NSW GOVERNMENT

NSW Resources Regulator

FIRES ON MOBILE PLANT

October – December 2020

NSW Resources Regulator

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Contents

Overview

In FY 2021 Q2, there were:

NOTIFIED INCIDENTS
48
DECREASE OF 13 FROM 61 Q1 FY2020

- **36** Surface coal (75%)
- **7** Underground metals (15%)
- **2** Underground coal (4%)
- **1** Construction materials (2%)
- **1** Mineral sands (2%)
- **1** Surface metals (2%)

NOTICES ISSUED
0

ANCILLARY REPORTS COMPLETED
48
Represents 100% 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 **42 of 48**	19 of 42	Accumulated flammable leaks and spills	19 of 42	Flammable fluid containment
Fire or explosion underground **6 of 48**	5 of 6	Mechanical energy in the presence of fuel	2 of 6	Manage fuel sources

FY2021 Q2

50% of incidents were classified against these two threats.
In 44% of incidents, the critical control failure related to fuel.

Ancillary reports summary

- Heat source **32%** TURBO
- Fuel source **52%** ENGINE OIL AND HYDRAULIC OIL
- Failed component **19%** HOSE
- Extinguished by **36%** FIRE PROTECTION SYSTEM (MANUALLY DEPLOYED)

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 October to 31 December 2020.

The change in legislation enacted in February 2020 to broaden the reporting requirement for fires on mobile plant has seen an increase in the number of reportable incidents as expected. This is building a wider understand of the true number of fires occurring within NSW mines.

The information contained within this report demonstrates a wide range of factors are continuing to contribute to fires.

These range from:

- quality issues related to maintenance work conducted at mine sites and workshops,
- hose management issues,
- turbo failures and
- electrical fires.

A consistent trend of more than half of fires have been ignited by the exhaust system and turbo charger has remained throughout 2020.

Mines must continue to work with original equipment manufacturers, overhaul workshops and third-party suppliers to manage hot surfaces on mobile plant. This should be an ongoing process to ensure mines are aware of current best practices and evolving technologies or techniques. Mines should also routinely consult OEM's and suppliers for the option and availability of fire-resistant fluids. 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.

Significant incidents

November 2020 – IncNot0038855

A Caterpillar AD55B dump truck was travelling out of the underground. As it exited the portal and was driving to the surface park up area, a small engine fire started.

The haul truck operator saw the flame coming from the exhaust guard. The operator manually initiated the fire suppression system which extinguished the flame. A large amount of hydraulic oil was evident over the engine bay.

The investigation noted that a fan motor hydraulic leak had been repaired prior to the incident. The investigation found an incorrect O ring was used during this repair. When the replacement O ring failed, hydraulic oil sprayed over the engine, assisted by the engine fan.

This incident is a pertinent reminder of the importance of quality maintenance work required. The potential existed for a much larger fire due to the fan working to spread oil over the engine.

Figure 1: *Engine bay covered in hydraulic oil*

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

November 2020 - IncNot0038725

A Sandvik TH663 dump truck was being driven out of the mine when a fire started due to the exhaust separating from the turbo which ignited the lagging.

The clamps connecting the turbocharger and the exhaust pipe had failed. The clamping bolt was missing from the clamp.

This failure caused the exhaust pipe and turbocharger to separate allowing excessive heat to flow around the heat turbo shielding. The excessive heat affected the wiring harness to the starter motor and the earthing harness at the rear of the engine. Also, part of the turbo shielding had scorching, evident of a small fire.

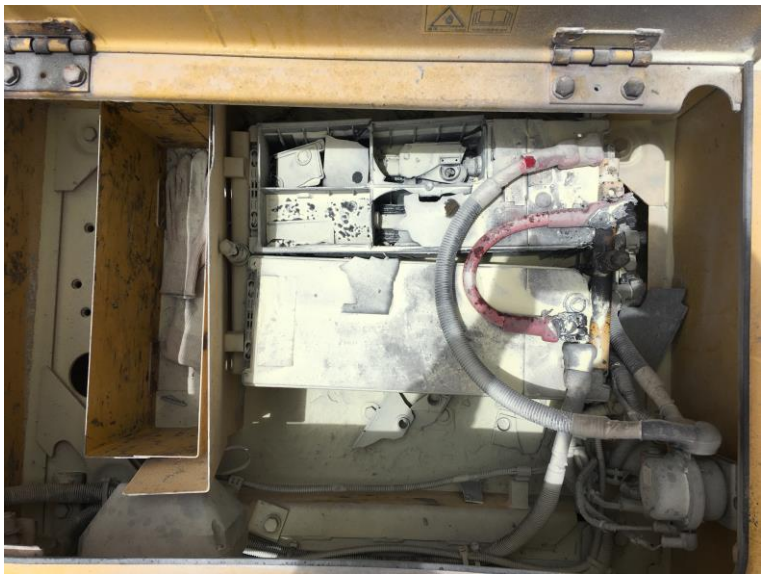
Figure 2: *Failed clamp*

November 2020 – IncNot0038752

The operator of a Komatsu PC350-8 excavator noticed smoke coming from the battery enclosure of the machine while loading a truck. The operator shut the excavator down and called the truck driver. When the enclosure was opened, the battery was on fire. The operator attempted to extinguish the fire using the fire extinguisher that was fitted to the excavator.

This extinguisher failed to work. When the operator moved away to retrieve a second extinguisher from the truck driver, the battery exploded. The worker was not injured.

Figure 3: *Damaged battery*



The investigation conducted by the mine identified that the bracket that retains the battery had become loose. This allowed the battery to move, which has led to the bracket contacting the terminals, shorting the battery.

The fire extinguisher fitted to the excavator was found to be ineffective as the powder had settled.

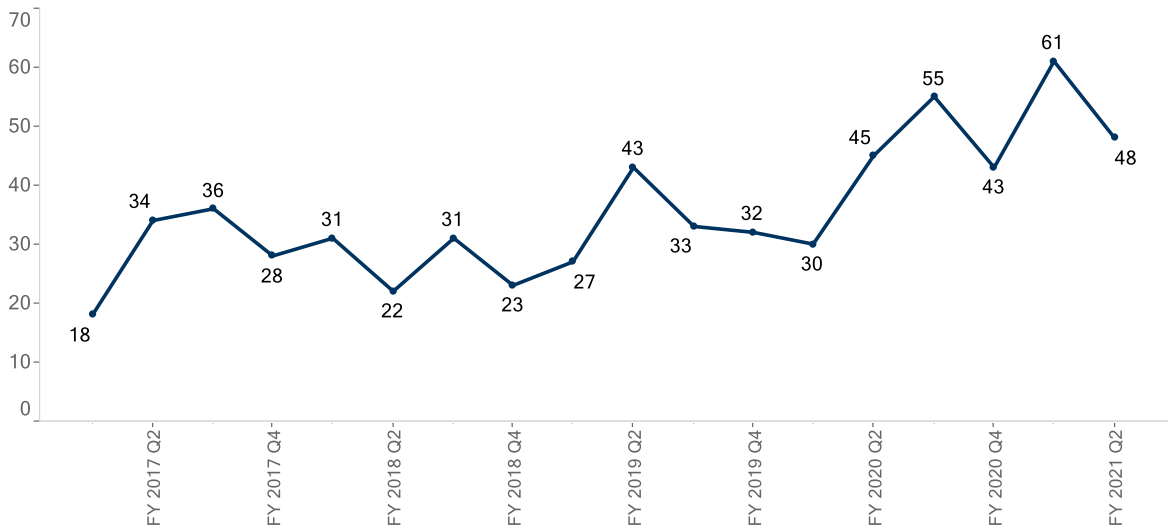
Notified incidents

Notified incidents for October to December 2020

Figure 4 relates to incidents involving fires on mobile plant notified in each quarter since July 2017. These incidents have decreased this quarter to 48 incidents notified compared to 61 in the previous quarter (FY2021 Q1). 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.

It is noted that during the quarter there was a reduction of operating hours in the surface coal sector due to operational shut down periods during school holidays and the Christmas/New Year period.

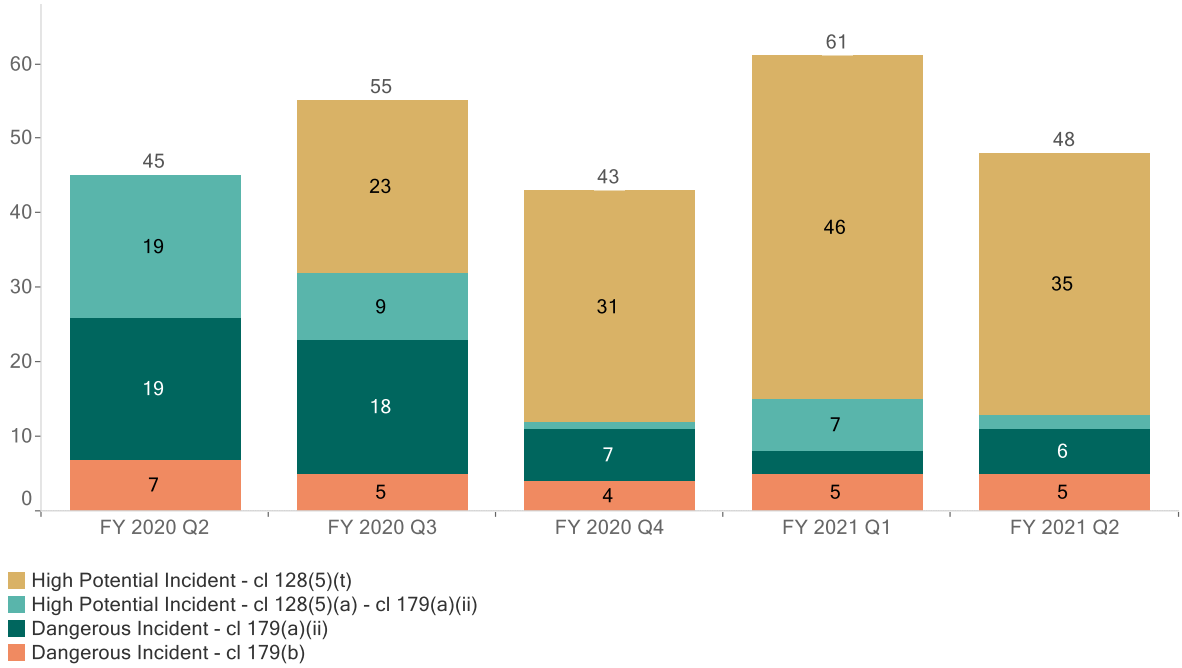
Figure 4: Notified Incidents – from 1 July 2017 to 31 December 2020



Notified incidents by legislative requirement to report

Figure 5 highlights the inclusion of clause 128(5)(t) to the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 in FY2020 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).

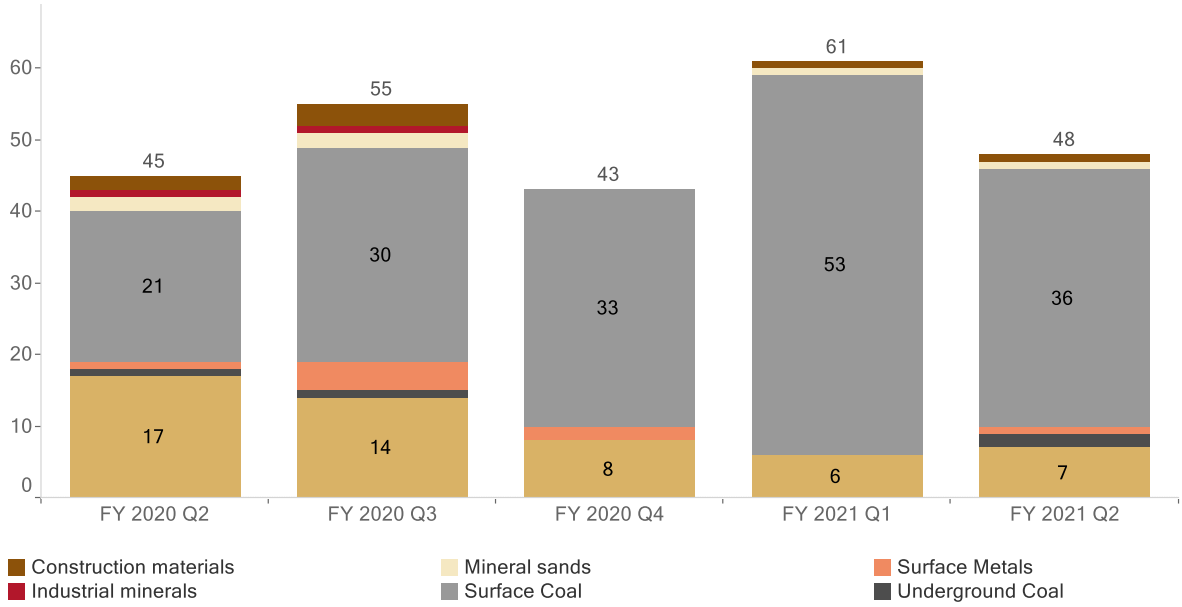
Figure 5: Notified incidents by legislative requirement to report – October 2019 to December 2020



Notified incidents by mine and operation type

Figure 6 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.

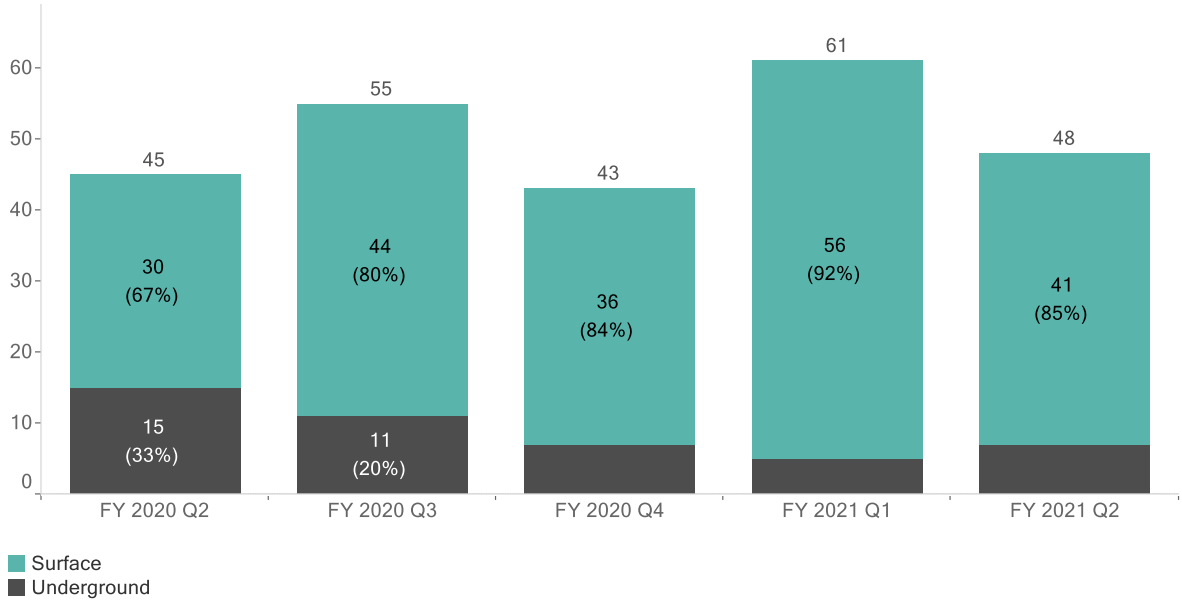
Figure 6: Notified Incidents by mine type and operation type – October 2019 to December 2020



Notified incidents by primary location

Figure 7 shows that the primary location of the majority of fires on mobile plant occur on the surface and these have decreased by 15 (from 56 to 41) this quarter.
Note that the primary location of the fire is the actual location where the fire occurred, irrespective of the mine operation type.

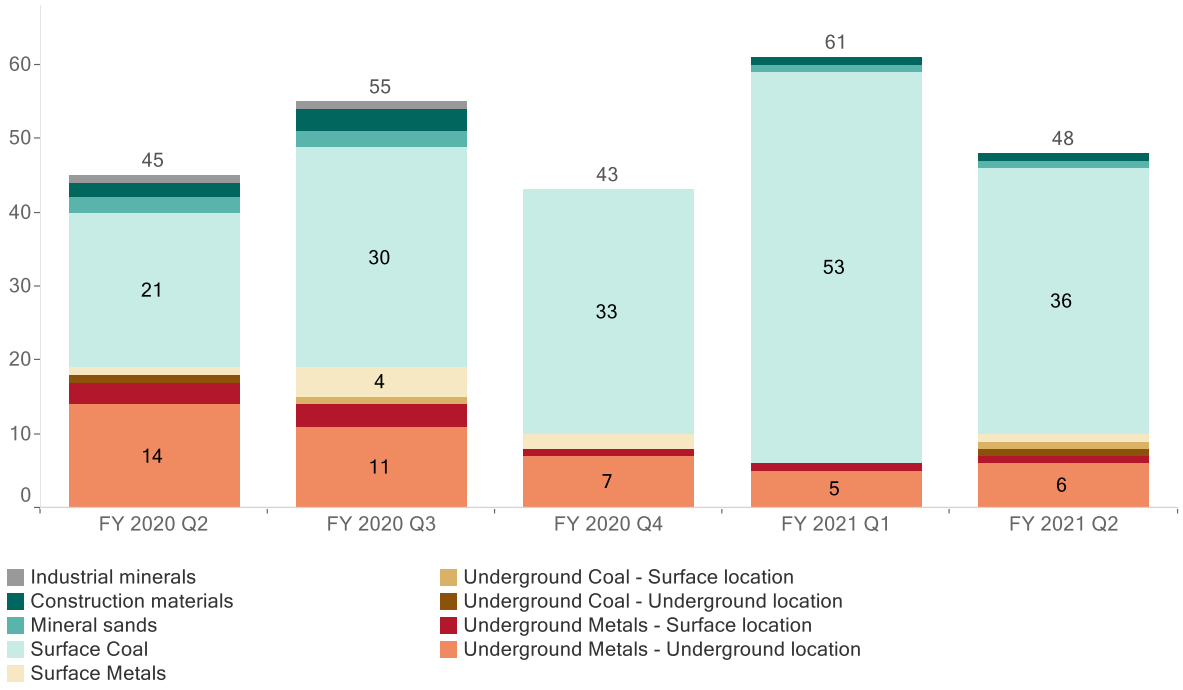
Figure 7: Notified incidents by primary location – October 2019 to December 2020



Notified incidents by mine type, operation type and primary location

Figure 8 shows FOMP incident notifications at surface coal operations have decreased this quarter (from 53 to 36). As noted above there was a decrease in utilisation during this quarter. There has been a slight increase in FOMP incident notifications at underground metals mines, increasing from 5 to 6 incidents. A single FOMP incident notification was recorded at an underground coal mine this quarter, which was the first one recorded since FY2020 Q2.

Figure 8: Quarterly incidents notified by mine type, operation type and primary location – October 2019 to December 2020

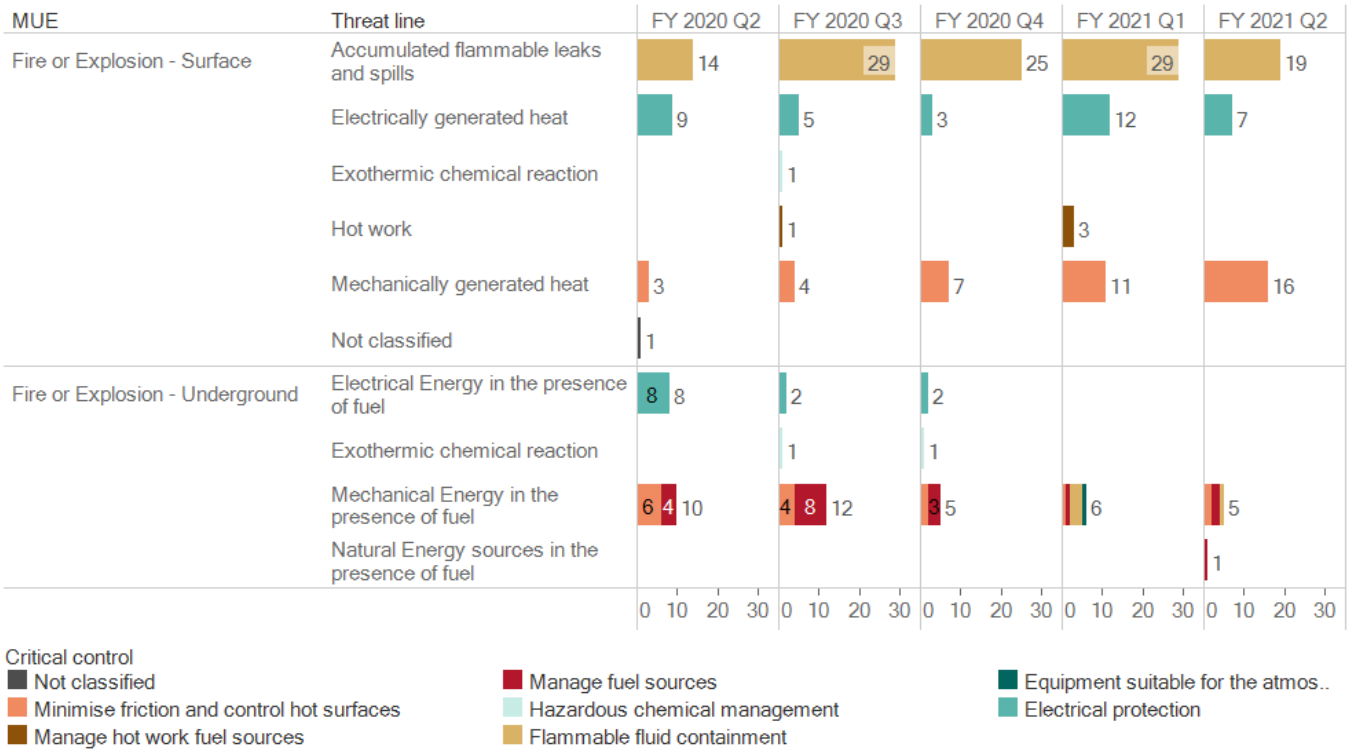


Notified incidents by material unwanted event, threat and critical control

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

Notified incidents which involve the threat line of mechanically generated heat continued to increase this quarter (from 11 to 16).

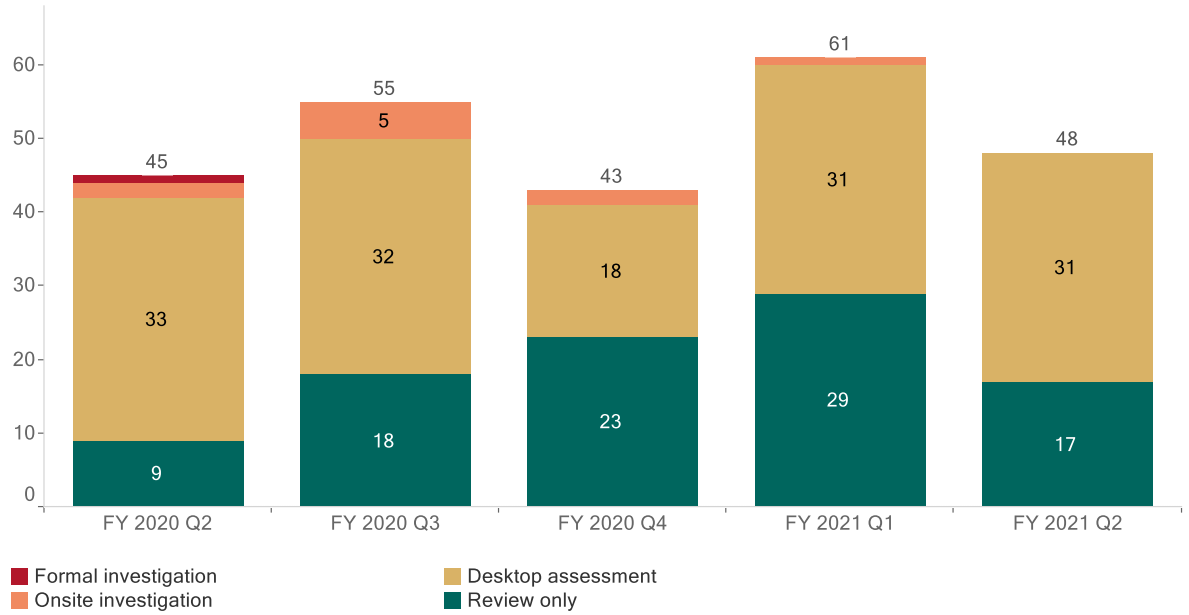
Figure 9: Notified incidents by MUE, threat and critical control for October 2019 to December 2020



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 are preventable. For each incident reported it is assessed and the outcomes reviewed. This may involve an inspector attending the mine (site assessment) or a review of the investigation findings and actions (desktop assessment). The figure below shows that there were no onsite investigations this quarter, with 31 desktop assessments being conducted in response to notified incidents involving fires on mobile plant.

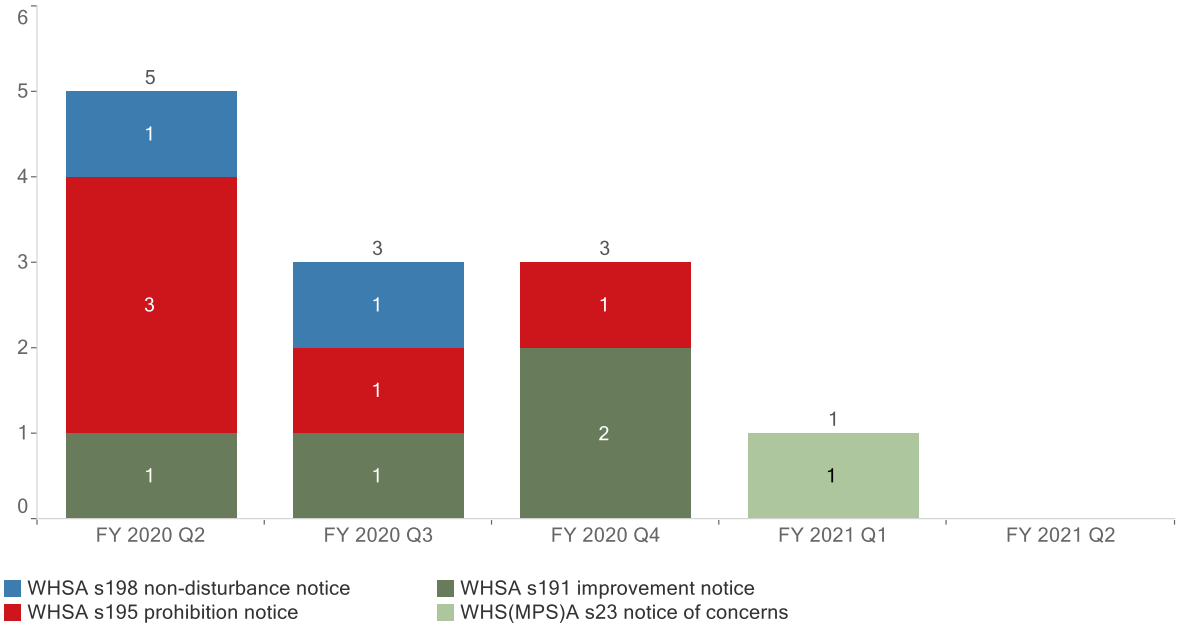
Figure 10: Notified incidents by response level – October 2019 to December 2020



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 notices will be issued to ensure the appropriate steps are taken. Figure 11 below shows that no notices were issued in relation to notified incidents involving FOMP this quarter.

Figure 11: Notices issued in relation to FOMP incidents – October 2019 to December 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 12: Ancillary Reports – Heat Sources – October 2020 to December 2020

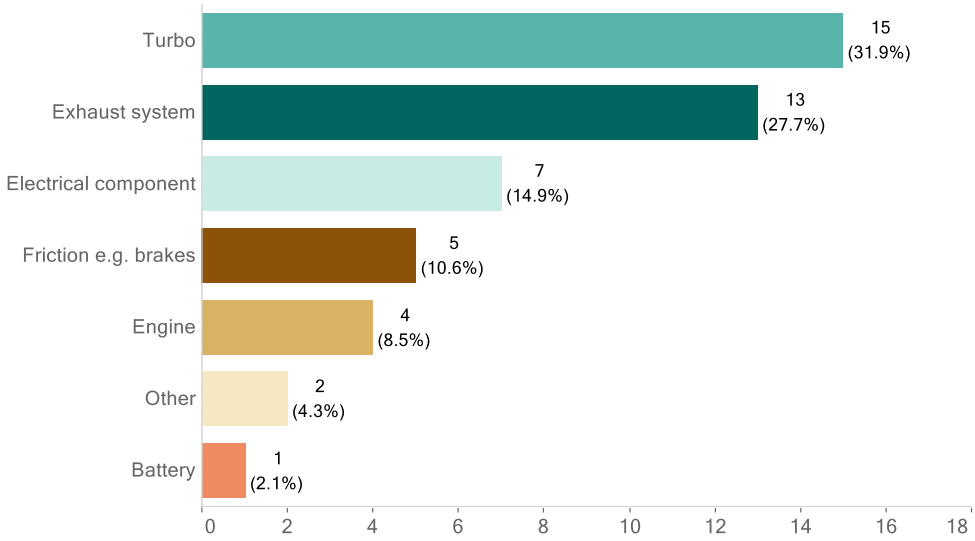
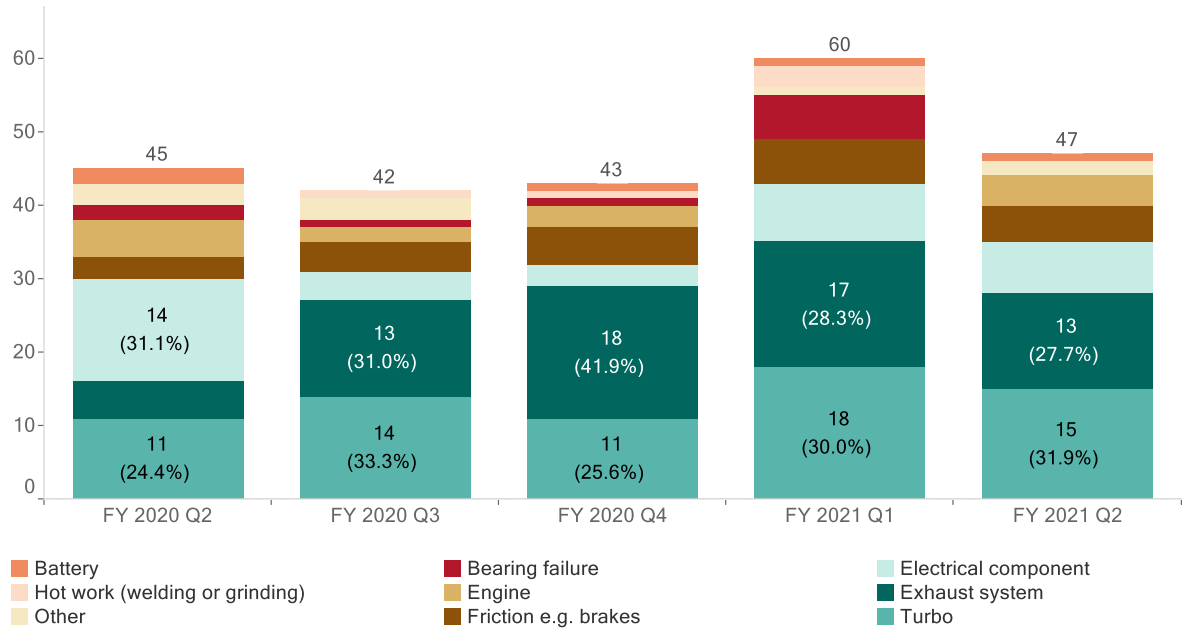


Figure 13: Ancillary Reports – Heat Sources – October 2019 To December 2020



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 14: Ancillary Reports – Fuel Sources – October 2020 to December 2020

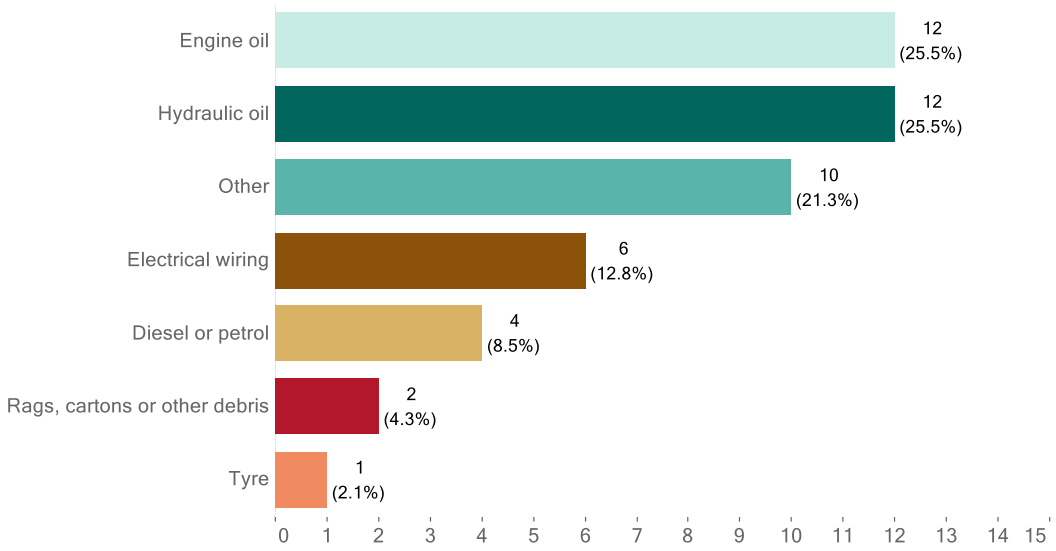
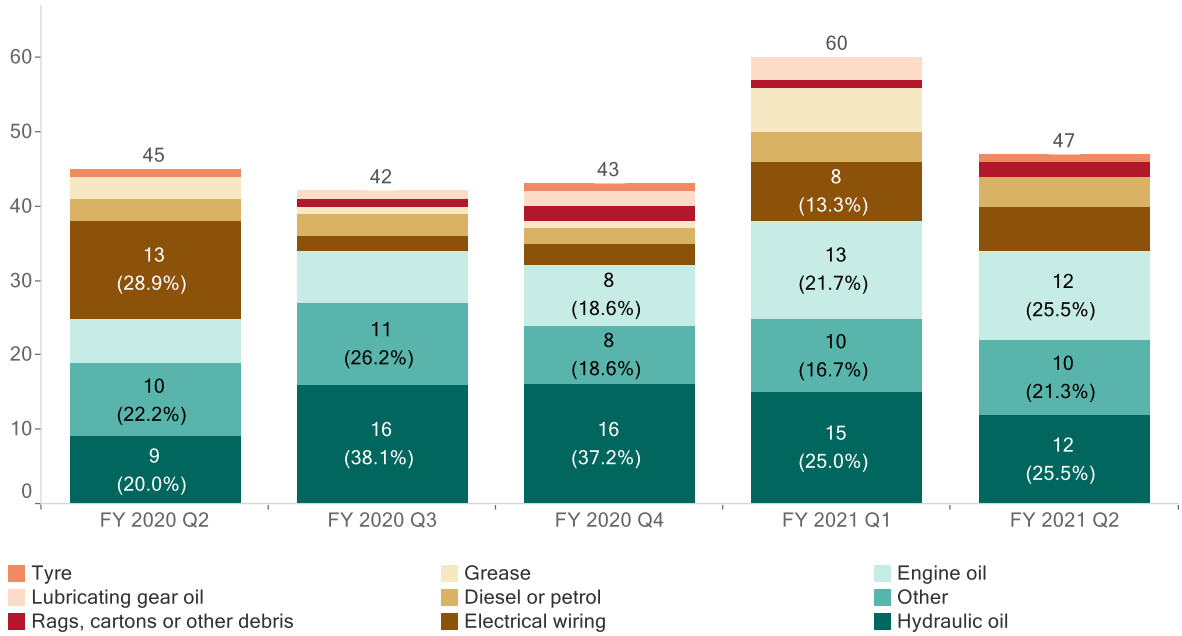


Figure 15: Ancillary Reports - Fuel Sources – October 2019 to December 2020



Ancillary reports – extinguished by

Figure 16: Ancillary Reports – Extinguished By – October 2020 to December 2020

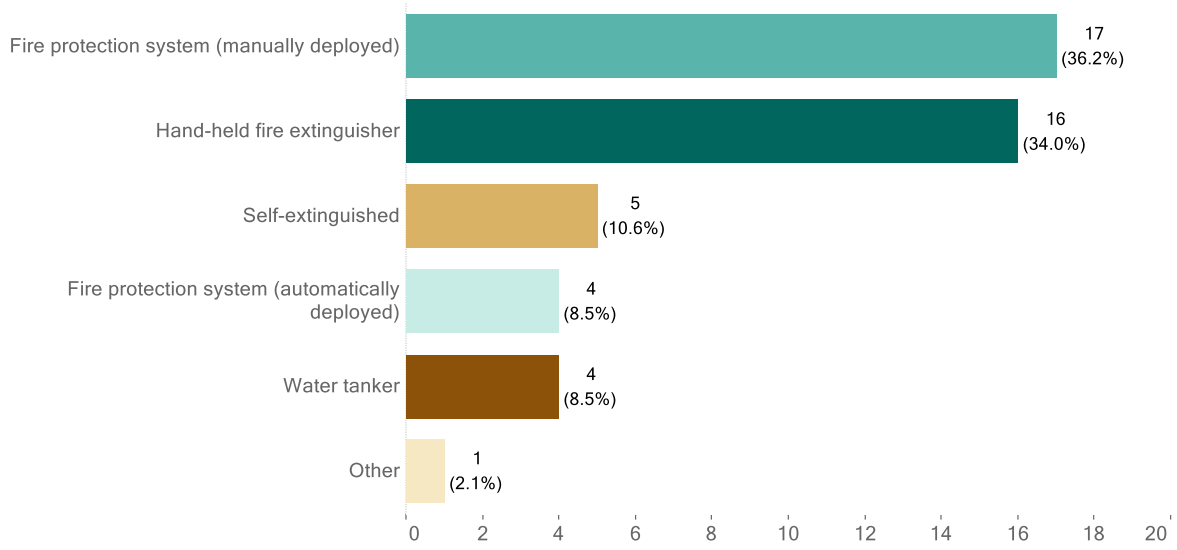
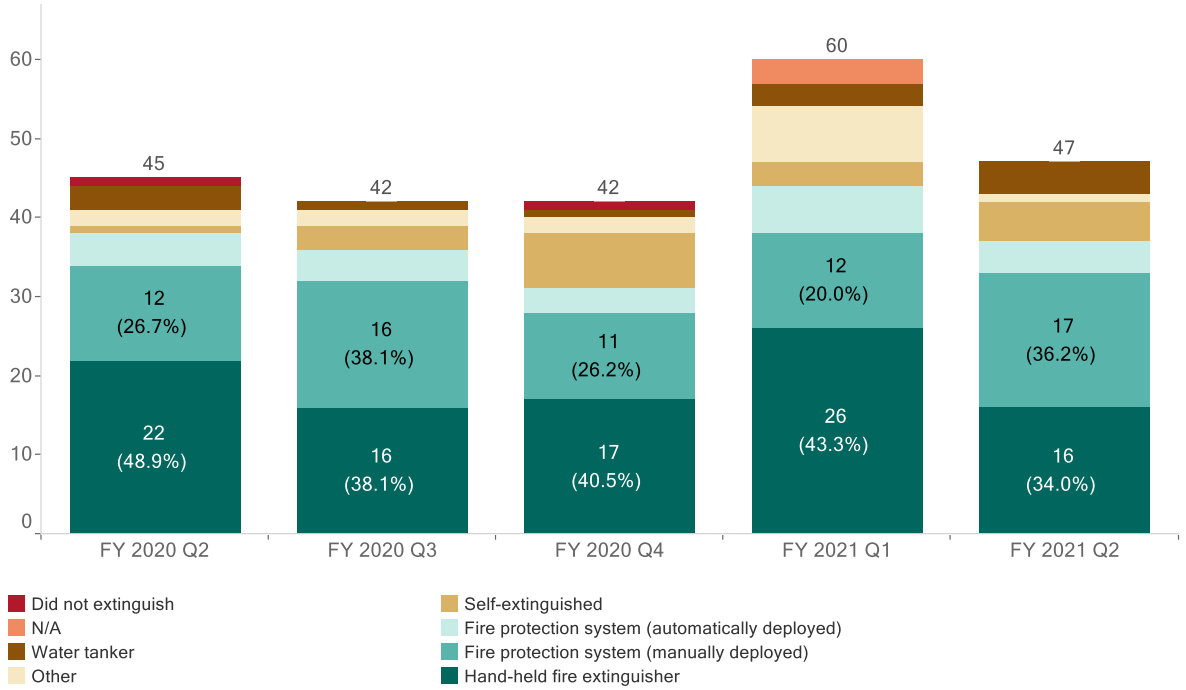


Figure 17: Ancillary Reports – Extinguished By – October 2019 to December 2020



Ancillary reports – failed component

Figure 18: Ancillary Reports – Failed Component – October 2020 to December 2020

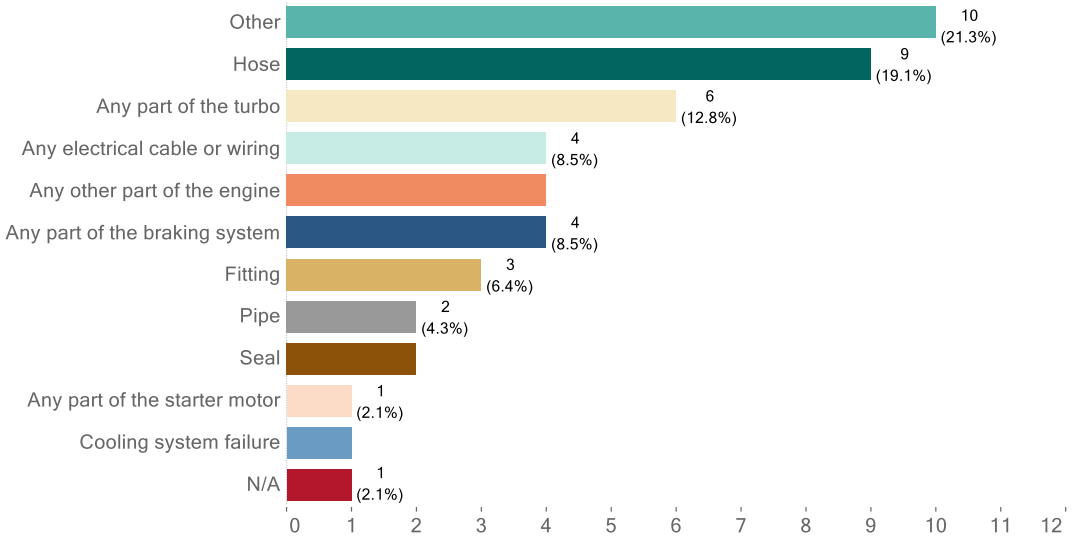
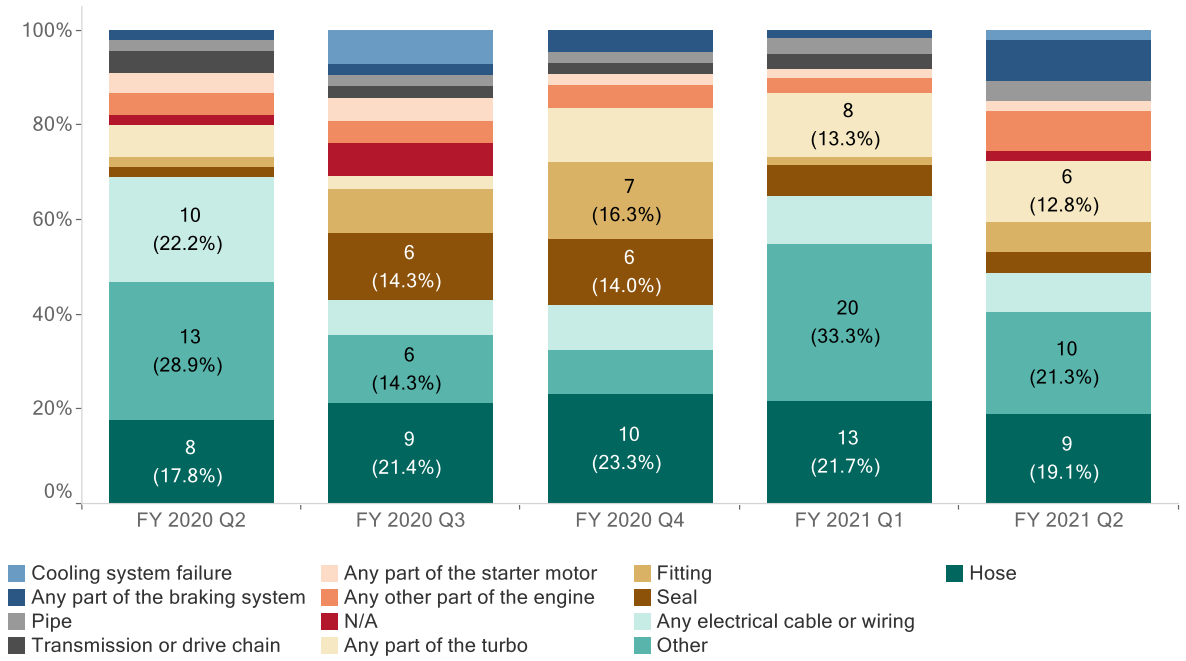


Figure 19: Ancillary Reports – Failed Component – October 2019 to December 2020



Incident details

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

Table 1: Incident details

DESCRIPTION	APPARENT CAUSES
A Caterpillar D10T dozer was being operated on the dump, when the operator noticed an oil leak. The operator shut down the dozer and called the workshop. Whilst speaking to the workshop on the mine radio, small flames became visible in the engine bay. The operator called an emergency and manually activated the dozer fire suppression system, which extinguished most of the oil fire. The operator then used a handheld extinguisher to put out other flames that were visible from the ground.	A hydraulic oil leak from the bottom side of the blade cylinder distribution manifold located on the top of the nose cone from the bottom hard pipe that connects to the manifold. Oil has sprayed through the radiator and throughout the engine bay. Oil has soaked the top of the engine and run down from the rocker covers onto the exhaust manifold which ignited the oil. On strip down it was found the bottom hard pipe mounting to the manifold had blown the O ring due to two broken bolts and one loose bolt.
The operator of a Caterpillar 16M grader noticed a check engine light alarm. As the operator checked the grader's engine diagnostics screen the operator noticed flames exiting the engine compartment. The operator immediately hit the E stop and exited the grader.	Failure of the Secondary Steer Motor.
While managing a waste dump the operator of a Caterpillar 854 wheel dozer noticed a loss of power. After seeing smoke and flames coming from the rear of the machine, the operator stopped the machine and raised the alarm. The fire was extinguished with extinguishers and a mine water truck.	Mechanical failure of turbo.
A Caterpillar 773 water cart was travelling up a ramp when an alarm activated on VIM. The truck then stalled with smoke coming out from under the truck. The operator applied the hand brake and called the OCE. As the smoke worsened, the operator activated the fire suppression system and called Emergency. The OCE arrived and inspected the truck and confirmed no flames present.	The Hydraulic Electronic Unit Injector (HEUI) pump hose failed at the hose tail due to fatigue, which allowed engine oil to escape and sprayed onto the hot engine bay area.
A Komatsu 830E haul truck was descending a ramp returning empty to the shovel and found that retard braking was ineffective. The truck was safely stopped by the operator using the service brake. The operator then noticed a small flame coming from the grid box. The grid box was cooled using the site's fire truck.	Failure of retard resistor grid elements.

DESCRIPTION	APPARENT CAUSES
An operator of a 621 Sandvik loader noticed a small fire on the turbo of the loader. The loader operator activated the automatic fire suppression system, which extinguished the fire.	A hydraulic cooler hose has rubbed on the main frame and burst causing hydraulic oil to contact the turbo.
A Caterpillar 793 dump truck was parked on the dump for maintenance works on the AM/FM aerial. Two fitters had been working on the truck for approximately 15 minutes when they noticed a burning smell. The operator was on the ground when they noticed a flickering light in the engine bay and alerted the fitters. The fitters opened the top engine bay door and located a small flame at the rear of the engine bay valley between the two exhaust pipes. The operator activated an emergency via the radio and a fire extinguisher was used to put out the flame.	A small piece of rag was identified in the engine bay valley.
The operator of a Caterpillar 24H grader noticed smoke emerging from behind the adjustable steering column area in the cab. The operator stopped, shut down the grader and activated an emergency via the two way. The operator then used a fire extinguisher to extinguish the flame.	A wire had a bad crimp and fell off the supply side of rear flood circuit breaker. This wire has touched the frame of the machine causing a short.
An operator of a Caterpillar 980H loader was loading a train when he noticed smoke coming from the side of the exhaust stack. He retreated the machine to a place of safety, near a fire hydrant. He lifted the engine cover and noticed flames. He extinguished the flames and notified his supervisor.	The attenuation system fitted to the exhaust system has created back pressure which has forced heat and sparks to escape from the flanged joint igniting in the exhaust.
A light vehicle driver was travelling past a Caterpillar 789C haul truck when he noticed smoke coming from the truck. On further inspection the light vehicle operator observed flames coming from the exhaust and immediately notified the operator of the haul truck. The fire suppression was manually activated, and an emergency was initiated.	Cyclic fatigue of the turbo compressor wheel (premature failure).
The operator of a Caterpillar D11T dozer was pushing coal on the ROM stockpile into the feeder. The operator noticed steam/smoke coming from the engine bay. The operator trammed the dozer off the stockpile. The engine compartment was inspected and flames were seen in the engine compartment. A fire extinguisher was used to extinguish the fire.	A replacement hydraulic hose fitting had not been tensioned correctly prior to return to service. Release of hydraulic fluid drawn into engine compartment accumulating on turbo lagging until ignition of hydraulic fluid.

DESCRIPTION	APPARENT CAUSES
A fire occurred on the turbo of the left-hand engine of a CAT6060 hydraulic excavator. The excavator had been relocated from one bench where it had been parked to avoid potential flooding during rain, to a lower bench where it was to operate. The relocation distance was less than 50 metres. After relocating the excavator, the operator noticed an orange glow from the engine compartment when exiting the machine. On inspection, the operator discovered a small fire on the turbo. The excavator was shutdown with the E-stop and the flames extinguished with a fire extinguisher. When the turbo thermal lagging was removed the cause of the fire was found to be that the turbo oil lube feed line had cracked from surface fretting from chafing of the wire mesh of the thermal lagging. Inspection of the lagging on the right-hand engine turbo identified similar surface fretting.	Turbo lube line was worn through by fretting from stainless steel outer wrapping of thermal lagging around turbo.
As a Caterpillar 789 rear dump truck approached the top of the dump ramp, the operator and passenger could smell smoke. The truck was taken to a safe location and parked up before the fire suppression system was manually discharged.	Turbo shaft failure allowed oil to pass through shaft seal onto turbo.
A fire occurred on a Terex SK50 drill rig while refuelling. The worker activated the fire suppression system and used a fire extinguisher to extinguish the fire.	Drill rig fuel tank top cover bulged and cracked on the top right-hand corner while it was being refuelled.
A small fire occurred on an Iveco blast hole stemming truck. No persons were injured, and no equipment damage was sustained.	The insulator in the battery isolator had worn away and gone to ground.
An operator noticed smoke from the rear end of a Merlo telehandler. The operator proceeded to park the Merlo and upon inspection found the brake disc glowing red and a small flame coming from the brake reservoir. The operator extinguished the flame with a fire extinguisher.	Bolts from the park brake actuator have fallen out causing the actuator to sag down putting pressure on the disc pads (one pad heavily worn). The friction between the pad and disc has caused the area to become extremely hot. This heat has caused the seal to blow, spraying hydraulic oil onto the heated components which ignited.
A loaded Komatsu 930E dump truck was descending an in-pit ramp at approximately 20 km/h when the operator noticed sparks coming from the resistor grid box. The operator stopped at the bottom of the ramp and called the OCE who directed the truck to continue onto the dump where the water cart could gain better	The most likely cause of this incident was a broken connection of the vertical rail to the right-hand side resistor assembly. The heat caused by the high resistance joint has then melted the surrounding grid material, causing damage to adjacent grid due to the direction of air flow.

DESCRIPTION	APPARENT CAUSES
access. An emergency was called, and a water cart directed to the dump. When the OCE arrived at the dump he witnessed a small amount of flame at the back of the resistor grid box. The truck was isolated, and the water cart applied water to extinguish the flame and cool the area.	Possible causes: 1. A mechanical failure of the connection point within the resistor grid assembly due to fatigue, cracking or a defective termination. 2. Electrical overloading of the resistor grid box assembly over time leading to the failure of the termination or connection point.
During loading of a Caterpillar AD55B dump truck, a bogger operator has noticed smoke emanating from the truck. Investigation has found a small fire located on the emergency steering pump of the truck. The fire was extinguished using a single handheld extinguisher.	A fuel hose in the engine assembly was degraded through corrosion which was hidden by virtue of its location (in the vehicle) and the aluminium component label (which covered the point of corrosion). The hose failed under pressure, spraying fuel onto the turbo which ignited.
The left-hand rear tyre of a Toyota Landcruiser caught alight whilst parked unattended. The light vehicle had been parked at this location safely, approximately 4 hours earlier due to flat tyre.	A failed brake hose due to impact damage and heat.
The operator of a Caterpillar AD55B dump truck has noticed a fire on the machine. The operator activated the onboard fire suppression and then used a fire extinguisher to put the fire out.	A hose failed due to moisture entering the internal wire braid through a cracked section of sheathing resulting in wire braid on the outer side of the hose bend radius to corrode. This corrosion has weakened the sidewall of the hose and along with additional influences of vibration caused by a missing saddle grommet and hose in a high heat region from exhaust system, the hose has failed causing a fuel leak from the damaged section of hose.
A Caterpillar 793D haul truck approached the tip head and experienced a sudden loss of drive. The operator then noticed a lot of smoke and sparks emitting from the right-hand side exhaust. The operator recognised the turbo was failing and initiated the mine emergency response process. Truck was made fundamental and shut down and the operator exited the truck safely. A fitter arrived to inspect the turbo and when the engine cover was lifted, a small flame was discovered which was extinguished with a fire extinguisher.	Internal turbo failure resulting in small external leak of engine oil (turbo cooling) onto hot exhaust. The turbo was a remanufactured unit with low hours (approx. 1000 hrs) at time of failure.
A Cat 6040 excavator was loading a haul truck when the haul truck operator identified flames coming from the top deck panels of the exhaust on the excavator. The truck operator alerted the excavator operator via radio of the suspected fire. The excavator operator shut down the engines and	Failed hydraulic pump pilot hose.

DESCRIPTION	APPARENT CAUSES
manually activated the fire suppression system. A fire extinguisher was the used to ensure that the fire was extinguished.	
An Epiroc MT5020 was being loaded with waste material when a small piece of timber from a broken pallet has fallen over the front of the tray and landed on the truck exhaust and started to burn. The fire was identified by a passing electrician and was extinguished with a handheld extinguisher.	Small piece of wood from pallet landing on engine bay / exhaust area, heating up to combust (heat and light).
A Volvo L90F integrated tool carrier was travelling down the main decline when the operator noticed smoke coming from beneath the machine. The operator stopped the machine and identified a small flame coming from the brake assembly. A fire extinguisher was used to extinguish the flame.	The wiring harness to the park brake release solenoid had damage to the wiring protection sleeve and had started to corrode. This failure caused the park brake solenoid to de-energize and apply the park brake mechanism (spring applied park brake calliper).
A Caterpillar 793D haul truck was ascending a ramp when it experienced a loss of power and de-rated performance. The operator reported this to maintenance and he was instructed to park up. When the fitter and the operator inspected the machine, they discovered a visible coolant leak from the engine. The fitter inspected more closely and discovered a small fire in the engine bay in the area surrounding the turbochargers. The fitter manually activated the onboard fire suppression system and followed up with a handheld fire extinguisher to ensure all flames were extinguished.	Cooling system connection failed due to fatigued retaining bolts permitting engine coolant to spray over hot exhaust and turbo. The dehydrated coolant ignited and caused a small fire.
Operator of a SMV noticed sparks coming from under the bonnet whilst driving underground. The machine was pulled over and a fitter called. The fitter found that the alternator pulley had slipped on its shaft and was rubbing on the guard/cover. The belts were intact and no indications of flames were noted. The SMV had undergone maintenance the shift prior.	Pulley has come off shaft due to loose or damaged nut. Loose pulley has contacted guard whilst still being able to rotate, generating friction between pulley and fixed guard. Alternator was replaced on the previous shift.
A Komatsu 830E-AC was hauling loaded with reject down a ramp. A following truck observed flames emitting from the position 5/6 brakes, who then notified the first truck. The truck was able to park fundamentally stable, activate the fire suppression system and safely exit the machine. A water cart then extinguished the fire.	Initial investigation indicates heating was caused by a prolonged service brake application causing the wheel motor covers to ignite.

DESCRIPTION	APPARENT CAUSES
At this time, flames were also observed coming from the position 3/4 brakes which were also extinguished; however, the valve stems in positions 3/4 melted, deflating these tyres.	
A right-hand side alternator fault light illuminated on a Hitachi EX5600BE-6 excavator. The operator called up the fault to the supervisor and idled the machine down. The operator inspected the right-hand side alternator in the engine bay and found smoke coming from the unit. The machine was shutdown. On reinspection, a small fire appeared on the alternator and a fire extinguisher was used to put out the flames.	Failed bearing on alternator causing overheating.
The operator of a Caterpillar 789B was returning from dumping the first load of rejects for the shift. The operator was monitoring for dust generation in the mirrors and noticed flames emanating from the exhaust of the truck. The operator called an emergency over the radio, stopped the truck and activated the emergency stop button. He then activated the fire suppression system as a precaution against a secondary engine bay ignition before exiting the vehicle. There was no evidence of a fire within the engine compartment and the flames are believed to be contained within the exhaust system until ejection from the exhaust exit.	Turbo failure contained within the turbo body and exhaust system.
The operator of a Komatsu PC4000-6 excavator was digging hard materials when they noticed oil on the right-hand window. Looking back flames were noticed around the exhaust stacks. An emergency was called on the two-way. As the excavator was at the edge of the bench and would not have clear egress via the emergency chute if needed, the operator walked the excavator back from the face approx. ten metres before hitting the e-stop and manually activating the fire suppression system. The operator waited in the cab until the fire suppression powder had settled then got off the machine via the main access ladder. By this stage, the supervisor had arrived on scene. The supervisor put out some flames on the underside of the excavator with a fire extinguisher. Two water carts attended but were not used.	The arch boom hose failed at machine end clamp releasing hydraulic oil over engine compartment and ignited on a hot engine surface. Maintenance inspection had identified the hose was due for replacement.

DESCRIPTION	APPARENT CAUSES
Whilst operating a Liebherr 996B excavator, the operator noticed a burning smell inside the cab. This led the operator to shut down the air-conditioner. An inspection of the air conditioner was undertaken. Smoke and a small flame were found emitting from the external air conditioning unit on the right-hand side of the cab.	Early life failed compressor clutch
A small fire was initiated in the engine bay of a Caterpillar 980K wheel loader after a coolant hose failed and sprayed the turbo. The fire extinguisher was used by the operator to suppress the fire.	Heater / coolant hose was heat affected and had failed, spraying the engine bay.
The operator of a Caterpillar 16M grader noticed smoke coming from the right-hand side of the engine bay. The operator found a close area to get off the roadway and called emergency. As he did, the fire suppression automatically activated.	The battery to starter motor cable shortening out on a signal line to the steering pump. This was due to the fracture failure of the Bakelite solenoid cap on the starter motor.
A Caterpillar 789D water cart was watering the roadway in the sump. The operator of the water truck noticed smoke emitting from the rear of the engine cover and initiated an emergency over the radio. The operator activated the fire suppression system which extinguished the fire and egressed the truck via the main stairway.	An oil leak from the water truck's foam pump outside of the engine bay has allowed oil to run into the engine bay and onto the right-hand exhaust riser. The sound attenuation on the engine cover showed signs of excessive heat.
A Caterpillar 789C dump truck had its right-hand front turbo fail resulting in a flame from the exhaust.	Failed turbo.
A Caterpillar 789C water cart was travelling from the dump when flames were witnessed coming out of the exhaust muffler box. The site emergency procedure was initiated, the operator parked the machine, shut the engine down, manually activated the fire suppression and then exited the machine via the front access stairs. The fire suppression system extinguished the fire.	The nut on one of the exhaust clamps between the muffler and tail pipe has vibrated loose and allowed the clamp to loosen. The muffler and tail pipe have then separated allowing exhaust gas to exit the pipe into the enclosed muffler box. The hot exhaust gases have then heated and ignited the sound suppression and the paint inside the muffler box.
A Caterpillar 789C dump truck was travelling along a haul road. The operator noticed an 'injector cylinder 16 error' on the engine management system and shortly after noticed a 'glow' and smoke coming from the engine bay. The operator stopped the truck and witnessed flames under the engine bonnet. The operator then shut down the truck, activated the site	The aftercooler had developed a leak sometime prior to the incident and had been leaking coolant into the engine air intake manifold. After the machine had been shut down for a crib, excess coolant ran into cylinder #16. Once the engine was started again, a 'hydraulic lock' occurred which caused excessive force to be applied to the injector and subsequently the

DESCRIPTION	APPARENT CAUSES
emergency procedure and disembarked the truck safely using the front access stairs. The truck's fire suppression system then automatically activated and extinguished the fire.	injector hold-down bolt then failed and the injector then damaged the rocker cover allowing a mix of vaporized diesel, engine oil and coolant to exit the head. The ignition point is then suspected to be the heat from the engine igniting the vaporized diesel.
A Caterpillar AD55B dump truck had exited the portal and was driving to the surface park up area when a small engine fire started. The haul truck operator saw the flame coming from the exhaust guard. The operator manually initiated the fire suppression system which extinguished the flame.	A fan motor hydraulic leak had been repaired prior to the incident. An incorrect O ring was used. When the replacement O ring failed, hydraulic oil sprayed onto hot engine components.
The operator of a Caterpillar 854 wheel dozer was maintaining the inpit dump when the automatic fire detection system alarmed. The operator observed blue smoke from the engine compartment, he then relocated the wheeled dozer from the tip face and shut down the machine. The fire detection system automatically activated, and the operator safely disembarked the dozer. The emergency procedures were initiated.	The fire was caused by a rupture of a pressurized diesel fuel hose within the engine compartment. This resulted in small hydrocarbon fire on the engine compartment / thermal engine lagging. Incorrect fuel hose orientation which has caused mechanical abrasive failure of the fuel hose outer sheath.
A Komatsu 785 water cart was conducting road watering activities when the operator has noticed oil/fluid on the windscreen. A passenger was in the water cart at the time undergoing training. Once the water cart pulled up the operators noticed a flame in the engine bay and manually activated the fire suppression and called an emergency. The fire was extinguished by the suppression system but an additional handheld fire hose from another water cart was used to cool the engine bay.	Failed hose which leaked onto engine bay.
A Caterpillar D11T dozer was cleaning up when an oil leak on the left-hand lift cylinder sprayed oil onto the engine. The operator backed the dozer out of the work area, called for a water cart and shut the machine down. Shortly afterwards, a fire ignited on the heat protection on the left turbo. An emergency was called, and the operator extinguished the fire using an extinguisher.	The bolt on the flange at the top of the blade lift cylinder failed causing oil to leak over the bonnet area. This was drawn across the engine by the fan. Oil soaked the lagging on the exhaust and seeped though, igniting on the hot exhaust surface. The failed bolt appears to have been subject to bending, possibly due to a face machining defect or inadequate tightening at installation.
A Hitachi EH4000-3 haul truck was loaded and when hauling away from excavator a park brake error was displayed and the truck stopped approximately 50m from the excavator. Another truck operator saw	The right-hand side inboard park brake calliper cover plate has failed. Three bolts had failed by fatigue allowing the cover plate to rotate and break off adjacent to the fourth bolt. This allowed ejection of

DESCRIPTION	APPARENT CAUSES
sparks coming from pos 3/4. Water cart, OCE and maintenance attended the scene and there was no evidence of flames when inspected. After further investigation from maintenance confirmed there was evidence of fire.	the piston, spring assembly, and a substantial volume of oil into the axle box. Heat from the left-hand side park brake calliper has ignited oil covering it and adjacent components. The park brake would have applied and been dragging, generating heat, when oil and pressure was lost from the system. The fire was likely fanned by the axle box blowers. There was evidence of fire damage around the left-hand side wheel motor, electrical conduit, and hoses.
As the operator was positioning a Reedrill SK75i overburden drill to begin drilling, they looked back over the engine and noticed an orange glow coming from the engine. On inspection it was found to be a fire. The operator then activated the E-Stop, manually activated the fire suppression system and called Emergency over the radio. The fire suppression system did not fully extinguish the flame, as it was burning from oil inside the exhaust lagging. The small fire was fully extinguished by a fire extinguisher.	A split turbo oil feed line leaked oil which soaked into the exhaust thermal lagging and ignited.
A Komatsu 930E rear dump truck was being loaded by an excavator when the operator was advised that they may have an oil leak. Soon after 'stop engine' and 'no propel' alarms came up on the control panel. The truck was shut down but restarted to move away from the excavator. After moving a short distance, the same alarms came up and the truck was shut down again. When inspecting the engine bay from the pos-2 wheel, a small flame on top of the turbo chargers was seen. The operator went back to cab and activated the fire suppression which extinguished the flame.	The cause of the fire appears to be that the protective wire mesh installed over the aftermarket thermal lagging installed over the turbo chargers and exhaust manifolds has worn through the lubricating oil line to the right-hand rear turbo. The oil released was ignited by the turbo and the resulting fire has melted a coolant supply line resulting in a significant loss of coolant. The coolant loss was the cause of the stop engine and the no propel alarms.