A. Boodoo

SIM 140202 – Identify opportunities to improve the safety of barring-down practices

MHSC

Golder Associates

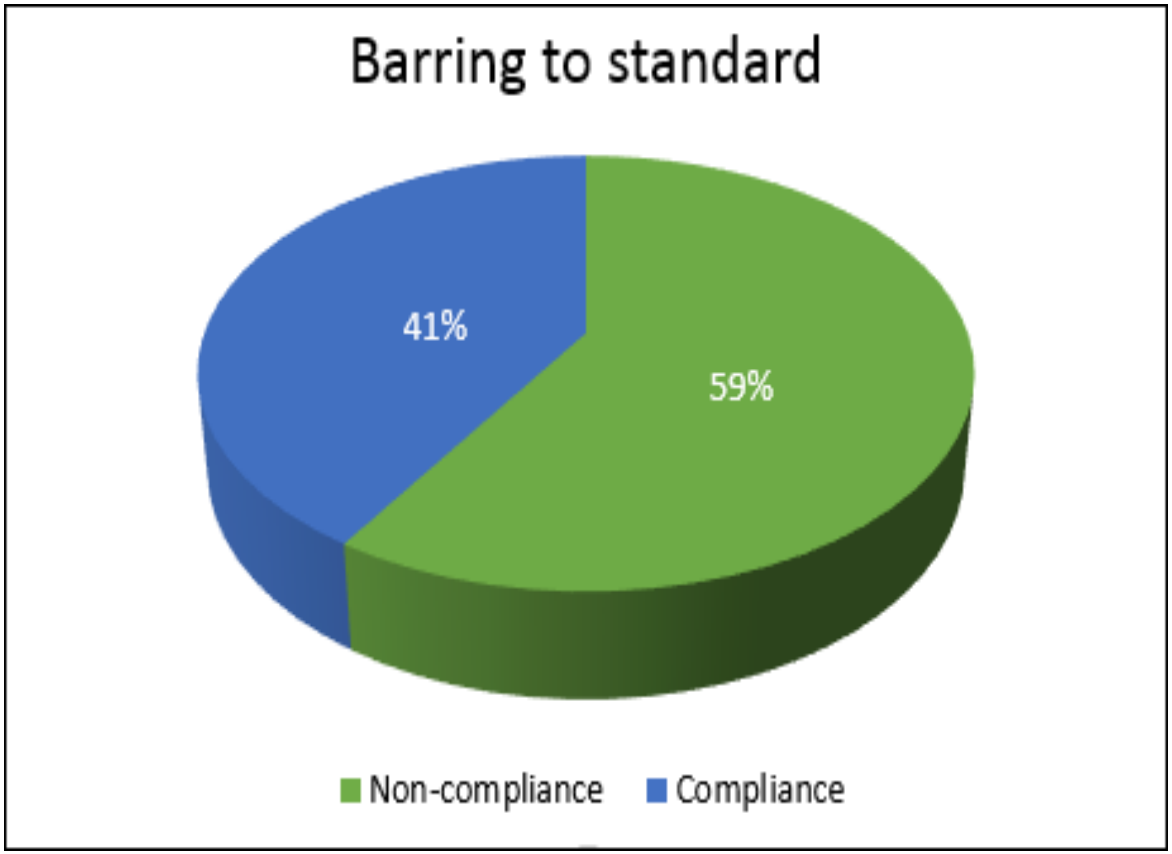
Presentation Outline

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

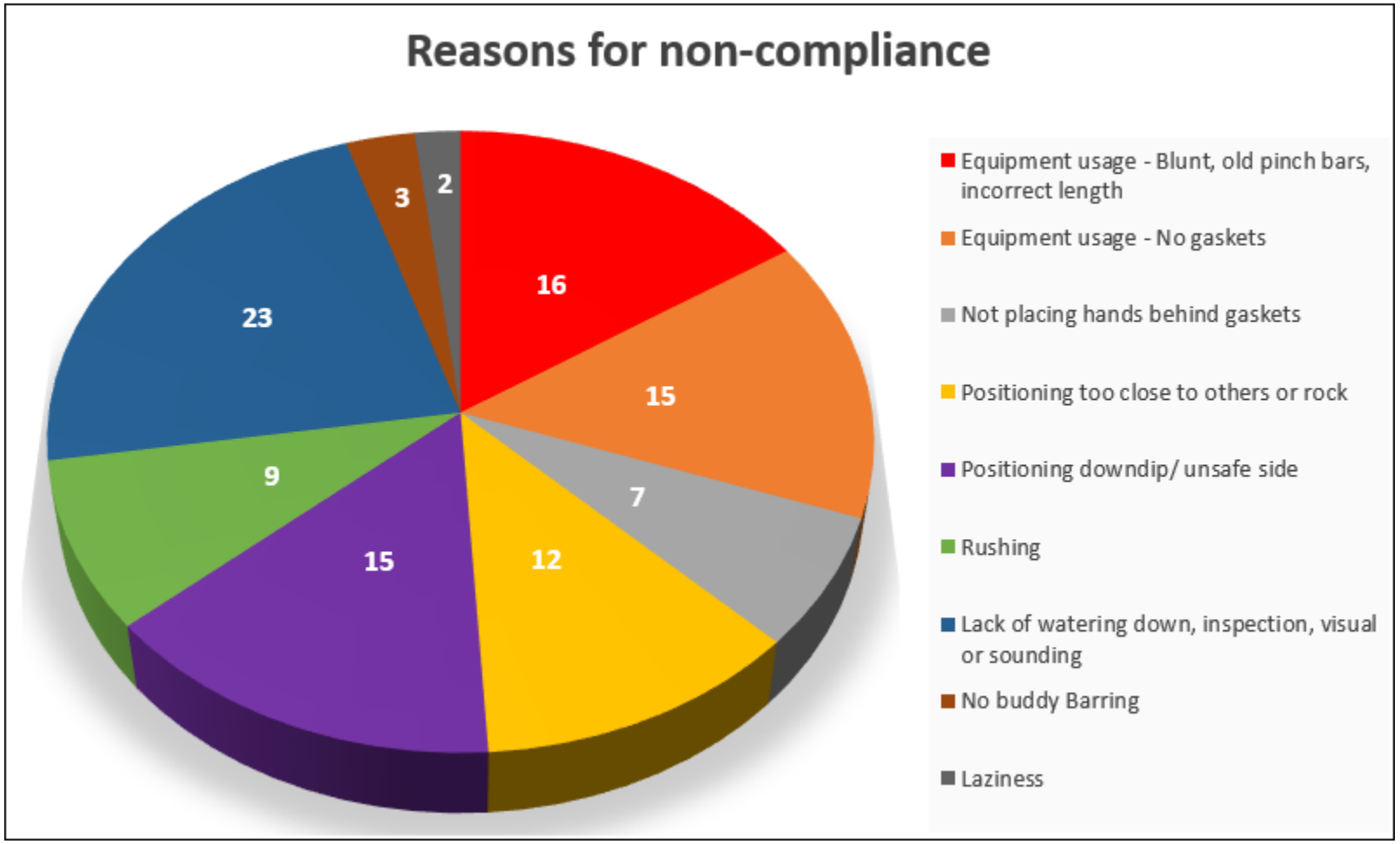
Introduction to the Project

- 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.

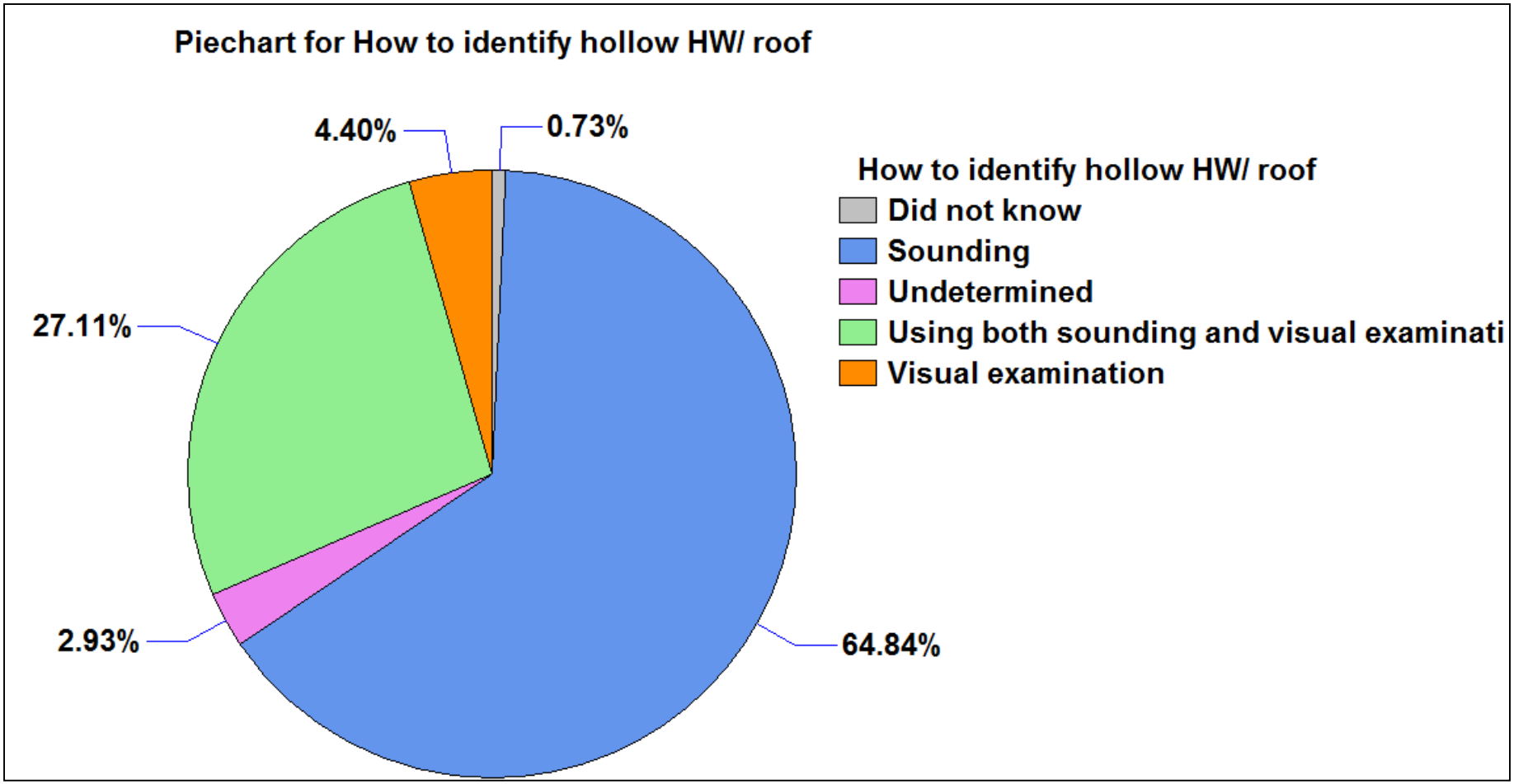
Rock Engineering Findings



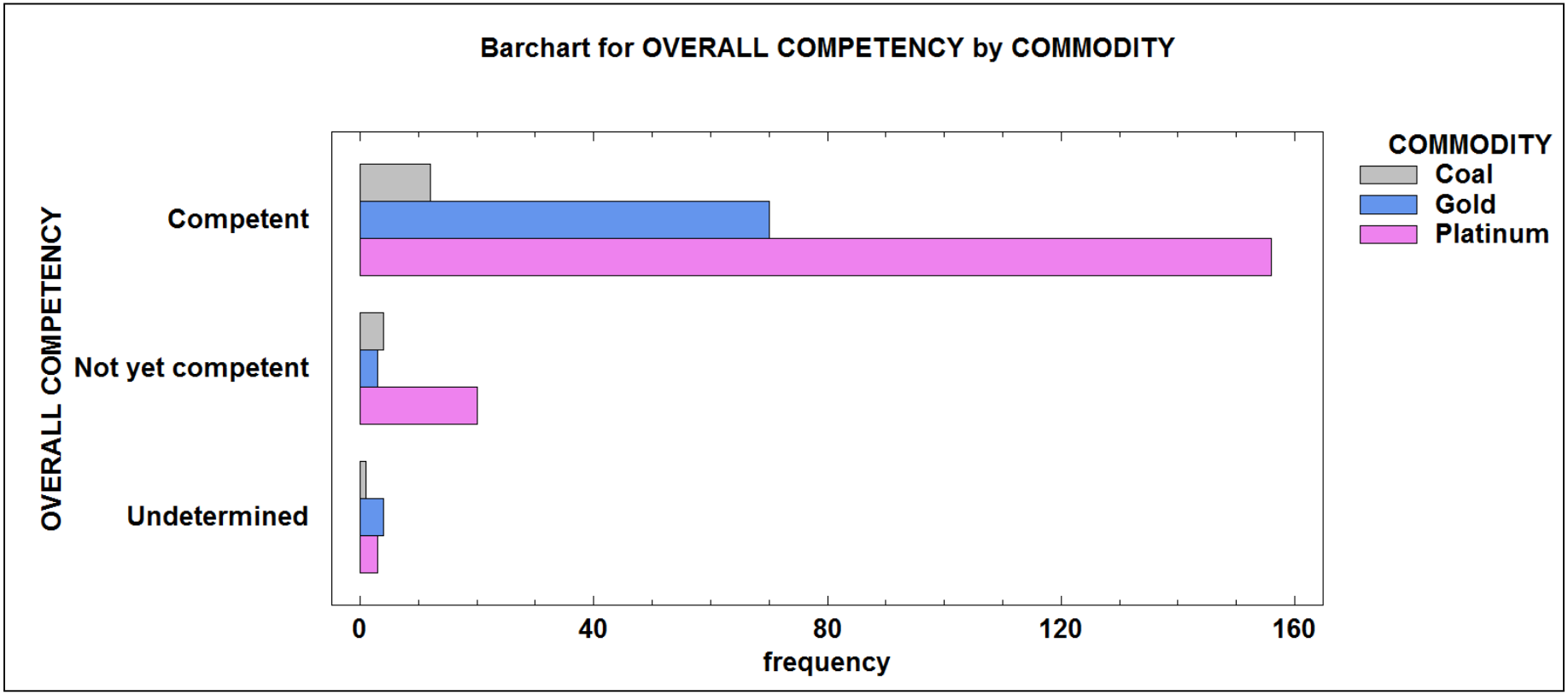
Rock Engineering Findings



Rock Engineering Findings



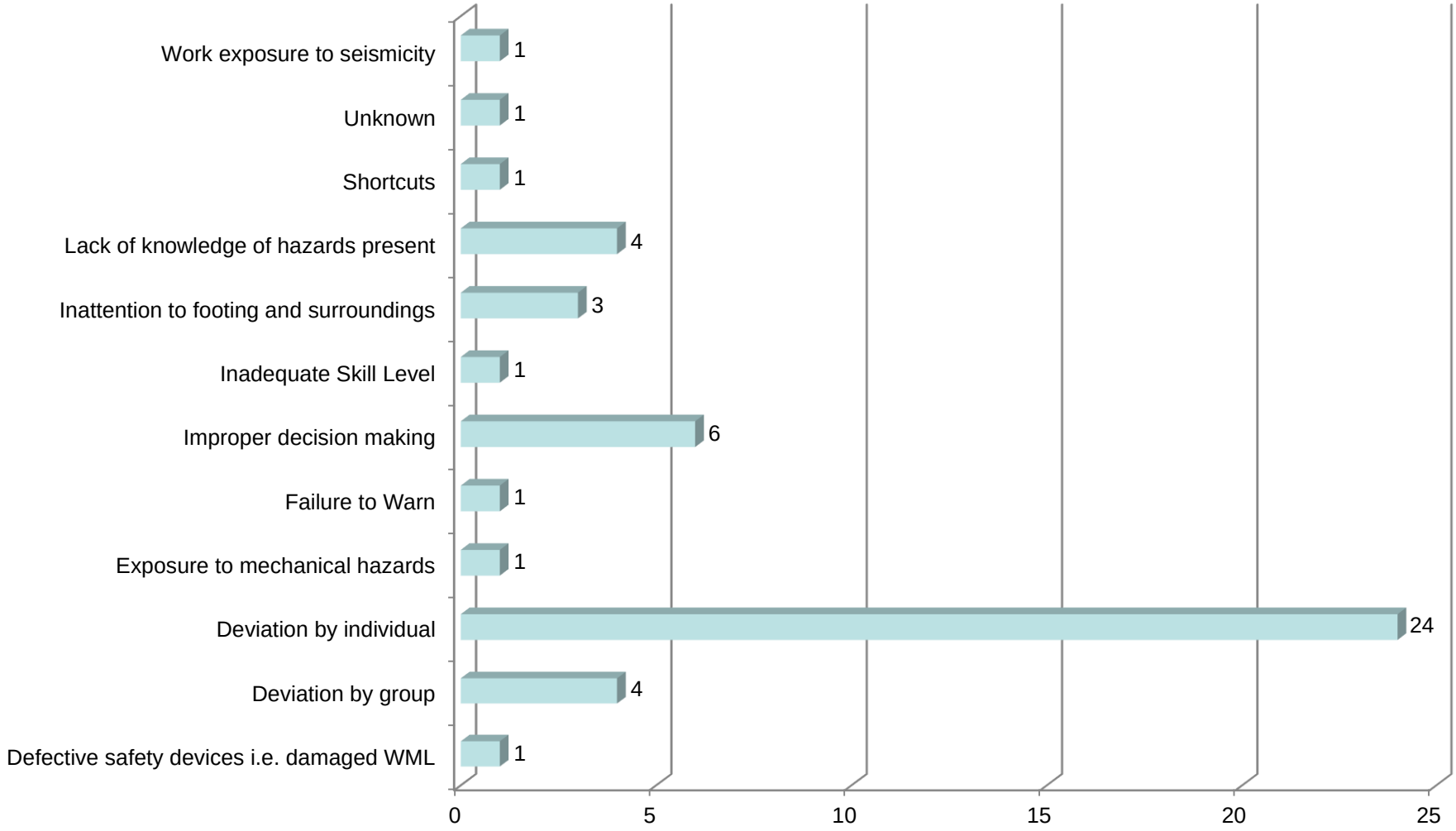
Rock Engineering Findings



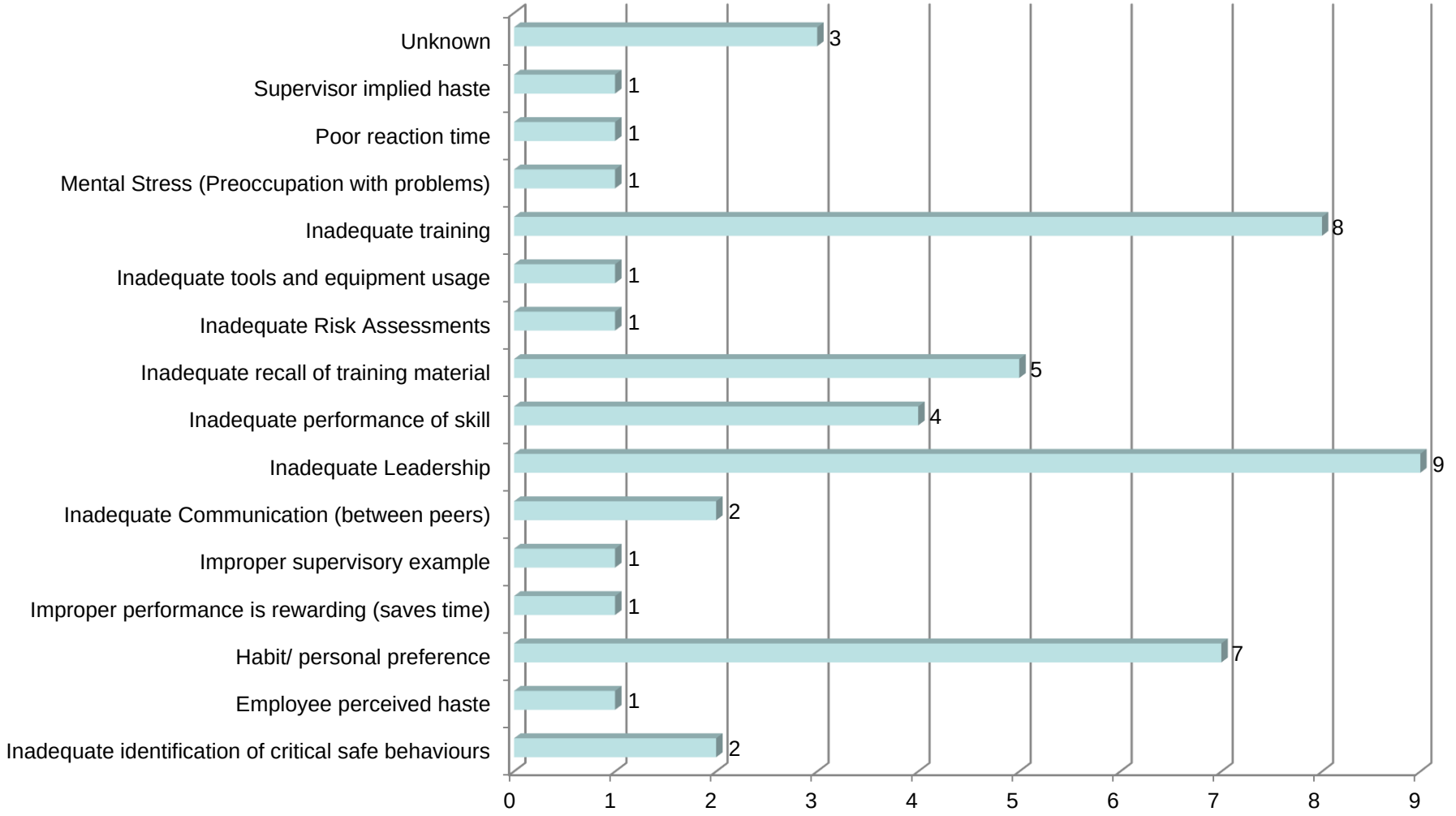
Root Cause Analysis

- 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



Root Cause Analysis – Root Causes

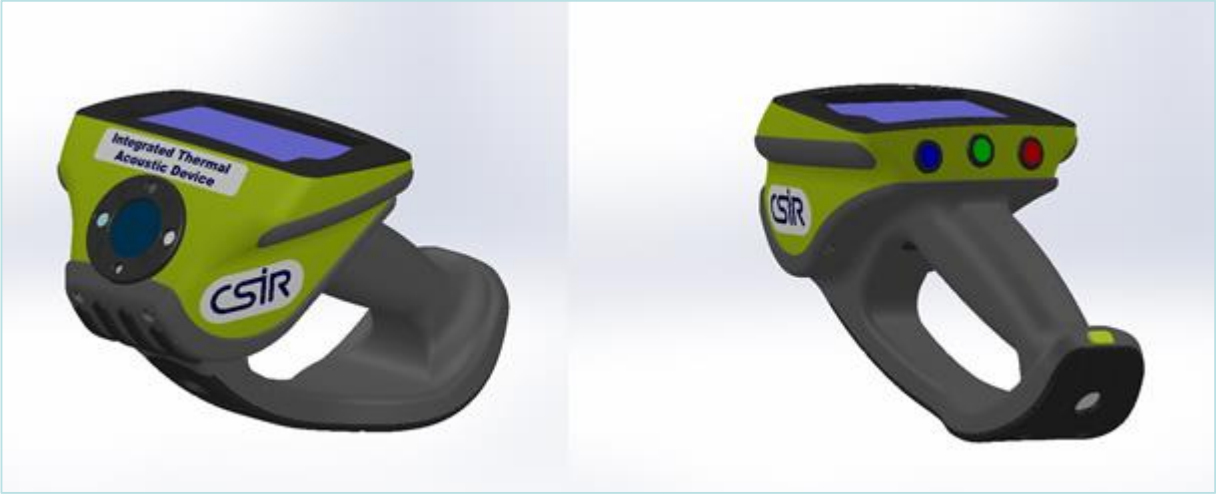


Opportunities for Improvement

- 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.

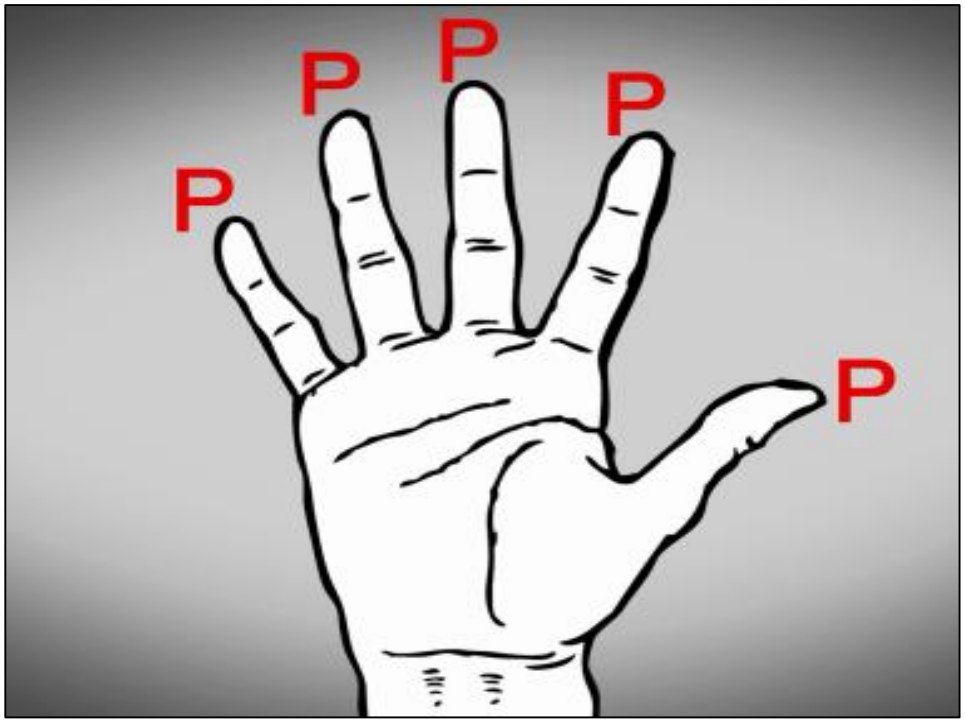
Technological Advancements

- 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.

MHSC

Golder Associates

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

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

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;

Acknowledgements

- MHSC and the DMR
- STS3D
- Rock Engineering, Safety and Training departments at the various champion mines for the study:
  - Lonmin
  - Anglo Platinum
  - Impala
  - Sibanye Gold
  - Anglogold Ashanti
  - Glencore and Glencore ECM
  - AATC
  - South 32
  - Exxaro
- Stefan Brink CSIR
- Duncan Adams

THANK YOU