

Summary

Investigation Report

Serious injury involving roof bolter at
AUSTAR COAL MINE on 3 March 2008

Report prepared for the Director General of NSW DPI.

Investigation Unit

Thornton

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NSW DEPARTMENT OF
PRIMARY INDUSTRIES

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Disclaimer

The information contained in this publication is based on knowledge and understanding at the time of writing. However, because of advances in knowledge, users are reminded of the need to ensure that information on which they rely is up to date and to check the currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent advisor.

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OVERVIEW

Austar Coal Mine is a large underground coal mine situated near Cessnock NSW employing over 250 mine workers and staff. Austar produced 1.42 million tonnes of raw coal in 06/07, using longwall top caving mining technology and continuous miner development units.

On 3 March 2008 a 39 year old production worker was operating a machine mounted drill rig when his arm became entangled in around the drill steel causing severe trauma to his arm. His arm was subsequently amputated in hospital.

The incident occurred because the twin wing drill bit was able to engage the roof mesh, and the measures to prevent unplanned rotation of the drill steel were inadequate. There were also insufficient safeguards to ensure separation at all times between the workman and moving powered equipment.



Photo 1

Result of the drill rotation incident on 3 March 2008

A 27mm twin wing drill bit and drill steel that has engaged a strand of rib mesh.

Mesh is wrapped around drill steel after rotation occurred

GENERAL INFORMATION

Austar has soft rib conditions which tend to fail and fall out (spall) from the roof horizon during the development of roadways and which further deteriorate when strata loading occurs during longwall extraction. The falling rib coal is a potential hazard to persons standing near the rib during development and longwall extraction.

Austar developed a practice of installing strata support to reduce the risk of rib spall by bolting sheets of steel mesh to the roof and sides. The practice relied on overlapping a rib mesh sheet with two overlapping roof sheets and simultaneously pinning the three mesh sheets to the roof with the outer roof bolt.



Photo 2

Incident scene showing roadway conditions and installed strata support on the right hand side rear of the continuous miner.

Visible is the overlap of roof and rib mesh at the roof horizon.

The practice required the mine worker to bend the rib mesh sheet and then overlap the roof mesh sheet together on the temporary roof support structure on the continuous miner. The operator then had to guide and align the two sheets of mesh into the roof mesh sheet already set to the roof.

Workmen were required to use a steel rod to guide the mesh into position. The guiding device generally used at Austar was a 1.3m drill steel with no drill bit fitted.



Photo 3

1.3m guide steel without a drill tip attached located in the drill rig on the left hand side of the continuous miner as found following the incident.

The guide steel locates the roof mesh and rib mesh above the continuous miner temporary roof support.

The guide steel is then used to locate the third sheet of mesh as seen at the roof level.

Once the mesh was set in position to the roof using the continuous miner temporary roof support (TRS) and guide steel, the guide steel was then replaced with a 2.1m length drill steel with drill bit attached to drill the roof bolt hole to allow a 2.1m roof bolt to be installed.

A single roof bolt pinned three sheets of mesh simultaneously.

The roof and rib mesh placed in this way provided full mesh coverage for the roof bolter operator located at the roof bolting position. The continuous miner also provided temporary rib side support and afforded protection for the operator during bolting operations with a hydraulic rib plate (sprag).

The Austar strata support method increased the number of work tasks to install roof and rib mesh because it required alignment of three mesh sheets together to allow a drill steel to drill through the mesh holes in the correct position.

As a consequence the method resulted in a greater exposure of the operator to unguarded rotating and moving bolting equipment.

DESCRIPTION OF INCIDENT

Dean McSporran was a mineworker employed at Austar Coal Mine.

At the time of the incident McSporran was engaged in erecting roof support on the right hand side of a continuous miner.

Generally a 1.3m drill steel without a drill bit attached would be used for the mesh alignment task and such a drill steel was observed available post the incident located in the rib mesh behind the machine. McSporran selected a 1.3m guide steel with twin wing drill bit attached to align the mesh. Just prior to the incident occurring McSporran had placed the roof and rib mesh on the guide steel with a

drill tip attached and looked around to the miner driver who was readying to move the machine forward to the next bolting row.

McSporran's left hand was holding onto the rib mesh sheet near the drill steel when the drill steel rotated. The rotating twin wing drill tip caught on the rib mesh sheet.



Photo 3

Simulation of the approximate position of McSporran's left arm in relation to the drill steel and rib mesh as demonstrated by Inspector of Mechanical Engineering W. Koppe.

(Note: A replacement 1.3m drill steel and white drill bit was used for the simulation. The folded rib mesh was cut during the rescue of McSporran. The drill rig is isolated for the purposes of the simulation)

The rib mesh sheet wrapped around the twin wing bit and as a consequence pulled McSporran's left hand and arm into the rotating drill steel.

McSporran's left forearm was broken and with severe muscle and nerve damage. The lower left arm was later amputated at the hospital.

INVESTIGATION OF INCIDENT

The incident was investigated by Tony Smith of the NSW DPI Investigation Unit. The investigation took place over several months in late 2008, and relied on examination of the scene and the equipment, discussions with witnesses, and examination of documents and records.

EXPECTED RISK CONTROLS

At the basic level the issue, like many industrial accidents, is one of ensuring separation of parts of the body from moving machinery. This is expected to be achieved through guarding or other engineered risk controls. At a minimum, this includes advice contained in;

- [AS 4024.1-2006 Safety of Machinery](#)
- [MDG 35 - 2006 Bolting and Drilling Equipment in Mines \(Published Draft\)](#)
- NSW DPI Safety Alert 05-05 - Drill rigs and serious injuries (May 05)
- NSW DPI Mech Engineer newsflash No 21 (4/05) – Arm entrapped in rib bolter
- NSW DPI Safety Alert 00-25 - Serious injury while roof bolting
- NSW DPI Safety Alert 99-16 - Continuous miner drill rig fatality
- NSW DPI Significant Incident Report SIR 94/4 – Operator injured by drill rig

INCIDENT ANALYSIS

The investigation identified a number of fundamental causes of the incident.

1. Work Method

The investigation was not able to identify a documented process that detailed how an operator should guide mesh sheets forward to the next bolt cycle.

No documentation was sighted for preventing the use of a drill steel with drill bit attached and used as a guide rod.

Mineworkers had prior experience with mesh catching on drill steel bits. Mineworkers had seen mesh wrapped around a drill steel prior to the incident a phenomenon termed as a 'bird cage'.

2. Plant

There was no segregation between the bolter control handles and it was possible to operate both the raise and rotate functions simultaneously with one hand.

The bolter rotation and bolter raise control handles are located beside each other at the same height but are differing shaped handles. The handle shape was not consistently applied to all control stations on the machine, and did not align with the principles of MDG35 (draft).

The injured mineworker reported that the bolter rig drill motor head was slowly dropping and required frequent drill rig alignment corrections.

ACTIONS TAKEN POST INCIDENT

A dividing steel plate barrier was placed in between the drill raise and drill rotation control handles to reduce likelihood of inadvertent selection of handle.

Austar conducted an external audit of the bolting equipment to applicable standards. A number of equipment non conformances were identified.

Twin wing drill bits were withdrawn from service. A trial with a full spade bit proved unsuccessful. A modified spade bit with a smaller indent was introduced that is expected to reduce the likelihood of mesh becoming caught.

A designated guide steel was introduced with the drill bit thread removed so that a drill bit could not be fitted to it.

Development strata support plans have been revised so that rib mesh is now not pinned by outer roof bolt and rib mesh is not required to overlap the roof mesh.

Safe Work Procedures have been developed instructing mineworkers not to operate bolting rigs while handling mesh or steels, and not to operate any function of the drill rig with mesh caught in the guide steel.

Mineworkers have been instructed to be aware of hazards while positioning steels, handling the steel and interacting with the rig of inadvertent operation.

Austar intends to upgrade the bolter control blocks on the machine.

RELATED PUBLICATIONS

Found on the NSW DPI web site at

<http://www.dpi.nsw.gov.au/minerals/safety/major-investigations/investigation-reports> -drill rig rotation -underground coal- Austar mine.ppt

Safety Alert SA 08-05 Miner's arm injured using drill rig

Safety Alert SA 05-05 Drill Rig Serious Injuries