



OCE FORUM MARCH 2026

COAL INSPECTORATE

Mechanical Fluid Injection/ RS 23 Fluid Power Safety in Coal Mines – Mechanical Inspector Presentation



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Pressure Events Reported to



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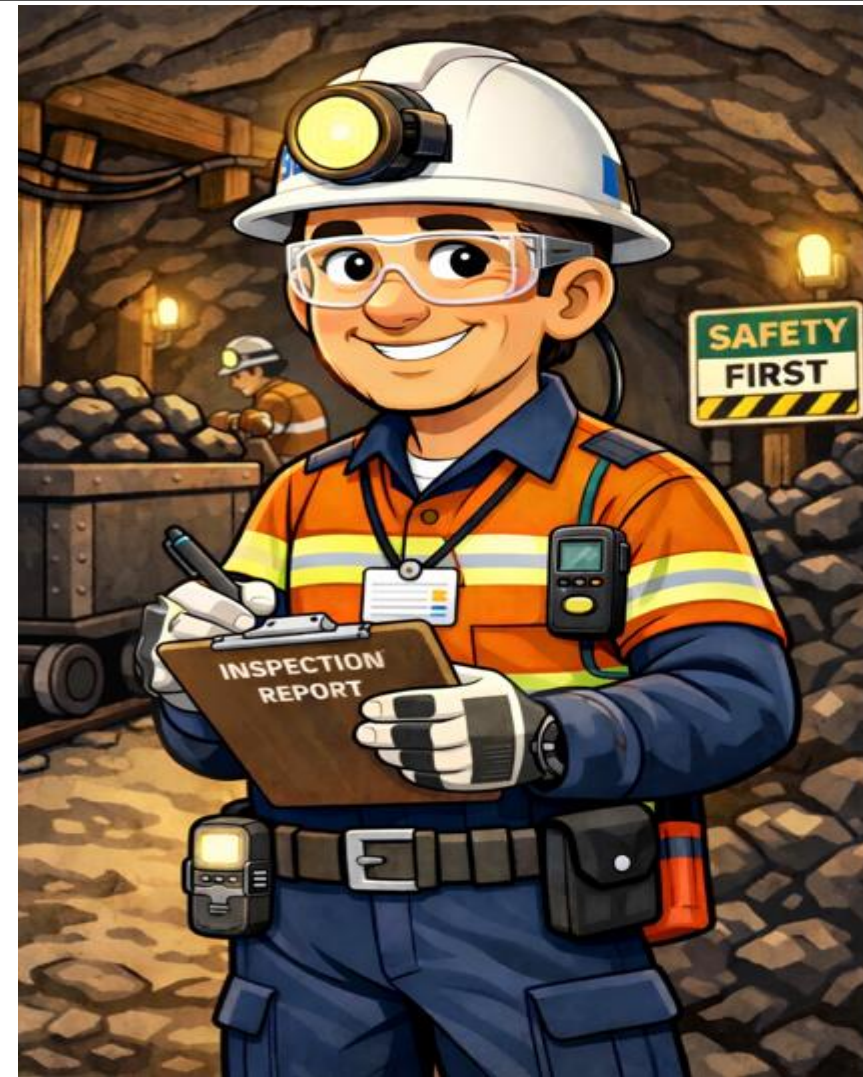
Since November 2025, a total of 14 pressure-related incidents, including fluid injection events, have been reported to the inspectorate. These incidents highlight the ongoing risks associated with high-pressure systems and equipment failures across various operations. Below is a summary of the reported events, which emphasises the importance of stringent maintenance practices, regular inspections, and adherence to safety protocols to minimise hazards and ensure workplace safety:

1. Luffing Cylinder – Suspected Fluid injection
2. Hytorc Hose Failure
3. Failure of HME Tyre (x3) - one of these incidents resulting in a shattered excavator window.
4. Battery-Powered Grease Gun – Fluid Injection
5. Pressure Filter on a Long Wall
6. Discharge Pipe in a CHPP dislodged due to the absence of a thrust clamp.



Pressure Events (Cont)

7. Diffuser Pipe Failure - sending debris approximately 20 metres.
8. Fuel Screen Blown Off During Refuelling
9. Compressed Air Pipe failure in service
10. Underground Pressure Pipe Failure whilst applying a pipe bandage
11. Jameson Cell Hose Failure
12. Compressor 4-Inch Airline Failure with debris found 20 metres away.
13. Pin-prick failure of a roof bolting rig hose inside the crimp ferrule.
14. Brake oil released through a broken bleed fitting on the POS2 brake calliper.



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Grease Injection Incident Summary:

On 17 January 2026, at an open cut coal mine, a coal mine worker (CMW) was lubricating the leaf spring bush assembly on a light vehicle using an 18V cordless grease gun when the grease pump hose failed adjacent to the grease coupler, resulting in a sudden release of energy. As a result, the worker sustained a grease injection injury to their left thumb and was transported to hospital by the Royal Flying Doctor Service (RFDS) for further medical treatment.



Issue Explained:

1. The cordless grease gun involved in the incident was fitted with a modified flexible grease hose that did not meet the minimum safety factor requirements specified in Recognised Standard 23 – Fluid Power Safety in Coal Mines for hoses and adaptor fittings (4:1 safety factor). The installed hose had an assessed safety factor of approximately 1.2, based on a maximum working pressure of 10,000 psi. The hose failed at the connection between the hose and fitting at the coupler end of the assembly, at a known stress and kink point.
2. The modified grease hose was not fitted with spring guards at either end. Spring guards are designed and fitted to prevent hose kinking and to improve the strength and security of the connection between the hose and metal coupling, thereby reducing the risk of hose failure when operating under high pressure.
3. The mine's Management of Change (MoC) process was not applied to the replacement or modification of the hose on the cordless grease gun. As a result, maximum working pressures were not assessed or verified, and the replacement hose was not confirmed as compliant with the minimum safety factor requirements for hoses and fittings specified in Recognised Standard 23 – Fluid Power Safety in Coal Mines.
4. Based on information provided by the OEM, the grease hose originally fitted to the cordless grease gun involved in the incident when purchased new is tested during manufacture to a 2:1 safety factor. The hose assembly supplied by the OEM is not tested or verified to meet the 4:1 safety factor required under Recognised Standard 23 – Fluid Power Safety in Coal Mines.
5. The gloves worn by the injured CMW for the assigned task were certified to EN388 (4131X) and EN407 (X1XXXX). However, these standards assess mechanical and thermal performance only and do not address protection against high-pressure fluid injection, which is a specialised hazard requiring dedicated testing and controls.



Recommendations:

1. Site Senior Executives are to discontinue the use of all cordless grease guns at the mine until compliance with fluid component safety factors for hoses and fittings is verified in accordance with Recognised Standard 23 – *Fluid Power Safety in Coal Mines*
2. Site Senior Executives are to ensure that all manually operated and battery-powered grease guns currently in use at the mine, along with similar fluid power equipment, are audited and subject to a gap analysis against Recognised Standard 23 – *Fluid Power Safety in Coal Mines*. In addition, the site's planned inspection and preventative maintenance schedules are to be reviewed and updated to ensure that high-pressure hoses on grease guns and comparable fluid power equipment are incorporated into a whole-of-life cycle maintenance strategy.
3. Site Senior Executives are to review contractor management and site acceptance procedures to ensure that all hydraulic tooling supplied to and used at the mine complies with Recognised Standard 23 – *Fluid Power Safety in Coal Mines*.
4. Site Senior Executives are to audit the mine's Emergency Response Plan and First Aid Management Plan to assess the effectiveness of controls for managing high-pressure fluid injection injuries, with reference to Recognised Standard 23 – *Fluid Power Safety in Coal Mines*, including the Emergency Procedure requirements and Appendix F: *Emergency Response Plans – High-Pressure Fluid Injection*.
5. Site Senior Executives are to review the personal protective equipment (PPE) provided to Coal Mine Workers (CMWs who may be exposed to high-pressure fluid injection hazards at the mine, and consult with glove manufacturers or suppliers to identify and procure gloves specifically designed to provide protection against high-pressure fluid injection risks





Coal Mining Safety and Health Regulation 2017

80 Fluid above and below atmospheric pressure: A coal mine's safety and health management system must provide for managing risk from using fluids above or below atmospheric pressure.

Recognised Standard 23 Fluid Power Safety in Coal Mines

The purpose recognised standard 23 is to establish minimum safety and health standards for fluid power systems in Queensland coal mines. The implementation of this recognised standard will assist in protecting workers and other people against harm to their health and safety through the elimination or reduction of lifecycle risks associated with fluid power systems at mines.

Fluid power systems include pressurised hydraulic and pneumatic systems for the transmission and control of energy.

It is expected that the following fluids will be considered:

- Compressed air and vacuum systems,
- Mine gas (mine gas drainage systems),
- Hydraulic fluids (mineral and water based),
- Diesel and petroleum systems, including grease,
- Water (reticulated systems, high pressure water blasting/cutting),
- Other hydrocarbons, paint, paint thinners and solvents



What is fluid injection?

1. Fluid injection is when a medium is injected into the body under high pressure. High pressure injection of a mediums such as hydraulic oil, grease, or paint **constitutes a medical and surgical emergency.** Examples: Hydraulic oil, Grease, Paint, Thinners, air & water
2. Fluid injection injuries are a serious workplace hazard, commonly caused by hydraulic hose failures.
3. Pressurised fluid can reach velocities exceeding 250 metres per second , comparable to the muzzle velocity of a gun.
4. The fluid jet is powerful enough to penetrate protective clothing, including gloves, and cause severe internal damage.





What are the Safety Factors for a hydraulic hose?

- Hose assemblies should have a factor of safety of at least 4:1,
- Adaptor fittings should have a factor of safety of at least 4:1 on rated working pressure to catastrophic failure of the adaptor or fitting,
- Other fluid power components, such as cylinders, valves, actuators or similar should have a factor of safety of at least 2.5:1.

What does Working Pressure (WP) Refer to?

- The maximum pressure at which a component or system is designed to operate safely during normal, continuous service. In the field this detail can be found written on the hose. Example W.P 5,076 psi

What does Burst Pressure (BP) Refer to?

- The absolute maximum internal pressure a component or system can withstand before it physically fails, ruptures, or "bursts". Example B.P 20,305 psi



Are gloves available for use by mine workers that offer protection from fluid injection hand injuries?

- There are gloves available in Australia that offer fluid injection protection for workers. It is strongly recommended that sites consult with glove manufacturers and current suppliers to identify and procure gloves specifically designed to provide protection against high-pressure fluid injection risks. Some examples below:

Glove Model	HexArmor PointGuard Ultra 9032	Pirtek 9030P / 4041P	HexArmor PointGuard Ultra 4048
Tested Pressure (PSI)	10,150 PSI	10,150 PSI	10,150 PSI
Tested Pressure (Bar)	700 Bar	700 Bar	700 Bar



What are the Key Risks?

Skin Penetration: Fluid injection can occur up to 100 mm away from the fluid source and has happened at pressures as low as 100psi.

Toxicity and Necrosis: Injected fluid is toxic, leading to necrosis (tissue death)

Compartment Syndrome: Fluid under pressure enters the hand, causing nerve and tendon damage by over-pressurising compartments. This results in severe pain, swelling, and potential permanent damage.

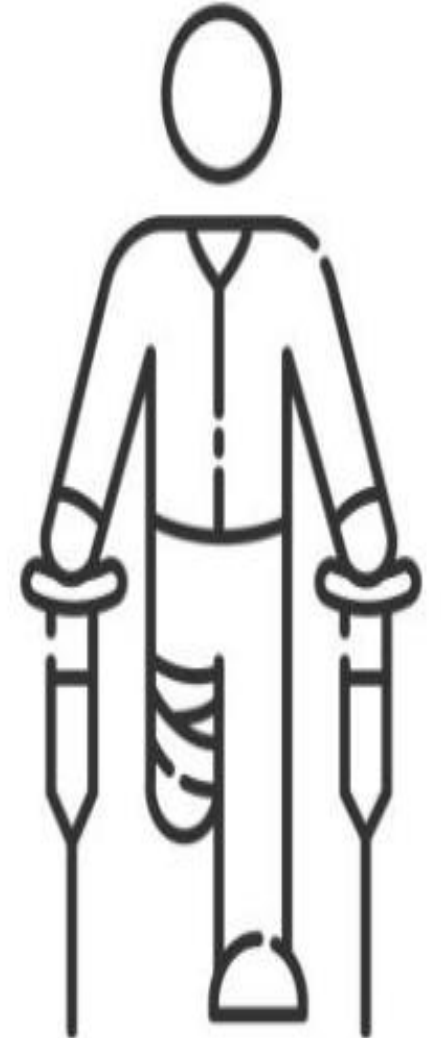
Infection and Blood Poisoning: Fluid injection has a high risk of bacterial infection and sepsis (body's immune system has an extreme response to an infection)





What are the possible Medical outcomes from Fluid Injection?

- Surgery is required in almost 100% of cases
- Surgery is essential to remove dead tissue and clean out the injected fluid.
- If untreated within 6 hours, the risk of amputation of fingers or limbs increases significantly
- With Fluid injection incidents there is a 16% to 48% chance that the person injured would have to go through an amputation procedure
- Extended recovery periods for the injured worker



What should be considered for my site's emergency management plan for fluid injection ?

- The mine must develop and implement emergency response procedures to deal with high pressure fluid injection injuries or suspected fluid injections.
- Patients suspected of having sustained a fluid injection injury should not be administered fluids or food. The patient should remain fasted in anticipation of anaesthesia and surgery potentially being required.
- If a high-pressure injection is suspected, contact the ambulance service, and request their attendance on site.

Note: Fluid injection injuries are often deceptive, as they are typically painless at the time of occurrence. However, it is crucial to emphasise the seriousness of these injuries to others, as they can easily be overlooked in a hospital setting. When triaging patients, hospital staff may not immediately recognise the severity of this type of injury, potentially resulting in the patient waiting for hours without receiving urgent care.

The responding ambulance personal will require the following information on arrival:

1. Material Safety Data Sheet (MSDS): Identification of the exact product injected (e.g., hydraulic oil, paint, grease) is critical
2. Hydraulic system Pressures
3. A “Dear Doctor” Letter and any Injury reports compiled: Documentation outlining the injury details must accompany the patient to the emergency department including (MSDS).

Note: Fluid Injection injuries constitute a medical and surgical emergency and must be treated as such.





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