

EXPLOSION OF FLAMMABLE GAS IN UNDERGROUND STOPE VOID

INCIDENT

A charge-up crew were employed cleaning out and charging a longhole stope ring in an ore drive. During the clean-out process (which used compressed air), two holes were found to breakthrough into the stope void. Compressed air was heard to escape into the stope void area. This void area was unventilated, which allowed an accumulation of flammable gases to occur.

During the charge-up process, the compressed air supply to the ANFO placer was interrupted, so the charge-up crew left the area to investigate. Upon restoration of the compressed air supply, the charge-up crew returned to the area to continue charge-up operations. Shortly after they left their vehicle they heard an explosion and a fireball appeared in the backs at the top of the rill in the area where the charge-up operations had been carried out. Both the immediate area and remainder of the mine were evacuated as a precautionary measure until an investigation had been carried out.

Two flammable gases were identified during the investigation: carbon monoxide and methane. High levels of carbon monoxide, which is also an asphyxiant, were measured and were found to be immediately dangerous to life and health.

Subsequently, alterations were made in the ventilation of the area to ventilate the stope. This was done initially, using directed primary ventilation, by building a brattice wall. Then later, a flameproof coal mine fan was used to remove the accumulated gases from the area. This resulted in excessive levels of carbon monoxide in a range immediately dangerous to life or health (IDLH) and a significant concentration of flammable gas being drawn from the area under negative pressure.

Suitable degassing procedures were not used during the ventilation of the stope to control the concentrations of gases being extracted from the area. This resulted in the creation of substantial secondary risks of toxic effects and explosion in other areas of the mine.

CAUSES

- Failure to monitor and prevent an accumulation of toxic, asphyxiant and flammable gases in the stope void.
- Failure to control the concentrations of toxic, asphyxiant and flammable gases extracted during the ventilation of the stope void. This resulted in the release of asphyxiant gases immediately dangerous to life and health, and could have resulted in the release of flammable gases within the explosive range.

PREVENTATIVE MEASURES

There is a need for thorough investigation of the likelihood of release of toxic, asphyxiant and flammable gases in all mines, including metalliferous mines. Such gases are NOT confined to coal operations.

Where a mine identifies the presence of toxic, asphyxiant or flammable gases, a hazard management plan should be formulated in accordance with MSI Regulation 9.29.

The plan should include the following requirements:

1. All development, stoping areas and voids should be adequately ventilated to prevent an accumulation of such gases.

2. For flammable gases, an analysis should be undertaken to determine the type of gas present so that the ignition temperature and explosive range can be determined.
3. Suitable primary and secondary ventilation, re-entry and degassing procedures should be developed to ensure the safety of all personnel. Non-flameproof or non-intrinsically safe electrical equipment should only be used where it is sited a minimum of 100 metres away on the intake side of the area to be degassed.
4. Any non-flameproof and non-intrinsically safe plant in use, such as electrical equipment or diesel equipment, should be immediately stopped and isolated where 1.25% of methane or any other flammable gas is found to be present. All such equipment should be purged of all hazardous gases prior to restoring power.
5. Restrictions should be placed on the use of explosives where 1.25% of a flammable gas is found to be present. Special explosive products are available and should be used where there is a requirement for the use of explosives in such atmospheres.
6. Restrictions should be placed on the use of light alloys, eg. aluminium alloys, in areas where flammable gases are found to be present.
7. Evacuation of the area should be undertaken in accordance with MSI Reg. 9.12(2) where toxic or asphyxiant gases at levels above the STEL (or immediately dangerous to life or health) are encountered or where 1.25% of a flammable gas is found to be present. Under MSI Reg. 9.12(2) where an area has been evacuated, no person is permitted to work in that workplace until a suitable written risk assessment has been made.
8. Steps should be taken to ensure that meteorological reports of barometric changes are made available to the mine to assist in the identification of low pressure conditions which may result in flammable gas migrating from the strata into the workplace.
9. A monitoring schedule should be implemented and monitoring equipment should be provided in accordance with MSI Reg. 9.29 to identify the presence of toxic, asphyxiant or flammable gases.
10. Any affected area should be designated with signs warning of the presence of flammable gases and prohibiting smoking.
11. As many of the gases involved are less dense than air, a survey should be undertaken to determine possible accumulation locations (such as high spots in the backs of development) and special local ventilation arrangements should be put in place to prevent such accumulations.

J M Torlach
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SAFETY AWARENESS SAVES LIVES