

POSITION PAPER

# PREVENTING FIRES ON MOBILE PLANT

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (October 2019). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the NSW Department of Planning and Environment or the user's independent advisor.

## Regulator's position

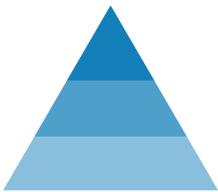
The NSW Resources Regulator's position is that all fires on mobile plant are avoidable and preventable and the Regulator will be taking a zero-tolerance approach where mine operators have not taken appropriate steps to manage this risk.

*"All fires on mobile plant are avoidable and preventable."*

Fires on mobile plant are inherently dangerous. They impact on the safety of workers and have potentially catastrophic consequences. Despite a focus on the issues in recent years, the number of incidents remains unacceptably high and without further action, the number of fires occurring on mobile plant will continue to be elevated.

The Regulator is committed to working with industry to ensure health and safety obligations are being met to reduce the number of fires on mobile plant and to prevent potentially catastrophic events. To achieve these goals, we have adopted the following position and expectations:

## Industry actions



### Hierarchy of controls and risk assessments

- Mine operators must undertake rigorous fire risk assessments and, wherever practical, seek to eliminate the hazard, such as potential fuel and ignition sources.
- Operators must not merely rely on fire suppression and detection systems, which are mitigation controls and do not eliminate or minimise the risk of a fire occurring.
- Identified controls must be effectively implemented and regularly monitored.



### Fire resistant fluids

- The use of suitable fire-resistant fluids must be considered by mine operators (where available).
- While currently there may be limited availability of suitable fluids, mine operators must continually test the market to identify when suitable products become available.



## Surface temperatures

- Mine operators and equipment manufacturers must implement engineering solutions to control surface temperatures, so far as is reasonably practicable.
- Controls such as turbo lagging, double skinned exhaust and water jacketed turbo and exhausts must be considered as part of this process.



## Non-metallic materials

- The use of non-metallic materials that burn and produce toxic emissions must be eliminated or minimised on all mobile plant.



## Maintenance practices

- Stringent monitoring and quality control of maintenance and repair activities must be undertaken to prevent fires on mobile plant.
- Sufficient time and resourcing must also be allocated to maintenance and repair tasks.

## Regulator actions



### Escalated regulatory approach

- All fires that occurs on mobile plant on a mine site in NSW will be subject to heightened assessment and investigation.
- Investigation inquiries will specifically examine the mine operator's consideration and application of the matters identified in the above industry actions.
- Where a mine operator has not taken appropriate steps to manage the risk of fires on mobile plant, escalated enforcement action will be taken.



## Data

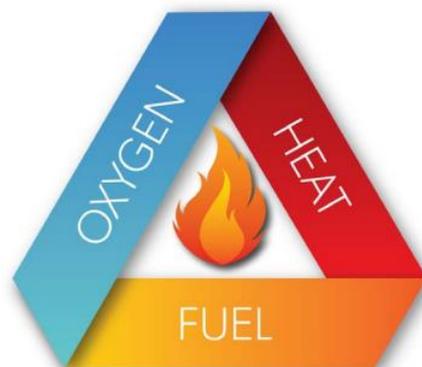
- We will regularly publish reports, including data on mobile plant fires, and will continue to report to industry on causal factors and include further categorisation of fires including location, proximity to operator, egress and fuel load.
- Mobile fleet censuses will be conducted regularly to improve the quality of the data collected.
- Amendments will be sought to legislative reporting requirements to require all fires on mobile plant to be reported to the Regulator.



## Advice and guidance

- We will facilitate workshops with mine operators and plant and fluid designers, manufacturers, suppliers and importers to facilitate further detailed discussion and problem solving with industry on the persistence of fires on mobile plant.
- As a matter of course, we will revise or redistribute guidelines and technical references for industry on best practice for reducing the risk of fires on mobile plant.

*Effective reduction of fires on mobile plant should address both fuel and heat.*



# 1. Introduction

The Regulator has been focussed on compliance and enforcement activities relating to fires on mobile plant. We are committed to working with industry to ensure health and safety obligations are being met, to reduce the number of fires on mobile plant and to prevent potentially catastrophic events. Working closely with the mining industry, we are proactively involving Original Equipment Manufacturers (OEMs), engineers and maintenance personnel to identify solutions. However, the number of incidents remains unacceptably high and without further action, the number of fires occurring on mobile plant will continue to rise.

A 2017 review of data on notified incidents identified an increase in the reported number of fires over time from 3.1 per month in 2008 (MDG 1032) to 8 per month (97 over 12 months) in the period between May 2016 and May 2017. This number does not consider any changes in reporting requirements introduced by changes to legislation.

Consistently high numbers of notifications of fires on mobile plant prompted us to implement a priority project of planned and targeted assessments of mine sites across NSW. An ongoing compliance program is underway to ensure that the risk of fires on mobile plant is being managed appropriately.

Increased inspections and assessments have focussed the attention of mine sites on reducing mobile plant fires. Data from 2018 reveals a slight reduction in fires, with NSW mines and quarries reporting 104 fires on mobile plant during 2018, compared with 112 fires reported in 2017. However more needs to be done to reduce the risks.

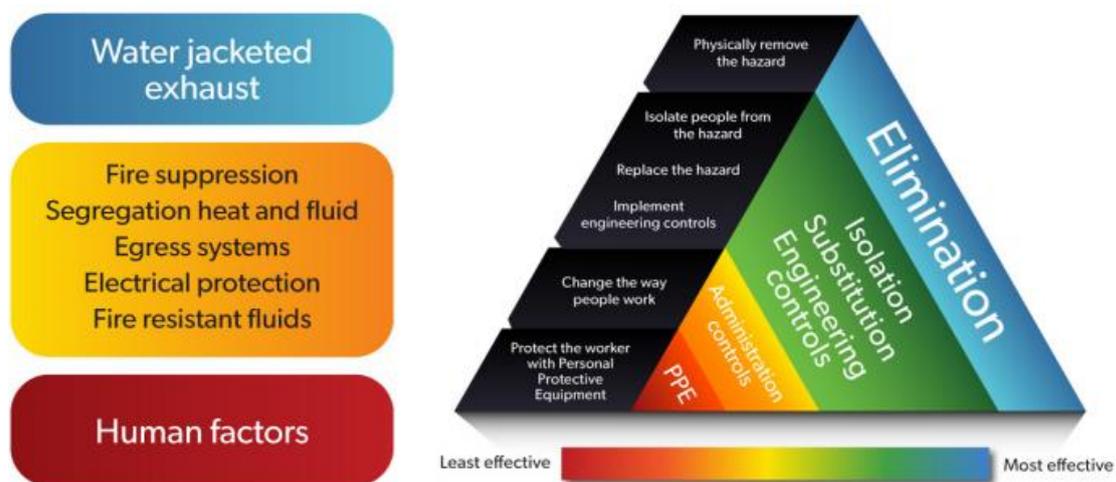
In August 2018, we released the Preventing fires on mobile plant discussion paper seeking feedback from the mining industry on the use of fire-resistant fluids and surface temperature-controlled engines. We received 29 submissions from a range of stakeholders including mine operators, fluid manufacturers and suppliers, equipment manufacturers and suppliers, industry groups as well as the Construction, Forestry, Maritime, Mining and Energy Union. All submissions have been considered in the development of this position paper.

## 2. Legislative requirements

A fire or explosion at a mine site can have catastrophic consequences, which may result in serious injuries or death, as well as substantial damage to property and business disruption.

In this respect, mine operators have legislative responsibilities to ensure the health and safety of workers on mine sites, so far as is reasonably practicable. In the hierarchy of risk control, wherever practical, the hazard, such as potential fuel and ignition sources, should first be eliminated. If elimination is not possible, the fuel and/or ignition source should be substituted with a less hazardous one.

Figure 1 Example of control measure hierarchy



Under the Work Health and Safety (Mines and Petroleum Sites) Act 2013, NSW mines are also required to notify the Regulator of incidents resulting in a fire on mobile plant. The term 'mobile plant' refers to powered mobile plant as defined in the Work Health and Safety Regulation 2017 (NSW):

*Powered mobile plant: Any plant that is provided with some form of self-propulsion that is ordinarily under the direct control of an operator.*

### 3. Position in relation to specific controls

In consideration of the research and ongoing assessments, we believe that control measures such as heat shielding, segregation of fluids from hot surfaces, the use of fire-resistant or less flammable fluids and minimising the use of flammable non-metallic components, must be considered when identifying risk controls to minimise harm to workers, mining operations and the environment.

Mine operators and mobile plant operators should also pay special attention to safety and maintenance of plant.

#### Fire-resistant fluids

##### Issue

Fuel, lubrication and hydraulic fluids are potential fuel sources for fires. Of the 114 fires reported in 2017, 80 were due to the release of a fluid, of which 37 fires were attributed to the release of hydraulic fluid. As these fluids cannot be eliminated, the use of fire-resistant fluids to replace mineral oil in hydraulic systems may serve to reduce the frequency and intensity of fires on mobile plant.

##### Stakeholder views

Several submissions, obtained through the stakeholder consultation period in 2018, stated there is currently no suitable fire-resistant hydraulic fluid available for use on plant operating on surface and underground metalliferous mines, and that while testing is underway, a suitable fire-resistant has not yet been released. Conversely, stakeholders also noted that although currently available fire-resistant fluids may be suitable for low pressure, low temperature environments, there is no suitable fire-resistant fluid or HFDU that can be substituted for mineral oil, for use in high pressure, high temperature environments. Research and development are underway to develop a fire-resistant fluid for use in high temperature, high pressure environments. However, the product has not met testing criteria to date.

Some stakeholders expressed concerns that fire-resistant fluids, which are not approved by OEMs, may pose performance and safety issues with brakes, steering and hydraulic hoist systems.

Stakeholders feedback also highlighted concerns with the cost of fire-resistant fluids, which is significantly higher than mineral oil. The costs of transitioning to fire-resistant fluids, increased condition monitoring, potential reduction in fluid life, total life cycle costs, availability of the bulk quantities required, and fluid storage and management requirements, also needed to be calculated.

Several stakeholders expressed a view that based on incident data, there was no case for a change to fire-resistant coolants, because the risks to people and assets is minimal and managed by on-board suppression systems.

OEMs generally only recommend glycol-based coolants. Some submissions noted that product trials and validation of performance in surface mining applications are not widely available. Concern was raised that the use of unapproved coolants may lead to engine failure.

### Our position

We are aware that fire-resistant fluids have been developed for mining where the risk of fire is high, particularly in underground environments. We expect that fire-resistant fluids are considered by mine operators for use where suitable fluids are available, to mitigate the severity of fire events where surface temperature is not controlled, especially in underground environments.

## Surface temperatures

### Issue

Engine exhaust surface temperatures and hot electrical joints contribute to fires on mobile plant in open cut and underground metalliferous mines, accounting for 69% of heat sources in reported fires in 2017.

### Stakeholder views

While many OEMs are working on limiting surface temperatures, it is understood that extensive design, production and testing is needed before modifications or new designs are implemented. Adverse and unintended consequences may arise from such implementation if assessment, testing and change management is less than adequate.

Stakeholder submissions indicated that shielding, such as turbo lagging, double skinned exhaust is implemented where practical to reduce surface temperatures. Water jacketed turbo and exhausts are not widely available and not widely used in NSW mines (other than underground coal mines).

Respondents indicated that retrofitting water jacketing to engines may not always be possible due to the constraints within the engine bay. Retrofitting would have significant implications for the design, including cooling capacity and emission control. Not all suppliers provide marine engine configurations. Marine engines are not retrofittable because they differ in configuration and their ability to be integrated into chassis and powertrains.

### Our position

Mine operators and equipment manufacturers are required to implement engineering solutions to control surface temperatures, so far as is reasonably practicable.

Notwithstanding generally lower power ratings, and potentially lower duty cycles, surface temperature control has been demonstrated to mitigate the risk of fires on mobile plant in underground coal mines. Reduction of surface temperatures may eliminate or reduce the ignition and heat source, when a combustible fluid escapes containment.

## Maintenance and safety inspections

### Issue

Arising from a review of incident data and assessment outcomes, it is considered that sub-standard maintenance and repair practices have a significant impact on the fire safety of vehicles on mine sites. Issues include fluids not being sufficiently cleaned and porous materials being soaked in flammable liquid, leading to fires when the plant is put back into service

### Our position

Stringent monitoring and quality control of maintenance and repair activities should be undertaken to prevent fires on mobile plant. Sufficient time and resourcing must also be allocated to maintenance and repair tasks. We have implemented a targeted assessment program on plant maintenance and fire prevention for high-risk sites (focussing on underground metalliferous mines and surface mines with a high incidence of fires on mobile plant). The outcomes of this program have informed the development of this position paper.

We will increase risk-based interventions and continue to use existing regulatory tools relating to maintenance practices and fire control measures, to ensure health and safety obligations are being met. This includes issuing notices and penalties, with a zero-tolerance approach to sub-standard maintenance practices and failures to control risks.

## Hierarchy of controls and risk assessments

### Issue

We believe the current approach to undertaking fire risk assessments is inadequate. Fire risk assessments should be rigorous and identified controls should be effectively implemented and regularly monitored.

### Stakeholder views

Many mine operators have processes in place intended to extensively assess the safety of mobile plant before it is placed into service. Failure Modes, Effects and Criticality Analysis (FMECA) are also undertaken on mobile plant to assess risks associated with equipment to develop effective maintenance strategies for specific equipment.

### Our position

Mobile plant must be rigorously assessed in relation to the risk of fire, including consideration of the flammability of non-metallic components, the toxic products of combustion, location of flammable components relative to heat sources, fire suppression systems and location of hand-held extinguishers. A fire risk assessment should include an assessment of material quantities, flammability characteristics, and in the event of a fire, the heat release rate and toxicity of products of combustion.

A comprehensive introduction to site processes, developed and overseen by qualified and experienced engineers, is an essential control to ensure mobile plant is safe to operate and fit for purpose, improving safety and reliability.

We are aware that many mine operators have processes in place intended to extensively assess the safety of mobile plant before it is placed into service. Failure Modes, Effects and Criticality Analysis (FMECA) are also undertaken on mobile plant to assess risks associated with equipment to develop effective maintenance strategies for specific equipment.

OEMs, designers and suppliers should develop solutions to address the persistence of fires on mobile plant, to ensure they are meeting their obligations under the work health and safety legislation. We will develop a compliance program to establish whether designers, manufacturers, suppliers and importers are fulfilling their Work Health and Safety Act 2011 PCBU duties in relation to fire risk analysis on plant being used in the NSW mining industry.

Notwithstanding concerns over the reliability of some types of systems, fire suppression and detection systems are considered a critical mitigating control. In reviewing an incident notification, we will consider whether the mine operator has assessed whether the installed system performed effectively and, where such a system is not installed, follow up with the mine operator as to why this is the case.

## Non-metallic materials

### Issue

The use of non-metallic materials and components can add to the fuel load and intensity of fires on mobile plant. While the use of these products has largely been eliminated in underground coal mines, they are still commonly used in other underground mines.

### Our position

The use of non-metallic materials that burn and produce toxic emissions should be eliminated or minimised on mobile plant.

MDG 15 provides guidance on fire prevention and protection for mobile plant, including specific considerations for fire risk assessments and the use of fire-resistant materials for covers and guards. MDG 3608 also provides guidance for use of non-metallic materials in underground coal mines, and shows test methods that establish flammability, ignitability and toxicity. Fire suppression systems should be able to extinguish non-metallic materials if such materials are utilised.

## 4. Regulator actions

### Escalated regulatory approach

All fires that occur on mobile plant on a mine site in NSW will be subject to heightened assessment and investigation. Investigation inquiries will specifically examine the mine operator's consideration and application of the matters identified under industry actions (refer to page 2).

Where a mine operator has not taken appropriate steps to manage the risk of fires on mobile plant, escalated enforcement action will be taken.

### Data

We will regularly publish reports, including data on mobile plant fires, and will continue to report to industry on causal factors and include further categorisation of fires including location, proximity to operator, egress and fuel load. Mobile fleet censuses will be conducted regularly to improve the quality of the data collected.

### Advice and guidance

We provide advice and guidance about fire prevention and maintenance to support industry in understanding its obligations in relation to preventing fires on mobile plant.

We will facilitate workshops with mine operators and plant and fluid designers, manufacturers, suppliers and importers to facilitate further detailed discussion and problem solving with industry on the persistence of fires on mobile plant.

As a matter of course, we will revise and/or redistribute guidelines and technical references for industry on best practice, to help reduce the risk of fires on mobile plant.