NSW GOVERNMENT

NSW Resources Regulator

FIRES ON MOBILE PLANT

April – June 2020

NSW Resources Regulator

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Contents

Overview

In FY 2020 Q4, there were:

NOTIFIED INCIDENTS
43
DECREASE OF 12 FROM Q3

- **33** Surface coal (77%)
- **8** Underground metals (18%)
- **2** Surface metals (5%)

NOTICES ISSUED
3
Section 191 (2)
Section 195 (1)

ANCILLARY REPORTS COMPLETED
43
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 **35 of 43**	25 of 35	Accumulated flammable leaks and spills	25 of 35	Flammable fluid containment
Fire or explosion underground **8 of 43**	5 of 8	Mechanical energy in the presence of fuel	3 of 8	Manage fuel sources

FY2020 Q4

Of the 43 related incidents, 30 were classified against these two threats (28 were classified against these two critical controls).

Ancillary reports summary

- Heat source **42%** EXHAUST SYSTEM
- Fuel source **37%** HYDRAULIC OIL
- Failed component **23%** HOSE
- Extinguished by **40%** FIRE PROTECTION SYSTEM AND HAND-HELD EXTINGUISHER

NSW Resources Regulator

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 April to 30 June 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 reporting period Quarter 2 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.

Significant incident 1

Figure 1. Short to earth in power supply to starter motor causes fire on haul truck

An operator was driving a haul truck in an underground metalliferous mine. The operator saw flames coming from the front of the machine. While the operator was attempting to activate the fire suppression system a fireball erupted from the engine bay. The operator immediately left the cab and went to a nearby crib cuddy to raise the alarm.

Two other workers who were nearby developed a plan and accessed the truck from the fresh air side. They attempted to extinguish the fire using handheld extinguishers but were unsuccessful. The workers also isolated possible power sources in the area that may have been affected by the fire.

The investigation identified the cause as a short to earth in the power supply to the truck's starter motor. The short resulted in the cable sheathing overheating and igniting. This fire then damaged the adjacent fuel return line which created a larger fuel source.

Significant incident 2

Figure 2a and 2b. Broken wire to brake solenoid causes fire to loader being operated under tele-remote conditions

A loader was being used to muck out under a shaft during construction and was being operated under tele-remote conditions from a nearby control hut. A fault occurred on the brake pack, which resulted in the brakes applying. As the loader was operated, the dragging brake generated sufficient heat to cause an ignition.

Another worker arrived at the hut and could smell burning rubber and informed the loader operator. The loader was shut down and the workers proceeded to the loader and saw a fire on the right rear tyre.

They returned to the hut, activated the fire suppression system and advised control of the emergency. The fire suppression was ineffective as the system does not cover the wheel areas of the machine. The workers returned to the loader and saw a small fire on the tyre. They used three extinguishers which knocked down the flames but the flames would then flare back up. The workers then proceeded to refuge chambers. The loader suffered extensive damage.

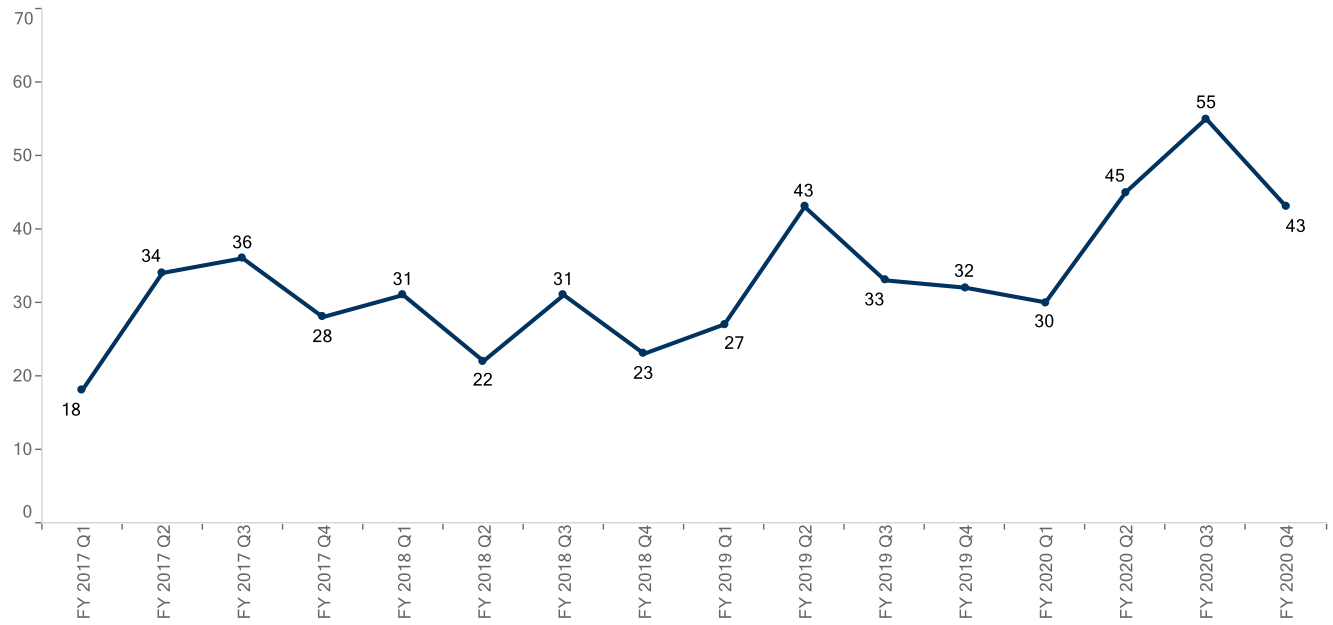
The cause of the fire was identified as a broken wire to the brake solenoid. The tele-remote system identified the fault, however, this fault was not immediately clear to the operator. The supplier of the system was engaged, and changes were made to how faults are communicated to the operator. Alarms are now audible and include a pop up style warning.

Notified incidents

Notified incidents for April to June 2020

Figure 3 relates to incidents involving fires on mobile plant notified in each quarter since July 2017. These incidents decreased for this quarter with 43 incidents notified compared to 55 in the previous quarter (FY2020 Q3). 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 from FY2020 Q2.

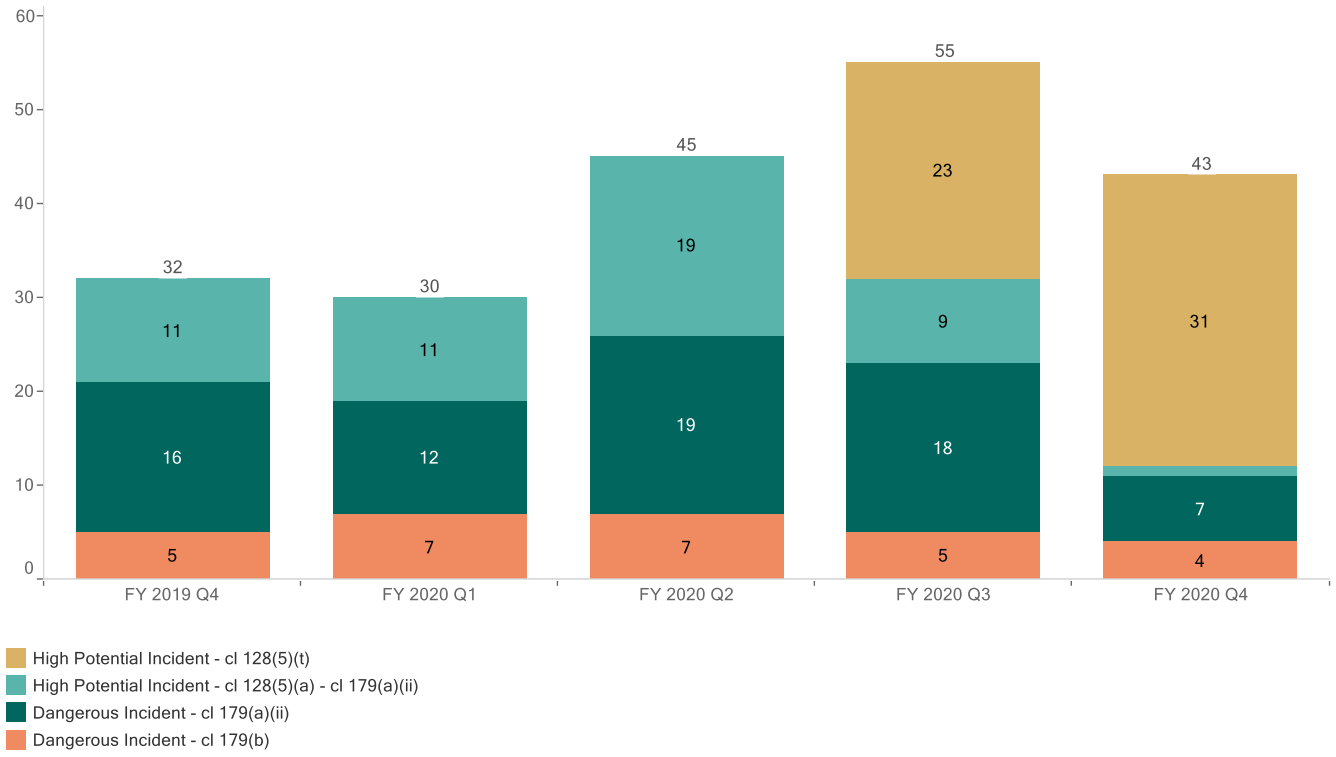
Figure 3. Notified incidents - from 1 July 2017 to 30 June 2020



Notified incidents by legislative requirement to report

Figure 4 highlights the inclusion of clause 128(5)(t) to the Work Health and Safety Regulation 2014 in FY20 Q3. There was also an observed shift from notifying under high potential incident clause 179(a)(ii) to 128(5)(t).

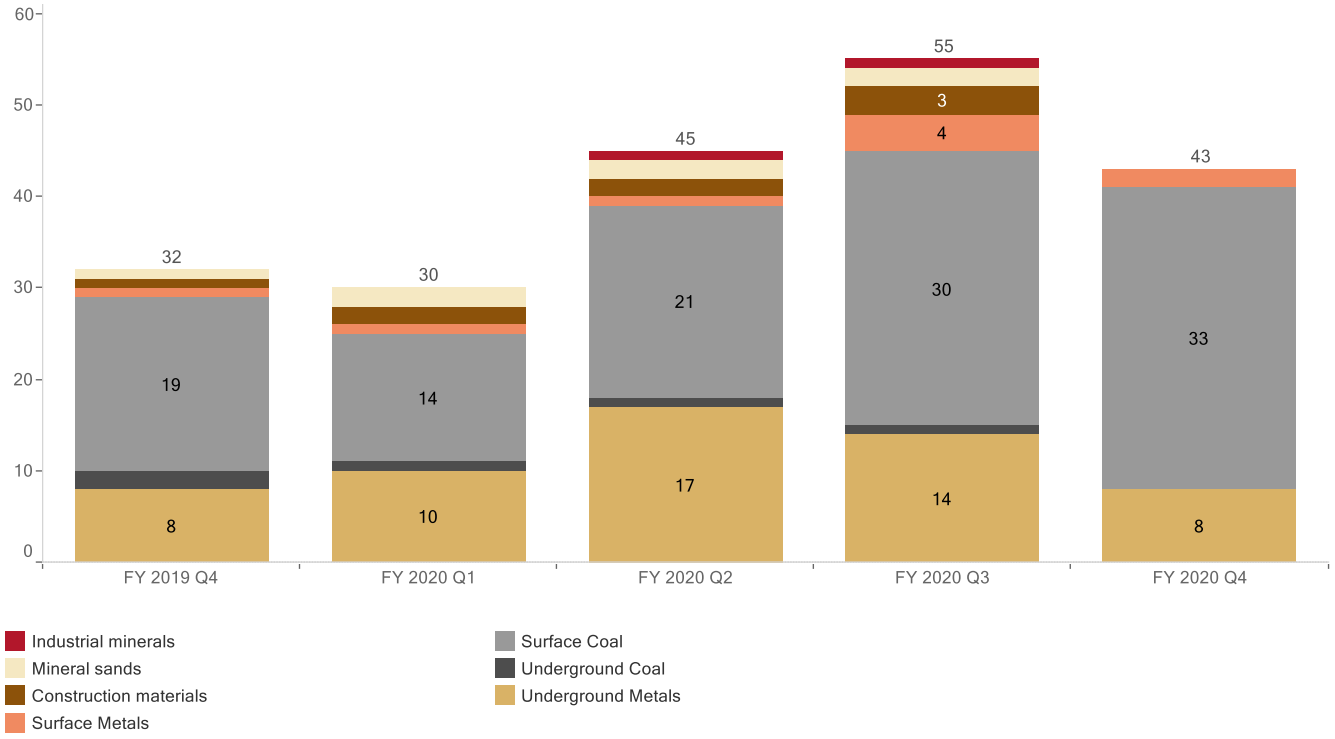
Figure 4. Notified incidents by legislative requirement to report - April 2019 to June 2020



Notified incidents by mine and operation type

Figure 5 shows the number of notified incidents by mine type and operation type. The primary source of the fire is not identified.

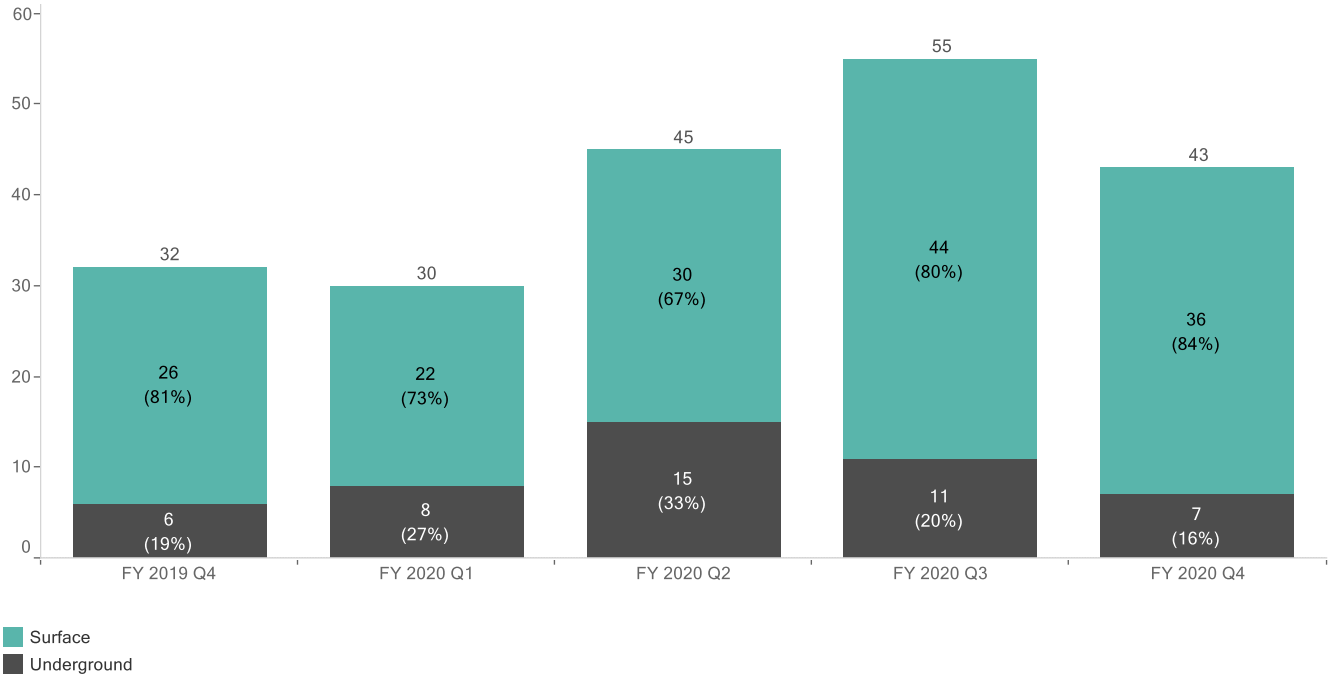
Figure 5. Notified incidents by mine type and operation type - April 2019 to June 2020



Notified incidents by primary location

Figure 6 shows that the primary location of the majority of fires on mobile plant occur on the surface and these have decreased by 8 (from 44 to 36) this quarter.
Note that the primary location of the fire is the actual location where the fire occurred, irrespective of the mine operation type.

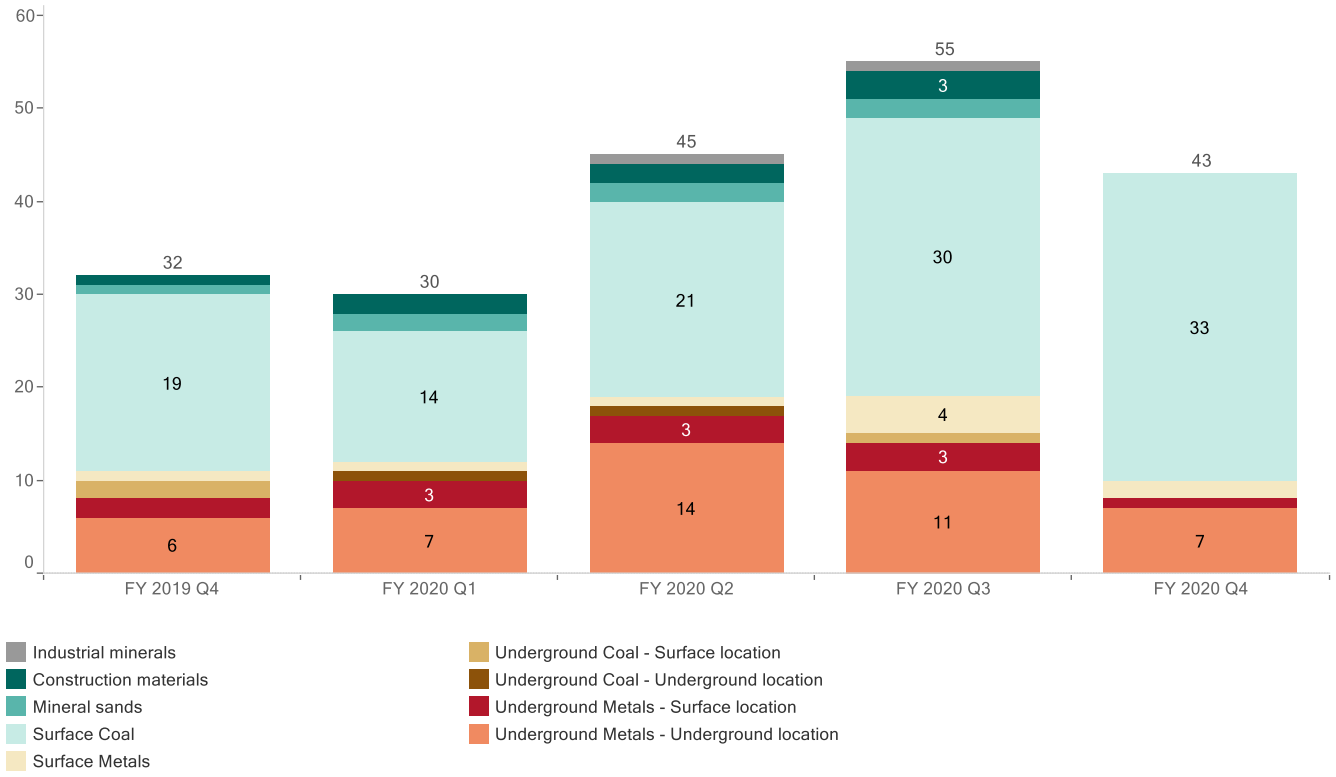
Figure 6. Notified incidents by primary location - April 2019 to June 2020



Notified incidents by mine type, operation type and primary location

FOMP incident notifications at surface coal operations continue to increase for this quarter (from 30 to 33). A decrease in fire incidents on mobile plant in underground locations at underground metals mines are continuing.

Figure 7. Quarterly incidents notified by mine type, operation type and primary location - April 2019 to June 2020

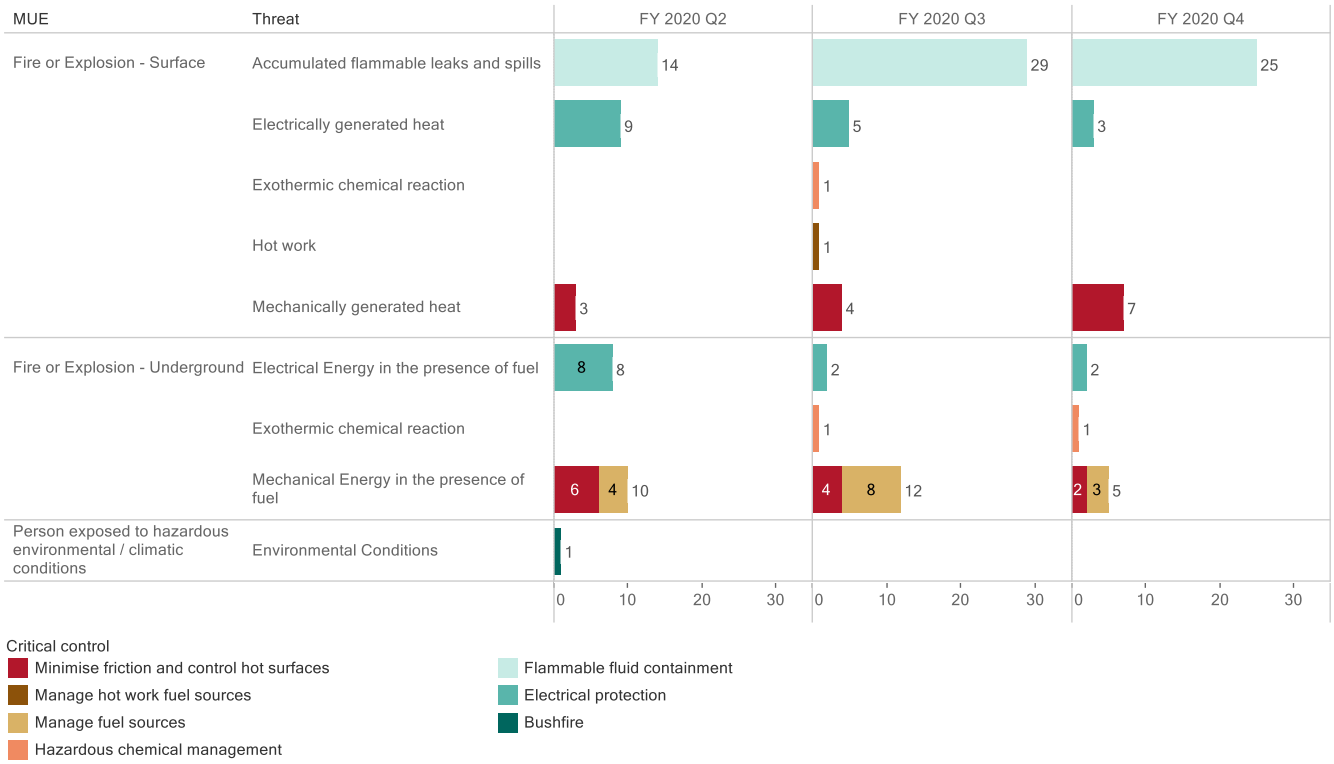


Notified incidents by material unwanted event, threat and critical control

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

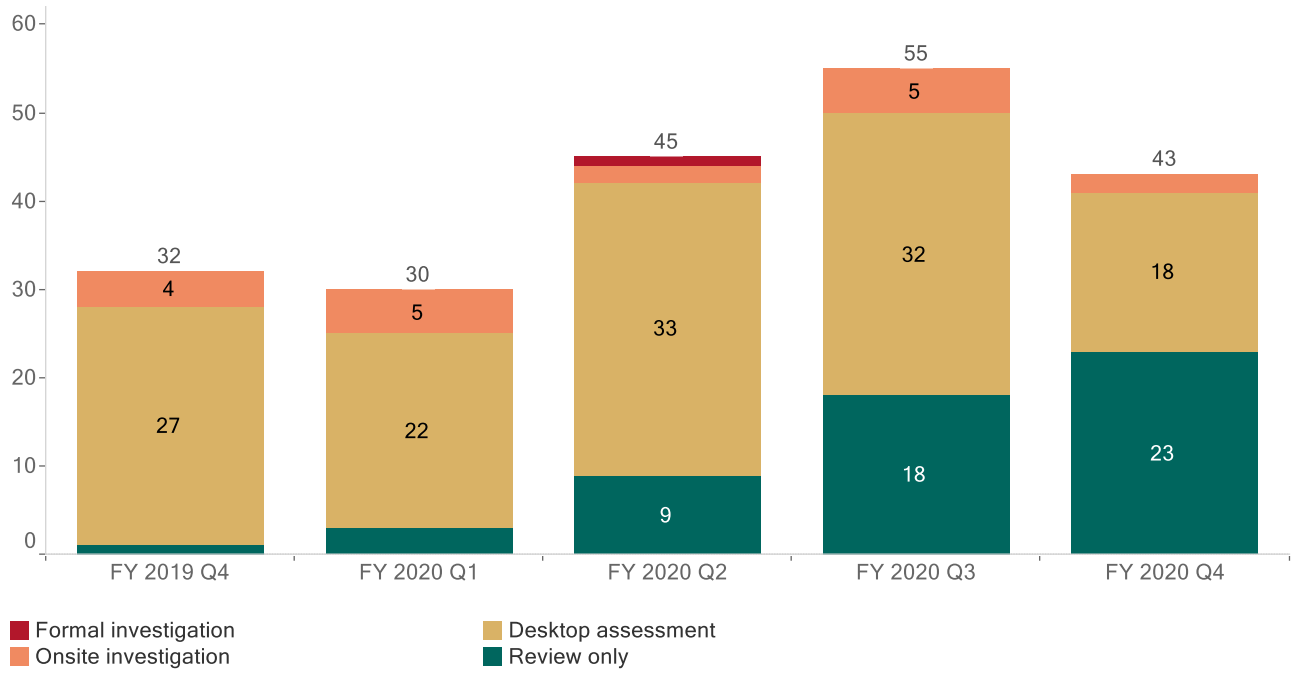
Figure 8. Notified incidents by MUE, threat and critical control for October 2019 to June 2020



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 9 below shows that two onsite investigations and 18 desktop assessments were conducted in response to notified incidents involving fires on mobile plant this quarter.

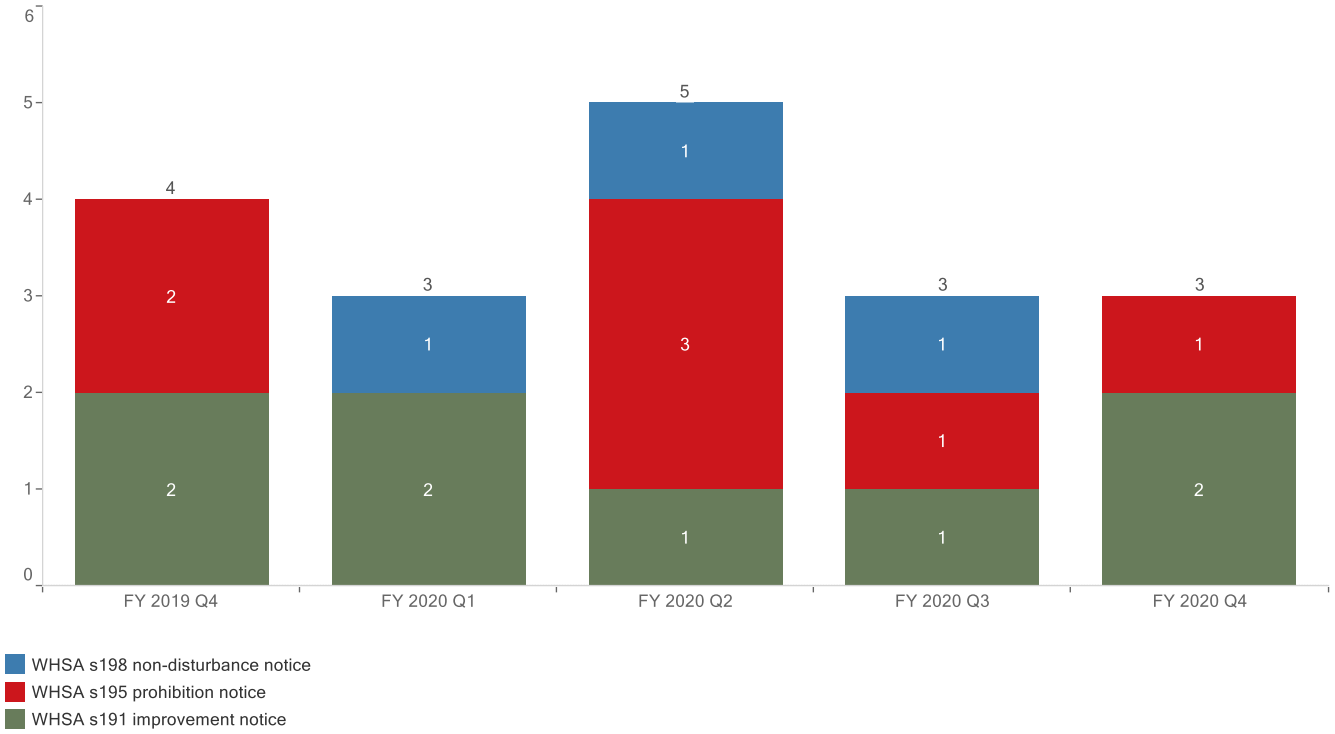
Figure 9. Notified incidents by response level - April 2019 to June 2020



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 10 below shows that three notices were issued in relation to notified incidents involving FOMP this quarter.

Figure 10. Notices issued in relation to FOMP incidents - April 2019 to June 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 11. Ancillary reports – heat sources – April 2020 to June 2020

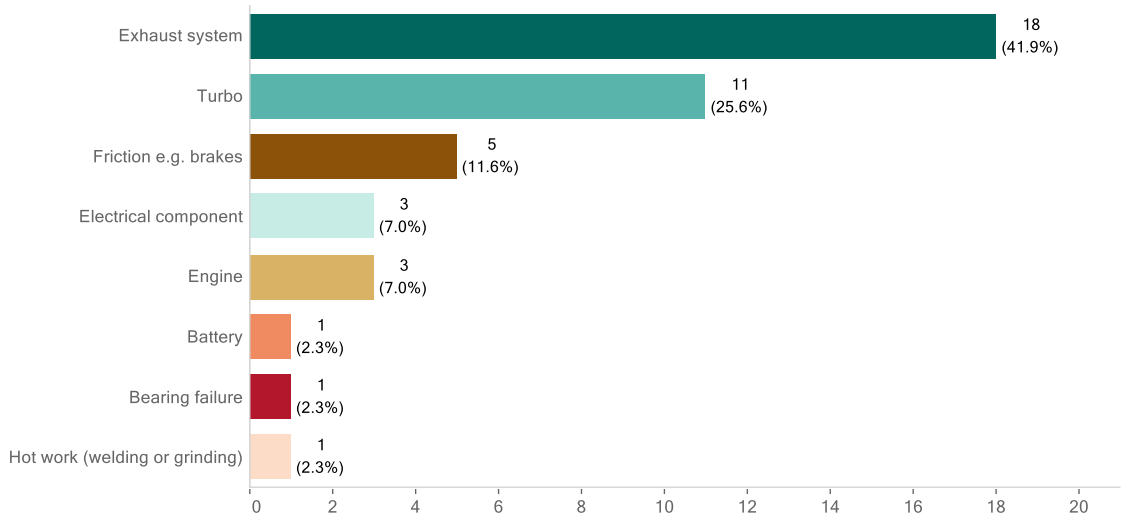
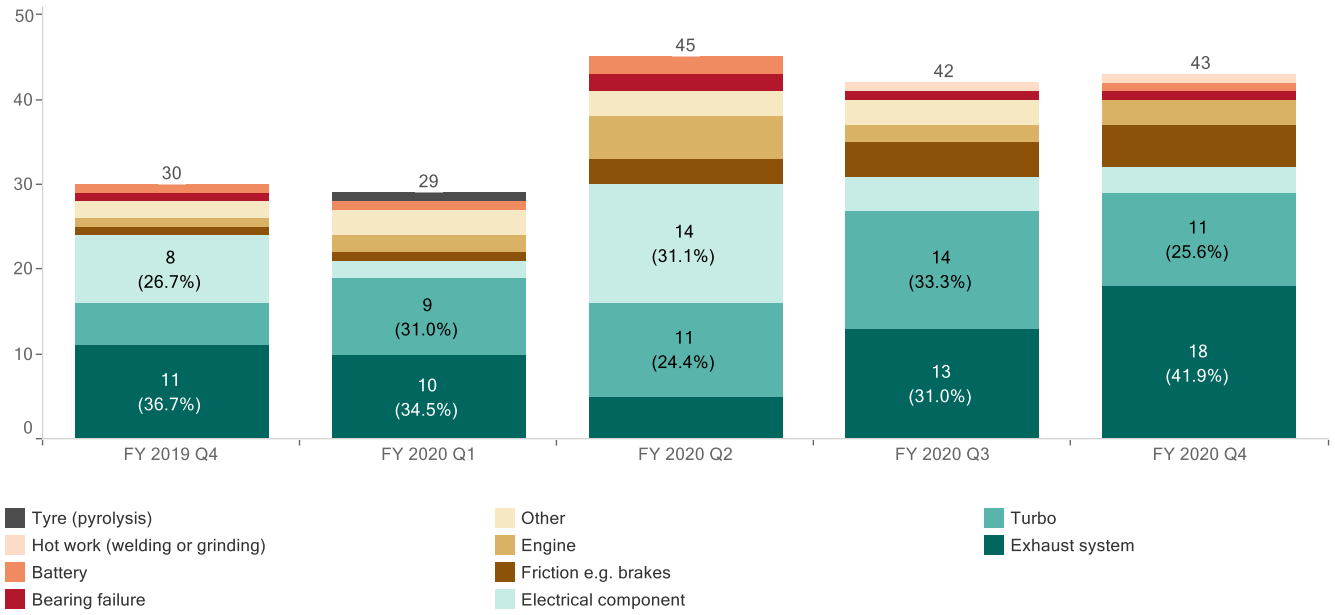


Figure 11. Ancillary reports – heat sources – April 2019 to June 2020



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 12. Ancillary reports – fuel sources – April 2020 to June 2020

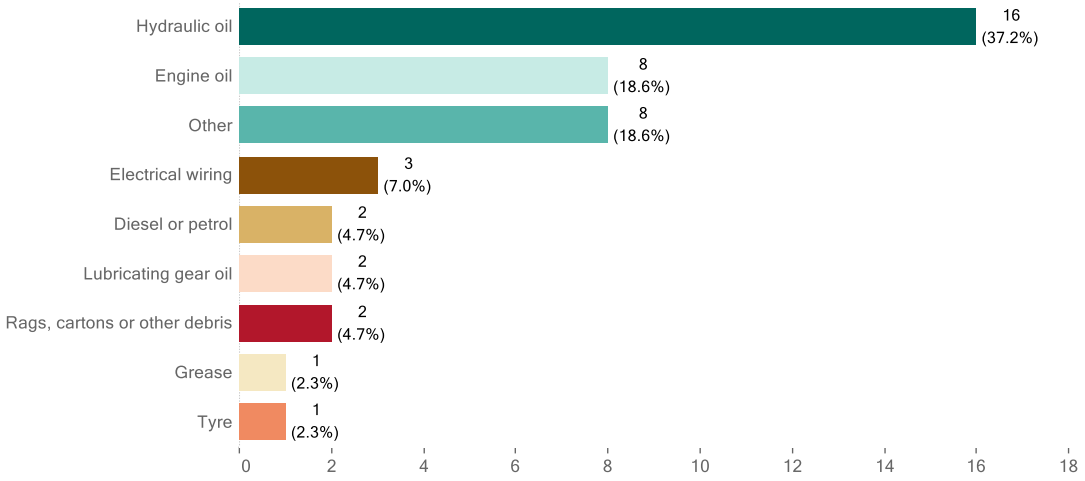
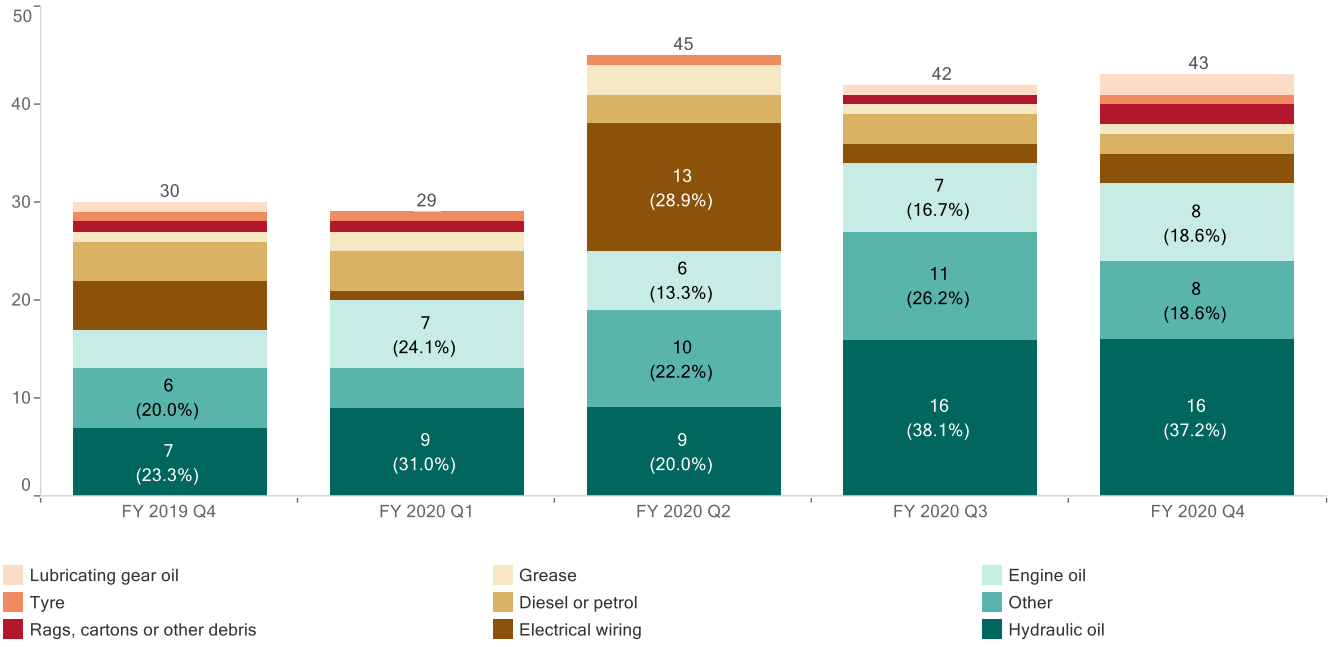


Figure 13. Ancillary reports - fuel sources – April 2019 to June 2020



Ancillary reports – extinguished by

Figure 14. Ancillary reports – extinguished by – April 2020 to June 2020

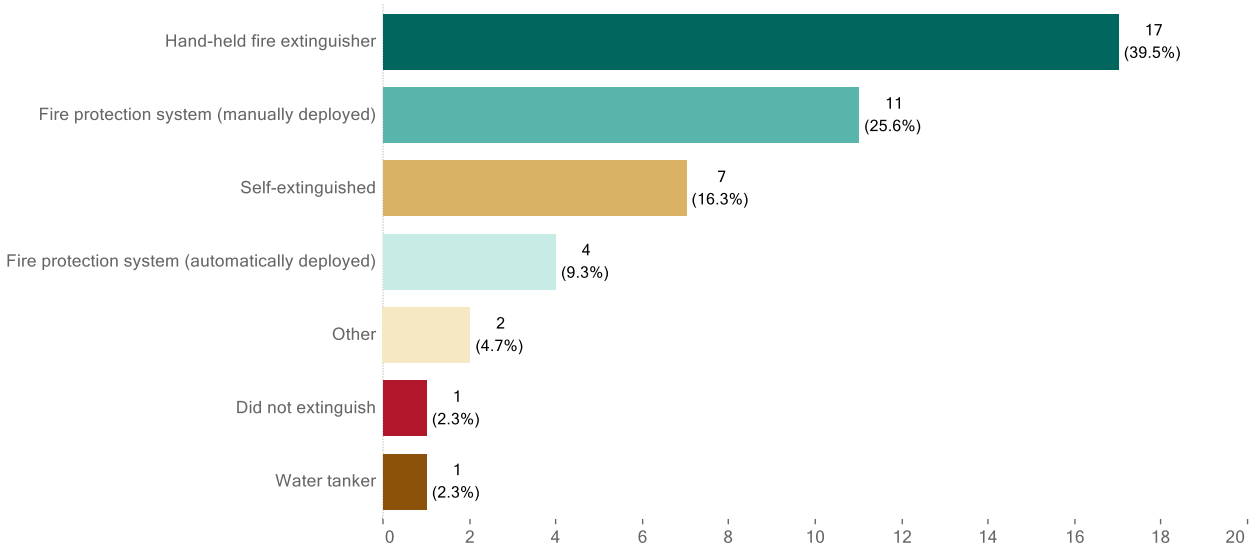
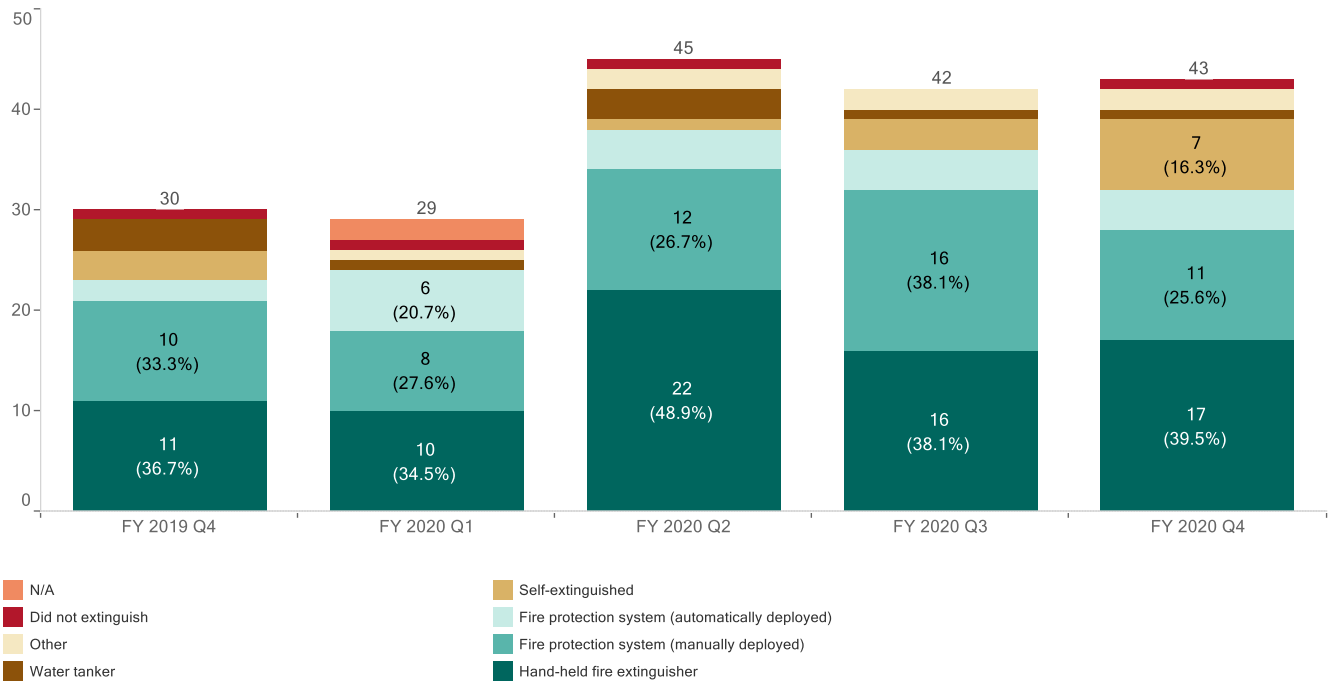


Figure 15. Ancillary reports – extinguished by – April 2019 to June 2020



Ancillary reports – failed component

Figure 16. Ancillary reports – failed component – April 2020 to June 2020

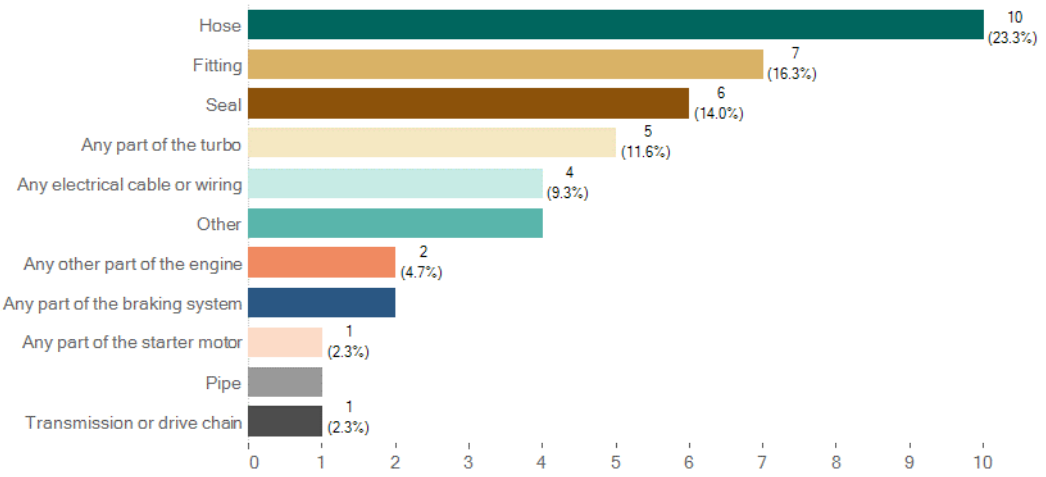
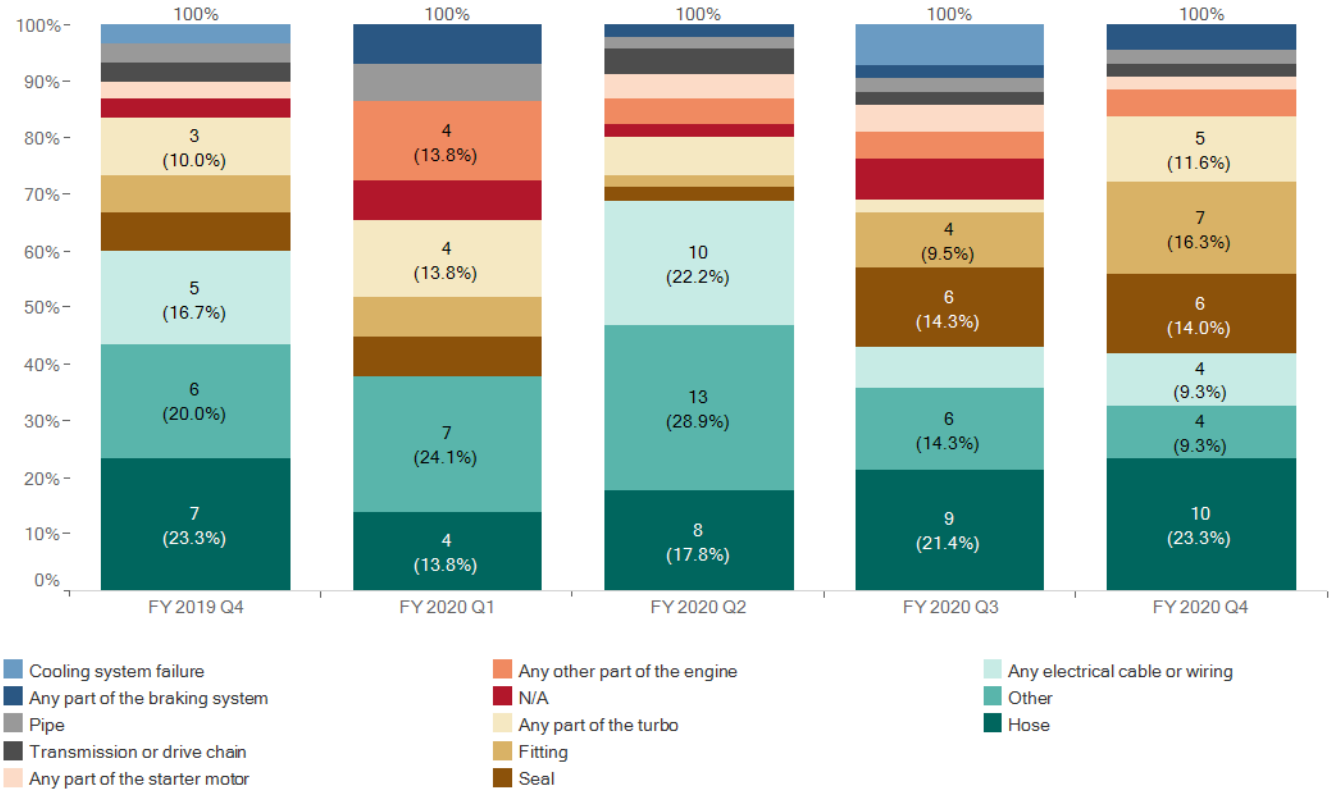


Figure 17. Ancillary reports – failed component – April 2019 to June 2020



Incidents of note

April 2020 – Northparkes Mines (IncNot0037083)
A Caterpillar 311D excavator was being used underground when the operator noticed smoke coming from the engine bay. The operator inspected the engine bay and identified a small flame which was quickly extinguished using a handheld extinguisher. A hydraulic hose had failed spraying hydraulic oil onto the engine.

April 2020 – Mangoola Coal Mine (IncNot0037126)
A worker saw smoke coming from a sound suppression box on top of a hydraulic cooler room on an excavator. The worker manually activated the fire suppression system and a water cart was also used to extinguish the fire. The excavator had undergone maintenance earlier in the day, and fish plates had been welded onto the bottom of the sound suppression box. The excavator had been idle for about an hour before starting up.

Figure 18. Mangoola coal mine

April 2020 – Southern Operations (IncNot0037233)

The operator of an underground dump truck saw flames coming from an engine bay. The operator tried to activate the fire suppression system but was unsuccessful. They immediately exited the cabin and retreated to the crib to report the incident.

Two other workers in the area tried to extinguish the fire with hand-held fire extinguishers but were unsuccessful.

The mine initiated its emergency response procedures and all workers retreated to fresh air bases. All workers were subsequently withdrawn to the surface. The mine's fire and rescue team members re-entered the mine and successfully extinguished the fire.

Figure 19. Southern Operations

May 2020 – Murrawombie Copper Mine (IncNot0037265)

A truck operator was driving up a decline when an alarm came on for low hydraulic pressure. The operator tried to drive the truck to the next level but it stopped and shutdown. The operator then noticed flames from the engine and activated the emergency protocol. The operator then used an extinguisher in the area of the flame.

The investigation identified a failed hydraulic hose that sprayed atomised oil which was drawn over the engine by the engine fan.

May 2020 – Cadia East UG (IncNot0037398)

An agitator was driving down the decline when the truck began to labour and a warning buzzer sounded. The operator noticed a glow on the decline wall and immediately stopped the agitator. The operator yelled to other workers nearby who assisted in extinguishing the fire.

The investigation identified a wire to a brake solenoid was rubbing on a hydraulic fitting causing the brakes to apply and drag. The heat generated from the dragging brake initiated the fire.

Figure 20. Cadia East underground

June 2020 – Mount Pleasant Operation - Thiess Pty Ltd (IncNot0037556)

A major hydraulic oil leak occurred on an excavator, resulting in hydraulic oil spraying onto the turbo and catching fire. The apparent cause of the leak was from a broken flange bolt. The automatic fire suppression system activated and the excavator operator used a fire extinguisher to extinguish the remaining flames.

Figure 21. Mount Pleasant Operations

June 2020 – Northparkes Mines (IncNot0037579)

A hydraulic hose connection was knocked loose on a "Commando" skid steer drilling machine underground, releasing hydraulic oil which came into contact with a hot surface resulting in a small fire which was extinguished by a handheld extinguisher.

Incident details

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

DESCRIPTION	APPARENT CAUSES
A Hitachi EX 3600-6 was being operated from the start of shift. Approximately 3.5 hours later during an operator changeover process, the reliving operator notice an oil leak from the engine area prompting both operators to proceed with an inspection of the engine area. When opening the rear engine bay door, the operator noticed a flame near the left bank front turbo, approximately 400 millimetres high. The operators used the onboard handheld fire extinguisher to extinguish the fire.	• Source of fuel: Turbo charger lubricating engine oil from the turbo's oil feed line • Ignition Source: Turbo charger hot surface
The operator in a loader (LO0795) had been building windrows around a crib hut. While relocating to the park up area the operator noticed a burning smell in the cab and smoke in front of the windscreen. The operator shut the loader down and initiated the emergency over the two-way. The operator exited the cab, proceeded to the rear of the loader to get the handheld extinguisher, walked around to the articulation area and extinguished the flame.	• Park brake dragging • Brake booster has failed leaking air pressure • Foreign materials reducing the life for the booster via plastic plug missing
A LeTourneau L1850 front end loader had just finished loading a dump truck with reject material on the stockpile when the hydraulic alarm initiated on the loader. The operator parked the loader and went to investigate the oil leak when he identified smoke emitting from above the engine bay and a flame near the exhaust riser. The operator re-entered the cab, manually actuated the fire suppression system and called an emergency. The operator exited the cab and egressed the machine safely.	• Steering pump oil leak at hose connection - over tensioning of hose clamp bolt beyond yield point which led to separation of bolt head and relief of clamping force across remaining bolts

DESCRIPTION	APPARENT CAUSES
A Liebherr R9400 was relocating to its new work area. The operator of EX1851 called field maintenance to notify of an extended walk (approx. 1.5 hours). EX1851 was hot seated at which time field maintenance completed a temperature check of the load roller and idler. It was identified that load roller #4 on the right side tracks was at 65°C, and was directed to rest for 20 minutes. 25 minutes after recommencing, a dozer operator noticed a flame from under the EX1851 house. The operator utilised a handheld fire extinguisher to extinguish the residual flame.	• Load roller failure due to wear • Long walk time interval, temperature checks and cooling down process were inadequate
A dozer was ripping on the excavator bench when the operator notice flame from the right hand side of the engine bay. The operator relocated the dozer off the bench to a more accessible location (for a water cart), then called an emergency and activated the fire suppression system. The operator waited until the fire suppression had cleared and then exited the cab and alighted the dozer.	• Incorrect installation/torque of a fuel transfer pump outlet fitting during engine rebuild by OEM fitter - leading to failure of threads on the fitting and housing allowing fuel to leak onto the exhaust lagging. • A hole in lagging allowed fuel to come in contact with hot exhaust surface.
A Caterpillar D10 dozer was placed on breakdown for an oil leak on the previous shift. A fitter repaired the leak and sent it back to work and observed for 5 minutes. The dozer stopped so the fitter could inspect the repair job and when he opened the door into the engine bay a fire on top of the manifold was observed. The fitter grabbed the fire extinguisher that was on the catwalk alongside him and put the fire out and emergency was called by the dozer operator.	• A failed pilot hose in the dozer hellhole sprayed oil forward onto the engine and manifold wraps • The failed hose was replaced, and both the engine and exhaust wraps were removed and washed. • The manifold wrap was not removed and washed as there was no evidence of oil contacting that part of the engine - this was an incorrect assessment by the fitter.
A Hitachi EH4500 rear dump truck had been loaded. As the truck was pulling away from the digger, the operator of the next truck in the EX1850 queue noticed a small flame under the RD1608 tray. An emergency was activated. OCE was first on scene and used a handheld fire extinguisher to extinguish the small flame.	• Prolonged heat from exhaust gases caused the rubber body pads to melt, producing the small flame reported

DESCRIPTION	APPARENT CAUSES
A small fire occurred on a light vehicle while parked on the surface. The fire was caused by a piece of cardboard which had fallen between the cabin and the tray of the vehicle and was resting on the exhaust. The hot exhaust caused the cardboard to ignite. The fire was noticed immediately by the operator who extinguished it using a handheld fire extinguisher. Only superficial damage was sustained to the vehicle.	• A piece of cardboard became lodged in the gap between the cabin and tray headboard, which then ignited on the hot exhaust • Inadequate housekeeping was identified as the underlying root cause
A Caterpillar 785 dump truck was tipping a load at a mill fines area then headed back to low grade dump to get loaded when the operator smelt smoke coming up from behind seat. The operator stopped the truck and opened door to look behind the seat and saw a small flame. The operator called Emergency, engaged the fire suppression system, exited the truck and waited for the emergency response.	• Moisture entered an unused electrical plug after the truck was washed for service – the moisture caused an electrical short and ignition of a small flame and subsequent smoke emanating from behind the operator seat in truck 435
A fire was detected in the engine bay of Haul Truck. The truck was safely parked, and the fire was extinguished by manual operation of the fire suppression system from ground level. No workers were injured in the incident and there was only a small amount of heat damage to the truck as most of the fire was contained within the turbocharger.	• An internal failure, possibly a bearing failure, of the turbocharger has allowed oil to leak through the seals and ignite on hot areas of the turbocharger and surrounding exhaust surfaces
Minor turbo fire on a Hitachi EX3600 (EX005) with a noticeable flame. The fire suppression system was activated which successfully extinguished the fire. No damage was sustained.	• The turbo oil feed line rubbed through against the turbo blanket
A Caterpillar D10 dozer, was being operated on nightshift when the operator noticed sparks coming from the radiator vents at the front of the dozer. The operator parked the dozer, got onto the ground to inspect the dozer and saw a flame on the right hand side of the engine. The operator returned to dozer cab to initiate the emergency two-way call and activate the fire suppression system. While doing so, the fire suppression activated automatically.	• Oil leaking from the right hand rear tappet cover which soaked the turbocharger lagging blanket and ignited a small flame • Minimal damage occurred to the equipment as result of the fire. Root cause determined to be incorrect torqueing of tappet cover bolts during maintenance tasks.
While operating a Caterpillar 789 dump truck the operator heard a loud bang from the engine area. When this occurred, another operator in another truck observed a ball of flame and smoke from the exhaust of the truck.	• The cause was a failed turbo (broken drive shaft)

DESCRIPTION	APPARENT CAUSES
Maintenance fitters were working on a drill rig that had failed a feed cylinder on the previous shift. The machine was started and run for a short period to set the drill up to allow access to the mast head from ground level. After shutting down the machine, one of the fitters could smell something burning or heating and there was also a slight amount of smoke coming from the engine bay (fully enclosed with sound suppression). They immediately investigated by removing the front side engine bay covers and observed a small flame (approximately 10 centimetres high) around the turbocharger and exhaust manifold.	• The cause of the flame was from oil that had leaked out of the failed feed cylinder onto the engine house and the exhaust/turbo area
A Caterpillar D11T was located in the south pit. The operator at the time reported that while he was setting up cabin ergonomics and adjusting the left hand side armrest height he heard an arcing noise and smelt smoke. The operator looked down to his left reported seeing a small piece of paper towel on fire which rapidly burnt out and self-extinguished. The operator safely alighted and isolated the machine. The fire suppression system and onboard fire extinguishers were not utilised.	• The suspected ignition source was wiring that was not adequately secured or routed • A discarded paper towel in the cab is the suspected fuel source
A fire occurred on a Komatsu PC5500 excavator as a result of a hydraulic leak. The residual flame was extinguished using a handheld extinguisher. There were no injuries or equipment damage sustained.	• A new hose had been fitted and the code 62 flange bolts had been tensioned unevenly creating an uneven gap around the face of the flange which caused the O-ring to extrude
A small electrical fire occurred on Bus 302 at a crib hut between the hours of 4 am and 6 am. The operator was returning to the Bus at the end of the night shift when they noticed an electrical smell. They attempted to start the Bus, however, the Bus would not start. Upon further investigation the operator noticed a small flame behind the bull bar where the battery isolator was located. The operator went to the crib hut to grab a handheld extinguisher, by the time they returned the flame had extinguished. The Bus was not running at the time and had been left stationary and turned off.	• Moisture ingress and contacts failed internally inside the battery isolators, shorting to the frame/chassis connection

DESCRIPTION	APPARENT CAUSES
A failed hydraulic connection caused a fire on a Caterpillar D11 dozer. The operator activated the fire suppression system. There were no injuries.	• Investigation revealed that the pipe elbow connection to the right hand side blade lift cylinder quick-drop valve failed. This allowed pressurised hydraulic oil (approx. 3300 psi) to spray onto the dozer, running into the engine bay • The oil has contacted hot engine and exhaust components and caught fire • One of the bolts on the elbow connection has failed by fatigue, allowing the joint to come open, bending the remaining bolt and causing the D-ring seal to blow out
A Caterpillar D10T was working on road works when the operator noticed smoke and small flame coming from the engine bay. The operator shut down the machine, activated the fire suppression system, called emergency and got off the machine with no issues.	• Upon inspection it was identified that failure of the right hand blade cylinder lift hose had sprayed oil onto a hot surface causing ignition of the flame
During the post engine repairs testing on a Hitachi EH4500 a small fire was observed from the left bank rear turbo. The machine was shut down immediately and the fire was extinguished via manual activation of the fire system from the operator's cabin. The engine bay doors were open during the testing and a Penske technician was standing outside the footprint of the machine viewing both sides of the truck watching for leaks. Upon inspection it was found that the fire originated from oil leaking from the turbo drain pipe on the left bank rear turbo.	• An incorrect bolt had been installed and bottomed out in the blind hole of the turbo which did not provide an adequate clamping force onto the drain gasket, allowing oil to leak down onto the exhaust manifold which was blanketed. • It was identified that the incorrect bolt that was used had come from the intercooler inlet elbow which uses similar size bolts, except slightly longer.
A water cart had just pulled into the north fill point, when the operator noticed flames from the right hand side of the engine bay. The operator called emergency, activated the fire suppression system and exited the truck. The Open Cut Examiner who was driving past at the time stopped and extinguished a small flame on the water cart using a hand extinguisher.	• An oil leak was determined as the fuel source • The right hand side exhaust manifold was the ignition point • Non-absorbent lagging was installed on the manifold and turbocharger, but oil likely flowed from the block onto the manifold underneath the lagging

DESCRIPTION	APPARENT CAUSES
While operating a Caterpillar 793D Haul truck the operator was called by a dozer operator after seeing white smoke present from the truck exhaust. After speaking with workshop, the truck was relocated approximately 300 metres down the road and parked in a stable location. At this point there were sparks present from the truck exhaust. The truck was parked and the operator exited safely. The mining supervisors were nearby and inspected the truck. A small flame was present around the lagging which was extinguished by the fire suppression system and a handheld extinguisher.	• Turbo failure as a result of the oil feed line venting into the exhaust causing excessive heat build-up • Heat build-up reached combustion temperature of the turbo lagging • Turbo lagging combustion maintained after shutdown due to turbo temperature
While a grader was operating on haul road in the south pit the driver of a passing light vehicle observed what he though was smoke coming from the left hand side engine door of the grader. The operator was notified and then moved the grader to a safe park up area. The light vehicle pulled up nearby. The driver of the light vehicle then observed flame from the left hand side engine bay door and called emergency. The grader operator hit e-stop, activated fire suppression system and safely alighted the grader. The water cart attended shortly afterwards and wet down the grader engine. There were no injuries. Subsequent investigation by maintenance personnel found no evidence of fire in the engine bay. They did find a rubbed through aftercooler boost hose, and a failed coolant hose. They also found loose mounting bolts on the aftercooler which would have caused the damage to both hoses. From these findings it was concluded that what the witness observed was the glow from excessively hot turbo and exhaust manifolds due to over-fuelling of the engine from the aftercooler boost hose failure. Leaking coolant from the failed coolant hose would have produced steam which the witness took to be smoke.	• Loose mounting bolts on the aftercooler caused the aftercooler to move and the aftercooler boost hose and a coolant hose to rub on adjacent structure • The aftercooler boost hose failure caused a drop in boost pressure • The ECM has compensated by increasing fuel to the engine which resulted in the turbo and exhaust manifolds getting excessively hot and glowing • The coolant hose leak generated steam when the coolant contacted hot lagging or turbo/exhaust surfaces

DESCRIPTION	APPARENT CAUSES
While drilling a 25° hole with the mast leaned over the engine, the fire detection alarm went off. The operator noticed an oil leak from the top of the mast dripping onto the engine. The operator then shut the machine down. A second worker who was located inside the cab then saw a small flame at the turbo area. The worker extinguished the fire with a handheld fire extinguisher. The operator and second worker decided not to activate the fire suppression system as it was only a small flame and the worker felt comfortable to use the extinguisher. The flame did not get big enough to activate the fire wire to then automatically activate the fire suppression system. An infra-red sensor detected a flame as designed and then alarmed the operator as designed. The flame was not big enough to latch the 20 second heat signal on the infra-red camera to then automatically activate the fire suppression system. Upon inspection , it was found that the oil leak was coming from a rotation motor hose o-ring which had been pinched during installation.	• During installation, an o-ring had been pinched on a rotation hose at the drill head • During drilling operation, the o-ring subsequently 'blew-out' and failed • At the time of failure, the drill was drilling 25° holes with the mast leaning over the top of the engine • At the time of failure, the drill head was at the top of the mast over the top of the engine
A dozer was carrying out a clean-up on a digger bench when the operator noticed an oil trail on the ground adjacent to the dozer. The operator relocated the dozer approximately 20 metres towards a lighting plant park area to inspect the leak. After calling maintenance to attend the fault, the operator noticed flames at the right hand side of the dozer engine bay. The operator manually activated the fire suppression system which shutdown the machine. The operator called the emergency via two-way and exited the cab and egressed the machine via the main stairway without injury.	• A failed o-ring on the fan pump blanking plate - apparent misaligned clamp sections
A Hitachi 3600 excavator caught on fire when a metal hydraulic oil line broke at a flexible joint, allowing oil to spray onto the top of the exhaust. The dozer driver working with the excavator saw the flames and called the excavator driver to shut down the machine. The fire burnt itself out. There were no injuries and minor damage to the excavator.	• Oil escaped around a flexible seal and escaped under pressure • Some of the escaped oil contacted the hot exhaust tip and caught on fire

DESCRIPTION	APPARENT CAUSES
A grader was returning to the workshop when the automatic fire suppression system alarmed and activated causing the grader to stop. The operator egressed. The operator and a fitter carried out an initial inspection of both left hand side and right hand side engine bays, but there was no sign of fire. The operator and fitter stepped back to inspect further and witnessed a flame, approximately 12 centimetres high on the left hand side of the engine, next to the turbo. The fire was extinguished by the operator using a handheld extinguisher. The grader turbo fuel feed line was repaired, heat blanket removed and inspected, and the area was washed off. The engine was run for 15 minutes to test the repairs. The operator was instructed to take the grader to the work shop for follow up. As the grader was on route to the workshop the water cart, which was following the grader as the fire suppression system was out of service, noticed the grade was presenting a small amount of smoke which was followed by flames. The grader operator stopped and was able to extinguish a small fire on the exhaust manifold heat blanket.	• Event 1. Failed turbo feed hose allowing oil to ignite after coming into contact with turbo • Event 2. Exhaust manifold blanket was oil soaked and ignited on the exhaust manifold
The operator noticed an oil leak that was spraying oil onto the ground behind the grader. The operator could smell it was hydraulic oil and moved the grader into a safe location away from the working dump. As the operator pulled the grader up, the low oil alarm initiated and the operator shut down the machine. The operator could see white smoke emitting from the engine bay, the operator then exited the cab to inspect the engine bay. A small flame approximately five centimetres wide and ten centimetres high was spotted at the top of the exhaust, at the turbo. The operator grabbed a hand held fire extinguisher and gave 'two quick squirts' which extinguished the flame. The operator then notified the OCE and arranged a water cart to stand by.	• A hydraulic hose failed in the articulation point of the grader • An insufficient firewall allowed the oil stream to spray through the pump compartment and onto the underside of the bonnet • Oil then dripped onto the turbo

DESCRIPTION	APPARENT CAUSES
A Caterpillar D10 dozer operator heard an unusual sound that he thought was a coolant leak. He parked the dozer up in an accessible location and shut the dozer down. The operator exited the dozer and went to investigate the leak. While doing so, he noticed smoke coming from the right hand side of the engine bay. The operator opened the rear engine bay door where flames were noticed. As he was attempting to get a fire extinguisher to put the flames out, the onboard fire system activated.	• A fan pump hydraulic hose developed a leak which is located under the cab of the dozer • During operation, oil has run down the right hand chassis rail of the dozer towards the engine bay and pooled around the exhaust manifold and turbo charger area • The cause of the hose leaking was due to a P clamp (segregating the hose from potential rub points) that had rubbed through the casing of the hose • This occurred due to the hose being fitted with an oversized P clamp
Flames ejected out the exhaust stacks of a Liebherr 996B	• Failure of the turbo bearing leaking engine oil into the exhaust system
An engine fire occurred on a Komatsu PC5500 excavator. The operator was alerted to the fire by the presence of smoke outside of the cab. The fire suppression system was activated which extinguished the fire, and the operator alighted from the excavator. An engine oil pressure sender fitting had disengaged with the oil cleaner housing causing oil to escape until the engine was shut down by the fire suppression system. No equipment damaged occurred as a result of the incident.	• The oil pressure sender ejected from the oil filter housing • A nonstandard extension fitting was fitted some time before the machine arrived on site and a mismatch in thread form between 1/4" BSPT (the fitting) and UNO o-ring (the housing) meant the threads were not adequately engaged • Either deterioration over time or slight looseness was enough to allow the threads to completely disengage
A watercart operator said he observed sparks coming from the artic area behind the cabin. The operator stopped the vehicle, called emergency and activated the fire suppression system. Flames were seen from the artic area, so operator used a hand held fire extinguisher to extinguish the flames.	• Dragging the park brake due to incorrect adjustment of the park brake • Inadequate troubleshooting of park brake defects prior to the incident

Summary of recommendations to industry

Recommendation

Inspections conducted after maintenance should identify new hazards that may have been inadvertently introduced as a result of that task. Appropriate controls should be put in place to manage the risks.

Vehicles used in underground mines must be rigorously assessed regarding the risk of fire.
An assessment program undertaken by the Regulator in 2019 focused on the contribution of maintenance practices to plant fires. The program identified significant deficiencies regarding fire risk assessments.

Refer to:

- SA19-02 Non-metallic materials add fuel to underground truck fire
- Position paper: Preventing fires on mobile plant

Mine and petroleum site operators are reminded that effective implementation of Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 emergency management (division 6) and information, training and instruction (division 7) requirements will have a significant impact on keeping workers safe in an emergency.

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