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LABORATORY




How good are  
laboratories at analysing  
silica in workplace air?

Results from the AIR  
proficiency testing  
scheme

Owen Butler

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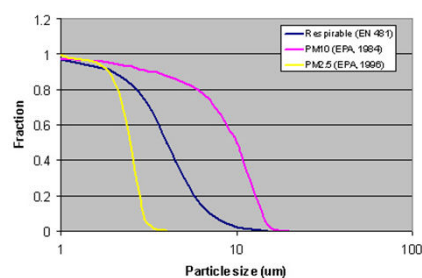
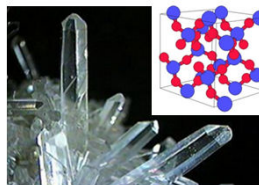
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## What is respirable crystalline silica?



- $\text{SiO}_2$  – Quartz, Cristobalite, Tridymite natural forms plus man-made variants
- Highly chemically resistant
- 1 – 15  $\mu\text{m}$  particles



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## Inhalation Exposure in the Workplace

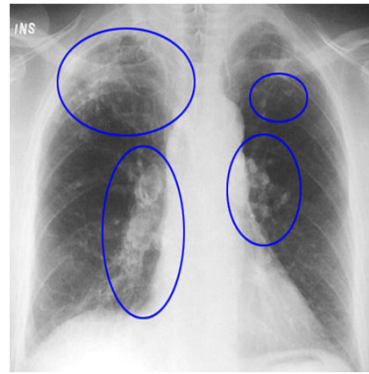


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## Health effects



- Silicosis  
Slow progressive disabling disease
- Recognised cause of lung cancer (IARC, 2012)
- Possible cause of Chronic Obstructive Pulmonary Disease (COPD)




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## Air sampling

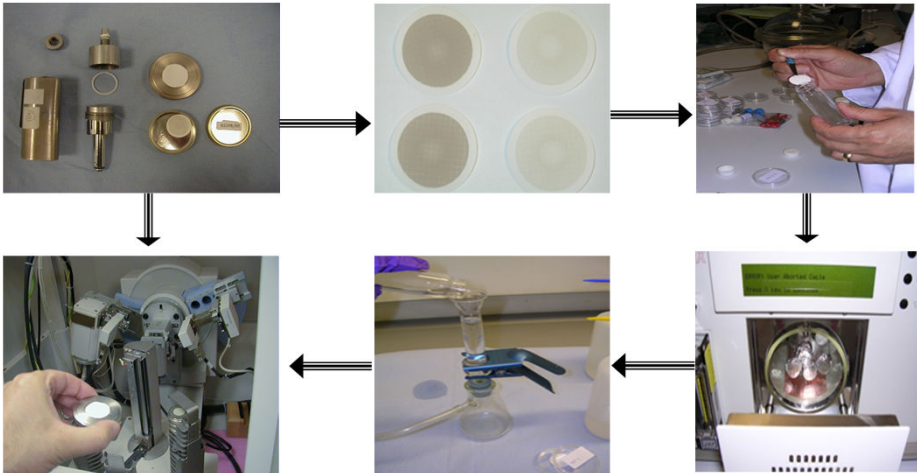


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## Filter preparation




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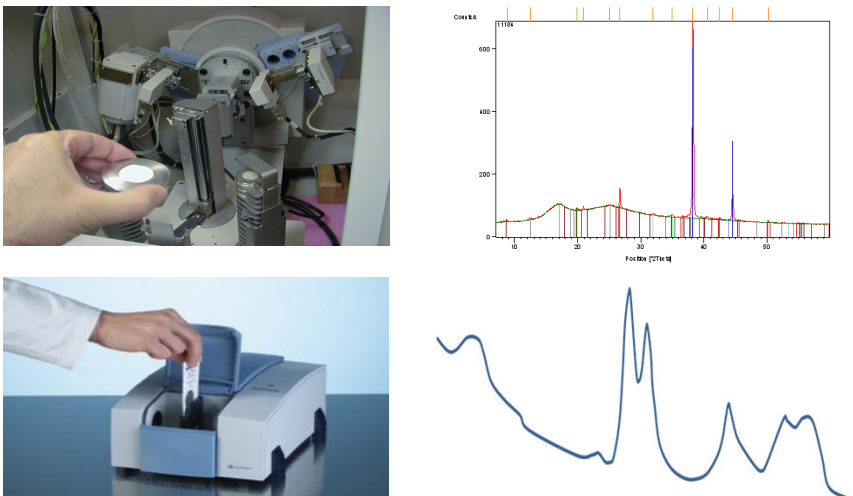


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## Filter analysis



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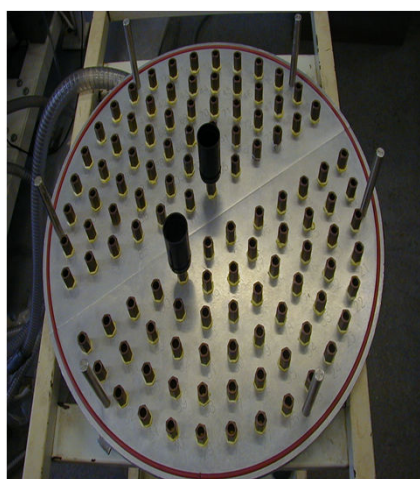
## Measurement summary



<p><b>XRD DIRECT ON FILTER</b></p> <p><b>ISO 16258-1:2015</b></p>	<p><b>FTIR DIRECT ON FILTER</b></p> <p><b>ISO DIS 19087:2017</b></p>
<p><b>XRD INDIRECT ANALYSIS</b></p> <p><b>ISO 16258-2:2015</b></p>	<p><b>FTIR INDIRECT ANALYSIS</b></p> <p><b>ISO DIS 19087:2017</b></p>

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## AIR PT: Preparing silica test items [1]



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## AIR PT: Preparing silica test item [2]



### Homogeneity testing

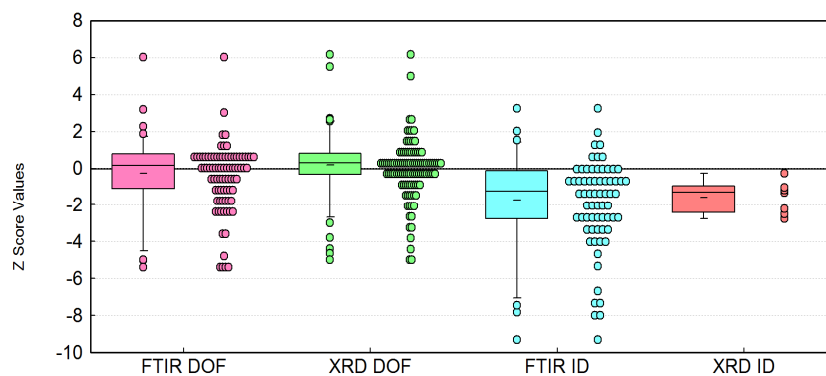
- Scan blank filter samples by FTIR for background spectra
- Assemble air samplers
- Sample aerosolised quartz onto filters
- Unload air samplers
- Rescan loaded filters by FTIR and quantify
- Scan blank filters for PT participants that use FTIR technique
- Blank match sample filters to appropriate blank filters
- Select filters sets of required homogeneity for PT round



- Analyte = HSL RM AA950 quartz (NIST SRM 1878a)
- Filter loading range = 60 – 240  $\mu\text{g}$
- SDPA = 10 % (EN 482.....ISO EN proposed work item)

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## AIR PT: Results



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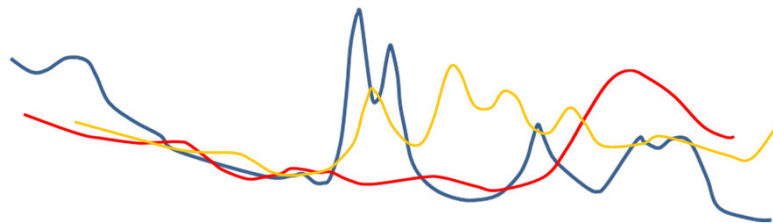
## Future Silica PT needs



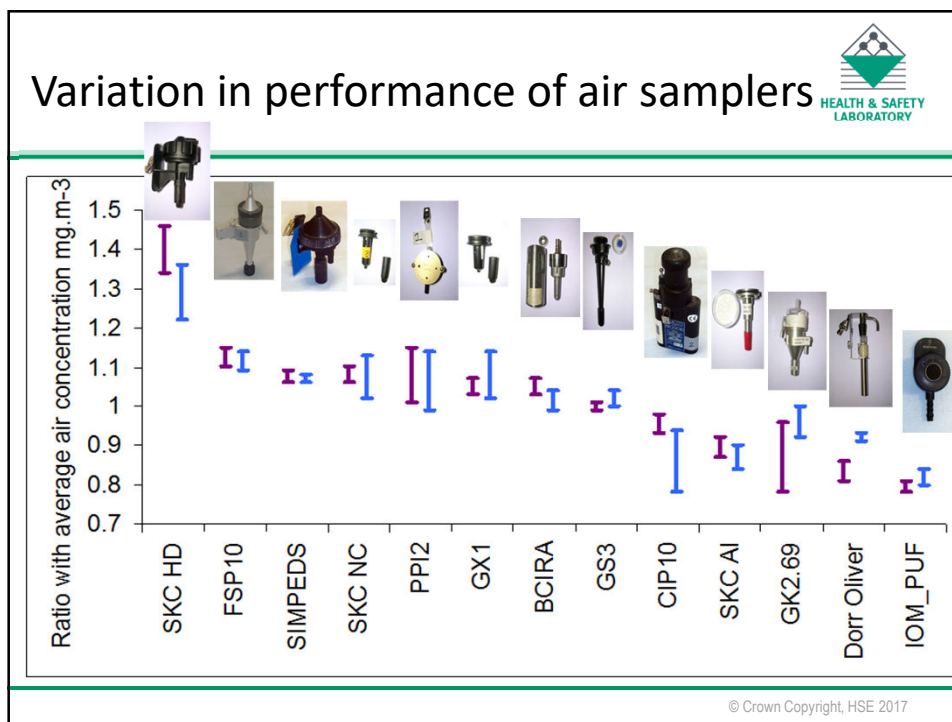
- Lower analyte-on-filter loadings?
- More challenging matrix test samples from the workplace?
- PT to include sampling aspects?

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## Real-world matrix samples



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## Summary

- Performance of laboratories that use direct-on-filter methods is generally good
- Performance of laboratories that use indirect methods can be prone to operator error during sample preparation
- Useful rapport between those involved in PT and those involved in producing standard methods
- Preparing air PT test items can be challenging!

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## Acknowledgements



- HSL: Darren Musgrove, Jack Mellor & Peter Stacey
- LGC Standards: Rita Sharma & Matthew Whetton



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