Knowledge transfer to minimise seismic risk in platinum mines

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Introduction

Following the detailed analysis of geo-technical conditions and common mining methods in the platinum mines of the Western Bushveld Complex (WBC), the outcomes of SIMRAC project SIM100301 suggested that both mine layout and mining practice offer a range of opportunities to reduce the severity of seismic response and the likelihood of rock bursting.

The project identified leading indicators for rockbursts and delivered concise guidelines on a number of issues central to the mitigation of this specific risk (Essrich et al., 2012). The outcomes motivated a subsequent initiative by the MHSC to actively facilitate the implementation of the guidelines by means of a knowledge and technology transfer project to create separate sets of training materials for production and for rock engineering personnel on PGM mines (SIM140301). It also made provision for once-off audits of seismic systems to be conducted on participating stakeholder mines.

Methodology

Subsequent to a consultation phase with experts in training, rock engineering and mine production, the project produced a set of innovative, high-quality animated training materials suitable for mine training centres with audio/video capability. The twelve modules covered issues such as stress, rock properties, seismic monitoring technology and recommended mining practice.

The project also provided for separate training materials for rock engineering personnel which were sourced and collated from existing handbooks and textbooks.

During the second half of the 2-year project, base-line audits of seismic monitoring and reporting procedures were conducted on nine Bushveld platinum mines with a known or perceived seismic risk.

Results and recommendations

The level of qualifications of the mine personnel to be trained ranges from Matric (NQF level 4) to mining engineer (level 8). Most can be assumed to be partly familiar with English, but are not necessarily fluent in English. At project initiation in late 2014, there were in excess of one thousand employees considered in need of such training. There are 16 training centres on shafts with appreciable seismic hazard in the WBC.

Training materials were rolled out through train-the-trainer workshops and are currently being incorporated into periodic or continual training on mines such as for leave returnees and for the induction of new employees (Figure 1).

Informing rock engineering personnel about the nature of seismicity in the PGM mining environment is deemed beneficial to raise awareness of this specific risk. Factors determining the severity of seismic response such as rock properties, stress levels, mining and support practice and geological conditions

Figure 1: 3D animated training modules for production personnel (left: Stress, right: gullies and sidings).
need to be understood and appreciated by mine rock engineering staff.

A total of 300 sets of the materials were distributed in printed and digital format across the Eastern and Western BC in June and July 2016 (Figure 2).

During the second half of the 2-year project, base-line audits of seismic monitoring and reporting procedures were conducted on nine Bushveld platinum mines with a known or perceived seismic risk.

The audit results were presented at workshops to inform stakeholders of the standard of seismic monitoring in the region. Each audited mine received an individual report with specific comments and recommendations for their operation. Mines were given the opportunity to choose between full disclosure of the audit results or confidentiality.

The seismic system audits, an initiative joined by all mines with active seismic networks in the Bushveld Complex, identified barriers to optimal monitoring practice that can be addressed and alleviated in the future. The compliance levels in terms of the applied score card ranged from 60% to 100% (Figure 3) and the barriers to full compliance identified during the audits mainly relate to the maintenance and repair of existing network equipment and the quality of seismic data affected by impaired equipment.

The level of participation by stakeholder mines from the early consultation period to the network audits was encouraging and reflects the general commitment to reduce seismic risk through increased knowledge and improved mining practice. The sudden failure of support pillars along gullies and the formation of irregular-shaped remnants is being addressed, especially in the deepest of the platinum mines.

References:
Essrich, F, Hanekom, JWL, Stankiewicz, TBA, Rangasamy T (2012): Minimising the increasing seismic risk in the platinum sector, MHSC, SIM100301 project report.