Characterization of respirable dust generated from full scale laboratory concrete cutting tests with conical picks at three stages of wear

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ABSTRACT

Airborne rock dust poses serious long-term health complications to workers in the underground mining and civil environment where rock excavation is utilized. During drilling, airborne rock particles are immediately released into the breathable environment where additionally, the settled dust can be reintroduced into the air further down in production. The purpose of this study is to build a characterization suite of dust particles such that underground operations can implement more appropriate dust suppression and mitigation techniques in accordance to pick wear. Therefore, concrete is cut to create a preliminary dust characterization baseline, where future cutting tests will be performed on limestone and sandstone rocks.

In this study, three conical pick wears (new, moderately worn, and fully worn picks) are used to generate dust from a concrete block and characteristics are statistically compared between the dusts. Airborne respirable particles are collected during cutting and deposited fine material, or particles left on the surface of the block, are collected after cutting. The dusts are then analysed through standardised methods, field emission scanning electron microscope image capture with image analyses, and laser diffraction methods. Findings reveal that the worn pick generated the highest concentration of respirable dust, all picks generated dust containing quartz, the three picks generally generated respirable dusts with similar particle shapes (in terms of roundness, roughness, and aspect ratio), and the worn pick generated the largest deposited fine material particles.