

A new strategy for managing falls of ground in South Africa

Falls of ground accounted for 78% of all fatal accidents at AngloGold Ashanti's South African operations during 2006 (88% in 2005). In South Africa 44% of fatalities were caused by seismic falls of ground (40% in 2005). Falls of ground may be related to either seismicity or gravity: seismic-related falls of rock occur when energy is released in the rock mass, causing ground movement and possible rock falls; gravity-based falls of rock occur when loose ground is not sufficiently stabilised or supported.

While the issue of falls of ground has been a major focus of attention for some years and a major fall of ground management campaign was initiated in 2003, the beginning of 2006 saw a significant increase in fall of ground fatalities. "This regression, after a period of sustained improvement, made us aware that the issue required urgent attention," says rock engineering manager Johan Laas. "We had a fall of ground management strategy in place: what was needed was a new initiative to give it a more consistent focus and close the gaps between its various components."

The existing fall of ground management strategy, initiated in 2002 and implemented since 2003, had five focus areas:

- preventing excess rock damage ahead of the work face (mine design);
- protecting people from rock falls in the workplace (mine support standards);
- promoting safe behaviour and work practices (mindset);
- providing warning of undesired trends (seismic and other monitoring); and
- problem-solving through research and development into new technologies.

In response to the identified need for a revised strategy, a high level review of fall of ground management at the South African operations was held on 28 March 2006, attended by senior production, safety and rock engineering staff from across the company.

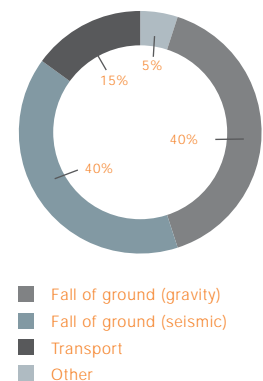
"The element we have added as a consequence of the review essentially deals with process," says Laas. "We have tried to integrate all risk management systems at mine and corporate level and have established a two-tier fall of ground management committee system, convened at corporate level by regional head of mining Mike O'Hare, and at mine level by the respective production managers.

Research, development and technology – the essential precursors to mine layout and design – remain integral to our strategy. Integrated Seismic Systems International Ltd (ISSI), a wholly-owned subsidiary of AngloGold Ashanti, was established in 1985 by Anglo American Corporation's Gold and Uranium Division to develop seismic interpretation and monitoring systems. (See case study in Report to Society 2005: Integrated Seismic Systems International.) Shaun Murphy, an experienced rock engineering manager at the corporate office, has been assigned to working closely with ISSI to combine mine-level practical experience with seismological methods. Together they are developing and integrating numerical simulated mine design with the seismic data that records the response of the rock mass to mining.

AngloGold Ashanti also continues to interact with a number of industry bodies, such as the Council for Scientific and Industrial Research (CSIR) and the Safety in Mines Research Advisory Council (SIMRAC). The unique nature of South African deep level mining has made the country's operations a focal point for



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international research into earthquakes and seismicity. The Natural Earthquake Laboratory in South African Mines (NELSAM), a collaborative research project between several universities in the United States, has staff members carrying out research at the TauTona and Mponeng mines in the West Wits region.

Further specific outcomes of the review include a revised strategy and an ongoing programme to enhance awareness at workplace level.

"A key aspect of the strategy is a move from lagging to leading indicators. We're still developing a system for consistent tracking of leading indicators, but the critical point is to identify and mitigate risks before an event happens, rather than analysing causes after the fact," says Laas. "For example, if one of the mining faces either lags or advances beyond the general line of the longwall, this imposes abnormal stresses on the rock with consequent rock engineering problems."

In the rock engineering field leading indicators can essentially be classified into two groups: pre-fall and pre-injury. The first comprises such aspects as mine layout and the seismic monitoring network managed by ISSI, and includes detailed analyses of the geology of each section of the mine.

The second focuses on, for example, detailed workplace-level analyses, again, for example, the analysis of fall of ground data. "When a fall of ground occurs that does not result in an injury, there is a tendency not to analyse it in detail," says Laas. "It's important that we capture and analyse that data as thoroughly as if an injury had in fact taken place."

Another planned initiative arising from the review is the development of a detailed workplace condition register, for every panel or development end in each of the six South African mines. This will involve monitoring adherence to mining standards through the continued deployment of the 'Rock Stars'. The Rock Stars, who, as members of the rock engineering department are independent of the mining hierarchy, carry out comprehensive workplace audits, the results of which are fed into the rock engineering database. Statistics relating to minor injuries arising from both seismic- and gravity related falls of ground are also analysed.

Events that have been predicted as likely by the various simulation systems can then be compared with subsequent actual experience in the workplace.

Another major focus area is the provision of what Laas calls an 'enabling environment'. "We cannot expect people to work safely in excessive heat, or if they have to walk excessive distances before reaching the workplace." Measures to mitigate the impact of the latter are essentially handled on a section-by-section basis, but increased awareness has been factored into all work schedules. At mine level, existing training, coaching and discipline procedures remain in place. To improve hazard identification, a checklist has been prepared for use at shiftboss and mine overseer level, enabling users to determine where special conditions exist that require additional attention or when expert rock engineering assistance is required in specific circumstances.

Finally, ongoing initiatives to enhance awareness and safe behaviour have been put in place. Fall of ground awareness audits are planned every six months. The first cycle has been completed, and results have been discussed with individual mine management teams. Competitions, based on continuous improvement, have been implemented at intra- and inter-mine level.

While it is too early to quantify the impact of the new strategy, the mining industry, through the Mine Health and Safety Council, has been set a target of a 20% annual reduction in the fall of ground-related fatality rate, and AngloGold Ashanti is fully committed to achieving this.