NSW GOVERNMENT

NSW Resources Regulator

FIRES ON MOBILE PLANT

July – September 2020

NSW Resources Regulator

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Contents

Overview

In FY 2021 Q1, there were:

NOTIFIED INCIDENTS
61
INCREASE OF 18 FROM 43 Q4 FY2020

- **53** Surface coal (86%)
- **6** Underground metals (10%)
- **1** Construction materials (2%)
- **1** Mineral sands (2%)

NOTICES ISSUED
1 Section 23 (1)

ANCILLARY REPORTS COMPLETED
60 Represents 93% of notified incidents

Incident notifications classified against material unwanted events (MUE)

MUE	Most common threat with failed critical control		Most common failed critical control	
Fire or explosion surface **55 of 61**	29 of 55	Accumulated flammable leaks and spills	29 of 55	Flammable fluid containment
Fire or explosion underground **6 of 61**	6 of 6	Mechanical energy in the presence of fuel	3 of 6	Flammable fluid containment

FY2021 Q1

Of the 61 related incidents, 55 were classified against these two threats (32 were classified against these two critical controls).

Ancillary reports summary

- Heat source **30%** EXHAUST SYSTEM
- Fuel source **25%** HYDRAULIC OIL
- Failed component **22%** HOSE
- Extinguished by **43%** FIRE PROTECTION SYSTEM AND HAND-HELD EXTINGUISHER

Foreword

This report has been prepared by the NSW Resources Regulator for mine operators in NSW. It contains quarterly data of notified incidents involving fires on mobile plant (FOMP) for the period 1 July to 30 September 2020.

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 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.

For further information visit our fires on mobile plant web page.

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.

During the reporting period 1 January to 31 March 2020 (Q3 FY2020) a legislation change was enacted requiring all fires on mobile plant to be reported to the Regulator. As part of this change, the requirement to complete an ancillary report was mandated after the requirement to report was introduced.

Changes to 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.

Emerging trend

Throughout this reporting period an emerging trend has continued to grow whereby poor maintenance practices and execution as well as inadequate housekeeping have been identified by mines as being the root cause of fire events. Practices identified have included:

- re-using old bolts during hose replacement
- failing to correctly torque bolts on clamps and bolted joints
- failing to route and clamp hoses to manufacturers design
- hot components not cleaned after an oil spray in the engine bay
- hose end failure due to inadequate crimp force during hose manufacture
- inadequate cleaning of gasket material from join before installing new hose
- incorrect O-ring used
- use of non-OEM part which does not have the same level of protection.

All of these events are preventable through the correct actions, techniques and application of good practice by maintenance workers. Mines should implement systems and processes that monitor workers for correct execution of maintenance work. This can be achieved in various ways such as post maintenance audits, rotation of workers within and between crews, and reviewing time allocation to complete tasks to prevent rushing.

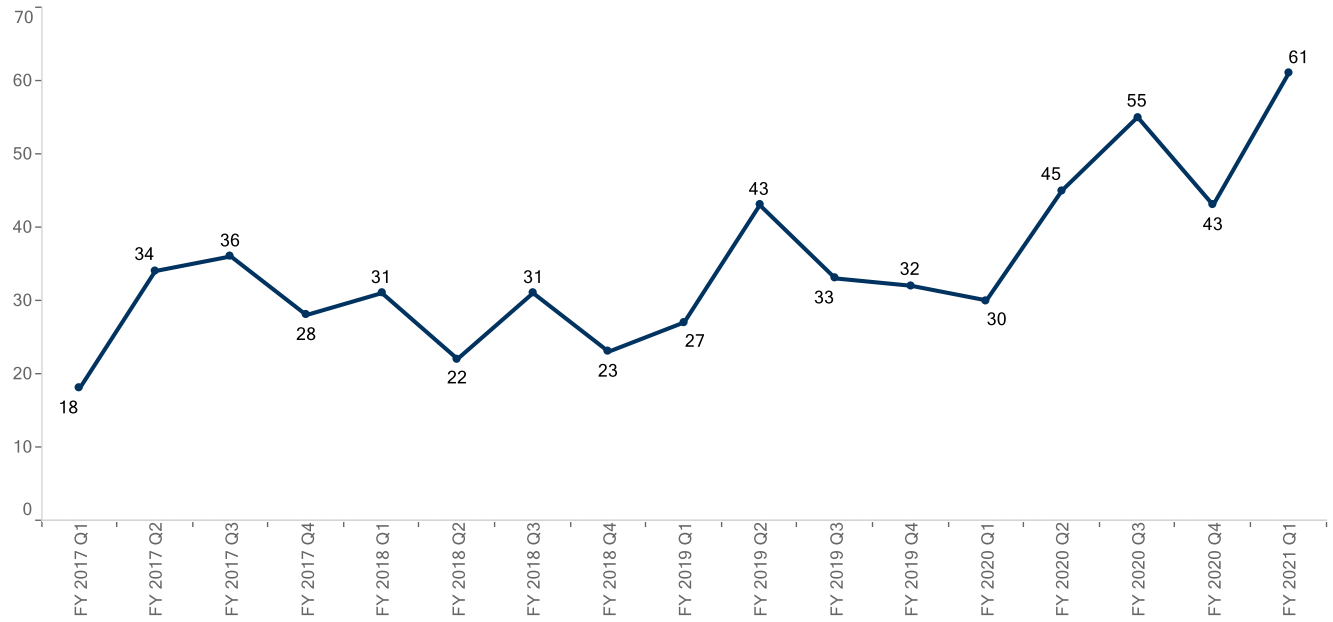
The expected standards should be defined and communicated effectively to workers, as well as ensuring work quality and compliance is monitored to ensure safe plant and prevent fires.

Notified incidents

Notified incidents for July to September 2020

Figure 1 relates to incidents involving fires on mobile plant notified in each quarter since July 2017. These incidents have increased this quarter to 61 incidents notified compared to 43 in the previous quarter (FY2020 Q4). The introduction of clause 128(5)(t) of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 in February 2020 has contributed to the increased number of FOMP incidents notified by mine operators since FY2020 Q2.

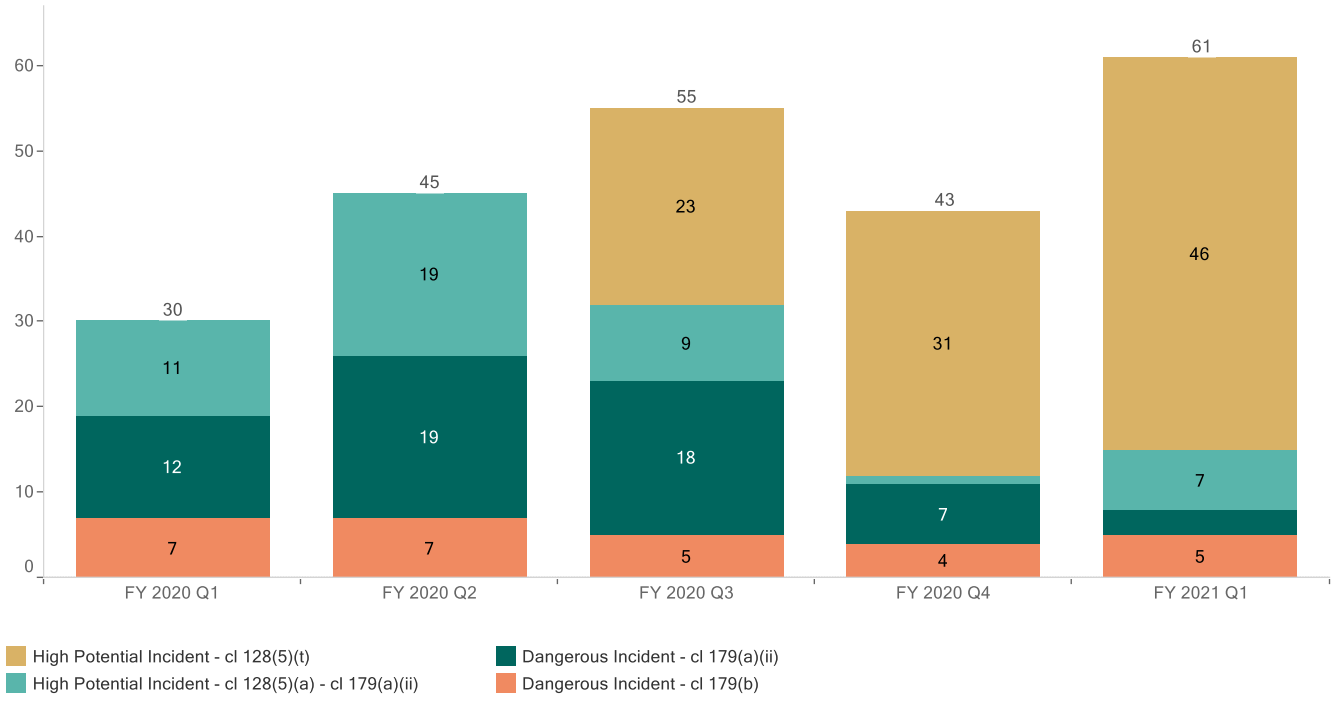
Figure 1. Notified Incidents – from 1 July 2017 to 30 September 2020



Notified incidents by legislative requirement to report

Figure 2 highlights the inclusion of clause 128(5)(t) to the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 in FY20 Q3 (February 2020). There was also an observed shift from notifying under high potential incident 128(5)(a) - clause 179(a)(ii) to 128(5)(t).

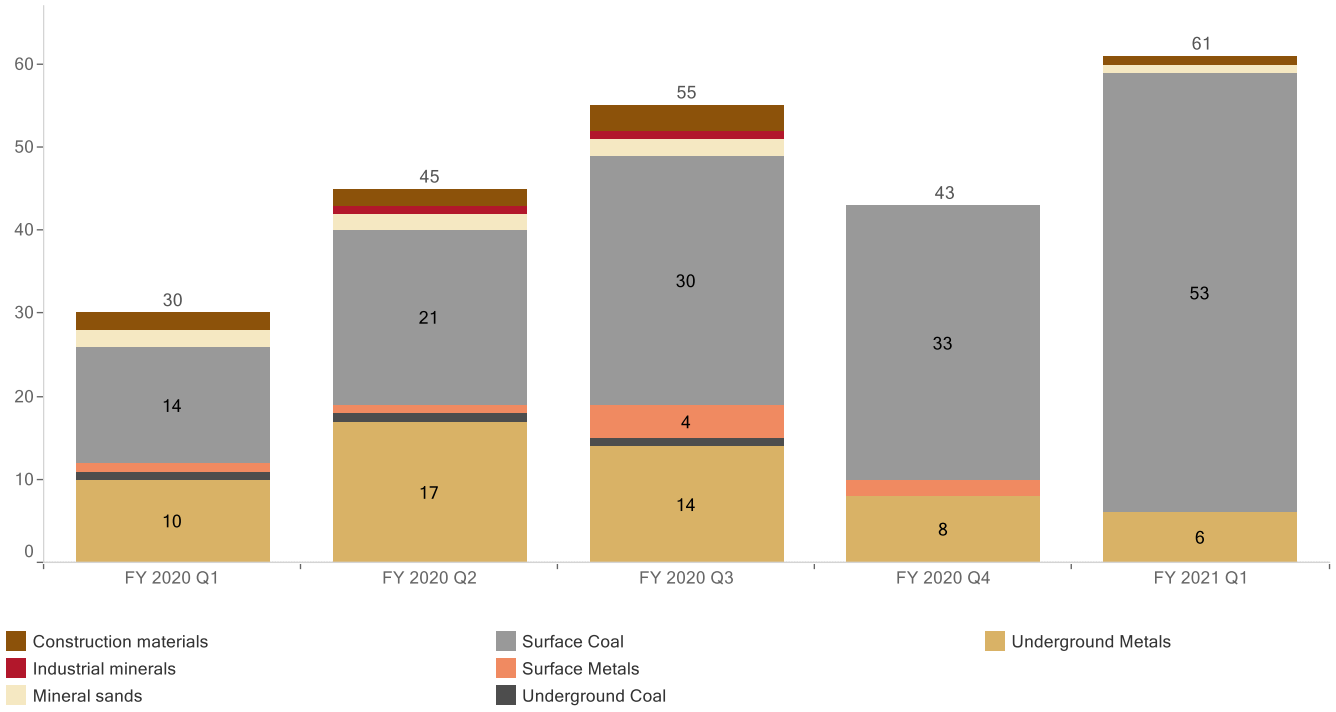
Figure 2. Notified incidents by legislative requirement to report – July 2019 to September 2020



Notified incidents by mine and operation type

Figure 3 shows the number of notified incidents by mine type and operation type. Surface coal continues to be the operation type most often reporting fire on mobile plant incidents. Of note the primary location of the fire is not identified here, that is for fires occurring at underground mines, it includes those occurring on the surface of the underground mine.

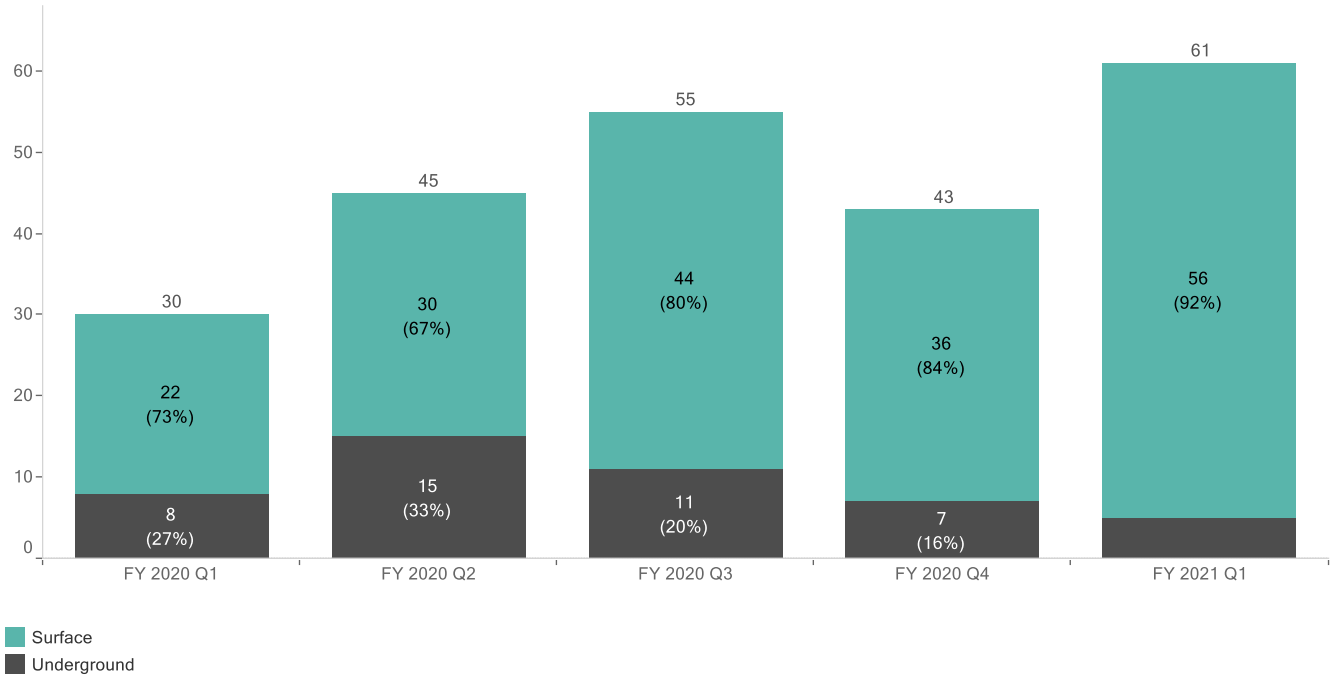
Figure 3. Notified Incidents by mine type and operation type – July 2019 to September 2020



Notified incidents by primary location

Figure 4 shows that the primary location of the majority of fires on mobile plant occur on the surface and these have increased by 20 (from 36 to 56) this quarter.
Note that the primary location of the fire is the actual location where the fire occurred, irrespective of the mine operation type.

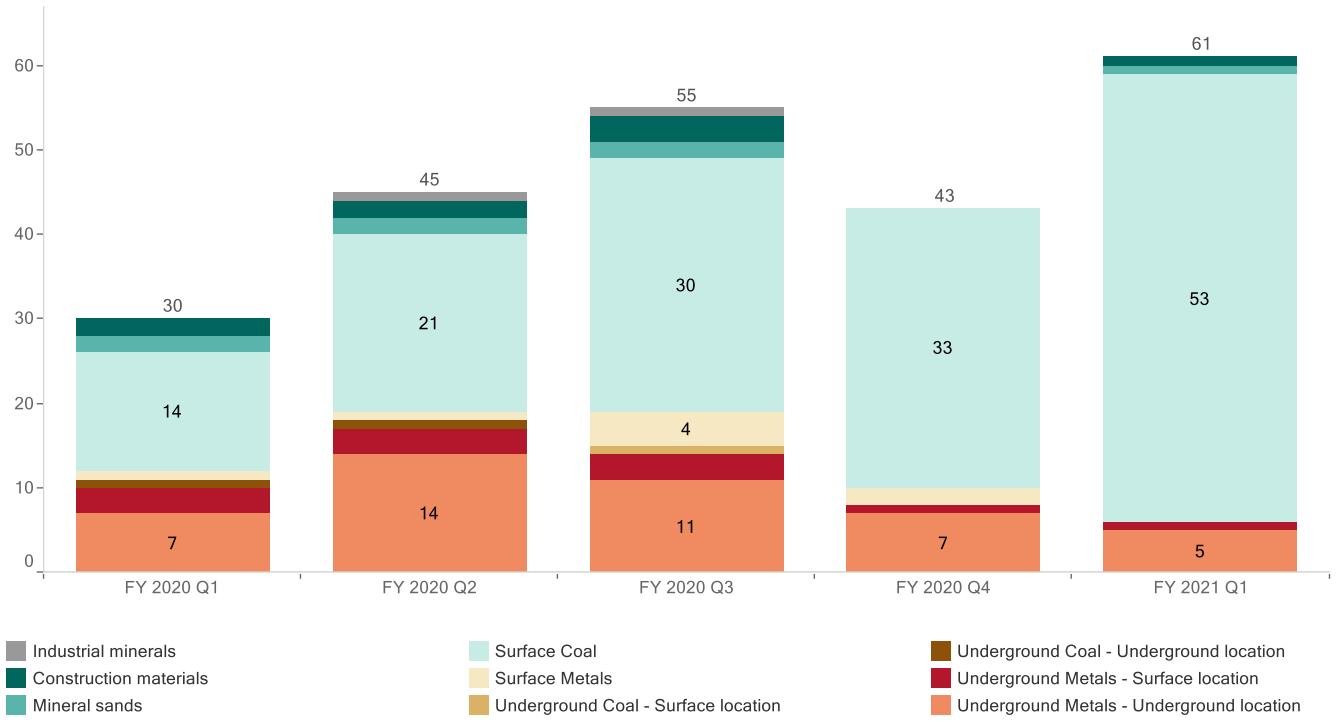
Figure 4. Notified incidents by primary location – July 2019 to September 2020



Notified incidents by mine type, operation type and primary location

Figure 5 shows FOMP incident notifications at surface coal operations continue to increase for this quarter (from 33 to 53) and underground metals mines are continuing a 12 month decreasing trend, decreasing from 7 to 5 incidents.

Figure 5. Quarterly incidents notified by mine type, operation type and primary location – July 2019 to September 2020



Notified incidents by material unwanted event, 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.

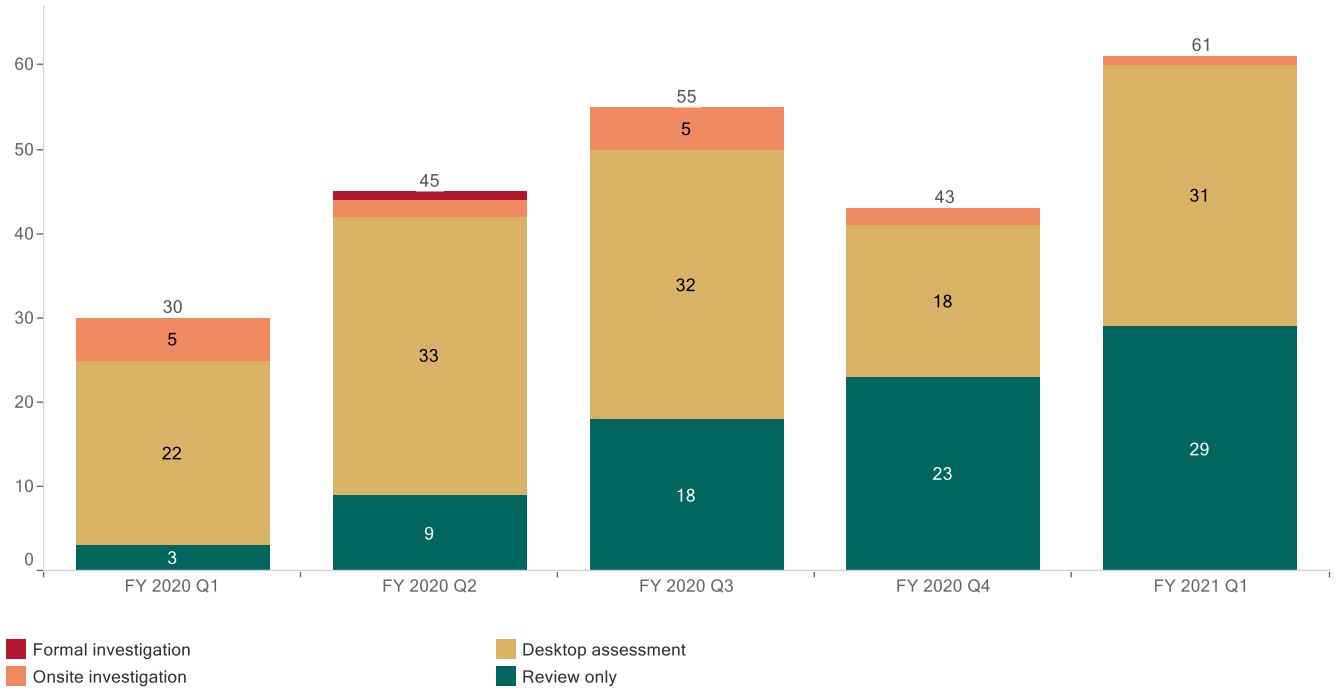
Figure 6 below shows notified incidents classified by MUE, threat and critical control.

Figure 6. Notified incidents by MUE, threat and critical control for October 2019 to September 2020

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 at a mine site in NSW will be subject to heightened assessment and investigation. Figure 7 below shows that one onsite investigation and 31 desktop assessments were conducted in response to notified incidents involving fires on mobile plant this quarter.

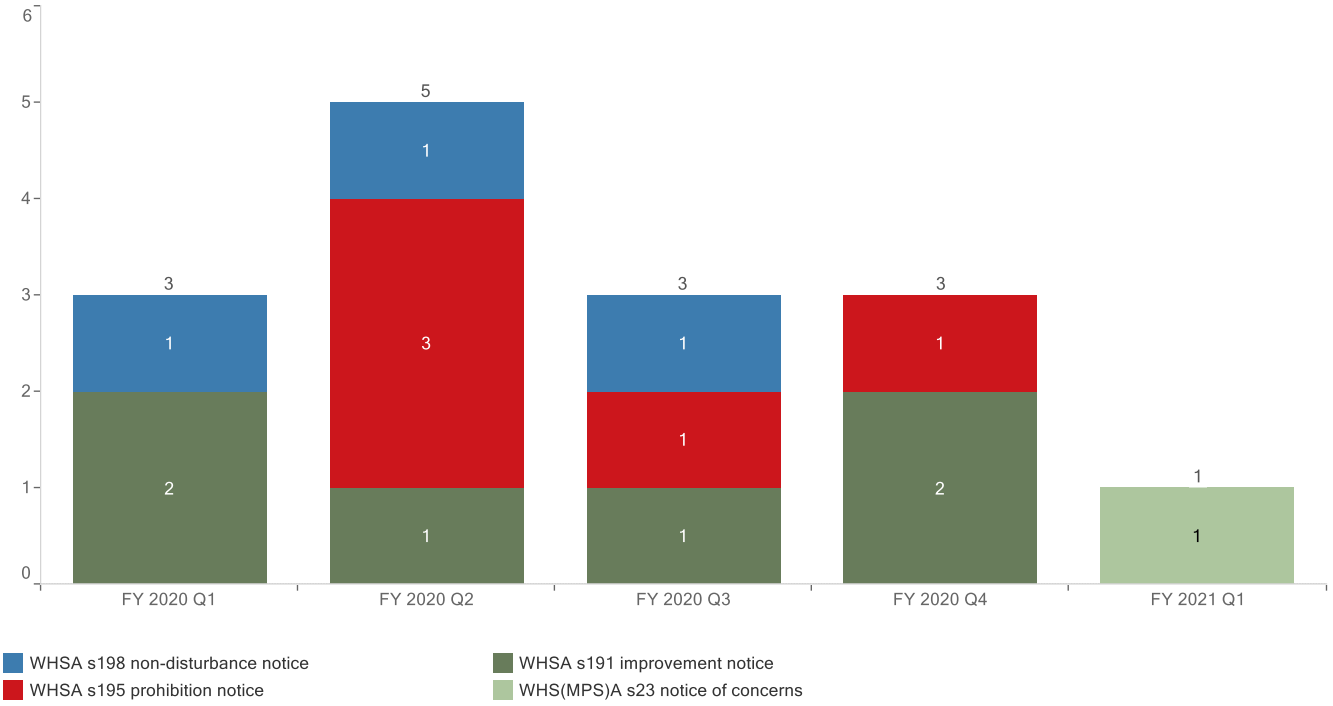
Figure 7. Notified incidents by response level – July 2019 to September 2020



Notices issued

As part of the Regulator's position paper on preventing fires on mobile plant where a mine operator has not taken appropriate steps to manage the risk of fires on mobile plant, escalated enforcement action will be taken. Figure 8 below shows that one notice was issued in relation to notified incidents involving FOMP this quarter.

Figure 8. Notices issued in relation to FOMP incidents – July 2019 to September 2020



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 – heat sources

Figure 9. Ancillary Reports – Heat Sources – July 2020 to September 2020

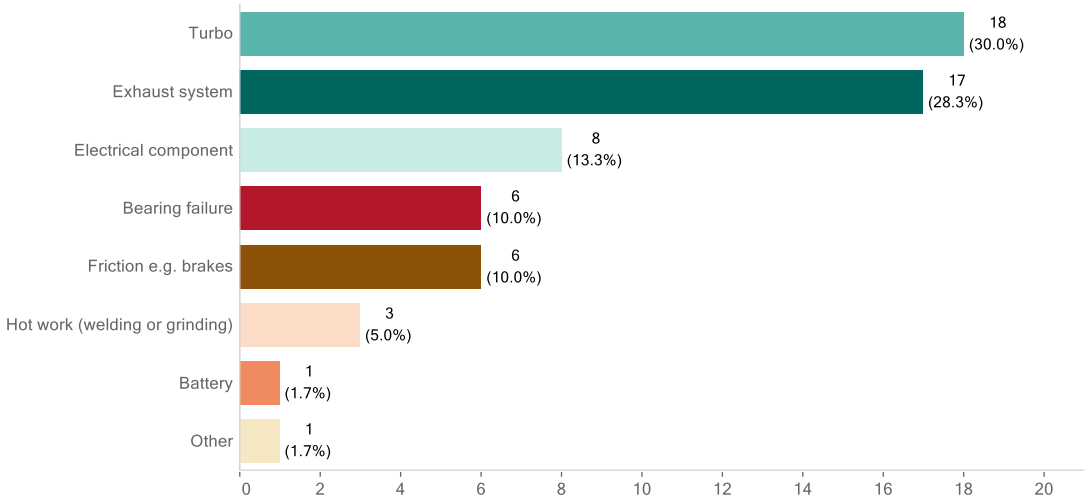
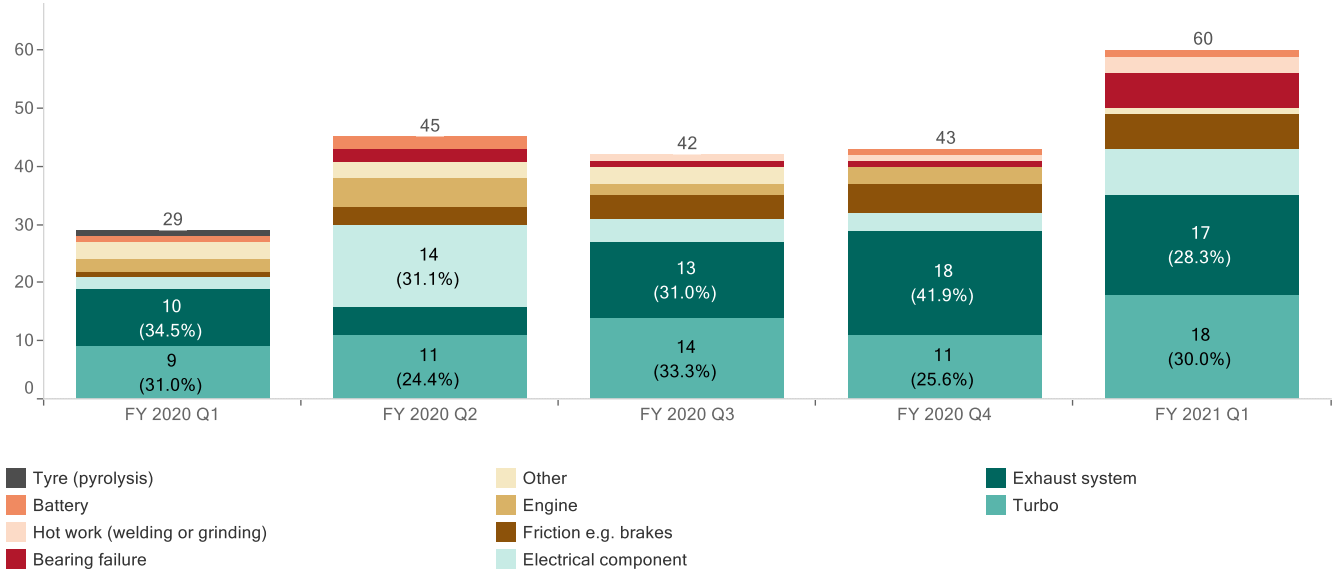


Figure 10. Ancillary Reports – Heat Sources – July 2019 To September 2020



Ancillary reports – fuel sources

As an ongoing improvement, additional categories will be periodically added to reduce the number of fuel sources reported as other.

Figure 11. Ancillary Reports – Fuel Sources – July 2020 to September 2020

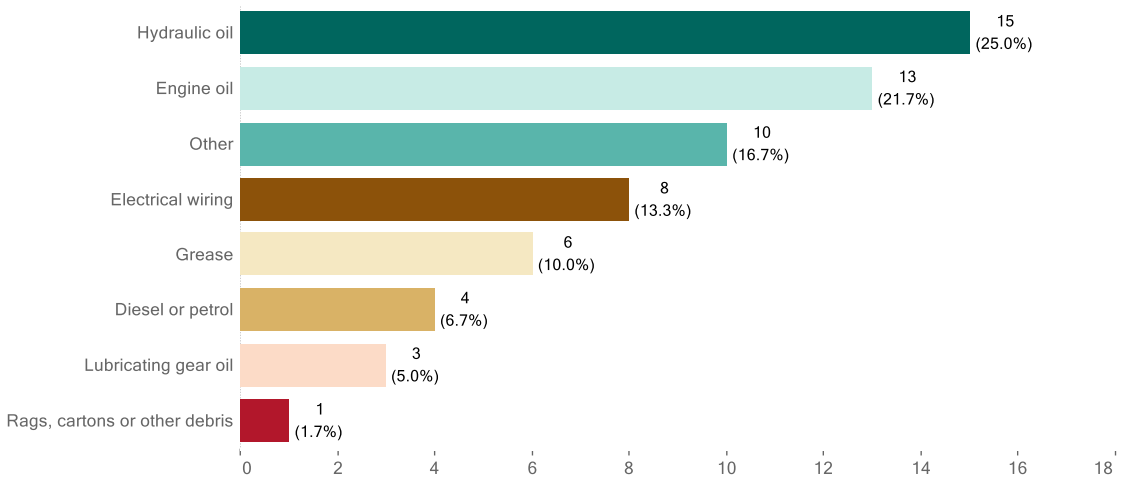
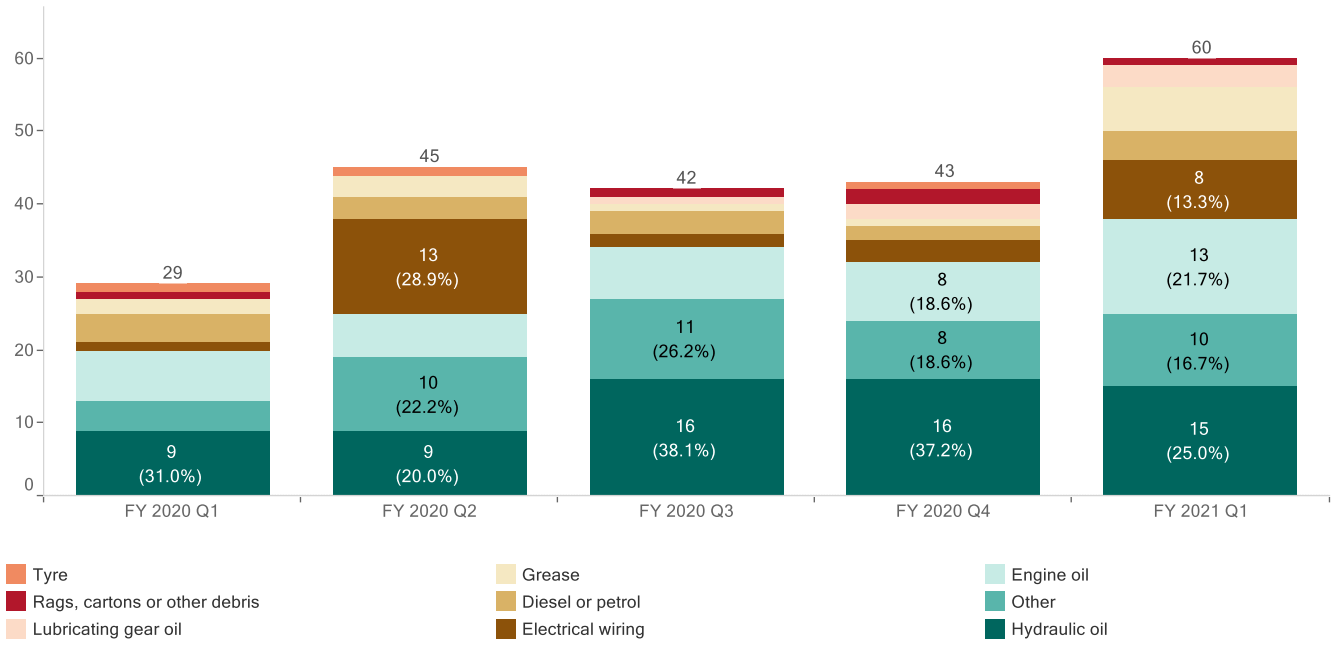


Figure 12. Ancillary Reports - Fuel Sources – July 2019 to September 2020



Ancillary reports – extinguished by

Figure 13. Ancillary Reports – Extinguished By – July 2020 to September 2020

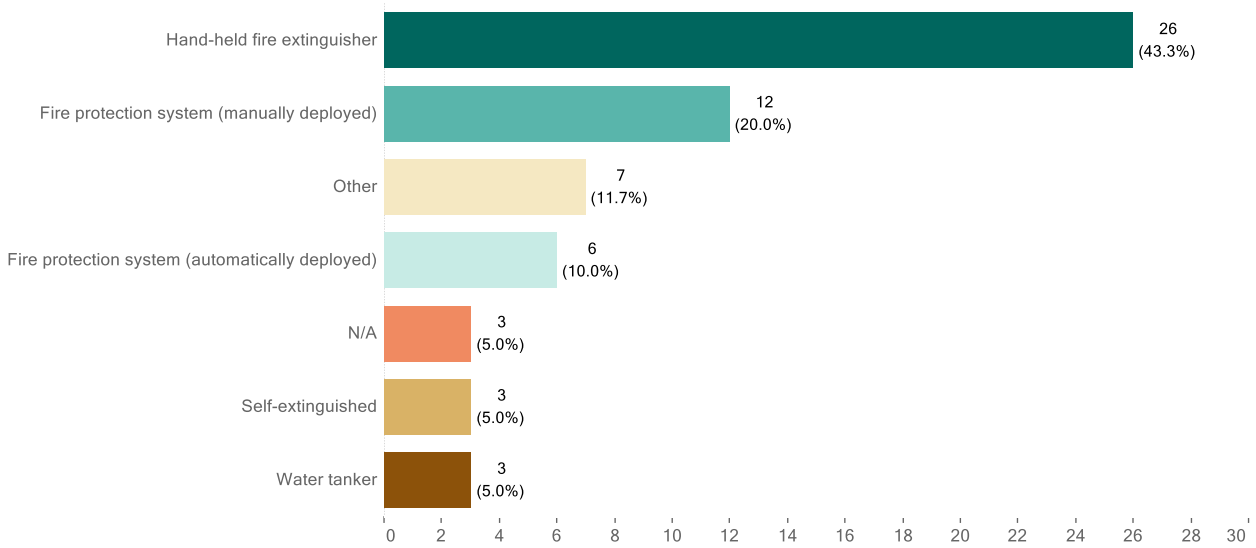
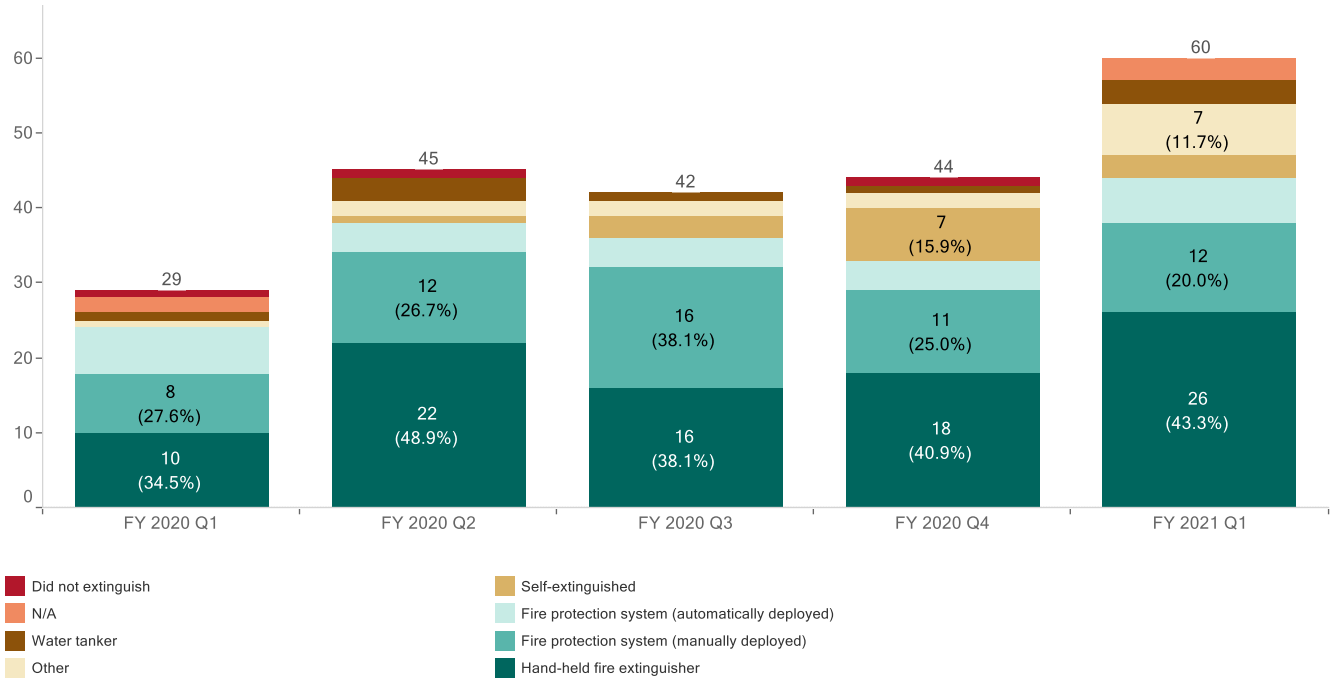


Figure 14. Ancillary Reports – Extinguished By – July 2019 to September 2020



Ancillary reports – failed component

Figure 15. Ancillary Reports – Failed Component – July 2020 to September 2020

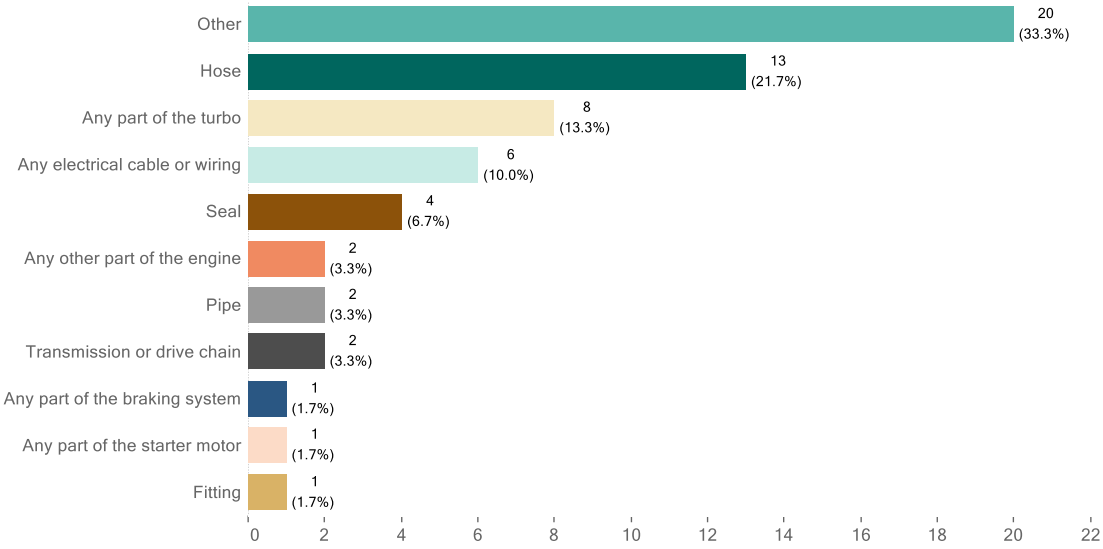
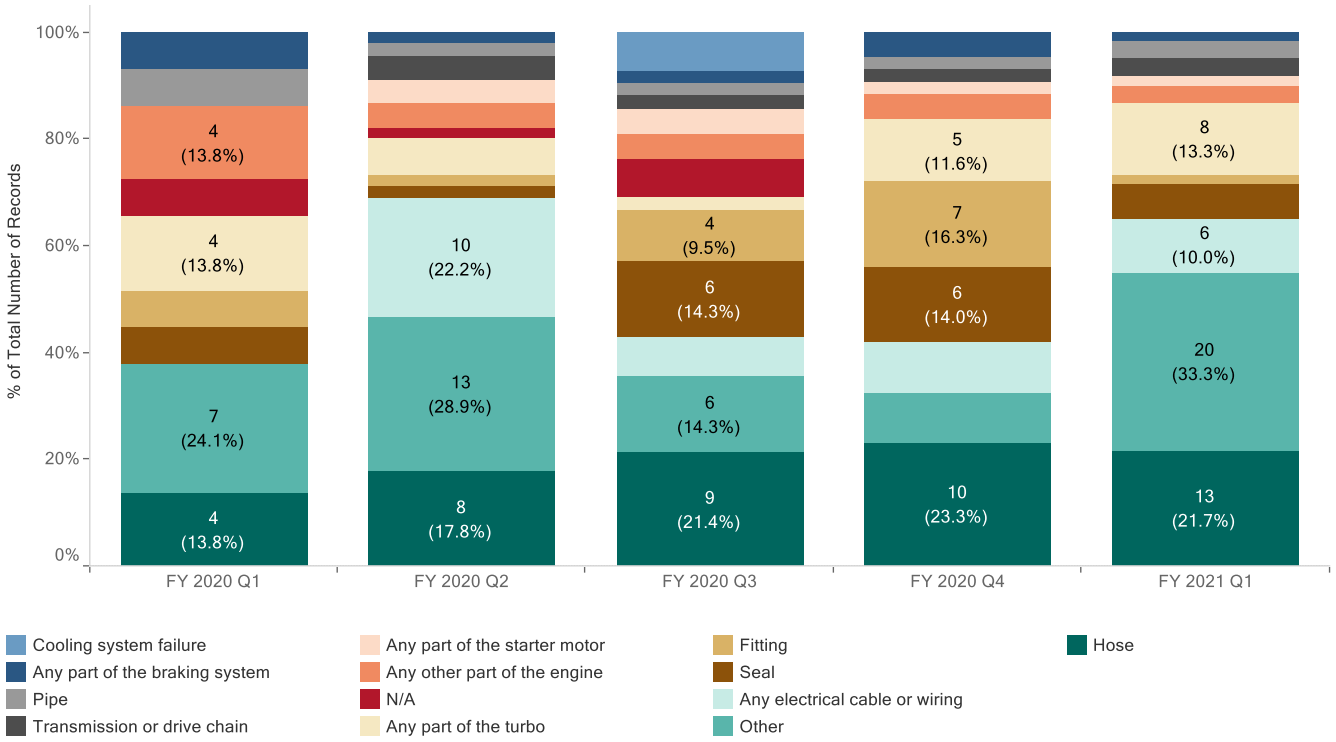


Figure 16. Ancillary Reports – Failed Component – July 2019 to September 2020



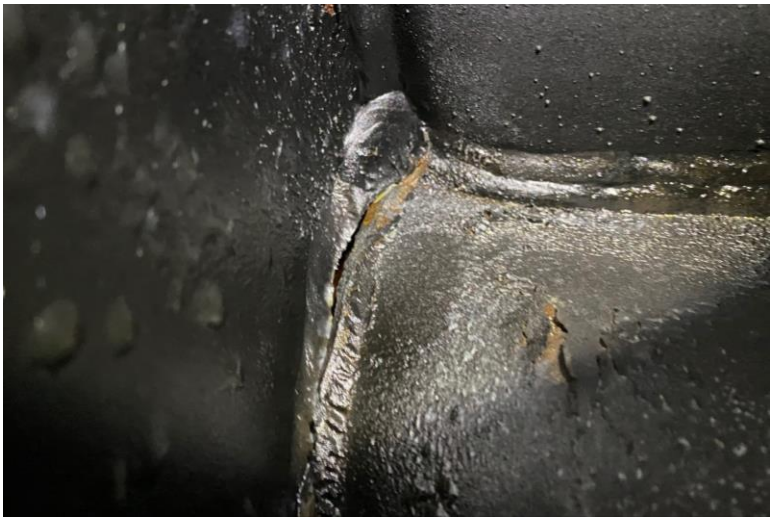
Incidents of note

July 2020 - Cadia East UG (IncNot0037723)

The operator of a loader in an extraction drive observed a flame coming from the muffler box on the loader. The operator stopped the machine and used a fire extinguisher to suppress the flame. The flame reignited and was extinguished again. The automatic fire suppression system was manually activated to cool the machine.

The apparent cause was fuel leaking from a crack in the internal fuel tank into the diesel particulate filter (DPF) box. The loader had previously contacted a wall, but the damage to the fuel tank was not identified at that time.

Figure 17. Location of cracked weld



August 2020 - Cadia East UG (IncNot0037919)

A Caterpillar R3000H Production Loader was travelling down the main decline when it lost power. The operator contacted the Maintenance Team who advised to park up. When the operator alighted from the machine a small flame was noted in the torque converter area. Both the onboard fire suppression system and a hand-held extinguisher were used to extinguish the flame.

The investigation identified a failed output bearing on the torque converter. The failure generated excessive heat which ignited the grease in the universal joint. The bearing failed due to a blockage in the oil supply gallery preventing the bearing from being lubricated.

Figure 18. Location of fire

September 2020 – Cadia East UG (IncNot0038277)

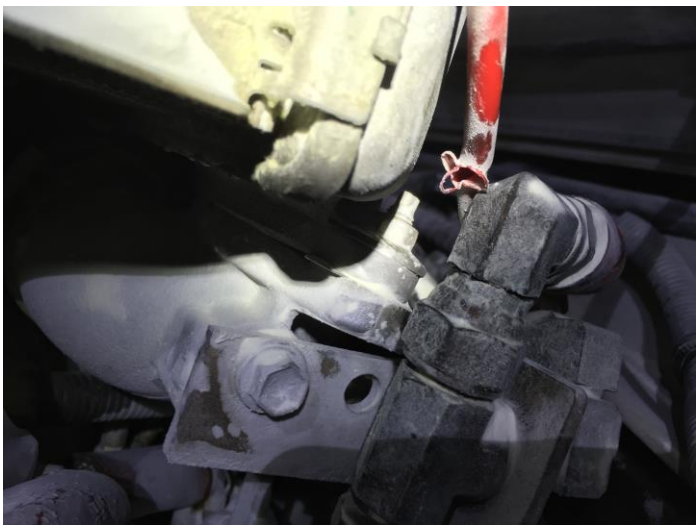
A hydraulic hose has blown and sprayed oil over a Caterpillar R3000H loader. The operator started to reverse the loader to the doors to enable safe access for maintenance workers. The operator noticed flames, shutdown the machine and manually active the fire suppression system. The flames were coming from inside the DPF box. The flames re-ignited and the operator used a handheld extinguisher to extinguish the flames.
The hose failure was attributed to a combination of heat exposure and corrosion of the hose.
The ignition point was a created due to a structural failure of the DPF filter which allowed the exhaust pipe to list up out of DPF box, exposing a normally shielded hot surface.

Figure 19. Damaged DPF box and exhaust pipe

September 2020 – Cadia East UG (IncNot0038316)

A truck operator observed a fire on a Landcruiser while it was travelling up the main decline. The vehicle was pulled over at a stockpile & the fire was extinguished with a handheld fire extinguisher.
The investigation identified an injector had been replaced by only removing one end of the fuel pipe and pushing it to the side instead of loosening / removing the pipe completely. This has caused the pipe to not seal correctly, fail and fuel has leaked down onto the exhaust manifold / turbo area which has ignited and caused a small flame.
The injector was inspected for leaks after replacement and no leaks were present, it is believed that after driving the pipe has failed.

Figure 20. Failed injector line



Incident details

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

Table. Incident details

DESCRIPTION	APPARENT CAUSES
The dozer operator of a Caterpillar D11T was pushing a dump when he noticed an oil leak on the ground. The operator relocated the dozer to an adjacent park up bay and shutdown the machine. When exiting the cab, the operator noticed the hydraulic oil level on the tank gauge was reading low and then observed fumes coming from the right hand side engine bay. After opening the engine bay door, the operator identified a small fire coming from the right hand turbo, he then returned to the cab, manually activated the fire suppression system and then used a fire extinguisher to cover the turbo fume.	The investigation identified an oil leak from the fan pilot hose had sprayed hydraulic oil across hot exhaust (underside of turbo). There was no consequential damage to dozer components identified. The fan pilot hose failure was caused by the hose rubbing on a boss welded to the chassis where the hoses are p-clamped.
A Normet Agitator was being driven to the site's shotcrete refill location. Approximately 150 metres outside the portal, warning lights in the operator's cabin indicated that the machine had lost oil pressure. The operator thought he had seen flames and initiated the fire suppression system.	The investigation identified a failure of the turbo oil supply hose, which sprayed oil over the turbo.
A witness noticed smoke emitting from the rear of a Caterpillar 854 rubber tyred dozer near the battery isolator. The operator was alerted and parked the machine. The fire was extinguished by the witness using a handheld fire extinguisher.	The fire was caused due to a hot joint on the starter isolator. Evidence of a break in lug and melted copper on the starter isolation terminal indicated potential arcing, which likely to have caused the ignition. Excess foreign material had also built up in the isolator compartment area reducing ventilation and increasing fuel sources. The fuel tank is adjacent to the isolator compartment area. Diesel fuel was found to be present in the isolator compartment due to an overflow/leak from the fuel tank breather, increasing fuel load for the fire.
An operator had just boarded a Hitachi EH5000 haul truck after having a break. The operator sat in the	Electrical harness caught on seat frame.

DESCRIPTION	APPARENT CAUSES
driver's seat of the truck and moved it forward. The operator then heard a noise and smelt something different. The operator looked down and noticed that a cable was caught around the seat frame and was sparking with a flame. The operator moved the seat back and blew out the flame. The operator then reported the incident.	
A truck operator noticed smoke, sparks and then flames coming out of the exhaust of a Hitachi EX8000 excavator. They notified the excavator operator who then shut the machine down. The excavator operator also noticed a flash of light. When the operator went to inspect the fire had been extinguished as a result of the machine shutting down.	Turbo failure.
A Caterpillar D11 dozer was operating and cleaning up was being undertaken by an excavator. The excavator operator observed flames near the tracks of the dozer and advised the dozer operator. An emergency was called. The dozer operator trammed the dozer to a nearby lighting plant and exited the machine. The operator used a handheld fire extinguisher to extinguish some small flames around the track idler roller pin. A water cart attended the incident and provided additional cooling of the tracks to prevent any possibility of flare up.	A roller bearing seized due to loss of lubrication. The loss of lubricating oil was via a worn duocone seal.
A Caterpillar 773 service cart was coming up a ramp when an oil alarm came on. The operator pulled the vehicle to the side of the road and alighted via the front access stairs and noticed oil on the road. The operator went back up the stairs to the cab and notice steam/smoke inside the engine bay though a gap around the radiator cowling. The operator returned to the ground and observed a flame around the left hand side turbo and extinguished the flame with a fire extinguisher.	A hydraulic hose in the brake accumulator circuit ruptured causing hydraulic oil to spray on the nearby exhaust lagging. The oil soaked through the lagging and ignited on the hot exhaust surface. The hose had been damaged under the OEM tab and slot clamp and failed at that location. The hose had been replaced at some point in the past with a non-OEM hose. The OEM hose has a metal section at the clamp mount and a heat protection sleeve which the failed hose did not have. Caterpillar has issued a service magazine release in Feb 2020 for a change to the routing of this hose to reduce damage from heat from the adjacent

DESCRIPTION	APPARENT CAUSES
	exhaust. This modification had not been installed at time of incident.
A Caterpillar 785D water cart had descended a ramp and was turning a corner on to the main haul road travelling approx. 15km/hr when the brake alarm came on. The operator pulled to the side of the road and found the retard brake not operating. The operator used the service brake (at under 15km/hr) to bring the vehicle to a stop and alighted the vehicle safely. Once on the ground, the operator observed what she though was steam from the vehicle. A nearby dozer operator observed what they thought was smoke and advised the supervisor. A water cart attended the scene after a short time, flames were observed by the dozer operator.	An undersized O-ring had been installed by the manufacturer on the nozzle of a water cannon. This allowed hydraulic oil to leak from the cannon on to the exhaust of the engine where it ignited.
While pushing material in the dozer push work area with a Caterpillar D11T, the operator noticed an unusual smell. While looking for the source of the smell the operator received a call over the two way from a dozer operator nearby to say that there was a glow coming from the left hand rear idler of the dozer. When the operator got out of the dozer to investigate, they noticed a small flame coming from the centre of the idler.	Fatigue cracking initiated from the sound suppression disc hub weld. The weld or weld process was incompatible with the casting material. The sound suppression and bearing lubricant was the fuel source.
While a Caterpillar 16M grader was being refuelled, the service truck refuelling operator identified diesel vapour and upon closer inspection observed fuel weeping from the fuel tank cap into the engine compartment. The refuelling operator inspected the engine compartment and located a small flame on the air intake pipework. The fire detection system was manually activated and the Mining Supervisor was alerted to the emergency. The flames were extinguished by the automatic system and a fire extinguisher.	Mechanical failure of the Caterpillar fuel tank ventilation breather system.

DESCRIPTION	APPARENT CAUSES
A Hitachi EH4500-2 was hauling waste and was queued on the excavator floor. The operator exited the cab to wash the windows when smoke was identified coming from behind the grid blower. The operator opened the top engine bay inspection hatch and confirmed a small flame visible around the right hand rear turbo. The operator extinguished the flame using a handheld fire extinguisher. Fire suppression did not activate due to the small flame size.	The turbo oil feed hose failed at the crimp.
A Caterpillar 789C truck had failed a turbo on a previous shift and the repairs, including replacement of the turbo were completed in the field. The truck engine had been run while stationary for approximately 30 minutes to remove residual oil from the exhaust system immediately prior to the end of shift. The fitters shut down the truck and left the area to finish their shift. Two pump crew personnel driving past the truck a short time afterwards noticed a flame on the exhaust of the stationary truck. The pump crew called an emergency and extinguished the flame with handheld fire extinguishers.	The failed turbo had been replaced. Residual oil on the exterior of the hot exhaust pipes has ignited.
During park up the operator of a haul truck noticed the access ladder would not actuate correctly. Maintenance personnel went to the machine and identified a damaged park brake solenoid valve. On inspection it was identified that the park brake solenoid valve plug harness and related harness were heat and flame affected.	A bad and/or loose connection between harness pin and receptacle.
While a Caterpillar 793D travelled from the dump to the digger the Open Cut Examiner (OCE) noticed a piece of rubber on the haul road that was on fire. The OCE called all trucks to stop and check the machines. The operator of the Caterpillar 793D truck got out of the cab to inspect, at which time the OCE stopped alongside and noticed a fire under the truck. The OCE	The fire initiated from a starter motor. Low voltage and high amperage in the solenoid circuit caused the contacts to fuse together. A culture of leaving lights on at night with the truck shut down at cribs or rest breaks contributed to the low voltage.

DESCRIPTION	APPARENT CAUSES
initiated the site's emergency response and then extinguished the fire with a fire extinguisher.	
The shaft of a turbo on an EH5000 rear dump truck failed allowing oil into the exhaust system which then caught on fire.	Failure of the turbo shaft.
A Caterpillar D11R was operating on the clean coal stockpile at the coal handling and preparation plant (CHPP). With the machine parked up, the operator was standing on the right hand side deck of the machine when he noticed what seemed to be a fluid mist from between the radiator and blade. The operator notified his supervisor of the issue and walked the machine off the stockpile to the hard stand nearby. When exiting the left cabin door, the operator then noticed a small flame coming from the left hand side (LHS) engine bay. He opened the LHS engine bay door to find a small flame approximately 15 centimetres high which the operator then extinguished using a handheld extinguisher. A nearby fire hose was run out and prepared in the event of re-ignition, which did not occur.	The oil leak originated from the transmission charge filter assembly from which oil travelled into the engine bay and contacted the LHS exhaust manifold, resulting in oil soaked turbo lagging that ignited. One of four bolts was found to be missing from a hydraulic hose clamp. When the missing bolt fell out of the connection, it allowed the half clamp arrangement to separate, causing the fitting to lift and subsequently force the O-ring to 'blow-out' which produced the oil leak. The cause of the missing bolt has been determined to be less than adequate torqueing of the bolt during the hose installation.
A Hitachi EX3600-5 hydraulic excavator was 15 minutes into a warmup/testing and commissioning after a maintenance period. An operator noticed smoke coming from the engine house and shut the excavator down. Upon initial investigation it was found that there were small flames on one of the turbos' exhaust lagging. The small flames were extinguished with a water hose, and after extinguishing the fire the tradesman remained in place as a fire watch to monitor for re-ignition. After approximately five minutes another small flame broke out on a different turbo. This flame started on the outside of the turbo thermal lagging and was extinguished with the water hose.	The aftermarket thermal Insulation was all brand new and had only been installed/replaced during the maintenance period and this was the first time that heat had been applied to the thermal lagging.

DESCRIPTION	APPARENT CAUSES
Fire watch remained in place until the excavator cooled down to ensure that there no more re-ignitions. The excavator was then inspected for a fuel source and cause of fire. No fuel, oil, leaks or other flammable materials were found in, around or on the turbos.	
A Caterpillar D11T was operating on the run of mine (ROM) stockpile when the operator noticed a fire and flames around the right hand side battery enclosure (located at deck height - off side of the dozer). The operator called an emergency, while tramming the dozer off the stockpile and down to the ROM floor, travelling approximately 20 meters. The operator retrieved the fire extinguisher located on the deck and extinguished the fire in the battery enclosure by hand. The operator then alighted the dozer after isolating the machine.	There were no nuts present on the studs that secure the hold down bracket in place, allowing for both movement of the batteries and associated clamps / connections to the battery terminals. The most likely cause of the fire was an internal failure (e.g. plate cracking or shorting together) and or thermal event (e.g. hot connection between clamp and battery stalk) that has occurred near the terminal end of the rear most battery, in the RHS battery enclosure.
A Caterpillar 793D haul truck was completing its first shift following maintenance when smoke/steam was identified coming from the engine bay. The fire suppression system was manually activated, and a nine kilogram fire extinguisher was used to extinguish the flame which was witnessed as a ‘pencil flame’ between pos 3 turbo and the rear aftercooler.	The fire was caused by coolant leaking from a loose coolant hose to pos 1 turbo and from the front aftercooler. After the water evaporated, the glycol ignited on the exhaust manifold. The root cause is attributed to a loose coolant hose fitting installed during maintenance when the coolant pipe between the aftercoolers was resealed.
While a Caterpillar D10T was operating in the working area of an excavator the operator became aware of a hydraulic leak and relocated the D10T dozer to a safe location to inspect and allow repairs. No vehicle intelligent monitoring system (VIMS) alarms or fire suppression alarms were observed. The operator parked and safely shut down the dozer, disembarked the cabin and investigated the smoke believed to be coming from behind the RHS engine compartment door. The operator used a handheld fire extinguisher	Mechanical failure of the pilot circuit filtration hosing resulted in release of hydraulic oil which contacted engine exhaust components.

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to extinguish a small flame on the RHS turbocharger lagging.	
A Komatsu PC5500 excavator was being walked to a new dig area. Upon arrival at the new area, a flame was observed emitting from an undercarriage load roller. The flame was extinguished and cooled with the water cart.	The digger was undertaking an extended walk. This involved walking for approximately one hour which was undertaken by two separate operators. This is in contravention to the OEM and site procedures, where maximum duration is 10-15 minutes before stopping and conducting a temperature test.
A 12 volt light system was in close proximity to grinding and air arc gouging on the tub of a dragline. The 12 volt power supply was wrapped in a heat blanket to protect it and a welding screen was in place between it and the work. The 12 volt lighting breakout box and light cabling caught alight. Persons in close proximity extinguished the flames.	Slag and sparks from hot work.
A Holden Colorado had a fire at the left front wheel. A worker returning from the pit was parking when a bystander alerted the driver that there were flames from the wheel of vehicle. The driver parked the vehicle and with the assistance of the two bystanders extinguished the fire.	Mud ingress into the wheel bearing caused bearing failure. The vehicle was driven for a period of time with a failed wheel bearing. The wheel rim rubbed on the brake calliper causing excess heating which ignited grease in wheel hub.
The operator of a Caterpillar 785 haul truck notice flames behind the cab of the truck. The operator exited and used a fire extinguisher to put out the fire.	The investigation found that the steel fuel return line from cylinder head number 12 to the fuel manifold was broken just above the nut at the bottom of the fuel line where it connects to the cylinder head.
Dragline shutdown tub repairs. A plastic safety step caught alight due to heat transferred from an adjacent (unconnected) segment of the tub. The fire spotter had been tasked with spotting this space as well as the adjacent space. The space containing the step was not occupied at the time. The fire spotter inspected the adjacent space and noted flames from the step. He used water on several occasions to extinguish the flames but was unsuccessful. He eventually got	The investigation determined that the most likely cause of the fire was flames and heat from hot work in the adjacent compartment had made their way through a hole in the shared wall, causing the plastic safety step to ignite. This incident had a higher potential for personal injury, as a boilermaker had been working in the compartment minutes earlier. As soon as the small flame was noticed, the fire watch attempted to extinguish the flames with a water sprayer. This caused the flames to flare up a few

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assistance and the fire was extinguished by throwing leather welding jackets on it. There were no injuries.	times, until a leather welding jacket was eventually used to smother the fire.
A Caterpillar 24H grader was cleaning up. After moving a large rock (approximately 400-500 millimetres) the operator noticed a loss of all hydraulic functions. The grader was parked and fitters were notified. The operator turned the machine off, then restarted to see if the hydraulic functions would reinstate. An approaching haul truck notified the grader of seeing smoke and a yellow glow coming from the engine bay. The grader operator activated the fire suppression system. A fitter arrived, opened the engine bay door and used a handheld extinguisher on a small residual fire which was still burning on turbo lagging.	Failed implement pump hose - oil igniting from contacting with exhaust clamp (lagging not covering clamp). Rubber guarding damaged on fire wall.
A Komatsu D475-5 dozer was pushing out coal on the product stockpile when the operator noticed smoke from the engine bay. The operator drove the dozer down off the stockpile whilst alerting other CHPP personnel via radio. The operator shut the machine down, activated the fire suppression, exited the dozer cabin and used fire extinguishers to put out a small flame that was present in the front of the engine bay.	The power supply cable to the starter motor has shorted to ground approximately 300 millimetres from the starter motor terminal, predominantly due to a lack of security or clamping.
A contractor boilermaker and fire spotter had finished a gouging task on a dragline tub rolling frame and were cleaning up their work area when the boilermaker noticed a small flame in the pinion changeout compartment below. Sparks had found their way through the compartment opening and onto grease residue in the compartment. Confined space work was being carried out in other areas of the tub, but not near the compartment where the fire occurred. Both personnel tried to find something to put out the fire before deciding to use the fire	The investigation determined that the most likely cause of the fire was sparks from air-arc gouging spraying into a swing pinion change-out compartment. As this area was not within the scope of the repair, it had not been completely cleaned of all flammable materials. It had also been opened for inspection, however, the cover had not been replaced.

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extinguisher at hand. The fire was extinguished and there were no injuries.	
A Caterpillar 793C was stopped on the dump when the operator noticed there was smoke and a flame coming out from under the bonnet on the top deck between the engine bay door and the dump body tray. The operator immediately shutdown the truck, activated the fire suppression system, called the emergency and alighted from the truck. No flames were witnessed after the fire suppression system was manually activated. Water carts were called and they flooded the engine bay area.	The right hand rear turbo oil feed line had rubbed through on the oil drainpipe allowing oil to make its way into the turbo lagging and ignited on the turbo. The oil lines / turbo was also found to be misaligned due to incorrect installation.
A Terex SK50 drill rig was tramming after some unrelated maintenance work on the mast locking ram was completed. After a short period (approximately two minutes) the operator noticed a loss of power and noticed dust out the window behind him. The operator quickly realised it was smoke and could also see flames near the engine bay. The fire suppression was activated, and the flames were extinguished.	Engine oil escaped pass the bearing seals due to the failure of the turbo shaft and contacted the hot surface of the turbo.
A Caterpillar D11T Dozer had a fire in the RHS engine bay while working in the open cut. As soon as the fire was noticed the dozer was parked, shutdown, and the fire system manual actuator pressed. It is believed that the fire system automatically activated before the manual activation was pressed. The operator got off the dozer, took the fire extinguisher and checked that the fire was completely extinguished. The handheld extinguisher was not required.	An incorrectly fitted hydraulic hose that ran up the right hand side of the engine bay sprayed hydraulic oil onto the engine. The hydraulic hose had not been run and clamped as per the OEM design. The hose was run next to and rubbed through on the RHS turbo/aftercooler pipe. The engine mounts were also found to be unserviceable, which could have contributed to the rub through.
During operation of the drag line the operator lost all operations, the generators shutdown, and the fire alarm sounded in cab. The operator exited the cab and noticed smoke/fire near drag drum (right hand front when observed from the cab) from grease on the gearbox floor. The fire was extinguished immediately by the machine	Possible fatigue cracking failure through the keyway causing the end of the drag shaft to make contact with a broken part of shaft, creating hot metal shards that ignited bearing grease that purges through the labyrinth seal.

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operator and the on-board relief operator using on board handheld fire extinguishers.	
A Komatsu WA700 loader lost power during operation. The operator noticed an oil leak. The operator reported the oil leak and was instructed to back up the loader and put it in a safe position on the floor. Upon exiting the loader the operator noticed flames in the engine bay which were extinguished using a handheld extinguisher. Site emergency response was also activated. The site was reassessed and preserved.	A burst hydraulic hose from pump to valve produced an oil mist over the hot manifold which ignited. This machine was not fitted with lagging, a key component that would have reduced the chance of ignition.
A Caterpillar 789C haul truck suffered a turbo failure. The operator reported seeing flames, initiated a site emergency and activated the fire suppression system.	Infantile failure of turbo. The cartridge oil seal failed, causing the impellor shaft to break which has allowed oil to leak onto the exhaust side of the turbo.
A Volvo EX300DL excavator was loading material into a crusher. The operator has noticed the presence of oil on the ground and shutdown the machine immediately. Upon inspection of the machine through the engine bay door a small flame has been noticed. The operator accessed the machine and used the onboard fire extinguisher to extinguish the flames.	Failed hydraulic hose. The hose was at 94% life.
Oil from the idler of a Caterpillar D11 dozer operating on a dump caught fire. The fire was extinguished with a handheld extinguisher.	The right hand rear idler failed and developed an oil leak. Upon loss of lubrication, the idler has become heated due to friction, and has caused the residual oil to ignite.
A Caterpillar D10T experienced an engine compartment fire. A blown hydraulic hose between the pump and blade lift control valve sprayed oil onto the RHS turbo causing the fire suppression system to activate.	The pressure hose between the pump and blade lift control valve failed, spraying oil onto the RHS turbo.
A JLG800AJ EWP was mobilising to the work location when the operator noticed smoke. Workers quickly extinguished the fire which was	The fire was caused due to a hole in the exhaust muffler, heating up the foam shielding/insulation, attached to the engine hood, directly adjacent to the hole in the muffler.

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contained to the heat shield within the engine compartment using the extinguisher from the EWP.	
An operator was driving a Caterpillar 789C up a ramp when he noticed an 'electrical' smell. The truck engine shut down and the screens went blank. The operator backed the truck against a windrow and reported the incident to maintenance. No fire was visible to the operator. Upon investigation by the shift electrician, the idle timer was found charred and soot was visible in the cabinet. No fire was visible or extinguished by any personnel. The electrical cabinet that the idle timer sits in is located outside the operator cab.	Component failure. The engine idle timer (Montronics MIT200) received the most damage, and this is strongly suspected to be the cause of the fault. Similar timers in similar installations have not had this issue on this site. This appears to be an isolated case.
The operator of a Caterpillar D11T could smelt smoke during operation. The operator parked up to inspect the machine and saw a small flame on the outside of the left hand rear idler. A fire extinguisher was used to extinguish the flame.	Idler failure due to loss of plug and lubricant.
A Reichs C700D drill was being relocated in the pit between drill benches, a distance of approximately 2 kilometres. As per procedure, the track roller temperatures were tested with an infrared temperature gun during travelling. After having travelled about 1.5 kilometres the number three roller on the cab side when tested was found to be very hot (160 degrees Celsius) so the operator cooled it down with the washdown hose for five minutes. The operator then recommenced tramming. When approximately 30-40 metres from the final location a dozer operator nearby notified the drill operator that there was an orange glow around the track frame. The drill operator ceased tramming and inspected the number three roller and found a small fire in progress. The drill operator extinguished the flames with the wash down hose.	A load carrying track roller (number three, cab side) had a bearing failure which resulted in overheating, causing the rubber bearing seals to melt, allowing the lubricating grease to escape and be ignited by the hot surface of the roller.

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A Toyota Hilux was driven from the shovel to the muster. When parking, the operator noticed smoke coming from the right front of the vehicle. He alighted and observed flame from the front right hand wheel. He used the fire extinguisher on board to start extinguishing the fire. Two persons nearby assisted the light vehicle operator using a fire reel hose directed on the right hand front wheel.	Wheel bearing failure resulting in misalignment of wheel and rubbing of rim on brake calliper. This resulted in brake fluid leaking from the calliper and igniting on heated brake/wheel surfaces.
An Epiroc MT5020 dump truck was travelling up a decline fully loaded. The occupants of a light vehicle that was following the dump truck noticed a glow from the rear of the truck. They notified the truck to pull in at the stockpile, they pulled in and the truck parked up. They noticed a small flame from the rear of the truck. The small flame was coming from around the support bearing on the drive line.	Heat generated from bearing failure caused grease to ignite.
The operator of a Le Tourneau L1850 heard a truck driver nearby call emergency. The loader operator looked back and noticed the engine was on fire. The operator switched off the engine, activated the manual fire suppression system and safely evacuated the loader. The fire suppression system extinguished the flames.	A turbo feed line hose failed due to rubbing on a heat shield plate.
A Caterpillar 789 haul truck suffered a turbo failure. Flames came from the exhaust and went out when engine was shut down. When inspected, there was a small flame burning escaped oil near the left hand rear turbo joint which was extinguished using a handheld extinguisher. The on-board fire system was not set off manually or automatically however the operator did remove the lock pin from the actuator just in case it was required.	A broken shaft on the exhaust side of the left hand rear turbo.
A right hand rear turbo failed on a Caterpillar 789C haul truck at approximately 705 hours since engine rebuild.	A broken turbo shaft.

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The operator of a Caterpillar D11 dozer working on a coal stockpile noticed an unusual smell emanating from the machine. The operator drove off the stockpile to investigate and found a track idler bearing significantly overheated. The worker used a fire extinguisher to cool the bearing and then drove the machine to the workshop.	A failed idler bearing seal caused loss of lubrication to the idler, which led to the idler bearing overheating and subsequent failure.
A Caterpillar D10 dozer, was being live tested (stationary), with fitters present, after having an oil leak from the tappet covers investigated. The dozer had been running for approximately 30 minutes to confirm if the leak was fixed before returning the dozer to service, at which time the fitters saw a flame occur from the tappet cover area. The fitters extinguished the flames using handheld fire extinguishers and the dozer's fire suppression was also manually activated.	A redundant clamp from a previous fuel line arrangement still fitted to the engine prevented the tappet cover from pulling down hard on the cover seal. Oil leaking from the unsealed tappet cover soaked into exhaust lagging around the exhaust manifold which ignited during testing.
A Caterpillar D10T dozer suffered a right hand side rear track idler collapsed causing heat and a small flame.	An idler shaft seal failed allowing oil to escape onto a hot idler causing a small flame.
While cleaning up the dig floor for an excavator using a Caterpillar D11T, the operator was told of an oil leak, at the same time he noticed a loss of blade control. The fire suppression system initiated and the operator also retrieved a fire extinguisher to fight the fire. A water cart arrived at the scene to extinguish the fire.	Failed hydraulic hose - Incorrect crimping pressure for the hose and end fitting specifications.
The fire check system activated on a Sandvik DR 460 drill ring. The operator did not recognise the alarm tone and called another drill operator that was on the drill pattern for assistance. Flames were seen coming from the engine bay, and the drill operator was advised to shut down and exit the machine while the emergency was called. The drill operator used a handheld fire extinguisher to extinguish the flames.	A hydraulic fitting cracked due to a pressure spike on the engine cooling fan hydraulic motor caused from crossover spool contamination. This led to hydraulic oil spraying over the engine bay and exhaust lagging. A small gap was evident at the turbo joint in the lagging which led to ignition of the hydraulic oil. This is considered to be an early life failure for this motor.

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20 minutes after a Toyota Landcruiser was parked and turned off, a nearby worker noticed a glow from the vehicle and raised the alarm with the mining supervisor. On closer inspection it was confirmed that the light vehicle was on fire. The fire was limited to the engine bay and was extinguished. There was no one in the vehicle at the time.	An electrical fault.
The operator of a Caterpillar MD6290 noticed smoke coming from the engine bay and shutdown the drill rig. Two maintenance technicians who were working on the drill responded and removed a cover and flames were observed near the turbo. The operator activated the fire suppression system.	The investigation determined that the most likely cause of the fire was an engine coolant leak from the turbocharger coolant vent (return) line. This leak was caused by degradation of the vent line PTFE inner liner, as a result of excessive heat. The degraded liner fractured from the pressure of the coolant during operation and released the coolant. The most likely sources of heat causing degradation to the coolant line, were identified as: ■ excessively heated coolant expelled from the turbocharger as a result of high operating temperatures ■ hot exhaust gases leaked from the adjacent exhaust manifold. To cause the fire, the leaked coolant has likely ignited by: ■ contacting the hot surfaces of the turbocharger and adjacent exhaust manifold ■ contacting the hot exhaust gases leaked from the adjacent exhaust manifold.
A Hitachi EX3600 was returned to work and soon after an emergency was called. The excavator operator heard a fire alarm beeping and moved the digger back from the highwall. The operator parked the machine, shut it down and inspected further. He saw smoke coming from the engine bay of the machine. No fire suppression system or handheld fire extinguishers were used.	The operator had called up earlier in the day regarding an engine oil leak and a tech was assigned to replace the turbo drain hose that was the cause of the leak. The old hose was removed and a new turbo drain hose and seals were fitted. The oil leaked from a loose fitting which was caused by gasket residue that had not been cleaned properly from the flange surface.

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The operator of a Caterpillar D11T noticed a hose had blown at the front of the dozer, shut the machine down and notified his supervisor and the maintenance supervisor of the machine break down. The operator put the ladder down and proceeded to exit the cab when he noticed a flame coming from the right hand side engine bay. The operator then extinguished the fire with a handheld extinguisher.	During the replacement, the old bolts from the hydraulic pipe fitting were used and were tightened using a rattle gun. A combination of an incorrect tightening technique and use of old bolts caused bolt fatigue and subsequent premature failure. One of the bolts in the connection was replaced on 1/6/2020 however the failed bolt in this instance was again re-used at this time leading to further fatigue.
A Komatsu 830E haul truck was returning from the dump when an electrical fault occurred and small flames were observed from a wheel motor. The operator safely parked, shutdown and alighted the truck. A water cart responded and applied water to the wheel motor area.	During truck propulsion, road conditions caused retard 'RP6' contactor to momentarily jolt closed, leading to a wheel motor overcurrent and subsequent flash over.
A Caterpillar 24M grader was operating on haul road when the fire alarm sounded. The operator hit delay and moved the grader off the haul road. As they parked the operator notice flame from the engine bay. At that time, the fire suppression system activated automatically. The operator alighted the machine via the emergency ladder and did not observe any more flame.	A failed lower O-ring on an injector sleeve allowed diesel to enter the cooling system. Diesel contamination led to failure of cooling system hoses. Failure of the cooling system (thermostat) hose allowed diesel contaminated coolant to spray on to a hot surface and ignite.
A Hitachi EX 3600-6 had been operated three and a half hours when during operator changeover process, the relieving operator notice an oil leak from the engine area and both operators proceeded to inspect the engine area. On opening the rear engine bay door, the operators found a flame approximately 400 millimetres high near the left bank front turbo. A handheld fire extinguisher was used to extinguish the fire.	Failure of the turbo charger feed line.