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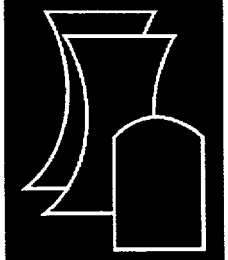

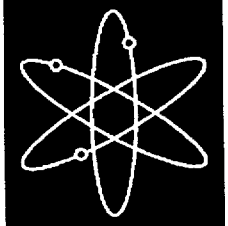

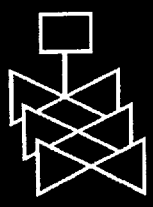

Component Performance Study—Motor-Operated Valves, 1987–1998

Commercial Power Reactors

U.S. Nuclear Regulatory Commission
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Component Performance Study—Motor-Operated Valves, 1987–1998

Commercial Power Reactors

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Prepared by
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Washington, DC 20555-0001

ABSTRACT

This report documents an analysis of the performance of safety-related motor-operated valve assemblies (valve body and motor operator subcomponents) used in the pressurized water reactor (PWR) and in the boiling water reactor (BWR) risk-important (RI) 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-operated valve components on an industry basis and the results were compared with data used by plant-specific probabilistic risk assessments. The engineering analysis of the PWR and the BWR RI systems used data from 1987–1995. Failure probability estimates used combined engineered safety features data (1987–1998) and surveillance test data (1987–1995).

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EXECUTIVE SUMMARY

This report provides the performance evaluation based on industry experience during the 1987 through 1998 period for motor-operated valves (MOVs) 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) developed to support the 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.

MOV failure and estimated demand data were 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 MOV estimated probability of failure on demand distributions were consistent with the generic value range from NUREG/CR-4550 (used as an input to NUREG-1150). Table ES-A lists the MOV probability of failure on demand estimates developed for the RI systems selected for this study and the NUREG/CR-4550 values. Table ES-B gives the standby failure rates for each system.

TABLE ES-A
MOV 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)	3.1E-4	2.1E-3	5.1E-3
high pressure injection (HPI)	1.9E-3	2.6E-3	3.4E-3
residual heat removal (RHR)	1.6E-4	1.5E-3	4.0E-3
chemical and volume control system (CVCS)	9.5E-5	2.3E-3	7.0E-3
containment spray (CS)	9.4E-4	5.5E-3	1.3E-2
reactor coolant system (RCS)	1.0E-4	2.6E-3	7.9E-3
BWR RI Systems			
high pressure coolant injection (HPCI)	5.4E-4	5.3E-3	1.4E-2
reactor core isolation cooling (RCIC)	1.7E-3	2.4E-3	3.2E-3
residual heat removal (RHR)	1.1E-3	1.5E-3	1.9E-3
low pressure core spray (LPCS)	2.3E-4	1.2E-3	2.9E-3
containment spray (CS)	1.1E-4	1.8E-3	5.3E-3
high pressure core spray (HPCS)	9.6E-4	2.6E-3	4.9E-3

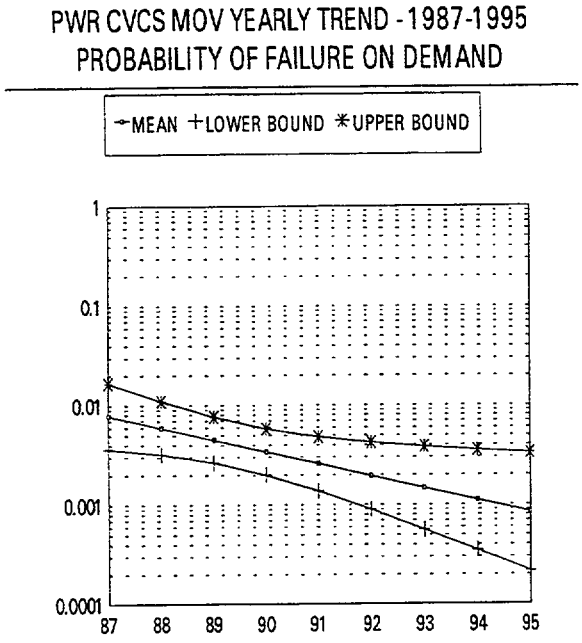
TABLE ES-B
MOV STANDBY FAILURE RATE (1987–1998)

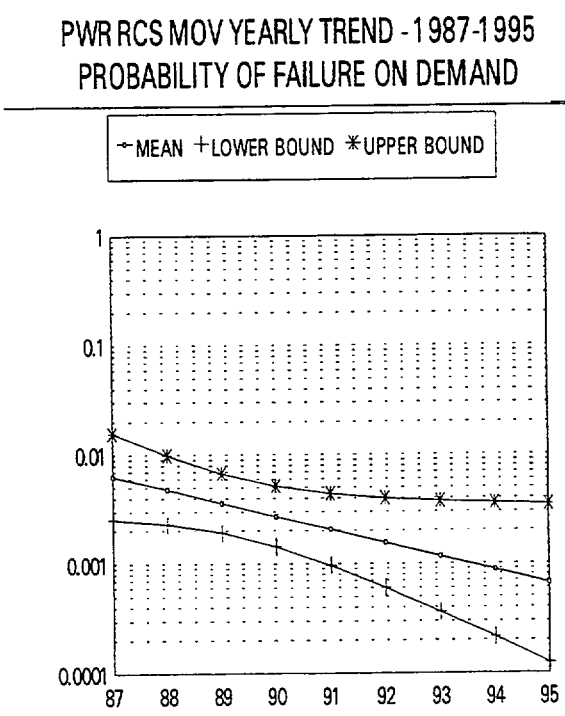
	LOWER BOUND(λ_L)	MEAN MEAN(λ)	UPPER BOUND(λ_U)
PWR RI Systems			
auxiliary feedwater (AFW)	8.1E-7/hour	1.1E-6/hour	1.4E-6/hour
high pressure injection (HPI)	7.8E-7/hour	1.0E-6/hour	1.4E-6/hour
residual heat removal (RHR)	5.2E-7/hour	6.7E-7/hour	7.7E-7/hour
chemical and volume control system (CVCS)	3.8E-7/hour	6.6E-7/hour	1.1E-6/hour
containment spray (CS)	1.5E-6/hour	2.1E-6/hour	2.8E-6/hour
reactor coolant system (RCS)	6.7E-7/hour	1.2E-6/hour	2.1E-6/hour
BWR RI Systems			
high pressure coolant injection (HPCI)	2.5E-6/hour	3.2E-6/hour	4.2E-6/hour
reactor core isolation cooling (RCIC)	9.1E-7/hour	1.3E-6/hour	1.8E-6/hour
residual heat removal (RHR)	6.2E-7/hour	8.3E-7/hour	1.1E-6/hour
low pressure core spray (LPCS)	4.1E-7/hour	6.9E-7/hour	1.1E-6/hour
containment spray (CS)	3.1E-7/hour	6.0E-7/hour	1.0E-6/hour
high pressure core spray (HPCS)	4.5E-7/hour	1.3E-6/hour	3.0E-6/hour

The yearly trend analysis of the MOV probability of failure on demand showed no statistically significant trends for the PWR AFW, HPI, and RHR systems or for the BWR RCIC and RHR systems. Statistically significant trends (decreasing) were identified for the PWR CVCS, RCS, and CS systems (see Figure ES-1) and for the BWR HPCI, HPCS, CS, and LPCS systems (see Figure ES-2). The data for these downward trends was examined to determine the appropriate value to use for the probability of failure on demand and identified that the majority of the decrease occurred in the first three years. An examination of the last six years identified no statistically significant trends. Therefore, the mean value over the 1987–1998 period was used.

The MOV mean probabilities of failure on demand used in plant-specific IPE studies were compared with the results of this study. PWR and BWR IPE mean values were generally consistent with the results of this study and NUREG/CR-4550 generic values. Figures ES-3, ES-4, and ES-5 show a sample of RI systems for the PWR AFW, PWR CS, and BWR HPCI systems, respectively.

The number of complete MOV common-cause failures (CCF) identified in this study was consistent with the expected number based on the CCF database parameters for the combined PWR and BWR complete failure population used in this study.





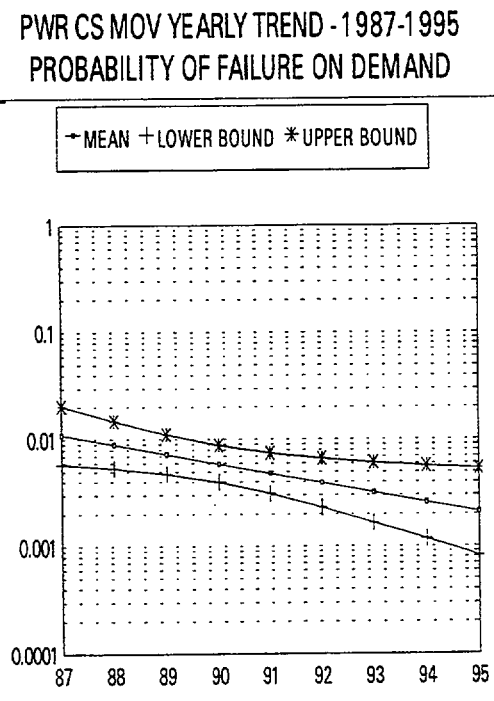


FIGURE ES-1
PWR RI SYSTEMS MOV PROBABILITY OF FAILURE ON DEMAND
YEARLY TRENDS

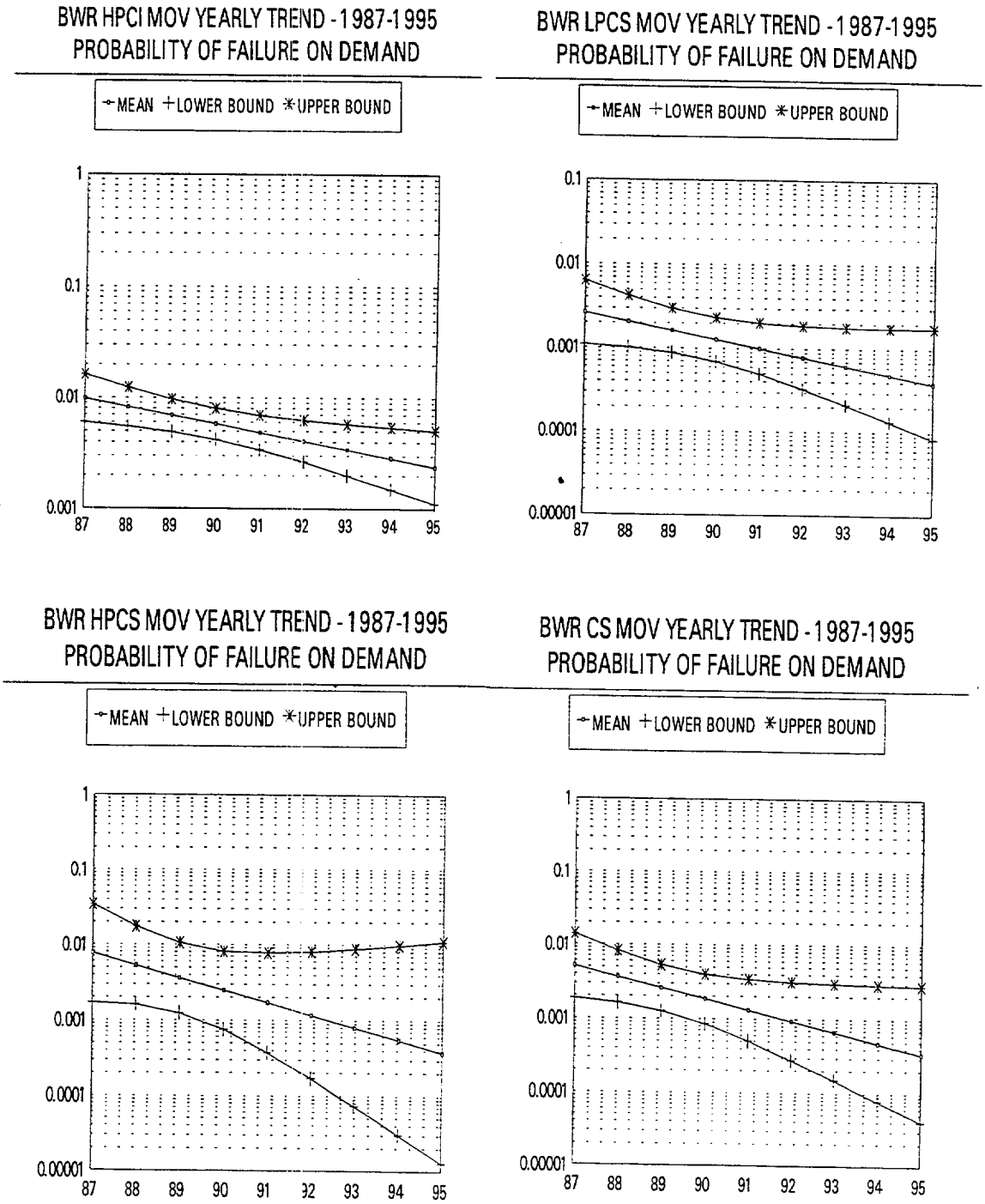


FIGURE ES-2
BWR RI SYSTEMS MOV PROBABILITY OF FAILURE ON DEMAND
YEARLY TRENDS

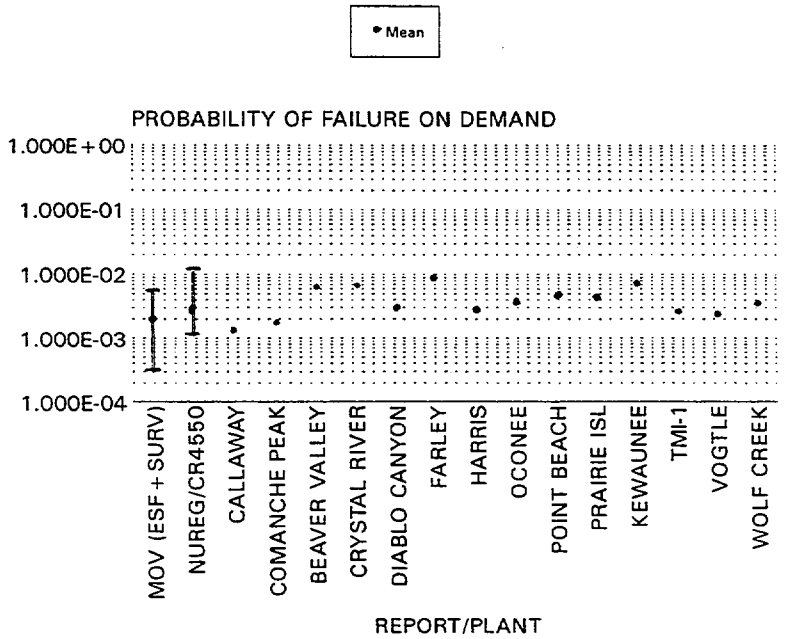


FIGURE ES-3
PWR AFW SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND
COMPARISON WITH VALUES USED IN IPEs

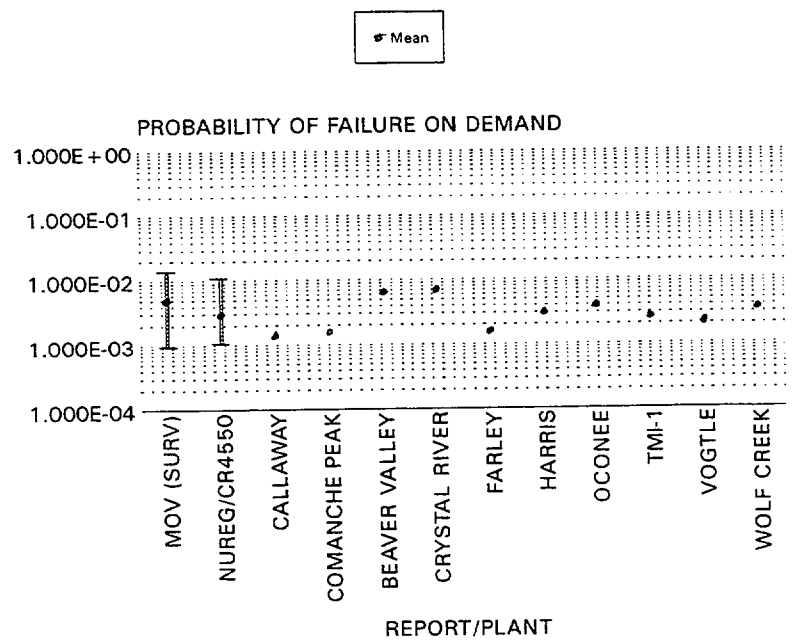


FIGURE ES-4
PWR CS SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND
COMPARISON WITH VALUES USED IN IPEs

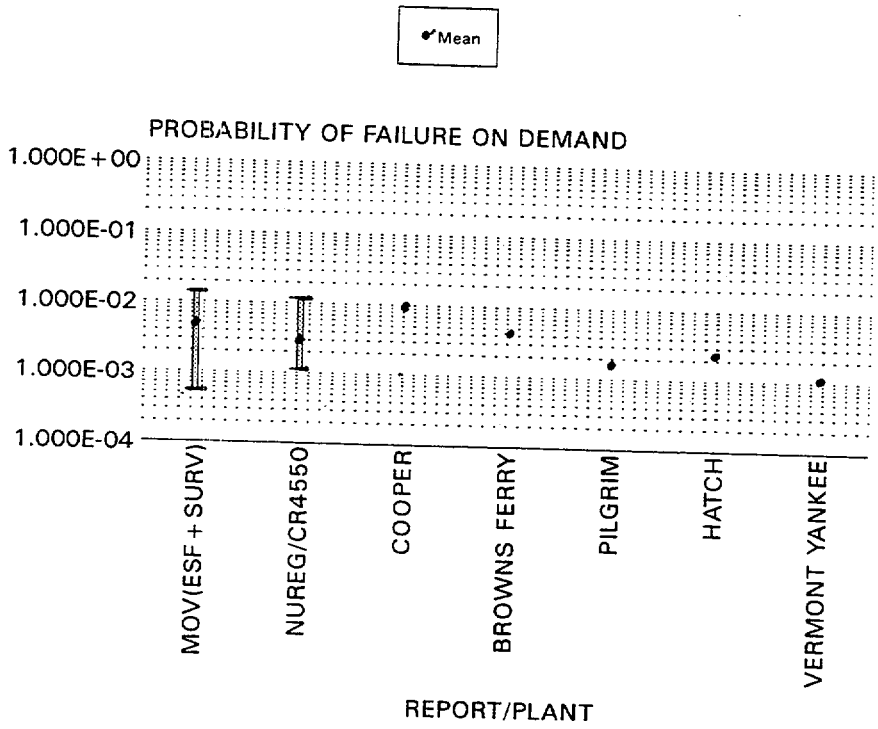


FIGURE ES-5
BWR HPCI SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND
COMPARISON WITH VALUES USED IN IPEs

The number of failures in PWR and BWR RI systems during the 1987-1995 period showed statistically significant decreasing trends (see Figure ES-6). Both the Maintenance Rule and voluntary industry joint owners group (JOG) initiatives were begun during the period. While there was insufficient information available to conclude whether these initiatives caused the trend, an improvement had occurred.

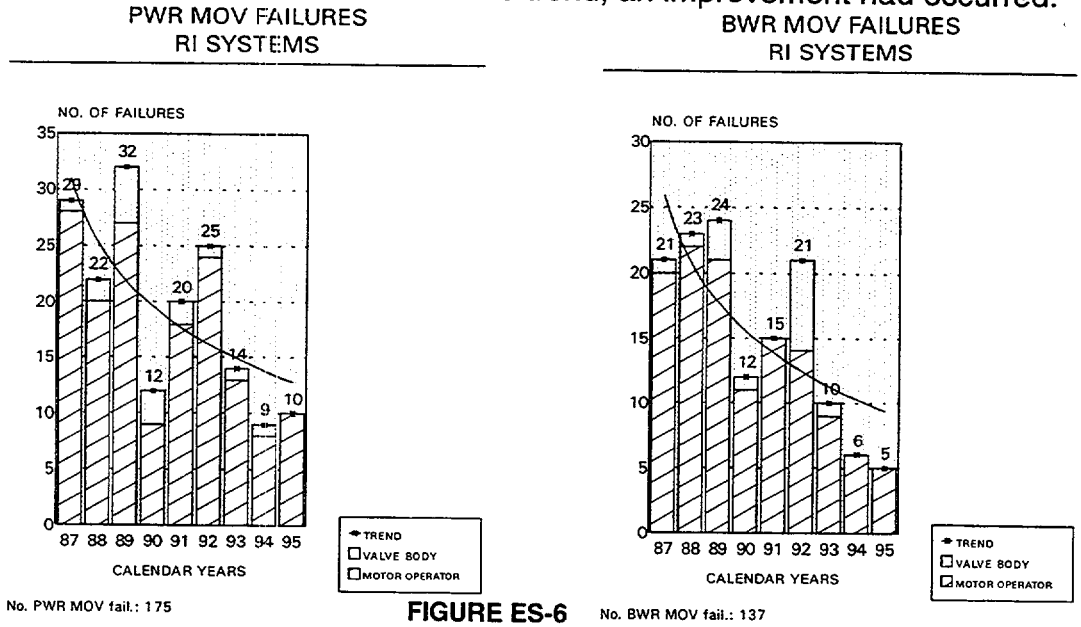


FIGURE ES-6
PWR AND BWR MOV FAILURE TRENDS

For both PWRs and BWRs, an analysis of failure rates, as a function of component-years, did not show evidence of an increase for any plant age groups (three groups of approximately equal size, from older to newer plants by commercial operation date) due to aging mechanisms.

The motor-operator subcomponent was the biggest contributor (approximately 90%) to MOV failures in both PWRs and BWRs. Figure ES-7 shows the PWR and BWR motor-operator subcomponent failure apportionment. For PWR motor-operators, torque switches (30%) were the predominant subcomponent part that failed; while for BWR motor-operators, motor internals (28%) were the predominant part that failed.

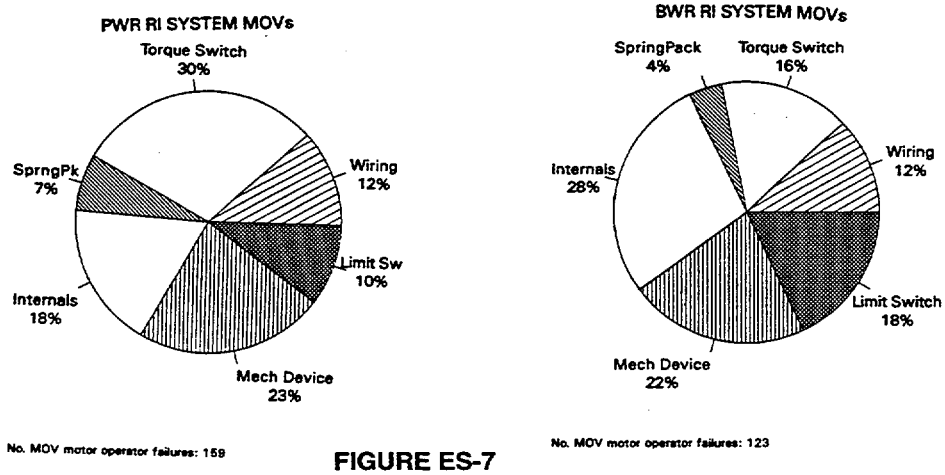


FIGURE ES-7
PWR AND BWR MOTOR OPERATOR SUBCOMPONENT PARTS FAILURE APPORTIONMENT

For reported failures, failure causes of MOV assemblies in PWR and BWR RI systems were mainly due to maintenance/procedural deficiencies, age/wear, and unknown causes. Figure ES-8 shows the PWR and BWR MOV assembly failure causes.

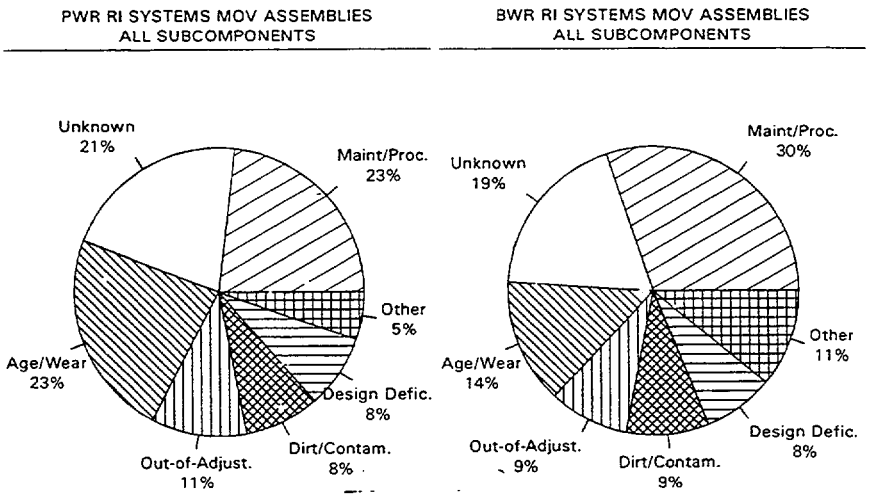


FIGURE ES-8
PWR AND BWR MOV ASSEMBLY FAILURE CAUSES

FOREWORD

This report provides information relevant to the performance of motor-operated valves (MOVs). 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 MOVs, 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 MOVs 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 MOVs. 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 MOVs, 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 MOV 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/). 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. 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). NRC staff and contractors can access that information through the EPIX database.

Common-cause failures used in this study were obtained from the Common-Cause Failure (CCF) Database. NRC staff and contractors can access the plant-specific CCF information through the CCF database which is available on CD-ROM and has been provided to the NRC Regions and NRC Office of Nuclear Regulation (NRR).

Table F-1
Summary of Risk-Important Information and Engineering Analysis For MOVs

	Description	Text Reference	Page Reference
1.	Risk-based analysis of operational data: calculation results	Section 3.1	9
2.	MOV probability of failure on demand	Table A, Appendix I	10
3.	MOV standby failure rate	Table B, Appendix I	11
4.	MOV yearly trends	Section 3.2, Figures 3 & 4	11, 12 & 13
5.	Common-cause failure events	Section 3.3, Table C	14, 14
6.	Comparison with IPEs	Section 3.4, Figures 5 – 16	15, 16–21
7.	Failure trend analysis	Section 4.1, Figure 17, Appendix III	22, 22
8.	Component trends in time	Section 4.2, Figure 18 & 19, Appendix II	23, 27 & 28
9.	Failures characteristics and their causes	Section 4.3, Figures 20 – 24, Appendix III	29, 30–34
10.	Related issues	Section 4.4, Table D	35, 35
11.	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. We also thank our colleague Erul Chelliah for his assistance in the reviewing and verifying technical data and results.

ACRONYMS

AFW	auxiliary feedwater system
ASME	American Society of Mechanical Engineers
BWR	boiling water reactor
CCF	common-cause failure
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
HPCI	high pressure coolant injection system
HPCS	high pressure core spray system
HPI	high pressure injection system
INEEL	Idaho National Engineering and Environmental Laboratory
INPO	The Institute of Nuclear Power Operations
IPE	Individual plant examination
IST	inservice test
JOG	joint owners group
LER	Licensee Event Report
LPCS	low pressure core spray system
LPI	low pressure injection system
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
PORV	power-operated relief valve
PRA	probabilistic risk assessment
PWR	pressurized water reactor
RBCC	reactor building closed cooling water system
RCIC	reactor core isolation cooling system
RCS	reactor coolant system
RHR	residual heat removal system
RI	risk-important
SCSS	Sequence Coding and Search System

COMPONENT PERFORMANCE STUDY
MOTOR-OPERATED VALVES, 1987–1998

1. INTRODUCTION

1.1 Purpose

This report provides the performance evaluation of motor-operated valve (MOV) 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 MOV 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.

This report provides an engineering analysis of the factors affecting component reliability and determined whether trends and patterns were present in the MOV operating data for the 1987–1995 period. This study was based on the actual operating history of MOVs for these safety-related, RI systems. The reliability parameters calculated in this study are the probability of failure on demand and standby failure rate. Supplemental failure and demand data for 1996–1998 from operational events (Engineered Safety Features actuations reported in Licensee Event Reports) were added to the 1987–1995 data for estimating the MOV probabilities of failure on demand when the data populations were the same.

1.2 Background

The U.S. Nuclear Regulatory Commission (NRC) PRA Policy Statement directs the staff to increase the use of 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 to actual operating experience.

Over the past decade, the NRC has issued studies applicable to MOV risk-important systems, MOV components or their subcomponent failures, failure on demand probabilities, and trends and patterns. The following provides a listing of these studies:

1. NUREG-1275, Vol.9, "Operating Experience Feedback Report - Pressure Locking and Thermal Binding of Gate Valves," March 1993 (Ref. 1)
2. NUREG/CR-5500, Vol 1, (INEEL/EXT-97-00740), "Reliability Study: Auxiliary/Emergency Feedwater System, 1987–1995," August 1998 (Ref. 2)
3. NUREG/CR-5500, Vol. 4, (INEL-94/0158), "Reliability Study: High Pressure Coolant Injection (HPCI) System, 1987–1993," September 1999 (Ref. 3)
4. NUREG/CR-5500, Vol.7, (INEL-95/0196), "Reliability Study: Reactor Core Isolation Cooling System, 1987–1993," September 1999 (Ref.4)
5. NUREG/CR-5500, Vol. 8, (INEL-95/00133), "Reliability Study: High-Pressure Core Spray System, 1987–1993," September 1999 (Ref. 5)
6. NUREG/CR-5500, Vol. 9, (INEEL/EXT-99-00373), "Reliability Study: High Pressure Safety Injection System Reliability, 1987–1997," October 2000 (Ref. 6)

1.3 Overall Study Structure

This study is arranged in six sections. Section 1 provides the introduction. Section 2 describes the scope of the study, risk-important systems, the MOV assembly and its subcomponent boundaries, and the methodology used for operational data collection and analysis. Section 3 provides the risk-based analysis of operational data, the calculation results for estimating MOV probabilities of failure on demand and standby failure rate, the contingency test for the data population, a listing of MOV common-cause failure events, the comparison of MOV probability values with those in IPEs and other sources, and the regulatory implications of this component performance study. Section 4 provides the engineering analyses (including failure trend analysis, component trends in time, the failure characteristics and their causes), a brief discussion and listing of NRC regulatory initiatives related to MOVs, and engineering insights resulting from the various analyses. Section 5 provides a summary of results, including MOV failure probabilities and engineering insights. Section 6 lists references used in the study.

The appendices provide related data used in this study and evaluation results. Appendix I provides the estimated probabilities of failure on demand and calculated standby failure rates. Appendix II provides tables of data for each plant age group used to plot the component trends in time and evaluation of aging effects on MOVs. Appendix III provides data used for engineering analysis and insights for 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

Risk-important (RI) systems were selected from a review of safety-related PWR and BWR systems. Application Coded MOVs were used in this study because of the consistency in reporting failures and identifying demands that are linked to these failures. The term "Application Coded" used in this study refers to risk-important components or subcomponents that are functionally designated within a specific system by the NPRDS. An example of the PWR RHR system MOV subcomponents that were separately Application Coded in NPRDS are as follows:

COMP. ASSY	SUBCOMP.	REACTOR TYPE	RI SYSTEM	APPLICATION CODE DESCRIPTION
MOV	Valves,damper	PWR	RHR	RHR Disch Isol Valve
MOV	Valve operator	PWR	RHR	RHR Disch Isol Valvop

The following PWR Risk-Important (RI) systems use Application Coded MOVs:

- auxiliary/emergency feedwater (AFW) system
- high pressure safety injection/safety injection (SI) system
- containment spray (CS) system
- chemical and volume control system (CVCS)
- residual heat removal/low pressure injection (RHR) system
- reactor coolant system (RCS - for pressurizer power operated relief valve block valves only)

For this study, the HPI system includes MOVs associated with high head safety injection flow paths.

The following BWR RI systems use Application Coded MOVs:

- high pressure core spray (HPCS) system
- low pressure core spray (LPCS) system
- high pressure coolant injection (HPCI) system
- containment spray (CS) system
- reactor core isolation cooling (RCIC) system
- residual heat removal/low pressure core injection (RHR)

PWR and BWR RI systems that do not have Application Coded MOVs are excluded from this study. Non-Application Coded MOVs (typically motor-operated butterfly valves) include PWR and BWR service water systems (NSW/ESW) and component cooling water systems (CCW/RBCC) MOVs.

2.2 MOV Assembly Description and Boundaries

Within the scope of this study, a MOV assembly consists of valve body and motor-operator subcomponents (excludes the circuit breaker). The valve circuit breaker was excluded because: (1) It is not an Application Coded subcomponent and, therefore, failure reporting is not consistent, (2) it normally does not change state to operate the valve, and (3) it plays no significant role in the risk-significant function of the valve (to open or close on demand). The valve body is generally a gate type. The motor-operator is generally a Limitorque or a Rotork alternating current (AC) or direct current (DC) motor actuator, designed to accommodate the system pressure/temperature requirements and the thrust requirements necessary for the valve's functional operation.

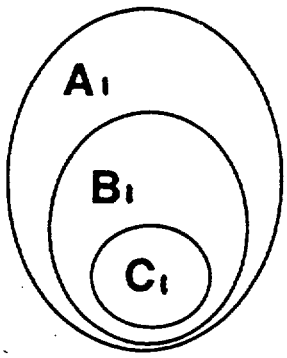
The component boundaries are the MOV assembly, its subcomponents described above, and the piece parts of the subcomponents. The piece parts of the valve body are the stem, packing, and internals. The motor-operator piece parts include torque switch, spring pack, limit switch, wiring/contacts, motor internals, and mechanical devices.

2.3 DATA COLLECTION

Data collection and reporting for the Nuclear Plant Reliability Data System (NPRDS) were terminated at the end of 1996. Therefore, the NPRDS does not have any failure information for the period 1997 and later. 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 is intended to replace the NPRDS system and yields additional information, such as demands and unavailability. At the time of this analysis, the EPIX system was not considered to be 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 Sequence Coding and Search System (SCSS) database of ESF failure and demand data (reported in LERs) was used for the 1996–1998 period.

The NPRDS database was used to obtain the number of Application Coded MOV assembly subcomponents. This was done for each selected RI system in PWRs and BWRs for each plant. The values developed in Appendix IV were also used in the development of all other appendices.

A detailed review and evaluation was performed of the licensee event reports (LERs) and the NPRDS failure histories to determine the total number of MOV failures used in this study. Only "complete" (i.e., catastrophic) failures were included in the failure count. For MOV valve body and motor operator subcomponents, the NPRDS "failure to close" (FC), "failure to open" (FO), and "failure to operate as required" (OR) failure modes were used for estimating probability of failure on demand. The OR failure mode meant that the valve could not open or close. Figure 1 illustrates the relationship between various NPRDS database failure data subsets.



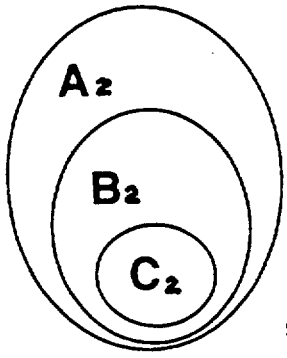
A1 All MOV assembly subcomponent failures as "complete"/catastrophic failure category (1987–1995).

B1 Subset — MOV Application Coded subcomponent failures for risk-important systems.

C1 Subset — MOV Application Coded subcomponent failures occurring during surveillance tests.

FIGURE 1
NPRDS DATABASE MOV FAILURES

The SCSS database (1987–1998) was used to determine the number of MOV failures, reported in LERs, that occurred during surveillance tests or that were associated with an engineered safety features (ESF) actuation. Surveillance test failures that were reported in LERs were excluded from the NPRDS failure counts, but included in the LER failure counts. This was done to prevent "double count" of failures. Figure 2 illustrates the relationship between various SCSS database (LERs) failure data subsets.



A2 All MOV assembly failures (1987–1998).

B2 Subset — MOV failures for risk-important systems.

C2 Subset — MOV failures associated with ESFs or occurring during surveillance tests.

FIGURE 2
SCSS DATABASE MOV FAILURES

MOV 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 trains, each train with several MOVs. Those other train MOVs that might have been actuated during pre-test or post-test system train alignment were not included in the surveillance test failure counts.

When it was determined by statistical means 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 the larger population of surveillance test demands (and associated failures) was used to calculate MOV reliability.

The first step for estimating ESF demands was to determine ESF actuations, and then to determine which component type and how many components of each type were actuated by this type of demand. Other demands that may have occurred during plant operation, startup, or shutdown that 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 LER database was used for the PWR and BWR RI systems LERs that were coded with "ESF Actuations" and those coded as "SCRAMS and Shutdowns." Each LER full text was reviewed to determine whether the selected systems were actuated; the number of trains actuated by the ESF; and the best estimate of the number of each Application Coded MOV actuated, based on the plant-specific train configuration.

The second step in estimating the total number of demands was the use of NPRDS testing frequencies as the basis for surveillance test demands. This was done for the NPRDS Application Coded, functionally designated MOV assembly subcomponents in the RI systems (see Section 2.1 for the description of the MOV assembly). An estimate was made for the MOV assembly testing frequency that used the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI Inservice Testing (IST) interval requirements (as required by the Technical Specifications), the system, and the subcomponent function in the MOV assembly. 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 system flow test once per refueling cycle, no additional demands were included because the surveillance test frequencies used in this study (e.g., monthly, quarterly, and once per refueling outage) were assumed to envelop these refueling cycle demands. Special tests, applicable to valve operability testing per Generic Letter (GL) 89-10, were separately identified for engineering evaluation.

The total number of demands for the MOVs in a specific system was the sum of MOV ESF demands and surveillance test demands, where the latter is the sum of the products of the MOVs and their estimated testing frequencies over the 9-year period (1987–1995), and the former (ESFs) is extended to 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 3.1 for contingency tests). Otherwise, the surveillance test demands (and associated failures) were used to calculate the MOVs unreliability. Special test data were excluded from this data set because of inadequate linkage of failure data to demand data.

The probability of failure on demand for MOVs was estimated by dividing total MOV failures by total MOV demands (i.e., ESF failures + surveillance test failures divided by ESF demands + surveillance test demands) when the ESF data and surveillance test data were statistically shown to be in the same population. Valves generally need only to change state to fulfil their risk-significant safety function. Therefore, calculation of failure-to-run/operate probabilities was not included in this study.

Surveillance tests and ESF actuations do not typically reflect design-basis conditions. This report estimates the probability of failure to perform risk-significant functions of MOVs in risk important systems. ESF actuations, and surveillance tests that reasonably replicate ESF actuation conditions, are used to calculate that probability. Therefore, they do not characterize the ability to perform under design-basis conditions, which are generally more severe and occur less frequently than the risk-significant safety function condition.

2.4 Operational Data Analysis

A contingency test was performed to **not reject** or to **reject** the hypothesis that failure and demand data from surveillance testing of Application Coded MOVs were in the same population as ESF failure and demand data. The analysis was performed using data for the MOVs in the PWR and BWR RI systems during the 1987-1995 period. A subsequent contingency test was performed to determine whether ESF data from the 1996-1998 period is in the

same population as the combined ESF plus surveillance test data from the 1987-1995 period.

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

$$\chi^2 = \frac{n(ad - bc)^2}{k}$$; **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 (to correct for continuity):

$$\chi^2 = \frac{n(|ad-bc| - n/2)^2}{k}$$

Bayes Method

The Bayes method (Ref. 7), as applied to this study for MOVs 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, this distribution was used as a Bayes prior distribution, and updated with the plant-specific failure data. This method was used in this study for the PWR and BWR RI systems.

Standby Failure Rate

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

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

where: f = the number of failures during the period
nc = the number of MOVs 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

The 90% confidence interval was also calculated for λ in each system.

3. RISK-BASED ANALYSIS

This section provides the risk-based analysis of operational data, the calculation results for estimating MOV probabilities of failure on demand and standby failure rate, the contingency test for the data population, the comparison of MOV probability values with those in IPEs and other sources, and the regulatory implications of this component performance study.

3.1 Calculation Results

Appendix I provides tables applicable to the MOV Probability of failure on demand for the selected systems in the PWR and BWR plants. The summary of results of the contingency tests for the hypothesis that ESFs and surveillance test data are in the same population is as follows:

PWR RI SYSTEM	HYPOTHESIS	BWR RI SYSTEM	HYPOTHESIS
HPI	Not Rejected	HPCS	Not Rejected
AFW	Not Rejected	HPCI	Not Rejected
RHR/LPI	Not Rejected	RCIC	Not Rejected
CVCS	Rejected	LPCS	Not Rejected
CS	No ESF Data	RHR/LPCI	Not Rejected
RCS	No ESF Data	CS	No ESF Data

For PWR CVCS MOVs, 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 PWR plant CVCS, there were relatively sparse ESF demands. The more extensive surveillance test data (1987–1995) was used for probability of failure on demand estimates. For the PWR CS and RCS (PORV block valves only) and BWR CS systems, there were no ESF failures or ESF demands, and the surveillance test data was also used 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. Therefore, the Bayes 90% intervals for ESF + surveillance test (1987–1995) + ESF (1996–1998) probability of failure on demand was used for these systems.

The generic 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 because data were available to allow matching failures to demands. Sufficient data on hours of operation from LERs and NPRDS were not adequate to compare with generic failure rates. The generic failure probability on demand values used in this study are from NUREG/CR-4550 "failure to operate" values for motor-operated valves (Ref. 8).

Table A shows the MOV probability of failure on demand values for the 1987–1998 period.

TABLE A
MOV PROBABILITY OF FAILURE ON DEMAND (1987–1998)

NUREG/CR-4550	LOWER BOUND 1.1E-3	MEAN 3E-3	UPPER BOUND 1.1E-2
PWR RI SYSTEMS			
ESF + SURV. TEST (1987–1998 Period):			
auxiliary feedwater (AFW)	3.1E-4	2.1E-3	5.1E-3
residual heat removal (RHR)	1.6E-4	1.5E-3	4.0E-3
ESF + SURV. TEST (1987–1995 Period):			
high pressure injection (HPI)	1.9E-3	2.6E-3	3.4E-3
SURV. Test (1987–1995 Period):			
chemical and volume control system (CVCS)	9.5E-5	2.3E-3	7.0E-3
containment spray (CS)	9.4E-4	5.5E-3	1.3E-2
reactor coolant system(RCS)	1.0E-4	2.6E-3	7.9E-3
BWR RI SYSTEMS:			
ESF + SURV. TEST (1987–1998 Period):			
high pressure coolant injection (HPCI)	5.4E-4	5.3E-3	1.4E-2
reactor core isolation cooling (RCIC)	1.7E-3	2.4E-3	3.2E-3
residual heat removal (RHR)	1.1E-3	1.5E-3	1.9E-3
low pressure core spray (LPCS)	2.3E-4	1.2E-3	2.9E-3
high pressure core spray (HPCS)	9.4E-4	2.6E-3	4.9E-3
SURV. Test (1987–1995 Period):			
containment spray (CS)	1.1E-4	1.8E-3	5.3E-3

The results shown in Table A indicated that the Bayes 90% interval probabilities of failure on demand for PWR and BWR RI systems were within the referenced generic value range for MOVs from NUREG/CR-4550 (Ref. 8).

Table B shows the average standby failure rates based on 1987–1998 failure data for the combined ESF and surveillance tests where the hypothesis was not rejected (see above).

TABLE B
MOV STANDBY FAILURE RATE (1987–1998)

	LOWER BOUND(λ_L)	MEAN(λ)	UPPER BOUND(λ_U)
PWR RI SYSTEMS			
auxiliary feedwater (AFW)	8.1E-7/hour	1.1E-6/hour	1.4E-6/hour
high pressure injection (HPI)	7.8E-7/hour	1.0E-6/hour	1.4E-6/hour
residual heat removal (RHR)	5.2E-7/hour	6.7E-7/hour	7.7E-7/hour
chemical and volume control system (CVCS)	3.8E-7/hour	6.6E-7/hour	1.1E-6/hour
containment spray (CS)	1.5E-6/hour	2.1E-6/hour	2.8E-6/hour
reactor coolant system(RCS)	6.7E-7/hour	1.2E-6/hour	2.1E-6/hour
BWR RI SYSTEMS			
high pressure coolant injection (HPCI)	2.5E-6/hour	3.2E-6/hour	4.2E-6/hour
reactor core isolation cooling (RCIC)	9.1E-7/hour	1.3E-6/hour	1.8E-6/hour
residual heat removal (RHR)	6.2E-7/hour	8.3E-7/hour	1.1E-6/hour
low pressure core spray (LPCS)	4.1E-7/hour	6.9E-7/hour	1.1E-6/hour
containment spray (CS)	3.1E-7/hour	6.0E-7/hour	1.0E-6/hour
high pressure core spray (HPCS)	4.5E-7/hour	1.3E-6/hour	3.0E-6/hour

3.2 MOV Yearly Trends

The yearly trend analysis of the MOV probability of failure on demand showed no statistically significant trends for the PWR AFW, HPI, and RHR systems or for the BWR RCIC and RHR systems. Statistically significant trends (decreasing) were identified for the PWR CVCS, RCS, and CS systems (see Figure 3) and for the BWR HPCI, HPCS, CS, and LPCS systems (see Figure 4). The data for these downward trends was examined to determine the appropriate value to use for the probability of failure on demand and identified that the majority of the decrease occurred in the first three years. An examination of the last six years identified no statistically significant trends. Therefore, the mean value over the 1987–1998 period was used. The bounds on the graphs for yearly trends represent confidence intervals for the trend line. They are different from the bounds calculated for the probability of failure on demand for the entire period, They differ because: (1) Each year has fewer data points than the total period, causing different values for the bounds and (2) In trending analyses the bounds are wider at the beginning and at the end of the plot. This reflects the greater uncertainty of the trend values at the ends versus the middle because of having less information on both sides of the mean estimate for a given year.

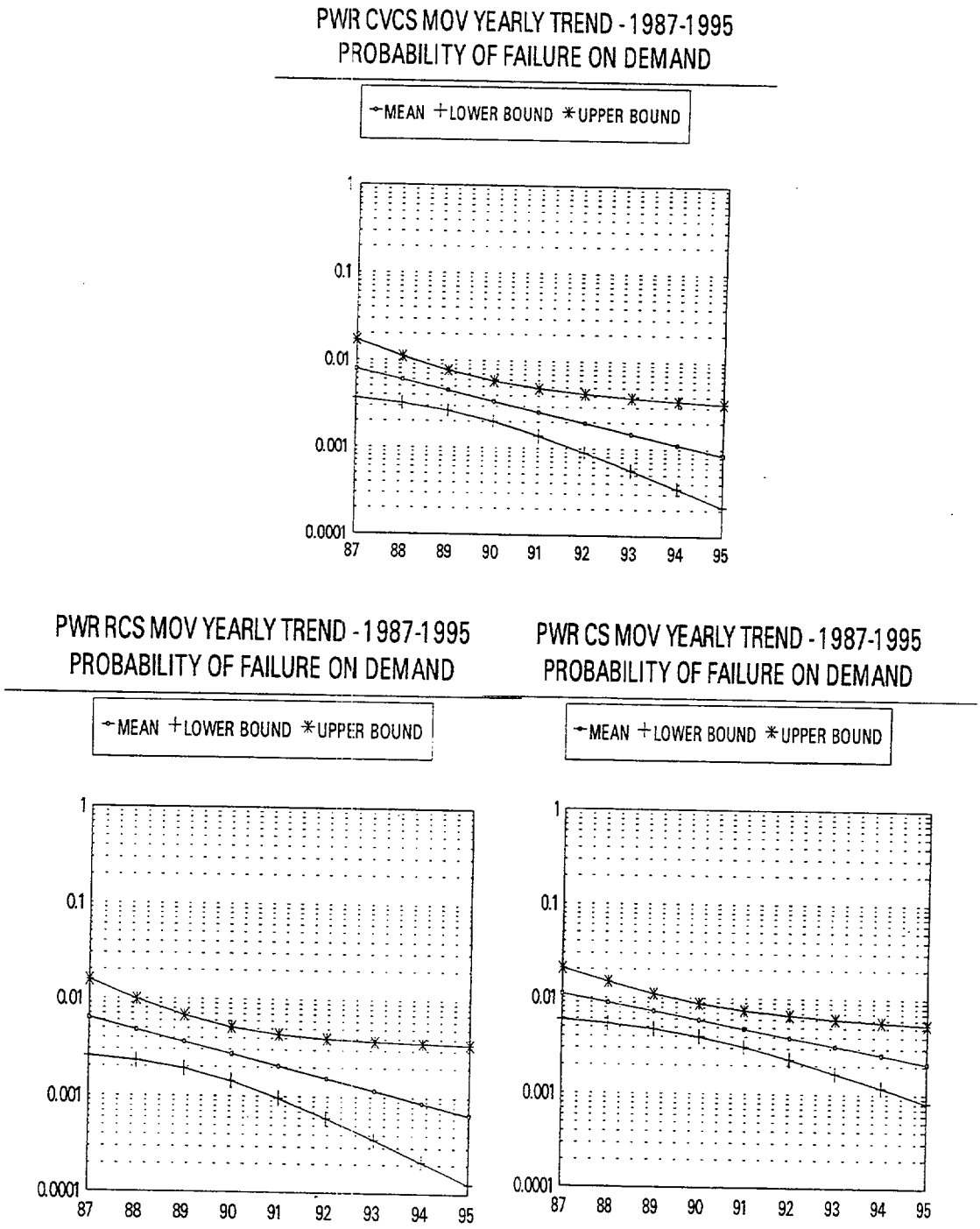


FIGURE 3
PWR RI SYSTEM MOV YEARLY TREND
PROBABILITY OF FAILURE ON DEMAND

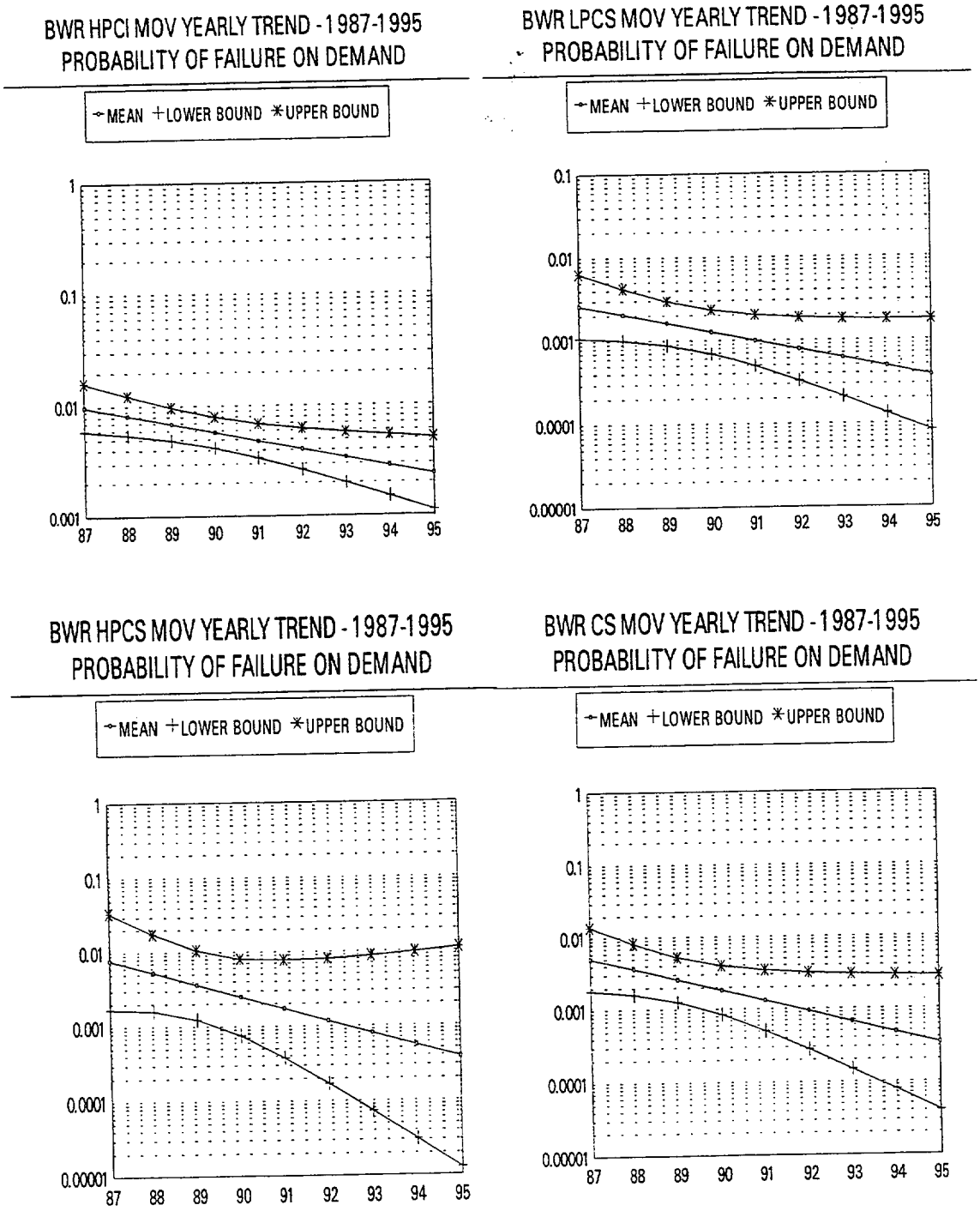


FIGURE 4
BWR RI SYSTEM MOV YEARLY TREND
PROBABILITY OF FAILURE ON DEMAND

3.3 MOV Common-Cause Failure Events

The review of the common-cause failure (CCF) database for the 1987–1995 period found eight complete MOV failures that were within the selected RI systems in the scope of this study's criteria (e.g., Application Coded MOVs with complete failures, failure modes of FC, FO, or OR, and occurred during surveillance testing or an ESF). This is consistent with the expected number of CCFs within the combined PWR and BWR failure population (312). Failure causes associated with these 8 failures were not significantly dfferent from the causes of single failure. Table C lists all MOV failures in the CCF database (with the complete failures applicable to this study in boldface). CCF numbers that include XXX denote that the source is the NPRDS database, and the docket number is not disclosed. For these CCFs, the plant identification (PLT ID) number gives the coded identifier for the plant for which the docket number is listed as XXX. Table C also references the Appendix IV table and item number for the complete failures within the scope of this study.

TABLE C
MOV FAILURES IN THE CCF DATABASE (1987–1995)

PWR/ BWR	SYS	COMPLETE/ DEGRADED	APPLIC. CODED	ESF/ SURV.	FAIL. MODE	CCF NUMBER	PLT ID/ DKT	TABLE/ ITEM
BWR	RHR	Complete	YES	NO	FO	L-333-91-0768-CC	333	
BWR	**RHR**	**Complete**	**YES**	**SPTST**	**FC**	**L-333-92-0762-00**	**333**	**II/97**
BWR	RHR	Degraded	YES	NO	OR	L-333-92-0770-00	333	
PWR	**AFW**	**Complete**	**YES**	**SPTST**	**FC**	**L-369-94-2494-00**	**369**	**I/97**
PWR	AFW	Degraded	YES	NO	FC	L-414-89-0580-00	414	
BWR	RHR	Degraded	YES	NO	FC	L-461-90-0775-00	461	
PWR	CS	Complete	YES	NO	OR	L-530-93-2495-CC	530	
BWR	RHR	Degraded	YES	NO	FC	N-XXX-89-0778-00	17	
PWR	HPI	Complete	YES	NO	FO	–XXX-88-0429-CC	19	
PWR	AFW	Complete	YES	NO	OR	N-XXX-88-0403-CC	28	
BWR	RHR	Degraded	YES	NO	FC	N-XXX-87-0793-00	34	
PWR	AFW	Degraded	YES	YES	FC	N-XXX-89-0404-00	35	
PWR	**RHR**	**Complete**	**YES**	**YES**	**FC**	**N-XXX-91-0479-00**	**35**	**I/115**
BWR	RHR	Complete	YES	NO	FO	N-XXX-95-2516-CC	36	
PWR	CS	Degraded	YES	YES	OR	L-213-87-0582-CC	213	
PWR	**CVCS**	**Complete**	**YES**	**YES**	**FO**	**L-295-94-2496-CC**	**295**	**I/155**
BWR	RHR	Degraded	YES	NO	OR	L-298-90-0761-CC	298	
PWR	**AFW**	**Complete**	**YES**	**YES**	**FC**	**L-302-92-0572-CC**	**302**	**I/120**
PWR	RHR	Complete	YES	NO	OR	L-323-91-0543-CC	323	
BWR	HPCI	Complete	YES	NO	FO	L-325-87-0764-CC	325	
BWR	RHR	Complete	YES	NO	FC	L-325-87-0765-CC	325	
BWR	RHR	Complete	YES	NO	FO	L-333-88-0766-CC	333	
BWR	RHR	Degraded	YES	YES	OR	L-333-91-0767-00	333	
BWR	**RHR**	**Complete**	**YES**	**YES**	**FC**	**N-XXX-88-0796-00**	**37**	**II/28**
PWR	RHR	Complete	YES	NO	FO	–XXX-87-0480-CC	38	
PWR	RHR	Degraded	YES	NO	FO	N-XXX-87-0669-CC	38	
PWR	HPI	Degraded	YES	YES	OR	N-XXX-87-0448-CC	39	
PWR	**HPI**	**Complete**	**YES**	**YES**	**FC**	**N-XXX-92-0586-00**	**41**	**I/137**

TABLE C (CONTINUED)
MOV FAILURES IN THE CCF DATABASE (1987–1995)

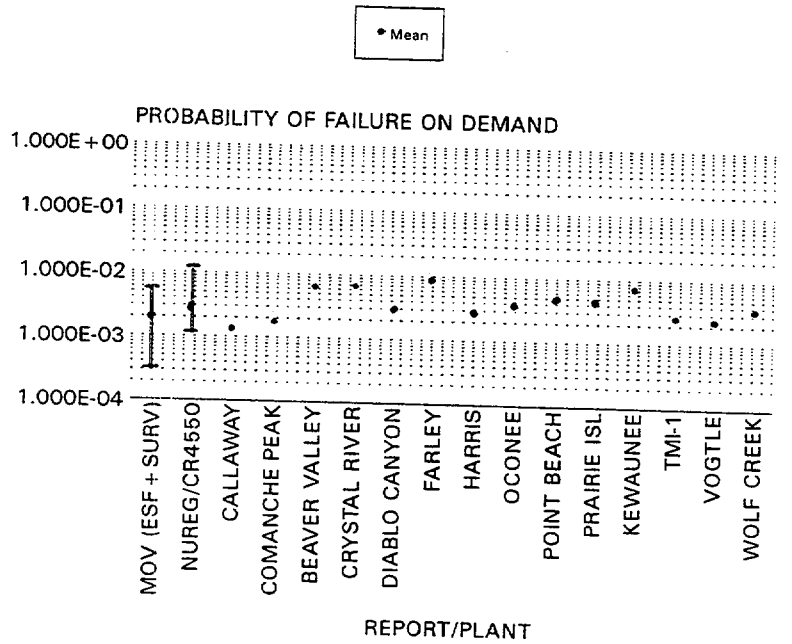
PWR/ BWR	SYS	COMPLETE/ DEGRADED	APPLIC. CODED	ESF/ SURV.	FAIL. MODE	CCF NUMBER	PLT ID/ DKT	TABLE/ ITEM
PWR	AFW	Degraded	YES	YES	FO	–XXX-92-0406-CC	46	
PWR	AFW	Degraded	YES	YES	FO	–XXX-92-0408-00	46	
PWR	AFW	Degraded	YES	YES	OR	N-XXX-92-2497-00	47	
PWR	HPI	Degraded	YES	YES	OR	N-XXX-87-0457-CC	60	
PWR	AFW	Degraded	YES	YES	OR	N-XXX-87-0411-CC	64	
PWR	RHR	Complete	YES	NO	FC	N-XXX-95-2511-00	71	
BWR	RHR	Degraded	YES	NO	FC	N-XXX-91-0818-00	73	
PWR	HPI	Degraded	YES	YES	OR	N-XXX-90-0460-CC	74	
PWR	CS	Degraded	YES	NO	OR	N-XXX-88-0487-CC	79	
PWR	CS	Complete	YES	NO	OR	N-XXX-88-0522-CC	79	
PWR	CS	Complete	YES	NO	FC	N-XXX-95-2507-00	79	
PWR	RHR	Complete	YES	NO	FO	–XXX-87-0824-CC	80	
PWR	HPI	Degraded	YES	YES	FO	N-XXX-94-2500-CC	82	
PWR	HPI	Degraded	YES	YES	FO	–XXX-94-2501-00	82	
PWR	AFW	Complete	YES	NO	FO	N-XXX-87-0413-CC	85	
PWR	HPI	Complete	YES	NO	OR	N-XXX-87-0489-CC	88	
BWR	RHR	Degraded	YES	YES	FC	N-XXX-91-0826-00	94	
BWR	RHR	Degraded	YES	YES	FC	N-XXX-92-0827-00	94	
PWR	AFW	Degraded	YES	NO	FC	N-XXX-88-0415-00	103	
PWR	HPI	Degraded	YES	YES	FC	N-XXX-91-0467-00	107	
PWR	HPI	Complete	YES	NO	OR	N-XXX-91-0468-CC	107	
PWR	CS	Degraded	YES	YES	OR	N-XXX-91-0535-CC	107	
PWR	HPI	Degraded	YES	YES	OR	N-XXX-89-0471-CC	109	
PWR	**HPI**	**Complete**	**YES**	**YES**	**FC**	**N-XXX-91-0472-00**	**109**	**I/101**

NOTE: SPTST denotes a special test, such as MOV testing in response to GL 89-10.

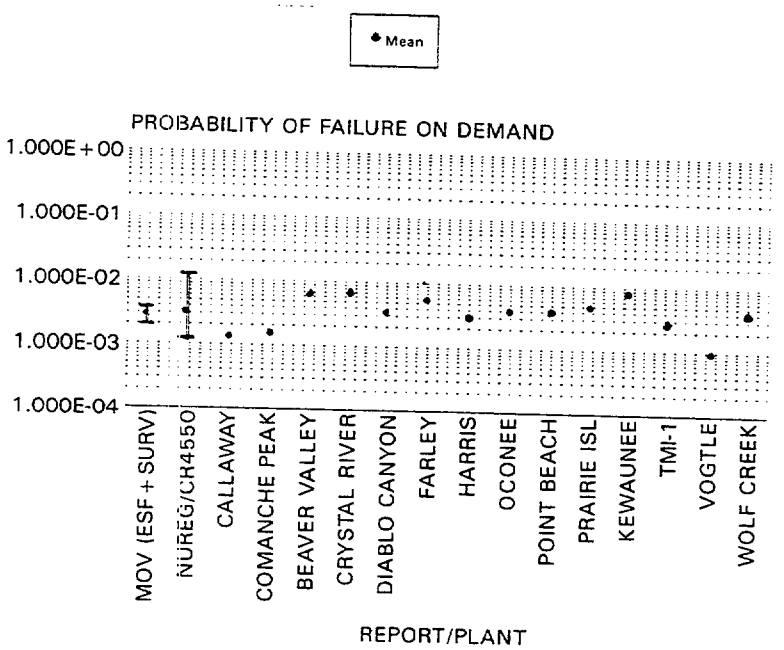
3.4 Comparison With IPEs and Other Sources

The MOV failure probabilities on demand developed for the PWR and BWR RI systems were compared with a selected group of plant-specific probabilistic risk assessment (PRA) values (mostly point estimates) developed to support the Individual Plant Examinations (IPEs), as shown in Figures 5 through 16. The PWR and BWR plants IPE mean values were generally consistent with the results of this study and the NUREG/CR-4550 generic values.

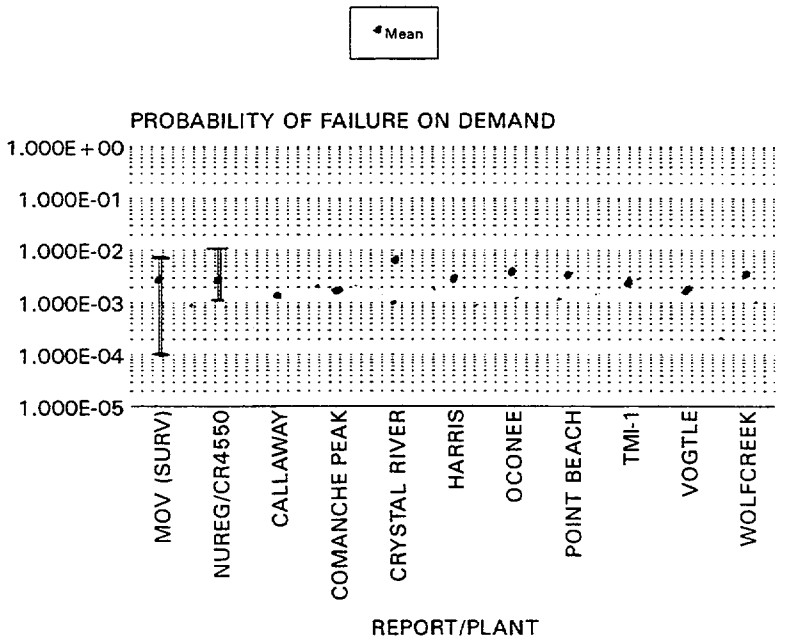
This comparison reflects readily available (docketed) IPE/PRA information. Licensees which have updated their IPE/PRAs without providing docketed information relating to MOVs are not reflected in this comparison.



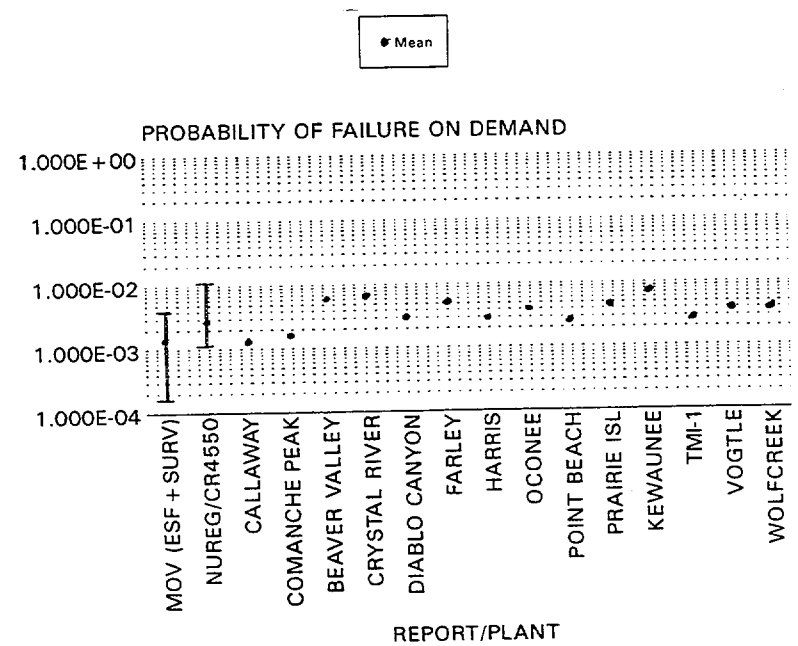
PWR AFW SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND
COMPARISON WITH VALUES USED IN IPEs
FIGURE 5



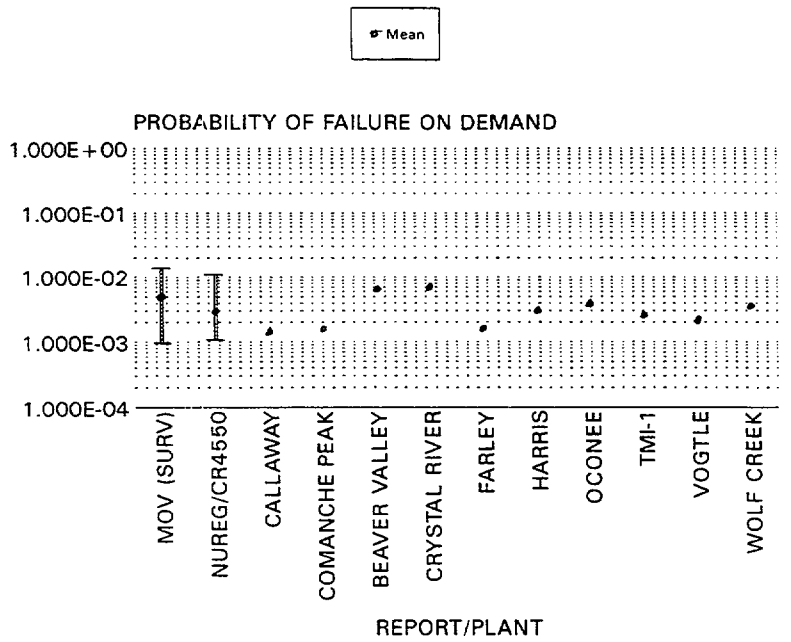
PWR HPI SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND
COMPARISON WITH VALUES USED IN IPEs
FIGURE 6



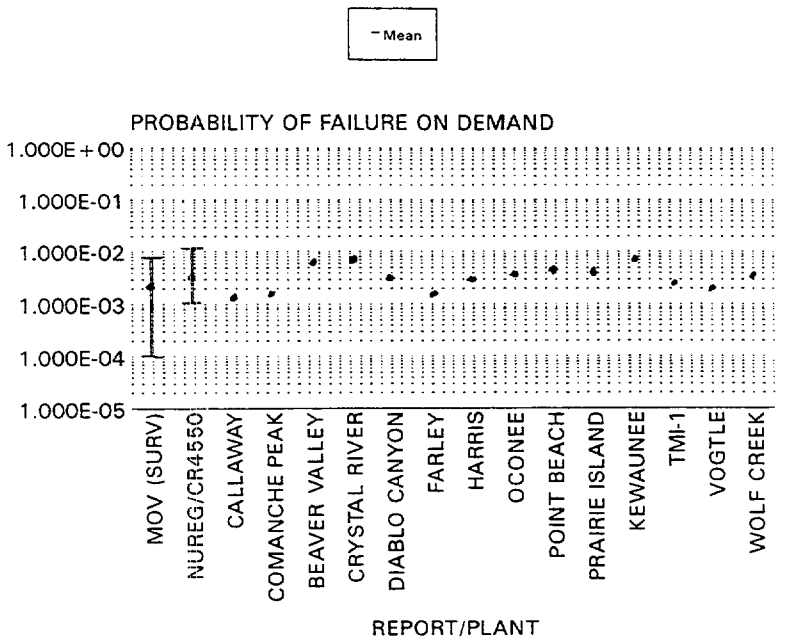
PWR CVCS SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND
COMPARISON WITH VALUES USED IN IPEs
FIGURE 7



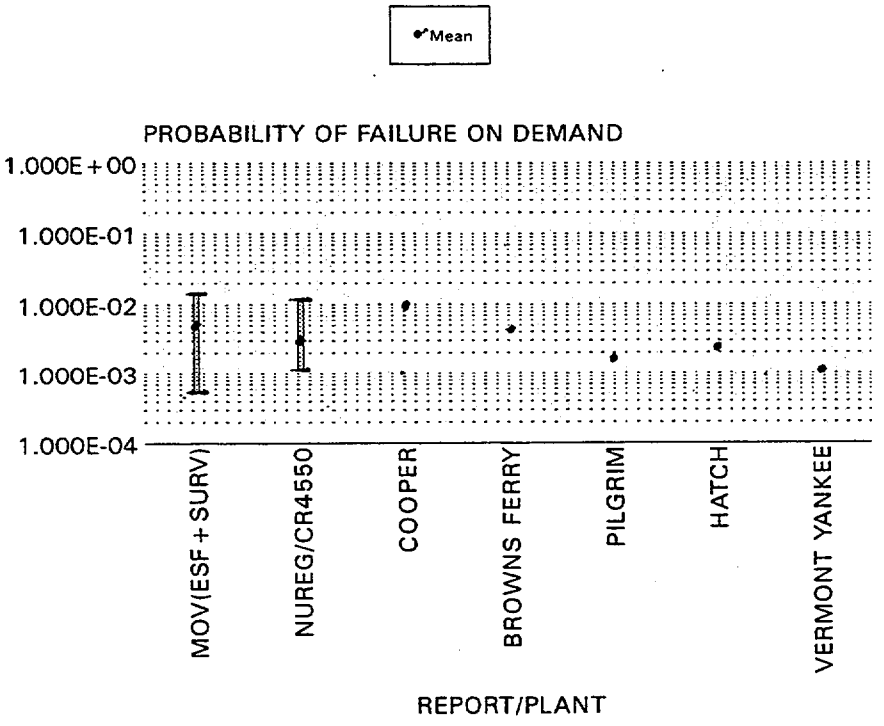
PWR RHR SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND
COMPARISON WITH VALUES USED IN IPEs
FIGURE 8



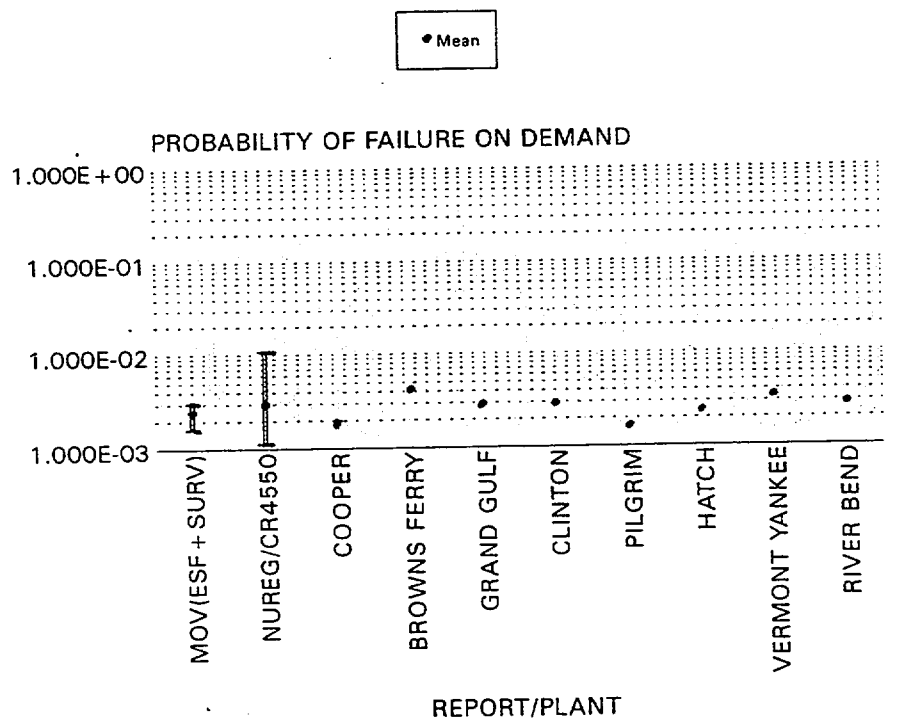
PWR CS SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND
COMPARISON WITH VALUES USED IN IPEs
FIGURE 9



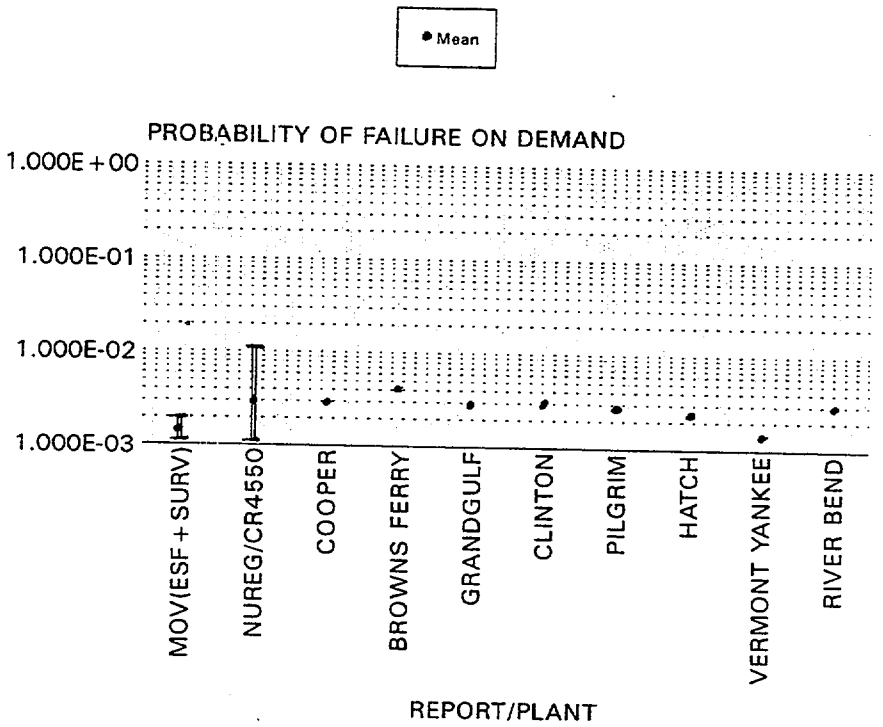
PWR RCS SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND
COMPARISON WITH VALUES USED IN IPEs
FIGURE 10



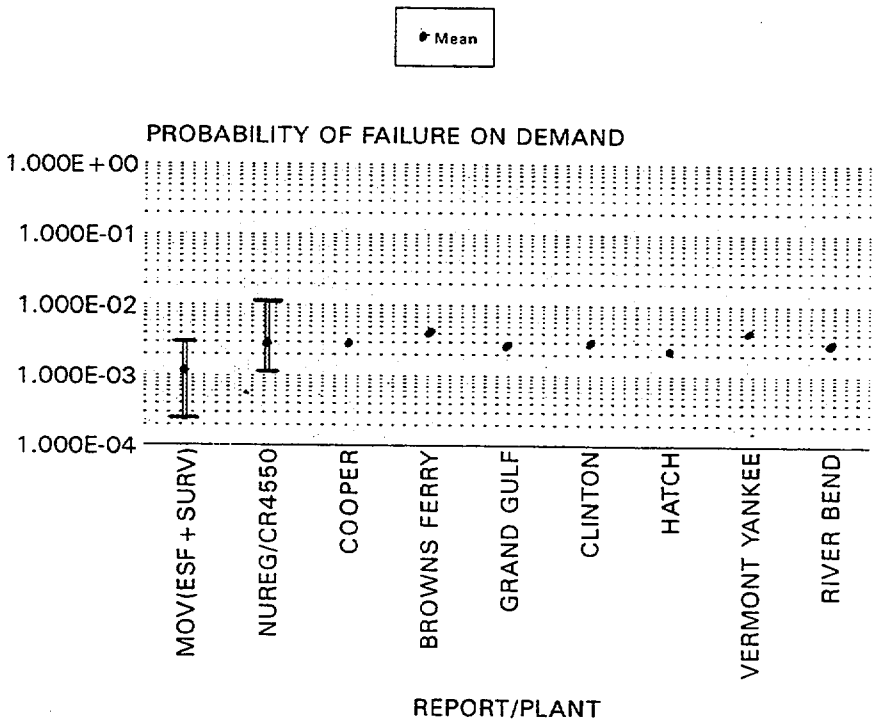
BWR HPCI SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND - COMPARISON WITH VALUES USED IN IPEs
FIGURE 11



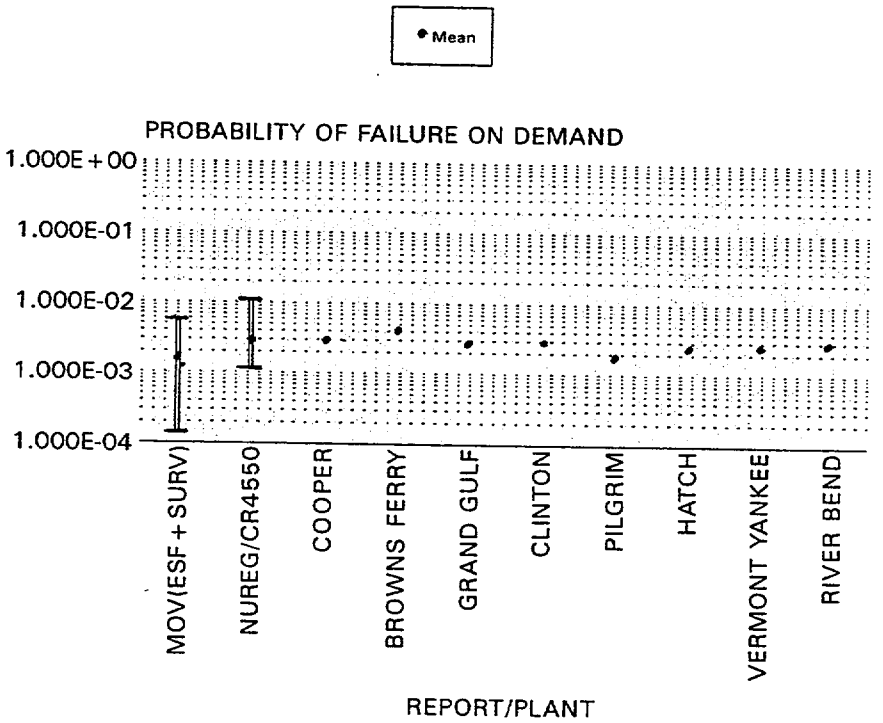
BWR RCIC SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND - COMPARISON WITH VALUES USED IN IPEs
FIGURE 12



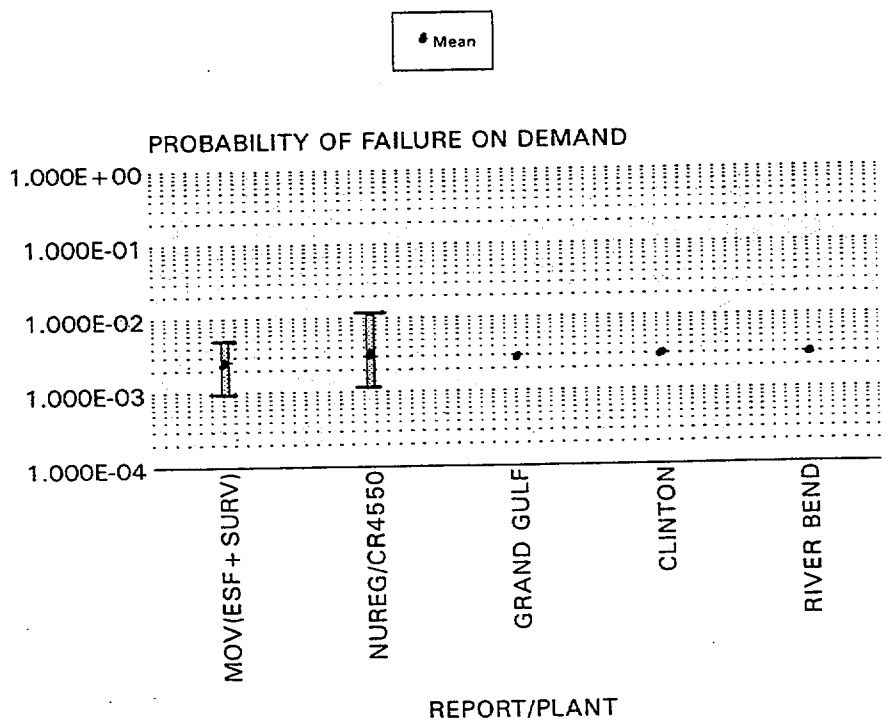
BWR RHR SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND - COMPARISON WITH VALUES USED IN IPEs
FIGURE 13



BWR LPCS SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND - COMPARISON WITH VALUES USED IN IPEs
FIGURE 14



BWR CS SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND - COMPARISON WITH VALUES USED IN IPEs
FIGURE 15



BWR HPCS SYSTEM MOV PROBABILITY OF FAILURE ON DEMAND - COMPARISON WITH VALUES USED IN IPEs
FIGURE 16

4. ENGINEERING ANALYSIS

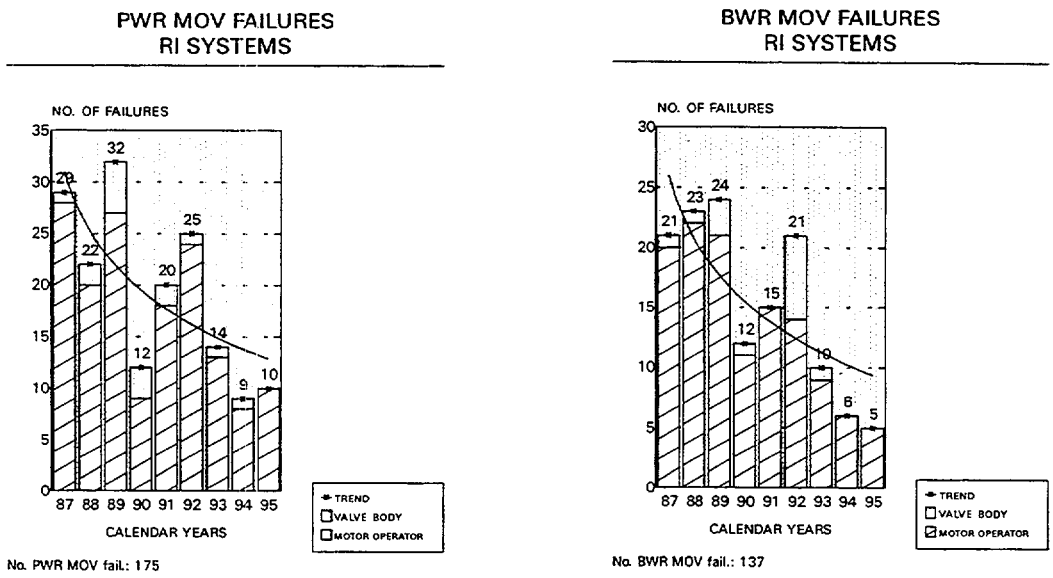
This section provides the engineering analyses including failure trend analysis, component trends in time, the failure characteristics and their causes, a brief discussion and listing of NRC regulatory initiatives related to MOVs, and engineering insights resulting from the various analyses.

4.1 Failure Trend Analysis

Appendix III provides applicable data for trending of MOV failures.

As indicated 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, failure data for trending in this study used NPRDS and LER failure data for the 1987–1995 period.

For the PWR and BWR RI systems during the 1987–1995 period, there was a statistically significant decreasing trend in the number of failures. Both the Maintenance Rule and voluntary industry joint owners group (JOG) initiatives were begun during this period. While there was not sufficient information to conclude whether these initiatives caused the decreasing trends, it is noted that an improvement in performance occurred. The increase in 1992 is consistent with nominal statistical year-to-year variation. A review of the data for that year did not attribute any single cause to this variation. Figure 17 shows the MOV failure trends for the 1987–1995.



PWR AND BWR MOV FAILURE TRENDS
FIGURE 17

4.2 Component Trends in Time

Methodology

The initial assumption made in this study, relative to aging effects on component assemblies, was that the rate of failure events over time (λ) is constant. Several evaluation methods were used to check this assumption. The reason for checking was to determine if any significant age-related increase in λ occurred among older plants. In order to conclude that an increase due to aging occurred, it would be necessary for all three of the following conditions to be present:

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

(2) λ was higher for older plants.

(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, $\lambda_{AVE.}$, equal to the total number of MOV failures for the 1987–1995 period, divided by the cumulative number of MOV component- years of standby operation during the period. Failure data from the 1996–1998 period was not included, as it was for ESF failures and limited surveillance test failure data only reported by LERs.

The cumulative number of failures was plotted against the number of MOV component-years since the beginning of the study period (1987) for comparison with $\lambda_{AVE.}$ This was done for PWRs and BWRs with plant age groups A, B, and C. These groups include 109 plants used as a basis for component studies with compilation of the number of MOV component-years for each specific plant. The following table gives the definition of each plant age group and its apportionment, in the 109-plant basis:

PLT AGE GROUP	COMMERCIAL OPERATION DATA	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	04/0184 and later	36	24	12

The assumption (i.e., null hypothesis) that $\lambda_{AVE.}$ is constant during the study period for each plant age group was evaluated. The failure rates ($\lambda_{AVE.}$) are the slopes of the plots for each plant age group. Comparison between plant age groups were made to determine whether there was any indication of plant aging (e.g., higher slope for the older plant age groups than for the newer plant age groups). Another test for the null hypothesis that the failure rate is constant 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 criteria 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, respectively, of the standard distribution). For a nonconstant failure rate (rejected null hypothesis) that is increasing (***U*** >+1.645), possible aging exists. The formula for the ***U*** statistic is as follows:

$$U = \frac{\bar{T} - L/2}{L\sqrt{1/12n}}$$

where: n = no. of failures, Ti = interval between failures in component-years,

$$\bar{T} = \Sigma Ti / n$$

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

Results

Appendix II provides tables applicable to component trends in time evaluations for MOVs. 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 MOV failures over time to the applicable average failure rate ($\lambda_{AVE.}$) plots for PWRs and BWRs indicated the following results:

PWRs (see Figure 18 and Appendix II, Tables I–III) - For the PWR RI systems, an analysis of failure rates did not show evidence of an increase in failure rates 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 rejected (decreasing). The value of ***U*** at the 10% significance level was -4.049 (<-1.645). The nonconstant failure rate is decreasing; therefore, there is no evidence of an increased failure rate due to aging mechanisms.

- For plant age group B, the hypothesis of a constant failure rate was rejected (decreasing). The value of U at the 10% significance level was -2.734 (<-1.645). The nonconstant failure rate is decreasing; therefore, there is no evidence of an increased failure rate due to aging mechanisms.

- For plant age group C, the hypothesis of a constant failure rate was not rejected. The value of U at the 10% significance level was -1.360 (>-1.645), 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. Differences occurred, where $\lambda_{AVE.}$ for A (0.013) was higher than B (0.008), and C (0.007) and B was slightly higher than C. This is indicative of a higher failure rate for older plants, but the trends (above) were constant or decreasing, and the causes (below) were not dominated by age/wear mechanisms.

- When the failure causes for PWR MOV assemblies were reviewed, maintenance/procedural deficiencies (23%), age/wear causes (23%), and unknown causes (21%) were the more significant causes (see Figure 23). Therefore, age/wear mechanisms were not the predominant cause of failure.

BWRs (see Figure 19 and Appendix II, Tables IV–VI)) - For the BWR RI systems MOVs, an analysis of failure rates did not show evidence of an increase in failure rates 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 rejected (decreasing). The value of U at the 10% significance level was -3.527 (<-1.645). The nonconstant failure rate is decreasing; therefore, there is no evidence of an increased failure rate due to aging mechanisms.

- For plant age group B, the hypothesis of a constant failure rate was rejected (decreasing). The value of U at the 10% significance level was -2.014 (<-1.645). The nonconstant failure rate is decreasing; therefore, there is no evidence of an increased failure rate due to aging mechanisms.

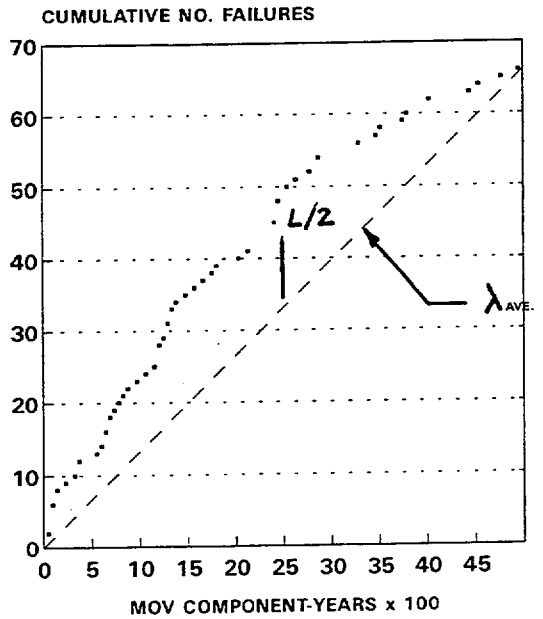
- For plant age group C, the hypothesis of a constant failure rate was rejected (decreasing). The value of U at the 10% significance level was -3.021 (<-1.645). The nonconstant failure rate is decreasing, therefore, there is no evidence of an increased failure rate due to aging mechanisms.

- When the average failure rates were compared among the plant age groups, plant age effects were assumed to be reflected by the highest average failure rates for the older plant age group A, ranging to the lowest average failure rate for plant age group C. Differences occurred, where $\lambda_{AVE.}$ for A (0.013) was higher than B (0.010), and C (0.009) and B were slightly higher than C. This is indicative of a higher failure rate for older plants, but the trends (above) were constant or decreasing, and the causes (below) were not dominated by age/wear mechanisms.

- When the failure causes for BWR MOV assemblies were reviewed, maintenance/procedural deficiencies (30%), unknown causes (19%), and age/wear causes (14%) were the more significant causes (see Figure 24). Therefore, age/wear mechanisms were not the predominant cause of failure.

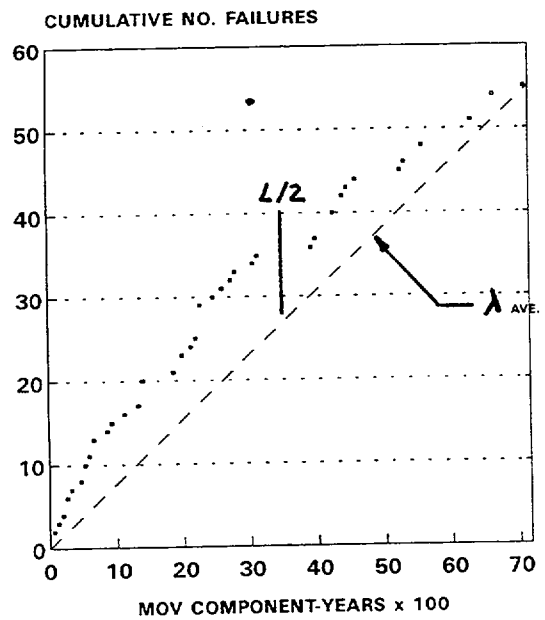
The analysis indicates no evidence to conclude that "aging" is adversely affecting the failure rate of MOVs in this report because the failure rates were not increasing over time and age/wear mechanisms were not the predominant cause of failure. It is not clear whether this is due to a lack of "aging" impacts or whether replacement/refurbishment of MOVs is responsible for the lack of an "aging" trend. Since specific component age information is not available, no additional assessment of causes for the lack of trends was performed.

MOVs - PLANT AGE GRP "A"
PWR RI SYSTEMS



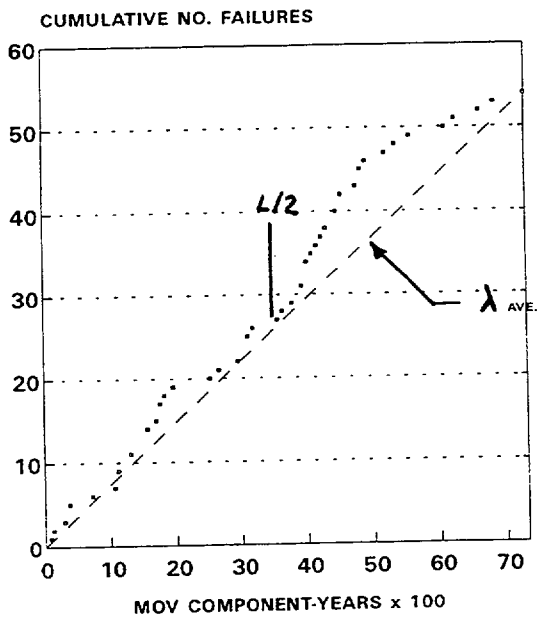
PERIOD: 1987-1995
No. fail.: 66

MOVs - PLANT AGE GRP "B"
PWR RI SYSTEMS



PERIOD: 1987-1995
No. fail.: 55

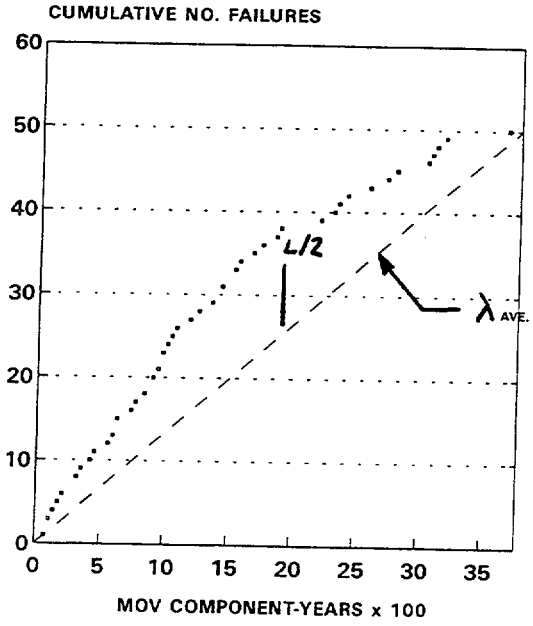
MOVs - PLANT AGE GRP "C"
PWR RI SYSTEMS



PERIOD: 1987-1995
No. fail.: 54

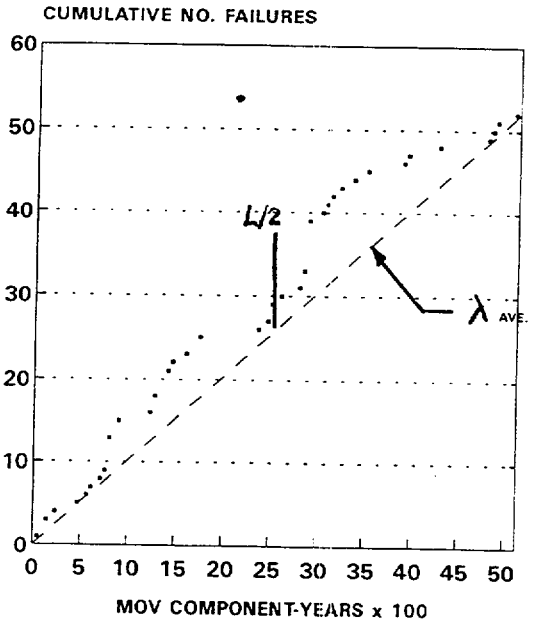
PWR RI SYSTEMS MOV COMPONENT TRENDS IN TIME
FIGURE 18

MOVs - PLANT AGE GRP "A"
BWR RI SYSTEMS



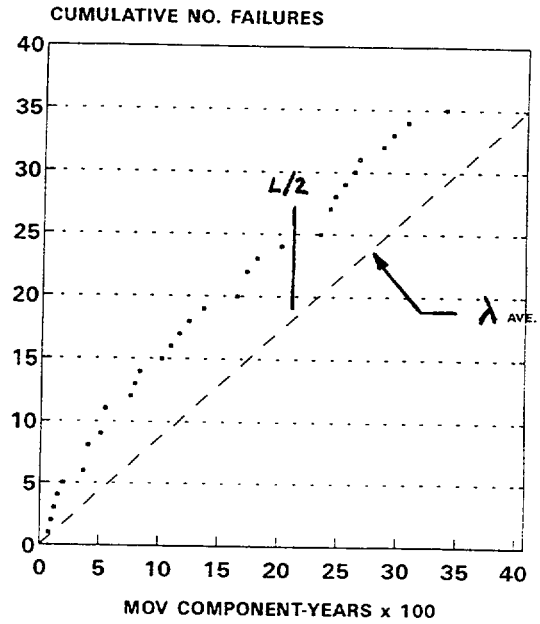
PERIOD: 1987-1995
No. fail.: 50

MOVs - PLANT AGE GRP "B"
BWR RI SYSTEMS



PERIOD: 1987-1995
No. fail.: 52

MOVs - PLANT AGE GRP "C"
BWR RI SYSTEMS



PERIOD: 1987-1995
No. fail.: 35

BWR RI SYSTEMS MOV COMPONENT TRENDS IN TIME
FIGURE 19

4.3 Failure Characteristics and Their Causes

Methodology

The MOV assembly failures and their causes were identified on a subcomponent level in the NPRDS database. For LER reported failures (SCSS database), sufficient information was provided to identify failed subcomponents and causes within the LER narrative, and to group these failures using the NPRDS categories. The apportionments were determined to provide insights into the predominant subcomponent failures and their causes by reactor type (i.e., PWR and BWR).

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

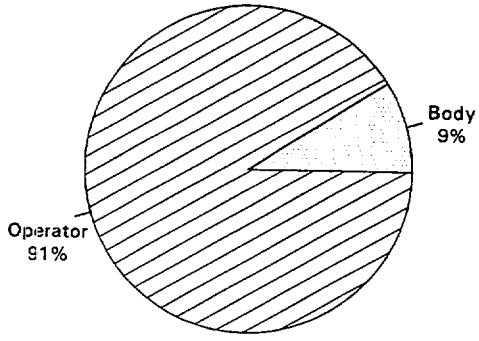
Age/Wear (AW)
Design Deficiency (DD)
Unknown (UK)
Out-of-Adjustment (OA)
Other Devices (OD)
Initial Installation (II)
Dirt/Contamination/Corrosion (DC)
Manufacturing Defect (MF)
Debris/Foreign Material (DF)
Mechanical Linkage (ML)
Maintenance/Procedural Deficiencies (MP)

Results

Figure 20 shows the MOV subcomponent failure apportionment for the PWR and BWR RI systems. Figures 21 and 22 show the MOV subcomponent parts failure apportionment for PWRs and BWRs, respectively. For both PWRs and BWRs, the evaluation of MOV subcomponent failure patterns determined that motor-operator failures accounted for approximately 90% of all MOV subcomponent failures. Fewer failures in the valve body, indicate that MOV valve body structural weakness and unreliability was a less significant concern than the motor-operator capability. For PWR motor-operators, torque switches (30%) were the predominant subcomponent part that failed; while for BWR motor-operators, motor internals (28%) were the predominant subcomponent part that failed.

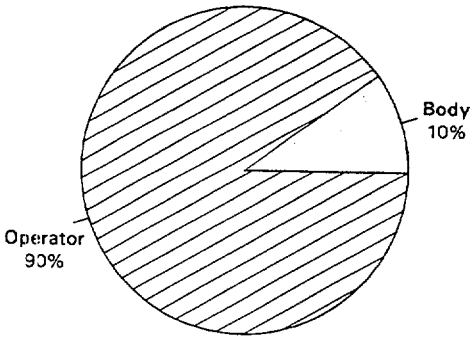
Failure causes for all MOV assemblies, based on reported failures, are illustrated in Figures 23 and 24 for PWRs and BWRs, respectively. For the PWR RI systems, the causes were mainly due to maintenance/procedural deficiencies (23%), age/wear (23%), and unknown (21%). For the BWR RI systems, the causes were mainly due to maintenance/procedural deficiencies (30%), unknown (19%), and age/wear (14%).

PWR RI SYSTEM MOVs



No. MOV Assy failures: 175

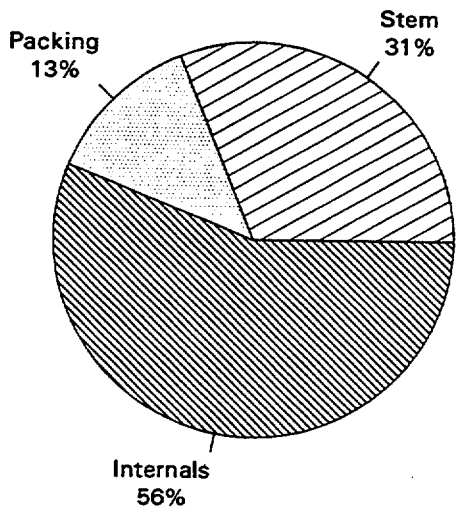
BWR RI SYSTEM MOVs



No. MOV Assy failures: 137

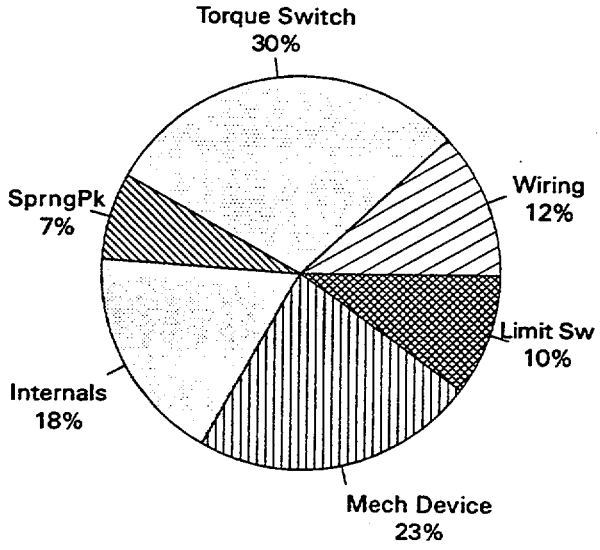
MOV SUBCOMPONENT FAILURE APPORTIONMENT
FIGURE 20

PWR RI SYSTEM MOVs
VALVE BODY SUBCOMPONENT PARTS FAILURES



No. MOV Valve Body failures: 16

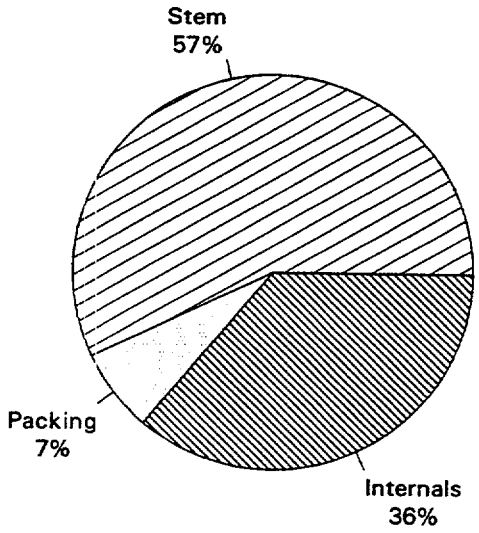
PWR RI SYSTEM MOVs
MOTOR OPERATOR SUBCOMPONENT PARTS FAILURES



No. MOV motor operator failures: 159

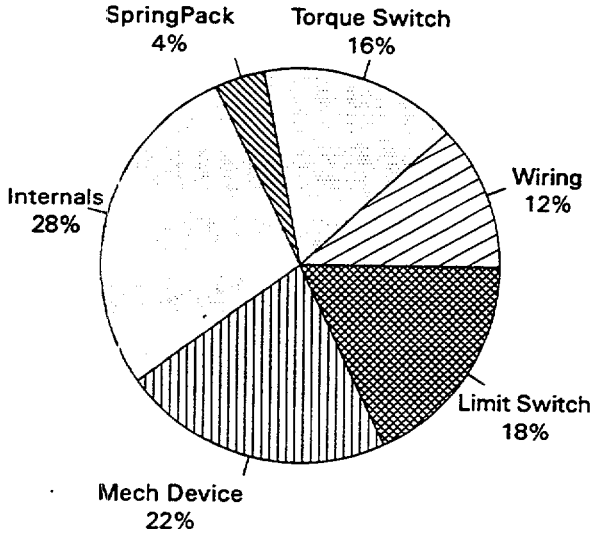
PWR MOV SUBOMPONENT PARTS FAILURE APPORTIONMENT
FIGURE 21

BWR RI SYSTEM MOVs
VALVE BODY SUBCOMPONENT PARTS FAILURES



No. MOV Valve Body failures: 14

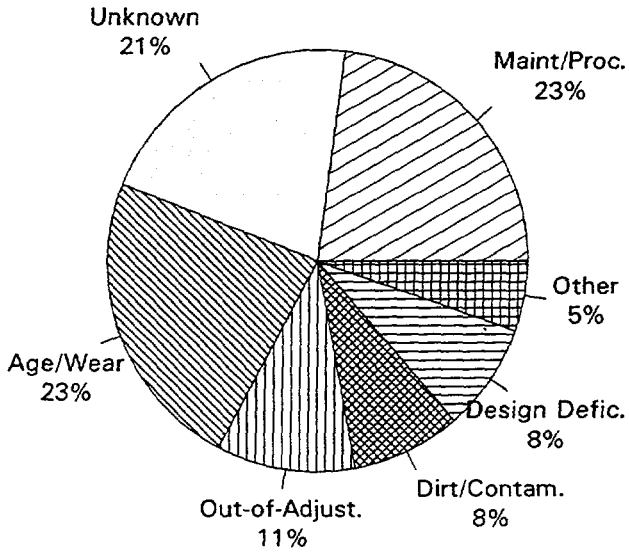
BWR RI SYSTEM MOVs
MOTOR OPERATOR SUBCOMPONENT PARTS FAILURES



No. MOV motor operator failures: 123

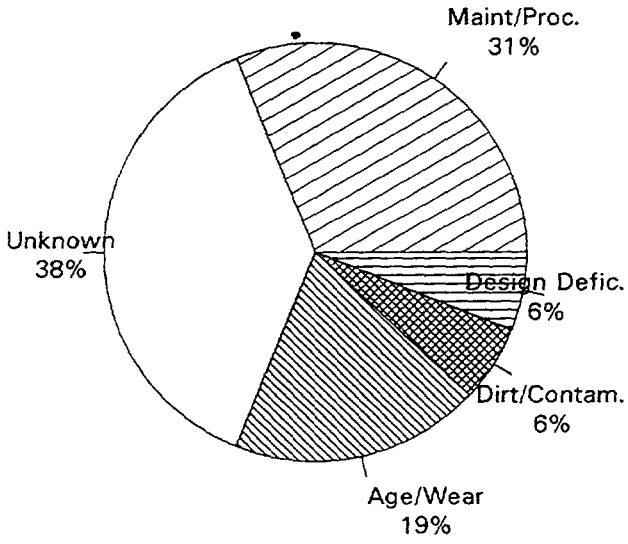
BWR MOV SUBCOMPONENT PARTS FAILURE APPORTIONMENT
FIGURE 22

PWR RI SYSTEMS MOV ASSEMBLIES
ALL SUBCOMPONENTS



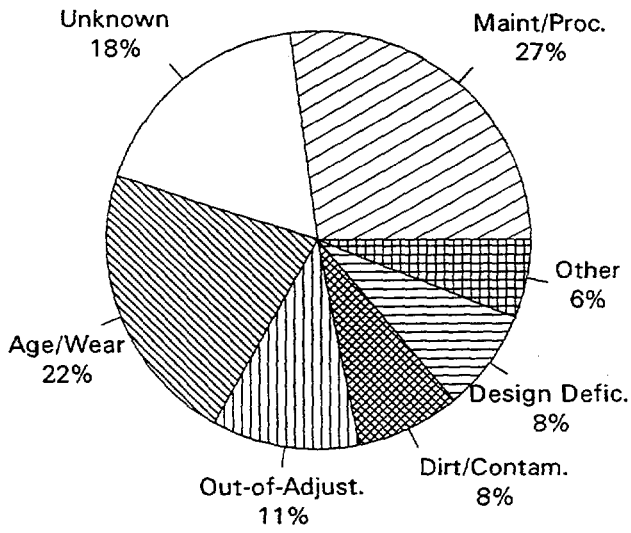
No. of MOV Assy failures: 175

PWR RI SYSTEMS MOV ASSEMBLIES
VALVE BODY FAILURE CAUSES



No. of MOV valve body failures: 16

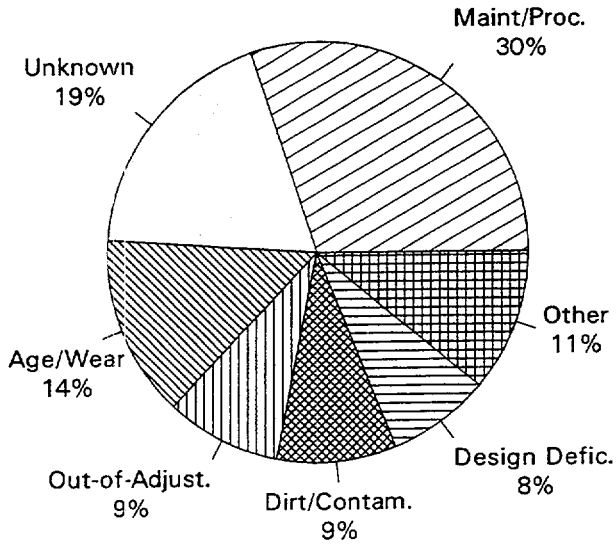
PWR RI SYSTEMS MOV ASSEMBLIES
MOTOR OPERATOR FAILURE CAUSES



No. of MOV Assy failures: 159

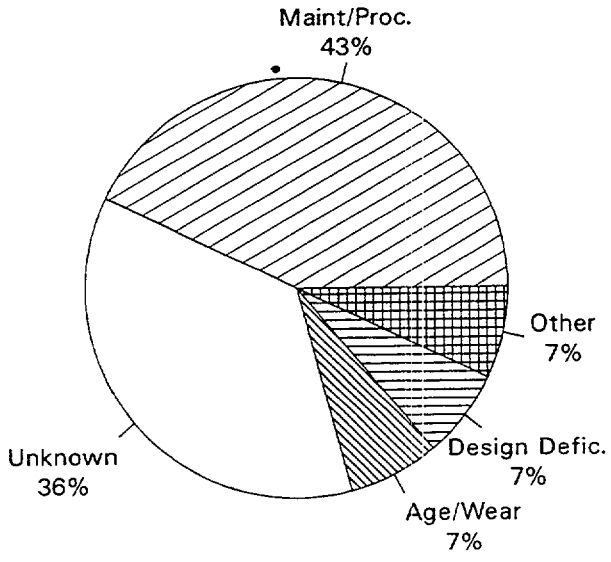
PWR RI SYSTEMS MOV FAILURE CAUSES
FIGURE 23

BWR RI SYSTEMS MOV ASSEMBLIES
ALL SUBCOMPONENTS



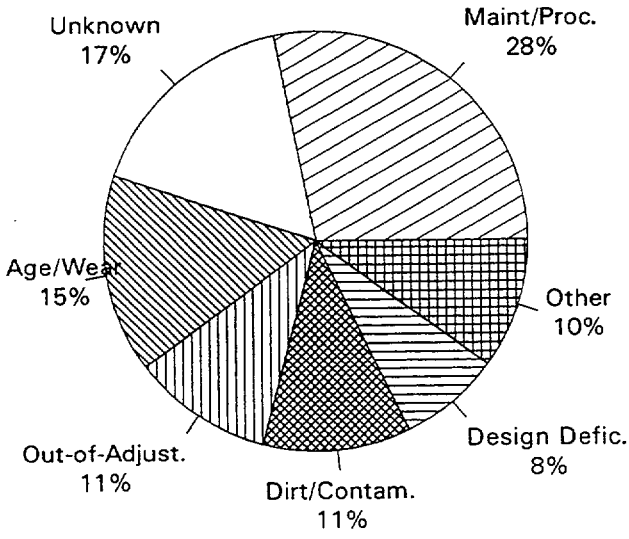
No. of MOV Assy failures: 137

BWR RI SYSTEMS MOV ASSEMBLIES
VALVE BODY FAILURE CAUSES



No. of MOV valve body failures: 14

BWR RI SYSTEMS MOV ASSEMBLIES
MOTOR OPERATOR FAILURE CAUSES



No. of MOV Assy failures: 123

BWR RI SYSTEMS MOV FAILURE CAUSES
FIGURE 24

4.4 Related Issues

Generic Letters and Information Notices

The review of NRC regulatory initiatives related to MOV assemblies and their subcomponents included Generic Letters (GLs), Circulars, Bulletins, and Information Notices (INs) was performed for the 1987-1998 period. This review determined that there were no Circulars or Bulletins involving MOVs for this period. The review determined that there were MOV failures reported by LERs associated with GL 89-10 that were within the scope of the failure population used in this study. Briefly, this scope was limited to Application Coded MOVs in PWR and BWR RI systems that failed completely (catastrophically) with "failure-to-open," "failure-to-close," or "failure-to-operate as required" failure modes, and occurred during ESF actuations, surveillance tests, or special tests associated with GL 89-10.

The LER reported failures that are applicable to GL 89-10 and within the scope of this study are included in Appendix IV. These specific LERs are: 333-92002, 361-92006, 302-92004, 275-92010, 305-93011, and 369-94008. No other GLs or INs were applicable to reported failure events within the scope of this study. Table D lists the GLs and INs that are applicable to all safety-related MOV assemblies and their subcomponents.

TABLE D
NRC GENERIC LETTERS (GLs) AND INFORMATION NOTICES (INs) CONCERNING MOV ASSEMBLIES (1987–1998)

Generic Letters:

GL 89-10	Safety-Related Motor-Operated Valve Testing and Surveillance, June 28, 1989
Supp. 1	Results of Public Workshops, June 13, 1990
Supp. 2	Availability of Program Descriptions, August 3, 1990
Supp. 3	Consideration of the Results of NRC-Sponsored Tests of Motor-Operated Valves, October 25, 1990
Supp. 4	Consideration of Valve Mispositioning in Boiling Water Reactors, February 12, 1992
Supp. 5	Inaccuracy of Motor-Operated Valve Diagnostic Equipment, June 28, 1993
Supp. 6	Information on Schedule and Grouping, and Staff Responses to Additional Public Questions, March 8, 1994
Supp. 7	Consideration of Valve Mispositioning in Pressurized Water Reactors, January 24, 1996
GL 95-07	Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves, August 17, 1995
GL 96-05	Periodic Verification of Design-Basis Capability of Safety-Related Power-Operated Valves, September 18, 1996

TABLE D (CONTINUED)
NRC GENERIC LETTERS (GLs) AND INFORMATION NOTICES (INs) CONCERNING MOV ASSEMBLIES (1987–1998)

Information Notices:

IN 87-08	Degraded Motor Leads in Limitorque DC Motor Operators
IN 87-40	Backseating Valves Routinely to Prevent Packing Leakage
IN 88-72	Inadequacies in Design of DC Motor Operated Valves
IN 88-84	Defective Motor Shaft Keys in Limitorque Motor Actuators
IN 89-11	Failure of DC Motor-Operated Valves to Develop Rated Torque Because of Improper Cable Sizing
IN 89-43	Permanent Deformation of Torque Switch Helical Springs in Limitorque SMA-Type Motor Operators
IN 89-88	Recent NRC-Sponsored Testing of Motor-Operated Valves
IN 90-21	Potential Failure of Motor-Operated Butterfly Valves to Operate Because Valve Seat Friction Was Underestimated
IN 90-37	Sheared Pinion Gear-to-Shaft Keys in Limitorque Motor Actuators
IN 90-40	Results of NRC-Sponsored Testing of Motor-Operated Valves
IN 91-58	Dependency of Offset Disc Butterfly Valves' Operation on Orientation With Respect to Flow
IN 91-61	Preliminary Results of Validation Testing of Motor-Operated Valve Diagnostic Equipment
IN 92-18	Potential for Loss of Remote Shutdown Capability During a Control Room Fire
IN 92-23	Results of Validation Testing of Motor-Operated Valve Diagnostic Equipment
IN 92-26	Pressure Locking of Motor-Operated Flexible Wedge Gate Valves
IN 92-59 (and Rev. 1)	Horizontally-Installed Motor-Operated Gate Valves
IN 92-70	Westinghouse Motor-Operated Valve Performance Data Supplied to Nuclear Power Plant Licensees
IN 92-83	Thrust Limits for Limitorque Actuators and Potential Overstressing of Motor-Operated Valves
IN 93-01	Accuracy of Motor-Operated Valve Diagnostic Equipment Manufactured by Liberty Technologies
IN 93-42	Failure of Anti-Rotation Keys in Motor-Operated Valves
IN 93-54	Motor-Operated Valve Actuator Thrust Variation Measured with Torque Thrust Cell and Strain Gage
IN 93-74	High Temperatures Reduce Limitorque AC Motor Operator Torque
IN 93-88	Status of Motor-Operated Valve Performance Prediction Program by the Electric Power Research Institute
IN 93-97	Failure of Yokes Installed on Walworth Gate and Globe Valves
IN 93-98	Motor Brakes on Valve Actuator Motors
IN 94-10	Failure of Motor-Operated Valve Electric Power Train Due to Sheared or Dislodged Motor Pinion Gear Key
IN 94-18	Accuracy of Motor-Operated Valve Diagnostic Equipment (Responses to Supplement 5 of Generic Letter 89-10)
IN 94-25	Failure of Containment Spray Header Valve to Open Due to Excessive Pressure From Internal Effects of Water
IN 94-49	Failure of Torque Switch Roll Pins
IN 94-67	Problems with Henry Pratt Motor-Operated Valves
IN 94-69	Potential Inadequacies in the Prediction of Torque Requirements for and Torque Output of Motor-Operated Butterfly Valves
IN 95-14	Susceptibility of Containment Sump Recirculation Gate Valves to Pressure Locking

TABLE D (CONTINUED)
NRC GENERIC LETTERS (GLs) AND INFORMATION NOTICES (INs) CONCERNING MOV ASSEMBLIES (1987–1998)

Information Notices (Continued):

IN 95-18 (and Supp.1)	Potential Pressure Locking of Safety-Related Power Operated Gate Valves
IN 95-30	Susceptibility of Low-Pressure Coolant Injection and Core Spray Injection Valves to Pressure Locking
IN 96-08	Thermally Induced Pressure Locking of a High Pressure Coolant Injection Gate Valve
IN 96-30	Inaccuracy of Diagnostic Equipment for Motor-Operated Butterfly Valves
IN 96-48 (and Supp.1)	Motor-Operated Valve Performance Issues
IN 97-07	Problems Identified During Generic Letter 89-10 Closeout Inspections
IN 97-32	Defective Worm Shaft Clutch Gears in Limitorque Motor-Operated Valve Actuators

NRC and Industry Initiatives

An improvement was indicated in the overall frequency of failure and in the probability of failure on demand for most systems. There were several industry and regulatory initiatives implemented at various times during the observed period of improving performance. However, this study could not causally link the initiatives to the performance improvements using the set of failures within the scope of this study.

In addition, many of the initiatives were focused on design basis capability, rather than the risk-significant functional reliability which was the subject of this analysis. While it is plausible that changes made in response to these design basis issues also improved the risk-significant functional reliability, the data is insufficient to establish cause and effect relationships.

5. SUMMARY OF RESULTS

5.1 Failure Probabilities

For the PWR and BWR RI systems, the MOV estimated probability of failure on demand distributions were consistent with the generic value range for MOVs from NUREG/CR-4550 (used as an input to NUREG-1150).

The yearly trend analysis of the MOV probability of failure on demand showed no statistically significant trends for the PWR AFW, HPI, and RHR systems or for the BWR RCIC and RHR systems. Statistically significant trends (decreasing) were identified for the PWR CVCS, RCS, and CS systems and for the BWR HPCI, HPCS, CS, and LPCS systems. The data for these downward trends was examined to determine the appropriate value to use for the probability of failure on demand and identified that the majority of the decrease occurred in the first three years. An examination of the last six years identified no statistically significant trends. Therefore, the mean value over the 1987–1998 period was used.

The MOV mean probabilities of failure on demand used in plant-specific IPE studies were compared with the results of this study. The PWR and BWR IPE mean values for RI systems were generally consistent with the results of this study and the NUREG/CR-4550 generic values.

5.2 Engineering Insights

The engineering insights gained from this study are summarized as follows:

- For the PWR and BWR RI systems during the 1987–1995 period, there was a statistically significant decreasing trend in the number of failures.
- For both PWRs and BWRs, an analysis of failure rates, as a function of component-years, did not show evidence of an increase for any plant age groups (three groups, of approximately equal size, from older to newer plants by commercial operations date) due to aging mechanisms.
- The number of complete MOV common-cause failures (CCF) identified in this study is consistent with the expected number based on the CCF database parameters for the combined PWR and BWR complete failure population used in this study.

- The evaluation of MOV subcomponent failure patterns demonstrated that motor-operator failures were significant contributors (approximately 90%) to MOV failures in both PWR and BWR RI systems. Fewer failures in the valve body, indicate that MOV valve body structural weakness and unreliability was a less significant concern than the motor-operator capability. For PWR motor-operators, torque switches were the predominant subcomponent part that failed; while for BWR motor-operators, motor internals were the predominant part that failed.

- For reported failures, failure causes for MOV assemblies in PWR RI systems were mainly due to maintenance/procedural deficiencies, age/wear, and unknown causes.

6. REFERENCES

1. NUREG-1275, "Operating Experience Feedback Report - Pressure Locking and Thermal Binding of Gate Valves," Vol. 9, March 1993.

2. NUREG/CR-5500, Vol 1, (INEEL/EXT-97-00740), "Reliability Study: Auxiliary/Emergency Feedwater System, 1987–1995," August 1998

3. NUREG/CR-5500, Vol. 4, (INEL-94/0158), "Reliability Study: High Pressure Coolant Injection (HPCI) System, 1987–1993," September 1999

4. NUREG/CR-5500, Vol.7, (INEL-95/0196), "Reliability Study: Reactor Core Isolation Cooling System, 1987–1993," September 1999

5. NUREG/CR-5500, Vol. 8, (INEL-95/00133), "Reliability Study: High-Pressure Core Spray System, 1987–1993," September 1999

6. NUREG/CR-5500, Vol. 9, (INEEL/EXT-99-00373), "Reliability Study: High Pressure Safety Injection System Reliability, 1987–1997," October 2000

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

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

APPENDIX I

MOV ASSEMBLY

FAILURE PROBABILITIES

APPENDIX I - MOV ASSEMBLY FAILURE PROBABILITIES

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

			PROBABILITY OF FAILURE ON DEMAND							
	NO.	NO.	90% CONFID. INTERVALS			BAYES 90% INTERVALS			PRIOR	
	FAIL.	DEMD	PLCB	PHAT	PUCB	PLO	MEAN	PUP	A	B
AFW	32	16485	1.4E-3	1.9E-3	2.6E-3	3.1E-4	2.1E-3	5.1E-3	1.7547	843.17
HPI	32	12573	1.8E-3	2.5E-3	3.4E-3	1.9E-3	2.6E-3	3.4E-3	Non-Informative	
RHR	46	31725	1.1E-3	1.4E-3	1.8E-3	1.6E-4	1.5E-3	4.0E-3	1.4412	958.85
CVCS	12	5655	1.2E-3	2.1E-3	3.4E-3	9.5E-5	2.3E-3	7.0E-3	0.9192	402.05
CS	29	5561	3.7E-3	5.2E-3	7.1E-3	9.4E-4	5.5E-3	1.3E-2	1.9396	353.60
RCS	12	4703	1.5E-3	2.6E-3	4.1E-3	1.0E-4	2.6E-3	7.9E-3	0.9142	354.60

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, RHR, and HPI systems. Since the contingency test for the 1996–1998 ESF data was also accepted for the AFW and RHR systems, the probability of failure on demand data combined the surveillance test data for 1987–1995 with ESF data for 1987–1998. For the HPI system, the contingency test for the 1996–1998 ESF data was rejected and the combined ESF and surveillance test data for 1987–1995 was used.

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 CVCS system. There was no ESF data (failures or demands) for the CS and RCS systems. The surveillance test data (1987–1995) was used for estimating the probability of failure on demand for these four 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.

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

	NO. FAIL.	NO. DEMD	PROBABILITY OF FAILURE ON DEMAND 90% CONFID. INTERVALS PLCB	PHAT	PUCB	BAYES 90% INTERVALS PLO	MEAN	PUP	PRIOR A	B
HPCI	44	8846	3.8E-3	5.0E-3	6.4E-3	5.4E-4	5.3E-3	1.4E-2	1.3732	257.72
RCIC	25	10784	1.6E-3	2.3E-3	3.2E-3	1.7E-3	2.4E-3	3.2E-3	Non-Informative	
RHR	36	24604	1.1E-3	1.5E-3	1.9E-3	1.1E-3	1.5E-3	1.9E-3	Non-Informative	
LPCS	13	10837	7.1E-4	1.2E-3	1.9E-3	2.3E-4	1.2E-3	2.9E-3	2.0840	1660.11
CS	9	4958	9.5E-4	1.8E-3	3.2E-3	1.1E-4	1.8E-3	5.3E-3	1.0908	600.05
HPCS	4	1585	8.6E-3	2.5E-3	5.8E-3	9.4E-4	2.6E-3	4.9E-3	Non-Informative	

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 listed 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 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.

APPENDIX II

MOV ASSEMBLY

COMPONENT TRENDS IN TIME

APPENDIX II
MOV ASSEMBLY COMPONENT TRENDS IN TIME

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

EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS
1/87	2	46	1/90	0	1711	1/93	0	3376
2/87	4	92	2/90	1	1757	2/93	0	3422
3/87	2	139	3/90	1	1804	3/93	1	3469
4/87	0	185	4/90	0	1850	4/93	1	3515
5/87	1	231	5/90	0	1896	5/93	0	3561
6/87	0	278	6/90	0	1942	6/93	0	3608
7/87	1	324	7/90	0	1989	7/93	0	3654
8/87	2	370	8/90	1	2035	8/93	0	3700
9/87	0	416	9/90	0	2081	9/93	1	3746
10/87	0	462	10/90	1	2127	10/93	1	3792
11/87	0	509	11/90	0	2174	11/93	0	3839
12/87	1	555	12/90	0	2220	12/93	0	3885
1/88	1	601	1/91	0	2266	1/94	0	3931
2/88	2	648	2/91	0	2312	2/94	0	3978
3/88	2	694	3/91	0	2359	3/94	2	4024
4/88	1	740	4/91	4	2405	4/94	0	4070
5/88	1	786	5/91	3	2451	5/94	0	4116
6/88	1	832	6/91	0	2498 - *L/2*	6/94	0	4162
7/88	1	879	7/91	2	2544	7/94	0	4209
8/88	0	925	8/91	0	2590	8/94	0	4255
9/88	1	971	9/91	1	2636	9/94	0	4301
10/88	0	1018	10/91	0	2682	10/94	0	4348
11/88	1	1064	11/91	0	2729	11/94	0	4394
12/88	0	1110	12/91	1	2775	12/94	1	4440
1/89	1	1156	1/92	0	2821	1/95	0	4486
2/89	3	1202	2/92	2	2868	2/95	1	4532
3/89	1	1249	3/92	0	2914	3/95	0	4579
4/89	2	1295	4/92	0	2960	4/95	0	4625
5/89	2	1341	5/92	0	3006	5/95	0	4671
6/89	1	1388	6/92	0	3052	6/95	0	4718
7/89	0	1434	7/92	0	3099	7/95	1	4764
8/89	1	1480	8/92	0	3145	8/95	0	4810
9/89	0	1526	9/92	0	3191	9/95	0	4856
10/89	1	1572	10/92	0	3238	10/95	0	4902
11/89	0	1619	11/92	2	3284	11/95	1	4949
12/89	1	1665	12/92	0	3330	12/95	0	4995
Totals:							**66**	

NOTES:

1. $\lambda_{AVE.} = \frac{66}{4995} = 0.013$ failures per component-year (1987–1995).
2. The mean time between failures = 1/0.013 = 77 component-years.
3. Failures are for the PWR RI systems in Plant Age Group A.
4. *L/2* indicates the midpoint of the cumulative MOV-years for the 1987–1995 period, for use in the Laplace test (see Section 4.2 in the text).
5. See Figure 18 in the text.

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

EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS
1/87	2	66	1/90	1	2457	1/93	0	4848
2/87	1	133	2/90	0	2524	2/93	0	4915
3/87	1	199	3/90	1	2590	3/93	0	4981
4/87	2	265	4/90	0	2657	4/93	0	5048
5/87	1	332	5/90	1	2723	5/93	0	5114
6/87	0	398	6/90	1	2790	6/93	0	5181
7/87	1	465	7/90	0	2856	7/93	1	5247
8/87	2	531	8/90	0	2922	8/93	1	5313
9/87	1	598	9/90	0	2989	9/93	0	5380
10/87	2	664	10/90	1	3055	10/93	0	5446
11/87	0	730	11/90	1	3122	11/93	0	5513
12/87	0	797	12/90	0	3188	12/93	2	5579
1/88	1	863	1/91	0	3254	1/94	0	5645
2/88	1	930	2/91	0	3321	2/94	0	5712
3/88	0	996	3/91	0	3387	3/94	0	5778
4/88	0	1063	4/91	0	3454	4/94	0	5845
5/88	1	1129	5/91	0	3520	5/94	0	5911
6/88	0	1196	6/91	0	3586 - *L/2*	6/94	0	5978
7/88	0	1262	7/91	0	3653	7/94	0	6044
8/88	1	1328	8/91	0	3719	8/94	0	6110
9/88	3	1395	9/91	0	3786	9/94	0	6177
10/88	0	1461	10/91	0	3852	10/94	0	6243
11/88	0	1528	11/91	1	3919	11/94	3	6310
12/88	0	1594	12/91	1	3985	12/94	0	6376
1/89	0	1660	1/92	0	4051	1/95	0	6442
2/89	0	1727	2/92	0	4118	2/95	0	6509
3/89	0	1793	3/92	0	4184	3/95	0	6575
4/89	1	1860	4/92	3	4251	4/95	3	6642
5/89	0	1926	5/92	0	4317	5/95	0	6708
6/89	2	1992	6/92	2	4384	6/95	0	6774
7/89	0	2059	7/92	1	4450	7/95	0	6841
8/89	1	2125	8/92	0	4516	8/95	0	6907
9/89	1	2192	9/92	1	4583	9/95	0	6974
10/89	4	2258	10/92	0	4649	10/95	0	7040
11/89	0	2324	11/92	0	4716	11/95	1	7107
12/89	0	2391	12/92	0	4782	12/95	0	7173
Totals:							**55**	

NOTES:

1. $\lambda_{AVE.} = \frac{55}{7173} = 0.008$ failures per component-year (1987–1995).
2. The mean time between failures = 1/0.008 = 125 component-years.
3. Failures are for the PWR RI systems in Plant Age Group B.
4. *L/2* indicates the midpoint of the cumulative MOV-years for the 1987–1995 period, for use in the Laplace test (see Section 4.2 in the text).
5. See Figure 18 in the text.

APPENDIX II - TABLE III
PWR RI SYSTEMS MOV ASSEMBLY FAILURES VERSUS COMPONENT-YEARS
PLANT AGE GROUPS C
ESF, SPECIAL TEST, AND SURVEILLANCE TEST FAILURES

EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS
1/87	0	41	1/90	0	2028	1/93	0	4681
2/87	1	82	2/901	0	2098	2/93	1	4756
3/87	1	123	3/90	0	2168	3/93	2	4832
4/87	0	164	4/90	0	2239	4/93	1	4907
5/87	0	205	5/90	0	2309	5/93	0	4982
6/87	0	246	6/90	0	2379	6/93	0	5058
7/87	1	288	7/90	0	2449	7/93	0	5133
8/87	0	329	8/90	1	2519	8/93	1	5208
9/87	2	370	9/90	0	2589	9/93	0	5283
10/87	0	411	10/90	1	2660	10/93	1	5358
11/87	0	452	11/90	0	2730	11/93	0	5434
12/87	0	493	12/90	0	2800	12/93	0	5509
1/88	0	550	1/91	0	2875	1/94	1	5584
2/88	0	608	2/91	1	2951	2/94	0	5660
3/88	0	665	3/91	0	3026	3/94	0	5735
4/88	1	722	4/91	3	3101	4/94	0	5811
5/88	0	779	5/91	1	3176	5/94	0	5886
6/88	0	836	6/91	0	3252	6/94	0	5961
7/88	0	894	7/91	0	3327	7/94	0	6036
8/88	0	951	8/91	0	3402	8/94	1	6112
9/88	0	1008	9/91	0	3477	9/94	0	6187
10/88	1	1066	10/91	1	3552	10/94	1	6262
11/88	2	1123	11/91	1	3628 *L/2*	11/94	0	6337
12/88	0	1180	12/91	0	3703	12/94	0	6412
1/89	0	1245	1/92	1	3778	1/95	0	6487
2/89	2	1310	2/92	0	3854	2/95	0	6562
3/89	0	1374	3/92	2	3929	3/95	1	6638
4/89	0	1439	4/92	3	4004	4/95	0	6713
5/89	0	1504	5/92	1	4079	5/95	0	6788
6/89	3	1569	6/92	1	4154	6/95	1	6863
7/89	0	1634	7/92	1	4230	7/95	0	6939
8/89	1	1699	8/92	1	4305	8/95	0	7014
9/89	2	1763	9/92	0	4380	9/95	0	7089
10/89	1	1828	10/92	2	4456	10/95	0	7164
11/89	0	1893	11/92	2	4531	11/95	0	7240
12/89	1	1958	12/92	0	4606	12/95	1	7315
Totals:							**54**	

NOTES:

1. $\lambda_{AVE.} = \frac{54}{7315} = 0.007$ failures per component-year 1987–1995).
2. The mean time between failures = 1/0.007 = 143 component-years.
3. Failures are for the PWR RI systems in Plant Age Group C.
4. *L/2* indicates the midpoint of the cumulative MOV-years for the 1987–1995 period, for use in the Laplace test (see Section 4.2 in the text).
5. See Figure 18 in the text.

APPENDIX II - TABLE IV
BWR RI SYSTEMS MOV ASSEMBLY FAILURES VERSUS COMPONENT-YEARS
PLANT AGE GROUP A
ESF, SPECIAL TEST, AND SURVEILLANCE TEST FAILURES

EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS
1/87	0	35	1/90	0	1295	1/93	0	2555
2/87	1	70	2/90	0	1330	2/93	1	2590
3/87	2	105	3/90	1	1365	3/93	0	2625
4/87	1	140	4/90	0	1400	4/93	0	2660
5/87	1	175	5/90	2	1435	5/93	0	2695
6/87	1	210	6/90	0	1470	6/93	1	2730
7/87	0	245	7/90	0	1505	7/93	0	2765
8/87	0	280	8/90	2	1540	8/93	1	2800
9/87	2	315	9/90	1	1575	9/93	0	2835
10/87	1	350	10/90	0	1610	10/93	0	2870
11/87	0	385	11/90	0	1610	11/93	0	2905
12/87	1	420	12/90	1	1680	12/93	0	2940
1/88	1	455	1/91	0	1715	1/94	0	2975
2/88	0	490	2/91	1	1750	2/94	0	3010
3/88	0	525	3/91	0	1785	3/94	1	3045
4/88	1	560	4/91	0	1820	4/94	1	3080
5/88	1	595	5/91	1	1855	5/94	1	3115
6/88	2	630	6/91	1	1890 - *L/2*	6/94	0	3150
7/88	0	665	7/91	0	1925	7/94	1	3185
8/88	0	700	8/91	0	1960	8/94	0	3220
9/88	1	735	9/91	0	1995	9/94	0	3255
10/88	1	770	10/91	0	2030	10/94	0	3290
11/88	0	805	11/91	0	2065	11/94	0	3325
12/88	1	840	12/91	0	2100	12/94	0	3360
1/89	0	875	1/92	0	2135	1/95	0	3395
2/89	2	910	2/92	0	2170	2/95	0	3430
3/89	1	945	3/92	1	2205	3/95	0	3465
4/89	2	980	4/92	0	2240	4/95	0	3500
5/89	1	1015	5/92	0	2275	5/95	0	3535
6/89	1	1050	6/92	1	2310	6/95	0	3570
7/89	1	1085	7/92	1	2345	7/95	0	3605
8/89	0	1120	8/92	0	2380	8/95	0	3640
9/89	0	1155	9/92	1	2415	9/95	1	3675
10/89	1	1190	10/92	0	2450	10/95	0	3710
11/89	0	1225	11/92	0	2485	11/95	0	3745
12/89	1	1260	12/92	0	2520	12/95	0	3780
Totals:							**50**	

NOTES:

1. $\lambda_{AVE.} = \frac{50}{3780} = 0.013$ failures per component-year (1987-1995).
2. The mean time between failures = 1/0.013 = 77 component-year.
3. Failures are for BWR RI systems only in Plant Age Group A.
4. *L/2* indicates the midpoint of the cumulative MOV-years for the 1987–1995 period, for use in the Laplace test (see Section 4.2 in the text).
5. See Figure 19 in the text.

APPENDIX II - TABLE V
BWR RI SYSTEMS MOV ASSEMBLY FAILURES VERSUS COMPONENT-YEARS
PLANT AGE GROUP B
ESF, SPECIAL TEST, AND SURVEILLANCE TEST FAILURES

EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS
1/87	1	48	1/90	2	1760	1/93	0	3474
2/87	0	95	2/90	0	1808	2/93	1	3521
3/87	2	143	3/90	0	1856	3/93	0	3569
4/87	0	190	4/90	0	1903	4/93	0	3616
5/87	1	238	5/90	0	1951	5/93	0	3664
6/87	0	285	6/90	0	1998	6/93	0	3711
7/87	0	333	7/90	0	2046	7/93	0	3759
8/87	0	381	8/90	0	2094	8/93	0	3807
9/87	0	428	9/90	0	2141	9/93	0	3854
10/87	1	476	10/90	0	2189	10/93	1	3902
11/87	0	523	11/90	0	2236	11/93	1	3949
12/87	1	571	12/90	0	2284	12/93	0	3997
1/88	1	618	1/91	0	2332	1/94	0	4044
2/88	0	666	2/91	1	2379	2/94	0	4092
3/88	1	714	3/91	0	2427	3/94	0	4140
4/88	1	761	4/91	1	2474	4/94	0	4187
5/88	4	809	5/91	2	2522	5/94	0	4235
6/88	0	856	6/91	0	2569 - *L/2*	6/94	1	4282
7/88	2	904	7/91	1	2617	7/94	0	4330
8/88	0	952	8/91	0	2665	8/94	0	4378
9/88	0	999	9/91	0	2712	9/94	0	4425
10/88	0	1047	10/91	0	2760	10/94	0	4473
11/88	0	1094	11/91	1	2808	11/94	0	4520
12/88	0	1142	12/91	2	2855	12/94	0	4568
1/89	0	1190	1/92	6	2902	1/95	0	4616
2/89	1	1237	2/92	0	2950	2/95	0	4663
3/89	2	1285	3/92	0	2998	3/95	0	4711
4/89	0	1332	4/92	1	3045	4/95	0	4758
5/89	0	1380	5/92	1	3093	5/95	1	4806
6/89	3	1427	6/92	1	3140	6/95	1	4853
7/89	1	1475	7/92	0	3188	7/95	1	4901
8/89	0	1523	8/92	1	3236	8/95	0	4949
9/89	0	1570	9/92	0	3283	9/95	0	4996
10/89	1	1618	10/92	0	3331	10/95	0	5044
11/89	0	1665	11/92	1	3378	11/95	1	5091
12/89	0	1713	12/92	0	3426	12/95	0	5139
Totals:							52	

NOTES:

1. $\lambda_{AVE.} = \frac{52}{5139} = 0.010$ failures per component-year (1987–1995).
2. The mean time between failures = 1/0.010 = 100 component-years.
3. Failures are for BWR RI systems only in Plant Age Group B.
4. *L/2* indicates the midpoint of the cumulative MOV-years for the 1987–1995 period, for use in the Laplace test (see Section 4.2 in the text).
5. See Figure 19 in the text.

APPENDIX II - TABLE VI
BWR RI SYSTEMS MOV ASSEMBLY FAILURES VERSUS COMPONENT-YEARS
PLANT AGE GROUP C
ESF, SPECIAL TEST, AND SURVEILLANCE TEST FAILURES

EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS	EVENT DATE	NO. FAIL.	CUMULATIVE MOV-YEARS
1/87	0	24	1/90	0	1205	1/93	1	2660
2/87	0	49	2/90	1	1245	2/93	0	2700
3/87	1	73	3/90	0	1286	3/93	0	2741
4/87	1	98	4/90	0	1326	4/93	0	2781
5/87	1	122	5/90	1	1366	5/93	0	2822
6/87	1	146	6/90	0	1406	6/93	1	2862
7/87	0	171	7/90	0	1446	7/93	0	2903
8/87	1	195	8/90	0	1486	8/93	1	2943
9/87	0	220	9/90	0	1526	9/93	0	2984
10/87	0	244	10/90	0	1567	10/93	0	3024
11/87	0	269	11/90	0	1607	11/93	1	3064
12/87	0	293	12/90	1	1647	12/93	0	3105
1/88	0	329	1/91	0	1688	1/94	0	3146
2/88	1	365	2/91	2	1728	2/94	0	3186
3/88	2	401	3/91	0	1768	3/94	0	3226
4/88	0	437	4/91	1	1809	4/94	0	3267
5/88	0	473	5/91	0	1850	5/94	0	3308
6/88	1	508	6/91	0	1890	6/94	0	3348
7/88	2	544	7/91	0	1931	7/94	1	3388
8/88	0	580	8/91	0	1971	8/94	0	3429
9/88	0	616	9/91	1	2012	9/94	0	3470
10/88	0	652	10/91	0	2052 - *L/2*	10/94	0	3510
11/88	0	688	11/91	0	2092	11/94	0	3551
12/88	0	724	12/91	0	2133	12/94	0	3591
1/89	1	761	1/92	0	2174	1/95	0	3632
2/89	1	798	2/92	0	2214	2/95	0	3672
3/89	1	834	3/92	0	2254	3/95	0	3712
4/89	0	871	4/92	0	2295	4/95	0	3753
5/89	0	908	5/92	1	2336	5/95	0	3794
6/89	0	944	6/92	0	2376	6/95	0	3834
7/89	0	981	7/92	2	2416	7/95	0	3874
8/89	1	1018	8/92	1	2457	8/95	0	3915
9/89	0	1055	9/92	0	2498	9/95	0	3956
10/89	1	1092	10/92	1	2538	10/95	0	3996
11/89	0	1128	11/92	0	2578	11/95	0	4036
12/89	1	1165	12/92	1	2619	12/95	0	4077
Totals:							**35**	

NOTES:

1. $\lambda_{AVE.} = \frac{35}{4077} = 0.0086$ failures per component-year (1987–1995).
2. The mean time between failures = 1/0.0086 = 116 component-years.
3. Failures are for BWR RI systems only in Plant Age Group C.
4. *L/2* indicates the midpoint of the cumulative MOV-years for the 1987–1995 period, for use in the Laplace test (see Section 4.2 in the text).
5. See Figure 19 in the text.

APPENDIX III

MOV ASSEMBLY

ENGINEERING INSIGHTS

APPENDIX III
MOV ASSEMBLY - ENGINEERING INSIGHTS

APPENDIX III - TABLE I
PWR RI SYSTEMS - FAILURES AND FAILURE FRACTIONS FOR MOV ASSEMBLIES AND SUBCOMPONENTS

VALVE BODIES	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	1	2	5	2	2	1	1	1	0	15
No. ESF Failures:	0	0	0	1	0	0	0	0	0	1
No. Special Test Failures:	0	0	0	0	0	0	0	0	0	0
Total No. Failures:	1	2	5	3	2	1	1	1	0	16
No. MOVs:	1812	2009	2078	2142	2255	2255	2255	2255	2255	
Failure Fraction	5E-4	1E-3	2E-3	1E-3	9E-4	4E-4	4E-4	4E-4	0	
Ave. Failure Fraction	----------8E-4----------									

MOTOR OPERATORS	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	27	18	25	9	17	19	11	5	10	141
No. ESF Failures:	3	2	2	0	0	2	1	0	0	10
No. Special Test Failures	0	0	0	0	1	3	1	3	0	8
Total No. Failures:	28	20	27	9	18	24	13	8	10	159
No. MOVs:	1812	2009	2078	2142	2255	2255	2255	2255	2255	
Failure Fraction	1.6E-2	1.0E-2	1.3E-2	4E-3	8E-3	1.0E-2	6E-3	4E-3	4E-3	
Ave. Failure Fraction	----------8E-3----------									

MOV ASSY (Includes above subcomponents)	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	28	20	30	11	19	20	12	6	10	156
No. ESF Failures:	3	2	2	1	0	2	1	0	0	11
No. Special Tests:	0	0	0	0	1	3	1	3	0	8
Total No. Failures:	31	22	32	12	20	25	14	9	10	175
No. MOVs:	1812	2009	2078	2142	2255	2255	2255	2255	2255	
Failure Fraction	1.7E-2	1.1E-2	1.5E-2	5E-3	9E-3	1.1E-2	6E-3	4E-3	4E-3	
Ave. Failure Fraction	----------9E-3----------									

Note: See Figure 17 in the text.

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

VALVE BODIES	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	1	1	3	1	0	2	1	0	0	9
No. ESF Failures:	0	0	0	0	0	0	0	0	0	0
No. Special Test Failures:	0	0	0	0	0	5	0	0	0	5
Total No. Failures:	1	1	3	1	0	7	1	0	0	14
No. MOVs:	1284	1422	1432	1473	1477	1477	1477	1477	1477	
Failure Fraction	8E-4	7E-4	2E-3	7E-4	0	5E-3	7E-4	0	0	
Ave. Failure Fraction	----------1E-3----------									

MOTOR OPERATORS	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	18	21	21	10	15	13	9	5	5	117
No. ESF Failures:	2	1	0	1	0	0	0	1	0	5
No. Special Test Failures	0	0	0	0	0	1	0	0	0	1
Total No. Failures:	20	22	21	11	15	14	9	6	5	123
No. MOVs:	1284	1422	1432	1473	1477	1477	1477	1477	1477	
Failure Fraction	1.6E-2	1.5E-2	1.5E-2	7E-3	1.0E-2	9E-3	6E-3	4E-3	3E-3	
Ave. Failure Fraction	----------1.0E-2----------									

MOV ASSY (Includes above subcomponents)	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
No. Surv. Test Failures:	19	22	24	11	15	15	10	5	5	126
No. ESF Failures:	2	1	0	1	0	0	0	1	0	5
No. Special Tests:	0	0	0	0	0	6	0	0	0	6
Total No. Failures:	21	23	24	12	15	21	10	6	5	137
No. MOVs:	1284	1422	1432	1473	1477	1477	1477	1477	1477	
Failure Fraction	1.6E-2	1.6E-2	1.7E-2	8E-3	1.0E-2	1.4E-2	7E-3	4E-3	3E-3	
Ave. Failure Fraction	----------1.1E-2----------									

Note: See Figure 17 in the text.

APPENDIX III - TABLE III
PWR RI SYSTEMS MOV ASSEMBLY AND SUBCOMPONENTS
FAILURE CAUSE APPORTIONMENT

	MOTOR OPERATORS		VALVE BODIES		MOV ASSEMBLIES	
FAILURE CAUSE	No. Fail.	%	No. Fail.	%	No. Fail.	%
Maint./Proc.	43	27	5	31	48	23
Unknown	29	18	6	38	35	21
Age/Wear	35	22	3	19	38	23
Out-of-Adjust.	18	11	0	0	18	11
Dirt/Contam.	12	8	1	6	13	8
Design Defic.	13	8	1	6	14	8
Other	9	6	0	0	9	5
Totals:	159	91	16	9	175	100

NOTE: See Figures 20 and 21 in the text.

APPENDIX III - TABLE IV
BWR RI SYSTEMS MOV ASSEMBLY AND SUBCOMPONENTS
FAILURE CAUSE APPORTIONMENT

	MOTOR OPERATORS		VALVE BODIES		MOV ASSEMBLIES	
FAILURE CAUSE	No. Fail.	%	No. Fail.	%	No. Fail.	%
Maint./Proc.	35	28	6	43	41	30
Unknown	21	17	5	36	26	19
Age/Wear	18	15	1	7	19	14
Out-of-Adjust.	13	11	0	0	13	9
Dirt/Contam.	13	11	0	0	13	9
Design Defic.	10	8	1	7	11	8
Other	13	10	1	7	14	11
Totals:	123	90	14	10	137	100

NOTE: See Figures 20 and 22 in the text.

APPENDIX IV

MOV ASSEMBLIES

DATA SOURCE INPUT FOR REPORTED FAILURES AND ESTIMATED DEMANDS

ABBREVIATIONS USED IN APPENDIX IV - TABLES I THROUGH IV

Column Headings:

ESF/SURV/ SPTST - Failure occurred with ESF, Surveillance Test, or Special Test (associated with GL 89-10).

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 Source, either as NPRDS failure history (FHIS) or as a 5-digit LER number, as applicable.

PLT AGE - Plant Age Group (A, B, or C) that indicates the plant commercial licsense date.as follows:
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, this is the event date, shown by month and year only (i.e., 0189 is January 1989, etc.).

SUB COMP - Subcomponent of the MOV assembly (VB - Valve Body and VO - Motor Operator).

COMP PART - Subcomponent part. These are as follows:

Valve Bodies (VB)	Motor Operators (MO)	
Internals (INT)	Motor Internals (MI)	Mechanical Device (MD)
Packing (PKG)	Spring Pack (SP)	Torque Switch (TS)
Stem (STM)	Wiring/Contacts (WC)	Limit switch (LS)

FAIL MODE - Failure Mode as follows:
Failure to close (FC)
Failure to open (FO)
Failure to operate as requied (both fail to open and fail to close - OR)

FAIL CAUS - Failure cause as follows:

Dirt/Contamination (DC)	Debris/Foreign Material (DF)	Age/Wear (AW)
Design Deficiency (DD)	Manufacturing Defect (MF)	
Out-of-Adjustment (OAI)	Unknown (UK)	
Setpoint Drift (SD)	Other Devices (OD)	
Initial Installation (II)	Maintenance/Procedural Deficiency (MP)	

APPENDIX IV
DATA SOURCE INPUT FOR REPORTED FAILURES AND ESTIMATED DEMANDS
LIST OF TABLES

APPENDIX IV
DATA SOURCE INPUT FOR REPORTED FAILURES AND ESTIMATED DEMANDS
LIST OF TABLES (CONTINUED)

APPENDIX IV - TABLE I
PWR MOV ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
SURVEILLANCE TEST AND ESF FAILURES 1987-1995

ITEM NO.	ESF/ SURV/ SPTST	PLT ID NO.	DATA SRC.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
1	SURV	72	FHIS	B	HPI	1	0187	VB	STM	FO	DC
2	SURV	72	FHIS	B	CS	1	0187	MO	WC	FC	UK
3	SURV	38	FHIS	A	RHR	1	0187	MO	TS	FO	MP
4	SURV	27	FHIS	A	RCS	1	0187	MO	SP	OR	AW
5	ESF	400	87008	C	CVCS	1	0287	MO	MI	FC	UK
6	SURV	27	FHIS	A	CVCS	1	0287	MO	MD	OR	OA
7	SURV	27	FHIS	A	CVCS	1	0287	MO	MD	OR	OA
8	SURV	28	FHIS	A	CVCS	1	0287	MO	MD	OR	OA
9	SURV	72	FHIS	B	RHR	1	0287	MO	MD	FO	UK
10	SURV	41	FHIS	A	RHR	1	0287	MO	TS	FO	DD
11	SURV	98	FHIS	C	RCS	1	0387	MO	TS	FO	AW
12	SURV	65	FHIS	B	RHR	1	0387	MO	LS	FO	DC
13	SURV	32	FHIS	A	RHR	1	0387	MO	TS	FO	DC
14	SURV	28	FHIS	A	CVCS	1	0387	MO	MD	OR	MP
15	SURV	64	FHIS	B	HPI	1	0487	MO	SP	OR	AW
16	SURV	62	FHIS	B	CS	1	0487	MO	TS	FO	MP
17	SURV	66	FHIS	B	CS	1	0587	MO	LS	FO	OA
18	SURV	29	FHIS	A	RHR	1	0587	MO	LS	FO	OA
19	SURV	19	FHIS	A	AFW	1	0787	MO	TS	OR	DC
20	SURV	108	FHIS	C	HPI	1	0787	MO	MD	OR	UK
21	SURV	55	FHIS	B	RHR	1	0787	MO	MI	OR	UK
22	SURV	295	87015	A	RHR	1	0887	MO	TS	FO	MP
23	ESF	369	87017	B	CVCS	2	0887	MO	MI	FO	UK
24	SURV	10	FHIS	A	RCS	1	0887	MO	TS	FC	AW
25	SURV	61	FHIS	B	CS	1	0987	MO	TS	FO	MP
26	SURV	103	FHIS	C	RHR	1	0987	MO	MD	FO	MP
27	SURV	103	FHIS	C	AFW	1	0987	MO	MD	OR	MP
28	SURV	62	FHIS	B	RCS	1	1087	MO	MD	FO	AW

APPENDIX IV - TABLE I (CONTINUED)
PWR MOV ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
SURVEILLANCE TEST AND ESF FAILURES 1987-1995

ITEM NO.	ESF/ SURV/ SPTST	PLT ID NO.	DATA SRC.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
29	SURV	62	FHIS	B	RCS	1	1087	MO	TS	FO	DD
30	SURV	33	FHIS	A	CS	1	1287	MO	MI	OR	MP
31	SURV	27	FHIS	A	RHR	1	0188	MO	MI	FO	AW
32	SURV	64	FHIS	B	AFW	1	0188	MO	WC	OR	MP
33	SURV	76	FHIS	B	CVCS	1	0288	MO	TS	OR	UK
34	SURV	6	FHIS	A	CS	1	0288	MO	MD	FO	OA
35	SURV	35	FHIS	A	RHR	1	0288	MO	TS	FO	UK
36	ESF	281	88004	A	HPI	1	0388	MO	LS	FC	MP
37	SURV	28	FHIS	A	AFW	1	0388	MO	LS	FO	DC
38	SURV	97	FHIS	C	HPI	1	0488	MO	TS	FC	SD
39	SURV	35	FHIS	A	CS	1	0488	MO	TS	FC	MP
40	SURV	48	FHIS	B	HPI	1	0588	MO	MD	FC	AW
41	SURV	11	FHIS	A	RHR	1	0588	MO	TS	FO	OA
42	SURV	2	FHIS	A	AFW	1	0688	MO	TS	FC	OA
43	SURV	27	FHIS	A	RHR	1	0788	MO	TS	FO	AW
44	SURV	369	88020	B	HPI	1	0888	VB	STM	FO	MP
45	ESF	344	88028	B	AFW	1	0988	MO	MD	OR	MP
46	SURV	40	FHIS	A	CVCS	1	0988	VB	INT	FO	UK
47	SURV	54	FHIS	B	RHR	2	0988	MO	LS	OR	OA
48	SURV	99	FHIS	C	CS	1	1088	MO	TS	OR	AW
49	SURV	30	FHIS	A	HPI	1	1188	MO	MD	FO	OA
50	SURV	88	FHIS	C	AFW	1	1188	MO	MI	OR	UK
51	SURV	85	FHIS	C	CVCS	1	1188	MO	SP	OR	UK
52	SURV	11	FHIS	A	RHR	1	0189	MO	MD	FO	UK
53	SURV	91	FHIS	C	RHR	1	0289	VB	INT	FO	UK
54	SURV	35	FHIS	A	CS	1	0289	MO	SP	FC	MP
55	SURV	45	FHIS	A	CS	1	0289	MO	TS	FO	OA

APPENDIX IV - TABLE I (CONTINUED)
PWR MOV ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
SURVEILLANCE TEST AND ESF FAILURES 1987-1995

ITEM NO.	ESF/ SURV SPTST	PLT ID NO.	DATA SRC.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
56	SURV	10	FHIS	A	AFW	1	0289	MO	MD	FO	OA
57	ESF	108	FHIS	C	AFW	1	0289	MO	WC	FC	DC
58	SURV	295	89007	A	RHR	1	0389	VB	PKG	FO	AW
59	SURV	344	89009	B	RHR	1	0489	MO	WC	FO	DC
60	SURV	2	FHIS	A	RHR	1	0489	MO	TS	FO	MP
61	SURV	40	FHIS	A	RCS	1	0489	MO	MD	FO	UK
62	SURV	27	FHIS	A	CS	1	0589	VB	INT	FO	AW
63	SURV	27	FHIS	A	CS	1	0589	VB	INT	FO	UK
64	SURV	91	FHIS	C	CS	1	0689	MO	TS	OR	OA
65	SURV	109	FHIS	C	AFW	1	0689	MO	MI	OR	MP
66	SURV	106	FHIS	C	RHR	1	0689	MO	MI	FO	UK
67	SURV	8	FHIS	A	RHR	1	0689	MO	WC	OR	MP
68	SURV	61	FHIS	B	HPI	1	0689	MO	LS	OR	DC
69	SURV	61	FHIS	B	CS	1	0689	MO	MD	OR	OA
70	SURV	28	FHIS	A	AFW	1	0889	MO	LS	OR	UK
71	SURV	103	FHIS	C	CS	1	0889	MO	TS	FO	DD
72	SURV	23	FHIS	B	HPI	1	0889	MO	TS	FC	AW
73	ESF	389	89007	C	AFW	1	0989	MO	MD	OR	AW
74	SURV	85	FHIS	C	RHR	1	0989	MO	LS	FC	MP
75	SURV	82	FHIS	B	AFW	1	0989	VB	STM	OR	UK
76	SURV	58	FHIS	B	RHR	1	1089	MO	MD	FO	AW
77	SURV	44	FHIS	B	HPI	1	1089	MO	WC	FO	MP
78	SURV	66	FHIS	B	AFW	1	1089	MO	MD	FO	AW
79	SURV	44	FHIS	B	HPI	1	1089	MO	MI	OR	AW
80	SURV	40	FHIS	A	AFW	1	1089	MO	MD	FO	UK
81	SURV	109	FHIS	C	AFW	1	1089	MO	TS	OR	AW
82	SURV	85	FHIS	C	CS	1	1289	MO	WC	FC	MP
83	SURV	35	FHIS	A	HPI	1	1289	MO	TS	FC	MP

APPENDIX IV - TABLE I (CONTINUED)
PWR MOV ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
SURVEILLANCE TEST AND ESF FAILURES 1987-1995

ITEM NO.	ESF/ SURV/ SPTST	PLT ID NO.	DATA SRC.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
84	ESF	65	FHIS	B	CVCS	1	0190	VB	INT	OR	MP
85	SURV	35	FHIS	A	CS	1	0290	MO	TS	FO	MP
86	SURV	61	FHIS	B	CS	1	0390	MO	TS	FO	AW
87	SURV	8	FHIS	A	RHR	1	0390	MO	MI	OR	DD
88	SURV	39	FHIS	B	CVCS	1	0590	MO	LS	FC	AW
89	SURV	65	FHIS	B	RCS	1	0690	VB	INT	FO	DD
90	SURV	40	FHIS	A	RCS	1	0890	MO	MD	FC	UK
91	SURV	99	FHIS	C	RHR	1	0890	MO	TS	FO	0D
92	SURV	82	FHIS	B	HPI	1	1090	VB	PKG	FO	MP
93	SURV	13	FHIS	A	AFW	1	1090	MO	TS	FC	MP
94	SURV	87	FHIS	C	HPI	1	1090	MO	TS	FC	MP
95	SURV	72	FHIS	B	HPI	1	1190	MO	LS	FO	AW
96	SURV	109	FHIS	C	CS	1	0291	MO	MD	FC	DD
97	SURV	41	FHIS	A	RHR	1	0491	MO	SP	FO	AW
98	SURV	99	FHIS	C	CS	1	0491	MO	MD	FC	MP
99	SURV	21	FHIS	A	CS	1	0491	MO	MI	FC	UK
100	SPTST	45	FHIS	A	RHR	1	0491	MO	MI	FC	UK
101	SURV	109	FHIS	C	HPI	1	0491	MO	SP	FC	DD
102	SURV	85	FHIS	C	HPI	1	0491	MO	TS	OR	DC
103	SURV	6	FHIS	A	HPI	1	0491	MO	SP	FO	MF
104	SURV	85	FHIS	C	HPI	1	0591	MO	MI	FC	DD
105	SURV	28	FHIS	A	RHR	1	0591	VB	STM	FO	AW
106	SURV	28	FHIS	A	RHR	1	0591	MO	MI	FC	UK
107	SURV	28	FHIS	A	CS	1	0591	MO	MI	FO	AW
108	SURV	8	FHIS	A	HPI	1	0791	MO	LS	FC	MP
109	SURV	28	FHIS	A	RCS	1	0791	MO	WC	FO	DC
110	SURV	33	FHIS	A	HPI	1	0991	VB	INT	FC	MP
111	SURV	97	FHIS	C	HPI	1	1091	MO	MD	FC	DD

APPENDIX IV - TABLE I (CONTINUED)
PWR MOV ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
SURVEILLANCE TEST AND ESF FAILURES 1987-1995

ITEM NO.	ESF/ SURV/ SPTST	PLT ID NO.	DATA SRC.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
112	SURV	59	FHIS	B	HPI	1	1191	MO	MD	FO	UK
113	SURV	100	FHIS	C	AFW	1	1191	MO	MD	FO	AW
114	SURV	46	FHIS	B	CS	1	1291	MO	WC	FC	AW
115	SURV	35	FHIS	A	RHR	1	1291	MO	LS	OR	MP
116	SURV	95	FHIS	C	AFW	1	0192	MO	LS	FC	OA
117	SURV	38	FHIS	A	RHR	1	0292	MO	SP	FO	UK
118	SURV	21	FHIS	A	RHR	1	0292	MO	MD	FC	OA
119	SPTST	361	92006	C	CS	2	0392	MO	TS	FC	DD
120	SURV	302	92004	B	AFW	1	0592	MO	MI	FC	AW
121	ESF	483	92005	C	AFW	1	0492	MO	WC	FO	AW
122	SURV	104	FHIS	C	RHR	1	0492	MO	MD	OR	AW
123	SURV	72	FHIS	B	RHR	1	0492	MO	WC	FO	MP
124	SURV	31	FHIS	B	RCS	1	0492	MO	TS	FO	OA
125	SURV	88	FHIS	C	AFW	1	0492	MO	MD	FC	UK
126	SURV	104	FHIS	C	AFW	1	0592	VB	INT	FO	MP
127	SPTST	275	92010	C	HPI	1	0692	MO	SP	FO	MP
128	SURV	59	FHIS	B	AFW	1	0692	MO	MD	OR	AW
129	SURV	47	FHIS	B	AFW	1	0692	MO	MD	OR	AW
130	SURV	98	FHIS	C	AFW	1	0792	MO	LS	FO	DC
131	SURV	47	FHIS	B	AFW	1	0792	MO	MI	FC	UK
132	SURV	103	FHIS	C	AFW	1	0892	MO	WC	OR	MP
133	SURV	59	FHIS	B	AFW	1	0992	MO	MI	FO	UK
134	SURV	109	FHIS	C	RHR	1	1092	MO	TS	FC	DD
135	SURV	95	FHIS	C	RHR	1	1092	MO	SP	OR	AW
136	ESF	304	92005	A	CVCS	1	1192	MO	WC	OR	MP
137	SURV	41	FHIS	A	HPI	1	0992	MO	MI	FC	UK
138	SURV	103	FHIS	C	RHR	1	1192	MO	MI	OR	MP
139	SURV	105	FHIS	C	HPI	1	1192	MO	MI	FO	UK

APPENDIX IV - TABLE I (CONTINUED)
PWR MOV ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
SURVEILLANCE TEST AND ESF FAILURES 1987-1995

ITEM NO.	ESF/ SURV/ SPTST	PLT ID NO.	DATA SRC.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
140	ESF	109	FHIS	C	AFW	1	0293	MO	MI	FO	UK
141	SURV	8	FHIS	A	RHR	1	0393	MO	MD	FO	MP
142	SURV	106	FHIS	C	RHR	1	0393	MO	MI	FC	MP
143	SURV	97	FHIS	C	RCS	1	0393	MO	TS	FO	AW
144	SPTST	305	93011	A	AFW	1	0493	MO	TS	FC	MP
145	SURV	108	FHIS	C	CS	1	0493	MO	MD	OR	DD
146	SURV	76	FHIS	B	CS	1	0793	MO	MI	FO	AW
147	SURV	58	FHIS	B	CS	1	0893	MO	TS	FO	MP
148	SURV	105	FHIS	C	RHR	1	0893	MO	MI	FO	MP
149	SURV	16	FHIS	A	HPI	1	0993	VB	STM	FC	UK
150	SURV	107	FHIS	C	HPI	1	1093	MO	MI	FO	AW
151	SURV	45	FHIS	A	CVCS	1	1093	MO	TS	FC	UK
152	SURV	47	FHIS	B	CS	1	1293	MO	TS	FC	AW
153	SURV	47	FHIS	B	RCS	1	1293	MO	TS	FC	DF
154	SURV	107	FHIS	C	CS	1	0194	MO	TS	FC	DD
155	SURV	295	94004	A	CVCS	2	0394	MO	WC	FO	MP
156	SURV	104	FHIS	C	HPI	1	0894	MO	WC	FO	AW
157	SURV	529	94005	C	HPI	1	1094	VB	INT	FO	UK
158	SPTST	369	94008	B	AFW	3	1194	MO	TS	FC	MF
159	SURV	32	FHIS	A	AFW	1	1294	MO	TS	FC	DC
160	SURV	270	95001	A	RHR	1	0295	MO	WC	FO	DC
161	SURV	88	FHIS	C	RHR	1	0395	MO	MD	FC	MP
162	SURV	72	FHIS	B	HPI	1	0495	MO	MI	FO	AW
163	SURV	31	FHIS	B	RHR	1	0495	MO	TS	FC	DF
164	SURV	49	FHIS	B	HPI	1	0495	MO	MD	FO	MP
165	SURV	51	FHIS	C	AFW	1	0695	MO	WC	FC	DF
166	SURV	13	FHIS	A	RHR	1	0795	MO	MD	OR	AW
167	SURV	47	FHIS	B	RHR	1	1195	MO	TS	FC	MP

APPENDIX IV - TABLE I (CONTINUED)
PWR MOV ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
SURVEILLANCE TEST AND ESF FAILURES 1987-1995

ITEM NO.	ESF/ SURV/ SPTST	PLT ID NO.	DATA SRC.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
168	SURV	43	FHIS	A	CVCS	1	1195	MO	WC	OR	MP
169	SURV	528	95016	C	CS	1	1295	MO	MI	FC	MP

APPENDIX IV - TABLE IA
PWR MOV ASSEMBLIES - VALVE OPERATORS - SELECTED RI SYSTEMS DATA SOURCE INPUTS
ESF FAILURES 1996-1998

ITEM NO.	ESF	DKT NO.	LERS NO.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
1	YES	269	98005	A	HPI	1	0298	VB	STM	FO	UK

APPENDIX IV - TABLE II
BWR MOV ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
SURVEILLANCE TEST AND ESF FAILURES 1987-1995

ITEM NO.	ESF/ SURV/ SPTST	PLT ID NO.	DATA SRC.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
1	ESF	324	87001	B	HPCI	1	0187	MO	MI	FO	UK
2	SURV	5	FHIS	A	RHR	1	0287	MO	MD	FO	UK
3	SURV	254	87004	A	HPCI	1	0387	MO	LS	FC	OA
4	ESF	324	87004	B	HPCI	1	0387	MO	MI	FO	UK
5	SURV	90	FHIS	C	HPCS	1	0387	MO	LS	FC	DC
6	SURV	56	FHIS	B	RCIC	1	0387	MO	WC	FC	MP
7	SURV	3	FHIS	A	LPCS	1	0387	MO	SP	OR	MP
8	SURV	5	FHIS	A	LPCS	1	0487	MO	TS	OR	MP
9	SURV	101	FHIS	C	RCIC	1	0487	MO	MI	FO	UK
10	SURV	352	87015	C	HPCI	1	0587	MO	MD	OR	MP
11	SURV	5	FHIS	A	CS	1	0587	MO	LS	FO	OA
12	SURV	56	FHIS	B	LPCS	1	0587	MO	SP	FC	MP
13	SURV	5	FHIS	A	CS	1	0687	MO	LS	FO	OA
14	SURV	63	FHIS	C	HPCI	1	0687	MO	TS	FC	OA
15	SURV	69	FHIS	C	HPCI	1	0887	MO	WC	OR	UK
16	SURV	249	87015	A	HPCI	1	0987	MO	MD	OR	OD
17	SURV	22	FHIS	A	LPCS	1	0987	VB	INT	OR	UK
18	SURV	5	FHIS	A	RHR	1	1087	MO	TS	FO	DC
19	SURV	80	FHIS	B	RHR	1	1087	MO	SP	FO	AW
20	SURV	325	87023	B	HPCI	1	1287	MO	MI	FO	DD
21	SURV	22	FHIS	A	CS	1	1287	MO	MD	OR	DD
22	SURV	254	88003	A	HPCI	1	0188	MO	LS	FO	MP
23	SURV	331	88001	B	RCIC	1	0188	MO	SP	OR	AW
24	SURV	101	FHIS	C	RHR	1	0288	VB	INT	FO	DD
25	SURV	57	FHIS	B	HPCI	1	0388	MO	MI	FO	MP
26	SURV	69	FHIS	C	RHR	1	0388	MO	MI	OR	UK
27	SURV	84	FHIS	C	HPCS	1	0388	MO	LS	FO	OA
28	SURV	37	FHIS	A	RHR	1	0388	MO	LS	FC	MP

APPENDIX IV - TABLE II (CONTINUED)
BWR MOV ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
SURVEILLANCE TEST AND ESF FAILURES 1987-1995

ITEM NO.	ESF/ SURV/ SPTST	PLT ID NO.	DATA SRC.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
29	SURV	53	FHIS	B	HPCI	1	0488	MO	MI	FO	OD
30	SURV	325	88012	B	HPCI	1	0588	MO	MI	FO	MP
31	SURV	22	FHIS	A	LPCS	1	0588	MO	LS	FO	OD
32	SURV	77	FHIS	B	RHR	1	0588	MO	TS	OR	AW
33	ESF	73	FHIS	B	RCIC	1	0588	MO	LS	OR	AW
34	SURV	53	FHIS	B	HPCI	1	0588	MO	MI	FO	MP
35	SURV	84	FHIS	C	CS	1	0688	MO	MD	OR	UK
36	SURV	37	FHIS	A	RCIC	1	0688	MO	TS	FO	MP
37	SURV	9	FHIS	A	RHR	1	0688	MO	MI	OR	DC
38	SURV	325	88017	B	HPCI	1	0788	MO	MI	FO	DD
39	SURV	69	FHIS	C	HPCI	1	0788	MO	WC	FC	DC
40	SURV	53	FHIS	B	HPCI	1	0788	MO	LS	FO	MP
41	SURV	63	FHIS	C	HPCI	1	0788	MO	WC	FO	MP
42	SURV	12	FHIS	A	HPCI	1	0988	MO	MD	FC	MF
43	SURV	7	FHIS	A	RHR	1	1088	MO	MD	OR	OA
44	SURV	9	FHIS	A	HPCI	1	1288	MO	MD	FO	AW
45	SURV	102	FHIS	C	RHR	1	0189	MO	MP	FC	MP
46	SURV	37	FHIS	A	RCIC	1	0289	MO	MI	OR	OD
47	SURV	9	FHIS	A	CS	1	0289	MO	MD	FO	AW
48	SURV	84	FHIS	C	HPCS	1	0289	MO	MD	OR	MF
49	SURV	53	FHIS	B	RHR	1	0289	MO	LS	OR	DC
50	SURV	50	FHIS	B	HPCI	1	0389	MO	MD	FO	DD
51	SURV	69	FHIS	C	HPCI	1	0389	MO	WC	FC	DC
52	SURV	57	FHIS	B	RHR	1	0389	MO	TS	FO	DC
53	SURV	293	89013	A	HPCI	1	0389	MO	TS	FO	MP
54	SURV	237	89014	A	HPCI	1	0489	MO	MI	FO	OD
55	SURV	4	FHIS	A	RHR	1	0489	MO	MI	FO	MP
56	SURV	8	FHIS	A	RHR	1	0589	MO	LS	FO	OA

APPENDIX IV - TABLE II (CONTINUED)
BWR MOV ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
SURVEILLANCE TEST AND ESF FAILURES 1987-1995

ITEM NO.	ESF/ SURV/ SPTST	PLT ID NO.	DATA SRC.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
57	SURV	4	FHIS	A	LPCS	1	0689	MO	LS	FO	OA
58	SURV	77	FHIS	B	RCIC	1	0689	VB	STM	FO	UK
59	SURV	52	FHIS	B	RHR	2	0689	VB	INT	FO	UK
60	SURV	271	89014	A	RCIC	1	0789	MO	MI	FC	AW
61	SURV	25	FHIS	B	RHR	1	0789	MO	MI	FC	MP
62	SURV	69	FHIS	C	HPCI	1	0889	MO	TS	FO	MP
63	SURV	333	89021	B	RCIC	1	1089	MO	MI	OR	MF
64	SURV	84	FHIS	C	LPCS	1	1089	MO	LS	FC	OA
65	SURV	12	FHIS	A	RHR	1	1089	MO	MI	FC	MF
66	SURV	67	FHIS	C	LPCS	1	1289	MO	LS	FO	OA
67	SURV	17	FHIS	A	RHR	1	1289	MO	MI	FC	DD
68	ESF	366	90001	B	HPCI	1	0190	MO	MI	FO	UK
69	SURV	57	FHIS	B	RHR	1	0190	MO	MI	FO	MP
70	SURV	90	FHIS	C	RCIC	1	0290	MO	WC	FC	AW
71	SURV	22	FHIS	A	CS	1	0390	MO	MI	FO	DC
72	SURV	440	90009	C	RHR	1	0590	MO	MD	OR	MP
73	SURV	7	FHIS	A	LPCS	1	0590	MO	MD	FO	UK
74	SURV	4	FHIS	A	RHR	1	0590	MO	MI	FC	UK
75	SURV	37	FHIS	A	CS	1	0890	VB	STM	FO	II
76	SURV	12	FHIS	A	RHR	1	0890	MO	TS	FO	AW
77	SURV	5	FHIS	A	HPCI	1	0990	MO	MD	FO	MP
78	SURV	5	FHIS	A	HPCI	1	1290	MO	WC	FC	MP
79	SURV	69	FHIS	C	RCIC	1	1290	MO	LS	FO	DC
80	SURV	102	FHIS	C	RCIC	1	0291	MO	MD	FO	MP
81	SURV	53	FHIS	B	RCIC	1	0291	MO	LS	FO	MP
82	SURV	69	FHIS	C	HPCI	1	0291	MO	LS	OR	UK
83	SURV	34	FHIS	A	LPCS	1	0291	MO	MD	FC	AW
84	SURV	73	FHIS	B	RCIC	1	0491	MO	MI	FO	AW

APPENDIX IV - TABLE II (CONTINUED)
BWR MOV ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
SURVEILLANCE TEST AND ESF FAILURES 1987-1995

ITEM NO.	ESF/ SURV/ SPTST	PLT ID NO.	DATA SRC.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
85	SURV	81	FHIS	C	RCIC	1	0491	MO	LS	FO	OA
86	SURV	254	91029	A	RCIC	1	0491	MO	LS	FO	UK
87	SURV	254	91012	A	HPCI	1	0591	MO	MD	FO	MF
88	SURV	26	FHIS	B	RCIC	1	0591	MO	MI	FO	UK
89	SURV	22	FHIS	A	RHR	1	0691	MO	MI	FC	OD
90	SURV	73	FHIS	B	RHR	1	0791	MO	TS	FC	AW
91	SURV	69	FHIS	C	HPCI	1	0991	MO	TS	FO	UK
92	SURV	50	FHIS	B	RCIC	1	1191	MO	MD	FO	UK
93	SURV	324	91020	B	HPCI	1	1291	MO	LS	FO	MP
94	SURV	52	FHIS	B	HPCI	1	1291	MO	MD	FO	MP
95	SPTST	333	92002	B	LPCS	1	0192	VB	STM	FC	MP
96	SPTST	333	92002	B	LPCS	1	0192	MO	SP	FC	AW
97	SPTST	333	92002	B	RHR	3	0192	VB	STM	FC	MP
98	SPTST	333	92002	B	HPCI	1	0192	VB	STM	FC	MP
99	SURV	7	FHIS	A	CS	1	0392	VB	INT	FO	UK
100	SURV	73	FHIS	B	RHR	1	0492	MO	MI	OR	OA
101	SURV	80	FHIS	B	HPCI	1	0592	MO	TS	FO	AW
102	SURV	84	FHIS	C	RHR	1	0592	MO	WC	FO	UK
103	SURV	298	92008	A	HPCI	1	0692	MO	MD	OR	MP
104	SURV	26	FHIS	B	LPCS	1	0692	MO	WC	FO	UK
105	SURV	37	FHIS	A	RCIC	1	0792	VB	PKG	FO	AW
106	SURV	86	FHIS	C	HPCS	1	0792	MO	TS	FO	DD
107	SURV	78	FHIS	C	RCIC	1	0792	MO	MD	FO	MP
108	SURV	78	FHIS	C	RCIC	1	0892	MO	TS	FO	UK
109	SURV	73	FHIS	B	CS	1	0892	MO	MD	FO	AW
110	SURV	12	FHIS	A	RHR	1	0992	MO	MD	FC	MP
111	SURV	69	FHIS	C	RCIC	1	1092	MO	WC	FO	MP
112	SURV	73	FHIS	B	HPCI	1	1192	MO	WC	FO	AW

APPENDIX IV - TABLE II (CONTINUED)
BWR MOV ASSEMBLIES - SELECTED RI SYSTEMS DATA SOURCE INPUTS
SURVEILLANCE TEST AND ESF FAILURES 1987-1995

ITEM NO.	ESF/ SURV/ SPTST	PLT ID NO.	DATA SRC.	PLT AGE	PLT SYS	NO. FAIL	DISC DATE	SUB COMP	COMP PART	FAIL MODE	FAIL CAUS
113	SURV	90	FHIS	C	RHR	1	1292	MO	LS	FO	DC
114	SURV	69	FHIS	C	HPCI	1	0193	MO	LS	FO	MP
115	SURV	293	93002	A	RCIC	1	0293	MO	MI	FO	DD
116	SURV	80	FHIS	B	HPCI	1	0293	MO	TS	FO	UK
117	SURV	18	FHIS	A	RHR	1	0593	MO	WC	FO	MP
118	SURV	63	FHIS	C	RHR	1	0693	MO	MD	FC	MP
119	SURV	298	93031	A	HPCI	1	0893	MO	MD	FO	DF
120	SURV	354	93005	C	HPCI	1	0893	MO	TS	FO	DD
121	SURV	56	FHIS	B	HPCI	1	1093	MO	MI	FO	AW
122	SURV	26	FHIS	B	RHR	1	1193	VB	STM	FC	MP
123	SURV	101	FHIS	C	RHR	1	1193	MO	WC	FC	OA
124	SURV	293	94002	A	HPCI	1	0394	MO	TS	FO	DD
125	SURV	22	FHIS	A	LPCS	1	0494	MO	MI	FC	OD
126	ESF	298	94010	A	RHR	1	0594	MO	TS	FC	DC
127	SURV	52	FHIS	B	RCIC	1	0694	MO	MI	FO	MP
128	SURV	12	FHIS	A	LPCS	1	0794	MO	MD	OR	MP
129	SURV	86	FHIS	C	RHR	1	0794	MO	WC	FO	DC
130	SURV	73	FHIS	B	RHR	1	0595	MO	MI	FO	DD
131	SURV	260	95005	B	HPCI	1	0695	MO	WC	FO	DC
132	SURV	278	95002	B	HPCI	1	0795	MO	MI	FO	UK
133	SURV	9	FHIS	A	HPCI	1	0995	MO	TS	FC	UK
134	SURV	73	FHIS	B	RCIC	1	1195	MO	MI	FO	AW

NOTE: There are no BWR MOV ESF failures during the 1996-1998 period.

APPENDIX IV - TABLE III
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
1	213	90017	AFW	0990	1	2	2
2	213	90018	AFW	0990	1	2	2
3	213	95016	AFW	0795	1	2	2
4	244	88003	AFW	0388	1	2	2
5	244	88005	AFW	0688	1	4	4
6	244	89004	AFW	0689	1	4	4
7	244	90007	AFW	0590	1	2	2
8	244	90012	AFW	0990	1	4	4
9	244	90013	AFW	1290	1	2	2
10	244	90018	AFW	1290	1	2	2
11	244	92002	AFW	0292	1	4	4
12	244	92003	AFW	0292	1	4	4
13	244	93006	AFW	1193	1	4	4
14	244	94007	AFW	0494	1	4	4
15	244	95008	AFW	0895	1	4	4
16	250	87001	AFW	0187	1	3	3
17	250	88004	AFW	0388	1	3	3
18	250	89005	AFW	0289	1	3	3
19	250	89020	AFW	1289	1	3	3
20	250	90011	AFW	0690	1	3	3
21	250	95007	AFW	1090	1	3	3
22	255	87029	AFW	0987	1	4	4
23	255	88006	AFW	0388	1	2	2
24	255	89020	AFW	0889	1	2	2
25	255	90001	AFW	0190	1	2	2
26	255	90002	AFW	0290	1	2	2
27	255	90003	AFW	0390	1	2	2
28	255	90014	AFW	0890	1	2	2
29	255	92034	AFW	0790	1	4	4
30	255	92035	AFW	0792	1	2	2
31	255	92037	AFW	0892	1	4	4
32	255	92039	AFW	1092	1	2	2
33	261	87018	AFW	0687	1	6	6
34	261	91011	AFW	0891	1	6	6
35	261	94016	AFW	0894	1	6	6
36	266	89006	AFW	0589	1	4	4
37	266	91008	AFW	0691	1	4	4
38	269	88009	AFW	0788	1	2	2
39	269	89001	AFW	0189	1	2	2
40	269	89002	AFW	0189	1	2	2
41	269	91011	AFW	1091	1	2	2
42	269	92004	AFW	0592	1	1	1
43	269	92015	AFW	1092	1	1	1
44	269	93008	AFW	0893	1	1	1
45	269	93010	AFW	1193	1	1	1
46	269	94002	AFW	0294	1	2	2
47	270	89004	AFW	0489	1	2	2
48	270	92004	AFW	1092	1	2	2
49	270	93001	AFW	0493	1	2	2
50	270	94002	AFW	0494	1	2	2
51	270	94005	AFW	0495	1	1	1
52	280	88003	AFW	0288	1	6	6
53	280	89004	AFW	0590	1	6	6
54	280	92001	AFW	0192	1	6	6
55	280	93001	AFW	0193	1	6	6

APPENDIX IV - TABLE III (CONTINUED)
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
56	280	93002	AFW	0293	1	6	6
57	280	94006	AFW	0594	1	6	6
58	280	95001	AFW	0195	2	6	12
59	280	95003	AFW	0495	1	6	6
60	281	88010	AFW	0388	1	6	6
61	281	89010	AFW	0989	1	6	6
62	281	90003	AFW	0590	1	6	6
63	281	90049	AFW	0890	1	6	6
64	281	91011	AFW	1291	1	6	6
65	281	92009	AFW	0792	1	6	6
66	281	93003	AFW	0893	1	6	6
67	281	93004	AFW	0893	1	6	6
68	281	93005	AFW	0893	1	6	6
69	281	93006	AFW	1193	1	6	6
70	281	95004	AFW	0595	1	6	6
71	281	95006	AFW	0695	1	6	6
72	281	95007	AFW	1195	1	6	6
73	282	89005	AFW	0589	1	2	2
74	282	89010	AFW	0789	1	2	2
75	282	93005	AFW	0293	1	2	2
76	287	91007	AFW	0791	1	3	3
77	287	92001	AFW	0192	1	3	3
78	287	92003	AFW	0692	1	3	3
79	287	93001	AFW	0193	1	3	3
80	287	94002	AFW	0894	1	3	3
81	287	94003	AFW	0894	1	3	3
82	295	94005	AFW	0494	1	8	8
83	301	87002	AFW	0887	1	2	2
84	302	88001	AFW	0188	1	2	2
85	302	88002	AFW	0188	1	2	2
86	302	88006	AFW	0288	1	2	2
87	302	89003	AFW	0189	1	4	4
88	302	89022	AFW	0689	1	4	4
89	302	89023	AFW	0689	1	4	4
90	302	90016	AFW	1090	1	4	4
91	302	91003	AFW	0491	1	4	4
92	302	91014	AFW	1191	1	4	4
93	302	91016	AFW	1191	1	4	4
94	302	91018	AFW	1291	1	4	4
95	302	92001	AFW	0392	1	2	2
97	302	92015	AFW	0792	1	4	4
98	302	92027	AFW	1292	1	4	4
99	304	88014	AFW	1288	1	6	6
100	306	90004	AFW	0990	1	4	4
101	306	90005	AFW	0990	1	2	2
102	306	90006	AFW	0990	1	2	2
103	306	92001	AFW	0292	1	2	2
104	306	92003	AFW	0392	1	2	2
105	306	94002	AFW	0794	1	4	4
106	306	95003	AFW	0695	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
107	313	87002	AFW	0587	1	6	6
108	313	87003	AFW	0887	1	6	6
109	313	87004	AFW	0887	1	6	6
110	313	87005	AFW	0887	1	6	6
111	313	88003	AFW	0288	1	3	3
112	313	88019	AFW	1288	1	3	3
113	313	89002	AFW	0189	1	6	6
114	313	89020	AFW	0589	1	3	3
115	313	89041	AFW	1289	1	6	6
116	313	89048	AFW	1289	1	6	6
117	313	91003	AFW	0491	1	6	6
118	313	91005	AFW	0591	1	6	6
119	313	92003	AFW	0492	1	6	6
120	313	94002	AFW	0494	1	6	6
121	313	95004	AFW	0495	1	6	6
122	315	87008	AFW	0687	1	17	17
123	315	87021	AFW	1087	1	17	17
124	315	88001	AFW	0188	1	17	17
125	315	88011	AFW	1088	1	8	8
126	315	88013	AFW	1188	1	8	8
127	315	89001	AFW	0189	1	17	17
128	315	89003	AFW	0389	1	8	8
129	315	91004	AFW	0591	1	17	17
130	315	95003	AFW	0795	1	8	8
131	315	95005	AFW	0795	1	8	8
132	316	87004	AFW	0687	1	17	17
133	316	87005	AFW	0687	1	8	8
134	316	87007	AFW	0787	1	17	17
135	316	87008	AFW	0787	1	17	17
136	316	89014	AFW	0887	1	8	8
137	316	90004	AFW	0690	1	8	8
138	316	90012	AFW	1290	1	17	17
139	316	90013	AFW	1290	1	17	17
140	316	91004	AFW	0391	1	17	17
141	316	91006	AFW	0891	1	17	17
142	316	91010	AFW	1191	1	17	17
143	316	93007	AFW	0893	1	17	17
144	316	94001	AFW	0294	1	8	8
145	316	94005	AFW	0894	1	8	8
146	316	94008	AFW	1294	1	8	8
147	316	95005	AFW	0895	1	17	17
148	316	95008	AFW	0995	1	8	8
149	327	88045	AFW	1188	1	1	1
150	327	88047	AFW	1288	1	1	1
151	327	89005	AFW	0289	1	1	1
152	327	90009	AFW	0590	1	1	1
153	327	90030	AFW	1190	1	1	1
154	327	92027	AFW	1292	1	1	1
155	327	94011	AFW	0794	1	1	1
156	327	94014	AFW	1194	1	1	1
157	327	95008	AFW	0695	1	1	1
158	328	88023	AFW	0588	1	1	1
159	328	88024	AFW	0588	1	1	1

APPENDIX IV - TABLE III (CONTINUED)
PWR MOV ASSEMBLIES -AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
160	328	88027	AFW	0688	1	1	1
161	328	88028	AFW	0688	1	1	1
162	328	89008	AFW	0789	1	1	1
163	328	91001	AFW	0191	1	1	1
164	328	91006	AFW	1191	1	1	1
165	328	91007	AFW	1295	1	1	1
166	335	87013	AFW	0687	1	2	2
167	335	87017	AFW	1287	1	4	4
168	335	88003	AFW	0388	1	4	4
169	335	88004	AFW	0688	1	2	2
170	335	88008	AFW	0988	1	2	2
171	335	91003	AFW	0591	1	2	2
172	335	91005	AFW	0791	1	3	3
173	335	91006	AFW	0991	1	3	3
174	335	94001	AFW	0194	1	2	2
175	335	95010	AFW	1195	1	2	2
176	338	87020	AFW	1187	1	4	4
177	338	88002	AFW	0188	1	4	4
178	338	88005	AFW	0188	1	4	4
179	338	88020	AFW	0888	1	4	4
180	338	89005	AFW	0289	1	4	4
181	338	89017	AFW	1289	1	4	4
182	338	94005	AFW	0994	1	4	4
183	339	90003	AFW	0890	1	4	4
184	339	90010	AFW	1190	1	4	4
185	339	93002	AFW	0493	1	4	4
186	339	93003	AFW	0493	1	4	4
187	344	87024	AFW	0887	1	4	4
188	344	88026	AFW	0888	1	4	4
189	344	88028	AFW	0988	1	4	4
190	344	88044	AFW	1188'	1	4	4
191	344	89010	AFW	0989	1	4	4
192	344	89017	AFW	0889	1	4	4
193	344	90033	AFW	0790	1	4	4
194	344	90034	AFW	0890	1	4	4
195	344	91004	AFW	0291	1	4	4
196	344	92020	AFW	0792	1	4	4
197	344	92027	AFW	0992	1	4	4
198	344	92028	AFW	0992	1	4	4
199	346	87001	AFW	0187	1	6	6
200	346	87006	AFW	0387	1	6	6
201	346	91008	AFW	1291	1	6	6
202	346	93005	AFW	1093	1	6	6
203	348	87002	AFW	0187	1	2	2
204	348	87003	AFW	0187	1	4	4
205	348	87004	AFW	0187	1	2	2
206	348	87010	AFW	0587	1	2	2
207	348	88021	AFW	1088	1	2	2
208	348	89006	AFW	1189	1	2	2
209	348	90005	AFW	0790	1	2	2
210	348	91006	AFW	0591	1	2	2
211	348	91007	AFW	0691	1	2	2
212	348	91008	AFW	0891	1	2	2
213	348	91009	AFW	0891	1	2	2
214	348	91010	AFW	1091	1	2	2

APPENDIX IV - TABLE III (CONTINUED)
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
215	348	92008	AFW	1292	1	2	2
216	348	95010	AFW	1195	1	2	2
217	361	87001	AFW	0287	1	2	2
218	361	87004	AFW	0387	1	2	2
219	361	87031	AFW	1287	1	4	4
220	361	89005	AFW	0289	1	2	2
221	361	90016	AFW	1290	1	4	4
222	361	92008	AFW	0492	1	2	2
223	361	92012	AFW	0792	1	4	4
224	362	87011	AFW	0687	1	4	4
225	362	87017	AFW	1087	1	2	2
226	362	88002	AFW	0288	1	2	2
227	362	89001	AFW	0189	1	2	2
228	362	89006	AFW	0489	1	4	4
229	362	90002	AFW	0290	1	4	4
230	362	91001	AFW	0391	1	2	2
231	362	92003	AFW	0592	1	2	2
232	362	92004	AFW	0792	1	4	4
233	362	93004	AFW	0793	1	4	4
234	364	87001	AFW	0287	1	2	2
235	364	89007	AFW	0589	1	2	2
236	364	89008	AFW	0589	1	2	2
237	364	89010	AFW	0989	1	2	2
238	364	89012	AFW	1089	1	2	2
239	364	89015	AFW	1189	1	2	2
240	364	91001	AFW	0491	1	2	2
241	364	91002	AFW	0491	1	2	2
242	364	91004	AFW	0491	1	2	2
243	364	91005	AFW	0891	1	2	2
244	364	92001	AFW	0192	1	2	2
245	364	92002	AFW	0392	1	2	2
246	364	92003	AFW	0592	1	2	2
247	364	92005	AFW	0592	1	2	2
248	364	92006	AFW	0592	1	2	2
249	364	92007	AFW	0592	1	2	2
250	364	92008	AFW	0592	1	2	2
251	364	92010	AFW	1092	1	2	2
252	364	93001	AFW	0293	1	2	2
253	368	87007	AFW	0987	1	8	8
254	368	87008	AFW	1187	1	8	8
255	368	88011	AFW	0888	1	8	8
256	368	88020	AFW	1288	2	4	8
257	368	89006	AFW	0489	1	8	8
258	368	89019	AFW	0889	1	4	4
259	368	89020	AFW	0989	1	4	4
260	368	89024	AFW	1289	1	8	8
261	368	90019	AFW	0890	1	4	4
262	368	90020	AFW	0990	1	4	4
263	368	91005	AFW	0291	1	8	8
264	369	87009	AFW	0487	1	4	4
265	369	87017	AFW	0887	1	8	8
266	369	87019	AFW	0987	1	4	4
267	369	87036	AFW	1287	1	4	4
268	369	88001	AFW	0188	1	4	4
269	369	88005	AFW	0388	1	4	4

APPENDIX IV - TABLE III (CONTINUED)
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
270	369	88007	AFW	0488	1	4	4
271	369	88013	AFW	0688	1	4	4
272	369	88015	AFW	0688	1	4	4
273	369	89022	AFW	0889	1	4	4
274	369	90001	AFW	0190	1	4	4
275	369	90027	AFW	1090	1	4	4
276	369	90032	AFW	1190	1	4	4
277	369	91001	AFW	0291	1	8	8
278	369	92009	AFW	0692	1	8	8
279	369	95001	AFW	0195	1	4	4
280	369	95005	AFW	0995	1	8	8
281	369	95006	AFW	1095	1	4	4
282	370	87003	AFW	0187	1	4	4
283	370	87017	AFW	1187	1	8	8
284	370	88001	AFW	0188	1	4	4
285	370	88008	AFW	0788	1	4	4
286	370	89001	AFW	0389	1	4	4
287	370	89002	AFW	0389	1	8	8
288	370	89003	AFW	0489	1	4	4
289	370	89009	AFW	0989	1	4	4
290	370	91010	AFW	0991	1	4	4
291	370	91011	AFW	1091	1	4	4
292	370	91012	AFW	1191	1	4	4
293	370	92004	AFW	0392	1	4	4
294	370	92006	AFW	0492	1	8	8
295	370	92007	AFW	0592	1	4	4
296	370	92009	AFW	0892	1	4	4
297	370	92010	AFW	0892	1	4	4
298	370	93001	AFW	0293	1	4	4
299	370	93002	AFW	0393	1	4	4
300	370	93008	AFW	1293	1	8	8
301	382	87008	AFW	0387	1	1	1
302	382	87012	AFW	0487	1	1	1
303	382	87016	AFW	0587	1	1	1
304	382	88016	AFW	0688	1	1	1
305	382	88033	AFW	1288	1	1	1
306	382	89013	AFW	0789	1	1	1
307	382	89024	AFW	1289	1	1	1
308	382	90002	AFW	0390	1	1	1
309	382	91019	AFW	0891	1	1	1
310	382	91022	AFW	1191	1	1	1
311	382	93001	AFW	0393	1	1	1
312	389	87001	AFW	0387	1	5	5
313	389	87003	AFW	0487	1	2	2
314	389	87004	AFW	0487	1	2	2
315	389	89007	AFW	0989	1	5	5
316	389	90001	AFW	0190	1	5	5
317	389	90006	AFW	0190	1	4	4
318	389	91001	AFW	0391	1	4	4
319	389	92005	AFW	0792	1	2	2
320	389	92006	AFW	0892	1	2	2
321	389	95002	AFW	0295	1	2	2
322	400	87008	AFW	0287	1	4	4
323	400	87012	AFW	0387	1	4	4
324	400	87013	AFW	0387	1	4	4

APPENDIX IV - TABLE III (CONTINUED)
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
325	400	87014	AFW	0387	1	4	4
326	400	87017	AFW	0387	1	7	7
327	400	87018	AFW	0487	1	4	4
328	400	87019	AFW	0487	1	4	4
329	400	87021	AFW	0487	1	4	4
330	400	87024	AFW	0487	1	4	4
331	400	87025	AFW	0487	1	4	4
332	400	87026	AFW	0487	1	4	4
333	400	87028	AFW	0587	1	4	4
334	400	87031	AFW	0587	1	4	4
335	400	87035	AFW	0687	1	7	7
336	400	87037	AFW	0687	1	4	4
337	400	87029	AFW	0687	1	4	4
338	400	87041	AFW	0887	1	4	4
339	400	87042	AFW	0787	1	7	7
340	400	87046	AFW	0787	1	4	4
341	400	87047	AFW	0887	1	4	4
342	400	87048	AFW	0987	1	4	4
343	400	87049	AFW	0987	1	4	4
344	400	87051	AFW	0887	1	4	4
345	400	87062	AFW	1187	1	7	7
346	400	87063	AFW	1187	1	4	4
347	400	88007	AFW	0388	1	4	4
348	400	88018	AFW	0788	1	4	4
349	400	88028	AFW	1088	1	4	4
350	400	89001	AFW	0189	1	7	7
351	400	89003	AFW	0289	1	7	7
352	400	89004	AFW	0289	1	4	4
353	400	89005	AFW	0289	1	7	7
354	400	89006	AFW	0389	1	4	4
355	400	89019	AFW	1289	1	7	7
356	400	89021	AFW	1289	1	7	7
357	400	91009	AFW	0591	1	4	4
358	400	91010	AFW	0691	1	7	7
359	400	91015	AFW	0591	1	4	4
360	400	92007	AFW	0792	1	4	4
361	400	92008	AFW	0792	1	4	4
362	400	92009	AFW	0792	1	4	4
363	400	92010	AFW	0792	1	7	7
364	400	93007	AFW	0593	1	7	7
365	400	95010	AFW	1095	1	4	4
366	413	87006	AFW	0187	1	8	8
367	413	87013	AFW	0387	1	8	8
368	413	87015	AFW	0487	1	8	8
369	413	87026	AFW	0787	1	5	5
370	413	87027	AFW	0787	1	5	5
371	413	87028	AFW	0787	1	8	8
372	413	87029	AFW	0787	1	8	8
373	413	88007	AFW	0188	1	8	8
374	413	89008	AFW	0389	1	8	8
375	413	89017	AFW	0689	1	8	8
376	413	89022	AFW	0889	1	8	8
377	413	91013	AFW	0691	1	8	8

APPENDIX IV - TABLE III (CONTINUED)
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
378	413	91015	AFW	0791	1	8	8
379	413	91018	AFW	0991	1	5	5
380	413	91019	AFW	0991	1	8	8
381	413	92008	AFW	0792	1	8	8
382	413	93006	AFW	0693	1	8	8
383	413	93007	AFW	0393	1	8	8
384	413	93008	AFW	0793	1	8	8
385	413	94001	AFW	0194	1	8	8
386	414	87002	AFW	0187	1	9	9
387	414	87003	AFW	0187	1	9	9
388	414	87007	AFW	0287	1	9	9
389	414	87010	AFW	0387	1	9	9
390	414	87013	AFW	0387	1	8	8
391	414	87018	AFW	0587	1	9	9
392	414	87019	AFW	0587	1	9	9
393	414	87021	AFW	0787	1	8	8
394	414	87025	AFW	0987	1	9	9
395	414	87027	AFW'	0987	1	9	9
396	414	87029	AFW	1187	1	5	5
397	414	88005	AFW	0288	1	8	8
398	414	88007	AFW	0288	1	8	8
399	414	88012	AFW	0388	1	9	9
400	414	88014	AFW	0488	1	8	8
401	414	88019	AFW	0588	1	9	9
402	414	88020	AFW	0588	1	8	8
403	414	88021	AFW	0688	1	9	9
404	414	88023	AFW	0688	1	9	9
405	414	88025	AFW	0688	1	9	9
406	414	88028	AFW	0988	1	8	8
407	414	88031	AFW	1188	1	9	9
408	414	89001	AFW	0189	1	9	9
409	414	89002	AFW	0189	1	9	9
410	414	89003	AFW	0289	1	9	9
411	414	89015	AFW	0689	1	8	8
412	414	90013	AFW	1090	1	9	9
413	414	91006	AFW	0491	1	8	8
414	414	91008	AFW	0591	1	9	9
415	414	92001	AFW	0192	1	9	9
416	414	92006	AFW	1292	1	9	9
417	414	93003	AFW	0993	1	9	9
418	414	94003	AFW	0794	1	8	8
419	414	94006	AFW	0994	1	9	9
420	414	94007	AFW	1094	1	9	9
421	414	95001	AFW	0295	1	9	9
422	414	95004	AFW	0495	1	9	9
423	414	95005	AFW	0595	1	8	8
424	424	87009	AFW	0387	1	11	11
425	424	87010	AFW	0387	1	11	11
426	424	87011	AFW	0387	1	11	11
427	424	87012	AFW	0487	1	10	10
428	424	87013	AFW	0487	1	10	10
429	424	87014	AFW	0487	1	11	11
430	424	87015	AFW	0487	1	10	10
431	424	87018	AFW	0487	1	11	11

APPENDIX IV - TABLE III (CONTINUED)
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
432	424	87025	AFW	0587	1	11	11
433	424	87026	AFW	0587	1	10	10
434	424	87027	AFW	0587	1	10	10
435	424	87030	AFW	0687	1	10	10
436	424	87033	AFW	0687	1	10	10
437	424	87035	AFW	0687	1	10	10
438	424	87039	AFW	0687	1	10	10
439	424	87041	AFW	0687	1	11	11
440	424	87047	AFW	0787	1	10	10
441	424	87050	AFW	0787	1	11	11
442	424	87063	AFW	1187	1	11	11
443	424	87066	AFW	1187	1	11	11
444	424	88001	AFW	0188	1	11	11
445	424	88006	AFW	0288	1	11	11
446	424	88008	AFW	0488	1	10	10
447	424	88013	AFW	0488	1	10	10
448	424	88022	AFW	0788	1	10	10
449	424	88024	AFW	0788	1	10	10
450	424	88025	AFW	0788	1	10	10
451	424	88044	AFW	1288	1	10	10
452	424	89005	AFW	0289	1	11	11
453	424	89012	AFW	0589	1	10	10
454	424	89018	AFW	1089	1	10	10
455	424	90001	AFW	0190	1	10	10
456	424	90011	AFW	0490	1	10	10
457	424	90016	AFW	0790	1	11	11
458	424	90023	AFW	1290	1	10	10
459	424	92008	AFW	0992	1	10	10
460	424	93006	AFW	0493	1	10	10
461	424	93008	AFW	0593	1	10	10
462	424	93009	AFW	0793	1	11	11
463	424	94001	AFW	0294	1	10	10
464	424	95002	AFW	0795	1	11	11
465	425	89006	AFW	0389	1	10	10
466	425	89015	AFW	0489	1	10	10
467	425	89018	AFW	0589	1	10	10
468	425	89019	AFW	0589	1	10	10
469	425	89020	AFW	0589	1	11	11
470	425	89021	AFW	0589	1	11	11
471	425	89023	AFW	0789	1	5	5
472	425	89024	AFW	0789	1	11	11
473	425	89027	AFW	1089	1	11	11
474	425	89029	AFW	1189	1	10	10
475	425	89031	AFW	1289	1	10	10
476	425	90002	AFW	0390	1	10	10
477	425	90007	AFW	0590	1	10	10
478	425	90008	AFW	0690	1	10	10
479	425	90009	AFW	0690	1	10	10
480	425	91005	AFW	0291	1	11	11
481	425	91006	AFW	0291	1	10	10
482	425	91007	AFW	0591	1	10	10
483	425	92002	AFW	0392	1	11	11
484	425	92010	AFW	0592	1	10	10

APPENDIX IV - TABLE III (CONTINUED)
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
485	425	93006	AFW	0993	1	11	11
486	425	94001	AFW	0194	1	11	11
487	425	94002	AFW	0194	1	11	11
488	443	87009	AFW	0387	1	9	9
489	443	90015	AFW	0690	1	18	18
490	443	90025	AFW	1190	1	18	18
491	443	91001	AFW	0291	1	18	18
492	443	91002	AFW	0391	1	18	18
493	443	91008	AFW	0691	1	18	18
494	443	91009	AFW	0791	1	18	18
495	443	92017	AFW	0992	1	18	18
496	443	92024	AFW	1192	1	18	18
497	443	92025	AFW	1292	1	18	18
498	443	93003	AFW	0193	1	18	18
499	443	93009	AFW	0593	1	18	18
500	443	93012	AFW	0793	1	18	18
501	443	93018	AFW	0993	1	18	18
502	443	95002	AFW	0695	1	18	18
503	445	90004	AFW	0390	1	8	8
504	445	90013	AFW	0590	1	1	1
505	445	90017	AFW	0590	1	8	8
506	445	90018	AFW	0690	1	8	8
507	445	90020	AFW	0790	1	8	8
508	445	90021	AFW	0790	1	8	8
509	445	90025	AFW	0890	1	8	8
510	445	90027	AFW	0890	1	8	8
511	445	90029	AFW	0990	1	8	8
512	445	90030	AFW	0990	1	8	8
513	445	90037	AFW	1190	1	8	8
514	445	91002	AFW	0191	1	8	8
515	445	91004	AFW	0291	1	8	8
516	445	91005	AFW	0291	1	1	1
517	445	91008	AFW	0391	1	8	8
518	445	91019	AFW	0691	1	8	8
519	445	91020	AFW	0791	1	8	8
520	445	91021	AFW	0791	1	8	8
521	445	91023	AFW	1091	1	8	8
522	445	92001	AFW	0192	1	8	8
523	445	92009	AFW	0592	1	8	8
524	445	92014	AFW	0692	1	9	9
525	445	92016	AFW	0692	1	8	8
526	445	92019	AFW	0792	1	8	8
527	445	92022	AFW	1092	1	8	8
528	445	95002	AFW	0595	1	8	8
529	445	95003	AFW	0695	1	9	9
530	445	95004	AFW	0695	1	9	9
531	445	95007	AFW	1195	1	8	8
532	454	87018	AFW	0887	1	8	8
533	454	87019	AFW	0887	1	8	8
534	454	88002	AFW	0488	1	8	8
535	454	88004	AFW	0788	1	8	8
536	454	88005	AFW	0888	1	8	8
537	454	89002	AFW	0189	1	8	8
538	454	90006	AFW	0590	1	8	8

APPENDIX IV - TABLE III (CONTINUED)
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
539	454	90010	AFW	0890	1	8	8
540	454	90011	AFW	0890	1	8	8
541	455	87005	AFW	0387	1	8	8
542	455	87006	AFW	0487	1	8	8
543	455	87007	AFW	0587	1	8	8
544	455	87009	AFW	0687	1	8	8
545	455	87011	AFW	0787	1	8	8
546	455	87016	AFW	0887	1	8	8
547	455	87018	AFW	1087	1	8	8
548	455	88004	AFW	0588	1	8	8
549	455	88006	AFW	0688	1	8	8
550	455	88008	AFW	0788	1	8	8
551	455	88009	AFW	0788	1	8	8
552	455	88012	AFW	1288	1	8	8
553	455	90010	AFW	1290	1	8	8
554	455	91005	AFW	1191	1	8	8
555	455	92003	AFW	0692	1	8	8
556	455	93003	AFW	0593	1	8	8
557	455	93008	AFW	1193	1	8	8
558	455	94003	AFW	0994	1	8	8
559	456	88025	AFW	1188	1	8	8
560	456	89004	AFW	0389	1	8	8
561	456	90007	AFW	0690	1	8	8
562	456	90021	AFW	1290	1	8	8
563	456	91012	AFW	1191	1	8	8
564	456	92022	AFW	1092	1	8	8
565	456	95004	AFW	0495	1	8	8
566	457	88006	AFW	0288	1	8	8
567	457	88012	AFW	0688	1	8	8
568	457	88013	AFW	0688	1	8	8
569	457	88014	AFW	0688	1	8	8
570	457	88016	AFW	0688	1	8	8
571	457	88018	AFW	0788	1	8	8
572	457	88019	AFW	0788	1	8	8
573	457	88020	AFW	0988	1	8	8
574	457	88028	AFW	1188	1	8	8
575	457	88029	AFW	1088	1	8	8
576	457	89002	AFW	0589	1	8	8
577	457	89004	AFW	0989	1	8	8
578	457	90010	AFW	0690	1	8	8
579	457	91006	AFW	1291	1	8	8
580	457	92001	AFW	0292	1	8	8
581	457	92002	AFW	0392	1	8	8
582	457	92006	AFW	0992	1	8	8
583	457	93007	AFW	1093	1	8	8
584	457	94002	AFW	0394	1	8	8
585	457	94005	AFW	0894	1	8	8
586	482	87002	AFW	0187	1	4	4
587	482	87004	AFW	0187	1	4	4
588	482	87005	AFW	0187	1	4	4
589	482	87017	AFW	0487	1	4	4
590	482	87022	AFW	0587	1	5	5
591	482	87027	AFW	0687	1	5	5
592	482	87030	AFW	0787	1	5	5

APPENDIX IV - TABLE III (CONTINUED)
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
593	482	87037	AFW	0987	1	5	5
594	482	87041	AFW	0987	1	4	4
595	482	89002	AFW	0189	1	4	4
596	482	89004	AFW	0289	1	4	4
597	482	90001	AFW	0290	1	4	4
598	482	90007	AFW	0590	1	4	4
599	482	90011	AFW	0590	1	4	4
600	482	90012	AFW	0590	1	4	4
601	482	90013	AFW	0590	1	4	4
602	482	90023	AFW	1090	1	5	5
603	482	91006	AFW	0591	1	5	5
604	482	92002	AFW	0292	1	4	4
605	482	92016	AFW	1192	1	5	5
606	482	94002	AFW	0194	1	4	4
607	482	95006	AFW	1195	1	5	5
608	483	87003	AFW	0487	1	4	4
609	483	87032	AFW	1187	1	4	4
610	483	88004	AFW	0288	1	4	4
611	483	88005	AFW	0488	1	4	4
612	483	88006	AFW	0488	1	4	4
613	483	88007	AFW	0588	1	4	4
614	483	88010	AFW	0988	1	4	4
615	483	88011	AFW	0988	1	1	1
616	483	89003	AFW	0389	1	4	4
617	483	89005	AFW	0589	1	4	4
618	483	89006	AFW	0589	1	4	4
619	483	89008	AFW	0689	1	1	1
620	483	90005	AFW	0590	1	4	4
621	483	90007	AFW	0690	1	4	4
622	483	90015	AFW	1190	1	5	5
623	483	90016	AFW	1190	1	4	4
624	483	90017	AFW	1290	1	4	4
625	483	91006	AFW	1191	1	4	4
626	483	92002	AFW	0192	1	4	4
627	483	92003	AFW	0192	1	4	4
628	483	92004	AFW	0392	1	4	4
629	483	92006	AFW	0592	1	4	4
630	483	92010	AFW	0992	1	4	4
631	483	95005	AFW	0895	1	4	4
632	483	95006	AFW	1095	1	4	4
633	498	88022	AFW	0288	1	5	5
634	498	88048	AFW	0888	1	2	2
635	498	89001	AFW	0189	1	5	5
636	498	89015	AFW	0789	1	5	5
637	498	90006	AFW	0790	1	5	5
638	498	90014	AFW	0690	1	4	4
639	498	90015	AFW	0690	1	4	4
640	498	90016	AFW	0790	1	5	5
641	498	90020	AFW	0790	1	5	5
642	498	90023	AFW	0790	1	5	5
643	498	90025	AFW	1190	1	5	5
644	498	91012	AFW	0491	1	5	5
645	498	91021	AFW	1091	1	5	5
646	498	91022	AFW	1091	1	5	5
647	498	92003	AFW	0392	1	5	5

APPENDIX IV - TABLE III (CONTINUED)
PWR MOV ASSEMBLIES - AFWSELECTED RI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
648	498	94009	AFW	0294	1	5	5
649	498	94015	AFW	0994	1	5	5
650	498	95001	AFW	0195	1	5	5
651	498	95009	AFW	0895	1	5	5
652	498	95013	AFW	1295	1	5	5
653	499	88022	AFW	0288	1	1	1
654	499	89009	AFW	0489	1	5	5
655	499	89011	AFW	0489	1	5	5
656	499	89013	AFW	0689	1	3	3
657	499	89016	AFW	0689	1	5	5
658	499	89017	AFW	0789	1	3	3
659	499	89019	AFW	0889	1	3	3
660	499	89021	AFW	0989	1	3	3
661	499	89022	AFW	0989	1	3	3
662	499	89026	AFW	1089	1	3	3
663	499	90002	AFW	0290	1	4	4
664	499	90004	AFW	0390	1	4	4
665	499	90005	AFW	0490	1	4	4
666	499	90013	AFW	0990	1	5	5
667	499	91001	AFW	0391	1	5	5
668	499	91003	AFW	0391	1	5	5
669	499	91004	AFW	0391	1	1	1
670	499	91010	AFW	1291	1	3	3
671	499	92001	AFW	0192	1	5	5
672	499	92003	AFW	0292	1	5	5
673	499	92010	AFW	1292	1	5	5
674	499	93001	AFW	0193	1	5	5
675	499	93004	AFW	0293	1	5	5
676	499	94007	AFW	0694	1	5	5
677	499	95008	AFW	1195	1	5	5
678	528	91009	AFW	0991	1	6	6
679	528	91010	AFW	1091	1	6	6
680	529	87008	AFW	0787	1	6	6
681	529	87010	AFW	0687	1	11	11
682	529	89001	AFW	0189	1	6	6
683	529	89003	AFW	0289	1	11	11
684	529	93004	AFW	1193	1	11	11
685	529	95005	AFW	0795	1	11	11
686	530	89001	AFW	0389	1	8	8
687	530	93001	AFW	0293	1	11	11
688	530	94005	AFW	0894	1	6	6

APPENDIX IV - TABLE IIIA
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1996-1998)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
1	244	96011	AFW	0896	1	2	2
2	244	96012	AFW	0896	1	4	4
3	255	98010	AFW	0798	1	4	4
4	261	97011	AFW	1197	1	6	6
5	261	98003	AFW	0498	1	6	6
6	261	98005	AFW	1098	1	6	6
7	269	96004	AFW	0296	1	2	2
8	269	97008	AFW	0797	1	2	2
9	270	98007	AFW	1198	1	2	2
10	280	98002	AFW	0298	1	6	6
11	280	98013	AFW	1198	1	6	6
12	281	96004	AFW	0696	1	6	6
13	281	96005	AFW	0896	1	6	6
14	281	96006	AFW	1296	1	6	6
15	281	97001	AFW	0297	1	6	6
16	281	97004	AFW	1297	1	6	6
17	282	96012	AFW	0696	1	4	4
18	282	97008	AFW	0697	1	4	4
19	282	98008	AFW	0698	1	4	4
20	287	96001	AFW	0396	1	3	3
21	295	96015	AFW	0496	1	4	4
22	301	96001	AFW	0596	1	2	2
23	302	96013	AFW	0496	1	4	4
24	302	96017	AFW	0596	1	8	8
25	302	98003	AFW	0298	1	8	8
26	313	96005	AFW	0596	1	6	6
27	313	96007	AFW	0996	1	6	6
28	313	97003	AFW	0797	1	3	3
29	313	98004	AFW	0998	1	3	3
30	313	98005	AFW	1298	1	6	6
31	315	96002	AFW	0396	1	17	17
32	316	96005	AFW	0596	1	8	8
33	316	97001	AFW	0397	1	17	17
34	323	97002	AFW	0397	1	1	1
35	323	97003	AFW	0797	1	1	1
36	323	97005	AFW	1097	1	1	1
37	327	96010	AFW	1196	1	1	1
38	327	97012	AFW	0897	1	1	1
39	327	98001	AFW	0598	1	1	1
40	335	96002	AFW	0296	1	2	2
41	335	98003	AFW	0198	1	2	2
42	338	96005	AFW	0896	1	4	4
43	339	96003	AFW	1196	1	4	4
44	369	96001	AFW	0296	1	4	4
45	369	96006	AFW	1196	1	4	4
46	369	97006	AFW	0597	1	4	4
47	369	97009	AFW	0997	1	8	8
48	369	98002	AFW	0298	1	8	8
49	370	96003	AFW	0596	1	4	4
50	370	97002	AFW	0797	1	4	4
51	370	98001	AFW	0298	1	8	8
52	382	96006	AFW	0596	1	1	1
53	382	98014	AFW	0798	1	1	1
54	389	96001	AFW	0196	1	5	5
55	389	96002	AFW	0696	1	5	5

APPENDIX IV - TABLE IIIA (CONTINUED)
PWR MOV ASSEMBLIES - AFW SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1996-1998)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
56	389	98006	AFW	0998	1	4	4
57	400	96008	AFW	0496	1	7	7
58	400	96018	AFW	0996	1	7	7
59	400	97001	AFW	0197	1	7	7
60	400	97016	AFW	0697	1	4	4
61	400	97019	AFW	0797	1	7	7
62	400	98007	AFW	1098	1	7	7
63	413	96005	AFW	0696	1	8	8
64	414	96001	AFW	0296	1	9	9
65	414	97006	AFW	0797	1	9	9
66	424	96006	AFW	0596	1	11	11
67	424	96012	AFW	1196	1	11	11
68	425	96006	AFW	1096	1	11	11
69	425	96008	AFW	1096	1	11	11
70	425	98003	AFW	0598	1	11	11
71	425	98005	AFW	0698	1	11	11
72	425	98007	AFW	0898	1	11	11
73	425	98008	AFW	0998	1	11	11
74	443	96001	AFW	0196	1	18	18
75	443	98014	AFW	1298	1	18	18
76	445	96001	AFW	0196	1	8	8
77	445	96002	AFW	0196	1	9	9
78	445	96003	AFW	0296	1	8	8
79	445	96007	AFW	0896	1	8	8
80	454	96011	AFW	0796	1	8	8
81	455	97003	AFW	1097	1	8	8
82	457	96005	AFW	0596	1	8	8
83	482	96006	AFW	0696	1	5	5
84	483	96003	AFW	1096	1	4	4
85	483	96005	AFW	1196	1	4	4
86	483	96006	AFW	1296	1	4	4
87	498	97012	AFW	1197	1	3	3
88	499	97004	AFW	0397	1	5	5
89	499	97005	AFW	0397	1	5	5
90	499	97006	AFW	0497	1	5	5
91	499	97007	AFW	1197	1	5	5
92	528	98002	AFW	0298	1	8	8

APPENDIX IV - TABLE IV
PWR MOV ASSEMBLIES - HPI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
1	213	95016	HPI	0795	1	4	4
2	244	88003	HPI	0388	1	4	4
3	244	88005	HPI	0688	1	4	4
4	244	90006	HPI	0590	1	4	4
5	247	88001	HPI	0188	1	6	6
6	247	91001	HPI	0191	1	6	6
7	247	92002	HPI	0192	1	6	6
8	250	87021	HPI	0787	1	1	1
9	250	87023	HPI	0987	1	1	1
10	250	89011	HPI	0689	1	1	1
11	250	90008	HPI	0489	1	1	1
12	250	94002	HPI	0594	1	1	1
13	251	89025	HPI	1189	1	1	1
14	261	89004	HPI	0289	1	3	3
15	261	92017	HPI	0892	1	3	3
16	266	87005	HPI	1187	1	4	4
17	266	91008	HPI	0691	1	4	4
18	269	89001	HPI	0189	1	1	1
19	269	89002	HPI	0189	1	1	1
20	269	91006	HPI	0591	1	1	1
21	269	93008	HPI	0893	1	1	1
22	269	93010	HPI	1193	1	1	1
23	269	94002	HPI	0294	1	1	1
24	270	92004	HPI	1092	1	1	1
25	270	94002	HPI	0494	1	1	1
26	272	89024	HPI	0689	1	3	3
27	272	91027	HPI	0891	1	1	1
28	272	94007	HPI	0794	2	3	6
29	275	89009	HPI	1089	1	3	3
30	275	90017	HPI	1290	1	3	3
31	275	91009	HPI	0591	1	3	3
32	280	87024	HPI	0987	1	4	4
33	280	90018	HPI	1290	1	4	4
34	280	93001	HPI	0193	2	4	8
35	285	92023	HPI	0792	1	8	8
36	285	93009	HPI	0593	1	8	8
37	285	94001	HPI	0294	1	8	8
38	286	87002	HPI	0287	1	6	6
39	286	87004	HPI	0487	1	6	6
40	286	87010	HPI	0987	1	6	6
41	287	91007	HPI	0791	1	1	1
42	295	87009	HPI	0487	1	3	3
43	295	91005	HPI	0591	1	3	3
44	295	92019	HPI	1092	1	1	1
45	301	88001	HPI	0488	1	4	4
46	302	87030	HPI	1187	1	4	4
47	302	88021	HPI	1088	1	4	4
48	302	91018	HPI	1291	1	1	1
49	304	88012	HPI	1288	1	3	3
50	309	88011	HPI	1288	1	6	6
51	311	88014	HPI	0688	1	3	3
52	311	89005	HPI	0389	1	3	3
53	311	90037	HPI	0990	1	1	1
54	311	91012	HPI	0891	1	1	1
55	313	89002	HPI	0189	1	2	2

APPENDIX IV - TABLE IV (CONTINUED)
PWR MOV ASSEMBLIES - HPI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
56	313	94002	HPI	0494	1	2	2
57	323	87003	HPI	0387	1	3	3
58	323	87004	HPI	0487	1	3	3
59	323	87016	HPI	0787	1	3	3
60	323	88008	HPI	0788	1	3	3
61	327	92011	HPI	0492	1	3	3
62	328	92011	HPI	0892	1	3	3
63	334	88007	HPI	0688	1	3	3
64	334	89007	HPI	0589	1	3	3
65	334	93013	HPI	1093	1	1	1
66	335	87010	HPI	0487	1	8	8
67	335	94009	HPI	1194	1	8	8
68	335	94010	HPI	1194	1	4	4
69	336	90015	HPI	0990	1	8	8
70	338	87017	HPI	0787	1	3	3
71	338	89017	HPI	1289	1	3	3
72	339	91009	HPI	0991	1	3	3
73	339	92007	HPI	0892	1	3	3
74	348	89006	HPI	1189	1	1	1
75	361	90014	HPI	1190	1	10	10
76	362	87011	HPI	0687	1	10	10
77	362	88002	HPI	0288	1	10	10
78	362	89001	HPI	0189	1	10	10
79	364	93001	HPI	0293	1	3	3
80	368	88011	HPI	0888	1	4	4
81	368	88020	HPI	1288	1	8	8
82	369	87012	HPI	0787	1	1	1
83	369	87017	HPI	0887	1	3	3
84	369	88005	HPI	0388	1	1	1
85	369	91001	HPI	0291	1	3	3
86	370	93008	HPI	1293	1	3	3
87	382	89024	HPI	1289	1	8	8
88	382	91019	HPI	0891	1	8	8
89	382	91022	HPI	1191	1	8	8
90	395	88006	HPI	0588	1	3	3
91	400	87062	HPI	1187	1	3	3
92	400	95011	HPI	1195	1	3	3
93	412	87011	HPI	0787	1	6	6
94	412	87024	HPI	0987	1	6	6
95	412	92006	HPI	0592	1	6	6
96	412	93002	HPI	0193	1	6	6
97	413	88007	HPI	0188	1	2	2
98	413	89008	HPI	0389	1	2	2
99	414	88003	HPI	0288	1	1	1
100	414	89003	HPI	0289	1	2	2
101	414	89004	HPI	0289	1	2	2
102	423	89033	HPI	1289	1	3	3
103	423	89034	HPI	1289	1	1	1
104	423	90002	HPI	0190	1	1	1
105	424	88028	HPI	1088	1	3	3
106	424	94001	HPI	0294	1	3	3
107	425	89006	HPI	0389	1	3	3
108	443	87009	HPI	0387	1	3	3
109	443	87012	HPI	0487	1	1	1

APPENDIX IV - TABLE IV (CONTINUED)
PWR MOV ASSEMBLIES - HPI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
110	443	87015	HPI	0887	1	1	1
111	443	94001	HPI	0194	1	3	3
112	445	90004	HPI	0390	1	1	1
113	445	90020	HPI	0790	1	3	3
114	445	90021	HPI	0790	1	3	3
115	454	87019	HPI	0887	1	3	3
116	455	87016	HPI	0887	1	1	1
117	455	89001	HPI	0289	1	1	1
118	455	90001	HPI	0190	1	1	1
119	456	89002	HPI	0489	1	3	3
120	456	91013	HPI	1091	1	1	1
121	482	87002	HPI	0187	1	3	3
122	482	93009	HPI	0593	1	3	3
123	498	88018	HPI	1288	1	9	9
124	498	88022	HPI	0288	1	9	9
125	498	88026	HPI	0288	1	9	9
126	498	88049	HPI	0888	1	9	9
127	499	89011	HPI	0489	1	9	9
128	499	91010	HPI	1291	1	9	9
129	528	91010	HPI	1091	1	10	10
130	529	87010	HPI	0687	1	10	10
131	529	88005	HPI	0288	1	10	10
132	529	89003	HPI	0289	1	10	10
133	529	89009	HPI	0789	1	10	10
134	529	92006	HPI	1192	1	10	10
135	529	93001	HPI	0393	1	10	10
136	530	89001	HPI	0389	1	10	10
137	530	91010	HPI	1191	1	10	10
138	530	93001	HPI	0293	1	10	10

APPENDIX IV - TABLE IVA
PWR MOV ASSEMBLIES -HPI SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1996-1998)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
1	247	97009	HPI	0597	1	6	6
2	247	97010	HPI	0597	1	6	6
3	250	96007	HPI	0396	1	1	1
4	280	98013	HPI	1198	1	4	4
5	302	96017	HPI	0596	1	1	1
6	313	96005	HPI	0596	1	2	2
7	323	97005	HPI	1097	1	3	3
8	370	97001	HPI	0597	1	1	1
9	414	96001	HPI	0296	1	1	1
10	445	96001	HPI	0196	1	3	3

APPENDIX IV - TABLE V
PWR MOV ASSEMBLIES - CVCS SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
1	272	89024	CVCS	0689	1	10	10
2	272	94007	CVCS	0494	2	10	20
3	295	87009	CVCS	0487	1	8	8
4	295	91008	CVCS	0591	1	8	8
5	295	91016	CVCS	1191	1	8	8
6	295	92019	CVCS	1092	1	4	4
7	295	95022	CVCS	1195	1	1	1
8	304	88012	CVCS	1288	1	8	8
9	311	88014	CVCS	0688	1	10	10
10	311	89005	CVCS	0389	1	10	10
11	311	90037	CVCS	0990	1	10	10
12	369	87017	CVCS	0887	1	6	6
13	369	88005	CVCS	0388	1	6	6
14	369	89004	CVCS	0389	1	1	1
15	369	91001	CVCS	0291	1	6	6
16	370	93003	CVCS	0393	1	1	1
17	370	93008	CVCS	1293	1	6	6
18	413	88007	CVCS	0188	1	9	9
19	413	89008	CVCS	0389	1	5	5
20	414	88003	CVCS	0288	1	5	5
21	414	89003	CVCS	0289	1	9	9
22	414	89004	CVCS	0289	1	9	9
23	424	88028	CVCS	1088	1	11	11
24	424	93006	CVCS	0493	1	11	11
25	424	94001	CVCS	0294	1	11	11
26	425	89006	CVCS	0389	1	11	11
27	443	87009	CVCS	0387	1	11	11
28	443	87012	CVCS	0487	1	6	6
29	443	87015	CVCS	0887	1	6	6
30	443	94001	CVCS	0194	1	11	11
31	445	90004	CVCS	0390	1	5	5
32	445	90020	CVCS	0790	1	10	10
33	445	90021	CVCS	0790	1	10	10
34	445	90037	CVCS	1190	1	1	1
35	445	91022	CVCS	0990	1	1	1
36	445	92016	CVCS	0692	1	10	10
37	482	87002	CVCS	0187	1	10	10
38	482	90023	CVCS	1090	1	1	1
39	482	93009	CVCS	0593	1	10	10

APPENDIX IV - TABLE VA
PWR MOV ASSEMBLIES - CVCS SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1996-1998)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
1	370	97001	CVCS	0597	1	6	6
2	413	97011	CVCS	1297	1	9	9
3	414	96001	CVCS	0296	1	5	5
4	445	96001	CVCS	0196	1	10	10

APPENDIX IV - TABLE VI
PWR MOV ASSEMBLIES - RHR SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1987-1995)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
1	244	95003	RHR	0495	1	2	2
2	255	95001	RHR	0395	1	2	2
3	295	92024	RHR	1292	1	1	1
4	295	93010	RHR	1193	1	1	1
5	295	95022	RHR	1195	1	1	1
6	302	87027	RHR	1087	1	1	1
7	302	87030	RHR	1187	1	1	1
8	313	90017	RHR	1290	1	1	1
9	346	80010	RHR	0590	1	1	1
10	348	95004	RHR	0495	1	2	2
11	382	89003	RHR	0289	1	2	2
12	529	93001	RHR	0393	1	5	5
13	530	93001	RHR	0293	1	5	5

APPENDIX IV - TABLE VIA
PWR MOV ASSEMBLIES - RHR SYSTEM DATA SOURCE INPUTS
ESF DEMANDS (1996-1998)

ITEM NO.	DOCKET NO.	LER NO.	PLANT SYSTEM	EVENT DATE	NO. OF ESFs	NO. OF MOVs	NO. OF MOV DEMANDS
1	266	96001	RHR	0496	1	1	1
2	306	98006	RHR	1298	1	1	1
3	315	98040	RHR	0896	1	5	5
4	348	96003	RHR	0696	1	2	2
5	364	98007	RHR	1198	1	2	2
6	400	97014	RHR	0597	1	4	4
7	529	96002	RHR	0496	1	5	5

APPENDIX IV - TABLE VII
BWR MOV ASSEMBLIES - RCIC SYSTEM DATA SOURCES
ESF DEMANDS (1987-1995)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
1	263	87003	RCIC	0487	1	4	4
2	263	91019	RCIC	0891	1	4	4
3	265	87013	RCIC	1087	1	3	3
4	277	89012	RCIC	0589	1	4	4
5	277	89033	RCIC	1289	1	4	4
6	277	92010	RCIC	0792	1	4	4
7	277	93004	RCIC	0393	1	4	4
8	278	92008	RCIC	1092	1	4	4
9	293	91024	RCIC	1091	1	3	3
10	293	93004	RCIC	0893	1	3	3
11	293	93022	RCIC	0993	1	3	3
12	298	87003	RCIC	0187	1	4	4
13	298	87009	RCIC	0287	1	4	4
14	298	87011	RCIC	0587	1	4	4
15	298	88021	RCIC	0888	1	4	4
16	298	89011	RCIC	1089	1	4	4
17	298	89026	RCIC	1189	1	4	4
18	298	89033	RCIC	1289	1	4	4
19	298	93038	RCIC	1293	1	4	4
20	298	94004	RCIC	0394	1	4	4
21	321	87011	RCIC	0787	1	5	5
22	321	87013	RCIC	0887	1	5	5
23	321	88013	RCIC	0988	1	5	5
24	321	88018	RCIC	1288	1	5	5
25	321	90013	RCIC	0690	1	5	5
26	321	91001	RCIC	0191	1	5	5
27	321	91017	RCIC	0991	1	5	5
28	321	92021	RCIC	0892	1	5	5
29	321	92024	RCIC	0992	1	5	5
30	321	93013	RCIC	1093	1	5	5
31	321	93016	RCIC	1293	1	5	5
32	324	87001	RCIC	0187	1	5	5
33	324	87004	RCIC	0387	1	5	5
34	324	88018	RCIC	1188	1	5	5
35	324	89009	RCIC	0689	1	5	5
36	324	90009	RCIC	0890	1	5	5
37	324	90015	RCIC	0990	4	5	20
38	324	90016	RCIC	1090	4	5	20
39	324	91001	RCIC	0191	1	5	5
40	324	92001	RCIC	0292	1	5	5
41	325	87019	RCIC	0787	1	5	5
42	325	91009	RCIC	0391	1	5	5
43	325	91018	RCIC	0791	1	5	5
44	325	92003	RCIC	0192	1	5	5
45	325	92005	RCIC	0292	1	5	5
46	325	95015	RCIC	0795	1	5	5
47	325	95018	RCIC	0995	1	5	5
48	331	87008	RCIC	0687	1	4	4
49	331	89003	RCIC	0289	1	4	4
50	331	89008	RCIC	0389	1	4	4
51	333	89020	RCIC	1189	1	3	3

APPENDIX IV - TABLE VII (CONTINUED)
BWR MOV ASSEMBLIES - RCIC SYSTEM DATA SOURCES
ESF DEMANDS (1987-1995)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
52	333	90009	RCIC	0390	1	3	3
53	333	93009	RCIC	0493	1	3	1
54	333	95013	RCIC	0995	1	3	1
55	341	87017	RCIC	0587	1	5	5
56	341	87025	RCIC	0687	1	5	5
57	341	88004	RCIC	0188	1	5	5
58	341	92012	RCIC	1192	1	5	5
59	341	93010	RCIC	0893	1	5	5
60	341	95004	RCIC	0495	1	5	5
61	352	87048	RCIC	0987	1	4	4
62	352	91009	RCIC	0491	1	4	4
63	353	90015	RCIC	0990	1	4	4
64	353	93001	RCIC	0193	1	4	4
65	353	94010	RCIC	1094	1	4	4
66	354	87017	RCIC	0287	1	3	3
67	354	87034	RCIC	0787	1	3	3
68	354	87037	RCIC	0887	1	3	3
69	354	87039	RCIC	0887	1	3	3
70	354	88012	RCIC	0488	1	3	3
71	354	88027	RCIC	1088	1	3	3
72	354	88029	RCIC	1188	1	3	3
73	354	90003	RCIC	0390	1	3	3
74	366	87003	RCIC	0187	1	5	5
75	366	87006	RCIC	0787	1	5	5
76	366	87007	RCIC	0737	1	5	5
77	366	87008	RCIC	0887	1	5	5
78	366	87009	RCIC	0887	1	5	5
79	366	88011	RCIC	0488	1	5	5
80	366	88017	RCIC	0588	1	5	5
81	366	88020	RCIC	0888	1	5	5
82	366	89005	RCIC	0989	1	5	5
83	366	92009	RCIC	0692	1	5	5
84	366	95001	RCIC	0795	1	5	5
85	373	92003	RCIC	0392	1	4	4
86	373	92008	RCIC	0692	1	4	4
87	373	93015	RCIC	0993	1	4	4
88	374	92005	RCIC	0392	1	4	4
89	374	92012	RCIC	0892	1	4	4
90	374	92013	RCIC	0992	1	4	4
91	374	92016	RCIC	1192	1	4	4
92	374	94008	RCIC	1094	1	4	4
93	374	94010	RCIC	1294	1	4	4
94	374	95001	RCIC	0195	1	4	4
95	387	87013	RCIC	0487	1	4	4
96	387	91008	RCIC	0791	1	4	4
97	388	87006	RCIC	0487	1	3	3
98	397	87002	RCIC	0387	1	4	4
99	397	88003	RCIC	0288	1	4	4
100	397	89002	RCIC	0189	1	4	4
101	397	91032	RCIC	11/91	1	4	4
102	397	93027	RCIC	0893	1	4	4

APPENDIX IV - TABLE VII (CONTINUED)
BWR MOV ASSEMBLIES - RCIC SYSTEM DATA SOURCES
ESF DEMANDS (1987-1995)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. TDPs	NO. TDP DEMANDS
103	397	95002	RCIC	0295	1	4	4
104	410	88001	RCIC	0188	1	3	3
105	410	88012	RCIC	0388	1	3	3
106	410	88014	RCIC	0388	1	3	3
107	410	89014	RCIC	0489	1	3	3
108	410	91023	RCIC	1291	1	3	3
109	416	89010	RCIC	0789	1	4	4
110	416	89016	RCIC	1189	1	4	4
111	416	90028	RCIC	1290	1	4	4
112	416	91007	RCIC	0791	1	4	4
113	416	95007	RCIC	0795	1	4	4
114	416	95008	RCIC	0795	1	4	4
115	440	87012	RCIC	0387	1	4	4
116	440	87064	RCIC	0987	1	4	4
117	440	87072	RCIC	1087	1	4	4
118	440	88012	RCIC	0488	1	4	4
119	440	90001	RCIC	0190	1	4	4
120	440	92017	RCIC	0992	1	4	4
121	440	95006	RCIC	0895	1	4	4
122	440	95006	RCIC	0995	1	4	4
123	440	95008	RCIC	0995	1	4	4
124	458	88018	RCIC	0888	1	4	4
125	458	88021	RCIC	0988	1	4	4
126	458	89004	RCIC	0289	1	4	4
127	458	89008	RCIC	0289	1	4	4
128	461	87001	RCIC	0187	1	3	3

APPENDIX IV - TABLE VIIA
BWR MOV ASSEMBLIES - RCIC SYSTEM DATA SOURCES
ESF DEMANDS (1996-1998)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
1	260	97001	RCIC	0497	1	6	6
2	271	98016	RCIC	0698	1	5	5
3	296	96002	RCIC	0496	1	6	6
4	296	96003	RCIC	0596	1	6	6
5	333	96003	RCIC	0296	1	3	3
6	333	99010	RCIC	0996	1	3	3
7	333	98004	RCIC	0598	1	3	3
8	333	98008	RCIC	0898	1	3	3
9	366	97007	RCIC	0497	1	5	5
10	366	97010	RCIC	1197	1	5	5
11	388	96004	RCIC	0796	1	3	3
12	397	98002	RCIC	0398	1	4	4
13	397	98003	RCIC	0398	1	4	4
14	416	98001	RCIC	0198	1	4	4
15	440	97001	RCIC	0197	1	4	4
16	440	98002	RCIC	0798	1	4	4

APPENDIX IV - TABLE VIII
BWR MOV ASSEMBLIES - HPCI SYSTEM DATA SOURCES
ESF DEMANDS (1987-1995)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
1	237	90002	HPCI	0190	1	4	4
2	249	89001	HPCI	0389	1	3	3
3	260	90005	HPCI	0590	1	2	2
4	260	94004	HPCI	0494	1	2	2
5	263	87009	HPCI	0487	1	2	2
6	263	91009	HPCI	0491	1	2	2
7	265	87013	HPCI	1087	1	3	3
8	265	87017	HPCI	1187	1	3	3
9	265	88027	HPCI	1188	1	3	3
10	271	95009	HPCI	0495	1	3	3
11	277	89012	HPCI	0589	1	3	3
12	277	89033	HPCI	1289	1	3	3
13	277	93004	HPCI	0393	1	3	3
14	278	90008	HPCI	0790	1	3	3
15	278	92008	HPCI	1092	1	3	3
16	293	90013	HPCI	0990	1	3	3
17	293	91024	HPCI	1291	1	3	3
18	293	93004	HPCI	0894	1	3	3
19	293	93022	HPCI	0993	1	3	3
20	298	87003	HPCI	0187	1	3	3
21	298	87009	HPCI	0287	1	3	3
22	298	88021	HPCI	0888	1	3	3
23	298	89026	HPCI	1189	1	3	3
24	298	90011	HPCI	1090	1	3	3
25	298	93038	HPCI	1293	1	3	3
26	298	94004	HPCI	0394	1	3	3
27	321	87011	HPCI	0787	1	3	3
28	321	87013	HPCI	0887	1	3	3
29	321	88018	HPCI	1288	1	3	3
30	321	89013	HPCI	0988	1	3	3
31	321	90013	HPCI	0690	1	3	3
32	321	91001	HPCI	0191	1	3	3
33	321	91007	HPCI	0291	1	3	3
34	321	91017	HPCI	0991	1	3	3
35	321	92021	HPCI	0892	1	3	3
36	321	92024	HPCI	0992	1	3	3
37	321	93013	HPCI	1093	1	3	3
38	321	93016	HPCI	1293	1	3	3
39	324	87001	HPCI	0187	1	3	3
40	324	87004	HPCI	0387	1	3	3
41	324	88018	HPCI	1188	1	3	3
42	324	89001	HPCI	0289	1	3	3
43	324	89009	HPCI	0689	1	3	3
44	324	90009	HPCI	0890	1	3	3
45	324	90015	HPCI	0990	1	3	3
46	324	90016	HPCI	1090	1	3	3
47	324	91001	HPCI	0191	1	3	3
48	324	91017	HPCI	0991	1	3	3
49	324	91021	HPCI	1291	1	3	3
50	324	92001	HPCI	0292	1	3	3
51	325	87017	HPCI	0687	1	3	3
52	325	87019	HPCI	0787	1	3	3
53	325	91009	HPCI	0391	1	3	3
54	325	91018	HPCI	0791	1	3	3

APPENDIX IV - TABLE VIII (CONTINUED)
BWR MOV ASSEMBLIES - HPCI SYSTEM DATA SOURCES
ESF DEMANDS (1987-1995)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
55	325	92003	HPCI	0192	1	3	3
56	325	94015	HPCI	1294	1	3	3
57	325	95015	HPCI	0795	1	3	3
58	325	95018	HPCI	0995	1	3	3
59	331	89003	HPCI	0289	1	3	3
60	331	89011	HPCI	0889	1	3	3
61	333	90009	HPCI	0390	1	3	3
62	333	93009	HPCI	0493	1	3	3
63	333	95013	HPCI	0995	1	3	3
64	341	88004	HPCI	0188	1	3	3
65	341	92012	HPCI	1192	1	3	3
66	341	93010	HPCI	0893	1	3	3
67	341	95004	HPCI	0495	1	3	3
68	352	87042	HPCI	0687	1	3	3
69	352	87048	HPCI	0987	1	3	3
70	352	91018	HPCI	0791	1	3	3
71	353	89013	HPCI	1189	1	3	3
72	353	90006	HPCI	0390	1	3	3
73	353	93005	HPCI	0393	1	3	3
74	353	94010	HPCI	1094	1	3	3
75	353	95006	HPCI	0395	1	3	3
76	354	87017	HPCI	0287	1	3	3
77	354	87030	HPCI	0787	1	3	3
78	354	87034	HPCI	0787	1	3	3
79	354	87037	HPCI	0887	1	3	3
80	354	87039	HPCI	0887	1	3	3
81	354	88012	HPCI	0488	1	3	3
82	354	88022	HPCI	0888	1	3	3
83	354	88027	HPCI	1088	1	3	3
84	354	88029	HPCI	1188	1	3	3
85	354	90003	HPCI	0390	1	3	3
86	354	90029	HPCI	1190	1	3	3
87	354	91008	HPCI	0591	1	3	3
88	354	91017	HPCI	0891	1	3	3
89	366	87003	HPCI	0187	1	3	3
90	366	87006	HPCI	0787	1	3	3
91	366	87008	HPCI	0487	1	3	3
92	366	87009	HPCI	0887	1	3	3
93	366	88011	HPCI	0488	1	3	3
94	366	88017	HPCI	0588	1	3	3
95	366	88020	HPCI	0888	1	3	3
96	366	89005	HPCI	0989	1	3	3
97	366	90001	HPCI	0190	1	3	3
98	366	92009	HPCI	0692	1	3	3
99	366	94007	HPCI	0894	1	3	3
100	366	95001	HPCI	0795	1	3	3
101	387	91008	HPCI	0791	1	3	3
102	388	87006	HPCI	0487	1	3	3

APPENDIX IV - TABLE VIIIA
BWR MOV ASSEMBLIES - HPCI SYSTEM DATA SOURCES
ESF DEMANDS (1996-1998)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
1	249	96004	HPCI	0596	1	3	3
2	260	97001	HPCI	0497	1	2	2
3	265	97001	HPCI	0297	1	3	3
4	293	96005	HPCI	0496	1	3	3
5	296	96002	HPCI	0496	1	2	2
6	296	96003	HPCI	0596	1	2	2
7	333	96003	HPCI	0296	1	3	3
8	333	96010	HPCI	0996	1	3	3
9	333	98004	HPCI	0598	1	3	3
10	333	98008	HPCI	0898	1	3	3
11	352	98001	HPCI	0198	1	3	3
12	366	97007	HPCI	0497	1	3	3
13	366	97010	HPCI	1197	1	3	3
14	388	96004	HPCI	0796	1	3	3

APPENDIX IV - TABLE IX
BWR MOV ASSEMBLIES - RHR SYSTEM DATA SOURCES
ESF DEMANDS (1987-1995)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
1	219	88002	RHR	1088	1	2	2
2	237	89005	RHR	0289	1	6	6
3	245	87033	RHR	0887	1	2	2
4	245	94014	RHR	0494	1	2	2
5	249	94019	RHR	1094	1	8	8
6	254	91004	RHR	0391	1	6	6
7	254	83019	RHR	0993	1	3	3
8	259	88003	RHR	1087	1	6	6
9	259	88049	RHR	1288	1	3	3
10	260	94012	RHR	1194	1	3	3
11	265	92009	RHR	0392	1	6	6
12	271	89016	RHR	0389	1	3	3
13	271	93018	RHR	1293	1	3	3
14	271	95009	RHR	0495	1	3	3
15	277	88028	RHR	1188	1	3	3
16	278	91008	RHR	0591	1	3	3
17	293	87024	RHR	1087	1	6	6
18	293	92011	RHR	0892	1	6	6
19	293	94003	RHR	0494	1	6	6
20	293	94006	RHR	0994	1	6	6
21	296	95005	RHR	1095	1	3	3
22	298	88003	RHR	0188	1	3	3
23	298	88018	RHR	0688	1	3	3
24	298	93010	RHR	0393	1	3	3
25	298	94005	RHR	0394	1	3	3
26	298	95021	RHR	1295	1	3	3
27	298	95022	RHR	1295	1	3	3
28	321	87028	RHR	0487	1	3	3
29	321	89008	RHR	0689	1	3	3
30	325	87021	RHR	0387	1	4	4
31	325	93008	RHR	0393	1	4	4
32	325	94001	RHR	0194	1	2	2
33	325	95004	RHR	0495	1	2	2
34	333	93005	RHR	0293	2	3	6
35	333	93012	RHR	0593	1	3	3
36	341	93010	RHR	0893	1	4	4
37	341	94001	RHR	0194	1	2	2
38	341	94010	RHR	1194	1	2	2
39	352	87019	RHR	0587	1	3	3
40	353	95006	RHR	0395	1	3	3
41	353	95010	RHR	0895	1	6	6
42	354	90029	RHR	1190	1	3	3
43	354	92004	RHR	0392	1	7	7
44	354	93009	RHR	1193	1	3	3
45	366	92023	RHR	1192	1	6	6
46	366	94003	RHR	0394	1	6	6
47	366	95007	RHR	1195	1	3	3
48	373	93001	RHR	0193	1	5	5
49	373	94007	RHR	0594	1	3	3
50	373	94009	RHR	0694	1	5	5
51	374	92005	RHR	0392	1	5	5
52	374	93003	RHR	0593	1	3	3
53	374	94010	RHR	1294	1	5	5
54	374	95001	RHR	0195	1	3	3

APPENDIX IV - TABLE IX (CONTINUED)
BWR MOV ASSEMBLIES - RHR SYSTEM DATA SOURCES
ESF DEMANDS (1987-1995)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
55	397	93019	RHR	0593	1	3	3
56	410	87077	RHR	1287	1	3	3
57	410	88014	RHR	0388	1	3	3
58	410	88051	RHR	0988	1	3	3
59	410	88054	RHR	0988	1	3	3
60	410	89004	RHR	0289	1	3	3
61	410	89010	RHR	0389	1	3	3
62	416	88011	RHR	0388	1	2	2
63	416	89004	RHR	0489	1	2	2
64	416	90002	RHR	1090	1	2	2
65	416	93010	RHR	1093	1	2	2
66	416	93011	RHR	1093	1	2	2
67	440	90037	RHR	1290	1	3	3
68	440	94017	RHR	0794	1	3	3
69	458	93010	RHR	0593	1	3	3
70	458	94018	RHR	0694	1	3	3
71	461	87001	RHR	0187	1	6	6
72	461	93003	RHR	1193	1	3	3

APPENDIX IV - TABLE IXA
BWR MOV ASSEMBLIES - RHR SYSTEM DATA SOURCES
ESF DEMANDS (1996-1998)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
1	259	96003	RHR	0496	1	3	3
2	271	98016	RHR	0698	1	6	6
3	293	96005	RHR	0496	1	6	6
4	293	96009	RHR	0996	1	6	6
5	293	97003	RHR	0297	1	6	6
6	293	97007	RHR	0497	1	6	6
7	293	97026	RHR	1297	1	6	6
8	298	97004	RHR	0597	1	6	6
9	325	96014	RHR	1096	1	2	2
10	333	96003	RHR	0296	1	6	6
11	341	96020	RHR	1296	1	2	2
12	397	98007	RHR	0598	1	3	3
13	440	97011	RHR	0997	1	3	3
14	458	97008	RHR	1097	1	3	3

APPENDIX IV - TABLE X
BWR MOV ASSEMBLIES - HPCS SYSTEM DATA SOURCES
ESF DEMANDS (1987-1995)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
1	373	89007	HPCS	0389	1	2	2
2	374	95007	HPCS	0595	1	2	2
3	397	87002	HPCS	0387	1	2	2
4	397	91032	HPCS	1191	1	2	2
5	410	88001	HPCS	0188	1	2	2
6	410	88012	HPCS	0388	1	2	2
7	410	88014	HPCS	0388	1	2	2
8	410	88043	HPCS	1088	1	2	2
9	410	89006	HPCS	0289	1	2	2
10	410	89014	HPCS	0489	1	2	2
11	410	91023	HPCS	1291	1	2	2
12	410	92008	HPCS	0392	1	2	2
13	416	88006	HPCS	0188	1	2	2
14	416	88019	HPCS	1088	1	2	2
15	416	90017	HPCS	0990	1	2	2
16	416	90028	HPCS	1290	1	2	2
17	416	91005	HPCS	0691	1	2	2
18	416	91007	HPCS	0791	1	2	2
19	416	93008	HPCS	0993	1	2	2
20	416	95007	HPCS	0795	1	2	2
21	416	95009	HPCS	0795	1	2	2
22	416	95011	HPCS	0995	1	2	2
23	440	87012	HPCS	0387	1	2	2
24	440	87014	HPCS	0387	1	2	2
25	440	87064	HPCS	0987	1	2	2
26	440	87072	HPCS	1087	1	2	2
27	440	90001	HPCS	0190	1	2	2
28	440	92017	HPCS	0992	1	2	2
29	440	93012	HPCS	0693	1	2	2
30	440	95005	HPCS	0895	1	2	2
31	440	95007	HPCS	0995	1	2	2
32	458	88018	HPCS	0888	1	2	2
33	458	88021	HPCS	0988	1	2	2
34	458	89042	HPCS	1289	1	2	2
35	458	93016	HPCS	0793	1	2	2
36	458	94023	HPCS	0994	1	2	2
37	461	87014	HPCS	0387	1	2	2
38	461	87022	HPCS	0487	1	2	2
39	461	87026	HPCS	0587	1	2	2
40	461	88006	HPCS	0188	1	2	2

APPENDIX IV - TABLE XA
BWR MOV ASSEMBLIES - HPCS SYSTEM DATA SOURCES
ESF DEMANDS (1996-1998)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
1	397	98002	HPCS	0398	1	2	2
2	440	96002	HPCS	0296	1	2	2
3	440	97001	HPCS	0197	1	2	2
4	440	97006	HPCS	0697	1	2	2
5	440	98002	HPCS	0798	1	2	2

APPENDIX IV - TABLE XI
BWR MOV ASSEMBLIES - LPCS SYSTEM DATA SOURCES
ESF DEMANDS (1987-1995)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
1	219	88002	LPCS	1088	1	4	4
2	219	91005	LPCS	0491	1	4	4
3	219	93008	LPCS	1293	1	2	2
4	237	89005	LPCS	0289	1	2	2
5	237	94012	LPCS	0494	1	2	2
6	245	90016	LPCS	1090	1	1	1
7	245	94014	LPCS	0494	1	2	2
8	260	88017	LPCS	1288	1	3	3
9	271	89016	LPCS	0389	1	2	2
10	298	88018	LPCS	0688	1	2	2
11	298	90004	LPCS	0490	1	2	2
12	321	94002	LPCS	0394	1	4	4
13	324	89008	LPCS	0689	1	2	2
14	325	87021	LPCS	0387	1	2	2
15	325	92018	LPCS	0791	1	2	2
16	341	88022	LPCS	0688	1	4	4
17	352	87019	LPCS	0587	1	2	2
18	352	90025	LPCS	1190	1	2	2
19	353	93003	LPCS	0293	1	2	2
20	353	95006	LPCS	0395	1	2	2
21	353	95010	LPCS	0895	1	4	4
22	354	92004	LPCS	0392	1	4	4
23	366	92023	LPCS	1192	1	4	4
24	373	93015	LPCS	0993	1	2	2
25	374	93003	LPCS	0593	1	2	2
26	374	95001	LPCS	0195	1	2	2
27	397	94014	LPCS	0794	1	1	1
28	410	88051	LPCS	0988	1	2	2

APPENDIX IV - TABLE XIA
BWR MOV ASSEMBLIES - LPCS SYSTEM DATA SOURCES
ESF DEMANDS (1996-1998)

ITEM NO.	DKT NO.	LER NO.	PLANT SYS.	EVENT DATE	NO. ESFs	NO. MOVs	NO. MOV DEMANDS
1	325	96017	LPCS	1296	1	2	2
2	397	98007	LPCS	0598	1	1	1

APPENDIX IV - TABLE XII
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
1	2	RCS	2	4	8	9	72
2	2	RHR	6	4	24	9	216
3	2	AFW	1	4	4	9	36
4	2	CS	1	4	4	9	36
5	2	HPI	4	4	16	9	144
6	6	RCS	2	4	8	9	72
7	6	RHR	9	4	36	9	324
8	6	AFW	4	4	16	9	144
9	6	CS	2	4	8	9	72
10	6	HPI	4	4	16	9	144
11	8	RCS	2	4	8	9	72
12	8	RHR	7	4	28	9	252
13	8	HPI	6	4	24	9	216
14	10	RCS	2	4	8	9	72
15	10	RHR	10	4	40	9	360
16	10	AFW	3	4	12	9	108
17A	10	HPI	4	0.67	2.67	9	
17B	10	HPI	2	4	8	9	96
18	11	RCS	2	4	8	9	72
19	11	RHR	10	4	40	9	360
20A	11	HPI	4	0.67	2.67	9	
20B	11	HPI	2	4	8	9	96
21	13	RCS	1	4	4	9	36
22	13	RHR	6	4	24	9	216
23	13	AFW	8	4	32	9	288
24	13	CVCS	1	4	4	9	36
25	13	HPI	8	4	32	9	288
26	16	RCS	2	4	8	9	72
27	16	RHR	14	4	56	9	504

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
28	16	AFW	6	4	24	9	216
29A	16	HPI	4	0.67	2.67	9	
29B	16	HPI	3	4	12	9	132
30	19	RCS	2	4	8	9	72
31	19	RHR	7	4	28	9	252
32	19	AFW	6	4	24	9	216
33	19	CVCS	1	4	4	9	36
34	19	HPI	4	4	16	9	144
35	20	RCS	1	4	4	9	36
36	20	RHR	9	4	36	9	324
37	20	AFW	3	4	12	9	108
38A	20	CVCS	2	0.67	1.33	9	
38B	20	CVCS	2	4	8	9	84
39	20	CS	2	4	8	9	72
40	20	HPI	2	4	8	9	72
41	21	RCS	1	4	4	9	36
42	21	RHR	9	4	36	9	324
43	21	AFW	3	4	12	9	108
44A	21	CVCS	2	0.67	1.33	9	
44B	21	CVCS	2	4	8	9	84
45	21	CS	2	4	8	9	72
46	21	HPI	2	4	8	9	72
47	23	RCS	2	4	8	9	72
48	23	RHR	16	4	64	9	576
49	23	CS	2	4	8	9	72
50A	23	CVCS	6	0.67	4	9	
50B	23	CVCS	4	4	16	9	180
51A	23	HPI	4	0.67	2.67	9	
51B	23	HPI	3	4	12	9	132

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
52	24	RCS	3	4	12	9	108
53	24	RHR	10	4	40	9	360
54A	24	HPI	4	0.67	2.67	9	
54B	24	HPI	3	4	12	9	132
55	27	RCS	3	4	12	9	108
56	27	RHR	15	4	60	9	540
57	27	AFW	6	4	24	9	216
58A	27	CVCS	6	0.67	4	9	
58B	27	CVCS	2	4	8	9	108
59	27	CS	2	4	8	9	72
60	27	HPI	4	4	16	9	144
61	28	RCS	2	4	8	9	72
62	28	RHR	15	4	60	9	540
63	28	AFW	6	4	24	9	216
64A	28	CVCS	4	0.67	2.67	9	
64B	28	CVCS	1	4	8	9	96
65	28	CS	2	4	8	9	72
66	28	HPI	5	4	20	9	180
67	29	RCS	2	4	8	9	72
68	29	RHR	13	4	52	9	468
69	29	AFW	4	4	16	9	144
70	29	HPI	4	4	16	9	144
71	30	RCS	2	4	8	9	72
72	30	CS	1	4	4	9	36
73	30	RHR	8	4	32	9	288
74	30	HPI	8	4	32	9	288
75	31	RCS	2	4	8	9	72
76	31	RHR	9	4	36	9	324

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
77A	31	HPI	4	0.67	2.67	9	
77B	31	HPI	6	4	24	9	240
78	32	RCS	1	4	4	9	36
79	32	RHR	9	4	36	9	324
80	32	AFW	3	4	12	9	108
81A	32	CVCS	2	1	2	9	
81B	32	CVCS	2	4	8	9	90
82	32	CS	2	4	8	9	72
83	32	HPI	2	4	8	9	72
84	33	RCS	1	4	4	9	36
85	33	RHR	7	4	28	9	252
86	33	AFW	2	4	8	9	72
87A	33	CVCS	3	1	3	9	
87B	33	CVCS	2	4	8	9	99
88	33	CS	2	4	8	9	72
89	33	HPI	4	4	16	9	144
90	35	RCS	2	4	8	9	72
91	35	RHR	9	4	36	9	324
92	35	AFW	8	4	32	9	288
93A	35	CVCS	4	1	4	9	
93B	35	CVCS	4	4	16	9	180
94	35	CS	1	4	4	9	36
95A	35	HPI	2	0.67	1.33	9	
95B	35	HPI	3	4	12	9	129
96	38	RCS	2	4	8	9	72
97	38	RHR	7	4	28	9	252
98	38	AFW	2	4	8	9	72

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
99	38	CVCS	2	4	8	9	72
100	38	HPI	4	4	16	9	144
101	39	RCS	1	4	4	9	36
102	39	RHR	10	4	40	9	360
103	39	AFW	7	4	28	9	252
104A	39	CVCS	3	1	3	9	
104B	39	CVCS	2	4	8	9	99
105	39	CS	2	4	8	9	72
106	39	HPI	4	4	16	9	144
107	40	RCS	2	4	8	9	72
108	40	RHR	9	4	36	9	324
109	40	AFW	8	4	32	9	288
110A	40	CVCS	4	1	4	9	
110B	40	CVCS	4	4	16	9	180
111	40	CS	1	4	4	9	36
112A	40	HPI	4	0.67	2.67	9	
112B	40	HPI	3	4	12	9	132
113	41	RCS	2	4	8	9	72
114	41	RHR	13	4	52	9	468
115A	41	HPI	2	0.67	1.33	9	
115B	41	HPI	2	4	8	9	84
116	42	RCS	2	4	8	9	72
117	42	RHR	13	4	52	9	468
118	42	AFW	4	4	16	9	144
119	42	HPI	4	4	16	9	144

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
120	43	RCS	2	4	8	9	72
121	43	RHR	12	4	48	9	432
122A	43	CVCS	7	1	7	9	
122B	43	CVCS	2	4	8	9	135
123A	43	CS	1	0.67	0.67	9	
123B	43	CS	2	4	8	9	78
124	43	HPI	6	4	24	9	216
125	44	RCS	2	4	8	9	72
126	44	RHR	16	4	64	9	576
127A	44	CVCS	6	1	6	9	
127B	44	CVCS	4	4	16	9	198
128	44	CS	2	4	8	9	72
129A	44	HPI	4	1	4	9	
134B	44	HPI	3	4	12	9	144
125	45	RCS	1	4	4	9	36
126	45	RHR	11	4	44	9	396
127	45	AFW	10	4	40	9	360
128	45	CVCS	7	4	28	9	252
129	45	CS	2	4	8	9	72
130	45	HPI	4	4	16	9	144
131	46	RCS	3	4	12	9	108
132	46	RHR	16	4	64	9	576
133A	46	AFW	6	0.67	4	9	
133B	46	AFW	8	4	32	9	324
134A	46	CVCS	2	1	2	9	
134B	46	CVCS	6	4	24	9	234
135A	46	CS	2	1	2	9	
135B	46	CS	4	4	16	9	162
136A	46	HPI	4	0.67	2.67	9	

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
136B	46	HPI	2	4	8	9	96
137	47	RCS	3	4	12	9	108
138	47	RHR	16	4	64	9	576
139A	47	AFW	6	0.67	4	9	
139B	47	AFW	9	4	36	9	360
140A	47	CVCS	4	0.67	2.67	9	
140B	47	CVCS	4	4	16	9	168
141A	47	CS	2	1	2	9	
141B	47	CS	4	4	16	9	162
142A	47	HPI	4	0.67	2.67	9	
142B	47	HPI	2	4	8	9	96
143	48	RCS	2	4	8	9	72
144	48	RHR	16	4	64	9	576
145	48	CVCS	1	4	4	9	36
146	48	CS	1	4	4	9	36
147	48	HPI	8	4	32	9	288
148	49	RCS	2	4	8	9	72
149	49	RHR	16	4	64	9	576
150	49	CVCS	1	4	4	9	36
151	49	CS	2	4	8	9	72
152	49	HPI	8	4	32	9	288
153	51	RCS	3	4	12	9	108
154	51	RHR	10	4	40	9	360
155	51	AFW	1	4	4	9	36
156A	51	HPI	3	0.67	2	9	
156B	51	HPI	4	4	16	9	162
157	54	RCS	2	4	8	9	72
158	54	RHR	9	4	36	9	324

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
159	54	AFW	1	4	4	9	36
160A	54	HPI	3	0.67	2	9	
160B	54	HPI	4	4	16	9	162
161	55	RCS	2	4	8	9	72
162	55	RHR	9	4	36	9	324
163	55	AFW	1	4	4	9	36
164	55	CS	2	4	8	9	72
165A	55	HPI	3	0.67	2	9	
165B	55	HPI	4	4	16	9	162
166	58	RCS	3	4	12	9	108
167	58	RHR	11	4	44	9	396
168	58	CS	1	4	4	9	36
169A	58	HPI	3	1	3	9	
169B	58	HPI	4	4	16	9	171
170	59	RCS	2	4	8	9	72
171	59	RHR	12	4	48	9	432
172	59	AFW	4	4	16	9	144
173	59	CS	2	4	8	9	72
174	59	HPI	8	4	32	9	288
175	60	RCS	2	4	8	9	72
176	60	RHR	10	4	40	9	360
177	60	AFW	1	4	4	9	36
178	60	CS	2	4	8	9	72
179	60	HPI	8	4	32	9	288
180	61	RCS	2	4	8	9	72
181	61	RHR	17	4	68	9	612
182	61	AFW	4	4	16	9	144
183	61	CS	2	4	8	9	72
184A	61	HPI	3	0.67	2	9	

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
184B	61	HPI	4	4	16	9	162
185	62	RCS	2	4	8	9	72
186	62	RHR	17	4	68	9	612
187	62	AFW	4	4	16	9	144
188	62	CS	2	4	8	9	72
189A	62	HPI	3	0.67	2	9	
189B	62	HPI	4	4	16	9	162
190	64	RCS	2	4	8	9	72
191	64	RHR	6	4	24	9	240
192	64	AFW	4	4	16	9	144
193	64	HPI	4	4	16	9	144
194	65	RCS	1	4	4	9	36
195	65	RHR	10	4	40	9	360
196	65	AFW	6	4	24	9	216
197A	65	CVCS	4	0.67	2.67	9	
197B	65	CVCS	4	4	16	9	168
198	65	CS	2	4	8	9	72
199	65	HPI	4	4	16	9	144
200	66	RCS	2	4	8	9	72
201	66	RHR	12	4	48	9	432
202A	66	AFW	2	0.67	1.33	9	
202B	66	AFW	4	4	16	9	156
203A	66	CS	2	0.67	1.33	9	
203B	66	CS	4	4	16	9	156
204	66	HPI	3	4	12	9	108

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
205	70	RHR	12	4	48	9	432
206	70	AFW	3	4	12	9	108
207	70	CS	2	4	8	9	72
208	70	HPI	10	4	40	9	360
209	71	RHR	12	4	48	9	432
210	71	AFW	3	4	12	9	108
211	71	CS	2	4	8	9	72
212	71	HPI	10	4	40	9	360
213	72	RCS	2	4	8	9	72
214	72	RHR	12	4	48	9	432
215A	72	AFW	2	0.67	1.33	9	
215B	72	AFW	4	4	16	9	156
216A	72	CS	2	0.67	1.33	9	
216B	72	CS	4	4	16	9	156
217	72	HPI	3	4	12	9	108
218	74	RHR	16	4	64	9	576
219A	74	AFW	5	0.67	3.33	9	
219B	74	AFW	8	4	32	9	318
220A	74	CVCS	2	0.67	1.33	9	
220B	74	CVCS	2	4	8	9	84
221A	74	CS	2	0.67	1.33	9	
221B	74	CS	4	4	16	9	156
222	74	HPI	8	4	32	9	288
223	75	RCS	3	4	12	9	108
224	75	RHR	10	4	40	9	360
225	75	AFW	8	4	32	9	288

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
226	75	CVCS	11	4	44	9	396
227	75	CS	4	4	16	9	144
228	75	HPI	3	4	12	9	108
229	76	RCS	3	4	12	9	108
230	76	RHR	10	4	40	9	360
231	76	AFW	8	4	32	9	288
232	76	CVCS	11	4	44	9	396
233	76	CS	4	4	16	9	144
234	76	HPI	3	4	12	9	108
235	79	RHR	8	4	32	9	288
236	79	AFW	1	4	4	9	36
237	79	HPI	8	4	32	9	288
238	82	RCS	2	4	8	9	72
239	82	RHR	12	4	48	9	432
240	82	AFW	5	4	20	9	180
241	82	CS	2	4	8	9	72
242	82	HPI	8	4	32	9	288
243	83	RCS	3	4	12	9	108
244	83	RHR	15	4	60	9	540
245	83	CS	4	4	16	9	144
246A	83	HPI	2	0.67	1.33	9	
246B	83	HPI	3	4	12	9	120
247	85	RCS	3	4	12	8.7	104
248	85	RHR	19	4	76	8.7	661
249A	85	AFW	7	0.67	4.67	8.7	
249B	85	AFW	7	4	28	8.7	284
250A	85	CVCS	8	0.67	5.33	8.7	
250B	85	CVCS	4	4	16	8.7	186
251A	85	CS	2	0.67	1.33	8.7	

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
251B	85	CS	4	4	16	8.7	151
252A	85	HPI	4	0.67	2.67	8.7	
252B	85	HPI	3	4	12	8.7	128
253	87	RCS	3	4	12	8.1	97
254	87	RHR	12	4	48	8.1	389
255A	87	CS	6	1	6	8.1	
255B	87	CS	4	4	16	8.1	178
256A	87	HPI	2	1	2	8.1	
256B	87	HPI	6	4	24	8.1	211
257	88	RCS	3	4	12	9	72
258	88	RHR	17	4	68	9	612
259	88	AFW	12	4	48	9	432
260	88	CVCS	9	4	36	9	324
261	88	CS	4	4	16	9	144
262	88	HPI	2	4	8	9	72
263	89	RCS	3	4	12	9	108
264	89	RHR	17	4	68	9	612
265	89	AFW	12	4	48	9	432
266	89	CVCS	9	4	36	9	324
267	89	CS	4	4	16	9	144
268	89	HPI	2	4	8	9	72
269	91	RCS	2	4	8	9	72
270	91	RHR	10	4	40	9	360
271	91	CS	4	4	16	9	144
272	91	HPI	3	4	12	9	108
273	92	RCS	2	4	8	8.6	69
274	92	RHR	16	4	64	8.6	550
275	92	AFW	13	4	52	8.6	447
276A	92	CVCS	9	0.67	6	8.6	

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
276B	92	CVCS	4	4	16	8.6	189
277	92	CS	6	4	24	8.6	206
278A	92	HPI	4	0.67	3.67	8.6	
278B	92	HPI	4	4	16	8.6	126
279	93	RCS	2	4	8	6.6	53
280	93	RHR	4	16	64	6.6	422
281	93	AFW	13	4	52	6.6	343
282A	93	CVCS	9	0.67	6	6.6	
282B	93	CVCS	4	4	16	6.6	145
283	93	CS	6	4	24	6.6	158
284A	93	HPI	2	0.67	1.33	6.6	
284B	93	HPI	3	4	12	6.6	88
285	95	RCS	2	4	8	5.3	42
286	95	RHR	4	16	64	5.3	339
287A	95	AFW	6	0.67	4	5.3	
287B	95	AFW	8	4	32	5.3	191
288	95	CVCS	11	4	44	5.3	233
289	95	CS	4	4	16	5.3	85
290	95	HPI	3	4	12	5.3	64
291	96	RCS	2	4	8	5.3	42
292	96	RHR	14	4	56	5.3	297
293A	96	AFW	4	0.67	2.67	5.3	
293B	96	AFW	8	4	32	5.3	184
294A	96	CVCS	8	0.67	5.33	5.3	
294B	96	CVCS	4	4	16	5.3	113
295A	96	CS	2	0.67	1.33	5.3	
295B	96	CS	4	4	16	5.3	92
296	96	HPI	3	4	12	5.3	64
297	97	RCS	2	4	8	9	72

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
298	97	RHR	13	4	52	9	468
299	97	AFW	8	4	32	9	288
300	97	CS	4	4	16	9	144
301	97	HPI	3	4	12	9	108
302	98	RCS	2	4	8	8.3	66
303	98	RHR	13	4	52	8.3	432
304	98	AFW	8	4	32	8.3	266
305	98	CS	4	4	16	8.3	133
306	98	HPI	3	4	12	8.3	100
307	99	RCS	2	4	8	7.7	62
308	99	RHR	12	4	48	7.7	370
309	99	AFW	8	4	32	7.7	246
310	99	CS	2	4	8	7.7	62
311	99	HPI	3	4	12	7.7	92
312	100	RCS	2	4	8	7.2	58
313	100	RHR	12	4	48	7.2	346
314	100	AFW	8	4	32	7.2	230
315	100	CS	2	4	8	7.2	58
316	100	HPI	3	4	12	7.2	86
317	103	RCS	2	4	8	9	72
318	103	RHR	18	4	72	9	648
319A	103	AFW	4	0.67	2.67	9	
319B	103	AFW	8	4	32	9	312
320A	103	CVCS	6	1	6	9	
320B	103	CVCS	4	4	16	9	198
321A	103	CS	2	1	2	9	
321B	103	CS	4	4	16	9	162

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
322A	103	HPI	4	1	4	9	
322B	103	HPI	3	4	12	9	144
323	104	RCS	2	4	8	9	72
324	104	RHR	19	4	76	9	684
325A	104	AFW	4	0.67	2.67	9	
325B	104	AFW	8	4	32	9	312
326	104	CVCS	1	4	4	9	36
327A	104	CS	2	0.67	1.33	9	
327B	104	CS	2	4	8	9	84
328A	104	HPI	4	0.67	2.67	9	
328B	104	HPI	3	4	12	9	132
329	105	RCS	2	4	8	6.5	52
330	105	RHR	24	4	96	6.5	624
331	105	AFW	5	4	20	6.5	130
332	105	CS	3	4	12	6.5	78
333	105	HPI	9	4	36	6.5	234
334	106	RCS	2	4	8	7.7	62
335	106	RHR	24	4	96	7.7	739
336	106	AFW	5	4	20	7.7	154
337	106	CS	3	4	12	7.7	92
338	106	HPI	9	4	36	7.7	277
339	107	RHR	20	4	80	9	720
340A	107	AFW	4	0.67	2.67	9	
340B	107	AFW	8	4	32	9	312
341	107	CVCS	2	4	8	9	72

APPENDIX IV - TABLE XII (CONTINUED)
PWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
342	107	CS	4	4	16	9	144
343	107	HPI	10	4	40	9	360
344	108	RHR	20	4	80	9	720
345A	108	AFW	4	0.67	2.67	9	
345B	108	AFW	8	4	32	9	312
346	108	CVCS	2	4	8	9	72
347	108	CS	4	4	16	9	144
348	108	HPI	10	4	40	9	360
349	109	RHR	20	4	80	8	640
350A	109	AFW	4	0.67	2.67	8	
350B	109	AFW	8	4	32	8	277
351	109	CVCS	2	4	8	8	64
352	109	CS	4	4	16	8	128
353	109	HPI	10	4	40	8	320

Totals: **2255**

APPENDIX IV - TABLE XIII
BWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
1A	3	CS	2	0.67	1.33	9	
1B	3	CS	2	4	8	9	84
2	3	RHR	5	4	20	9	180
3A	3	LPCS	6	0.67	4	9	
3B	3	LPCS	4	4	16	9	180
4	4	RHR	3	4	12	9	108
5A	4	LPCS	6	0.67	4	9	
5B	4	LPCS	6	4	24	9	252
6A	5	CS	4	0.67	2.67	9	
6B	5	CS	4	4	16	9	168
7A	5	RHR	10	4	40	9	
7B	5	RHR	6	12	72	9	1008
8A	5	LPCS	4	4	16	9	
8B	5	LPCS	2	12	24	9	360
9A	5	HPCI	4	4	16	9	
9B	5	HPCI	3	12	36	9	468
10	7	CS	3	4	12	9	108
11	7	RHR	2	4	8	9	72
12	7	LPCS	2	12	24	9	216
13	7	HPCI	2	4	8	9	72
14A	9	CS	4	0.67	2.67	9	
14B	9	CS	4	4	16	9	168
15A	9	RHR	10	4	40	9	
15B	9	RHR	6	12	72	9	1008
16A	9	LPCS	3	0.67	1.33	9	
16B	9	LPCS	2	4	8	9	
16C	9	LPCS	2	12	24	9	300
17A	9	HPCI	3	4	12	9	
17B	9	HPCI	3	12	36	9	432

APPENDIX IV - TABLE XIII (CONTINUED)
BWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
18A	12	CS	2	0.67	1.33	9	
18B	12	CS	4	4	16	9	156
19A	12	RCIC	2	0.67	1.33	9	
19B	12	RCIC	4	4	16	9	156
20A	12	RHR	2	1	2	9	
20B	12	RHR	6	4	24	9	
20C	12	RHR	6	12	72	9	882
21A	12	LPCS	4	4	16	9	
21B	12	LPCS	2	12	24	9	360
22	12	HPCI	6	4	24	9	216
23A	14	CS	2	1	2	9	
23B	14	CS	4	4	16	9	162
24A	14	RCIC	5	1	5	9	
24B	14	RCIC	3	4	12	9	
24C	14	RCIC	5	12	60	9	693
25A	14	RHR	10	4	40	9	
25B	14	RHR	6	12	72	9	1008
26A	14	LPCS	6	4	24	9	
26B	14	LPCS	4	12	48	9	648
27A	14	HPCI	6	4	24	9	
27A	14	HPCI	3	12	36	9	540
28A	15	CS	2	0.67	1.33	9	
28B	15	CS	4	4	16	9	156
29A	15	RCIC	5	0.67	3.33	9	
29B	15	RCIC	8	4	32	9	318
30A	15	RHR	6	0.67	4	9	
30B	15	RHR	8	4	32	9	324
31A	15	LPCS	10	4	40	9	

APPENDIX IV - TABLE XIII (CONTINUED)
BWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
31B	15	LPCS	4	12	48	9	792
32	15	HPCI	9	4	36	9	324
33A	17	CS	2	1	2	9	
33B	17	CS	4	4	16	9	162
34A	17	RCIC	5	1	5	9	
34B	17	RCIC	5	4	20	9	225
35A	17	RHR	6	1	6	9	
35B	17	RHR	4	4	16	9	
35C	17	RHR	4	12	48	9	630
36A	17	LPCS	4	4	16	9	
36B	17	LPCS	2	12	24	9	360
37	17	HPCI	7	4	28	9	252
38A	18	CS	2	1	2	9	
38B	18	CS	4	4	16	9	162
39A	18	RCIC	2	0.67	1.33	9	
39B	18	RCIC	4	4	16	9	156
40A	18	RHR	2	1	2	9	
40B	18	RHR	6	4	24	9	
40C	18	RHR	6	12	72	9	882
41A	18	LPCS	4	4	16	9	
41B	18	LPCS	2	12	24	9	360
42	18	HPCI	6	4	24	9	216
43A	22	CS	2	0.67	1.33	9	
43B	22	CS	4	4	16	9	156
44A	22	RCIC	5	.67	3.33	9	
44B	22	RCIC	7	4	28	9	282

APPENDIX IV - TABLE XIII (CONTINUED)
BWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
45A	22	RHR	2	0.67	1.33	9	
45B	22	RHR	14	4	56	9	
45C	22	RHR	6	12	72	9	1164
46	22	LPCS	8	4	32	9	288
47A	22	HPCI	9	4	36	9	324
48A	25	CS	2	0.67	1.33	9	
48B	25	CS	4	4	16	9	156
49A	25	RCIC	2	0.67	1.33	9	
49B	25	RCIC	3	4	12	9	
49C	25	RCIC	4	12	48	9	540
50A	25	RHR	2	0.67	1.33	9	2
50B	25	RHR	10	4	40	9	
50C	25	RHR	6	12	72	9	1020
51A	25	LPCS	4	0.67	2.67	9	
51B	25	LPCS	4	4	16	9	
51C	25	LPCS	2	12	24	9	384
52A	25	HPCI	2	0.67	1.33	9	
52B	25	HPCI	3	4	12	9	
52C	25	HPCI	3	12	36	9	432
53A	26	CS	2	1	2	9	
53B	26	CS	4	4	16	9	162
54A	26	RCIC	3	4	12	9	
54B	26	RCIC	4	12	48	9	540
55A	26	RHR	11	4	44	9	
55B	26	RHR	6	12	72	9	1044
56A	26	LPCS	6	4	24	9	
56B	26	LPCS	4	12	48	9	648
57A	26	HPCI	3	4	12	9	
57B	26	HPCI	3	12	36	9	432

APPENDIX IV - TABLE XIII (CONTINUED)
BWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
58A	34	CS	2	0.67	1.33	9	
58B	34	CS	4	4	16	9	156
59A	34	RCIC	3	4	12	9	
59B	34	RCIC	3	12	36	9	432
60A	34	RHR	8	4	32	9	
60B	34	RHR	6	12	72	9	936
61A	34	LPCS	2	4	8	9	
61B	34	LPCS	2	12	24	9	288
62A	34	HPCI	3	4	12	9	
62B	34	HPCI	3	12	36	9	432
63A	36	CS	2	0.67	1.33	9	
63B	36	CS	4	4	16	9	156
64A	36	RCIC	5	0.67	3.33	9	
64B	36	RCIC	8	4	32	9	318
65	36	RHR	18	4	72	9	648
66A	36	LPCS	6	4	24	9	
66B	36	LPCS	4	12	48	9	648
67A	36	HPCI	6	4	24	9	
67B	36	HPCI	3	12	36	9	540
68A	37	CS	4	1	4	9	
68B	37	CS	4	4	16	9	180
69A	37	RCIC	2	4	8	9	
69B	37	RCIC	4	12	48	9	468
70A	37	RHR	2	1	2	9	
70B	37	RHR	4	4	16	9	
70C	37	RHR	6	12	72	9	810
71A	37	LPCS	4	4	16	9	
71B	37	LPCS	2	12	24	9	360
72A	37	HPCI	2	4	8	9	

APPENDIX IV - TABLE XIII (CONTINUED)
BWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
72B	37	HPCI	3	12	36	9	396
73A	50	CS	2	1	2	9	
73B	50	CS	4	4	16	9	162
74A	50	RCIC	5	1	5	9	
74B	50	RCIC	2	4	8	9	
74C	50	RCIC	5	12	60	9	657
75A	50	RHR	10	4	40	9	
75B	50	RHR	6	12	72	9	1008
76A	50	LPCS	4	4	16	9	
76B	50	LPCS	2	12	24	9	360
77A	50	HPCI	3	4	12	9	
77B	50	HPCI	3	12	36	9	432
78A	52	CS	2	1	2	9	
78B	52	CS	4	4	16	9	156
79A	52	RCIC	5	1	5	9	
79B	52	RCIC	2	4	8	9	
79C	52	RCIC	5	12	60	9	657
80A	52	RHR	12	4	48	9	
80B	52	RHR	6	12	72	9	1080
81	52	LPCS	8	4	32	9	288
82A	52	HPCI	5	4	20	9	
82B	52	HPCI	3	12	36	9	504
83A	53	CS	2	1	2	9	
83B	53	CS	4	4	16	9	156
84A	53	RCIC	5	1	5	9	
84B	53	RCIC	2	4	8	9	
84C	53	RCIC	5	12	60	9	657
85A	53	RHR	12	4	48	9	
85B	53	RHR	6	12	72	9	1080

APPENDIX IV - TABLE XIII (CONTINUED)
BWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
86	53	LPCS	8	4	32	9	288
87A	53	HPCI	5	4	20	9	
87B	53	HPCI	3	12	36	9	504
88A	56	CS	2	0.67	1.33	9	
88B	56	CS	4	4	16	9	156
89	56	RCIC	7	4	28	9	252
90A	56	RHR	8	0.67	5.33	9	
90B	56	RHR	10	4	40	9	408
91A	56	LPCS	2	0.67	1.33	9	
91B	56	LPCS	6	4	24	9	228
92A	56	HPCI	3	0.67	2	9	
92B	56	HPCI	1	4	4	9	
92C	56	HPCI	3	12	36	9	378
93A	57	CS	2	1	2	9	
93B	57	CS	4	4	16	9	162
94A	57	RCIC	3	4	12	9	
94B	57	RCIC	3	12	36	9	432
95A	57	RHR	6	4	24	9	
95B	57	RHR	6	12	72	9	864
96A	57	LPCS	2	1	2	9	
96B	57	LPCS	2	4	8	9	
96C	57	LPCS	3	12	36	9	414
97A	57	HPCI	3	4	12	9	
97	57	HPCI	3	12	36	9	432
98A	63	CS	2	0.67	1.33	8	
98B	63	CS	4	4	16	8	155
99A	63	RCIC	2	0.67	1.33	8	
99B	63	RCIC	7	4	28	8	235
100A	63	RHR	10	0.67	6.67	8	

APPENDIX IV - TABLE XIII (CONTINUED)
BWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
100B	63	RHR	12	4	48	8	437
101A	63	LPCS	4	0.67	2.67	8	
101B	63	LPCS	4	4	16	8	149
102A	63	HPC1	3	0.67	2	8	
102B	63	HPCI	5	4	20	8	176
103A	67	CS	2	0.67	1.33	9	
103B	67	CS	4	4	16	9	156
104	67	RCIC	7	4	28	9	252
105A	67	RHR	12	4	48	9	
105B	67	RHR	6	12	72	9	1080
106A	67	LPCS	4	4	16	9	
106B	67	LPCS	4	12	48	9	576
107	67	HPCI	6	4	24	9	216
108A	68	CS	2	0.67	1.33	5.9	
108B	68	CS	2	4	8	5.9	55
109	68	RCIC	7	4	28	5.9	165
110A	68	RHR	10	0.67	6.67	5.9	
110B	68	RHR	12	4	48	5.9	322
111A	68	LPCS	2	0.67	1.33	5.9	
111B	68	LPCS	6	4	24	5.9	149
112	68	HPCI	4	4	16	5.9	94
113A	69	CS	2	0.67	1.33	9	
113B	69	CS	4	4	16	9	156
114A	69	RCIC	1	0.67	0.67	9	
114B	69	RCIC	4	4	16	9	150
115	69	RHR	22	4	88	9	792
116	69	LPCS	8	4	32	9	288
117	69	HPCI	5	4	20	9	180
118A	73	CS	2	1	2	9	

APPENDIX IV - TABLE XIII (CONTINUED)
BWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
118B	73	CS	2	4	8	9	90
119A	73	RCIC	5	0.67	3.33	9	
119B	73	RCIC	2	4	8	9	
119C	73	RCIC	5	12	60	9	642
120	73	RHR	16	4	64	9	576
121	73	LPCS	6	4	24	9	216
122	73	HPCI	6	4	24	9	216
123A	77	CS	2	0.67	1.33	9	
123B	77	CS	4	4	16	9	156
124A	77	RCIC	1	0.67	0.67	9	
124B	77	RCIC	5	4	20	9	186
125A	77	RHR	6	0.67	4	9	
125B	77	RHR	6	4	24	9	252
126A	77	LPCS	1	0.67	0.67	9	
126B	77	LPCS	2	4	8	9	78
127	77	HPCS	4	4	16	9	144
128A	78	CS	2	0.67	1.33	9	
128B	78	CS	4	4	16	9	156
129A	78	RCIC	2	0.67	1.33	9	
129B	78	RCIC	4	4	16	9	156
130A	78	RHR	5	0.67	3.33	9	
130B	78	RHR	8	4	32	9	318
131A	78	LPCS	1	0.67	0.67	9	
131B	78	LPCS	2	4	8	9	78
132	78	HPCS	4	4	16	9	144
133A	80	CS	2	0.67	1.33	9	
133B	80	CS	4	4	16	9	156
134A	80	RCIC	3	0.67	2	9	
134B	80	RCIC	5	4	20	9	198

APPENDIX IV - TABLE XIII (CONTINUED)
BWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
135A	80	RHR	14	0.67	9.33	9	
135B	80	RHR	10	4	40	9	444
136A	80	LPCS	4	0.67	2.67	9	
136B	80	LPCS	4	4	16	9	168
137A	80	HPCI	3	0.67	2	9	
137B	80	HPCI	5	4	20	9	198
138A	81	CS	2	0.67	1.33	9	
138B	81	CS	4	4	16	9	156
140	81	RCIC	7	4	28	9	252
141A	81	RHR	10	0.67	6.67	9	
141B	81	RHR	10	4	40	9	420
142A	81	LPCS	4	0.67	2.67	9	
142B	81	LPCS	4	4	16	9	168
143A	81	HPCI	3	0.67	2	9	
143B	81	HPCI	5	4	20	9	198
144A	84	CS	2	0.67	1.33	9	
144B	84	CS	4	4	16	9	156
145A	84	RCIC	1	0.67	0.67	9	
145B	84	RCIC	5	4	20	9	186
146A	84	RHR	9	0.67	6	9	
146B	84	RHR	8	4	32	9	342
147	84	LPCS	2	4	8	9	72
148A	84	HPCS	1	0.67	0.67	9	
148B	84	HPCS	4	4	16	9	150
149A	86	CS	2	0.67	1.33	7.7	
149B	86	CS	4	4	16	7.7	133
150	86	RCIC	5	4	20	7.7	154
151A	86	RHR	8	0.67	5.33	7.7	
151B	86	RHR	6	4	24	7.7	226

APPENDIX IV - TABLE XIII (CONTINUED)
BWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
152A	86	LPCS	1	0.67	0.67	7.7	
152B	86	LPCS	2	4	8	7.7	67
153A	86	HPCS	1	0.67	0.67	7.7	
153B	86	HPCS	4	4	16	7.7	128
154	90	CS	2	4	8	9	72
155A	90	RCIC	4	0.67	2.67	9	
155B	90	RCIC	6	4	24	9	240
156A	90	RHR	10	4	40	9	
156B	90	RHR	6	12	72	9	1008
157	90	LPCS	4	12	48	9	432
158A	90	HPCS	4	4	16	9	
158B	90	HPCS	3	12	36	9	468
159A	94	CS	2	0.67	1.33	8.1	
159B	94	CS	4	4	16	8.1	140
160	94	RCIC	6	4	24	8.1	194
161	94	RHR	19	4	76	8.1	616
162	94	LPCS	3	4	12	8.1	97
163A	94	HPCS	1	0.67	0.67	8.1	
163B	94	HPCS	4	4	16	8.1	135
164	101	CS	2	4	8	9	72
165A	101	RCIC	4	0.67	2.67	9	
165B	101	RCIC	6	4	24	9	240
166A	101	RHR	10	0.67	6.67	9	
166B	101	RHR	9	4	36	9	384
167	101	LPCS	3	4	12	9	108
168	101	HPCS	5	4	20	9	180
169	102	CS	2	4	8	8.1	65
170A	102	RCIC	1	0.67	0.67	8.1	
170B	102	RCIC	4	4	16	8.1	135

APPENDIX IV - TABLE XIII (CONTINUED)
BWR APPLICATION CODED MOV ASSEMBLY - SELECTED SYSTEM DATA SOURCE INPUTS
ESTIMATED SURVEILLANCE TEST DEMANDS - 1987-1995

ITEM NUMBER	PLANT ID NUMBER	PLANT SYSTEM	NO. MOVs/ SYSTEM	SURV TST FREQ./YR	DEMAND/ YEAR	NO. YRS/ PERIOD	SYS TOT MOV-DEM
171A	102	RHR	9	4	36	8.1	
171B	102	RHR	6	12	72	8.1	875
172	102	LPCS	3	4	12	8.1	97
173A	102	HPCS	3	0.67	2	8.1	
173B	102	HPCS	1	4	4	8.1	
173C	102	HPCS	1	12	12	8.1	146

Totals: 1477

NRC FORM 335 (2-89) NRCM 1102. 3201. 3202

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)

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10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

This report documents an analysis of the performance of safety-related motor-operated valve assemblies (valve body and motor operator subcomponents) used in pressurized water reactors (PWRs) and boiling water reactors (BWRs) 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-operated valve components on an industry basis and comparison of results with data used by plant-specific probabalistic risk assessments. The data used in this report was from the 1992-1995 period for engineering analysis of riisk-important systems, Failure Probability estimates used combined engineering safety features data (1987-1998) and surveillance test data (1987-1995).

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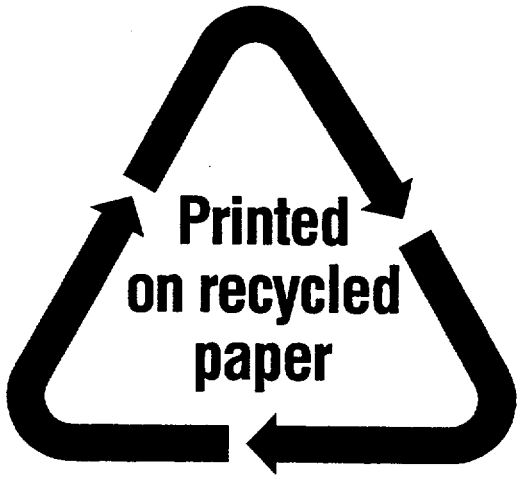

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