Enhancing safety training by incorporating virtual reality: Module 7 – Outburst management

Presenting today: James O’Rourke, Chris Fowler, John McKendry

- The University of New South Wales School of Mining Engineering is developing virtual reality training material for use by Mines Rescue Pty Ltd.
- There are five modules in the second tranche which is currently under development.
  - Hazard Awareness
  - Isolation Procedures
  - Spontaneous Combustion
  - Outburst Management
  - Deputies Inspection
- The Outburst Management module will include training in outburst indicators.
Module 7
Outburst management

• The outburst module is located in a virtual longwall coal mine that is being developed to house this and other modules.
• The action will take place in the longwall development panel.
• The module will include ten outburst indicators.
• It is designed to run on Virtual Reality (VR) systems which range from a flat screen with single projector to a fully-immersive, twelve projector 360 degree 3-D environment.
• A new Southern Mines Rescue Station is currently under construction at Woonona. It will include
  A 360 degree AVIE (Advanced Visualisation and Interaction Environment)
  A VR theatre with large curved screen
  Three iDomes (single user immersive environments)
Outburst management module
Virtual longwall coal mine
Outburst management module
Development headings
Outburst management module
Scenario

• You are a member of a longwall development panel crew. The crew enters the panel and ‘does the wrong thing’, proceeding directly to the face without confirming gas has been properly drained and there is a Permit to Mine.

• You are in the vicinity of the face when you witness an outburst.

• You are advised that the incident was not inevitable and could have been avoided by proper adherence to procedures.

• You inspect the aftermath of the outburst.

• History is rewritten! This time the crew ‘does the right thing’. After entering the panel they pause at the crib room for a briefing etc. You read the permit to mine, structures mapped and refresh your knowledge of outburst indicators.

• You then commence mining, ‘spotting’ each outburst indicator.

• You will given a score as to indicators observed. You may review any indicators that have been missed.
Scene One
Outburst witnessed

- Mining is taking place when a deterioration in face conditions is observed.
- Coal is under stress and observed to be spitting (visual/sound) and a bulge is evident. Bumping takes place.
- Suddenly a ‘gas trip’ occurs.
- Believing an outburst be imminent, both the miner driver and the shuttle car driver leap from their seats and run outbye.
- You follow (not altogether surprisingly!).
- Before you get very far, you are all caught up in an outburst.
- What has happened is explained.
- It is emphasised that the incident could have been avoided by proper adherence to procedures.
Scene Two

Inspection of the aftermath

• You inspect the aftermath of the outburst.
  – Partially buried continuous miner
  – Partially buried shuttle car
  – Damage to ventilation system
  – Outburst cone at face
Scene Three
History is rewritten!

- This time the crew ‘does the right thing’. After entering the panel they pause at the crib room for a briefing.
- You peruse relevant documentation which includes
  - Permit to Mine and conditions
  - Outburst Hazard Plan (map)
  - Deputies’ Reports
- In particular, you refresh your knowledge of outburst indicators.
- A Summary of Outburst Indicators (ten items) is displayed in the crib room.
- Clicking on each item opens a dialog box with text and graphics explaining the indicator. Optionally, you may ‘drill down’ for more detail of outburst mechanisms, etc.
- The program will not permit you to proceed further until all ten outburst indicators have been covered.
Scene Four

‘Spotting’ outburst indicators

- You leave the crib room and commence mining.
- For the first 10 metres advanced, conditions are ‘normal’.
- In the zone comprising the next 15 metres of roadway, ten outburst indicators are present (see following slide).
- You are allocated a score at the beginning of this zone.
- Your score is displayed and is decremented as time elapses.
- You are required to ‘spot’ each outburst indicator by clicking on it.
- For a ‘real hit’, a dialog box will open explaining the nature of the indicator.
- If an area is clicked where there is no indicator, you will be informed and your score will be decremented.
- You score will also be decremented if you pass an indicator without selecting it.
Visual outburst indicators

Observing change is emphasised

• Increase in CH$_4$/$CO_2$ concentration.
• Sudden deterioration of roof conditions (stretch marks? guttering?).
• Sudden deterioration of face/rib conditions (coal splitting/bulging).
• Significant change in direction/intensity of cleat/jointing.
• ‘Bumping’
• Mini outburst cones.
• Changes in water make.
• Slickensides in the roof or coal.
• Mylonite zone.
• Intersection of a structure (strike-slip fault or dyke).
Scene Five
Scoring and review

- Your score will be visible.
- You may review any indicators that you have missed.
- If you choose to do this, a dialog box will open listing all ‘missed’ indicators.
- Clicking on any item in the list will take you back to a location near to the ‘missed’ outburst indicator.
- The indicator will be highlighted.
- A dialog box that describes the indicator in detail will also be displayed.
- As in Scene 3, you may ‘drill down’ for more information.
Outburst management module
Today’s presentation

- The module is the last of the current tranche to be developed.
- What you are going to see today is an early ‘work in progress’.
- James is now going to show you the framework of scenes one, two and three.
- Further information is required by the development team.
- If you can contribute relevant material, please contact Chris Fowler (c.fowler@unsw.edu.au).