

When subjected to burning, polyurethane foam systems will yield toxic fumes consisting of various gases, which may include, but not limited to, carbon monoxide, carbon dioxide and oxides of nitrogen, which may also present a risk to respiratory tract and eyes. Comparison studies of the relative toxicity of materials in fire situations have shown polyurethanes, poly isocyanurates and polystyrene foam to be less toxic than wood in terms of causing death or incapacitation in test animals (See Tables 2 and 3 attached).

Table 2. Relative Toxicity of Off-Gases from Thermal Insulation Materials (PSC Procedure 1, or NASA-USF Procedure B)

Material	Time to Death min
polymethacrylimide rigid foam	11.45 ± 2.31
polybismaleimide rigid foam	12.80 ± 1.04
cellulose insulation, untreated	15.85 ± 1.15
hardboard	15.90 ± 2.62
phenolic rigid foam, GM-57	17.17 ± 0.83
fiberboard sheathing, asphalt impregnated	17.44 ± 2.05
medium density hardboard	17.87 ± 0.32
chipboard	18.23 ± 0.95
cellulose insulation, treated, 5-mol borax	19.11 ± 0.74
polyisocyanurate rigid foam, T2	19.75 ± 0.79
fiberboard soundstop	19.88 ± 5.04
cellulose core board	20.58 ± 4.38
polyisocyanurate rigid foam, GM-43	21.14 ± 1.13
polyisocynaurate rigid foam, T1	21.22 ± 1.67
polyurethane rigid foam, R2	23.74 ± 2.11
polyurethane rigid foam, R1	23.92 ± 2.14
polyvinyl chloride rigid foam	24.40 ± 2.83
polyurethane rigid foam, R4	24.93 ± 2.69
polyurethane rigid foam, R3	25.69 ± 0.80
polystyrene rigid foam	26.25 ± 0.64
high temperature insulation, perlited	n. d.

n.d. – no deaths

TABLE 3
RELATIVE TOXICITY OF POLYMERS BY GENERIC TYPE

Polymer	No. of samples	Time, min To death	To incapacitation	No. of tests
Polyether sulfone	3	12.30 ± 2.08	11.25 ± 1.93	7
Polyphenylene sulfide	4	13.21 ± 3.80	11.58 ± 2.68	9
Polyaryl sulfone	2	13.48 ± 3.17	10.31 ± 0.42	5
Wood	12	14.03 ± 1.48	9.92 ± 1.09	33
Polyurethane flexible foam	29	14.15 ± 2.84	10.45 ± 1.36	61
Polyamide (nylon)	3	14.36 ± 1.71	12.35 ± 1.44	7
Polyphenyl sulfone	1	15.46	13.32	2
Polyurethane rigid foam	7	15.49 ± 4.06	11.77 ± 2.95	17
Polymethylmethacrylate (PMMA)	1	15.58	12.61	2
Polyvinylidene fluoride	1	15.86	6.50	2
Cellulosic board	8	16.57 ± 3.54	10.10 ± 1.35	28
Polyvinyl chloride (PVC)	2	16.60 ± 0.33	9.32 ± 4.77	4
Acrylonitrile/butadiene/styrene (ABS)	3	17.13 ± 2.45	11.82 ± 1.52	9
Polyethylene, including foam	5	17.31 ± 3.73	10.67 ± 3.65	11
Acrylonitrile rubber (NBR)	3	19.13 ± 2.89	12.46 ± 2.56	9
Polyphenylene oxide, modified	1	19.96	8.65	2
Bisphenol A polycarbonate	3	20.40 ± 3.77	14.71 ± 1.68	24
Polyvinyl fluoride	1	20.50	16.94	2
Ethylene/propylene/diene (EPDM)	2	20.69 ± 0.04	12.97 ± 3.04	5
Chlorosulfonated polyethylene	2	20.88 ± 2.07	12.64 ± 6.25	7
Polyisocyanurate rigid foam	2	21.68 ± 1.38	18.90 ± 1.55	4
Polyisoprene (natural rubber)	1	22.13	15.35	3
Chlorinated polyvinyl chloride	2	22.25 ± 0.69	7.64 ± 1.92	4
Polychloroprene, including foam	6	22.33 ± 3.80	13.61 ± 1.69	21
Polystyrene	2	23.10 ± 4.33	17.11 ± 2.73	4
Styrene butadiene rubber (SBR)	1	24.11	15.73	3
Chlorinated polyethylene	2	26.08 ± 1.80	9.31 ± 2.55	4