MINING INDUSTRY
OCCUPATIONAL
SAFETY & HEALTH

MINERALS COUNCIL
SOUTH AFRICA

IMPROVED UNDERGROUND WORKFACE VISIBILITY

Adwoa Issaka

Adoption Team Manager, Minerals Council South Africa

Silverstar Casino, Muldersdrift

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Content

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1. Investigation timeline

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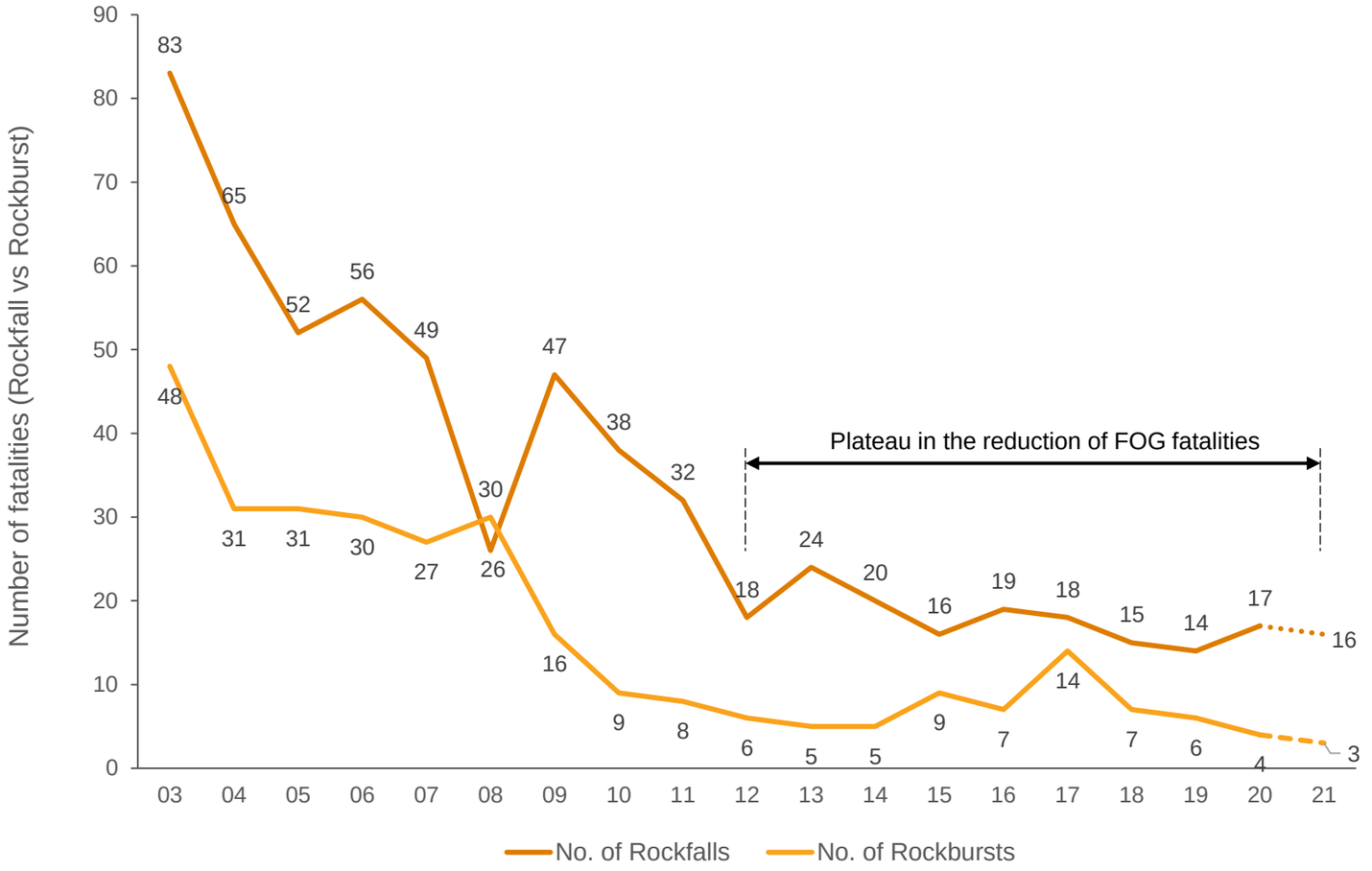
Project origin

Plateau in FOG safety performance

- Steep decline in Falls-of-Ground fatalities from 2003 to 2011
- Plateau since 2012
- Rate of improvement of FOG fatalities has reduced over time
- Reduction in the acceleration (or pace) is working against the zero-harm goal

Fall of Ground Action Plan (FOGAP)

Pillar 1 identifies the improvement of underground workface visibility to an appropriate standards as a quick-win project



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Project timeline

July 2021

Development of the FOGAP through the mandate of CEO Zero Harm Forum and internal stakeholders

Aug-Sep 2021

- FOGAP finalised
- Underground workface visibility formally identified as a quick win project

Oct - Nov 2021

- Recommendation for MOSH FOG team to investigate potential leading practice
- Identified project case studies / source mines

Nov-Dec 2021

- Started investigating project
- Started literature review
- Visited case study mines to document (Eland and Dishaba)

Jan - Feb 2022

- Held meetings to better understand the LED lights from supplier perspective
- Continued documentation of the leading practice guideline

Mar-Apr 2022

- Planned and held focus group discussions with source mine
- Incorporated feedback into the leading practice guideline

Apr - May 2022

- Circulated document to relevant stakeholders for input
- Soured additional input from industry experts in occupational health and safety and engineering

Jun 2022

- Took guide line through MOSH process
- MOSH Learning Hub conducted visit to Eland Mine
- Learning Hub commissioned project as a full leading practice

July 2022

Finalisation and launch of the ***"Improved Underground Workface Visibility Leading Practice"***

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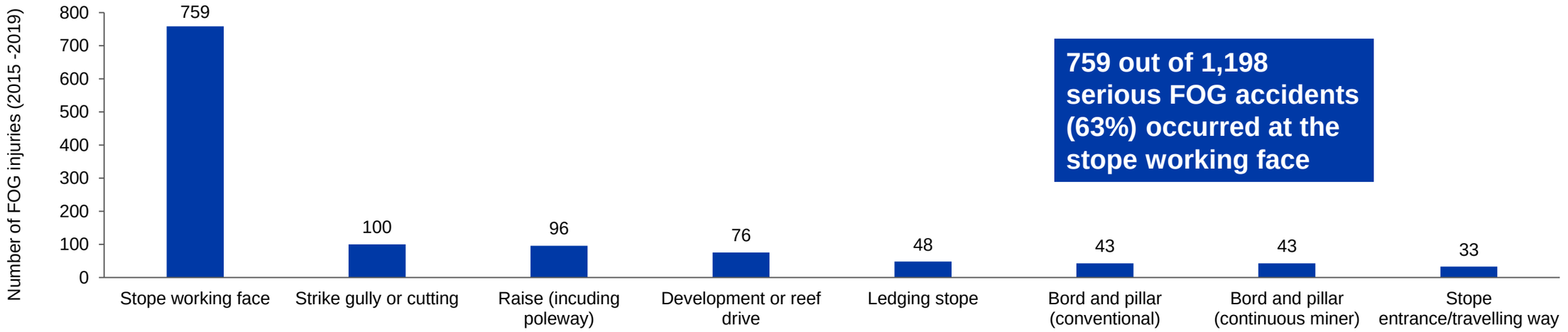
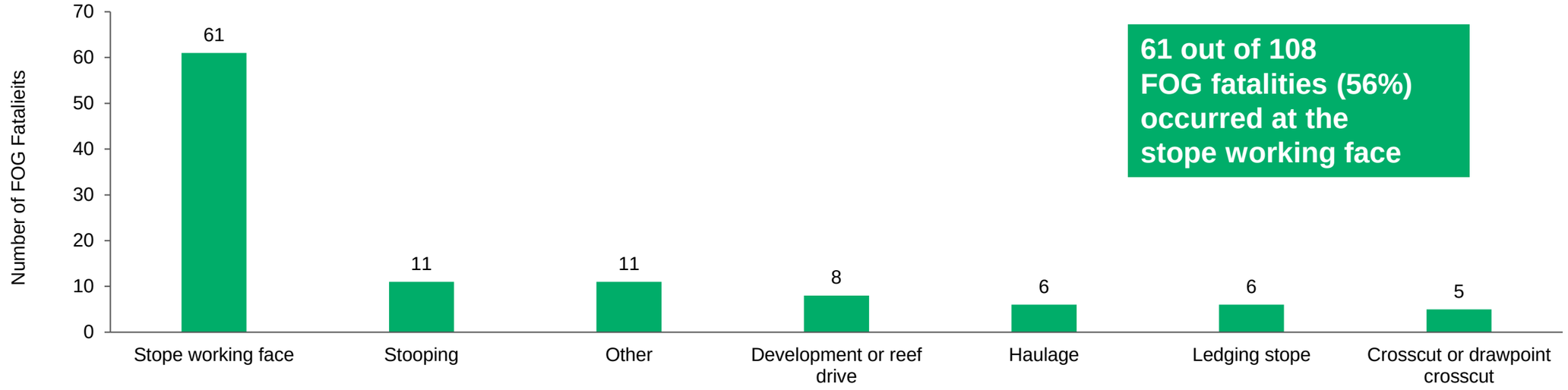
Analysis of the DMRE SAMRASS data for 2015-2019



759 out of 1,198 serious FOG accidents (63%) occurred at the stope working face



61 out of 108 FOG fatalities (56%) occurred at the stope working face

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2. Rationale behind the Leading Practice

- FOG injuries and fatalities mainly occur at the working faces of conventional stopes
- These excavations usually have the highest concentration of employees during the shift
- FOG hazards, and exposure of personnel combine to make this one of the most high-risk working area underground
- Stopes and ancillary excavations usually dark; employees primarily rely only on cap lamps for illumination
- Cap lamps: provide enough illumination for navigation, however the not sufficient for proper hazard identification
- Anecdotal evidence: Proper in-stope illumination will improve the identification of rockfall hazards

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Literature Study

1. The importance of good illumination

- 85% of information received through sight
- Aid with visibility and peripheral vision
- Reduces eye fatigue
- Improves work efficiency
- Creates a pleasant atmosphere

2. Challenges of underground illumination

- Constantly changing environment
- Narrow and confined
- Other areas very large and open
- Far from power source
- Strict lighting regulations
- Curbing electricity and other costs
- Managing load on power grid

3. Occupational health factors

4. Research relevant to this leading practice

GAP 804: *The role of illumination in reducing risk to health and safety in South African gold and platinum mines*.

SIM 160701: *Proposed illumination guidelines for equipment operating in the South African mining industry (SAMI)*

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Various illumination options

Selection criteria											
Light type	**Handing during EEMs**	**Portability**	**Power source /Maintenance**	**Light intensity adjustability**	**Durability**	**Even light distribution**	**Glaring**	**Cost**	**Security**	**Sum**	**Weighted performance**
Compact florescent bulb	2	2,5	2	2	1	2	2	5	5	23,5	44,0%
Stick LED light	5	5	5	3	3	2	2	2	1	28	60,0%
LED strip	4	2,5	3	3	4	5	5	3	5	34,5	65,0%

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3. Factors to consider when adopting the leading practice

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Purpose of the lights

Primary purpose:

- To illuminate the face area
- To further enable the identification of rockfall / ground control hazards (and other hazards)
- To aid Entry Examination and Making Safe (EEMS)

Secondary purpose:

- To provide sufficient illumination for marking, drilling, support installation.

Illumination selection criteria

1. Product testing and certification
2. Product robustness and durability
3. LED lifespan
4. Product reliability
5. Product flexibility and adaptability
6. Light intensity
7. Power requirements
8. Energy efficiency and costs

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Technical factors to consider

1. Mining layout and power source
2. Positioning of the lights
   - installed at least 1.5m from the face
   - not in direct line of sight
   - removed at the end of the shift
3. Risk assessments
   - looking at all risk aspects including occupational health and safety
4. Standards and procedures
5. Quality assurance and quality control (QA/QC)

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Behavioural and leadership factors

1. Rationale
- Clear, well understood, well communicated
- Align with the leading practice

2. Support
- Urgency
- Buy-in from top-down and bottom-up
- Allocation of financial and other resources

3. Good communication
- In a timely manner
- Effective and sustainable communication channels

4. Adequate training
- Updating training and induction material to include this initiative
- Creation of Planned Task Observations

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4. SWOT analysis

Strengths	Weaknesses
• Energy efficient • Easy installation • Non-toxic • Low costs in the long term • Durable, robust, dust and waterproof • Low temperature, easy to handle • Powered by specific voltage making, difficult to steal	• Imported product • Supply constraints - no local manufacturer • High initial costs • No standardised form of measuring illumination across the South African mining industry • No standardised values for minimum illumination in workfaces
Opportunities	**Threats**

• Local manufacturing:
  • creation of several job opportunities
  • reduction of the price of lighting units
• Improved safety and productivity in mines
	• Cheap substitutes with poor quality
	• Supply not being able to meet the demand
	• Rechargeable LEDs – risk of theft and use by illegal miners

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5. Conclusion

- Many FOG injuries and fatalities occur at the working face
- Anecdotal evidence that improved lighting contributes to improved safety
- Case studies show that adequate lighting increases employee morale and productivity
- LED lights work very well, and they can be used to aid EEMS and hazard identification
- Keep the following in mind:
  - Primary and secondary purpose of the lights
  - Product safety and specifications
  - Factors to consider listed in the leading practice
- South African mining industry should invest adequately
- Our workfaces are dark, we need to illuminate

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Thank you

T +27 11 498 7100 **E** info@mineralscouncil.org.za **W** www.mineralscouncil.org.za

Rosebank Towers, 19 Biermann Ave, Rosebank, Johannesburg, 2196

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