

Case Study: Adoption of Conveyor Belt Automated Transfer Point Dust Suppression and Continuous Real Time Monitoring at Exxaro Matla

Happy Morebodi

Biography

Happy Morebodi has 28 years experience in the ventilation department of which 6 months was in underground deep mines and the rest in underground coal mines. He is married and has four kids (two boys and two girls).

Happy Morebodi started his mining career as a ventilation trainee at South Deep in 1995 while it was still owned by JCI. He then moved to Tavistock Collieries the same year where he obtained his practical and intermediate certificates in Environmental Control. Early in 1996, he was appointed Ventilation Assistant at Arthur Taylor. He then moved to Greenside Colliery in 2004 as a Ventilation officer till 2009. He obtained his Certificate in MEC in 2010 passed my whilst at Kroonfontein. I was then Appointed as Vent Supt.

Moved to Exxaro Matla since 2013 to date as Head Ventilation. I have 9 years proto experience.

He is currently a Ventilation Superintendent [12.1 Appointee] at Exxaro Matla. He is a member of both Mine Ventilation Society South Africa and SACESHA where he serves as a Council member.

EXXARO MATLA COAL

Adoption of

Conveyor Belt Automated Transfer-Point Fogging
Dust Suppression System and Continuous Real
Time Dust Monitoring Leading Practices



"Safety always, all the way"



Background

- Our responsibility as Matla Operation is to ensure workers' exposure to respirable dust is at acceptable levels and does not exceed $2\text{mg}/\text{m}^3$ average concentration for an 8-hour period.
- Hence Matla decided to adopt the CBAT fogging Dust Suppression System and Continuous Real Time Dust Monitoring.
- With the recent increase in world-wide environmental legislation, there has evolved a general requirement for the employer to continuously monitor dust and ensure that emissions to atmosphere are kept below the maximum legal enforcement level.
- Also, Mineral Council of South Africa is engaging mining companies to look at how they can effectively control dust and have stringent measures in place to ensure dust levels are lowered to below the prescribed limits.
- During 2019, Matla Coal Mine also embarked in an initiative of installing continuous real time dust monitors at the conveyor belts drives. The name of these monitors are called GST 13D and Energy Tech 301 – Dust Monitors for mine 2 and 3 respectively.



Overview

1.Scope of the Leading Practice

- Dust Suppression Installations

2.Adoption of the Leading Practice (CBAT SLP)

- Leadership Involvement
- Underground Installation - Sampling Results
 - Pre-installation & Post installation
- Challenges & Learnings

3.Use of Real Time Dust Monitors (CRTM – LP)

- Continuous real time dust monitor
- Benefits of the monitor
- Progress of CRTM : Current Installation
- Success of CRTM
- Challenges of CRTM

3.Conclusion

4.Acknowledgement



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Scope of the Leading Practice



Underground Installation

- Selection of the system – engaging preferred Supplier
- Identification and select(Fogger unit)
- Ion of pilot site – baseline dust measurements



Demonstration of the Leading Practice



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Leadership Involvement

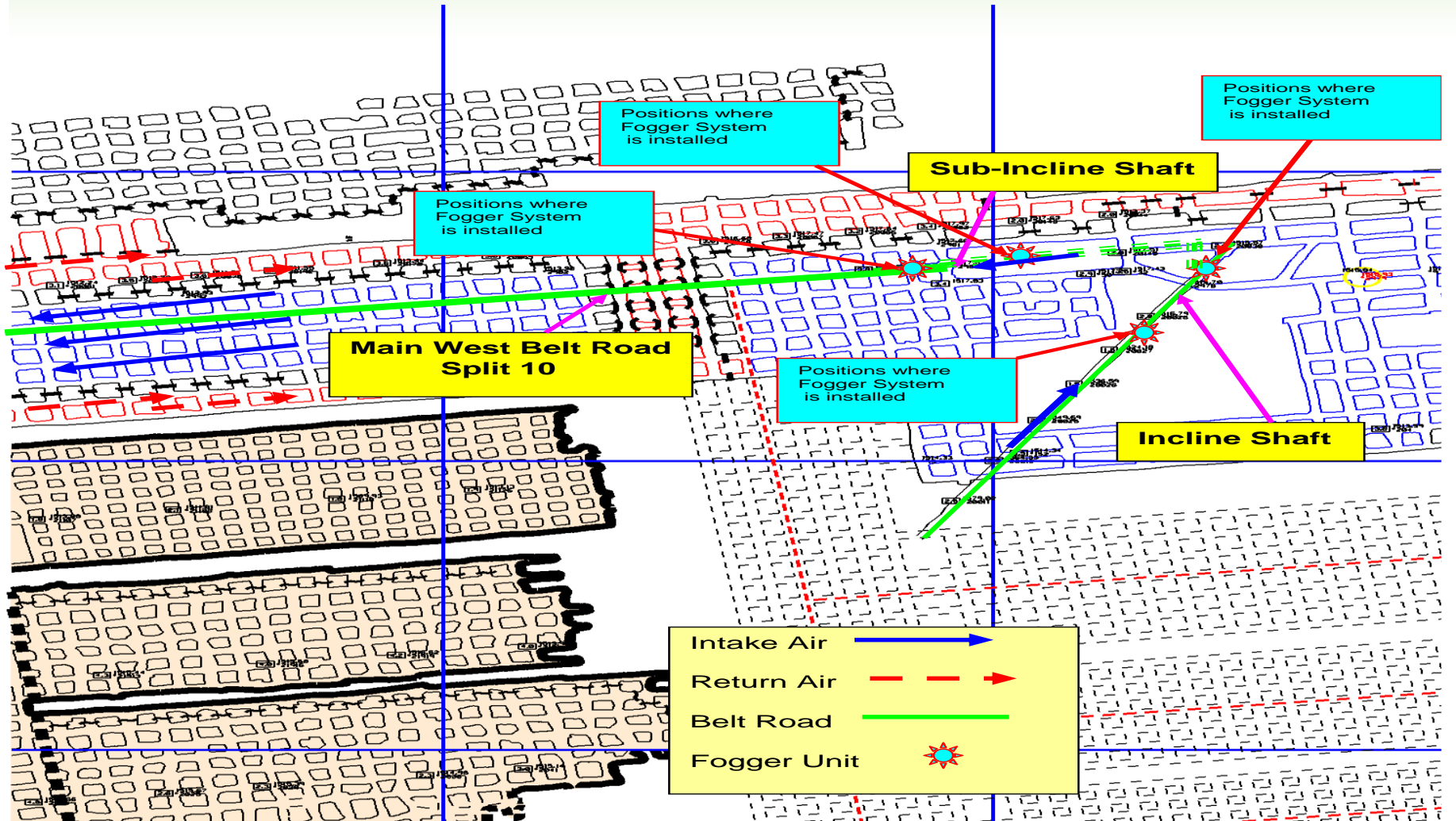
- **Project Sponsor**
 - Manager Mining
- **Project Manager**
 - Head Ventilation
- **Unions & Associations**
 - Solidarity Representative
 - NUM Representative
- **Mine Team**
 - Chairperson(Engineers)
 - VOHE Practitioners
 - Shaft managers
- **Other Members**
 - MOSH Dust Team
 - Suppliers



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Underground Installed fogger – 2 Seam Shaft Area @ Matla 2



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Technical Specifications of the Fogger Dust Suppression System

Fogger Dust Suppression System	
Energy consumption	<ul style="list-style-type: none"> •380 VAC, 7.5 kW Electrical Motor
Water consumption	<ul style="list-style-type: none"> • 40 litres/min, High pressure pump (machine rated up to 120 bar) • 0.2mm nozzle orifice (number of nozzles installed = 420) • Operating pressures of between 70 and 90 bar
Application	<ul style="list-style-type: none"> •Vapour Fogger at Transfers, Crushers, Tip Screens, Haulages, Roadways, Footwall, Air Scrubbing of Airways, Bunkers and Silos
Installation	<ul style="list-style-type: none"> •Four to Six weeks after delivery. Two weeks lead way after order has been placed
Operation	<ul style="list-style-type: none"> •Manual •Automated start up signals. Audio, air movement, IR, mechanical
Maintenance	<ul style="list-style-type: none"> •Regular maintenance
Impact on occupational environment	<ul style="list-style-type: none"> •Cleaner Environment •No impact on environment •Product bio gradable
Cost to purchase and install	<ul style="list-style-type: none"> •R233, 191, 04
<u>Operating costs</u> Maintenance	<ul style="list-style-type: none"> • R68 000,00/month average per shaft



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Underground Installation - Dust Results

SUMMARY FOR THE DRIVE SAMPLES AT THE BEGINNING

SECTION	AVE. DUST COUNT BEFORE	AVE. DUST COUNT/NO AFTER
	Fogger Sytem off.	Fogger Sytem on
sub incline feeders	0.64	0.08
main west one spilt10	0.28	0.18
tripper spilt 57	4.36	0.35
section drive	0.66	0.02
main west two drive	0.19	0.11
Ave dust	1.23	0.15

Notes:
Measurement methodology



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Challenges

Fogger Dust Suppression System

- Numerous problems were experienced during the sampling period, for example
 - Employees tampering with the system – closing of valves
 - Employees closing main water feeding line, etc
 - Challenges on installation and operation of the system not foreseen
 - OEMs competencies not compatible to mine's requirements
- Reasons for these tampering
 - Wind chill factor and poor visibility

A positive change only transpired after the issue of the Fogger unit was discussed with employees during the pre-shift safety meetings.

Supplier has an extensive service and maintenance plan for the Fogger units – without the cooperation of any mine or host it is an impossible task to ensure the smooth running of any system.



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Learnings

- The composition of the project team
 - Include the engineering department as per the MOSH leading practice adoption guide
 - Include operators to facilitate better “buy in”
- Ensuring Supplier competency and compliance to the mine standard
- System required modifications to suit specific areas. “One size does not fit all”
 - Visibility issues need to be addressed
- The involvement of unions and associations facilitated a better behavior change communication process
- Positive feedback received once system was operational.
 - Some employees questioned if the same principle can be applied elsewhere within the mine to alleviate high dust counts
- The leading practice adoption guiding principles has assisted management in attaining skills for the use of adopting and rolling out other best practices
 - Communication, stakeholder involvement and employee “buy in”
- The project has raised the awareness on the hazards and controlling of dust in an underground mine.



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CRTM

- **Continuous Real Time Dust Monitoring
Leading Practices**



Belt drives where monitors are installed

- At Mine 2 We have 7 Sensors installed on Drives namely the:
- Main West 1
- North 1 Belt Drive
- North 2 Belt Drive
- East 1 Belt Drive
- East 2 Belt Drive
- South 1 Belt Drive
- South 2 Belt Drive



Continuous real time dust monitor : Energy Tech 301 Mine 2 and 4 Seam

AF18 DRIVE

H28 BELT DRIVE

E19WB BELT
DRIVE

NORTH BELT
DRIVE

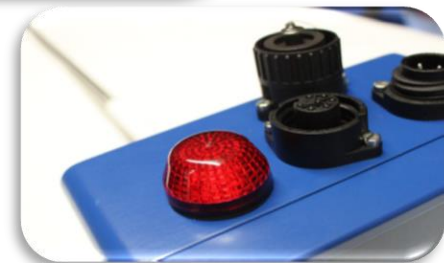
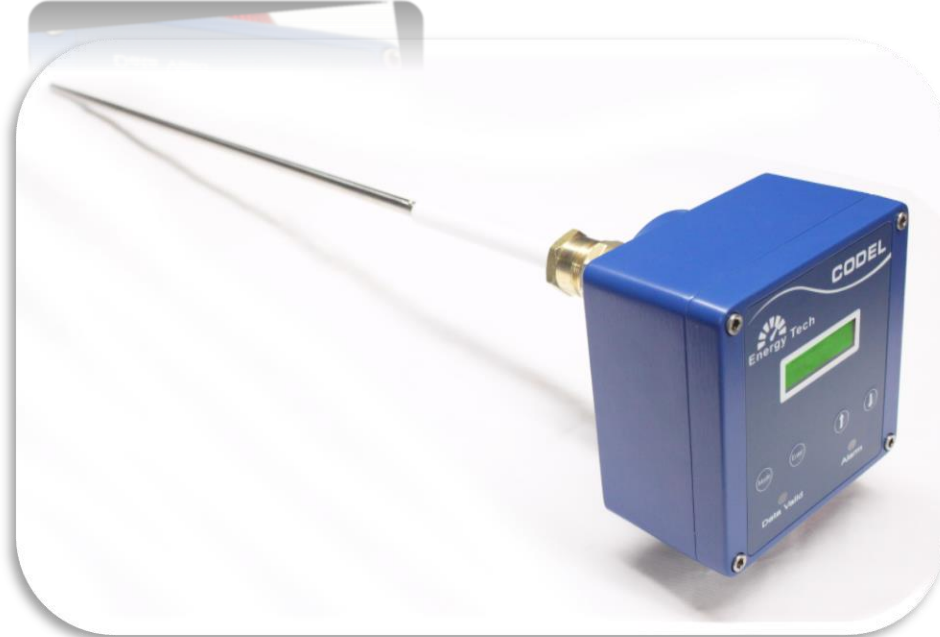
SOUTH BELT DRIVE

EAST BELT DRIVE

H28 BELT DRIVE

SOUTH BELT DRIVE

AF18 DRIVE



Continues real time dust sensors As shown in the Control room

Environmental			
U221 SUB CO 1: -2,04 ppm SUB CO 2: -2,14 ppm U222 U222 SUB CO: 0,18 ppm	SECT 21 A/B DRIVE SECT 21A DRIVE CO SENSOR: -0,85 PPM SECT 21A DRIVE SO2 SENSOR: -0,99 ppm SECT 21 DRIVE CO SENSOR: 1,71 PPM SECT 21 DRIVE SO2 SENSOR: 0,84 PPM	S WALL DRIVE SENSOR S WALL DRIVE CO: 5,13 ppm S WALL DRIVE SO2: 0,34 PPM	S WALL DEWATERING SENSOR S WALL DEWATERING CO: -45,02 ppm S WALL DEWATERING SO2: -0,37 ppm
MW1 MW1 SUB CO: 3,31 ppm MW1 DRIVE CO: -0,14 ppm MW1 SO2: 0,09 ppm MW1 DUST: 0,13 %	SECT 22 CROSS/A DRIVE SECT 22 CROSS CO: -0,17 PPM SECT 22 CROSS SO2: -0,23 PPM SECT 22A DRIVE CO: -0,30 PPM SECT 22A DRIVE SO2: 3,89 PPM	SOUTH DRIVE SENSOR SOUTH DRIVE CO SENSOR: 0,00 ppm SOUTH DRIVE SO2 SENSOR: 0,00 ppm SOUTH DRIVE DUST SENSOR: 2,10 %	EAST DRIVE SENSOR EAST DRIVE CO: -0,39 ppm EAST DRIVE DUST SENSOR: 3,04 % EAST DRIVE SO2 SENSOR: -0,09 ppm
MW1 RETURN MW1 N RETURN CO: 5,50 ppm MW1 N RETURN CH4: 0,13 % MW1 N RETURN CO2: 0,02 %	SECT 22 B/C DRIVE SECT 22B DRIVE CO: -0,18 ppm SECT 22B DRIVE SO2: 0,22 PPM SECT 22C DRIVE CO: -0,18 ppm SECT 22C DRIVE SO2: 0,17 PPM	SOUTH2 DRIVE SOUTH2 DRIVE CO: -0,67 ppm SOUTH2 DRIVE SO2 SENSOR: 0,00 ppm SOUTH2 DRIVE DUST SENSOR: 1,07 %	EAST DRIVE MAGNET EAST DRIVE MAGNET CO: -0,11 ppm EAST DRIVE MAGNET SO2: -0,04 ppm
SUB INCLINE SUB INCLINE CO: 2,04 ppm SUB INCLINE SO2: 0,13 ppm MW1 MAGNET SENSOR MW1 MAGNET CO: 0,00 ppm MW1 MAGNET SO2: 0,08 ppm	SECT 22 D DRIVE SECT 22D DRIVE CO: -0,85 ppm SECT 22D DRIVE SO2: -0,98 ppm SECT 23 DRIVE SECT 23 DRIVE CO: 4,70 ppm SECT 23 DRIVE SO2: 0,47 ppm	NORTH DRIVE SENSOR NORTH DRIVE CO SENSOR: 0,38 ppm NORTH DRIVE SO2 SENSOR: 0,24 ppm NORTH DRIVE DUST SENSOR: 3,05 % NORTH DRIVE SMOKE 1: 0,00 % NORTH DRIVE SMOKE 2: 0,00 %	EAST2 DRIVE SENSOR EAST2 DRIVE CO SENSOR: 0,43 ppm EAST2 DRIVE DUST SENSOR: 0,48 ppm EAST2 DRIVE SO2 SENSOR: 0,24 %
FEEDERS FEEDERS A SUB CO: 0,40 ppm FEEDERS B SUB CO: -2,59 ppm FEEDERS SO2: 1,23 ppm FEEDERS CO: -1,66 ppm FEEDERS INCLINE CO: -49,78 ppm	SECT 24 A DRIVE SECT 24A DRIVE CO: 0,73 ppm SECT 24A DRIVE SO2: -0,64 ppm SECT 24 B DRIVE SECT 24A DRIVE CO: -0,31 ppm SECT 24A DRIVE SO2: -2,54 ppm	NORTH2 DRIVE SENSOR NORTH2 DRIVE CO SENSOR: 0,00 ppm NORTH2 DRIVE SO2 SENSOR: 0,02 ppm NORTH2 DRIVE DUST SENSOR: 3,17 %	NORTH WEST ACCESS NWA DRIVE 1 CO: 0,49 ppm NWA DRIVE 2 CO: 1,53 ppm
LAMP ROOM SENSOR 1: -0,00 % SENSOR 2: -0,01 % SENSOR 3: -0,04 %	SECT 24 DRIVE SECT 24 DRIVE CO: -24,41 ppm SECT 24 DRIVE SO2: -2,35 PPM NORTH2 DEWATERING SENSOR NORTH2 DEWATERING CO: 0,20 ppm NORTH2 DEWATERING SO2: 0,00 ppm	4 SEAM 4 SEAM CO: -42,94 ppm 4 SEAM CH4: 0,21 % 5 SEAM 5 SEAM CO: 3,24 ppm 5 SEAM CH4: 0,05 %	BATTERY BAY 1 BATTERY BAY 1 CO: -0,56 ppm BATTERY BAY 1 CH4: 0,38 % BATTERY BAY 1 VELOCITY: 0,39 m/s



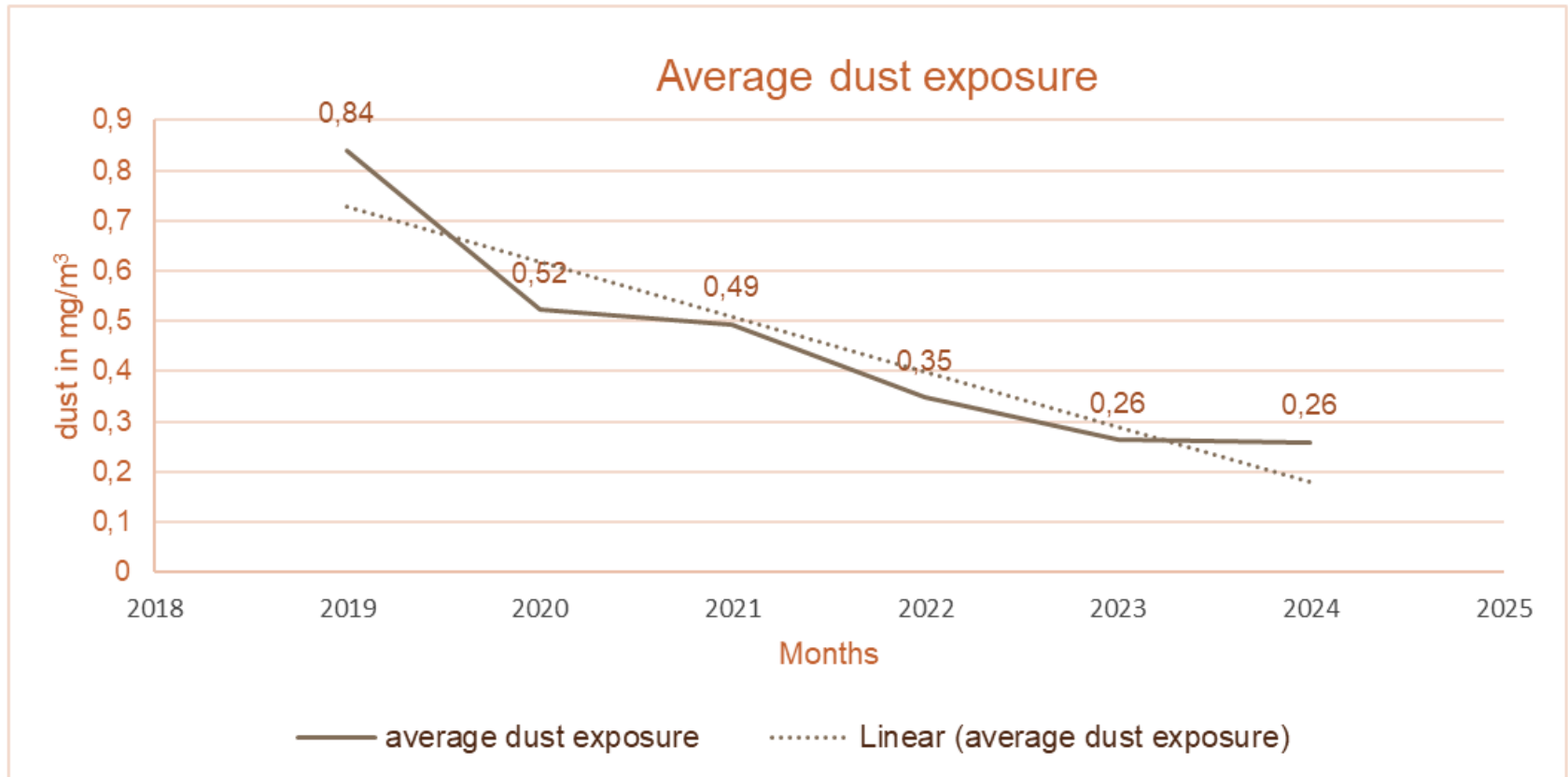
Current Installations – Mine 3 Underground

CO ALARM		CH4 ALARM		AIR ALARM		DUST ALARM		Sensor Healthy		Sensor Fault				
								Sensor Alarm		Panel Offline				
NORTH			AF18N			SECTION 41 DRIVE			2 SEAM			SECTION 21 DRIVE		
CO - North Sub (LV)	000 ppm	CO - Drive	002 ppm	CO - Drive	009 ppm	CO - Feeder Sub	001 ppm	CO - Drive	002 ppm					
CO - North Sub (HV)	001 ppm	AIR - Return	10,0 m/s	SECTION 41 INTAKE A2			CO - Transf Sub	001 ppm	SECTION 21 INTAKE A2					
CO - Drive	002 ppm	Dust - Belt Drive	0,71 mg/m3	CO	000 ppm	CO - Sacrificial	001 ppm	CO - Intake	001 ppm	CO	002 ppm			
AIR - Return	00,8 m/s	AF16E			CH4	0,00 %	CH4 - Intake	0,02 %	CH4	0,00 %				
Dust - Belt Drive	0,16 mg/m3	CO - Drive	001 ppm	SECTION 41 RETURN A1			AIR - Intake	03,1 m/s	AIR	01,5 m/s				
SO2 - Belt Drive	00,4 ppm	SO2 - Belt Drive	00,3 ppm	CO	000 ppm	2 SEAM SOUTH			SECTION 21 RETURN A3					
SPLIT 81			AE16E DRIVE			CH4	0,02 %	CO - South Belt	000 ppm	CO	002 ppm			
CO - Return	001 ppm	CO - Drive	000 ppm	AIR	01,5 m/s	CO - South Sub (LV)	002 ppm	CO - South Sub (HV)	003 ppm	CH4	0,08 %			
CH4 - Return	0,03 %	SO2 - Belt Drive	00,0 ppm	SECTION 42 DRIVE			CO - South Sub(11kV)	001 ppm	Dust - Belt Drive	0,44 mg/m3	AIR	02,4 m/s		
AIR - Return	03,6 m/s	A16E DRIVE			CO - Drive	005 ppm	2 SEAM EAST			SECTION 22A DRIVE				
CO - North Tail-end	005 ppm	CO	003 ppm	CO - Drive	005 ppm	CO - Drive	000 ppm	Dust - Belt Drive	0,44 mg/m3	CO - Belt Drive	003 ppm			
E19 WEST						CH4	0,00 %	SO2 - Belt Drive	00,3 ppm	SO2 - Drive	00,1 ppm			
CO - Belt Drive	008 ppm				SECTION 42 INTAKE A2			SECTION 22 INTAKE A2						
SO2 - Belt Drive	00,4 ppm				CO	001 ppm	CO - Drive	000 ppm	CH4	0,00 %				
E19 WEST B						CH4	0,00 %	CO - Return	000 ppm	AIR	02,7 m/s			
Dust - Belt Drive	0,00 mg/m3				AIR	01,1 m/s	CH4 - Return	0,10 %	SECTION 22 RETURN A3					
CO - Return	000 ppm				SECTION 42 RETURN A3			AIR - Return	02,3 m/s	CH4	0,02 %			
CO - Belt Drive	005 ppm				CO	000 ppm	CO - Drive	000 ppm	Dust - Belt Drive	0,48 mg/m3	AIR	03,3 m/s		
CO - Sub	005 ppm				CH4	0,01 %	E29S DRIVE			SECTION 22A DRIVE				
CO - HV Sub	006 ppm				AIR	01,8 m/s	CO - Drive	006 ppm	CO - Drive	006 ppm	CO	006 ppm		
CO - Transf Sub	006 ppm				SECTION 43 DRIVE			SO2 - Drive	00,4 ppm	SO2 - Drive	00,3 ppm			
E19 WEST C						CO	002 ppm	H28 SOUTH DRIVE			SECTION 23B DRIVE			
CO - Belt Drive	000 ppm				SECTION 43 INTAKE A4			CO	004 ppm	CO - Drive	000 ppm			
SO2 - Belt Drive	00,7 ppm				CO	000 ppm	CO	000 ppm	SO2 - Drive	00,6 ppm	SECTION 23 INTAKE A4			
E19 WEST D						CH4	0,07 %	Dust - Belt Drive	0,23 mg/m3	SECTION 23 RETURN A5				
CO - Belt Drive	000 ppm				AIR	01,1 m/s	E31W DRIVE			CO	000 ppm			
SO2 - Belt Drive	00,0 ppm				SECTION 43 RETURN A5			CO - Drive	002 ppm	CH4	0,04 %			
						CO	000 ppm	SO2 - Drive	00,6 ppm	AIR	01,2 m/s			
						CH4	0,05 %				CH4	0,05 %		
						AIR	01,6 m/s				AIR	01,9 m/s		



Success of CRTM

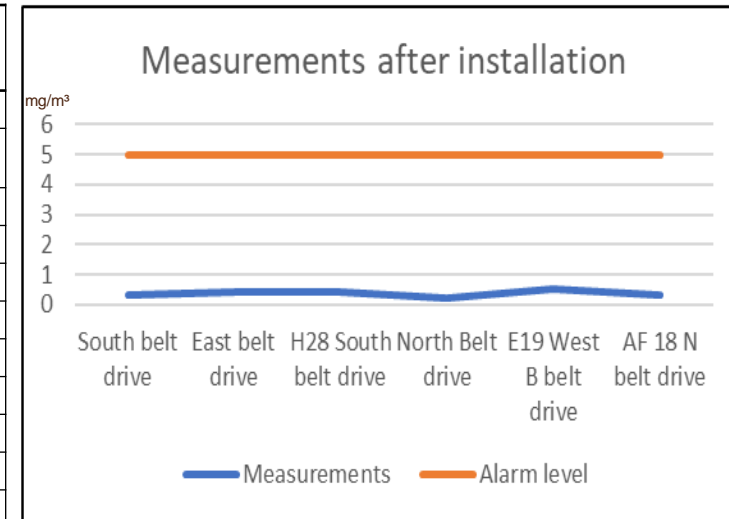
Average Backbye Dust Exposure Mine 2



Success of CRTM

Baseline measurements vs measurements after installation

Positions	Dust reading on the monitors	Occupations	before measurements	after measurements
2 seam				
South belt drive	0,31 mg/m ³	Attendant, belt sweeper	2,80 mg/m ³	1,08 mg/m ³
East belt drive	0,42 mg/m ³	Attendant belt	1,59 mg/m ³	0,20 mg/m ³
H28 South belt drive	0,42 mg/m ³	Operator belt	1,07 mg/m ³	0,11 mg/m ³
		Electrician	0,73 mg/m ³	0,13 mg/m ³
		Fitter	0,95 mg/m ³	0,40 mg/m ³
4 seam				
North Belt drive	0,20 mg/m ³			
E19 West B belt drive	0,55 mg/m ³			
AF 18 N belt drive	0,31 mg/m ³			



- Predominantly, the instrument is used to determine and control the efficiency of engineering controls on the belt road
- The following benefits have been observed:
 - Reduced respirable dust
 - Reduced risk of dust explosion
 - Improved travelling roads treatment



Challenges of CRTM

CRTM System

Numerous problems were experienced during the installation of the systems underground
example

- Misalignment between various disciplines (Engineering not coping with installation schedule due to staff shortages)
- Poor or no communication - Control room not alerting mining and engineering personnel to investigate high dust readings on time to fix or unblock sprays.
- No Audible alarm in the control room if the dust system indicate high dust reading
- Changes of the control room systems to Wonderware causing the delays



Conclusions

The MOSH process is a comprehensive system which yield positive results if implemented as described in the Leading Practice Adoption Guide.

Though the use of the fogger system, the reduction of the respirable intake dust is significant and will assist in achieving the silicosis milestones as well as having a future potential financial benefit in reduced dust risk levies.

- After evaluating the results, it is therefore evident that the continuous monitoring of the belts with the real time dust monitors assisted Matla in reducing dust levels. The personal dust results on the “Belt sweeper” shows an overall improvement of 78,6% at mine 3 and 90% at mine 2
- The mine could easily identify from the control room if the belt has high concentration of dust and that can be reported to Engineering department to investigate the root course of the dust.
- Coal dust exposure related illnesses/condition are preventable, if we take care of our controls
- It is still your duty as an employee to protect your own health and that of your brothers or sisters
- Hazardous dust is not always visible, so it needs to be always monitored. Therefore, do not tamper with measuring instruments



Acknowledgement

- Matla Management
- Union Leadership
- Health and Safety Reps
- Environclear & Guduza Contractors
- Minerals Council of South Africa (MOSH Dust Team)



Thank you



"Safety always, all the way"

