Tracer Gas Study of Nano Diesel Particulate Matter (nDPM) Behaviour in Secondary Ventilation Practices

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ABSTRACT

The mine ventilation system plays an important role in mitigating human exposure to diesel particulate matter (DPM) emissions, exhaust gases and heat in underground mines. The mine's secondary ventilation systems are critical for diluting contaminants when working at the face of a heading.

It is important to understand the localized flow profiles on a "micro scale" to identify areas of improvement and ensure that the ventilation system is optimized to maximise dilution of exhaust gases. The application of tracer gas technology enables reliable measurements of flow behavior and differentiation between the contribution of various contaminant sources including nano DPM (nDPM).

A tracer gas study was conducted at the underground Sunrise Dam gold mine focusing on mining activities under auxiliary ventilation at the face of a development heading.

The tracer gas sulfur hexafluoride (SF_6) was used to study the transport of nDPM between source and proximate equipment operators to assess the potential real-time exposure of underground workers (e.g. Service crews, Shotcreters, Jumbo drill operators, Bogger operators and Shift Supervisors) and the efficiency of secondary ventilation systems at each worksite over similar periods of time. The key benefit of tracer gas studies is that they enable differentiation between nDPM sources and allow accurate characterisation of air flow behaviour.

This paper describes how the use of tracer gas technology identified anomalies and concentration differences for various activities. The information obtained can then be used to better inform the planning of administrative controls to manage activities around other major diesel activities.

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