

SAFETY BULLETIN

Diesel emissions in mines

Background

In 1998 diesel exhaust was classified as *probably* carcinogenic to humans. However, in June 2012 the International Agency for Research on Cancer reclassified whole diesel exhaust as a carcinogen to humans. This change has implications for the mining industry.

Diesel exhaust contains a complex mixture of gases, vapours, aerosols and particulate matter and most mines use diesel engines in some form or other.

Diesel particulate matter (DPM) consists of Elemental Carbon (EC), Organic Carbon (OC) plus other trace metals.

Legislation

The *Work Health and Safety Act 2011* (WHS) imposes a duty on mine operators to ensure, so far as is reasonably practicable, the health of workers. Without limitation, this duty extends to the work environment; safe plant; safe systems of work; information; training; and conditions of the workplace being monitored for the purpose of preventing illness.

Refer to: [Guidance on the interpretation of workplace exposure standards for airborne contaminants](#), April 2013, Safe Work Australia

Mining legislation requires that pollutants from diesel plant in underground parts of the mine are minimised as far as reasonably practicable.

Coal mining specific legislation also requires management systems to control diesel pollutants in the underground parts of a coal operation and sets out limits and requirements for diesel engine exhaust analysis through gazette.

For specific legislative requirements see www.resources.nsw.gov.au/safety/legislation.

What does that mean for mines?

All mines should have a documented strategy to control diesel emissions - Diesel Emissions Plan (DEP). The objective should be to minimise people's exposure to diesel emissions to the lowest level reasonably practicable.

The DEP should be an integral part of the mine's health and safety management system, take a holistic risk based approach, be consistent with WHS legislation and follow the hierarchy of risk controls.

All areas and tasks where workers may be exposed to diesel exhaust emissions should be identified and effectively controlled through risk assessment. Parameters which may increase the risk such as; the type of work being carried out, ventilation, use and number of diesel engines in the same ventilated area, the number of people exposed, and the duration of exposure, should be considered.

A unified approach between mine management, health, ventilation, and maintenance departments in conjunction with OEM's is also required.

Areas where workers may be exposed to inhalation of diesel exhausts include:

- Underground parts of the mine.
- Other confined or enclosed areas as identified by risk assessment, e.g. tunnels, pits, buildings, workshops.

What should mines do?

Mines should consider the guidance in MDG 29, [Guideline for the management of diesel engine pollutants in underground environments](#).

Mines should also consider:

- Identifying each risk area.
- Controlling emissions at the source (diesel engine)
 - Review options for use of modern low emission diesel engines, i.e. phase out old diesels
 - Use of emissions curtailment devices such as particulate filters, catalysts, etc.
 - Use of low emission fuels and quality uncontaminated lubricants
 - Education of workforce on how driver behaviour affects emissions
 - Emissions based maintenance strategy
 - regularly monitor diesel engine condition for deterioration from a baseline
 - periodic testing of diesel engine emissions by a NATA accredited laboratory using equipment and procedures consistent with MDG 29
- Controlling exposure to airborne emissions
 - Good ventilation strategies,
 - use 0.06m³ of ventilation current for each kW of engine power
 - minimise use of diesel engines in series
 - Control of diesel engines at areas of identified risk
 - Minimise the number of diesel engines operating at the same time
 - Information and training of workers
 - Use of appropriate respiratory protection, if required
 - Workplace area monitoring
- Personal exposure monitoring
- Review and monitor risk control measures to ensure the lowest level reasonably practicable is being achieved
 - Looking at what other mines are doing and where technologies/research is heading
- Audit site practices

Personal exposure monitoring of elemental carbon (EC)

Exposure limit

There is no published occupational exposure standard for DPM or EC.

MDG 29 recommends a maximum workplace exposure of 0.1mg/m³, (100µg/m³) in the EC fraction (0.2 mg/m³ DPM). Personal exposure monitoring of EC at mines indicates this target is achievable with currently available control strategies. Mines should strive to reduce worker exposure further where possible.

The EC fraction of diesel particulate has proven to be a good stable surrogate for measuring diesel particulates in the mine environment where concentrations are relatively low.

Collection and Analysis

Where risk is identified mines should implement a program for regular testing of workers. A risk assessment should identify sampling frequencies and methodologies. Table 1 below provides some guidance. Consideration should be given to:

- Monitoring people who are more likely to be exposed to diesel particulate
- Samples being collected in accordance with AS 2985-2009 - *Workplace atmospheres - Method for sampling and gravimetric determination of respirable dust*
- Collection of samples being done under the direction of a suitably competent Occupational Hygienist independent to the mine
- Analysis of EC filters by a NATA accredited laboratory (or equivalent) using the NIOSH Method 5040
- A suitable size selection device with a respirable cyclone sampler and quartz filter
- Where results indicate personal exposure in excess of 0.1mg/m³ EC –
 - An investigation should be carried out and a resample taken after any corrective actions
 - Workers should be advised of the occurrence and recommendations to prevent a reoccurrence.
- Records being held by the mine for 30 years. See clause 50 WHS Regulation.

Table 1 – Recommended monitoring frequencies

| Risk Area / Location | Frequency of sampling EC ¹ | Persons to be sampled where available | Area to be sampled ² |
|---|---|--|--|
| In any part of a mine which is a single entry | Each production shift ~6 monthly | On up to 5 persons working in the heading | At entry & near face |
| General production areas | Each production shift ~12 monthly | On up to 5 persons working in the area | Near production areas |
| Longwall changeouts | One group sample per operational shift during changeout | On up to 5 persons working on the changeout | On recovery & installation face |
| Outbye areas of the mine | Each ventilation district ~12 monthly | On up to 5 persons working in the ventilation district | Point of highest risk for the ventilation district |
| Diesel workshops | ~12 monthly | On up to 5 persons working in workshop | Exhaust area of the workshop |
| Other identified risk areas / tasks | ~12 monthly | On up to 5 persons working in area | As required |

¹ Diesel equipment needs to be in operation during monitoring

² Sampling of areas are recommended as a means to validate DEP's

Further Guidance

- Diesel emissions workshop presentations, see www.resources.nsw.gov.au/safety/publications/seminar-presentations/dew-sydney
- RI 9687, Diesel Aerosols and Gases in Underground Mines: Guide to Exposure Assessment and Control, CDC 2011

Proposed Mine Safety strategies

- Assess industry practices on managing diesel emissions.
- Change emission performance requirements for new engines entering coal mines.
- Review and update MDG 29 to current practices and methodologies.
- Assist in establishing a consultative working group on diesel emission reductions.
- Check mines have DEP's which include fit for purpose engines, ventilation management and personal exposure monitoring.

NOTE: Please ensure all relevant people in your organisation receive a copy of this Safety Bulletin, and are informed of its content and recommendations. This Safety Bulletin should be processed in a systematic manner through the mine's information and communication process. It should also be placed on the mine's notice board.

Signed



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MINE SAFETY OPERATIONS
NSW TRADE & INVESTMENT

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