

# Diesel emissions



## What are diesel emissions?

Diesel engines emit diesel particulate matter (DPM), exhaust gases (including a wide range of organic vapours), and a small amount of metallic compounds. For the purposes of this information sheet, these components are collectively referred to as diesel emissions.



Diesel emissions are a particular problem in enclosed environments such as underground mines, workshops and train load-out tunnels where exhaust particulates and gases can accumulate if ventilation is inadequate.

Exposure to heat, noise, vibration and nanoparticles should also be considered as part of the risk management process with respect to workers operating in the vicinity of diesel engines.

## Health effects of diesel emissions

Exposure to diesel emissions can cause both short-term (acute) and long-term (chronic) health effects.<sup>1</sup>

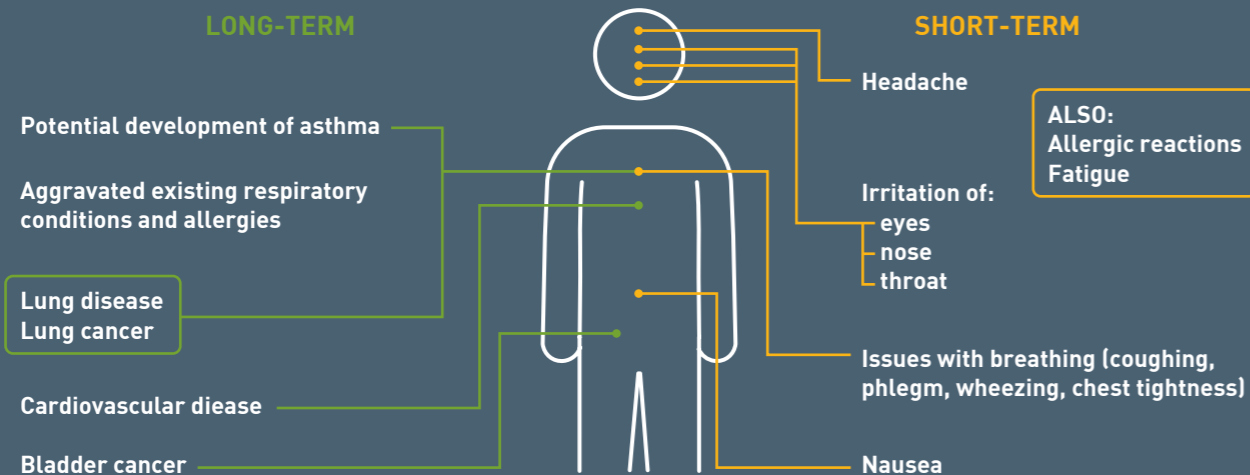
### SHORT-TERM (ACUTE) EFFECTS

Short-term exposure to high concentrations of diesel exhaust can irritate the eyes, nose, throat and lungs, and cause light-headedness, coughing, phlegm and nausea. Very high levels of diesel exhaust exposure can lead to asphyxiation from carbon monoxide poisoning.



### LONG-TERM (CHRONIC) EFFECTS

In 2012, IARC classified diesel engine exhaust as carcinogenic to humans (Group 1). Diesel engine exhaust emissions contain many known carcinogenic substances, for example, PAHs and dioxins that adhere to the surface of the DPM, and metallic compounds such as arsenic and cadmium. Long-term exposure to diesel emissions can worsen asthma and allergies, and increase the risk of heart and lung disease.



## Regulatory requirements

In addition to the mandatory requirements described to minimise the risk as far as reasonably practical (r35, r648), the Work Health and Safety (Mines) Regulations 2022 prescribe the following concerning diesel emissions.

- R656A(1)(a), that the design and construction of the diesel unit is suitable for use in underground conditions
- R656A(1)(b), the diesel unit is maintained in accordance with the original equipment manufacturer (OEM) specifications
- R656A(1)(c) that the exhaust gas emissions of the diesel unit, under any condition of engine speed or load, are as follows:
  - i. less than 1000 ppm of oxides of nitrogen
  - ii. less than 1500 ppm of carbon monoxide
- R656A(2) diesel exhaust emissions are minimised as far as reasonably practical by:
  - a. selecting and using suitable diesel fuel
  - b. treating exhaust emissions
  - c. properly maintaining and using diesel units
- R656A(3), a monitoring and maintenance schedule is developed and implemented to ensure diesel emission requirements are being met
- R656C additional ventilation requirements for diesel units are provided for underground operations, where diesel units operating underground in any ventilation system of the mine have a minimum ventilation volume specified.

### COMPLIANCE



## Workplace exposure standards (WESs) for diesel emissions

Concentrations of gases and vapours are usually indicated in parts per million by volume (ppm or ppmv). The time-weighted average (TWA) and short-term exposure standards (STELs) for some common gases found underground are:

1. 30 ppm TWA for carbon monoxide
2. 5000 ppm TWA and 30,000 ppm STEL for carbon dioxide and
3. 3 ppm TWA and 5 ppm STEL for nitrogen dioxide

R656B provides a WES for diesel particulates at a TWA concentration of 0.1 mg per cubic metre of air (measured as sub-micron elemental carbon).

Exposure to heat, noise, vibration and nanoparticles should also be considered as part of any diesel emissions risk assessment.<sup>2</sup>

## Diesel emissions management plan

All mines with diesel emissions as a risk should have a diesel emissions management plan (DEMP) documented, outlining the strategies used to control diesel emissions. The objective should be to minimise people's exposure to diesel emissions to the lowest level reasonably practicable concentration.<sup>3</sup>

The DEMP 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 that 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.



### Resources and further information

- 1 DMIRS (2013) Management of diesel emissions in Western Australian mining operations, guideline
- 2 AIOH (2017) Diesel Particulate Matter and Occupational Health
- 3 DNRME (2014) QGN 21 Guidance note for management of diesel engine exhaust in metalliferous mines
- 4 NSW Resources Regulator (2008) MDG29 Guideline for the management of diesel engine pollutants in underground environments
- 5 DNRME (2019) Diesel Emissions Management in Underground Coal Mines

## Diesel emission controls

Reducing diesel emissions at source should be the primary consideration when applying the hierarchy of control.<sup>4</sup> The DEMP must document the strategies employed, which can be broken down as follows.

### MINIMISING DIESEL EXHAUST EMISSIONS AT THE SOURCE

- Review options for the use of modern low-emission diesel engines, i.e. phase out old inefficient engines.<sup>5</sup>
- Buy clean, select low-emission fleet equipment that is compatible with the intended operating environment.
- Use of emissions curtailment devices such as particulate filters, catalytic converters, scrubbers, etc.
- Use of low-emission fuels and quality uncontaminated lubricants.
- Education of the workforce on how driver behaviour affects emissions.
- Emissions-based maintenance strategy.
- Regularly monitor diesel engine condition for deterioration from a baseline.
- Regular testing of diesel engine emissions by using equipment and procedures consistent with MDG 29.

### MINIMISING THE TRANSMISSION OF AIRBORNE EMISSIONS THROUGHOUT THE WORK ENVIRONMENT

- Appropriate ventilation strategies.
- Use greater than 0.05 m<sup>3</sup> per second of ventilation current for each kW of engine power (r656C).
- Minimise the 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.

### MINIMISING EXPOSURE TO INDIVIDUALS AT RISK

- Use of enclosed cabs with positive pressure HEPA-filtered air supply, where possible.
- Information and training of workers.
- Use of appropriate respiratory protection, with associated fit testing if required.
- Personal exposure monitoring.

### REGULAR REVIEW OF SITE PRACTICES

- Review and monitor risk control measures to ensure the lowest level reasonably practicable is being achieved.
- Look at what other mines are doing and where technologies/research is heading.
- Audit site practices with appropriate KPIs and corrective actions as required.

### HIERARCHY OF CONTROLS

