

Optimizing Blast Designs for Community Safety and Regulatory Compliance

Presented by: **Jaques Botha**
High-Tech Specialist



Problem Statement

Blasting close to communities

2010

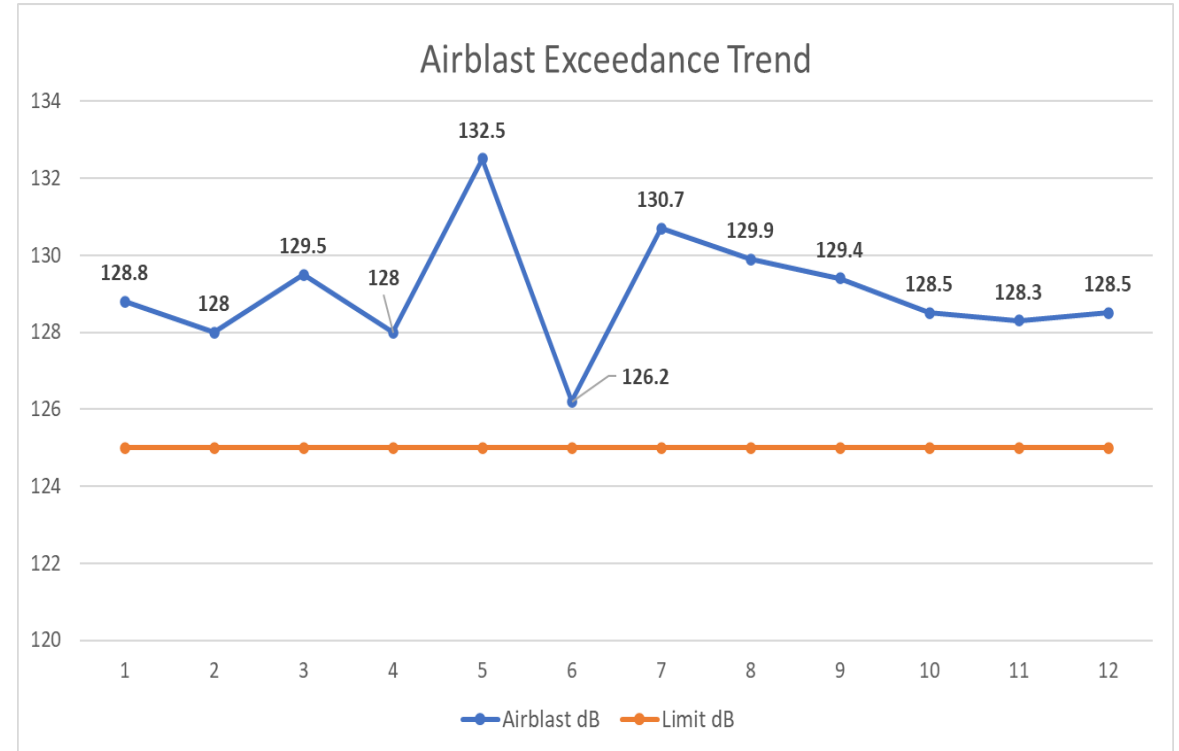
2023



Images courtesy of Afrisam

Problem statement

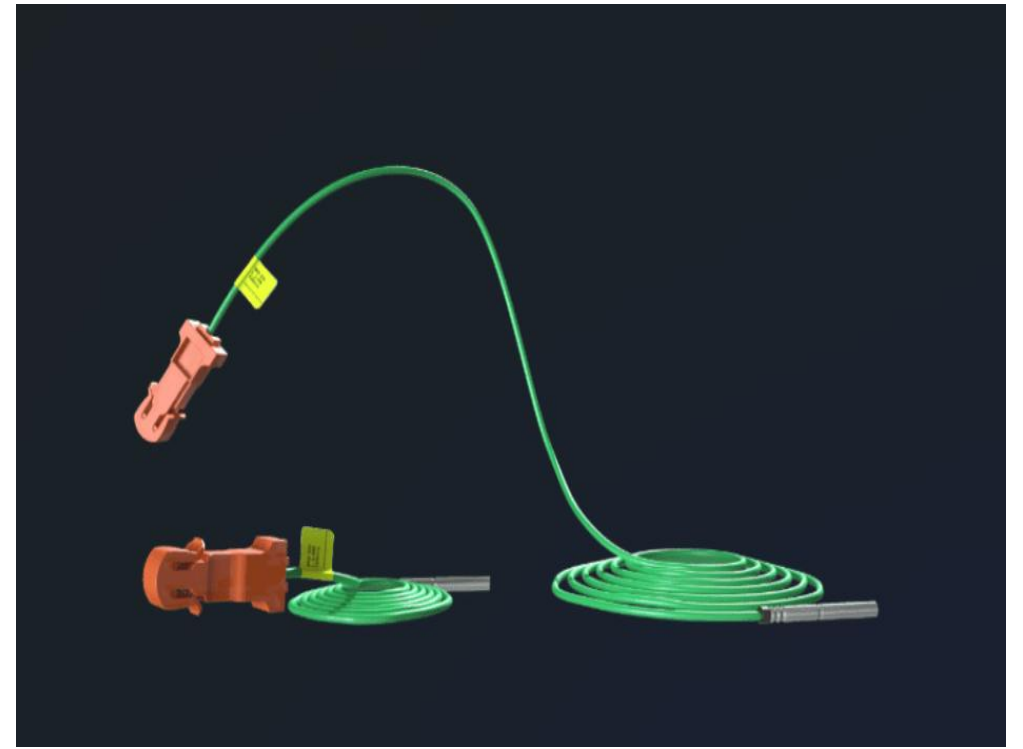
- Following a complaint from the neighbouring community about elevated airblast levels, the mining operation received a Section 54 notice.
- This halted mining activities until corrective measures were implemented.
- The operation had a mandated air blast level of 125dB.
- A total of 29 blasts were initiated in a six month period. During this time, 12 of these blasts exceeded the desired airblast limit at the community.
- Exceedance rate of 41.4%
- Pre-split and production blasts were main contributors to the elevated airblast levels.



Technical evaluations

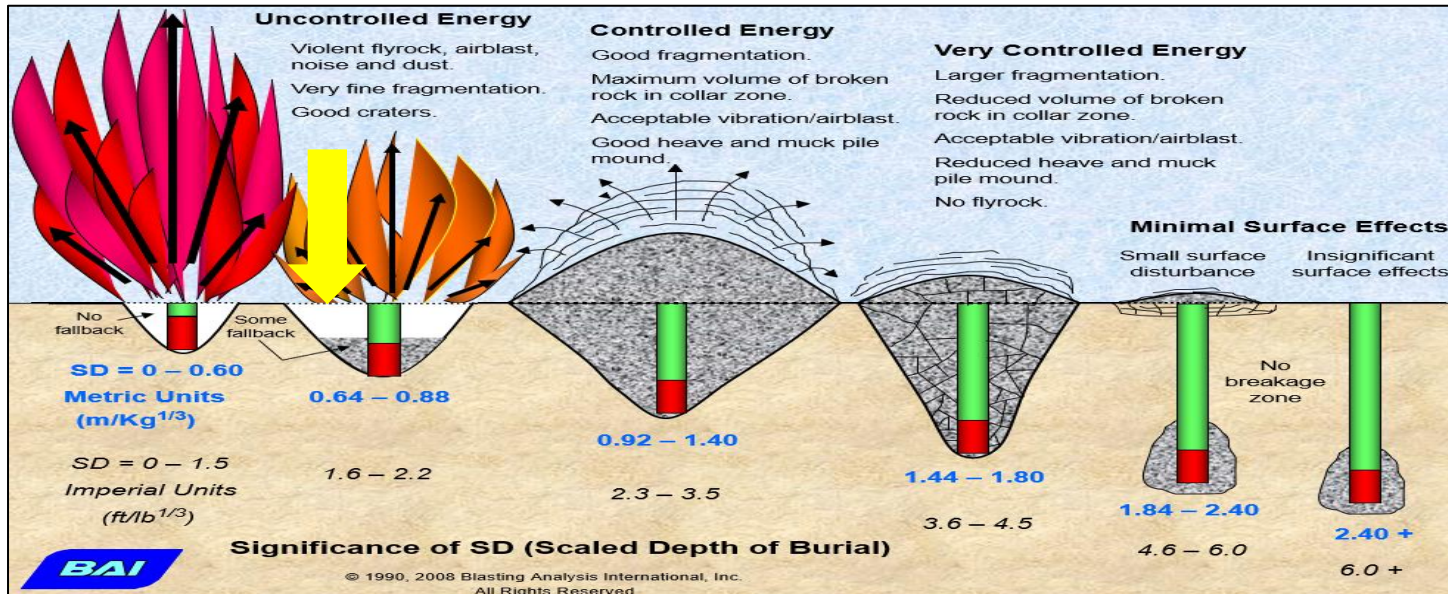
Initiation System and Timing

- A Shocktube initiation system was used on production blocks.
- Limited timing options.
- Inherent scatter of the pyrotechnic delay element.
- Multiple holes firing at a time.
- Increasing the charge mass per delay amplifies airblast intensity.
- Detonating cord were used for pre-split blasting.



Stemming length and Material

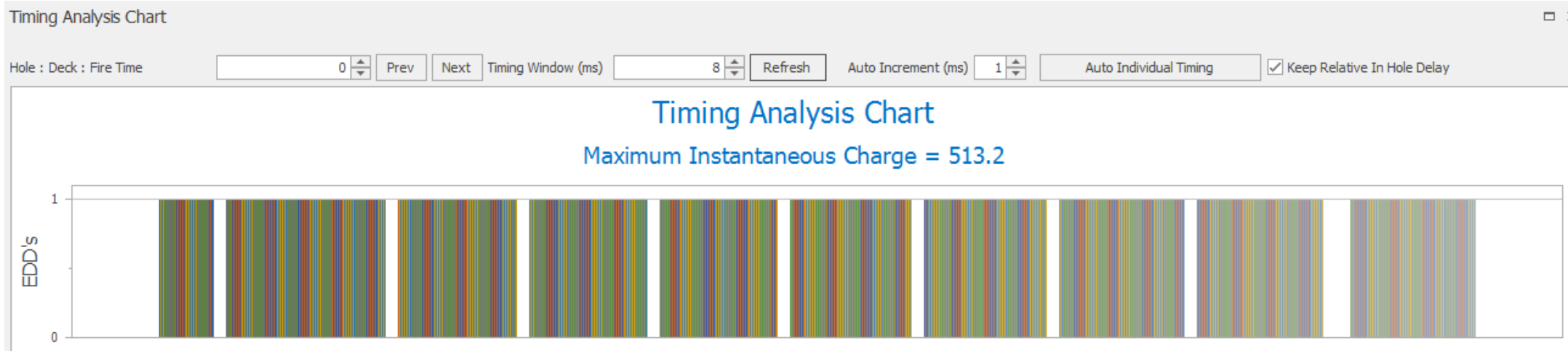
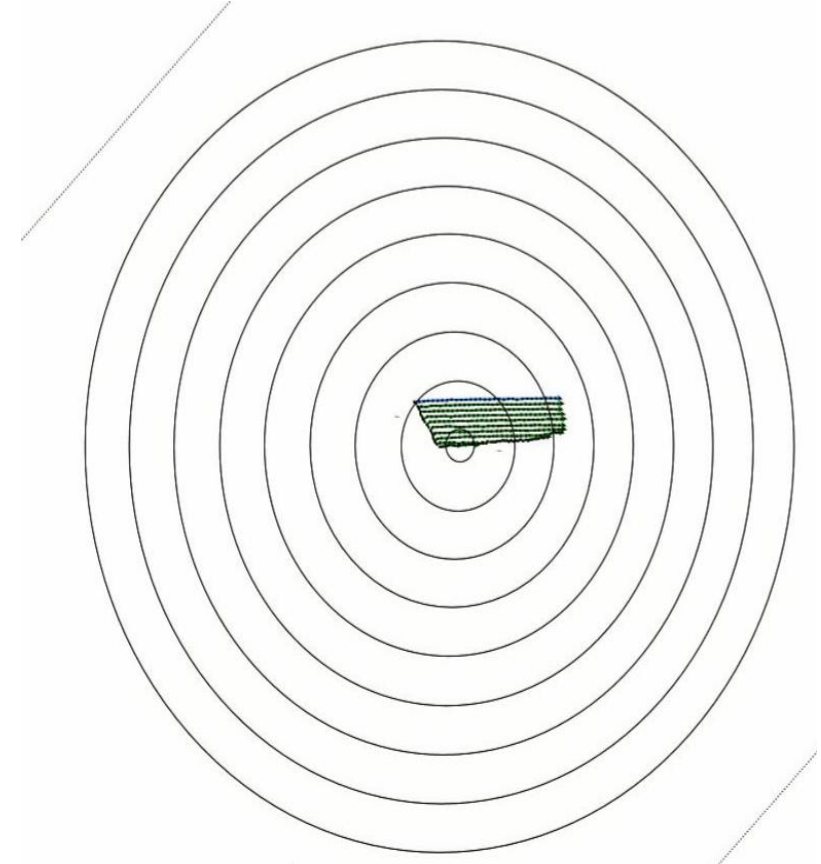
- The typical stemming length at the mine on production blocks were 2.0m, using a 165mm hole diameter.
- This fell within the uncontrolled energy range as per Scaled Depth of Burial (SDOB) calculations.
- Discarded material from the beneficiation plant was used as a stemming material.
- Open Pre-split holes.



Blast Design Changes

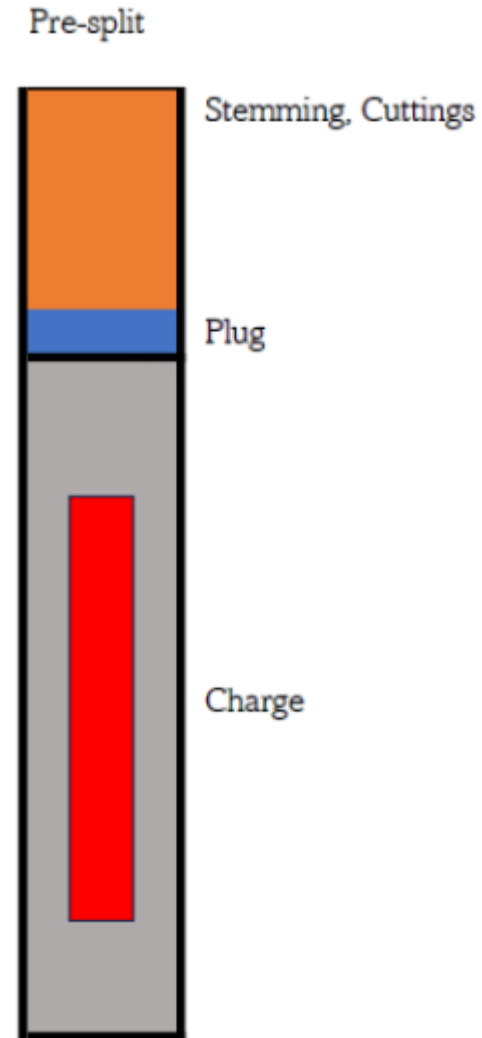
Initiation System and Timing

- The mine converted to the BME's AXXIS Titanium electronic initiation system on production blasts.
- This ensured single-hole firing, which eliminated the overlap of shock waves, minimising the intensity of airblast at the community.
- The mine eliminated the use of detonating cord on Pre-splits and switched to the AXXIS Titanium electronics.



Stemming length and Material

- Using the Scaled Depth of Burial (SDOB) as a guideline, the stemming length was increased to 3.0m, aligning with the controlled energy range.
- To mitigate the risk of oversize material in the collar region, a 0.5m air deck was introduced.
- The mine transitioned to using graded aggregates as stemming material.
- For pre-split blasting the charge was reduced by 5%. A stemming plug was placed at 1.0m, and holes were stemmed using drill cuttings to minimise airblast levels.



The Outcome



- The results when is all comes together:
- Safe and clean High wall.
- Descent fragmentation and blast gain.
- Acceptable airblast levels.

Additional Airblast Control Measures

Additional Measures

- Drone footage was captured for every blast.
- A renewed emphasis was placed on stemming control.
- As drilled CSV files were generated for each blast, enabling customised timing designs with accurate prediction models.
- Reduced the blast size, this gave the blasting team additional time to perform thorough quality checks.
- Engaged with the community before every blast.



Optimising Costs

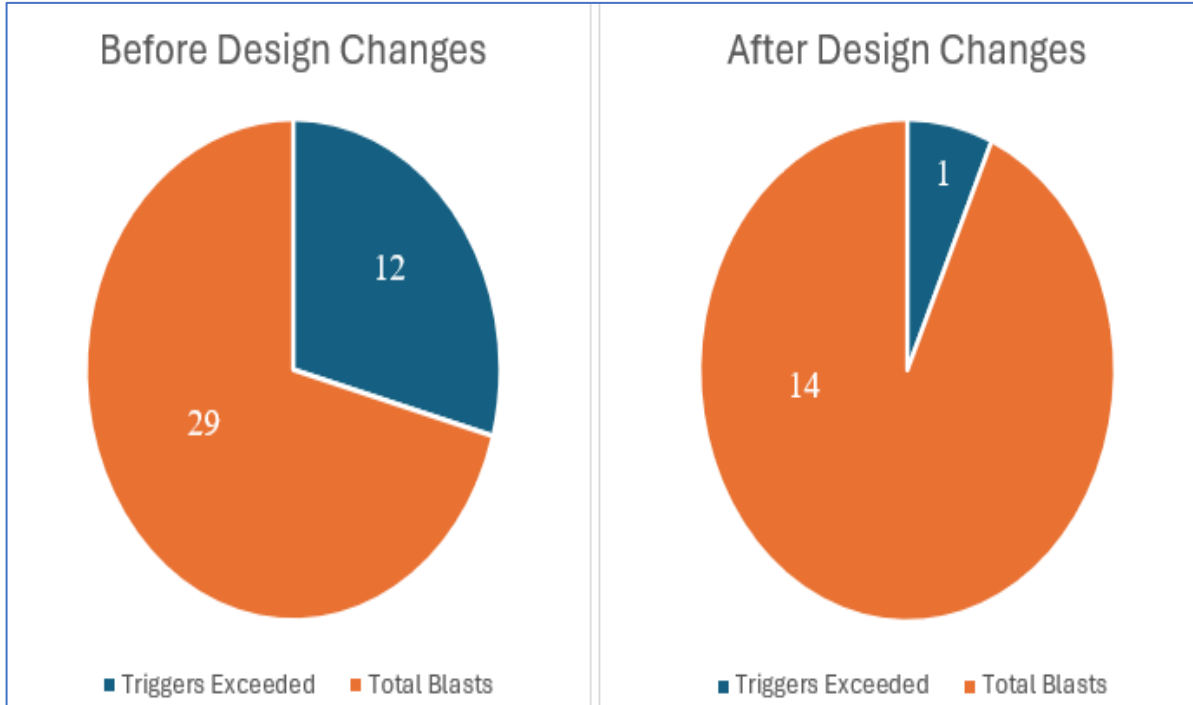
Finding a balance between safety, cost and Quality blast results

- To align blasting costs associated with the implementation of an electronic initiation system, and graded aggregates, The following was implemented:
- Expanding the pattern from a 4m x 4m to a 4.5m x 4.5m.
- Stemming length was adjusted from 2m to 3m
- Saving on per block with dimensions: 35m wide x100m long x21m deep

Metric	Saving
Drilling meters (m)	1 449
Holes (count)	69
Time (hours)	48
Time (shifts, 8h, 2 drills)	3
Explosives total cost (Total)	R502 142

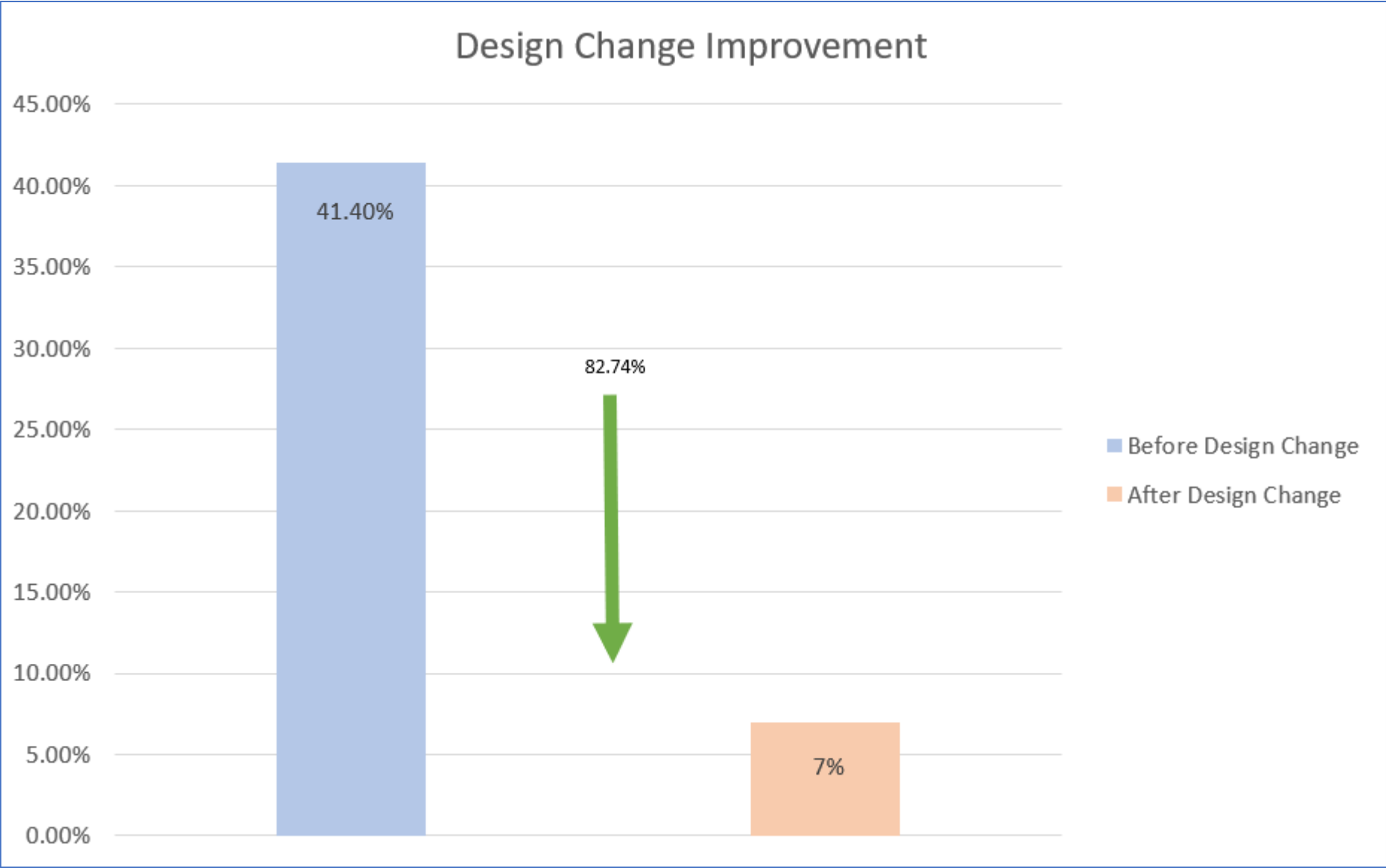
Improvements

Airblast Reduction



- Pre-implementation exceedance rate: 41.4% (12 out of 29 blasts exceeded 125 dB limit).
- Post-implementation exceedance rate: 7.1% (1 out of 14 blasts exceeded limit).
- Percentage improvement: 83% reduction in exceedance rate.
- Average exceedance airblast level = 129dB
- Average airblast level after optimization = 116.4dB

Airblast Reduction



**Additional Value
realised**

Additional Value

- Further production stoppages and other sanctions from relevant authorities were successfully averted.
- By maintaining operations, job security was preserved for mine employees—many of whom are from the local community.
- The community felt safe and respected.
- This allowed the mine to continue extracting coal in the area over a five-month period.
- Enhanced the mines reputation as a safety focused operator.
- Drilling efficiencies were optimised by 21%.
- Alternatively, the mine could extend production blasts by an additional 27m x 35m (48 holes), effectively enabling one free blast after every 5 blocks— Boosting production

THANK YOU

**Our Promise
to you:
Unwavering
Commitment to
Your Success**

At BME, we believe in a partnership-driven approach
to ensure the success of your mining operations.
Our promise to you includes: