

Component Performance Studies

Summary

1987–2003

The component studies look at four specific components: motor-driven pumps, turbine driven pumps, motor-operated valves, and air operated valves. These components are in several systems each (see [Table 1](#)). The systems were selected based on risk importance (RI). This report presents a performance evaluation of these components at United States commercial reactors. The evaluation is based on the operating experience from 1987 through 2003, as reported in Licensee Event Reports (LERs), Nuclear Plant Reliability Data System (NPRDS), and Equipment Performance and Information Exchange (EPIX). This report updates *NUREG-1715, Volume 1 through 4*.

Table 1. Component studies component and system cross-reference.

Plant Type	RI System	MDP	TDP	MOV	AOV
PWR	AFW	■	■	■	■
	CCW	■			
	CSS	■		■	
	CVC	■		■	■
	HPI	■		■	■
	ESW	■			
	RCS			■	
	RHR	■		■	■
BWR	ESW	■			
	HCI		■	■	■
	HCS	■		■	
	LCS	■		■	■
	RBC	■			
	RCI		■	■	■
	RHR	■		■	■

1 LATEST UNAVAILABILITY VALUES AND TRENDS

1.1 Overall Unavailability

The industry-wide unavailability of the AOV and MOV components have been calculated from the operating experience for failure on demand, failure-to-open (FO), and for the failure-to-close (FC). The estimates are based on failures that occurred during unplanned demands, and cyclic and quarterly surveillance tests.

The industry-wide unavailability of MDP and TDP components have been calculated from the operating experience for failure on demand for the failure-to-start (FTS). The estimates are based on failures that occurred during unplanned demands, and cyclic and quarterly surveillance tests.

Table 2 shows a summary of the failure probabilities for the components studied over the entire industry. Failure probability estimates for the resulting failure modes combinations are given in the table. Both ESF actuations and surveillance tests were treated as opportunities to observe possible failures.

Table 2. Component performance data from 1987-2003.

Component	Estimated Number of Demands	Failure Mode	Number of Failures	Failure Probability		
				Lower Bound	MLE	Upper Bound
Air-operated valve	52512	Failure to close	27	2.02E-06	5.14E-04	1.98E-03
	52514	Failure to open	28	2.10E-06	5.33E-04	2.05E-03
	52516	Failure on demand	70	5.24E-06	1.33E-03	5.12E-03
Motor-operated valve	251952	Failure to close	116	1.81E-06	4.60E-04	1.77E-03
	251954	Failure to open	192	3.00E-06	7.62E-04	2.93E-03
	251958	Failure on demand	386	6.02E-06	1.53E-03	5.89E-03
Motor-driven Pump	192847	Failure to start	260	5.30E-06	1.35E-03	5.18E-03
	192848	Failure on demand	300	6.12E-06	1.56E-03	5.98E-03
Turbine-driven pump	19155	Failure to start	174	3.57E-05	9.08E-03	3.49E-02
	19156	Failure on demand	244	5.01E-05	1.27E-02	4.89E-02