

Geotechnical Hazard Maps

BHP Billiton Mitsubishi Alliance–Poitrel Mine

The Initiative

One of the greatest Principal Hazards within an open pit coal mine is working near slopes and crests. People working within the shell of the pit or active benches are exposed to a variety of potential failures and geotechnical hazards that can lead to serious or fatal injuries. Any method, innovation or control that can reduce the risk of injury or damage to personnel and equipment from this Principal Hazard is worthy of the pursuit of solutions.

The Solutions

In a proactive effort to effectively manage and monitor this Principal Hazard, Poitrel Mine has developed Geotechnical Hazards Map (GHM). These maps are simplistic tools that use colour coded ratings of green, orange and red to visually display the level of risk associated with entering the pit shell and active benches near identified geotechnical hazards. The meanings of these colours are clear and effective and are based upon the traffic light system.

The GHM was initially created by Pete Brooks Senior Resource Geologist and Technical Services Superintendent, Yosef Setiyawan at Poitrel using an extensive and complex technical data set gathered from grade control drilling, observations, I Site scans, research and past knowledge.

The GHM and associated processes were implemented in November 2009 by Poitrel's site contractor, Leighton Contractors Pty Ltd (LCPL).

The initial GHM were A0 in size and highlighted the colour coded risks on a contoured map. Operators indicated the maps were extremely useful, however they stated they felt more confident in identifying their location if an aerial map was used. The team re-developed the maps using aerial photography. Subsequent maps now also include bolded crib hut locations and bolded strip and block number labels to assist in area identification.

The process of developing and maintaining the maps is complex, despite the simplicity of the final product. The GHM are maintained, used and re-developed through a number of processes.

- Poitrel Mine requires all operational site personnel to be trained in geotechnical awareness, which covers information relating to the GHM. All personnel are expected to be aware of all elements relating to the maps. In an effort to monitor this knowledge, routine questions concerning the maps must be answered during Safety Area Observations.

- The colour zone controls used on the maps are outlined in Job Safety Analyses (JSA), which are developed by an Open Cut Examiner, Mining Superintendent, geologist and or geotechnical engineer and approved by the Project Manager.
- All coal mine workers that are required to work near slopes and crests or in active bench areas must read the JSA and understand the controls before commencing work. The JSA requires workers to utilise the GHM and understand the colour codes stand-off zones, bund height requirements and placement of lighting plants and pumps in the area of work.
- At prestart meetings, the Open Cut Examiner or Supervisor reviews the maps with their team. This reinforces the usefulness of the maps and refreshes their memories to implement controls that will effectively manage specific hazards.
- GHM are printed onsite weekly or as required and are displayed in areas where toolbox talks are regularly conducted by Poitrel employees and Leighton Contractors.
- GHM are reviewed at least weekly by the geological team and circuit signage is updated to include geotechnical risk colour coding.
- The ongoing maintenance and development of the maps is determined by data collected from the FY Grade Control drilling programs and other site databases. These results are evaluated and inserted into future maps.

The GHM have the potential to effectively contribute to all controls outlined in the hierarchy of controls. Here are some demonstrated examples of how the map has been successfully used as a high level control.

- Elimination—GHM assisted operational workers in identifying a thrust fault plane day lighting within a highwall face that was deemed high risk, and subsequently eliminated the risk by using a specific bench blast pattern 2 and 1/2 strips wide. The highwall returned to a 70 degree batter allowing crews to cast blast in the next strip. The highwall changed from a red zone into a green zone.
- Substitution—The maps assisted crews to identify an orange zone highwall with an established two metre high bund, ten metres from the toe of the wall. The wall was subsequently upgraded to a red zone following new tension cracks observed on the highwall bench. The updated map assisted crews to recognise that action needed to be taken, so the bund height was increased to five metres. The highwall failed two weeks later, but was captured within the higher bund.

The estimated annual operation costs to continue utilising the GHM amounts to \$300,000 per year.

Geotechnical failure is a Principal Hazard at Poitrel Mine and may result in multiple fatalities if not managed effectively. The GHM provides us with a proactive tool to manage the potential for geotechnical failure. Before the implementation of the GHM,

uncontrolled movements (without bunds, rills, berms etc) were common. To date, there have been no uncontrolled failures in our highwalls or lowwalls.

Benefits/Effects

The GHM have proven to be a simple visual indicator for complex issues faced in open cut mining. Poitrel has identified that the innovation is benefiting the mine in a variety of ways.

- Reduces risk of injury
- Reduces risk of damage to equipment and machinery
- Has encouraged better communication lines between the mine and contractors
- Demonstrated to reduce costs as innovation uses information collected in everyday operations
- Addresses high level Hierarchy of Controls

In addition to the above, this project has facilitated the awareness of all site personnel of current geotechnical hazards on site. The information is now readily and visually available in an easy to read, simple format.

The GHM initiative is effective, intuitive, and easily transferred and communicated to the entire workforce.

Transferability

Poitrel's GHM can be developed and used by any open pit mine facing hazards associated with slopes and crests.

Poitrel is committed to the safety of its personnel as well as the safety of the industry. The map represents a very significant safety initiative with the potential to impact many sites and eliminate high risk high consequence hazards. For this reason, Poitrel Mine is eager to share and communicate all knowledge and learning's associated with this project.

- BMA CEO Marcelo Bastos has indicated that the GHM is an effective and useful safety tool. He noted that they were extremely relevant for use at BMA mine sites.
- The Regional Mines Inspector has openly recognised the value these maps have for the industry.
- Poitrel's General Manager, David Chatto, has actively promoted this innovative map and method to all BMA General Managers and has suggested

that idea be rolled-out as a One BMA safety initiative. Subsequently, South Walker Creek Mine has expressed an interest in the innovation and is in the process of conducting a site visit to view its effectiveness.

Poitrel's GHM initiative has been presented at the BMA Central Queensland Geologists meeting and a paper on the development and implementation of the project is proposed for the Bowen Basin Geologist Symposium in October 2010.

This initiative has the potential to be implemented in open cut mines and mines exposed to slopes and crests hazards across the industry.

Innovations

To date, Poitrel is not aware of any other mine or industry that has employed a similar process to address hazards associated with slopes and crests.

Innovative measures used to develop the GHM include:


- The use of Acoustic Televiewer tool (ATV) and Optical Televiewer tool (OTV) to gather data used to define status and colour coding on map. These technologies had not previously been used in BMA mine operations, so trials and tests are still continuing to ensure accuracy and consistency.
- The development of theoretical concepts and data gathering methodology devised and conducted by onsite personnel. This is continuing.
- Regular reviews, updates and management of maps.
- Gathering feedback and initiating discussion on the usefulness and effectiveness of the maps.
- Proactively acquiring data to construct a structural model within the Geotechnical Module in Vulcan, which acts as a useful resource to further develop and evaluate slopes and crests featured on the maps. This tool has significant advantages in short term mine planning.
- Training all personnel in geotechnical awareness.
- Using specialised tools such as the I Site scanner and supplemented with Tech Services own Topcon survey equipment to supplement databases with information.

Photographs

Image 1 - Poitrel's Geotechnical Hazard map (note the colour coded guidelines listed in the bottom left hand corner)




Image 2 - Colour coded guidelines used for Geotechnical Hazard Maps.



BMA
BHP Billiton Mitsubishi Alliance

Poitrel Mine

SAFETY BRIEF



29 October 2009

Guidelines for working near Slopes and Crests

Working near slopes and crests is one of Poitrel's largest hazards. If not managed appropriately the potential consequences are unacceptable. To more effectively manage this hazard Poitrel has developed a guideline for working near slopes and crests.

Minimum standoffs for Poitrel shall be:

- Five metres from all slope crests,
- Ten metres from the toe of a continuous highwall slope less than 60m high
- Fifteen metres from the toe of a continuous highwall slope greater than 60m high

Please note that equipment (i.e. loaders/excavators) that reach inside these standoff distances as long as the cab and operator remain outside are not considered to be working within the standoff.

Minimum requirement for working within standoffs is Site Induction including the Geotechnical Awareness training. Coal mine workers who have not completed the geotechnical awareness training must be accompanied by someone who has and together complete a BMASAFE.

Circuit call up signs will be fitted with Geotechnical Status ratings in Green, Orange or Red. The OCE will be responsible for ensuring the appropriate colour rating is displayed on the call up sign that matches the rating in the written OCE report and verbal report given at pre-start meetings.

GREEN ZONE

- No modifications required to general operations.
- Can enter 10m standoff in machine after completion of a BMASAFE covering geotechnical aspects
- Can enter 10m standoff on foot following a JSA signed off by OCE and Supervisor
- Lighting plants/pumps etc can be set up in 10m standoff following a JSA signed off by OCE and Supervisor. Where possible this should be avoided and positions outside the standoff should be actively sought.

ORANGE ZONE

- Some modifications may be required to general operations. These modifications will be outlined in a JSA developed by an OCE and Mining Superintendent which includes the orange zone geotechnical advice. The controls will be referred to by the OCE, supervisor and workgroup in that area
- OCE/Supervisor to reinforce hazard to be monitored and required controls at pre-start meetings
- Can enter 10m standoff in machine only in area inspected and approved by OCE. A BMA SAFE will still be required. Time in 10m standoff to be limited to minimum required for the task eg no equipment standing waiting to do task
- Lighting plants/pumps etc are NOT to be set up in the 10m standoff. Only exception is to be by JSA approved by OCE and Mining Superintendent
- Entering on foot restricted to only in area covered by JSA approved by OCE and Mining Superintendent.
- Grader rill along roadway edge to be established and maintained at approx 10m out from toe of slope to assist in demarcating the required zone.
- High-wall markers will be installed to demarcate the start and end of a ORANGE zone.

RED ZONE

- Significant modifications will be required to general operations. These modifications will be outlined in a JSA developed by an OCE, Mining Superintendent, geologist and/or geotechnical engineer and approved by the Project Manager.
- All coal mine workers involved in the excavation in this area will be required to understand the controls and sign on to this JSA before commencing work. Subsequent shifts working in this zone will not require another signature unless the JSA has materially changed.
- OCE/Supervisor to reinforce hazard to be monitored and required controls at pre-start meetings
- Lighting plants/ pumps etc are NOT to be set up in the 10m standoff.
- Minimum standard for demarcation of the 10m standoff is to be a 2m bund. The JSA may require bund specifications above this minimum as required
- High-wall markers will be installed to demarcate the start and end of a RED zone.

Any enquiries should be directed to Yosef Setiyawan on EXT 8728
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Please remove from noticeboards on
29th November, 2009.