

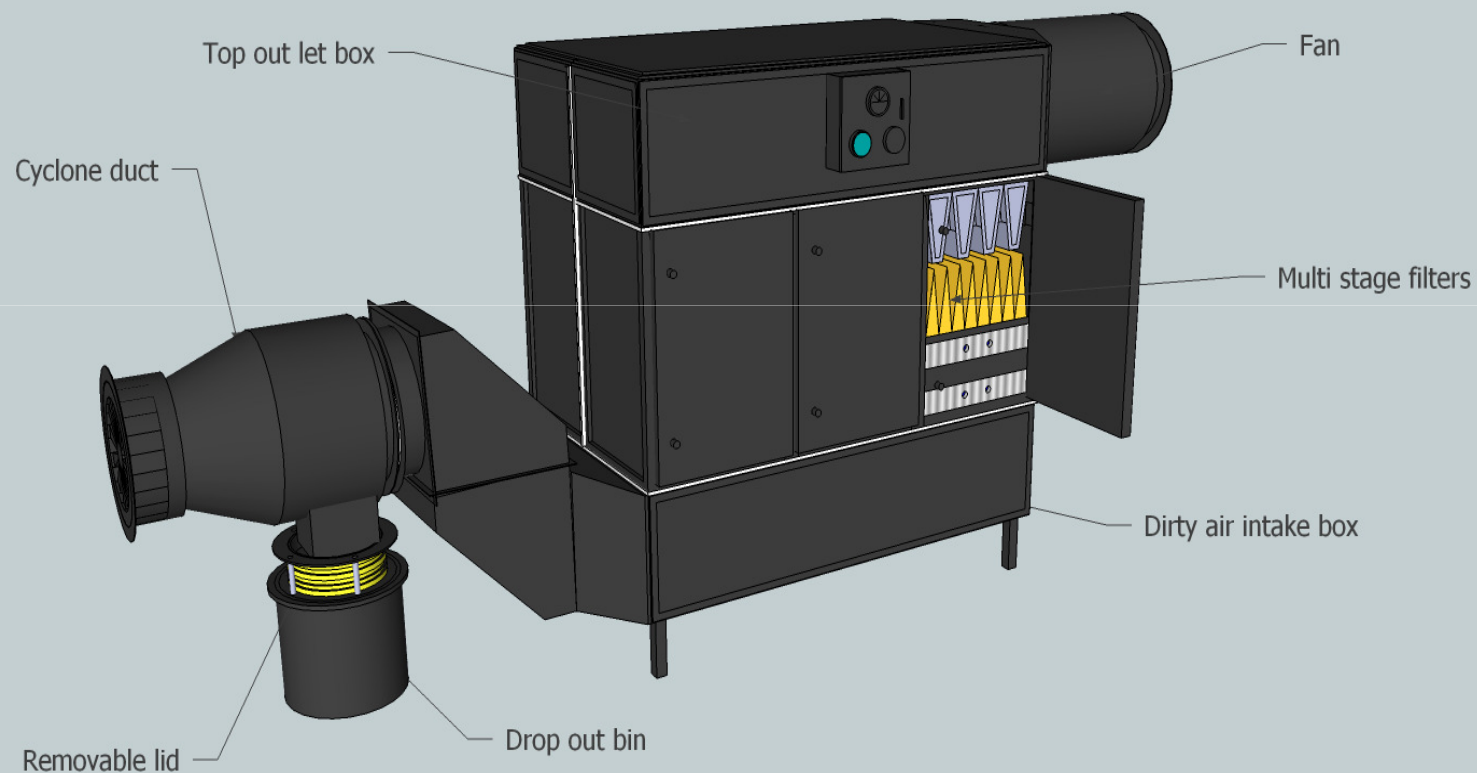
Multi- Stage Filtration System At Phakisa Mine

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17 July 2013

Multi-stage filtration system unit



- Overview of the system
 - Operating principles of the system
 - Filtration stages effectiveness
- Benefits to date
 - Graphs
- Conclusion
- Phakisa plan going forward

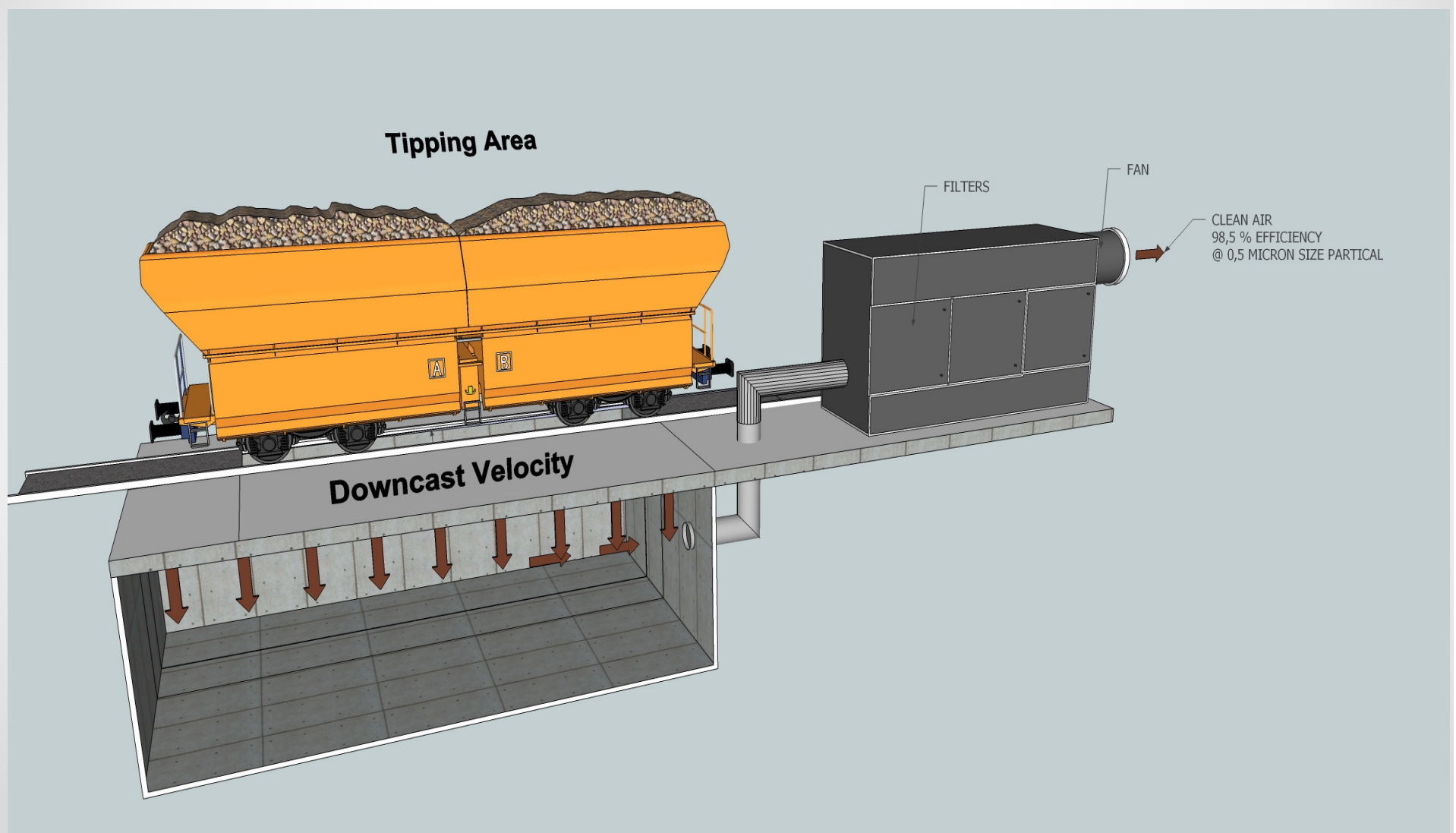


Multi-Filtration System Overview

- The system was identified as primary preventative control
- Implemented in May 2012 at Phakisa Mine
- Ten units installed
- Initially, three stages
- Pre-filtration stage added on high dust load tips
- Pocket filters were replaced with the HEPA filters
- Robotic predictive maintenance system installed

- This system entails:
 - Exhausting dusty air from the main tips through a series of filtration stages
 - This removes dust particles and releases clean air into the intake air system
- Each filtration stage is made up of a different filtration material
- Efficiency of dust filtration depends on the number of filtration stages, size and the general conditions of the filter unit

Schematic overview



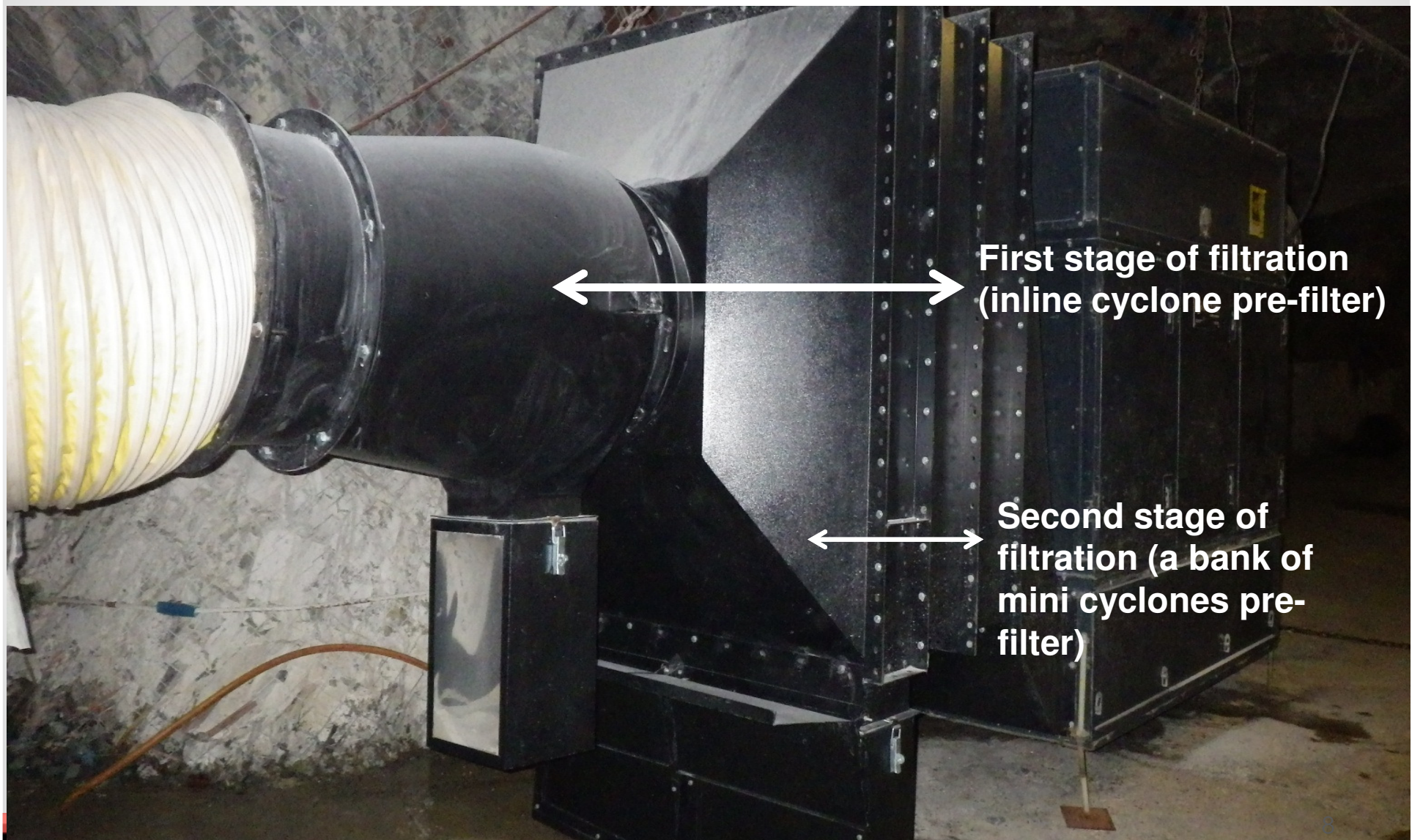


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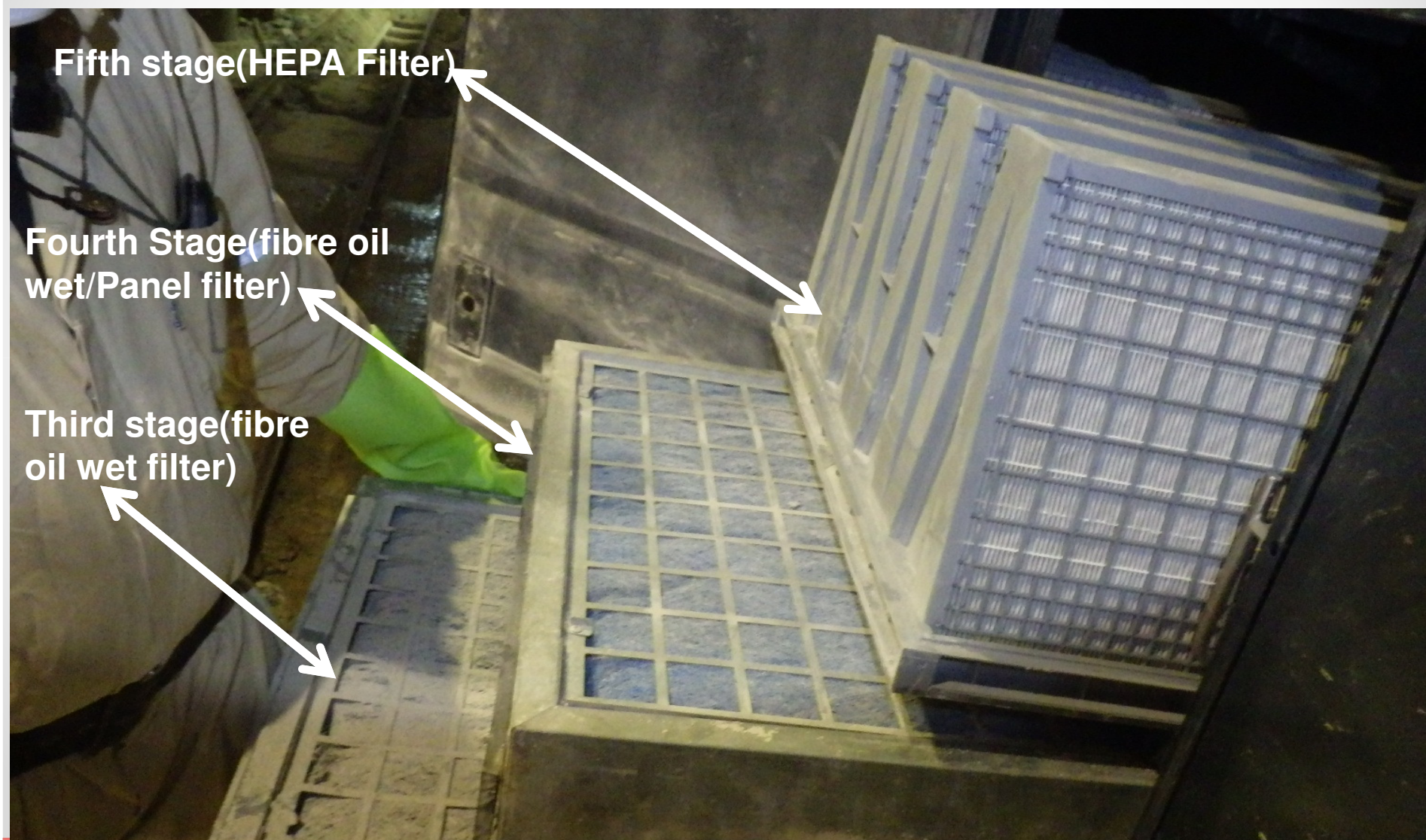
Multi-Filtration Stages Effectiveness

- With three stages of filtration and an average improvement of 71% in terms of dust load (TWA) on the intake air ways was achieved
- However with a pre-filter added, and pocket filters being replaced:
 - With HEPA filters an average improvement of 86% was achieved
 - Addition of a of pre-filtration system resulted in positive cost implications
 - HEPA filter designed to eliminate 98.5% of 0.5micron and 100% at >1 micron particle size

Multi-Filtration System Stages

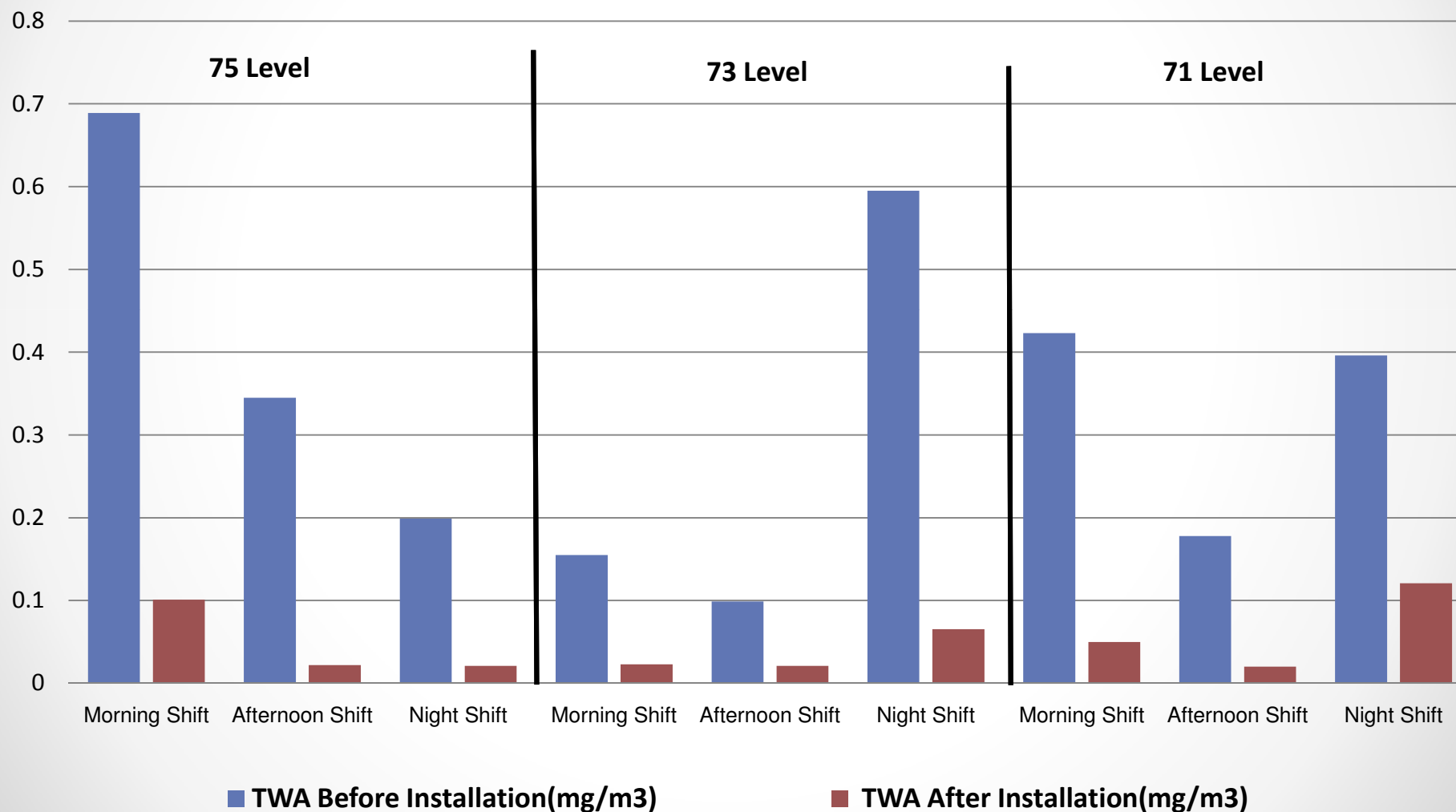


Different filtration stages

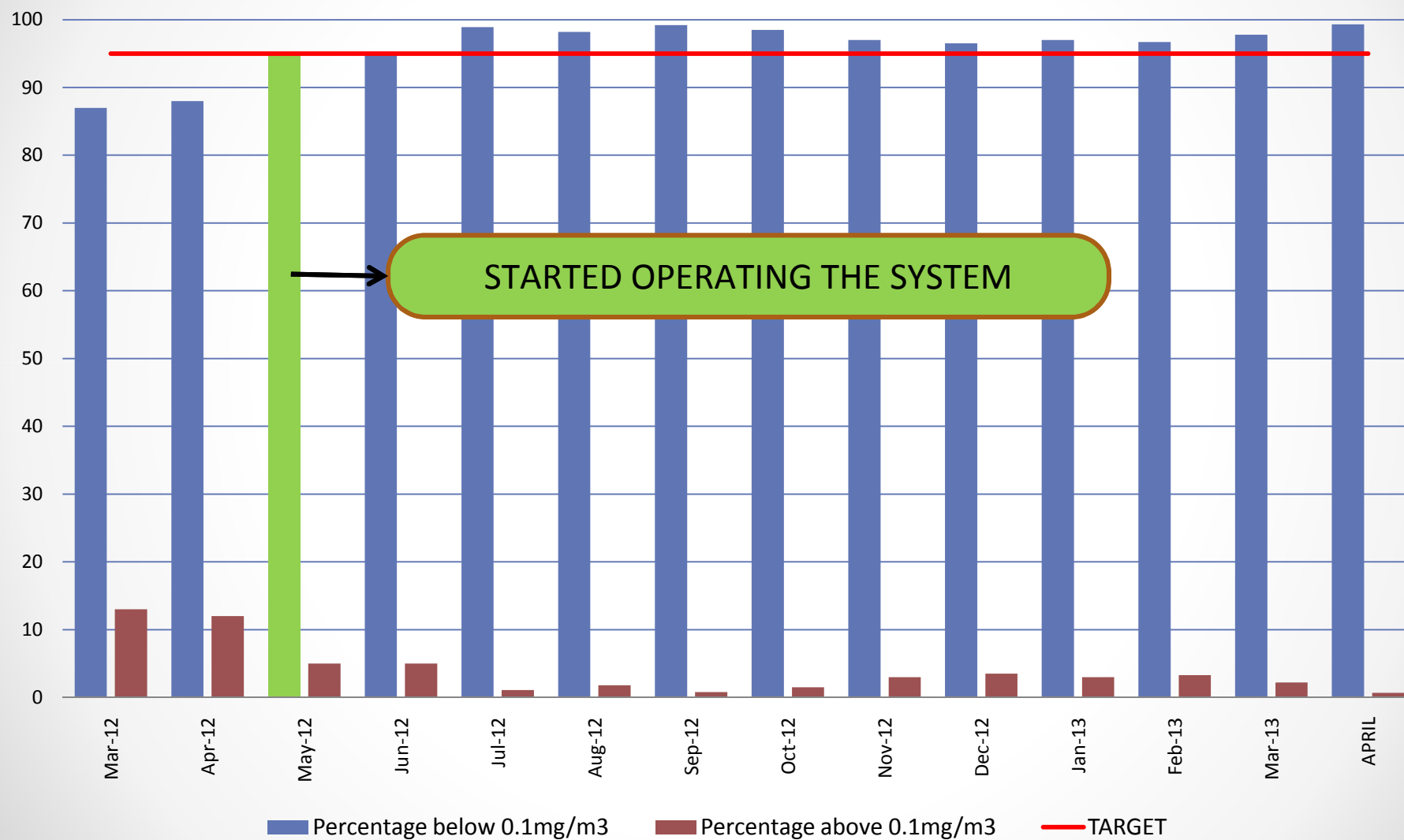


Benefits to date

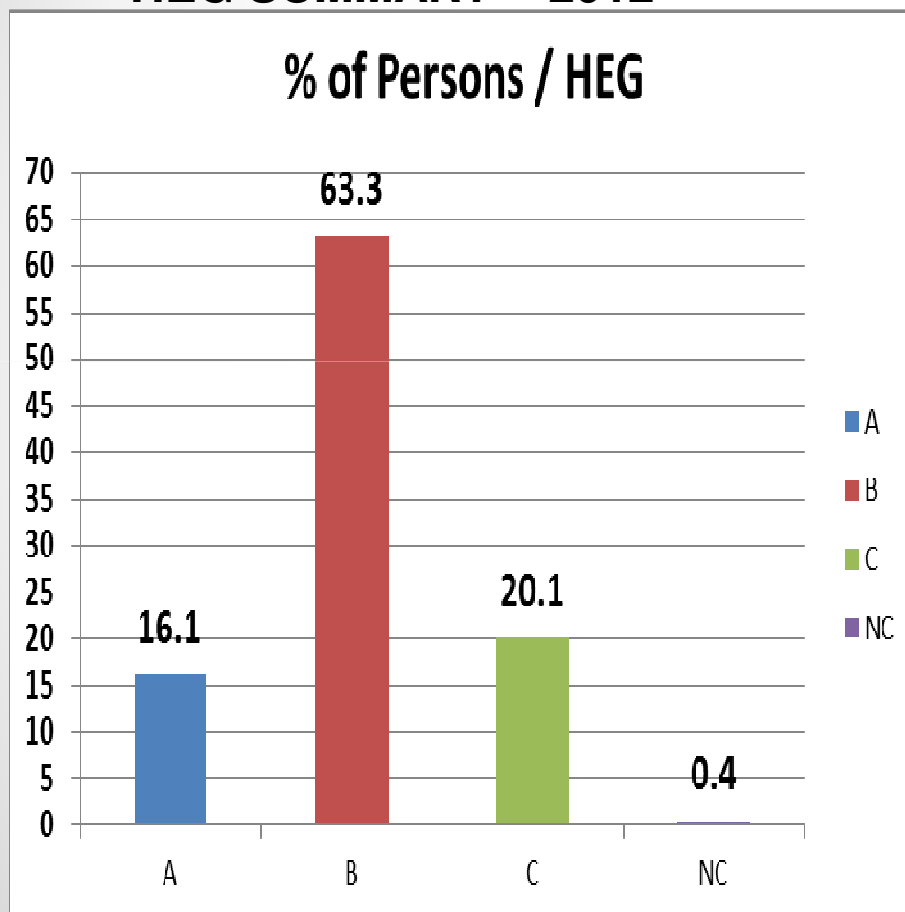
Area Sampling Results Before and After Implementation



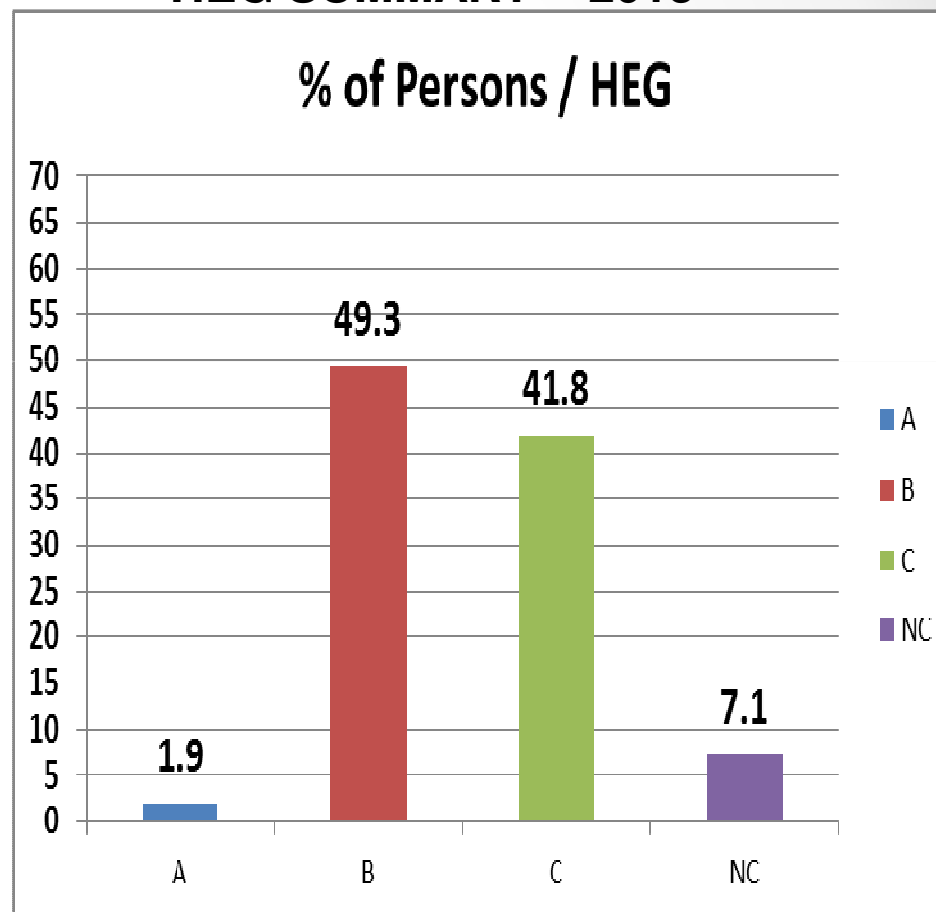
Compliance to 2008 Silicosis Elimination Milestone



HEG SUMMARY - 2012



HEG SUMMARY - 2013



- The Multi-Stage Filtration system resulted in significant improvement
- Reflected on the milestone achievement
- Reduction in number of employees exposed to $\geq$ OEL
- Can get to as low as reasonably achievable crystalline silica dust exposures

- A variety of secondary controls on the intake air ways are being explored
- The face is still a huge challenge but other interventions are being looked at



Multi-Filtration System

Mr Fanie Bekker

- Installation
- Maintenance
- Training
- Safety during Filter changing
 - Disposal of dirty filters
- Communication and responsibilities

- Installation was physically demonstrated and a demonstration Video issued by the OEM.
- The assembly and installation of the filter unit is easy and short
- the pipe installation may be time consuming especially
In areas with limited space.
- The installation of the units was done simultaneously with the tip covers
- Purpose of tip covers is to avoid up casting of tips and to allow improved suction by the fans



Multi-Filtration System





- Pressure indicator light has been installed on all filtration units
- The indicator light turns red once the differential pressure exceeds 400pa
- The indicator light reduces dependency on an individual on timing the necessity for the filters to be changed,
- When the robot turns red it is investigated within 12 hours and rectified within 24 hours
- This ensures that the filters are in a good condition at all times, hence efficient



- On the job Training on maintenance and changing of tip filters is done by OEM (section on installation DVD).
 - To tip attendants
 - Maintenance crew
 - This training take about 30 minutes.
- One on One Interviews with key role players
- Inspections and Planed Task Observations
- Communication on principle of operation extended to loco-operators

- Maintenance plan:
 - The maintenance crew has to know the procedure for changing the tip filters and the Fan lock out procedure.
 - Changing of filters is done during shift change overs or on an off shift to avoid dust over exposures
 - Sealable carry bags and Protective Equipment (respirators, long gloves, goggles etc) a must
 - Coaching and PTOs a must
 - Dirty filters are carefully put in a zipper bag, sealed and send to wash bay on surface
 - The filter bags are Disposed of as general waste

Adequate PPE



- The Shaft Foreman is directly responsible for the tip covers and tip multi-filtration system
- The Shaft team leader does visual inspections on every shift and report to Shafts foreman
- The tip attendants are on the tips during all shifts and report any deviations to the control room and to the Team leader
- The tramming Mine overseer also report any deviations with regard to the tip covers and multi-filtration system
- Occupational Hygienist does visual inspections and evaluate effectiveness
- All loco operators aware of the robotic system principle

Mr. Moses Motlhageng

Lessons Learned:

- We must have “buy in” from all stakeholders
- The installation must be done with trained or skilled individuals
- The maintenance crew to know the procedure for changing filters
- A pressure indicating warning system has to be installed to ensure filters are changed timeously
- Take the OEM up on their offer for training programmes both for installation and maintenance

Make or break issues:

- The system will only work if properly and timeously maintained
- Ownership of individual sections
- Training
- Back up service of spare parts and replacement filters