	AFW	0587	1	2	2
531	348	88021	AFW	1088	1	2	2
532	348	88022	AFW	1188	1	1	1
533	348	88024	AFW	1288	1	1	1
534	348	89006	AFW	1189	1	2	2
535	348	89006	HPI	1189	1	1	1
536	348	90005	AFW	0790	1	2	2
537	348	91006	AFW	0591	1	2	2
538	348	91007	AFW	0691	1	2	2
539	348	91008	AFW	0891	1	2	2
540	348	91009	AFW	0891	1	2	2
541	348	91010	AFW	1091	1	2	2
542	348	92003	AFW	0792	1	1	1
543	348	92008	AFW	1292	1	2	2
544	348	95004	RHR	0495	1	1	1
545	348	95010	AFW	1195	1	2	2
546	361	87001	AFW	0287	1	2	2
547	361	87004	AFW	0387	1	2	2
548	361	87031	AFW	1287	1	2	2
549	361	89005	AFW	0289	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
550	361	90014	CS	1190	1	2	2
551	361	90014	HPI	1190	1	2	2
552	361	90016	AFW	1290	1	2	2
553	361	92008	AFW	0492	1	2	2
554	361	92012	AFW	0792	1	2	2
555	362	87011	AFW	0687	1	2	2
556	362	87011	HPI	0687	1	2	2
557	362	87017	AFW	1087	1	2	2
558	362	88002	AFW	0288	1	2	2
559	362	88002	HPI	0288	1	2	2
560	362	89001	AFW	0189	1	2	2
561	362	89001	HPI	0189	1	2	2
562	362	89006	AFW	0489	1	2	2
563	362	90002	AFW	0290	1	2	2
564	362	91001	AFW	0391	1	2	2
565	362	92003	AFW	0592	1	2	2
566	362	92004	AFW	0792	1	2	2
567	362	93004	AFW	0793	1	2	2
568	364	87001	AFW	0287	1	2	2
569	364	89005	HPI	0489	1	1	1
570	364	89007	AFW	0589	1	2	2
571	364	89008	AFW	0589	1	2	2
572	364	89010	AFW	0989	1	2	2
573	364	89012	AFW	1089	1	2	2
574	364	89015	AFW	1189	1	2	2
575	364	90004	HPI	1190	1	1	1
576	364	91001	AFW	0491	1	2	2
577	364	91002	AFW	0491	1	2	2
578	364	91004	AFW	0491	1	2	2
579	364	91005	AFW	0891	1	2	2
580	364	92001	AFW	0192	1	2	2
581	364	92002	AFW	0392	1	2	2
582	364	92003	AFW	0592	1	2	2
583	364	92005	AFW	0592	1	2	2
584	364	92006	AFW	0592	1	2	2
585	364	92007	AFW	0592	1	2	2
586	364	92008	AFW	0592	1	2	2
587	364	92010	AFW	1092	1	2	2
588	364	93001	HPI	0293	1	2	2
589	368	87007	AFW	0987	1	1	1
590	368	87008	AFW	1187	1	1	1
591	368	88011	AFW	0888	1	1	1
592	368	88011	HPI	0888	1	1	1
593	368	88020	HPI	1288	1	2	2
594	368	89006	AFW	0489	1	1	1
595	368	89012	HPI	0689	3	1	3
596	368	89024	AFW	1289	1	1	1
597	368	90019	AFW	0890	1	1	1
598	368	90020	AFW	0990	1	1	1
599	368	91005	AFW	0291	1	1	1

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
600	369	87009	AFW	0487	1	2	2
601	369	87012	AFW	0787	1	1	1
602	369	87012	HPI	0787	1	1	1
603	369	87017	AFW	0887	1	2	2
604	369	87017	CVCS	0887	1	1	1
605	369	87017	HPI	0887	1	2	2
606	369	87019	AFW	0987	1	2	2
607	369	87036	AFW	1287	1	2	2
608	369	88001	AFW	0188	1	2	2
609	369	88005	AFW	0388	1	2	2
610	369	88005	CVCS	0388	1	1	1
611	369	88005	HPI	0388	1	1	1
612	369	88007	AFW	0488	1	2	2
613	369	88009	AFW	0588	1	1	1
614	369	88009	NSW	0588	1	1	1
615	369	88009	NSW	0588	1	1	1
616	369	88013	AFW	0688	1	2	2
617	369	88015	AFW	0688	1	2	2
618	369	88042	AFW	1288	1	2	2
619	369	89004	CVCS	0389	1	1	1
620	369	89022	AFW	0889	1	2	2
621	369	90001	AFW	0190	1	2	2
622	369	90027	AFW	1090	1	2	2
623	369	90032	AFW	1190	1	2	2
624	369	90032	NSW	1190	1	2	2
625	369	91001	AFW	0291	1	2	2
626	369	91001	CVCS	0291	1	1	1
627	369	91001	HPI	0291	1	2	2
628	369	92004	AFW	0492	1	1	1
629	369	92009	AFW	0692	1	2	2
630	369	94004	AFW	0594	1	2	2
631	369	95001	AFW	0195	1	2	2
632	369	95005	AFW	0995	1	2	2
633	369	95006	AFW	1095	1	2	2
634	370	87003	AFW	0187	1	2	2
635	370	87019	AFW	1187	1	2	2
636	370	88001	AFW	0188	1	2	2
637	370	88008	AFW	0788	1	2	2
638	370	89001	AFW	0389	1	2	2
639	370	89002	AFW	0389	1	2	2
640	370	89003	AFW	0489	1	2	2
641	370	89009	AFW	0989	1	2	2
642	370	90006	AFW	0590	1	1	1
643	370	91003	AFW	0691	1	1	1
644	370	91010	AFW	0991	1	2	2
645	370	91011	AFW	1091	1	2	2
646	370	91012	AFW	1191	1	2	2
647	370	91012	NSW	1191	1	1	1
648	370	92004	AFW	0392	1	2	2
649	370	92006	AFW	0492	1	2	2
650	370	92007	AFW	0592	1	2	2
651	370	92009	AFW	0892	1	2	2
652	370	92010	AFW	0892	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
653	370	93001	AFW	0293	1	2	2
654	370	93002	AFW	0393	1	2	2
655	370	93003	CVCS	0393	1	1	1
656	370	93005	NSW	0793	1	1	1
657	370	93008	AFW	1293	1	2	2
658	370	93008	CVCS	1293	1	2	2
659	370	93008	HPI	1293	1	2	2
660	382	87008	AFW	0387	1	2	2
661	382	87012	AFW	0487	1	2	2
662	382	87016	AFW	0587	1	2	2
663	382	87029	AFW	0787	1	2	2
664	382	87028	AFW	1287	1	2	2
665	382	88016	AFW	0688	1	2	2
666	382	88033	AFW	1288	1	2	2
667	382	89003	RHR	0289	1	1	1
668	382	89013	AFW	0789	1	2	2
669	382	89024	AFW	1289	1	2	2
670	382	89024	HPI	1289	1	2	2
671	382	90002	AFW	0390	1	2	2
672	382	90003	AFW	0390	1	2	2
673	382	91013	AFW	0691	1	2	2
674	382	91019	AFW	0891	1	1	1
675	382	91019	HPI	0891	1	2	2
676	382	91022	AFW	1191	1	2	2
677	382	91022	HPI	1191	1	2	2
678	382	93001	AFW	0393	1	2	2
679	382	95002	AFW	0695	1	2	2
680	389	87001	AFW	0387	1	2	2
681	389	87002	AFW	0387	1	1	1
682	389	87003	AFW	0487	1	2	2
683	389	87004	AFW	0487	1	2	2
684	389	89007	AFW	0989	1	2	2
685	389	90001	AFW	0190	1	2	2
686	389	90006	AFW	1290	1	1	1
687	389	91001	AFW	0391	1	1	1
688	389	92005	AFW	0792	1	2	2
689	389	92006	AFW	0892	1	2	2
690	389	95002	AFW	0295	1	2	2
691	395	87015	AFW	0687	1	2	2
692	395	87021	AFW	0987	1	2	2
693	395	87022	AFW	0987	1	1	1
694	395	87027	AFW	1087	1	2	2
695	395	87029	CCW	1287	1	1	1
696	395	88002	AFW	0588	1	2	2
697	395	88006	AFW	0588	1	2	2
698	395	88006	HPI	0588	1	2	2
699	395	88007	AFW	0688	1	1	1
700	395	88009	AFW	0788	1	1	1
701	395	88013	HPI	1288	1	1	1
702	395	89004	CCW	0389	1	1	1
703	395	89020	AFW	1289	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
704	395	89021	NSW	1289	1	1	1
705	395	90008	AFW	0590	1	1	1
706	395	93001	AFW	0193	1	2	2
707	400	87008	AFW	0287	1	2	2
708	400	87012	AFW	0387	1	2	2
709	400	87013	AFW	0387	1	2	2
710	400	87014	AFW	0387	1	2	2
711	400	87017	AFW	0387	1	2	2
712	400	87018	AFW	0487	1	2	2
713	400	87019	AFW	0487	1	2	2
714	400	87021	AFW	0487	1	2	2
715	400	87024	AFW	0487	1	2	2
716	400	87025	AFW	0487	1	2	2
717	400	87026	AFW	0487	1	2	2
718	400	87028	AFW	0587	1	2	2
719	400	87031	AFW	0587	1	2	2
720	400	87035	AFW	0687	1	2	2
721	400	87037	AFW	0687	1	2	2
722	400	87029	AFW	0687	1	2	2
723	400	87041	AFW	0887	1	2	2
724	400	87042	AFW	0787	1	2	2
725	400	87046	AFW	0787	1	2	2
726	400	87047	AFW	0887	1	2	2
727	400	87048	AFW	0987	1	2	2
728	400	87049	AFW	0987	1	2	2
729	400	87051	AFW	0887	1	2	2
730	400	87062	AFW	1187	1	2	2
731	400	87062	HPI	1187	1	2	2
732	400	87063	AFW	1187	1	2	2
733	400	88007	AFW	0388	1	2	2
734	400	88008	NSW	0288	1	1	1
735	400	88013	NSW	0688	1	1	1
736	400	88018	AFW	0788	1	2	2
737	400	88021	AFW	0888	1	1	1
738	400	88028	AFW	1088	1	2	2
739	400	88029	AFW	0988	1	1	1
740	400	88029	NSW	0988	1	1	1
741	400	89001	AFW	0189	1	2	2
742	400	89003	AFW	0289	1	2	2
743	400	89004	AFW	0289	1	2	2
744	400	89005	AFW	0289	1	2	2
745	400	89006	AFW	0389	1	2	2
746	400	89013	NSW	0889	1	1	1
747	400	89016	NSW	0989	1	1	1
748	400	89017	AFW	1089	1	1	1
749	400	89019	AFW	1289	1	2	2
750	400	89021	AFW	1289	1	2	2
751	400	91009	AFW	0591	1	2	2
752	400	91010	AFW	0691	1	2	2
753	400	91012	AFW	0591	1	1	1
754	400	91015	AFW	0591	1	2	2
755	400	92007	AFW	0792	1	2	2
756	400	92008	AFW	0792	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
757	400	92009	AFW	0792	1	2	2
758	400	92010	AFW	0792	1	2	2
759	400	93007	AFW	0593	1	2	2
760	400	95010	AFW	1095	1	2	2
761	400	95011	HPI	1195	1	2	2
762	412	87005	AFW	0787	1	2	2
763	412	87011	HPI	0787	1	2	2
764	412	87016	AFW	0887	1	1	1
765	412	87017	AFW	0887	1	2	2
766	412	87020	AFW	0987	1	2	2
767	412	87023	AFW	0987	1	2	2
768	412	87024	AFW	0987	1	2	2
769	412	87024	HPI	0987	1	2	2
770	412	87025	AFW	0987	1	2	2
771	412	87026	AFW	1087	1	2	2
772	412	87026	NSW	1087	1	2	2
773	412	87028	AFW	1087	1	2	2
774	412	87030	AFW	1087	1	2	2
775	412	87032	AFW	1087	1	2	2
776	412	87034	AFW	1087	1	2	2
777	412	87035	AFW	1187	1	2	2
778	412	88002	NSW	0188	1	1	1
779	412	88004	CCW	0288	1	1	1
780	412	88004	HPI	0288	1	1	1
781	412	88011	AFW	0888	1	2	2
782	412	89003	AFW	0189	1	2	2
783	412	89015	AFW	0589	1	2	2
784	412	89019	AFW	0689	1	2	2
785	412	89020	AFW	0689	1	2	2
786	412	90008	AFW	0790	1	2	2
787	412	91005	AFW	1191	1	2	2
788	412	92006	AFW	0592	1	2	2
789	412	92006	HPI	0592	1	2	2
790	412	92007	AFW	0592	1	2	2
791	412	92009	AFW	0692	1	2	2
792	412	93002	AFW	0193	1	2	2
793	412	93002	HPI	0193	1	2	2
794	412	93002	NSW	0193	1	1	1
795	412	94004	HPI	0394	1	1	1
796	412	95006	AFW	0895	1	2	2
797	413	87006	AFW	0187	1	2	2
798	413	87013	AFW	0387	1	2	2
799	413	87015	AFW	0487	1	2	2
800	413	87026	AFW	0787	1	1	1
801	413	87027	AFW	0787	1	1	1
802	413	87028	AFW	0787	1	2	2
803	413	87029	AFW	0787	1	2	2
804	413	87034	AFW	0887	1	1	1
805	413	87039	AFW	1187	1	1	1
806	413	88007	AFW	0188	1	2	2
807	413	88007	CVCS	0188	1	2	2
808	413	88007	HPI	0188	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
809	413	89008	AFW	0389	1	2	2
810	413	89008	CVCS	0389	1	1	1
811	413	89008	HPI	0389	1	2	2
812	413	89017	AFW	0689	1	2	2
813	413	89022	AFW	0889	1	2	2
814	413	91013	AFW	0691	1	2	2
815	413	91015	AFW	0791	1	2	2
816	413	91018	AFW	0991	1	1	1
817	413	91019	AFW	0991	1	2	2
818	413	92008	AFW	0792	1	2	2
819	413	92011	AFW	0892	1	1	1
820	413	93006	AFW	0693	1	2	2
821	413	93007	AFW	0393	1	2	2
822	413	93008	AFW	0793	1	2	2
823	413	94001	AFW	0194	1	2	2
824	414	87002	AFW	0187	1	2	2
825	414	87003	AFW	0187	1	2	2
826	414	87007	AFW	0287	1	2	2
827	414	87010	AFW	0387	1	2	2
828	414	87013	AFW	0387	1	2	2
829	414	87018	AFW	0587	1	2	2
830	414	87019	AFW	0587	1	2	2
831	414	87021	AFW	0787	1	2	2
832	414	87022	AFW	0787	1	1	1
833	414	87024	AFW	0887	1	1	1
834	414	87025	AFW	0987	1	2	2
835	414	87027	AFW	0987	1	2	2
836	414	87029	AFW	1187	1	1	1
837	414	88003	AFW	0288	1	1	1
838	414	88003	CVCS	0288	1	1	1
839	414	88003	HPI	0288	1	1	1
840	414	88005	AFW	0288	1	2	2
841	414	88007	AFW	0288	1	2	2
842	414	88012	AFW	0388	1	2	2
843	414	88014	AFW	0388	1	2	2
844	414	88019	AFW	0588	1	2	2
845	414	88020	AFW	0588	1	2	2
846	414	88021	AFW	0688	1	2	2
847	414	88023	AFW	0688	1	2	2
848	414	88025	AFW	0688	1	2	2
849	414	88028	AFW	0988	1	2	2
850	414	88031	AFW	1188	1	2	2
851	414	88032	AFW	1188	1	1	1
852	414	89001	AFW	0189	1	2	2
853	414	89002	AFW	0189	1	2	2
854	414	89003	AFW	0289	1	2	2
855	414	89003	CVCS	0289	1	2	2
856	414	89003	HPI	0289	1	2	2
857	414	89004	CVCS	0289	1	2	2
858	414	89004	HPI	0289	1	2	2
859	414	89015	AFW	0689	1	2	2
860	414	90013	AFW	1090	1	2	2
861	414	91003	AFW	0191	1	1	1

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
862	414	91006	AFW	0491	1	2	2
863	414	91008	AFW	0591	1	2	2
864	414	91012	AFW	1091	1	1	1
865	414	92001	AFW	0192	1	2	2
866	414	92006	AFW	1292	1	2	2
867	414	93003	AFW	0993	1	2	2
868	414	94003	AFW	0794	1	2	2
869	414	94006	AFW	0994	1	2	2
870	414	94007	AFW	1094	1	2	2
871	414	95001	AFW	0295	1	2	2
872	414	95004	AFW	0495	1	2	2
873	414	95005	AFW	0595	1	2	2
874	423	87016	CVCS	0387	1	1	1
875	423	87026	AFW	0587	1	1	1
876	423	87031	AFW	0687	1	2	2
877	423	88023	AFW	1088	1	2	2
878	423	88024	AFW	1088	1	2	2
879	423	88028	AFW	1288	1	2	2
880	423	89005	CVCS	0289	1	1	1
881	423	89008	AFW	0589	1	2	2
882	423	89009	AFW	0589	1	2	2
883	423	89023	CVCS	1289	1	1	1
884	423	89033	CVCS	1289	1	2	2
885	423	89033	HPI	1289	1	2	2
886	423	89034	AFW	1289	1	1	1
887	423	89034	CVCS	1289	1	1	1
888	423	89034	HPI	1289	1	1	1
889	423	90002	AFW	0190	1	1	1
890	423	90002	CVCS	0190	1	1	1
891	423	90002	HPI	0190	1	1	1
892	423	90005	AFW	0190	1	2	2
893	423	90011	AFW	0390	1	2	2
894	423	90013	AFW	0490	1	2	2
895	423	90014	AFW	0590	1	2	2
896	423	90016	AFW	0590	1	2	2
897	423	90019	AFW	0690	1	2	2
898	423	90030	AFW	1290	1	2	2
899	423	91014	AFW	0691	1	2	2
900	423	92011	AFW	0492	1	2	2
901	423	92029	AFW	1192	1	2	2
902	423	93004	AFW	0393	1	2	2
903	423	94011	AFW	0994	1	2	2
904	423	95007	AFW	0495	1	1	1
905	423	95022	AFW	1295	1	1	1
906	424	87009	AFW	0387	1	2	2
907	424	87010	AFW	0387	1	2	2
908	424	87011	AFW	0387	1	2	2
909	424	87012	AFW	0487	1	2	2
910	424	87013	AFW	0487	1	2	2
911	424	87014	AFW	0487	1	2	2
912	424	87015	AFW	0487	1	2	2
913	424	87018	AFW	0487	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
914	424	87025	AFW	0587	1	2	2
915	424	87026	AFW	0587	1	2	2
916	424	87027	AFW	0587	1	2	2
917	424	87029	AFW	0587	1	2	2
918	424	87030	AFW	0687	1	2	2
919	424	87033	AFW	0687	1	2	2
920	424	87035	AFW	0687	1	2	2
921	424	87039	AFW	0687	1	2	2
922	424	87041	AFW	0687	1	2	2
923	424	87047	AFW	0787	1	2	2
924	424	87050	AFW	0787	1	2	2
925	424	87063	AFW	1187	1	2	2
926	424	87066	AFW	1187	1	2	2
927	424	88001	AFW	0188	1	2	2
928	424	88006	AFW	0288	1	2	2
929	424	88008	AFW	0488	1	2	2
930	424	88013	AFW	0488	1	2	2
931	424	88022	AFW	0788	1	2	2
932	424	88024	AFW	0788	1	2	2
933	424	88025	AFW	0788	1	2	2
934	424	88028	CVCS	1088	1	2	2
935	424	88028	HPI	1088	1	2	2
936	424	88044	AFW	1288	1	2	2
937	424	89005	AFW	0289	1	2	2
938	424	89012	AFW	0589	1	2	2
939	424	89018	AFW	1089	1	2	2
940	424	90001	AFW	0190	1	2	2
941	424	90011	AFW	0490	1	2	2
942	424	90016	AFW	0790	1	2	2
943	424	90023	AFW	1290	1	2	2
944	424	91011	AFW	1191	1	1	1
945	424	92008	AFW	0992	1	2	2
946	424	93006	CVCS	0493	1	2	2
947	424	93008	AFW	0593	1	2	2
948	424	93009	AFW	0793	1	2	2
949	424	94001	AFW	0294	1	2	2
950	424	94001	CVCS	0294	1	2	2
951	424	94001	HPI	0294	1	2	2
952	424	95002	AFW	0795	1	2	2
953	425	89006	CVCS	0389	1	2	2
954	425	89006	HPI	0389	1	2	2
955	425	89015	AFW	0489	1	2	2
956	425	89018	AFW	0489	1	2	2
957	425	89019	AFW	0589	1	2	2
958	425	89020	AFW	0589	1	2	2
959	425	89021	AFW	0589	1	2	2
960	425	89023	AFW	0789	1	1	1
961	425	89024	AFW	0789	1	2	2
962	425	89027	AFW	1089	1	2	2
963	425	89029	AFW	1189	1	2	2
964	425	89031	AFW	1289	1	2	2
965	425	90002	AFW	0390	1	2	2
966	425	90007	AFW	0590	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
967	425	90008	AFW	0690	1	2	2
968	425	90009	AFW	0690	1	2	2
969	425	91005	AFW	0291	1	2	2
970	425	91006	AFW	0291	1	2	2
971	425	91007	AFW	0591	1	2	2
972	425	91009	HPI	0891	1	1	1
973	425	92002	AFW	0392	1	2	2
974	425	92010	AFW	0592	1	2	2
975	425	93006	AFW	0993	1	2	2
976	425	94001	AFW	0194	1	2	2
977	425	94002	AFW	0194	1	2	2
978	425	95004	AFW	0395	1	1	1
979	443	87009	AFW	0387	1	1	1
980	443	87009	CVCS	0387	1	2	2
981	443	87009	HPI	0387	1	2	2
982	443	87012	CVCS	0487	1	1	1
983	443	87012	HPI	0487	1	1	1
984	443	87015	CVCS	0887	1	1	1
985	443	87015	HPI	0887	1	1	1
986	443	90015	AFW	0690	1	1	1
987	443	90025	AFW	1190	1	1	1
988	443	91001	AFW	0291	1	1	1
989	443	91002	AFW	0391	1	1	1
990	443	91008	AFW	0691	1	1	1
991	443	91009	AFW	0791	1	1	1
992	443	92017	AFW	0992	1	1	1
993	443	92024	AFW	1192	1	1	1
994	443	92025	AFW	1292	1	1	1
995	443	93003	AFW	0193	1	1	1
996	443	93009	AFW	0593	1	1	1
997	443	93012	AFW	0793	1	1	1
998	443	93018	AFW	0993	1	1	1
999	443	94001	CVCS	0194	1	2	2
1000	443	94001	HPI	0194	1	2	2
1001	443	95002	AFW	0695	1	1	1
1002	445	90004	AFW	0390	1	1	1
1003	445	90004	CVCS	0390	1	1	1
1004	445	90004	HPI	0390	1	1	1
1005	445	90017	AFW	0590	1	2	2
1006	445	90018	AFW	0690	1	1	1
1007	445	90020	AFW	0790	1	2	2
1008	445	90020	CVCS	0790	1	2	2
1009	445	90020	HPI	0790	1	2	2
1010	445	90021	AFW	0790	1	2	2
1011	445	90021	CVCS	0790	1	2	2
1012	445	90021	HPI	0790	1	2	2
1013	445	90025	AFW	0890	1	2	2
1014	445	90027	AFW	0990	1	2	2
1015	445	90029	AFW	0990	1	2	2
1016	445	90030	AFW	0990	1	2	2
1017	445	90037	CVCS	1190	1	1	1
1018	445	91002	AFW	0191	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
1019	445	91004	AFW	0291	1	2	2
1020	445	91008	AFW	0391	1	2	2
1021	445	91019	AFW	0691	1	2	2
1022	445	91020	AFW	0791	1	2	2
1023	445	91021	AFW	0791	1	2	2
1024	445	91022	AFW	0991	1	1	1
1025	445	91022	CVCS	0991	1	1	1
1026	445	91023	AFW	1091	1	2	2
1027	445	92001	AFW	0192	1	2	2
1028	445	92009	AFW	0592	1	2	2
1029	445	92014	AFW	0692	1	2	2
1030	445	92016	AFW	0692	1	2	2
1031	445	92016	CVCS	0692	1	2	2
1032	445	92019	AFW	0792	1	2	2
1033	445	92022	AFW	1092	1	2	2
1034	445	93001	AFW	0193	1	1	1
1035	445	93007	AFW	0693	1	1	1
1036	445	95002	AFW	0595	1	2	2
1037	445	95003	AFW	0695	1	2	2
1038	445	95004	AFW	0695	1	2	2
1039	445	95007	AFW	1195	1	2	2
1040	454	87018	AFW	0887	1	1	1
1041	454	87019	AFW	0887	1	1	1
1042	454	87019	CVCS	0887	1	2	2
1043	454	87019	HPI	0887	1	2	2
1044	454	88002	AFW	0488	1	1	1
1045	454	88004	AFW	0788	1	1	1
1046	454	88005	AFW	0888	1	1	1
1047	454	89002	AFW	0189	1	1	1
1048	454	90006	AFW	0590	1	1	1
1049	454	90010	AFW	0890	1	1	1
1050	454	90011	AFW	0890	1	1	1
1051	455	87005	AFW	0387	1	1	1
1052	455	87006	AFW	0487	1	1	1
1053	455	87007	AFW	0587	1	1	1
1054	455	87009	AFW	0687	1	1	1
1055	455	87011	AFW	0787	1	1	1
1056	455	87016	AFW	0887	1	1	1
1057	455	87016	CVCS	0887	1	1	1
1058	455	87016	HPI	0887	1	1	1
1059	455	87018	AFW	1087	1	1	1
1060	455	88004	AFW	0588	1	1	1
1061	455	88006	AFW	0688	1	1	1
1062	455	88008	AFW	0788	1	1	1
1063	455	88009	AFW	0788	1	1	1
1064	455	88012	AFW	1288	1	1	1
1065	455	89001	CVCS	0289	1	2	2
1066	455	89001	HPI	0289	1	1	1
1067	455	90001	CVCS	0190	1	2	2
1068	455	90001	HPI	0190	1	2	2
1069	455	90010	AFW	1290	1	1	1
1070	455	91005	AFW	1191	1	1	1

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
1071	455	92003	AFW	0692	1	1	1
1072	455	93003	AFW	0593	1	1	1
1073	455	93004	HPI	0993	1	1	1
1074	455	93008	AFW	1193	1	1	1
1075	455	94003	AFW	0994	1	1	1
1076	456	87062	NSW	1287	1	1	1
1077	456	88002	CVCS	0188	1	1	1
1078	456	88025	AFW	1188	1	1	1
1079	456	89002	CVCS	0489	1	2	2
1080	456	89002	HPI	0489	1	2	2
1081	456	89004	AFW	0389	1	1	1
1082	456	90007	AFW	0690	1	1	1
1083	456	90018	HPI	0990	1	1	1
1084	456	90021	AFW	1290	1	1	1
1085	456	90023	AFW	1290	1	1	1
1086	456	91012	AFW	1191	1	1	1
1087	456	91013	CVCS	1091	1	2	2
1088	456	91013	HPI	1091	1	1	1
1089	456	92022	AFW	1092	1	1	1
1090	456	95004	AFW	0495	1	1	1
1091	457	88006	AFW	0288	1	1	1
1092	457	88012	AFW	0688	1	1	1
1093	457	88013	AFW	0688	1	1	1
1094	457	88014	AFW	0688	1	1	1
1095	457	88016	AFW	0688	1	1	1
1096	457	88018	AFW	0788	1	1	1
1097	457	88019	AFW	0788	1	1	1
1098	457	88020	AFW	0988	1	1	1
1099	457	88028	AFW	1188	1	1	1
1100	457	88029	AFW	1088	1	1	1
1101	457	89002	AFW	0589	1	1	1
1102	457	89004	AFW	0989	1	1	1
1103	457	90010	AFW	0690	1	1	1
1104	457	91006	AFW	1291	1	1	1
1105	457	92001	AFW	0292	1	1	1
1106	457	92002	AFW	0392	1	1	1
1107	457	92003	NSW	0592	1	1	1
1108	457	92006	AFW	0992	1	1	1
1109	457	93007	AFW	1093	1	1	1
1110	457	94002	AFW	0394	1	1	1
1111	457	94005	AFW	0894	1	1	1
1112	482	87002	AFW	0187	1	2	2
1113	482	87002	NSW	0187	1	1	1
1114	482	87002	CVCS	0187	1	2	2
1115	482	87002	HPI	0187	1	2	2
1116	482	87004	AFW	0187	1	2	2
1117	482	87005	AFW	0187	1	2	2
1118	482	87017	AFW	0487	1	2	2
1119	482	87022	AFW	0587	1	2	2
1120	482	87027	AFW	0687	1	2	2
1121	482	87030	AFW	0787	1	1	1

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
1122	482	87037	AFW	0987	1	2	2
1123	482	87041	AFW	0987	1	2	2
1124	482	87051	AFW	1287	1	1	1
1125	482	89002	AFW	0189	1	2	2
1126	482	89004	AFW	0289	1	2	2
1127	482	89013	AFW	0789	1	1	1
1128	482	90001	AFW	0290	1	2	2
1129	482	90007	AFW	0590	1	2	2
1130	482	90011	AFW	0590	1	2	2
1131	482	90012	AFW	0590	1	2	2
1132	482	90013	AFW	0590	1	2	2
1133	482	90014	AFW	0690	1	1	1
1134	482	90023	AFW	1090	1	2	2
1135	482	90023	CVCS	1090	1	1	1
1136	482	91006	AFW	0591	1	2	2
1137	482	92002	AFW	0292	1	2	2
1138	482	92016	AFW	1192	1	2	2
1139	482	93009	CVCS	0593	1	2	2
1140	482	93009	HPI	0593	1	2	2
1141	482	94002	AFW	0194	1	2	2
1142	482	95006	AFW	1195	1	2	2
1143	483	87003	AFW	0487	1	2	2
1144	483	87032	AFW	1187	1	2	2
1145	483	88004	AFW	0288	1	2	2
1146	483	88005	AFW	0488	1	2	2
1147	483	88006	AFW	0488	1	2	2
1148	483	88007	AFW	0588	1	2	2
1149	483	88010	AFW	0988	1	2	2
1150	483	88015	AFW	1188	1	1	1
1151	483	89003	AFW	0389	1	2	2
1152	483	89005	AFW	0589	1	2	2
1153	483	89006	AFW	0589	1	2	2
1154	483	89007	AFW	0689	1	1	1
1155	483	89010	AFW	0989	1	1	1
1156	483	90005	AFW	0590	1	2	2
1157	483	90007	AFW	0690	1	2	2
1158	483	90015	AFW	1190	1	2	2
1159	483	90016	AFW	1190	1	2	2
1160	483	90017	AFW	1290	1	2	2
1161	483	91006	AFW	1191	1	2	2
1162	483	92002	AFW	0192	1	2	2
1163	483	92003	AFW	0192	1	2	2
1164	483	92004	AFW	0392	1	2	2
1165	483	92006	AFW	0592	1	2	2
1166	483	92010	AFW	0992	1	2	2
1167	483	95005	AFW	0895	1	2	2
1168	483	95006	AFW	1095	1	2	2
1169	498	88018	HPI	0288	1	3	3
1170	498	88022	AFW	0288	1	3	3
1171	498	88022	HPI	0288	1	3	3
1172	498	88026	HPI	0388	1	3	3
1173	498	88045	AFW	0788	1	1	1

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
1174	498	88048	AFW	0888	1	2	2
1175	498	88049	HPI	0888	1	3	3
1176	498	88059	HPI	1088	1	1	1
1177	498	89001	AFW	0189	1	3	3
1178	498	89015	AFW	0789	1	3	3
1179	498	90006	AFW	0790	1	3	3
1180	498	90014	AFW	0690	1	2	2
1181	498	90015	AFW	0690	1	2	2
1182	498	90016	AFW	0790	1	3	3
1183	498	90020	AFW	0790	1	3	3
1184	498	90023	AFW	0990	1	3	3
1185	498	90025	AFW	1190	1	3	3
1186	498	91012	AFW	0491	1	3	3
1187	498	91015	AFW	0491	1	1	1
1188	498	91021	AFW	1091	1	3	3
1189	498	91022	AFW	1091	1	3	3
1190	498	92003	AFW	0392	1	3	3
1191	498	92005	CCW	0692	1	1	1
1192	498	92009	AFW	0892	1	1	1
1193	498	92010	CCW	0892	1	1	1
1194	498	92015	CCW	1092	1	1	1
1195	498	92016	CCW	1092	1	1	1
1196	498	94009	AFW	0294	1	3	3
1197	498	94015	AFW	0994	1	3	3
1198	498	95001	AFW	0195	1	3	3
1199	498	95009	AFW	0895	1	3	3
1200	498	95013	AFW	1295	1	3	3
1201	499	89009	AFW	0489	1	3	3
1202	499	89011	AFW	0489	1	3	3
1203	499	89011	HPI	0489	1	3	3
1204	499	89013	AFW	0689	1	1	1
1205	499	89016	AFW	0689	1	3	3
1206	499	89017	AFW	0789	1	3	3
1207	499	89019	AFW	0889	1	3	3
1208	499	89021	AFW	0989	1	3	3
1209	499	89022	AFW	0989	1	3	3
1210	499	89023	AFW	0989	1	3	3
1211	499	89026	AFW	1089	1	3	3
1212	499	90002	AFW	0290	1	2	2
1213	499	90004	AFW	0390	1	2	2
1214	499	90005	AFW	0490	1	2	2
1215	499	90013	AFW	0990	1	3	3
1216	499	91001	AFW	0191	1	3	3
1217	499	91003	AFW	0391	1	3	3
1218	499	91009	AFW	0791	1	1	1
1219	499	91010	HPI	1291	1	3	3
1220	499	92001	AFW	0192	1	3	3
1221	499	92003	AFW	0292	1	3	3
1222	499	92006	CCW	0592	1	1	1
1223	499	92010	AFW	1292	1	3	3
1224	499	93001	AFW	0193	1	3	3
1225	499	93004	AFW	0293	1	3	3
1226	499	93013	CCW	0793	1	1	1

APPENDIX IV - TABLE III (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
1227	499	93016	CCW	1093	1	1	1
1228	499	94007	AFW	0694	1	3	3
1229	499	94007	CCW	0694	1	1	1
1230	499	95003	AFW	0395	1	3	3
1231	499	95005	CCW	0495	1	1	1
1232	499	95008	AFW	1195	1	3	3
1233	528	87003	AFW	0187	1	1	1
1234	528	88024	AFW	0888	1	1	1
1235	528	91004	AFW	0391	1	1	1
1236	528	91009	AFW	0991	1	2	2
1237	528	91010	AFW	1091	1	2	2
1238	528	91010	HPI	1091	1	2	2
1239	528	92007	AFW	0592	1	1	1
1240	529	87008	AFW	0787	1	2	2
1241	529	87010	AFW	0687	1	2	2
1242	529	87010	HPI	0687	1	2	2
1243	529	88005	HPI	0288	1	2	2
1244	529	89001	AFW	0189	1	1	1
1245	529	89003	AFW	0289	1	1	1
1246	529	89003	HPI	0289	1	2	2
1247	529	89009	HPI	0789	1	2	2
1248	529	92001	AFW	0192	1	1	1
1249	529	92006	AFW	1192	1	1	1
1250	529	92006	HPI	1192	1	2	2
1251	529	93001	AFW	0393	1	1	1
1252	529	93001	CCW	0393	1	2	2
1253	529	93001	CS	0393	1	2	2
1254	529	93001	HPI	0393	1	2	2
1255	529	93001	NSW	0393	1	2	2
1256	529	93001	RHR	0393	1	2	2
1257	529	93004	AFW	1193	1	2	2
1258	529	93004	CCW	1193	1	2	2
1259	529	93004	NSW	1193	1	2	2
1260	529	95005	AFW	0795	1	1	1
1261	530	89001	AFW	0389	1	1	1
1262	530	89001	HPI	0389	1	2	2
1263	530	91003	AFW	0691	1	1	1
1264	530	91003	CS	0691	1	2	2
1265	530	91006	AFW	0891	1	1	1
1266	530	91010	AFW	1191	1	1	1
1267	530	91010	HPI	1191	1	2	2
1268	530	93001	AFW	0293	1	2	2
1269	530	93001	CCW	0293	1	2	2
1270	530	93001	CS	0293	1	2	2
1271	530	93001	HPI	0293	1	2	2
1272	530	93001	NSW	0293	1	2	2
1273	530	93001	RHR	0293	1	2	2
1274	530	94005	AFW	0894	1	2	2
1275	530	94005	CCW	0894	1	2	2
1276	530	94005	NSW	0894	1	2	2
1277	530	94007	AFW	0894	1	1	1

APPENDIX IV - TABLE IIIA
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1996-1998)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
1	244	96002	AFW	0396	1	2	2
2	244	96004	AFW	0396	1	1	1
3	244	96008	AFW	0796	1	1	1
4	244	96010	AFW	0896	1	1	1
5	244	96011	AFW	0896	1	2	2
6	244	96012	AFW	0896	1	2	2
7	244	98005	CCW	1198	1	1	1
8	244	98005	NSW	1198	1	3	3
9	247	96003	AFW	0396	1	2	2
10	247	97001	AFW	0197	1	2	2
11	247	97009	HPI	0597	1	3	3
12	247	97010	AFW	0597	1	1	1
13	247	97010	HPI	0597	1	3	3
14	247	97018	AFW	0797	1	1	1
15	250	96007	HPI	0396	1	3	3
16	255	98010	AFW	0798	1	2	2
17	261	97011	AFW	1197	1	2	2
18	261	98003	AFW	0498	1	2	2
19	261	98005	AFW	1098	1	2	2
20	266	96001	AFW	0496	1	1	1
21	266	96001	NSW	0496	1	3	3
22	266	96001	RHR	0496	1	1	1
23	266	98006	NSW	0198	1	1	1
24	266	98014	NSW	0498	1	1	1
25	269	96004	AFW	0296	1	2	2
26	269	97008	AFW	0797	1	2	2
27	270	98003	HPI	0698	1	1	1
28	270	98007	AFW	1198	1	2	2
29	272	98006	AFW	0298	1	2	2
30	275	96008	AFW	0696	1	2	2
31	275	96012	AFW	0896	1	2	2
32	275	96017	AFW	1196	1	2	2
33	280	98002	AFW	0298	1	2	2
34	280	98013	AFW	1198	1	2	2
35	280	98013	AFW	1198	1	1	1
36	280	98013	HPI	1198	1	2	2
37	281	96004	AFW	0696	1	2	2
38	281	96005	AFW	0896	1	2	2
39	281	96006	AFW	1296	1	2	2
40	281	97001	AFW	0297	1	2	2
41	281	97004	AFW	1297	1	2	2
42	282	96012	AFW	0696	1	1	1
43	282	96016	CCW	0996	1	1	1

APPENDIX IV - TABLE IIIA (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1996-1998)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
44	282	97008	AFW	0697	1	1	1
45	282	98008	AFW	0698	1	1	1
46	286	96007	AFW	0396	1	1	1
47	286	97009	CCW	0697	1	2	2
48	286	97009	NSW	0697	1	1	1
49	286	97023	AFW	0997	1	2	2
50	286	97025	AFW	0997	1	2	2
51	286	98003	AFW	0598	1	1	1
52	286	98003	CCW	0598	1	1	1
53	286	98003	NSW	0598	1	2	2
54	286	98006	AFW	0898	1	2	2
55	287	96001	AFW	0396	1	2	2
56	289	97007	AFW	0697	1	2	2
57	295	96015	AFW	0496	1	2	2
58	301	96001	AFW	0596	1	2	2
59	302	96013	CCW	0496	1	1	1
60	302	96017	AFW	0596	1	1	1
61	302	96017	HPI	0596	1	1	1
62	302	98003	AFW	0298	1	1	1
63	304	97001	CCW	0997	1	2	2
64	304	97004	NSW	1297	1	1	1
65	305	96003	AFW	0496	1	2	2
66	305	98005	AFW	0298	1	2	2
67	306	96003	CCW	1296	1	1	1
68	306	98001	CCW	0198	1	1	1
69	306	98006	CCW	1298	1	1	1
70	306	98006	RHR	1298	1	1	1
71	311	97014	AFW	1097	1	2	2
72	311	98011	CCW	0898	1	1	1
73	313	96005	AFW	0596	1	1	1
74	313	96005	HPI	0596	1	1	1
75	313	96007	AFW	0996	1	1	1
76	313	97003	AFW	0797	1	1	1
77	313	98004	AFW	0998	1	1	1
78	313	98005	AFW	1298	1	1	1
79	315	96002	AFW	0396	1	2	2
80	315	98040	NSW	0898	1	1	1
81	315	98040	RHR	0898	1	1	1
82	316	96005	AFW	0596	1	2	2
83	316	97001	AFW	0397	1	2	2
84	318	96005	AFW	1196	1	1	1

APPENDIX IV - TABLE IIIA (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1996-1998)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
85	323	97002	AFW	0397	1	2	2
86	323	97003	AFW	0797	1	2	2
87	323	97005	AFW	1097	1	2	2
88	323	97005	CVCS	1097	1	2	2
89	323	97005	HPI	1097	1	2	2
90	323	98005	AFW	1298	1	2	2
91	327	96010	AFW	1196	1	2	2
92	327	97012	AFW	0897	1	2	2
93	327	98001	AFW	0598	1	2	2
94	327	98003	AFW	1198	1	2	2
95	328	96001	AFW	0496	1	1	1
96	328	96001	CCW	0496	1	2	2
97	328	96005	AFW	1096	1	2	2
98	328	96006	AFW	1296	1	2	2
99	328	98001	AFW	0898	1	2	2
100	328	98002	AFW	1098	1	2	2
101	334	96003	AFW	0396	1	2	2
102	334	96007	AFW	0596	1	2	2
103	334	96008	AFW	0596	1	2	2
104	334	97005	AFW	0397	1	2	2
105	334	97025	AFW	0897	1	2	2
106	335	96002	AFW	0296	1	2	2
107	335	96008	CS	0696	1	1	1
108	335	97003	AFW	0397	1	1	1
109	335	98003	AFW	0198	1	2	2
110	338	96005	AFW	0896	1	2	2
111	339	96003	AFW	1196	1	2	2
112	346	98011	AFW	1098	1	1	1
113	348	96003	AFW	0696	1	1	1
114	348	96003	RHR	0696	1	1	1
115	364	98007	AFW	1198	1	1	1
116	364	98007	RHR	1198	1	1	1
117	369	96001	AFW	0296	1	2	2
118	369	96006	AFW	1196	1	2	2
119	369	97006	AFW	0597	1	2	2
120	369	97006	NSW	0597	1	1	1
121	369	97009	AFW	0997	1	2	2
122	369	98002	AFW	0298	1	2	2
123	370	96003	AFW	0596	1	2	2
124	370	97001	CVCS	0597	1	1	1
125	370	97001	HPI	0597	1	1	1
126	370	97001	NSW	0597	1	1	1
127	370	97002	AFW	0797	1	2	2

APPENDIX IV - TABLE IIIA (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1996-1998)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
128	370	98001	AFW	0298	1	2	2
129	382	96006	AFW	0596	1	2	2
130	382	98014	AFW	0798	1	2	2
131	389	96001	AFW	0196	1	2	2
132	389	96002	AFW	0696	1	2	2
133	389	98006	AFW	0998	1	1	1
134	395	97002	AFW	0497	1	2	2
135	400	96008	AFW	0496	1	2	2
136	400	96018	AFW	0996	1	2	2
137	400	97001	AFW	0197	1	2	2
138	400	97014	NSW	0597	1	1	1
139	400	97014	RHR	0597	1	1	1
140	400	97016	AFW	0697	1	2	2
141	400	97019	AFW	0797	1	2	2
142	400	98007	AFW	1098	1	2	2
143	413	96005	AFW	0696	1	2	2
144	413	97011	CVCS	1297	1	1	1
145	414	96001	AFW	0296	1	2	2
146	414	96001	CVCS	0296	1	1	1
147	414	96001	HPI	0296	1	1	1
148	414	97006	AFW	0797	1	2	2
149	423	98023	AFW	0498	1	2	2
150	423	98033	AFW	0698	1	2	2
151	423	98044	AFW	1198	1	2	2
152	423	98045	AFW	1298	1	2	2
153	424	96006	AFW	0596	1	2	2
154	424	96012	AFW	1196	1	2	2
155	425	96006	AFW	1096	1	2	2
156	425	96008	AFW	1096	1	2	2
157	425	98003	AFW	0598	1	2	2
158	425	98005	AFW	0698	1	2	2
159	425	98007	AFW	0898	1	2	2
160	425	98008	AFW	0998	1	2	2
161	443	96001	AFW	0196	1	1	1
162	443	98014	AFW	1298	1	1	1
163	445	96001	AFW	0196	1	2	2
164	445	96001	CCW	0196	1	2	2
165	445	96001	CS	0196	1	2	2
166	445	96001	CVCS	0196	1	2	2
167	445	96001	HPI	0196	1	2	2
168	445	96002	AFW	0196	1	2	2
169	445	96003	AFW	0296	1	2	2
170	445	96007	AFW	0896	1	2	2

APPENDIX IV - TABLE IIIA (CONTINUED)
PWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1996-1998)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
171	454	96011	AFW	0796	1	1	1
172	455	97003	AFW	1097	1	1	1
173	457	96005	AFW	0596	1	1	1
174	482	96002	NSW	0196	1	2	2
175	482	96006	AFW	0696	1	2	2
176	483	96003	AFW	1096	1	2	2
177	483	96005	AFW	1196	1	2	2
178	483	96006	AFW	1296	1	2	2
179	498	97012	AFW	1197	1	1	1
180	499	96001	AFW	0196	1	1	1
181	499	97004	AFW	0397	1	3	3
182	499	97005	AFW	0397	1	3	3
183	499	97006	AFW	0497	1	3	3
184	499	97007	AFW	1197	1	3	3
185	528	98002	AFW	0298	1	1	1
186	529	96002	NSW	0496	1	1	1
187	529	96002	RHR	0496	1	1	1
188	529	97005	NSW	0997	1	1	1

APPENDIX IV - TABLE IV
BWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
1	219	88002	LPCS	1088	1	4	4
2	219	88022	RHR	1088	1	2	2
3	219	91005	LPCS	0491	1	4	4
4	219	93008	LPCS	1293	1	2	2
5	237	89005	RHR	0289	1	2	2
6	237	89005	LPCS	0289	1	1	1
7	237	94012	LPCS	0494	1	1	1
8	245	87033	RHR	0887	1	2	2
9	245	90016	LPCS	1090	1	1	1
10	245	94014	LPCS	0494	1	2	2
11	245	94014	RHR	0494	1	2	2
12	249	94019	RHR	1094	1	2	2
13	254	91004	RHR	0391	1	2	2
14	254	93019	RHR	0993	1	1	1
15	259	88003	RHR	1087	1	3	3
16	259	94001	ESW	0294	1	1	1
17	259	88005	ESW	0188	1	1	1
18	259	88011	ESW	0388	1	3	3
19	259	88021	ESW	0788	1	1	1
20	259	88027	ESW	0988	1	1	1
21	259	88049	RHR	1288	1	1	1
22	259	88049	ESW	1288	1	2	2
23	259	89012	ESW	0588	1	2	2
24	259	91004	ESW	0491	1	1	1
25	259	93002	RBCC	0293	1	1	1
26	259	94001	RBCC	0294	1	1	1
27	259	95001	RBCC	0695	1	1	1
28	260	88017	LPCS	1288	1	1	1
29	260	88017	ESW	1288	1	1	1
30	260	91003	ESW	0291	1	1	1
31	260	92002	ESW	0492	1	1	1
32	260	94012	RHR	1194	1	1	1
33	265	92009	RHR	0392	1	2	2
34	271	87008	ESW	0887	1	2	2
35	271	89016	LPCS	0389	1	1	1
36	271	89016	RHR	0389	1	1	1
37	271	93011	RHR	0893	1	1	1
38	271	93018	RHR	1293	1	1	1
39	271	95009	RHR	0495	1	1	1
40	277	88028	RHR	1188	1	2	2
41	277	91004	ESW	0291	1	1	1
42	278	91008	RHR	0591	1	1	1
43	293	87024	RHR	1087	1	2	2
44	293	87024	RBCC	1087	1	3	3

APPENDIX IV - TABLE IV (CONTINUED)
BWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
45	293	88012	RBCC	0488	1	1	1
46	293	92011	RHR	0892	1	2	2
47	293	94003	RHR	0494	1	2	2
48	293	94006	RHR	0994	1	2	2
49	296	95003	RBCC	0995	1	1	1
50	296	95005	RHR	1095	1	1	1
51	298	88003	RHR	0188	1	1	1
52	298	88018	RHR	0688	1	1	1
53	298	88018	LPCS	0688	1	1	1
54	298	90004	LPCS	0490	1	1	1
55	298	93010	RHR	0393	1	1	1
56	298	94005	RHR	0394	1	1	1
57	298	95021	RHR	1295	1	1	1
58	298	95022	RHR	1295	1	1	1
59	321	87028	RHR	0487	1	1	1
60	321	94002	LPCS	0394	1	2	2
61	324	89008	RHR	0689	1	4	4
62	324	89008	LPCS	0689	1	2	2
63	324	94008	ESW	0594	1	1	1
64	325	87021	RHR	0387	1	2	2
65	325	87021	LPCS	0387	1	1	1
66	325	92018	LPCS	0791	1	2	2
67	325	93008	RHR	0393	1	2	2
68	325	94001	RHR	0194	1	1	1
69	325	95004	RHR	0495	1	1	1
70	331	87017	ESW	0587	1	1	1
71	331	93001	ESW	0293	1	2	2
72	333	93005	RHR	0293	2	1	2
73	333	93012	RHR	0593	1	1	1
74	341	87051	ESW	0987	1	1	1
75	341	88022	LPCS	0688	1	2	2
76	341	92004	ESW	0592	1	1	1
77	341	93009	ESW	0793	1	4	4
78	341	93010	RHR	0893	1	2	2
79	341	94001	RBCC	0194	1	1	1
80	341	94001	RHR	0194	1	1	1
81	341	94010	RHR	1194	1	1	1
82	352	87019	RHR	0587	1	1	1
83	352	87019	LPCS	0587	1	1	1
84	352	88023	ESW	0688	1	1	1
85	352	89018	ESW	0389	2	1	2
86	352	90025	LPCS	1190	1	1	1
87	353	91004	ESW	0391	1	1	1
88	353	93003	LPCS	0293	1	1	1

APPENDIX IV - TABLE IV (CONTINUED)
BWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
89	353	95006	LPCS	0395	1	1	1
90	353	95010	LPCS	0895	1	2	2
91	353	95010	RHR	0895	1	2	2
92	353	95006	RHR	0395	1	1	1
93	354	90029	RHR	1190	1	1	1
94	354	92004	RHR	0392	1	2	2
95	354	92004	LPCS	0392	1	2	2
96	354	93009	RHR	1193	1	1	1
97	354	93011	ESW	1193	1	1	1
98	354	95041	ESW	1295	1	1	1
99	366	92023	RHR	1192	1	4	4
100	366	92023	LPCS	1192	1	2	2
101	366	94003	RHR	0394	1	2	2
102	366	95007	RHR	1195	1	1	1
103	373	89009	HPCS	0389	1	1	1
104	373	93001	RHR	0193	1	2	2
105	373	94007	RHR	0594	1	1	1
106	373	94009	RHR	0694	1	2	2
107	373	93015	LPCS	0993	1	1	1
108	374	92005	RHR	0392	1	2	2
109	374	93003	LPCS	0593	1	1	1
110	374	93003	RHR	0593	1	1	1
111	374	94010	RHR	1294	1	2	2
112	374	95001	LPCS	0195	1	1	1
113	374	95001	RHR	0195	1	1	1
114	374	95009	HPCS	0595	1	1	1
115	387	93011	ESW	0993	1	1	1
116	387	93011	RBCC	0993	1	2	2
117	397	87002	HPCS	0387	1	1	1
118	397	91032	HPCS	1191	1	1	1
119	397	93019	RHR	0593	1	1	1
120	397	94014	LPCS	0794	1	1	1
121	410	87077	RHR	1287	1	1	1
122	410	88001	HPCS	0188	1	1	1
123	410	88012	HPCS	0388	1	1	1
124	410	88014	HPCS	0388	1	1	1
125	410	88014	RHR	0388	1	1	1
126	410	88043	HPCS	1088	1	1	1
127	410	88051	RHR	0988	1	1	1
128	410	88051	LPCS	0988	1	1	1
129	410	88054	RHR	0988	1	1	1
130	410	89004	RHR	0289	1	1	1
131	410	89006	HPCS	0289	1	1	1
132	410	89010	RHR	0389	1	1	1
133	410	89010	ESW	0389	1	2	2
134	410	89014	HPCS	0489	1	1	1

APPENDIX IV - TABLE IV (CONTINUED)
BWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
135	410	91023	HPCS	1291	1	1	1
136	410	92008	HPCS	0392	1	1	1
137	410	93011	RHR	1193	1	2	2
138	416	88006	HPCS	0188	1	1	1
139	416	88011	RHR	0388	1	1	1
140	416	88019	HPCS	1088	1	1	1
141	416	89004	RHR	0489	1	1	1
142	416	90017	HPCS	0990	1	1	1
143	416	90022	RHR	1090	1	1	1
144	416	90028	HPCS	1290	1	1	1
145	416	91005	HPCS	0691	1	1	1
146	416	91007	HPCS	0791	1	1	1
147	416	93004	ESW	0593	1	3	3
148	416	93008	HPCS	0993	1	1	1
149	416	93010	RHR	1093	1	1	1
150	416	93011	RHR	1093	1	1	1
151	416	95005	ESW	0495	1	3	3
152	416	95007	HPCS	0795	1	1	1
153	416	95009	HPCS	0795	1	1	1
154	416	95011	HPCS	0995	1	1	1
155	440	87012	HPCS	0387	1	1	1
156	440	87014	HPCS	0387	1	1	1
157	440	87064	HPCS	0987	1	1	1
158	440	87072	HPCS	1087	1	1	1
159	440	89011	ESW	0489	1	1	1
160	440	89013	ESW	0489	1	1	1
161	440	90001	HPCS	0190	1	1	1
162	440	90037	RHR	1290	1	1	1
163	440	92017	HPCS	0992	1	1	1
164	440	93012	ESW	0693	1	1	1
165	440	93012	HPCS	0693	1	1	1
166	440	94010	ESW	0494	1	1	1
167	440	94017	RHR	0794	1	1	1
168	440	95005	HPCS	0895	1	1	1
169	440	95006	RBCC	0995	1	1	1
170	440	95007	HPCS	0995	1	1	1
171	458	87011	ESW	1187	1	1	1
172	458	88018	HPCS	0888	1	1	1
173	458	88021	HPCS	0988	1	1	1
174	458	89027	ESW	0589	1	1	1
175	458	89042	HPCS	1289	1	1	1
176	458	89042	ESW	1289	1	1	1
177	458	89045	ESW	1289	1	2	2
178	458	92001	ESW	0292	1	2	2
179	458	93010	RHR	0593	1	1	1
180	458	93016	HPCS	0793	1	1	1
181	458	94005	RBCC	0594	1	2	2
182	458	94011	ESW	0594	1	2	2
183	458	94018	RHR	0694	1	1	1
184	458	94019	ESW	0694	1	2	2
185	458	94023	HPCS	0984	1	1	1

APPENDIX IV - TABLE IV (CONTINUED)
BWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
186	461	87001	RHR	0187	1	2	2
187	461	87014	HPCS	0387	1	1	1
188	461	87022	HPCS	0487	1	1	1
189	461	87022	ESW	0487	1	1	1
190	461	87026	HPCS	0587	1	1	1
191	461	87026	ESW	0587	1	1	1
192	461	88006	HPCS	0188	1	1	1
193	461	93002	ESW	0993	1	3	3
194	461	93003	RHR	1193	1	1	1

APPENDIX IV - TABLE IVA
BWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1996-1998)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
1	245	97023	ESW	0497	1	1	1
2	259	96003	ESW	0496	1	3	3
3	259	96003	RHR	0496	1	1	1
4	260	97005	ESW	1097	1	3	3
5	271	98016	RHR	0698	1	2	2
6	293	96005	RHR	0496	1	2	2
7	293	96009	RHR	0996	1	2	2
8	293	97003	RHR	0297	1	2	2
9	293	97007	ESW	0497	1	1	1
10	293	97007	RBCC	0497	1	2	2
11	293	97007	RHR	0497	1	2	2
12	293	97026	RHR	1297	1	2	2
13	296	98007	ESW	1198	1	3	3
14	298	97004	RHR	0597	1	2	2
15	325	96014	RHR	1096	1	1	1
16	325	96017	ESW	1296	1	1	1
17	325	96017	LPCS	1296	1	1	1
18	333	96003	RHR	0296	1	2	2
19	341	96015	ESW	1096	1	2	2
20	341	96020	RHR	1296	1	1	1
21	341	98002	RBCC	0298	1	2	2
22	354	96027	RBCC	1296	1	1	1
23	354	97019	RBCC	0897	1	1	1
24	354	97008	ESW	0597	1	1	1
25	397	98002	HPCS	0398	1	1	1
26	397	98007	LPCS	0598	1	1	1
27	397	98007	RHR	0598	1	1	1
28	410	98006	ESW	0398	1	1	1
29	440	96002	ESW	0296	1	1	1
30	440	96002	HPCS	0296	1	1	1
31	440	97001	ESW	0197	1	2	2
32	440	97001	HPCS	0197	1	1	1
33	440	97006	ESW	0697	1	1	1
34	440	97006	HPCS	0697	1	1	1
35	440	97011	ESW	0997	1	1	1
36	440	97011	RBCC	0997	1	2	2
37	440	97011	RHR	0997	1	1	1
38	440	98002	HPCS	0798	1	1	1
39	458	97008	RHR	1097	1	1	1

APPENDIX IV - TABLE IVA (CONTINUED)
BWR MDP ASSEMBLIES - SELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1996-1998)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MDPs	NO. OF DEMANDS
40	461	98015	ESW	0498	1	1	1
41	461	98018	ESW	0498	1	1	1

APPENDIX IV - TABLE V
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYS	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
1	1	RHR	4	4	16	9	144
2	1	AFW	1	12	12	9	108
3	1	CVCS	2	4	8	9	72
4	1	CS	2	4	8	9	72
5	1	HPI	2	4	8	9	72
6	1	NSW	2	4	8	9	72
7	1	CCW	3	4	12	9	108
8	2	RHR	2	12	24	9	216
9	2	CVCS	2	4	8	9	72
10	2	HPI	2	4	8	9	72
11	2	NSW	2	4	8	9	72
12	2	CCW	3	4	12	9	108
13	6	RHR	2	4	8	9	72
14A	6	AFW	1	1	1	9	
14B	6	AFW	1	12	12	9	117
15	6	CS	2	12	24	9	216
16	6	HPI	3	4	12	9	108
17	6	NSW	2	12	24	9	216
18	6	CCW	2	12	24	9	216
19	8	RHR	2	12	24	9	216
20	8	AFW	2	4	8	9	72
21	8	CS	2	12	24	9	216
22	8	HPI	3	12	36	9	324
23	8	NSW	3	4	12	9	108
24	8	CCW	3	4	12	9	108

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
25	10	RHR	2	12	24	9	216
26	10	CS	2	12	24	9	216
27	10	HPI	2	12	24	9	216
28	10	NSW	3	4	12	9	108
29	10	CCW	4	4	16	9	144
30	11	RHR	2	12	24	9	216
31	11	CS	2	12	24	9	216
32	11	HPI	2	12	24	9	216
33	11	NSW	4	4	16	9	144
34	11	CCW	3	4	12	9	108
35	13	RHR	2	4	8	9	72
36	13	AFW	2	12	24	9	216
37	13	CS	3	4	12	9	108
38	13	HPI	2	4	8	9	72
39	13	NSW	3	4	12	9	108
40	13	CCW	3	4	12	9	108
41	16	RHR	2	12	24	9	216
42	16	AFW	2	12	24	9	216
43	16	CS	2	12	24	9	216
44A	16	HPI	1	4	4	9	
44B	16	HPI	2	12	24	9	252
45	16	NSW	4	12	48	9	432
46	16	CCW	3	12	36	9	324
47	19	RHR	2	12	24	9	216
48	19	AFW	1	12	12	9	108

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
49	19	CS	2	12	24	9	216
50	19	HPI	2	12	24	9	216
51	19	NSW	3	12	36	9	324
52	19	CCW	2	12	24	9	216
53	20	RHR	3	12	36	9	324
54	20	AFW	2	12	24	9	216
55	20	CS	2	12	24	9	216
56	20	HPI	3	12	36	9	324
57	20	NSW	3	12	36	9	324
58	20	CCW	2	12	24	9	216
59	21	RHR	3	12	36	9	324
60	21	AFW	2	12	24	9	216
61	21	CS	2	12	24	9	216
62	21	HPI	3	12	36	9	324
63	21	NSW	3	12	36	9	324
64	21	CCW	2	12	24	9	216
65	23	RHR	2	12	24	9	216
66	23	AFW	2	12	24	9	216
67	23	CVCS	2	12	24	9	216
68	23	CS	2	12	24	9	216
69	23	HPI	2	12	24	9	216
70	23	NSW	4	12	48	9	432
71	23	CCW	3	12	36	9	324
72	24	RHR	2	4	8	9	72
73	24	AFW	2	12	24	9	216
74	24	CVCS	2	4	8	9	72
75	24	CS	2	4	8	9	72
76	24	HPI	2	4	8	9	72
77	24	NSW	2	4	8	9	72

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
78	24	CCW	3	4	12	9	108
79	27	RHR	2	12	24	9	216
80	27	AFW	2	12	24	9	216
81	27	CS	3	12	36	9	324
82A	27	HPI	1	4	4	9	
82B	27	HPI	3	12	24	9	252
83	27	NSW	4	12	48	9	432
84	27	CCW	4	4	16	9	144
85	28	RHR	2	12	24	9	216
86	28	AFW	2	12	24	9	216
87	28	CS	3	12	36	9	324
88A	28	HPI	1	4	4	9	
88B	28	HPI	2	12	24	9	252
89	28	NSW	4	12	48	9	432
90	28	CCW	4	12	48	9	432
91	29	RHR	2	12	24	9	216
92	29	AFW	1	12	12	9	108
93	29	CS	2	4	8	9	72
94	29	HPI	2	12	24	9	216
95	29	NSW	2	4	8	9	72
96	29	CCW	4	4	16	9	144
97	30	RHR	2	4	8	9	72
98	30	AFW	1	4	4	9	36
99	30	CS	3	4	12	9	108
100	30	HPI	3	4	12	9	108

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
101	30	NSW	4	12	48	9	432
102	30	CCW	3	12	36	9	324
103	31	RHR	2	12	24	9	216
104	31	AFW	2	12	24	9	216
105	31	CS	2	12	24	9	216
106	31	HPI	3	12	36	9	324
107	31	NSW	4	12	48	9	432
108	31	CCW	3	12	36	9	324
109	32	RHR	3	12	36	9	324
110	32	AFW	2	12	24	9	216
111	32	CS	2	12	24	9	216
112	32	HPI	3	12	36	9	324
113	32	NSW	2	12	24	9	216
114	32	CCW	2	12	24	9	216
115	33	RHR	3	12	36	9	324
116	33	AFW	2	12	24	9	216
117	33	CS	2	12	24	9	216
118	33	HPI	3	4	12	9	108
119	33	NSW	4	12	48	9	432
120	33	CCW	3	36	36	9	324
121	35	RHR	2	12	24	9	216
122	35	AFW	2	12	24	9	216
123	35	CVCS	2	12	24	9	216
124	35	CS	2	12	24	9	216
125	35	HPI	2	12	24	9	216
126	35	NSW	3	4	12	9	108
127	35	CCW	3	4	12	9	108
128	38	AFW	2	12	24	9	216

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
129	38	RHR	2	12	24	9	216
130	38	CS	2	12	24	9	216
131	38	HPI	2	12	24	9	216
132	38	NSW	3	12	36	9	324
133	38	CCW	2	4	8	9	72
134	39	RHR	2	4	8	9	72
135	39	AFW	1	4	4	9	36
136	39	CS	2	4	8	9	72
137	39	HPI	3	4	12	9	108
138	39	NSW	3	4	12	9	108
139	39	CCW	3	4	12	9	108
140	40	RHR	2	12	24	9	216
141	40	AFW	2	12	24	9	216
142	40	CVCS	2	12	24	9	216
143	40	CS	2	12	24	9	216
144	40	HPI	2	12	24	9	216
145A	40	NSW	2	4	8	9	
145B	40	NSW	1	12	12	9	180
146	40	CCW	2	4	8	9	72
147	41	RHR	2	12	24	9	216
148	41	AFW	2	12	24	9	216
149	41	CS	2	4	8	9	72
150	41	HPI	2	4	8	9	72
151	41	NSW	3	4	12	9	108
152	41	CCW	2	4	8	9	72
153	42	RHR	2	12	24	9	216
154	42	AFW	1	12	12	9	108

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
155	42	CS	2	4	8	9	72
156	42	HPI	2	12	24	9	216
157	42	NSW	4	4	16	9	144
158	42	CCW	2	4	8	9	72
159	43	RHR	2	12	24	9	216
160	43	AFW	2	4	8	9	72
161	43	CS	3	12	36	9	324
162A	43	HPI	1	4	4	9	
162B	43	HPI	2	12	24	9	252
163	43	NSW	4	12	48	9	432
164	43	CCW	4	12	48	9	432
165	44	RHR	2	12	24	9	216
166	44	AFW	2	12	24	9	216
167	44	CVCS	2	12	24	9	216
168	44	CS	2	12	24	9	216
169	44	HPI	2	12	24	9	216
170	44	NSW	4	12	48	9	432
171	44	CCW	3	4	12	9	108
172	45	RHR	2	4	8	9	72
173	45	AFW	1	4	4	9	36
174	45	CS	2	4	8	9	72
175A	45	HPI	1	4	4	9	
175B	45	HPI	2	12	24	9	252
176	45	NSW	4	4	16	9	144
177	45	CCW	3	12	36	9	324
178	46	RHR	2	12	24	9	216
179	46	AFW	2	12	24	9	216
180	46	CVCS	2	4	8	9	72
181	46	CS	2	12	24	9	216

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
182	46	HPI	2	12	24	9	216
183	46	NSW	2	12	24	9	216
184	46	CCW	3	12	36	9	324
185	47	RHR	2	12	24	9	216
186	47	AFW	2	12	24	9	216
187	47	CVCS	2	12	24	9	216
188	47	CS	2	12	24	9	216
189	47	HPI	2	12	24	9	216
190	47	NSW	2	12	24	9	216
191	47	CCW	2	12	24	9	216
192	48	RHR	2	12	24	9	216
193	48	AFW	1	12	12	9	108
194	48	CS	2	4	8	9	72
195A	48	HPI	1	4	4	9	
195B	48	HPI	2	12	24	9	252
196	48	NSW	3	12	36	9	324
197	48	CCW	3	12	36	9	324
198	49	RHR	2	12	24	9	216
199	49	AFW	1	12	12	9	108
200	49	CS	2	4	8	9	72
201A	49	HPI	1	4	4	9	
201B	49	HPI	2	12	24	9	252
202	49	NSW	3	12	36	9	324
203	49	CCW	3	12	36	9	324
204	51	RHR	3	12	36	9	324
205	51	AFW	2	12	24	9	216

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
206	51	CVCS	2	4	8	9	72
207	51	CS	2	4	8	9	72
208	51	HPI	2	4	8	9	72
209	51	NSW	2	4	8	9	72
210	51	CCW	3	4	12	9	108
211	54	RHR	2	4	8	9	72
212	54	AFW	2	12	24	9	216
213	54	CVCS	2	4	8	9	72
214	54	CS	2	4	8	9	72
215	54	HPI	2	4	8	9	72
216	54	NSW	3	4	12	9	108
217	54	CCW	3	4	12	9	108
218	55	RHR	2	4	8	9	72
219	55	AFW	2	12	24	9	216
220	55	CVCS	2	4	8	9	72
221	55	CS	2	4	8	9	72
222	55	HPI	2	4	8	9	72
223	55	NSW	3	12	36	9	324
224	55	CCW	2	4	8	9	72
225	58	RHR	2	12	24	9	216
226	58	AFW	2	12	24	9	216
227	58	CS	3	12	36	9	324
228A	58	HPI	1	4	4	9	
228B	58	HPI	2	12	24	9	252
229	58	NSW	3	12	36	9	324
230	58	CCW	3	12	36	9	324
231	59	RHR	2	12	24	9	216
232	59	AFW	2	12	24	9	216

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
233	59	CS	2	12	24	9	216
234	59	HPI	2	12	24	9	216
235	59	NSW	3	12	36	9	324
236	59	CCW	3	12	36	9	324
237	60	RHR	2	4	8	9	72
238	60	AFW	2	4	8	9	72
239	60	CVCS	3	12	36	9	324
240	60	CS	2	12	24	9	216
241A	60	HPI	1	4	4	9	
242	60	HPI	2	12	24	9	252
243	60	NSW	3	12	36	9	324
244	60	CCW	3	12	36	9	324
245	61	RHR	2	4	8	9	72
246	61	AFW	2	4	8	9	72
247	61	CS	4	12	48	9	432
248A	61	HPI	1	4	4	9	
248B	61	HPI	2	12	24	9	252
249A	61	NSW	2	4	8	9	
249B	61	NSW	1	12	12	9	180
250	61	CCW	3	4	12	9	108
251	62	RHR	2	12	24	9	216
252	62	AFW	2	4	8	9	72
253	62	CS	4	12	48	9	432
254A	62	HPI	1	4	4	9	
254B	62	HPI	2	12	24	9	252
255	62	NSW	3	12	36	9	324
256	62	CCW	3	4	12	9	108

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
257	64	RHR	2	12	24	9	216
258	64	CVCS	2	12	24	9	216
259	64	CS	2	12	24	9	216
260	64	HPI	2	12	24	9	216
261	64	NSW	3	12	36	9	324
262	64	CCW	3	12	36	9	324
263	65	RHR	2	12	24	9	216
264	65	AFW	1	4	4	9	36
265	65	CS	2	4	8	9	72
266	65	HPI	2	4	8	9	72
267	65	NSW	3	4	12	9	108
268	65	CCW	3	4	12	9	108
269	66	RHR	2	12	24	9	216
270	66	AFW	2	12	24	9	216
271	66	CS	2	12	24	9	216
272A	66	HPI	1	4	4	9	
272B	66	HPI	2	12	24	9	252
273	66	NSW	3	12	36	9	324
274	66	CCW	3	12	36	9	324
275	70	RHR	2	4	8	9	72
276	70	AFW	2	12	24	9	216
279	70	CS	2	4	8	9	72
280	70	HPI	3	4	12	9	108
281	70	NSW	3	4	12	9	108
282	70	CCW	3	4	12	9	108
283	71	RHR	2	4	8	9	72
284	71	AFW	2	4	8	9	72

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
285	71	CS	2	4	8	9	72
286	71	HPI	3	4	12	9	108
287	71	NSW	3	4	12	9	108
288	71	CCW	3	4	12	9	108
289	72	RHR	2	12	24	9	216
290	72	AFW	2	12	24	9	216
291	72	CS	2	12	24	9	216
292A	72	HPI	1	4	4	9	
292A	72	HPI	2	12	24	9	252
293	72	NSW	3	12	36	9	324
294	72	CCW	3	12	36	9	324
295	74	RHR	2	4	8	9	72
296	74	AFW	1	12	12	9	108
297	74	CS	2	4	8	9	72
298A	74	HPI	1	4	4	9	
298B	74	HPI	2	12	24	9	252
299	74	NSW	3	4	12	9	108
300	74	CCW	3	4	12	9	108
301	75	RHR	2	12	24	9	216
302	75	AFW	2	12	24	9	216
303	75	CVCS	2	12	24	9	216
304	75	CS	2	12	24	9	216
305	75	HPI	2	12	24	9	216
306	75	NSW	2	4	8	9	72
307	75	CCW	4	4	16	9	144
308	76	RHR	2	12	24	9	216
309	76	AFW	2	12	24	9	216

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
310	76	CVCS	2	12	24	9	216
311	76	CS	2	12	24	9	216
312	76	HPI	2	12	24	9	216
313	76	NSW	2	4	8	9	72
314	76	CCW	4	4	16	9	144
315	79	RHR	2	4	8	9	72
316	79	AFW	2	12	24	9	216
317	79	CS	2	4	8	9	72
318	79	HPI	3	4	12	9	108
319	79	CCW	3	4	12	9	108
320	82	RHR	2	12	24	9	216
321	82	AFW	2	12	24	9	216
322	82	CS	2	12	24	9	216
323	82	HPI	2	12	24	9	216
324	82	NSW	3	12	36	9	324
325	82	CCW	3	12	36	9	324
326	83	RHR	2	4	8	9	72
327	83	AFW	2	4	8	9	72
328	83	CS	2	4	8	9	72
329	83	HPI	3	4	12	9	108
330	83	NSW	3	12	36	9	324
331	83	CCW	3	12	36	9	324
332	85	RHR	2	4	8	8.7	70
333	85	AFW	2	4	8	8.7	70
334	85	CS	2	4	8	8.7	70
335	85	HPI	3	4	12	8.7	104

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
336	85	NSW	4	4	16	8.7	139
337A	85	CCW	2	4	8	8.7	
337B	85	CCW	1	12	12	8.7	174
338	87	RHR	3	12	36	8.1	292
339	87	AFW	2	12	24	8.1	194
340	87	CS	2	12	24	8.1	194
341A	87	HPI	1	4	4	8.1	
341B	87	HPI	2	12	24	8.1	227
342	87	NSW	3	12	36	8.1	292
343	87	CCW	3	12	36	8.1	292
344	88	RHR	2	4	8	9	72
345	88	AFW	2	12	24	9	216
346	88	CVCS	2	4	8	9	72
347	88	CS	2	12	24	9	216
348	88	HPI	2	4	8	9	72
349	88	NSW	2	4	8	9	72
350	88	CCW	4	4	16	9	144
351	89	RHR	2	4	8	9	72
352	89	AFW	2	12	24	9	216
353	89	CVCS	2	4	8	9	72
354	89	CS	2	12	24	9	216
355	89	HPI	2	4	8	9	72
356	89	NSW	2	4	8	9	72
357	89	CCW	4	4	16	9	144
358	91	RHR	2	4	8	9	72
359	91	AFW	2	12	24	9	216
360	91	CVCS	3	4	12	9	108
361	91	HPI	2	4	8	9	72

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
362	91	NSW	3	4	12	9	108
363	91	CCW	3	4	12	9	108
364	92	RHR	2	4	8	8.6	69
365	92	AFW	2	4	8	8.6	69
366	92	CVCS	2	4	8	8.6	69
367	92	CS	2	12	24	8.6	206
368	92	HPI	2	4	8	8.6	69
369	92	NSW	3	4	12	8.6	103
370	92	CCW	3	4	12	8.6	103
371	93	RHR	2	4	8	6.6	53
372	93	AFW	2	4	8	6.6	53
373	93	CVCS	2	4	8	6.6	53
374	93	CS	2	12	24	6.6	158
375	93	HPI	2	4	8	6.6	53
376	93	NSW	3	4	12	6.6	79
377	93	CCW	3	4	12	6.6	79
378	95	RHR	2	4	8	5.3	42
379	95	AFW	1	4	4	5.3	21
380	95	CVCS	2	12	24	5.3	127
381	95	CS	2	4	8	5.3	42
382	95	HPI	2	12	24	5.3	127
383	95	NSW	4	4	16	5.3	85
384	95	CCW	4	4	16	5.3	85
385	96	RHR	2	4	8	5.3	42
386	96	AFW	2	4	8	5.3	42

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
387	96	CVCS	2	4	8	5.3	42
388	96	CS	4	4	16	5.3	85
389	96	HPI	2	4	8	5.3	42
390	96	NSW	2	4	8	5.3	42
391	96	CCW	2	4	8	5.3	42
392	97	RHR	2	4	8	9	72
393	97	AFW	1	12	12	9	108
393	97	CVCS	2	4	8	9	72
394	97	CS	2	4	8	9	72
395	97	HPI	2	4	8	9	72
396	97	NSW	2	4	8	9	72
397	97	CCW	3	4	12	9	108
398	98	RHR	2	4	8	8.3	66
399	98	AFW	1	12	12	8.3	100
400	98	CVCS	2	4	8	8.3	66
401	98	CS	2	4	8	8.3	66
402	98	HPI	2	4	8	8.3	66
403	98	NSW	2	4	8	8.3	66
404	98	CCW	2	4	8	8.3	66
405	99	RHR	2	4	8	7.7	62
406	99	AFW	1	12	12	7.7	92
407	99	CVCS	2	4	8	7.7	62
408	99	CS	2	4	8	7.7	62
409	99	HPI	2	4	8	7.7	62
410	99	NSW	2	4	8	7.7	62
411	99	CCW	3	4	12	7.7	92
412	100	RHR	2	4	8	7.2	58
413	100	AFW	1	12	12	7.2	86

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
414	100	CVCS	3	4	12	7.2	86
415	100	CS	2	4	8	7.2	58
416	100	HPI	2	4	8	7.2	58
417	100	NSW	2	4	8	7.2	58
418	100	CCW	2	4	8	7.2	58
419	103	RHR	2	4	8	9	72
420	103	AFW	2	4	8	9	72
421	103	CVCS	2	4	8	9	72
422	103	CS	2	4	8	9	72
423	103	HPI	2	4	8	9	72
424	103	NSW	2	4	8	9	72
425	103	CCW	2	4	8	9	72
426	104	RHR	2	4	8	9	72
427	104	AFW	2	12	24	9	216
428	104	CVCS	2	4	8	9	72
429	104	CS	2	12	24	9	216
430	104	HPI	2	4	8	9	72
431	104	NSW	2	4	8	9	72
432	104	CCW	2	4	8	9	72
433	105	RHR	3	4	12	6.5	78
424	105	AFW	3	4	12	6.5	78
425	105	CS	3	4	12	6.5	78
426	105	HPI	3	4	12	6.5	78
427	105	NSW	3	4	12	6.5	78
428	105	CCW	3	4	12	6.5	78

APPENDIX IV - TABLE V (CONTINUED)
PWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
429	106	RHR	3	4	12	7.7	92
430	106	AFW	3	4	12	7.7	92
431	106	CS	3	4	12	7.7	92
432	106	HPI	3	4	12	7.7	92
433	106	NSW	3	4	12	7.7	92
434	106	CCW	3	4	12	7.7	92
435	107	RHR	2	12	24	9	216
436	107	AFW	2	12	24	9	216
437	107	CS	2	12	24	9	216
438	107	HPI	2	12	24	9	216
439	107	NSW	2	12	24	9	216
440	107	CCW	3	12	36	9	324
441	108	RHR	2	12	24	9	216
442	108	AFW	2	12	24	9	216
443	108	CS	2	12	24	9	216
444	108	HPI	2	12	24	9	216
445	108	NSW	2	12	24	9	216
446	108	CCW	3	12	36	9	324
447	109	RHR	2	12	24	8	192
448	109	AFW	2	12	24	8	192
449	109	CS	2	12	24	8	192
450	109	HPI	2	12	24	8	192
451	109	NSW	2	12	24	8	192
452	109	CCW	3	12	36	8	288

APPENDIX IV - TABLE VI
BWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NO.	PLT ID NO.	PLT SYS	NO.MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
1	3	RHR	3	4	12	9	108
2	3	LPCS	4	12	48	9	432
3	3	ESW	4	12	48	9	432
4	3	RBCC	2	4	8	9	72
5	4	RHR	3	4	12	9	108
6	4	LPCS	4	4	16	9	144
7	4	ESW	4	4	16	9	144
8	4	RBCC	3	4	12	9	108
9	5	RHR	4	4	16	9	144
10	5	LPCS	2	12	24	9	216
11	5	ESW	4	4	16	9	144
12	5	RBCC	3	4	12	9	108
13	7	RHR	4	12	48	9	432
14	7	LPCS	2	12	24	9	216
15	7	ESW	4	4	16	9	144
16	7	RBCC	2	4	8	9	72
17	9	RHR	4	12	48	9	432
18	9	LPCS	2	12	24	9	216
19	9	ESW	4	4	16	9	144
20	9	RBCC	2	4	8	9	72
21	12	RHR	4	4	16	9	144
22	12	LPCS	2	4	8	9	72

APPENDIX IV - TABLE VI (CONTINUED)
BWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
23	12	ESW	4	4	16	9	144
24	12	RBCC	3	4	12	9	108
25	14	RHR	4	12	48	9	432
26	14	LPCS	4	12	48	9	432
27	14	ESW	4	12	48	9	432
28	14	RBCC	2	12	24	9	216
29	15	RHR	4	4	16	9	144
30	15	LPCS	4	4	16	9	144
31	15	ESW	4	4	16	9	144
32	15	RBCC	3	4	12	9	108
33	17	RHR	4	4	16	9	144
34	17	LPCS	2	4	8	9	72
35	17	ESW	4	12	48	9	432
36	17	RBCC	2	4	8	9	72
37	18	RHR	4	4	16	9	144
38	18	LPCS	2	4	8	9	72
39	18	ESW	4	4	16	9	144
40	18	RBCC	2	4	8	9	72
41	22	RHR	4	4	16	9	144
42	22	LPCS	2	4	8	9	72
43	22	ESW	4	4	16	9	144
44	22	RBCC	2	4	8	9	72
45	25	RHR	4	12	48	9	432
46	25	LPCS	4	4	16	9	144
47	25	ESW	4	4	16	9	144
48	25	RBCC	2	4	8	9	72

APPENDIX IV - TABLE VI (CONTINUED)
BWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NO.	PLT ID NO.	PLT SYS	NO.MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
49	26	RHR	4	12	48	9	432
50	26	LPCS	4	4	16	9	144
51	26	ESW	4	4	16	9	144
52	26	RBCC	2	4	8	9	72
53	34	RHR	4	12	48	9	432
54	34	LPCS	2	12	24	9	216
55	34	ESW	4	4	16	9	144
56	34	RBCC	3	4	12	9	108
57	36	RHR	4	4	16	9	144
58	36	LPCS	4	4	16	9	144
59	36	ESW	4	4	16	9	144
60	36	RBCC	2	4	8	9	72
61	37	RHR	4	12	48	9	432
62	37	LPCS	2	12	24	9	216
63	37	ESW	4	12	48	9	432
64	37	RBCC	3	12	36	9	324
65	50	RHR	4	12	48	9	432
66	50	LPCS	2	12	24	9	216
67	50	ESW	4	4	16	9	144
68	50	RBCC	3	4	12	9	108
69	52	RHR	4	12	48	9	432
70	52	LPCS	2	12	24	9	216
71	52	ESW	4	4	16	9	144
72	52	RBCC	3	4	12	9	108
73	53	RHR	4	12	48	9	432
74	53	LPCS	3	12	36	9	324

APPENDIX IV - TABLE VI (CONTINUED)
BWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
75	53	ESW	4	4	16	9	144
76	53	RBCC	3	4	12	9	108
77	56	RHR	4	4	16	9	144
78	56	LPCS	2	4	8	9	72
79A	56	ESW	2	4	8	9	
79B	56	ESW	2	12	24	9	288
80	56	RBCC	3	4	12	9	108
81	57	RHR	4	12	48	9	432
82	57	LPCS	2	12	24	9	216
83	57	ESW	3	12	36	9	324
84	57	RBCC	3	4	12	9	108
85	63	RHR	4	4	16	8	128
86	63	LPCS	4	4	16	8	128
87	63	ESW	4	4	16	8	128
88	63	RBCC	3	4	12	8	96
89	67	RHR	4	4	16	9	144
90	67	LPCS	4	4	16	9	144
91	67	ESW	4	4	16	9	144
92	67	RBCC	4	4	16	9	144
93	68	RHR	4	4	16	5.9	94
94	68	LPCS	4	4	16	5.9	94
95	68	ESW	4	4	16	5.9	94
96	68	RBCC	4	4	16	5.9	94
97	69	RHR	4	4	16	9	144
98	69	LPCS	4	4	16	9	144
99	69	ESW	4	4	16	9	144
100	69	RBCC	3	4	12	9	108
101	73	RHR	4	4	16	9	144

APPENDIX IV - TABLE VI (CONTINUED)
BWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NO.	PLT ID NO.	PLT SYS	NO.MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
102	73	LPCS	2	4	8	9	72
103	73	ESW	4	4	16	9	144
104	73	RBCC	3	4	12	9	108
105	77	RHR	3	4	12	9	108
106	77	LPCS	1	4	4	9	36
107	77	HPCS	1	4	4	9	36
108	77	ESW	4	4	16	9	144
109	77	RBCC	3	4	12	9	108
110	78	RHR	3	4	12	9	108
111	78	LPCS	1	4	4	9	36
112	78	HPCS	1	4	4	9	36
113	78	ESW	4	4	16	9	144
114	78	RBCC	2	4	8	9	72
115	80	RHR	4	4	16	9	144
116	80	LPCS	4	4	16	9	144
117	80	ESW	3	4	12	9	108
118	80	RBCC	2	4	8	9	72
119	81	RHR	4	4	16	9	144
120	81	LPCS	4	4	16	9	144
121	81	ESW	3	4	12	9	108
122	81	RBCC	2	4	8	9	72
123	84	RHR	3	4	12	9	108
124	84	LPCS	1	4	4	9	36
125	84	HPCS	1	4	4	9	36
126	84	ESW	3	4	12	9	108
127	84	RBCC	3	4	12	9	108
128	86	RHR	3	4	12	7.7	92

APPENDIX IV - TABLE VI (CONTINUED)
BWR MDP ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NO.	PLT ID NO.	PLT SYS	NO. MDPs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MDP-DEM
129	86	LPCS	1	4	4	7.7	31
130	86	HPCS	1	4	4	7.7	31
131	86	ESW	3	4	12	7.7	92
132	86	RBCC	3	4	12	7.7	92
133	90	RHR	3	12	36	9	324
134	90	LPCS	1	12	12	9	108
135	90	HPCS	1	12	12	9	108
136	90	ESW	3	12	36	9	324
137	90	RBCC	3	12	36	9	324
138	94	RHR	3	4	12	8.1	97
139	94	LPCS	1	4	4	8.1	32
140	94	HPCS	1	4	4	8.1	32
141	94	ESW	3	4	12	8.1	97
142	94	RBCC	2	12	24	8.1	194
143	101	RHR	3	4	12	9	108
144	101	LPCS	1	4	4	9	36
145	101	HPCS	1	4	4	9	36
146	101	ESW	4	4	16	9	144
147	101	RBCC	3	4	12	9	108
148	102	RHR	3	12	36	8.1	292
149	102	LPCS	1	12	12	8.1	97
150	102	HPCS	1	12	12	8.1	97
151	102	ESW	3	12	36	8.1	292
152	102	RBCC	3	12	36	8.1	292

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11. ABSTRACT *(200 words or less)*

This report documents an analysis of the performance of safety-related motor-driven pump assemblies (motor-driver, pump, and circuit breaker subcomponents) used in pressurized water reactor (PWR) and boiling water reactor (BWR) risk-important systems in U.S. commercial power reactor plants.

A risk-based analysis of operating data and an engineering analysis of trends and patterns was performed to provide insights into the performance of motor-driven pump components on an industry basis and comparison of results with data used by plant-specific probabilistic risk assessments. The data used in this report was from the 1987-1995 period for engineering analysis. Failure probability estimates used combined engineered safety features data (1987-1998) and surveillance test data (1987-1995).

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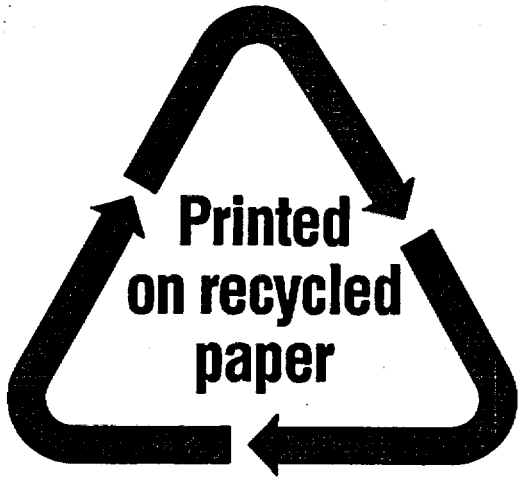

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