

MINERALS COUNCIL
SOUTH AFRICA

**FOGAP DAY OF
LEARNING 2023**

NEWSLETTER

MAY 2023



Keeping mining operations safe during every shift is like sweeping water uphill. It's an unrelenting effort, with tragic consequences if there's a lapse in focus.

Japie Fullard, chair of the Minerals Council's CEO Zero Harm Forum, said at the *Fall Of Ground Action Plan (FOGAP) Day of Learning* after every blast the underground work environment is different, and conditions have changed, requiring dynamic approaches to risk assessments.

After the industry reported four FOG-related fatalities within a month by the end of March 2023 compared to a record-low six FOG-related deaths in the whole of 2022, companies must not discard the six-pillar FOGAP developed in 2021, he said. FOGAP must be relentlessly implemented and run its course. However, the industry must assess whether the FOGAP could have prevented the latest fatalities after contributing a 70% reduction in deaths last year..

For example, the industry's focus is predominantly on netting and bolting hanging walls, but there are high-potential risk incidents that come from sidewalls collapsing. "It's something for teams to consider."

"Our FOGAP framework is sound. We must implement it, measure it and continuously review it."

Technology plays an important role in miners assessing their work environment, identifying risks and resolving them. The mining industry has spent hundreds of millions of rands in technology to remove employees from high-risk working areas, using roof bolters, scalers, underground illumination, and, at some operations, permanent netting, which is an expensive option.

"The most difficult thing to do is always controlling human behaviour. How do we make sure we keep our people aligned, safe and alive every single day? It's important to use technology because we cannot only rely on human behaviour," Mr Fullard said.

"Zero harm is achievable. We've shown that. We must keep on doing what we are doing with what we know is working. Collaboration is critical because we cannot do it alone as just the employers."



THE SIX FOGAP PILLARS

- Adoption of leading practices
- research and development,
- skills development
- policy issues
- achieving zero harm production
- implementation and monitoring of leading practices

FOGAP FRAMEWORK IS DELIVERING

- In 2022, there were 6 FOG-related fatalities, a 70% reduction from the 20 deaths the year before.
- The number of FOG fatalities had fallen to an average of 24 a year in the 2016-2020 five-year period from an average of 111 a year in 2001-2005, a 78% improvement.
- Some of the key interventions were:
 - the implementation of entry examinations and actively making working areas safe daily from 2009.
 - In 2012, the netting and bolting of tunnel roofs and walls were introduced, and
 - the use of steel nets has become a common feature in South Africa's deep-level mines.
 - Impact of planning and modelling of seismicity risks in certain work areas.
 - In-stope lighting/improved illumination.

THE PATH TO SUCCESS

The Minerals Council will implement the FOG Action Plan project in partnership with:

- Association of Mine Managers of South Africa (AMMSA)
- South African Collieries Managers (SACMA)
- South African National Institute of Rock Engineering (SANIRE)
- organised labour
- the regulator (DMRE)
- suppliers
- research institutions
- universities

Why FOGAP is working

- FOGAP programme is making good progress
- Model works well with inputs from many sources
- Excellent input from professional associations
- Programme is holistic, contributing to a reduction in FOG-related fatalities
- New approaches are being explored to discover solutions to FOG problems

Partnerships and collaboration are key

- To promote knowledge transfer and collaboration with stakeholders by sharing of best practices in the mining industry as well as the adoption of leading practices.
- Associations and Stakeholders commitment to support the fall of ground action plan across the South African mining industry and providing an opportunity to share learnings and best practices.
- Unions and employees are essential to ensure acceptance and correct, continuous application of best practices and new technologies

What is FOG Action Plan

- Addresses FOG fatalities
- CEO endorsed
- R46m budget over 5 years
- Owned by AMMSA, SACMA, SANIRE
- Oversight by RETC
- Holistic – 6 pillars

**Professional Associations
[AMMSA, SACMA & SANIRE]**

Minerals Council [Employer, CEOship]



**Zero
FOG
Harm**

**Equipment Manufacturers, Suppliers, R&D and
Academic Institutions**

Labour [Our Workforce, Our Responsibility]

Hydro-drilling – lessons from Implats

Remote in-stope drilling using hydro power is undergoing a trial at Impala Rustenburg, using the Isidingo Drill as an integral part of the assessment to find an alternative to compressed air.

One immediate win is the first woman employed at Impala Rustenburg as a rock drill operator, says **Kabelo Lefifi, Head: Best Practice at Impala**. “It’s a great milestone for us.”

The six-month trial by two suppliers at two half-levels with 17 crews at different shafts will end in June 2023, but already the results are encouraging as Impala explores ways to remove operators from the face. Remote in-stope drilling using a rig, keeps the RDO under netting.

The Impala Rustenburg mine layouts and more distant working places meant there was insufficient compressed air for conventional drills, so the company started searching for alternative drilling technology in 2020.

“This is not a new technology. It has been around for some time, but in our business, it is new. To be successful, the technology must be accepted by operators who are using it daily in the workplace,” said Mr Lefifi.

Among the 25 key performance metrics Impala set were:

1. Remote drilling and safer environment for RDOs – move from conventional handheld to rig drilling. Conventional handheld, 1 metre from face, now 2m under a net
2. Noise reduction to comply with the Mine Health and Safety Act – as we go through the process, we see benefits versus conventional compressed air
3. Improved drilling speed – increased penetration rates – quicker than conventional drills
4. Drilling accuracy – improved drilling discipline



BENEFITS OF HYDRO-DRILLING

Improved Safety:

Minimise exposure to high-risk zones.

Operator removed from the face.

Better Ergonomics:

Less physical effort & easy to operate (women RDO's now possible)

Reduces noise & vibration exposure

Current RDOs are aging and with this new technology there is ease of handling

ESG Compliance:

Reduce water & energy usage footprint.

Non-polluting & aligned with Impala's sustainability goals.

Increased Production & lower AISC costs per ton mined :

Precision drilling, improve blast efficiency & advance rates - yield more tons

Replace inefficient, expensive & slow compressed air with proven water hydraulics



Sibanye-Stillwater shines a light on underground illumination

Sibanye-Stillwater intends making underground illumination and improved underground workface visibility one of their minimum standards.

Sibanye has met with quick wins in illuminating underground areas used by trackless mobile machinery, development ends, travelling ways and cross cuts, which can use a higher voltage than is safe in a conventional stope, said **Eric Cilliers, Engineering Manager at Sibanye.**

The immediate limitation of low-voltage LED strips is that their performance is reduced by the length of face as well as distance to an electrical outlet.

Sibanye is working in partnership with suppliers to raise the voltage of LED cables.

“Every day we send people down into an everchanging, hazardous environment,” said Mr Cilliers.

“For us as leaders to enable our employees to identify hazards to the best of their ability is the way forward. This will assist with operational excellence. It will become industry best practice.”

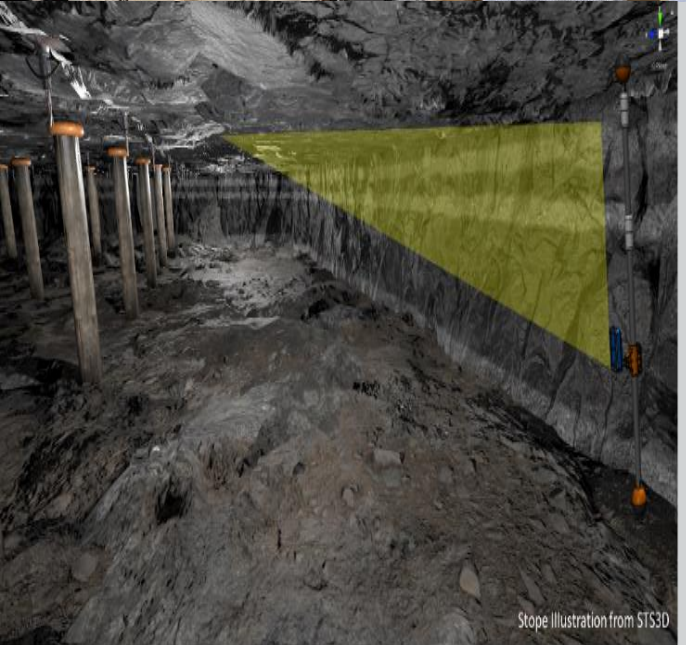
Adwoa Issaka of the Minerals Council’s MOSH FOG Team said in workfaces and ancillary excavations, employees rely only on their cap lamps for illumination. Cap lamps are inadequate for proper rockfall hazard identification.

In 2021, when the FOGAP was adopted by the CEO Zero Harm Forum, workface visibility was identified as a quick-win project.

MOSH approved Improved Underground Workface Visibility Leading Practice in 2022.

LED Strip Light Comparison – Sibanye-Stillwater

Description	X-Glo	Halo1	Schauenburg	Hella
LED Configuration	24 per <u>Metre</u>	60-100 per <u>Metre</u>	72-140 per <u>Metre</u>	70 per <u>Metre</u>
IP Rating	IP67	IP68	IP68	IP67
<u>Colour Rendering Index (CRI)</u>	>70	>80	75	>70
<u>Colour Temperature (CT)</u>	6500 Kelvin	5500 Kelvin	3000-10000 Kelvin	5000 Kelvin
<u>Lumens per Metre</u>	350	1000-1100	960-2000	1200
<u>Power Consumption per Metre</u>	3,6 Watts	12 Watts	16 Watts	11 Watts
<u>Lifespan</u>	>50 000 Hours	>50 000 Hours	>50 000 Hours	>50 000 Hours
<u>LED Degradation</u>	+/- 5% per Year	+/- 5% per Year	+/- 5% per Year	+/- 5% per Year
<u>Cost per Metre</u>	R587,47	R505,00	-	R437,50



NanoRadar FOG system – Anglo American

Anglo American is working with Australia’s Geobotica on a radar system as small as a mobile phone to use underground and monitor rock movements. The intention is to give employees advance warning of changes and potential rockfalls or bursts.

The NanoRadar system has moved from the building of the prototype in the second half of 2022, to laboratory testing in the first quarter of 2023 to deployment at an active underground platinum mine in South Africa between April and August this year, said **Dewaldt van Rooyen, a geotechnical specialist at Anglo American.**

The system essentially compresses the large radar systems used to monitor slopes in open pit mines and can be used to scan and check for movement in hanging walls, sidewalls and working faces, ignoring the movement of people and blast-on nets with apertures of 85mm.

“This device is millimetre precise. It can measure a person’s heartbeat,” he said.

Anglo American is developing the system as part of its Elimination of Fatalities work.

The system is robust, waterproof, with a long battery life, no moving parts and no buttons that can accidentally be pushed. It covers a large area, unlike existing systems that are narrowly focused.

The NanoRadar is set up using software, eliminating the need for calibration. It communicates its data easily through Bluetooth or WiFi, and data can be delivered in real time to multiple users.

The system collects data, which geotechnical staff can use for analysis of the rock mass, how it behaves, trigger points for failures, and what happens during rockfalls.

In future, the NanoRadar could be fed into the FOGAP programme as part of the mining industry’s initiative to eliminate fatalities and injuries from falls of ground, Mr van Rooyen said.

Underground NanoRadar system critical risk testing

Test accomplishments:

- Sync connectivity and communication
- Data recording
- Deploying Stick/Pole concept
- No button functionalities
- Zero false alarm rate
- Lights visible
- Rock scanning
- Equipment and people removal algorithm
- H₂O has very low influence
- Scan through blast-on mesh



Concern to be tested

- Sensitivity to vibration
- Any movement must be less than 0.5mm (Face handheld driller causes 0.4mm movement)

Machines do the dangerous work at Palabora Mining

Palabora Mining Company has entirely mechanised the scaling, support drilling and installation and shotcrete spraying operations at its copper mine.

No work is done by people beyond the last line of supported hanging walls and sidewalls because of the technology deployed underground, said **Thokozani Mtshali, Superintendent Geotechnical at Palabora.**

“One rig does almost everything, scaling of the hanging and side walls, it drills holes, supports and blasts the face. We have removed people from the face.”

Even the marking of support is done by a miner standing under the supported area by using a long pole.

