Explosions and Refuge Chambers

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Effects of blast pressure on structures and the human body

The following table 1, based on Department of Defense data from Glasstone and Dolan (1977) and Sartori (1983), summarizes the effects of increasing blast pressure on various structures and the human body. This data originates from weapons tests and blast studies to assess the effect of blast overpressure on structures and people. This data provides some guidance on the possible effects of mine explosions on miners.

Table 1 – Effect of various long duration blast overpressures and the associated maximum wind speed on various structures and the human body.

Peak overpressure	Maximum wind speed	Effect on structures	Effect on the human body
1 psi	38 mph	Window glass shatters	Light injuries from fragments occur
2 psi	70 mph	Moderate damage to houses (windows and doors blown out and severe damage to roofs)	People injured by flying glass and debris
3 psi	102 mph	Residential structures collapse	Serious injuries are common, fatalities may occur
5 psi	163 mph	Most buildings collapse	Injuries are universal, fatalities are widespread
10 psi	294 mph	Reinforced concrete buildings are severely damaged or demolished	Most people are killed
20 psi	502 mph	Heavily built concrete buildings are severely damaged or demolished	Fatalities approach 100%

The human body can survive relatively high blast overpressure without experiencing barotrauma. A 5 psi blast overpressure will rupture eardrums in about 1% of subjects, and a 45 psi overpressure will cause eardrum rupture in about 99% of all subjects. The threshold for lung damage occurs at about 15 psi blast overpressure. A 35-45 psi overpressure may cause 1% fatalities, and 55 to 65 psi overpressure may cause 99% fatalities. (Glasstone and Dolan, 1977; TM 5-1300, 1990)

Table 1 also shows the maximum wind speed associated with the given overpressure. In mine explosions, as in war-related explosions, it is the blast wind resulting from the blast overpressure that leads to injuries and fatalities. The human body may be thrown