Shock tubes and high explosives were used to produce blast waves of various pressure-time patterns in order to study their biological effects. Data obtained from these experiments showed that, against a reflecting surface the LD50 reflected pressure for any given species remained fairly constant at the "longer" durations and then rose sharply at the "shorter" times. For dogs and goats, "long" durations were beyond 20 msec and for mice, rats, guinea pigs, and rabbits, beyond 1 to 3 msec. At the "shorter" durations,response depended to a great extent on the impulse, and on peak pressure for the "longer" pulses. Higher reflected pressure can be withstood if animals are located beyond a certain distance from the reflecting surface where they receive the incident and reflected pressures in two steps, separated by a given time-interval.

In freestream exposures to air blast, orientation was significant. Animals suspended vertically or prone-side-on showed a lower tolerance to blast waves of a given intensity or at a given range than those end-on because the dynamic pressure appeared to add to their side-on pressure dose. Except for eardrum rupture and sinus hemorrhage, animals exhibited a remarkable tolerance to "slow" rising blast pressures without the presence of shock fronts.

The lungs are considered the critical target organs in blast effects studies. The release of air bubbles from disrupted alveoli of the lungs into the vascular system probably accounted for the rapid deaths. The degree of lung hemorrhage was related to both the blast dose and the increase in lung weight over control values. For larger animals, the threshold for potechial hemorrhage was near 10 to 15 psi at "long" durations and 30 to 35 psi for pulses of 5 msec. At LD50 values lung weights were two to four times normal.

Ear injury was not systematically studied; however, data gleaned from lethality and lung-injury experiments indicated that: eardrum response to blast pressures is subject to wide variation; a duration effect was observed in sheep, with 38-per cent rupture recorded at 21.4 psi for durations near 100 msec versus no eardrum rupture at 32.4 psi when the durations were about 5 msec; and the severity of ear damage increased with the intensity of the blast.

From the presented data, tentative estimations of mans response to "fast"-rising pressures of 3 msec duration were compiled. Pressures for threshold and severe lung-hemorrhage levels were 30 to 40 and above 80 psi, respectively. The threshold for lethality was 100 to 120 psi with an LD50 range of 130 to 180 psi. Time-honored estimates for human eardrum rupture values of 5 and 15 psi, respectively, for threshold and 50 per cent could not be revised at this time.

The estimates were given in terms of maximal effective pressure which may be received from the incident plus dynamic, or reflected pressure, dependent on orientation. For an individual against a reflecting surface that is normal to the incident shock, or prone with the charge detonated overhead, the maximal effective dose is the reflected pressure. If, however, the man is standing a few feet from this same reflecting surface or directly below the charge, he is subjected to pressures that rise in two steps; whereas, in the former situation, the maximal effective pressure would probably be the incident plus the dynamic pressures in the first step and, in the latter, only the side-on incident pressure in the initial step. The exact distance from a reflecting surface where the effective pressure changes from the reflected to incident, or incident plus dynamic, cannot be stated for man at this time. For personnel standing or prone-side-on to the charge when it is detonated at or nearr the surface, the side-on incident plus dynamic pressures become the effective pressure; however, with orientations end-on in this situation, only the side-on incident pressure appears to be the maximal effective pressure.