Summary of SPAR Component Unreliability Data and Results
2015 Paramater Estimation Update
12/21/16 12:00 PM

Grouping	Component Type	Component Failure Mode	Description	Data Source	Data				Industry-average Failure Probability or Rate Distribution (note a)									Date Range	Comments (see Appendix A for details)	Effective Date
					Failures	Demands or Hours	d or h	Components	Distribution	Analysis Type	5th	Median	Mean	95th	α	β	Error Factor (note b)			
Valves	Air-Operated Valve (AOV)	AOV-FTO	Air Operated Valve Fails To Open	EPIX/RADS	78	201,147	d	1767	Beta	EB/PL/KS	1.04E-05	2.44E-04	3.91E-04	1.27E-03	0.793	2.030E+03	5.2	1998--2015		Dec-2016
		AOV-FTC	Air Operated Valve Fails To Close	EPIX/RADS	53	201,147	d	1767	Beta	EB/PL/KS	2.24E-06	1.78E-04	3.63E-04	1.35E-03	0.547	1.510E+03	7.6	1998--2015		Dec-2016
		AOV-FTOC	Air Operated Valve Fails To Open	EPIX/RADS	134	201,147	d	1767	Beta	EB/PL/KS	4.49E-05	5.49E-04	7.78E-04	2.29E-03	1.050	1.350E+03	4.2	1998--2015		Dec-2016
		AOV-FC	Air Operated Valve Fails To Control	EPIX/RADS	279	1,347,257,000	h	8784	Gamma	EB/PL/KS	2.41E-08	1.77E-07	2.28E-07	6.08E-07	1.410	6.170E+06	3.4	1998--2015		Dec-2016
		AOV-SOP	Air Operated Valve Transfers Positions	EPIX/RADS	132	1,347,257,000	h	8784	Gamma	EB/PL/KS	7.28E-09	7.61E-08	1.05E-07	2.99E-07	1.140	1.090E+07	3.9	1998--2015		Dec-2016
		AOV-ILS	Air-Operated Valve Internal Leakage (Small)	EPIX/RADS	104	1,347,257,000	h	8784	Gamma	JNID/IL	6.57E-08	7.75E-08	7.76E-08	9.07E-08	105.000	1.350E+09	1.2	1998--2015		Dec-2016
		AOV-ILL	Air-Operated Valve Internal Leakage (Rupture)	EPIX/RADS	104	1,347,257,000	h	8784	Gamma	JNID/IL	1.66E-13	3.78E-10	1.55E-09	7.10E-09	0.300	1.933E+08	18.8	1998--2015	AOV leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		AOV-ELS	Air-Operated Valve External Leakage (Small)	EPIX/RADS	60	1,347,257,000	h	8784	Gamma	JNID/IL	3.58E-08	4.46E-08	4.49E-08	5.47E-08	60.500	1.350E+09	1.2	1998--2015		Dec-2016
		AOV-ELL	Air-Operated Valve External Leakage (Rupture)	EPIX/RADS	60	1,347,257,000	h	8784	Gamma	JNID/IL	3.36E-13	7.66E-10	3.14E-09	1.44E-08	0.300	9.545E+07	18.8	1998--2015	AOV leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		CCW-AOV-OC	CCW AOV Spuriously Transfers	EPIX/RADS	25	178,863,300	h	1161	Gamma	JNID/IL	9.94E-08	1.41E-07	1.43E-07	1.92E-07	25.500	1.790E+08	1.4	1998--2015		Dec-2016
		IAS-AOV-OC	Instrument Air System AOV Spuriously Transfers	EPIX/RADS	0	7,056,096	h	45	Gamma	JNID/IL	2.78E-10	3.22E-08	7.09E-08	2.72E-07	0.500	7.060E+06	8.4	1998--2015		Dec-2016
	Motor-Operated Valve (MOV)	MOV-FTO	Motor Operated Valve Fail To Open	EPIX/RADS	293	740,890	d	6902	Beta	EB/PL/KS	1.17E-04	3.76E-04	4.21E-04	8.76E-04	3.080	7.320E+03	2.3	1998--2015		Dec-2016
		MOV-FTC	Motor Operated Valve Fail To Close	EPIX/RADS	234	740,890	d	6902	Beta	EB/PL/KS	5.25E-05	2.76E-04	3.35E-04	8.17E-04	1.820	5.440E+03	3.0	1998--2015		Dec-2016
		MOV-FTOC	Motor Operated Valve Fails to Open/Close	EPIX/RADS	558	740,890	d	6902	Beta	EB/PL/KS	2.00E-04	7.20E-04	8.22E-04	1.78E-03	2.660	3.240E+03	2.5	1998--2015		Dec-2016
		MOV-FC	Motor Operated Feed Control Valve Fails To Operate	EPIX/RADS	119	1,983,522,000	h	13001	Gamma	EB/PL/KS	7.49E-09	4.69E-08	5.90E-08	1.50E-07	1.580	2.690E+07	3.2	1998--2015		Dec-2016
		MOV-SOP	Motor Operated Valve Fails To Remain Open	EPIX/RADS	63	1,983,522,000	h	13001	Gamma	EB/PL/KS	2.90E-10	1.69E-08	3.24E-08	1.17E-07	0.593	1.830E+07	6.9	1998--2015		Dec-2016
		MOV-ILS	Motor Operated Valve Internal Leakage (Small)	EPIX/RADS	141	1,983,522,000	h	13001	Gamma	EB/PL/KS	1.66E-09	4.58E-08	7.58E-08	2.52E-07	0.747	9.860E+06	5.5	1998--2015		Dec-2016
		MOV-ILL	Motor Operated Valve Internal Leakage (Rupture)	EPIX/RADS	141	1,983,522,000	h	13001	Gamma	EB/PL/KS	1.62E-13	3.70E-10	1.52E-09	6.93E-09	0.300	1.979E+08	18.8	1998--2015	MOV leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		MOV-ELS	Motor Operated Valve External Leakage (Small)	EPIX/RADS	51	1,983,522,000	h	13001	Gamma	EB/PL/KS	9.56E-11	1.21E-08	2.71E-08	1.05E-07	0.490	1.810E+07	8.7	1998--2015		Dec-2016
		MOV-ELL	Motor Operated Valve External Leakage (Rupture)	EPIX/RADS	51	1,983,522,000	h	13001	Gamma	EB/PL/KS	2.03E-13	4.62E-10	1.90E-09	8.68E-09	0.300	1.581E+08	18.8	1998--2015	MOV leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		MOV-FTO-BFV	Butterfly Valve Fail To Open	EPIX/RADS	27	109,522	d	961	Beta	JNID/IL	1.79E-04	2.49E-04	2.51E-04	3.36E-04	27.500	1.090E+05	1.3	1998--2015		Dec-2016
		MOV-FTC-BFV	Butterfly Valve Fail To Close	EPIX/RADS	34	109,522	d	961	Beta	EB/PL/KS	2.30E-05	2.45E-04	3.38E-04	9.68E-04	1.130	3.350E+03	4.0	1998--2015		Dec-2016
		MOV-FTOC-BFV	Butterfly Valve Fail To Open/Close	EPIX/RADS	65	109,522	d	961	Beta	EB/PL/KS	3.84E-05	4.98E-04	7.14E-04	2.12E-03	1.020	1.430E+03	4.3	1998--2015		Dec-2016
		CCW-BFV-OC	CCW Butterfly Valve Spuriously Transfers	EPIX/RADS	6	106,466,800	h	708	Gamma	JNID/IL	2.78E-08	5.82E-08	6.11E-08	1.05E-07	6.500	1.060E+08	1.8	1998--2015		Dec-2016
		CCW-MOV-OC	CCW MOV Spuriously Transfers	EPIX/RADS	6	223,471,400	h	1443	Gamma	JNID/IL	1.32E-08	2.77E-08	2.91E-08	5.01E-08	6.500	2.230E+08	1.8	1998--2015		Dec-2016
		SWS-MOV-OC	Standby Service Water Motor Operated Valve Spuriously Transfers	EPIX/RADS	3	73,067,170	h	495	Gamma	JNID/IL	1.48E-08	4.34E-08	4.79E-08	9.62E-08	3.500	7.310E+07	2.2	1998--2015		Dec-2016
	Hydraulic-Operated Valve (HOV)	HOV-FTOC	Hydraulic Operated Valve Fails To Open	EPIX/RADS	26	19,863	d	230	Beta	JNID/IL	9.40E-04	1.32E-03	1.33E-03	1.79E-03	26.500	1.980E+04	1.4	1998--2015		Dec-2016
		HOV-FC	Hydraulic Valve Fail To Control	EPIX/RADS	42	93,083,360	h	601	Gamma	JNID/IL	3.48E-07	4.53E-07	4.57E-07	5.77E-07	42.500	9.310E+07	1.3	1998--2015		Dec-2016
		HOV-SOP	Hydraulic valve spurios operation	EPIX/RADS	17	93,083,360	h	601	Gamma	JNID/IL	1.21E-07	1.84E-07	1.88E-07	2.67E-07	17.500	9.310E+07	1.5	1998--2015		Dec-2016
		HOV-ILS	Hydraulic Operated Valve Internal Leakage (Small)	EPIX/RADS	4	93,083,360	h	601	Gamma	JNID/IL	1.79E-08	4.48E-08	4.83E-08	9.09E-08	4.500	9.310E+07	2.0	1998--2015		Dec-2016
		HOV-ILL	Hydraulic Operated Valve Internal Leakage (Rupture)	EPIX/RADS	4	93,083,360	h	601	Gamma	JNID/IL	1.03E-13	2.35E-10	9.66E-10	4.42E-09	0.300	3.106E+08	18.8	1998--2015	HOV leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		HOV-ELS	Hydraulic Operated Valve External Leakage (Small)	EPIX/RADS	12	93,083,360	h	601	Gamma	JNID/IL	7.85E-08	1.31E-07	1.34E-07	2.02E-07	12.500	9.310E+07	1.5	1998--2015		Dec-2016
		HOV-ELL	Hydraulic Operated Valve External Leakage (Rupture)	EPIX/RADS	12	93,083,360	h	601	Gamma	JNID/IL	1.00E-12	2.29E-09	9.38E-09	4.29E-08	0.300	3.198E+07	18.8	1998--2015	HOV leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
	Solenoid-Operated Valve (SOV)	SOV-FTOC	Solenoid Operated Valve Fails To Open	EPIX/RADS	23	33,317	d	759	Beta	JNID/IL	4.84E-04	6.95E-04	7.05E-04	9.60E-04	23.500	3.330E+04	1.4	1998--2015		Dec-2016
		SOV-FC	Solenoid Operated Valve Fails To Control	EPIX/RADS	58	143,582,100	h	1161	Gamma	JNID/IL	3.23E-07	4.04E-07	4.07E-07	4.97E-07	58.500	1.440E+08	1.2	1998--2015		Dec-2016
		SOV-SOP	Solenoid-Operated Valve Spuriously Open or Close	EPIX/RADS	9	143,582,100	h	1161	Gamma	JNID/IL	3.51E-08	6.37E-08	6.62E-08	1.05E-07	9.500	1.440E+08	1.6	1998--2015		Dec-2016
		SOV-ILS	Solenoid Operated Valve Internal Leakage (Small)	EPIX/RADS	20	143,582,100	h	1161	Gamma	JNID/IL	9.49E-08	1.40E-07	1.43E-07	1.98E-07	20.500	1.440E+08	1.4	1998--2015		Dec-2016
		SOV-ILL	Solenoid Operated Valve Internal Leakage (Rupture)	EPIX/RADS	20	143,582,100	h	1161	Gamma	JNID/IL	3.06E-13	6.97E-10	2.86E-09	1.31E-08	0.300	1.049E+08	18.8	1998--2015	SOV leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		SOV-ELS	Solenoid Operated Valve External Leakage (Small)	EPIX/RADS	3	143,582,100	h	1161	Gamma	JNID/IL	7.53E-09	2.20E-08	2.44E-08	4.88E-08	3.500	1.440E+08	2.2	1998--2015		Dec-2016
		SOV-ELL	Solenoid Operated Valve External Leakage (Rupture)	EPIX/RADS	3	143,582,100	h	1161	Gamma	JNID/IL	1.83E-13	4.16E-10	1.71E-09	7.81E-09	0.300	1.756E+08	18.8	1998--2015	SOV leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
	Explosive-Operated Valve (EOV)	EOV-FTO	Explosive Valve Fails To Open	EPIX/RADS	3	713	d	57	Beta	JNID/IL	1.52E-03	4.44E-03	4.90E-03	9.83E-03	3.500	7.110E+02	2.2	1998--2015		Dec-2016
	Vacuum Breaker Valve (VBV)	VBV-FTO	Vacuum Breaker Valve Fail to Open	EPIX/RADS	2	27,842	d	167	Beta	JNID/IL	2.06E-05	7.83E-05	8.98E-05	1.99E-04	2.500	2.780E+04	2.5	1998--2015		Dec-2016
		VBV-FTC	Vacuum breaker fails to close	EPIX/RADS	6	27,842	d	167	Beta	EB/PL/KS	4.03E-06	1.27E-04	2.15E-04	7.25E-04	0.715	3.330E+03	5.7	1998--2015		Dec-2016
		VBV-FTOC	Vacuum Breaker Valve Fails to Open/Close	EPIX/RADS	8	27,842	d	167	Beta	EB/PL/KS	5.55E-06	1.94E-04	3.37E-04	1.15E-03	0.690	2.050E+03	5.9	1998--2015		Dec-2016
		VBV-SOP	Vacuum Breaker Fails Open	EPIX/RADS	1	52,796,540	h	342	Gamma	JNID/IL	3.33E-09	2.24E-08	2.84E-08	7.40E-08	1.500	5.280E+07	3.3	1998--2015		Dec-2016
		VBV-ILS	Vacuum Breaker Valve Internal Leakage (Small)	EPIX/RADS	15	52,796,540	h	342	Gamma	JNID/IL	1.83E-07	2.87E-07	2.94E-07	4.26E-07	15.500	5.280E+07	1.5	1998--2015		Dec-2016
		VBV-ILL	Vacuum Breaker Valve Internal Leakage (Rupture)	EPIX/RADS	15	52,796,540	h	342	Gamma	JNID/IL	6.29E-13	1.43E-09	5.88E-09	2.69E-08	0.300	5.102E+07	18.8	1998--2015	VBV leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
	Turbine Bypass Valve (TBV)	TBV-FTO	Turbine Bypass Valve Fail to Open	EPIX/RADS	8	2,725	d	73	Beta	JNID/IL	1.59E-03	2.99E-03	3.12E-03	5.05E-03	8.500	2.720E+03	1.7	1998--2015		Dec-2016
		TBV-FTC	Turbine Bypass Valve Fails to Close	EPIX/RADS	0	2,725	d	73	Beta	JNID/IL	7.20E-07	8.33E-05	1.83E-04	7.03E-04	0.500	2.730E+03	8.4	1998--2015		Dec-2016
		TBV-FTOC	Turbine Bypass Valve Fail to Open/Close	EPIX/RADS	8	2,725	d	73	Beta	JNID/IL	1.59E-03	2.99E-03	3.12E-03	5.05E-03	8.500	2.720E+03	1.7	1998--2015		Dec-2016
		TBV-FC	Turbine Bypass Valve Fails To Control	EPIX/RADS	14	23,964,260	h	156	Gamma	JNID/IL	3.69E-07	5.90E-07	6.05E-07	8.87E-07	14.500	2.400E+07	1.5	1998--2015		Dec-2016
	Main Steam Isolation Valve (MSV)	MSV-FTOC	Main Steam Isolation Valve Fails to Open/Close	EPIX/RADS	34	38,629	d	419	Beta	JNID/IL	6.59E-04	8.84E-04	8.93E-04	1.16E-03	34.500	3.860E+04	1.3	1998--2015		Dec-2016
		MSV-SOP	Main Steam Isolation Fails To Remain Open	EPIX/RADS	25	79,241,950	h	513	Gamma	EB/PL/KS	1.44E-09	1.45E-07	3.10E-07	1.18E-06	0.516	1.660E+06	8.1	1998--2015		Dec-2016
		MSV-ILS	Main Steam Isolation Internal Leakage (Small)	EPIX/RADS	63	79,241,950	h	513	Gamma	JNID/IL	6.44E-07	7.98E-07	8.01E-07	9.74E-07	63.500	7.920E+07	1.2	1998--2015		Dec-2016
		MSV-ILL	Main Steam Isolation Internal Leakage (Rupture)	EPIX/RADS	63	79,241,950	h	513	Gamma	JNID/IL	1.71E-12	3.91E-09	1.60E-08	7.33E-08	0.300	1.873E+07	18.8	1998--2015	MSV leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		MSV-ELS	Main Steam Isolation External Leakage (Small)	EPIX/RADS	2	79,241,950	h	513	Gamma	JNID/IL	7.23E-09	2.75E-08	3.15E-08	6.99E-08	2.500	7.920E+07	2.5	1998--2015		Dec-2016
		MSV-ELL	Main Steam Isolation External Leakage (Rupture)	EPIX/RADS	2	79,241,950	h	513	Gamma	JNID/IL	2.36E-13	5.38E-10	2.21E-09	1.01E-08	0.300	1.361E+08	18.8	1998--2015	MSV leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
	Check Valve (CKV)	CKV-FTO	Check Valve Fails To Open Fails To Open	EPIX/RADS	0	54,126	d	496	Beta	JNID/IL	3.63E-08	4.20E-06	9.24E-06	3.55E-05	0.500	5.410E+04	8.4	1998--2015		Dec-2016
		CKV-FTC	Check Valve Fails To Close	EPIX/RADS	8	54,126	d	496	Beta	JNID/IL	8.01E-05	1.51E-04	1.57E-04	2.55E-04	8.500	5.410E+04	1.7	1998--2015		Dec-2016
		CKV-SO	Check Valve Fails to Remain Open	EPIX/RADS	2	977,258,600	h	6331	Gamma	JNID/IL	5.86E-10	2.23E-09	2.56E-09	5.67E-09	2.500	9.770E+08	2.5	1998--2015		Dec-2016
		CKV-SC	Check Valve Fails to Remain Open (Spurious Close)	EPIX/RADS	5	977,258,600	h	6331	Gamma	JNID/IL	2.34E-09	5.29E-09	5.63E-09	1.01E-08	5.500	9.770E+08	1.9	1998--2015		Dec-2016
		CKV-ILS	Check Valve Internal Leakage (Small)	EPIX/RADS	143	977,258,600	h	6331	Gamma	EB/PL/KS	1.14E-09	1.00E-07	2.08E-07	7.80E-07	0.534	2.570E+06	7.8	1998--2015		Dec-2016
		CKV-ILL	Check Valve Internal Leakage (Rupture)	EPIX/RADS	143	977,258,600	h	6331	Gamma	EB/PL/KS	4.45E-13	1.01E-09	4.16E-09	1.90E-08	0.300	7.212E+07	18.8	1998--2015	CKV leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		CKV-ELS	Check Valve External Leakage (Small)	EPIX/RADS	7	977,258,600	h	6331	Gamma	JNID/IL	3.72E-09	7.34E-09	7.67E-09	1.28E-08	7.500	9.770E+08	1.7	1998--2015		Dec-2016
		CKV-ELL	Check Valve External Leakage (Rupture)	EPIX/RADS	7	977,258,600	h	6331	Gamma	JNID/IL	5.75E-14	1.31E-10	5.37E-10	2.46E-09	0.300	5.588E+08	18.8	1998--2015	CKV leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
	Manual Valve (XVM)	XVM-FTOC	Manual Valve Fails To Open	EPIX/RADS	1	3,270	d	66	Beta	JNID/IL	5.38E-05	3.62E-04	4.59E-04	1.19E-03	1.500	3.270E+03	3.3	1998--2015		Dec-2016
		XVM-SOP	Manual Valve Spurious Transfer	EPIX/RADS	6	128,295,300	h	866	Gamma	JNID/IL	2.30E-08	4.82E-08	5.07E-08	8.74E-08	6.500	1.280E+08	1.8	1998--2015		Dec-2016
		XVM-ILS	Manual Valve Internal Leakage (Small)	EPIX/RADS	7	128,295,300	h	866	Gamma	EB/PL/KS	9.97E-10	3.89E-08	6.88E-08	2.38E-07	0.667	9.700E+06	6.1	1998--2015		Dec-2016
		XVM-ILL	Manual Valve Internal Leakage (Rupture)	EPIX/RADS	7	128,295,300	h	866	Gamma	EB/PL/KS	1.47E-13	3.35E-10	1.38E-09	6.29E-09	0.300	2.180E+08	18.8	1998--2015	XVM leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		XVM-ELS	Manual Valve External Leakage (Small)	EPIX/RADS	14	128,295,300	h	866	Gamma	JNID/IL	6.92E-08	1.11E-07	1.13E-07	1.66E-07	14.500	1.280E+08	1.5	1998--2015		Dec-2016
		XVM-ELL	Manual Valve External Leakage (Rupture)	EPIX/RADS	14	128,295,300	h	866	Gamma	JNID/IL	8.47E-13	1.93E-09	7.91E-09	3.62E-08	0.300	3.793E+07	18.8	1998--2015	XVM leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		SWS-XVM-OC	Standby Service Water Manual Valve Spuriously Transfers	EPIX/RADS	2	18,346,180	h	121	Gamma	JNID/IL	3.13E-08	1.19E-07	1.36E-07	3.02E-07	2.500	1.830E+07	2.5	1998--2015		Dec-2016
	Flow Control Valve (FCV)	FCV-FTOC	Flow Control Valve Fails To Open/Close	EPIX/RADS	5	12,488	d	96	Beta	JNID/IL	1.83E-04	4.13E-04	4.40E-04	7.87E-04	5.500	1.250E+04	1.9	1998--2015		Dec-2016
		FCV-FC	Flow Control Valve Fails To Control	EPIX/RADS	16	88,861,090	h	574	Gamma	JNID/IL	1.17E-07	1.82E-07	1.86E-07	2.67E-07	16.500	8.890E+07	1.5	1998--2015		Dec-2016
		FCV-SO	Flow Control Valve Transfers Positions	EPIX/RADS	10	88,861,090	h	574	Gamma	JNID/IL	6.52E-08	1.14E-07	1.18E-07	1.84E-07	10.500	8.890E+07	1.6	1998--2015		Dec-2016
		FRV-FO	Feedwater Regulating Valve Fail To Operate	EPIX/RADS	72	33,730,380	h	216	Gamma	EB/PL/KS	3.08E-07	1.72E-06	2.10E-06	5.23E-06	1.730	8.220E+05	3.0	1998--2015		Dec-2016
Pumps	Motor-Driven Pump (MDP)	MDP-SBY-FTS	Motor Driven Pump Fails To Start, Normally Standby	EPIX/RADS	351	482,206	d	1311	Beta	EB/PL/KS	1.59E-04	6.78E-04	7.94E-04	1.83E-03	2.210	2.780E+03	2.7	1998--2015		Dec-2016
		MDP-SBY-FTR<1H	Motor Driven Pump Fails To Run, Early Term	EPIX/RADS	48	437,647	h	1311	Gamma	EB/PL/KS	3.94E-06	7.86E-05	1.22E-04	3.89E-04	0.844	6.910E+03	4.9	1998--2015		Dec-2016
		MDP-SBY-FTR>1H	Motor Driven Pump Fails To Run, Late Term	EPIX/RADS	143	20,062,180	h	1311	Gamma	EB/PL/KS	1.35E-07	6.28E-06	1.15E-05	4.07E-05	0.632	5.490E+04	6.5	1998--2015		Dec-2016
		MDP-ELS	Motor Driven Pump External Leakage (Small)	EPIX/RADS	105	347,850,600	h	2344	Gamma	EB/PL/KS	9.46E-09	1.87E-07	2.91E-07	9.22E-07	0.847	2.920E+06	4.9	1998--2015		Dec-2016
		MDP-ELL	Motor Driven Pump External Leakage (Rupture)	EPIX/RADS	105	347,850,600	h	2344	Gamma	EB/PL/KS	2.18E-12	4.97E-09	2.04E-08	9.32E-08	0.300	1.473E+07	18.8	1998--2015	MDP leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		MDP-NR-FTS	Motor-driven pump Fail to Start, Normally Running	EPIX/RADS	147	138,319	d	670	Beta	EB/PL/KS	2.61E-04	9.52E-04	1.08E-03	2.37E-03	2.620	2.410E+03	2.5	1998--2015		Dec-2016
		MDP-NR-FTR	Motor-driven pump Fail to Run, Normally Running	EPIX/RADS	225	59,582,350	h	664	Gamma	EB/PL/KS	1.15E-06	3.43E-06	3.79E-06	7.68E-06	3.420	9.010E+05	2.2	1998--2015		Dec-2016
		MDP-CCW-FTS	CCW Motor-driven pump Fail to Start	EPIX/RADS	69	88,693	h	291	Beta	EB/PL/KS	5.86E-05	6.32E-04	8.78E-04	2.52E-03	1.120	1.280E+03	4.0	1998--2015		Dec-2016
		MDP-CCW-FTR	CCW Motor-driven pump Fail to Run (Yr-1)	EPIX/RADS	53	19,648,220	h	291	Gamma	EB/PL/KS	2.87E-07	2.13E-06	2.76E-06	7.33E-06	1.400	5.090E+05	3.4	1998--2015		Dec-2016
		MDP-SWS-FTS	SWS Pump FTS	EPIX/RADS	180	264,384	d	549	Beta	EB/PL/KS	6.20E-05	6.17E-04	8.41E-04	2.38E-03	1.170	1.390E+03	3.9	1998--2015		Dec-2016
		SWS-MDP-FS-NE	SWS Pump Non-Enviro-FTS	EPIX/RADS	149	249,957	h	446	Beta	EB/PL/KS	5.67E-05	5.56E-04	7.55E-04	2.14E-03	1.180	1.560E+03	3.8	1998--2015		Dec-2016
		SWS-MDP-FR-NE	Service Water Motor-Driven Pump (Running) Fail to Run Non-ExEE (yr-1)	EPIX/RADS	2	16,692,670	h	446	Gamma	JNID/IL	3.43E-08	1.30E-07	1.50E-07	3.31E-07	2.500	1.670E+07	2.5	1998--2015		Dec-2016
		MDP-SWS-FTR	SWS Pump FTR (hr-1)	EPIX/RADS	64	10,443,960	h	106	Gamma	EB/PL/KS	4.14E-07	4.70E-06	6.56E-06	1.91E-05	1.090	1.660E+05	4.1	1998--2015		Dec-2016
		NSW-MDP-FR	Nuclear Service Water MDP Fails to Run	EPIX/RADS	64	10,256,170	h	104	Gamma	EB/PL/KS	4.34E-07	4.85E-06	6.72E-06	1.96E-05	1.100	1.630E+05	4.0	1998--2015		Dec-2016
		MDP-FS-NE-SWS	Service Water MDP Fail to Run, Non-Environmental	EPIX/RADS	179	264,384	d	549	Beta	EB/PL/KS	6.39E-05	6.18E-04	8.36E-04	2.36E-03	1.190	1.420E+03	3.8	1998--2015		Dec-2016
		MDP-FR-NE-SWS	Service Water MDP Fail to Run, Non-Environmental	EPIX/RADS	151	26,944,240	h	548	Gamma	EB/PL/KS	8.93E-07	4.69E-06	5.67E-06	1.39E-05	1.820	3.200E+05	3.0	1998--2015		Dec-2016
		CSW-MDP-FR	CSW Motor Driven Pump Fails to Run	EPIX/RADS	25	3,654,539	h	32	Gamma	JNID/IL	4.88E-06	6.90E-06	6.98E-06	9.41E-06	25.500	3.650E+06	1.4	1998--2015		Dec-2016
	Turbine-Driven Pump (TDP)	TDP-SBY-FTS	Turbine Driven Pump Fails To Start (Pooled Systems), Normally Standby	EPIX/RADS	146	26,558	d	133	Beta	EB/PL/KS	4.70E-04	4.47E-03	6.01E-03	1.69E-02	1.200	1.980E+02	3.8	1998--2015		Dec-2016
		TDP-SBY-FTR<1H	Turbine Driven Pump Fails To Run (Pooled Systems), Early Term	EPIX/RADS	61	18,025	h	133	Gamma	EB/PL/KS	1.34E-04	2.43E-03	3.70E-03	1.16E-02	0.878	2.370E+02	4.8	1998--2015		Dec-2016
		TDP-SBY-FTR>1H	Turbine Driven Pump Fails To Run (Pooled Systems), Late Term	EPIX/RADS	23	11,205	h	133	Gamma	JNID/IL	1.44E-03	2.07E-03	2.10E-03	2.86E-03	23.500	1.120E+04	1.4	1998--2015		Dec-2016
		TDP-NR-FTS	Turbine Driven Pump Fails To Start (Pooled Systems), Normally Running	EPIX/RADS	12	1,395	d	43	Beta	EB/PL/KS	4.04E-04	6.25E-03	9.17E-03	2.81E-02	0.938	1.010E+02	4.5	1998--2015		Dec-2016
		TDP-NR-FTR	Turbine Driven Pump Fails To Run (Pooled Systems), Normally Running	EPIX/RADS	62	5,984,882	h	43	Gamma	EB/PL/KS	1.43E-06	8.73E-06	1.09E-05	2.77E-05	1.610	1.480E+05	3.2	1998--2015		Dec-2016
		TDP-ELS	Turbine-Driven Pump External Leakage (Small)	EPIX/RADS	15	28,788,990	h	186	Gamma	JNID/IL	3.35E-07	5.27E-07	5.38E-07	7.81E-07	15.500	2.880E+07	1.5	1998--2015		Dec-2016
		TDP-ELL	Turbine Bypass Valve External Leakage (Rupture)	EPIX/RADS	15	28,788,990	h	186	Gamma	JNID/IL	4.03E-12	9.18E-09	3.77E-08	1.72E-07	0.300	7.966E+06	18.8	1998--2015	TDP leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		TDP-FS-NS-AFW	AFW Turbine Driven Pump Fails To Start, Normally Standby	EPIX/RADS	72	18,054	d	74	Beta	EB/PL/KS	9.44E-05	2.62E-03	4.33E-03	1.43E-02	0.746	1.720E+02	5.5	1998--2015		Dec-2016
		TDP-FR-E-AFW	AFW Turbine Driven Pump Fails To Run, Early Term	EPIX/RADS	40	12,076	h	74	Gamma	EB/PL/KS	9.03E-05	2.26E-03	3.67E-03	1.20E-02	0.774	2.110E+02	5.3	1998--2015		Dec-2016
		TDP-FR-L-AFW	AFW Turbine Driven Pump Fails To Run, Late Term	EPIX/RADS	13	9,283	h	74	Gamma	JNID/IL	8.70E-04	1.42E-03	1.45E-03	2.16E-03	13.500	9.280E+03	1.5	1998--2015		Dec-2016
		TDP-FS-NS-HCI-RCI	HCI-RCI Turbine Driven Pump Fails To Start, Normally Standby	EPIX/RADS	41	4,929	d	31	Beta	EB/PL/KS	2.52E-03	7.90E-03	8.78E-03	1.81E-02	3.160	3.560E+02	2.3	1998--2015		Dec-2016
		TDP-FR-E-HCI-RCI	HCI Turbine Driven Pump Fails To Run, Early Term	EPIX/RADS	21	5,949	h	59	Gamma	EB/PL/KS	2.36E-04	2.68E-03	3.75E-03	1.09E-02	1.090	2.910E+02	4.1	1998--2015		Dec-2016
		TDP-FR-L-HCI-RCI	HCI-RCI Turbine Driven Pump Fails To Run, Late Term	EPIX/RADS	10	1,922	h	59	Gamma	EB/PL/KS	1.04E-03	4.67E-03	5.52E-03	1.29E-02	2.100	3.810E+02	2.8	1998--2015		Dec-2016
		TDP-FS-NR-MFW	MFW Turbine Driven Pump Fails To Start, Normally Running	EPIX/RADS	62	5,984,882	d	43	Gamma	EB/PL/KS	1.43E-06	8.73E-06	1.09E-05	2.77E-05	1.610	1.480E+05	3.2	1998--2015		Dec-2016
		TDP-FR-NR-MFW	MFW Turbine Driven Pump Fails To Run, Normally Running	EPIX/RADS	62	5,984,882	h	43	Gamma	EB/PL/KS	1.43E-06	8.73E-06	1.09E-05	2.77E-05	1.610	1.480E+05	3.2	1998--2015		Dec-2016
	Engine-Driven Pump (EDP)	EDP-FTS	Engine Driven Pump Fails To Start, Normally Standby	EPIX/RADS	26	17,988	d	37	Beta	EB/PL/KS	2.52E-05	1.19E-03	2.17E-03	7.68E-03	0.630	2.890E+02	6.5	1998--2015		Dec-2016
		EDP-FTR<1H	Engine Driven Pump Fails To Run, Early Term, Normally Standby	EPIX/RADS	10	10,717	h	37	Gamma	JNID/IL	5.42E-04	9.50E-04	9.80E-04	1.53E-03	10.500	1.070E+04	1.6	1998--2015		Dec-2016
		EDP-FTR>1H	Engine Driven Pump Fails To Run, Late Term, Normally Standby	EPIX/RADS	11	5,820	h	37	Gamma	JNID/IL	1.12E-03	1.92E-03	1.98E-03	3.02E-03	11.500	5.820E+03	1.6	1998--2015		Dec-2016
		EDP-ELS	Engine-Driven Pump External Leakage (Small)	EPIX/RADS	8	9,129,089	h	69	Gamma	EB/PL/KS	5.15E-08	6.42E-07	9.12E-07	2.70E-06	1.040	1.140E+06	4.2	1998--2015		Dec-2016
		EDP-ELL	Engine Driven Pump External Leakage (Rupture)	EPIX/RADS	8	9,129,089	h	69	Gamma	EB/PL/KS	6.83E-12	1.56E-08	6.38E-08	2.92E-07	0.300	4.699E+06	18.8	1998--2015	EDP leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		AFW-EDP-FTS	AFW Engine-driven pump Fails to Start	EPIX/RADS	3	1,275	d	5	Beta	JNID/IL	8.52E-04	2.49E-03	2.74E-03	5.52E-03	3.500	1.270E+03	2.2	1998--2015		Dec-2016
		AFW-EDP-FTR<1H	AFW Engine-driven pump Fails to Run <1H	EPIX/RADS	4	739	h	5	Gamma	JNID/IL	2.25E-03	5.64E-03	6.09E-03	1.14E-02	4.500	7.390E+02	2.0	1998--2015		Dec-2016
		AFW-EDP-FTR>1H	AFW Engine-driven pump Fails to Run >1H	EPIX/RADS	2	262	h	5	Gamma	JNID/IL	2.19E-03	8.30E-03	9.53E-03	2.11E-02	2.500	2.620E+02	2.5	1998--2015		Dec-2016
	Positive Displacement Pump (PDP)	PDP-NR-FTS	Positive Displacement Pump Fails To Start, Normally Running	EPIX/RADS	78	35,863	d	63	Beta	EB/PL/KS	3.63E-04	2.13E-03	2.63E-03	6.63E-03	1.660	6.280E+02	3.1	1998--2015		Dec-2016
		PDP-NR-FTR	Positive Displacement Pump Fails To Run, Normally Running	EPIX/RADS	71	2,905,081	h	60	Gamma	EB/PL/KS	1.43E-06	2.49E-05	3.77E-05	1.17E-04	0.892	2.370E+04	4.7	1998--2015		Dec-2016
		PDP-SBY-FTS	Positive Displacement Pump Fails To Start, Normally Standby	EPIX/RADS	16	10,799	d	72	Beta	JNID/IL	9.65E-04	1.49E-03	1.53E-03	2.19E-03	16.500	1.080E+04	1.5	1998--2015		Dec-2016
		PDP-SBY-FTR<1H	Positive Displacement Pump Fails To Run, Early Term	EPIX/RADS	2	4,699	h	72	Gamma	JNID/IL	1.22E-04	4.63E-04	5.32E-04	1.18E-03	2.500	4.700E+03	2.5	1998--2015		Dec-2016
		PDP-SBY-FTR>1H	Positive Displacement Pump Fails To Run, Late Term	EPIX/RADS	2	1,710	h	72	Gamma	JNID/IL	3.35E-04	1.27E-03	1.46E-03	3.24E-03	2.500	1.710E+03	2.5	1998--2015		Dec-2016
		PDP-ELS	Positive Displacement Pump External Leakage (Small)	EPIX/RADS	28	26,271,740	h	175	Gamma	JNID/IL	7.73E-07	1.07E-06	1.08E-06	1.44E-06	28.500	2.630E+07	1.3	1998--2015		Dec-2016
		PDP-ELL	Positive Displacement Pump External Leakage (Rupture)	EPIX/RADS	28	26,271,740	h	175	Gamma	JNID/IL	8.09E-12	1.84E-08	7.56E-08	3.46E-07	0.300	3.968E+06	18.8	1998--2015	PDP leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
	Pump Volute (PMP)	PMP-Volute	Pump Volute Fails To Run (Driver Independent Centrifugal Pumps)	EPIX/RADS	25	158,885	h	207	Gamma	JNID/IL	1.12E-04	1.58E-04	1.60E-04	2.16E-04	25.500	1.590E+05	1.4	1998--2015		Dec-2016
Generators	Emergency Diesel Generator (EDG)	EDG-FTS	Diesel Generator Fails To Start, Normally Standby	EPIX/RADS	214	75,452	d	232	Beta	EB/PL/KS	1.52E-03	2.78E-03	2.88E-03	4.60E-03	9.190	3.180E+03	1.7	1998--2015		Dec-2016
		EDG-FTLR	Diesel Generator Fails To Load And Run, Early	EPIX/RADS	239	65,993	h	232	Gamma	EB/PL/KS	1.14E-03	3.37E-03	3.72E-03	7.49E-03	3.470	9.330E+02	2.2	1998--2015		Dec-2016
		EDG-FTR	Diesel Generator Fails To Run, Late Term	EPIX/RADS	184	133,976	h	232	Gamma	EB/PL/KS	3.53E-04	1.33E-03	1.52E-03	3.36E-03	2.530	1.660E+03	2.5	1998--2015		Dec-2016
	Hydro Turbine Generator (HTG)	HTG-FTS	Hydro Electric Turbine Generator Fails To Start	EPIX/RADS	11	7,270	d	2	Beta	JNID/IL	9.00E-04	1.54E-03	1.58E-03	2.42E-03	11.500	7.260E+03	1.6	1998--2015		Dec-2016
		HTG-FTLR	Hydro Electric Turbine Generator Fail To Run (< 1 Hour)	EPIX/RADS	7	4,629	h	2	Gamma	JNID/IL	7.84E-04	1.55E-03	1.62E-03	2.70E-03	7.500	4.630E+03	1.7	1998--2015		Dec-2016
		HTG-FTR	Hydro Electric Turbine Generator Fail To Run (> 1 Hour)	EPIX/RADS	1	10,678	h	2	Gamma	JNID/IL	1.64E-05	1.11E-04	1.40E-04	3.65E-04	1.500	1.070E+04	3.3	1998--2015		Dec-2016
	Combustion Turbine Generator (CTG)	CTG-FTS	Gas Turbine Generator Fails To Start, Normally Standby	EPIX/RADS	18	503	d	3	Beta	EB/PL/KS	2.98E-03	3.73E-02	5.12E-02	1.48E-01	1.030	1.900E+01	4.0	1998--2015		Dec-2016
		CTG-FTLR	Gas Turbine Generator Fails To Load And Run, Early Term	EPIX/RADS	2	432	d	2	Gamma	JNID/IL	1.33E-03	5.04E-03	5.79E-03	1.28E-02	2.500	4.320E+02	2.5	1998--2015		Dec-2016
		CTG-FTR	Gas Turbine Generator Fails To Run, Late Term	EPIX/RADS	5	648	h	2	Gamma	JNID/IL	3.53E-03	7.98E-03	8.49E-03	1.52E-02	5.500	6.480E+02	1.9	1998--2015		Dec-2016
	High-Pressure Core Spray Generator	EDG-HCS-FTS	HCS Generator Fail to Start	EPIX/RADS	2	2,654	d	8	Beta	JNID/IL	2.16E-04	8.20E-04	9.42E-04	2.09E-03	2.500	2.650E+03	2.5	1998--2015		Dec-2016
		EDG-HCS-FTR	HCS Generator Fail to Run	EPIX/RADS	4	3,948	h	8	Gamma	JNID/IL	4.21E-04	1.06E-03	1.14E-03	2.14E-03	4.500	3.950E+03	2.0	1998--2015		Dec-2016
	Station Blackout Generator (SBO)	EDG-SBO-FTS	SBO Generator Fail to Start	EPIX/RADS	12	419	d	4	Beta	JNID/IL	1.75E-02	2.90E-02	2.98E-02	4.45E-02	12.500	4.080E+02	1.5	1998--2015		Dec-2016
		EDG-SBO-FTR	SBO Generator Fail to Run	EPIX/RADS	2	1,668	h	4	Gamma	JNID/IL	3.43E-04	1.30E-03	1.50E-03	3.31E-03	2.500	1.670E+03	2.5	1998--2015		Dec-2016
	Safety Relief Valve (SRV)	SRV-FTO	Safety relief valve fails to open	EPIX/RADS	23	9,720	d	440	Beta	JNID/IL	1.66E-03	2.38E-03	2.42E-03	3.29E-03	23.500	9.700E+03	1.4	1998--2015		Dec-2016
		SRV-FTC	BWR ADS/SRV Fails To Reclose	EPIX/RADS	8	9,720	d	440	Beta	EB/PL/KS	9.42E-05	6.85E-04	8.86E-04	2.34E-03	1.420	1.610E+03	3.4	1998--2015		Dec-2016
		SRV-FC	Safety Relief Valve (BWR Only) Fails To Control	EPIX/RADS	0	72,220,220	h	558	Gamma	JNID/IL	2.72E-11	3.15E-09	6.92E-09	2.66E-08	0.500	7.220E+07	8.4	1998--2015		Dec-2016
		SRV-SOP	Safety Relief Valve (BWR Only) SPURIOUSLY OPENS	EPIX/RADS	9	72,220,220	h	558	Gamma	EB/PL/KS	6.03E-09	9.44E-08	1.40E-07	4.29E-07	0.935	6.680E+06	4.6	1998--2015		Dec-2016
		SRV-SOP	Safety Relief Valve (BWR Only) SPURIOUSLY OPENS	EPIX/RADS	9	72,220,220	h	558	Gamma	EB/PL/KS	6.03E-09	9.44E-08	1.40E-07	4.29E-07	0.935	6.680E+06	4.6	1998--2015		Dec-2016
		SRV-ILS	Safety Relief Valve (BWR Only) Internal Leakage (Small)	EPIX/RADS	25	72,220,220	h	558	Gamma	EB/PL/KS	1.16E-09	1.76E-07	4.09E-07	1.61E-06	0.471	1.150E+06	9.1	1998--2015		Dec-2016
		SRV-ILL	Safety Relief Valve (BWR Only) Internal Leakage (Rupture)	EPIX/RADS	25	72,220,220	h	558	Gamma	EB/PL/KS	8.76E-13	1.99E-09	8.18E-09	3.74E-08	0.300	3.667E+07	18.8	1998--2015	SRV leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		SRV-ELS	Safety Relief Valve (BWR Only) External Leakage (Small)	EPIX/RADS	0	72,220,220	h	558	Gamma	JNID/IL	2.72E-11	3.15E-09	6.92E-09	2.66E-08	0.500	7.220E+07	8.4	1998--2015		Dec-2016
		SRV-ELL	Safety Relief Valve (BWR Only) External Leakage (Rupture)	EPIX/RADS	0	72,220,220	h	558	Gamma	JNID/IL	5.18E-14	1.18E-10	4.84E-10	2.22E-09	0.300	6.193E+08	18.8	1998--2015	SRV leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		SVV-FTO	BWR Code Safety Fails To Open	EPIX/RADS	5	23,801	d	960	Beta	EB/PL/KS	4.04E-07	8.73E-05	2.18E-04	8.77E-04	0.438	2.010E+03	10.0	1998--2015		Dec-2016
		SVV-FTC	BWR Code Safety Fails To Reclose	EPIX/RADS	3	23,801	d	960	Beta	JNID/IL	4.55E-05	1.33E-04	1.47E-04	2.95E-04	3.500	2.380E+04	2.2	1998--2015		Dec-2016

Grouping	Component Type	Component Failure Mode	Description	Data Source	Data				Industry-average Failure Probability or Rate Distribution (note a)									Date Range	Comments (see Appendix A for details)	Effective Date
					Failures	Demands or Hours	d or h	Components	Distribution	Analysis Type	5th	Median	Mean	95th	α	β	Error Factor (note b)			
Relief Valves	Safety Valve (SVV)	SVV-SOP	Code Safety Valve Spurious Operation	EPIX/RADS	11	211,426,600	h	1426	Gamma	JNID/IL	3.10E-08	5.29E-08	5.44E-08	8.33E-08	11.500	2.110E+08	1.6	1998--2015		Dec-2016
		SVV-ILS	Code Safety Valve Internal Leakage (Small)	EPIX/RADS	14	211,426,600	h	1426	Gamma	JNID/IL	4.20E-08	6.71E-08	6.86E-08	1.01E-07	14.500	2.110E+08	1.5	1998--2015		Dec-2016
		SVV-ILL	Code Safety Valve Internal Leakage (Rupture)	EPIX/RADS	14	211,426,600	h	1426	Gamma	JNID/IL	1.47E-13	3.34E-10	1.37E-09	6.28E-09	0.300	2.187E+08	18.8	1998--2015	SVV leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		SVV-ELS	Code Safety Valve External Leakage (Small)	EPIX/RADS	2	211,426,600	h	1426	Gamma	JNID/IL	2.71E-09	1.03E-08	1.18E-08	2.62E-08	2.500	2.110E+08	2.5	1998--2015		Dec-2016
		SVV-ELL	Code Safety Valve External Leakage (Rupture)	EPIX/RADS	2	211,426,600	h	1426	Gamma	JNID/IL	8.84E-14	2.01E-10	8.26E-10	3.78E-09	0.300	3.632E+08	18.8	1998--2015	SVV leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		SVV-FTO-PWR-MSS	Safety valve fails to open (main steam system, PWRs)	EPIX/RADS	4	20,243	d	762	Beta	JNID/IL	8.23E-05	2.06E-04	2.22E-04	4.19E-04	4.500	2.020E+04	2.0	1998--2015		Dec-2016
		SVV-FTC-PWR-MSS	Steam generator code safety valves fail to close	EPIX/RADS	2	20,243	d	762	Beta	JNID/IL	2.84E-05	1.08E-04	1.23E-04	2.74E-04	2.500	2.020E+04	2.5	1998--2015		Dec-2016
		SVV-SOP-PWR-MSS	Safety valve spurious operation (main steam system)	EPIX/RADS	8	172,245,500	h	1137	Gamma	JNID/IL	2.52E-08	4.75E-08	4.93E-08	8.02E-08	8.500	1.720E+08	1.7	1998--2015		Dec-2016
		SVV-FTO-PWR-RCS	PZR Code Safety Relief (SVV) Fails to Open	EPIX/RADS	1	2,907	d	155	Beta	JNID/IL	6.04E-05	4.06E-04	5.16E-04	1.34E-03	1.500	2.910E+03	3.3	1998--2015		Dec-2016
		SVV-FTC-PWR-RCS	PZR Code Safety Relief (SVV) Fails to Close	EPIX/RADS	1	2,907	d	155	Beta	JNID/IL	6.04E-05	4.06E-04	5.16E-04	1.34E-03	1.500	2.910E+03	3.3	1998--2015		Dec-2016
		SVV-SOP-PWR-RCS	Safety valve spurious operation (reactor coolant system)	EPIX/RADS	3	29,547,930	h	224	Gamma	JNID/IL	3.67E-08	1.08E-07	1.18E-07	2.38E-07	3.500	2.950E+07	2.2	1998--2015		Dec-2016
	Power-Operated Relief Valve (PORV)	PORV-FTO-PPR	PZR Power Operated Relief/Dump Valve Fails To Open	EPIX/RADS	16	6,130	d	114	Beta	EB/PL/KS	2.05E-05	1.60E-03	3.24E-03	1.20E-02	0.550	1.700E+02	7.5	1998--2015		Dec-2016
		PRV-CC-PZR	PZR Power Operated Relief/Dump Valve Fails To Open	EPIX/RADS	16	6,130	d	114	Beta	EB/PL/KS	2.05E-05	1.60E-03	3.24E-03	1.20E-02	0.550	1.700E+02	7.5	1998--2015		Dec-2016
		PORV-FTC-PPR	PZR One PORV/SRV Fails To Reclose	EPIX/RADS	4	6,130	d	114	Beta	JNID/IL	2.71E-04	6.80E-04	7.34E-04	1.38E-03	4.500	6.130E+03	2.0	1998--2015		Dec-2016
		PORV-FTO-MSS	Main Steam Power Operated Relief/Dump Valve Fails To Open	EPIX/RADS	42	10,401	d	111	Beta	EB/PL/KS	4.08E-04	3.67E-03	4.91E-03	1.36E-02	1.240	2.520E+02	3.7	1998--2015		Dec-2016
		ARV-OO-MSS	Main Steam Power Operated Relief/Dump Fails to Close	EPIX/RADS	19	10,401	d	111	Beta	EB/PL/KS	8.60E-06	1.00E-03	2.21E-03	8.46E-03	0.499	2.260E+02	8.4	1998--2015		Dec-2016
		PORV-FTC-MSS	Main Steam Power Operated Relief/Dump Fails to Close	EPIX/RADS	19	10,401	d	111	Beta	EB/PL/KS	8.60E-06	1.00E-03	2.21E-03	8.46E-03	0.499	2.260E+02	8.4	1998--2015		Dec-2016
		PORV-FC-MSS	Main Steam Power Operated Relief Fails To Control (Cooldown)	EPIX/RADS	13	49,398,360	d	317	Gamma	EB/PL/KS	4.91E-10	1.04E-07	2.57E-07	1.03E-06	0.440	1.710E+06	10.0	1998--2015		Dec-2016
		ARV-CC-MSS	Main Steam Power Operated Relief/Dump Valve Fails To Open	EPIX/RADS	42	10,401	d	111	Beta	EB/PL/KS	4.08E-04	3.67E-03	4.91E-03	1.36E-02	1.240	2.520E+02	3.7	1998--2015		Dec-2016
		PORV-FC	Main Steam Power Operated Relief Fails To Control (Cooldown)	EPIX/RADS	13	49,398,360	d	317	Gamma	EB/PL/KS	4.91E-10	1.04E-07	2.57E-07	1.03E-06	0.440	1.710E+06	10.0	1998--2015		Dec-2016
		PORV-SOP	Power Operated Relief Spurious Opening	EPIX/RADS	24	69,470,980	h	448	Gamma	JNID/IL	2.44E-07	3.48E-07	3.53E-07	4.77E-07	24.500	6.950E+07	1.4	1998--2015		Dec-2016
		PORV-ILS	Power Operated Relief Internal Leakage (Small)	EPIX/RADS	18	69,470,980	h	448	Gamma	JNID/IL	1.73E-07	2.61E-07	2.66E-07	3.75E-07	18.500	6.950E+07	1.4	1998--2015		Dec-2016
		PORV-ILL	Power Operated Relief Internal Leakage (Rupture)	EPIX/RADS	18	69,470,980	h	448	Gamma	JNID/IL	5.69E-13	1.30E-09	5.32E-09	2.43E-08	0.300	5.639E+07	18.8	1998--2015	PORV leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		PORV-ELS	Power Operated Relief External Leakage (Small)	EPIX/RADS	0	69,470,980	h	448	Gamma	JNID/IL	2.83E-11	3.27E-09	7.20E-09	2.76E-08	0.500	6.950E+07	8.4	1998--2015		Dec-2016
		PORV-ELL	Power Operated Relief External Leakage (Rupture)	EPIX/RADS	0	69,470,980	h	448	Gamma	JNID/IL	5.39E-14	1.23E-10	5.04E-10	2.31E-09	0.300	5.952E+08	18.8	1998--2015	PORV leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		PORV-L	PORVs/SRVs Open During LOOP	Special Calc			d	0	Point Estimate	MLE			1.48E-01							Nov-2011
		PORV-T	PORVs/SRVs Open During Transient	Special Calc			d	0	Point Estimate	MLE			3.55E-02							Nov-2011
		PORV-Lquid	PORVs Fail To Close After Passing Liquid	Special Calc	0	7	d	0	Beta	JNID/IL	6.45E-05	2.46E-02	6.25E-02	2.54E-01	0.393	5.895E+00	10.3			Nov-2011
		PORV-P1	PWR One PORV/SRV Sticks Open	Special Calc	18	13,897	d	0	Beta	JNID/IL	2.61E-04	1.23E-03	1.46E-03	3.46E-03	2.009	1.374E+03	2.8			Nov-2011
	Low-Capacity Relief Valve (RVL)	RVL-FTO	Low Capacity Relief Valve Fails to Close	EPIX/RADS	5	78	d	12	Beta	EB/PL/KS	1.67E-04	4.78E-02	1.07E-01	4.14E-01	0.413	3.450E+00	8.6	1998--2015		Dec-2016
		RVL-FTC	Low Capacity Relief Valve Fails To Open	EPIX/RADS	0	78	d	12	Beta	JNID/IL	2.52E-05	2.91E-03	6.34E-03	2.43E-02	0.500	7.840E+01	8.4	1998--2015		Dec-2016
		RVL-SO	Low Capacity Relief Valve Spurious Operation	EPIX/RADS	0	9,633,048	h	81	Gamma	JNID/IL	2.04E-10	2.36E-08	5.19E-08	1.99E-07	0.500	9.630E+06	8.4	1998--2015		Dec-2016
		RVL-ILS	Low Capacity Relief Valve Internal Leakage (Small)	EPIX/RADS	11	9,633,048	h	81	Gamma	JNID/IL	6.80E-07	1.16E-06	1.19E-06	1.83E-06	11.500	9.630E+06	1.6	1998--2015		Dec-2016
		RVL-ILL	Low Capacity Relief Valve Internal Leakage (Rupture)	EPIX/RADS	11	9,633,048	h	81	Gamma	JNID/IL	2.55E-12	5.80E-09	2.38E-08	1.09E-07	0.300	1.261E+07	18.8	1998--2015	RVL leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		RVL-ELS	Low Capacity Relief Valve External Leakage (Small)	EPIX/RADS	2	9,633,048	h	81	Gamma	JNID/IL	5.95E-08	2.26E-07	2.60E-07	5.75E-07	2.500	9.630E+06	2.5	1998--2015		Dec-2016
		RVL-ELL	Low Capacity Relief Valve External Leakage (Rupture)	EPIX/RADS	2	9,633,048	h	81	Gamma	JNID/IL	1.95E-12	4.44E-09	1.82E-08	8.33E-08	0.300	1.648E+07	18.8	1998--2015	RVL leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
Electrical Equipment	Battery Charger (BCH)	BCH-FTOP	Battery Charger Fails to Operate	EPIX/RADS	294	120,676,300	h	790	Gamma	EB/PL/KS	2.67E-07	2.00E-06	2.59E-06	6.93E-06	1.390	5.360E+05	3.5	1998--2015		Dec-2016
	Battery (BAT)	BAT-FTOP	Battery Fails to Operate	EPIX/RADS	23	63,157,740	h	415	Gamma	JNID/IL	2.55E-07	3.67E-07	3.72E-07	5.06E-07	23.500	6.320E+07	1.4	1998--2015		Dec-2016
	Automatic Bus Transfer Switch	ABT-FF	Automatic Power Transfer Switch Fails To Transfer	EPIX/RADS	4	3,976	d	27	Beta	JNID/IL	4.19E-04	1.05E-03	1.13E-03	2.13E-03	4.500	3.970E+03	2.0	1998--2015		Dec-2016
		ABT-SO	Automatic Power Transfer Switch Transfers Open	EPIX/RADS	0	5,048,822	h	32	Gamma	JNID/IL	3.89E-10	4.50E-08	9.90E-08	3.80E-07	0.500	5.050E+06	8.4	1998--2015		Dec-2016
	Circuit Breaker (CBK)	CBK-FTOC	Circuit Breaker Fails To Open/Close	EPIX/RADS	154	141,621	d	3512	Beta	EB/PL/KS	4.77E-05	1.26E-03	2.07E-03	6.85E-03	0.758	3.650E+02	5.4	1998--2015		Dec-2016
		CBK-SOP	Circuit Breaker (All Voltages) Transfers Open	EPIX/RADS	77	690,765,200	h	4609	Gamma	EB/PL/KS	2.06E-09	9.01E-08	1.63E-07	5.72E-07	0.644	3.950E+06	6.4	1998--2015		Dec-2016
		CBKHV-FTOC	High Voltage (13.8 and 16 Kv) Circuit Breaker Fails To Open/Close	EPIX/RADS	21	11,066	d	258	Beta	EB/PL/KS	3.93E-05	1.59E-03	2.83E-03	9.84E-03	0.659	2.320E+02	6.2	1998--2015		Dec-2016
		CBKHV-SOP	High Voltage (13.8 and 16 Kv) Circuit Breaker Spurious Operation	EPIX/RADS	17	43,105,710	h	298	Gamma	EB/PL/KS	1.67E-09	2.15E-07	4.83E-07	1.87E-06	0.488	1.010E+06	8.7	1998--2015		Dec-2016
		CBKMV-FTOC	Medium Voltage (4160 v and 6.9 Kv) Circuit Breaker Fails To Open/Close	EPIX/RADS	72	60,179	d	1093	Beta	EB/PL/KS	3.15E-05	1.38E-03	2.49E-03	8.72E-03	0.644	2.580E+02	6.3	1998--2015		Dec-2016
		CBKMV-SOP	Medium Voltage (4160 v and 6.9 Kv) Circuit Breaker Spurious Operation	EPIX/RADS	19	184,867,300	h	1245	Gamma	EB/PL/KS	2.80E-10	4.81E-08	1.15E-07	4.53E-07	0.459	4.010E+06	9.4	1998--2015		Dec-2016
		CRB-FTOC-480	Low Voltage (480 v) Circuit Breaker Fails To Open/Close	EPIX/RADS	56	55,060	d	1776	Beta	JNID/IL	8.13E-04	1.02E-03	1.03E-03	1.26E-03	56.500	5.500E+04	1.2	1998--2015		Dec-2016
		CRB-CO-480	Low Voltage (480 v) Circuit Breaker Spurious Operation	EPIX/RADS	39	396,295,000	h	2629	Gamma	JNID/IL	7.52E-08	9.89E-08	9.97E-08	1.27E-07	39.500	3.960E+08	1.3	1998--2015		Dec-2016
		CBKDC-FTOC	DC Circuit Breaker Fails to Open/Close	EPIX/RADS	2	5,777	d	217	Beta	JNID/IL	9.91E-05	3.76E-04	4.33E-04	9.57E-04	2.500	5.780E+03	2.5	1998--2015		Dec-2016
		CBKDC-SOP	DC Circuit Breaker Spurious Operation	EPIX/RADS	1	42,345,960	h	271	Gamma	JNID/IL	4.16E-09	2.80E-08	3.54E-08	9.24E-08	1.500	4.230E+07	3.3	1998--2015		Dec-2016
	Inverter (INV)	INV-FTOP	Inverter Fails to Operate	EPIX/RADS	92	30,051,790	h	210	Gamma	EB/PL/KS	3.40E-07	3.61E-06	4.97E-06	1.43E-05	1.130	2.270E+05	4.0	1998--2015		Dec-2016
	Bus (BUS)	BUS-FTOP-AC	AC Bus Fails to Operate	EPIX/RADS	129	198,241,600	h	1352	Gamma	EB/PL/KS	6.10E-08	6.81E-07	9.55E-07	2.75E-06	1.100	1.160E+06	4.0	1998--2015		Dec-2016
		BUS-FTOP-DC	DC Bus Fails to Operate	EPIX/RADS	0	2,305,320	h	15	Gamma	JNID/IL	8.51E-10	9.85E-08	2.17E-07	8.31E-07	0.500	2.310E+06	8.4	1998--2015		Dec-2016
	Motor Control Center (MCC)	MCC-FTOP	Motor Control Center Fail to Operate	EPIX/RADS	6	34,080,880	h	217	Gamma	JNID/IL	8.64E-08	1.81E-07	1.91E-07	3.28E-07	6.500	3.410E+07	1.8	1998--2018		Dec-2016
	Transformer (TFM)	TFM-FTOP	Transformer Fail to Operate	EPIX/RADS	185	71,234,060	h	506	Gamma	EB/PL/KS	6.33E-07	2.50E-06	2.89E-06	6.47E-06	2.400	8.320E+05	2.6	1998--2015		Dec-2016
	Sequencer (SEQ)	SEQ	Sequencer fails to operate (as a Sub Component of the EDG)	EPIX/RADS	8	65,993	d	232	Gamma	EB/PL/KS	1.37E-06	6.51E-05	1.20E-04	4.24E-04	0.628	5.240E+03	6.5	1998--2015		Dec-2016
	Fuse	FUS-CO	Fuse Transfer to Open State	EPIX/RADS	2	203,224,300	h	1289	Gamma	JNID/IL	2.82E-09	1.07E-08	1.23E-08	2.73E-08	2.500	2.030E+08	2.5	1998--2015		Dec-2016
Strainers/Filters	Filter (FLT)	STR-FLT-PG	Strainer Plugging (Dirty water systems)	EPIX/RADS	10	9,300,024	h	59	Gamma	JNID/IL	6.23E-07	1.09E-06	1.13E-06	1.76E-06	10.500	9.300E+06	1.6	1998--2015		Dec-2016
		STR-FLT-ELS	Filter External Leakage (Small) All Systems	EPIX/RADS	3	33,686,420	h	220	Gamma	JNID/IL	3.22E-08	9.42E-08	1.04E-07	2.09E-07	3.500	3.370E+07	2.2	1998--2015		Dec-2016
		STR-FLT-ELL	Filter External Leakage (Small) All Systems	EPIX/RADS	3	33,686,420	h	220	Gamma	JNID/IL	7.79E-13	1.77E-09	7.28E-09	3.33E-08	0.300	4.121E+07	18.8	1998--2015	STR leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		STR-FLT-CLEAN-PG	Filter Plugging, Clean Systems	EPIX/RADS	2	10,115,010	h	68	Gamma	JNID/IL	5.67E-08	2.15E-07	2.47E-07	5.48E-07	2.500	1.010E+07	2.5	1998--2015		Dec-2016
		STR-FLT-CLEAN-BYP	Clean Systems Passive Filter Bypass	EPIX/RADS	0	10,115,010	h	68	Gamma	JNID/IL	1.95E-10	2.25E-08	4.94E-08	1.90E-07	0.500	1.010E+07	8.4	1998--2015		Dec-2016
		IAS-FLT-PG	Instrument Air System Filter Plugs	EPIX/RADS	0	122,688	h	2	Gamma	JNID/IL	1.60E-08	1.85E-06	4.08E-06	1.56E-05	0.500	1.230E+05	8.4	1998--2015		Dec-2016
		IAS-FLT-FC	Instrument Air System Filter Fails	EPIX/RADS	0	122,688	h	2	Gamma	JNID/IL	1.60E-08	1.85E-06	4.08E-06	1.56E-05	0.500	1.230E+05	8.4	1998--2015		Dec-2016
	Self-Cleaning Strainer (FLTSC)	STR-FLTSC-PG	Self Cleaning Filter Plugging	EPIX/RADS	55	25,738,850	h	166	Gamma	JNID/IL	1.71E-06	2.15E-06	2.16E-06	2.66E-06	55.500	2.570E+07	1.2	1998--2015		Dec-2016
		STR-FLTSC-BYP	Self Cleaning Filter Bypass	EPIX/RADS	1	25,738,850	h	166	Gamma	JNID/IL	6.85E-09	4.60E-08	5.83E-08	1.52E-07	1.500	2.570E+07	3.3	1998--2015		Dec-2016
		STR-FLTSC-FTOP	Self Cleaning Filter Fails to Operate	EPIX/RADS	91	25,738,850	h	166	Gamma	JNID/IL	2.97E-06	3.55E-06	3.55E-06	4.19E-06	91.500	2.570E+07	1.2	1998--2015		Dec-2016
		STR-FLTSC-ELS	Self Cleaning Filter External Leakage (Small)	EPIX/RADS	14	25,738,850	h	166	Gamma	JNID/IL	3.45E-07	5.51E-07	5.63E-07	8.28E-07	14.500	2.570E+07	1.5	1998--2015		Dec-2016
		STR-FLTSC-ELL	Self Cleaning Filter External Leakage (Rupture)	EPIX/RADS	14	25,738,850	h	166	Gamma	JNID/IL	4.22E-12	9.61E-09	3.94E-08	1.80E-07	0.300	7.612E+06	18.8	1998--2015	STR leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		STR-PE-SWS	Strainer Plugging (Dirty water systems), Environmental	EPIX/RADS	1	9,198,527	h	59	Gamma	JNID/IL	1.91E-08	1.29E-07	1.63E-07	4.25E-07	1.500	9.200E+06	3.3	1998--2015		Dec-2016
		STR-PG-NE-SWS	Strainer Plugging (Dirty water systems), Non-Environmental	EPIX/RADS	35	25,738,850	h	166	Gamma	JNID/IL	1.02E-06	1.37E-06	1.38E-06	1.78E-06	35.500	2.570E+07	1.3	1998--2015		Dec-2016
		SWS-STR-PG	Standby Service Water Strainer Plugs	EPIX/RADS	13	9,198,527	h	59	Gamma	JNID/IL	8.78E-07	1.43E-06	1.47E-06	2.18E-06	13.500	9.200E+06	1.5	1998--2015		Dec-2016
		NSW-STR-PG	Nuclear Service Water Strainer Plugs	EPIX/RADS	42	15,944,260	h	103	Gamma	JNID/IL	2.04E-06	2.65E-06	2.67E-06	3.38E-06	42.500	1.590E+07	1.3	1998--2015		Dec-2016
	Sump Strainer (SMP)	SMP-PG	Containment Sump Plugging (pooled BWR and PWR)	EPIX/RADS	1	14,682,020	h	95	Gamma	JNID/IL	1.20E-08	8.05E-08	1.02E-07	2.66E-07	1.500	1.470E+07	3.3	1998--2015		Dec-2016
		STR-SUMP-PG	Containment Sump Plugging (pooled PWR and BWR)	EPIX/RADS	4	14,682,020	h	95	Gamma	JNID/IL	1.13E-07	2.84E-07	3.06E-07	5.75E-07	4.500	1.470E+07	2.0	1998--2015		Dec-2016
		BWR-RHR-SUMP-PG	Containment Sump Plugging (BWRs, suppression pool strainers)	EPIX/RADS	0	6,565,272	h	42	Gamma	JNID/IL	2.99E-10	3.46E-08	7.62E-08	2.92E-07	0.500	6.570E+06	8.4	1998--2015		Dec-2016
		SMP-PG-PWR	Containment Sump Plugging (PWRs)	EPIX/RADS	1	4,382,688	h	29	Gamma	JNID/IL	4.02E-08	2.70E-07	3.42E-07	8.92E-07	1.500	4.380E+06	3.3	1998--2015		Dec-2016
	Traveling Screen Assembly (TSA)	TSA-FS	Traveling Screen Fails To Start	EPIX/RADS	97	30,417,290	d	212	Gamma	EB/PL/KS	3.30E-08	1.92E-06	3.67E-06	1.32E-05	0.594	1.620E+05	6.9	1998--2015		Dec-2016
		TSA-PG	Traveling Screen Plugging	EPIX/RADS	68	30,417,290	h	212	Gamma	EB/PL/KS	6.77E-09	1.08E-06	2.53E-06	9.98E-06	0.466	1.840E+05	9.2	1998--2015		Dec-2016
		TSA-BYP	Traveling Screen Bypass	EPIX/RADS	8	30,417,290	h	212	Gamma	JNID/IL	1.43E-07	2.69E-07	2.79E-07	4.54E-07	8.500	3.040E+07	1.7	1998--2015		Dec-2016
		TSA-FR	Traveling Screen Fails To Run	EPIX/RADS	97	30,417,290	h	212	Gamma	EB/PL/KS	3.30E-08	1.92E-06	3.67E-06	1.32E-05	0.594	1.620E+05	6.9	1998--2015		Dec-2016
		TSA-FTOP	Traveling Screen Fails to Operate	EPIX/RADS	97	30,417,290	h	212	Gamma	EB/PL/KS	3.30E-08	1.92E-06	3.67E-06	1.32E-05	0.594	1.620E+05	6.9	1998--2015		Dec-2016
		TSA-PG-NE-SWS	Traveling Screens Plug Nonenvironmental (hr-1)	EPIX/RADS	0	2,331,600	h	15	Gamma	JNID/IL	8.44E-10	9.76E-08	2.14E-07	8.24E-07	0.500	2.330E+06	8.4	1998--2015		Dec-2016
		SWS-TSA-PG	Standby Service Water Traveling Screen Plugs	EPIX/RADS	0	2,331,600	h	15	Gamma	JNID/IL	8.44E-10	9.76E-08	2.14E-07	8.24E-07	0.500	2.330E+06	8.4	1998--2015		Dec-2016
	Trash Rack (TRK)	TRK-PG	Trash Rack Plugging	EPIX/RADS	3	1,577,760	h	10	Gamma	EB/PL/KS	2.05E-08	1.17E-06	2.23E-06	8.03E-06	0.597	2.680E+05	6.9	1998--2015		Dec-2016
RPS	Bistable (BIS)	BIS FTOP	Bistable Fail to Operate	RPS SSs	55	102,094	d		Beta	JNID/IL	2.14E-06	2.47E-04	5.44E-04	2.09E-03	0.500	9.193E+02	8.4			Feb-2007
	Process Logic Components	PLF FTOP	Process Logic (Flow) Fail to Operate	RPS SSs	3	6,075	d		Beta	JNID/IL	2.46E-06	2.85E-04	6.25E-04	2.40E-03	0.500	7.990E+02	8.4		The PLL data was used to estimate the flow process logic reliability.	Feb-2007
		PLL FTOP	Process Logic (Level) Fail to Operate	RPS SSs	3	6,075	d		Beta	JNID/IL	2.46E-06	2.85E-04	6.25E-04	2.40E-03	0.500	7.990E+02	8.4			Feb-2007
		PLP FTOP	Process Logic (Pressure) Fail to Operate	RPS SSs	6	38,115	d		Beta	JNID/IL	6.29E-07	7.28E-05	1.60E-04	6.15E-04	0.500	3.124E+03	8.4			Feb-2007
		PLDT FTOP	Process Logic (Delta Temperature) Fail to Operate	RPS SSs	24	4,887	d		Beta	JNID/IL	2.01E-05	2.32E-03	5.07E-03	1.94E-02	0.500	9.805E+01	8.4		The PLL data was used to estimate the flow process logic reliability.	Feb-2007
	Sensor/Transmitter Components	STF FTOP-D	Sensor/Transmitter (Flow) Fail to Operate on Demand	RPS SSs	5	6,750	d		Beta	JNID/IL	3.21E-06	3.71E-04	8.15E-04	3.13E-03	0.500	6.132E+02	8.4		The STL data was used to estimate the flow senser/transmitter reliability.	Feb-2007
		STF FTOP-R	Sensor/Transmitter (Flow) Fail to Operate per Hour	RPS SSs	0	9,831,970	h		Gamma	JNID/IL	4.00E-10	4.63E-08	1.02E-07	3.91E-07	0.500	4.916E+06	8.4			Feb-2007
		STL FTOP-D	Sensor/Transmitter (Level) Fail to Operate on Demand	RPS SSs	5	6,750	d		Beta	JNID/IL	3.21E-06	3.71E-04	8.15E-04	3.13E-03	0.500	6.132E+02	8.4			Feb-2007
		STL FTOP-R	Sensor/Transmitter (Level) Fail to Operate per Hour	RPS SSs	0	9,831,970	h		Gamma	JNID/IL	4.00E-10	4.63E-08	1.02E-07	3.91E-07	0.500	4.916E+06	8.4			Feb-2007
		STP FTOP-D	Sensor/Transmitter (Pressure) Fail to Operate on Demand	RPS SSs	2	23,960	d		Beta	JNID/IL	4.60E-07	5.32E-05	1.17E-04	4.49E-04	0.500	4.278E+03	8.4			Feb-2007
		STP FTOP-R	Sensor/Transmitter (Pressure) Fail to Operate per Hour	RPS SSs	35	43,430,500	h		Gamma	JNID/IL	3.23E-09	3.74E-07	8.22E-07	3.16E-06	0.500	6.083E+05	8.4			Feb-2007
		STT FTOP-D	Sensor/Transmitter (Temperature) Fail to Operate on Demand	RPS SSs	17	40,759	d		Beta	JNID/IL	1.70E-06	1.97E-04	4.32E-04	1.66E-03	0.500	1.157E+03	8.4		The STL data was used to estimate the flow senser/transmitter reliability.	Feb-2007
		STT FTOP-R	Sensor/Transmitter (Temperature) Fail to Operate per Hour	RPS SSs	29	35,107,400	h		Gamma	JNID/IL	3.30E-09	3.82E-07	8.40E-07	3.23E-06	0.500	5.950E+05	8.4			Feb-2007
	Reactor Trip Breaker (RTB)	RTB (BME) FTO/C	RPS Breaker (Mechanical) Fail to Open or Close	RPS SSs	1	97,359	d		Beta	JNID/IL	6.06E-08	7.01E-06	1.54E-05	5.92E-05	0.500	3.245E+04	8.4			Feb-2007
		RTB (BSN) FTOP	RPS Breaker (Shunt Trip) Fail to Operate	RPS SSs	14	44,104	d		Beta	JNID/IL	1.29E-06	1.50E-04	3.29E-04	1.26E-03	0.500	1.520E+03	8.4			Feb-2007
		RTB (BUV) FTOP	RPS Breaker (Undervoltage Trip) Fail to Operate	RPS SSs	23	57,199	d		Beta	JNID/IL	1.62E-06	1.88E-04	4.13E-04	1.58E-03	0.500	1.211E+03	8.4			Feb-2007
		RTB FTO/C	RPS Breaker (Combined) Fail to Open or Close	RPS SSs			d		Beta	JNID/IL	6.11E-08	7.07E-06	1.55E-05	5.97E-05	0.500	3.217E+04	8.4			Feb-2007
	Manual Switch (MSW)	MSW FTO/C	Manual Switch Fail to Open or Close	RPS SSs	2	19,789	d		Beta	JNID/IL	4.97E-07	5.75E-05	1.26E-04	4.85E-04	0.500	3.958E+03	8.4			Feb-2007
	Relay (RLY)	RLY FTOP	Relay Fail to Operate	RPS SSs	24	974,417	d		Beta	JNID/IL	9.77E-08	1.13E-05	2.48E-05	9.54E-05	0.500	2.013E+04	8.4			Feb-2007
Control Rods	Control Rod Drive (CRD)	CRD-FTOP	Control Rod Fail to Insert Rod	EPIX/RADS	18	183,267,700	d	1201	Gamma	EB/PL/KS	1.62E-10	4.40E-08	1.15E-07	4.71E-07	0.419	3.640E+06	10.7	1998--2015		Dec-2016
		CRD-SOP	Control Rod Drive Spurious Operation	EPIX/RADS	34	183,267,700	h	1201	Gamma	JNID/IL	1.39E-07	1.87E-07	1.88E-07	2.44E-07	34.500	1.830E+08	1.3	1998--2015		Dec-2016
	Control Rod (ROD)	ROD-FTOP	Control Rod Fails to Operate/ Insert Rod	EPIX/RADS	20	132,832,800	d	846	Gamma	JNID/IL	1.03E-07	1.52E-07	1.54E-07	2.14E-07	20.500	1.330E+08	1.4	1998--2015		Dec-2016
		ROD-SOP	Control Rod Spurious Operation	EPIX/RADS	20	132,832,800	h	846	Gamma	JNID/IL	1.03E-07	1.52E-07	1.54E-07	2.14E-07	20.500	1.330E+08	1.4	1998--2015		Dec-2016
	Hydraulic Control Unit (HCU)	HCU-FTI	Hydraulic Control Unit Fails to Insert	EPIX/RADS	0	-	d	0	--	--	--		--	--	--	--		1998--2015		Dec-2016
		HCU-FTOP	Hydraulic Control Unit Fails to Operate	EPIX/RADS	29	1,625,902,000	h	10436	Gamma	EB/PL/KS	1.16E-09	1.30E-08	1.81E-08	5.23E-08	1.100	6.090E+07	4.0	1998--2015		Dec-2016
		HCU-SOP	Hydraulic Control Unit Spurious Operation	EPIX/RADS	35	1,625,902,000	h	10436	Gamma	EB/PL/KS	6.01E-09	1.93E-08	2.16E-08	4.49E-08	3.080	1.430E+08	2.3	1998--2015		Dec-2016
Heating & Ventilation	Air Damper (DMP)	AOD-FTOC	Air-Operated Damper Fails To Open/Close	EPIX/RADS	2	7,799	d	49	Beta	JNID/IL	7.34E-05	2.79E-04	3.21E-04	7.09E-04	2.500	7.800E+03	2.5	1998--2015		Dec-2016
		AOD-SOP	Air-Operated Damper Spurious Operation	EPIX/RADS	3	31,342,830	h	209	Gamma	JNID/IL	3.46E-08	1.01E-07	1.12E-07	2.25E-07	3.500	3.130E+07	2.2	1998--2015		Dec-2016
		AOD-ILS	Air-Operated Damper Internal Leakage (Small)	EPIX/RADS	5	31,342,830	h	209	Gamma	JNID/IL	7.31E-08	1.65E-07	1.75E-07	3.14E-07	5.500	3.130E+07	1.9	1998--2015		Dec-2016
		AOD-ILL	Air-Operated Damper Internal Leakage (Rupture)	EPIX/RADS	5	31,342,830	h	209	Gamma	JNID/IL	3.75E-13	8.53E-10	3.50E-09	1.60E-08	0.300	8.571E+07	18.8	1998--2015	DMP leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		HOD-FTOC	Hydraulic Operated Damper Fails To Open/Close	EPIX/RADS	11	6,225	d	39	Beta	EB/PL/KS	3.41E-05	2.74E-03	5.57E-03	2.07E-02	0.545	9.730E+01	7.5	1998--2015		Dec-2016
		HOD-SOP	Hydraulic Operated Damper Spurious Operation	EPIX/RADS	8	19,397,950	h	128	Gamma	JNID/IL	2.23E-07	4.21E-07	4.38E-07	7.11E-07	8.500	1.940E+07	1.7	1998--2015		Dec-2016
		HOD-ILS	Hydraulic Operated Damper Internal Leakage (Small)	EPIX/RADS	0	19,397,950	h	128	Gamma	JNID/IL	1.01E-10	1.17E-08	2.58E-08	9.90E-08	0.500	1.940E+07	8.4	1998--2015		Dec-2016
		HOD-ILL	Hydraulic Operated Damper Internal Leakage (Rupture)	EPIX/RADS	0	19,397,950	h	128	Gamma	JNID/IL	5.52E-14	1.26E-10	5.16E-10	2.36E-09	0.300	5.814E+08	18.8	1998--2015	DMP leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		MOD-FTOC	Motor Operated Damper Fails To Open	EPIX/RADS	7	33,254	d	45	Beta	JNID/IL	1.09E-04	2.16E-04	2.26E-04	3.76E-04	7.500	3.320E+04	1.7	1998--2015		Dec-2016
		MOD-SOP	Motor Operated Damper Fails To Remain Open	EPIX/RADS	0	17,147,900	h	111	Gamma	JNID/IL	1.15E-10	1.33E-08	2.92E-08	1.12E-07	0.500	1.710E+07	8.4	1998--2015		Dec-2016
		MOD-ILS	Motor Operated Damper Internal Leakage (Small)	EPIX/RADS	1	17,147,900	d	111	Gamma	JNID/IL	1.03E-08	6.92E-08	8.75E-08	2.29E-07	1.500	1.710E+07	3.3	1998--2015		Dec-2016
		MOD-ILL	Motor Operated Damper Internal Leakage (Rupture)	EPIX/RADS	1	17,147,900	h	111	Gamma	JNID/IL	1.87E-13	4.27E-10	1.75E-09	8.01E-09	0.300	1.714E+08	18.8	1998--2015	DMP leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
	Air Handling	AHU-NR-FTS	Air Handling/Heating Fan Fails To Start, Normally Running	EPIX/RADS	45	17,336	d	139	Beta	EB/PL/KS	7.32E-06	1.18E-03	2.76E-03	1.09E-02	0.465	1.680E+02	9.2	1998--2015		Dec-2016
		AHU-NR-FTR	Air Handling/Heating Unit Fails To Run, Normally Running	EPIX/RADS	62	17,498,560	h	139	Gamma	EB/PL/KS	2.64E-08	3.03E-06	6.65E-06	2.55E-05	0.501	7.530E+04	8.4	1998--2015		Dec-2016
	Air Cooling	ACX-FTS	Air Handling/Heating Fan Fails To Start, Normally Running	EPIX/RADS	45	17,336	d	139	Beta	EB/PL/KS	7.32E-06	1.18E-03	2.76E-03	1.09E-02	0.465	1.680E+02	9.2	1998--2015		Dec-2016
		ACX-FTR	Air Handling/Heating Unit Fails To Run, Normally Running	EPIX/RADS	62	21,790,640	h	139	Gamma	EB/PL/KS	5.80E-08	2.25E-06	3.98E-06	1.38E-05	0.668	1.680E+05	6.1	1998--2015		Dec-2016
		ACX-FTS-NS	Air Cooling Heat Exchanger Fails to Start, Normally Standby	EPIX/RADS	55	149,242	d	382	Beta	EB/PL/KS	3.06E-06	2.68E-04	5.57E-04	2.09E-03	0.534	9.580E+02	7.8	1998--2015		Dec-2016
		ACX-FTR<1H	Air Cooling Heat Exchanger Fails to Run <1H Normally Standby	EPIX/RADS	0	148,103	h	382	Gamma	JNID/IL	1.33E-08	1.54E-06	3.38E-06	1.30E-05	0.500	1.480E+05	8.4	1998--2015		Dec-2016
		ACX-FTR>1H	Air Cooling Heat Exchanger Fails to Run >1H Normally Standby	EPIX/RADS	45	10,793,680	h	382	Gamma	JNID/IL	3.24E-06	4.18E-06	4.22E-06	5.29E-06	45.500	1.080E+07	1.3	1998--2015		Dec-2016
	Chiller (CHL)	CHL-FTS	Chiller Unit Fails To Start, Normally Running	EPIX/RADS	121	18,215	d	80	Beta	EB/PL/KS	1.35E-04	5.25E-03	9.21E-03	3.17E-02	0.667	7.180E+01	6.0	1998--2015		Dec-2016
		CHL-FTR	Chiller Unit Fails To Run, Normally Running	EPIX/RADS	349	6,464,949	h	80	Gamma	EB/PL/KS	4.19E-06	4.94E-05	6.93E-05	2.03E-04	1.070	1.540E+04	4.1	1998--2015		Dec-2016
		CHL-FTS-NS	Chiller Unit Fails To Start, Normally Standby	EPIX/RADS	0	20,433	d	63	Beta	JNID/IL	9.64E-08	1.12E-05	2.45E-05	9.42E-05	0.500	2.040E+04	8.4	1998--2015		Dec-2016
		CHL-FTR<1H	Chiller Unit Fails To Run <1H, Normally Standby	EPIX/RADS	61	279,348	h	63	Gamma	JNID/IL	1.76E-04	2.19E-04	2.20E-04	2.69E-04	61.500	2.790E+05	1.2	1998--2015		Dec-2016
		CHL-FTR>1H	Chiller Unit Fails To Run >1H, Normally Standby	EPIX/RADS	61	279,348	h	63	Gamma	JNID/IL	1.76E-04	2.19E-04	2.20E-04	2.69E-04	61.500	2.790E+05	1.2	1998--2015		Dec-2016
	Fan (FAN)	FAN-SBY-FTS	HVAC Fan Fails To Start, Normally Standby	EPIX/RADS	37	57,512	d	130	Beta	JNID/IL	4.87E-04	6.46E-04	6.52E-04	8.36E-04	37.500	5.750E+04	1.3	1998--2015		Dec-2016
		FAN-SBY-FTR<1H	HVAC Fan Fails To Run, Early Term, Normally Standby	EPIX/RADS	16	43,744	h	130	Gamma	JNID/IL	2.39E-04	3.70E-04	3.77E-04	5.42E-04	16.500	4.370E+04	1.5	1998--2015		Dec-2016
		FAN-SBY-FTR>1H	HVAC Fan Fails To Run, Late Term, Normally Standby	EPIX/RADS	27	137,892	h	130	Gamma	JNID/IL	1.41E-04	1.97E-04	1.99E-04	2.66E-04	27.500	1.380E+05	1.3	1998--2015		Dec-2016
		FAN-NR-FTS	HVAC Fan Fails To Start, Normally Running	EPIX/RADS	46	85,577	d	218	Beta	JNID/IL	4.19E-04	5.40E-04	5.43E-04	6.81E-04	46.500	8.550E+04	1.3	1998--2015		Dec-2016
		FAN-NR-FTR	HVAC Fan Fails To Run, Normally Running	EPIX/RADS	67	17,511,120	h	218	Gamma	EB/PL/KS	3.07E-08	2.21E-06	4.41E-06	1.63E-05	0.561	1.270E+05	7.4	1998--2015		Dec-2016
	Air Compressor (CMP)	MDC-FTS	Motor Driven Compressor Fail To Start, Normally Running	EPIX/RADS	109	9,197	d	70	Beta	EB/PL/KS	2.06E-04	1.72E-02	3.41E-02	1.25E-01	0.539	1.530E+01	7.3	1998--2015		Dec-2016
		MDC-FTR	Motor Driven Compressor Fails To Run	EPIX/RADS	307	5,595,966	h	70	Gamma	EB/PL/KS	1.20E-05	5.50E-05	6.51E-05	1.53E-04	2.060	3.160E+04	2.8	1998--2015		Dec-2016
		MDC-FTS-NS	Motor Driven Compressor Fail To Start, Normally Standby	EPIX/RADS	61	23,363	d	58	Beta	EB/PL/KS	3.58E-04	3.14E-03	4.16E-03	1.15E-02	1.260	3.010E+02	3.7	1998--2015		Dec-2016
		MDC-FTR<1H	Motor Driven Compressor Fail To Run (0 To 1 Hour)	EPIX/RADS	22	1,683,943	h	58	Gamma	JNID/IL	9.11E-06	1.32E-05	1.34E-05	1.84E-05	22.500	1.680E+06	1.4	1998--2015		Dec-2016
		MDC-FTR>1H	Motor Driven Compressor Fail To Run (> 1 Hour)	EPIX/RADS	22	1,683,943	h	58	Gamma	JNID/IL	9.11E-06	1.32E-05	1.34E-05	1.84E-05	22.500	1.680E+06	1.4	1998--2015		Dec-2016
		EDC-FS-NS	Engine Driven Compressor Fails To Start, Normally Standby	EPIX/RADS	17	2,122	d	5	Beta	JNID/IL	5.29E-03	8.07E-03	8.24E-03	1.17E-02	17.500	2.110E+03	1.4	1998--2015		Dec-2016

Grouping	Component Type	Component Failure Mode	Description	Data Source	Data				Industry-average Failure Probability or Rate Distribution (note a)									Date Range	Comments (see Appendix A for details)	Effective Date
					Failures	Demands or Hours	d or h	Components	Distribution	Analysis Type	5th	Median	Mean	95th	α	β	Error Factor (note b)			
Miscellaneous Equipment		EDC-FR-E	Engine Driven Compressor Fails To Run <1H, Normally Standby	EPIX/RADS	0	2,122	h	5	Gamma	JNID/IL	9.27E-07	1.07E-04	2.36E-04	9.06E-04	0.500	2.120E+03	8.4	1998–2015		Dec-2016
		EDC-FR-L	Engine Driven Compressor Fails To Run >1H, Normally Standby	EPIX/RADS	0	1,735	h	5	Gamma	JNID/IL	1.13E-06	1.31E-04	2.88E-04	1.10E-03	0.500	1.740E+03	8.4	1998–2015		Dec-2016
		IAS-MDC-FR	Instrument Air System Motor Driven Compressor Fails to Run	EPIX/RADS	186	2,680,601	h	41	Gamma	EB/PL/KS	1.95E-05	6.64E-05	7.50E-05	1.60E-04	2.850	3.800E+04	2.4	1998–2015		Dec-2016
		PCA-MDC-FR	PCA Motor Driven Compressor Fails to Run	EPIX/RADS	3	118,273	h	2	Gamma	JNID/IL	9.18E-06	2.69E-05	2.96E-05	5.96E-05	3.500	1.180E+05	2.2	1998–2015		Dec-2016
	Air Drier Unit (ADU)	ADU-FTOP	Air dryer unit fails to operate	NUREG/CR-6928			h		Gamma	JNID/IL	5.35E-10	1.22E-06	5.00E-06	2.29E-05	0.300	6.000E+04	18.8			Jun-2005
	Accumulator (ACC)	ACC-FTOP	Accumulator Fails to Operate	EPIX/RADS	18	96,227,420	h	617	Gamma	JNID/IL	1.25E-07	1.89E-07	1.92E-07	2.71E-07	18.500	9.620E+07	1.4	1998–2015		Dec-2016
		ACC-ELS	Accumulator External Leakage (Small)	EPIX/RADS	11	96,227,420	h	617	Gamma	JNID/IL	6.80E-08	1.16E-07	1.20E-07	1.83E-07	11.500	9.620E+07	1.6	1998–2015		Dec-2016
		ACC-ELL	Accumulator External Leakage (Rupture)	EPIX/RADS	11	96,227,420	h	617	Gamma	JNID/IL	8.99E-13	2.05E-09	8.40E-09	3.84E-08	0.300	3.571E+07	18.8	1998–2015	ACC leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
	Cooling Tower Fan (CTF)	CTF-STBY-FTS	Cooling Tower Fan Fails To Start (Standby)	EPIX/RADS	16	44,600	d	54	Beta	JNID/IL	2.34E-04	3.62E-04	3.70E-04	5.31E-04	16.500	4.460E+04	1.5	1998–2015		Dec-2016
		CTF-STBY-FTR<1H	Cooling Tower Fan Fails To Run <1H (Standby)	EPIX/RADS	0	44,488	h	54	Gamma	JNID/IL	4.42E-08	5.11E-06	1.12E-05	4.32E-05	0.500	4.450E+04	8.4	1998–2015		Dec-2016
		CTF-STBY-FTR>1H	Cooling Tower Fan Fails To Run >1H (Standby)	EPIX/RADS	2	1,073,115	h	54	Gamma	JNID/IL	5.35E-07	2.03E-06	2.33E-06	5.17E-06	2.500	1.070E+06	2.5	1998–2015		Dec-2016
		CTF-NR-FTS	Cooling Tower Fan Fails To Start	EPIX/RADS	1	2,687	d	20	Beta	JNID/IL	6.54E-05	4.40E-04	5.58E-04	1.45E-03	1.500	2.690E+03	3.3	1998–2015		Dec-2016
		CTF-NR-FTR	Cooling Tower Fan Fails To Run	EPIX/RADS	3	1,504,717	h	20	Gamma	JNID/IL	7.22E-07	2.12E-06	2.33E-06	4.69E-06	3.500	1.500E+06	2.2	1998–2015		Dec-2016
	Tank (TNK)	TNK-FC	Tank Rupture	EPIX/RADS	15	59,350,270	h	379	Gamma	JNID/IL	1.62E-07	2.55E-07	2.61E-07	3.79E-07	15.500	5.940E+07	1.5	1998–2018		Dec-2016
		TNK-PRESS-LIQ-ELS	Pressurized Liquid Tank Small Leakage External Leakage (Small)	EPIX/RADS	8	24,349,940	h	156	Gamma	EB/PL/KS	1.22E-09	1.49E-07	3.31E-07	1.28E-06	0.494	1.490E+06	8.6	1998–2015		Dec-2016
		TNK-PRESS-LIQ-ELL	Pressurized Liquid Tank Small Leakage External Leakage (Rupture)	EPIX/RADS	8	24,349,940	h	156	Gamma	EB/PL/KS	2.48E-12	5.65E-09	2.32E-08	1.06E-07	0.300	1.295E+07	18.8	1998–2015	TNK leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		TNK-UNPRESS-LIQ-ELS	Unpressurized Liquid Tank Small Leakage External Leakage (Small)	EPIX/RADS	7	29,235,430	h	191	Gamma	JNID/IL	1.24E-07	2.46E-07	2.57E-07	4.28E-07	7.500	2.920E+07	1.7	1998–2015		Dec-2016
		TNK-UNPRESS-LIQ-ELL	Unpressurized Liquid Tank Small Leakage External Leakage (Rupture)	EPIX/RADS	7	29,235,430	h	191	Gamma	JNID/IL	1.93E-12	4.39E-09	1.80E-08	8.23E-08	0.300	1.668E+07	18.8	1998–2015	TNK leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
		SWS-TNK-FC	Standby Service Water Tank Fails to Control	EPIX/RADS	0	1,086,910	h	7	Gamma	JNID/IL	1.80E-09	2.09E-07	4.60E-07	1.76E-06	0.500	1.090E+06	8.4	1998–2015		Dec-2016
		IAS-TNK-FC	Instrument Air System Tank Fails to Control	EPIX/RADS	0	3,944,400	h	25	Gamma	JNID/IL	4.99E-10	5.77E-08	1.27E-07	4.87E-07	0.500	3.940E+06	8.4	1998–2015		Dec-2016
		TNK-GAS-ELS	Gas Tank Small Leakage External Leakage (Small)	EPIX/RADS	2	5,048,832	h	32	Gamma	JNID/IL	1.13E-07	4.31E-07	4.95E-07	1.10E-06	2.500	5.050E+06	2.5	1998–2015		Dec-2016
		TNK-GAS-ELL	Gas Tank Small Leakage External Leakage (Rupture)	EPIX/RADS	2	5,048,832	h	32	Gamma	JNID/IL	3.71E-12	8.45E-09	3.47E-08	1.59E-07	0.300	8.658E+06	18.8	1998–2015	TNK leak rate > 50 gpm. Small external leak times 0.07.	Dec-2016
	Orifice (ORF)	ORF-PG	Orifice Plugging	WSRV			h		Gamma	JNID/IL	1.07E-10	2.44E-07	1.00E-06	4.57E-06	0.300	3.000E+05	18.8			Jun-2005
	Pipe (PIPE)	PIPE OTHER-ELS	Piping Non-Service Water System External Leak Small	EPIX	5	15,830,000,000	h-ft		Gamma	JNID/IL	9.94E-13	1.15E-10	2.53E-10	9.71E-10	0.500	1.979E+09	8.4			Feb-2007
		PIPE OTHER-ELL	Piping Non-Service Water System External Leak Large	EPIX	5	15,830,000,000	h-ft		Gamma	JNID/IL	2.70E-15	6.16E-12	2.53E-11	1.16E-10	0.300	1.187E+10	18.8		Pipe leakage > 50 gpm, small leakage times 0.1.	Feb-2007
		PIPE SWS-ELS	Piping Service Water System External Leak Small	EPIX	9	13,060,000,000	h-ft		Gamma	JNID/IL	2.71E-12	3.14E-10	6.89E-10	2.65E-09	0.500	7.256E+08	8.4			Feb-2007
		PIPE SWS-ELL	Piping Service Water System External Leak Large	EPIX	9	13,060,000,000	h-ft		Gamma	JNID/IL	1.48E-14	3.36E-11	1.38E-10	6.30E-10	0.300	2.177E+09	18.8		Pipe leakage > 50 gpm, small leakage times 0.2.	Feb-2007
	Heat Exchanger (HTX)	HTX-LOHT	Heat Exchanger Plugging/Heat Transfer (Pooled)	EPIX/RADS	87	269,796,800	h	1770	Gamma	EB/PL/KS	2.32E-09	1.88E-07	3.85E-07	1.44E-06	0.544	1.410E+06	7.6	1998–2015		Dec-2016
		HTX-ILS	Heat Exchanger Internal Leakage (Small)	EPIX/RADS	98	269,796,800	h	1770	Gamma	EB/PL/KS	5.03E-10	1.42E-07	3.73E-07	1.54E-06	0.416	1.110E+06	10.8	1998–2015		Dec-2016
		HTX-ILL	Heat Exchanger Internal Leakage (Rupture)	EPIX/RADS	98	269,796,800	h	1770	Gamma	EB/PL/KS	7.98E-13	1.82E-09	7.46E-09	3.41E-08	0.300	4.021E+07	18.8	1998–2015	HTX leak rate > 50 gpm. Small internal leak times 0.02.	Dec-2016
		HTX-ELS	Heat Exchanger External Leakage (Small)	EPIX/RADS	65	269,796,800	h	1770	Gamma	EB/PL/KS	9.77E-09	1.82E-07	2.79E-07	8.81E-07	0.867	3.100E+06	4.8	1998–2015		Dec-2016
		HTX-ELL	Heat Exchanger External Leakage (Rupture)	EPIX/RADS	65	269,796,800	h	1770	Gamma	EB/PL/KS	4.48E-12	1.02E-08	4.19E-08	1.91E-07	0.300	7.168E+06	18.8	1998–2015	HTX leak rate > 50 gpm. Small external leak times 0.15.	Dec-2016
		HTX-PG-CCW	Heat Exchanger Plugging Non Standby	EPIX/RADS	17	34,265,020	h	227	Gamma	EB/PL/KS	5.34E-10	1.92E-07	5.33E-07	2.22E-06	0.398	7.470E+05	11.5	1998–2015		Dec-2016
		HTX-CCW-LOHT	CCW Heat Exchanger Fails to Control	EPIX/RADS	17	34,265,020	h	227	Gamma	EB/PL/KS	5.34E-10	1.92E-07	5.33E-07	2.22E-06	0.398	7.470E+05	11.5	1998–2015		Dec-2016
		HTX-PG-NE-CCW	CCW Heat Exchanger Plugging Non-ExEE (hr-1)	EPIX/RADS	7	34,265,020	h	227	Gamma	EB/PL/KS	2.32E-10	7.56E-08	2.06E-07	8.51E-07	0.405	1.970E+06	11.2	1998–2015		Dec-2016
	Instrumentation	ICC-FA	Failure of instrument and control for a turbine trip	NUCLARR			d		Lognormal	NUCLARR	6.89E-04	1.52E-03	1.70E-03	3.33E-03	2.200		2.2			Jun-2005
		ICC-FC	Instrumentation and Control Circuit Fails	NUCLARR			d		Lognormal	NUCLARR	6.89E-04	1.52E-03	1.70E-03	3.33E-03	2.200		2.2			Jun-2005
		ACT-FC	Automatic actuation and control circuit fails	NUCLARR			d		Lognormal	NUCLARR	6.89E-04	1.52E-03	1.70E-03	3.33E-03	2.200		2.2			Dec-2011

Acronyms - BWR (boiling water reactor), EB/PL/KS (empirical Bayes/plant level/Kass Steffey), EPIX (Equipment Performance and Information Exchange), JNID/IL (Jeffreys noninformative distribution/industry level), LL (lower limit), PLL (process logic level), PWR (pressurized water reactor), SCNID (simplified constrained noninformative distribution), SS (system study), SWS (service water system), WSRC (Westinghouse Savannah River Company)

Note a - If these distributions are to be used as priors in Bayesian updates using plant-specific data, then a check for consistency between the prior and the data should be performed first, as suggested in supporting requirement DA-D4c in Reference 59 in NUREG/CR-6928 and outlined in Section 6.2.3.5 in Reference 17 in NUREG/CR-6928.

Note b - The error factor is from an empirical Bayes analysis at the plant level, with Kass-Steffey adjustment. The error factor is the 95th percentile divided by the median.