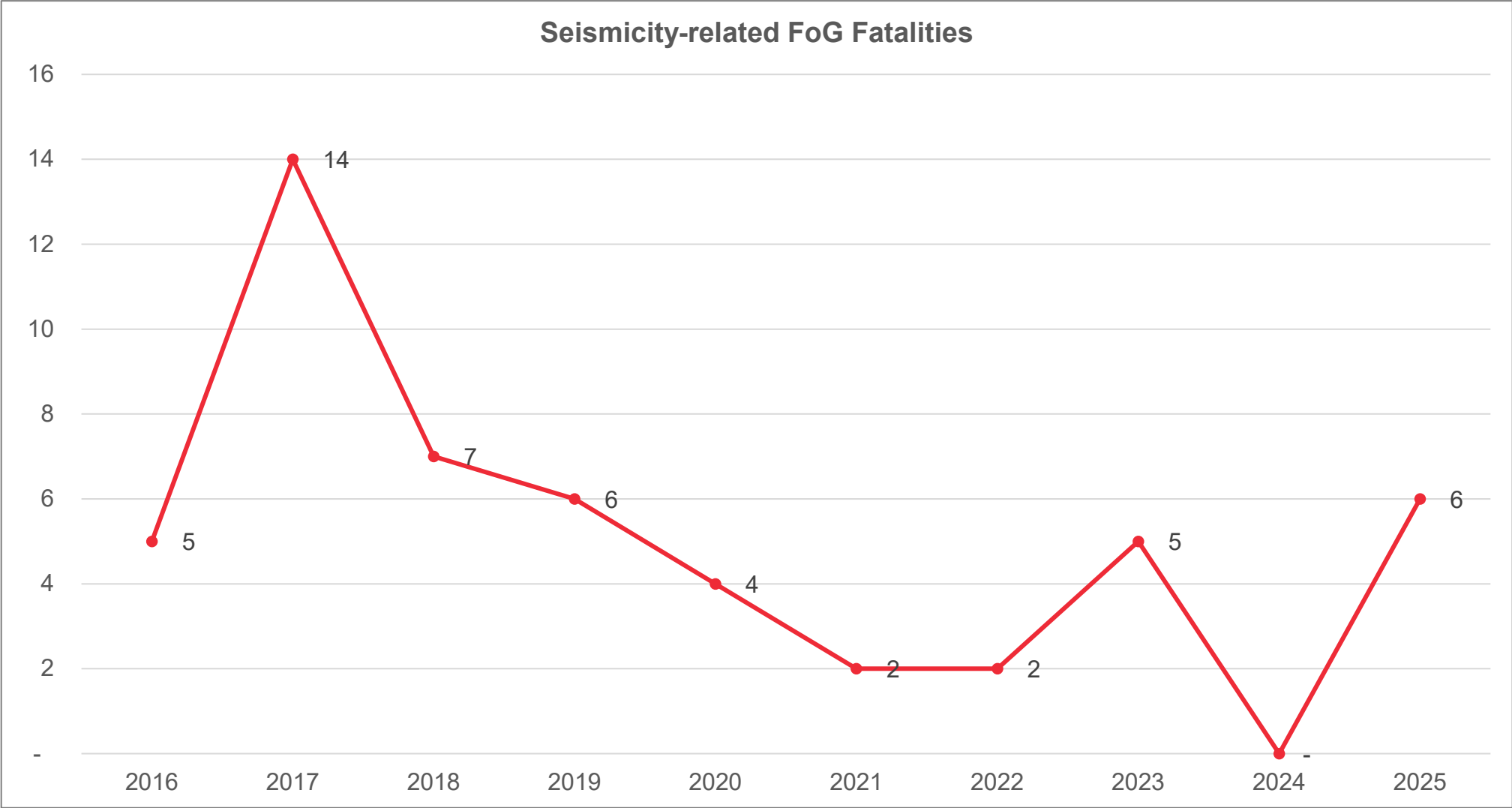


# Seismic research feedback

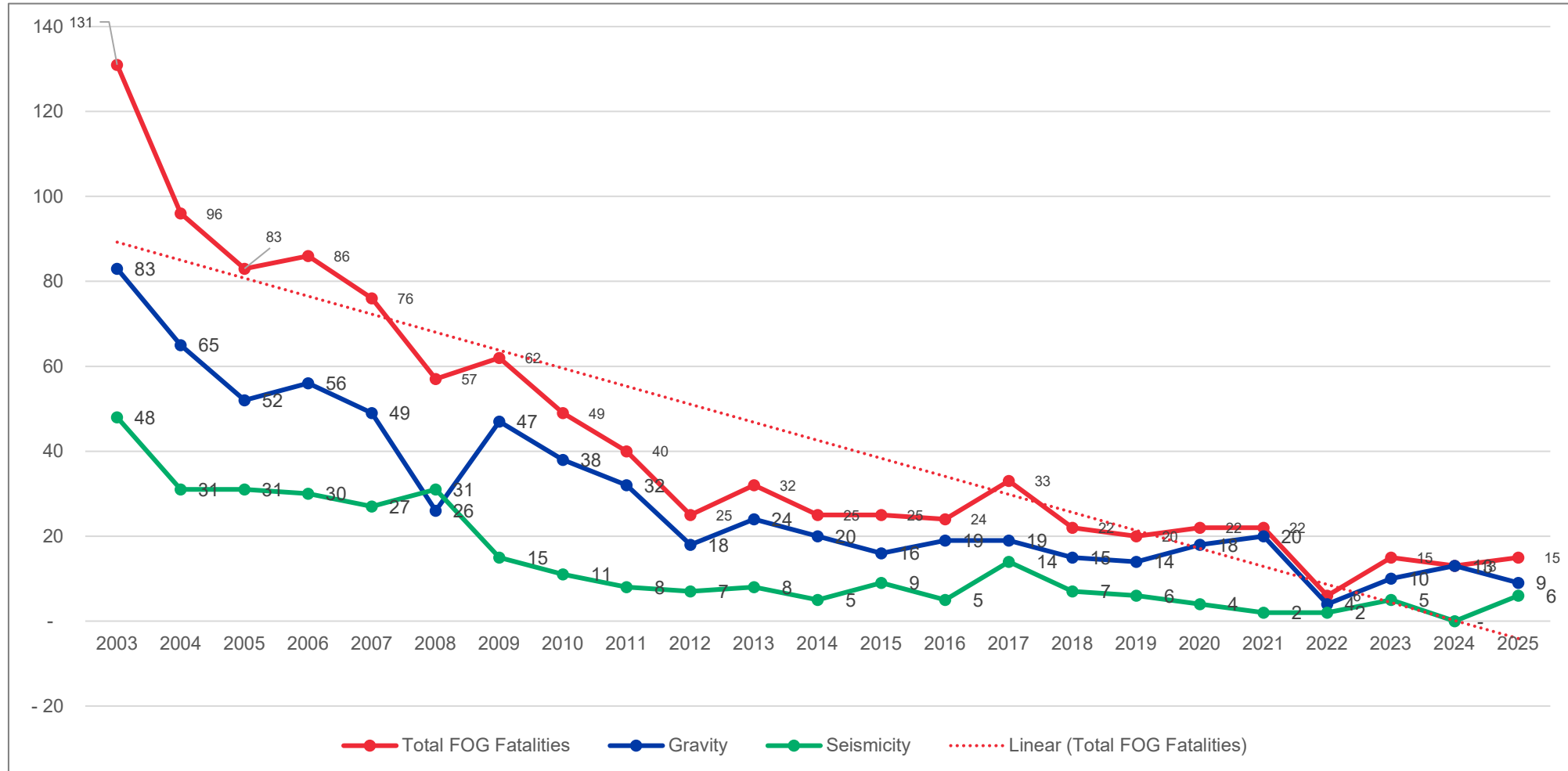
FOGAP Day Of Learning 27 March 2026



### Seismicity-related FoG Fatalities

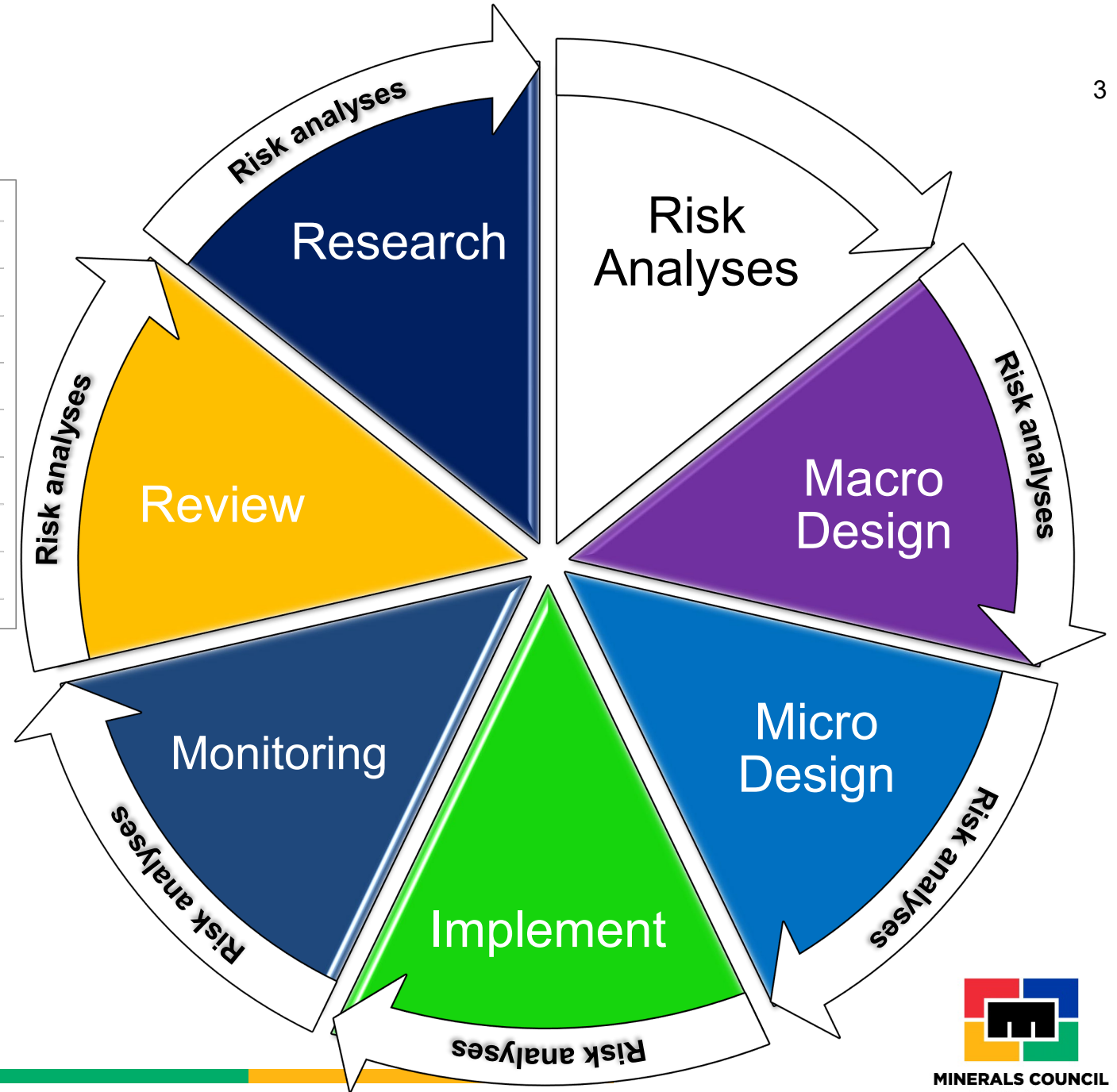
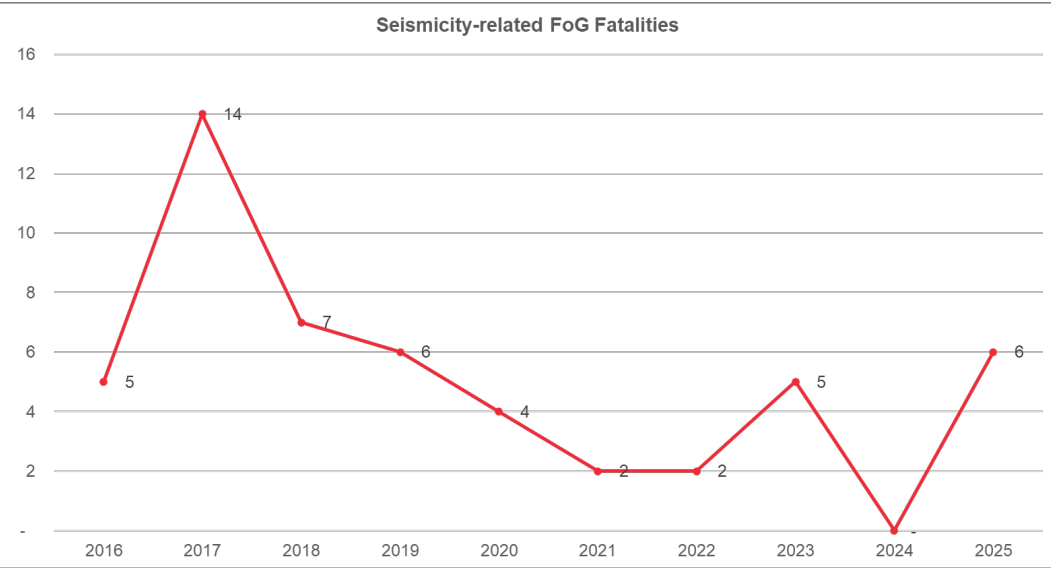


# FoG Fatalities

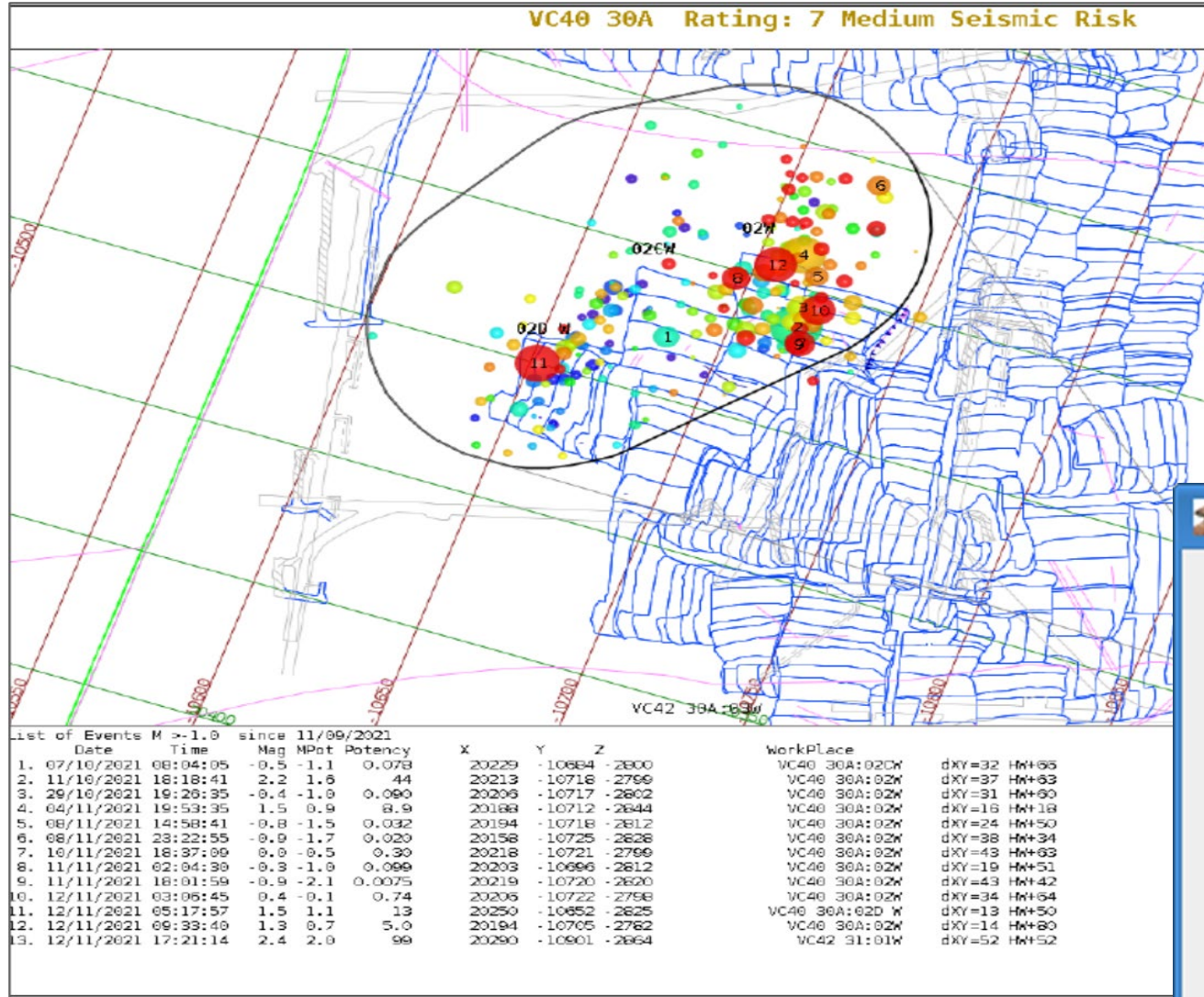


# The IGCF Technical Elements

Seismicity-related FoG Fatalities



# Short-term seismic rating



## Seismic Ratings Reference Table

Ratings Colour Legend	
No Analysis Possible	No Ratings
0 to 4	<b>LOW</b> short term seismic rating
5	<b>MEDIUM</b> short term seismic rating
6 to 10	<b>HIGH</b> short term seismic rating

<?>

	Thresholds		Changes		
	Low	High	Increase	Decrease	Any change
App.Volume	<input type="text" value="0.05"/>	<input type="text" value="0.25"/>	<input checked="" type="radio"/> +	<input type="radio"/> -	<input type="radio"/> any
Energy Index	<input type="text" value="0.10"/>	<input type="text" value="1.00"/>	<input type="radio"/> +	<input type="radio"/> -	<input checked="" type="radio"/> any
Activity	<input type="text" value="0.05"/>	<input type="text" value="0.25"/>	<input checked="" type="radio"/> +	<input type="radio"/> -	<input type="radio"/> any
Schmidt	<input type="text" value="0.50"/>	<input type="text" value="2.00"/>	<input type="radio"/> +	<input checked="" type="radio"/> -	<input type="radio"/> any
Large Event	<input type="text" value="0.80"/>	<input type="text" value="1.20"/>	Magnitude		<input type="text" value="1.0"/>

# Seismic research outcomes

## Best Practice Guidelines for Seismic Monitoring in Underground Mining

WC Joughin (SRK Consulting)

JWL Hanekom (CSIR)

F Essrich (SiM Mining Consultants)

H Greeff (CSIR)

July 2025

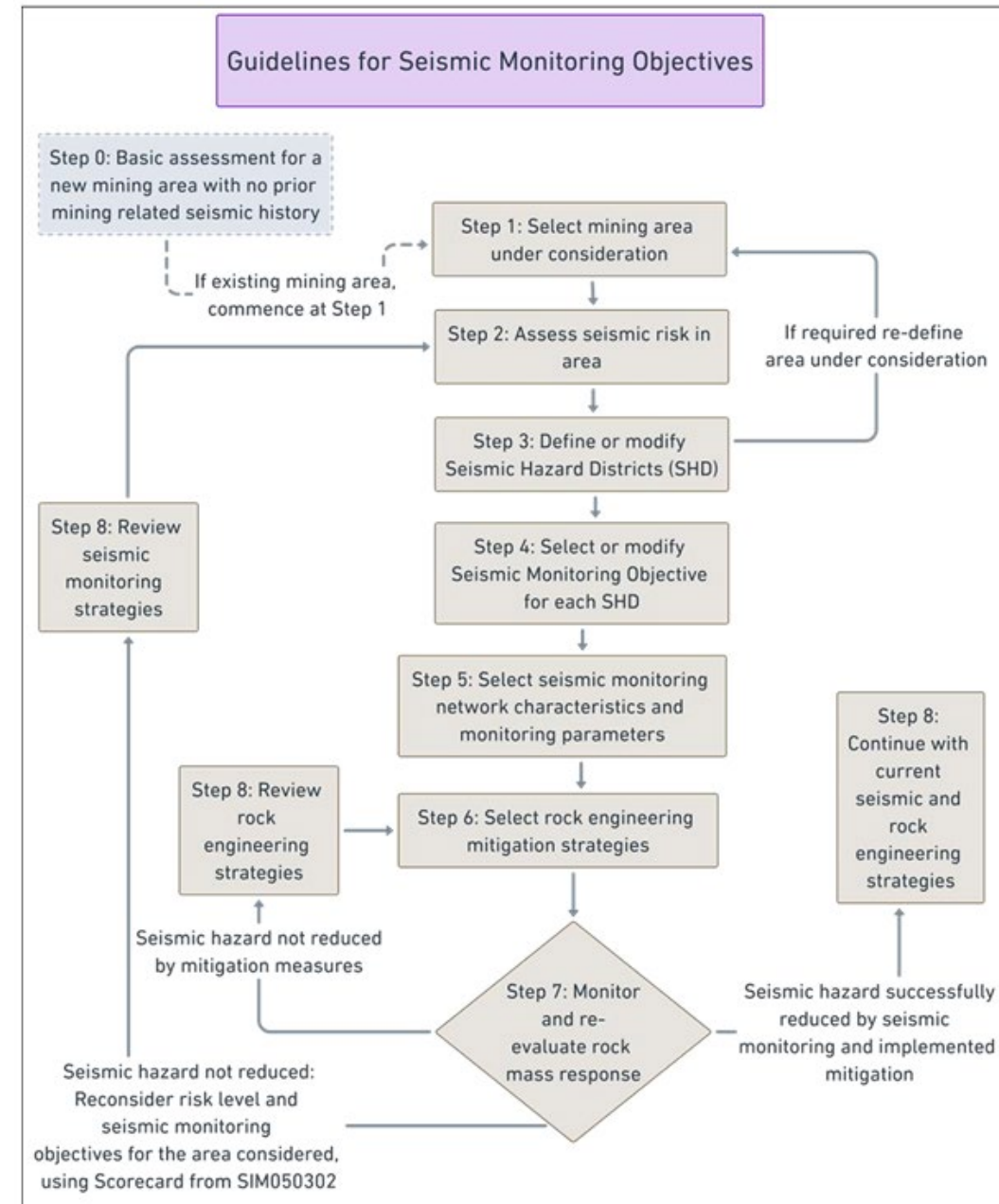


Figure 5: Seismic Monitoring Best Practice Guideline Process

# Seismic research project – short-term seismic rating

What did we NOT get from the research so far?

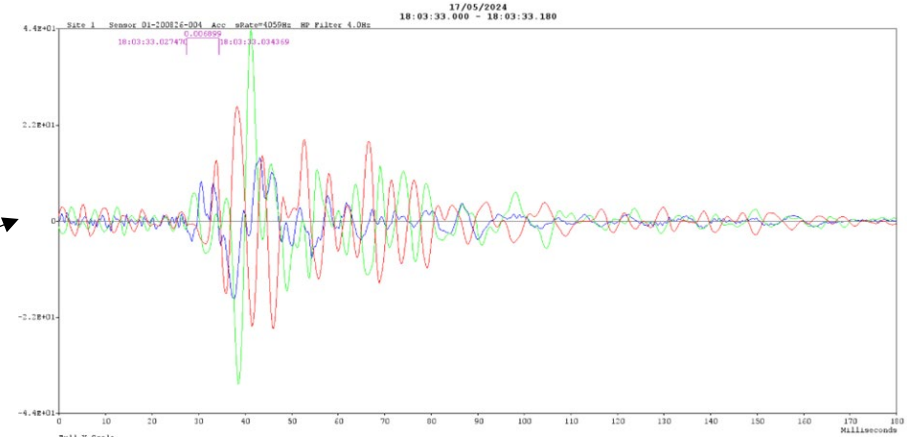
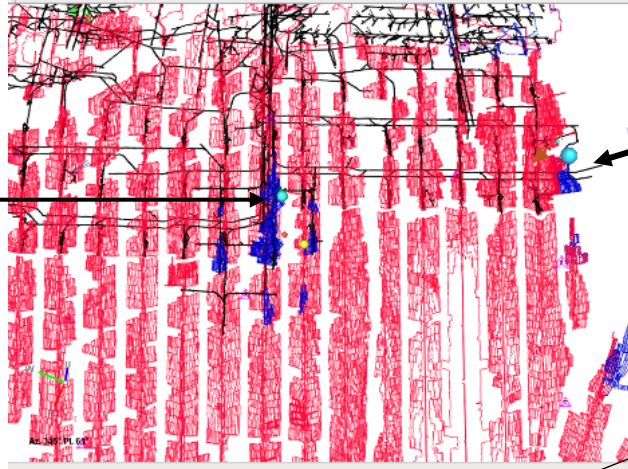
- A more accurate rating system implemented somewhere internationally that we can adopt
- New parameters to use in the rating system
- Additional parameters to use in the rating system

SibanyeStillwater has made some progress towards new parameters that may improve on the short-term seismic rating system – **combining seismic and non-seismic data**

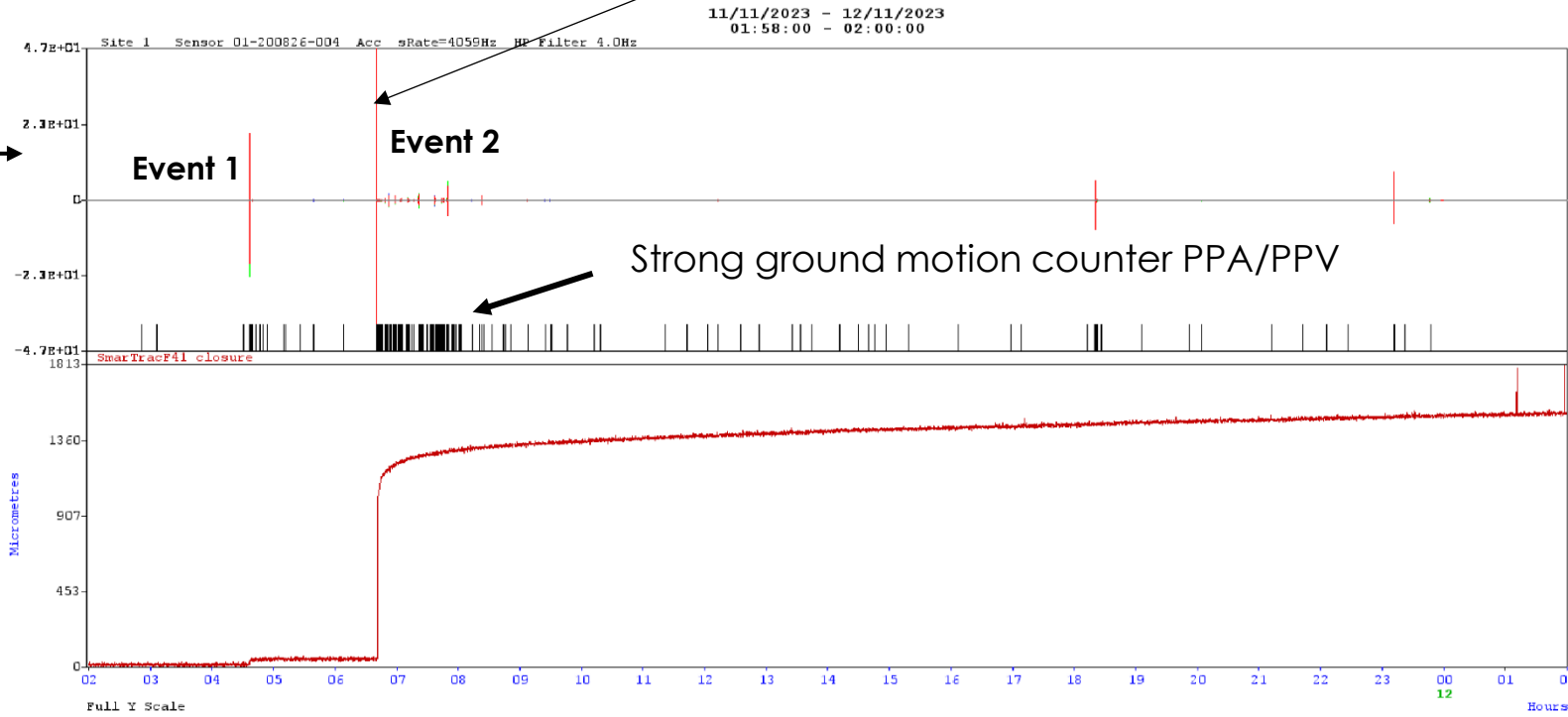
## Example of seismic and non-seismic data combined

**Event 2**  
11 Nov 2023  
0.5 Mag @  
4:30

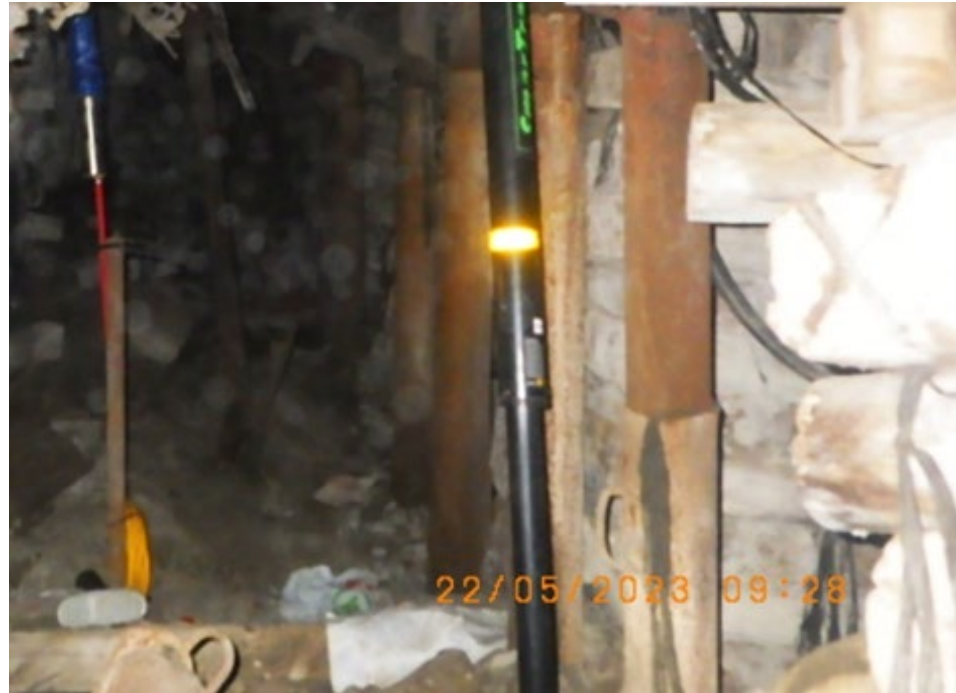
**Event 1**  
11 Nov 2023  
2.2 Mag @  
6:40



Recording from  
accelerometer  
and closure meter  
located at 38 21



## Monitoring equipment

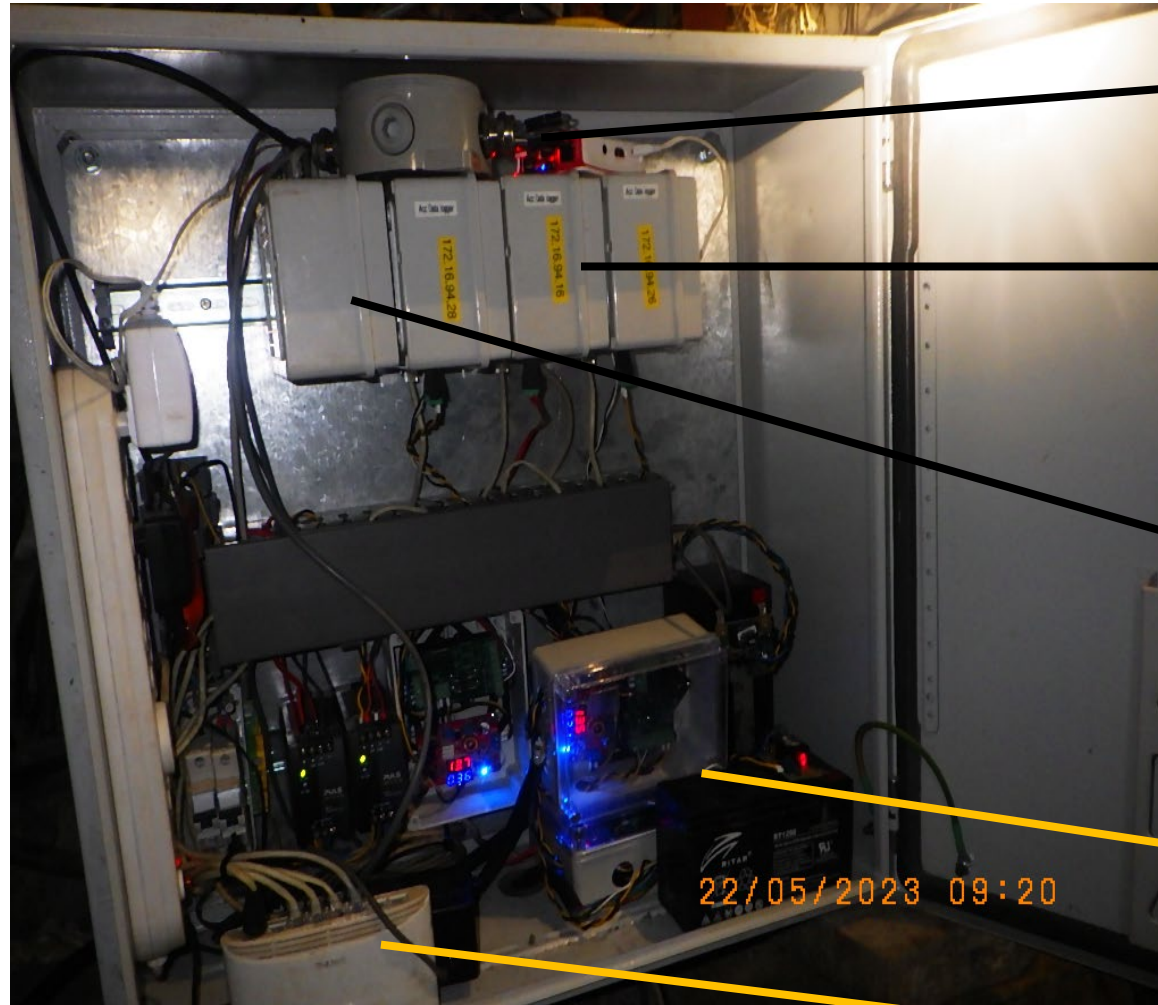


The SmarTrac telescopic type closure meter is robust and reliable, designed for underground mine use. Its primary function is to measure closure in a narrow tabular stope accurately. It also measures ride through the use of accelerometers. The frequency of readings is adjustable. With readings taken every 10 seconds, it can operate for a year on a single battery charge. It can communicate with a wireless communication system



To achieve the recording of micro seismic events (fracturing), two inexpensive 8 G mems accelerometers were installed. The accelerometer fits in a standard production hole (34 mm) and is grouted in the hole. The upper bandwidth limit of the accelerometer is around 1 KHz. The captured waveforms are sampled at 4 KHz.

## In-stope communication setup



Data logger rapid closure meter.  
Sampling at 30Hz

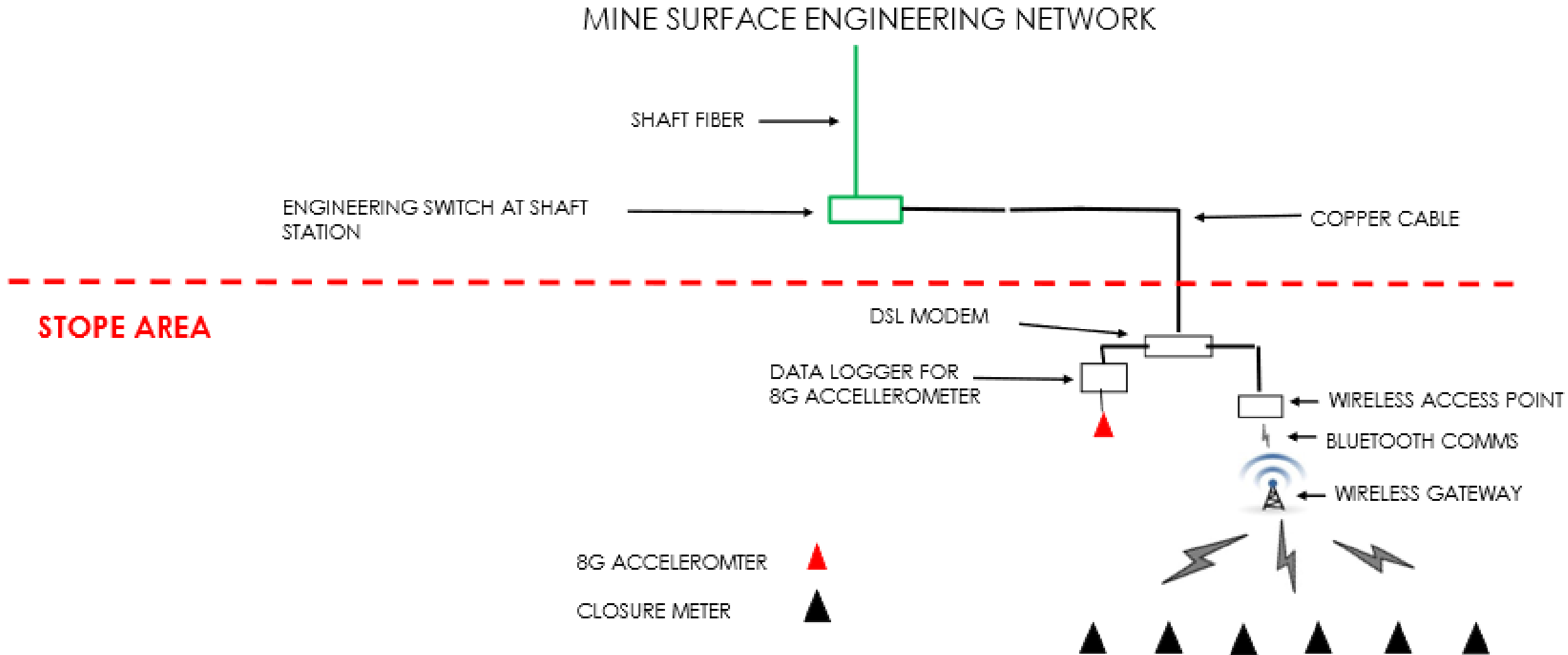
3 x data loggers for three mems  
accelerometers  
Gets time from ATU master on  
surface

Wireless access point and data  
logger for up to 8 x closure meters. All  
data transmitted to surface every 10  
seconds.  
Gets time from ATU master –  
common time with accelerometer  
data logger

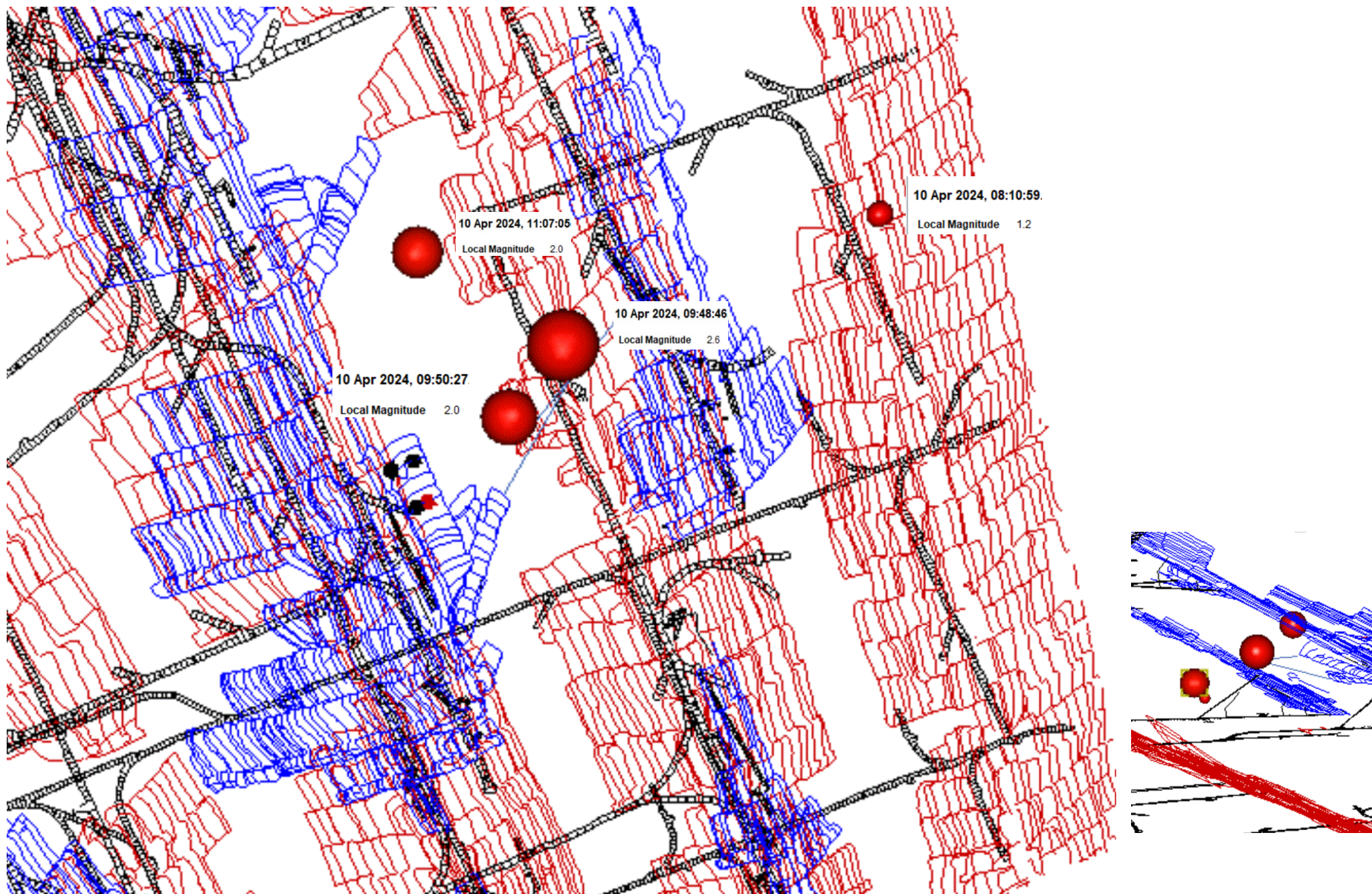
Power and ups units

Network connectivity to surface via  
remote modem

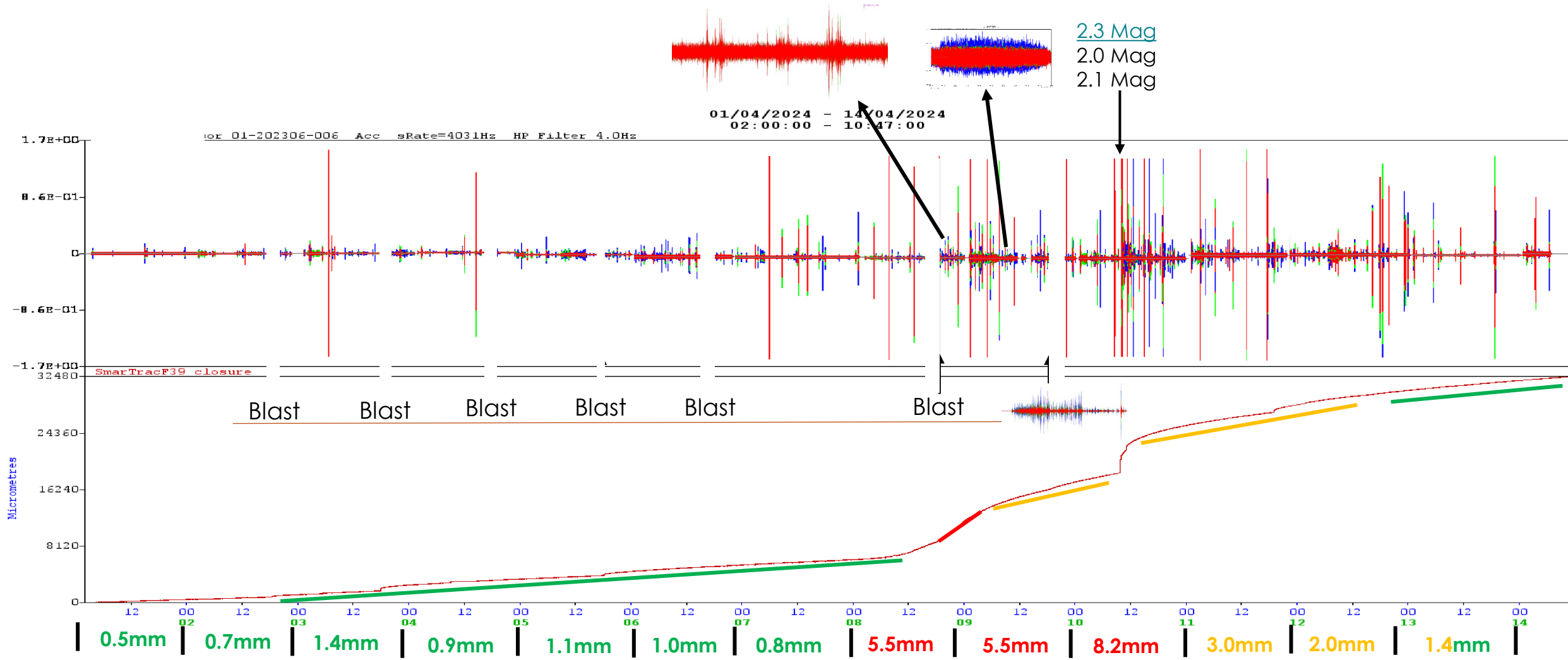
# WIRELESS COMMUNICATION DEVELOPEMENT COMPLETED EXCLUDING REPEATER



## Major seismic flurry 10 April at test site



# 8G ACCELEROMETER CONTINUOUS RECORD AND CLOSURE – 40 21 8E UPDIP PANEL



## Short-term seismic hazard assessment research

FOGAP wants to support the SibanyeStillwater research to benefit the industry by funding research into the integration of seismic and non-seismic instrumentation

- Leading practice principle
- Expand the number of instruments and generate large amounts of data
- Identify precursory activity or improvements in the short-term seismic hazard system