AIR-BLAST ANALYSIS AND SECONDARY SHOCK FEATURES FOR LARGE-SCALE SURFACE CHEMICAL EXPLOSIONS AT SAYARIM MILITARY RANGE, ISRAEL

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A series on-surface shots was designed and conducted by the Geophysical Institute of Israel at Sayarim Military Range (SMR) in Negev desert, including two large-scale calibration explosions: about 82 tons of strong IMI explosives in August 2009, and about 100 tons of ANFO explosives in January 2011. The main goal was reached: to provide fully controlled strong infrasound sources in different weather/wind conditions, for calibration of infrasound stations in Europe, Mediterranean, Middle East and Asia, designed for monitoring nuclear tests.

Strong boosters and upward charge detonation scheme were applied to provide a reduced energy release to the ground and an enlarged energy radiation to the atmosphere, for better observation of infrasound signals at far-regional stations. Smaller than expected crater sizes and local seismic magnitudes evidence the required explosives energy partition for this charge design.

High-pressure gauges were deployed at 100-600m to record air-blast properties, evaluate blast efficiency, and provide reliable estimation of the charge yield. Empirical relationships for air-blast parameters - peak pressure, impulse, positive phase duration and the rarely reported Secondary Shock (SS) time delay - depending on distance, were developed and analyzed. The parameters, scaled by the cubic root of estimated TNT equivalent charges, were found consistent for all analyzed explosions, except of SS delays clearly separated for the shot of IMI explosives, demonstrating clearly dependence on the detonation velocity. Additionally air-blast records from non-Sayarim shots, including a tiny gas bubble shot and huge WSMR Distant Image and Minor Uncle ANFO explosions, were used to extend the charge (1g-2000t) and distance (0.15m-60km) range for the SS delay scaled relationship, and showed consistency with data for SMR shots.

Obtained and published data suppose that measured SS delay can be used as a new yield estimator based on the developed relationship of scaled SS delay versus scaled distance.