

SPAR Basic Event Unavailability Data and Results

Train Unavailability Event	Train Description	Data Source	Industry-average Probability Distribution (note a)										Comments (see Appendix B for details)	Effective Date
			Data MSPI Trains	Distribution (note b)	Mean	α	β	Error Factor	Rounded Mean (note c)	Rounded α (note c)	β (note d)	Error Factor		
AHU-TM	Air Handling Unit Test or Maintenance	IPEs		Beta (IPEs, SCNID)	2.48E-03	0.500	2.011E+02	8.4	2.5E-03	0.50	2.00E+02	8.4		Feb-07
BAC-TM	Bus (ac) Test or Maintenance	IPEs		Beta (IPEs, SCNID)	2.15E-04	0.500	2.325E+03	8.4	2.0E-04	0.50	2.50E+03	8.4		Feb-07
BCH-TM	Battery Charger Test or Maintenance	IPEs		Beta (IPEs, SCNID)	2.20E-03	0.500	2.268E+02	8.4	2.0E-03	0.50	2.50E+02	8.4		Feb-07
CHL-TM	Chiller Test or Maintenance	IPEs		Beta (IPEs/2, SCNID)	1.98E-02	0.500	2.482E+01	8.2	2.0E-02	0.50	2.45E+01	8.2	Comparison of IPE UAs versus 2002 - 2004 MSPI UAs and 1998 - 2002 ROP SSU UAs indicates a drop of approximately 50% for IPE UAs > 5.0E-3. IPE value divided by 2.	Feb-07
CTF-TM	Cooling Tower Fan Test or Maintenance	IPEs		Beta (IPEs, SCNID)	1.86E-03	0.500	2.683E+02	8.4	2.0E-03	0.50	2.50E+02	8.4		Feb-07
CTG-TM	Combustion Turbine Generator Test or Maintenance	IPEs		Beta (IPEs/2, SCNID)	5.00E-02	0.500	9.500E+00	7.7	5.0E-02	0.50	9.50E+00	7.7	Comparison of IPE UAs versus 2002 - 2004 MSPI UAs and 1998 - 2002 ROP SSU UAs indicates a drop of approximately 50% for IPE UAs > 5.0E-3. IPE value divided by 2.	Feb-07
DDP-TM (AFWS)	Diesel-Driven Pump Test or Maintenance (AFWS)	MSPI	5	Beta (MSPI, MSPI)	9.70E-03	10.946	1.118E+03	1.6	1.0E-02	10.00	9.90E+02	1.6		Feb-07
DDP-TM (SWS)	Diesel-Driven Pump Test or Maintenance (SWS)	MSPI	5	Beta (MSPI, MSPI)	2.95E-02	6.134	2.018E+02	1.8	3.0E-02	6.00	1.94E+02	1.8		Feb-07
EDG-TM (EPS)	Emergency Diesel Generator Test or Maintenance (EPS)	MSPI	219	Beta (MSPI, MSPI)	1.34E-02	3.586	2.640E+02	2.2	1.2E-02	4.00	3.29E+02	2.1		Feb-07
EDG-TM (HPCS)	Emergency Diesel Generator Test or Maintenance (HPCS)	MSPI	8	Beta (MSPI, MSPI)	1.33E-02	5.761	4.274E+02	1.9	1.2E-02	6.00	4.94E+02	1.8		Feb-07
EOV-TM	Explosive-Operated Valve Test or Maintenance	IPEs		Beta (IPEs, SCNID)	5.52E-04	0.500	9.053E+02	8.4	6.0E-04	0.50	8.33E+02	8.4		Feb-07
FAN-TM	Fan Test or Maintenance	IPEs		Beta (IPEs, SCNID)	2.00E-03	0.500	2.495E+02	8.4	2.0E-03	0.50	2.50E+02	8.4		Feb-07
FWR-TM	Feedwater Injection Test or Maintenance	MSPI	4	Beta (MSPI, MSPI Ave)	1.60E-02	2.500	1.538E+02	2.5	1.5E-02	2.50	1.64E+02	2.5	Limited data. Average α used.	Feb-07
HDR-TM (ESW)	Piping Header Test or Maintenance (ESW)	MSPI	53	Beta (MSPI, MSPI)	8.65E-03	1.000	1.146E+02	4.3	9.0E-03	1.00	1.10E+02	4.3	Header may include 1 MDP or 2 or more MDPs in parallel	Feb-07
HDR-TM (RHR-SW)	Piping Header Test or Maintenance (RHR-SW)	MSPI	38	Beta (MSPI, MSPI)	3.63E-03	1.747	4.795E+02	3.0	4.0E-03	1.50	3.74E+02	3.3	Header includes either 1 MDP or 2 MDPs in parallel	Feb-07
HTG-TM	Hydro Turbine Generator Test or Maintenance	SSU		Beta (SSU, MSPI Ave)	8.97E-03	2.500	2.761E+02	2.5	9.0E-03	2.50	2.75E+02	2.5	Limited data. Average α used. MSPI data cover mainly the transmission lines (underground and aboveground from the HTGs to the plants)	Feb-07
HTX-TM (CCW)	Heat Exchanger Test or Maintenance (CCW)	MSPI	73	Beta (MSPI, MSPI)	7.23E-03	1.000	1.373E+02	4.3	7.0E-03	1.00	1.42E+02	4.3	CCW HTX trains may include 1 MDP or 2 MDPs in parallel	Feb-07
HTX-TM (RHR-BWR)	Heat Exchanger Test or Maintenance (RHR-BWR)	MSPI	70	Beta (MSPI, MSPI)	7.62E-03	3.759	4.895E+02	2.2	8.0E-03	4.00	4.96E+02	2.1	RHR-BWR HTX trains include 1 MDP or 2 MDPs in parallel	Feb-07
HTX-TM (RHR-PWR)	Heat Exchanger Test or Maintenance (RHR-PWR)	MSPI	145	Beta (MSPI, MSPI)	5.18E-03	2.748	5.278E+02	2.4	5.0E-03	2.50	4.98E+02	2.5	RHR-PWR HTX trains include 1 MDP or 2 MDPs in parallel	Feb-07
IC-TM	Isolation Condenser Test or Maintenance	MSPI	6	Beta (MSPI, MSPI)	5.86E-03	1.265	2.146E+02	3.6	6.0E-03	1.20	1.99E+02	3.8		Feb-07
MDC-TM	Motor-Driven Compressor Test or Maintenance	IPEs		Beta (IPEs/2, SCNID)	1.30E-02	0.500	3.796E+01	8.3	1.2E-02	0.50	4.12E+01	8.3	Comparison of IPE UAs versus 2002 - 2004 MSPI UAs and 1998 - 2002 ROP SSU UAs indicates a drop of approximately 50% for IPE UAs > 5.0E-3. IPE value divided by 2.	Feb-07
MDP-TM (AFWS)	Motor-Driven Pump Test or Maintenance (AFWS)	MSPI	122	Beta (MSPI, MSPI)	3.95E-03	2.387	6.019E+02	2.6	4.0E-03	2.50	6.23E+02	2.5		Feb-07

Train Unavailability Event	Train Description	Data Source	Data MSPI Trains	Distribution (note b)	Industry-average Probability Distribution (note a)							Error Factor	Comments (see Appendix B for details)	Effective Date
					Mean	α	β	Error Factor	Rounded Mean (note c)	Rounded α (note c)	β (note d)			
MDP-TM (CCW)	Motor-Driven Pump Test or Maintenance (CCW)	MSPI	133	Beta (MSPI, MSPI)	5.91E-03	1.288	2.166E+02	3.6	6.0E-03	1.20	1.99E+02	3.8		Feb-07
MDP-TM (HPCS)	Motor-Driven Pump Test or Maintenance (HPCS)	MSPI	8	Beta (MSPI, MSPI)	1.31E-02	1.537	1.158E+02	3.2	1.2E-02	1.50	1.24E+02	3.3		Feb-07
MDP-TM (HPSI)	Motor-Driven Pump Test or Maintenance (HPSI)	MSPI	196	Beta (MSPI, MSPI)	4.12E-03	2.348	5.676E+02	2.6	4.0E-03	2.50	6.23E+02	2.5		Feb-07
MDP-TM (ESW)	Motor-Driven Pump Test or Maintenance (ESW)	MSPI	223	Beta (MSPI, MSPI)	1.30E-02	1.000	7.592E+01	4.3	1.2E-02	1.00	8.23E+01	4.3		Feb-07
MDP-TM (NSW)	Motor-Driven Pump Test or Maintenance (NSW)	MSPI	6	Beta (MSPI, MSPI)	1.64E-02	6.278	3.765E+02	1.8	1.5E-02	6.00	3.94E+02	1.8		Feb-07
MDP-TM (RHRSW)	Motor-Driven Pump Test or Maintenance (RHRSW)	MSPI	8	Beta (MSPI, MSPI)	5.76E-03	1.320	2.278E+02	3.6	6.0E-03	1.20	1.99E+02	3.8	Most RHRSW MDPs are included in header trains with 2 parallel MDPs, rather than reported individually	Feb-07
MDP-TM (Other)	Motor-Driven Pump Test or Maintenance (Other)	MSPI	696	Beta (MSPI, MSPI)	7.51E-03	1.000	1.322E+02	4.3	8.0E-03	1.00	1.24E+02	4.3	Results from all MDP data combined	Feb-07
PDP-TM	Positive Displacement Pump Test or Maintenance	IPEs		Beta (IPEs, SCNID)	3.19E-03	0.500	1.562E+02	8.4	3.0E-03	0.50	1.66E+02	8.4		Feb-07
SPC-TM	Signal Processing Channel Test or Maintenance	SS		Beta (SS, SCNID)	5.80E-02	0.500	8.121E+00	7.6	6.0E-02	0.50	7.83E+00	7.6		Feb-07
TDP-TM (AFWS)	Turbine-Driven Pump Test or Maintenance (AFWS)	MSPI	69	Beta (MSPI, MSPI)	5.44E-03	2.177	3.980E+02	2.7	5.0E-03	2.00	3.98E+02	2.8		Feb-07
TDP-TM (HPCI)	Turbine-Driven Pump Test or Maintenance (HPCI)	MSPI	24	Beta (MSPI, MSPI)	1.30E-02	3.288	2.496E+02	2.3	1.2E-02	3.00	2.47E+02	2.3		Feb-07
TDP-TM (RCIC)	Turbine-Driven Pump Test or Maintenance (RCIC)	MSPI	30	Beta (MSPI, MSPI)	1.07E-02	4.703	4.348E+02	2.0	1.0E-02	5.00	4.95E+02	2.0		Feb-07

Acronyms - AFWS (auxiliary feedwater system), BWR (boiling water reactor), CCW (component cooling water), EPS (emergency power system), ESW (emergency or essential service water), HPCI (high-pressure coolant injection), HPCS (high-pressure core spray), IC (isolation condenser), HTX (heat exchanger), IPE (Individual Plant Examination), MDP (motor-driven pump), MSPI (Mitigating Systems Performance Index), NSW (normal service water), PWR (pressurized water reactor), RCIC (reactor core isolation cooling), RHR (residual heat removal), RHRSW (residual heat removal service water), ROP (Reactor Oversight Process), SCNID (simplified constrained noninformative distribution), SS (system study), SSU (Safety System Unavailability), SWS (service water system)

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 format for the distributions is the following: distribution type (source for mean, source for α factor). If the source for the mean indicates IPE/2, these are cases in which the IPE value was divided by 2 to reflect more current performance.

Note c - The value is rounded to 1.0, 1.2, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, or 9.0 times the appropriate power of ten.

Note d - The β factor is determined from the mean and α . The β factor is presented to three significant figures to preserve the mean of the distribution.