

Component Performance Studies

Summary

1987–2004

The component studies look at four specific components: motor-driven pumps (MDPs), turbine driven pumps (TDPs), motor-operated valves (MOVs), and air operated valves (AOVs). 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 2004, 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, Volumes 1 through 4*, updating data, availability estimates, trends, and figures.

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 has 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 unavailabilities of MDP and TDP components has been calculated from the operating experience for failure on demand and for 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 studies over the entire industry. Failure probability estimates for the resulting failure modes 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 1987-2004.

Component	Estimated Number of Demands	Failure Mode	Number of Failures	Failure Probability		
				Lower Bound	MLE	Upper Bound
Air Operated Valve	56073	Fail-to-Close	29	2.03E-06	5.17E-04	1.99E-03
	56076	Fail-to-Open	31	2.17E-06	5.53E-04	2.12E-03
	56078	Fail on demand	76	5.33E-06	1.36E-03	5.21E-03
Motor-operated valve	269698	Failure to close	126	1.84E-06	4.67E-04	1.79E-03
	269700	Failure to open	199	2.90E-06	7.38E-04	2.83E-03
	269704	Failure on demand	403	5.88E-06	1.49E-03	5.74E-03
Motor-driven Pump	206411	Failure on demand	330	6.29E-06	1.60E-03	6.14E-03
	206410	Failure to start	282	5.37E-06	1.37E-03	5.25E-03
Turbine-driven pump	20506	Failure to start	183	3.51E-05	8.92E-03	3.43E-02
	20507	Failure on demand	256	4.91E-05	1.25E-02	4.80E-02