

CCF Parameter Estimations 2003

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This report documents the quantitative results of the common-cause failure (CCF) data collection effort. These results are for use in Probabilistic Risk Assessment studies of commercial nuclear power plants in the U.S. It summarizes the results of the parameter estimation quantification process, performed on CCF data in the U.S. NRC CCF database. This is the 2003 update to NUREG/CR-5496, updating data and parameter estimations.

This release, CCF Parameter Estimation for 2003, reflects the CCF data contained within the CCF database, Version 3.4.x. This version of the CCF database contains data from 1980 to 2003.

The applications contained within were created with a starting date of 1/1/1985. This date was selected in order to use as much of the CCF data as possible, but to avoid using the large number of CCF events in the 1980 to 1985 period since the trend is decreasing significantly from 1980 to 1985. In addition, further analysis of the nature of CCF events and the large amount of CCF data now available has indicated that the previously recommended value for rho (the mapping up factor) of 0.85 was very conservative. The NRC now recommends 0.50 for rho and this change is reflected in this update to the CCF Parameter Estimation document.

The way to provide a reference for this update is:

U.S. Nuclear Regulatory Commission, "CCF Parameter Estimations, 2003 Update",
<http://nrcoe.inl.gov/results/CCF/ParamEst2003/ccfparamest.htm>, May 2006.

1 Industry Component CCF Distributions

This section contains CCF applications created for components pooled at various levels. The first level presented is the industry-wide component specific pooled distribution. The pooled distribution represents the pooling of the more specific distributions shown under the pooled distribution. Typically, the pooling takes place across systems.

It is up to the user to decide the level of pooling that is appropriate to the intended use. If data exist at the system/component level most appropriate to the intended use, and are not sparse, it is recommended to use the more specific data. Otherwise, it is recommended to use the industry level pooled component data. If no pooled components are listed that are similar to the intended use, the use of the No Data (Prior Only) pooled distribution may be appropriate.

1.1 Motor Driven Pumps

1.1.1 Pooled Motor Driven Pump Distributions

1.1.1.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9697060	0.9775830	0.9778790	0.9844590	0.9777010	1.0546E+03	2.4183E+01
2	1.55E-02	2.24E-02	2.21E-02	3.03E-02	2.23E-02	2.4183E+01	1.0546E+03

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9713240	0.9776820	0.9778760	0.9833670	0.9778630	1.5801E+03	3.6070E+01
2	1.06E-02	1.53E-02	1.51E-02	2.06E-02	1.51E-02	2.4682E+01	1.5915E+03
3	4.01E-03	7.05E-03	6.84E-03	1.08E-02	7.04E-03	1.1388E+01	1.6048E+03

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9736840	0.9790110	0.9791580	0.9838270	0.9793150	2.1049E+03	4.5127E+01
2	7.69E-03	1.11E-02	1.10E-02	1.51E-02	1.09E-02	2.3952E+01	2.1261E+03
3	4.47E-03	7.18E-03	7.03E-03	1.04E-02	7.19E-03	1.5437E+01	2.1346E+03
4	1.14E-03	2.67E-03	2.52E-03	4.72E-03	2.64E-03	5.7379E+00	2.1443E+03

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9755010	0.9800980	0.9802180	0.9842930	0.9805380	2.6671E+03	5.4159E+01
2	6.37E-03	9.15E-03	9.03E-03	1.24E-02	8.75E-03	2.4908E+01	2.6964E+03
3	3.68E-03	5.87E-03	5.75E-03	8.46E-03	5.77E-03	1.5969E+01	2.7053E+03
4	2.12E-03	3.84E-03	3.72E-03	5.97E-03	3.87E-03	1.0442E+01	2.7108E+03
5	2.71E-04	1.04E-03	9.24E-04	2.22E-03	1.06E-03	2.8401E+00	2.7184E+03

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9770440	0.9811290	0.9812300	0.9848780	0.9816260	3.1936E+03	6.1425E+01
2	5.48E-03	7.84E-03	7.74E-03	1.05E-02	7.47E-03	2.5519E+01	3.2295E+03
3	2.94E-03	4.73E-03	4.63E-03	6.86E-03	4.60E-03	1.5385E+01	3.2396E+03
4	2.22E-03	3.81E-03	3.71E-03	5.74E-03	3.80E-03	1.2396E+01	3.2426E+03
5	9.36E-04	2.04E-03	1.94E-03	3.49E-03	2.07E-03	6.6463E+00	3.2484E+03
6	5.21E-05	4.54E-04	3.57E-04	1.19E-03	4.47E-04	1.4790E+00	3.2536E+03

ALPHA FACTOR AND MGL PARAMETERS

Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 1678
Total Number of Common-Cause Failure Events: 112

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9777010	0.9778630	0.9793150	0.9805380	0.9816260
2	2.23E-02	1.51E-02	1.09E-02	8.75E-03	7.47E-03
3		7.04E-03	7.19E-03	5.77E-03	4.60E-03
4			2.64E-03	3.87E-03	3.80E-03
5				1.06E-03	2.07E-03
6					4.47E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.78E-01	9.78E-01	9.79E-01	9.81E-01	9.82E-01
Beta	2.23E-02	2.21E-02	2.07E-02	1.95E-02	1.84E-02
Gamma		3.18E-01	4.75E-01	5.50E-01	5.94E-01
Delta			2.69E-01	4.61E-01	5.79E-01
Epsilon				2.15E-01	3.98E-01
Mu					1.78E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	992.90	1489.35	1985.80	2482.25	2978.70
N 1	47.6114	54.5855	61.7214	67.9404	73.7056
N 2	23.7311	23.8317	22.7028	22.7668	23.2151
N 3		11.1205	15.0265	15.0115	14.2868
N 4			5.5174	10.0727	11.8137
N 5				2.7647	6.4298
N 6					1.3894

1.1.1.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9368480	0.9520440	0.9525520	0.9655170	0.9516180	5.6723E+02	2.8572E+01
2	3.45E-02	4.80E-02	4.75E-02	6.32E-02	4.84E-02	2.8572E+01	5.6723E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9427030	0.9547140	0.9550570	0.9655630	0.9540460	8.4922E+02	4.0282E+01
2	2.00E-02	2.86E-02	2.82E-02	3.83E-02	2.88E-02	2.5416E+01	8.6409E+02
3	1.03E-02	1.67E-02	1.64E-02	2.43E-02	1.71E-02	1.4866E+01	8.7464E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9473110	0.9573990	0.9576590	0.9666090	0.9568240	1.1292E+03	5.0246E+01
2	1.57E-02	2.22E-02	2.20E-02	2.97E-02	2.23E-02	2.6208E+01	1.1532E+03
3	8.85E-03	1.40E-02	1.37E-02	2.00E-02	1.43E-02	1.6470E+01	1.1630E+03
4	3.13E-03	6.42E-03	6.14E-03	1.07E-02	6.56E-03	7.5681E+00	1.1719E+03

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9541390	0.9625150	0.9627180	0.9702000	0.9618160	1.4509E+03	5.6504E+01
2	1.05E-02	1.53E-02	1.51E-02	2.09E-02	1.51E-02	2.3084E+01	1.4843E+03
3	7.57E-03	1.17E-02	1.15E-02	1.66E-02	1.21E-02	1.7694E+01	1.4897E+03
4	4.53E-03	7.87E-03	7.65E-03	1.19E-02	8.28E-03	1.1859E+01	1.4956E+03
5	8.57E-04	2.57E-03	2.35E-03	5.01E-03	2.73E-03	3.8674E+00	1.5035E+03

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9584380	0.9657680	0.9659420	0.9725140	0.9653500	1.7369E+03	6.1565E+01
2	7.95E-03	1.18E-02	1.16E-02	1.63E-02	1.15E-02	2.1229E+01	1.7772E+03
3	5.99E-03	9.39E-03	9.21E-03	1.34E-02	9.55E-03	1.6889E+01	1.7816E+03
4	4.49E-03	7.50E-03	7.32E-03	1.11E-02	7.81E-03	1.3484E+01	1.7850E+03
5	2.17E-03	4.38E-03	4.20E-03	7.22E-03	4.64E-03	7.8801E+00	1.7906E+03
6	2.17E-04	1.16E-03	9.80E-04	2.71E-03	1.21E-03	2.0833E+00	1.7964E+03

ALPHA FACTOR AND MGL PARAMETERS

Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 1010
Total Number of Common-Cause Failure Events: 99

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9516180	0.9540460	0.9568240	0.9618160	0.9653500
2	4.84E-02	2.88E-02	2.23E-02	1.51E-02	1.15E-02
3		1.71E-02	1.43E-02	1.21E-02	9.55E-03
4			6.56E-03	8.28E-03	7.81E-03
5				2.73E-03	4.64E-03
6					1.21E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.52E-01	9.54E-01	9.57E-01	9.62E-01	9.65E-01
Beta	4.84E-02	4.60E-02	4.32E-02	3.82E-02	3.47E-02
Gamma		3.73E-01	4.84E-01	6.05E-01	6.70E-01
Delta			3.14E-01	4.77E-01	5.88E-01
Epsilon				2.48E-01	4.28E-01
Mu					2.06E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	510.10	765.15	1020.20	1275.25	1530.30
N 1	42.9990	47.9327	51.6417	58.8066	65.3927
N 2	28.1205	24.5657	24.9585	20.9429	18.9249
N 3		14.5986	16.0597	16.7368	15.7907
N 4			7.3476	11.4904	12.9019
N 5				3.7920	7.6636
N 6					1.9937

1.1.2 Pooled Clean System Motor Driven Pump Distributions

1.1.2.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	Chemical and Volume Control AUXILIARY FEEDWATER SYSTEM CONTAINMENT SPRAY SYSTEM HIGH PRESSURE SAFETY INJECTION (PWR) LOW PRESSURE CORE SPRAY RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9675250	0.9782210	0.9787610	0.9870830	0.9784520	5.7846E+02	1.2879E+01
2	1.29E-02	2.18E-02	2.12E-02	3.25E-02	2.16E-02	1.2879E+01	5.7846E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9686370	0.9773780	0.9777350	0.9849050	0.9776990	8.7265E+02	2.0198E+01
2	9.80E-03	1.61E-02	1.57E-02	2.35E-02	1.58E-02	1.4329E+01	8.7852E+02
3	2.84E-03	6.57E-03	6.21E-03	1.16E-02	6.55E-03	5.8690E+00	8.8698E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9725100	0.9796550	0.9799210	0.9858870	0.9802510	1.1683E+03	2.4263E+01
2	5.90E-03	1.02E-02	9.89E-03	1.54E-02	9.59E-03	1.2118E+01	1.1804E+03
3	4.02E-03	7.65E-03	7.37E-03	1.22E-02	7.69E-03	9.1207E+00	1.1834E+03
4	6.97E-04	2.54E-03	2.26E-03	5.30E-03	2.47E-03	3.0238E+00	1.1895E+03

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9750060	0.9810670	0.9812730	0.9864170	0.9819620	1.5017E+03	2.8981E+01
2	4.60E-03	7.93E-03	7.71E-03	1.20E-02	7.08E-03	1.2131E+01	1.5186E+03
3	3.21E-03	6.07E-03	5.85E-03	9.65E-03	5.90E-03	9.2829E+00	1.5214E+03
4	1.74E-03	3.97E-03	3.76E-03	6.93E-03	4.05E-03	6.0777E+00	1.5246E+03
5	1.13E-04	9.73E-04	7.66E-04	2.54E-03	1.00E-03	1.4895E+00	1.5292E+03

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9768320	0.9821940	0.9823660	0.9869550	0.9832010	1.7996E+03	3.2624E+01
2	3.90E-03	6.70E-03	6.52E-03	1.01E-02	5.91E-03	1.2270E+01	1.8200E+03
3	2.36E-03	4.63E-03	4.45E-03	7.50E-03	4.38E-03	8.4777E+00	1.8238E+03
4	1.89E-03	3.96E-03	3.78E-03	6.64E-03	3.95E-03	7.2486E+00	1.8250E+03
5	6.91E-04	2.09E-03	1.91E-03	4.09E-03	2.14E-03	3.8225E+00	1.8284E+03
6	1.23E-05	4.40E-04	2.76E-04	1.42E-03	4.24E-04	8.0526E-01	1.8314E+03

ALPHA FACTOR AND MGL PARAMETERS

System :	Chemical and Volume Control AUXILIARY FEEDWATER SYSTEM CONTAINMENT SPRAY SYSTEM HIGH PRESSURE SAFETY INJECTION (PWR) LOW PRESSURE CORE SPRAY RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 719
Total Number of Common-Cause Failure Events: 45

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9784520	0.9776990	0.9802510	0.9819620	0.9832010
2	2.16E-02	1.58E-02	9.59E-03	7.08E-03	5.91E-03
3		6.55E-03	7.69E-03	5.90E-03	4.38E-03
4			2.47E-03	4.05E-03	3.95E-03
5				1.00E-03	2.14E-03
6					4.24E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.79E-01	9.78E-01	9.80E-01	9.82E-01	9.83E-01
Beta	2.16E-02	2.23E-02	1.98E-02	1.80E-02	1.68E-02
Gamma		2.94E-01	5.14E-01	6.07E-01	6.48E-01
Delta			2.44E-01	4.61E-01	5.98E-01
Epsilon				1.99E-01	3.93E-01
Mu					1.66E-01

Motor Driven Pumps
Pooled Clean System Motor Driven Pump Distributions
Fail to Run

2003

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	544.70	817.05	1089.39	1361.74	1634.09
N 1	19.6273	19.4621	21.5484	23.1144	24.2613
N 2	12.4280	13.4789	10.8680	9.9898	9.9667
N 3		5.6017	8.7101	8.3255	7.3798
N 4			2.8033	5.7089	6.6668
N 5				1.4141	3.6060
N 6					0.7157

1.1.2.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	Chemical and Volume Control
	AUXILIARY FEEDWATER SYSTEM CONTAINMENT SPRAY SYSTEM HIGH PRESSURE SAFETY INJECTION (PWR) LOW PRESSURE CORE SPRAY RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9308660	0.9487580	0.9494070	0.9644470	0.9480950	4.3809E+02	2.3661E+01
2	3.56E-02	5.12E-02	5.06E-02	6.91E-02	5.19E-02	2.3661E+01	4.3809E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9426510	0.9561370	0.9565770	0.9681330	0.9553500	6.6295E+02	3.0413E+01
2	1.63E-02	2.52E-02	2.48E-02	3.57E-02	2.53E-02	1.7478E+01	6.7589E+02
3	1.11E-02	1.87E-02	1.82E-02	2.78E-02	1.93E-02	1.2935E+01	6.8043E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9491790	0.9602880	0.9606180	0.9702590	0.9597410	8.8585E+02	3.6633E+01
2	1.19E-02	1.85E-02	1.82E-02	2.64E-02	1.83E-02	1.7079E+01	9.0540E+02
3	8.25E-03	1.39E-02	1.36E-02	2.08E-02	1.44E-02	1.2864E+01	9.0962E+02
4	3.34E-03	7.25E-03	6.90E-03	1.24E-02	7.50E-03	6.6903E+00	9.1579E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9571230	0.9661640	0.9664260	0.9743110	0.9656670	1.1500E+03	4.0274E+01
2	7.16E-03	1.18E-02	1.15E-02	1.74E-02	1.11E-02	1.4046E+01	1.1762E+03
3	6.48E-03	1.09E-02	1.07E-02	1.63E-02	1.13E-02	1.2999E+01	1.1773E+03
4	4.45E-03	8.23E-03	7.96E-03	1.30E-02	8.82E-03	9.8012E+00	1.1805E+03
5	8.79E-04	2.88E-03	2.61E-03	5.82E-03	3.13E-03	3.4279E+00	1.1869E+03

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9620610	0.9698690	0.9700920	0.9769280	0.9697940	1.3788E+03	4.2835E+01
2	4.92E-03	8.49E-03	8.26E-03	1.28E-02	7.65E-03	1.2070E+01	1.4096E+03
3	4.65E-03	8.13E-03	7.91E-03	1.24E-02	8.20E-03	1.1564E+01	1.4101E+03
4	4.19E-03	7.52E-03	7.29E-03	1.16E-02	7.93E-03	1.0696E+01	1.4109E+03
5	2.14E-03	4.67E-03	4.44E-03	7.99E-03	5.04E-03	6.6436E+00	1.4150E+03
6	2.12E-04	1.31E-03	1.08E-03	3.18E-03	1.39E-03	1.8615E+00	1.4198E+03

ALPHA FACTOR AND MGL PARAMETERS

System :	Chemical and Volume Control AUXILIARY FEEDWATER SYSTEM CONTAINMENT SPRAY SYSTEM HIGH PRESSURE SAFETY INJECTION (PWR) LOW PRESSURE CORE SPRAY RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 580
Total Number of Common-Cause Failure Events: 49

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9480950	0.9553500	0.9597410	0.9656670	0.9697940
2	5.19E-02	2.53E-02	1.83E-02	1.11E-02	7.65E-03
3		1.93E-02	1.44E-02	1.13E-02	8.20E-03
4			7.50E-03	8.82E-03	7.93E-03
5				3.13E-03	5.04E-03
6					1.39E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.48E-01	9.55E-01	9.60E-01	9.66E-01	9.70E-01
Beta	5.19E-02	4.47E-02	4.03E-02	3.43E-02	3.02E-02
Gamma		4.32E-01	5.45E-01	6.76E-01	7.47E-01
Delta			3.42E-01	5.15E-01	6.36E-01
Epsilon				2.62E-01	4.48E-01
Mu					2.16E-01

Motor Driven Pumps
 Pooled Clean System Motor Driven Pump Distributions
 Fail to Start

2003

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	405.59	608.39	811.19	1013.99	1216.78
N 1	18.3635	18.4176	17.2798	19.1261	20.7745
N 2	23.2099	16.6277	15.8291	11.9047	9.7667
N 3		12.6674	12.4538	12.0420	10.4658
N 4			6.4698	9.4324	10.1142
N 5				3.3525	6.4271
N 6					1.7719

1.1.3 PWR Containment Spray Pumps

1.1.3.1 Fail to Run

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

1.1.3.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	CONTAINMENT SPRAY SYSTEM
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8820500	0.9447380	0.9509050	0.9863000	0.9339290	4.4758E+01	2.6181E+00
2	1.37E-02	5.53E-02	4.91E-02	1.18E-01	6.61E-02	2.6181E+00	4.4758E+01

ALPHA FACTOR AND MGL PARAMETERS

System :	CONTAINMENT SPRAY SYSTEM
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 40
Total Number of Common-Cause Failure Events: 3

Alpha Factor	CCCG=2
1	0.9339290
2	6.61E-02

MGL Parameter	CCCG=2
1-Beta	9.34E-01
Beta	6.61E-02

Avg. Impact Vector	CCCG=2
Adj. Ind. Events	29.96
N 1	0.6667
N 2	2.1667

1.1.4 BWR Residual Heat Removal Pumps

1.1.4.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9866260	0.9964250	0.9982680	0.9999780	0.9993730	1.4951E+02	5.3644E-01
2	2.02E-05	3.58E-03	1.73E-03	1.34E-02	6.28E-04	5.3644E-01	1.4951E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9847100	0.9942880	0.9955910	0.9994200	0.9987440	2.3896E+02	1.3727E+00
2	3.00E-04	4.60E-03	3.32E-03	1.33E-02	1.26E-03	1.1054E+00	2.3923E+02
3	3.87E-08	1.11E-03	2.22E-04	5.28E-03	0.00E+00	2.6733E-01	2.4007E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9837860	0.9927520	0.9937240	0.9984110	0.9981150	3.2746E+02	2.3907E+00
2	8.02E-04	5.33E-03	4.37E-03	1.32E-02	1.89E-03	1.7595E+00	3.2809E+02
3	1.54E-06	1.25E-03	4.66E-04	5.12E-03	0.00E+00	4.1063E-01	3.2944E+02
4	2.54E-09	6.69E-04	8.88E-05	3.36E-03	0.00E+00	2.2054E-01	3.2963E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 268

Total Number of Common-Cause Failure Events: 2

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9993730	0.9987440	0.9981150
2	6.28E-04	1.26E-03	1.89E-03
3		0.00E+00	0.00E+00
4			0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.99E-01	9.99E-01	9.98E-01
Beta	6.28E-04	1.26E-03	1.89E-03
Gamma		0.00E+00	0.00E+00
Delta			0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	134.00	201.00	268.00
N 1	1.3800	1.8150	2.0800
N 2	0.0850	0.2550	0.5100
N 3		0.0000	0.0000
N 4			0.0000

1.1.4.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9427150	0.9720770	0.9748420	0.9919930	0.9725290	1.0894E+02	3.1293E+00
2	8.01E-03	2.79E-02	2.52E-02	5.73E-02	2.75E-02	3.1293E+00	1.0894E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9489270	0.9716550	0.9733740	0.9885150	0.9720830	1.7632E+02	5.1435E+00
2	4.19E-03	1.58E-02	1.41E-02	3.34E-02	1.40E-02	2.8722E+00	1.7859E+02
3	2.61E-03	1.25E-02	1.08E-02	2.84E-02	1.39E-02	2.2713E+00	1.7919E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9481670	0.9682680	0.9695160	0.9841220	0.9682690	2.4160E+02	7.9176E+00
2	8.66E-03	2.11E-02	1.99E-02	3.79E-02	2.11E-02	5.2720E+00	2.4425E+02
3	6.16E-04	5.71E-03	4.46E-03	1.51E-02	5.33E-03	1.4246E+00	2.4809E+02
4	3.95E-04	4.89E-03	3.65E-03	1.36E-02	5.26E-03	1.2210E+00	2.4830E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 170
 Total Number of Common-Cause Failure Events: 11

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9725290	0.9720830	0.9682690
2	2.75E-02	1.40E-02	2.11E-02
3		1.39E-02	5.33E-03
4			5.26E-03

Motor Driven Pumps
 BWR Residual Heat Removal Pumps
 Fail to Start

2003

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.73E-01	9.72E-01	9.68E-01
Beta	2.75E-02	2.79E-02	3.17E-02
Gamma		4.98E-01	3.34E-01
Delta			4.97E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	89.01	133.51	178.01
N 1	5.7942	6.6695	6.2110
N 2	2.6779	2.0218	4.0225
N 3		2.0040	1.0140
N 4			1.0005

1.1.5 AFW Motor-Driven Pumps

1.1.5.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9634030	0.9840940	0.9864100	0.9968750	0.9859080	1.3337E+02	2.1557E+00
2	3.13E-03	1.59E-02	1.36E-02	3.66E-02	1.41E-02	2.1557E+00	1.3337E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9552000	0.9748090	0.9762600	0.9894720	0.9758080	2.1104E+02	5.4537E+00
2	8.60E-03	2.22E-02	2.07E-02	4.07E-02	2.20E-02	4.7979E+00	2.1170E+02
3	4.13E-05	3.03E-03	1.70E-03	1.05E-02	2.17E-03	6.5583E-01	2.1584E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9579800	0.9745870	0.9756500	0.9875760	0.9761680	2.8882E+02	7.5311E+00
2	6.47E-03	1.65E-02	1.54E-02	3.02E-02	1.54E-02	4.8944E+00	2.9146E+02
3	1.53E-03	7.52E-03	6.44E-03	1.72E-02	7.67E-03	2.2282E+00	2.9412E+02
4	1.65E-06	1.38E-03	5.13E-04	5.68E-03	7.93E-04	4.0854E-01	2.9594E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 146

Total Number of Common-Cause Failure Events: 14

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9859080	0.9758080	0.9761680
2	1.41E-02	2.20E-02	1.54E-02
3		2.17E-03	7.67E-03
4			7.93E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.86E-01	9.76E-01	9.76E-01
Beta	1.41E-02	2.42E-02	2.38E-02
Gamma		8.96E-02	3.55E-01
Delta			9.37E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	110.61	165.91	221.21
N 1	8.6247	8.9895	10.2333
N 2	1.7043	3.9475	3.6449
N 3		0.3885	1.8176
N 4			0.1880

1.1.5.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9142310	0.9457080	0.9474780	0.9711260	0.9434750	1.5799E+02	9.0701E+00
2	2.89E-02	5.43E-02	5.25E-02	8.58E-02	5.65E-02	9.0701E+00	1.5799E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9347440	0.9571320	0.9582940	0.9755450	0.9549880	2.4974E+02	1.1185E+01
2	1.02E-02	2.31E-02	2.19E-02	4.01E-02	2.31E-02	6.0239E+00	2.5490E+02
3	8.00E-03	1.98E-02	1.86E-02	3.57E-02	2.19E-02	5.1615E+00	2.5576E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9458690	0.9635810	0.9644540	0.9783240	0.9626390	3.4093E+02	1.2886E+01
2	5.22E-03	1.35E-02	1.26E-02	2.49E-02	1.20E-02	4.7874E+00	3.4903E+02
3	6.12E-03	1.49E-02	1.40E-02	2.69E-02	1.66E-02	5.2868E+00	3.4853E+02
4	2.05E-03	7.95E-03	7.04E-03	1.69E-02	8.80E-03	2.8114E+00	3.5100E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 162
 Total Number of Common-Cause Failure Events: 15

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9434750	0.9549880	0.9626390
2	5.65E-02	2.31E-02	1.20E-02
3		2.19E-02	1.66E-02
4			8.80E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.44E-01	9.55E-01	9.63E-01
Beta	5.65E-02	4.50E-02	3.74E-02
Gamma		4.86E-01	6.79E-01
Delta			3.47E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	139.06	208.58	278.11
N 1	4.7960	5.0205	5.4442
N 2	8.6187	5.1735	3.5379
N 3		4.8942	4.8762
N 4			2.5909

1.1.6 AFW Turbine-Driven Pumps

1.1.6.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9653580	0.9824670	0.9839910	0.9943590	0.9834810	2.0386E+02	3.6381E+00
2	5.64E-03	1.75E-02	1.60E-02	3.46E-02	1.65E-02	3.6381E+00	2.0386E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9735610	0.9857750	0.9867580	0.9946200	0.9878180	3.2026E+02	4.6214E+00
2	1.53E-03	7.16E-03	6.18E-03	1.62E-02	5.13E-03	2.3259E+00	3.2256E+02
3	1.48E-03	7.07E-03	6.08E-03	1.60E-02	7.05E-03	2.2955E+00	3.2259E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 234

Total Number of Common-Cause Failure Events: 6

Alpha Factor	CCCG=2	CCCG=3
1	0.9834810	0.9878180
2	1.65E-02	5.13E-03
3		7.05E-03

MGL Parameter	CCCG=2	CCCG=3
1-Beta	9.84E-01	9.88E-01
Beta	1.65E-02	1.22E-02
Gamma		5.79E-01

Motor Driven Pumps
AFW Turbine-Driven Pumps
Fail to Run

2003

Avg. Impact Vector	CCCG=2	CCCG=3
Adj. Ind. Events	187.20	280.80
N 1	2.5267	3.3145
N 2	3.1867	1.4755
N 3		2.0282

1.1.6.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9830670	0.9928930	0.9940460	0.9987680	0.9942310	2.7263E+02	1.9514E+00
2	1.23E-03	7.11E-03	5.95E-03	1.69E-02	5.77E-03	1.9514E+00	2.7263E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9854470	0.9930780	0.9938360	0.9981360	0.9952880	4.2339E+02	2.9510E+00
2	6.99E-04	4.34E-03	3.59E-03	1.05E-02	2.57E-03	1.8504E+00	4.2449E+02
3	1.67E-04	2.58E-03	1.86E-03	7.47E-03	2.14E-03	1.1006E+00	4.2524E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 258
 Total Number of Common-Cause Failure Events: 2

Alpha Factor	CCCG=2	CCCG=3
1	0.9942310	0.9952880
2	5.77E-03	2.57E-03
3		2.14E-03

MGL Parameter	CCCG=2	CCCG=3
1-Beta	9.94E-01	9.95E-01
Beta	5.77E-03	4.71E-03
Gamma		4.55E-01

Avg. Impact Vector	CCCG=2	CCCG=3
Adj. Ind. Events	258.00	387.00
N 1	0.5000	0.2500
N 2	1.5000	1.0000
N 3		0.8333

1.1.7 Emergency Service Water Pump

1.1.7.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	EMERGENCY/ESSENTIAL SERVICE WATER
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9683450	0.9798690	0.9805280	0.9891390	0.9802070	4.7210E+02	9.6990E+00
2	1.09E-02	2.01E-02	1.95E-02	3.17E-02	1.98E-02	9.6990E+00	4.7210E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9704760	0.9797190	0.9801530	0.9874780	0.9802410	7.1639E+02	1.4830E+01
2	7.50E-03	1.37E-02	1.33E-02	2.15E-02	1.33E-02	1.0047E+01	7.2117E+02
3	2.52E-03	6.54E-03	6.10E-03	1.21E-02	6.51E-03	4.7828E+00	7.2644E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9710740	0.9791090	0.9794380	0.9860320	0.9798080	9.5791E+02	2.0439E+01
2	7.33E-03	1.26E-02	1.22E-02	1.89E-02	1.20E-02	1.2290E+01	9.6606E+02
3	2.49E-03	5.84E-03	5.51E-03	1.03E-02	5.77E-03	5.7146E+00	9.7263E+02
4	5.55E-04	2.49E-03	2.16E-03	5.55E-03	2.41E-03	2.4344E+00	9.7592E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9722450	0.9792440	0.9794990	0.9853780	0.9801560	1.2374E+03	2.6228E+01
2	6.84E-03	1.12E-02	1.10E-02	1.65E-02	1.06E-02	1.4206E+01	1.2494E+03
3	2.53E-03	5.43E-03	5.17E-03	9.22E-03	5.17E-03	6.8649E+00	1.2568E+03
4	1.07E-03	3.15E-03	2.89E-03	6.11E-03	3.16E-03	3.9814E+00	1.2597E+03
5	6.93E-05	9.31E-04	6.84E-04	2.63E-03	9.63E-04	1.1759E+00	1.2625E+03

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9736390	0.9799090	0.9801230	0.9854580	0.9809090	1.4817E+03	3.0379E+01
2	6.01E-03	9.77E-03	9.56E-03	1.43E-02	9.12E-03	1.4773E+01	1.4973E+03
3	2.38E-03	4.93E-03	4.71E-03	8.21E-03	4.65E-03	7.4520E+00	1.5046E+03
4	1.30E-03	3.29E-03	3.07E-03	6.03E-03	3.22E-03	4.9755E+00	1.5071E+03
5	3.92E-04	1.68E-03	1.47E-03	3.70E-03	1.70E-03	2.5402E+00	1.5095E+03
6	5.15E-06	4.22E-04	2.32E-04	1.49E-03	4.02E-04	6.3826E-01	1.5114E+03

ALPHA FACTOR AND MGL PARAMETERS

System :	EMERGENCY/ESSENTIAL SERVICE WATER
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 895
 Total Number of Common-Cause Failure Events: 59

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9802070	0.9802410	0.9798080	0.9801560	0.9809090
2	1.98E-02	1.33E-02	1.20E-02	1.06E-02	9.12E-03
3		6.51E-03	5.77E-03	5.17E-03	4.65E-03
4			2.41E-03	3.16E-03	3.22E-03
5				9.63E-04	1.70E-03
6					4.02E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.80E-01	9.80E-01	9.80E-01	9.80E-01	9.81E-01
Beta	1.98E-02	1.98E-02	2.02E-02	1.98E-02	1.91E-02
Gamma		3.29E-01	4.05E-01	4.68E-01	5.22E-01
Delta			2.95E-01	4.44E-01	5.34E-01
Epsilon				2.34E-01	3.95E-01
Mu					1.91E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	432.37	648.55	864.73	1080.92	1297.10
N 1	25.5951	31.6964	35.7999	39.5909	43.4237
N 2	9.2476	9.1963	11.0403	12.0647	12.4696
N 3		4.5155	5.3040	5.9075	6.3541
N 4			2.2139	3.6126	4.3937
N 5				1.1005	2.3237
N 6					0.5487

1.1.7.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	EMERGENCY/ESSENTIAL SERVICE WATER
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9605120	0.9793460	0.9809320	0.9927560	0.9801620	1.9450E+02	4.1020E+00
2	7.25E-03	2.07E-02	1.91E-02	3.95E-02	1.98E-02	4.1020E+00	1.9450E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9517680	0.9693990	0.9704100	0.9835850	0.9693160	2.9965E+02	9.4590E+00
2	1.27E-02	2.55E-02	2.45E-02	4.18E-02	2.59E-02	7.8865E+00	3.0122E+02
3	6.46E-04	5.09E-03	4.07E-03	1.30E-02	4.80E-03	1.5725E+00	3.0754E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9515740	0.9670770	0.9678180	0.9800410	0.9668810	4.0401E+02	1.3754E+01
2	1.26E-02	2.32E-02	2.25E-02	3.65E-02	2.36E-02	9.7053E+00	4.0806E+02
3	2.30E-03	7.81E-03	7.04E-03	1.60E-02	7.96E-03	3.2628E+00	4.1450E+02
4	4.87E-05	1.88E-03	1.17E-03	6.14E-03	1.58E-03	7.8574E-01	4.1698E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9553820	0.9683530	0.9689060	0.9794420	0.9677500	5.4708E+02	1.7879E+01
2	1.05E-02	1.89E-02	1.83E-02	2.92E-02	1.92E-02	1.0669E+01	5.5429E+02
3	3.45E-03	8.77E-03	8.20E-03	1.61E-02	9.00E-03	4.9566E+00	5.6000E+02
4	5.57E-04	3.35E-03	2.79E-03	8.08E-03	3.43E-03	1.8951E+00	5.6306E+02
5	3.02E-07	6.35E-04	2.01E-04	2.74E-03	6.37E-04	3.5864E-01	5.6460E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9571850	0.9688960	0.9693560	0.9790280	0.9684520	6.5460E+02	2.1014E+01
2	9.25E-03	1.64E-02	1.59E-02	2.51E-02	1.65E-02	1.1067E+01	6.6455E+02
3	3.73E-03	8.65E-03	8.17E-03	1.52E-02	8.96E-03	5.8457E+00	6.6977E+02
4	1.03E-03	4.08E-03	3.61E-03	8.77E-03	4.11E-03	2.7589E+00	6.7286E+02
5	1.08E-04	1.64E-03	1.18E-03	4.74E-03	1.68E-03	1.1092E+00	6.7451E+02
6	2.62E-09	3.45E-04	5.21E-05	1.71E-03	2.71E-04	2.3326E-01	6.7538E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	EMERGENCY/ESSENTIAL SERVICE WATER
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 409

Total Number of Common-Cause Failure Events: 47

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9801620	0.9693160	0.9668810	0.9677500	0.9684520
2	1.98E-02	2.59E-02	2.36E-02	1.92E-02	1.65E-02
3		4.80E-03	7.96E-03	9.00E-03	8.96E-03
4			1.58E-03	3.43E-03	4.11E-03
5				6.37E-04	1.68E-03
6					2.71E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.80E-01	9.69E-01	9.67E-01	9.68E-01	9.69E-01
Beta	1.98E-02	3.07E-02	3.31E-02	3.23E-02	3.16E-02
Gamma		1.57E-01	2.88E-01	4.05E-01	4.76E-01
Delta			1.65E-01	3.12E-01	4.04E-01
Epsilon				1.57E-01	3.23E-01
Mu					1.39E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	156.41	234.61	312.81	391.01	469.22
N 1	23.9555	28.8971	33.8203	39.1962	44.1702
N 2	3.6506	7.0361	8.4558	8.5278	8.7630
N 3		1.3052	2.8522	3.9992	4.7478
N 4			0.5652	1.5263	2.1771
N 5				0.2832	0.8927
N 6					0.1437

1.1.8 PWR High Pressure Safety Injection Pump

1.1.8.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9552910	0.9744700	0.9758480	0.9889530	0.9748410	2.2215E+02	5.8201E+00
2	1.11E-02	2.55E-02	2.42E-02	4.47E-02	2.52E-02	5.8201E+00	2.2215E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9556130	0.9715160	0.9724010	0.9843920	0.9716950	3.4283E+02	1.0051E+01
2	9.76E-03	2.04E-02	1.95E-02	3.41E-02	2.01E-02	7.1979E+00	3.4568E+02
3	2.12E-03	8.09E-03	7.18E-03	1.72E-02	8.19E-03	2.8535E+00	3.5003E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9612140	0.9741730	0.9748320	0.9848830	0.9750120	4.6430E+02	1.2309E+01
2	5.84E-03	1.31E-02	1.24E-02	2.27E-02	1.20E-02	6.2404E+00	4.7037E+02
3	3.56E-03	9.54E-03	8.86E-03	1.78E-02	9.91E-03	4.5459E+00	4.7206E+02
4	3.85E-04	3.20E-03	2.53E-03	8.27E-03	3.12E-03	1.5230E+00	4.7509E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 270

Total Number of Common-Cause Failure Events: 21

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9748410	0.9716950	0.9750120
2	2.52E-02	2.01E-02	1.20E-02
3		8.19E-03	9.91E-03
4			3.12E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.75E-01	9.72E-01	9.75E-01
Beta	2.52E-02	2.83E-02	2.50E-02
Gamma		2.90E-01	5.21E-01
Delta			2.40E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	199.26	298.89	398.52
N 1	8.7627	7.7965	8.4019
N 2	5.3687	6.3475	4.9909
N 3		2.5862	4.1353
N 4			1.3025

1.1.8.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9441270	0.9707030	0.9729240	0.9896920	0.9708960	1.3567E+02	4.0947E+00
2	1.03E-02	2.93E-02	2.71E-02	5.59E-02	2.91E-02	4.0947E+00	1.3567E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9439050	0.9659820	0.9673730	0.9833080	0.9651710	2.1427E+02	7.5457E+00
2	1.05E-02	2.49E-02	2.35E-02	4.42E-02	2.53E-02	5.5274E+00	2.1629E+02
3	1.65E-03	9.10E-03	7.67E-03	2.14E-02	9.49E-03	2.0183E+00	2.1980E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9480570	0.9665950	0.9676160	0.9816330	0.9661890	2.9248E+02	1.0108E+01
2	8.92E-03	2.02E-02	1.91E-02	3.50E-02	1.99E-02	6.0981E+00	2.9649E+02
3	2.57E-03	9.63E-03	8.57E-03	2.03E-02	1.03E-02	2.9142E+00	2.9967E+02
4	2.32E-04	3.62E-03	2.60E-03	1.05E-02	3.60E-03	1.0956E+00	3.0149E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 183
Total Number of Common-Cause Failure Events: 12

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9708960	0.9651710	0.9661890
2	2.91E-02	2.53E-02	1.99E-02
3		9.49E-03	1.03E-02
4			3.60E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.71E-01	9.65E-01	9.66E-01
Beta	2.91E-02	3.48E-02	3.38E-02
Gamma		2.72E-01	4.11E-01
Delta			2.59E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	115.46	173.19	230.91
N 1	6.0800	4.9430	4.1916
N 2	3.6433	4.6770	4.8486
N 3		1.7510	2.5036
N 4			0.8751

1.1.9 PWR Residual Heat Removal Pump

1.1.9.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9661960	0.9810220	0.9821230	0.9920770	0.9816610	2.8231E+02	5.4614E+00
2	7.92E-03	1.90E-02	1.79E-02	3.38E-02	1.83E-02	5.4614E+00	2.8231E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9760100	0.9861750	0.9868950	0.9938760	0.9876540	4.3838E+02	6.1457E+00
2	2.30E-03	7.60E-03	6.87E-03	1.54E-02	6.21E-03	3.3774E+00	4.4115E+02
3	1.58E-03	6.23E-03	5.50E-03	1.33E-02	6.14E-03	2.7683E+00	4.4176E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9804900	0.9884570	0.9889920	0.9945880	0.9906670	5.9367E+02	6.9329E+00
2	9.94E-04	4.24E-03	3.71E-03	9.32E-03	2.40E-03	2.5481E+00	5.9806E+02
3	1.29E-03	4.85E-03	4.32E-03	1.03E-02	4.63E-03	2.9142E+00	5.9769E+02
4	2.78E-04	2.45E-03	1.92E-03	6.41E-03	2.31E-03	1.4706E+00	5.9913E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 268

Total Number of Common-Cause Failure Events: 6

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9816610	0.9876540	0.9906670
2	1.83E-02	6.21E-03	2.40E-03
3		6.14E-03	4.63E-03
4			2.31E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.82E-01	9.88E-01	9.91E-01
Beta	1.83E-02	1.24E-02	9.33E-03
Gamma		4.97E-01	7.43E-01
Delta			3.33E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	268.00	402.00	536.00
N 1	0.1800	0.2430	0.2916
N 2	5.0100	2.5270	1.2986
N 3		2.5010	2.5036
N 4			1.2501

1.1.9.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9385750	0.9638530	0.9655500	0.9833420	0.9633990	1.7478E+02	6.5547E+00
2	1.67E-02	3.62E-02	3.45E-02	6.14E-02	3.66E-02	6.5547E+00	1.7478E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9568400	0.9739980	0.9751040	0.9873890	0.9746000	2.7687E+02	7.3914E+00
2	5.06E-03	1.44E-02	1.33E-02	2.77E-02	1.32E-02	4.1059E+00	2.8016E+02
3	3.42E-03	1.16E-02	1.04E-02	2.35E-02	1.22E-02	3.2855E+00	2.8098E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9649510	0.9783550	0.9791740	0.9889550	0.9801830	3.7806E+02	8.3641E+00
2	2.35E-03	8.20E-03	7.37E-03	1.69E-02	5.87E-03	3.1697E+00	3.8325E+02
3	2.78E-03	8.98E-03	8.15E-03	1.80E-02	9.35E-03	3.4706E+00	3.8295E+02
4	6.51E-04	4.46E-03	3.64E-03	1.11E-02	4.60E-03	1.7238E+00	3.8470E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 170
Total Number of Common-Cause Failure Events: 8

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9633990	0.9746000	0.9801830
2	3.66E-02	1.32E-02	5.87E-03
3		1.22E-02	9.35E-03
4			4.60E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.63E-01	9.75E-01	9.80E-01
Beta	3.66E-02	2.54E-02	1.98E-02
Gamma		4.81E-01	7.04E-01
Delta			3.29E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	159.62	239.44	319.25
N 1	1.0267	1.2845	1.4330
N 2	6.1033	3.2555	1.9202
N 3		3.0182	3.0600
N 4			1.5033

1.1.10 BWR High Pressure Coolant Injection and Reactor Core Isolation Cooling Pumps

1.1.10.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	HIGH PRESSURE COOLANT INJECTION (BWR)
	REACTOR CORE ISOLATION COOLING
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9907740	0.9976360	0.9989700	0.9999940	0.9998660	2.0108E+02	4.7644E-01
2	7.18E-06	2.36E-03	1.03E-03	9.23E-03	1.34E-04	4.7644E-01	2.0108E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	HIGH PRESSURE COOLANT INJECTION (BWR)
	REACTOR CORE ISOLATION COOLING
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 186

Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2
1	0.9998660
2	1.34E-04

MGL Parameter	CCCG=2
1-Beta	1.00E+00
Beta	1.34E-04

Avg. Impact Vector	CCCG=2
Adj. Ind. Events	186.00
N 1	0.9500
N 2	0.0250

1.1.10.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	HIGH PRESSURE COOLANT INJECTION (BWR)
	REACTOR CORE ISOLATION COOLING
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9853670	0.9944300	0.9956360	0.9993770	0.9959350	2.5913E+02	1.4514E+00
2	6.21E-04	5.57E-03	4.37E-03	1.46E-02	4.07E-03	1.4514E+00	2.5913E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	HIGH PRESSURE COOLANT INJECTION (BWR)
	REACTOR CORE ISOLATION COOLING
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 245
 Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2
1	0.9959350
2	4.07E-03

MGL Parameter	CCCG=2
1-Beta	9.96E-01
Beta	4.07E-03

Avg. Impact Vector	CCCG=2
Adj. Ind. Events	245.00
N 1	0.0000
N 2	1.0000

1.1.11 BWR Standby Liquid Control Pump

1.1.11.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	STANDBY LIQUID CONTROL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9340310	0.9698060	0.9735030	0.9929410	0.9699680	8.0520E+01	2.5069E+00
2	7.06E-03	3.02E-02	2.65E-02	6.60E-02	3.00E-02	2.5069E+00	8.0520E+01

ALPHA FACTOR AND MGL PARAMETERS

System :	STANDBY LIQUID CONTROL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 64

Total Number of Common-Cause Failure Events: 8

Alpha Factor	CCCG=2
1	0.9699680
2	3.00E-02

MGL Parameter	CCCG=2
1-Beta	9.70E-01
Beta	3.00E-02

Avg. Impact Vector	CCCG=2
Adj. Ind. Events	64.00
N 1	2.3890
N 2	2.0555

1.1.11.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	STANDBY LIQUID CONTROL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8886720	0.9543900	0.9622400	0.9932120	0.9450740	3.5811E+01	1.7114E+00
2	6.79E-03	4.56E-02	3.78E-02	1.11E-01	5.49E-02	1.7114E+00	3.5811E+01

ALPHA FACTOR AND MGL PARAMETERS

System :	STANDBY LIQUID CONTROL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 21
 Total Number of Common-Cause Failure Events: 3

Alpha Factor	CCCG=2
1	0.9450740
2	5.49E-02

MGL Parameter	CCCG=2
1-Beta	9.45E-01
Beta	5.49E-02

Avg. Impact Vector	CCCG=2
Adj. Ind. Events	21.00
N 1	0.6800
N 2	1.2600

1.2 Motor Operated Valves

1.2.1 Pooled Motor Operated Valve Distributions

1.2.1.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9510650	0.9645050	0.9650380	0.9761370	0.9643880	5.6210E+02	2.0686E+01
2	2.39E-02	3.55E-02	3.50E-02	4.89E-02	3.56E-02	2.0686E+01	5.6210E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9596890	0.9697670	0.9701260	0.9786230	0.9697560	8.5035E+02	2.6510E+01
2	1.07E-02	1.72E-02	1.68E-02	2.50E-02	1.70E-02	1.5087E+01	8.6177E+02
3	7.42E-03	1.30E-02	1.27E-02	1.99E-02	1.33E-02	1.1423E+01	8.6544E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9625370	0.9710360	0.9713020	0.9786170	0.9711830	1.1343E+03	3.3834E+01
2	9.73E-03	1.51E-02	1.48E-02	2.14E-02	1.48E-02	1.7621E+01	1.1505E+03
3	4.02E-03	7.69E-03	7.41E-03	1.23E-02	7.73E-03	8.9791E+00	1.1592E+03
4	2.96E-03	6.19E-03	5.91E-03	1.04E-02	6.33E-03	7.2342E+00	1.1609E+03

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9657130	0.9729510	0.9731590	0.9794690	0.9731590	1.4567E+03	4.0498E+01
2	8.40E-03	1.28E-02	1.26E-02	1.79E-02	1.23E-02	1.9127E+01	1.4781E+03
3	3.52E-03	6.53E-03	6.32E-03	1.03E-02	6.41E-03	9.7822E+00	1.4874E+03
4	2.43E-03	5.02E-03	4.80E-03	8.34E-03	5.19E-03	7.5092E+00	1.4897E+03
5	9.45E-04	2.73E-03	2.51E-03	5.25E-03	2.91E-03	4.0800E+00	1.4931E+03

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9680030	0.9744250	0.9746050	0.9802490	0.9747710	1.7436E+03	4.5763E+01
2	7.46E-03	1.12E-02	1.10E-02	1.56E-02	1.08E-02	2.0088E+01	1.7693E+03
3	2.96E-03	5.48E-03	5.30E-03	8.63E-03	5.30E-03	9.8040E+00	1.7796E+03
4	2.23E-03	4.48E-03	4.29E-03	7.35E-03	4.52E-03	8.0095E+00	1.7814E+03
5	1.20E-03	2.95E-03	2.76E-03	5.32E-03	3.07E-03	5.2701E+00	1.7841E+03
6	3.44E-04	1.45E-03	1.27E-03	3.17E-03	1.52E-03	2.5915E+00	1.7868E+03

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9705270	0.9761840	0.9763290	0.9813360	0.9767360	2.0906E+03	5.1004E+01
2	6.28E-03	9.43E-03	9.28E-03	1.31E-02	8.87E-03	2.0195E+01	2.1214E+03
3	2.81E-03	5.04E-03	4.89E-03	7.79E-03	4.81E-03	1.0796E+01	2.1308E+03
4	1.90E-03	3.80E-03	3.64E-03	6.21E-03	3.75E-03	8.1281E+00	2.1335E+03
5	1.42E-03	3.11E-03	2.95E-03	5.31E-03	3.21E-03	6.6498E+00	2.1350E+03
6	6.26E-04	1.85E-03	1.69E-03	3.59E-03	1.97E-03	3.9541E+00	2.1377E+03
7	5.29E-05	5.98E-04	4.52E-04	1.64E-03	6.55E-04	1.2808E+00	2.1403E+03

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9725070	0.9776360	0.9777690	0.9823180	0.9783120	2.3926E+03	5.4732E+01
2	5.39E-03	8.13E-03	7.99E-03	1.13E-02	7.53E-03	1.9887E+01	2.4274E+03
3	2.63E-03	4.63E-03	4.50E-03	7.10E-03	4.41E-03	1.1338E+01	2.4360E+03
4	1.58E-03	3.20E-03	3.07E-03	5.28E-03	3.10E-03	7.8365E+00	2.4395E+03
5	1.37E-03	2.90E-03	2.77E-03	4.89E-03	2.95E-03	7.1058E+00	2.4402E+03
6	8.77E-04	2.16E-03	2.02E-03	3.89E-03	2.26E-03	5.2749E+00	2.4421E+03
7	2.59E-04	1.07E-03	9.41E-04	2.34E-03	1.15E-03	2.6266E+00	2.4447E+03
8	3.83E-06	2.71E-04	1.52E-04	9.40E-04	2.87E-04	6.6269E-01	2.4467E+03

ALPHA FACTOR AND MGL PARAMETERS

Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 1379
Total Number of Common-Cause Failure Events: 77

Motor Operated Valves
Pooled Motor Operated Valve Distributions
Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9643880	0.9697560	0.9711830	0.9731590	0.9747710	0.9767360	0.9783120
2	3.56E-02	1.70E-02	1.48E-02	1.23E-02	1.08E-02	8.87E-03	7.53E-03
3		1.33E-02	7.73E-03	6.41E-03	5.30E-03	4.81E-03	4.41E-03
4			6.33E-03	5.19E-03	4.52E-03	3.75E-03	3.10E-03
5				2.91E-03	3.07E-03	3.21E-03	2.95E-03
6					1.52E-03	1.97E-03	2.26E-03
7						6.55E-04	1.15E-03
8							2.87E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.64E-01	9.70E-01	9.71E-01	9.73E-01	9.75E-01	9.77E-01	9.78E-01
Beta	3.56E-02	3.02E-02	2.88E-02	2.68E-02	2.52E-02	2.33E-02	2.17E-02
Gamma		4.39E-01	4.88E-01	5.40E-01	5.71E-01	6.19E-01	6.53E-01
Delta			4.50E-01	5.58E-01	6.33E-01	6.66E-01	6.88E-01
Epsilon				3.59E-01	5.04E-01	6.09E-01	6.82E-01
Mu					3.31E-01	4.50E-01	5.56E-01
Upsilon						2.49E-01	3.89E-01
Sigma							2.00E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	521.36	782.04	1042.72	1303.40	1564.08	1824.76	2085.44
N 1	26.6066	32.1729	34.1498	36.4353	38.3000	41.2180	43.9494
N 2	20.2348	14.2369	16.3712	16.9851	17.7842	16.9430	16.3893
N 3		11.1558	8.5685	8.8248	8.7061	9.1821	9.6032
N 4			7.0137	7.1404	7.4277	7.1643	6.7455
N 5				4.0046	5.0536	6.1316	6.4182
N 6					2.5019	3.7720	4.9151
N 7						1.2508	2.5094
N 8							0.6253

1.2.1.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9683020	0.9818340	0.9828000	0.9920570	0.9824280	3.2273E+02	5.9713E+00
2	7.95E-03	1.82E-02	1.72E-02	3.17E-02	1.76E-02	5.9713E+00	3.2273E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9673930	0.9788860	0.9795150	0.9882240	0.9795950	4.9305E+02	1.0635E+01
2	7.73E-03	1.56E-02	1.49E-02	2.56E-02	1.50E-02	7.8464E+00	4.9584E+02
3	1.42E-03	5.54E-03	4.90E-03	1.18E-02	5.41E-03	2.7885E+00	5.0090E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9653120	0.9757630	0.9762290	0.9846170	0.9764830	6.5994E+02	1.6392E+01
2	9.99E-03	1.74E-02	1.69E-02	2.63E-02	1.70E-02	1.1739E+01	6.6459E+02
3	1.02E-03	4.06E-03	3.58E-03	8.73E-03	3.78E-03	2.7450E+00	6.7359E+02
4	4.73E-04	2.82E-03	2.35E-03	6.79E-03	2.74E-03	1.9083E+00	6.7442E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9671990	0.9761830	0.9765430	0.9839480	0.9770630	8.6622E+02	2.1134E+01
2	8.62E-03	1.46E-02	1.42E-02	2.17E-02	1.41E-02	1.2917E+01	8.7444E+02
3	2.27E-03	5.70E-03	5.33E-03	1.04E-02	5.35E-03	5.0590E+00	8.8230E+02
4	5.19E-04	2.54E-03	2.17E-03	5.79E-03	2.45E-03	2.2493E+00	8.8511E+02
5	4.10E-05	1.02E-03	6.83E-04	3.17E-03	1.09E-03	9.0904E-01	8.8645E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9682900	0.9764210	0.9767230	0.9835380	0.9773590	1.0366E+03	2.5032E+01
2	7.90E-03	1.31E-02	1.28E-02	1.93E-02	1.26E-02	1.3867E+01	1.0478E+03
3	2.48E-03	5.67E-03	5.36E-03	9.90E-03	5.37E-03	6.0139E+00	1.0556E+03
4	8.34E-04	2.95E-03	2.64E-03	6.10E-03	2.78E-03	3.1284E+00	1.0585E+03
5	1.72E-04	1.43E-03	1.13E-03	3.71E-03	1.42E-03	1.5190E+00	1.0601E+03
6	1.95E-06	4.75E-04	2.18E-04	1.82E-03	4.52E-04	5.0396E-01	1.0611E+03

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9700380	0.9772390	0.9774820	0.9836100	0.9784580	1.2667E+03	2.9502E+01
2	6.88E-03	1.12E-02	1.10E-02	1.64E-02	1.06E-02	1.4546E+01	1.2817E+03
3	2.68E-03	5.60E-03	5.35E-03	9.39E-03	5.31E-03	7.2635E+00	1.2889E+03
4	1.12E-03	3.19E-03	2.94E-03	6.13E-03	2.98E-03	4.1401E+00	1.2921E+03
5	3.69E-04	1.77E-03	1.52E-03	4.01E-03	1.66E-03	2.2888E+00	1.2939E+03
6	4.35E-05	7.93E-04	5.56E-04	2.35E-03	7.94E-04	1.0276E+00	1.2952E+03
7	1.60E-09	1.82E-04	2.83E-05	8.97E-04	1.94E-04	2.3621E-01	1.2960E+03

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9714230	0.9780280	0.9782440	0.9839000	0.9793260	1.4518E+03	3.2616E+01
2	6.16E-03	1.00E-02	9.78E-03	1.46E-02	9.34E-03	1.4838E+01	1.4696E+03
3	2.54E-03	5.18E-03	4.96E-03	8.58E-03	4.91E-03	7.6952E+00	1.4767E+03
4	1.24E-03	3.22E-03	3.00E-03	5.96E-03	3.04E-03	4.7820E+00	1.4796E+03
5	5.21E-04	1.96E-03	1.74E-03	4.15E-03	1.83E-03	2.9119E+00	1.4815E+03
6	1.43E-04	1.09E-03	8.72E-04	2.76E-03	1.03E-03	1.6114E+00	1.4828E+03
7	5.21E-06	4.30E-04	2.36E-04	1.51E-03	4.29E-04	6.3755E-01	1.4838E+03
8	2.14E-13	9.43E-05	2.99E-06	5.26E-04	8.45E-05	1.3999E-01	1.4843E+03

ALPHA FACTOR AND MGL PARAMETERS

Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 785
Total Number of Common-Cause Failure Events: 49

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9824280	0.9795950	0.9764830	0.9770630	0.9773590	0.9784580	0.9793260
2	1.76E-02	1.50E-02	1.70E-02	1.41E-02	1.26E-02	1.06E-02	9.34E-03
3		5.41E-03	3.78E-03	5.35E-03	5.37E-03	5.31E-03	4.91E-03
4			2.74E-03	2.45E-03	2.78E-03	2.98E-03	3.04E-03
5				1.09E-03	1.42E-03	1.66E-03	1.83E-03
6					4.52E-04	7.94E-04	1.03E-03
7						1.94E-04	4.29E-04
8							8.45E-05

Motor Operated Valves
Pooled Motor Operated Valve Distributions
Fail to Close

2003

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.82E-01	9.80E-01	9.77E-01	9.77E-01	9.77E-01	9.79E-01	9.79E-01
Beta	1.76E-02	2.04E-02	2.35E-02	2.29E-02	2.26E-02	2.15E-02	2.07E-02
Gamma		2.65E-01	2.77E-01	3.88E-01	4.43E-01	5.08E-01	5.48E-01
Delta			4.20E-01	3.98E-01	4.65E-01	5.15E-01	5.67E-01
Epsilon				3.07E-01	4.03E-01	4.71E-01	5.26E-01
Mu					2.41E-01	3.73E-01	4.57E-01
Upsilon						1.96E-01	3.32E-01
Sigma							1.65E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	290.20	435.30	580.41	725.51	870.61	1015.71	1160.81
N 1	18.4019	21.6068	22.1498	23.8380	24.8233	26.3941	27.7105
N 2	5.5199	6.9960	10.4895	10.7754	11.5635	11.2942	11.3399
N 3		2.5212	2.3344	4.1016	4.9160	5.6500	5.9604
N 4			1.6878	1.8805	2.5466	3.1763	3.6910
N 5				0.8336	1.3025	1.7706	2.2243
N 6					0.4144	0.8455	1.2516
N 7						0.2062	0.5204
N 8							0.1026

1.2.1.3 Fail to Operate

ALPHA FACTOR DISTRIBUTIONS

Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9609960	0.9707960	0.9711480	0.9794050	0.9708250	8.7115E+02	2.6206E+01
2	2.06E-02	2.92E-02	2.89E-02	3.90E-02	2.92E-02	2.6206E+01	8.7115E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9655720	0.9731930	0.9734250	0.9800180	0.9732840	1.3079E+03	3.6027E+01
2	1.12E-02	1.64E-02	1.62E-02	2.25E-02	1.63E-02	2.2083E+01	1.3218E+03
3	6.28E-03	1.04E-02	1.01E-02	1.53E-02	1.05E-02	1.3944E+01	1.3300E+03

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9663320	0.9729310	0.9731050	0.9789280	0.9730920	1.7377E+03	4.8346E+01
2	1.12E-02	1.57E-02	1.56E-02	2.09E-02	1.56E-02	2.8110E+01	1.7579E+03
3	3.59E-03	6.34E-03	6.15E-03	9.70E-03	6.31E-03	1.1314E+01	1.7747E+03
4	2.60E-03	5.00E-03	4.81E-03	8.02E-03	5.04E-03	8.9220E+00	1.7771E+03

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9686660	0.9743570	0.9744950	0.9795680	0.9745690	2.2072E+03	5.8089E+01
2	9.52E-03	1.32E-02	1.31E-02	1.74E-02	1.29E-02	2.9902E+01	2.2354E+03
3	3.70E-03	6.13E-03	5.98E-03	9.05E-03	6.03E-03	1.3884E+01	2.2514E+03
4	2.20E-03	4.15E-03	4.00E-03	6.59E-03	4.21E-03	9.3896E+00	2.2559E+03
5	8.47E-04	2.17E-03	2.02E-03	3.99E-03	2.26E-03	4.9136E+00	2.2604E+03

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9703440	0.9754310	0.9755500	0.9801150	0.9757100	2.6404E+03	6.6506E+01
2	8.51E-03	1.17E-02	1.16E-02	1.53E-02	1.15E-02	3.1651E+01	2.6753E+03
3	3.34E-03	5.44E-03	5.32E-03	7.95E-03	5.32E-03	1.4720E+01	2.6922E+03
4	2.16E-03	3.90E-03	3.78E-03	6.06E-03	3.89E-03	1.0556E+01	2.6964E+03
5	1.11E-03	2.43E-03	2.31E-03	4.16E-03	2.48E-03	6.5727E+00	2.7003E+03
6	3.03E-04	1.11E-03	9.90E-04	2.33E-03	1.14E-03	3.0058E+00	2.7039E+03

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9724290	0.9769510	0.9770530	0.9811310	0.9773650	3.1343E+03	7.3946E+01
2	7.14E-03	9.82E-03	9.71E-03	1.28E-02	9.49E-03	3.1489E+01	3.1768E+03
3	3.24E-03	5.13E-03	5.02E-03	7.36E-03	4.98E-03	1.6446E+01	3.1918E+03
4	2.00E-03	3.52E-03	3.42E-03	5.40E-03	3.47E-03	1.1304E+01	3.1969E+03
5	1.34E-03	2.63E-03	2.52E-03	4.27E-03	2.65E-03	8.4204E+00	3.1998E+03
6	5.76E-04	1.50E-03	1.39E-03	2.77E-03	1.55E-03	4.7996E+00	3.2035E+03
7	5.36E-05	4.64E-04	3.65E-04	1.21E-03	4.89E-04	1.4869E+00	3.2068E+03

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9740950	0.9782070	0.9782960	0.9820240	0.9786860	3.5829E+03	7.9822E+01
2	6.19E-03	8.53E-03	8.44E-03	1.12E-02	8.18E-03	3.1227E+01	3.6315E+03
3	3.03E-03	4.72E-03	4.63E-03	6.73E-03	4.59E-03	1.7298E+01	3.6454E+03
4	1.79E-03	3.15E-03	3.06E-03	4.81E-03	3.08E-03	1.1528E+01	3.6512E+03
5	1.35E-03	2.55E-03	2.46E-03	4.05E-03	2.55E-03	9.3301E+00	3.6534E+03
6	8.10E-04	1.78E-03	1.69E-03	3.06E-03	1.82E-03	6.5265E+00	3.6562E+03
7	2.44E-04	8.59E-04	7.70E-04	1.78E-03	8.93E-04	3.1469E+00	3.6596E+03
8	4.96E-06	2.09E-04	1.28E-04	6.89E-04	2.15E-04	7.6529E-01	3.6620E+03

ALPHA FACTOR AND MGL PARAMETERS

Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 2164
Total Number of Common-Cause Failure Events: 126

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9708250	0.9732840	0.9730920	0.9745690	0.9757100	0.9773650	0.9786860
2	2.92E-02	1.63E-02	1.56E-02	1.29E-02	1.15E-02	9.49E-03	8.18E-03
3		1.05E-02	6.31E-03	6.03E-03	5.32E-03	4.98E-03	4.59E-03
4			5.04E-03	4.21E-03	3.89E-03	3.47E-03	3.08E-03
5				2.26E-03	2.48E-03	2.65E-03	2.55E-03
6					1.14E-03	1.55E-03	1.82E-03
7						4.89E-04	8.93E-04
8							2.15E-04

Motor Operated Valves
Pooled Motor Operated Valve Distributions
Fail to Operate

2003

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.71E-01	9.73E-01	9.73E-01	9.75E-01	9.76E-01	9.77E-01	9.79E-01
Beta	2.92E-02	2.67E-02	2.69E-02	2.54E-02	2.43E-02	2.26E-02	2.13E-02
Gamma		3.92E-01	4.22E-01	4.91E-01	5.28E-01	5.81E-01	6.16E-01
Delta			4.44E-01	5.17E-01	5.86E-01	6.21E-01	6.51E-01
Epsilon				3.49E-01	4.82E-01	5.75E-01	6.40E-01
Mu					3.15E-01	4.35E-01	5.35E-01
Upsilon						2.40E-01	3.79E-01
Sigma							1.94E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	812.01	1218.01	1624.02	2030.02	2436.02	2842.03	3248.03
N 1	45.0084	53.7797	56.2996	60.2733	63.1233	67.6122	71.6599
N 2	25.7547	21.2329	26.8607	27.7605	29.3477	28.2372	27.7292
N 3		13.6771	10.9029	12.9264	13.6221	14.8321	15.5636
N 4			8.7015	9.0208	9.9743	10.3406	10.4365
N 5				4.8382	6.3562	7.9022	8.6425
N 6					2.9162	4.6175	6.1667
N 7						1.4569	3.0297
N 8							0.7279

1.2.2 PWR Containment Spray Motor Operated Valves

1.2.2.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	CONTAINMENT SPRAY SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8337120	0.9204310	0.9285700	0.9792670	0.8842010	3.1433E+01	2.7173E+00
2	2.07E-02	7.96E-02	7.14E-02	1.66E-01	1.16E-01	2.7173E+00	3.1433E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8855230	0.9400230	0.9444830	0.9792610	0.9000650	6.1302E+01	3.9113E+00
2	1.00E-02	4.05E-02	3.59E-02	8.68E-02	6.41E-02	2.6420E+00	6.2571E+01
3	1.72E-03	1.95E-02	1.48E-02	5.31E-02	3.58E-02	1.2693E+00	6.3944E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8991880	0.9427250	0.9458010	0.9757340	0.9007770	8.9878E+01	5.4605E+00
2	1.05E-02	3.48E-02	3.16E-02	7.01E-02	5.74E-02	3.3220E+00	9.2017E+01
3	1.60E-03	1.49E-02	1.16E-02	3.92E-02	2.79E-02	1.4178E+00	9.3921E+01
4	1.47E-04	7.56E-03	4.51E-03	2.54E-02	1.39E-02	7.2074E-01	9.4618E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9256390	0.9549380	0.9567750	0.9779680	0.9122680	1.5713E+02	7.4147E+00
2	7.94E-03	2.35E-02	2.16E-02	4.56E-02	3.92E-02	3.8710E+00	1.6067E+02
3	2.42E-03	1.28E-02	1.08E-02	2.96E-02	2.59E-02	2.0986E+00	1.6245E+02
4	4.58E-04	6.81E-03	4.94E-03	1.95E-02	1.70E-02	1.1197E+00	1.6343E+02
5	4.35E-07	1.98E-03	5.49E-04	8.81E-03	5.67E-03	3.2544E-01	1.6422E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9309540	0.9569800	0.9585180	0.9777600	0.9191820	1.8911E+02	8.5012E+00
2	6.87E-03	2.01E-02	1.85E-02	3.87E-02	3.18E-02	3.9630E+00	1.9365E+02
3	2.14E-03	1.09E-02	9.30E-03	2.52E-02	2.03E-02	2.1548E+00	1.9546E+02
4	8.21E-04	7.35E-03	5.77E-03	1.93E-02	1.67E-02	1.4523E+00	1.9616E+02
5	6.89E-05	3.63E-03	2.15E-03	1.22E-02	9.60E-03	7.1658E-01	1.9690E+02
6	2.89E-09	1.09E-03	1.35E-04	5.49E-03	2.40E-03	2.1456E-01	1.9740E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9416040	0.9617020	0.9627520	0.9782030	0.9234730	2.8008E+02	1.1154E+01
2	6.83E-03	1.72E-02	1.61E-02	3.13E-02	2.93E-02	5.0080E+00	2.8623E+02
3	2.04E-03	8.73E-03	7.63E-03	1.92E-02	1.55E-02	2.5411E+00	2.8869E+02
4	1.01E-03	6.30E-03	5.22E-03	1.53E-02	1.45E-02	1.8358E+00	2.8940E+02
5	3.06E-04	4.06E-03	2.99E-03	1.14E-02	1.11E-02	1.1817E+00	2.9005E+02
6	6.32E-06	1.70E-03	7.67E-04	6.54E-03	5.21E-03	4.9459E-01	2.9074E+02
7	1.79E-17	3.18E-04	1.16E-06	1.85E-03	1.04E-03	9.2505E-02	2.9114E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9447030	0.9629710	0.9638770	0.9781360	0.9261320	3.2613E+02	1.2541E+01
2	6.72E-03	1.61E-02	1.52E-02	2.87E-02	2.89E-02	5.4594E+00	3.3321E+02
3	1.77E-03	7.52E-03	6.58E-03	1.65E-02	1.20E-02	2.5481E+00	3.3612E+02
4	9.39E-04	5.62E-03	4.68E-03	1.35E-02	1.20E-02	1.9024E+00	3.3677E+02
5	4.46E-04	4.18E-03	3.26E-03	1.11E-02	1.07E-02	1.4164E+00	3.3725E+02
6	7.95E-05	2.48E-03	1.60E-03	7.90E-03	7.09E-03	8.4112E-01	3.3783E+02
7	1.11E-07	9.00E-04	2.25E-04	4.09E-03	2.76E-03	3.0465E-01	3.3837E+02
8	2.01E-22	2.03E-04	7.27E-08	1.17E-03	4.61E-04	6.8686E-02	3.3860E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	CONTAINMENT SPRAY SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 30
Total Number of Common-Cause Failure Events: 9

Motor Operated Valves
PWR Containment Spray Motor Operated Valves
Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.8842010	0.9000650	0.9007770	0.9122680	0.9191820	0.9234730	0.9261320
2	1.16E-01	6.41E-02	5.74E-02	3.92E-02	3.18E-02	2.93E-02	2.89E-02
3		3.58E-02	2.79E-02	2.59E-02	2.03E-02	1.55E-02	1.20E-02
4			1.39E-02	1.70E-02	1.67E-02	1.45E-02	1.20E-02
5				5.67E-03	9.60E-03	1.11E-02	1.07E-02
6					2.40E-03	5.21E-03	7.09E-03
7						1.04E-03	2.76E-03
8							4.61E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	8.84E-01	9.00E-01	9.01E-01	9.12E-01	9.19E-01	9.24E-01	9.26E-01
Beta	1.16E-01	9.99E-02	9.92E-02	8.77E-02	8.08E-02	7.65E-02	7.39E-02
Gamma		3.59E-01	4.21E-01	5.53E-01	6.06E-01	6.18E-01	6.09E-01
Delta			3.32E-01	4.67E-01	5.86E-01	6.73E-01	7.34E-01
Epsilon				2.50E-01	4.18E-01	5.44E-01	6.38E-01
Mu					2.00E-01	3.61E-01	4.90E-01
Upsilon						1.67E-01	3.13E-01
Sigma							1.43E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	15.00	22.50	30.00	37.50	45.00	52.50	60.00
N 1	2.3016	2.6607	2.4993	2.7593	2.9030	2.9407	2.8797
N 2	2.2659	1.7916	2.0725	1.7296	1.6593	1.7562	1.9617
N 3		1.0020	1.0072	1.1412	1.0569	0.9276	0.8133
N 4			0.5002	0.7509	0.8705	0.8720	0.8114
N 5				0.2500	0.5001	0.6635	0.7288
N 6					0.1250	0.3125	0.4813
N 7						0.0625	0.1875
N 8							0.0313

1.2.2.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	CONTAINMENT SPRAY SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8496630	0.9412040	0.9527480	0.9931410	0.9011320	2.3261E+01	1.4531E+00
2	6.86E-03	5.88E-02	4.73E-02	1.50E-01	9.89E-02	1.4531E+00	2.3261E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9065800	0.9591430	0.9649010	0.9919790	0.9316090	4.9831E+01	2.1227E+00
2	5.63E-04	1.65E-02	1.08E-02	5.17E-02	3.40E-04	8.5535E-01	5.1098E+01
3	2.16E-03	2.44E-02	1.86E-02	6.65E-02	6.81E-02	1.2673E+00	5.0686E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9230370	0.9631840	0.9670560	0.9900940	0.9475510	7.5626E+01	2.8906E+00
2	1.39E-03	1.60E-02	1.22E-02	4.40E-02	5.19E-04	1.2595E+00	7.7257E+01
3	6.51E-06	5.23E-03	1.97E-03	2.15E-02	0.00E+00	4.1063E-01	7.8106E+01
4	1.27E-03	1.55E-02	1.17E-02	4.31E-02	5.19E-02	1.2205E+00	7.7296E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9413890	0.9683860	0.9705260	0.9880600	0.9573110	1.3967E+02	4.5597E+00
2	2.94E-03	1.50E-02	1.28E-02	3.44E-02	7.01E-04	2.1581E+00	1.4207E+02
3	3.07E-04	6.64E-03	4.54E-03	2.01E-02	0.00E+00	9.5737E-01	1.4327E+02
4	2.13E-04	6.02E-03	3.95E-03	1.89E-02	2.10E-02	8.6878E-01	1.4336E+02
5	3.14E-05	3.99E-03	2.05E-03	1.46E-02	2.10E-02	5.7544E-01	1.4365E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9453950	0.9694350	0.9712170	0.9873750	0.9638770	1.6856E+02	5.3144E+00
2	2.87E-03	1.34E-02	1.16E-02	3.01E-02	8.81E-04	2.3287E+00	1.7155E+02
3	4.07E-04	6.31E-03	4.55E-03	1.83E-02	0.00E+00	1.0979E+00	1.7278E+02
4	1.49E-04	4.78E-03	3.07E-03	1.53E-02	8.81E-03	8.3178E-01	1.7304E+02
5	7.83E-05	4.12E-03	2.44E-03	1.39E-02	1.76E-02	7.1648E-01	1.7316E+02
6	6.08E-07	1.95E-03	5.77E-04	8.58E-03	8.81E-03	3.3956E-01	1.7354E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9525870	0.9712490	0.9724290	0.9858780	0.9685840	2.5654E+02	7.5940E+00
2	3.69E-03	1.24E-02	1.12E-02	2.53E-02	1.04E-03	3.2861E+00	2.6085E+02
3	8.09E-04	6.11E-03	4.92E-03	1.55E-02	9.11E-06	1.6138E+00	2.6252E+02
4	2.60E-04	4.12E-03	2.96E-03	1.20E-02	3.80E-03	1.0888E+00	2.6305E+02
5	1.29E-04	3.38E-03	2.24E-03	1.05E-02	1.14E-02	8.9322E-01	2.6324E+02
6	1.43E-05	2.11E-03	1.05E-03	7.79E-03	1.14E-02	5.5709E-01	2.6358E+02
7	9.70E-12	5.87E-04	2.76E-05	3.21E-03	3.80E-03	1.5501E-01	2.6398E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9552720	0.9721960	0.9732090	0.9856460	0.9721100	2.9969E+02	8.5710E+00
2	3.61E-03	1.15E-02	1.05E-02	2.29E-02	1.20E-03	3.5426E+00	3.0472E+02
3	8.30E-04	5.63E-03	4.60E-03	1.39E-02	1.60E-05	1.7354E+00	3.0653E+02
4	2.68E-04	3.74E-03	2.74E-03	1.06E-02	1.67E-03	1.1535E+00	3.0711E+02
5	1.33E-04	3.04E-03	2.06E-03	9.31E-03	6.67E-03	9.3763E-01	3.0732E+02
6	4.94E-05	2.38E-03	1.43E-03	7.96E-03	1.00E-02	7.3482E-01	3.0753E+02
7	6.76E-07	1.19E-03	3.90E-04	5.09E-03	6.67E-03	3.6715E-01	3.0789E+02
8	1.86E-16	3.24E-04	1.91E-06	1.88E-03	1.67E-03	9.9886E-02	3.0816E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	CONTAINMENT SPRAY SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 22

Total Number of Common-Cause Failure Events: 2

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9011320	0.9316090	0.9475510	0.9573110	0.9638770	0.9685840	0.9721100
2	9.89E-02	3.40E-04	5.19E-04	7.01E-04	8.81E-04	1.04E-03	1.20E-03
3		6.81E-02	0.00E+00	0.00E+00	0.00E+00	9.11E-06	1.60E-05
4			5.19E-02	2.10E-02	8.81E-03	3.80E-03	1.67E-03
5				2.10E-02	1.76E-02	1.14E-02	6.67E-03
6					8.81E-03	1.14E-02	1.00E-02
7						3.80E-03	6.67E-03
8							1.67E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.01E-01	9.32E-01	9.48E-01	9.57E-01	9.64E-01	9.69E-01	9.72E-01
Beta	9.89E-02	6.84E-02	5.25E-02	4.27E-02	3.61E-02	3.14E-02	2.79E-02
Gamma		9.95E-01	9.90E-01	9.84E-01	9.76E-01	9.67E-01	9.57E-01
Delta			1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.99E-01
Epsilon				5.00E-01	7.50E-01	8.75E-01	9.38E-01
Mu					3.33E-01	5.71E-01	7.33E-01
Upsilon						2.50E-01	4.55E-01
Sigma							2.00E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	8.80	13.20	17.60	22.00	26.40	30.80	35.20
N 1	0.3300	0.4900	0.6467	0.8000	0.9500	1.0973	1.2415
N 2	1.0017	0.0050	0.0100	0.0167	0.0250	0.0343	0.0449
N 3		1.0000	0.0000	0.0000	0.0000	0.0003	0.0006
N 4			1.0000	0.5000	0.2500	0.1250	0.0625
N 5				0.5000	0.5000	0.3750	0.2500
N 6					0.2500	0.3750	0.3750
N 7						0.1250	0.2500
N 8							0.0625

1.2.3 BWR Residual Heat Removal Motor-Operated Valves

1.2.3.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9714030	0.9850560	0.9862110	0.9947560	0.9859500	2.7166E+02	4.1213E+00
2	5.25E-03	1.49E-02	1.38E-02	2.86E-02	1.41E-02	4.1213E+00	2.7166E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9755800	0.9860280	0.9867780	0.9939010	0.9875610	4.2068E+02	5.9611E+00
2	2.69E-03	8.46E-03	7.71E-03	1.68E-02	7.09E-03	3.6106E+00	4.2303E+02
3	1.19E-03	5.51E-03	4.76E-03	1.24E-02	5.35E-03	2.3505E+00	4.2429E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9766670	0.9856530	0.9862080	0.9927330	0.9876450	5.6803E+02	8.2684E+00
2	3.26E-03	8.40E-03	7.83E-03	1.55E-02	6.94E-03	4.8382E+00	5.7146E+02
3	4.20E-04	2.95E-03	2.40E-03	7.36E-03	2.49E-03	1.6985E+00	5.7460E+02
4	4.41E-04	3.01E-03	2.45E-03	7.46E-03	2.92E-03	1.7317E+00	5.7457E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9783990	0.9860250	0.9864440	0.9922110	0.9889120	7.5424E+02	1.0690E+01
2	2.92E-03	7.07E-03	6.65E-03	1.27E-02	5.07E-03	5.4082E+00	7.5952E+02
3	9.04E-04	3.59E-03	3.17E-03	7.72E-03	2.77E-03	2.7454E+00	7.6218E+02
4	3.20E-04	2.23E-03	1.82E-03	5.56E-03	2.08E-03	1.7063E+00	7.6322E+02
5	3.33E-05	1.09E-03	6.93E-04	3.47E-03	1.17E-03	8.2984E-01	7.6410E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9798550	0.9866340	0.9869840	0.9922110	0.9896720	9.0506E+02	1.2261E+01
2	2.57E-03	6.11E-03	5.75E-03	1.09E-02	4.28E-03	5.6044E+00	9.1172E+02
3	8.88E-04	3.26E-03	2.91E-03	6.84E-03	2.45E-03	2.9912E+00	9.1433E+02
4	3.64E-04	2.12E-03	1.77E-03	5.07E-03	1.77E-03	1.9442E+00	9.1538E+02
5	1.16E-04	1.37E-03	1.03E-03	3.78E-03	1.35E-03	1.2549E+00	9.1607E+02
6	1.37E-06	5.08E-04	2.17E-04	2.00E-03	4.88E-04	4.6636E-01	9.1686E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9802790	0.9863940	0.9866780	0.9915330	0.9901920	1.1148E+03	1.5377E+01
2	2.74E-03	5.94E-03	5.65E-03	1.01E-02	3.85E-03	6.7152E+00	1.1235E+03
3	1.00E-03	3.17E-03	2.88E-03	6.32E-03	2.19E-03	3.5838E+00	1.1266E+03
4	4.24E-04	2.03E-03	1.74E-03	4.61E-03	1.48E-03	2.2921E+00	1.1279E+03
5	2.09E-04	1.49E-03	1.21E-03	3.73E-03	1.29E-03	1.6809E+00	1.1285E+03
6	2.93E-05	7.85E-04	5.17E-04	2.45E-03	7.84E-04	8.8689E-01	1.1293E+03
7	6.42E-10	1.93E-04	2.50E-05	9.72E-04	2.10E-04	2.1831E-01	1.1300E+03

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9813100	0.9868920	0.9871400	0.9916270	0.9907670	1.2799E+03	1.6999E+01
2	2.46E-03	5.28E-03	5.03E-03	8.96E-03	3.27E-03	6.8486E+00	1.2901E+03
3	1.05E-03	3.08E-03	2.82E-03	5.96E-03	2.20E-03	3.9884E+00	1.2929E+03
4	3.76E-04	1.78E-03	1.53E-03	4.04E-03	1.19E-03	2.3115E+00	1.2946E+03
5	2.37E-04	1.45E-03	1.20E-03	3.50E-03	1.16E-03	1.8781E+00	1.2950E+03
6	8.70E-05	9.86E-04	7.45E-04	2.71E-03	8.96E-04	1.2789E+00	1.2956E+03
7	3.06E-06	4.34E-04	2.18E-04	1.60E-03	4.34E-04	5.6245E-01	1.2963E+03
8	6.11E-14	1.01E-04	2.47E-06	5.71E-04	9.17E-05	1.3149E-01	1.2968E+03

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 663
 Total Number of Common-Cause Failure Events: 17

Motor Operated Valves
 BWR Residual Heat Removal Motor-Operated Valves
 Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9859500	0.9875610	0.9876450	0.9889120	0.9896720	0.9901920	0.9907670
2	1.41E-02	7.09E-03	6.94E-03	5.07E-03	4.28E-03	3.85E-03	3.27E-03
3		5.35E-03	2.49E-03	2.77E-03	2.45E-03	2.19E-03	2.20E-03
4			2.92E-03	2.08E-03	1.77E-03	1.48E-03	1.19E-03
5				1.17E-03	1.35E-03	1.29E-03	1.16E-03
6					4.88E-04	7.84E-04	8.96E-04
7						2.10E-04	4.34E-04
8							9.17E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.86E-01	9.88E-01	9.88E-01	9.89E-01	9.90E-01	9.90E-01	9.91E-01
Beta	1.41E-02	1.24E-02	1.24E-02	1.11E-02	1.03E-02	9.81E-03	9.23E-03
Gamma		4.30E-01	4.38E-01	5.43E-01	5.86E-01	6.07E-01	6.46E-01
Delta			5.40E-01	5.39E-01	5.95E-01	6.32E-01	6.32E-01
Epsilon				3.61E-01	5.10E-01	6.08E-01	6.85E-01
Mu					2.66E-01	4.34E-01	5.51E-01
Upsilon						2.11E-01	3.70E-01
Sigma							1.75E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	250.66	375.99	501.32	626.65	751.98	877.32	1002.65
N 1	6.8697	8.5442	9.3332	10.7180	11.8715	12.8632	13.9506
N 2	3.6699	2.7602	3.5887	3.2668	3.3007	3.4634	3.3509
N 3		2.0832	1.2879	1.7880	1.8933	1.9703	2.2536
N 4			1.5112	1.3375	1.3624	1.3283	1.2205
N 5				0.7544	1.0384	1.1627	1.1905
N 6					0.3768	0.7048	0.9191
N 7						0.1883	0.4453
N 8							0.0941

1.2.3.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9654240	0.9852300	0.9875000	0.9972820	0.9871380	1.3623E+02	2.0423E+00
2	2.72E-03	1.48E-02	1.25E-02	3.46E-02	1.29E-02	2.0423E+00	1.3623E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9671220	0.9832860	0.9847170	0.9945540	0.9859730	2.1780E+02	3.7021E+00
2	3.35E-03	1.28E-02	1.14E-02	2.72E-02	1.08E-02	2.8406E+00	2.1866E+02
3	1.34E-04	3.89E-03	2.54E-03	1.23E-02	3.23E-03	8.6153E-01	2.2064E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9668590	0.9812020	0.9822470	0.9919660	0.9843400	2.9794E+02	5.7078E+00
2	4.50E-03	1.31E-02	1.21E-02	2.54E-02	1.12E-02	3.9852E+00	2.9966E+02
3	3.40E-04	4.09E-03	3.06E-03	1.13E-02	3.40E-03	1.2404E+00	3.0241E+02
4	5.15E-06	1.59E-03	7.01E-04	6.18E-03	1.07E-03	4.8224E-01	3.0317E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9676210	0.9799370	0.9806840	0.9896950	0.9836420	4.1613E+02	8.5198E+00
2	5.30E-03	1.28E-02	1.20E-02	2.28E-02	1.08E-02	5.4252E+00	4.1923E+02
3	8.90E-04	4.83E-03	4.08E-03	1.14E-02	3.60E-03	2.0525E+00	4.2260E+02
4	6.34E-05	1.98E-03	1.28E-03	6.30E-03	1.55E-03	8.4108E-01	4.2381E+02
5	5.20E-10	4.73E-04	4.99E-05	2.44E-03	4.13E-04	2.0104E-01	4.2445E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9681440	0.9794380	0.9800600	0.9885990	0.9830040	4.9887E+02	1.0473E+01
2	5.42E-03	1.22E-02	1.15E-02	2.11E-02	1.07E-02	6.2015E+00	5.0314E+02
3	1.04E-03	4.71E-03	4.08E-03	1.05E-02	3.57E-03	2.3981E+00	5.0695E+02
4	2.02E-04	2.43E-03	1.82E-03	6.75E-03	1.80E-03	1.2381E+00	5.0811E+02
5	3.12E-06	9.49E-04	4.19E-04	3.69E-03	7.34E-04	4.8338E-01	5.0886E+02
6	3.49E-12	2.99E-04	1.31E-05	1.64E-03	1.72E-04	1.5216E-01	5.0919E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9694910	0.9793800	0.9798640	0.9876020	0.9836130	6.4104E+02	1.3497E+01
2	5.19E-03	1.09E-02	1.04E-02	1.83E-02	9.19E-03	7.1430E+00	6.4739E+02
3	1.45E-03	4.96E-03	4.46E-03	1.02E-02	3.85E-03	3.2442E+00	6.5129E+02
4	4.11E-04	2.71E-03	2.22E-03	6.67E-03	1.91E-03	1.7731E+00	6.5276E+02
5	6.08E-05	1.42E-03	9.59E-04	4.37E-03	9.76E-04	9.3152E-01	6.5361E+02
6	1.79E-07	5.25E-04	1.57E-04	2.30E-03	3.82E-04	3.4359E-01	6.5419E+02
7	5.41E-25	9.37E-05	1.11E-08	5.28E-04	7.39E-05	6.1305E-02	6.5448E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9707380	0.9798210	0.9802420	0.9874560	0.9840920	7.3828E+02	1.5205E+01
2	4.79E-03	9.88E-03	9.45E-03	1.65E-02	8.18E-03	7.4474E+00	7.4604E+02
3	1.50E-03	4.75E-03	4.32E-03	9.48E-03	3.83E-03	3.5821E+00	7.4990E+02
4	5.03E-04	2.73E-03	2.30E-03	6.41E-03	2.00E-03	2.0567E+00	7.5143E+02
5	1.31E-04	1.62E-03	1.21E-03	4.53E-03	1.11E-03	1.2221E+00	7.5226E+02
6	9.72E-06	8.37E-04	4.56E-04	2.96E-03	5.61E-04	6.3062E-01	7.5285E+02
7	6.62E-10	2.82E-04	3.42E-05	1.43E-03	1.98E-04	2.1255E-01	7.5327E+02
8	2.17E-28	7.03E-05	1.62E-09	3.82E-04	3.23E-05	5.2986E-02	7.5343E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 326
 Total Number of Common-Cause Failure Events: 16

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9871380	0.9859730	0.9843400	0.9836420	0.9830040	0.9836130	0.9840920
2	1.29E-02	1.08E-02	1.12E-02	1.08E-02	1.07E-02	9.19E-03	8.18E-03
3		3.23E-03	3.40E-03	3.60E-03	3.57E-03	3.85E-03	3.83E-03
4			1.07E-03	1.55E-03	1.80E-03	1.91E-03	2.00E-03
5				4.13E-04	7.34E-04	9.76E-04	1.11E-03
6					1.72E-04	3.82E-04	5.61E-04
7						7.39E-05	1.98E-04
8							3.23E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.87E-01	9.86E-01	9.84E-01	9.84E-01	9.83E-01	9.84E-01	9.84E-01
Beta	1.29E-02	1.40E-02	1.57E-02	1.64E-02	1.70E-02	1.64E-02	1.59E-02
Gamma		2.30E-01	2.85E-01	3.40E-01	3.70E-01	4.39E-01	4.86E-01
Delta			2.40E-01	3.53E-01	4.31E-01	4.65E-01	5.05E-01
Epsilon				2.10E-01	3.34E-01	4.28E-01	4.87E-01
Mu					1.90E-01	3.18E-01	4.17E-01
Upsilon						1.62E-01	2.91E-01
Sigma							1.41E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	115.81	173.71	231.62	289.52	347.42	405.33	463.23
N 1	6.2932	7.9496	8.9424	9.7409	10.2408	11.0686	11.8019
N 2	1.5909	1.9902	2.7357	3.2838	3.8978	3.8912	3.9497
N 3		0.5942	0.8298	1.0951	1.3002	1.6307	1.8473
N 4			0.2617	0.4723	0.6563	0.8093	0.9657
N 5				0.1256	0.2669	0.4133	0.5345
N 6					0.0626	0.1615	0.2708
N 7						0.0313	0.0954
N 8							0.0156

1.2.4 BWR Isolation Condenser Motor-Operated Valves

1.2.4.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	ISOLATION CONDENSER
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9336980	0.9830180	0.9925620	0.9999490	0.9987140	2.7098E+01	4.6814E-01
2	4.79E-05	1.70E-02	7.44E-03	6.63E-02	1.29E-03	4.6814E-01	2.7098E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9421750	0.9794090	0.9847250	0.9984600	0.9974290	5.5541E+01	1.1677E+00
2	6.28E-04	1.59E-02	1.07E-02	4.90E-02	2.57E-03	9.0035E-01	5.5808E+01
3	1.66E-07	4.71E-03	9.49E-04	2.24E-02	0.00E+00	2.6733E-01	5.6441E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9452300	0.9767420	0.9803680	0.9958570	0.9961390	8.3179E+01	1.9807E+00
2	1.57E-03	1.59E-02	1.22E-02	4.25E-02	3.86E-03	1.3495E+00	8.3810E+01
3	6.00E-06	4.82E-03	1.82E-03	1.98E-02	0.00E+00	4.1063E-01	8.4749E+01
4	9.87E-09	2.59E-03	3.46E-04	1.30E-02	0.00E+00	2.2054E-01	8.4939E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9524460	0.9757580	0.9778090	0.9920780	0.9950520	1.4905E+02	3.7030E+00
2	3.18E-03	1.50E-02	1.30E-02	3.40E-02	4.85E-03	2.2981E+00	1.5046E+02
3	2.93E-04	6.29E-03	4.31E-03	1.91E-02	1.02E-04	9.6067E-01	1.5179E+02
4	1.42E-06	2.41E-03	7.97E-04	1.03E-02	0.00E+00	3.6878E-01	1.5238E+02
5	2.22E-20	4.94E-04	4.00E-07	2.87E-03	0.00E+00	7.5435E-02	1.5268E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9542970	0.9754590	0.9771630	0.9908120	0.9940030	1.7973E+02	4.5218E+00
2	3.20E-03	1.37E-02	1.20E-02	3.01E-02	5.78E-03	2.5276E+00	1.8172E+02
3	3.93E-04	6.00E-03	4.34E-03	1.73E-02	2.17E-04	1.1063E+00	1.8315E+02
4	2.61E-05	3.16E-03	1.63E-03	1.15E-02	2.58E-06	5.8188E-01	1.8367E+02
5	3.51E-09	1.18E-03	1.50E-04	5.93E-03	0.00E+00	2.1648E-01	1.8404E+02
6	9.73E-18	4.86E-04	1.43E-06	2.84E-03	0.00E+00	8.9555E-02	1.8416E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	ISOLATION CONDENSER
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 24

Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9987140	0.9974290	0.9961390	0.9950520	0.9940030
2	1.29E-03	2.57E-03	3.86E-03	4.85E-03	5.78E-03
3		0.00E+00	0.00E+00	1.02E-04	2.17E-04
4			0.00E+00	0.00E+00	2.58E-06
5				0.00E+00	0.00E+00
6					0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.99E-01	9.97E-01	9.96E-01	9.95E-01	9.94E-01
Beta	1.29E-03	2.57E-03	3.86E-03	4.95E-03	6.00E-03
Gamma		0.00E+00	0.00E+00	2.06E-02	3.66E-02
Delta			0.00E+00	0.00E+00	1.18E-02
Epsilon				0.00E+00	0.00E+00
Mu					0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	12.00	18.00	24.00	30.00	36.00
N 1	0.9667	1.4000	1.8000	2.1750	2.5230
N 2	0.0167	0.0500	0.1000	0.1567	0.2239
N 3		0.0000	0.0000	0.0033	0.0084
N 4			0.0000	0.0000	0.0001
N 5				0.0000	0.0000
N 6					0.0000

1.2.4.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	ISOLATION CONDENSER
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1980/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9128170	0.9764940	0.9883470	0.9998660	0.9898000	2.2214E+01	5.3474E-01
2	1.35E-04	2.35E-02	1.17E-02	8.72E-02	1.02E-02	5.3474E-01	2.2214E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9265760	0.9723040	0.9784000	0.9971690	0.9793810	4.8016E+01	1.3677E+00
2	1.46E-03	2.23E-02	1.62E-02	6.38E-02	2.06E-02	1.1004E+00	4.8283E+01
3	1.90E-07	5.41E-03	1.09E-03	2.57E-02	0.00E+00	2.6733E-01	4.9116E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9298630	0.9683670	0.9724240	0.9929800	0.9687500	7.2879E+01	2.3807E+00
2	3.51E-03	2.33E-02	1.92E-02	5.69E-02	3.13E-02	1.7495E+00	7.3510E+01
3	6.80E-06	5.46E-03	2.06E-03	2.24E-02	0.00E+00	4.1063E-01	7.4849E+01
4	1.12E-08	2.93E-03	3.92E-04	1.47E-02	0.00E+00	2.2054E-01	7.5039E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9437340	0.9703840	0.9725950	0.9894760	0.9692100	1.3611E+02	4.1541E+00
2	4.61E-03	1.88E-02	1.66E-02	4.07E-02	2.52E-02	2.6414E+00	1.3762E+02
3	4.62E-04	7.62E-03	5.44E-03	2.22E-02	5.60E-03	1.0685E+00	1.3920E+02
4	1.55E-06	2.63E-03	8.68E-04	1.12E-02	0.00E+00	3.6878E-01	1.3990E+02
5	2.42E-20	5.38E-04	4.36E-07	3.12E-03	0.00E+00	7.5435E-02	1.4019E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9463280	0.9703930	0.9722310	0.9881790	0.9696230	1.6416E+02	5.0085E+00
2	4.28E-03	1.66E-02	1.47E-02	3.52E-02	2.10E-02	2.8006E+00	1.6637E+02
3	6.96E-04	7.66E-03	5.82E-03	2.09E-02	8.34E-03	1.2954E+00	1.6787E+02
4	3.55E-05	3.59E-03	1.91E-03	1.28E-02	1.04E-03	6.0648E-01	1.6856E+02
5	3.83E-09	1.28E-03	1.63E-04	6.46E-03	0.00E+00	2.1648E-01	1.6895E+02
6	1.06E-17	5.29E-04	1.56E-06	3.09E-03	0.00E+00	8.9555E-02	1.6908E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	ISOLATION CONDENSER
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1980/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 15
 Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9898000	0.9793810	0.9687500	0.9692100	0.9696230
2	1.02E-02	2.06E-02	3.13E-02	2.52E-02	2.10E-02
3		0.00E+00	0.00E+00	5.60E-03	8.34E-03
4			0.00E+00	0.00E+00	1.04E-03
5				0.00E+00	0.00E+00
6					0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.90E-01	9.79E-01	9.69E-01	9.69E-01	9.70E-01
Beta	1.02E-02	2.06E-02	3.13E-02	3.08E-02	3.04E-02
Gamma		0.00E+00	0.00E+00	1.82E-01	3.09E-01
Delta			0.00E+00	0.00E+00	1.11E-01
Epsilon				0.00E+00	0.00E+00
Mu					0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	7.50	11.25	15.00	18.75	22.50
N 1	0.5833	0.6250	0.5000	0.4861	0.4537
N 2	0.0833	0.2500	0.5000	0.5000	0.4969
N 3		0.0000	0.0000	0.1111	0.1975
N 4			0.0000	0.0000	0.0247
N 5				0.0000	0.0000
N 6					0.0000

1.2.5 PWR Auxiliary Feedwater Motor-Operated Valves

1.2.5.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9503150	0.9786700	0.9818890	0.9960240	0.9803850	9.4362E+01	2.0566E+00
2	3.98E-03	2.13E-02	1.81E-02	4.97E-02	1.96E-02	2.0566E+00	9.4362E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9545260	0.9768850	0.9788620	0.9925010	0.9789970	1.5506E+02	3.6690E+00
2	4.46E-03	1.75E-02	1.55E-02	3.72E-02	1.58E-02	2.7694E+00	1.5596E+02
3	2.21E-04	5.67E-03	3.77E-03	1.76E-02	5.21E-03	8.9963E-01	1.5783E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9547600	0.9743530	0.9757810	0.9890820	0.9765980	2.1434E+02	5.6418E+00
2	6.05E-03	1.78E-02	1.64E-02	3.45E-02	1.66E-02	3.9195E+00	2.1606E+02
3	4.14E-04	5.41E-03	4.00E-03	1.52E-02	4.85E-03	1.1892E+00	2.1879E+02
4	1.33E-05	2.42E-03	1.17E-03	9.09E-03	1.95E-03	5.3314E-01	2.1945E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9561400	0.9726120	0.9735880	0.9857390	0.9738390	3.1124E+02	8.7644E+00
2	8.05E-03	1.85E-02	1.75E-02	3.23E-02	1.89E-02	5.9167E+00	3.1409E+02
3	7.77E-04	5.36E-03	4.37E-03	1.33E-02	3.80E-03	1.7155E+00	3.1829E+02
4	1.10E-04	2.81E-03	1.87E-03	8.74E-03	2.66E-03	9.0048E-01	3.1910E+02
5	5.08E-09	7.24E-04	1.08E-04	3.58E-03	7.83E-04	2.3174E-01	3.1977E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9586120	0.9733650	0.9741820	0.9853250	0.9751030	3.7360E+02	1.0223E+01
2	6.85E-03	1.56E-02	1.48E-02	2.73E-02	1.55E-02	6.0026E+00	3.7782E+02
3	1.26E-03	5.99E-03	5.16E-03	1.36E-02	5.04E-03	2.3000E+00	3.8152E+02
4	2.39E-04	3.11E-03	2.30E-03	8.74E-03	2.56E-03	1.1924E+00	3.8263E+02
5	1.01E-05	1.46E-03	7.31E-04	5.38E-03	1.44E-03	5.6028E-01	3.8326E+02
6	2.89E-11	4.37E-04	2.69E-05	2.35E-03	3.28E-04	1.6766E-01	3.8366E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9622880	0.9746960	0.9753150	0.9849910	0.9772570	4.9533E+02	1.2859E+01
2	5.81E-03	1.28E-02	1.21E-02	2.19E-02	1.17E-02	6.4899E+00	5.0170E+02
3	1.86E-03	6.37E-03	5.73E-03	1.30E-02	5.85E-03	3.2349E+00	5.0495E+02
4	4.62E-04	3.30E-03	2.68E-03	8.27E-03	2.58E-03	1.6773E+00	5.0651E+02
5	9.93E-05	1.96E-03	1.36E-03	5.87E-03	1.72E-03	9.9492E-01	5.0719E+02
6	7.12E-07	7.73E-04	2.75E-04	3.23E-03	7.61E-04	3.9299E-01	5.0780E+02
7	1.74E-22	1.36E-04	5.15E-08	7.81E-04	1.41E-04	6.9105E-02	5.0812E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9645600	0.9758230	0.9763590	0.9852520	0.9789240	5.7221E+02	1.4177E+01
2	4.93E-03	1.09E-02	1.04E-02	1.88E-02	9.21E-03	6.4053E+00	5.7998E+02
3	1.94E-03	6.13E-03	5.58E-03	1.22E-02	5.89E-03	3.5941E+00	5.8279E+02
4	5.57E-04	3.28E-03	2.74E-03	7.87E-03	2.64E-03	1.9247E+00	5.8446E+02
5	1.80E-04	2.13E-03	1.60E-03	5.90E-03	1.78E-03	1.2505E+00	5.8514E+02
6	2.13E-05	1.20E-03	7.01E-04	4.07E-03	1.09E-03	7.0362E-01	5.8568E+02
7	4.86E-09	4.13E-04	6.76E-05	2.02E-03	3.96E-04	2.4215E-01	5.8615E+02
8	1.35E-26	9.70E-05	5.12E-09	5.37E-04	6.18E-05	5.6886E-02	5.8633E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 239
Total Number of Common-Cause Failure Events: 9

Motor Operated Valves
PWR Auxiliary Feedwater Motor-Operated Valves
Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9803850	0.9789970	0.9765980	0.9738390	0.9751030	0.9772570	0.9789240
2	1.96E-02	1.58E-02	1.66E-02	1.89E-02	1.55E-02	1.17E-02	9.21E-03
3		5.21E-03	4.85E-03	3.80E-03	5.04E-03	5.85E-03	5.89E-03
4			1.95E-03	2.66E-03	2.56E-03	2.58E-03	2.64E-03
5				7.83E-04	1.44E-03	1.72E-03	1.78E-03
6					3.28E-04	7.61E-04	1.09E-03
7						1.41E-04	3.96E-04
8							6.18E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.80E-01	9.79E-01	9.77E-01	9.74E-01	9.75E-01	9.77E-01	9.79E-01
Beta	1.96E-02	2.10E-02	2.34E-02	2.62E-02	2.49E-02	2.27E-02	2.11E-02
Gamma		2.48E-01	2.90E-01	2.77E-01	3.77E-01	4.86E-01	5.63E-01
Delta			2.87E-01	4.76E-01	4.62E-01	4.70E-01	5.03E-01
Epsilon				2.27E-01	4.09E-01	5.05E-01	5.58E-01
Mu					1.85E-01	3.44E-01	4.65E-01
Upsilon						1.56E-01	2.96E-01
Sigma							1.35E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	76.85	115.27	153.70	192.12	230.55	268.97	307.40
N 1	3.3812	3.6528	3.2571	2.2462	1.8409	1.7204	1.5639
N 2	1.6052	1.9190	2.6700	3.7753	3.6989	3.2381	2.9076
N 3		0.6323	0.7786	0.7581	1.2021	1.6214	1.8593
N 4			0.3126	0.5317	0.6106	0.7135	0.8337
N 5				0.1563	0.3438	0.4767	0.5629
N 6					0.0781	0.2109	0.3438
N 7						0.0391	0.1250
N 8							0.0195

1.2.5.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9333740	0.9731220	0.9780040	0.9961730	0.9743650	6.0734E+01	1.6775E+00
2	3.83E-03	2.69E-02	2.20E-02	6.66E-02	2.56E-02	1.6775E+00	6.0734E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9293940	0.9632040	0.9660440	0.9873060	0.9596020	1.0362E+02	3.9584E+00
2	9.07E-03	3.04E-02	2.76E-02	6.16E-02	3.44E-02	3.2723E+00	1.0431E+02
3	1.04E-04	6.38E-03	3.69E-03	2.18E-02	5.96E-03	6.8613E-01	1.0689E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9278590	0.9576770	0.9596760	0.9806580	0.9508770	1.4509E+02	6.4119E+00
2	1.17E-02	3.06E-02	2.85E-02	5.65E-02	3.67E-02	4.6307E+00	1.4687E+02
3	9.43E-04	9.15E-03	7.10E-03	2.44E-02	1.06E-02	1.3857E+00	1.5012E+02
4	2.52E-06	2.61E-03	9.39E-04	1.09E-02	1.90E-03	3.9554E-01	1.5111E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9395980	0.9620770	0.9633880	0.9800880	0.9530970	2.2550E+02	8.8888E+00
2	8.78E-03	2.18E-02	2.05E-02	3.94E-02	2.61E-02	5.1110E+00	2.2928E+02
3	2.92E-03	1.16E-02	1.03E-02	2.50E-02	1.55E-02	2.7232E+00	2.3167E+02
4	1.48E-04	3.82E-03	2.54E-03	1.19E-02	4.63E-03	8.9638E-01	2.3349E+02
5	1.63E-11	6.75E-04	3.42E-05	3.68E-03	7.27E-04	1.5824E-01	2.3423E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9433950	0.9634590	0.9645520	0.9797790	0.9558810	2.7080E+02	1.0271E+01
2	6.74E-03	1.73E-02	1.62E-02	3.17E-02	1.88E-02	4.8581E+00	2.7621E+02
3	3.29E-03	1.14E-02	1.02E-02	2.33E-02	1.55E-02	3.1944E+00	2.7788E+02
4	7.30E-04	5.65E-03	4.53E-03	1.44E-02	7.42E-03	1.5882E+00	2.7948E+02
5	7.11E-06	1.78E-03	8.14E-04	6.84E-03	2.10E-03	5.0108E-01	2.8057E+02
6	1.77E-13	4.59E-04	1.02E-05	2.59E-03	2.90E-04	1.2886E-01	2.8094E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9501740	0.9664300	0.9672310	0.9799660	0.9587770	3.7525E+02	1.3035E+01
2	5.82E-03	1.40E-02	1.32E-02	2.50E-02	1.39E-02	5.4368E+00	3.8285E+02
3	3.17E-03	9.66E-03	8.83E-03	1.90E-02	1.36E-02	3.7504E+00	3.8453E+02
4	1.31E-03	6.07E-03	5.25E-03	1.37E-02	8.87E-03	2.3574E+00	3.8593E+02
5	1.87E-04	2.85E-03	2.06E-03	8.23E-03	3.75E-03	1.1070E+00	3.8718E+02
6	2.38E-07	8.62E-04	2.49E-04	3.80E-03	9.72E-04	3.3469E-01	3.8795E+02
7	2.57E-30	1.25E-04	9.65E-10	6.60E-04	1.18E-04	4.8605E-02	3.8824E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9532430	0.9679740	0.9686640	0.9803380	0.9615520	4.3494E+02	1.4390E+01
2	4.94E-03	1.20E-02	1.13E-02	2.14E-02	1.05E-02	5.3769E+00	4.4395E+02
3	2.74E-03	8.36E-03	7.64E-03	1.64E-02	1.13E-02	3.7561E+00	4.4557E+02
4	1.50E-03	6.03E-03	5.32E-03	1.30E-02	9.07E-03	2.7112E+00	4.4662E+02
5	4.62E-04	3.55E-03	2.85E-03	9.05E-03	5.09E-03	1.5964E+00	4.4773E+02
6	2.81E-05	1.57E-03	9.19E-04	5.32E-03	1.93E-03	7.0522E-01	4.4863E+02
7	4.01E-10	4.41E-04	4.49E-05	2.28E-03	4.55E-04	1.9835E-01	4.4913E+02
8	8.79E-32	1.03E-04	3.94E-10	5.30E-04	4.93E-05	4.6186E-02	4.4928E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 101
Total Number of Common-Cause Failure Events: 8

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9743650	0.9596020	0.9508770	0.9530970	0.9558810	0.9587770	0.9615520
2	2.56E-02	3.44E-02	3.67E-02	2.61E-02	1.88E-02	1.39E-02	1.05E-02
3		5.96E-03	1.06E-02	1.55E-02	1.55E-02	1.36E-02	1.13E-02
4			1.90E-03	4.63E-03	7.42E-03	8.87E-03	9.07E-03
5				7.27E-04	2.10E-03	3.75E-03	5.09E-03
6					2.90E-04	9.72E-04	1.93E-03
7						1.18E-04	4.55E-04
8							4.93E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.74E-01	9.60E-01	9.51E-01	9.53E-01	9.56E-01	9.59E-01	9.62E-01
Beta	2.56E-02	4.04E-02	4.91E-02	4.69E-02	4.41E-02	4.12E-02	3.85E-02
Gamma		1.47E-01	2.54E-01	4.45E-01	5.73E-01	6.63E-01	7.26E-01
Delta			1.52E-01	2.57E-01	3.88E-01	5.02E-01	5.95E-01
Epsilon				1.36E-01	2.44E-01	3.53E-01	4.53E-01
Mu					1.21E-01	2.25E-01	3.24E-01
Upsilon						1.09E-01	2.07E-01
Sigma							9.78E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	42.53	63.79	85.05	106.32	127.58	148.84	170.11
N 1	4.0729	3.6874	2.6624	2.3098	2.0094	1.7675	1.5750
N 2	1.2261	2.4219	3.3812	2.9696	2.5544	2.1850	1.8792
N 3		0.4188	0.9751	1.7658	2.0965	2.1369	2.0213
N 4			0.1750	0.5276	1.0064	1.3936	1.6202
N 5				0.0828	0.2846	0.5888	0.9088
N 6					0.0393	0.1526	0.3454
N 7						0.0186	0.0812
N 8							0.0088

1.2.6 PWR High Pressure Safety Injection Motor-Operated Valves

1.2.6.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9038670	0.9443980	0.9471660	0.9754580	0.9404780	1.0044E+02	5.9135E+00
2	2.45E-02	5.56E-02	5.28E-02	9.61E-02	5.95E-02	5.9135E+00	1.0044E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9287120	0.9568210	0.9585880	0.9789000	0.9531710	1.6434E+02	7.4162E+00
2	8.40E-03	2.39E-02	2.21E-02	4.56E-02	2.42E-02	4.1050E+00	1.6765E+02
3	5.77E-03	1.93E-02	1.74E-02	3.91E-02	2.26E-02	3.3112E+00	1.6845E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9378150	0.9605860	0.9618820	0.9789340	0.9580130	2.2681E+02	9.3064E+00
2	7.11E-03	1.91E-02	1.77E-02	3.56E-02	1.84E-02	4.5042E+00	2.3161E+02
3	3.66E-03	1.31E-02	1.17E-02	2.70E-02	1.51E-02	3.0802E+00	2.3304E+02
4	1.06E-03	7.29E-03	5.96E-03	1.81E-02	8.49E-03	1.7220E+00	2.3439E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9465550	0.9644690	0.9653810	0.9792820	0.9611100	3.2730E+02	1.2058E+01
2	7.12E-03	1.67E-02	1.58E-02	2.95E-02	1.61E-02	5.6762E+00	3.3368E+02
3	2.63E-03	9.25E-03	8.30E-03	1.91E-02	9.96E-03	3.1387E+00	3.3622E+02
4	1.58E-03	7.12E-03	6.18E-03	1.59E-02	9.36E-03	2.4173E+00	3.3694E+02
5	7.36E-05	2.43E-03	1.55E-03	7.79E-03	3.43E-03	8.2554E-01	3.3853E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9494300	0.9654970	0.9662560	0.9789650	0.9626940	3.9227E+02	1.4018E+01
2	7.20E-03	1.59E-02	1.51E-02	2.72E-02	1.59E-02	6.4463E+00	3.9984E+02
3	1.91E-03	7.16E-03	6.37E-03	1.51E-02	6.94E-03	2.9079E+00	4.0338E+02
4	1.52E-03	6.38E-03	5.59E-03	1.39E-02	7.71E-03	2.5935E+00	4.0370E+02
5	5.19E-04	3.95E-03	3.18E-03	1.01E-02	5.33E-03	1.6061E+00	4.0468E+02
6	3.01E-06	1.14E-03	4.87E-04	4.51E-03	1.44E-03	4.6456E-01	4.0582E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9546140	0.9680410	0.9686210	0.9794780	0.9652980	5.1665E+02	1.7057E+01
2	6.66E-03	1.38E-02	1.32E-02	2.30E-02	1.36E-02	7.3684E+00	5.2634E+02
3	2.04E-03	6.57E-03	5.96E-03	1.32E-02	6.25E-03	3.5037E+00	5.3020E+02
4	1.27E-03	5.09E-03	4.48E-03	1.10E-02	5.79E-03	2.7147E+00	5.3099E+02
5	8.16E-04	4.11E-03	3.51E-03	9.45E-03	5.53E-03	2.1909E+00	5.3152E+02
6	1.18E-04	1.99E-03	1.41E-03	5.83E-03	2.91E-03	1.0617E+00	5.3265E+02
7	1.29E-09	4.08E-04	5.24E-05	2.05E-03	6.20E-04	2.1751E-01	5.3349E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9572600	0.9694670	0.9699730	0.9799370	0.9673110	5.9611E+02	1.8774E+01
2	6.09E-03	1.24E-02	1.19E-02	2.06E-02	1.20E-02	7.6375E+00	6.0725E+02
3	2.01E-03	6.13E-03	5.60E-03	1.20E-02	5.91E-03	3.7666E+00	6.1112E+02
4	1.02E-03	4.25E-03	3.73E-03	9.27E-03	4.42E-03	2.6129E+00	6.1227E+02
5	8.21E-04	3.82E-03	3.30E-03	8.61E-03	4.83E-03	2.3485E+00	6.1254E+02
6	3.54E-04	2.65E-03	2.13E-03	6.70E-03	3.68E-03	1.6274E+00	6.1326E+02
7	1.39E-05	1.06E-03	5.88E-04	3.69E-03	1.55E-03	6.4995E-01	6.1423E+02
8	1.22E-13	2.13E-04	5.15E-06	1.20E-03	2.73E-04	1.3119E-01	6.1475E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 217
Total Number of Common-Cause Failure Events: 18

Motor Operated Valves
PWR High Pressure Safety Injection Motor-Operated Valves
Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9404780	0.9531710	0.9580130	0.9611100	0.9626940	0.9652980	0.9673110
2	5.95E-02	2.42E-02	1.84E-02	1.61E-02	1.59E-02	1.36E-02	1.20E-02
3		2.26E-02	1.51E-02	9.96E-03	6.94E-03	6.25E-03	5.91E-03
4			8.49E-03	9.36E-03	7.71E-03	5.79E-03	4.42E-03
5				3.43E-03	5.33E-03	5.53E-03	4.83E-03
6					1.44E-03	2.91E-03	3.68E-03
7						6.20E-04	1.55E-03
8							2.73E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.41E-01	9.53E-01	9.58E-01	9.61E-01	9.63E-01	9.65E-01	9.67E-01
Beta	5.95E-02	4.68E-02	4.20E-02	3.89E-02	3.73E-02	3.47E-02	3.27E-02
Gamma		4.83E-01	5.62E-01	5.85E-01	5.74E-01	6.08E-01	6.32E-01
Delta			3.60E-01	5.62E-01	6.76E-01	7.04E-01	7.14E-01
Epsilon				2.68E-01	4.67E-01	6.10E-01	7.00E-01
Mu					2.13E-01	3.90E-01	5.33E-01
Upsilon						1.76E-01	3.31E-01
Sigma							1.50E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	80.52	120.78	161.04	201.30	241.56	281.82	322.08
N 1	5.7842	7.4217	8.3925	9.1294	9.4983	10.1847	10.7813
N 2	5.4621	3.2546	3.2547	3.5348	4.1426	4.1166	4.1398
N 3		3.0439	2.6696	2.1813	1.8100	1.8902	2.0318
N 4			1.5015	2.0485	2.0117	1.7509	1.5219
N 5				0.7501	1.3896	1.6727	1.6609
N 6					0.3750	0.8796	1.2676
N 7						0.1875	0.5328
N 8							0.0938

1.2.6.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9567600	0.9875400	0.9929760	0.9998280	0.9946810	5.1701E+01	6.5234E-01
2	1.68E-04	1.25E-02	7.03E-03	4.32E-02	5.32E-03	6.5234E-01	5.1701E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9546370	0.9816250	0.9849330	0.9973030	0.9893100	9.1898E+01	1.7202E+00
2	1.75E-03	1.55E-02	1.22E-02	4.06E-02	1.07E-02	1.4529E+00	9.2165E+01
3	9.98E-08	2.86E-03	5.72E-04	1.35E-02	0.00E+00	2.6733E-01	9.3351E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9524830	0.9769730	0.9793080	0.9934870	0.9838780	1.3092E+02	3.0858E+00
2	4.16E-03	1.83E-02	1.60E-02	4.05E-02	1.61E-02	2.4545E+00	1.3155E+02
3	3.81E-06	3.07E-03	1.15E-03	1.26E-02	1.34E-06	4.1073E-01	1.3360E+02
4	6.26E-09	1.65E-03	2.19E-04	8.26E-03	0.00E+00	2.2054E-01	1.3379E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9549920	0.9747690	0.9762410	0.9895290	0.9801980	2.0800E+02	5.3839E+00
2	6.18E-03	1.83E-02	1.68E-02	3.54E-02	1.89E-02	3.8985E+00	2.0949E+02
3	2.78E-04	4.88E-03	3.45E-03	1.44E-02	9.01E-04	1.0412E+00	2.1234E+02
4	1.02E-06	1.73E-03	5.70E-04	7.38E-03	0.00E+00	3.6878E-01	2.1302E+02
5	1.59E-20	3.54E-04	2.86E-07	2.05E-03	0.00E+00	7.5435E-02	2.1331E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9547450	0.9731420	0.9743650	0.9873740	0.9765790	2.4965E+02	6.8902E+00
2	7.06E-03	1.84E-02	1.72E-02	3.40E-02	2.18E-02	4.7227E+00	2.5182E+02
3	4.28E-04	4.93E-03	3.72E-03	1.36E-02	1.51E-03	1.2658E+00	2.5527E+02
4	2.12E-05	2.32E-03	1.22E-03	8.37E-03	1.25E-04	5.9568E-01	2.5595E+02
5	2.52E-09	8.44E-04	1.07E-04	4.26E-03	0.00E+00	2.1648E-01	2.5632E+02
6	6.98E-18	3.49E-04	1.02E-06	2.04E-03	0.00E+00	8.9555E-02	2.5645E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9579550	0.9732490	0.9741190	0.9855680	0.9761520	3.5061E+02	9.6368E+00
2	7.00E-03	1.62E-02	1.53E-02	2.84E-02	2.00E-02	5.8365E+00	3.5441E+02
3	1.06E-03	5.73E-03	4.85E-03	1.34E-02	3.50E-03	2.0645E+00	3.5818E+02
4	1.44E-04	2.79E-03	1.94E-03	8.32E-03	3.05E-04	1.0032E+00	3.5924E+02
5	7.01E-06	1.45E-03	6.82E-04	5.47E-03	1.78E-05	5.2052E-01	3.5973E+02
6	1.28E-10	5.06E-04	4.03E-05	2.67E-03	0.00E+00	1.8209E-01	3.6007E+02
7	0.00E+00	8.33E-05	1.48E-13	3.23E-04	0.00E+00	3.0005E-02	3.6022E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9592700	0.9733690	0.9741190	0.9849000	0.9755080	4.0661E+02	1.1125E+01
2	6.80E-03	1.51E-02	1.44E-02	2.61E-02	1.92E-02	6.3223E+00	4.1141E+02
3	1.25E-03	5.71E-03	4.95E-03	1.28E-02	4.43E-03	2.3862E+00	4.1535E+02
4	2.27E-04	2.89E-03	2.14E-03	8.09E-03	7.79E-04	1.2054E+00	4.1653E+02
5	2.84E-05	1.67E-03	9.68E-04	5.68E-03	5.78E-05	6.9613E-01	4.1704E+02
6	4.24E-07	8.62E-04	2.75E-04	3.71E-03	2.72E-06	3.6022E-01	4.1738E+02
7	1.16E-14	2.80E-04	3.98E-06	1.61E-03	0.00E+00	1.1715E-01	4.1762E+02
8	2.20E-38	8.95E-05	1.23E-11	4.12E-04	0.00E+00	3.7386E-02	4.1770E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 120
Total Number of Common-Cause Failure Events: 9

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9946810	0.9893100	0.9838780	0.9801980	0.9765790	0.9761520	0.9755080
2	5.32E-03	1.07E-02	1.61E-02	1.89E-02	2.18E-02	2.00E-02	1.92E-02
3		0.00E+00	1.34E-06	9.01E-04	1.51E-03	3.50E-03	4.43E-03
4			0.00E+00	0.00E+00	1.25E-04	3.05E-04	7.79E-04
5				0.00E+00	0.00E+00	1.78E-05	5.78E-05
6					0.00E+00	0.00E+00	2.72E-06
7						0.00E+00	0.00E+00
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.95E-01	9.89E-01	9.84E-01	9.80E-01	9.77E-01	9.76E-01	9.76E-01
Beta	5.32E-03	1.07E-02	1.61E-02	1.98E-02	2.34E-02	2.39E-02	2.45E-02
Gamma		0.00E+00	8.30E-05	4.55E-02	6.99E-02	1.60E-01	2.15E-01
Delta			0.00E+00	0.00E+00	7.65E-02	8.46E-02	1.59E-01
Epsilon				0.00E+00	0.00E+00	5.52E-02	7.22E-02
Mu					0.00E+00	0.00E+00	4.49E-02
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	34.83	52.25	69.67	87.08	104.50	121.92	139.33
N 1	2.7399	3.5074	3.8732	4.0466	3.9441	4.0454	4.0269
N 2	0.2009	0.6025	1.2050	1.7571	2.4190	2.5847	2.8246
N 3		0.0000	0.0001	0.0838	0.1679	0.4510	0.6514
N 4			0.0000	0.0000	0.0139	0.0394	0.1144
N 5				0.0000	0.0000	0.0023	0.0085
N 6					0.0000	0.0000	0.0004
N 7						0.0000	0.0000
N 8							0.0000

1.2.7 PWR Residual Heat Removal Motor-Operated Valves

1.2.7.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9697200	0.9841700	0.9853910	0.9944390	0.9850670	2.5617E+02	4.1205E+00
2	5.56E-03	1.58E-02	1.46E-02	3.03E-02	1.49E-02	4.1205E+00	2.5617E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9745650	0.9855070	0.9863000	0.9937410	0.9870850	3.9760E+02	5.8471E+00
2	2.62E-03	8.53E-03	7.73E-03	1.72E-02	7.07E-03	3.4408E+00	4.0001E+02
3	1.32E-03	5.96E-03	5.17E-03	1.33E-02	5.84E-03	2.4063E+00	4.0104E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9760590	0.9853870	0.9859740	0.9927080	0.9874740	5.3750E+02	7.9710E+00
2	3.03E-03	8.20E-03	7.61E-03	1.54E-02	6.63E-03	4.4716E+00	5.4100E+02
3	4.56E-04	3.15E-03	2.56E-03	7.83E-03	2.69E-03	1.7164E+00	5.4376E+02
4	5.00E-04	3.27E-03	2.69E-03	8.03E-03	3.21E-03	1.7830E+00	5.4369E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9774130	0.9854080	0.9858480	0.9918890	0.9883550	7.1582E+02	1.0600E+01
2	3.14E-03	7.54E-03	7.09E-03	1.35E-02	5.50E-03	5.4754E+00	7.2095E+02
3	7.86E-04	3.43E-03	2.99E-03	7.59E-03	2.53E-03	2.4929E+00	7.2393E+02
4	3.71E-04	2.44E-03	2.01E-03	6.02E-03	2.32E-03	1.7751E+00	7.2465E+02
5	3.98E-05	1.18E-03	7.65E-04	3.73E-03	1.29E-03	8.5674E-01	7.2556E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9785880	0.9857570	0.9861250	0.9916680	0.9888130	8.5868E+02	1.2407E+01
2	3.05E-03	6.95E-03	6.58E-03	1.21E-02	5.17E-03	6.0548E+00	8.6503E+02
3	7.32E-04	3.02E-03	2.65E-03	6.58E-03	2.12E-03	2.6343E+00	8.6845E+02
4	3.76E-04	2.21E-03	1.85E-03	5.31E-03	1.85E-03	1.9274E+00	8.6916E+02
5	1.39E-04	1.50E-03	1.14E-03	4.10E-03	1.51E-03	1.3103E+00	8.6978E+02
6	1.74E-06	5.51E-04	2.42E-04	2.15E-03	5.38E-04	4.8016E-01	8.7061E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9797420	0.9860830	0.9863810	0.9914010	0.9900380	1.0613E+03	1.4978E+01
2	2.71E-03	5.99E-03	5.68E-03	1.03E-02	3.77E-03	6.4412E+00	1.0698E+03
3	9.55E-04	3.16E-03	2.85E-03	6.39E-03	2.11E-03	3.3954E+00	1.0729E+03
4	4.37E-04	2.11E-03	1.81E-03	4.81E-03	1.55E-03	2.2727E+00	1.0740E+03
5	2.32E-04	1.60E-03	1.30E-03	3.98E-03	1.42E-03	1.7193E+00	1.0746E+03
6	3.59E-05	8.59E-04	5.77E-04	2.64E-03	8.78E-04	9.2429E-01	1.0754E+03
7	1.04E-09	2.09E-04	2.92E-05	1.04E-03	2.31E-04	2.2531E-01	1.0761E+03

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9811130	0.9868490	0.9871090	0.9916970	0.9909600	1.2191E+03	1.6246E+01
2	2.30E-03	5.13E-03	4.86E-03	8.86E-03	2.94E-03	6.3332E+00	1.2290E+03
3	9.11E-04	2.89E-03	2.63E-03	5.77E-03	1.90E-03	3.5718E+00	1.2318E+03
4	4.27E-04	1.94E-03	1.68E-03	4.35E-03	1.36E-03	2.3987E+00	1.2330E+03
5	2.55E-04	1.54E-03	1.28E-03	3.70E-03	1.25E-03	1.8958E+00	1.2335E+03
6	1.01E-04	1.07E-03	8.19E-04	2.91E-03	1.00E-03	1.3253E+00	1.2340E+03
7	4.03E-06	4.74E-04	2.45E-04	1.72E-03	4.86E-04	5.8595E-01	1.2348E+03
8	1.18E-13	1.09E-04	2.99E-06	6.13E-04	1.01E-04	1.3509E-01	1.2352E+03

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 663
Total Number of Common-Cause Failure Events: 15

Motor Operated Valves
PWR Residual Heat Removal Motor-Operated Valves
Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9850670	0.9870850	0.9874740	0.9883550	0.9888130	0.9900380	0.9909600
2	1.49E-02	7.07E-03	6.63E-03	5.50E-03	5.17E-03	3.77E-03	2.94E-03
3		5.84E-03	2.69E-03	2.53E-03	2.12E-03	2.11E-03	1.90E-03
4			3.21E-03	2.32E-03	1.85E-03	1.55E-03	1.36E-03
5				1.29E-03	1.51E-03	1.42E-03	1.25E-03
6					5.38E-04	8.78E-04	1.00E-03
7						2.31E-04	4.86E-04
8							1.01E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.85E-01	9.87E-01	9.88E-01	9.88E-01	9.89E-01	9.90E-01	9.91E-01
Beta	1.49E-02	1.29E-02	1.25E-02	1.17E-02	1.12E-02	9.96E-03	9.04E-03
Gamma		4.52E-01	4.71E-01	5.28E-01	5.38E-01	6.21E-01	6.75E-01
Delta			5.45E-01	5.88E-01	6.48E-01	6.59E-01	6.88E-01
Epsilon				3.57E-01	5.25E-01	6.20E-01	6.77E-01
Mu					2.63E-01	4.38E-01	5.59E-01
Upsilon						2.08E-01	3.70E-01
Sigma							1.73E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	236.79	355.18	473.57	591.96	710.36	828.75	947.14
N 1	5.2452	6.2774	6.5550	6.9855	7.1102	7.9435	8.7338
N 2	3.6691	2.5904	3.2221	3.3340	3.7511	3.1894	2.8355
N 3		2.1390	1.3058	1.5355	1.5364	1.7819	1.8370
N 4			1.5625	1.4063	1.3456	1.3089	1.3077
N 5				0.7813	1.0938	1.2011	1.2082
N 6					0.3906	0.7422	0.9655
N 7						0.1953	0.4688
N 8							0.0977

1.2.7.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9837640	0.9951910	0.9971650	0.9999090	0.9980510	1.4715E+02	7.1114E-01
2	8.90E-05	4.81E-03	2.84E-03	1.62E-02	1.95E-03	7.1114E-01	1.4715E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9807430	0.9919890	0.9933230	0.9986660	0.9960960	2.3488E+02	1.8967E+00
2	9.25E-04	6.88E-03	5.55E-03	1.74E-02	3.90E-03	1.6294E+00	2.3515E+02
3	3.93E-08	1.13E-03	2.25E-04	5.36E-03	0.00E+00	2.6733E-01	2.3651E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9786990	0.9894120	0.9903970	0.9967510	0.9941320	3.2133E+02	3.4387E+00
2	2.23E-03	8.65E-03	7.66E-03	1.84E-02	5.87E-03	2.8075E+00	3.2196E+02
3	1.56E-06	1.26E-03	4.73E-04	5.20E-03	0.00E+00	4.1063E-01	3.2436E+02
4	2.57E-09	6.79E-04	9.02E-05	3.41E-03	0.00E+00	2.2054E-01	3.2455E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9786570	0.9880870	0.9888010	0.9950770	0.9944480	4.4646E+02	5.3830E+00
2	2.53E-03	7.97E-03	7.26E-03	1.59E-02	4.41E-03	3.6031E+00	4.4824E+02
3	2.84E-04	2.96E-03	2.26E-03	8.00E-03	1.14E-03	1.3357E+00	4.5051E+02
4	4.78E-07	8.16E-04	2.69E-04	3.49E-03	0.00E+00	3.6878E-01	4.5147E+02
5	7.48E-21	1.67E-04	1.35E-07	9.68E-04	0.00E+00	7.5435E-02	4.5177E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9795650	0.9880940	0.9886910	0.9946000	0.9945310	5.3631E+02	6.4620E+00
2	2.34E-03	7.04E-03	6.45E-03	1.38E-02	3.82E-03	3.8219E+00	5.3895E+02
3	4.05E-04	3.01E-03	2.43E-03	7.61E-03	1.35E-03	1.6341E+00	5.4114E+02
4	2.24E-05	1.29E-03	7.52E-04	4.39E-03	2.98E-04	6.9998E-01	5.4207E+02
5	1.19E-09	3.99E-04	5.07E-05	2.01E-03	0.00E+00	2.1648E-01	5.4256E+02
6	3.30E-18	1.65E-04	4.84E-07	9.62E-04	0.00E+00	8.9555E-02	5.4268E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9793160	0.9870700	0.9875330	0.9932380	0.9947800	6.8531E+02	8.9769E+00
2	2.61E-03	6.82E-03	6.36E-03	1.26E-02	3.21E-03	4.7372E+00	6.8955E+02
3	6.74E-04	3.26E-03	2.80E-03	7.43E-03	1.41E-03	2.2651E+00	6.9202E+02
4	1.37E-04	1.74E-03	1.29E-03	4.87E-03	5.23E-04	1.2061E+00	6.9308E+02
5	5.37E-06	8.01E-04	3.99E-04	2.96E-03	8.25E-05	5.5642E-01	6.9373E+02
6	6.65E-11	2.62E-04	2.09E-05	1.38E-03	0.00E+00	1.8209E-01	6.9411E+02
7	0.00E+00	4.32E-05	7.69E-14	1.67E-04	0.00E+00	3.0005E-02	6.9426E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9801040	0.9872470	0.9876500	0.9930110	0.9949470	7.8944E+02	1.0198E+01
2	2.47E-03	6.26E-03	5.85E-03	1.14E-02	2.84E-03	5.0017E+00	7.9464E+02
3	6.85E-04	3.06E-03	2.65E-03	6.81E-03	1.34E-03	2.4443E+00	7.9719E+02
4	1.95E-04	1.79E-03	1.40E-03	4.74E-03	6.49E-04	1.4342E+00	7.9820E+02
5	2.61E-05	9.89E-04	6.16E-04	3.22E-03	1.95E-04	7.9063E-01	7.9885E+02
6	2.93E-07	4.66E-04	1.55E-04	1.98E-03	2.36E-05	3.7232E-01	7.9927E+02
7	6.04E-15	1.47E-04	2.08E-06	8.39E-04	0.00E+00	1.1715E-01	7.9952E+02
8	1.15E-38	4.68E-05	6.43E-12	2.15E-04	0.00E+00	3.7386E-02	7.9960E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 326

Total Number of Common-Cause Failure Events: 6

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9980510	0.9960960	0.9941320	0.9944480	0.9945310	0.9947800	0.9949470
2	1.95E-03	3.90E-03	5.87E-03	4.41E-03	3.82E-03	3.21E-03	2.84E-03
3		0.00E+00	0.00E+00	1.14E-03	1.35E-03	1.41E-03	1.34E-03
4			0.00E+00	0.00E+00	2.98E-04	5.23E-04	6.49E-04
5				0.00E+00	0.00E+00	8.25E-05	1.95E-04
6					0.00E+00	0.00E+00	2.36E-05
7						0.00E+00	0.00E+00
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.98E-01	9.96E-01	9.94E-01	9.94E-01	9.95E-01	9.95E-01	9.95E-01
Beta	1.95E-03	3.90E-03	5.87E-03	5.55E-03	5.47E-03	5.22E-03	5.05E-03
Gamma		0.00E+00	0.00E+00	2.06E-01	3.01E-01	3.86E-01	4.37E-01
Delta			0.00E+00	0.00E+00	1.81E-01	3.01E-01	3.93E-01
Epsilon				0.00E+00	0.00E+00	1.36E-01	2.52E-01
Mu					0.00E+00	0.00E+00	1.08E-01
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	130.40	195.60	260.80	326.00	391.20	456.40	521.60
N 1	2.6140	3.1420	3.1507	3.5858	3.9038	4.2689	4.5875
N 2	0.2597	0.7790	1.5580	1.4617	1.5182	1.4854	1.5040
N 3		0.0000	0.0000	0.3783	0.5362	0.6516	0.7095
N 4			0.0000	0.0000	0.1182	0.2423	0.3432
N 5				0.0000	0.0000	0.0382	0.1030
N 6					0.0000	0.0000	0.0125
N 7						0.0000	0.0000
N 8							0.0000

1.2.8 BWR High Pressure Coolant Injection and Reactor Core Isolation Cooling Motor-Operated Valves

1.2.8.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	HIGH PRESSURE COOLANT INJECTION (BWR)
	REACTOR CORE ISOLATION COOLING
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9220420	0.9696510	0.9757550	0.9963690	0.9699060	4.7839E+01	1.4973E+00
2	3.63E-03	3.04E-02	2.43E-02	7.80E-02	3.01E-02	1.4973E+00	4.7839E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9428050	0.9747320	0.9782100	0.9947680	0.9781490	8.6577E+01	2.2444E+00
2	5.27E-04	1.09E-02	7.55E-03	3.29E-02	2.35E-03	9.7145E-01	8.7850E+01
3	1.27E-03	1.43E-02	1.09E-02	3.92E-02	1.95E-02	1.2729E+00	8.7548E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9497950	0.9755950	0.9780410	0.9930380	0.9819520	1.2448E+02	3.1139E+00
2	1.30E-03	1.15E-02	9.03E-03	3.00E-02	3.12E-03	1.4627E+00	1.2613E+02
3	5.61E-06	3.37E-03	1.33E-03	1.36E-02	2.84E-04	4.3003E-01	1.2716E+02
4	7.77E-04	9.57E-03	7.16E-03	2.66E-02	1.46E-02	1.2212E+00	1.2637E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9564520	0.9761490	0.9776810	0.9906230	0.9840340	2.0060E+02	4.9015E+00
2	2.70E-03	1.19E-02	1.04E-02	2.65E-02	3.68E-03	2.4543E+00	2.0305E+02
3	2.51E-04	4.87E-03	3.38E-03	1.45E-02	4.98E-04	9.9977E-01	2.0450E+02
4	1.13E-06	1.81E-03	6.03E-04	7.71E-03	3.64E-05	3.7188E-01	2.0513E+02
5	3.21E-04	5.23E-03	3.74E-03	1.52E-02	1.18E-02	1.0755E+00	2.0443E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9589410	0.9766040	0.9778810	0.9899100	0.9853000	2.4152E+02	5.7860E+00
2	2.75E-03	1.10E-02	9.70E-03	2.36E-02	4.07E-03	2.7177E+00	2.4459E+02
3	3.51E-04	4.74E-03	3.49E-03	1.34E-02	7.26E-04	1.1718E+00	2.4613E+02
4	2.09E-05	2.39E-03	1.24E-03	8.63E-03	7.96E-05	5.8988E-01	2.4672E+02
5	2.70E-09	8.77E-04	1.12E-04	4.42E-03	4.91E-06	2.1698E-01	2.4709E+02
6	2.79E-04	4.41E-03	3.16E-03	1.28E-02	9.82E-03	1.0896E+00	2.4622E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	HIGH PRESSURE COOLANT INJECTION (BWR)
	REACTOR CORE ISOLATION COOLING
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 111

Total Number of Common-Cause Failure Events: 5

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9699060	0.9781490	0.9819520	0.9840340	0.9853000
2	3.01E-02	2.35E-03	3.12E-03	3.68E-03	4.07E-03
3		1.95E-02	2.84E-04	4.98E-04	7.26E-04
4			1.46E-02	3.64E-05	7.96E-05
5				1.18E-02	4.91E-06
6					9.82E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.70E-01	9.78E-01	9.82E-01	9.84E-01	9.85E-01
Beta	3.01E-02	2.19E-02	1.81E-02	1.60E-02	1.47E-02
Gamma		8.93E-01	8.27E-01	7.70E-01	7.23E-01
Delta			9.81E-01	9.59E-01	9.32E-01
Epsilon				9.97E-01	9.92E-01
Mu					1.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	32.65	48.97	65.29	81.62	97.94
N 1	1.0581	1.4661	1.8127	2.1094	2.3656
N 2	1.0459	0.1211	0.2132	0.3129	0.4140
N 3		1.0056	0.0194	0.0424	0.0739
N 4			1.0007	0.0031	0.0081
N 5				1.0001	0.0005
N 6					1.0000

1.2.8.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	HIGH PRESSURE COOLANT INJECTION (BWR)
	REACTOR CORE ISOLATION COOLING
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9455410	0.9856610	0.9932770	0.9999350	0.9973200	3.4860E+01	5.0714E-01
2	6.21E-05	1.43E-02	6.73E-03	5.45E-02	2.68E-03	5.0714E-01	3.4860E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9492770	0.9814290	0.9858810	0.9983630	0.9951220	6.7085E+01	1.2694E+00
2	7.46E-04	1.46E-02	1.02E-02	4.33E-02	4.63E-03	9.9425E-01	6.7360E+01
3	1.89E-07	4.03E-03	8.53E-04	1.89E-02	2.51E-04	2.7513E-01	6.8079E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9508230	0.9785760	0.9816650	0.9957750	0.9933460	9.8479E+01	2.1560E+00
2	1.76E-03	1.49E-02	1.18E-02	3.85E-02	5.98E-03	1.4968E+00	9.9138E+01
3	8.08E-06	4.35E-03	1.75E-03	1.75E-02	6.53E-04	4.3763E-01	1.0020E+02
4	8.88E-09	2.20E-03	2.97E-04	1.10E-02	2.42E-05	2.2154E-01	1.0041E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9557450	0.9770690	0.9788920	0.9921640	0.9922190	1.6808E+02	3.9446E+00
2	3.29E-03	1.44E-02	1.25E-02	3.18E-02	6.44E-03	2.4738E+00	1.6955E+02
3	3.22E-04	5.94E-03	4.16E-03	1.76E-02	1.23E-03	1.0210E+00	1.7100E+02
4	1.42E-06	2.18E-03	7.31E-04	9.24E-03	1.05E-04	3.7418E-01	1.7165E+02
5	2.19E-20	4.40E-04	3.64E-07	2.55E-03	3.88E-06	7.5635E-02	1.7195E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9573570	0.9767400	0.9782600	0.9909460	0.9913790	2.0251E+02	4.8225E+00
2	3.28E-03	1.31E-02	1.16E-02	2.81E-02	6.61E-03	2.7127E+00	2.0462E+02
3	4.58E-04	5.82E-03	4.32E-03	1.63E-02	1.74E-03	1.2057E+00	2.0613E+02
4	2.66E-05	2.88E-03	1.51E-03	1.04E-02	2.46E-04	5.9698E-01	2.0674E+02
5	3.35E-09	1.05E-03	1.35E-04	5.29E-03	1.78E-05	2.1758E-01	2.0712E+02
6	8.65E-18	4.32E-04	1.27E-06	2.52E-03	0.00E+00	8.9555E-02	2.0724E+02

ALPHA FACTOR AND MGL PARAMETERS

System :		HIGH PRESSURE COOLANT INJECTION (BWR)	
	REACTOR CORE ISOLATION COOLING	Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :		FAIL TO CLOSE (NORMALLY OPEN)	
Start Date :		1985/01/01	
Data Version :		2003/12/31	

Total Number of Independent Failure Events: 67

Total Number of Common-Cause Failure Events: 3

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9973200	0.9951220	0.9933460	0.9922190	0.9913790
2	2.68E-03	4.63E-03	5.98E-03	6.44E-03	6.61E-03
3		2.51E-04	6.53E-04	1.23E-03	1.74E-03
4			2.42E-05	1.05E-04	2.46E-04
5				3.88E-06	1.78E-05
6					0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.97E-01	9.95E-01	9.93E-01	9.92E-01	9.91E-01
Beta	2.68E-03	4.88E-03	6.65E-03	7.78E-03	8.62E-03
Gamma		5.14E-02	1.02E-01	1.72E-01	2.33E-01
Delta			3.57E-02	8.09E-02	1.31E-01
Epsilon				3.57E-02	6.75E-02
Mu					0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	20.09	30.13	40.18	50.22	60.27
N 1	0.6386	0.8140	0.9204	0.9928	1.0333
N 2	0.0557	0.1439	0.2473	0.3324	0.4090
N 3		0.0078	0.0270	0.0636	0.1078
N 4			0.0010	0.0054	0.0152
N 5				0.0002	0.0011
N 6					0.0000

1.2.9 Pressurizer PORV Motor-Operated Block Valves

1.2.9.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	REACTOR COOLANT
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9386280	0.9764320	0.9813720	0.9973370	0.9787230	6.0131E+01	1.4514E+00
2	2.67E-03	2.36E-02	1.86E-02	6.14E-02	2.13E-02	1.4514E+00	6.0131E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9543930	0.9802560	0.9831600	0.9961920	0.9857140	1.0514E+02	2.1177E+00
2	1.24E-03	1.26E-02	9.71E-03	3.38E-02	7.14E-03	1.3504E+00	1.0591E+02
3	1.73E-04	7.15E-03	4.41E-03	2.35E-02	7.14E-03	7.6733E-01	1.0649E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9601280	0.9810810	0.9831440	0.9949780	0.9892470	1.4938E+02	2.8807E+00
2	1.16E-03	9.85E-03	7.80E-03	2.55E-02	2.69E-03	1.4995E+00	1.5076E+02
3	2.42E-04	5.98E-03	4.00E-03	1.85E-02	5.38E-03	9.1063E-01	1.5135E+02
4	8.77E-06	3.09E-03	1.34E-03	1.21E-02	2.69E-03	4.7054E-01	1.5179E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9641930	0.9807840	0.9821210	0.9928010	0.9913790	2.3187E+02	4.5430E+00
2	1.99E-03	9.59E-03	8.24E-03	2.18E-02	1.08E-03	2.2664E+00	2.3415E+02
3	5.40E-04	5.64E-03	4.32E-03	1.52E-02	3.23E-03	1.3324E+00	2.3508E+02
4	6.80E-05	3.15E-03	1.90E-03	1.05E-02	3.23E-03	7.4378E-01	2.3567E+02
5	8.94E-10	8.48E-04	8.87E-05	4.37E-03	1.08E-03	2.0044E-01	2.3621E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9666210	0.9814080	0.9825230	0.9923750	0.9928060	2.7921E+02	5.2894E+00
2	1.81E-03	8.32E-03	7.20E-03	1.87E-02	4.50E-04	2.3662E+00	2.8213E+02
3	4.63E-04	4.74E-03	3.64E-03	1.28E-02	1.80E-03	1.3479E+00	2.8315E+02
4	1.55E-04	3.36E-03	2.30E-03	1.02E-02	2.70E-03	9.5678E-01	2.8354E+02
5	4.42E-06	1.64E-03	7.01E-04	6.45E-03	1.80E-03	4.6648E-01	2.8403E+02
6	6.18E-12	5.35E-04	2.34E-05	2.94E-03	4.50E-04	1.5206E-01	2.8435E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	REACTOR COOLANT
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 46
 Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9787230	0.9857140	0.9892470	0.9913790	0.9928060
2	2.13E-02	7.14E-03	2.69E-03	1.08E-03	4.50E-04
3		7.14E-03	5.38E-03	3.23E-03	1.80E-03
4			2.69E-03	3.23E-03	2.70E-03
5				1.08E-03	1.80E-03
6					4.50E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.79E-01	9.86E-01	9.89E-01	9.91E-01	9.93E-01
Beta	2.13E-02	1.43E-02	1.08E-02	8.62E-03	7.19E-03
Gamma		5.00E-01	7.50E-01	8.75E-01	9.38E-01
Delta			3.33E-01	5.71E-01	7.33E-01
Epsilon				2.50E-01	4.55E-01
Mu					2.00E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	46.00	69.00	92.00	115.00	138.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	1.0000	0.5000	0.2500	0.1250	0.0625
N 3		0.5000	0.5000	0.3750	0.2500
N 4			0.2500	0.3750	0.3750
N 5				0.1250	0.2500
N 6					0.0625

1.2.9.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	REACTOR COOLANT
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9618690	0.9854040	0.9884960	0.9983550	0.9882040	9.8321E+01	1.4564E+00
2	1.65E-03	1.46E-02	1.15E-02	3.81E-02	1.18E-02	1.4564E+00	9.8321E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9700450	0.9870410	0.9889540	0.9974910	0.9920290	1.6241E+02	2.1323E+00
2	8.32E-04	8.29E-03	6.41E-03	2.22E-02	4.04E-03	1.3647E+00	1.6318E+02
3	1.12E-04	4.67E-03	2.87E-03	1.53E-02	3.93E-03	7.6763E-01	1.6378E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9731920	0.9872770	0.9886660	0.9966050	0.9939300	2.2572E+02	2.9088E+00
2	8.10E-04	6.68E-03	5.30E-03	1.72E-02	1.64E-03	1.5266E+00	2.2710E+02
3	1.61E-04	3.99E-03	2.67E-03	1.23E-02	2.96E-03	9.1163E-01	2.2772E+02
4	5.83E-06	2.06E-03	8.88E-04	8.07E-03	1.48E-03	4.7054E-01	2.2816E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9742530	0.9861740	0.9871420	0.9947960	0.9950570	3.2728E+02	4.5883E+00
2	1.47E-03	6.96E-03	6.00E-03	1.57E-02	7.94E-04	2.3093E+00	3.2956E+02
3	3.86E-04	4.02E-03	3.08E-03	1.09E-02	1.78E-03	1.3347E+00	3.3053E+02
4	4.84E-05	2.24E-03	1.35E-03	7.46E-03	1.77E-03	7.4388E-01	3.3112E+02
5	6.36E-10	6.04E-04	6.31E-05	3.11E-03	5.91E-04	2.0044E-01	3.3167E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9759430	0.9865800	0.9873870	0.9944690	0.9957970	3.9367E+02	5.3550E+00
2	1.36E-03	6.08E-03	5.28E-03	1.36E-02	4.88E-04	2.4273E+00	3.9660E+02
3	3.33E-04	3.39E-03	2.60E-03	9.13E-03	1.00E-03	1.3522E+00	3.9767E+02
4	1.10E-04	2.40E-03	1.64E-03	7.29E-03	1.48E-03	9.5698E-01	3.9807E+02
5	3.15E-06	1.17E-03	5.00E-04	4.60E-03	9.86E-04	4.6648E-01	3.9856E+02
6	4.40E-12	3.81E-04	1.67E-05	2.09E-03	2.47E-04	1.5206E-01	3.9887E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	REACTOR COOLANT
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 84
 Total Number of Common-Cause Failure Events: 2

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9882040	0.9920290	0.9939300	0.9950570	0.9957970
2	1.18E-02	4.04E-03	1.64E-03	7.94E-04	4.88E-04
3		3.93E-03	2.96E-03	1.78E-03	1.00E-03
4			1.48E-03	1.77E-03	1.48E-03
5				5.91E-04	9.86E-04
6					2.47E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.88E-01	9.92E-01	9.94E-01	9.95E-01	9.96E-01
Beta	1.18E-02	7.97E-03	6.07E-03	4.94E-03	4.20E-03
Gamma		4.93E-01	7.31E-01	8.39E-01	8.84E-01
Delta			3.33E-01	5.70E-01	7.30E-01
Epsilon				2.50E-01	4.54E-01
Mu					2.00E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	84.00	126.00	168.00	210.00	252.00
N 1	0.1900	0.2708	0.3430	0.4073	0.4643
N 2	1.0050	0.5143	0.2771	0.1679	0.1236
N 3		0.5003	0.5010	0.3773	0.2543
N 4			0.2500	0.3751	0.3752
N 5				0.1250	0.2500
N 6					0.0625

1.3 Air Operated Valves

1.3.1 Pooled Air Operated Valves

1.3.1.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9465580	0.9782680	0.9821310	0.9967700	0.9803330	7.7990E+01	1.7325E+00
2	3.23E-03	2.17E-02	1.79E-02	5.34E-02	1.97E-02	1.7325E+00	7.7990E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9397760	0.9680710	0.9703830	0.9884540	0.9673250	1.2913E+02	4.2589E+00
2	8.82E-03	2.73E-02	2.50E-02	5.37E-02	2.90E-02	3.6405E+00	1.2975E+02
3	4.99E-05	4.64E-03	2.50E-03	1.65E-02	3.65E-03	6.1843E-01	1.3277E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9402180	0.9648520	0.9665100	0.9838330	0.9632550	1.7936E+02	6.5338E+00
2	9.57E-03	2.51E-02	2.34E-02	4.63E-02	2.69E-02	4.6595E+00	1.8123E+02
3	9.05E-04	7.92E-03	6.24E-03	2.07E-02	8.38E-03	1.4716E+00	1.8442E+02
4	2.36E-06	2.17E-03	7.95E-04	8.97E-03	1.44E-03	4.0274E-01	1.8549E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9478060	0.9670970	0.9682170	0.9825730	0.9644280	2.6818E+02	9.1240E+00
2	8.22E-03	1.97E-02	1.86E-02	3.51E-02	2.12E-02	5.4609E+00	2.7184E+02
3	2.02E-03	8.90E-03	7.75E-03	1.97E-02	9.63E-03	2.4679E+00	2.7484E+02
4	2.02E-04	3.70E-03	2.59E-03	1.10E-02	4.18E-03	1.0246E+00	2.7628E+02
5	5.49E-11	6.15E-04	4.02E-05	3.30E-03	6.07E-04	1.7064E-01	2.7713E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9499810	0.9674120	0.9683470	0.9816550	0.9649940	3.2163E+02	1.0834E+01
2	7.62E-03	1.76E-02	1.66E-02	3.09E-02	1.90E-02	5.8515E+00	3.2661E+02
3	1.94E-03	7.95E-03	6.99E-03	1.73E-02	8.27E-03	2.6434E+00	3.2982E+02
4	6.14E-04	4.77E-03	3.82E-03	1.22E-02	5.37E-03	1.5861E+00	3.3088E+02
5	1.92E-05	1.85E-03	9.90E-04	6.59E-03	2.13E-03	6.1398E-01	3.3185E+02
6	8.83E-13	4.20E-04	1.31E-05	2.34E-03	2.67E-04	1.3946E-01	3.3233E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9538220	0.9684720	0.9691650	0.9807460	0.9651060	4.3394E+02	1.4127E+01
2	7.80E-03	1.62E-02	1.55E-02	2.71E-02	1.86E-02	7.2756E+00	4.4079E+02
3	1.89E-03	6.80E-03	6.09E-03	1.42E-02	6.62E-03	3.0488E+00	4.4502E+02
4	9.03E-04	4.72E-03	4.01E-03	1.10E-02	5.32E-03	2.1168E+00	4.4595E+02
5	2.14E-04	2.70E-03	2.01E-03	7.56E-03	3.19E-03	1.2097E+00	4.4686E+02
6	1.33E-06	9.36E-04	3.59E-04	3.82E-03	1.09E-03	4.1939E-01	4.4765E+02
7	1.03E-26	1.26E-04	5.91E-09	6.94E-04	1.21E-04	5.6305E-02	4.4801E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9551850	0.9687060	0.9693110	0.9801720	0.9648620	5.0120E+02	1.6191E+01
2	8.01E-03	1.59E-02	1.52E-02	2.58E-02	1.91E-02	8.2020E+00	5.0919E+02
3	1.61E-03	5.85E-03	5.23E-03	1.22E-02	5.24E-03	3.0281E+00	5.1436E+02
4	8.95E-04	4.36E-03	3.74E-03	9.94E-03	4.72E-03	2.2542E+00	5.1514E+02
5	3.82E-04	3.03E-03	2.42E-03	7.76E-03	3.57E-03	1.5669E+00	5.1582E+02
6	4.96E-05	1.61E-03	1.03E-03	5.14E-03	1.91E-03	8.3122E-01	5.1656E+02
7	1.16E-08	4.97E-04	9.22E-05	2.39E-03	5.69E-04	2.5735E-01	5.1713E+02
8	4.85E-29	9.91E-05	1.53E-09	5.32E-04	5.64E-05	5.1286E-02	5.1734E+02

ALPHA FACTOR AND MGL PARAMETERS

Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 157

Total Number of Common-Cause Failure Events: 13

Air Operated Valves
Pooled Air Operated Valves
Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9803330	0.9673250	0.9632550	0.9644280	0.9649940	0.9651060	0.9648620
2	1.97E-02	2.90E-02	2.69E-02	2.12E-02	1.90E-02	1.86E-02	1.91E-02
3		3.65E-03	8.38E-03	9.63E-03	8.27E-03	6.62E-03	5.24E-03
4			1.44E-03	4.18E-03	5.37E-03	5.32E-03	4.72E-03
5				6.07E-04	2.13E-03	3.19E-03	3.57E-03
6					2.67E-04	1.09E-03	1.91E-03
7						1.21E-04	5.69E-04
8							5.64E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.80E-01	9.67E-01	9.63E-01	9.64E-01	9.65E-01	9.65E-01	9.65E-01
Beta	1.97E-02	3.27E-02	3.68E-02	3.56E-02	3.50E-02	3.49E-02	3.51E-02
Gamma		1.12E-01	2.67E-01	4.05E-01	4.58E-01	4.68E-01	4.57E-01
Delta			1.47E-01	3.32E-01	4.84E-01	5.95E-01	6.74E-01
Epsilon				1.27E-01	3.08E-01	4.53E-01	5.64E-01
Mu					1.12E-01	2.76E-01	4.16E-01
Upsilon						9.98E-02	2.46E-01
Sigma							9.02E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	57.51	86.26	115.02	143.77	172.53	201.28	230.04
N 1	6.3489	6.7333	6.9616	7.5424	7.8940	8.0171	7.9071
N 2	1.2811	2.7901	3.4100	3.3195	3.5478	4.0238	4.7043
N 3		0.3511	1.0610	1.5105	1.5455	1.4353	1.2933
N 4			0.1822	0.6558	1.0043	1.1530	1.1632
N 5				0.0952	0.3975	0.6915	0.8793
N 6					0.0499	0.2373	0.4714
N 7						0.0263	0.1402
N 8							0.0139

1.3.1.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9384220	0.9784910	0.9843330	0.9985770	0.9822430	5.0186E+01	1.1032E+00
2	1.42E-03	2.15E-02	1.57E-02	6.16E-02	1.78E-02	1.1032E+00	5.0186E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9308870	0.9664280	0.9697770	0.9905030	0.9639660	8.8277E+01	3.0666E+00
2	7.96E-03	3.06E-02	2.73E-02	6.48E-02	3.60E-02	2.7961E+00	8.8548E+01
3	1.17E-07	2.96E-03	6.07E-04	1.40E-02	5.92E-05	2.7053E-01	9.1073E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9226490	0.9556720	0.9579890	0.9807680	0.9451370	1.2431E+02	5.7660E+00
2	1.60E-02	3.94E-02	3.70E-02	7.08E-02	5.47E-02	5.1222E+00	1.2495E+02
3	4.89E-06	3.25E-03	1.26E-03	1.32E-02	1.77E-04	4.2313E-01	1.2965E+02
4	6.49E-09	1.70E-03	2.26E-04	8.52E-03	1.41E-06	2.2064E-01	1.2986E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9332780	0.9582800	0.9597470	0.9782810	0.9413100	1.9899E+02	8.6633E+00
2	1.46E-02	3.16E-02	3.01E-02	5.38E-02	5.07E-02	6.5634E+00	2.0109E+02
3	1.10E-03	7.97E-03	6.46E-03	2.00E-02	8.00E-03	1.6552E+00	2.0600E+02
4	1.06E-06	1.78E-03	5.87E-04	7.59E-03	5.73E-06	3.6928E-01	2.0728E+02
5	1.63E-20	3.63E-04	2.94E-07	2.11E-03	0.00E+00	7.5435E-02	2.0758E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9353370	0.9580730	0.9592930	0.9766340	0.9405710	2.3852E+02	1.0438E+01
2	1.34E-02	2.82E-02	2.70E-02	4.74E-02	4.57E-02	7.0289E+00	2.4193E+02
3	1.94E-03	9.23E-03	7.95E-03	2.09E-02	1.16E-02	2.2978E+00	2.4666E+02
4	9.07E-05	3.24E-03	2.04E-03	1.05E-02	2.16E-03	8.0528E-01	2.4815E+02
5	2.61E-09	8.70E-04	1.11E-04	4.39E-03	9.67E-07	2.1658E-01	2.4874E+02
6	7.20E-18	3.60E-04	1.06E-06	2.10E-03	0.00E+00	8.9555E-02	2.4887E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9445800	0.9625900	0.9634630	0.9776010	0.9451170	3.3769E+02	1.3124E+01
2	1.04E-02	2.13E-02	2.04E-02	3.53E-02	3.52E-02	7.4644E+00	3.4335E+02
3	2.92E-03	9.64E-03	8.73E-03	1.95E-02	1.48E-02	3.3818E+00	3.4743E+02
4	4.80E-04	4.20E-03	3.30E-03	1.10E-02	4.26E-03	1.4734E+00	3.4934E+02
5	1.51E-05	1.69E-03	8.82E-04	6.10E-03	6.20E-04	5.9242E-01	3.5022E+02
6	1.32E-10	5.19E-04	4.14E-05	2.74E-03	0.00E+00	1.8209E-01	3.5063E+02
7	0.00E+00	8.55E-05	1.52E-13	3.32E-04	0.00E+00	3.0005E-02	3.5078E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9478610	0.9641920	0.9649530	0.9779320	0.9481960	3.9192E+02	1.4555E+01
2	8.91E-03	1.83E-02	1.76E-02	3.05E-02	2.92E-02	7.4557E+00	3.9902E+02
3	3.02E-03	9.23E-03	8.43E-03	1.81E-02	1.49E-02	3.7501E+00	4.0273E+02
4	7.89E-04	4.70E-03	3.91E-03	1.13E-02	6.03E-03	1.9090E+00	4.0457E+02
5	8.67E-05	2.22E-03	1.47E-03	6.88E-03	1.57E-03	9.0123E-01	4.0557E+02
6	7.49E-07	9.46E-04	3.28E-04	3.98E-03	1.82E-04	3.8452E-01	4.0609E+02
7	1.19E-14	2.88E-04	4.09E-06	1.65E-03	0.00E+00	1.1715E-01	4.0636E+02
8	2.26E-38	9.20E-05	1.27E-11	4.24E-04	0.00E+00	3.7386E-02	4.0644E+02

ALPHA FACTOR AND MGL PARAMETERS

Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 106
Total Number of Common-Cause Failure Events: 15

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9822430	0.9639660	0.9451370	0.9413100	0.9405710	0.9451170	0.9481960
2	1.78E-02	3.60E-02	5.47E-02	5.07E-02	4.57E-02	3.52E-02	2.92E-02
3		5.92E-05	1.77E-04	8.00E-03	1.16E-02	1.48E-02	1.49E-02
4			1.41E-06	5.73E-06	2.16E-03	4.26E-03	6.03E-03
5				0.00E+00	9.67E-07	6.20E-04	1.57E-03
6					0.00E+00	0.00E+00	1.82E-04
7						0.00E+00	0.00E+00
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.82E-01	9.64E-01	9.45E-01	9.41E-01	9.41E-01	9.45E-01	9.48E-01
Beta	1.78E-02	3.60E-02	5.49E-02	5.87E-02	5.94E-02	5.49E-02	5.18E-02
Gamma		1.64E-03	3.24E-03	1.36E-01	2.32E-01	3.58E-01	4.37E-01
Delta			7.94E-03	7.16E-04	1.57E-01	2.48E-01	3.44E-01
Epsilon				0.00E+00	4.47E-04	1.27E-01	2.26E-01
Mu					0.00E+00	0.00E+00	1.04E-01
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	31.50	47.25	63.00	78.75	94.50	110.25	126.00
N 1	4.5547	4.8863	3.9333	3.3729	2.8135	2.7970	2.6652
N 2	0.6518	1.9457	3.8727	4.4220	4.7252	4.2126	3.9580
N 3		0.0032	0.0125	0.6978	1.1999	1.7683	2.0153
N 4			0.0001	0.0005	0.2235	0.5096	0.8180
N 5				0.0000	0.0001	0.0742	0.2136
N 6					0.0000	0.0000	0.0247
N 7						0.0000	0.0000
N 8							0.0000

1.3.1.3 Fail to Operate

ALPHA FACTOR DISTRIBUTIONS

Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9530620	0.9789180	0.9816760	0.9953490	0.9803780	1.1071E+02	2.3843E+00
2	4.65E-03	2.11E-02	1.83E-02	4.69E-02	1.96E-02	2.3843E+00	1.1071E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9414450	0.9659790	0.9676660	0.9847410	0.9649470	1.7626E+02	6.2078E+00
2	1.30E-02	3.06E-02	2.89E-02	5.41E-02	3.26E-02	5.5862E+00	1.7688E+02
3	3.74E-05	3.41E-03	1.84E-03	1.21E-02	2.44E-03	6.2163E-01	1.8185E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9357000	0.9583280	0.9595440	0.9767930	0.9552420	2.3961E+02	1.0419E+01
2	1.76E-02	3.41E-02	3.29E-02	5.49E-02	3.82E-02	8.5322E+00	2.4150E+02
3	6.87E-04	5.94E-03	4.68E-03	1.55E-02	5.63E-03	1.4842E+00	2.4855E+02
4	1.76E-06	1.61E-03	5.91E-04	6.67E-03	9.56E-04	4.0284E-01	2.4963E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9416180	0.9600110	0.9608680	0.9754730	0.9546140	3.4196E+02	1.4244E+01
2	1.51E-02	2.78E-02	2.69E-02	4.34E-02	3.28E-02	9.8829E+00	3.4632E+02
3	2.55E-03	8.89E-03	7.99E-03	1.83E-02	9.37E-03	3.1657E+00	3.5304E+02
4	1.57E-04	2.88E-03	2.02E-03	8.53E-03	2.78E-03	1.0251E+00	3.5518E+02
5	4.27E-11	4.79E-04	3.12E-05	2.57E-03	4.04E-04	1.7064E-01	3.5603E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9434160	0.9601240	0.9608410	0.9743830	0.9547310	4.0892E+02	1.6983E+01
2	1.38E-02	2.48E-02	2.41E-02	3.84E-02	2.95E-02	1.0577E+01	4.1533E+02
3	3.01E-03	9.02E-03	8.27E-03	1.76E-02	9.79E-03	3.8432E+00	4.2206E+02
4	6.64E-04	4.25E-03	3.50E-03	1.04E-02	4.38E-03	1.8096E+00	4.2409E+02
5	1.50E-05	1.44E-03	7.72E-04	5.14E-03	1.42E-03	6.1398E-01	4.2529E+02
6	6.89E-13	3.27E-04	1.02E-05	1.83E-03	1.78E-04	1.3946E-01	4.2576E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9487100	0.9627850	0.9633410	0.9749630	0.9564890	5.3529E+02	2.0691E+01
2	1.18E-02	2.07E-02	2.01E-02	3.15E-02	2.54E-02	1.1488E+01	5.4449E+02
3	3.35E-03	8.66E-03	8.08E-03	1.60E-02	9.86E-03	4.8171E+00	5.5116E+02
4	1.14E-03	4.72E-03	4.15E-03	1.03E-02	5.12E-03	2.6263E+00	5.5336E+02
5	2.06E-04	2.31E-03	1.75E-03	6.33E-03	2.36E-03	1.2840E+00	5.5470E+02
6	1.07E-06	7.54E-04	2.89E-04	3.08E-03	7.31E-04	4.1939E-01	5.5556E+02
7	8.27E-27	1.01E-04	4.76E-09	5.59E-04	8.10E-05	5.6305E-02	5.5593E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9507760	0.9637010	0.9641810	0.9749800	0.9574580	6.1649E+02	2.3221E+01
2	1.11E-02	1.90E-02	1.85E-02	2.87E-02	2.35E-02	1.2160E+01	6.2755E+02
3	3.13E-03	7.88E-03	7.38E-03	1.44E-02	8.97E-03	5.0434E+00	6.3467E+02
4	1.34E-03	4.80E-03	4.30E-03	9.99E-03	5.37E-03	3.0722E+00	6.3664E+02
5	4.25E-04	2.78E-03	2.29E-03	6.84E-03	2.96E-03	1.7805E+00	6.3793E+02
6	4.51E-05	1.34E-03	8.68E-04	4.23E-03	1.35E-03	8.5592E-01	6.3886E+02
7	9.34E-09	4.02E-04	7.45E-05	1.93E-03	3.80E-04	2.5735E-01	6.3945E+02
8	3.92E-29	8.02E-05	1.24E-09	4.31E-04	3.77E-05	5.1286E-02	6.3966E+02

ALPHA FACTOR AND MGL PARAMETERS

Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 263
Total Number of Common-Cause Failure Events: 28

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9803780	0.9649470	0.9552420	0.9546140	0.9547310	0.9564890	0.9574580
2	1.96E-02	3.26E-02	3.82E-02	3.28E-02	2.95E-02	2.54E-02	2.35E-02
3		2.44E-03	5.63E-03	9.37E-03	9.79E-03	9.86E-03	8.97E-03
4			9.56E-04	2.78E-03	4.38E-03	5.12E-03	5.37E-03
5				4.04E-04	1.42E-03	2.36E-03	2.96E-03
6					1.78E-04	7.31E-04	1.35E-03
7						8.10E-05	3.80E-04
8							3.77E-05

Air Operated Valves
Pooled Air Operated Valves
Fail to Operate

2003

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.80E-01	9.65E-01	9.55E-01	9.55E-01	9.55E-01	9.57E-01	9.58E-01
Beta	1.96E-02	3.51E-02	4.48E-02	4.54E-02	4.53E-02	4.35E-02	4.25E-02
Gamma		6.96E-02	1.47E-01	2.77E-01	3.48E-01	4.17E-01	4.48E-01
Delta			1.45E-01	2.54E-01	3.79E-01	4.57E-01	5.30E-01
Epsilon				1.27E-01	2.67E-01	3.82E-01	4.68E-01
Mu					1.12E-01	2.56E-01	3.73E-01
Upsilon						9.98E-02	2.37E-01
Sigma							9.02E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	85.67	128.50	171.34	214.17	257.00	299.84	342.67
N 1	10.9036	11.6196	10.8949	10.9153	10.7076	10.8142	10.5723
N 2	1.9329	4.7358	7.2827	7.7415	8.2730	8.2363	8.6623
N 3		0.3543	1.0736	2.2083	2.7453	3.2036	3.3086
N 4			0.1823	0.6563	1.2278	1.6625	1.9812
N 5				0.0952	0.3975	0.7658	1.0929
N 6					0.0499	0.2373	0.4961
N 7						0.0263	0.1402
N 8							0.0139

1.3.2 BWR Isolation Condenser Air-Operated Valves

1.3.2.1 Fail to Open

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

1.3.2.2 Fail to Close

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

1.3.3 PWR Auxiliary Feedwater Air-Operated Valves

1.3.3.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9311660	0.9733920	0.9788590	0.9969070	0.9749450	5.3922E+01	1.4740E+00
2	3.10E-03	2.66E-02	2.11E-02	6.88E-02	2.51E-02	1.4740E+00	5.3922E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9289060	0.9642000	0.9673370	0.9887560	0.9606000	9.3819E+01	3.4834E+00
2	7.83E-03	2.94E-02	2.63E-02	6.19E-02	3.36E-02	2.8650E+00	9.4437E+01
3	6.86E-05	6.36E-03	3.44E-03	2.26E-02	5.85E-03	6.1843E-01	9.6684E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9347270	0.9639620	0.9661770	0.9856170	0.9607370	1.3329E+02	4.9830E+00
2	6.40E-03	2.25E-02	2.02E-02	4.63E-02	2.35E-02	3.1087E+00	1.3516E+02
3	1.22E-03	1.06E-02	8.39E-03	2.78E-02	1.34E-02	1.4716E+00	1.3680E+02
4	3.18E-06	2.91E-03	1.07E-03	1.21E-02	2.31E-03	4.0274E-01	1.3787E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9440030	0.9662090	0.9676220	0.9835840	0.9608320	2.1086E+02	7.3743E+00
2	6.66E-03	1.89E-02	1.75E-02	3.61E-02	2.03E-02	4.1287E+00	2.1411E+02
3	1.73E-03	9.40E-03	7.94E-03	2.20E-02	1.12E-02	2.0504E+00	2.1618E+02
4	2.57E-04	4.70E-03	3.30E-03	1.39E-02	6.70E-03	1.0246E+00	2.1721E+02
5	6.98E-11	7.82E-04	5.10E-05	4.19E-03	9.73E-04	1.7064E-01	2.1806E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9459840	0.9661350	0.9673130	0.9822530	0.9606560	2.5309E+02	8.8714E+00
2	6.69E-03	1.77E-02	1.65E-02	3.28E-02	2.00E-02	4.6268E+00	2.5734E+02
3	1.41E-03	7.75E-03	6.54E-03	1.82E-02	8.01E-03	2.0301E+00	2.5993E+02
4	6.29E-04	5.58E-03	4.38E-03	1.46E-02	7.55E-03	1.4611E+00	2.6050E+02
5	2.44E-05	2.34E-03	1.26E-03	8.36E-03	3.41E-03	6.1398E-01	2.6135E+02
6	1.12E-12	5.32E-04	1.67E-05	2.97E-03	4.29E-04	1.3946E-01	2.6182E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9508250	0.9673840	0.9682330	0.9810530	0.9601130	3.5423E+02	1.1943E+01
2	7.34E-03	1.66E-02	1.58E-02	2.89E-02	2.10E-02	6.0906E+00	3.6008E+02
3	1.38E-03	6.42E-03	5.55E-03	1.45E-02	5.47E-03	2.3514E+00	3.6382E+02
4	8.19E-04	5.07E-03	4.20E-03	1.23E-02	6.60E-03	1.8551E+00	3.6432E+02
5	2.36E-04	3.20E-03	2.35E-03	9.05E-03	4.83E-03	1.1704E+00	3.6500E+02
6	1.62E-06	1.15E-03	4.39E-04	4.68E-03	1.76E-03	4.1939E-01	3.6575E+02
7	1.26E-26	1.54E-04	7.24E-09	8.50E-04	1.95E-04	5.6305E-02	3.6612E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9522070	0.9674980	0.9682280	0.9802850	0.9591820	4.1035E+02	1.3785E+01
2	7.82E-03	1.65E-02	1.58E-02	2.79E-02	2.30E-02	7.0166E+00	4.1712E+02
3	1.14E-03	5.42E-03	4.66E-03	1.23E-02	3.67E-03	2.2983E+00	4.2184E+02
4	7.32E-04	4.44E-03	3.69E-03	1.07E-02	5.17E-03	1.8835E+00	4.2225E+02
5	3.87E-04	3.44E-03	2.70E-03	9.03E-03	5.04E-03	1.4597E+00	4.2268E+02
6	5.69E-05	1.93E-03	1.23E-03	6.20E-03	2.99E-03	8.1852E-01	4.2332E+02
7	1.41E-08	6.07E-04	1.13E-04	2.91E-03	9.14E-04	2.5735E-01	4.2388E+02
8	5.92E-29	1.21E-04	1.87E-09	6.49E-04	9.06E-05	5.1286E-02	4.2408E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 100
Total Number of Common-Cause Failure Events: 9

Air Operated Valves
PWR Auxiliary Feedwater Air-Operated Valves
Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9749450	0.9606000	0.9607370	0.9608320	0.9606560	0.9601130	0.9591820
2	2.51E-02	3.36E-02	2.35E-02	2.03E-02	2.00E-02	2.10E-02	2.30E-02
3		5.85E-03	1.34E-02	1.12E-02	8.01E-03	5.47E-03	3.67E-03
4			2.31E-03	6.70E-03	7.55E-03	6.60E-03	5.17E-03
5				9.73E-04	3.41E-03	4.83E-03	5.04E-03
6					4.29E-04	1.76E-03	2.99E-03
7						1.95E-04	9.14E-04
8							9.06E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.75E-01	9.61E-01	9.61E-01	9.61E-01	9.61E-01	9.60E-01	9.59E-01
Beta	2.51E-02	3.94E-02	3.93E-02	3.92E-02	3.93E-02	3.99E-02	4.08E-02
Gamma		1.48E-01	4.01E-01	4.81E-01	4.93E-01	4.73E-01	4.38E-01
Delta			1.47E-01	4.07E-01	5.87E-01	7.10E-01	7.94E-01
Epsilon				1.27E-01	3.37E-01	5.07E-01	6.36E-01
Mu					1.12E-01	2.88E-01	4.43E-01
Upsilon						9.98E-02	2.52E-01
Sigma							9.02E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	35.97	53.96	71.94	89.93	107.91	125.90	143.88
N 1	3.8214	3.7175	3.9744	4.0569	3.9674	3.6932	3.2197
N 2	1.0226	2.0146	1.8592	1.9873	2.3231	2.8388	3.5189
N 3		0.3511	1.0610	1.0930	0.9322	0.7379	0.5635
N 4			0.1822	0.6558	0.8793	0.8913	0.7925
N 5				0.0952	0.3975	0.6522	0.7721
N 6					0.0499	0.2373	0.4587
N 7						0.0263	0.1402
N 8							0.0139

1.3.3.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9244740	0.9744260	0.9819540	0.9986470	0.9776110	3.8221E+01	1.0031E+00
2	1.36E-03	2.56E-02	1.81E-02	7.55E-02	2.24E-02	1.0031E+00	3.8221E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9202330	0.9623080	0.9664390	0.9902530	0.9543780	7.0630E+01	2.7664E+00
2	7.94E-03	3.40E-02	2.99E-02	7.43E-02	4.55E-02	2.4959E+00	7.0901E+01
3	1.46E-07	3.69E-03	7.57E-04	1.74E-02	8.86E-05	2.7053E-01	7.3126E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9131440	0.9514320	0.9542390	0.9801150	0.9302580	1.0119E+02	5.1655E+00
2	1.61E-02	4.25E-02	3.97E-02	7.87E-02	6.95E-02	4.5217E+00	1.0183E+02
3	5.99E-06	3.98E-03	1.55E-03	1.62E-02	2.65E-04	4.2313E-01	1.0593E+02
4	7.94E-09	2.08E-03	2.77E-04	1.04E-02	2.12E-06	2.2064E-01	1.0614E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9295130	0.9570130	0.9587160	0.9787000	0.9287800	1.7059E+02	7.6625E+00
2	1.32E-02	3.12E-02	2.95E-02	5.51E-02	5.92E-02	5.5626E+00	1.7269E+02
3	1.28E-03	9.29E-03	7.53E-03	2.33E-02	1.21E-02	1.6552E+00	1.7660E+02
4	1.23E-06	2.07E-03	6.84E-04	8.84E-03	8.64E-06	3.6928E-01	1.7788E+02
5	1.90E-20	4.23E-04	3.43E-07	2.46E-03	0.00E+00	7.5435E-02	1.7818E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9306580	0.9558770	0.9572910	0.9762640	0.9247220	2.0444E+02	9.4368E+00
2	1.32E-02	2.94E-02	2.79E-02	5.05E-02	5.81E-02	6.2776E+00	2.0760E+02
3	1.76E-03	9.58E-03	8.09E-03	2.25E-02	1.39E-02	2.0478E+00	2.1183E+02
4	1.06E-04	3.77E-03	2.38E-03	1.22E-02	3.27E-03	8.0528E-01	2.1307E+02
5	3.04E-09	1.01E-03	1.29E-04	5.11E-03	1.46E-06	2.1658E-01	2.1366E+02
6	8.38E-18	4.19E-04	1.23E-06	2.44E-03	0.00E+00	8.9555E-02	2.1379E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9412870	0.9609010	0.9618910	0.9771390	0.9294460	2.9792E+02	1.2122E+01
2	1.05E-02	2.23E-02	2.12E-02	3.75E-02	4.63E-02	6.9001E+00	3.0314E+02
3	2.66E-03	9.70E-03	8.67E-03	2.03E-02	1.77E-02	3.0068E+00	3.0704E+02
4	4.83E-04	4.55E-03	3.54E-03	1.21E-02	5.67E-03	1.4109E+00	3.0863E+02
5	1.71E-05	1.91E-03	9.98E-04	6.90E-03	9.41E-04	5.9242E-01	3.0945E+02
6	1.49E-10	5.87E-04	4.69E-05	3.10E-03	0.00E+00	1.8209E-01	3.0986E+02
7	0.00E+00	9.68E-05	1.72E-13	3.75E-04	0.00E+00	3.0005E-02	3.1001E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9445440	0.9623560	0.9632060	0.9772480	0.9324650	3.4647E+02	1.3553E+01
2	9.25E-03	1.95E-02	1.87E-02	3.28E-02	3.96E-02	7.0315E+00	3.5299E+02
3	2.76E-03	9.25E-03	8.35E-03	1.88E-02	1.79E-02	3.3283E+00	3.5669E+02
4	7.43E-04	4.91E-03	4.03E-03	1.21E-02	7.59E-03	1.7684E+00	3.5825E+02
5	9.15E-05	2.46E-03	1.62E-03	7.68E-03	2.22E-03	8.8553E-01	3.5914E+02
6	8.46E-07	1.07E-03	3.70E-04	4.50E-03	2.77E-04	3.8452E-01	3.5964E+02
7	1.34E-14	3.25E-04	4.62E-06	1.86E-03	0.00E+00	1.1715E-01	3.5991E+02
8	2.55E-38	1.04E-04	1.43E-11	4.79E-04	0.00E+00	3.7386E-02	3.5999E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 62
Total Number of Common-Cause Failure Events: 13

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9776110	0.9543780	0.9302580	0.9287800	0.9247220	0.9294460	0.9324650
2	2.24E-02	4.55E-02	6.95E-02	5.92E-02	5.81E-02	4.63E-02	3.96E-02
3		8.86E-05	2.65E-04	1.21E-02	1.39E-02	1.77E-02	1.79E-02
4			2.12E-06	8.64E-06	3.27E-03	5.67E-03	7.59E-03
5				0.00E+00	1.46E-06	9.41E-04	2.22E-03
6					0.00E+00	0.00E+00	2.77E-04
7						0.00E+00	0.00E+00
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.78E-01	9.54E-01	9.30E-01	9.29E-01	9.25E-01	9.29E-01	9.33E-01
Beta	2.24E-02	4.56E-02	6.97E-02	7.12E-02	7.53E-02	7.06E-02	6.75E-02
Gamma		1.94E-03	3.84E-03	1.70E-01	2.28E-01	3.44E-01	4.14E-01
Delta			7.94E-03	7.16E-04	1.91E-01	2.72E-01	3.61E-01
Epsilon				0.00E+00	4.47E-04	1.42E-01	2.47E-01
Mu					0.00E+00	0.00E+00	1.11E-01
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	20.16	30.24	40.33	50.41	60.49	70.57	80.65
N 1	3.9299	4.2493	3.4843	3.3121	2.7410	2.7130	2.5699
N 2	0.5517	1.6455	3.2722	3.4212	3.9739	3.6483	3.5338
N 3		0.0032	0.0125	0.6978	0.9499	1.3933	1.5935
N 4			0.0001	0.0005	0.2235	0.4471	0.6774
N 5				0.0000	0.0001	0.0742	0.1979
N 6					0.0000	0.0000	0.0247
N 7						0.0000	0.0000
N 8							0.0000

1.3.4 High Pressure Coolant Injection and Reactor Core Isolation Cooling Air Operated Valves

1.3.4.1 Fail to Open

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

1.3.4.2 Fail to Close

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

1.4 Check Valves

1.4.1 Pooled Check Valves

1.4.1.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

Component :		CHECK VALVE	
	STOP CHECK VALVE	Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :		1985/01/01	
Data Version :		2003/12/31	

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8965120	0.9560630	0.9628520	0.9923650	0.9495610	4.1781E+01	1.9201E+00
2	7.64E-03	4.39E-02	3.72E-02	1.04E-01	5.04E-02	1.9201E+00	4.1781E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9134760	0.9562890	0.9600550	0.9862100	0.9442670	7.6266E+01	3.4860E+00
2	5.59E-03	2.76E-02	2.37E-02	6.28E-02	3.18E-02	2.1998E+00	7.7552E+01
3	1.46E-03	1.61E-02	1.23E-02	4.39E-02	2.40E-02	1.2862E+00	7.8466E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9269150	0.9605150	0.9631570	0.9850730	0.9522800	1.1049E+02	4.5420E+00
2	4.38E-03	2.03E-02	1.76E-02	4.55E-02	1.95E-02	2.3358E+00	1.1270E+02
3	1.51E-03	1.29E-02	1.02E-02	3.35E-02	1.93E-02	1.4856E+00	1.1355E+02
4	1.22E-04	6.27E-03	3.73E-03	2.10E-02	8.97E-03	7.2064E-01	1.1431E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9413950	0.9655670	0.9671980	0.9841810	0.9568210	1.8285E+02	6.5206E+00
2	4.86E-03	1.68E-02	1.51E-02	3.45E-02	1.51E-02	3.1818E+00	1.8619E+02
3	1.67E-03	1.00E-02	8.34E-03	2.40E-02	1.36E-02	1.8941E+00	1.8748E+02
4	3.97E-04	5.91E-03	4.29E-03	1.70E-02	1.09E-02	1.1193E+00	1.8825E+02
5	3.78E-07	1.72E-03	4.77E-04	7.65E-03	3.63E-03	3.2544E-01	1.8905E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9451850	0.9667430	0.9681040	0.9836630	0.9600480	2.2003E+02	7.5693E+00
2	4.40E-03	1.47E-02	1.33E-02	2.97E-02	1.26E-02	3.3356E+00	2.2426E+02
3	1.52E-03	8.65E-03	7.26E-03	2.06E-02	1.06E-02	1.9696E+00	2.2563E+02
4	5.61E-04	5.86E-03	4.49E-03	1.58E-02	9.15E-03	1.3330E+00	2.2627E+02
5	5.98E-05	3.15E-03	1.86E-03	1.06E-02	6.09E-03	7.1658E-01	2.2688E+02
6	2.51E-09	9.43E-04	1.17E-04	4.77E-03	1.52E-03	2.1456E-01	2.2739E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9518860	0.9690830	0.9700400	0.9830310	0.9629010	3.1630E+02	1.0091E+01
2	4.56E-03	1.29E-02	1.19E-02	2.45E-02	9.91E-03	4.1951E+00	3.2220E+02
3	1.87E-03	7.89E-03	6.91E-03	1.73E-02	1.01E-02	2.5740E+00	3.2382E+02
4	6.31E-04	4.88E-03	3.91E-03	1.24E-02	6.59E-03	1.5914E+00	3.2480E+02
5	2.46E-04	3.50E-03	2.56E-03	1.00E-02	6.57E-03	1.1434E+00	3.2525E+02
6	5.64E-06	1.52E-03	6.84E-04	5.84E-03	3.28E-03	4.9459E-01	3.2590E+02
7	1.60E-17	2.83E-04	1.03E-06	1.65E-03	6.57E-04	9.2505E-02	3.2630E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9548250	0.9703950	0.9712210	0.9831530	0.9658620	3.6782E+02	1.1222E+01
2	3.91E-03	1.11E-02	1.02E-02	2.11E-02	6.37E-03	4.1868E+00	3.7486E+02
3	2.11E-03	7.80E-03	6.95E-03	1.64E-02	1.13E-02	2.9554E+00	3.7609E+02
4	5.20E-04	4.13E-03	3.29E-03	1.06E-02	4.37E-03	1.5643E+00	3.7748E+02
5	3.22E-04	3.46E-03	2.64E-03	9.42E-03	5.78E-03	1.3130E+00	3.7773E+02
6	6.69E-05	2.19E-03	1.40E-03	7.00E-03	4.33E-03	8.2862E-01	3.7821E+02
7	9.91E-08	8.04E-04	2.01E-04	3.66E-03	1.73E-03	3.0465E-01	3.7874E+02
8	1.79E-22	1.81E-04	6.49E-08	1.04E-03	2.89E-04	6.8686E-02	3.7897E+02

ALPHA FACTOR AND MGL PARAMETERS

Component :		CHECK VALVE	
	STOP CHECK VALVE	Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :		1985/01/01	
Data Version :		2003/12/31	

Total Number of Independent Failure Events: 83
Total Number of Common-Cause Failure Events: 5

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9495610	0.9442670	0.9522800	0.9568210	0.9600480	0.9629010	0.9658620
2	5.04E-02	3.18E-02	1.95E-02	1.51E-02	1.26E-02	9.91E-03	6.37E-03
3		2.40E-02	1.93E-02	1.36E-02	1.06E-02	1.01E-02	1.13E-02
4			8.97E-03	1.09E-02	9.15E-03	6.59E-03	4.37E-03
5				3.63E-03	6.09E-03	6.57E-03	5.78E-03
6					1.52E-03	3.28E-03	4.33E-03
7						6.57E-04	1.73E-03
8							2.89E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.50E-01	9.44E-01	9.52E-01	9.57E-01	9.60E-01	9.63E-01	9.66E-01
Beta	5.04E-02	5.57E-02	4.77E-02	4.32E-02	4.00E-02	3.71E-02	3.41E-02
Gamma		4.30E-01	5.92E-01	6.51E-01	6.85E-01	7.33E-01	8.14E-01
Delta			3.18E-01	5.17E-01	6.12E-01	6.29E-01	5.94E-01
Epsilon				2.50E-01	4.54E-01	6.14E-01	7.35E-01
Mu					2.00E-01	3.75E-01	5.24E-01
Upsilon						1.67E-01	3.18E-01
Sigma							1.43E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	25.94	38.91	51.88	64.84	77.81	90.78	103.75
N 1	1.7097	1.2151	1.2293	1.1414	1.0069	0.8811	0.8190
N 2	1.4687	1.3494	1.0863	1.0404	1.0319	0.9433	0.6891
N 3		1.0189	1.0750	0.9367	0.8717	0.9605	1.2206
N 4			0.5001	0.7505	0.7512	0.6276	0.4733
N 5				0.2500	0.5001	0.6252	0.6254
N 6					0.1250	0.3125	0.4688
N 7						0.0625	0.1875
N 8							0.0313

1.4.1.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

Component :		CHECK VALVE	
	STOP CHECK VALVE	Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :		1985/01/01	
Data Version :		2003/12/31	

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9120190	0.9480610	0.9504340	0.9760050	0.9452980	1.1885E+02	6.5111E+00
2	2.40E-02	5.19E-02	4.96E-02	8.80E-02	5.47E-02	6.5111E+00	1.1885E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9240220	0.9513540	0.9528570	0.9735410	0.9470610	1.8945E+02	9.6872E+00
2	1.54E-02	3.32E-02	3.17E-02	5.64E-02	3.56E-02	6.6151E+00	1.9252E+02
3	4.33E-03	1.54E-02	1.38E-02	3.20E-02	1.73E-02	3.0721E+00	1.9607E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9284230	0.9515540	0.9526620	0.9709070	0.9468840	2.5820E+02	1.3146E+01
2	1.35E-02	2.77E-02	2.65E-02	4.58E-02	2.95E-02	7.5086E+00	2.6384E+02
3	5.19E-03	1.50E-02	1.38E-02	2.87E-02	1.72E-02	4.0562E+00	2.6729E+02
4	7.47E-04	5.83E-03	4.67E-03	1.49E-02	6.41E-03	1.5809E+00	2.6977E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9357120	0.9544830	0.9552760	0.9705520	0.9470770	3.6466E+02	1.7390E+01
2	1.25E-02	2.38E-02	2.30E-02	3.79E-02	2.66E-02	9.0872E+00	3.7296E+02
3	4.83E-03	1.25E-02	1.17E-02	2.31E-02	1.46E-02	4.7822E+00	3.7727E+02
4	1.84E-03	7.24E-03	6.40E-03	1.55E-02	9.16E-03	2.7644E+00	3.7929E+02
5	4.52E-05	1.98E-03	1.21E-03	6.55E-03	2.60E-03	7.5604E-01	3.8129E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9373480	0.9544410	0.9551060	0.9692730	0.9469130	4.3539E+02	2.0783E+01
2	1.27E-02	2.30E-02	2.23E-02	3.55E-02	2.63E-02	1.0470E+01	4.4570E+02
3	3.61E-03	9.78E-03	9.08E-03	1.84E-02	1.08E-02	4.4628E+00	4.5171E+02
4	2.73E-03	8.29E-03	7.59E-03	1.63E-02	1.03E-02	3.7829E+00	4.5239E+02
5	4.67E-04	3.54E-03	2.84E-03	8.98E-03	4.49E-03	1.6127E+00	4.5456E+02
6	2.30E-06	9.96E-04	4.14E-04	3.96E-03	1.17E-03	4.5416E-01	4.5572E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9441990	0.9585120	0.9590260	0.9710570	0.9500760	5.6615E+02	2.4505E+01
2	1.10E-02	1.93E-02	1.88E-02	2.95E-02	2.27E-02	1.1407E+01	5.7925E+02
3	3.43E-03	8.59E-03	8.04E-03	1.56E-02	9.62E-03	5.0729E+00	5.8558E+02
4	2.12E-03	6.43E-03	5.88E-03	1.26E-02	7.89E-03	3.7981E+00	5.8686E+02
5	1.31E-03	4.92E-03	4.37E-03	1.04E-02	6.64E-03	2.9046E+00	5.8775E+02
6	1.18E-04	1.85E-03	1.33E-03	5.37E-03	2.54E-03	1.0939E+00	5.8956E+02
7	2.31E-09	3.87E-04	5.59E-05	1.92E-03	5.53E-04	2.2871E-01	5.9043E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9472050	0.9602550	0.9607040	0.9717610	0.9523240	6.5183E+02	2.6979E+01
2	1.02E-02	1.76E-02	1.71E-02	2.66E-02	2.07E-02	1.1926E+01	6.6688E+02
3	3.20E-03	7.82E-03	7.34E-03	1.41E-02	8.76E-03	5.3094E+00	6.7350E+02
4	1.71E-03	5.36E-03	4.88E-03	1.06E-02	6.24E-03	3.6379E+00	6.7517E+02
5	1.34E-03	4.68E-03	4.20E-03	9.65E-03	6.10E-03	3.1767E+00	6.7563E+02
6	5.74E-04	3.07E-03	2.60E-03	7.17E-03	4.22E-03	2.0820E+00	6.7673E+02
7	1.79E-05	1.03E-03	6.00E-04	3.51E-03	1.43E-03	6.9945E-01	6.7811E+02
8	1.44E-12	2.18E-04	8.53E-06	1.20E-03	2.70E-04	1.4769E-01	6.7866E+02

ALPHA FACTOR AND MGL PARAMETERS

Component :		CHECK VALVE	
	STOP CHECK VALVE	Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :		1985/01/01	
Data Version :		2003/12/31	

Total Number of Independent Failure Events: 251
Total Number of Common-Cause Failure Events: 30

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9452980	0.9470610	0.9468840	0.9470770	0.9469130	0.9500760	0.9523240
2	5.47E-02	3.56E-02	2.95E-02	2.66E-02	2.63E-02	2.27E-02	2.07E-02
3		1.73E-02	1.72E-02	1.46E-02	1.08E-02	9.62E-03	8.76E-03
4			6.41E-03	9.16E-03	1.03E-02	7.89E-03	6.24E-03
5				2.60E-03	4.49E-03	6.64E-03	6.10E-03
6					1.17E-03	2.54E-03	4.22E-03
7						5.53E-04	1.43E-03
8							2.70E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.45E-01	9.47E-01	9.47E-01	9.47E-01	9.47E-01	9.50E-01	9.52E-01
Beta	5.47E-02	5.29E-02	5.31E-02	5.29E-02	5.31E-02	4.99E-02	4.77E-02
Gamma		3.27E-01	4.44E-01	4.98E-01	5.05E-01	5.46E-01	5.67E-01
Delta			2.72E-01	4.46E-01	5.96E-01	6.47E-01	6.76E-01
Epsilon				2.21E-01	3.55E-01	5.52E-01	6.58E-01
Mu					2.07E-01	3.18E-01	4.92E-01
Upsilon						1.79E-01	2.87E-01
Sigma							1.59E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	92.45	138.67	184.90	231.12	277.35	323.57	369.80
N 1	12.2667	14.6354	15.9198	16.6726	16.8320	17.9425	18.7823
N 2	6.0597	5.7647	6.2591	6.9458	8.1661	8.1548	8.4281
N 3		2.8048	3.6456	3.8248	3.3649	3.4594	3.5746
N 4			1.3604	2.3956	3.2011	2.8343	2.5469
N 5				0.6806	1.3962	2.3864	2.4891
N 6					0.3646	0.9118	1.7222
N 7						0.1987	0.5823
N 8							0.1103

1.4.2 BWR Residual Heat Removal Check Valves

1.4.2.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8839060	0.9620370	0.9742190	0.9985010	0.9505770	2.2603E+01	8.9194E-01
2	1.50E-03	3.80E-02	2.58E-02	1.16E-01	4.94E-02	8.9194E-01	2.2603E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8944520	0.9519200	0.9578440	0.9891190	0.8990060	4.7587E+01	2.4035E+00
2	8.30E-03	4.24E-02	3.64E-02	9.69E-02	9.96E-02	2.1183E+00	4.7872E+01
3	3.84E-07	5.71E-03	1.29E-03	2.65E-02	1.41E-03	2.8523E-01	4.9705E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9109360	0.9553640	0.9593250	0.9862430	0.9089730	7.2358E+01	3.3807E+00
2	5.77E-03	2.88E-02	2.47E-02	6.56E-02	5.64E-02	2.1781E+00	7.3561E+01
3	6.44E-04	1.30E-02	9.00E-03	3.88E-02	3.47E-02	9.8203E-01	7.4757E+01
4	1.11E-08	2.91E-03	3.89E-04	1.46E-02	0.00E+00	2.2054E-01	7.5518E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9331610	0.9626020	0.9647760	0.9846070	0.9149750	1.3532E+02	5.2573E+00
2	5.62E-03	2.08E-02	1.86E-02	4.37E-02	3.90E-02	2.9271E+00	1.3765E+02
3	1.58E-03	1.16E-02	9.42E-03	2.93E-02	3.37E-02	1.6360E+00	1.3894E+02
4	4.75E-05	4.40E-03	2.38E-03	1.56E-02	1.24E-02	6.1878E-01	1.3996E+02
5	2.41E-20	5.37E-04	4.35E-07	3.12E-03	0.00E+00	7.5435E-02	1.4050E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9371480	0.9634880	0.9653040	0.9836370	0.9205370	1.6314E+02	6.1822E+00
2	4.77E-03	1.75E-02	1.56E-02	3.66E-02	2.77E-02	2.9644E+00	1.6636E+02
3	1.72E-03	1.08E-02	8.95E-03	2.62E-02	3.07E-02	1.8300E+00	1.6749E+02
4	2.60E-04	5.65E-03	3.86E-03	1.72E-02	1.57E-02	9.5678E-01	1.6837E+02
5	6.57E-07	2.02E-03	6.00E-04	8.84E-03	5.25E-03	3.4148E-01	1.6898E+02
6	1.06E-17	5.29E-04	1.55E-06	3.09E-03	0.00E+00	8.9555E-02	1.6923E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9468240	0.9669070	0.9681070	0.9829020	0.9271400	2.5009E+02	8.5594E+00
2	4.63E-03	1.43E-02	1.30E-02	2.81E-02	1.59E-02	3.6893E+00	2.5496E+02
3	2.21E-03	9.62E-03	8.39E-03	2.13E-02	3.19E-02	2.4885E+00	2.5616E+02
4	5.00E-04	5.18E-03	3.97E-03	1.40E-02	1.37E-02	1.3388E+00	2.5731E+02
5	7.16E-05	2.97E-03	1.83E-03	9.76E-03	9.11E-03	7.6822E-01	2.5788E+02
6	1.25E-08	9.46E-04	1.58E-04	4.61E-03	2.28E-03	2.4459E-01	2.5841E+02
7	0.00E+00	1.16E-04	2.07E-13	4.50E-04	0.00E+00	3.0005E-02	2.5862E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9503430	0.9684440	0.9694770	0.9830250	0.9356650	2.9234E+02	9.5257E+00
2	3.66E-03	1.17E-02	1.06E-02	2.33E-02	1.01E-03	3.5290E+00	2.9834E+02
3	2.54E-03	9.58E-03	8.52E-03	2.02E-02	3.72E-02	2.8911E+00	2.9898E+02
4	4.89E-04	4.65E-03	3.61E-03	1.24E-02	1.01E-02	1.4035E+00	3.0046E+02
5	1.71E-04	3.31E-03	2.30E-03	9.91E-03	1.01E-02	1.0001E+00	3.0087E+02
6	7.95E-06	1.71E-03	8.01E-04	6.49E-03	5.03E-03	5.1612E-01	3.0135E+02
7	3.60E-12	4.92E-04	1.97E-05	2.71E-03	1.01E-03	1.4845E-01	3.0172E+02
8	3.04E-38	1.24E-04	1.70E-11	5.71E-04	0.00E+00	3.7386E-02	3.0183E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 20
 Total Number of Common-Cause Failure Events: 2

Check Valves
 BWR Residual Heat Removal Check Valves
 Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9505770	0.8990060	0.9089730	0.9149750	0.9205370	0.9271400	0.9356650
2	4.94E-02	9.96E-02	5.64E-02	3.90E-02	2.77E-02	1.59E-02	1.01E-03
3		1.41E-03	3.47E-02	3.37E-02	3.07E-02	3.19E-02	3.72E-02
4			0.00E+00	1.24E-02	1.57E-02	1.37E-02	1.01E-02
5				0.00E+00	5.25E-03	9.11E-03	1.01E-02
6					0.00E+00	2.28E-03	5.03E-03
7						0.00E+00	1.01E-03
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.51E-01	8.99E-01	9.09E-01	9.15E-01	9.21E-01	9.27E-01	9.36E-01
Beta	4.94E-02	1.01E-01	9.10E-02	8.50E-02	7.95E-02	7.29E-02	6.43E-02
Gamma		1.39E-02	3.81E-01	5.42E-01	6.51E-01	7.81E-01	9.84E-01
Delta			0.00E+00	2.69E-01	4.06E-01	4.40E-01	4.13E-01
Epsilon				0.00E+00	2.50E-01	4.55E-01	6.15E-01
Mu					0.00E+00	2.00E-01	3.75E-01
Upsilon						0.00E+00	1.67E-01
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	7.27	10.91	14.55	18.18	21.82	25.45	29.09
N 1	1.2024	0.5357	0.4286	0.2679	0.1071	0.0000	0.0000
N 2	0.4405	1.2679	0.9286	0.7857	0.6607	0.4375	0.0313
N 3		0.0179	0.5714	0.6786	0.7321	0.8750	1.1563
N 4			0.0000	0.2500	0.3750	0.3750	0.3125
N 5				0.0000	0.1250	0.2500	0.3125
N 6					0.0000	0.0625	0.1563
N 7						0.0000	0.0313
N 8							0.0000

1.4.2.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9414400	0.9832530	0.9906760	0.9997980	0.9921350	3.7279E+01	6.3494E-01
2	2.04E-04	1.68E-02	9.32E-03	5.86E-02	7.87E-03	6.3494E-01	3.7279E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9436730	0.9776220	0.9818790	0.9970100	0.9857930	7.0398E+01	1.6114E+00
2	1.73E-03	1.83E-02	1.40E-02	4.93E-02	1.34E-02	1.3157E+00	7.0694E+01
3	3.89E-07	4.11E-03	9.86E-04	1.89E-02	8.17E-04	2.9573E-01	7.1714E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9441170	0.9737120	0.9766570	0.9932410	0.9807250	1.0253E+02	2.7681E+00
2	3.56E-03	1.93E-02	1.64E-02	4.52E-02	1.71E-02	2.0368E+00	1.0326E+02
3	2.03E-05	4.81E-03	2.23E-03	1.84E-02	2.08E-03	5.0623E-01	1.0479E+02
4	1.05E-08	2.14E-03	2.99E-04	1.07E-02	9.78E-05	2.2504E-01	1.0507E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9505310	0.9730270	0.9747860	0.9895190	0.9781810	1.7286E+02	4.7918E+00
2	5.02E-03	1.76E-02	1.58E-02	3.63E-02	1.72E-02	3.1281E+00	1.7452E+02
3	5.27E-04	6.75E-03	5.01E-03	1.89E-02	4.23E-03	1.1996E+00	1.7645E+02
4	1.85E-06	2.18E-03	7.67E-04	9.16E-03	3.36E-04	3.8798E-01	1.7726E+02
5	2.75E-20	4.29E-04	3.75E-07	2.49E-03	1.22E-05	7.6135E-02	1.7758E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9519410	0.9724660	0.9739290	0.9880050	0.9766100	2.0797E+02	5.8884E+00
2	4.91E-03	1.60E-02	1.45E-02	3.22E-02	1.64E-02	3.4239E+00	2.1044E+02
3	8.53E-04	7.10E-03	5.63E-03	1.84E-02	6.14E-03	1.5175E+00	2.1234E+02
4	3.62E-05	2.98E-03	1.64E-03	1.05E-02	8.12E-04	6.3728E-01	2.1322E+02
5	3.80E-09	1.03E-03	1.36E-04	5.17E-03	5.27E-05	2.2008E-01	2.1364E+02
6	8.70E-18	4.19E-04	1.24E-06	2.45E-03	1.46E-06	8.9655E-02	2.1377E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9567840	0.9733290	0.9743360	0.9864260	0.9782780	3.0237E+02	8.2854E+00
2	4.82E-03	1.35E-02	1.25E-02	2.58E-02	1.20E-02	4.2072E+00	3.0645E+02
3	1.45E-03	7.15E-03	6.12E-03	1.64E-02	7.64E-03	2.2206E+00	3.0844E+02
4	2.34E-04	3.57E-03	2.57E-03	1.03E-02	1.81E-03	1.1074E+00	3.0955E+02
5	9.78E-06	1.73E-03	8.37E-04	6.47E-03	2.35E-04	5.3692E-01	3.1012E+02
6	1.66E-10	5.90E-04	4.80E-05	3.11E-03	1.51E-05	1.8329E-01	3.1047E+02
7	0.00E+00	9.66E-05	1.72E-13	3.75E-04	0.00E+00	3.0005E-02	3.1063E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9590170	0.9740750	0.9749420	0.9861660	0.9796570	3.5196E+02	9.3675E+00
2	4.33E-03	1.20E-02	1.11E-02	2.26E-02	9.10E-03	4.3214E+00	3.5701E+02
3	1.52E-03	6.76E-03	5.88E-03	1.50E-02	7.83E-03	2.4433E+00	3.5888E+02
4	3.58E-04	3.71E-03	2.84E-03	1.00E-02	2.74E-03	1.3391E+00	3.5999E+02
5	4.41E-05	2.06E-03	1.24E-03	6.84E-03	6.05E-04	7.4243E-01	3.6059E+02
6	5.66E-07	1.01E-03	3.31E-04	4.34E-03	7.18E-05	3.6632E-01	3.6096E+02
7	1.46E-14	3.25E-04	4.70E-06	1.86E-03	4.42E-06	1.1755E-01	3.6121E+02
8	2.54E-38	1.04E-04	1.42E-11	4.77E-04	0.00E+00	3.7386E-02	3.6129E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 70
 Total Number of Common-Cause Failure Events: 4

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9921350	0.9857930	0.9807250	0.9781810	0.9766100	0.9782780	0.9796570
2	7.87E-03	1.34E-02	1.71E-02	1.72E-02	1.64E-02	1.20E-02	9.10E-03
3		8.17E-04	2.08E-03	4.23E-03	6.14E-03	7.64E-03	7.83E-03
4			9.78E-05	3.36E-04	8.12E-04	1.81E-03	2.74E-03
5				1.22E-05	5.27E-05	2.35E-04	6.05E-04
6					1.46E-06	1.51E-05	7.18E-05
7						0.00E+00	4.42E-06
8							0.00E+00

Check Valves
 BWR Residual Heat Removal Check Valves
 Fail to Close

2003

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.92E-01	9.86E-01	9.81E-01	9.78E-01	9.77E-01	9.78E-01	9.80E-01
Beta	7.87E-03	1.42E-02	1.93E-02	2.18E-02	2.34E-02	2.17E-02	2.03E-02
Gamma		5.75E-02	1.13E-01	2.10E-01	2.99E-01	4.47E-01	5.53E-01
Delta			4.50E-02	7.59E-02	1.24E-01	2.12E-01	3.04E-01
Epsilon				3.52E-02	6.25E-02	1.22E-01	1.99E-01
Mu					2.70E-02	6.03E-02	1.12E-01
Upsilon						0.00E+00	5.80E-02
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	21.54	32.31	43.08	53.85	64.62	75.38	86.15
N 1	1.6079	1.9465	2.0705	2.1365	2.1435	2.3525	2.5563
N 2	0.1835	0.4653	0.7873	0.9867	1.1202	0.9554	0.8237
N 3		0.0284	0.0956	0.2422	0.4196	0.6071	0.7085
N 4			0.0045	0.0192	0.0555	0.1436	0.2481
N 5				0.0007	0.0036	0.0187	0.0548
N 6					0.0001	0.0012	0.0065
N 7						0.0000	0.0004
N 8							0.0000

1.4.3 PWR Auxiliary Feedwater Check Valves

1.4.3.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9093160	0.9768270	0.9898930	0.9999350	0.9981240	1.9451E+01	4.6144E-01
2	6.08E-05	2.32E-02	1.01E-02	9.07E-02	1.88E-03	4.6144E-01	1.9451E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9285870	0.9746750	0.9812780	0.9981790	0.9964920	4.4094E+01	1.1457E+00
2	7.16E-04	1.94E-02	1.29E-02	6.03E-02	3.38E-03	8.7735E-01	4.4362E+01
3	2.17E-07	5.93E-03	1.21E-03	2.81E-02	1.25E-04	2.6833E-01	4.4971E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9345090	0.9723440	0.9767220	0.9952090	0.9950820	6.7961E+01	1.9330E+00
2	1.71E-03	1.86E-02	1.42E-02	5.03E-02	4.57E-03	1.2981E+00	6.8596E+01
3	7.82E-06	5.93E-03	2.26E-03	2.43E-02	3.39E-04	4.1423E-01	6.9480E+01
4	1.21E-08	3.16E-03	4.23E-04	1.59E-02	9.40E-06	2.2064E-01	6.9673E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9465600	0.9728880	0.9752160	0.9912630	0.9938580	1.3006E+02	3.6245E+00
2	3.36E-03	1.66E-02	1.42E-02	3.78E-02	5.49E-03	2.2143E+00	1.3147E+02
3	3.41E-04	7.22E-03	4.96E-03	2.18E-02	6.10E-04	9.6547E-01	1.3272E+02
4	1.64E-06	2.76E-03	9.14E-04	1.18E-02	3.77E-05	3.6928E-01	1.3332E+02
5	2.54E-20	5.64E-04	4.58E-07	3.28E-03	0.00E+00	7.5435E-02	1.3361E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9488880	0.9727140	0.9746480	0.9899370	0.9928110	1.5699E+02	4.4037E+00
2	3.30E-03	1.49E-02	1.29E-02	3.32E-02	6.19E-03	2.4021E+00	1.5899E+02
3	4.58E-04	6.89E-03	4.99E-03	1.98E-02	9.18E-04	1.1125E+00	1.6028E+02
4	3.01E-05	3.61E-03	1.87E-03	1.31E-02	7.55E-05	5.8298E-01	1.6081E+02
5	4.04E-09	1.34E-03	1.71E-04	6.77E-03	6.29E-06	2.1658E-01	1.6118E+02
6	1.11E-17	5.55E-04	1.63E-06	3.24E-03	0.00E+00	8.9555E-02	1.6130E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9544590	0.9731330	0.9743890	0.9875240	0.9919120	2.4301E+02	6.7093E+00
2	4.10E-03	1.35E-02	1.22E-02	2.73E-02	6.70E-03	3.3758E+00	2.4634E+02
3	8.87E-04	6.55E-03	5.29E-03	1.65E-02	1.24E-03	1.6365E+00	2.4808E+02
4	1.83E-04	3.87E-03	2.65E-03	1.17E-02	1.40E-04	9.6643E-01	2.4875E+02
5	9.87E-06	2.08E-03	9.77E-04	7.87E-03	1.08E-05	5.1842E-01	2.4920E+02
6	1.85E-10	7.29E-04	5.82E-05	3.85E-03	0.00E+00	1.8209E-01	2.4954E+02
7	0.00E+00	1.20E-04	2.14E-13	4.66E-04	0.00E+00	3.0005E-02	2.4969E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9565470	0.9735800	0.9746570	0.9869470	0.9911590	2.8420E+02	7.7124E+00
2	4.02E-03	1.25E-02	1.14E-02	2.47E-02	7.04E-03	3.6465E+00	2.8827E+02
3	9.17E-04	6.06E-03	4.97E-03	1.49E-02	1.57E-03	1.7679E+00	2.9015E+02
4	2.40E-04	3.75E-03	2.70E-03	1.09E-02	2.18E-04	1.0956E+00	2.9082E+02
5	3.85E-05	2.36E-03	1.36E-03	8.06E-03	1.89E-05	6.8803E-01	2.9122E+02
6	6.02E-07	1.23E-03	3.93E-04	5.31E-03	0.00E+00	3.5982E-01	2.9155E+02
7	1.66E-14	4.01E-04	5.70E-06	2.30E-03	0.00E+00	1.1715E-01	2.9180E+02
8	3.15E-38	1.28E-04	1.76E-11	5.91E-04	0.00E+00	3.7386E-02	2.9188E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 18
Total Number of Common-Cause Failure Events: 1

Check Valves
PWR Auxiliary Feedwater Check Valves
Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9981240	0.9964920	0.9950820	0.9938580	0.9928110	0.9919120	0.9911590
2	1.88E-03	3.38E-03	4.57E-03	5.49E-03	6.19E-03	6.70E-03	7.04E-03
3		1.25E-04	3.39E-04	6.10E-04	9.18E-04	1.24E-03	1.57E-03
4			9.40E-06	3.77E-05	7.55E-05	1.40E-04	2.18E-04
5				0.00E+00	6.29E-06	1.08E-05	1.89E-05
6					0.00E+00	0.00E+00	0.00E+00
7						0.00E+00	0.00E+00
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.98E-01	9.97E-01	9.95E-01	9.94E-01	9.93E-01	9.92E-01	9.91E-01
Beta	1.88E-03	3.51E-03	4.92E-03	6.14E-03	7.19E-03	8.09E-03	8.84E-03
Gamma		3.57E-02	7.08E-02	1.06E-01	1.39E-01	1.72E-01	2.04E-01
Delta			2.70E-02	5.81E-02	8.18E-02	1.09E-01	1.31E-01
Epsilon				0.00E+00	7.69E-02	7.14E-02	8.00E-02
Mu					0.00E+00	0.00E+00	0.00E+00
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	5.14	7.71	10.29	12.86	15.43	18.00	20.57
N 1	0.1800	0.2430	0.2916	0.3281	0.3543	0.3720	0.3826
N 2	0.0100	0.0270	0.0486	0.0729	0.0984	0.1240	0.1488
N 3		0.0010	0.0036	0.0081	0.0146	0.0230	0.0331
N 4			0.0001	0.0005	0.0012	0.0026	0.0046
N 5				0.0000	0.0001	0.0002	0.0004
N 6					0.0000	0.0000	0.0000
N 7						0.0000	0.0000
N 8							0.0000

1.4.3.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8878050	0.9525140	0.9599100	0.9918900	0.9429630	3.7933E+01	1.8911E+00
2	8.11E-03	4.75E-02	4.01E-02	1.12E-01	5.70E-02	1.8911E+00	3.7933E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9128180	0.9570540	0.9611140	0.9874060	0.9439540	7.0903E+01	3.1816E+00
2	6.55E-03	3.09E-02	2.67E-02	6.93E-02	3.90E-02	2.2867E+00	7.1798E+01
3	4.68E-04	1.21E-02	8.06E-03	3.74E-02	1.70E-02	8.9493E-01	7.3190E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9200030	0.9563820	0.9591880	0.9831620	0.9417590	1.0274E+02	4.6856E+00
2	7.64E-03	2.78E-02	2.49E-02	5.77E-02	3.60E-02	2.9817E+00	1.0444E+02
3	8.12E-04	1.09E-02	8.05E-03	3.07E-02	1.58E-02	1.1709E+00	1.0626E+02
4	2.72E-05	4.96E-03	2.40E-03	1.86E-02	6.49E-03	5.3304E-01	1.0689E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9333700	0.9599310	0.9616260	0.9806920	0.9383090	1.7250E+02	7.2004E+00
2	9.00E-03	2.45E-02	2.27E-02	4.59E-02	3.81E-02	4.3977E+00	1.7530E+02
3	1.30E-03	9.30E-03	7.55E-03	2.33E-02	1.20E-02	1.6709E+00	1.7803E+02
4	1.96E-04	5.01E-03	3.33E-03	1.55E-02	8.96E-03	9.0008E-01	1.7880E+02
5	9.05E-09	1.29E-03	1.92E-04	6.38E-03	2.64E-03	2.3174E-01	1.7947E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9342440	0.9586460	0.9600600	0.9782340	0.9340480	2.0680E+02	8.9209E+00
2	1.01E-02	2.45E-02	2.31E-02	4.39E-02	4.25E-02	5.2894E+00	2.1043E+02
3	1.15E-03	7.94E-03	6.48E-03	1.97E-02	8.75E-03	1.7124E+00	2.1401E+02
4	4.24E-04	5.52E-03	4.09E-03	1.55E-02	8.68E-03	1.1912E+00	2.1453E+02
5	1.80E-05	2.60E-03	1.30E-03	9.57E-03	4.90E-03	5.6028E-01	2.1516E+02
6	5.15E-11	7.77E-04	4.79E-05	4.18E-03	1.11E-03	1.6766E-01	2.1555E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9428280	0.9620980	0.9630780	0.9780100	0.9349090	3.0041E+02	1.1835E+01
2	9.42E-03	2.07E-02	1.97E-02	3.54E-02	3.96E-02	6.4625E+00	3.0578E+02
3	1.65E-03	7.58E-03	6.55E-03	1.70E-02	9.28E-03	2.3655E+00	3.0988E+02
4	6.16E-04	4.96E-03	3.96E-03	1.28E-02	7.23E-03	1.5499E+00	3.1070E+02
5	1.62E-04	3.19E-03	2.21E-03	9.55E-03	5.88E-03	9.9482E-01	3.1125E+02
6	1.16E-06	1.26E-03	4.48E-04	5.26E-03	2.60E-03	3.9299E-01	3.1185E+02
7	2.84E-22	2.21E-04	8.38E-08	1.27E-03	4.82E-04	6.9105E-02	3.1218E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9451490	0.9627980	0.9636430	0.9775530	0.9350310	3.4906E+02	1.3488E+01
2	9.20E-03	1.94E-02	1.86E-02	3.27E-02	3.86E-02	7.0430E+00	3.5551E+02
3	1.69E-03	7.12E-03	6.23E-03	1.56E-02	9.22E-03	2.5807E+00	3.5997E+02
4	6.15E-04	4.53E-03	3.66E-03	1.14E-02	6.01E-03	1.6424E+00	3.6091E+02
5	2.70E-04	3.36E-03	2.51E-03	9.38E-03	5.79E-03	1.2189E+00	3.6133E+02
6	3.44E-05	1.94E-03	1.14E-03	6.59E-03	3.75E-03	7.0362E-01	3.6184E+02
7	7.86E-09	6.68E-04	1.09E-04	3.26E-03	1.36E-03	2.4215E-01	3.6231E+02
8	2.19E-26	1.57E-04	8.29E-09	8.69E-04	2.13E-04	5.6886E-02	3.6249E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 61
Total Number of Common-Cause Failure Events: 13

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9429630	0.9439540	0.9417590	0.9383090	0.9340480	0.9349090	0.9350310
2	5.70E-02	3.90E-02	3.60E-02	3.81E-02	4.25E-02	3.96E-02	3.86E-02
3		1.70E-02	1.58E-02	1.20E-02	8.75E-03	9.28E-03	9.22E-03
4			6.49E-03	8.96E-03	8.68E-03	7.23E-03	6.01E-03
5				2.64E-03	4.90E-03	5.88E-03	5.79E-03
6					1.11E-03	2.60E-03	3.75E-03
7						4.82E-04	1.36E-03
8							2.13E-04

Check Valves
PWR Auxiliary Feedwater Check Valves
Fail to Close

2003

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.43E-01	9.44E-01	9.42E-01	9.38E-01	9.34E-01	9.35E-01	9.35E-01
Beta	5.70E-02	5.61E-02	5.82E-02	6.17E-02	6.60E-02	6.51E-02	6.50E-02
Gamma		3.04E-01	3.83E-01	3.83E-01	3.55E-01	3.91E-01	4.05E-01
Delta			2.91E-01	4.91E-01	6.27E-01	6.36E-01	6.50E-01
Epsilon				2.27E-01	4.09E-01	5.54E-01	6.49E-01
Mu					1.85E-01	3.44E-01	4.79E-01
Upsilon						1.56E-01	2.96E-01
Sigma							1.35E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	20.07	30.10	40.13	50.16	60.20	70.23	80.26
N 1	3.7318	4.6615	5.2272	5.4686	5.3933	5.5410	5.5476
N 2	1.4397	1.4363	1.7322	2.2563	2.9857	3.2107	3.5453
N 3		0.6276	0.7603	0.7135	0.6145	0.7520	0.8459
N 4			0.3125	0.5313	0.6094	0.5861	0.5514
N 5				0.1563	0.3438	0.4766	0.5313
N 6					0.0781	0.2109	0.3438
N 7						0.0391	0.1250
N 8							0.0195

1.4.4 PWR High Pressure Safety Injection Check Valves

1.4.4.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8840630	0.9549990	0.9640740	0.9948200	0.9434070	3.0801E+01	1.4514E+00
2	5.18E-03	4.50E-02	3.59E-02	1.16E-01	5.66E-02	1.4514E+00	3.0801E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9231450	0.9665240	0.9713180	0.9934770	0.9615380	6.1141E+01	2.1177E+00
2	4.50E-04	1.34E-02	8.77E-03	4.24E-02	0.00E+00	8.5035E-01	6.2408E+01
3	1.77E-03	2.00E-02	1.52E-02	5.47E-02	3.85E-02	1.2673E+00	6.1991E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9354310	0.9692200	0.9725060	0.9917750	0.9708710	9.0709E+01	2.8807E+00
2	1.14E-03	1.34E-02	1.01E-02	3.68E-02	0.00E+00	1.2495E+00	9.2340E+01
3	3.94E-04	9.73E-03	6.53E-03	3.00E-02	1.46E-02	9.1063E-01	9.2679E+01
4	1.50E-04	7.70E-03	4.59E-03	2.58E-02	1.46E-02	7.2054E-01	9.2869E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9482370	0.9721430	0.9740540	0.9895200	0.9765640	1.5854E+02	4.5430E+00
2	2.56E-03	1.31E-02	1.12E-02	3.03E-02	0.00E+00	2.1414E+00	1.6094E+02
3	5.86E-04	7.40E-03	5.51E-03	2.07E-02	5.86E-03	1.2074E+00	1.6188E+02
4	1.88E-04	5.33E-03	3.49E-03	1.67E-02	1.17E-02	8.6878E-01	1.6221E+02
5	4.39E-07	2.00E-03	5.54E-04	8.89E-03	5.86E-03	3.2544E-01	1.6276E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9517990	0.9730820	0.9746740	0.9889260	0.9803920	1.9121E+02	5.2894E+00
2	2.48E-03	1.17E-02	1.01E-02	2.65E-02	0.00E+00	2.3037E+00	1.9420E+02
3	5.05E-04	6.22E-03	4.65E-03	1.73E-02	2.45E-03	1.2229E+00	1.9528E+02
4	2.24E-04	4.87E-03	3.33E-03	1.48E-02	7.35E-03	9.5678E-01	1.9554E+02
5	2.67E-05	3.01E-03	1.57E-03	1.09E-02	7.35E-03	5.9148E-01	1.9591E+02
6	2.91E-09	1.09E-03	1.36E-04	5.52E-03	2.45E-03	2.1456E-01	1.9629E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 25
Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9434070	0.9615380	0.9708710	0.9765640	0.9803920
2	5.66E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		3.85E-02	1.46E-02	5.86E-03	2.45E-03
4			1.46E-02	1.17E-02	7.35E-03
5				5.86E-03	7.35E-03
6					2.45E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.43E-01	9.62E-01	9.71E-01	9.77E-01	9.80E-01
Beta	5.66E-02	3.85E-02	2.91E-02	2.34E-02	1.96E-02
Gamma		1.00E+00	1.00E+00	1.00E+00	1.00E+00
Delta			5.00E-01	7.50E-01	8.75E-01
Epsilon				3.33E-01	5.71E-01
Mu					2.50E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	16.67	25.00	33.33	41.67	50.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	1.0000	0.0000	0.0000	0.0000	0.0000
N 3		1.0000	0.5000	0.2500	0.1250
N 4			0.5000	0.5000	0.3750
N 5				0.2500	0.3750
N 6					0.1250

1.4.4.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9440200	0.9785240	0.9830420	0.9975780	0.9811320	6.6131E+01	1.4514E+00
2	2.42E-03	2.15E-02	1.70E-02	5.60E-02	1.89E-02	1.4514E+00	6.6131E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9578960	0.9817840	0.9844720	0.9964900	0.9873420	1.1414E+02	2.1177E+00
2	1.15E-03	1.16E-02	8.96E-03	3.12E-02	6.33E-03	1.3504E+00	1.1491E+02
3	1.59E-04	6.60E-03	4.07E-03	2.17E-02	6.33E-03	7.6733E-01	1.1549E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9630200	0.9824630	0.9843850	0.9953490	0.9904760	1.6138E+02	2.8807E+00
2	1.08E-03	9.13E-03	7.23E-03	2.37E-02	2.38E-03	1.4995E+00	1.6276E+02
3	2.24E-04	5.54E-03	3.71E-03	1.71E-02	4.76E-03	9.1063E-01	1.6335E+02
4	8.12E-06	2.87E-03	1.24E-03	1.12E-02	2.38E-03	4.7054E-01	1.6379E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9663120	0.9819300	0.9831910	0.9932290	0.9923660	2.4687E+02	4.5430E+00
2	1.87E-03	9.02E-03	7.75E-03	2.05E-02	9.54E-04	2.2664E+00	2.4915E+02
3	5.07E-04	5.30E-03	4.06E-03	1.43E-02	2.86E-03	1.3324E+00	2.5008E+02
4	6.39E-05	2.96E-03	1.79E-03	9.84E-03	2.86E-03	7.4378E-01	2.5067E+02
5	8.41E-10	7.97E-04	8.34E-05	4.11E-03	9.54E-04	2.0044E-01	2.5121E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9685970	0.9825140	0.9835650	0.9928320	0.9936310	2.9721E+02	5.2894E+00
2	1.70E-03	7.82E-03	6.77E-03	1.76E-02	3.98E-04	2.3662E+00	3.0013E+02
3	4.35E-04	4.46E-03	3.42E-03	1.20E-02	1.59E-03	1.3479E+00	3.0115E+02
4	1.45E-04	3.16E-03	2.16E-03	9.61E-03	2.39E-03	9.5678E-01	3.0154E+02
5	4.16E-06	1.54E-03	6.59E-04	6.07E-03	1.59E-03	4.6648E-01	3.0203E+02
6	5.81E-12	5.03E-04	2.20E-05	2.76E-03	3.98E-04	1.5206E-01	3.0235E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 52

Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9811320	0.9873420	0.9904760	0.9923660	0.9936310
2	1.89E-02	6.33E-03	2.38E-03	9.54E-04	3.98E-04
3		6.33E-03	4.76E-03	2.86E-03	1.59E-03
4			2.38E-03	2.86E-03	2.39E-03
5				9.54E-04	1.59E-03
6					3.98E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.81E-01	9.87E-01	9.91E-01	9.92E-01	9.94E-01
Beta	1.89E-02	1.27E-02	9.52E-03	7.63E-03	6.37E-03
Gamma		5.00E-01	7.50E-01	8.75E-01	9.38E-01
Delta			3.33E-01	5.71E-01	7.33E-01
Epsilon				2.50E-01	4.55E-01
Mu					2.00E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	52.00	78.00	104.00	130.00	156.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	1.0000	0.5000	0.2500	0.1250	0.0625
N 3		0.5000	0.5000	0.3750	0.2500
N 4			0.2500	0.3750	0.3750
N 5				0.1250	0.2500
N 6					0.0625

1.4.5 PWR Residual Heat Removal Check Valves

1.4.5.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1980/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8806990	0.9616220	0.9744510	0.9986720	0.9473910	2.1334E+01	8.5144E-01
2	1.33E-03	3.84E-02	2.56E-02	1.19E-01	5.26E-02	8.5144E-01	2.1334E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9061860	0.9602610	0.9664540	0.9931270	0.9272730	4.6341E+01	1.9177E+00
2	3.41E-03	3.01E-02	2.38E-02	7.80E-02	5.46E-02	1.4504E+00	4.6808E+01
3	2.67E-05	9.68E-03	4.19E-03	3.80E-02	1.82E-02	4.6733E-01	4.7791E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9181600	0.9608550	0.9649620	0.9894860	0.9302160	7.0709E+01	2.8807E+00
2	3.11E-03	2.24E-02	1.83E-02	5.60E-02	2.79E-02	1.6495E+00	7.1940E+01
3	5.75E-04	1.28E-02	8.76E-03	3.90E-02	3.72E-02	9.4393E-01	7.2646E+01
4	2.80E-07	3.90E-03	8.92E-04	1.81E-02	4.66E-03	2.8724E-01	7.3302E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9389700	0.9670990	0.9693300	0.9875950	0.9434070	1.3354E+02	4.5430E+00
2	3.03E-03	1.55E-02	1.32E-02	3.58E-02	0.00E+00	2.1414E+00	1.3594E+02
3	1.58E-03	1.18E-02	9.50E-03	2.97E-02	3.77E-02	1.6241E+00	1.3646E+02
4	8.99E-05	5.08E-03	2.98E-03	1.72E-02	1.89E-02	7.0208E-01	1.3738E+02
5	2.45E-20	5.46E-04	4.43E-07	3.17E-03	0.00E+00	7.5435E-02	1.3801E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9432030	0.9682310	0.9700880	0.9869060	0.9523810	1.6121E+02	5.2894E+00
2	2.93E-03	1.38E-02	1.19E-02	3.12E-02	0.00E+00	2.3037E+00	1.6420E+02
3	4.25E-04	6.59E-03	4.75E-03	1.91E-02	0.00E+00	1.0979E+00	1.6540E+02
4	1.22E-03	9.50E-03	7.62E-03	2.42E-02	4.76E-02	1.5818E+00	1.6492E+02
5	3.89E-09	1.30E-03	1.66E-04	6.56E-03	0.00E+00	2.1648E-01	1.6628E+02
6	1.08E-17	5.38E-04	1.58E-06	3.14E-03	0.00E+00	8.9555E-02	1.6641E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9511730	0.9704170	0.9716340	0.9854890	0.9588980	2.4797E+02	7.5594E+00
2	3.74E-03	1.27E-02	1.15E-02	2.60E-02	0.00E+00	3.2518E+00	2.5228E+02
3	8.36E-04	6.31E-03	5.08E-03	1.60E-02	0.00E+00	1.6135E+00	2.5392E+02
4	5.33E-04	5.34E-03	4.12E-03	1.43E-02	1.64E-02	1.3638E+00	2.5417E+02
5	2.93E-04	4.38E-03	3.17E-03	1.26E-02	2.47E-02	1.1182E+00	2.5441E+02
6	1.81E-10	7.13E-04	5.69E-05	3.76E-03	0.00E+00	1.8209E-01	2.5535E+02
7	0.00E+00	1.17E-04	2.09E-13	4.56E-04	0.00E+00	3.0005E-02	2.5550E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9540060	0.9714340	0.9724790	0.9852800	0.9638600	2.8992E+02	8.5255E+00
2	3.65E-03	1.17E-02	1.07E-02	2.35E-02	0.00E+00	3.4977E+00	2.9495E+02
3	8.57E-04	5.81E-03	4.75E-03	1.44E-02	0.00E+00	1.7348E+00	2.9671E+02
4	3.55E-04	4.19E-03	3.15E-03	1.16E-02	5.78E-03	1.2510E+00	2.9719E+02
5	2.88E-04	3.91E-03	2.88E-03	1.11E-02	1.74E-02	1.1676E+00	2.9728E+02
6	4.65E-05	2.41E-03	1.43E-03	8.12E-03	1.30E-02	7.1982E-01	2.9773E+02
7	1.62E-14	3.93E-04	5.57E-06	2.25E-03	0.00E+00	1.1715E-01	2.9833E+02
8	3.08E-38	1.25E-04	1.72E-11	5.78E-04	0.00E+00	3.7386E-02	2.9841E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1980/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 20
Total Number of Common-Cause Failure Events: 1

Check Valves
PWR Residual Heat Removal Check Valves
Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9473910	0.9272730	0.9302160	0.9434070	0.9523810	0.9588980	0.9638600
2	5.26E-02	5.46E-02	2.79E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		1.82E-02	3.72E-02	3.77E-02	0.00E+00	0.00E+00	0.00E+00
4			4.66E-03	1.89E-02	4.76E-02	1.64E-02	5.78E-03
5				0.00E+00	0.00E+00	2.47E-02	1.74E-02
6					0.00E+00	0.00E+00	1.30E-02
7						0.00E+00	0.00E+00
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.47E-01	9.27E-01	9.30E-01	9.43E-01	9.52E-01	9.59E-01	9.64E-01
Beta	5.26E-02	7.27E-02	6.98E-02	5.66E-02	4.76E-02	4.11E-02	3.61E-02
Gamma		2.50E-01	6.00E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Delta			1.11E-01	3.33E-01	1.00E+00	1.00E+00	1.00E+00
Epsilon				0.00E+00	0.00E+00	6.00E-01	8.40E-01
Mu					0.00E+00	0.00E+00	4.29E-01
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	6.67	10.00	13.33	16.67	20.00	23.33	26.67
N 1	0.5333	0.2000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.4000	0.6000	0.4000	0.0000	0.0000	0.0000	0.0000
N 3		0.2000	0.5333	0.6667	0.0000	0.0000	0.0000
N 4			0.0667	0.3333	1.0000	0.4000	0.1600
N 5				0.0000	0.0000	0.6000	0.4800
N 6					0.0000	0.0000	0.3600
N 7						0.0000	0.0000
N 8							0.0000

1.4.5.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9400670	0.9792750	0.9850560	0.9987170	0.9832850	5.0704E+01	1.0731E+00
2	1.29E-03	2.07E-02	1.50E-02	5.99E-02	1.67E-02	1.0731E+00	5.0704E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9440910	0.9751170	0.9784640	0.9947050	0.9785710	9.0159E+01	2.3006E+00
2	2.63E-03	1.83E-02	1.50E-02	4.54E-02	1.53E-02	1.6922E+00	9.0767E+01
3	6.63E-05	6.58E-03	3.52E-03	2.35E-02	6.18E-03	6.0843E-01	9.1851E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9467910	0.9731550	0.9755080	0.9914810	0.9771250	1.2875E+02	3.5516E+00
2	3.43E-03	1.68E-02	1.45E-02	3.83E-02	1.34E-02	2.2258E+00	1.3008E+02
3	2.46E-04	6.67E-03	4.40E-03	2.08E-02	6.45E-03	8.8203E-01	1.3142E+02
4	6.77E-06	3.35E-03	1.37E-03	1.34E-02	3.06E-03	4.4374E-01	1.3186E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9526630	0.9731130	0.9745970	0.9885100	0.9764780	2.0551E+02	5.6781E+00
2	4.70E-03	1.57E-02	1.42E-02	3.19E-02	1.30E-02	3.3185E+00	2.0787E+02
3	6.83E-04	6.59E-03	5.11E-03	1.76E-02	4.78E-03	1.3913E+00	2.0980E+02
4	7.65E-05	3.53E-03	2.13E-03	1.17E-02	4.14E-03	7.4458E-01	2.1044E+02
5	4.82E-09	1.06E-03	1.46E-04	5.30E-03	1.63E-03	2.2374E-01	2.1096E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9541410	0.9727570	0.9739920	0.9871680	0.9757610	2.4698E+02	6.9169E+00
2	4.95E-03	1.50E-02	1.37E-02	2.92E-02	1.38E-02	3.7946E+00	2.5010E+02
3	6.39E-04	5.72E-03	4.49E-03	1.50E-02	3.27E-03	1.4527E+00	2.5244E+02
4	1.80E-04	3.81E-03	2.61E-03	1.15E-02	3.56E-03	9.6738E-01	2.5293E+02
5	9.20E-06	2.02E-03	9.45E-04	7.69E-03	2.74E-03	5.1388E-01	2.5338E+02
6	3.17E-10	7.42E-04	6.54E-05	3.88E-03	9.11E-04	1.8836E-01	2.5371E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9586900	0.9738900	0.9747670	0.9860890	0.9780380	3.4788E+02	9.3268E+00
2	4.77E-03	1.28E-02	1.19E-02	2.38E-02	1.03E-02	4.5536E+00	3.5265E+02
3	1.13E-03	5.92E-03	5.03E-03	1.38E-02	3.98E-03	2.1145E+00	3.5509E+02
4	3.19E-04	3.59E-03	2.72E-03	9.85E-03	2.53E-03	1.2828E+00	3.5592E+02
5	8.51E-05	2.43E-03	1.59E-03	7.64E-03	2.77E-03	8.6732E-01	3.5634E+02
6	1.48E-06	1.16E-03	4.35E-04	4.75E-03	1.83E-03	4.1279E-01	3.5679E+02
7	4.47E-17	2.68E-04	1.22E-06	1.56E-03	5.22E-04	9.5805E-02	3.5711E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9610480	0.9748500	0.9756070	0.9860610	0.9798310	4.0395E+02	1.0422E+01
2	4.27E-03	1.13E-02	1.05E-02	2.09E-02	8.11E-03	4.6617E+00	4.0971E+02
3	1.21E-03	5.65E-03	4.87E-03	1.27E-02	4.21E-03	2.3397E+00	4.1203E+02
4	3.36E-04	3.32E-03	2.56E-03	8.89E-03	1.98E-03	1.3753E+00	4.1300E+02
5	1.25E-04	2.42E-03	1.68E-03	7.24E-03	2.20E-03	1.0030E+00	4.1337E+02
6	2.35E-05	1.61E-03	9.13E-04	5.58E-03	2.15E-03	6.6782E-01	4.1370E+02
7	6.03E-08	7.07E-04	1.66E-04	3.26E-03	1.22E-03	2.9275E-01	4.1408E+02
8	1.43E-19	1.96E-04	2.87E-07	1.14E-03	3.06E-04	8.1286E-02	4.1429E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 70
Total Number of Common-Cause Failure Events: 3

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9832850	0.9785710	0.9771250	0.9764780	0.9757610	0.9780380	0.9798310
2	1.67E-02	1.53E-02	1.34E-02	1.30E-02	1.38E-02	1.03E-02	8.11E-03
3		6.18E-03	6.45E-03	4.78E-03	3.27E-03	3.98E-03	4.21E-03
4			3.06E-03	4.14E-03	3.56E-03	2.53E-03	1.98E-03
5				1.63E-03	2.74E-03	2.77E-03	2.20E-03
6					9.11E-04	1.83E-03	2.15E-03
7						5.22E-04	1.22E-03
8							3.06E-04

Check Valves
PWR Residual Heat Removal Check Valves
Fail to Close

2003

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.83E-01	9.79E-01	9.77E-01	9.77E-01	9.76E-01	9.78E-01	9.80E-01
Beta	1.67E-02	2.14E-02	2.29E-02	2.35E-02	2.42E-02	2.20E-02	2.02E-02
Gamma		2.88E-01	4.16E-01	4.49E-01	4.33E-01	5.30E-01	5.98E-01
Delta			3.21E-01	5.47E-01	6.88E-01	6.58E-01	6.51E-01
Epsilon				2.83E-01	5.07E-01	6.69E-01	7.48E-01
Mu					2.49E-01	4.59E-01	6.26E-01
Upsilon						2.22E-01	4.16E-01
Sigma							2.00E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	35.00	52.50	70.00	87.50	105.00	122.50	140.00
N 1	1.5733	1.5183	1.3734	1.1367	0.7732	0.7387	0.6973
N 2	0.6217	0.8418	0.9763	1.1771	1.4909	1.3018	1.1640
N 3		0.3411	0.4714	0.4339	0.3548	0.5010	0.6049
N 4			0.2232	0.3758	0.3856	0.3190	0.2843
N 5				0.1483	0.2974	0.3491	0.3154
N 6					0.0988	0.2307	0.3080
N 7						0.0658	0.1756
N 8							0.0439

1.4.6 BWR High Pressure Coolant Injection/Reactor Core Isolation Cooling Check Valves

1.4.6.1 Fail to Open

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

1.4.6.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	HIGH PRESSURE COOLANT INJECTION (BWR)
	REACTOR CORE ISOLATION COOLING
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9282660	0.9723980	0.9781430	0.9968710	0.9736840	5.1131E+01	1.4514E+00
2	3.13E-03	2.76E-02	2.19E-02	7.17E-02	2.63E-02	1.4514E+00	5.1131E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9478920	0.9774130	0.9807180	0.9956350	0.9823010	9.1641E+01	2.1177E+00
2	1.42E-03	1.44E-02	1.11E-02	3.86E-02	8.85E-03	1.3504E+00	9.2408E+01
3	1.98E-04	8.18E-03	5.05E-03	2.68E-02	8.85E-03	7.6733E-01	9.2991E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9548230	0.9785440	0.9808780	0.9942920	0.9866670	1.3138E+02	2.8807E+00
2	1.32E-03	1.12E-02	8.85E-03	2.89E-02	3.33E-03	1.4995E+00	1.3276E+02
3	2.74E-04	6.78E-03	4.54E-03	2.09E-02	6.67E-03	9.1063E-01	1.3335E+02
4	9.95E-06	3.51E-03	1.52E-03	1.37E-02	3.33E-03	4.7054E-01	1.3379E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9604530	0.9787620	0.9802350	0.9920370	0.9893050	2.0937E+02	4.5430E+00
2	2.20E-03	1.06E-02	9.11E-03	2.41E-02	1.34E-03	2.2664E+00	2.1165E+02
3	5.97E-04	6.23E-03	4.77E-03	1.68E-02	4.01E-03	1.3324E+00	2.1258E+02
4	7.52E-05	3.48E-03	2.10E-03	1.16E-02	4.01E-03	7.4378E-01	2.1317E+02
5	9.88E-10	9.37E-04	9.80E-05	4.83E-03	1.34E-03	2.0044E-01	2.1371E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9631490	0.9794590	0.9806860	0.9915740	0.9910710	2.5221E+02	5.2894E+00
2	2.00E-03	9.19E-03	7.95E-03	2.06E-02	5.58E-04	2.3662E+00	2.5513E+02
3	5.12E-04	5.24E-03	4.02E-03	1.41E-02	2.23E-03	1.3479E+00	2.5615E+02
4	1.71E-04	3.72E-03	2.54E-03	1.13E-02	3.35E-03	9.5678E-01	2.5654E+02
5	4.88E-06	1.81E-03	7.75E-04	7.13E-03	2.23E-03	4.6648E-01	2.5703E+02
6	6.83E-12	5.91E-04	2.59E-05	3.24E-03	5.58E-04	1.5206E-01	2.5735E+02

ALPHA FACTOR AND MGL PARAMETERS

System :		HIGH PRESSURE COOLANT INJECTION (BWR)	
	REACTOR CORE ISOLATION COOLING	Component :	CHECK VALVE
Failure Mode :		FAIL TO CLOSE (NORMALLY OPEN)	
Start Date :		1985/01/01	
Data Version :		2003/12/31	

Total Number of Independent Failure Events: 37
 Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9736840	0.9823010	0.9866670	0.9893050	0.9910710
2	2.63E-02	8.85E-03	3.33E-03	1.34E-03	5.58E-04
3		8.85E-03	6.67E-03	4.01E-03	2.23E-03
4			3.33E-03	4.01E-03	3.35E-03
5				1.34E-03	2.23E-03
6					5.58E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.74E-01	9.82E-01	9.87E-01	9.89E-01	9.91E-01
Beta	2.63E-02	1.77E-02	1.33E-02	1.07E-02	8.93E-03
Gamma		5.00E-01	7.50E-01	8.75E-01	9.38E-01
Delta			3.33E-01	5.71E-01	7.33E-01
Epsilon				2.50E-01	4.55E-01
Mu					2.00E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	37.00	55.50	74.00	92.50	111.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	1.0000	0.5000	0.2500	0.1250	0.0625
N 3		0.5000	0.5000	0.3750	0.2500
N 4			0.2500	0.3750	0.3750
N 5				0.1250	0.2500
N 6					0.0625

1.5 Strainers, Trash Racks, and Filters

1.5.1 Pooled Strainers (Non-ESW)

1.5.1.1 No Flow/Plugged

ALPHA FACTOR DISTRIBUTIONS

System :	AUXILIARY FEEDWATER SYSTEM CONTAINMENT SPRAY SYSTEM HIGH PRESSURE COOLANT INJECTION (BWR) HIGH PRESSURE SAFETY INJECTION (PWR) ISOLATION CONDENSER LOW PRESSURE CORE SPRAY REACTOR CORE ISOLATION COOLING REACTOR COOLANT RESIDUAL HEAT REMOVAL
Component :	STRAINER - MAIN PUMP SUCTION OR DISCHARGE
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8220930	0.9344660	0.9496930	0.9945880	0.8000000	1.7131E+01	1.2014E+00
2	5.41E-03	6.55E-02	5.03E-02	1.78E-01	2.00E-01	1.2014E+00	1.7131E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8738320	0.9419420	0.9488140	0.9865030	0.7310970	3.9766E+01	2.4510E+00
2	6.13E-03	4.09E-02	3.38E-02	9.97E-02	1.77E-01	1.7254E+00	4.0492E+01
3	3.47E-04	1.72E-02	1.04E-02	5.73E-02	9.24E-02	7.2563E-01	4.1491E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8929680	0.9453660	0.9498700	0.9823660	0.7210220	6.1740E+01	3.5680E+00
2	5.29E-03	3.00E-02	2.53E-02	7.06E-02	1.17E-01	1.9578E+00	6.3350E+01
3	1.12E-03	1.69E-02	1.23E-02	4.85E-02	1.15E-01	1.1050E+00	6.4203E+01
4	3.25E-05	7.74E-03	3.59E-03	2.95E-02	4.71E-02	5.0524E-01	6.4803E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9245950	0.9574150	0.9597920	0.9821170	0.7338730	1.2207E+02	5.4296E+00
2	5.07E-03	2.07E-02	1.83E-02	4.47E-02	7.02E-02	2.6391E+00	1.2486E+02
3	1.76E-03	1.29E-02	1.04E-02	3.23E-02	9.63E-02	1.6403E+00	1.2586E+02
4	2.71E-04	7.02E-03	4.67E-03	2.18E-02	7.43E-02	8.9538E-01	1.2660E+02
5	4.19E-08	2.00E-03	3.65E-04	9.62E-03	2.53E-02	2.5484E-01	1.2725E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9299140	0.9590840	0.9610620	0.9814900	0.7538790	1.4732E+02	6.2849E+00
2	4.17E-03	1.71E-02	1.51E-02	3.71E-02	4.03E-02	2.6307E+00	1.5097E+02
3	1.49E-03	1.08E-02	8.75E-03	2.71E-02	6.90E-02	1.6573E+00	1.5195E+02
4	5.90E-04	7.72E-03	5.72E-03	2.17E-02	7.46E-02	1.1865E+00	1.5242E+02
5	3.91E-05	3.95E-03	2.10E-03	1.41E-02	4.81E-02	6.0648E-01	1.5300E+02
6	1.79E-09	1.33E-03	1.46E-04	6.81E-03	1.41E-02	2.0396E-01	1.5340E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AUXILIARY FEEDWATER SYSTEM CONTAINMENT SPRAY SYSTEM HIGH PRESSURE COOLANT INJECTION (BWR) HIGH PRESSURE SAFETY INJECTION (PWR) ISOLATION CONDENSER LOW PRESSURE CORE SPRAY REACTOR CORE ISOLATION COOLING REACTOR COOLANT RESIDUAL HEAT REMOVAL
Component :	STRAINER - MAIN PUMP SUCTION OR DISCHARGE
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 2

Total Number of Common-Cause Failure Events: 2

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.8000000	0.7310970	0.7210220	0.7338730	0.7538790
2	2.00E-01	1.77E-01	1.17E-01	7.02E-02	4.03E-02
3		9.24E-02	1.15E-01	9.63E-02	6.90E-02
4			4.71E-02	7.43E-02	7.46E-02
5				2.53E-02	4.81E-02
6					1.41E-02

Strainers, Trash Racks, and Filters
 Pooled Strainers (Non-ESW)
 No Flow/Plugged

2003

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	8.00E-01	7.31E-01	7.21E-01	7.34E-01	7.54E-01
Beta	2.00E-01	2.69E-01	2.79E-01	2.66E-01	2.46E-01
Gamma		3.44E-01	5.80E-01	7.36E-01	8.36E-01
Delta			2.91E-01	5.08E-01	6.65E-01
Epsilon				2.54E-01	4.55E-01
Mu					2.27E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	2.00	3.00	4.00	5.00	6.00
N 1	1.0000	0.6250	0.3611	0.2025	0.1123
N 2	0.7500	0.8750	0.7083	0.4977	0.3270
N 3		0.4583	0.6944	0.6829	0.5594
N 4			0.2847	0.5266	0.6047
N 5				0.1794	0.3900
N 6					0.1144

1.5.2 Emergency Service Water Strainers, Trash Racks

1.5.2.1 No Flow/Plugged

ALPHA FACTOR DISTRIBUTIONS

System :	EMERGENCY/ESSENTIAL SERVICE WATER
Component :	STRAINER, TRASH RACKS
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.7446570	0.8580070	0.8657390	0.9448720	0.7592720	2.6582E+01	4.3991E+00
2	5.51E-02	1.42E-01	1.34E-01	2.55E-01	2.41E-01	4.3991E+00	2.6582E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8255840	0.8968100	0.9012610	0.9528070	0.7733880	5.3229E+01	6.1247E+00
2	9.41E-03	4.11E-02	3.60E-02	9.01E-02	7.19E-02	2.4394E+00	5.6914E+01
3	2.06E-02	6.21E-02	5.72E-02	1.20E-01	1.55E-01	3.6853E+00	5.5668E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8555550	0.9105280	0.9136750	0.9547380	0.7861070	7.8996E+01	7.7625E+00
2	9.52E-03	3.44E-02	3.09E-02	7.14E-02	6.32E-02	2.9862E+00	8.3772E+01
3	1.65E-03	1.60E-02	1.24E-02	4.24E-02	3.54E-02	1.3847E+00	8.5374E+01
4	1.20E-02	3.91E-02	3.56E-02	7.81E-02	1.15E-01	3.3916E+00	8.3367E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8989380	0.9346110	0.9364950	0.9638430	0.8024050	1.4315E+02	1.0015E+01
2	7.54E-03	2.35E-02	2.15E-02	4.65E-02	4.47E-02	3.6047E+00	1.4956E+02
3	3.48E-03	1.57E-02	1.36E-02	3.49E-02	4.41E-02	2.4012E+00	1.5076E+02
4	1.98E-03	1.22E-02	1.01E-02	2.93E-02	4.56E-02	1.8616E+00	1.5130E+02
5	2.74E-03	1.40E-02	1.20E-02	3.23E-02	6.33E-02	2.1479E+00	1.5102E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9065100	0.9381610	0.9397480	0.9643830	0.8139220	1.7206E+02	1.1341E+01
2	7.62E-03	2.20E-02	2.03E-02	4.22E-02	4.55E-02	4.0289E+00	1.7937E+02
3	2.15E-03	1.14E-02	9.67E-03	2.65E-02	2.62E-02	2.0895E+00	1.8131E+02
4	2.15E-03	1.14E-02	9.66E-03	2.65E-02	3.97E-02	2.0865E+00	1.8132E+02
5	1.97E-03	1.10E-02	9.24E-03	2.58E-02	4.73E-02	2.0099E+00	1.8139E+02
6	4.19E-04	6.14E-03	4.47E-03	1.76E-02	2.74E-02	1.1265E+00	1.8228E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	EMERGENCY/ESSENTIAL SERVICE WATER
Component :	STRAINER, TRASH RACKS
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 18
 Total Number of Common-Cause Failure Events: 8

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.7592720	0.7733880	0.7861070	0.8024050	0.8139220
2	2.41E-01	7.19E-02	6.32E-02	4.47E-02	4.55E-02
3		1.55E-01	3.54E-02	4.41E-02	2.62E-02
4			1.15E-01	4.56E-02	3.97E-02
5				6.33E-02	4.73E-02
6					2.74E-02

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	7.59E-01	7.73E-01	7.86E-01	8.02E-01	8.14E-01
Beta	2.41E-01	2.27E-01	2.14E-01	1.98E-01	1.86E-01
Gamma		6.83E-01	7.05E-01	7.74E-01	7.55E-01
Delta			7.65E-01	7.12E-01	8.14E-01
Epsilon				5.81E-01	6.53E-01
Mu					3.66E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	9.00	13.50	18.00	22.50	27.00
N 1	3.4513	3.5880	3.6173	3.7835	3.8452
N 2	3.9477	1.5890	1.7367	1.4633	1.7252
N 3		3.4180	0.9741	1.4438	0.9916
N 4			3.1711	1.4928	1.5047
N 5				2.0725	1.7934
N 6					1.0369

1.5.3 Emergency Service Water Strainers

1.5.3.1 No Flow/Plugged

ALPHA FACTOR DISTRIBUTIONS

System :	EMERGENCY/ESSENTIAL SERVICE WATER
Component :	STRAINER - MAIN PUMP SUCTION OR DISCHARGE
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8584750	0.8994810	0.9010950	0.9349620	0.8927250	1.4814E+02	1.6555E+01
2	6.50E-02	1.01E-01	9.89E-02	1.42E-01	1.07E-01	1.6555E+01	1.4814E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8733150	0.9053690	0.9064470	0.9337510	0.8941100	2.2735E+02	2.3763E+01
2	2.84E-02	4.84E-02	4.72E-02	7.25E-02	5.29E-02	1.2162E+01	2.3895E+02
3	2.67E-02	4.62E-02	4.50E-02	6.98E-02	5.30E-02	1.1601E+01	2.3951E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8874720	0.9139510	0.9147760	0.9376230	0.9022950	3.0653E+02	2.8860E+01
2	2.07E-02	3.56E-02	3.47E-02	5.37E-02	3.87E-02	1.1945E+01	3.2345E+02
3	1.54E-02	2.86E-02	2.77E-02	4.50E-02	3.32E-02	9.5859E+00	3.2580E+02
4	1.06E-02	2.19E-02	2.09E-02	3.64E-02	2.57E-02	7.3290E+00	3.2806E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9062670	0.9272180	0.9278380	0.9460490	0.9117580	4.2479E+02	3.3344E+01
2	1.38E-02	2.44E-02	2.37E-02	3.73E-02	2.67E-02	1.1166E+01	4.4697E+02
3	1.22E-02	2.22E-02	2.15E-02	3.46E-02	2.73E-02	1.0177E+01	4.4796E+02
4	9.29E-03	1.82E-02	1.75E-02	2.96E-02	2.36E-02	8.3540E+00	4.4978E+02
5	2.55E-03	7.96E-03	7.26E-03	1.58E-02	1.06E-02	3.6467E+00	4.5449E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9148880	0.9333180	0.9338450	0.9499430	0.9197470	5.0806E+02	3.6299E+01
2	1.00E-02	1.84E-02	1.78E-02	2.87E-02	1.93E-02	9.9898E+00	5.3437E+02
3	9.51E-03	1.77E-02	1.71E-02	2.79E-02	2.14E-02	9.6260E+00	5.3473E+02
4	8.45E-03	1.62E-02	1.57E-02	2.60E-02	2.07E-02	8.8397E+00	5.3552E+02
5	4.75E-03	1.09E-02	1.03E-02	1.91E-02	1.44E-02	5.9415E+00	5.3842E+02
6	5.84E-04	3.49E-03	2.91E-03	8.41E-03	4.54E-03	1.9022E+00	5.4246E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	EMERGENCY/ESSENTIAL SERVICE WATER
Component :	STRAINER - MAIN PUMP SUCTION OR DISCHARGE
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 226
 Total Number of Common-Cause Failure Events: 42

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.8927250	0.8941100	0.9022950	0.9117580	0.9197470
2	1.07E-01	5.29E-02	3.87E-02	2.67E-02	1.93E-02
3		5.30E-02	3.32E-02	2.73E-02	2.14E-02
4			2.57E-02	2.36E-02	2.07E-02
5				1.06E-02	1.44E-02
6					4.54E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	8.93E-01	8.94E-01	9.02E-01	9.12E-01	9.20E-01
Beta	1.07E-01	1.06E-01	9.77E-02	8.82E-02	8.03E-02
Gamma		5.01E-01	6.04E-01	6.97E-01	7.60E-01
Delta			4.37E-01	5.56E-01	6.49E-01
Epsilon				3.09E-01	4.77E-01
Mu					2.41E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	115.90	173.85	231.79	289.74	347.69
N 1	18.1125	17.3571	17.3632	18.1773	19.1621
N 2	16.1038	11.3116	10.6957	9.0250	7.6861
N 3		11.3332	9.1753	9.2194	8.5281
N 4			7.1085	7.9852	8.2579
N 5				3.5713	5.7250
N 6					1.8126

1.5.4 PWR Containment Sump Strainers

1.5.4.1 No Flow/Plugged

ALPHA FACTOR DISTRIBUTIONS

System :	CONTAINMENT SPRAY SYSTEM
Component :	STRAINER - MAIN PUMP SUCTION OR DISCHARGE
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8198830	0.9389420	0.9567270	0.9970610	0.5000000	1.4631E+01	9.5144E-01
2	2.94E-03	6.11E-02	4.33E-02	1.80E-01	5.00E-01	9.5144E-01	1.4631E+01

ALPHA FACTOR AND MGL PARAMETERS

System :	CONTAINMENT SPRAY SYSTEM
Component :	STRAINER - MAIN PUMP SUCTION OR DISCHARGE
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 0

Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2
1	0.5000000
2	5.00E-01

MGL Parameter	CCCG=2
1-Beta	5.00E-01
Beta	5.00E-01

Avg. Impact Vector	CCCG=2
Adj. Ind. Events	0.00
N 1	0.5000
N 2	0.5000

1.5.5 BWR Suppression Pool Strainers

1.5.5.1 No Flow/Plugged

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	STRAINER - MAIN PUMP SUCTION OR DISCHARGE
Failure Mode :	NO FLOW/PLUGGED
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8652620	0.9595300	0.9755080	0.9992520	0.9090910	1.6631E+01	7.0144E-01
2	7.45E-04	4.05E-02	2.45E-02	1.35E-01	9.09E-02	7.0144E-01	1.6631E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9019470	0.9606710	0.9679000	0.9946390	0.8709680	3.9516E+01	1.6177E+00
2	2.48E-03	2.98E-02	2.26E-02	8.19E-02	9.68E-02	1.2254E+00	3.9908E+01
3	8.82E-06	9.54E-03	3.43E-03	3.98E-02	3.23E-02	3.9233E-01	4.0741E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9135740	0.9599960	0.9646850	0.9903600	0.8607590	6.1629E+01	2.5682E+00
2	3.43E-03	2.53E-02	2.06E-02	6.34E-02	7.60E-02	1.6245E+00	6.2573E+01
3	1.46E-04	1.03E-02	5.84E-03	3.56E-02	5.06E-02	6.6063E-01	6.3537E+01
4	2.75E-07	4.41E-03	9.83E-04	2.05E-02	1.27E-02	2.8304E-01	6.3914E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9354230	0.9655370	0.9679690	0.9873400	0.8638610	1.2203E+02	4.3556E+00
2	4.41E-03	1.94E-02	1.69E-02	4.29E-02	5.24E-02	2.4539E+00	1.2393E+02
3	8.81E-04	1.01E-02	7.61E-03	2.76E-02	5.24E-02	1.2699E+00	1.2512E+02
4	2.11E-05	4.16E-03	1.98E-03	1.57E-02	2.62E-02	5.2508E-01	1.2586E+02
5	3.14E-15	8.45E-04	7.34E-06	4.89E-03	5.24E-03	1.0674E-01	1.2628E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9390050	0.9660280	0.9680490	0.9861480	0.8724750	1.4730E+02	5.1801E+00
2	3.91E-03	1.67E-02	1.46E-02	3.64E-02	3.36E-02	2.5381E+00	1.4994E+02
3	9.84E-04	9.25E-03	7.21E-03	2.45E-02	4.47E-02	1.4104E+00	1.5107E+02
4	1.57E-04	5.35E-03	3.40E-03	1.72E-02	3.36E-02	8.1618E-01	1.5166E+02
5	2.96E-07	2.04E-03	5.26E-04	9.21E-03	1.34E-02	3.1028E-01	1.5217E+02
6	1.70E-15	6.90E-04	5.51E-06	4.00E-03	2.23E-03	1.0516E-01	1.5238E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	STRAINER - MAIN PUMP SUCTION OR DISCHARGE
Failure Mode :	NO FLOW/PLUGGED
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 2

Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9090910	0.8709680	0.8607590	0.8638610	0.8724750
2	9.09E-02	9.68E-02	7.60E-02	5.24E-02	3.36E-02
3		3.23E-02	5.06E-02	5.24E-02	4.47E-02
4			1.27E-02	2.62E-02	3.36E-02
5				5.24E-03	1.34E-02
6					2.23E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.09E-01	8.71E-01	8.61E-01	8.64E-01	8.73E-01
Beta	9.09E-02	1.29E-01	1.39E-01	1.36E-01	1.28E-01
Gamma		2.50E-01	4.55E-01	6.15E-01	7.37E-01
Delta			2.00E-01	3.75E-01	5.24E-01
Epsilon				1.67E-01	3.18E-01
Mu					1.43E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	2.00	3.00	4.00	5.00	6.00
N 1	0.5000	0.3750	0.2500	0.1563	0.0938
N 2	0.2500	0.3750	0.3750	0.3125	0.2344
N 3		0.1250	0.2500	0.3125	0.3125
N 4			0.0625	0.1563	0.2344
N 5				0.0313	0.0938
N 6					0.0156

1.5.6 PWR Containment Sump Strainers

1.5.6.1 No Flow/Plugged

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

1.5.7 BWR Suppression Pool Strainer

1.5.7.1 No Flow/Plugged

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

1.6 Heat Exchangers

1.6.1 Pooled Heat Exchanger Plugged or Failure to Transfer Heat

ALPHA FACTOR DISTRIBUTIONS

Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.7068190	0.7924510	0.7953690	0.8681030	0.7433780	5.3141E+01	1.3918E+01
2	1.32E-01	2.08E-01	2.05E-01	2.93E-01	2.57E-01	1.3918E+01	5.3141E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.7853240	0.8456470	0.8477820	0.8986870	0.7803160	9.1481E+01	1.6698E+01
2	4.12E-02	7.88E-02	7.62E-02	1.25E-01	1.08E-01	8.5204E+00	9.9658E+01
3	3.89E-02	7.56E-02	7.30E-02	1.21E-01	1.12E-01	8.1773E+00	1.0000E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8165530	0.8652580	0.8669050	0.9083370	0.7963220	1.2790E+02	1.9917E+01
2	2.96E-02	5.72E-02	5.52E-02	9.15E-02	8.13E-02	8.4491E+00	1.3937E+02
3	1.70E-02	3.93E-02	3.72E-02	6.85E-02	6.09E-02	5.8011E+00	1.4202E+02
4	1.64E-02	3.83E-02	3.63E-02	6.73E-02	6.15E-02	5.6670E+00	1.4215E+02

ALPHA FACTOR AND MGL PARAMETERS

Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 44

Total Number of Common-Cause Failure Events: 20

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.7433780	0.7803160	0.7963220
2	2.57E-01	1.08E-01	8.13E-02
3		1.12E-01	6.09E-02
4			6.15E-02

Heat Exchangers
 Pooled Heat Exchanger Plugged or Failure to Transfer Heat
 No Flow/Plugged

2003

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	7.43E-01	7.80E-01	7.96E-01
Beta	2.57E-01	2.20E-01	2.04E-01
Gamma		5.08E-01	6.01E-01
Delta			5.03E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	33.21	49.81	66.42
N 1	5.8000	5.5300	4.0978
N 2	13.4667	7.6700	7.1996
N 3		7.9100	5.3905
N 4			5.4465

1.6.2 Containment Spray Heat Exchanger

1.6.2.1 Plugged or Failure to Transfer Heat

ALPHA FACTOR DISTRIBUTIONS

System :	CONTAINMENT SPRAY SYSTEM
Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.6709580	0.7906800	0.7961870	0.8915420	0.6659730	2.8021E+01	7.4181E+00
2	1.09E-01	2.09E-01	2.04E-01	3.29E-01	3.34E-01	7.4181E+00	2.8021E+01

ALPHA FACTOR AND MGL PARAMETERS

System :	CONTAINMENT SPRAY SYSTEM
Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 14

Total Number of Common-Cause Failure Events: 12

Alpha Factor	CCCG=2
1	0.6659730
2	3.34E-01

MGL Parameter	CCCG=2
1-Beta	6.66E-01
Beta	3.34E-01

Avg. Impact Vector	CCCG=2
Adj. Ind. Events	9.09
N 1	4.8000
N 2	6.9667

1.6.3 BWR Residual Heat Removal Heat Exchanger

1.6.3.1 Plugged or Failure to Transfer Heat

ALPHA FACTOR DISTRIBUTIONS

System :	RESIDUAL HEAT REMOVAL
Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8741840	0.9404090	0.9468000	0.9847380	0.9268290	4.2631E+01	2.7014E+00
2	1.53E-02	5.96E-02	5.32E-02	1.26E-01	7.32E-02	2.7014E+00	4.2631E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9136840	0.9559540	0.9596100	0.9857070	0.9442900	7.8516E+01	3.6177E+00
2	5.57E-03	2.71E-02	2.34E-02	6.14E-02	3.06E-02	2.2254E+00	7.9908E+01
3	1.77E-03	1.70E-02	1.32E-02	4.49E-02	2.51E-02	1.3923E+00	8.0741E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9285460	0.9613520	0.9639280	0.9853420	0.9544010	1.1363E+02	4.5681E+00
2	3.48E-03	1.80E-02	1.53E-02	4.15E-02	1.49E-02	2.1245E+00	1.1607E+02
3	1.95E-03	1.41E-02	1.14E-02	3.52E-02	2.12E-02	1.6606E+00	1.1654E+02
4	1.71E-04	6.63E-03	4.13E-03	2.16E-02	9.54E-03	7.8304E-01	1.1742E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	RESIDUAL HEAT REMOVAL
Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 28

Total Number of Common-Cause Failure Events: 3

Heat Exchangers
 BWR Residual Heat Removal Heat Exchanger
 Plugged or Failure to Transfer Heat

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9268290	0.9442900	0.9544010
2	7.32E-02	3.06E-02	1.49E-02
3		2.51E-02	2.12E-02
4			9.54E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.27E-01	9.44E-01	9.54E-01
Beta	7.32E-02	5.57E-02	4.56E-02
Gamma		4.50E-01	6.74E-01
Delta			3.10E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	28.00	42.00	56.00
N 1	0.5000	0.3750	0.2500
N 2	2.2500	1.3750	0.8750
N 3		1.1250	1.2500
N 4			0.5625

1.6.4 BWR Isolation Condenser Heat Exchanger

1.6.4.1 Plugged or Failure to Transfer Heat

ALPHA FACTOR DISTRIBUTIONS

System :	ISOLATION CONDENSER
Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8652620	0.9595300	0.9755080	0.9992520	0.9090910	1.6631E+01	7.0144E-01
2	7.45E-04	4.05E-02	2.45E-02	1.35E-01	9.09E-02	7.0144E-01	1.6631E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9019470	0.9606710	0.9679000	0.9946390	0.8709680	3.9516E+01	1.6177E+00
2	2.48E-03	2.98E-02	2.26E-02	8.19E-02	9.68E-02	1.2254E+00	3.9908E+01
3	8.82E-06	9.54E-03	3.43E-03	3.98E-02	3.23E-02	3.9233E-01	4.0741E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9135740	0.9599960	0.9646850	0.9903600	0.8607590	6.1629E+01	2.5682E+00
2	3.43E-03	2.53E-02	2.06E-02	6.34E-02	7.60E-02	1.6245E+00	6.2573E+01
3	1.46E-04	1.03E-02	5.84E-03	3.56E-02	5.06E-02	6.6063E-01	6.3537E+01
4	2.75E-07	4.41E-03	9.83E-04	2.05E-02	1.27E-02	2.8304E-01	6.3914E+01

ALPHA FACTOR AND MGL PARAMETERS

System :	ISOLATION CONDENSER
Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 2

Total Number of Common-Cause Failure Events: 1

Heat Exchangers
 BWR Isolation Condenser Heat Exchanger
 Plugged or Failure to Transfer Heat

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9090910	0.8709680	0.8607590
2	9.09E-02	9.68E-02	7.60E-02
3		3.23E-02	5.06E-02
4			1.27E-02

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.09E-01	8.71E-01	8.61E-01
Beta	9.09E-02	1.29E-01	1.39E-01
Gamma		2.50E-01	4.55E-01
Delta			2.00E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	2.00	3.00	4.00
N 1	0.5000	0.3750	0.2500
N 2	0.2500	0.3750	0.3750
N 3		0.1250	0.2500
N 4			0.0625

1.7 Safety and Relief Valves

1.7.1 Pooled Safety and Relief Valves

1.7.1.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

Component :	SAFETY VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9109280	0.9682120	0.9763460	0.9976520	0.9676550	3.5195E+01	1.1555E+00
2	2.35E-03	3.18E-02	2.37E-02	8.91E-02	3.24E-02	1.1555E+00	3.5195E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9158420	0.9602930	0.9646580	0.9897990	0.9489340	6.6354E+01	2.7436E+00
2	6.69E-03	3.23E-02	2.79E-02	7.30E-02	4.34E-02	2.2331E+00	6.6865E+01
3	3.28E-05	7.39E-03	3.46E-03	2.81E-02	7.64E-03	5.1053E-01	6.8587E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9183190	0.9560770	0.9590660	0.9836210	0.9387170	9.6432E+01	4.4301E+00
2	8.75E-03	3.07E-02	2.77E-02	6.31E-02	4.44E-02	3.0975E+00	9.7765E+01
3	5.53E-04	1.01E-02	7.13E-03	3.00E-02	1.47E-02	1.0215E+00	9.9841E+01
4	4.61E-07	3.09E-03	8.02E-04	1.39E-02	2.18E-03	3.1114E-01	1.0055E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9321330	0.9594930	0.9612660	0.9807860	0.9334000	1.6462E+02	6.9497E+00
2	9.04E-03	2.50E-02	2.32E-02	4.71E-02	4.19E-02	4.2846E+00	1.6729E+02
3	1.84E-03	1.10E-02	9.20E-03	2.65E-02	1.83E-02	1.8937E+00	1.6968E+02
4	5.56E-05	3.87E-03	2.19E-03	1.34E-02	5.78E-03	6.6448E-01	1.7091E+02
5	2.44E-15	6.23E-04	5.47E-06	3.61E-03	6.16E-04	1.0694E-01	1.7146E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9338660	0.9588290	0.9603090	0.9787460	0.9307350	1.9756E+02	8.4829E+00
2	8.64E-03	2.26E-02	2.11E-02	4.19E-02	3.90E-02	4.6646E+00	2.0138E+02
3	2.22E-03	1.09E-02	9.31E-03	2.47E-02	1.88E-02	2.2360E+00	2.0381E+02
4	3.79E-04	5.50E-03	4.00E-03	1.57E-02	9.10E-03	1.1328E+00	2.0491E+02
5	6.87E-07	1.70E-03	5.26E-04	7.40E-03	2.22E-03	3.5088E-01	2.0569E+02
6	1.92E-16	4.79E-04	2.62E-06	2.79E-03	1.50E-04	9.8655E-02	2.0594E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9421360	0.9618480	0.9628640	0.9780750	0.9294540	2.8953E+02	1.1484E+01
2	8.33E-03	1.93E-02	1.83E-02	3.39E-02	3.67E-02	5.8129E+00	2.9520E+02
3	2.48E-03	9.48E-03	8.42E-03	2.01E-02	1.78E-02	2.8533E+00	2.9816E+02
4	8.27E-04	5.70E-03	4.65E-03	1.42E-02	1.08E-02	1.7158E+00	2.9930E+02
5	8.84E-05	2.79E-03	1.79E-03	8.87E-03	4.59E-03	8.3842E-01	3.0018E+02
6	5.50E-09	7.71E-04	1.15E-04	3.82E-03	7.16E-04	2.3209E-01	3.0078E+02
7	3.22E-44	1.06E-04	7.04E-13	4.34E-04	2.72E-05	3.1905E-02	3.0098E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9443670	0.9624380	0.9633130	0.9775030	0.9289440	3.3662E+02	1.3138E+01
2	7.99E-03	1.79E-02	1.70E-02	3.09E-02	3.48E-02	6.2474E+00	3.4351E+02
3	2.44E-03	8.76E-03	7.85E-03	1.82E-02	1.68E-02	3.0646E+00	3.4669E+02
4	9.16E-04	5.46E-03	4.55E-03	1.31E-02	1.04E-02	1.9083E+00	3.4785E+02
5	2.93E-04	3.54E-03	2.65E-03	9.82E-03	6.96E-03	1.2369E+00	3.4852E+02
6	6.54E-06	1.46E-03	6.82E-04	5.57E-03	1.93E-03	5.1212E-01	3.4925E+02
7	2.03E-13	3.74E-04	8.93E-06	2.11E-03	1.74E-04	1.3085E-01	3.4963E+02
8	4.02E-38	1.08E-04	1.62E-11	4.97E-04	2.53E-06	3.7586E-02	3.4972E+02

ALPHA FACTOR AND MGL PARAMETERS

Component :	SAFETY VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 117
Total Number of Common-Cause Failure Events: 41

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9676550	0.9489340	0.9387170	0.9334000	0.9307350	0.9294540	0.9289440
2	3.24E-02	4.34E-02	4.44E-02	4.19E-02	3.90E-02	3.67E-02	3.48E-02
3		7.64E-03	1.47E-02	1.83E-02	1.88E-02	1.78E-02	1.68E-02
4			2.18E-03	5.78E-03	9.10E-03	1.08E-02	1.04E-02
5				6.16E-04	2.22E-03	4.59E-03	6.96E-03
6					1.50E-04	7.16E-04	1.93E-03
7						2.72E-05	1.74E-04
8							2.53E-06

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.68E-01	9.49E-01	9.39E-01	9.33E-01	9.31E-01	9.30E-01	9.29E-01
Beta	3.24E-02	5.11E-02	6.13E-02	6.66E-02	6.93E-02	7.06E-02	7.11E-02
Gamma		1.50E-01	2.75E-01	3.71E-01	4.37E-01	4.80E-01	5.10E-01
Delta			1.29E-01	2.59E-01	3.79E-01	4.76E-01	5.36E-01
Epsilon				9.63E-02	2.07E-01	3.31E-01	4.67E-01
Mu					6.34E-02	1.40E-01	2.32E-01
Upsilon						3.66E-02	8.36E-02
Sigma							1.44E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	15.60	23.40	31.20	39.00	46.80	54.60	62.40
N 1	5.4640	6.8134	7.8528	8.7447	9.5495	10.2875	10.9717
N 2	0.7041	1.3827	1.8480	2.1432	2.3609	2.5611	2.7497
N 3		0.2432	0.6109	0.9363	1.1381	1.2398	1.3298
N 4			0.0906	0.2957	0.5510	0.7520	0.8173
N 5				0.0315	0.1344	0.3202	0.5493
N 6					0.0091	0.0500	0.1523
N 7						0.0019	0.0137
N 8							0.0002

1.7.1.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

Component :	SAFETY VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1980/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9265450	0.9813690	0.9920420	0.9999520	0.9996840	2.3942E+01	4.5454E-01
2	4.44E-05	1.86E-02	7.96E-03	7.35E-02	3.16E-04	4.5454E-01	2.3942E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9383960	0.9783190	0.9840930	0.9985020	0.9993810	5.0844E+01	1.1268E+00
2	5.73E-04	1.65E-02	1.09E-02	5.18E-02	6.12E-04	8.5935E-01	5.1111E+01
3	1.82E-07	5.15E-03	1.04E-03	2.44E-02	6.80E-06	2.6743E-01	5.1703E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9425720	0.9759280	0.9798310	0.9959320	0.9990920	7.6968E+01	1.8985E+00
2	1.41E-03	1.61E-02	1.22E-02	4.40E-02	8.88E-04	1.2669E+00	7.7600E+01
3	6.53E-06	5.21E-03	1.97E-03	2.14E-02	2.04E-05	4.1103E-01	7.8455E+01
4	1.07E-08	2.80E-03	3.74E-04	1.40E-02	0.00E+00	2.2054E-01	7.8646E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9511790	0.9753510	0.9775090	0.9921570	0.9988160	1.4134E+02	3.5720E+00
2	2.96E-03	1.50E-02	1.28E-02	3.44E-02	1.14E-03	2.1693E+00	1.4274E+02
3	3.07E-04	6.61E-03	4.53E-03	2.01E-02	4.49E-05	9.5847E-01	1.4395E+02
4	1.50E-06	2.55E-03	8.40E-04	1.09E-02	0.00E+00	3.6878E-01	1.4454E+02
5	2.34E-20	5.21E-04	4.22E-07	3.02E-03	0.00E+00	7.5435E-02	1.4484E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9533710	0.9752330	0.9770260	0.9909780	0.9985580	1.7057E+02	4.3318E+00
2	2.89E-03	1.34E-02	1.16E-02	3.01E-02	1.37E-03	2.3439E+00	1.7256E+02
3	4.07E-04	6.29E-03	4.54E-03	1.82E-02	7.48E-05	1.1001E+00	1.7380E+02
4	2.75E-05	3.33E-03	1.72E-03	1.21E-02	0.00E+00	5.8178E-01	1.7432E+02
5	3.70E-09	1.24E-03	1.58E-04	6.25E-03	0.00E+00	2.1648E-01	1.7469E+02
6	1.03E-17	5.12E-04	1.50E-06	2.99E-03	0.00E+00	8.9555E-02	1.7481E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9575980	0.9750750	0.9762620	0.9885080	0.9983140	2.5887E+02	6.6173E+00
2	3.71E-03	1.25E-02	1.13E-02	2.53E-02	1.57E-03	3.3057E+00	2.6218E+02
3	8.09E-04	6.09E-03	4.91E-03	1.54E-02	1.14E-04	1.6174E+00	2.6387E+02
4	1.70E-04	3.63E-03	2.49E-03	1.10E-02	0.00E+00	9.6383E-01	2.6452E+02
5	9.26E-06	1.95E-03	9.18E-04	7.40E-03	0.00E+00	5.1822E-01	2.6497E+02
6	1.74E-10	6.86E-04	5.47E-05	3.62E-03	0.00E+00	1.8209E-01	2.6531E+02
7	0.00E+00	1.13E-04	2.01E-13	4.38E-04	0.00E+00	3.0005E-02	2.6546E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9595220	0.9754770	0.9764960	0.9879670	0.9980830	3.0234E+02	7.6006E+00
2	3.64E-03	1.15E-02	1.05E-02	2.29E-02	1.76E-03	3.5665E+00	3.0637E+02
3	8.32E-04	5.62E-03	4.60E-03	1.39E-02	1.61E-04	1.7411E+00	3.0820E+02
4	2.23E-04	3.52E-03	2.53E-03	1.02E-02	0.00E+00	1.0910E+00	3.0885E+02
5	3.62E-05	2.22E-03	1.28E-03	7.59E-03	0.00E+00	6.8763E-01	3.0925E+02
6	5.67E-07	1.16E-03	3.70E-04	5.00E-03	0.00E+00	3.5982E-01	3.0958E+02
7	1.56E-14	3.78E-04	5.36E-06	2.17E-03	0.00E+00	1.1715E-01	3.0982E+02
8	2.97E-38	1.21E-04	1.66E-11	5.56E-04	0.00E+00	3.7386E-02	3.0990E+02

ALPHA FACTOR AND MGL PARAMETERS

Component :	SAFETY VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1980/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 77

Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9996840	0.9993810	0.9990920	0.9988160	0.9985580	0.9983140	0.9980830
2	3.16E-04	6.12E-04	8.88E-04	1.14E-03	1.37E-03	1.57E-03	1.76E-03
3		6.80E-06	2.04E-05	4.49E-05	7.48E-05	1.14E-04	1.61E-04
4			0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5				0.00E+00	0.00E+00	0.00E+00	0.00E+00
6					0.00E+00	0.00E+00	0.00E+00
7						0.00E+00	0.00E+00
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	1.00E+00	9.99E-01	9.99E-01	9.99E-01	9.99E-01	9.98E-01	9.98E-01
Beta	3.16E-04	6.19E-04	9.08E-04	1.18E-03	1.44E-03	1.69E-03	1.92E-03
Gamma		1.10E-02	2.25E-02	3.79E-02	5.19E-02	6.75E-02	8.39E-02
Delta			0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Epsilon				0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mu					0.00E+00	0.00E+00	0.00E+00
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	9.63	14.44	19.25	24.06	28.88	33.69	38.50
N 1	0.1813	0.2628	0.3388	0.4096	0.4754	0.5367	0.5938
N 2	0.0031	0.0090	0.0174	0.0279	0.0402	0.0539	0.0688
N 3		0.0001	0.0004	0.0011	0.0022	0.0039	0.0063
N 4			0.0000	0.0000	0.0000	0.0000	0.0000
N 5				0.0000	0.0000	0.0000	0.0000
N 6					0.0000	0.0000	0.0000
N 7						0.0000	0.0000
N 8							0.0000

1.7.2 PWR Steam Generator Safety Valves

1.7.2.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	MAIN STEAM
Component :	SAFETY VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9032440	0.9655300	0.9743870	0.9974970	0.9627780	3.2067E+01	1.1448E+00
2	2.50E-03	3.45E-02	2.56E-02	9.68E-02	3.72E-02	1.1448E+00	3.2067E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9105630	0.9579030	0.9625660	0.9892890	0.9413030	6.1704E+01	2.7117E+00
2	6.97E-03	3.42E-02	2.95E-02	7.75E-02	4.97E-02	2.2013E+00	6.2214E+01
3	3.51E-05	7.92E-03	3.71E-03	3.01E-02	8.95E-03	5.1043E-01	6.3905E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9139230	0.9538440	0.9570100	0.9829250	0.9296880	9.0268E+01	4.3680E+00
2	8.99E-03	3.21E-02	2.88E-02	6.63E-02	5.05E-02	3.0362E+00	9.1600E+01
3	5.88E-04	1.08E-02	7.59E-03	3.19E-02	1.73E-02	1.0207E+00	9.3615E+01
4	4.92E-07	3.29E-03	8.55E-04	1.49E-02	2.56E-03	3.1114E-01	9.4325E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9297600	0.9581960	0.9600470	0.9802950	0.9238380	1.5696E+02	6.8478E+00
2	9.11E-03	2.56E-02	2.36E-02	4.85E-02	4.71E-02	4.1852E+00	1.5962E+02
3	1.92E-03	1.16E-02	9.63E-03	2.77E-02	2.15E-02	1.8913E+00	1.6192E+02
4	5.82E-05	4.06E-03	2.30E-03	1.40E-02	6.81E-03	6.6438E-01	1.6314E+02
5	2.55E-15	6.53E-04	5.73E-06	3.78E-03	7.26E-04	1.0694E-01	1.6370E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9317410	0.9576500	0.9591970	0.9782840	0.9211190	1.8843E+02	8.3328E+00
2	8.59E-03	2.30E-02	2.14E-02	4.28E-02	4.32E-02	4.5194E+00	1.9224E+02
3	2.31E-03	1.13E-02	9.73E-03	2.59E-02	2.21E-02	2.2312E+00	1.9453E+02
4	3.97E-04	5.76E-03	4.19E-03	1.65E-02	1.08E-02	1.1327E+00	1.9563E+02
5	7.19E-07	1.78E-03	5.51E-04	7.74E-03	2.62E-03	3.5088E-01	1.9641E+02
6	2.01E-16	5.01E-04	2.75E-06	2.92E-03	1.78E-04	9.8655E-02	1.9666E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9408820	0.9611410	0.9621990	0.9778000	0.9200580	2.7895E+02	1.1278E+01
2	8.20E-03	1.94E-02	1.83E-02	3.42E-02	4.00E-02	5.6149E+00	2.8461E+02
3	2.56E-03	9.80E-03	8.70E-03	2.08E-02	2.09E-02	2.8450E+00	2.8738E+02
4	8.57E-04	5.91E-03	4.82E-03	1.47E-02	1.27E-02	1.7156E+00	2.8851E+02
5	9.17E-05	2.89E-03	1.86E-03	9.20E-03	5.43E-03	8.3842E-01	2.8939E+02
6	5.71E-09	8.00E-04	1.20E-04	3.96E-03	8.47E-04	2.3209E-01	2.9000E+02
7	3.36E-44	1.10E-04	7.30E-13	4.50E-04	3.22E-05	3.1905E-02	2.9020E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9433350	0.9618710	0.9627830	0.9773020	0.9199030	3.2460E+02	1.2867E+01
2	7.77E-03	1.78E-02	1.68E-02	3.10E-02	3.74E-02	5.9900E+00	3.3148E+02
3	2.51E-03	9.04E-03	8.09E-03	1.88E-02	1.98E-02	3.0517E+00	3.3442E+02
4	9.49E-04	5.65E-03	4.71E-03	1.36E-02	1.23E-02	1.9080E+00	3.3556E+02
5	3.04E-04	3.67E-03	2.74E-03	1.02E-02	8.24E-03	1.2369E+00	3.3623E+02
6	6.78E-06	1.52E-03	7.06E-04	5.78E-03	2.28E-03	5.1212E-01	3.3696E+02
7	2.10E-13	3.88E-04	9.26E-06	2.19E-03	2.05E-04	1.3085E-01	3.3734E+02
8	4.17E-38	1.11E-04	1.68E-11	5.15E-04	3.00E-06	3.7586E-02	3.3743E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	MAIN STEAM
Component :	SAFETY VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 104
Total Number of Common-Cause Failure Events: 38

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9627780	0.9413030	0.9296880	0.9238380	0.9211190	0.9200580	0.9199030
2	3.72E-02	4.97E-02	5.05E-02	4.71E-02	4.32E-02	4.00E-02	3.74E-02
3		8.95E-03	1.73E-02	2.15E-02	2.21E-02	2.09E-02	1.98E-02
4			2.56E-03	6.81E-03	1.08E-02	1.27E-02	1.23E-02
5				7.26E-04	2.62E-03	5.43E-03	8.24E-03
6					1.78E-04	8.47E-04	2.28E-03
7						3.22E-05	2.05E-04
8							3.00E-06

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.63E-01	9.41E-01	9.30E-01	9.24E-01	9.21E-01	9.20E-01	9.20E-01
Beta	3.72E-02	5.87E-02	7.03E-02	7.62E-02	7.89E-02	7.99E-02	8.01E-02
Gamma		1.53E-01	2.82E-01	3.82E-01	4.52E-01	4.99E-01	5.33E-01
Delta			1.29E-01	2.59E-01	3.80E-01	4.77E-01	5.38E-01
Epsilon				9.63E-02	2.07E-01	3.31E-01	4.67E-01
Mu					6.34E-02	1.40E-01	2.32E-01
Upsilon						3.66E-02	8.36E-02
Sigma							1.44E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	13.32	19.99	26.65	33.31	39.97	46.64	53.30
N 1	4.6156	5.5725	6.2390	6.7768	7.2459	7.6658	8.0489
N 2	0.6934	1.3509	1.7867	2.0438	2.2157	2.3631	2.4923
N 3		0.2431	0.6101	0.9339	1.1333	1.2315	1.3169
N 4			0.0906	0.2956	0.5509	0.7518	0.8170
N 5				0.0315	0.1344	0.3202	0.5493
N 6					0.0091	0.0500	0.1523
N 7						0.0019	0.0137
N 8							0.0002

1.7.3 BWR Safety Relief Valves

1.7.3.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	MAIN STEAM
Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9621050	0.9862960	0.9896930	0.9988640	0.9896310	8.8783E+01	1.2336E+00
2	1.14E-03	1.37E-02	1.03E-02	3.79E-02	1.04E-02	1.2336E+00	8.8783E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9576040	0.9795200	0.9816190	0.9942560	0.9826810	1.4638E+02	3.0605E+00
2	4.16E-03	1.73E-02	1.52E-02	3.77E-02	1.55E-02	2.5913E+00	1.4685E+02
3	8.77E-06	3.14E-03	1.35E-03	1.23E-02	1.80E-03	4.6923E-01	1.4897E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9551370	0.9750950	0.9766080	0.9898930	0.9778210	2.0256E+02	5.1737E+00
2	6.50E-03	1.90E-02	1.75E-02	3.67E-02	1.82E-02	3.9500E+00	2.0378E+02
3	1.92E-04	4.48E-03	3.03E-03	1.37E-02	3.51E-03	9.3143E-01	2.0680E+02
4	1.18E-07	1.41E-03	3.29E-04	6.49E-03	4.83E-04	2.9224E-01	2.0744E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9560260	0.9728680	0.9738940	0.9861990	0.9743640	2.9656E+02	8.2705E+00
2	8.04E-03	1.88E-02	1.78E-02	3.31E-02	1.95E-02	5.7277E+00	2.9910E+02
3	1.01E-03	6.14E-03	5.10E-03	1.48E-02	4.96E-03	1.8718E+00	3.0296E+02
4	1.31E-05	1.85E-03	9.28E-04	6.79E-03	1.05E-03	5.6258E-01	3.0427E+02
5	2.02E-15	3.56E-04	3.37E-06	2.05E-03	1.79E-04	1.0844E-01	3.0472E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9557460	0.9713830	0.9722420	0.9841030	0.9719540	3.5510E+02	1.0461E+01
2	8.36E-03	1.82E-02	1.73E-02	3.09E-02	1.97E-02	6.6368E+00	3.5892E+02
3	1.56E-03	6.82E-03	5.94E-03	1.51E-02	6.34E-03	2.4930E+00	3.6307E+02
4	9.88E-05	2.48E-03	1.65E-03	7.69E-03	1.48E-03	9.0708E-01	3.6465E+02
5	1.61E-07	8.72E-04	2.35E-04	3.91E-03	4.65E-04	3.1888E-01	3.6524E+02
6	7.69E-16	2.89E-04	2.34E-06	1.67E-03	7.23E-05	1.0546E-01	3.6546E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9575220	0.9710180	0.9716590	0.9823200	0.9704660	4.7257E+02	1.4105E+01
2	8.36E-03	1.66E-02	1.60E-02	2.72E-02	1.90E-02	8.0969E+00	4.7858E+02
3	2.37E-03	7.43E-03	6.76E-03	1.48E-02	7.83E-03	3.6149E+00	4.8306E+02
4	3.06E-04	2.90E-03	2.25E-03	7.69E-03	1.74E-03	1.4089E+00	4.8527E+02
5	2.64E-05	1.45E-03	8.53E-04	4.93E-03	7.42E-04	7.0782E-01	4.8597E+02
6	4.83E-09	4.90E-04	7.77E-05	2.41E-03	2.21E-04	2.3849E-01	4.8644E+02
7	4.59E-38	7.77E-05	1.30E-11	3.61E-04	3.05E-05	3.7805E-02	4.8664E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9584660	0.9709850	0.9715460	0.9815960	0.9698460	5.4520E+02	1.6292E+01
2	7.81E-03	1.52E-02	1.46E-02	2.46E-02	1.73E-02	8.5376E+00	5.5295E+02
3	2.93E-03	7.95E-03	7.38E-03	1.49E-02	9.39E-03	4.4658E+00	5.5703E+02
4	4.08E-04	2.96E-03	2.39E-03	7.44E-03	1.96E-03	1.6602E+00	5.5983E+02
5	8.00E-05	1.72E-03	1.17E-03	5.20E-03	9.46E-04	9.6273E-01	5.6053E+02
6	2.53E-06	8.47E-04	3.68E-04	3.31E-03	3.97E-04	4.7532E-01	5.6102E+02
7	1.99E-12	2.65E-04	1.07E-05	1.46E-03	1.08E-04	1.4865E-01	5.6134E+02
8	3.18E-35	7.35E-05	5.29E-11	3.59E-04	1.34E-05	4.1286E-02	5.6145E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	MAIN STEAM
Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 404
 Total Number of Common-Cause Failure Events: 28

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9896310	0.9826810	0.9778210	0.9743640	0.9719540	0.9704660	0.9698460
2	1.04E-02	1.55E-02	1.82E-02	1.95E-02	1.97E-02	1.90E-02	1.73E-02
3		1.80E-03	3.51E-03	4.96E-03	6.34E-03	7.83E-03	9.39E-03
4			4.83E-04	1.05E-03	1.48E-03	1.74E-03	1.96E-03
5				1.79E-04	4.65E-04	7.42E-04	9.46E-04
6					7.23E-05	2.21E-04	3.97E-04
7						3.05E-05	1.08E-04
8							1.34E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.90E-01	9.83E-01	9.78E-01	9.74E-01	9.72E-01	9.71E-01	9.70E-01
Beta	1.04E-02	1.73E-02	2.22E-02	2.56E-02	2.81E-02	2.95E-02	3.02E-02
Gamma		1.04E-01	1.80E-01	2.41E-01	2.98E-01	3.58E-01	4.25E-01
Delta			1.21E-01	1.99E-01	2.41E-01	2.59E-01	2.67E-01
Epsilon				1.46E-01	2.67E-01	3.63E-01	4.28E-01
Mu					1.34E-01	2.53E-01	3.54E-01
Upsilon						1.22E-01	2.35E-01
Sigma							1.10E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	68.36	102.54	136.72	170.90	205.08	239.26	273.43
N 1	6.2919	7.6969	8.4623	8.7847	8.8084	8.6739	8.5182
N 2	0.7822	1.7409	2.7005	3.5863	4.3331	4.8451	5.0399
N 3		0.2019	0.5208	0.9144	1.3951	2.0014	2.7310
N 4			0.0717	0.1938	0.3253	0.4451	0.5692
N 5				0.0330	0.1024	0.1896	0.2751
N 6					0.0159	0.0564	0.1155
N 7						0.0078	0.0315
N 8							0.0039

1.7.3.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	MAIN STEAM
Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9315260	0.9822830	0.9920300	0.9999390	0.9976450	2.6670E+01	4.8104E-01
2	5.81E-05	1.77E-02	7.97E-03	6.85E-02	2.36E-03	4.8104E-01	2.6670E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9404160	0.9785590	0.9839400	0.9983000	0.9955080	5.4867E+01	1.2022E+00
2	7.25E-04	1.66E-02	1.13E-02	5.07E-02	4.38E-03	9.3265E-01	5.5137E+01
3	1.84E-07	4.81E-03	9.83E-04	2.27E-02	1.17E-04	2.6953E-01	5.5800E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9435290	0.9757820	0.9794430	0.9955180	0.9935830	8.2246E+01	2.0413E+00
2	1.76E-03	1.66E-02	1.30E-02	4.40E-02	6.08E-03	1.4016E+00	8.2886E+01
3	7.05E-06	4.97E-03	1.91E-03	2.03E-02	3.36E-04	4.1903E-01	8.3868E+01
4	1.00E-08	2.62E-03	3.50E-04	1.31E-02	4.00E-06	2.2064E-01	8.4067E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9512200	0.9749590	0.9770220	0.9916630	0.9918610	1.4784E+02	3.7971E+00
2	3.43E-03	1.57E-02	1.36E-02	3.50E-02	7.48E-03	2.3750E+00	1.4926E+02
3	3.14E-04	6.45E-03	4.45E-03	1.94E-02	6.41E-04	9.7737E-01	1.5066E+02
4	1.45E-06	2.44E-03	8.05E-04	1.04E-02	1.60E-05	3.6928E-01	1.5127E+02
5	2.23E-20	4.98E-04	4.03E-07	2.89E-03	0.00E+00	7.5435E-02	1.5156E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9529890	0.9745720	0.9762860	0.9903090	0.9903380	1.7825E+02	4.6508E+00
2	3.48E-03	1.44E-02	1.26E-02	3.11E-02	8.61E-03	2.6256E+00	1.8028E+02
3	4.32E-04	6.21E-03	4.53E-03	1.77E-02	1.02E-03	1.1360E+00	1.8177E+02
4	2.66E-05	3.19E-03	1.65E-03	1.16E-02	3.74E-05	5.8318E-01	1.8232E+02
5	3.54E-09	1.18E-03	1.51E-04	5.97E-03	0.00E+00	2.1648E-01	1.8268E+02
6	9.80E-18	4.90E-04	1.44E-06	2.86E-03	0.00E+00	8.9555E-02	1.8281E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9570230	0.9743820	0.9755280	0.9878440	0.9889980	2.6772E+02	7.0386E+00
2	4.30E-03	1.33E-02	1.22E-02	2.63E-02	9.47E-03	3.6643E+00	2.7109E+02
3	8.56E-04	6.10E-03	4.95E-03	1.53E-02	1.46E-03	1.6770E+00	2.7308E+02
4	1.66E-04	3.52E-03	2.41E-03	1.07E-02	7.35E-05	9.6703E-01	2.7379E+02
5	8.95E-06	1.89E-03	8.87E-04	7.15E-03	0.00E+00	5.1822E-01	2.7424E+02
6	1.68E-10	6.63E-04	5.29E-05	3.50E-03	0.00E+00	1.8209E-01	2.7458E+02
7	0.00E+00	1.09E-04	1.95E-13	4.24E-04	0.00E+00	3.0005E-02	2.7473E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9587160	0.9746300	0.9756130	0.9871920	0.9878300	3.1233E+02	8.1302E+00
2	4.29E-03	1.25E-02	1.15E-02	2.41E-02	1.01E-02	3.9995E+00	3.1646E+02
3	9.08E-04	5.72E-03	4.73E-03	1.39E-02	1.94E-03	1.8314E+00	3.1863E+02
4	2.20E-04	3.42E-03	2.46E-03	9.91E-03	1.25E-04	1.0972E+00	3.1936E+02
5	3.50E-05	2.15E-03	1.24E-03	7.34E-03	2.01E-06	6.8773E-01	3.1977E+02
6	5.48E-07	1.12E-03	3.58E-04	4.84E-03	0.00E+00	3.5982E-01	3.2010E+02
7	1.51E-14	3.66E-04	5.19E-06	2.09E-03	0.00E+00	1.1715E-01	3.2034E+02
8	2.87E-38	1.17E-04	1.61E-11	5.38E-04	0.00E+00	3.7386E-02	3.2042E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	MAIN STEAM
Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 67

Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9976450	0.9955080	0.9935830	0.9918610	0.9903380	0.9889980	0.9878300
2	2.36E-03	4.38E-03	6.08E-03	7.48E-03	8.61E-03	9.47E-03	1.01E-02
3		1.17E-04	3.36E-04	6.41E-04	1.02E-03	1.46E-03	1.94E-03
4			4.00E-06	1.60E-05	3.74E-05	7.35E-05	1.25E-04
5				0.00E+00	0.00E+00	0.00E+00	2.01E-06
6					0.00E+00	0.00E+00	0.00E+00
7						0.00E+00	0.00E+00
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.98E-01	9.96E-01	9.94E-01	9.92E-01	9.90E-01	9.89E-01	9.88E-01
Beta	2.36E-03	4.49E-03	6.42E-03	8.14E-03	9.66E-03	1.10E-02	1.22E-02
Gamma		2.60E-02	5.29E-02	8.07E-02	1.09E-01	1.39E-01	1.70E-01
Delta			1.18E-02	2.44E-02	3.54E-02	4.80E-02	6.12E-02
Epsilon				0.00E+00	0.00E+00	0.00E+00	1.59E-02
Mu					0.00E+00	0.00E+00	0.00E+00
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	12.18	18.27	24.36	30.45	36.55	42.64	48.73
N 1	0.3589	0.4560	0.5066	0.5164	0.4910	0.4353	0.3541
N 2	0.0296	0.0823	0.1521	0.2336	0.3219	0.4125	0.5018
N 3		0.0022	0.0084	0.0200	0.0381	0.0635	0.0966
N 4			0.0001	0.0005	0.0014	0.0032	0.0062
N 5				0.0000	0.0000	0.0000	0.0001
N 6					0.0000	0.0000	0.0000
N 7						0.0000	0.0000
N 8							0.0000

1.7.4 BWR Safety Valve

1.7.4.1 Fail to Open

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

1.7.4.2 Fail to Close

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

1.7.5 PWR Pressurizer Safety Valve

1.7.5.1 Fail to Open

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

1.7.5.2 Fail to Close

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

1.7.6 PORVs

1.7.6.1 Pooled PORVs

1.7.6.2 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
	RELIEF VALVE: SOLENOID OPERATED RELIEF VALVE: MOTOR OPERATED RELIEF VALVE: HYDRAULIC OPERATOR
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8909370	0.9187840	0.9197450	0.9433590	0.9161310	2.6713E+02	2.3613E+01
2	5.66E-02	8.12E-02	8.03E-02	1.09E-01	8.39E-02	2.3613E+01	2.6713E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8883730	0.9117990	0.9124360	0.9330590	0.9063200	3.9478E+02	3.8188E+01
2	4.20E-02	5.94E-02	5.87E-02	7.91E-02	6.28E-02	2.5713E+01	4.0726E+02
3	1.70E-02	2.88E-02	2.81E-02	4.31E-02	3.09E-02	1.2475E+01	4.2049E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9002070	0.9196770	0.9201680	0.9374800	0.9140660	5.2623E+02	4.5960E+01
2	2.67E-02	3.90E-02	3.84E-02	5.31E-02	4.10E-02	2.2297E+01	5.4989E+02
3	1.70E-02	2.71E-02	2.65E-02	3.91E-02	2.94E-02	1.5499E+01	5.5669E+02
4	7.19E-03	1.43E-02	1.37E-02	2.33E-02	1.55E-02	8.1637E+00	5.6403E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9127380	0.9288050	0.9291890	0.9435750	0.9208050	6.9579E+02	5.3334E+01
2	1.93E-02	2.86E-02	2.82E-02	3.93E-02	3.07E-02	2.1413E+01	7.2771E+02
3	1.35E-02	2.14E-02	2.09E-02	3.07E-02	2.39E-02	1.5998E+01	7.3313E+02
4	9.12E-03	1.58E-02	1.54E-02	2.40E-02	1.83E-02	1.1843E+01	7.3728E+02
5	1.89E-03	5.45E-03	5.01E-03	1.05E-02	6.37E-03	4.0799E+00	7.4504E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9187790	0.9330910	0.9334170	0.9462950	0.9257650	8.2944E+02	5.9477E+01
2	1.62E-02	2.40E-02	2.37E-02	3.30E-02	2.56E-02	2.1363E+01	8.6755E+02
3	1.03E-02	1.67E-02	1.63E-02	2.43E-02	1.85E-02	1.4833E+01	8.7408E+02
4	8.77E-03	1.47E-02	1.44E-02	2.19E-02	1.68E-02	1.3096E+01	8.7582E+02
5	4.55E-03	9.08E-03	8.71E-03	1.49E-02	1.06E-02	8.0679E+00	8.8085E+02
6	4.54E-04	2.38E-03	2.02E-03	5.54E-03	2.73E-03	2.1167E+00	8.8680E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9261910	0.9385970	0.9388680	0.9500880	0.9296930	1.0216E+03	6.6833E+01
2	1.44E-02	2.10E-02	2.07E-02	2.86E-02	2.28E-02	2.2819E+01	1.0656E+03
3	7.98E-03	1.31E-02	1.28E-02	1.92E-02	1.47E-02	1.4248E+01	1.0742E+03
4	7.02E-03	1.19E-02	1.16E-02	1.77E-02	1.39E-02	1.2914E+01	1.0755E+03
5	5.38E-03	9.71E-03	9.41E-03	1.51E-02	1.17E-02	1.0566E+01	1.0779E+03
6	1.94E-03	4.80E-03	4.50E-03	8.68E-03	5.88E-03	5.2249E+00	1.0832E+03
7	5.77E-05	9.75E-04	6.91E-04	2.86E-03	1.20E-03	1.0607E+00	1.0874E+03

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9302030	0.9415440	0.9417840	0.9520770	0.9329860	1.1687E+03	7.2559E+01
2	1.32E-02	1.92E-02	1.89E-02	2.60E-02	2.09E-02	2.3801E+01	1.2175E+03
3	6.75E-03	1.12E-02	1.09E-02	1.65E-02	1.25E-02	1.3869E+01	1.2274E+03
4	5.48E-03	9.52E-03	9.26E-03	1.45E-02	1.11E-02	1.1819E+01	1.2294E+03
5	5.20E-03	9.15E-03	8.89E-03	1.40E-02	1.10E-02	1.1363E+01	1.2299E+03
6	3.16E-03	6.37E-03	6.11E-03	1.05E-02	7.78E-03	7.9086E+00	1.2334E+03
7	7.58E-04	2.61E-03	2.34E-03	5.35E-03	3.21E-03	3.2338E+00	1.2380E+03
8	3.25E-06	4.55E-04	2.29E-04	1.67E-03	5.43E-04	5.6429E-01	1.2407E+03

ALPHA FACTOR AND MGL PARAMETERS

Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
	RELIEF VALVE: SOLENOID OPERATED RELIEF VALVE: MOTOR OPERATED RELIEF VALVE: HYDRAULIC OPERATOR
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 596
 Total Number of Common-Cause Failure Events: 99

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9161310	0.9063200	0.9140660	0.9208050	0.9257650	0.9296930	0.9329860
2	8.39E-02	6.28E-02	4.10E-02	3.07E-02	2.56E-02	2.28E-02	2.09E-02
3		3.09E-02	2.94E-02	2.39E-02	1.85E-02	1.47E-02	1.25E-02
4			1.55E-02	1.83E-02	1.68E-02	1.39E-02	1.11E-02
5				6.37E-03	1.06E-02	1.17E-02	1.10E-02
6					2.73E-03	5.88E-03	7.78E-03
7						1.20E-03	3.21E-03
8							5.43E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.16E-01	9.06E-01	9.14E-01	9.21E-01	9.26E-01	9.30E-01	9.33E-01
Beta	8.39E-02	9.37E-02	8.59E-02	7.92E-02	7.42E-02	7.03E-02	6.70E-02
Gamma		3.29E-01	5.23E-01	6.13E-01	6.55E-01	6.75E-01	6.88E-01
Delta			3.45E-01	5.07E-01	6.20E-01	6.90E-01	7.29E-01
Epsilon				2.59E-01	4.41E-01	5.74E-01	6.71E-01
Mu					2.05E-01	3.77E-01	5.12E-01
Upsilon						1.70E-01	3.26E-01
Sigma							1.45E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	211.72	317.58	423.45	529.31	635.17	741.03	846.89
N 1	41.2828	41.0613	45.4043	49.6145	53.0619	55.9731	58.5280
N 2	23.1617	24.8629	21.0473	19.2719	19.0597	19.5669	20.3030
N 3		12.2074	15.0879	15.0407	13.7351	12.6347	12.1345
N 4			7.9432	11.4740	12.5141	11.9500	10.7281
N 5				4.0045	7.8514	10.0473	10.6756
N 6					2.0271	5.0428	7.5488
N 7						1.0307	3.1166
N 8							0.5269

1.7.6.3 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
	RELIEF VALVE: SOLENOID OPERATED RELIEF VALVE: MOTOR OPERATED RELIEF VALVE: HYDRAULIC OPERATOR
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9497630	0.9793670	0.9829300	0.9967920	0.9814530	8.4956E+01	1.7898E+00
2	3.21E-03	2.06E-02	1.71E-02	5.02E-02	1.86E-02	1.7898E+00	8.4956E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9382670	0.9661430	0.9682890	0.9866910	0.9647910	1.3877E+02	4.8629E+00
2	1.16E-02	3.11E-02	2.89E-02	5.79E-02	3.39E-02	4.4607E+00	1.3917E+02
3	3.03E-06	2.80E-03	1.03E-03	1.16E-02	1.27E-03	4.0223E-01	1.4323E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9449040	0.9677410	0.9692910	0.9852770	0.9675210	1.9313E+02	6.4378E+00
2	7.40E-03	2.09E-02	1.93E-02	3.98E-02	2.08E-02	4.1656E+00	1.9540E+02
3	1.77E-03	9.96E-03	8.38E-03	2.36E-02	1.12E-02	1.9881E+00	1.9758E+02
4	9.15E-08	1.42E-03	3.18E-04	6.63E-03	4.53E-04	2.8414E-01	1.9928E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9519800	0.9699350	0.9709920	0.9842760	0.9694920	2.8562E+02	8.8533E+00
2	6.20E-03	1.61E-02	1.50E-02	2.97E-02	1.50E-02	4.7461E+00	2.8973E+02
3	2.59E-03	9.79E-03	8.70E-03	2.07E-02	1.11E-02	2.8826E+00	2.9159E+02
4	2.54E-04	3.80E-03	2.75E-03	1.09E-02	4.30E-03	1.1178E+00	2.9336E+02
5	1.38E-15	3.63E-04	3.16E-06	2.10E-03	1.80E-04	1.0684E-01	2.9437E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9548190	0.9708730	0.9717610	0.9839110	0.9711210	3.4289E+02	1.0287E+01
2	5.21E-03	1.35E-02	1.26E-02	2.49E-02	1.19E-02	4.7734E+00	3.4840E+02
3	2.36E-03	8.56E-03	7.65E-03	1.79E-02	9.27E-03	3.0220E+00	3.5016E+02
4	7.89E-04	5.09E-03	4.19E-03	1.25E-02	5.86E-03	1.7985E+00	3.5138E+02
5	1.43E-05	1.66E-03	8.64E-04	6.03E-03	1.79E-03	5.8768E-01	3.5259E+02
6	7.55E-16	2.98E-04	2.39E-06	1.73E-03	7.56E-05	1.0526E-01	3.5307E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9586280	0.9721060	0.9727680	0.9833230	0.9725630	4.5921E+02	1.3177E+01
2	5.09E-03	1.20E-02	1.13E-02	2.12E-02	9.99E-03	5.6612E+00	4.6673E+02
3	2.26E-03	7.32E-03	6.64E-03	1.47E-02	7.65E-03	3.4595E+00	4.6893E+02
4	1.10E-03	5.04E-03	4.36E-03	1.13E-02	5.87E-03	2.3794E+00	4.7001E+02
5	2.34E-04	2.69E-03	2.03E-03	7.40E-03	3.11E-03	1.2687E+00	4.7112E+02
6	4.71E-07	7.83E-04	2.59E-04	3.34E-03	7.80E-04	3.7009E-01	4.7202E+02
7	4.73E-38	8.00E-05	1.34E-11	3.71E-04	3.23E-05	3.7805E-02	4.7235E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9607510	0.9730460	0.9736190	0.9833780	0.9738710	5.3069E+02	1.4701E+01
2	4.66E-03	1.08E-02	1.02E-02	1.89E-02	8.66E-03	5.8745E+00	5.3952E+02
3	2.01E-03	6.44E-03	5.85E-03	1.29E-02	6.47E-03	3.5113E+00	5.4188E+02
4	1.09E-03	4.66E-03	4.07E-03	1.03E-02	5.29E-03	2.5433E+00	5.4285E+02
5	4.47E-04	3.12E-03	2.54E-03	7.79E-03	3.70E-03	1.7034E+00	5.4369E+02
6	4.31E-05	1.49E-03	9.44E-04	4.81E-03	1.65E-03	8.1342E-01	5.4458E+02
7	9.71E-10	3.91E-04	4.80E-05	1.98E-03	3.51E-04	2.1345E-01	5.4518E+02
8	3.27E-35	7.57E-05	5.45E-11	3.70E-04	1.42E-05	4.1286E-02	5.4535E+02

ALPHA FACTOR AND MGL PARAMETERS

Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
	RELIEF VALVE: SOLENOID OPERATED RELIEF VALVE: MOTOR OPERATED RELIEF VALVE: HYDRAULIC OPERATOR
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 132
 Total Number of Common-Cause Failure Events: 9

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9814530	0.9647910	0.9675210	0.9694920	0.9711210	0.9725630	0.9738710
2	1.86E-02	3.39E-02	2.08E-02	1.50E-02	1.19E-02	9.99E-03	8.66E-03
3		1.27E-03	1.12E-02	1.11E-02	9.27E-03	7.65E-03	6.47E-03
4			4.53E-04	4.30E-03	5.86E-03	5.87E-03	5.29E-03
5				1.80E-04	1.79E-03	3.11E-03	3.70E-03
6					7.56E-05	7.80E-04	1.65E-03
7						3.23E-05	3.51E-04
8							1.42E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.82E-01	9.65E-01	9.68E-01	9.70E-01	9.71E-01	9.73E-01	9.74E-01
Beta	1.86E-02	3.52E-02	3.25E-02	3.05E-02	2.89E-02	2.74E-02	2.61E-02
Gamma		3.60E-02	3.60E-01	5.10E-01	5.88E-01	6.36E-01	6.69E-01
Delta			3.88E-02	2.88E-01	4.55E-01	5.61E-01	6.30E-01
Epsilon				4.02E-02	2.41E-01	4.01E-01	5.19E-01
Mu					4.06E-02	2.07E-01	3.53E-01
Upsilon						3.98E-02	1.81E-01
Sigma							3.89E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	66.00	99.00	132.00	165.00	198.00	231.00	264.00
N 1	4.8247	3.6268	3.7530	3.7500	3.6757	3.5649	3.4365
N 2	1.3384	3.6103	2.9161	2.6047	2.4697	2.4094	2.3768
N 3		0.1349	1.5775	1.9252	1.9241	1.8460	1.7765
N 4			0.0636	0.7490	1.2167	1.4156	1.4523
N 5				0.0314	0.3712	0.7505	1.0158
N 6					0.0157	0.1880	0.4536
N 7						0.0078	0.0963
N 8							0.0039

1.7.7 PWR Steam Generator PORV

1.7.7.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	MAIN STEAM
Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
	RELIEF VALVE: SOLENOID OPERATED RELIEF VALVE: MOTOR OPERATED RELIEF VALVE: HYDRAULIC OPERATOR
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9345350	0.9558190	0.9568470	0.9735900	0.9551300	2.8105E+02	1.2991E+01
2	2.64E-02	4.42E-02	4.32E-02	6.55E-02	4.49E-02	1.2991E+01	2.8105E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9310000	0.9491680	0.9498410	0.9650470	0.9472680	4.2303E+02	2.2655E+01
2	2.06E-02	3.33E-02	3.26E-02	4.84E-02	3.43E-02	1.4847E+01	4.3084E+02
3	8.68E-03	1.75E-02	1.68E-02	2.88E-02	1.85E-02	7.8080E+00	4.3788E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9383840	0.9533960	0.9539060	0.9666810	0.9517530	5.6747E+02	2.7739E+01
2	1.39E-02	2.30E-02	2.24E-02	3.39E-02	2.32E-02	1.3673E+01	5.8154E+02
3	7.03E-03	1.39E-02	1.33E-02	2.26E-02	1.46E-02	8.2593E+00	5.8695E+02
4	4.19E-03	9.76E-03	9.21E-03	1.72E-02	1.04E-02	5.8068E+00	5.8940E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9458720	0.9582510	0.9586430	0.9692970	0.9560110	7.5038E+02	3.2692E+01
2	1.06E-02	1.75E-02	1.71E-02	2.59E-02	1.75E-02	1.3734E+01	7.6934E+02
3	5.99E-03	1.15E-02	1.10E-02	1.83E-02	1.21E-02	8.9709E+00	7.7410E+02
4	4.31E-03	9.09E-03	8.68E-03	1.53E-02	1.02E-02	7.1199E+00	7.7595E+02
5	9.60E-04	3.66E-03	3.25E-03	7.78E-03	4.21E-03	2.8675E+00	7.8021E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9498120	0.9607860	0.9611120	0.9706340	0.9589900	8.9758E+02	3.6635E+01
2	9.05E-03	1.49E-02	1.46E-02	2.20E-02	1.48E-02	1.3949E+01	9.2027E+02
3	4.77E-03	9.26E-03	8.91E-03	1.49E-02	9.58E-03	8.6523E+00	9.2556E+02
4	3.88E-03	8.00E-03	7.65E-03	1.33E-02	8.74E-03	7.4718E+00	9.2674E+02
5	2.16E-03	5.43E-03	5.08E-03	9.89E-03	6.16E-03	5.0752E+00	9.2914E+02
6	1.84E-04	1.59E-03	1.25E-03	4.15E-03	1.77E-03	1.4864E+00	9.3273E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9537750	0.9633390	0.9636110	0.9719840	0.9612410	1.1035E+03	4.1995E+01
2	8.37E-03	1.34E-02	1.32E-02	1.95E-02	1.33E-02	1.5395E+01	1.1301E+03
3	3.94E-03	7.62E-03	7.34E-03	1.23E-02	7.78E-03	8.7287E+00	1.1368E+03
4	3.17E-03	6.54E-03	6.25E-03	1.09E-02	7.14E-03	7.4869E+00	1.1380E+03
5	2.44E-03	5.48E-03	5.19E-03	9.48E-03	6.29E-03	6.2716E+00	1.1392E+03
6	8.92E-04	2.95E-03	2.67E-03	5.99E-03	3.50E-03	3.3833E+00	1.1421E+03
7	1.28E-05	6.37E-04	3.80E-04	2.13E-03	7.65E-04	7.2921E-01	1.1448E+03

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9561810	0.9649250	0.9651590	0.9728630	0.9630270	1.2642E+03	4.5954E+01
2	7.90E-03	1.25E-02	1.23E-02	1.79E-02	1.24E-02	1.6367E+01	1.2938E+03
3	3.37E-03	6.57E-03	6.32E-03	1.06E-02	6.61E-03	8.6022E+00	1.3016E+03
4	2.56E-03	5.41E-03	5.16E-03	9.11E-03	5.77E-03	7.0870E+00	1.3031E+03
5	2.28E-03	5.01E-03	4.76E-03	8.58E-03	5.65E-03	6.5602E+00	1.3036E+03
6	1.43E-03	3.69E-03	3.44E-03	6.80E-03	4.30E-03	4.8294E+00	1.3053E+03
7	3.09E-04	1.62E-03	1.37E-03	3.77E-03	1.93E-03	2.1205E+00	1.3080E+03
8	2.47E-07	2.96E-04	1.03E-04	1.24E-03	3.37E-04	3.8759E-01	1.3098E+03

ALPHA FACTOR AND MGL PARAMETERS

System :	MAIN STEAM
Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
	RELIEF VALVE: SOLENOID OPERATED RELIEF VALVE: MOTOR OPERATED RELIEF VALVE: HYDRAULIC OPERATOR
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
System :	MAIN STEAM
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 430
Total Number of Common-Cause Failure Events: 51

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9551300	0.9472680	0.9517530	0.9560110	0.9589900	0.9612410	0.9630270
2	4.49E-02	3.43E-02	2.32E-02	1.75E-02	1.48E-02	1.33E-02	1.24E-02
3		1.85E-02	1.46E-02	1.21E-02	9.58E-03	7.78E-03	6.61E-03
4			1.04E-02	1.02E-02	8.74E-03	7.14E-03	5.77E-03
5				4.21E-03	6.16E-03	6.29E-03	5.65E-03
6					1.77E-03	3.50E-03	4.30E-03
7						7.65E-04	1.93E-03
8							3.37E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.55E-01	9.47E-01	9.52E-01	9.56E-01	9.59E-01	9.61E-01	9.63E-01
Beta	4.49E-02	5.27E-02	4.83E-02	4.40E-02	4.10E-02	3.88E-02	3.70E-02
Gamma		3.50E-01	5.20E-01	6.02E-01	6.40E-01	6.57E-01	6.65E-01
Delta			4.16E-01	5.44E-01	6.35E-01	6.95E-01	7.31E-01
Epsilon				2.93E-01	4.76E-01	5.97E-01	6.79E-01
Mu					2.23E-01	4.04E-01	5.37E-01
Upsilon						1.79E-01	3.45E-01
Sigma							1.49E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	239.55	359.33	479.11	598.89	718.66	838.44	958.22
N 1	27.3710	27.5599	30.9850	34.6175	37.7064	40.3848	42.7336
N 2	12.5395	13.9966	12.4234	11.5926	11.6451	12.1435	12.8696
N 3		7.5407	7.8487	8.0135	7.5544	7.1152	6.8674
N 4			5.5863	6.7511	6.8900	6.5231	5.9960
N 5				2.7921	4.8587	5.7534	5.8726
N 6					1.3968	3.2012	4.4696
N 7						0.6992	2.0033
N 8							0.3502

1.7.7.2 Fail to Close

No Data. Check the Pooled Industry Distributions for less specific, but available data for the component and failure mode you are interested in.

PWR Pressurizer Power Operated Relief Valves

1.7.7.3 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	REACTOR COOLANT
Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
	RELIEF VALVE: SOLENOID OPERATED RELIEF VALVE: MOTOR OPERATED RELIEF VALVE: HYDRAULIC OPERATOR
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9149200	0.9448090	0.9463920	0.9692780	0.9427510	1.7617E+02	1.0291E+01
2	3.07E-02	5.52E-02	5.36E-02	8.51E-02	5.73E-02	1.0291E+01	1.7617E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9260780	0.9489820	0.9500190	0.9683540	0.9458610	2.7358E+02	1.4708E+01
2	1.89E-02	3.46E-02	3.35E-02	5.39E-02	3.64E-02	9.9759E+00	2.7831E+02
3	6.30E-03	1.64E-02	1.53E-02	3.03E-02	1.78E-02	4.7321E+00	2.8356E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9386210	0.9567910	0.9575700	0.9722950	0.9547290	3.7218E+02	1.6808E+01
2	8.81E-03	1.84E-02	1.76E-02	3.09E-02	1.80E-02	7.1730E+00	3.8182E+02
3	8.73E-03	1.83E-02	1.75E-02	3.07E-02	2.04E-02	7.1289E+00	3.8186E+02
4	1.49E-03	6.44E-03	5.62E-03	1.42E-02	6.93E-03	2.5057E+00	3.8648E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	REACTOR COOLANT
Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
	RELIEF VALVE: SOLENOID OPERATED RELIEF VALVE: MOTOR OPERATED RELIEF VALVE: HYDRAULIC OPERATOR
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 166

Total Number of Common-Cause Failure Events: 20

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9427510	0.9458610	0.9547290
2	5.73E-02	3.64E-02	1.80E-02
3		1.78E-02	2.04E-02
4			6.93E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.43E-01	9.46E-01	9.55E-01
Beta	5.73E-02	5.41E-02	4.53E-02
Gamma		3.29E-01	6.03E-01
Delta			2.54E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	154.42	231.63	308.84
N 1	7.6200	5.8045	5.9570
N 2	9.8400	9.1255	5.9235
N 3		4.4648	6.7183
N 4			2.2852

1.7.7.4 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	REACTOR COOLANT
Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
	RELIEF VALVE: SOLENOID OPERATED RELIEF VALVE: MOTOR OPERATED RELIEF VALVE: HYDRAULIC OPERATOR
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9536600	0.9857090	0.9910250	0.9996240	0.9917360	5.4128E+01	7.8474E-01
2	3.74E-04	1.43E-02	8.97E-03	4.63E-02	8.26E-03	7.8474E-01	5.4128E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9497490	0.9782260	0.9814170	0.9957950	0.9833330	9.5141E+01	2.1177E+00
2	3.10E-03	1.90E-02	1.58E-02	4.59E-02	1.67E-02	1.8504E+00	9.5408E+01
3	9.60E-08	2.75E-03	5.51E-04	1.30E-02	0.00E+00	2.6733E-01	9.6991E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9563290	0.9792650	0.9815240	0.9944850	0.9874480	1.3605E+02	2.8807E+00
2	1.89E-03	1.26E-02	1.03E-02	3.10E-02	6.28E-03	1.7495E+00	1.3718E+02
3	2.65E-04	6.56E-03	4.39E-03	2.02E-02	6.28E-03	9.1063E-01	1.3802E+02
4	6.03E-09	1.59E-03	2.11E-04	7.97E-03	0.00E+00	2.2054E-01	1.3871E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9614950	0.9793260	0.9807610	0.9922500	0.9899330	2.1520E+02	4.5430E+00
2	2.40E-03	1.09E-02	9.44E-03	2.43E-02	2.52E-03	2.3914E+00	2.1735E+02
3	7.45E-04	6.63E-03	5.21E-03	1.74E-02	5.03E-03	1.4574E+00	2.1829E+02
4	3.03E-05	2.82E-03	1.52E-03	1.00E-02	2.52E-03	6.1878E-01	2.1912E+02
5	1.54E-20	3.43E-04	2.78E-07	1.99E-03	0.00E+00	7.5435E-02	2.1967E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9641130	0.9800020	0.9811980	0.9917940	0.9915970	2.5921E+02	5.2894E+00
2	2.05E-03	9.18E-03	7.98E-03	2.04E-02	1.05E-03	2.4287E+00	2.6207E+02
3	6.36E-04	5.57E-03	4.38E-03	1.46E-02	3.15E-03	1.4729E+00	2.6303E+02
4	1.66E-04	3.62E-03	2.47E-03	1.10E-02	3.15E-03	9.5678E-01	2.6354E+02
5	4.20E-07	1.29E-03	3.84E-04	5.66E-03	1.05E-03	3.4148E-01	2.6416E+02
6	6.77E-18	3.39E-04	9.94E-07	1.98E-03	0.00E+00	8.9555E-02	2.6441E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9661840	0.9795620	0.9804190	0.9900040	0.9927890	3.6231E+02	7.5594E+00
2	2.67E-03	8.96E-03	8.09E-03	1.82E-02	4.51E-04	3.3143E+00	3.6656E+02
3	8.20E-04	5.04E-03	4.18E-03	1.22E-02	1.80E-03	1.8635E+00	3.6801E+02
4	3.49E-04	3.62E-03	2.77E-03	9.78E-03	2.70E-03	1.3388E+00	3.6853E+02
5	5.00E-05	2.08E-03	1.28E-03	6.83E-03	1.80E-03	7.6822E-01	3.6910E+02
6	8.73E-09	6.61E-04	1.11E-04	3.22E-03	4.51E-04	2.4459E-01	3.6963E+02
7	0.00E+00	8.11E-05	1.45E-13	3.15E-04	0.00E+00	3.0005E-02	3.6984E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9679390	0.9801320	0.9808710	0.9897930	0.9936830	4.2058E+02	8.5257E+00
2	2.57E-03	8.22E-03	7.47E-03	1.64E-02	1.98E-04	3.5290E+00	4.2558E+02
3	7.31E-04	4.41E-03	3.67E-03	1.06E-02	9.87E-04	1.8911E+00	4.2722E+02
4	3.43E-04	3.27E-03	2.54E-03	8.70E-03	1.97E-03	1.4035E+00	4.2770E+02
5	1.20E-04	2.33E-03	1.62E-03	6.97E-03	1.97E-03	1.0001E+00	4.2811E+02
6	5.59E-06	1.20E-03	5.63E-04	4.57E-03	9.87E-04	5.1612E-01	4.2859E+02
7	2.53E-12	3.46E-04	1.38E-05	1.91E-03	1.98E-04	1.4845E-01	4.2896E+02
8	2.14E-38	8.71E-05	1.20E-11	4.02E-04	0.00E+00	3.7386E-02	4.2907E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	REACTOR COOLANT
Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED
	RELIEF VALVE: SOLENOID OPERATED RELIEF VALVE: MOTOR OPERATED RELIEF VALVE: HYDRAULIC OPERATOR
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 59
Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9917360	0.9833330	0.9874480	0.9899330	0.9915970	0.9927890	0.9936830
2	8.26E-03	1.67E-02	6.28E-03	2.52E-03	1.05E-03	4.51E-04	1.98E-04
3		0.00E+00	6.28E-03	5.03E-03	3.15E-03	1.80E-03	9.87E-04
4			0.00E+00	2.52E-03	3.15E-03	2.70E-03	1.97E-03
5				0.00E+00	1.05E-03	1.80E-03	1.97E-03
6					0.00E+00	4.51E-04	9.87E-04
7						0.00E+00	1.98E-04
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.92E-01	9.83E-01	9.87E-01	9.90E-01	9.92E-01	9.93E-01	9.94E-01
Beta	8.26E-03	1.67E-02	1.26E-02	1.01E-02	8.40E-03	7.21E-03	6.32E-03
Gamma		0.00E+00	5.00E-01	7.50E-01	8.75E-01	9.38E-01	9.69E-01
Delta			0.00E+00	3.33E-01	5.71E-01	7.33E-01	8.39E-01
Epsilon				0.00E+00	2.50E-01	4.55E-01	6.15E-01
Mu					0.00E+00	2.00E-01	3.75E-01
Upsilon						0.00E+00	1.67E-01
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	39.33	59.00	78.67	98.33	118.00	137.67	157.33
N 1	0.6667	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.3333	1.0000	0.5000	0.2500	0.1250	0.0625	0.0313
N 3		0.0000	0.5000	0.5000	0.3750	0.2500	0.1563
N 4			0.0000	0.2500	0.3750	0.3750	0.3125
N 5				0.0000	0.1250	0.2500	0.3125
N 6					0.0000	0.0625	0.1563
N 7						0.0000	0.0313
N 8							0.0000

1.8 Main Steam Isolation Valves

1.8.1 PWR Main Steam Isolation Valves

1.8.1.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	MAIN STEAM
Component :	AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9176630	0.9616190	0.9660220	0.9905200	0.9596180	6.6054E+01	2.6364E+00
2	9.48E-03	3.84E-02	3.40E-02	8.23E-02	4.04E-02	2.6364E+00	6.6054E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9385210	0.9686500	0.9712800	0.9897760	0.9680190	1.1348E+02	3.6727E+00
2	2.75E-03	1.63E-02	1.36E-02	3.89E-02	1.32E-02	1.9054E+00	1.1525E+02
3	2.30E-03	1.51E-02	1.24E-02	3.70E-02	1.88E-02	1.7673E+00	1.1539E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9471410	0.9712380	0.9731270	0.9888880	0.9729060	1.6008E+02	4.7406E+00
2	2.77E-03	1.36E-02	1.16E-02	3.09E-02	9.33E-03	2.2345E+00	1.6259E+02
3	3.53E-04	6.28E-03	4.43E-03	1.85E-02	5.92E-03	1.0356E+00	1.6379E+02
4	1.02E-03	8.92E-03	7.03E-03	2.33E-02	1.18E-02	1.4705E+00	1.6335E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9547370	0.9732890	0.9745360	0.9875890	0.9757810	2.4485E+02	6.7196E+00
2	3.60E-03	1.26E-02	1.13E-02	2.58E-02	7.75E-03	3.1583E+00	2.4841E+02
3	8.12E-04	6.30E-03	5.05E-03	1.61E-02	4.79E-03	1.5858E+00	2.4998E+02
4	4.46E-04	5.07E-03	3.83E-03	1.39E-02	6.91E-03	1.2751E+00	2.5030E+02
5	4.87E-05	2.78E-03	1.63E-03	9.46E-03	4.77E-03	7.0044E-01	2.5087E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9577200	0.9742520	0.9752940	0.9872350	0.9777180	2.9442E+02	7.7809E+00
2	3.40E-03	1.12E-02	1.02E-02	2.26E-02	6.92E-03	3.3881E+00	2.9881E+02
3	8.33E-04	5.70E-03	4.66E-03	1.42E-02	3.99E-03	1.7237E+00	3.0048E+02
4	3.87E-04	4.28E-03	3.25E-03	1.17E-02	4.54E-03	1.2928E+00	3.0091E+02
5	1.55E-04	3.22E-03	2.22E-03	9.73E-03	4.84E-03	9.7428E-01	3.0123E+02
6	1.43E-06	1.33E-03	4.86E-04	5.52E-03	1.99E-03	4.0206E-01	3.0180E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9611530	0.9749490	0.9757080	0.9861460	0.9791620	4.0302E+02	1.0356E+01
2	3.91E-03	1.07E-02	9.89E-03	2.01E-02	6.35E-03	4.4087E+00	4.0897E+02
3	1.12E-03	5.45E-03	4.68E-03	1.24E-02	3.52E-03	2.2544E+00	4.1112E+02
4	4.71E-04	3.77E-03	3.01E-03	9.68E-03	3.26E-03	1.5579E+00	4.1182E+02
5	2.45E-04	2.98E-03	2.23E-03	8.29E-03	3.92E-03	1.2330E+00	4.1214E+02
6	3.26E-05	1.73E-03	1.02E-03	5.84E-03	2.93E-03	7.1529E-01	4.1266E+02
7	1.63E-10	4.51E-04	3.84E-05	2.37E-03	8.58E-04	1.8631E-01	4.1319E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9631480	0.9757260	0.9763880	0.9860560	0.9803150	4.6678E+02	1.1613E+01
2	3.77E-03	9.87E-03	9.20E-03	1.83E-02	5.90E-03	4.7217E+00	4.7367E+02
3	1.11E-03	5.02E-03	4.35E-03	1.12E-02	3.22E-03	2.4035E+00	4.7599E+02
4	4.52E-04	3.39E-03	2.73E-03	8.60E-03	2.56E-03	1.6232E+00	4.7677E+02
5	2.53E-04	2.74E-03	2.08E-03	7.46E-03	3.00E-03	1.3097E+00	4.7708E+02
6	9.92E-05	2.04E-03	1.41E-03	6.16E-03	2.98E-03	9.7752E-01	4.7742E+02
7	2.44E-06	9.64E-04	4.08E-04	3.81E-03	1.66E-03	4.6135E-01	4.7793E+02
8	6.98E-15	2.41E-04	3.19E-06	1.39E-03	3.76E-04	1.1549E-01	4.7828E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	MAIN STEAM
Component :	AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 84
Total Number of Common-Cause Failure Events: 5

Main Steam Isolation Valves
PWR Main Steam Isolation Valves
Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9596180	0.9680190	0.9729060	0.9757810	0.9777180	0.9791620	0.9803150
2	4.04E-02	1.32E-02	9.33E-03	7.75E-03	6.92E-03	6.35E-03	5.90E-03
3		1.88E-02	5.92E-03	4.79E-03	3.99E-03	3.52E-03	3.22E-03
4			1.18E-02	6.91E-03	4.54E-03	3.26E-03	2.56E-03
5				4.77E-03	4.84E-03	3.92E-03	3.00E-03
6					1.99E-03	2.93E-03	2.98E-03
7						8.58E-04	1.66E-03
8							3.76E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.60E-01	9.68E-01	9.73E-01	9.76E-01	9.78E-01	9.79E-01	9.80E-01
Beta	4.04E-02	3.20E-02	2.71E-02	2.42E-02	2.23E-02	2.08E-02	1.97E-02
Gamma		5.87E-01	6.56E-01	6.80E-01	6.89E-01	6.95E-01	7.01E-01
Delta			6.67E-01	7.09E-01	7.40E-01	7.57E-01	7.66E-01
Epsilon				4.08E-01	6.01E-01	7.03E-01	7.58E-01
Mu					2.92E-01	4.91E-01	6.26E-01
Upsilon						2.27E-01	4.06E-01
Sigma							1.85E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	49.41	74.12	98.82	123.53	148.24	172.94	197.65
N 1	2.5133	3.2150	3.8800	4.4543	4.9672	5.4395	5.8844
N 2	2.1850	1.0550	0.9850	1.0169	1.0844	1.1569	1.2240
N 3		1.5000	0.6250	0.6284	0.6258	0.6409	0.6687
N 4			1.2500	0.9063	0.7110	0.5941	0.5322
N 5				0.6250	0.7578	0.7148	0.6221
N 6					0.3125	0.5332	0.6177
N 7						0.1563	0.3442
N 8							0.0781

1.8.1.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	MAIN STEAM
Component :	AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8902850	0.9284820	0.9304530	0.9599400	0.9239340	1.3424E+02	1.0340E+01
2	4.01E-02	7.15E-02	6.96E-02	1.10E-01	7.61E-02	1.0340E+01	1.3424E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8916080	0.9228560	0.9241100	0.9498150	0.9134580	2.0687E+02	1.7293E+01
2	3.40E-02	5.70E-02	5.57E-02	8.45E-02	6.38E-02	1.2780E+01	2.1138E+02
3	7.52E-03	2.01E-02	1.87E-02	3.76E-02	2.27E-02	4.5127E+00	2.1965E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8988450	0.9252260	0.9261630	0.9483950	0.9147000	2.7903E+02	2.2551E+01
2	2.58E-02	4.31E-02	4.21E-02	6.39E-02	4.85E-02	1.2996E+01	2.8859E+02
3	1.09E-02	2.31E-02	2.21E-02	3.89E-02	2.71E-02	6.9791E+00	2.9460E+02
4	2.03E-03	8.54E-03	7.48E-03	1.87E-02	9.72E-03	2.5754E+00	2.9901E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9158300	0.9365510	0.9372500	0.9548950	0.9227660	3.9108E+02	2.6495E+01
2	1.66E-02	2.86E-02	2.79E-02	4.32E-02	3.30E-02	1.1945E+01	4.0563E+02
3	1.07E-02	2.06E-02	1.99E-02	3.32E-02	2.58E-02	8.6177E+00	4.0896E+02
4	4.28E-03	1.12E-02	1.05E-02	2.08E-02	1.45E-02	4.6875E+00	4.1289E+02
5	2.50E-04	2.98E-03	2.23E-03	8.26E-03	3.93E-03	1.2443E+00	4.1633E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9236720	0.9418710	0.9424610	0.9580470	0.9300200	4.6827E+02	2.8900E+01
2	1.14E-02	2.06E-02	2.00E-02	3.21E-02	2.26E-02	1.0262E+01	4.8691E+02
3	9.76E-03	1.85E-02	1.78E-02	2.94E-02	2.30E-02	9.1827E+00	4.8799E+02
4	4.98E-03	1.16E-02	1.10E-02	2.05E-02	1.48E-02	5.7716E+00	4.9140E+02
5	1.66E-03	6.06E-03	5.41E-03	1.27E-02	7.95E-03	3.0114E+00	4.9416E+02
6	2.02E-05	1.35E-03	7.68E-04	4.67E-03	1.66E-03	6.7206E-01	4.9650E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9335640	0.9486900	0.9491620	0.9622100	0.9356240	6.0443E+02	3.2691E+01
2	9.07E-03	1.64E-02	1.59E-02	2.54E-02	1.77E-02	1.0446E+01	6.2668E+02
3	7.17E-03	1.38E-02	1.33E-02	2.22E-02	1.77E-02	8.8000E+00	6.2832E+02
4	5.05E-03	1.08E-02	1.03E-02	1.83E-02	1.46E-02	6.8807E+00	6.3024E+02
5	2.45E-03	6.78E-03	6.27E-03	1.29E-02	9.36E-03	4.3187E+00	6.3280E+02
6	5.12E-04	3.02E-03	2.52E-03	7.24E-03	4.29E-03	1.9246E+00	6.3520E+02
7	9.71E-08	5.03E-04	1.36E-04	2.25E-03	7.16E-04	3.2061E-01	6.3680E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9383720	0.9520310	0.9524460	0.9642820	0.9401540	6.9570E+02	3.5054E+01
2	7.73E-03	1.41E-02	1.36E-02	2.19E-02	1.47E-02	1.0272E+01	7.2048E+02
3	5.56E-03	1.11E-02	1.06E-02	1.81E-02	1.38E-02	8.0935E+00	7.2266E+02
4	4.58E-03	9.68E-03	9.24E-03	1.63E-02	1.30E-02	7.0746E+00	7.2368E+02
5	2.85E-03	7.08E-03	6.64E-03	1.28E-02	9.75E-03	5.1737E+00	7.2558E+02
6	1.18E-03	4.22E-03	3.77E-03	8.77E-03	5.92E-03	3.0813E+00	7.2767E+02
7	1.20E-04	1.61E-03	1.18E-03	4.55E-03	2.30E-03	1.1761E+00	7.2958E+02
8	6.56E-11	2.50E-04	2.00E-05	1.32E-03	3.15E-04	1.8249E-01	7.3057E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	MAIN STEAM
Component :	AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 201
Total Number of Common-Cause Failure Events: 33

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.92239340	0.9134580	0.9147000	0.9227660	0.9300200	0.9356240	0.9401540
2	7.61E-02	6.38E-02	4.85E-02	3.30E-02	2.26E-02	1.77E-02	1.47E-02
3		2.27E-02	2.71E-02	2.58E-02	2.30E-02	1.77E-02	1.38E-02
4			9.72E-03	1.45E-02	1.48E-02	1.46E-02	1.30E-02
5				3.93E-03	7.95E-03	9.36E-03	9.75E-03
6					1.66E-03	4.29E-03	5.92E-03
7						7.16E-04	2.30E-03
8							3.15E-04

Main Steam Isolation Valves
PWR Main Steam Isolation Valves
Fail to Close

2003

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.24E-01	9.14E-01	9.15E-01	9.23E-01	9.30E-01	9.36E-01	9.40E-01
Beta	7.61E-02	8.65E-02	8.53E-02	7.72E-02	7.00E-02	6.44E-02	5.99E-02
Gamma		2.63E-01	4.32E-01	5.73E-01	6.77E-01	7.25E-01	7.54E-01
Delta			2.64E-01	4.17E-01	5.15E-01	6.21E-01	6.94E-01
Epsilon				2.13E-01	3.94E-01	4.97E-01	5.84E-01
Mu					1.73E-01	3.49E-01	4.67E-01
Upsilon						1.43E-01	3.07E-01
Sigma							1.21E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	104.42	156.62	208.83	261.04	313.25	365.45	417.66
N 1	15.6913	14.1074	12.8167	13.1692	13.8123	14.3393	14.7920
N 2	9.8885	11.9295	11.7463	9.8031	7.9580	7.1946	6.7740
N 3		4.2454	6.5685	7.6603	8.0848	7.1865	6.3587
N 4			2.3549	4.3187	5.1898	5.9169	5.9836
N 5				1.1689	2.7949	3.8005	4.4861
N 6					0.5825	1.7425	2.7215
N 7						0.2906	1.0589
N 8							0.1451

1.8.2 BWR Main Steam Isolation Valves

1.8.2.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	MAIN STEAM
Component :	AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9213770	0.9728420	0.9804290	0.9983550	0.9751090	3.7942E+01	1.0592E+00
2	1.64E-03	2.72E-02	1.96E-02	7.86E-02	2.49E-02	1.0592E+00	3.7942E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9312530	0.9696300	0.9738010	0.9937410	0.9692470	7.1100E+01	2.2269E+00
2	2.90E-03	2.19E-02	1.77E-02	5.51E-02	2.09E-02	1.6025E+00	7.1724E+01
3	9.59E-05	8.52E-03	4.65E-03	3.01E-02	9.90E-03	6.2443E-01	7.2703E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9374710	0.9689960	0.9718760	0.9906610	0.9699060	1.0356E+02	3.3135E+00
2	2.98E-03	1.78E-02	1.48E-02	4.25E-02	1.36E-02	1.8966E+00	1.0498E+02
3	4.54E-04	9.19E-03	6.36E-03	2.76E-02	1.20E-02	9.8203E-01	1.0589E+02
4	7.27E-06	4.07E-03	1.63E-03	1.64E-02	4.50E-03	4.3484E-01	1.0644E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9474660	0.9706720	0.9724060	0.9879550	0.9708670	1.7423E+02	5.2642E+00
2	4.20E-03	1.60E-02	1.42E-02	3.37E-02	1.22E-02	2.8627E+00	1.7663E+02
3	6.85E-04	7.32E-03	5.59E-03	1.99E-02	6.04E-03	1.3145E+00	1.7818E+02
4	2.00E-04	5.04E-03	3.36E-03	1.56E-02	9.07E-03	9.0448E-01	1.7859E+02
5	2.69E-10	1.02E-03	8.18E-05	5.37E-03	1.81E-03	1.8254E-01	1.7931E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9494600	0.9705010	0.9719400	0.9866220	0.9704630	2.0962E+02	6.3714E+00
2	4.77E-03	1.57E-02	1.42E-02	3.16E-02	1.54E-02	3.3857E+00	2.1261E+02
3	3.27E-04	5.08E-03	3.66E-03	1.47E-02	0.00E+00	1.0979E+00	2.1489E+02
4	3.46E-04	5.17E-03	3.75E-03	1.49E-02	7.60E-03	1.1175E+00	2.1487E+02
5	3.81E-05	2.99E-03	1.66E-03	1.05E-02	6.08E-03	6.4508E-01	2.1535E+02
6	1.18E-13	5.80E-04	1.14E-05	3.29E-03	5.07E-04	1.2526E-01	2.1587E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9539170	0.9710110	0.9720070	0.9847000	0.9692640	3.0394E+02	9.0740E+00
2	5.87E-03	1.52E-02	1.42E-02	2.81E-02	1.85E-02	4.7664E+00	3.0825E+02
3	6.82E-04	5.16E-03	4.15E-03	1.31E-02	0.00E+00	1.6135E+00	3.1140E+02
4	1.44E-04	3.08E-03	2.11E-03	9.33E-03	0.00E+00	9.6383E-01	3.1205E+02
5	3.53E-04	4.05E-03	3.06E-03	1.12E-02	9.17E-03	1.2682E+00	3.1175E+02
6	2.36E-06	1.38E-03	5.46E-04	5.58E-03	3.06E-03	4.3209E-01	3.1258E+02
7	0.00E+00	9.59E-05	1.71E-13	3.72E-04	0.00E+00	3.0005E-02	3.1298E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9552530	0.9710180	0.9718800	0.9838550	0.9675560	3.5330E+02	1.0545E+01
2	6.35E-03	1.52E-02	1.43E-02	2.70E-02	2.17E-02	5.5171E+00	3.5833E+02
3	7.02E-04	4.77E-03	3.90E-03	1.18E-02	1.07E-06	1.7349E+00	3.6211E+02
4	1.90E-04	3.00E-03	2.15E-03	8.70E-03	0.00E+00	1.0910E+00	3.6275E+02
5	3.08E-05	1.89E-03	1.09E-03	6.47E-03	0.00E+00	6.8763E-01	3.6316E+02
6	3.71E-04	3.74E-03	2.88E-03	1.00E-02	1.07E-02	1.3598E+00	3.6249E+02
7	1.33E-14	3.22E-04	4.57E-06	1.84E-03	0.00E+00	1.1715E-01	3.6373E+02
8	2.53E-38	1.03E-04	1.41E-11	4.74E-04	0.00E+00	3.7386E-02	3.6381E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	MAIN STEAM
Component :	AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 84
 Total Number of Common-Cause Failure Events: 5

Main Steam Isolation Valves
 BWR Main Steam Isolation Valves
 Fail to Open

2003

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9751090	0.9692470	0.9699060	0.9708670	0.9704630	0.9692640	0.9675560
2	2.49E-02	2.09E-02	1.36E-02	1.22E-02	1.54E-02	1.85E-02	2.17E-02
3		9.90E-03	1.20E-02	6.04E-03	0.00E+00	0.00E+00	1.07E-06
4			4.50E-03	9.07E-03	7.60E-03	0.00E+00	0.00E+00
5				1.81E-03	6.08E-03	9.17E-03	0.00E+00
6					5.07E-04	3.06E-03	1.07E-02
7						0.00E+00	0.00E+00
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.75E-01	9.69E-01	9.70E-01	9.71E-01	9.71E-01	9.69E-01	9.68E-01
Beta	2.49E-02	3.08E-02	3.01E-02	2.91E-02	2.95E-02	3.07E-02	3.24E-02
Gamma		3.22E-01	5.48E-01	5.81E-01	4.80E-01	3.98E-01	3.31E-01
Delta			2.73E-01	6.43E-01	1.00E+00	1.00E+00	1.00E+00
Epsilon				1.67E-01	4.64E-01	1.00E+00	1.00E+00
Mu					7.69E-02	2.50E-01	1.00E+00
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	22.11	33.16	44.21	55.26	66.32	77.37	88.42
N 1	1.7010	1.7994	1.9678	2.0990	2.0861	1.9289	1.6275
N 2	0.6078	0.7521	0.6471	0.7213	1.0820	1.5146	2.0194
N 3		0.3571	0.5714	0.3571	0.0000	0.0000	0.0001
N 4			0.2143	0.5357	0.5357	0.0000	0.0000
N 5				0.1071	0.4286	0.7500	0.0000
N 6					0.0357	0.2500	1.0000
N 7						0.0000	0.0000
N 8							0.0000

1.8.2.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	MAIN STEAM
Component :	AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9094500	0.9536060	0.9573950	0.9847930	0.9501070	7.5261E+01	3.6615E+00
2	1.52E-02	4.64E-02	4.26E-02	9.06E-02	4.99E-02	3.6615E+00	7.5261E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9198100	0.9533840	0.9556740	0.9791420	0.9467970	1.2516E+02	6.1198E+00
2	8.53E-03	2.70E-02	2.46E-02	5.35E-02	2.86E-02	3.5384E+00	1.2774E+02
3	4.71E-03	1.97E-02	1.73E-02	4.28E-02	2.46E-02	2.5814E+00	1.2870E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9216610	0.9505270	0.9521670	0.9737870	0.9419800	1.7322E+02	9.0157E+00
2	1.28E-02	3.03E-02	2.86E-02	5.36E-02	3.47E-02	5.5155E+00	1.7672E+02
3	4.51E-04	6.31E-03	4.62E-03	1.80E-02	6.02E-03	1.1506E+00	1.8109E+02
4	2.79E-03	1.29E-02	1.12E-02	2.89E-02	1.73E-02	2.3496E+00	1.7989E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9290670	0.9520710	0.9531790	0.9712990	0.9373470	2.5874E+02	1.3025E+01
2	1.49E-02	2.96E-02	2.84E-02	4.82E-02	3.89E-02	8.0305E+00	2.6374E+02
3	1.55E-03	7.94E-03	6.77E-03	1.83E-02	7.93E-03	2.1574E+00	2.6961E+02
4	4.46E-05	2.57E-03	1.50E-03	8.75E-03	2.18E-03	6.9898E-01	2.7107E+02
5	1.53E-03	7.87E-03	6.70E-03	1.82E-02	1.36E-02	2.1385E+00	2.6963E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9285370	0.9498760	0.9508000	0.9680720	0.9331170	3.0844E+02	1.6276E+01
2	1.65E-02	3.03E-02	2.93E-02	4.74E-02	4.20E-02	9.8354E+00	3.1488E+02
3	2.24E-03	8.67E-03	7.69E-03	1.85E-02	9.59E-03	2.8160E+00	3.2190E+02
4	2.16E-04	3.38E-03	2.43E-03	9.78E-03	2.87E-03	1.0967E+00	3.2362E+02
5	1.46E-06	1.25E-03	4.65E-04	5.18E-03	1.06E-03	4.0708E-01	3.2431E+02
6	1.25E-03	6.53E-03	5.55E-03	1.52E-02	1.13E-02	2.1209E+00	3.2260E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9337840	0.9517080	0.9523970	0.9672880	0.9294240	4.1672E+02	2.1145E+01
2	1.66E-02	2.82E-02	2.75E-02	4.24E-02	4.41E-02	1.2366E+01	4.2550E+02
3	3.11E-03	9.10E-03	8.36E-03	1.76E-02	1.15E-02	3.9823E+00	4.3388E+02
4	4.79E-04	3.66E-03	2.94E-03	9.32E-03	3.10E-03	1.6037E+00	4.3626E+02
5	6.58E-05	1.95E-03	1.27E-03	6.18E-03	1.63E-03	8.5572E-01	4.3701E+02
6	4.81E-05	1.81E-03	1.13E-03	5.88E-03	2.95E-03	7.9199E-01	4.3707E+02
7	4.36E-04	3.53E-03	2.81E-03	9.09E-03	7.33E-03	1.5456E+00	4.3632E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9342070	0.9509610	0.9515590	0.9656790	0.9263470	4.7976E+02	2.4740E+01
2	1.69E-02	2.78E-02	2.72E-02	4.08E-02	4.51E-02	1.4030E+01	4.9047E+02
3	3.87E-03	9.83E-03	9.19E-03	1.80E-02	1.38E-02	4.9604E+00	4.9954E+02
4	5.51E-04	3.56E-03	2.93E-03	8.73E-03	3.02E-03	1.7976E+00	5.0270E+02
5	1.61E-04	2.27E-03	1.66E-03	6.48E-03	1.97E-03	1.1468E+00	5.0335E+02
6	5.07E-05	1.65E-03	1.05E-03	5.26E-03	2.01E-03	8.3032E-01	5.0367E+02
7	2.10E-05	1.35E-03	7.71E-04	4.63E-03	2.41E-03	6.7975E-01	5.0382E+02
8	2.32E-04	2.57E-03	1.95E-03	7.02E-03	5.38E-03	1.2952E+00	5.0321E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	MAIN STEAM
Component :	AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 201
 Total Number of Common-Cause Failure Events: 28

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9501070	0.9467970	0.9419800	0.9373470	0.9331170	0.9294240	0.9263470
2	4.99E-02	2.86E-02	3.47E-02	3.89E-02	4.20E-02	4.41E-02	4.51E-02
3		2.46E-02	6.02E-03	7.93E-03	9.59E-03	1.15E-02	1.38E-02
4			1.73E-02	2.18E-03	2.87E-03	3.10E-03	3.02E-03
5				1.36E-02	1.06E-03	1.63E-03	1.97E-03
6					1.13E-02	2.95E-03	2.01E-03
7						7.33E-03	2.41E-03
8							5.38E-03

Main Steam Isolation Valves
 BWR Main Steam Isolation Valves
 Fail to Close

2003

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.50E-01	9.47E-01	9.42E-01	9.37E-01	9.33E-01	9.29E-01	9.26E-01
Beta	4.99E-02	5.32E-02	5.80E-02	6.27E-02	6.69E-02	7.06E-02	7.37E-02
Gamma		4.63E-01	4.02E-01	3.79E-01	3.72E-01	3.75E-01	3.88E-01
Delta			7.42E-01	6.66E-01	6.14E-01	5.67E-01	5.17E-01
Epsilon				8.62E-01	8.12E-01	7.94E-01	7.96E-01
Mu					9.14E-01	8.63E-01	8.33E-01
Upsilon						7.13E-01	7.95E-01
Sigma							6.91E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	51.60	77.41	103.21	129.01	154.81	180.62	206.42
N 1	9.5298	11.6067	12.6316	12.8553	12.4213	11.4594	10.0918
N 2	3.2101	2.6880	4.2660	5.8891	7.5317	9.1138	10.5324
N 3		2.3141	0.7400	1.2000	1.7181	2.3688	3.2256
N 4			2.1291	0.3302	0.5149	0.6399	0.7066
N 5				2.0631	0.1906	0.3375	0.4592
N 6					2.0313	0.6099	0.4705
N 7						1.5156	0.5626
N 8							1.2578

1.9 Emergency Power System

1.9.1 Emergency Diesel Generators

1.9.1.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	EMERGENCY POWER
Component :	EMERGENCY DIESEL GENERATOR
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9594570	0.9718300	0.9723930	0.9822860	0.9719040	5.4405E+02	1.5770E+01
2	1.77E-02	2.82E-02	2.76E-02	4.05E-02	2.81E-02	1.5770E+01	5.4405E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9586470	0.9690490	0.9694170	0.9781820	0.9690050	8.1656E+02	2.6080E+01
2	1.42E-02	2.17E-02	2.14E-02	3.06E-02	2.17E-02	1.8316E+01	8.2432E+02
3	4.54E-03	9.21E-03	8.83E-03	1.52E-02	9.31E-03	7.7643E+00	8.3488E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9611530	0.9699750	0.9702570	0.9778450	0.9700710	1.0888E+03	3.3703E+01
2	1.08E-02	1.65E-02	1.62E-02	2.32E-02	1.63E-02	1.8540E+01	1.1040E+03
3	5.58E-03	9.89E-03	9.60E-03	1.52E-02	1.01E-02	1.1099E+01	1.1114E+03
4	1.25E-03	3.62E-03	3.33E-03	6.98E-03	3.62E-03	4.0637E+00	1.1184E+03

ALPHA FACTOR AND MGL PARAMETERS

System :	EMERGENCY POWER
Component :	EMERGENCY DIESEL GENERATOR
Failure Mode :	FAIL TO RUN
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 660

Total Number of Common-Cause Failure Events: 62

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9719040	0.9690050	0.9700710
2	2.81E-02	2.17E-02	1.63E-02
3		9.31E-03	1.01E-02
4			3.62E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.72E-01	9.69E-01	9.70E-01
Beta	2.81E-02	3.10E-02	2.99E-02
Gamma		3.00E-01	4.57E-01
Delta			2.65E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	501.90	752.85	1003.80
N 1	28.0219	27.5669	27.6110
N 2	15.3190	17.4660	17.2901
N 3		7.4970	10.6883
N 4			3.8432

1.9.1.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	EMERGENCY POWER
Component :	EMERGENCY DIESEL GENERATOR
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9764530	0.9849520	0.9854330	0.9918010	0.9853080	6.5521E+02	1.0010E+01
2	8.20E-03	1.51E-02	1.46E-02	2.35E-02	1.47E-02	1.0010E+01	6.5521E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9741770	0.9816410	0.9819570	0.9880160	0.9820890	9.8611E+02	1.8443E+01
2	8.45E-03	1.39E-02	1.36E-02	2.05E-02	1.36E-02	1.4000E+01	9.9055E+02
3	1.62E-03	4.42E-03	4.10E-03	8.33E-03	4.32E-03	4.4430E+00	1.0001E+03

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9752370	0.9816460	0.9818820	0.9872390	0.9822640	1.3168E+03	2.4621E+01
2	6.65E-03	1.09E-02	1.06E-02	1.59E-02	1.04E-02	1.4550E+01	1.3269E+03
3	2.90E-03	5.86E-03	5.61E-03	9.65E-03	5.81E-03	7.8558E+00	1.3336E+03
4	3.32E-04	1.65E-03	1.41E-03	3.79E-03	1.56E-03	2.2151E+00	1.3392E+03

ALPHA FACTOR AND MGL PARAMETERS

System :	EMERGENCY POWER
Component :	EMERGENCY DIESEL GENERATOR
Failure Mode :	FAIL TO START
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 829
 Total Number of Common-Cause Failure Events: 42

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9853080	0.9820890	0.9822640
2	1.47E-02	1.36E-02	1.04E-02
3		4.32E-03	5.81E-03
4			1.56E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.85E-01	9.82E-01	9.82E-01
Beta	1.47E-02	1.79E-02	1.77E-02
Gamma		2.41E-01	4.15E-01
Delta			2.11E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	616.36	924.54	1232.71
N 1	24.7188	25.4284	26.6850
N 2	9.5589	13.1498	13.3003
N 3		4.1757	7.4452
N 4			1.9946

1.10 BWR Pressure Suppression

1.10.1 BWR Pressure Suppression Chamber Vacuum Breakers

1.10.1.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	CONTAINMENT VACUUM RELIEF
Component :	VACUUM BREAKER CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8314920	0.9338600	0.9466750	0.9922480	0.8642380	2.0500E+01	1.4519E+00
2	7.75E-03	6.61E-02	5.33E-02	1.69E-01	1.36E-01	1.4519E+00	2.0500E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8987540	0.9556710	0.9618910	0.9912940	0.9050580	4.5688E+01	2.1192E+00
2	2.83E-03	2.83E-02	2.20E-02	7.52E-02	4.75E-02	1.3519E+00	4.6455E+01
3	3.91E-04	1.61E-02	9.98E-03	5.24E-02	4.74E-02	7.6733E-01	4.7040E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9174350	0.9604900	0.9646280	0.9893760	0.9269320	7.0103E+01	2.8837E+00
2	2.46E-03	2.06E-02	1.64E-02	5.31E-02	1.84E-02	1.5025E+00	7.1484E+01
3	5.07E-04	1.25E-02	8.39E-03	3.84E-02	3.64E-02	9.1063E-01	7.2076E+01
4	1.84E-05	6.45E-03	2.80E-03	2.52E-02	1.82E-02	4.7054E-01	7.2516E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9385840	0.9668800	0.9691270	0.9875030	0.9405500	1.3277E+02	4.5480E+00
2	3.45E-03	1.65E-02	1.43E-02	3.74E-02	7.69E-03	2.2714E+00	1.3505E+02
3	9.32E-04	9.70E-03	7.45E-03	2.62E-02	2.22E-02	1.3324E+00	1.3599E+02
4	1.17E-04	5.42E-03	3.28E-03	1.80E-02	2.22E-02	7.4378E-01	1.3657E+02
5	1.54E-09	1.46E-03	1.53E-04	7.52E-03	7.39E-03	2.0044E-01	1.3712E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9428370	0.9680140	0.9698800	0.9868050	0.9498620	1.6030E+02	5.2968E+00
2	3.14E-03	1.43E-02	1.24E-02	3.20E-02	3.47E-03	2.3735E+00	1.6322E+02
3	7.98E-04	8.14E-03	6.26E-03	2.19E-02	1.25E-02	1.3480E+00	1.6425E+02
4	2.66E-04	5.78E-03	3.95E-03	1.75E-02	1.87E-02	9.5678E-01	1.6464E+02
5	7.61E-06	2.82E-03	1.21E-03	1.11E-02	1.24E-02	4.6648E-01	1.6513E+02
6	1.06E-11	9.18E-04	4.03E-05	5.05E-03	3.11E-03	1.5206E-01	1.6545E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	CONTAINMENT VACUUM RELIEF
Component :	VACUUM BREAKER CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 11
 Total Number of Common-Cause Failure Events: 2

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.8642380	0.9050580	0.9269320	0.9405500	0.9498620
2	1.36E-01	4.75E-02	1.84E-02	7.69E-03	3.47E-03
3		4.74E-02	3.64E-02	2.22E-02	1.25E-02
4			1.82E-02	2.22E-02	1.87E-02
5				7.39E-03	1.24E-02
6					3.11E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	8.64E-01	9.05E-01	9.27E-01	9.41E-01	9.50E-01
Beta	1.36E-01	9.49E-02	7.31E-02	5.95E-02	5.01E-02
Gamma		4.99E-01	7.48E-01	8.71E-01	9.31E-01
Delta			3.33E-01	5.71E-01	7.33E-01
Epsilon				2.50E-01	4.55E-01
Mu					2.00E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	6.29	9.43	12.57	15.71	18.86
N 1	0.0790	0.1170	0.1540	0.1900	0.2252
N 2	1.0005	0.5015	0.2530	0.1300	0.0698
N 3		0.5000	0.5000	0.3750	0.2501
N 4			0.2500	0.3750	0.3750
N 5				0.1250	0.2500
N 6					0.0625

1.11 AC Power Distribution Breakers

1.11.1 480 Vac Circuit Breakers

1.11.1.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	AC POWER DISTRIBUTION
Component :	480 V AC CIRCUIT BREAKERS
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8981730	0.9545220	0.9605060	0.9903860	0.9484860	4.7407E+01	2.2587E+00
2	9.61E-03	4.55E-02	3.95E-02	1.02E-01	5.15E-02	2.2587E+00	4.7407E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9148340	0.9555760	0.9589760	0.9846950	0.9450820	8.4552E+01	3.9308E+00
2	5.84E-03	2.67E-02	2.32E-02	5.94E-02	2.95E-02	2.3591E+00	8.6124E+01
3	2.28E-03	1.78E-02	1.43E-02	4.52E-02	2.55E-02	1.5717E+00	8.6911E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9147780	0.9501040	0.9524730	0.9773420	0.9339990	1.1979E+02	6.2909E+00
2	1.14E-02	3.25E-02	3.00E-02	6.19E-02	4.26E-02	4.0939E+00	1.2199E+02
3	2.52E-04	6.95E-03	4.57E-03	2.17E-02	6.96E-03	8.7593E-01	1.2521E+02
4	9.91E-04	1.05E-02	8.03E-03	2.84E-02	1.65E-02	1.3211E+00	1.2476E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9262790	0.9529770	0.9544610	0.9745970	0.9271470	1.9293E+02	9.5197E+00
2	1.28E-02	2.93E-02	2.78E-02	5.10E-02	4.62E-02	5.9307E+00	1.9652E+02
3	1.65E-03	9.59E-03	8.03E-03	2.29E-02	1.20E-02	1.9421E+00	2.0051E+02
4	2.83E-04	5.10E-03	3.59E-03	1.51E-02	8.08E-03	1.0314E+00	2.0142E+02
5	3.20E-05	3.04E-03	1.63E-03	1.08E-02	6.58E-03	6.1554E-01	2.0183E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9270130	0.9515700	0.9528050	0.9719000	0.9231310	2.3072E+02	1.1743E+01
2	1.28E-02	2.75E-02	2.63E-02	4.67E-02	4.51E-02	6.6764E+00	2.3579E+02
3	2.98E-03	1.16E-02	1.02E-02	2.46E-02	1.76E-02	2.8001E+00	2.3966E+02
4	2.98E-04	4.56E-03	3.29E-03	1.32E-02	5.40E-03	1.1056E+00	2.4136E+02
5	9.30E-05	3.32E-03	2.09E-03	1.07E-02	6.07E-03	8.0488E-01	2.4166E+02
6	6.55E-07	1.47E-03	4.61E-04	6.34E-03	2.74E-03	3.5556E-01	2.4211E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9388120	0.9579960	0.9588810	0.9741490	0.9298020	3.2860E+02	1.4408E+01
2	9.68E-03	2.05E-02	1.95E-02	3.44E-02	3.37E-02	7.0183E+00	3.3599E+02
3	3.45E-03	1.07E-02	9.77E-03	2.12E-02	1.84E-02	3.6705E+00	3.3934E+02
4	9.28E-04	5.55E-03	4.62E-03	1.33E-02	8.40E-03	1.9032E+00	3.4111E+02
5	1.79E-04	3.07E-03	2.17E-03	9.01E-03	4.78E-03	1.0524E+00	3.4196E+02
6	1.68E-05	1.76E-03	9.27E-04	6.30E-03	3.76E-03	6.0199E-01	3.4241E+02
7	1.61E-11	4.71E-04	2.55E-05	2.55E-03	1.18E-03	1.6141E-01	3.4285E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9432170	0.9604860	0.9612550	0.9751230	0.9354150	3.8169E+02	1.5703E+01
2	7.86E-03	1.70E-02	1.62E-02	2.88E-02	2.56E-02	6.7360E+00	3.9066E+02
3	3.45E-03	1.01E-02	9.25E-03	1.94E-02	1.79E-02	3.9973E+00	3.9340E+02
4	1.22E-03	5.79E-03	4.99E-03	1.31E-02	9.56E-03	2.3019E+00	3.9509E+02
5	3.33E-04	3.40E-03	2.61E-03	9.16E-03	5.24E-03	1.3512E+00	3.9604E+02
6	6.26E-05	2.08E-03	1.32E-03	6.65E-03	3.67E-03	8.2482E-01	3.9657E+02
7	8.39E-07	9.79E-04	3.44E-04	4.11E-03	2.15E-03	3.8895E-01	3.9700E+02
8	3.10E-16	2.58E-04	1.77E-06	1.50E-03	5.14E-04	1.0249E-01	3.9729E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AC POWER DISTRIBUTION
Component :	480 V AC CIRCUIT BREAKERS
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 118
 Total Number of Common-Cause Failure Events: 11

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9484860	0.9450820	0.9339990	0.9271470	0.9231310	0.9298020	0.9354150
2	5.15E-02	2.95E-02	4.26E-02	4.62E-02	4.51E-02	3.37E-02	2.56E-02
3		2.55E-02	6.96E-03	1.20E-02	1.76E-02	1.84E-02	1.79E-02
4			1.65E-02	8.08E-03	5.40E-03	8.40E-03	9.56E-03
5				6.58E-03	6.07E-03	4.78E-03	5.24E-03
6					2.74E-03	3.76E-03	3.67E-03
7						1.18E-03	2.15E-03
8							5.14E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.49E-01	9.45E-01	9.34E-01	9.27E-01	9.23E-01	9.30E-01	9.35E-01
Beta	5.15E-02	5.49E-02	6.60E-02	7.29E-02	7.69E-02	7.02E-02	6.46E-02
Gamma		4.64E-01	3.55E-01	3.66E-01	4.13E-01	5.20E-01	6.04E-01
Delta			7.03E-01	5.50E-01	4.47E-01	4.96E-01	5.42E-01
Epsilon				4.49E-01	6.20E-01	5.36E-01	5.48E-01
Mu					3.11E-01	5.08E-01	5.47E-01
Upsilon						2.38E-01	4.20E-01
Sigma							1.93E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	29.17	43.76	58.34	72.93	87.52	102.10	116.69
N 1	4.1062	4.6506	4.0711	3.1309	1.9854	1.8552	1.7446
N 2	1.8073	1.5087	2.8444	3.7893	4.3727	3.7665	3.2383
N 3		1.3044	0.4653	0.9847	1.7022	2.0570	2.2625
N 4			1.1006	0.6626	0.5238	0.9394	1.2109
N 5				0.5401	0.5884	0.5342	0.6636
N 6					0.2660	0.4199	0.4650
N 7						0.1314	0.2718
N 8							0.0651

1.11.1.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	AC POWER DISTRIBUTION
Component :	480 V AC CIRCUIT BREAKERS
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9389830	0.9703740	0.9733440	0.9916130	0.9705910	1.0084E+02	3.0787E+00
2	8.39E-03	2.96E-02	2.67E-02	6.10E-02	2.94E-02	3.0787E+00	1.0084E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9433060	0.9681470	0.9699750	0.9867370	0.9676240	1.6374E+02	5.3872E+00
2	5.87E-03	1.96E-02	1.77E-02	3.97E-02	1.87E-02	3.3137E+00	1.6581E+02
3	2.30E-03	1.23E-02	1.04E-02	2.86E-02	1.37E-02	2.0735E+00	1.6705E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9462920	0.9673890	0.9687200	0.9839520	0.9670890	2.2558E+02	7.6045E+00
2	6.56E-03	1.83E-02	1.69E-02	3.46E-02	1.73E-02	4.2583E+00	2.2893E+02
3	1.69E-03	8.96E-03	7.60E-03	2.09E-02	9.65E-03	2.0891E+00	2.3110E+02
4	4.62E-04	5.39E-03	4.06E-03	1.49E-02	5.96E-03	1.2571E+00	2.3193E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9505520	0.9677940	0.9687200	0.9818790	0.9662400	3.2517E+02	1.0821E+01
2	7.92E-03	1.80E-02	1.71E-02	3.13E-02	1.81E-02	6.0467E+00	3.2994E+02
3	1.51E-03	7.00E-03	6.04E-03	1.57E-02	6.46E-03	2.3501E+00	3.3364E+02
4	7.40E-04	5.11E-03	4.16E-03	1.27E-02	6.25E-03	1.7156E+00	3.3428E+02
5	3.84E-05	2.11E-03	1.24E-03	7.14E-03	2.94E-03	7.0864E-01	3.3528E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9512980	0.9671070	0.9678760	0.9802850	0.9651750	3.8917E+02	1.3236E+01
2	8.75E-03	1.82E-02	1.74E-02	3.03E-02	1.95E-02	7.3136E+00	3.9509E+02
3	1.28E-03	5.89E-03	5.10E-03	1.32E-02	4.96E-03	2.3710E+00	4.0004E+02
4	7.11E-04	4.52E-03	3.73E-03	1.10E-02	4.82E-03	1.8188E+00	4.0059E+02
5	2.51E-04	3.06E-03	2.29E-03	8.51E-03	3.95E-03	1.2309E+00	4.0118E+02
6	5.02E-06	1.25E-03	5.70E-04	4.78E-03	1.61E-03	5.0196E-01	4.0190E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9556760	0.9689830	0.9695700	0.9802790	0.9669300	5.1287E+02	1.6417E+01
2	7.76E-03	1.54E-02	1.48E-02	2.51E-02	1.64E-02	8.1513E+00	5.2114E+02
3	1.94E-03	6.41E-03	5.80E-03	1.30E-02	5.96E-03	3.3912E+00	5.2590E+02
4	7.39E-04	3.94E-03	3.33E-03	9.21E-03	3.76E-03	2.0848E+00	5.2720E+02
5	3.48E-04	2.88E-03	2.28E-03	7.45E-03	3.38E-03	1.5243E+00	5.2776E+02
6	8.16E-05	1.80E-03	1.22E-03	5.48E-03	2.58E-03	9.5229E-01	5.2834E+02
7	9.28E-08	5.91E-04	1.54E-04	2.67E-03	9.49E-04	3.1301E-01	5.2897E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9577820	0.9699490	0.9704600	0.9803680	0.9681460	5.9157E+02	1.8328E+01
2	7.14E-03	1.39E-02	1.34E-02	2.25E-02	1.48E-02	8.5011E+00	6.0140E+02
3	2.06E-03	6.24E-03	5.71E-03	1.22E-02	6.11E-03	3.8064E+00	6.0609E+02
4	7.54E-04	3.68E-03	3.16E-03	8.41E-03	3.41E-03	2.2465E+00	6.0765E+02
5	3.55E-04	2.66E-03	2.14E-03	6.75E-03	2.76E-03	1.6239E+00	6.0827E+02
6	1.55E-04	1.98E-03	1.47E-03	5.54E-03	2.49E-03	1.2047E+00	6.0869E+02
7	2.06E-05	1.16E-03	6.76E-04	3.92E-03	1.73E-03	7.0495E-01	6.0919E+02
8	4.24E-09	3.94E-04	6.34E-05	1.93E-03	5.98E-04	2.4029E-01	6.0966E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	AC POWER DISTRIBUTION
Component :	480 V AC CIRCUIT BREAKERS
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 232
 Total Number of Common-Cause Failure Events: 18

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9705910	0.9676240	0.9670890	0.9662400	0.9651750	0.9669300	0.9681460
2	2.94E-02	1.87E-02	1.73E-02	1.81E-02	1.95E-02	1.64E-02	1.48E-02
3		1.37E-02	9.65E-03	6.46E-03	4.96E-03	5.96E-03	6.11E-03
4			5.96E-03	6.25E-03	4.82E-03	3.76E-03	3.41E-03
5				2.94E-03	3.95E-03	3.38E-03	2.76E-03
6					1.61E-03	2.58E-03	2.49E-03
7						9.49E-04	1.73E-03
8							5.98E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.71E-01	9.68E-01	9.67E-01	9.66E-01	9.65E-01	9.67E-01	9.68E-01
Beta	2.94E-02	3.24E-02	3.29E-02	3.38E-02	3.48E-02	3.31E-02	3.19E-02
Gamma		4.23E-01	4.74E-01	4.63E-01	4.40E-01	5.03E-01	5.37E-01
Delta			3.82E-01	5.87E-01	6.77E-01	6.41E-01	6.43E-01
Epsilon				3.20E-01	5.36E-01	6.48E-01	6.90E-01
Mu					2.89E-01	5.11E-01	6.36E-01
Upsilon						2.69E-01	4.83E-01
Sigma							2.57E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	75.94	113.91	151.88	189.85	227.82	265.79	303.76
N 1	10.7703	13.6922	16.3171	18.4537	20.1420	22.4366	24.5617
N 2	2.6273	2.4633	3.0088	3.9053	5.0099	4.8995	5.0034
N 3		1.8062	1.6785	1.3927	1.2731	1.7777	2.0716
N 4			1.0366	1.3468	1.2370	1.1210	1.1555
N 5				0.6332	1.0144	1.0061	0.9363
N 6					0.4124	0.7702	0.8449
N 7						0.2830	0.5878
N 8							0.2029

1.11.2 4160 vac and 6.9Kva Distribution Circuit Breakers

1.11.2.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	AC POWER DISTRIBUTION
Component :	4160 V AC CIRCUIT BREAKERS
	6.9 KV AC CIRCUIT BREAKERS
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9093250	0.9653760	0.9727170	0.9962730	0.9633150	3.9140E+01	1.4038E+00
2	3.73E-03	3.46E-02	2.73E-02	9.07E-02	3.67E-02	1.4038E+00	3.9140E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9140620	0.9576830	0.9616900	0.9875980	0.9455760	7.1984E+01	3.1807E+00
2	7.88E-03	3.35E-02	2.94E-02	7.30E-02	4.40E-02	2.5163E+00	7.2648E+01
3	1.28E-04	8.84E-03	5.03E-03	3.05E-02	1.05E-02	6.6443E-01	7.4500E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9190960	0.9555250	0.9582960	0.9824950	0.9402910	1.0397E+02	4.8393E+00
2	7.82E-03	2.80E-02	2.51E-02	5.78E-02	3.62E-02	3.0408E+00	1.0577E+02
3	1.46E-03	1.32E-02	1.04E-02	3.47E-02	2.07E-02	1.4376E+00	1.0737E+02
4	1.67E-06	3.32E-03	1.07E-03	1.43E-02	2.83E-03	3.6094E-01	1.0845E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9343160	0.9605540	0.9622390	0.9810460	0.9407830	1.7430E+02	7.1578E+00
2	6.91E-03	2.08E-02	1.91E-02	4.07E-02	2.69E-02	3.7817E+00	1.7768E+02
3	2.68E-03	1.27E-02	1.10E-02	2.87E-02	2.20E-02	2.3027E+00	1.7916E+02
4	2.65E-04	5.40E-03	3.73E-03	1.63E-02	1.00E-02	9.7988E-01	1.8048E+02
5	4.11E-17	5.16E-04	2.02E-06	3.01E-03	2.97E-04	9.3535E-02	1.8136E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9369030	0.9606570	0.9620580	0.9796220	0.9408360	2.0932E+02	8.5724E+00
2	7.16E-03	1.98E-02	1.83E-02	3.73E-02	2.77E-02	4.3082E+00	2.1358E+02
3	1.13E-03	7.83E-03	6.38E-03	1.95E-02	8.40E-03	1.7059E+00	2.1619E+02
4	1.91E-03	9.84E-03	8.38E-03	2.27E-02	2.16E-02	2.1437E+00	2.1575E+02
5	3.25E-07	1.49E-03	4.13E-04	6.65E-03	1.50E-03	3.2508E-01	2.1757E+02
6	8.23E-18	4.11E-04	1.21E-06	2.40E-03	0.00E+00	8.9555E-02	2.1780E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9445170	0.9634070	0.9643870	0.9789580	0.9406760	3.0331E+02	1.1521E+01
2	7.84E-03	1.83E-02	1.73E-02	3.22E-02	2.99E-02	5.7525E+00	3.0908E+02
3	1.15E-03	6.38E-03	5.37E-03	1.51E-02	4.73E-03	2.0090E+00	3.1282E+02
4	1.20E-03	6.51E-03	5.50E-03	1.53E-02	1.30E-02	2.0483E+00	3.1278E+02
5	5.59E-04	4.76E-03	3.76E-03	1.24E-02	1.17E-02	1.4984E+00	3.1333E+02
6	1.50E-10	5.79E-04	4.63E-05	3.06E-03	2.39E-06	1.8229E-01	3.1465E+02
7	0.00E+00	9.53E-05	1.70E-13	3.70E-04	0.00E+00	3.0005E-02	3.1480E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9465020	0.9638500	0.9646960	0.9783250	0.9399710	3.5233E+02	1.3214E+01
2	8.14E-03	1.78E-02	1.70E-02	3.05E-02	3.19E-02	6.5166E+00	3.5903E+02
3	1.30E-03	6.24E-03	5.37E-03	1.42E-02	5.77E-03	2.2814E+00	3.6326E+02
4	3.69E-04	3.72E-03	2.86E-03	1.00E-02	2.84E-03	1.3597E+00	3.6419E+02
5	1.18E-03	5.97E-03	5.09E-03	1.37E-02	1.58E-02	2.1812E+00	3.6336E+02
6	3.82E-05	1.97E-03	1.17E-03	6.64E-03	3.81E-03	7.2082E-01	3.6482E+02
7	1.32E-14	3.21E-04	4.55E-06	1.84E-03	0.00E+00	1.1715E-01	3.6543E+02
8	2.51E-38	1.02E-04	1.41E-11	4.71E-04	0.00E+00	3.7386E-02	3.6551E+02

ALPHA FACTOR AND MGL PARAMETERS

System :		AC POWER DISTRIBUTION	
Component :		4160 V AC CIRCUIT BREAKERS	
	6.9 KV AC CIRCUIT BREAKERS	Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :		1985/01/01	
Data Version :		2003/12/31	

Total Number of Independent Failure Events: 88
 Total Number of Common-Cause Failure Events: 14

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9633150	0.9455760	0.9402910	0.9407830	0.9408360	0.9406760	0.9399710
2	3.67E-02	4.40E-02	3.62E-02	2.69E-02	2.77E-02	2.99E-02	3.19E-02
3		1.05E-02	2.07E-02	2.20E-02	8.40E-03	4.73E-03	5.77E-03
4			2.83E-03	1.00E-02	2.16E-02	1.30E-02	2.84E-03
5				2.97E-04	1.50E-03	1.17E-02	1.58E-02
6					0.00E+00	2.39E-06	3.81E-03
7						0.00E+00	0.00E+00
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.63E-01	9.46E-01	9.40E-01	9.41E-01	9.41E-01	9.41E-01	9.40E-01
Beta	3.67E-02	5.44E-02	5.97E-02	5.92E-02	5.92E-02	5.93E-02	6.00E-02
Gamma		1.93E-01	3.95E-01	5.46E-01	5.32E-01	4.96E-01	4.69E-01
Delta			1.20E-01	3.19E-01	7.33E-01	8.39E-01	7.95E-01
Epsilon				2.88E-02	6.50E-02	4.75E-01	8.74E-01
Mu					0.00E+00	2.04E-04	1.95E-01
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	20.21	30.31	40.41	50.52	60.62	70.72	80.83
N 1	4.7993	5.5331	6.1832	6.9089	7.4889	7.9457	8.2491
N 2	0.9524	1.6659	1.7913	1.6403	2.0045	2.5007	3.0189
N 3		0.3971	1.0270	1.3453	0.6080	0.3955	0.5466
N 4			0.1404	0.6111	1.5619	1.0845	0.2687
N 5				0.0181	0.1086	0.9802	1.4936
N 6					0.0000	0.0002	0.3610
N 7						0.0000	0.0000
N 8							0.0000

1.11.2.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :		AC POWER DISTRIBUTION	
Component :		4160 V AC CIRCUIT BREAKERS	
	6.9 KV AC CIRCUIT BREAKERS	Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :		1985/01/01	
Data Version :		2003/12/31	

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9686060	0.9900840	0.9935710	0.9996740	0.9944330	8.4297E+01	8.4424E-01
2	3.24E-04	9.92E-03	6.43E-03	3.14E-02	5.57E-03	8.4424E-01	8.4297E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9640700	0.9841610	0.9863670	0.9967200	0.9891720	1.4027E+02	2.2575E+00
2	2.44E-03	1.38E-02	1.16E-02	3.28E-02	1.07E-02	1.9710E+00	1.4056E+02
3	1.40E-07	2.01E-03	4.56E-04	9.33E-03	1.82E-04	2.8653E-01	1.4224E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9606750	0.9794510	0.9810350	0.9928110	0.9841980	1.9480E+02	4.0870E+00
2	5.17E-03	1.70E-02	1.54E-02	3.43E-02	1.53E-02	3.3825E+00	1.9550E+02
3	7.93E-06	2.43E-03	1.07E-03	9.43E-03	5.16E-04	4.8273E-01	1.9840E+02
4	4.53E-09	1.12E-03	1.50E-04	5.59E-03	8.60E-06	2.2174E-01	1.9867E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9595360	0.9758410	0.9769150	0.9884890	0.9794910	2.8695E+02	7.1041E+00
2	7.90E-03	1.88E-02	1.77E-02	3.34E-02	1.95E-02	5.5280E+00	2.8853E+02
3	2.60E-04	3.83E-03	2.78E-03	1.10E-02	9.70E-04	1.1259E+00	2.9293E+02
4	8.39E-07	1.27E-03	4.28E-04	5.41E-03	3.40E-05	3.7468E-01	2.9368E+02
5	1.21E-20	2.57E-04	2.10E-07	1.49E-03	5.76E-07	7.5535E-02	2.9398E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9576890	0.9731750	0.9740620	0.9856220	0.9750370	3.4337E+02	9.4649E+00
2	9.66E-03	2.03E-02	1.94E-02	3.39E-02	2.34E-02	7.1476E+00	3.4569E+02
3	4.25E-04	4.00E-03	3.11E-03	1.06E-02	1.52E-03	1.4124E+00	3.5142E+02
4	1.58E-05	1.70E-03	8.93E-04	6.11E-03	8.10E-05	5.9858E-01	3.5224E+02
5	1.87E-09	6.14E-04	7.83E-05	3.10E-03	1.45E-06	2.1678E-01	3.5262E+02
6	5.07E-18	2.54E-04	7.44E-07	1.48E-03	0.00E+00	8.9555E-02	3.5275E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9609290	0.9739940	0.9746590	0.9847890	0.9762640	4.5985E+02	1.2278E+01
2	8.13E-03	1.65E-02	1.58E-02	2.71E-02	1.87E-02	7.7671E+00	4.6436E+02
3	1.50E-03	5.88E-03	5.20E-03	1.26E-02	4.83E-03	2.7777E+00	4.6935E+02
4	1.10E-04	2.12E-03	1.47E-03	6.35E-03	1.59E-04	1.0020E+00	4.7113E+02
5	5.26E-06	1.10E-03	5.18E-04	4.17E-03	4.15E-06	5.1922E-01	4.7161E+02
6	9.79E-11	3.86E-04	3.08E-05	2.04E-03	0.00E+00	1.8209E-01	4.7195E+02
7	0.00E+00	6.36E-05	1.13E-13	2.46E-04	0.00E+00	3.0005E-02	4.7210E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9628010	0.9747420	0.9753190	0.9847140	0.9772430	5.3146E+02	1.3771E+01
2	6.97E-03	1.42E-02	1.36E-02	2.34E-02	1.54E-02	7.7177E+00	5.3751E+02
3	2.05E-03	6.53E-03	5.93E-03	1.30E-02	6.65E-03	3.5589E+00	5.4167E+02
4	2.13E-04	2.37E-03	1.79E-03	6.48E-03	7.25E-04	1.2900E+00	5.4394E+02
5	2.09E-05	1.27E-03	7.31E-04	4.33E-03	9.11E-06	6.9013E-01	5.4454E+02
6	3.24E-07	6.60E-04	2.11E-04	2.84E-03	7.29E-07	3.6002E-01	5.4487E+02
7	8.85E-15	2.15E-04	3.05E-06	1.23E-03	0.00E+00	1.1715E-01	5.4511E+02
8	1.68E-38	6.86E-05	9.43E-12	3.16E-04	0.00E+00	3.7386E-02	5.4519E+02

ALPHA FACTOR AND MGL PARAMETERS

System :		AC POWER DISTRIBUTION	
Component :		4160 V AC CIRCUIT BREAKERS	
	6.9 KV AC CIRCUIT BREAKERS	Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :		1985/01/01	
Data Version :		2003/12/31	

Total Number of Independent Failure Events: 279
 Total Number of Common-Cause Failure Events: 21

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9944330	0.9891720	0.9841980	0.9794910	0.9750370	0.9762640	0.9772430
2	5.57E-03	1.07E-02	1.53E-02	1.95E-02	2.34E-02	1.87E-02	1.54E-02
3		1.82E-04	5.16E-04	9.70E-04	1.52E-03	4.83E-03	6.65E-03
4			8.60E-06	3.40E-05	8.10E-05	1.59E-04	7.25E-04
5				5.76E-07	1.45E-06	4.15E-06	9.11E-06
6					0.00E+00	0.00E+00	7.29E-07
7						0.00E+00	0.00E+00
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.94E-01	9.89E-01	9.84E-01	9.80E-01	9.75E-01	9.76E-01	9.77E-01
Beta	5.57E-03	1.08E-02	1.58E-02	2.05E-02	2.50E-02	2.37E-02	2.28E-02
Gamma		1.69E-02	3.32E-02	4.90E-02	6.41E-02	2.10E-01	3.24E-01
Delta			1.64E-02	3.44E-02	5.16E-02	3.26E-02	9.96E-02
Epsilon				1.67E-02	1.75E-02	2.55E-02	1.34E-02
Mu					0.00E+00	0.00E+00	7.41E-02
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	62.00	93.00	124.00	155.00	186.00	217.00	248.00
N 1	8.1661	11.1286	13.4161	15.0769	16.1547	18.2134	20.2131
N 2	0.3928	1.1206	2.1330	3.3866	4.8439	4.5153	4.2200
N 3		0.0192	0.0721	0.1685	0.3145	1.1642	1.8241
N 4			0.0012	0.0059	0.0168	0.0382	0.1990
N 5				0.0001	0.0003	0.0010	0.0025
N 6					0.0000	0.0000	0.0002
N 7						0.0000	0.0000
N 8							0.0000

Batteries

No Voltage/Amperage Output

1.12 DC Power System - Batteries, Chargers, and Breakers

1.12.1 Batteries

1.12.1.1 No Voltage/Amperage Output

ALPHA FACTOR DISTRIBUTIONS

System :	DC POWER
Component :	BATTERY
Failure Mode :	NO VOLTAGE/AMPERAGE OUTPUT
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9775670	0.9918100	0.9937960	0.9992720	0.9941570	1.5471E+02	1.2776E+00
2	7.26E-04	8.19E-03	6.21E-03	2.24E-02	5.84E-03	1.2776E+00	1.5471E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9745820	0.9877960	0.9890770	0.9966190	0.9909370	2.4537E+02	3.0314E+00
2	2.29E-03	9.99E-03	8.71E-03	2.21E-02	7.73E-03	2.4816E+00	2.4592E+02
3	1.41E-05	2.21E-03	1.09E-03	8.21E-03	1.34E-03	5.4983E-01	2.4785E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9747290	0.9864080	0.9873530	0.9948620	0.9902390	3.3526E+02	4.6197E+00
2	2.52E-03	9.02E-03	8.08E-03	1.88E-02	6.48E-03	3.0672E+00	3.3681E+02
3	2.80E-04	3.55E-03	2.64E-03	9.94E-03	2.84E-03	1.2069E+00	3.3867E+02
4	3.64E-07	1.02E-03	3.07E-04	4.44E-03	4.46E-04	3.4564E-01	3.3953E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9751360	0.9852800	0.9859600	0.9930940	0.9903390	4.6342E+02	6.9236E+00
2	2.82E-03	8.34E-03	7.66E-03	1.62E-02	5.10E-03	3.9246E+00	4.6642E+02
3	8.29E-04	4.43E-03	3.75E-03	1.04E-02	3.21E-03	2.0821E+00	4.6826E+02
4	4.17E-05	1.66E-03	1.03E-03	5.42E-03	1.17E-03	7.7898E-01	4.6957E+02
5	4.92E-13	2.93E-04	8.77E-06	1.64E-03	1.79E-04	1.3794E-01	4.7021E+02

Batteries

No Voltage/Amperage Output

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9763530	0.9854860	0.9860530	0.9926750	0.9906820	5.5644E+02	8.1949E+00
2	2.43E-03	7.08E-03	6.51E-03	1.37E-02	4.05E-03	3.9995E+00	5.6064E+02
3	9.03E-04	4.18E-03	3.61E-03	9.40E-03	3.01E-03	2.3593E+00	5.6228E+02
4	2.00E-04	2.27E-03	1.71E-03	6.22E-03	1.66E-03	1.2788E+00	5.6336E+02
5	1.41E-06	7.73E-04	3.09E-04	3.12E-03	5.25E-04	4.3648E-01	5.6420E+02
6	1.88E-14	2.14E-04	3.54E-06	1.22E-03	7.47E-05	1.2086E-01	5.6451E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	DC POWER
Component :	BATTERY
Failure Mode :	NO VOLTAGE/AMPERAGE OUTPUT
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 198

Total Number of Common-Cause Failure Events: 11

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9941570	0.9909370	0.9902390	0.9903390	0.9906820
2	5.84E-03	7.73E-03	6.48E-03	5.10E-03	4.05E-03
3		1.34E-03	2.84E-03	3.21E-03	3.01E-03
4			4.46E-04	1.17E-03	1.66E-03
5				1.79E-04	5.25E-04
6					7.47E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.94E-01	9.91E-01	9.90E-01	9.90E-01	9.91E-01
Beta	5.84E-03	9.06E-03	9.76E-03	9.66E-03	9.32E-03
Gamma		1.48E-01	3.36E-01	4.73E-01	5.66E-01
Delta			1.36E-01	2.96E-01	4.29E-01
Epsilon				1.32E-01	2.65E-01
Mu					1.25E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	136.08	204.12	272.16	340.21	408.25
N 1	4.4959	5.1127	5.7163	6.3435	6.9824
N 2	0.8262	1.6312	1.8177	1.7832	1.6958
N 3		0.2825	0.7963	1.1247	1.2614
N 4			0.1251	0.4102	0.6970
N 5				0.0625	0.2200
N 6					0.0313

1.12.2 Battery Chargers

1.12.2.1 No Voltage/Amperage Output

ALPHA FACTOR DISTRIBUTIONS

System :	DC POWER
Component :	BATTERY CHARGER
Failure Mode :	NO VOLTAGE/AMPERAGE OUTPUT
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9832840	0.9915760	0.9923240	0.9973140	0.9923670	4.2638E+02	3.6223E+00
2	2.69E-03	8.42E-03	7.68E-03	1.67E-02	7.63E-03	3.6223E+00	4.2638E+02

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9764000	0.9849610	0.9854490	0.9918480	0.9858620	6.4615E+02	9.8656E+00
2	7.43E-03	1.41E-02	1.36E-02	2.24E-02	1.35E-02	9.2159E+00	6.4680E+02
3	1.30E-05	9.90E-04	5.51E-04	3.46E-03	6.18E-04	6.4973E-01	6.5537E+02

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9772270	0.9846160	0.9849780	0.9907520	0.9857960	8.6684E+02	1.3544E+01
2	5.76E-03	1.08E-02	1.04E-02	1.71E-02	1.00E-02	9.4893E+00	8.7090E+02
3	1.34E-03	4.16E-03	3.79E-03	8.25E-03	3.96E-03	3.6628E+00	8.7672E+02
4	4.03E-07	4.45E-04	1.58E-04	1.86E-03	2.09E-04	3.9204E-01	8.7999E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9782460	0.9846610	0.9849450	0.9901210	0.9863190	1.1258E+03	1.7538E+01
2	4.90E-03	8.94E-03	8.66E-03	1.40E-02	7.90E-03	1.0223E+01	1.1331E+03
3	1.82E-03	4.53E-03	4.24E-03	8.20E-03	4.12E-03	5.1742E+00	1.1382E+03
4	3.00E-04	1.72E-03	1.44E-03	4.10E-03	1.56E-03	1.9670E+00	1.1414E+03
5	1.77E-11	1.52E-04	1.04E-05	8.10E-04	9.58E-05	1.7344E-01	1.1432E+03

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9789800	0.9847920	0.9850300	0.9898010	0.9864900	1.3488E+03	2.0829E+01
2	4.54E-03	8.07E-03	7.83E-03	1.24E-02	7.14E-03	1.1048E+01	1.3586E+03
3	1.70E-03	4.06E-03	3.82E-03	7.23E-03	3.64E-03	5.5536E+00	1.3641E+03
4	5.86E-04	2.17E-03	1.93E-03	4.56E-03	1.95E-03	2.9691E+00	1.3667E+03
5	5.36E-05	8.12E-04	5.86E-04	2.34E-03	7.32E-04	1.1124E+00	1.3685E+03
6	5.29E-13	1.06E-04	3.94E-06	5.88E-04	4.58E-05	1.4556E-01	1.3695E+03

ALPHA FACTOR AND MGL PARAMETERS

System :	DC POWER
Component :	BATTERY CHARGER
Failure Mode :	NO VOLTAGE/AMPERAGE OUTPUT
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 1001
 Total Number of Common-Cause Failure Events: 39

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9923670	0.9858620	0.9857960	0.9863190	0.9864900
2	7.63E-03	1.35E-02	1.00E-02	7.90E-03	7.14E-03
3		6.18E-04	3.96E-03	4.12E-03	3.64E-03
4			2.09E-04	1.56E-03	1.95E-03
5				9.58E-05	7.32E-04
6					4.58E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.92E-01	9.86E-01	9.86E-01	9.86E-01	9.87E-01
Beta	7.63E-03	1.41E-02	1.42E-02	1.37E-02	1.35E-02
Gamma		4.37E-02	2.94E-01	4.23E-01	4.71E-01
Delta			5.01E-02	2.87E-01	4.28E-01
Epsilon				5.78E-02	2.85E-01
Mu					5.88E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	390.25	585.38	780.51	975.63	1170.76
N 1	21.9943	24.6259	28.9471	33.2698	36.8708
N 2	3.1709	8.3655	8.2398	8.0817	8.7440
N 3		0.3824	3.2522	4.2168	4.4557
N 4			0.1715	1.5982	2.3873
N 5				0.0980	0.8959
N 6					0.0560

1.12.3 DC Power Distribution Circuit Breakers

1.12.3.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	DC POWER
Component :	DC DISTRIBUTION CIRCUIT BREAKERS
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8568490	0.9332250	0.9407410	0.9838530	0.9108810	3.5424E+01	2.5347E+00
2	1.61E-02	6.68E-02	5.93E-02	1.43E-01	8.91E-02	2.5347E+00	3.5424E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8904130	0.9418640	0.9459930	0.9791990	0.9106340	6.6711E+01	4.1177E+00
2	6.47E-03	3.14E-02	2.71E-02	7.11E-02	4.10E-02	2.2254E+00	6.8603E+01
3	4.50E-03	2.67E-02	2.24E-02	6.37E-02	4.84E-02	1.8923E+00	6.8936E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9009160	0.9427340	0.9455960	0.9747780	0.9078980	9.6809E+01	5.8806E+00
2	9.38E-03	3.16E-02	2.87E-02	6.42E-02	4.61E-02	3.2495E+00	9.9440E+01
3	3.59E-04	8.87E-03	5.95E-03	2.73E-02	1.15E-02	9.1063E-01	1.0178E+02
4	2.46E-03	1.68E-02	1.37E-02	4.14E-02	3.45E-02	1.7205E+00	1.0097E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9285680	0.9565750	0.9583220	0.9786230	0.9249390	1.6616E+02	7.5430E+00
2	6.22E-03	2.00E-02	1.82E-02	4.00E-02	2.50E-02	3.4747E+00	1.7023E+02
3	1.40E-03	9.76E-03	7.95E-03	2.43E-02	1.39E-02	1.6955E+00	1.7201E+02
4	1.77E-04	5.00E-03	3.28E-03	1.57E-02	9.38E-03	8.6878E-01	1.7283E+02
5	1.03E-03	8.66E-03	6.86E-03	2.24E-02	2.68E-02	1.5040E+00	1.7220E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9358530	0.9602690	0.9617300	0.9796860	0.9366490	2.0035E+02	8.2895E+00
2	4.43E-03	1.53E-02	1.38E-02	3.14E-02	1.41E-02	3.1926E+00	2.0545E+02
3	1.71E-03	9.57E-03	8.06E-03	2.26E-02	1.42E-02	1.9970E+00	2.0664E+02
4	1.95E-04	4.49E-03	3.04E-03	1.37E-02	5.62E-03	9.3668E-01	2.0770E+02
5	6.10E-05	3.39E-03	1.99E-03	1.15E-02	7.76E-03	7.0628E-01	2.0793E+02
6	7.84E-04	6.98E-03	5.48E-03	1.83E-02	2.17E-02	1.4569E+00	2.0718E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9464920	0.9652880	0.9663020	0.9806230	0.9452070	2.9364E+02	1.0559E+01
2	4.22E-03	1.26E-02	1.16E-02	2.47E-02	8.12E-03	3.8444E+00	3.0036E+02
3	1.90E-03	8.23E-03	7.18E-03	1.82E-02	1.22E-02	2.5038E+00	3.0170E+02
4	5.16E-04	4.72E-03	3.69E-03	1.25E-02	6.47E-03	1.4359E+00	3.0276E+02
5	6.35E-05	2.55E-03	1.58E-03	8.36E-03	3.53E-03	7.7592E-01	3.0342E+02
6	2.90E-05	2.15E-03	1.20E-03	7.49E-03	6.47E-03	6.5439E-01	3.0355E+02
7	4.30E-04	4.42E-03	3.39E-03	1.19E-02	1.80E-02	1.3449E+00	3.0285E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9505440	0.9674090	0.9682880	0.9812800	0.9517260	3.4211E+02	1.1526E+01
2	3.71E-03	1.10E-02	1.01E-02	2.14E-02	4.77E-03	3.8928E+00	3.4974E+02
3	1.66E-03	7.14E-03	6.24E-03	1.57E-02	9.54E-03	2.5251E+00	3.5111E+02
4	6.76E-04	4.78E-03	3.88E-03	1.19E-02	7.22E-03	1.6888E+00	3.5195E+02
5	1.14E-04	2.64E-03	1.79E-03	8.10E-03	2.99E-03	9.3513E-01	3.5270E+02
6	1.74E-05	1.72E-03	9.19E-04	6.16E-03	3.01E-03	6.0942E-01	3.5303E+02
7	1.17E-05	1.60E-03	8.10E-04	5.88E-03	5.43E-03	5.6695E-01	3.5307E+02
8	3.41E-04	3.70E-03	2.81E-03	1.01E-02	1.53E-02	1.3073E+00	3.5233E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	DC POWER
Component :	DC DISTRIBUTION CIRCUIT BREAKERS
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 69
 Total Number of Common-Cause Failure Events: 4

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9108810	0.9106340	0.9078980	0.9249390	0.9366490	0.9452070	0.9517260
2	8.91E-02	4.10E-02	4.61E-02	2.50E-02	1.41E-02	8.12E-03	4.77E-03
3		4.84E-02	1.15E-02	1.39E-02	1.42E-02	1.22E-02	9.54E-03
4			3.45E-02	9.38E-03	5.62E-03	6.47E-03	7.22E-03
5				2.68E-02	7.76E-03	3.53E-03	2.99E-03
6					2.17E-02	6.47E-03	3.01E-03
7						1.80E-02	5.43E-03
8							1.53E-02

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.11E-01	9.11E-01	9.08E-01	9.25E-01	9.37E-01	9.45E-01	9.52E-01
Beta	8.91E-02	8.94E-02	9.21E-02	7.51E-02	6.34E-02	5.48E-02	4.83E-02
Gamma		5.42E-01	5.00E-01	6.67E-01	7.78E-01	8.52E-01	9.01E-01
Delta			7.50E-01	7.23E-01	7.11E-01	7.39E-01	7.81E-01
Epsilon				7.41E-01	8.40E-01	8.12E-01	7.88E-01
Mu					7.36E-01	8.74E-01	8.88E-01
Upsilon						7.36E-01	8.73E-01
Sigma							7.38E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	19.71	29.57	39.43	49.29	59.14	69.00	78.86
N 1	1.5833	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	2.0833	1.3750	2.0000	1.3333	0.8889	0.5926	0.3951
N 3		1.6250	0.5000	0.7381	0.8991	0.8903	0.7903
N 4			1.5000	0.5000	0.3549	0.4721	0.5978
N 5				1.4286	0.4898	0.2577	0.2475
N 6					1.3673	0.4723	0.2496
N 7						1.3149	0.4498
N 8							1.2699

1.12.3.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	DC POWER
Component :	DC DISTRIBUTION CIRCUIT BREAKERS
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9402580	0.9835770	0.9915240	0.9998760	0.9941170	3.4121E+01	5.6974E-01
2	1.26E-04	1.64E-02	8.47E-03	5.97E-02	5.88E-03	5.6974E-01	3.4121E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9437200	0.9784010	0.9829400	0.9975600	0.9888330	6.5806E+01	1.4527E+00
2	1.32E-03	1.75E-02	1.30E-02	4.90E-02	1.08E-02	1.1754E+00	6.6083E+01
3	2.10E-07	4.12E-03	8.87E-04	1.93E-02	3.33E-04	2.7733E-01	6.6981E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9446580	0.9747360	0.9778640	0.9941160	0.9843730	9.6553E+01	2.5026E+00
2	2.96E-03	1.85E-02	1.53E-02	4.47E-02	1.46E-02	1.8298E+00	9.7226E+01
3	1.01E-05	4.55E-03	1.89E-03	1.81E-02	1.00E-03	4.5043E-01	9.8605E+01
4	9.47E-09	2.25E-03	3.05E-04	1.13E-02	4.52E-05	2.2234E-01	9.8833E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9509900	0.9737610	0.9756010	0.9902510	0.9815080	1.6546E+02	4.4585E+00
2	4.67E-03	1.73E-02	1.54E-02	3.63E-02	1.61E-02	2.9368E+00	1.6698E+02
3	3.81E-04	6.29E-03	4.49E-03	1.84E-02	2.25E-03	1.0688E+00	1.6885E+02
4	1.54E-06	2.22E-03	7.53E-04	9.41E-03	1.70E-04	3.7718E-01	1.6954E+02
5	2.33E-20	4.46E-04	3.73E-07	2.59E-03	6.06E-06	7.5735E-02	1.6984E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9521850	0.9730180	0.9745480	0.9886390	0.9791610	1.9915E+02	5.5224E+00
2	4.83E-03	1.62E-02	1.46E-02	3.28E-02	1.70E-02	3.3104E+00	2.0136E+02
3	5.78E-04	6.34E-03	4.82E-03	1.73E-02	3.38E-03	1.2978E+00	2.0338E+02
4	2.93E-05	2.96E-03	1.58E-03	1.06E-02	4.16E-04	6.0638E-01	2.0407E+02
5	3.53E-09	1.07E-03	1.38E-04	5.37E-03	2.87E-05	2.1818E-01	2.0445E+02
6	9.09E-18	4.38E-04	1.30E-06	2.56E-03	1.69E-06	8.9655E-02	2.0458E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9559620	0.9729330	0.9739750	0.9863300	0.9773180	2.9185E+02	8.1193E+00
2	5.48E-03	1.48E-02	1.38E-02	2.78E-02	1.75E-02	4.4516E+00	2.9552E+02
3	1.08E-03	6.39E-03	5.33E-03	1.53E-02	4.40E-03	1.9162E+00	2.9805E+02
4	1.81E-04	3.39E-03	2.37E-03	1.01E-02	7.50E-04	1.0154E+00	2.9895E+02
5	8.74E-06	1.75E-03	8.29E-04	6.59E-03	8.00E-05	5.2372E-01	2.9945E+02
6	1.58E-10	6.08E-04	4.88E-05	3.21E-03	4.36E-06	1.8239E-01	2.9979E+02
7	0.00E+00	1.00E-04	1.78E-13	3.88E-04	0.00E+00	3.0005E-02	2.9994E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9574150	0.9730270	0.9739240	0.9855700	0.9758600	3.3969E+02	9.4164E+00
2	5.45E-03	1.40E-02	1.30E-02	2.56E-02	1.75E-02	4.8715E+00	3.4424E+02
3	1.20E-03	6.15E-03	5.24E-03	1.42E-02	5.28E-03	2.1483E+00	3.4696E+02
4	2.54E-04	3.38E-03	2.49E-03	9.54E-03	1.14E-03	1.1803E+00	3.4793E+02
5	3.51E-05	2.01E-03	1.17E-03	6.82E-03	1.66E-04	7.0063E-01	3.4841E+02
6	5.18E-07	1.03E-03	3.31E-04	4.45E-03	1.53E-05	3.6102E-01	3.4875E+02
7	1.41E-14	3.36E-04	4.79E-06	1.92E-03	1.28E-06	1.1725E-01	3.4899E+02
8	2.63E-38	1.07E-04	1.47E-11	4.94E-04	0.00E+00	3.7386E-02	3.4907E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	DC POWER
Component :	DC DISTRIBUTION CIRCUIT BREAKERS
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 39

Total Number of Common-Cause Failure Events: 3

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9941170	0.9888330	0.9843730	0.9815080	0.9791610	0.9773180	0.9758600
2	5.88E-03	1.08E-02	1.46E-02	1.61E-02	1.70E-02	1.75E-02	1.75E-02
3		3.33E-04	1.00E-03	2.25E-03	3.38E-03	4.40E-03	5.28E-03
4			4.52E-05	1.70E-04	4.16E-04	7.50E-04	1.14E-03
5				6.06E-06	2.87E-05	8.00E-05	1.66E-04
6					1.69E-06	4.36E-06	1.53E-05
7						0.00E+00	1.28E-06
8							0.00E+00

DC Power Distribution Circuit Breakers

Fail to Close

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.94E-01	9.89E-01	9.84E-01	9.82E-01	9.79E-01	9.77E-01	9.76E-01
Beta	5.88E-03	1.12E-02	1.56E-02	1.85E-02	2.08E-02	2.27E-02	2.41E-02
Gamma		2.99E-02	6.69E-02	1.31E-01	1.84E-01	2.31E-01	2.74E-01
Delta			4.33E-02	7.24E-02	1.17E-01	1.59E-01	2.00E-01
Epsilon				3.45E-02	6.82E-02	1.01E-01	1.38E-01
Mu					5.56E-02	5.17E-02	9.09E-02
Upsilon						0.00E+00	7.69E-02
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	18.01	27.02	36.03	45.03	54.04	63.05	72.06
N 1	1.9800	2.6450	3.1443	3.5633	3.8948	4.1626	4.3791
N 2	0.1183	0.3250	0.5803	0.7954	1.0067	1.1998	1.3738
N 3		0.0100	0.0398	0.1114	0.1999	0.3027	0.4135
N 4			0.0018	0.0084	0.0246	0.0516	0.0893
N 5				0.0003	0.0017	0.0055	0.0130
N 6					0.0001	0.0003	0.0012
N 7						0.0000	0.0001
N 8							0.0000

1.13 Reactor Protection System

1.13.1 Reactor Trip Breakers

1.13.1.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	REACTOR PROTECTION
Component :	REACTOR PROTECTION TRIP CIRCUIT BREAKERS
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9491980	0.9866820	0.9938200	0.9999430	0.9978220	3.7171E+01	5.0174E-01
2	5.44E-05	1.33E-02	6.18E-03	5.08E-02	2.18E-03	5.0174E-01	3.7171E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9517140	0.9823330	0.9865770	0.9984450	0.9956320	7.0540E+01	1.2686E+00
2	7.27E-04	1.39E-02	9.76E-03	4.15E-02	4.37E-03	1.0013E+00	7.0807E+01
3	1.30E-07	3.72E-03	7.48E-04	1.77E-02	0.00E+00	2.6733E-01	7.1541E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9525570	0.9792600	0.9822180	0.9958530	0.9934330	1.0305E+02	2.1826E+00
2	1.85E-03	1.47E-02	1.18E-02	3.77E-02	6.57E-03	1.5514E+00	1.0368E+02
3	4.85E-06	3.90E-03	1.47E-03	1.60E-02	0.00E+00	4.1063E-01	1.0482E+02
4	7.98E-09	2.10E-03	2.80E-04	1.05E-02	0.00E+00	2.2054E-01	1.0501E+02

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9563560	0.9772370	0.9790020	0.9920840	0.9912260	1.7370E+02	4.0461E+00
2	3.64E-03	1.49E-02	1.31E-02	3.22E-02	8.77E-03	2.6445E+00	1.7510E+02
3	2.49E-04	5.39E-03	3.68E-03	1.63E-02	0.00E+00	9.5737E-01	1.7679E+02
4	1.22E-06	2.08E-03	6.84E-04	8.86E-03	0.00E+00	3.6878E-01	1.7738E+02
5	1.91E-20	4.24E-04	3.44E-07	2.46E-03	0.00E+00	7.5435E-02	1.7767E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9572920	0.9764460	0.9779180	0.9905850	0.9890080	2.0911E+02	5.0441E+00
2	3.99E-03	1.43E-02	1.28E-02	2.96E-02	1.10E-02	3.0584E+00	2.1110E+02
3	3.30E-04	5.13E-03	3.69E-03	1.48E-02	0.00E+00	1.0979E+00	2.1306E+02
4	2.24E-05	2.72E-03	1.40E-03	9.87E-03	0.00E+00	5.8178E-01	2.1357E+02
5	3.02E-09	1.01E-03	1.29E-04	5.10E-03	0.00E+00	2.1648E-01	2.1394E+02
6	8.37E-18	4.18E-04	1.23E-06	2.44E-03	0.00E+00	8.9555E-02	2.1407E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9596100	0.9755210	0.9765350	0.9879780	0.9867800	3.0350E+02	7.6159E+00
2	5.00E-03	1.39E-02	1.28E-02	2.62E-02	1.32E-02	4.3083E+00	3.0681E+02
3	6.86E-04	5.19E-03	4.17E-03	1.32E-02	0.00E+00	1.6135E+00	3.0950E+02
4	1.45E-04	3.10E-03	2.12E-03	9.39E-03	0.00E+00	9.6383E-01	3.1015E+02
5	7.90E-06	1.67E-03	7.83E-04	6.31E-03	0.00E+00	5.1822E-01	3.1060E+02
6	1.49E-10	5.85E-04	4.67E-05	3.09E-03	0.00E+00	1.8209E-01	3.1093E+02
7	0.00E+00	9.64E-05	1.72E-13	3.74E-04	0.00E+00	3.0005E-02	3.1109E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9605920	0.9753130	0.9761860	0.9870650	0.9845420	3.5297E+02	8.9342E+00
2	5.31E-03	1.36E-02	1.27E-02	2.48E-02	1.55E-02	4.9064E+00	3.5700E+02
3	7.06E-04	4.79E-03	3.92E-03	1.19E-02	0.00E+00	1.7348E+00	3.6017E+02
4	1.91E-04	3.02E-03	2.16E-03	8.75E-03	0.00E+00	1.0910E+00	3.6081E+02
5	3.10E-05	1.90E-03	1.10E-03	6.50E-03	0.00E+00	6.8763E-01	3.6122E+02
6	4.85E-07	9.94E-04	3.17E-04	4.28E-03	0.00E+00	3.5982E-01	3.6154E+02
7	1.34E-14	3.24E-04	4.59E-06	1.85E-03	0.00E+00	1.1715E-01	3.6179E+02
8	2.54E-38	1.03E-04	1.42E-11	4.76E-04	0.00E+00	3.7386E-02	3.6187E+02

ALPHA FACTOR AND MGL PARAMETERS

System :	REACTOR PROTECTION
Component :	REACTOR PROTECTION TRIP CIRCUIT BREAKERS
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1985/01/01
Data Version :	2003/12/31

Total Number of Independent Failure Events: 97
 Total Number of Common-Cause Failure Events: 5

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9978220	0.9956320	0.9934330	0.9912260	0.9890080	0.9867800	0.9845420
2	2.18E-03	4.37E-03	6.57E-03	8.77E-03	1.10E-02	1.32E-02	1.55E-02
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5				0.00E+00	0.00E+00	0.00E+00	0.00E+00
6					0.00E+00	0.00E+00	0.00E+00
7						0.00E+00	0.00E+00
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.98E-01	9.96E-01	9.93E-01	9.91E-01	9.89E-01	9.87E-01	9.85E-01
Beta	2.18E-03	4.37E-03	6.57E-03	8.77E-03	1.10E-02	1.32E-02	1.55E-02
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Delta			0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Epsilon				0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mu					0.00E+00	0.00E+00	0.00E+00
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	21.56	32.33	43.11	53.89	64.67	75.44	86.22
N 1	1.4797	2.0686	2.5569	2.9445	3.2316	3.4180	3.5038
N 2	0.0503	0.1509	0.3019	0.5031	0.7547	1.0565	1.4087
N 3		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 4			0.0000	0.0000	0.0000	0.0000	0.0000
N 5				0.0000	0.0000	0.0000	0.0000
N 6					0.0000	0.0000	0.0000
N 7						0.0000	0.0000
N 8							0.0000

2 No Data (Prior Only)

The section labeled No Data (Prior Only) shows the prior used in the CCF database. This is the result of calculating an application without any data, which is the same as calculating an application with all the events in the CCF database. These CCF parameters may be used for those cases where there is no reasonable set of data to approximate the intended event.

2.1 No Data

2.1.1 Prior Only

2.1.1.1 All Failure Modes

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.8783440	0.9690420	0.9866290	0.9999290	----	1.4131E+01	4.5144E-01
2	7.24E-05	3.09E-02	1.33E-02	1.21E-01	----	4.5144E-01	1.4131E+01

CCCG = 3	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9148940	0.9700020	0.9779420	0.9979420	----	3.6141E+01	1.1176E+00
2	7.72E-04	2.28E-02	1.50E-02	7.15E-02	----	8.5035E-01	3.6408E+01
3	2.53E-07	7.17E-03	1.45E-03	3.40E-02	----	2.6733E-01	3.6991E+01

CCCG = 4	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9243310	0.9682640	0.9733830	0.9946800	----	5.7379E+01	1.8806E+00
2	1.80E-03	2.10E-02	1.59E-02	5.78E-02	----	1.2495E+00	5.8010E+01
3	8.65E-06	6.92E-03	2.61E-03	2.84E-02	----	4.1063E-01	5.8849E+01
4	1.42E-08	3.72E-03	4.98E-04	1.86E-02	----	2.2054E-01	5.9039E+01

CCCG = 5	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9416970	0.9705760	0.9731470	0.9906680	----	1.1687E+02	3.5429E+00
2	3.47E-03	1.77E-02	1.51E-02	4.09E-02	----	2.1414E+00	1.1827E+02
3	3.67E-04	7.95E-03	5.44E-03	2.40E-02	----	9.5737E-01	1.1945E+02
4	1.80E-06	3.06E-03	1.01E-03	1.30E-02	----	3.6878E-01	1.2004E+02
5	2.81E-20	6.26E-04	5.08E-07	3.64E-03	----	7.5435E-02	1.2033E+02

CCCG = 6	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9444530	0.9705190	0.9726530	0.9893010	----	1.4121E+02	4.2894E+00
2	3.35E-03	1.58E-02	1.36E-02	3.57E-02	----	2.3037E+00	1.4319E+02
3	4.86E-04	7.54E-03	5.44E-03	2.17E-02	----	1.0979E+00	1.4440E+02
4	3.30E-05	3.99E-03	2.06E-03	1.45E-02	----	5.8178E-01	1.4491E+02
5	4.45E-09	1.48E-03	1.89E-04	7.50E-03	----	2.1648E-01	1.4528E+02
6	1.23E-17	6.15E-04	1.80E-06	3.59E-03	----	8.9555E-02	1.4541E+02

CCCG = 7	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9516920	0.9716290	0.9729760	0.9869580	----	2.2464E+02	6.5594E+00
2	4.13E-03	1.40E-02	1.26E-02	2.87E-02	----	3.2518E+00	2.2794E+02
3	9.24E-04	6.97E-03	5.61E-03	1.76E-02	----	1.6135E+00	2.2958E+02
4	1.95E-04	4.16E-03	2.85E-03	1.26E-02	----	9.6383E-01	2.3023E+02
5	1.06E-05	2.24E-03	1.05E-03	8.49E-03	----	5.1822E-01	2.3068E+02
6	2.00E-10	7.87E-04	6.28E-05	4.15E-03	----	1.8209E-01	2.3101E+02
7	1.08E-46	1.29E-04	2.31E-13	5.03E-04	----	3.0005E-02	2.3116E+02

CCCG = 8	5th%	Mean	Median	95th%	MLE	a	b
Alpha Factor							
1	0.9540630	0.9722080	0.9733600	0.9864020	----	2.6325E+02	7.5254E+00
2	4.02E-03	1.29E-02	1.17E-02	2.58E-02	----	3.4977E+00	2.6727E+02
3	9.44E-04	6.40E-03	5.23E-03	1.58E-02	----	1.7348E+00	2.6904E+02
4	2.55E-04	4.02E-03	2.89E-03	1.16E-02	----	1.0910E+00	2.6968E+02
5	4.14E-05	2.53E-03	1.46E-03	8.68E-03	----	6.8763E-01	2.7008E+02
6	6.49E-07	1.32E-03	4.24E-04	5.72E-03	----	3.5982E-01	2.7041E+02
7	1.78E-14	4.32E-04	6.14E-06	2.47E-03	----	1.1715E-01	2.7065E+02
8	3.39E-38	1.38E-04	1.90E-11	6.36E-04	----	3.7386E-02	2.7073E+02

ALPHA FACTOR AND MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9690420	0.9700020	0.9682640	0.9705760	0.9705190	0.9716290	0.9722080
2	3.09E-02	2.28E-02	2.10E-02	1.77E-02	1.58E-02	1.40E-02	1.29E-02
3		7.17E-03	6.92E-03	7.95E-03	7.54E-03	6.97E-03	6.40E-03
4			3.72E-03	3.06E-03	3.99E-03	4.16E-03	4.02E-03
5				6.26E-04	1.48E-03	2.24E-03	2.53E-03
6					6.15E-04	7.87E-04	1.32E-03
7						1.29E-04	4.32E-04
8							1.38E-04

No Data
Prior Only
All Failure Modes

2003

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.69E-01	9.70E-01	9.68E-01	9.70E-01	9.70E-01	9.71E-01	9.72E-01
Beta	3.09E-02	3.00E-02	3.17E-02	2.94E-02	2.94E-02	2.83E-02	2.77E-02
Gamma		2.39E-01	3.35E-01	3.95E-01	4.62E-01	5.04E-01	5.35E-01
Delta			3.49E-01	3.16E-01	4.47E-01	5.12E-01	5.69E-01
Epsilon				1.69E-01	3.44E-01	4.31E-01	5.24E-01
Mu					2.92E-01	2.90E-01	4.27E-01
Upsilon						1.41E-01	3.00E-01
Sigma							2.41E-01