

SPAR Initiating Event Data and Results
2015 Parameter Estimation Update
12/21/16 12:00 PM

Section	Sub Section	Initiating Event	Description	Data			Industry-average Frequency Distribution (note a)										Baseline Period	Comments (see Appendix D for details)	Effective Date
				Source	Number of Events	Critical Years (rcry)	Distribution	Analysis Type	5th	Median	Mean	95th	α	β	Error Factor				
Primary/Secondary Inventory Control	High Energy Line Breaks	FWLB BWR FI	Feedwater Line Break (BWR)	RADS	0	833.7	Gamma	JNID/IL	2.36E-06	2.73E-04	6.00E-04	2.30E-03	0.5	834	8.4	1988-2015	Dec-2016		
		FWLB PWR FI	Feedwater Line Break (PWR)	RADS	2	1662.6	Gamma	JNID/IL	3.45E-04	1.31E-03	1.50E-03	3.33E-03	2.5	1660	2.5	1988-2015	Dec-2016		
		SLBIC PWR FI	Steamline Break Inside Containment (PWRs)	RADS	0	1662.6	Gamma	JNID/IL	1.18E-06	1.37E-04	3.01E-04	1.16E-03	0.5	1660	8.4	1988-2015	Dec-2016		
		SLBOC BWR FI	Steamline Break Outside Containment (BWRs)	RADS	2	833.7	Gamma	JNID/IL	6.87E-04	2.61E-03	3.00E-03	6.64E-03	2.5	834	2.5	1988-2015	Dec-2016		
		SLBOC PWR FI	Steamline Break Outside Containment (PWRs)	RADS	10	1662.6	Gamma	JNID/IL	3.49E-03	6.13E-03	6.32E-03	9.84E-03	10.5	1660	1.6	1988-2015	Dec-2016		
	Loss of Coolant Accidents	SGTR	Steam Generator Tube Rupture	RADS	2	1502.7	Gamma	JNID/IL	3.82E-04	1.45E-03	1.66E-03	3.69E-03	2.5	1500	2.5	1991-2015	Dec-2016		
		LLOCA-BWR	Large Loss Of Coolant Event (BWR)	NUREG-1829			Gamma	Geo Mean Aggregate	1.90E-08	2.91E-06	6.78E-06	2.66E-05	0.5	69322	9.1		Expert Elicitation, converted from Rx-Calendar Years to Rx-Critical Years	Jun-2005	
		LLOCA-PWR	Large Loss Of Coolant Event (PWR)	NUREG-1829			Gamma	Geo Mean Aggregate	1.90E-09	5.10E-07	1.33E-06	5.43E-06	0.4	315789	10.7		Expert Elicitation, converted from Rx-Calendar Years to Rx-Critical Years	Jun-2005	
		MLOCA-BWR	Medium Loss-Of-Coolant Accident (BWRs)	NUREG-1829			Gamma	Geo Mean Aggregate	1.05E-06	5.54E-05	1.04E-04	3.72E-04	0.6	5865	6.7		Expert Elicitation, converted from Rx-Calendar Years to Rx-Critical Years	Jun-2005	
		MLOCA-PWR	Medium Loss-Of-Coolant Accident (PWRs)	NUREG-1829			Gamma	Geo Mean Aggregate	9.72E-07	2.05E-04	5.10E-04	2.05E-03	0.4	863	10.0		Expert Elicitation, converted from Rx-Calendar Years to Rx-Critical Years	Jun-2005	
		SLOCA BWR	Small Loss-Of-Coolant Accident (BWRs)	RADS	1	833.7	Gamma	JNID/IL	2.11E-04	1.42E-03	1.80E-03	4.69E-03	1.5	834	3.3	1988-2015	Dec-2016		
		SLOCA PWR	Small Loss-Of-Coolant Accident (PWRs)	RADS	0	1662.6	Gamma	JNID/IL	1.18E-06	1.37E-04	3.01E-04	1.16E-03	0.5	1660	8.4	1988-2015	Dec-2016		
		VSLOCA BWR FI	Very Small Loss-of-Coolant Accident (BWRs)	RADS	2	734.9	Gamma	JNID/IL	7.79E-04	2.96E-03	3.40E-03	7.53E-03	2.5	735	2.5	1992-2015	Dec-2016		
		VSLOCA PWR FI	Very Small Loss-of-Coolant Accident (PWRs)	RADS	0	1445	Gamma	JNID/IL	1.36E-06	1.57E-04	3.46E-04	1.32E-03	0.5	1450	8.4	1992-2015	Dec-2016		
		SORV1 BWR FI	Stuck Open Safety/Relief Valve (BWR)	RADS	9	709.7	Gamma	EB/PL/KS	5.31E-04	8.47E-03	1.26E-02	3.88E-02	0.9	74	4.6	1993-2015	Dec-2016		
		SORV2 BWR FI	Stuck Open Relief Valve >2 (BWR)	RADS	0	709.7	Gamma	JNID/IL	2.77E-06	3.20E-04	7.05E-04	2.71E-03	0.5	710	8.4	1993-2015	Dec-2016		
		SORV1 PWR FI	Stuck Open Safety/Relief Valve (PWR)	RADS	2	1662.6	Gamma	JNID/IL	3.45E-04	1.31E-03	1.50E-03	3.33E-03	2.5	1660	2.5	1988-2015	Dec-2016		
		SORV2 PWR FI	Stuck Open Relief Valve >2 (PWR)	RADS	0	1106.6	Gamma	JNID/IL	1.79E-06	2.07E-04	4.54E-04	1.75E-03	0.5	1100	8.4	1998-2015	Dec-2016		
		ISLOCA BWR FI	Interfacing System Loss of Coolant Accident (BWR)	RADS	0	323.4	Gamma	JNID/IL	6.09E-06	7.04E-04	1.55E-03	5.95E-03	0.5	323	8.4	2006-2015	Dec-2016		
		ISLOCA PWR FI	Interfacing System Loss of Coolant Accident (PWR)	RADS	0	610	Gamma	JNID/IL	3.22E-06	3.73E-04	8.20E-04	3.15E-03	0.5	610	8.4	2006-2015	Dec-2016		
RCPLOCA		Reactor Coolant Pump Seal Loss-of-Coolant Accident (PWRs)	RADS	0	610	Gamma	JNID/IL	3.22E-06	3.73E-04	8.20E-04	3.15E-03	0.5	610	8.4	2006-2015	Dec-2016			
XLOCA		Excessive Loss Of Coolant Event (Vessel Rupture)	NUREG/CR-4550			Gamma	JNID/IL	1.07E-11	2.44E-08	1.00E-07	4.57E-07	0.3	3000000	18.8		Jun-2005			
Transients		General Transient	TRANS BWR	Transient Initiating Event (BWR)	RADS	441	598.2	Gamma	EB/PL/KS	4.26E-01	7.21E-01	7.40E-01	1.13E+00	11.8	16	1.6	1997-2015	Dec-2016	
		Loss of Condenser Heat Sink	TRANS PWR	Transient Initiating Event (PWR)	RADS	743	1100.6	Gamma	EB/PL/KS	3.35E-01	6.49E-01	6.76E-01	1.12E+00	7.9	12	1.7	1998-2015	Dec-2016	
			LOCHS BWR FI	Loss Of Condenser Heat Sink (BWR)	RADS	69	626.6	Gamma	EB/PL/KS	3.51E-02	1.00E-01	1.10E-01	2.18E-01	3.7	33	2.2	1996-2015	Dec-2016	
Loss of Feedwater	LOCHS PWR FI	Loss Of Condenser Heat Sink (PWR)	RADS	61	1271.4	Gamma	EB/PL/KS	1.11E-02	4.20E-02	4.82E-02	1.07E-01	2.5	52	2.5	1995-2015	Dec-2016			
	LOMFW	Loss Of Main Feedwater	RADS	124	2096.3	Gamma	EB/PL/KS	1.11E-02	5.02E-02	5.94E-02	1.39E-01	2.1	35	2.8	1993-2015	Dec-2016			
	LOSWS	Loss Of Safety Related Cooling Water	RADS	0	2496.3	Gamma	JNID/IL	7.86E-07	9.10E-05	2.00E-04	7.68E-04	0.5	2500	8.4	1988-2015	Dec-2016			
	PLOSWS FI	Partial Loss Of SWS Initiating Event	RADS	4	2496.3	Gamma	JNID/IL	6.65E-04	1.67E-03	1.80E-03	3.38E-03	4.5	2500	2.0	1988-2015	Dec-2016			
	LOCWC FI	Loss Of Safety Related Cooling Water (Closed System)	RADS	0	2496.3	Gamma	JNID/IL	7.86E-07	9.10E-05	2.00E-04	7.68E-04	0.5	2500	8.4	1988-2015	Dec-2016			
	Loss of Instrument Control Air	PLOCCW FI	Partial Loss Of CCW Initiating Event	RADS	4	2496.3	Gamma	JNID/IL	6.65E-04	1.67E-03	1.80E-03	3.38E-03	4.5	2500	2.0	1988-2015	Dec-2016		
		LOIA BWR	Loss Of Instrument Air (BWR)	RADS	5	761.2	Gamma	JNID/IL	3.01E-03	6.79E-03	7.23E-03	1.29E-02	5.5	761	1.9	1991-2015	Dec-2016		
		LOIA PWR	Loss Of Instrument Air (PWR)	RADS	9	1153.5	Gamma	JNID/IL	4.40E-03	7.97E-03	8.24E-03	1.31E-02	9.5	1150	1.6	1997-2015	Dec-2016		
		PO.LOOP	Loss of offsite power, all categories, power	RADS	54	1751.7	Gamma	JNID/IL	2.45E-02	3.10E-02	3.11E-02	3.84E-02	54.5	1750	1.2	1997-2015	Dec-2016		
		PO.LOOP-GR	Loss of offsite power, grid-related, power operation, per rcry	RADS	18	1751.7	Gamma	EB/PP/KS	1.10E-04	5.86E-03	1.10E-02	3.94E-02	0.6	55	6.7	1997-2015	Dec-2016		
Loss of Offsite Power	Loss of Offsite Power, Power Operations	PO.LOOP-PC	Loss of offsite power, plant-centered, power operation, per rcry	RADS	3	1751.7	Gamma	JNID/IL	6.19E-04	1.81E-03	2.00E-03	4.02E-03	3.5	1750	2.2	1997-2015	Dec-2016		
		PO.LOOP-SC	Loss of offsite power, switchyard-centered, power operation, per rcry	RADS	23	1751.7	Gamma	JNID/IL	9.22E-03	1.32E-02	1.34E-02	1.83E-02	23.5	1750	1.4	1997-2015	Dec-2016		
		PO.LOOP-WR	Loss of offsite power, weather-related, power operation, per rcry	RADS	13	2566.5	Gamma	EB/PL/KS	7.86E-04	4.18E-03	5.08E-03	1.25E-02	1.8	354	3.0	1986-2015	Dec-2016		
	Loss of Offsite Power, Shutdown Operations	SD.LOOP	Loss of offsite power, all categories, Shutdown operation, per rcry	RADS	36	213.5	Gamma	EB/PL/KS	5.12E-02	1.53E-01	1.69E-01	3.43E-01	3.4	20	2.2	1997-2015	Dec-2016		
		SD.LOOP-GR	Loss of offsite power, grid-related, Shutdown operation, per rcry	RADS	6	468.4	Gamma	JNID/IL	6.29E-03	1.32E-02	1.39E-02	2.39E-02	6.5	468	1.8	1986-2015	Dec-2016		
		SD.LOOP-PC	Loss of offsite power, plant-centered, Shutdown operation, per rcry	RADS	23	468.4	Gamma	EB/PL/KS	2.04E-03	3.24E-02	4.80E-02	1.48E-01	0.9	19	4.6	1986-2015	Dec-2016		
		SD.LOOP-SC	Loss of offsite power, switchyard-centered, Shutdown operation, per rcry	RADS	17	213.5	Gamma	JNID/IL	5.27E-02	8.06E-02	8.20E-02	1.17E-01	17.5	213	1.5	1997-2015	Dec-2016		
		SD.LOOP-WR	Loss of offsite power, weather-related, Shutdown operation, per rcry	RADS	16	468.4	Gamma	EB/PL/KS	2.60E-04	1.72E-02	3.39E-02	1.24E-01	0.6	17	7.2	1986-2015	Dec-2016		
Electrical Power	Loss of AC Electrical Bus	LOAC	Loss Of Vital AC Bus	RADS	12	2179.9	Gamma	JNID/IL	3.35E-03	5.58E-03	5.73E-03	8.64E-03	12.5	2180	1.5	1992-2015	Dec-2016		
		LOAC 4160V FI	Loss Of Vital AC Bus (4160 Volt)	RADS	7	2179.9	Gamma	JNID/IL	1.67E-03	3.29E-03	3.44E-03	5.73E-03	7.5	2180	1.7	1992-2015	Dec-2016		
		LOAC L0VV FI	Loss Of Vital AC Bus (Low Voltage)	RADS	5	2179.9	Gamma	JNID/IL	1.05E-03	2.37E-03	2.52E-03	4.51E-03	5.5	2180	1.9	1992-2015	Dec-2016		
	LOACB2	Loss Of Vital AC Bus Event (2 Buses modeled as IEs)	RADS Adjusted	12	2179.9	Gamma	JNID/IL	3.07E-07	6.98E-04	2.87E-03	1.31E-02	0.3	105	18.8	1992-2015	Adjusted for initiation by 2-busses (0.5) Dec-2016			
	Loss of DC Electrical Bus	LODC	Loss Of Vital DC Bus	RADS	2	2496.3	Gamma	JNID/IL	2.29E-04	8.70E-04	1.00E-03	2.21E-03	2.5	2500	2.5	1988-2015	Dec-2016		
		LODCB2	Loss Of Vital DC Bus Event (2 Buses modeled as IEs)	RADS Adjusted	2	2496.3	Gamma	JNID/IL	5.35E-08	1.22E-04	5.00E-04	2.29E-03	0.3	600	18.8	1988-2015	Adjusted for initiation by 2-busses (0.5) Dec-2016		

Acronyms - BWR (boiling water reactor), EB (empirical Bayes), EE (expert elicitation), IE (initiating event), IEDB (initiating events database - <http://nrcoe.inl.gov>), PWR (pressurized water reactor)

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.