CCF Parameter Estimations 2005

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 used in the SPAR Version 3.45 models. This is the 2005 update to NUREG/CR-5496, updating data and parameter estimations.

This release, CCF Parameter Estimation for 2005, reflects the CCF data contained within the CCF database, Version 4.0.2005. This version of the CCF database contains data from 1980 to 2005.

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. Two exceptions to the starting date search are the check valves failure to open (AFW and All). These use 1/1/1984 since the software would not allow zero event applications at the time these parameters were supplied to the SPAR models. In future updates these two applications will use 1/1/1991. The other 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, 2005 Update", http://nrcoe.inl.gov/results/CCF/ParamEst2005/ccfparamest.htm, September 2008.

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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 No Data (Prior Only) pooled distribution may be appropriate.

2.1 Motor Driven Pumps

2.1.1 Pooled Motor Driven Pump Distributions

2.1.1.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9715740	0.9815650	0.9821100	0.9896860	0.9819800	5.7269E+02	1.0756E+01
2	1.03E-02	1.84E-02	1.79E-02	2.84E-02	1.80E-02	1.0756E+01	5.7269E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9728480	0.9809760	0.9813360	0.9878730	0.9815830	8.6519E+02	1.6779E+01
2	7.76E-03	1.35E-02	1.31E-02	2.04E-02	1.30E-02	1.1869E+01	8.7010E+02
3	2.17E-03	5.57E-03	5.20E-03	1.02E-02	5.45E-03	4.9098E+00	8.7706E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9750490	0.9818760	0.9821460	0.9877700	0.9827490	1.1553E+03	2.1325E+01
2	5.86E-03	1.01E-02	9.87E-03	1.54E-02	9.49E-03	1.1935E+01	1.1647E+03
3	2.71E-03	5.83E-03	5.55E-03	9.89E-03	5.72E-03	6.8566E+00	1.1698E+03
4	5.01E-04	2.15E-03	1.88E-03	4.74E-03	2.05E-03	2.5332E+00	1.1741E+03

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9766930	0.9825770	0.9827920	0.9877340	0.9838600	1.4785E+03	2.6216E+01
2	5.01E-03	8.50E-03	8.28E-03	1.27E-02	7.59E-03	1.2783E+01	1.4919E+03
3	2.43E-03	5.01E-03	4.79E-03	8.32E-03	4.67E-03	7.5331E+00	1.4972E+03
4	1.17E-03	3.10E-03	2.88E-03	5.77E-03	3.06E-03	4.6676E+00	1.5000E+03
5	6.72E-05	8.19E-04	6.12E-04	2.28E-03	8.26E-04	1.2327E+00	1.5035E+03

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9780280	0.9832790	0.9834600	0.9879210	0.9846190	1.7720E+03	3.0133E+01
2	4.51E-03	7.52E-03	7.33E-03	1.11E-02	6.73E-03	1.3545E+01	1.7886E+03
3	1.96E-03	4.07E-03	3.89E-03	6.81E-03	3.69E-03	7.3414E+00	1.7948E+03
4	1.31E-03	3.12E-03	2.94E-03	5.54E-03	2.99E-03	5.6193E+00	1.7965E+03
5	4.43E-04	1.64E-03	1.46E-03	3.46E-03	1.63E-03	2.9596E+00	1.7992E+03
6	5.39E-06	3.70E-04	2.10E-04	1.28E-03	3.48E-04	6.6764E-01	1.8015E+03

ALPHA FACTOR and MGL PARAMETERS

Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 883
Total Number of Common-Cause Failure Events: 46

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9819800	0.9815830	0.9827490	0.9838600	0.9846190
2	1.80E-02	1.30E-02	9.49E-03	7.59E-03	6.73E-03
3		5.45E-03	5.72E-03	4.67E-03	3.69E-03
4			2.05E-03	3.06E-03	2.99E-03
5				8.26E-04	1.63E-03
6					3.48E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.82E-01	9.82E-01	9.83E-01	9.84E-01	9.85E-01
Beta	1.80E-02	1.84E-02	1.73E-02	1.61E-02	1.54E-02
Gamma		2.96E-01	4.50E-01	5.30E-01	5.63E-01
Delta			2.64E-01	4.54E-01	5.74E-01
Epsilon				2.13E-01	3.98E-01
Mu					1.76E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	541.72	812.58	1083.44	1354.29	1625.15
N_1	20.7260	23.0532	25.6824	28.0926	29.8993
N_2	10.3212	11.0358	10.7070	10.6687	11.3061
N_3		4.6426	6.4523	6.5557	6.1996
N_4			2.3105	4.2932	5.0271
N_5				1.1604	2.7374
N_6					0.5844

2.1.1.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9472420	0.9632170	0.9639250	0.9767610	0.9633160	4.1741E+02	1.5940E+01
2	2.32E-02	3.68E-02	3.61E-02	5.28E-02	3.67E-02	1.5940E+01	4.1741E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9517290	0.9643970	0.9648680	0.9754480	0.9644120	6.3030E+02	2.3269E+01
2	1.40E-02	2.27E-02	2.22E-02	3.30E-02	2.25E-02	1.4828E+01	6.3874E+02
3	6.60E-03	1.29E-02	1.24E-02	2.09E-02	1.31E-02	8.4407E+00	6.4513E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9554450	0.9661050	0.9664640	0.9755470	0.9663830	8.3986E+02	2.9465E+01
2	1.13E-02	1.81E-02	1.77E-02	2.61E-02	1.76E-02	1.5715E+01	8.5361E+02
3	5.67E-03	1.07E-02	1.03E-02	1.70E-02	1.08E-02	9.3037E+00	8.6002E+02
4	1.88E-03	5.12E-03	4.74E-03	9.63E-03	5.14E-03	4.4468E+00	8.6488E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9614920	0.9702860	0.9705690	0.9781250	0.9708510	1.0857E+03	3.3248E+01
2	7.26E-03	1.21E-02	1.18E-02	1.79E-02	1.12E-02	1.3526E+01	1.1054E+03
3	5.20E-03	9.39E-03	9.10E-03	1.46E-02	9.35E-03	1.0506E+01	1.1084E+03
4	2.89E-03	6.18E-03	5.89E-03	1.05E-02	6.42E-03	6.9164E+00	1.1120E+03
5	4.31E-04	2.06E-03	1.77E-03	4.66E-03	2.19E-03	2.2997E+00	1.1166E+03

CCCG = 6 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9654300	0.9730830	0.9733160	0.9799370	0.9739160	1.3020E+03	3.6016E+01
2	5.29E-03	9.10E-03	8.85E-03	1.37E-02	8.16E-03	1.2173E+01	1.3258E+03
3	3.99E-03	7.38E-03	7.13E-03	1.16E-02	7.17E-03	9.8708E+00	1.3281E+03
4	3.00E-03	6.01E-03	5.76E-03	9.85E-03	6.12E-03	8.0353E+00	1.3300E+03
5	1.31E-03	3.47E-03	3.23E-03	6.47E-03	3.63E-03	4.6442E+00	1.3334E+03
6	8.70E-05	9.66E-04	7.32E-04	2.65E-03	9.94E-04	1.2925E+00	1.3367E+03

ALPHA FACTOR and MGL PARAMETERS

Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 744
Total Number of Common-Cause Failure Events: 52

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9633160	0.9644120	0.9663830	0.9708510	0.9739160
2	3.67E-02	2.25E-02	1.76E-02	1.12E-02	8.16E-03
3		1.31E-02	1.08E-02	9.35E-03	7.17E-03
4			5.14E-03	6.42E-03	6.12E-03
5				2.19E-03	3.63E-03
6					9.94E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.63E-01	9.64E-01	9.66E-01	9.71E-01	9.74E-01
Beta	3.67E-02	3.56E-02	3.36E-02	2.91E-02	2.61E-02
Gamma		3.69E-01	4.75E-01	6.16E-01	6.87E-01
Delta			3.22E-01	4.79E-01	6.00E-01
Epsilon				2.54E-01	4.31E-01
Mu					2.15E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	383.51	575.26	767.01	958.76	1150.52
N_1	23.6501	25.4807	26.7173	30.7728	34.4943
N_2	15.5050	13.9944	14.4871	11.4120	9.9338
N_3		8.1735	8.8994	9.5282	8.7290
N_4			4.2241	6.5420	7.4431
N_5				2.2274	4.4220
N_6					1.2093

2.1.2 Pooled Pump Volutes

2.1.2.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

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 :	**2005/12/31**
System :	**AUXILIARY FEEDWATER SYSTEM**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9744610	0.9858580	0.9867290	0.9942750	0.9866530	3.6202E+02	5.1932E+00
2	5.73E-03	1.41E-02	1.33E-02	2.55E-02	1.33E-02	5.1932E+00	3.6202E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9751100	0.9845310	0.9851000	0.9920050	0.9857120	5.5298E+02	8.6882E+00
2	4.76E-03	1.08E-02	1.02E-02	1.88E-02	9.87E-03	6.0767E+00	5.5559E+02
3	1.12E-03	4.65E-03	4.08E-03	1.01E-02	4.41E-03	2.6115E+00	5.5906E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9776450	0.9854720	0.9858970	0.9918390	0.9871150	7.4204E+02	1.0939E+01
2	3.35E-03	7.77E-03	7.34E-03	1.37E-02	6.55E-03	5.8480E+00	7.4713E+02
3	1.58E-03	4.90E-03	4.47E-03	9.69E-03	4.66E-03	3.6883E+00	7.4929E+02
4	1.95E-04	1.86E-03	1.44E-03	4.96E-03	1.67E-03	1.4027E+00	7.5158E+02

ALPHA FACTOR and MGL PARAMETERS

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 :	**2005/12/31**

Total Number of Independent Failure Events: 495
Total Number of Common-Cause Failure Events: 19

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
$_1$	0.9866530	0.9857120	0.9871150
$_2$	1.33E-02	9.87E-03	6.55E-03
$_3$		4.41E-03	4.66E-03
$_4$			1.67E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.87E-01	9.86E-01	9.87E-01
Beta	1.33E-02	1.43E-02	1.29E-02
Gamma		3.09E-01	4.91E-01
Delta			2.64E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	342.56	513.84	685.12
N_1	9.2160	9.5810	10.7792
N_2	4.7587	5.2430	4.6199
N_3		2.3443	3.2840
N_4			1.1800

2.1.3 Pooled Clean System Motor Driven Pump Distributions

2.1.3.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

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 :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9677620	0.9821860	0.9832900	0.9928270	0.9830680	2.8247E+02	5.1232E+00
2	7.17E-03	1.78E-02	1.67E-02	3.22E-02	1.69E-02	5.1232E+00	2.8247E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9689710	0.9807880	0.9815060	0.9901450	0.9820310	4.3383E+02	8.4982E+00
2	5.78E-03	1.33E-02	1.26E-02	2.34E-02	1.23E-02	5.8967E+00	4.3643E+02
3	1.41E-03	5.88E-03	5.16E-03	1.28E-02	5.67E-03	2.6015E+00	4.3973E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9723870	0.9821420	0.9826770	0.9900580	0.9839700	5.8336E+02	1.0607E+01
2	3.93E-03	9.36E-03	8.81E-03	1.66E-02	7.93E-03	5.5578E+00	5.8841E+02
3	1.97E-03	6.14E-03	5.60E-03	1.22E-02	5.94E-03	3.6485E+00	5.9032E+02
4	2.47E-04	2.36E-03	1.83E-03	6.28E-03	2.16E-03	1.4010E+00	5.9257E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9742600	0.9825990	0.9830070	0.9895300	0.9852510	7.6610E+02	1.3567E+01
2	3.62E-03	8.09E-03	7.67E-03	1.40E-02	6.17E-03	6.3068E+00	7.7336E+02
3	1.77E-03	5.16E-03	4.74E-03	9.97E-03	4.48E-03	4.0238E+00	7.7564E+02
4	7.77E-04	3.29E-03	2.88E-03	7.22E-03	3.23E-03	2.5675E+00	7.7710E+02
5	1.26E-05	8.58E-04	4.86E-04	2.97E-03	8.78E-04	6.6908E-01	7.7900E+02

Pooled Clean System Motor Driven Pump Distributions
Fail to Run

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9759380	0.9833520	0.9836970	0.9895940	0.9861300	9.1935E+02	1.5564E+01
2	3.23E-03	7.06E-03	6.71E-03	1.21E-02	5.36E-03	6.6013E+00	9.2831E+02
3	1.40E-03	4.17E-03	3.82E-03	8.12E-03	3.38E-03	3.8957E+00	9.3102E+02
4	8.99E-04	3.25E-03	2.91E-03	6.79E-03	3.01E-03	3.0414E+00	9.3187E+02
5	2.37E-04	1.75E-03	1.41E-03	4.43E-03	1.74E-03	1.6396E+00	9.3327E+02
6	3.37E-07	4.13E-04	1.44E-04	1.74E-03	3.72E-04	3.8624E-01	9.3453E+02

ALPHA FACTOR and MGL PARAMETERS

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 :	**2005/12/31**

Total Number of Independent Failure Events: 381
Total Number of Common-Cause Failure Events: 18

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9830680	0.9820310	0.9839700	0.9852510	0.9861300
2	1.69E-02	1.23E-02	7.93E-03	6.17E-03	5.36E-03
3		5.67E-03	5.94E-03	4.48E-03	3.38E-03
4			2.16E-03	3.23E-03	3.01E-03
5				8.78E-04	1.74E-03
6					3.72E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.83E-01	9.82E-01	9.84E-01	9.85E-01	9.86E-01
Beta	1.69E-02	1.80E-02	1.60E-02	1.47E-02	1.39E-02
Gamma		3.16E-01	5.05E-01	5.82E-01	6.13E-01
Delta			2.66E-01	4.78E-01	6.02E-01
Epsilon				2.14E-01	4.13E-01
Mu					1.76E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	263.67	395.50	527.34	659.17	791.00
N_1	8.5560	8.7710	9.8882	10.7644	11.4092
N_2	4.6887	5.0630	4.3297	4.1926	4.3621
N_3		2.3343	3.2442	3.0464	2.7539
N_4			1.1783	2.1931	2.4492
N_5				0.5968	1.4174
N_6					0.3030

2.1.3.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

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 :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9369740	0.9568950	0.9578230	0.9736370	0.9568140	3.1223E+02	1.4065E+01
2	2.64E-02	4.31E-02	4.22E-02	6.30E-02	4.32E-02	1.4065E+01	3.1223E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9484040	0.9632730	0.9638920	0.9760150	0.9632200	4.7732E+02	1.8199E+01
2	1.11E-02	2.03E-02	1.96E-02	3.16E-02	1.98E-02	1.0035E+01	4.8548E+02
3	8.31E-03	1.65E-02	1.58E-02	2.68E-02	1.70E-02	8.1639E+00	4.8736E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9544470	0.9666670	0.9671390	0.9772890	0.9670840	6.3905E+02	2.2036E+01
2	8.24E-03	1.51E-02	1.46E-02	2.37E-02	1.43E-02	9.9946E+00	6.5109E+02
3	5.75E-03	1.17E-02	1.12E-02	1.93E-02	1.19E-02	7.7274E+00	6.5336E+02
4	2.35E-03	6.53E-03	6.03E-03	1.24E-02	6.67E-03	4.3137E+00	6.5677E+02

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9614480	0.9713740	0.9717410	0.9800520	0.9722730	8.3616E+02	2.4641E+01
2	5.00E-03	9.81E-03	9.43E-03	1.59E-02	8.31E-03	8.4425E+00	8.5236E+02
3	4.53E-03	9.15E-03	8.77E-03	1.50E-02	9.06E-03	7.8745E+00	8.5293E+02
4	3.11E-03	7.07E-03	6.69E-03	1.23E-02	7.51E-03	6.0877E+00	8.5471E+02
5	5.29E-04	2.60E-03	2.22E-03	5.94E-03	2.84E-03	2.2367E+00	8.5856E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9659950	0.9745490	0.9748530	0.9820580	0.9758630	1.0039E+03	2.6218E+01
2	3.35E-03	7.01E-03	6.70E-03	1.18E-02	5.49E-03	7.2249E+00	1.0229E+03
3	3.20E-03	6.80E-03	6.48E-03	1.15E-02	6.45E-03	7.0040E+00	1.0231E+03
4	2.88E-03	6.33E-03	6.02E-03	1.09E-02	6.52E-03	6.5229E+00	1.0236E+03
5	1.45E-03	4.08E-03	3.77E-03	7.80E-03	4.38E-03	4.2045E+00	1.0259E+03
6	1.05E-04	1.22E-03	9.21E-04	3.38E-03	1.30E-03	1.2612E+00	1.0289E+03

ALPHA FACTOR and MGL PARAMETERS

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 :	**2005/12/31**

Total Number of Independent Failure Events: 398
Total Number of Common-Cause Failure Events: 26

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9568140	0.9632200	0.9670840	0.9722730	0.9758630
2	4.32E-02	1.98E-02	1.43E-02	8.31E-03	5.49E-03
3		1.70E-02	1.19E-02	9.06E-03	6.45E-03
4			6.67E-03	7.51E-03	6.52E-03
5				2.84E-03	4.38E-03
6					1.30E-03

Pooled Clean System Motor Driven Pump Distributions
Fail to Start

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.57E-01	9.63E-01	9.67E-01	9.72E-01	9.76E-01
Beta	4.32E-02	3.68E-02	3.29E-02	2.77E-02	2.41E-02
Gamma		4.62E-01	5.66E-01	7.00E-01	7.73E-01
Delta			3.58E-01	5.33E-01	6.54E-01
Epsilon				2.75E-01	4.65E-01
Mu					2.28E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	291.58	437.36	583.15	728.94	874.73
N_1	10.4060	10.4080	9.7667	11.0553	12.2635
N_2	13.6303	9.2010	8.7665	6.3283	4.9857
N_3		7.8967	7.3231	6.8971	5.8622
N_4			4.0910	5.7133	5.9307
N_5				2.1644	3.9823
N_6					1.1780

2.1.4 PWR Containment Spray Pumps

2.1.4.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	**CONTAINMENT SPRAY SYSTEM**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
$_1$	0.9346760	0.9837140	0.9933760	0.9999680	1.0000000	2.6246E+01	4.3452E-01
$_2$	2.96E-05	1.63E-02	6.63E-03	6.53E-02	0.00E+00	4.3452E-01	2.6246E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**CONTAINMENT SPRAY SYSTEM**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 16
Total Number of Common-Cause Failure Events: 0

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	16.00
N_1	0.0000
N_2	0.0000

2.1.4.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	**CONTAINMENT SPRAY SYSTEM**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
$_1$	0.8935100	0.9500380	0.9556090	0.9875020	0.9476990	5.0413E+01	2.6512E+00
$_2$	1.25E-02	5.00E-02	4.44E-02	1.06E-01	5.23E-02	2.6512E+00	5.0413E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**CONTAINMENT SPRAY SYSTEM**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 47
Total Number of Common-Cause Failure Events: 4

Alpha Factor	**CCCG=2**
$_1$	0.9476990
$_2$	5.23E-02

MGL Parameter	**CCCG=2**
1-Beta	9.48E-01
Beta	5.23E-02

Avg. Impact Vector	**CCCG=2**
Adj. Ind. Events	37.60
N_1	2.5667
N_2	2.2167

2.1.5 BWR Residual Heat Removal Pumps

2.1.5.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9209060	0.9789480	0.9898620	0.9999010	0.9940140	2.4079E+01	5.1782E-01
2	1.02E-04	2.11E-02	1.01E-02	7.91E-02	5.99E-03	5.1782E-01	2.4079E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9299900	0.9737210	0.9795870	0.9973770	0.9879520	5.0055E+01	1.3509E+00
2	1.34E-03	2.11E-02	1.53E-02	6.07E-02	1.20E-02	1.0837E+00	5.0322E+01
3	1.82E-07	5.20E-03	1.05E-03	2.47E-02	0.00E+00	2.6722E-01	5.1139E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9305920	0.9688030	0.9728540	0.9931630	0.9818180	7.3136E+01	2.3551E+00
2	3.40E-03	2.29E-02	1.88E-02	5.63E-02	1.82E-02	1.7281E+00	7.3763E+01
3	6.02E-06	5.36E-03	1.98E-03	2.21E-02	0.00E+00	4.0431E-01	7.5087E+01
4	1.27E-08	2.95E-03	4.03E-04	1.48E-02	0.00E+00	2.2267E-01	7.5268E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 26
Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9940140	0.9879520	0.9818180
2	5.99E-03	1.20E-02	1.82E-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	9.88E-01	9.82E-01
Beta	5.99E-03	1.20E-02	1.82E-02
Gamma		0.00E+00	0.00E+00
Delta			0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	13.00	19.50	26.00
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 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8614380	0.9323270	0.9388180	0.9809920	0.9236690	4.1003E+01	2.9762E+00
2	1.90E-02	6.77E-02	6.12E-02	1.39E-01	7.63E-02	2.9762E+00	4.1003E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8908230	0.9400200	0.9437220	0.9765610	0.9246910	7.4065E+01	4.7259E+00
2	7.16E-03	3.12E-02	2.73E-02	6.85E-02	3.38E-02	2.4587E+00	7.6332E+01
3	6.04E-03	2.88E-02	2.49E-02	6.48E-02	4.15E-02	2.2672E+00	7.6524E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8934350	0.9356570	0.9382750	0.9689260	0.9159060	1.0332E+02	7.1051E+00
2	1.52E-02	4.06E-02	3.78E-02	7.53E-02	5.21E-02	4.4781E+00	1.0595E+02
3	1.35E-03	1.27E-02	9.92E-03	3.37E-02	1.60E-02	1.4043E+00	1.0902E+02
4	9.02E-04	1.11E-02	8.29E-03	3.08E-02	1.60E-02	1.2227E+00	1.0920E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 52
Total Number of Common-Cause Failure Events: 6

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9236690	0.9246910	0.9159060
2	7.63E-02	3.38E-02	5.21E-02
3		4.15E-02	1.60E-02
4			1.60E-02

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.24E-01	9.25E-01	9.16E-01
Beta	7.63E-02	7.53E-02	8.41E-02
Gamma		5.52E-01	3.81E-01
Delta			5.00E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	28.34	42.51	56.68
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 Auxiliary Feedwater Pump

2.1.6.1 AFW Motor-Driven Pumps

2.1.6.1.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9692400	0.9918050	0.9960530	0.9999550	0.9982640	6.3883E+01	5.2782E-01
2	4.30E-05	8.19E-03	3.94E-03	3.08E-02	1.74E-03	5.2782E-01	6.3883E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9672030	0.9877400	0.9905230	0.9987690	0.9967520	1.0975E+02	1.3622E+00
2	6.16E-04	9.77E-03	7.03E-03	2.83E-02	3.13E-03	1.0857E+00	1.1003E+02
3	1.23E-07	2.49E-03	5.30E-04	1.17E-02	1.16E-04	2.7652E-01	1.1084E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9661890	0.9849460	0.9869790	0.9967660	0.9955210	1.5277E+02	2.3349E+00
2	1.51E-03	1.08E-02	8.75E-03	2.69E-02	4.13E-03	1.6700E+00	1.5343E+02
3	5.50E-06	2.84E-03	1.15E-03	1.14E-02	3.40E-04	4.4071E-01	1.5466E+02
4	6.75E-09	1.45E-03	2.00E-04	7.22E-03	1.40E-05	2.2417E-01	1.5488E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 69
Total Number of Common-Cause Failure Events: 3

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9982640	0.9967520	0.9955210
2	1.74E-03	3.13E-03	4.13E-03
3		1.16E-04	3.40E-04
4			1.40E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.98E-01	9.97E-01	9.96E-01
Beta	1.74E-03	3.25E-03	4.48E-03
Gamma		3.56E-02	7.90E-02
Delta			3.96E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	51.69	77.53	103.37
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

2.1.6.1.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9068510	0.9468070	0.9496110	0.9771750	0.9453980	9.9882E+01	5.6115E+00
2	2.28E-02	5.32E-02	5.04E-02	9.32E-02	5.46E-02	5.6115E+00	9.9882E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9300940	0.9580270	0.9598170	0.9798500	0.9566910	1.6274E+02	7.1299E+00
2	6.81E-03	2.13E-02	1.94E-02	4.20E-02	2.00E-02	3.6117E+00	1.6626E+02
3	6.50E-03	2.07E-02	1.89E-02	4.12E-02	2.34E-02	3.5182E+00	1.6635E+02

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9421470	0.9642090	0.9655410	0.9817320	0.9649580	2.2318E+02	8.2844E+00
2	3.29E-03	1.24E-02	1.11E-02	2.63E-02	9.00E-03	2.8787E+00	2.2859E+02
3	4.50E-03	1.47E-02	1.33E-02	2.96E-02	1.64E-02	3.4079E+00	2.2806E+02
4	1.54E-03	8.63E-03	7.26E-03	2.04E-02	9.67E-03	1.9978E+00	2.2947E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 104
Total Number of Common-Cause Failure Events: 8

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9453980	0.9566910	0.9649580
2	5.46E-02	2.00E-02	9.00E-03
3		2.34E-02	1.64E-02
4			9.67E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.45E-01	9.57E-01	9.65E-01
Beta	5.46E-02	4.33E-02	3.50E-02
Gamma		5.39E-01	7.43E-01
Delta			3.71E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	87.39	131.09	174.79
N_1	2.2460	2.0910	2.2543
N_2	5.1770	2.7780	1.6506
N_3		3.2510	3.0036
N_4			1.7751

2.1.6.2 AFW Pump Volutes

2.1.6.2.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9853270	0.9959200	0.9978530	0.9999640	0.9987980	1.4594E+02	5.9782E-01
2	3.80E-05	4.08E-03	2.15E-03	1.47E-02	1.20E-03	5.9782E-01	1.4594E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9829880	0.9933730	0.9947110	0.9991720	0.9977830	2.3267E+02	1.5522E+00
2	4.69E-04	5.40E-03	4.08E-03	1.49E-02	2.12E-03	1.2657E+00	2.3296E+02
3	8.52E-08	1.22E-03	2.77E-04	5.68E-03	9.48E-05	2.8652E-01	2.3394E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9819150	0.9916440	0.9926500	0.9979460	0.9970070	3.1647E+02	2.6666E+00
2	1.07E-03	6.14E-03	5.15E-03	1.46E-02	2.70E-03	1.9603E+00	3.1718E+02
3	4.78E-06	1.51E-03	6.62E-04	5.86E-03	2.81E-04	4.8041E-01	3.1866E+02
4	3.62E-09	7.08E-04	9.94E-05	3.53E-03	1.18E-05	2.2587E-01	3.1891E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 183
Total Number of Common-Cause Failure Events: 4

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.9987980	0.9977830	0.9970070
2	1.20E-03	2.12E-03	2.70E-03
3		9.48E-05	2.81E-04
4			1.18E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.99E-01	9.98E-01	9.97E-01
Beta	1.20E-03	2.22E-03	2.99E-03
Gamma		4.28E-02	9.77E-02
Delta			4.04E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	133.09	199.64	266.18
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

2.1.7 Emergency Service Water Pump

2.1.7.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	**EMERGENCY/ESSENTIAL SERVICE WATER**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9719720	0.9860480	0.9873430	0.9957120	0.9872590	2.4303E+02	3.4387E+00
2	4.29E-03	1.40E-02	1.27E-02	2.80E-02	1.27E-02	3.4387E+00	2.4303E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9734750	0.9849410	0.9857770	0.9935460	0.9867610	3.7625E+02	5.7526E+00
2	4.07E-03	1.13E-02	1.04E-02	2.13E-02	9.88E-03	4.3050E+00	3.7770E+02
3	4.20E-04	3.79E-03	2.97E-03	9.97E-03	3.36E-03	1.4476E+00	3.8055E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9729440	0.9832030	0.9838230	0.9913350	0.9854530	5.0557E+02	8.6372E+00
2	5.09E-03	1.17E-02	1.10E-02	2.04E-02	1.02E-02	5.9930E+00	5.0821E+02
3	5.80E-04	3.60E-03	2.98E-03	8.74E-03	3.11E-03	1.8520E+00	5.1236E+02
4	4.09E-05	1.54E-03	9.62E-04	5.01E-03	1.22E-03	7.9217E-01	5.1341E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9733780	0.9823940	0.9828620	0.9897990	0.9854640	6.6837E+02	1.1978E+01
2	5.26E-03	1.09E-02	1.04E-02	1.81E-02	9.11E-03	7.4062E+00	6.7294E+02
3	1.13E-03	4.26E-03	3.79E-03	9.02E-03	3.31E-03	2.9002E+00	6.7745E+02
4	1.81E-04	1.94E-03	1.48E-03	5.27E-03	1.62E-03	1.3173E+00	6.7903E+02
5	2.28E-07	5.21E-04	1.63E-04	2.26E-03	4.86E-04	3.5468E-01	6.7999E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9741830	0.9823700	0.9827600	0.9892130	0.9854530	8.0160E+02	1.4386E+01
2	5.05E-03	1.00E-02	9.62E-03	1.63E-02	8.54E-03	8.1745E+00	8.0781E+02
3	1.23E-03	4.11E-03	3.71E-03	8.35E-03	3.19E-03	3.3557E+00	8.1263E+02
4	3.45E-04	2.22E-03	1.82E-03	5.42E-03	1.75E-03	1.8079E+00	8.1418E+02
5	3.02E-05	1.01E-03	6.42E-04	3.24E-03	8.65E-04	8.2340E-01	8.1516E+02
6	1.27E-09	2.75E-04	3.78E-05	1.37E-03	2.03E-04	2.2404E-01	8.1576E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**EMERGENCY/ESSENTIAL SERVICE WATER**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 436
Total Number of Common-Cause Failure Events: 21

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9872590	0.9867610	0.9854530	0.9854640	0.9854530
2	1.27E-02	9.88E-03	1.02E-02	9.11E-03	8.54E-03
3		3.36E-03	3.11E-03	3.31E-03	3.19E-03
4			1.22E-03	1.62E-03	1.75E-03
5				4.86E-04	8.65E-04
6					2.03E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.87E-01	9.87E-01	9.85E-01	9.85E-01	9.85E-01
Beta	1.27E-02	1.32E-02	1.45E-02	1.45E-02	1.45E-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	223.59	335.38	447.18	558.97	670.77
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

2.1.7.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	**EMERGENCY/ESSENTIAL SERVICE WATER**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9644790	0.9848080	0.9871340	0.9971930	0.9870000	1.3283E+02	2.0491E+00
2	2.81E-03	1.52E-02	1.29E-02	3.55E-02	1.30E-02	2.0491E+00	1.3283E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9536440	0.9737140	0.9751740	0.9888060	0.9753170	2.0904E+02	5.6432E+00
2	9.93E-03	2.43E-02	2.29E-02	4.37E-02	2.39E-02	5.2252E+00	2.0946E+02
3	2.71E-06	1.95E-03	7.44E-04	7.96E-03	8.19E-04	4.1802E-01	2.1427E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9527720	0.9706470	0.9717170	0.9848620	0.9724840	2.8258E+02	8.5453E+00
2	1.03E-02	2.24E-02	2.13E-02	3.83E-02	2.18E-02	6.5251E+00	2.8460E+02
3	8.69E-04	5.93E-03	4.85E-03	1.47E-02	5.44E-03	1.7270E+00	2.8940E+02
4	8.72E-08	1.01E-03	2.37E-04	4.64E-03	2.90E-04	2.9317E-01	2.9083E+02

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9572660	0.9719910	0.9727740	0.9840540	0.9744610	3.9044E+02	1.1251E+01
2	7.91E-03	1.70E-02	1.62E-02	2.87E-02	1.56E-02	6.8126E+00	3.9488E+02
3	2.42E-03	8.19E-03	7.38E-03	1.67E-02	7.65E-03	3.2879E+00	3.9840E+02
4	1.50E-04	2.60E-03	1.84E-03	7.67E-03	2.23E-03	1.0464E+00	4.0064E+02
5	4.80E-16	2.59E-04	1.95E-06	1.50E-03	1.05E-04	1.0408E-01	4.0159E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9597000	0.9728710	0.9735200	0.9838170	0.9756170	4.6878E+02	1.3072E+01
2	6.64E-03	1.42E-02	1.36E-02	2.41E-02	1.28E-02	6.8545E+00	4.7500E+02
3	2.47E-03	7.64E-03	6.97E-03	1.51E-02	7.04E-03	3.6815E+00	4.7817E+02
4	6.33E-04	3.88E-03	3.22E-03	9.38E-03	3.54E-03	1.8690E+00	4.7998E+02
5	8.71E-06	1.18E-03	5.97E-04	4.32E-03	9.59E-04	5.6810E-01	4.8128E+02
6	8.92E-17	2.05E-04	1.14E-06	1.19E-03	4.35E-05	9.8937E-02	4.8175E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**EMERGENCY/ESSENTIAL SERVICE WATER**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 291
Total Number of Common-Cause Failure Events: 24

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9870000	0.9753170	0.9724840	0.9744610	0.9756170
2	1.30E-02	2.39E-02	2.18E-02	1.56E-02	1.28E-02
3		8.19E-04	5.44E-03	7.65E-03	7.04E-03
4			2.90E-04	2.23E-03	3.54E-03
5				1.05E-04	9.59E-04
6					4.35E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.87E-01	9.75E-01	9.72E-01	9.74E-01	9.76E-01
Beta	1.30E-02	2.47E-02	2.75E-02	2.55E-02	2.44E-02
Gamma		3.32E-02	2.08E-01	3.91E-01	4.75E-01
Delta			5.06E-02	2.33E-01	3.92E-01
Epsilon				4.52E-02	2.21E-01
Mu					4.34E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	110.02	165.03	220.04	275.05	330.06
$\mathbf{N_1}$	12.5641	14.4546	16.4090	19.2332	21.7828
$\mathbf{N_2}$	1.6146	4.3915	5.2970	4.6984	4.6153
$\mathbf{N_3}$		0.1508	1.3227	2.3105	2.5397
$\mathbf{N_4}$			0.0705	0.6720	1.2768
$\mathbf{N_5}$				0.0318	0.3459
$\mathbf{N_6}$					0.0157

2.1.8 PWR High Pressure Safety Injection Pump

2.1.8.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	**HIGH PRESSURE SAFETY INJECTION (PWR)**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9466720	0.9723180	0.9745010	0.9905110	0.9733710	1.3862E+02	3.9465E+00
2	9.49E-03	2.77E-02	2.55E-02	5.33E-02	2.66E-02	3.9465E+00	1.3862E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9480220	0.9690220	0.9703980	0.9853180	0.9697980	2.1856E+02	6.9869E+00
2	8.52E-03	2.17E-02	2.03E-02	3.97E-02	2.08E-02	4.8947E+00	2.2065E+02
3	1.75E-03	9.28E-03	7.87E-03	2.16E-02	9.36E-03	2.0922E+00	2.2345E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9546500	0.9717680	0.9727900	0.9853850	0.9737100	2.9697E+02	8.6275E+00
2	5.21E-03	1.43E-02	1.32E-02	2.69E-02	1.22E-02	4.3659E+00	3.0123E+02
3	2.88E-03	1.02E-02	9.14E-03	2.11E-02	1.05E-02	3.1121E+00	3.0249E+02
4	2.68E-04	3.76E-03	2.75E-03	1.07E-02	3.60E-03	1.1495E+00	3.0445E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**HIGH PRESSURE SAFETY INJECTION (PWR)**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 179
Total Number of Common-Cause Failure Events: 13

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.9733710	0.9697980	0.9737100
2	2.66E-02	2.08E-02	1.22E-02
3		9.36E-03	1.05E-02
4			3.60E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.73E-01	9.70E-01	9.74E-01
Beta	2.66E-02	3.02E-02	2.63E-02
Gamma		3.10E-01	5.37E-01
Delta			2.55E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	122.60	183.90	245.21
N_1	5.7760	5.1030	5.6221
N_2	3.5120	4.0610	3.1378
N_3		1.8250	2.7078
N_4			0.9268

2.1.8.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	**HIGH PRESSURE SAFETY INJECTION (PWR)**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9519810	0.9794880	0.9826330	0.9962480	0.9819330	9.6756E+01	2.0262E+00
2	3.75E-03	2.05E-02	1.74E-02	4.80E-02	1.81E-02	2.0262E+00	9.6756E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9556950	0.9775560	0.9794970	0.9927850	0.9807100	1.5793E+02	3.6259E+00
2	4.28E-03	1.69E-02	1.50E-02	3.62E-02	1.45E-02	2.7337E+00	1.5882E+02
3	2.11E-04	5.52E-03	3.66E-03	1.72E-02	4.77E-03	8.9222E-01	1.6066E+02

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9615090	0.9792770	0.9807000	0.9921780	0.9842330	2.1702E+02	4.5926E+00
2	2.40E-03	1.08E-02	9.41E-03	2.42E-02	6.77E-03	2.4031E+00	2.1921E+02
3	1.03E-03	7.46E-03	6.04E-03	1.88E-02	7.20E-03	1.6543E+00	2.1996E+02
4	1.35E-05	2.41E-03	1.17E-03	9.04E-03	1.80E-03	5.3517E-01	2.2108E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**HIGH PRESSURE SAFETY INJECTION (PWR)**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 116
Total Number of Common-Cause Failure Events: 4

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
$_1$	0.9819330	0.9807100	0.9842330
$_2$	1.81E-02	1.45E-02	6.77E-03
$_3$		4.77E-03	7.20E-03
$_4$			1.80E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.82E-01	9.81E-01	9.84E-01
Beta	1.81E-02	1.93E-02	1.58E-02
Gamma		2.48E-01	5.71E-01
Delta			2.00E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	84.36	126.55	168.73
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

2.1.9 PWR Residual Heat Removal Pump

2.1.9.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9618300	0.9854630	0.9885880	0.9984030	0.9886360	9.7246E+01	1.4345E+00
2	1.60E-03	1.45E-02	1.14E-02	3.82E-02	1.14E-02	1.4345E+00	9.7246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9699080	0.9870430	0.9889840	0.9975360	0.9923950	1.6005E+02	2.1009E+00
2	7.91E-04	8.23E-03	6.31E-03	2.22E-02	3.80E-03	1.3337E+00	1.6082E+02
3	1.14E-04	4.73E-03	2.91E-03	1.55E-02	3.80E-03	7.6722E-01	1.6138E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9728780	0.9871970	0.9886190	0.9966410	0.9942860	2.2014E+02	2.8551E+00
2	7.63E-04	6.63E-03	5.22E-03	1.73E-02	1.43E-03	1.4781E+00	2.2152E+02
3	1.60E-04	4.06E-03	2.70E-03	1.26E-02	2.86E-03	9.0431E-01	2.2209E+02
4	6.16E-06	2.12E-03	9.18E-04	8.30E-03	1.43E-03	4.7267E-01	2.2252E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 87
Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9886360	0.9923950	0.9942860
2	1.14E-02	3.80E-03	1.43E-03
3		3.80E-03	2.86E-03
4			1.43E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.89E-01	9.92E-01	9.94E-01
Beta	1.14E-02	7.60E-03	5.71E-03
Gamma		5.00E-01	7.50E-01
Delta			3.33E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	87.00	130.50	174.00
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

2.1.9.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9220450	0.9641050	0.9684000	0.9914730	0.9649570	6.8163E+01	2.5378E+00
2	8.53E-03	3.59E-02	3.16E-02	7.80E-02	3.50E-02	2.5378E+00	6.8163E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9432930	0.9717710	0.9743650	0.9913840	0.9744210	1.1617E+02	3.3746E+00
2	3.31E-03	1.75E-02	1.49E-02	4.06E-02	1.41E-02	2.0892E+00	1.1746E+02
3	9.66E-04	1.08E-02	8.17E-03	2.94E-02	1.15E-02	1.2854E+00	1.1826E+02

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9507450	0.9738150	0.9757020	0.9904400	0.9788990	1.6135E+02	4.3386E+00
2	2.53E-03	1.30E-02	1.11E-02	2.99E-02	7.82E-03	2.1483E+00	1.6354E+02
3	1.00E-03	8.84E-03	6.95E-03	2.31E-02	9.01E-03	1.4643E+00	1.6422E+02
4	8.72E-05	4.38E-03	2.62E-03	1.47E-02	4.28E-03	7.2597E-01	1.6496E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 64
Total Number of Common-Cause Failure Events: 4

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9649570	0.9744210	0.9788990
2	3.50E-02	1.41E-02	7.82E-03
3		1.15E-02	9.01E-03
4			4.28E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.65E-01	9.74E-01	9.79E-01
Beta	3.50E-02	2.56E-02	2.11E-02
Gamma		4.48E-01	6.29E-01
Delta			3.22E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	56.89	85.33	113.78
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

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

2.1.10.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	**HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING**
Component :	**TURBINE DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
$_1$	0.9860590	0.9965430	0.9986160	0.9999880	1.0000000	1.2525E+02	4.3452E-01
$_2$	6.14E-06	3.46E-03	1.38E-03	1.39E-02	0.00E+00	4.3452E-01	1.2525E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING**
Component :	**TURBINE DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 115
Total Number of Common-Cause Failure Events: 0

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	115.00
N_1	0.0000
N_2	0.0000

2.1.10.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	**HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING**
Component :	**TURBINE DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
$_1$	0.9795350	0.9922330	0.9939200	0.9991480	0.9942530	1.8325E+02	1.4345E+00
$_2$	8.50E-04	7.77E-03	6.08E-03	2.05E-02	5.75E-03	1.4345E+00	1.8325E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING**
Component :	**TURBINE DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 173
Total Number of Common-Cause Failure Events: 1

Alpha Factor	**CCCG=2**
$_1$	0.9942530
$_2$	5.75E-03

MGL Parameter	**CCCG=2**
1-Beta	9.94E-01
Beta	5.75E-03

Avg. Impact Vector	**CCCG=2**
Adj. Ind. Events	173.00
N_1	0.0000
N_2	1.0000

2.1.11 BWR Standby Liquid Control Pump

2.1.11.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	**STANDBY LIQUID CONTROL**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
$_1$	0.8840750	0.9467130	0.9530600	0.9876040	0.9429180	4.3696E+01	2.4595E+00
$_2$	1.24E-02	5.33E-02	4.69E-02	1.16E-01	5.71E-02	2.4595E+00	4.3696E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**STANDBY LIQUID CONTROL**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 32
Total Number of Common-Cause Failure Events: 3

Alpha Factor	**CCCG=2**
$_1$	0.9429180
$_2$	5.71E-02

MGL Parameter	**CCCG=2**
1-Beta	9.43E-01
Beta	5.71E-02

Avg. Impact Vector	**CCCG=2**
Adj. Ind. Events	32.00
N_1	1.4500
N_2	2.0250

2.1.11.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	**STANDBY LIQUID CONTROL**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
$_1$	0.9209180	0.9765530	0.9861170	0.9995900	0.9862720	2.8926E+01	6.9452E-01
$_2$	4.07E-04	2.34E-02	1.39E-02	7.91E-02	1.37E-02	6.9452E-01	2.8926E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**STANDBY LIQUID CONTROL**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 18
Total Number of Common-Cause Failure Events: 2

Alpha Factor	**CCCG=2**
$_1$	0.9862720
$_2$	1.37E-02

MGL Parameter	**CCCG=2**
1-Beta	9.86E-01
Beta	1.37E-02

Avg. Impact Vector	**CCCG=2**
Adj. Ind. Events	18.00
N_1	0.6800
N_2	0.2600

2.1.12 Component Cooling Water Pumps

2.1.12.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	**Component Cooling Water**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1997/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9069840	0.9767390	0.9904340	0.9999540	1.0000000	1.8246E+01	4.3452E-01
2	4.27E-05	2.33E-02	9.56E-03	9.30E-02	0.00E+00	4.3452E-01	1.8246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9187120	0.9715210	0.9791840	0.9981180	1.0000000	3.7555E+01	1.1009E+00
2	6.87E-04	2.16E-02	1.40E-02	6.82E-02	0.00E+00	8.3366E-01	3.7822E+01
3	2.43E-07	6.91E-03	1.40E-03	3.28E-02	0.00E+00	2.6722E-01	3.8389E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**Component Cooling Water**
Component :	**MOTOR DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1997/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 8
Total Number of Common-Cause Failure Events: 0

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	8.00	8.00
N_1	0.0000	0.0000
N_2	0.0000	0.0000
N_3		0.0000

2.1.12.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	Component Cooling Water
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1997/01/01
Data Version :	2005/12/31

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9321500	0.9830800	0.9931110	0.9999660	1.0000000	2.5246E+01	4.3452E-01
2	3.07E-05	1.69E-02	6.89E-03	6.78E-02	0.00E+00	4.3452E-01	2.5246E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9310130	0.9758870	0.9824220	0.9984090	1.0000000	4.4555E+01	1.1009E+00
2	5.79E-04	1.83E-02	1.18E-02	5.78E-02	0.00E+00	8.3366E-01	4.4822E+01
3	2.05E-07	5.85E-03	1.18E-03	2.78E-02	0.00E+00	2.6722E-01	4.5389E+01

ALPHA FACTOR and MGL PARAMETERS

System :	Component Cooling Water
Component :	MOTOR DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1997/01/01
Data Version :	2005/12/31

Total Number of Independent Failure Events: 15
Total Number of Common-Cause Failure Events: 0

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	15.00	15.00
N_1	0.0000	0.0000
N_2	0.0000	0.0000
N_3		0.0000

2.2 Turbine Driven Pumps

2.2.1 Pooled Turbine Driven Pumps

2.2.1.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

Component :	**TURBINE DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9882440	0.9969250	0.9985810	0.9999890	0.9995440	1.6358E+02	5.0452E-01
2	1.27E-05	3.07E-03	1.42E-03	1.18E-02	4.56E-04	5.0452E-01	1.6358E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9864570	0.9950470	0.9962440	0.9995510	0.9991740	2.5936E+02	1.2909E+00
2	2.07E-04	3.89E-03	2.72E-03	1.16E-02	7.83E-04	1.0137E+00	2.5964E+02
3	5.36E-08	1.06E-03	2.27E-04	4.99E-03	4.35E-05	2.7722E-01	2.6037E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**TURBINE DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 229
Total Number of Common-Cause Failure Events: 1

Alpha Factor	**CCCG=2**	**CCCG=3**
1	0.9995440	0.9991740
2	4.56E-04	7.83E-04
3		4.35E-05

MGL Parameter	**CCCG=2**	**CCCG=3**
1-Beta	1.00E+00	9.99E-01
Beta	4.56E-04	8.26E-04
Gamma		5.26E-02

Avg. Impact Vector	CCCG=2	CCCG=3
Adj. Ind. Events	152.67	229.00
N_1	0.6600	0.8100
N_2	0.0700	0.1800
N_3		0.0100

2.2.1.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

Component :	**TURBINE DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9887550	0.9957390	0.9966740	0.9995330	0.9969330	3.3525E+02	1.4345E+00
2	4.65E-04	4.26E-03	3.33E-03	1.12E-02	3.07E-03	1.4345E+00	3.3525E+02

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9905670	0.9959530	0.9965670	0.9992360	0.9979530	5.1705E+02	2.1009E+00
2	2.46E-04	2.57E-03	1.97E-03	6.95E-03	1.02E-03	1.3337E+00	5.1782E+02
3	3.54E-05	1.48E-03	9.07E-04	4.86E-03	1.02E-03	7.6722E-01	5.1838E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**TURBINE DRIVEN PUMP**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 325
Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3
1	0.9969330	0.9979530
2	3.07E-03	1.02E-03
3		1.02E-03

MGL Parameter	CCCG=2	CCCG=3
1-Beta	9.97E-01	9.98E-01
Beta	3.07E-03	2.05E-03
Gamma		5.00E-01

Avg. Impact Vector	CCCG=2	CCCG=3
Adj. Ind. Events	325.00	487.50
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 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**TURBINE DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9779560	0.9942280	0.9973370	0.9999740	0.9990880	8.6906E+01	5.0452E-01
2	2.40E-05	5.77E-03	2.67E-03	2.20E-02	9.12E-04	5.0452E-01	8.6906E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9758120	0.9911380	0.9932600	0.9991960	0.9983480	1.4437E+02	1.2909E+00
2	3.72E-04	6.96E-03	4.87E-03	2.07E-02	1.57E-03	1.0137E+00	1.4465E+02
3	9.60E-08	1.90E-03	4.07E-04	8.93E-03	8.70E-05	2.7722E-01	1.4538E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**TURBINE DRIVEN PUMP**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 114
Total Number of Common-Cause Failure Events: 1

Alpha Factor	**CCCG=2**	**CCCG=3**
1	0.9990880	0.9983480
2	9.12E-04	1.57E-03
3		8.70E-05

MGL Parameter	**CCCG=2**	**CCCG=3**
1-Beta	9.99E-01	9.98E-01
Beta	9.12E-04	1.65E-03
Gamma		5.26E-02

Avg. Impact Vector	CCCG=2	CCCG=3
Adj. Ind. Events	76.00	114.00
N_1	0.6600	0.8100
N_2	0.0700	0.1800
N_3		0.0100

2.2.2.2 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2005/12/31

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9892250	0.9973290	0.9989330	0.9999900	1.0000000	1.6225E+02	4.3452E-01
2	4.74E-06	2.67E-03	1.07E-03	1.08E-02	0.00E+00	4.3452E-01	1.6225E+02

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9825940	0.9939730	0.9956510	0.9996070	1.0000000	1.8155E+02	1.1009E+00
2	1.43E-04	4.56E-03	2.93E-03	1.46E-02	0.00E+00	8.3366E-01	1.8182E+02
3	5.07E-08	1.46E-03	2.92E-04	6.94E-03	0.00E+00	2.6722E-01	1.8238E+02

ALPHA FACTOR and MGL PARAMETERS

System :	AUXILIARY FEEDWATER SYSTEM
Component :	TURBINE DRIVEN PUMP
Failure Mode :	FAIL TO START
Start Date :	1991/01/01
Data Version :	2005/12/31

Total Number of Independent Failure Events: 152
Total Number of Common-Cause Failure Events: 0

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	152.00	152.00
N_1	0.0000	0.0000
N_2	0.0000	0.0000
N_3		0.0000

2.3 Motor Operated Valves

2.3.1 Pooled Motor Operated Valve Distributions

2.3.1.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9583740	0.9757300	0.9769290	0.9890010	0.9764240	2.5677E+02	6.3868E+00
2	1.10E-02	2.43E-02	2.31E-02	4.16E-02	2.36E-02	6.3868E+00	2.5677E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9667540	0.9794980	0.9802790	0.9895680	0.9807570	3.9744E+02	8.3189E+00
2	5.24E-03	1.29E-02	1.21E-02	2.33E-02	1.17E-02	5.2321E+00	4.0053E+02
3	2.13E-03	7.61E-03	6.81E-03	1.58E-02	7.52E-03	3.0868E+00	4.0267E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9704260	0.9809470	0.9815300	0.9894660	0.9828390	5.3489E+02	1.0389E+01
2	3.75E-03	9.37E-03	8.78E-03	1.70E-02	7.81E-03	5.1105E+00	5.4017E+02
3	2.18E-03	6.75E-03	6.16E-03	1.33E-02	6.59E-03	3.6805E+00	5.4160E+02
4	3.81E-04	2.93E-03	2.35E-03	7.47E-03	2.77E-03	1.5982E+00	5.4368E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9725170	0.9814720	0.9819150	0.9889100	0.9842040	7.0555E+02	1.3319E+01
2	3.56E-03	8.21E-03	7.76E-03	1.44E-02	6.12E-03	5.9009E+00	7.1297E+02
3	1.95E-03	5.64E-03	5.19E-03	1.09E-02	4.97E-03	4.0530E+00	7.1482E+02
4	8.67E-04	3.62E-03	3.18E-03	7.91E-03	3.60E-03	2.6052E+00	7.1626E+02
5	2.45E-05	1.06E-03	6.45E-04	3.49E-03	1.11E-03	7.5978E-01	7.1811E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9743770	0.9823350	0.9827040	0.9890200	0.9852200	8.4680E+02	1.5228E+01
2	3.10E-03	7.06E-03	6.68E-03	1.23E-02	5.19E-03	6.0827E+00	8.5594E+02
3	1.59E-03	4.65E-03	4.27E-03	8.99E-03	3.87E-03	4.0074E+00	8.5802E+02
4	9.72E-04	3.52E-03	3.15E-03	7.36E-03	3.30E-03	3.0366E+00	8.5899E+02
5	2.71E-04	1.94E-03	1.57E-03	4.87E-03	1.96E-03	1.6738E+00	8.6035E+02
6	7.86E-07	4.95E-04	1.93E-04	2.01E-03	4.64E-04	4.2704E-01	8.6160E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9754280	0.9825420	0.9828430	0.9886160	0.9861590	1.0344E+03	1.8380E+01
2	3.08E-03	6.58E-03	6.27E-03	1.11E-02	4.46E-03	6.9297E+00	1.0459E+03
3	1.52E-03	4.17E-03	3.86E-03	7.88E-03	3.20E-03	4.3931E+00	1.0484E+03
4	9.38E-04	3.15E-03	2.84E-03	6.42E-03	2.70E-03	3.3199E+00	1.0495E+03
5	5.25E-04	2.33E-03	2.02E-03	5.19E-03	2.24E-03	2.4545E+00	1.0503E+03
6	6.36E-05	1.03E-03	7.34E-04	2.99E-03	1.04E-03	1.0816E+00	1.0517E+03
7	2.08E-10	1.91E-04	2.01E-05	9.82E-04	1.99E-04	2.0097E-01	1.0526E+03

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9767520	0.9832410	0.9835090	0.9888200	0.9869720	1.1896E+03	2.0276E+01
2	2.79E-03	5.88E-03	5.61E-03	9.90E-03	3.83E-03	7.1159E+00	1.2028E+03
3	1.43E-03	3.81E-03	3.54E-03	7.11E-03	2.92E-03	4.6060E+00	1.2053E+03
4	7.63E-04	2.65E-03	2.38E-03	5.45E-03	2.09E-03	3.2009E+00	1.2067E+03
5	5.95E-04	2.32E-03	2.05E-03	4.95E-03	2.13E-03	2.8036E+00	1.2071E+03
6	2.23E-04	1.47E-03	1.20E-03	3.61E-03	1.43E-03	1.7747E+00	1.2081E+03
7	7.36E-06	5.42E-04	3.03E-04	1.89E-03	5.42E-04	6.5577E-01	1.2092E+03
8	5.97E-15	9.84E-05	1.51E-06	5.62E-04	8.73E-05	1.1902E-01	1.2098E+03

ALPHA FACTOR and MGL PARAMETERS

Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 720
Total Number of Common-Cause Failure Events: 23

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9764240	0.9807570	0.9828390	0.9842040	0.9852200	0.9861590	0.9869720
2	2.36E-02	1.17E-02	7.81E-03	6.12E-03	5.19E-03	4.46E-03	3.83E-03
3		7.52E-03	6.59E-03	4.97E-03	3.87E-03	3.20E-03	2.92E-03
4			2.77E-03	3.60E-03	3.30E-03	2.70E-03	2.09E-03
5				1.11E-03	1.96E-03	2.24E-03	2.13E-03
6					4.64E-04	1.04E-03	1.43E-03
7						1.99E-04	5.42E-04
8							8.73E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.76E-01	9.81E-01	9.83E-01	9.84E-01	9.85E-01	9.86E-01	9.87E-01
Beta	2.36E-02	1.92E-02	1.72E-02	1.58E-02	1.48E-02	1.38E-02	1.30E-02
Gamma		3.91E-01	5.45E-01	6.13E-01	6.49E-01	6.78E-01	7.06E-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	240.00	360.00	480.00	600.00	720.00	840.00	960.00
N_1	6.5203	7.8821	8.7545	9.3851	9.8603	10.3535	10.8266
N_2	5.9523	4.3984	3.8824	3.7867	3.8435	3.8419	3.7712
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9809950	0.9929080	0.9945250	0.9992870	0.9948830	1.9103E+02	1.3644E+00
2	7.10E-04	7.09E-03	5.47E-03	1.90E-02	5.12E-03	1.3644E+00	1.9103E+02

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9755510	0.9875380	0.9886000	0.9959030	0.9901880	2.9815E+02	3.7624E+00
2	3.48E-03	1.14E-02	1.03E-02	2.29E-02	9.58E-03	3.4312E+00	2.9848E+02
3	2.79E-07	1.10E-03	3.12E-04	4.86E-03	2.36E-04	3.3122E-01	3.0158E+02

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9713590	0.9830350	0.9838160	0.9920350	0.9859260	4.0104E+02	6.9212E+00
2	6.50E-03	1.48E-02	1.40E-02	2.58E-02	1.34E-02	6.0378E+00	4.0192E+02
3	2.27E-05	1.62E-03	9.11E-04	5.62E-03	7.12E-04	6.6061E-01	4.0730E+02
4	2.35E-09	5.46E-04	7.43E-05	2.73E-03	2.78E-07	2.2277E-01	4.0774E+02

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9715380	0.9818080	0.9823890	0.9900890	0.9856550	5.3809E+02	9.9703E+00
2	6.32E-03	1.32E-02	1.26E-02	2.21E-02	1.14E-02	7.2389E+00	5.4082E+02
3	8.03E-04	4.02E-03	3.43E-03	9.23E-03	2.73E-03	2.2008E+00	5.4586E+02
4	2.03E-06	8.36E-04	3.51E-04	3.31E-03	1.87E-04	4.5829E-01	5.4760E+02
5	1.08E-21	1.32E-04	7.43E-08	7.62E-04	0.00E+00	7.2277E-02	5.4799E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9719510	0.9813660	0.9818500	0.9891230	0.9851310	6.4541E+02	1.2255E+01
2	6.13E-03	1.22E-02	1.18E-02	2.00E-02	1.08E-02	8.0534E+00	6.4961E+02
3	1.12E-03	4.31E-03	3.82E-03	9.18E-03	3.16E-03	2.8368E+00	6.5483E+02
4	8.69E-05	1.57E-03	1.10E-03	4.64E-03	8.19E-04	1.0314E+00	6.5663E+02
5	6.42E-09	3.80E-04	6.65E-05	1.84E-03	5.18E-05	2.5000E-01	6.5741E+02
6	2.14E-19	1.27E-04	2.21E-07	7.37E-04	0.00E+00	8.3237E-02	6.5758E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9724300	0.9809200	0.9813100	0.9880710	0.9854210	7.9928E+02	1.5547E+01
2	5.80E-03	1.11E-02	1.07E-02	1.77E-02	9.50E-03	9.0185E+00	8.0581E+02
3	1.55E-03	4.69E-03	4.29E-03	9.18E-03	3.50E-03	3.8193E+00	8.1101E+02
4	3.43E-04	2.21E-03	1.82E-03	5.42E-03	1.30E-03	1.8016E+00	8.1303E+02
5	1.33E-05	8.38E-04	4.81E-04	2.88E-03	2.58E-04	6.8287E-01	8.1414E+02
6	1.78E-10	2.40E-04	2.35E-05	1.24E-03	1.49E-05	1.9558E-01	8.1463E+02
7	0.00E+00	3.57E-05	3.12E-14	1.34E-04	0.00E+00	2.9071E-02	8.1480E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9732540	0.9810970	0.9814350	0.9877820	0.9855700	9.2051E+02	1.7736E+01
2	5.47E-03	1.02E-02	9.86E-03	1.61E-02	8.75E-03	9.5767E+00	9.2867E+02
3	1.58E-03	4.46E-03	4.12E-03	8.54E-03	3.44E-03	4.1889E+00	9.3406E+02
4	5.18E-04	2.46E-03	2.12E-03	5.57E-03	1.63E-03	2.3083E+00	9.3594E+02
5	7.03E-05	1.15E-03	8.18E-04	3.35E-03	5.17E-04	1.0765E+00	9.3717E+02
6	7.11E-07	4.54E-04	1.77E-04	1.85E-03	8.31E-05	4.2616E-01	9.3782E+02
7	3.16E-14	1.34E-04	2.71E-06	7.62E-04	4.35E-06	1.2607E-01	9.3812E+02
8	3.25E-43	3.53E-05	5.02E-13	1.49E-04	0.00E+00	3.3124E-02	9.3821E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 517
Total Number of Common-Cause Failure Events: 28

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9948830	0.9901880	0.9859260	0.9856550	0.9851310	0.9854210	0.9855700
2	5.12E-03	9.58E-03	1.34E-02	1.14E-02	1.08E-02	9.50E-03	8.75E-03
3		2.36E-04	7.12E-04	2.73E-03	3.16E-03	3.50E-03	3.44E-03
4			2.78E-07	1.87E-04	8.19E-04	1.30E-03	1.63E-03
5				0.00E+00	5.18E-05	2.58E-04	5.17E-04
6					0.00E+00	1.49E-05	8.31E-05
7						0.00E+00	4.35E-06
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	9.86E-01	9.86E-01	9.85E-01	9.85E-01	9.86E-01
Beta	5.12E-03	9.81E-03	1.41E-02	1.43E-02	1.49E-02	1.46E-02	1.44E-02
Gamma		2.40E-02	5.06E-02	2.03E-01	2.71E-01	3.48E-01	3.93E-01
Delta			3.90E-04	6.42E-02	2.16E-01	3.10E-01	3.94E-01
Epsilon				0.00E+00	5.95E-02	1.73E-01	2.70E-01
Mu					0.00E+00	5.46E-02	1.45E-01
Upsilon						0.00E+00	4.98E-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	171.19	256.79	342.38	427.98	513.58	599.17	684.77
N_1	9.5986	11.8004	12.5278	13.9523	14.8899	16.0582	17.0118
N_2	0.9299	2.5975	4.8097	5.1247	5.8142	5.9307	6.2320
N_3		0.0640	0.2563	1.2234	1.6950	2.1881	2.4505
N_4			0.0001	0.0839	0.4392	0.8127	1.1618
N_5				0.0000	0.0278	0.1611	0.3682
N_6					0.0000	0.0093	0.0592
N_7						0.0000	0.0031
N_8							0.0000

2.3.1.3 Fail to Operate

ALPHA FACTOR DISTRIBUTIONS

Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)** **FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
$_1$	0.9725510	0.9835450	0.9842620	0.9920810	0.9841410	4.3732E+02	7.3167E+00
$_2$	7.92E-03	1.65E-02	1.57E-02	2.74E-02	1.59E-02	7.3167E+00	4.3732E+02

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
$_1$	0.9750590	0.9837730	0.9842440	0.9908640	0.9847070	6.6569E+02	1.0980E+01
$_2$	5.73E-03	1.16E-02	1.11E-02	1.90E-02	1.08E-02	7.8296E+00	6.6884E+02
$_3$	1.33E-03	4.66E-03	4.18E-03	9.62E-03	4.46E-03	3.1508E+00	6.7352E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9752850	0.9829190	0.9832700	0.9893420	0.9841270	8.8935E+02	1.5455E+01
2	5.95E-03	1.10E-02	1.06E-02	1.72E-02	1.01E-02	9.9203E+00	8.9489E+02
3	1.47E-03	4.35E-03	3.99E-03	8.46E-03	4.12E-03	3.9368E+00	9.0087E+02
4	2.30E-04	1.77E-03	1.42E-03	4.50E-03	1.61E-03	1.5983E+00	9.0321E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9764220	0.9830700	0.9833470	0.9887730	0.9848050	1.1469E+03	1.9751E+01
2	5.32E-03	9.45E-03	9.17E-03	1.45E-02	8.35E-03	1.1026E+01	1.1556E+03
3	1.84E-03	4.52E-03	4.24E-03	8.16E-03	4.03E-03	5.2764E+00	1.1614E+03
4	5.69E-04	2.30E-03	2.03E-03	4.99E-03	2.17E-03	2.6891E+00	1.1640E+03
5	1.51E-05	6.51E-04	3.97E-04	2.15E-03	6.44E-04	7.5988E-01	1.1659E+03

CCCG = 6 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9774130	0.9834000	0.9836320	0.9885970	0.9851750	1.3746E+03	2.3204E+01
2	4.91E-03	8.51E-03	8.28E-03	1.29E-02	7.57E-03	1.1897E+01	1.3859E+03
3	1.73E-03	4.08E-03	3.85E-03	7.23E-03	3.57E-03	5.7024E+00	1.3921E+03
4	7.67E-04	2.49E-03	2.25E-03	5.00E-03	2.26E-03	3.4757E+00	1.3943E+03
5	1.74E-04	1.22E-03	9.89E-04	3.04E-03	1.16E-03	1.7016E+00	1.3961E+03
6	4.85E-07	3.06E-04	1.19E-04	1.24E-03	2.69E-04	4.2704E-01	1.3974E+03

CCCG = 7 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9782020	0.9836060	0.9838000	0.9883560	0.9858420	1.6488E+03	2.7481E+01
2	4.53E-03	7.67E-03	7.48E-03	1.15E-02	6.58E-03	1.2860E+01	1.6634E+03
3	1.79E-03	3.93E-03	3.73E-03	6.73E-03	3.33E-03	6.5812E+00	1.6697E+03
4	8.62E-04	2.47E-03	2.27E-03	4.73E-03	2.12E-03	4.1326E+00	1.6721E+03
5	3.74E-04	1.56E-03	1.37E-03	3.41E-03	1.41E-03	2.6156E+00	1.6737E+03
6	4.11E-05	6.51E-04	4.66E-04	1.89E-03	6.09E-04	1.0908E+00	1.6752E+03
7	1.31E-10	1.20E-04	1.26E-05	6.17E-04	1.16E-04	2.0097E-01	1.6761E+03

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9791300	0.9840960	0.9842660	0.9884880	0.9863760	1.8904E+03	3.0551E+01
2	4.15E-03	6.95E-03	6.78E-03	1.03E-02	5.90E-03	1.3348E+01	1.9076E+03
3	1.73E-03	3.67E-03	3.50E-03	6.20E-03	3.14E-03	7.0565E+00	1.9139E+03
4	8.23E-04	2.27E-03	2.10E-03	4.30E-03	1.90E-03	4.3627E+00	1.9166E+03
5	4.73E-04	1.65E-03	1.48E-03	3.41E-03	1.45E-03	3.1717E+00	1.9178E+03
6	1.52E-04	9.55E-04	7.88E-04	2.33E-03	8.66E-04	1.8339E+00	1.9191E+03
7	4.74E-06	3.43E-04	1.92E-04	1.19E-03	3.16E-04	6.5887E-01	1.9203E+03
8	3.76E-15	6.20E-05	9.50E-07	3.54E-04	5.07E-05	1.1902E-01	1.9208E+03

ALPHA FACTOR and MGL PARAMETERS

Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)** **FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 1237
Total Number of Common-Cause Failure Events: 51

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9841410	0.9847070	0.9841270	0.9848050	0.9851750	0.9858420	0.9863760
2	1.59E-02	1.08E-02	1.01E-02	8.35E-03	7.57E-03	6.58E-03	5.90E-03
3		4.46E-03	4.12E-03	4.03E-03	3.57E-03	3.33E-03	3.14E-03
4			1.61E-03	2.17E-03	2.26E-03	2.12E-03	1.90E-03
5				6.44E-04	1.16E-03	1.41E-03	1.45E-03
6					2.69E-04	6.09E-04	8.66E-04
7						1.16E-04	3.16E-04
8							5.07E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.84E-01	9.85E-01	9.84E-01	9.85E-01	9.85E-01	9.86E-01	9.86E-01
Beta	1.59E-02	1.53E-02	1.59E-02	1.52E-02	1.48E-02	1.42E-02	1.36E-02
Gamma		2.92E-01	3.61E-01	4.50E-01	4.90E-01	5.35E-01	5.67E-01
Delta			2.80E-01	4.11E-01	5.08E-01	5.61E-01	5.94E-01
Epsilon				2.29E-01	3.87E-01	5.02E-01	5.86E-01
Mu					1.89E-01	3.40E-01	4.59E-01
Upsilon						1.60E-01	2.98E-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	410.96	616.45	821.93	1027.41	1232.89	1438.37	1643.85
N_1	16.1189	19.6825	21.2823	23.3374	24.7502	26.4117	27.8384
N_2	6.8822	6.9959	8.6922	8.9114	9.6576	9.7726	10.0032
N_3		2.8836	3.5325	4.2990	4.5606	4.9500	5.3181
N_4			1.3756	2.3147	2.8835	3.1437	3.2162
N_5				0.6876	1.4794	2.0938	2.4634
N_6					0.3438	0.9045	1.4669
N_7						0.1719	0.5359
N_8							0.0859

2.3.1.4 Spurious Operation

ALPHA FACTOR DISTRIBUTIONS

Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**SPURIOUS ACTUATION**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9602830	0.9900840	0.9959540	0.9999790	0.9998510	4.3886E+01	4.3952E-01
2	1.91E-05	9.92E-03	4.04E-03	3.97E-02	1.49E-04	4.3952E-01	4.3886E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9606300	0.9862480	0.9899890	0.9990730	0.9997110	8.0001E+01	1.1155E+00
2	3.46E-04	1.05E-02	6.80E-03	3.30E-02	2.83E-04	8.4796E-01	8.0269E+01
3	1.16E-07	3.30E-03	6.63E-04	1.56E-02	5.95E-06	2.6752E-01	8.0849E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9607900	0.9836630	0.9863700	0.9972870	0.9995840	1.1338E+02	1.8831E+00
2	9.34E-04	1.09E-02	8.22E-03	3.00E-02	4.01E-04	1.2551E+00	1.1401E+02
3	4.01E-06	3.52E-03	1.30E-03	1.45E-02	1.49E-05	4.0531E-01	1.1486E+02
4	8.30E-09	1.93E-03	2.63E-04	9.67E-03	0.00E+00	2.2267E-01	1.1504E+02

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9613510	0.9805060	0.9822210	0.9937990	0.9994740	1.8019E+02	3.5824E+00
2	2.30E-03	1.17E-02	1.00E-02	2.70E-02	4.92E-04	2.1556E+00	1.8162E+02
3	2.61E-04	5.33E-03	3.68E-03	1.60E-02	3.21E-05	9.8008E-01	1.8279E+02
4	1.34E-06	2.04E-03	6.85E-04	8.66E-03	1.19E-06	3.7449E-01	1.8340E+02
5	3.24E-21	3.93E-04	2.22E-07	2.27E-03	0.00E+00	7.2277E-02	1.8370E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9631570	0.9804520	0.9818740	0.9928840	0.9993750	2.1776E+02	4.3417E+00
2	2.18E-03	1.03E-02	8.91E-03	2.34E-02	5.70E-04	2.2967E+00	2.1980E+02
3	3.66E-04	5.16E-03	3.78E-03	1.47E-02	5.25E-05	1.1471E+00	2.2095E+02
4	2.38E-05	2.67E-03	1.39E-03	9.63E-03	1.98E-06	5.9242E-01	2.2151E+02
5	4.17E-09	1.00E-03	1.35E-04	5.01E-03	0.00E+00	2.2220E-01	2.2188E+02
6	6.34E-19	3.75E-04	6.55E-07	2.19E-03	0.00E+00	8.3237E-02	2.2202E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9638090	0.9788130	0.9798390	0.9903020	0.9992840	3.0165E+02	6.5293E+00
2	2.94E-03	1.03E-02	9.22E-03	2.11E-02	6.36E-04	3.1627E+00	3.0502E+02
3	7.22E-04	5.32E-03	4.30E-03	1.34E-02	7.48E-05	1.6400E+00	3.0654E+02
4	1.61E-04	3.21E-03	2.22E-03	9.64E-03	5.10E-06	9.8947E-01	3.0719E+02
5	8.31E-06	1.69E-03	8.01E-04	6.40E-03	0.00E+00	5.2177E-01	3.0766E+02
6	2.18E-10	6.04E-04	5.16E-05	3.17E-03	0.00E+00	1.8628E-01	3.0799E+02
7	0.00E+00	9.43E-05	8.25E-14	3.55E-04	0.00E+00	2.9071E-02	3.0815E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9652940	0.9790160	0.9798940	0.9897300	0.9992020	3.5310E+02	7.5683E+00
2	2.92E-03	9.53E-03	8.64E-03	1.92E-02	6.91E-04	3.4376E+00	3.5723E+02
3	7.25E-04	4.86E-03	3.98E-03	1.20E-02	9.82E-05	1.7516E+00	3.5892E+02
4	2.25E-04	3.18E-03	2.32E-03	9.07E-03	8.18E-06	1.1476E+00	3.5952E+02
5	3.57E-05	1.96E-03	1.15E-03	6.65E-03	7.44E-07	7.0843E-01	3.5996E+02
6	5.75E-07	1.02E-03	3.33E-04	4.35E-03	0.00E+00	3.6696E-01	3.6030E+02
7	4.51E-14	3.41E-04	6.13E-06	1.94E-03	0.00E+00	1.2297E-01	3.6055E+02
8	8.45E-43	9.18E-05	1.31E-12	3.88E-04	0.00E+00	3.3124E-02	3.6064E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**SPURIOUS ACTUATION**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 67
Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9998510	0.9997110	0.9995840	0.9994740	0.9993750	0.9992840	0.9992020
2	1.49E-04	2.83E-04	4.01E-04	4.92E-04	5.70E-04	6.36E-04	6.91E-04
3		5.95E-06	1.49E-05	3.21E-05	5.25E-05	7.48E-05	9.82E-05
4			0.00E+00	1.19E-06	1.98E-06	5.10E-06	8.18E-06
5				0.00E+00	0.00E+00	0.00E+00	7.44E-07
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	9.99E-01	9.99E-01	9.99E-01	9.99E-01
Beta	1.49E-04	2.89E-04	4.16E-04	5.26E-04	6.25E-04	7.16E-04	7.98E-04
Gamma		2.05E-02	3.57E-02	6.33E-02	8.73E-02	1.12E-01	1.34E-01
Delta			0.00E+00	3.57E-02	3.64E-02	6.38E-02	8.33E-02
Epsilon				0.00E+00	0.00E+00	0.00E+00	8.33E-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	33.50	50.25	67.00	83.75	100.50	117.25	134.00
N_1	0.1400	0.1958	0.2430	0.2835	0.3175	0.3457	0.3688
N_2	0.0050	0.0143	0.0270	0.0414	0.0575	0.0749	0.0929
N_3		0.0003	0.0010	0.0027	0.0053	0.0088	0.0132
N_4			0.0000	0.0001	0.0002	0.0006	0.0011
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

2.3.2 PWR Containment Spray Motor Operated Valves

2.3.2.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**CONTAINMENT SPRAY SYSTEM**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9111370	0.9771100	0.9898100	0.9999280	0.9962360	2.0145E+01	4.7192E-01
2	6.81E-05	2.29E-02	1.02E-02	8.89E-02	3.76E-03	4.7192E-01	2.0145E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9263470	0.9733430	0.9799200	0.9978320	0.9924500	4.4291E+01	1.2130E+00
2	9.44E-04	2.08E-02	1.43E-02	6.28E-02	7.55E-03	9.4576E-01	4.4558E+01
3	2.06E-07	5.87E-03	1.18E-03	2.79E-02	0.00E+00	2.6722E-01	4.5237E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9290270	0.9692960	0.9737990	0.9941620	0.9886330	6.5644E+01	2.0794E+00
2	2.42E-03	2.14E-02	1.69E-02	5.59E-02	1.14E-02	1.4524E+00	6.6271E+01
3	6.72E-06	5.97E-03	2.21E-03	2.47E-02	0.00E+00	4.0431E-01	6.7319E+01
4	1.42E-08	3.29E-03	4.50E-04	1.65E-02	0.00E+00	2.2267E-01	6.7501E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9392920	0.9685200	0.9710010	0.9892560	0.9847860	1.2036E+02	3.9120E+00
2	4.62E-03	2.00E-02	1.75E-02	4.40E-02	1.52E-02	2.4880E+00	1.2178E+02
3	3.84E-04	7.86E-03	5.43E-03	2.37E-02	0.00E+00	9.7738E-01	1.2329E+02
4	1.98E-06	3.01E-03	1.01E-03	1.28E-02	0.00E+00	3.7439E-01	1.2390E+02
5	4.80E-21	5.82E-04	3.29E-07	3.37E-03	0.00E+00	7.2277E-02	1.2420E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9413050	0.9678640	0.9699130	0.9874120	0.9809090	1.4575E+02	4.8394E+00
2	4.81E-03	1.86E-02	1.65E-02	3.95E-02	1.91E-02	2.7999E+00	1.4779E+02
3	5.33E-04	7.58E-03	5.54E-03	2.16E-02	0.00E+00	1.1418E+00	1.4945E+02
4	3.51E-05	3.93E-03	2.06E-03	1.42E-02	0.00E+00	5.9222E-01	1.5000E+02
5	6.17E-09	1.48E-03	2.00E-04	7.39E-03	0.00E+00	2.2220E-01	1.5037E+02
6	9.36E-19	5.53E-04	9.66E-07	3.23E-03	0.00E+00	8.3237E-02	1.5051E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9464140	0.9678160	0.9691990	0.9845080	0.9770130	2.1740E+02	7.2296E+00
2	5.80E-03	1.72E-02	1.58E-02	3.35E-02	2.30E-02	3.8721E+00	2.2076E+02
3	9.79E-04	7.26E-03	5.86E-03	1.83E-02	8.79E-06	1.6315E+00	2.2300E+02
4	2.21E-04	4.40E-03	3.05E-03	1.32E-02	0.00E+00	9.8887E-01	2.2364E+02
5	1.14E-05	2.32E-03	1.10E-03	8.78E-03	0.00E+00	5.2177E-01	2.2411E+02
6	2.99E-10	8.29E-04	7.08E-05	4.35E-03	0.00E+00	1.8628E-01	2.2444E+02
7	0.00E+00	1.29E-04	1.13E-13	4.87E-04	0.00E+00	2.9071E-02	2.2460E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9483500	0.9679060	0.9690790	0.9834640	0.9730940	2.5654E+02	8.5065E+00
2	6.07E-03	1.66E-02	1.54E-02	3.12E-02	2.69E-02	4.3896E+00	2.6066E+02
3	9.71E-04	6.56E-03	5.37E-03	1.62E-02	1.54E-05	1.7390E+00	2.6331E+02
4	3.06E-04	4.33E-03	3.16E-03	1.23E-02	0.00E+00	1.1465E+00	2.6390E+02
5	4.86E-05	2.67E-03	1.57E-03	9.05E-03	0.00E+00	7.0833E-01	2.6434E+02
6	7.83E-07	1.38E-03	4.53E-04	5.92E-03	0.00E+00	3.6696E-01	2.6468E+02
7	6.14E-14	4.64E-04	8.34E-06	2.64E-03	0.00E+00	1.2297E-01	2.6492E+02
8	1.15E-42	1.25E-04	1.78E-12	5.28E-04	0.00E+00	3.3124E-02	2.6501E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**CONTAINMENT SPRAY SYSTEM**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 32
Total Number of Common-Cause Failure Events: 2

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9962360	0.9924500	0.9886330	0.9847860	0.9809090	0.9770130	0.9730940
2	3.76E-03	7.55E-03	1.14E-02	1.52E-02	1.91E-02	2.30E-02	2.69E-02
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.79E-06	1.54E-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	9.96E-01	9.92E-01	9.89E-01	9.85E-01	9.81E-01	9.77E-01	9.73E-01
Beta	3.76E-03	7.55E-03	1.14E-02	1.52E-02	1.91E-02	2.30E-02	2.69E-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	9.14	13.71	18.29	22.86	27.43	32.00	36.57
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**CONTAINMENT SPRAY SYSTEM**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9050540	0.9762180	0.9901730	0.9999520	0.9997780	1.7906E+01	4.3622E-01
2	4.48E-05	2.38E-02	9.82E-03	9.49E-02	2.22E-04	4.3622E-01	1.7906E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9251430	0.9737640	0.9808200	0.9982520	0.9995650	4.1045E+01	1.1059E+00
2	6.44E-04	1.99E-02	1.30E-02	6.28E-02	4.35E-04	8.3866E-01	4.1312E+01
3	2.22E-07	6.34E-03	1.28E-03	3.01E-02	0.00E+00	2.6722E-01	4.1884E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9295110	0.9705440	0.9753540	0.9951200	0.9993480	6.1453E+01	1.8651E+00
2	1.65E-03	1.96E-02	1.48E-02	5.38E-02	6.52E-04	1.2381E+00	6.2080E+01
3	7.19E-06	6.39E-03	2.37E-03	2.64E-02	0.00E+00	4.0431E-01	6.2914E+01
4	1.52E-08	3.52E-03	4.82E-04	1.76E-02	0.00E+00	2.2267E-01	6.3095E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9407930	0.9700880	0.9726900	0.9904870	0.9991280	1.1529E+02	3.5549E+00
2	3.48E-03	1.79E-02	1.53E-02	4.14E-02	8.72E-04	2.1309E+00	1.1671E+02
3	4.01E-04	8.22E-03	5.68E-03	2.47E-02	0.00E+00	9.7738E-01	1.1787E+02
4	2.07E-06	3.15E-03	1.06E-03	1.34E-02	0.00E+00	3.7439E-01	1.1847E+02
5	5.02E-21	6.08E-04	3.44E-07	3.52E-03	0.00E+00	7.2277E-02	1.1877E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9438180	0.9701540	0.9723050	0.9891430	0.9989120	1.3989E+02	4.3037E+00
2	3.27E-03	1.57E-02	1.35E-02	3.56E-02	1.09E-03	2.2642E+00	1.4193E+02
3	5.57E-04	7.92E-03	5.79E-03	2.26E-02	0.00E+00	1.1418E+00	1.4305E+02
4	3.67E-05	4.11E-03	2.15E-03	1.48E-02	0.00E+00	5.9222E-01	1.4360E+02
5	6.44E-09	1.54E-03	2.09E-04	7.72E-03	0.00E+00	2.2220E-01	1.4397E+02
6	9.78E-19	5.77E-04	1.01E-06	3.37E-03	0.00E+00	8.3237E-02	1.4411E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9491090	0.9701810	0.9716110	0.9863650	0.9987090	2.1082E+02	6.4796E+00
2	4.08E-03	1.44E-02	1.29E-02	2.96E-02	1.28E-03	3.1221E+00	2.1418E+02
3	1.01E-03	7.51E-03	6.06E-03	1.90E-02	1.12E-05	1.6315E+00	2.1567E+02
4	2.28E-04	4.55E-03	3.15E-03	1.37E-02	0.00E+00	9.8887E-01	2.1631E+02
5	1.18E-05	2.40E-03	1.14E-03	9.08E-03	0.00E+00	5.2177E-01	2.1678E+02
6	3.09E-10	8.57E-04	7.32E-05	4.50E-03	0.00E+00	1.8628E-01	2.1711E+02
7	0.00E+00	1.34E-04	1.17E-13	5.04E-04	0.00E+00	2.9071E-02	2.1727E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9516800	0.9707700	0.9719820	0.9857120	0.9985140	2.4930E+02	7.5065E+00
2	4.01E-03	1.32E-02	1.20E-02	2.66E-02	1.47E-03	3.3896E+00	2.5342E+02
3	1.00E-03	6.77E-03	5.54E-03	1.67E-02	1.96E-05	1.7390E+00	2.5507E+02
4	3.16E-04	4.46E-03	3.26E-03	1.27E-02	0.00E+00	1.1465E+00	2.5566E+02
5	5.02E-05	2.76E-03	1.62E-03	9.34E-03	0.00E+00	7.0833E-01	2.5610E+02
6	8.09E-07	1.43E-03	4.68E-04	6.11E-03	0.00E+00	3.6696E-01	2.5644E+02
7	6.34E-14	4.79E-04	8.61E-06	2.73E-03	0.00E+00	1.2297E-01	2.5668E+02
8	1.19E-42	1.29E-04	1.84E-12	5.45E-04	0.00E+00	3.3124E-02	2.5677E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**CONTAINMENT SPRAY SYSTEM**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 22
Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9997780	0.9995650	0.9993480	0.9991280	0.9989120	0.9987090	0.9985140
2	2.22E-04	4.35E-04	6.52E-04	8.72E-04	1.09E-03	1.28E-03	1.47E-03
3		0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.12E-05	1.96E-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	2.22E-04	4.35E-04	6.52E-04	8.72E-04	1.09E-03	1.29E-03	1.49E-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	7.33	11.00	14.67	18.33	22.00	25.67	29.33
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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9435500	0.9777480	0.9820780	0.9971340	0.9810260	6.9152E+01	1.5738E+00
2	2.87E-03	2.23E-02	1.79E-02	5.64E-02	1.90E-02	1.5738E+00	6.9152E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9545930	0.9793790	0.9819840	0.9952700	0.9846230	1.1756E+02	2.4752E+00
2	2.00E-03	1.40E-02	1.15E-02	3.50E-02	9.54E-03	1.6863E+00	1.1835E+02
3	1.73E-04	6.57E-03	4.11E-03	2.14E-02	5.84E-03	7.8892E-01	1.1925E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9579510	0.9788820	0.9807670	0.9933640	0.9859780	1.6309E+02	3.5184E+00
2	2.29E-03	1.23E-02	1.04E-02	2.89E-02	6.98E-03	2.0560E+00	1.6455E+02
3	2.98E-04	5.94E-03	4.11E-03	1.78E-02	4.93E-03	9.8921E-01	1.6562E+02
4	8.31E-06	2.84E-03	1.23E-03	1.11E-02	2.11E-03	4.7317E-01	1.6614E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9604050	0.9776940	0.9789670	0.9906210	0.9865880	2.4195E+02	5.5202E+00
2	3.36E-03	1.22E-02	1.09E-02	2.54E-02	6.12E-03	3.0183E+00	2.4445E+02
3	7.83E-04	6.28E-03	5.01E-03	1.61E-02	3.90E-03	1.5536E+00	2.4592E+02
4	6.78E-05	3.03E-03	1.84E-03	1.01E-02	2.55E-03	7.5099E-01	2.4672E+02
5	6.71E-10	7.97E-04	7.99E-05	4.12E-03	8.46E-04	1.9728E-01	2.4727E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9624540	0.9779910	0.9790510	0.9899050	0.9870980	2.9153E+02	6.5606E+00
2	3.08E-03	1.07E-02	9.61E-03	2.20E-02	5.35E-03	3.1855E+00	2.9491E+02
3	9.20E-04	5.99E-03	4.93E-03	1.47E-02	3.64E-03	1.7863E+00	2.9630E+02
4	1.55E-04	3.26E-03	2.23E-03	9.84E-03	2.14E-03	9.7062E-01	2.9712E+02
5	4.59E-06	1.58E-03	6.86E-04	6.21E-03	1.41E-03	4.7240E-01	2.9762E+02
6	2.50E-12	4.89E-04	1.82E-05	2.71E-03	3.53E-04	1.4574E-01	2.9794E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9638880	0.9773730	0.9781750	0.9881340	0.9877400	3.8746E+02	8.9698E+00
2	3.40E-03	9.97E-03	9.16E-03	1.93E-02	4.21E-03	3.9542E+00	3.9248E+02
3	1.42E-03	6.23E-03	5.42E-03	1.38E-02	4.07E-03	2.4703E+00	3.9396E+02
4	3.04E-04	3.30E-03	2.51E-03	8.99E-03	1.55E-03	1.3077E+00	3.9512E+02
5	6.59E-05	2.11E-03	1.35E-03	6.72E-03	1.52E-03	8.3467E-01	3.9560E+02
6	2.88E-07	8.64E-04	2.58E-04	3.78E-03	7.59E-04	3.4258E-01	3.9609E+02
7	4.19E-25	1.52E-04	1.54E-08	8.55E-04	1.52E-04	6.0371E-02	3.9637E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9657550	0.9780270	0.9787180	0.9879510	0.9886270	4.5103E+02	1.0133E+01
2	2.90E-03	8.54E-03	7.84E-03	1.66E-02	2.52E-03	3.9374E+00	4.5723E+02
3	1.69E-03	6.32E-03	5.62E-03	1.33E-02	5.01E-03	2.9158E+00	4.5825E+02
4	3.12E-04	3.02E-03	2.34E-03	8.05E-03	1.04E-03	1.3915E+00	4.5977E+02
5	1.20E-04	2.22E-03	1.55E-03	6.58E-03	1.33E-03	1.0217E+00	4.6014E+02
6	1.24E-05	1.30E-03	6.88E-04	4.69E-03	9.98E-04	6.0136E-01	4.6056E+02
7	1.43E-09	4.70E-04	5.99E-05	2.37E-03	3.99E-04	2.1677E-01	4.6095E+02
8	2.52E-30	1.06E-04	8.41E-10	5.57E-04	6.64E-05	4.8724E-02	4.6111E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 149
Total Number of Common-Cause Failure Events: 5

Fail to Open

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9810260	0.9846230	0.9859780	0.9865880	0.9870980	0.9877400	0.9886270
2	1.90E-02	9.54E-03	6.98E-03	6.12E-03	5.35E-03	4.21E-03	2.52E-03
3		5.84E-03	4.93E-03	3.90E-03	3.64E-03	4.07E-03	5.01E-03
4			2.11E-03	2.55E-03	2.14E-03	1.55E-03	1.04E-03
5				8.46E-04	1.41E-03	1.52E-03	1.33E-03
6					3.53E-04	7.59E-04	9.98E-04
7						1.52E-04	3.99E-04
8							6.64E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.81E-01	9.85E-01	9.86E-01	9.87E-01	9.87E-01	9.88E-01	9.89E-01
Beta	1.90E-02	1.54E-02	1.40E-02	1.34E-02	1.29E-02	1.23E-02	1.14E-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	57.31	85.96	114.62	143.27	171.92	200.58	229.23
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9511370	0.9862450	0.9925700	0.9998560	0.9947800	4.3769E+01	6.1042E-01
2	1.42E-04	1.38E-02	7.43E-03	4.89E-02	5.22E-03	6.1042E-01	4.3769E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9508230	0.9806810	0.9844820	0.9975410	0.9907910	7.9404E+01	1.5642E+00
2	1.37E-03	1.56E-02	1.18E-02	4.28E-02	8.57E-03	1.2647E+00	7.9704E+01
3	3.93E-07	3.70E-03	9.06E-04	1.69E-02	6.42E-04	2.9952E-01	8.0669E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9502010	0.9768930	0.9796080	0.9943040	0.9880610	1.1215E+02	2.6528E+00
2	2.77E-03	1.65E-02	1.38E-02	3.96E-02	1.00E-02	1.8971E+00	1.1291E+02
3	2.54E-05	4.64E-03	2.24E-03	1.74E-02	1.92E-03	5.3291E-01	1.1427E+02
4	8.38E-09	1.94E-03	2.65E-04	9.72E-03	1.50E-06	2.2277E-01	1.1458E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9529760	0.9745610	0.9762750	0.9903010	0.9865990	1.7828E+02	4.6537E+00
2	4.43E-03	1.62E-02	1.45E-02	3.40E-02	1.03E-02	2.9711E+00	1.7996E+02
3	5.04E-04	6.53E-03	4.84E-03	1.83E-02	2.60E-03	1.1938E+00	1.8174E+02
4	3.09E-06	2.28E-03	8.67E-04	9.32E-03	5.06E-04	4.1649E-01	1.8252E+02
5	3.26E-21	3.95E-04	2.23E-07	2.28E-03	0.00E+00	7.2277E-02	1.8286E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9543630	0.9740250	0.9754470	0.9888450	0.9853710	2.1508E+02	5.7357E+00
2	4.46E-03	1.50E-02	1.35E-02	3.04E-02	1.07E-02	3.3054E+00	2.1751E+02
3	6.91E-04	6.43E-03	5.02E-03	1.70E-02	2.80E-03	1.4203E+00	2.1940E+02
4	5.19E-05	3.13E-03	1.81E-03	1.07E-02	9.88E-04	6.9062E-01	2.2013E+02
5	9.37E-09	1.07E-03	1.66E-04	5.26E-03	1.40E-04	2.3610E-01	2.2058E+02
6	6.38E-19	3.77E-04	6.58E-07	2.20E-03	0.00E+00	8.3237E-02	2.2073E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9564760	0.9731850	0.9742050	0.9863970	0.9847190	2.9818E+02	8.2161E+00
2	5.10E-03	1.41E-02	1.30E-02	2.66E-02	1.06E-02	4.3152E+00	3.0208E+02
3	1.13E-03	6.44E-03	5.40E-03	1.53E-02	2.95E-03	1.9732E+00	3.0442E+02
4	2.63E-04	3.73E-03	2.73E-03	1.07E-02	1.34E-03	1.1442E+00	3.0525E+02
5	1.31E-05	1.84E-03	9.26E-04	6.76E-03	3.61E-04	5.6357E-01	3.0583E+02
6	3.24E-10	6.23E-04	5.70E-05	3.25E-03	3.97E-05	1.9088E-01	3.0621E+02
7	0.00E+00	9.49E-05	8.30E-14	3.57E-04	0.00E+00	2.9071E-02	3.0637E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9580160	0.9733330	0.9742060	0.9856570	0.9841460	3.4879E+02	9.5562E+00
2	5.09E-03	1.33E-02	1.24E-02	2.45E-02	1.06E-02	4.7498E+00	3.5360E+02
3	1.14E-03	5.93E-03	5.04E-03	1.38E-02	2.92E-03	2.1240E+00	3.5622E+02
4	3.72E-04	3.78E-03	2.90E-03	1.02E-02	1.57E-03	1.3534E+00	3.5699E+02
5	5.73E-05	2.20E-03	1.37E-03	7.16E-03	5.99E-04	7.8743E-01	3.5756E+02
6	8.40E-07	1.07E-03	3.71E-04	4.51E-03	1.29E-04	3.8396E-01	3.5796E+02
7	6.10E-14	3.47E-04	6.61E-06	1.97E-03	1.14E-05	1.2447E-01	3.5822E+02
8	8.51E-43	9.24E-05	1.32E-12	3.90E-04	0.00E+00	3.3124E-02	3.5831E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 99
Total Number of Common-Cause Failure Events: 9

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9947800	0.9907910	0.9880610	0.9865990	0.9853710	0.9847190	0.9841460
2	5.22E-03	8.57E-03	1.00E-02	1.03E-02	1.07E-02	1.06E-02	1.06E-02
3		6.42E-04	1.92E-03	2.60E-03	2.80E-03	2.95E-03	2.92E-03
4			1.50E-06	5.06E-04	9.88E-04	1.34E-03	1.57E-03
5				0.00E+00	1.40E-04	3.61E-04	5.99E-04
6					0.00E+00	3.97E-05	1.29E-04
7						0.00E+00	1.14E-05
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	9.91E-01	9.88E-01	9.87E-01	9.85E-01	9.85E-01	9.84E-01
Beta	5.22E-03	9.21E-03	1.19E-02	1.34E-02	1.46E-02	1.53E-02	1.59E-02
Gamma		6.97E-02	1.61E-01	2.32E-01	2.68E-01	3.07E-01	3.29E-01
Delta			7.77E-04	1.63E-01	2.87E-01	3.71E-01	4.41E-01
Epsilon				0.00E+00	1.24E-01	2.30E-01	3.21E-01
Mu					0.00E+00	9.91E-02	1.90E-01
Upsilon						0.00E+00	8.11E-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	30.75	46.12	61.49	76.86	92.24	107.61	122.98
N_1	2.7732	3.7288	4.5257	5.2600	5.9022	6.5193	7.0802
N_2	0.1759	0.4310	0.6690	0.8569	1.0662	1.2274	1.4051
N_3		0.0323	0.1286	0.2164	0.2785	0.3420	0.3856
N_4			0.0001	0.0421	0.0984	0.1553	0.2069
N_5				0.0000	0.0139	0.0418	0.0791
N_6					0.0000	0.0046	0.0170
N_7						0.0000	0.0015
N_8							0.0000

2.3.4 BWR Isolation Condenser Motor-Operated Valves

2.3.4.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**ISOLATION CONDENSER**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9197400	0.9799580	0.9917970	0.9999600	1.0000000	2.1246E+01	4.3452E-01
2	3.66E-05	2.00E-02	8.20E-03	8.03E-02	0.00E+00	4.3452E-01	2.1246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9244850	0.9735720	0.9807070	0.9982570	1.0000000	4.0555E+01	1.1009E+00
2	6.36E-04	2.00E-02	1.30E-02	6.33E-02	0.00E+00	8.3366E-01	4.0822E+01
3	2.25E-07	6.41E-03	1.30E-03	3.04E-02	0.00E+00	2.6722E-01	4.1389E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9246840	0.9685530	0.9736960	0.9948200	1.0000000	5.7136E+01	1.8551E+00
2	1.73E-03	2.08E-02	1.57E-02	5.74E-02	0.00E+00	1.2281E+00	5.7763E+01
3	7.72E-06	6.85E-03	2.54E-03	2.83E-02	0.00E+00	4.0431E-01	5.8587E+01
4	1.63E-08	3.77E-03	5.17E-04	1.89E-02	0.00E+00	2.2267E-01	5.8768E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9367020	0.9680370	0.9708150	0.9898600	1.0000000	1.0716E+02	3.5382E+00
2	3.68E-03	1.91E-02	1.63E-02	4.41E-02	0.00E+00	2.1142E+00	1.0858E+02
3	4.31E-04	8.83E-03	6.10E-03	2.65E-02	0.00E+00	9.7738E-01	1.0972E+02
4	2.22E-06	3.38E-03	1.14E-03	1.44E-02	0.00E+00	3.7439E-01	1.1032E+02
5	5.39E-21	6.53E-04	3.69E-07	3.78E-03	0.00E+00	7.2277E-02	1.1063E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9390430	0.9676400	0.9699700	0.9882600	1.0000000	1.2794E+02	4.2787E+00
2	3.48E-03	1.69E-02	1.46E-02	3.85E-02	0.00E+00	2.2392E+00	1.2998E+02
3	6.08E-04	8.64E-03	6.32E-03	2.46E-02	0.00E+00	1.1418E+00	1.3108E+02
4	4.01E-05	4.48E-03	2.35E-03	1.62E-02	0.00E+00	5.9222E-01	1.3163E+02
5	7.03E-09	1.68E-03	2.28E-04	8.42E-03	0.00E+00	2.2220E-01	1.3200E+02
6	1.07E-18	6.30E-04	1.10E-06	3.67E-03	0.00E+00	8.3237E-02	1.3214E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**ISOLATION CONDENSER**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 11
Total Number of Common-Cause Failure Events: 0

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	11.00	11.00	11.00	11.00	11.00
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**ISOLATION CONDENSER**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8959650	0.9739500	0.9892430	0.9999480	1.0000000	1.6246E+01	4.3452E-01
2	4.81E-05	2.60E-02	1.08E-02	1.04E-01	0.00E+00	4.3452E-01	1.6246E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9143470	0.9699670	0.9780280	0.9980130	1.0000000	3.5555E+01	1.1009E+00
2	7.25E-04	2.27E-02	1.48E-02	7.18E-02	0.00E+00	8.3366E-01	3.5822E+01
3	2.56E-07	7.29E-03	1.48E-03	3.46E-02	0.00E+00	2.6722E-01	3.6389E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9178250	0.9656410	0.9712250	0.9943340	1.0000000	5.2136E+01	1.8551E+00
2	1.89E-03	2.27E-02	1.72E-02	6.27E-02	0.00E+00	1.2281E+00	5.2763E+01
3	8.45E-06	7.49E-03	2.78E-03	3.09E-02	0.00E+00	4.0431E-01	5.3587E+01
4	1.78E-08	4.12E-03	5.66E-04	2.07E-02	0.00E+00	2.2267E-01	5.3768E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9337450	0.9665250	0.9694270	0.9893730	1.0000000	1.0216E+02	3.5382E+00
2	3.85E-03	2.00E-02	1.71E-02	4.62E-02	0.00E+00	2.1142E+00	1.0358E+02
3	4.52E-04	9.25E-03	6.39E-03	2.78E-02	0.00E+00	9.7738E-01	1.0472E+02
4	2.33E-06	3.54E-03	1.19E-03	1.50E-02	0.00E+00	3.7439E-01	1.0532E+02
5	5.65E-21	6.84E-04	3.87E-07	3.96E-03	0.00E+00	7.2277E-02	1.0563E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9366750	0.9663680	0.9687880	0.9877920	1.0000000	1.2294E+02	4.2787E+00
2	3.62E-03	1.76E-02	1.51E-02	4.00E-02	0.00E+00	2.2392E+00	1.2498E+02
3	6.32E-04	8.98E-03	6.57E-03	2.55E-02	0.00E+00	1.1418E+00	1.2608E+02
4	4.16E-05	4.66E-03	2.44E-03	1.68E-02	0.00E+00	5.9222E-01	1.2663E+02
5	7.30E-09	1.75E-03	2.37E-04	8.75E-03	0.00E+00	2.2220E-01	1.2700E+02
6	1.11E-18	6.54E-04	1.14E-06	3.82E-03	0.00E+00	8.3237E-02	1.2714E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**ISOLATION CONDENSER**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9328370	0.9825560	0.9920780	0.9999360	0.9969880	2.7392E+01	4.8632E-01
2	6.07E-05	1.74E-02	7.92E-03	6.72E-02	3.01E-03	4.8632E-01	2.7392E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9392850	0.9778610	0.9832200	0.9981010	0.9942740	5.5131E+01	1.2482E+00
2	8.53E-04	1.73E-02	1.20E-02	5.19E-02	5.57E-03	9.7696E-01	5.5402E+01
3	1.96E-07	4.81E-03	9.95E-04	2.27E-02	1.55E-04	2.7122E-01	5.6108E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9403430	0.9740420	0.9777890	0.9949270	0.9918550	8.0063E+01	2.1337E+00
2	2.13E-03	1.81E-02	1.44E-02	4.69E-02	7.67E-03	1.4906E+00	8.0706E+01
3	7.41E-06	5.11E-03	1.98E-03	2.08E-02	4.71E-04	4.2041E-01	8.1776E+01
4	1.17E-08	2.71E-03	3.70E-04	1.36E-02	0.00E+00	2.2267E-01	8.1974E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9463020	0.9720700	0.9742550	0.9903750	0.9897410	1.3837E+02	3.9758E+00
2	4.10E-03	1.76E-02	1.54E-02	3.87E-02	9.32E-03	2.5115E+00	1.3983E+02
3	3.86E-04	7.15E-03	5.01E-03	2.12E-02	9.43E-04	1.0176E+00	1.4133E+02
4	1.73E-06	2.63E-03	8.85E-04	1.12E-02	0.00E+00	3.7439E-01	1.4197E+02
5	4.19E-21	5.08E-04	2.87E-07	2.94E-03	0.00E+00	7.2277E-02	1.4227E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9481840	0.9715870	0.9733970	0.9888130	0.9879320	1.6738E+02	4.8948E+00
2	4.13E-03	1.61E-02	1.43E-02	3.44E-02	1.05E-02	2.7749E+00	1.6950E+02
3	5.75E-04	7.09E-03	5.30E-03	1.97E-02	1.57E-03	1.2222E+00	1.7105E+02
4	3.07E-05	3.44E-03	1.80E-03	1.24E-02	0.00E+00	5.9222E-01	1.7168E+02
5	5.39E-09	1.29E-03	1.75E-04	6.46E-03	0.00E+00	2.2220E-01	1.7205E+02
6	8.18E-19	4.83E-04	8.44E-07	2.82E-03	0.00E+00	8.3237E-02	1.7219E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9516830	0.9709860	0.9722320	0.9860260	0.9864340	2.4267E+02	7.2512E+00
2	4.94E-03	1.50E-02	1.37E-02	2.95E-02	1.12E-02	3.7534E+00	2.4617E+02
3	1.08E-03	7.09E-03	5.82E-03	1.74E-02	2.37E-03	1.7718E+00	2.4815E+02
4	1.98E-04	3.96E-03	2.74E-03	1.19E-02	0.00E+00	9.8887E-01	2.4893E+02
5	1.03E-05	2.09E-03	9.88E-04	7.89E-03	0.00E+00	5.2177E-01	2.4940E+02
6	2.69E-10	7.45E-04	6.36E-05	3.91E-03	0.00E+00	1.8628E-01	2.4973E+02
7	0.00E+00	1.16E-04	1.02E-13	4.38E-04	0.00E+00	2.9071E-02	2.4989E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9535900	0.9712180	0.9722790	0.9852170	0.9852450	2.8551E+02	8.4610E+00
2	4.92E-03	1.40E-02	1.29E-02	2.68E-02	1.14E-02	4.1197E+00	2.8985E+02
3	1.16E-03	6.68E-03	5.60E-03	1.59E-02	3.32E-03	1.9634E+00	2.9201E+02
4	2.76E-04	3.90E-03	2.85E-03	1.11E-02	0.00E+00	1.1465E+00	2.9282E+02
5	4.38E-05	2.41E-03	1.42E-03	8.16E-03	0.00E+00	7.0833E-01	2.9326E+02
6	7.06E-07	1.25E-03	4.08E-04	5.34E-03	0.00E+00	3.6696E-01	2.9360E+02
7	5.54E-14	4.18E-04	7.52E-06	2.38E-03	0.00E+00	1.2297E-01	2.9385E+02
8	1.04E-42	1.13E-04	1.60E-12	4.76E-04	0.00E+00	3.3124E-02	2.9394E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9969880	0.9942740	0.9918550	0.9897410	0.9879320	0.9864340	0.9852450
2	3.01E-03	5.57E-03	7.67E-03	9.32E-03	1.05E-02	1.12E-02	1.14E-02
3		1.55E-04	4.71E-04	9.43E-04	1.57E-03	2.37E-03	3.32E-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	9.97E-01	9.94E-01	9.92E-01	9.90E-01	9.88E-01	9.86E-01	9.85E-01
Beta	3.01E-03	5.73E-03	8.14E-03	1.03E-02	1.21E-02	1.36E-02	1.48E-02
Gamma		2.72E-02	5.78E-02	9.19E-02	1.30E-01	1.74E-01	2.25E-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	16.50	24.75	33.00	41.25	49.50	57.75	66.00
N_1	0.6464	0.8263	0.9268	0.9598	0.9375	0.8719	0.7750
N_2	0.0518	0.1433	0.2625	0.3973	0.5357	0.6656	0.7750
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9347000	0.9816660	0.9901330	0.9998170	0.9924350	3.2245E+01	6.0222E-01
2	1.80E-04	1.83E-02	9.86E-03	6.53E-02	7.57E-03	6.0222E-01	3.2245E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9382410	0.9757960	0.9805830	0.9969790	0.9866600	6.2150E+01	1.5416E+00
2	1.66E-03	1.95E-02	1.48E-02	5.37E-02	1.24E-02	1.2431E+00	6.2449E+01
3	4.84E-07	4.69E-03	1.14E-03	2.15E-02	9.47E-04	2.9852E-01	6.3393E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9385400	0.9715500	0.9749090	0.9930790	0.9827320	8.9178E+01	2.6114E+00
2	3.32E-03	2.03E-02	1.69E-02	4.87E-02	1.44E-02	1.8593E+00	8.9930E+01
3	3.06E-05	5.77E-03	2.78E-03	2.17E-02	2.86E-03	5.2941E-01	9.1260E+01
4	1.04E-08	2.43E-03	3.31E-04	1.21E-02	0.00E+00	2.2267E-01	9.1567E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9456090	0.9707710	0.9727870	0.9890520	0.9822250	1.4969E+02	4.5070E+00
2	4.67E-03	1.81E-02	1.61E-02	3.85E-02	1.24E-02	2.7910E+00	1.5141E+02
3	6.52E-04	7.96E-03	5.96E-03	2.21E-02	4.59E-03	1.2276E+00	1.5297E+02
4	3.64E-06	2.70E-03	1.03E-03	1.10E-02	7.65E-04	4.1609E-01	1.5378E+02
5	3.86E-21	4.69E-04	2.65E-07	2.71E-03	0.00E+00	7.2277E-02	1.5412E+02

CCCG = 6 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9480990	0.9707950	0.9724660	0.9877830	0.9821280	1.8094E+02	5.4434E+00
2	4.25E-03	1.58E-02	1.41E-02	3.31E-02	1.07E-02	2.9382E+00	1.8345E+02
3	9.32E-04	7.99E-03	6.31E-03	2.08E-02	5.33E-03	1.4894E+00	1.8489E+02
4	6.40E-05	3.74E-03	2.18E-03	1.27E-02	1.60E-03	6.9642E-01	1.8569E+02
5	1.11E-08	1.27E-03	1.97E-04	6.24E-03	2.13E-04	2.3610E-01	1.8615E+02
6	7.56E-19	4.47E-04	7.80E-07	2.60E-03	0.00E+00	8.3237E-02	1.8630E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9520480	0.9707640	0.9719330	0.9854800	0.9823150	2.5852E+02	7.7857E+00
2	4.71E-03	1.42E-02	1.30E-02	2.78E-02	9.26E-03	3.7896E+00	2.6252E+02
3	1.42E-03	7.70E-03	6.51E-03	1.81E-02	5.53E-03	2.0502E+00	2.6426E+02
4	3.17E-04	4.36E-03	3.20E-03	1.24E-02	2.28E-03	1.1614E+00	2.6514E+02
5	1.52E-05	2.12E-03	1.07E-03	7.79E-03	5.65E-04	5.6457E-01	2.6574E+02
6	3.73E-10	7.17E-04	6.56E-05	3.74E-03	6.07E-05	1.9088E-01	2.6611E+02
7	0.00E+00	1.09E-04	9.55E-14	4.11E-04	0.00E+00	2.9071E-02	2.6628E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9543280	0.9713460	0.9723440	0.9849520	0.9826820	3.0365E+02	8.9576E+00
2	4.46E-03	1.29E-02	1.19E-02	2.49E-02	7.99E-03	4.0353E+00	3.0857E+02
3	1.42E-03	7.06E-03	6.04E-03	1.62E-02	5.41E-03	2.2058E+00	3.1040E+02
4	4.53E-04	4.43E-03	3.42E-03	1.18E-02	2.74E-03	1.3835E+00	3.1122E+02
5	6.71E-05	2.53E-03	1.58E-03	8.23E-03	9.59E-04	7.9123E-01	3.1182E+02
6	9.67E-07	1.23E-03	4.26E-04	5.18E-03	1.99E-04	3.8416E-01	3.1222E+02
7	6.99E-14	3.98E-04	7.58E-06	2.26E-03	1.74E-05	1.2447E-01	3.1248E+02
8	9.75E-43	1.06E-04	1.51E-12	4.48E-04	0.00E+00	3.3124E-02	3.1257E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 56
Total Number of Common-Cause Failure Events: 3

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9924350	0.9866600	0.9827320	0.9822250	0.9821280	0.9823150	0.9826820
2	7.57E-03	1.24E-02	1.44E-02	1.24E-02	1.07E-02	9.26E-03	7.99E-03
3		9.47E-04	2.86E-03	4.59E-03	5.33E-03	5.53E-03	5.41E-03
4			0.00E+00	7.65E-04	1.60E-03	2.28E-03	2.74E-03
5				0.00E+00	2.13E-04	5.65E-04	9.59E-04
6					0.00E+00	6.07E-05	1.99E-04
7						0.00E+00	1.74E-05
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	9.87E-01	9.83E-01	9.82E-01	9.82E-01	9.82E-01	9.83E-01
Beta	7.57E-03	1.33E-02	1.73E-02	1.78E-02	1.79E-02	1.77E-02	1.73E-02
Gamma		7.10E-02	1.65E-01	3.01E-01	4.00E-01	4.77E-01	5.39E-01
Delta			0.00E+00	1.43E-01	2.54E-01	3.44E-01	4.20E-01
Epsilon				0.00E+00	1.18E-01	2.16E-01	3.00E-01
Mu					0.00E+00	9.70E-02	1.84E-01
Upsilon						0.00E+00	8.02E-02
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	21.01	31.52	42.03	52.53	63.04	73.55	84.05
N_1	0.9895	1.0749	1.0124	0.9999	0.9648	0.9202	0.8734
N_2	0.1677	0.4094	0.6312	0.6768	0.6990	0.7018	0.6906
N_3		0.0313	0.1251	0.2502	0.3476	0.4190	0.4674
N_4			0.0000	0.0417	0.1042	0.1725	0.2370
N_5				0.0000	0.0139	0.0428	0.0829
N_6					0.0000	0.0046	0.0172
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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**HIGH PRESSURE SAFETY INJECTION (PWR)**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9169940	0.9671860	0.9734930	0.9957800	0.9694600	4.6069E+01	1.5630E+00
2	4.22E-03	3.28E-02	2.65E-02	8.30E-02	3.05E-02	1.5630E+00	4.6069E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9373340	0.9716260	0.9752280	0.9935950	0.9758450	8.3003E+01	2.4239E+00
2	2.57E-03	1.90E-02	1.54E-02	4.78E-02	1.45E-02	1.6254E+00	8.3802E+01
3	2.57E-04	9.35E-03	5.90E-03	3.02E-02	9.70E-03	7.9852E-01	8.4628E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9437290	0.9719870	0.9745620	0.9914480	0.9790290	1.1714E+02	3.3760E+00
2	2.57E-03	1.55E-02	1.30E-02	3.74E-02	8.91E-03	1.8740E+00	1.1864E+02
3	4.74E-04	8.54E-03	6.02E-03	2.52E-02	8.62E-03	1.0293E+00	1.1949E+02
4	1.14E-05	3.92E-03	1.70E-03	1.53E-02	3.45E-03	4.7267E-01	1.2004E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9507950	0.9726310	0.9742770	0.9888480	0.9816050	1.8473E+02	5.1981E+00
2	3.41E-03	1.39E-02	1.23E-02	3.02E-02	5.93E-03	2.6490E+00	1.8728E+02
3	1.03E-03	8.22E-03	6.57E-03	2.10E-02	6.46E-03	1.5607E+00	1.8837E+02
4	1.11E-04	4.17E-03	2.60E-03	1.35E-02	4.62E-03	7.9109E-01	1.8914E+02
5	8.74E-10	1.04E-03	1.04E-04	5.37E-03	1.39E-03	1.9728E-01	1.8973E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9541300	0.9735540	0.9749230	0.9883140	0.9834940	2.2309E+02	6.0600E+00
2	2.95E-03	1.18E-02	1.04E-02	2.54E-02	4.34E-03	2.7081E+00	2.2644E+02
3	9.95E-04	7.23E-03	5.85E-03	1.82E-02	4.76E-03	1.6557E+00	2.2749E+02
4	2.78E-04	4.64E-03	3.31E-03	1.36E-02	4.38E-03	1.0644E+00	2.2809E+02
5	7.19E-06	2.12E-03	9.43E-04	8.22E-03	2.45E-03	4.8610E-01	2.2866E+02
6	3.25E-12	6.36E-04	2.37E-05	3.52E-03	5.79E-04	1.4574E-01	2.2900E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9573400	0.9736450	0.9746400	0.9865540	0.9849870	3.0777E+02	8.3307E+00
2	3.47E-03	1.11E-02	1.01E-02	2.22E-02	3.37E-03	3.5116E+00	3.1259E+02
3	1.23E-03	6.58E-03	5.58E-03	1.54E-02	3.58E-03	2.0814E+00	3.1402E+02
4	5.14E-04	4.60E-03	3.61E-03	1.21E-02	3.70E-03	1.4542E+00	3.1465E+02
5	1.00E-04	2.77E-03	1.82E-03	8.69E-03	2.82E-03	8.7597E-01	3.1522E+02
6	4.07E-07	1.10E-03	3.34E-04	4.79E-03	1.28E-03	3.4718E-01	3.1575E+02
7	5.26E-25	1.91E-04	1.93E-08	1.07E-03	2.49E-04	6.0371E-02	3.1604E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9596790	0.9744600	0.9753130	0.9863320	0.9862150	3.6001E+02	9.4358E+00
2	3.30E-03	1.01E-02	9.24E-03	1.99E-02	2.73E-03	3.7356E+00	3.6571E+02
3	1.12E-03	5.78E-03	4.91E-03	1.34E-02	2.77E-03	2.1346E+00	3.6731E+02
4	5.48E-04	4.28E-03	3.42E-03	1.09E-02	3.03E-03	1.5807E+00	3.6787E+02
5	1.92E-04	2.98E-03	2.14E-03	8.61E-03	2.73E-03	1.0995E+00	3.6835E+02
6	1.79E-05	1.67E-03	9.01E-04	5.95E-03	1.75E-03	6.1836E-01	3.6883E+02
7	1.96E-09	5.91E-04	7.66E-05	2.97E-03	6.65E-04	2.1827E-01	3.6923E+02
8	3.14E-30	1.32E-04	1.05E-09	6.95E-04	1.09E-04	4.8724E-02	3.6940E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**HIGH PRESSURE SAFETY INJECTION (PWR)**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 103
Total Number of Common-Cause Failure Events: 5

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9694600	0.9758450	0.9790290	0.9816050	0.9834940	0.9849870	0.9862150
2	3.05E-02	1.45E-02	8.91E-03	5.93E-03	4.34E-03	3.37E-03	2.73E-03
3		9.70E-03	8.62E-03	6.46E-03	4.76E-03	3.58E-03	2.77E-03
4			3.45E-03	4.62E-03	4.38E-03	3.70E-03	3.03E-03
5				1.39E-03	2.45E-03	2.82E-03	2.73E-03
6					5.79E-04	1.28E-03	1.75E-03
7						2.49E-04	6.65E-04
8							1.09E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.69E-01	9.76E-01	9.79E-01	9.82E-01	9.83E-01	9.85E-01	9.86E-01
Beta	3.05E-02	2.42E-02	2.10E-02	1.84E-02	1.65E-02	1.50E-02	1.38E-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	34.33	51.50	68.67	85.83	103.00	120.17	137.33
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**HIGH PRESSURE SAFETY INJECTION (PWR)**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9386700	0.9824660	0.9902420	0.9997900	0.9921770	3.5509E+01	6.3372E-01
2	2.12E-04	1.75E-02	9.76E-03	6.13E-02	7.82E-03	6.3372E-01	3.5509E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9387700	0.9752240	0.9796880	0.9964130	0.9842330	6.6852E+01	1.6984E+00
2	2.30E-03	2.09E-02	1.64E-02	5.47E-02	1.58E-02	1.4312E+00	6.7119E+01
3	1.36E-07	3.90E-03	7.83E-04	1.85E-02	0.00E+00	2.6722E-01	6.8283E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9358450	0.9689130	0.9720450	0.9912630	0.9761590	9.5069E+01	3.0502E+00
2	5.56E-03	2.47E-02	2.15E-02	5.46E-02	2.38E-02	2.4231E+00	9.5696E+01
3	4.63E-06	4.12E-03	1.52E-03	1.70E-02	1.99E-06	4.0441E-01	9.7715E+01
4	9.76E-09	2.27E-03	3.10E-04	1.14E-02	0.00E+00	2.2267E-01	9.7897E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9410010	0.9668740	0.9687830	0.9862390	0.9706630	1.5654E+02	5.3632E+00
2	8.01E-03	2.38E-02	2.19E-02	4.62E-02	2.80E-02	3.8556E+00	1.5805E+02
3	3.90E-04	6.55E-03	4.67E-03	1.92E-02	1.34E-03	1.0609E+00	1.6084E+02
4	1.52E-06	2.31E-03	7.78E-04	9.82E-03	0.00E+00	3.7439E-01	1.6153E+02
5	3.68E-21	4.46E-04	2.52E-07	2.58E-03	0.00E+00	7.2277E-02	1.6183E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9409350	0.9649030	0.9664810	0.9834890	0.9652300	1.8849E+02	6.8562E+00
2	9.02E-03	2.37E-02	2.21E-02	4.39E-02	3.23E-02	4.6358E+00	1.9071E+02
3	6.21E-04	6.70E-03	5.11E-03	1.82E-02	2.25E-03	1.3088E+00	1.9404E+02
4	3.06E-05	3.10E-03	1.65E-03	1.11E-02	1.88E-04	6.0612E-01	1.9474E+02
5	4.75E-09	1.14E-03	1.54E-04	5.70E-03	0.00E+00	2.2220E-01	1.9512E+02
6	7.21E-19	4.26E-04	7.44E-07	2.49E-03	0.00E+00	8.3237E-02	1.9526E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9459780	0.9656720	0.9667920	0.9815480	0.9645740	2.6698E+02	9.4908E+00
2	8.67E-03	2.04E-02	1.93E-02	3.61E-02	2.97E-02	5.6424E+00	2.7083E+02
3	1.41E-03	7.53E-03	6.38E-03	1.76E-02	5.23E-03	2.0807E+00	2.7439E+02
4	2.05E-04	3.72E-03	2.61E-03	1.10E-02	4.58E-04	1.0283E+00	2.7544E+02
5	9.52E-06	1.90E-03	9.00E-04	7.15E-03	2.68E-05	5.2407E-01	2.7595E+02
6	2.43E-10	6.74E-04	5.75E-05	3.54E-03	0.00E+00	1.8628E-01	2.7628E+02
7	0.00E+00	1.05E-04	9.20E-14	3.96E-04	0.00E+00	2.9071E-02	2.7644E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9479650	0.9659840	0.9669360	0.9807350	0.9635990	3.1292E+02	1.1019E+01
2	8.39E-03	1.89E-02	1.79E-02	3.28E-02	2.85E-02	6.1308E+00	3.1781E+02
3	1.62E-03	7.37E-03	6.38E-03	1.65E-02	6.64E-03	2.3873E+00	3.2155E+02
4	3.35E-04	3.89E-03	2.93E-03	1.07E-02	1.17E-03	1.2608E+00	3.2268E+02
5	4.20E-05	2.21E-03	1.31E-03	7.46E-03	8.70E-05	7.1683E-01	3.2322E+02
6	6.47E-07	1.13E-03	3.72E-04	4.85E-03	4.09E-06	3.6736E-01	3.2357E+02
7	5.02E-14	3.80E-04	6.82E-06	2.16E-03	0.00E+00	1.2297E-01	3.2382E+02
8	9.42E-43	1.02E-04	1.46E-12	4.32E-04	0.00E+00	3.3124E-02	3.2391E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**HIGH PRESSURE SAFETY INJECTION (PWR)**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 82
Total Number of Common-Cause Failure Events: 8

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9921770	0.9842330	0.9761590	0.9706630	0.9652300	0.9645740	0.9635990
2	7.82E-03	1.58E-02	2.38E-02	2.80E-02	3.23E-02	2.97E-02	2.85E-02
3		0.00E+00	1.99E-06	1.34E-03	2.25E-03	5.23E-03	6.64E-03
4			0.00E+00	0.00E+00	1.88E-04	4.58E-04	1.17E-03
5				0.00E+00	0.00E+00	2.68E-05	8.70E-05
6					0.00E+00	0.00E+00	4.09E-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	9.84E-01	9.76E-01	9.71E-01	9.65E-01	9.65E-01	9.64E-01
Beta	7.82E-03	1.58E-02	2.38E-02	2.93E-02	3.48E-02	3.54E-02	3.64E-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	22.62	33.93	45.24	56.55	67.86	79.17	90.48
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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9263860	0.9661700	0.9702460	0.9920050	0.9673130	7.2196E+01	2.5279E+00
2	8.00E-03	3.38E-02	2.98E-02	7.36E-02	3.27E-02	2.5279E+00	7.2196E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9462080	0.9732780	0.9757540	0.9918900	0.9762440	1.2224E+02	3.3562E+00
2	3.11E-03	1.65E-02	1.40E-02	3.85E-02	1.31E-02	2.0765E+00	1.2352E+02
3	9.07E-04	1.02E-02	7.73E-03	2.79E-02	1.07E-02	1.2797E+00	1.2432E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9531980	0.9751640	0.9769690	0.9909750	0.9804370	1.6945E+02	4.3156E+00
2	2.39E-03	1.23E-02	1.05E-02	2.84E-02	7.24E-03	2.1386E+00	1.7163E+02
3	9.38E-04	8.37E-03	6.57E-03	2.19E-02	8.35E-03	1.4543E+00	1.7231E+02
4	8.14E-05	4.16E-03	2.48E-03	1.40E-02	3.98E-03	7.2267E-01	1.7304E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9581070	0.9757190	0.9769500	0.9891360	0.9828580	2.5002E+02	6.2218E+00
2	3.06E-03	1.14E-02	1.02E-02	2.40E-02	5.16E-03	2.9224E+00	2.5332E+02
3	1.17E-03	7.23E-03	5.99E-03	1.75E-02	5.59E-03	1.8527E+00	2.5439E+02
4	2.98E-04	4.39E-03	3.19E-03	1.26E-02	4.79E-03	1.1244E+00	2.5512E+02
5	2.54E-07	1.26E-03	3.44E-04	5.62E-03	1.60E-03	3.2228E-01	2.5592E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9611000	0.9767320	0.9777580	0.9888690	0.9845170	3.0131E+02	7.1780E+00
2	2.69E-03	9.77E-03	8.73E-03	2.04E-02	4.13E-03	3.0128E+00	3.0548E+02
3	1.02E-03	6.14E-03	5.11E-03	1.48E-02	4.01E-03	1.8926E+00	3.0660E+02
4	4.22E-04	4.35E-03	3.34E-03	1.17E-02	4.00E-03	1.3422E+00	3.0715E+02
5	4.56E-05	2.34E-03	1.39E-03	7.87E-03	2.67E-03	7.2220E-01	3.0777E+02
6	1.20E-09	6.75E-04	7.79E-05	3.44E-03	6.67E-04	2.0824E-01	3.0828E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9634110	0.9768260	0.9776020	0.9875920	0.9861410	3.9900E+02	9.4660E+00
2	3.07E-03	9.29E-03	8.50E-03	1.82E-02	3.24E-03	3.7946E+00	4.0467E+02
3	1.14E-03	5.53E-03	4.74E-03	1.26E-02	2.87E-03	2.2578E+00	4.0621E+02
4	5.75E-04	4.10E-03	3.33E-03	1.03E-02	3.15E-03	1.6764E+00	4.0679E+02
5	1.99E-04	2.81E-03	2.05E-03	8.00E-03	2.87E-03	1.1468E+00	4.0732E+02
6	4.75E-06	1.22E-03	5.55E-04	4.69E-03	1.43E-03	4.9878E-01	4.0797E+02
7	9.17E-18	2.24E-04	7.63E-07	1.31E-03	2.87E-04	9.1571E-02	4.0837E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9654970	0.9776670	0.9783370	0.9875570	0.9873560	4.6425E+02	1.0605E+01
2	2.93E-03	8.49E-03	7.81E-03	1.64E-02	2.77E-03	4.0329E+00	4.7082E+02
3	9.92E-04	4.79E-03	4.11E-03	1.09E-02	2.15E-03	2.2722E+00	4.7258E+02
4	5.42E-04	3.66E-03	3.00E-03	9.07E-03	2.39E-03	1.7403E+00	4.7311E+02
5	2.78E-04	2.84E-03	2.18E-03	7.66E-03	2.58E-03	1.3489E+00	4.7351E+02
6	5.53E-05	1.76E-03	1.13E-03	5.62E-03	1.89E-03	8.3576E-01	4.7402E+02
7	9.55E-08	6.54E-04	1.69E-04	2.96E-03	7.54E-04	3.1047E-01	4.7454E+02
8	7.96E-24	1.36E-04	2.65E-08	7.72E-04	1.26E-04	6.4424E-02	4.7479E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 173
Total Number of Common-Cause Failure Events: 6

Fail to Open

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9673130	0.9762440	0.9804370	0.9828580	0.9845170	0.9861410	0.9873560
2	3.27E-02	1.31E-02	7.24E-03	5.16E-03	4.13E-03	3.24E-03	2.77E-03
3		1.07E-02	8.35E-03	5.59E-03	4.01E-03	2.87E-03	2.15E-03
4			3.98E-03	4.79E-03	4.00E-03	3.15E-03	2.39E-03
5				1.60E-03	2.67E-03	2.87E-03	2.58E-03
6					6.67E-04	1.43E-03	1.89E-03
7						2.87E-04	7.54E-04
8							1.26E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.67E-01	9.76E-01	9.80E-01	9.83E-01	9.85E-01	9.86E-01	9.87E-01
Beta	3.27E-02	2.38E-02	1.96E-02	1.71E-02	1.55E-02	1.39E-02	1.26E-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	61.02	91.53	122.05	152.56	183.07	213.58	244.09
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9547860	0.9870980	0.9928530	0.9998410	0.9948050	4.8546E+01	6.3452E-01
2	1.56E-04	1.29E-02	7.15E-03	4.52E-02	5.19E-03	6.3452E-01	4.8546E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9521860	0.9806950	0.9842020	0.9972100	0.9895560	8.6405E+01	1.7009E+00
2	1.79E-03	1.63E-02	1.28E-02	4.27E-02	1.04E-02	1.4337E+00	8.6672E+01
3	1.06E-07	3.03E-03	6.08E-04	1.44E-02	0.00E+00	2.6722E-01	8.7839E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9491270	0.9754010	0.9779120	0.9930960	0.9842520	1.2114E+02	3.0551E+00
2	4.40E-03	1.96E-02	1.70E-02	4.33E-02	1.57E-02	2.4281E+00	1.2177E+02
3	3.65E-06	3.26E-03	1.20E-03	1.35E-02	0.00E+00	4.0431E-01	1.2379E+02
4	7.70E-09	1.79E-03	2.44E-04	8.98E-03	0.00E+00	2.2267E-01	1.2397E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9542450	0.9749680	0.9765810	0.9901900	0.9859530	1.8974E+02	4.8716E+00
2	4.54E-03	1.60E-02	1.44E-02	3.30E-02	1.05E-02	3.1142E+00	1.9150E+02
3	6.26E-04	6.73E-03	5.14E-03	1.83E-02	3.51E-03	1.3107E+00	1.9330E+02
4	1.26E-06	1.92E-03	6.46E-04	8.17E-03	0.00E+00	3.7439E-01	1.9424E+02
5	3.06E-21	3.71E-04	2.10E-07	2.15E-03	0.00E+00	7.2277E-02	1.9454E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9568210	0.9753910	0.9767320	0.9893950	0.9867970	2.2904E+02	5.7786E+00
2	3.92E-03	1.36E-02	1.22E-02	2.78E-02	8.31E-03	3.1836E+00	2.3163E+02
3	8.71E-04	6.76E-03	5.42E-03	1.72E-02	3.91E-03	1.5862E+00	2.3323E+02
4	5.31E-05	3.00E-03	1.75E-03	1.02E-02	9.78E-04	7.0332E-01	2.3412E+02
5	3.95E-09	9.46E-04	1.28E-04	4.74E-03	0.00E+00	2.2220E-01	2.3460E+02
6	5.99E-19	3.54E-04	6.19E-07	2.07E-03	0.00E+00	8.3237E-02	2.3474E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9594800	0.9751790	0.9761560	0.9875460	0.9881560	3.1476E+02	8.0116E+00
2	4.05E-03	1.20E-02	1.10E-02	2.34E-02	6.02E-03	3.8841E+00	3.1889E+02
3	1.29E-03	6.64E-03	5.65E-03	1.54E-02	3.86E-03	2.1423E+00	3.2063E+02
4	2.98E-04	3.75E-03	2.79E-03	1.05E-02	1.68E-03	1.2111E+00	3.2156E+02
5	1.19E-05	1.73E-03	8.65E-04	6.39E-03	2.80E-04	5.5877E-01	3.2221E+02
6	2.08E-10	5.77E-04	4.92E-05	3.03E-03	0.00E+00	1.8628E-01	3.2259E+02
7	0.00E+00	9.01E-05	7.88E-14	3.39E-04	0.00E+00	2.9071E-02	3.2274E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9616340	0.9758830	0.9767220	0.9872790	0.9891730	3.6803E+02	9.0951E+00
2	3.71E-03	1.07E-02	9.87E-03	2.06E-02	4.63E-03	4.0430E+00	3.7308E+02
3	1.23E-03	5.99E-03	5.14E-03	1.36E-02	3.44E-03	2.2579E+00	3.7487E+02
4	4.29E-04	3.85E-03	3.02E-03	1.01E-02	2.02E-03	1.4517E+00	3.7567E+02
5	6.04E-05	2.14E-03	1.35E-03	6.91E-03	6.55E-04	8.0713E-01	3.7632E+02
6	7.22E-07	1.01E-03	3.43E-04	4.25E-03	8.15E-05	3.7926E-01	3.7675E+02
7	4.31E-14	3.26E-04	5.86E-06	1.86E-03	0.00E+00	1.2297E-01	3.7700E+02
8	8.09E-43	8.78E-05	1.25E-12	3.71E-04	0.00E+00	3.3124E-02	3.7709E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 93
Total Number of Common-Cause Failure Events: 2

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9948050	0.9895560	0.9842520	0.9859530	0.9867970	0.9881560	0.9891730
2	5.19E-03	1.04E-02	1.57E-02	1.05E-02	8.31E-03	6.02E-03	4.63E-03
3		0.00E+00	0.00E+00	3.51E-03	3.91E-03	3.86E-03	3.44E-03
4			0.00E+00	0.00E+00	9.78E-04	1.68E-03	2.02E-03
5				0.00E+00	0.00E+00	2.80E-04	6.55E-04
6					0.00E+00	0.00E+00	8.15E-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	9.84E-01	9.86E-01	9.87E-01	9.88E-01	9.89E-01
Beta	5.19E-03	1.04E-02	1.57E-02	1.40E-02	1.32E-02	1.18E-02	1.08E-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	37.20	55.80	74.40	93.00	111.60	130.20	148.80
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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9519530	0.9880240	0.9951380	0.9999760	0.9999220	3.6012E+01	4.3652E-01
2	2.22E-05	1.20E-02	4.87E-03	4.80E-02	7.76E-05	4.3652E-01	3.6012E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9541960	0.9840280	0.9883870	0.9989410	0.9998450	6.8193E+01	1.1069E+00
2	3.90E-04	1.21E-02	7.85E-03	3.84E-02	1.53E-04	8.3956E-01	6.8460E+01
3	1.35E-07	3.86E-03	7.75E-04	1.83E-02	2.59E-06	2.6732E-01	6.9033E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9548970	0.9812410	0.9843630	0.9969160	0.9997750	9.7643E+01	1.8667E+00
2	1.04E-03	1.25E-02	9.37E-03	3.44E-02	2.21E-04	1.2395E+00	9.8270E+01
3	4.57E-06	4.07E-03	1.50E-03	1.68E-02	3.88E-06	4.0451E-01	9.9105E+01
4	9.62E-09	2.24E-03	3.05E-04	1.12E-02	0.00E+00	2.2267E-01	9.9287E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9569740	0.9783220	0.9802350	0.9931330	0.9997050	1.6054E+02	3.5572E+00
2	2.52E-03	1.30E-02	1.11E-02	3.00E-02	2.87E-04	2.1327E+00	1.6196E+02
3	2.91E-04	5.96E-03	4.11E-03	1.79E-02	7.76E-06	9.7788E-01	1.6312E+02
4	1.50E-06	2.28E-03	7.67E-04	9.69E-03	0.00E+00	3.7439E-01	1.6372E+02
5	3.63E-21	4.40E-04	2.49E-07	2.55E-03	0.00E+00	7.2277E-02	1.6402E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9590510	0.9783030	0.9798880	0.9921360	0.9996380	1.9418E+02	4.3067E+00
2	2.37E-03	1.14E-02	9.82E-03	2.59E-02	3.49E-04	2.2662E+00	1.9622E+02
3	4.05E-04	5.76E-03	4.21E-03	1.64E-02	1.29E-05	1.1428E+00	1.9734E+02
4	2.66E-05	2.98E-03	1.56E-03	1.08E-02	0.00E+00	5.9222E-01	1.9789E+02
5	4.67E-09	1.12E-03	1.52E-04	5.61E-03	0.00E+00	2.2220E-01	1.9826E+02
6	7.09E-19	4.19E-04	7.33E-07	2.45E-03	0.00E+00	8.3237E-02	1.9840E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 77
Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9999220	0.9998450	0.9997750	0.9997050	0.9996380
2	7.76E-05	1.53E-04	2.21E-04	2.87E-04	3.49E-04
3		2.59E-06	3.88E-06	7.76E-06	1.29E-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	7.76E-05	1.55E-04	2.25E-04	2.95E-04	3.62E-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	25.67	38.50	51.33	64.17	77.00
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9309070	0.9827620	0.9929720	0.9999660	0.9999730	2.4795E+01	4.3492E-01
2	3.15E-05	1.72E-02	7.03E-03	6.91E-02	2.75E-05	4.3492E-01	2.4795E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9398520	0.9790020	0.9847160	0.9986190	0.9999500	5.1378E+01	1.1020E+00
2	5.05E-04	1.59E-02	1.03E-02	5.04E-02	5.04E-05	8.3476E-01	5.1645E+01
3	1.78E-07	5.09E-03	1.03E-03	2.42E-02	0.00E+00	2.6722E-01	5.2213E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9421240	0.9759090	0.9798980	0.9960510	0.9999280	7.5232E+01	1.8572E+00
2	1.32E-03	1.60E-02	1.20E-02	4.41E-02	7.22E-05	1.2302E+00	7.5859E+01
3	5.89E-06	5.24E-03	1.94E-03	2.17E-02	0.00E+00	4.0431E-01	7.6685E+01
4	1.24E-08	2.89E-03	3.95E-04	1.45E-02	0.00E+00	2.2267E-01	7.6867E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9483530	0.9739710	0.9762620	0.9917650	0.9999010	1.3253E+02	3.5418E+00
2	3.00E-03	1.56E-02	1.33E-02	3.60E-02	9.90E-05	2.1178E+00	1.3395E+02
3	3.50E-04	7.18E-03	4.96E-03	2.16E-02	0.00E+00	9.7738E-01	1.3509E+02
4	1.81E-06	2.75E-03	9.26E-04	1.17E-02	0.00E+00	3.7439E-01	1.3570E+02
5	4.38E-21	5.31E-04	3.00E-07	3.07E-03	0.00E+00	7.2277E-02	1.3600E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9509580	0.9740150	0.9759120	0.9905920	0.9998760	1.6058E+02	4.2841E+00
2	2.80E-03	1.36E-02	1.17E-02	3.10E-02	1.24E-04	2.2446E+00	1.6262E+02
3	4.87E-04	6.93E-03	5.06E-03	1.97E-02	0.00E+00	1.1418E+00	1.6372E+02
4	3.21E-05	3.59E-03	1.88E-03	1.30E-02	0.00E+00	5.9222E-01	1.6427E+02
5	5.63E-09	1.35E-03	1.83E-04	6.75E-03	0.00E+00	2.2220E-01	1.6464E+02
6	8.55E-19	5.05E-04	8.83E-07	2.95E-03	0.00E+00	8.3237E-02	1.6478E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 58
Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9999730	0.9999500	0.9999280	0.9999010	0.9998760
2	2.75E-05	5.04E-05	7.22E-05	9.90E-05	1.24E-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	2.75E-05	5.04E-05	7.22E-05	9.90E-05	1.24E-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	14.50	21.75	29.00	36.25	43.50
$\mathbf{N_1}$	0.0493	0.0729	0.0957	0.1179	0.1393
$\mathbf{N_2}$	0.0004	0.0011	0.0021	0.0036	0.0054
$\mathbf{N_3}$		0.0000	0.0000	0.0000	0.0000
$\mathbf{N_4}$			0.0000	0.0000	0.0000
$\mathbf{N_5}$				0.0000	0.0000
$\mathbf{N_6}$					0.0000

2.3.9 Pressurizer PORV Motor-Operated Block Valves

2.3.9.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**REACTOR COOLANT**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9548460	0.9887660	0.9954610	0.9999780	1.0000000	3.8246E+01	4.3452E-01
2	2.02E-05	1.12E-02	4.54E-03	4.52E-02	0.00E+00	4.3452E-01	3.8246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9461540	0.9812320	0.9863620	0.9987720	1.0000000	5.7555E+01	1.1009E+00
2	4.49E-04	1.42E-02	9.19E-03	4.51E-02	0.00E+00	8.3366E-01	5.7822E+01
3	1.59E-07	4.56E-03	9.16E-04	2.16E-02	0.00E+00	2.6722E-01	5.8389E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9413420	0.9755880	0.9796330	0.9959980	1.0000000	7.4136E+01	1.8551E+00
2	1.33E-03	1.62E-02	1.22E-02	4.47E-02	0.00E+00	1.2281E+00	7.4763E+01
3	5.98E-06	5.32E-03	1.97E-03	2.20E-02	0.00E+00	4.0431E-01	7.5587E+01
4	1.26E-08	2.93E-03	4.01E-04	1.47E-02	0.00E+00	2.2267E-01	7.5768E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9450420	0.9722920	0.9747250	0.9912290	1.0000000	1.2416E+02	3.5382E+00
2	3.18E-03	1.66E-02	1.41E-02	3.83E-02	0.00E+00	2.1142E+00	1.2558E+02
3	3.73E-04	7.65E-03	5.28E-03	2.30E-02	0.00E+00	9.7738E-01	1.2672E+02
4	1.93E-06	2.93E-03	9.87E-04	1.25E-02	0.00E+00	3.7439E-01	1.2732E+02
5	4.67E-21	5.66E-04	3.20E-07	3.28E-03	0.00E+00	7.2277E-02	1.2763E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9459230	0.9713260	0.9734100	0.9896140	1.0000000	1.4494E+02	4.2787E+00
2	3.08E-03	1.50E-02	1.29E-02	3.41E-02	0.00E+00	2.2392E+00	1.4698E+02
3	5.38E-04	7.65E-03	5.59E-03	2.18E-02	0.00E+00	1.1418E+00	1.4808E+02
4	3.55E-05	3.97E-03	2.08E-03	1.43E-02	0.00E+00	5.9222E-01	1.4863E+02
5	6.22E-09	1.49E-03	2.02E-04	7.46E-03	0.00E+00	2.2220E-01	1.4900E+02
6	9.45E-19	5.58E-04	9.75E-07	3.25E-03	0.00E+00	8.3237E-02	1.4914E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**REACTOR COOLANT**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 28
Total Number of Common-Cause Failure Events: 0

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	28.00	28.00	28.00	28.00	28.00
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**REACTOR COOLANT**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9690240	0.9922720	0.9968610	0.9999840	0.9998920	5.6436E+01	4.3952E-01
2	1.48E-05	7.73E-03	3.14E-03	3.10E-02	1.08E-04	4.3952E-01	5.6436E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9680050	0.9888390	0.9918910	0.9992490	0.9997890	9.8826E+01	1.1155E+00
2	2.80E-04	8.48E-03	5.51E-03	2.68E-02	2.06E-04	8.4796E-01	9.9094E+01
3	9.42E-08	2.68E-03	5.37E-04	1.27E-02	4.33E-06	2.6752E-01	9.9674E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9677530	0.9865840	0.9888140	0.9977760	0.9996960	1.3848E+02	1.8832E+00
2	7.66E-04	8.94E-03	6.74E-03	2.46E-02	2.93E-04	1.2552E+00	1.3911E+02
3	3.29E-06	2.89E-03	1.07E-03	1.19E-02	1.08E-05	4.0531E-01	1.3996E+02
4	6.81E-09	1.59E-03	2.16E-04	7.94E-03	0.00E+00	2.2267E-01	1.4014E+02

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9669460	0.9833440	0.9848170	0.9947080	0.9996080	2.1157E+02	3.5835E+00
2	1.97E-03	1.00E-02	8.55E-03	2.31E-02	3.72E-04	2.1571E+00	2.1300E+02
3	2.23E-04	4.55E-03	3.14E-03	1.37E-02	1.99E-05	9.7968E-01	2.1417E+02
4	1.14E-06	1.74E-03	5.85E-04	7.39E-03	8.66E-07	3.7449E-01	2.1478E+02
5	2.77E-21	3.36E-04	1.90E-07	1.94E-03	0.00E+00	7.2277E-02	2.1508E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9684470	0.9832750	0.9844980	0.9939120	0.9995260	2.5540E+02	4.3443E+00
2	1.87E-03	8.86E-03	7.63E-03	2.00E-02	4.41E-04	2.3003E+00	2.5744E+02
3	3.12E-04	4.41E-03	3.22E-03	1.26E-02	3.10E-05	1.1461E+00	2.5860E+02
4	2.04E-05	2.28E-03	1.19E-03	8.24E-03	1.44E-06	5.9242E-01	2.5915E+02
5	3.57E-09	8.55E-04	1.16E-04	4.29E-03	0.00E+00	2.2220E-01	2.5952E+02
6	5.42E-19	3.20E-04	5.59E-07	1.87E-03	0.00E+00	8.3237E-02	2.5966E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**REACTOR COOLANT**
Component :	**MOTOR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9998920	0.9997890	0.9996960	0.9996080	0.9995260
2	1.08E-04	2.06E-04	2.93E-04	3.72E-04	4.41E-04
3		4.33E-06	1.08E-05	1.99E-05	3.10E-05
4			0.00E+00	8.66E-07	1.44E-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	1.08E-04	2.11E-04	3.04E-04	3.92E-04	4.74E-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	46.00	69.00	92.00	115.00	138.00
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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

Component :	**AIR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9363850	0.9743390	0.9790040	0.9963420	0.9772680	6.3786E+01	1.6799E+00
2	3.66E-03	2.57E-02	2.10E-02	6.36E-02	2.27E-02	1.6799E+00	6.3786E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9295310	0.9628540	0.9655990	0.9867970	0.9623860	1.0718E+02	4.1349E+00
2	9.97E-03	3.16E-02	2.88E-02	6.27E-02	3.33E-02	3.5166E+00	1.0780E+02
3	5.98E-05	5.55E-03	3.00E-03	1.97E-02	4.35E-03	6.1832E-01	1.1070E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9300430	0.9591470	0.9611200	0.9815060	0.9581510	1.4777E+02	6.2940E+00
2	1.06E-02	2.87E-02	2.67E-02	5.37E-02	3.01E-02	4.4238E+00	1.4964E+02
3	1.08E-03	9.51E-03	7.49E-03	2.49E-02	1.00E-02	1.4653E+00	1.5260E+02
4	2.97E-06	2.63E-03	9.70E-04	1.09E-02	1.72E-03	4.0487E-01	1.5366E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9394070	0.9620660	0.9633960	0.9801920	0.9602080	2.2222E+02	8.7622E+00
2	8.81E-03	2.20E-02	2.06E-02	3.98E-02	2.26E-02	5.0766E+00	2.2591E+02
3	2.47E-03	1.08E-02	9.39E-03	2.38E-02	1.15E-02	2.4879E+00	2.2849E+02
4	2.47E-04	4.46E-03	3.14E-03	1.32E-02	5.00E-03	1.0302E+00	2.2995E+02
5	4.72E-11	7.25E-04	4.45E-05	3.90E-03	7.25E-04	1.6748E-01	2.3081E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9426070	0.9629340	0.9640440	0.9794740	0.9615610	2.6727E+02	1.0288E+01
2	7.73E-03	1.89E-02	1.78E-02	3.40E-02	1.93E-02	5.2513E+00	2.7231E+02
3	2.40E-03	9.68E-03	8.53E-03	2.09E-02	9.89E-03	2.6873E+00	2.7487E+02
4	7.49E-04	5.75E-03	4.62E-03	1.46E-02	6.42E-03	1.5965E+00	2.7596E+02
5	2.42E-05	2.23E-03	1.20E-03	7.93E-03	2.54E-03	6.1970E-01	2.7694E+02
6	3.80E-13	4.80E-04	1.24E-05	2.70E-03	3.19E-04	1.3314E-01	2.7742E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9472320	0.9643250	0.9651580	0.9785890	0.9623890	3.5849E+02	1.3262E+01
2	7.72E-03	1.71E-02	1.63E-02	2.94E-02	1.81E-02	6.3616E+00	3.6539E+02
3	2.30E-03	8.25E-03	7.38E-03	1.71E-02	7.92E-03	3.0665E+00	3.6869E+02
4	1.12E-03	5.76E-03	4.90E-03	1.33E-02	6.36E-03	2.1419E+00	3.6961E+02
5	2.60E-04	3.26E-03	2.43E-03	9.12E-03	3.82E-03	1.2133E+00	3.7054E+02
6	1.72E-06	1.14E-03	4.41E-04	4.64E-03	1.31E-03	4.2358E-01	3.7133E+02
7	5.04E-27	1.49E-04	5.79E-09	8.19E-04	1.45E-04	5.5371E-02	3.7170E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9493600	0.9650050	0.9657220	0.9782090	0.9627980	4.1712E+02	1.5127E+01
2	7.72E-03	1.63E-02	1.56E-02	2.74E-02	1.80E-02	7.0490E+00	4.2520E+02
3	1.94E-03	7.01E-03	6.27E-03	1.46E-02	6.28E-03	3.0317E+00	4.2921E+02
4	1.13E-03	5.34E-03	4.60E-03	1.21E-02	5.65E-03	2.3097E+00	4.2994E+02
5	4.73E-04	3.67E-03	2.94E-03	9.37E-03	4.27E-03	1.5876E+00	4.3066E+02
6	6.15E-05	1.94E-03	1.25E-03	6.18E-03	2.29E-03	8.3836E-01	4.3141E+02
7	1.80E-08	6.09E-04	1.18E-04	2.90E-03	6.80E-04	2.6317E-01	4.3198E+02
8	2.91E-31	1.09E-04	5.36E-10	5.66E-04	6.75E-05	4.7024E-02	4.3220E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**AIR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 125
Total Number of Common-Cause Failure Events: 12

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9772680	0.9623860	0.9581510	0.9602080	0.9615610	0.9623890	0.9627980
2	2.27E-02	3.33E-02	3.01E-02	2.26E-02	1.93E-02	1.81E-02	1.80E-02
3		4.35E-03	1.00E-02	1.15E-02	9.89E-03	7.92E-03	6.28E-03
4			1.72E-03	5.00E-03	6.42E-03	6.36E-03	5.65E-03
5				7.25E-04	2.54E-03	3.82E-03	4.27E-03
6					3.19E-04	1.31E-03	2.29E-03
7						1.45E-04	6.80E-04
8							6.75E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.77E-01	9.62E-01	9.58E-01	9.60E-01	9.62E-01	9.62E-01	9.63E-01
Beta	2.27E-02	3.76E-02	4.18E-02	3.98E-02	3.84E-02	3.76E-02	3.72E-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	47.62	71.43	95.24	119.05	142.86	166.67	190.48
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

Component :	**AIR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9265240	0.9761140	0.9839130	0.9990560	0.9827960	3.6632E+01	8.9642E-01
2	9.41E-04	2.39E-02	1.61E-02	7.35E-02	1.72E-02	8.9642E-01	3.6632E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9227370	0.9646650	0.9689910	0.9917960	0.9651120	6.7760E+01	2.4820E+00
2	6.45E-03	3.15E-02	2.72E-02	7.14E-02	3.48E-02	2.2126E+00	6.8029E+01
3	1.46E-07	3.84E-03	7.82E-04	1.81E-02	5.56E-05	2.6942E-01	6.9973E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9150710	0.9538460	0.9568540	0.9823440	0.9469070	9.5240E+01	4.6084E+00
2	1.38E-02	3.98E-02	3.67E-02	7.62E-02	5.29E-02	3.9725E+00	9.5876E+01
3	5.36E-06	4.14E-03	1.57E-03	1.70E-02	1.72E-04	4.1321E-01	9.9435E+01
4	9.59E-09	2.23E-03	3.04E-04	1.12E-02	0.00E+00	2.2267E-01	9.9626E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9302710	0.9585980	0.9604520	0.9805780	0.9493890	1.5694E+02	6.7783E+00
2	1.09E-02	2.85E-02	2.66E-02	5.26E-02	3.98E-02	4.6649E+00	1.5905E+02
3	1.42E-03	1.02E-02	8.27E-03	2.55E-02	1.08E-02	1.6667E+00	1.6205E+02
4	1.50E-06	2.29E-03	7.69E-04	9.71E-03	0.00E+00	3.7439E-01	1.6334E+02
5	3.64E-21	4.41E-04	2.49E-07	2.55E-03	0.00E+00	7.2277E-02	1.6365E+02

CCCG = 6 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9365780	0.9614150	0.9629680	0.9809590	0.9561830	1.8976E+02	7.6157E+00
2	7.49E-03	2.11E-02	1.95E-02	4.02E-02	2.53E-02	4.1696E+00	1.9321E+02
3	2.52E-03	1.18E-02	1.02E-02	2.65E-02	1.56E-02	2.3262E+00	1.9505E+02
4	1.20E-04	4.13E-03	2.62E-03	1.33E-02	2.92E-03	8.1442E-01	1.9656E+02
5	4.70E-09	1.13E-03	1.52E-04	5.64E-03	0.00E+00	2.2220E-01	1.9715E+02
6	7.13E-19	4.22E-04	7.37E-07	2.46E-03	0.00E+00	8.3237E-02	1.9729E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9446540	0.9645410	0.9656490	0.9806440	0.9610320	2.6888E+02	9.8847E+00
2	6.23E-03	1.65E-02	1.54E-02	3.07E-02	1.72E-02	4.6028E+00	2.7416E+02
3	2.90E-03	1.07E-02	9.53E-03	2.24E-02	1.52E-02	2.9748E+00	2.7579E+02
4	6.29E-04	5.37E-03	4.24E-03	1.40E-02	5.74E-03	1.4959E+00	2.7727E+02
5	1.96E-05	2.14E-03	1.12E-03	7.70E-03	8.39E-04	5.9587E-01	2.7817E+02
6	2.41E-10	6.68E-04	5.70E-05	3.51E-03	0.00E+00	1.8628E-01	2.7858E+02
7	0.00E+00	1.04E-04	9.12E-14	3.92E-04	0.00E+00	2.9071E-02	2.7874E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9484410	0.9663020	0.9672540	0.9809250	0.9646990	3.1556E+02	1.1004E+01
2	5.27E-03	1.40E-02	1.30E-02	2.61E-02	1.23E-02	4.5775E+00	3.2199E+02
3	2.64E-03	9.43E-03	8.44E-03	1.96E-02	1.33E-02	3.0779E+00	3.2349E+02
4	9.48E-04	5.76E-03	4.78E-03	1.39E-02	7.31E-03	1.8798E+00	3.2468E+02
5	1.17E-04	2.82E-03	1.89E-03	8.69E-03	2.12E-03	9.2153E-01	3.2564E+02
6	1.08E-06	1.20E-03	4.25E-04	5.02E-03	2.46E-04	3.9166E-01	3.2617E+02
7	4.98E-14	3.77E-04	6.77E-06	2.14E-03	0.00E+00	1.2297E-01	3.2644E+02
8	9.33E-43	1.01E-04	1.44E-12	4.28E-04	0.00E+00	3.3124E-02	3.2653E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**AIR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 82
Total Number of Common-Cause Failure Events: 6

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9827960	0.9651120	0.9469070	0.9493890	0.9561830	0.9610320	0.9646990
2	1.72E-02	3.48E-02	5.29E-02	3.98E-02	2.53E-02	1.72E-02	1.23E-02
3		5.56E-05	1.72E-04	1.08E-02	1.56E-02	1.52E-02	1.33E-02
4			0.00E+00	0.00E+00	2.92E-03	5.74E-03	7.31E-03
5				0.00E+00	0.00E+00	8.39E-04	2.12E-03
6					0.00E+00	0.00E+00	2.46E-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	9.83E-01	9.65E-01	9.47E-01	9.49E-01	9.56E-01	9.61E-01	9.65E-01
Beta	1.72E-02	3.49E-02	5.31E-02	5.06E-02	4.38E-02	3.90E-02	3.53E-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	24.01	36.02	48.02	60.03	72.04	84.04	96.05
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

2.4.1.3 Fail to Operate

ALPHA FACTOR DISTRIBUTIONS

Component :	**AIR OPERATED VALVE, WATER**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9509090	0.9786270	0.9817140	0.9957950	0.9809190	9.8523E+01	2.1517E+00
2	4.21E-03	2.14E-02	1.83E-02	4.91E-02	1.91E-02	2.1517E+00	9.8523E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9400620	0.9660740	0.9679620	0.9856450	0.9665330	1.5787E+02	5.5440E+00
2	1.19E-02	3.01E-02	2.82E-02	5.48E-02	3.08E-02	4.9225E+00	1.5849E+02
3	4.18E-05	3.80E-03	2.06E-03	1.35E-02	2.67E-03	6.2152E-01	1.6279E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9352430	0.9591190	0.9604900	0.9783240	0.9585070	2.1349E+02	9.0998E+00
2	1.56E-02	3.24E-02	3.10E-02	5.40E-02	3.43E-02	7.2169E+00	2.1537E+02
3	7.64E-04	6.64E-03	5.23E-03	1.73E-02	6.15E-03	1.4779E+00	2.2111E+02
4	2.05E-06	1.82E-03	6.71E-04	7.52E-03	1.04E-03	4.0497E-01	2.2218E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9425050	0.9617380	0.9627110	0.9776540	0.9604590	3.0373E+02	1.2084E+01
2	1.20E-02	2.44E-02	2.34E-02	4.01E-02	2.58E-02	7.7002E+00	3.0811E+02
3	2.91E-03	1.01E-02	9.07E-03	2.07E-02	1.02E-02	3.1853E+00	3.1263E+02
4	1.81E-04	3.26E-03	2.29E-03	9.66E-03	3.04E-03	1.0307E+00	3.1478E+02
5	3.45E-11	5.30E-04	3.25E-05	2.85E-03	4.41E-04	1.6748E-01	3.1565E+02

CCCG = 6 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9466640	0.9637170	0.9645340	0.9779970	0.9632530	3.6493E+02	1.3739E+01
2	9.24E-03	1.92E-02	1.84E-02	3.21E-02	1.96E-02	7.2801E+00	3.7139E+02
3	3.45E-03	1.03E-02	9.41E-03	2.00E-02	1.07E-02	3.8862E+00	3.7478E+02
4	7.57E-04	4.81E-03	3.97E-03	1.17E-02	4.77E-03	1.8200E+00	3.7685E+02
5	1.77E-05	1.64E-03	8.82E-04	5.82E-03	1.54E-03	6.1970E-01	3.7805E+02
6	2.78E-13	3.52E-04	9.05E-06	1.98E-03	1.94E-04	1.3314E-01	3.7854E+02

CCCG = 7 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9509980	0.9655470	0.9661780	0.9779370	0.9651520	4.7227E+02	1.6852E+01
2	8.18E-03	1.64E-02	1.57E-02	2.68E-02	1.65E-02	8.0006E+00	4.8112E+02
3	3.33E-03	9.06E-03	8.40E-03	1.71E-02	9.38E-03	4.4331E+00	4.8469E+02
4	1.32E-03	5.42E-03	4.76E-03	1.18E-02	5.57E-03	2.6514E+00	4.8647E+02
5	2.36E-04	2.63E-03	1.99E-03	7.21E-03	2.56E-03	1.2876E+00	4.8783E+02
6	1.31E-06	8.66E-04	3.35E-04	3.53E-03	7.95E-04	4.2358E-01	4.8870E+02
7	3.83E-27	1.13E-04	4.40E-09	6.22E-04	8.81E-05	5.5371E-02	4.8907E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9534110	0.9666750	0.9672260	0.9780680	0.9664490	5.4699E+02	1.8857E+01
2	7.61E-03	1.49E-02	1.43E-02	2.41E-02	1.50E-02	8.4306E+00	5.5742E+02
3	2.85E-03	7.78E-03	7.21E-03	1.47E-02	7.85E-03	4.4043E+00	5.6144E+02
4	1.49E-03	5.39E-03	4.82E-03	1.12E-02	5.60E-03	3.0476E+00	5.6280E+02
5	4.94E-04	3.18E-03	2.62E-03	7.80E-03	3.22E-03	1.8012E+00	5.6405E+02
6	5.27E-05	1.53E-03	9.93E-04	4.81E-03	1.46E-03	8.6306E-01	5.6498E+02
7	1.37E-08	4.65E-04	9.00E-05	2.22E-03	4.13E-04	2.6317E-01	5.6558E+02
8	2.22E-31	8.31E-05	4.09E-10	4.32E-04	4.09E-05	4.7024E-02	5.6580E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**AIR OPERATED VALVE, WATER**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 235
Total Number of Common-Cause Failure Events: 19

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9809190	0.9665330	0.9585070	0.9604590	0.9632530	0.9651520	0.9664490
2	1.91E-02	3.08E-02	3.43E-02	2.58E-02	1.96E-02	1.65E-02	1.50E-02
3		2.67E-03	6.15E-03	1.02E-02	1.07E-02	9.38E-03	7.85E-03
4			1.04E-03	3.04E-03	4.77E-03	5.57E-03	5.60E-03
5				4.41E-04	1.54E-03	2.56E-03	3.22E-03
6					1.94E-04	7.95E-04	1.46E-03
7						8.81E-05	4.13E-04
8							4.09E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.81E-01	9.67E-01	9.59E-01	9.60E-01	9.63E-01	9.65E-01	9.66E-01
Beta	1.91E-02	3.35E-02	4.15E-02	3.95E-02	3.67E-02	3.48E-02	3.36E-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	79.80	119.69	159.59	199.49	239.39	279.29	319.19
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

2.4.2 BWR Isolation Condenser Air-Operated Valves

2.4.2.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**ISOLATION CONDENSER**
Component :	**AIR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8636860	0.9657330	0.9856730	0.9999380	1.0000000	1.2246E+01	4.3452E-01
2	6.41E-05	3.43E-02	1.43E-02	1.36E-01	0.00E+00	4.3452E-01	1.2246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9040420	0.9662880	0.9752810	0.9977560	1.0000000	3.1555E+01	1.1009E+00
2	8.16E-04	2.55E-02	1.67E-02	8.05E-02	0.00E+00	8.3366E-01	3.1822E+01
3	2.88E-07	8.18E-03	1.66E-03	3.88E-02	0.00E+00	2.6722E-01	3.2389E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9113590	0.9628920	0.9688970	0.9938680	1.0000000	4.8136E+01	1.8551E+00
2	2.04E-03	2.46E-02	1.86E-02	6.77E-02	0.00E+00	1.2281E+00	4.8763E+01
3	9.14E-06	8.09E-03	3.01E-03	3.34E-02	0.00E+00	4.0431E-01	4.9587E+01
4	1.93E-08	4.45E-03	6.12E-04	2.23E-02	0.00E+00	2.2267E-01	4.9768E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9311740	0.9652090	0.9682200	0.9889480	1.0000000	9.8161E+01	3.5382E+00
2	4.01E-03	2.08E-02	1.77E-02	4.80E-02	0.00E+00	2.1142E+00	9.9585E+01
3	4.70E-04	9.61E-03	6.64E-03	2.89E-02	0.00E+00	9.7738E-01	1.0072E+02
4	2.42E-06	3.68E-03	1.24E-03	1.56E-02	0.00E+00	3.7439E-01	1.0132E+02
5	5.87E-21	7.11E-04	4.02E-07	4.12E-03	0.00E+00	7.2277E-02	1.0163E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9346440	0.9652760	0.9677640	0.9873890	1.0000000	1.1894E+02	4.2787E+00
2	3.74E-03	1.82E-02	1.56E-02	4.13E-02	0.00E+00	2.2392E+00	1.2098E+02
3	6.53E-04	9.27E-03	6.78E-03	2.64E-02	0.00E+00	1.1418E+00	1.2208E+02
4	4.30E-05	4.81E-03	2.52E-03	1.73E-02	0.00E+00	5.9222E-01	1.2263E+02
5	7.54E-09	1.80E-03	2.45E-04	9.04E-03	0.00E+00	2.2220E-01	1.2300E+02
6	1.14E-18	6.76E-04	1.18E-06	3.94E-03	0.00E+00	8.3237E-02	1.2314E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**ISOLATION CONDENSER**
Component :	**AIR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**ISOLATION CONDENSER**
Component :	**AIR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
$_1$	0.8522320	0.9628000	0.9843830	0.9999320	1.0000000	1.1246E+01	4.3452E-01
$_2$	7.00E-05	3.72E-02	1.56E-02	1.48E-01	0.00E+00	4.3452E-01	1.1246E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
$_1$	0.9010680	0.9652240	0.9744830	0.9976820	1.0000000	3.0555E+01	1.1009E+00
$_2$	8.43E-04	2.63E-02	1.72E-02	8.30E-02	0.00E+00	8.3366E-01	3.0822E+01
$_3$	2.98E-07	8.44E-03	1.71E-03	4.00E-02	0.00E+00	2.6722E-01	3.1389E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
$_1$	0.9095820	0.9621340	0.9682530	0.9937390	1.0000000	4.7136E+01	1.8551E+00
$_2$	2.09E-03	2.51E-02	1.89E-02	6.90E-02	0.00E+00	1.2281E+00	4.7763E+01
$_3$	9.32E-06	8.25E-03	3.07E-03	3.41E-02	0.00E+00	4.0431E-01	4.8587E+01
$_4$	1.97E-08	4.55E-03	6.24E-04	2.28E-02	0.00E+00	2.2267E-01	4.8768E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9304990	0.9648630	0.9678980	0.9888360	1.0000000	9.7161E+01	3.5382E+00
2	4.05E-03	2.10E-02	1.79E-02	4.85E-02	0.00E+00	2.1142E+00	9.8585E+01
3	4.74E-04	9.71E-03	6.71E-03	2.92E-02	0.00E+00	9.7738E-01	9.9722E+01
4	2.45E-06	3.72E-03	1.25E-03	1.58E-02	0.00E+00	3.7439E-01	1.0032E+02
5	5.93E-21	7.18E-04	4.06E-07	4.16E-03	0.00E+00	7.2277E-02	1.0063E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9341160	0.9649920	0.9674990	0.9872840	1.0000000	1.1794E+02	4.2787E+00
2	3.77E-03	1.83E-02	1.58E-02	4.16E-02	0.00E+00	2.2392E+00	1.1998E+02
3	6.58E-04	9.34E-03	6.84E-03	2.66E-02	0.00E+00	1.1418E+00	1.2108E+02
4	4.33E-05	4.85E-03	2.54E-03	1.75E-02	0.00E+00	5.9222E-01	1.2163E+02
5	7.60E-09	1.82E-03	2.47E-04	9.11E-03	0.00E+00	2.2220E-01	1.2200E+02
6	1.15E-18	6.81E-04	1.19E-06	3.98E-03	0.00E+00	8.3237E-02	1.2214E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**ISOLATION CONDENSER**
Component :	**AIR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**AIR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9060830	0.9639610	0.9714940	0.9960260	0.9656850	3.8019E+01	1.4214E+00
2	3.97E-03	3.60E-02	2.85E-02	9.39E-02	3.43E-02	1.4214E+00	3.8019E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9076550	0.9537680	0.9578780	0.9858090	0.9462370	6.9307E+01	3.3595E+00
2	9.67E-03	3.77E-02	3.36E-02	8.00E-02	4.54E-02	2.7412E+00	6.9925E+01
3	9.20E-05	8.51E-03	4.61E-03	3.02E-02	8.36E-03	6.1832E-01	7.2048E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9158920	0.9539690	0.9568850	0.9820810	0.9475380	9.8299E+01	4.7432E+00
2	7.42E-03	2.79E-02	2.49E-02	5.86E-02	2.99E-02	2.8730E+00	1.0017E+02
3	1.62E-03	1.42E-02	1.12E-02	3.71E-02	1.93E-02	1.4653E+00	1.0158E+02
4	4.45E-06	3.93E-03	1.45E-03	1.62E-02	3.31E-03	4.0487E-01	1.0264E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9300790	0.9581700	0.9599840	0.9800680	0.9488680	1.6063E+02	7.0125E+00
2	7.35E-03	2.23E-02	2.05E-02	4.37E-02	2.40E-02	3.7444E+00	1.6390E+02
3	2.31E-03	1.24E-02	1.05E-02	2.88E-02	1.61E-02	2.0704E+00	1.6557E+02
4	3.41E-04	6.15E-03	4.33E-03	1.82E-02	9.65E-03	1.0302E+00	1.6661E+02
5	6.51E-11	9.99E-04	6.14E-05	5.38E-03	1.40E-03	1.6748E-01	1.6748E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9335280	0.9587760	0.9602860	0.9788770	0.9498760	1.9362E+02	8.3249E+00
2	6.90E-03	1.99E-02	1.84E-02	3.83E-02	2.21E-02	4.0266E+00	1.9792E+02
3	1.92E-03	1.03E-02	8.70E-03	2.40E-02	1.15E-02	2.0740E+00	1.9987E+02
4	8.32E-04	7.29E-03	5.74E-03	1.90E-02	1.09E-02	1.4715E+00	2.0047E+02
5	3.33E-05	3.07E-03	1.66E-03	1.09E-02	4.92E-03	6.1970E-01	2.0133E+02
6	5.23E-13	6.59E-04	1.70E-05	3.71E-03	6.18E-04	1.3314E-01	2.0181E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9404390	0.9609760	0.9620570	0.9778340	0.9503910	2.7282E+02	1.1079E+01
2	7.38E-03	1.82E-02	1.71E-02	3.29E-02	2.24E-02	5.1766E+00	2.7872E+02
3	1.82E-03	8.34E-03	7.22E-03	1.87E-02	7.90E-03	2.3691E+00	2.8153E+02
4	1.09E-03	6.62E-03	5.51E-03	1.60E-02	9.54E-03	1.8802E+00	2.8202E+02
5	3.08E-04	4.14E-03	3.05E-03	1.17E-02	6.98E-03	1.1740E+00	2.8272E+02
6	2.25E-06	1.49E-03	5.78E-04	6.07E-03	2.54E-03	4.2358E-01	2.8348E+02
7	6.60E-27	1.95E-04	7.58E-09	1.07E-03	2.82E-04	5.5371E-02	2.8384E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9429750	0.9617060	0.9626320	0.9772810	0.9503790	3.1947E+02	1.2721E+01
2	7.65E-03	1.77E-02	1.67E-02	3.09E-02	2.38E-02	5.8636E+00	3.2633E+02
3	1.46E-03	6.93E-03	5.97E-03	1.57E-02	5.32E-03	2.3019E+00	3.2989E+02
4	1.00E-03	5.84E-03	4.88E-03	1.39E-02	7.48E-03	1.9390E+00	3.3025E+02
5	5.13E-04	4.46E-03	3.51E-03	1.16E-02	7.28E-03	1.4804E+00	3.3071E+02
6	7.53E-05	2.49E-03	1.59E-03	7.96E-03	4.33E-03	8.2566E-01	3.3137E+02
7	2.34E-08	7.92E-04	1.53E-04	3.78E-03	1.32E-03	2.6317E-01	3.3193E+02
8	3.78E-31	1.42E-04	6.97E-10	7.36E-04	1.31E-04	4.7024E-02	3.3214E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**AIR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 64
Total Number of Common-Cause Failure Events: 8

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9656850	0.9462370	0.9475380	0.9488680	0.9498760	0.9503910	0.9503790
2	3.43E-02	4.54E-02	2.99E-02	2.40E-02	2.21E-02	2.24E-02	2.38E-02
3		8.36E-03	1.93E-02	1.61E-02	1.15E-02	7.90E-03	5.32E-03
4			3.31E-03	9.65E-03	1.09E-02	9.54E-03	7.48E-03
5				1.40E-03	4.92E-03	6.98E-03	7.28E-03
6					6.18E-04	2.54E-03	4.33E-03
7						2.82E-04	1.32E-03
8							1.31E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.66E-01	9.46E-01	9.48E-01	9.49E-01	9.50E-01	9.50E-01	9.50E-01
Beta	3.43E-02	5.38E-02	5.25E-02	5.11E-02	5.01E-02	4.96E-02	4.96E-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	24.38	36.57	48.76	60.95	73.14	85.33	97.52
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**AIR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9149130	0.9734500	0.9830360	0.9992590	0.9812670	2.9197E+01	7.9632E-01
2	7.38E-04	2.65E-02	1.70E-02	8.51E-02	1.87E-02	7.9632E-01	2.9197E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9161240	0.9630730	0.9681820	0.9925390	0.9619800	5.6903E+01	2.1818E+00
2	5.55E-03	3.24E-02	2.72E-02	7.67E-02	3.79E-02	1.9124E+00	5.7172E+01
3	1.73E-07	4.56E-03	9.31E-04	2.16E-02	7.74E-05	2.6942E-01	5.8815E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9103370	0.9529470	0.9564600	0.9835500	0.9421110	8.1171E+01	4.0079E+00
2	1.21E-02	3.96E-02	3.60E-02	7.92E-02	5.77E-02	3.3720E+00	8.1807E+01
3	6.29E-06	4.85E-03	1.84E-03	1.99E-02	2.39E-04	4.1321E-01	8.4766E+01
4	1.13E-08	2.61E-03	3.57E-04	1.31E-02	0.00E+00	2.2267E-01	8.4956E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9307000	0.9603270	0.9624170	0.9828010	0.9512430	1.3985E+02	5.7775E+00
2	8.17E-03	2.52E-02	2.30E-02	4.95E-02	3.37E-02	3.6641E+00	1.4196E+02
3	1.60E-03	1.14E-02	9.30E-03	2.86E-02	1.50E-02	1.6667E+00	1.4396E+02
4	1.69E-06	2.57E-03	8.65E-04	1.09E-02	0.00E+00	3.7439E-01	1.4525E+02
5	4.09E-21	4.96E-04	2.80E-07	2.87E-03	0.00E+00	7.2277E-02	1.4556E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9362490	0.9623890	0.9641330	0.9825850	0.9572560	1.6925E+02	6.6144E+00
2	5.97E-03	1.94E-02	1.76E-02	3.90E-02	2.16E-02	3.4183E+00	1.7245E+02
3	2.21E-03	1.18E-02	1.00E-02	2.75E-02	1.71E-02	2.0762E+00	1.7379E+02
4	1.35E-04	4.63E-03	2.94E-03	1.49E-02	4.07E-03	8.1442E-01	1.7505E+02
5	5.28E-09	1.26E-03	1.71E-04	6.33E-03	0.00E+00	2.2220E-01	1.7564E+02
6	8.01E-19	4.73E-04	8.27E-07	2.76E-03	0.00E+00	8.3237E-02	1.7578E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9442180	0.9650060	0.9662190	0.9816460	0.9615120	2.4496E+02	8.8830E+00
2	5.51E-03	1.59E-02	1.47E-02	3.06E-02	1.50E-02	4.0386E+00	2.4980E+02
3	2.46E-03	1.02E-02	8.99E-03	2.23E-02	1.53E-02	2.5998E+00	2.5124E+02
4	6.16E-04	5.65E-03	4.41E-03	1.49E-02	7.02E-03	1.4334E+00	2.5241E+02
5	2.15E-05	2.35E-03	1.23E-03	8.46E-03	1.17E-03	5.9587E-01	2.5325E+02
6	2.65E-10	7.34E-04	6.26E-05	3.85E-03	0.00E+00	1.8628E-01	2.5366E+02
7	0.00E+00	1.15E-04	1.00E-13	4.31E-04	0.00E+00	2.9071E-02	2.5381E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9477450	0.9664610	0.9674970	0.9816280	0.9647220	2.8822E+02	1.0002E+01
2	4.91E-03	1.39E-02	1.29E-02	2.66E-02	1.12E-02	4.1533E+00	2.9407E+02
3	2.18E-03	8.91E-03	7.83E-03	1.93E-02	1.27E-02	2.6560E+00	2.9557E+02
4	8.63E-04	5.83E-03	4.77E-03	1.44E-02	8.23E-03	1.7392E+00	2.9648E+02
5	1.21E-04	3.04E-03	2.02E-03	9.41E-03	2.74E-03	9.0583E-01	2.9732E+02
6	1.18E-06	1.31E-03	4.66E-04	5.49E-03	3.43E-04	3.9166E-01	2.9783E+02
7	5.46E-14	4.12E-04	7.41E-06	2.35E-03	0.00E+00	1.2297E-01	2.9810E+02
8	1.02E-42	1.11E-04	1.58E-12	4.69E-04	0.00E+00	3.3124E-02	2.9819E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**AIR OPERATED VALVE, WATER**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 43
Total Number of Common-Cause Failure Events: 4

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9812670	0.9619800	0.9421110	0.9512430	0.9572560	0.9615120	0.9647220
2	1.87E-02	3.79E-02	5.77E-02	3.37E-02	2.16E-02	1.50E-02	1.12E-02
3		7.74E-05	2.39E-04	1.50E-02	1.71E-02	1.53E-02	1.27E-02
4			0.00E+00	0.00E+00	4.07E-03	7.02E-03	8.23E-03
5				0.00E+00	0.00E+00	1.17E-03	2.74E-03
6					0.00E+00	0.00E+00	3.43E-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	9.81E-01	9.62E-01	9.42E-01	9.51E-01	9.57E-01	9.62E-01	9.65E-01
Beta	1.87E-02	3.80E-02	5.79E-02	4.88E-02	4.27E-02	3.85E-02	3.53E-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	17.20	25.80	34.40	43.00	51.60	60.20	68.80
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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

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 :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8959650	0.9739500	0.9892430	0.9999480	1.0000000	1.6246E+01	4.3452E-01
2	4.81E-05	2.60E-02	1.08E-02	1.04E-01	0.00E+00	4.3452E-01	1.6246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9143470	0.9699670	0.9780280	0.9980130	1.0000000	3.5555E+01	1.1009E+00
2	7.25E-04	2.27E-02	1.48E-02	7.18E-02	0.00E+00	8.3366E-01	3.5822E+01
3	2.56E-07	7.29E-03	1.48E-03	3.46E-02	0.00E+00	2.6722E-01	3.6389E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9178250	0.9656410	0.9712250	0.9943340	1.0000000	5.2136E+01	1.8551E+00
2	1.89E-03	2.27E-02	1.72E-02	6.27E-02	0.00E+00	1.2281E+00	5.2763E+01
3	8.45E-06	7.49E-03	2.78E-03	3.09E-02	0.00E+00	4.0431E-01	5.3587E+01
4	1.78E-08	4.12E-03	5.66E-04	2.07E-02	0.00E+00	2.2267E-01	5.3768E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9337450	0.9665250	0.9694270	0.9893730	1.0000000	1.0216E+02	3.5382E+00
2	3.85E-03	2.00E-02	1.71E-02	4.62E-02	0.00E+00	2.1142E+00	1.0358E+02
3	4.52E-04	9.25E-03	6.39E-03	2.78E-02	0.00E+00	9.7738E-01	1.0472E+02
4	2.33E-06	3.54E-03	1.19E-03	1.50E-02	0.00E+00	3.7439E-01	1.0532E+02
5	5.65E-21	6.84E-04	3.87E-07	3.96E-03	0.00E+00	7.2277E-02	1.0563E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9366750	0.9663680	0.9687880	0.9877920	1.0000000	1.2294E+02	4.2787E+00
2	3.62E-03	1.76E-02	1.51E-02	4.00E-02	0.00E+00	2.2392E+00	1.2498E+02
3	6.32E-04	8.98E-03	6.57E-03	2.55E-02	0.00E+00	1.1418E+00	1.2608E+02
4	4.16E-05	4.66E-03	2.44E-03	1.68E-02	0.00E+00	5.9222E-01	1.2663E+02
5	7.30E-09	1.75E-03	2.37E-04	8.75E-03	0.00E+00	2.2220E-01	1.2700E+02
6	1.11E-18	6.54E-04	1.14E-06	3.82E-03	0.00E+00	8.3237E-02	1.2714E+02

ALPHA FACTOR and MGL PARAMETERS

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 :	**2005/12/31**

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

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

2.4.4.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

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 :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8636860	0.9657330	0.9856730	0.9999380	1.0000000	1.2246E+01	4.3452E-01
2	6.41E-05	3.43E-02	1.43E-02	1.36E-01	0.00E+00	4.3452E-01	1.2246E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9040420	0.9662880	0.9752810	0.9977560	1.0000000	3.1555E+01	1.1009E+00
2	8.16E-04	2.55E-02	1.67E-02	8.05E-02	0.00E+00	8.3366E-01	3.1822E+01
3	2.88E-07	8.18E-03	1.66E-03	3.88E-02	0.00E+00	2.6722E-01	3.2389E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9113590	0.9628920	0.9688970	0.9938680	1.0000000	4.8136E+01	1.8551E+00
2	2.04E-03	2.46E-02	1.86E-02	6.77E-02	0.00E+00	1.2281E+00	4.8763E+01
3	9.14E-06	8.09E-03	3.01E-03	3.34E-02	0.00E+00	4.0431E-01	4.9587E+01
4	1.93E-08	4.45E-03	6.12E-04	2.23E-02	0.00E+00	2.2267E-01	4.9768E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9311740	0.9652090	0.9682200	0.9889480	1.0000000	9.8161E+01	3.5382E+00
2	4.01E-03	2.08E-02	1.77E-02	4.80E-02	0.00E+00	2.1142E+00	9.9585E+01
3	4.70E-04	9.61E-03	6.64E-03	2.89E-02	0.00E+00	9.7738E-01	1.0072E+02
4	2.42E-06	3.68E-03	1.24E-03	1.56E-02	0.00E+00	3.7439E-01	1.0132E+02
5	5.87E-21	7.11E-04	4.02E-07	4.12E-03	0.00E+00	7.2277E-02	1.0163E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9346440	0.9652760	0.9677640	0.9873890	1.0000000	1.1894E+02	4.2787E+00
2	3.74E-03	1.82E-02	1.56E-02	4.13E-02	0.00E+00	2.2392E+00	1.2098E+02
3	6.53E-04	9.27E-03	6.78E-03	2.64E-02	0.00E+00	1.1418E+00	1.2208E+02
4	4.30E-05	4.81E-03	2.52E-03	1.73E-02	0.00E+00	5.9222E-01	1.2263E+02
5	7.54E-09	1.80E-03	2.45E-04	9.04E-03	0.00E+00	2.2220E-01	1.2300E+02
6	1.14E-18	6.76E-04	1.18E-06	3.94E-03	0.00E+00	8.3237E-02	1.2314E+02

ALPHA FACTOR and MGL PARAMETERS

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 :	**2005/12/31**

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

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

High Pressure Coolant Injection and Reactor Core Isolation Cooling Air Operated Valves
Fail to Close

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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1984/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8974730	0.9566140	0.9633870	0.9925580	0.9557430	4.1928E+01	1.9016E+00
2	7.44E-03	4.34E-02	3.66E-02	1.03E-01	4.43E-02	1.9016E+00	4.1928E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9132620	0.9562530	0.9600450	0.9862630	0.9513050	7.5734E+01	3.4647E+00
2	5.52E-03	2.75E-02	2.36E-02	6.28E-02	2.77E-02	2.1786E+00	7.7020E+01
3	1.47E-03	1.62E-02	1.24E-02	4.42E-02	2.10E-02	1.2861E+00	7.7913E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9252720	0.9596930	0.9624070	0.9848290	0.9584530	1.0732E+02	4.5074E+00
2	4.39E-03	2.06E-02	1.78E-02	4.64E-02	1.69E-02	2.3053E+00	1.0952E+02
3	1.53E-03	1.32E-02	1.05E-02	3.44E-02	1.68E-02	1.4793E+00	1.1035E+02
4	1.27E-04	6.46E-03	3.86E-03	2.17E-02	7.83E-03	7.2277E-01	1.1110E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9380980	0.9636340	0.9653550	0.9833060	0.9625280	1.7226E+02	6.5008E+00
2	5.02E-03	1.76E-02	1.58E-02	3.61E-02	1.30E-02	3.1395E+00	1.7562E+02
3	1.81E-03	1.07E-02	8.94E-03	2.56E-02	1.18E-02	1.9141E+00	1.7685E+02
4	4.28E-04	6.29E-03	4.57E-03	1.80E-02	9.49E-03	1.1249E+00	1.7764E+02
5	3.65E-07	1.80E-03	4.93E-04	8.05E-03	3.16E-03	3.2228E-01	1.7844E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9423190	0.9650210	0.9664540	0.9828410	0.9654300	2.0790E+02	7.5357E+00
2	4.43E-03	1.51E-02	1.36E-02	3.08E-02	1.07E-02	3.2483E+00	2.1219E+02
3	1.69E-03	9.35E-03	7.88E-03	2.20E-02	9.25E-03	2.0135E+00	2.1342E+02
4	6.06E-04	6.24E-03	4.79E-03	1.68E-02	7.97E-03	1.3434E+00	2.1409E+02
5	6.55E-05	3.35E-03	1.99E-03	1.13E-02	5.31E-03	7.2230E-01	2.1471E+02
6	1.73E-09	9.67E-04	1.12E-04	4.93E-03	1.33E-03	2.0824E-01	2.1523E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9484710	0.9670000	0.9680360	0.9819950	0.9684510	2.8995E+02	9.8949E+00
2	4.44E-03	1.31E-02	1.20E-02	2.54E-02	7.65E-03	3.9243E+00	2.9592E+02
3	2.10E-03	8.73E-03	7.66E-03	1.90E-02	9.01E-03	2.6167E+00	2.9723E+02
4	7.15E-04	5.39E-03	4.34E-03	1.37E-02	5.74E-03	1.6165E+00	2.9823E+02
5	2.71E-04	3.83E-03	2.79E-03	1.09E-02	5.72E-03	1.1470E+00	2.9870E+02
6	6.47E-06	1.66E-03	7.57E-04	6.39E-03	2.86E-03	4.9878E-01	2.9935E+02
7	1.25E-17	3.05E-04	1.04E-06	1.78E-03	5.72E-04	9.1571E-02	2.9975E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9519720	0.9686280	0.9695180	0.9822560	0.9715620	3.3965E+02	1.1000E+01
2	3.63E-03	1.09E-02	9.99E-03	2.13E-02	3.86E-03	3.8248E+00	3.4683E+02
3	2.36E-03	8.58E-03	7.67E-03	1.79E-02	1.02E-02	3.0090E+00	3.4764E+02
4	6.17E-04	4.63E-03	3.73E-03	1.17E-02	3.82E-03	1.6223E+00	3.4903E+02
5	3.64E-04	3.80E-03	2.91E-03	1.03E-02	5.02E-03	1.3337E+00	3.4932E+02
6	7.49E-05	2.38E-03	1.53E-03	7.60E-03	3.77E-03	8.3576E-01	3.4981E+02
7	1.29E-07	8.85E-04	2.28E-04	4.01E-03	1.51E-03	3.1047E-01	3.5034E+02
8	1.08E-23	1.84E-04	3.59E-08	1.05E-03	2.51E-04	6.4424E-02	3.5059E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1984/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 81
Total Number of Common-Cause Failure Events: 5

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9557430	0.9513050	0.9584530	0.9625280	0.9654300	0.9684510	0.9715620
2	4.43E-02	2.77E-02	1.69E-02	1.30E-02	1.07E-02	7.65E-03	3.86E-03
3		2.10E-02	1.68E-02	1.18E-02	9.25E-03	9.01E-03	1.02E-02
4			7.83E-03	9.49E-03	7.97E-03	5.74E-03	3.82E-03
5				3.16E-03	5.31E-03	5.72E-03	5.02E-03
6					1.33E-03	2.86E-03	3.77E-03
7						5.72E-04	1.51E-03
8							2.51E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.56E-01	9.51E-01	9.58E-01	9.63E-01	9.65E-01	9.68E-01	9.72E-01
Beta	4.43E-02	4.87E-02	4.15E-02	3.75E-02	3.46E-02	3.15E-02	2.84E-02
Gamma		4.31E-01	5.94E-01	6.54E-01	6.90E-01	7.58E-01	8.64E-01
Delta			3.18E-01	5.16E-01	6.12E-01	6.23E-01	5.85E-01
Epsilon				2.50E-01	4.54E-01	6.14E-01	7.34E-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	30.00	45.00	60.00	75.00	90.00	105.00	120.00
N_1	1.6824	1.1787	1.1868	1.0959	0.9614	0.8970	0.9226
N_2	1.4671	1.3449	1.0772	1.0253	1.0091	0.8365	0.4801
N_3		1.0189	1.0750	0.9367	0.8717	0.9855	1.2706
N_4			0.5001	0.7505	0.7512	0.6276	0.4758
N_5				0.2500	0.5001	0.6252	0.6254
N_6					0.1250	0.3125	0.4688
N_7						0.0625	0.1875
N_8							0.0313

2.5.1.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9052950	0.9525310	0.9567290	0.9853910	0.9513270	6.7587E+01	3.3682E+00
2	1.46E-02	4.75E-02	4.33E-02	9.47E-02	4.87E-02	3.3682E+00	6.7587E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9234610	0.9574880	0.9600310	0.9828360	0.9552020	1.1402E+02	5.0624E+00
2	8.65E-03	2.83E-02	2.57E-02	5.69E-02	2.87E-02	3.3754E+00	1.1571E+02
3	2.02E-03	1.42E-02	1.16E-02	3.53E-02	1.61E-02	1.6870E+00	1.1740E+02

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9282950	0.9570350	0.9588830	0.9794650	0.9552550	1.5712E+02	7.0538E+00
2	8.67E-03	2.48E-02	2.29E-02	4.74E-02	2.45E-02	4.0704E+00	1.6010E+02
3	2.26E-03	1.24E-02	1.04E-02	2.90E-02	1.40E-02	2.0304E+00	1.6214E+02
4	2.65E-04	5.80E-03	3.96E-03	1.76E-02	6.29E-03	9.5297E-01	1.6322E+02

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9360060	0.9588420	0.9600970	0.9773950	0.9549070	2.3329E+02	1.0014E+01
2	9.57E-03	2.27E-02	2.14E-02	4.03E-02	2.38E-02	5.5312E+00	2.3777E+02
3	2.34E-03	1.02E-02	8.91E-03	2.26E-02	1.05E-02	2.4864E+00	2.4082E+02
4	7.59E-04	6.27E-03	4.98E-03	1.62E-02	8.01E-03	1.5250E+00	2.4178E+02
5	5.54E-06	1.94E-03	8.37E-04	7.59E-03	2.78E-03	4.7138E-01	2.4283E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9376380	0.9584360	0.9594780	0.9756780	0.9539880	2.7984E+02	1.2136E+01
2	1.01E-02	2.22E-02	2.11E-02	3.79E-02	2.48E-02	6.4711E+00	2.8550E+02
3	2.04E-03	8.70E-03	7.61E-03	1.91E-02	8.19E-03	2.5401E+00	2.8944E+02
4	9.49E-04	6.14E-03	5.06E-03	1.50E-02	7.04E-03	1.7936E+00	2.9018E+02
5	1.91E-04	3.51E-03	2.46E-03	1.04E-02	4.69E-03	1.0236E+00	2.9095E+02
6	1.40E-07	1.05E-03	2.67E-04	4.78E-03	1.31E-03	3.0714E-01	2.9167E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9424340	0.9600100	0.9607960	0.9748980	0.9540780	3.7267E+02	1.5524E+01
2	1.02E-02	2.05E-02	1.97E-02	3.36E-02	2.46E-02	7.9596E+00	3.8023E+02
3	2.20E-03	7.90E-03	7.07E-03	1.64E-02	7.26E-03	3.0666E+00	3.8513E+02
4	1.02E-03	5.39E-03	4.57E-03	1.26E-02	5.59E-03	2.0938E+00	3.8610E+02
5	4.67E-04	3.90E-03	3.09E-03	1.01E-02	5.03E-03	1.5157E+00	3.8668E+02
6	3.82E-05	1.88E-03	1.13E-03	6.30E-03	2.75E-03	7.3068E-01	3.8746E+02
7	8.94E-12	4.06E-04	2.02E-05	2.21E-03	6.49E-04	1.5747E-01	3.8804E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9442310	0.9603970	0.9610750	0.9742470	0.9537290	4.3280E+02	1.7847E+01
2	1.05E-02	2.00E-02	1.93E-02	3.19E-02	2.52E-02	9.0088E+00	4.4164E+02
3	2.11E-03	7.21E-03	6.49E-03	1.48E-02	6.73E-03	3.2490E+00	4.4740E+02
4	9.18E-04	4.75E-03	4.04E-03	1.10E-02	4.42E-03	2.1387E+00	4.4851E+02
5	5.43E-04	3.78E-03	3.08E-03	9.43E-03	4.44E-03	1.7055E+00	4.4894E+02
6	1.82E-04	2.55E-03	1.87E-03	7.27E-03	3.49E-03	1.1503E+00	4.4950E+02
7	3.67E-06	1.08E-03	4.80E-04	4.19E-03	1.62E-03	4.8647E-01	4.5016E+02
8	1.32E-15	2.40E-04	2.26E-06	1.39E-03	3.35E-04	1.0832E-01	4.5054E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 145
Total Number of Common-Cause Failure Events: 18

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9513270	0.9552020	0.9552550	0.9549070	0.9539880	0.9540780	0.9537290
2	4.87E-02	2.87E-02	2.45E-02	2.38E-02	2.48E-02	2.46E-02	2.52E-02
3		1.61E-02	1.40E-02	1.05E-02	8.19E-03	7.26E-03	6.73E-03
4			6.29E-03	8.01E-03	7.04E-03	5.59E-03	4.42E-03
5				2.78E-03	4.69E-03	5.03E-03	4.44E-03
6					1.31E-03	2.75E-03	3.49E-03
7						6.49E-04	1.62E-03
8							3.35E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.51E-01	9.55E-01	9.55E-01	9.55E-01	9.54E-01	9.54E-01	9.54E-01
Beta	4.87E-02	4.48E-02	4.47E-02	4.51E-02	4.60E-02	4.59E-02	4.63E-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	49.74	74.61	99.49	124.36	149.23	174.10	198.97
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

2.5.1.3 Spurious Operation

ALPHA FACTOR DISTRIBUTIONS

Component :	**CHECK VALVE**
Failure Mode :	**SPURIOUS ACTUATION** **FAIL TO REMAIN CLOSED (DETECTABLE LEAKAGE)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
$_1$	0.9296180	0.9669190	0.9706150	0.9915660	0.9680470	7.9908E+01	2.7339E+00
$_2$	8.44E-03	3.31E-02	2.94E-02	7.04E-02	3.20E-02	2.7339E+00	7.9908E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9306650	0.9610950	0.9633330	0.9838840	0.9602300	1.3117E+02	5.3097E+00
2	1.10E-02	3.08E-02	2.85E-02	5.83E-02	3.18E-02	4.1978E+00	1.3228E+02
3	5.41E-04	8.15E-03	5.90E-03	2.34E-02	7.98E-03	1.1119E+00	1.3537E+02

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9285770	0.9557240	0.9573410	0.9773430	0.9537830	1.7868E+02	8.2777E+00
2	1.38E-02	3.16E-02	2.99E-02	5.50E-02	3.37E-02	5.9055E+00	1.8105E+02
3	1.44E-03	9.48E-03	7.79E-03	2.33E-02	9.84E-03	1.7716E+00	1.8519E+02
4	3.05E-05	3.21E-03	1.70E-03	1.15E-02	2.72E-03	6.0057E-01	1.8636E+02

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9357520	0.9575770	0.9586960	0.9755770	0.9535530	2.5990E+02	1.1514E+01
2	1.23E-02	2.59E-02	2.48E-02	4.35E-02	2.87E-02	7.0391E+00	2.6437E+02
3	3.14E-03	1.13E-02	1.01E-02	2.34E-02	1.21E-02	3.0564E+00	2.6836E+02
4	3.09E-04	4.27E-03	3.13E-03	1.21E-02	4.57E-03	1.1586E+00	2.7026E+02
5	2.48E-08	9.58E-04	1.81E-04	4.58E-03	1.09E-03	2.5998E-01	2.7115E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9378360	0.9576380	0.9585710	0.9742480	0.9534420	3.1160E+02	1.3784E+01
2	1.13E-02	2.31E-02	2.22E-02	3.83E-02	2.59E-02	7.5265E+00	3.1786E+02
3	3.53E-03	1.11E-02	1.01E-02	2.20E-02	1.21E-02	3.6044E+00	3.2178E+02
4	8.44E-04	5.49E-03	4.52E-03	1.35E-02	5.85E-03	1.7875E+00	3.2360E+02
5	3.47E-05	2.12E-03	1.22E-03	7.24E-03	2.28E-03	6.8850E-01	3.2470E+02
6	8.86E-11	5.44E-04	3.99E-05	2.89E-03	4.59E-04	1.7704E-01	3.2521E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9428040	0.9595910	0.9603050	0.9739370	0.9542920	4.0963E+02	1.7250E+01
2	1.03E-02	2.00E-02	1.93E-02	3.23E-02	2.31E-02	8.5510E+00	4.1833E+02
3	3.72E-03	1.02E-02	9.46E-03	1.93E-02	1.16E-02	4.3619E+00	4.2252E+02
4	1.36E-03	5.88E-03	5.13E-03	1.30E-02	6.44E-03	2.5117E+00	4.2437E+02
5	2.70E-04	3.02E-03	2.29E-03	8.26E-03	3.24E-03	1.2880E+00	4.2559E+02
6	2.73E-06	1.08E-03	4.57E-04	4.27E-03	1.16E-03	4.6138E-01	4.2642E+02
7	1.05E-20	1.78E-04	1.53E-07	1.03E-03	1.98E-04	7.5971E-02	4.2680E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9451900	0.9605550	0.9611730	0.9738030	0.9551130	4.7511E+02	1.9510E+01
2	9.58E-03	1.83E-02	1.76E-02	2.91E-02	2.12E-02	9.0271E+00	4.8559E+02
3	3.55E-03	9.39E-03	8.74E-03	1.75E-02	1.08E-02	4.6452E+00	4.8997E+02
4	1.55E-03	5.86E-03	5.21E-03	1.24E-02	6.52E-03	2.8970E+00	4.9172E+02
5	5.16E-04	3.51E-03	2.86E-03	8.69E-03	3.82E-03	1.7343E+00	4.9289E+02
6	6.15E-05	1.75E-03	1.15E-03	5.52E-03	1.86E-03	8.6756E-01	4.9375E+02
7	3.45E-08	5.71E-04	1.26E-04	2.66E-03	5.94E-04	2.8237E-01	4.9434E+02
8	1.14E-26	1.14E-04	5.62E-09	6.32E-04	8.72E-05	5.6524E-02	4.9456E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**CHECK VALVE**
Failure Mode :	**SPURIOUS ACTUATION** **FAIL TO REMAIN CLOSED (DETECTABLE LEAKAGE)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 158
Total Number of Common-Cause Failure Events: 31

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9680470	0.9602300	0.9537830	0.9535530	0.9534420	0.9542920	0.9551130
2	3.20E-02	3.18E-02	3.37E-02	2.87E-02	2.59E-02	2.31E-02	2.12E-02
3		7.98E-03	9.84E-03	1.21E-02	1.21E-02	1.16E-02	1.08E-02
4			2.72E-03	4.57E-03	5.85E-03	6.44E-03	6.52E-03
5				1.09E-03	2.28E-03	3.24E-03	3.82E-03
6					4.59E-04	1.16E-03	1.86E-03
7						1.98E-04	5.94E-04
8							8.72E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.68E-01	9.60E-01	9.54E-01	9.54E-01	9.53E-01	9.54E-01	9.55E-01
Beta	3.20E-02	3.98E-02	4.62E-02	4.64E-02	4.66E-02	4.57E-02	4.49E-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	60.08	90.11	120.15	150.19	180.23	210.27	240.30
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

2.5.2 BWR Residual Heat Removal Check Valves

2.5.2.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8549460	0.9548630	0.9712200	0.9988610	0.9473460	1.6243E+01	7.6782E-01
2	1.14E-03	4.51E-02	2.88E-02	1.45E-01	5.27E-02	7.6782E-01	1.6243E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8791540	0.9470210	0.9543870	0.9896480	0.8888890	3.7555E+01	2.1009E+00
2	7.58E-03	4.62E-02	3.88E-02	1.10E-01	1.11E-01	1.8337E+00	3.7822E+01
3	2.37E-07	6.74E-03	1.36E-03	3.20E-02	0.00E+00	2.6722E-01	3.9389E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9000510	0.9521450	0.9571280	0.9871870	0.9143100	5.6806E+01	2.8551E+00
2	4.32E-03	2.90E-02	2.39E-02	7.10E-02	4.28E-02	1.7281E+00	5.7933E+01
3	6.06E-04	1.52E-02	1.02E-02	4.67E-02	4.28E-02	9.0431E-01	5.8757E+01
4	1.61E-08	3.73E-03	5.11E-04	1.87E-02	0.00E+00	2.2267E-01	5.9438E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9263250	0.9602000	0.9628640	0.9849590	0.9302160	1.0949E+02	4.5383E+00
2	4.53E-03	2.07E-02	1.80E-02	4.63E-02	1.74E-02	2.3642E+00	1.1166E+02
3	1.50E-03	1.30E-02	1.02E-02	3.37E-02	3.49E-02	1.4774E+00	1.1255E+02
4	6.14E-05	5.48E-03	2.98E-03	1.94E-02	1.74E-02	6.2439E-01	1.1340E+02
5	5.23E-21	6.34E-04	3.58E-07	3.67E-03	0.00E+00	7.2277E-02	1.1396E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9318270	0.9618090	0.9640170	0.9842400	0.9411760	1.3294E+02	5.2787E+00
2	3.73E-03	1.71E-02	1.48E-02	3.82E-02	7.35E-03	2.3642E+00	1.3585E+02
3	1.32E-03	1.10E-02	8.72E-03	2.83E-02	2.21E-02	1.5168E+00	1.3670E+02
4	3.32E-04	7.00E-03	4.81E-03	2.11E-02	2.21E-02	9.6722E-01	1.3725E+02
5	9.35E-07	2.51E-03	7.66E-04	1.09E-02	7.35E-03	3.4720E-01	1.3787E+02
6	1.02E-18	6.02E-04	1.05E-06	3.51E-03	0.00E+00	8.3237E-02	1.3814E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9414370	0.9645750	0.9660420	0.9827100	0.9491610	2.0272E+02	7.4450E+00
2	4.30E-03	1.50E-02	1.35E-02	3.08E-02	3.18E-03	3.1503E+00	2.0701E+02
3	1.48E-03	8.95E-03	7.45E-03	2.16E-02	1.27E-02	1.8812E+00	2.0828E+02
4	6.49E-04	6.49E-03	5.01E-03	1.74E-02	1.91E-02	1.3639E+00	2.0880E+02
5	8.99E-05	3.67E-03	2.27E-03	1.20E-02	1.27E-02	7.7177E-01	2.0939E+02
6	1.90E-08	1.18E-03	2.05E-04	5.74E-03	3.18E-03	2.4878E-01	2.0992E+02
7	0.00E+00	1.38E-04	1.21E-13	5.21E-04	0.00E+00	2.9071E-02	2.1014E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9451800	0.9659540	0.9672010	0.9824850	0.9552090	2.4006E+02	8.4612E+00
2	4.12E-03	1.36E-02	1.23E-02	2.74E-02	1.40E-03	3.3760E+00	2.4515E+02
3	1.27E-03	7.62E-03	6.35E-03	1.83E-02	7.00E-03	1.8947E+00	2.4663E+02
4	6.60E-04	5.87E-03	4.61E-03	1.54E-02	1.40E-02	1.4590E+00	2.4706E+02
5	2.23E-04	4.11E-03	2.88E-03	1.22E-02	1.40E-02	1.0208E+00	2.4750E+02
6	1.05E-05	2.11E-03	9.99E-04	7.95E-03	7.00E-03	5.2326E-01	2.4800E+02
7	9.39E-12	6.21E-04	2.87E-05	3.40E-03	1.40E-03	1.5427E-01	2.4837E+02
8	1.23E-42	1.33E-04	1.90E-12	5.63E-04	0.00E+00	3.3124E-02	2.4849E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9473460	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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9106300	0.9748500	0.9863950	0.9997570	0.9874320	2.3265E+01	6.0022E-01
2	2.45E-04	2.52E-02	1.36E-02	8.94E-02	1.26E-02	6.0022E-01	2.3265E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9217740	0.9692170	0.9752190	0.9961160	0.9772580	4.8665E+01	1.5456E+00
2	2.16E-03	2.49E-02	1.90E-02	6.82E-02	2.14E-02	1.2522E+00	4.8958E+01
3	5.16E-07	5.84E-03	1.39E-03	2.69E-02	1.34E-03	2.9342E-01	4.9917E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9229390	0.9640490	0.9681670	0.9910780	0.9690770	7.1144E+01	2.6531E+00
2	4.55E-03	2.62E-02	2.21E-02	6.21E-02	2.74E-02	1.9350E+00	7.1862E+01
3	2.40E-05	6.65E-03	3.00E-03	2.56E-02	3.36E-03	4.9091E-01	7.3306E+01
4	1.70E-08	3.08E-03	4.41E-04	1.53E-02	1.74E-04	2.2717E-01	7.3570E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9348970	0.9646650	0.9669970	0.9864650	0.9651400	1.2703E+02	4.6531E+00
2	6.24E-03	2.27E-02	2.03E-02	4.73E-02	2.74E-02	2.9892E+00	1.2869E+02
3	7.08E-04	9.09E-03	6.76E-03	2.55E-02	6.88E-03	1.1973E+00	1.3049E+02
4	2.79E-06	2.99E-03	1.07E-03	1.25E-02	6.00E-04	3.9359E-01	1.3129E+02
5	6.74E-21	5.54E-04	3.40E-07	3.21E-03	2.19E-05	7.2977E-02	1.3161E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9372430	0.9642270	0.9661520	0.9846240	0.9627130	1.5361E+02	5.6990E+00
2	5.93E-03	2.02E-02	1.83E-02	4.13E-02	2.59E-02	3.2254E+00	1.5608E+02
3	1.15E-03	9.52E-03	7.56E-03	2.46E-02	9.84E-03	1.5167E+00	1.5779E+02
4	5.28E-05	4.07E-03	2.26E-03	1.42E-02	1.46E-03	6.4772E-01	1.5866E+02
5	7.24E-09	1.42E-03	1.99E-04	7.07E-03	9.45E-05	2.2580E-01	1.5908E+02
6	9.24E-19	5.23E-04	9.23E-07	3.05E-03	2.63E-06	8.3337E-02	1.5923E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9447350	0.9661150	0.9674290	0.9830010	0.9658890	2.2673E+02	7.9523E+00
2	5.63E-03	1.66E-02	1.53E-02	3.23E-02	1.84E-02	3.9026E+00	2.3078E+02
3	1.81E-03	9.20E-03	7.85E-03	2.12E-02	1.20E-02	2.1602E+00	2.3252E+02
4	3.33E-04	4.83E-03	3.51E-03	1.38E-02	3.25E-03	1.1325E+00	2.3355E+02
5	1.35E-05	2.30E-03	1.12E-03	8.60E-03	4.23E-04	5.4047E-01	2.3414E+02
6	3.18E-10	7.99E-04	6.95E-05	4.19E-03	2.72E-05	1.8748E-01	2.3449E+02
7	0.00E+00	1.24E-04	1.08E-13	4.66E-04	0.00E+00	2.9071E-02	2.3465E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9479720	0.9672540	0.9683780	0.9827130	0.9683330	2.6741E+02	9.0530E+00
2	5.07E-03	1.46E-02	1.35E-02	2.81E-02	1.39E-02	4.0434E+00	2.7242E+02
3	1.79E-03	8.40E-03	7.25E-03	1.90E-02	1.16E-02	2.3219E+00	2.7414E+02
4	5.24E-04	5.04E-03	3.91E-03	1.34E-02	4.94E-03	1.3946E+00	2.7507E+02
5	6.50E-05	2.76E-03	1.69E-03	9.10E-03	1.09E-03	7.6313E-01	2.7570E+02
6	8.69E-07	1.35E-03	4.52E-04	5.74E-03	1.29E-04	3.7346E-01	2.7609E+02
7	6.37E-14	4.46E-04	8.15E-06	2.54E-03	7.96E-06	1.2337E-01	2.7634E+02
8	1.10E-42	1.20E-04	1.71E-12	5.06E-04	0.00E+00	3.3124E-02	2.7643E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

Fail to Close

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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1984/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8942440	0.9729290	0.9881340	0.9999300	0.9958000	1.6576E+01	4.6122E-01
2	7.12E-05	2.71E-02	1.19E-02	1.06E-01	4.20E-03	4.6122E-01	1.6576E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9181860	0.9706360	0.9780410	0.9977420	0.9917820	3.8968E+01	1.1789E+00
2	9.32E-04	2.27E-02	1.54E-02	6.94E-02	8.11E-03	9.1066E-01	3.9236E+01
3	2.44E-07	6.68E-03	1.36E-03	3.17E-02	1.05E-04	2.6822E-01	3.9879E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9226620	0.9668700	0.9718700	0.9939560	0.9879130	5.8584E+01	2.0074E+00
2	2.34E-03	2.27E-02	1.77E-02	6.03E-02	1.18E-02	1.3767E+00	5.9215E+01
3	8.04E-06	6.73E-03	2.52E-03	2.77E-02	2.86E-04	4.0791E-01	6.0183E+01
4	1.60E-08	3.68E-03	5.04E-04	1.84E-02	7.94E-06	2.2277E-01	6.0369E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9362060	0.9671870	0.9698510	0.9890510	0.9841870	1.1161E+02	3.7864E+00
2	4.44E-03	2.04E-02	1.77E-02	4.56E-02	1.53E-02	2.3538E+00	1.1304E+02
3	4.26E-04	8.54E-03	5.92E-03	2.56E-02	5.16E-04	9.8548E-01	1.1441E+02
4	2.16E-06	3.25E-03	1.10E-03	1.38E-02	3.19E-05	3.7489E-01	1.1502E+02
5	5.17E-21	6.26E-04	3.54E-07	3.63E-03	0.00E+00	7.2277E-02	1.1532E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9388080	0.9668300	0.9690340	0.9873230	0.9805800	1.3533E+02	4.6430E+00
2	4.43E-03	1.85E-02	1.62E-02	4.02E-02	1.86E-02	2.5876E+00	1.3739E+02
3	5.98E-04	8.26E-03	6.07E-03	2.34E-02	7.78E-04	1.1564E+00	1.3882E+02
4	3.82E-05	4.24E-03	2.22E-03	1.53E-02	6.40E-05	5.9342E-01	1.3938E+02
5	6.68E-09	1.59E-03	2.16E-04	7.96E-03	5.33E-06	2.2230E-01	1.3975E+02
6	1.01E-18	5.95E-04	1.04E-06	3.47E-03	0.00E+00	8.3237E-02	1.3989E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9453730	0.9675240	0.9689860	0.9846920	0.9793730	2.0541E+02	6.8948E+00
2	5.11E-03	1.64E-02	1.49E-02	3.28E-02	1.83E-02	3.4868E+00	2.0882E+02
3	1.11E-03	7.91E-03	6.43E-03	1.98E-02	2.20E-03	1.6792E+00	2.1063E+02
4	2.36E-04	4.67E-03	3.24E-03	1.40E-02	1.19E-04	9.9147E-01	2.1131E+02
5	1.21E-05	2.46E-03	1.16E-03	9.29E-03	9.17E-06	5.2197E-01	2.1178E+02
6	3.17E-10	8.77E-04	7.49E-05	4.61E-03	0.00E+00	1.8628E-01	2.1212E+02
7	0.00E+00	1.37E-04	1.20E-13	5.15E-04	0.00E+00	2.9071E-02	2.1228E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9480550	0.9681300	0.9693690	0.9839830	0.9782870	2.4303E+02	8.0004E+00
2	5.01E-03	1.51E-02	1.38E-02	2.96E-02	1.81E-02	3.7935E+00	2.4724E+02
3	1.15E-03	7.26E-03	6.00E-03	1.77E-02	3.35E-03	1.8215E+00	2.4921E+02
4	3.30E-04	4.60E-03	3.37E-03	1.31E-02	2.86E-04	1.1536E+00	2.4988E+02
5	5.15E-05	2.82E-03	1.66E-03	9.55E-03	1.61E-05	7.0873E-01	2.5032E+02
6	8.27E-07	1.46E-03	4.79E-04	6.25E-03	0.00E+00	3.6696E-01	2.5066E+02
7	6.49E-14	4.90E-04	8.81E-06	2.79E-03	0.00E+00	1.2297E-01	2.5091E+02
8	1.21E-42	1.32E-04	1.88E-12	5.58E-04	0.00E+00	3.3124E-02	2.5100E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1984/01/01**
Data Version :	**2005/12/31**

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

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9958000	0.9917820	0.9879130	0.9841870	0.9805800	0.9793730	0.9782870
2	4.20E-03	8.11E-03	1.18E-02	1.53E-02	1.86E-02	1.83E-02	1.81E-02
3		1.05E-04	2.86E-04	5.16E-04	7.78E-04	2.20E-03	3.35E-03
4			7.94E-06	3.19E-05	6.40E-05	1.19E-04	2.86E-04
5				0.00E+00	5.33E-06	9.17E-06	1.61E-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	9.96E-01	9.92E-01	9.88E-01	9.84E-01	9.81E-01	9.79E-01	9.78E-01
Beta	4.20E-03	8.22E-03	1.21E-02	1.58E-02	1.94E-02	2.06E-02	2.17E-02
Gamma		1.28E-02	2.43E-02	3.46E-02	4.36E-02	1.13E-01	1.68E-01
Delta			2.70E-02	5.81E-02	8.18E-02	5.51E-02	8.28E-02
Epsilon				0.00E+00	7.69E-02	7.14E-02	5.33E-02
Mu					0.00E+00	0.00E+00	0.00E+00
Upsilon						0.00E+00	0.00E+00
Sigma							0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	5.85	8.77	11.69	14.62	17.54	20.46	23.38
N_1	0.4800	0.6430	0.7583	0.8281	0.8543	0.8970	0.9226
N_2	0.0267	0.0770	0.1486	0.2396	0.3484	0.3990	0.4488
N_3		0.0010	0.0036	0.0081	0.0146	0.0480	0.0831
N_4			0.0001	0.0005	0.0012	0.0026	0.0071
N_5				0.0000	0.0001	0.0002	0.0004
N_6					0.0000	0.0000	0.0000
N_7						0.0000	0.0000
N_8							0.0000

2.5.3.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8986360	0.9722500	0.9857880	0.9998080	0.9871110	1.9421E+01	5.5432E-01
2	1.90E-04	2.78E-02	1.42E-02	1.01E-01	1.29E-02	5.5432E-01	1.9421E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9151310	0.9672300	0.9739720	0.9962530	0.9742340	4.2955E+01	1.4553E+00
2	2.07E-03	2.67E-02	2.00E-02	7.43E-02	2.56E-02	1.1856E+00	4.3225E+01
3	2.34E-07	6.07E-03	1.25E-03	2.87E-02	1.82E-04	2.6972E-01	4.4141E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9163450	0.9613640	0.9659340	0.9907490	0.9614140	6.3547E+01	2.5539E+00
2	4.98E-03	2.90E-02	2.44E-02	6.88E-02	3.80E-02	1.9168E+00	6.4184E+01
3	8.30E-06	6.27E-03	2.39E-03	2.57E-02	5.58E-04	4.1441E-01	6.5686E+01
4	1.45E-08	3.37E-03	4.61E-04	1.69E-02	0.00E+00	2.2267E-01	6.5878E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9294590	0.9616060	0.9641030	0.9852110	0.9486470	1.1737E+02	4.6862E+00
2	7.82E-03	2.65E-02	2.40E-02	5.39E-02	5.02E-02	3.2369E+00	1.1882E+02
3	4.27E-04	8.21E-03	5.73E-03	2.45E-02	1.13E-03	1.0026E+00	1.2105E+02
4	2.02E-06	3.07E-03	1.03E-03	1.30E-02	0.00E+00	3.7439E-01	1.2168E+02
5	4.89E-21	5.92E-04	3.35E-07	3.43E-03	0.00E+00	7.2277E-02	1.2198E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9298960	0.9595450	0.9616080	0.9821550	0.9359410	1.4173E+02	5.9754E+00
2	8.91E-03	2.63E-02	2.42E-02	5.09E-02	6.22E-02	3.8855E+00	1.4382E+02
3	6.23E-04	8.07E-03	5.99E-03	2.26E-02	1.90E-03	1.1922E+00	1.4651E+02
4	3.58E-05	4.01E-03	2.10E-03	1.45E-02	0.00E+00	5.9222E-01	1.4711E+02
5	6.29E-09	1.50E-03	2.04E-04	7.54E-03	0.00E+00	2.2220E-01	1.4748E+02
6	9.54E-19	5.64E-04	9.85E-07	3.29E-03	0.00E+00	8.3237E-02	1.4762E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9369280	0.9605340	0.9619140	0.9794190	0.9253600	2.1229E+02	8.7225E+00
2	9.71E-03	2.37E-02	2.23E-02	4.26E-02	7.07E-02	5.2459E+00	2.1577E+02
3	1.18E-03	7.92E-03	6.49E-03	1.95E-02	3.91E-03	1.7506E+00	2.1926E+02
4	2.24E-04	4.47E-03	3.10E-03	1.34E-02	0.00E+00	9.8887E-01	2.2002E+02
5	1.16E-05	2.36E-03	1.12E-03	8.92E-03	0.00E+00	5.2177E-01	2.2049E+02
6	3.04E-10	8.43E-04	7.19E-05	4.42E-03	0.00E+00	1.8628E-01	2.2083E+02
7	0.00E+00	1.32E-04	1.15E-13	4.95E-04	0.00E+00	2.9071E-02	2.2098E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9384830	0.9601770	0.9613520	0.9778660	0.9152910	2.5027E+02	1.0380E+01
2	1.02E-02	2.32E-02	2.20E-02	4.03E-02	7.86E-02	6.0515E+00	2.5460E+02
3	1.29E-03	7.47E-03	6.25E-03	1.78E-02	6.06E-03	1.9471E+00	2.5870E+02
4	3.14E-04	4.41E-03	3.23E-03	1.26E-02	9.87E-05	1.1499E+00	2.5950E+02
5	4.95E-05	2.72E-03	1.60E-03	9.20E-03	0.00E+00	7.0833E-01	2.5994E+02
6	7.97E-07	1.41E-03	4.61E-04	6.02E-03	0.00E+00	3.6696E-01	2.6028E+02
7	6.25E-14	4.72E-04	8.48E-06	2.69E-03	0.00E+00	1.2297E-01	2.6053E+02
8	1.17E-42	1.27E-04	1.81E-12	5.37E-04	0.00E+00	3.3124E-02	2.6062E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AUXILIARY FEEDWATER SYSTEM**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9871110	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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**HIGH PRESSURE SAFETY INJECTION (PWR)**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9392010	0.9848500	0.9938480	0.9999700	1.0000000	2.8246E+01	4.3452E-01
2	2.74E-05	1.52E-02	6.15E-03	6.08E-02	0.00E+00	4.3452E-01	2.8246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9352220	0.9773740	0.9835210	0.9985130	1.0000000	4.7555E+01	1.1009E+00
2	5.43E-04	1.71E-02	1.11E-02	5.43E-02	0.00E+00	8.3366E-01	4.7822E+01
3	1.92E-07	5.49E-03	1.11E-03	2.61E-02	0.00E+00	2.6722E-01	4.8389E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9325730	0.9718890	0.9765150	0.9953800	1.0000000	6.4136E+01	1.8551E+00
2	1.54E-03	1.86E-02	1.40E-02	5.14E-02	0.00E+00	1.2281E+00	6.4763E+01
3	6.90E-06	6.13E-03	2.27E-03	2.53E-02	0.00E+00	4.0431E-01	6.5587E+01
4	1.46E-08	3.37E-03	4.62E-04	1.69E-02	0.00E+00	2.2267E-01	6.5768E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9404240	0.9699380	0.9725650	0.9904720	1.0000000	1.1416E+02	3.5382E+00
2	3.46E-03	1.80E-02	1.53E-02	4.15E-02	0.00E+00	2.1142E+00	1.1558E+02
3	4.05E-04	8.30E-03	5.74E-03	2.50E-02	0.00E+00	9.7738E-01	1.1672E+02
4	2.09E-06	3.18E-03	1.07E-03	1.35E-02	0.00E+00	3.7439E-01	1.1732E+02
5	5.07E-21	6.14E-04	3.47E-07	3.55E-03	0.00E+00	7.2277E-02	1.1763E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9420760	0.9692670	0.9714860	0.9888580	1.0000000	1.3494E+02	4.2787E+00
2	3.30E-03	1.61E-02	1.38E-02	3.66E-02	0.00E+00	2.2392E+00	1.3698E+02
3	5.77E-04	8.20E-03	6.00E-03	2.34E-02	0.00E+00	1.1418E+00	1.3808E+02
4	3.80E-05	4.25E-03	2.23E-03	1.53E-02	0.00E+00	5.9222E-01	1.3863E+02
5	6.67E-09	1.60E-03	2.16E-04	8.00E-03	0.00E+00	2.2220E-01	1.3900E+02
6	1.01E-18	5.98E-04	1.05E-06	3.49E-03	0.00E+00	8.3237E-02	1.3914E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**HIGH PRESSURE SAFETY INJECTION (PWR)**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**HIGH PRESSURE SAFETY INJECTION (PWR)**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8897140	0.9574090	0.9661310	0.9952030	0.9565220	3.2246E+01	1.4345E+00
2	4.79E-03	4.26E-02	3.39E-02	1.10E-01	4.35E-02	1.4345E+00	3.2246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9251830	0.9675060	0.9722040	0.9937370	0.9705880	6.2555E+01	2.1009E+00
2	2.00E-03	2.06E-02	1.59E-02	5.53E-02	1.47E-02	1.3337E+00	6.3322E+01
3	2.88E-04	1.19E-02	7.35E-03	3.88E-02	1.47E-02	7.6722E-01	6.3889E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9354260	0.9692970	0.9726040	0.9918620	0.9777780	9.0136E+01	2.8551E+00
2	1.84E-03	1.59E-02	1.26E-02	4.13E-02	5.56E-03	1.4781E+00	9.1513E+01
3	3.87E-04	9.72E-03	6.51E-03	3.00E-02	1.11E-02	9.0431E-01	9.2087E+01
4	1.48E-05	5.08E-03	2.21E-03	1.99E-02	5.56E-03	4.7267E-01	9.2518E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9458520	0.9708520	0.9728490	0.9890350	0.9821430	1.5116E+02	4.5383E+00
2	2.95E-03	1.44E-02	1.24E-02	3.27E-02	2.23E-03	2.2392E+00	1.5346E+02
3	8.57E-04	8.69E-03	6.69E-03	2.33E-02	6.70E-03	1.3524E+00	1.5435E+02
4	1.07E-04	4.81E-03	2.93E-03	1.59E-02	6.70E-03	7.4939E-01	1.5495E+02
5	1.07E-09	1.27E-03	1.27E-04	6.56E-03	2.23E-03	1.9728E-01	1.5550E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9497750	0.9719550	0.9736130	0.9884700	0.9850750	1.8294E+02	5.2787E+00
2	2.58E-03	1.22E-02	1.05E-02	2.76E-02	9.33E-04	2.3017E+00	1.8592E+02
3	7.67E-04	7.39E-03	5.74E-03	1.97E-02	3.73E-03	1.3918E+00	1.8683E+02
4	2.43E-04	5.14E-03	3.53E-03	1.55E-02	5.60E-03	9.6722E-01	1.8725E+02
5	7.25E-06	2.51E-03	1.09E-03	9.83E-03	3.73E-03	4.7220E-01	1.8775E+02
6	3.96E-12	7.74E-04	2.89E-05	4.29E-03	9.33E-04	1.4574E-01	1.8807E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**HIGH PRESSURE SAFETY INJECTION (PWR)**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 22
Total Number of Common-Cause Failure Events: 1

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9565220	0.9705880	0.9777780	0.9821430	0.9850750
2	4.35E-02	1.47E-02	5.56E-03	2.23E-03	9.33E-04
3		1.47E-02	1.11E-02	6.70E-03	3.73E-03
4			5.56E-03	6.70E-03	5.60E-03
5				2.23E-03	3.73E-03
6					9.33E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.57E-01	9.71E-01	9.78E-01	9.82E-01	9.85E-01
Beta	4.35E-02	2.94E-02	2.22E-02	1.79E-02	1.49E-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	22.00	33.00	44.00	55.00	66.00
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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8734960	0.9682380	0.9867710	0.9999360	1.0000000	1.3246E+01	4.3452E-01
2	5.92E-05	3.18E-02	1.32E-02	1.27E-01	0.00E+00	4.3452E-01	1.3246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9068390	0.9672900	0.9760300	0.9978250	1.0000000	3.2555E+01	1.1009E+00
2	7.91E-04	2.48E-02	1.62E-02	7.82E-02	0.00E+00	8.3366E-01	3.2822E+01
3	2.80E-07	7.94E-03	1.61E-03	3.77E-02	0.00E+00	2.6722E-01	3.3389E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9130680	0.9636200	0.9695110	0.9939910	1.0000000	4.9136E+01	1.8551E+00
2	2.00E-03	2.41E-02	1.82E-02	6.63E-02	0.00E+00	1.2281E+00	4.9763E+01
3	8.95E-06	7.93E-03	2.95E-03	3.27E-02	0.00E+00	4.0431E-01	5.0587E+01
4	1.89E-08	4.37E-03	5.99E-04	2.19E-02	0.00E+00	2.2267E-01	5.0768E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9318350	0.9655480	0.9685320	0.9890570	1.0000000	9.9161E+01	3.5382E+00
2	3.97E-03	2.06E-02	1.76E-02	4.76E-02	0.00E+00	2.1142E+00	1.0059E+02
3	4.65E-04	9.52E-03	6.58E-03	2.86E-02	0.00E+00	9.7738E-01	1.0172E+02
4	2.40E-06	3.65E-03	1.23E-03	1.55E-02	0.00E+00	3.7439E-01	1.0232E+02
5	5.81E-21	7.04E-04	3.98E-07	4.08E-03	0.00E+00	7.2277E-02	1.0263E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9351640	0.9655550	0.9680290	0.9874920	1.0000000	1.1994E+02	4.2787E+00
2	3.71E-03	1.80E-02	1.55E-02	4.10E-02	0.00E+00	2.2392E+00	1.2198E+02
3	6.48E-04	9.19E-03	6.73E-03	2.62E-02	0.00E+00	1.1418E+00	1.2308E+02
4	4.26E-05	4.77E-03	2.50E-03	1.72E-02	0.00E+00	5.9222E-01	1.2363E+02
5	7.48E-09	1.79E-03	2.43E-04	8.96E-03	0.00E+00	2.2220E-01	1.2400E+02
6	1.14E-18	6.70E-04	1.17E-06	3.91E-03	0.00E+00	8.3237E-02	1.2414E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9431390	0.9666920	0.9682910	0.9847850	1.0000000	1.8705E+02	6.4450E+00
2	4.50E-03	1.60E-02	1.43E-02	3.30E-02	0.00E+00	3.0878E+00	1.9041E+02
3	1.14E-03	8.43E-03	6.81E-03	2.13E-02	0.00E+00	1.6312E+00	1.9186E+02
4	2.56E-04	5.11E-03	3.54E-03	1.53E-02	0.00E+00	9.8887E-01	1.9251E+02
5	1.33E-05	2.70E-03	1.28E-03	1.02E-02	0.00E+00	5.2177E-01	1.9297E+02
6	3.47E-10	9.63E-04	8.22E-05	5.05E-03	0.00E+00	1.8628E-01	1.9331E+02
7	0.00E+00	1.50E-04	1.32E-13	5.66E-04	0.00E+00	2.9071E-02	1.9347E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9461690	0.9674460	0.9688010	0.9841110	1.0000000	2.2173E+02	7.4610E+00
2	4.39E-03	1.46E-02	1.32E-02	2.95E-02	0.00E+00	3.3447E+00	2.2585E+02
3	1.12E-03	7.58E-03	6.21E-03	1.88E-02	0.00E+00	1.7384E+00	2.2745E+02
4	3.54E-04	5.00E-03	3.66E-03	1.42E-02	0.00E+00	1.1465E+00	2.2804E+02
5	5.63E-05	3.09E-03	1.82E-03	1.05E-02	0.00E+00	7.0833E-01	2.2848E+02
6	9.06E-07	1.60E-03	5.24E-04	6.85E-03	0.00E+00	3.6696E-01	2.2882E+02
7	7.11E-14	5.37E-04	9.65E-06	3.05E-03	0.00E+00	1.2297E-01	2.2907E+02
8	1.33E-42	1.45E-04	2.06E-12	6.11E-04	0.00E+00	3.3124E-02	2.2916E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8861020	0.9621350	0.9737870	0.9983020	0.9642860	2.3746E+01	9.3452E-01
2	1.70E-03	3.79E-02	2.62E-02	1.14E-01	3.57E-02	9.3452E-01	2.3746E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9110340	0.9622510	0.9681110	0.9934080	0.9595160	4.9305E+01	1.9342E+00
2	2.54E-03	2.60E-02	2.01E-02	6.97E-02	2.43E-02	1.3337E+00	4.9906E+01
3	1.12E-04	1.17E-02	6.25E-03	4.19E-02	1.62E-02	6.0052E-01	5.0639E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9202830	0.9619850	0.9660220	0.9898780	0.9631180	7.2247E+01	2.8550E+00
2	2.64E-03	2.08E-02	1.67E-02	5.29E-02	1.23E-02	1.5614E+00	7.3541E+01
3	3.75E-04	1.13E-02	7.36E-03	3.57E-02	1.64E-02	8.4871E-01	7.4253E+01
4	1.22E-05	5.92E-03	2.43E-03	2.37E-02	8.20E-03	4.4487E-01	7.4657E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9361040	0.9654040	0.9677060	0.9868240	0.9680520	1.2871E+02	4.6124E+00
2	3.65E-03	1.72E-02	1.49E-02	3.89E-02	5.51E-03	2.2994E+00	1.3102E+02
3	9.92E-04	1.01E-02	7.79E-03	2.72E-02	1.10E-02	1.3478E+00	1.3197E+02
4	1.22E-04	5.59E-03	3.39E-03	1.85E-02	1.10E-02	7.4479E-01	1.3258E+02
5	6.23E-09	1.65E-03	2.20E-04	8.30E-03	4.41E-03	2.2038E-01	1.3310E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9406280	0.9666320	0.9685470	0.9861080	0.9724600	1.5596E+02	5.3837E+00
2	3.10E-03	1.45E-02	1.25E-02	3.25E-02	2.31E-03	2.3318E+00	1.5901E+02
3	8.91E-04	8.61E-03	6.68E-03	2.29E-02	6.15E-03	1.3887E+00	1.5995E+02
4	2.79E-04	5.97E-03	4.09E-03	1.81E-02	9.23E-03	9.6262E-01	1.6038E+02
5	1.53E-05	3.21E-03	1.51E-03	1.22E-02	7.38E-03	5.1850E-01	1.6083E+02
6	2.86E-10	1.13E-03	9.01E-05	5.96E-03	2.46E-03	1.8204E-01	1.6116E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9474050	0.9681080	0.9694200	0.9843470	0.9760360	2.2956E+02	7.5623E+00
2	3.76E-03	1.32E-02	1.19E-02	2.72E-02	9.27E-04	3.1310E+00	2.3399E+02
3	1.14E-03	7.49E-03	6.15E-03	1.84E-02	3.09E-03	1.7752E+00	2.3535E+02
4	4.76E-04	5.39E-03	4.07E-03	1.48E-02	6.18E-03	1.2770E+00	2.3585E+02
5	1.28E-04	3.66E-03	2.39E-03	1.15E-02	7.41E-03	8.6747E-01	2.3625E+02
6	2.40E-06	1.76E-03	6.70E-04	7.20E-03	4.94E-03	4.1678E-01	2.3671E+02
7	4.94E-17	4.00E-04	1.72E-06	2.33E-03	1.41E-03	9.4871E-02	2.3703E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9506230	0.9692710	0.9703830	0.9841180	0.9788780	2.7073E+02	8.5831E+00
2	3.64E-03	1.20E-02	1.09E-02	2.44E-02	3.61E-04	3.3639E+00	2.7595E+02
3	1.02E-03	6.50E-03	5.36E-03	1.59E-02	1.45E-03	1.8152E+00	2.7750E+02
4	4.62E-04	4.79E-03	3.67E-03	1.29E-02	3.61E-03	1.3385E+00	2.7797E+02
5	1.94E-04	3.64E-03	2.54E-03	1.08E-02	5.78E-03	1.0156E+00	2.7830E+02
6	3.66E-05	2.41E-03	1.38E-03	8.32E-03	5.78E-03	6.7426E-01	2.7864E+02
7	1.10E-07	1.07E-03	2.59E-04	4.90E-03	3.31E-03	2.9857E-01	2.7901E+02
8	2.75E-20	2.76E-04	2.64E-07	1.60E-03	8.26E-04	7.7024E-02	2.7924E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 13
Total Number of Common-Cause Failure Events: 1

Fail to Close

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9642860	0.9595160	0.9631180	0.9680520	0.9724600	0.9760360	0.9788780
2	3.57E-02	2.43E-02	1.23E-02	5.51E-03	2.31E-03	9.27E-04	3.61E-04
3		1.62E-02	1.64E-02	1.10E-02	6.15E-03	3.09E-03	1.45E-03
4			8.20E-03	1.10E-02	9.23E-03	6.18E-03	3.61E-03
5				4.41E-03	7.38E-03	7.41E-03	5.78E-03
6					2.46E-03	4.94E-03	5.78E-03
7						1.41E-03	3.31E-03
8							8.26E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.64E-01	9.60E-01	9.63E-01	9.68E-01	9.72E-01	9.76E-01	9.79E-01
Beta	3.57E-02	4.05E-02	3.69E-02	3.19E-02	2.75E-02	2.40E-02	2.11E-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	13.00	19.50	26.00	32.50	39.00	45.50	52.00
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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

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 :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8959650	0.9739500	0.9892430	0.9999480	1.0000000	1.6246E+01	4.3452E-01
2	4.81E-05	2.60E-02	1.08E-02	1.04E-01	0.00E+00	4.3452E-01	1.6246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9143470	0.9699670	0.9780280	0.9980130	1.0000000	3.5555E+01	1.1009E+00
2	7.25E-04	2.27E-02	1.48E-02	7.18E-02	0.00E+00	8.3366E-01	3.5822E+01
3	2.56E-07	7.29E-03	1.48E-03	3.46E-02	0.00E+00	2.6722E-01	3.6389E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9178250	0.9656410	0.9712250	0.9943340	1.0000000	5.2136E+01	1.8551E+00
2	1.89E-03	2.27E-02	1.72E-02	6.27E-02	0.00E+00	1.2281E+00	5.2763E+01
3	8.45E-06	7.49E-03	2.78E-03	3.09E-02	0.00E+00	4.0431E-01	5.3587E+01
4	1.78E-08	4.12E-03	5.66E-04	2.07E-02	0.00E+00	2.2267E-01	5.3768E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9337450	0.9665250	0.9694270	0.9893730	1.0000000	1.0216E+02	3.5382E+00
2	3.85E-03	2.00E-02	1.71E-02	4.62E-02	0.00E+00	2.1142E+00	1.0358E+02
3	4.52E-04	9.25E-03	6.39E-03	2.78E-02	0.00E+00	9.7738E-01	1.0472E+02
4	2.33E-06	3.54E-03	1.19E-03	1.50E-02	0.00E+00	3.7439E-01	1.0532E+02
5	5.65E-21	6.84E-04	3.87E-07	3.96E-03	0.00E+00	7.2277E-02	1.0563E+02

Fail to Open

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9366750	0.9663680	0.9687880	0.9877920	1.0000000	1.2294E+02	4.2787E+00
2	3.62E-03	1.76E-02	1.51E-02	4.00E-02	0.00E+00	2.2392E+00	1.2498E+02
3	6.32E-04	8.98E-03	6.57E-03	2.55E-02	0.00E+00	1.1418E+00	1.2608E+02
4	4.16E-05	4.66E-03	2.44E-03	1.68E-02	0.00E+00	5.9222E-01	1.2663E+02
5	7.30E-09	1.75E-03	2.37E-04	8.75E-03	0.00E+00	2.2220E-01	1.2700E+02
6	1.11E-18	6.54E-04	1.14E-06	3.82E-03	0.00E+00	8.3237E-02	1.2714E+02

ALPHA FACTOR and MGL PARAMETERS

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 :	**2005/12/31**

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

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

2.5.6.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9431410	0.9858370	0.9942570	0.9999720	1.0000000	3.0246E+01	4.3452E-01
2	2.56E-05	1.42E-02	5.74E-03	5.69E-02	0.00E+00	4.3452E-01	3.0246E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9377460	0.9782670	0.9841800	0.9985670	1.0000000	4.9555E+01	1.1009E+00
2	5.21E-04	1.65E-02	1.07E-02	5.22E-02	0.00E+00	8.3366E-01	4.9822E+01
3	1.85E-07	5.28E-03	1.06E-03	2.50E-02	0.00E+00	2.6722E-01	5.0389E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9345310	0.9727160	0.9772120	0.9955190	1.0000000	6.6136E+01	1.8551E+00
2	1.49E-03	1.81E-02	1.36E-02	4.99E-02	0.00E+00	1.2281E+00	6.6763E+01
3	6.69E-06	5.95E-03	2.20E-03	2.46E-02	0.00E+00	4.0431E-01	6.7587E+01
4	1.41E-08	3.27E-03	4.48E-04	1.64E-02	0.00E+00	2.2267E-01	6.7768E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9414090	0.9704400	0.9730260	0.9906340	1.0000000	1.1616E+02	3.5382E+00
2	3.40E-03	1.77E-02	1.51E-02	4.09E-02	0.00E+00	2.1142E+00	1.1758E+02
3	3.99E-04	8.17E-03	5.64E-03	2.46E-02	0.00E+00	9.7738E-01	1.1872E+02
4	2.06E-06	3.13E-03	1.05E-03	1.33E-02	0.00E+00	3.7439E-01	1.1932E+02
5	4.98E-21	6.04E-04	3.41E-07	3.49E-03	0.00E+00	7.2277E-02	1.1963E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9428920	0.9697020	0.9718920	0.9890180	1.0000000	1.3694E+02	4.2787E+00
2	3.26E-03	1.59E-02	1.36E-02	3.61E-02	0.00E+00	2.2392E+00	1.3898E+02
3	5.69E-04	8.09E-03	5.91E-03	2.30E-02	0.00E+00	1.1418E+00	1.4008E+02
4	3.75E-05	4.19E-03	2.20E-03	1.51E-02	0.00E+00	5.9222E-01	1.4063E+02
5	6.58E-09	1.57E-03	2.13E-04	7.88E-03	0.00E+00	2.2220E-01	1.4100E+02
6	9.98E-19	5.89E-04	1.03E-06	3.44E-03	0.00E+00	8.3237E-02	1.4114E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**HIGH PRESSURE COOLANT INJECTION (BWR) REACTOR CORE ISOLATION COOLING**
Component :	**CHECK VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 20
Total Number of Common-Cause Failure Events: 0

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

BWR High Pressure Coolant Injection/Reactor Core Isolation Cooling Check Valves
Fail to Close

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	20.00	20.00	20.00	20.00	20.00
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 No Flow/Plugged

ALPHA FACTOR DISTRIBUTIONS

System :	**AUXILIARY FEEDWATER SYSTEM CONTAINMENT SPRAY SYSTEM HIGH PRESSURE COOLANT INJECTION (BWR) HIGH PRESSURE SAFETY INJECTION (PWR) ISOLATION CONDENSER LOW PRESSURE CORE SPRAY REACTOR CORE ISOLATION COOLING REACTOR COOLANT RESIDUAL HEAT REMOVAL**
Component :	**STRAINER - MAIN PUMP SUCTION OR DISCHARGE**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8298400	0.9490320	0.9692610	0.9991320	0.9090910	1.2746E+01	6.8452E-01
2	8.69E-04	5.10E-02	3.07E-02	1.70E-01	9.09E-02	6.8452E-01	1.2746E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8844160	0.9536380	0.9621340	0.9937460	0.8709680	3.2930E+01	1.6009E+00
2	2.84E-03	3.50E-02	2.65E-02	9.64E-02	9.68E-02	1.2087E+00	3.3322E+01
3	1.05E-05	1.14E-02	4.10E-03	4.73E-02	3.23E-02	3.9222E-01	3.4139E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8962690	0.9519620	0.9575640	0.9884790	0.8607590	5.0386E+01	2.5426E+00
2	4.04E-03	3.03E-02	2.46E-02	7.61E-02	7.59E-02	1.6031E+00	5.1325E+01
3	1.69E-04	1.24E-02	6.98E-03	4.29E-02	5.06E-02	6.5431E-01	5.2274E+01
4	3.62E-07	5.39E-03	1.22E-03	2.50E-02	1.27E-02	2.8517E-01	5.2643E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9230100	0.9588260	0.9616920	0.9848410	0.8638610	1.0132E+02	4.3509E+00
2	5.17E-03	2.30E-02	2.00E-02	5.08E-02	5.24E-02	2.4267E+00	1.0324E+02
3	1.11E-03	1.22E-02	9.29E-03	3.33E-02	5.24E-02	1.2899E+00	1.0438E+02
4	2.70E-05	5.02E-03	2.42E-03	1.88E-02	2.62E-02	5.3069E-01	1.0514E+02
5	1.59E-15	9.80E-04	7.19E-06	5.69E-03	5.24E-03	1.0358E-01	1.0557E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9277100	0.9596770	0.9620470	0.9835400	0.8724750	1.2303E+02	5.1694E+00
2	4.42E-03	1.93E-02	1.69E-02	4.25E-02	3.36E-02	2.4736E+00	1.2573E+02
3	1.27E-03	1.13E-02	8.92E-03	2.97E-02	4.47E-02	1.4543E+00	1.2675E+02
4	1.97E-04	6.45E-03	4.13E-03	2.06E-02	3.36E-02	8.2662E-01	1.2737E+02
5	4.22E-07	2.46E-03	6.56E-04	1.11E-02	1.34E-02	3.1600E-01	1.2788E+02
6	3.26E-16	7.71E-04	4.28E-06	4.49E-03	2.23E-03	9.8837E-02	1.2810E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AUXILIARY FEEDWATER SYSTEM CONTAINMENT SPRAY SYSTEM HIGH PRESSURE COOLANT INJECTION (BWR) HIGH PRESSURE SAFETY INJECTION (PWR) ISOLATION CONDENSER LOW PRESSURE CORE SPRAY REACTOR CORE ISOLATION COOLING REACTOR COOLANT RESIDUAL HEAT REMOVAL**
Component :	**STRAINER - MAIN PUMP SUCTION OR DISCHARGE**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9090910	0.8709680	0.8607590	0.8638610	0.8724750
2	9.09E-02	9.68E-02	7.59E-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

Pooled Strainers (Non-ESW)
No Flow/Plugged

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

2.6.2 Emergency Service Water

2.6.2.1 Emergency Service Water Strainers

2.6.2.1.1 Trash Racks

2.6.2.1.1.1 No Flow/Plugged

ALPHA FACTOR DISTRIBUTIONS

System :	**EMERGENCY/ESSENTIAL SERVICE WATER**
Component :	**STRAINER, TRASH RACKS**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8972520	0.9656530	0.9760810	0.9983780	0.9696080	2.6836E+01	9.5452E-01
2	1.62E-03	3.43E-02	2.39E-02	1.03E-01	3.04E-02	9.5452E-01	2.6836E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9121270	0.9614540	0.9668400	0.9923310	0.9582420	5.3650E+01	2.1509E+00
2	3.99E-03	2.92E-02	2.38E-02	7.30E-02	3.16E-02	1.6287E+00	5.4172E+01
3	4.67E-05	9.36E-03	4.47E-03	3.52E-02	1.01E-02	5.2222E-01	5.5279E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9174130	0.9588110	0.9625400	0.9874570	0.9551290	7.7680E+01	3.3370E+00
2	4.86E-03	2.57E-02	2.19E-02	5.95E-02	2.58E-02	2.0788E+00	7.8938E+01
3	4.56E-04	1.12E-02	7.55E-03	3.46E-02	1.53E-02	9.1041E-01	8.0107E+01
4	1.62E-06	4.29E-03	1.32E-03	1.87E-02	3.79E-03	3.4777E-01	8.0669E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9323150	0.9619730	0.9641460	0.9841970	0.9557790	1.3519E+02	5.3441E+00
2	5.56E-03	2.07E-02	1.85E-02	4.35E-02	1.95E-02	2.9109E+00	1.3762E+02
3	1.52E-03	1.15E-02	9.24E-03	2.90E-02	1.55E-02	1.6112E+00	1.3892E+02
4	7.98E-05	4.89E-03	2.83E-03	1.67E-02	7.66E-03	6.8719E-01	1.3985E+02
5	9.90E-13	9.59E-04	2.61E-05	5.39E-03	1.53E-03	1.3478E-01	1.4040E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9361860	0.9627230	0.9645300	0.9830990	0.9577790	1.6349E+02	6.3304E+00
2	4.75E-03	1.75E-02	1.56E-02	3.65E-02	1.49E-02	2.9644E+00	1.6686E+02
3	1.61E-03	1.05E-02	8.63E-03	2.57E-02	1.31E-02	1.7803E+00	1.6804E+02
4	3.73E-04	6.25E-03	4.45E-03	1.83E-02	9.66E-03	1.0615E+00	1.6876E+02
5	2.94E-06	2.41E-03	9.03E-04	9.93E-03	3.86E-03	4.0970E-01	1.6941E+02
6	1.59E-14	6.74E-04	8.55E-06	3.88E-03	6.44E-04	1.1454E-01	1.6971E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**EMERGENCY/ESSENTIAL SERVICE WATER**
Component :	**STRAINER, TRASH RACKS**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 19
Total Number of Common-Cause Failure Events: 3

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9696080	0.9582420	0.9551290	0.9557790	0.9577790
2	3.04E-02	3.16E-02	2.58E-02	1.95E-02	1.49E-02
3		1.01E-02	1.53E-02	1.55E-02	1.31E-02
4			3.79E-03	7.66E-03	9.66E-03
5				1.53E-03	3.86E-03
6					6.44E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.70E-01	9.58E-01	9.55E-01	9.56E-01	9.58E-01
Beta	3.04E-02	4.18E-02	4.49E-02	4.42E-02	4.22E-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	14.23	21.35	28.46	35.58	42.70
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

2.6.2.1.2 Discharge Strainers

2.6.2.1.2.1 No Flow/Plugged

ALPHA FACTOR DISTRIBUTIONS

System :	**EMERGENCY/ESSENTIAL SERVICE WATER**
Component :	**STRAINER - MAIN PUMP SUCTION OR DISCHARGE**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8353370	0.8955580	0.8987710	0.9447960	0.8860100	7.3439E+01	8.5646E+00
2	5.52E-02	1.04E-01	1.01E-01	1.65E-01	1.14E-01	8.5646E+00	7.3439E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8607910	0.9057090	0.9077550	0.9436310	0.8880400	1.1953E+02	1.2444E+01
2	2.09E-02	4.66E-02	4.43E-02	8.01E-02	5.25E-02	6.1530E+00	1.2582E+02
3	2.16E-02	4.77E-02	4.54E-02	8.15E-02	5.95E-02	6.2909E+00	1.2568E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8744080	0.9116900	0.9132280	0.9437280	0.8934240	1.6268E+02	1.5758E+01
2	1.71E-02	3.70E-02	3.53E-02	6.27E-02	4.12E-02	6.5978E+00	1.7184E+02
3	1.09E-02	2.76E-02	2.58E-02	5.02E-02	3.46E-02	4.9169E+00	1.7352E+02
4	8.55E-03	2.38E-02	2.20E-02	4.50E-02	3.08E-02	4.2432E+00	1.7419E+02

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8989600	0.9272110	0.9283080	0.9517130	0.9038570	2.4009E+02	1.8848E+01
2	1.10E-02	2.43E-02	2.31E-02	4.19E-02	2.63E-02	6.3029E+00	2.5263E+02
3	9.67E-03	2.24E-02	2.12E-02	3.93E-02	3.03E-02	5.8013E+00	2.5314E+02
4	6.81E-03	1.79E-02	1.67E-02	3.32E-02	2.68E-02	4.6438E+00	2.5429E+02
5	1.54E-03	8.11E-03	6.88E-03	1.89E-02	1.27E-02	2.0997E+00	2.5684E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9087770	0.9335390	0.9344700	0.9551080	0.9134270	2.8851E+02	2.0540E+01
2	7.43E-03	1.78E-02	1.67E-02	3.16E-02	1.73E-02	5.4917E+00	3.0356E+02
3	7.11E-03	1.73E-02	1.62E-02	3.10E-02	2.23E-02	5.3377E+00	3.0371E+02
4	7.00E-03	1.71E-02	1.61E-02	3.07E-02	2.50E-02	5.2826E+00	3.0377E+02
5	3.18E-03	1.07E-02	9.66E-03	2.18E-02	1.64E-02	3.3064E+00	3.0574E+02
6	2.44E-04	3.63E-03	2.63E-03	1.04E-02	5.53E-03	1.1213E+00	3.0793E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**EMERGENCY/ESSENTIAL SERVICE WATER**
Component :	**STRAINER - MAIN PUMP SUCTION OR DISCHARGE**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 89
Total Number of Common-Cause Failure Events: 21

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.8860100	0.8880400	0.8934240	0.9038570	0.9134270
2	1.14E-01	5.25E-02	4.12E-02	2.63E-02	1.73E-02
3		5.95E-02	3.46E-02	3.03E-02	2.23E-02
4			3.08E-02	2.68E-02	2.50E-02
5				1.27E-02	1.64E-02
6					5.53E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	8.86E-01	8.88E-01	8.93E-01	9.04E-01	9.13E-01
Beta	1.14E-01	1.12E-01	1.07E-01	9.61E-02	8.66E-02
Gamma		5.31E-01	6.14E-01	7.26E-01	8.00E-01
Delta			4.71E-01	5.66E-01	6.77E-01
Epsilon				3.22E-01	4.68E-01
Mu					2.52E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	55.80	83.70	111.60	139.50	167.40
N_1	7.3931	6.2704	4.9474	4.4260	4.1693
N_2	8.1301	5.3193	5.3697	4.1887	3.2525
N_3		6.0237	4.5126	4.8239	4.1959
N_4			4.0205	4.2694	4.6904
N_5				2.0274	3.0842
N_6					1.0381

2.6.3 Pooled Sump Strainers

2.6.3.1 No Flow/Plugged

ALPHA FACTOR DISTRIBUTIONS

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 :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8298400	0.9490320	0.9692610	0.9991320	0.9090910	1.2746E+01	6.8452E-01
2	8.69E-04	5.10E-02	3.07E-02	1.70E-01	9.09E-02	6.8452E-01	1.2746E+01

ALPHA FACTOR and MGL PARAMETERS

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 :	**2005/12/31**

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

Alpha Factor	**CCCG=2**
1	0.9090910
2	9.09E-02

MGL Parameter	**CCCG=2**
1-Beta	9.09E-01
Beta	9.09E-02

Avg. Impact Vector	**CCCG=2**
Adj. Ind. Events	2.00
N_1	0.5000
N_2	0.2500

2.6.4 PWR Containment Sump Strainers

2.6.4.1 No Flow/Plugged

ALPHA FACTOR DISTRIBUTIONS

System :	**CONTAINMENT SPRAY SYSTEM**
Component :	**STRAINER - MAIN PUMP SUCTION OR DISCHARGE**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8386830	0.9593170	0.9828300	0.9999250	0.9985140	1.0246E+01	4.3452E-01
2	7.70E-05	4.07E-02	1.72E-02	1.61E-01	0.00E+00	4.3452E-01	1.0246E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**CONTAINMENT SPRAY SYSTEM**
Component :	**STRAINER - MAIN PUMP SUCTION OR DISCHARGE**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

Alpha Factor	**CCCG=2**
1	0.9985140
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 No Flow/Plugged

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**STRAINER - MAIN PUMP SUCTION OR DISCHARGE**
Failure Mode :	**NO FLOW/PLUGGED**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8298400	0.9490320	0.9692610	0.9991320	0.9090910	1.2746E+01	6.8452E-01
2	8.69E-04	5.10E-02	3.07E-02	1.70E-01	9.09E-02	6.8452E-01	1.2746E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8844160	0.9536380	0.9621340	0.9937460	0.8709680	3.2930E+01	1.6009E+00
2	2.84E-03	3.50E-02	2.65E-02	9.64E-02	9.68E-02	1.2087E+00	3.3322E+01
3	1.05E-05	1.14E-02	4.10E-03	4.73E-02	3.23E-02	3.9222E-01	3.4139E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8962690	0.9519620	0.9575640	0.9884790	0.8607590	5.0386E+01	2.5426E+00
2	4.04E-03	3.03E-02	2.46E-02	7.61E-02	7.59E-02	1.6031E+00	5.1325E+01
3	1.69E-04	1.24E-02	6.98E-03	4.29E-02	5.06E-02	6.5431E-01	5.2274E+01
4	3.62E-07	5.39E-03	1.22E-03	2.50E-02	1.27E-02	2.8517E-01	5.2643E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9230100	0.9588260	0.9616920	0.9848410	0.8638610	1.0132E+02	4.3509E+00
2	5.17E-03	2.30E-02	2.00E-02	5.08E-02	5.24E-02	2.4267E+00	1.0324E+02
3	1.11E-03	1.22E-02	9.29E-03	3.33E-02	5.24E-02	1.2899E+00	1.0438E+02
4	2.70E-05	5.02E-03	2.42E-03	1.88E-02	2.62E-02	5.3069E-01	1.0514E+02
5	1.59E-15	9.80E-04	7.19E-06	5.69E-03	5.24E-03	1.0358E-01	1.0557E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9277100	0.9596770	0.9620470	0.9835400	0.8724750	1.2303E+02	5.1694E+00
2	4.42E-03	1.93E-02	1.69E-02	4.25E-02	3.36E-02	2.4736E+00	1.2573E+02
3	1.27E-03	1.13E-02	8.92E-03	2.97E-02	4.47E-02	1.4543E+00	1.2675E+02
4	1.97E-04	6.45E-03	4.13E-03	2.06E-02	3.36E-02	8.2662E-01	1.2737E+02
5	4.22E-07	2.46E-03	6.56E-04	1.11E-02	1.34E-02	3.1600E-01	1.2788E+02
6	3.26E-16	7.71E-04	4.28E-06	4.49E-03	2.23E-03	9.8837E-02	1.2810E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**STRAINER - MAIN PUMP SUCTION OR DISCHARGE**
Failure Mode :	**NO FLOW/PLUGGED**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9090910	0.8709680	0.8607590	0.8638610	0.8724750
2	9.09E-02	9.68E-02	7.59E-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
$\mathbf{N_1}$	0.5000	0.3750	0.2500	0.1563	0.0938
$\mathbf{N_2}$	0.2500	0.3750	0.3750	0.3125	0.2344
$\mathbf{N_3}$		0.1250	0.2500	0.3125	0.3125
$\mathbf{N_4}$			0.0625	0.1563	0.2344
$\mathbf{N_5}$				0.0313	0.0938
$\mathbf{N_6}$					0.0156

2.7 Heat Exchangers

2.7.1 Pooled Heat Exchanger Plugged or Failure to Transfer Heat

ALPHA FACTOR DISTRIBUTIONS

Component :	**HEAT EXCHANGER**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8001600	0.8859890	0.8917100	0.9522300	0.8631430	3.9836E+01	5.1262E+00
2	4.78E-02	1.14E-01	1.08E-01	2.00E-01	1.37E-01	5.1262E+00	3.9836E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8607540	0.9167790	0.9202720	0.9608610	0.8869770	7.2717E+01	6.6009E+00
2	1.43E-02	4.47E-02	4.09E-02	8.81E-02	5.57E-02	3.5462E+00	7.5772E+01
3	1.09E-02	3.85E-02	3.47E-02	7.92E-02	5.73E-02	3.0547E+00	7.6263E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8832600	0.9275300	0.9300940	0.9630350	0.9016980	1.0279E+02	8.0312E+00
2	9.26E-03	3.04E-02	2.76E-02	6.10E-02	3.40E-02	3.3667E+00	1.0745E+02
3	5.49E-03	2.31E-02	2.03E-02	5.03E-02	3.43E-02	2.5588E+00	1.0826E+02
4	3.64E-03	1.90E-02	1.62E-02	4.40E-02	3.00E-02	2.1057E+00	1.0872E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**HEAT EXCHANGER**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 38
Total Number of Common-Cause Failure Events: 8

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.8631430	0.8869770	0.9016980
2	1.37E-01	5.57E-02	3.40E-02
3		5.73E-02	3.43E-02
4			3.00E-02

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

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	8.63E-01	8.87E-01	9.02E-01
Beta	1.37E-01	1.13E-01	9.83E-02
Gamma		5.07E-01	6.54E-01
Delta			4.66E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	27.64	41.45	55.27
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 Plugged or Failure to Transfer Heat

ALPHA FACTOR DISTRIBUTIONS

System :	**CONTAINMENT SPRAY SYSTEM**
Component :	**HEAT EXCHANGER**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
$_1$	0.7443110	0.8900180	0.9057870	0.9815510	0.7600890	1.4576E+01	1.8012E+00
$_2$	1.84E-02	1.10E-01	9.42E-02	2.56E-01	2.40E-01	1.8012E+00	1.4576E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**CONTAINMENT SPRAY SYSTEM**
Component :	**HEAT EXCHANGER**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

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 Plugged or Failure to Transfer Heat

ALPHA FACTOR DISTRIBUTIONS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**HEAT EXCHANGER**
Failure Mode :	**NO FLOW/PLUGGED**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.7426140	0.8747350	0.8864000	0.9668230	0.7906980	1.8746E+01	2.6845E+00
2	3.32E-02	1.25E-01	1.14E-01	2.57E-01	2.09E-01	2.6845E+00	1.8746E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8468710	0.9209130	0.9270420	0.9739790	0.8319330	4.1930E+01	3.6009E+00
2	1.00E-02	4.85E-02	4.20E-02	1.09E-01	9.24E-02	2.2087E+00	4.3322E+01
3	3.24E-03	3.06E-02	2.40E-02	8.05E-02	7.56E-02	1.3922E+00	4.4139E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8755940	0.9321280	0.9364100	0.9740230	0.8580860	6.2386E+01	4.5426E+00
2	6.06E-03	3.14E-02	2.69E-02	7.24E-02	4.62E-02	2.1031E+00	6.4825E+01
3	3.45E-03	2.47E-02	2.02E-02	6.16E-02	6.60E-02	1.6543E+00	6.5274E+01
4	3.07E-04	1.17E-02	7.35E-03	3.81E-02	2.97E-02	7.8517E-01	6.6143E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**RESIDUAL HEAT REMOVAL**
Component :	**HEAT EXCHANGER**
Failure Mode :	**NO FLOW/PLUGGED**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 8
Total Number of Common-Cause Failure Events: 3

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
$_1$	0.7906980	0.8319330	0.8580860
$_2$	2.09E-01	9.24E-02	4.62E-02
$_3$		7.56E-02	6.60E-02
$_4$			2.97E-02

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	7.91E-01	8.32E-01	8.58E-01
Beta	2.09E-01	1.68E-01	1.42E-01
Gamma		4.50E-01	6.74E-01
Delta			3.10E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	8.00	12.00	16.00
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 Plugged or Failure to Transfer Heat

ALPHA FACTOR DISTRIBUTIONS

System :	**ISOLATION CONDENSER**
Component :	**HEAT EXCHANGER**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8522320	0.9628000	0.9843830	0.9999320	1.0000000	1.1246E+01	4.3452E-01
2	7.00E-05	3.72E-02	1.56E-02	1.48E-01	0.00E+00	4.3452E-01	1.1246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9010680	0.9652240	0.9744830	0.9976820	1.0000000	3.0555E+01	1.1009E+00
2	8.43E-04	2.63E-02	1.72E-02	8.30E-02	0.00E+00	8.3366E-01	3.0822E+01
3	2.98E-07	8.44E-03	1.71E-03	4.00E-02	0.00E+00	2.6722E-01	3.1389E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9095820	0.9621340	0.9682530	0.9937390	1.0000000	4.7136E+01	1.8551E+00
2	2.09E-03	2.51E-02	1.89E-02	6.90E-02	0.00E+00	1.2281E+00	4.7763E+01
3	9.32E-06	8.25E-03	3.07E-03	3.41E-02	0.00E+00	4.0431E-01	4.8587E+01
4	1.97E-08	4.55E-03	6.24E-04	2.28E-02	0.00E+00	2.2267E-01	4.8768E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**ISOLATION CONDENSER**
Component :	**HEAT EXCHANGER**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

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 Plugged or Failure to Transfer Heat

ALPHA FACTOR DISTRIBUTIONS

System :	**Component Cooling Water**
Component :	**HEAT EXCHANGER**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1997/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8859520	0.9696810	0.9854280	0.9998650	0.9877550	1.6296E+01	5.0952E-01
2	1.38E-04	3.03E-02	1.46E-02	1.14E-01	1.22E-02	5.0952E-01	1.6296E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9119680	0.9672670	0.9747540	0.9969360	0.9779920	3.8443E+01	1.3009E+00
2	1.42E-03	2.57E-02	1.83E-02	7.54E-02	2.06E-02	1.0212E+00	3.8723E+01
3	3.93E-07	7.04E-03	1.55E-03	3.29E-02	1.38E-03	2.7972E-01	3.9464E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9167730	0.9632430	0.9682780	0.9924840	0.9708330	5.7786E+01	2.2051E+00
2	3.14E-03	2.55E-02	2.04E-02	6.51E-02	2.50E-02	1.5281E+00	5.8463E+01
3	1.77E-05	7.57E-03	3.18E-03	3.00E-02	4.17E-03	4.5431E-01	5.9537E+01
4	1.60E-08	3.71E-03	5.09E-04	1.86E-02	0.00E+00	2.2267E-01	5.9768E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**Component Cooling Water**
Component :	**HEAT EXCHANGER**
Failure Mode :	**NO FLOW/PLUGGED**
Start Date :	**1997/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 14
Total Number of Common-Cause Failure Events: 1

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.9877550	0.9779920	0.9708330
2	1.22E-02	2.06E-02	2.50E-02
3		1.38E-03	4.17E-03
4			0.00E+00

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.88E-01	9.78E-01	9.71E-01
Beta	1.22E-02	2.20E-02	2.92E-02
Gamma		6.25E-02	1.43E-01
Delta			0.00E+00

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	5.60	8.40	11.20
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 and Relief Valves

2.8.1.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

Component :	**SAFETY VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9288260	0.9805330	0.9900550	0.9998640	0.9930830	2.8178E+01	5.5942E-01
2	1.37E-04	1.95E-02	9.94E-03	7.12E-02	6.92E-03	5.5942E-01	2.8178E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9343460	0.9747580	0.9800280	0.9971380	0.9869110	5.6118E+01	1.4532E+00
2	1.54E-03	2.04E-02	1.52E-02	5.72E-02	1.27E-02	1.1748E+00	5.6396E+01
3	2.57E-07	4.84E-03	1.05E-03	2.26E-02	4.16E-04	2.7842E-01	5.7293E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9343560	0.9699240	0.9735940	0.9929430	0.9814660	8.1144E+01	2.5162E+00
2	3.59E-03	2.21E-02	1.84E-02	5.32E-02	1.73E-02	1.8463E+00	8.1814E+01
3	1.12E-05	5.34E-03	2.20E-03	2.13E-02	1.18E-03	4.4641E-01	8.3214E+01
4	1.20E-08	2.67E-03	3.68E-04	1.34E-02	2.24E-05	2.2347E-01	8.3437E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9411910	0.9682560	0.9703990	0.9879900	0.9766780	1.3946E+02	4.5722E+00
2	5.91E-03	2.12E-02	1.90E-02	4.38E-02	2.10E-02	3.0468E+00	1.4099E+02
3	4.58E-04	7.46E-03	5.34E-03	2.17E-02	2.19E-03	1.0746E+00	1.4296E+02
4	1.87E-06	2.63E-03	8.96E-04	1.11E-02	9.25E-05	3.7849E-01	1.4365E+02
5	4.14E-21	5.02E-04	2.83E-07	2.90E-03	0.00E+00	7.2277E-02	1.4396E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9422530	0.9670680	0.9688450	0.9858200	0.9724890	1.6838E+02	5.7340E+00
2	6.30E-03	2.01E-02	1.83E-02	4.01E-02	2.39E-02	3.5039E+00	1.7061E+02
3	7.15E-04	7.58E-03	5.80E-03	2.05E-02	3.37E-03	1.3202E+00	1.7279E+02
4	3.38E-05	3.47E-03	1.84E-03	1.24E-02	2.29E-04	6.0432E-01	1.7351E+02
5	5.36E-09	1.28E-03	1.73E-04	6.40E-03	1.89E-06	2.2230E-01	1.7389E+02
6	8.09E-19	4.78E-04	8.35E-07	2.79E-03	0.00E+00	8.3237E-02	1.7403E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9464280	0.9668230	0.9680540	0.9830200	0.9688560	2.4354E+02	8.3572E+00
2	7.11E-03	1.86E-02	1.73E-02	3.44E-02	2.60E-02	4.6872E+00	2.4721E+02
3	1.29E-03	7.61E-03	6.35E-03	1.82E-02	4.64E-03	1.9159E+00	2.4998E+02
4	2.16E-04	4.04E-03	2.82E-03	1.20E-02	4.51E-04	1.0166E+00	2.5088E+02
5	1.02E-05	2.07E-03	9.82E-04	7.83E-03	6.51E-06	5.2217E-01	2.5138E+02
6	2.67E-10	7.40E-04	6.31E-05	3.88E-03	0.00E+00	1.8628E-01	2.5171E+02
7	0.00E+00	1.15E-04	1.01E-13	4.34E-04	0.00E+00	2.9071E-02	2.5187E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9479820	0.9667100	0.9677540	0.9818610	0.9657230	2.8617E+02	9.8546E+00
2	7.28E-03	1.78E-02	1.67E-02	3.20E-02	2.76E-02	5.2709E+00	2.9075E+02
3	1.42E-03	7.27E-03	6.19E-03	1.68E-02	5.90E-03	2.1507E+00	2.9387E+02
4	3.16E-04	4.06E-03	3.01E-03	1.14E-02	7.75E-04	1.2006E+00	2.9482E+02
5	4.38E-05	2.40E-03	1.41E-03	8.11E-03	1.43E-05	7.0933E-01	2.9532E+02
6	7.01E-07	1.24E-03	4.06E-04	5.30E-03	0.00E+00	3.6696E-01	2.9566E+02
7	5.50E-14	4.15E-04	7.47E-06	2.36E-03	0.00E+00	1.2297E-01	2.9590E+02
8	1.03E-42	1.12E-04	1.59E-12	4.73E-04	0.00E+00	3.3124E-02	2.9599E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**SAFETY VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 108
Total Number of Common-Cause Failure Events: 29

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9930830	0.9869110	0.9814660	0.9766780	0.9724890	0.9688560	0.9657230
2	6.92E-03	1.27E-02	1.73E-02	2.10E-02	2.39E-02	2.60E-02	2.76E-02
3		4.16E-04	1.18E-03	2.19E-03	3.37E-03	4.64E-03	5.90E-03
4			2.24E-05	9.25E-05	2.29E-04	4.51E-04	7.75E-04
5				0.00E+00	1.89E-06	6.51E-06	1.43E-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	9.81E-01	9.77E-01	9.72E-01	9.69E-01	9.66E-01
Beta	6.92E-03	1.31E-02	1.85E-02	2.33E-02	2.75E-02	3.11E-02	3.43E-02
Gamma		3.18E-02	6.49E-02	9.80E-02	1.31E-01	1.64E-01	1.95E-01
Delta			1.86E-02	4.05E-02	6.40E-02	8.98E-02	1.18E-01
Epsilon				0.00E+00	8.20E-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	14.63	21.95	29.27	36.59	43.90	51.22	58.54
N_1	3.3024	4.6125	5.7383	6.7068	7.5426	8.2667	8.8975
N_2	0.1249	0.3411	0.6182	0.9326	1.2647	1.5994	1.9262
N_3		0.0112	0.0421	0.0972	0.1784	0.2847	0.4123
N_4			0.0008	0.0041	0.0121	0.0277	0.0541
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

Component :	**SAFETY VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9661660	0.9915920	0.9966210	0.9999830	1.0000000	5.1246E+01	4.3452E-01
2	1.51E-05	8.41E-03	3.38E-03	3.38E-02	0.00E+00	4.3452E-01	5.1246E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9558450	0.9846370	0.9888550	0.9989940	1.0000000	7.0555E+01	1.1009E+00
2	3.66E-04	1.16E-02	7.51E-03	3.70E-02	0.00E+00	8.3366E-01	7.0822E+01
3	1.30E-07	3.73E-03	7.48E-04	1.77E-02	0.00E+00	2.6722E-01	7.1389E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9498280	0.9791540	0.9826310	0.9965960	1.0000000	8.7136E+01	1.8551E+00
2	1.14E-03	1.38E-02	1.04E-02	3.82E-02	0.00E+00	1.2281E+00	8.7763E+01
3	5.10E-06	4.54E-03	1.68E-03	1.88E-02	0.00E+00	4.0431E-01	8.8587E+01
4	1.08E-08	2.50E-03	3.42E-04	1.25E-02	0.00E+00	2.2267E-01	8.8768E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9500720	0.9748520	0.9770720	0.9920540	1.0000000	1.3716E+02	3.5382E+00
2	2.89E-03	1.50E-02	1.28E-02	3.48E-02	0.00E+00	2.1142E+00	1.3858E+02
3	3.39E-04	6.95E-03	4.79E-03	2.09E-02	0.00E+00	9.7738E-01	1.3972E+02
4	1.75E-06	2.66E-03	8.95E-04	1.13E-02	0.00E+00	3.7439E-01	1.4032E+02
5	4.24E-21	5.14E-04	2.90E-07	2.97E-03	0.00E+00	7.2277E-02	1.4063E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9502170	0.9736240	0.9755500	0.9904570	1.0000000	1.5794E+02	4.2787E+00
2	2.83E-03	1.38E-02	1.19E-02	3.14E-02	0.00E+00	2.2392E+00	1.5998E+02
3	4.95E-04	7.04E-03	5.14E-03	2.01E-02	0.00E+00	1.1418E+00	1.6108E+02
4	3.26E-05	3.65E-03	1.91E-03	1.32E-02	0.00E+00	5.9222E-01	1.6163E+02
5	5.72E-09	1.37E-03	1.86E-04	6.86E-03	0.00E+00	2.2220E-01	1.6200E+02
6	8.69E-19	5.13E-04	8.97E-07	2.99E-03	0.00E+00	8.3237E-02	1.6214E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9524010	0.9721590	0.9735110	0.9873120	1.0000000	2.2505E+02	6.4450E+00
2	3.75E-03	1.33E-02	1.20E-02	2.76E-02	0.00E+00	3.0878E+00	2.2841E+02
3	9.49E-04	7.05E-03	5.69E-03	1.78E-02	0.00E+00	1.6312E+00	2.2986E+02
4	2.14E-04	4.27E-03	2.96E-03	1.28E-02	0.00E+00	9.8887E-01	2.3051E+02
5	1.11E-05	2.25E-03	1.07E-03	8.52E-03	0.00E+00	5.2177E-01	2.3097E+02
6	2.90E-10	8.05E-04	6.87E-05	4.22E-03	0.00E+00	1.8628E-01	2.3131E+02
7	0.00E+00	1.26E-04	1.10E-13	4.73E-04	0.00E+00	2.9071E-02	2.3147E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9537680	0.9720760	0.9732440	0.9863880	1.0000000	2.5973E+02	7.4610E+00
2	3.76E-03	1.25E-02	1.13E-02	2.54E-02	0.00E+00	3.3447E+00	2.6385E+02
3	9.62E-04	6.51E-03	5.32E-03	1.61E-02	0.00E+00	1.7384E+00	2.6545E+02
4	3.04E-04	4.29E-03	3.14E-03	1.22E-02	0.00E+00	1.1465E+00	2.6604E+02
5	4.82E-05	2.65E-03	1.56E-03	8.97E-03	0.00E+00	7.0833E-01	2.6648E+02
6	7.77E-07	1.37E-03	4.50E-04	5.88E-03	0.00E+00	3.6696E-01	2.6682E+02
7	6.09E-14	4.60E-04	8.27E-06	2.62E-03	0.00E+00	1.2297E-01	2.6707E+02
8	1.14E-42	1.24E-04	1.77E-12	5.24E-04	0.00E+00	3.3124E-02	2.6716E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**SAFETY VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**MAIN STEAM**
Component :	**SAFETY VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9196470	0.9781760	0.9890110	0.9998580	0.9921830	2.4513E+01	5.4692E-01
2	1.39E-04	2.18E-02	1.10E-02	8.04E-02	7.82E-03	5.4692E-01	2.4513E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9287150	0.9728020	0.9786010	0.9970460	0.9852790	5.0651E+01	1.4161E+00
2	1.55E-03	2.19E-02	1.61E-02	6.19E-02	1.42E-02	1.1378E+00	5.0929E+01
3	2.83E-07	5.35E-03	1.16E-03	2.50E-02	5.18E-04	2.7832E-01	5.1789E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9295950	0.9679940	0.9719920	0.9927040	0.9792470	7.3900E+01	2.4435E+00
2	3.58E-03	2.32E-02	1.92E-02	5.67E-02	1.93E-02	1.7747E+00	7.4569E+01
3	1.21E-05	5.83E-03	2.40E-03	2.33E-02	1.45E-03	4.4531E-01	7.5898E+01
4	1.32E-08	2.93E-03	4.04E-04	1.46E-02	2.82E-05	2.2347E-01	7.6120E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9384630	0.9669910	0.9692730	0.9877090	0.9740110	1.3046E+02	4.4534E+00
2	5.87E-03	2.17E-02	1.94E-02	4.55E-02	2.32E-02	2.9309E+00	1.3198E+02
3	4.85E-04	7.94E-03	5.68E-03	2.31E-02	2.68E-03	1.0717E+00	1.3384E+02
4	1.99E-06	2.81E-03	9.57E-04	1.19E-02	1.16E-04	3.7849E-01	1.3453E+02
5	4.42E-21	5.36E-04	3.03E-07	3.10E-03	0.00E+00	7.2277E-02	1.3484E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9398690	0.9659410	0.9678260	0.9855670	0.9695130	1.5766E+02	5.5591E+00
2	6.15E-03	2.04E-02	1.85E-02	4.13E-02	2.61E-02	3.3349E+00	1.5988E+02
3	7.53E-04	8.05E-03	6.15E-03	2.19E-02	4.11E-03	1.3144E+00	1.6190E+02
4	3.61E-05	3.70E-03	1.97E-03	1.33E-02	2.86E-04	6.0422E-01	1.6261E+02
5	5.72E-09	1.36E-03	1.85E-04	6.82E-03	2.38E-06	2.2230E-01	1.6300E+02
6	8.63E-19	5.10E-04	8.91E-07	2.98E-03	0.00E+00	8.3237E-02	1.6314E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9448970	0.9660700	0.9673600	0.9828350	0.9656890	2.3110E+02	8.1166E+00
2	6.90E-03	1.86E-02	1.73E-02	3.49E-02	2.81E-02	4.4570E+00	2.3476E+02
3	1.34E-03	7.97E-03	6.64E-03	1.91E-02	5.64E-03	1.9058E+00	2.3731E+02
4	2.28E-04	4.25E-03	2.97E-03	1.26E-02	5.62E-04	1.0163E+00	2.3820E+02
5	1.08E-05	2.18E-03	1.03E-03	8.25E-03	8.21E-06	5.2217E-01	2.3869E+02
6	2.81E-10	7.79E-04	6.65E-05	4.09E-03	0.00E+00	1.8628E-01	2.3903E+02
7	0.00E+00	1.22E-04	1.06E-13	4.57E-04	0.00E+00	2.9071E-02	2.3919E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9467350	0.9661190	0.9672210	0.9817570	0.9624630	2.7202E+02	9.5395E+00
2	6.99E-03	1.77E-02	1.65E-02	3.22E-02	2.94E-02	4.9721E+00	2.7659E+02
3	1.47E-03	7.58E-03	6.45E-03	1.76E-02	7.16E-03	2.1348E+00	2.7942E+02
4	3.32E-04	4.26E-03	3.16E-03	1.20E-02	9.70E-04	1.2002E+00	2.8036E+02
5	4.61E-05	2.52E-03	1.48E-03	8.52E-03	1.81E-05	7.0933E-01	2.8085E+02
6	7.37E-07	1.30E-03	4.27E-04	5.58E-03	0.00E+00	3.6696E-01	2.8119E+02
7	5.78E-14	4.37E-04	7.85E-06	2.49E-03	0.00E+00	1.2297E-01	2.8144E+02
8	1.08E-42	1.18E-04	1.68E-12	4.97E-04	0.00E+00	3.3124E-02	2.8153E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**MAIN STEAM**
Component :	**SAFETY VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 94
Total Number of Common-Cause Failure Events: 25

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9921830	0.9852790	0.9792470	0.9740110	0.9695130	0.9656890	0.9624630
2	7.82E-03	1.42E-02	1.93E-02	2.32E-02	2.61E-02	2.81E-02	2.94E-02
3		5.18E-04	1.45E-03	2.68E-03	4.11E-03	5.64E-03	7.16E-03
4			2.82E-05	1.16E-04	2.86E-04	5.62E-04	9.70E-04
5				0.00E+00	2.38E-06	8.21E-06	1.81E-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	9.85E-01	9.79E-01	9.74E-01	9.70E-01	9.66E-01	9.62E-01
Beta	7.82E-03	1.47E-02	2.08E-02	2.60E-02	3.05E-02	3.43E-02	3.75E-02
Gamma		3.52E-02	7.10E-02	1.08E-01	1.44E-01	1.81E-01	2.17E-01
Delta			1.91E-02	4.17E-02	6.55E-02	9.19E-02	1.21E-01
Epsilon				0.00E+00	8.26E-03	1.44E-02	1.83E-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	11.90	17.85	23.80	29.75	35.70	41.65	47.59
N_1	2.3668	3.2461	3.9637	4.5462	5.0172	5.3970	5.7030
N_2	0.1124	0.3041	0.5466	0.8167	1.0957	1.3692	1.6274
N_3		0.0111	0.0410	0.0943	0.1726	0.2746	0.3964
N_4			0.0008	0.0041	0.0120	0.0274	0.0537
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

2.8.3 BWR Safety Relief Valves

2.8.3.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

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 :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9367310	0.9806500	0.9879870	0.9995370	0.9886010	3.8579E+01	7.6122E-01
2	4.61E-04	1.93E-02	1.20E-02	6.33E-02	1.14E-02	7.6122E-01	3.8579E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9359640	0.9726720	0.9768600	0.9950570	0.9788580	7.1200E+01	2.0004E+00
2	3.33E-03	2.31E-02	1.89E-02	5.73E-02	2.02E-02	1.6928E+00	7.1508E+01
3	5.70E-07	4.20E-03	1.08E-03	1.91E-02	9.50E-04	3.0762E-01	7.2893E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9333120	0.9664050	0.9693490	0.9894240	0.9707310	1.0066E+02	3.4992E+00
2	6.59E-03	2.61E-02	2.31E-02	5.58E-02	2.65E-02	2.7174E+00	1.0144E+02
3	3.62E-05	5.35E-03	2.68E-03	1.97E-02	2.71E-03	5.5681E-01	1.0360E+02
4	1.06E-08	2.16E-03	3.02E-04	1.08E-02	4.09E-05	2.2497E-01	1.0393E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9383270	0.9643870	0.9662010	0.9842500	0.9642100	1.6327E+02	6.0292E+00
2	8.97E-03	2.50E-02	2.32E-02	4.73E-02	3.04E-02	4.2327E+00	1.6507E+02
3	7.67E-04	7.91E-03	6.08E-03	2.13E-02	5.20E-03	1.3396E+00	1.6796E+02
4	1.79E-06	2.27E-03	7.88E-04	9.56E-03	1.42E-04	3.8429E-01	1.6891E+02
5	4.18E-21	4.29E-04	2.51E-07	2.48E-03	4.31E-06	7.2577E-02	1.6923E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9383810	0.9624850	0.9639900	0.9814520	0.9592380	1.9641E+02	7.6556E+00
2	9.44E-03	2.40E-02	2.25E-02	4.38E-02	3.21E-02	4.8986E+00	1.9917E+02
3	1.43E-03	8.98E-03	7.43E-03	2.18E-02	8.33E-03	1.8316E+00	2.0223E+02
4	3.26E-05	3.03E-03	1.63E-03	1.08E-02	3.16E-04	6.1842E-01	2.0345E+02
5	4.98E-09	1.10E-03	1.51E-04	5.48E-03	1.81E-05	2.2370E-01	2.0384E+02
6	6.90E-19	4.08E-04	7.13E-07	2.38E-03	0.00E+00	8.3237E-02	2.0398E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9426440	0.9626890	0.9637650	0.9790700	0.9557820	2.7575E+02	1.0687E+01
2	9.47E-03	2.14E-02	2.03E-02	3.70E-02	3.16E-02	6.1180E+00	2.8032E+02
3	2.49E-03	9.72E-03	8.61E-03	2.08E-02	1.20E-02	2.7848E+00	2.8365E+02
4	2.07E-04	3.64E-03	2.57E-03	1.07E-02	5.60E-04	1.0426E+00	2.8539E+02
5	9.42E-06	1.84E-03	8.75E-04	6.92E-03	4.69E-05	5.2627E-01	2.8591E+02
6	2.39E-10	6.51E-04	5.57E-05	3.42E-03	2.08E-06	1.8648E-01	2.8625E+02
7	0.00E+00	1.01E-04	8.88E-14	3.82E-04	0.00E+00	2.9071E-02	2.8641E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9444390	0.9628380	0.9637530	0.9780990	0.9541650	3.2267E+02	1.2454E+01
2	8.80E-03	1.93E-02	1.84E-02	3.31E-02	2.87E-02	6.4742E+00	3.2865E+02
3	3.21E-03	1.04E-02	9.41E-03	2.08E-02	1.59E-02	3.4755E+00	3.3165E+02
4	3.24E-04	3.76E-03	2.84E-03	1.04E-02	1.06E-03	1.2616E+00	3.3386E+02
5	4.11E-05	2.15E-03	1.27E-03	7.22E-03	9.73E-05	7.1893E-01	3.3441E+02
6	6.29E-07	1.10E-03	3.60E-04	4.69E-03	6.43E-06	3.6766E-01	3.3476E+02
7	4.86E-14	3.67E-04	6.59E-06	2.09E-03	0.00E+00	1.2297E-01	3.3500E+02
8	9.09E-43	9.88E-05	1.41E-12	4.18E-04	0.00E+00	3.3124E-02	3.3509E+02

ALPHA FACTOR and MGL PARAMETERS

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 :	**2005/12/31**

Total Number of Independent Failure Events: 138
Total Number of Common-Cause Failure Events: 23

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9886010	0.9788580	0.9707310	0.9642100	0.9592380	0.9557820	0.9541650
2	1.14E-02	2.02E-02	2.65E-02	3.04E-02	3.21E-02	3.16E-02	2.87E-02
3		9.50E-04	2.71E-03	5.20E-03	8.33E-03	1.20E-02	1.59E-02
4			4.09E-05	1.42E-04	3.16E-04	5.60E-04	1.06E-03
5				4.31E-06	1.81E-05	4.69E-05	9.73E-05
6					0.00E+00	2.08E-06	6.43E-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	9.89E-01	9.79E-01	9.71E-01	9.64E-01	9.59E-01	9.56E-01	9.54E-01
Beta	1.14E-02	2.11E-02	2.93E-02	3.58E-02	4.08E-02	4.42E-02	4.58E-02
Gamma		4.49E-02	9.42E-02	1.50E-01	2.12E-01	2.86E-01	3.73E-01
Delta			1.49E-02	2.74E-02	3.86E-02	4.82E-02	6.78E-02
Epsilon				2.94E-02	5.42E-02	8.05E-02	8.94E-02
Mu					0.00E+00	4.26E-02	6.19E-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	24.23	36.35	48.46	60.58	72.70	84.81	96.93
N_1	4.1029	5.2952	6.0674	6.5258	6.7678	6.8862	7.0119
N_2	0.3267	0.8591	1.4893	2.1185	2.6594	3.0302	3.1295
N_3		0.0404	0.1525	0.3622	0.6898	1.1536	1.7371
N_4			0.0023	0.0099	0.0262	0.0537	0.1151
N_5				0.0003	0.0015	0.0045	0.0106
N_6					0.0000	0.0002	0.0007
N_7						0.0000	0.0000
N_8							0.0000

2.8.3.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

Component :	**RELIEF VALVE: AIR OR NITROGEN OPERATED RELIEF VALVE: SOLENOID OPERATED**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8815610	0.9695640	0.9865170	0.9999180	0.9935210	1.4785E+01	4.6412E-01
2	8.35E-05	3.04E-02	1.35E-02	1.18E-01	6.48E-03	4.6412E-01	1.4785E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9121150	0.9683610	0.9762700	0.9975340	0.9875930	3.6281E+01	1.1854E+00
2	1.02E-03	2.44E-02	1.66E-02	7.46E-02	1.21E-02	9.1596E-01	3.6550E+01
3	2.75E-07	7.19E-03	1.48E-03	3.40E-02	3.23E-04	2.6942E-01	3.7197E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9176610	0.9646490	0.9699420	0.9935080	0.9822090	5.5003E+01	2.0157E+00
2	2.51E-03	2.42E-02	1.89E-02	6.41E-02	1.68E-02	1.3802E+00	5.5638E+01
3	9.34E-06	7.24E-03	2.75E-03	2.97E-02	9.31E-04	4.1271E-01	5.6606E+01
4	1.70E-08	3.91E-03	5.36E-04	1.96E-02	1.11E-05	2.2277E-01	5.6796E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9335900	0.9658110	0.9685790	0.9885710	0.9773540	1.0713E+02	3.7923E+00
2	4.60E-03	2.12E-02	1.84E-02	4.73E-02	2.08E-02	2.3478E+00	1.0857E+02
3	4.62E-04	8.99E-03	6.26E-03	2.68E-02	1.78E-03	9.9738E-01	1.0992E+02
4	2.24E-06	3.38E-03	1.14E-03	1.43E-02	4.46E-05	3.7489E-01	1.1055E+02
5	5.38E-21	6.52E-04	3.68E-07	3.77E-03	0.00E+00	7.2277E-02	1.1085E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9364320	0.9655320	0.9678120	0.9868250	0.9730350	1.2998E+02	4.6401E+00
2	4.52E-03	1.90E-02	1.67E-02	4.15E-02	2.40E-02	2.5611E+00	1.3206E+02
3	6.62E-04	8.76E-03	6.48E-03	2.47E-02	2.84E-03	1.1799E+00	1.3344E+02
4	3.98E-05	4.41E-03	2.31E-03	1.59E-02	1.04E-04	5.9362E-01	1.3403E+02
5	6.90E-09	1.65E-03	2.24E-04	8.27E-03	0.00E+00	2.2220E-01	1.3440E+02
6	1.05E-18	6.18E-04	1.08E-06	3.61E-03	0.00E+00	8.3237E-02	1.3454E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9435460	0.9663960	0.9678970	0.9841280	0.9691920	1.9913E+02	6.9242E+00
2	5.30E-03	1.70E-02	1.54E-02	3.39E-02	2.65E-02	3.5003E+00	2.0255E+02
3	1.17E-03	8.22E-03	6.70E-03	2.05E-02	4.08E-03	1.6947E+00	2.0436E+02
4	2.43E-04	4.81E-03	3.34E-03	1.44E-02	2.06E-04	9.9207E-01	2.0506E+02
5	1.24E-05	2.53E-03	1.20E-03	9.57E-03	0.00E+00	5.2177E-01	2.0553E+02
6	3.26E-10	9.04E-04	7.72E-05	4.75E-03	0.00E+00	1.8628E-01	2.0587E+02
7	0.00E+00	1.41E-04	1.24E-13	5.31E-04	0.00E+00	2.9071E-02	2.0603E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9462070	0.9669270	0.9681990	0.9833160	0.9658150	2.3581E+02	8.0657E+00
2	5.28E-03	1.58E-02	1.45E-02	3.07E-02	2.84E-02	3.8465E+00	2.4003E+02
3	1.20E-03	7.52E-03	6.23E-03	1.83E-02	5.46E-03	1.8350E+00	2.4204E+02
4	3.38E-04	4.73E-03	3.46E-03	1.34E-02	3.51E-04	1.1527E+00	2.4272E+02
5	5.29E-05	2.90E-03	1.71E-03	9.83E-03	5.65E-06	7.0843E-01	2.4317E+02
6	8.52E-07	1.50E-03	4.93E-04	6.44E-03	0.00E+00	3.6696E-01	2.4351E+02
7	6.68E-14	5.04E-04	9.07E-06	2.87E-03	0.00E+00	1.2297E-01	2.4375E+02
8	1.25E-42	1.36E-04	1.94E-12	5.74E-04	0.00E+00	3.3124E-02	2.4384E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**RELIEF VALVE: AIR OR NITROGEN OPERATED RELIEF VALVE: SOLENOID OPERATED**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9935210	0.9875930	0.9822090	0.9773540	0.9730350	0.9691920	0.9658150
2	6.48E-03	1.21E-02	1.68E-02	2.08E-02	2.40E-02	2.65E-02	2.84E-02
3		3.23E-04	9.31E-04	1.78E-03	2.84E-03	4.08E-03	5.46E-03
4			1.11E-05	4.46E-05	1.04E-04	2.06E-04	3.51E-04
5				0.00E+00	0.00E+00	0.00E+00	5.65E-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	9.94E-01	9.88E-01	9.82E-01	9.77E-01	9.73E-01	9.69E-01	9.66E-01
Beta	6.48E-03	1.24E-02	1.78E-02	2.26E-02	2.70E-02	3.08E-02	3.42E-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	4.18	6.27	8.36	10.45	12.55	14.64	16.73
N_1	0.3589	0.4560	0.5066	0.5164	0.4910	0.4353	0.3541
N_2	0.0296	0.0823	0.1521	0.2336	0.3219	0.4125	0.5018
N_3		0.0022	0.0084	0.0200	0.0381	0.0635	0.0966
N_4			0.0001	0.0005	0.0014	0.0032	0.0062
N_5				0.0000	0.0000	0.0000	0.0001
N_6					0.0000	0.0000	0.0000
N_7						0.0000	0.0000
N_8							0.0000

2.8.4 PWR Pressurizer Safety Valve

2.8.4.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**REACTOR COOLANT**
Component :	**SAFETY VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9116630	0.9779210	0.9909360	0.9999560	1.0000000	1.9246E+01	4.3452E-01
2	4.05E-05	2.21E-02	9.06E-03	8.83E-02	0.00E+00	4.3452E-01	1.9246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9207320	0.9722390	0.9797180	0.9981670	1.0000000	3.8555E+01	1.1009E+00
2	6.69E-04	2.10E-02	1.37E-02	6.65E-02	0.00E+00	8.3366E-01	3.8822E+01
3	2.37E-07	6.74E-03	1.36E-03	3.20E-02	0.00E+00	2.6722E-01	3.9389E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9220800	0.9674500	0.9727570	0.9946390	1.0000000	5.5136E+01	1.8551E+00
2	1.79E-03	2.15E-02	1.63E-02	5.94E-02	0.00E+00	1.2281E+00	5.5763E+01
3	8.00E-06	7.09E-03	2.63E-03	2.93E-02	0.00E+00	4.0431E-01	5.6587E+01
4	1.69E-08	3.91E-03	5.36E-04	1.96E-02	0.00E+00	2.2267E-01	5.6768E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**REACTOR COOLANT**
Component :	**SAFETY VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 9
Total Number of Common-Cause Failure Events: 0

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	9.00	9.00	9.00
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	REACTOR COOLANT
Component :	SAFETY VALVE
Failure Mode :	FAIL TO CLOSE (NORMALLY OPEN)
Plant Type :	PWR
Start Date :	1991/01/01
Data Version :	2005/12/31

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8734960	0.9682380	0.9867710	0.9999360	1.0000000	1.3246E+01	4.3452E-01
2	5.92E-05	3.18E-02	1.32E-02	1.27E-01	0.00E+00	4.3452E-01	1.3246E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9068390	0.9672900	0.9760300	0.9978250	1.0000000	3.2555E+01	1.1009E+00
2	7.91E-04	2.48E-02	1.62E-02	7.82E-02	0.00E+00	8.3366E-01	3.2822E+01
3	2.80E-07	7.94E-03	1.61E-03	3.77E-02	0.00E+00	2.6722E-01	3.3389E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9130680	0.9636200	0.9695110	0.9939910	1.0000000	4.9136E+01	1.8551E+00
2	2.00E-03	2.41E-02	1.82E-02	6.63E-02	0.00E+00	1.2281E+00	4.9763E+01
3	8.95E-06	7.93E-03	2.95E-03	3.27E-02	0.00E+00	4.0431E-01	5.0587E+01
4	1.89E-08	4.37E-03	5.99E-04	2.19E-02	0.00E+00	2.2267E-01	5.0768E+01

ALPHA FACTOR and MGL PARAMETERS

System :	**REACTOR COOLANT**
Component :	**SAFETY VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

Component :	**RELIEF VALVE: AIR OR NITROGEN OPERATED** **RELIEF VALVE: SOLENOID OPERATED** **RELIEF VALVE: MOTOR OPERATED** **RELIEF VALVE: HYDRAULIC OPERATOR**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9152080	0.9470670	0.9489200	0.9725850	0.9461900	1.5161E+02	8.4737E+00
2	2.74E-02	5.29E-02	5.11E-02	8.48E-02	5.38E-02	8.4737E+00	1.5161E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9109480	0.9379660	0.9391410	0.9609670	0.9342740	2.3226E+02	1.5361E+01
2	2.88E-02	4.91E-02	4.79E-02	7.36E-02	5.22E-02	1.2165E+01	2.3546E+02
3	3.74E-03	1.29E-02	1.16E-02	2.65E-02	1.35E-02	3.1958E+00	2.4443E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9209750	0.9432520	0.9441390	0.9624930	0.9401890	3.1280E+02	1.8819E+01
2	1.65E-02	3.02E-02	2.93E-02	4.71E-02	3.10E-02	1.0021E+01	3.2160E+02
3	1.05E-02	2.19E-02	2.10E-02	3.65E-02	2.42E-02	7.2652E+00	3.2435E+02
4	5.63E-04	4.62E-03	3.67E-03	1.19E-02	4.62E-03	1.5325E+00	3.3009E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9309720	0.9490760	0.9497430	0.9649100	0.9446760	4.2651E+02	2.2885E+01
2	1.25E-02	2.28E-02	2.21E-02	3.54E-02	2.32E-02	1.0227E+01	4.3917E+02
3	7.91E-03	1.64E-02	1.57E-02	2.73E-02	1.83E-02	7.3652E+00	4.4203E+02
4	3.80E-03	1.02E-02	9.44E-03	1.90E-02	1.20E-02	4.5626E+00	4.4483E+02
5	3.29E-05	1.63E-03	9.71E-04	5.44E-03	1.88E-03	7.3028E-01	4.4866E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9355160	0.9516380	0.9522010	0.9658460	0.9478260	5.1058E+02	2.5947E+01
2	1.08E-02	1.94E-02	1.88E-02	3.01E-02	1.97E-02	1.0426E+01	5.2610E+02
3	5.88E-03	1.27E-02	1.21E-02	2.15E-02	1.36E-02	6.7923E+00	5.2974E+02
4	4.34E-03	1.03E-02	9.74E-03	1.84E-02	1.19E-02	5.5476E+00	5.3098E+02
5	1.31E-03	5.16E-03	4.56E-03	1.11E-02	6.13E-03	2.7671E+00	5.3376E+02
6	1.01E-06	7.72E-04	2.92E-04	3.17E-03	7.97E-04	4.1444E-01	5.3611E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9408630	0.9547730	0.9552270	0.9671470	0.9502560	6.4069E+02	3.0349E+01
2	9.96E-03	1.74E-02	1.69E-02	2.64E-02	1.78E-02	1.1646E+01	6.5939E+02
3	4.74E-03	1.02E-02	9.70E-03	1.73E-02	1.08E-02	6.8342E+00	6.6420E+02
4	3.63E-03	8.52E-03	8.03E-03	1.51E-02	9.83E-03	5.7148E+00	6.6532E+02
5	2.26E-03	6.33E-03	5.85E-03	1.21E-02	7.76E-03	4.2489E+00	6.6679E+02
6	3.66E-04	2.55E-03	2.07E-03	6.35E-03	3.17E-03	1.7091E+00	6.6933E+02
7	2.23E-10	2.92E-04	2.87E-05	1.51E-03	3.47E-04	1.9597E-01	6.7084E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9439660	0.9566540	0.9570500	0.9679930	0.9523590	7.3822E+02	3.3449E+01
2	9.28E-03	1.59E-02	1.55E-02	2.40E-02	1.64E-02	1.2273E+01	7.5940E+02
3	4.18E-03	8.93E-03	8.51E-03	1.51E-02	9.45E-03	6.8944E+00	7.6477E+02
4	2.80E-03	6.86E-03	6.44E-03	1.24E-02	7.60E-03	5.2929E+00	7.6638E+02
5	2.42E-03	6.25E-03	5.83E-03	1.15E-02	7.55E-03	4.8257E+00	7.6684E+02
6	1.08E-03	3.91E-03	3.50E-03	8.19E-03	4.86E-03	3.0207E+00	7.6865E+02
7	7.24E-05	1.33E-03	9.30E-04	3.94E-03	1.65E-03	1.0248E+00	7.7064E+02
8	6.49E-15	1.52E-04	2.17E-06	8.70E-04	1.54E-04	1.1732E-01	7.7155E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**RELIEF VALVE: AIR OR NITROGEN OPERATED** **RELIEF VALVE: SOLENOID OPERATED** **RELIEF VALVE: MOTOR OPERATED** **RELIEF VALVE: HYDRAULIC OPERATOR**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 415
Total Number of Common-Cause Failure Events: 53

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9461900	0.9342740	0.9401890	0.9446760	0.9478260	0.9502560	0.9523590
2	5.38E-02	5.22E-02	3.10E-02	2.32E-02	1.97E-02	1.78E-02	1.64E-02
3		1.35E-02	2.42E-02	1.83E-02	1.36E-02	1.08E-02	9.45E-03
4			4.62E-03	1.20E-02	1.19E-02	9.83E-03	7.60E-03
5				1.88E-03	6.13E-03	7.76E-03	7.55E-03
6					7.97E-04	3.17E-03	4.86E-03
7						3.47E-04	1.65E-03
8							1.54E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.46E-01	9.34E-01	9.40E-01	9.45E-01	9.48E-01	9.50E-01	9.52E-01
Beta	5.38E-02	6.57E-02	5.98E-02	5.53E-02	5.22E-02	4.97E-02	4.76E-02
Gamma		2.05E-01	4.82E-01	5.81E-01	6.22E-01	6.42E-01	6.56E-01
Delta			1.60E-01	4.31E-01	5.81E-01	6.61E-01	6.98E-01
Epsilon				1.36E-01	3.67E-01	5.34E-01	6.52E-01
Mu					1.15E-01	3.12E-01	4.69E-01
Upsilon						9.88E-02	2.71E-01
Sigma							8.54E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	123.15	184.72	246.29	307.86	369.44	431.01	492.58
N_1	18.2113	17.9853	20.3753	22.4909	24.2029	25.6284	26.9090
N_2	8.0392	11.3316	8.7934	8.1127	8.1865	8.5584	8.9278
N_3		2.9286	6.8609	6.3878	5.6505	5.2030	5.1560
N_4			1.3098	4.1882	4.9554	4.7259	4.1464
N_5				0.6580	2.5449	3.7271	4.1174
N_6					0.3312	1.5228	2.6537
N_7						0.1669	0.9018
N_8							0.0842

2.9.1.2 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

Component :	**RELIEF VALVE: AIR OR NITROGEN OPERATED** **RELIEF VALVE: SOLENOID OPERATED** **RELIEF VALVE: MOTOR OPERATED** **RELIEF VALVE: HYDRAULIC OPERATOR**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8988690	0.9607470	0.9686840	0.9954360	0.9613200	3.5835E+01	1.4641E+00
2	4.56E-03	3.93E-02	3.13E-02	1.01E-01	3.87E-02	1.4641E+00	3.5835E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9289930	0.9688000	0.9731570	0.9937030	0.9724680	6.7861E+01	2.1854E+00
2	2.18E-03	2.02E-02	1.59E-02	5.32E-02	1.48E-02	1.4160E+00	6.8630E+01
3	2.68E-04	1.10E-02	6.81E-03	3.59E-02	1.27E-02	7.6942E-01	6.9277E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9376140	0.9698790	0.9729580	0.9916210	0.9777350	9.7103E+01	3.0157E+00
2	2.21E-03	1.63E-02	1.32E-02	4.09E-02	7.71E-03	1.6302E+00	9.8488E+01
3	3.72E-04	9.12E-03	6.12E-03	2.81E-02	9.75E-03	9.1271E-01	9.9206E+01
4	1.38E-05	4.72E-03	2.05E-03	1.85E-02	4.80E-03	4.7277E-01	9.9646E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9466270	0.9708760	0.9727670	0.9886730	0.9806620	1.5976E+02	4.7924E+00
2	3.43E-03	1.50E-02	1.31E-02	3.32E-02	5.53E-03	2.4728E+00	1.6208E+02
3	8.45E-04	8.34E-03	6.45E-03	2.23E-02	6.09E-03	1.3724E+00	1.6318E+02
4	1.01E-04	4.56E-03	2.77E-03	1.51E-02	5.79E-03	7.4989E-01	1.6380E+02
5	1.01E-09	1.20E-03	1.20E-04	6.20E-03	1.93E-03	1.9728E-01	1.6436E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9499840	0.9716240	0.9731940	0.9879050	0.9824430	1.9312E+02	5.6401E+00
2	3.20E-03	1.32E-02	1.16E-02	2.87E-02	4.96E-03	2.6236E+00	1.9614E+02
3	7.83E-04	7.19E-03	5.62E-03	1.90E-02	3.72E-03	1.4299E+00	1.9733E+02
4	2.32E-04	4.87E-03	3.35E-03	1.47E-02	4.85E-03	9.6862E-01	1.9779E+02
5	6.87E-06	2.38E-03	1.03E-03	9.30E-03	3.22E-03	4.7220E-01	1.9829E+02
6	3.75E-12	7.33E-04	2.74E-05	4.06E-03	8.06E-04	1.4574E-01	1.9861E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9538590	0.9717720	0.9728830	0.9858860	0.9836040	2.7280E+02	7.9243E+00
2	3.95E-03	1.26E-02	1.14E-02	2.51E-02	4.92E-03	3.5316E+00	2.7719E+02
3	1.06E-03	6.59E-03	5.46E-03	1.60E-02	2.44E-03	1.8509E+00	2.7887E+02
4	4.27E-04	4.65E-03	3.54E-03	1.27E-02	3.50E-03	1.3046E+00	2.7942E+02
5	9.29E-05	2.97E-03	1.91E-03	9.48E-03	3.46E-03	8.3427E-01	2.7989E+02
6	4.07E-07	1.22E-03	3.64E-04	5.34E-03	1.73E-03	3.4258E-01	2.8038E+02
7	5.92E-25	2.15E-04	2.17E-08	1.21E-03	3.47E-04	6.0371E-02	2.8066E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9561820	0.9724500	0.9734000	0.9854660	0.9844020	3.2000E+02	9.0657E+00
2	3.93E-03	1.17E-02	1.08E-02	2.29E-02	5.03E-03	3.8621E+00	3.2520E+02
3	9.98E-04	5.86E-03	4.89E-03	1.40E-02	1.85E-03	1.9287E+00	3.2714E+02
4	4.34E-04	4.22E-03	3.26E-03	1.13E-02	2.34E-03	1.3871E+00	3.2768E+02
5	1.68E-04	3.10E-03	2.17E-03	9.21E-03	3.04E-03	1.0209E+00	3.2804E+02
6	1.74E-05	1.83E-03	9.65E-04	6.56E-03	2.28E-03	6.0136E-01	3.2846E+02
7	2.00E-09	6.59E-04	8.40E-05	3.32E-03	9.12E-04	2.1677E-01	3.2885E+02
8	3.53E-30	1.48E-04	1.18E-09	7.81E-04	1.52E-04	4.8724E-02	3.2902E+02

ALPHA FACTOR and MGL PARAMETERS

Component :	**RELIEF VALVE: AIR OR NITROGEN OPERATED** **RELIEF VALVE: SOLENOID OPERATED** **RELIEF VALVE: MOTOR OPERATED** **RELIEF VALVE: HYDRAULIC OPERATOR**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 82
Total Number of Common-Cause Failure Events: 2

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9613200	0.9724680	0.9777350	0.9806620	0.9824430	0.9836040	0.9844020
2	3.87E-02	1.48E-02	7.71E-03	5.53E-03	4.96E-03	4.92E-03	5.03E-03
3		1.27E-02	9.75E-03	6.09E-03	3.72E-03	2.44E-03	1.85E-03
4			4.80E-03	5.79E-03	4.85E-03	3.50E-03	2.34E-03
5				1.93E-03	3.22E-03	3.46E-03	3.04E-03
6					8.06E-04	1.73E-03	2.28E-03
7						3.47E-04	9.12E-04
8							1.52E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.61E-01	9.72E-01	9.78E-01	9.81E-01	9.82E-01	9.84E-01	9.84E-01
Beta	3.87E-02	2.75E-02	2.23E-02	1.93E-02	1.76E-02	1.64E-02	1.56E-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	25.23	37.85	50.46	63.08	75.69	88.31	100.92
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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**MAIN STEAM**
Component :	**RELIEF VALVE: AIR OR NITROGEN OPERATED** **RELIEF VALVE: SOLENOID OPERATED** **RELIEF VALVE: MOTOR OPERATED** **RELIEF VALVE: HYDRAULIC OPERATOR**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9574140	0.9804360	0.9828170	0.9953280	0.9823000	1.2914E+02	2.5769E+00
2	4.67E-03	1.96E-02	1.72E-02	4.26E-02	1.77E-02	2.5769E+00	1.2914E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9486360	0.9701360	0.9716170	0.9865700	0.9711720	2.0338E+02	6.2608E+00
2	1.06E-02	2.56E-02	2.41E-02	4.57E-02	2.53E-02	5.3598E+00	2.0428E+02
3	1.68E-04	4.30E-03	2.86E-03	1.33E-02	3.54E-03	9.0102E-01	2.0874E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9522550	0.9704170	0.9715110	0.9848350	0.9722580	2.7604E+02	8.4151E+00
2	6.79E-03	1.73E-02	1.62E-02	3.16E-02	1.56E-02	4.9142E+00	2.7954E+02
3	3.07E-03	1.09E-02	9.76E-03	2.25E-02	1.14E-02	3.0959E+00	2.8136E+02
4	1.61E-06	1.42E-03	5.25E-04	5.89E-03	7.71E-04	4.0497E-01	2.8405E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9566700	0.9716440	0.9724420	0.9839000	0.9740660	3.8221E+02	1.1154E+01
2	6.11E-03	1.44E-02	1.36E-02	2.54E-02	1.21E-02	5.6590E+00	3.8771E+02
3	2.54E-03	8.49E-03	7.67E-03	1.72E-02	8.04E-03	3.3392E+00	3.9003E+02
4	8.95E-04	5.06E-03	4.25E-03	1.20E-02	5.50E-03	1.9887E+00	3.9138E+02
5	2.77E-11	4.26E-04	2.61E-05	2.29E-03	3.24E-04	1.6748E-01	3.9320E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9592870	0.9726530	0.9733160	0.9837490	0.9754010	4.5900E+02	1.2905E+01
2	5.37E-03	1.24E-02	1.17E-02	2.18E-02	1.03E-02	5.8649E+00	4.6604E+02
3	2.05E-03	6.95E-03	6.27E-03	1.42E-02	6.10E-03	3.2805E+00	4.6862E+02
4	1.14E-03	5.14E-03	4.46E-03	1.15E-02	5.22E-03	2.4235E+00	4.6948E+02
5	1.99E-04	2.55E-03	1.89E-03	7.15E-03	2.80E-03	1.2030E+00	4.7070E+02
6	2.23E-13	2.82E-04	7.26E-06	1.59E-03	1.42E-04	1.3314E-01	4.7177E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9614830	0.9731700	0.9736940	0.9830570	0.9764430	5.8198E+02	1.6045E+01
2	5.42E-03	1.16E-02	1.10E-02	1.96E-02	9.39E-03	6.9149E+00	5.9111E+02
3	1.95E-03	6.09E-03	5.55E-03	1.21E-02	4.93E-03	3.6416E+00	5.9438E+02
4	1.14E-03	4.57E-03	4.03E-03	9.83E-03	4.27E-03	2.7304E+00	5.9529E+02
5	5.40E-04	3.20E-03	2.67E-03	7.69E-03	3.42E-03	1.9158E+00	5.9611E+02
6	3.43E-05	1.32E-03	8.19E-04	4.29E-03	1.47E-03	7.8708E-01	5.9724E+02
7	3.13E-27	9.26E-05	3.59E-09	5.09E-04	6.45E-05	5.5371E-02	5.9797E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9632320	0.9739190	0.9743770	0.9830480	0.9772830	6.7242E+02	1.8007E+01
2	5.22E-03	1.08E-02	1.03E-02	1.79E-02	8.82E-03	7.4413E+00	6.8299E+02
3	1.74E-03	5.36E-03	4.89E-03	1.06E-02	4.23E-03	3.7015E+00	6.8673E+02
4	9.98E-04	3.97E-03	3.50E-03	8.54E-03	3.43E-03	2.7397E+00	6.8769E+02
5	6.29E-04	3.17E-03	2.71E-03	7.30E-03	3.19E-03	2.1890E+00	6.8824E+02
6	2.10E-04	2.02E-03	1.56E-03	5.39E-03	2.21E-03	1.3949E+00	6.8903E+02
7	2.62E-06	7.15E-04	3.22E-04	2.76E-03	7.98E-04	4.9347E-01	6.8993E+02
8	1.82E-31	6.81E-05	3.35E-10	3.54E-04	2.99E-05	4.7024E-02	6.9038E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**MAIN STEAM**
Component :	**RELIEF VALVE: AIR OR NITROGEN OPERATED** **RELIEF VALVE: SOLENOID OPERATED** **RELIEF VALVE: MOTOR OPERATED** **RELIEF VALVE: HYDRAULIC OPERATOR**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 208
Total Number of Common-Cause Failure Events: 18

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9823000	0.9711720	0.9722580	0.9740660	0.9754010	0.9764430	0.9772830
2	1.77E-02	2.53E-02	1.56E-02	1.21E-02	1.03E-02	9.39E-03	8.82E-03
3		3.54E-03	1.14E-02	8.04E-03	6.10E-03	4.93E-03	4.23E-03
4			7.71E-04	5.50E-03	5.22E-03	4.27E-03	3.43E-03
5				3.24E-04	2.80E-03	3.42E-03	3.19E-03
6					1.42E-04	1.47E-03	2.21E-03
7						6.45E-05	7.98E-04
8							2.99E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.82E-01	9.71E-01	9.72E-01	9.74E-01	9.75E-01	9.76E-01	9.77E-01
Beta	1.77E-02	2.88E-02	2.77E-02	2.59E-02	2.46E-02	2.36E-02	2.27E-02
Gamma		1.23E-01	4.38E-01	5.35E-01	5.80E-01	6.01E-01	6.12E-01
Delta			6.34E-02	4.20E-01	5.72E-01	6.52E-01	6.96E-01
Epsilon				5.57E-02	3.60E-01	5.37E-01	6.45E-01
Mu					4.84E-02	3.10E-01	4.88E-01
Upsilon						4.19E-02	2.72E-01
Sigma							3.62E-02

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	110.05	165.08	220.11	275.13	330.16	385.19	440.21
N_1	8.8485	8.7466	9.7952	10.9240	11.8963	12.7432	13.4826
N_2	2.1424	4.5261	3.6861	3.5448	3.6257	3.8271	4.0966
N_3		0.6338	2.6916	2.3618	2.1387	2.0104	1.9631
N_4			0.1823	1.6143	1.8313	1.7415	1.5932
N_5				0.0952	0.9808	1.3940	1.4807
N_6					0.0499	0.6008	1.0279
N_7						0.0263	0.3705
N_8							0.0139

2.9.2.2 Fail to Close

2.9.3 PWR Pressurizer Power Operated Relief Valves

2.9.3.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**MAIN STEAM**
Component :	**RELIEF VALVE: AIR OR NITROGEN OPERATED** **RELIEF VALVE: SOLENOID OPERATED** **RELIEF VALVE: MOTOR OPERATED** **RELIEF VALVE: HYDRAULIC OPERATOR**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED))**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8875550	0.9345420	0.9376830	0.9707750	0.9312770	8.5726E+01	6.0045E+00
2	2.92E-02	6.55E-02	6.23E-02	1.12E-01	6.87E-02	6.0045E+00	8.5726E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9015000	0.9372050	0.9391660	0.9662030	0.9301890	1.3883E+02	9.3019E+00
2	2.15E-02	4.58E-02	4.37E-02	7.70E-02	5.06E-02	6.7802E+00	1.4135E+02
3	3.97E-03	1.70E-02	1.49E-02	3.73E-02	1.92E-02	2.5217E+00	1.4561E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9192960	0.9473730	0.9488450	0.9704160	0.9430110	1.9109E+02	1.0615E+01
2	9.39E-03	2.40E-02	2.25E-02	4.40E-02	2.35E-02	4.8461E+00	1.9686E+02
3	8.08E-03	2.19E-02	2.04E-02	4.11E-02	2.61E-02	4.4210E+00	1.9728E+02
4	6.54E-04	6.68E-03	5.14E-03	1.80E-02	7.32E-03	1.3480E+00	2.0036E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**MAIN STEAM**
Component :	**RELIEF VALVE: AIR OR NITROGEN OPERATED** **RELIEF VALVE: SOLENOID OPERATED** **RELIEF VALVE: MOTOR OPERATED** **RELIEF VALVE: HYDRAULIC OPERATOR**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 79
Total Number of Common-Cause Failure Events: 12

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
1	0.9312770	0.9301890	0.9430110
2	6.87E-02	5.06E-02	2.35E-02
3		1.92E-02	2.61E-02
4			7.32E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.31E-01	9.30E-01	9.43E-01
Beta	6.87E-02	6.98E-02	5.70E-02
Gamma		2.75E-01	5.87E-01
Delta			2.19E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	70.22	105.33	140.44
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**REACTOR COOLANT**
Component :	**RELIEF VALVE: AIR OR NITROGEN OPERATED** **RELIEF VALVE: SOLENOID OPERATED** **RELIEF VALVE: MOTOR OPERATED** **RELIEF VALVE: HYDRAULIC OPERATOR**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9481780	0.9870990	0.9947740	0.9999740	1.0000000	3.3246E+01	4.3452E-01
2	2.33E-05	1.29E-02	5.22E-03	5.18E-02	0.00E+00	4.3452E-01	3.3246E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9411940	0.9794830	0.9850750	0.9986510	1.0000000	5.2555E+01	1.1009E+00
2	4.91E-04	1.55E-02	1.01E-02	4.93E-02	0.00E+00	8.3366E-01	5.2822E+01
3	1.74E-07	4.98E-03	1.00E-03	2.36E-02	0.00E+00	2.6722E-01	5.3389E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9372600	0.9738690	0.9781850	0.9957110	1.0000000	6.9136E+01	1.8551E+00
2	1.43E-03	1.73E-02	1.30E-02	4.78E-02	0.00E+00	1.2281E+00	6.9763E+01
3	6.41E-06	5.70E-03	2.11E-03	2.35E-02	0.00E+00	4.0431E-01	7.0587E+01
4	1.35E-08	3.14E-03	4.29E-04	1.57E-02	0.00E+00	2.2267E-01	7.0768E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9428260	0.9711630	0.9736890	0.9908660	1.0000000	1.1916E+02	3.5382E+00
2	3.31E-03	1.72E-02	1.47E-02	3.99E-02	0.00E+00	2.1142E+00	1.2058E+02
3	3.89E-04	7.97E-03	5.50E-03	2.40E-02	0.00E+00	9.7738E-01	1.2172E+02
4	2.00E-06	3.05E-03	1.03E-03	1.30E-02	0.00E+00	3.7439E-01	1.2232E+02
5	4.86E-21	5.89E-04	3.33E-07	3.41E-03	0.00E+00	7.2277E-02	1.2263E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9440680	0.9703320	0.9724840	0.9892500	1.0000000	1.3994E+02	4.2787E+00
2	3.19E-03	1.55E-02	1.33E-02	3.53E-02	0.00E+00	2.2392E+00	1.4198E+02
3	5.57E-04	7.92E-03	5.79E-03	2.26E-02	0.00E+00	1.1418E+00	1.4308E+02
4	3.67E-05	4.11E-03	2.15E-03	1.48E-02	0.00E+00	5.9222E-01	1.4363E+02
5	6.44E-09	1.54E-03	2.09E-04	7.72E-03	0.00E+00	2.2220E-01	1.4400E+02
6	9.77E-19	5.77E-04	1.01E-06	3.37E-03	0.00E+00	8.3237E-02	1.4414E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9484230	0.9698120	0.9712660	0.9862250	1.0000000	2.0705E+02	6.4450E+00
2	4.07E-03	1.45E-02	1.30E-02	2.99E-02	0.00E+00	3.0878E+00	2.1041E+02
3	1.03E-03	7.64E-03	6.17E-03	1.93E-02	0.00E+00	1.6312E+00	2.1186E+02
4	2.32E-04	4.63E-03	3.21E-03	1.39E-02	0.00E+00	9.8887E-01	2.1251E+02
5	1.20E-05	2.44E-03	1.16E-03	9.24E-03	0.00E+00	5.2177E-01	2.1297E+02
6	3.15E-10	8.73E-04	7.45E-05	4.58E-03	0.00E+00	1.8628E-01	2.1331E+02
7	0.00E+00	1.36E-04	1.19E-13	5.13E-04	0.00E+00	2.9071E-02	2.1347E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9504510	0.9700590	0.9713070	0.9853950	1.0000000	2.4173E+02	7.4610E+00
2	4.04E-03	1.34E-02	1.21E-02	2.72E-02	0.00E+00	3.3447E+00	2.4585E+02
3	1.03E-03	6.98E-03	5.71E-03	1.73E-02	0.00E+00	1.7384E+00	2.4745E+02
4	3.26E-04	4.60E-03	3.36E-03	1.31E-02	0.00E+00	1.1465E+00	2.4804E+02
5	5.17E-05	2.84E-03	1.67E-03	9.62E-03	0.00E+00	7.0833E-01	2.4848E+02
6	8.33E-07	1.47E-03	4.82E-04	6.30E-03	0.00E+00	3.6696E-01	2.4882E+02
7	6.53E-14	4.93E-04	8.87E-06	2.81E-03	0.00E+00	1.2297E-01	2.4907E+02
8	1.22E-42	1.33E-04	1.89E-12	5.62E-04	0.00E+00	3.3124E-02	2.4916E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**REACTOR COOLANT**
Component :	**RELIEF VALVE: AIR OR NITROGEN OPERATED** **RELIEF VALVE: SOLENOID OPERATED** **RELIEF VALVE: MOTOR OPERATED** **RELIEF VALVE: HYDRAULIC OPERATOR**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 23
Total Number of Common-Cause Failure Events: 0

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	23.00	23.00	23.00	23.00	23.00	23.00	23.00
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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**MAIN STEAM**
Component :	**AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8477100	0.9406750	0.9524560	0.9932260	0.9259260	2.2746E+01	1.4345E+00
2	6.77E-03	5.93E-02	4.75E-02	1.52E-01	7.41E-02	1.4345E+00	2.2746E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9044360	0.9583210	0.9642440	0.9919120	0.9493670	4.8305E+01	2.1009E+00
2	5.24E-04	1.65E-02	1.07E-02	5.24E-02	0.00E+00	8.3366E-01	4.9572E+01
3	2.22E-03	2.51E-02	1.92E-02	6.85E-02	5.06E-02	1.2672E+00	4.9139E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9191030	0.9614130	0.9655060	0.9897220	0.9615380	7.1136E+01	2.8551E+00
2	1.37E-03	1.66E-02	1.25E-02	4.59E-02	0.00E+00	1.2281E+00	7.2763E+01
3	6.14E-06	5.46E-03	2.02E-03	2.26E-02	0.00E+00	4.0431E-01	7.3587E+01
4	1.35E-03	1.65E-02	1.24E-02	4.58E-02	3.85E-02	1.2227E+00	7.2768E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9362140	0.9656060	0.9679370	0.9870320	0.9689920	1.2741E+02	4.5382E+00
2	3.08E-03	1.60E-02	1.36E-02	3.71E-02	0.00E+00	2.1142E+00	1.2983E+02
3	3.61E-04	7.41E-03	5.11E-03	2.23E-02	0.00E+00	9.7738E-01	1.3097E+02
4	2.39E-04	6.63E-03	4.36E-03	2.08E-02	1.55E-02	8.7439E-01	1.3107E+02
5	3.33E-05	4.34E-03	2.21E-03	1.58E-02	1.55E-02	5.7228E-01	1.3138E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9409120	0.9669500	0.9688860	0.9863860	0.9740260	1.5444E+02	5.2787E+00
2	2.88E-03	1.40E-02	1.20E-02	3.19E-02	0.00E+00	2.2392E+00	1.5748E+02
3	5.03E-04	7.15E-03	5.22E-03	2.04E-02	0.00E+00	1.1418E+00	1.5858E+02
4	1.70E-04	5.27E-03	3.40E-03	1.67E-02	6.49E-03	8.4222E-01	1.5888E+02
5	8.84E-05	4.52E-03	2.69E-03	1.52E-02	1.30E-02	7.2220E-01	1.5900E+02
6	5.58E-07	2.09E-03	6.00E-04	9.22E-03	6.49E-03	3.3324E-01	1.5939E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9476300	0.9683520	0.9696700	0.9845720	0.9776540	2.2780E+02	7.4450E+00
2	3.69E-03	1.31E-02	1.18E-02	2.72E-02	0.00E+00	3.0878E+00	2.3216E+02
3	9.34E-04	6.93E-03	5.60E-03	1.75E-02	0.00E+00	1.6312E+00	2.3361E+02
4	3.15E-04	4.74E-03	3.43E-03	1.36E-02	2.79E-03	1.1139E+00	2.3413E+02
5	1.47E-04	3.81E-03	2.53E-03	1.18E-02	8.38E-03	8.9677E-01	2.3435E+02
6	1.67E-05	2.39E-03	1.20E-03	8.78E-03	8.38E-03	5.6128E-01	2.3468E+02
7	9.68E-12	6.55E-04	3.01E-05	3.59E-03	2.79E-03	1.5407E-01	2.3509E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9508070	0.9694760	0.9705970	0.9843140	0.9803920	2.6873E+02	8.4610E+00
2	3.63E-03	1.21E-02	1.09E-02	2.44E-02	0.00E+00	3.3447E+00	2.7385E+02
3	9.27E-04	6.27E-03	5.13E-03	1.55E-02	0.00E+00	1.7384E+00	2.7545E+02
4	3.45E-04	4.36E-03	3.24E-03	1.22E-02	1.23E-03	1.2090E+00	2.7598E+02
5	1.60E-04	3.46E-03	2.36E-03	1.05E-02	4.90E-03	9.5833E-01	2.7623E+02
6	5.73E-05	2.68E-03	1.62E-03	8.91E-03	7.35E-03	7.4196E-01	2.7645E+02
7	8.57E-07	1.35E-03	4.50E-04	5.72E-03	4.90E-03	3.7297E-01	2.7682E+02
8	5.42E-17	3.45E-04	1.56E-06	2.01E-03	1.23E-03	9.5624E-02	2.7710E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**MAIN STEAM**
Component :	**AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9259260	0.9493670	0.9615380	0.9689920	0.9740260	0.9776540	0.9803920
2	7.41E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3		5.06E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4			3.85E-02	1.55E-02	6.49E-03	2.79E-03	1.23E-03
5				1.55E-02	1.30E-02	8.38E-03	4.90E-03
6					6.49E-03	8.38E-03	7.35E-03
7						2.79E-03	4.90E-03
8							1.23E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.26E-01	9.49E-01	9.62E-01	9.69E-01	9.74E-01	9.78E-01	9.80E-01
Beta	7.41E-02	5.06E-02	3.85E-02	3.10E-02	2.60E-02	2.23E-02	1.96E-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	12.50	18.75	25.00	31.25	37.50	43.75	50.00
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**MAIN STEAM**
Component :	**AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8263900	0.9026580	0.9080040	0.9606240	0.8873050	4.5222E+01	4.8767E+00
2	3.94E-02	9.73E-02	9.20E-02	1.74E-01	1.13E-01	4.8767E+00	4.5222E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8793590	0.9292100	0.9324800	0.9678940	0.9103120	8.1060E+01	6.1754E+00
2	1.13E-02	3.76E-02	3.41E-02	7.59E-02	4.33E-02	3.2822E+00	8.3953E+01
3	8.91E-03	3.32E-02	2.97E-02	6.94E-02	4.64E-02	2.8932E+00	8.4342E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8968900	0.9367200	0.9391110	0.9683910	0.9206420	1.1380E+02	7.6878E+00
2	9.02E-03	2.88E-02	2.62E-02	5.72E-02	3.08E-02	3.4946E+00	1.1799E+02
3	3.50E-03	1.78E-02	1.52E-02	4.08E-02	2.39E-02	2.1579E+00	1.1933E+02
4	3.08E-03	1.68E-02	1.42E-02	3.92E-02	2.47E-02	2.0353E+00	1.1945E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9211000	0.9495600	0.9511280	0.9726530	0.9330610	1.8048E+02	9.5871E+00
2	6.33E-03	1.94E-02	1.78E-02	3.82E-02	1.75E-02	3.6961E+00	1.8637E+02
3	3.69E-03	1.45E-02	1.28E-02	3.10E-02	1.97E-02	2.7563E+00	1.8731E+02
4	2.22E-03	1.13E-02	9.68E-03	2.62E-02	1.97E-02	2.1561E+00	1.8791E+02
5	2.51E-04	5.15E-03	3.55E-03	1.55E-02	1.00E-02	9.7858E-01	1.8909E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9291590	0.9539600	0.9552780	0.9742530	0.9418130	2.1789E+02	1.0516E+01
2	4.63E-03	1.50E-02	1.37E-02	3.02E-02	1.12E-02	3.4362E+00	2.2497E+02
3	2.87E-03	1.17E-02	1.03E-02	2.52E-02	1.42E-02	2.6633E+00	2.2574E+02
4	2.15E-03	1.01E-02	8.74E-03	2.29E-02	1.61E-02	2.3139E+00	2.2609E+02
5	8.67E-04	6.86E-03	5.48E-03	1.75E-02	1.25E-02	1.5660E+00	2.2684E+02
6	1.32E-05	2.35E-03	1.14E-03	8.79E-03	4.23E-03	5.3634E-01	2.2787E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9392640	0.9591170	0.9600850	0.9756510	0.9482840	3.0163E+02	1.2857E+01
2	4.54E-03	1.30E-02	1.20E-02	2.50E-02	8.09E-03	4.0909E+00	3.1040E+02
3	2.36E-03	9.03E-03	8.02E-03	1.92E-02	9.76E-03	2.8408E+00	3.1165E+02
4	1.90E-03	8.11E-03	7.09E-03	1.78E-02	1.26E-02	2.5496E+00	3.1194E+02
5	1.18E-03	6.47E-03	5.46E-03	1.52E-02	1.22E-02	2.0356E+00	3.1245E+02
6	2.16E-04	3.45E-03	2.47E-03	1.00E-02	7.25E-03	1.0847E+00	3.1340E+02
7	1.76E-08	8.13E-04	1.49E-04	3.91E-03	1.83E-03	2.5567E-01	3.1423E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9439600	0.9617230	0.9625610	0.9766250	0.9532180	3.5291E+02	1.4046E+01
2	4.19E-03	1.17E-02	1.08E-02	2.21E-02	6.65E-03	4.2805E+00	3.6268E+02
3	1.78E-03	7.27E-03	6.39E-03	1.57E-02	6.59E-03	2.6666E+00	3.6429E+02
4	1.55E-03	6.78E-03	5.90E-03	1.50E-02	9.52E-03	2.4865E+00	3.6447E+02
5	1.22E-03	6.03E-03	5.16E-03	1.38E-02	1.07E-02	2.2137E+00	3.6474E+02
6	5.39E-04	4.27E-03	3.41E-03	1.09E-02	8.52E-03	1.5669E+00	3.6539E+02
7	3.01E-05	1.87E-03	1.08E-03	6.40E-03	4.00E-03	6.8547E-01	3.6627E+02
8	2.23E-12	3.99E-04	1.52E-05	2.21E-03	8.05E-04	1.4642E-01	3.6681E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**MAIN STEAM**
Component :	**AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**PWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 72
Total Number of Common-Cause Failure Events: 9

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.8873050	0.9103120	0.9206420	0.9330610	0.9418130	0.9482840	0.9532180
2	1.13E-01	4.33E-02	3.08E-02	1.75E-02	1.12E-02	8.09E-03	6.65E-03
3		4.64E-02	2.39E-02	1.97E-02	1.42E-02	9.76E-03	6.59E-03
4			2.47E-02	1.97E-02	1.61E-02	1.26E-02	9.52E-03
5				1.00E-02	1.25E-02	1.22E-02	1.07E-02
6					4.23E-03	7.25E-03	8.52E-03
7						1.83E-03	4.00E-03
8							8.05E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	8.87E-01	9.10E-01	9.21E-01	9.33E-01	9.42E-01	9.48E-01	9.53E-01
Beta	1.13E-01	8.97E-02	7.94E-02	6.69E-02	5.82E-02	5.17E-02	4.68E-02
Gamma		5.17E-01	6.11E-01	7.38E-01	8.08E-01	8.44E-01	8.58E-01
Delta			5.08E-01	6.02E-01	6.98E-01	7.76E-01	8.36E-01
Epsilon				3.37E-01	5.11E-01	6.28E-01	7.16E-01
Mu					2.52E-01	4.26E-01	5.55E-01
Upsilon						2.01E-01	3.60E-01
Sigma							1.68E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
Adj. Ind. Events	33.26	49.88	66.51	83.14	99.77	116.40	133.03
N_1	1.7157	1.6251	1.1558	1.1746	1.1835	1.1765	1.1470
N_2	4.4422	2.4485	2.2665	1.5819	1.1970	1.0031	0.9358
N_3		2.6260	1.7536	1.7789	1.5215	1.2096	0.9282
N_4			1.8126	1.7817	1.7217	1.5607	1.3400
N_5				0.9063	1.3438	1.5138	1.5054
N_6					0.4531	0.8984	1.1999
N_7						0.2266	0.5625
N_8							0.1133

2.10.2 BWR Main Steam Isolation Valves

2.10.2.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**MAIN STEAM**
Component :	**AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8891410	0.9713990	0.9872060	0.9999170	0.9937890	1.5974E+01	4.7032E-01
2	8.43E-05	2.86E-02	1.28E-02	1.11E-01	6.21E-03	4.7032E-01	1.5974E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9150290	0.9692220	0.9767910	0.9975120	0.9875200	3.8046E+01	1.2082E+00
2	1.08E-03	2.40E-02	1.65E-02	7.25E-02	1.25E-02	9.4096E-01	3.8313E+01
3	2.39E-07	6.81E-03	1.38E-03	3.23E-02	0.00E+00	2.6722E-01	3.8987E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9194600	0.9651450	0.9702360	0.9933910	0.9811600	5.7307E+01	2.0696E+00
2	2.72E-03	2.43E-02	1.92E-02	6.34E-02	1.88E-02	1.4426E+00	5.7934E+01
3	7.67E-06	6.81E-03	2.53E-03	2.81E-02	0.00E+00	4.0431E-01	5.8972E+01
4	1.62E-08	3.75E-03	5.14E-04	1.88E-02	0.00E+00	2.2267E-01	5.9154E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9340010	0.9657800	0.9684780	0.9883400	0.9747310	1.0995E+02	3.8957E+00
2	4.98E-03	2.17E-02	1.90E-02	4.78E-02	2.53E-02	2.4717E+00	1.1137E+02
3	4.19E-04	8.59E-03	5.93E-03	2.58E-02	0.00E+00	9.7738E-01	1.1287E+02
4	2.16E-06	3.29E-03	1.11E-03	1.40E-02	0.00E+00	3.7439E-01	1.1347E+02
5	5.24E-21	6.35E-04	3.59E-07	3.68E-03	0.00E+00	7.2277E-02	1.1377E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9362860	0.9651300	0.9673540	0.9863670	0.9681980	1.3327E+02	4.8150E+00
2	5.16E-03	2.01E-02	1.78E-02	4.28E-02	3.18E-02	2.7755E+00	1.3531E+02
3	5.82E-04	8.27E-03	6.05E-03	2.35E-02	0.00E+00	1.1418E+00	1.3694E+02
4	3.83E-05	4.29E-03	2.25E-03	1.55E-02	0.00E+00	5.9222E-01	1.3749E+02
5	6.73E-09	1.61E-03	2.18E-04	8.06E-03	0.00E+00	2.2220E-01	1.3786E+02
6	1.02E-18	6.03E-04	1.05E-06	3.52E-03	0.00E+00	8.3237E-02	1.3800E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9429360	0.9657420	0.9672140	0.9835330	0.9616040	2.0285E+02	7.1958E+00
2	6.11E-03	1.83E-02	1.68E-02	3.56E-02	3.84E-02	3.8386E+00	2.0621E+02
3	1.05E-03	7.77E-03	6.27E-03	1.96E-02	0.00E+00	1.6312E+00	2.0841E+02
4	2.36E-04	4.71E-03	3.26E-03	1.41E-02	0.00E+00	9.8887E-01	2.0906E+02
5	1.22E-05	2.48E-03	1.18E-03	9.39E-03	0.00E+00	5.2177E-01	2.0952E+02
6	3.20E-10	8.87E-04	7.57E-05	4.65E-03	0.00E+00	1.8628E-01	2.0986E+02
7	0.00E+00	1.38E-04	1.21E-13	5.21E-04	0.00E+00	2.9071E-02	2.1002E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9451480	0.9659330	0.9671800	0.9824730	0.9549080	2.3993E+02	8.4620E+00
2	6.37E-03	1.75E-02	1.62E-02	3.30E-02	4.51E-02	4.3457E+00	2.4405E+02
3	1.04E-03	7.00E-03	5.73E-03	1.73E-02	0.00E+00	1.7384E+00	2.4665E+02
4	3.27E-04	4.62E-03	3.37E-03	1.31E-02	0.00E+00	1.1465E+00	2.4725E+02
5	5.19E-05	2.85E-03	1.68E-03	9.65E-03	0.00E+00	7.0833E-01	2.4768E+02
6	8.36E-07	1.48E-03	4.84E-04	6.32E-03	0.00E+00	3.6696E-01	2.4803E+02
7	6.56E-14	4.95E-04	8.90E-06	2.82E-03	0.00E+00	1.2297E-01	2.4827E+02
8	1.23E-42	1.33E-04	1.90E-12	5.64E-04	0.00E+00	3.3124E-02	2.4836E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**MAIN STEAM**
Component :	**AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 21
Total Number of Common-Cause Failure Events: 2

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9937890	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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**MAIN STEAM**
Component :	**AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9159540	0.9750480	0.9851920	0.9995610	0.9848200	2.7179E+01	6.9552E-01
2	4.37E-04	2.50E-02	1.48E-02	8.40E-02	1.52E-02	6.9552E-01	2.7179E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9199890	0.9663960	0.9717850	0.9943480	0.9691830	5.4167E+01	1.8835E+00
2	3.89E-03	2.88E-02	2.34E-02	7.23E-02	3.08E-02	1.6162E+00	5.4434E+01
3	1.67E-07	4.77E-03	9.60E-04	2.26E-02	3.94E-06	2.6732E-01	5.5783E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9162820	0.9579540	0.9616620	0.9869410	0.9530720	7.7916E+01	3.4199E+00
2	8.94E-03	3.43E-02	3.06E-02	7.26E-02	4.69E-02	2.7925E+00	7.8543E+01
3	5.63E-06	4.98E-03	1.84E-03	2.06E-02	1.20E-05	4.0471E-01	8.0931E+01
4	1.18E-08	2.74E-03	3.74E-04	1.37E-02	0.00E+00	2.2267E-01	8.1113E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9256620	0.9569260	0.9590740	0.9808420	0.9385040	1.3468E+02	6.0624E+00
2	1.24E-02	3.27E-02	3.05E-02	6.04E-02	6.05E-02	4.5956E+00	1.3615E+02
3	3.93E-04	7.25E-03	5.09E-03	2.15E-02	1.04E-03	1.0201E+00	1.3972E+02
4	1.75E-06	2.66E-03	8.95E-04	1.13E-02	0.00E+00	3.7439E-01	1.4037E+02
5	4.24E-21	5.14E-04	2.90E-07	2.97E-03	0.00E+00	7.2277E-02	1.4067E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9236120	0.9529630	0.9547320	0.9762590	0.9236340	1.6175E+02	7.9839E+00
2	1.50E-02	3.45E-02	3.27E-02	6.01E-02	7.45E-02	5.8520E+00	1.6388E+02
3	5.91E-04	7.23E-03	5.41E-03	2.01E-02	1.76E-03	1.2272E+00	1.6851E+02
4	3.32E-05	3.53E-03	1.86E-03	1.27E-02	1.44E-04	5.9922E-01	1.6913E+02
5	5.47E-09	1.31E-03	1.77E-04	6.56E-03	0.00E+00	2.2220E-01	1.6951E+02
6	8.30E-19	4.90E-04	8.57E-07	2.86E-03	0.00E+00	8.3237E-02	1.6965E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9290780	0.9530960	0.9543160	0.9729390	0.9084370	2.3469E+02	1.1550E+01
2	1.65E-02	3.27E-02	3.14E-02	5.32E-02	8.89E-02	8.0435E+00	2.3820E+02
3	1.07E-03	7.14E-03	5.86E-03	1.76E-02	2.30E-03	1.7592E+00	2.4448E+02
4	2.15E-04	4.10E-03	2.86E-03	1.22E-02	3.53E-04	1.0086E+00	2.4523E+02
5	1.06E-05	2.12E-03	1.01E-03	8.02E-03	2.15E-05	5.2297E-01	2.4572E+02
6	2.73E-10	7.56E-04	6.46E-05	3.97E-03	0.00E+00	1.8628E-01	2.4605E+02
7	0.00E+00	1.18E-04	1.03E-13	4.44E-04	0.00E+00	2.9071E-02	2.4621E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9284320	0.9509240	0.9519640	0.9698770	0.8929310	2.7477E+02	1.4181E+01
2	1.86E-02	3.41E-02	3.30E-02	5.33E-02	1.04E-01	9.8531E+00	2.7910E+02
3	1.11E-03	6.60E-03	5.50E-03	1.59E-02	2.70E-03	1.9080E+00	2.8704E+02
4	3.10E-04	4.10E-03	3.02E-03	1.15E-02	5.93E-04	1.1837E+00	2.8777E+02
5	4.58E-05	2.47E-03	1.45E-03	8.33E-03	6.69E-05	7.1253E-01	2.8824E+02
6	7.22E-07	1.27E-03	4.16E-04	5.43E-03	3.19E-06	3.6716E-01	2.8858E+02
7	5.63E-14	4.26E-04	7.65E-06	2.42E-03	0.00E+00	1.2297E-01	2.8883E+02
8	1.06E-42	1.15E-04	1.63E-12	4.84E-04	0.00E+00	3.3124E-02	2.8892E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**MAIN STEAM**
Component :	**AIR OR GAS OPERATED MAIN STEAM ISOLATION VALVE**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Plant Type :	**BWR**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 51
Total Number of Common-Cause Failure Events: 14

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9848200	0.9691830	0.9530720	0.9385040	0.9236340	0.9084370	0.8929310
2	1.52E-02	3.08E-02	4.69E-02	6.05E-02	7.45E-02	8.89E-02	1.04E-01
3		3.94E-06	1.20E-05	1.04E-03	1.76E-03	2.30E-03	2.70E-03
4			0.00E+00	0.00E+00	1.44E-04	3.53E-04	5.93E-04
5				0.00E+00	0.00E+00	2.15E-05	6.69E-05
6					0.00E+00	0.00E+00	3.19E-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	9.85E-01	9.69E-01	9.53E-01	9.39E-01	9.24E-01	9.08E-01	8.93E-01
Beta	1.52E-02	3.08E-02	4.69E-02	6.15E-02	7.64E-02	9.16E-02	1.07E-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	13.23	19.84	26.46	33.07	39.69	46.30	52.92
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 Emergency Diesel Generators

2.11.1 Emergency Diesel Generators

2.11.1.1 Fail to Run

ALPHA FACTOR DISTRIBUTIONS

System :	**EMERGENCY POWER**
Component :	**EMERGENCY DIESEL GENERATOR**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9715520	0.9827180	0.9834260	0.9914530	0.9832870	4.4210E+02	7.7747E+00
2	8.54E-03	1.73E-02	1.66E-02	2.84E-02	1.67E-02	7.7747E+00	4.4210E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9728450	0.9819410	0.9824060	0.9894350	0.9827790	6.7147E+02	1.2349E+01
2	6.05E-03	1.20E-02	1.15E-02	1.95E-02	1.13E-02	8.1954E+00	6.7562E+02
3	2.13E-03	6.07E-03	5.60E-03	1.16E-02	5.95E-03	4.1535E+00	6.7967E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9746990	0.9824000	0.9827480	0.9889000	0.9835670	8.9804E+02	1.6088E+01
2	4.73E-03	9.26E-03	8.91E-03	1.50E-02	8.36E-03	8.4689E+00	9.0566E+02
3	2.42E-03	5.88E-03	5.52E-03	1.06E-02	5.74E-03	5.3728E+00	9.0876E+02
4	5.03E-04	2.46E-03	2.11E-03	5.62E-03	2.34E-03	2.2468E+00	9.1188E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**EMERGENCY POWER**
Component :	**EMERGENCY DIESEL GENERATOR**
Failure Mode :	**FAIL TO RUN**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 503
Total Number of Common-Cause Failure Events: 32

Alpha Factor	**CCCG=2**	**CCCG=3**	**CCCG=4**
1	0.9832870	0.9827790	0.9835670
2	1.67E-02	1.13E-02	8.36E-03
3		5.95E-03	5.74E-03
4			2.34E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.83E-01	9.83E-01	9.84E-01
Beta	1.67E-02	1.72E-02	1.64E-02
Gamma		3.46E-01	4.91E-01
Delta			2.89E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	417.43	626.14	834.85
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 Fail to Start

ALPHA FACTOR DISTRIBUTIONS

System :	**EMERGENCY POWER**
Component :	**EMERGENCY DIESEL GENERATOR**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9775250	0.9869530	0.9876170	0.9941240	0.9875730	4.8048E+02	6.3516E+00
2	5.87E-03	1.30E-02	1.24E-02	2.25E-02	1.24E-02	6.3516E+00	4.8048E+02

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9768980	0.9849270	0.9853590	0.9914770	0.9858280	7.2871E+02	1.1152E+01
2	5.43E-03	1.09E-02	1.04E-02	1.78E-02	1.02E-02	8.0347E+00	7.3183E+02
3	1.19E-03	4.21E-03	3.78E-03	8.73E-03	4.02E-03	3.1173E+00	7.3674E+02

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9782320	0.9850750	0.9853970	0.9908070	0.9862850	9.7453E+02	1.4766E+01
2	4.48E-03	8.71E-03	8.38E-03	1.41E-02	7.85E-03	8.6191E+00	9.8068E+02
3	1.63E-03	4.45E-03	4.12E-03	8.41E-03	4.25E-03	4.4059E+00	9.8489E+02
4	2.60E-04	1.76E-03	1.44E-03	4.36E-03	1.61E-03	1.7405E+00	9.8755E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**EMERGENCY POWER**
Component :	**EMERGENCY DIESEL GENERATOR**
Failure Mode :	**FAIL TO START**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 630
Total Number of Common-Cause Failure Events: 24

Alpha Factor	CCCG=2	CCCG=3	CCCG=4
$_1$	0.9875730	0.9858280	0.9862850
$_2$	1.24E-02	1.02E-02	7.85E-03
$_3$		4.02E-03	4.25E-03
$_4$			1.61E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4
1-Beta	9.88E-01	9.86E-01	9.86E-01
Beta	1.24E-02	1.42E-02	1.37E-02
Gamma		2.84E-01	4.28E-01
Delta			2.75E-01

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4
Adj. Ind. Events	458.18	687.27	916.36
N_1	12.0558	11.8827	12.0312
N_2	5.9171	7.2010	7.3910
N_3		2.8501	4.0016
N_4			1.5178

2.12 BWR Pressure Suppression Chamber Vacuum Breakers

2.12.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**CONTAINMENT VACUUM RELIEF**
Component :	**VACUUM BREAKER CHECK VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.7981270	0.9204990	0.9356790	0.9907610	0.8642380	1.6615E+01	1.4350E+00
2	9.24E-03	7.95E-02	6.43E-02	2.02E-01	1.36E-01	1.4350E+00	1.6615E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8835330	0.9489760	0.9560930	0.9900350	0.9050580	3.9102E+01	2.1024E+00
2	3.19E-03	3.24E-02	2.52E-02	8.64E-02	4.75E-02	1.3352E+00	3.9869E+01
3	4.55E-04	1.86E-02	1.16E-02	6.07E-02	4.74E-02	7.6722E-01	4.0437E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9032480	0.9536910	0.9585230	0.9876000	0.9269320	5.8860E+01	2.8581E+00
2	2.81E-03	2.40E-02	1.91E-02	6.21E-02	1.84E-02	1.4811E+00	6.0237E+01
3	5.86E-04	1.47E-02	9.84E-03	4.52E-02	3.64E-02	9.0431E-01	6.0814E+01
4	2.24E-05	7.66E-03	3.34E-03	2.99E-02	1.82E-02	4.7267E-01	6.1245E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9278720	0.9610370	0.9636460	0.9852710	0.9405500	1.1206E+02	4.5433E+00
2	3.97E-03	1.92E-02	1.66E-02	4.37E-02	7.69E-03	2.2442E+00	1.1436E+02
3	1.15E-03	1.16E-02	8.95E-03	3.11E-02	2.22E-02	1.3524E+00	1.1525E+02
4	1.43E-04	6.43E-03	3.91E-03	2.13E-02	2.22E-02	7.4939E-01	1.1585E+02
5	1.43E-09	1.69E-03	1.70E-04	8.76E-03	7.39E-03	1.9728E-01	1.1641E+02

Fail to Open
Fail to Start

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9332340	0.9625940	0.9647570	0.9845570	0.9498620	1.3603E+02	5.2861E+00
2	3.47E-03	1.63E-02	1.41E-02	3.68E-02	3.47E-03	2.3090E+00	1.3901E+02
3	1.02E-03	9.85E-03	7.65E-03	2.62E-02	1.24E-02	1.3919E+00	1.3992E+02
4	3.25E-04	6.84E-03	4.70E-03	2.07E-02	1.87E-02	9.6722E-01	1.4035E+02
5	9.67E-06	3.34E-03	1.45E-03	1.31E-02	1.24E-02	4.7220E-01	1.4084E+02
6	5.28E-12	1.03E-03	3.86E-05	5.71E-03	3.11E-03	1.4574E-01	1.4117E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**CONTAINMENT VACUUM RELIEF**
Component :	**VACUUM BREAKER CHECK VALVE**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 11
Total Number of Common-Cause Failure Events: 2

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.8642380	0.9050580	0.9269320	0.9405500	0.9498620
2	1.36E-01	4.75E-02	1.84E-02	7.69E-03	3.47E-03
3		4.74E-02	3.64E-02	2.22E-02	1.24E-02
4			1.82E-02	2.22E-02	1.87E-02
5				7.39E-03	1.24E-02
6					3.11E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	8.64E-01	9.05E-01	9.27E-01	9.41E-01	9.50E-01
Beta	1.36E-01	9.49E-02	7.31E-02	5.94E-02	5.01E-02
Gamma		4.99E-01	7.48E-01	8.71E-01	9.31E-01
Delta			3.33E-01	5.71E-01	7.33E-01
Epsilon				2.50E-01	4.55E-01
Mu					2.00E-01

Fail to Open
Fail to Start

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	6.29	9.43	12.57	15.71	18.86
N_1	0.0790	0.1170	0.1540	0.1900	0.2252
N_2	1.0005	0.5015	0.2530	0.1300	0.0698
N_3		0.5000	0.5000	0.3750	0.2501
N_4			0.2500	0.3750	0.3750
N_5				0.1250	0.2500
N_6					0.0625

2.13 AC Power Distribution Breakers

2.13.1480 Vac Circuit Breakers

2.13.1.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**AC POWER DISTRIBUTION**
Component :	**480 V AC CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9093120	0.9710950	0.9809990	0.9990420	0.9779160	2.8282E+01	8.4182E-01
2	9.55E-04	2.89E-02	1.90E-02	9.07E-02	2.21E-02	8.4182E-01	2.8282E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9245050	0.9687020	0.9739330	0.9949980	0.9738830	5.6146E+01	1.8140E+00
2	2.04E-03	2.23E-02	1.71E-02	6.04E-02	1.68E-02	1.2924E+00	5.6668E+01
3	4.46E-05	9.00E-03	4.29E-03	3.39E-02	9.32E-03	5.2162E-01	5.7438E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9214530	0.9610900	0.9647010	0.9883690	0.9607500	8.0657E+01	3.2654E+00
2	5.69E-03	2.71E-02	2.34E-02	6.10E-02	2.91E-02	2.2725E+00	8.1650E+01
3	1.19E-04	7.98E-03	4.55E-03	2.75E-02	7.38E-03	6.6961E-01	8.3253E+01
4	8.03E-07	3.85E-03	1.06E-03	1.72E-02	2.80E-03	3.2327E-01	8.3599E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9323960	0.9617320	0.9638500	0.9838260	0.9554970	1.3860E+02	5.5150E+00
2	7.24E-03	2.36E-02	2.14E-02	4.74E-02	2.90E-02	3.4035E+00	1.4071E+02
3	1.15E-03	1.01E-02	7.99E-03	2.65E-02	1.09E-02	1.4621E+00	1.4265E+02
4	2.12E-05	3.73E-03	1.81E-03	1.39E-02	3.66E-03	5.3699E-01	1.4358E+02
5	1.13E-14	7.80E-04	8.96E-06	4.49E-03	9.03E-04	1.1238E-01	1.4400E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9347130	0.9613210	0.9630810	0.9819360	0.9535560	1.6731E+02	6.7318E+00
2	6.65E-03	2.08E-02	1.89E-02	4.10E-02	2.60E-02	3.6119E+00	1.7043E+02
3	1.71E-03	1.06E-02	8.79E-03	2.57E-02	1.33E-02	1.8440E+00	1.7220E+02
4	1.74E-04	4.98E-03	3.25E-03	1.56E-02	5.18E-03	8.6602E-01	1.7318E+02
5	2.62E-07	1.78E-03	4.62E-04	8.07E-03	1.67E-03	3.1060E-01	1.7373E+02
6	2.71E-16	5.70E-04	3.24E-06	3.32E-03	3.03E-04	9.9237E-02	1.7394E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9416850	0.9630690	0.9642890	0.9802820	0.9534150	2.4235E+02	9.2934E+00
2	6.55E-03	1.77E-02	1.64E-02	3.32E-02	2.23E-02	4.4543E+00	2.4719E+02
3	2.27E-03	9.89E-03	8.62E-03	2.18E-02	1.40E-02	2.4882E+00	2.4916E+02
4	5.86E-04	5.58E-03	4.33E-03	1.48E-02	6.78E-03	1.4033E+00	2.5024E+02
5	4.26E-05	2.71E-03	1.55E-03	9.29E-03	2.60E-03	6.8097E-01	2.5096E+02
6	6.26E-09	9.19E-04	1.36E-04	4.55E-03	7.34E-04	2.3118E-01	2.5141E+02
7	4.82E-40	1.41E-04	7.50E-12	6.27E-04	1.05E-04	3.5471E-02	2.5161E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9446150	0.9640130	0.9650530	0.9798520	0.9542330	2.8497E+02	1.0638E+01
2	6.00E-03	1.58E-02	1.47E-02	2.92E-02	1.90E-02	4.6630E+00	2.9095E+02
3	2.24E-03	9.07E-03	7.99E-03	1.96E-02	1.36E-02	2.6809E+00	2.9293E+02
4	8.17E-04	5.73E-03	4.66E-03	1.43E-02	7.90E-03	1.6949E+00	2.9391E+02
5	1.52E-04	3.25E-03	2.23E-03	9.87E-03	3.65E-03	9.6193E-01	2.9465E+02
6	3.70E-06	1.55E-03	6.48E-04	6.13E-03	1.30E-03	4.5696E-01	2.9515E+02
7	2.19E-12	4.90E-04	1.78E-05	2.72E-03	3.14E-04	1.4477E-01	2.9546E+02
8	7.46E-40	1.21E-04	7.33E-12	5.40E-04	3.75E-05	3.5724E-02	2.9557E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AC POWER DISTRIBUTION**
Component :	**480 V AC CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 82
Total Number of Common-Cause Failure Events: 6

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9779160	0.9738830	0.9607500	0.9554970	0.9535560	0.9534150	0.9542330
2	2.21E-02	1.68E-02	2.91E-02	2.90E-02	2.60E-02	2.23E-02	1.90E-02
3		9.32E-03	7.38E-03	1.09E-02	1.33E-02	1.40E-02	1.36E-02
4			2.80E-03	3.66E-03	5.18E-03	6.78E-03	7.90E-03
5				9.03E-04	1.67E-03	2.60E-03	3.65E-03
6					3.03E-04	7.34E-04	1.30E-03
7						1.05E-04	3.14E-04
8							3.75E-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	9.61E-01	9.55E-01	9.54E-01	9.53E-01	9.54E-01
Beta	2.21E-02	2.61E-02	3.92E-02	4.45E-02	4.64E-02	4.66E-02	4.58E-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	16.13	24.19	32.25	40.31	48.38	56.44	64.50
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**AC POWER DISTRIBUTION**
Component :	**480 V AC CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9246330	0.9656790	0.9699390	0.9921400	0.9667980	6.8921E+01	2.4495E+00
2	7.86E-03	3.43E-02	3.01E-02	7.54E-02	3.32E-02	2.4495E+00	6.8921E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9375420	0.9676460	0.9702040	0.9889920	0.9688610	1.1641E+02	3.8923E+00
2	2.98E-03	1.66E-02	1.40E-02	3.91E-02	1.30E-02	1.9983E+00	1.1830E+02
3	2.64E-03	1.57E-02	1.31E-02	3.77E-02	1.81E-02	1.8940E+00	1.1841E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9445670	0.9692460	0.9711060	0.9875610	0.9724490	1.6131E+02	5.1183E+00
2	2.85E-03	1.36E-02	1.18E-02	3.09E-02	8.81E-03	2.2717E+00	1.6416E+02
3	1.39E-03	9.98E-03	8.10E-03	2.50E-02	1.06E-02	1.6614E+00	1.6477E+02
4	5.42E-04	7.12E-03	5.27E-03	2.00E-02	8.13E-03	1.1852E+00	1.6524E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9508250	0.9704280	0.9716880	0.9857190	0.9744380	2.3951E+02	7.2986E+00
2	4.15E-03	1.37E-02	1.24E-02	2.76E-02	8.58E-03	3.3765E+00	2.4343E+02
3	1.04E-03	7.04E-03	5.76E-03	1.74E-02	5.17E-03	1.7378E+00	2.4507E+02
4	7.30E-04	6.12E-03	4.85E-03	1.59E-02	7.72E-03	1.5107E+00	2.4530E+02
5	4.12E-05	2.73E-03	1.56E-03	9.41E-03	4.09E-03	6.7358E-01	2.4613E+02

CCCG = 6 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9535640	0.9711250	0.9721750	0.9850910	0.9755550	2.8832E+02	8.5728E+00
2	4.33E-03	1.30E-02	1.19E-02	2.53E-02	9.14E-03	3.8454E+00	2.9305E+02
3	7.80E-04	5.61E-03	4.55E-03	1.41E-02	2.99E-03	1.6670E+00	2.9523E+02
4	5.35E-04	4.86E-03	3.80E-03	1.28E-02	4.84E-03	1.4416E+00	2.9545E+02
5	2.68E-04	3.84E-03	2.80E-03	1.10E-02	5.22E-03	1.1390E+00	2.9575E+02
6	5.10E-06	1.62E-03	7.10E-04	6.30E-03	2.26E-03	4.7984E-01	2.9641E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9575550	0.9723370	0.9731340	0.9844120	0.9780930	3.8378E+02	1.0919E+01
2	4.27E-03	1.15E-02	1.06E-02	2.14E-02	7.03E-03	4.5242E+00	3.9017E+02
3	1.16E-03	5.69E-03	4.88E-03	1.30E-02	3.01E-03	2.2452E+00	3.9245E+02
4	5.30E-04	4.06E-03	3.26E-03	1.03E-02	3.00E-03	1.6019E+00	3.9310E+02
5	3.30E-04	3.40E-03	2.61E-03	9.18E-03	4.02E-03	1.3425E+00	3.9336E+02
6	8.90E-05	2.28E-03	1.52E-03	7.09E-03	3.50E-03	9.0058E-01	3.9380E+02
7	9.37E-08	7.71E-04	1.92E-04	3.51E-03	1.35E-03	3.0417E-01	3.9439E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9602780	0.9736260	0.9743150	0.9846360	0.9800520	4.4680E+02	1.2103E+01
2	3.86E-03	1.02E-02	9.47E-03	1.89E-02	5.68E-03	4.6667E+00	4.5424E+02
3	1.17E-03	5.27E-03	4.57E-03	1.18E-02	2.91E-03	2.4164E+00	4.5649E+02
4	4.88E-04	3.58E-03	2.89E-03	9.04E-03	2.14E-03	1.6450E+00	4.5726E+02
5	2.99E-04	2.98E-03	2.30E-03	8.00E-03	2.83E-03	1.3676E+00	4.5754E+02
6	1.53E-04	2.39E-03	1.72E-03	6.92E-03	3.13E-03	1.0961E+00	4.5781E+02
7	2.30E-05	1.48E-03	8.47E-04	5.09E-03	2.39E-03	6.7907E-01	4.5822E+02
8	3.61E-09	5.06E-04	7.55E-05	2.50E-03	8.55E-04	2.3212E-01	4.5867E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AC POWER DISTRIBUTION**
Component :	**480 V AC CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 169
Total Number of Common-Cause Failure Events: 6

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9667980	0.9688610	0.9724490	0.9744380	0.9755550	0.9780930	0.9800520
2	3.32E-02	1.30E-02	8.81E-03	8.58E-03	9.14E-03	7.03E-03	5.68E-03
3		1.81E-02	1.06E-02	5.17E-03	2.99E-03	3.01E-03	2.91E-03
4			8.13E-03	7.72E-03	4.84E-03	3.00E-03	2.14E-03
5				4.09E-03	5.22E-03	4.02E-03	2.83E-03
6					2.26E-03	3.50E-03	3.13E-03
7						1.35E-03	2.39E-03
8							8.55E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.67E-01	9.69E-01	9.72E-01	9.74E-01	9.76E-01	9.78E-01	9.80E-01
Beta	3.32E-02	3.11E-02	2.76E-02	2.56E-02	2.44E-02	2.19E-02	1.99E-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	56.33	84.50	112.67	140.83	169.00	197.17	225.33
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 Spurious Operation

ALPHA FACTOR DISTRIBUTIONS

System :	**AC POWER DISTRIBUTION**
Component :	**480 V AC CIRCUIT BREAKERS**
Failure Mode :	**SPURIOUS ACTUATION**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9305310	0.9733530	0.9789510	0.9970230	0.9768100	5.2592E+01	1.4398E+00
2	2.98E-03	2.66E-02	2.11E-02	6.95E-02	2.32E-02	1.4398E+00	5.2592E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9486870	0.9777670	0.9810250	0.9957090	0.9842670	9.3054E+01	2.1159E+00
2	1.40E-03	1.42E-02	1.09E-02	3.80E-02	7.97E-03	1.3482E+00	9.3822E+01
3	1.95E-04	8.07E-03	4.98E-03	2.65E-02	7.76E-03	7.6772E-01	9.4402E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9545960	0.9784300	0.9807740	0.9942570	0.9880010	1.3078E+02	2.8831E+00
2	1.34E-03	1.13E-02	8.92E-03	2.91E-02	3.22E-03	1.5041E+00	1.3216E+02
3	2.70E-04	6.78E-03	4.53E-03	2.10E-02	5.86E-03	9.0631E-01	1.3276E+02
4	1.03E-05	3.54E-03	1.54E-03	1.38E-02	2.92E-03	4.7267E-01	1.3319E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9587890	0.9778170	0.9793400	0.9916350	0.9902340	2.0195E+02	4.5816E+00
2	2.30E-03	1.10E-02	9.49E-03	2.50E-02	1.53E-03	2.2775E+00	2.0425E+02
3	6.52E-04	6.57E-03	5.06E-03	1.77E-02	3.56E-03	1.3574E+00	2.0517E+02
4	8.05E-05	3.63E-03	2.20E-03	1.20E-02	3.51E-03	7.4939E-01	2.0578E+02
5	8.04E-10	9.55E-04	9.58E-05	4.94E-03	1.17E-03	1.9728E-01	2.0633E+02

CCCG = 6 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9616640	0.9785780	0.9798440	0.9911640	0.9917180	2.4387E+02	5.3387E+00
2	2.04E-03	9.44E-03	8.16E-03	2.12E-02	8.79E-04	2.3517E+00	2.4686E+02
3	5.90E-04	5.63E-03	4.37E-03	1.49E-02	2.03E-03	1.4018E+00	2.4781E+02
4	1.84E-04	3.88E-03	2.66E-03	1.17E-02	2.93E-03	9.6722E-01	2.4824E+02
5	5.47E-06	1.89E-03	8.20E-04	7.42E-03	1.95E-03	4.7220E-01	2.4874E+02
6	2.99E-12	5.85E-04	2.18E-05	3.24E-03	4.88E-04	1.4574E-01	2.4906E+02

CCCG = 7 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9632800	0.9778120	0.9787420	0.9891610	0.9926850	3.3210E+02	7.5359E+00
2	2.73E-03	9.42E-03	8.48E-03	1.93E-02	7.48E-04	3.1994E+00	3.3644E+02
3	8.20E-04	5.29E-03	4.36E-03	1.30E-02	1.12E-03	1.7979E+00	3.3784E+02
4	3.50E-04	3.83E-03	2.91E-03	1.05E-02	2.10E-03	1.3014E+00	3.3833E+02
5	7.68E-05	2.46E-03	1.58E-03	7.84E-03	2.10E-03	8.3427E-01	3.3880E+02
6	3.37E-07	1.01E-03	3.01E-04	4.42E-03	1.05E-03	3.4258E-01	3.3929E+02
7	4.89E-25	1.78E-04	1.79E-08	9.99E-04	2.10E-04	6.0371E-02	3.3958E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9651180	0.9783400	0.9791380	0.9888300	0.9933830	3.8788E+02	8.5877E+00
2	2.71E-03	8.77E-03	7.96E-03	1.76E-02	7.69E-04	3.4757E+00	3.9299E+02
3	7.45E-04	4.65E-03	3.85E-03	1.13E-02	6.16E-04	1.8433E+00	3.9462E+02
4	3.55E-04	3.48E-03	2.69E-03	9.31E-03	1.38E-03	1.3810E+00	3.9509E+02
5	1.39E-04	2.57E-03	1.80E-03	7.65E-03	1.84E-03	1.0208E+00	3.9545E+02
6	1.44E-05	1.52E-03	8.01E-04	5.45E-03	1.38E-03	6.0136E-01	3.9587E+02
7	1.66E-09	5.47E-04	6.97E-05	2.76E-03	5.51E-04	2.1677E-01	3.9625E+02
8	2.93E-30	1.23E-04	9.78E-10	6.48E-04	9.16E-05	4.8724E-02	3.9642E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AC POWER DISTRIBUTION**
Component :	**480 V AC CIRCUIT BREAKERS**
Failure Mode :	**SPURIOUS ACTUATION**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 95
Total Number of Common-Cause Failure Events: 3

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9768100	0.9842670	0.9880010	0.9902340	0.9917180	0.9926850	0.9933830
2	2.32E-02	7.97E-03	3.22E-03	1.53E-03	8.79E-04	7.48E-04	7.69E-04
3		7.76E-03	5.86E-03	3.56E-03	2.03E-03	1.12E-03	6.16E-04
4			2.92E-03	3.51E-03	2.93E-03	2.10E-03	1.38E-03
5				1.17E-03	1.95E-03	2.10E-03	1.84E-03
6					4.88E-04	1.05E-03	1.38E-03
7						2.10E-04	5.51E-04
8							9.16E-05

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.77E-01	9.84E-01	9.88E-01	9.90E-01	9.92E-01	9.93E-01	9.93E-01
Beta	2.32E-02	1.57E-02	1.20E-02	9.77E-03	8.28E-03	7.31E-03	6.62E-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	40.69	61.03	81.37	101.71	122.06	142.40	162.74
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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**AC POWER DISTRIBUTION**
Component :	**4160 V AC CIRCUIT BREAKERS** **6.9 KV AC CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9242090	0.9790560	0.9890720	0.9998310	0.9916530	2.6843E+01	5.7422E-01
2	1.67E-04	2.09E-02	1.09E-02	7.58E-02	8.35E-03	5.7422E-01	2.6843E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9307570	0.9731080	0.9785610	0.9968020	0.9842100	5.4070E+01	1.4942E+00
2	1.77E-03	2.19E-02	1.64E-02	6.05E-02	1.53E-02	1.2142E+00	5.4350E+01
3	2.83E-07	5.04E-03	1.10E-03	2.36E-02	5.14E-04	2.8002E-01	5.5284E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9307300	0.9679460	0.9717220	0.9922270	0.9775550	7.8361E+01	2.5950E+00
2	4.07E-03	2.37E-02	1.99E-02	5.64E-02	2.10E-02	1.9214E+00	7.9035E+01
3	1.21E-05	5.55E-03	2.30E-03	2.21E-02	1.37E-03	4.4941E-01	8.0507E+01
4	1.30E-08	2.77E-03	3.84E-04	1.38E-02	4.55E-05	2.2417E-01	8.0732E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9385220	0.9665690	0.9687630	0.9871250	0.9715880	1.3591E+02	4.7008E+00
2	6.52E-03	2.25E-02	2.03E-02	4.62E-02	2.58E-02	3.1705E+00	1.3744E+02
3	4.72E-04	7.66E-03	5.48E-03	2.23E-02	2.42E-03	1.0766E+00	1.3953E+02
4	2.02E-06	2.71E-03	9.33E-04	1.14E-02	1.66E-04	3.8119E-01	1.4023E+02
5	4.75E-21	5.15E-04	2.98E-07	2.98E-03	4.89E-06	7.2477E-02	1.4054E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9393760	0.9651400	0.9669470	0.9847220	0.9662270	1.6406E+02	5.9258E+00
2	7.08E-03	2.17E-02	1.99E-02	4.27E-02	2.98E-02	3.6930E+00	1.6629E+02
3	7.26E-04	7.74E-03	5.92E-03	2.10E-02	3.57E-03	1.3161E+00	1.6867E+02
4	3.65E-05	3.59E-03	1.92E-03	1.28E-02	3.69E-04	6.1022E-01	1.6938E+02
5	5.80E-09	1.31E-03	1.80E-04	6.57E-03	2.05E-05	2.2320E-01	1.6976E+02
6	8.29E-19	4.90E-04	8.56E-07	2.86E-03	0.00E+00	8.3237E-02	1.6990E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9441820	0.9652190	0.9664700	0.9819940	0.9620270	2.3844E+02	8.5920E+00
2	7.83E-03	1.99E-02	1.86E-02	3.64E-02	3.23E-02	4.9164E+00	2.4212E+02
3	1.29E-03	7.71E-03	6.43E-03	1.85E-02	4.84E-03	1.9049E+00	2.4513E+02
4	2.31E-04	4.17E-03	2.93E-03	1.23E-02	7.23E-04	1.0298E+00	2.4600E+02
5	1.08E-05	2.13E-03	1.01E-03	8.02E-03	6.37E-05	5.2537E-01	2.4651E+02
6	2.77E-10	7.55E-04	6.46E-05	3.96E-03	3.54E-06	1.8648E-01	2.4685E+02
7	0.00E+00	1.18E-04	1.03E-13	4.43E-04	0.00E+00	2.9071E-02	2.4700E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9457370	0.9650610	0.9661220	0.9807560	0.9581820	2.8028E+02	1.0147E+01
2	8.09E-03	1.92E-02	1.81E-02	3.40E-02	3.46E-02	5.5684E+00	2.8486E+02
3	1.39E-03	7.29E-03	6.19E-03	1.69E-02	5.88E-03	2.1162E+00	2.8831E+02
4	3.39E-04	4.20E-03	3.14E-03	1.17E-02	1.16E-03	1.2211E+00	2.8921E+02
5	4.71E-05	2.47E-03	1.46E-03	8.33E-03	1.45E-04	7.1763E-01	2.8971E+02
6	7.26E-07	1.27E-03	4.15E-04	5.41E-03	1.09E-05	3.6766E-01	2.9006E+02
7	5.60E-14	4.23E-04	7.61E-06	2.41E-03	0.00E+00	1.2297E-01	2.9030E+02
8	1.05E-42	1.14E-04	1.62E-12	4.82E-04	0.00E+00	3.3124E-02	2.9039E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AC POWER DISTRIBUTION**
Component :	**4160 V AC CIRCUIT BREAKERS** **6.9 KV AC CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 67
Total Number of Common-Cause Failure Events: 7

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9916530	0.9842100	0.9775550	0.9715880	0.9662270	0.9620270	0.9581820
2	8.35E-03	1.53E-02	2.10E-02	2.58E-02	2.98E-02	3.23E-02	3.46E-02
3		5.14E-04	1.37E-03	2.42E-03	3.57E-03	4.84E-03	5.88E-03
4			4.55E-05	1.66E-04	3.69E-04	7.23E-04	1.16E-03
5				4.89E-06	2.05E-05	6.37E-05	1.45E-04
6					0.00E+00	3.54E-06	1.09E-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	9.84E-01	9.78E-01	9.72E-01	9.66E-01	9.62E-01	9.58E-01
Beta	8.35E-03	1.58E-02	2.24E-02	2.84E-02	3.38E-02	3.80E-02	4.18E-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	14.66	21.99	29.32	36.65	43.98	51.31	58.64
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**AC POWER DISTRIBUTION**
Component :	**4160 V AC CIRCUIT BREAKERS** **6.9 KV AC CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9594710	0.9892530	0.9948740	0.9999450	0.9977410	4.7830E+01	5.1962E-01
2	5.24E-05	1.07E-02	5.12E-03	4.05E-02	2.26E-03	5.1962E-01	4.7830E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9587200	0.9846430	0.9881660	0.9985060	0.9958190	8.5700E+01	1.3366E+00
2	7.26E-04	1.22E-02	8.69E-03	3.55E-02	4.00E-03	1.0595E+00	8.5977E+01
3	1.61E-07	3.18E-03	6.82E-04	1.49E-02	1.76E-04	2.7712E-01	8.6759E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9579950	0.9813810	0.9839250	0.9960740	0.9941950	1.2073E+02	2.2906E+00
2	1.78E-03	1.32E-02	1.07E-02	3.33E-02	5.33E-03	1.6278E+00	1.2139E+02
3	6.74E-06	3.57E-03	1.44E-03	1.43E-02	4.61E-04	4.3891E-01	1.2258E+02
4	8.36E-09	1.82E-03	2.51E-04	9.10E-03	1.60E-05	2.2387E-01	1.2280E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9586570	0.9782200	0.9798470	0.9922230	0.9928210	1.8910E+02	4.2103E+00
2	3.50E-03	1.40E-02	1.24E-02	3.01E-02	6.32E-03	2.7054E+00	1.9060E+02
3	3.18E-04	5.44E-03	3.86E-03	1.60E-02	8.00E-04	1.0523E+00	1.9226E+02
4	1.44E-06	1.97E-03	6.74E-04	8.31E-03	6.20E-05	3.8019E-01	1.9293E+02
5	3.26E-21	3.74E-04	2.14E-07	2.17E-03	1.07E-06	7.2377E-02	1.9324E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9597960	0.9776570	0.9790060	0.9909020	0.9916570	2.2816E+02	5.2144E+00
2	3.60E-03	1.30E-02	1.16E-02	2.70E-02	7.05E-03	3.0303E+00	2.3034E+02
3	4.75E-04	5.44E-03	4.11E-03	1.50E-02	1.14E-03	1.2695E+00	2.3210E+02
4	2.62E-05	2.61E-03	1.39E-03	9.33E-03	1.48E-04	6.0882E-01	2.3277E+02
5	4.05E-09	9.53E-04	1.29E-04	4.77E-03	2.67E-06	2.2250E-01	2.3315E+02
6	6.03E-19	3.57E-04	6.23E-07	2.08E-03	0.00E+00	8.3237E-02	2.3329E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9607030	0.9761610	0.9771460	0.9882650	0.9907330	3.1348E+02	7.6556E+00
2	4.41E-03	1.27E-02	1.17E-02	2.43E-02	7.52E-03	4.0703E+00	3.1707E+02
3	8.94E-04	5.67E-03	4.68E-03	1.38E-02	1.45E-03	1.8205E+00	3.1932E+02
4	1.76E-04	3.20E-03	2.24E-03	9.47E-03	2.89E-04	1.0267E+00	3.2011E+02
5	8.07E-06	1.63E-03	7.71E-04	6.15E-03	7.65E-06	5.2277E-01	3.2061E+02
6	2.09E-10	5.80E-04	4.95E-05	3.04E-03	0.00E+00	1.8628E-01	3.2095E+02
7	0.00E+00	9.05E-05	7.92E-14	3.41E-04	0.00E+00	2.9071E-02	3.2111E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9618910	0.9761200	0.9769640	0.9874760	0.9899340	3.6632E+02	8.9617E+00
2	4.49E-03	1.21E-02	1.12E-02	2.25E-02	7.91E-03	4.5235E+00	3.7076E+02
3	9.34E-04	5.29E-03	4.44E-03	1.25E-02	1.65E-03	1.9844E+00	3.7330E+02
4	2.62E-04	3.25E-03	2.42E-03	9.07E-03	4.91E-04	1.2197E+00	3.7406E+02
5	3.49E-05	1.89E-03	1.11E-03	6.41E-03	1.68E-05	7.1083E-01	3.7457E+02
6	5.55E-07	9.78E-04	3.20E-04	4.18E-03	1.34E-06	3.6716E-01	3.7491E+02
7	4.34E-14	3.28E-04	5.89E-06	1.86E-03	0.00E+00	1.2297E-01	3.7516E+02
8	8.13E-43	8.83E-05	1.26E-12	3.73E-04	0.00E+00	3.3124E-02	3.7525E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**AC POWER DISTRIBUTION**
Component :	**4160 V AC CIRCUIT BREAKERS** **6.9 KV AC CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 190
Total Number of Common-Cause Failure Events: 9

Fail to Close

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9977410	0.9958190	0.9941950	0.9928210	0.9916570	0.9907330	0.9899340
2	2.26E-03	4.00E-03	5.33E-03	6.32E-03	7.05E-03	7.52E-03	7.91E-03
3		1.76E-04	4.61E-04	8.00E-04	1.14E-03	1.45E-03	1.65E-03
4			1.60E-05	6.20E-05	1.48E-04	2.89E-04	4.91E-04
5				1.07E-06	2.67E-06	7.65E-06	1.68E-05
6					0.00E+00	0.00E+00	1.34E-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	9.94E-01	9.93E-01	9.92E-01	9.91E-01	9.90E-01
Beta	2.26E-03	4.18E-03	5.80E-03	7.18E-03	8.34E-03	9.27E-03	1.01E-02
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	34.55	51.82	69.09	86.36	103.64	120.91	138.18
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

2.13.2.3 Spurious Operation

ALPHA FACTOR DISTRIBUTIONS

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 :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8565620	0.9310690	0.9380610	0.9816240	0.9210130	3.7877E+01	2.8042E+00
2	1.84E-02	6.89E-02	6.19E-02	1.43E-01	7.90E-02	2.8042E+00	3.7877E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8954470	0.9446290	0.9485910	0.9802470	0.9309160	7.0049E+01	4.1060E+00
2	6.55E-03	3.08E-02	2.67E-02	6.92E-02	3.34E-02	2.2869E+00	7.1868E+01
3	3.91E-03	2.45E-02	2.04E-02	5.93E-02	3.57E-02	1.8191E+00	7.2336E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9055840	0.9459700	0.9487900	0.9767090	0.9329620	9.9055E+01	5.6576E+00
2	8.30E-03	2.93E-02	2.64E-02	6.05E-02	3.25E-02	3.0729E+00	1.0164E+02
3	7.07E-04	1.06E-02	7.71E-03	3.05E-02	1.25E-02	1.1120E+00	1.0360E+02
4	1.62E-03	1.41E-02	1.11E-02	3.66E-02	2.20E-02	1.4727E+00	1.0324E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9218970	0.9516260	0.9533940	0.9753120	0.9332090	1.6124E+02	8.1963E+00
2	9.49E-03	2.58E-02	2.40E-02	4.85E-02	3.25E-02	4.3780E+00	1.6506E+02
3	1.81E-03	1.10E-02	9.19E-03	2.66E-02	1.28E-02	1.8716E+00	1.6756E+02
4	9.82E-05	4.42E-03	2.69E-03	1.47E-02	5.38E-03	7.4939E-01	1.6869E+02
5	5.49E-04	7.07E-03	5.25E-03	1.98E-02	1.61E-02	1.1973E+00	1.6824E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9253840	0.9521800	0.9536510	0.9739390	0.9338000	1.9407E+02	9.7465E+00
2	8.93E-03	2.32E-02	2.17E-02	4.28E-02	3.02E-02	4.7312E+00	1.9909E+02
3	2.67E-03	1.19E-02	1.04E-02	2.65E-02	1.56E-02	2.4301E+00	2.0139E+02
4	2.25E-04	4.75E-03	3.26E-03	1.44E-02	4.54E-03	9.6732E-01	2.0285E+02
5	6.70E-06	2.32E-03	1.00E-03	9.07E-03	3.03E-03	4.7220E-01	2.0334E+02
6	3.98E-04	5.62E-03	4.11E-03	1.60E-02	1.29E-02	1.1457E+00	2.0267E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9365910	0.9577740	0.9588360	0.9753250	0.9410190	2.7385E+02	1.2073E+01
2	7.56E-03	1.85E-02	1.74E-02	3.32E-02	2.30E-02	5.2802E+00	2.8064E+02
3	2.62E-03	9.98E-03	8.86E-03	2.12E-02	1.28E-02	2.8543E+00	2.8307E+02
4	8.53E-04	5.95E-03	4.85E-03	1.48E-02	7.47E-03	1.7016E+00	2.8422E+02
5	9.12E-05	2.92E-03	1.87E-03	9.31E-03	3.27E-03	8.3427E-01	2.8509E+02
6	9.49E-05	2.95E-03	1.90E-03	9.37E-03	6.88E-03	8.4258E-01	2.8508E+02
7	1.36E-05	1.96E-03	9.82E-04	7.22E-03	5.57E-03	5.6037E-01	2.8536E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9413890	0.9603410	0.9612590	0.9761750	0.9463920	3.2116E+02	1.3263E+01
2	6.57E-03	1.60E-02	1.50E-02	2.86E-02	1.84E-02	5.3352E+00	3.2909E+02
3	2.36E-03	8.79E-03	7.83E-03	1.85E-02	1.11E-02	2.9388E+00	3.3148E+02
4	9.97E-04	5.80E-03	4.85E-03	1.39E-02	7.34E-03	1.9413E+00	3.3248E+02
5	2.66E-04	3.53E-03	2.60E-03	9.96E-03	4.37E-03	1.1808E+00	3.3324E+02
6	8.45E-05	2.55E-03	1.65E-03	8.07E-03	4.48E-03	8.5136E-01	3.3357E+02
7	4.07E-05	2.14E-03	1.27E-03	7.23E-03	5.49E-03	7.1677E-01	3.3371E+02
8	9.21E-08	8.93E-04	2.17E-04	4.09E-03	2.45E-03	2.9872E-01	3.3412E+02

ALPHA FACTOR and MGL PARAMETERS

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 :	**2005/12/31**

Total Number of Independent Failure Events: 117
Total Number of Common-Cause Failure Events: 8

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9210130	0.9309160	0.9329620	0.9332090	0.9338000	0.9410190	0.9463920
2	7.90E-02	3.34E-02	3.25E-02	3.25E-02	3.02E-02	2.30E-02	1.84E-02
3		3.57E-02	1.25E-02	1.28E-02	1.56E-02	1.28E-02	1.11E-02
4			2.20E-02	5.38E-03	4.54E-03	7.47E-03	7.34E-03
5				1.61E-02	3.03E-03	3.27E-03	4.37E-03
6					1.29E-02	6.88E-03	4.48E-03
7						5.57E-03	5.49E-03
8							2.45E-03

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.21E-01	9.31E-01	9.33E-01	9.33E-01	9.34E-01	9.41E-01	9.46E-01
Beta	7.90E-02	6.91E-02	6.70E-02	6.68E-02	6.62E-02	5.90E-02	5.36E-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	25.30	37.95	50.59	63.24	75.89	88.54	101.19
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

2.14 DC Power System - Batteries, Chargers, and Breakers

2.14.1 Batteries

2.14.1.1 No Voltage/Amperage Output

ALPHA FACTOR DISTRIBUTIONS

System :	**DC POWER**
Component :	**BATTERY**
Failure Mode :	**NO VOLTAGE/AMPERAGE OUTPUT**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9670750	0.9884850	0.9916130	0.9992130	0.9920720	9.6404E+01	1.1230E+00
2	7.84E-04	1.15E-02	8.39E-03	3.29E-02	7.93E-03	1.1230E+00	9.6404E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9640820	0.9833510	0.9853220	0.9958960	0.9879120	1.5747E+02	2.6661E+00
2	2.62E-03	1.34E-02	1.15E-02	3.09E-02	1.02E-02	2.1487E+00	1.5799E+02
3	1.52E-05	3.23E-03	1.52E-03	1.22E-02	1.93E-03	5.1742E-01	1.5962E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9647970	0.9816910	0.9831300	0.9936630	0.9873710	2.1588E+02	4.0263E+00
2	2.85E-03	1.19E-02	1.04E-02	2.58E-02	8.02E-03	2.6067E+00	2.1730E+02
3	2.97E-04	4.87E-03	3.48E-03	1.42E-02	3.88E-03	1.0719E+00	2.1883E+02
4	5.93E-07	1.58E-03	4.82E-04	6.89E-03	7.27E-04	3.4767E-01	2.1956E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9659140	0.9802930	0.9813030	0.9912170	0.9876380	3.0775E+02	6.1867E+00
2	3.34E-03	1.09E-02	9.89E-03	2.20E-02	6.11E-03	3.4242E+00	3.1051E+02
3	9.93E-04	6.01E-03	4.99E-03	1.45E-02	4.24E-03	1.8852E+00	3.1205E+02
4	5.08E-05	2.37E-03	1.43E-03	7.87E-03	1.72E-03	7.4249E-01	3.1319E+02
5	4.42E-13	4.29E-04	1.17E-05	2.41E-03	2.92E-04	1.3478E-01	3.1380E+02

Batteries
No Voltage/Amperage Output

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9677660	0.9806660	0.9815060	0.9906880	0.9882100	3.7040E+02	7.3026E+00
2	2.80E-03	9.12E-03	8.27E-03	1.83E-02	4.70E-03	3.4453E+00	3.7426E+02
3	1.08E-03	5.62E-03	4.78E-03	1.31E-02	3.83E-03	2.1238E+00	3.7558E+02
4	2.42E-04	3.15E-03	2.33E-03	8.87E-03	2.33E-03	1.1908E+00	3.7651E+02
5	1.83E-06	1.13E-03	4.44E-04	4.60E-03	8.03E-04	4.2820E-01	3.7727E+02
6	7.13E-15	3.03E-04	3.84E-06	1.74E-03	1.22E-04	1.1454E-01	3.7759E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**DC POWER**
Component :	**BATTERY**
Failure Mode :	**NO VOLTAGE/AMPERAGE OUTPUT**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 124
Total Number of Common-Cause Failure Events: 7

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9920720	0.9879120	0.9873710	0.9876380	0.9882100
2	7.93E-03	1.02E-02	8.02E-03	6.11E-03	4.70E-03
3		1.93E-03	3.88E-03	4.24E-03	3.83E-03
4			7.27E-04	1.72E-03	2.33E-03
5				2.92E-04	8.03E-04
6					1.22E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.92E-01	9.88E-01	9.87E-01	9.88E-01	9.88E-01
Beta	7.93E-03	1.21E-02	1.26E-02	1.24E-02	1.18E-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

Batteries
No Voltage/Amperage Output

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	82.67	124.00	165.33	206.67	248.00
$\mathbf{N_1}$	3.4879	3.9169	4.4146	4.9216	5.4553
$\mathbf{N_2}$	0.6885	1.3150	1.3786	1.3100	1.2061
$\mathbf{N_3}$		0.2502	0.6676	0.9078	0.9820
$\mathbf{N_4}$			0.1250	0.3681	0.5986
$\mathbf{N_5}$				0.0625	0.2060
$\mathbf{N_6}$					0.0313

2.14.2 Battery Chargers

2.14.2.1 No Voltage/Amperage Output

ALPHA FACTOR DISTRIBUTIONS

System :	**DC POWER**
Component :	**BATTERY CHARGER**
Failure Mode :	**NO VOLTAGE/AMPERAGE OUTPUT**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9781730	0.9901980	0.9914850	0.9978130	0.9915930	2.4461E+02	2.4214E+00
2	2.18E-03	9.80E-03	8.51E-03	2.18E-02	8.41E-03	2.4214E+00	2.4461E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9783530	0.9884990	0.9893350	0.9957860	0.9906190	3.7911E+02	4.4110E+00
2	2.58E-03	8.65E-03	7.81E-03	1.76E-02	7.04E-03	3.3185E+00	3.8020E+02
3	1.81E-04	2.85E-03	2.05E-03	8.26E-03	2.34E-03	1.0925E+00	3.8243E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9783230	0.9873300	0.9879560	0.9942140	0.9899900	5.1036E+02	6.5491E+00
2	2.93E-03	8.21E-03	7.59E-03	1.56E-02	6.44E-03	4.2460E+00	5.1266E+02
3	4.73E-04	3.30E-03	2.68E-03	8.22E-03	2.77E-03	1.7054E+00	5.1520E+02
4	1.07E-05	1.16E-03	6.07E-04	4.16E-03	8.00E-04	5.9767E-01	5.1631E+02

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9774920	0.9856780	0.9861460	0.9922560	0.9892880	6.7449E+02	9.8006E+00
2	3.73E-03	8.62E-03	8.14E-03	1.51E-02	6.47E-03	5.8959E+00	6.7839E+02
3	8.91E-04	3.76E-03	3.29E-03	8.25E-03	2.74E-03	2.5763E+00	6.8171E+02
4	9.41E-05	1.56E-03	1.11E-03	4.57E-03	1.19E-03	1.0686E+00	6.8322E+02
5	9.75E-09	3.80E-04	7.16E-05	1.82E-03	3.21E-04	2.5978E-01	6.8403E+02

Battery Chargers
No Voltage/Amperage Output

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9777800	0.9852930	0.9856820	0.9914680	0.9888590	8.0909E+02	1.2077E+01
2	3.73E-03	8.11E-03	7.72E-03	1.38E-02	6.32E-03	6.6628E+00	8.1450E+02
3	1.08E-03	3.81E-03	3.42E-03	7.89E-03	2.84E-03	3.1284E+00	8.1804E+02
4	1.95E-04	1.76E-03	1.38E-03	4.65E-03	1.22E-03	1.4486E+00	8.1972E+02
5	1.12E-05	8.04E-04	4.52E-04	2.79E-03	6.26E-04	6.6010E-01	8.2051E+02
6	3.51E-11	2.16E-04	1.58E-05	1.15E-03	1.34E-04	1.7704E-01	8.2099E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**DC POWER**
Component :	**BATTERY CHARGER**
Failure Mode :	**NO VOLTAGE/AMPERAGE OUTPUT**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 569
Total Number of Common-Cause Failure Events: 17

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9915930	0.9906190	0.9899900	0.9892880	0.9888590
2	8.41E-03	7.04E-03	6.44E-03	6.47E-03	6.32E-03
3		2.34E-03	2.77E-03	2.74E-03	2.84E-03
4			8.00E-04	1.19E-03	1.22E-03
5				3.21E-04	6.26E-04
6					1.34E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.92E-01	9.91E-01	9.90E-01	9.89E-01	9.89E-01
Beta	8.41E-03	9.38E-03	1.00E-02	1.07E-02	1.11E-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	224.90	337.35	449.80	562.25	674.70
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

2.14.2.2 Loss of Function

ALPHA FACTOR DISTRIBUTIONS

System :	**DC POWER**
Component :	**BATTERY CHARGER**
Failure Mode :	**NO VOLTAGE/AMPERAGE OUTPUT** **HIGH VOLTAGE/AMPERAGE OUTPUT**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9789580	0.9902580	0.9914160	0.9975920	0.9915080	2.7240E+02	2.6797E+00
2	2.41E-03	9.74E-03	8.58E-03	2.10E-02	8.49E-03	2.6797E+00	2.7240E+02

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9779540	0.9878040	0.9885620	0.9950710	0.9896460	4.2002E+02	5.1860E+00
2	3.36E-03	9.63E-03	8.87E-03	1.85E-02	8.26E-03	4.0935E+00	4.2111E+02
3	1.63E-04	2.57E-03	1.84E-03	7.45E-03	2.09E-03	1.0925E+00	4.2411E+02

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9768770	0.9858400	0.9864010	0.9928840	0.9880840	5.6388E+02	8.0991E+00
2	4.35E-03	1.01E-02	9.57E-03	1.78E-02	8.72E-03	5.7960E+00	5.6618E+02
3	4.28E-04	2.98E-03	2.43E-03	7.43E-03	2.48E-03	1.7054E+00	5.7027E+02
4	9.68E-06	1.04E-03	5.49E-04	3.76E-03	7.16E-04	5.9767E-01	5.7138E+02

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9764910	0.9845430	0.9849670	0.9911320	0.9876020	7.4103E+02	1.1634E+01
2	4.70E-03	9.77E-03	9.34E-03	1.63E-02	8.03E-03	7.3543E+00	7.4531E+02
3	1.06E-03	3.92E-03	3.49E-03	8.26E-03	3.02E-03	2.9513E+00	7.4971E+02
4	8.56E-05	1.42E-03	1.01E-03	4.15E-03	1.06E-03	1.0686E+00	7.5160E+02
5	8.86E-09	3.45E-04	6.51E-05	1.65E-03	2.87E-04	2.5978E-01	7.5240E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9770130	0.9843580	0.9847110	0.9904830	0.9874060	8.8869E+02	1.4122E+01
2	4.42E-03	8.86E-03	8.50E-03	1.45E-02	7.37E-03	7.9996E+00	8.9481E+02
3	1.34E-03	4.12E-03	3.76E-03	8.13E-03	3.30E-03	3.7187E+00	8.9909E+02
4	2.19E-04	1.74E-03	1.38E-03	4.45E-03	1.25E-03	1.5666E+00	9.0125E+02
5	1.02E-05	7.31E-04	4.11E-04	2.54E-03	5.60E-04	6.6010E-01	9.0215E+02
6	3.19E-11	1.96E-04	1.43E-05	1.04E-03	1.20E-04	1.7704E-01	9.0264E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**DC POWER**
Component :	**BATTERY CHARGER**
Failure Mode :	**NO VOLTAGE/AMPERAGE OUTPUT** **HIGH VOLTAGE/AMPERAGE OUTPUT**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 621
Total Number of Common-Cause Failure Events: 20

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1	0.9915080	0.9896460	0.9880840	0.9876020	0.9874060
2	8.49E-03	8.26E-03	8.72E-03	8.03E-03	7.37E-03
3		2.09E-03	2.48E-03	3.02E-03	3.30E-03
4			7.16E-04	1.06E-03	1.25E-03
5				2.87E-04	5.60E-04
6					1.20E-04

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
1-Beta	9.92E-01	9.90E-01	9.88E-01	9.88E-01	9.87E-01
Beta	8.49E-03	1.04E-02	1.19E-02	1.24E-02	1.26E-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

Battery Chargers
Loss of Function

Avg. Impact Vector	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6
Adj. Ind. Events	250.91	376.36	501.82	627.27	752.73
$\mathbf{N_1}$	11.2430	14.1047	15.9277	17.5949	19.0167
$\mathbf{N_2}$	2.2452	3.2598	4.5679	5.2401	5.7604
$\mathbf{N_3}$		0.8253	1.3011	1.9739	2.5769
$\mathbf{N_4}$			0.3750	0.6942	0.9744
$\mathbf{N_5}$				0.1875	0.4379
$\mathbf{N_6}$					0.0938

2.14.3DC Power Distribution Circuit Breakers

2.14.3.1 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**DC POWER**
Component :	**DC DISTRIBUTION CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8518480	0.9381820	0.9481710	0.9902570	0.9255830	2.6829E+01	1.7678E+00
2	9.75E-03	6.18E-02	5.18E-02	1.48E-01	7.44E-02	1.7678E+00	2.6829E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8883830	0.9451520	0.9503380	0.9841570	0.9227200	5.3435E+01	3.1009E+00
2	5.26E-03	3.24E-02	2.71E-02	7.79E-02	3.86E-02	1.8337E+00	5.4702E+01
3	1.98E-03	2.24E-02	1.71E-02	6.11E-02	3.86E-02	1.2672E+00	5.5269E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.8922480	0.9404220	0.9440040	0.9763470	0.9104480	7.6636E+01	4.8551E+00
2	1.17E-02	3.96E-02	3.59E-02	8.02E-02	5.97E-02	3.2281E+00	7.8263E+01
3	5.57E-06	4.96E-03	1.84E-03	2.05E-02	0.00E+00	4.0431E-01	8.1087E+01
4	1.23E-03	1.50E-02	1.13E-02	4.16E-02	2.99E-02	1.2227E+00	8.0268E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9213040	0.9535730	0.9557100	0.9785470	0.9270610	1.3429E+02	6.5383E+00
2	7.58E-03	2.45E-02	2.23E-02	4.90E-02	3.24E-02	3.4475E+00	1.3738E+02
3	1.60E-03	1.17E-02	9.46E-03	2.93E-02	1.62E-02	1.6441E+00	1.3918E+02
4	1.75E-06	2.66E-03	8.94E-04	1.13E-02	0.00E+00	3.7439E-01	1.4045E+02
5	4.65E-04	7.61E-03	5.45E-03	2.22E-02	2.43E-02	1.0723E+00	1.3976E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9290090	0.9571770	0.9589630	0.9792470	0.9384620	1.6269E+02	7.2786E+00
2	5.25E-03	1.84E-02	1.65E-02	3.79E-02	1.82E-02	3.1281E+00	1.6684E+02
3	2.18E-03	1.19E-02	1.01E-02	2.81E-02	1.82E-02	2.0307E+00	1.6794E+02
4	1.39E-04	4.79E-03	3.04E-03	1.54E-02	4.56E-03	8.1442E-01	1.6915E+02
5	5.46E-09	1.31E-03	1.77E-04	6.55E-03	0.00E+00	2.2220E-01	1.6975E+02
6	3.98E-04	6.37E-03	4.57E-03	1.85E-02	2.05E-02	1.0832E+00	1.6889E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9397950	0.9617420	0.9629810	0.9794420	0.9467900	2.3743E+02	9.4451E+00
2	4.83E-03	1.49E-02	1.36E-02	2.94E-02	1.05E-02	3.6804E+00	2.4319E+02
3	2.37E-03	1.02E-02	8.92E-03	2.25E-02	1.58E-02	2.5201E+00	2.4435E+02
4	6.33E-04	5.81E-03	4.54E-03	1.53E-02	7.88E-03	1.4333E+00	2.4544E+02
5	2.21E-05	2.41E-03	1.27E-03	8.70E-03	1.31E-03	5.9587E-01	2.4628E+02
6	2.72E-10	7.55E-04	6.44E-05	3.96E-03	0.00E+00	1.8628E-01	2.4669E+02
7	2.30E-04	4.17E-03	2.93E-03	1.23E-02	1.77E-02	1.0291E+00	2.4585E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9443500	0.9639510	0.9650110	0.9799320	0.9531250	2.7973E+02	1.0461E+01
2	4.22E-03	1.29E-02	1.18E-02	2.53E-02	6.17E-03	3.7398E+00	2.8645E+02
3	2.03E-03	8.71E-03	7.61E-03	1.92E-02	1.23E-02	2.5285E+00	2.8766E+02
4	8.86E-04	5.99E-03	4.90E-03	1.48E-02	9.26E-03	1.7391E+00	2.8845E+02
5	1.24E-04	3.12E-03	2.08E-03	9.67E-03	3.09E-03	9.0583E-01	2.8929E+02
6	1.22E-06	1.35E-03	4.79E-04	5.65E-03	3.86E-04	3.9166E-01	2.8980E+02
7	5.61E-14	4.24E-04	7.62E-06	2.41E-03	0.00E+00	1.2297E-01	2.9007E+02
8	1.98E-04	3.56E-03	2.50E-03	1.05E-02	1.56E-02	1.0331E+00	2.8916E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**DC POWER**
Component :	**DC DISTRIBUTION CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 61
Total Number of Common-Cause Failure Events: 3

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9255830	0.9227200	0.9104480	0.9270610	0.9384620	0.9467900	0.9531250
2	7.44E-02	3.86E-02	5.97E-02	3.24E-02	1.82E-02	1.05E-02	6.17E-03
3		3.86E-02	0.00E+00	1.62E-02	1.82E-02	1.58E-02	1.23E-02
4			2.99E-02	0.00E+00	4.56E-03	7.88E-03	9.26E-03
5				2.43E-02	0.00E+00	1.31E-03	3.09E-03
6					2.05E-02	0.00E+00	3.86E-04
7						1.77E-02	0.00E+00
8							1.56E-02

MGL Parameter	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1-Beta	9.26E-01	9.23E-01	9.10E-01	9.27E-01	9.38E-01	9.47E-01	9.53E-01
Beta	7.44E-02	7.73E-02	8.96E-02	7.29E-02	6.15E-02	5.32E-02	4.69E-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	15.25	22.88	30.50	38.13	45.75	53.38	61.00
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 Fail to Close

ALPHA FACTOR DISTRIBUTIONS

System :	**DC POWER**
Component :	**DC DISTRIBUTION CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Fail to Close

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9099520	0.9761110	0.9885770	0.9998890	0.9928450	2.0889E+01	5.1122E-01
2	1.09E-04	2.39E-02	1.14E-02	9.00E-02	7.15E-03	5.1122E-01	2.0889E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9244190	0.9718900	0.9783250	0.9973410	0.9868590	4.5325E+01	1.3109E+00
2	1.26E-03	2.22E-02	1.58E-02	6.49E-02	1.25E-02	1.0337E+00	4.5602E+01
3	3.03E-07	5.94E-03	1.28E-03	2.79E-02	6.26E-04	2.7722E-01	4.6359E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9271850	0.9678070	0.9722080	0.9933590	0.9824460	6.6950E+01	2.2270E+00
2	2.86E-03	2.25E-02	1.81E-02	5.73E-02	1.56E-02	1.5584E+00	6.7619E+01
3	1.31E-05	6.42E-03	2.63E-03	2.57E-02	1.88E-03	4.4411E-01	6.8733E+01
4	1.55E-08	3.24E-03	4.52E-04	1.62E-02	8.50E-05	2.2447E-01	6.8953E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9381320	0.9675280	0.9699710	0.9885620	0.9789530	1.2194E+02	4.0926E+00
2	4.89E-03	2.04E-02	1.80E-02	4.45E-02	1.75E-02	2.5762E+00	1.2346E+02
3	5.02E-04	8.42E-03	6.00E-03	2.46E-02	3.17E-03	1.0610E+00	1.2497E+02
4	2.34E-06	3.04E-03	1.05E-03	1.28E-02	3.19E-04	3.8279E-01	1.2565E+02
5	5.62E-21	5.76E-04	3.37E-07	3.33E-03	1.14E-05	7.2577E-02	1.2596E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9404320	0.9670730	0.9690970	0.9868070	0.9762030	1.4765E+02	5.0273E+00
2	4.83E-03	1.85E-02	1.65E-02	3.92E-02	1.87E-02	2.8262E+00	1.4985E+02
3	7.46E-04	8.38E-03	6.36E-03	2.30E-02	4.39E-03	1.2800E+00	1.5140E+02
4	4.19E-05	4.02E-03	2.16E-03	1.43E-02	6.87E-04	6.1382E-01	1.5206E+02
5	6.74E-09	1.47E-03	2.02E-04	7.33E-03	5.40E-05	2.2390E-01	1.5245E+02
6	9.64E-19	5.46E-04	9.63E-07	3.18E-03	3.18E-06	8.3337E-02	1.5259E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9460730	0.9674560	0.9688230	0.9841830	0.9741790	2.1965E+02	7.3887E+00
2	5.51E-03	1.67E-02	1.53E-02	3.26E-02	1.90E-02	3.7828E+00	2.2326E+02
3	1.29E-03	8.07E-03	6.68E-03	1.96E-02	5.51E-03	1.8324E+00	2.2521E+02
4	2.52E-04	4.54E-03	3.19E-03	1.34E-02	1.15E-03	1.0309E+00	2.2601E+02
5	1.20E-05	2.32E-03	1.11E-03	8.74E-03	1.42E-04	5.2697E-01	2.2651E+02
6	3.04E-10	8.22E-04	7.05E-05	4.31E-03	8.21E-06	1.8658E-01	2.2685E+02
7	0.00E+00	1.28E-04	1.12E-13	4.82E-04	0.00E+00	2.9071E-02	2.2701E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9484330	0.9678890	0.9690510	0.9833850	0.9726430	2.5919E+02	8.5990E+00
2	5.43E-03	1.54E-02	1.42E-02	2.95E-02	1.90E-02	4.1332E+00	2.6366E+02
3	1.34E-03	7.49E-03	6.30E-03	1.77E-02	6.42E-03	2.0055E+00	2.6578E+02
4	3.64E-04	4.54E-03	3.38E-03	1.27E-02	1.67E-03	1.2160E+00	2.6657E+02
5	5.18E-05	2.69E-03	1.59E-03	9.05E-03	2.79E-04	7.1993E-01	2.6707E+02
6	7.97E-07	1.37E-03	4.52E-04	5.87E-03	2.88E-05	3.6816E-01	2.6742E+02
7	6.20E-14	4.60E-04	8.29E-06	2.62E-03	2.40E-06	1.2307E-01	2.6767E+02
8	1.14E-42	1.24E-04	1.76E-12	5.23E-04	0.00E+00	3.3124E-02	2.6776E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**DC POWER**
Component :	**DC DISTRIBUTION CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO CLOSE (NORMALLY OPEN)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 21
Total Number of Common-Cause Failure Events: 2

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.9928450	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 Spurious Operation

ALPHA FACTOR DISTRIBUTIONS

System :	**DC POWER**
Component :	**DC DISTRIBUTION CIRCUIT BREAKERS**
Failure Mode :	**SPURIOUS ACTUATION**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
$_1$	0.9580820	0.9895750	0.9957970	0.9999790	1.0000000	4.1246E+01	4.3452E-01
$_2$	1.87E-05	1.04E-02	4.21E-03	4.19E-02	0.00E+00	4.3452E-01	4.1246E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
$_1$	0.9487490	0.9821450	0.9870280	0.9988330	1.0000000	6.0555E+01	1.1009E+00
$_2$	4.27E-04	1.35E-02	8.74E-03	4.29E-02	0.00E+00	8.3366E-01	6.0822E+01
$_3$	1.51E-07	4.33E-03	8.71E-04	2.06E-02	0.00E+00	2.6722E-01	6.1389E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9435450	0.9765150	0.9804130	0.9961580	1.0000000	7.7136E+01	1.8551E+00
2	1.28E-03	1.55E-02	1.17E-02	4.30E-02	0.00E+00	1.2281E+00	7.7763E+01
3	5.75E-06	5.12E-03	1.89E-03	2.12E-02	0.00E+00	4.0431E-01	7.8587E+01
4	1.21E-08	2.82E-03	3.85E-04	1.41E-02	0.00E+00	2.2267E-01	7.8768E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9462910	0.9729280	0.9753080	0.9914330	1.0000000	1.2716E+02	3.5382E+00
2	3.11E-03	1.62E-02	1.38E-02	3.74E-02	0.00E+00	2.1142E+00	1.2858E+02
3	3.65E-04	7.48E-03	5.16E-03	2.25E-02	0.00E+00	9.7738E-01	1.2972E+02
4	1.88E-06	2.86E-03	9.64E-04	1.22E-02	0.00E+00	3.7439E-01	1.3032E+02
5	4.56E-21	5.53E-04	3.12E-07	3.20E-03	0.00E+00	7.2277E-02	1.3063E+02

CCCG = 6 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9469780	0.9718910	0.9739370	0.9898220	1.0000000	1.4794E+02	4.2787E+00
2	3.02E-03	1.47E-02	1.26E-02	3.35E-02	0.00E+00	2.2392E+00	1.4998E+02
3	5.28E-04	7.50E-03	5.48E-03	2.14E-02	0.00E+00	1.1418E+00	1.5108E+02
4	3.48E-05	3.89E-03	2.04E-03	1.40E-02	0.00E+00	5.9222E-01	1.5163E+02
5	6.10E-09	1.46E-03	1.98E-04	7.31E-03	0.00E+00	2.2220E-01	1.5200E+02
6	9.26E-19	5.47E-04	9.56E-07	3.19E-03	0.00E+00	8.3237E-02	1.5214E+02

CCCG = 7 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9502700	0.9709020	0.9723060	0.9867330	1.0000000	2.1505E+02	6.4450E+00
2	3.92E-03	1.39E-02	1.25E-02	2.89E-02	0.00E+00	3.0878E+00	2.1841E+02
3	9.92E-04	7.36E-03	5.94E-03	1.86E-02	0.00E+00	1.6312E+00	2.1986E+02
4	2.24E-04	4.46E-03	3.09E-03	1.34E-02	0.00E+00	9.8887E-01	2.2051E+02
5	1.16E-05	2.36E-03	1.12E-03	8.90E-03	0.00E+00	5.2177E-01	2.2097E+02
6	3.03E-10	8.41E-04	7.18E-05	4.41E-03	0.00E+00	1.8628E-01	2.2131E+02
7	0.00E+00	1.31E-04	1.15E-13	4.94E-04	0.00E+00	2.9071E-02	2.2147E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9519800	0.9709900	0.9722010	0.9858570	1.0000000	2.4973E+02	7.4610E+00
2	3.91E-03	1.30E-02	1.18E-02	2.63E-02	0.00E+00	3.3447E+00	2.5385E+02
3	1.00E-03	6.76E-03	5.53E-03	1.67E-02	0.00E+00	1.7384E+00	2.5545E+02
4	3.15E-04	4.46E-03	3.26E-03	1.27E-02	0.00E+00	1.1465E+00	2.5604E+02
5	5.01E-05	2.75E-03	1.62E-03	9.32E-03	0.00E+00	7.0833E-01	2.5648E+02
6	8.07E-07	1.43E-03	4.67E-04	6.10E-03	0.00E+00	3.6696E-01	2.5682E+02
7	6.33E-14	4.78E-04	8.60E-06	2.72E-03	0.00E+00	1.2297E-01	2.5707E+02
8	1.19E-42	1.29E-04	1.83E-12	5.44E-04	0.00E+00	3.3124E-02	2.5716E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**DC POWER**
Component :	**DC DISTRIBUTION CIRCUIT BREAKERS**
Failure Mode :	**SPURIOUS ACTUATION**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

Total Number of Independent Failure Events: 31
Total Number of Common-Cause Failure Events: 0

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	31.00	31.00	31.00	31.00	31.00	31.00	31.00
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 Fail to Open

ALPHA FACTOR DISTRIBUTIONS

System :	**REACTOR PROTECTION**
Component :	**REACTOR PROTECTION TRIP CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

CCCG = 2 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9633370	0.9908870	0.9963330	0.9999820	1.0000000	4.7246E+01	4.3452E-01
2	1.63E-05	9.11E-03	3.67E-03	3.67E-02	0.00E+00	4.3452E-01	4.7246E+01

CCCG = 3 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9532560	0.9837280	0.9881890	0.9989340	1.0000000	6.6555E+01	1.1009E+00
2	3.88E-04	1.23E-02	7.96E-03	3.91E-02	0.00E+00	8.3366E-01	6.6822E+01
3	1.38E-07	3.95E-03	7.93E-04	1.87E-02	0.00E+00	2.6722E-01	6.7389E+01

CCCG = 4 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9474900	0.9781730	0.9818070	0.9964330	1.0000000	8.3136E+01	1.8551E+00
2	1.19E-03	1.44E-02	1.09E-02	4.00E-02	0.00E+00	1.2281E+00	8.3763E+01
3	5.34E-06	4.76E-03	1.76E-03	1.97E-02	0.00E+00	4.0431E-01	8.4587E+01
4	1.13E-08	2.62E-03	3.58E-04	1.31E-02	0.00E+00	2.2267E-01	8.4768E+01

CCCG = 5 **Alpha Factor**	**5th%**	**Mean**	**Median**	**95th%**	**MLE**	**a**	**b**
1	0.9486250	0.9741160	0.9763980	0.9918180	1.0000000	1.3316E+02	3.5382E+00
2	2.97E-03	1.55E-02	1.32E-02	3.58E-02	0.00E+00	2.1142E+00	1.3458E+02
3	3.49E-04	7.15E-03	4.93E-03	2.15E-02	0.00E+00	9.7738E-01	1.3572E+02
4	1.80E-06	2.74E-03	9.22E-04	1.16E-02	0.00E+00	3.7439E-01	1.3632E+02
5	4.36E-21	5.29E-04	2.99E-07	3.06E-03	0.00E+00	7.2277E-02	1.3663E+02

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9489700	0.9729570	0.9749300	0.9902120	1.0000000	1.5394E+02	4.2787E+00
2	2.90E-03	1.42E-02	1.22E-02	3.22E-02	0.00E+00	2.2392E+00	1.5598E+02
3	5.07E-04	7.22E-03	5.27E-03	2.06E-02	0.00E+00	1.1418E+00	1.5708E+02
4	3.34E-05	3.74E-03	1.96E-03	1.35E-02	0.00E+00	5.9222E-01	1.5763E+02
5	5.87E-09	1.40E-03	1.90E-04	7.04E-03	0.00E+00	2.2220E-01	1.5800E+02
6	8.91E-19	5.26E-04	9.20E-07	3.07E-03	0.00E+00	8.3237E-02	1.5814E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9515710	0.9716700	0.9730440	0.9870870	1.0000000	2.2105E+02	6.4450E+00
2	3.82E-03	1.36E-02	1.22E-02	2.81E-02	0.00E+00	3.0878E+00	2.2441E+02
3	9.66E-04	7.17E-03	5.79E-03	1.81E-02	0.00E+00	1.6312E+00	2.2586E+02
4	2.18E-04	4.35E-03	3.01E-03	1.30E-02	0.00E+00	9.8887E-01	2.2651E+02
5	1.13E-05	2.29E-03	1.09E-03	8.67E-03	0.00E+00	5.2177E-01	2.2697E+02
6	2.95E-10	8.19E-04	6.99E-05	4.30E-03	0.00E+00	1.8628E-01	2.2731E+02
7	0.00E+00	1.28E-04	1.12E-13	4.81E-04	0.00E+00	2.9071E-02	2.2747E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9530660	0.9716520	0.9728360	0.9861790	1.0000000	2.5573E+02	7.4610E+00
2	3.82E-03	1.27E-02	1.15E-02	2.57E-02	0.00E+00	3.3447E+00	2.5985E+02
3	9.77E-04	6.61E-03	5.40E-03	1.63E-02	0.00E+00	1.7384E+00	2.6145E+02
4	3.08E-04	4.36E-03	3.18E-03	1.24E-02	0.00E+00	1.1465E+00	2.6204E+02
5	4.90E-05	2.69E-03	1.58E-03	9.11E-03	0.00E+00	7.0833E-01	2.6248E+02
6	7.89E-07	1.39E-03	4.56E-04	5.96E-03	0.00E+00	3.6696E-01	2.6282E+02
7	6.19E-14	4.67E-04	8.40E-06	2.66E-03	0.00E+00	1.2297E-01	2.6307E+02
8	1.16E-42	1.26E-04	1.79E-12	5.32E-04	0.00E+00	3.3124E-02	2.6316E+02

ALPHA FACTOR and MGL PARAMETERS

System :	**REACTOR PROTECTION**
Component :	**REACTOR PROTECTION TRIP CIRCUIT BREAKERS**
Failure Mode :	**FAIL TO OPEN (NORMALLY CLOSED)**
Start Date :	**1991/01/01**
Data Version :	**2005/12/31**

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

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	37.00	37.00	37.00	37.00	37.00	37.00	37.00
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.

ALPHA FACTOR DISTRIBUTIONS

Data Version :	2005/12/31

CCCG = 2 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8386830	0.9593170	0.9828300	0.9999250	----	1.0246E+01	4.3452E-01
2	7.69E-05	4.06E-02	1.71E-02	1.61E-01	----	4.3452E-01	1.0246E+01

CCCG = 3 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.8979020	0.9640890	0.9736330	0.9976040	----	2.9555E+01	1.1008E+00
2	8.71E-04	2.71E-02	1.77E-02	8.57E-02	----	8.3366E-01	2.9822E+01
3	3.07E-07	8.71E-03	1.77E-03	4.13E-02	----	2.6722E-01	3.0388E+01

CCCG = 4 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9077330	0.9613450	0.9675780	0.9936050	----	4.6136E+01	1.8550E+00
2	2.13E-03	2.55E-02	1.93E-02	7.04E-02	----	1.2281E+00	4.6763E+01
3	9.52E-06	8.42E-03	3.13E-03	3.47E-02	----	4.0431E-01	4.7586E+01
4	2.00E-08	4.64E-03	6.37E-04	2.32E-02	----	2.2267E-01	4.7768E+01

CCCG = 5 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9298110	0.9645110	0.9675740	0.9887220	----	9.6161E+01	3.5382E+00
2	4.08E-03	2.12E-02	1.80E-02	4.89E-02	----	2.1142E+00	9.7585E+01
3	4.79E-04	9.80E-03	6.77E-03	2.94E-02	----	9.7738E-01	9.8721E+01
4	2.47E-06	3.75E-03	1.26E-03	1.59E-02	----	3.7439E-01	9.9324E+01
5	5.98E-21	7.25E-04	4.10E-07	4.19E-03	----	7.2277E-02	9.9627E+01

CCCG = 6 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9335790	0.9647030	0.9672350	0.9871780	----	1.1694E+02	4.2786E+00
2	3.80E-03	1.84E-02	1.58E-02	4.19E-02	----	2.2392E+00	1.1897E+02
3	6.63E-04	9.41E-03	6.89E-03	2.68E-02	----	1.1418E+00	1.2007E+02
4	4.37E-05	4.88E-03	2.56E-03	1.76E-02	----	5.9222E-01	1.2062E+02
5	7.66E-09	1.83E-03	2.48E-04	9.18E-03	----	2.2220E-01	1.2099E+02
6	1.16E-18	6.86E-04	1.20E-06	4.00E-03	----	8.3237E-02	1.2113E+02

CCCG = 7 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9422570	0.9661670	0.9677850	0.9845420	----	1.8405E+02	6.4449E+00
2	4.56E-03	1.62E-02	1.45E-02	3.35E-02	----	3.0878E+00	1.8740E+02
3	1.15E-03	8.56E-03	6.91E-03	2.16E-02	----	1.6312E+00	1.8886E+02
4	2.60E-04	5.19E-03	3.59E-03	1.55E-02	----	9.8887E-01	1.8950E+02
5	1.34E-05	2.73E-03	1.29E-03	1.03E-02	----	5.2177E-01	1.8997E+02
6	3.52E-10	9.77E-04	8.35E-05	5.13E-03	----	1.8628E-01	1.9030E+02
7	5.33E-48	1.52E-04	1.33E-13	5.74E-04	----	2.9071E-02	1.9046E+02

CCCG = 8 Alpha Factor	5th%	Mean	Median	95th%	MLE	a	b
1	0.9454620	0.9670150	0.9683850	0.9838980	----	2.1873E+02	7.4609E+00
2	4.45E-03	1.47E-02	1.33E-02	2.99E-02	----	3.3447E+00	2.2284E+02
3	1.13E-03	7.68E-03	6.29E-03	1.90E-02	----	1.7384E+00	2.2445E+02
4	3.58E-04	5.06E-03	3.70E-03	1.44E-02	----	1.1465E+00	2.2504E+02
5	5.70E-05	3.13E-03	1.84E-03	1.06E-02	----	7.0833E-01	2.2548E+02
6	9.18E-07	1.62E-03	5.31E-04	6.94E-03	----	3.6696E-01	2.2582E+02
7	7.20E-14	5.43E-04	9.77E-06	3.09E-03	----	1.2297E-01	2.2606E+02
8	1.34E-42	1.46E-04	2.08E-12	6.19E-04	----	3.3124E-02	2.2615E+02

ALPHA FACTOR and MGL PARAMETERS

Data Version :	2005/12/31

Alpha Factor	CCCG=2	CCCG=3	CCCG=4	CCCG=5	CCCG=6	CCCG=7	CCCG=8
1	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
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

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.