Trade & Investment Mine Safety

MINE SAFETY INVESTIGATION UNIT

INFORMATION RELEASE

Serious injury

Date	12 August 2012
Event	Surface drilling incident resulting in spinal injuries
Location	Ashton Mine, Camberwell, NSW

At a glance

- A 26 year old man is now a quadriplegic following a drilling incident at Ashton Coal Mine.
- Severe pressure associated with the drilling resulted in the violent lifting of a work platform and a blooie line.
- The drill rig operator who was on the work platform was thrown into the air from the impact and was hit by the blooie line.
- The drilling company had attached a 90° elbow to the end of the blooie line increasing the probability of the line lifting under high pressure forces.
- Investigators are checking whether the appropriate drilling method was used and whether or not appropriate risk control measures were implemented.

The incident

In August 2012 a surface drill rig operator was seriously injured at Ashton Coal Mine.

During drilling operations on alluvial plains, the drill head became bogged at a depth of around 120 m. It could rotate, but could not be raised or lowered. Compressed air was applied by the drill string to the drill head in an effort to force a discharge of material from the borehole.

Witnesses reported a loud noise, like an explosion. The blooie line was seen to rise into the air and to cause the driller's floor and the deck floor to also rise. The drill rig operator was thrown up and fell onto the driller's console with the blooie line falling on him.

The incident scene

The Mine

The Ashton Coal Project is located about 14 km north-west of Singleton in the Hunter Valley, NSW. The project includes an open cut coal mine, an underground coal mine, a coal preparation plant and a rail siding.

The drilling program

Ashton Coal contracted Silver City Drilling (NSW) Pty Ltd to drill two large diameter surface-to-seam boreholes to dewater their longwall operations. The target depth was to be about 180 m with a 600 mm primary surface casing and a 406 mm secondary casing to be installed. The drilling company used rotary hammer drilling to cut the holes. This is a well-known technique for drilling in hard, competent ground. It is also known that issues can arise when this technique is utilised in soft, unconsolidated wet ground. The fluid used to expel the cuttings was either compressed air or compressed air and foam or compressed air and water (depending on depth, geology and water make). Three compressors were used in parallel during the drilling process giving a maximum volume of air up to 1500 litres per second at 2400 kPa.

The drilling company used a single surface casing (diameter 600 mm) for the whole drilling program. A diverter box with a non-rotating rubber seal sat above the casing to allow the drill pipe to travel through and maintain rotation. A diverter box was designed to divert the cuttings into the blooie line which would expel the cuttings into a purpose-built sump. The configuration of the drill pad meant that the blooie line passed beneath the driller's platform.

Once drilling was complete, a secondary casing (diameter 406 mm) was to be installed for the purposes of dewatering the mine.

Issues with the previous borehole

Silver City Drilling began drilling operations on a ridge (borehole 3) at the underground mining lease.

There were two environmental incidents on this site in connection with the drilling operation. Both incidents involved the release of drilling fluids into the surrounding environment instead of into a purpose-built sump.

As an interim measure, a shovel was tied to the end of the blooie line to deflect material downwards.

Blooie line at borehole 3 passing under the driller's platform

Before starting borehole 4, the end of the blooie line was modified by fitting a 90° elbow on the end of it to try to direct the drilling fluids into the sump below.

A driller's offsider reported that the air discharge line was seen to move when in use, which led to attempts to anchor the pipe with two star pickets and fencing wire.

The modification to the blooie line configuration appears to have been ad hoc, and undertaken without proper design consideration or risk assessment.

Issues with the incident borehole

The topography and geology of the site for borehole 4 was considerably different to that of borehole 3. Borehole 4 was on the Hunter River alluvial plains right next to a creek. This area was known to be difficult to drill due to ground water, variations in alluvial depth and broken ground.

Before starting drilling operations at borehole 4 the licensed water bore driller identified that difficult drilling conditions were likely to be encountered. A large mud pump was available to allow mud drilling but this was not used and the drill rig was set up in the same way as at borehole 3, with the exception of a 90° elbow attached to the end of the blooie line.

A drill crew member noted in his daily log that the first 5–10 m was sand and from 10–19 m the geology was gravel. He also indicated that the hole was collaring badly.

After two weeks there was a change of drill crew. Drilling continued with widening of the hole for the surface casing to be installed.

The surface casing was installed to a depth of about 11 m. At this depth, the casing only reached the middle of the alluvial zone and was not in competent bedrock as expected for the drilling method employed. After the surface casing was grouted, drilling continued until the incident occurred.

Cause and circumstances

The cause and circumstances of the incident are being investigated, but through observation of the drill rig and subsequent inquiries it has become apparent that; drilling technique (rotary air hammer), water make, air pressure and stuffing box/surface casing/blooie line design are significant factors.

It seems that the primary surface casing was not installed to the correct depth and as a result the borehole wall lost integrity below the casing. This caused alluvial material and water to enter the borehole and jam the drill pipe in the hole. The driller, in his efforts to free the stuck drill pipe, pressurised the hole behind the blockage and began back reaming.

As the blockage broke free a catastrophic release of water and cuttings has ejected from the borehole annulus creating the explosion observed by the drilling supervisor.

Investigators are examining the extent to which the following failures contributed to the incident:

- Failure to effectively case off the Hunter River alluvials.
- Failure to design an effective blooie line and anchoring system.
- Failure to move to an alternative method of drilling (e.g. mud drilling) when conditions required.
- Failure to effectively identify the changes which occurred in the system of work and to manage the associated risks appropriately.

Observations

Investigators are looking at other drilling operations that are being conducted in alluvial ground. A number of observations are being made that might assist drilling companies contemplating this type of work:

- Provide geotechnical assistance to the drilling crew to install surface casing in competent bedrock.
- Design surface casing to effectively withstand the maximum possible pressure available from the drilling operations.
- Design an anchoring system for the air discharge line to withstand maximum possible pressure available from the drilling operations.
- Design the drill pad and sump so that a 90° elbow is not required.
- Create a drill program in consultation with the drillers who are to perform the work.
- Identify change in the system of work and effectively manage the risk created from that change.

A blooie line anchoring method used at Ashton Coal following the incident

About this information release

The Mine Safety Investigation Unit has issued this information to draw attention to the occurrence of a serious incident in the mining industry. This information has been uncovered during the course of the investigation which at the time of publication is ongoing. Any work practices, work methods or depicted initiatives are not an indication of endorsement by the department. Best practice methods will generally be referred to by reference to Standards, Guidelines, Codes of Practice or other approved publications.

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 the information upon which they rely is up to date and to check the currency of the information with the appropriate officer of the Department of Trade and Investment, Regional Infrastructure and Services or the user's independent adviser.

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www.resources.nsw.gov.au/safety/major-investigations

For information about health and safety regulation on mine sites contact a mines inspector at one of our local offices www.resources.nsw.gov.au/safety/mine-safety-offices.

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