

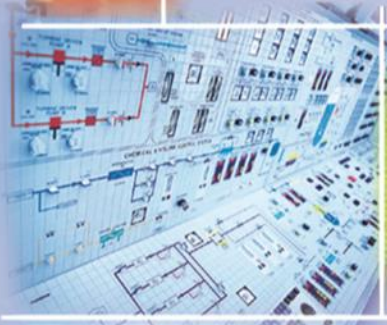


EPM

Engineering Planning and Management, Inc.

ONET GROUP

Conservatism in Non-Suppression Probability (NSP) Data



FPRA FAQ Public Meeting
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Description of Potential Realism Improvement: NSP Data Conservatism

- There is a disconnect between the average durations of fire scenarios in Fire PRAs vs. fire event experience
 - The fire durations include time lags or delays associated with reporting time to control the fire versus time to extinguish the fire and time associated with de-energizing equipment, offsite fire brigade response, and water application
- In Fire PRAs, the source scenarios reach peak HRR in 12 minutes. Using FLASH-CAT, multiple trays are involved well before 20 minutes. Peak ZOI and HGL occur before 20 minutes.
- Typically, on-site fire brigade arrival is expected to be 10-15 minutes, and upon arrival, fire is under control within 5-10 minutes.
- From the NSP data, more than 25% of fire events have durations longer than 20 minutes

Identification of Relevant Guidance

- NUREG-2169, Section 5.2. NSP Estimation Update, provides the following probability distributions for rates of fires suppressed per unit time, λ (data is based on fire events from 1981-2009)

Suppression Curve	Number of Events in Curve	Total Duration (minutes)	Rate of Fire Suppressed (λ)			
			Mean	5th Percent	50th Percent	95th Percent
T/G fires	30	1167	0.026	0.019	0.025	0.034
Control room	12	37	0.324	0.187	0.315	0.492
PWR containment (AP)	3	40	0.075	0.020	0.067	0.157
Containment (LPSD)	31	299	0.104	0.075	0.103	0.136
Outdoor transformers	24	928	0.026	0.018	0.026	0.035
Flammable gas	8	234	0.034	0.017	0.033	0.056
Oil fires	50	562	0.089	0.069	0.088	0.111
Cable fires	4	29	0.138	0.047	0.127	0.267
Electrical fires	177	1815	0.098	0.086	0.097	0.110
Welding fires	52	484	0.107	0.084	0.107	0.133
Transient fires	43	386	0.111	0.085	0.111	0.141
HEAFs	8	602	0.013	0.007	0.013	0.022
All fires	442	6583	0.067	0.062	0.067	0.072

Proposed Approach to Enhance Realism: Initial Assessment

- Review fire event information obtained from NRC Event Reports, Licensee Event Reports, or through Plant contacts.
- Re-examine when the fires were under control, rather than totally extinguished. At the control point, the fire is no longer a threat to fire spread, hot gas layer formation, additional target damage.
- Consider limiting data to only the more recent fire events to be consistent with fire ignition frequency data

Proposed Approach to Enhance Realism: Initial Assessment

- Initial scoping of high-duration electrical cabinet fires from NRC Event Reports:

EPRI Fire ID	Event Date	Power Mode	Fire Severity	Bin Designation	NSP Category	Suppression Time (min)
1097	11/15/1986	Low-power operation	Undetermined	26	Electrical	95
418	4/28/1984	Low-power operation	Challenging	10	Electrical	60
642	11/4/1987	Power operation	Challenging	15.1	Electrical	50
98	10/8/1998	RF	PC	15	Electrical	46
30362	12/16/2001	RF	PC	21	Electrical	45
50829	9/11/2004	PO	PC	23	Electrical	45
175	11/22/2009	CD	CH	15	Electrical	45
121	4/26/2003	PO	U	21	Electrical	37
505	1/8/1986	Low-power operation	Undetermined	21	Electrical	36
20302	7/25/1993	PO	U	15	Electrical	35
238	1/24/1981	Power operation	Challenging	21	Electrical	30
557	1/31/1987	Low-power operation	Challenging	22	Electrical	30
656	12/17/1987	Power operation	Challenging	22	Electrical	30
97	6/10/1998	PO	PC	22	Electrical	29
10626	12/11/2002	PO	PC	21	Electrical	27
235	12/30/1992	PO	PC	26	Electrical	25

Summary of Anticipated Realism Improvements

- Preliminary estimates based on expert judgement
- For events over 20 minutes in duration, reduce the duration by half, but not less than 20 minutes;
- Events under 20 minutes were unaltered
 - i.e., 50 min event was reduced to 25 min, while 30 min event to 20 min

NSP Curve	Total Number Events	Sum of Durations	Average Duration [min]	NSP at time = 20
NUREG-2169	177	1815	10.3	0.142
Estimate of Improvement	177	1492	8.4	0.093

- The average duration was reduced by ~20%
- NSP at 20 minutes reduced by 35%