

Analysis of Coal Mine Seal Integrity from Explosively Driven Projectiles

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Underground coal mines have several dangers particular to that type of mining, the most hazardous of which is the possibility of an explosion or fire caused by a buildup of methane gas. To reduce this danger, coal mines are required by MSHA to close off abandoned areas (which are no longer ventilated) with concrete walls or seals in order to stop an explosion from propagating into working areas of the mine. However, though seal designs have been pressure tested and rated, none have been tested for their resistance to the impact of heavy objects. Underground explosions produce high velocity gasses that, traveling through mine openings, may propel objects in the mine at a high velocity causing them to impact and damage the mine seals. The objective of this project is to assess the performance and integrity of current seal designs when impacted by objects typically found in an underground coal mine that have become improvised projectiles when subjected to an explosion.

To test the effects of impact on mine seals a projectile generator has been constructed. The projectile generator is a 12-inch inner diameter steel pipe with a 4-inch wall, is 8.5 feet in length, sealed on one end, and is effectively a large muzzle loading cannon. Projectiles are propelled by a charge of black powder and held by a wood cup-type sabot in the bore. This system, combined with the large bore, allows firing of many different potential projectiles that may be found in an underground mine at a high velocity into the seals. Impact damage will be assessed, and the results will be analyzed to determine the resistance seals to various types of projectiles at different impact energies. The significance of these results is discussed in regards to how concrete seals react to impact, what if any design changes may be necessary, and further testing that may improve the understanding of projectile impact on coal mine seals.



Cannon under construction



Completed cannon