

SILICA CONTROL IN SOUTHERN AFRICA



ANGLOGOLD ASHANTI

ICMM Conference

November 2006

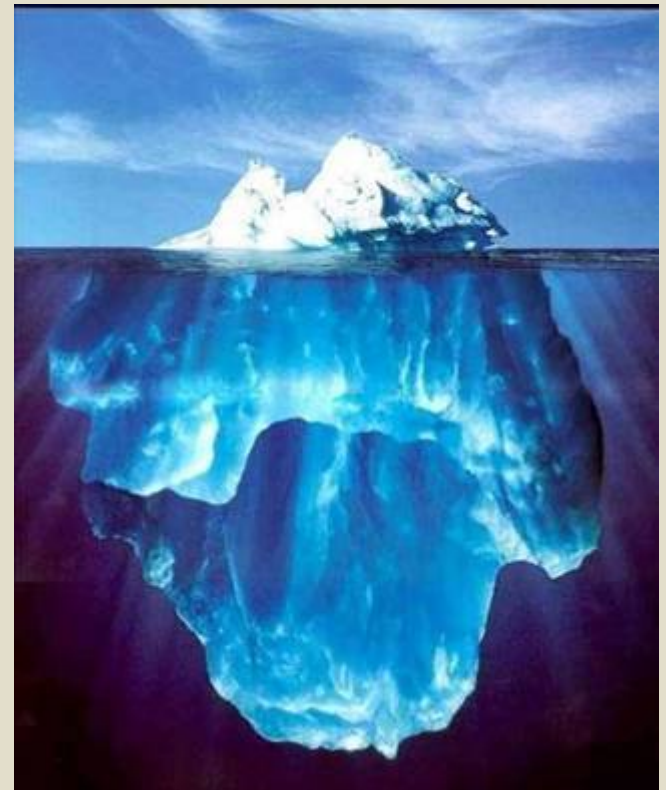
Des Wrigley



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- Introduction
- Milestones
- Occupational Hygiene Programme
 - Workplace risk assessment
 - Measure exposures
 - Health statistics
 - Control
 - Monitor
 - Review
- Management systems
- Problems remaining
- The way forward
- Conclusion

Wellness in the Workplace



Do we know the Stats ?

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Occupational hygiene programme

Introduction

Sampling

$$RQC_{(TWA)} = TWA_{(RD)} \times SiO_2 \text{ Concentration}$$

Legal Limit
0,1 mg/m³

**Dust
Management
Indicator**

**Only variable that
Can be managed**

-Variable Range
-Latency in analysis

Occupational hygiene programme

Introduction

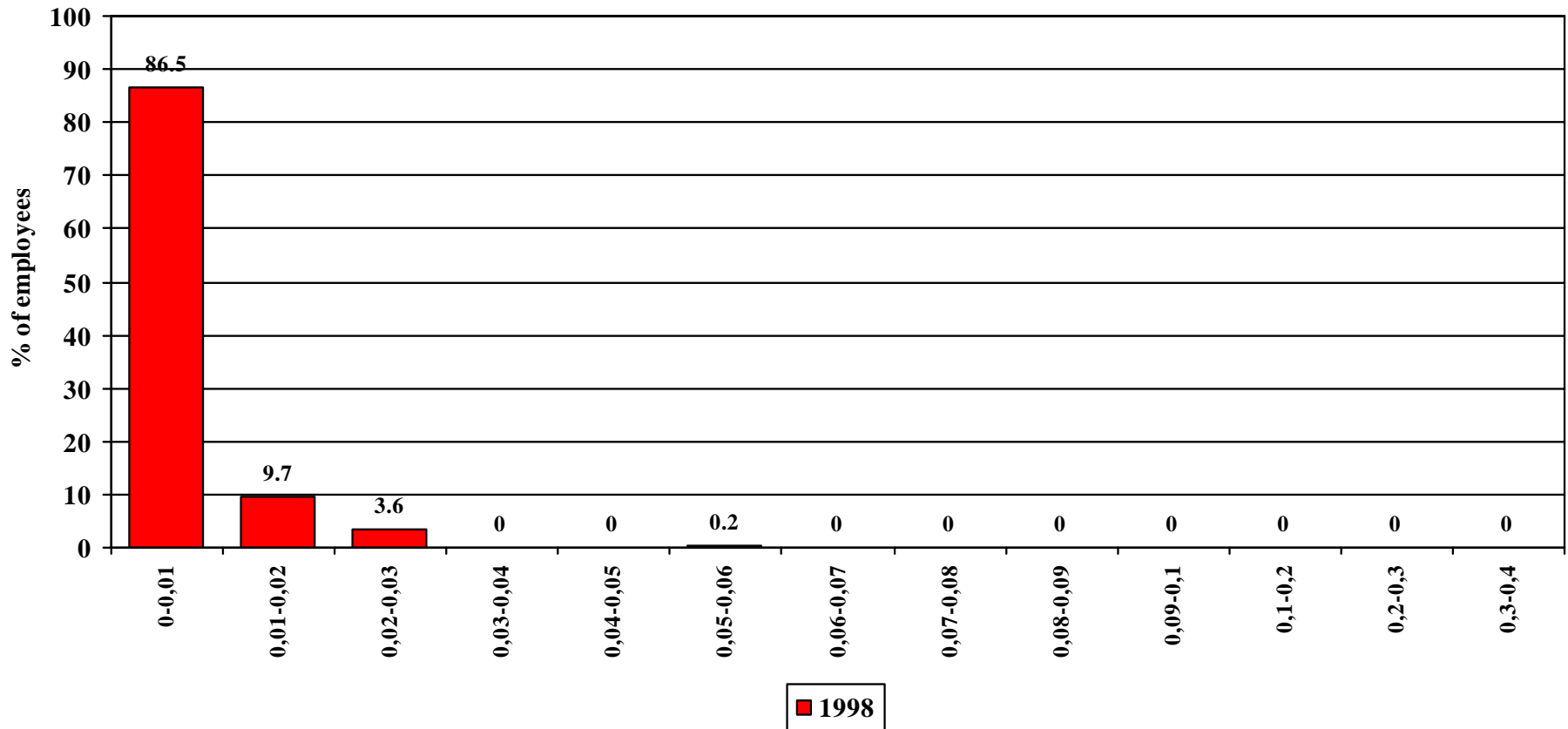
Silica analysis results

	1st Quarter 2004	2nd Quarter 2004	3rd Quarter 2004	4th Quarter 2004	1st Quarter 2005	2nd Quarter 2005	3rd Quarter 2005	4th Quarter 2005	1st Quarter 2006	2nd Quarter 2006
GN 1/1	23.1	18.4	16.16	21.55	51.09	12.7	16.71	21.54	16.36	30.86
GN 1/2	27.73	14.33		25.51	16.75	17.75	34.21		8.82	25.68
GN 2/1				24.34	10.35		21.13	16.06	27.71	17.46
GN 2/2				8.62						
GN 3/1	22.93	25.71	15.82	15.88	24.41	20.87	22.76	13.75	22.07	28.95
GN 3/2	22.31	15.97	17.14	10.21			12.31		16.11	
GN 4/1	16.39	19.98	19.34	21.92	25.97	9.77	14.51	16.15	14.38	15.82
GN 4/2		9.16		21.57	20.55		14.15	17.37	6.34	20.28
GN 4/5		11.7								
GN 5/3	20.96	15.83	12.17	19.25	18.41	17.21	22.42	16.06	7.65	32.13
GN 6/1	15.28	9.42								
GN 6/3	22.61									
GN 6/5	34.27	14.27	16.42	20.56	17	18.34	19.33	17.39	20.21	13.16
GN 8/2	22.41	9.67								
GN 8/3	36.91	15.04			5.65					
GN 8/4	39.73	31.16	24.33	24.18	5.66	22.52	23.26	28.57	31.29	14.44
GN 8/5	25.54	29.77								

Occupational hygiene programme

Introduction

Alpha quartz concentrations

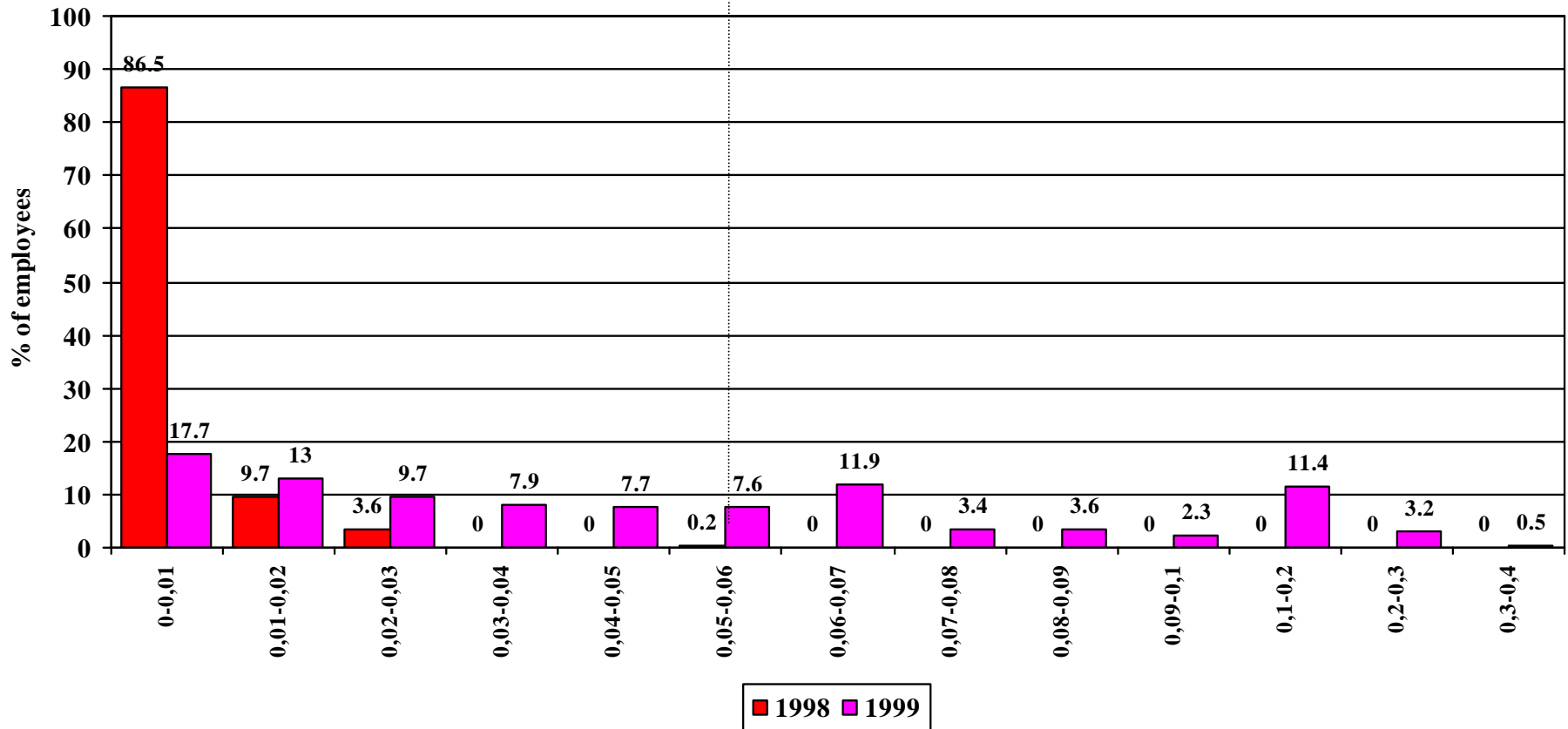


Occupational hygiene programme

Introduction

Change in sampling strategies

Alpha quartz concentrations

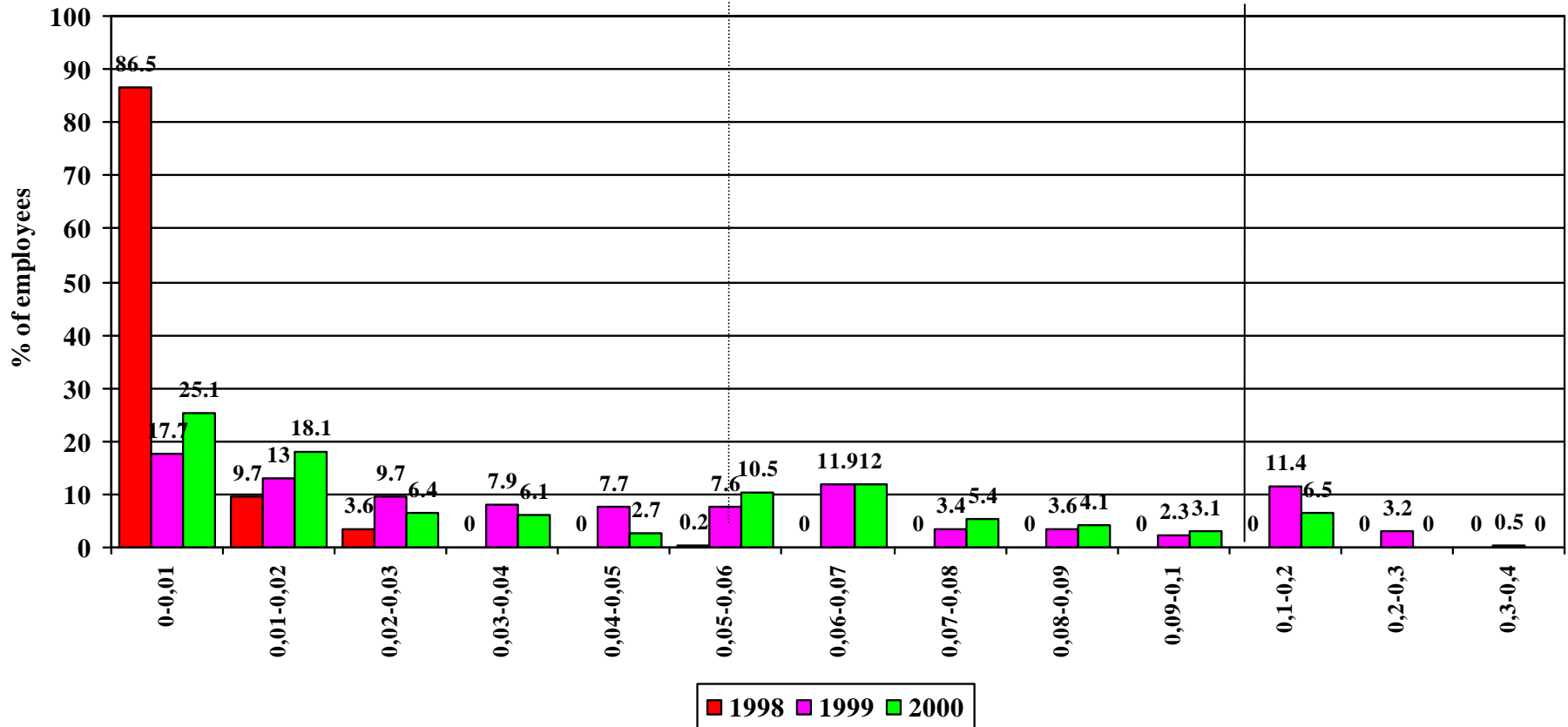


Occupational hygiene programme

Introduction

Change in sampling strategies

Alpha quartz concentrations



Occupational hygiene programme

Introduction

Typical sources of airborne dust

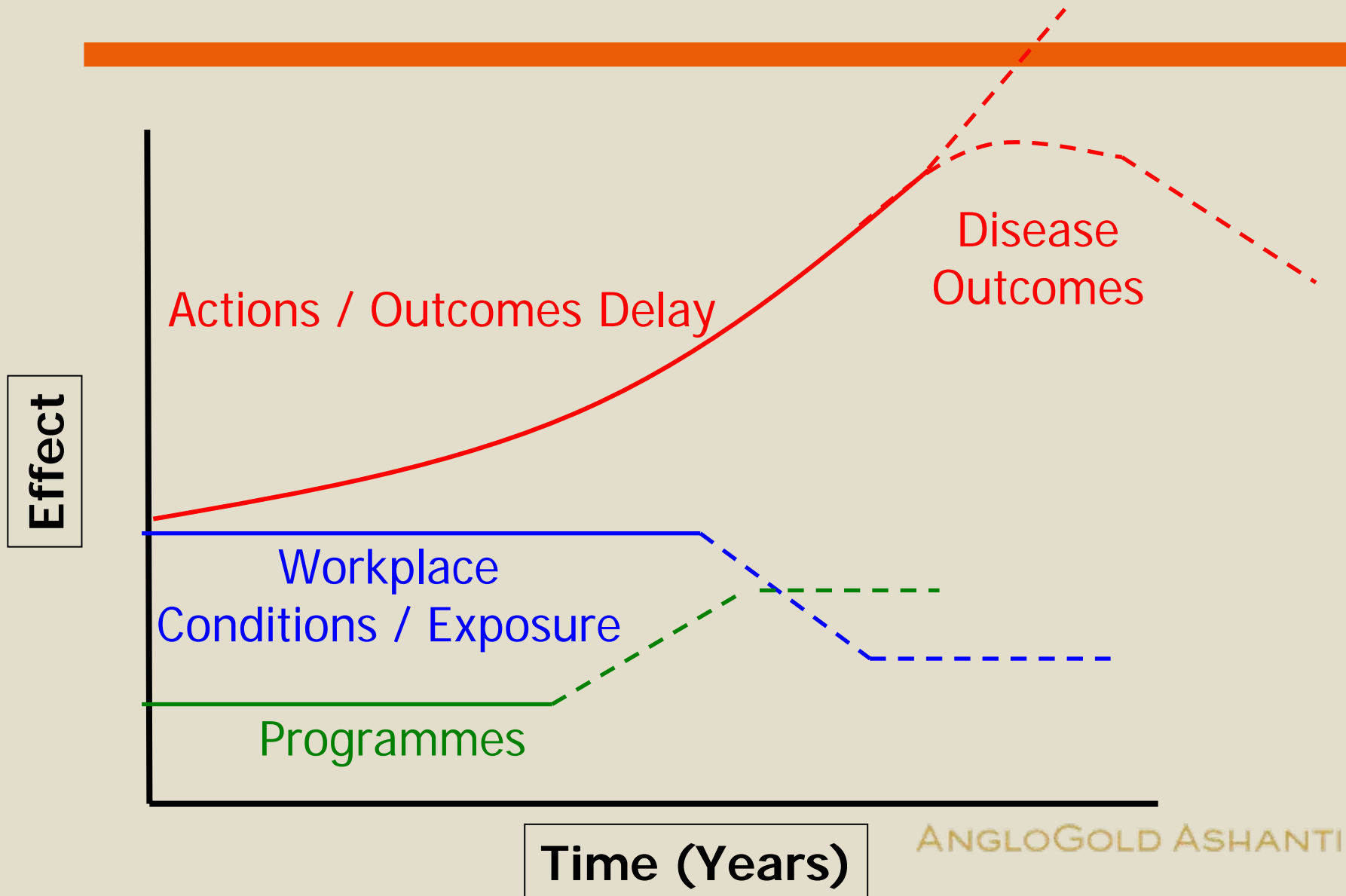
- Blasting
- Blast hole drilling and cleaning
- Barring down of loose rock
- Face cleaning
- Sweeping of fines
- Ore tipping
- Ore transport and handling
- Re-entrainment of dust due to velocity / vehicle movement
- Transfer of ore in ore-passes
- Movement of people
- Rock crushing
- Ore screening, milling, grinding
- Backfill placement

Milestones

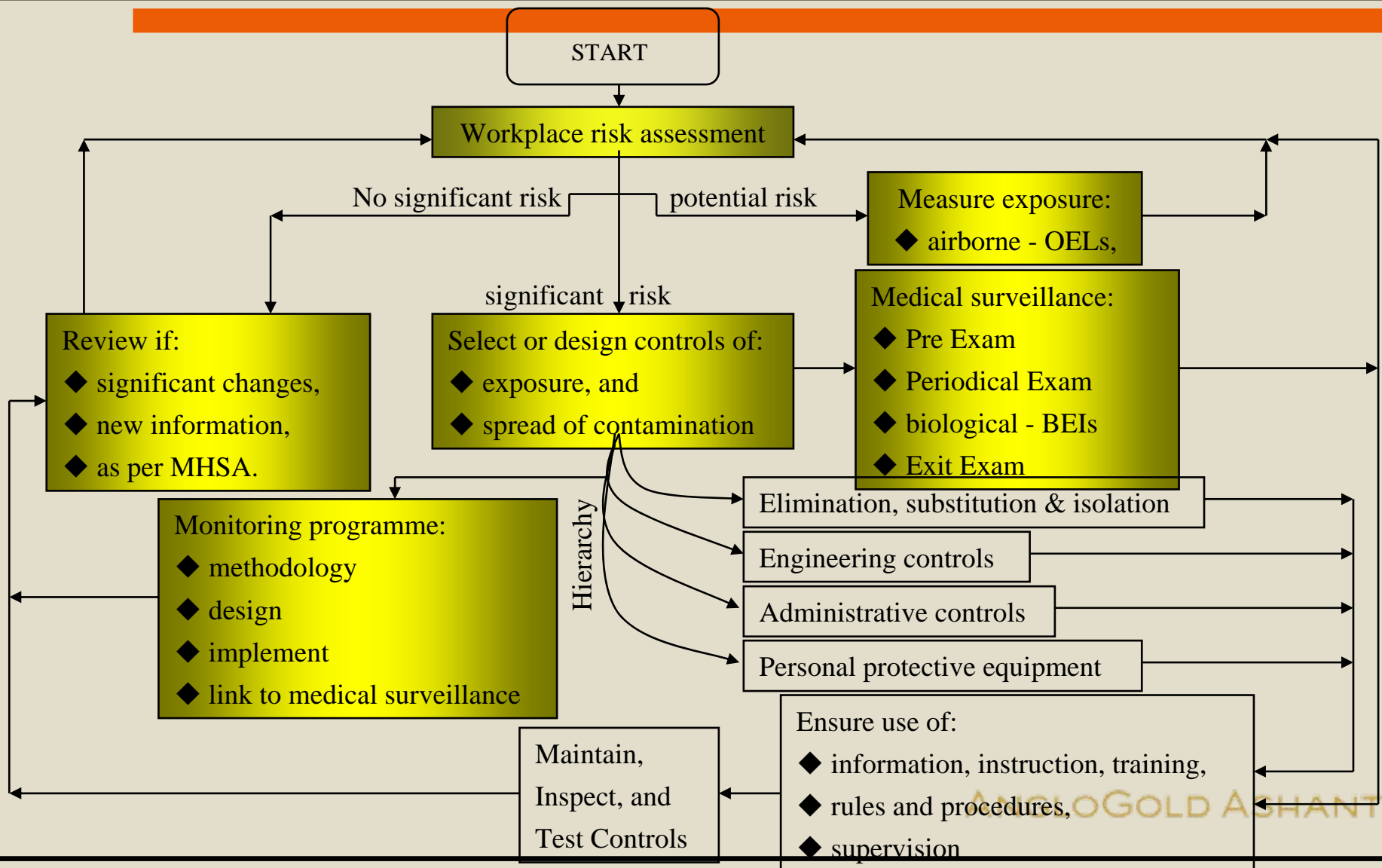
The **Industry Milestones** for silica dust:

- By December 2008, 95% of all exposure measurement results will be below the occupational exposure limit for respirable crystalline silica of 0.1mg/m³ (these results are individual readings and not average results)
- After December 2013, using present diagnostic techniques, no new cases of silicosis will occur amongst previously unexposed individuals (Previously unexposed individual = individuals unexposed prior to 2008, i.e. equivalent to a new person entering the industry at 2008).

Outcomes

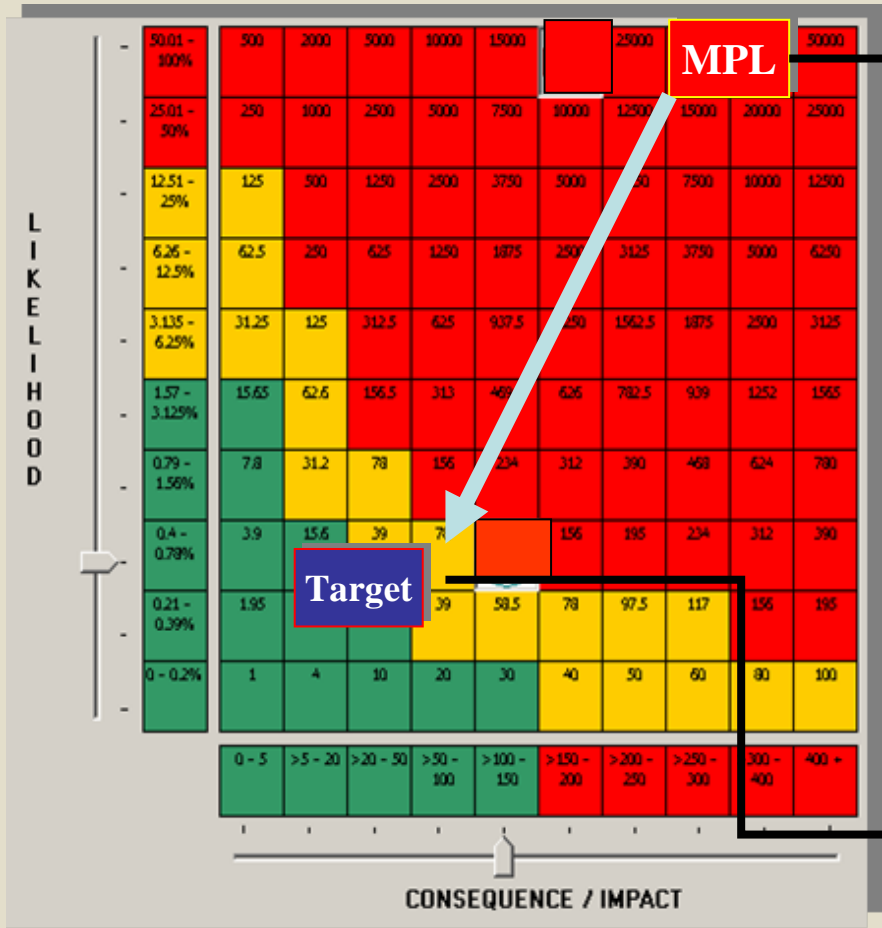


Occupational Hygiene Programme



Occupational hygiene programme

Workplace risk assessment



MPL – Max Potential Loss “R”

RISK ASSESSMENT
 overall **process** of estimating the **magnitude** of risk and deciding whether or not the risk is tolerable

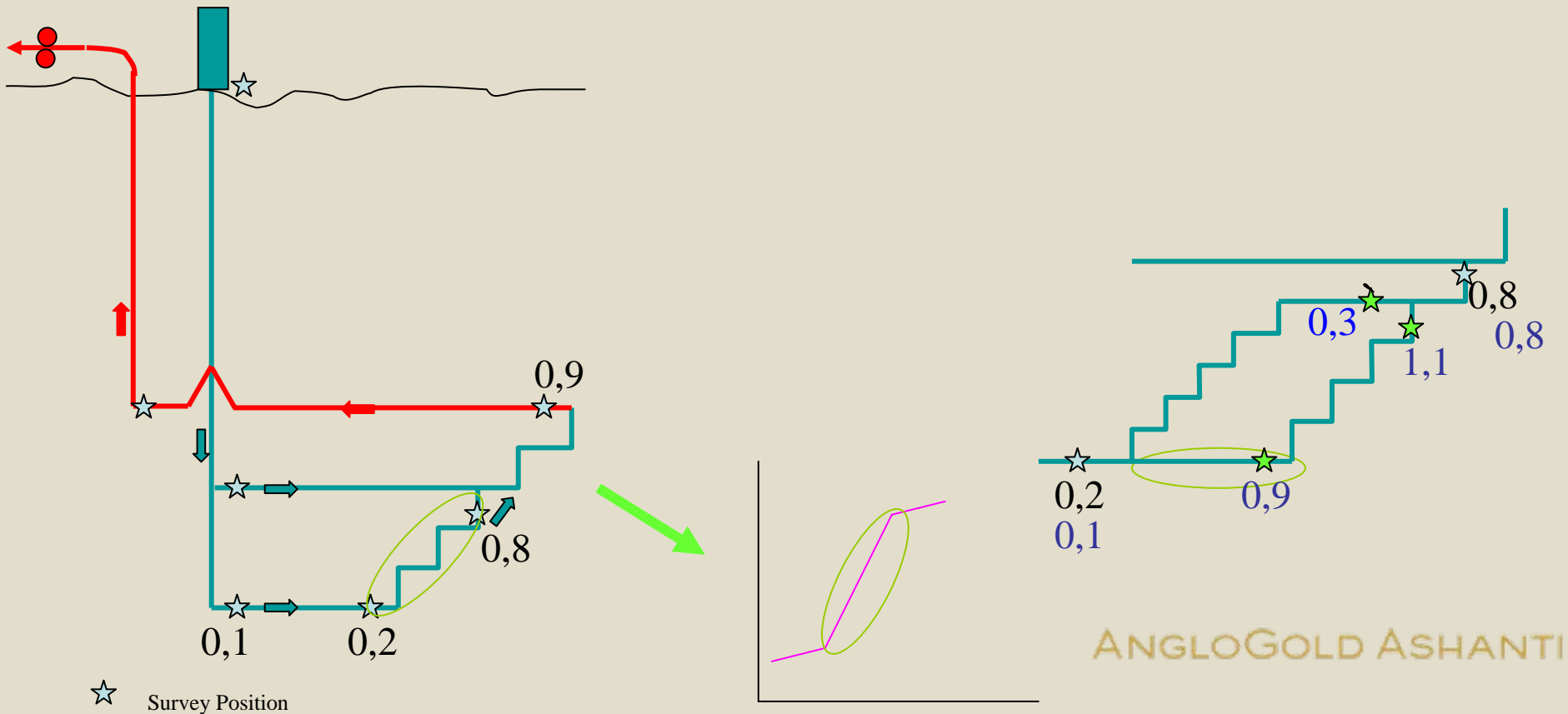
Risk Target to be achieved within a set time period (achievable) – ALARP

Risk Bearing Capacity

Occupational hygiene programme

Workplace risk assessment

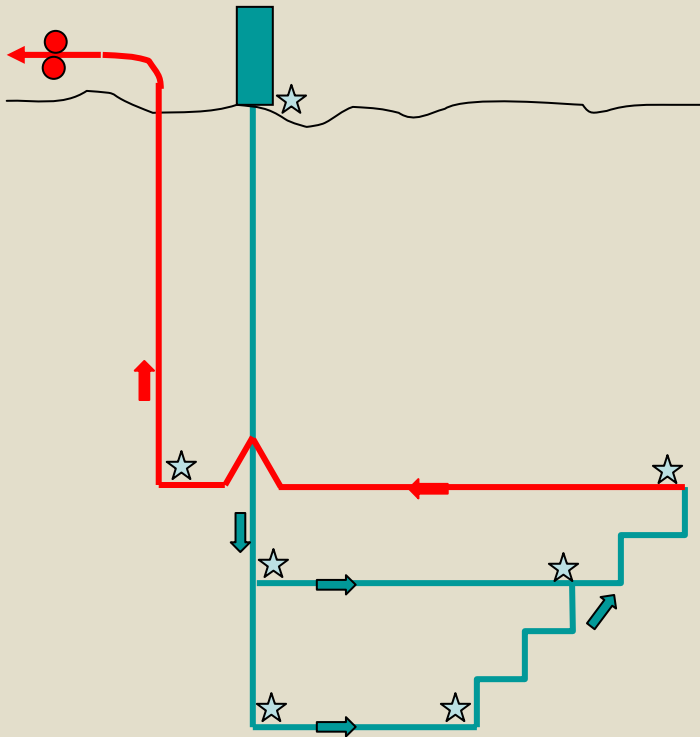
Phase 1 – Determine background dust concentration



Occupational hygiene programme

Measure exposures

Phase 1 – Area and activity dust concentrations



☆ Survey Position

Conducted during working shift.

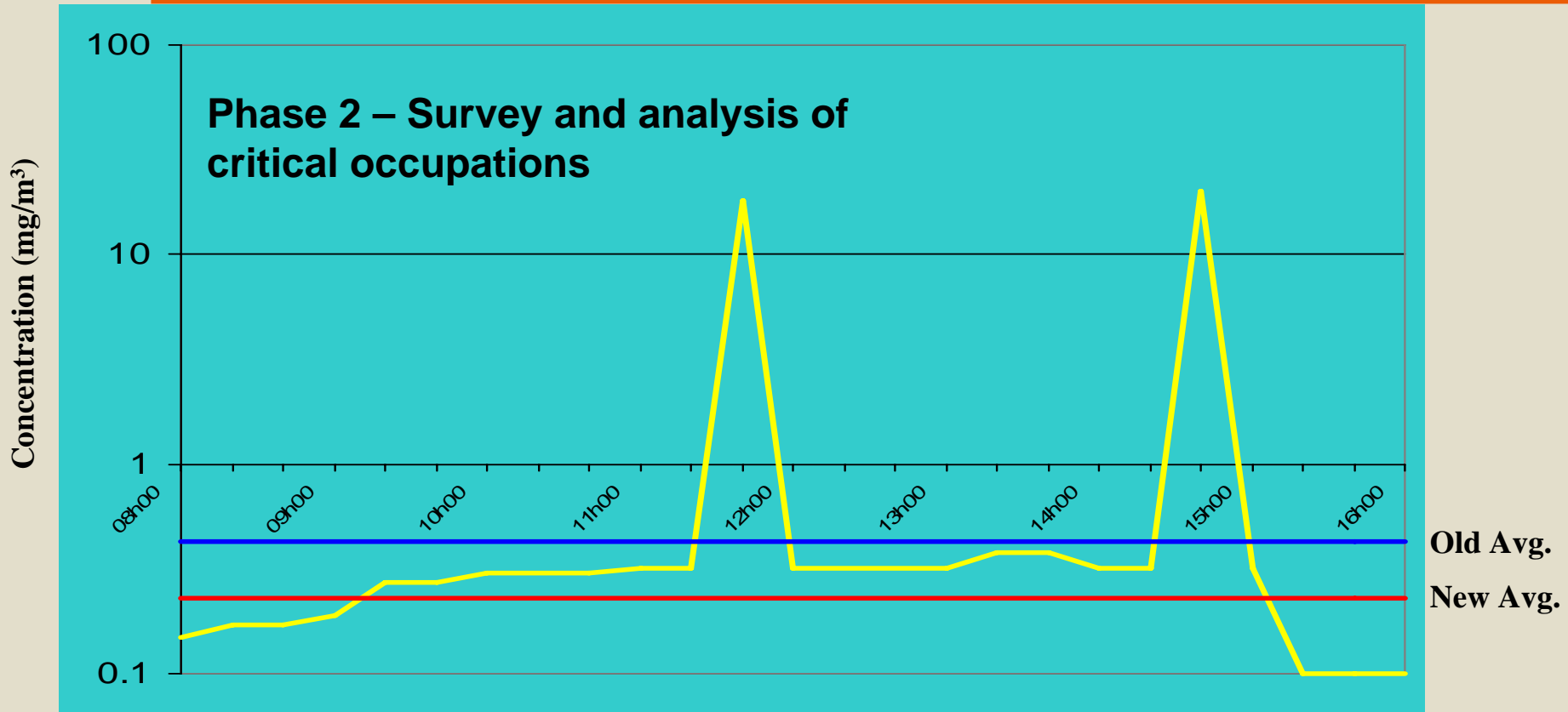
Utilizing continuous dust monitoring instruments.

Full shift real time aerosol determination

May indicate areas / activities which result in elevated dust concentration.

Occupational hygiene programme

Measure exposures



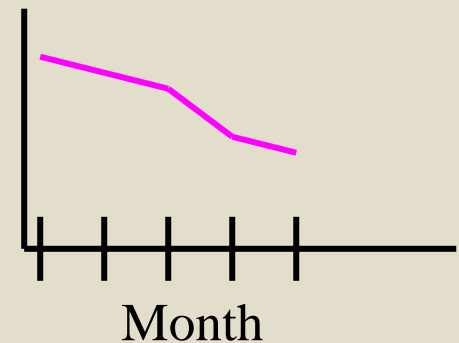
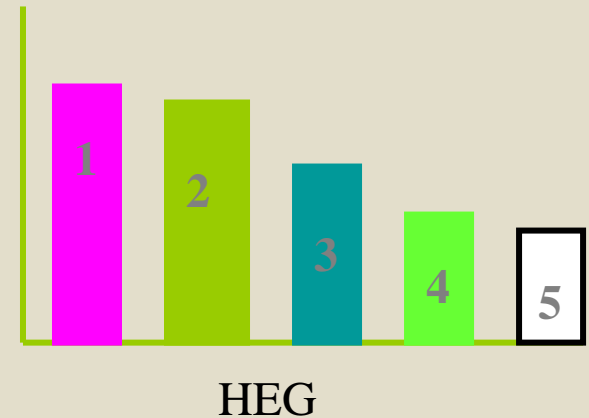
Location	Station	Hlge	X/cut	Stope	X/cut	Hlge	Station	Surface
Task	Travel	Travel	Meeting	Sweeping	Rest	Travel	Sleeping	Reporting
Source ID	Nil	Nil	Nil	Sweeping	Nil	Nil	Tipping	Nil

Occupational hygiene programme

Control

Phase 3 – Develop a new dust control method

- Establish Dust Committee
- Rank HEGs from Highest to Lowest TWA.
- Corrective action plans for worst 5 HEGs.
- For each of worst 5:
 - Progressive TWA monitored on monthly basis.
 - Done to evaluate effectiveness of corrective action plan.
- Ranking revised annually / bi-annually.



Occupational hygiene programme

Control

Technology !

- [Automated in-stope waterblast](#)
 - Suppression of dust at stope face after blast
- Hopper covers
 - Covering of train hoppers during transport to prevent windblown dust
- Filtration
 - [Effective filtration media based on dust load and particle size](#)
 - [Effective filtration units e.g. 2 stage, 3 stage etc.](#)
- Real-time dust monitor
 - [On-line dust monitoring linked to a computerised system](#)
- Enclose/isolate ore pass systems
 - Enclosure of tipping points to prevent upcasting of contaminated air
- Fogger systems
 - [Waterspray systems at ore transfer points](#)

Occupational hygiene programme

Control

Engineering Controls

- Strict adherence to Ventilation standards
- Effective watering down practice
- Effective water quality management
- [Footwall treatment programmes](#)
- Filtration systems

Occupational hygiene programme

Control

Administrative Controls

- Blast re-entry times
- [Shift length](#)

Personal Protective Equipment

- Respiratory protection in defined higher risk areas

Medical Surveillance

- Early silicosis, incidence and prevalence of OLD to inform effort

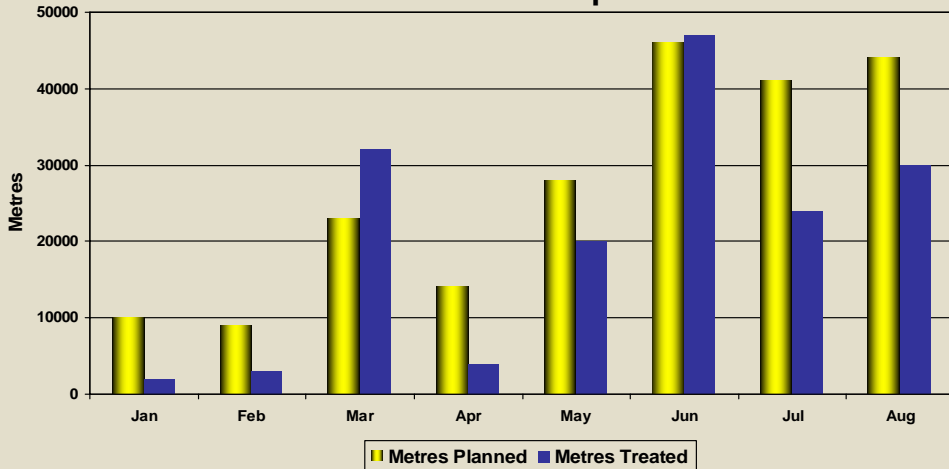
Training and Awareness

- Initial induction, annual induction, awareness campaigns

Occupational hygiene programme

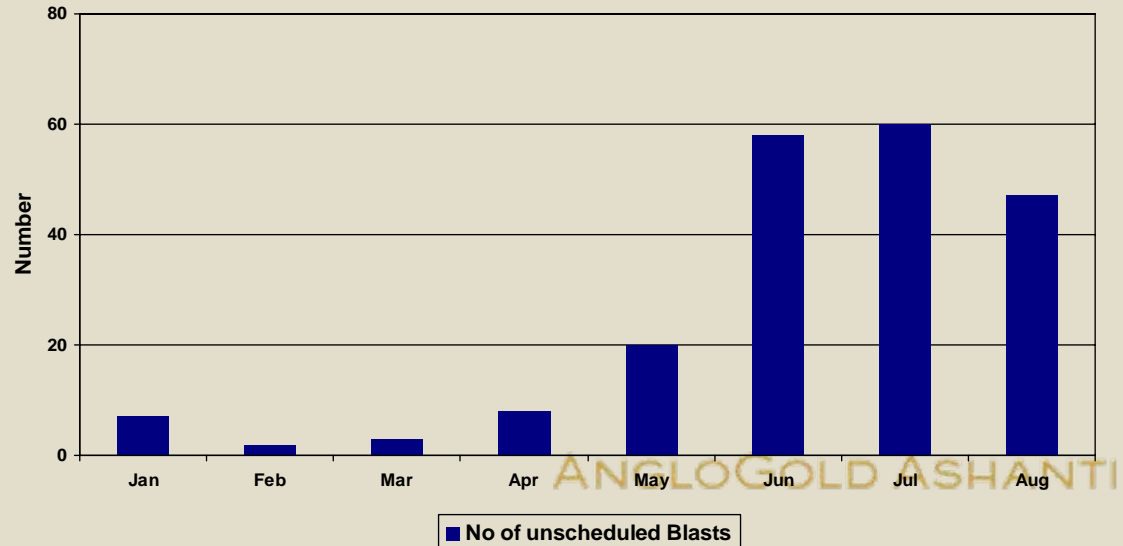
Control

Footwall treatment - SA Operations



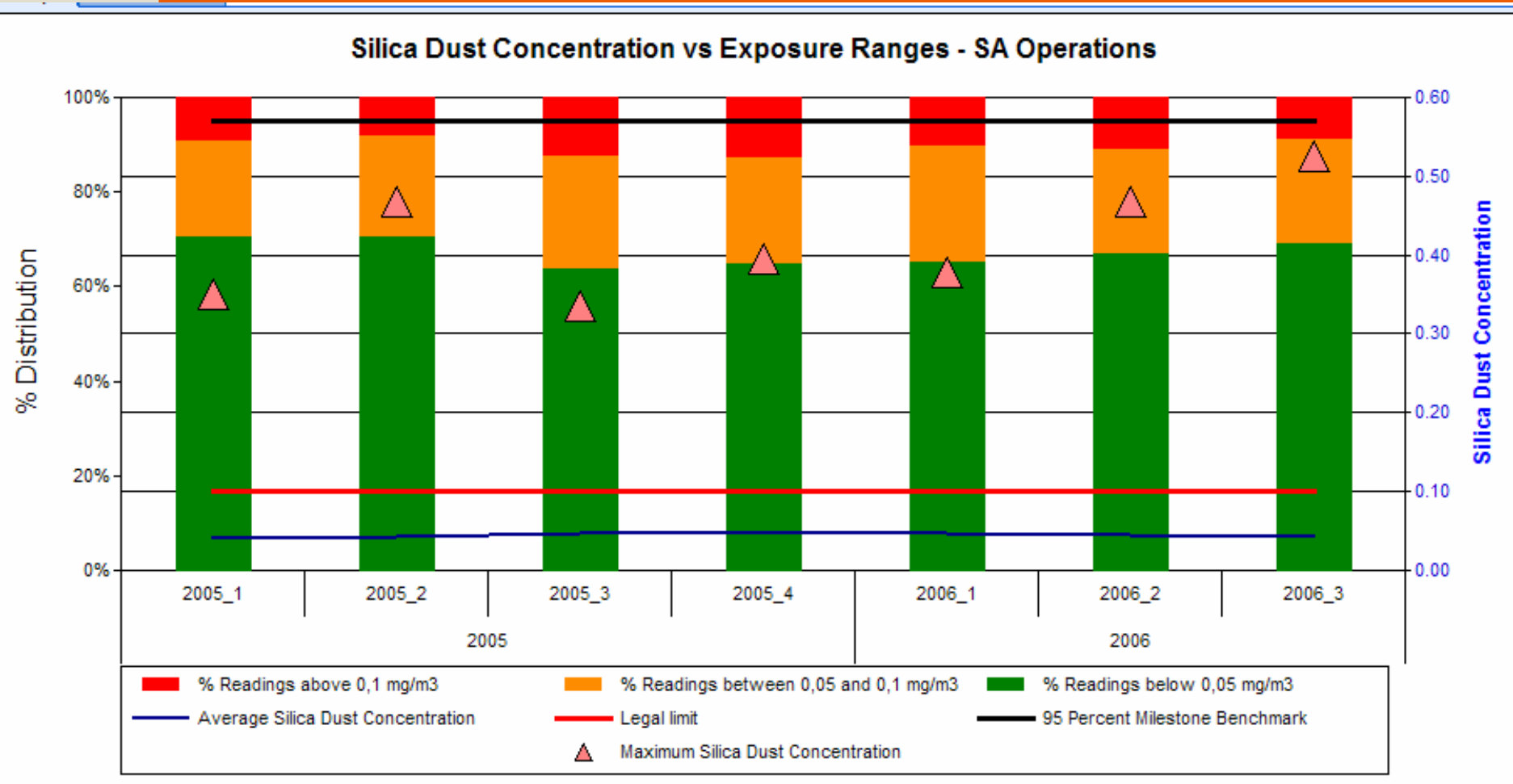
Leading indicators

"Unscheduled" Blasting - SA Operations



Occupational hygiene programme

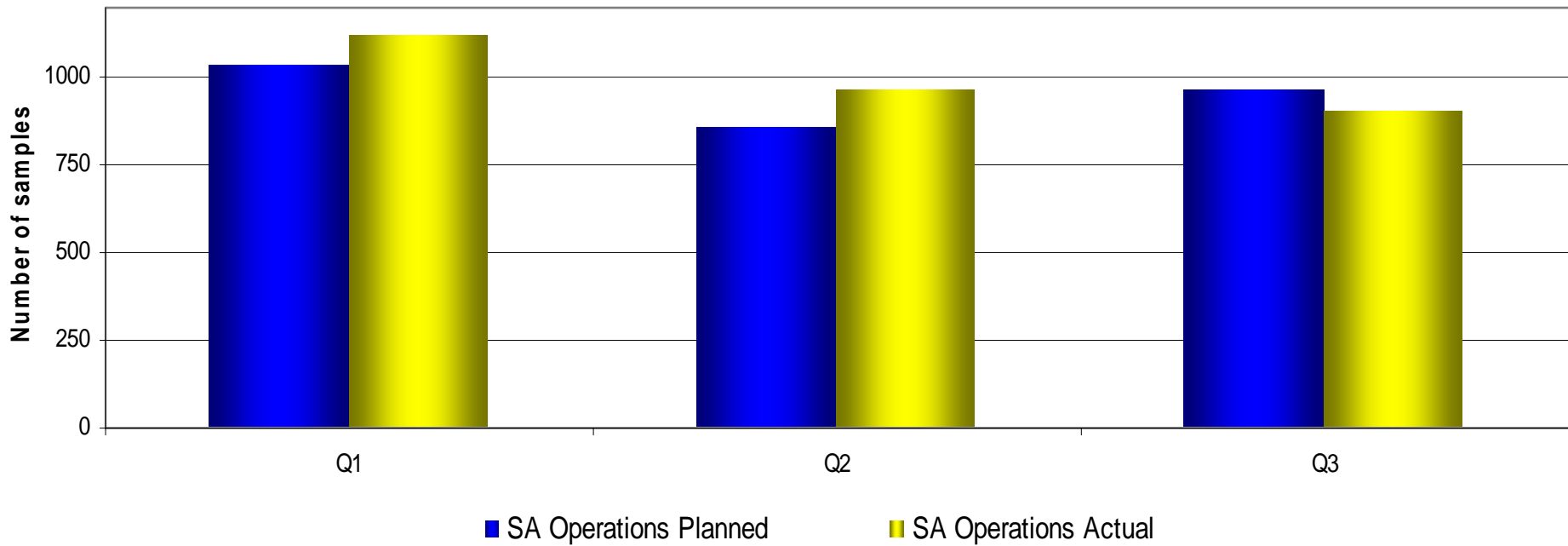
Monitor



Occupational hygiene programme

Monitor

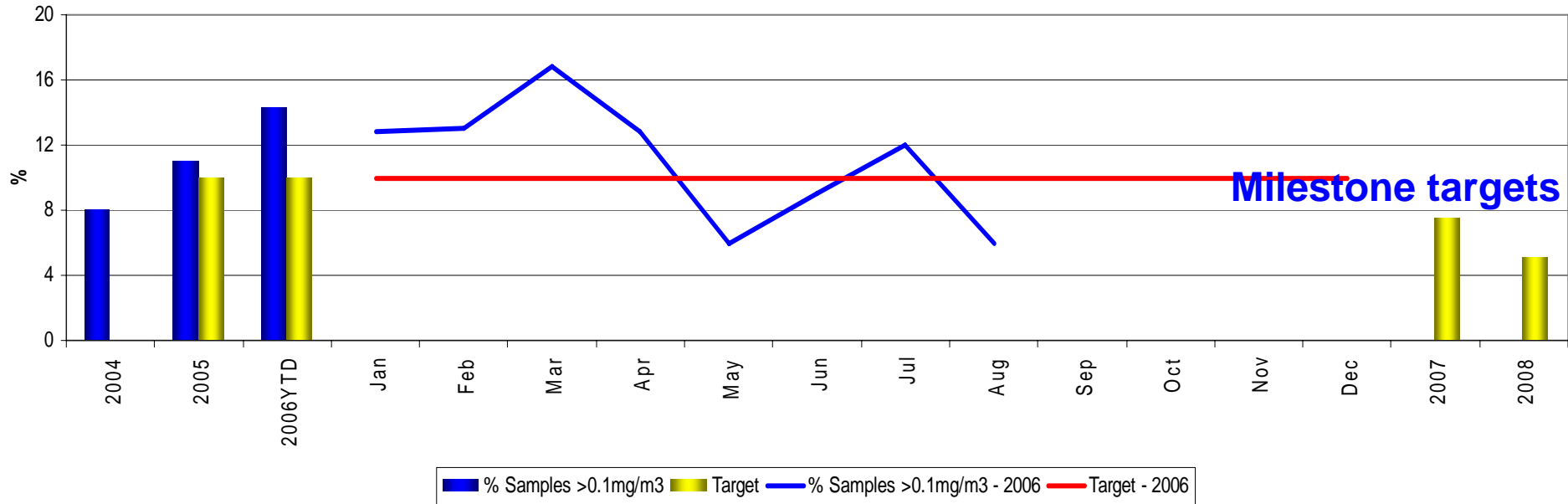
Number of dust samples taken - SA Operations



Occupational hygiene programme

Monitor

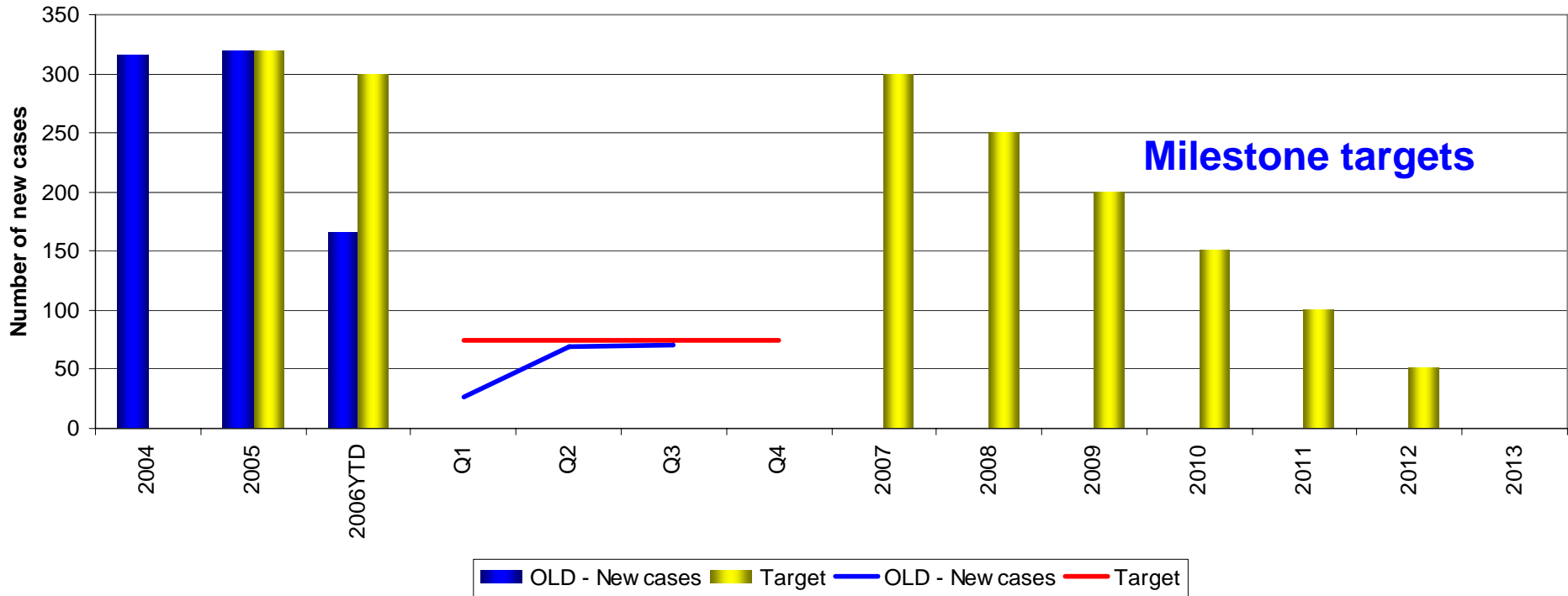
Milestone - Dust - % samples > 0,1 mg/m³ - SA Operations



Occupational hygiene programme

Monitor

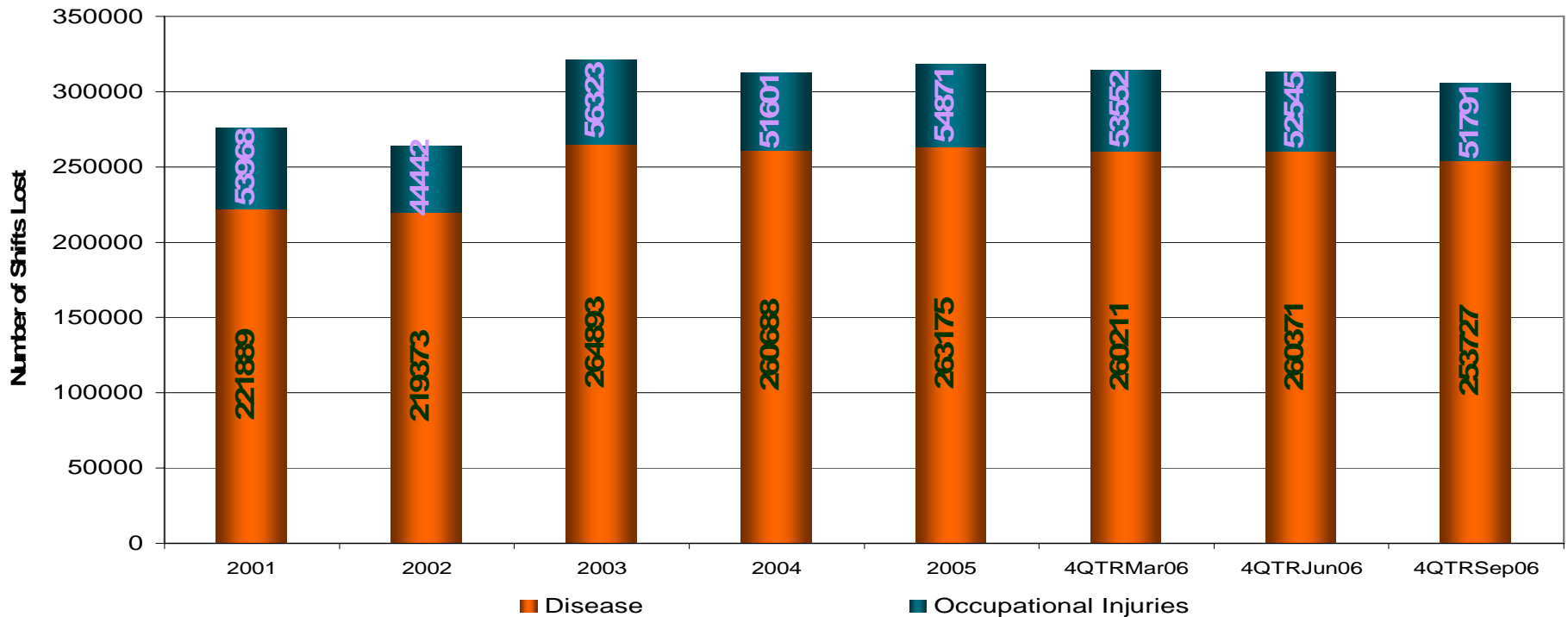
Milestone - Dust - New Occupational Lung Disease (OLD) cases - SA Operations



Occupational hygiene programme

Monitor

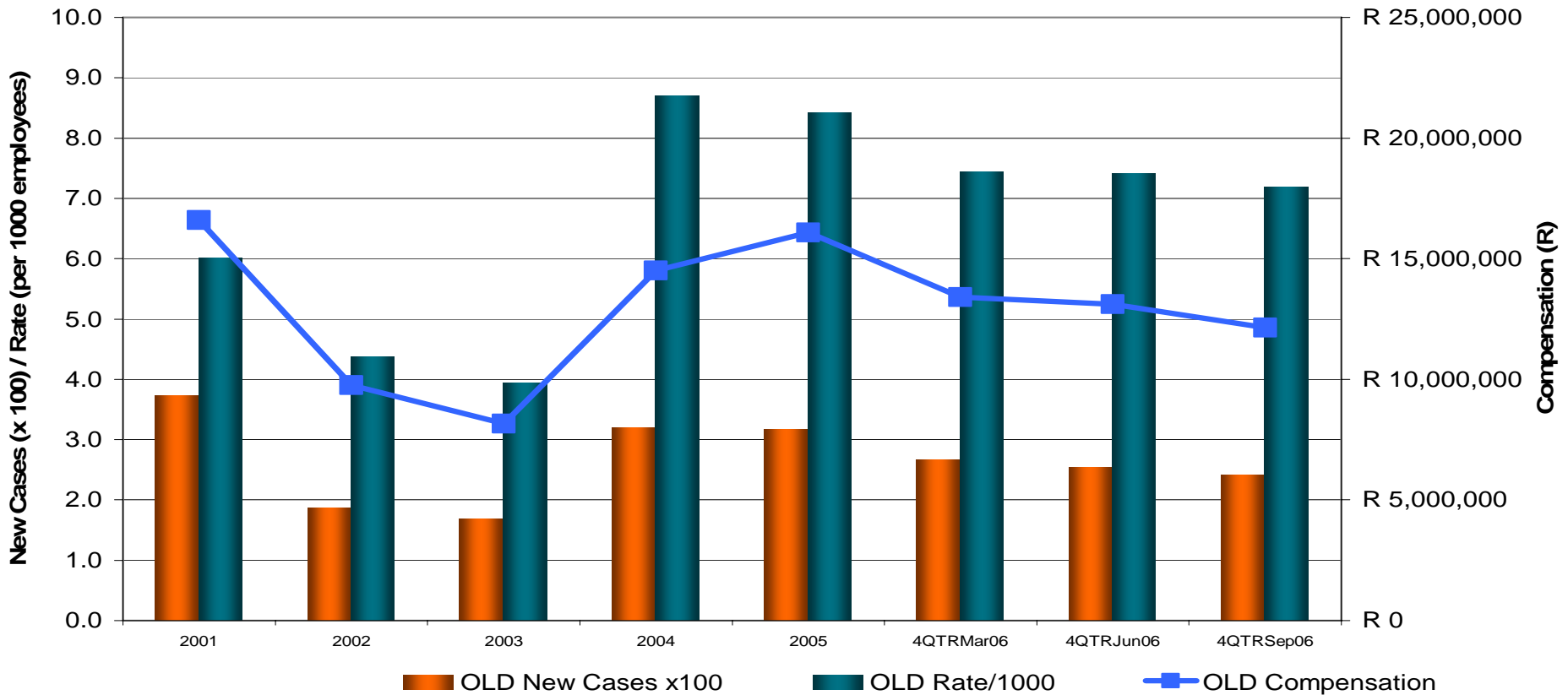
**Shifts Lost
(Occupational Injuries and Diseases)**



Occupational hygiene programme

Health statistics

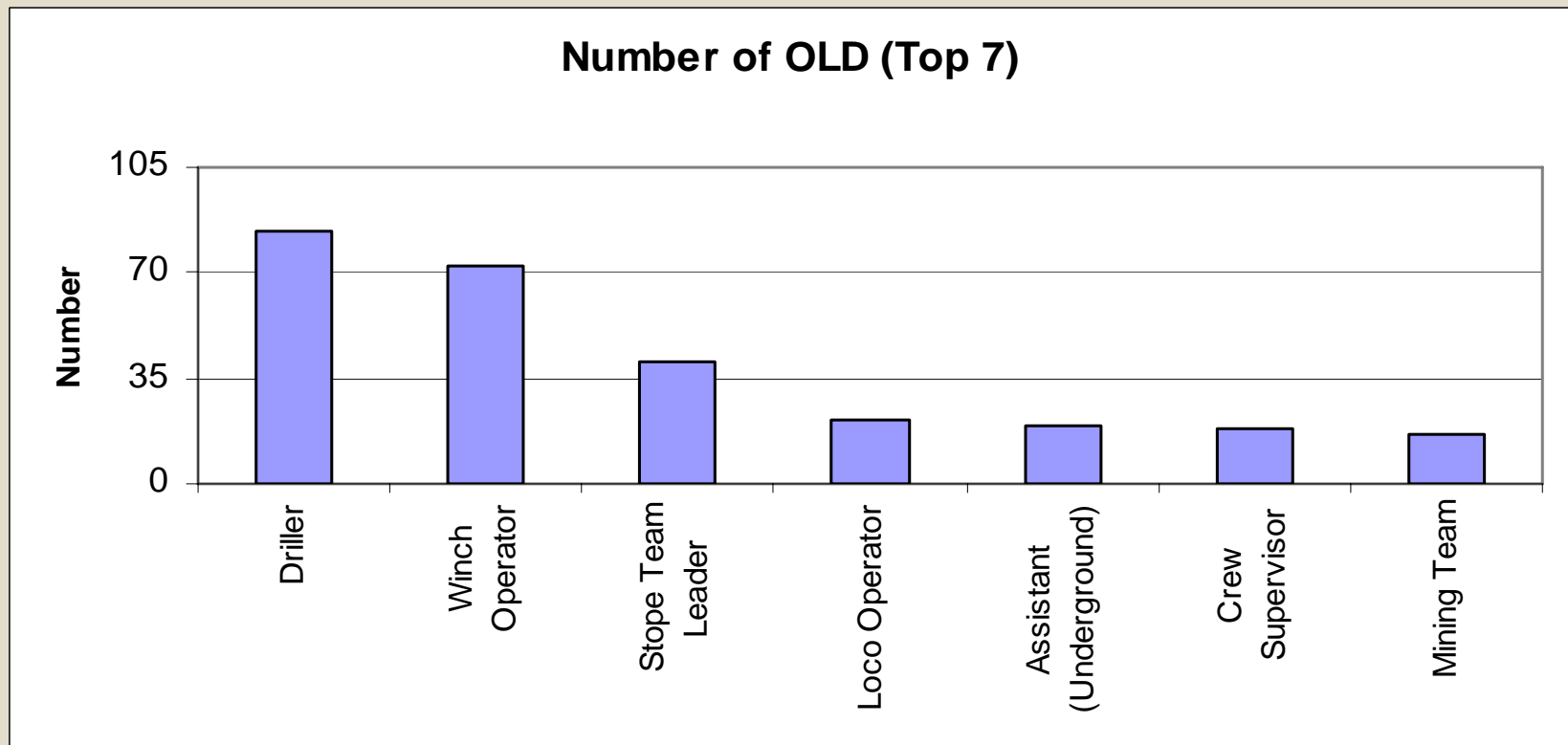
Occupational Lung Disease (OLD)



Occupational hygiene programme

Review

Review of baseline assessment



Occupational hygiene programme

Review

HEG1

Column1

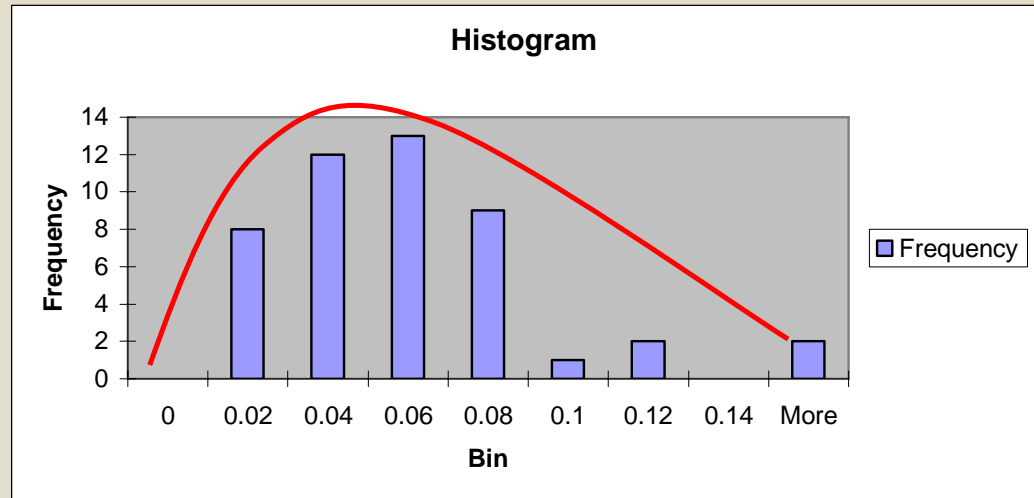
Mean	0.054
Standard Error	0.007
Median	0.05
Mode	#N/A
Standard Deviation	0.046
Sample Variance	0.002
Kurtosis	10.08
Skewness	2.733
Range	0.256
Minimum	0.003
Maximum	0.259
Sum	2.518
Count	47
Confidence Level(95.0%)	0.013

2SD	0.091
Mean - 2SD	-0.038
Mean + 2SD	0.145
90th percentile	0.08

Mean value category	B
90th percentile category	B

<Mean-2SD	0
>Mean-2SD	2
Percentage Vs 5%	4.255

Reclassification of HEGs



Classifications:

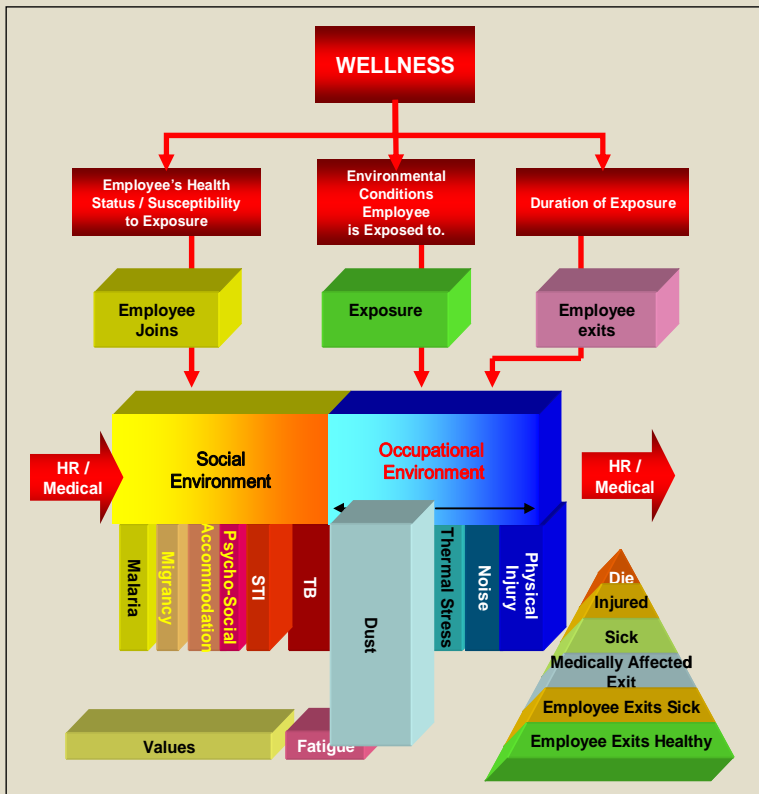
A = $>0,1 \text{ mg/m}^3$ – 4 samples / year

B = $>0,05$ & $<0,1 \text{ mg/m}^3$ – 2 samples / year

A = $>0,01$ & $<0,05 \text{ mg/m}^3$ – 1 sample / year

Management system

SILICA DUST



- Monitoring
- Dust in water
- Unscheduled blasts
- Filtration
- Footwall treatment

- OLD Compensation
- Lost shifts
- RPE consumption

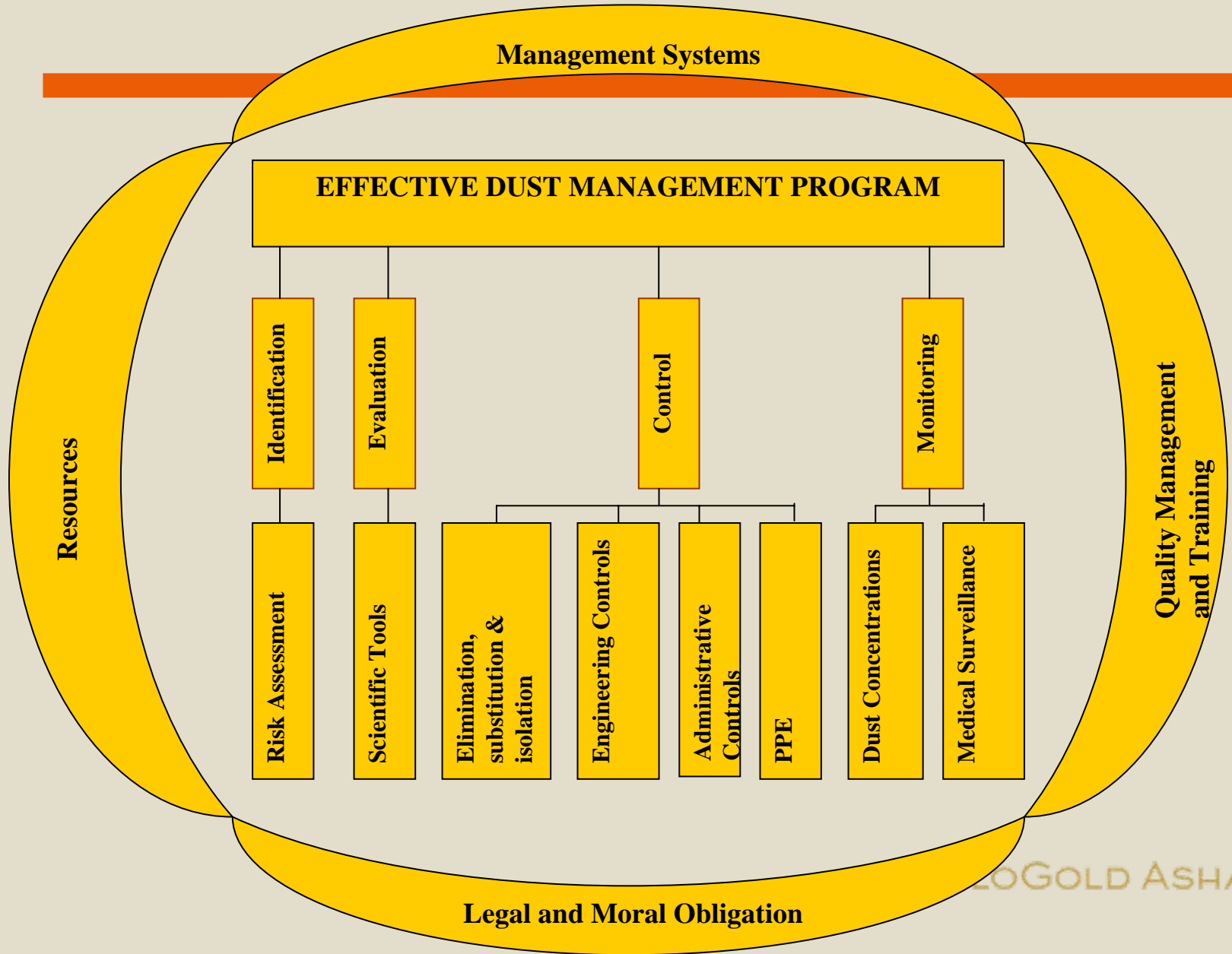
- Milestones
- Baseline

Prevention, Engineering Design, Filtration

Respiration protection



Management systems



Management systems

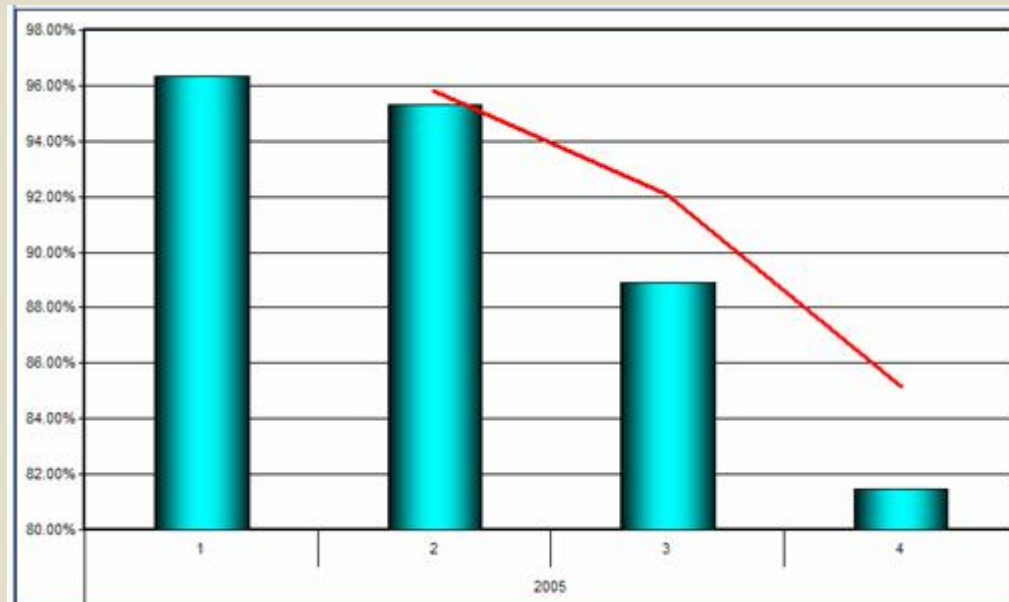


OHSAS18001

Management systems

IRMS (Integrated Risk Management System)

- Risk rating
- Monitoring results
- Inspections
- Action manager
- Investigations



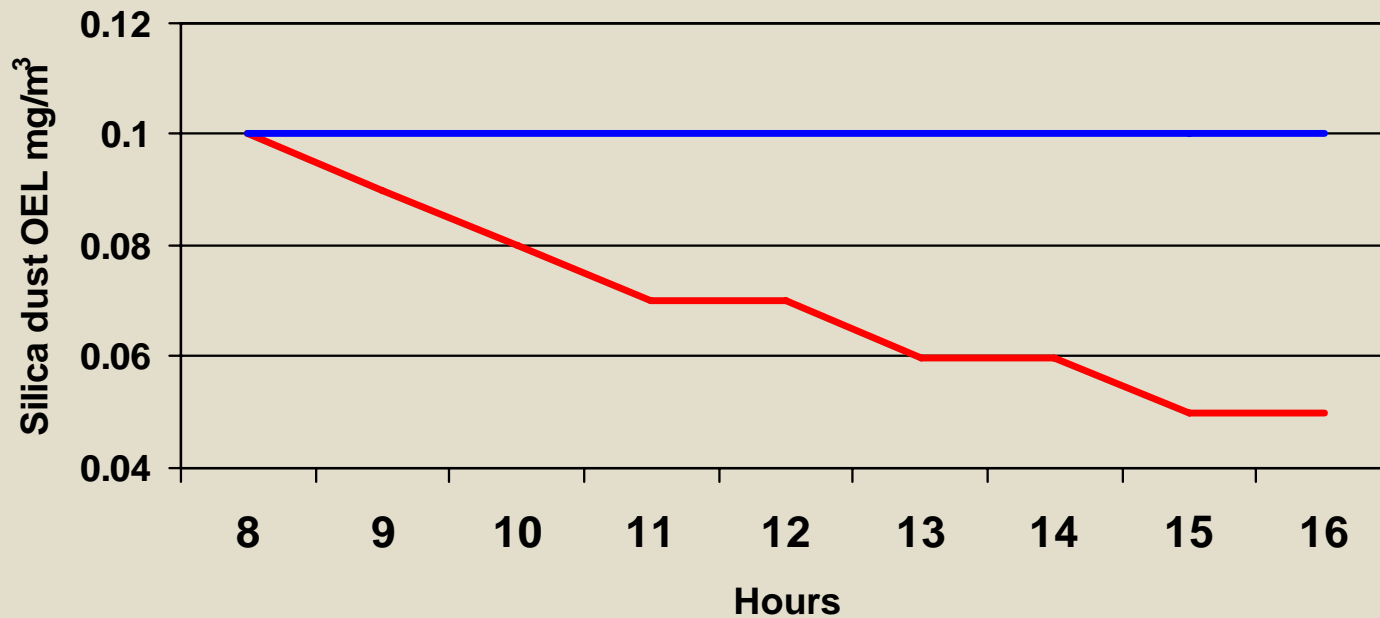
Problems remaining

- Leading indicators
- Confidence in exposure allocation
- Effectiveness of controls
- Holistic management on dust control

Problems remaining

Exposure times

Silica Dust Occupational Exposure Limit (OEL) Vs Hours worked



— "New" OEL — OEL (8 hours)

The way forward

- **Identify, test, evaluate new technology:**
- Fogger system at tips
- Water down tool (spray nozzle)
- Automated in-stope waterblast
- Development waterblast
- Drip feeds in strike gullies
- Enclosure of tips
- Modular filters
- Foam products at crushers / conveyors
- Hopper covers (tarpaulin / fibreglass)

The way forward

- **Identify, test, evaluate new technology:**
- Exhaust filter systems in loading x/c and raisebore drilling
- Air mover / dust suppressor
- Real-time dust monitor
- Mechanical loader - dust spray
- Alternative footwall treatment products
- Disposable filter bags
- Spray system "Wash bay" for loaded hoppers
- Surfactant addition to water
- Void filling for Vent, Heat, Radiation

The way forward

- Area sampling strategy to be (re)considered
- Specific targets to be set against time
- Line KRAs to be reviewed to include Milestones (leading indicators)
- Awareness campaign
- Hygiene items to always form part of H&S Committee agenda
- Occ Health stats to feature at least as prominently as safety stats
- Quality control required on data

The way forward

Do the basics well !

Ventilation controls

Watering down

Water quality

Re-entry periods

Tip covers

Filtration

Conclusion

- The management of silica exposures is no small order !
- Only dedication, commitment and enthusiasm by all stakeholders (Management, Employees, Unions and Associations) will result in reduced dust concentrations thus reduced medical outcomes.

Thank You

Questions?