RECOMMENDATIONS FOR CUBICLE SEPARATION IN LARGE-SCALE EXPLOSIVE ARENA TRIALS

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ABSTRACT

In large-scale arena blast testing, a common and economical practice undertaken is to position several cubicle targets radially around a central charge. To gain maximal benefit from this, targets should be positioned at their minimum permissible separation at which no blast wave interference is sustained from neighbouring obstructions. This interference typically occurs either when targets positioned at the same stand-off range are too close creating an amplification effect where a superposition forms between the incident blast wave and the reflected wave off the cubicle, or, where a target is positioned in the region behind another target, which causes a shadowing effect with decreased magnitudes of pressure and impulse.

A comprehensive computational modelling study was undertaken using the hydrocode Air3D to examine the influence of cubicle positioning at different ranges on the surrounding blast wave pressure-time fields. A systematic series of simulations were conducted to show the differences in incident peak overpressure and positive phase impulse between free-field and obstructed-field simulation configurations. The predictions from the modelling study indicated that the presence of cubicle target obstructions resulted in differences in peak incident overpressure and positive phase impulse in nearby pressure waves. In all cases, at close separation distances, there were greater differences in peak pressure than positive phase impulse. However, with increased separation, peak pressure returned to free-field conditions sooner whilst differences in impulse remained significant, thus governing separation distance recommendations.

The simulations showed that, for targets at the same stand-off range, clear separations of between 3.88 m and 6.92 m were required to achieve free-field equivalency, depending on the distance from the charge to the target. For targets at different stand-off ranges an angle greater than 54.2° from the front corner of the cubicle has been shown to ensure free-field equivalent conditions. A bespoke recommendation table has been generated to provide precise positioning for cubicles at different stand-off ranges in a look-up matrix format that can be readily used by engineers in the field.