ELIMINATION OF FALLS OF GROUND FATALITIES ACTION PLAN

FOGAP NEWSLETTER
DAY OF LEARNING
MAY 2024

An action-filled FOGAP Day of Learning held in April packed a punch as the mining industry was challenged to deliver the next step change to eliminate fatalities from falls of ground incidents.

The annual FOGAP Day of Learning was held on Friday, 5th April 2024 at the Emperors Palace Conference Centre. The day was attended by more than **230 people** which was made up of delegates and exhibitors., according to the registration desk. There were at least **196 online participants** on-line. The in-person delegates represented a diverse cross-section of the mining industry. This was also reflected in the presenters on the programme.

The event was staged around a boxing ring in which presenters and panellists delivered their messages in the fight against FOG-related fatalities and injuries through the adoption of leading practices and technologies. There was little doubt that these interventions are making a difference to the lives of underground crews and their families.

FOG was for decades one of the leading agencies of fatalities in South African mining. The unrelenting focus on addressing falls of ground has delivered the step change in the industry's quest for Zero Harm.

The number of **FOG-related fatalities** has **reduced by 94%** to 15 last year from 239 in 1994. The industry reported a **record low** of 6 FOG fatalities in 2022, an indication that the FOGAP and earlier interventions are working.

The reduction in FOG fatalities and the 91% decline in transport and mining (TMM) deaths to 8 from 87 thirty years ago, have contributed significantly to **fatalities falling by 88%** to 55 last year from 484 in 1994.

While the reduction is commendable and to be applauded, there is more work to be done to achieve Zero Harm and the conference heard about the interventions that are delivering and which were encouraged to be adopted across the underground mining sector. Bolted netting and permanent mesh installations, illumination of working areas, and in-stope drilling guides were the key topics of presentations and the subjects of informative on-site displays by vendors supplying the sector.

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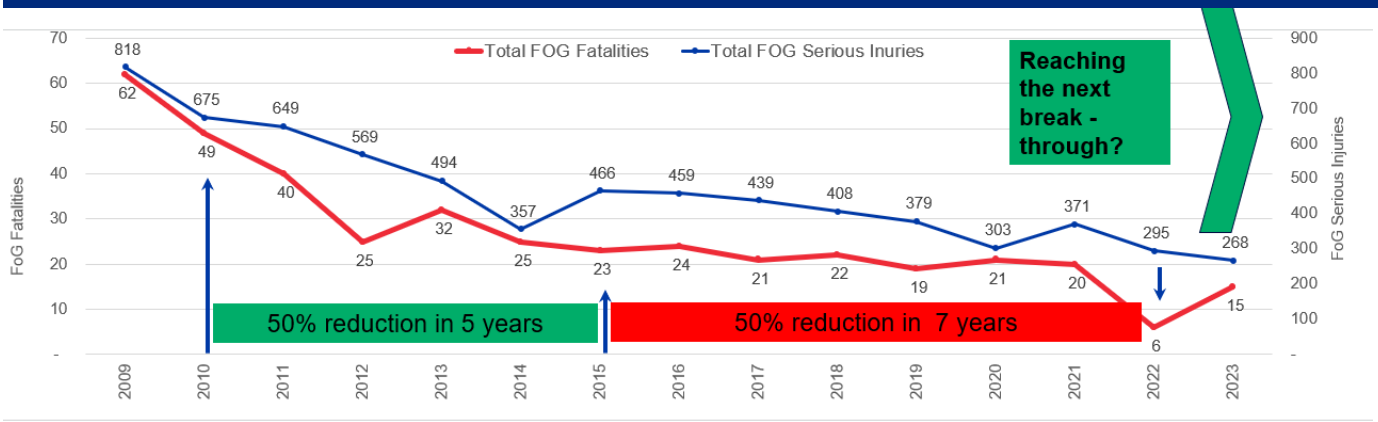
MINERALS COUNCIL SOUTH AFRICA

Mzila Mthenjane, Minerals Council South Africa CEO, challenges all stakeholders to find the next breakthrough intervention



The keynote address by **Mzila Mthenjane**, CEO of the Minerals Council South Africa, set the scene for the day.

While the mining industry had made significant reductions in fatalities since 2009, halving the number of deaths in a five-year and seven-year period, the challenge was now to eliminate FOG fatalities, he said.

As a mining engineer, Mr Mthenjane outlined **five proposals** to achieve Zero Harm.

- **Reinforce** widespread implementation of Fall of Ground Action Plan
- **Learning and sharing** of leading and best practices and research
- **Collaboration is key** - no one can solve mine safety alone.
- **Replicate the successes** in FOGAP in other agencies of fatalities and injuries.
- **AI and rapidly developing technology** are tools that will bring us into a new era in mining

At the heart of the quest for Zero Harm is the human factor, with the employer committing to safety first, always, while employees committed to "**first my life, then my work**".

In the adoption of new technologies and ways of working, human-centred design and change management are critical.

Regular assessments of employees' adoption and satisfaction with the new technologies identifies gaps and areas for improvement. Keeping pace with innovation by updating employee skills will match the evolving technological landscape.

Technology must be integrated into the fabric of organisations and into the day-to-day lives of employees, with robust data infrastructure.

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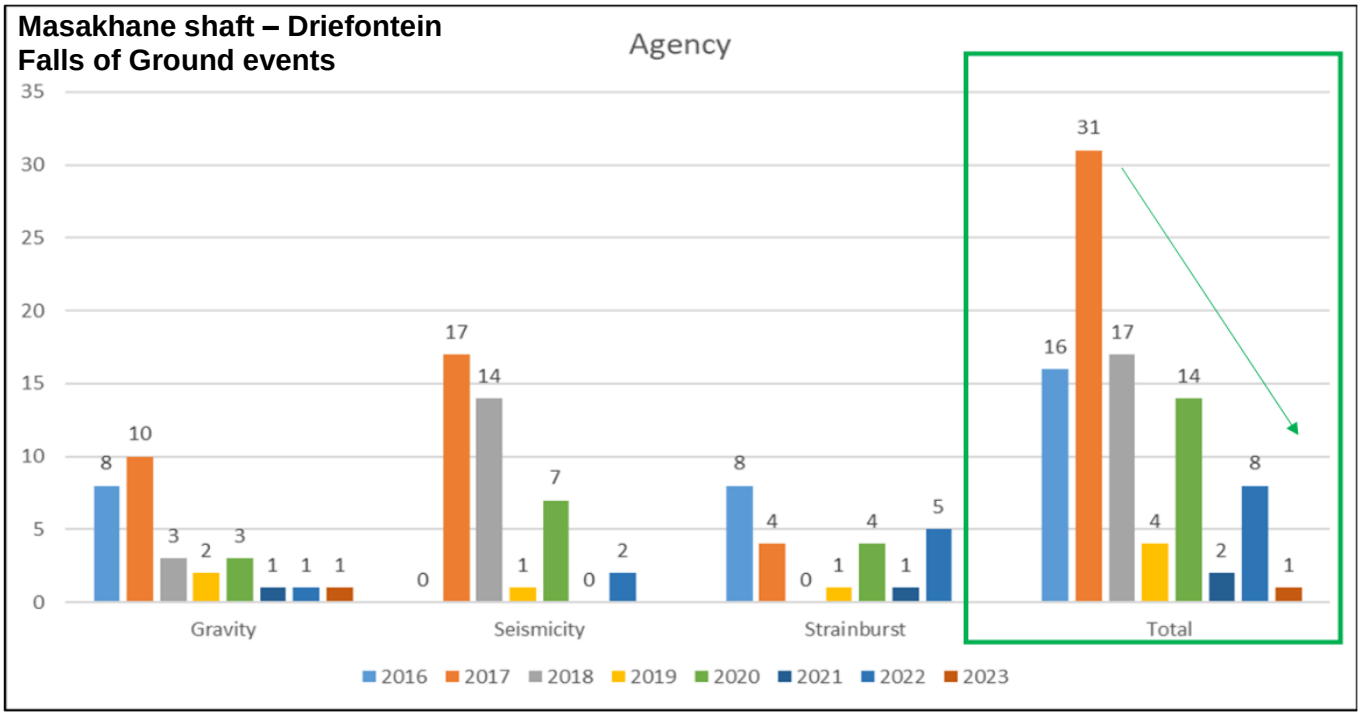
Permanent netting – lived experiences at Sibanye-Stillwater and Harmony Gold demonstrates the merits outweigh the costs

Vuyisile Sithole, Underground Manager at Sibanye-Stillwater, outlined the company's reasons and journey to install permanent blast-on steel mesh at different mines, using the **Masakhane** shaft at the Driefontein gold mine as an example because of its high levels of falls of ground.



Sibanye-Stillwater has successfully implemented three types of permanent blast-on mesh across the different shafts:

- Geobrugg Mesh
- LAW Mining Steel Nets
- Rope Nets

At the Masakhane shaft, which has experienced a large number of gravity and dynamic-related falls of ground incidents, Sibanye-Stillwater has during the past three years worked tirelessly on enforcing proper entry examination and safe declaration, barring practices, marking and drilling practices, mining lay-outs and reporting of poor ground conditions through the TARP process. The next phase to achieve Zero Harm is the installation of permanent in-stope steel netting.

The primary focus on permanent mesh installation is to eliminate all rocks from falling uncontrolled (reactive control) and ensuring that the integrity of the stope or any other excavations on the reef plane are secure and supported until the life of the specific excavation expires (effectiveness control). Permanent mesh is to deal with such controls. "The first and most important advantage is we are saving lives," said Ms Sithole.

Examples of post-seismic events at Masakhane where the nets have caught falling rock.

The high-tensile steel permanent nets are expensive compared to the temporary and reusable nylon nets, with extra hydra bolts to pin the net with steel plates to properly tension the mesh, but the steel nets work as the statistics in the graph show. Initially, there is a large additional cost but this is offset by the benefit of minimising accidents and stoppages, said Ms Sithole

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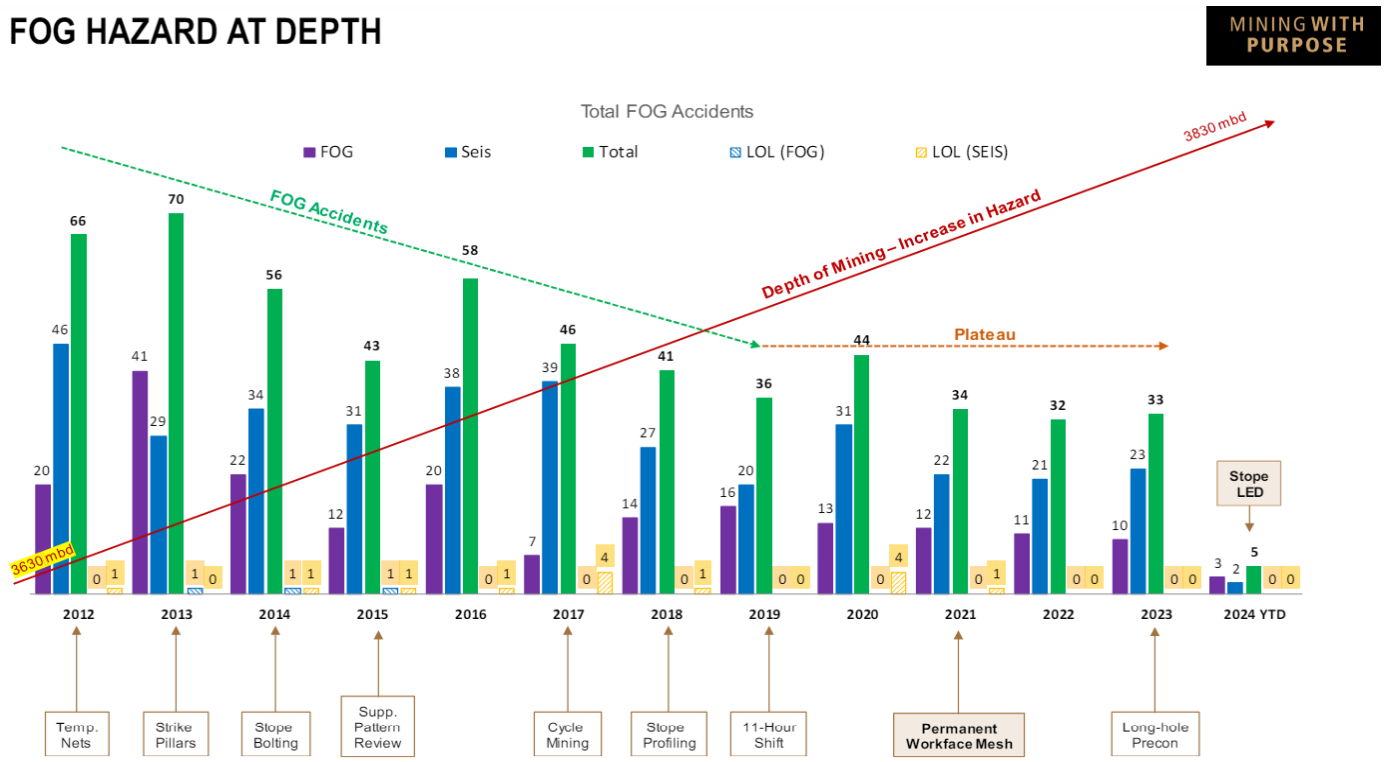
Mponeng gold mine – Harmony Gold



At Harmony's Mponeng, the world's deepest mine, South Africa's largest gold miner has recently introduced permanent workface netting as well as in-stope illumination as operations reach more than 3.8km below surface.

The deeper the 38-year-old mine becomes the more the hazards increase, said **Ronald Mulaudzi**, Mponeng General Manager.

Mponeng experiences more than **800 seismic events a day**. The mine, which has produced 429 tonnes of gold, records about 200 seismic events a year with a magnitude greater than 1.0. The mine has a life up to 2045 and it is essential that miners' safety is protected. As at end-December 2023, the mine had two consecutive fatality free years.

Harmony switched to permanent workface steel netting from nylon throughout the mine in the middle of 2021 at a cost of R46 million.

"Permanent workface netting did not solve all our problems – but I have seen it save many lives. We believe that improved workface visibility is the next step in our journey to being injury free," said Mr Mulaudzi.

The benefits of illumination are

- Improved hazard identification
- Improved hazard communication in the workplace
- Improved physical conditions
- Improved control performance (support)

Mining crews have responded well, with **morale boosted** and a willingness to install the lights, which takes less than half an hour.

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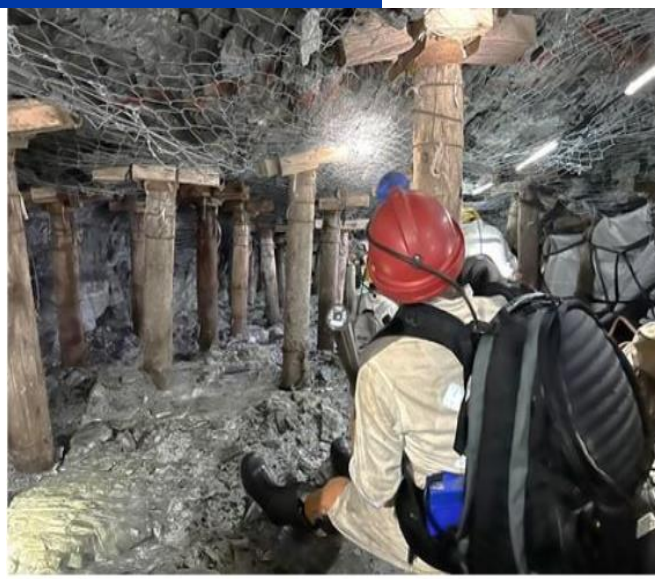
Harmony noted that strata control compliance increased from 56% to 92% (test crew).

However, the threats include the novelty of technology for in-stope illumination, limited product choice and limited legislative guidance.

“Each new implementation of a leading practice brings us closer to our goal of Zero Harm,” Mr Mulaudzi said.

"We can't just sit back and say we've arrived. We need to constantly seek additional ways on how we can enhance the manner in which work is conducted as well as the safety associated with that activity."



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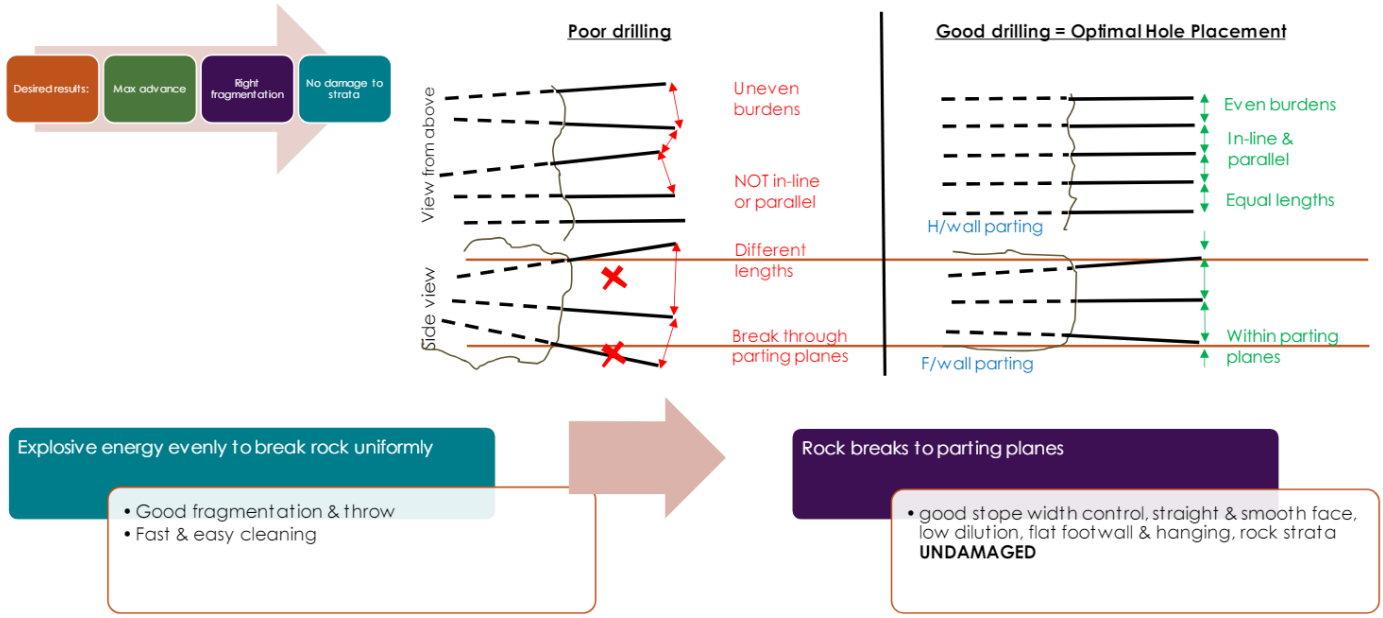
Rock Drill Guides and Robocop suits



Mandla Msiza, Senior Manager Operations at Sibanye-Stillwater, outlined the merits of using in-stope drill guides as a valuable tool in the Falls of Ground elimination strategy at a mine, helping miners work more safely and efficiently in challenging underground conditions.

In conventional stoping, drilling accuracy is crucial for both safety and productivity. Drill guides also known as jigs, ensure that drill holes are consistently placed at the correct angles and positions, reducing deviations from the planned drilling pattern by drilling accurate, straight and parallel holes. Precision drilling results in a straight face, better consistency in broken rock, and less waste. It also prevents drilling into the hanging wall and footwall, damaging the strata, Mr Msiza said.

Drill guides are typically equipped with adjustable components to accommodate different drilling angles and positions. Drill guides may include supports, clamps, and stabilising features to secure drilling equipment in place to improve accuracy and fatigue management.

Sibanye-Stillwater is testing hydropower drills at its Burnstone gold mine. The drills and rigs use hydropower to push the drill forward quickly, about 20% faster, and weigh less than compressed air-powered drills. “The old drill operators said these things weren’t going to work. By the time we finished training on the second day, the crews were demanding to have these drill and jigs in their panels today! That’s how much they love these things,” said Mr Msiza.

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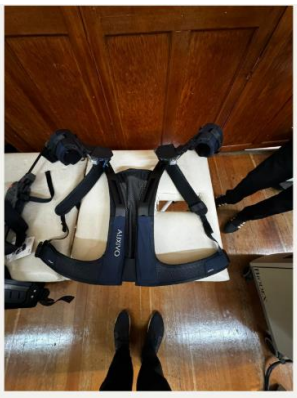
Taygan Nadar, from University of Johannesburg, presented the results of a muscle assessment study on three exoskeletons.

He conducted a study to measure the muscle activation of six miners who used different exoskeletons as they held and operated long, heavy pinch bars as they would do during underground barring.

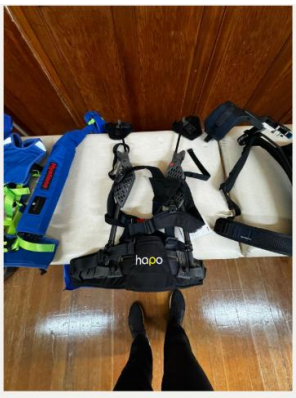
Other industries use exoskeletons to assist people who have to use their arms in elevated positions for prolonged periods. The exoskeletons are designed to provide support and stability to the operators' joints. In this case it was to lift and operate the pinch bar. The tests were expected to show that the muscles would require less effort in this task.

It was found during the assessment that the exoskeletons reduced muscle activation, while increasing the strength and endurance of the miners.

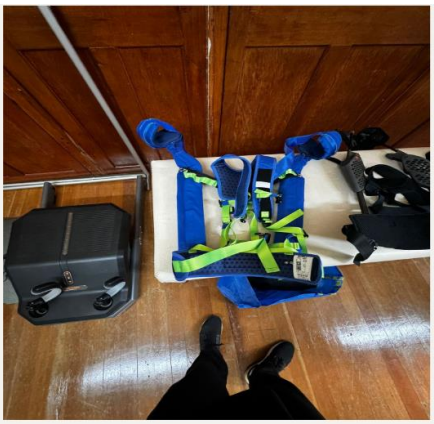
Mr Nadar also conducted two additional tests to demonstrate the benefits of the exoskeletons through an isokinetic strength test and a static hold test. He concluded that the exoskeletons increased the force output, the strength endurance, and the joint stability of the miners. However, there are disadvantages such as comfort and fit.



Exoskeleton 1



Exoskeleton 2



Exoskeleton 3

Pinch bars

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Closing comments from the Presidents

Londolani Rampfumedzi, President of SACMA

He is a coal miner with 20 years of experience. He shared his personal story in his closing address of the tragedy of losing a colleague to a fall of ground incident and how it motivated him in the fight for Zero Harm. He highlighted the importance of technology, innovation, collaboration, and education. “There's a lot of technology that we can adapt for our needs to make mining safer, whether it is from other industries or organisations. Technology and innovation are always improving,” he said. He challenged the coal industry to participate more in the work within FOGAP and to learn from mining companies in other commodities. He expressed his conviction that the fight against fall of ground is a fixed fight that can be won with collective effort and belief. “We will continue this fight. We will not be tired out by how many rounds this fight is going to last. We will win it."

Kevin Le Bron, President of SANIRE

Participating in FOGAP and the Day of Learning has been beneficial on a personal level, providing insights into leading practices for mitigating falls of ground. The knowledge gained not only serves to broaden my expertise, but also empowers me to contribute more effectively to industry projects and discussions.

The FOGAP and Day of Learning, are thought to have a profound impact on the industry at large, serving as crucial platforms for knowledge exchange, networking, and collaboration among professionals, researchers, and all stakeholders in the mining industry. By inculcating a culture of continuous learning and innovation, these initiatives contribute to elevated industry standards, enhanced safety protocols, and the development of sustainable solutions for rock-fall challenges.

In summary, the FOGAP program and the Day of Learning are pivotal drivers of progress and resilience in the mining industry. Their positive impact extends to individuals and the broader industry, shaping a landscape of continual improvement and innovation.”

Stuart Sepetla, President of AMMSA

Our view is that FOGAP, as a CEO-led safety initiative in the mining industry, provides a united front in our battle with falls of ground and will help us achieve Zero Harm. The programme not only provides a platform for directing research into the various falls of ground agencies and controls but it also brings together role players like AMMSA, SACMA, SANIRE and others to collaborate and find common solutions that cut across the industry. The opportunity to interact and learn from each other’s operations and various research organisations must not be underestimated. These Days of Learning have an important role to ensure that the initiatives are properly communicated and where we share our success in achieving our common goal of zero loss of lives in the mining industry.