SIM 140202 – Identify opportunities to improve the safety of barraging-down practices
Presentation Outline

- Introduction to the Project
- Rock Engineering Findings
- Root Cause Analysis
- Technological advancements
- Leading Practices Identified
- Acknowledgments
Introduction to the Project

- The Four Main Objectives of the study
  - Root Cause Analysis
  - Identification of leading practices
  - Assessment of barring training
  - The development of innovative barring training material

- Methodology
  - On-Site Data Collection (1300 man hours at 37 shafts), Social Data Collection in Focus Group Discussions (18) and Key Informant Interviews (45) at seven mining houses, Work-shopping with representatives from champion mines, Detailed Root Cause Analysis, On-Site Assessment of Training material, Identification of leading practices underground and identification of feasible implementation solutions and development of Training material.
Reasons for non-compliance

- Equipment usage - Blunt, old pinch bars, incorrect length: 16
- Equipment usage - No gaskets: 15
- Not placing hands behind gaskets: 12
- Positioning too close to others or rock: 7
- Positioning down dip/unsafe side: 15
- Rushing: 9
- Lack of watering down, inspection, visual or sounding: 23
- No buddy Barring: 3
- Laziness: 2

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Pie chart for how to identify hollow HW/roof:

- Did not know: 27.11%
- Sounding: 64.84%
- Undetermined: 4.40%
- Using both sounding and visual examination: 0.73%
- Visual examination: 2.93%
Many FOG and barring related accident reports were sourced from the various mines. Ultimately, a small data set of relevant accidents was created for the years 2011 and 2012.

- 29 accidents out of 351 reports - Platinum
- 17 accidents out of 178 reports - Gold
- 2 relevant accidents – Coal
Root Cause Analysis – Immediate Causes

- Work exposure to seismicity: 1
- Unknown: 1
- Shortcuts: 1
- Lack of knowledge of hazards present: 4
- Inattention to footing and surroundings: 3
- Inadequate Skill Level: 1
- Improper decision making: 6
- Failure to Warn: 1
- Exposure to mechanical hazards: 1
- Deviation by individual: 24
- Deviation by group: 4
- Defective safety devices i.e. damaged WML: 1
Inadequate identification of critical safe behaviours
Employee perceived haste
Habit/ personal preference
Improper performance is rewarding (saves time)
Habit/ personal preference
Employee perceived haste
Inadequate tools and equipment usage
Inadequate Risk Assessments
Inadequate recall of training material
Inadequate performance of skill
Inadequate Leadership
Inadequate Communication (between peers)
Improper supervisory example
Improper performance is rewarding (saves time)
Mental Stress (Preoccupation with problems)
Poor reaction time
Supervisor implied haste
Unknown
Opportunities for Improvement

- Training improvements, interventions and perhaps a greater emphasis on refresher training is required.
- Leadership drives and interventions are clearly needed in the gold industry. This recommendation is aided by the perceptions that have arisen from the social studies undertaken.
- Equipment usage was not a factor in the accident reviewed yet observations underground showed that the availability of new pinch bars fitted with gaskets to be a consistent problem.
- Positioning of people close to each other was a cause of one of the accidents. This is common from underground observations as well.
Technological Advancements

- Illumination
- Pinch bar developments
- Acoustic Techniques
- Infrared Thermography
- CSIR ESD
- Thermal Imaging
- CSIR Integrated Thermal Acoustic device
Leading Practices

- The Action of barring – The 5P’s to safe barring

Each finger represents one of the barring 5 P’s i.e. Prepare yourself, Prepare the area, Prepare others, Position yourself, and Proceed with barring.
Leading Practices

- Risk Assessment – MOSH EE and TARP
- Skills – Higher frequency of training and issuing of a barring license
- Training – The use of innovative visual training material, excellent mock-ups or underground training facilities, Training the trainer initiatives
Leading Practices

- Illumination – The use of an EE light
- Teamwork – Buddy Barring
# Feasible Implementation Solutions

<table>
<thead>
<tr>
<th>Risk Assessment</th>
<th>Skills</th>
<th>Training</th>
<th>Equipment Selection</th>
<th>Geotechnical Environment</th>
<th>Size of excavation &gt; 2m high</th>
<th>Size of excavation &lt; 2m high</th>
<th>Leadership</th>
<th>Human Behaviour</th>
<th>Communication</th>
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</thead>
<tbody>
<tr>
<td>Adoption of the MOSH Entry Examination initiative</td>
<td>The introduction of barring licences</td>
<td>Underground training facilities</td>
<td>Combination pinch bars and Sounding sticks at collieries</td>
<td>Adoption of the MOSH Blasting initiative to minimise damage to the hangingwall in hard rock mines</td>
<td>Mechanical Barring equipment: Scalers</td>
<td>Telescopic pinch bars and shorter 1m long pinch bars</td>
<td>Increase in leadership visibility/VFL underground/Active supervision</td>
<td>Culture change initiatives</td>
<td>Practice of buddy barring to improve inter-crew communication</td>
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<tr>
<td>Adoption of the MOSH Trigger Action Response Plan initiative</td>
<td>Shorter time periods between refresher training</td>
<td>The use of realistic mock mines on surface</td>
<td>Optimisation of gasket design for hard rock environments i.e. better fitting or fixed gaskets. Fixed gaskets on 3m pinch bars or longer.</td>
<td>Geotechnical environment specific hazard identification training</td>
<td>Better Illumination</td>
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<td>Leadership training with soft skills development for all levels of supervision</td>
<td>Behaviour Based Safety training on barring</td>
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<td>Improved illumination e.g. use of EE lights’</td>
<td>Bi-monthly PTO’s per person</td>
<td>‘Training-the-trainer’ initiatives</td>
<td>The correct usage of safety nets post barring</td>
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<td>Longer pinch bars</td>
<td>Emphasis on the correct kneeling stances in the training process to enable quick escape</td>
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<td>Mentoring/Coaching in formalised processes for the workforce</td>
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<td>Visual computer based training i.e. Desktop VR methods</td>
<td>Use of CSIR Integrated Acoustic Thermal device (currently in trial phases)</td>
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<td>Sturdy platforms with safety harnesses in extremely high excavations i.e. &gt;5m such and fridge plant and station areas.</td>
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<td>Semi-immersive VR techniques i.e. use of cylinders as classrooms</td>
<td>Mechanical baring equipment: pneumatic pinch bars and scalers</td>
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<td>Fully immersive VR techniques such as the use of the Oculus Rift</td>
<td>Learner Miner Shadowing</td>
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Feasible Implementation Solutions

- Adoption of MOSH Entry Examination initiative;
- Adoption of MOSH Trigger Action Response Plan (TARP) initiative;
- Improved Illumination;
- Buddy Barring;
- Behaviour-based Safety training;
- Leadership training;
- Increased Visible Felt Leadership;
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THANK YOU