Spotlight: University of Maryland computational explosion modeling finds that rock debris in coal mines can be conducive to detonation explosions.

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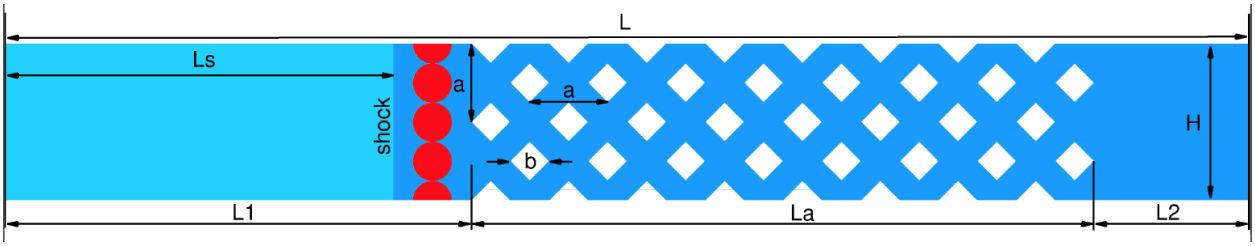
Tests were performed to examine shock attenuation by arrays of obstacles used as a model for piles of rubble in mines. The pressure history at the end wall of the channel was recorded while the properties of the system such as Mach number, geometry parameters, scale, numerical resolution, etc. were varied.

The results show that even a very loose pile of rocks (blockage ratio = 0.5) can eliminate inert pressure pulses if the length of the pile is comparable to the pulse length. The pile becomes damps the pressure pulse more efficiently as the blockage ratio increases, or the size of rocks decreases.

This is not, however, the case for reactive waves, such as flames and detonations. *Piles of rubble do not necessarily attenuate the effects of these.* This is related to the fact that flames propagating through obstacle arrays accelerate and generate strong shocks or detonations. In simulations or laboratory experiments, the formation of detonations can be suppressed by using dense arrays of small obstacles. In realistic coal mine environments, however, the piles of rock rubble are likely to contain interconnected voids or irregular channels with cross-sections comparable to or larger than the detonation cell size for stoichiometric methane-air mixtures (~ 0.20 m). If these voids and the area between the pile of rubble and the protective wall (seal) are filled with a methane-air mixture containing 8-13% CH_4, and this mixture is ignited, a detonation is likely to form and generate peak pressures exceeding 100 atm at the wall. One possible way to reduce these pressures is to avoid formation of flammable methane-air mixtures in the vicinity of the protective wall including the pile of rubble. This could be achieved through ventilation or injection of inert gases in this area.



Computational setup for studying the effects of rubble piles on pressures created by Deflagrations and detonations.