NSW Resources
Resources Regulator

Investigation report

Two workers injured by catastrophic truck tyre failure

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Introduction

A truck tyre catastrophically failed, injuring two workers with debris and air blast pressure, at the Clovass Quarry on 8 February 2024. The incident occurred in the quarry workshop when the workers were trying to locate an air leak on the tyre while it was secured on a tyre-fitting machine and being inflated with compressed air.

The quarry

The quarry is an open-cut quarry near Casino in the Northern Rivers region of New South Wales. Its nominated operator is Holmes's Pty Ltd. The quarry produces aggregates for various infrastructure and civil projects primarily around northern New South Wales and southeast Queensland. The quarry uses mobile plant and equipment to crush and screen extracted materials and has a fleet of road trucks that transport the extracted materials.

The incident

A flat tyre was identified on the inside rear axle of a B-double semi-trailer truck during maintenance work at the quarry workshop on 8 February 2024.

A truck driver and a mechanic removed the tyre and wheel assembly from the truck's trailer axle to inspect it for damage and/or leaks and assess whether it could be repaired or needed to be replaced.

Once removed, the truck driver took the tyre to a tyre-fitting machine in an area adjacent to the workshop. He visually inspected the outside of the tyre for signs of damage or leaks but did not find any.

The mechanic was asked to assist with another task and left the area.

A second truck driver offered to assist.

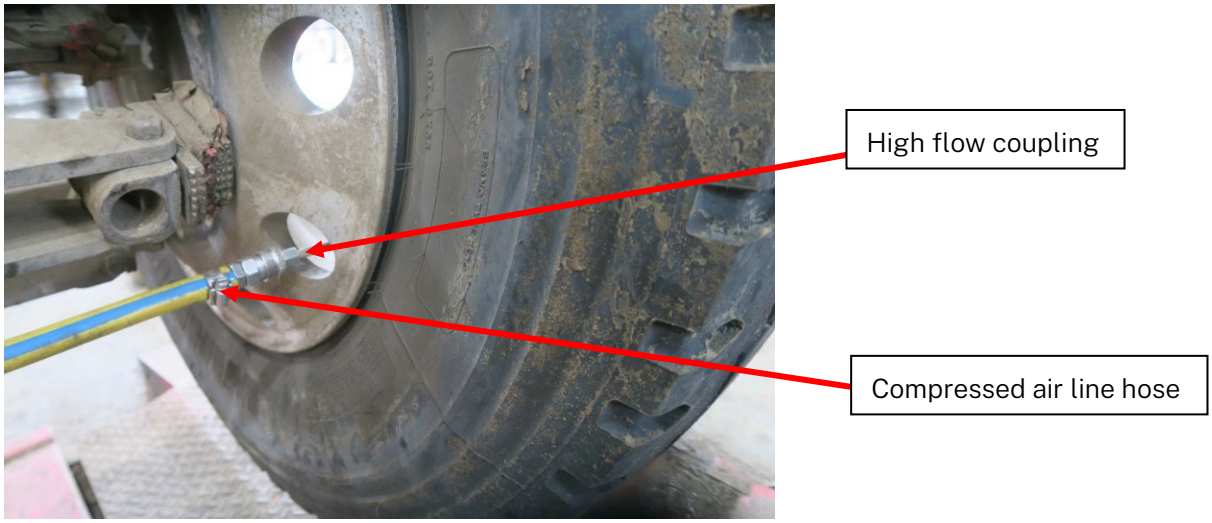
The 2 truck drivers:

- loaded the tyre and wheel assembly onto the tyre-fitting machine, operating its controls to secure and lift it (see Figures 1 and 2). This was done to allow the machine to rotate the tyre so it could be further inspected for damage and/or leaks
- connected the workshop's compressed air system to the tyre via an air line hose by removing the tyre's valve stem and connecting a high-flow valve coupling (see Figure 3). This caused air to flow into the unseated tyre.
- seated the tyre bead onto the wheel rim using a hand-held compressed air tank to create a sufficient seal that caused the tyre to inflate.

Figure 1: Front view of tyre and wheel assembly fitted to the tyre-fitting machine after the incident

Figure 2: Rear view of tyre and wheel assembly fitted to tyre-fitting machine after the incident

Figure 3: Compressed air line hose and high-flow coupling fitted to the tyre and wheel assembly



As the tyre began inflating, one of the truck drivers returned the hand-held compressed air tank to its storage location a few metres from the rear of the tyre-fitting machine. The other truck driver began rotating the wheel using the tyre-fitting machine's controls, while spraying the tyre tread with a soapy solution. This process was used to identify air leaks through bubbling of the solution and a popping noise. He was in front of the rotating tyre, in close proximity, while spraying the solution and looking for bubbles. He was not wearing hearing protection.

Around this time, a third worker attended the area and began looking for air leaks in the soapy solution. This worker was near the right-hand side edge of the tyre's front face and was not wearing hearing or eye protection.

The compressed air line system continued to pump air into the tyre, inflating it, until there was a loud bang and the 2 workers at the front of the tyre were hit with pressure of an air blast and debris from the tyre. The air pressure knocked one worker to the floor and tore off his shirt.

First responders immediately assisted the injured workers, rendering first aid until emergency services were contacted and paramedics arrived. The workers were treated on site and then taken to hospital for further assessment and treatment.

As a result of the incident, one worker suffered perforated ear drums, hearing loss, soft tissue contusions and abrasions on the face, torso and upper body. The other worker suffered injuries to both eyes caused by tyre rubber and steel foreign body fragments and ongoing tinnitus.

Investigation findings and outcome

The Resource Regulator's Major Safety Investigation Unit investigated the incident to determine its cause and circumstances.

Cause of the incident

The investigation determined that the catastrophic tyre failure occurred when the sidewall of the tyre failed and violently tore open while it was being inflated (see Figure 4). This type of tyre failure is referred to as a zipper failure, which is often caused by the tyre being run while overloaded, under-inflated or flat. In these circumstances, over time, the structural integrity of the tyre's sidewall becomes weakened making it prone to rupture. Post-incident examination of the internal and external parts of the tyre identified visible signs that it had likely been run while underinflated or flat.

Figure 4: Front view of tyre showing side wall failure

Contributing factors

The investigation found several factors contributed to workers being exposed to the risk of serious injury or death while inspecting and inflating tyres including the following:

Risk management

1. Workers were not required to, and did not routinely undertake, formal risk assessments to identfy hazards and appropriate controls when inspecting, detecting air leaks, puncture repairing and inflating tyres (**the work**) including those set out at points 2 to 8 below.
2. There was no written procedure, instructions or guidelines detailing a step-by-step process for the work that consolidated appropriate controls identified by risk assessment (refer point 1.) including those set out at points 3 to 8 below.

Engineering controls

3. The compressed air line system used to inflate tyres was not fitted with a device, such as an in-line pressure guage/digital display and inflation control device(s) (see Figure 5 and 6) that enabled workers to continously monitor the tyres' air pressure and manually control the level of inflation from a safe distance, clear of the line-of-fire, in the event of tyre failure.
4. During inflation, tyres were not suitably restrained in a cage or similar device that provided a physical barrier to protect workers from projectiles, debris and air blasts generated in the event of a tyre failure (see Figure 7 and 8).

Administrative (procedural) controls

5. There was no requirement for designated exclusion zones to be implemented while inflating tyres to ensure that workers were clear of the line-of-fire
6. When inspecting tyres for punctures and air leaks, there were no formal procedures or instructions that required:
    a. tyres to only be inflated to a designtated low-as-practicable air pressure
    b. partially inflated tyres still fitted on wheel rims to be fully deflated, removed from the wheel and internally inspected for concealed signs of structural damage before being reinflated

Administrative (information, instruction and training) controls

7. Workers were not provided with adequate information, instruction and training about how to inspect the external and internal parts of tyres to identify signs of structural damage including damage caused by being run overloaded, underinflated or flat.

Personal protective equipment (PPE)

8. The quarry's PPE policies and procedures requiring workers to wear hearing and eye protection while using the compressed air line system to inflate tyres were not routinely adhered to.

Investigation outcome

Arising from the incident and the Regulator's investigation, Holmes's Pty Ltd has entered into a Work Health Safety undertaking.

Recommendations

Quarry and mine operators are reminded of their duty to identify hazards and manage risks to health and safety in accordance with provisions of the *Work Health and Safety Act 2011* and *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and Regulations.

In particular, quarry and mine operators must:

Risk assessment

- undertake a detailed risk assessment to identify the hazards and controls required to manage the risks to health and safety associated with tasks involved in the inspection, maintenance, repair and inflation of pneumatic truck tyres at the workplace

Engineering controls

- develop and implement a safe system of work for inflating truck tyres, which incorporates where reasonably practicable, higher order controls to eliminate (where possible) or minimise the risk to health and safety associated with tyre failures, such as:
  - compressed air line systems that:
    - allow continuous monitoring of tyre air pressures and control of inflation levels from a safe location, clear of the potential line of fire. For example, the use of an inline pressure gauge/digital display and inflation control device (see Figure 5 and 6), fitted to a long air hose of at least three metres of length (after the gauge/digital display and control device), that connects and locks onto the tyre's air valve
    - incorporate a remote dump valve or similar device that is capable of rapidly deflating the tyre in an emergency.
  - tyre cage or similar device that restrains tyres and provides a physical barrier of protection from projectiles, debris and air blasts generated in the event of a tyre failure (see Figure 7 and 8)

Figure 5: Digital inflation control device

Figure 6: Inline pressure gauge fitted to compressed air line system

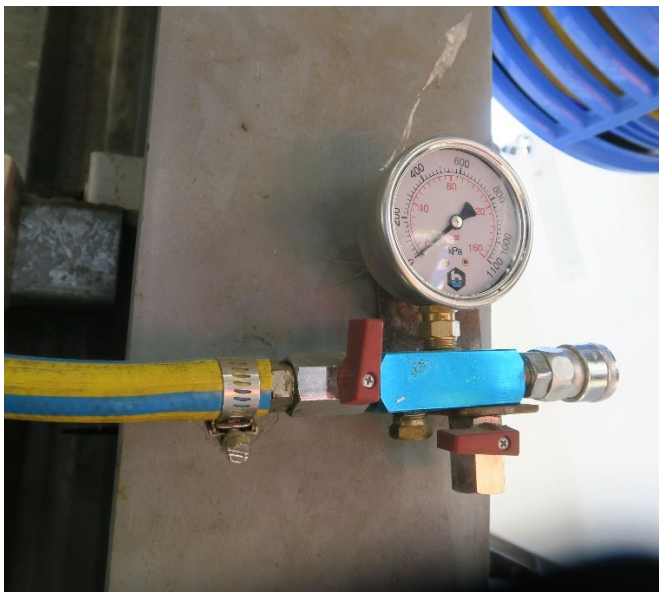


Figure 7: Tyre inflation cage used at Clovass Quarry post incident

Figure 8: Tyre inflation cage used at Clovass Quarry post incident

Administrative (procedural) controls

- ensure exclusion zones demarcated by physical barricades such as portable safety bollards, barriers or tape, are implemented to keep workers clear of the potential line of fire, whenever tyres are being inflated.
- ensure that tyres are only inflated to a designated low-as-practicable air pressure when trying to identify punctures and air leaks, with workers remaining clear of the potential line-of-fire
- ensure that flat, underinflated tyres (below 80% of recommended operating pressures) or tyres suspected of being damaged are fully deflated, removed from the wheel, thoroughly inspected (externally and internally) and confirmed as being structurally sound before being repaired, refitted and reinflated
- ensure tyres identified during inspections as being structurally damaged and non-repairable are clearly marked or labelled, separated from tyre storage locations and disposed of appropriately

Administrative (information, instruction and training) controls

- provide workers with adequate training and instruction in how to inspect the external and internal parts of tyres to identify signs of structural damage, including damage caused by being run overloaded, underinflated or flat. Signs of damage caused by a tyre being run overloaded, underinflated or flat include:
  - ripples, bulges or softness in the external upper sidewall, or crunching, or popping sounds when the sidewall is flexed
  - exposed and/or damaged wire cords or metal belts visible from the internal areas of the tyre
  - wrinkled, creased or discoloured inside lining of the tyre
  - accumulation of rubber tyre particles ‘crumbs’ within the inside of the tyre.

- provide workers with adequate instruction, training and supervision to ensure adherence to hazard identification, risk assessment and PPE policy and procedures, with systems in place to manage non-compliance.

Workers are reminded of their duty to take care for their own health and safety and that of their co-workers. They must also comply with reasonable work instructions, policies and procedures.

In particular, workers must:

- maintain awareness of the work environment when using compressed air to inflate tyres, and never position themselves or allow others to be positioned in the line-of-fire in the event of a tyre failure
- comply with safe work procedures, hazard identification, risk management processes, and PPE policy and procedures, particularly procedures and instructions governing the use of compressed air tools to inflate tyres.

Further information

Please refer to the following guidance materials:

- Australian Standard 1937-1993: Pneumatic tyres – passenger car, light truck, and truck/bus- Retreading and repair processes
- Australian Standard 4457.2-2004: Earther-moving machinery- Off-the-road wheels, rims and tyres – Maintenance and repair Part 2: Tyres
- MDG 15 – Guideline for mobile and transportable plant for use at mines other than underground coal mines
- Safe Work Australia - Model code of practice: Managing the risks of plant in the workplace
- Safe Work Australia - Compressed air and air receiver information sheet
- Safe Work Australia - Guide for split rims
- SafeWork NSW Tyres, compressed air and split rims
- Resources Safety and Health QLD - Guidance Note: Tyre, wheel & rim management
- UK Health and Safety Executive - Tyre removal, replacement and inflation

Please take note of the following safety alerts:

- Safety Alert SA24-01 - Wheel rim ejected during tyre inflation
- SafeWork NSW - Split rim or multi-piece wheels video safety alert
- WorkSafe ACT - Heavy vehicle tyre inflation
- WA Department of Mines and Petroleum (Resources Safety) - Mines Safety Bulletin No. 122: Use of tyre inflation cages
- WA Department of Mines, Industry Regulation and Safety - Off-highway haul truck tyre blowout in workshop injures worker
- WA Department of Local Government, Industry Regulation and Safety - Mining contractor fined after worker seriously injured by exploding tyre
- Safety Alert – Tyre exploded during inflation.