

Rates of Fire Events at U.S. Nuclear Power Plants 1988–2002

The fire study uses operating experience to characterize the frequency and nature of fire event data from operating U.S. commercial nuclear power plants.

This report presents an analysis of fire event frequencies at United States (U.S.) nuclear power plants. The evaluation is based on the operating experience from 1988 through 2002. The data sources for this report include:

- License Event Reports (LERs), 1988 to 2002
- Nuclear Plant Reliability Data System (NPRDS), 1988 to 1996
- Equipment Performance and Information Exchange (EPIX), 1997 to 2002
- Electric Power Research Institute (EPRI), 1986 to 1988
- National Electric Insurers Limited (NEIL), 1993 to 1999.

This report updates the Office for Analysis and Evaluation of Operational Data (AEOD) report AEOD/S97-03, “*Special Study, Fire Events – Feedback of U.S. Operating Experience*,” June 1997.

1 LATEST FREQUENCIES AND TRENDS

1.1 Fire Event Occurrences by Year

Fire frequency trends are plotted for fires that are of sufficient duration and size to be called “severe.” [Figure 1](#) shows the trend of fires for all plant conditions, the decreasing trend is statistically significant¹. [Figure 2](#) shows the trend of fires for at power conditions, the decreasing trend is statistically significant. [Figure 3](#) shows the trend of fires for at shutdown conditions, the trend is not statistically significant. [Table 1](#), [Table 2](#), and [Table 3](#) show the data points for these figures.

¹ The term “statistically significant” means that the data are too closely correlated to be attributed to chances and consequently have a systematic relationship. A p-value of less than 0.05 is generally considered to be statistically significant.

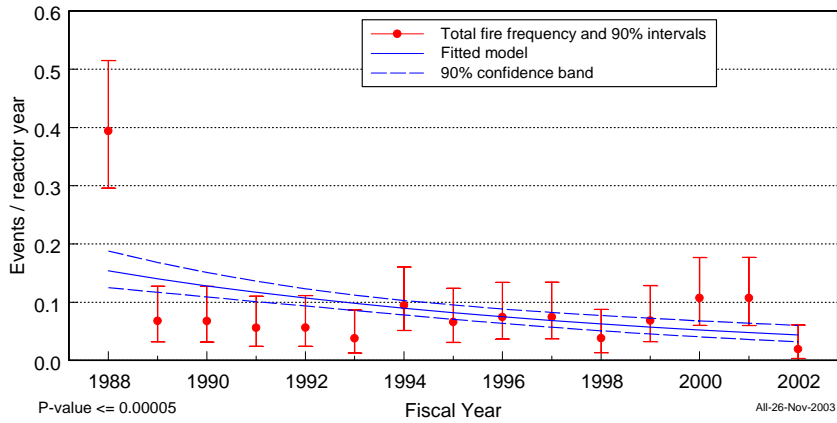


Figure 1. Fire events by fiscal year for plant at power and shutdown.

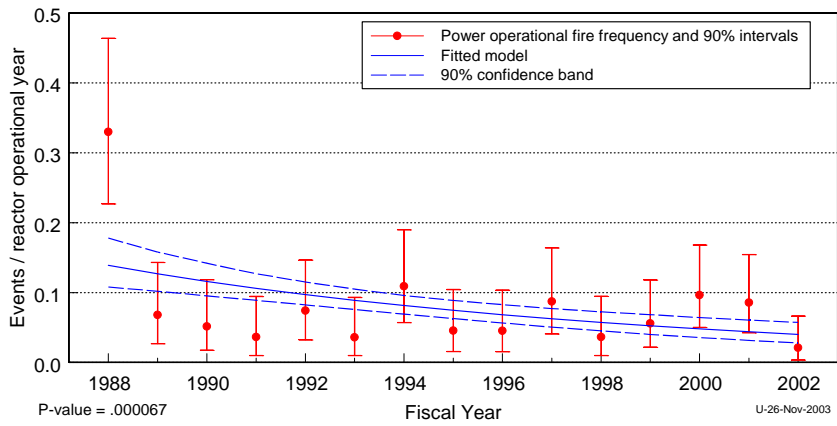


Figure 2. Fire events by fiscal year for plant at power.

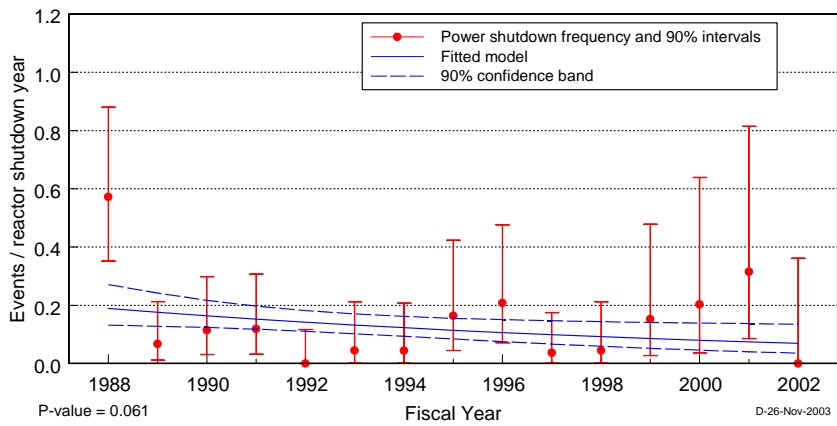


Figure 3. Fire events by fiscal year for plant shutdown.

2 FIRE DATA SUMMARY

The raw fire event data were sliced to show selected distributions. These distributions are based on all modes of operation and all severities of fires.

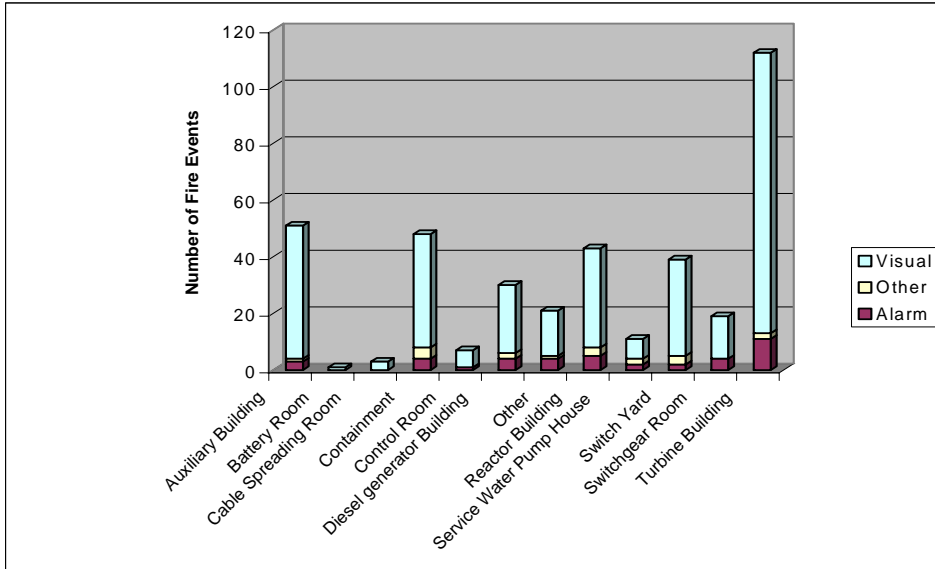


Figure 4. Distribution of fire events by plant location and fire discovery method.

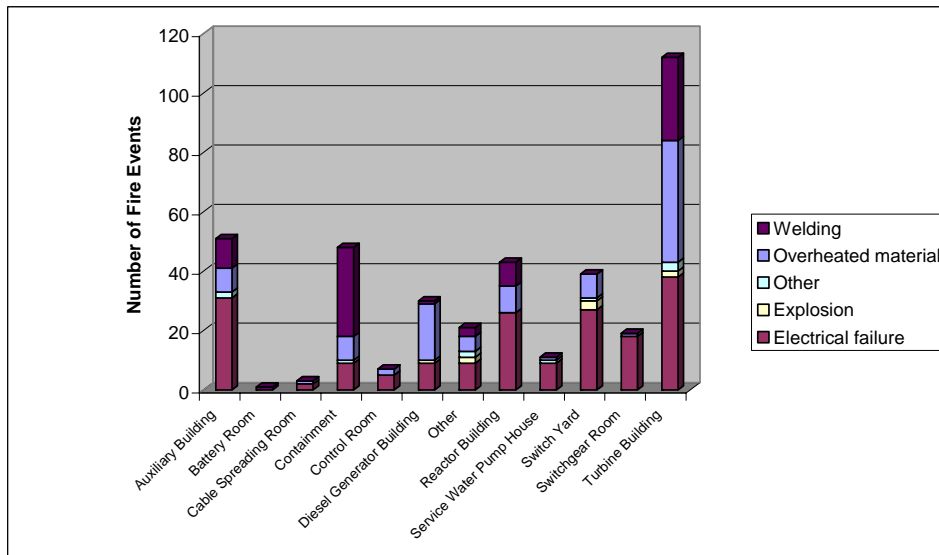


Figure 5. Distribution of fire events by plant location and cause.

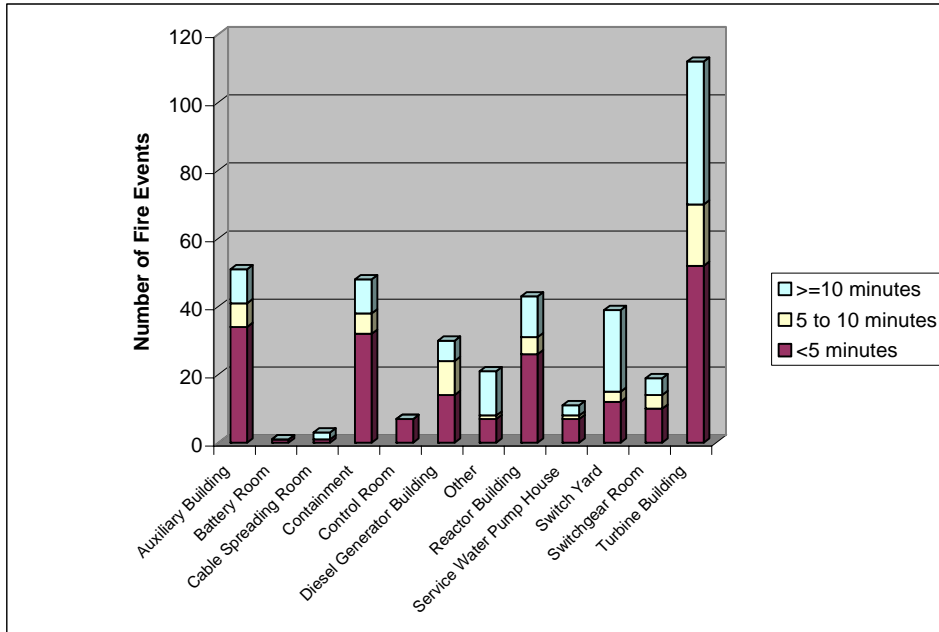


Figure 6. Distribution of fire events by plant location and fire duration.

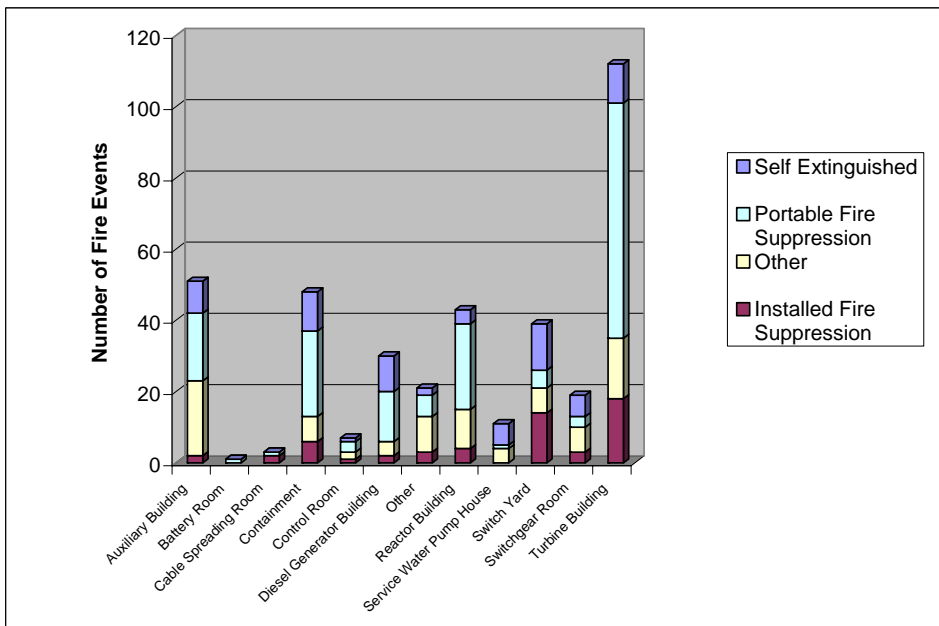


Figure 7. Distribution of fire events by plant location and method of suppression.

3 DATA TABLES

3.1 Data Tables for Fire Event Trends

Table 1. Fire events all modes of operation. Figure 1

FY	Plot Trend Error Bar Points			Regression Curve Data Points		
	Lower (5%)	Mean	Upper (95%)	Lower (5%)	Mean	Upper (95%)
1987	1.09E-01	1.85E-01	2.93E-01	1.34E-01	1.68E-01	2.11E-01
1988	2.97E-01	3.94E-01	5.15E-01	1.25E-01	1.54E-01	1.88E-01
1989	3.18E-02	6.79E-02	1.27E-01	1.17E-01	1.40E-01	1.68E-01
1990	3.18E-02	6.77E-02	1.27E-01	1.09E-01	1.28E-01	1.51E-01
1991	2.43E-02	5.59E-02	1.10E-01	1.01E-01	1.17E-01	1.36E-01
1992	2.46E-02	5.64E-02	1.11E-01	9.36E-02	1.07E-01	1.23E-01
1993	1.29E-02	3.79E-02	8.67E-02	8.58E-02	9.81E-02	1.12E-01
1994	5.13E-02	9.46E-02	1.60E-01	7.81E-02	8.97E-02	1.03E-01
1995	3.10E-02	6.60E-02	1.24E-01	7.06E-02	8.20E-02	9.52E-02
1996	3.70E-02	7.44E-02	1.34E-01	6.35E-02	7.50E-02	8.85E-02
1997	3.71E-02	7.46E-02	1.35E-01	5.70E-02	6.86E-02	8.25E-02
1998	1.31E-02	3.84E-02	8.78E-02	5.09E-02	6.27E-02	7.72E-02
1999	3.21E-02	6.85E-02	1.29E-01	4.54E-02	5.73E-02	7.24E-02
2000	5.97E-02	1.07E-01	1.76E-01	4.04E-02	5.24E-02	6.79E-02
2001	5.99E-02	1.07E-01	1.77E-01	3.60E-02	4.79E-02	6.38E-02
2002	3.45E-03	1.94E-02	6.11E-02	3.20E-02	4.38E-02	6.00E-02

Table 2. Fire events at power. Figure 2

FY	Plot Trend Error Bar Points			Regression Curve Data Points		
	Lower (5%)	Mean	Upper (95%)	Lower (5%)	Mean	Upper (95%)
1987	1.09E-01	2.02E-01	3.42E-01	1.15E-01	1.51E-01	2.00E-01
1988	2.28E-01	3.30E-01	4.65E-01	1.08E-01	1.39E-01	1.78E-01
1989	2.68E-02	6.81E-02	1.43E-01	1.02E-01	1.27E-01	1.58E-01
1990	1.77E-02	5.17E-02	1.18E-01	9.53E-02	1.16E-01	1.42E-01
1991	9.95E-03	3.65E-02	9.44E-02	8.89E-02	1.06E-01	1.27E-01
1992	3.23E-02	7.43E-02	1.47E-01	8.24E-02	9.73E-02	1.15E-01
1993	9.83E-03	3.61E-02	9.32E-02	7.59E-02	8.91E-02	1.05E-01
1994	5.66E-02	1.09E-01	1.89E-01	6.93E-02	8.15E-02	9.59E-02
1995	1.56E-02	4.56E-02	1.04E-01	6.28E-02	7.46E-02	8.87E-02
1996	1.55E-02	4.53E-02	1.04E-01	5.65E-02	6.83E-02	8.26E-02
1997	4.10E-02	8.74E-02	1.64E-01	5.06E-02	6.25E-02	7.72E-02
1998	9.99E-03	3.66E-02	9.47E-02	4.52E-02	5.73E-02	7.25E-02
1999	2.21E-02	5.61E-02	1.18E-01	4.02E-02	5.24E-02	6.83E-02
2000	5.03E-02	9.63E-02	1.68E-01	3.57E-02	4.80E-02	6.44E-02
2001	4.26E-02	8.56E-02	1.54E-01	3.17E-02	4.39E-02	6.08E-02
2002	3.75E-03	2.11E-02	6.65E-02	2.81E-02	4.02E-02	5.75E-02

Table 3. Fire events with plant shutdown. Figure 3

FY	Plot Trend Error Bar Points			Regression Curve Data Points		
	Lower (5%)	Mean	Upper (95%)	Lower (5%)	Mean	Upper (95%)
1987	3.92E-02	1.44E-01	3.72E-01	1.35E-01	2.03E-01	3.06E-01
1988	3.53E-01	5.72E-01	8.82E-01	1.32E-01	1.89E-01	2.71E-01
1989	1.20E-02	6.73E-02	2.12E-01	1.28E-01	1.76E-01	2.42E-01
1990	3.14E-02	1.15E-01	2.98E-01	1.24E-01	1.64E-01	2.17E-01
1991	3.24E-02	1.19E-01	3.07E-01	1.18E-01	1.52E-01	1.97E-01
1992	0.00E+00	0.00E+00	1.17E-01	1.11E-01	1.42E-01	1.82E-01
1993	2.29E-03	4.47E-02	2.12E-01	1.02E-01	1.32E-01	1.70E-01
1994	2.25E-03	4.39E-02	2.08E-01	9.34E-02	1.23E-01	1.62E-01
1995	4.47E-02	1.64E-01	4.24E-01	8.42E-02	1.14E-01	1.55E-01
1996	7.09E-02	2.08E-01	4.75E-01	7.52E-02	1.06E-01	1.51E-01
1997	1.90E-03	3.70E-02	1.75E-01	6.68E-02	9.91E-02	1.47E-01
1998	2.29E-03	4.47E-02	2.12E-01	5.91E-02	9.22E-02	1.44E-01
1999	2.70E-02	1.52E-01	4.79E-01	5.21E-02	8.58E-02	1.41E-01
2000	3.61E-02	2.03E-01	6.39E-01	4.59E-02	7.99E-02	1.39E-01
2001	8.59E-02	3.15E-01	8.15E-01	4.03E-02	7.43E-02	1.37E-01
2002	0.00E+00	0.00E+00	3.62E-01	3.54E-02	6.92E-02	1.35E-01