NSW GOVERNMENT

NSW Resources Regulator

FIRES ON MOBILE PLANT

January – March 2021

NSW Resources Regulator

Document control

Published by NSW Resources Regulator
Title: Fires on mobile plant, January – March 2021
First published: September 2021
Authorised by: Chief Inspector
CM9 reference: DOC21/526820

AMENDMENT SCHEDULE

Date	Version	Amendment
September 2021	1.0	First published

Contents

Overview

In FY 2021 Q3, there were:

NOTIFIED INCIDENTS 52

INCREASE OF 4 FROM 48 Q2 FY 2021

- **38** Surface coal (73%)
- **11** Underground metals (21%)
- **1** Underground coal (2%)
- **1** Construction materials (2%)
- **1** Mineral sands (2%)

Incidents classified against a material unwanted event (MUE) - fire or explosion

MUE		Most common threat with failed critical control		Most common failed critical control
Surface 44	21 of 44	Accumulated flammable leaks and spills	21 of 44	Flammable fluid containment
Underground 8	6 of 8	Mechanical energy in the presence of fuel	4 of 8	Minimise friction and control hot surfaces

Ancillary reports summary

- Heat source **38%** TURBO
- Fuel source **25%** ENGINE OIL
- Failed component **27%** HOSE
- Extinguished by **40%** HAND-HELD FIRE EXTINGUISHER

Executive Summary

This report has been prepared by the NSW Resources Regulator for the NSW mining industry, original equipment manufacturers and suppliers. It contains quarterly data of notified incidents involving fires on mobile plant (FOMP) for the period 1 January 2021 to 31 March 2021.

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

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 high. 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.

Quarterly data for the period 1 January 2021 to 31 March 2021 identified the following:

- there has been an 8% increase in total FOMP incident notifications this quarter
- for the past five quarters the proportion of mobile plant fires occurring on the surface has been 80% or higher
- accumulated flammable leaks and spills remain the highest threat line for fire and explosion on the surface, accounting for nearly half of mobile plant fires at the surface this quarter
- the most common combination for heat source and fuel source has been 'turbo' and 'engine oil' for the last three quarters, and accounting for 15% of all FOMP notifiable incidents this quarter
- hoses were identified to be the most common failed component this quarter, being attributed to 14 mobile plant fires
- a hand-held fire extinguisher was identified to be the most common form of extinguishment this quarter, being used in just over 40% of mobile plant fires.

Significant incidents

March 2021 - IncNot0039384

A worker was backfilling a chute on the surface part of the mine's stockpile area using a Caterpillar 336D excavator when they heard a loud bang. The worker observed a flash of light as the engine bay exploded into flames.

The fire brigade was called and the excavator was extinguished.

The excavator was extensively damaged, however, the investigation identified sufficient evidence to support the cause of the fire as a failure of the hydraulic system.

Figure 1: Excavator fire damage

This incident is a reminder of the importance of quality maintenance and inspection work in the prevention of premature failure of components.

March 2021 – IncNot0039430

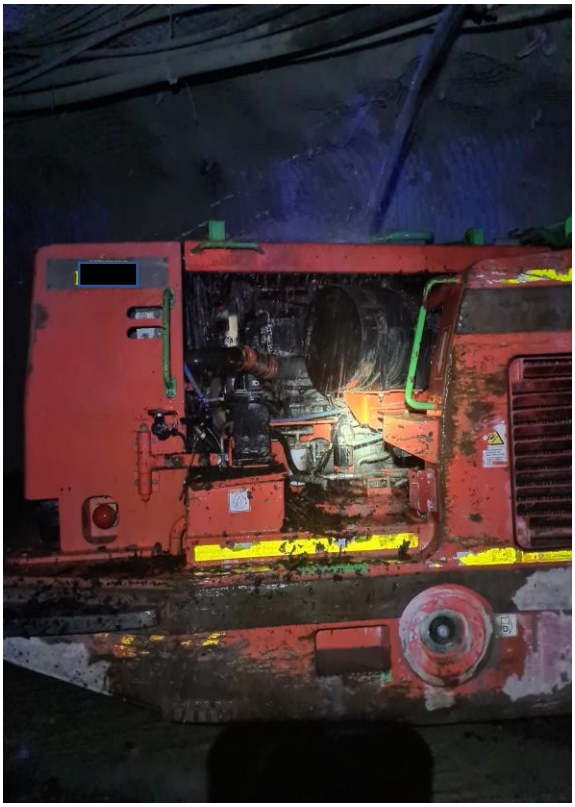
A worker was operating a Sandvik LHD loader in the underground production level of a metalliferous mine when the worker observed flames coming from the engine bay. The worker stopped the machine and used the onboard fire suppression system and a hand-held fire extinguisher to put out the fire.

The mine identified that a brake cooling hose had been rubbing on the adjacent steel pipe causing the hose to fail and spray oil into the engine bay compartment.

This incident is a reminder of the importance of quality maintenance and inspection work in the prevention of premature failure of components.

Additionally, for this type of incident where a fuel source is sprayed over the engine, hot surface protection or fire-resistant fluids are the only preventative controls available.

Figure 2: Loader fire location and damage



Notified incidents

Notified incidents for January 2019 to March 2021

The chart below relates to incidents involving fires on mobile plant notified to the Regulator each month since January 2019. The two trend graphs below represent the periods before and after this amendment took place. While notifications in March 2021 were up five from 16 in February, an overall steady trend in notifications can be seen since the legislation was amended in February 2020.

In February 2020, amendments to the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 saw a change to the duty to notify all incidents involving fires on mobile plant (see Annexure A).

Note that the information in this report is based on the date the incident occurred rather than the date the incident was notified to the Regulator.

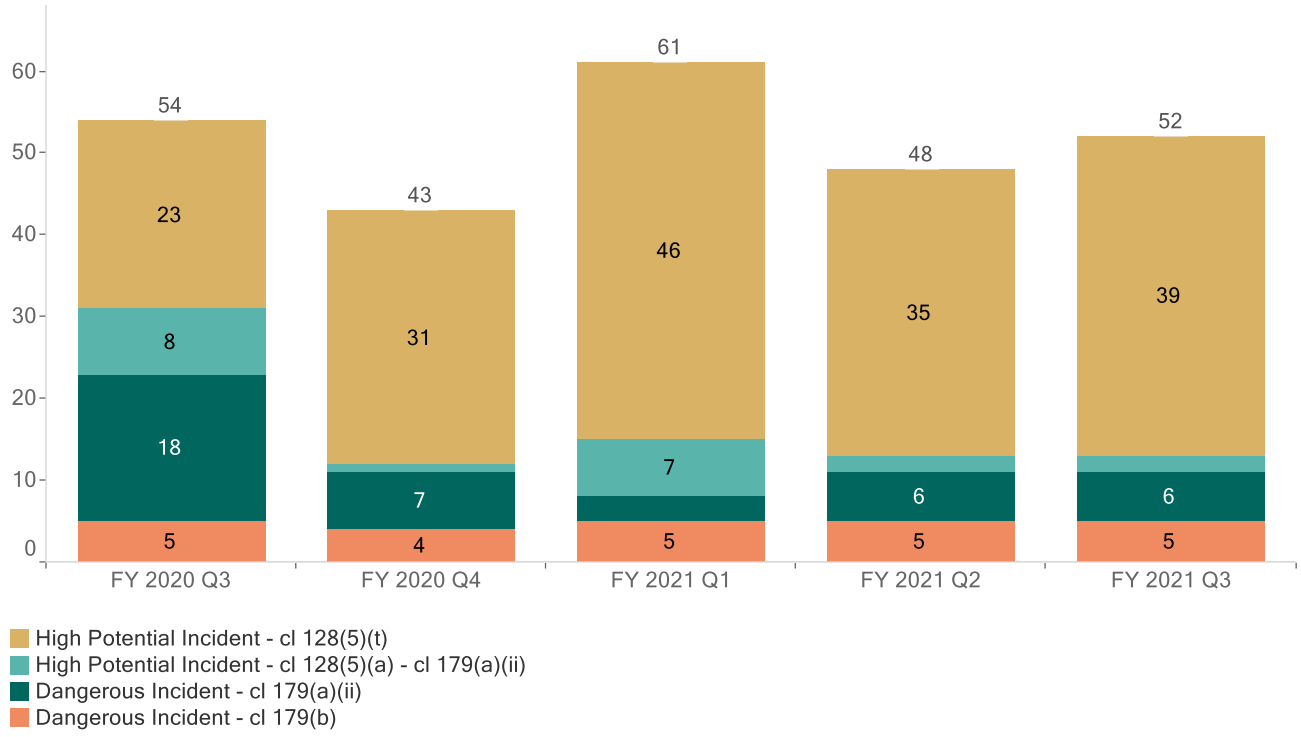
Figure 3: Notified incidents from 1 January 2019 to 31 March 2021

Notified incidents by legislative requirement to report

The below chart highlights the number of notified incidents recorded by the legislative requirement to report.

The inclusion of clause 128(5)(t) to the Work Health and Safety Regulation 2014 occurred during FY2020 Q3 (see Annexure A). This is reflected in the higher number of incidents reported under 179(a)(ii) for that quarter.

Figure 4: Notified incidents by legislative requirement to report for 1 January 2020 to 31 March 2021



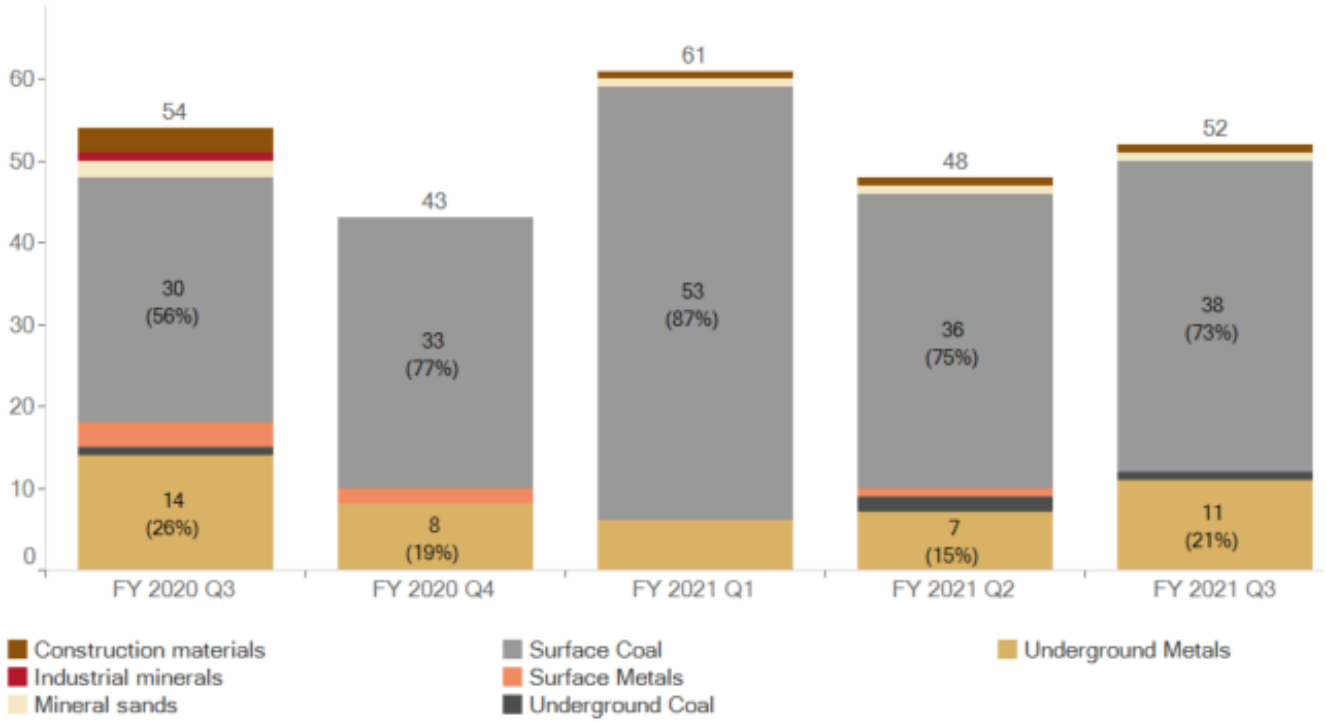
Notified incidents by mine and operation type

The below chart shows the number of notified incidents by mine type and operation type.

Surface coal remains subject to the highest number of notified incidents, being 73% of notified incidents for this quarter.

There has been an increase in notified incidents occurring at mines categorised as underground metals, increasing from 15% of total notifiable incidents in FY 2021 Q2 to 21% of total notifiable incidents this quarter.

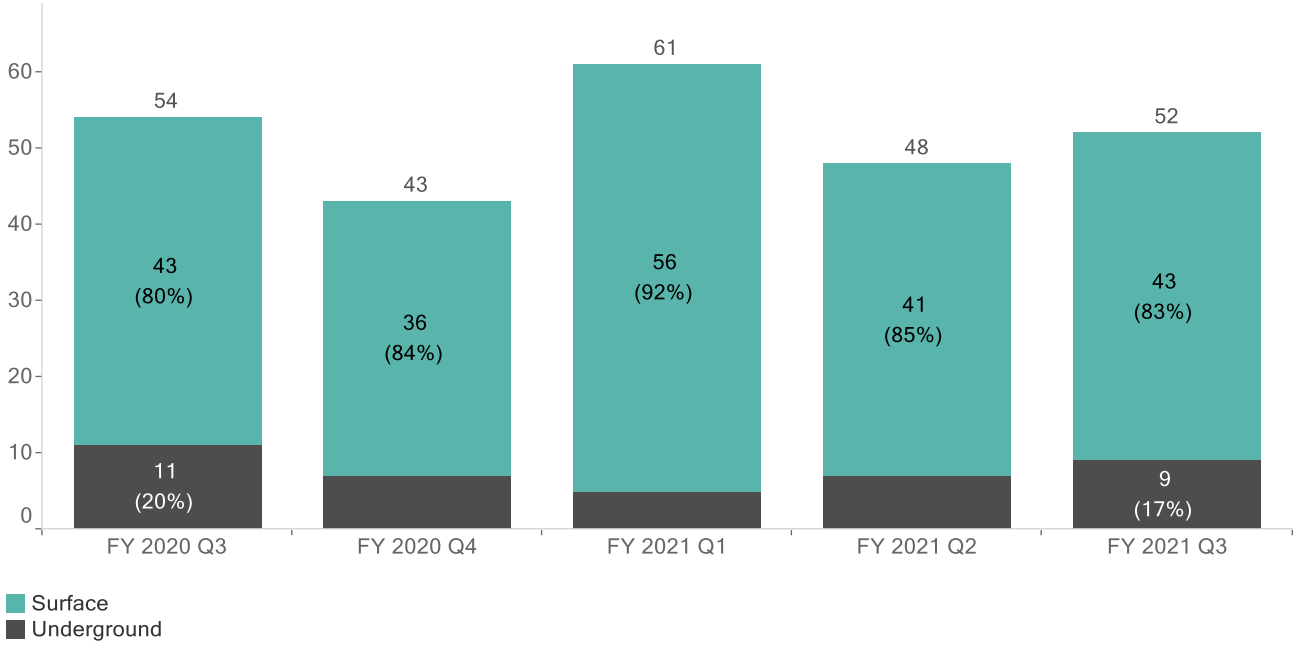
Figure 5: Notified incidents by mine and operation type for 1 January 2020 to 31 March 2021



Notified incidents by primary location

The below figure shows that the actual location of FOMP incidents, irrespective of the mine operation type, typically occurs on the surface rather than underground. For the past five quarters the proportion of mobile plant fires occurring at the surface has been 80% or higher. Additionally, the trend of increasing fires underground is of concern.

Figure 6: Notified incidents by primary location for 1 January 2020 to 31 March 2021



Notified incidents by mine type, operation type and incident location

Table 1: Notified incidents by mine type, operation type and incident location from 1 January 2020 to 31 March 2021

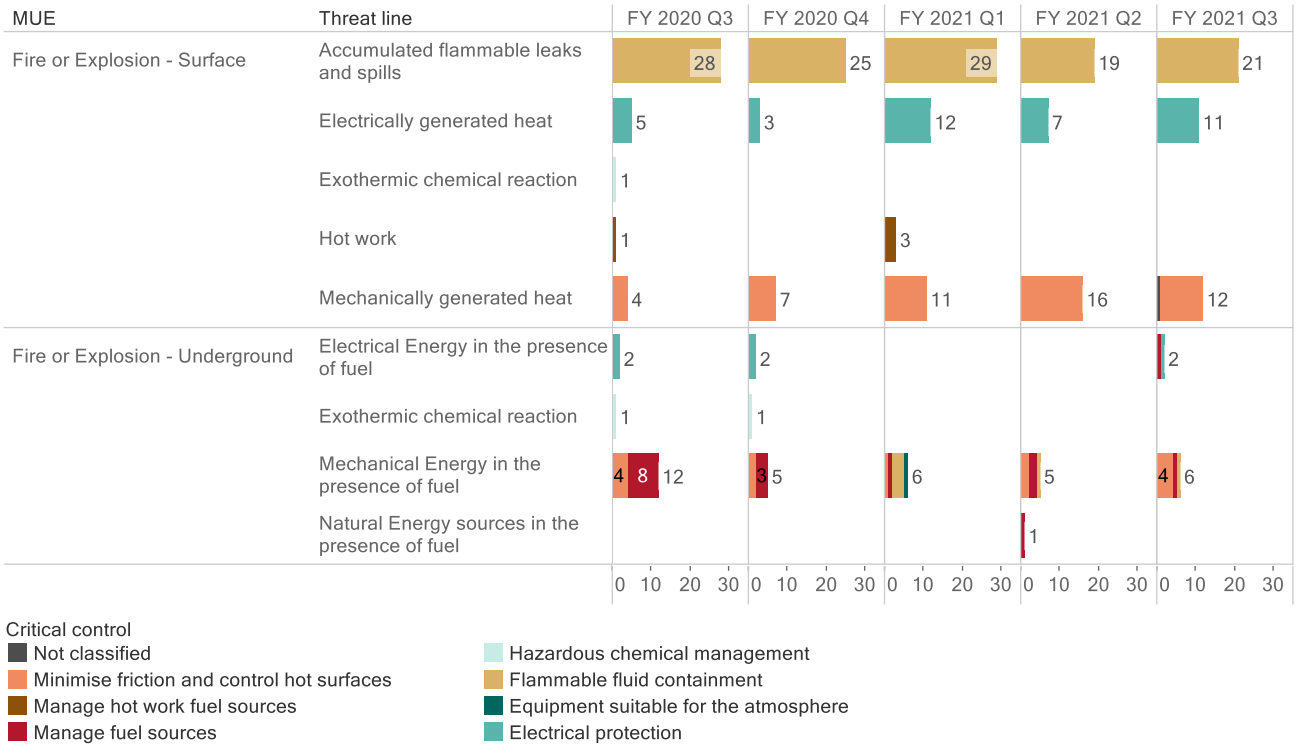
MINE TYPE / OPERATION TYPE / INCIDENT LOCATION	FY 2020 Q3	FY 2020 Q4	FY 2021 Q1	FY 2021 Q2	FY 2021 Q3	GRAND TOTAL
Coal / Surface / Surface	30	33	53	36	38	190
Coal / Underground / Surface	1			1	1	3
Coal / Underground / Underground				1		1
Metals / Surface / Surface	3	2		1		6
Metals / Underground / Surface	3	1	1	1	2	8
Metals / Underground / Underground	11	7	5	6	9	38
Mineral sands / Surface / Surface	2		1	1	1	5
Construction materials / Surface / Surface	3		1	1	1	6
Industrial materials / Surface / Surface	1					1

Classified notified incidents by hazard, threat and critical control

Hazard management bowties are a widely used risk management tool that incorporate preventative and mitigating controls onto threat lines that relate to a material unwanted event (MUE). The Regulator uses MUE bowtie frameworks when proactively assessing how mine sites manage their principal hazards and since October 2019, these MUE bowtie frameworks have also been used to classify notified incidents. Classifications highlight increased areas of risk at the hazard, MUE, threat and critical control level.

The below chart shows notified incidents classified by MUE, threat and critical control.

Figure 7: Notified incidents by MUE, threat and critical control for 1 January 2020 to 31 March 2021

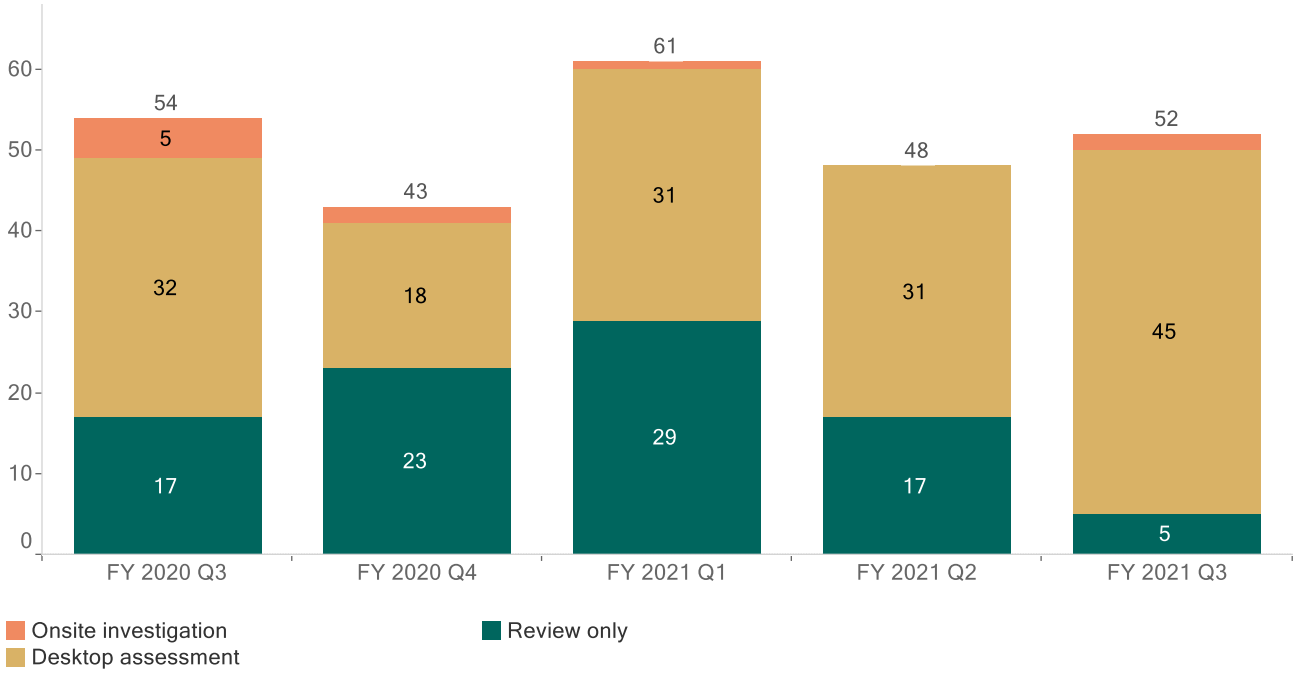


Our response to notified incidents involving FOMP

As part of the Regulator's position paper on preventing fires on mobile plant, all fires that occur on mobile plant are preventable. For each incident reported, it is assessed and the outcomes reviewed. This may involve an inspector attending the mine (onsite investigation) or a review of the investigation findings and actions (desktop assessment).

The chart below shows that for this quarter there were two onsite investigations and 45 desktop assessments conducted in response to notified incidents involving fires on mobile plant.

Figure 8: Notified incidents by response level for 1 January 2020 to 31 March 2021



Fires on mobile plant ancillary reports

When an incident involving fires on mobile plant is notified to the Regulator, additional information, known as an ancillary report, must be submitted via the Regulator Portal no later than 30 days after the incident was required to be notified.

Ancillary reports – combination heat/fuel sources

Data for heat sources and fuel sources for FOMP notifiable incidents this quarter indicates that the turbo heat source category and engine oil fuel source category combined for eight out of 52 incidents (15%). The second most common combination this quarter was electrical component and electrical wiring, accounting for six out of 52 incidents (12%).

Figure 9: Ancillary reports - fuel sources combined with heat sources, for 1 January 2021 to 31 March 2021

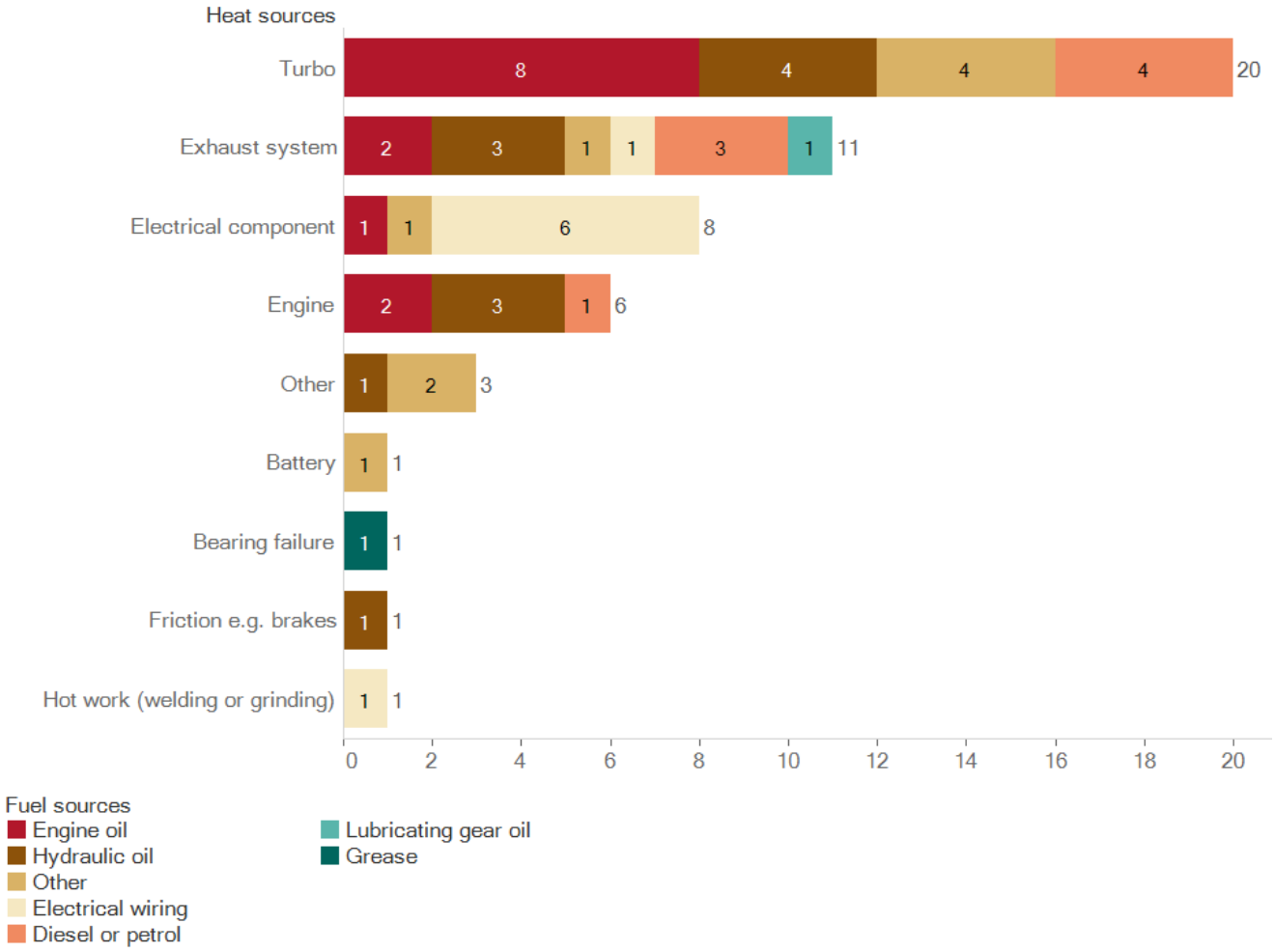


Table 2: Ancillary reports – fuel sources combined with heat sources, for 1 January 2020 to 31 March 2021[1]

HEAT SOURCE + FUEL SOURCE	FY 2020 Q3	FY 2020 Q4	FY 2021 Q1	FY 2021 Q2	FY 2021 Q3	GRAND TOTAL
Turbo + Engine oil	2	3	10	8	8	31
Exhaust system + Hydraulic oil	4	9	8	4	3	28
Turbo + Hydraulic oil	6	6	6	3	4	25
Electrical component + Electrical wiring	2	2	7	6	6	23
Exhaust system + Engine oil	3	5	3	3	2	16
Turbo + Other	5	2	2	1	4	14
Exhaust system + Diesel or petrol	2	1	4		3	10
Exhaust system + Other	2	1	2	4	1	10

[1] 10 or more incidents since 1 January 2020

Ancillary reports – extinguished by

The below charts show that a hand-held fire extinguisher remains one of the highest recorded methods of extinguishment. The second highest method of extinguishment this quarter is recorded as a manually deployed fire protection system, recorded in 15 notified incidents of fire on mobile plant.

Figure 10: Ancillary reports - extinguished by, for 1 January 2021 to 31 March 2021

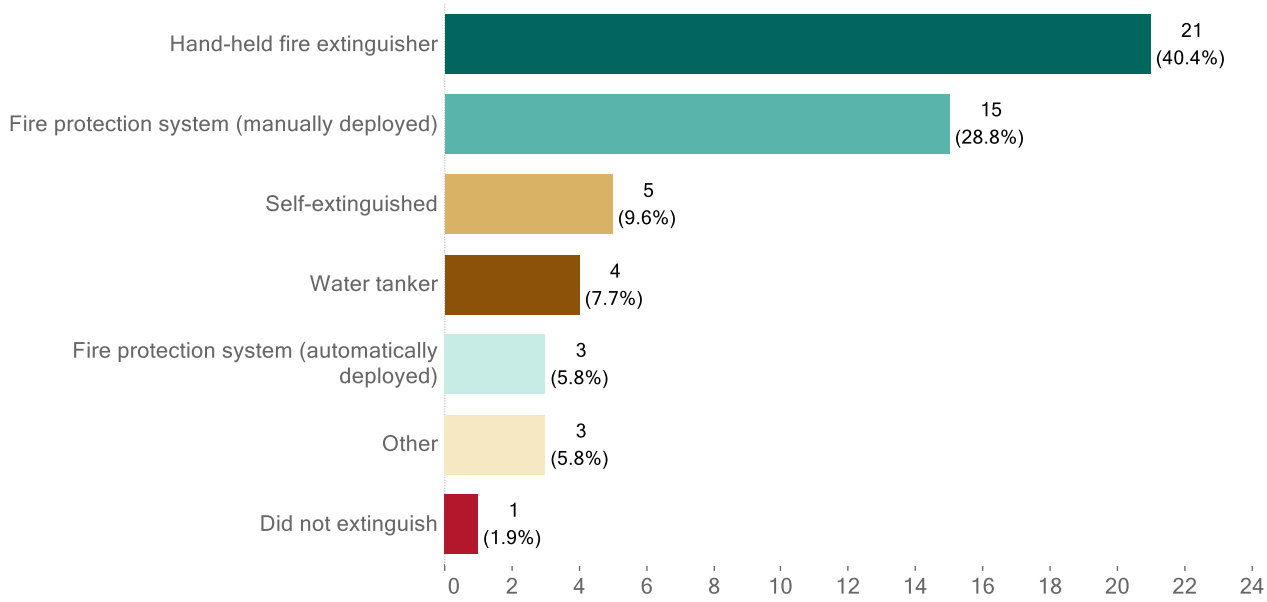


Table 3: Ancillary reports – extinguished by, for 1 January 2020 to 31 March 2021

EXTINGUISHED BY	FY 2020 Q3	FY 2020 Q4	FY 2021 Q1	FY 2021 Q2	FY 2021 Q3	GRAND TOTAL
Hand-held fire extinguisher	17	17	26	17	21	98
Fire protection system (manually deployed)	16	11	12	17	15	71
Self-extinguished	3	7	3	5	5	23
Fire protection system (automatically deployed)	4	4	6	4	3	21
Other	2	2	7	1	3	15
Water tanker	1	1	3	4	4	13
N/A			3			3
Did not extinguish		1			1	2

Ancillary reports – failed component

There has been an increase in the category of hose being recorded as the failed component for fires on mobile plant this quarter, from nine to 14 incidents.

Figure 11: Ancillary reports - failed components, from 1 January 2021 to 31 March 2021

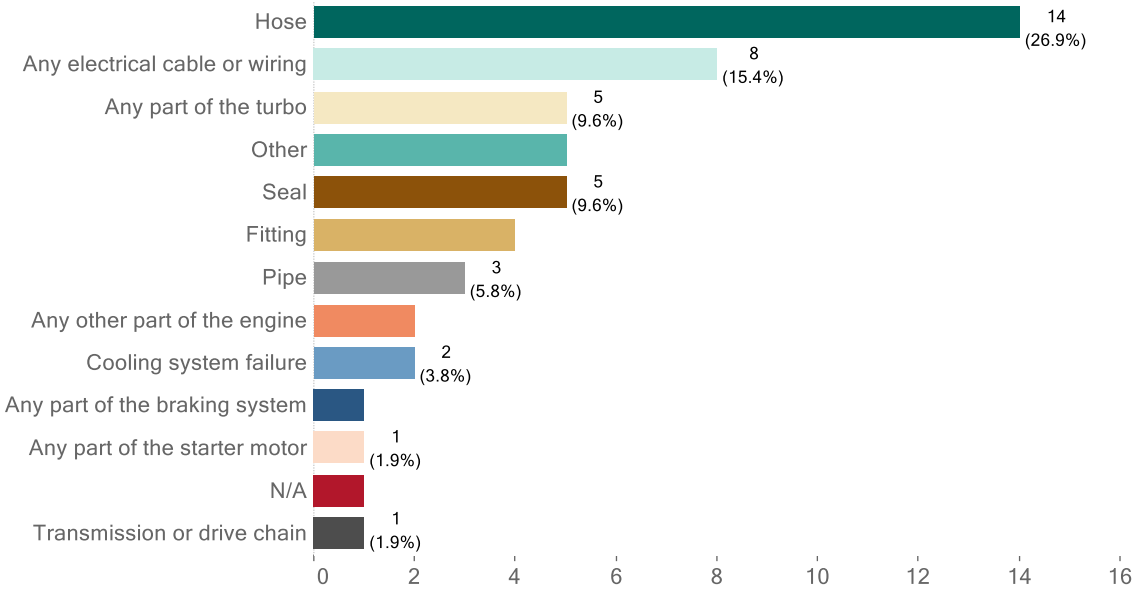


Table 4: Ancillary reports – failed component, for 1 January 2020 to 31 March 2021

FAILED COMPONENT	FY 2020 Q3	FY 2020 Q4	FY 2021 Q1	FY 2021 Q2	FY 2021 Q3	GRAND TOTAL
Hose	9	10	13	9	14	55
Other	6	4	20	10	5	45
Any electrical cable or wiring	3	4	6	5	8	26
Any part of the turbo	1	5	8	6	5	25
Seal	6	6	4	2	5	23
Fitting	4	7	1	3	4	19
Any other part of the engine	2	2	2	4	2	12
Any part of the braking system	1	2	1	4	1	9
Pipe	1	1	2	2	3	9
Any part of the starter motor	2	1	1	1	1	6
Cooling system failure	3			1	2	6
Transmission or drive chain	1	1	2		1	5

Ancillary reports – combination failed component and cause of component failure

Hoses being the failed component combined with wear and tear as the cause of component failure combined for 6 out of 52 incidents (12%). The second most common combination this quarter is 'other' and 'other', being the most frequent combination since 1 January 2020. These categories may be recorded as 'other' for several reasons including human errors or uncategorised component failures.

Figure 12: Ancillary reports - failed component and cause of component failure, for 1 January 2021 to 31 March 2021

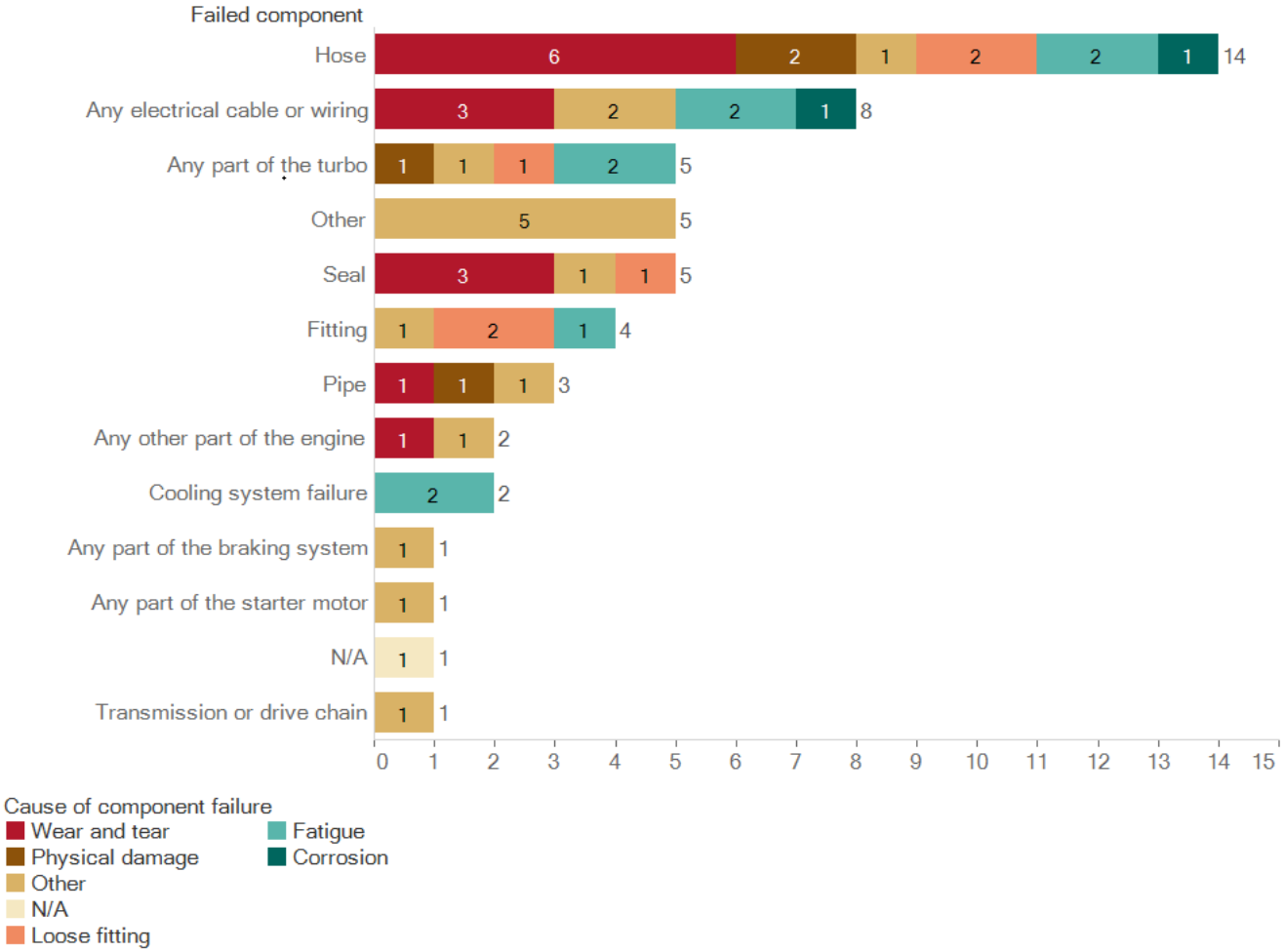


Table 5: Ancillary reports - failed component and cause of component failure, for 1 January 2021 to 31 March 2021[2]

FAILED COMPONENT + CAUSE	FY 2020 Q3	FY 2020 Q4	FY 2021 Q1	FY 2021 Q2	FY 2021 Q3	GRAND TOTAL
Other + Other	3	3	12	7	5	30
Hose + Wear and tear	2	3	4	4	6	19
Hose + Physical damage	3	3	2	2	2	12
Any part of the turbo + Fatigue		3	4	3	2	12
Hose + Other	2	3	4		1	10
Any electrical cable or wiring + Other	1	2	2	2	2	9

[2] 9 or more incidents since 1 January 2020

Incident details

The information in the table below provides a brief summary of the incident and the reported apparent cause.

DESCRIPTION	APPARENT CAUSES
A Komatsu 830E haul truck had pulled up at a crib hut. As the operator was alighting truck, the operator of another truck pulling up adjacent, alerted the operator of oil under the pos 2 wheel. On inspection, fire was observed from around the brake calliper area. The fire was extinguished by the second operator with the fire extinguisher from the front of the truck while the other operator raised the emergency. The area was cleared until the tyre was assessed by the tyre services provider. No tyre heating was identified.	The brake pads had been changed on the pos 2 wheel on the Saturday night shift prior to the Monday dayshift event. The brake pads were installed backwards so the backing plate rather than the sintered material was in contact with the disc. The brake pad was being installed with the wheel in-situ by sliding the pad into the calliper. OEM procedure is to remove the wheel. The brake pads are symmetrical and will slide in to position even if the wrong way around.
A jumbo operator was tramming a Sandvik DS421 jumbo in the 200 level when the operator saw an electrical arc in the engine bay. The operator stopped the jumbo and activated fire suppression system. Preliminary findings appear wires have melted due to heat and arced. Scene is frozen.	Starter motor and starter slave solenoid have been stripped with no signs of damage. Turbo drain line is still flexible and not showing signs of brittle/age. No signs of electrical faults. Current likely cause is an electrical harness within fireproof sleeve, which are located close to the exhaust, has ignited, directing a flame at the turbo drain line causing a secondary fire.
The operator of a Caterpillar MD6420 drill rig noticed a small fire on the side of the engine bay. The operator activated both E-Stop and fire suppression and proceeded to call an emergency then exit the drill cabin and move away from the Drill.	The drill rig had a failed engine fuel line (CAT P/N: 361-1997) that was worn through as it was rubbing against a metal support. Diesel escaped from the failed engine fuel line and contacted the hot surfaces of the engine bay area, which resulted in a fire.
Service crew members had returned to the diesel tanks to refill the onboard fuel tank which are used for refuelling of various pumps and generators on site. Both workers exited the Iveco Eurocargo 4x4 and noticed the smell of something burning. Upon further investigation it was identified there was a small fire under the front of the vehicle near starter motor area which was immediately extinguished using a hand-held extinguisher.	Starter motor failed to disengage from the flywheel after starting to cause it to overheat and catch fire.
A loaded Caterpillar AD55 truck was travelling up the pit ramp when the operator noticed flames from beneath the engine cover. The truck was parked, and the onboard fire suppression was operated to extinguish the fire.	A failed fuel hose located near the turbo. The engine only ~8000hrs since rebuild

DESCRIPTION	APPARENT CAUSES
While operating a Caterpillar D11T dozer as a clean-up machine for an excavator. The operator noticed smoke coming from the front of the machine. After parking the machine up the worker exited the cab to investigate the issue. Initially there were no visible flames however after getting a fire extinguisher for a precautionary measure the worker spotted some flame and put them out. There was a reignition, so the operator initiated the fire suppression system.	Hoses rubbing through.
The operator of a Jaycon Maxijet (small shotcrete machine) was setting up to commence spraying when he noticed a small fire coming from an electrical box above the pos-4 tyre. The operator extinguished the flame with a hand-held extinguisher.	The source is believed to be a failed solenoid for the oscillating head function.
The operator of a Sandvik DP1500i blast hole drill rig noticed a split hydraulic hose spraying oil onto the engine. Sprayed oil ignited on the turbo resulting in a small fire. The operator shut down the machine and extinguished the fire with a hand-held extinguisher. There was no person harmed nor any damage to the rig.	Upon investigation into the oil leak that caused the fire in the engine bay of the drill, it was found that the leak was coming from the engine cooling fan motor. The output shaft seal had failed, which allowed oil to flow through onto the fan where it was blown back over the engine. When the motor was stripped it was found to have slight wear in the bearings.
A Caterpillar D11T dozer was cleaning up the tip head on the dump. The operator noticed a bright light and realised the dozer was on fire. Realising it was a fire, the operator shut down the dozer via the E stop, activated the fire suppression and site emergency, then egressed the machine to a safe location. First response attended. On arrival a hand-held extinguisher was used to extinguish the remaining small fire.	Electrical wiring from starter motor rubbing.
While driving a Hitachi EH5000 the operator noticed fire at the bottom of the engine. The operator pulled the truck up and evacuated the truck. A maintenance supervisor happened to be following the truck. The fire suppression was activated and put the fire out.	A loose turbo lubrication line which allowed oil to spray in the engine area.

DESCRIPTION	APPARENT CAUSES
A hired JLG 600AJ boom type EWP was being used during a shutdown. Boilermakers were elevated in the basket of the EWP when the spotter at ground level noticed smoke coming from the engine compartment area of the EWP. The emergency stop on the EWP was used and a fire extinguisher was used to extinguish the flames that were approximately 100mm high. The EWP was assessed and was able to be operated to lower the basket and personnel to the ground. No injuries occurred.	Slag dropping on combustible material (wiring).
An operator was driving a loaded Caterpillar AD55 truck up the decline and noticed flame coming from the engine cover. Before the operator could activate the AFFF it set off automatically via the burn tube and extinguished the fire.	Failure of low-pressure fuel return hose spraying atomised diesel onto nearby heat shielded turbo.
A fire has occurred on a Sandvik 621 underground loader in the air filter area of the machine. The operator activated the on-board fire suppression but used a 9kg extinguisher to put out the fire. Some persons in the area went to the refuge chamber, but no emergency was activated. Approx. 15mins later a small fire flared up again on some plastic.	Ignition source believed to be a failed brake hose.
While travelling up the northern decline, the operator of an EPIROC MT6020 dump truck noticed a small fire in the engine bay. The operator stopped the truck and used a hand-held extinguisher to put out the fire. The fire suppression system did not activate. The truck had been serviced for a scheduled exhaust filter change on day shift and it appears that the DP filter was blocked causing overheating that led to the lagging catching fire.	Diesel particulate filter (DPF) blocked causing increased heat in surrounding area.

DESCRIPTION	APPARENT CAUSES
The operator of Caterpillar D11T dozer witnessed a hydraulic oil leak from the front left-hand lift cylinder hard pipe, with oil spraying back all over the machine. As the dozer was parked to investigate the leak, the operator of a water cart who was close by witnessed a small flame inside the left-hand side engine compartment. The operator of the watercart directed the operator of the dozer to re-enter the cabin so that he could direct water onto the flame with the cannon of his water cart. The dozer operator called in the emergency. After dousing the flames, both operators checked the status of the flame with no further sign of fire reported.	Accident damage from a rock rolling over the blade and damaging the blade lift cylinder causing one of the 2 x retaining cap bolts to snap spraying hydraulic oil over the bonnet.
A Komatsu 930E-3 was returning to an excavator on the dig floor. Upon travelling down the dig area entry ramp, the excavator operator has noticed sparks and flames emitting from the rear of the grid box and notified the truck operator. The operator has parked fundamentally stable, activated the fire suppression, shutdown machine and exited safely. A watercart has attended and assisted to cool down the grid box.	Short circuit in retarder grid resistor circuit due to either fatigue or debris.
A Caterpillar 793 truck was empty and returning to the excavator. A fire occurred in the engine bay. The operator has heard a bang, slowed the truck then noticed some flames. The operator then activated the fire suppression and exited the vehicle. A watercart arrived after the fire had been extinguished to cool the truck after the fire. The operator appeared to have experienced some smoke inhalation (was coughing and spluttering) and was taken to hospital as a precaution (not via ambulance). The truck was parked up off the haul road and a load of dirt was pushed up in front.	Catastrophic failure of engine to be investigated.

DESCRIPTION	APPARENT CAUSES
A fire occurred on a Caterpillar 336D excavator on the coal stockpile. The operator said the machine "just exploded". The operator did not have time to hit the fire suppression, the operator just jumped straight out of the cab. The fire brigade attended to extinguish the fire. No one was injured.	The root cause of the excavator fire was a pin hole/failure on a hydraulic hose which caused vaporized hydraulic oil to pool under the machine's engine covers until an ignition point was found. The alternator being the most likely ignition source. Once ignited the collection of vaporized hydraulic oil exploded rupturing the hydraulic lines to the excavator boom which released more hydraulic oil to feed the fire.
An operator of a Epiroc MT6020 truck was driving up the main decline full of ore when they saw a flash from the engine turbo area. The operator parked the truck and investigated. There is no visible evidence of fire, however the truck remains undisturbed under fire watch.	No turbo failure, rather a missing plug which has allowed exhaust gases straight out of the hot turbo. The turbo cover may have sparked once it had penetrated the outer material and a flame size would be similar to that of a cigarette lighter. No charring observed from a fire, nor suppression/extinguisher applied to stop.
A Caterpillar 16M Grader was being inspected and refuelled at the workshop. A mine mechanical tradesperson was adjusting the engine coolant level and completing opportune refuelling activity. During this time, he has identified diesel escaping from the fuel tank cap onto the engine exhaust area above the engine compartment. The mechanical tradesperson identified and extinguished a hydrocarbon fire on top of the engine compartment with a 9kg LVS fire extinguisher.	Overfilling and over pressurisation of the Caterpillar 16M's fuel tank due to the operator console fuel gauge indicated half tank volume. Mechanical Tradesperson has undertaken refuelling activity and as a result diesel hydrocarbon has leaked from the OEM fuel tank cap. 16M Grader fuel tank overfill protection system has failed to relieve tank pressure and volume, due to a failed fitting on the base of the ventilation assembly.
Volvo L120 IT tramming up from SP 9 with forks on when it shut down at SP 6 area in the main decline. The operator tried to re-start engine without success before he exited machine and lifted engine cover to investigate the cause and saw small flame at the turbo area (approx. 50mm high flame). Operator then extinguished with fire extinguisher (AFFF not activated).	Glycol coolant in the heat blanket around turbo.
A Caterpillar 16M grader was parked off to the side of the haul road whilst the operator was tending to some lighting plant relocations. Whilst parked up, a fire has started in the engine bay which was noticed by a passing by haul truck. The fire was extinguished by the fire suppression and hand-held extinguishers. The grader was fuelled up approximately 40 minutes before the fire started. The grader operator was first responder to the fire as well as a nearby dozer operator.	Quick fill fuel system failed to shut off allowing a higher level of fuel within the tank. Excess fuel has then entered the tanks breather system and over the engine bay onto a hot surface.

DESCRIPTION	APPARENT CAUSES
The operator of a Bell B50D service cart noticed an orange glow and smoke under the engine bay cover. The service cart was shut down and emergency was activated. The service cart operator discharged a 9kg fire extinguisher into the engine bay and put the fire out.	The cause of this incident can be attributed to a combination of an overfull transmission, a blocked transmission breather, a higher than necessary transmission retarder setpoint and a transmission dipstick positioned above the left-hand turbo. Increased heat induced into the transmission resulted in expanding oil exiting the dipstick and contacting the turbo heat shielding.
Minor amount of smoke and a small flame identified on a Volvo L120F Integrated Tool Carrier (IT), coming from righthand side of engine bay. The operator exited the machine and noticed the smoke, lifted the cover, saw the flame on lagging and used a portable extinguisher to fully control the flame. Machine was isolated, sentry in place, area barricaded off and inspected by maintenance personnel. Photos and statements taken, supervisor, HSET and management informed. Incident report / investigation commenced.	Hot exhaust lagging on the exhaust manifold side of the new engine, fitted ~120-Feb-21 to 16-Feb-21. According to mechanical inspection it appears that "heat has ignited paint on the manifold and eventually super-heated the protective coverings causing the smoke and small flame that was seen at the time of the incident. The exhaust coverings are OEM specific exhaust shields that are standard fitment across the Volvo IT fleet".
A Caterpillar 793D was waiting to be loaded by an excavator when the operator noticed an electrical burning smell. The operator notified the shift maintenance supervisor (two way), parked the truck in a safe location and turned off the ignition. The machine did not appear to be going to shut down via the ignition, so the operator activated the emergency stop and the machine shut down. When the operator exited the cab, they noticed smoke emitting from the electrical enclosure behind the cab. The operator activated a site emergency and disembarked the machine. On investigation, the attending electrician found the idle shutdown timer, located in the electrical enclosure behind the cab, had burnt out and appeared to have been the source of the smoke. Minimal other damage was evident to surrounding apparatus and the heating event was contained to the sealed enclosure.	Internal overheating of idle timer components. Consultation commenced with supplier. Idle timer dispatched to the supplier for inspection and testing.
A minor fire occurred on a Bucyrus SK50 Drill Rig around the exhaust lagging due to a mechanical failure in the turbo system. The operator had used the fire suppression system to put the fire out as intended. Area isolated and investigation commenced.	Engine oil escaped from the failed turbo impeller seal and flowed towards the exhaust piping. During the process, the engine oil escaped through the slip ring seal between the turbo and the exhaust piping, which contacted the hot external surface of the turbo, resulting in a fire.

DESCRIPTION	APPARENT CAUSES
While being refuelled on the ancillary go line, fuel escaped from the tank breather of a Caterpillar 777 watercart and caught fire on the machine muffler. Fire suppression was manually activated and serviceman used a hand-held extinguisher to finish putting the fire out.	Failure of the tank vent valve.
While operating a Caterpillar 6040 excavator the operator has identified slow performance and the fire suppression system has alerted to a potential fire through IR camera identification (single camera --> alarms, dual camera --> triggers automatic). This has been raised to the operator through the on-board engine camera system switching on and the LHS engine bay LHS turbo being of concern (smoke, glow). The operator has exited the cabin and investigated, finding a small flame above the LHS turbo. The operator has returned to the cab and raised emergency response, obtaining a fire extinguisher and successfully eliminated the fire. Emergency response team and water cart have responded, watering down area to remove residual heat. It was identified that an internal shaft of the turbo has failed due to normal cyclic loading (turbo at 97% life and planned for replacement in 1.5 months) allowing residual oil to leak from connection and ignite on hot turbo component.	End of life turbo 97% life of strategy (10,000hrs) has had fatigue/cyclic fracture of main turbo shaft. This has resulted in turbo engine oil leaking internally and out through turbo connection to exhaust, contacting hot surface of turbo and igniting a small flame.
A fire had occurred in the engine bay of a Caterpillar D11T dozer whilst pushing off the tip head. The fire occurred due to the failure of a hydraulic line which had generated a mist of oil which then made contact with a hot surface resulting in an ignition. The dozer's fire suppression system was activated immediately, the machine was shut down and the fire was suppressed. The operator was in the cabin at the time of the event and had no immediate exposure for the very short period in which the flame had occurred in the engine bay.	The implement pump hose clamp mounting bolt (1 of 4) had come loose, allowing hydraulic oil to escape and contacted the hot surfaces of the engine bay area resulting in a fire.
While pushing a coal stockpile, the operator noticed a fire in the engine bay of a Caterpillar D11T dozer. The operator manually discharged the on-board fire suppression and exited the machine.	Wiring short.

DESCRIPTION	APPARENT CAUSES
A Caterpillar 24M grader was grading the drill prep when the fire alarm activated. The operator looked behind and saw flame coming from the engine bay and called an emergency on the two-way radio. The operator attempted to activate the fire suppression, but it had already deployed automatically. The operator evacuated the grader and moved a safe distance from the machine. The OCE and pit supervisors attended the scene along with two (2) watercarts who were instructed to direct the water cannons toward the engine bay of the grader. The fire was extinguished and the area preserved. The operator of the grader was taken to the first aid room for a check and was cleared of any injury.	The main battery positive cable has short circuited to a metal bracket resulting in the ignition of electrical insulation and other thermoplastic components in the vicinity due to the cable not being securely affixed into a stauff clamp. Restricted access into this area to conduct visual inspection of these cables prevents the ongoing auditing of these control measures to ensure they are maintained through the equipment lifecycle. Problematic areas of inspection should be targeted specifically in maintenance regimes including allowance for the resources and time which will ensure adequate implementation of all risk control measures.
While operating a Caterpillar 6040 Excavator the fire suppression system has automatically discharged. A fire was detected in the left-hand side engine bay on the left-hand side turbo and lagging. On investigation, a hose blanking plate seal on main pump 1 has failed allowing hydraulic oil to be released and enter the engine bay.	It was identified that the incorrect o-ring has been installed on a porting plate of the pump. This has resulted from an early life warranty issue with leaking of newly installed pump. O-ring has released with hydraulic leak at pump pressure occurring. Oil has reached top deck and tracked through machine segments, dripping onto left-hand side turbo.
A Hitachi EX3600-5 excavator was working on a bench when the fire suppression system automatically deployed. Smoke and steam were seen emanating from the engine bay. The emergency was called. The operator exited the machine safely to ground. Water carts and the ERT team attended. It appears a RH rear turbo coolant drain hose has ruptured. No flames have been reported, however there was evidence of scorching at the turbo lagging indicating possible small coolant fire. The operator was uninjured.	Coolant hose has been perforated due to abrasion on the aftermarket turbo lagging.
A Liebherr 996 excavator operator was waiting for a truck to return when the operator noticed visible flames through in cab camera of the engine bay. The operator hit the E-Stop and initiated the fire suppression system. The operator then exited the cab and got off the machine safely using the main access ladder.	Failure of turbo oil feed line crimp resulting in the sudden release of pressurized oil only hot engine exhaust surfaces. Fire propagation throughout the engine bay and pump area followed due to various other fuel sources.

DESCRIPTION	APPARENT CAUSES
A Caterpillar D11T dozer was returned to service after maintenance. The operator was cleaning the roads, working back towards the dump, when they noticed an oil smell. The operator stopped and shut the dozer down to inspect oil leaks. The operator then called maintenance. The operator then started the dozer to move it closer to the lighting plant. A short period later, the operator noticed smoke coming from the engine bay, so he shut the dozer down and opened the engine bay doors and noticed flames. The operator then re-entered the cab to call emergency and activated the on-board fire system. Once the fire suppression system powder settled, the fire was out. Water trucks arrived and doused the engine bay as a precaution.	Valve cover bolts were not torqued up correctly allowing oil to leak out onto hot surface.
The Operator of a Bell B50 service cart noticed an orange glow and smoke on the left-hand side of engine bay. The service cart was shut down and an emergency was activated. The service cart operator discharged a 9kg fire extinguisher into the engine bay.	A turbo feed line banjo fitting was found to be loose. Oil made contact with the hot exhaust resulting in a fire.
A Caterpillar MD6420 drill rig operator had finished drilling a hole and started to pull the drill rods out. The operator cracked off the drill rod and went to put it in the carousel when they heard a loud 'pop' sound. Additionally, the operator noticed a blown hose near the motor and saw a small flame coming out from the exhaust stacks near the motor. The fire was extinguished by the operator with a hand-held fire extinguisher. The mining superintendent later arrived and manually activated the fire suppression system.	A hydraulic hose (from auxiliary pump to auxiliary control valve) ruptured from the rubbing of an adjacent hose.
The operator of a Liebherr 996 excavator noticed black smoke coming from engine bay. The operator has entered the engine bay to inspect and found visible flame coming off the turbo of power pack 2. The operator returned to the cab to initiate the site emergency process and activate the fire suppression before leaving the machine.	Internal turbo failure resulting in small external leak of engine oil (turbo cooling) onto hot exhaust components.

DESCRIPTION	APPARENT CAUSES
A Hitachi EX5600-6 excavator was in operation when the operator observed a small fire within the Electrical Control Cabinet. The operator proceeded to shut down and isolate the machine before returning and finding the fire had self-extinguished.	Inadequate support of wiring harness leading to insulation damage and electrical fault.
A small fire observed on the turbo of a Driltech D75K blast hole drill rig. The operator shut down the drill and put the fire out with a hand-held extinguisher. A site emergency was activated and water cart mobilised to monitor the area.	Catastrophic failure of the gasket seal on the oil feed line to the turbo.
The low coolant level alarm on a Hitachi EH5000 rear dump truck activated as the truck approached the top of a ramp in the mine. After checking the pump, the operator drove the truck to a safe location at the top of the ramp and after noticing a small flame, initiated the fire suppression system, raised the alarm and evacuated from the truck.	A small leak in a coolant supply line.
A Caterpillar 785B dump truck had a small fire behind the driver's seat in an electrical circuit box. The onboard fire suppression was activated but the fire was put out by a hand-held extinguisher. There were no injuries.	Two wires supplying power to the headlights (negative and positive) were touching due to chaffing which exposed the wires. The short circuit caused by the touching wires triggered the circuit breaker. This circuit breaker had an auto reset which allowed the short circuit to continually activate which caused heat and eventually a fire.
The operator of a Caterpillar 773 service truck was arriving to fuel up a water cart. The water cart operator noticed a small flame coming from the front left-hand side of the service cart. The operator of the service cart stopped the vehicle and extinguished the flame with his glove.	Internal failure of LED Indicator Lamp resulting in electrical heating.
A Toyota Hilux was entering muster car park at end of night shift when a member of the blast crew noticed smoke coming from the front left wheel. On closer inspection there were visible flame present. The flames were extinguished, and wheel hosed down.	Found front left wheel bearing has failed and has caused brake rotor to wobble and in turn, brake calliper has failed. Excessive heating of the hub, wheel studs and nuts has caused the plastic wheel nut indicators to ignite. Root cause of the wheel bearing failure appeared to be dirt/mud ingress through the bearing seals.

DESCRIPTION	APPARENT CAUSES
A small fire occurred in the engine bay of a Sandvik DR460 drill. The operator noticed an unusual noise from the engine and inspected. Flames and smoke were found in the engine bay. An emergency was initiated by radio and then the fire was extinguished using a portable fire extinguisher. Once the flames were extinguished the operator maintained a fire watch with the second extinguisher until the water cart arrived. No further firefighting was required. No persons were exposed or injured.	A pin hole perforation in oil cooler. Oil mist has been blown through the engine bay by the cooling fan and ignited near the turbo. There was a very small gap in the lagging.
A Caterpillar 789C haul truck was taking a load of coal back to the ROM when the truck failed a turbo. The operator had noticed the truck becoming sluggish going up the ramp and white smoke came out of the deck vent then flames also came out of the deck vent and the exhaust. The operator activated the onboard fire suppression system as a precaution. When inspected, there was no evidence of fire under the bonnet. The four turbos were planned to be replaced at 9,000 hours but had an early failure at 7,890 hours.	Broken shaft.
A Caterpillar 797F dump truck was in the workshop for a scheduled service. The maintainers were performing running checks when a maintainer noticed a shower of sparks coming from the left front engine bay. A plastic burning smell was also present, and on inspection, the maintainer found a small flame on the alternator power cable, just below the alternator. The nearest Emergency Stop was activated and the flame was extinguished with a fire hose.	Loose or overly tight P-Clamp.
A small fire has occurred on a Volvo L120 integrated tool carrier underground when oil leaked onto the turbo. It reportedly lasted only for a few minutes. Six operators below the level retreated to points of refuge. The operator was treated for smoke inhalation on site as a precaution.	Missing and loose bolts on turbocharger drainpipe. Missing heat shield.

DESCRIPTION	APPARENT CAUSES
A Powerscreen 550 impactor (mobile crusher) was operating when a nearby loader operator noticed flame from the main rotor bearing. The operator enlisted the help of another nearby loader operator. The fire was extinguished with a hand-held fire extinguisher and the mobile crusher was shut down.	The impactor bearing had an early life failure of its seal (3,683hrs), which resulted in coal ingress past damaged bearing seal and contaminated the grease. The bearing overheated due to the contaminated grease not being able to carry out the required lubrication, which led to the grease contacting the hot bearing surface and produced a flame.
While working on dump preparation, the operator of a Caterpillar D11T dozer noticed an oil spray from the left-hand blade lift cylinder and over the dozer bonnet. The operator relocated the dozer away from the tip head and parked the dozer to inspect the leak. Prior to exiting the dozer, the operator noticed flames on the left-hand side of engine bay and has activated the manual fire suppression.	It was identified that an O-ring had failed from a dislodged pipe at the left-hand blade lift cylinder quick drop valve and directed an oil spray towards exhaust components via the engine bonnet grille. No consequential damage to dozer components.
A vacuum truck was being used to vacuum sediment from the heavy vehicle wash bay sump. The truck was then turned off and parked before the workers went for lunch. On the workers' return, the operator saw the vac truck on fire. At the time of the incident, there were workers washing a dozer in the wash bay. The workers in the bay noticed flames coming from the vac truck, stopped what they were doing and headed over to the truck to start fighting the fire with 9kg DCP extinguishers.	Less than adequate segregation and use of split conduit in electrical battery cabling resulted in rubbing until exposed wire came into contact with the engine-mounting bracket and sparked.
A boom arch hose failed on a Komatsu PC5500 excavator, spraying hydraulic fluid in the vicinity of the exhaust mufflers (upper rear deck of the machine). A fire was observed by the excavator operator. The operator stopped the excavator and suppressed the fire with a 4.5kg extinguisher. A site emergency was activated. A water cart attended the scene and applied support. The excavator's fire suppression system was manually activated.	Corrosion of the hose structure (wires) resulted in premature failure of the hose. Hose sheathing installed on the boom arch hoses has retained water/moisture and accelerated the corrosion of wires exposed (skived) during the hose assembly process. The hose sheathing did not contain oil released during the hose failure event.

For further information refer to our dedicated Fires on mobile plant web page.

Annexure A

Changes to the duty to notify the Regulator

In February 2020, amendments to the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 saw a change to the duty to notify incidents involving fires on mobile plant to the NSW Resources Regulator.

In the definitions of 'high potential incidents' there was an additional incident added to clause 128(5):

> 128(5)(t) *an uncontrolled fire on mobile plant that is in operation (whether operated directly, remotely or autonomously)*

An uncontrolled fire on mobile plant is any fire or ignition that is not intended as part of the normal function of that item of mobile plant. This applies regardless of the level of damage or means of extinguishing the fire. Examples of fires and ignitions that are intended include internal combustion, flame heaters, such as on bitumen tankers, and maintenance works, such as welding and oxy cutting (unless control is lost during the task).

This clause also requires fires to be notified when they occur on autonomous plant operating without a worker present.

Any fire underground in a mine, including a fire on mobile plant, must still be reported as a dangerous incident under clause 179(b).

Where a worker or any other person is exposed to a serious risk to the person's health or safety from fire, the incident must be notified as a dangerous incident under clause 179(a)(ii).

For further information refer to the factsheet – Changes to Work Health and Safety (Mines and Petroleum Sites) notifications to the Regulator.