

SAFETY ALERT

Longwall hydraulic system over-pressurised

INCIDENT

A longwall hydraulic system became over-pressurised, resulting in the catastrophic failure of hydraulic isolation valves and other fittings in the pump station. These failures released fluid under high pressure.

While no person was injured, the uncontrolled release of high pressure fluid in the workplace has potential for fatal injuries.

Refer to Safety Alert SA06-16 [Fatal High Pressure Hydraulic Injection v2](#)

CIRCUMSTANCES

The pump station shut down on several occasions due to over-pressure trips. Two tradesmen investigated the cause of the trips. They isolated two of the three pumps and the face delivery line to assist in fault finding.

When the 3rd pump was started, pressure rose quickly throughout the remaining hydraulic system causing various valves and fittings to catastrophically fail.

INVESTIGATION

An investigation identified the following:

1. The system pressure setting (transducer) was reading lower than the actual system pressure. Water contamination was identified as the cause of the faulty transducer.

The failure resulted in the pumps not unloading, i.e. the transducer gave a signal for the pump to continue to operate even though the system design pressure was exceeded.

2. The trip point for over-pressure from the sensor (transducer) had a one second delay timer prior to shutting the pump motors down. With the face isolated and a single pump being run, the pressure rose very quickly beyond the system trip point (380bar) due to almost zero storage capacity.

3. The two mechanical system safety relief valves did not activate and were found to be corroded closed. These should normally prevent pressures rising above the system design points.
4. The electric unloaders were checked and tested and found to be working as designed.

RECOMMENDATIONS

Clause 137(1)(c) of the *Occupational Health and Safety Regulation 2001* imposes an obligation on employers to ensure:

“all safety features and warning devices of plant are maintained and tested”.

1. All mines should review their maintenance management systems to ensure safety-critical systems which control hydraulic pressure are periodically maintained and tested. This review should include:
 - pressure relief valves
 - pressure sensors/transducers
 - pump unloader valves (electric or mechanical)
 - any control device between sensors and actuating devices, including PLC programs
 - OEM maintenance requirements
 - competence of people undertaking any testing or maintenance

Clauses 13(e)(v) & 13(f)(vii) of the *Coal Mine Health and Safety Regulation 2006* impose an obligation on electrical and mechanical engineering management plans to:

“control risks by providing safeguards (mechanical or electrical), with a probability of failure appropriate to the degree of risk posed by the hazard”.

Refer LU07-05 [Electrical and mechanical safeguards with appropriate safety integrity](#)

2. All mines and OEMs should undertake a functional safety review of the pump-station control system. This review should ensure:
 - a) control systems have the appropriate minimum safety integrity level as defined in AS 61508 or category as defined in AS 4024.1501 & 1502 (see ‘Standards’ below).
 - b) control systems are designed and validated in accordance with established functional safety and machinery safeguarding concepts. Refer to AS 61508, AS 62061 and AS 4024.1501 & 1502.

- c) the validation risk assessment is in the form which systematically analyses the failure modes and integrity of each safety critical component of the control system (e.g. FMEA – *Failure modes effects analysis*). It should also specify minimum testing, inspection and maintenance requirements.
 - d) the functional safety assessment considers various circumstances of operation and maintenance of the pump station.
 - e) fit-for-purpose pressure control devices and their respective maintenance requirements, including; transducers, unloaders, relief valves, all electrical controls and interfacing communications.
 - f) any single point component failure that may result in an over-pressure condition is backed up with a secondary control that prevents over-pressure.
3. Mines should use safe work procedures when interacting with high pressure fluids. Where there are no procedures available for a specific task at hand, a formal risk assessment should be carried out and a procedure developed prior to undertaking the task.
4. Mines should specify minimum competency requirements for associated high-pressure maintenance tasks.

Standards

AS 61508 - Functional safety of electrical/electronic/programmable electronic safety-related systems

AS 4024.1501 & 1502 - Safety of machinery – Design of safety related parts of control systems.

AS 62061 - Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems.

NOTE: Please ensure all relevant people in your organisation receive a copy of this Safety Alert, and are informed of its content and recommendations.

Signed



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