

BIOEFFECTS OF SIMULATED MUZZLE BLASTS

YELVERTON, J.T.; RICHMOND, D.R.; FLETCHER, E.R.

The muzzle blast pressure-time patterns recorded at the crew positions of the M198, 155mm howitzer, and an 81mm mortar were simulated for assessing non-auditory blast injuries. The most intense pressure-time patterns associated with the M198 had peak pressures of 3 psi, durations of 4-8 ms, and positive impulses of 4-8 psi ms. These waveforms were simulated at a range of 6 ft from the open end of a shocktube driven by high explosives. The shocktube was approximately 120 ft long, 60 ft was 6 ft I.D. and the distal 60-ft section was 10 ft I.D. Primacord charges (100 grain/ft), in a circular coil, were held in frames that were inserted through the top of the shocktube. Each charge had its detonator and firing line (with plug-in) attached to facilitate rapid firing, 100 blasts at a rate of 1 per minute.

Thirty-three percent of the animal models given 2.5 psi 50 times sustained a few petechial hemorrhages in the lining of the upper respiratory tract (larynx, pharynx, or trachea). The incidence of these lesions rose but not the severity of the lesions in groups receiving 2.6 psi 100 times, 5.0 psi 50 and 100 times, and 8.2 psi 5 times. There were no lesions detected in the lungs or gastrointestinal tracts of these animals.

The muzzle blast measured 1.64 ft from the 81mm mortar selected for study had a peak overpressure of near 6 psi, a duration of slightly less than 1 ms, and an impulse of 1.1 psi ms. This waveform was simulated 1.64 ft from a 3.4-ft-long vertical shocktube of 8.5-in I.D. The charge consisted of 7.5-ft length of primacord folded into a 7x5-in coil that was detonated 14 in into the tube. Nine tests were conducted each involved exposing four large animal models to 300 consecutive blasts at a rate of just over 2 per minute. There were no gross non-auditory blast injuries detected in any of the 36 test specimens.

This paper will also present and discuss damage-risk criteria for personnel exposed to 1 or 20 blasts in the short-duration range and 1 or 5 blasts in the long-duration range.