NSW GOVERNMENT

NSW Resources Regulator

FIRES ON MOBILE PLANT

October – December 2021

NSW Resources Regulator

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Contents

Overview

In FY 2022 Q2, there were:

NOTIFIED INCIDENTS
59
SAME AS Q1

- **41** Surface coal (69%)
- **14** Underground metals (24%)
- **2** Construction materials (3%)
- **1** Surface metals (2%)
- **1** Underground coal (2%)

NOTICES ISSUED
1

ANCILLARY REPORTS COMPLETED
58 Represents 98% 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 **44**	27 of 44	Accumulated flammable leaks and spills	27 of 44	Flammable fluid containment
Fire or explosion underground **15**	13 of 15	Mechanical energy in the presence of fuel	6 of 15	Minimise friction and control hot surfaces

Ancillary reports summary

Heat source	Fuel source	Failed component	Extinguished by
28%	**22%**	**21%**	**45%**
EXHAUST SYSTEM	**HYDRAULIC OIL**	**HOSE**	**HANDHELD FIRE EXTINGUISHER**

Executive summary

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

The Regulator's position is that all fires on mobile plant are avoidable and preventable and we have 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 affect the safety of workers and have potentially catastrophic consequences. Despite a focus on the issues in recent years, the number of incidents remains high. The Regulator is committed to working with industry to ensure health and safety obligations are being met to reduce the number of fires on mobile plant and to prevent potentially catastrophic events.

Quarterly data for 1 October 2021 to 31 December 2021 identified the following:

- One fire on mobile plant incident resulted in a serious injury (refer to Significant Incidents section of this report). This is the first time a serious injury has been recorded for a FOMP incident in the reporting period since June 2018.
- Fourteen FOMP incidents occurred underground, being 24% of the total incidents recorded for this quarter and the highest percentage since the October to December 2019 quarter.
- There was a 49% increase in desktop assessments being conducted for FOMP incidents, and one formal investigation being commenced.
- The most common combination of heat source and fuel source for FOMP notifiable incidents this quarter were electrical component and electrical wiring - combining for 9 out of 58 incidents (16%) recorded in ancillary reports

Trends and recommendations

Throughout this reporting period, the following were identified as an ongoing and or emerging trends:

- hose failures due to poor installation, routing, and segregation
- poor installation of components.
- electrical cable failure due to poor installation, routing, and segregation

Recommendations

Hose failures

Effective control measures should be applied to the management of hoses, including:

- All pipes and hoses should be routed and supported in a manner that will give them maximum mechanical protection against wear and damage.
- All pipes and hoses should be adequately segregated to prevent rubbing.
- Shielding should be installed between pipes/hoses and any adjacent components that have operating surface temperatures more than 150 degrees Celsius (for example fire walls, lagging and deflective guards).
- Installation drawings are to be provided/made available to workers.
- Inspections of all hoses are to be included in maintenance and inspection regimes.
- Maintenance strategies for the replacement of hoses must take into consideration the risks associated with their failure to the health and safety of workers based on the hose location. This should include the risk to workers both directly (fluid injection) and indirectly (fire).
- The strategy for hose replacement should include considerations for any recommendations from manufacturers and the analysis of data from past failures.
- Workers who are installing and inspecting hose assemblies must be trained on what to look for, replacement criteria and correct methods of installation.

A number of the above issues are similar in nature to the issues identified in the mining design guideline (MDG 41) Fluid power safety systems at mines.

Mine operators should also review the times allocated for inspecting hoses to allow workers sufficient time to carry out inspections.

Poor installation of components

Mine operators should review the following:

- The training and competence of workers in relation to the work they are undertaking.
- Supervision of workers.
- Timeframes allocated to tasks to ensure enough time has been allocated
- The handover information provided to workers when activities are being conducted over multiple shifts.
- Work order information/instruction provided to workers. This information should include all the relevant information to carry out the tasks being performed. For example, but not limited to the torque requirements for components, installation procedures or instruction, drawings/schematics, extract from manufactures manuals, commissioning checks
- The reuse of previously torqued bolts. Bolts that are required to be torqued should be replaced in accordance with manufactures recommendations
- The checks carried out before returning equipment to service post maintenance.

Electrical cable failure

Effective control measures should be applied to the management of electrical cabling, including:

- All electrical cabling should be routed and supported in a manner that will give them maximum mechanical protection against wear and damage.
- All electrical systems should have fit-for-purpose circuit protection in place.

Significant incidents

November 2021 – IncNot0041070

While refuelling a Caterpillar R3000 loader at an underground metalliferous mine, pressure caused a bolt to be released from an air filter housing, allowing fuel to spray onto the turbo exhaust system. A service person used a fire extinguisher to extinguish the fire. Fuel then sprayed onto the DPF box and caught fire and a second extinguisher was used to extinguish the fire.
This incident is an important reminder that before undertaking any changes, an assessment of that change should be conducted to ensure no other hazards are introduced as a result of the change.

Figure 1: Loader fire

Figure 2: Excavator fire

December 2021 – IncNot0041304

At an open cut quarry, a worker was operating a Doosan DX300LC excavator when they noticed a fire in the engine bay. The operator stopped and exited the machine. Workers tried unsuccessfully to to stop the fire with extinguishers. The fire brigade was called and attended the scene. The fire was put out by the fire brigade. The machine was destroyed.
This incident is an important reminder to have a system in place to check and clean engine bays of equipment to prevent the build-up of combustible materials.

December 2021 – IncNot0041314

At an open cut quarry, a Caterpillar 740 articulated dump truck caught on fire. The operator stopped the machine and called for assistance.
The fire brigade attended and controlled the fire.
This incident is a reminder of the importance of quality maintenance and pre-use inspections in the prevention of premature failure of components.

Figure 3: Articulated dump truck fire

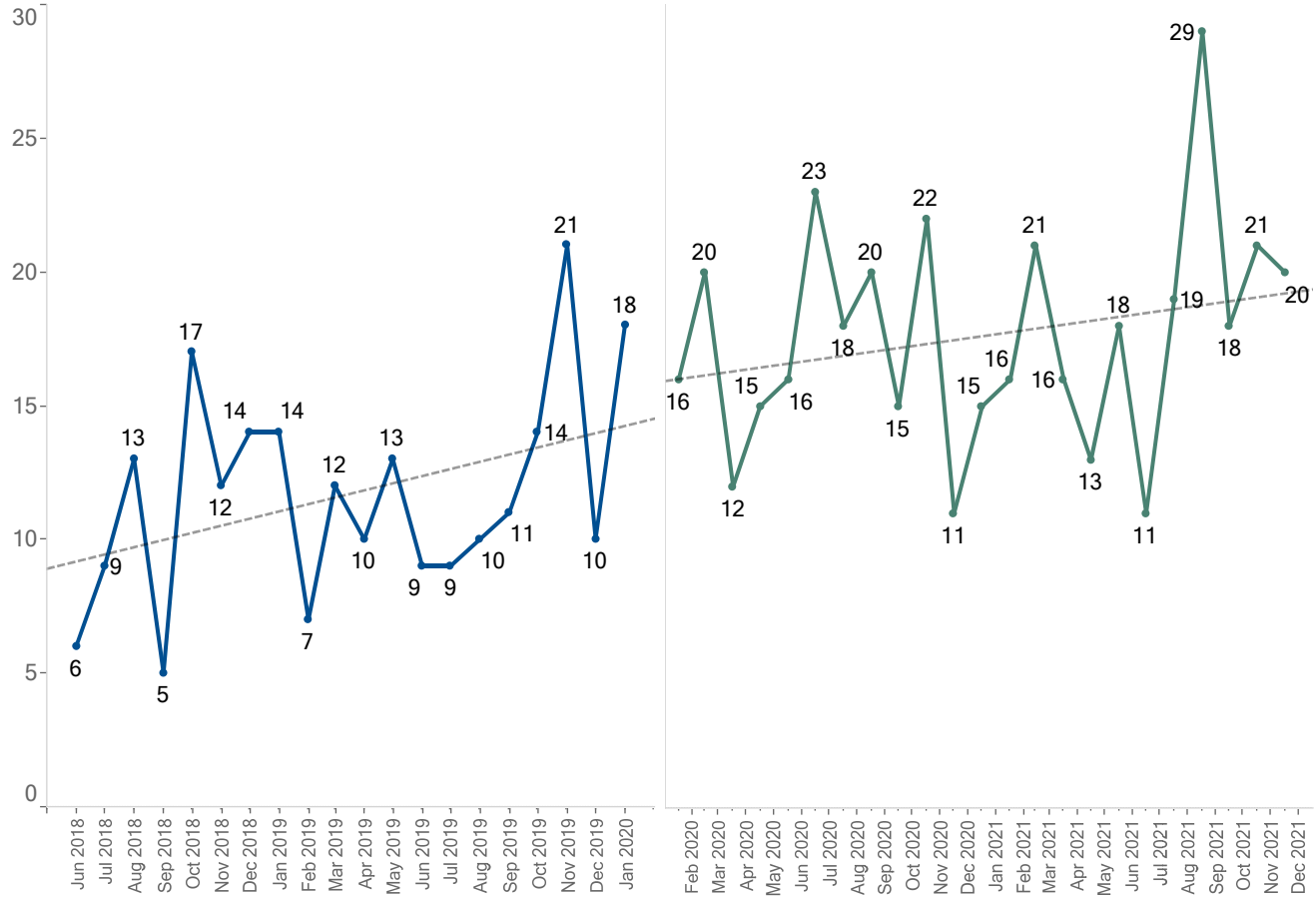
Notified incidents

Notified incidents between June 2018 and December 2021

Figure 3 relates to incidents involving fires on mobile plant notified to the Regulator each month since June 2018, based on the date the incident occurred.

In February 2020, amendments to the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 saw a change to the duty to notify all incidents involving fires on mobile plant (see Annexure A). The two trend graphs below represent the periods before and after this amendment took place, revealing an increase in FOMP notified incidents since this time.

Figure 3: Notified incidents between 1 June 2018 and 31 December 2021



Notified incidents by legislative requirement to report

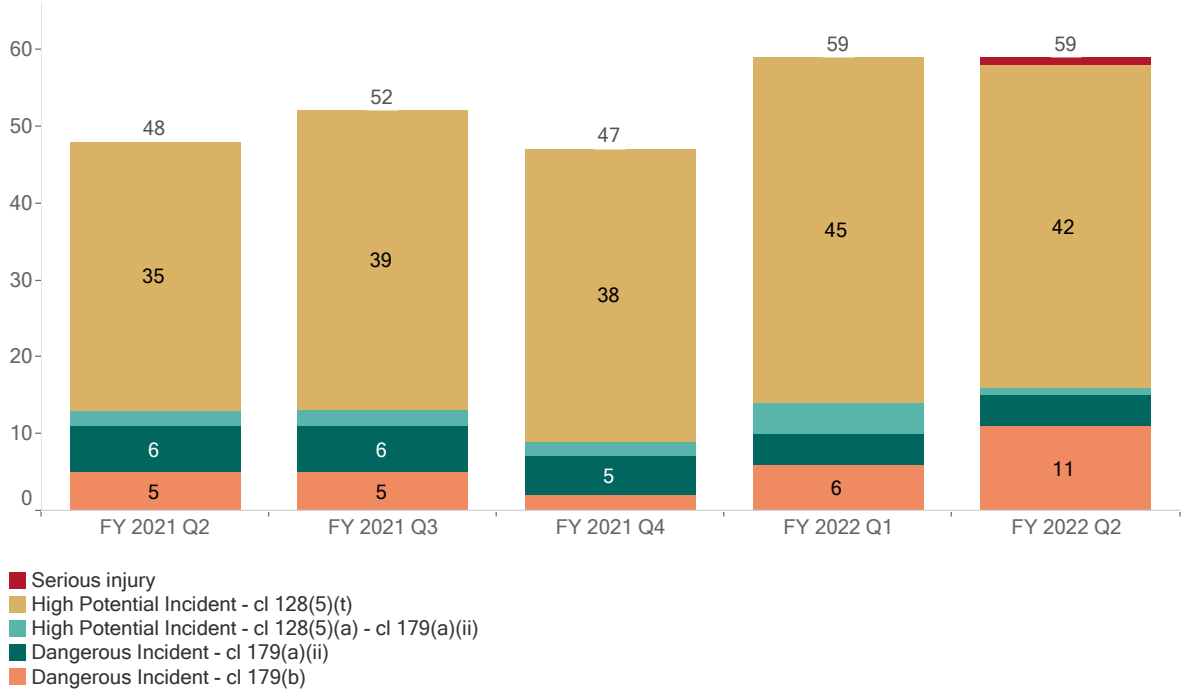
Figure 4 highlights the number of notified incidents recorded by the legislative requirement to report.

The majority of fires on mobile plant notified to the Regulator since 1 October 2020 were recorded as a high potential incident under cl 128(5)(t), where there was 'an uncontrolled fire on mobile plant that is in operations (whether operated directly, remotely or autonomously)'.

Eleven incidents were recorded this quarter as a dangerous incident under cl 179(b) where there was 'a fire in the underground parts of a mine, including where fire is in the form of an oxidation that releases heat and light'.

The graph below also highlights that there was one fire on mobile plant incident recorded this quarter that has resulted in a serious injury (refer to significant incidents section of this report).

Figure 4: Notified incidents by legislative requirement to report between 1 October 2020 and 31 December 2021



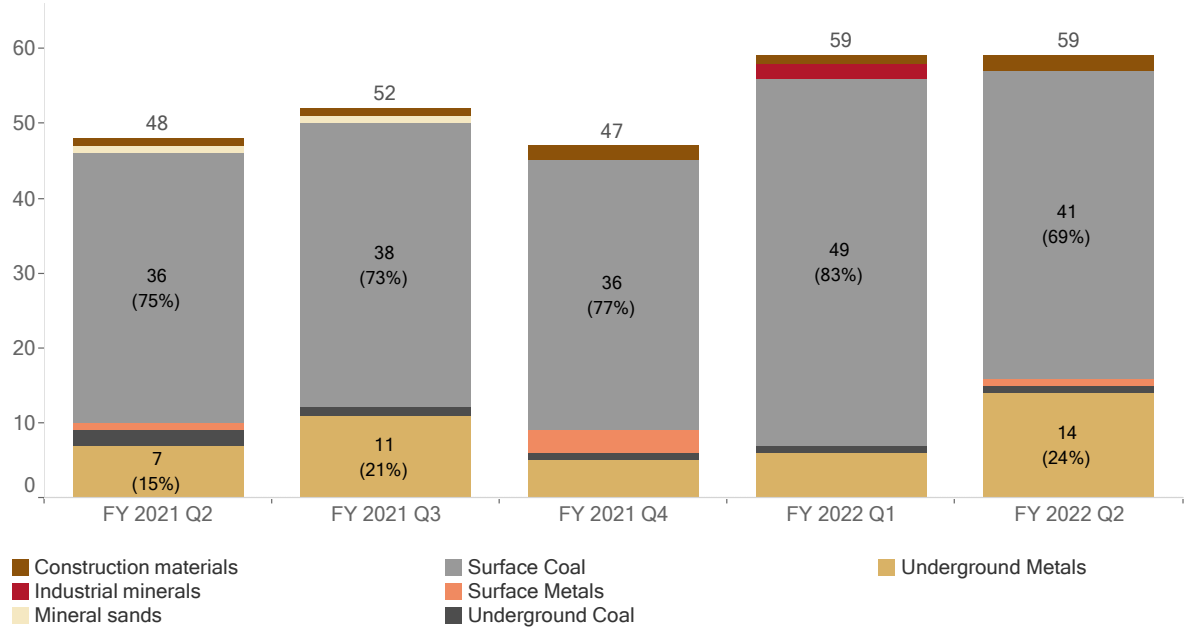
Notified incidents by mine and operation type

Figure 5 shows the number of notified incidents by mine type and operation type.

There was a 16% decrease in notified incidents occurring at mines categorised as surface coal this quarter, however this mine type still has the highest percentage of notified incidents.

There was an increase in notified incidents occurring at mines categorised as underground metals, with 14 notifiable incidents this quarter compared to 6 last quarter.

Figure 5: Notified incidents by mine and operation type between 1 October 2020 and 31 December 2021

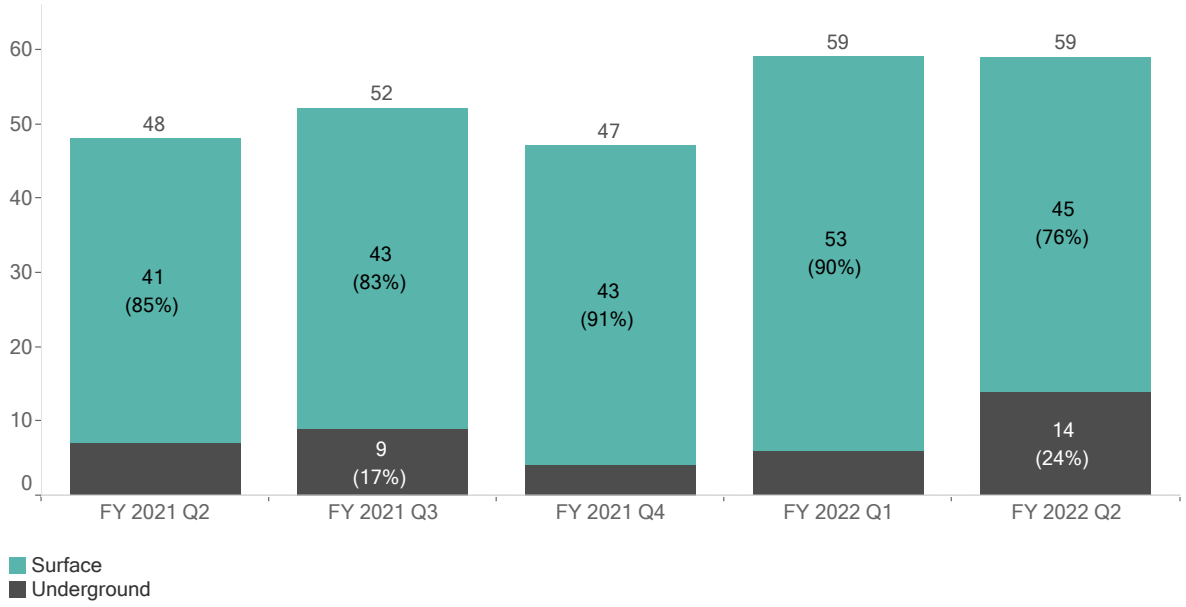


Notified incidents by primary location

Figure 6 shows that the actual location of FOMP incidents, irrespective of the mine operation type, typically occurs on the surface rather than underground.

There have been 14 fire on mobile plant incidents reported as occurring underground for this quarter, a substantial increase from 6 underground incidents last quarter.

Figure 6: Notified incidents by primary location between 1 October 2020 and 31 December 2021



Notified incidents by mine type, operation type and incident location

Notified incidents occurring on the surface at a surface coal mine account for 69% of all fires on mobile plant this quarter.

Table 1: Notified incidents by mine type, operation type and incident location between 1 October 2020 and 31 December 2021

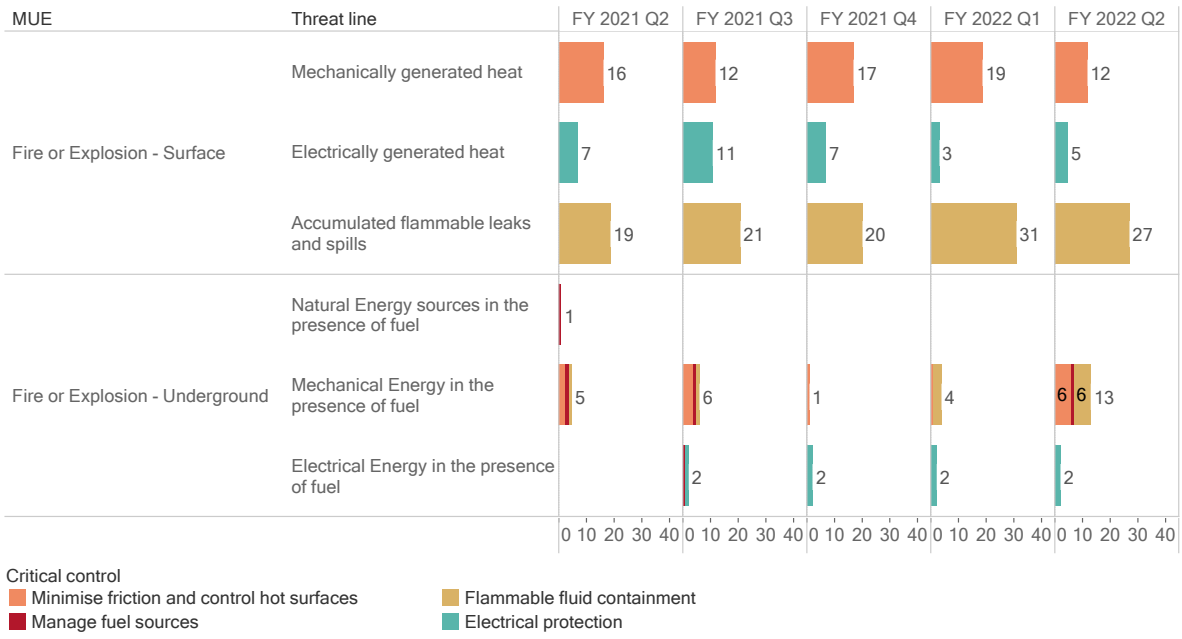
MINE TYPE/OPERATION TYPE/ INCIDENT LOCATION	FY2021 Q2	FY2021 Q3	FY2021 Q4	FY2022 Q1	FY2022 Q2	GRAND TOTAL
Coal/surface/surface	36	38	36	49	41	200
Coal/underground/surface	1	1	1	1	-	4
Coal/underground/underground	1	-	-	-	1	2
Metals/surface/surface	1	-	3	-	1	5
Metals/underground/surface	1	2	1	-	1	5
Metals/underground/underground	6	9	4	6	13	38
Mineral sand /surface/surface	1	1	-	-	-	2
Construction materials/surface/surface	1	1	2	1	2	7
Industrial minerals/surface/surface	-	-	-	2	-	2
Grand total	48	52	47	59	59	265

Classified notified incidents by hazard, threat and critical control

Hazard management bowties are a widely used risk management tool that incorporate preventative and mitigating controls onto threat lines that relate to a material unwanted event (MUE). The Regulator uses MUE bowtie frameworks when proactively assessing how mine sites manage their principal hazards. 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 7 shows notified incidents classified by MUE, threat and critical control.

Figure 7: Notified incidents by MUE, threat and critical control between 1 October 2020 and 31 December 2021



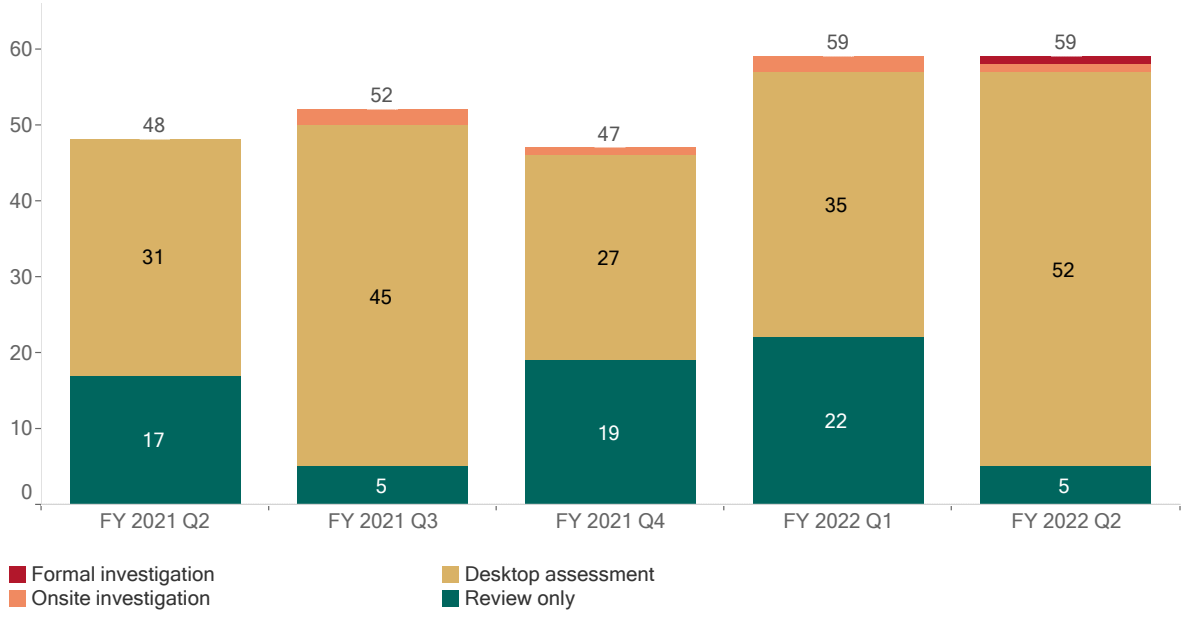
Our response to notified incidents involving FOMP

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

Figure 8 shows that for this quarter there was a 49% increase in desktop assessments, with a 77% decrease in reviews of FOMP incidents.

One formal investigation was commenced in the last quarter that related to fire on mobile plant incidents that resulted in a serious injury (refer to significant incidents section of this report).

Figure 8: Notified incidents by response level between 1 October 2020 and 31 December 2021

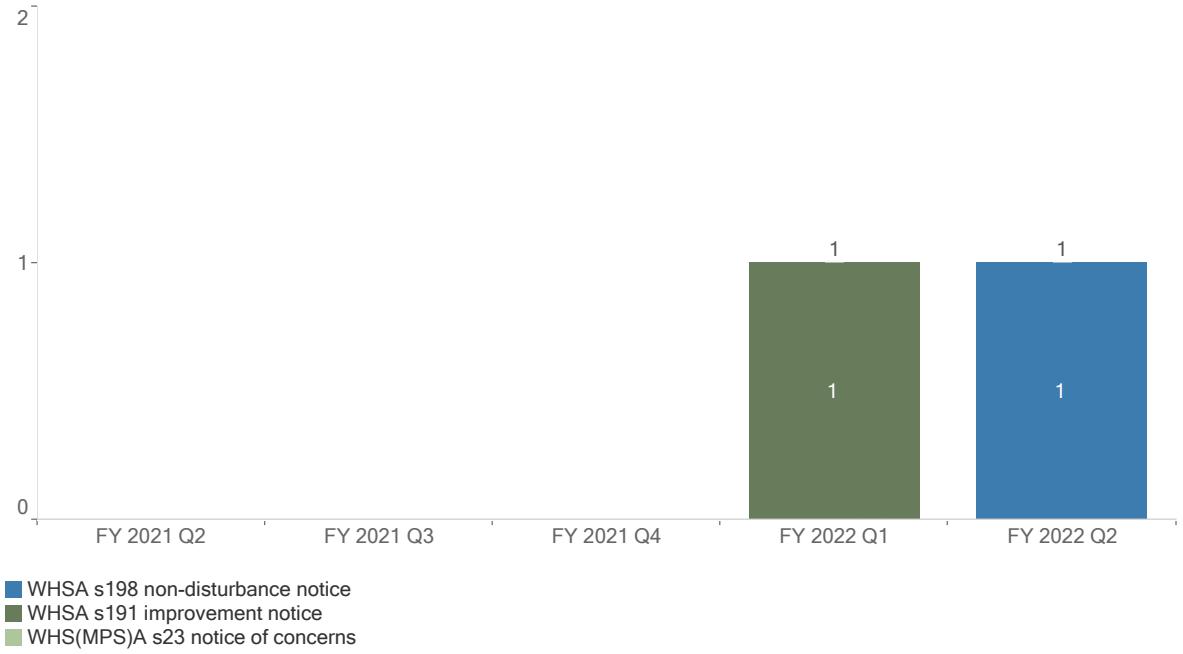


Notices issued

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 9 shows that one notice was issued in relation to notified incidents involving FOMP this quarter.

Figure 9: Notices issued in relation to FOMP incidents between 1 October 2020 and 31 December 2021



Fires on mobile plant ancillary reports

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

At the time of this report, 58 ancillary reports were received, with one ancillary report outstanding.

Ancillary reports – combination heat/fuel sources

Data for heat sources and fuel sources for FOMP notifiable incidents this quarter indicate that the electrical component heat source category and electrical wiring fuel source category combined for nine out of 58 incidents (16%) recorded in ancillary reports. The second most common combination this quarter was turbo and engine oil, accounting for seven out of the 58 incidents (12%).

Figure 10: Ancillary reports - fuel sources combined with heat sources, between 1 October 2021 and 31 December 2021

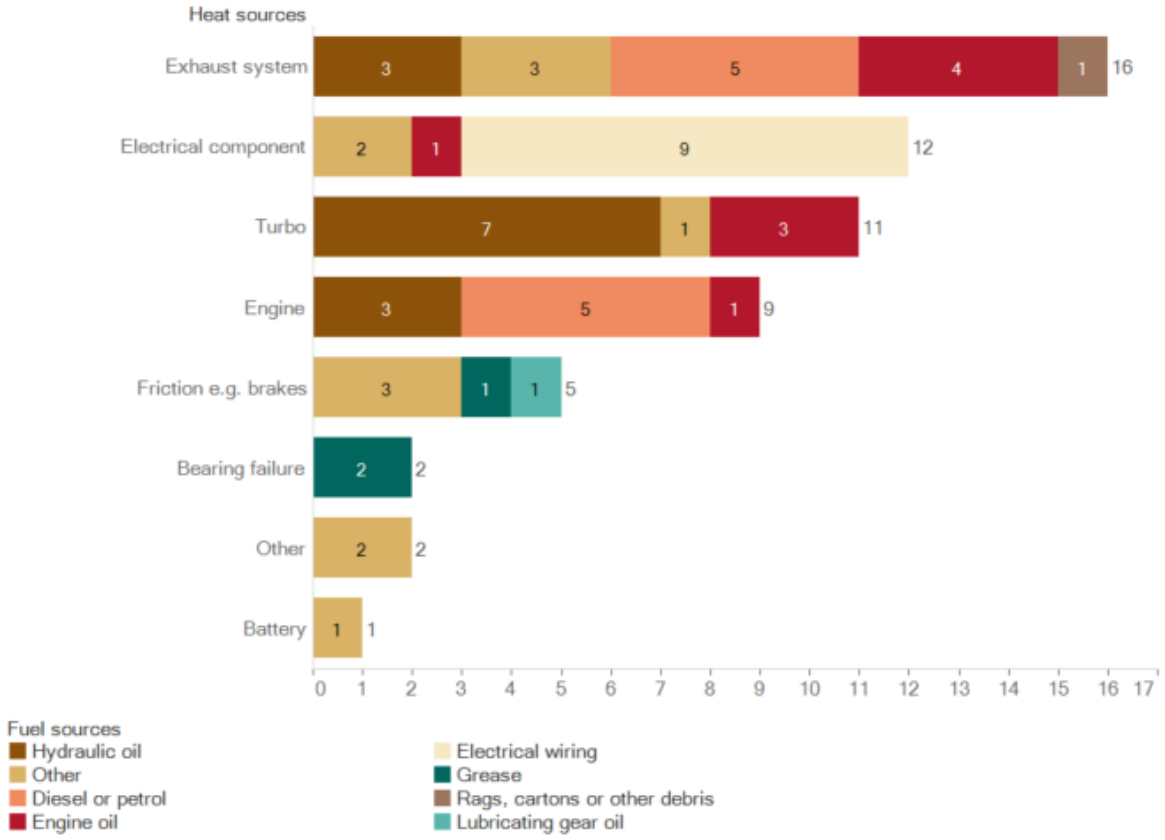


Table 2: Ancillary reports – fuel sources combined with heat sources, between 1 October 2020 and 31 December 2021[1]

HEAT SOURCE + FUEL SOURCE	FY2021 Q2	FY2021 Q3	FY2021 Q4	FY2022 Q1	FY2022 Q2	GRAND TOTAL
Electrical component + electrical wiring	6	6	6	5	9	32
Turbo + engine oil	8	8	4	8	3	31
Turbo + hydraulic oil	3	4	3	6	7	23
Exhaust system + engine oil	3	2	7	6	4	22
Exhaust system + hydraulic oil	4	3	5	7	3	22
Exhaust system + diesel or petrol		3	2	3	5	13
Exhaust system + other	4	1	1	4	3	13
Turbo + other	1	4	3	2	1	11

[1] 10 or more incidents since 1 October 2020

Ancillary reports – extinguished by

Figure 11 shows that a handheld fire extinguisher remains one of the highest recorded methods of extinguishment. The second highest method of extinguishment this quarter was recorded as a manually deployed fire protection system, recorded in 14 notified incidents of fire on mobile plant.

Figure 11: Ancillary reports - extinguished by, between 1 October 2021 and 31 December 2021

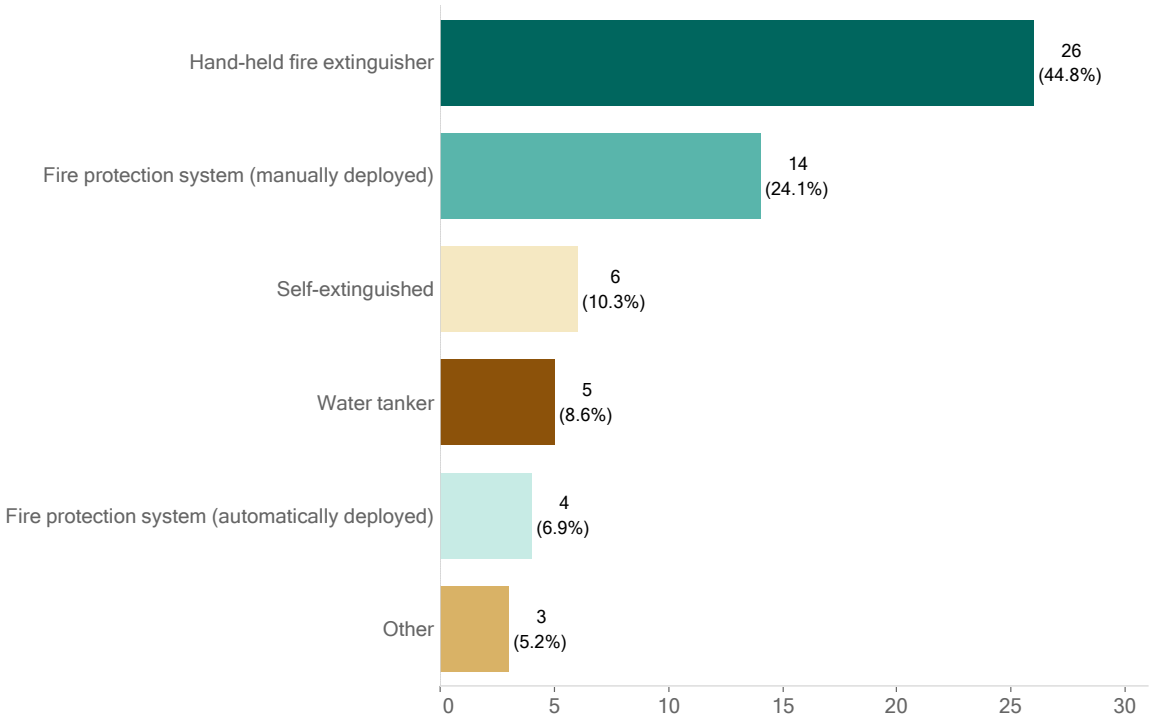


Table 3: Ancillary reports – extinguished by, between 1 October 2020 and 31 December 2021

EXTINGUISHED BY	FY 2021 Q2	FY 2021 Q3	FY 2021 Q4	FY 2022 Q1	FY 2022 Q2	GRAND TOTAL
Handheld fire extinguisher	17	21	20	21	26	105
Fire protection system (manually deployed)	17	15	11	16	14	74
Fire protection system (automatically deployed)	4	3	6	11	4	28
Self-extinguished	5	5	5	5	6	26
Water tanker	4	4	2	4	5	19
Other	1	3	3	-	3	10
N/A	-	-	-	1	-	1
Did not extinguish	-	1	-	-	-	1

Ancillary reports - failed component

The hose remains the most common single failed component since FY 2020 Q2.

The category of 'other' as a failed component has decreased from 15 incidents last quarter to nine incidents this quarter. The Regulator recently conducted a review of incidents in which the failed component was listed as 'other' in an effort to reduce future FOMP incident notifications with this category.

Figure 12: Ancillary reports - failed components, between 1 October 2021 and 31 December 2021

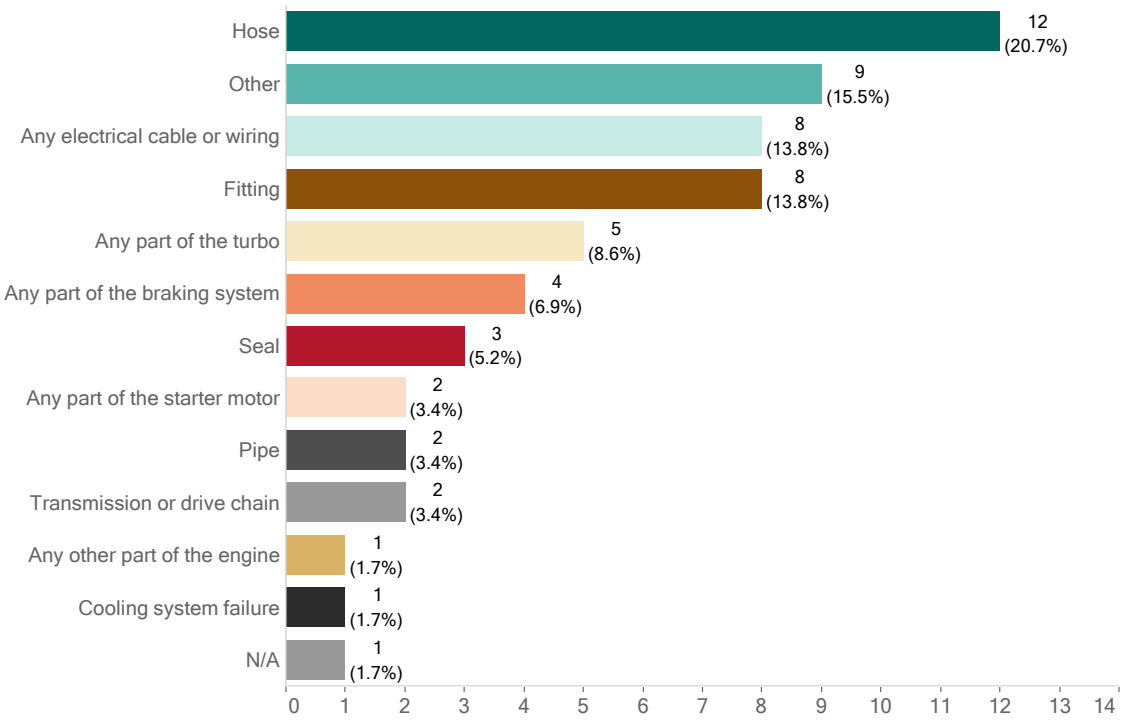


Table 4: Ancillary reports – failed component, between 1 October 2020 and 31 December 2021

FAILED COMPONENT	FY 2021 Q2	FY 2021 Q3	FY 2021 Q4	FY 2022 Q1	FY 2022 Q2	GRAND TOTAL
Hose	9	14	9	12	12	56
Other	10	5	9	15	9	48
Any electrical cable or wiring	5	8	7	5	8	33
Any part of the turbo	6	5	6	6	5	28
Fitting	3	4	3	5	8	23
Seal	2	5	3	5	3	18
Any other part of the engine	4	2	4	5	1	16
Any part of the braking system	4	1	2	--	4	11
Pipe	2	3	1	1	2	9
Any part of the starter motor	1	1	2	1	2	7
Cooling system failure	1	2	--	2	1	6
Transmission or drive chain	--	1	--	--	2	3

Ancillary reports - combination failed component and cause of component failure

The most common combination this quarter was ‘other’ and ‘other’, with six notified incidents out of 58 (10%) noting this combination. This is a decrease from last month where 11 incidents were categorised with this combination.

These categories may be recorded as ‘other’ for several reasons including human errors or uncategorised component failures. The Regulator recently conducted a review of incidents in which failed components and cause of component failure were listed as ‘other’ in an effort to reduce the instances of this grouping.

Figure 13: Ancillary reports - failed component and cause of component failure, between 1 October 2021 and 31 December 2021

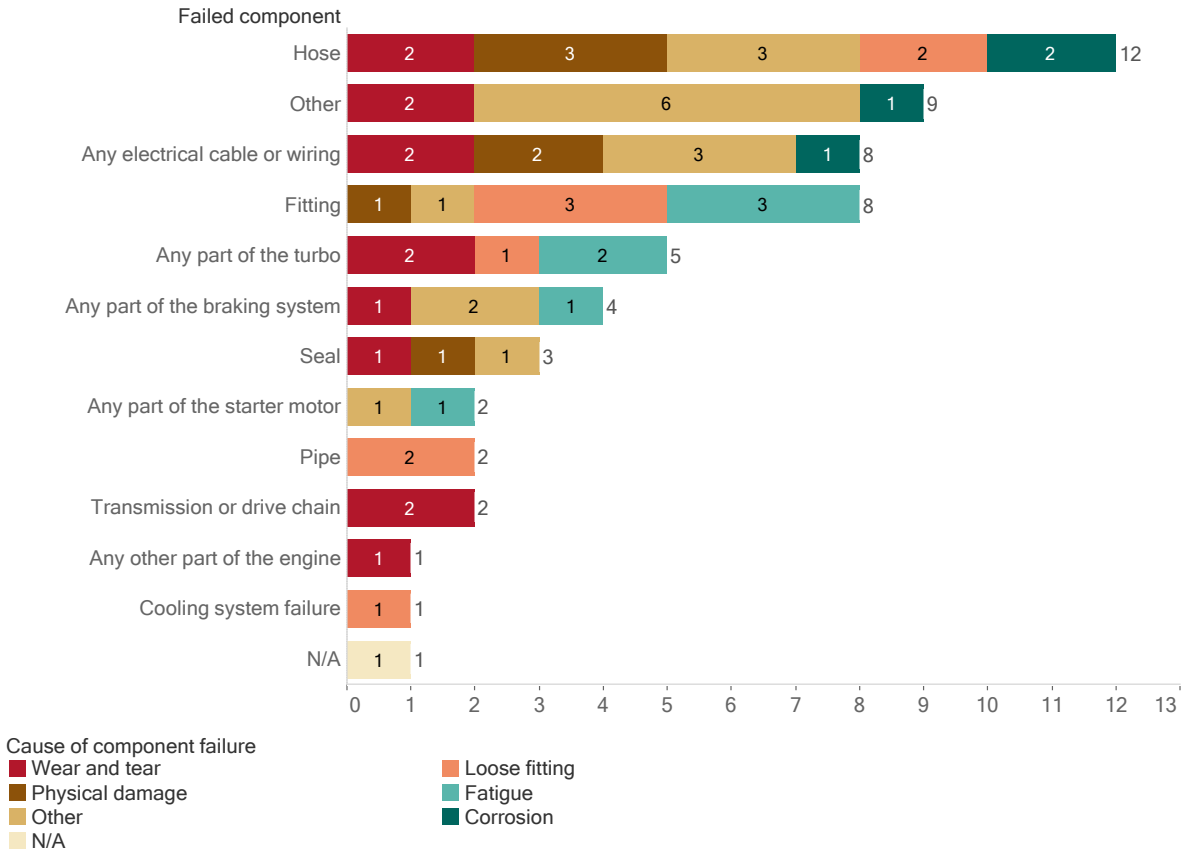


Table 5: Ancillary reports - failed component and cause of component failure, between 1 October 2020 and 31 December 2021[2]

FAILED COMPONENT + CAUSE	FY 2021 Q2	FY 2021 Q3	FY 2021 Q4	FY 2022 Q1	FY 2022 Q2	GRAND TOTAL
Other + other	7	5	8	11	6	37
Hose + wear and tear	4	6	4	1	2	17
Any electrical cable or wiring + other	2	2	4	2	3	13
Hose + physical damage	2	2	3	3	3	13
Fitting + loose fitting	2	2	1	4	3	12
Any electrical cable or wiring + wear and tear	1	3	3	1	2	10
Any part of the turbo + fatigue	3	2	1	1	2	9
Hose + fatigue	2	2	2	3	-	9
Hose + other	-	1	-	5	3	9

[2] 9 or more incidents since 1 July 2020

Incident details

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

DESCRIPTION	APPARENT CAUSES
At an open cut coal mine, the operator of a Caterpillar 24M grader noticed smoke and flames from the right-hand side of the engine bay. The operator stopped the machine and lowered the implements to the ground. The fire system automatically activated simultaneously to the operator manually activating the fire system, which then successfully extinguished the fire. The operator activated the site emergency process and then safely egressed from the machine.	A 90 degree fuel fitting elbow that was incorporated into the hose assembly and located at the fuel filter failed and sprayed atomised diesel in the engine bay, which then ignited. During the previous investigation, it was identified the fitting was known by the original equipment manufacturer (OEM) to have the potential to fail in this manner, and a technical bulletin was issued in June 2021 that did not adequately address appropriate preventative actions. As a result of the previous incident, this failed fitting and hose assembly was eliminated from the grader using a procedure and update developed by the OEM, which incorporated a 90 degree solid elbow and straight end hose. After being fitted with the new OEM updated hose and fitting in 2021, the grader went offsite to the OEM for a planned overhaul. During this overhaul, the OEM has removed the new updated hose and fitting and an original design hose assembly was installed on the grader, which then returned to site. This original design fitting failed and caused the fire event.
At an open cut coal mine, the operator of a Liebherr 9800 excavator was about to start loading a truck when the truck operator called on the radio and said the digger had a bad oil leak. The excavator operator put the bucket on the ground. The dozer operator then called to say there was smoke and they had called emergency. The excavator operator then went to the engine room and saw flames near the turbo. They manually activated the fire suppression system, which extinguished the flames.	The hydraulic hose to the fan motor with bolted connections had recently been changed. The bolts for the hose clamps on each end are a different length, 40 mm and 45 mm. The 40 mm bolts go into a block with blind holes. It appears that the bolts were mixed up and some 45 mm bolts were fitted to the wrong end. Analysis of the bolts indicate that they bottomed out in the block when tensioned, resulting in inadequate tension that in turn resulted in flexing and fatigue failure. The failure of two bolts allowed oil to spray from the joint, which was blown back over the engine and ignited on the hot exhaust surface.
At an open cut coal mine an electrician was carrying out fault finding on a Caterpillar D11N Dozer top cab lights when the operator of the dozer noticed a	Initial investigation indicated a hot joint within the 3-way deutsch connector caused heating within the connector. This heating propagated

DESCRIPTION	APPARENT CAUSES
small flame coming from a 24V DC 3-way deutsch electrical connector connecting the lights on top of dozer cab. They informed the electrician who extinguished the flame using a glove. The supervisor was then notified.	into an electrical short between the 24VDC positive and negative wires within the plug, which then ignited.
At an underground metalliferous mine, the operator of a Normet LF600 concrete agitator (Agi) parked the machine to deliver cement to a shotcrete rig underground. The shotcreter sprayed the pillar and was moving forward to spray the remainder of the cut when the Agi operator walked back to the Agi and saw a fire on the retarder. The Agi operator isolated the Agi truck while the shotcreter put out the fire with a handheld extinguisher.	The direct cause of the incident was difficult to confirm, however, it was likely that one of the retarder coils had a low resistance (short) thus drawing more current that caused the driving contact to weld its contacts closed, keeping the coil energised, even with the control in the off position. The cable was protected via a fuse link on the relays that did eventually blow but not before enough heat was generated to cause the fire.
At an open cut coal mine, the operator of a Hitachi 5500 excavator was loading a truck when the left-hand side engine light came on and the engine shutdown. The operator called the fitters but received no response. They opened the door to the LH engine house and observed flames about 300 mm high on top of the engine near the turbo. They returned to the operator's cabin and manually activated the fire suppression system and called emergency. The fire suppression system extinguished the flame, however the powder from the system created a cloud around the walkway and egress point. The operator of the nearest haul truck assisted in the safe egress of the excavator operator.	The root cause of the incident was the failure of a welch plug in the valley of the engine that released coolant onto the turbo directly above it causing the coolant to evaporate and ignite.
At an open cut coal mine, two maintenance fitters were tasked with shimming the body pads on a Caterpillar 793F haul truck in the workshop. The haul truck was under live testing for the shimming process whilst raising and lowering the body. During this work, the fitters smelled an electrical burning smell under the truck. The starter motor area was inspected. A small fire around the starter motor area was identified. The truck was isolated and the fire was promptly put out with a handheld fire extinguisher.	A shorted output terminal on top of the starter motor igniting the electrical insulation.
At an open cut coal mine, an operator of a 24 m grader was grading the run of mine (ROM) after starting shift when the grader lost power. Whilst contacting the workshop smoke was seen from the exhaust which was followed by flames.	Internal failure in turbo. Turbo was at 106% component life (8538 hours). Turbo lubrication oil entered through failed turbo and ignited in the exhaust system.

DESCRIPTION	APPARENT CAUSES
The operator shut down the grader, manually activated fire suppression and an emergency was called. The operator exited the machine safely. The flames were extinguished a short time later by a watercart and fire extinguisher.	
At an open cut coal mine, the operator of a Caterpillar D11R dozer identified smoke coming from the rear left hand side of the engine. The operator notified their supervisor who then activated the site emergency procedure. The operator shut down the machine and exited the cab to investigate, the operator then saw flames at the rear left hand side of the engine. The operator activated the fire suppression in the cab and then used a fire extinguisher to assist in extinguishing the fire. A water cart was on scene shortly afterwards but was not required or used.	The investigation revealed that a lock nut on a right-angle fuel fitting (adjustable STOR fitting) was inadvertently loosed during the installation of a fuel line that was removed for engine-related repairs. As it was inadvertently loosened, the technician did not tighten the fitting after installing the fuel line. The lock nut on the fitting loosened further due to machine vibration while operating. This in turn has allowed the O ring seal to unseat and allow pressurised fuel to be dispersed in the engine bay of the machine and igniting on the exhaust system.
At an underground metalliferous mine, a Epiroc ST-18 loader was being operating in semi-autonomous mode from the surface at an extraction level of the mine when it shut down. Once access to the loader was gained there was evidence of smouldering (fire) on the starting batteries.	A smaller dimensional battery was installed in battery compartment that allowed the battery to move underneath the clamp and chafe the battery cable. This was compounded by the fact that the cable was routed adjacent to the battery clamp.
At an open cut coal mine, an operator of a Caterpillar 785C watercart was travelling down a haul road when they detected smoke and flames from the engine bay. The operator activated an emergency via the two-way radio, parked the truck safely, manually activated the fire suppression system and exited the machine, waiting for emergency responders. Site emergency responders including additional water trucks were dispatched. One of the water trucks flooded the engine bay using the installed firefighting cannon.	Electrical battery cables to engine starter motor have rubbed, creating an electrical shorting event. The cause of the rubbing appears to be due to poor installation - two cable in one p-clamp arrangement, loose fitting and allowing the mechanical protection to rub through. Fuel sources being cabling and other services in area of the fire. There was also a possibility coolant leak could have attributed to the fire.
At an underground metalliferous mine, a maintenance crew was looking into an air conditioning issue on an Sandvik LH621 underground loader when they saw smoke coming from the hydraulic tank area. When they opened the enclosure, they saw a small flame coming from a solenoid/wiring area at the bottom of the hydraulic tank.	The solenoid causing the smoke failed due to water ingress and internal damage. After searching Sandvik Bulletins it was found that these solenoids were upgraded to prevent this issue, only to be reverted back to a previous part over time. This is due to fitters using old parts books.

DESCRIPTION	APPARENT CAUSES
The flame was extinguished with a handheld extinguisher.	
At an open cut coal mine, the fire suppression system on Caterpillar 773D service cart detected a flame, initiated engine shutdown and discharged the suppression system. The operator of the service cart exited he vehicle safely and confirmed the presence of flames in the engine bay. They activated the mine's emergency management procedure by calling in the emergency and extinguishing the remaining flame using a handheld extinguisher.	Pressurised fuel escaped from the diesel primer pump and covered to the entire engine bay, causing multiple splash points. The most likely cause was that the plunger retaining nut was not secured after the fuel system was last primed.
At an open cut coal mine, a small fire was observed on the exhaust system of a Drilltech D75K blasthole drill. The drill was not in operation when the fire was observed. The drill operator exited that cab to clean windows and identified a small amount of smoke on the off-cab-side engine, inspected the area and put the fire out with a handheld extinguisher. A site emergency was activated, and the area was monitored.	The turbo oil feedline gasket seal failed. Oil leaked directly on to the turbo and exhaust system igniting. The limited data available suggests that blocked air filters increased exhaust temperatures and damaged to the turbo oil seals. Actions were put in place to gather additional information around this failure.
At an underground metalliferous mine, a small fire occurred in rags that were left near the exhaust on a Sandvik 663 underground haul truck when in operation at the mine. The fire did not set off the fire suppression system, it was identified by the driver who extinguised it with a handheld extinguisher.	Rags were left in between exhaust and engine base plate after an engine repair.
At an open cut quarry, a Caterpillar 740 articulated dump truck caught on fire. The operator stopped the machine and called for assistance. The fire brigade attended and controlled the fire.	A hydraulic hose failed in the engine compartment spraying oil onto the exhaust system and ignited.
At an underground metalliferous mine, a worker was tramming a Merlo P40.13EE telehandler up the main decline when a flame was notice by another operator. The fire was extinguished with a handheld extinguisher.	The vehicle was driven while the park brake was engaged. Brake pad material broke down due to heat and friction.
At an open cut coal mine, a worker was operating a Caterpillar MT4400 haul truck when they called up for a fault on the machine. A maintenance person went down to the machine to address the issue. Not long after the machine was released, the operator called back up with the fault again. The operator was informed by maintenance to take the machine back to maintenance area in the pit. When moving the truck back with the fault, the brakes heated to a	A damaged brake valve caused the brakes to drag. The haul truck was operated with dragging brakes.

DESCRIPTION	APPARENT CAUSES
point where the wheel motor cover on position 3 melted and initiated a small fire on the wheel motor cover at position 4.	
At an open cut quarry, a worker was operating a Doosan DX300LC excavator when they noticed a fire in the engine bay. The operator stopped and exited the machine. Workers tried unsuccessfully to stop the fire with extinguishers. The fire brigade was called and attended the scene. The fire was put out by the fire brigade. The machine was destroyed.	Overheating of the turbo charger. Radiant heat from the overheating turbo charger ignited the noise-deadening foam layer that lined the walls and top cover of the engine compartment.
At an underground coal mine, a small fire was seen on a supply pod trailer wheel bearing on arrival at the outbye crib room. The pod was towed by a JUG-A-0 ute from the pit top, carrying two cassettes of supplies for a continuous miner a distance of approximately 6-7 km. The fire was extinguished by a water hose.	Water ingress into the inner bearing caused corrosion. The corrosion caused the inner wheel bearing to fail. Friction from the failed inner bearing caused the grease in the bearing to catch fire.
At an open cut coal mine, a UGL train locomotive was travelling along the rail loop in preparation to be loaded. Two train operators were in the front locomotive when they noticed the third locomotive on fire. The two operators stopped the train, activated the site emergency process and egressed from the train. The two train operators made the decision not to attempt to fight the fire and waited for the site rescue team. The site rescue team successfully extinguished the fire.	The cause of the fuel leak can be attributed to a faulty high pressure fuel pump. The main internal spring within the component was found to be shattered, with pieces being allowed to ricochet within the assembly and cause further damage. A piece of broken spring was assumed to have been allowed to come between the push rod and the pump effectively extending its range/extent transferring additional force into the pump, which resulted in the failure of the retaining bolts that allowed for the leakage of the diesel.
At an underground metalliferous mine, a Sandvik LH62Li underground loader was tramming from one level to another when the operator identified a loud noise from the machine and could smell smoke. The operator pulled up to investigate further. The operator couldn't identify anything and contacted a fitter who came down to the loader. The fitter could also smell smoke and climbed onto the machine and lifted the bonnet where they identified a flame coming from the high-speed drive shaft. The operator used a fire extinguisher to extinguish the flame.	Wear and tear of the high-speed shaft bearing resulted in excessive friction that provided the heat source that ignited the grease.
At an open cut coal mine, a Caterpillar SKF blasthole rotary drill was operating on the drill pattern when the operator noticed a hydraulic leak and immediately shut the drill down via the ignition to investigate further. Upon leaving the cab, the operator noticed smoke and turned to grab a fire	The direct cause of the fire was corrosion of the mast valve assembly to auxiliary pump manifold hydraulic hose fitting and internal steel core, resulting in hose wall failure, and subsequently the hydraulic oil released contacting unprotected

DESCRIPTION	APPARENT CAUSES
extinguisher. At this point, a fire ignited in the exhaust housing area. The operator extinguished the fire using the 9.0kg ABE dry chemical powder handheld extinguisher, before using a second extinguisher as a precaution.	hot surfaces of the exhaust system (tip and muffler).
At an open cut coal mine, an operator of a Caterpillar 773F water truck parked the machine due to an accumulator fault light illumination and alighted to board an adjacent water cart. The operator conducted a walk around inspection on the water truck and noticed what appeared to be a small flame in the engine bay area. The operator boarded the adjacent water cart and doused the engine bay area with water, extinguishing any signs of flame.	The turbo cooling hose was loose and has allowed oil to leak out onto the turbo area of the engine.
On the surface area of an underground metalliferous mine, a Sandvik TH663 underground haul truck was initiating refuelling at the surface refuelling area. When the operator pushed the activation button to start the pump, the fuel delivery hose failed, spraying fuel on the truck exhaust resulting in a small fire. The operator immediately stopped refuelling, accessed the onboard fire extinguisher and extinguished the small flame on the muffler.	The fuel supply line from fuelling station burst when operator started the filling process. There was evidence that the hose was damaged.
At an underground metalliferous mine, an Isuzu NPS 75/45-155 300 flatbed stores truck was operating in the underground part of the mine carrying a load of cement when a small fire was identified near the left rear wheel. The operator stopped the machine and extinguished the fire using a handheld fire extinguisher.	Electric cables were rubbing on the chassis causing it to lose its insulation and leading to a voltage leak. This caused a short circuit, setting the cables on fire.
At an open cut coal mine, the operator of a Liebherr 9250 excavator was called by the clean-up dozer that there was a visible oil leak coming from the machine. The operator shut down the machine, advised the supervisor of the breakdown and then investigated the leak. When opening the engine bay doors, the operator identified a fire on the turbo. The operator went back to the cab of the machine and activated the site emergency process and then used a handheld extinguisher to extinguish the fire.	Two studs failed on a hydraulic fitting inside the hydraulic compartment. When the control valves were replaced at 27,000 hours, new high pressure screen mounting studs were not supplied or ordered. The original high pressure screen mounting studs were removed from the old control valves and reinstalled and retorqued into the new control valves. The studs fatigued and failed over time due to the retorquing, machine vibration and the physical weight of the high pressure screen assembly. Oil sprayed all over the machine and onto the top deck. A small gap in the top deck around the fire deluge

DESCRIPTION	APPARENT CAUSES
	pipe allowed oil to drip down onto the turbo, penetrate the metal cover, soak the lagging and ignite.
At an open cut coal mine, an operator of a Caterpillar 793D dump truck was driving along a haul road returning to the dig unit when the engine turbo suffered a mechanical failure causing visible flame in the engine bay. The site emergency process was initiated, fire suppression activated and flames extinguished.	The turbo failed due to the over-hung mass of the turbocharger. The 397-6397 V-band clamp was not robust enough to hold the exhaust snail and cartridge together securely . This allowed the housing flanges to fret against each other. As the fretting progressed the alignment of the exhaust turbine to exhaust snail worsened until the exhaust turbine fins started to make contact with the inside of the exhaust snail. The exhaust turbine seized in the exhaust snail due to the fin contact elevating the turbine temperature even further, becasue of the high temperatures and inertia forces of the compressor wheel spinning the shaft shears and separating the turbine from the main shaft.
At an open cut coal mine, the operator of a Caterpillar 789D dump truck was travelling up the main ramp loaded when they observed smoke rising from the engine bonnet adjacent to the passenger side of cab. The operator called an emergency over the two-way and parked the truck. On inspection of the engine bay, a small flame was observed and was suppressed with manual activation of the onboard fire suppression system.	It was observed that the muffler had shifted in the restraints and dislodged an exhaust elbow joint, causing exhaust gases to escape past the lagging and contact the bonnet. This resulted in a section of the fibreglass bonnet that was in contact with the exhaust elbow to ignite.
At an open cut coal mine, the operator of a Caterpillar D11T dozer was reversing when they noticed a trail of oil on the ground and immediately parked up for inspection. During park up, the automatic fire suppression system activated. The dozer operator safety exited and then used the onboard fire extinguisher to assist the suppression system with dousing the fire.	The female fitting of the tilt supply hydraulic hose unscrewed from the male fitting on the valve bank allowing hydraulic oil to escape onto hot engine components and ignite.
At an open cut coal mine, the operator of a Caterpillar 24H grader noticed a burning smell in the cabin while operating the machine. The operator noticed smoke coming from the right hand console (gear stick area), parked the grader on the side of the road in a clear area and noticed a flame coming from the same area. The flame was contained in the right hand console that houses the gear selector switch, park brake lever and various electrical switches (lights etc). The operator called emergency	Rubbed through harness found in the engine bay. Faulty circuit breaker did not trip when a fault was detected. Less than adequate wiring was used on the aftermarket reverse light relay. Evidence of high current in the wiring, due to a short circuit to ground on either wire 117 or 321a caused melting of the insulation for the associated wiring.

DESCRIPTION	APPARENT CAUSES
and notified the supervisor. They then activated the graders fire suppression system. The operator exited the cab to retrieve a handheld extinguisher from the access platform outside the cab and extinguished the fire.	Damage to wire 105 was a result of the localised fire.
At an open cut coal mine, a Komatsu 830E-1AC electric drive haul truck sustained loss of propel and retard while hauling loaded down a ramp. The operator applied the service brake, which resulted in fire.	The loss of propel/retard was caused by the AFSE panel door freely swinging due to the top retaining screw coming loose and the bottom one was missing , which shorted terminals on the panel door. The fire was caused by the service brake friction.
At an underground metalliferous mine, a Caterpillar AD60 underground articulated truck was tramming to the surface when the operator noticed the steering became loose. The operator shut down the truck and exited the cab. They then noticed flames coming from the engine bay.	The failure of brake hydraulic hose assembly resulted in hydraulic fluid spraying onto the exhaust and igniting. The hose failed due to incorrect length. The hydraulic hose was 30 mm less than OEM design. A faulty charge valve in the hydraulic service brake system caused excessive cycling that also contributed to the failure of the hose. Fire shielding/protection (rubber flap/grommet) was not refitted following previous maintenance activities.
At an open cut coal mine, a Caterpillar 773F water truck was travelling along the haul road and entered the pit dump. Flames were noticed on the left-hand side of the truck by the operator who actuated the fire suppression, called emergency and shut down the machine. The operator exited the machine cabin and used a handheld extinguisher to extinguish a small remaining flame under the water body.	A high-pressure hydraulic hose feeding the water pump for the module failed at the crimp at entry to the HP screen. Evidence of significant corrosion of reinforcing wire in the hose was present. This sprayed a significant volume of oil onto the engine that ran behind the exhaust manifold lagging (between the lagging and the head) and ignited on the manifold.
At an underground metalliferous mine, a small fire was discovered on a Volvo L120 integrated tool carrier after completing work in the pit. The machine overheated, spilling coolant onto exhaust lagging leading to smouldering and some flame.	There was not a good seal on the header tank fill neck that caused initial overheating. Once overheated, coolant began to release from the system. The radiator overflow hose was not fitted, which would have diverted the coolant away from hot exhaust area as designed. The coolant came into contact with the exhaust system. Once vapourised, it ignited.
At an open cut coal mine, a Liebherr 996B excavator was returning to service after an overhaul. It had completed commissioning and the operator was walking back into the dig when the machine's fire suppression system alarmed and automatically	A radiator hydraulic fan hose retaining plate O-ring let go and sprayed the engine with hydraulic oil as the result of loose bolts. Poor workmanship was the cause.

DESCRIPTION	APPARENT CAUSES
discharged. A flame was seen on the top engine bay of the rear engine.	
At an open cut coal mine, a Caterpillar D11T GEB dozer was operating near excavator work area when a hydraulic alarm activated. The operator inspected the hydraulic tank and noted that the level was low. They moved to ground level and could see oil coming the front area of the dozer. They opened the right-hand side engine bay door and observed flames below the air filters. The operator activated the fire suppression system and called the emergency. The fire suppression system extinguished the fire.	An investigation revealed the hydraulic oil leak was coming from a test hose for the hydraulic fan circuit under the cab. The test hose was rubbing on the crimp sleeve of the implement pump suction hose and had worn through causing the leak. The hydraulic oil assisted by the engine fan and a gap in the rubber barrier sprayed into the engine bay area, making contact with the hot turbo/exhaust manifold surfaces on the right hand side of the engine and igniting.
At an open cut coal mine, after replacing 2 left hand turbos, 2 fitters were test driving a Hitachi EH3500-AC3 dump truck RDT054 through the workshop yard. After load box testing a small flame was seen coming from the left-hand exhaust. Emergency procedures were initiated, and a water cart attended the scene. When the water cart arrived at the scene the flame was no longer present but as a precaution the area around the exhaust was wet down.	Residual oil from a failed turbo flared up inside the exhaust.
At an underground metalliferous mine, an Atlas Copco MT6020 underground mine truck was under test in the underground workshop because it was reportedly low on power. During the test, the fitter noticed flames emanating from the diesel particulate filter. The engine was immediately shut down and the flames appeared to self-extinguish.	The turbocharger hot wheel failed causing an imbalance in the turbo shaft, resulting in turbocharger lubricating oil to pass the oil seal leaking into the exhaust housing side of the turbo. This oil combined with poorly combusted over-fuelled engine emissions has presented to the diesel particulate filter (DPF). The DPF operating at high temperature accumulated sufficient hydrocarbon build-up until the fuel source ignited within the DPF.
At an open cut coal mine, the operator of a Liebherr T282C electric drive haul truck was loaded and travelling up a low wall ramp when the operator noticed the haul truck was starting to lose power. The haul truck then lost all power. The haul truck was shut down and the operator noticed smoke coming from the area of Pos 1 tyre. The operator activated the fire suppression system and called an emergency. The operator safely alighted from the haul truck.	The main alternator failed as a result of the alternator output cables detaching from the stator winding (I.e., soldered joint failure). There was a turn-to-turn failure and a high resistive joint failure in around the stator winding. The turn-to-turn short occurred first and caused the lead connection to heat up and throw its solder out. Once the solder wasn't present, the connection heated up and ignited the electrical cablings insulation.
While refuelling a Caterpillar R3000 loader at an underground metalliferous mine, pressure caused a bolt to be released from the air filter housing	The air filter box hold down bolt that is mounted on top of the fuel tank had stripped thread,

DESCRIPTION	APPARENT CAUSES
allowing fuel to spray onto the turbo exhaust system. The service person used a fire extinguisher to extinguish the fire. Fuel sprayed onto the DPF box and caught fire and a second extinguisher was used to extinguish the fire.	which then popped out when the tank pressurised during refuelling. This allowed a small amount of diesel to spray on to the exhaust manifold/turbo.
At an open cut coal mine, the operator of a Komatsu 830E dump truck pulled into the park area of a crib hut. As they climbed off the ladder, they noticed a small fire of about 200 mm high inside the position 2 rim. They proceeded to the crib hut and called an emergency. Another operator extinguished the fire with a handheld fire extinguisher. A water cart cooled the truck rim, a tyre fitter checked the tyre temperature that was found to be cool.	The pos 2 wheel bearing collapsed due to wear and tear. The component was at the end of its life. The component was condition monitored with oil analysis as part of the maintenance strategy. Oil analysis flagged rising PQ. Visual inspection was triggered and conducted based on VA. Visual inspection was carried out and confirmed iron generation. Based on the inspection, the wheel bearing should have been escalated to be changed out, but this did not occur.
At an open cut coal mine, a Caterpillar 24 m grader was being re-energised after repair works were completed when smoke was noticed coming from the engine bay. On inspection, there was a small visible flame around the starter motor. The machine was isolated and the flame was extinguished using a handheld extinguisher.	An internal failure of the starter motor occurred. The solenoid switch was the most obvious point of failure. The failure was such that the switch remained in the closed position because of insulation failure and low resistance connection to ground generating heat when the battery isolation was removed. This failure has melted/ignited the insulating material that was part of the starter motor housing.
While operating a Caterpillar D11T dozer at an open cut coal mine and doing a clean-up for an excavator, an operator noticed smoke coming from the bonnet area. They stopped, parked safely and shut the machine down. The operator opened the engine bay doors and saw flames under the turbo and lots of oil everywhere. They climbed back into the cab, activated the fire suppression and called emergency. The operator was successful in extinguishing the fire.	The hose was the incorrect part fitted. The correct part number was 358-2475. The 345-8870 that was fitted was 184 mm longer, which allowed the hose to sit against the implement pump housing, instead of clearing it. The vibration caused relative movement between the hose and pump housing, rubbing through the outer sheathing, steel wire braid, and inner liner layers of the hose.
At an open cut coal mine, an operator was following a Komatsu 830E-1AC haul truck while descending the pit ramp when they noticed sparks and flames coming from the Komatsu's right side. The operator following the Komatsu advised its operator of the situation. An emergency was called and the truck was parked fundamental, switched off and the operator disembarked. The truck was isolated at the battery isolator. Emergency services attended and a watercart was used to cool heat from resistor grids.	The initial failure occurred in between RG1A and RG1B grids. It likely started as a hairline fracture on the weld of the fin in RG1A grid and developed over time before creating a hot joint that led to the failure. The subsequent damage on RG1B, RG3A, RG3B and RG3C grids was a result of arcing/molten material caused by the failure of the RG1A grid. The mix of D and J series grids in a single bank were not appropriate to maintain the improved thermal capabilities.

DESCRIPTION	APPARENT CAUSES
	The use of J2 style grids improved the weak point in the grid element where the ribbon was connected to the top and side bus bar connection point.
At an open cut coal mine, the operator of a Liebherr 996 excavator noticed oil on the cabin window and investigated. A hydraulic fitting failed near the back of the cabin and dripped oil through the deck and over both engines. After noticing the oil, the operator walked the excavator to a safe location, shut down the machine and released the pressure from the hydraulic tank. The engine bay area was inspected. A small fire on the PP2 exhaust shield was identified and put out with a handheld fire extinguisher.	The flexible mounting arrangement of an electrical cabinet that the hydraulic bleed down valve was mounted to allowed a fitting on the valve to impact the boom arch hose support bracket, during operations that failed.
At an open cut coal mine, a Caterpillar 16M grader was being refuelled by serviceman from Caterpillar 775F. The grader was turned off and isolated. At the completion of refuelling and as the fuel cart operator was reeling in the fill hose, the serviceman and the grader operator noticed smoke coming from the engine bay of the grader. The fire suppression was manually activated and an emergency initiated on the two-way radio.	Leaking diesel fuel cap sprayed fuel onto hot components of the engine. It wa suspected that quick fill cut out failed (Cat Sure Aero), placing pressure on the diesel fuel cap, which dislodged under the pressure and sprayed the engine with fuel.
At an underground metalliferous mine, a Toyota tray back ute was being driven up the decline between levels when the driver and passenger noticed a reflection of flames on the side wall. The vehicle was immediately parked up and secured after which the operator detected flames coming from the DPF exhaust area.	The investigation revealed that injector lines were single use items and should be replaced once removed. The refitting of the injector line resulted in a complete seal not being established and gradual leak on the number 4 injector, causing fuel to run down the side of the engine in proximity of the DPF exhaust system.
At an open cut coal mine, the operator of Toyota coaster bus noticed smoke coming from the engine bay while driving to the muster area at end of shift. The operator enacted the site emergency response procedure and stopped the bus. ERT personnel attended the scene and upon inspection, a small visible flame was identified in the left hand side of the engine bay and was extinguished with a handheld extinguisher.	Steel core, rubber steer hose perished due to heating from an electrical short circuit. This allowed the hose section to leak steering fluid (oil).
At an open cut coal mine, the operator of Caterpillar D10T dozer was on a dump when they noticed hydraulic oil spilled on the ground behind the machine. The operator established a windrow, and reversed to a safe park-up area. The high engine	There was a rub-through of hydraulic hose in the hell hole. Atomised oil ignited on the exhaust surface.

DESCRIPTION	APPARENT CAUSES
temperature alarm light was displayed so the operator lowered the ladder and shut the machine down. They egressed down the ladder when they saw smoke coming from the engine bay. They opened the front left engine door and observed the flicker of a small flame at the rear right of the engine bay. Deciding they did not have a good angle of attack with a fire extinguisher from the left hand side of the machine, they went back to the cab and manually operated the fire suppression system. They then alighted the machine and called the emergency. No further fire was detected.	Hose 200-5290, which was mechanically protected by spiral wrap, was rubbing on adjacent hose and rubbed through.
At an underground metalliferous mine, a small fire occurred on the offside front mud flap of an Atlas Copco MT6020 60T haul truck while operating underground. The fire was described as the size of a hand/fist and was extinguished with a handheld fire extinguisher.	Rubber guarding over the RF wheel arch replaced at PM service was not installed as per the OEM requirements resulting in the rubber (fuel source) being in the line of fire of the DPF hot exhaust gasses (heat source).
At an underground metalliferous mine, a fire occurred on a Sandvik 621 loader while it was operating underground.	This incident was under investigation at the time of this report.
At an open cut coal mine, the operator of a Caterpillar 980M front end loader heard a noise and stopped the machine on the side of the road. When the operator got down to inspect the loader, flames were seen coming from the centre bearing on the front driveshaft. The operator initiated the site emergency procedure and extinguished the fire using a handheld extinguisher.	The front driveshaft center bearing failed. Metallurgical examination of the bearing completed by Bureau Veritas identified that the centre bearing failed due to a lack of lubrication. Inspection on the machine after the event identified that the grease supply line going to the front frame (which supplies the centre bearing) failed and was leaking grease. The investigation also outlined that the centre bearing grease injector was adjusted slightly low. The mine had experienced significant rainfall in the days before the incident. The loader was used to clean-up haul roads, swillies and windrows and was working in significantly muddy conditions. This caused significant mud build-up on the machine and the failed centre bearing. The combination of the low injector setting, the failed supply line and the specific working conditions at the time of the event led to a lack of lubrication causing catastrophic failure of the bearing and the subsequent ignition of grease.
At an open cut coal mine, a supervisor was opening engine bay doors to check heater taps on a Caterpillar D11T dozer. As as they opened the right hand side door they noticed a small fire around the	A return fuel hose at the R/H rear of the engine rubbed through behind P clamp causing leaking fuel into engine bay area and igniting on the exhaust manifold.

DESCRIPTION	APPARENT CAUSES
rear engine area about 300 mm long x 100 mm in height. They asked the operator to grab an extinguisher and called the emergency over the radio. The supervisor opened the rear engine bay door to gain access to the fire and also grabbed a fire extinguisher from the right hand side deck and discharged it at the same time as the operator discharged his extinguisher. The flame extinguished quickly.	
While tramming a Hitachi 3600 excavator at an open cut coal mine, an operator heard the fire suppression system alarm, looked in the engine bay fire cameras and noticed that there was a small fire in the engine bay. The operator shut down the machine and activated the fire suppression system and called an emergency. A water cart was used to deluge the engine bay area as a precaution for about 5 minutes. A hydraulic return flow hard pipe had migrated from a pipe joining clamp, allowing a flow of hydraulic oil into the engine bay area and onto hot components. A pipe clamp above the joint clamp was missing.	A main return flow hydraulic pipe migrated from its joiner due to a missing support bracket. The missing lower horizontal support bracket allowed movement in the return pipe system that led to the vertical support clamp to fail, releasing oil into the engine bay area.
When disembarking from a dozer, the operator noticed smoke coming from the right hand side of cab. On inspection, visible flames were noticed around the hydraulic tank. The small flame was extinguished using a handheld extinguisher.	It was found that an electrical wiring harness had rubbed through the insulation, short circuited to ground and ignited oil that was laying on and around the harness. The rub through was caused by a poorly installed non-genuine hydraulic pilot line that was not adequately secured or segregated.
Cat D11T dozer was doing bulk push when the low engine oil light alarm came on. The operator reversed the dozer up the ramp and shut down the engine. The operator observed a flash of fire fomr the left hand side of the engine. The operator manually activated the fire suppression system, called an emergency and alighted the dozer. No further fire observed.	The engine failed resulting in the conrod exiting the block, releasing oil or oil vapour in the engine bay. The oil or oil vapour ignited, possibly on exposed hot engine internal components to cause what the operator described as a flash of fire.
At an open cut coal mine, a Caterpillar D6T dozer was parked idling in the south east tailings area of the mine when the operator reported seeing smoke coming from the fuse box. The operator opened the fuse box and saw a small fire coming from the 24V main relay. The operator isolated power to the machine and extinguished the fire using the on board handheld extinguisher.	There was an internal failure of the main 24V dc relay, possibly due to fatigue or water ingress.

DESCRIPTION	APPARENT CAUSES
At an open cut coal mine, a Caterpillar D11T dozer was working on an overburden dump when the operator noticed flames coming out of the left hand side of the engine bay. The operator reversed from the dump and shut the machine down. The operator grabbed a fire extinguisher but could not open one of the engine bay doors because the latch was not working. The operator returned to the cab and manually activated the fire suppression system that extinguished the flames.	There was an engine oil leak from the left hand rear engine tappet cover that was recently resealed. A tradesperson ran engine for 15 minutes to check that the repair was effective and thought it was. It appears that the tappet cover continued to leak after the repair and the exhaust thermal lagging also contained some residual oil from the previous leak. Oil came into contact with hot exhaust surface and ignited.
At an open cut coal mine, the operator of Caterpillar 24M grader observed smoke and flames in the engine bay. The operator stopped the machine, activated the site emergency procedure, manually activated the on-board fire suppression system and exited the machine safely. A watercart was used to hose and cool the engine bay to confirm the fire was extinguished.	A fitting failed on a fuel hose inside the engine bay that allowed diesel to spray over the engine and ignite. The fitting that failed was a 90 degree 1\4" bent pipe fitting that was incorporated into the end of the fuel hose assembly. Westrac issued a technical bulletin (TIB167) in April 2021 regarding this particular hose fitting. The alert recommended to: 1. inspect the 90 degrees fitting for cracks 2. inspect the tension on the hose and fitting 3. inspect the hose and its durability The mine received TIB167 in June 2021 and on review rather than only inspecting for cracks, the mine scheduled and replaced the hose on the grader. However, the alert did not adequately outline the actual issue with the hose and fitting (excessive load placed on the fitting by installing in a certain orientation). When the hose was replaced in July 2021, it was installed in an orientation that added load onto the fitting that over time due to vibration, fatigued, cracked and subsequently failed. The root cause was that the design of fitting was suitable for fluid pressure however design was not suitable for the mechanical load and vibration it was exposed to while in operation.

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

Annexure A

Changes to the duty to notify the Regulator

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

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

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

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

Plant that is in operation refers to any plant that is in service at the mine. This includes the testing, commissioning and maintenance of plant.

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.