



**NSW
Resources
Regulator**

POSITION PAPER

IMPLEMENTING AN EXPOSURE STANDARD FOR DIESEL PARTICULATE MATTER IN NSW MINES



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Contents

Scope.....4

Background5

Exposure standard for diesel particulate6

Notification of an exceedance7

Obligations of mine operators.....7

Monitoring diesel particulate exposure8

Monitoring methodology9

Industry engagement.....9

Conclusion.....9

Scope

Diesel exhaust emissions contain a range of chemicals, gases and diesel particulate matter. The adverse health impacts of diesel emissions are well known. Studies indicate the particulate matter component of diesel exhaust can contribute to acute and chronic health conditions.

The International Agency for Research on Cancer classified diesel particulate extract as carcinogenic to humans in 2012, based on evidence from human and animal studies.

Since the mid-1980s, an exposure standard for diesel particulate matter was thought to be necessary, particularly for the mining industry. However, Australia does not have a national exposure standard due to conflicting epidemiological studies and a lack of historical quantitative exposure data.

The NSW Resources Regulator (the Regulator) sought feedback on a proposal to legislate an exposure standard for the elemental carbon fraction of diesel particulate in the NSW mining industry. The Regulator released a discussion paper in September 2019 and received five submissions from stakeholders such as the NSW Mineral Council and Coal Services. Stakeholders raised no objections to the proposed introduction of an exposure standard.

The Regulator's position on workplace exposure to atmospheric concentrations of diesel exhaust emissions in the NSW mining industry encompasses:

- the introduction a personal exposure standard of 0.1 mg/m³ for diesel particulate matter, measured as elemental carbon, introduced into legislation on 1 February 2020 and effective from 1 February 2021 after a 12-month transitional period.

This change was implemented through an amendment of clause 39 (1) of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014.

This position paper details the regulatory approach during the period January to December 2021, and subsequent regulatory amendments in relation to diesel particulate matter as part of the remade Work Health and Safety (Mines and Petroleum Sites) Regulation 2022 that commenced on 1 September 2022.

Background

Diesel engines were introduced into the NSW coal industry in the early 1950s. Metalliferous mines followed in the 1960s and diesel usage peaked in the mid-1980s. During this time, many workers were exposed to the complex mixture of toxic gases, organic substances and particulate matter found in the raw diesel exhaust emissions.

The chemicals in diesel emissions can cause adverse health outcomes, including acute and chronic pulmonary and cardiovascular diseases. Studies have demonstrated a link between occupational exposure to diesel exhaust and increased risk of lung cancer. Other health effects associated with exposure to diesel exhaust emissions include eye complaints, throat and bronchial irritation and neurophysiological symptoms such as headache, light headedness, nausea, vomiting as well as numbness and tingling of the extremities.

Australian studies in underground coal and metalliferous mines have noted that the level of eye and upper respiratory tract irritation is significantly reduced at diesel particulate matter exposure concentrations of 0.2 mg/m³ or less (approximately 0.1 mg/m³ submicron elemental carbon).

The Australian Institute of Occupational Hygienists (AIOH) guidelines recommend that a worker's exposure to diesel particulate matter should be controlled to below 0.1 mg/m³ measured as submicron elemental carbon. Regulatory authorities and many mine operators have adopted this exposure threshold.

SafeWork Australia's workplace exposure standards for airborne contaminants list (WESFAC) does not include diesel emissions. However, it references the AIOH recommendations for use as a workplace exposure standard.

Similarly, the NSW government publication *Mining Design Guideline 29* (2008) recommends an 8-hour, time-weighted average exposure standard of 0.1 mg/m³ (as submicron elemental carbon, sampled by NIOSH 5040 methodology) in underground environments.

The NSW Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 (the 2014 Regulation) required that an operator of a mine identifies the risks of diesel emission exposure, assesses the extent of the risk, and prepares and implements a management plan for that risk.

Our introduction of a prescribed exposure limit of 0.1 mg/m³ for diesel particulate matter, (measured as elemental carbon) to the 2014 Regulation is considered achievable and within acceptable limits. Implementing this limit will reduce the exposure and therefore the risk of occupational illness to mine workers.

Exposure standard for diesel particulate

NSW was the first mining jurisdiction in Australian to implement an exposure standard for diesel particulate matter.

The exposure standard of 0.1mg/m³ for diesel particulate matter, measured as elemental carbon, came into force on 1 February 2021.

Mine and petroleum site operators will need to adhere to the regulatory requirements of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2022 (2022 Regulation), in section 41 (1) (b)

41 Ensuring exposure standards for dust and diesel particulate matter and carbon dioxide not exceeded

- (1) The operator of a mine or petroleum site must-
 - (a) as far as is reasonably practicable, minimise the exposure of persons at the mine or petroleum site to dust and diesel particulate matter, and
 - (b) ensure no person at the mine or petroleum site is exposed to 8-hour time-weighted average atmospheric concentrations of airborne dust and diesel particulate matter that is more than—
 - (i) for respirable dust—3mg per cubic metre of air, or for a coal mine, 1.5mg per cubic metre of air, or
 - (ii) for inhalable dust— 10mg per cubic metre of air, or
 - (iii) for diesel particulate matter— 0.1mg per cubic metre, measured as sub-micron elemental carbon.
- (2) Without limiting subsection (1), the operator of an underground coal mine must—
 - (a) as far as reasonably practicable, minimise the exposure of persons to carbon dioxide in the mine, and
 - (b) must ensure no person in the mine is exposed to an 8-hour time-weighted average atmospheric concentration of carbon dioxide that is more than—
 - (i) for short term exposure limits—30,000 parts per million, or
 - (ii) otherwise—12,500 parts per million.
- (3) The Workplace Exposure Standards for Airborne Contaminants apply in relation to a concentration referred to in subsection (1) or (2) as if the concentration were an exposure standard referred to in the document.
- (4) In this section—

8-hour time-weighted average has the same meaning as in the *Workplace Exposure Standards for Airborne Contaminants*.

short term exposure limit has the same meaning as in the *Workplace Exposure Standards for Airborne Contaminants*.

Notification of an exceedance

Mine operators are required to notify the Resources Regulator of high potential incidents under section 124(5) of the 2022 Regulation. Amendments outlined in section 124(5)(q) of the 2022 Regulation describes the mine or petroleum site operators' duty to notify the Regulator when a person has been exposed to an 8-hour time-weighted average atmospheric concentration of airborne dust and diesel particulate matter that is more than the amounts specified in section 41(1)(b).

Mine operators should notify the Regulator of an exceedance incident using the safety and health reporting function of the Regulator Portal. Information relating to the exceedance incident will be collected, such as the similar exposure group (SEG) of the worker, the tasks undertaken / equipment used, and respiratory protection worn during the monitoring, in addition to the measured exposure concentration.

Further information about the initial notification of incidents can be found in the *Notification of incident and injury guide* on the Regulator website.

Obligations of mine operators

Under section 14 of the 2022 Regulation, mine operators are required to manage risks to health and safety at a mine site, including risks in relation to diesel exhaust emissions.

Mine operators should identify and effectively control areas and tasks where workers may be exposed to diesel exhaust emissions through risk assessment. Using the hierarchy of control, appropriate control measures should be implemented to eliminate or minimise the risk of worker exposure to diesel exhaust emissions. Control methods to minimise workplace exposure to diesel emissions are readily available, as are commonly employed atmospheric monitoring and personal exposure monitoring strategies.

Mine operators should consider:

- identifying areas of exposure risk
- controlling diesel exhaust emissions at the source
 - using low emission diesel engines/equipment selection
 - using emission reduction devices such as particulate filters, catalysts etc
 - using low emission fuels and quality lubricants
 - worker training on driving behaviour and effect on emissions
 - robust maintenance strategy and exhaust gas emissions testing
- controlling exposure to airborne diesel emissions
 - good ventilation strategies and systems
 - provision of air conditioned (filtered) operators' cabins
 - control of diesel engines in areas of identified risk

- minimise number of diesel engines operating at same time
 - information and training of workers
 - using appropriate respiratory protective equipment
 - workplace area atmospheric monitoring / ventilation monitoring
- review and monitoring of risk control measures to ensure compliance with the exposure limit and maintain atmospheric concentrations to as low as reasonably practicable
 - maintaining awareness of best practice methodologies and new technological innovations
 - audit site practices.

Further guidance for managing diesel exhaust exposure is available in the NSW government publication mining design guideline 29 Guideline for the management of diesel engine pollutants in underground environments (2008).

The controls identified in the risk assessment must be included in the principal hazard management plan (PHMP) for air quality or dust or other airborne contaminants. The development of the exposure standard should also trigger the review of this PHMP.

Monitoring diesel particulate exposure

Under clause 50 of the Work Health and Safety Regulation 2017 a person conducting a business or undertaking (PCBU) is required to conduct air monitoring to determine the concentration of air contaminants to which an exposure standard applies. Section 42 of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2022 stipulates the requirement for personal exposure monitoring of workers to diesel particulate matter.

Where a mine operator has identified a risk of worker exposure to diesel particulate, they should undertake personal exposure monitoring of workers. Mine operators may also need to implement ongoing exposure monitoring programs to measure the level of personal exposure where an ongoing risk is identified. The monitoring frequency and methodologies of an exposure monitoring program should be determined by the risk, with consideration given to the following:

- monitoring people who are more likely to be exposed to diesel particulate
- monitoring over a range of standard operational processes in addition to exposure which occurs during abnormal mining operations
- the inclusion of static positional monitoring to determine airborne concentrations of diesel particulate matter, and for determination of the effectiveness of implemented control measures

Monitoring methodology

Mine operators should adopt risk-based approaches to the personal exposure monitoring strategy. Mine operators should collect samples in accordance with relevant Australian Standards and recognised methodologies under the direction of a suitably competent occupational hygienist, independent to the mine.

Subsequent analysis should be undertaken by a NATA accredited laboratory using the NIOSH method 5040 for the determination of elemental carbon.

Where results indicate personal exposure in excess of $0.1\text{mg}/\text{m}^3$ elemental carbon:

- the mine operator should undertake an investigation and a resample taken after implementing any corrective actions
- the mine operator should review the principal hazard management plan for air quality or dust or other airborne contaminants
- workers should be advised of the occurrence and recommendations to prevent a reoccurrence.

Records should be held by the mine for 30 years (as per clause 50 of the Work Health and Safety Regulation 2017).

Industry engagement

With the implementation of exceedance notification requirements for personal exposure to diesel exhaust emissions, airborne contaminants will continue to be a focus area during 2022-2023. The Regulator will actively engage industry during this period. This will include:

- planned inspection programs focusing on the management of diesel particulate matter
- presentations at industry forums, seminars and industry roadshows
- publishing fact sheets and other guidance material
- correspondence to mine operators, introducing the exceedance notification requirements and the need to review and modify systems and processes to achieve compliance.

Conclusion

The Regulator is committed to ensuring that the NSW mining industry understands its obligations and the Regulator's expectations.

It is necessary to improve conditions relating to the health and safety of workers and reduce the potential risk of all airborne contaminants. We expect that all mine operators will actively work toward reducing exposure to diesel particulate emissions, not only to below the prescribed maximum, but to as low as reasonably practicable.