

Pilot of an External Quality Assurance Programme for Crystalline Silica

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A WHO Collaborating Centre and ILO/CIS National Centre



National Institute for Occupational Health (NIOH)

- SA's major centre for occupational health development, training and research
- Research, training and services relating to occupational health
- Sections include: Toxicology, Occupational Medicine, Analytical Chemistry, Pathology, Epidemiology, Microbiology and occupational Hygiene

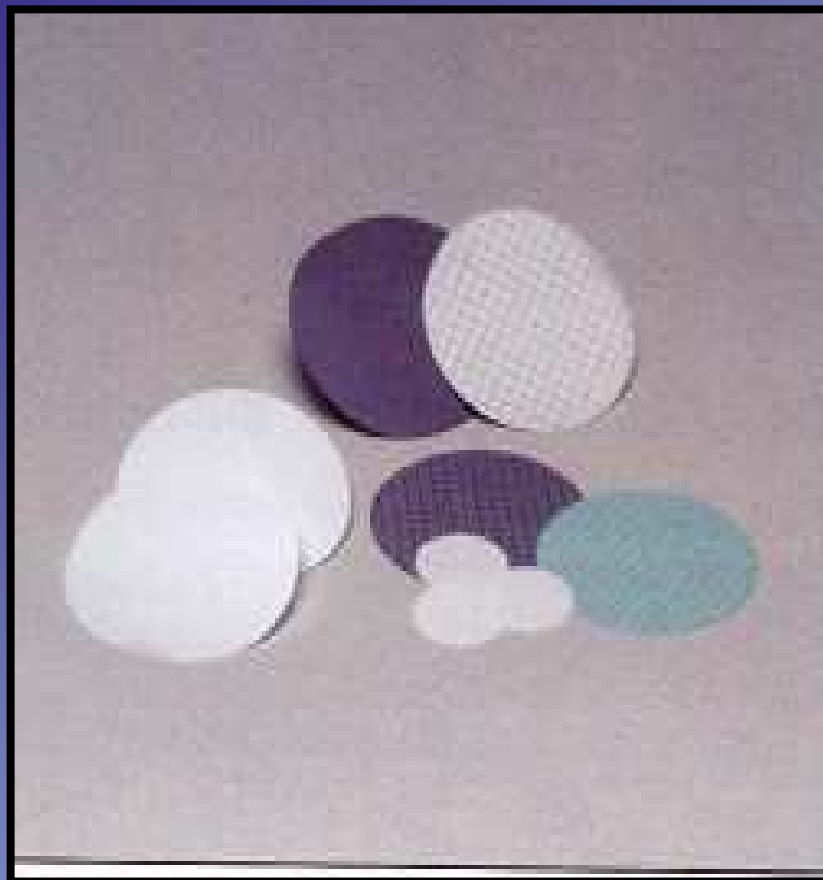


Occupational Hygiene

- Assessing hazards to health in the workplace
- Providing advice on how to control these hazards
- Training and teaching employees and students
- Carrying out research

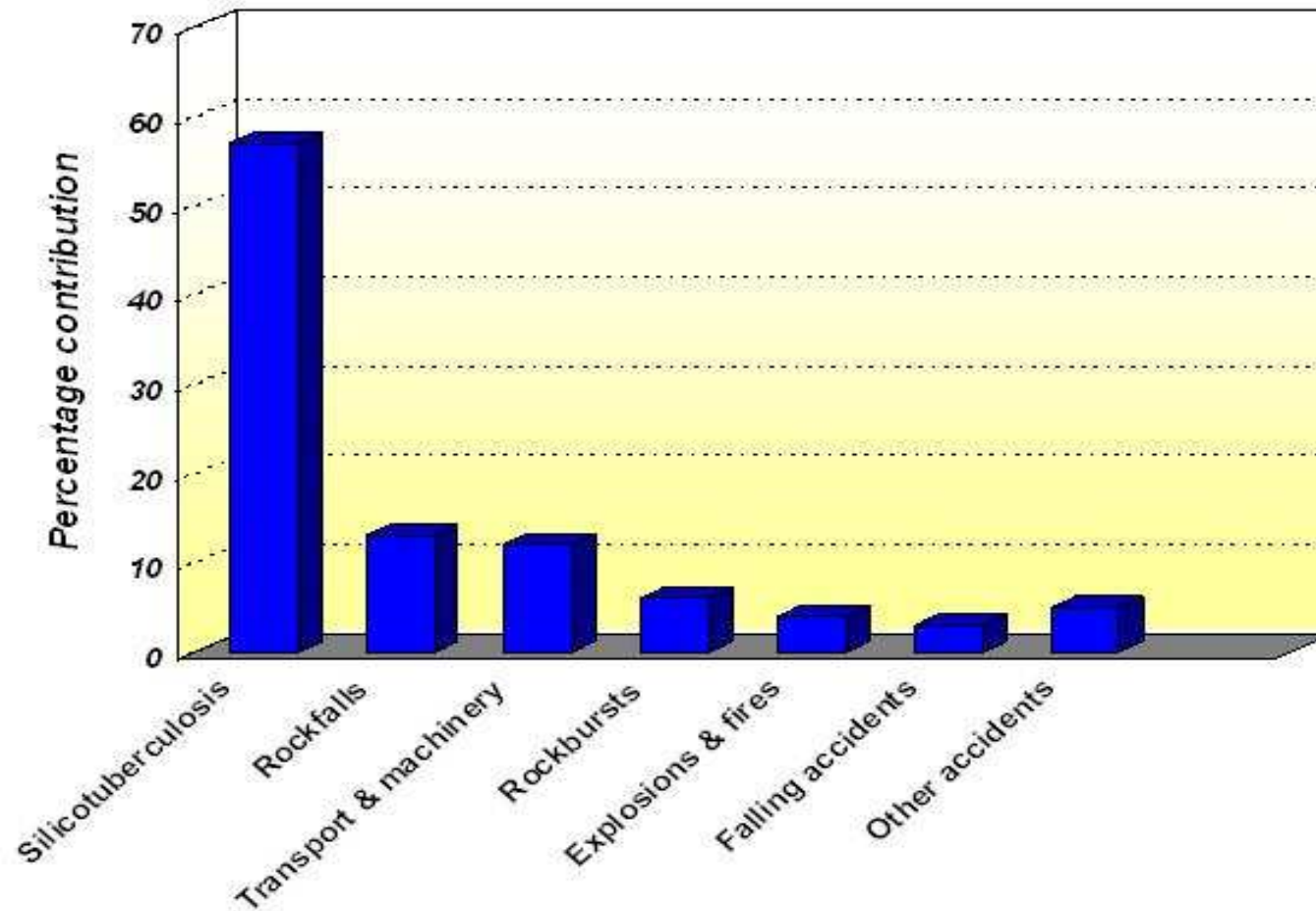
Hazards assessment

- Silica sampling



Carrying Out Research

Distribution of fatalities within selected research thrust areas and other categories for the period 1999 to 2002



Objective

- Set up a South African External Quality Assurance (EQA) programme for Respirable Crystalline Silica (RCS) analysis using X-ray diffraction (XRD) and Fourier Transform Infrared (FTIR)

Why?

- South African National Accreditation System (SANAS) requirement
- Only international programmes
 - NIOH is a member of the Health and Safety Executive (HSE) Work Analysis scheme for proficiency (WASP)
- Local EQA programme
 - Lower cost
 - Faster turnaround times
 - Access to advice and support



The Process

- Laboratories invited
- QA sample preparation
- Samples sent to laboratories
- Assessment of results
- Report



Participating Laboratories

Laboratory Code	Method used
A	XRD direct-on-filter
B	XRD direct-on-filter
C	IR KBr pellet
D _{XRD}	XRD direct-on-filter
D _{FTIR}	FTIR direct-on-filter

QA Sample Preparation

Cyclone + PVC filter
(to collect silica dust)

Rubber bulb
(to create dust cloud)

Filter (to prevent over
pressurization)



Personal
sampling
pump

Fine
powdered
crystalline
silica
(known
content)

QA samples

- Analysed using XRD and FTIR

Sample No.	Gravimetric (μg)	XRD (μg)	FTIR (μg)
A1	67	64	68
A2	161	170	166
A3	268	268	285
A4	387	394	401
B1	104	102	112
B2	155	159	157
B3	218	235	231
B4	397	396	393

Results Analysis (1)

- Gravimetric result = Target value
- Difference from the target value
(±15% acceptance criterion)
- Z- scores

Results Analysis (2)

- $Z\text{-score} = \frac{(\text{Lab result} - \text{Target value})}{(\text{SD})}$

- Where $\text{SD} = 0.075 \times \text{Target value}$

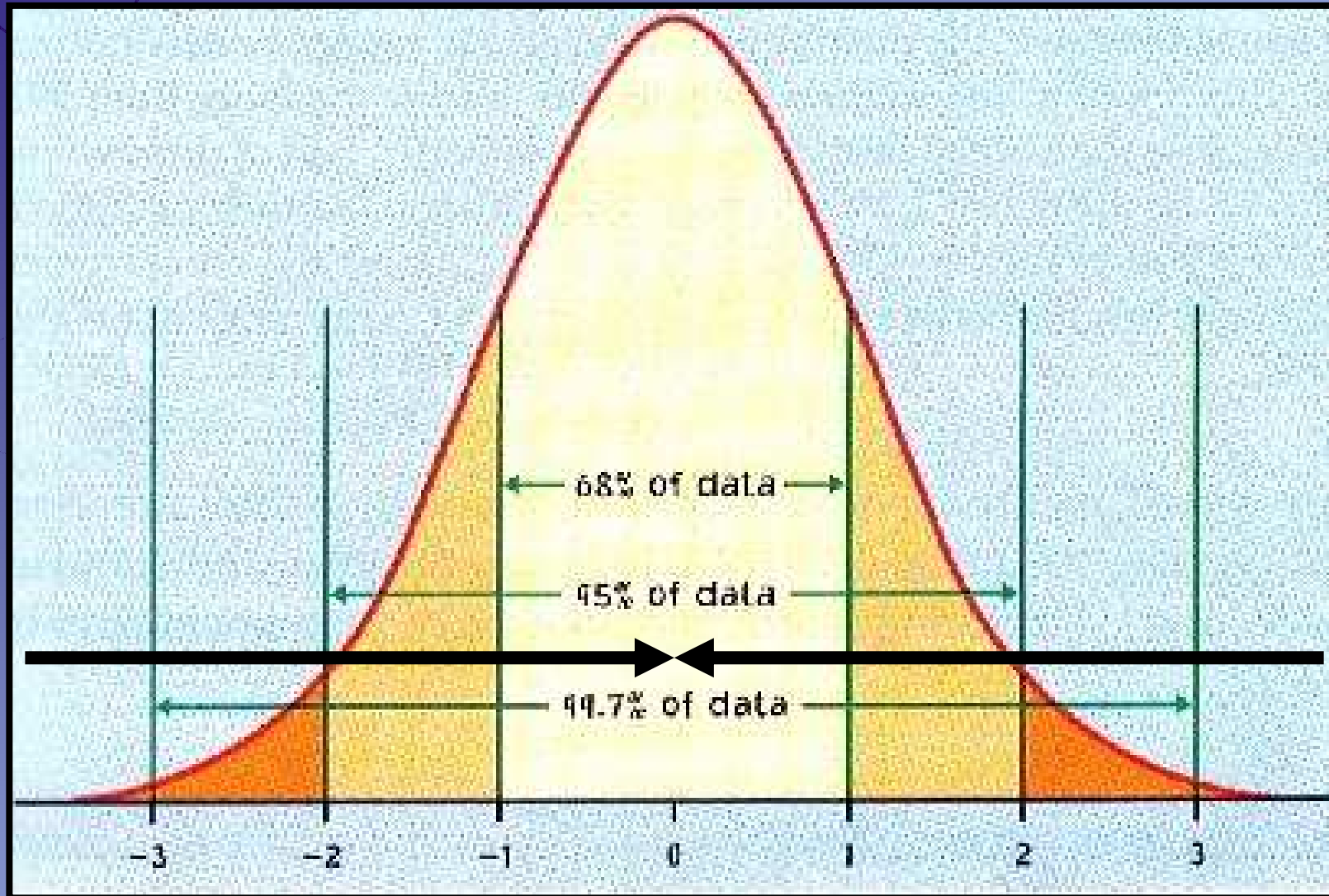
- Z-scores:

- ± 1 and ± 2 = acceptable**

- ± 3 = warning**

- ± 4 and greater = unacceptable**

Z-Scores Graph



Results (Z-scores)

Lab	Round 1	Round 2	Round 3	Round 4	Round 5
A	Green	Green	Green	Green	Green
B	Red	Green	Green	Green	Green
C	White	White	White	White	Red
D _{XRD}	White	Red	Red	Green	Green
D _{FTIR}	White	White	Red	White	White

- White= No return
- Green= Acceptable
- Yellow= Warning
- Red= Unacceptable



Challenges

- Lack of access to respirable crystalline silica standards
 - Standards provided
- Little experience of these analytical methods
 - Methods demonstrated
- Calculation errors
 - Blank and crystalline silica content correction

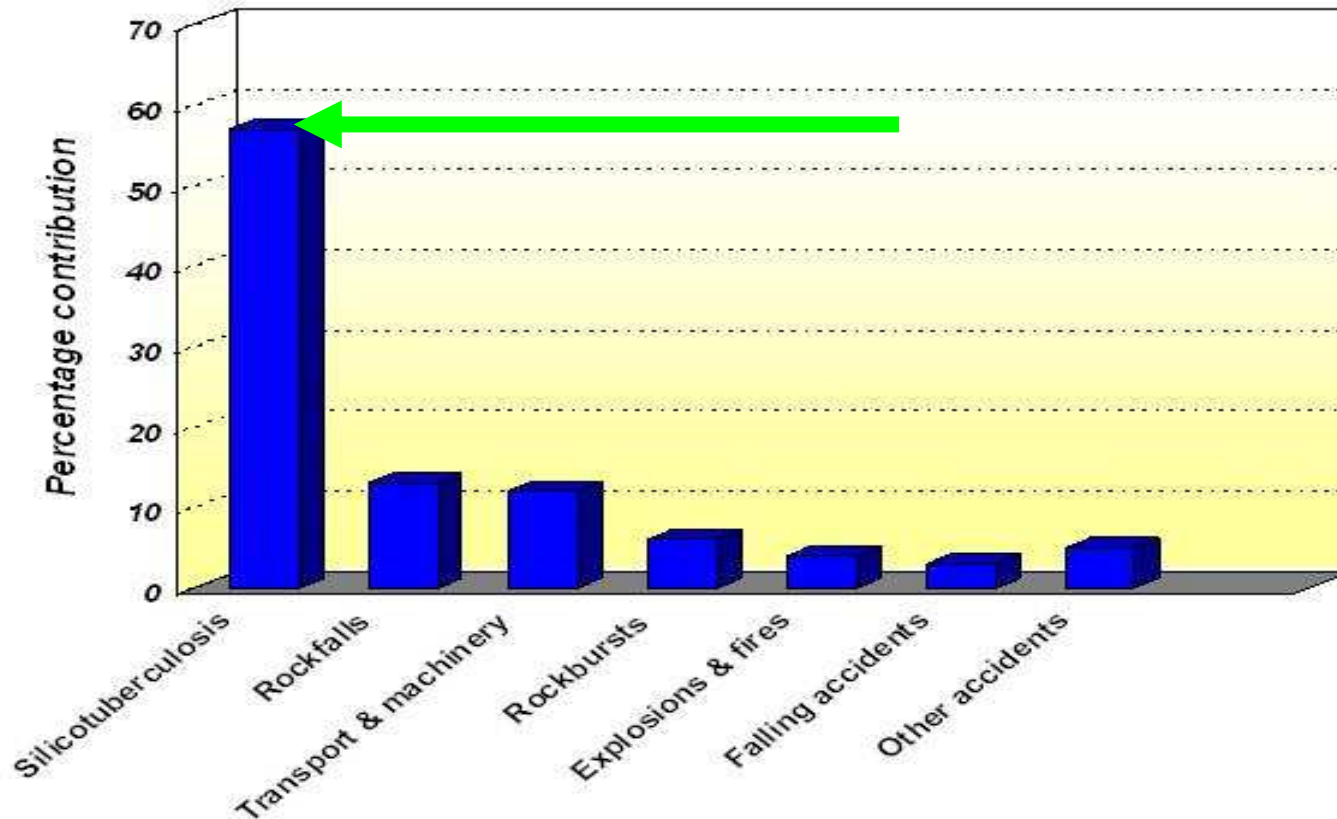
Conclusions (1)

- A regional SA EQA programme is feasible
- Involvement leads to improved results
- The NIOH is now rolling a SA EQA programme for RCS analysis

Conclusions (2)

- Accurate & reliable results → better control decisions → reduction in silicosis

Distribution of fatalities within selected research thrust areas and other categories for the period 1999 to 2002



Acknowledgements

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 - Project No. : SIM30603

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