NSW GOVERNMENT

NSW Resources Regulator

PUBLIC SUBMISSIONS

Diesel particulate exposure standard for NSW mines

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December 2019	1.0	Original version

Introduction

The NSW Resources Regulator sought feedback from mining industry stakeholders regarding the potential introduction of a diesel particulate workplace exposure standard for mines in NSW.

The consultation period closed on 11 October 2019.

The following submissions were provided to the Regulator as part of the consultation process.

Submissions have been published in full where consent has been given. Personal information has been redacted if requested.

Contents

NSW Resources Regulator

1. Individual submission – name redacted

Name	Personal details redacted
Email	
Street address	
Postal address (if different)	
Are you an individual representing an organisation	No
If you are representing an organisation, please name it	

Privacy – please tick ONE option

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☐ I do not want my submission published on the NSW Resources Regulator website

DO YOU HAVE ANY COMMENTS ON THE QUESTIONS BELOW? *(Please outline the reasons to support your views)*	
Supporting the introduction of 0.1 mg/m^3 limit measured in the elemental carbon fraction into the WES list through SafeWork Australia's review process. This would mandate the exposure standard through cl 49 of the Work Health and Safety Regulation 2017	I fully support the introduction of 0.1 mg/m^3 limit measured as elemental carbon into the WES. Diesel exhaust is not a mining centric exposure and workers in other sectors should be equally protected by diesel exhaust by having a mandated exposure standard. The AIOH also recommended a trigger value of 0.05 mg/m^3. This is also important for employers to start action at an earlier stage.

Prescribing a limit of 0.1 mg/m^3 limit measured in the elemental carbon fraction in the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014**,** if SafeWork Australia does not include diesel emissions in the WES or proposes a higher limit.	Absolutely, if SafeWork does not prescribe a WES, then 0.1 mg/m^3, and the associated action limit should be prescribed in the WHS (Mines and Petroleum Sites) Regulation 2014. Diesel exposure is prevalent in these industries, and although some of these industries are able to implement state of the art, low emitting diesel engines, or even remove diesel engines, this will not occur across most mining associated workplaces for many years, if at all. If SafeWork Australia does introduce the exposure standard without the action limit, then the action limit should be included in WHS Regulation 2014. This is a more likely location for this value, as the current WES format does not encourage a trigger value.
Updating MDG 29 to provide guidance on the requirements of a principal mining hazard management plan, specific to the operation of diesel engines underground, assessment and testing of compliance with the plan, and actions required, should the assessment reveal temporary and/or long-term deficiencies.	MDG 29 is an excellent, albeit outdated reference. It definitely requires updating and providing further guidance on managing and controlling diesel emissions is essential. MDG 29 is the go-to document in the mining industry in relation to diesel measurement and control and is referenced and used in other industries as well. It is lacking up-to-date information and practices. It would be good to see more Emissions based maintenance information, and the benefits that can be provided by this – both to the health of workers, reduced fuel usage and likely other benefits such as reduced diesel exhaust use, and a more available fleet.
Do you have any comments of a general nature?	I think implementing an exposure standard is a must. Having a number legislated does not fix the issues or control exposure in any way, however, it does give sites something that is mandatory to work towards, which will reduce exposure. It provides something tangible that is a requirement. More focus should be on testing and maintenance of engines, clearly showing a difference between Original Engine Manufacturer (OEM) requirements and Emissions-based maintenance, or pro-active maintenance of diesel engines done by measuring and understanding exhaust on individual engines and

	maintaining using this information. If MDG 29 is updated, it should also be open for comment before finalising. Implementing an exposure standard would also allow transparency on exposures. Exposure to diesel exhaust should be treated in the same way that exposure to dust is in the mines with mandatory monitoring and information review and sharing through the Standing Committee on Airborne Contaminants & Occupational Hygiene (formerly the Standing Dust Committee).

2. Individual submission – name redacted

Name	Personal details redacted
Email	
Street address	
Postal address (if different)	
Are you an individual representing an organisation	No
If you are representing an organisation, please name it	Not applicable

Privacy – please tick ONE option

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DO YOU HAVE ANY COMMENTS ON THE QUESTIONS BELOW? *(Please outline the reasons to support your views)*	
Supporting the introduction of 0.1 mg/m^3 limit measured in the elemental carbon fraction into the WES list through SafeWork Australia's review process. This would mandate the exposure standard through cl 49 of the Work Health and Safety Regulation 2017	I am in total agreement with the introduction of an exposure standard of 0.1 mg/m^3 limit measured in the elemental carbon. I would strongly recommend that the "trigger value" of 0.05 mg/m^3 EC as recommended by the Australian Institute of Occupational Hygienists be implemented so as to ensure exposures are controlled in an appropriate and timely manner without exceedance of the 0.1 mg/m^3 EC limit. As the 0.1mg/m^3 limit is based on irritation I would not recommend any adjustment for shift length be introduced as the introduction of the trigger level would be a much better and more practical control approach.

Prescribing a limit of 0.1 mg/m^3 limit measured in the elemental carbon fraction in the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014**,** if SafeWork Australia does not include diesel emissions in the WES or proposes a higher limit.	Yes, this action should be taken if SafeWork Australia does not address the issue of an exposure standard for diesel particulate matter.
Updating MDG 29 to provide guidance on the requirements of a principal mining hazard management plan, specific to the operation of diesel engines underground, assessment and testing of compliance with the plan, and actions required, should the assessment reveal temporary and/or long-term deficiencies.	Recent research by Mrs Jen Hines (Hines J (2018) Linking Diesel Maintenance Personnel to Occupational Hygienists to Improve Worker Health (presentation at AIOH Annual Conference Melbourne, December 2018) has demonstrated that an effective emissions based maintenance (EBM) programme can have a dramatic effect in reducing employee exposure to diesel emissions with a substantial productivity gain. The revamp of MDG 29 should draw on Mrs Hines findings as an example of what can be done to control employee exposures to diesel emissions.
Do you have any comments of a general nature?	While the implementation of an exposure limit for diesel particular matter is an appropriate step forward such action on its own will never result in controlling employee exposures. Well known and tested control strategies (including EBM programmes) not only need to be fitted to diesel vehicles they need to be regularly tested for operational performance and become part of the maintenance culture of a mine not be seen as just an "add-on". EBM programmes ensure all control technologies are working all the time and are critical in the overall reduction of employee exposures.

3. NSW Minerals Council

Note: See submission over page

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Discussion Paper - Diesel Particulate Exposure Standard for NSW Mines

NSW Minerals Council submission – 11 October 2019

Introduction

NSW Minerals Council (NSWMC) appreciates the opportunity to provide comments on the *Discussion Paper - Diesel Particulate Exposure Standard for NSW Mines* (Discussion Paper).

The Discussion Paper sets out the Resources Regulator's proposal to:

- support the introduction of 0.1 mg/m3 limit measured in the elemental carbon fraction into the WESFAC through SWA's review process. This would mandate the exposure standard through clause 49 of the Work Health and Safety Regulation 2017.
- prescribe a limit of 0.1 mg/m3 limit measured in the elemental carbon fraction in the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014*, if SWA does not include diesel emissions in the WESFAC or proposes a higher limit.
- have any such exposure limit take effect within 12 months of the decision to impose the standard.
- update MDG 29 to provide guidance on the requirements of a principal mining hazard management plan specific to the operation of diesel engines underground, assessment and testing of compliance with the plan, and actions required should the assessment reveal temporary and/or long-term deficiencies.

Health and safety is the highest priority of the NSW mining industry. The industry operates to the highest standards and continues to strive towards improved health and safety outcomes.

The NSW mining industry currently manages diesel particulate exposure to be as low as is reasonably practicable. While exposure standards are considered to be an upper limit, this operating philosophy and legislative requirement sees many sites already operating at or below the proposed exposure standards.

However, there are some circumstances where industry may experience difficulties in achieving the proposed exposure standard. These circumstances are typically for short periods of time during intensive activities such as longwall moves. For this reason, NSWMC seeks a collaborative approach from the Regulator in introducing the proposed exposure standard to allow industry time to identify feasible controls to further reduce exposures.

NSWMC supports the Resources Regulator's proposal to support the introduction of a 0.1 mg/m3 limit measured in the elemental carbon fraction into the Workplace Exposure Standards for Airborne Contaminants (WESFAC) through SWA's review process.

Subject to appropriate transitional arrangements and a collaborative regulatory approach, NSWMC broadly supports the introduction of a prescribed limit of 0.1 mg/m3 measured in the elemental carbon fraction in the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* (WHS(MP) Regulation).

NSWMC supports the transitional arrangements proposed of the exposure limit taking effect with a 12 month transitional period.

NSWMC conditionally supports the update of MDG 29 provided that industry consultation takes place during the review process.

Diesel Emissions and the NSW Mining Industry

In October 1999 NSWMC released *Diesel Emissions in Underground Mines - Management & Control* which covered:

- Health effects of diesel emissions
- Exposure standards for diesel emissions
- Managing exposure to diesel emissions
- Risk control options

The document noted that research measuring personal exposure to diesel particulate of over 1,000 employees in NSW, WA and Queensland coal and metalliferous mines has found that at levels of 0.2mg/m3 or below, the effects of irritation from diesel particulate are minimal (equivalent to 0.16 mg/m3 submicron total carbon or 0.1 mg/m3 submicron elemental carbon).

The document suggests that mine management and workers act conservatively and minimise exposure to diesel particulates as far as reasonably practicable. Clause 55(c) of the WHS(MP) Regulation provides that:

> *The mine operator of an underground mine must ensure that the ventilation system for the mine provides air that is of sufficient volume, velocity and quality to ensure that the general body of air in the areas in which persons work or travel:*
>
> > *(c) if diesel engines are used underground - has a concentration of diesel emissions (including diesel particulates and any known harmful emissions from diesel engine systems) that is as low as is reasonably practicable.*

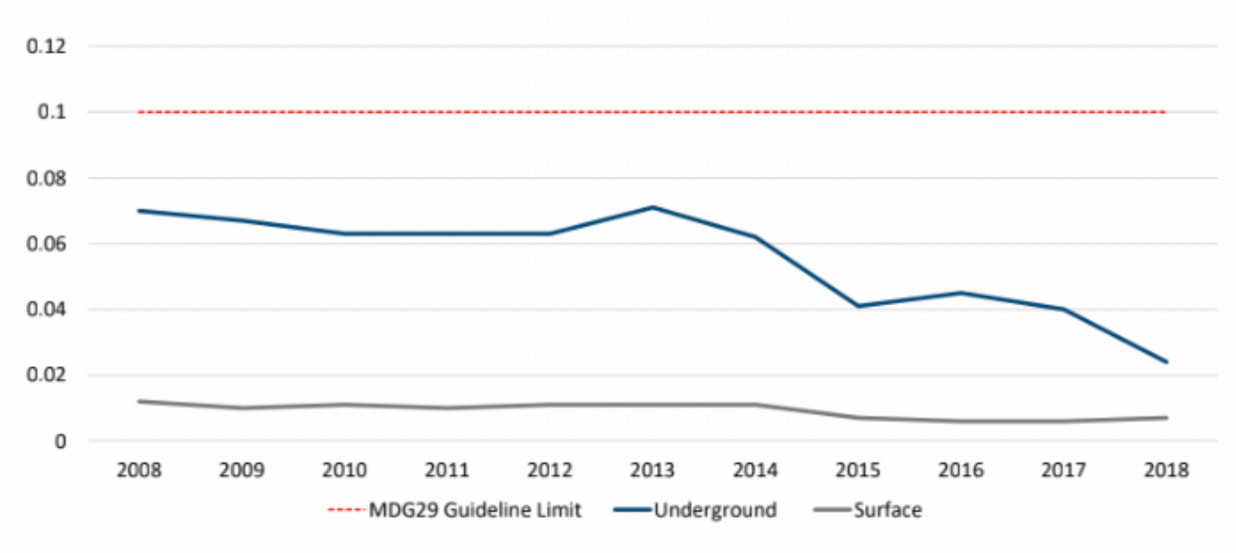
The Australian Institute of Occupational Hygienists (AIOH) recommends that a worker’s exposure to diesel particulate matter (DPM) should be controlled to below 0.1 mg/m3, measured as submicron elemental carbon.

Similarly, MDG 29 *Guideline for the management of diesel engine pollutants in underground environments* provides that given the current state of knowledge there is sufficient evidence to indicate that an 8-hour time weighted average exposure standard of 0.1 mg/m3 (measured as elemental carbon) should provide adequate protection against irritant effects and also minimise any risk of lung cancer.

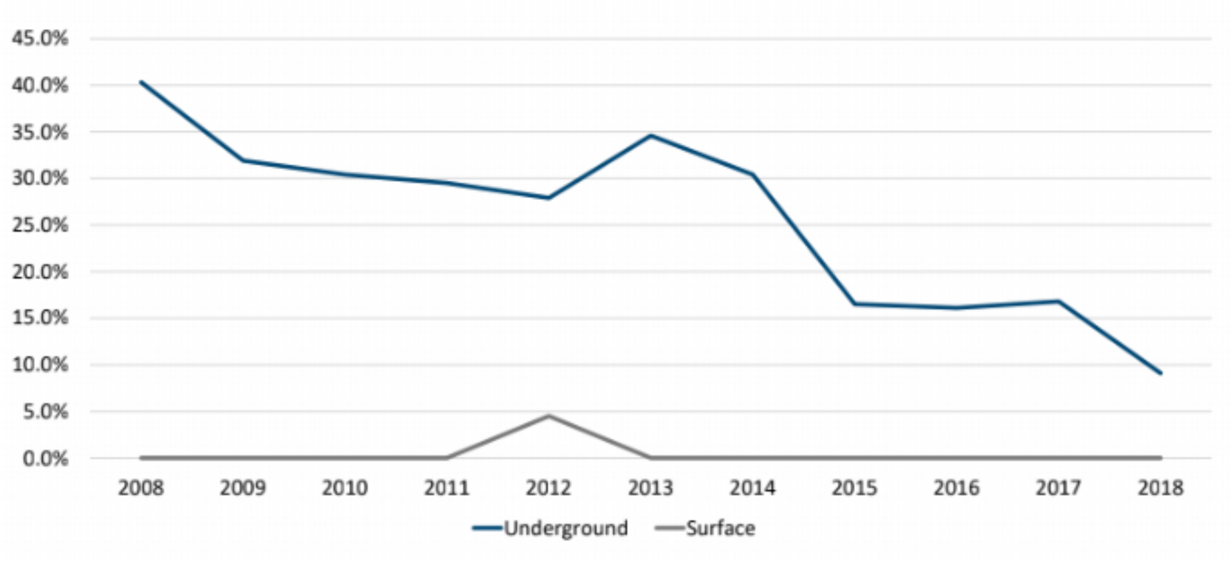
The mining industry has a strong performance record in managing airborne contaminants in NSW, including silica, coal and diesel emissions. Under MDG 29, the industry has been working towards the 0.1 mg/m3 submicron elemental carbon exposure value, introducing risk controls to manage exposure to diesel emissions.

An analysis of DPM results collected at NSW coal sites by Coal Services from 2008 to 2018 reveals a clear downward trend in average DPM exposure and in exceedance rates of the 0.1mg/m3 exposure limit.

Average DPM (Elemental Carbon) Exposure - NSW Underground & Surface Coal Sites

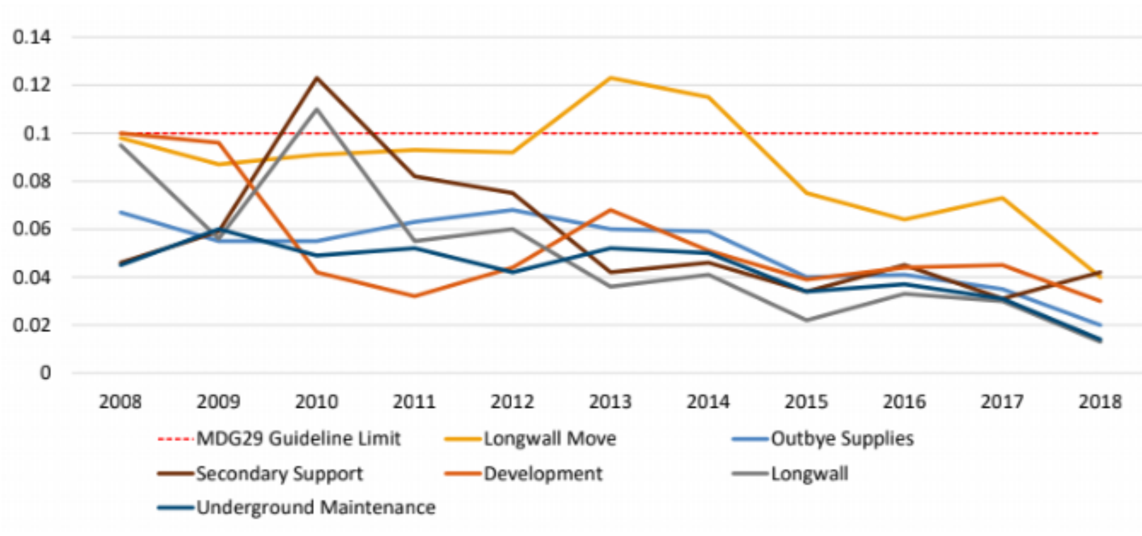


Exceedance rate of 0.1mg/m3 - NSW Underground and Surface Coal Sites

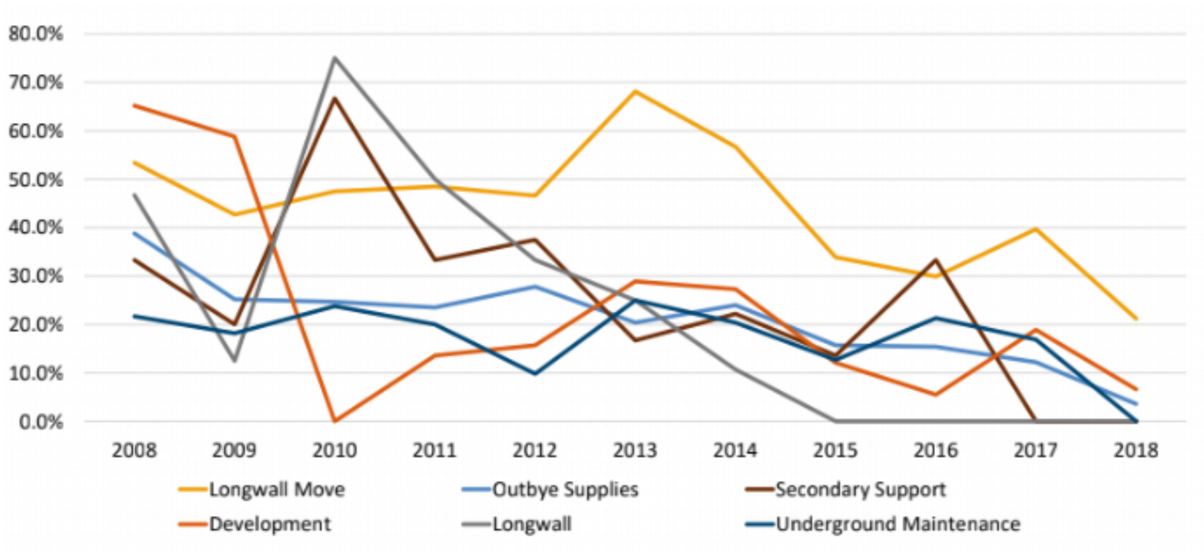


NSWMC supports the implementation of a 0.1 mg/m3 diesel particulate exposure limit and in general is already meeting this standard. However, as indicated in the below graphs, industry recognises that there are challenging circumstances where further controls will be required in order to achieve compliance with the limit. e.g. Longwall moves.

Average DPM (Elemental Carbon) Exposure - NSW Underground Coal Sites



Exceedance rate of 0.1mg/m3 - NSW Underground Coal Sites



It is appropriate that there be an adequate transitional period in place during the implementation of the 0.1 mg/m3 diesel particulate exposure standard to allow industry to further enhance the controls in place to manage diesel emissions.

The industry will continue to focus on meeting the 0.1 mg/m3 diesel particulate exposure limit or achieving better.

A collaborative approach

NSWMC recommends that a collaborative approach be undertaken between the Resources Regulator and industry in the implementation of a diesel particulate exposure standard. This would facilitate the sharing of best practice, learnings from any exceedances and encourage improvements in performance of industry.

NSWMC would also appreciate the opportunity to provide feedback on any proposed changes that are to be made to MDG 29 to provide guidance on the requirements of a principal mining hazard management plan specific to the operation of diesel engines underground, assessment and testing of compliance with the plan, and actions required should the assessment reveal temporary and/or long-term deficiencies.

NSWMC looks forward to continuing to engage collaboratively with the Resources Regulator.

4. Coal Services Pty Limited

Name	Lucy Flemming
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Postal address (if different)	GPO Box 3842, Sydney NSW 2001
Are you an individual representing an organisation	Yes
If you are representing an organisation, please name it	Coal Services Pty Limited

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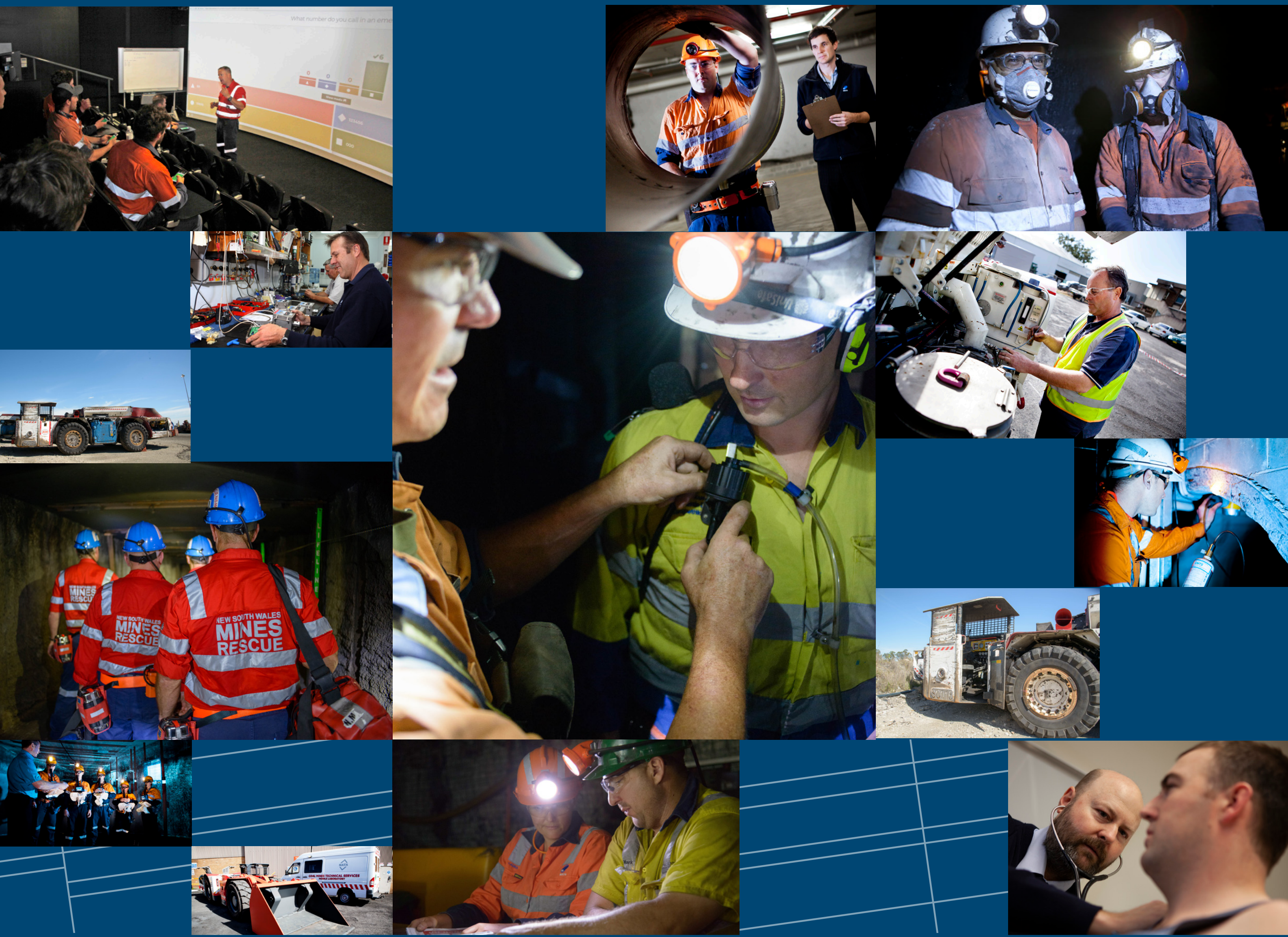
DO YOU HAVE ANY COMMENTS ON THE QUESTIONS BELOW? *(Please outline the reasons to support your views)*

Supporting the introduction of 0.1 mg/m^3 limit measured in the elemental carbon fraction into the WES list through SafeWork Australia's review process. This would mandate the exposure standard through cl 49 of the Work Health and Safety Regulation 2017	**Please refer to attached submission**
Prescribing a limit of 0.1 mg/m^3 limit measured in the elemental carbon fraction in the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014, if SafeWork Australia does not include diesel emissions in the WES or proposes a higher limit.	

Updating MDG 29 to provide guidance on the requirements of a principal mining hazard management plan, specific to the operation of diesel engines underground, assessment and testing of compliance with the plan, and actions required, should the assessment reveal temporary and/or long-term deficiencies.	
Do you have any comments of a general nature?	



Submission to the NSW Resources Regulator

Response to Discussion Paper: Diesel Particulate Exposure Standard for NSW Mines

Coal Services

Coal Services

Table of contents

1. Introduction

This paper is provided to the NSW Resources Regulator in response to the release for industry stakeholder feedback on the Discussion Paper - Diesel Particulate Exposure Standards for NSW Mines.

Reducing exposure to diesel exhaust is critical from a health perspective. Exposure can cause both short-term (acute) and long term (chronic) health effects. Coal Services appreciates the opportunity to provide comment on this very important health matter.

2. Brief history of Coal Services

On 1 January 2002 the *Coal Industry Act 2001* was enacted, creating Coal Services Pty Limited and its subsidiary entities (Coal Services) to undertake the functions formerly performed by the Joint Coal Board (JCB) and the NSW Mines Rescue Board.

The new organisational arrangements were necessary following a decision of the Commonwealth Government to repeal the Commonwealth's *Coal Industry Act 1946* and withdraw from its involvement with the JCB. In recognition of the importance of the functions that had been carried out by the JCB and the significant improvements to health and safety that it had helped deliver to the NSW coal industry, the NSW Government decided to create an independent, industry owned organisation that provided essential health, safety and other services specific to that industry.

Coal Services is owned jointly by two shareholders – the NSW Minerals Council and the CFMMEU. Shareholders do not receive any dividends.

Coal Services has statutory functions, as directed by the NSW *Coal Industry Act 2001*. These functions include, but are not limited to, the provision of workers compensation, occupational health and rehabilitation services, the collection of statistics and the provision of mines rescue emergency services and training to the NSW coal industry.

2.1. Coal Mines Insurance (1922)

Coal Mines Insurance (then known as Mine Owners Insurance Ltd) was established in December 1921 to provide specialist workers compensation insurance to the NSW coal industry. In 1946 the then Government and Board made two improvements; one, to create a specialised insurer that was the sole insurer to the NSW coal industry for workers compensation, so that the industry risk could be fairly shared across the industry, and two, to create Health Bureaus and implement dust monitoring through the establishment of the JCB.

More recently (1 July 2018), the legislation was amended to take into account changing employment relationships, especially labour hire and contractors in the industry, and to go back to the original intent of the Scheme, which was to look after all coal mining industry workers.

2.2. The Joint Coal Board (JCB) (1947)

In 1946, dust-related lung disease was prevalent in the NSW coal mining workforce. The 1939 Royal Commission into Health and Safety recommended a minimum dust concentration standard. Once the JCB began operating, it started to address the dust problem through medical surveillance, promoting dust control and managing the associated compensation problem. The JCB established medical bureaus in each major NSW coal region and began medical examinations to identify and remove 'dusted' workers and protect those at risk.

The creation of the JCB in 1947 provided greater institutional and government commitment to enforcing compliance with this dust standard and the Board began to manage dust suppression techniques and practices that had been mandated by amendments to the *Coal Mines Regulation Act*. To maintain this focus and provide independent oversight, **The Airborne Contaminants and Occupational Hygiene Standing Committee** or Standing Dust Committee on Dust Research and Control (SDC) was formed in 1954. This Committee remains in place today and has more recently been acknowledged in the findings from the various Queensland Inquiries into dust disease, as a key and unique driver of the world-class performance of the NSW coal industry in terms of dust prevention standards and the resultant low level of reported coal workers pneumoconiosis and silicosis cases in recent times.

The Standing Dust Committee also has in its remit the ability to oversee other airborne contaminants such as noise and diesel and has previously published information to workers on diesel contaminants and relevant protection measures.

2.3. Mines Rescue (1926)

On 1 September 1923, 21 miners died in the Bellbird coal mine disaster. This followed several mining disasters between 1887 and 1921 which killed a total of 293 people in NSW. A coronial inquest and Royal Commission extensively debated the value of breathing apparatus and the establishment of a mines rescue service.

The *Mines Rescue Act 1925* governed the establishment of rescue stations and brigadesmen teams, and instigated equipment and maintenance standards. This remains the foundation for governing mines rescue operations in NSW to this day.

Mines Rescue conduct comprehensive training to the industry on rescue and self-escape, as well as many other mining related matters and also incorporate education on dust exposure and mitigation and the effective use of appropriate respiratory protective equipment.

3. Health Effects of Diesel

3.1. 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.

3.2. Long-term (Chronic) Effects

Long term exposure can cause inflammation in the lungs, which may aggravate chronic respiratory symptoms and increase the frequency or intensity of asthma attacks. It can also increase the risk of heart disease.

Diesel engine exhaust emissions contain many known carcinogenic substances, for example poly aromatic hydrocarbons (PAHs) which adhere to the surface of the diesel particulate matter (DPM). DPM is easily inhaled into the respiratory tract and there is epidemiological evidence which indicates ongoing exposure to diesel exhaust emissions may result not just in an increase in the risk of lung cancer but possibly bladder cancer.

A panel of scientific experts convened by the World Health Organization's (WHO) International Agency for Research on Cancer (IARC) concluded in June 2012 that diesel engine exhaust is a Group 1 carcinogen - that is, carcinogenic to humans. In Australia, diesel engine exhaust is the second most common cancer-causing agent (carcinogen) workers are exposed to, behind ultraviolet radiation exposure. The Australian Cancer Council estimates that around 1.2 million Australians are exposed to diesel engine exhaust at work each year and that 130 workers each year are diagnosed with lung cancer as a result of their exposure on the job.

3.3. Other Airborne Contaminants for Consideration

3.3.1. Welding Fumes

Welding poses a range of hazards to a person’s health. Long term significant exposure to welding fumes can cause lung damage and is linked to various types of cancer, including lung, larynx and urinary tract. Chromium (VI), a specific chemical form of chromium can be created during welding of many stainless steels and non-ferrous alloys and is highly toxic and can cause cancer. Certain fumes created by the welding process, such as zinc, may induce metal fume fever, stomach ulcers, kidney damage and nervous system damage. Prolonged exposure to manganese fume can cause Parkinson’s–like symptoms.

In 2017, the World Health Organization's (WHO) International Agency for Research on Cancer (IARC) classified welding fumes and UV radiation from welding as Group 1 carcinogens (carcinogenic to humans).

A 2014 workers compensation case in Victoria recognised a link between welding and lung cancer when a welder succeeded in gaining compensation for lung cancer, after the Victorian County Court found his work caused the disease.

4. NSW Coal Mines Diesel Particulate Matter Exposure Trends 2008-18

Coal Services has been collecting and analysing DPM exposure levels in NSW Coal Mines since 2004. DPM monitoring is not prescribed as per the requirements for Airborne Dust Monitoring. Data summarised in this section has been collected under commercial contracts at coal sites. Sampling and analysis has been completed using NIOSH method 5040 with results reported as Elemental Carbon (EC) in mg/m³. From 2008 onwards, collected exposure results have been stored in the Coal Services Occupational Hygiene Database. A summary of exposure trends based on collected DPM (Elemental Carbon) data by Coal Services in NSW Coal operations has been included in this paper to assist the NSW Resources Regulator with its DPM exposure limit review.

Data collected by Coal Services between 2008 and 2018 in NSW Coal operations indicates significant DPM exposure level reductions in underground workers over this 10-year period. During this period average DPM (Elemental Carbon) exposure levels for NSW underground coal workers reduced from 0.07mg/m³ to 0.024 mg/m³, whilst exceedance rates of the MDG29 guidance limit (0.1mg/m³) reduced from 40.3% to 9.1%.

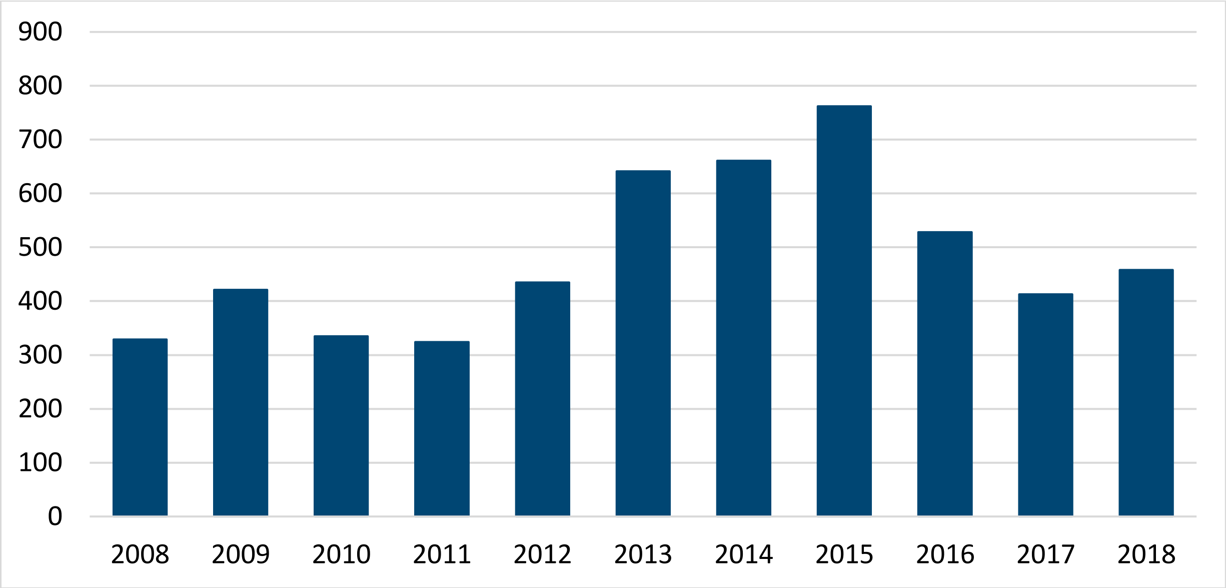


Figure 3.1 DPM Results collected at NSW Coal Operations by Coal Services

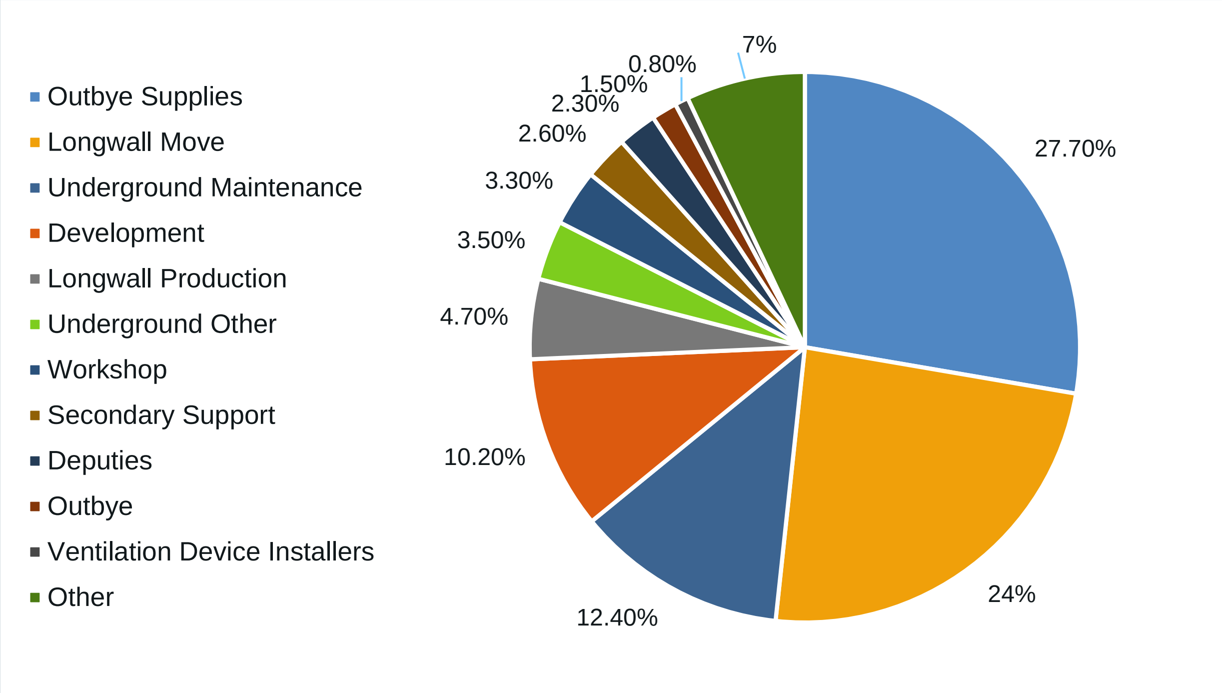


Figure 3.2 Location of Diesel Particulate Matter (DPM) Results Collected at NSW Coal Sites by Coal Services 2008-18

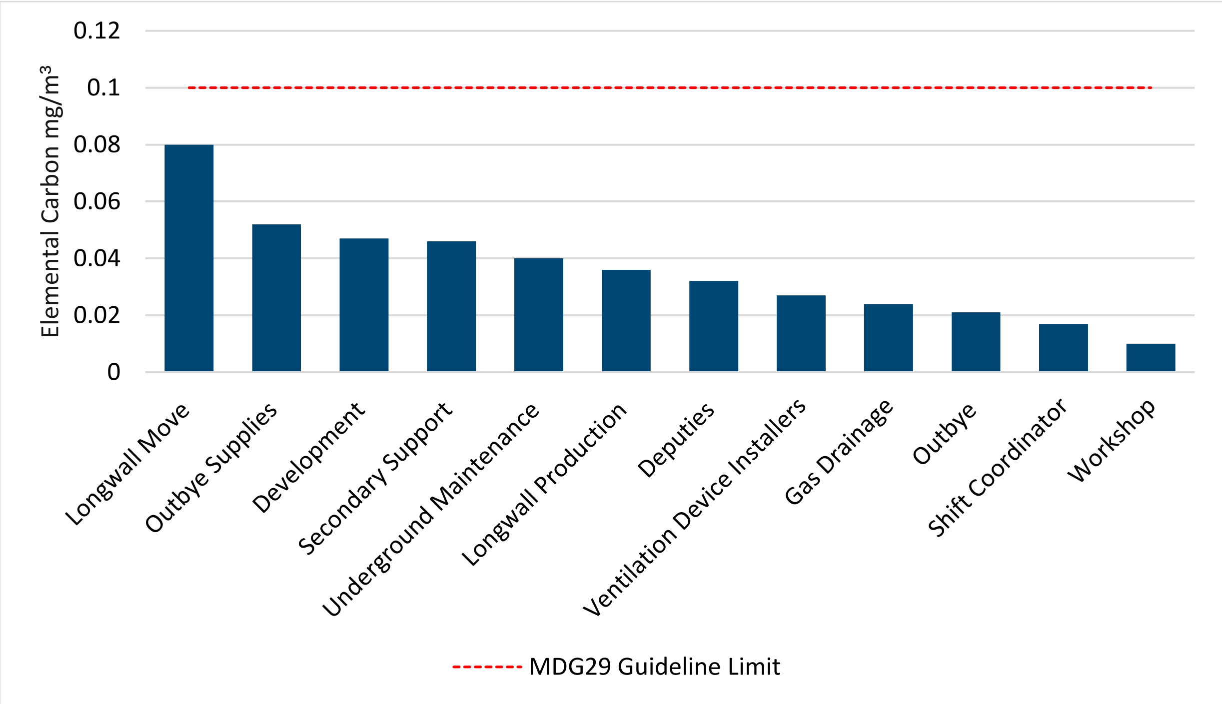


Figure 3.3 Average DPM (Elemental Carbon) Exposure at NSW Coal Sites 2008-18

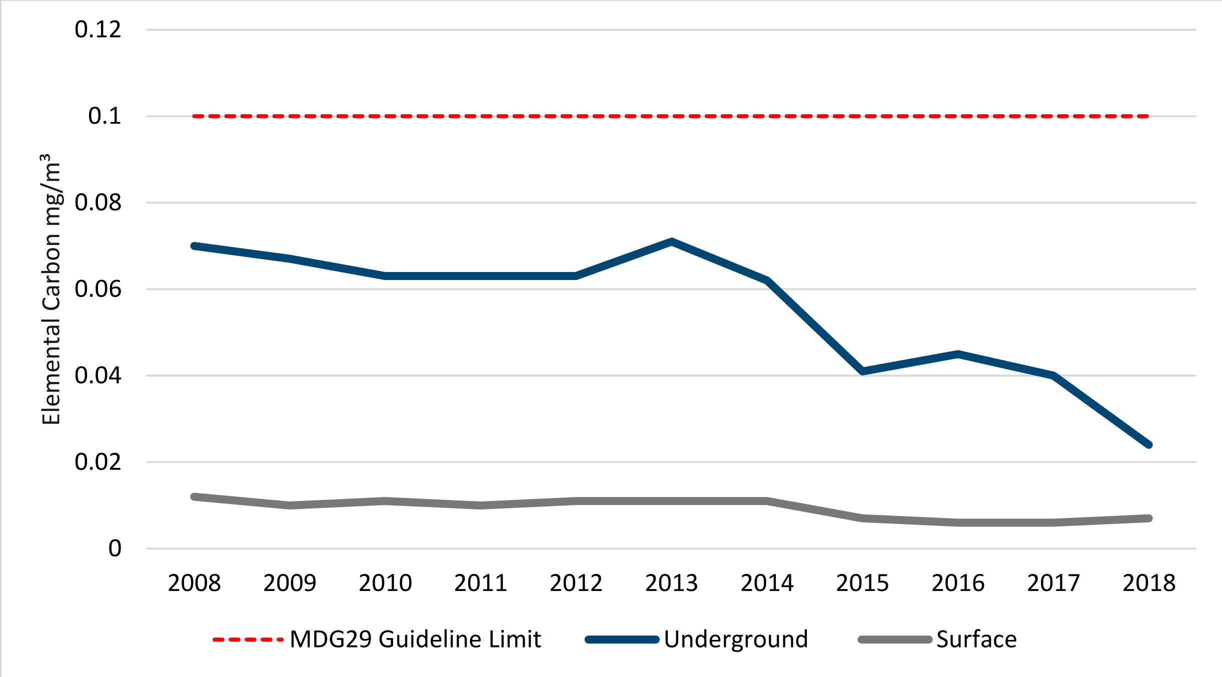


Figure 3.4 Average DPM (Elemental Carbon) Exposure at NSW Underground and Surface Coal Sites

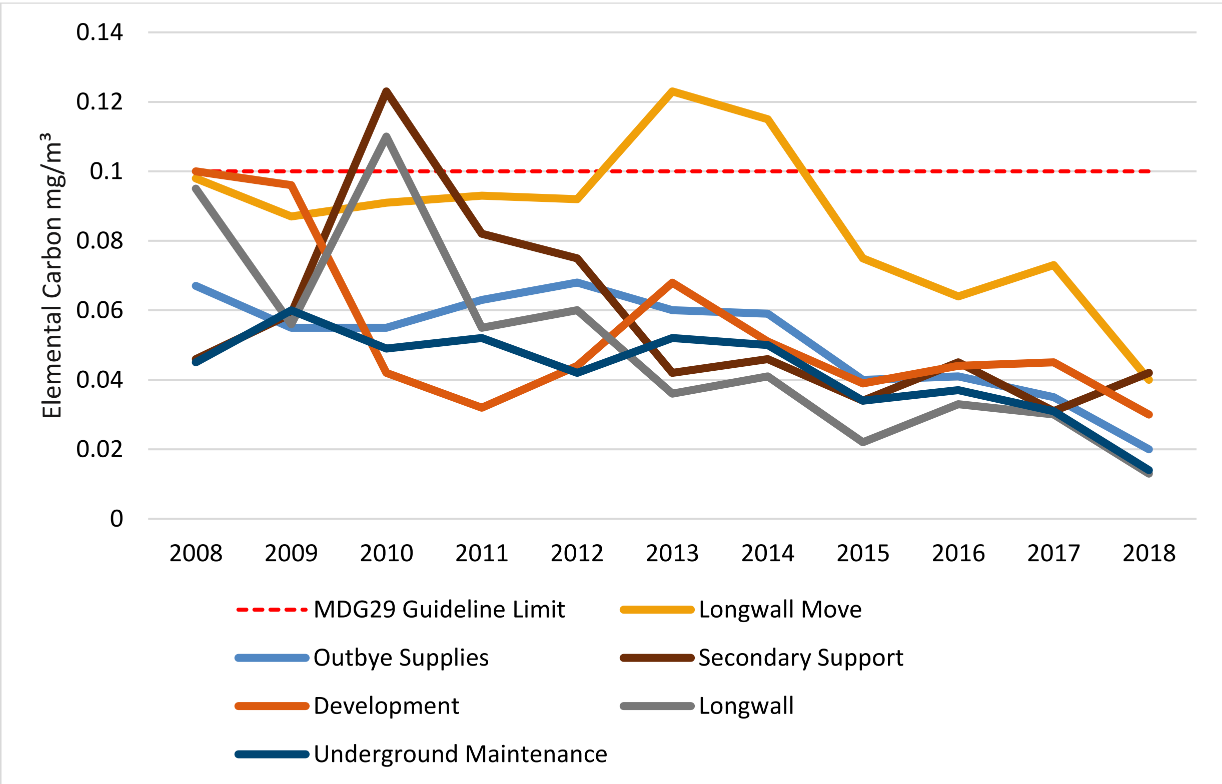


Figure 3.5 Average DPM (Elemental Carbon) Exposure at NSW Underground Coal Sites

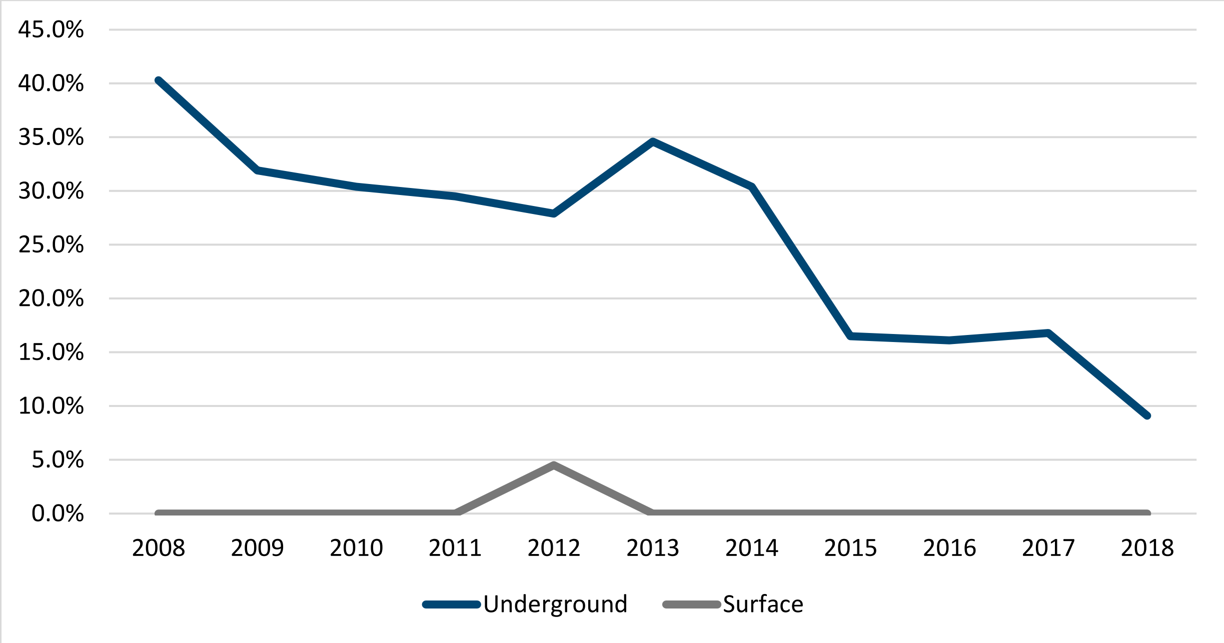


Figure 3.6 MDG29 DPM (Elemental Carbon) Guidance Limit (0.1 mg/m³) Exceedance Rate NSW Underground and Surface Coal Sites

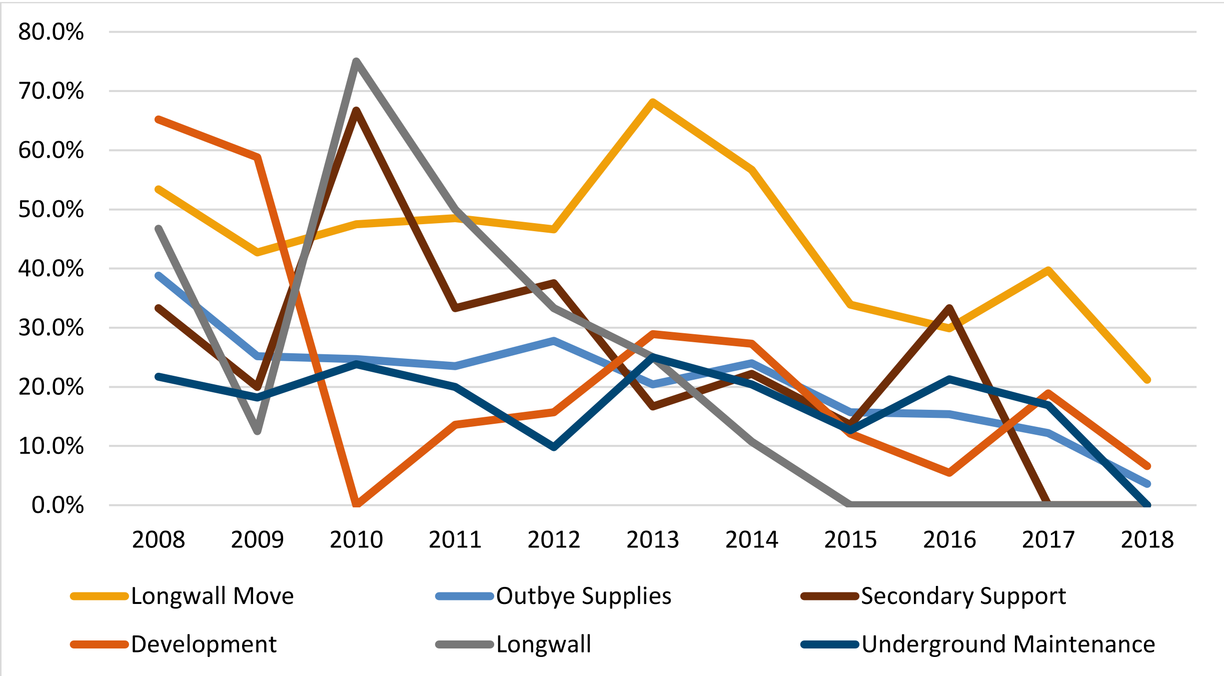


Figure 3.7 MDG29 DPM (Elemental Carbon) Guidance Limit (0.1 mg/m³) Exceedance Rate NSW Underground Coal Sites

5. Feedback to NSW Resources Regulator on proposed actions

The NSW Resources Regulator has requested feedback on four proposed actions as part of its industry stakeholder consultation process.

The four proposed NSW Resources Regulator actions are:

1. Support the introduction of 0.1 mg/m³ limit measured in the elemental carbon fraction into the WESFAC through SWA's review process.
2. Prescribe a limit of 0.1 mg/m³ limit measured in the elemental carbon fraction in the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014*, if SWA does not include diesel emissions in the WESFAC or proposes a higher limit.
3. Have any such exposure limit take effect within 12 months of the decision to impose the standard.
4. Update MDG29 to provide guidance on the requirements of a principle mining hazard management plan specific to the operation of diesel engines underground, assessment and testing of compliance with the plan, and actions required should the assessment reveal temporary and/or long-term deficiencies.

Coal Services provides the following response and observations, referring to the material contained in the full submission.

5.1. Support introduction of 0.1 mg/m³ DPM (Elemental Carbon) exposure standard into WESFAC

Coal Services supports the introduction of 0.1 mg/m³ Elemental Carbon (EC) as a workplace exposure standard for DPM exposure in WESFAC through SWA's review process. Coal Services is monitoring the SWA review process and is awaiting the release of the applicable schedule of contaminants to see if Diesel Particulate Matter / Elemental Carbon is to be included in WESFAC. Coal Services plans provide comment to SWA in alignment with the proposed position of the NSW Resources Regulator.

5.2. Prescribe 0.1 mg/m³ DPM (Elemental Carbon) exposure standard in *WHS (Mines and Petroleum Sites) Regulations 2014*

Coal Services supports the inclusion of prescribed DPM exposure monitoring requirements in the *Work Health and Safety (Mines and Petroleum Sites) Regulations 2014*. The following three changes to the Regulations are suggested:

5.2.1. Prescribed DPM Limit

In Clause 55(1)(c), we recommend that air quality for diesel particulate should reference a prescribed exposure limit of 0.1 mg/m³ measured as elemental carbon (EC) rather than 'as low as is reasonably practicable'.

5.2.2. Prescribed DPM Exposure Monitoring Requirements

It is suggested that the creation of an additional schedule for diesel emissions, similar to Schedule 6 “Sampling airborne dust at coal mines”, would considerably strengthen the airborne contaminant monitoring provisions of the Regulations.

5.2.3. Prescribed Requirements If Exposure Standard Are Not Met

It is suggested that reference is made to DPM in Clause 57 to ensure re-samples are undertaken following exceedances of the proposed DPM exposure limit.

Coal Services view is that there exist substantial benefits to industry by adopting the recommended changes. A similar holistic system to that adopted in the management of airborne dust and the resulting control of pneumoconiosis is recommended. Components and benefits to industry would include:

- Prescribed exposure standards
- Prescribed monitoring regimes
- Data integrity ensured. Monitoring via a licenced and independent statutory body
- Transparency and analysis of monitoring results via an industry consultative working group (i.e. Standing Dust Committee)
- Benchmarking and trending of data across industry to identify areas of heightened risk, emerging issues and current best practices, and
- Dissemination of results and improvement initiatives back to industry.

Based on the substantive learnings and data collected to date, Coal Services would welcome the opportunity to provide a draft diesel emission monitoring schedule for consideration.

5.3. Have any such exposure limit take effect within 12 months of the decision to impose the standard

Coal Services supports a 12-month transition period for the exposure limit to take effect.

5.4. Update of MDG 29

Coal Mines Technical Services are NATA accredited and a licenced provider of Raw Diesel Analysis and have tested 1640 Diesel engines in 2018-19 and have been a provider for over 15 years.

Coal Mines Technical Services supports a change to MDG29 with consultation with CMTS and a place on the committee to put practical changes into the MDG29.

6. Recommendation

Coal Services would like to thank the NSW Resources Regulator for the opportunity to comment on the proposed DPM (Elemental Carbon) exposure limit changes and supports any initiative that leads to improved health and safety outcomes for the NSW coal industry in the first instance, but that may also lead into other industries or locations.

5. Mark Clarkson – individual submission

Note: See submission over the page

Executive Summary.

Whilst this submission generally applauds the proposed new DPM and nDPM standards and regulations for mining, oil and gas sites, corporations exist foremostly to make profits. Within a playing field delineated by regulation, they compete with other corporates for personnel, resources and for sales. Their profits are largely determined by the extent to which they minimise their costs. If corporations spend on incentives not mandated by regulation, they are likely to lose a competitive advantage to other corporations that keep costs lower by only meeting regulatory demands.

The most effective control mechanism for any hazard is avoidance, by elimination/substitution. The operators of resource projects are unable to measure DPM and nDPM with any precision. The measuring equipment needed is just not yet available. Compliance with the conditions of resource approvals and regulatory regimes is not robust. Regulatory capture may result in a lack of enforcement. For open cut mines, quarries and oil and gas sites, DPM and nDPM monitoring, assessment and enforcement actions by the NSW Resources Regulator will need to be proactive and effective. For the operators of underground mines, there should be two main choices:

1. If diesel powered, the plant, machinery and equipment must be controlled and operated by remote or tele-remote technologies.
2. If not controlled and operated by remote or tele-remote technologies, the plant, machinery and equipment must be electric.

Contents.

1. Introduction.

Mine ventilation is one of the most demanding tasks in mining. It needs specialist high level skills and training. It carries enormous responsibility. The risk to workers from poisonous atmosphere or from explosions caused by the ignition of gas or dust is extreme. If the person charged with the ventilation duties gets it wrong, severe adverse consequences may follow. Multiple deaths may occur. Yet mine ventilation is not always well resourced. It is often the job on a mine site that not many people want. The duties of Ventilation Officers (VO) often overlap those of Occupational Hygienists (OH) and other personnel, in dealing with the occupational hazards listed in Table 1 (below).

The submission to the Queensland Parliament *Coal Workers' Pneumoconiosis Select Committee* by the Mine Ventilation Society of Australia (MVSA*)* advocated a national approach mandating a competent Atmosphere and Environment Officer (AEO) with duties to address all the occupational hazards included in Table One (below). The AEO would manage resource project atmosphere and environs at all mining, oil and gas facilities, including underground mines, surface mines and quarries. The concerns of any smaller entities complaining that they cannot afford to hire a dedicated competent AEO for their operation could be met by the capacity of any entity to hire a full or part time competent AEO on contract.

Table 1. Atmosphere and Environmental Hazards.

Category	Hazard
Atmospheric contaminants	Dust, respirable crystalline silica, inhalable dust, respirable dust, respirable synthetic mineral fibre, blast residue, nitrogen dioxide (NO2), CO, CO2, diesel particulate matter (DPM and nDPM), abrasive blasting.
Safety and Health	Self-rescuer, resuscitation equipment, atmospheric monitoring, health surveillance, PPE.
Radiation	Dose, collective effective dose, committed effective dose, contamination level, does constraint, dose limit, and controlled area. Radiation PPE.
Noise	Noise level, noise exposure, peak noise level, action noise level, noise reduction and abatement.
Heat	Hot work procedures, ambient temperature, air temperature, humidity.
Water	Stagnant, potable, dust control water, wetting down.
Weather	Shelter, protection, PPE.
Hygiene and Sanitation	Eating places, washrooms, change rooms, hand basins, toilets, sewage.
Hazardous substances	Registers, containers, labelling, enclosed systems, MSDS, engineering and ventilation controls, atmospheric monitoring, health surveillance, PPE.
Explosives	Explosive coal dust, explosive coal seam gas, and the manufacture, storage, transport, supply, use and disposal of blasting compounds.

Not all Australian States and Territories adopted the Commonwealth Model *Work Health and Safety Act 2011* (Cth) (WHSA)[1] or the Commonwealth Model *Work Health and Safety Regulations 2011* (Cth) (WHSR)[2] for harmonisation of workplace health and safety. There are many problems in creating a national legislative standard and the harmonisation of mining legislation. Creating a unified workplace health and safety scheme sounds good, but may not be achievable, because every polity wants to do things their own way – and often say they don't want to lower their own standards by joining a national scheme.

In some states, mining is totally exempted from the model legislation. In others, some of the provisions of WHSA have been weaved into State mining legislation. In some jurisdictions, coal, hard rock mining and quarries are covered under the same legislation. Other jurisdictions have separate provisions for coal mining hard rock mines and quarries. In some jurisdictions, coal seam gas is classed as a petroleum gas. Whether harvested as an ancillary byproduct of coal mining or vented to the atmosphere in order to reduce the hazards it may pose, coal seam gas may come under oil and gas legislation, as well as legislative provisions relating to coal mining. In some jurisdictions, general pieces of legislation cover all resources, in addition to legislative provisions relating to specific facets.

Management systems are designed to deal with the many risks that may be encountered in mining operations. Any failure of mine operational management systems is likely to have consequences that pose a risk to personnel, mine infrastructure, and the environment – and all risks are assessed and managed in that light. Management systems are mandated by legislation in 'the mining States' – Queensland, New South Wales, and Western Australia. In other jurisdictions without comprehensive legislative provisions, the in-house corporate and site-specific management systems may be utilized, particularly by the larger resource houses.

Employed under an overarching management system, the Legal and Regulatory Compliance Management System (LRCMS) for resource projects lists the Statutes, Regulations, By-Laws, Codes of Practice, Hazard Management Plans, Trigger Action Response Plans (TARPs), and Standard Operating Procedures (SOPs) amongst the other requirements with which the project must comply in its operations. A Work Breakdown Schedule assigns the responsibilities to specific personnel for compliance. Each Australian jurisdiction has different legislative obligations for management systems (and the duties and responsibilities which are mandated for personnel can overlap).

[1] http://www8.austlii.edu.au/cgi-bin/viewdb/au/legis/cth/consol_act/whasa2011218/
[2] http://www8.austlii.edu.au/cgi-bin/viewdb/au/legis/cth/consol_reg/whasr2011327/

Mine ventilation is dealt with comprehensively in some jurisdictions, with specific duties assigned to specific personnel, including a VO. In other jurisdictions, there is no VO and the duties and responsibilities for mine ventilation are assigned to other personnel. In some jurisdictions, there are few or no legislative provisions relating to mine ventilation. Everyone on a mine site, not just the VO, should understand the statutory and other obligations of a VO. All mine workers have to breathe the same air.

Harvesting mining, oil and gas resources occurs in one of the most politically charged arenas. Special interest groups often attack resource projects by holding them to account against what may seem to be very exacting standards of compliance with legislative provisions. Coal mining has been a particular focus of these groups. Resource professionals need to accept that they are coming under increasing scrutiny, and ensure projects comply in minute detail with any provisions governing their operations.

2. Best Ventilation Practice.

Generally, Principle 3, set by the Initiative for Responsible Mining Assurance (IRMA)[3] mandates an intent for operating companies to engage with stakeholders to ensure that mining is planned and carried out in a manner that maintains or enhances environmental values and avoids or minimizes impacts to the environment and communities. IRMA identifies the following environmental risks to mining operations.[4]

- Chapter 3.1—Water Quality: To protect water quality and avoid harm to human health, ecosystems and future water uses.
- Chapter 3.2—Water Quantity: To maximize efficiency of water-use and minimize off-site impacts to the environment through the adoption of leading water management strategies and practices throughout the full mine life cycle.
- Chapter 3.3—Mine Waste Management: To eliminate off-site contamination, minimize short- and long-term risks to communities and the environment, and protect future land uses.
- Chapter 3.4—Air Quality: To protect and maintain pre-mine air quality conditions.

[3] Initiative for Responsible Mining Assurance (‘IRMA’). (2016, April 5). *IRMA Standard for Responsible Mining – IRMA-STD-001 – Draft v2.0*. <www.responsiblemining.net>.
[4] Ibid, 12.

- Chapter 3.5—Noise: To preserve the amenity or health and well-being of nearby noise receptors, properties, and communities.
- Chapter 3.6—Greenhouse Gas Emissions: To minimize climate change impacts through increased energy efficiency, reduced energy consumption, and reduced emissions of greenhouse gases.
- Chapter 3.7—Protected Areas: To respect, support and strengthen the effectiveness of legally designated protected areas.
- Chapter 3.8—Biodiversity Outside Officially Protected Areas: To avoid contributing to the global loss of biodiversity.
- Chapter 3.9—Cyanide: To protect human health and the environment through the responsible management of cyanide.
- Chapter 3.10—Mercury Management: To protect human health and the environment through the responsible management of mercury.

This list should not be in any way seen as exhaustive. Each site, and mining operation has its own particular environmental risks, and these must be identified early in the mine planning process, or as soon as they arise in operations. The failure to identify any environmental risks, and manage them within the mine risk management processes can have far reaching, and expensive consequences that may include closure of the mine.

It should not be assumed that toxic gases affect mine workers only in underground mines, or that all dust, fumes and toxic gases, including blast fumes and diesel particulate matter vent to the atmosphere in open cut mines. Better standards may have prevented the incidents in Queensland open cut coal mines in March that saw coal mine workers overcome by blast fumes,[5] and hospitalised, and toxic clouds of dust and blast fumes impacting upon the wider community.[6] These incidents only add weight to the protests by special interest groups wanting to close down all coal mines.

Unfortunately, in the demand for greater production, mines often only comply with the minimum legislative requirements. The compliance cost of the measures recommended below is small compared to the impacts upon workers and the wider community, and the cost of lost production if a high potential incident or serious accident closes the mine.

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[5] Cole Latimer, 'Blast fumes injure miners', *Australian Mining* (online at 05 April 2011) <https://www.australianmining.com.au/news/blast-fumes-injure-miners/>.

[6] Rory Callihan, 'Queensland locals fuming as mine blasts send toxic clouds into neighbourhood', *The Australian* (online at 05 October 2011) <http://www.theaustralian.com.au/national-affairs/state-politics/queensland-locals-fuming-as-mine-blasts-send-toxic-clouds-into-neighbourhood/story-e6frgczx-1226158548213>.

Figure 1. Orange blast fume plume over Muswellbrook after a blast at BHP's Mt Arthur Coal Mine (from Lamacraft, 2014).

Figure 1 (above) shows an orange blast fume plume over Muswellbrook after a blast at BHP's Mt Arthur Coal Mine. As for the incidents in Queensland dealt with above, this is not a good look and the appointment of a competent Atmosphere and Environment Officer (AEO) may prevent these incidents, which in the new age of increasing public scrutiny may impact upon the mine's social licence to operate.

A similar incident at the Collinsville coal mine in 2012 caused mining at night to be temporarily suspended, because of the perception that the major problem with the gases was at night, when atmospheric conditions and temperature inversions held them in place. During the day, because they are produced in fairly low concentrations, they disperse naturally very quickly.[7] Also, not a good look.

Figure 2. Gas rises from the ground at the Collinsville open cut coal mine (from Wordsworth, 2012).

[7] Matt Wordsworth, 'Toxic mine gas sparks work suspension', *ABC News* (online at 3 April 2012) <http://www.abc.net.au/news/2012-04-02/toxic-mine-gas-sparks-work-suspension/3926516>.

The ultimate objective of the regulatory schemes within which blasts must be conducted, and the management plans that govern them is the optimization of blasting operations, whilst ensuring that they are conducted safely. This is achieved by constant monitoring, assessing, analysis, review and audit. Optimisation seeks to improve the blasting performance, to minimise the overall cost, and maximize the value of the resulting outputs. The appearance of distinctly orange coloured fumes after an ANFO blast may indicate too little FO in at least some of the ANFO. These fumes can also appear where properly mixed ANFO has become wet and has absorbed blasthole water.

The Queensland Mining Safety and Health Commissioner Stewart Bell (as he then was) was reported as saying that 62 people were taken to hospital in 2011 when fumes from open cut mines went beyond exclusion zones.[8] A Safety Alert[9] and a Guidance Note[10] sought to rectify the problem. In addition, from 1 January 2017, two new recognised standards sought to drive best practice monitoring and control of respirable dust in coal mines.[11] These apply to open cut and underground coal mines.

Queensland and New South Wales have comprehensive underground coal mine ventilation legislation that works reasonably well, but could be improved. The open cut coal and hard rock mine ventilation legislation leaves much to be desired. Western Australia has simple, clear, comprehensive and effective mine ventilation legislation that applies to all mining methods and resources. The other states and the ACT and NT have little to offer to the equation.

The best features from each of the best legislative schemes recommends the WA requirement for a VO for open cut and underground mines and quarries regardless of the resource and extending the NSW requirement for regular 12 monthly ventilation audits by a licensed ventilation auditor to all mining methods and resources. These measures should be an Australasian wide legislative requirement.

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[8] Fidelis Rego, 'Miners deny gas impact from open cut blasts', *ABC News* (online at 05 October 2011) <http://www.abc.net.au/news/2011-10-05/miners-deny-gas-impact-from-open-cut-blasts/3299686>.

[9] Queensland Government, Department of Natural Resources and Mines, 'Prevention and management of blast fumes' (Explosives safety alert no. 44, Version 2, 15 March 2011) <https://www.dnrm.qld.gov.au/mining/safety-and-health/alerts-bulletins-search-tool/alerts-bulletins-search/alerts-bulletins/explosives/prevention-management-blast-fumes#>.

[10] Queensland Government, Department of Natural Resources and Mines, *Guidance Note – QGN 20: Management of oxides of nitrogen in open cut blasting*, (2011) <http://dnrm.qld.gov.au/__data/assets/pdf_file/0010/212500/qld-guidance-note-20-mgmt-oxides-nitrogen.pdf>.

[11] Queensland Government, Business and industry portal, *Regulatory changes* (2016) <https://www.business.qld.gov.au/industry/mining/safety-health/mining-safety-health/medicals/pneumoconiosis/regulatory-changes>.

There is no 'Mine Ventilation Engineering' discipline recognised by *The AusIMM* or 'Mine Ventilation Engineering' area of engineering recognised by the *Board of Professional Engineers Queensland*. It was generally thought that Mine Ventilation Engineering came exclusively under Mining. However, that does not appear to be the case.

In WA, a VO must have a diploma or degree in Mining Engineering, where Mine Ventilation is a substantial part of the curriculum; or the equivalent as recognised by the State WA Chief Mining Engineer.[12] The other jurisdictions have other, mostly lower standards of competency for a VO.

3. New South Wales.

NSW has now consolidated all its legislation for regulating mining, oil and gas operations, including coal, hard rock mines and petroleum sites in the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* (NSW)[13] and the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* (NSW).[14] The new legislation is construed as if it formed part,[15] of the *Work Health and Safety Act 2011* (NSW),[16] which emulates the Commonwealth model WHSA.

It is an offence for anyone to occupy a statutory role, without the mandated competencies and a current practising certificate that authorises the exercise of any 'statutory function', and an offence for any workplace to employ or maintain the employment of anyone not meeting these criteria. Almost all the roles relating to explosives are statutory roles.

The statutory function of a VO in NSW underground coal mines is to control and manage the ventilation activities and standards forming a part of the mining operations at the mine and the VO must hold a current practising certificate that authorises the exercise of the statutory function.[17] The ventilation system and ventilation control plan for the mine at each underground coal mine must be audited at intervals not exceeding 12 months by a Ventilation Auditor,[18] who

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12 *Mines Safety and Inspection Regulations 1995* (WA) s 9.4.
13 http://www8.austlii.edu.au/cgi-bin/viewdb/au/legis/nsw/consol_act/whasapsa2013472/
14 http://www8.austlii.edu.au/cgi-bin/viewdb/au/legis/nsw/consol_reg/whasapsr2014563/
15 *Work Health and Safety (Mines and Petroleum Sites) Act 2013* (NSW) s 4.
16 http://www8.austlii.edu.au/cgi-bin/viewdb/au/legis/nsw/consol_act/whasa2011218/
17 *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* (NSW), Sch 10, Pt 2, reg 8; NSW Department of Trade and Investment – Mine Safety, *Statutory Functions* (December 2014) <http://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0011/537293/Statutory-functions-guide.pdf>.
18 *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* (NSW), reg 71(4).

must hold a current practising certificate that authorises the exercise of this statutory function.[19] **These provisions *do not* apply to open cut coal mines, or underground or open cut hard rock mines.** General requirements for managing risks from airborne contaminants and hazardous atmospheres (including diesel particulates) for all mines, including underground mines are included in the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* (NSW),[20] which sets out additional requirements relating to underground coal mines,[21] and in the *Work Health and Safety Regulation 2017* (NSW) (all workplaces, including mines).[22]

Like for other jurisdictions, in NSW the legislation is only part of the regulation of coal mining operations. For example, the *Clarence Colliery* (Clarence), an underground thermal coal mine, with attendant facilities including the water treatment plant, coal loader and coal handling and preparation plant (CHPP), located on the Newnes Plateau, in the Western Coalfields, 10 km East of Lithgow,[23] incorporates environmental risk management within its management systems, run on a risk management basis. Clarence faces continuing and intense scrutiny by environmentalists.[24]

Clarence is primarily bound by the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* (NSW), the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* (NSW) and the Statutory Codes of Practice (COP), relevant to various operations (hereinafter called '*the statutory framework*'). Risk Assessments at *Clarence* use a Workplace Risk Assessment and Control (WRAC) methodology,[25] following the Centennial Coal Risk Management Standard (MS-004), which is based on Risk Management ISO31000:2009, Environmental Management ISO14001:2015), the Minerals Industry Safety and Health Risk Management Guideline – MDG1010:2011), and the Centennial Coal risk assessment guidelines.

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[19] Ibid, Sch 10, Pt 2, reg 7.
[20] Ibid Pt 2, div 4, sub-div 2.
[21] Ibid Pt 2, div 4, sub-div 3.
[22] *Work Health and Safety Regulation 2011* (NSW) Pt 3.2, divs 7 and 8.
[23] Centennial Coal. (2019), *Clarence,* <http://www.centennialcoal.com.au/ Operations/OperationsList/ Clarence.aspx>.
[24] Aal-E Ali, Vladimir Strezov, P. Davies, I. Wright, & Tao Kan, 'Impact of Coal Mining on River Sediment Quality in the Sydney Basin, Australia', (2017) 11 (4) *World Academy of Science, Engineering and Technology, International Journal of Environmental, Chemical, Ecological, Geological and Geophysical Engineering* 279-284, 280; Ian A Wright, Nakia Belmer, & Peter J. Davies, 'Coal mine water pollution and ecological impairment of one of Australia's most "protected" high conservation-value rivers', (2017) 288 (3) *Water, Air, & Soil Pollution* 91-96.
[25] Centennial Coal. (2013). WRAC Analysis Worksheet. In *Clarence: Environmental Approval for Domestic Coal Road Haulage Risk Assessment* (pp. 65-75). <https://www.data.centennialcoal.com.au/file/ trucking/FINAL.pdf>

WRAC is a specific risk assessment method developed for the mining industry and is the most common or preferred method used. It is a participative, pro-active procedure utilizing the expertise and knowledge of the people that are closely associated with the plant or process under review. WRAC loosely follows the Risk Management Process in ISO31000:2009 (Figure 3 below), and is said to comply with the requirements of *the statutory framework*. There are normally three stages of the WRAC method: scoping, assessing, and controls implementation. Thereafter management formulates directions, which become rule compliance for end-point decision makers to guide their decisions and workflows, as recommended by Hopkins (2010).[26] These rules are said to result from the risk assessment, but are also designed overcome some of the vices identified by Gunningham and Sinclair (2017) relating to management-based regulation.[27]

Risk management, which follows AHP and Fine Kinney methodologies,[28] is mandated by the *Safety Management Systems in Mines Code of Practice,*[29] in four steps:

1. **identify hazards** – find out what could cause harm;
2. **assess risks if necessary** – understand the nature of the harm that could be caused by the hazard, how serious the harm could be and the likelihood of it happening;
3. **control risks** – eliminate the risk or, if this is not possible, minimise the risk through risk control measures; and
4. **review** control measures to ensure they are working as planned.

The statutory framework adopts for NSW the ‘as low as reasonably practicable’ (ALARP) standard for risk. *Regulation* 35 demands that duty holders in managing risks to health and safety must eliminate or minimise those risks so far as is reasonably practicable. Environmental risks are managed within this same schema.

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[26] Andrew Hopkins, 'Risk Management and Rule Compliance Decision Making in Hazardous Industries', (NRCOHSR Working Paper No 72, 2010), Australian National University. Retrieved from <http://regnet.anu.edu.au/research/publications/3062/wp-72-risk-management-and-rule-compliance-decision-making-hazardous>, 24.
[27] Neil Gunningham, & Darren Sinclair, 'Trust, culture and the limits of management-based regulation: Lessons from the mining industry', In Peter Drahos (ed) *Regulatory Theory: Foundations and Applications* (pp.711-724). ANU Press, 2017), 720-721.
[28] Ali Kokangül, Ulviye Polat, & Cansu Dağsuyu. 'A new approximation for risk assessment using the AHP and Fine Kinney methodologies' (2017) 91 *Safety science* 24-32.
[29] New South Wales Department of Planning and Environment. *Safety Management Systems in Mines Code of Practice* (1 February 2015) <http://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0008/543941/NSW-code-of-practice-Safety-managment-systems-in-mines.pdf>, 27-28.

Professional Risk Management tends to follow a schema mirrored on that prescribed by ISO31000:2009, and set out in Figure 3 (below), tempered by statutory requirements, and corporate policies. Assessment of environmental risks tend to be integrated in management systems designed to deal with the many risks that may be encountered in mining operations. Any failure of mine operational management systems is likely to have consequences that pose a risk to the environment – and environmental risks are usually assessed and managed in that light. Only the largest of operations provide dedicated environmental risk personnel, and environmental risk management duties are usually the province of the Mine Technical Services team, and overlap Mine Planning, Survey, VO, and OH roles.

Figure 3. The Risk Management Process (adapted from ISO31000:2009).

The *Safety Management Systems in Mines Code of Practice* mandates the design and implementation of a Safety Management System (SMS), with mandatory and optional components.[30] The SMS elements are set out in Figure 4 below. These elements include many risks to the safety of personnel, and infrastructure that are also 'environmental risks', such as Ground or Strata Instability, Inundation and Inrush, Air Quality, Dust and Contaminants (including DPM and nDPM), Fire and Explosion, Gas Outburst, Spontaneous Combustion, and Subsidence.

[30] Ibid, 6; 17-26.

At Clarence, during round table risk assessments with relevant stakeholders, risks, including the environmental risks, are identified and rated, and current and recommended controls are listed as against Likelihood, Maximum Reasonable Consequence, and Risk Rank on the Centennial Coal Risk Matrix (Figure 5, below).

Figure 4. The elements of a safety management system (from *Safety Management Systems in Mines COP*, p.6).

These risk assessments are conducted regularly during the progress of mine operations, at regular intervals dictated by the mine management systems as part of the continuing process of assessment, monitor, review and control, and as dictated by Trigger Action Response Plans (TARPs) in response to incidents, or other triggers. However, despite all their best endeavours, Clarence should have better considered the natural hazards of bushfires and floods intermittently prevalent in the Blue Mountains,[31] and implemented appropriate crisis management for when those risks occur.[32] The failure to do so led to the collapse of a coal stockpile, and contamination of water courses. The resultant environmental damage cost Clarence dearly in lost production, fiscal penalties, and reputational damage.[33]

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[31] Arnaud Mignan, et al, 'Harmonized approach to stress tests for critical infrastructures against natural hazards (STREST)', In *16th World Conference on Earthquake* (Paper No. 4205, 9-13 January 2017), Santiago, Chile.
[32] Frederick Benaben, et al, 'A Conceptual Framework and a Suite of Tools to Support Crisis Management', In *Proceedings of the 50th Hawaii International Conference on System Sciences* (pp.237-246). 4-7 January 2017, Big Island, Hawaii, USA.
[33] Ali et al; Wright et al, above N 24.

RISK MANAGEMENT STANDARD — **Management Standard-004**

CENTENNIAL RISK MATRIX

Rating	Consequence Note: Consequence may consist of a single event or may represent a cumulative impact over a period of 12 months. Use the worst case consequence if there are more than one.						Likelihood				
	Impact to Annual Business Plan (F)	Personal Injury (PI)	Business Interruption (BI)	Legal (L)	Reputation (R)	Environment (E)	A Certain	B Probable	C Possible	D Remote	E Improbable
							"Common" Frequent incidents Operations – within 3 months Project – Every project	"Has Happened within Centennial" Regular incidents Operations – within 2 years Project – Every 2 projects	"Could Happen & has happened in non-CEY operations" Infrequent incidents Operations – within 5 years Project – Every 5 projects	"Not Likely" Unlikely to occur. Very few recorded or known incidents. Operations – within 10 years Project – Every 10 projects	"Practically impossible" May occur in exceptional circumstances. Almost no recorded incidents. Operations – within 30 years Project – Every 30 projects
1. Catastrophic	>$50m	Multiple Fatalities	> 1month	Prolonged litigation, heavy fines, potential jail term	Prolonged International media attention	Long term impairment habitats/ ecosystem	1 (E)	2 (E)	5 (H)	7 (H)	11 (S)
2. Major	$10m - $50m	Single Fatality	1 week to 1 month	Major breach/ major litigation	International media attention	Long term effects of ecosystem	3 (E)	4 (E)	8 (H)	12 (S)	16 (M)
3. Moderate	$1m - $10m	Serious/ Disabling Injury	1 day to 1 week	Serious breach of regulation. prosecution/ fine	National media attention	Serious medium term environmental effects	6 (H)	9 (H)	13 (S)	17 (M)	20 (L)
4. Minor	$100k - $1m	Lost Time Injury	12 hrs to 1 day	Non-compliance, breaches in regulation	Adverse local public attention	Minor effects to physical environment	10 (S)	14 (S)	18 (M)	21 (L)	23 (L)
5. Insignificant	<$100k	First Aid Treatment Only	< 12 hrs	Low level compliance issue	Local complaints	Limited physical damage	15 (S)	19 (M)	22 (L)	24 (L)	25 (L)

Risk Rating	Risk Category		Generic Management Actions
1 to 4	E	Extreme	Immediate intervention required from senior management to eliminate or reduce this risk
5 to 9	H	High	Imperative to eliminate or reduce risk to a lower level by the introduction of control measures. Management planning required at senior levels
10 to 15	S	Significant	Corrective action required, senior management attention needed to eliminate or reduce risk
16 to 19	M	Moderate	Corrective action to be determined, management responsibility must be specified
20 to 25	L	Low	Monitor and manage by corrective action where practicable

Figure 5. The Centennial Risk Matrix (from Centennial Coal, 2013, pp.7-10).

4. DPM and nDPM.

Diesel engines produce exhaust particles, which are known as Diesel Particulate Matter (DPM). When breathed in these increase the risk of developing long-term health problems, including lung cancer and possibly bladder cancer. Morin et al (2008) note that diesel soot concentrations of 10-100 µg/cm2 applied to a cell culture monolayer are equivalent to instant dust inhalation of 10-100 g by a human of 70 kg.[34] Simon Ridge, Executive Director Resources Safety for Western Australia and Chair of the Mining Industry Advisory Committee (MIAC) noted that newer technology diesel engines produce high quantities of smaller-sized diesel particles of less than 100 nanometres, known as Nano Diesel Particulate Matter (nDPM). He added that "nDPM is difficult to capture with diesel particulate filters, as it is like a gas and travels further in the

[34] Jean-Paul Morin et al, 'Prevalidation of in vitro continuous flow exposure systems as alternatives to in vivo inhalation safety evaluation experimentations: outcome from MAAPHRI-PCRD5 research program', (2018) 60 (2-3) *Experimental and Toxicologic Pathology* 195-205.

mine". When inhaled, nDPM can pass through lung walls into the bloodstream and enter cells. Importantly, nDPM absorbs and transports more toxic and carcinogenic substances. Research shows that occupational exposure affects human DNA and the resulting genetic effects may be passed on to the children of exposed workers.[35] In his paper presented to the *Hard Rock Mine Ventilation Conference 2013,* Dr Patrick Glynn, from the CSIRO (Winner of New Inventors Award for the project with ACARP and Peak3 - June 2010) noted:[36]

- With increasing research into the clinical effects of breathing air with diesel particulate matter, the indications at this point are that there is likely to be no safe level of ingestion of DPM.

- The recommended DPM mass level of 0.1mg/m^3 is also being questioned, as with the aim of reducing DPM mass, engine manufacturers have improved the combustion efficiency of diesel engines by the introduction of common rail and turbo-charging to achieve this reduction.

- An unwanted outcome of the improved diesel engine efficiency was an increase in the number of diesel particulates with over a 50% reduction in average diesel particulate size.

- This reduction in DPM size is of particular concern as larger DPM <2.5 micron coated with poly aromatic hydrocarbons (PAH) (a known carcinogen) will effect a minority of the population, whereas the smaller DPM <100 nanometre can cross the lung membrane barrier into the bloodstream, and this has the potential for health effects on 100% of the population.

Despite general provisions in the laws of various Australian polities demanding that risks to workers be risk managed and reduced to a generic standard 'as low as is reasonably achievable' (ALARA) or some other like provision, and despite the dangers presented by DPM and nDPM being well known, there is presently no specific Australian standard for DPM or nDPM. Chang, and Xu (2017)[37] note:

> In order to minimize DPM health hazards, the DPM concentration should be maintained below an acceptable standard. Germany, Canada and the USA have already set their limit or standard

[35] Western Australia DMIRS, 'Nano Diesel Particulate Matter Research Underway', (2017) 5 (2) *Resources Safety Matters* 36-37.
[36] Dr Patrick Glynn, 'Understanding DPM and the Scale of the Problem' (paper presented to the IQPC *Hard Rock Mine Ventilation Conference 2013*, 26 - 28 February 2013, Holiday Inn, Perth, Australia), (2013) 12 *WOMP e-Journal.*
[37] Ping Chang & Guang Xu, 'A review of the health effects and exposure-responsible relationship of diesel particulate matter for underground mines', (2017) 27 (5) *International Journal of Mining Science and Technology* 831-838.

> for DPM exposure for mining industries. Germany sets the DPM limit for underground noncoal mines and other surface workplaces at 0.3 and 0.1 mg/m^3, respectively. The Canada Centre for Mineral and Energy Technology sets the standard of DPM at 0.75 mg/m^3. In the US, the Mine Safety and Health Administration (MSHA) has an exposure standard of DPM for metal/nonmetal mines of 0.16 mg/m^3 (measured as total carbon). The development of regulations and standards for the DPM exposure in underground mines is still in its early stage in Australia. Currently, the official limit for DPM exposure for underground mines is still not established, and the level of regulation in different states varies. In Australia, many regulatory agencies have considered 0.1 mg/m^3 (measured as elemental carbon, TWA) of DPM as a recommended exposure limit, and this is also recommended by the Australian Institute of Occupational Hygienists (AIOH). (references omitted)

Chang, and Xu (2017) were speaking of DPM, not nDPM. For nDPM, which presents greater risks, but the situation seems to be bogged-down in a technical soup concatenating all 'nanomaterials'.

Figure 6 contains images illustrating the effects of nano particles on human cells.

A. Particles sized at 5,000 nanometres (5 micrometres) remain outside the cell.

B. A few particles at 200 nanometres (0.2 micrometres) have entered the cell.

C. Particles at 70 nanometres (0.07 micrometres) which is at nDPM size, enter and damage the cell.

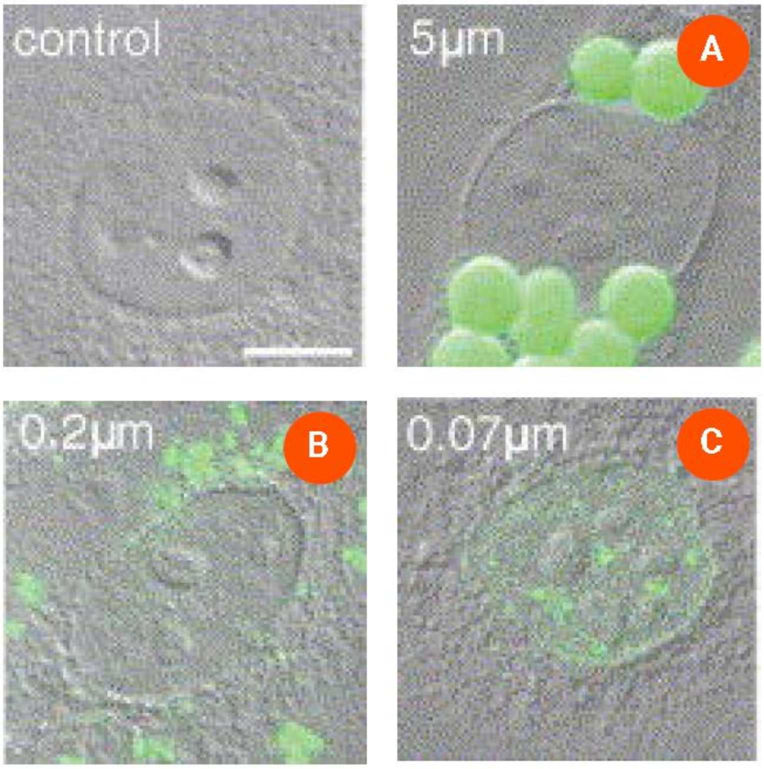

Figure 6. The effects of nano-particles on human cells (from Western Australia DMIRS, 2017).

In a study for Work Safe Australia, Jackson, Lopata, Elms, and Wright (2009)[38] noted:

> There are currently two engineered nanomaterials for which Australian National Exposure Standards have previously been established, i.e. the time-weighted average (TWA) for fumed silica and carbon black is 2 and 3 mg/m^3, respectively. The fact that these have been established indicates that there is evidence of safe levels of exposure to some engineered nanomaterials, however for most engineered nanomaterials the evidence is lacking.
>
> …
>
> There are also few publications of nanomaterial quantitative risk assessments; an example is that of Kuempel et al. (2006) for ultrafine titanium dioxide (TiO_2), ultrafine carbon black and diesel exhaust particulates. The authors concluded that established quantitative risk assessment methods are useful in estimating occupational exposure risk to ultrafine and fine particles and provide a scientific basis for the evaluation of potential risk of exposure to engineered nanomaterials.

Many think that the scientific basis for the evaluation of potential risk of exposure to nDPM is well established and should not be awaiting the further generic examination of 'engineered nanomaterials' at large.

There are provisions in some State laws setting ventilation levels for mines using diesel powered equipment and vehicles. In Western Australia, these are a ventilating volume rate for diesel units of 0.03 – 0.05 m^{3}s per kw x number of units. Not more than 2 000 ppm of carbon monoxide or more than 1 800 ppm of the oxides of nitrogen for each diesel unit. In Queensland, the exposure standard assigned to the contaminant in NOHSC:1003. In NSW, the exposure standard for contaminants (including DPM) in the *Workplace Exposure Standards for Airborne Contaminants* and as low as is reasonably practicable. In the Northern Territory, a safe oxygen level must be maintained, and the concentration of flammable gas, vapour, mist or fumes must not exceed 5% of the LEL for the gas, vapour, mist or fumes. Combustible dust cannot present a hazard. Otherwise the exposure standard for contaminants (including DPM and nDPM) in *the Workplace Exposure Standards for Airborne Contaminants*. In South Australia, a level of 19.5% oxygen must be maintained in ventilated air. The level must not exceed 5% LEL for gas, vapour, mist or fumes. Otherwise the exposure standard for contaminants (including DPM and nDPM) in *the Workplace Exposure Standards for Airborne Contaminants*.

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[38] N Jackson, A Lopata, T Elms, & P Wright, 'Engineered Nanomaterials: Evidence on the Effectiveness of Workplace Controls to Prevent Exposure', *Safe Work Australia* (November 2009) <https://www.safeworkaustralia.gov.au/system/files/documents/1702/engineerednanomaterials_evidence_effectiveness_workplacecontrolstopreventexposure_2009_rtf.doc>.

In Tasmania, a "safe level" of oxygen in ventilated air must be maintained, and air flow for the ventilation current is determined by the aggregate number diesel units by maximum rated output. Otherwise the exposure standard for contaminants in *the Workplace Exposure Standards for Airborne Contaminants.* Victoria has not adopted the Commonwealth Model *Work Health and Safety Act 2011* (Cth) (WHSA). The regulation of all mines for all mining methods and all resources is left to the *Occupational Health and Safety Regulations 2007* (Vic). The provisions relating to mine ventilation contained in Part 5.3 are encapsulated in seven sentences. The principal obligation is to ensure "the air does not pass through so many work areas that it becomes unfit to breathe". The slightly more comprehensive provisions dealing with confined spaces do not apply to mines.

The ACT adopted the *WHSA 2011* (ACT), but the *WHS Regulations 2011* (ACT) do *not* include Chapter 10 applying to mining. The confined spaces provisions of the *WHS Regulations 2011* (ACT) do not apply to a mine shaft or the workings of a mine. There is no mining and only a couple of quarries in the ACT. For matters otherwise falling within the Commonwealth domain, Onshore and in coastal waters, the states and territories own and allocate mineral and petroleum rights, administer operations, including OH&S and collect royalties on production. Beyond the coastal waters (seaward of 3 three nautical miles of the territorial sea) to the outer limits of Australia's continental shelf, mineral and petroleum rights are held by the Commonwealth, but administered jointly with the relevant state or territory.

5. Measuring DPM and nDPM.

Gunningham and Sinclair (2017),[39] contrast management-based regulation of occupational health and safety with government-imposed regulation. Management regulation involves companies developing their own process and management system standards and developing internal planning and management practices designed to achieve regulatory or corporate goals. Gunningham and Sinclair (2017) conclude that in the mining industry, management-based regulation is vulnerable to failure for a variety of often interrelated reasons, which included low levels of trust between workers and management and the inability to overcome a combination of mine management resistance, middle management inertia and the unwillingness of deputies to take managerial responsibility and implement management systems at the mine site.[40]

[39] Above N 27, 711-712.
[40] Ibid, 720-721.

In his paper *Nano Diesel Particulate Matter – A Review*,[41] Professor Michael Tuck observed:

> Measuring and determining the overall toxicity of diesel exhaust is difficult but essential to ensure compliance with established threshold limit values and to enable exposure to be monitored and recorded effectively. A number of substances are typically used as surrogates for the assessment of the exposure as a whole, Noll et al (2006), Tuck (2017). Direct reading electronic instruments or colorimetric tubes are often used for the gaseous components to measure concentrations of CO2, CO, NOx gases and where significant amounts of sulphur are present in the fuel, SO2.
>
> Determining the concentration of particulate matter is significantly more complex. The largest part of diesel particulate matter is carbon, and is the usual surrogate measure for overall DPM. Some measurement and analysis methods measure Elemental Carbon (EC) only, whilst others measure both Elemental and Organic Carbon (OC) combined also known as Total Carbon (TC) where (TC= EC+OC) whereas others measure just the combustible carbon. The analytical methods employed usually fall into three categories; gravimetric, coulometric and thermal optical.
>
> Measuring diesel particulate in underground coal mines presents an exclusive problem. A substantial portion of diesel particulate Elemental Carbon is chemically identical to coal dust and the only physical difference between the two is the particle size. This has led to numerous methods for the measurement of diesel particulate, with some being appropriate for hard rock mines whilst others only for underground coal mines. Diesel particulates can be measured either in the general body of the atmospheric air or in the raw diesel exhaust in the tail pipe. (references omitted)

At present the methods employed for measuring ventilation flows, dust and fumes, including DPM and nDPM are mostly completed (if at all) by the use of archaic instruments and processes. In NSW, the lack of a legislated ventilation competency for open cut coal mines, underground and open cut hard rock mines, has enabled those mine operators to largely self-set and monitor the ventilation risks associated with their operations – and regulators merely review the management systems that operators design and implement.

The introduction into underground coal mines of newer digital technologies has been delayed by the need to render them intrinsically safe. Only recently Australia's first tablet device certified for use in underground coal mines was introduced into the Queensland Moranbah North underground coal mine,[42] enabling communication and information gathering and

[41] Professor Michael Tuck, *Nano Diesel Particulate Matter – A Review*. (Minesafe International 2017, Paper No.44). The Australasian Institute of Mining and Metallurgy, Carlton VIC 3053 Australia, 3.
[42] Venessa Zhou, 'Anglo American pioneers underground tech across QLD operations', *Australian Mining* (online at 29 July 2019) <https://www.australianmining.com.au/news/anglo-american-pioneers-underground-tech-across-qld-operations/>.

sharing below surface. It took five years to develop. This was followed by the introduction of intrinsically safe smartphones and tablets in the Queensland underground coal mine at Carborough Downs.[43] Digital devices will revolutionize all facets of underground coal mining, including mine vent. It is not just the capacity to "remove underground paperwork and transition to electronic storage of statutory and production reports" that is important – but the capacity to include real time digital measuring and recording equipment in underground coal mines will revolutionise mine ventilation practices and procedures. However, these will only migrate across to open cut coal mines, underground and open cut hard rock mines and quarries in NSW with the introduction of a ventilation competency for these resources and mining methods, with mandated ventilation benchmarks. In other words, mine operators usually will only adopt methods and practices mandated by legislation.

As Robert Reich (2008) observed, corporations exist foremostly to make profits. Within a playing field delineated by regulation, they compete with other corporates for personnel, resources and for sales. Their profits are largely determined by the extent to which they minimise their costs. If corporations spend on incentives not mandated by regulation, they are likely to lose a competitive advantage to other corporations that keep costs lower by only meeting regulatory demands. In that regard, hoping that corporations will become willing become 'good corporate citizens' and adopt 'corporate social responsibility' incentives that cost them money and threaten their competitive advantage is somewhat delusional.[44]

6. Controlling DPM and nDPM.

The most effective control mechanism for any hazard is avoidance, by elimination/substitution.[45] The next effective is reduction. Despite the message from the renown W Edwards Deming that "It is wrong to suppose that if you can't measure it, you can't manage it – a costly myth"[46] – the main driver for the reduction of DPM and nDPM is measurement. Whilst you can manage it, even if you can't measure it, mining companies are corporations and tend to look primarily at profit (Reich, 2008).[47] They will ignore any hazards not measured to

[43] Venessa Zhou, 'Fitzroy Australia executes digital planning at Carborough Downs', *Australian Mining* (online at 26 August 2019), <https://www.australianmining.com.au/news/fitzroy-australia-executes-digital-planning-at-carborough-downs/>.
[44] Robert Reich, *Supercapitalism: the transformation of business, democracy, and everyday life*, (Scribe, Carlton North, 2008), 142-194.
[45] Professor Michael Tuck, above N 41, 5.
[46] W. Edwards Deming, *The New Economics for Industry, Government, Education.* (2nd Ed). The MIT Press.
[47] Above N 44.

embarrassing levels and presenting widespread public condemnation. Unfortunately, as shown above, in NSW measuring DPM and nDPM is confined mainly by regulation to underground coal mines with a ventilation competency and mandated ventilation standards. However, these do not apply to open cut coal mines, or open cut and underground hard rock mines and quarries and even with a rigorous desire to measure DPM and nDPM levels, mine operators are not really able to do so with any precision. The measuring equipment needed is just not yet available.

Moreover, if and when that requisite measuring equipment becomes available, there is no guarantee that mine operators will comply with mandated DPM and nDPM regulatory measuring regimes. As the instances shown above demonstrate, mine operators struggle now to comply with the regulatory regimes for dust, blast fumes and other toxic atmospheric hazards affecting mines sites. Risk Assessment just don't seem sufficient. Whilst there are few Australian studies evaluating the "gap" between the conditions set in regulatory approvals for resource projects and the subsequent compliance with those approvals and regulatory regimes, the experience in New Zealand suggests that the gap is acute.[48] The Report of the Parliamentary *Inquiry into the re-identification of Coal Workers' Pneumoconiosis in Queensland* suggests not merely a compliance gap, but grave regulatory capture.[49] Moreover, the report observes that: "The sampling technology used in gravimetric personal dust monitors has remained largely unchanged since the 1960s",[50] and that: "No person or entity has ever been prosecuted in Queensland for failing to meet a health and safety obligation in relation to respirable dust".[51] The Parliamentary Committee did not appear to accept that this meant that there were no instances of noncompliance that could be prosecuted.

Is there another choice? Professor Michael Tuck observes that:[52]

> Within the hierarchy of controls the most effective method is elimination/substitution. For this to be the case there needs to be an alternative to diesel powered vehicles. Two such options exist, electrical drive vehicles (either cable or battery) which is existing technology, or fuel cell technology which is a developing technology. Plans are underway to make mines all electric, an example here being Goldcorp’s plan to use battery powered equipment at its proposed Borden

[48] Marie Brown, Bruce D Clarkson, Barry J Barton and Chaitanya Joshi, 'Ecological compensation: an evaluation of regulatory compliance in New Zealand', (2013) 31 (1) *Impact Assessment and Project Appraisal* 34.
[49] Coal Workers’ Pneumoconiosis Select Committee, Parliament of Queensland, *Inquiry into the re-identification of Coal Workers' Pneumoconiosis in Queensland* (Report No. 2, 55th Parliament, May 2017) 251.
[50] Ibid 127.
[51] Ibid 130.
[52] Professor Michael Tuck, above N 41, 5.

> development in Ontario Canada, Batten (2016). These are options worth pursuing, however electric powered vehicles do not currently offer the flexibility of diesel power across the whole range of mining methods.
>
> Engineering controls are applicable to the control of both DPM and nDPM. Examples here include:
> 1. Application of existing remote or tele remote technologies to remove operators from proximity to the diesel exhaust emissions
>
> …

Firstly, it should be noted that apart from the plant, machinery and equipment used in the initial construction of mines, most of the plant, machinery and equipment used in underground coal mining for development or production is electric. No diesels. No DPM or nDPM. The continuous miners, shuttle cars, continuous haulage, longwalls, conveyers, bolters, ventilation fans and equipment and all other equipment are all electric. It is proven technology and could be mandated for use in all underground hard rock mines.

As for open cut coal and hard rock mines and quarries, the remote or tele-remote technologies of which Professor Tuck speaks, which remove operators from proximity to diesel exhaust emissions,[53] are now also widely used and proven technologies.

Rio Tinto are acknowledged as the industry leader in remote and tele-remote technologies employing Autonomous Haulage Systems (AHS), with a fleet of AHS trucks and loaders operated on mine sites in the Pilbara from remote access facilities in Perth,[54] Automated Drilling Systems (ADS), and AutoHaul® automating the trains transporting the iron ore to port facilities – all operating since 2017. There are plans to extend the technology to all their operations.[55] BHP is very much chasing the leader and playing 'catch-up' on ADS, which presents Rio Tinto with a competitive advantage. However, the competitive advantage Rio Tinto enjoys is not merely based on ADS, but upon the integration of ADS into its business systems.[56] And it reduces costs. A report by McNab et al (2013) based on conversations with

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[53] Ibid.
[54] Rio Tinto, *Mine of the Future™*, (2019) < http://www.riotinto.com/australia/pilbara/mine-of-the-future-9603.aspx>
[55] Len Dodgson, 'Rio Tinto: rolling out the world's first fully driverless mines', *Mining Technology* (online at 31 March 2016) <http://www.mining-technology.com/features/featurerio-tinto-rolling-out-the-worlds-first-fully-driverless-mines-4831021/>.
[56] Karen McNab, et al, 'Exploring the social dimensions of autonomous and remote operation mining: Applying social licence in design' *Prepared for CSIRO Minerals Down Under Flagship, Mineral Futures Collaboration*

industry representatives, concluded that the introduction of fully ADS fleets could result in a 30 to 40 percent reduction in the workforce of a typical open-cut iron ore mine.[57] Robert Reich would be so pleased!

But it is not only Rio Tinto and BHP chasing automation to save costs. Removing personnel from underground hazardous working areas was cited as by Northparkes Mine as one reason for their adoption of fully automated underground load/haul technologies, which have been successfully employed since 2013.[58] Operator CMOC now run one of the most fully automated underground copper/gold mines in the world.[59]

Why don't all underground mines use electric plant, machinery and equipment or if diesel, utilize it by remote or tele-remote technologies? Answer: they don't have to.

7. A Critique of the Discussion Paper.

Two matters appear to be glossed over in the Discussion Paper.[60]

1. The human body cannot deal with nDPM from the newer tier-one engines. It goes straight into the blood stream and is more dangerous than the sooty black stuff from tier-four engines (with which the human body can better cope). Everyone in contact with nDPM will have an adverse health impact.

2. Those mines that have eliminated diesel-powered machinery from underground in favour of an electric powered fleet have found that years later they still record excess levels of DPM. It sticks like a gooey semi-fluid in underground drives and workings and is liberated and disturbed every time personnel or a vehicle transverses the area, swirling around like in a vortex, before settling on everything and everyone.

Cluster, by the Centre for Social Responsibility in Mining and the Minerals Industry Safety and Health Centre, Sustainable Minerals Institute, The University of Queensland, Brisbane (2013), 8.

[57] Ibid, 16.

[58] NSW Mining, 'Focus on safety at Northparkes Mines, following the 1999 airblast disaster', *YouTube* (online at 16 May 2014) < https://www.youtube.com/watch?v=5A7u6lgl8b0>.

[59] CMOC, *The Northparkes Difference* (2019) < http://www.northparkes.com/>.

[60] NSW Resources Regulator, 'Public consultation - Diesel Particulate Exposure Standard for NSW mines' (Discussion Paper, August 2019) <https://www.resourcesregulator.nsw.gov.au/__data/assets/pdf_file/0007/1154464/Discussion-Paper-Diesel-particulate-exposure-standard-for-NSW-Mines.pdf>.

8. Submissions and Recommendations.

Whilst this submission generally applauds the proposed new standards and regulations for mining, oil and gas sites, it recommends that diesel powered plant, machinery and equipment be totally prohibited in underground mine workings for development and production where personnel are working.

For open cut mines, quarries and oil and gas sites, the new standards will theoretically be a great incentive. However, measuring DPM and nDPM will still present a challenge and the NSW Resource Regulator may need to mandate the type of measuring equipment that needs to be employed by resource sites to measure DPM and nDPM, and to design a DPM and nDPM Management System that sets by regulation the frequency of measurements and the reporting of these measurements. Penalties for noncompliance need to be mandated and monitoring, assessment and enforcement actions by the Resources Regulator will need to be proactive and effective. Sites should not be permitted to largely self-regulate.

For the operators of underground mines, there should be two main choices:

3. If diesel powered, the plant, machinery and equipment must be controlled and operated by remote or tele-remote technologies.

4. If not controlled and operated by remote or tele-remote technologies, the plant, machinery and equipment must be electric.

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