Management of Silica Dust.

Kevin Hedges
Department of Mines and Energy
Safety and Health
Senior Principal Occupational Hygienist (Northern Region)
kevin.hedges@dme.qld.gov.au

Fritz Djukic
Department of Mines and Energy
Safety and Health
Senior Principal Occupational Hygienist (Southern Region)
fritz.djukic@dme.qld.gov.au

What is respirable crystalline silica?

Crystalline silica is a common mineral (SiO_2) found in most types of rock/stone, sands, shale, clays and gravel.
It mainly occurs in the form of quartz.

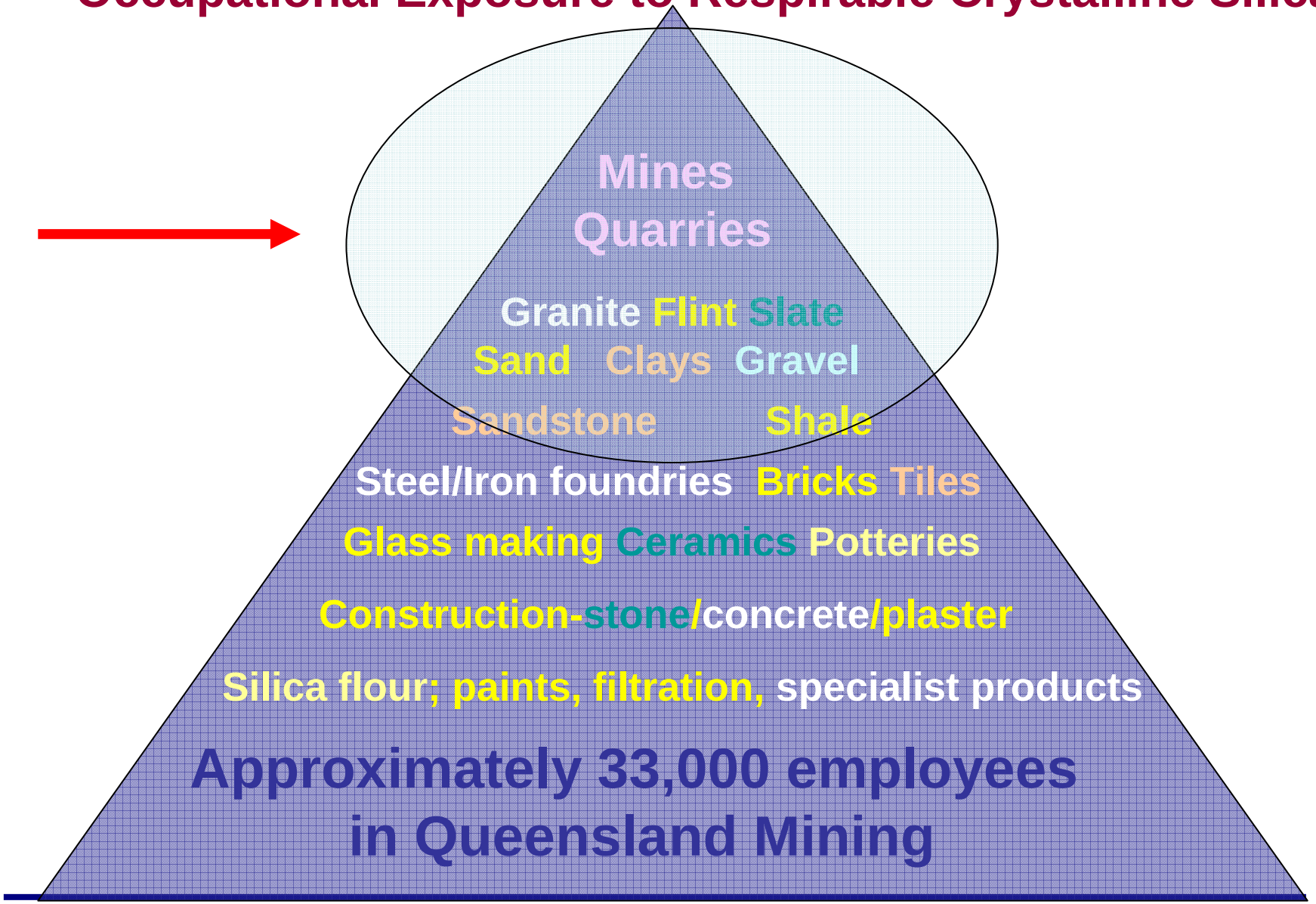
Sandstone – > 70% quartz.
Granite - up to 30% quartz.
Clays - 6-30% quartz.

"Respirable" : airborne particles small enough to reach the deep lung (less than 10 microns diameter).

Crystalline silica

- Why a priority
- The risk
- How well is the risk being managed
- The way forward

Occupational Exposure to Respirable Crystalline Silica



Health effects

Silicosis

Lung cancer

Chronic obstructive pulmonary disease (COPD)

Silicosis

- **High exposures** over just **a few months** can result in **“acute silicosis" –** often a fatal condition.
- Chronic silicosis is a slow progressive, **irreversible disease** that usually takes many years to develop.
- *Silicosis may **further develop** even when exposure to silica has ceased.*

What are the symptoms of silicosis?

Early stages

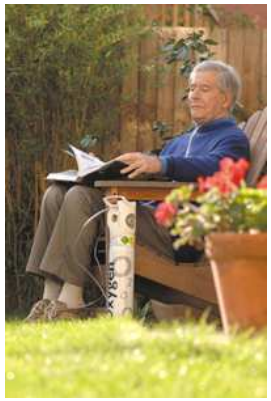
Without medical exam may go unnoticed

Continued exposure

Shortness of breath upon exercising
Possible fever
Bluish skin at ear lobes or lips
Susceptibility to infectious lung diseases such as tuberculosis.

Progression of the disease

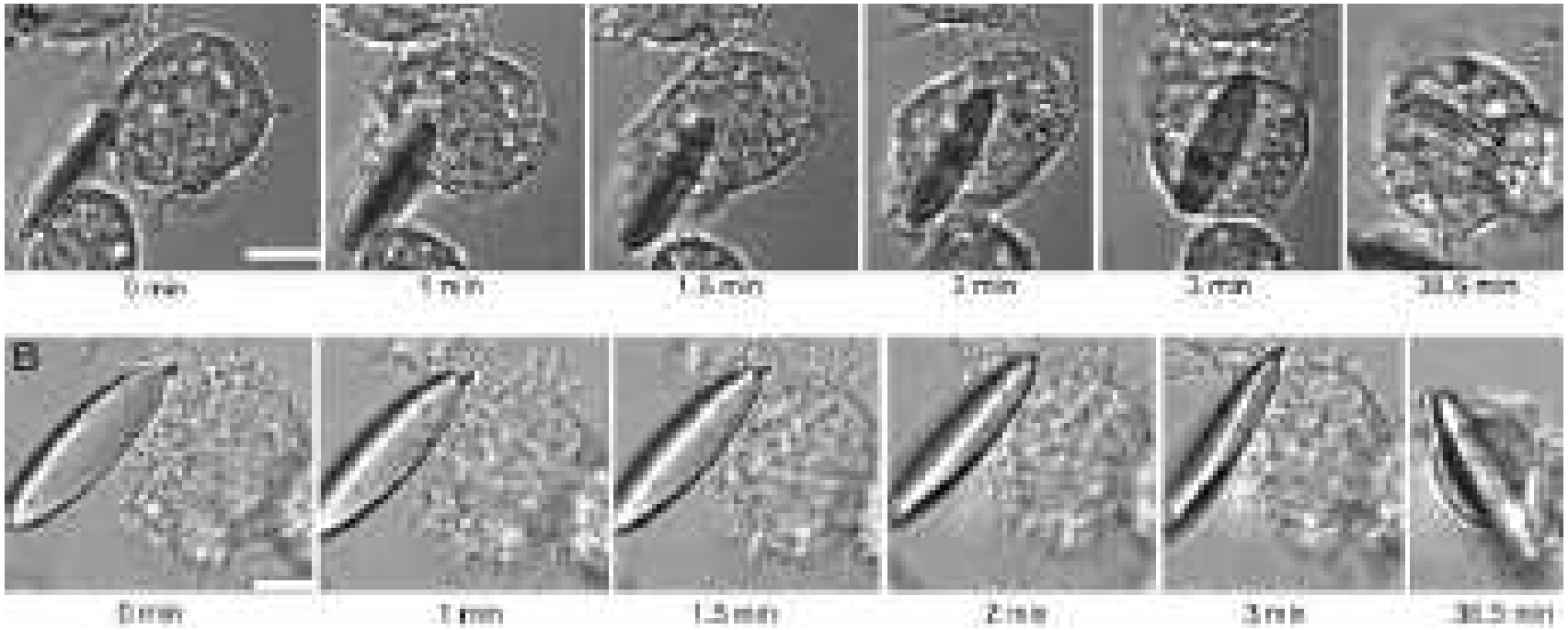
Fatigue
Extreme shortness of breath
Loss of appetite
Pain in the chest
Respiratory failure



Suffering prior to death may occur for many years.

The Hazard

- Significant risk from dust containing silica, in:
  - Rock
  - Sands
  - Clays
  - Shale
  - Gravel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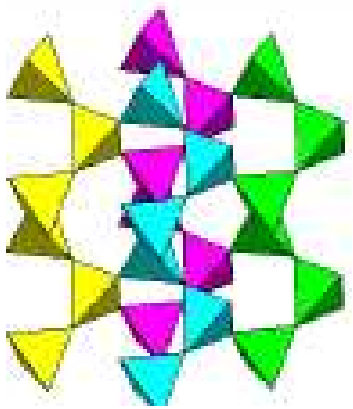


Intensity of exposure.

Freshly cut crystalline silica has a higher degree of potency to crystalline silica that has aged.

This may mean that if you breath in a relatively high concentration for a short duration of time this may be more hazardous than breathing in a lower concentration over a longer period of time.

Even though the average exposure over a day is the same.

Potency matrix

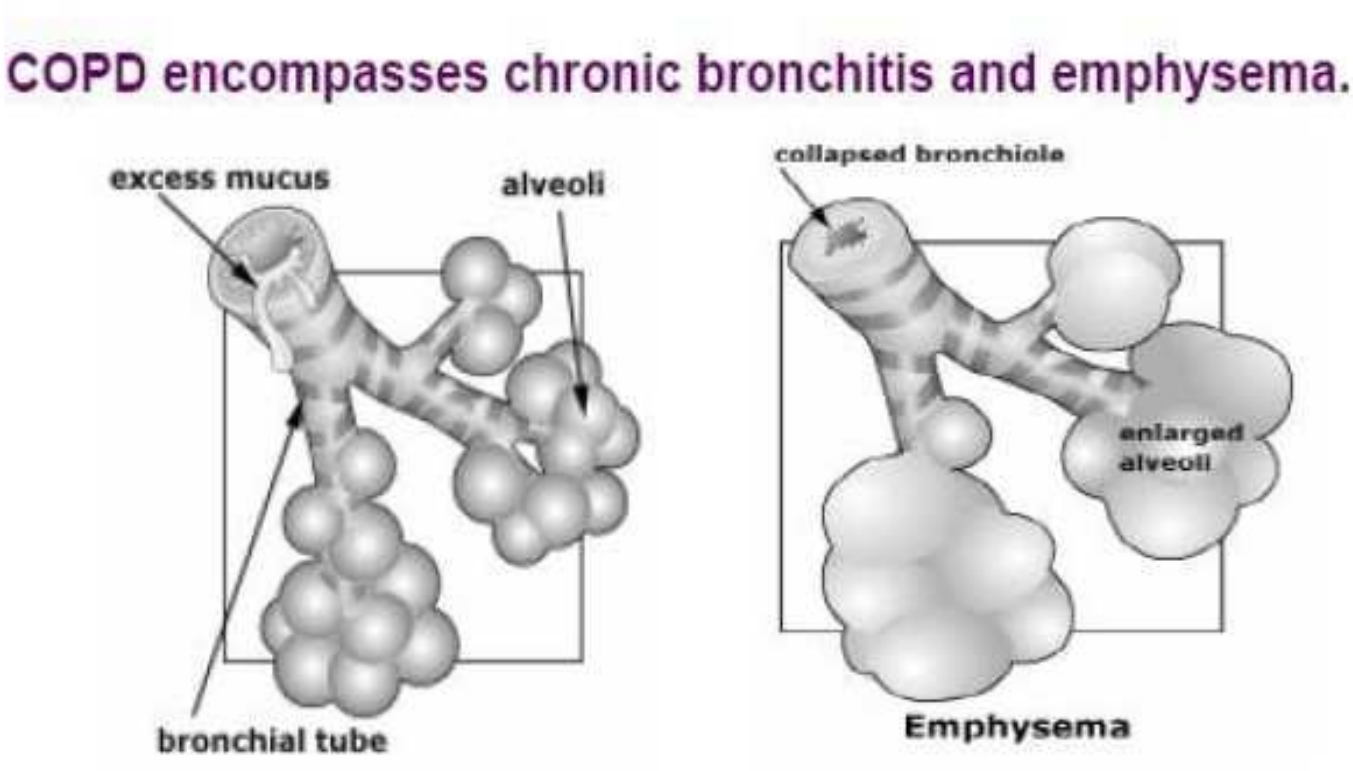
Factors	Comment	Situations
Particle size	Enhances potency	Grinding and abrasive process.
Dry and freshly cut	Reference point to compare potency	Drilling, crushing.
Wetting	From dust suppression	Wet extraction processes
Aged	Reduces potency	No abrasion, grinding.
Presence of clay	Aluminium reduces potency	Mines extracting low rank coal

Adapted from HSE EH 75/4 page 7


DANGER
ISOLATE
BEFORE ENTRY


DAEWOO

Chronic obstructive pulmonary disease (COPD)



What is the risk?

What is the risk?

Study in Scottish coal miners.

15 years exposure to RCS in mg/m³	Predicted risks of developing silicosis within 15 years following exposure
0.02	0.25%
0.04	0.5%
0.1	2.5%
0.3	20%

Study in Scottish Coal Miners Source: HSE EH75/4 2002 p. 73.

"*The quality of the exposure data for this study is more detailed and better documented compared to other studies*"

HSE 2002 EH75/4 p.67

According to this study:
15 years exposure at 0.1mg/m^3
followed by 15 years of non exposure,
equals:

1 in 40 chance of being diagnosed with silicosis

(ILO Category 2/1)

There is an additional risk!

What about long periods of low exposure with short periods of high exposure.

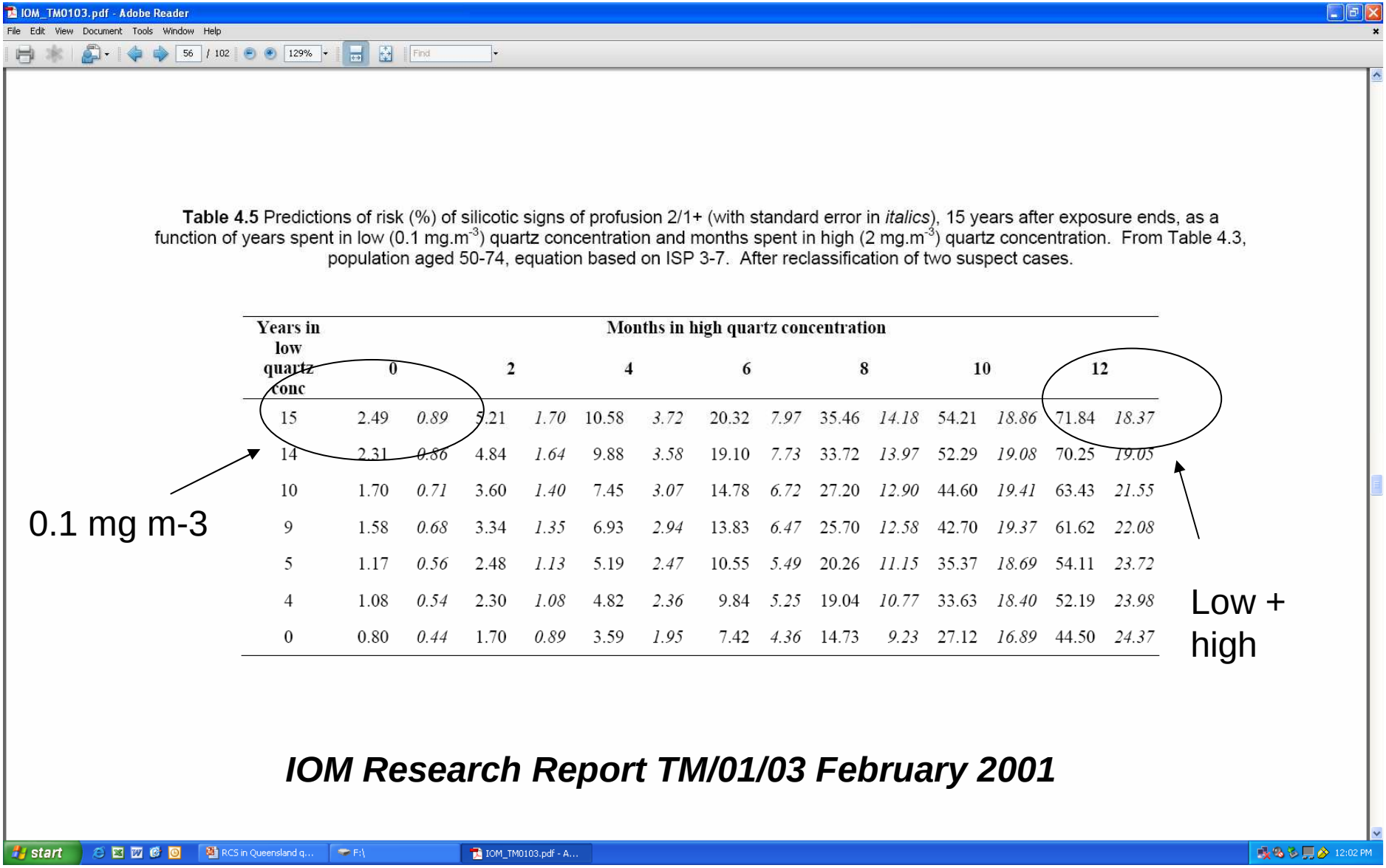


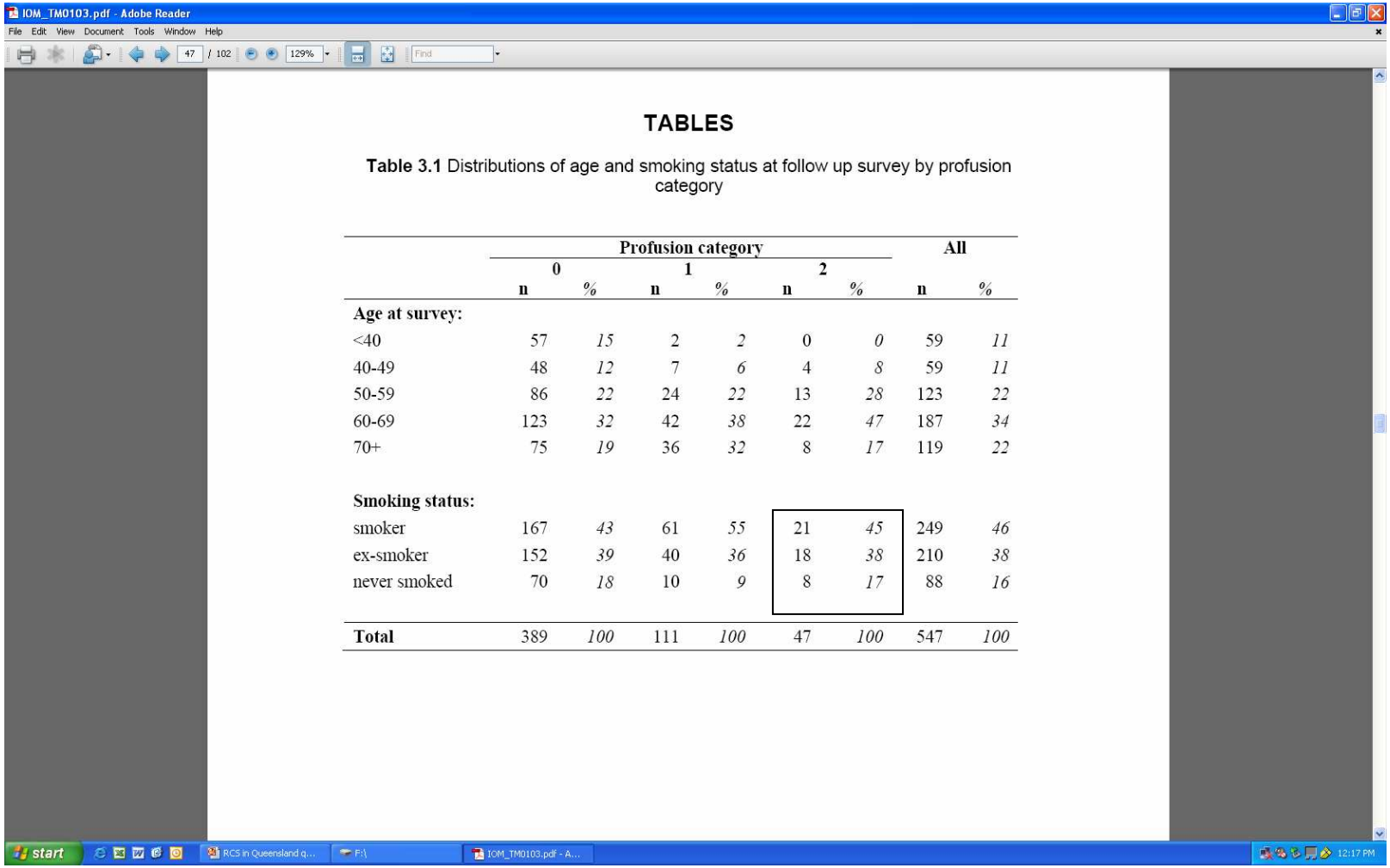
Table 4.5 Predictions of risk (%) of silicotic signs of profusion 2/1+ (with standard error in *italics*), 15 years after exposure ends, as a function of years spent in low (0.1 mg.m^{-3}) quartz concentration and months spent in high (2 mg.m^{-3}) quartz concentration. From Table 4.3, population aged 50-74, equation based on ISP 3-7. After reclassification of two suspect cases.

Years in low quartz conc	Months in high quartz concentration													
	0		2		4		6		8		10		12	
15	2.49	*0.89*	3.21	*1.70*	10.58	*3.72*	20.32	*7.97*	35.46	*14.18*	54.21	*18.86*	71.84	*18.37*
14	2.31	*0.86*	4.84	*1.64*	9.88	*3.58*	19.10	*7.73*	33.72	*13.97*	52.29	*19.08*	70.25	*19.05*
10	1.70	*0.71*	3.60	*1.40*	7.45	*3.07*	14.78	*6.72*	27.20	*12.90*	44.60	*19.41*	63.43	*21.55*
9	1.58	*0.68*	3.34	*1.35*	6.93	*2.94*	13.83	*6.47*	25.70	*12.58*	42.70	*19.37*	61.62	*22.08*
5	1.17	*0.56*	2.48	*1.13*	5.19	*2.47*	10.55	*5.49*	20.26	*11.15*	35.37	*18.69*	54.11	*23.72*
4	1.08	*0.54*	2.30	*1.08*	4.82	*2.36*	9.84	*5.25*	19.04	*10.77*	33.63	*18.40*	52.19	*23.98*
0	0.80	*0.44*	1.70	*0.89*	3.59	*1.95*	7.42	*4.36*	14.73	*9.23*	27.12	*16.89*	44.50	*24.37*

0.1 mg m-3

Low + high

IOM Research Report TM/01/03 February 2001



IOM Research Report TM/01/03 February 2001

Country	Occupational Exposure Limit for Alpha Quartz (mg/m^3)
UK	0.1
Austria	0.15
Netherlands	0.075
France	0.1
Belgium	0.1
Ireland	0.05
Italy	0.05
Australia	0.10
ACGIH	0.025

Occupational Exposure Limits – are not fine dividing lines!

Case in point respirable crystalline silica!

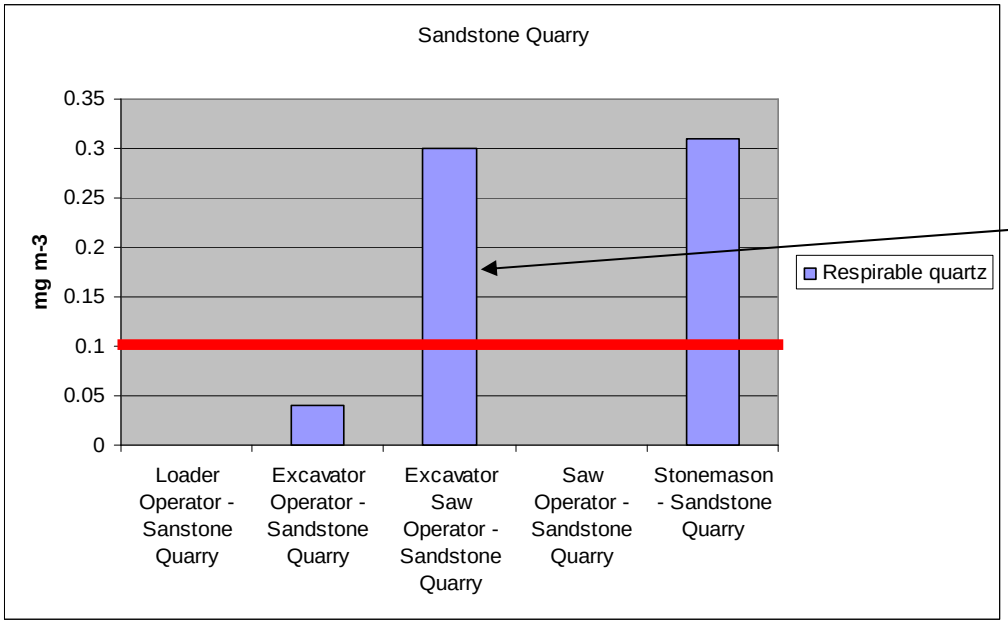
Australian Institute of Occupational Hygienists (AIOH)

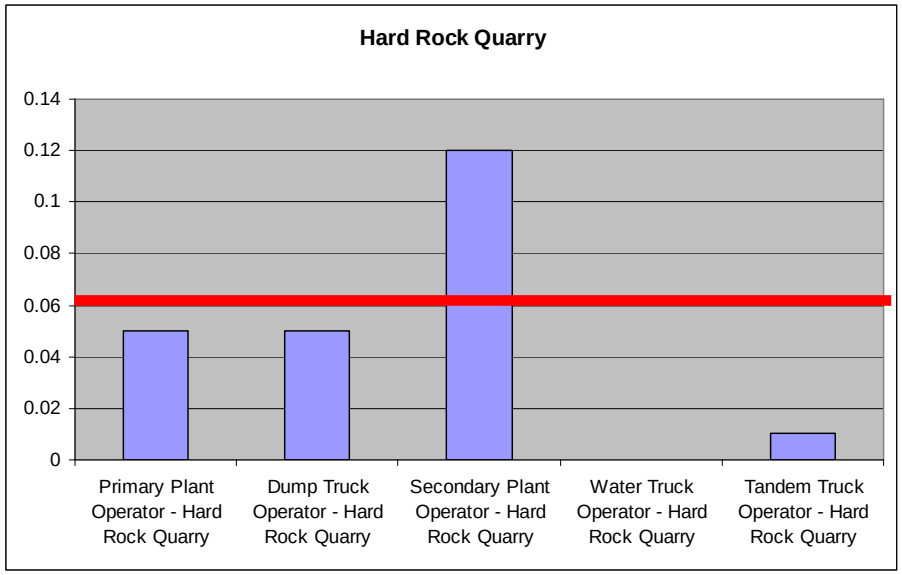
"Where there is a **likelihood** of 50% of the exposure standard being exceeded, control strategies and health surveillance should apply".

*AIOH **draft position paper** for respirable crystalline silica. Rio Tinto also **requires health surveillance** at 50% of the exposure standard.*

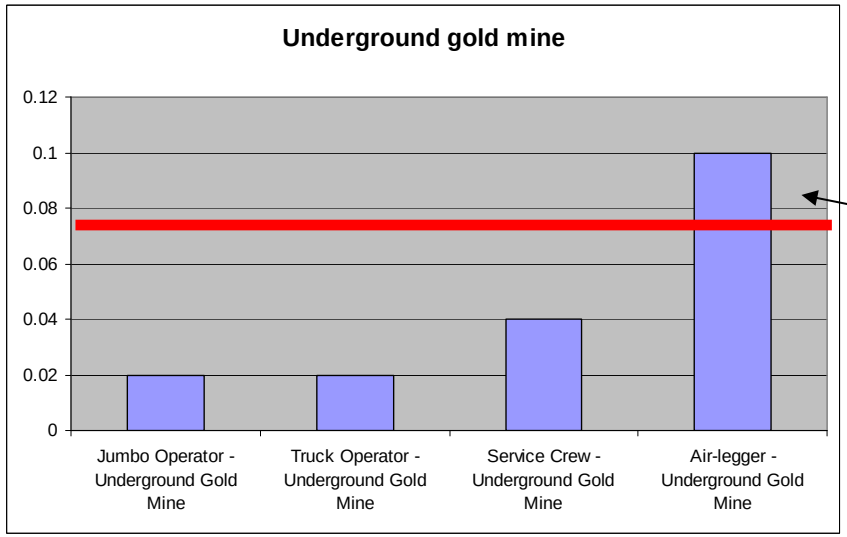
Current situation

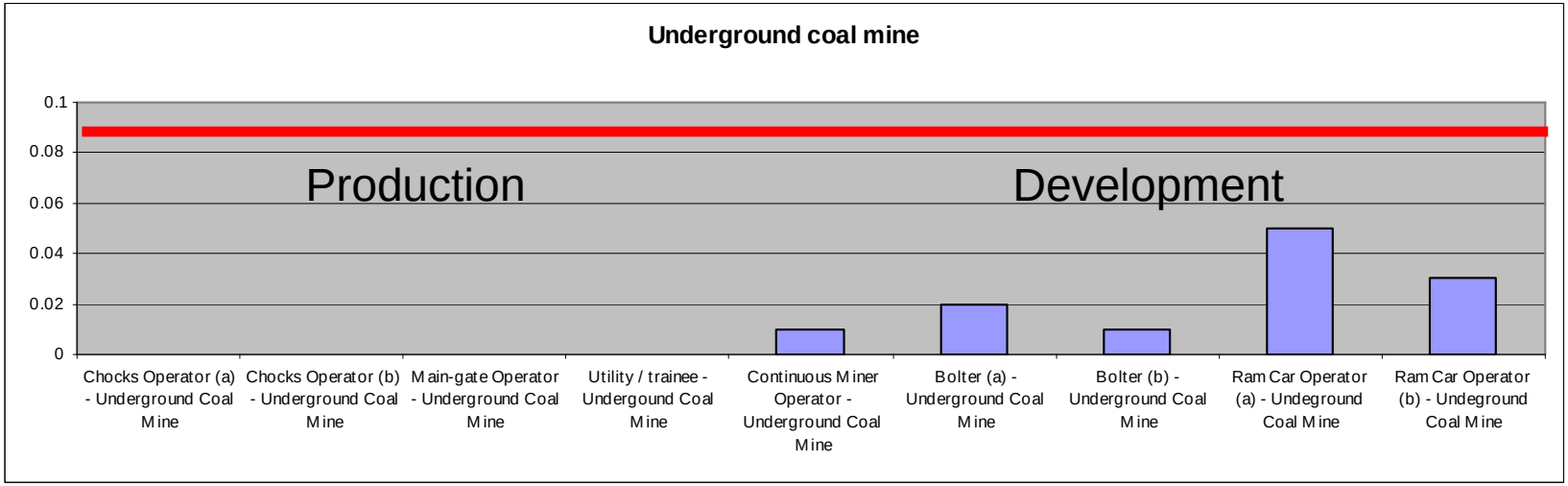
“Snapshot of mining”


Sandstone Quarry
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
mg m-3
Respirable quartz
Loader Operator - Sanstone Quarry
Excavator Operator - Sandstone Quarry
Excavator Saw Operator - Sandstone Quarry
Saw Operator - Sandstone Quarry
Stonemason - Sandstone Quarry


Hard Rock Quarry
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Primary Plant Operator - Hard Rock Quarry
Dump Truck Operator - Hard Rock Quarry
Secondary Plant Operator - Hard Rock Quarry
Water Truck Operator - Hard Rock Quarry
Tandem Truck Operator - Hard Rock Quarry


KOMATSU
60208


Underground gold mine
0.12
0.1
0.08
0.06
0.04
0.02
0
Jumbo Operator - Underground Gold Mine
Truck Operator - Underground Gold Mine
Service Crew - Underground Gold Mine
Air-legger - Underground Gold Mine


Underground coal mine
0.1
0.08
0.06
0.04
0.02
0
Production
Development
Chocks Operator (a) - Underground Coal Mine
Chocks Operator (b) - Underground Coal Mine
Main-gate Operator - Underground Coal Mine
Utility / trainee - Underground Coal Mine
Continuous Miner Operator - Underground Coal Mine
Bolter (a) - Underground Coal Mine
Bolter (b) - Underground Coal Mine
Ram Car Operator (a) - Undeground Coal Mine
Ram Car Operator (b) - Undeground Coal Mine

3 of the 23 workers exceeded 0.1mg m^{-3}

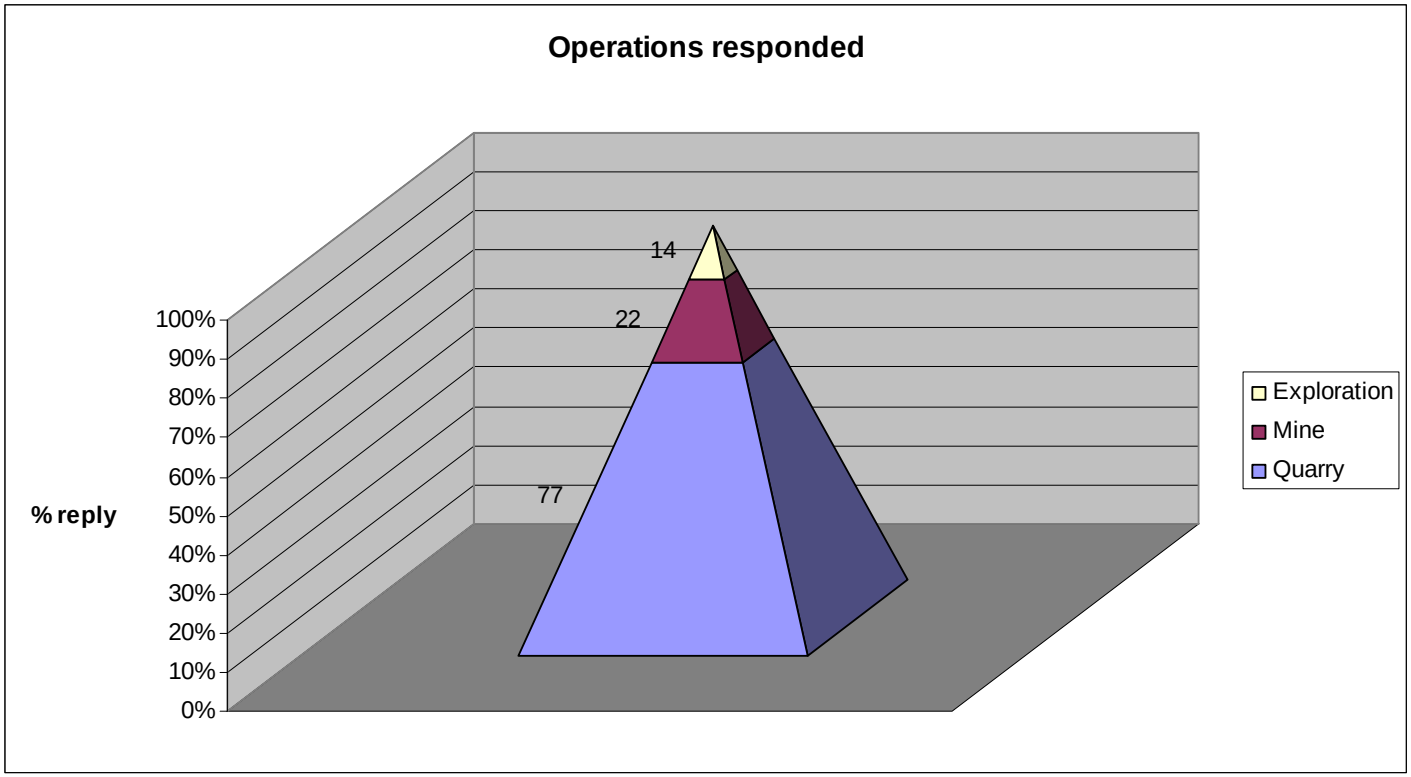
These employees were not wearing respiratory protective equipment (dust masks).

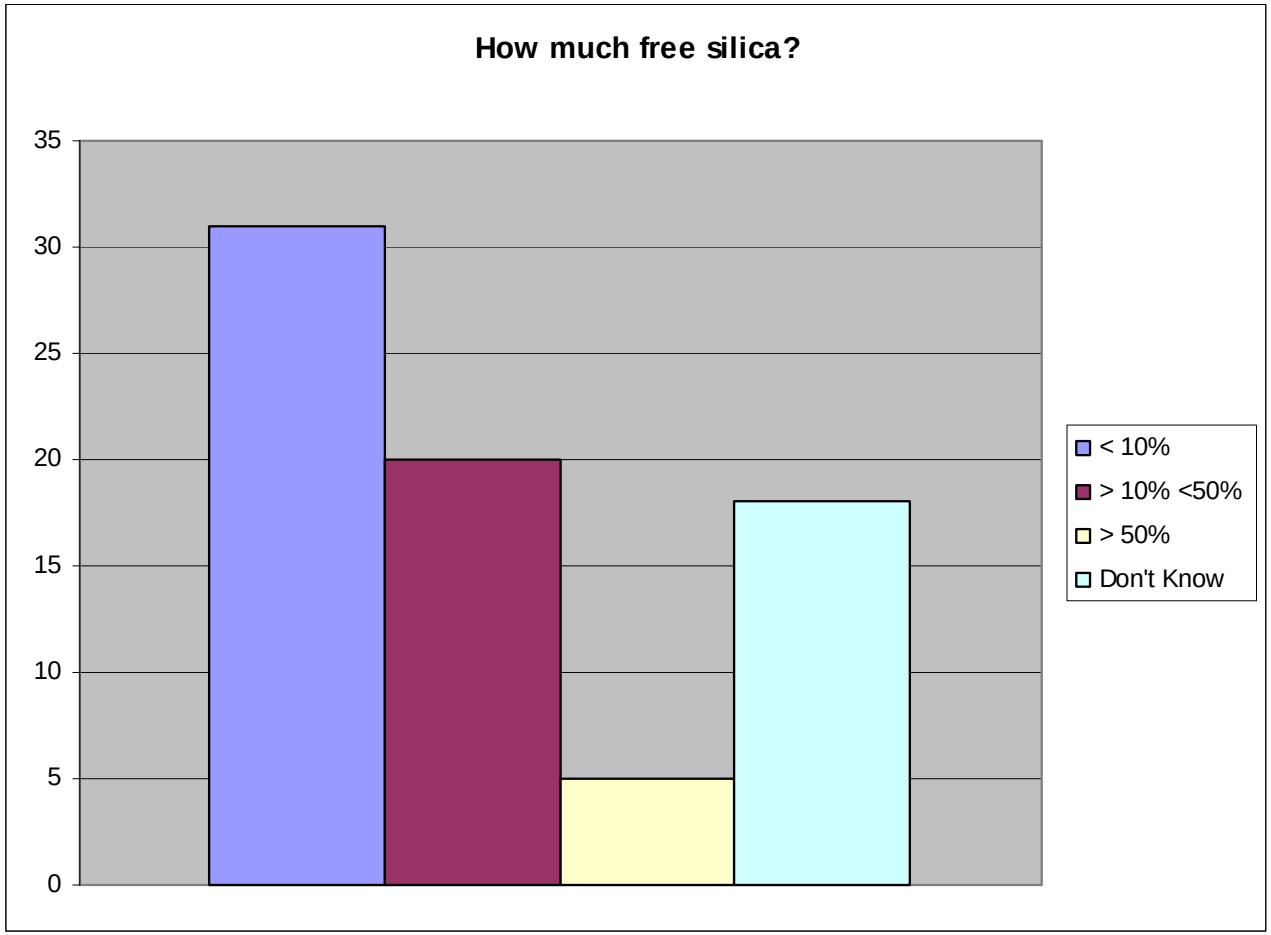
Equates to 13% at risk.

Crude estimate – a lot more data is needed.

Questionnaire Feedback

About 113 completed questionnaires have been assessed





Silica flour 100%

Sandstone, quartzite 100%

Sand / gravel / flint > 70%

Calcined diatomite 25 – 65%

Shale 40 – 60%

Marl up to 60%

Slate up to 40%

Granite up to 30%

Talc up to 30%

Ball clay 15 to 30%

Pumice up to 25%

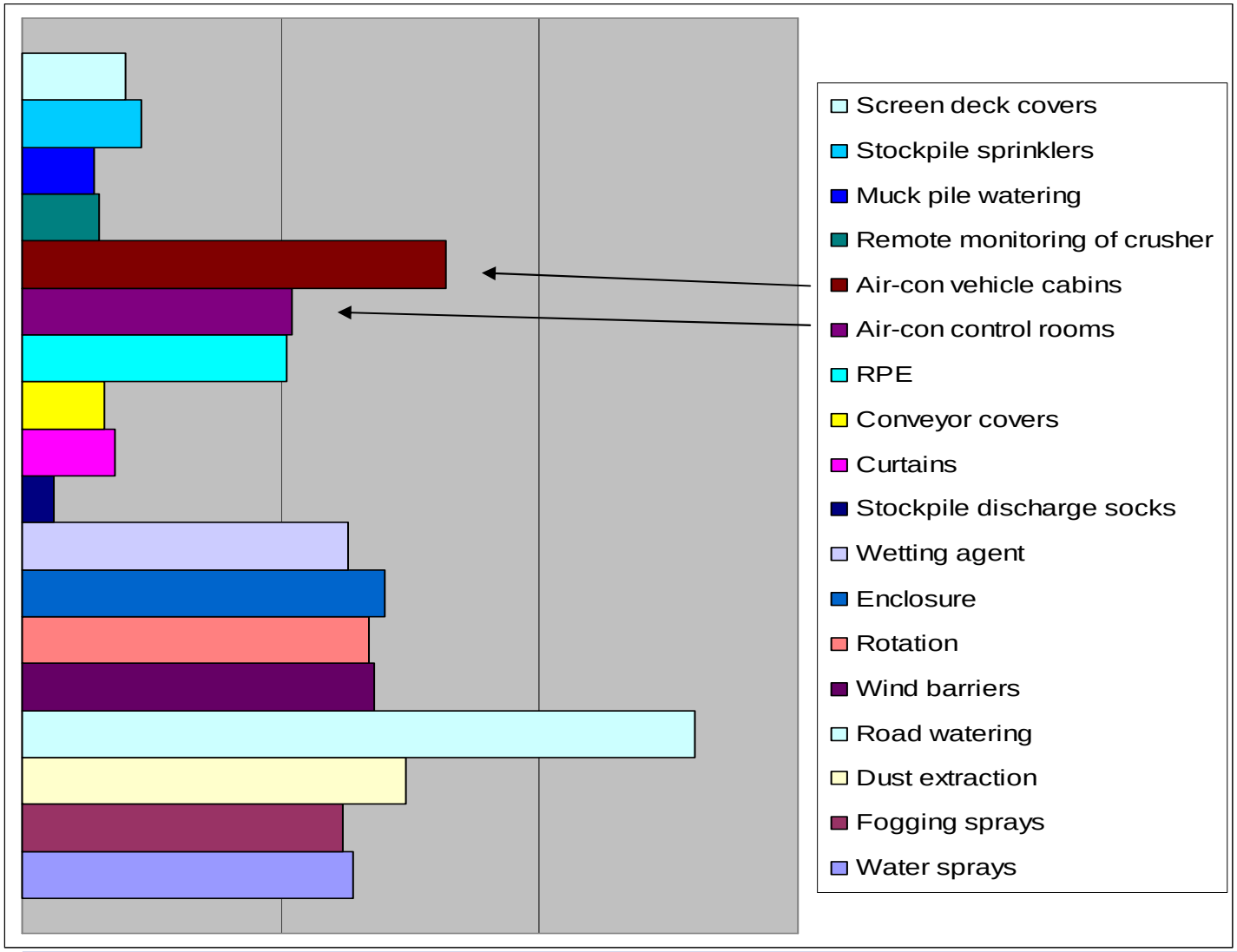
Ironstone up to 15%

Basalt, dolerite up to 5%

Kaolinite < 5%

Limestone, chalk, marble < 2%

Controls


Screen deck covers
Stockpile sprinklers
Muck pile watering
Remote monitoring of crusher
Air-con vehicle cabins
Air-con control rooms
RPE
Conveyor covers
Curtains
Stockpile discharge socks
Wetting agent
Enclosure
Rotation
Wind barriers
Road watering
Dust extraction
Fogging sprays
Water sprays

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Controls

Do the controls work?

Have you checked their effectiveness?

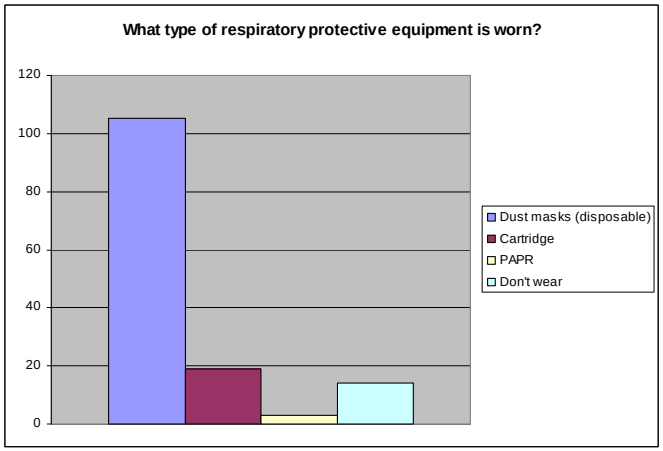
Control rooms

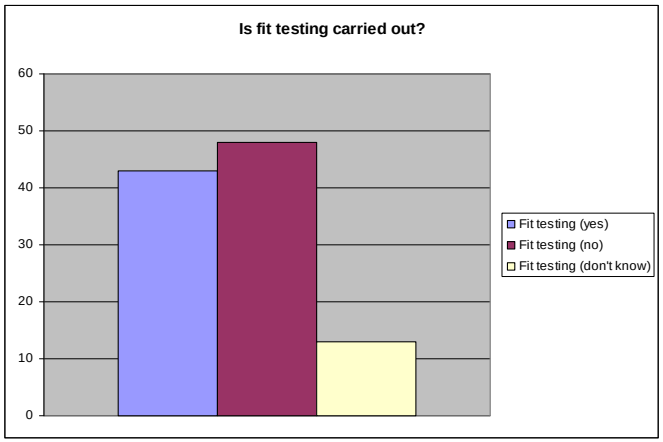
Are the control rooms under positive pressure?
Do the filters remove very fine particles?

Vehicle cabins

Are the cabins under positive pressure?
Do the filters remove very fine particles?

Dust masks

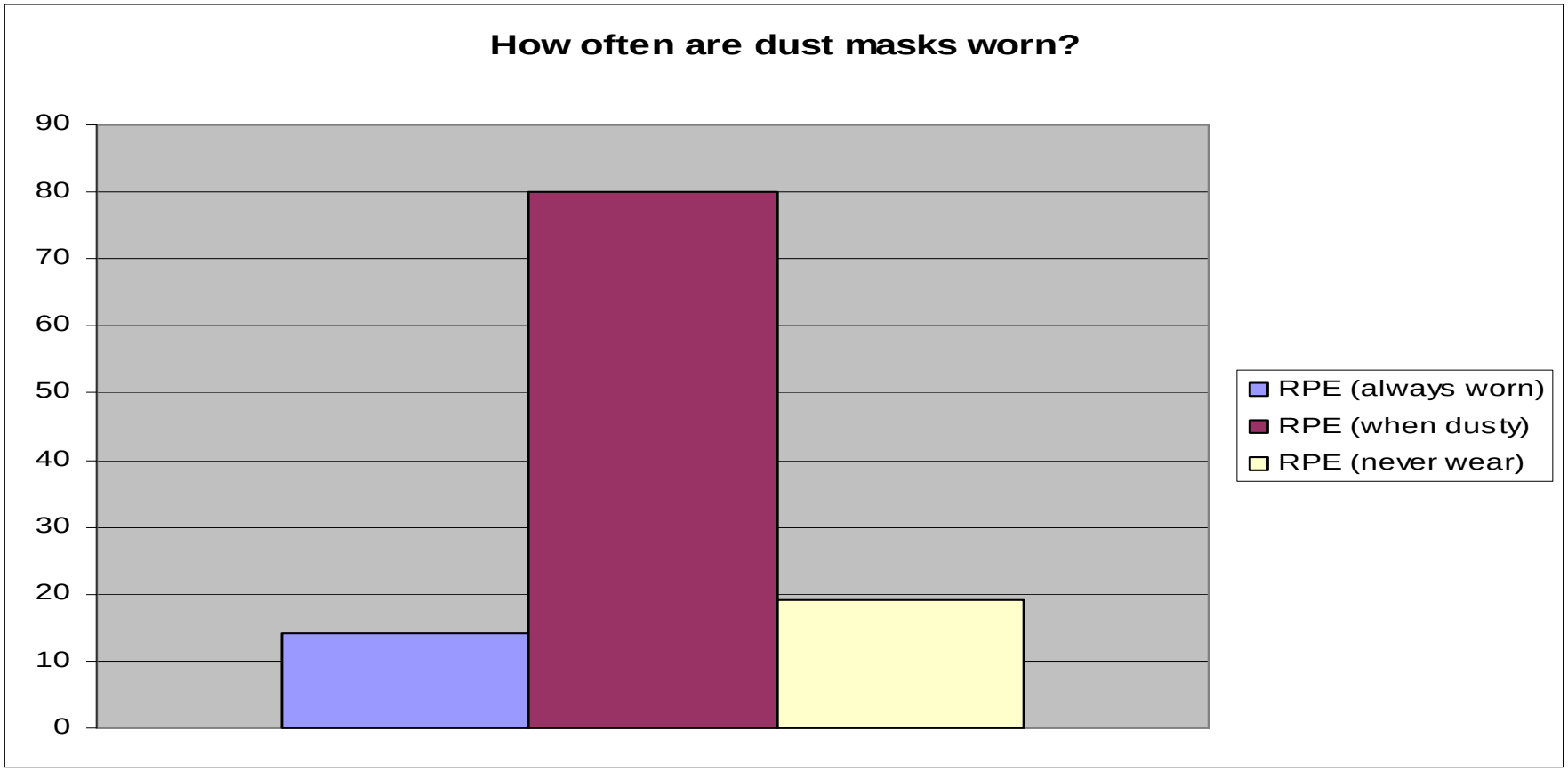


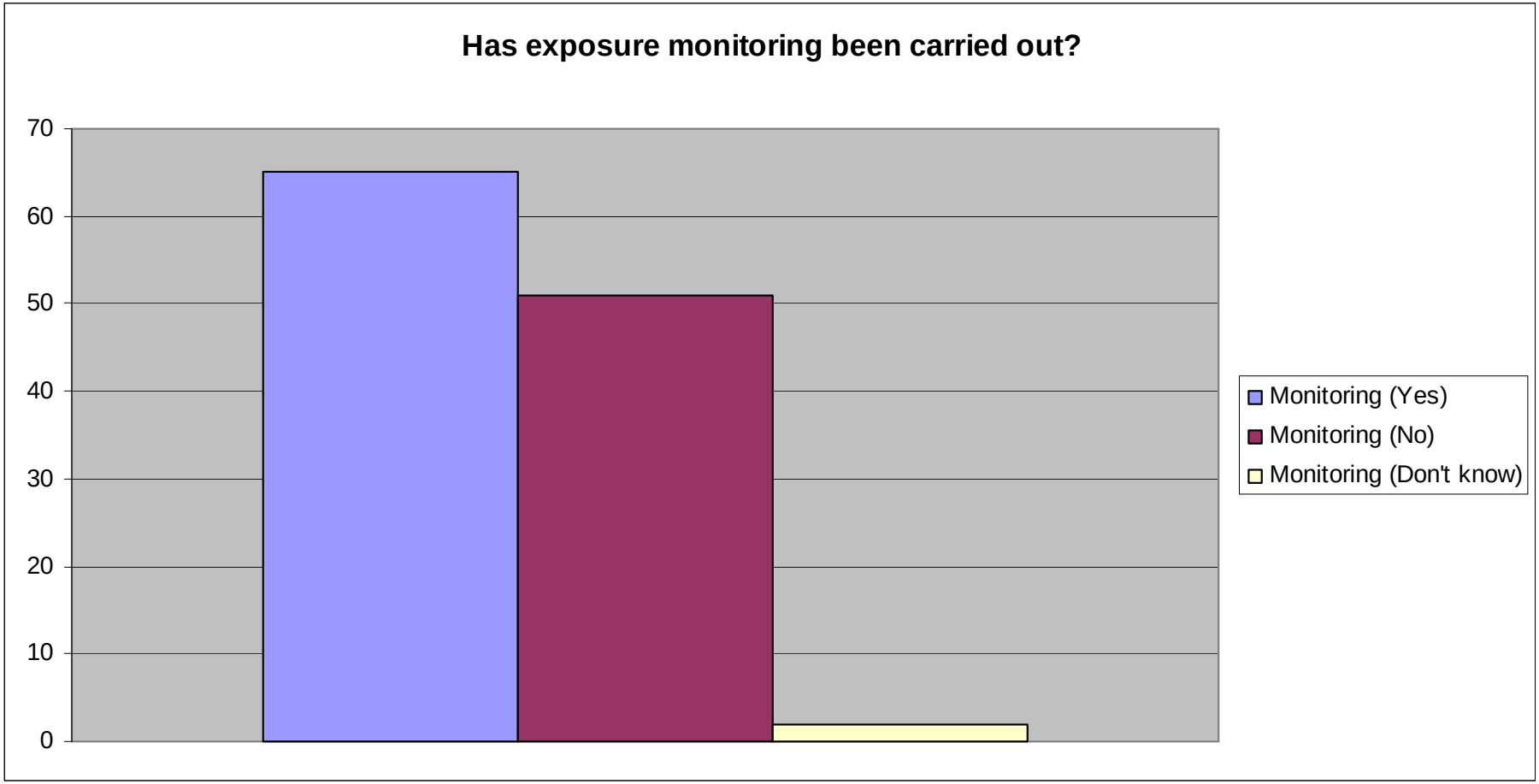


Does your site have a clean shaven policy?

Is fit testing carried out?

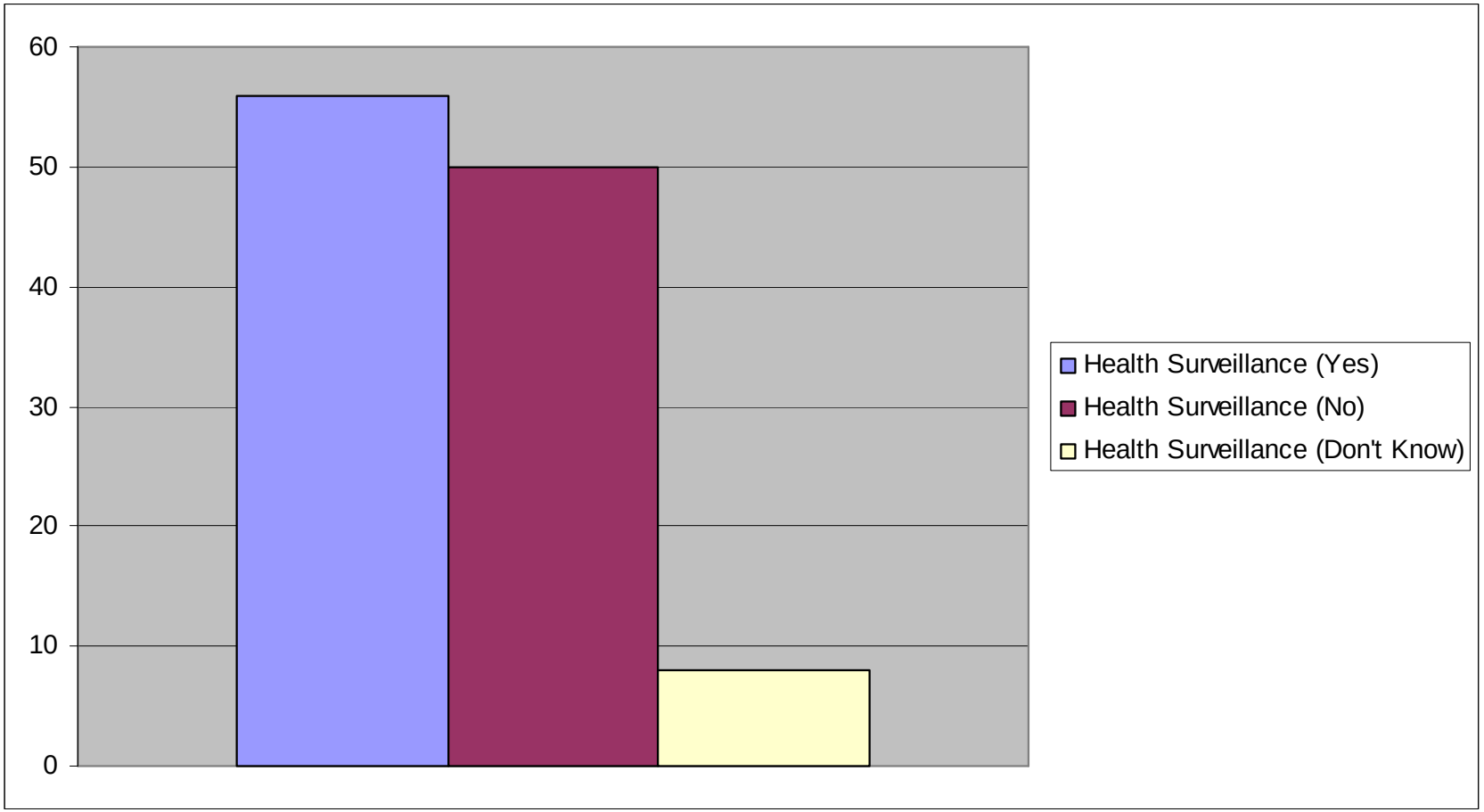
Respirable dust is invisable!





Monitoring should be carried out to evaluate the effectiveness of controls!

Health Surveillance



Do you use an appropriate doctor?

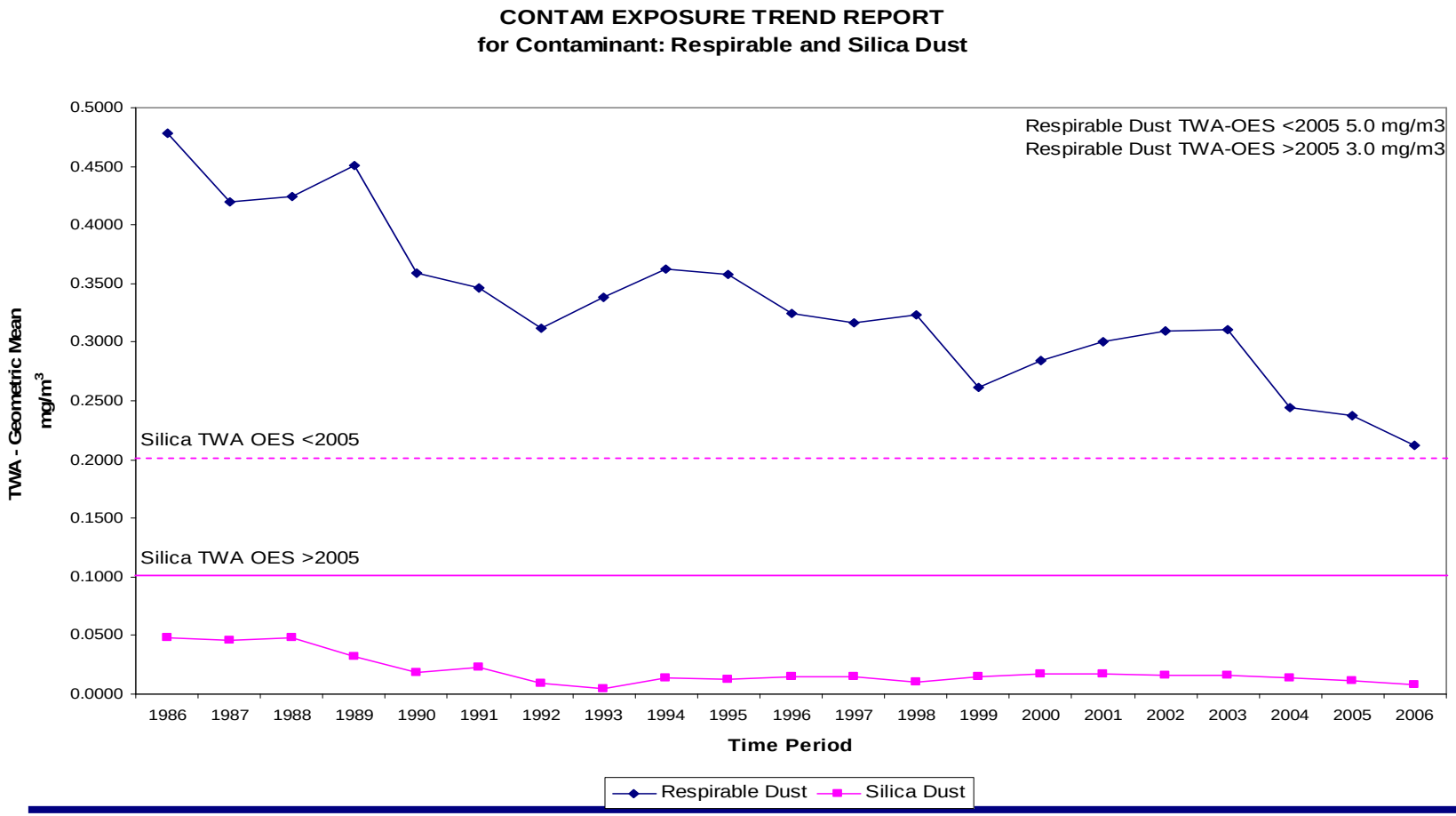
The way forward!

Review and **improve controls** and then monitoring.

What gets measured gets noticed,

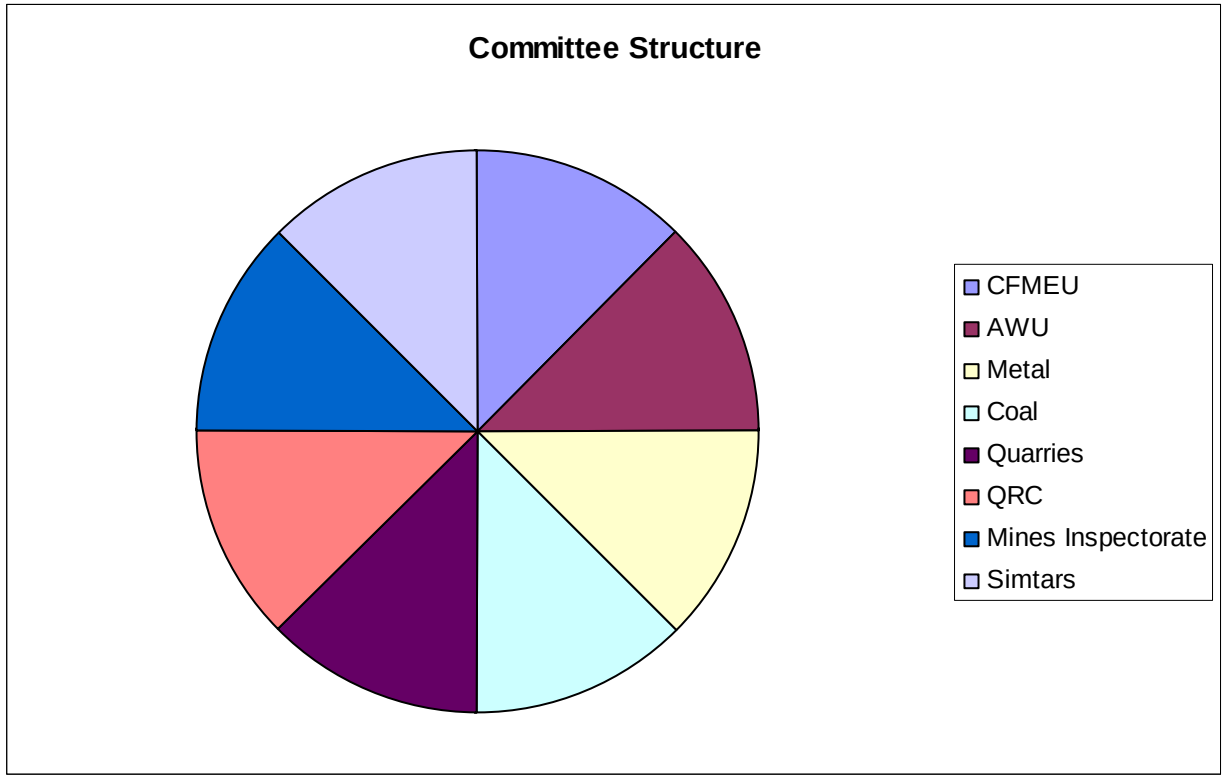
what gets noticed gets action!

Respirable dust and respirable crystalline in WA Mining



Source Lindy Nield DOCEP

Queensland Mining Health Improvement and Awareness Committee



2nd Meeting hosted by Xstrata

Topics:

1. Pneumoconiosis in USA
2. Health surveillance
3. Dust control in coal mines
4. Dust control in quarries
5. Dust control in metal mines
6. Exposure assessment
7. Dust plan including research and auditing