CCF Parameter Estimations 2007

This report documents the quantitative results of the common-cause failure (CCF) data collection effort and summarizes the results of the parameter estimation quantification process, performed on CCF data in the U.S. NRC CCF database.

These results are appropriate for use in Probabilistic Risk Assessment studies of commercial nuclear power plants in the U.S.

Included in these results are the applications to be used in the SPAR Version greater than 3.45 models. This is the 2007 update to NUREG/CR-5496, updating data and parameter estimations.

This release, CCF Parameter Estimation for 2007, reflects the CCF data contained within the CCF database, Version 4.0.2007. This version of the CCF database contains data from 1980 to 2007.

The applications contained within were created with a starting date of 1/1/1991. 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 1991 period since the trend is decreasing significantly from 1980 to 1991. The exception is the rules for CCW components. Since the CCW components were added to the CCF database during the EPIX era, the applications start at 1/1/1997.

The way to provide a reference for this update is:

U.S. Nuclear Regulatory Commission, "CCF Parameter Estimations, 2007 Update", http://nrcoe.inl.gov/results/CCF/ParamEst2007/ccfparamest.htm, September 2008.

1 CCF Parameter Estimation Introduction

A general conclusion from probabilistic risk assessments (PRAs) of commercial nuclear power plants is that common cause failures (CCFs) are significant contributors to the unavailability of safety systems. A CCF event consists of component failures that meet the following four criteria: (1) two or more components fail or are degraded at the same plant and in the same system, (2) component failures occur within a selected period of time such that success of the PRA mission would be uncertain, (3) the component failures result from a single shared cause and are linked by a coupling mechanism such that other components in the group are susceptible to the same cause and failure mode and, (4) the equipment failures are not caused by the failure of equipment outside the established component boundary.

In response to these deficiencies, the Idaho National Laboratory (INL) staff and the Nuclear Regulatory Commission's (NRC) Office of Nuclear Regulatory Research have developed a CCF data collection and analysis system that includes a method for identifying CCF events, coding and classifying those events for use in CCF studies, and a computer system for storing and analyzing the data. The system is based, in part, on previous CCF methods and models and is designed to run on a personal computer (PC). The data collection effort has collected CCF events from 1980 through 2005 for use in CCF analyses. The current data collection effort has separated the data by system. The principal products of this CCF data collection and analysis system (CCF database) are the method for identifying and classifying CCF events, the CCF database containing both CCF events and independent failure counts, and the CCF parameter estimation software.

Three data sources are used to select equipment failure reports to be reviewed for CCF event identification: the Nuclear Plant Reliability Data System (NPRDS), which contained component failure information prior to 1997; the Equipment Performance and Information Exchange (EPIX), which contains component failure information since 1997; and the Sequence Coding and Search System (SCSS), which contains Licensee Event Reports (LERs). All events that meet the above criteria are identified as CCF events and included in the CCF database.

2 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 Generic Demand, Generic Rate, or the No Data (Prior Only) pooled distribution may be appropriate.

This update to the parameter estimation report includes the SPAR alpha factor basic event name to facilitate the cross reference of this report to the SPAR models. The SPAR basic event name can be found in the title of the application report and in the topic text if SPAR uses the parameter estimate.

2.1 Motor Driven Pumps

2.1.1 Pooled Motor Driven Pump Distributions

2.1.1.1 MOTOR DRIVEN PUMP FAIL TO RUN ALL SYSTEMS

Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 985
Total Number of Common-Cause Failure Events: 50

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9697030	0.9795330	0.9800160	0.9877070	0.9796800	6.4360E+02	1.3448E+01
2	1.23E-02	2.05E-02	2.00E-02	3.03E-02	2.03E-02	1.3448E+01	6.4360E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9717180	0.9795950	0.9799140	0.9863720	0.9797950	9.7510E+02	2.0311E+01
2	8.26E-03	1.37E-02	1.34E-02	2.03E-02	1.35E-02	1.3651E+01	9.8176E+02
3	3.08E-03	6.69E-03	6.36E-03	1.14E-02	6.73E-03	6.6604E+00	9.8875E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9743930	0.9809420	0.9811800	0.9866700	0.9813400	1.3051E+03	2.5355E+01
2	5.91E-03	9.92E-03	9.67E-03	1.48E-02	9.51E-03	1.3197E+01	1.3173E+03
3	3.47E-03	6.68E-03	6.43E-03	1.07E-02	6.72E-03	8.8810E+00	1.3216E+03
4	7.25E-04	2.46E-03	2.22E-03	5.04E-03	2.43E-03	3.2775E+00	1.3272E+03

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9768430	0.9823770	0.9825670	0.9872730	0.9829590	1.6799E+03	3.0135E+01
2	4.73E-03	7.89E-03	7.70E-03	1.17E-02	7.32E-03	1.3500E+01	1.6965E+03
3	2.67E-03	5.15E-03	4.96E-03	8.28E-03	5.01E-03	8.8010E+00	1.7012E+03
4	1.62E-03	3.64E-03	3.45E-03	6.31E-03	3.73E-03	6.2217E+00	1.7038E+03
5	1.24E-04	9.43E-04	7.57E-04	2.40E-03	9.81E-04	1.6125E+00	1.7084E+03

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9784770	0.9833640	0.9835230	0.9877190	0.9840570	2.0217E+03	3.4201E+01
2	4.16E-03	6.85E-03	6.70E-03	1.01E-02	6.31E-03	1.4093E+01	2.0418E+03
3	2.03E-03	4.02E-03	3.86E-03	6.55E-03	3.81E-03	8.2546E+00	2.0476E+03
4	1.59E-03	3.38E-03	3.22E-03	5.73E-03	3.38E-03	6.9573E+00	2.0489E+03
5	6.79E-04	1.97E-03	1.81E-03	3.80E-03	2.03E-03	4.0496E+00	2.0519E+03
6	1.34E-05	4.12E-04	2.66E-04	1.31E-03	4.12E-04	8.4662E-01	2.0551E+03

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9796800	0.9797950	0.9813400	0.9829590	0.9840570
2	2.03E-02	1.35E-02	9.51E-03	7.32E-03	6.31E-03
3		6.73E-03	6.72E-03	5.01E-03	3.81E-03
4			2.43E-03	3.73E-03	3.38E-03
5				9.81E-04	2.03E-03
6					4.12E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.80E-01	9.80E-01	9.81E-01	9.83E-01	9.84E-01
Beta	2.03E-02	2.02E-02	1.87E-02	1.70E-02	1.59E-02
Gamma		3.33E-01	4.91E-01	5.70E-01	6.04E-01
Delta			2.66E-01	4.84E-01	6.05E-01
Epsilon				2.08E-01	4.20E-01
Mu					1.69E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	604.29	906.44	1208.59	1510.74	1812.88
N 1	21.8927	23.5532	25.6824	28.0926	29.8993
N 2	12.9878	12.7858	11.9570	11.4604	11.8130
N 3		6.3926	8.4523	7.8473	7.1301
N 4			3.0605	5.8349	6.3326
N 5				1.5354	3.8069
N 6					0.7719

2.1.1.2 MOTOR DRIVEN PUMP FAIL TO START ALL SYSTEMS

Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 855
Total Number of Common-Cause Failure Events: 55

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9513690	0.9656690	0.9662820	0.9778720	0.9653520	4.8656E+02	1.7298E+01
2	2.21E-02	3.43E-02	3.37E-02	4.86E-02	3.46E-02	1.7298E+01	4.8656E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9555390	0.9668460	0.9672560	0.9767580	0.9662870	7.3782E+02	2.5300E+01
2	1.36E-02	2.14E-02	2.10E-02	3.07E-02	2.16E-02	1.6359E+01	7.4676E+02
3	6.12E-03	1.17E-02	1.13E-02	1.88E-02	1.21E-02	8.9413E+00	7.5418E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9585410	0.9680910	0.9683950	0.9765960	0.9676300	9.8590E+02	3.2496E+01
2	1.14E-02	1.77E-02	1.73E-02	2.49E-02	1.77E-02	1.7977E+01	1.0004E+03
3	5.22E-03	9.65E-03	9.33E-03	1.52E-02	9.94E-03	9.8281E+00	1.0086E+03
4	1.75E-03	4.61E-03	4.29E-03	8.56E-03	4.73E-03	4.6911E+00	1.0137E+03

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9647870	0.9725670	0.9728040	0.9795330	0.9721350	1.2822E+03	3.6166E+01
2	6.98E-03	1.13E-02	1.11E-02	1.65E-02	1.10E-02	1.4910E+01	1.3035E+03
3	4.99E-03	8.74E-03	8.49E-03	1.33E-02	9.00E-03	1.1523E+01	1.3068E+03
4	2.66E-03	5.54E-03	5.29E-03	9.27E-03	5.89E-03	7.3038E+00	1.3111E+03
5	4.10E-04	1.84E-03	1.60E-03	4.11E-03	2.00E-03	2.4295E+00	1.3159E+03

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9686140	0.9753410	0.9755370	0.9813900	0.9752180	1.5459E+03	3.9084E+01
2	4.94E-03	8.31E-03	8.10E-03	1.24E-02	7.77E-03	1.3166E+01	1.5718E+03
3	3.90E-03	6.94E-03	6.73E-03	1.07E-02	7.04E-03	1.0992E+01	1.5740E+03
4	2.81E-03	5.47E-03	5.26E-03	8.82E-03	5.74E-03	8.6651E+00	1.5763E+03
5	1.21E-03	3.10E-03	2.89E-03	5.70E-03	3.33E-03	4.9147E+00	1.5801E+03
6	8.26E-05	8.50E-04	6.51E-04	2.29E-03	9.07E-04	1.3465E+00	1.5836E+03

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9653520	0.9662870	0.9676300	0.9721350	0.9752180
2	3.46E-02	2.16E-02	1.77E-02	1.10E-02	7.77E-03
3		1.21E-02	9.94E-03	9.00E-03	7.04E-03
4			4.73E-03	5.89E-03	5.74E-03
5				2.00E-03	3.33E-03
6					9.07E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.65E-01	9.66E-01	9.68E-01	9.72E-01	9.75E-01
Beta	3.46E-02	3.37E-02	3.24E-02	2.79E-02	2.48E-02
Gamma		3.59E-01	4.53E-01	6.07E-01	6.87E-01
Delta			3.22E-01	4.67E-01	5.86E-01
Epsilon				2.54E-01	4.25E-01
Mu					2.14E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	444.16	666.23	888.31	1110.39	1332.47
N 1	24.9834	26.4807	26.7173	30.7728	34.4943
N 2	16.8383	15.4944	16.7371	12.8704	10.8852
N 3		8.6735	9.3994	10.5698	9.8679
N 4			4.4741	6.9170	8.0404
N 5				2.3524	4.6720
N 6					1.2718

2.1.2 Pooled Pump Volutes

2.1.2.1 CLEAN SYSTEM PUMP VOLUTES FAIL TO RUN SPAR: PMP-FR

System :	AUXILIARY FEEDWATER SYSTEM CONTAINMENT SPRAY SYSTEM HIGH PRESSURE SAFETY INJECTION (PWR) LOW PRESSURE CORE SPRAY RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 524
Total Number of Common-Cause Failure Events: 20

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9731420	0.9844750	0.9852720	0.9930750	0.9849520	3.9435E+02	6.2187E+00
2	6.92E-03	1.55E-02	1.47E-02	2.69E-02	1.50E-02	6.2187E+00	3.9435E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9751710	0.9842210	0.9847390	0.9914910	0.9849280	6.0627E+02	9.7199E+00
2	4.92E-03	1.07E-02	1.02E-02	1.83E-02	1.01E-02	6.6078E+00	6.0938E+02
3	1.43E-03	5.05E-03	4.53E-03	1.05E-02	4.99E-03	3.1121E+00	6.1288E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9781490	0.9855620	0.9859490	0.9916480	0.9866670	8.1709E+02	1.1970E+01
2	3.25E-03	7.37E-03	6.98E-03	1.28E-02	6.44E-03	6.1099E+00	8.2295E+02
3	1.80E-03	5.08E-03	4.69E-03	9.70E-03	5.00E-03	4.2127E+00	8.2485E+02
4	2.70E-04	1.99E-03	1.60E-03	5.01E-03	1.89E-03	1.6470E+00	8.2741E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.9849520	0.9849280	0.9866670
2	1.50E-02	1.01E-02	6.44E-03
3		4.99E-03	5.00E-03
4			1.89E-03

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**
1-Beta	9.85E-01	9.85E-01	9.87E-01
Beta	1.50E-02	1.51E-02	1.33E-02
Gamma		3.31E-01	5.17E-01
Delta			2.74E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	367.72	551.58	735.44
N 1	9.2160	9.5810	10.7792
N 2	5.7587	5.7430	4.8699
N 3		2.8443	3.7840
N 4			1.4300

2.1.3 Pooled Clean System Motor Driven Pump Distributions

2.1.3.1 CLEAN SYSTEM MOTOR DRIVEN PUMPS FAIL TO RUN SPAR: MDP-FR

System :	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 :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 404
Total Number of Common-Cause Failure Events: 19

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9663560	0.9805810	0.9815820	0.9913750	0.9809590	3.1048E+02	6.1487E+00
2	8.62E-03	1.94E-02	1.84E-02	3.36E-02	1.90E-02	6.1487E+00	3.1048E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9693210	0.9805580	0.9812060	0.9895800	0.9810840	4.8064E+02	9.5299E+00
2	5.94E-03	1.31E-02	1.25E-02	2.25E-02	1.25E-02	6.4278E+00	4.8374E+02
3	1.78E-03	6.33E-03	5.67E-03	1.31E-02	6.38E-03	3.1021E+00	4.8707E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9732540	0.9824050	0.9828860	0.9898990	0.9834330	6.4977E+02	1.1638E+01
2	3.78E-03	8.80E-03	8.31E-03	1.55E-02	7.78E-03	5.8197E+00	6.5559E+02
3	2.22E-03	6.31E-03	5.82E-03	1.21E-02	6.36E-03	4.1729E+00	6.5723E+02
4	3.38E-04	2.49E-03	2.01E-03	6.28E-03	2.43E-03	1.6452E+00	6.5976E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9758540	0.9834930	0.9838550	0.9898820	0.9849550	8.6309E+02	1.4487E+01
2	3.26E-03	7.24E-03	6.87E-03	1.25E-02	5.89E-03	6.3576E+00	8.7122E+02
3	1.81E-03	4.99E-03	4.61E-03	9.42E-03	4.67E-03	4.3751E+00	8.7320E+02
4	9.07E-04	3.37E-03	3.00E-03	7.09E-03	3.50E-03	2.9549E+00	8.7462E+02
5	2.48E-05	9.10E-04	5.71E-04	2.95E-03	9.85E-04	7.9893E-01	8.7678E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9775660	0.9843170	0.9846220	0.9900270	0.9859950	1.0439E+03	1.6633E+01
2	2.91E-03	6.32E-03	6.01E-03	1.08E-02	5.04E-03	6.7050E+00	1.0538E+03
3	1.36E-03	3.89E-03	3.59E-03	7.47E-03	3.42E-03	4.1284E+00	1.0564E+03
4	9.97E-04	3.25E-03	2.95E-03	6.55E-03	3.22E-03	3.4489E+00	1.0571E+03
5	3.02E-04	1.80E-03	1.50E-03	4.33E-03	1.90E-03	1.9101E+00	1.0586E+03
6	7.94E-07	4.15E-04	1.67E-04	1.67E-03	4.17E-04	4.4022E-01	1.0601E+03

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9809590	0.9810840	0.9834330	0.9849550	0.9859950
2	1.90E-02	1.25E-02	7.78E-03	5.89E-03	5.04E-03
3		6.38E-03	6.36E-03	4.67E-03	3.42E-03
4			2.43E-03	3.50E-03	3.22E-03
5				9.85E-04	1.90E-03
6					4.17E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.81E-01	9.81E-01	9.83E-01	9.85E-01	9.86E-01
Beta	1.90E-02	1.89E-02	1.66E-02	1.50E-02	1.40E-02
Gamma		3.38E-01	5.30E-01	6.09E-01	6.40E-01
Delta			2.76E-01	4.90E-01	6.18E-01
Epsilon				2.19E-01	4.19E-01
Mu					1.80E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	284.51	426.76	569.01	711.27	853.52
N 1	8.5560	8.7710	9.8882	10.7644	11.4092
N 2	5.6887	5.5630	4.5797	4.3176	4.4246
N 3		2.8343	3.7442	3.4214	3.0039
N 4			1.4283	2.5681	2.8242
N 5				0.7218	1.6674
N 6					0.3655

2.1.3.2 CLEAN SYSTEM MOTOR DRIVEN PUMPS FAIL TO START SPAR:MDP-FS

System :	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 :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 426
Total Number of Common-Cause Failure Events: 27

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9391470	0.9579040	0.9587510	0.9737560	0.9570450	3.4338E+02	1.5090E+01
2	2.62E-02	4.21E-02	4.12E-02	6.09E-02	4.30E-02	1.5090E+01	3.4338E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9511010	0.9649120	0.9654740	0.9767930	0.9639370	5.2884E+02	1.9230E+01
2	1.07E-02	1.93E-02	1.87E-02	2.98E-02	1.93E-02	1.0566E+01	5.3750E+02
3	8.16E-03	1.58E-02	1.52E-02	2.55E-02	1.67E-02	8.6645E+00	5.3941E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9573550	0.9686080	0.9690310	0.9784070	0.9680080	7.1174E+02	2.3067E+01
2	7.67E-03	1.40E-02	1.35E-02	2.17E-02	1.36E-02	1.0257E+01	7.2455E+02
3	5.68E-03	1.12E-02	1.08E-02	1.83E-02	1.18E-02	8.2518E+00	7.2655E+02
4	2.32E-03	6.20E-03	5.76E-03	1.16E-02	6.56E-03	4.5580E+00	7.3025E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9645480	0.9735550	0.9738840	0.9814460	0.9731120	9.4101E+02	2.5561E+01
2	4.49E-03	8.79E-03	8.45E-03	1.42E-02	7.85E-03	8.4933E+00	9.5808E+02
3	4.30E-03	8.51E-03	8.17E-03	1.39E-02	8.85E-03	8.2258E+00	9.5834E+02
4	3.04E-03	6.70E-03	6.36E-03	1.15E-02	7.41E-03	6.4751E+00	9.6010E+02
5	5.30E-04	2.45E-03	2.11E-03	5.51E-03	2.78E-03	2.3665E+00	9.6420E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9688640	0.9765820	0.9768580	0.9833760	0.9766380	1.1379E+03	2.7286E+01
2	3.02E-03	6.29E-03	6.01E-03	1.05E-02	5.14E-03	7.3286E+00	1.1579E+03
3	2.97E-03	6.21E-03	5.93E-03	1.04E-02	6.23E-03	7.2367E+00	1.1579E+03
4	2.78E-03	5.95E-03	5.67E-03	1.01E-02	6.42E-03	6.9304E+00	1.1583E+03
5	1.42E-03	3.84E-03	3.56E-03	7.22E-03	4.31E-03	4.4750E+00	1.1607E+03
6	1.05E-04	1.13E-03	8.60E-04	3.07E-03	1.26E-03	1.3152E+00	1.1639E+03

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9570450	0.9639370	0.9680080	0.9731120	0.9766380
2	4.30E-02	1.93E-02	1.36E-02	7.85E-03	5.14E-03
3		1.67E-02	1.18E-02	8.85E-03	6.23E-03
4			6.56E-03	7.41E-03	6.42E-03
5				2.78E-03	4.31E-03
6					1.26E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.57E-01	9.64E-01	9.68E-01	9.73E-01	9.77E-01
Beta	4.30E-02	3.61E-02	3.20E-02	2.69E-02	2.34E-02
Gamma		4.64E-01	5.74E-01	7.08E-01	7.80E-01
Delta			3.57E-01	5.35E-01	6.58E-01
Epsilon				2.73E-01	4.65E-01
Mu					2.27E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	315.56	473.33	631.11	788.89	946.67
N 1	10.4060	10.4080	9.7667	11.0553	12.2635
N 2	14.6303	9.7010	9.0165	6.4533	5.0482
N 3		8.3967	7.8231	7.2721	6.1122
N 4			4.3410	6.0883	6.3057
N 5				2.2894	4.2323
N 6					1.2405

2.1.4 PWR Containment Spray Pumps

2.1.4.1 CONTAINMENT SPRAY MDP-FR

System :	CONTAINMENT SPRAY SYSTEM
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 19
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9508940	0.9875260	0.9946550	0.9999660	1.0000000	3.6418E+01	4.6002E-01
2	3.16E-05	1.25E-02	5.34E-03	4.91E-02	0.00E+00	4.6002E-01	3.6418E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2
1	1.0000000
2	0.00E+00

MGL Parameter	CCCG=2
1-Beta	1.00E+00
Beta	0.00E+00

Avg. Impact Vector	CCCG=2
Adj. Ind. Events	19.00
N 1	0.0000
N 2	0.0000

2.1.4.2 CONTAINMENT SPRAY MDP-FS

System :	CONTAINMENT SPRAY SYSTEM
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 52

Total Number of Common-Cause Failure Events: 4

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9111570	0.9583470	0.9630240	0.9895350	0.9522090	6.1585E+01	2.6767E+00
2	1.05E-02	4.17E-02	3.70E-02	8.88E-02	4.78E-02	2.6767E+00	6.1585E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**
1	0.9522090
2	4.78E-02

MGL Parameter	**CCCG=2**
1-Beta	9.52E-01
Beta	4.78E-02

Avg. Impact Vector	**CCCG=2**
Adj. Ind. Events	41.60
N 1	2.5667
N 2	2.2167

2.1.5 BWR Residual Heat Removal Pumps

2.1.5.1 BWR RHR MDP FAIL TO RUN

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 28
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9386920	0.9834320	0.9917530	0.9998970	0.9944160	3.2251E+01	5.4332E-01
2	1.01E-04	1.66E-02	8.25E-03	6.13E-02	5.58E-03	5.4332E-01	3.2251E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9464810	0.9798130	0.9842690	0.9979050	0.9887640	6.7105E+01	1.3826E+00
2	1.10E-03	1.63E-02	1.19E-02	4.66E-02	1.12E-02	1.1148E+00	6.7373E+01
3	1.39E-07	3.91E-03	7.88E-04	1.85E-02	0.00E+00	2.6776E-01	6.8220E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9481150	0.9766690	0.9797070	0.9948420	0.9830510	9.9868E+01	2.3856E+00
2	2.54E-03	1.70E-02	1.40E-02	4.19E-02	1.69E-02	1.7400E+00	1.0051E+02
3	6.86E-06	4.19E-03	1.65E-03	1.70E-02	0.00E+00	4.2870E-01	1.0182E+02
4	6.54E-09	2.12E-03	2.72E-04	1.07E-02	0.00E+00	2.1695E-01	1.0204E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9944160	0.9887640	0.9830510
2	5.58E-03	1.12E-02	1.69E-02
3		0.00E+00	0.00E+00
4			0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.94E-01	9.89E-01	9.83E-01
Beta	5.58E-03	1.12E-02	1.69E-02
Gamma		0.00E+00	0.00E+00
Delta			0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	14.00	21.00	28.00
N 1	0.8333	1.0000	1.0000
N 2	0.0833	0.2500	0.5000
N 3		0.0000	0.0000
N 4			0.0000

2.1.5.2 BWR RHR MDP FAIL TO START

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 57
Total Number of Common-Cause Failure Events: 6

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8856780	0.9443060	0.9497350	0.9843450	0.9294330	5.0895E+01	3.0017E+00
2	1.57E-02	5.57E-02	5.03E-02	1.14E-01	7.06E-02	3.0017E+00	5.0895E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9118420	0.9516760	0.9547090	0.9811360	0.9305760	9.3695E+01	4.7576E+00
2	5.86E-03	2.53E-02	2.21E-02	5.55E-02	3.11E-02	2.4898E+00	9.5963E+01
3	4.82E-03	2.30E-02	1.99E-02	5.20E-02	3.83E-02	2.2678E+00	9.6185E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9157160	0.9492610	0.9513790	0.9755590	0.9226580	1.3350E+02	7.1357E+00
2	1.19E-02	3.19E-02	2.97E-02	5.94E-02	4.79E-02	4.4900E+00	1.3615E+02
3	1.11E-03	1.02E-02	7.95E-03	2.68E-02	1.47E-02	1.4287E+00	1.3921E+02
4	6.97E-04	8.65E-03	6.46E-03	2.41E-02	1.47E-02	1.2170E+00	1.3942E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.9294330	0.9305760	0.9226580
2	7.06E-02	3.11E-02	4.79E-02
3		3.83E-02	1.47E-02
4			1.47E-02

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**
1-Beta	9.29E-01	9.31E-01	9.23E-01
Beta	7.06E-02	6.94E-02	7.73E-02
Gamma		5.52E-01	3.81E-01
Delta			5.00E-01

Avg. Impact Vector	**CCCG=2**	**CCCG=3**	**CCCG=4**
Adj. Ind. Events	31.06	46.59	62.13
N 1	2.4167	2.0000	0.5000
N 2	2.5417	1.6250	3.2500
N 3		2.0000	1.0000
N 4			1.0000

2.1.6 AFW Motor-Driven Pumps

2.1.6.1 AFW MOTOR DRIVEN PUMP FAIL TO RUN SPAR: AFW-MDP-FR

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 74
Total Number of Common-Cause Failure Events: 3

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9728870	0.9926570	0.9963310	0.9999550	0.9983770	7.4795E+01	5.5332E-01
2	4.84E-05	7.34E-03	3.67E-03	2.71E-02	1.62E-03	5.5332E-01	7.4795E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9720170	0.9894650	0.9918070	0.9989040	0.9969640	1.3092E+02	1.3939E+00
2	5.66E-04	8.44E-03	6.13E-03	2.42E-02	2.93E-03	1.1168E+00	1.3120E+02
3	1.05E-07	2.09E-03	4.47E-04	9.82E-03	1.08E-04	2.7706E-01	1.3204E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9717210	0.9873750	0.9890610	0.9972530	0.9958130	1.8499E+02	2.3654E+00
2	1.27E-03	8.98E-03	7.30E-03	2.24E-02	3.86E-03	1.6819E+00	1.8567E+02
3	6.59E-06	2.48E-03	1.06E-03	9.77E-03	3.18E-04	4.6510E-01	1.8689E+02
4	3.92E-09	1.17E-03	1.52E-04	5.87E-03	1.31E-05	2.1845E-01	1.8714E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.9983770	0.9969640	0.9958130
2	1.62E-03	2.93E-03	3.86E-03
3		1.08E-04	3.18E-04
4			1.31E-05

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**
1-Beta	9.98E-01	9.97E-01	9.96E-01
Beta	1.62E-03	3.04E-03	4.19E-03
Gamma		3.56E-02	7.90E-02
Delta			3.96E-02

Avg. Impact Vector	**CCCG=2**	**CCCG=3**	**CCCG=4**
Adj. Ind. Events	55.43	83.15	110.86
N 1	1.9467	2.6680	3.2660
N 2	0.0933	0.2520	0.4419
N 3		0.0093	0.0364
N 4			0.0015

2.1.6.2 AFW MOTOR DRIVEN PUMP FAIL TO START SPAR: AFW-MDP-FS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 110
Total Number of Common-Cause Failure Events: 9

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9073450	0.9450200	0.9474680	0.9743410	0.9399380	1.1408E+02	6.6370E+00
2	2.57E-02	5.50E-02	5.25E-02	9.27E-02	6.01E-02	6.6370E+00	1.1408E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9329210	0.9585690	0.9601150	0.9789380	0.9533730	1.8883E+02	8.1616E+00
2	7.43E-03	2.10E-02	1.94E-02	4.01E-02	2.17E-02	4.1428E+00	1.9285E+02
3	7.06E-03	2.04E-02	1.88E-02	3.92E-02	2.49E-02	4.0188E+00	1.9297E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9457710	0.9656620	0.9668050	0.9816650	0.9625770	2.6196E+02	9.3149E+00
2	3.30E-03	1.16E-02	1.04E-02	2.39E-02	9.57E-03	3.1406E+00	2.6813E+02
3	4.93E-03	1.45E-02	1.33E-02	2.81E-02	1.76E-02	3.9323E+00	2.6734E+02
4	1.69E-03	8.26E-03	7.09E-03	1.88E-02	1.02E-02	2.2420E+00	2.6903E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9399380	0.9533730	0.9625770
2	6.01E-02	2.17E-02	9.57E-03
3		2.49E-02	1.76E-02
4			1.02E-02

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.40E-01	9.53E-01	9.63E-01
Beta	6.01E-02	4.66E-02	3.74E-02
Gamma		5.34E-01	7.44E-01
Delta			3.66E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	94.42	141.63	188.84
N 1	2.2460	2.0910	2.2543
N 2	6.1770	3.2780	1.9006
N 3		3.7510	3.5036
N 4			2.0251

2.1.7 AFW Pump Volutes

2.1.7.1 AFW PUMP VOLUTES FAIL TO RUN SPAR: AFW-PMP-FR

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR DRIVEN PUMP TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 194
Total Number of Common-Cause Failure Events: 4

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9863480	0.9961460	0.9979120	0.9999580	0.9988650	1.6111E+02	6.2332E-01
2	4.28E-05	3.85E-03	2.09E-03	1.37E-02	1.14E-03	6.2332E-01	1.6111E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9845650	0.9939500	0.9951500	0.9992200	0.9979060	2.6022E+02	1.5839E+00
2	4.50E-04	4.95E-03	3.76E-03	1.35E-02	2.00E-03	1.2968E+00	2.6051E+02
3	7.77E-08	1.10E-03	2.49E-04	5.09E-03	8.95E-05	2.8706E-01	2.6152E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9838290	0.9925060	0.9934000	0.9981440	0.9971740	3.5720E+02	2.6971E+00
2	9.60E-04	5.48E-03	4.60E-03	1.30E-02	2.55E-03	1.9722E+00	3.5792E+02
3	5.81E-06	1.40E-03	6.45E-04	5.37E-03	2.65E-04	5.0480E-01	3.5939E+02
4	2.27E-09	6.12E-04	8.09E-05	3.07E-03	1.11E-05	2.2015E-01	3.5968E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.9988650	0.9979060	0.9971740
2	1.14E-03	2.00E-03	2.55E-03
3		8.95E-05	2.65E-04
4			1.11E-05

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**
1-Beta	9.99E-01	9.98E-01	9.97E-01
Beta	1.14E-03	2.09E-03	2.83E-03
Gamma		4.28E-02	9.77E-02
Delta			4.04E-02

Avg. Impact Vector	**CCCG=2**	**CCCG=3**	**CCCG=4**
Adj. Ind. Events	141.09	211.64	282.18
N 1	2.6067	3.4780	4.1570
N 2	0.1633	0.4320	0.7322
N 3		0.0193	0.0761
N 4			0.0032

2.1.8 Emergency Service Water Pump

2.1.8.1 SERVICE WATER MDP FAIL TO RUN SPAR:ESW-MDP-FR

System :	EMERGENCY/ESSENTIAL SERVICE WATER
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 479
Total Number of Common-Cause Failure Events: 21

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9747920	0.9874360	0.9885960	0.9961150	0.9883480	2.7225E+02	3.4642E+00
2	3.88E-03	1.26E-02	1.14E-02	2.52E-02	1.17E-02	3.4642E+00	2.7225E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9763560	0.9865690	0.9873130	0.9942350	0.9879000	4.2488E+02	5.7843E+00
2	3.65E-03	1.01E-02	9.32E-03	1.90E-02	9.03E-03	4.3361E+00	4.2633E+02
3	3.73E-04	3.36E-03	2.63E-03	8.85E-03	3.07E-03	1.4482E+00	4.2922E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9760660	0.9851340	0.9856830	0.9923210	0.9867100	5.7440E+02	8.6678E+00
2	4.50E-03	1.03E-02	9.74E-03	1.80E-02	9.34E-03	6.0049E+00	5.7706E+02
3	5.28E-04	3.22E-03	2.67E-03	7.78E-03	2.84E-03	1.8764E+00	5.8119E+02
4	3.50E-05	1.35E-03	8.39E-04	4.40E-03	1.12E-03	7.8645E-01	5.8228E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9769090	0.9847520	0.9851620	0.9911900	0.9867250	7.6840E+02	1.1898E+01
2	4.52E-03	9.40E-03	8.98E-03	1.57E-02	8.32E-03	7.3320E+00	7.7297E+02
3	9.70E-04	3.69E-03	3.27E-03	7.82E-03	3.02E-03	2.8765E+00	7.7742E+02
4	1.62E-04	1.70E-03	1.30E-03	4.62E-03	1.48E-03	1.3297E+00	7.7897E+02
5	2.23E-07	4.61E-04	1.47E-04	1.99E-03	4.44E-04	3.5953E-01	7.7994E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9775900	0.9846920	0.9850300	0.9906260	0.9867170	9.2974E+02	1.4454E+01
2	4.39E-03	8.70E-03	8.36E-03	1.42E-02	7.80E-03	8.2157E+00	9.3598E+02
3	1.06E-03	3.54E-03	3.19E-03	7.19E-03	2.91E-03	3.3384E+00	9.4086E+02
4	3.11E-04	1.95E-03	1.61E-03	4.74E-03	1.60E-03	1.8404E+00	9.4235E+02
5	2.89E-05	8.94E-04	5.76E-04	2.84E-03	7.90E-04	8.4392E-01	9.4335E+02
6	6.42E-10	2.28E-04	2.87E-05	1.15E-03	1.85E-04	2.1552E-01	9.4398E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9883480	0.9879000	0.9867100	0.9867250	0.9867170
2	1.17E-02	9.03E-03	9.34E-03	8.32E-03	7.80E-03
3		3.07E-03	2.84E-03	3.02E-03	2.91E-03
4			1.12E-03	1.48E-03	1.60E-03
5				4.44E-04	7.90E-04
6					1.85E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.88E-01	9.88E-01	9.87E-01	9.87E-01	9.87E-01
Beta	1.17E-02	1.21E-02	1.33E-02	1.33E-02	1.33E-02
Gamma		2.54E-01	2.97E-01	3.73E-01	4.13E-01
Delta			2.82E-01	3.89E-01	4.69E-01
Epsilon				2.30E-01	3.79E-01
Mu					1.90E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	245.64	368.46	491.28	614.10	736.92
N 1	9.1933	11.3187	12.2511	13.2414	13.8894
N 2	3.0042	3.4713	4.7649	5.2920	5.9353
N 3		1.1804	1.4477	1.9228	2.2139
N 4			0.5695	0.9429	1.2157
N 5				0.2824	0.6012
N 6					0.1408

2.1.8.2 SERVICE WATER MDP FAIL TO START SPAR:ESW-MDP-FS

System :	EMERGENCY/ESSENTIAL SERVICE WATER
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 316
Total Number of Common-Cause Failure Events: 26

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9655480	0.9845140	0.9865420	0.9965600	0.9858450	1.5309E+02	2.4080E+00
2	3.44E-03	1.55E-02	1.35E-02	3.45E-02	1.42E-02	2.4080E+00	1.5309E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9546700	0.9732890	0.9745450	0.9876280	0.9727860	2.4322E+02	6.6749E+00
2	1.12E-02	2.50E-02	2.38E-02	4.31E-02	2.65E-02	6.2563E+00	2.4364E+02
3	2.35E-06	1.67E-03	6.41E-04	6.85E-03	7.40E-04	4.1856E-01	2.4948E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9522210	0.9690230	0.9699370	0.9827150	0.9676520	3.3083E+02	1.0576E+01
2	1.29E-02	2.50E-02	2.41E-02	4.03E-02	2.72E-02	8.5370E+00	3.3287E+02
3	7.66E-04	5.13E-03	4.20E-03	1.27E-02	4.92E-03	1.7514E+00	3.3965E+02
4	6.04E-08	8.42E-04	1.91E-04	3.90E-03	2.62E-04	2.8745E-01	3.4112E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9591180	0.9724410	0.9730960	0.9835270	0.9708660	4.6472E+02	1.3170E+01
2	8.48E-03	1.69E-02	1.62E-02	2.76E-02	1.81E-02	8.0717E+00	4.6982E+02
3	2.79E-03	8.23E-03	7.55E-03	1.60E-02	8.93E-03	3.9308E+00	4.7396E+02
4	1.31E-04	2.22E-03	1.57E-03	6.50E-03	2.02E-03	1.0588E+00	4.7683E+02
5	1.46E-15	2.28E-04	2.21E-06	1.32E-03	9.54E-05	1.0893E-01	4.7778E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9622430	0.9739480	0.9744880	0.9838070	0.9728740	5.6603E+02	1.5140E+01
2	6.62E-03	1.34E-02	1.28E-02	2.21E-02	1.38E-02	7.7846E+00	5.7339E+02
3	2.93E-03	7.83E-03	7.28E-03	1.46E-02	8.62E-03	4.5531E+00	5.7662E+02
4	7.00E-04	3.65E-03	3.10E-03	8.49E-03	3.77E-03	2.1237E+00	5.7905E+02
5	8.78E-06	1.01E-03	5.26E-04	3.67E-03	8.69E-04	5.8862E-01	5.8058E+02
6	4.25E-18	1.56E-04	4.87E-07	9.07E-04	3.95E-05	9.0422E-02	5.8108E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9858450	0.9727860	0.9676520	0.9708660	0.9728740
2	1.42E-02	2.65E-02	2.72E-02	1.81E-02	1.38E-02
3		7.40E-04	4.92E-03	8.93E-03	8.62E-03
4			2.62E-04	2.02E-03	3.77E-03
5				9.54E-05	8.69E-04
6					3.95E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.86E-01	9.73E-01	9.68E-01	9.71E-01	9.73E-01
Beta	1.42E-02	2.72E-02	3.23E-02	2.91E-02	2.71E-02
Gamma		2.72E-02	1.60E-01	3.79E-01	4.90E-01
Delta			5.06E-02	1.91E-01	3.52E-01
Epsilon				4.52E-02	1.94E-01
Mu					4.34E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	121.77	182.66	243.55	304.43	365.32
N 1	13.8974	15.4546	16.4090	19.2332	21.7828
N 2	1.9480	5.3915	7.2970	6.0317	5.5042
N 3		0.1508	1.3227	2.9771	3.4286
N 4			0.0705	0.6720	1.4990
N 5				0.0318	0.3459
N 6					0.0157

2.1.9 PWR High Pressure Safety Injection Pump

2.1.9.1 HIGH PRESSURE INJECTION MOTOR DRIVEN PUMP FAIL TO RUN

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 191
Total Number of Common-Cause Failure Events: 14

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9441910	0.9692580	0.9711710	0.9877720	0.9686360	1.5676E+02	4.9720E+00
2	1.22E-02	3.07E-02	2.88E-02	5.58E-02	3.14E-02	4.9720E+00	1.5676E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9494680	0.9689900	0.9701900	0.9844040	0.9675710	2.5056E+02	8.0186E+00
2	8.73E-03	2.10E-02	1.98E-02	3.74E-02	2.15E-02	5.4258E+00	2.5315E+02
3	2.40E-03	1.00E-02	8.79E-03	2.19E-02	1.09E-02	2.5928E+00	2.5599E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9570560	0.9726620	0.9735470	0.9852360	0.9722930	3.4362E+02	9.6580E+00
2	4.95E-03	1.31E-02	1.22E-02	2.43E-02	1.21E-02	4.6278E+00	3.4865E+02
3	3.30E-03	1.03E-02	9.38E-03	2.04E-02	1.14E-02	3.6365E+00	3.4964E+02
4	4.09E-04	3.95E-03	3.06E-03	1.05E-02	4.19E-03	1.3937E+00	3.5188E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9686360	0.9675710	0.9722930
2	3.14E-02	2.15E-02	1.21E-02
3		1.09E-02	1.14E-02
4			4.19E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.69E-01	9.68E-01	9.72E-01
Beta	3.14E-02	3.24E-02	2.77E-02
Gamma		3.38E-01	5.64E-01
Delta			2.68E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	133.57	200.35	267.13
N 1	5.7760	5.1030	5.6221
N 2	4.5120	4.5610	3.3878
N 3		2.3250	3.2078
N 4			1.1768

2.1.9.2 HIGH PRESSURE INJECTION MOTOR DRIVEN PUMP FAIL TO RUN

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 122
Total Number of Common-Cause Failure Events: 4

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9566070	0.9814080	0.9842340	0.9965510	0.9827870	1.0830E+02	2.0517E+00
2	3.45E-03	1.86E-02	1.58E-02	4.34E-02	1.72E-02	2.0517E+00	1.0830E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9607470	0.9800870	0.9818020	0.9935610	0.9816280	1.8002E+02	3.6576E+00
2	3.84E-03	1.51E-02	1.33E-02	3.22E-02	1.38E-02	2.7648E+00	1.8091E+02
3	1.86E-04	4.86E-03	3.22E-03	1.51E-02	4.55E-03	8.9276E-01	1.8278E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9663610	0.9818770	0.9831190	0.9931340	0.9849870	2.5047E+02	4.6231E+00
2	2.10E-03	9.47E-03	8.22E-03	2.11E-02	6.44E-03	2.4150E+00	2.5268E+02
3	9.25E-04	6.58E-03	5.34E-03	1.65E-02	6.86E-03	1.6787E+00	2.5341E+02
4	1.10E-05	2.08E-03	9.94E-04	7.80E-03	1.71E-03	5.2945E-01	2.5456E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.9827870	0.9816280	0.9849870
2	1.72E-02	1.38E-02	6.44E-03
3		4.55E-03	6.86E-03
4			1.71E-03

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**
1-Beta	9.83E-01	9.82E-01	9.85E-01
Beta	1.72E-02	1.84E-02	1.50E-02
Gamma		2.48E-01	5.71E-01
Delta			2.00E-01

Avg. Impact Vector	**CCCG=2**	**CCCG=3**	**CCCG=4**
Adj. Ind. Events	88.73	133.09	177.45
N 1	2.1500	1.8250	2.1500
N 2	1.5917	1.9000	1.1750
N 3		0.6250	1.2500
N 4			0.3125

2.1.10 PWR Residual Heat Removal Pump

2.1.10.1 PWR RHR MDP FAIL TO RUN

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 88
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9643240	0.9863400	0.9892320	0.9984540	0.9887640	1.0542E+02	1.4600E+00
2	1.55E-03	1.37E-02	1.08E-02	3.57E-02	1.12E-02	1.4600E+00	1.0542E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9724850	0.9881020	0.9898670	0.9976980	0.9924810	1.7710E+02	2.1326E+00
2	7.63E-04	7.61E-03	5.88E-03	2.04E-02	3.76E-03	1.3648E+00	1.7787E+02
3	1.03E-04	4.28E-03	2.64E-03	1.41E-02	3.76E-03	7.6776E-01	1.7846E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9755880	0.9884460	0.9897260	0.9969370	0.9943500	2.4687E+02	2.8856E+00
2	6.95E-04	5.97E-03	4.71E-03	1.55E-02	1.41E-03	1.4900E+00	2.4827E+02
3	1.58E-04	3.72E-03	2.51E-03	1.14E-02	2.82E-03	9.2870E-01	2.4883E+02
4	5.07E-06	1.87E-03	8.01E-04	7.35E-03	1.41E-03	4.6695E-01	2.4929E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9887640	0.9924810	0.9943500
2	1.12E-02	3.76E-03	1.41E-03
3		3.76E-03	2.82E-03
4			1.41E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.89E-01	9.92E-01	9.94E-01
Beta	1.12E-02	7.52E-03	5.65E-03
Gamma		5.00E-01	7.50E-01
Delta			3.33E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	88.00	132.00	176.00
N 1	0.0000	0.0000	0.0000
N 2	1.0000	0.5000	0.2500
N 3		0.5000	0.5000
N 4			0.2500

2.1.10.2 PWR RHR MDP FAIL TO START

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 68
Total Number of Common-Cause Failure Events: 4

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9317260	0.9685290	0.9722840	0.9924640	0.9669140	7.8885E+01	2.5633E+00
2	7.53E-03	3.15E-02	2.77E-02	6.83E-02	3.31E-02	2.5633E+00	7.8885E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9513380	0.9757500	0.9779760	0.9925630	0.9758700	1.3706E+02	3.4063E+00
2	2.91E-03	1.51E-02	1.29E-02	3.49E-02	1.33E-02	2.1203E+00	1.3835E+02
3	8.22E-04	9.16E-03	6.95E-03	2.50E-02	1.08E-02	1.2860E+00	1.3918E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9584200	0.9778840	0.9794760	0.9919080	0.9801010	1.9319E+02	4.3692E+00
2	2.15E-03	1.09E-02	9.33E-03	2.52E-02	7.37E-03	2.1602E+00	1.9540E+02
3	8.78E-04	7.54E-03	5.95E-03	1.96E-02	8.49E-03	1.4887E+00	1.9607E+02
4	7.05E-05	3.65E-03	2.16E-03	1.23E-02	4.03E-03	7.2025E-01	1.9684E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.9669140	0.9758700	0.9801010
2	3.31E-02	1.33E-02	7.37E-03
3		1.08E-02	8.49E-03
4			4.03E-03

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**
1-Beta	9.67E-01	9.76E-01	9.80E-01
Beta	3.31E-02	2.41E-02	1.99E-02
Gamma		4.48E-01	6.29E-01
Delta			3.22E-01

Avg. Impact Vector	**CCCG=2**	**CCCG=3**	**CCCG=4**
Adj. Ind. Events	60.44	90.67	120.89
N 1	1.0267	1.2845	1.4330
N 2	2.1033	1.2555	0.9202
N 3		1.0182	1.0600
N 4			0.5033

2.1.11 BWR Standby Liquid Control Pump

2.1.11.1 STANDBY LIQUID CONTROL MDP FAIL TO RUN SPAR: SLC-MDP-FR

System :	STANDBY LIQUID CONTROL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 33
Total Number of Common-Cause Failure Events: 3

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9005100	0.9542800	0.9597580	0.9893060	0.9444830	5.1868E+01	2.4850E+00
2	1.07E-02	4.57E-02	4.02E-02	9.95E-02	5.55E-02	2.4850E+00	5.1868E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**
1	0.9444830
2	5.55E-02

MGL Parameter	**CCCG=2**
1-Beta	9.44E-01
Beta	5.55E-02

Avg. Impact Vector	**CCCG=2**
Adj. Ind. Events	33.00
N 1	1.4500
N 2	2.0250

2.1.11.2 STANDBY LIQUID CONTROL MDP FAIL TO START SPAR: SLC-MDP-FS

System :	STANDBY LIQUID CONTROL
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 19
Total Number of Common-Cause Failure Events: 2

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9364670	0.9809610	0.9885350	0.9996230	0.9869610	3.7098E+01	7.2002E-01
2	3.75E-04	1.90E-02	1.15E-02	6.35E-02	1.30E-02	7.2002E-01	3.7098E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**
1	0.9869610
2	1.30E-02

MGL Parameter	**CCCG=2**
1-Beta	9.87E-01
Beta	1.30E-02

Avg. Impact Vector	**CCCG=2**
Adj. Ind. Events	19.00
N 1	0.6800
N 2	0.2600

2.1.12 Component Cooling Water Pumps

2.1.12.1 CCW MOTOR DRIVEN PUMP FAIL TO RUN SPAR:CCW-MDP-FR

System :	Component Cooling Water
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1997/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 37
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9669430	0.9916170	0.9964320	0.9999770	1.0000000	5.4418E+01	4.6002E-01
2	2.11E-05	8.38E-03	3.57E-03	3.31E-02	0.00E+00	4.6002E-01	5.4418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9612490	0.9863940	0.9900450	0.9990520	1.0000000	8.2105E+01	1.1325E+00
2	3.64E-04	1.04E-02	6.82E-03	3.26E-02	0.00E+00	8.6476E-01	8.2373E+01
3	1.14E-07	3.22E-03	6.47E-04	1.53E-02	0.00E+00	2.6776E-01	8.2970E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**
1	1.0000000	1.0000000
2	0.00E+00	0.00E+00
3		0.00E+00

MGL Parameter	**CCCG=2**	**CCCG=3**
1-Beta	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00
Gamma		0.00E+00

Avg. Impact Vector	**CCCG=2**	**CCCG=3**
Adj. Ind. Events	37.00	37.00
N 1	0.0000	0.0000
N 2	0.0000	0.0000
N 3		0.0000

2.1.12.2 CCW MOTOR DRIVEN PUMP FAIL TO START SPAR: CCW-MDP-FS

System :	Component Cooling Water
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1997/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 66
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9783490	0.9945160	0.9976770	0.9999850	1.0000000	8.3418E+01	4.6002E-01
2	1.37E-05	5.48E-03	2.33E-03	2.17E-02	0.00E+00	4.6002E-01	8.3418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9712130	0.9899100	0.9926310	0.9992980	1.0000000	1.1111E+02	1.1325E+00
2	2.69E-04	7.70E-03	5.05E-03	2.42E-02	0.00E+00	8.6476E-01	1.1138E+02
3	8.47E-08	2.39E-03	4.79E-04	1.13E-02	0.00E+00	2.6776E-01	1.1197E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3
1	1.0000000	1.0000000
2	0.00E+00	0.00E+00
3		0.00E+00

MGL Parameter	CCCG=2	CCCG=3
1-Beta	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00
Gamma		0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3
Adj. Ind. Events	66.00	66.00
N 1	0.0000	0.0000
N 2	0.0000	0.0000
N 3		0.0000

2.1.13 RHR Service Water

2.1.13.1 RHR SERVICE WATER MDP-FR

System :	RHR Service Water System
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 8
Total Number of Common-Cause Failure Events: 2

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8668240	0.9524830	0.9646000	0.9966320	0.8857100	2.2585E+01	1.1267E+00
2	3.37E-03	4.75E-02	3.54E-02	1.33E-01	1.14E-01	1.1267E+00	2.2585E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2
1	0.8857100
2	1.14E-01

MGL Parameter	CCCG=2
1-Beta	8.86E-01
Beta	1.14E-01

Avg. Impact Vector	CCCG=2
Adj. Ind. Events	4.00
N 1	1.1667
N 2	0.6667

2.1.13.2 RHR SERVICE WATER MDP-FS

System :	RHR Service Water System
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 7
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9274070	0.9815090	0.9920120	0.9999490	1.0000000	2.4418E+01	4.6002E-01
2	4.73E-05	1.85E-02	7.99E-03	7.26E-02	0.00E+00	4.6002E-01	2.4418E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**
1	1.0000000
2	0.00E+00

MGL Parameter	**CCCG=2**
1-Beta	1.00E+00
Beta	0.00E+00

Avg. Impact Vector	**CCCG=2**
Adj. Ind. Events	7.00
N 1	0.0000
N 2	0.0000

2.2 Turbine Driven Pumps

2.2.1 Pooled Turbine Driven Pumps

2.2.1.1 TURBINE DRIVEN PUMP FAIL TO RUN ALL SYSTEMS SPAR: TDP-FR

Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 249
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9892150	0.9971290	0.9986190	0.9999860	0.9995800	1.8408E+02	5.3002E-01
2	1.53E-05	2.87E-03	1.38E-03	1.08E-02	4.20E-04	5.3002E-01	1.8408E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9878890	0.9955360	0.9965860	0.9995770	0.9992400	2.9492E+02	1.3226E+00
2	2.02E-04	3.53E-03	2.49E-03	1.04E-02	7.20E-04	1.0448E+00	2.9520E+02
3	4.81E-08	9.38E-04	2.01E-04	4.39E-03	4.00E-05	2.7776E-01	2.9596E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**
1	0.9995800	0.9992400
2	4.20E-04	7.20E-04
3		4.00E-05

MGL Parameter	**CCCG=2**	**CCCG=3**
1-Beta	1.00E+00	9.99E-01
Beta	4.20E-04	7.60E-04
Gamma		5.26E-02

Avg. Impact Vector	**CCCG=2**	**CCCG=3**
Adj. Ind. Events	166.00	249.00
N 1	0.6600	0.8100
N 2	0.0700	0.1800
N 3		0.0100

2.2.1.2 TURBINE DRIVEN PUMP FAIL TO STARTALL SYSTEMS SPAR: TDP-FS

Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 354

Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9897300	0.9960850	0.9969310	0.9995580	0.9971830	3.7142E+02	1.4600E+00
2	4.40E-04	3.92E-03	3.07E-03	1.03E-02	2.82E-03	1.4600E+00	3.7142E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9914420	0.9963120	0.9968690	0.9992880	0.9981200	5.7610E+02	2.1326E+00
2	2.36E-04	2.36E-03	1.82E-03	6.34E-03	9.40E-04	1.3648E+00	5.7687E+02
3	3.19E-05	1.33E-03	8.15E-04	4.37E-03	9.40E-04	7.6776E-01	5.7746E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**
1	0.9971830	0.9981200
2	2.82E-03	9.40E-04
3		9.40E-04

MGL Parameter	**CCCG=2**	**CCCG=3**
1-Beta	9.97E-01	9.98E-01
Beta	2.82E-03	1.88E-03
Gamma		5.00E-01

Avg. Impact Vector	**CCCG=2**	**CCCG=3**
Adj. Ind. Events	354.00	531.00
N 1	0.0000	0.0000
N 2	1.0000	0.5000
N 3		0.5000

2.2.2 AFW Turbine-Driven Pumps

2.2.2.1 TURBINE DRIVEN PUMP FAIL TO RUN SPAR: AFW-TDP-FR

System :	AUXILIARY FEEDWATER SYSTEM
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 120
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9798230	0.9946250	0.9974160	0.9999690	0.9991330	9.8078E+01	5.3002E-01
2	2.87E-05	5.38E-03	2.59E-03	2.02E-02	8.67E-04	5.3002E-01	9.8078E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9785890	0.9920910	0.9939460	0.9992490	0.9984300	1.6591E+02	1.3226E+00
2	3.59E-04	6.25E-03	4.42E-03	1.84E-02	1.49E-03	1.0448E+00	1.6619E+02
3	8.54E-08	1.66E-03	3.56E-04	7.78E-03	8.26E-05	2.7776E-01	1.6695E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3
1	0.9991330	0.9984300
2	8.67E-04	1.49E-03
3		8.26E-05

MGL Parameter	CCCG=2	CCCG=3
1-Beta	9.99E-01	9.98E-01
Beta	8.67E-04	1.57E-03
Gamma		5.26E-02

Avg. Impact Vector	CCCG=2	CCCG=3
Adj. Ind. Events	80.00	120.00
N 1	0.6600	0.8100
N 2	0.0700	0.1800
N 3		0.0100

2.2.2.2 TURBINE DRIVEN PUMP FAIL TO START SPAR: AFW-TDP-FS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 164
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9900050	0.9974710	0.9989350	0.9999870	1.0000000	1.8142E+02	4.6002E-01
2	6.30E-06	2.53E-03	1.07E-03	1.00E-02	0.00E+00	4.6002E-01	1.8142E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9845960	0.9946130	0.9960800	0.9996260	1.0000000	2.0910E+02	1.1325E+00
2	1.43E-04	4.11E-03	2.69E-03	1.29E-02	0.00E+00	8.6476E-01	2.0937E+02
3	4.51E-08	1.27E-03	2.55E-04	6.04E-03	0.00E+00	2.6776E-01	2.0996E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3
1	1.0000000	1.0000000
2	0.00E+00	0.00E+00
3		0.00E+00

MGL Parameter	CCCG=2	CCCG=3
1-Beta	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00
Gamma		0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3
Adj. Ind. Events	164.00	164.00
N 1	0.0000	0.0000
N 2	0.0000	0.0000
N 3		0.0000

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

2.2.3.1 COMBINED HPCI AND RCIC TDP FAIL TO RUN

System :	HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 129
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9876210	0.9968680	0.9986730	0.9999930	1.0000000	1.4642E+02	4.6002E-01
2	7.81E-06	3.13E-03	1.32E-03	1.24E-02	0.00E+00	4.6002E-01	1.4642E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2
1	1.0000000
2	0.00E+00

MGL Parameter	CCCG=2
1-Beta	1.00E+00
Beta	0.00E+00

Avg. Impact Vector	CCCG=2
Adj. Ind. Events	129.00
N 1	0.0000
N 2	0.0000

2.2.3.2 COMBINED HPCI AND RCIC TDP FAIL TO START

System :	HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 190
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9816850	0.9930100	0.9945060	0.9992100	0.9947640	2.0742E+02	1.4600E+00
2	7.88E-04	6.99E-03	5.49E-03	1.83E-02	5.24E-03	1.4600E+00	2.0742E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**
1	0.9947640
2	5.24E-03

MGL Parameter	**CCCG=2**
1-Beta	9.95E-01
Beta	5.24E-03

Avg. Impact Vector	**CCCG=2**
Adj. Ind. Events	190.00
N 1	0.0000
N 2	1.0000

2.3 Motor Operated Valves

2.3.1 Pooled Motor Operated Valve Distributions

2.3.1.1 MOV FAIL TO OPEN ALL SYSTEMS SPAR: MOV-CC

Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 765
Total Number of Common-Cause Failure Events: 24

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9609140	0.9771710	0.9782920	0.9896120	0.9773670	2.7601E+02	6.4481E+00
2	1.04E-02	2.28E-02	2.17E-02	3.91E-02	2.26E-02	6.4481E+00	2.7601E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9688910	0.9807540	0.9814760	0.9901470	0.9813710	4.3099E+02	8.4577E+00
2	5.04E-03	1.22E-02	1.15E-02	2.19E-02	1.15E-02	5.3703E+00	4.3408E+02
3	1.97E-03	7.03E-03	6.29E-03	1.46E-02	7.17E-03	3.0874E+00	4.3636E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9723370	0.9821010	0.9826370	0.9900270	0.9832200	5.8348E+02	1.0634E+01
2	3.69E-03	8.98E-03	8.44E-03	1.61E-02	7.86E-03	5.3367E+00	5.8878E+02
3	2.02E-03	6.24E-03	5.69E-03	1.23E-02	6.28E-03	3.7049E+00	5.9041E+02
4	3.47E-04	2.68E-03	2.15E-03	6.84E-03	2.64E-03	1.5925E+00	5.9252E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9746700	0.9828710	0.9832720	0.9896880	0.9843840	7.8009E+02	1.3595E+01
2	3.46E-03	7.79E-03	7.38E-03	1.35E-02	6.38E-03	6.1838E+00	7.8750E+02
3	1.75E-03	5.08E-03	4.67E-03	9.80E-03	4.74E-03	4.0293E+00	7.8966E+02
4	7.93E-04	3.30E-03	2.89E-03	7.19E-03	3.44E-03	2.6176E+00	7.9107E+02
5	2.28E-05	9.63E-04	5.90E-04	3.17E-03	1.06E-03	7.6463E-01	7.9292E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9762300	0.9835080	0.9838450	0.9896450	0.9852140	9.4415E+02	1.5832E+01
2	3.19E-03	6.94E-03	6.60E-03	1.18E-02	5.64E-03	6.6596E+00	9.5332E+02
3	1.42E-03	4.16E-03	3.82E-03	8.05E-03	3.69E-03	3.9901E+00	9.5599E+02
4	8.90E-04	3.20E-03	2.86E-03	6.66E-03	3.15E-03	3.0691E+00	9.5691E+02
5	2.51E-04	1.76E-03	1.43E-03	4.41E-03	1.87E-03	1.6943E+00	9.5829E+02
6	6.09E-07	4.36E-04	1.66E-04	1.78E-03	4.43E-04	4.1852E-01	9.5956E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9774150	0.9838810	0.9841560	0.9894110	0.9859690	1.1586E+03	1.8982E+01
2	3.19E-03	6.51E-03	6.23E-03	1.08E-02	5.08E-03	7.6640E+00	1.1699E+03
3	1.30E-03	3.63E-03	3.36E-03	6.91E-03	3.06E-03	4.2801E+00	1.1733E+03
4	8.22E-04	2.79E-03	2.51E-03	5.70E-03	2.58E-03	3.2841E+00	1.1743E+03
5	4.71E-04	2.09E-03	1.82E-03	4.64E-03	2.14E-03	2.4606E+00	1.1751E+03
6	5.82E-05	9.25E-04	6.62E-04	2.69E-03	9.90E-04	1.0890E+00	1.1765E+03
7	2.32E-10	1.73E-04	1.89E-05	8.88E-04	1.90E-04	2.0393E-01	1.1774E+03

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9784980	0.9844190	0.9846590	0.9895260	0.9866030	1.3296E+03	2.1045E+01
2	3.01E-03	6.01E-03	5.76E-03	9.83E-03	4.63E-03	8.1126E+00	1.3425E+03
3	1.22E-03	3.32E-03	3.08E-03	6.24E-03	2.78E-03	4.4806E+00	1.3462E+03
4	6.44E-04	2.29E-03	2.05E-03	4.77E-03	1.99E-03	3.0982E+00	1.3475E+03
5	5.31E-04	2.07E-03	1.83E-03	4.43E-03	2.03E-03	2.7981E+00	1.3478E+03
6	1.98E-04	1.31E-03	1.07E-03	3.23E-03	1.37E-03	1.7695E+00	1.3489E+03
7	6.81E-06	4.89E-04	2.75E-04	1.70E-03	5.17E-04	6.6019E-01	1.3500E+03
8	2.13E-14	9.32E-05	1.87E-06	5.29E-04	8.33E-05	1.2591E-01	1.3505E+03

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1	0.9773670	0.9813710	0.9832200	0.9843840	0.9852140	0.9859690	0.9866030
2	2.26E-02	1.15E-02	7.86E-03	6.38E-03	5.64E-03	5.08E-03	4.63E-03
3		7.17E-03	6.28E-03	4.74E-03	3.69E-03	3.06E-03	2.78E-03
4			2.64E-03	3.44E-03	3.15E-03	2.58E-03	1.99E-03
5				1.06E-03	1.87E-03	2.14E-03	2.03E-03
6					4.43E-04	9.90E-04	1.37E-03
7						1.90E-04	5.17E-04
8							8.33E-05

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1-Beta	9.77E-01	9.81E-01	9.83E-01	9.84E-01	9.85E-01	9.86E-01	9.87E-01
Beta	2.26E-02	1.86E-02	1.68E-02	1.56E-02	1.48E-02	1.40E-02	1.34E-02
Gamma		3.85E-01	5.32E-01	5.91E-01	6.19E-01	6.38E-01	6.55E-01
Delta			2.96E-01	4.87E-01	5.97E-01	6.59E-01	6.83E-01
Epsilon				2.36E-01	4.23E-01	5.63E-01	6.67E-01
Mu					1.91E-01	3.56E-01	4.92E-01
Upsilon						1.61E-01	3.05E-01
Sigma							1.39E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	251.64	377.47	503.29	629.11	754.93	880.76	1006.58
N 1	6.9489	8.4178	9.3260	9.9208	10.2888	10.6035	10.8266
N 2	5.9881	4.5055	4.0967	4.1438	4.3792	4.5919	4.7712
N 3		2.8196	3.2762	3.0756	2.8656	2.7619	2.8676
N 4			1.3755	2.2308	2.4444	2.3310	2.0544
N 5				0.6875	1.4516	1.9327	2.0953
N 6					0.3438	0.8953	1.4077
N 7						0.1719	0.5328
N 8							0.0859

2.3.1.2 MOV SPURIOUS OPERATION ALL SYSTEMS SPAR: MOV-CO

Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	SPURIOUS ACTUATION
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 73
Total Number of Common-Cause Failure Events: 2

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9315960	0.9736150	0.9790700	0.9969650	0.9733030	5.4058E+01	1.4650E+00
2	3.04E-03	2.64E-02	2.09E-02	6.84E-02	2.67E-02	1.4650E+00	5.4058E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9517030	0.9789900	0.9820330	0.9958780	0.9818690	1.0005E+02	2.1472E+00
2	3.15E-04	8.60E-03	5.68E-03	2.69E-02	2.56E-04	8.7906E-01	1.0132E+02
3	1.09E-03	1.24E-02	9.40E-03	3.40E-02	1.79E-02	1.2681E+00	1.0093E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9583850	0.9801820	0.9823160	0.9946820	0.9861590	1.4411E+02	2.9137E+00
2	7.52E-04	8.62E-03	6.52E-03	2.37E-02	3.64E-04	1.2670E+00	1.4576E+02
3	4.84E-06	2.92E-03	1.15E-03	1.18E-02	1.35E-05	4.2970E-01	1.4659E+02
4	6.66E-04	8.28E-03	6.18E-03	2.31E-02	1.35E-02	1.2170E+00	1.4581E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9645350	0.9810120	0.9823470	0.9929270	0.9887210	2.3259E+02	4.5019E+00
2	1.65E-03	8.78E-03	7.44E-03	2.05E-02	4.47E-04	2.0814E+00	2.3501E+02
3	1.85E-04	4.03E-03	2.75E-03	1.23E-02	2.92E-05	9.5639E-01	2.3614E+02
4	1.40E-04	3.74E-03	2.47E-03	1.17E-02	5.40E-03	8.8694E-01	2.3620E+02
5	1.94E-05	2.43E-03	1.25E-03	8.87E-03	5.40E-03	5.7713E-01	2.3651E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9671570	0.9816090	0.9826870	0.9923630	0.9904130	2.8875E+02	5.4100E+00
2	1.70E-03	7.95E-03	6.86E-03	1.79E-02	5.19E-04	2.3379E+00	2.9182E+02
3	2.63E-04	3.84E-03	2.79E-03	1.10E-02	4.78E-05	1.1298E+00	2.9303E+02
4	1.07E-04	2.97E-03	1.95E-03	9.33E-03	2.26E-03	8.7491E-01	2.9329E+02
5	5.43E-05	2.52E-03	1.52E-03	8.40E-03	4.51E-03	7.4272E-01	2.9342E+02
6	2.38E-07	1.10E-03	3.05E-04	4.92E-03	2.25E-03	3.2472E-01	2.9384E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9694980	0.9816690	0.9824590	0.9911330	0.9916060	3.9530E+02	7.3814E+00
2	2.23E-03	7.82E-03	7.02E-03	1.61E-02	5.80E-04	3.1470E+00	3.9953E+02
3	4.59E-04	3.79E-03	3.01E-03	9.80E-03	6.81E-05	1.5270E+00	4.0115E+02
4	1.65E-04	2.68E-03	1.91E-03	7.80E-03	9.72E-04	1.0787E+00	4.0160E+02
5	8.81E-05	2.24E-03	1.49E-03	6.96E-03	2.90E-03	9.0295E-01	4.0178E+02
6	1.05E-05	1.41E-03	7.15E-04	5.18E-03	2.90E-03	5.6873E-01	4.0211E+02
7	8.16E-12	3.90E-04	1.92E-05	2.13E-03	9.68E-04	1.5703E-01	4.0252E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9710410	0.9821430	0.9828250	0.9909140	0.9924920	4.5858E+02	8.3375E+00
2	2.25E-03	7.36E-03	6.66E-03	1.48E-02	6.30E-04	3.4343E+00	4.6348E+02
3	4.66E-04	3.48E-03	2.80E-03	8.82E-03	8.95E-05	1.6262E+00	4.6529E+02
4	1.55E-04	2.37E-03	1.71E-03	6.85E-03	4.31E-04	1.1074E+00	4.6581E+02
5	9.27E-05	2.04E-03	1.39E-03	6.21E-03	1.70E-03	9.5290E-01	4.6596E+02
6	3.30E-05	1.58E-03	9.48E-04	5.27E-03	2.54E-03	7.3684E-01	4.6618E+02
7	5.60E-07	8.08E-04	2.74E-04	3.43E-03	1.70E-03	3.7739E-01	4.6654E+02
8	2.65E-16	2.20E-04	1.51E-06	1.27E-03	4.24E-04	1.0250E-01	4.6682E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9733030	0.9818690	0.9861590	0.9887210	0.9904130	0.9916060	0.9924920
2	2.67E-02	2.56E-04	3.64E-04	4.47E-04	5.19E-04	5.80E-04	6.30E-04
3		1.79E-02	1.35E-05	2.92E-05	4.78E-05	6.81E-05	8.95E-05
4			1.35E-02	5.40E-03	2.26E-03	9.72E-04	4.31E-04
5				5.40E-03	4.51E-03	2.90E-03	1.70E-03
6					2.25E-03	2.90E-03	2.54E-03
7						9.68E-04	1.70E-03
8							4.24E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.73E-01	9.82E-01	9.86E-01	9.89E-01	9.90E-01	9.92E-01	9.92E-01
Beta	2.67E-02	1.81E-02	1.38E-02	1.13E-02	9.59E-03	8.39E-03	7.51E-03
Gamma		9.86E-01	9.74E-01	9.60E-01	9.46E-01	9.31E-01	9.16E-01
Delta			9.99E-01	9.97E-01	9.95E-01	9.91E-01	9.87E-01
Epsilon				5.00E-01	7.50E-01	8.74E-01	9.36E-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	36.50	54.75	73.00	91.25	109.50	127.75	146.00
N 1	0.1400	0.1958	0.2430	0.2835	0.3175	0.3457	0.3688
N 2	1.0050	0.0143	0.0270	0.0414	0.0575	0.0749	0.0929
N 3		1.0003	0.0010	0.0027	0.0053	0.0088	0.0132
N 4			1.0000	0.5001	0.2502	0.1256	0.0636
N 5				0.5000	0.5000	0.3750	0.2501
N 6					0.2500	0.3750	0.3750
N 7						0.1250	0.2500
N 8							0.0625

2.3.1.3 MOV FAIL TO OPERATE ALL SYSTEMS SPAR: MOV-FO

Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN) FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 1313
Total Number of Common-Cause Failure Events: 54

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9738450	0.9841820	0.9848440	0.9922450	0.9845630	4.7460E+02	7.6279E+00
2	7.75E-03	1.58E-02	1.52E-02	2.62E-02	1.54E-02	7.6279E+00	4.7460E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9756170	0.9839040	0.9843360	0.9907040	0.9844660	7.2552E+02	1.1869E+01
2	6.11E-03	1.18E-02	1.14E-02	1.90E-02	1.14E-02	8.7178E+00	7.2867E+02
3	1.22E-03	4.27E-03	3.83E-03	8.83E-03	4.17E-03	3.1514E+00	7.3424E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9752730	0.9826120	0.9829330	0.9888450	0.9832890	9.7198E+02	1.7200E+01
2	6.75E-03	1.18E-02	1.14E-02	1.79E-02	1.14E-02	1.1646E+01	9.7753E+02
3	1.36E-03	4.00E-03	3.68E-03	7.77E-03	3.85E-03	3.9612E+00	9.8522E+02
4	2.08E-04	1.61E-03	1.29E-03	4.11E-03	1.50E-03	1.5926E+00	9.8759E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9768140	0.9831240	0.9833750	0.9885710	0.9840170	1.2638E+03	2.1695E+01
2	5.73E-03	9.77E-03	9.52E-03	1.47E-02	9.22E-03	1.2559E+01	1.2729E+03
3	1.87E-03	4.41E-03	4.16E-03	7.82E-03	4.13E-03	5.6694E+00	1.2798E+03
4	5.21E-04	2.10E-03	1.85E-03	4.54E-03	2.03E-03	2.7015E+00	1.2828E+03
5	1.41E-05	5.95E-04	3.64E-04	1.96E-03	6.03E-04	7.6473E-01	1.2847E+03

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9777690	0.9834330	0.9836430	0.9883880	0.9843940	1.5225E+03	2.5648E+01
2	5.27E-03	8.77E-03	8.56E-03	1.30E-02	8.28E-03	1.3578E+01	1.5346E+03
3	1.82E-03	4.07E-03	3.86E-03	7.04E-03	3.79E-03	6.2962E+00	1.5419E+03
4	7.49E-04	2.35E-03	2.14E-03	4.66E-03	2.20E-03	3.6332E+00	1.5445E+03
5	1.62E-04	1.11E-03	9.06E-04	2.77E-03	1.08E-03	1.7221E+00	1.5464E+03
6	3.77E-07	2.70E-04	1.03E-04	1.11E-03	2.52E-04	4.1852E-01	1.5477E+03

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9787500	0.9838350	0.9840100	0.9883310	0.9850170	1.8318E+03	3.0097E+01
2	4.81E-03	7.85E-03	7.67E-03	1.15E-02	7.27E-03	1.4614E+01	1.8473E+03
3	1.83E-03	3.85E-03	3.67E-03	6.47E-03	3.55E-03	7.1615E+00	1.8547E+03
4	8.48E-04	2.34E-03	2.17E-03	4.43E-03	2.14E-03	4.3583E+00	1.8575E+03
5	3.49E-04	1.43E-03	1.26E-03	3.10E-03	1.34E-03	2.6611E+00	1.8592E+03
6	3.78E-05	5.90E-04	4.24E-04	1.71E-03	5.69E-04	1.0982E+00	1.8608E+03
7	1.47E-10	1.10E-04	1.20E-05	5.62E-04	1.08E-04	2.0393E-01	1.8617E+03

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9796060	0.9842780	0.9844320	0.9884380	0.9854980	2.0975E+03	3.3503E+01
2	4.46E-03	7.19E-03	7.03E-03	1.04E-02	6.61E-03	1.5314E+01	2.1157E+03
3	1.76E-03	3.59E-03	3.44E-03	5.95E-03	3.33E-03	7.6541E+00	2.1233E+03
4	8.18E-04	2.17E-03	2.02E-03	4.05E-03	1.98E-03	4.6306E+00	2.1264E+03
5	4.51E-04	1.54E-03	1.38E-03	3.14E-03	1.42E-03	3.2735E+00	2.1277E+03
6	1.38E-04	8.64E-04	7.14E-04	2.10E-03	8.17E-04	1.8414E+00	2.1292E+03
7	4.42E-06	3.11E-04	1.75E-04	1.08E-03	2.96E-04	6.6329E-01	2.1303E+03
8	1.35E-14	5.91E-05	1.18E-06	3.35E-04	4.74E-05	1.2591E-01	2.1309E+03

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1	0.9845630	0.9844660	0.9832890	0.9840170	0.9843940	0.9850170	0.9854980
2	1.54E-02	1.14E-02	1.14E-02	9.22E-03	8.28E-03	7.27E-03	6.61E-03
3		4.17E-03	3.85E-03	4.13E-03	3.79E-03	3.55E-03	3.33E-03
4			1.50E-03	2.03E-03	2.20E-03	2.14E-03	1.98E-03
5				6.03E-04	1.08E-03	1.34E-03	1.42E-03
6					2.52E-04	5.69E-04	8.17E-04
7						1.08E-04	2.96E-04
8							4.74E-05

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1-Beta	9.85E-01	9.84E-01	9.83E-01	9.84E-01	9.84E-01	9.85E-01	9.85E-01
Beta	1.54E-02	1.55E-02	1.67E-02	1.60E-02	1.56E-02	1.50E-02	1.45E-02
Gamma		2.69E-01	3.20E-01	4.23E-01	4.70E-01	5.15E-01	5.44E-01
Delta			2.80E-01	3.89E-01	4.83E-01	5.40E-01	5.78E-01
Epsilon				2.29E-01	3.77E-01	4.85E-01	5.66E-01
Mu					1.89E-01	3.35E-01	4.50E-01
Upsilon						1.60E-01	2.96E-01
Sigma							1.38E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	439.13	658.70	878.26	1097.83	1317.39	1536.96	1756.52
N 1	18.0475	21.7183	22.8538	24.9148	26.2204	27.6744	28.8029
N 2	7.1679	7.8530	10.4064	10.5185	11.2975	11.5422	11.9723
N 3		2.8836	3.5325	4.7157	5.1717	5.6433	6.0411
N 4			1.3756	2.3147	3.0085	3.4052	3.5868
N 5				0.6876	1.4794	2.1332	2.5707
N 6					0.3438	0.9045	1.4796
N 7						0.1719	0.5359
N 8							0.0859

2.3.1.4 MOV FAIL TO CLOSE ALL SYSTEMS SPAR: MOV-OO

Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 548
Total Number of Common-Cause Failure Events: 30

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9808580	0.9924050	0.9938650	0.9989670	0.9940420	2.1428E+02	1.6399E+00
2	1.03E-03	7.59E-03	6.14E-03	1.91E-02	5.96E-03	1.6399E+00	2.1428E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9751620	0.9866970	0.9876380	0.9950240	0.9884490	3.3705E+02	4.5441E+00
2	4.39E-03	1.23E-02	1.14E-02	2.35E-02	1.13E-02	4.2123E+00	3.3738E+02
3	2.50E-07	9.71E-04	2.77E-04	4.30E-03	2.17E-04	3.3176E-01	3.4126E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9705700	0.9818000	0.9824850	0.9906880	0.9832340	4.5593E+02	8.4517E+00
2	7.93E-03	1.63E-02	1.56E-02	2.69E-02	1.61E-02	7.5497E+00	4.5683E+02
3	2.37E-05	1.48E-03	8.49E-04	5.06E-03	6.54E-04	6.8500E-01	4.6370E+02
4	1.44E-09	4.67E-04	5.97E-05	2.36E-03	2.55E-07	2.1705E-01	4.6416E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9721780	0.9817150	0.9822180	0.9895250	0.9833870	6.2046E+02	1.1556E+01
2	6.79E-03	1.33E-02	1.28E-02	2.16E-02	1.31E-02	8.4147E+00	6.2360E+02
3	9.78E-04	4.10E-03	3.59E-03	8.97E-03	3.36E-03	2.5938E+00	6.2942E+02
4	2.11E-06	7.45E-04	3.21E-04	2.92E-03	1.72E-04	4.7074E-01	6.3155E+02
5	1.28E-20	1.22E-04	1.18E-07	7.09E-04	0.00E+00	7.7129E-02	6.3194E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9728670	0.9815170	0.9819320	0.9887380	0.9831630	7.5215E+02	1.4163E+01
2	6.34E-03	1.20E-02	1.16E-02	1.91E-02	1.19E-02	9.1987E+00	7.5711E+02
3	1.37E-03	4.48E-03	4.05E-03	9.03E-03	3.96E-03	3.4306E+00	7.6288E+02
4	1.18E-04	1.55E-03	1.15E-03	4.37E-03	9.68E-04	1.1889E+00	7.6512E+02
5	1.39E-08	3.53E-04	7.19E-05	1.67E-03	4.77E-05	2.7052E-01	7.6604E+02
6	3.02E-21	9.75E-05	7.28E-08	5.65E-04	0.00E+00	7.4722E-02	7.6624E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9740380	0.9817060	0.9820390	0.9882250	0.9836140	9.3444E+02	1.7413E+01
2	5.73E-03	1.05E-02	1.02E-02	1.65E-02	1.02E-02	1.0023E+01	9.4183E+02
3	1.69E-03	4.62E-03	4.28E-03	8.73E-03	4.25E-03	4.3996E+00	9.4745E+02
4	3.85E-04	2.13E-03	1.79E-03	5.03E-03	1.58E-03	2.0273E+00	9.4983E+02
5	1.53E-05	7.65E-04	4.56E-04	2.57E-03	2.95E-04	7.2835E-01	9.5112E+02
6	2.69E-10	2.13E-04	2.30E-05	1.09E-03	1.37E-05	2.0303E-01	9.5165E+02
7	1.40E-44	3.36E-05	2.42E-13	1.38E-04	0.00E+00	3.2027E-02	9.5182E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9749070	0.9819860	0.9822760	0.9880610	0.9838940	1.0732E+03	1.9687E+01
2	5.35E-03	9.65E-03	9.35E-03	1.50E-02	9.31E-03	1.0542E+01	1.0823E+03
3	1.68E-03	4.38E-03	4.08E-03	8.09E-03	4.10E-03	4.7865E+00	1.0881E+03
4	5.57E-04	2.36E-03	2.06E-03	5.17E-03	1.98E-03	2.5761E+00	1.0903E+03
5	8.06E-05	1.08E-03	7.93E-04	3.05E-03	6.15E-04	1.1782E+00	1.0917E+03
6	6.95E-07	3.97E-04	1.58E-04	1.60E-03	9.31E-05	4.3384E-01	1.0925E+03
7	6.09E-14	1.19E-04	2.81E-06	6.73E-04	4.01E-06	1.3049E-01	1.0928E+03
8	1.60E-36	3.66E-05	1.59E-11	1.76E-04	0.00E+00	4.0005E-02	1.0928E+03

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9940420	0.9884490	0.9832340	0.9833870	0.9831630	0.9836140	0.9838940
2	5.96E-03	1.13E-02	1.61E-02	1.31E-02	1.19E-02	1.02E-02	9.31E-03
3		2.17E-04	6.54E-04	3.36E-03	3.96E-03	4.25E-03	4.10E-03
4			2.55E-07	1.72E-04	9.68E-04	1.58E-03	1.98E-03
5				0.00E+00	4.77E-05	2.95E-04	6.15E-04
6					0.00E+00	1.37E-05	9.31E-05
7						0.00E+00	4.01E-06
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	9.88E-01	9.83E-01	9.83E-01	9.83E-01	9.84E-01	9.84E-01
Beta	5.96E-03	1.16E-02	1.68E-02	1.66E-02	1.68E-02	1.64E-02	1.61E-02
Gamma		1.88E-02	3.90E-02	2.13E-01	2.95E-01	3.75E-01	4.22E-01
Delta			3.90E-04	4.87E-02	2.04E-01	3.08E-01	3.96E-01
Epsilon				0.00E+00	4.70E-02	1.63E-01	2.64E-01
Mu					0.00E+00	4.43E-02	1.36E-01
Upsilon						0.00E+00	4.13E-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	185.76	278.64	371.53	464.41	557.29	650.17	743.05
N 1	11.0986	13.3004	13.5278	14.9940	15.9315	17.0710	17.9763
N 2	1.1799	3.3475	6.3097	6.3747	6.9183	6.9504	7.2011
N 3		0.0640	0.2563	1.6401	2.3061	2.8814	3.1735
N 4			0.0001	0.0839	0.5642	1.0742	1.5323
N 5				0.0000	0.0278	0.2004	0.4754
N 6					0.0000	0.0093	0.0720
N 7						0.0000	0.0031
N 8							0.0000

2.3.2 PWR Containment Spray Motor Operated Valves

2.3.2.1 CONTAINMENT SPRAY MOV-CC

System :	CONTAINMENT SPRAY SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 35
Total Number of Common-Cause Failure Events: 2

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9337500	0.9826530	0.9919650	0.9999290	0.9965360	2.8177E+01	4.9742E-01
2	6.81E-05	1.73E-02	8.03E-03	6.62E-02	3.46E-03	4.9742E-01	2.8177E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9451690	0.9800460	0.9849070	0.9983060	0.9930540	6.1131E+01	1.2446E+00
2	7.69E-04	1.57E-02	1.09E-02	4.69E-02	6.95E-03	9.7686E-01	6.1399E+01
3	1.53E-07	4.29E-03	8.66E-04	2.04E-02	0.00E+00	2.6776E-01	6.2108E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9482620	0.9776000	0.9808910	0.9956910	0.9895390	9.2086E+01	2.1100E+00
2	1.77E-03	1.55E-02	1.23E-02	4.05E-02	1.05E-02	1.4643E+00	9.2732E+01
3	7.45E-06	4.55E-03	1.79E-03	1.84E-02	0.00E+00	4.2870E-01	9.3767E+01
4	7.10E-09	2.30E-03	2.96E-04	1.16E-02	0.00E+00	2.1695E-01	9.3979E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9564740	0.9776240	0.9794560	0.9925110	0.9860050	1.6740E+02	3.8315E+00
2	3.14E-03	1.41E-02	1.23E-02	3.14E-02	1.40E-02	2.4138E+00	1.6882E+02
3	2.54E-04	5.57E-03	3.80E-03	1.69E-02	0.00E+00	9.5369E-01	1.7028E+02
4	1.87E-06	2.26E-03	7.91E-04	9.49E-03	0.00E+00	3.8684E-01	1.7084E+02
5	4.74E-20	4.50E-04	4.37E-07	2.62E-03	0.00E+00	7.7129E-02	1.7115E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9583670	0.9771960	0.9786580	0.9910320	0.9824450	2.1031E+02	4.9078E+00
2	3.45E-03	1.32E-02	1.17E-02	2.80E-02	1.76E-02	2.8411E+00	2.1238E+02
3	3.55E-04	5.22E-03	3.79E-03	1.50E-02	0.00E+00	1.1245E+00	2.1409E+02
4	3.25E-05	2.90E-03	1.58E-03	1.03E-02	0.00E+00	6.2471E-01	2.1459E+02
5	1.37E-08	1.13E-03	1.86E-04	5.51E-03	0.00E+00	2.4272E-01	2.1498E+02
6	1.08E-20	3.47E-04	2.60E-07	2.01E-03	0.00E+00	7.4722E-02	2.1514E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9617730	0.9772020	0.9782220	0.9891580	0.9788700	3.0355E+02	7.0817E+00
2	4.16E-03	1.24E-02	1.14E-02	2.42E-02	2.11E-02	3.8564E+00	3.0678E+02
3	5.87E-04	4.89E-03	3.88E-03	1.27E-02	8.08E-06	1.5185E+00	3.0911E+02
4	1.40E-04	3.07E-03	2.09E-03	9.34E-03	0.00E+00	9.5310E-01	3.0968E+02
5	8.85E-06	1.70E-03	8.12E-04	6.40E-03	0.00E+00	5.2795E-01	3.1010E+02
6	4.03E-10	6.24E-04	5.94E-05	3.24E-03	0.00E+00	1.9373E-01	3.1044E+02
7	4.48E-44	1.03E-04	7.41E-13	4.24E-04	0.00E+00	3.2027E-02	3.1060E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9628880	0.9771220	0.9779990	0.9883700	0.9752760	3.5345E+02	8.2757E+00
2	4.43E-03	1.21E-02	1.12E-02	2.29E-02	2.47E-02	4.3863E+00	3.5734E+02
3	5.90E-04	4.46E-03	3.59E-03	1.13E-02	1.42E-05	1.6136E+00	3.6011E+02
4	1.65E-04	2.89E-03	2.04E-03	8.50E-03	0.00E+00	1.0438E+00	3.6068E+02
5	3.43E-05	1.94E-03	1.14E-03	6.60E-03	0.00E+00	7.0280E-01	3.6102E+02
6	5.09E-07	1.00E-03	3.21E-04	4.30E-03	0.00E+00	3.6184E-01	3.6136E+02
7	1.05E-13	3.52E-04	7.46E-06	1.99E-03	0.00E+00	1.2739E-01	3.6160E+02
8	4.83E-36	1.11E-04	4.79E-11	5.31E-04	0.00E+00	4.0005E-02	3.6169E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9965360	0.9930540	0.9895390	0.9860050	0.9824450	0.9788700	0.9752760
2	3.46E-03	6.95E-03	1.05E-02	1.40E-02	1.76E-02	2.11E-02	2.47E-02
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.08E-06	1.42E-05
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	9.97E-01	9.93E-01	9.90E-01	9.86E-01	9.82E-01	9.79E-01	9.75E-01
Beta	3.46E-03	6.95E-03	1.05E-02	1.40E-02	1.76E-02	2.11E-02	2.47E-02
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.82E-04	5.74E-04
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	10.00	15.00	20.00	25.00	30.00	35.00	40.00
N 1	0.7586	1.0257	1.2181	1.3357	1.3786	1.3473	1.2415
N 2	0.0374	0.1121	0.2243	0.3738	0.5607	0.7843	1.0449
N 3		0.0000	0.0000	0.0000	0.0000	0.0003	0.0006
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

2.3.2.2 CONTAINMENT SPRAY MOV-OO

System :	CONTAINMENT SPRAY SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 24
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9309010	0.9823840	0.9923720	0.9999510	0.9997960	2.5748E+01	4.6172E-01
2	4.59E-05	1.76E-02	7.63E-03	6.91E-02	2.04E-04	4.6172E-01	2.5748E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9450800	0.9806320	0.9857650	0.9986380	0.9996000	5.7595E+01	1.1375E+00
2	5.30E-04	1.48E-02	9.78E-03	4.63E-02	4.00E-04	8.6976E-01	5.7863E+01
3	1.63E-07	4.56E-03	9.20E-04	2.16E-02	0.00E+00	2.6776E-01	5.8465E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9493290	0.9787980	0.9822590	0.9964360	0.9994000	8.7515E+01	1.8957E+00
2	1.19E-03	1.40E-02	1.06E-02	3.85E-02	6.00E-04	1.2500E+00	8.8161E+01
3	7.85E-06	4.79E-03	1.89E-03	1.94E-02	0.00E+00	4.2870E-01	8.8982E+01
4	7.49E-09	2.43E-03	3.11E-04	1.22E-02	0.00E+00	2.1695E-01	8.9194E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9580120	0.9789860	0.9808860	0.9934610	0.9991980	1.6186E+02	3.4744E+00
2	2.31E-03	1.24E-02	1.05E-02	2.91E-02	8.02E-04	2.0567E+00	1.6328E+02
3	2.64E-04	5.77E-03	3.94E-03	1.75E-02	0.00E+00	9.5369E-01	1.6438E+02
4	1.94E-06	2.34E-03	8.19E-04	9.83E-03	0.00E+00	3.8684E-01	1.6495E+02
5	4.91E-20	4.67E-04	4.53E-07	2.71E-03	0.00E+00	7.7129E-02	1.6526E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9605210	0.9790060	0.9805190	0.9923190	0.9989990	2.0388E+02	4.3721E+00
2	2.34E-03	1.11E-02	9.55E-03	2.50E-02	1.00E-03	2.3054E+00	2.0595E+02
3	3.67E-04	5.40E-03	3.92E-03	1.55E-02	0.00E+00	1.1245E+00	2.0713E+02
4	3.36E-05	3.00E-03	1.63E-03	1.06E-02	0.00E+00	6.2471E-01	2.0763E+02
5	1.41E-08	1.17E-03	1.92E-04	5.69E-03	0.00E+00	2.4272E-01	2.0801E+02
6	1.11E-20	3.59E-04	2.69E-07	2.08E-03	0.00E+00	7.4722E-02	2.0818E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9640100	0.9790780	0.9801230	0.9905710	0.9988120	2.9630E+02	6.3317E+00
2	2.90E-03	1.03E-02	9.21E-03	2.12E-02	1.18E-03	3.1064E+00	2.9953E+02
3	6.03E-04	5.02E-03	3.98E-03	1.30E-02	1.03E-05	1.5185E+00	3.0111E+02
4	1.43E-04	3.15E-03	2.15E-03	9.58E-03	0.00E+00	9.5310E-01	3.0168E+02
5	9.09E-06	1.74E-03	8.33E-04	6.57E-03	0.00E+00	5.2795E-01	3.0210E+02
6	4.14E-10	6.40E-04	6.10E-05	3.33E-03	0.00E+00	1.9373E-01	3.0244E+02
7	4.48E-44	1.06E-04	7.61E-13	4.35E-04	0.00E+00	3.2027E-02	3.0260E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9655910	0.9793730	0.9802710	0.9900780	0.9986330	3.4545E+02	7.2757E+00
2	2.91E-03	9.60E-03	8.69E-03	1.94E-02	1.35E-03	3.3863E+00	3.4934E+02
3	6.05E-04	4.57E-03	3.68E-03	1.16E-02	1.80E-05	1.6136E+00	3.5111E+02
4	1.69E-04	2.96E-03	2.09E-03	8.72E-03	0.00E+00	1.0438E+00	3.5168E+02
5	3.52E-05	1.99E-03	1.16E-03	6.77E-03	0.00E+00	7.0280E-01	3.5202E+02
6	5.22E-07	1.03E-03	3.30E-04	4.41E-03	0.00E+00	3.6184E-01	3.5236E+02
7	1.08E-13	3.61E-04	7.65E-06	2.05E-03	0.00E+00	1.2739E-01	3.5260E+02
8	4.95E-36	1.13E-04	4.92E-11	5.45E-04	0.00E+00	4.0005E-02	3.5269E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9997960	0.9996000	0.9994000	0.9991980	0.9989990	0.9988120	0.9986330
2	2.04E-04	4.00E-04	6.00E-04	8.02E-04	1.00E-03	1.18E-03	1.35E-03
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E-05	1.80E-05
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	1.00E+00	9.99E-01	9.99E-01	9.99E-01	9.99E-01	9.99E-01
Beta	2.04E-04	4.00E-04	6.00E-04	8.02E-04	1.00E-03	1.19E-03	1.37E-03
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.67E-03	1.32E-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	8.00	12.00	16.00	20.00	24.00	28.00	32.00
N 1	0.3300	0.4900	0.6467	0.8000	0.9500	1.0973	1.2415
N 2	0.0017	0.0050	0.0100	0.0167	0.0250	0.0343	0.0449
N 3		0.0000	0.0000	0.0000	0.0000	0.0003	0.0006
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

2.3.3 BWR Residual Heat Removal Motor-Operated Valves

2.3.3.1 BWR RHR MOV FAIL TO OPEN

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 166
Total Number of Common-Cause Failure Events: 5

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9521430	0.9810650	0.9847160	0.9975060	0.9828900	8.2865E+01	1.5993E+00
2	2.50E-03	1.89E-02	1.53E-02	4.79E-02	1.71E-02	1.5993E+00	8.2865E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9621370	0.9827620	0.9849260	0.9960020	0.9861440	1.4292E+02	2.5069E+00
2	1.72E-03	1.18E-02	9.66E-03	2.93E-02	8.60E-03	1.7174E+00	1.4371E+02
3	1.43E-04	5.43E-03	3.39E-03	1.76E-02	5.26E-03	7.8946E-01	1.4464E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9654690	0.9826410	0.9841890	0.9945180	0.9873700	2.0090E+02	3.5489E+00
2	1.89E-03	1.01E-02	8.57E-03	2.36E-02	6.29E-03	2.0679E+00	2.0238E+02
3	2.64E-04	4.96E-03	3.47E-03	1.47E-02	4.44E-03	1.0136E+00	2.0344E+02
4	6.24E-06	2.29E-03	9.81E-04	8.99E-03	1.90E-03	4.6745E-01	2.0398E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9685610	0.9823760	0.9834050	0.9926620	0.9879240	3.0320E+02	5.4396E+00
2	2.57E-03	9.54E-03	8.50E-03	2.01E-02	5.51E-03	2.9441E+00	3.0570E+02
3	6.03E-04	4.96E-03	3.94E-03	1.28E-02	3.51E-03	1.5299E+00	3.0711E+02
4	5.83E-05	2.47E-03	1.52E-03	8.15E-03	2.29E-03	7.6344E-01	3.0788E+02
5	7.76E-10	6.55E-04	7.00E-05	3.37E-03	7.62E-04	2.0213E-01	3.0844E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9702580	0.9825450	0.9833830	0.9919620	0.9883870	3.7314E+02	6.6289E+00
2	2.48E-03	8.50E-03	7.65E-03	1.74E-02	4.82E-03	3.2267E+00	3.7654E+02
3	7.05E-04	4.66E-03	3.82E-03	1.15E-02	3.28E-03	1.7690E+00	3.7800E+02
4	1.37E-04	2.64E-03	1.84E-03	7.89E-03	1.93E-03	1.0031E+00	3.7877E+02
5	4.74E-06	1.30E-03	5.84E-04	5.01E-03	1.27E-03	4.9292E-01	3.7928E+02
6	5.43E-13	3.61E-04	1.06E-05	2.02E-03	3.18E-04	1.3722E-01	3.7963E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9718440	0.9824370	0.9830710	0.9908630	0.9889660	4.9349E+02	8.8219E+00
2	2.66E-03	7.84E-03	7.20E-03	1.52E-02	3.79E-03	3.9385E+00	4.9837E+02
3	1.01E-03	4.69E-03	4.05E-03	1.06E-02	3.67E-03	2.3573E+00	4.9995E+02
4	2.21E-04	2.53E-03	1.91E-03	6.97E-03	1.39E-03	1.2719E+00	5.0104E+02
5	5.35E-05	1.67E-03	1.08E-03	5.33E-03	1.37E-03	8.4085E-01	5.0147E+02
6	2.75E-07	6.97E-04	2.14E-04	3.03E-03	6.83E-04	3.5003E-01	5.0196E+02
7	3.36E-24	1.26E-04	2.08E-08	7.15E-04	1.37E-04	6.3327E-02	5.0225E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9732670	0.9829430	0.9834920	0.9907330	0.9897660	5.7066E+02	9.9025E+00
2	2.29E-03	6.78E-03	6.22E-03	1.32E-02	2.27E-03	3.9341E+00	5.7663E+02
3	1.23E-03	4.81E-03	4.25E-03	1.03E-02	4.51E-03	2.7904E+00	5.7777E+02
4	1.99E-04	2.22E-03	1.68E-03	6.08E-03	9.38E-04	1.2888E+00	5.7927E+02
5	9.36E-05	1.75E-03	1.22E-03	5.21E-03	1.20E-03	1.0162E+00	5.7955E+02
6	9.42E-06	1.03E-03	5.39E-04	3.70E-03	8.98E-04	5.9624E-01	5.7997E+02
7	1.50E-09	3.81E-04	5.09E-05	1.91E-03	3.59E-04	2.2119E-01	5.8034E+02
8	4.05E-27	9.58E-05	3.90E-09	5.27E-04	5.97E-05	5.5605E-02	5.8051E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9828900	0.9861440	0.9873700	0.9879240	0.9883870	0.9889660	0.9897660
2	1.71E-02	8.60E-03	6.29E-03	5.51E-03	4.82E-03	3.79E-03	2.27E-03
3		5.26E-03	4.44E-03	3.51E-03	3.28E-03	3.67E-03	4.51E-03
4			1.90E-03	2.29E-03	1.93E-03	1.39E-03	9.38E-04
5				7.62E-04	1.27E-03	1.37E-03	1.20E-03
6					3.18E-04	6.83E-04	8.98E-04
7						1.37E-04	3.59E-04
8							5.97E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.83E-01	9.86E-01	9.87E-01	9.88E-01	9.88E-01	9.89E-01	9.90E-01
Beta	1.71E-02	1.39E-02	1.26E-02	1.21E-02	1.16E-02	1.10E-02	1.02E-02
Gamma		3.80E-01	5.02E-01	5.44E-01	5.85E-01	6.57E-01	7.78E-01
Delta			3.00E-01	4.65E-01	5.17E-01	4.94E-01	4.34E-01
Epsilon				2.49E-01	4.52E-01	6.11E-01	7.28E-01
Mu					2.00E-01	3.75E-01	5.23E-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	63.85	95.77	127.69	159.62	191.54	223.46	255.38
N 1	1.5965	2.0421	2.3375	2.5236	2.6684	2.8298	3.0654
N 2	1.1393	0.8526	0.8279	0.9041	0.9463	0.8664	0.5927
N 3		0.5217	0.5849	0.5762	0.6445	0.8391	1.1774
N 4			0.2505	0.3766	0.3784	0.3188	0.2450
N 5				0.1250	0.2502	0.3129	0.3134
N 6					0.0625	0.1563	0.2344
N 7						0.0313	0.0938
N 8							0.0156

2.3.3.2 BWR RHR MOV FAIL TO CLOSE

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 109
Total Number of Common-Cause Failure Events: 10

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9576660	0.9873610	0.9924430	0.9997570	0.9933580	5.6185E+01	7.1922E-01
2	2.46E-04	1.26E-02	7.56E-03	4.23E-02	6.64E-03	7.1922E-01	5.6185E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9573220	0.9823220	0.9853010	0.9971390	0.9877400	1.0257E+02	1.8459E+00
2	1.84E-03	1.48E-02	1.18E-02	3.79E-02	1.17E-02	1.5458E+00	1.0287E+02
3	3.10E-07	2.87E-03	7.05E-04	1.31E-02	5.55E-04	3.0006E-01	1.0412E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9565270	0.9787630	0.9808540	0.9938390	0.9831780	1.4671E+02	3.1834E+00
2	3.58E-03	1.61E-02	1.40E-02	3.57E-02	1.52E-02	2.4090E+00	1.4748E+02
3	2.52E-05	3.72E-03	1.86E-03	1.37E-02	1.67E-03	5.5730E-01	1.4934E+02
4	4.48E-09	1.45E-03	1.86E-04	7.30E-03	1.30E-06	2.1705E-01	1.4968E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9608400	0.9782130	0.9795230	0.9911050	0.9814320	2.3526E+02	5.2399E+00
2	4.49E-03	1.45E-02	1.31E-02	2.90E-02	1.50E-02	3.4803E+00	2.3702E+02
3	4.44E-04	5.21E-03	3.92E-03	1.44E-02	3.12E-03	1.2535E+00	2.3925E+02
4	2.92E-06	1.78E-03	7.01E-04	7.23E-03	4.39E-04	4.2894E-01	2.4007E+02
5	3.37E-20	3.21E-04	3.11E-07	1.86E-03	0.00E+00	7.7129E-02	2.4042E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9620740	0.9777030	0.9787620	0.9897050	0.9799760	2.9135E+02	6.6443E+00
2	4.63E-03	1.34E-02	1.24E-02	2.59E-02	1.50E-02	4.0063E+00	2.9399E+02
3	6.67E-04	5.27E-03	4.21E-03	1.35E-02	3.88E-03	1.5696E+00	2.9642E+02
4	5.18E-05	2.47E-03	1.49E-03	8.25E-03	9.79E-04	7.3701E-01	2.9726E+02
5	1.94E-08	8.61E-04	1.59E-04	4.14E-03	1.21E-04	2.5662E-01	2.9774E+02
6	7.76E-21	2.51E-04	1.88E-07	1.45E-03	0.00E+00	7.4722E-02	2.9792E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9644600	0.9776780	0.9784590	0.9882390	0.9791190	3.9779E+02	9.0822E+00
2	4.90E-03	1.23E-02	1.16E-02	2.25E-02	1.46E-02	5.0229E+00	4.0185E+02
3	9.86E-04	5.18E-03	4.40E-03	1.21E-02	4.43E-03	2.1090E+00	4.0476E+02
4	2.00E-04	2.82E-03	2.06E-03	8.04E-03	1.46E-03	1.1478E+00	4.0572E+02
5	1.07E-05	1.41E-03	7.16E-04	5.14E-03	3.31E-04	5.7215E-01	4.0630E+02
6	4.42E-10	4.87E-04	4.95E-05	2.52E-03	3.45E-05	1.9833E-01	4.0667E+02
7	3.36E-44	7.87E-05	5.65E-13	3.23E-04	0.00E+00	3.2027E-02	4.0684E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9655020	0.9777090	0.9783840	0.9876210	0.9784310	4.6090E+02	1.0508E+01
2	4.90E-03	1.17E-02	1.10E-02	2.08E-02	1.43E-02	5.5181E+00	4.6589E+02
3	1.05E-03	4.94E-03	4.25E-03	1.11E-02	4.69E-03	2.3265E+00	4.6908E+02
4	2.66E-04	2.81E-03	2.15E-03	7.62E-03	1.85E-03	1.3250E+00	4.7008E+02
5	4.42E-05	1.68E-03	1.05E-03	5.46E-03	5.76E-04	7.9040E-01	4.7062E+02
6	5.77E-07	8.04E-04	2.74E-04	3.40E-03	1.14E-04	3.7924E-01	4.7103E+02
7	1.06E-13	2.73E-04	6.10E-06	1.55E-03	9.87E-06	1.2889E-01	4.7128E+02
8	3.70E-36	8.49E-05	3.68E-11	4.08E-04	0.00E+00	4.0005E-02	4.7137E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9933580	0.9877400	0.9831780	0.9814320	0.9799760	0.9791190	0.9784310
2	6.64E-03	1.17E-02	1.52E-02	1.50E-02	1.50E-02	1.46E-02	1.43E-02
3		5.55E-04	1.67E-03	3.12E-03	3.88E-03	4.43E-03	4.69E-03
4			1.30E-06	4.39E-04	9.79E-04	1.46E-03	1.85E-03
5				0.00E+00	1.21E-04	3.31E-04	5.76E-04
6					0.00E+00	3.45E-05	1.14E-04
7						0.00E+00	9.87E-06
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.93E-01	9.88E-01	9.83E-01	9.81E-01	9.80E-01	9.79E-01	9.78E-01
Beta	6.64E-03	1.23E-02	1.68E-02	1.86E-02	2.00E-02	2.09E-02	2.16E-02
Gamma		4.53E-02	9.92E-02	1.92E-01	2.49E-01	3.00E-01	3.36E-01
Delta			7.77E-04	1.23E-01	2.21E-01	2.92E-01	3.52E-01
Epsilon				0.00E+00	1.10E-01	2.00E-01	2.75E-01
Mu					0.00E+00	9.43E-02	1.77E-01
Upsilon						0.00E+00	7.94E-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	35.16	52.74	70.32	87.90	105.48	123.06	140.65
N 1	3.6065	4.7288	5.5257	6.3016	6.9438	7.5321	8.0447
N 2	0.2592	0.6810	1.1690	1.4403	1.7259	1.9508	2.1767
N 3		0.0323	0.1286	0.2998	0.4451	0.5908	0.7135
N 4			0.0001	0.0421	0.1123	0.1947	0.2812
N 5				0.0000	0.0139	0.0442	0.0876
N 6					0.0000	0.0046	0.0174
N 7						0.0000	0.0015
N 8							0.0000

2.3.4 BWR Isolation Condenser Motor-Operated Valves

2.3.4.1 ISO CONDENSER MOV FAIL TO OPEN

System :	ISOLATION CONDENSER
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 13
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9414140	0.9851020	0.9936000	0.9999590	1.0000000	3.0418E+01	4.6002E-01
2	3.79E-05	1.49E-02	6.40E-03	5.86E-02	0.00E+00	4.6002E-01	3.0418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9456980	0.9808820	0.9859710	0.9986680	1.0000000	5.8105E+01	1.1325E+00
2	5.14E-04	1.46E-02	9.61E-03	4.57E-02	0.00E+00	8.6476E-01	5.8373E+01
3	1.61E-07	4.52E-03	9.12E-04	2.14E-02	0.00E+00	2.6776E-01	5.8970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9473780	0.9780110	0.9816130	0.9963270	1.0000000	8.3868E+01	1.8857E+00
2	1.21E-03	1.45E-02	1.09E-02	3.99E-02	0.00E+00	1.2400E+00	8.4514E+01
3	8.19E-06	5.00E-03	1.97E-03	2.02E-02	0.00E+00	4.2870E-01	8.5325E+01
4	7.81E-09	2.53E-03	3.25E-04	1.28E-02	0.00E+00	2.1695E-01	8.5537E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9560980	0.9780490	0.9800390	0.9931910	1.0000000	1.5406E+02	3.4577E+00
2	2.38E-03	1.30E-02	1.10E-02	3.04E-02	0.00E+00	2.0400E+00	1.5548E+02
3	2.77E-04	6.05E-03	4.13E-03	1.84E-02	0.00E+00	9.5369E-01	1.5656E+02
4	2.03E-06	2.46E-03	8.60E-04	1.03E-02	0.00E+00	3.8684E-01	1.5713E+02
5	5.15E-20	4.90E-04	4.75E-07	2.85E-03	0.00E+00	7.7129E-02	1.5744E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9583070	0.9778520	0.9794540	0.9919230	1.0000000	1.9193E+02	4.3471E+00
2	2.43E-03	1.16E-02	1.00E-02	2.63E-02	0.00E+00	2.2804E+00	1.9400E+02
3	3.89E-04	5.73E-03	4.16E-03	1.64E-02	0.00E+00	1.1245E+00	1.9515E+02
4	3.57E-05	3.18E-03	1.73E-03	1.13E-02	0.00E+00	6.2471E-01	1.9565E+02
5	1.50E-08	1.24E-03	2.04E-04	6.04E-03	0.00E+00	2.4272E-01	1.9603E+02
6	1.18E-20	3.81E-04	2.85E-07	2.21E-03	0.00E+00	7.4722E-02	1.9620E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00
Delta			0.00E+00	0.00E+00	0.00E+00
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	13.00	13.00	13.00	13.00	13.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000
N 3		0.0000	0.0000	0.0000	0.0000
N 4			0.0000	0.0000	0.0000
N 5				0.0000	0.0000
N 6					0.0000

2.3.4.2 ISO CONDENSER MOV FAIL TO CLOSE

System :	ISOLATION CONDENSER
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 6
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9243930	0.9807350	0.9916680	0.9999470	1.0000000	2.3418E+01	4.6002E-01
2	4.93E-05	1.93E-02	8.33E-03	7.56E-02	0.00E+00	4.6002E-01	2.3418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9385070	0.9783200	0.9840670	0.9984800	1.0000000	5.1105E+01	1.1325E+00
2	5.84E-04	1.66E-02	1.09E-02	5.18E-02	0.00E+00	8.6476E-01	5.1373E+01
3	1.83E-07	5.13E-03	1.04E-03	2.43E-02	0.00E+00	2.6776E-01	5.1970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9427520	0.9760560	0.9799650	0.9959900	1.0000000	7.6868E+01	1.8857E+00
2	1.32E-03	1.57E-02	1.19E-02	4.34E-02	0.00E+00	1.2400E+00	7.7514E+01
3	8.92E-06	5.44E-03	2.15E-03	2.20E-02	0.00E+00	4.2870E-01	7.8325E+01
4	8.51E-09	2.75E-03	3.54E-04	1.39E-02	0.00E+00	2.1695E-01	7.8537E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9540690	0.9770280	0.9791120	0.9928760	1.0000000	1.4706E+02	3.4577E+00
2	2.49E-03	1.36E-02	1.15E-02	3.18E-02	0.00E+00	2.0400E+00	1.4848E+02
3	2.90E-04	6.34E-03	4.33E-03	1.92E-02	0.00E+00	9.5369E-01	1.4956E+02
4	2.13E-06	2.57E-03	9.00E-04	1.08E-02	0.00E+00	3.8684E-01	1.5013E+02
5	5.39E-20	5.12E-04	4.98E-07	2.98E-03	0.00E+00	7.7129E-02	1.5044E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9567730	0.9770330	0.9786920	0.9916210	1.0000000	1.8493E+02	4.3471E+00
2	2.52E-03	1.20E-02	1.04E-02	2.73E-02	0.00E+00	2.2804E+00	1.8700E+02
3	4.04E-04	5.94E-03	4.32E-03	1.70E-02	0.00E+00	1.1245E+00	1.8815E+02
4	3.70E-05	3.30E-03	1.79E-03	1.17E-02	0.00E+00	6.2471E-01	1.8865E+02
5	1.55E-08	1.28E-03	2.11E-04	6.26E-03	0.00E+00	2.4272E-01	1.8903E+02
6	1.22E-20	3.95E-04	2.96E-07	2.29E-03	0.00E+00	7.4722E-02	1.8920E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00
Delta			0.00E+00	0.00E+00	0.00E+00
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	6.00	6.00	6.00	6.00	6.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000
N 3		0.0000	0.0000	0.0000	0.0000
N 4			0.0000	0.0000	0.0000
N 5				0.0000	0.0000
N 6					0.0000

2.3.5 PWR Auxiliary Feedwater Motor-Operated Valves

2.3.5.1 AFW MOV FAIL TO OPEN SPAR AFW-MOV-CC

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 103
Total Number of Common-Cause Failure Events: 3

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9472570	0.9857230	0.9928740	0.9999110	0.9957260	3.7803E+01	5.4752E-01
2	9.04E-05	1.43E-02	7.13E-03	5.27E-02	4.27E-03	5.4752E-01	3.7803E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9521320	0.9819440	0.9859320	0.9981190	0.9916800	7.5427E+01	1.3870E+00
2	9.76E-04	1.45E-02	1.06E-02	4.16E-02	8.19E-03	1.1152E+00	7.5699E+01
3	1.47E-07	3.54E-03	7.32E-04	1.67E-02	1.31E-04	2.7176E-01	7.6542E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9532480	0.9790170	0.9817700	0.9953830	0.9878600	1.1098E+02	2.3786E+00
2	2.21E-03	1.51E-02	1.24E-02	3.75E-02	1.17E-02	1.7168E+00	1.1164E+02
3	8.04E-06	3.92E-03	1.61E-03	1.57E-02	3.97E-04	4.4480E-01	1.1291E+02
4	5.90E-09	1.91E-03	2.45E-04	9.65E-03	0.00E+00	2.1695E-01	1.1314E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9587290	0.9782020	0.9798150	0.9921650	0.9842820	1.9083E+02	4.2524E+00
2	3.69E-03	1.43E-02	1.27E-02	3.05E-02	1.49E-02	2.7945E+00	1.9229E+02
3	2.59E-04	5.09E-03	3.53E-03	1.53E-02	7.95E-04	9.9389E-01	1.9409E+02
4	1.64E-06	1.98E-03	6.94E-04	8.33E-03	0.00E+00	3.8684E-01	1.9470E+02
5	4.16E-20	3.95E-04	3.84E-07	2.30E-03	0.00E+00	7.7129E-02	1.9501E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9599170	0.9774380	0.9787300	0.9905370	0.9809420	2.3822E+02	5.4989E+00
2	4.14E-03	1.38E-02	1.24E-02	2.78E-02	1.77E-02	3.3518E+00	2.4037E+02
3	3.89E-04	4.94E-03	3.67E-03	1.38E-02	1.33E-03	1.2049E+00	2.4251E+02
4	2.87E-05	2.56E-03	1.39E-03	9.08E-03	0.00E+00	6.2471E-01	2.4309E+02
5	1.21E-08	9.96E-04	1.64E-04	4.86E-03	0.00E+00	2.4272E-01	2.4348E+02
6	9.50E-21	3.07E-04	2.29E-07	1.78E-03	0.00E+00	7.4722E-02	2.4364E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9625270	0.9771540	0.9780760	0.9886390	0.9778470	3.3589E+02	7.8533E+00
2	4.84E-03	1.31E-02	1.21E-02	2.45E-02	2.02E-02	4.4877E+00	3.3926E+02
3	6.65E-04	4.83E-03	3.91E-03	1.21E-02	2.00E-03	1.6588E+00	3.4208E+02
4	1.26E-04	2.77E-03	1.89E-03	8.44E-03	0.00E+00	9.5310E-01	3.4279E+02
5	8.00E-06	1.54E-03	7.34E-04	5.78E-03	0.00E+00	5.2795E-01	3.4322E+02
6	3.64E-10	5.64E-04	5.37E-05	2.93E-03	0.00E+00	1.9373E-01	3.4355E+02
7	4.06E-44	9.32E-05	6.69E-13	3.83E-04	0.00E+00	3.2027E-02	3.4371E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9633330	0.9768920	0.9776860	0.9877430	0.9750020	3.9021E+02	9.2302E+00
2	5.14E-03	1.28E-02	1.20E-02	2.32E-02	2.22E-02	5.1164E+00	3.9432E+02
3	7.34E-04	4.60E-03	3.81E-03	1.12E-02	2.81E-03	1.8380E+00	3.9760E+02
4	1.49E-04	2.61E-03	1.84E-03	7.70E-03	0.00E+00	1.0438E+00	3.9840E+02
5	3.11E-05	1.76E-03	1.03E-03	5.97E-03	0.00E+00	7.0280E-01	3.9874E+02
6	4.61E-07	9.06E-04	2.91E-04	3.89E-03	0.00E+00	3.6184E-01	3.9908E+02
7	9.52E-14	3.19E-04	6.75E-06	1.81E-03	0.00E+00	1.2739E-01	3.9931E+02
8	4.37E-36	1.00E-04	4.34E-11	4.81E-04	0.00E+00	4.0005E-02	3.9940E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1	0.9957260	0.9916800	0.9878600	0.9842820	0.9809420	0.9778470	0.9750020
2	4.27E-03	8.19E-03	1.17E-02	1.49E-02	1.77E-02	2.02E-02	2.22E-02
3		1.31E-04	3.97E-04	7.95E-04	1.33E-03	2.00E-03	2.81E-03
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	9.96E-01	9.92E-01	9.88E-01	9.84E-01	9.81E-01	9.78E-01	9.75E-01
Beta	4.27E-03	8.32E-03	1.21E-02	1.57E-02	1.91E-02	2.22E-02	2.50E-02
Gamma		1.57E-02	3.27E-02	5.06E-02	6.98E-02	9.03E-02	1.13E-01
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	19.31	28.96	38.61	48.27	57.92	67.57	77.23
N 1	1.0750	1.3621	1.4982	1.4955	1.3661	1.1219	0.7750
N 2	0.0875	0.2504	0.4768	0.7545	1.0714	1.4156	1.7750
N 3		0.0040	0.0161	0.0402	0.0804	0.1406	0.2250
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

2.3.5.2 AFW MOV FAIL TO CLOSE SPAR AFW-MOV-OO

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 56
Total Number of Common-Cause Failure Events: 4

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9394660	0.9812050	0.9880780	0.9994830	0.9862900	4.1474E+01	7.9442E-01
2	5.14E-04	1.88E-02	1.19E-02	6.05E-02	1.37E-02	7.9442E-01	4.1474E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9416060	0.9748250	0.9785670	0.9952490	0.9739530	8.0280E+01	2.0733E+00
2	3.31E-03	2.15E-02	1.78E-02	5.26E-02	2.52E-02	1.7742E+00	8.0579E+01
3	3.81E-07	3.63E-03	8.87E-04	1.66E-02	8.67E-04	2.9906E-01	8.2054E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9404840	0.9697320	0.9723010	0.9901950	0.9630790	1.1668E+02	3.6419E+00
2	6.34E-03	2.39E-02	2.13E-02	5.02E-02	3.43E-02	2.8712E+00	1.1745E+02
3	3.03E-05	4.60E-03	2.29E-03	1.70E-02	2.63E-03	5.5380E-01	1.1977E+02
4	5.55E-09	1.80E-03	2.31E-04	9.09E-03	0.00E+00	2.1695E-01	1.2011E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9525410	0.9733330	0.9748720	0.9888800	0.9666140	1.9806E+02	5.4264E+00
2	5.05E-03	1.66E-02	1.51E-02	3.35E-02	2.28E-02	3.3835E+00	2.0010E+02
3	9.27E-04	7.55E-03	6.01E-03	1.94E-02	9.90E-03	1.5372E+00	2.0195E+02
4	3.43E-06	2.11E-03	8.27E-04	8.54E-03	7.07E-04	4.2854E-01	2.0306E+02
5	3.98E-20	3.79E-04	3.68E-07	2.20E-03	0.00E+00	7.7129E-02	2.0341E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9561700	0.9743230	0.9755630	0.9882490	0.9692210	2.4709E+02	6.5118E+00
2	4.14E-03	1.35E-02	1.22E-02	2.72E-02	1.63E-02	3.4239E+00	2.5018E+02
3	1.28E-03	7.56E-03	6.31E-03	1.81E-02	1.13E-02	1.9165E+00	2.5169E+02
4	1.06E-04	3.31E-03	2.13E-03	1.05E-02	3.06E-03	8.4001E-01	2.5276E+02
5	2.28E-08	1.01E-03	1.87E-04	4.86E-03	1.98E-04	2.5662E-01	2.5335E+02
6	9.13E-21	2.95E-04	2.20E-07	1.71E-03	0.00E+00	7.4722E-02	2.5353E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9609010	0.9756790	0.9765690	0.9874230	0.9713350	3.4652E+02	8.6379E+00
2	3.98E-03	1.15E-02	1.06E-02	2.20E-02	1.22E-02	4.0702E+00	3.5109E+02
3	1.47E-03	6.71E-03	5.81E-03	1.50E-02	1.06E-02	2.3817E+00	3.5278E+02
4	3.71E-04	3.79E-03	2.91E-03	1.02E-02	4.83E-03	1.3478E+00	3.5381E+02
5	1.71E-05	1.71E-03	9.11E-04	6.12E-03	9.78E-04	6.0785E-01	3.5455E+02
6	5.06E-10	5.58E-04	5.67E-05	2.88E-03	5.63E-05	1.9833E-01	3.5496E+02
7	3.92E-44	9.02E-05	6.48E-13	3.70E-04	0.00E+00	3.2027E-02	3.5513E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9629680	0.9764140	0.9771830	0.9872480	0.9731460	4.0268E+02	9.7268E+00
2	3.66E-03	1.03E-02	9.47E-03	1.95E-02	9.55E-03	4.2295E+00	4.0818E+02
3	1.37E-03	6.00E-03	5.22E-03	1.33E-02	9.28E-03	2.4755E+00	4.0993E+02
4	4.88E-04	3.82E-03	3.06E-03	9.78E-03	5.74E-03	1.5771E+00	4.1083E+02
5	7.95E-05	2.14E-03	1.41E-03	6.70E-03	1.95E-03	8.8450E-01	4.1152E+02
6	8.49E-07	9.49E-04	3.36E-04	3.97E-03	3.17E-04	3.9134E-01	4.1202E+02
7	1.21E-13	3.13E-04	6.97E-06	1.77E-03	1.61E-05	1.2889E-01	4.1228E+02
8	4.24E-36	9.70E-05	4.20E-11	4.66E-04	0.00E+00	4.0005E-02	4.1237E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9862900	0.9739530	0.9630790	0.9666140	0.9692210	0.9713350	0.9731460
2	1.37E-02	2.52E-02	3.43E-02	2.28E-02	1.63E-02	1.22E-02	9.55E-03
3		8.67E-04	2.63E-03	9.90E-03	1.13E-02	1.06E-02	9.28E-03
4			0.00E+00	7.07E-04	3.06E-03	4.83E-03	5.74E-03
5				0.00E+00	1.98E-04	9.78E-04	1.95E-03
6					0.00E+00	5.63E-05	3.17E-04
7						0.00E+00	1.61E-05
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.86E-01	9.74E-01	9.63E-01	9.67E-01	9.69E-01	9.71E-01	9.73E-01
Beta	1.37E-02	2.60E-02	3.69E-02	3.34E-02	3.08E-02	2.87E-02	2.69E-02
Gamma		3.33E-02	7.12E-02	3.18E-01	4.72E-01	5.74E-01	6.44E-01
Delta			0.00E+00	6.67E-02	2.24E-01	3.57E-01	4.64E-01
Epsilon				0.00E+00	6.06E-02	1.76E-01	2.85E-01
Mu					0.00E+00	5.44E-02	1.46E-01
Upsilon						0.00E+00	4.84E-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	22.40	33.60	44.80	56.00	67.20	78.40	89.60
N 1	1.6562	1.5749	1.0124	0.9999	0.9648	0.9202	0.8734
N 2	0.3344	0.9094	1.6312	1.3435	1.1435	0.9981	0.8881
N 3		0.0313	0.1251	0.5835	0.7920	0.8635	0.8625
N 4			0.0000	0.0417	0.2153	0.3947	0.5333
N 5				0.0000	0.0139	0.0799	0.1817
N 6					0.0000	0.0046	0.0295
N 7						0.0000	0.0015
N 8							0.0000

2.3.5.3 MOV FAIL TO OPERATE AFW SPAR: AFW-MOV-FO

System :	AUXILIARY FEEDWATER SYSTEM
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN) FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 159
Total Number of Common-Cause Failure Events: 7

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9570200	0.9861840	0.9908270	0.9994830	0.9908190	6.2949E+01	8.8192E-01
2	5.14E-04	1.38E-02	9.17E-03	4.30E-02	9.18E-03	8.8192E-01	6.2949E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9544200	0.9796820	0.9824070	0.9956340	0.9825090	1.1224E+02	2.3278E+00
2	3.23E-03	1.77E-02	1.49E-02	4.14E-02	1.70E-02	2.0247E+00	1.1254E+02
3	3.12E-07	2.65E-03	6.59E-04	1.21E-02	5.17E-04	3.0306E-01	1.1426E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9517150	0.9746510	0.9765700	0.9910380	0.9751090	1.5898E+02	4.1347E+00
2	6.20E-03	2.05E-02	1.86E-02	4.14E-02	2.33E-02	3.3480E+00	1.5977E+02
3	2.62E-05	3.49E-03	1.78E-03	1.28E-02	1.56E-03	5.6980E-01	1.6254E+02
4	4.09E-09	1.33E-03	1.70E-04	6.71E-03	0.00E+00	2.1695E-01	1.6290E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9581980	0.9757730	0.9770010	0.9891610	0.9753840	2.5056E+02	6.2211E+00
2	5.68E-03	1.61E-02	1.49E-02	3.08E-02	1.87E-02	4.1380E+00	2.5264E+02
3	7.85E-04	6.14E-03	4.92E-03	1.57E-02	5.56E-03	1.5774E+00	2.5520E+02
4	2.71E-06	1.67E-03	6.55E-04	6.77E-03	3.71E-04	4.2854E-01	2.5635E+02
5	3.15E-20	3.00E-04	2.91E-07	1.75E-03	0.00E+00	7.7129E-02	2.5670E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9602020	0.9758490	0.9768450	0.9881040	0.9752590	3.0966E+02	7.6636E+00
2	5.26E-03	1.42E-02	1.32E-02	2.65E-02	1.65E-02	4.4953E+00	3.1283E+02
3	1.12E-03	6.29E-03	5.29E-03	1.49E-02	6.51E-03	1.9969E+00	3.1533E+02
4	8.45E-05	2.65E-03	1.70E-03	8.43E-03	1.61E-03	8.4001E-01	3.1648E+02
5	1.82E-08	8.09E-04	1.49E-04	3.88E-03	1.04E-04	2.5662E-01	3.1707E+02
6	7.29E-21	2.35E-04	1.76E-07	1.36E-03	0.00E+00	7.4722E-02	3.1725E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9630490	0.9762500	0.9769890	0.9869420	0.9749770	4.1904E+02	1.0194E+01
2	5.33E-03	1.28E-02	1.20E-02	2.28E-02	1.55E-02	5.4858E+00	4.2375E+02
3	1.36E-03	5.88E-03	5.13E-03	1.29E-02	6.45E-03	2.5223E+00	4.2671E+02
4	3.06E-04	3.14E-03	2.41E-03	8.47E-03	2.53E-03	1.3478E+00	4.2789E+02
5	1.41E-05	1.42E-03	7.53E-04	5.07E-03	5.13E-04	6.0785E-01	4.2863E+02
6	4.19E-10	4.62E-04	4.69E-05	2.39E-03	2.95E-05	1.9833E-01	4.2904E+02
7	3.22E-44	7.46E-05	5.36E-13	3.06E-04	0.00E+00	3.2027E-02	4.2920E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9642220	0.9763950	0.9770330	0.9863990	0.9746450	4.8506E+02	1.1727E+01
2	5.29E-03	1.21E-02	1.14E-02	2.11E-02	1.50E-02	6.0045E+00	4.9078E+02
3	1.35E-03	5.44E-03	4.79E-03	1.17E-02	6.13E-03	2.7005E+00	4.9409E+02
4	4.05E-04	3.17E-03	2.54E-03	8.12E-03	3.01E-03	1.5771E+00	4.9521E+02
5	6.60E-05	1.78E-03	1.17E-03	5.57E-03	1.02E-03	8.8450E-01	4.9590E+02
6	7.05E-07	7.88E-04	2.79E-04	3.30E-03	1.66E-04	3.9134E-01	4.9640E+02
7	1.01E-13	2.59E-04	5.79E-06	1.47E-03	8.46E-06	1.2889E-01	4.9666E+02
8	3.52E-36	8.05E-05	3.49E-11	3.87E-04	0.00E+00	4.0005E-02	4.9675E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9908190	0.9825090	0.9751090	0.9753840	0.9752590	0.9749770	0.9746450
2	9.18E-03	1.70E-02	2.33E-02	1.87E-02	1.65E-02	1.55E-02	1.50E-02
3		5.17E-04	1.56E-03	5.56E-03	6.51E-03	6.45E-03	6.13E-03
4			0.00E+00	3.71E-04	1.61E-03	2.53E-03	3.01E-03
5				0.00E+00	1.04E-04	5.13E-04	1.02E-03
6					0.00E+00	2.95E-05	1.66E-04
7						0.00E+00	8.46E-06
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.91E-01	9.83E-01	9.75E-01	9.75E-01	9.75E-01	9.75E-01	9.75E-01
Beta	9.18E-03	1.75E-02	2.49E-02	2.46E-02	2.47E-02	2.50E-02	2.54E-02
Gamma		2.95E-02	6.27E-02	2.41E-01	3.32E-01	3.81E-01	4.08E-01
Delta			0.00E+00	6.27E-02	2.08E-01	3.23E-01	4.07E-01
Epsilon				0.00E+00	6.06E-02	1.76E-01	2.85E-01
Mu					0.00E+00	5.44E-02	1.46E-01
Upsilon						0.00E+00	4.84E-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	42.80	64.20	85.60	107.00	128.40	149.80	171.20
N 1	2.7312	2.9369	2.5106	2.4955	2.3308	2.0421	1.6484
N 2	0.4219	1.1599	2.1080	2.0980	2.2149	2.4137	2.6631
N 3		0.0353	0.1411	0.6237	0.8724	1.0041	1.0875
N 4			0.0000	0.0417	0.2153	0.3947	0.5333
N 5				0.0000	0.0139	0.0799	0.1817
N 6					0.0000	0.0046	0.0295
N 7						0.0000	0.0015
N 8							0.0000

2.3.6 PWR High Pressure Safety Injection Motor-Operated Valves

2.3.6.1 HIGH PRESSURE INJECTION MOTOR OPERATED VALVE FAIL TO OPEN

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 107
Total Number of Common-Cause Failure Events: 5

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9286840	0.9717200	0.9771160	0.9962870	0.9705290	5.4581E+01	1.5885E+00
2	3.72E-03	2.83E-02	2.29E-02	7.13E-02	2.95E-02	1.5885E+00	5.4581E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9474520	0.9761610	0.9791760	0.9945650	0.9766960	1.0055E+02	2.4556E+00
2	2.23E-03	1.61E-02	1.31E-02	4.02E-02	1.39E-02	1.6565E+00	1.0135E+02
3	2.13E-04	7.76E-03	4.89E-03	2.51E-02	9.36E-03	7.9906E-01	1.0221E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9537710	0.9769730	0.9790920	0.9929410	0.9797710	1.4453E+02	3.4065E+00
2	2.12E-03	1.27E-02	1.06E-02	3.06E-02	8.59E-03	1.8859E+00	1.4605E+02
3	4.18E-04	7.12E-03	5.06E-03	2.09E-02	8.31E-03	1.0537E+00	1.4688E+02
4	8.58E-06	3.16E-03	1.35E-03	1.24E-02	3.33E-03	4.6695E-01	1.4747E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9611420	0.9785060	0.9798310	0.9913430	0.9822620	2.3297E+02	5.1175E+00
2	2.57E-03	1.08E-02	9.48E-03	2.36E-02	5.72E-03	2.5748E+00	2.3551E+02
3	7.92E-04	6.46E-03	5.14E-03	1.66E-02	6.23E-03	1.5370E+00	2.3655E+02
4	9.40E-05	3.37E-03	2.13E-03	1.09E-02	4.45E-03	8.0354E-01	2.3728E+02
5	1.01E-09	8.49E-04	9.08E-05	4.36E-03	1.34E-03	2.0213E-01	2.3789E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9640220	0.9792400	0.9803120	0.9907950	0.9840840	2.8908E+02	6.1284E+00
2	2.36E-03	9.31E-03	8.23E-03	2.00E-02	4.19E-03	2.7493E+00	2.9246E+02
3	7.52E-04	5.55E-03	4.48E-03	1.40E-02	4.59E-03	1.6384E+00	2.9357E+02
4	2.38E-04	3.72E-03	2.67E-03	1.08E-02	4.22E-03	1.0969E+00	2.9411E+02
5	7.25E-06	1.72E-03	7.92E-04	6.56E-03	2.36E-03	5.0662E-01	2.9470E+02
6	6.99E-13	4.65E-04	1.36E-05	2.60E-03	5.58E-04	1.3722E-01	2.9507E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9670210	0.9797340	0.9805190	0.9897580	0.9855240	3.9558E+02	8.1828E+00
2	2.69E-03	8.66E-03	7.86E-03	1.74E-02	3.25E-03	3.4959E+00	4.0027E+02
3	8.52E-04	4.88E-03	4.09E-03	1.16E-02	3.46E-03	1.9684E+00	4.0179E+02
4	3.76E-04	3.51E-03	2.74E-03	9.31E-03	3.57E-03	1.4184E+00	4.0234E+02
5	8.04E-05	2.18E-03	1.44E-03	6.84E-03	2.72E-03	8.8215E-01	4.0288E+02
6	3.84E-07	8.78E-04	2.75E-04	3.80E-03	1.24E-03	3.5463E-01	4.0341E+02
7	4.18E-24	1.57E-04	2.58E-08	8.89E-04	2.40E-04	6.3327E-02	4.0370E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9687540	0.9803330	0.9810110	0.9895940	0.9867100	4.5883E+02	9.2050E+00
2	2.60E-03	7.97E-03	7.28E-03	1.57E-02	2.63E-03	3.7323E+00	4.6430E+02
3	7.69E-04	4.29E-03	3.61E-03	1.01E-02	2.67E-03	2.0092E+00	4.6603E+02
4	3.62E-04	3.16E-03	2.48E-03	8.25E-03	2.92E-03	1.4780E+00	4.6656E+02
5	1.49E-04	2.34E-03	1.68E-03	6.78E-03	2.63E-03	1.0940E+00	4.6694E+02
6	1.36E-05	1.31E-03	7.01E-04	4.67E-03	1.69E-03	6.1324E-01	4.6742E+02
7	2.04E-09	4.76E-04	6.46E-05	2.38E-03	6.41E-04	2.2269E-01	4.6781E+02
8	5.03E-27	1.19E-04	4.84E-09	6.54E-04	1.05E-04	5.5605E-02	4.6798E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1	0.9705290	0.9766960	0.9797710	0.9822620	0.9840840	0.9855240	0.9867100
2	2.95E-02	1.39E-02	8.59E-03	5.72E-03	4.19E-03	3.25E-03	2.63E-03
3		9.36E-03	8.31E-03	6.23E-03	4.59E-03	3.46E-03	2.67E-03
4			3.33E-03	4.45E-03	4.22E-03	3.57E-03	2.92E-03
5				1.34E-03	2.36E-03	2.72E-03	2.63E-03
6					5.58E-04	1.24E-03	1.69E-03
7						2.40E-04	6.41E-04
8							1.05E-04

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1-Beta	9.71E-01	9.77E-01	9.80E-01	9.82E-01	9.84E-01	9.86E-01	9.87E-01
Beta	2.95E-02	2.33E-02	2.02E-02	1.77E-02	1.59E-02	1.45E-02	1.33E-02
Gamma		4.02E-01	5.75E-01	6.78E-01	7.37E-01	7.75E-01	8.02E-01
Delta			2.86E-01	4.82E-01	6.08E-01	6.92E-01	7.50E-01
Epsilon				2.31E-01	4.09E-01	5.40E-01	6.34E-01
Mu					1.91E-01	3.52E-01	4.81E-01
Upsilon						1.63E-01	3.06E-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	35.67	53.50	71.33	89.17	107.00	124.83	142.67
N 1	1.4930	1.9479	2.3332	2.7429	3.1455	3.5482	3.9531
N 2	1.1285	0.7917	0.6459	0.5348	0.4689	0.4238	0.3909
N 3		0.5313	0.6250	0.5833	0.5139	0.4502	0.3962
N 4			0.2500	0.4167	0.4722	0.4653	0.4342
N 5				0.1250	0.2639	0.3542	0.3912
N 6					0.0625	0.1609	0.2514
N 7						0.0313	0.0953
N 8							0.0156

2.3.6.2 HIGH PRESSURE INJECTION MOTOR OPERATED VALVE FAIL TO CLOSE

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 84
Total Number of Common-Cause Failure Events: 8

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9481430	0.9849800	0.9914490	0.9997900	0.9923420	4.3231E+01	6.5922E-01
2	2.12E-04	1.50E-02	8.55E-03	5.19E-02	7.66E-03	6.5922E-01	4.3231E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9498690	0.9796370	0.9832710	0.9969820	0.9845710	8.3232E+01	1.7301E+00
2	1.96E-03	1.72E-02	1.36E-02	4.48E-02	1.54E-02	1.4623E+00	8.3500E+01
3	1.12E-07	3.15E-03	6.34E-04	1.49E-02	0.00E+00	2.6776E-01	8.4694E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9487370	0.9751510	0.9776650	0.9929740	0.9766710	1.2090E+02	3.0807E+00
2	4.43E-03	1.96E-02	1.71E-02	4.35E-02	2.33E-02	2.4350E+00	1.2155E+02
3	5.66E-06	3.46E-03	1.36E-03	1.40E-02	1.95E-06	4.2880E-01	1.2355E+02
4	5.39E-09	1.75E-03	2.24E-04	8.83E-03	0.00E+00	2.1695E-01	1.2376E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9545090	0.9746160	0.9761240	0.9895760	0.9712990	2.0282E+02	5.2826E+00
2	6.01E-03	1.82E-02	1.66E-02	3.55E-02	2.74E-02	3.7814E+00	2.0432E+02
3	2.81E-04	4.98E-03	3.52E-03	1.47E-02	1.31E-03	1.0372E+00	2.0707E+02
4	1.54E-06	1.86E-03	6.50E-04	7.81E-03	0.00E+00	3.8684E-01	2.0772E+02
5	3.89E-20	3.71E-04	3.60E-07	2.15E-03	0.00E+00	7.7129E-02	2.0803E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9550100	0.9732710	0.9744820	0.9874060	0.9659910	2.5214E+02	6.9246E+00
2	6.89E-03	1.81E-02	1.68E-02	3.34E-02	3.16E-02	4.6770E+00	2.5439E+02
3	4.50E-04	4.99E-03	3.78E-03	1.36E-02	2.20E-03	1.2915E+00	2.5777E+02
4	3.02E-05	2.47E-03	1.36E-03	8.66E-03	1.83E-04	6.3861E-01	2.5843E+02
5	1.13E-08	9.37E-04	1.54E-04	4.58E-03	0.00E+00	2.4272E-01	2.5882E+02
6	8.93E-21	2.88E-04	2.16E-07	1.67E-03	0.00E+00	7.4722E-02	2.5899E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9591110	0.9741480	0.9750150	0.9862140	0.9653520	3.5206E+02	9.3429E+00
2	6.59E-03	1.56E-02	1.47E-02	2.76E-02	2.91E-02	5.6267E+00	3.5578E+02
3	9.51E-04	5.44E-03	4.56E-03	1.30E-02	5.11E-03	1.9677E+00	3.5944E+02
4	1.39E-04	2.75E-03	1.90E-03	8.24E-03	4.48E-04	9.9250E-01	3.6041E+02
5	7.81E-06	1.47E-03	7.03E-04	5.52E-03	2.62E-05	5.3025E-01	3.6087E+02
6	3.47E-10	5.36E-04	5.11E-05	2.79E-03	0.00E+00	1.9373E-01	3.6121E+02
7	3.78E-44	8.86E-05	6.37E-13	3.64E-04	0.00E+00	3.2027E-02	3.6137E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9604240	0.9742760	0.9750250	0.9855660	0.9644040	4.0861E+02	1.0788E+01
2	6.47E-03	1.46E-02	1.38E-02	2.54E-02	2.79E-02	6.1275E+00	4.1327E+02
3	1.11E-03	5.39E-03	4.63E-03	1.23E-02	6.49E-03	2.2619E+00	4.1714E+02
4	1.99E-04	2.76E-03	2.02E-03	7.85E-03	1.14E-03	1.1581E+00	4.1824E+02
5	3.13E-05	1.70E-03	9.98E-04	5.73E-03	8.50E-05	7.1130E-01	4.1869E+02
6	4.43E-07	8.64E-04	2.78E-04	3.71E-03	4.00E-06	3.6224E-01	4.1904E+02
7	9.06E-14	3.04E-04	6.43E-06	1.72E-03	0.00E+00	1.2739E-01	4.1927E+02
8	4.16E-36	9.54E-05	4.13E-11	4.58E-04	0.00E+00	4.0005E-02	4.1936E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9923420	0.9845710	0.9766710	0.9712990	0.9659910	0.9653520	0.9644040
2	7.66E-03	1.54E-02	2.33E-02	2.74E-02	3.16E-02	2.91E-02	2.79E-02
3		0.00E+00	1.95E-06	1.31E-03	2.20E-03	5.11E-03	6.49E-03
4			0.00E+00	0.00E+00	1.83E-04	4.48E-04	1.14E-03
5				0.00E+00	0.00E+00	2.62E-05	8.50E-05
6					0.00E+00	0.00E+00	4.00E-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	9.92E-01	9.85E-01	9.77E-01	9.71E-01	9.66E-01	9.65E-01	9.64E-01
Beta	7.66E-03	1.54E-02	2.33E-02	2.87E-02	3.40E-02	3.46E-02	3.56E-02
Gamma		0.00E+00	8.37E-05	4.58E-02	7.02E-02	1.61E-01	2.17E-01
Delta			0.00E+00	0.00E+00	7.68E-02	8.49E-02	1.60E-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	23.17	34.76	46.34	57.93	69.52	81.10	92.69
N 1	2.6433	3.3674	3.6932	3.8291	3.6918	3.7609	3.7125
N 2	0.1992	0.5975	1.1950	1.7414	2.3966	2.5546	2.7861
N 3		0.0000	0.0001	0.0835	0.1670	0.4495	0.6489
N 4			0.0000	0.0000	0.0139	0.0394	0.1143
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

2.3.7 PWR Residual Heat Removal Motor-Operated Valves

2.3.7.1 PWR RHR MOV FAIL TO OPEN

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 178
Total Number of Common-Cause Failure Events: 6

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9337110	0.9694900	0.9731570	0.9927270	0.9681920	8.1138E+01	2.5534E+00
2	7.27E-03	3.05E-02	2.68E-02	6.63E-02	3.18E-02	2.5534E+00	8.1138E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9526490	0.9764450	0.9786220	0.9928090	0.9768890	1.4044E+02	3.3879E+00
2	2.80E-03	1.47E-02	1.25E-02	3.40E-02	1.27E-02	2.1076E+00	1.4172E+02
3	7.92E-04	8.90E-03	6.75E-03	2.44E-02	1.04E-02	1.2803E+00	1.4255E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9594950	0.9784890	0.9800470	0.9921580	0.9809700	1.9770E+02	4.3461E+00
2	2.08E-03	1.06E-02	9.08E-03	2.46E-02	7.04E-03	2.1505E+00	1.9990E+02
3	8.43E-04	7.32E-03	5.77E-03	1.91E-02	8.12E-03	1.4787E+00	2.0057E+02
4	6.75E-05	3.55E-03	2.10E-03	1.20E-02	3.87E-03	7.1695E-01	2.0133E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9651670	0.9798960	0.9809330	0.9910740	0.9833270	2.9933E+02	6.1411E+00
2	2.44E-03	9.32E-03	8.28E-03	1.98E-02	5.02E-03	2.8482E+00	3.0262E+02
3	9.50E-04	5.99E-03	4.95E-03	1.46E-02	5.44E-03	1.8290E+00	3.0364E+02
4	2.58E-04	3.72E-03	2.71E-03	1.06E-02	4.66E-03	1.1368E+00	3.0433E+02
5	2.45E-07	1.07E-03	2.99E-04	4.76E-03	1.55E-03	3.2713E-01	3.0514E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9678020	0.9807190	0.9815640	0.9907460	0.9849430	3.6859E+02	7.2464E+00
2	2.26E-03	8.13E-03	7.27E-03	1.69E-02	4.02E-03	3.0540E+00	3.7278E+02
3	8.18E-04	4.99E-03	4.14E-03	1.21E-02	3.90E-03	1.8753E+00	3.7396E+02
4	3.70E-04	3.66E-03	2.82E-03	9.80E-03	3.89E-03	1.3747E+00	3.7446E+02
5	4.24E-05	1.98E-03	1.19E-03	6.58E-03	2.60E-03	7.4272E-01	3.7509E+02
6	5.32E-10	5.31E-04	5.50E-05	2.74E-03	6.49E-04	1.9972E-01	3.7564E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9703120	0.9812750	0.9819140	0.9900510	0.9865230	4.8832E+02	9.3181E+00
2	2.50E-03	7.59E-03	6.94E-03	1.49E-02	3.15E-03	3.7789E+00	4.9386E+02
3	8.36E-04	4.31E-03	3.67E-03	9.98E-03	2.80E-03	2.1448E+00	4.9549E+02
4	4.47E-04	3.30E-03	2.66E-03	8.32E-03	3.07E-03	1.6406E+00	4.9600E+02
5	1.66E-04	2.32E-03	1.69E-03	6.60E-03	2.79E-03	1.1530E+00	4.9649E+02
6	4.27E-06	1.02E-03	4.68E-04	3.89E-03	1.39E-03	5.0623E-01	4.9713E+02
7	2.10E-17	1.90E-04	7.96E-07	1.11E-03	2.79E-04	9.4527E-02	4.9754E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9719940	0.9819630	0.9825160	0.9900350	0.9877060	5.6479E+02	1.0374E+01
2	2.41E-03	7.01E-03	6.44E-03	1.35E-02	2.69E-03	4.0296E+00	5.7113E+02
3	7.25E-04	3.73E-03	3.18E-03	8.64E-03	2.09E-03	2.1468E+00	5.7302E+02
4	3.85E-04	2.85E-03	2.30E-03	7.19E-03	2.32E-03	1.6376E+00	5.7353E+02
5	2.26E-04	2.34E-03	1.79E-03	6.31E-03	2.51E-03	1.3434E+00	5.7382E+02
6	4.45E-05	1.44E-03	9.23E-04	4.62E-03	1.83E-03	8.3064E-01	5.7433E+02
7	9.05E-08	5.47E-04	1.44E-04	2.47E-03	7.33E-04	3.1489E-01	5.7485E+02
8	5.87E-22	1.24E-04	6.21E-08	7.15E-04	1.22E-04	7.1305E-02	5.7509E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9681920	0.9768890	0.9809700	0.9833270	0.9849430	0.9865230	0.9877060
2	3.18E-02	1.27E-02	7.04E-03	5.02E-03	4.02E-03	3.15E-03	2.69E-03
3		1.04E-02	8.12E-03	5.44E-03	3.90E-03	2.80E-03	2.09E-03
4			3.87E-03	4.66E-03	3.89E-03	3.07E-03	2.32E-03
5				1.55E-03	2.60E-03	2.79E-03	2.51E-03
6					6.49E-04	1.39E-03	1.83E-03
7						2.79E-04	7.33E-04
8							1.22E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.68E-01	9.77E-01	9.81E-01	9.83E-01	9.85E-01	9.87E-01	9.88E-01
Beta	3.18E-02	2.31E-02	1.90E-02	1.67E-02	1.51E-02	1.35E-02	1.23E-02
Gamma		4.49E-01	6.30E-01	6.99E-01	7.33E-01	7.66E-01	7.81E-01
Delta			3.23E-01	5.33E-01	6.47E-01	7.29E-01	7.83E-01
Epsilon				2.50E-01	4.55E-01	5.93E-01	6.91E-01
Mu					2.00E-01	3.75E-01	5.18E-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	62.79	94.18	125.57	156.97	188.36	219.75	251.15
N 1	0.9298	1.1520	1.2623	1.2992	1.2998	1.3748	1.4305
N 2	2.0934	1.2428	0.9105	0.8082	0.7736	0.7068	0.6882
N 3		1.0125	1.0500	0.8753	0.7508	0.6266	0.5338
N 4			0.5000	0.7500	0.7500	0.6875	0.5938
N 5				0.2500	0.5000	0.6250	0.6406
N 6					0.1250	0.3125	0.4688
N 7						0.0625	0.1875
N 8							0.0313

2.3.7.2 PWR RHR MOV FAIL TO CLOSE

System :	RESIDUAL HEAT REMOVAL
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 99
Total Number of Common-Cause Failure Events: 2

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9611730	0.9887710	0.9936300	0.9998380	0.9951100	5.8118E+01	6.6002E-01
2	1.58E-04	1.12E-02	6.37E-03	3.88E-02	4.89E-03	6.6002E-01	5.8118E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9601900	0.9838520	0.9867510	0.9976090	0.9901720	1.0556E+02	1.7326E+00
2	1.56E-03	1.37E-02	1.08E-02	3.56E-02	9.83E-03	1.4648E+00	1.0583E+02
3	8.86E-08	2.50E-03	5.01E-04	1.18E-02	0.00E+00	2.6776E-01	1.0702E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9585450	0.9799310	0.9819730	0.9943330	0.9851850	1.5067E+02	3.0856E+00
2	3.58E-03	1.59E-02	1.38E-02	3.52E-02	1.48E-02	2.4400E+00	1.5132E+02
3	4.55E-06	2.79E-03	1.10E-03	1.13E-02	0.00E+00	4.2870E-01	1.5333E+02
4	4.34E-09	1.41E-03	1.81E-04	7.12E-03	0.00E+00	2.1695E-01	1.5354E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9641100	0.9804790	0.9817680	0.9924430	0.9867880	2.4064E+02	4.7910E+00
2	3.44E-03	1.24E-02	1.11E-02	2.58E-02	9.91E-03	3.0400E+00	2.4239E+02
3	4.70E-04	5.24E-03	3.98E-03	1.44E-02	3.30E-03	1.2870E+00	2.4414E+02
4	1.30E-06	1.58E-03	5.51E-04	6.62E-03	0.00E+00	3.8684E-01	2.4504E+02
5	3.30E-20	3.14E-04	3.05E-07	1.83E-03	0.00E+00	7.7129E-02	2.4535E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9662940	0.9807710	0.9818140	0.9916800	0.9875840	2.9823E+02	5.8470E+00
2	3.09E-03	1.06E-02	9.55E-03	2.17E-02	7.82E-03	3.2248E+00	3.0085E+02
3	6.53E-04	5.16E-03	4.12E-03	1.32E-02	3.68E-03	1.5689E+00	3.0251E+02
4	5.04E-05	2.42E-03	1.45E-03	8.08E-03	9.20E-04	7.3581E-01	3.0334E+02
5	9.66E-09	7.98E-04	1.31E-04	3.90E-03	0.00E+00	2.4272E-01	3.0383E+02
6	7.61E-21	2.46E-04	1.84E-07	1.42E-03	0.00E+00	7.4722E-02	3.0400E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9688350	0.9810130	0.9817800	0.9905650	0.9888630	4.0631E+02	7.8637E+00
2	3.13E-03	9.34E-03	8.56E-03	1.82E-02	5.66E-03	3.8684E+00	4.1031E+02
3	8.89E-04	4.90E-03	4.13E-03	1.15E-02	3.63E-03	2.0293E+00	4.1214E+02
4	2.11E-04	2.84E-03	2.09E-03	8.02E-03	1.58E-03	1.1753E+00	4.1300E+02
5	9.82E-06	1.36E-03	6.87E-04	5.01E-03	2.63E-04	5.6495E-01	4.1361E+02
6	3.02E-10	4.68E-04	4.46E-05	2.43E-03	0.00E+00	1.9373E-01	4.1398E+02
7	3.36E-44	7.73E-05	5.56E-13	3.18E-04	0.00E+00	3.2027E-02	4.1414E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9704230	0.9815320	0.9821940	0.9903720	0.9898210	4.7111E+02	8.8643E+00
2	2.91E-03	8.42E-03	7.74E-03	1.62E-02	4.35E-03	4.0397E+00	4.7593E+02
3	8.56E-04	4.44E-03	3.78E-03	1.03E-02	3.24E-03	2.1325E+00	4.7784E+02
4	2.75E-04	2.81E-03	2.16E-03	7.58E-03	1.90E-03	1.3490E+00	4.7863E+02
5	4.61E-05	1.67E-03	1.05E-03	5.41E-03	6.15E-04	8.0160E-01	4.7917E+02
6	5.08E-07	7.79E-04	2.61E-04	3.31E-03	7.66E-05	3.7414E-01	4.7960E+02
7	7.92E-14	2.65E-04	5.62E-06	1.50E-03	0.00E+00	1.2739E-01	4.7985E+02
8	3.64E-36	8.33E-05	3.61E-11	4.00E-04	0.00E+00	4.0005E-02	4.7993E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9951100	0.9901720	0.9851850	0.9867880	0.9875840	0.9888630	0.9898210
2	4.89E-03	9.83E-03	1.48E-02	9.91E-03	7.82E-03	5.66E-03	4.35E-03
3		0.00E+00	0.00E+00	3.30E-03	3.68E-03	3.63E-03	3.24E-03
4			0.00E+00	0.00E+00	9.20E-04	1.58E-03	1.90E-03
5				0.00E+00	0.00E+00	2.63E-04	6.15E-04
6					0.00E+00	0.00E+00	7.66E-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	9.95E-01	9.90E-01	9.85E-01	9.87E-01	9.88E-01	9.89E-01	9.90E-01
Beta	4.89E-03	9.83E-03	1.48E-02	1.32E-02	1.24E-02	1.11E-02	1.02E-02
Gamma		0.00E+00	0.00E+00	2.50E-01	3.70E-01	4.92E-01	5.73E-01
Delta			0.00E+00	0.00E+00	2.00E-01	3.36E-01	4.45E-01
Epsilon				0.00E+00	0.00E+00	1.43E-01	2.67E-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	39.60	59.40	79.20	99.00	118.80	138.60	158.40
N 1	1.1000	1.0500	0.6000	0.5833	0.5000	0.5056	0.5007
N 2	0.2000	0.6000	1.2000	1.0000	0.9444	0.7963	0.6983
N 3		0.0000	0.0000	0.3333	0.4444	0.5111	0.5195
N 4			0.0000	0.0000	0.1111	0.2222	0.3052
N 5				0.0000	0.0000	0.0370	0.0988
N 6					0.0000	0.0000	0.0123
N 7						0.0000	0.0000
N 8							0.0000

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

2.3.8.1 COMBINED HPCI AND RCIC MOTOR OPERATED VALVE FAIL TO OPEN

System :	HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 82
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9598780	0.9898020	0.9956260	0.9999710	0.9999270	4.4844E+01	4.6202E-01
2	2.64E-05	1.02E-02	4.37E-03	4.01E-02	7.29E-05	4.6202E-01	4.4844E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9629440	0.9869710	0.9904530	0.9990820	0.9998540	8.6243E+01	1.1385E+00
2	3.56E-04	9.96E-03	6.56E-03	3.12E-02	1.43E-04	8.7066E-01	8.6511E+01
3	1.09E-07	3.07E-03	6.17E-04	1.45E-02	2.43E-06	2.6786E-01	8.7114E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9643780	0.9851320	0.9875850	0.9975090	0.9997890	1.2571E+02	1.8973E+00
2	8.36E-04	9.81E-03	7.39E-03	2.70E-02	2.08E-04	1.2514E+00	1.2636E+02
3	5.51E-06	3.36E-03	1.32E-03	1.36E-02	3.65E-06	4.2890E-01	1.2718E+02
4	5.24E-09	1.70E-03	2.18E-04	8.58E-03	0.00E+00	2.1695E-01	1.2739E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9673480	0.9836840	0.9851710	0.9949360	0.9997230	2.0960E+02	3.4767E+00
2	1.79E-03	9.66E-03	8.17E-03	2.26E-02	2.70E-04	2.0585E+00	2.1102E+02
3	2.05E-04	4.48E-03	3.05E-03	1.36E-02	7.29E-06	9.5419E-01	2.1212E+02
4	1.50E-06	1.82E-03	6.35E-04	7.63E-03	0.00E+00	3.8684E-01	2.1269E+02
5	3.80E-20	3.62E-04	3.51E-07	2.10E-03	0.00E+00	7.7129E-02	2.1300E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9689760	0.9835240	0.9847210	0.9939770	0.9996600	2.6117E+02	4.3751E+00
2	1.84E-03	8.69E-03	7.49E-03	1.96E-02	3.28E-04	2.3074E+00	2.6324E+02
3	2.88E-04	4.24E-03	3.08E-03	1.22E-02	1.22E-05	1.1255E+00	2.6442E+02
4	2.63E-05	2.35E-03	1.28E-03	8.33E-03	0.00E+00	6.2471E-01	2.6492E+02
5	1.11E-08	9.14E-04	1.51E-04	4.46E-03	0.00E+00	2.4272E-01	2.6530E+02
6	8.71E-21	2.81E-04	2.10E-07	1.63E-03	0.00E+00	7.4722E-02	2.6547E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9999270	0.9998540	0.9997890	0.9997230	0.9996600
2	7.29E-05	1.43E-04	2.08E-04	2.70E-04	3.28E-04
3		2.43E-06	3.65E-06	7.29E-06	1.22E-05
4			0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	7.29E-05	1.46E-04	2.11E-04	2.77E-04	3.40E-04
Gamma		1.67E-02	1.72E-02	2.63E-02	3.57E-02
Delta			0.00E+00	0.00E+00	0.00E+00
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	27.33	41.00	54.67	68.33	82.00
N 1	0.0960	0.1382	0.1766	0.2115	0.2430
N 2	0.0020	0.0059	0.0114	0.0185	0.0270
N 3		0.0001	0.0002	0.0005	0.0010
N 4			0.0000	0.0000	0.0000
N 5				0.0000	0.0000
N 6					0.0000

2.3.8.2 COMBINED HPCI AND RCIC MOTOR OPERATED VALVE FAIL TO CLOSE

System :	HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 59
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9445900	0.9859100	0.9939490	0.9999610	0.9999730	3.2217E+01	4.6042E-01
2	3.59E-05	1.41E-02	6.05E-03	5.54E-02	2.70E-05	4.6042E-01	3.2217E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9529080	0.9834370	0.9878550	0.9988460	0.9999500	6.7308E+01	1.1336E+00
2	4.46E-04	1.27E-02	8.32E-03	3.96E-02	4.95E-05	8.6586E-01	6.7576E+01
3	1.39E-07	3.91E-03	7.89E-04	1.85E-02	0.00E+00	2.6776E-01	6.8174E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9558050	0.9815560	0.9845940	0.9969220	0.9999290	1.0046E+02	1.8878E+00
2	1.02E-03	1.21E-02	9.14E-03	3.35E-02	7.10E-05	1.2421E+00	1.0111E+02
3	6.85E-06	4.19E-03	1.65E-03	1.70E-02	0.00E+00	4.2870E-01	1.0192E+02
4	6.54E-09	2.12E-03	2.72E-04	1.07E-02	0.00E+00	2.1695E-01	1.0213E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9618330	0.9809320	0.9826680	0.9940940	0.9999030	1.7806E+02	3.4613E+00
2	2.07E-03	1.13E-02	9.52E-03	2.64E-02	9.73E-05	2.0436E+00	1.7948E+02
3	2.40E-04	5.25E-03	3.58E-03	1.60E-02	0.00E+00	9.5369E-01	1.8057E+02
4	1.76E-06	2.13E-03	7.46E-04	8.95E-03	0.00E+00	3.8684E-01	1.8113E+02
5	4.47E-20	4.25E-04	4.12E-07	2.47E-03	0.00E+00	7.7129E-02	1.8144E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9639870	0.9808830	0.9822720	0.9930310	0.9998780	2.2332E+02	4.3525E+00
2	2.10E-03	1.00E-02	8.64E-03	2.27E-02	1.22E-04	2.2858E+00	2.2539E+02
3	3.35E-04	4.94E-03	3.59E-03	1.42E-02	0.00E+00	1.1245E+00	2.2655E+02
4	3.07E-05	2.74E-03	1.49E-03	9.72E-03	0.00E+00	6.2471E-01	2.2705E+02
5	1.29E-08	1.07E-03	1.76E-04	5.21E-03	0.00E+00	2.4272E-01	2.2743E+02
6	1.02E-20	3.28E-04	2.46E-07	1.90E-03	0.00E+00	7.4722E-02	2.2760E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9999730	0.9999500	0.9999290	0.9999030	0.9998780
2	2.70E-05	4.95E-05	7.10E-05	9.73E-05	1.22E-04
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	2.70E-05	4.95E-05	7.10E-05	9.73E-05	1.22E-04
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00
Delta			0.00E+00	0.00E+00	0.00E+00
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	14.75	22.13	29.50	36.88	44.25
N 1	0.0493	0.0729	0.0957	0.1179	0.1393
N 2	0.0004	0.0011	0.0021	0.0036	0.0054
N 3		0.0000	0.0000	0.0000	0.0000
N 4			0.0000	0.0000	0.0000
N 5				0.0000	0.0000
N 6					0.0000

2.3.9 Pressurizer PORV Motor-Operated Block Valves

2.3.9.1 PRESSURIZER PORV BLOCK MOVS FAIL TO OPEN

System :	REACTOR COOLANT
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 30
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9621290	0.9903920	0.9959030	0.9999740	1.0000000	4.7418E+01	4.6002E-01
2	2.42E-05	9.61E-03	4.10E-03	3.79E-02	0.00E+00	4.6002E-01	4.7418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9577140	0.9851450	0.9891220	0.9989650	1.0000000	7.5105E+01	1.1325E+00
2	3.98E-04	1.13E-02	7.45E-03	3.56E-02	0.00E+00	8.6476E-01	7.5373E+01
3	1.25E-07	3.51E-03	7.07E-04	1.67E-02	0.00E+00	2.6776E-01	7.5970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9560120	0.9816490	0.9846760	0.9969430	1.0000000	1.0087E+02	1.8857E+00
2	1.01E-03	1.21E-02	9.08E-03	3.33E-02	0.00E+00	1.2400E+00	1.0152E+02
3	6.82E-06	4.17E-03	1.64E-03	1.69E-02	0.00E+00	4.2870E-01	1.0233E+02
4	6.51E-09	2.11E-03	2.71E-04	1.07E-02	0.00E+00	2.1695E-01	1.0254E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9603430	0.9801870	0.9819910	0.9938610	1.0000000	1.7106E+02	3.4577E+00
2	2.15E-03	1.17E-02	9.88E-03	2.74E-02	0.00E+00	2.0400E+00	1.7248E+02
3	2.50E-04	5.46E-03	3.73E-03	1.66E-02	0.00E+00	9.5369E-01	1.7356E+02
4	1.83E-06	2.22E-03	7.76E-04	9.31E-03	0.00E+00	3.8684E-01	1.7413E+02
5	4.65E-20	4.42E-04	4.29E-07	2.57E-03	0.00E+00	7.7129E-02	1.7444E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9616080	0.9796180	0.9810970	0.9925720	1.0000000	2.0893E+02	4.3471E+00
2	2.23E-03	1.07E-02	9.20E-03	2.42E-02	0.00E+00	2.2804E+00	2.1100E+02
3	3.58E-04	5.27E-03	3.83E-03	1.51E-02	0.00E+00	1.1245E+00	2.1215E+02
4	3.28E-05	2.93E-03	1.59E-03	1.04E-02	0.00E+00	6.2471E-01	2.1265E+02
5	1.38E-08	1.14E-03	1.88E-04	5.56E-03	0.00E+00	2.4272E-01	2.1303E+02
6	1.09E-20	3.50E-04	2.62E-07	2.03E-03	0.00E+00	7.4722E-02	2.1320E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00
Delta			0.00E+00	0.00E+00	0.00E+00
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	30.00	30.00	30.00	30.00	30.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000
N 3		0.0000	0.0000	0.0000	0.0000
N 4			0.0000	0.0000	0.0000
N 5				0.0000	0.0000
N 6					0.0000

2.3.9.2 PRESSURIZER PORV BLOCK MOVS FAIL TO CLOSE

System :	REACTOR COOLANT
Component :	MOTOR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 48
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9723400	0.9929620	0.9969800	0.9999790	0.9998960	6.5608E+01	4.6502E-01
2	1.88E-05	7.04E-03	3.02E-03	2.77E-02	1.04E-04	4.6502E-01	6.5608E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9725050	0.9903220	0.9929030	0.9993080	0.9997980	1.1738E+02	1.1471E+00
2	2.72E-04	7.42E-03	4.89E-03	2.32E-02	1.98E-04	8.7906E-01	1.1765E+02
3	8.12E-08	2.26E-03	4.55E-04	1.07E-02	4.15E-06	2.6806E-01	1.1826E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9729200	0.9886840	0.9905480	0.9980830	0.9997080	1.6721E+02	1.9138E+00
2	6.53E-04	7.49E-03	5.66E-03	2.06E-02	2.81E-04	1.2671E+00	1.6786E+02
3	4.21E-06	2.54E-03	1.00E-03	1.03E-02	1.04E-05	4.2970E-01	1.6869E+02
4	3.95E-09	1.28E-03	1.64E-04	6.47E-03	0.00E+00	2.1695E-01	1.6891E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9735640	0.9867800	0.9879870	0.9958750	0.9996240	2.6147E+02	3.5030E+00
2	1.48E-03	7.86E-03	6.66E-03	1.83E-02	3.56E-04	2.0829E+00	2.6289E+02
3	1.66E-04	3.61E-03	2.46E-03	1.10E-02	1.91E-05	9.5599E-01	2.6402E+02
4	1.21E-06	1.46E-03	5.11E-04	6.13E-03	8.30E-07	3.8694E-01	2.6459E+02
5	3.06E-20	2.91E-04	2.82E-07	1.69E-03	0.00E+00	7.7129E-02	2.6490E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9746780	0.9865390	0.9875180	0.9950570	0.9995460	3.2339E+02	4.4127E+00
2	1.53E-03	7.14E-03	6.17E-03	1.61E-02	4.23E-04	2.3415E+00	3.2546E+02
3	2.35E-04	3.44E-03	2.50E-03	9.87E-03	2.98E-05	1.1288E+00	3.2667E+02
4	2.14E-05	1.91E-03	1.03E-03	6.75E-03	1.38E-06	6.2491E-01	3.2718E+02
5	8.96E-09	7.40E-04	1.22E-04	3.62E-03	0.00E+00	2.4272E-01	3.2756E+02
6	7.06E-21	2.28E-04	1.70E-07	1.32E-03	0.00E+00	7.4722E-02	3.2773E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9998960	0.9997980	0.9997080	0.9996240	0.9995460
2	1.04E-04	1.98E-04	2.81E-04	3.56E-04	4.23E-04
3		4.15E-06	1.04E-05	1.91E-05	2.98E-05
4			0.00E+00	8.30E-07	1.38E-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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	1.04E-04	2.02E-04	2.92E-04	3.76E-04	4.54E-04
Gamma		2.05E-02	3.56E-02	5.30E-02	6.86E-02
Delta			0.00E+00	4.17E-02	4.44E-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	48.00	72.00	96.00	120.00	144.00
N 1	0.1900	0.2708	0.3430	0.4073	0.4643
N 2	0.0050	0.0143	0.0271	0.0429	0.0611
N 3		0.0003	0.0010	0.0023	0.0043
N 4			0.0000	0.0001	0.0002
N 5				0.0000	0.0000
N 6					0.0000

2.4 Air Operated Valves

2.4.1 Pooled Air Operated Valves

2.4.1.1 AOV FAIL TO OPEN ALL SYSTEMS SPAR: AOV-CC

Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 139
Total Number of Common-Cause Failure Events: 12

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9459560	0.9781340	0.9820790	0.9968220	0.9792830	7.6288E+01	1.7054E+00
2	3.18E-03	2.19E-02	1.79E-02	5.40E-02	2.07E-02	1.7054E+00	7.6288E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9413910	0.9691130	0.9714020	0.9889960	0.9657800	1.3073E+02	4.1666E+00
2	8.33E-03	2.63E-02	2.40E-02	5.22E-02	3.03E-02	3.5477E+00	1.3135E+02
3	4.95E-05	4.59E-03	2.48E-03	1.63E-02	3.96E-03	6.1886E-01	1.3428E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9427800	0.9666220	0.9682550	0.9848960	0.9619730	1.8316E+02	6.3246E+00
2	8.66E-03	2.34E-02	2.18E-02	4.38E-02	2.74E-02	4.4357E+00	1.8505E+02
3	9.17E-04	7.86E-03	6.21E-03	2.05E-02	9.09E-03	1.4897E+00	1.8799E+02
4	2.16E-06	2.11E-03	7.65E-04	8.75E-03	1.56E-03	3.9915E-01	1.8909E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9518510	0.9699740	0.9710500	0.9844150	0.9638760	2.8045E+02	8.6815E+00
2	6.87E-03	1.73E-02	1.62E-02	3.15E-02	2.05E-02	5.0024E+00	2.8413E+02
3	1.93E-03	8.52E-03	7.42E-03	1.89E-02	1.04E-02	2.4642E+00	2.8667E+02
4	2.05E-04	3.61E-03	2.55E-03	1.06E-02	4.53E-03	1.0426E+00	2.8809E+02
5	6.26E-11	5.96E-04	4.01E-05	3.19E-03	6.58E-04	1.7233E-01	2.8896E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9548840	0.9708780	0.9717590	0.9838750	0.9651300	3.4526E+02	1.0356E+01
2	6.09E-03	1.49E-02	1.40E-02	2.67E-02	1.75E-02	5.2925E+00	3.5032E+02
3	1.84E-03	7.51E-03	6.61E-03	1.63E-02	8.97E-03	2.6700E+00	3.5295E+02
4	6.15E-04	4.58E-03	3.69E-03	1.16E-02	5.83E-03	1.6290E+00	3.5399E+02
5	2.23E-05	1.80E-03	9.92E-04	6.32E-03	2.31E-03	6.4022E-01	3.5498E+02
6	6.33E-14	3.50E-04	6.70E-06	1.99E-03	2.90E-04	1.2462E-01	3.5549E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9588770	0.9722990	0.9729590	0.9834620	0.9658990	4.6030E+02	1.3114E+01
2	6.03E-03	1.34E-02	1.27E-02	2.31E-02	1.64E-02	6.3459E+00	4.6707E+02
3	1.68E-03	6.24E-03	5.56E-03	1.31E-02	7.18E-03	2.9535E+00	4.7046E+02
4	8.45E-04	4.45E-03	3.77E-03	1.04E-02	5.77E-03	2.1061E+00	4.7131E+02
5	2.07E-04	2.58E-03	1.92E-03	7.19E-03	3.46E-03	1.2194E+00	4.7219E+02
6	1.53E-06	9.10E-04	3.59E-04	3.68E-03	1.19E-03	4.3103E-01	4.7298E+02
7	6.15E-26	1.23E-04	8.59E-09	6.87E-04	1.32E-04	5.8327E-02	4.7336E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9604230	0.9727590	0.9733360	0.9831390	0.9662880	5.3193E+02	1.4896E+01
2	6.09E-03	1.29E-02	1.23E-02	2.17E-02	1.63E-02	7.0457E+00	5.3978E+02
3	1.41E-03	5.31E-03	4.73E-03	1.12E-02	5.69E-03	2.9063E+00	5.4392E+02
4	8.09E-04	4.04E-03	3.45E-03	9.27E-03	5.12E-03	2.2070E+00	5.4462E+02
5	3.71E-04	2.89E-03	2.31E-03	7.39E-03	3.87E-03	1.5821E+00	5.4524E+02
6	4.74E-05	1.52E-03	9.76E-04	4.87E-03	2.07E-03	8.3324E-01	5.4599E+02
7	1.72E-08	4.89E-04	9.77E-05	2.32E-03	6.17E-04	2.6759E-01	5.4656E+02
8	7.85E-28	9.86E-05	2.79E-09	5.38E-04	6.11E-05	5.3905E-02	5.4677E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9792830	0.9657800	0.9619730	0.9638760	0.9651300	0.9658990	0.9662880
2	2.07E-02	3.03E-02	2.74E-02	2.05E-02	1.75E-02	1.64E-02	1.63E-02
3		3.96E-03	9.09E-03	1.04E-02	8.97E-03	7.18E-03	5.69E-03
4			1.56E-03	4.53E-03	5.83E-03	5.77E-03	5.12E-03
5				6.58E-04	2.31E-03	3.46E-03	3.87E-03
6					2.90E-04	1.19E-03	2.07E-03
7						1.32E-04	6.17E-04
8							6.11E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.79E-01	9.66E-01	9.62E-01	9.64E-01	9.65E-01	9.66E-01	9.66E-01
Beta	2.07E-02	3.42E-02	3.80E-02	3.61E-02	3.49E-02	3.41E-02	3.37E-02
Gamma		1.16E-01	2.80E-01	4.33E-01	4.99E-01	5.20E-01	5.17E-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	52.95	79.43	105.90	132.38	158.86	185.33	211.81
N 1	5.9204	6.1976	6.3902	7.0067	7.4655	7.7671	7.9071
N 2	1.2454	2.6829	3.1957	2.9624	3.0121	3.2738	3.7043
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

2.4.1.2 AOV FAIL TO OPERATE ALL SYSTEMS SPAR:AOV-FO

Component :	AIR OPERATED VALVE, WATER
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 255
Total Number of Common-Cause Failure Events: 19

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9564980	0.9810110	0.9837350	0.9962190	0.9822570	1.1248E+02	2.1772E+00
2	3.78E-03	1.90E-02	1.63E-02	4.35E-02	1.77E-02	2.1772E+00	1.1248E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9479250	0.9705280	0.9721690	0.9875090	0.9689180	1.8361E+02	5.5757E+00
2	1.04E-02	2.62E-02	2.45E-02	4.76E-02	2.86E-02	4.9536E+00	1.8423E+02
3	3.62E-05	3.29E-03	1.78E-03	1.17E-02	2.48E-03	6.2206E-01	1.8856E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9445220	0.9650080	0.9661890	0.9814510	0.9615010	2.5180E+02	9.1304E+00
2	1.33E-02	2.77E-02	2.65E-02	4.62E-02	3.18E-02	7.2288E+00	2.5370E+02
3	6.80E-04	5.76E-03	4.55E-03	1.49E-02	5.71E-03	1.5023E+00	2.5943E+02
4	1.57E-06	1.53E-03	5.55E-04	6.36E-03	9.69E-04	3.9925E-01	2.6053E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9521100	0.9682130	0.9690390	0.9815100	0.9633400	3.6561E+02	1.2003E+01
2	9.91E-03	2.02E-02	1.94E-02	3.34E-02	2.40E-02	7.6260E+00	3.6999E+02
3	2.40E-03	8.37E-03	7.52E-03	1.73E-02	9.47E-03	3.1616E+00	3.7445E+02
4	1.57E-04	2.76E-03	1.95E-03	8.14E-03	2.82E-03	1.0431E+00	3.7657E+02
5	4.79E-11	4.56E-04	3.07E-05	2.44E-03	4.08E-04	1.7233E-01	3.7744E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9559610	0.9700550	0.9707310	0.9818380	0.9659470	4.4729E+02	1.3808E+01
2	7.64E-03	1.59E-02	1.52E-02	2.65E-02	1.81E-02	7.3213E+00	4.5378E+02
3	2.81E-03	8.39E-03	7.69E-03	1.64E-02	9.88E-03	3.8689E+00	4.5723E+02
4	6.48E-04	4.02E-03	3.33E-03	9.75E-03	4.42E-03	1.8525E+00	4.5925E+02
5	1.72E-05	1.39E-03	7.65E-04	4.88E-03	1.43E-03	6.4022E-01	4.6046E+02
6	4.88E-14	2.70E-04	5.17E-06	1.54E-03	1.80E-04	1.2462E-01	4.6097E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9600300	0.9719690	0.9724930	0.9821100	0.9677210	5.7919E+02	1.6704E+01
2	6.69E-03	1.34E-02	1.29E-02	2.20E-02	1.52E-02	7.9849E+00	5.8791E+02
3	2.62E-03	7.25E-03	6.71E-03	1.37E-02	8.69E-03	4.3201E+00	5.9157E+02
4	1.06E-03	4.39E-03	3.85E-03	9.57E-03	5.16E-03	2.6156E+00	5.9328E+02
5	1.96E-04	2.17E-03	1.65E-03	5.94E-03	2.38E-03	1.2938E+00	5.9460E+02
6	1.22E-06	7.23E-04	2.85E-04	2.93E-03	7.36E-04	4.3103E-01	5.9546E+02
7	4.89E-26	9.79E-05	6.82E-09	5.45E-04	8.16E-05	5.8327E-02	5.9584E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9619420	0.9728580	0.9733140	0.9822110	0.9689330	6.6763E+02	1.8626E+01
2	6.27E-03	1.23E-02	1.18E-02	1.99E-02	1.39E-02	8.4273E+00	6.7783E+02
3	2.24E-03	6.24E-03	5.76E-03	1.18E-02	7.27E-03	4.2789E+00	6.8198E+02
4	1.15E-03	4.29E-03	3.82E-03	9.04E-03	5.18E-03	2.9449E+00	6.8331E+02
5	4.04E-04	2.62E-03	2.15E-03	6.42E-03	2.98E-03	1.7957E+00	6.8446E+02
6	4.24E-05	1.25E-03	8.12E-04	3.95E-03	1.35E-03	8.5794E-01	6.8540E+02
7	1.37E-08	3.90E-04	7.79E-05	1.85E-03	3.82E-04	2.6759E-01	6.8599E+02
8	6.26E-28	7.85E-05	2.23E-09	4.28E-04	3.79E-05	5.3905E-02	6.8620E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9822570	0.9689180	0.9615010	0.9633400	0.9659470	0.9677210	0.9689330
2	1.77E-02	2.86E-02	3.18E-02	2.40E-02	1.81E-02	1.52E-02	1.39E-02
3		2.48E-03	5.71E-03	9.47E-03	9.88E-03	8.69E-03	7.27E-03
4			9.69E-04	2.82E-03	4.42E-03	5.16E-03	5.18E-03
5				4.08E-04	1.43E-03	2.38E-03	2.98E-03
6					1.80E-04	7.36E-04	1.35E-03
7						8.16E-05	3.82E-04
8							3.79E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.82E-01	9.69E-01	9.62E-01	9.63E-01	9.66E-01	9.68E-01	9.69E-01
Beta	1.77E-02	3.11E-02	3.85E-02	3.67E-02	3.41E-02	3.23E-02	3.11E-02
Gamma		7.97E-02	1.73E-01	3.46E-01	4.67E-01	5.28E-01	5.54E-01
Delta			1.45E-01	2.54E-01	3.79E-01	4.90E-01	5.78E-01
Epsilon				1.27E-01	2.67E-01	3.82E-01	4.78E-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	86.59	129.88	173.17	216.47	259.76	303.06	346.35
N 1	8.4766	8.6261	7.7661	8.0818	8.5999	8.9296	9.0744
N 2	1.7172	4.0888	5.9888	5.5860	5.0409	4.9128	5.0859
N 3		0.3543	1.0736	2.2079	2.7444	2.8019	2.6659
N 4			0.1823	0.6563	1.2278	1.6625	1.9011
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

2.4.1.3 AOV FAIL TO CLOSE ALL SYSTEMS SPAR: AOV-OO

Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 87
Total Number of Common-Cause Failure Events: 6

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9390900	0.9800430	0.9864370	0.9991520	0.9836890	4.5274E+01	9.2192E-01
2	8.46E-04	2.00E-02	1.36E-02	6.09E-02	1.63E-02	9.2192E-01	4.5274E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9376080	0.9714400	0.9749390	0.9933060	0.9669410	8.5501E+01	2.5137E+00
2	5.28E-03	2.55E-02	2.20E-02	5.77E-02	3.30E-02	2.2437E+00	8.5771E+01
3	1.19E-07	3.07E-03	6.26E-04	1.45E-02	5.27E-05	2.6996E-01	8.7745E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9329580	0.9636270	0.9660300	0.9860870	0.9497460	1.2290E+02	4.6389E+00
2	1.08E-02	3.12E-02	2.88E-02	6.00E-02	5.01E-02	3.9844E+00	1.2355E+02
3	6.36E-06	3.43E-03	1.38E-03	1.38E-02	1.62E-04	4.3760E-01	1.2710E+02
4	5.24E-09	1.70E-03	2.18E-04	8.58E-03	0.00E+00	2.1695E-01	1.2732E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9465540	0.9684370	0.9698970	0.9853300	0.9521260	2.0550E+02	6.6977E+00
2	8.17E-03	2.16E-02	2.01E-02	4.02E-02	3.77E-02	4.5907E+00	2.0761E+02
3	1.05E-03	7.74E-03	6.26E-03	1.95E-02	1.02E-02	1.6430E+00	2.1055E+02
4	1.51E-06	1.82E-03	6.37E-04	7.66E-03	0.00E+00	3.8684E-01	2.1181E+02
5	3.82E-20	3.63E-04	3.53E-07	2.11E-03	0.00E+00	7.7129E-02	2.1212E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9520940	0.9708740	0.9720550	0.9856160	0.9585710	2.5614E+02	7.6841E+00
2	5.69E-03	1.60E-02	1.48E-02	3.04E-02	2.40E-02	4.2108E+00	2.5961E+02
3	1.85E-03	8.75E-03	7.54E-03	1.98E-02	1.47E-02	2.3089E+00	2.6152E+02
4	1.05E-04	3.21E-03	2.07E-03	1.02E-02	2.76E-03	8.4691E-01	2.6298E+02
5	1.11E-08	9.20E-04	1.52E-04	4.49E-03	0.00E+00	2.4272E-01	2.6358E+02
6	8.77E-21	2.83E-04	2.12E-07	1.64E-03	0.00E+00	7.4722E-02	2.6375E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9583710	0.9734620	0.9743150	0.9856290	0.9631720	3.5716E+02	9.7368E+00
2	4.70E-03	1.25E-02	1.16E-02	2.33E-02	1.62E-02	4.5871E+00	3.6231E+02
3	2.05E-03	7.80E-03	6.93E-03	1.65E-02	1.44E-02	2.8618E+00	3.6404E+02
4	4.48E-04	3.98E-03	3.12E-03	1.04E-02	5.43E-03	1.4601E+00	3.6544E+02
5	1.57E-05	1.64E-03	8.67E-04	5.89E-03	7.93E-04	6.0205E-01	3.6629E+02
6	3.41E-10	5.28E-04	5.03E-05	2.74E-03	0.00E+00	1.9373E-01	3.6670E+02
7	3.78E-44	8.73E-05	6.27E-13	3.59E-04	0.00E+00	3.2027E-02	3.6686E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9610460	0.9746900	0.9754270	0.9858060	0.9666430	4.1489E+02	1.0774E+01
2	4.03E-03	1.07E-02	9.99E-03	2.00E-02	1.16E-02	4.5742E+00	4.2109E+02
3	1.87E-03	6.94E-03	6.18E-03	1.46E-02	1.26E-02	2.9525E+00	4.2271E+02
4	6.36E-04	4.17E-03	3.43E-03	1.03E-02	6.90E-03	1.7771E+00	4.2389E+02
5	8.80E-05	2.15E-03	1.44E-03	6.64E-03	2.01E-03	9.1600E-01	4.2475E+02
6	7.46E-07	9.08E-04	3.17E-04	3.82E-03	2.33E-04	3.8654E-01	4.2528E+02
7	8.93E-14	2.99E-04	6.33E-06	1.69E-03	0.00E+00	1.2739E-01	4.2554E+02
8	4.10E-36	9.40E-05	4.07E-11	4.51E-04	0.00E+00	4.0005E-02	4.2562E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9836890	0.9669410	0.9497460	0.9521260	0.9585710	0.9631720	0.9666430
2	1.63E-02	3.30E-02	5.01E-02	3.77E-02	2.40E-02	1.62E-02	1.16E-02
3		5.27E-05	1.62E-04	1.02E-02	1.47E-02	1.44E-02	1.26E-02
4			0.00E+00	0.00E+00	2.76E-03	5.43E-03	6.90E-03
5				0.00E+00	0.00E+00	7.93E-04	2.01E-03
6					0.00E+00	0.00E+00	2.33E-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	9.84E-01	9.67E-01	9.50E-01	9.52E-01	9.59E-01	9.63E-01	9.67E-01
Beta	1.63E-02	3.31E-02	5.03E-02	4.79E-02	4.14E-02	3.68E-02	3.34E-02
Gamma		1.59E-03	3.23E-03	2.13E-01	4.22E-01	5.60E-01	6.52E-01
Delta			0.00E+00	0.00E+00	1.58E-01	3.02E-01	4.20E-01
Epsilon				0.00E+00	0.00E+00	1.28E-01	2.45E-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	25.48	38.21	50.95	63.69	76.43	89.17	101.90
N 1	2.3763	2.1855	1.0844	0.7471	0.7802	0.7904	0.7847
N 2	0.4619	1.3789	2.7444	2.5507	1.9304	1.5150	1.2328
N 3		0.0022	0.0089	0.6893	1.1844	1.3436	1.3395
N 4			0.0000	0.0000	0.2222	0.5070	0.7333
N 5				0.0000	0.0000	0.0741	0.2132
N 6					0.0000	0.0000	0.0247
N 7						0.0000	0.0000
N 8							0.0000

2.4.2 BWR Isolation Condenser Air-Operated Valves

2.4.2.1 ISO CONDENSER AOV FAIL TO OPEN

System :	ISOLATION CONDENSER
Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 2
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9093360	0.9768580	0.9899370	0.9999370	1.0000000	1.9418E+01	4.6002E-01
2	5.96E-05	2.31E-02	1.01E-02	9.07E-02	0.00E+00	4.6002E-01	1.9418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9334650	0.9765220	0.9827270	0.9983550	1.0000000	4.7105E+01	1.1325E+00
2	6.34E-04	1.79E-02	1.18E-02	5.60E-02	0.00E+00	8.6476E-01	4.7373E+01
3	1.99E-07	5.55E-03	1.12E-03	2.63E-02	0.00E+00	2.6776E-01	4.7970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9397250	0.9747750	0.9788830	0.9957720	1.0000000	7.2868E+01	1.8857E+00
2	1.40E-03	1.66E-02	1.25E-02	4.57E-02	0.00E+00	1.2400E+00	7.3514E+01
3	9.41E-06	5.73E-03	2.27E-03	2.32E-02	0.00E+00	4.2870E-01	7.4325E+01
4	8.97E-09	2.90E-03	3.73E-04	1.46E-02	0.00E+00	2.1695E-01	7.4537E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9528260	0.9764010	0.9785390	0.9926790	1.0000000	1.4306E+02	3.4577E+00
2	2.56E-03	1.39E-02	1.18E-02	3.26E-02	0.00E+00	2.0400E+00	1.4448E+02
3	2.98E-04	6.51E-03	4.45E-03	1.98E-02	0.00E+00	9.5369E-01	1.4556E+02
4	2.19E-06	2.64E-03	9.24E-04	1.11E-02	0.00E+00	3.8684E-01	1.4613E+02
5	5.54E-20	5.26E-04	5.11E-07	3.06E-03	0.00E+00	7.7129E-02	1.4644E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9558470	0.9765380	0.9782350	0.9914380	1.0000000	1.8093E+02	4.3471E+00
2	2.57E-03	1.23E-02	1.06E-02	2.79E-02	0.00E+00	2.2804E+00	1.8300E+02
3	4.12E-04	6.07E-03	4.41E-03	1.74E-02	0.00E+00	1.1245E+00	1.8415E+02
4	3.78E-05	3.37E-03	1.83E-03	1.19E-02	0.00E+00	6.2471E-01	1.8465E+02
5	1.59E-08	1.31E-03	2.16E-04	6.40E-03	0.00E+00	2.4272E-01	1.8503E+02
6	1.25E-20	4.03E-04	3.02E-07	2.34E-03	0.00E+00	7.4722E-02	1.8520E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00
Delta			0.00E+00	0.00E+00	0.00E+00
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	2.00	2.00	2.00	2.00	2.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000
N 3		0.0000	0.0000	0.0000	0.0000
N 4			0.0000	0.0000	0.0000
N 5				0.0000	0.0000
N 6					0.0000

2.4.2.2 ISO CONDENSER AOV FAIL TO CLOSE

System :	ISOLATION CONDENSER
Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 1
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9045870	0.9756320	0.9893850	0.9999330	1.0000000	1.8418E+01	4.6002E-01
2	6.29E-05	2.44E-02	1.06E-02	9.54E-02	0.00E+00	4.6002E-01	1.8418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9320790	0.9760250	0.9823570	0.9983200	1.0000000	4.6105E+01	1.1325E+00
2	6.47E-04	1.83E-02	1.21E-02	5.72E-02	0.00E+00	8.6476E-01	4.6373E+01
3	2.03E-07	5.67E-03	1.15E-03	2.69E-02	0.00E+00	2.6776E-01	4.6970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9389170	0.9744330	0.9785940	0.9957140	1.0000000	7.1868E+01	1.8857E+00
2	1.42E-03	1.68E-02	1.27E-02	4.63E-02	0.00E+00	1.2400E+00	7.2514E+01
3	9.53E-06	5.81E-03	2.30E-03	2.35E-02	0.00E+00	4.2870E-01	7.3325E+01
4	9.09E-09	2.94E-03	3.78E-04	1.48E-02	0.00E+00	2.1695E-01	7.3537E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9525050	0.9762390	0.9783910	0.9926290	1.0000000	1.4206E+02	3.4577E+00
2	2.58E-03	1.40E-02	1.19E-02	3.28E-02	0.00E+00	2.0400E+00	1.4348E+02
3	3.00E-04	6.55E-03	4.48E-03	1.99E-02	0.00E+00	9.5369E-01	1.4456E+02
4	2.20E-06	2.66E-03	9.31E-04	1.12E-02	0.00E+00	3.8684E-01	1.4513E+02
5	5.58E-20	5.30E-04	5.15E-07	3.08E-03	0.00E+00	7.7129E-02	1.4544E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9556100	0.9764100	0.9781170	0.9913910	1.0000000	1.7993E+02	4.3471E+00
2	2.59E-03	1.24E-02	1.07E-02	2.80E-02	0.00E+00	2.2804E+00	1.8200E+02
3	4.15E-04	6.10E-03	4.43E-03	1.75E-02	0.00E+00	1.1245E+00	1.8315E+02
4	3.80E-05	3.39E-03	1.84E-03	1.20E-02	0.00E+00	6.2471E-01	1.8365E+02
5	1.60E-08	1.32E-03	2.17E-04	6.43E-03	0.00E+00	2.4272E-01	1.8403E+02
6	1.26E-20	4.05E-04	3.04E-07	2.35E-03	0.00E+00	7.4722E-02	1.8420E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00
Delta			0.00E+00	0.00E+00	0.00E+00
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	1.00	1.00	1.00	1.00	1.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000
N 3		0.0000	0.0000	0.0000	0.0000
N 4			0.0000	0.0000	0.0000
N 5				0.0000	0.0000
N 6					0.0000

2.4.3 PWR Auxiliary Feedwater Air-Operated Valves

2.4.3.1 AOV FAIL TO OPEN SPAR: AFW-AOV-CC

System :	AUXILIARY FEEDWATER SYSTEM
Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 71
Total Number of Common-Cause Failure Events: 8

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9237270	0.9706560	0.9767630	0.9966870	0.9686000	4.7861E+01	1.4469E+00
2	3.32E-03	2.93E-02	2.32E-02	7.63E-02	3.14E-02	1.4469E+00	4.7861E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9264940	0.9632390	0.9665390	0.9886880	0.9509110	8.8857E+01	3.3912E+00
2	7.75E-03	3.01E-02	2.67E-02	6.38E-02	4.15E-02	2.7723E+00	8.9476E+01
3	7.26E-05	6.71E-03	3.63E-03	2.38E-02	7.63E-03	6.1886E-01	9.1629E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9343700	0.9641460	0.9664510	0.9860490	0.9521770	1.2837E+02	4.7737E+00
2	5.77E-03	2.17E-02	1.93E-02	4.56E-02	2.72E-02	2.8849E+00	1.3026E+02
3	1.31E-03	1.12E-02	8.85E-03	2.91E-02	1.76E-02	1.4897E+00	1.3165E+02
4	3.08E-06	3.00E-03	1.09E-03	1.25E-02	3.02E-03	3.9915E-01	1.3274E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9468410	0.9683670	0.9697810	0.9850570	0.9534390	2.1220E+02	6.9318E+00
2	5.42E-03	1.67E-02	1.53E-02	3.30E-02	2.18E-02	3.6702E+00	2.1546E+02
3	1.72E-03	9.34E-03	7.89E-03	2.19E-02	1.46E-02	2.0467E+00	2.1709E+02
4	2.71E-04	4.76E-03	3.36E-03	1.40E-02	8.79E-03	1.0426E+00	2.1809E+02
5	8.26E-11	7.86E-04	5.30E-05	4.21E-03	1.28E-03	1.7233E-01	2.1896E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9501870	0.9691420	0.9702850	0.9841920	0.9543950	2.6361E+02	8.3933E+00
2	5.20E-03	1.50E-02	1.38E-02	2.87E-02	2.01E-02	4.0678E+00	2.6794E+02
3	1.40E-03	7.56E-03	6.39E-03	1.77E-02	1.05E-02	2.0567E+00	2.6995E+02
4	6.54E-04	5.53E-03	4.37E-03	1.44E-02	9.91E-03	1.5040E+00	2.7050E+02
5	2.91E-05	2.35E-03	1.30E-03	8.26E-03	4.48E-03	6.4022E-01	2.7136E+02
6	8.27E-14	4.58E-04	8.77E-06	2.60E-03	5.62E-04	1.2462E-01	2.7188E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9554460	0.9709470	0.9717800	0.9836110	0.9549010	3.6531E+02	1.0931E+01
2	5.54E-03	1.37E-02	1.29E-02	2.48E-02	2.03E-02	5.1609E+00	3.7108E+02
3	1.23E-03	6.00E-03	5.15E-03	1.37E-02	7.18E-03	2.2561E+00	3.7398E+02
4	7.86E-04	4.90E-03	4.06E-03	1.19E-02	8.67E-03	1.8444E+00	3.7440E+02
5	2.36E-04	3.14E-03	2.31E-03	8.85E-03	6.35E-03	1.1802E+00	3.7506E+02
6	1.93E-06	1.15E-03	4.52E-04	4.64E-03	2.31E-03	4.3103E-01	3.7581E+02
7	7.74E-26	1.55E-04	1.08E-08	8.64E-04	2.56E-04	5.8327E-02	3.7618E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9571270	0.9713600	0.9720760	0.9831470	0.9549170	4.2362E+02	1.2490E+01
2	5.81E-03	1.34E-02	1.27E-02	2.36E-02	2.16E-02	5.8603E+00	4.3025E+02
3	9.85E-04	4.99E-03	4.26E-03	1.15E-02	4.83E-03	2.1765E+00	4.3393E+02
4	6.71E-04	4.21E-03	3.48E-03	1.02E-02	6.79E-03	1.8363E+00	4.3427E+02
5	3.87E-04	3.38E-03	2.66E-03	8.85E-03	6.62E-03	1.4749E+00	4.3464E+02
6	5.59E-05	1.88E-03	1.20E-03	6.04E-03	3.93E-03	8.2054E-01	4.3529E+02
7	2.15E-08	6.14E-04	1.23E-04	2.91E-03	1.20E-03	2.6759E-01	4.3584E+02
8	9.85E-28	1.24E-04	3.50E-09	6.74E-04	1.19E-04	5.3905E-02	4.3606E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9686000	0.9509110	0.9521770	0.9534390	0.9543950	0.9549010	0.9549170
2	3.14E-02	4.15E-02	2.72E-02	2.18E-02	2.01E-02	2.03E-02	2.16E-02
3		7.63E-03	1.76E-02	1.46E-02	1.05E-02	7.18E-03	4.83E-03
4			3.02E-03	8.79E-03	9.91E-03	8.67E-03	6.79E-03
5				1.28E-03	4.48E-03	6.35E-03	6.62E-03
6					5.62E-04	2.31E-03	3.93E-03
7						2.56E-04	1.20E-03
8							1.19E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.69E-01	9.51E-01	9.52E-01	9.53E-01	9.54E-01	9.55E-01	9.55E-01
Beta	3.14E-02	4.91E-02	4.78E-02	4.66E-02	4.56E-02	4.51E-02	4.51E-02
Gamma		1.55E-01	4.30E-01	5.31E-01	5.58E-01	5.49E-01	5.21E-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	4.42E-01
Upsilon						9.98E-02	2.51E-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	27.05	40.57	54.10	67.62	81.14	94.67	108.19
N 1	3.3929	3.1818	3.4029	3.5212	3.5389	3.4432	3.2197
N 2	0.9869	1.9075	1.6449	1.6302	1.7874	2.0888	2.5189
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

2.4.3.2 AOV FAIL TO CLOSE SPAR: AFW-AOV-OO

System :	AUXILIARY FEEDWATER SYSTEM
Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 45
Total Number of Common-Cause Failure Events: 4

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9312750	0.9783680	0.9860210	0.9993370	0.9820120	3.7169E+01	8.2182E-01
2	6.60E-04	2.16E-02	1.40E-02	6.87E-02	1.80E-02	8.2182E-01	3.7169E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9337950	0.9708250	0.9748640	0.9940370	0.9635190	7.3654E+01	2.2135E+00
2	4.47E-03	2.56E-02	2.16E-02	6.06E-02	3.64E-02	1.9435E+00	7.3924E+01
3	1.38E-07	3.56E-03	7.28E-04	1.68E-02	7.43E-05	2.6996E-01	7.5598E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9308700	0.9637930	0.9665320	0.9873400	0.9444990	1.0750E+02	4.0384E+00
2	9.29E-03	3.03E-02	2.76E-02	6.08E-02	5.53E-02	3.3839E+00	1.0815E+02
3	7.28E-06	3.92E-03	1.58E-03	1.58E-02	2.29E-04	4.3760E-01	1.1110E+02
4	5.99E-09	1.95E-03	2.49E-04	9.81E-03	0.00E+00	2.1695E-01	1.1132E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9479600	0.9703980	0.9720110	0.9873090	0.9532770	1.8675E+02	5.6969E+00
2	5.94E-03	1.87E-02	1.70E-02	3.70E-02	3.23E-02	3.5899E+00	1.8886E+02
3	1.16E-03	8.54E-03	6.91E-03	2.15E-02	1.44E-02	1.6430E+00	1.9080E+02
4	1.66E-06	2.01E-03	7.03E-04	8.44E-03	0.00E+00	3.8684E-01	1.9206E+02
5	4.21E-20	4.01E-04	3.89E-07	2.33E-03	0.00E+00	7.7129E-02	1.9237E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9528360	0.9721930	0.9734950	0.9871070	0.9590540	2.3364E+02	6.6828E+00
2	4.45E-03	1.44E-02	1.31E-02	2.89E-02	2.07E-02	3.4595E+00	2.3686E+02
3	1.59E-03	8.57E-03	7.25E-03	2.01E-02	1.64E-02	2.0589E+00	2.3826E+02
4	1.15E-04	3.52E-03	2.28E-03	1.12E-02	3.90E-03	8.4691E-01	2.3948E+02
5	1.22E-08	1.01E-03	1.66E-04	4.93E-03	0.00E+00	2.4272E-01	2.4008E+02
6	9.63E-21	3.11E-04	2.33E-07	1.80E-03	0.00E+00	7.4722E-02	2.4025E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9587690	0.9742820	0.9752090	0.9866320	0.9631410	3.3091E+02	8.7351E+00
2	4.08E-03	1.18E-02	1.09E-02	2.28E-02	1.44E-02	4.0229E+00	3.3562E+02
3	1.68E-03	7.32E-03	6.38E-03	1.62E-02	1.46E-02	2.4868E+00	3.3716E+02
4	4.29E-04	4.11E-03	3.19E-03	1.10E-02	6.72E-03	1.3976E+00	3.3825E+02
5	1.70E-05	1.77E-03	9.37E-04	6.37E-03	1.12E-03	6.0205E-01	3.3904E+02
6	3.69E-10	5.70E-04	5.44E-05	2.96E-03	0.00E+00	1.9373E-01	3.3945E+02
7	4.06E-44	9.43E-05	6.78E-13	3.87E-04	0.00E+00	3.2027E-02	3.3961E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9611730	0.9752420	0.9760430	0.9865840	0.9662220	3.8490E+02	9.7713E+00
2	3.70E-03	1.05E-02	9.70E-03	2.01E-02	1.07E-02	4.1500E+00	3.9052E+02
3	1.49E-03	6.41E-03	5.60E-03	1.41E-02	1.22E-02	2.5306E+00	3.9214E+02
4	5.60E-04	4.15E-03	3.34E-03	1.05E-02	7.88E-03	1.6365E+00	3.9303E+02
5	8.89E-05	2.28E-03	1.52E-03	7.09E-03	2.63E-03	9.0030E-01	3.9377E+02
6	8.04E-07	9.79E-04	3.42E-04	4.12E-03	3.28E-04	3.8654E-01	3.9428E+02
7	9.63E-14	3.23E-04	6.83E-06	1.83E-03	0.00E+00	1.2739E-01	3.9454E+02
8	4.43E-36	1.01E-04	4.39E-11	4.87E-04	0.00E+00	4.0005E-02	3.9463E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9820120	0.9635190	0.9444990	0.9532770	0.9590540	0.9631410	0.9662220
2	1.80E-02	3.64E-02	5.53E-02	3.23E-02	2.07E-02	1.44E-02	1.07E-02
3		7.43E-05	2.29E-04	1.44E-02	1.64E-02	1.46E-02	1.22E-02
4			0.00E+00	0.00E+00	3.90E-03	6.72E-03	7.88E-03
5				0.00E+00	0.00E+00	1.12E-03	2.63E-03
6					0.00E+00	0.00E+00	3.28E-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	9.44E-01	9.53E-01	9.59E-01	9.63E-01	9.66E-01
Beta	1.80E-02	3.65E-02	5.55E-02	4.67E-02	4.09E-02	3.69E-02	3.38E-02
Gamma		2.04E-03	4.13E-03	3.08E-01	4.95E-01	6.10E-01	6.82E-01
Delta			0.00E+00	0.00E+00	1.92E-01	3.49E-01	4.70E-01
Epsilon				0.00E+00	0.00E+00	1.43E-01	2.73E-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	18.00	27.00	36.00	45.00	54.00	63.00	72.00
N 1	1.7514	1.5485	0.6354	0.6863	0.7077	0.7064	0.6893
N 2	0.3618	1.0787	2.1439	1.5499	1.1791	0.9508	0.8086
N 3		0.0022	0.0089	0.6893	0.9344	0.9686	0.9176
N 4			0.0000	0.0000	0.2222	0.4445	0.5927
N 5				0.0000	0.0000	0.0741	0.1975
N 6					0.0000	0.0000	0.0247
N 7						0.0000	0.0000
N 8							0.0000

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

2.4.4.1 COMBINED HPCI AND RCIC AIR OPERATED VALVE FAIL TO OPEN

System :	HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING
Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 7
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9274070	0.9815090	0.9920120	0.9999490	1.0000000	2.4418E+01	4.6002E-01
2	4.73E-05	1.85E-02	7.99E-03	7.26E-02	0.00E+00	4.6002E-01	2.4418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9396500	0.9787270	0.9843700	0.9985140	1.0000000	5.2105E+01	1.1325E+00
2	5.73E-04	1.62E-02	1.07E-02	5.08E-02	0.00E+00	8.6476E-01	5.2373E+01
3	1.80E-07	5.03E-03	1.02E-03	2.38E-02	0.00E+00	2.6776E-01	5.2970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9434620	0.9763570	0.9802180	0.9960460	1.0000000	7.7868E+01	1.8857E+00
2	1.31E-03	1.55E-02	1.17E-02	4.29E-02	0.00E+00	1.2400E+00	7.8514E+01
3	8.81E-06	5.38E-03	2.12E-03	2.18E-02	0.00E+00	4.2870E-01	7.9325E+01
4	8.40E-09	2.72E-03	3.49E-04	1.37E-02	0.00E+00	2.1695E-01	7.9537E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9543690	0.9771800	0.9792500	0.9929240	1.0000000	1.4806E+02	3.4577E+00
2	2.47E-03	1.35E-02	1.14E-02	3.15E-02	0.00E+00	2.0400E+00	1.4948E+02
3	2.88E-04	6.29E-03	4.30E-03	1.91E-02	0.00E+00	9.5369E-01	1.5056E+02
4	2.11E-06	2.55E-03	8.94E-04	1.07E-02	0.00E+00	3.8684E-01	1.5113E+02
5	5.35E-20	5.09E-04	4.94E-07	2.96E-03	0.00E+00	7.7129E-02	1.5144E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9569980	0.9771540	0.9788040	0.9916650	1.0000000	1.8593E+02	4.3471E+00
2	2.51E-03	1.20E-02	1.03E-02	2.71E-02	0.00E+00	2.2804E+00	1.8800E+02
3	4.01E-04	5.91E-03	4.29E-03	1.69E-02	0.00E+00	1.1245E+00	1.8915E+02
4	3.68E-05	3.28E-03	1.78E-03	1.16E-02	0.00E+00	6.2471E-01	1.8965E+02
5	1.55E-08	1.28E-03	2.10E-04	6.23E-03	0.00E+00	2.4272E-01	1.9003E+02
6	1.22E-20	3.93E-04	2.94E-07	2.28E-03	0.00E+00	7.4722E-02	1.9020E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00
Delta			0.00E+00	0.00E+00	0.00E+00
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	7.00	7.00	7.00	7.00	7.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000
N 3		0.0000	0.0000	0.0000	0.0000
N 4			0.0000	0.0000	0.0000
N 5				0.0000	0.0000
N 6					0.0000

2.4.4.2 COMBINED HPCI AND RCIC AIR OPERATED VALVE FAIL TO CLOSE

System :	HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING
Component :	AIR OPERATED VALVE, WATER
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 2
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9093360	0.9768580	0.9899370	0.9999370	1.0000000	1.9418E+01	4.6002E-01
2	5.96E-05	2.31E-02	1.01E-02	9.07E-02	0.00E+00	4.6002E-01	1.9418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9334650	0.9765220	0.9827270	0.9983550	1.0000000	4.7105E+01	1.1325E+00
2	6.34E-04	1.79E-02	1.18E-02	5.60E-02	0.00E+00	8.6476E-01	4.7373E+01
3	1.99E-07	5.55E-03	1.12E-03	2.63E-02	0.00E+00	2.6776E-01	4.7970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9397250	0.9747750	0.9788830	0.9957720	1.0000000	7.2868E+01	1.8857E+00
2	1.40E-03	1.66E-02	1.25E-02	4.57E-02	0.00E+00	1.2400E+00	7.3514E+01
3	9.41E-06	5.73E-03	2.27E-03	2.32E-02	0.00E+00	4.2870E-01	7.4325E+01
4	8.97E-09	2.90E-03	3.73E-04	1.46E-02	0.00E+00	2.1695E-01	7.4537E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9528260	0.9764010	0.9785390	0.9926790	1.0000000	1.4306E+02	3.4577E+00
2	2.56E-03	1.39E-02	1.18E-02	3.26E-02	0.00E+00	2.0400E+00	1.4448E+02
3	2.98E-04	6.51E-03	4.45E-03	1.98E-02	0.00E+00	9.5369E-01	1.4556E+02
4	2.19E-06	2.64E-03	9.24E-04	1.11E-02	0.00E+00	3.8684E-01	1.4613E+02
5	5.54E-20	5.26E-04	5.11E-07	3.06E-03	0.00E+00	7.7129E-02	1.4644E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9558470	0.9765380	0.9782350	0.9914380	1.0000000	1.8093E+02	4.3471E+00
2	2.57E-03	1.23E-02	1.06E-02	2.79E-02	0.00E+00	2.2804E+00	1.8300E+02
3	4.12E-04	6.07E-03	4.41E-03	1.74E-02	0.00E+00	1.1245E+00	1.8415E+02
4	3.78E-05	3.37E-03	1.83E-03	1.19E-02	0.00E+00	6.2471E-01	1.8465E+02
5	1.59E-08	1.31E-03	2.16E-04	6.40E-03	0.00E+00	2.4272E-01	1.8503E+02
6	1.25E-20	4.03E-04	3.02E-07	2.34E-03	0.00E+00	7.4722E-02	1.8520E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00
Delta			0.00E+00	0.00E+00	0.00E+00
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	2.00	2.00	2.00	2.00	2.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000
N 3		0.0000	0.0000	0.0000	0.0000
N 4			0.0000	0.0000	0.0000
N 5				0.0000	0.0000
N 6					0.0000

2.5 Check Valves

2.5.1 Pooled Check Valves

2.5.1.1 CHECK VALVE FAIL TO OPEN ALL SYSTEMS SPAR CKV-CC

Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 49
Total Number of Common-Cause Failure Events: 2

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9556580	0.9862130	0.9912430	0.9996090	0.9915000	5.7465E+01	8.0332E-01
2	3.88E-04	1.38E-02	8.76E-03	4.43E-02	8.50E-03	8.0332E-01	5.7465E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9533580	0.9796770	0.9826060	0.9959850	0.9828870	1.0415E+02	2.1606E+00
2	2.98E-03	1.78E-02	1.49E-02	4.26E-02	1.71E-02	1.8918E+00	1.0442E+02
3	9.33E-08	2.53E-03	5.11E-04	1.20E-02	1.66E-05	2.6876E-01	1.0604E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9596320	0.9807340	0.9827940	0.9947940	0.9868040	1.4956E+02	2.9379E+00
2	1.81E-03	1.17E-02	9.67E-03	2.87E-02	6.88E-03	1.7886E+00	1.5071E+02
3	2.63E-04	6.11E-03	4.13E-03	1.87E-02	6.32E-03	9.3230E-01	1.5157E+02
4	4.41E-09	1.42E-03	1.82E-04	7.18E-03	1.25E-06	2.1705E-01	1.5228E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9653110	0.9813910	0.9826890	0.9930340	0.9891210	2.3939E+02	4.5392E+00
2	2.10E-03	9.69E-03	8.38E-03	2.17E-02	3.25E-03	2.3629E+00	2.4157E+02
3	6.76E-04	5.99E-03	4.71E-03	1.57E-02	5.11E-03	1.4618E+00	2.4247E+02
4	3.18E-05	2.61E-03	1.44E-03	9.19E-03	2.52E-03	6.3734E-01	2.4329E+02
5	3.32E-20	3.16E-04	3.07E-07	1.84E-03	0.00E+00	7.7129E-02	2.4385E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9678120	0.9819370	0.9829870	0.9924610	0.9906420	2.9688E+02	5.4613E+00
2	1.91E-03	8.28E-03	7.22E-03	1.83E-02	1.88E-03	2.5038E+00	2.9984E+02
3	5.99E-04	5.01E-03	3.97E-03	1.30E-02	3.27E-03	1.5141E+00	3.0083E+02
4	1.71E-04	3.31E-03	2.30E-03	9.90E-03	3.16E-03	1.0009E+00	3.0134E+02
5	7.00E-07	1.22E-03	3.99E-04	5.20E-03	1.05E-03	3.6782E-01	3.0197E+02
6	7.65E-21	2.47E-04	1.85E-07	1.43E-03	0.00E+00	7.4722E-02	3.0227E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9699990	0.9819340	0.9827060	0.9912280	0.9917110	4.0477E+02	7.4469E+00
2	2.32E-03	7.91E-03	7.12E-03	1.62E-02	1.34E-03	3.2586E+00	4.0896E+02
3	6.69E-04	4.35E-03	3.57E-03	1.07E-02	1.97E-03	1.7912E+00	4.1043E+02
4	3.08E-04	3.23E-03	2.47E-03	8.74E-03	2.72E-03	1.3307E+00	4.1089E+02
5	4.74E-05	1.89E-03	1.17E-03	6.18E-03	1.80E-03	7.7815E-01	4.1144E+02
6	1.38E-08	6.22E-04	1.14E-04	2.99E-03	4.51E-04	2.5623E-01	4.1196E+02
7	3.36E-44	7.77E-05	5.58E-13	3.19E-04	0.00E+00	3.2027E-02	4.1218E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9714850	0.9823840	0.9830500	0.9910030	0.9925050	4.6939E+02	8.4172E+00
2	2.30E-03	7.37E-03	6.69E-03	1.47E-02	1.14E-03	3.5215E+00	4.7429E+02
3	5.86E-04	3.77E-03	3.11E-03	9.23E-03	1.20E-03	1.8023E+00	4.7600E+02
4	2.83E-04	2.85E-03	2.19E-03	7.66E-03	2.00E-03	1.3609E+00	4.7645E+02
5	1.14E-04	2.13E-03	1.48E-03	6.33E-03	1.98E-03	1.0157E+00	4.7679E+02
6	5.14E-06	1.08E-03	5.10E-04	4.11E-03	9.87E-04	5.1814E-01	4.7729E+02
7	8.41E-12	3.32E-04	1.70E-05	1.81E-03	1.98E-04	1.5869E-01	4.7765E+02
8	3.65E-36	8.37E-05	3.63E-11	4.02E-04	0.00E+00	4.0005E-02	4.7777E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9915000	0.9828870	0.9868040	0.9891210	0.9906420	0.9917110	0.9925050
2	8.50E-03	1.71E-02	6.88E-03	3.25E-03	1.88E-03	1.34E-03	1.14E-03
3		1.66E-05	6.32E-03	5.11E-03	3.27E-03	1.97E-03	1.20E-03
4			1.25E-06	2.52E-03	3.16E-03	2.72E-03	2.00E-03
5				0.00E+00	1.05E-03	1.80E-03	1.98E-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	9.89E-01	9.91E-01	9.92E-01	9.93E-01
Beta	8.50E-03	1.71E-02	1.32E-02	1.09E-02	9.36E-03	8.29E-03	7.50E-03
Gamma		9.73E-04	4.79E-01	7.01E-01	8.00E-01	8.38E-01	8.48E-01
Delta			1.99E-04	3.30E-01	5.63E-01	7.17E-01	8.12E-01
Epsilon				0.00E+00	2.50E-01	4.53E-01	6.12E-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	39.20	58.80	78.40	98.00	117.60	137.20	156.80
N 1	0.8467	0.2430	0.2916	0.3281	0.3543	0.3720	0.3826
N 2	0.3433	1.0270	0.5486	0.3229	0.2234	0.1865	0.1801
N 3		0.0010	0.5036	0.5081	0.3896	0.2730	0.1893
N 4			0.0001	0.2505	0.3762	0.3776	0.3171
N 5				0.0000	0.1251	0.2502	0.3129
N 6					0.0000	0.0625	0.1563
N 7						0.0000	0.0313
N 8							0.0000

2.5.1.2 CKV FAIL TO REMAIN CLOSED (LEAKAGE) ALL SYSTEMS SPAR:CKV-CO

Component :	CHECK VALVE
Failure Mode :	SPURIOUS ACTUATION FAIL TO REMAIN CLOSED (DETECTABLE LEAKAGE)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 170
Total Number of Common-Cause Failure Events: 31

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9378780	0.9707690	0.9740340	0.9924980	0.9699510	9.1640E+01	2.7594E+00
2	7.50E-03	2.92E-02	2.60E-02	6.21E-02	3.00E-02	2.7594E+00	9.1640E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9400860	0.9663880	0.9683300	0.9860650	0.9626480	1.5357E+02	5.3414E+00
2	9.55E-03	2.66E-02	2.46E-02	5.04E-02	2.99E-02	4.2289E+00	1.5468E+02
3	4.65E-04	7.00E-03	5.07E-03	2.01E-02	7.50E-03	1.1125E+00	1.5780E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9392580	0.9623800	0.9637670	0.9807650	0.9566320	2.1254E+02	8.3083E+00
2	1.17E-02	2.68E-02	2.54E-02	4.67E-02	3.16E-02	5.9174E+00	2.1493E+02
3	1.26E-03	8.13E-03	6.70E-03	1.99E-02	9.23E-03	1.7960E+00	2.1905E+02
4	2.45E-05	2.69E-03	1.41E-03	9.71E-03	2.55E-03	5.9485E-01	2.2025E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9469920	0.9651040	0.9660440	0.9799910	0.9564470	3.1621E+02	1.1433E+01
2	1.00E-02	2.13E-02	2.03E-02	3.58E-02	2.69E-02	6.9649E+00	3.2068E+02
3	2.56E-03	9.26E-03	8.28E-03	1.93E-02	1.14E-02	3.0327E+00	3.2461E+02
4	2.64E-04	3.57E-03	2.63E-03	1.01E-02	4.28E-03	1.1710E+00	3.2647E+02
5	2.55E-08	8.08E-04	1.58E-04	3.85E-03	1.02E-03	2.6483E-01	3.2738E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9492840	0.9654670	0.9662360	0.9790180	0.9563680	3.8728E+02	1.3852E+01
2	9.22E-03	1.89E-02	1.81E-02	3.12E-02	2.43E-02	7.5677E+00	3.9356E+02
3	2.83E-03	8.94E-03	8.14E-03	1.78E-02	1.13E-02	3.5871E+00	3.9755E+02
4	7.14E-04	4.54E-03	3.74E-03	1.11E-02	5.49E-03	1.8200E+00	3.9931E+02
5	3.22E-05	1.77E-03	1.04E-03	5.98E-03	2.14E-03	7.0902E-01	4.0042E+02
6	3.03E-11	4.20E-04	2.63E-05	2.26E-03	4.31E-04	1.6852E-01	4.0096E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9538380	0.9674780	0.9680670	0.9791000	0.9571840	5.0875E+02	1.7102E+01
2	8.33E-03	1.62E-02	1.56E-02	2.62E-02	2.16E-02	8.5353E+00	5.1732E+02
3	2.89E-03	8.08E-03	7.47E-03	1.54E-02	1.08E-02	4.2489E+00	5.2160E+02
4	1.07E-03	4.71E-03	4.10E-03	1.04E-02	6.03E-03	2.4759E+00	5.2338E+02
5	2.22E-04	2.46E-03	1.87E-03	6.73E-03	3.04E-03	1.2941E+00	5.2456E+02
6	2.47E-06	8.92E-04	3.83E-04	3.50E-03	1.09E-03	4.6883E-01	5.2538E+02
7	3.73E-20	1.50E-04	1.75E-07	8.73E-04	1.86E-04	7.8927E-02	5.2577E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9556630	0.9681930	0.9687050	0.9789640	0.9579720	5.8685E+02	1.9279E+01
2	7.81E-03	1.49E-02	1.44E-02	2.38E-02	1.98E-02	9.0238E+00	5.9711E+02
3	2.77E-03	7.46E-03	6.92E-03	1.40E-02	1.01E-02	4.5198E+00	6.0161E+02
4	1.18E-03	4.61E-03	4.08E-03	9.86E-03	6.11E-03	2.7943E+00	6.0334E+02
5	4.17E-04	2.85E-03	2.33E-03	7.08E-03	3.58E-03	1.7288E+00	6.0440E+02
6	4.90E-05	1.42E-03	9.26E-04	4.49E-03	1.75E-03	8.6244E-01	6.0527E+02
7	3.32E-08	4.73E-04	1.07E-04	2.20E-03	5.56E-04	2.8679E-01	6.0584E+02
8	2.95E-24	1.05E-04	1.74E-08	5.93E-04	8.16E-05	6.3405E-02	6.0607E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9699510	0.9626480	0.9566320	0.9564470	0.9563680	0.9571840	0.9579720
2	3.00E-02	2.99E-02	3.16E-02	2.69E-02	2.43E-02	2.16E-02	1.98E-02
3		7.50E-03	9.23E-03	1.14E-02	1.13E-02	1.08E-02	1.01E-02
4			2.55E-03	4.28E-03	5.49E-03	6.03E-03	6.11E-03
5				1.02E-03	2.14E-03	3.04E-03	3.58E-03
6					4.31E-04	1.09E-03	1.75E-03
7						1.86E-04	5.56E-04
8							8.16E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.70E-01	9.63E-01	9.57E-01	9.56E-01	9.56E-01	9.57E-01	9.58E-01
Beta	3.00E-02	3.74E-02	4.34E-02	4.36E-02	4.36E-02	4.28E-02	4.20E-02
Gamma		2.01E-01	2.72E-01	3.83E-01	4.44E-01	4.94E-01	5.28E-01
Delta			2.17E-01	3.19E-01	4.16E-01	4.89E-01	5.43E-01
Epsilon				1.93E-01	3.19E-01	4.17E-01	4.94E-01
Mu					1.67E-01	2.96E-01	4.00E-01
Upsilon						1.46E-01	2.67E-01
Sigma							1.28E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	64.64	96.96	129.28	161.60	193.92	226.24	258.56
N 1	9.5823	11.5094	12.3942	13.5512	14.4260	15.3140	16.0799
N 2	2.2994	3.3641	4.6774	4.9249	5.2873	5.4632	5.6824
N 3		0.8447	1.3673	2.0790	2.4626	2.7307	2.9068
N 4			0.3779	0.7842	1.1953	1.5228	1.7505
N 5				0.1877	0.4663	0.7662	1.0260
N 6					0.0938	0.2751	0.5006
N 7						0.0469	0.1594
N 8							0.0234

2.5.1.3 CHECK VALVE FAIL TO CLOSE ALL SYSTEMS SPAR:CKV-OO

Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 149
Total Number of Common-Cause Failure Events: 18

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9148760	0.9573240	0.9611120	0.9868200	0.9524090	7.6129E+01	3.3937E+00
2	1.32E-02	4.27E-02	3.89E-02	8.51E-02	4.76E-02	3.3937E+00	7.6129E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9329020	0.9627420	0.9649770	0.9849370	0.9562220	1.3163E+02	5.0941E+00
2	7.65E-03	2.49E-02	2.26E-02	5.00E-02	2.81E-02	3.4065E+00	1.3332E+02
3	1.76E-03	1.23E-02	1.01E-02	3.07E-02	1.57E-02	1.6876E+00	1.3504E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9382700	0.9630400	0.9646430	0.9823420	0.9562860	1.8459E+02	7.0844E+00
2	7.45E-03	2.13E-02	1.97E-02	4.08E-02	2.39E-02	4.0823E+00	1.8759E+02
3	1.98E-03	1.07E-02	9.07E-03	2.51E-02	1.37E-02	2.0548E+00	1.8962E+02
4	2.22E-04	4.94E-03	3.36E-03	1.51E-02	6.14E-03	9.4725E-01	1.9073E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9468570	0.9659300	0.9669920	0.9813840	0.9559590	2.8162E+02	9.9333E+00
2	7.81E-03	1.87E-02	1.76E-02	3.33E-02	2.32E-02	5.4570E+00	2.8610E+02
3	1.91E-03	8.45E-03	7.35E-03	1.87E-02	1.03E-02	2.4627E+00	2.8909E+02
4	6.46E-04	5.27E-03	4.19E-03	1.36E-02	7.83E-03	1.5374E+00	2.9002E+02
5	4.95E-06	1.63E-03	7.12E-04	6.38E-03	2.71E-03	4.7623E-01	2.9108E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9488390	0.9659250	0.9667920	0.9800640	0.9550690	3.4594E+02	1.2204E+01
2	8.30E-03	1.82E-02	1.73E-02	3.11E-02	2.42E-02	6.5123E+00	3.5163E+02
3	1.64E-03	7.04E-03	6.15E-03	1.55E-02	8.00E-03	2.5228E+00	3.5562E+02
4	8.07E-04	5.10E-03	4.21E-03	1.24E-02	6.87E-03	1.8261E+00	3.5632E+02
5	1.67E-04	2.92E-03	2.06E-03	8.59E-03	4.58E-03	1.0441E+00	3.5710E+02
6	8.57E-08	8.34E-04	2.02E-04	3.82E-03	1.28E-03	2.9862E-01	3.5785E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9533560	0.9676980	0.9683490	0.9798050	0.9551670	4.6062E+02	1.5376E+01
2	8.32E-03	1.67E-02	1.60E-02	2.73E-02	2.41E-02	7.9439E+00	4.6805E+02
3	1.67E-03	6.21E-03	5.53E-03	1.30E-02	7.09E-03	2.9536E+00	4.7304E+02
4	7.98E-04	4.32E-03	3.65E-03	1.01E-02	5.46E-03	2.0580E+00	4.7394E+02
5	3.85E-04	3.20E-03	2.53E-03	8.28E-03	4.91E-03	1.5218E+00	4.7447E+02
6	3.26E-05	1.55E-03	9.32E-04	5.17E-03	2.69E-03	7.3813E-01	4.7526E+02
7	1.04E-11	3.37E-04	1.79E-05	1.83E-03	6.34E-04	1.6043E-01	4.7584E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9546920	0.9679350	0.9684990	0.9792440	0.9548330	5.3177E+02	1.7616E+01
2	8.60E-03	1.64E-02	1.58E-02	2.62E-02	2.46E-02	9.0055E+00	5.4038E+02
3	1.61E-03	5.69E-03	5.10E-03	1.18E-02	6.57E-03	3.1236E+00	5.4626E+02
4	6.75E-04	3.71E-03	3.12E-03	8.73E-03	4.31E-03	2.0360E+00	5.4735E+02
5	4.42E-04	3.09E-03	2.52E-03	7.72E-03	4.34E-03	1.7000E+00	5.4769E+02
6	1.47E-04	2.08E-03	1.52E-03	5.95E-03	3.41E-03	1.1451E+00	5.4824E+02
7	3.19E-06	8.94E-04	4.00E-04	3.45E-03	1.58E-03	4.9089E-01	5.4890E+02
8	5.69E-15	2.10E-04	2.73E-06	1.20E-03	3.27E-04	1.1520E-01	5.4927E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1	0.9524090	0.9562220	0.9562860	0.9559590	0.9550690	0.9551670	0.9548330
2	4.76E-02	2.81E-02	2.39E-02	2.32E-02	2.42E-02	2.41E-02	2.46E-02
3		1.57E-02	1.37E-02	1.03E-02	8.00E-03	7.09E-03	6.57E-03
4			6.14E-03	7.83E-03	6.87E-03	5.46E-03	4.31E-03
5				2.71E-03	4.58E-03	4.91E-03	4.34E-03
6					1.28E-03	2.69E-03	3.41E-03
7						6.34E-04	1.58E-03
8							3.27E-04

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1-Beta	9.52E-01	9.56E-01	9.56E-01	9.56E-01	9.55E-01	9.55E-01	9.55E-01
Beta	4.76E-02	4.38E-02	4.37E-02	4.40E-02	4.49E-02	4.48E-02	4.52E-02
Gamma		3.58E-01	4.53E-01	4.72E-01	4.61E-01	4.63E-01	4.55E-01
Delta			3.10E-01	5.07E-01	6.14E-01	6.59E-01	6.80E-01
Epsilon				2.58E-01	4.60E-01	6.01E-01	6.91E-01
Mu					2.18E-01	4.04E-01	5.51E-01
Upsilon						1.91E-01	3.59E-01
Sigma							1.71E-01

Avg. Impact Vector	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
Adj. Ind. Events	51.11	76.67	102.23	127.79	153.34	178.90	204.46
N 1	7.6005	9.8591	11.4958	12.7734	13.6707	14.5238	15.1044
N 2	2.9337	2.5417	2.8423	3.4170	4.2319	4.8718	5.6641
N 3		1.4198	1.6261	1.5090	1.3983	1.4354	1.5106
N 4			0.7303	1.1506	1.2014	1.1049	0.9922
N 5				0.3991	0.8014	0.9939	0.9972
N 6					0.2239	0.5444	0.7833
N 7						0.1284	0.3635
N 8							0.0752

2.5.2 BWR Residual Heat Removal Check Valves

2.5.2.1 BWR RHR CHECK VALVE FAIL TO OPEN

System :	RESIDUAL HEAT REMOVAL
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 8
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8951910	0.9672290	0.9789920	0.9990900	0.9473460	2.3415E+01	7.9332E-01
2	9.07E-04	3.28E-02	2.10E-02	1.05E-01	5.27E-02	7.9332E-01	2.3415E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9117590	0.9613930	0.9668320	0.9923960	0.8888890	5.3105E+01	2.1326E+00
2	5.61E-03	3.38E-02	2.83E-02	8.06E-02	1.11E-01	1.8648E+00	5.3373E+01
3	1.73E-07	4.85E-03	9.79E-04	2.30E-02	0.00E+00	2.6776E-01	5.4970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9284360	0.9658190	0.9694350	0.9908300	0.9143100	8.1538E+01	2.8856E+00
2	3.08E-03	2.06E-02	1.70E-02	5.06E-02	4.28E-02	1.7400E+00	8.2684E+01
3	4.71E-04	1.10E-02	7.45E-03	3.36E-02	4.28E-02	9.2870E-01	8.3495E+01
4	7.93E-09	2.57E-03	3.30E-04	1.30E-02	0.00E+00	2.1695E-01	8.4207E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9476080	0.9719370	0.9738990	0.9895670	0.9302160	1.5439E+02	4.4577E+00
2	3.03E-03	1.44E-02	1.24E-02	3.26E-02	1.74E-02	2.2900E+00	1.5656E+02
3	1.03E-03	9.15E-03	7.19E-03	2.40E-02	3.49E-02	1.4537E+00	1.5739E+02
4	4.87E-05	4.01E-03	2.21E-03	1.41E-02	1.74E-02	6.3684E-01	1.5821E+02
5	5.11E-20	4.86E-04	4.71E-07	2.82E-03	0.00E+00	7.7129E-02	1.5877E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9523180	0.9733020	0.9748650	0.9889560	0.9411760	1.9493E+02	5.3471E+00
2	2.66E-03	1.20E-02	1.04E-02	2.68E-02	7.35E-03	2.4054E+00	1.9787E+02
3	8.83E-04	7.49E-03	5.92E-03	1.94E-02	2.21E-02	1.4995E+00	1.9878E+02
4	2.57E-04	4.99E-03	3.47E-03	1.49E-02	2.21E-02	9.9971E-01	1.9928E+02
5	1.06E-06	1.84E-03	6.03E-04	7.85E-03	7.35E-03	3.6772E-01	1.9991E+02
6	1.16E-20	3.73E-04	2.79E-07	2.16E-03	0.00E+00	7.4722E-02	2.0020E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9585540	0.9751090	0.9761850	0.9880000	0.9491610	2.8587E+02	7.2971E+00
2	3.04E-03	1.07E-02	9.60E-03	2.21E-02	3.18E-03	3.1346E+00	2.9003E+02
3	9.13E-04	6.03E-03	4.95E-03	1.48E-02	1.27E-02	1.7682E+00	2.9140E+02
4	4.31E-04	4.53E-03	3.47E-03	1.23E-02	1.91E-02	1.3281E+00	2.9184E+02
5	6.66E-05	2.65E-03	1.64E-03	8.68E-03	1.27E-02	7.7795E-01	2.9239E+02
6	1.94E-08	8.74E-04	1.61E-04	4.20E-03	3.18E-03	2.5623E-01	2.9291E+02
7	4.62E-44	1.09E-04	7.85E-13	4.49E-04	0.00E+00	3.2027E-02	2.9314E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9608990	0.9759180	0.9768440	0.9877860	0.9552090	3.3354E+02	8.2304E+00
2	2.98E-03	9.87E-03	8.93E-03	2.00E-02	1.40E-03	3.3727E+00	3.3840E+02
3	7.84E-04	5.18E-03	4.25E-03	1.27E-02	7.00E-03	1.7693E+00	3.4000E+02
4	3.92E-04	3.97E-03	3.05E-03	1.07E-02	1.40E-02	1.3563E+00	3.4041E+02
5	1.59E-04	2.97E-03	2.08E-03	8.84E-03	1.40E-02	1.0153E+00	3.4076E+02
6	7.18E-06	1.52E-03	7.13E-04	5.75E-03	7.00E-03	5.1814E-01	3.4125E+02
7	1.18E-11	4.64E-04	2.37E-05	2.53E-03	1.40E-03	1.5869E-01	3.4161E+02
8	5.11E-36	1.17E-04	5.08E-11	5.62E-04	0.00E+00	4.0005E-02	3.4173E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9473460	0.8888890	0.9143100	0.9302160	0.9411760	0.9491610	0.9552090
2	5.27E-02	1.11E-01	4.28E-02	1.74E-02	7.35E-03	3.18E-03	1.40E-03
3		0.00E+00	4.28E-02	3.49E-02	2.21E-02	1.27E-02	7.00E-03
4			0.00E+00	1.74E-02	2.21E-02	1.91E-02	1.40E-02
5				0.00E+00	7.35E-03	1.27E-02	1.40E-02
6					0.00E+00	3.18E-03	7.00E-03
7						0.00E+00	1.40E-03
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	8.89E-01	9.14E-01	9.30E-01	9.41E-01	9.49E-01	9.55E-01
Beta	5.27E-02	1.11E-01	8.57E-02	6.98E-02	5.88E-02	5.08E-02	4.48E-02
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	5.33	8.00	10.67	13.33	16.00	18.67	21.33
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

2.5.2.2 BWR RHR CHECK VALVE FAIL TO CLOSE

System :	RESIDUAL HEAT REMOVAL
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 36
Total Number of Common-Cause Failure Events: 3

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9293110	0.9798560	0.9888530	0.9997700	0.9874320	3.0437E+01	6.2572E-01
2	2.32E-04	2.01E-02	1.11E-02	7.07E-02	1.26E-02	6.2572E-01	3.0437E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9392830	0.9760270	0.9806680	0.9968980	0.9772580	6.4215E+01	1.5773E+00
2	1.76E-03	1.95E-02	1.49E-02	5.31E-02	2.14E-02	1.2833E+00	6.4509E+01
3	4.00E-07	4.47E-03	1.06E-03	2.06E-02	1.34E-03	2.9396E-01	6.5498E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9416160	0.9727710	0.9759090	0.9932030	0.9690770	9.5876E+01	2.6837E+00
2	3.44E-03	1.98E-02	1.66E-02	4.68E-02	2.74E-02	1.9469E+00	9.6613E+01
3	2.42E-05	5.23E-03	2.46E-03	1.98E-02	3.36E-03	5.1530E-01	9.8044E+01
4	9.01E-09	2.25E-03	3.03E-04	1.13E-02	1.74E-04	2.2145E-01	9.8338E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9519080	0.9740930	0.9758670	0.9902220	0.9651400	1.7192E+02	4.5725E+00
2	4.43E-03	1.65E-02	1.47E-02	3.47E-02	2.74E-02	2.9150E+00	1.7358E+02
3	4.96E-04	6.65E-03	4.90E-03	1.88E-02	6.88E-03	1.1736E+00	1.7532E+02
4	2.65E-06	2.30E-03	8.52E-04	9.50E-03	6.00E-04	4.0604E-01	1.7609E+02
5	6.52E-20	4.41E-04	4.60E-07	2.57E-03	2.19E-05	7.7829E-02	1.7641E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9542850	0.9739470	0.9753640	0.9887780	0.9627130	2.1560E+02	5.7674E+00
2	4.36E-03	1.48E-02	1.33E-02	3.01E-02	2.59E-02	3.2666E+00	2.1810E+02
3	7.98E-04	6.77E-03	5.36E-03	1.76E-02	9.84E-03	1.4994E+00	2.1987E+02
4	4.82E-05	3.07E-03	1.76E-03	1.06E-02	1.46E-03	6.8021E-01	2.2069E+02
5	1.59E-08	1.11E-03	1.89E-04	5.41E-03	9.45E-05	2.4632E-01	2.2112E+02
6	1.10E-20	3.38E-04	2.56E-07	1.96E-03	2.63E-06	7.4822E-02	2.2129E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9596770	0.9754330	0.9764270	0.9878090	0.9658890	3.0988E+02	7.8044E+00
2	4.12E-03	1.22E-02	1.12E-02	2.38E-02	1.84E-02	3.8869E+00	3.1380E+02
3	1.18E-03	6.44E-03	5.44E-03	1.51E-02	1.20E-02	2.0472E+00	3.1564E+02
4	2.21E-04	3.45E-03	2.48E-03	9.99E-03	3.25E-03	1.0967E+00	3.1659E+02
5	1.06E-05	1.72E-03	8.46E-04	6.40E-03	4.23E-04	5.4665E-01	3.1714E+02
6	4.34E-10	6.14E-04	5.95E-05	3.18E-03	2.72E-05	1.9493E-01	3.1749E+02
7	4.34E-44	1.01E-04	7.24E-13	4.14E-04	0.00E+00	3.2027E-02	3.1765E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9617980	0.9761380	0.9769940	0.9875600	0.9683330	3.6089E+02	8.8222E+00
2	3.78E-03	1.09E-02	1.01E-02	2.10E-02	1.39E-02	4.0401E+00	3.6567E+02
3	1.19E-03	5.94E-03	5.08E-03	1.36E-02	1.16E-02	2.1965E+00	3.6752E+02
4	3.15E-04	3.49E-03	2.65E-03	9.56E-03	4.94E-03	1.2919E+00	3.6842E+02
5	4.71E-05	2.05E-03	1.25E-03	6.77E-03	1.09E-03	7.5760E-01	3.6895E+02
6	5.79E-07	9.96E-04	3.27E-04	4.26E-03	1.29E-04	3.6834E-01	3.6934E+02
7	1.11E-13	3.46E-04	7.42E-06	1.96E-03	7.96E-06	1.2779E-01	3.6958E+02
8	4.72E-36	1.08E-04	4.69E-11	5.20E-04	0.00E+00	4.0005E-02	3.6967E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9874320	0.9772580	0.9690770	0.9651400	0.9627130	0.9658890	0.9683330
2	1.26E-02	2.14E-02	2.74E-02	2.74E-02	2.59E-02	1.84E-02	1.39E-02
3		1.34E-03	3.36E-03	6.88E-03	9.84E-03	1.20E-02	1.16E-02
4			1.74E-04	6.00E-04	1.46E-03	3.25E-03	4.94E-03
5				2.19E-05	9.45E-05	4.23E-04	1.09E-03
6					2.63E-06	2.72E-05	1.29E-04
7						0.00E+00	7.96E-06
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.87E-01	9.77E-01	9.69E-01	9.65E-01	9.63E-01	9.66E-01	9.68E-01
Beta	1.26E-02	2.27E-02	3.09E-02	3.49E-02	3.73E-02	3.41E-02	3.17E-02
Gamma		5.89E-02	1.14E-01	2.15E-01	3.06E-01	4.59E-01	5.61E-01
Delta			4.94E-02	8.30E-02	1.36E-01	2.36E-01	3.47E-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	12.00	18.00	24.00	30.00	36.00	42.00	48.00
N 1	1.0186	1.1095	1.0080	0.8642	0.6703	0.6806	0.6813
N 2	0.1657	0.4185	0.7069	0.8750	0.9862	0.8148	0.6987
N 3		0.0262	0.0866	0.2199	0.3749	0.5290	0.5835
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

2.5.3 PWR Auxiliary Feedwater Check Valves

2.5.3.1 CHECK VALVE FAIL TO OPEN SPAR: AFW-CKV-CC

System :	AUXILIARY FEEDWATER SYSTEM
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 10
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9351560	0.9834990	0.9928960	0.9999550	1.0000000	2.7418E+01	4.6002E-01
2	4.20E-05	1.65E-02	7.11E-03	6.48E-02	0.00E+00	4.6002E-01	2.7418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9428310	0.9798620	0.9852140	0.9985950	1.0000000	5.5105E+01	1.1325E+00
2	5.42E-04	1.54E-02	1.01E-02	4.81E-02	0.00E+00	8.6476E-01	5.5373E+01
3	1.70E-07	4.76E-03	9.61E-04	2.26E-02	0.00E+00	2.6776E-01	5.5970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9454900	0.9772140	0.9809410	0.9961920	1.0000000	8.0868E+01	1.8857E+00
2	1.26E-03	1.50E-02	1.13E-02	4.13E-02	0.00E+00	1.2400E+00	8.1514E+01
3	8.49E-06	5.18E-03	2.04E-03	2.10E-02	0.00E+00	4.2870E-01	8.2325E+01
4	8.09E-09	2.62E-03	3.37E-04	1.32E-02	0.00E+00	2.1695E-01	8.2537E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9552480	0.9776230	0.9796500	0.9930620	1.0000000	1.5106E+02	3.4577E+00
2	2.43E-03	1.32E-02	1.12E-02	3.09E-02	0.00E+00	2.0400E+00	1.5248E+02
3	2.82E-04	6.17E-03	4.21E-03	1.87E-02	0.00E+00	9.5369E-01	1.5356E+02
4	2.07E-06	2.50E-03	8.76E-04	1.05E-02	0.00E+00	3.8684E-01	1.5413E+02
5	5.25E-20	4.99E-04	4.85E-07	2.90E-03	0.00E+00	7.7129E-02	1.5444E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9576600	0.9775090	0.9791350	0.9917960	1.0000000	1.8893E+02	4.3471E+00
2	2.47E-03	1.18E-02	1.02E-02	2.67E-02	0.00E+00	2.2804E+00	1.9100E+02
3	3.95E-04	5.82E-03	4.23E-03	1.67E-02	0.00E+00	1.1245E+00	1.9215E+02
4	3.62E-05	3.23E-03	1.76E-03	1.14E-02	0.00E+00	6.2471E-01	1.9265E+02
5	1.52E-08	1.26E-03	2.07E-04	6.13E-03	0.00E+00	2.4272E-01	1.9303E+02
6	1.20E-20	3.87E-04	2.89E-07	2.24E-03	0.00E+00	7.4722E-02	1.9320E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9617570	0.9777880	0.9789010	0.9900070	1.0000000	2.7720E+02	6.2971E+00
2	3.03E-03	1.08E-02	9.71E-03	2.25E-02	0.00E+00	3.0721E+00	2.8043E+02
3	6.43E-04	5.36E-03	4.25E-03	1.39E-02	0.00E+00	1.5182E+00	2.8198E+02
4	1.53E-04	3.36E-03	2.29E-03	1.02E-02	0.00E+00	9.5310E-01	2.8254E+02
5	9.70E-06	1.86E-03	8.90E-04	7.01E-03	0.00E+00	5.2795E-01	2.8297E+02
6	4.42E-10	6.83E-04	6.51E-05	3.55E-03	0.00E+00	1.9373E-01	2.8330E+02
7	4.90E-44	1.13E-04	8.12E-13	4.64E-04	0.00E+00	3.2027E-02	2.8347E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9633530	0.9780530	0.9790120	0.9894730	1.0000000	3.2221E+02	7.2302E+00
2	3.04E-03	1.01E-02	9.17E-03	2.06E-02	0.00E+00	3.3414E+00	3.2610E+02
3	6.47E-04	4.90E-03	3.94E-03	1.24E-02	0.00E+00	1.6130E+00	3.2783E+02
4	1.81E-04	3.17E-03	2.24E-03	9.33E-03	0.00E+00	1.0438E+00	3.2840E+02
5	3.77E-05	2.13E-03	1.25E-03	7.24E-03	0.00E+00	7.0280E-01	3.2874E+02
6	5.59E-07	1.10E-03	3.53E-04	4.72E-03	0.00E+00	3.6184E-01	3.2908E+02
7	1.15E-13	3.87E-04	8.19E-06	2.19E-03	0.00E+00	1.2739E-01	3.2931E+02
8	5.30E-36	1.21E-04	5.27E-11	5.83E-04	0.00E+00	4.0005E-02	3.2940E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	10.00	10.00	10.00	10.00	10.00	10.00	10.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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

2.5.3.2 CHECK VALVE FAIL TO CLOSE SPAR: AFW-CKV-OO

System :	AUXILIARY FEEDWATER SYSTEM
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 25
Total Number of Common-Cause Failure Events: 8

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9230690	0.9786620	0.9887830	0.9998200	0.9871110	2.6593E+01	5.7982E-01
2	1.78E-04	2.13E-02	1.12E-02	7.69E-02	1.29E-02	5.7982E-01	2.6593E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9360140	0.9752140	0.9802820	0.9970810	0.9742340	5.8505E+01	1.4870E+00
2	1.65E-03	2.03E-02	1.52E-02	5.62E-02	2.56E-02	1.2167E+00	5.8775E+01
3	1.77E-07	4.50E-03	9.25E-04	2.13E-02	1.82E-04	2.7026E-01	5.9722E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9383670	0.9715570	0.9749490	0.9931510	0.9614140	8.8279E+01	2.5845E+00
2	3.65E-03	2.12E-02	1.78E-02	5.05E-02	3.80E-02	1.9287E+00	8.8935E+01
3	9.13E-06	4.83E-03	1.95E-03	1.94E-02	5.58E-04	4.3880E-01	9.0425E+01
4	7.37E-09	2.39E-03	3.06E-04	1.20E-02	0.00E+00	2.1695E-01	9.0646E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9488930	0.9724010	0.9742710	0.9895290	0.9486470	1.6227E+02	4.6056E+00
2	5.46E-03	1.90E-02	1.71E-02	3.89E-02	5.02E-02	3.1627E+00	1.6371E+02
3	2.87E-04	5.87E-03	4.05E-03	1.77E-02	1.13E-03	9.7889E-01	1.6590E+02
4	1.92E-06	2.32E-03	8.11E-04	9.74E-03	0.00E+00	3.8684E-01	1.6649E+02
5	4.86E-20	4.62E-04	4.49E-07	2.69E-03	0.00E+00	7.7129E-02	1.6680E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9500300	0.9711880	0.9726750	0.9872750	0.9359410	2.0372E+02	6.0438E+00
2	6.37E-03	1.87E-02	1.72E-02	3.62E-02	6.22E-02	3.9267E+00	2.0584E+02
3	4.18E-04	5.60E-03	4.13E-03	1.58E-02	1.90E-03	1.1749E+00	2.0859E+02
4	3.34E-05	2.98E-03	1.62E-03	1.05E-02	0.00E+00	6.2471E-01	2.0914E+02
5	1.40E-08	1.16E-03	1.91E-04	5.65E-03	0.00E+00	2.4272E-01	2.0952E+02
6	1.10E-20	3.56E-04	2.67E-07	2.07E-03	0.00E+00	7.4722E-02	2.0969E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9546370	0.9717950	0.9728220	0.9854350	0.9253600	2.9544E+02	8.5746E+00
2	7.00E-03	1.72E-02	1.62E-02	3.10E-02	7.07E-02	5.2302E+00	2.9878E+02
3	7.29E-04	5.39E-03	4.35E-03	1.36E-02	3.91E-03	1.6376E+00	3.0238E+02
4	1.43E-04	3.14E-03	2.14E-03	9.54E-03	0.00E+00	9.5310E-01	3.0306E+02
5	9.05E-06	1.74E-03	8.30E-04	6.54E-03	0.00E+00	5.2795E-01	3.0349E+02
6	4.12E-10	6.37E-04	6.07E-05	3.31E-03	0.00E+00	1.9373E-01	3.0382E+02
7	4.48E-44	1.05E-04	7.57E-13	4.33E-04	0.00E+00	3.2027E-02	3.0398E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9553960	0.9713220	0.9722090	0.9842310	0.9152910	3.4375E+02	1.0149E+01
2	7.52E-03	1.71E-02	1.62E-02	2.97E-02	7.86E-02	6.0482E+00	3.4785E+02
3	8.12E-04	5.15E-03	4.25E-03	1.26E-02	6.06E-03	1.8217E+00	3.5208E+02
4	1.70E-04	2.96E-03	2.09E-03	8.71E-03	9.87E-05	1.0472E+00	3.5285E+02
5	3.51E-05	1.99E-03	1.16E-03	6.74E-03	0.00E+00	7.0280E-01	3.5320E+02
6	5.21E-07	1.02E-03	3.28E-04	4.40E-03	0.00E+00	3.6184E-01	3.5354E+02
7	1.07E-13	3.60E-04	7.62E-06	2.04E-03	0.00E+00	1.2739E-01	3.5377E+02
8	4.94E-36	1.13E-04	4.90E-11	5.43E-04	0.00E+00	4.0005E-02	3.5386E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1	0.9871110	0.9742340	0.9614140	0.9486470	0.9359410	0.9253600	0.9152910
2	1.29E-02	2.56E-02	3.80E-02	5.02E-02	6.22E-02	7.07E-02	7.86E-02
3		1.82E-04	5.58E-04	1.13E-03	1.90E-03	3.91E-03	6.06E-03
4			0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.87E-05
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	9.87E-01	9.74E-01	9.61E-01	9.49E-01	9.36E-01	9.25E-01	9.15E-01
Beta	1.29E-02	2.58E-02	3.86E-02	5.14E-02	6.41E-02	7.46E-02	8.47E-02
Gamma		7.05E-03	1.45E-02	2.20E-02	2.97E-02	5.24E-02	7.27E-02
Delta			0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E-02
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	6.78	10.16	13.55	16.94	20.33	23.71	27.10
N 1	2.3949	3.2404	3.8614	4.2654	4.4600	4.5256	4.4392
N 2	0.1198	0.3519	0.6887	1.1227	1.6463	2.1581	2.7068
N 3		0.0025	0.0101	0.0252	0.0504	0.1194	0.2087
N 4			0.0000	0.0000	0.0000	0.0000	0.0034
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

2.5.4 PWR High Pressure Safety Injection Check Valves

2.5.4.1 HIGH PRESSURE INJECTION CHECK VALVE FAIL TO OPEN

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 18
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9495330	0.9871780	0.9945080	0.9999650	1.0000000	3.5418E+01	4.6002E-01
2	3.25E-05	1.28E-02	5.49E-03	5.05E-02	0.00E+00	4.6002E-01	3.5418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9498850	0.9823700	0.9870690	0.9987720	1.0000000	6.3105E+01	1.1325E+00
2	4.73E-04	1.35E-02	8.85E-03	4.22E-02	0.00E+00	8.6476E-01	6.3373E+01
3	1.49E-07	4.17E-03	8.41E-04	1.98E-02	0.00E+00	2.6776E-01	6.3970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9502490	0.9792220	0.9826340	0.9965330	1.0000000	8.8868E+01	1.8857E+00
2	1.15E-03	1.37E-02	1.03E-02	3.77E-02	0.00E+00	1.2400E+00	8.9514E+01
3	7.73E-06	4.72E-03	1.86E-03	1.91E-02	0.00E+00	4.2870E-01	9.0325E+01
4	7.38E-09	2.39E-03	3.07E-04	1.21E-02	0.00E+00	2.1695E-01	9.0537E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9574380	0.9787240	0.9806560	0.9934030	1.0000000	1.5906E+02	3.4577E+00
2	2.30E-03	1.26E-02	1.06E-02	2.94E-02	0.00E+00	2.0400E+00	1.6048E+02
3	2.68E-04	5.87E-03	4.01E-03	1.78E-02	0.00E+00	9.5369E-01	1.6156E+02
4	1.97E-06	2.38E-03	8.33E-04	1.00E-02	0.00E+00	3.8684E-01	1.6213E+02
5	4.99E-20	4.75E-04	4.61E-07	2.76E-03	0.00E+00	7.7129E-02	1.6244E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9593350	0.9784030	0.9799660	0.9921250	1.0000000	1.9693E+02	4.3471E+00
2	2.37E-03	1.13E-02	9.76E-03	2.57E-02	0.00E+00	2.2804E+00	1.9900E+02
3	3.79E-04	5.59E-03	4.06E-03	1.60E-02	0.00E+00	1.1245E+00	2.0015E+02
4	3.48E-05	3.10E-03	1.69E-03	1.10E-02	0.00E+00	6.2471E-01	2.0065E+02
5	1.46E-08	1.21E-03	1.99E-04	5.89E-03	0.00E+00	2.4272E-01	2.0103E+02
6	1.15E-20	3.71E-04	2.78E-07	2.15E-03	0.00E+00	7.4722E-02	2.0120E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00
Delta			0.00E+00	0.00E+00	0.00E+00
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	18.00	18.00	18.00	18.00	18.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000
N 3		0.0000	0.0000	0.0000	0.0000
N 4			0.0000	0.0000	0.0000
N 5				0.0000	0.0000
N 6					0.0000

2.5.4.2 HIGH PRESSURE INJECTION CHECK VALVE FAIL TO CLOSE

System :	HIGH PRESSURE SAFETY INJECTION (PWR)
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 23
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9098960	0.9651370	0.9722560	0.9959800	0.9583330	4.0418E+01	1.4600E+00
2	4.02E-03	3.49E-02	2.77E-02	9.01E-02	4.17E-02	1.4600E+00	4.0418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9400330	0.9739100	0.9776770	0.9949040	0.9718310	7.9605E+01	2.1326E+00
2	1.69E-03	1.67E-02	1.29E-02	4.45E-02	1.41E-02	1.3648E+00	8.0373E+01
3	2.28E-04	9.39E-03	5.81E-03	3.08E-02	1.41E-02	7.6776E-01	8.0970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9493420	0.9759040	0.9785070	0.9935750	0.9787230	1.1687E+02	2.8856E+00
2	1.46E-03	1.24E-02	9.85E-03	3.23E-02	5.32E-03	1.4900E+00	1.1827E+02
3	3.31E-04	7.75E-03	5.24E-03	2.38E-02	1.06E-02	9.2870E-01	1.1883E+02
4	1.06E-05	3.90E-03	1.67E-03	1.53E-02	5.32E-03	4.6695E-01	1.1929E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9589220	0.9780430	0.9795930	0.9918620	0.9829060	1.9856E+02	4.4577E+00
2	2.10E-03	1.07E-02	9.10E-03	2.46E-02	2.14E-03	2.1650E+00	2.0085E+02
3	6.24E-04	6.54E-03	5.01E-03	1.77E-02	6.41E-03	1.3287E+00	2.0169E+02
4	8.80E-05	3.75E-03	2.30E-03	1.24E-02	6.41E-03	7.6184E-01	2.0226E+02
5	1.18E-09	9.96E-04	1.07E-04	5.12E-03	2.14E-03	2.0213E-01	2.0282E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9622270	0.9788890	0.9801350	0.9912810	0.9857140	2.4793E+02	5.3471E+00
2	1.99E-03	9.25E-03	7.99E-03	2.08E-02	8.93E-04	2.3429E+00	2.5093E+02
3	5.50E-04	5.43E-03	4.19E-03	1.45E-02	3.57E-03	1.3745E+00	2.5190E+02
4	2.03E-04	3.95E-03	2.74E-03	1.18E-02	5.36E-03	9.9971E-01	2.5228E+02
5	7.10E-06	1.95E-03	8.76E-04	7.51E-03	3.57E-03	4.9272E-01	2.5278E+02
6	8.15E-13	5.42E-04	1.59E-05	3.03E-03	8.93E-04	1.3722E-01	2.5314E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9583330	0.9718310	0.9787230	0.9829060	0.9857140
2	4.17E-02	1.41E-02	5.32E-03	2.14E-03	8.93E-04
3		1.41E-02	1.06E-02	6.41E-03	3.57E-03
4			5.32E-03	6.41E-03	5.36E-03
5				2.14E-03	3.57E-03
6					8.93E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.58E-01	9.72E-01	9.79E-01	9.83E-01	9.86E-01
Beta	4.17E-02	2.82E-02	2.13E-02	1.71E-02	1.43E-02
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	23.00	34.50	46.00	57.50	69.00
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

2.5.5 PWR Residual Heat Removal Check Valves

2.5.5.1 PWR RHR CHECK VALVE FAIL TO OPEN

System :	RESIDUAL HEAT REMOVAL
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 3
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9136330	0.9779660	0.9904340	0.9999400	1.0000000	2.0418E+01	4.6002E-01
2	5.66E-05	2.20E-02	9.56E-03	8.64E-02	0.00E+00	4.6002E-01	2.0418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9348050	0.9769990	0.9830830	0.9983850	1.0000000	4.8105E+01	1.1325E+00
2	6.20E-04	1.76E-02	1.16E-02	5.49E-02	0.00E+00	8.6476E-01	4.8373E+01
3	1.94E-07	5.44E-03	1.10E-03	2.58E-02	0.00E+00	2.6776E-01	4.8970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9405110	0.9751080	0.9791640	0.9958290	1.0000000	7.3868E+01	1.8857E+00
2	1.38E-03	1.64E-02	1.23E-02	4.51E-02	0.00E+00	1.2400E+00	7.4514E+01
3	9.28E-06	5.66E-03	2.24E-03	2.29E-02	0.00E+00	4.2870E-01	7.5325E+01
4	8.85E-09	2.86E-03	3.68E-04	1.44E-02	0.00E+00	2.1695E-01	7.5537E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9531430	0.9765610	0.9786850	0.9927300	1.0000000	1.4406E+02	3.4577E+00
2	2.54E-03	1.38E-02	1.17E-02	3.24E-02	0.00E+00	2.0400E+00	1.4548E+02
3	2.96E-04	6.46E-03	4.41E-03	1.96E-02	0.00E+00	9.5369E-01	1.4656E+02
4	2.17E-06	2.62E-03	9.18E-04	1.10E-02	0.00E+00	3.8684E-01	1.4713E+02
5	5.50E-20	5.23E-04	5.08E-07	3.04E-03	0.00E+00	7.7129E-02	1.4744E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9560820	0.9766640	0.9783520	0.9914850	1.0000000	1.8193E+02	4.3471E+00
2	2.56E-03	1.22E-02	1.05E-02	2.77E-02	0.00E+00	2.2804E+00	1.8400E+02
3	4.10E-04	6.04E-03	4.39E-03	1.73E-02	0.00E+00	1.1245E+00	1.8515E+02
4	3.76E-05	3.35E-03	1.82E-03	1.19E-02	0.00E+00	6.2471E-01	1.8565E+02
5	1.58E-08	1.30E-03	2.15E-04	6.36E-03	0.00E+00	2.4272E-01	1.8603E+02
6	1.24E-20	4.01E-04	3.00E-07	2.33E-03	0.00E+00	7.4722E-02	1.8620E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9607960	0.9772250	0.9783700	0.9897560	1.0000000	2.7020E+02	6.2971E+00
2	3.11E-03	1.11E-02	9.96E-03	2.31E-02	0.00E+00	3.0721E+00	2.7343E+02
3	6.60E-04	5.49E-03	4.35E-03	1.42E-02	0.00E+00	1.5182E+00	2.7498E+02
4	1.57E-04	3.45E-03	2.35E-03	1.05E-02	0.00E+00	9.5310E-01	2.7554E+02
5	9.95E-06	1.91E-03	9.12E-04	7.19E-03	0.00E+00	5.2795E-01	2.7597E+02
6	4.53E-10	7.01E-04	6.68E-05	3.64E-03	0.00E+00	1.9373E-01	2.7630E+02
7	5.04E-44	1.16E-04	8.33E-13	4.76E-04	0.00E+00	3.2027E-02	2.7647E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9625660	0.9775760	0.9785600	0.9892380	1.0000000	3.1521E+02	7.2302E+00
2	3.11E-03	1.04E-02	9.37E-03	2.10E-02	0.00E+00	3.3414E+00	3.1910E+02
3	6.61E-04	5.00E-03	4.02E-03	1.27E-02	0.00E+00	1.6130E+00	3.2083E+02
4	1.85E-04	3.24E-03	2.29E-03	9.54E-03	0.00E+00	1.0438E+00	3.2140E+02
5	3.85E-05	2.18E-03	1.27E-03	7.40E-03	0.00E+00	7.0280E-01	3.2174E+02
6	5.72E-07	1.12E-03	3.61E-04	4.82E-03	0.00E+00	3.6184E-01	3.2208E+02
7	1.18E-13	3.95E-04	8.37E-06	2.24E-03	0.00E+00	1.2739E-01	3.2231E+02
8	5.42E-36	1.24E-04	5.38E-11	5.96E-04	0.00E+00	4.0005E-02	3.2240E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	3.00	3.00	3.00	3.00	3.00	3.00	3.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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

2.5.5.2 PWR RHR CHECK VALVE FAIL TO CLOSE

System :	RESIDUAL HEAT REMOVAL
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

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

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9151290	0.9716620	0.9803040	0.9986550	0.9687500	3.2918E+01	9.6002E-01
2	1.35E-03	2.83E-02	1.97E-02	8.49E-02	3.12E-02	9.6002E-01	3.2918E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9336930	0.9718440	0.9762250	0.9950150	0.9646660	6.7855E+01	1.9659E+00
2	1.98E-03	1.95E-02	1.52E-02	5.21E-02	2.12E-02	1.3648E+00	6.8456E+01
3	8.26E-05	8.61E-03	4.58E-03	3.08E-02	1.41E-02	6.0106E-01	6.9220E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9416790	0.9722180	0.9751970	0.9925770	0.9678600	1.0098E+02	2.8856E+00
2	1.94E-03	1.51E-02	1.22E-02	3.86E-02	1.07E-02	1.5733E+00	1.0229E+02
3	3.02E-04	8.41E-03	5.53E-03	2.63E-02	1.43E-02	8.7310E-01	1.0299E+02
4	8.02E-06	4.23E-03	1.71E-03	1.70E-02	7.14E-03	4.3915E-01	1.0343E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9539440	0.9752550	0.9769690	0.9907220	0.9721880	1.7861E+02	4.5318E+00
2	2.47E-03	1.22E-02	1.04E-02	2.77E-02	4.80E-03	2.2252E+00	1.8092E+02
3	6.85E-04	7.23E-03	5.53E-03	1.96E-02	9.59E-03	1.3241E+00	1.8182E+02
4	9.51E-05	4.13E-03	2.53E-03	1.37E-02	9.59E-03	7.5724E-01	1.8238E+02
5	6.09E-09	1.23E-03	1.72E-04	6.14E-03	3.83E-03	2.2523E-01	1.8292E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9577080	0.9762340	0.9776080	0.9900740	0.9760430	2.2395E+02	5.4521E+00
2	2.26E-03	1.03E-02	8.96E-03	2.32E-02	2.01E-03	2.3730E+00	2.2703E+02
3	6.03E-04	5.98E-03	4.62E-03	1.60E-02	5.35E-03	1.3714E+00	2.2803E+02
4	2.21E-04	4.34E-03	3.01E-03	1.30E-02	8.03E-03	9.9511E-01	2.2841E+02
5	1.36E-05	2.35E-03	1.14E-03	8.78E-03	6.42E-03	5.3902E-01	2.2886E+02
6	8.90E-11	7.56E-04	5.21E-05	4.04E-03	2.14E-03	1.7352E-01	2.2923E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9623660	0.9773350	0.9783040	0.9890000	0.9791640	3.1971E+02	7.4144E+00
2	2.70E-03	9.52E-03	8.54E-03	1.97E-02	8.06E-04	3.1153E+00	3.2401E+02
3	7.03E-04	5.08E-03	4.11E-03	1.28E-02	2.69E-03	1.6622E+00	3.2546E+02
4	3.16E-04	3.79E-03	2.84E-03	1.05E-02	5.37E-03	1.2412E+00	3.2588E+02
5	9.56E-05	2.67E-03	1.75E-03	8.38E-03	6.45E-03	8.7365E-01	3.2625E+02
6	1.98E-06	1.30E-03	5.03E-04	5.28E-03	4.30E-03	4.2423E-01	3.2670E+02
7	9.32E-17	2.99E-04	1.56E-06	1.74E-03	1.23E-03	9.7827E-02	3.2703E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9644580	0.9780530	0.9788840	0.9888060	0.9816420	3.7221E+02	8.3523E+00
2	2.66E-03	8.83E-03	7.99E-03	1.79E-02	3.14E-04	3.3606E+00	3.7720E+02
3	6.29E-04	4.44E-03	3.61E-03	1.11E-02	1.26E-03	1.6898E+00	3.7887E+02
4	2.68E-04	3.25E-03	2.43E-03	9.02E-03	3.14E-03	1.2358E+00	3.7933E+02
5	1.40E-04	2.65E-03	1.85E-03	7.91E-03	5.03E-03	1.0101E+00	3.7955E+02
6	2.59E-05	1.76E-03	9.97E-04	6.08E-03	5.03E-03	6.6914E-01	3.7989E+02
7	9.35E-08	7.96E-04	1.98E-04	3.63E-03	2.87E-03	3.0299E-01	3.8026E+02
8	4.92E-19	2.20E-04	4.08E-07	1.29E-03	7.18E-04	8.3905E-02	3.8048E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9687500	0.9646660	0.9678600	0.9721880	0.9760430	0.9791640	0.9816420
2	3.12E-02	2.12E-02	1.07E-02	4.80E-03	2.01E-03	8.06E-04	3.14E-04
3		1.41E-02	1.43E-02	9.59E-03	5.35E-03	2.69E-03	1.26E-03
4			7.14E-03	9.59E-03	8.03E-03	5.37E-03	3.14E-03
5				3.83E-03	6.42E-03	6.45E-03	5.03E-03
6					2.14E-03	4.30E-03	5.03E-03
7						1.23E-03	2.87E-03
8							7.18E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.69E-01	9.65E-01	9.68E-01	9.72E-01	9.76E-01	9.79E-01	9.82E-01
Beta	3.12E-02	3.53E-02	3.21E-02	2.78E-02	2.40E-02	2.08E-02	1.84E-02
Gamma		4.00E-01	6.67E-01	8.28E-01	9.16E-01	9.61E-01	9.83E-01
Delta			3.33E-01	5.83E-01	7.56E-01	8.66E-01	9.30E-01
Epsilon				2.86E-01	5.16E-01	6.90E-01	8.13E-01
Mu					2.50E-01	4.62E-01	6.32E-01
Upsilon						2.22E-01	4.17E-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	15.00	22.50	30.00	37.50	45.00	52.50	60.00
N 1	0.5000	0.2500	0.1111	0.0463	0.0185	0.0072	0.0027
N 2	0.5000	0.5000	0.3333	0.1852	0.0926	0.0432	0.0192
N 3		0.3333	0.4444	0.3704	0.2469	0.1440	0.0768
N 4			0.2222	0.3704	0.3704	0.2881	0.1920
N 5				0.1481	0.2963	0.3457	0.3073
N 6					0.0988	0.2305	0.3073
N 7						0.0658	0.1756
N 8							0.0439

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

2.5.6.1 COMBINED HPCI AND RCIC CHECK VALVE FAIL TO OPEN

System :	HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING
Component :	CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 6
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9239590	0.9804710	0.9913790	0.9999400	0.9983840	2.3598E+01	4.7002E-01
2	5.65E-05	1.95E-02	8.62E-03	7.60E-02	1.62E-03	4.7002E-01	2.3598E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9411720	0.9790930	0.9845190	0.9984560	0.9969800	5.4348E+01	1.1605E+00
2	6.19E-04	1.61E-02	1.07E-02	4.97E-02	2.91E-03	8.9176E-01	5.4617E+01
3	1.80E-07	4.84E-03	9.85E-04	2.29E-02	1.08E-04	2.6876E-01	5.5240E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9459910	0.9772270	0.9808560	0.9960560	0.9957630	8.3160E+01	1.9380E+00
2	1.37E-03	1.51E-02	1.15E-02	4.12E-02	3.94E-03	1.2886E+00	8.3809E+01
3	8.77E-06	5.08E-03	2.02E-03	2.05E-02	2.92E-04	4.3230E-01	8.4666E+01
4	7.92E-09	2.55E-03	3.28E-04	1.29E-02	8.10E-06	2.1705E-01	8.4881E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9560230	0.9778700	0.9798310	0.9930160	0.9947110	1.5639E+02	3.5392E+00
2	2.53E-03	1.32E-02	1.12E-02	3.06E-02	4.73E-03	2.1129E+00	1.5782E+02
3	2.81E-04	6.01E-03	4.12E-03	1.82E-02	5.26E-04	9.6179E-01	1.5897E+02
4	2.02E-06	2.42E-03	8.49E-04	1.02E-02	3.24E-05	3.8734E-01	1.5954E+02
5	5.07E-20	4.82E-04	4.68E-07	2.80E-03	0.00E+00	7.7129E-02	1.5985E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9586390	0.9778860	0.9794450	0.9917990	0.9938110	1.9728E+02	4.4614E+00
2	2.58E-03	1.18E-02	1.02E-02	2.64E-02	5.33E-03	2.3788E+00	1.9936E+02
3	3.94E-04	5.65E-03	4.12E-03	1.61E-02	7.91E-04	1.1391E+00	2.0060E+02
4	3.50E-05	3.10E-03	1.69E-03	1.10E-02	6.50E-05	6.2591E-01	2.0112E+02
5	1.46E-08	1.20E-03	1.99E-04	5.88E-03	5.41E-06	2.4282E-01	2.0150E+02
6	1.15E-20	3.70E-04	2.77E-07	2.15E-03	0.00E+00	7.4722E-02	2.0167E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9983840	0.9969800	0.9957630	0.9947110	0.9938110
2	1.62E-03	2.91E-03	3.94E-03	4.73E-03	5.33E-03
3		1.08E-04	2.92E-04	5.26E-04	7.91E-04
4			8.10E-06	3.24E-05	6.50E-05
5				0.00E+00	5.41E-06
6					0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.98E-01	9.97E-01	9.96E-01	9.95E-01	9.94E-01
Beta	1.62E-03	3.02E-03	4.24E-03	5.29E-03	6.19E-03
Gamma		3.57E-02	7.07E-02	1.06E-01	1.39E-01
Delta			2.70E-02	5.81E-02	8.18E-02
Epsilon				0.00E+00	7.69E-02
Mu					0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	6.00	9.00	12.00	15.00	18.00
N 1	0.1800	0.2430	0.2916	0.3281	0.3543
N 2	0.0100	0.0270	0.0486	0.0729	0.0984
N 3		0.0010	0.0036	0.0081	0.0146
N 4			0.0001	0.0005	0.0012
N 5				0.0000	0.0001
N 6					0.0000

2.5.6.2 COMBINED HPCI AND RCIC CHECK VALVE FAIL TO OPEN

System :	HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING
Component :	CHECK VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 21
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9534070	0.9881680	0.9949340	0.9999670	1.0000000	3.8418E+01	4.6002E-01
2	2.99E-05	1.18E-02	5.06E-03	4.66E-02	0.00E+00	4.6002E-01	3.8418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9521020	0.9831560	0.9876520	0.9988290	1.0000000	6.6105E+01	1.1325E+00
2	4.52E-04	1.29E-02	8.45E-03	4.03E-02	0.00E+00	8.6476E-01	6.6373E+01
3	1.42E-07	3.98E-03	8.03E-04	1.89E-02	0.00E+00	2.6776E-01	6.6970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9518270	0.9798870	0.9831940	0.9966450	1.0000000	9.1868E+01	1.8857E+00
2	1.11E-03	1.32E-02	9.96E-03	3.65E-02	0.00E+00	1.2400E+00	9.2514E+01
3	7.48E-06	4.57E-03	1.80E-03	1.85E-02	0.00E+00	4.2870E-01	9.3325E+01
4	7.14E-09	2.31E-03	2.97E-04	1.17E-02	0.00E+00	2.1695E-01	9.3537E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9582030	0.9791100	0.9810080	0.9935250	1.0000000	1.6206E+02	3.4577E+00
2	2.26E-03	1.23E-02	1.04E-02	2.89E-02	0.00E+00	2.0400E+00	1.6348E+02
3	2.63E-04	5.76E-03	3.93E-03	1.75E-02	0.00E+00	9.5369E-01	1.6456E+02
4	1.93E-06	2.34E-03	8.18E-04	9.82E-03	0.00E+00	3.8684E-01	1.6513E+02
5	4.90E-20	4.66E-04	4.52E-07	2.71E-03	0.00E+00	7.7129E-02	1.6544E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9599280	0.9787200	0.9802620	0.9922420	1.0000000	1.9993E+02	4.3471E+00
2	2.33E-03	1.12E-02	9.61E-03	2.53E-02	0.00E+00	2.2804E+00	2.0200E+02
3	3.74E-04	5.50E-03	4.00E-03	1.58E-02	0.00E+00	1.1245E+00	2.0315E+02
4	3.43E-05	3.06E-03	1.66E-03	1.08E-02	0.00E+00	6.2471E-01	2.0365E+02
5	1.44E-08	1.19E-03	1.96E-04	5.80E-03	0.00E+00	2.4272E-01	2.0403E+02
6	1.13E-20	3.66E-04	2.74E-07	2.12E-03	0.00E+00	7.4722E-02	2.0420E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma		0.00E+00	0.00E+00	0.00E+00	0.00E+00
Delta			0.00E+00	0.00E+00	0.00E+00
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	21.00	21.00	21.00	21.00	21.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000
N 3		0.0000	0.0000	0.0000	0.0000
N 4			0.0000	0.0000	0.0000
N 5				0.0000	0.0000
N 6					0.0000

2.6 Strainers, Trash Racks, and Filters

2.6.1 Pooled Strainers (Non-ESW)

2.6.1.1 GENERIC CLEAN STRAINER PLUGS

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 :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 4
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8954620	0.9686220	0.9810440	0.9994010	0.9473680	2.1918E+01	7.1002E-01
2	5.96E-04	3.14E-02	1.90E-02	1.05E-01	5.26E-02	7.1002E-01	2.1918E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9232680	0.9692620	0.9749510	0.9957790	0.9272730	5.1480E+01	1.6326E+00
2	1.98E-03	2.33E-02	1.77E-02	6.41E-02	5.45E-02	1.2398E+00	5.1873E+01
3	6.86E-06	7.39E-03	2.66E-03	3.08E-02	1.82E-02	3.9276E-01	5.2720E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9317460	0.9685020	0.9722470	0.9924290	0.9230770	7.9118E+01	2.5731E+00
2	2.65E-03	1.98E-02	1.60E-02	4.98E-02	4.20E-02	1.6150E+00	8.0076E+01
3	1.30E-04	8.31E-03	4.78E-03	2.85E-02	2.80E-02	6.7870E-01	8.1012E+01
4	1.88E-07	3.42E-03	7.44E-04	1.60E-02	6.99E-03	2.7945E-01	8.1412E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9481580	0.9725370	0.9745420	0.9900710	0.9259180	1.5122E+02	4.2703E+00
2	3.28E-03	1.51E-02	1.31E-02	3.39E-02	2.85E-02	2.3525E+00	1.5314E+02
3	7.09E-04	8.14E-03	6.15E-03	2.24E-02	2.85E-02	1.2662E+00	1.5422E+02
4	2.10E-05	3.49E-03	1.71E-03	1.30E-02	1.42E-02	5.4314E-01	1.5495E+02
5	3.96E-15	6.97E-04	6.61E-06	4.03E-03	2.85E-03	1.0843E-01	1.5538E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9520950	0.9733120	0.9749070	0.9890870	0.9314030	1.9102E+02	5.2378E+00
2	2.98E-03	1.28E-02	1.12E-02	2.82E-02	1.81E-02	2.5148E+00	1.9374E+02
3	8.03E-04	7.32E-03	5.73E-03	1.93E-02	2.41E-02	1.4370E+00	1.9482E+02
4	1.50E-04	4.38E-03	2.85E-03	1.38E-02	1.81E-02	8.5911E-01	1.9540E+02
5	4.97E-07	1.71E-03	5.00E-04	7.55E-03	7.22E-03	3.3652E-01	1.9592E+02
6	1.21E-17	4.60E-04	1.43E-06	2.69E-03	1.20E-03	9.0322E-02	1.9617E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9473680	0.9272730	0.9230770	0.9259180	0.9314030
2	5.26E-02	5.45E-02	4.20E-02	2.85E-02	1.81E-02
3		1.82E-02	2.80E-02	2.85E-02	2.41E-02
4			6.99E-03	1.42E-02	1.81E-02
5				2.85E-03	7.22E-03
6					1.20E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.47E-01	9.27E-01	9.23E-01	9.26E-01	9.31E-01
Beta	5.26E-02	7.27E-02	7.69E-02	7.41E-02	6.86E-02
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	4.00	6.00	8.00	10.00	12.00
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

2.6.2 Emergency Service Water Strainers

2.6.2.1 SERVICE WATER TRAVELING SCREEN PLUG SPAR:TSA-PG

System :	EMERGENCY/ESSENTIAL SERVICE WATER
Component :	STRAINER, TRASH RACKS
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 27
Total Number of Common-Cause Failure Events: 3

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9287250	0.9760840	0.9832930	0.9988040	0.9774890	3.9998E+01	9.8002E-01
2	1.19E-03	2.39E-02	1.67E-02	7.13E-02	2.25E-02	9.8002E-01	3.9998E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9380580	0.9728440	0.9766710	0.9945470	0.9692400	7.8190E+01	2.1826E+00
2	2.88E-03	2.07E-02	1.68E-02	5.15E-02	2.33E-02	1.6598E+00	7.8713E+01
3	3.25E-05	6.50E-03	3.10E-03	2.45E-02	7.47E-03	5.2276E-01	7.9850E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9425320	0.9714050	0.9740360	0.9912850	0.9670810	1.1440E+02	3.3675E+00
2	3.37E-03	1.78E-02	1.51E-02	4.12E-02	1.89E-02	2.0907E+00	1.1568E+02
3	3.45E-04	7.94E-03	5.38E-03	2.43E-02	1.12E-02	9.3480E-01	1.1683E+02
4	9.61E-07	2.90E-03	8.68E-04	1.27E-02	2.78E-03	3.4205E-01	1.1743E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9528880	0.9737260	0.9752910	0.9892290	0.9676470	1.9507E+02	5.2635E+00
2	3.70E-03	1.42E-02	1.26E-02	3.00E-02	1.43E-02	2.8367E+00	1.9750E+02
3	1.02E-03	7.92E-03	6.36E-03	2.02E-02	1.14E-02	1.5875E+00	1.9875E+02
4	6.08E-05	3.49E-03	2.04E-03	1.19E-02	5.60E-03	6.9964E-01	1.9963E+02
5	1.51E-12	6.97E-04	2.19E-05	3.89E-03	1.12E-03	1.3963E-01	2.0019E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9561100	0.9743890	0.9756480	0.9883780	0.9691770	2.4345E+02	6.3988E+00
2	3.31E-03	1.20E-02	1.08E-02	2.51E-02	1.09E-02	3.0056E+00	2.4684E+02
3	1.06E-03	7.06E-03	5.79E-03	1.74E-02	9.59E-03	1.7630E+00	2.4809E+02
4	2.79E-04	4.38E-03	3.15E-03	1.27E-02	7.05E-03	1.0940E+00	2.4875E+02
5	2.87E-06	1.72E-03	6.79E-04	6.97E-03	2.82E-03	4.3022E-01	2.4942E+02
6	1.31E-15	4.24E-04	3.55E-06	2.46E-03	4.70E-04	1.0602E-01	2.4974E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9774890	0.9692400	0.9670810	0.9676470	0.9691770
2	2.25E-02	2.33E-02	1.89E-02	1.43E-02	1.09E-02
3		7.47E-03	1.12E-02	1.14E-02	9.59E-03
4			2.78E-03	5.60E-03	7.05E-03
5				1.12E-03	2.82E-03
6					4.70E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.77E-01	9.69E-01	9.67E-01	9.68E-01	9.69E-01
Beta	2.25E-02	3.08E-02	3.29E-02	3.24E-02	3.08E-02
Gamma		2.43E-01	4.26E-01	5.59E-01	6.47E-01
Delta			1.98E-01	3.72E-01	5.19E-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	20.22	30.34	40.45	50.56	60.67
N 1	2.3600	2.7450	3.0840	3.4502	3.8452
N 2	0.5200	0.7950	0.8507	0.7967	0.7252
N 3		0.2550	0.5061	0.6338	0.6385
N 4			0.1251	0.3128	0.4693
N 5				0.0625	0.1875
N 6					0.0313

2.6.2.2 SERVICE WATER PUMP STRAINER PLUG SPAR:STR-PG

System :	EMERGENCY/ESSENTIAL SERVICE WATER
Component :	STRAINER - MAIN PUMP SUCTION OR DISCHARGE
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 149
Total Number of Common-Cause Failure Events: 21

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8930680	0.9329880	0.9352640	0.9651320	0.9261970	1.1805E+02	8.4790E+00
2	3.49E-02	6.70E-02	6.47E-02	1.07E-01	7.38E-02	8.4790E+00	1.1805E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9105230	0.9400580	0.9414980	0.9646850	0.9296490	1.9147E+02	1.2209E+01
2	1.28E-02	2.92E-02	2.77E-02	5.08E-02	3.23E-02	5.9508E+00	1.9773E+02
3	1.38E-02	3.07E-02	2.92E-02	5.28E-02	3.80E-02	6.2581E+00	1.9742E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9205630	0.9447320	0.9457920	0.9652690	0.9343360	2.6280E+02	1.5374E+01
2	1.02E-02	2.27E-02	2.16E-02	3.90E-02	2.47E-02	6.3145E+00	2.7186E+02
3	6.74E-03	1.74E-02	1.62E-02	3.19E-02	2.14E-02	4.8270E+00	2.7335E+02
4	5.44E-03	1.52E-02	1.41E-02	2.89E-02	1.95E-02	4.2327E+00	2.7394E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9356480	0.9540960	0.9548570	0.9699490	0.9415450	3.7934E+02	1.8251E+01
2	6.57E-03	1.50E-02	1.42E-02	2.62E-02	1.55E-02	5.9748E+00	3.9162E+02
3	5.85E-03	1.39E-02	1.31E-02	2.48E-02	1.81E-02	5.5395E+00	3.9205E+02
4	4.41E-03	1.17E-02	1.08E-02	2.17E-02	1.68E-02	4.6324E+00	3.9296E+02
5	1.00E-03	5.29E-03	4.49E-03	1.23E-02	8.01E-03	2.1045E+00	3.9549E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9426470	0.9585380	0.9591660	0.9722820	0.9477180	4.6377E+02	2.0060E+01
2	4.67E-03	1.12E-02	1.06E-02	2.01E-02	1.05E-02	5.4377E+00	4.7839E+02
3	4.01E-03	1.02E-02	9.54E-03	1.87E-02	1.27E-02	4.9394E+00	4.7889E+02
4	4.41E-03	1.08E-02	1.02E-02	1.95E-02	1.54E-02	5.2437E+00	4.7859E+02
5	2.05E-03	6.88E-03	6.21E-03	1.40E-02	1.03E-02	3.3269E+00	4.8050E+02
6	1.52E-04	2.30E-03	1.66E-03	6.63E-03	3.45E-03	1.1128E+00	4.8272E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9261970	0.9296490	0.9343360	0.9415450	0.9477180
2	7.38E-02	3.23E-02	2.47E-02	1.55E-02	1.05E-02
3		3.80E-02	2.14E-02	1.81E-02	1.27E-02
4			1.95E-02	1.68E-02	1.54E-02
5				8.01E-03	1.03E-02
6					3.45E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.26E-01	9.30E-01	9.34E-01	9.42E-01	9.48E-01
Beta	7.38E-02	7.04E-02	6.57E-02	5.85E-02	5.23E-02
Gamma		5.41E-01	6.24E-01	7.34E-01	7.99E-01
Delta			4.77E-01	5.78E-01	6.96E-01
Epsilon				3.23E-01	4.72E-01
Mu					2.52E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	93.42	140.13	186.83	233.54	280.25
N 1	7.2154	6.2371	5.0998	4.7435	4.5883
N 2	8.0190	5.0860	5.0745	3.9348	3.1573
N 3		5.9903	4.3983	4.5858	3.8149
N 4			4.0158	4.2456	4.6190
N 5				2.0274	3.0842
N 6					1.0381

2.6.3 Pooled Sump Strainers

2.6.3.1 SUMP SUCTION PLUGGED

System :	CONTAINMENT SPRAY SYSTEM LOW PRESSURE CORE SPRAY RESIDUAL HEAT REMOVAL
Component :	STRAINER - MAIN PUMP SUCTION OR DISCHARGE
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 4
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8954620	0.9686220	0.9810440	0.9994010	0.9473680	2.1918E+01	7.1002E-01
2	5.96E-04	3.14E-02	1.90E-02	1.05E-01	5.26E-02	7.1002E-01	2.1918E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2
1	0.9473680
2	5.26E-02

MGL Parameter	CCCG=2
1-Beta	9.47E-01
Beta	5.26E-02

Avg. Impact Vector	CCCG=2
Adj. Ind. Events	4.00
N 1	0.5000
N 2	0.2500

2.6.4 PWR Containment Sump Strainers

2.6.4.1 CONTAINMENT SPRAY STR-PG

System :	CONTAINMENT SPRAY SYSTEM
Component :	STRAINER - MAIN PUMP SUCTION OR DISCHARGE
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 0
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8993200	0.9742690	0.9887700	0.9999290	0.9986330	1.7418E+01	4.6002E-01
2	6.66E-05	2.57E-02	1.12E-02	1.01E-01	0.00E+00	4.6002E-01	1.7418E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**
1	0.9986330
2	0.00E+00

MGL Parameter	**CCCG=2**
1-Beta	0.00E+00
Beta	0.00E+00

Avg. Impact Vector	**CCCG=2**
Adj. Ind. Events	0.00
N 1	0.0000
N 2	0.0000

2.6.5 BWR Suppression Pool Strainers

2.6.5.1 BWR RHR STRAINER PLUG

System :	RESIDUAL HEAT REMOVAL
Component :	STRAINER - MAIN PUMP SUCTION OR DISCHARGE
Failure Mode :	NO FLOW/PLUGGED
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 2
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8855160	0.9655800	0.9791470	0.9993400	0.9090910	1.9918E+01	7.1002E-01
2	6.57E-04	3.44E-02	2.09E-02	1.14E-01	9.09E-02	7.1002E-01	1.9918E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9187480	0.9674220	0.9734320	0.9955200	0.8709680	4.8480E+01	1.6326E+00
2	2.10E-03	2.47E-02	1.87E-02	6.79E-02	9.68E-02	1.2398E+00	4.8873E+01
3	7.28E-06	7.84E-03	2.82E-03	3.27E-02	3.23E-02	3.9276E-01	4.9720E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9282850	0.9668800	0.9708060	0.9920360	0.8607590	7.5118E+01	2.5731E+00
2	2.79E-03	2.08E-02	1.68E-02	5.23E-02	7.59E-02	1.6150E+00	7.6076E+01
3	1.37E-04	8.74E-03	5.03E-03	2.99E-02	5.06E-02	6.7870E-01	7.7012E+01
4	1.97E-07	3.60E-03	7.83E-04	1.68E-02	1.27E-02	2.7945E-01	7.7412E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9464530	0.9716240	0.9736920	0.9897370	0.8638610	1.4622E+02	4.2703E+00
2	3.39E-03	1.56E-02	1.35E-02	3.50E-02	5.24E-02	2.3525E+00	1.4814E+02
3	7.33E-04	8.41E-03	6.36E-03	2.31E-02	5.24E-02	1.2662E+00	1.4922E+02
4	2.17E-05	3.61E-03	1.77E-03	1.34E-02	2.62E-02	5.4314E-01	1.4995E+02
5	4.09E-15	7.21E-04	6.83E-06	4.16E-03	5.24E-03	1.0843E-01	1.5038E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9505980	0.9724700	0.9741130	0.9887340	0.8724750	1.8502E+02	5.2378E+00
2	3.07E-03	1.32E-02	1.16E-02	2.91E-02	3.36E-02	2.5148E+00	1.8774E+02
3	8.29E-04	7.55E-03	5.91E-03	1.99E-02	4.47E-02	1.4370E+00	1.8882E+02
4	1.54E-04	4.52E-03	2.94E-03	1.42E-02	3.36E-02	8.5911E-01	1.8940E+02
5	5.12E-07	1.77E-03	5.15E-04	7.79E-03	1.34E-02	3.3652E-01	1.8992E+02
6	1.25E-17	4.75E-04	1.48E-06	2.77E-03	2.23E-03	9.0322E-02	1.9017E+02

ALPHA FACTOR and MGL PARAMETERS

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	7.59E-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	8.72E-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

2.7 Heat Exchangers

2.7.1 Pooled Heat Exchanger Plugged or Failure to Transfer Heat

2.7.1.1 HEAT EXCHANGER PLUGGED ALL SYSTEMS SPAR:HTX-PG

Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 42
Total Number of Common-Cause Failure Events: 8

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8350720	0.9064510	0.9113590	0.9610310	0.8738510	4.9918E+01	5.1517E+00
2	3.90E-02	9.35E-02	8.86E-02	1.65E-01	1.26E-01	5.1517E+00	4.9918E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8877710	0.9331860	0.9360860	0.9686900	0.8962900	9.2637E+01	6.6326E+00
2	1.15E-02	3.60E-02	3.30E-02	7.10E-02	5.11E-02	3.5773E+00	9.5692E+01
3	8.66E-03	3.08E-02	2.77E-02	6.35E-02	5.26E-02	3.0553E+00	9.6214E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9078440	0.9429870	0.9450700	0.9710170	0.9100320	1.3334E+02	8.0618E+00
2	7.28E-03	2.39E-02	2.17E-02	4.81E-02	3.12E-02	3.3786E+00	1.3802E+02
3	4.37E-03	1.83E-02	1.60E-02	3.98E-02	3.14E-02	2.5832E+00	1.3882E+02
4	2.83E-03	1.49E-02	1.26E-02	3.45E-02	2.74E-02	2.1000E+00	1.3930E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.8738510	0.8962900	0.9100320
2	1.26E-01	5.11E-02	3.12E-02
3		5.26E-02	3.14E-02
4			2.74E-02

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**
1-Beta	8.74E-01	8.96E-01	9.10E-01
Beta	1.26E-01	1.04E-01	9.00E-02
Gamma		5.07E-01	6.54E-01
Delta			4.66E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	30.55	45.82	61.09
N 1	1.9500	1.7125	1.3818
N 2	4.6917	2.7125	2.1386
N 3		2.7875	2.1545
N 4			1.8830

2.7.2 Containment Spray Heat Exchanger

2.7.2.1 CONTAINMENT SPRAY HTX PLUG

System :	CONTAINMENT SPRAY SYSTEM
Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 5
Total Number of Common-Cause Failure Events: 3

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8176220	0.9225140	0.9342700	0.9870800	0.7600890	2.1748E+01	1.8267E+00
2	1.29E-02	7.75E-02	6.57E-02	1.82E-01	2.40E-01	1.8267E+00	2.1748E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2
1	0.7600890
2	2.40E-01

MGL Parameter	CCCG=2
1-Beta	7.60E-01
Beta	2.40E-01

Avg. Impact Vector	CCCG=2
Adj. Ind. Events	3.33
N 1	1.0000
N 2	1.3667

2.7.3 BWR Residual Heat Removal Heat Exchanger

2.7.3.1 BWR RHR HEAT EXCHANGER PLUG

System :	RESIDUAL HEAT REMOVAL
Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 9
Total Number of Common-Cause Failure Events: 3

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8096860	0.9085320	0.9176650	0.9760580	0.8085110	2.6918E+01	2.7100E+00
2	2.39E-02	9.15E-02	8.23E-02	1.90E-01	1.91E-01	2.7100E+00	2.6918E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8870230	0.9419830	0.9466440	0.9809900	0.8473280	5.8980E+01	3.6326E+00
2	7.44E-03	3.58E-02	3.09E-02	8.06E-02	8.40E-02	2.2398E+00	6.0373E+01
3	2.34E-03	2.22E-02	1.74E-02	5.88E-02	6.87E-02	1.3928E+00	6.1220E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9100920	0.9511890	0.9543770	0.9813940	0.8716420	8.9118E+01	4.5732E+00
2	4.36E-03	2.26E-02	1.93E-02	5.21E-02	4.18E-02	2.1150E+00	9.1576E+01
3	2.54E-03	1.79E-02	1.46E-02	4.46E-02	5.97E-02	1.6787E+00	9.2012E+01
4	2.11E-04	8.32E-03	5.18E-03	2.71E-02	2.69E-02	7.7945E-01	9.2912E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.8085110	0.8473280	0.8716420
2	1.91E-01	8.40E-02	4.18E-02
3		6.87E-02	5.97E-02
4			2.69E-02

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	8.09E-01	8.47E-01	8.72E-01
Beta	1.91E-01	1.53E-01	1.28E-01
Gamma		4.50E-01	6.74E-01
Delta			3.10E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	9.00	13.50	18.00
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

2.7.4 BWR Isolation Condenser Heat Exchanger

2.7.4.1 ISO CONDENSER HEAT EXCHANGER PLUG/LOSS OF HEAT TRANSFER

System :	ISOLATION CONDENSER
Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 1
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9045870	0.9756320	0.9893850	0.9999330	1.0000000	1.8418E+01	4.6002E-01
2	6.29E-05	2.44E-02	1.06E-02	9.54E-02	0.00E+00	4.6002E-01	1.8418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9320790	0.9760250	0.9823570	0.9983200	1.0000000	4.6105E+01	1.1325E+00
2	6.47E-04	1.83E-02	1.21E-02	5.72E-02	0.00E+00	8.6476E-01	4.6373E+01
3	2.03E-07	5.67E-03	1.15E-03	2.69E-02	0.00E+00	2.6776E-01	4.6970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9389170	0.9744330	0.9785940	0.9957140	1.0000000	7.1868E+01	1.8857E+00
2	1.42E-03	1.68E-02	1.27E-02	4.63E-02	0.00E+00	1.2400E+00	7.2514E+01
3	9.53E-06	5.81E-03	2.30E-03	2.35E-02	0.00E+00	4.2870E-01	7.3325E+01
4	9.09E-09	2.94E-03	3.78E-04	1.48E-02	0.00E+00	2.1695E-01	7.3537E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00
3		0.00E+00	0.00E+00
4			0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00
Gamma		0.00E+00	0.00E+00
Delta			0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	1.00	1.00	1.00
N 1	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000
N 3		0.0000	0.0000
N 4			0.0000

2.7.5 Component Cooling Heat Exchanger

2.7.5.1 CCW HEAT EXCHANGER PLUGGING SPAR: CCW-HTX-PG

System :	Component Cooling Water
Component :	HEAT EXCHANGER
Failure Mode :	NO FLOW/PLUGGED
Start Date :	1997/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 16
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9199330	0.9784290	0.9893270	0.9998770	0.9891700	2.4268E+01	5.3502E-01
2	1.23E-04	2.16E-02	1.07E-02	8.01E-02	1.08E-02	5.3502E-01	2.4268E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9368190	0.9764260	0.9817810	0.9977100	0.9805590	5.5193E+01	1.3326E+00
2	1.10E-03	1.86E-02	1.33E-02	5.43E-02	1.82E-02	1.0523E+00	5.5473E+01
3	2.81E-07	4.96E-03	1.09E-03	2.32E-02	1.22E-03	2.8026E-01	5.6245E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9413450	0.9741110	0.9776830	0.9946610	0.9742650	8.4118E+01	2.2357E+00
2	2.21E-03	1.78E-02	1.43E-02	4.57E-02	2.21E-02	1.5400E+00	8.4814E+01
3	1.74E-05	5.54E-03	2.44E-03	2.16E-02	3.68E-03	4.7870E-01	8.5875E+01
4	7.75E-09	2.51E-03	3.23E-04	1.27E-02	0.00E+00	2.1695E-01	8.6137E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9891700	0.9805590	0.9742650
2	1.08E-02	1.82E-02	2.21E-02
3		1.22E-03	3.68E-03
4			0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.89E-01	9.81E-01	9.74E-01
Beta	1.08E-02	1.94E-02	2.57E-02
Gamma		6.25E-02	1.43E-01
Delta			0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	6.40	9.60	12.80
N 1	0.4500	0.4875	0.4500
N 2	0.0750	0.1875	0.3000
N 3		0.0125	0.0500
N 4			0.0000

2.8 Safety and Relief Valves

2.8.1 Pooled Safety Valves

2.8.1.1 SAFETY VALVES (DIRECT ACTING) FAIL TO OPEN ALL SYS

Component :	SAFETY VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 113
Total Number of Common-Cause Failure Events: 37

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9427020	0.9840590	0.9915740	0.9998570	0.9932300	3.6373E+01	5.8922E-01
2	1.42E-04	1.59E-02	8.42E-03	5.73E-02	6.77E-03	5.8922E-01	3.6373E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9482380	0.9799500	0.9840560	0.9976200	0.9871730	7.3189E+01	1.4975E+00
2	1.33E-03	1.63E-02	1.22E-02	4.52E-02	1.24E-02	1.2184E+00	7.3468E+01
3	2.02E-07	3.74E-03	8.12E-04	1.75E-02	3.97E-04	2.7906E-01	7.4407E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9493680	0.9767190	0.9795370	0.9944380	0.9818070	1.0788E+02	2.5714E+00
2	2.83E-03	1.70E-02	1.42E-02	4.09E-02	1.70E-02	1.8825E+00	1.0857E+02
3	1.22E-05	4.27E-03	1.85E-03	1.67E-02	1.13E-03	4.7120E-01	1.0998E+02
4	6.37E-09	1.97E-03	2.55E-04	9.93E-03	2.12E-05	2.1775E-01	1.1023E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9559070	0.9763180	0.9779620	0.9911250	0.9770700	1.8684E+02	4.5321E+00
2	4.34E-03	1.57E-02	1.41E-02	3.28E-02	2.07E-02	3.0121E+00	1.8836E+02
3	3.20E-04	5.50E-03	3.90E-03	1.61E-02	2.10E-03	1.0519E+00	1.9032E+02
4	1.82E-06	2.04E-03	7.24E-04	8.55E-03	8.75E-05	3.9094E-01	1.9098E+02
5	4.24E-20	4.03E-04	3.91E-07	2.34E-03	0.00E+00	7.7129E-02	1.9129E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9571390	0.9754910	0.9768080	0.9893590	0.9729040	2.3333E+02	5.8623E+00
2	4.80E-03	1.51E-02	1.37E-02	2.99E-02	2.37E-02	3.6029E+00	2.3559E+02
3	5.02E-04	5.46E-03	4.15E-03	1.49E-02	3.23E-03	1.3049E+00	2.3789E+02
4	3.23E-05	2.66E-03	1.46E-03	9.37E-03	2.18E-04	6.3691E-01	2.3856E+02
5	1.23E-08	1.02E-03	1.67E-04	4.96E-03	1.79E-06	2.4282E-01	2.3895E+02
6	9.68E-21	3.12E-04	2.34E-07	1.81E-03	0.00E+00	7.4722E-02	2.3912E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9602830	0.9754980	0.9764320	0.9875340	0.9692730	3.3012E+02	8.2916E+00
2	5.40E-03	1.40E-02	1.31E-02	2.59E-02	2.59E-02	4.7505E+00	3.3366E+02
3	8.32E-04	5.34E-03	4.40E-03	1.30E-02	4.44E-03	1.8062E+00	3.3661E+02
4	1.42E-04	2.90E-03	2.00E-03	8.73E-03	4.27E-04	9.8080E-01	3.3743E+02
5	8.16E-06	1.56E-03	7.46E-04	5.88E-03	6.16E-06	5.2835E-01	3.3788E+02
6	3.70E-10	5.72E-04	5.46E-05	2.97E-03	0.00E+00	1.9373E-01	3.3822E+02
7	4.06E-44	9.46E-05	6.80E-13	3.89E-04	0.00E+00	3.2027E-02	3.3838E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9611610	0.9752540	0.9760570	0.9866100	0.9661130	3.8353E+02	9.7318E+00
2	5.63E-03	1.37E-02	1.28E-02	2.45E-02	2.75E-02	5.3703E+00	3.8789E+02
3	9.38E-04	5.16E-03	4.35E-03	1.22E-02	5.65E-03	2.0304E+00	3.9123E+02
4	1.79E-04	2.79E-03	2.01E-03	8.08E-03	7.36E-04	1.0981E+00	3.9216E+02
5	3.18E-05	1.79E-03	1.05E-03	6.07E-03	1.35E-05	7.0380E-01	3.9256E+02
6	4.68E-07	9.20E-04	2.96E-04	3.96E-03	0.00E+00	3.6184E-01	3.9290E+02
7	9.66E-14	3.24E-04	6.86E-06	1.83E-03	0.00E+00	1.2739E-01	3.9313E+02
8	4.44E-36	1.02E-04	4.41E-11	4.89E-04	0.00E+00	4.0005E-02	3.9322E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9932300	0.9871730	0.9818070	0.9770700	0.9729040	0.9692730	0.9661130
2	6.77E-03	1.24E-02	1.70E-02	2.07E-02	2.37E-02	2.59E-02	2.75E-02
3		3.97E-04	1.13E-03	2.10E-03	3.23E-03	4.44E-03	5.65E-03
4			2.12E-05	8.75E-05	2.18E-04	4.27E-04	7.36E-04
5				0.00E+00	1.79E-06	6.16E-06	1.35E-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	9.93E-01	9.87E-01	9.82E-01	9.77E-01	9.73E-01	9.69E-01	9.66E-01
Beta	6.77E-03	1.28E-02	1.82E-02	2.29E-02	2.71E-02	3.07E-02	3.39E-02
Gamma		3.10E-02	6.31E-02	9.52E-02	1.27E-01	1.58E-01	1.89E-01
Delta			1.85E-02	4.01E-02	6.38E-02	8.89E-02	1.17E-01
Epsilon				0.00E+00	8.13E-03	1.42E-02	1.81E-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	15.29	22.94	30.58	38.23	45.87	53.52	61.16
N 1	3.6647	5.1436	6.4301	7.5519	8.5335	9.3965	10.1593
N 2	0.1292	0.3536	0.6425	0.9721	1.3225	1.6784	2.0289
N 3		0.0113	0.0425	0.0982	0.1804	0.2880	0.4174
N 4			0.0008	0.0041	0.0122	0.0277	0.0543
N 5				0.0000	0.0001	0.0004	0.0010
N 6					0.0000	0.0000	0.0000
N 7						0.0000	0.0000
N 8							0.0000

2.8.1.2 SAFETY VALVES (DIRECT ACTING) FAIL TO CLOSE ALL SYS

Component :	SAFETY VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 41
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9691860	0.9921870	0.9966780	0.9999780	1.0000000	5.8418E+01	4.6002E-01
2	1.96E-05	7.81E-03	3.32E-03	3.08E-02	0.00E+00	4.6002E-01	5.8418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9630110	0.9870180	0.9905050	0.9990960	1.0000000	8.6105E+01	1.1325E+00
2	3.47E-04	9.91E-03	6.50E-03	3.11E-02	0.00E+00	8.6476E-01	8.6373E+01
3	1.09E-07	3.07E-03	6.17E-04	1.46E-02	0.00E+00	2.6776E-01	8.6970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9602330	0.9834240	0.9861660	0.9972420	1.0000000	1.1187E+02	1.8857E+00
2	9.13E-04	1.09E-02	8.20E-03	3.01E-02	0.00E+00	1.2400E+00	1.1252E+02
3	6.16E-06	3.77E-03	1.48E-03	1.53E-02	0.00E+00	4.2870E-01	1.1333E+02
4	5.88E-09	1.91E-03	2.44E-04	9.62E-03	0.00E+00	2.1695E-01	1.1354E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9626780	0.9813620	0.9830620	0.9942340	1.0000000	1.8206E+02	3.4577E+00
2	2.02E-03	1.10E-02	9.29E-03	2.58E-02	0.00E+00	2.0400E+00	1.8348E+02
3	2.35E-04	5.14E-03	3.51E-03	1.56E-02	0.00E+00	9.5369E-01	1.8456E+02
4	1.73E-06	2.09E-03	7.29E-04	8.76E-03	0.00E+00	3.8684E-01	1.8513E+02
5	4.37E-20	4.16E-04	4.04E-07	2.42E-03	0.00E+00	7.7129E-02	1.8544E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9634790	0.9806170	0.9820270	0.9929390	1.0000000	2.1993E+02	4.3471E+00
2	2.12E-03	1.02E-02	8.75E-03	2.31E-02	0.00E+00	2.2804E+00	2.2200E+02
3	3.40E-04	5.01E-03	3.64E-03	1.44E-02	0.00E+00	1.1245E+00	2.2315E+02
4	3.12E-05	2.79E-03	1.51E-03	9.87E-03	0.00E+00	6.2471E-01	2.2365E+02
5	1.31E-08	1.08E-03	1.78E-04	5.29E-03	0.00E+00	2.4272E-01	2.2403E+02
6	1.03E-20	3.33E-04	2.49E-07	1.93E-03	0.00E+00	7.4722E-02	2.2420E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9655090	0.9799770	0.9809840	0.9909990	1.0000000	3.0820E+02	6.2971E+00
2	2.73E-03	9.77E-03	8.75E-03	2.03E-02	0.00E+00	3.0721E+00	3.1143E+02
3	5.80E-04	4.83E-03	3.83E-03	1.25E-02	0.00E+00	1.5182E+00	3.1298E+02
4	1.38E-04	3.03E-03	2.06E-03	9.22E-03	0.00E+00	9.5310E-01	3.1354E+02
5	8.74E-06	1.68E-03	8.02E-04	6.32E-03	0.00E+00	5.2795E-01	3.1397E+02
6	3.98E-10	6.16E-04	5.87E-05	3.20E-03	0.00E+00	1.9373E-01	3.1430E+02
7	4.34E-44	1.02E-04	7.32E-13	4.18E-04	0.00E+00	3.2027E-02	3.1447E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9664920	0.9799410	0.9808200	0.9903800	1.0000000	3.5321E+02	7.2302E+00
2	2.78E-03	9.27E-03	8.38E-03	1.88E-02	0.00E+00	3.3414E+00	3.5710E+02
3	5.91E-04	4.48E-03	3.60E-03	1.14E-02	0.00E+00	1.6130E+00	3.5883E+02
4	1.65E-04	2.90E-03	2.04E-03	8.53E-03	0.00E+00	1.0438E+00	3.5940E+02
5	3.45E-05	1.95E-03	1.14E-03	6.62E-03	0.00E+00	7.0280E-01	3.5974E+02
6	5.11E-07	1.00E-03	3.22E-04	4.32E-03	0.00E+00	3.6184E-01	3.6008E+02
7	1.05E-13	3.53E-04	7.48E-06	2.00E-03	0.00E+00	1.2739E-01	3.6031E+02
8	4.85E-36	1.11E-04	4.81E-11	5.33E-04	0.00E+00	4.0005E-02	3.6040E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	41.00	41.00	41.00	41.00	41.00	41.00	41.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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

2.8.2 PWR Steam Generator Safety Valves

2.8.2.1 PWR MAIN STEAM CODE SAFETIES FAIL TO OPEN

System :	MAIN STEAM
Component :	SAFETY VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 97
Total Number of Common-Cause Failure Events: 33

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9370700	0.9826150	0.9909370	0.9998580	0.9923700	3.2597E+01	5.7672E-01
2	1.41E-04	1.74E-02	9.06E-03	6.29E-02	7.63E-03	5.7672E-01	3.2597E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9449570	0.9788440	0.9832720	0.9975900	0.9856180	6.7562E+01	1.4603E+00
2	1.31E-03	1.71E-02	1.27E-02	4.80E-02	1.39E-02	1.1813E+00	6.7841E+01
3	2.18E-07	4.04E-03	8.78E-04	1.89E-02	4.92E-04	2.7896E-01	6.8743E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9467700	0.9757210	0.9787380	0.9943620	0.9796780	1.0042E+02	2.4987E+00
2	2.78E-03	1.76E-02	1.46E-02	4.27E-02	1.89E-02	1.8109E+00	1.0111E+02
3	1.29E-05	4.57E-03	1.98E-03	1.79E-02	1.37E-03	4.7010E-01	1.0245E+02
4	6.84E-09	2.12E-03	2.74E-04	1.07E-02	2.65E-05	2.1775E-01	1.0270E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9545590	0.9757500	0.9774760	0.9910610	0.9745020	1.7758E+02	4.4133E+00
2	4.24E-03	1.59E-02	1.42E-02	3.35E-02	2.28E-02	2.8962E+00	1.7910E+02
3	3.34E-04	5.76E-03	4.08E-03	1.69E-02	2.54E-03	1.0490E+00	1.8094E+02
4	1.91E-06	2.15E-03	7.61E-04	8.99E-03	1.09E-04	3.9094E-01	1.8160E+02
5	4.46E-20	4.24E-04	4.11E-07	2.46E-03	0.00E+00	7.7129E-02	1.8192E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9560710	0.9750550	0.9764340	0.9893380	0.9700240	2.2230E+02	5.6873E+00
2	4.63E-03	1.51E-02	1.37E-02	3.03E-02	2.58E-02	3.4339E+00	2.2455E+02
3	5.20E-04	5.70E-03	4.33E-03	1.55E-02	3.90E-03	1.2990E+00	2.2669E+02
4	3.38E-05	2.79E-03	1.54E-03	9.82E-03	2.71E-04	6.3681E-01	2.2735E+02
5	1.30E-08	1.07E-03	1.76E-04	5.20E-03	2.24E-06	2.4282E-01	2.2774E+02
6	1.02E-20	3.28E-04	2.45E-07	1.90E-03	0.00E+00	7.4722E-02	2.2791E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9596450	0.9752550	0.9762250	0.9875600	0.9661790	3.1731E+02	8.0511E+00
2	5.18E-03	1.39E-02	1.29E-02	2.60E-02	2.79E-02	4.5203E+00	3.2084E+02
3	8.54E-04	5.52E-03	4.55E-03	1.35E-02	5.36E-03	1.7961E+00	3.2357E+02
4	1.48E-04	3.01E-03	2.08E-03	9.08E-03	5.30E-04	9.8060E-01	3.2438E+02
5	8.49E-06	1.62E-03	7.76E-04	6.11E-03	7.71E-06	5.2835E-01	3.2483E+02
6	3.85E-10	5.95E-04	5.68E-05	3.09E-03	0.00E+00	1.9373E-01	3.2517E+02
7	4.20E-44	9.84E-05	7.07E-13	4.04E-04	0.00E+00	3.2027E-02	3.2533E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9606910	0.9751140	0.9759490	0.9866940	0.9629180	3.6898E+02	9.4166E+00
2	5.35E-03	1.34E-02	1.26E-02	2.43E-02	2.93E-02	5.0715E+00	3.7333E+02
3	9.58E-04	5.32E-03	4.48E-03	1.26E-02	6.81E-03	2.0145E+00	3.7638E+02
4	1.86E-04	2.90E-03	2.09E-03	8.40E-03	9.12E-04	1.0976E+00	3.7730E+02
5	3.30E-05	1.86E-03	1.09E-03	6.31E-03	1.70E-05	7.0380E-01	3.7769E+02
6	4.87E-07	9.56E-04	3.07E-04	4.11E-03	0.00E+00	3.6184E-01	3.7803E+02
7	1.00E-13	3.37E-04	7.13E-06	1.91E-03	0.00E+00	1.2739E-01	3.7827E+02
8	4.62E-36	1.06E-04	4.58E-11	5.08E-04	0.00E+00	4.0005E-02	3.7836E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1	0.9923700	0.9856180	0.9796780	0.9745020	0.9700240	0.9661790	0.9629180
2	7.63E-03	1.39E-02	1.89E-02	2.28E-02	2.58E-02	2.79E-02	2.93E-02
3		4.92E-04	1.37E-03	2.54E-03	3.90E-03	5.36E-03	6.81E-03
4			2.65E-05	1.09E-04	2.71E-04	5.30E-04	9.12E-04
5				0.00E+00	2.24E-06	7.71E-06	1.70E-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	9.92E-01	9.86E-01	9.80E-01	9.75E-01	9.70E-01	9.66E-01	9.63E-01
Beta	7.63E-03	1.44E-02	2.03E-02	2.55E-02	3.00E-02	3.38E-02	3.71E-02
Gamma		3.42E-02	6.88E-02	1.04E-01	1.39E-01	1.74E-01	2.09E-01
Delta			1.90E-02	4.12E-02	6.53E-02	9.12E-02	1.20E-01
Epsilon				0.00E+00	8.20E-03	1.43E-02	1.82E-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	12.45	18.68	24.90	31.13	37.36	43.58	49.81
N 1	2.7291	3.7771	4.6555	5.3913	6.0082	6.5268	6.9649
N 2	0.1167	0.3165	0.5709	0.8562	1.1535	1.4482	1.7301
N 3		0.0112	0.0414	0.0953	0.1745	0.2779	0.4015
N 4			0.0008	0.0041	0.0121	0.0275	0.0538
N 5				0.0000	0.0001	0.0004	0.0010
N 6					0.0000	0.0000	0.0000
N 7						0.0000	0.0000
N 8							0.0000

2.8.2.2 PWR MAIN STEAM CODE SAFETIES FAIL TO CLOSE

System :	MAIN STEAM
Component :	SAFETY VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 35
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9656970	0.9913000	0.9962950	0.9999760	1.0000000	5.2418E+01	4.6002E-01
2	2.19E-05	8.70E-03	3.71E-03	3.43E-02	0.00E+00	4.6002E-01	5.2418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9603030	0.9860590	0.9897970	0.9990290	1.0000000	8.0105E+01	1.1325E+00
2	3.73E-04	1.06E-02	6.99E-03	3.34E-02	0.00E+00	8.6476E-01	8.0373E+01
3	1.17E-07	3.30E-03	6.63E-04	1.56E-02	0.00E+00	2.6776E-01	8.0970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9580370	0.9825010	0.9853910	0.9970860	1.0000000	1.0587E+02	1.8857E+00
2	9.64E-04	1.15E-02	8.66E-03	3.18E-02	0.00E+00	1.2400E+00	1.0652E+02
3	6.51E-06	3.98E-03	1.57E-03	1.61E-02	0.00E+00	4.2870E-01	1.0733E+02
4	6.21E-09	2.01E-03	2.58E-04	1.02E-02	0.00E+00	2.1695E-01	1.0754E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9614390	0.9807390	0.9824940	0.9940350	1.0000000	1.7606E+02	3.4577E+00
2	2.09E-03	1.14E-02	9.61E-03	2.67E-02	0.00E+00	2.0400E+00	1.7748E+02
3	2.43E-04	5.31E-03	3.63E-03	1.61E-02	0.00E+00	9.5369E-01	1.7856E+02
4	1.78E-06	2.15E-03	7.54E-04	9.05E-03	0.00E+00	3.8684E-01	1.7913E+02
5	4.52E-20	4.30E-04	4.17E-07	2.50E-03	0.00E+00	7.7129E-02	1.7944E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9624810	0.9800850	0.9815310	0.9927440	1.0000000	2.1393E+02	4.3471E+00
2	2.18E-03	1.04E-02	8.99E-03	2.37E-02	0.00E+00	2.2804E+00	2.1600E+02
3	3.50E-04	5.15E-03	3.74E-03	1.48E-02	0.00E+00	1.1245E+00	2.1715E+02
4	3.21E-05	2.86E-03	1.55E-03	1.01E-02	0.00E+00	6.2471E-01	2.1765E+02
5	1.35E-08	1.11E-03	1.83E-04	5.43E-03	0.00E+00	2.4272E-01	2.1803E+02
6	1.06E-20	3.42E-04	2.56E-07	1.98E-03	0.00E+00	7.4722E-02	2.1820E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9648430	0.9795880	0.9806140	0.9908230	1.0000000	3.0220E+02	6.2971E+00
2	2.79E-03	9.96E-03	8.92E-03	2.07E-02	0.00E+00	3.0721E+00	3.0543E+02
3	5.91E-04	4.92E-03	3.90E-03	1.27E-02	0.00E+00	1.5182E+00	3.0698E+02
4	1.41E-04	3.09E-03	2.10E-03	9.40E-03	0.00E+00	9.5310E-01	3.0754E+02
5	8.91E-06	1.71E-03	8.17E-04	6.44E-03	0.00E+00	5.2795E-01	3.0797E+02
6	4.06E-10	6.28E-04	5.99E-05	3.26E-03	0.00E+00	1.9373E-01	3.0830E+02
7	4.48E-44	1.04E-04	7.46E-13	4.27E-04	0.00E+00	3.2027E-02	3.0847E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9659230	0.9796010	0.9804950	0.9902160	1.0000000	3.4721E+02	7.2302E+00
2	2.83E-03	9.43E-03	8.52E-03	1.91E-02	0.00E+00	3.3414E+00	3.5110E+02
3	6.01E-04	4.55E-03	3.66E-03	1.15E-02	0.00E+00	1.6130E+00	3.5283E+02
4	1.68E-04	2.94E-03	2.08E-03	8.68E-03	0.00E+00	1.0438E+00	3.5340E+02
5	3.50E-05	1.98E-03	1.16E-03	6.73E-03	0.00E+00	7.0280E-01	3.5374E+02
6	5.20E-07	1.02E-03	3.28E-04	4.39E-03	0.00E+00	3.6184E-01	3.5408E+02
7	1.07E-13	3.59E-04	7.61E-06	2.04E-03	0.00E+00	1.2739E-01	3.5431E+02
8	4.93E-36	1.13E-04	4.89E-11	5.42E-04	0.00E+00	4.0005E-02	3.5440E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	35.00	35.00	35.00	35.00	35.00	35.00	35.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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

2.8.3 BWR Safety Relief Valves

2.8.3.1 SAFETY RELIEF VALVE FAIL TO OPEN SPAR: SRV-CC

Component :	RELIEF VALVE: AIR OR NITROGEN OPERATED RELIEF VALVE: SOLENOID OPERATED
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 146
Total Number of Common-Cause Failure Events: 42

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9008630	0.9547430	0.9602880	0.9896530	0.9450030	5.1289E+01	2.4312E+00
2	1.04E-02	4.53E-02	3.97E-02	9.91E-02	5.50E-02	2.4312E+00	5.1289E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9095670	0.9500430	0.9530760	0.9801370	0.9273490	9.3214E+01	4.9016E+00
2	1.16E-02	3.63E-02	3.32E-02	7.16E-02	5.20E-02	3.5615E+00	9.4554E+01
3	1.33E-03	1.37E-02	1.05E-02	3.67E-02	2.07E-02	1.3401E+00	9.6775E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9183210	0.9513190	0.9534560	0.9770270	0.9267930	1.3345E+02	6.8288E+00
2	8.17E-03	2.56E-02	2.34E-02	5.06E-02	3.48E-02	3.5884E+00	1.3669E+02
3	3.99E-03	1.75E-02	1.53E-02	3.87E-02	3.01E-02	2.4587E+00	1.3782E+02
4	1.43E-04	5.57E-03	3.47E-03	1.82E-02	8.36E-03	7.8175E-01	1.3950E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9340290	0.9579290	0.9592690	0.9772680	0.9262900	2.1784E+02	9.5672E+00
2	8.80E-03	2.21E-02	2.07E-02	4.01E-02	3.60E-02	5.0209E+00	2.2239E+02
3	2.03E-03	9.88E-03	8.49E-03	2.25E-02	1.56E-02	2.2477E+00	2.2516E+02
4	1.17E-03	7.75E-03	6.36E-03	1.91E-02	1.66E-02	1.7614E+00	2.2565E+02
5	1.34E-05	2.36E-03	1.15E-03	8.84E-03	5.55E-03	5.3723E-01	2.2687E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9375790	0.9587300	0.9598120	0.9761810	0.9259070	2.6968E+02	1.1609E+01
2	8.85E-03	2.06E-02	1.94E-02	3.61E-02	3.57E-02	5.7809E+00	2.7551E+02
3	2.09E-03	8.97E-03	7.84E-03	1.97E-02	1.43E-02	2.5243E+00	2.7876E+02
4	6.96E-04	5.55E-03	4.43E-03	1.42E-02	9.54E-03	1.5599E+00	2.7973E+02
5	4.09E-04	4.57E-03	3.46E-03	1.25E-02	1.06E-02	1.2860E+00	2.8000E+02
6	3.93E-06	1.63E-03	6.83E-04	6.45E-03	3.91E-03	4.5772E-01	2.8083E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9448840	0.9620860	0.9628830	0.9765750	0.9260320	3.7180E+02	1.4652E+01
2	8.42E-03	1.79E-02	1.71E-02	3.02E-02	3.41E-02	6.9266E+00	3.7953E+02
3	2.53E-03	8.54E-03	7.70E-03	1.74E-02	1.58E-02	3.2986E+00	3.8315E+02
4	6.14E-04	4.36E-03	3.54E-03	1.09E-02	6.47E-03	1.6837E+00	3.8477E+02
5	3.54E-04	3.54E-03	2.73E-03	9.49E-03	7.42E-03	1.3664E+00	3.8509E+02
6	1.43E-04	2.64E-03	1.85E-03	7.85E-03	7.33E-03	1.0218E+00	3.8543E+02
7	4.02E-07	9.18E-04	2.87E-04	3.97E-03	2.86E-03	3.5473E-01	3.8610E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9472730	0.9630200	0.9637060	0.9764140	0.9271500	4.3066E+02	1.6537E+01
2	7.84E-03	1.63E-02	1.56E-02	2.72E-02	3.10E-02	7.2960E+00	4.3990E+02
3	2.96E-03	8.76E-03	8.04E-03	1.70E-02	1.80E-02	3.9162E+00	4.4328E+02
4	5.73E-04	3.89E-03	3.18E-03	9.62E-03	5.43E-03	1.7376E+00	4.4546E+02
5	3.00E-04	3.03E-03	2.33E-03	8.17E-03	5.12E-03	1.3572E+00	4.4584E+02
6	1.63E-04	2.48E-03	1.79E-03	7.15E-03	5.85E-03	1.1088E+00	4.4609E+02
7	5.10E-05	1.81E-03	1.14E-03	5.83E-03	5.32E-03	8.0759E-01	4.4639E+02
8	1.13E-07	7.02E-04	1.84E-04	3.16E-03	2.14E-03	3.1381E-01	4.4688E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9450030	0.9273490	0.9267930	0.9262900	0.9259070	0.9260320	0.9271500
2	5.50E-02	5.20E-02	3.48E-02	3.60E-02	3.57E-02	3.41E-02	3.10E-02
3		2.07E-02	3.01E-02	1.56E-02	1.43E-02	1.58E-02	1.80E-02
4			8.36E-03	1.66E-02	9.54E-03	6.47E-03	5.43E-03
5				5.55E-03	1.06E-02	7.42E-03	5.12E-03
6					3.91E-03	7.33E-03	5.85E-03
7						2.86E-03	5.32E-03
8							2.14E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.45E-01	9.27E-01	9.27E-01	9.26E-01	9.26E-01	9.26E-01	9.27E-01
Beta	5.50E-02	7.27E-02	7.32E-02	7.37E-02	7.41E-02	7.40E-02	7.29E-02
Gamma		2.85E-01	5.25E-01	5.12E-01	5.18E-01	5.39E-01	5.75E-01
Delta			2.18E-01	5.86E-01	6.28E-01	6.04E-01	5.70E-01
Epsilon				2.51E-01	6.04E-01	7.31E-01	7.72E-01
Mu					2.69E-01	5.79E-01	7.22E-01
Upsilon						2.80E-01	5.61E-01
Sigma							2.87E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	26.96	40.44	53.92	67.41	80.89	94.37	107.85
N 1	6.9107	7.6694	8.6602	9.3672	9.8580	10.2261	10.5986
N 2	1.9712	2.6967	2.3484	2.9809	3.5005	3.8545	3.9546
N 3		1.0723	2.0300	1.2940	1.3998	1.7804	2.3032
N 4			0.5648	1.3746	0.9352	0.7306	0.6938
N 5				0.4601	1.0433	0.8384	0.6544
N 6					0.3830	0.8281	0.7470
N 7						0.3227	0.6802
N 8							0.2738

2.8.3.2 SAFETY RELIEF VALVE FAIL TO CLOSE SPAR: ADS-SRV-OO

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)
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 36
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9243100	0.9802710	0.9909590	0.9999250	0.9957340	2.4327E+01	4.8962E-01
2	7.15E-05	1.97E-02	9.04E-03	7.57E-02	4.27E-03	4.8962E-01	2.4327E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9404970	0.9784970	0.9838320	0.9982520	0.9918440	5.5381E+01	1.2170E+00
2	7.59E-04	1.67E-02	1.15E-02	5.07E-02	7.94E-03	9.4706E-01	5.5651E+01
3	1.85E-07	4.77E-03	9.78E-04	2.26E-02	2.12E-04	2.6996E-01	5.6328E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9448750	0.9763470	0.9799180	0.9956110	0.9883260	8.4465E+01	2.0463E+00
2	1.68E-03	1.61E-02	1.25E-02	4.27E-02	1.11E-02	1.3921E+00	8.5119E+01
3	9.33E-06	5.05E-03	2.03E-03	2.03E-02	6.11E-04	4.3710E-01	8.6074E+01
4	7.79E-09	2.51E-03	3.22E-04	1.27E-02	7.27E-06	2.1705E-01	8.6294E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9549650	0.9770390	0.9789810	0.9924880	0.9851670	1.5794E+02	3.7118E+00
2	2.94E-03	1.41E-02	1.21E-02	3.19E-02	1.36E-02	2.2736E+00	1.5938E+02
3	2.91E-04	6.02E-03	4.15E-03	1.82E-02	1.17E-03	9.7369E-01	1.6068E+02
4	2.00E-06	2.40E-03	8.40E-04	1.01E-02	2.92E-05	3.8734E-01	1.6126E+02
5	5.02E-20	4.77E-04	4.63E-07	2.77E-03	0.00E+00	7.7129E-02	1.6157E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9573840	0.9768930	0.9784400	0.9911350	0.9823640	1.9906E+02	4.7085E+00
2	3.07E-03	1.28E-02	1.12E-02	2.78E-02	1.57E-02	2.6023E+00	2.0117E+02
3	4.17E-04	5.71E-03	4.19E-03	1.62E-02	1.86E-03	1.1626E+00	2.0261E+02
4	3.47E-05	3.07E-03	1.67E-03	1.09E-02	6.83E-05	6.2611E-01	2.0314E+02
5	1.44E-08	1.19E-03	1.96E-04	5.82E-03	0.00E+00	2.4272E-01	2.0353E+02
6	1.14E-20	3.67E-04	2.74E-07	2.13E-03	0.00E+00	7.4722E-02	2.0369E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9614090	0.9772090	0.9782750	0.9893830	0.9798860	2.9055E+02	6.7763E+00
2	3.64E-03	1.17E-02	1.06E-02	2.35E-02	1.73E-02	3.4846E+00	2.9384E+02
3	6.82E-04	5.32E-03	4.26E-03	1.36E-02	2.67E-03	1.5817E+00	2.9574E+02
4	1.48E-04	3.22E-03	2.19E-03	9.77E-03	1.34E-04	9.5630E-01	2.9637E+02
5	9.25E-06	1.78E-03	8.48E-04	6.68E-03	0.00E+00	5.2795E-01	2.9680E+02
6	4.21E-10	6.52E-04	6.21E-05	3.39E-03	0.00E+00	1.9373E-01	2.9713E+02
7	4.62E-44	1.08E-04	7.74E-13	4.43E-04	0.00E+00	3.2027E-02	2.9729E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9629050	0.9773930	0.9783090	0.9887660	0.9777180	3.3874E+02	7.8349E+00
2	3.70E-03	1.11E-02	1.02E-02	2.16E-02	1.85E-02	3.8432E+00	3.4273E+02
3	7.11E-04	4.93E-03	4.02E-03	1.23E-02	3.56E-03	1.7096E+00	3.4487E+02
4	1.75E-04	3.03E-03	2.14E-03	8.91E-03	2.28E-04	1.0500E+00	3.4552E+02
5	3.59E-05	2.03E-03	1.19E-03	6.89E-03	3.68E-06	7.0290E-01	3.4587E+02
6	5.32E-07	1.04E-03	3.35E-04	4.49E-03	0.00E+00	3.6184E-01	3.4621E+02
7	1.10E-13	3.68E-04	7.78E-06	2.08E-03	0.00E+00	1.2739E-01	3.4645E+02
8	5.04E-36	1.15E-04	5.00E-11	5.54E-04	0.00E+00	4.0005E-02	3.4653E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9957340	0.9918440	0.9883260	0.9851670	0.9823640	0.9798860	0.9777180
2	4.27E-03	7.94E-03	1.11E-02	1.36E-02	1.57E-02	1.73E-02	1.85E-02
3		2.12E-04	6.11E-04	1.17E-03	1.86E-03	2.67E-03	3.56E-03
4			7.27E-06	2.92E-05	6.83E-05	1.34E-04	2.28E-04
5				0.00E+00	0.00E+00	0.00E+00	3.68E-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	9.96E-01	9.92E-01	9.88E-01	9.85E-01	9.82E-01	9.80E-01	9.78E-01
Beta	4.27E-03	8.16E-03	1.17E-02	1.48E-02	1.76E-02	2.01E-02	2.23E-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	6.55	9.82	13.09	16.36	19.64	22.91	26.18
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

2.8.4 PWR Pressurizer Safety Valve

2.8.4.1 PWR PRESSURIZER CODE SAFETIES FAIL TO OPEN

System :	REACTOR COOLANT
Component :	SAFETY VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 11
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9373860	0.9840700	0.9931470	0.9999560	1.0000000	2.8418E+01	4.6002E-01
2	4.05E-05	1.59E-02	6.86E-03	6.26E-02	0.00E+00	4.6002E-01	2.8418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9438200	0.9802140	0.9854750	0.9986190	1.0000000	5.6105E+01	1.1325E+00
2	5.32E-04	1.51E-02	9.95E-03	4.73E-02	0.00E+00	8.6476E-01	5.6373E+01
3	1.67E-07	4.68E-03	9.45E-04	2.22E-02	0.00E+00	2.6776E-01	5.6970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9461340	0.9774860	0.9811710	0.9962380	1.0000000	8.1868E+01	1.8857E+00
2	1.24E-03	1.48E-02	1.12E-02	4.08E-02	0.00E+00	1.2400E+00	8.2514E+01
3	8.39E-06	5.12E-03	2.02E-03	2.07E-02	0.00E+00	4.2870E-01	8.3325E+01
4	8.00E-09	2.59E-03	3.33E-04	1.31E-02	0.00E+00	2.1695E-01	8.3537E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00
3		0.00E+00	0.00E+00
4			0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00
Gamma		0.00E+00	0.00E+00
Delta			0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	11.00	11.00	11.00
N 1	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000
N 3		0.0000	0.0000
N 4			0.0000

2.8.4.2 PWR PRESSURIZER CODE SAFETIES FAIL TO CLOSE

System :	REACTOR COOLANT
Component :	SAFETY VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 3
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9136330	0.9779660	0.9904340	0.9999400	1.0000000	2.0418E+01	4.6002E-01
2	5.66E-05	2.20E-02	9.56E-03	8.64E-02	0.00E+00	4.6002E-01	2.0418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9348050	0.9769990	0.9830830	0.9983850	1.0000000	4.8105E+01	1.1325E+00
2	6.20E-04	1.76E-02	1.16E-02	5.49E-02	0.00E+00	8.6476E-01	4.8373E+01
3	1.94E-07	5.44E-03	1.10E-03	2.58E-02	0.00E+00	2.6776E-01	4.8970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9405110	0.9751080	0.9791640	0.9958290	1.0000000	7.3868E+01	1.8857E+00
2	1.38E-03	1.64E-02	1.23E-02	4.51E-02	0.00E+00	1.2400E+00	7.4514E+01
3	9.28E-06	5.66E-03	2.24E-03	2.29E-02	0.00E+00	4.2870E-01	7.5325E+01
4	8.85E-09	2.86E-03	3.68E-04	1.44E-02	0.00E+00	2.1695E-01	7.5537E+01

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00
3		0.00E+00	0.00E+00
4			0.00E+00

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**
1-Beta	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00
Gamma		0.00E+00	0.00E+00
Delta			0.00E+00

Avg. Impact Vector	**CCCG=2**	**CCCG=3**	**CCCG=4**
Adj. Ind. Events	3.00	3.00	3.00
N 1	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000
N 3		0.0000	0.0000
N 4			0.0000

2.9 PORVs

2.9.1 Pooled PORVs

2.9.1.1 POWER OPERATED RELIEF VALVES FAIL TO OPEN ALL SYSTEMS

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 :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 451
Total Number of Common-Cause Failure Events: 74

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8986480	0.9330750	0.9348050	0.9616070	0.9281290	1.5558E+02	1.1159E+01
2	3.84E-02	6.69E-02	6.52E-02	1.01E-01	7.19E-02	1.1159E+01	1.5558E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8974750	0.9258660	0.9269530	0.9505350	0.9151500	2.4113E+02	1.9307E+01
2	3.32E-02	5.41E-02	5.29E-02	7.89E-02	6.17E-02	1.4079E+01	2.4636E+02
3	8.18E-03	2.01E-02	1.89E-02	3.61E-02	2.32E-02	5.2283E+00	2.5521E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9107350	0.9338360	0.9346560	0.9541300	0.9233210	3.2800E+02	2.3239E+01
2	1.77E-02	3.13E-02	3.04E-02	4.79E-02	3.50E-02	1.0983E+01	3.4026E+02
3	1.38E-02	2.61E-02	2.52E-02	4.14E-02	3.14E-02	9.1670E+00	3.4207E+02
4	2.47E-03	8.80E-03	7.88E-03	1.82E-02	1.03E-02	3.0893E+00	3.4815E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9251300	0.9433310	0.9439390	0.9594610	0.9294990	4.5902E+02	2.7575E+01
2	1.30E-02	2.29E-02	2.23E-02	3.51E-02	2.67E-02	1.1167E+01	4.7543E+02
3	8.62E-03	1.70E-02	1.63E-02	2.76E-02	2.14E-02	8.2734E+00	4.7832E+02
4	5.31E-03	1.22E-02	1.15E-02	2.14E-02	1.62E-02	5.9397E+00	4.8066E+02
5	8.99E-04	4.51E-03	3.85E-03	1.04E-02	6.19E-03	2.1949E+00	4.8440E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9311200	0.9470990	0.9476080	0.9613560	0.9338970	5.5729E+02	3.1128E+01
2	1.12E-02	1.96E-02	1.91E-02	2.98E-02	2.28E-02	1.1535E+01	5.7688E+02
3	6.18E-03	1.27E-02	1.22E-02	2.11E-02	1.57E-02	7.4850E+00	5.8093E+02
4	5.01E-03	1.10E-02	1.05E-02	1.89E-02	1.45E-02	6.4892E+00	5.8193E+02
5	2.16E-03	6.51E-03	5.96E-03	1.27E-02	8.85E-03	3.8295E+00	5.8459E+02
6	4.67E-04	3.04E-03	2.50E-03	7.46E-03	4.23E-03	1.7889E+00	5.8663E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9383620	0.9519310	0.9523400	0.9641190	0.9372880	7.0564E+02	3.5632E+01
2	1.02E-02	1.72E-02	1.68E-02	2.58E-02	2.07E-02	1.2773E+01	7.2850E+02
3	4.77E-03	9.91E-03	9.48E-03	1.65E-02	1.25E-02	7.3480E+00	7.3392E+02
4	3.86E-03	8.57E-03	8.14E-03	1.48E-02	1.16E-02	6.3559E+00	7.3492E+02
5	2.74E-03	6.87E-03	6.43E-03	1.25E-02	9.75E-03	5.0890E+00	7.3618E+02
6	8.02E-04	3.43E-03	3.00E-03	7.55E-03	5.03E-03	2.5445E+00	7.3873E+02
7	2.47E-04	2.05E-03	1.63E-03	5.32E-03	3.18E-03	1.5216E+00	7.3975E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9417700	0.9541430	0.9545010	0.9653000	0.9401480	8.1055E+02	3.8956E+01
2	9.56E-03	1.59E-02	1.55E-02	2.36E-02	1.92E-02	1.3519E+01	8.3599E+02
3	4.15E-03	8.63E-03	8.25E-03	1.44E-02	1.08E-02	7.3350E+00	8.4217E+02
4	2.91E-03	6.79E-03	6.41E-03	1.20E-02	8.91E-03	5.7690E+00	8.4374E+02
5	2.67E-03	6.43E-03	6.05E-03	1.15E-02	8.98E-03	5.4640E+00	8.4404E+02
6	1.45E-03	4.43E-03	4.05E-03	8.71E-03	6.41E-03	3.7618E+00	8.4574E+02
7	2.89E-04	2.01E-03	1.64E-03	5.02E-03	2.98E-03	1.7093E+00	8.4780E+02
8	1.71E-04	1.65E-03	1.28E-03	4.39E-03	2.56E-03	1.3980E+00	8.4811E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9281290	0.9151500	0.9233210	0.9294990	0.9338970	0.9372880	0.9401480
2	7.19E-02	6.17E-02	3.50E-02	2.67E-02	2.28E-02	2.07E-02	1.92E-02
3		2.32E-02	3.14E-02	2.14E-02	1.57E-02	1.25E-02	1.08E-02
4			1.03E-02	1.62E-02	1.45E-02	1.16E-02	8.91E-03
5				6.19E-03	8.85E-03	9.75E-03	8.98E-03
6					4.23E-03	5.03E-03	6.41E-03
7						3.18E-03	2.98E-03
8							2.56E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.28E-01	9.15E-01	9.23E-01	9.29E-01	9.34E-01	9.37E-01	9.40E-01
Beta	7.19E-02	8.49E-02	7.67E-02	7.05E-02	6.61E-02	6.27E-02	5.99E-02
Gamma		2.73E-01	5.44E-01	6.22E-01	6.54E-01	6.69E-01	6.79E-01
Delta			2.47E-01	5.12E-01	6.37E-01	7.03E-01	7.34E-01
Epsilon				2.76E-01	4.75E-01	6.09E-01	7.01E-01
Mu					3.23E-01	4.57E-01	5.71E-01
Upsilon						3.88E-01	4.64E-01
Sigma							4.62E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	116.84	175.26	233.68	292.10	350.52	408.94	467.36
N 1	21.3222	20.7686	23.4530	25.8626	27.8385	29.4986	30.9806
N 2	10.6988	13.2147	9.7434	9.1266	9.2550	9.7009	10.1771
N 3		4.9605	8.7383	7.3197	6.3605	5.8298	5.7220
N 4			2.8724	5.5529	5.8645	5.4028	4.7252
N 5				2.1178	3.5868	4.5610	4.7612
N 6					1.7142	2.3508	3.4000
N 7						1.4896	1.5819
N 8							1.3580

2.9.1.2 POWER OPERATED RELIEF VALVES FAIL TO CLOSE ALL SYSTEMS

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 :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 90
Total Number of Common-Cause Failure Events: 2

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9184280	0.9682770	0.9746730	0.9962320	0.9645920	4.5467E+01	1.4896E+00
2	3.77E-03	3.17E-02	2.53E-02	8.16E-02	3.54E-02	1.4896E+00	4.5467E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9435940	0.9751780	0.9786380	0.9949330	0.9748260	8.7101E+01	2.2171E+00
2	1.81E-03	1.62E-02	1.28E-02	4.24E-02	1.35E-02	1.4471E+00	8.7871E+01
3	2.11E-04	8.62E-03	5.33E-03	2.82E-02	1.17E-02	7.6996E-01	8.8548E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9514020	0.9765310	0.9789380	0.9934340	0.9796550	1.2675E+02	3.0463E+00
2	1.73E-03	1.27E-02	1.02E-02	3.18E-02	7.05E-03	1.6421E+00	1.2815E+02
3	3.15E-04	7.22E-03	4.90E-03	2.21E-02	8.91E-03	9.3710E-01	1.2886E+02
4	9.79E-06	3.60E-03	1.54E-03	1.41E-02	4.38E-03	4.6705E-01	1.2933E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9596700	0.9781380	0.9795990	0.9916130	0.9823370	2.1081E+02	4.7118E+00
2	2.46E-03	1.11E-02	9.66E-03	2.48E-02	5.05E-03	2.3986E+00	2.1312E+02
3	6.13E-04	6.26E-03	4.81E-03	1.68E-02	5.56E-03	1.3487E+00	2.1417E+02
4	8.31E-05	3.54E-03	2.17E-03	1.17E-02	5.29E-03	7.6234E-01	2.1476E+02
5	1.11E-09	9.38E-04	1.00E-04	4.82E-03	1.76E-03	2.0213E-01	2.1532E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9625070	0.9787160	0.9798940	0.9908940	0.9839710	2.6250E+02	5.7084E+00
2	2.44E-03	9.94E-03	8.75E-03	2.15E-02	4.53E-03	2.6648E+00	2.6554E+02
3	5.60E-04	5.27E-03	4.10E-03	1.40E-02	3.39E-03	1.4126E+00	2.6680E+02
4	1.93E-04	3.73E-03	2.59E-03	1.12E-02	4.43E-03	1.0011E+00	2.6721E+02
5	6.70E-06	1.84E-03	8.27E-04	7.09E-03	2.94E-03	4.9272E-01	2.6772E+02
6	7.70E-13	5.12E-04	1.50E-05	2.86E-03	7.36E-04	1.3722E-01	2.6807E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9656550	0.9791150	0.9799650	0.9896590	0.9850330	3.6456E+02	7.7764E+00
2	2.95E-03	9.44E-03	8.58E-03	1.89E-02	4.49E-03	3.5159E+00	3.6882E+02
3	6.89E-04	4.67E-03	3.82E-03	1.16E-02	2.22E-03	1.7379E+00	3.7060E+02
4	2.97E-04	3.41E-03	2.57E-03	9.38E-03	3.19E-03	1.2688E+00	3.7107E+02
5	7.21E-05	2.26E-03	1.45E-03	7.19E-03	3.16E-03	8.4045E-01	3.7150E+02
6	3.72E-07	9.40E-04	2.89E-04	4.09E-03	1.58E-03	3.5003E-01	3.7199E+02
7	4.53E-24	1.70E-04	2.80E-08	9.65E-04	3.17E-04	6.3327E-02	3.7227E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9672540	0.9795570	0.9802900	0.9893480	0.9857650	4.2333E+02	8.8349E+00
2	2.99E-03	8.93E-03	8.18E-03	1.74E-02	4.59E-03	3.8588E+00	4.2831E+02
3	6.49E-04	4.17E-03	3.44E-03	1.02E-02	1.69E-03	1.8033E+00	4.3036E+02
4	2.65E-04	2.97E-03	2.25E-03	8.15E-03	2.13E-03	1.2844E+00	4.3088E+02
5	1.25E-04	2.35E-03	1.64E-03	6.99E-03	2.77E-03	1.0154E+00	4.3115E+02
6	1.27E-05	1.38E-03	7.24E-04	4.97E-03	2.08E-03	5.9624E-01	4.3157E+02
7	2.01E-09	5.12E-04	6.84E-05	2.57E-03	8.32E-04	2.2119E-01	4.3194E+02
8	5.44E-27	1.29E-04	5.25E-09	7.08E-04	1.38E-04	5.5605E-02	4.3211E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9645920	0.9748260	0.9796550	0.9823370	0.9839710	0.9850330	0.9857650
2	3.54E-02	1.35E-02	7.05E-03	5.05E-03	4.53E-03	4.49E-03	4.59E-03
3		1.17E-02	8.91E-03	5.56E-03	3.39E-03	2.22E-03	1.69E-03
4			4.38E-03	5.29E-03	4.43E-03	3.19E-03	2.13E-03
5				1.76E-03	2.94E-03	3.16E-03	2.77E-03
6					7.36E-04	1.58E-03	2.08E-03
7						3.17E-04	8.32E-04
8							1.38E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.65E-01	9.75E-01	9.80E-01	9.82E-01	9.84E-01	9.85E-01	9.86E-01
Beta	3.54E-02	2.52E-02	2.03E-02	1.77E-02	1.60E-02	1.50E-02	1.42E-02
Gamma		4.63E-01	6.54E-01	7.14E-01	7.18E-01	7.00E-01	6.78E-01
Delta			3.30E-01	5.59E-01	7.05E-01	7.88E-01	8.25E-01
Epsilon				2.50E-01	4.54E-01	6.13E-01	7.32E-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	27.69	41.54	55.38	69.23	83.08	96.92	110.77
N 1	0.3589	0.4560	0.5066	0.5164	0.4910	0.4353	0.3541
N 2	1.0296	0.5823	0.4021	0.3586	0.3844	0.4438	0.5174
N 3		0.5022	0.5084	0.3950	0.2881	0.2197	0.1903
N 4			0.2501	0.3755	0.3764	0.3157	0.2406
N 5				0.1250	0.2500	0.3125	0.3126
N 6					0.0625	0.1563	0.2344
N 7						0.0313	0.0938
N 8							0.0156

2.9.2 PWR Steam Generator PORV

2.9.2.1 PWR MAIN STEAM PORV FAIL TO OPEN SPAR: ADV-CC

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 :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 235

Total Number of Common-Cause Failure Events: 20

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9474590	0.9733620	0.9756560	0.9914300	0.9732250	1.3219E+02	3.6176E+00
2	8.57E-03	2.66E-02	2.43E-02	5.25E-02	2.68E-02	3.6176E+00	1.3219E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9446680	0.9666500	0.9680580	0.9838360	0.9642940	2.1269E+02	7.3379E+00
2	1.03E-02	2.47E-02	2.33E-02	4.40E-02	2.63E-02	5.4363E+00	2.1459E+02
3	1.45E-03	8.64E-03	7.21E-03	2.08E-02	9.40E-03	1.9016E+00	2.1813E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9503070	0.9684140	0.9694460	0.9830010	0.9666150	2.9239E+02	9.5366E+00
2	6.60E-03	1.66E-02	1.56E-02	3.02E-02	1.65E-02	5.0170E+00	2.9691E+02
3	2.93E-03	1.03E-02	9.27E-03	2.14E-02	1.17E-02	3.1203E+00	2.9881E+02
4	4.84E-04	4.63E-03	3.60E-03	1.23E-02	5.16E-03	1.3993E+00	3.0053E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9571540	0.9714880	0.9722160	0.9833290	0.9691570	4.1655E+02	1.2225E+01
2	5.72E-03	1.34E-02	1.26E-02	2.36E-02	1.30E-02	5.7363E+00	4.2304E+02
3	2.30E-03	7.73E-03	6.98E-03	1.57E-02	8.31E-03	3.3155E+00	4.2546E+02
4	8.32E-04	4.67E-03	3.92E-03	1.10E-02	5.68E-03	2.0011E+00	4.2677E+02
5	2.03E-04	2.73E-03	2.01E-03	7.74E-03	3.85E-03	1.1723E+00	4.2760E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9601900	0.9728170	0.9734210	0.9833970	0.9709460	5.0822E+02	1.4201E+01
2	5.19E-03	1.17E-02	1.11E-02	2.04E-02	1.14E-02	6.1334E+00	5.1629E+02
3	1.83E-03	6.25E-03	5.63E-03	1.28E-02	6.31E-03	3.2632E+00	5.1916E+02
4	1.06E-03	4.70E-03	4.09E-03	1.04E-02	5.40E-03	2.4560E+00	5.1996E+02
5	1.90E-04	2.34E-03	1.75E-03	6.53E-03	2.89E-03	1.2235E+00	5.2120E+02
6	1.46E-04	2.15E-03	1.56E-03	6.18E-03	3.10E-03	1.1246E+00	5.2130E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9633750	0.9742030	0.9746780	0.9834240	0.9722780	6.5013E+02	1.7215E+01
2	5.17E-03	1.08E-02	1.03E-02	1.81E-02	1.05E-02	7.2174E+00	6.6013E+02
3	1.65E-03	5.29E-03	4.80E-03	1.06E-02	5.10E-03	3.5286E+00	6.6382E+02
4	9.99E-04	4.04E-03	3.55E-03	8.73E-03	4.42E-03	2.6946E+00	6.6465E+02
5	4.87E-04	2.88E-03	2.40E-03	6.91E-03	3.54E-03	1.9219E+00	6.6542E+02
6	3.19E-05	1.19E-03	7.44E-04	3.87E-03	1.53E-03	7.9453E-01	6.6655E+02
7	9.34E-05	1.59E-03	1.12E-03	4.65E-03	2.61E-03	1.0583E+00	6.6629E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9650790	0.9749950	0.9754090	0.9835010	0.9733050	7.4865E+02	1.9200E+01
2	5.07E-03	1.02E-02	9.82E-03	1.68E-02	1.01E-02	7.8622E+00	7.5999E+02
3	1.47E-03	4.66E-03	4.23E-03	9.29E-03	4.38E-03	3.5761E+00	7.6427E+02
4	8.32E-04	3.43E-03	3.01E-03	7.47E-03	3.55E-03	2.6370E+00	7.6521E+02
5	5.63E-04	2.84E-03	2.43E-03	6.55E-03	3.30E-03	2.1835E+00	7.6567E+02
6	1.86E-04	1.81E-03	1.40E-03	4.83E-03	2.29E-03	1.3897E+00	7.6646E+02
7	2.50E-06	6.48E-04	2.94E-04	2.49E-03	8.26E-04	4.9789E-01	7.6735E+02
8	8.01E-05	1.37E-03	9.72E-04	4.03E-03	2.26E-03	1.0539E+00	7.6680E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1	0.9732250	0.9642940	0.9666150	0.9691570	0.9709460	0.9722780	0.9733050
2	2.68E-02	2.63E-02	1.65E-02	1.30E-02	1.14E-02	1.05E-02	1.01E-02
3		9.40E-03	1.17E-02	8.31E-03	6.31E-03	5.10E-03	4.38E-03
4			5.16E-03	5.68E-03	5.40E-03	4.42E-03	3.55E-03
5				3.85E-03	2.89E-03	3.54E-03	3.30E-03
6					3.10E-03	1.53E-03	2.29E-03
7						2.61E-03	8.26E-04
8							2.26E-03

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1-Beta	9.73E-01	9.64E-01	9.67E-01	9.69E-01	9.71E-01	9.72E-01	9.73E-01
Beta	2.68E-02	3.57E-02	3.34E-02	3.08E-02	2.91E-02	2.77E-02	2.67E-02
Gamma		2.63E-01	5.06E-01	5.78E-01	6.09E-01	6.20E-01	6.22E-01
Delta			3.05E-01	5.34E-01	6.44E-01	7.03E-01	7.36E-01
Epsilon				4.04E-01	5.26E-01	6.34E-01	7.10E-01
Mu					5.17E-01	5.39E-01	6.20E-01
Upsilon						6.31E-01	5.74E-01
Sigma							7.32E-01

Avg. Impact Vector	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
Adj. Ind. Events	105.62	158.43	211.24	264.04	316.85	369.66	422.47
N 1	9.1515	9.1557	10.2801	11.4543	12.4418	13.2735	13.9675
N 2	3.1576	4.5715	3.7770	3.6963	3.8530	4.1453	4.5208
N 3		1.6338	2.6916	2.3618	2.1387	2.0104	1.9631
N 4			1.1823	1.6143	1.8313	1.7415	1.5932
N 5				1.0952	0.9808	1.3940	1.4807
N 6					1.0499	0.6008	1.0279
N 7						1.0263	0.3705
N 8							1.0139

2.9.2.2 PWR MAIN STEAM PORV FAIL TO CLOSE

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 CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 41
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9366570	0.9756170	0.9806930	0.9972160	0.9761900	5.8418E+01	1.4600E+00
2	2.79E-03	2.44E-02	1.93E-02	6.33E-02	2.38E-02	1.4600E+00	5.8418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9547960	0.9803890	0.9832550	0.9961870	0.9840000	1.0661E+02	2.1326E+00
2	1.26E-03	1.26E-02	9.71E-03	3.35E-02	8.00E-03	1.3648E+00	1.0738E+02
3	1.71E-04	7.06E-03	4.36E-03	2.32E-02	8.00E-03	7.6776E-01	1.0797E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9609680	0.9814730	0.9834970	0.9950760	0.9879520	1.5287E+02	2.8856E+00
2	1.12E-03	9.57E-03	7.56E-03	2.49E-02	3.01E-03	1.4900E+00	1.5427E+02
3	2.54E-04	5.96E-03	4.03E-03	1.83E-02	6.02E-03	9.2870E-01	1.5483E+02
4	8.14E-06	3.00E-03	1.29E-03	1.18E-02	3.01E-03	4.6695E-01	1.5529E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9663300	0.9820270	0.9833050	0.9933460	0.9903380	2.4356E+02	4.4577E+00
2	1.72E-03	8.73E-03	7.45E-03	2.01E-02	1.21E-03	2.1650E+00	2.4585E+02
3	5.10E-04	5.36E-03	4.10E-03	1.45E-02	3.62E-03	1.3287E+00	2.4669E+02
4	7.20E-05	3.07E-03	1.88E-03	1.01E-02	3.62E-03	7.6184E-01	2.4726E+02
5	9.67E-10	8.15E-04	8.72E-05	4.19E-03	1.21E-03	2.0213E-01	2.4782E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9688280	0.9825990	0.9836330	0.9928230	0.9919350	3.0193E+02	5.3471E+00
2	1.64E-03	7.62E-03	6.59E-03	1.72E-02	5.04E-04	2.3429E+00	3.0493E+02
3	4.53E-04	4.47E-03	3.45E-03	1.20E-02	2.02E-03	1.3745E+00	3.0590E+02
4	1.67E-04	3.25E-03	2.26E-03	9.73E-03	3.02E-03	9.9971E-01	3.0628E+02
5	5.85E-06	1.60E-03	7.21E-04	6.19E-03	2.02E-03	4.9272E-01	3.0678E+02
6	6.72E-13	4.47E-04	1.31E-05	2.50E-03	5.04E-04	1.3722E-01	3.0714E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9708760	0.9825420	0.9833040	0.9916000	0.9930780	4.1070E+02	7.2973E+00
2	2.09E-03	7.42E-03	6.65E-03	1.54E-02	2.17E-04	3.1034E+00	4.1489E+02
3	5.60E-04	4.01E-03	3.25E-03	1.00E-02	1.08E-03	1.6745E+00	4.1632E+02
4	2.62E-04	3.03E-03	2.28E-03	8.34E-03	2.16E-03	1.2656E+00	4.1673E+02
5	6.42E-05	2.01E-03	1.29E-03	6.40E-03	2.16E-03	8.4045E-01	4.1716E+02
6	3.31E-07	8.37E-04	2.57E-04	3.64E-03	1.08E-03	3.5003E-01	4.1765E+02
7	4.04E-24	1.52E-04	2.50E-08	8.59E-04	2.17E-04	6.3327E-02	4.1793E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9723630	0.9830110	0.9836690	0.9914030	0.9939390	4.7621E+02	8.2303E+00
2	2.08E-03	6.93E-03	6.26E-03	1.41E-02	9.45E-05	3.3570E+00	4.8108E+02
3	5.06E-04	3.52E-03	2.87E-03	8.78E-03	5.68E-04	1.7068E+00	4.8273E+02
4	2.33E-04	2.64E-03	1.99E-03	7.25E-03	1.42E-03	1.2782E+00	4.8316E+02
5	1.12E-04	2.10E-03	1.46E-03	6.24E-03	1.89E-03	1.0153E+00	4.8343E+02
6	1.13E-05	1.23E-03	6.46E-04	4.44E-03	1.42E-03	5.9624E-01	4.8384E+02
7	1.80E-09	4.57E-04	6.11E-05	2.29E-03	5.68E-04	2.2119E-01	4.8422E+02
8	4.85E-27	1.15E-04	4.68E-09	6.32E-04	9.45E-05	5.5605E-02	4.8438E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9761900	0.9840000	0.9879520	0.9903380	0.9919350	0.9930780	0.9939390
2	2.38E-02	8.00E-03	3.01E-03	1.21E-03	5.04E-04	2.17E-04	9.45E-05
3		8.00E-03	6.02E-03	3.62E-03	2.02E-03	1.08E-03	5.68E-04
4			3.01E-03	3.62E-03	3.02E-03	2.16E-03	1.42E-03
5				1.21E-03	2.02E-03	2.16E-03	1.89E-03
6					5.04E-04	1.08E-03	1.42E-03
7						2.17E-04	5.68E-04
8							9.45E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.76E-01	9.84E-01	9.88E-01	9.90E-01	9.92E-01	9.93E-01	9.94E-01
Beta	2.38E-02	1.60E-02	1.20E-02	9.66E-03	8.06E-03	6.92E-03	6.06E-03
Gamma		5.00E-01	7.50E-01	8.75E-01	9.38E-01	9.69E-01	9.84E-01
Delta			3.33E-01	5.71E-01	7.33E-01	8.39E-01	9.05E-01
Epsilon				2.50E-01	4.55E-01	6.15E-01	7.37E-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	41.00	61.50	82.00	102.50	123.00	143.50	164.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	1.0000	0.5000	0.2500	0.1250	0.0625	0.0313	0.0156
N 3		0.5000	0.5000	0.3750	0.2500	0.1563	0.0938
N 4			0.2500	0.3750	0.3750	0.3125	0.2344
N 5				0.1250	0.2500	0.3125	0.3125
N 6					0.0625	0.1563	0.2344
N 7						0.0313	0.0938
N 8							0.0156

2.9.3 PWR Pressurizer Power Operated Relief Valves

2.9.3.1 PRESSURIZER PORVS FAIL TO OPEN SPAR: PPR-SRV-CC

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 :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 80
Total Number of Common-Cause Failure Events: 12

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8961650	0.9395900	0.9425100	0.9730290	0.9320230	9.3788E+01	6.0300E+00
2	2.70E-02	6.04E-02	5.75E-02	1.04E-01	6.80E-02	6.0300E+00	9.3788E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9112200	0.9434510	0.9452350	0.9695840	0.9309760	1.5572E+02	9.3336E+00
2	1.94E-02	4.13E-02	3.94E-02	6.94E-02	5.00E-02	6.8113E+00	1.5824E+02
3	3.56E-03	1.53E-02	1.34E-02	3.35E-02	1.90E-02	2.5223E+00	1.6253E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9284080	0.9533590	0.9546760	0.9738040	0.9436630	2.1760E+02	1.0646E+01
2	8.32E-03	2.13E-02	1.99E-02	3.90E-02	2.33E-02	4.8580E+00	2.2339E+02
3	7.20E-03	1.95E-02	1.81E-02	3.65E-02	2.58E-02	4.4454E+00	2.2380E+02
4	5.71E-04	5.88E-03	4.51E-03	1.59E-02	7.24E-03	1.3422E+00	2.2690E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9320230	0.9309760	0.9436630
2	6.80E-02	5.00E-02	2.33E-02
3		1.90E-02	2.58E-02
4			7.24E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.32E-01	9.31E-01	9.44E-01
Beta	6.80E-02	6.90E-02	5.63E-02
Gamma		2.75E-01	5.87E-01
Delta			2.19E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	71.11	106.67	142.22
N 1	5.2600	3.9435	4.5127
N 2	5.5700	5.9465	3.6180
N 3		2.2545	4.0167
N 4			1.1253

2.9.3.2 PRESSURIZER PORVS FAIL TO CLOSE

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 :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 25
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9577330	0.9892710	0.9954190	0.9999700	1.0000000	4.2418E+01	4.6002E-01
2	2.71E-05	1.07E-02	4.58E-03	4.23E-02	0.00E+00	4.6002E-01	4.2418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9547700	0.9841020	0.9883520	0.9988960	1.0000000	7.0105E+01	1.1325E+00
2	4.26E-04	1.21E-02	7.98E-03	3.81E-02	0.00E+00	8.6476E-01	7.0373E+01
3	1.34E-07	3.76E-03	7.57E-04	1.78E-02	0.00E+00	2.6776E-01	7.0970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9537810	0.9807100	0.9838860	0.9967840	1.0000000	9.5868E+01	1.8857E+00
2	1.06E-03	1.27E-02	9.55E-03	3.50E-02	0.00E+00	1.2400E+00	9.6514E+01
3	7.18E-06	4.39E-03	1.73E-03	1.78E-02	0.00E+00	4.2870E-01	9.7325E+01
4	6.84E-09	2.22E-03	2.85E-04	1.12E-02	0.00E+00	2.1695E-01	9.7537E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9591820	0.9796030	0.9814580	0.9936840	1.0000000	1.6606E+02	3.4577E+00
2	2.21E-03	1.20E-02	1.02E-02	2.82E-02	0.00E+00	2.0400E+00	1.6748E+02
3	2.57E-04	5.63E-03	3.84E-03	1.71E-02	0.00E+00	9.5369E-01	1.6856E+02
4	1.89E-06	2.28E-03	7.99E-04	9.58E-03	0.00E+00	3.8684E-01	1.6913E+02
5	4.78E-20	4.55E-04	4.42E-07	2.65E-03	0.00E+00	7.7129E-02	1.6944E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9606930	0.9791290	0.9806420	0.9923920	1.0000000	2.0393E+02	4.3471E+00
2	2.29E-03	1.09E-02	9.43E-03	2.48E-02	0.00E+00	2.2804E+00	2.0600E+02
3	3.67E-04	5.40E-03	3.92E-03	1.55E-02	0.00E+00	1.1245E+00	2.0715E+02
4	3.36E-05	3.00E-03	1.63E-03	1.06E-02	0.00E+00	6.2471E-01	2.0765E+02
5	1.41E-08	1.17E-03	1.92E-04	5.69E-03	0.00E+00	2.4272E-01	2.0803E+02
6	1.11E-20	3.59E-04	2.68E-07	2.08E-03	0.00E+00	7.4722E-02	2.0820E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9636680	0.9789040	0.9799630	0.9905170	1.0000000	2.9220E+02	6.2971E+00
2	2.88E-03	1.03E-02	9.22E-03	2.14E-02	0.00E+00	3.0721E+00	2.9543E+02
3	6.11E-04	5.09E-03	4.03E-03	1.32E-02	0.00E+00	1.5182E+00	2.9698E+02
4	1.45E-04	3.19E-03	2.18E-03	9.71E-03	0.00E+00	9.5310E-01	2.9754E+02
5	9.21E-06	1.77E-03	8.45E-04	6.66E-03	0.00E+00	5.2795E-01	2.9797E+02
6	4.20E-10	6.49E-04	6.19E-05	3.37E-03	0.00E+00	1.9373E-01	2.9830E+02
7	4.62E-44	1.07E-04	7.71E-13	4.41E-04	0.00E+00	3.2027E-02	2.9847E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9649390	0.9790090	0.9799280	0.9899300	1.0000000	3.3721E+02	7.2302E+00
2	2.91E-03	9.70E-03	8.77E-03	1.97E-02	0.00E+00	3.3414E+00	3.4110E+02
3	6.19E-04	4.68E-03	3.77E-03	1.19E-02	0.00E+00	1.6130E+00	3.4283E+02
4	1.73E-04	3.03E-03	2.14E-03	8.93E-03	0.00E+00	1.0438E+00	3.4340E+02
5	3.61E-05	2.04E-03	1.19E-03	6.93E-03	0.00E+00	7.0280E-01	3.4374E+02
6	5.35E-07	1.05E-03	3.37E-04	4.52E-03	0.00E+00	3.6184E-01	3.4408E+02
7	1.10E-13	3.70E-04	7.83E-06	2.09E-03	0.00E+00	1.2739E-01	3.4431E+02
8	5.07E-36	1.16E-04	5.04E-11	5.58E-04	0.00E+00	4.0005E-02	3.4440E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	25.00	25.00	25.00	25.00	25.00	25.00	25.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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

2.10 Main Steam Isolation Valves

2.10.1 PWR Main Steam Isolation Valves

2.10.1.1 PWR MSIV FAIL TO OPEN

System :	MAIN STEAM
Component :	AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 28
Total Number of Common-Cause Failure Events: 1

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8857840	0.9555930	0.9645080	0.9948400	0.9333330	3.1418E+01	1.4600E+00
2	5.16E-03	4.44E-02	3.55E-02	1.14E-01	6.67E-02	1.4600E+00	3.1418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9283390	0.9687480	0.9732160	0.9938740	0.9545450	6.6105E+01	2.1326E+00
2	4.45E-04	1.27E-02	8.33E-03	3.97E-02	0.00E+00	8.6476E-01	6.7373E+01
3	1.64E-03	1.86E-02	1.41E-02	5.08E-02	4.55E-02	1.2678E+00	6.6970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9404800	0.9716400	0.9746780	0.9924200	0.9655170	9.8868E+01	2.8857E+00
2	1.02E-03	1.22E-02	9.17E-03	3.37E-02	0.00E+00	1.2400E+00	1.0051E+02
3	6.89E-06	4.21E-03	1.66E-03	1.71E-02	0.00E+00	4.2870E-01	1.0132E+02
4	9.66E-04	1.20E-02	8.95E-03	3.33E-02	3.45E-02	1.2170E+00	1.0054E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9538500	0.9753060	0.9770450	0.9908380	0.9722220	1.7606E+02	4.4577E+00
2	2.07E-03	1.13E-02	9.55E-03	2.65E-02	0.00E+00	2.0400E+00	1.7848E+02
3	2.41E-04	5.28E-03	3.60E-03	1.61E-02	0.00E+00	9.5369E-01	1.7956E+02
4	1.84E-04	4.91E-03	3.25E-03	1.53E-02	1.39E-02	8.8684E-01	1.7963E+02
5	2.54E-05	3.20E-03	1.64E-03	1.16E-02	1.39E-02	5.7713E-01	1.7994E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9577520	0.9763690	0.9777630	0.9902360	0.9767440	2.2093E+02	5.3471E+00
2	2.11E-03	1.01E-02	8.67E-03	2.28E-02	0.00E+00	2.2804E+00	2.2400E+02
3	3.37E-04	4.97E-03	3.61E-03	1.43E-02	0.00E+00	1.1245E+00	2.2515E+02
4	1.39E-04	3.87E-03	2.54E-03	1.21E-02	5.81E-03	8.7471E-01	2.2540E+02
5	7.06E-05	3.28E-03	1.98E-03	1.09E-02	1.16E-02	7.4272E-01	2.2553E+02
6	3.09E-07	1.44E-03	3.97E-04	6.40E-03	5.81E-03	3.2472E-01	2.2595E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9624190	0.9774430	0.9784230	0.9891290	0.9800000	3.1620E+02	7.2971E+00
2	2.66E-03	9.50E-03	8.51E-03	1.97E-02	0.00E+00	3.0721E+00	3.2043E+02
3	5.63E-04	4.69E-03	3.72E-03	1.21E-02	0.00E+00	1.5182E+00	3.2198E+02
4	2.05E-04	3.33E-03	2.38E-03	9.71E-03	2.50E-03	1.0781E+00	3.2242E+02
5	1.10E-04	2.79E-03	1.86E-03	8.66E-03	7.50E-03	9.0295E-01	3.2259E+02
6	1.31E-05	1.76E-03	8.91E-04	6.44E-03	7.50E-03	5.6873E-01	3.2293E+02
7	1.02E-11	4.85E-04	2.39E-05	2.65E-03	2.50E-03	1.5703E-01	3.2334E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9644860	0.9781370	0.9789770	0.9889150	0.9824560	3.6821E+02	8.2302E+00
2	2.66E-03	8.88E-03	8.02E-03	1.80E-02	0.00E+00	3.3414E+00	3.7310E+02
3	5.66E-04	4.28E-03	3.45E-03	1.09E-02	0.00E+00	1.6130E+00	3.7483E+02
4	1.92E-04	2.94E-03	2.12E-03	8.48E-03	1.10E-03	1.1063E+00	3.7533E+02
5	1.15E-04	2.53E-03	1.72E-03	7.70E-03	4.39E-03	9.5280E-01	3.7549E+02
6	4.09E-05	1.96E-03	1.18E-03	6.53E-03	6.58E-03	7.3684E-01	3.7570E+02
7	6.95E-07	1.00E-03	3.40E-04	4.25E-03	4.39E-03	3.7739E-01	3.7606E+02
8	3.28E-16	2.72E-04	1.87E-06	1.58E-03	1.10E-03	1.0250E-01	3.7634E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9333330	0.9545450	0.9655170	0.9722220	0.9767440	0.9800000	0.9824560
2	6.67E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		4.55E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			3.45E-02	1.39E-02	5.81E-03	2.50E-03	1.10E-03
5				1.39E-02	1.16E-02	7.50E-03	4.39E-03
6					5.81E-03	7.50E-03	6.58E-03
7						2.50E-03	4.39E-03
8							1.10E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.33E-01	9.55E-01	9.66E-01	9.72E-01	9.77E-01	9.80E-01	9.82E-01
Beta	6.67E-02	4.55E-02	3.45E-02	2.78E-02	2.33E-02	2.00E-02	1.75E-02
Gamma		1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Delta			1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
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	14.00	21.00	28.00	35.00	42.00	49.00	56.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 3		1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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

2.10.1.2 PWR MSIV FAIL TO CLOSE

System :	MAIN STEAM
Component :	AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 84
Total Number of Common-Cause Failure Events: 11

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8477390	0.9109940	0.9151030	0.9601880	0.8877280	6.0580E+01	5.9188E+00
2	3.98E-02	8.90E-02	8.49E-02	1.52E-01	1.12E-01	5.9188E+00	6.0580E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8968870	0.9374910	0.9399960	0.9695430	0.9123310	1.0884E+02	7.2571E+00
2	8.82E-03	2.90E-02	2.63E-02	5.82E-02	3.58E-02	3.3633E+00	1.1273E+02
3	1.14E-02	3.35E-02	3.09E-02	6.47E-02	5.19E-02	3.8938E+00	1.1220E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9144220	0.9461450	0.9479550	0.9716760	0.9237750	1.5478E+02	8.8101E+00
2	7.02E-03	2.20E-02	2.01E-02	4.35E-02	2.59E-02	3.5940E+00	1.6000E+02
3	4.08E-03	1.64E-02	1.45E-02	3.54E-02	2.49E-02	2.6865E+00	1.6090E+02
4	3.62E-03	1.55E-02	1.35E-02	3.39E-02	2.55E-02	2.5296E+00	1.6106E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9361440	0.9584460	0.9596330	0.9766920	0.9356520	2.4562E+02	1.0649E+01
2	4.81E-03	1.46E-02	1.34E-02	2.87E-02	1.53E-02	3.7530E+00	2.5252E+02
3	3.20E-03	1.17E-02	1.04E-02	2.44E-02	1.83E-02	2.9937E+00	2.5328E+02
4	2.56E-03	1.04E-02	9.17E-03	2.25E-02	2.04E-02	2.6688E+00	2.5360E+02
5	3.97E-04	4.81E-03	3.60E-03	1.34E-02	1.03E-02	1.2334E+00	2.5504E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9436760	0.9626930	0.9636640	0.9783880	0.9439160	3.0411E+02	1.1785E+01
2	3.73E-03	1.16E-02	1.06E-02	2.29E-02	1.04E-02	3.6560E+00	3.1224E+02
3	2.27E-03	8.84E-03	7.83E-03	1.89E-02	1.26E-02	2.7921E+00	3.1310E+02
4	2.16E-03	8.62E-03	7.61E-03	1.85E-02	1.58E-02	2.7226E+00	3.1317E+02
5	1.08E-03	6.21E-03	5.20E-03	1.48E-02	1.30E-02	1.9615E+00	3.1393E+02
6	2.76E-05	2.07E-03	1.15E-03	7.21E-03	4.36E-03	6.5282E-01	3.1524E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9519840	0.9672690	0.9679930	0.9800670	0.9499670	4.1297E+02	1.3975E+01
2	3.63E-03	1.01E-02	9.32E-03	1.91E-02	8.02E-03	4.3031E+00	4.2264E+02
3	1.71E-03	6.62E-03	5.86E-03	1.41E-02	8.51E-03	2.8246E+00	4.2412E+02
4	1.65E-03	6.48E-03	5.73E-03	1.39E-02	1.18E-02	2.7667E+00	4.2418E+02
5	1.26E-03	5.66E-03	4.91E-03	1.26E-02	1.23E-02	2.4169E+00	4.2453E+02
6	3.04E-04	3.14E-03	2.41E-03	8.49E-03	7.48E-03	1.3421E+00	4.2560E+02
7	1.47E-07	7.52E-04	2.04E-04	3.37E-03	1.88E-03	3.2113E-01	4.2662E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9555710	0.9693130	0.9699430	0.9808980	0.9545490	4.7852E+02	1.5149E+01
2	3.45E-03	9.23E-03	8.57E-03	1.72E-02	6.96E-03	4.5547E+00	4.8911E+02
3	1.28E-03	5.31E-03	4.66E-03	1.16E-02	5.80E-03	2.6229E+00	4.9105E+02
4	1.21E-03	5.16E-03	4.51E-03	1.13E-02	8.62E-03	2.5455E+00	4.9112E+02
5	1.18E-03	5.11E-03	4.46E-03	1.13E-02	1.04E-02	2.5211E+00	4.9115E+02
6	6.22E-04	3.80E-03	3.15E-03	9.18E-03	8.68E-03	1.8742E+00	4.9179E+02
7	5.58E-05	1.71E-03	1.11E-03	5.44E-03	4.13E-03	8.4619E-01	4.9282E+02
8	1.16E-10	3.74E-04	3.10E-05	1.97E-03	8.29E-04	1.8451E-01	4.9348E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.8877280	0.9123310	0.9237750	0.9356520	0.9439160	0.9499670	0.9545490
2	1.12E-01	3.58E-02	2.59E-02	1.53E-02	1.04E-02	8.02E-03	6.96E-03
3		5.19E-02	2.49E-02	1.83E-02	1.26E-02	8.51E-03	5.80E-03
4			2.55E-02	2.04E-02	1.58E-02	1.18E-02	8.62E-03
5				1.03E-02	1.30E-02	1.23E-02	1.04E-02
6					4.36E-03	7.48E-03	8.68E-03
7						1.88E-03	4.13E-03
8							8.29E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	8.88E-01	9.12E-01	9.24E-01	9.36E-01	9.44E-01	9.50E-01	9.55E-01
Beta	1.12E-01	8.77E-02	7.62E-02	6.43E-02	5.61E-02	5.00E-02	4.55E-02
Gamma		5.92E-01	6.60E-01	7.62E-01	8.15E-01	8.40E-01	8.47E-01
Delta			5.06E-01	6.28E-01	7.25E-01	7.97E-01	8.49E-01
Epsilon				3.36E-01	5.23E-01	6.47E-01	7.36E-01
Mu					2.52E-01	4.32E-01	5.66E-01
Upsilon						2.01E-01	3.63E-01
Sigma							1.67E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	41.08	61.61	82.15	102.69	123.23	143.77	164.30
N 1	2.0824	2.1251	1.7669	1.8748	1.9538	2.0002	2.0100
N 2	5.4588	2.4985	2.3540	1.7130	1.3756	1.2310	1.2133
N 3		3.6260	2.2578	2.0400	1.6676	1.3064	1.0099
N 4			2.3126	2.2820	2.0979	1.8136	1.5017
N 5				1.1563	1.7188	1.8889	1.8183
N 6					0.5781	1.1484	1.5124
N 7						0.2891	0.7188
N 8							0.1445

2.10.2 BWR Main Steam Isolation Valves

2.10.2.1 BWR MSIV FAIL TO OPEN

System :	MAIN STEAM
Component :	AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 21
Total Number of Common-Cause Failure Events: 2

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9199540	0.9790280	0.9902670	0.9999160	0.9937890	2.3146E+01	4.9582E-01
2	8.14E-05	2.10E-02	9.73E-03	8.00E-02	6.21E-03	4.9582E-01	2.3146E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9378670	0.9773900	0.9828940	0.9980850	0.9875200	5.3596E+01	1.2398E+00
2	8.61E-04	1.77E-02	1.23E-02	5.32E-02	1.25E-02	9.7206E-01	5.3864E+01
3	1.74E-07	4.88E-03	9.86E-04	2.31E-02	0.00E+00	2.6776E-01	5.4568E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9423290	0.9750400	0.9787050	0.9952160	0.9811600	8.2039E+01	2.1002E+00
2	1.95E-03	1.73E-02	1.36E-02	4.51E-02	1.88E-02	1.4545E+00	8.2685E+01
3	8.35E-06	5.10E-03	2.01E-03	2.06E-02	0.00E+00	4.2870E-01	8.3710E+01
4	7.96E-09	2.58E-03	3.31E-04	1.30E-02	0.00E+00	2.1695E-01	8.3922E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9532020	0.9759550	0.9779300	0.9919710	0.9747310	1.5485E+02	3.8152E+00
2	3.34E-03	1.51E-02	1.31E-02	3.37E-02	2.53E-02	2.3975E+00	1.5627E+02
3	2.75E-04	6.01E-03	4.10E-03	1.83E-02	0.00E+00	9.5369E-01	1.5771E+02
4	2.02E-06	2.44E-03	8.53E-04	1.02E-02	0.00E+00	3.8684E-01	1.5828E+02
5	5.11E-20	4.86E-04	4.72E-07	2.83E-03	0.00E+00	7.7129E-02	1.5859E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9554190	0.9756010	0.9771720	0.9904270	0.9681980	1.9526E+02	4.8834E+00
2	3.65E-03	1.41E-02	1.25E-02	2.99E-02	3.18E-02	2.8167E+00	1.9733E+02
3	3.82E-04	5.62E-03	4.08E-03	1.61E-02	0.00E+00	1.1245E+00	1.9902E+02
4	3.50E-05	3.12E-03	1.69E-03	1.11E-02	0.00E+00	6.2471E-01	1.9952E+02
5	1.47E-08	1.21E-03	2.00E-04	5.92E-03	0.00E+00	2.4272E-01	1.9990E+02
6	1.16E-20	3.73E-04	2.79E-07	2.17E-03	0.00E+00	7.4722E-02	2.0007E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9596440	0.9759500	0.9770280	0.9885820	0.9616040	2.8600E+02	7.0479E+00
2	4.34E-03	1.30E-02	1.20E-02	2.55E-02	3.84E-02	3.8229E+00	2.8923E+02
3	6.22E-04	5.18E-03	4.11E-03	1.34E-02	0.00E+00	1.5182E+00	2.9153E+02
4	1.48E-04	3.25E-03	2.22E-03	9.89E-03	0.00E+00	9.5310E-01	2.9209E+02
5	9.39E-06	1.80E-03	8.61E-04	6.78E-03	0.00E+00	5.2795E-01	2.9252E+02
6	4.28E-10	6.61E-04	6.30E-05	3.44E-03	0.00E+00	1.9373E-01	2.9285E+02
7	4.62E-44	1.09E-04	7.86E-13	4.49E-04	0.00E+00	3.2027E-02	2.9302E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9608810	0.9759070	0.9768320	0.9877790	0.9549080	3.3341E+02	8.2312E+00
2	4.61E-03	1.27E-02	1.18E-02	2.40E-02	4.51E-02	4.3424E+00	3.3730E+02
3	6.24E-04	4.72E-03	3.80E-03	1.20E-02	0.00E+00	1.6130E+00	3.4003E+02
4	1.74E-04	3.06E-03	2.16E-03	9.00E-03	0.00E+00	1.0438E+00	3.4060E+02
5	3.64E-05	2.06E-03	1.20E-03	6.98E-03	0.00E+00	7.0280E-01	3.4094E+02
6	5.39E-07	1.06E-03	3.40E-04	4.55E-03	0.00E+00	3.6184E-01	3.4128E+02
7	1.11E-13	3.73E-04	7.89E-06	2.11E-03	0.00E+00	1.2739E-01	3.4151E+02
8	5.11E-36	1.17E-04	5.08E-11	5.63E-04	0.00E+00	4.0005E-02	3.4160E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1	0.9937890	0.9875200	0.9811600	0.9747310	0.9681980	0.9616040	0.9549080
2	6.21E-03	1.25E-02	1.88E-02	2.53E-02	3.18E-02	3.84E-02	4.51E-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	9.94E-01	9.88E-01	9.81E-01	9.75E-01	9.68E-01	9.62E-01	9.55E-01
Beta	6.21E-03	1.25E-02	1.88E-02	2.53E-02	3.18E-02	3.84E-02	4.51E-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	5.25	7.88	10.50	13.13	15.75	18.38	21.00
N 1	0.4785	0.6105	0.6710	0.6600	0.5775	0.4235	0.1980
N 2	0.0358	0.1073	0.2145	0.3575	0.5363	0.7508	1.0010
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

2.10.2.2 BWR MSIV FAIL TO CLOSE

System :	MAIN STEAM
Component :	AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	BWR
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 55
Total Number of Common-Cause Failure Events: 14

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9334400	0.9800340	0.9879570	0.9996030	0.9856860	3.5391E+01	7.2102E-01
2	3.95E-04	2.00E-02	1.20E-02	6.66E-02	1.43E-02	7.2102E-01	3.5391E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9378090	0.9738340	0.9780250	0.9955210	0.9709660	7.1277E+01	1.9152E+00
2	3.11E-03	2.25E-02	1.83E-02	5.62E-02	2.90E-02	1.6473E+00	7.1545E+01
3	1.31E-07	3.66E-03	7.38E-04	1.73E-02	3.71E-06	2.6786E-01	7.2924E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9363970	0.9681020	0.9709440	0.9900750	0.9558150	1.0472E+02	3.4504E+00
2	6.74E-03	2.59E-02	2.31E-02	5.49E-02	4.42E-02	2.8044E+00	1.0537E+02
3	6.52E-06	3.97E-03	1.56E-03	1.61E-02	1.13E-05	4.2910E-01	1.0774E+02
4	6.18E-09	2.01E-03	2.57E-04	1.01E-02	0.00E+00	2.1695E-01	1.0795E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9447790	0.9682100	0.9698540	0.9860150	0.9421670	1.8218E+02	5.9818E+00
2	9.00E-03	2.40E-02	2.24E-02	4.48E-02	5.69E-02	4.5214E+00	1.8364E+02
3	2.71E-04	5.30E-03	3.68E-03	1.58E-02	9.78E-04	9.9639E-01	1.8717E+02
4	1.70E-06	2.06E-03	7.19E-04	8.64E-03	0.00E+00	3.8684E-01	1.8777E+02
5	4.31E-20	4.10E-04	3.98E-07	2.38E-03	0.00E+00	7.7129E-02	1.8808E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9442440	0.9657210	0.9670380	0.9827130	0.9282340	2.2685E+02	8.0523E+00
2	1.09E-02	2.51E-02	2.38E-02	4.38E-02	7.00E-02	5.8932E+00	2.2901E+02
3	4.08E-04	5.15E-03	3.83E-03	1.44E-02	1.65E-03	1.2099E+00	2.3369E+02
4	3.15E-05	2.69E-03	1.47E-03	9.49E-03	1.36E-04	6.3171E-01	2.3427E+02
5	1.25E-08	1.03E-03	1.70E-04	5.05E-03	0.00E+00	2.4272E-01	2.3466E+02
6	9.85E-21	3.18E-04	2.38E-07	1.84E-03	0.00E+00	7.4722E-02	2.3483E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9479410	0.9657480	0.9666760	0.9803820	0.9140490	3.2148E+02	1.1402E+01
2	1.21E-02	2.41E-02	2.32E-02	3.94E-02	8.34E-02	8.0278E+00	3.2485E+02
3	6.74E-04	4.95E-03	4.00E-03	1.25E-02	2.16E-03	1.6462E+00	3.3124E+02
4	1.40E-04	2.92E-03	2.01E-03	8.83E-03	3.32E-04	9.7280E-01	3.3191E+02
5	8.37E-06	1.59E-03	7.61E-04	5.98E-03	2.02E-05	5.2915E-01	3.3235E+02
6	3.76E-10	5.82E-04	5.55E-05	3.02E-03	0.00E+00	1.9373E-01	3.3269E+02
7	4.06E-44	9.62E-05	6.91E-13	3.95E-04	0.00E+00	3.2027E-02	3.3285E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9470580	0.9638930	0.9646940	0.9780090	0.8995720	3.7240E+02	1.3950E+01
2	1.39E-02	2.55E-02	2.47E-02	3.99E-02	9.73E-02	9.8498E+00	3.7650E+02
3	7.06E-04	4.61E-03	3.79E-03	1.13E-02	2.53E-03	1.7826E+00	3.8457E+02
4	1.73E-04	2.80E-03	2.00E-03	8.14E-03	5.56E-04	1.0810E+00	3.8527E+02
5	3.30E-05	1.83E-03	1.07E-03	6.20E-03	6.28E-05	7.0700E-01	3.8564E+02
6	4.79E-07	9.37E-04	3.01E-04	4.03E-03	2.99E-06	3.6204E-01	3.8599E+02
7	9.84E-14	3.30E-04	6.98E-06	1.87E-03	0.00E+00	1.2739E-01	3.8622E+02
8	4.52E-36	1.04E-04	4.49E-11	4.97E-04	0.00E+00	4.0005E-02	3.8631E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**	**CCCG=5**	**CCCG=6**	**CCCG=7**	**CCCG=8**
1	0.9856860	0.9709660	0.9558150	0.9421670	0.9282340	0.9140490	0.8995720
2	1.43E-02	2.90E-02	4.42E-02	5.69E-02	7.00E-02	8.34E-02	9.73E-02
3		3.71E-06	1.13E-05	9.78E-04	1.65E-03	2.16E-03	2.53E-03
4			0.00E+00	0.00E+00	1.36E-04	3.32E-04	5.56E-04
5				0.00E+00	0.00E+00	2.02E-05	6.28E-05
6					0.00E+00	0.00E+00	2.99E-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	9.86E-01	9.71E-01	9.56E-01	9.42E-01	9.28E-01	9.14E-01	9.00E-01
Beta	1.43E-02	2.90E-02	4.42E-02	5.78E-02	7.18E-02	8.60E-02	1.00E-01
Gamma		1.28E-04	2.56E-04	1.69E-02	2.49E-02	2.92E-02	3.14E-02
Delta			0.00E+00	0.00E+00	7.58E-02	1.40E-01	1.97E-01
Epsilon				0.00E+00	0.00E+00	5.74E-02	1.06E-01
Mu					0.00E+00	0.00E+00	4.55E-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	14.27	21.40	28.53	35.67	42.80	49.94	57.07
N 1	3.7031	4.7721	5.3199	5.4508	5.1236	4.3449	3.1199
N 2	0.2610	0.7825	1.5644	2.4814	3.6128	4.9557	6.5084
N 3		0.0001	0.0004	0.0427	0.0854	0.1280	0.1696
N 4			0.0000	0.0000	0.0070	0.0197	0.0372
N 5				0.0000	0.0000	0.0012	0.0042
N 6					0.0000	0.0000	0.0002
N 7						0.0000	0.0000
N 8							0.0000

2.11 Generators

2.11.1 Emergency Diesel Generators

2.11.1.1 EMERGENCY DIESEL GENERATOR SPAR:DGN-FR

System :	EMERGENCY POWER
Component :	EMERGENCY DIESEL GENERATOR
Failure Mode :	FAIL TO RUN
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 557
Total Number of Common-Cause Failure Events: 32

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9744210	0.9844580	0.9850950	0.9923080	0.9848350	4.9408E+02	7.8002E+00
2	7.69E-03	1.55E-02	1.49E-02	2.56E-02	1.52E-02	7.8002E+00	4.9408E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9757220	0.9838500	0.9842660	0.9905490	0.9843860	7.5424E+02	1.2381E+01
2	5.42E-03	1.07E-02	1.03E-02	1.75E-02	1.02E-02	8.2265E+00	7.5839E+02
3	1.90E-03	5.42E-03	4.99E-03	1.04E-02	5.39E-03	4.1541E+00	7.6247E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9774690	0.9843280	0.9846420	0.9901150	0.9851080	1.0124E+03	1.6119E+01
2	4.21E-03	8.25E-03	7.93E-03	1.34E-02	7.58E-03	8.4808E+00	1.0200E+03
3	2.16E-03	5.25E-03	4.93E-03	9.41E-03	5.20E-03	5.3972E+00	1.0231E+03
4	4.44E-04	2.18E-03	1.87E-03	4.98E-03	2.12E-03	2.2411E+00	1.0263E+03

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.9848350	0.9843860	0.9851080
2	1.52E-02	1.02E-02	7.58E-03
3		5.39E-03	5.20E-03
4			2.12E-03

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**
1-Beta	9.85E-01	9.84E-01	9.85E-01
Beta	1.52E-02	1.56E-02	1.49E-02
Gamma		3.46E-01	4.91E-01
Delta			2.89E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	462.24	693.36	924.48
N 1	14.4263	15.7777	17.0563
N 2	7.3402	7.3617	7.2408
N 3		3.8863	4.9685
N 4			2.0241

2.11.1.2 EMERGENCY DIESEL GENERATOR SPAR:DGN-FS

System :	EMERGENCY POWER
Component :	EMERGENCY DIESEL GENERATOR
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 719
Total Number of Common-Cause Failure Events: 25

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9802830	0.9885000	0.9890680	0.9947660	0.9889650	5.5890E+02	6.5021E+00
2	5.23E-03	1.15E-02	1.09E-02	1.97E-02	1.10E-02	6.5021E+00	5.5890E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9796750	0.9866690	0.9870410	0.9923890	0.9873010	8.5084E+02	1.1496E+01
2	4.92E-03	9.68E-03	9.30E-03	1.57E-02	9.17E-03	8.3471E+00	8.5399E+02
3	1.04E-03	3.65E-03	3.28E-03	7.55E-03	3.53E-03	3.1491E+00	8.5919E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9807860	0.9867530	0.9870300	0.9917650	0.9876030	1.1411E+03	1.5319E+01
2	4.10E-03	7.83E-03	7.55E-03	1.25E-02	7.21E-03	9.0528E+00	1.1474E+03
3	1.45E-03	3.91E-03	3.63E-03	7.33E-03	3.78E-03	4.5240E+00	1.1519E+03
4	2.23E-04	1.51E-03	1.23E-03	3.73E-03	1.41E-03	1.7426E+00	1.1547E+03

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9889650	0.9873010	0.9876030
2	1.10E-02	9.17E-03	7.21E-03
3		3.53E-03	3.78E-03
4			1.41E-03

MGL Parameter	**CCCG=2**	**CCCG=3**	**CCCG=4**
1-Beta	9.89E-01	9.87E-01	9.88E-01
Beta	1.10E-02	1.27E-02	1.24E-02
Gamma		2.78E-01	4.18E-01
Delta			2.71E-01

Avg. Impact Vector	**CCCG=2**	**CCCG=3**	**CCCG=4**
Adj. Ind. Events	528.68	793.01	1057.35
N 1	12.8058	12.7264	12.8750
N 2	6.0421	7.4823	7.8128
N 3		2.8813	4.0953
N 4			1.5256

2.12 Vacuum Breakers

2.12.1 BWR Pressure Suppression Vacuum Breakers

2.12.1.1 CONTAINMENT VACUUM RELIEF CHECK FAIL TO OPEN

System :	CONTAINMENT VACUUM RELIEF
Component :	VACUUM BREAKER CHECK VALVE
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 12
Total Number of Common-Cause Failure Events: 2

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8554290	0.9434300	0.9545300	0.9933570	0.8739850	2.4357E+01	1.4605E+00
2	6.64E-03	5.66E-02	4.55E-02	1.45E-01	1.26E-01	1.4605E+00	2.4357E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9153490	0.9629800	0.9682120	0.9927100	0.9122150	5.5512E+01	2.1341E+00
2	2.41E-03	2.37E-02	1.84E-02	6.30E-02	4.40E-02	1.3663E+00	5.6280E+01
3	3.24E-04	1.33E-02	8.26E-03	4.36E-02	4.38E-02	7.6776E-01	5.6878E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9309570	0.9670320	0.9705230	0.9911580	0.9325350	8.4732E+01	2.8886E+00
2	2.01E-03	1.70E-02	1.35E-02	4.41E-02	1.70E-02	1.4930E+00	8.6128E+01
3	4.54E-04	1.06E-02	7.18E-03	3.24E-02	3.36E-02	9.2870E-01	8.6692E+01
4	1.45E-05	5.33E-03	2.29E-03	2.09E-02	1.68E-02	4.6695E-01	8.7154E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9488430	0.9725970	0.9745130	0.9898080	0.9451870	1.5839E+02	4.4627E+00
2	2.64E-03	1.33E-02	1.14E-02	3.06E-02	7.09E-03	2.1700E+00	1.6068E+02
3	7.79E-04	8.16E-03	6.25E-03	2.21E-02	2.05E-02	1.3287E+00	1.6152E+02
4	1.10E-04	4.68E-03	2.87E-03	1.54E-02	2.05E-02	7.6184E-01	1.6209E+02
5	1.47E-09	1.24E-03	1.33E-04	6.38E-03	6.82E-03	2.0213E-01	1.6265E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9533780	0.9738910	0.9754200	0.9891940	0.9537950	1.9973E+02	5.3545E+00
2	2.48E-03	1.15E-02	9.91E-03	2.57E-02	3.20E-03	2.3502E+00	2.0273E+02
3	6.80E-04	6.70E-03	5.18E-03	1.79E-02	1.15E-02	1.3746E+00	2.0371E+02
4	2.51E-04	4.87E-03	3.39E-03	1.46E-02	1.72E-02	9.9971E-01	2.0408E+02
5	8.77E-06	2.40E-03	1.08E-03	9.27E-03	1.15E-02	4.9272E-01	2.0459E+02
6	1.01E-12	6.69E-04	1.96E-05	3.75E-03	2.87E-03	1.3722E-01	2.0495E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.8739850	0.9122150	0.9325350	0.9451870	0.9537950
2	1.26E-01	4.40E-02	1.70E-02	7.09E-03	3.20E-03
3		4.38E-02	3.36E-02	2.05E-02	1.15E-02
4			1.68E-02	2.05E-02	1.72E-02
5				6.82E-03	1.15E-02
6					2.87E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	8.74E-01	9.12E-01	9.33E-01	9.45E-01	9.54E-01
Beta	1.26E-01	8.78E-02	6.75E-02	5.48E-02	4.62E-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	6.86	10.29	13.71	17.14	20.57
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

2.13 AC Power Distribution Breakers

2.13.1 480 Vac Circuit Breakers

2.13.1.1 480 V CIRCUIT BREAKERS FAIL TO OPEN

System :	AC POWER DISTRIBUTION
Component :	480 V AC CIRCUIT BREAKERS
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 84
Total Number of Common-Cause Failure Events: 6

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9264550	0.9763750	0.9843220	0.9991500	0.9783740	3.5844E+01	8.6732E-01
2	8.47E-04	2.36E-02	1.57E-02	7.35E-02	2.16E-02	8.6732E-01	3.5844E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9400920	0.9751030	0.9792440	0.9959450	0.9744350	7.2286E+01	1.8457E+00
2	1.71E-03	1.79E-02	1.37E-02	4.81E-02	1.64E-02	1.3235E+00	7.2808E+01
3	3.50E-05	7.04E-03	3.36E-03	2.66E-02	9.12E-03	5.2216E-01	7.3609E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9391700	0.9698930	0.9727140	0.9909740	0.9615950	1.0618E+02	3.2959E+00
2	4.40E-03	2.09E-02	1.80E-02	4.71E-02	2.84E-02	2.2844E+00	1.0719E+02
3	1.08E-04	6.34E-03	3.69E-03	2.16E-02	7.22E-03	6.9400E-01	1.0878E+02
4	5.18E-07	2.90E-03	7.78E-04	1.30E-02	2.74E-03	3.1755E-01	1.0916E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9491210	0.9713870	0.9730290	0.9880440	0.9564680	1.8449E+02	5.4344E+00
2	5.26E-03	1.75E-02	1.59E-02	3.55E-02	2.84E-02	3.3293E+00	1.8660E+02
3	8.33E-04	7.57E-03	5.93E-03	1.99E-02	1.07E-02	1.4384E+00	1.8849E+02
4	1.83E-05	2.89E-03	1.43E-03	1.07E-02	3.58E-03	5.4944E-01	1.8937E+02
5	2.59E-14	6.17E-04	8.80E-06	3.54E-03	8.83E-04	1.1723E-01	1.8981E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9515900	0.9713410	0.9726540	0.9865990	0.9545710	2.3048E+02	6.8002E+00
2	4.96E-03	1.54E-02	1.41E-02	3.04E-02	2.54E-02	3.6531E+00	2.3363E+02
3	1.22E-03	7.70E-03	6.37E-03	1.87E-02	1.30E-02	1.8267E+00	2.3545E+02
4	1.47E-04	3.79E-03	2.52E-03	1.18E-02	5.07E-03	8.9851E-01	2.3638E+02
5	3.54E-07	1.40E-03	3.97E-04	6.18E-03	1.64E-03	3.3112E-01	2.3695E+02
6	1.16E-17	3.82E-04	1.22E-06	2.23E-03	2.96E-04	9.0722E-02	2.3719E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9567830	0.9727830	0.9737140	0.9855960	0.9544430	3.2688E+02	9.1455E+00
2	4.87E-03	1.32E-02	1.23E-02	2.48E-02	2.19E-02	4.4386E+00	3.3159E+02
3	1.54E-03	7.07E-03	6.12E-03	1.58E-02	1.37E-02	2.3752E+00	3.3365E+02
4	4.08E-04	4.07E-03	3.14E-03	1.09E-02	6.63E-03	1.3675E+00	3.3466E+02
5	3.33E-05	2.04E-03	1.18E-03	7.00E-03	2.55E-03	6.8715E-01	3.3534E+02
6	7.05E-09	7.10E-04	1.13E-04	3.49E-03	7.18E-04	2.3863E-01	3.3579E+02
7	2.40E-37	1.14E-04	2.53E-11	5.36E-04	1.02E-04	3.8427E-02	3.3599E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9587200	0.9733440	0.9741470	0.9852220	0.9552520	3.8003E+02	1.0407E+01
2	4.53E-03	1.19E-02	1.11E-02	2.22E-02	1.86E-02	4.6597E+00	3.8578E+02
3	1.54E-03	6.55E-03	5.72E-03	1.44E-02	1.33E-02	2.5555E+00	3.8788E+02
4	5.28E-04	4.08E-03	3.27E-03	1.04E-02	7.72E-03	1.5922E+00	3.8885E+02
5	1.12E-04	2.45E-03	1.67E-03	7.45E-03	3.57E-03	9.5640E-01	3.8948E+02
6	2.59E-06	1.16E-03	4.79E-04	4.61E-03	1.27E-03	4.5184E-01	3.8999E+02
7	3.07E-12	3.82E-04	1.56E-05	2.11E-03	3.07E-04	1.4919E-01	3.9029E+02
8	4.33E-34	1.09E-04	1.28E-10	5.42E-04	3.66E-05	4.2605E-02	3.9039E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9783740	0.9744350	0.9615950	0.9564680	0.9545710	0.9544430	0.9552520
2	2.16E-02	1.64E-02	2.84E-02	2.84E-02	2.54E-02	2.19E-02	1.86E-02
3		9.12E-03	7.22E-03	1.07E-02	1.30E-02	1.37E-02	1.33E-02
4			2.74E-03	3.58E-03	5.07E-03	6.63E-03	7.72E-03
5				8.83E-04	1.64E-03	2.55E-03	3.57E-03
6					2.96E-04	7.18E-04	1.27E-03
7						1.02E-04	3.07E-04
8							3.66E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.78E-01	9.74E-01	9.62E-01	9.56E-01	9.55E-01	9.54E-01	9.55E-01
Beta	2.16E-02	2.56E-02	3.84E-02	4.35E-02	4.54E-02	4.56E-02	4.47E-02
Gamma		3.57E-01	2.59E-01	3.48E-01	4.40E-01	5.20E-01	5.85E-01
Delta			2.75E-01	2.95E-01	3.50E-01	4.22E-01	4.93E-01
Epsilon				1.98E-01	2.76E-01	3.37E-01	4.02E-01
Mu					1.53E-01	2.44E-01	3.11E-01
Upsilon						1.25E-01	2.13E-01
Sigma							1.07E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	16.52	24.78	33.04	41.30	49.56	57.82	66.08
N 1	1.9062	2.4006	2.2711	2.1309	1.9854	1.8552	1.7446
N 2	0.4073	0.4587	1.0444	1.2893	1.3727	1.3665	1.3183
N 3		0.2544	0.2653	0.4847	0.7022	0.8570	0.9425
N 4			0.1006	0.1626	0.2738	0.4144	0.5484
N 5				0.0401	0.0884	0.1592	0.2536
N 6					0.0160	0.0449	0.0900
N 7						0.0064	0.0218
N 8							0.0026

2.13.1.2 480 V CIRCUIT BREAKERS FAIL TO CLOSE

System :	AC POWER DISTRIBUTION
Component :	480 V AC CIRCUIT BREAKERS
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 173
Total Number of Common-Cause Failure Events: 6

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9320930	0.9690270	0.9728610	0.9928500	0.9675160	7.7433E+01	2.4750E+00
2	7.15E-03	3.10E-02	2.71E-02	6.79E-02	3.25E-02	2.4750E+00	7.7433E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9451030	0.9715410	0.9737950	0.9902800	0.9695410	1.3396E+02	3.9240E+00
2	2.69E-03	1.47E-02	1.24E-02	3.45E-02	1.27E-02	2.0294E+00	1.3585E+02
3	2.30E-03	1.37E-02	1.15E-02	3.30E-02	1.78E-02	1.8946E+00	1.3599E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9521260	0.9734400	0.9750550	0.9892440	0.9730540	1.8871E+02	5.1489E+00
2	2.47E-03	1.18E-02	1.01E-02	2.67E-02	8.62E-03	2.2836E+00	1.9158E+02
3	1.23E-03	8.70E-03	7.07E-03	2.17E-02	1.04E-02	1.6858E+00	1.9217E+02
4	4.58E-04	6.08E-03	4.49E-03	1.72E-02	7.95E-03	1.1795E+00	1.9268E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9591570	0.9755290	0.9765990	0.9882600	0.9750050	2.8774E+02	7.2179E+00
2	3.33E-03	1.12E-02	1.01E-02	2.28E-02	8.39E-03	3.3023E+00	2.9166E+02
3	8.42E-04	5.81E-03	4.74E-03	1.44E-02	5.05E-03	1.7141E+00	2.9324E+02
4	6.23E-04	5.16E-03	4.10E-03	1.34E-02	7.55E-03	1.5231E+00	2.9343E+02
5	3.57E-05	2.30E-03	1.32E-03	7.91E-03	4.00E-03	6.7843E-01	2.9428E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9617250	0.9761920	0.9770640	0.9876840	0.9761000	3.5431E+02	8.6412E+00
2	3.60E-03	1.07E-02	9.82E-03	2.08E-02	8.94E-03	3.8866E+00	3.5906E+02
3	6.22E-04	4.55E-03	3.67E-03	1.14E-02	2.92E-03	1.6497E+00	3.6130E+02
4	4.64E-04	4.06E-03	3.19E-03	1.06E-02	4.73E-03	1.4741E+00	3.6148E+02
5	2.31E-04	3.19E-03	2.34E-03	9.07E-03	5.10E-03	1.1595E+00	3.6179E+02
6	3.71E-06	1.30E-03	5.61E-04	5.09E-03	2.21E-03	4.7132E-01	3.6248E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9656040	0.9776710	0.9783310	0.9874940	0.9785820	4.7159E+02	1.0771E+01
2	3.47E-03	9.35E-03	8.68E-03	1.75E-02	6.88E-03	4.5085E+00	4.7785E+02
3	8.52E-04	4.42E-03	3.76E-03	1.03E-02	2.94E-03	2.1322E+00	4.8023E+02
4	4.09E-04	3.25E-03	2.59E-03	8.32E-03	2.93E-03	1.5661E+00	4.8079E+02
5	2.73E-04	2.80E-03	2.15E-03	7.54E-03	3.93E-03	1.3486E+00	4.8101E+02
6	7.51E-05	1.88E-03	1.25E-03	5.83E-03	3.42E-03	9.0803E-01	4.8145E+02
7	8.44E-08	6.37E-04	1.61E-04	2.89E-03	1.32E-03	3.0713E-01	4.8205E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9677740	0.9787040	0.9792730	0.9876900	0.9805000	5.4562E+02	1.1872E+01
2	3.17E-03	8.36E-03	7.78E-03	1.55E-02	5.55E-03	4.6634E+00	5.5283E+02
3	8.60E-04	4.11E-03	3.53E-03	9.33E-03	2.85E-03	2.2910E+00	5.5520E+02
4	3.40E-04	2.77E-03	2.20E-03	7.13E-03	2.09E-03	1.5423E+00	5.5595E+02
5	2.43E-04	2.44E-03	1.88E-03	6.57E-03	2.77E-03	1.3621E+00	5.5613E+02
6	1.24E-04	1.96E-03	1.40E-03	5.68E-03	3.06E-03	1.0909E+00	5.5640E+02
7	1.95E-05	1.23E-03	7.04E-04	4.21E-03	2.34E-03	6.8349E-01	5.5681E+02
8	4.33E-09	4.29E-04	6.82E-05	2.10E-03	8.36E-04	2.3900E-01	5.5725E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9675160	0.9695410	0.9730540	0.9750050	0.9761000	0.9785820	0.9805000
2	3.25E-02	1.27E-02	8.62E-03	8.39E-03	8.94E-03	6.88E-03	5.55E-03
3		1.78E-02	1.04E-02	5.05E-03	2.92E-03	2.94E-03	2.85E-03
4			7.95E-03	7.55E-03	4.73E-03	2.93E-03	2.09E-03
5				4.00E-03	5.10E-03	3.93E-03	2.77E-03
6					2.21E-03	3.42E-03	3.06E-03
7						1.32E-03	2.34E-03
8							8.36E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.68E-01	9.70E-01	9.73E-01	9.75E-01	9.76E-01	9.79E-01	9.80E-01
Beta	3.25E-02	3.05E-02	2.69E-02	2.50E-02	2.39E-02	2.14E-02	1.95E-02
Gamma		5.83E-01	6.80E-01	6.64E-01	6.26E-01	6.79E-01	7.15E-01
Delta			4.34E-01	6.96E-01	8.05E-01	7.98E-01	7.96E-01
Epsilon				3.46E-01	6.07E-01	7.47E-01	8.11E-01
Mu					3.02E-01	5.47E-01	6.92E-01
Upsilon						2.78E-01	5.09E-01
Sigma							2.64E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	57.67	86.50	115.33	144.17	173.00	201.83	230.67
N 1	2.3450	2.3529	2.5081	2.5140	2.3759	2.5627	2.7362
N 2	2.0150	1.1646	1.0436	1.2623	1.6062	1.4364	1.3220
N 3		1.6268	1.2571	0.7604	0.5252	0.6140	0.6780
N 4			0.9625	1.1363	0.8494	0.6130	0.4985
N 5				0.6013	0.9168	0.8207	0.6593
N 6					0.3966	0.7143	0.7291
N 7						0.2751	0.5561
N 8							0.1990

2.13.1.3 480 V CIRCUIT BREAKERS SPURIOUS ACTUATION

System :	AC POWER DISTRIBUTION
Component :	480 V AC CIRCUIT BREAKERS
Failure Mode :	SPURIOUS ACTUATION
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 105
Total Number of Common-Cause Failure Events: 3

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9419060	0.9776320	0.9822890	0.9974340	0.9788940	6.4044E+01	1.4653E+00
2	2.57E-03	2.24E-02	1.77E-02	5.81E-02	2.11E-02	1.4653E+00	6.4044E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9578190	0.9816710	0.9843380	0.9964100	0.9856910	1.1502E+02	2.1476E+00
2	1.21E-03	1.18E-02	9.13E-03	3.14E-02	7.25E-03	1.3793E+00	1.1579E+02
3	1.59E-04	6.56E-03	4.05E-03	2.15E-02	7.06E-03	7.6826E-01	1.1640E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9633280	0.9825520	0.9844440	0.9953250	0.9890920	1.6408E+02	2.9137E+00
2	1.09E-03	9.08E-03	7.21E-03	2.35E-02	2.93E-03	1.5160E+00	1.6548E+02
3	2.39E-04	5.57E-03	3.76E-03	1.71E-02	5.33E-03	9.3070E-01	1.6606E+02
4	7.59E-06	2.80E-03	1.20E-03	1.10E-02	2.65E-03	4.6695E-01	1.6653E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9678930	0.9828240	0.9840350	0.9936040	0.9911240	2.5755E+02	4.5010E+00
2	1.69E-03	8.41E-03	7.19E-03	1.93E-02	1.39E-03	2.2033E+00	2.5985E+02
3	4.88E-04	5.09E-03	3.90E-03	1.38E-02	3.23E-03	1.3337E+00	2.6072E+02
4	6.81E-05	2.91E-03	1.78E-03	9.58E-03	3.19E-03	7.6184E-01	2.6129E+02
5	9.15E-10	7.71E-04	8.25E-05	3.96E-03	1.06E-03	2.0213E-01	2.6185E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9701880	0.9833170	0.9842990	0.9930790	0.9924730	3.1870E+02	5.4071E+00
2	1.62E-03	7.38E-03	6.40E-03	1.65E-02	7.99E-04	2.3929E+00	3.2171E+02
3	4.38E-04	4.27E-03	3.31E-03	1.14E-02	1.85E-03	1.3845E+00	3.2272E+02
4	1.59E-04	3.08E-03	2.14E-03	9.23E-03	2.66E-03	9.9971E-01	3.2311E+02
5	5.54E-06	1.52E-03	6.84E-04	5.87E-03	1.78E-03	4.9272E-01	3.2361E+02
6	6.37E-13	4.23E-04	1.24E-05	2.37E-03	4.44E-04	1.3722E-01	3.2397E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9719020	0.9831180	0.9838460	0.9918350	0.9933530	4.3024E+02	7.3880E+00
2	2.09E-03	7.27E-03	6.54E-03	1.50E-02	6.80E-04	3.1837E+00	4.3444E+02
3	5.43E-04	3.85E-03	3.13E-03	9.63E-03	1.02E-03	1.6849E+00	4.3594E+02
4	2.50E-04	2.89E-03	2.18E-03	7.97E-03	1.90E-03	1.2656E+00	4.3636E+02
5	6.13E-05	1.92E-03	1.24E-03	6.11E-03	1.90E-03	8.4045E-01	4.3679E+02
6	3.16E-07	8.00E-04	2.46E-04	3.48E-03	9.52E-04	3.5003E-01	4.3728E+02
7	3.86E-24	1.45E-04	2.38E-08	8.21E-04	1.91E-04	6.3327E-02	4.3756E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9732590	0.9835120	0.9841410	0.9916060	0.9939880	4.9849E+02	8.3569E+00
2	2.12E-03	6.85E-03	6.21E-03	1.38E-02	6.99E-04	3.4724E+00	5.0337E+02
3	4.92E-04	3.39E-03	2.76E-03	8.43E-03	5.60E-04	1.7179E+00	5.0513E+02
4	2.23E-04	2.52E-03	1.91E-03	6.93E-03	1.25E-03	1.2783E+00	5.0557E+02
5	1.07E-04	2.00E-03	1.40E-03	5.96E-03	1.67E-03	1.0153E+00	5.0583E+02
6	1.08E-05	1.18E-03	6.17E-04	4.24E-03	1.25E-03	5.9624E-01	5.0625E+02
7	1.72E-09	4.36E-04	5.83E-05	2.19E-03	5.01E-04	2.2119E-01	5.0663E+02
8	4.64E-27	1.10E-04	4.47E-09	6.04E-04	8.32E-05	5.5605E-02	5.0679E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9788940	0.9856910	0.9890920	0.9911240	0.9924730	0.9933530	0.9939880
2	2.11E-02	7.25E-03	2.93E-03	1.39E-03	7.99E-04	6.80E-04	6.99E-04
3		7.06E-03	5.33E-03	3.23E-03	1.85E-03	1.02E-03	5.60E-04
4			2.65E-03	3.19E-03	2.66E-03	1.90E-03	1.25E-03
5				1.06E-03	1.78E-03	1.90E-03	1.67E-03
6					4.44E-04	9.52E-04	1.25E-03
7						1.91E-04	5.01E-04
8							8.32E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.79E-01	9.86E-01	9.89E-01	9.91E-01	9.92E-01	9.93E-01	9.94E-01
Beta	2.11E-02	1.43E-02	1.09E-02	8.88E-03	7.53E-03	6.65E-03	6.01E-03
Gamma		4.93E-01	7.32E-01	8.43E-01	8.94E-01	8.98E-01	8.84E-01
Delta			3.32E-01	5.68E-01	7.26E-01	8.30E-01	8.95E-01
Epsilon				2.50E-01	4.55E-01	6.15E-01	7.37E-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	44.97	67.45	89.94	112.42	134.90	157.39	179.87
N 1	1.6560	2.4695	3.2753	4.0750	4.8700	5.6456	6.4113
N 2	1.0053	0.5145	0.2760	0.1633	0.1125	0.1116	0.1310
N 3		0.5005	0.5020	0.3800	0.2600	0.1667	0.1049
N 4			0.2500	0.3750	0.3750	0.3125	0.2345
N 5				0.1250	0.2500	0.3125	0.3125
N 6					0.0625	0.1563	0.2344
N 7						0.0313	0.0938
N 8							0.0156

2.13.24160 vac and 6.9Kva Distribution Circuit Breakers

2.13.2.1 ACP 4160 AND 6.9 CIRCUIT BREAKERS FAIL TO OPEN SPAR: CRB-CC

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 :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 69
Total Number of Common-Cause Failure Events: 7

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9389360	0.9828920	0.9908310	0.9998330	0.9918670	3.4455E+01	5.9972E-01
2	1.64E-04	1.71E-02	9.17E-03	6.11E-02	8.13E-03	5.9972E-01	3.4455E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9455140	0.9787510	0.9830160	0.9973970	0.9846180	7.0281E+01	1.5259E+00
2	1.47E-03	1.73E-02	1.31E-02	4.77E-02	1.49E-02	1.2453E+00	7.0562E+01
3	2.23E-07	3.91E-03	8.57E-04	1.83E-02	5.01E-04	2.8056E-01	7.1526E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9467900	0.9753690	0.9782840	0.9939900	0.9781390	1.0397E+02	2.6256E+00
2	3.12E-03	1.81E-02	1.52E-02	4.31E-02	2.05E-02	1.9333E+00	1.0466E+02
3	1.31E-05	4.44E-03	1.94E-03	1.74E-02	1.33E-03	4.7380E-01	1.0612E+02
4	6.90E-09	2.05E-03	2.67E-04	1.03E-02	4.43E-05	2.1845E-01	1.0638E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9541220	0.9752310	0.9769140	0.9906010	0.9723320	1.8191E+02	4.6202E+00
2	4.69E-03	1.66E-02	1.49E-02	3.43E-02	2.51E-02	3.0963E+00	1.8343E+02
3	3.30E-04	5.64E-03	4.01E-03	1.66E-02	2.36E-03	1.0529E+00	1.8548E+02
4	1.97E-06	2.11E-03	7.54E-04	8.81E-03	1.62E-04	3.9364E-01	1.8614E+02
5	4.81E-20	4.15E-04	4.11E-07	2.41E-03	4.76E-06	7.7329E-02	1.8645E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9553260	0.9743140	0.9756610	0.9887160	0.9671170	2.2737E+02	5.9942E+00
2	5.24E-03	1.60E-02	1.46E-02	3.14E-02	2.90E-02	3.7342E+00	2.2963E+02
3	5.08E-04	5.57E-03	4.23E-03	1.52E-02	3.48E-03	1.2988E+00	2.3207E+02
4	3.46E-05	2.75E-03	1.52E-03	9.65E-03	3.59E-04	6.4271E-01	2.3272E+02
5	1.33E-08	1.04E-03	1.74E-04	5.09E-03	2.00E-05	2.4372E-01	2.3312E+02
6	9.92E-21	3.20E-04	2.40E-07	1.86E-03	0.00E+00	7.4722E-02	2.3329E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9588810	0.9745320	0.9754830	0.9869440	0.9630270	3.2312E+02	8.4441E+00
2	5.79E-03	1.48E-02	1.38E-02	2.71E-02	3.15E-02	4.9007E+00	3.2666E+02
3	8.33E-04	5.40E-03	4.45E-03	1.32E-02	4.71E-03	1.7919E+00	3.2977E+02
4	1.52E-04	3.00E-03	2.08E-03	8.99E-03	7.04E-04	9.9400E-01	3.3057E+02
5	8.63E-06	1.60E-03	7.70E-04	6.02E-03	6.20E-05	5.3155E-01	3.3103E+02
6	3.84E-10	5.85E-04	5.59E-05	3.04E-03	3.44E-06	1.9393E-01	3.3137E+02
7	4.20E-44	9.66E-05	6.94E-13	3.97E-04	0.00E+00	3.2027E-02	3.3153E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9597760	0.9742720	0.9750850	0.9859810	0.9592910	3.7551E+02	9.9163E+00
2	6.08E-03	1.44E-02	1.36E-02	2.56E-02	3.37E-02	5.5651E+00	3.7986E+02
3	9.16E-04	5.17E-03	4.34E-03	1.22E-02	5.73E-03	1.9908E+00	3.8344E+02
4	1.94E-04	2.90E-03	2.10E-03	8.35E-03	1.13E-03	1.1184E+00	3.8431E+02
5	3.42E-05	1.85E-03	1.09E-03	6.24E-03	1.41E-04	7.1210E-01	3.8471E+02
6	4.86E-07	9.41E-04	3.03E-04	4.04E-03	1.06E-05	3.6254E-01	3.8506E+02
7	9.86E-14	3.31E-04	7.00E-06	1.87E-03	0.00E+00	1.2739E-01	3.8530E+02
8	4.53E-36	1.04E-04	4.50E-11	4.99E-04	0.00E+00	4.0005E-02	3.8539E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9918670	0.9846180	0.9781390	0.9723320	0.9671170	0.9630270	0.9592910
2	8.13E-03	1.49E-02	2.05E-02	2.51E-02	2.90E-02	3.15E-02	3.37E-02
3		5.01E-04	1.33E-03	2.36E-03	3.48E-03	4.71E-03	5.73E-03
4			4.43E-05	1.62E-04	3.59E-04	7.04E-04	1.13E-03
5				4.76E-06	2.00E-05	6.20E-05	1.41E-04
6					0.00E+00	3.44E-06	1.06E-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	9.92E-01	9.85E-01	9.78E-01	9.72E-01	9.67E-01	9.63E-01	9.59E-01
Beta	8.13E-03	1.54E-02	2.19E-02	2.77E-02	3.29E-02	3.70E-02	4.07E-02
Gamma		3.25E-02	6.30E-02	9.14E-02	1.17E-01	1.48E-01	1.72E-01
Delta			3.22E-02	6.59E-02	9.83E-02	1.40E-01	1.83E-01
Epsilon				2.86E-02	5.26E-02	8.50E-02	1.18E-01
Mu					0.00E+00	5.26E-02	7.00E-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	15.10	22.65	30.20	37.75	45.30	52.84	60.39
N 1	1.9373	2.5255	2.9051	3.1032	3.1423	3.0830	2.9072
N 2	0.1397	0.3805	0.6933	1.0563	1.4538	1.8286	2.2237
N 3		0.0128	0.0451	0.0992	0.1743	0.2737	0.3778
N 4			0.0015	0.0068	0.0180	0.0409	0.0746
N 5				0.0002	0.0010	0.0036	0.0093
N 6					0.0000	0.0002	0.0007
N 7						0.0000	0.0000
N 8							0.0000

2.13.2.2 ACP 4160 AND 6.9 CIRCUIT BREAKERS SPURIOUS OP SPAR: CRB-CO

System :	AC POWER DISTRIBUTION
Component :	4160 V AC CIRCUIT BREAKERS 6.9 KV AC CIRCUIT BREAKERS
Failure Mode :	SPURIOUS ACTUATION
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 121
Total Number of Common-Cause Failure Events: 8

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8789520	0.9419430	0.9479100	0.9844910	0.9232140	4.5910E+01	2.8297E+00
2	1.55E-02	5.81E-02	5.21E-02	1.21E-01	7.68E-02	2.8297E+00	4.5910E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9140340	0.9545440	0.9578440	0.9837740	0.9329060	8.6889E+01	4.1377E+00
2	5.47E-03	2.55E-02	2.21E-02	5.71E-02	3.24E-02	2.3180E+00	8.8709E+01
3	3.18E-03	2.00E-02	1.66E-02	4.84E-02	3.46E-02	1.8197E+00	8.9207E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9240850	0.9566480	0.9589500	0.9813310	0.9349460	1.2552E+02	5.6882E+00
2	6.65E-03	2.35E-02	2.11E-02	4.85E-02	3.16E-02	3.0848E+00	1.2812E+02
3	6.04E-04	8.66E-03	6.33E-03	2.47E-02	1.21E-02	1.1364E+00	1.3007E+02
4	1.27E-03	1.12E-02	8.81E-03	2.92E-02	2.14E-02	1.4670E+00	1.2974E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9391580	0.9625010	0.9639220	0.9810090	0.9352240	2.0831E+02	8.1156E+00
2	7.20E-03	1.99E-02	1.84E-02	3.76E-02	3.15E-02	4.3038E+00	2.1212E+02
3	1.38E-03	8.54E-03	7.08E-03	2.07E-02	1.24E-02	1.8479E+00	2.1458E+02
4	8.25E-05	3.52E-03	2.16E-03	1.16E-02	5.21E-03	7.6184E-01	2.1566E+02
5	4.35E-04	5.55E-03	4.12E-03	1.56E-02	1.56E-02	1.2021E+00	2.1522E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9428790	0.9634420	0.9645900	0.9800910	0.9358200	2.5866E+02	9.8149E+00
2	6.86E-03	1.78E-02	1.66E-02	3.27E-02	2.93E-02	4.7724E+00	2.6370E+02
3	1.99E-03	8.99E-03	7.80E-03	2.00E-02	1.51E-02	2.4128E+00	2.6606E+02
4	1.92E-04	3.72E-03	2.59E-03	1.11E-02	4.40E-03	9.9981E-01	2.6748E+02
5	6.69E-06	1.84E-03	8.26E-04	7.08E-03	2.93E-03	4.9272E-01	2.6798E+02
6	2.94E-04	4.24E-03	3.09E-03	1.21E-02	1.25E-02	1.1372E+00	2.6734E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9516430	0.9679390	0.9687760	0.9813870	0.9428340	3.6003E+02	1.1925E+01
2	5.78E-03	1.42E-02	1.33E-02	2.55E-02	2.23E-02	5.2645E+00	3.6669E+02
3	1.86E-03	7.37E-03	6.51E-03	1.58E-02	1.24E-02	2.7413E+00	3.6921E+02
4	6.21E-04	4.48E-03	3.63E-03	1.12E-02	7.24E-03	1.6658E+00	3.7029E+02
5	7.22E-05	2.26E-03	1.45E-03	7.19E-03	3.17E-03	8.4045E-01	3.7111E+02
6	7.55E-05	2.29E-03	1.48E-03	7.25E-03	6.67E-03	8.5003E-01	3.7111E+02
7	1.08E-05	1.51E-03	7.62E-04	5.57E-03	5.40E-03	5.6333E-01	3.7139E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9551020	0.9697720	0.9704990	0.9819770	0.9480530	4.1810E+02	1.3032E+01
2	5.08E-03	1.24E-02	1.16E-02	2.22E-02	1.78E-02	5.3319E+00	4.2580E+02
3	1.68E-03	6.53E-03	5.78E-03	1.39E-02	1.07E-02	2.8134E+00	4.2832E+02
4	6.81E-04	4.26E-03	3.53E-03	1.04E-02	7.12E-03	1.8386E+00	4.2929E+02
5	2.03E-04	2.73E-03	2.01E-03	7.71E-03	4.23E-03	1.1753E+00	4.2996E+02
6	6.40E-05	1.96E-03	1.27E-03	6.23E-03	4.34E-03	8.4624E-01	4.3029E+02
7	3.24E-05	1.67E-03	9.92E-04	5.63E-03	5.32E-03	7.2119E-01	4.3041E+02
8	8.99E-08	7.09E-04	1.78E-04	3.22E-03	2.38E-03	3.0560E-01	4.3083E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9232140	0.9329060	0.9349460	0.9352240	0.9358200	0.9428340	0.9480530
2	7.68E-02	3.24E-02	3.16E-02	3.15E-02	2.93E-02	2.23E-02	1.78E-02
3		3.46E-02	1.21E-02	1.24E-02	1.51E-02	1.24E-02	1.07E-02
4			2.14E-02	5.21E-03	4.40E-03	7.24E-03	7.12E-03
5				1.56E-02	2.93E-03	3.17E-03	4.23E-03
6					1.25E-02	6.67E-03	4.34E-03
7						5.40E-03	5.32E-03
8							2.38E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.23E-01	9.33E-01	9.35E-01	9.35E-01	9.36E-01	9.43E-01	9.48E-01
Beta	7.68E-02	6.71E-02	6.51E-02	6.48E-02	6.42E-02	5.72E-02	5.19E-02
Gamma		5.16E-01	5.15E-01	5.14E-01	5.44E-01	6.10E-01	6.57E-01
Delta			6.39E-01	6.27E-01	5.67E-01	6.44E-01	6.85E-01
Epsilon				7.50E-01	7.78E-01	6.78E-01	6.96E-01
Mu					8.10E-01	7.92E-01	7.40E-01
Upsilon						4.47E-01	6.40E-01
Sigma							3.09E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	26.16	39.24	52.32	65.41	78.49	91.57	104.65
N 1	2.3315	2.5441	2.3289	1.8417	1.2382	1.2576	1.2387
N 2	2.3697	1.4532	1.8448	2.2638	2.4920	2.1924	1.9905
N 3		1.5519	0.7077	0.8942	1.2883	1.2231	1.2004
N 4			1.2500	0.3750	0.3751	0.7127	0.7948
N 5				1.1250	0.2500	0.3125	0.4725
N 6					1.0625	0.6563	0.4844
N 7						0.5313	0.5938
N 8							0.2656

2.13.2.3 ACP 4160 AND 6.9 CIRCUIT BREAKERS SPURIOUS OP SPAR: CRB-OO

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 :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 204
Total Number of Common-Cause Failure Events: 9

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9651940	0.9906150	0.9953550	0.9999450	0.9978840	5.7542E+01	5.4512E-01
2	5.78E-05	9.38E-03	4.64E-03	3.48E-02	2.12E-03	5.4512E-01	5.7542E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9656770	0.9871450	0.9900430	0.9986990	0.9960850	1.0507E+02	1.3683E+00
2	6.53E-04	1.02E-02	7.38E-03	2.96E-02	3.75E-03	1.0906E+00	1.0535E+02
3	1.34E-07	2.61E-03	5.60E-04	1.22E-02	1.64E-04	2.7766E-01	1.0616E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9658380	0.9848160	0.9868780	0.9967580	0.9945640	1.5055E+02	2.3212E+00
2	1.46E-03	1.07E-02	8.68E-03	2.70E-02	4.99E-03	1.6397E+00	1.5123E+02
3	7.87E-06	3.03E-03	1.29E-03	1.19E-02	4.32E-04	4.6330E-01	1.5241E+02
4	4.72E-09	1.43E-03	1.85E-04	7.19E-03	1.50E-05	2.1815E-01	1.5265E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9677230	0.9831100	0.9844070	0.9940560	0.9932790	2.4037E+02	4.1297E+00
2	2.61E-03	1.08E-02	9.46E-03	2.34E-02	5.91E-03	2.6312E+00	2.4187E+02
3	2.32E-04	4.21E-03	2.96E-03	1.25E-02	7.49E-04	1.0286E+00	2.4347E+02
4	1.47E-06	1.61E-03	5.71E-04	6.71E-03	5.80E-05	3.9264E-01	2.4411E+02
5	3.49E-20	3.16E-04	3.10E-07	1.84E-03	1.00E-06	7.7229E-02	2.4442E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9686840	0.9825690	0.9836170	0.9928590	0.9921880	2.9778E+02	5.2828E+00
2	2.83E-03	1.01E-02	9.08E-03	2.10E-02	6.60E-03	3.0715E+00	2.9999E+02
3	3.51E-04	4.13E-03	3.11E-03	1.14E-02	1.07E-03	1.2522E+00	3.0181E+02
4	2.64E-05	2.12E-03	1.17E-03	7.43E-03	1.39E-04	6.4131E-01	3.0242E+02
5	9.84E-09	8.02E-04	1.32E-04	3.91E-03	2.50E-06	2.4302E-01	3.0282E+02
6	7.63E-21	2.47E-04	1.84E-07	1.43E-03	0.00E+00	7.4722E-02	3.0299E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9698630	0.9818240	0.9825940	0.9911420	0.9913250	4.0554E+02	7.5077E+00
2	3.40E-03	9.82E-03	9.04E-03	1.89E-02	7.04E-03	4.0546E+00	4.0899E+02
3	5.95E-04	4.13E-03	3.37E-03	1.03E-02	1.36E-03	1.7075E+00	4.1134E+02
4	1.21E-04	2.40E-03	1.66E-03	7.20E-03	2.71E-04	9.9090E-01	4.1206E+02
5	6.73E-06	1.28E-03	6.12E-04	4.82E-03	7.17E-06	5.2895E-01	4.1252E+02
6	3.03E-10	4.69E-04	4.47E-05	2.44E-03	0.00E+00	1.9373E-01	4.1285E+02
7	3.36E-44	7.75E-05	5.57E-13	3.19E-04	0.00E+00	3.2027E-02	4.1302E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9707040	0.9817620	0.9824260	0.9905480	0.9905780	4.6998E+02	8.7309E+00
2	3.51E-03	9.44E-03	8.77E-03	1.77E-02	7.40E-03	4.5202E+00	4.7419E+02
3	6.29E-04	3.88E-03	3.22E-03	9.41E-03	1.54E-03	1.8590E+00	4.7685E+02
4	1.56E-04	2.33E-03	1.69E-03	6.72E-03	4.60E-04	1.1170E+00	4.7759E+02
5	2.64E-05	1.47E-03	8.63E-04	5.00E-03	1.57E-05	7.0530E-01	4.7801E+02
6	3.87E-07	7.56E-04	2.43E-04	3.25E-03	1.26E-06	3.6204E-01	4.7835E+02
7	7.94E-14	2.66E-04	5.63E-06	1.51E-03	0.00E+00	1.2739E-01	4.7858E+02
8	3.65E-36	8.36E-05	3.62E-11	4.01E-04	0.00E+00	4.0005E-02	4.7867E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9978840	0.9960850	0.9945640	0.9932790	0.9921880	0.9913250	0.9905780
2	2.12E-03	3.75E-03	4.99E-03	5.91E-03	6.60E-03	7.04E-03	7.40E-03
3		1.64E-04	4.32E-04	7.49E-04	1.07E-03	1.36E-03	1.54E-03
4			1.50E-05	5.80E-05	1.39E-04	2.71E-04	4.60E-04
5				1.00E-06	2.50E-06	7.17E-06	1.57E-05
6					0.00E+00	0.00E+00	1.26E-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	9.98E-01	9.96E-01	9.95E-01	9.93E-01	9.92E-01	9.91E-01	9.91E-01
Beta	2.12E-03	3.92E-03	5.44E-03	6.72E-03	7.81E-03	8.67E-03	9.42E-03
Gamma		4.20E-02	8.22E-02	1.20E-01	1.55E-01	1.88E-01	2.14E-01
Delta			3.35E-02	7.30E-02	1.17E-01	1.70E-01	2.36E-01
Epsilon				1.69E-02	1.78E-02	2.58E-02	3.56E-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	37.09	55.64	74.18	92.73	111.27	129.82	148.36
N 1	3.0339	4.3251	5.5003	6.5797	7.5792	8.5218	9.4077
N 2	0.0851	0.2258	0.3997	0.5912	0.7911	0.9825	1.1788
N 3		0.0099	0.0346	0.0749	0.1277	0.1893	0.2460
N 4			0.0012	0.0058	0.0166	0.0378	0.0732
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

2.14 DC Power System - Batteries, Chargers, and Breakers

2.14.1 Batteries

2.14.1.1 DC POWER BATTERY NO OUTPUT SPAR:BAT-LP

System :	DC POWER
Component :	BATTERY
Failure Mode :	NO VOLTAGE/AMPERAGE OUTPUT
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 130
Total Number of Common-Cause Failure Events: 7

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9700170	0.9894370	0.9922520	0.9992430	0.9924210	1.0758E+02	1.1485E+00
2	7.55E-04	1.06E-02	7.75E-03	3.00E-02	7.58E-03	1.1485E+00	1.0758E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9680590	0.9851540	0.9868970	0.9963020	0.9884470	1.7902E+02	2.6978E+00
2	2.38E-03	1.20E-02	1.03E-02	2.76E-02	9.71E-03	2.1798E+00	1.7954E+02
3	1.35E-05	2.85E-03	1.34E-03	1.08E-02	1.85E-03	5.1796E-01	1.8120E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9691660	0.9839440	0.9852010	0.9944190	0.9879320	2.4861E+02	4.0568E+00
2	2.50E-03	1.04E-02	9.10E-03	2.25E-02	7.66E-03	2.6186E+00	2.5005E+02
3	2.78E-04	4.34E-03	3.12E-03	1.26E-02	3.71E-03	1.0963E+00	2.5157E+02
4	4.45E-07	1.35E-03	4.03E-04	5.93E-03	6.95E-04	3.4195E-01	2.5232E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9712410	0.9834410	0.9843060	0.9926830	0.9881890	3.6265E+02	6.1061E+00
2	2.73E-03	9.08E-03	8.21E-03	1.84E-02	5.84E-03	3.3500E+00	3.6541E+02
3	8.20E-04	5.05E-03	4.19E-03	1.22E-02	4.05E-03	1.8615E+00	3.6689E+02
4	4.65E-05	2.05E-03	1.25E-03	6.77E-03	1.64E-03	7.5494E-01	3.6800E+02
5	8.17E-13	3.79E-04	1.19E-05	2.11E-03	2.79E-04	1.3963E-01	3.6862E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9728250	0.9836840	0.9843900	0.9921230	0.9887370	4.4439E+02	7.3710E+00
2	2.39E-03	7.72E-03	7.00E-03	1.55E-02	4.49E-03	3.4865E+00	4.4827E+02
3	8.86E-04	4.66E-03	3.96E-03	1.09E-02	3.66E-03	2.1065E+00	4.4965E+02
4	2.19E-04	2.71E-03	2.02E-03	7.55E-03	2.23E-03	1.2233E+00	4.5054E+02
5	2.13E-06	9.93E-04	4.08E-04	3.96E-03	7.67E-04	4.4872E-01	4.5131E+02
6	7.23E-16	2.35E-04	1.96E-06	1.36E-03	1.17E-04	1.0602E-01	4.5166E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9924210	0.9884470	0.9879320	0.9881890	0.9887370
2	7.58E-03	9.71E-03	7.66E-03	5.84E-03	4.49E-03
3		1.85E-03	3.71E-03	4.05E-03	3.66E-03
4			6.95E-04	1.64E-03	2.23E-03
5				2.79E-04	7.67E-04
6					1.17E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.92E-01	9.88E-01	9.88E-01	9.88E-01	9.89E-01
Beta	7.58E-03	1.16E-02	1.21E-02	1.18E-02	1.13E-02
Gamma		1.60E-01	3.65E-01	5.05E-01	6.01E-01
Delta			1.58E-01	3.22E-01	4.60E-01
Epsilon				1.45E-01	2.84E-01
Mu					1.32E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	86.67	130.00	173.33	216.67	260.00
N 1	3.4879	3.9169	4.4146	4.9216	5.4553
N 2	0.6885	1.3150	1.3786	1.3100	1.2061
N 3		0.2502	0.6676	0.9078	0.9820
N 4			0.1250	0.3681	0.5986
N 5				0.0625	0.2060
N 6					0.0313

2.14.2 Battery Chargers

2.14.2.1 DC POWER BATTERY CHARGER LOSS OF FUNCTION SPAR: BCH-FC

System :	DC POWER
Component :	BATTERY CHARGER
Failure Mode :	NO VOLTAGE/AMPERAGE OUTPUT HIGH VOLTAGE/AMPERAGE OUTPUT
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 661
Total Number of Common-Cause Failure Events: 20

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9804640	0.9909350	0.9920090	0.9977400	0.9919970	2.9573E+02	2.7052E+00
2	2.26E-03	9.06E-03	7.99E-03	1.95E-02	8.00E-03	2.7052E+00	2.9573E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9797480	0.9887800	0.9894760	0.9954470	0.9902460	4.5982E+02	5.2177E+00
2	3.11E-03	8.87E-03	8.18E-03	1.70E-02	7.78E-03	4.1246E+00	4.6091E+02
3	1.49E-04	2.35E-03	1.69E-03	6.82E-03	1.97E-03	1.0931E+00	4.6394E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9789070	0.9870770	0.9875880	0.9935020	0.9887760	6.2094E+02	8.1297E+00
2	3.97E-03	9.23E-03	8.72E-03	1.63E-02	8.21E-03	5.8079E+00	6.2326E+02
3	4.03E-04	2.75E-03	2.24E-03	6.83E-03	2.34E-03	1.7298E+00	6.2734E+02
4	8.36E-06	9.41E-04	4.91E-04	3.40E-03	6.74E-04	5.9195E-01	6.2848E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9789990	0.9862110	0.9865940	0.9921140	0.9883240	8.2633E+02	1.1553E+01
2	4.16E-03	8.69E-03	8.30E-03	1.45E-02	7.56E-03	7.2801E+00	8.3060E+02
3	9.34E-04	3.49E-03	3.11E-03	7.37E-03	2.85E-03	2.9276E+00	8.3496E+02
4	7.98E-05	1.29E-03	9.22E-04	3.76E-03	1.00E-03	1.0810E+00	8.3680E+02
5	9.87E-09	3.16E-04	6.18E-05	1.50E-03	2.70E-04	2.6463E-01	8.3762E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9794300	0.9859960	0.9863120	0.9914760	0.9881410	9.9916E+02	1.4190E+01
2	3.97E-03	7.93E-03	7.61E-03	1.30E-02	6.94E-03	8.0408E+00	1.0053E+03
3	1.18E-03	3.65E-03	3.33E-03	7.22E-03	3.10E-03	3.7014E+00	1.0096E+03
4	2.05E-04	1.58E-03	1.26E-03	4.02E-03	1.17E-03	1.5991E+00	1.0118E+03
5	1.05E-05	6.72E-04	3.85E-04	2.31E-03	5.28E-04	6.8062E-01	1.0127E+03
6	1.20E-11	1.66E-04	1.04E-05	8.93E-04	1.13E-04	1.6852E-01	1.0132E+03

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9919970	0.9902460	0.9887760	0.9883240	0.9881410
2	8.00E-03	7.78E-03	8.21E-03	7.56E-03	6.94E-03
3		1.97E-03	2.34E-03	2.85E-03	3.10E-03
4			6.74E-04	1.00E-03	1.17E-03
5				2.70E-04	5.28E-04
6					1.13E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.92E-01	9.90E-01	9.89E-01	9.88E-01	9.88E-01
Beta	8.00E-03	9.75E-03	1.12E-02	1.17E-02	1.19E-02
Gamma		2.02E-01	2.68E-01	3.53E-01	4.15E-01
Delta			2.24E-01	3.09E-01	3.69E-01
Epsilon				2.13E-01	3.53E-01
Mu					1.76E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	267.07	400.61	534.14	667.68	801.21
N 1	11.2430	14.1047	15.9277	17.5949	19.0167
N 2	2.2452	3.2598	4.5679	5.2401	5.7604
N 3		0.8253	1.3011	1.9739	2.5769
N 4			0.3750	0.6942	0.9744
N 5				0.1875	0.4379
N 6					0.0938

2.14.2.2 DC POWER BATTERY CHARGER NO OUTPUT SPAR:BCH-LP

System :	DC POWER
Component :	BATTERY CHARGER
Failure Mode :	NO VOLTAGE/AMPERAGE OUTPUT
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 599
Total Number of Common-Cause Failure Events: 17

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9795870	0.9908040	0.9920040	0.9979260	0.9919950	2.6364E+02	2.4469E+00
2	2.07E-03	9.20E-03	8.00E-03	2.04E-02	8.01E-03	2.4469E+00	2.6364E+02

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9799700	0.9893430	0.9901190	0.9960750	0.9910700	4.1245E+02	4.4427E+00
2	2.41E-03	8.03E-03	7.26E-03	1.63E-02	6.70E-03	3.3496E+00	4.1354E+02
3	1.67E-04	2.62E-03	1.88E-03	7.60E-03	2.23E-03	1.0931E+00	4.1580E+02

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9801060	0.9883630	0.9889310	0.9946750	0.9904720	5.5882E+02	6.5796E+00
2	2.69E-03	7.53E-03	6.96E-03	1.43E-02	6.13E-03	4.2579E+00	5.6114E+02
3	4.48E-04	3.06E-03	2.50E-03	7.59E-03	2.64E-03	1.7298E+00	5.6367E+02
4	9.30E-06	1.05E-03	5.46E-04	3.78E-03	7.61E-04	5.9195E-01	5.6481E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9798260	0.9871900	0.9876130	0.9930980	0.9898050	7.4903E+02	9.7199E+00
2	3.30E-03	7.67E-03	7.24E-03	1.35E-02	6.16E-03	5.8217E+00	7.5293E+02
3	7.89E-04	3.36E-03	2.94E-03	7.39E-03	2.60E-03	2.5526E+00	7.5620E+02
4	8.82E-05	1.42E-03	1.02E-03	4.15E-03	1.13E-03	1.0810E+00	7.5767E+02
5	1.09E-08	3.49E-04	6.82E-05	1.66E-03	3.05E-04	2.6463E-01	7.5849E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9800430	0.9867810	0.9871310	0.9923200	0.9893980	9.0666E+02	1.2145E+01
2	3.36E-03	7.30E-03	6.94E-03	1.24E-02	6.01E-03	6.7040E+00	9.1210E+02
3	9.54E-04	3.39E-03	3.03E-03	7.02E-03	2.70E-03	3.1111E+00	9.1569E+02
4	1.85E-04	1.61E-03	1.27E-03	4.21E-03	1.16E-03	1.4811E+00	9.1732E+02
5	1.16E-05	7.41E-04	4.24E-04	2.55E-03	5.95E-04	6.8062E-01	9.1812E+02
6	1.32E-11	1.83E-04	1.15E-05	9.85E-04	1.28E-04	1.6852E-01	9.1864E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9919950	0.9910700	0.9904720	0.9898050	0.9893980
2	8.01E-03	6.70E-03	6.13E-03	6.16E-03	6.01E-03
3		2.23E-03	2.64E-03	2.60E-03	2.70E-03
4			7.61E-04	1.13E-03	1.16E-03
5				3.05E-04	5.95E-04
6					1.28E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.92E-01	9.91E-01	9.90E-01	9.90E-01	9.89E-01
Beta	8.01E-03	8.93E-03	9.53E-03	1.02E-02	1.06E-02
Gamma		2.49E-01	3.57E-01	3.96E-01	4.33E-01
Delta			2.24E-01	3.55E-01	4.11E-01
Epsilon				2.13E-01	3.83E-01
Mu					1.76E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	236.76	355.14	473.52	591.90	710.28
N 1	9.4596	12.2047	14.4277	16.0741	17.4459
N 2	1.9869	2.4848	3.0179	3.7817	4.4236
N 3		0.8253	1.3011	1.5989	1.9866
N 4			0.3750	0.6942	0.8564
N 5				0.1875	0.4379
N 6					0.0938

2.14.3 DC Power Distribution Circuit Breakers

2.14.3.1 DC POWER BREAKER FAIL TO OPEN

System :	DC POWER
Component :	DC DISTRIBUTION CIRCUIT BREAKERS
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 62
Total Number of Common-Cause Failure Events: 3

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8806000	0.9502470	0.9583650	0.9920740	0.9266070	3.4251E+01	1.7933E+00
2	7.93E-03	4.98E-02	4.16E-02	1.19E-01	7.34E-02	1.7933E+00	3.4251E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9118970	0.9567840	0.9609300	0.9874880	0.9238100	6.9355E+01	3.1326E+00
2	4.25E-03	2.57E-02	2.15E-02	6.17E-02	3.81E-02	1.8648E+00	7.0623E+01
3	1.54E-03	1.75E-02	1.33E-02	4.78E-02	3.81E-02	1.2678E+00	7.1220E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9169780	0.9542350	0.9570470	0.9818750	0.9117650	1.0187E+02	4.8857E+00
2	8.97E-03	3.03E-02	2.75E-02	6.16E-02	5.88E-02	3.2400E+00	1.0352E+02
3	6.57E-06	4.02E-03	1.58E-03	1.63E-02	0.00E+00	4.2870E-01	1.0633E+02
4	9.20E-04	1.14E-02	8.53E-03	3.17E-02	2.94E-02	1.2170E+00	1.0554E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9408710	0.9653310	0.9669870	0.9841400	0.9281440	1.7981E+02	6.4576E+00
2	5.50E-03	1.81E-02	1.64E-02	3.65E-02	3.19E-02	3.3733E+00	1.8289E+02
3	1.16E-03	8.70E-03	7.01E-03	2.20E-02	1.60E-02	1.6204E+00	1.8465E+02
4	1.72E-06	2.08E-03	7.27E-04	8.72E-03	0.00E+00	3.8684E-01	1.8588E+02
5	3.56E-04	5.78E-03	4.14E-03	1.68E-02	2.40E-02	1.0771E+00	1.8519E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9476220	0.9684370	0.9697690	0.9847030	0.9393940	2.2543E+02	7.3470E+00
2	3.92E-03	1.36E-02	1.22E-02	2.80E-02	1.80E-02	3.1693E+00	2.2961E+02
3	1.56E-03	8.65E-03	7.29E-03	2.04E-02	1.80E-02	2.0134E+00	2.3076E+02
4	1.19E-04	3.64E-03	2.35E-03	1.15E-02	4.49E-03	8.4691E-01	2.3193E+02
5	1.26E-08	1.04E-03	1.72E-04	5.09E-03	0.00E+00	2.4272E-01	2.3253E+02
6	2.83E-04	4.62E-03	3.30E-03	1.35E-02	2.02E-02	1.0747E+00	2.3170E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9555210	0.9718910	0.9728350	0.9850320	0.9475980	3.2145E+02	9.2971E+00
2	3.57E-03	1.11E-02	1.01E-02	2.19E-02	1.04E-02	3.6647E+00	3.2708E+02
3	1.61E-03	7.28E-03	6.31E-03	1.62E-02	1.55E-02	2.4071E+00	3.2834E+02
4	4.41E-04	4.23E-03	3.28E-03	1.12E-02	7.76E-03	1.3975E+00	3.2935E+02
5	1.74E-05	1.82E-03	9.62E-04	6.54E-03	1.29E-03	6.0205E-01	3.3015E+02
6	3.79E-10	5.86E-04	5.58E-05	3.04E-03	0.00E+00	1.9373E-01	3.3055E+02
7	1.73E-04	3.12E-03	2.19E-03	9.23E-03	1.75E-02	1.0320E+00	3.2972E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9586540	0.9733890	0.9742040	0.9853340	0.9538460	3.7421E+02	1.0230E+01
2	3.18E-03	9.72E-03	8.88E-03	1.91E-02	6.08E-03	3.7365E+00	3.8070E+02
3	1.38E-03	6.25E-03	5.42E-03	1.40E-02	1.22E-02	2.4031E+00	3.8204E+02
4	5.75E-04	4.26E-03	3.43E-03	1.08E-02	9.12E-03	1.6364E+00	3.8280E+02
5	9.13E-05	2.34E-03	1.56E-03	7.27E-03	3.04E-03	9.0030E-01	3.8354E+02
6	8.26E-07	1.01E-03	3.51E-04	4.23E-03	3.80E-04	3.8654E-01	3.8405E+02
7	9.89E-14	3.31E-04	7.01E-06	1.88E-03	0.00E+00	1.2739E-01	3.8431E+02
8	1.53E-04	2.71E-03	1.91E-03	7.98E-03	1.54E-02	1.0400E+00	3.8340E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9266070	0.9238100	0.9117650	0.9281440	0.9393940	0.9475980	0.9538460
2	7.34E-02	3.81E-02	5.88E-02	3.19E-02	1.80E-02	1.04E-02	6.08E-03
3		3.81E-02	0.00E+00	1.60E-02	1.80E-02	1.55E-02	1.22E-02
4			2.94E-02	0.00E+00	4.49E-03	7.76E-03	9.12E-03
5				2.40E-02	0.00E+00	1.29E-03	3.04E-03
6					2.02E-02	0.00E+00	3.80E-04
7						1.75E-02	0.00E+00
8							1.54E-02

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.27E-01	9.24E-01	9.12E-01	9.28E-01	9.39E-01	9.48E-01	9.54E-01
Beta	7.34E-02	7.62E-02	8.82E-02	7.19E-02	6.06E-02	5.24E-02	4.62E-02
Gamma		5.00E-01	3.33E-01	5.56E-01	7.04E-01	8.02E-01	8.68E-01
Delta			1.00E+00	6.00E-01	5.79E-01	6.31E-01	6.97E-01
Epsilon				1.00E+00	8.18E-01	7.07E-01	6.73E-01
Mu					1.00E+00	9.31E-01	8.38E-01
Upsilon						1.00E+00	9.76E-01
Sigma							1.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	15.50	23.25	31.00	38.75	46.50	54.25	62.00
N 1	1.3333	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	1.3333	1.0000	2.0000	1.3333	0.8889	0.5926	0.3951
N 3		1.0000	0.0000	0.6667	0.8889	0.8889	0.7901
N 4			1.0000	0.0000	0.2222	0.4444	0.5926
N 5				1.0000	0.0000	0.0741	0.1975
N 6					1.0000	0.0000	0.0247
N 7						1.0000	0.0000
N 8							1.0000

2.14.3.2 DC POWER BREAKER FAIL TO CLOSE

System :	DC POWER
Component :	DC DISTRIBUTION CIRCUIT BREAKERS
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 21
Total Number of Common-Cause Failure Events: 2

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9303170	0.9812320	0.9907220	0.9998920	0.9928450	2.8061E+01	5.3672E-01
2	1.09E-04	1.88E-02	9.28E-03	6.97E-02	7.15E-03	5.3672E-01	2.8061E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9422610	0.9784220	0.9833060	0.9978740	0.9868590	6.0875E+01	1.3426E+00
2	1.04E-03	1.71E-02	1.23E-02	4.97E-02	1.25E-02	1.0648E+00	6.1153E+01
3	2.31E-07	4.46E-03	9.63E-04	2.09E-02	6.26E-04	2.7776E-01	6.1940E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9456710	0.9759680	0.9792650	0.9949960	0.9824460	9.1682E+01	2.2576E+00
2	2.14E-03	1.67E-02	1.34E-02	4.25E-02	1.56E-02	1.5703E+00	9.2369E+01
3	1.38E-05	4.99E-03	2.15E-03	1.96E-02	1.88E-03	4.6850E-01	9.3471E+01
4	7.99E-09	2.33E-03	3.05E-04	1.17E-02	8.50E-05	2.1875E-01	9.3721E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9548900	0.9765180	0.9783560	0.9918790	0.9789530	1.6684E+02	4.0120E+00
2	3.39E-03	1.46E-02	1.28E-02	3.22E-02	1.75E-02	2.5020E+00	1.6835E+02
3	3.43E-04	6.07E-03	4.29E-03	1.79E-02	3.17E-03	1.0373E+00	1.6981E+02
4	2.22E-06	2.31E-03	8.30E-04	9.64E-03	3.19E-04	3.9524E-01	1.7046E+02
5	5.52E-20	4.53E-04	4.54E-07	2.64E-03	1.14E-05	7.7429E-02	1.7077E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9570810	0.9762700	0.9777370	0.9904580	0.9762030	2.0964E+02	5.0957E+00
2	3.52E-03	1.34E-02	1.19E-02	2.82E-02	1.87E-02	2.8674E+00	2.1187E+02
3	5.08E-04	5.88E-03	4.43E-03	1.62E-02	4.39E-03	1.2627E+00	2.1347E+02
4	3.87E-05	3.01E-03	1.67E-03	1.05E-02	6.87E-04	6.4631E-01	2.1409E+02
5	1.49E-08	1.14E-03	1.90E-04	5.55E-03	5.40E-05	2.4442E-01	2.1449E+02
6	1.14E-20	3.48E-04	2.64E-07	2.02E-03	3.18E-06	7.4822E-02	2.1466E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9610310	0.9766460	0.9776660	0.9887850	0.9741790	3.0280E+02	7.2408E+00
2	4.00E-03	1.22E-02	1.11E-02	2.38E-02	1.90E-02	3.7671E+00	3.0627E+02
3	8.07E-04	5.55E-03	4.53E-03	1.38E-02	5.51E-03	1.7194E+00	3.0832E+02
4	1.63E-04	3.21E-03	2.23E-03	9.62E-03	1.15E-03	9.9510E-01	3.0905E+02
5	9.40E-06	1.72E-03	8.28E-04	6.45E-03	1.42E-04	5.3315E-01	3.0951E+02
6	4.14E-10	6.26E-04	5.99E-05	3.25E-03	8.21E-06	1.9403E-01	3.0985E+02
7	4.48E-44	1.03E-04	7.42E-13	4.24E-04	0.00E+00	3.2027E-02	3.1001E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9624870	0.9768220	0.9777000	0.9881690	0.9726430	3.5267E+02	8.3682E+00
2	4.01E-03	1.14E-02	1.05E-02	2.19E-02	1.90E-02	4.1299E+00	3.5691E+02
3	8.57E-04	5.21E-03	4.33E-03	1.26E-02	6.42E-03	1.8801E+00	3.5916E+02
4	2.04E-04	3.08E-03	2.23E-03	8.88E-03	1.67E-03	1.1133E+00	3.5992E+02
5	3.71E-05	1.98E-03	1.17E-03	6.68E-03	2.79E-04	7.1440E-01	3.6032E+02
6	5.25E-07	1.01E-03	3.24E-04	4.32E-03	2.88E-05	3.6304E-01	3.6068E+02
7	1.07E-13	3.53E-04	7.50E-06	2.00E-03	2.40E-06	1.2749E-01	3.6091E+02
8	4.84E-36	1.11E-04	4.80E-11	5.32E-04	0.00E+00	4.0005E-02	3.6100E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9928450	0.9868590	0.9824460	0.9789530	0.9762030	0.9741790	0.9726430
2	7.15E-03	1.25E-02	1.56E-02	1.75E-02	1.87E-02	1.90E-02	1.90E-02
3		6.26E-04	1.88E-03	3.17E-03	4.39E-03	5.51E-03	6.42E-03
4			8.50E-05	3.19E-04	6.87E-04	1.15E-03	1.67E-03
5				1.14E-05	5.40E-05	1.42E-04	2.79E-04
6					3.18E-06	8.21E-06	2.88E-05
7						0.00E+00	2.40E-06
8							0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.93E-01	9.87E-01	9.82E-01	9.79E-01	9.76E-01	9.74E-01	9.73E-01
Beta	7.15E-03	1.31E-02	1.76E-02	2.10E-02	2.38E-02	2.58E-02	2.74E-02
Gamma		4.76E-02	1.12E-01	1.67E-01	2.16E-01	2.64E-01	3.07E-01
Delta			4.33E-02	9.43E-02	1.45E-01	1.91E-01	2.36E-01
Epsilon				3.45E-02	7.69E-02	1.16E-01	1.57E-01
Mu					5.56E-02	5.45E-02	1.01E-01
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	9.33	14.00	18.67	23.33	28.00	32.67	37.33
N 1	1.3133	1.7700	2.1443	2.4522	2.7097	2.9335	3.1305
N 2	0.0767	0.2000	0.3303	0.4620	0.5870	0.6950	0.7885
N 3		0.0100	0.0398	0.0836	0.1382	0.2012	0.2671
N 4			0.0018	0.0084	0.0216	0.0420	0.0695
N 5				0.0003	0.0017	0.0052	0.0116
N 6					0.0001	0.0003	0.0012
N 7						0.0000	0.0001
N 8							0.0000

2.14.3.3 DC POWER BREAKER SPURIOUS ACTUATION

System :	DC POWER
Component :	DC DISTRIBUTION CIRCUIT BREAKERS
Failure Mode :	SPURIOUS ACTUATION
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 32
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9636420	0.9907770	0.9960660	0.9999750	1.0000000	4.9418E+01	4.6002E-01
2	2.32E-05	9.22E-03	3.93E-03	3.64E-02	0.00E+00	4.6002E-01	4.9418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9587870	0.9855250	0.9894030	0.9989910	1.0000000	7.7105E+01	1.1325E+00
2	3.88E-04	1.11E-02	7.26E-03	3.47E-02	0.00E+00	8.6476E-01	7.7373E+01
3	1.22E-07	3.42E-03	6.89E-04	1.62E-02	0.00E+00	2.6776E-01	7.7970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9568450	0.9820000	0.9849700	0.9970020	1.0000000	1.0287E+02	1.8857E+00
2	9.92E-04	1.18E-02	8.91E-03	3.27E-02	0.00E+00	1.2400E+00	1.0352E+02
3	6.69E-06	4.09E-03	1.61E-03	1.66E-02	0.00E+00	4.2870E-01	1.0433E+02
4	6.38E-09	2.07E-03	2.66E-04	1.04E-02	0.00E+00	2.1695E-01	1.0454E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9607890	0.9804120	0.9821960	0.9939320	1.0000000	1.7306E+02	3.4577E+00
2	2.12E-03	1.16E-02	9.77E-03	2.71E-02	0.00E+00	2.0400E+00	1.7448E+02
3	2.47E-04	5.40E-03	3.69E-03	1.64E-02	0.00E+00	9.5369E-01	1.7556E+02
4	1.81E-06	2.19E-03	7.67E-04	9.20E-03	0.00E+00	3.8684E-01	1.7613E+02
5	4.59E-20	4.37E-04	4.24E-07	2.54E-03	0.00E+00	7.7129E-02	1.7644E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9619620	0.9798070	0.9812730	0.9926420	1.0000000	2.1093E+02	4.3471E+00
2	2.21E-03	1.06E-02	9.12E-03	2.40E-02	0.00E+00	2.2804E+00	2.1300E+02
3	3.55E-04	5.22E-03	3.79E-03	1.50E-02	0.00E+00	1.1245E+00	2.1415E+02
4	3.25E-05	2.90E-03	1.58E-03	1.03E-02	0.00E+00	6.2471E-01	2.1465E+02
5	1.37E-08	1.13E-03	1.86E-04	5.51E-03	0.00E+00	2.4272E-01	2.1503E+02
6	1.08E-20	3.47E-04	2.60E-07	2.01E-03	0.00E+00	7.4722E-02	2.1520E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9645000	0.9793870	0.9804230	0.9907370	1.0000000	2.9920E+02	6.2971E+00
2	2.81E-03	1.01E-02	9.01E-03	2.09E-02	0.00E+00	3.0721E+00	3.0243E+02
3	5.97E-04	4.97E-03	3.94E-03	1.29E-02	0.00E+00	1.5182E+00	3.0398E+02
4	1.42E-04	3.12E-03	2.13E-03	9.49E-03	0.00E+00	9.5310E-01	3.0454E+02
5	9.00E-06	1.73E-03	8.26E-04	6.51E-03	0.00E+00	5.2795E-01	3.0497E+02
6	4.10E-10	6.34E-04	6.04E-05	3.30E-03	0.00E+00	1.9373E-01	3.0530E+02
7	4.48E-44	1.05E-04	7.53E-13	4.31E-04	0.00E+00	3.2027E-02	3.0547E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9656340	0.9794270	0.9803280	0.9901320	1.0000000	3.4421E+02	7.2302E+00
2	2.85E-03	9.51E-03	8.59E-03	1.93E-02	0.00E+00	3.3414E+00	3.4810E+02
3	6.06E-04	4.59E-03	3.69E-03	1.16E-02	0.00E+00	1.6130E+00	3.4983E+02
4	1.70E-04	2.97E-03	2.10E-03	8.75E-03	0.00E+00	1.0438E+00	3.5040E+02
5	3.53E-05	2.00E-03	1.17E-03	6.79E-03	0.00E+00	7.0280E-01	3.5074E+02
6	5.24E-07	1.03E-03	3.31E-04	4.43E-03	0.00E+00	3.6184E-01	3.5108E+02
7	1.08E-13	3.62E-04	7.67E-06	2.05E-03	0.00E+00	1.2739E-01	3.5131E+02
8	4.97E-36	1.14E-04	4.94E-11	5.47E-04	0.00E+00	4.0005E-02	3.5140E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	32.00	32.00	32.00	32.00	32.00	32.00	32.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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

2.15 Reactor Protection System, Reactor Trip Breakers

2.15.1 Reactor Trip Breakers

2.15.1.1 REACTOR TRIP BREAKERS FAIL TO OPEN

System :	REACTOR PROTECTION
Component :	REACTOR PROTECTION TRIP CIRCUIT BREAKERS
Failure Mode :	FAIL TO OPEN (NORMALLY CLOSED)
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 39
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9681020	0.9919120	0.9965600	0.9999780	1.0000000	5.6418E+01	4.6002E-01
2	2.03E-05	8.09E-03	3.44E-03	3.19E-02	0.00E+00	4.6002E-01	5.6418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9621530	0.9867130	0.9902800	0.9990750	1.0000000	8.4105E+01	1.1325E+00
2	3.56E-04	1.01E-02	6.66E-03	3.18E-02	0.00E+00	8.6476E-01	8.4373E+01
3	1.12E-07	3.14E-03	6.32E-04	1.49E-02	0.00E+00	2.6776E-01	8.4970E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9595270	0.9831270	0.9859170	0.9971920	1.0000000	1.0987E+02	1.8857E+00
2	9.29E-04	1.11E-02	8.34E-03	3.07E-02	0.00E+00	1.2400E+00	1.1052E+02
3	6.27E-06	3.84E-03	1.51E-03	1.55E-02	0.00E+00	4.2870E-01	1.1133E+02
4	5.98E-09	1.94E-03	2.49E-04	9.79E-03	0.00E+00	2.1695E-01	1.1154E+02

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9622740	0.9811590	0.9828770	0.9941690	1.0000000	1.8006E+02	3.4577E+00
2	2.04E-03	1.11E-02	9.40E-03	2.61E-02	0.00E+00	2.0400E+00	1.8148E+02
3	2.37E-04	5.20E-03	3.55E-03	1.58E-02	0.00E+00	9.5369E-01	1.8256E+02
4	1.74E-06	2.11E-03	7.37E-04	8.85E-03	0.00E+00	3.8684E-01	1.8313E+02
5	4.42E-20	4.20E-04	4.08E-07	2.44E-03	0.00E+00	7.7129E-02	1.8344E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9631520	0.9804430	0.9818640	0.9928750	1.0000000	2.1793E+02	4.3471E+00
2	2.14E-03	1.03E-02	8.83E-03	2.33E-02	0.00E+00	2.2804E+00	2.2000E+02
3	3.43E-04	5.06E-03	3.67E-03	1.45E-02	0.00E+00	1.1245E+00	2.2115E+02
4	3.15E-05	2.81E-03	1.53E-03	9.95E-03	0.00E+00	6.2471E-01	2.2165E+02
5	1.32E-08	1.09E-03	1.80E-04	5.33E-03	0.00E+00	2.4272E-01	2.2203E+02
6	1.04E-20	3.36E-04	2.52E-07	1.95E-03	0.00E+00	7.4722E-02	2.2220E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9652860	0.9798490	0.9808620	0.9909410	1.0000000	3.0620E+02	6.2971E+00
2	2.75E-03	9.83E-03	8.81E-03	2.04E-02	0.00E+00	3.0721E+00	3.0943E+02
3	5.83E-04	4.86E-03	3.85E-03	1.26E-02	0.00E+00	1.5182E+00	3.1098E+02
4	1.39E-04	3.05E-03	2.08E-03	9.28E-03	0.00E+00	9.5310E-01	3.1154E+02
5	8.80E-06	1.69E-03	8.07E-04	6.36E-03	0.00E+00	5.2795E-01	3.1197E+02
6	4.01E-10	6.20E-04	5.91E-05	3.22E-03	0.00E+00	1.9373E-01	3.1230E+02
7	4.34E-44	1.02E-04	7.37E-13	4.21E-04	0.00E+00	3.2027E-02	3.1247E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9663010	0.9798290	0.9807130	0.9903260	1.0000000	3.5121E+02	7.2302E+00
2	2.80E-03	9.32E-03	8.43E-03	1.89E-02	0.00E+00	3.3414E+00	3.5510E+02
3	5.95E-04	4.50E-03	3.62E-03	1.14E-02	0.00E+00	1.6130E+00	3.5683E+02
4	1.66E-04	2.91E-03	2.06E-03	8.58E-03	0.00E+00	1.0438E+00	3.5740E+02
5	3.47E-05	1.96E-03	1.15E-03	6.66E-03	0.00E+00	7.0280E-01	3.5774E+02
6	5.14E-07	1.01E-03	3.24E-04	4.34E-03	0.00E+00	3.6184E-01	3.5808E+02
7	1.06E-13	3.55E-04	7.52E-06	2.01E-03	0.00E+00	1.2739E-01	3.5831E+02
8	4.87E-36	1.12E-04	4.84E-11	5.36E-04	0.00E+00	4.0005E-02	3.5840E+02

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	39.00	39.00	39.00	39.00	39.00	39.00	39.00
N 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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

3 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.

3.1 Generic Distributions

3.1.1 Generic Demand CCF Distribution

3.1.1.1 ALL CCF PROBABILITY BASED EVENTS 1991 TO CURRENT SPAR: CCF-DEM

Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN) FAIL TO OPEN (NORMALLY CLOSED) FAIL TO START FAIL TO STOP
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 5722
Total Number of Common-Cause Failure Events: 375

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9575610	0.9648240	0.9649860	0.9715280	0.9647330	1.8100E+03	6.5990E+01
2	2.85E-02	3.52E-02	3.50E-02	4.24E-02	3.53E-02	6.5990E+01	1.8100E+03

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9579120	0.9639110	0.9640230	0.9695270	0.9637140	2.6833E+03	1.0046E+02
2	1.94E-02	2.39E-02	2.38E-02	2.89E-02	2.40E-02	6.6566E+01	2.7172E+03
3	8.97E-03	1.22E-02	1.21E-02	1.58E-02	1.23E-02	3.3898E+01	2.7499E+03

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9596480	0.9647820	0.9648640	0.9696300	0.9645940	3.5506E+03	1.2961E+02
2	1.59E-02	1.95E-02	1.94E-02	2.34E-02	1.96E-02	7.1769E+01	3.6084E+03
3	7.69E-03	1.03E-02	1.02E-02	1.31E-02	1.04E-02	3.7766E+01	3.6424E+03
4	3.62E-03	5.45E-03	5.37E-03	7.59E-03	5.50E-03	2.0074E+01	3.6601E+03

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9634500	0.9678320	0.9679010	0.9719870	0.9675650	4.4690E+03	1.4854E+02
2	1.20E-02	1.48E-02	1.47E-02	1.78E-02	1.48E-02	6.8136E+01	4.5494E+03
3	6.70E-03	8.84E-03	8.77E-03	1.12E-02	8.91E-03	4.0807E+01	4.5767E+03
4	4.33E-03	6.08E-03	6.01E-03	8.08E-03	6.19E-03	2.8077E+01	4.5895E+03
5	1.42E-03	2.49E-03	2.42E-03	3.81E-03	2.56E-03	1.1519E+01	4.6060E+03

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9658770	0.9697650	0.9698190	0.9734600	0.9695410	5.3515E+03	1.6685E+02
2	1.02E-02	1.26E-02	1.25E-02	1.52E-02	1.26E-02	6.9522E+01	5.4488E+03
3	5.42E-03	7.19E-03	7.13E-03	9.15E-03	7.22E-03	3.9655E+01	5.4787E+03
4	4.09E-03	5.64E-03	5.59E-03	7.40E-03	5.72E-03	3.1149E+01	5.4872E+03
5	2.30E-03	3.50E-03	3.44E-03	4.90E-03	3.57E-03	1.9307E+01	5.4990E+03
6	6.22E-04	1.31E-03	1.25E-03	2.20E-03	1.34E-03	7.2149E+00	5.5111E+03

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9647330	0.9637140	0.9645940	0.9675650	0.9695410
2	3.53E-02	2.40E-02	1.96E-02	1.48E-02	1.26E-02
3		1.23E-02	1.04E-02	8.91E-03	7.22E-03
4			5.50E-03	6.19E-03	5.72E-03
5				2.56E-03	3.57E-03
6					1.34E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.65E-01	9.64E-01	9.65E-01	9.68E-01	9.70E-01
Beta	3.53E-02	3.63E-02	3.54E-02	3.24E-02	3.05E-02
Gamma		3.39E-01	4.48E-01	5.44E-01	5.86E-01
Delta			3.47E-01	4.95E-01	5.96E-01
Epsilon				2.92E-01	4.62E-01
Mu					2.72E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	1665.79	2498.69	3331.59	4164.48	4997.38
N 1	126.7808	139.4699	148.1039	163.4328	175.2169
N 2	65.5304	65.7013	70.5289	66.0962	67.2412
N 3		33.6300	37.3376	39.8533	38.5304
N 4			19.8568	27.6898	30.5239
N 5				11.4416	19.0639
N 6					7.1402

3.1.2 Generic Rate CCF Distribution

3.1.2.1 ALL CCF RATE BASED EVENTS 1991 TO CURRENT SPAR: CCF-RATE

Failure Mode :	SPURIOUS ACTUATION FAIL TO RUN FAIL TO REMAIN CLOSED (DETECTABLE LEAKAGE) NO VOLTAGE/AMPERAGE OUTPUT HIGH VOLTAGE/AMPERAGE OUTPUT NO FLOW/PLUGGED
Start Date :	1991/01/01
Data Version :	2007/12/31

Total Number of Independent Failure Events: 4161

Total Number of Common-Cause Failure Events: 270

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9654480	0.9721610	0.9723360	0.9782680	0.9721390	1.7231E+03	4.9343E+01
2	2.17E-02	2.78E-02	2.77E-02	3.46E-02	2.79E-02	4.9343E+01	1.7231E+03

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9667950	0.9722490	0.9723650	0.9772920	0.9721910	2.5686E+03	7.3317E+01
2	1.34E-02	1.73E-02	1.72E-02	2.17E-02	1.73E-02	4.5816E+01	2.5961E+03
3	7.39E-03	1.04E-02	1.03E-02	1.39E-02	1.05E-02	2.7501E+01	2.6144E+03

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9686110	0.9732420	0.9733290	0.9775700	0.9732230	3.4094E+03	9.3738E+01
2	1.07E-02	1.37E-02	1.36E-02	1.71E-02	1.36E-02	4.8060E+01	3.4551E+03
3	5.97E-03	8.33E-03	8.23E-03	1.10E-02	8.38E-03	2.9168E+01	3.4740E+03
4	2.98E-03	4.71E-03	4.62E-03	6.76E-03	4.75E-03	1.6510E+01	3.4866E+03

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9707490	0.9747580	0.9748320	0.9785210	0.9747130	4.2943E+03	1.1120E+02
2	8.72E-03	1.12E-02	1.11E-02	1.39E-02	1.11E-02	4.9342E+01	4.3562E+03
3	5.10E-03	7.04E-03	6.96E-03	9.23E-03	7.05E-03	3.1009E+01	4.3745E+03
4	3.30E-03	4.89E-03	4.82E-03	6.74E-03	4.97E-03	2.1551E+01	4.3840E+03
5	1.12E-03	2.11E-03	2.04E-03	3.36E-03	2.16E-03	9.3017E+00	4.3962E+03

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9724430	0.9760120	0.9760750	0.9793740	0.9760020	5.1456E+03	1.2647E+02
2	7.54E-03	9.65E-03	9.59E-03	1.20E-02	9.55E-03	5.0864E+01	5.2212E+03
3	4.25E-03	5.87E-03	5.81E-03	7.70E-03	5.86E-03	3.0945E+01	5.2411E+03
4	3.19E-03	4.61E-03	4.55E-03	6.24E-03	4.65E-03	2.4301E+01	5.2478E+03
5	1.69E-03	2.77E-03	2.71E-03	4.06E-03	2.82E-03	1.4595E+01	5.2575E+03
6	4.66E-04	1.09E-03	1.03E-03	1.93E-03	1.12E-03	5.7620E+00	5.2663E+03

ALPHA FACTOR and MGL PARAMETERS

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9721390	0.9721910	0.9732230	0.9747130	0.9760020
2	2.79E-02	1.73E-02	1.36E-02	1.11E-02	9.55E-03
3		1.05E-02	8.38E-03	7.05E-03	5.86E-03
4			4.75E-03	4.97E-03	4.65E-03
5				2.16E-03	2.82E-03
6					1.12E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.72E-01	9.72E-01	9.73E-01	9.75E-01	9.76E-01
Beta	2.79E-02	2.78E-02	2.68E-02	2.53E-02	2.40E-02
Gamma		3.77E-01	4.90E-01	5.61E-01	6.02E-01
Delta			3.62E-01	5.03E-01	5.94E-01
Epsilon				3.04E-01	4.58E-01
Mu					2.84E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	1612.79	2419.19	3225.58	4031.98	4838.37
N 1	92.8699	104.3539	112.9131	121.2745	128.2814
N 2	48.8831	44.9509	46.8198	47.3017	48.5832
N 3		27.2328	28.7397	30.0557	29.8202
N 4			16.2932	21.1643	23.6763
N 5				9.2246	14.3525
N 6					5.6873

3.1.3 CCF Prior Distribution

3.1.3.1 No Data (Prior Only)

Data Version :	2007/12/31

Total Number of Independent Failure Events: 0
Total Number of Common-Cause Failure Events: 0

ALPHA FACTOR DISTRIBUTIONS

CCCG = 2

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8993200	0.9742690	0.9887700	0.9999290	----	1.7418E+01	4.6002E-01
2	6.65E-05	2.57E-02	1.12E-02	1.00E-01	----	4.6002E-01	1.7418E+01

CCCG = 3

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9306240	0.9755060	0.9819700	0.9982830	----	4.5105E+01	1.1325E+00
2	6.61E-04	1.87E-02	1.23E-02	5.84E-02	----	8.6476E-01	4.5372E+01
3	2.07E-07	5.79E-03	1.17E-03	2.74E-02	----	2.6776E-01	4.5969E+01

CCCG = 4

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9380870	0.9740820	0.9782970	0.9956540	----	7.0868E+01	1.8856E+00
2	1.43E-03	1.70E-02	1.28E-02	4.69E-02	----	1.2400E+00	7.1513E+01
3	9.66E-06	5.89E-03	2.32E-03	2.38E-02	----	4.2870E-01	7.2324E+01
4	9.21E-09	2.98E-03	3.83E-04	1.50E-02	----	2.1695E-01	7.2536E+01

CCCG = 5

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9521790	0.9760740	0.9782400	0.9925770	----	1.4106E+02	3.4576E+00
2	2.59E-03	1.41E-02	1.19E-02	3.30E-02	----	2.0400E+00	1.4247E+02
3	3.01E-04	6.59E-03	4.50E-03	2.00E-02	----	9.5369E-01	1.4356E+02
4	2.21E-06	2.67E-03	9.37E-04	1.12E-02	----	3.8684E-01	1.4413E+02
5	5.61E-20	5.33E-04	5.18E-07	3.10E-03	----	7.7129E-02	1.4444E+02

CCCG = 6

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9553700	0.9762820	0.9779970	0.9913440	----	1.7893E+02	4.3470E+00
2	2.60E-03	1.24E-02	1.07E-02	2.81E-02	----	2.2804E+00	1.8099E+02
3	4.16E-04	6.13E-03	4.45E-03	1.75E-02	----	1.1245E+00	1.8215E+02
4	3.82E-05	3.40E-03	1.85E-03	1.20E-02	----	6.2471E-01	1.8265E+02
5	1.60E-08	1.32E-03	2.18E-04	6.46E-03	----	2.4272E-01	1.8303E+02
6	1.26E-20	4.07E-04	3.05E-07	2.36E-03	----	7.4722E-02	1.8320E+02

CCCG = 7

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9603690	0.9769760	0.9781320	0.9896440	----	2.6720E+02	6.2971E+00
2	3.14E-03	1.12E-02	1.00E-02	2.33E-02	----	3.0721E+00	2.7042E+02
3	6.66E-04	5.55E-03	4.40E-03	1.43E-02	----	1.5182E+00	2.7197E+02
4	1.58E-04	3.48E-03	2.37E-03	1.06E-02	----	9.5310E-01	2.7254E+02
5	1.00E-05	1.93E-03	9.22E-04	7.26E-03	----	5.2795E-01	2.7296E+02
6	4.58E-10	7.08E-04	6.75E-05	3.68E-03	----	1.9373E-01	2.7330E+02
7	5.03E-44	1.17E-04	8.41E-13	4.81E-04	----	3.2027E-02	2.7346E+02

CCCG = 8

Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9622170	0.9773660	0.9783580	0.9891370	----	3.1221E+02	7.2302E+00
2	3.13E-03	1.04E-02	9.45E-03	2.12E-02	----	3.3414E+00	3.1609E+02
3	6.67E-04	5.04E-03	4.06E-03	1.28E-02	----	1.6130E+00	3.1782E+02
4	1.86E-04	3.26E-03	2.30E-03	9.62E-03	----	1.0438E+00	3.1839E+02
5	3.88E-05	2.20E-03	1.28E-03	7.47E-03	----	7.0280E-01	3.1873E+02
6	5.77E-07	1.13E-03	3.63E-04	4.86E-03	----	3.6184E-01	3.1907E+02
7	1.19E-13	3.98E-04	8.44E-06	2.25E-03	----	1.2739E-01	3.1931E+02
8	5.47E-36	1.25E-04	5.43E-11	6.01E-04	----	4.0005E-02	3.1940E+02

4 Glossary

Application
A particular set of CCF events selected from the CCF database for use in a specific study.
Average Impact Vector
An average over the impact vectors for different hypotheses regarding the number of components failed in an event.
Available
The component is available if it is capable of performing its function according to a specified success criterion.
Basic Event
An event in a reliability logic model that represents the state in which a component or group of components is unavailable and does not require further development in terms of contributing causes.
Common Cause Event
A dependent failure in which two or more component fault states exist simultaneously, or within a short time interval, and are a direct result of a shared cause.
Common Cause Basic Event
In system modeling, a basic event that represents the unavailability of a specific set of components because of shared causes that are not explicitly represented in the system logic model as other basic events.
Common Cause Component Group
A group of (usually similar [in mission, manufacturer, maintenance, environment, etc.]) components that are considered to have a high potential for failure due to the same cause or causes.
Common Cause Failure Model
The basis for quantifying the frequency of common cause events. Examples include the beta factor, alpha factor, and basic parameter, and the binomial failure rate models.
Complete Common Cause Failure
A CCF in which all redundant components are failed simultaneously as a direct result of a shared cause; i.e., the component degradation value equals 1.0 for all components, and both the timing factor and the shared cause factor are equal to 1.0.
Component
An element of plant hardware designed to provide a particular function.
Component Boundary
The component boundary encompasses the set of piece parts that are considered to form the component.
Component Degradation Value (p)
The assessed probability ($0.0 = p = 1.0$) that a functionally or physically degraded component would fail to complete the mission.
Component State
Component state defines the component status in regard to its intended function. Two general categories of component states are defined as available and unavailable.
Timing Factor (q)
The probability ($0.0 = q = 1.0$) that two or more component failures (or degraded states) separated in time represent a CCF. This can be viewed as an indication of the strength-of-coupling in synchronizing failure times.
Unavailable
The component is unavailable if the component is unable to perform its intended function according to a stated success criterion. Two subsets of unavailable states are failure and functionally unavailable.
Exposed Population

The set of components within the plant that are potentially affected by the CCF under consideration.

Failure

The component is not capable of performing its specified operation according to a success criterion.

Functionally Unavailable

The component is capable of operation, but the function normally provided by the component is unavailable due to lack of proper input, lack of support function from a source outside the component (i.e., motive power, actuation signal), maintenance, testing, the improper interference of a person, etc.

Potentially Unavailable

The component is capable of performing its function according to a success criterion, but an incipient or degraded condition exists. (N.B., potentially unavailable is not synonymous with hypothetical.)

Defense

Any operational, maintenance, and design measures taken to diminish the frequency and/or consequences of CCFs.

Degraded

The component is in such a state that it exhibits reduced performance but insufficient degradation to declare the component unavailable according to the specified success criterion.

Impact Vector

An assessment of the impact an event would have on a common cause component group. The impact is usually measured as the number of failed components out of a set of similar components in the common cause component group.

Incipient

The component is in a condition that, if left unremedied, could ultimately lead to a degraded or unavailable state.

Reliability Logic Model

A logical representation of the combinations of component states that could lead to system failure. A fault tree is an example of a system logic model.

Root Cause

The most basic reason for a component failure, which, if corrected, could prevent recurrence. The identified root cause may vary depending on the particular defensive strategy adopted against the failure mechanism.

Shared Cause Factor/Mechanism

A set of causes and factors characterizing why and how a failure is systematically induced in several components.

Failure Mechanism

The history describing the events and influences leading to a given failure.

Failure Mode

A description of component failure in terms of the component function that was actually or potentially unavailable.

Failure Mode Applicability

The analyst's probability that the specified component failure mode for a given event is appropriate to the particular application.

Mapping

The impact vector of an event must be "mapped up" or "mapped down" when the exposed population of the target plant is higher or lower than that of the original plant that experienced the CCF. The end result of mapping an impact vector is an adjusted impact vector applicable to the target plant.

Mapping Up Factor

A factor used to adjust the impact vector of an event when the exposed population of the target plan is higher than that of the original plant that experienced the CCF.

Potential Common Cause Failure

Any common cause event in which at least one component degradation value is less than 1.0.

Proximate Cause
A characterization of the condition that is readily identified as leading to failure of the component. It might alternatively be characterized as a symptom.
Shared-Cause Factor (c)
A number that reflects the analyst's uncertainty ($0.0 = c = 1.0$) about the existence of coupling among the failures of two or more components, i.e., whether a shared cause of failure can be clearly identified.
Shock
A shock is an event that occurs at a random point in time and acts on the system; i.e., all the components in the system simultaneously. There are two kinds of shocks distinguished by the potential impact of the shock event, i.e., lethal and non-lethal.
System
The entity that encompasses an interacting collection of components to provide a particular function or functions.