Component Performance Studies

Summary

1987–2005

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 fiscal year 1987 through 2005, 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 unavailabilities of the AOV and MOV components have been calculated from the operating experience for failure on demand, failure-to-open, and for the failure-to-close.

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 have been calculated from the operating experience for failure on demand and for failure-to-start. 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 based on 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 1987-2005.

Component	Estimated Number of Demands	Failure Mode	Number of Failures	Failure Probability		
				Lower Bound	MLE	Upper Bound
Air Operated Valve	58486	Fail to close	31	2.08E-06	5.30E-04	2.04E-03
	58490	Fail to open	34	2.29E-06	5.81E-04	2.23E-03
	58493	Fail on demand	85	5.71E-06	1.45E-03	5.58E-03
Motor-operated valve	281735	Fail to close	137	1.91E-06	4.86E-04	1.87E-03
	281737	Fail to open	204	2.85E-06	7.24E-04	2.78E-03
	281740	Fail on demand	419	5.85E-06	1.49E-03	5.71E-03
Motor-driven Pump	214924	Fail on demand	346	6.33E-06	1.61E-03	6.18E-03
	214923	Fail to start	295	5.40E-06	1.37E-03	5.27E-03
Turbine-driven pump	22029	Fail to start	191	3.41E-05	8.67E-03	3.33E-02
	22029	Fail on demand	266	4.75E-05	1.21E-02	4.64E-02