



Mines Safety Bulletin No. 74

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Subject: Explosive gases associated with mining

Hazard

Numerous gases are associated with mining and are generally divided into combustible, toxic and asphyxiant types. Some of the more common gases encountered are methane, carbon dioxide (CO₂), carbon monoxide (CO), oxides of nitrogen (NO, NO₂), hydrogen sulphide (H₂S) and sulphur dioxide (SO₂).

Methane is the most common combustible (explosive) gas. It is lighter than air, odourless and explodes at concentrations between 5% and 15%.

Gases are often detected during underground development and from both surface and underground diamond drilling. The effects of a gas explosion can be severe. In South Africa, multiple fatalities involving 25 deaths over a 10 year period have occurred as the result of methane explosions in the gold mining industry. While there has been no recent loss of life in Western Australia, fires, equipment damage and loss of production have resulted from methane intersections.

Contributory factors

Although gas occurrences continue to be reported to Resources Safety, the inspectorate has become increasingly concerned about recent notifications that have resulted in fires and the burning of gases.

In one case, a flame about one metre high coming from the muckpile was noticed during bogging operations in an underground development heading. In another case, a drill hole caught fire at a surface diamond drilling operation after methane was intersected. Flames were observed at the drill hole and extended to the top of the drill mast. The fire continued to burn for about 24 hours.

A few years ago, flammable gas exploded in an underground stope void. The gas was believed to have built up in the unventilated stope prior to the incident.

Further information on underground gas explosions can be obtained from *Significant Incident Reports 85* (1997) and *102* (1999).

Recommendations

All gas inflows at a mine should be treated as potentially hazardous until proven otherwise.

It has been determined that certain mineralogy may indicate the presence of gases. As such, geological data should be reviewed to ascertain if the strata intersected have the potential to release gases.

Operators and supervisors should be trained in the proper use of monitoring devices for gases that could be encountered, the hazards associated with those gases and the precautions to be taken in the event of an emission of gas.

The safe work practices developed for an outburst of gas should address as a minimum requirement:

- the types of gases that could be detected and the hazards associated with those gases;
- the need for adequate ventilation underground to dilute any gases encountered, especially at drill sites;
- notification of supervisors, underground manager, ventilation officer and the emergency response team, if necessary, when gases are detected;
- evacuation of the area;
- isolation of electrical installations and diesel equipment;
- prohibition of smoking and naked flames;
- barricading of areas likely to be affected;
- development of blow out procedures; and
- conditions for re-establishing work under regulation 10.12 of the Mines Safety and Inspection Regulations 1995 (MSIR).

Regulation 9.29 of the MSIR outlines duties and requirements relating to the monitoring of toxic, asphyxiant and explosive gases in mines, while rr. 9.11(3) and 9.14 detail requirements for minimum oxygen content and general air supply in underground workplaces.

A range of monitoring devices is available to detect many of the gases commonly intersected in mine workings. In particular, devices to measure the oxygen level stipulated in r. 9.11(3) and the methane level in r. 9.29(3) are readily available. There are also devices that detect the presence of other gases such as carbon dioxide, carbon monoxide, nitrogen dioxide, hydrogen sulphide and sulphur dioxide.

The recognised gas hazards associated with diamond drilling indicate that suitable monitoring devices should be available at such working areas to detect the presence of dangerous gas emissions.

The ventilation officer has specific duties under r. 9.5(a) of the MSIR to regularly inspect workplaces throughout the mine. Drill sites should be included in the regular inspection program.

Managers of mine sites are reminded of their obligation to report to Resources Safety all outbursts of gas that are potentially harmful. This includes gases encountered during mining-related activities.

Martin Knee
STATE MINING ENGINEER