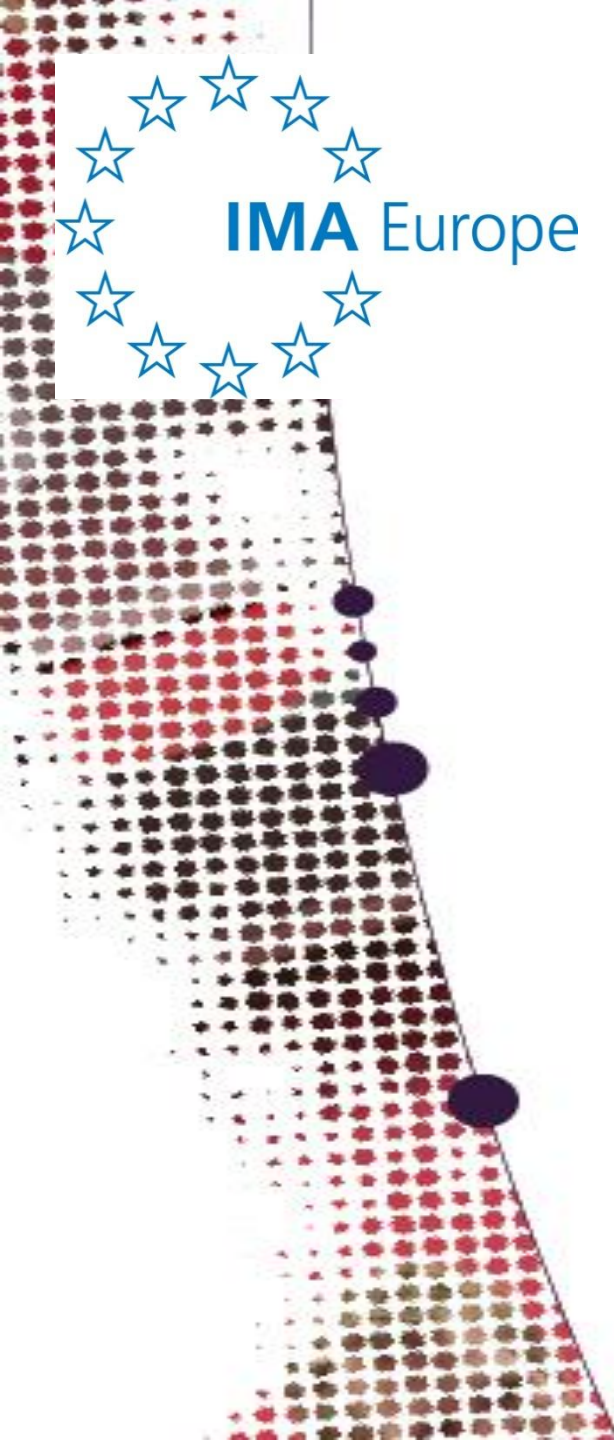




Industrial Minerals Association Europe Dust Monitoring Programme

More than 20 years from exposure
monitoring to prevention

Hans Kromhout
21 April 2026

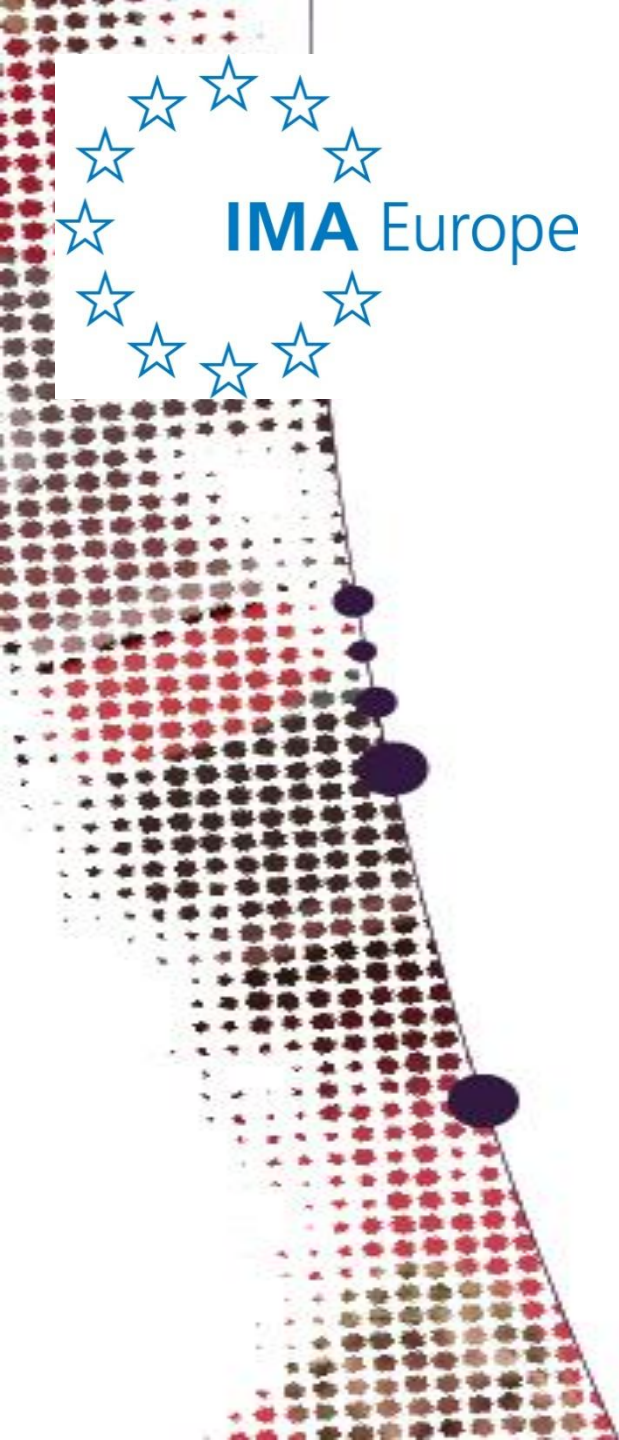


Universiteit Utrecht

Institute for Risk Assessment Sciences



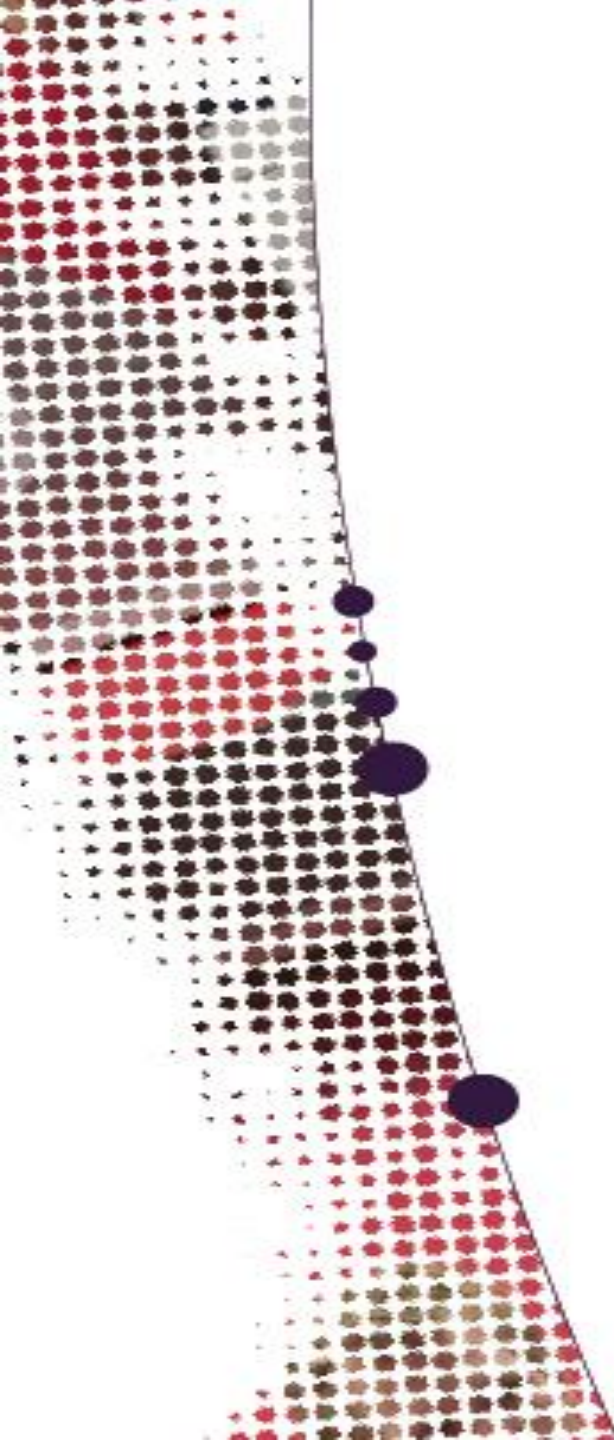
Netherlands Expertise Centre for Occupational Respiratory Disorders



Conflict of Interest

Management and research of
Dust Monitoring Programme (DMP)
sponsored by
Industrial Minerals Association Europe
from 2006 - 2025





Respirable Crystalline Silica carcinogenicity

- IARC Monograph vol. 68 (1997)
 - There is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica in the form of quartz or cristobalite from occupational sources
 - There is sufficient evidence in experimental animals for the carcinogenicity of quartz and cristobalite
- IARC Monograph vol. 100C (2009)
 - Established mechanistic event: Impaired particle clearance leading to macrophage activation and persistent inflammation
 - An increased risk of **lung cancer** was observed across various industries and processes
 - The Working Group reaffirmed crystalline silica dust as a Group 1 carcinogen



Developments in exposure limits Respirable Crystalline Silica

- Europe
 - SCOEL 2003 Occupational Exposure Limit Value OELV **0.100** mg/m³
 - Health Council of The Netherlands and Nordic Expert Group 2024 Health-Based Prohibition Risk Level (High Level) (4 additional lung cancer deaths per 1,000 workers) (HBC-OCRv) **0.0363** mg/m³
 - EU Impact study examining different possible OELVs due Autumn 2026
- USA
 - ACGIH 2010 Threshold Limit Value (TLV) **0.025** mg/m³
 - OSHA 2019 Permissible Exposure Level (PEL) **0.050** mg/m³ with an action level for respirable **0.025** mg/m³
- Australia
 - WorkSafe 2020 workplace exposure standard (WES) **0.050** mg/m³
 - WorkSafe 1st July 2024 **ban** on manufacture, supply, processing and installation of engineered stone benchtops, panels and slabs

IMA Europe

Industrial Minerals Association

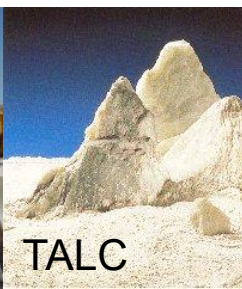
- Took up its responsibility now more than two decades ago
- Set up a Dust Monitoring Programme in 1999/2000
- Transferred the IMA-DMP database to The Netherlands in 2006, where it is coordinated in a collaborative project of NECORD and IRAS



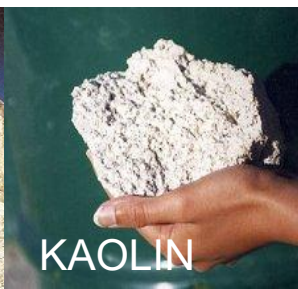
SILICA



CLAYS



TALC



KAOLIN



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IMA Europe Industrial Minerals Association

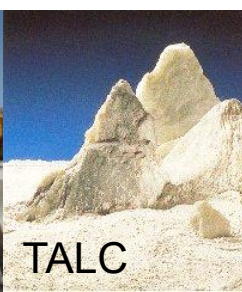
- Initiator of NEPSI Agreement innovative Social Dialogue Agreement on workers' health protection through good handling and use of crystalline silica and products containing it in 2006
- Social partners of 19 concerned sectors are committed to controlling exposure of workers to dust and crystalline silica by applying good practices (see Good Practice Guide <https://guide.nepsi.eu/>)
- First and only multisectoral social dialogue agreement signed at European level (<https://nepsi.eu/>)



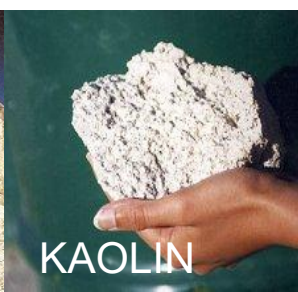
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IMA Dust Monitoring Programme

Goals and minerals covered

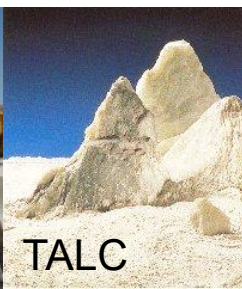
- To have (statistically) reliable exposure data
- To be able to discuss with authorities on new/future exposure limits
- To develop prevention strategies to reduce exposure (develop prevention culture)
- To improve compliance with current exposure limits
 - At industry level
 - At company level
- To be used as a resource for exposure assessment for future epidemiological studies
- To check effectiveness of implemented control measures



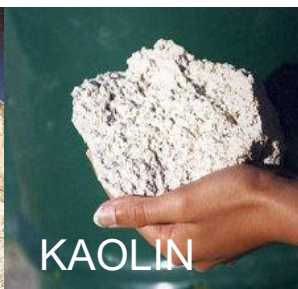
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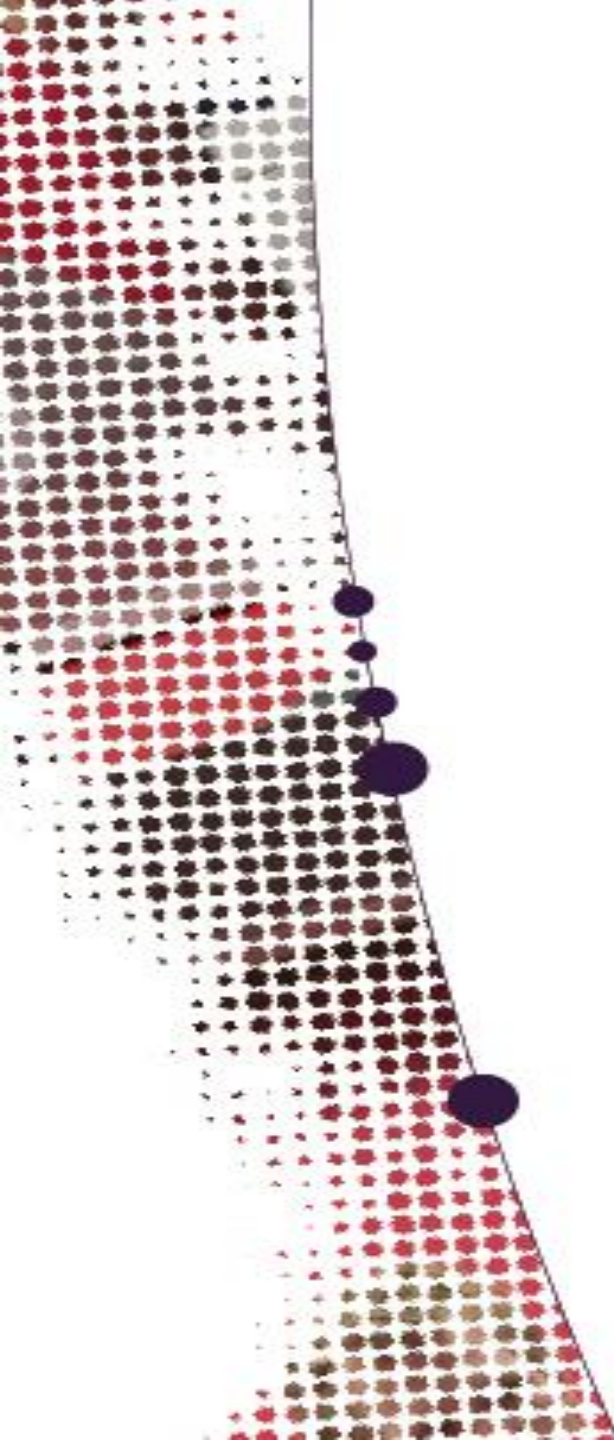
KAOLIN



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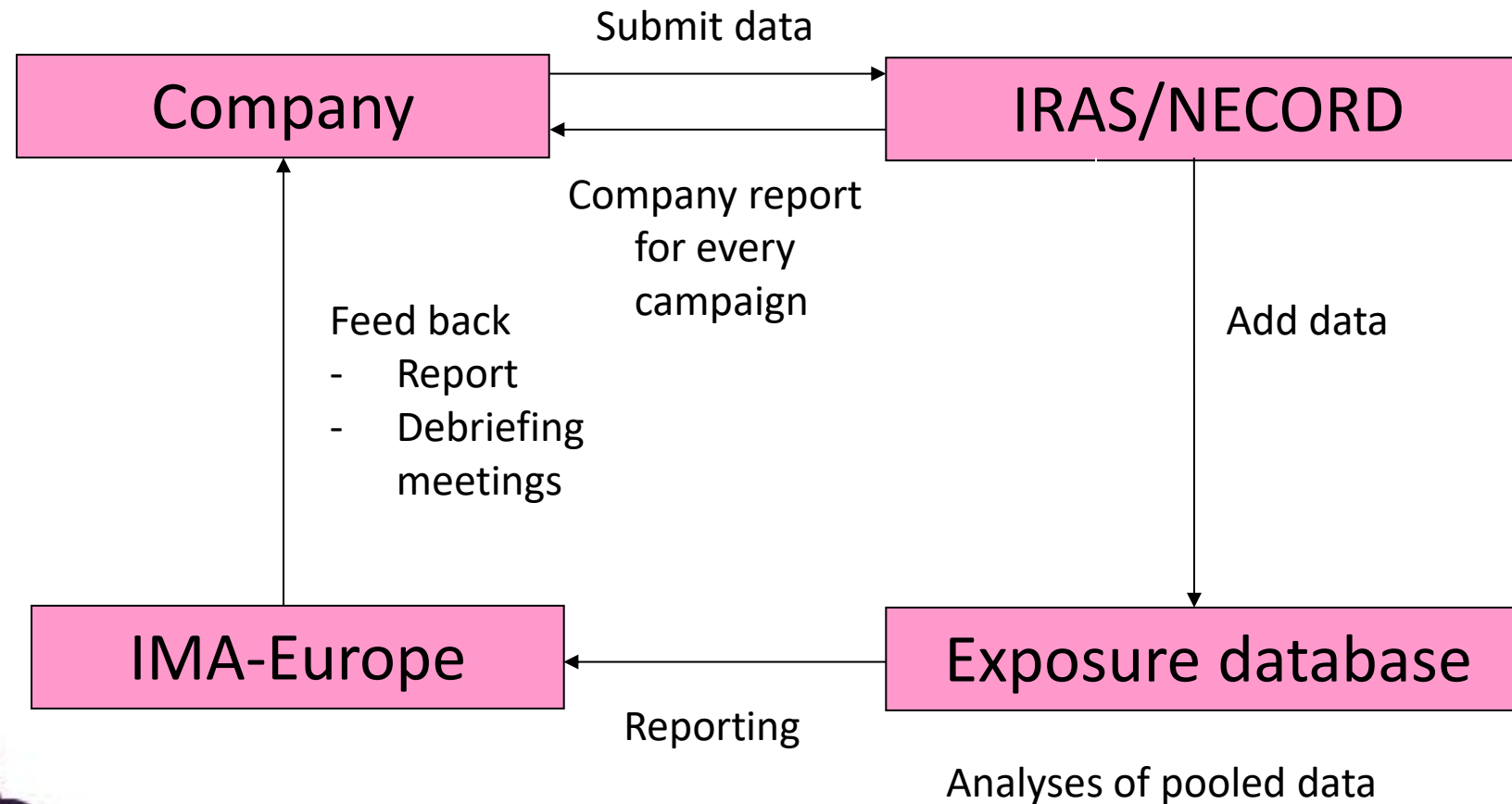


Measurement strategy

IMA-DMP Protocol

- Collect 6 dust samples per job function per site and per campaign (include repeats!)
- Personal measurements
- At least respirable dust
- Sampling equipment conform EN481
- Analytical technique either X-ray diffraction or Fourier transform infrared spectroscopy
- Full documentation of measurement required
- Labs involved should join an interlaboratory round robin

Lines of communication

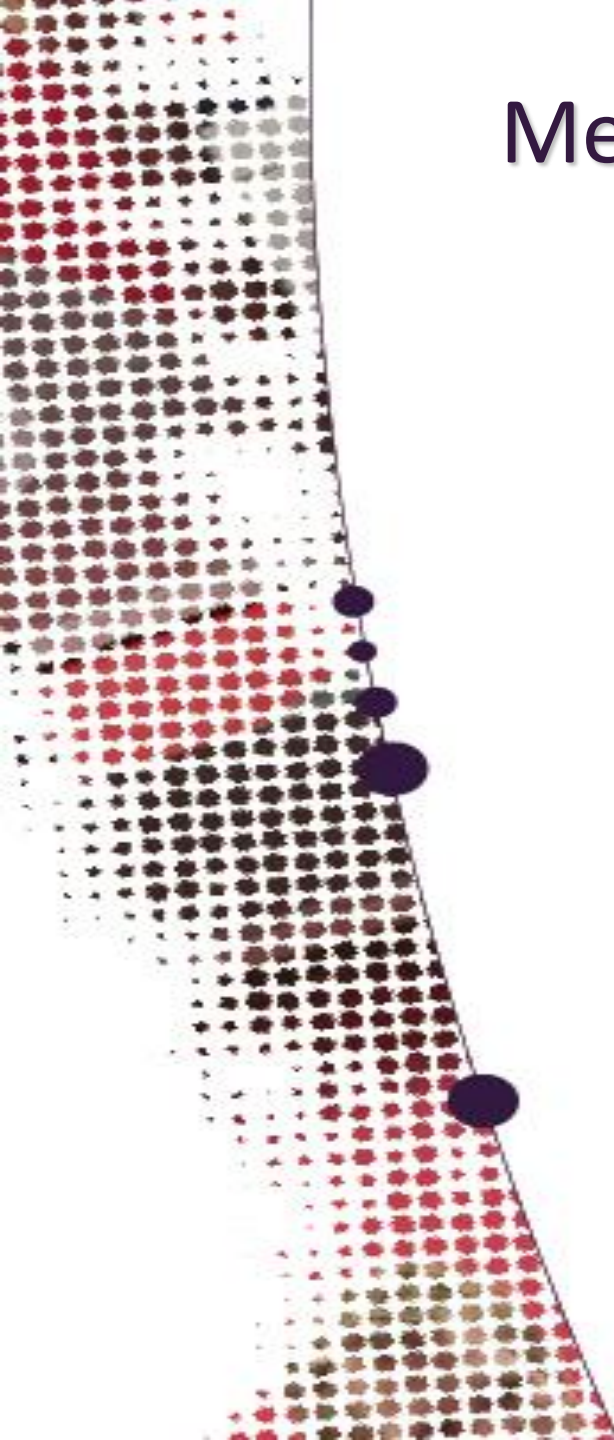


Reports 2003, 2005, 2006, 2007, 2008, 2009, 2011, 2013, 2015, 2017, 2019, 2022, 2024

Presentations at conferences IOHA, ISEE, EPICOH, IP, DOHS, X-conferences, AIRMON

Scientific papers:

- Zilaout, Vlaanderen, Houba, Kromhout. Database paper. Int J Hyg Environ Health 2017
- Zilaout, Houba, Kromhout. Trends paper. Occupational and Environmental Medicine 2020
- D'Errico, Houba, Kromhout. New EN689 a better standard to test compliance? Annals of Work Exposures and Health 2022
- Zilaout, Houba, Kromhout. Trends in variability. Annals of Work Exposures and Health 2023
- Blagrove-Hall, Houba, Kromhout. Meteorological conditions and exposure. Annals of Work Exposures and Health 2026



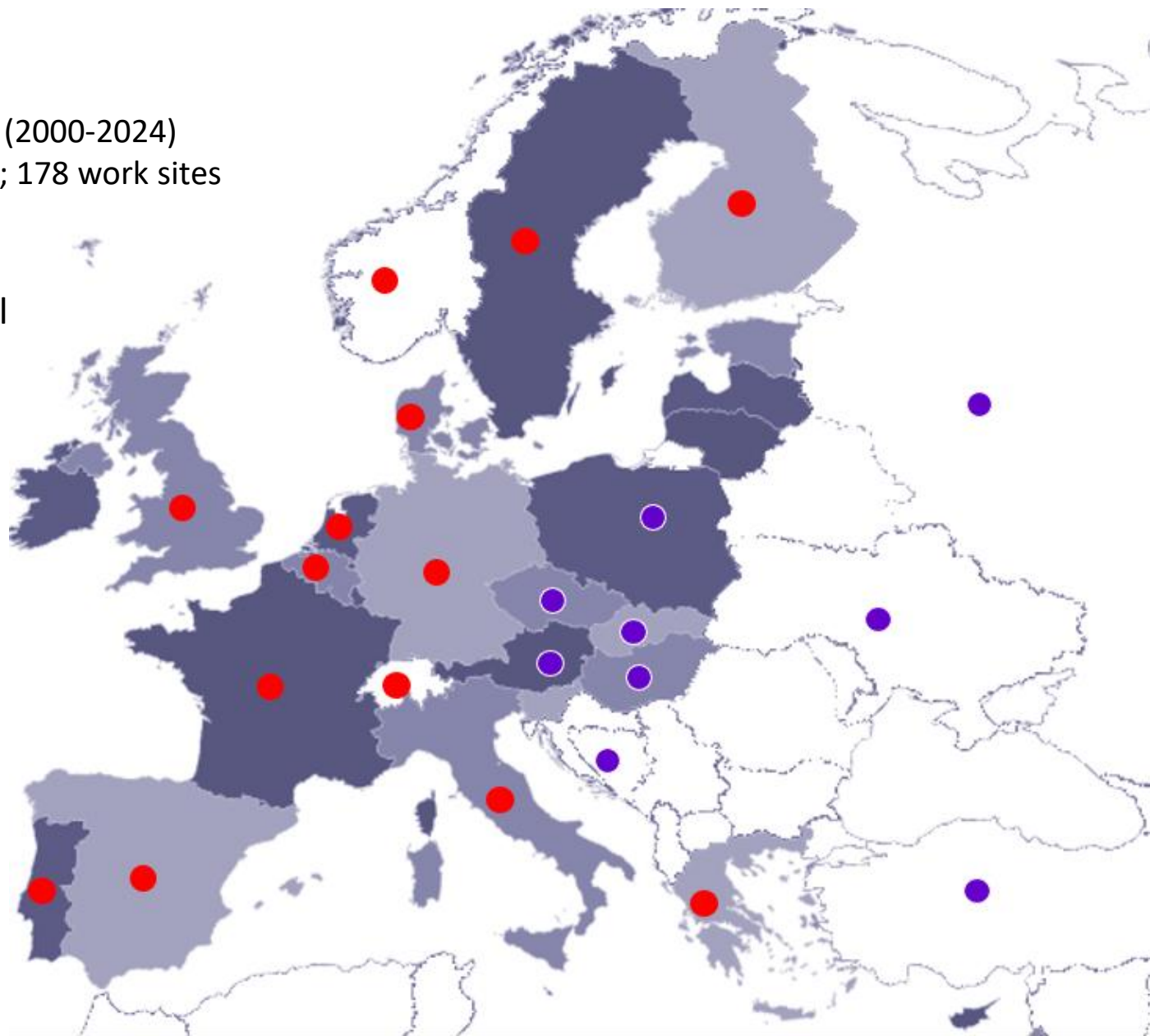
Measurement data in IMA-DMP database per September 2024

- Total **49,954** measurements
- 49,785 respirable dust and 44,364 respirable quartz
- Collected prospectively in 47 campaigns over 23.5 years between winter 2000/2001 until winter 2023/2024
- The measurements have been collected at 36 companies in 23 countries among workers employed at 178 sites
- Representative for a total workforce of >> 5,000

Available data per September 2024

47 campaigns (2000-2024)
36 companies; 178 work sites
23 countries

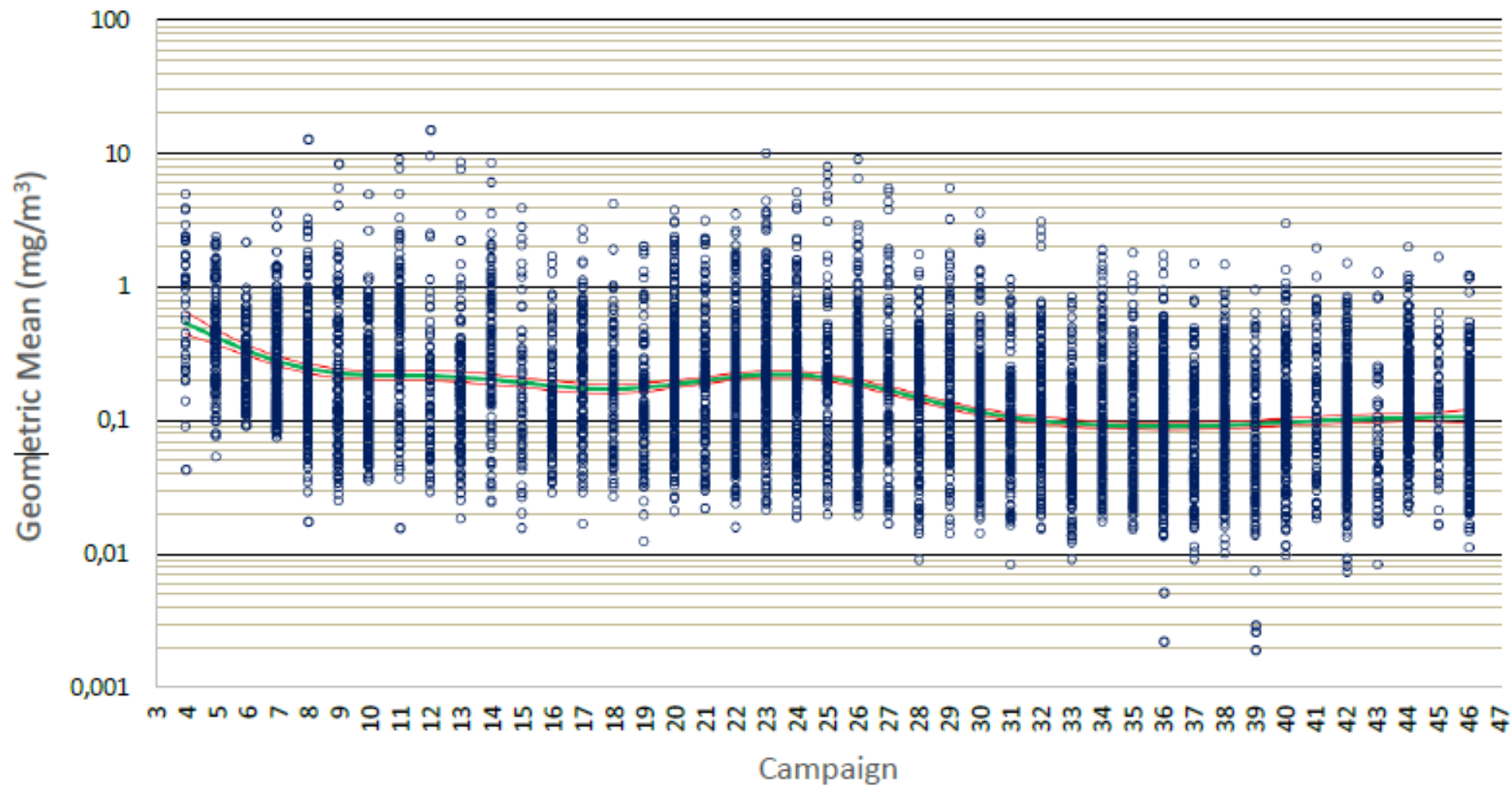
Geographical
distribution



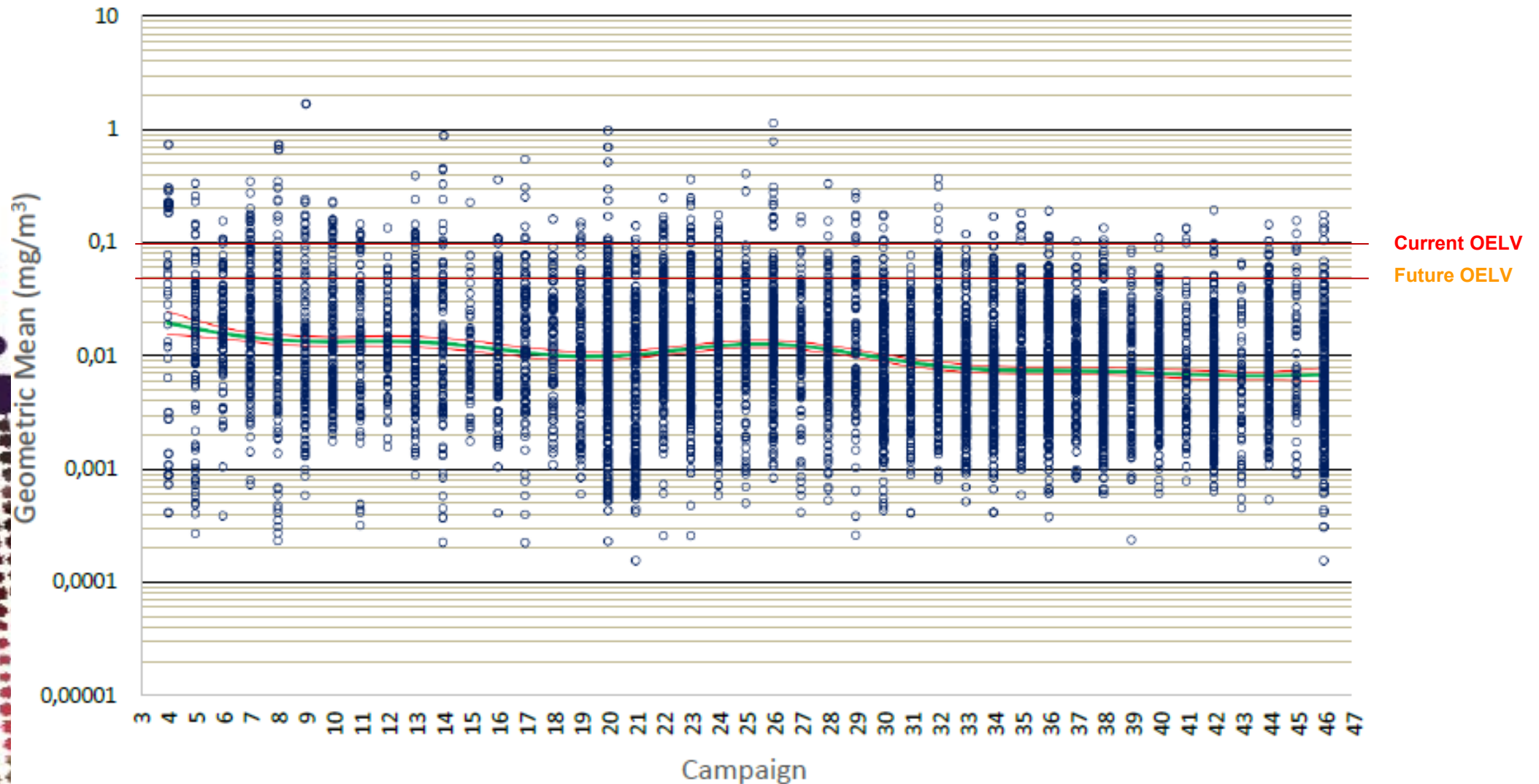
Available data per country

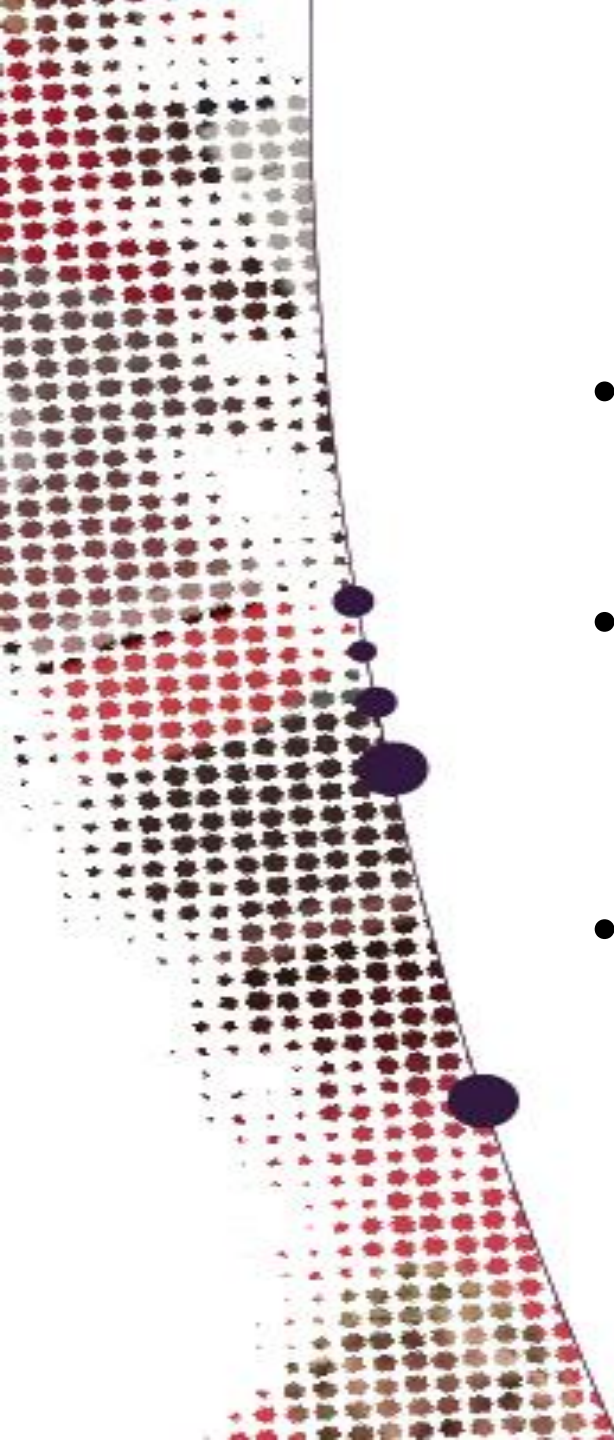
Country	Respirable dust (%)	Respirable quartz (%)	More recent countries	Respirable dust (%)	Respirable quartz (%)
Belgium	2,188 (4.4)	2,056 (4.6)	Austria	184	153
Denmark	294 (0.6)	294 (0.7)	Bosnia	66	18
Finland	1,290 (2.6)	939 (2.1)	Czech Republic	419	419
France	8,463 (17)	7,106 (16)	Hungary	39	34
Germany	4,973 (10)	4,914 (11)	Poland	456	456
Greece	740 (1.5)	246 (0.6)	Russia	891	891
Italy	4,751 (9.5)	4,215 (9.5)	Slovakia	161	161
Netherlands	3,061 (6.2)	2,062 (4.7)	Turkey	850	835
Norway	1,688 (3.4)	724 (1.6)	Ukraine	718	716
Portugal	820 (1.7)	812 (1.8)	Total	3,784 (8)	3,683 (8)
Spain	8,022 (16)	7,651 (17)			
Sweden	1,036 (2.1)	1,035 (2.3)			
Switzerland	0	84 ((0.2)			
United Kingdom	8,675 (17)	8,543 (19)			
Total	46,001 (92)	40,681 (92)			

Temporal trends in respirable dust concentration in mg/m^3



Temporal trends in respirable quartz concentration in mg/m^3

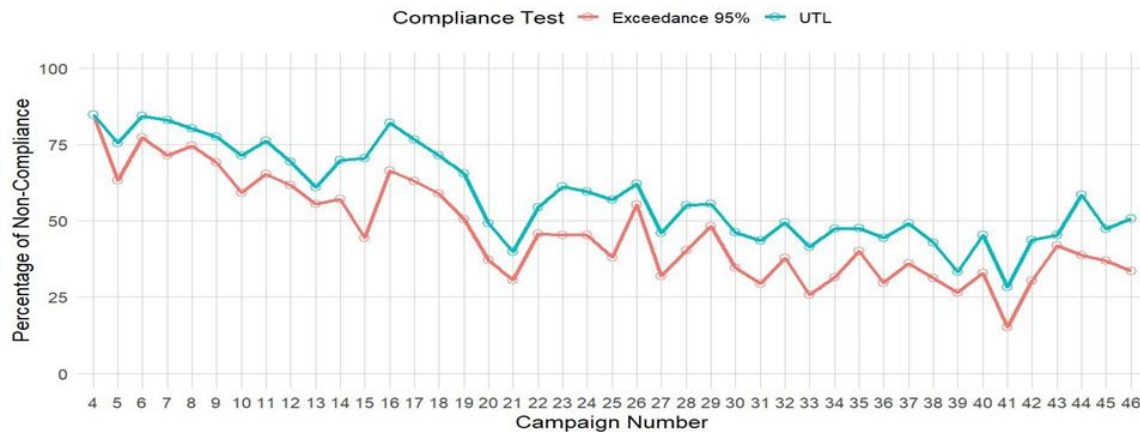
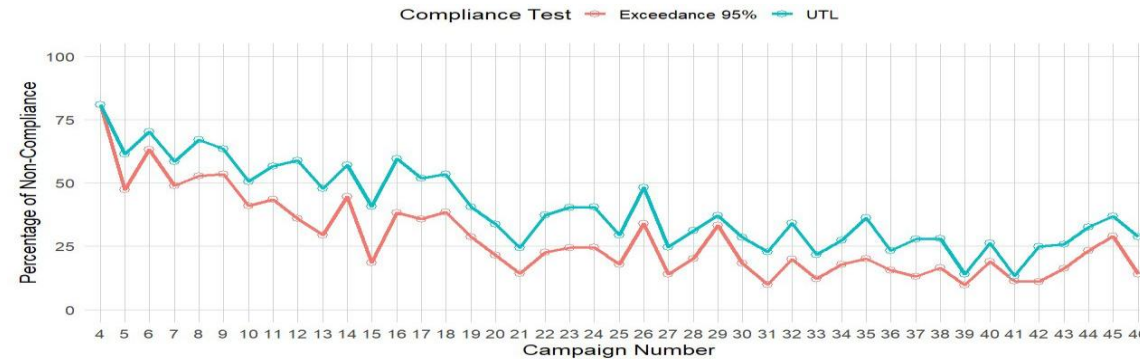


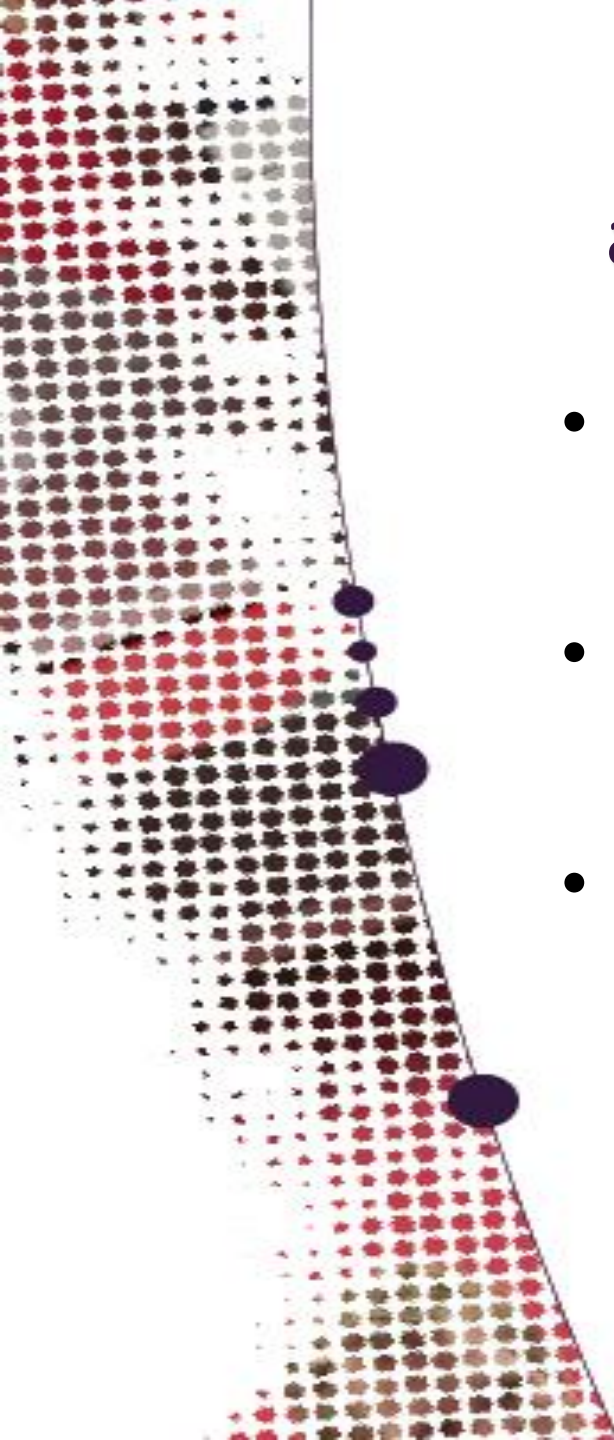


Recent and future developments

- New European Standard for testing compliance with OEELV (EN 689:2018)
- Future lowering of EU OELV from 0.100 mg/m^3 to 0.050 mg/m^3 or maybe even 0.025 mg/m^3 respirable crystalline silica
- Monitoring lower concentrations of quartz and limit of detection/quantification

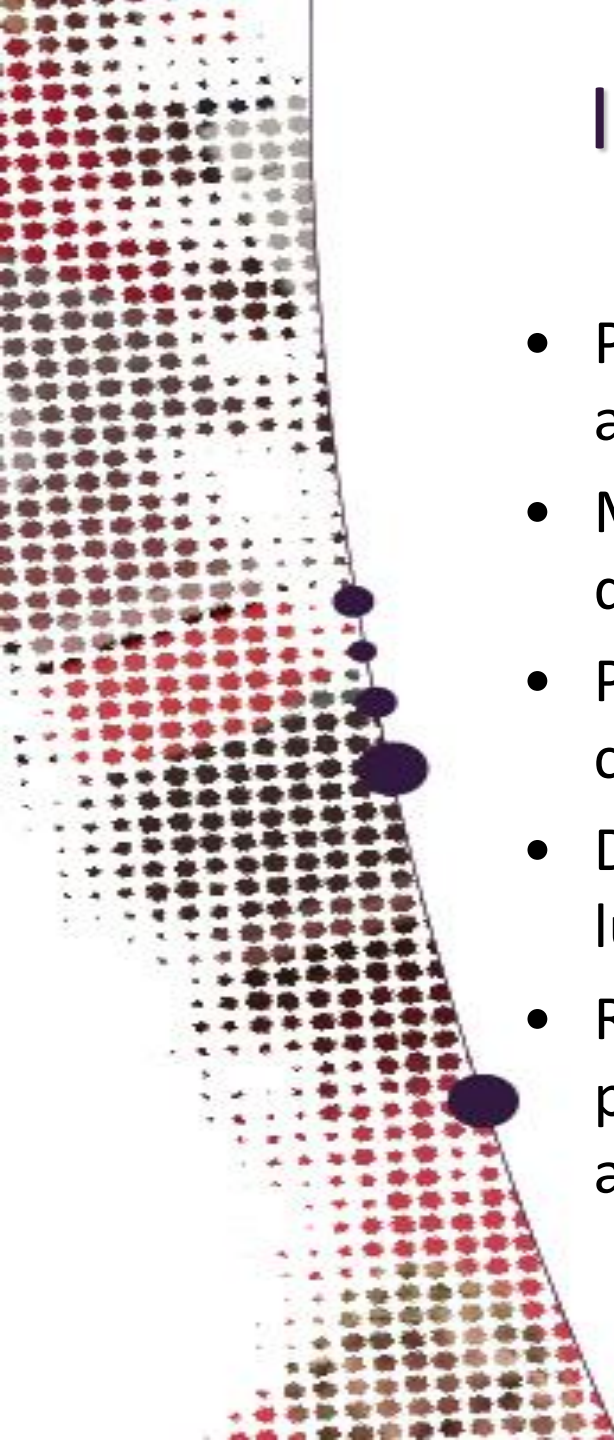
Consequence EN 689:2018 and lower OELV?





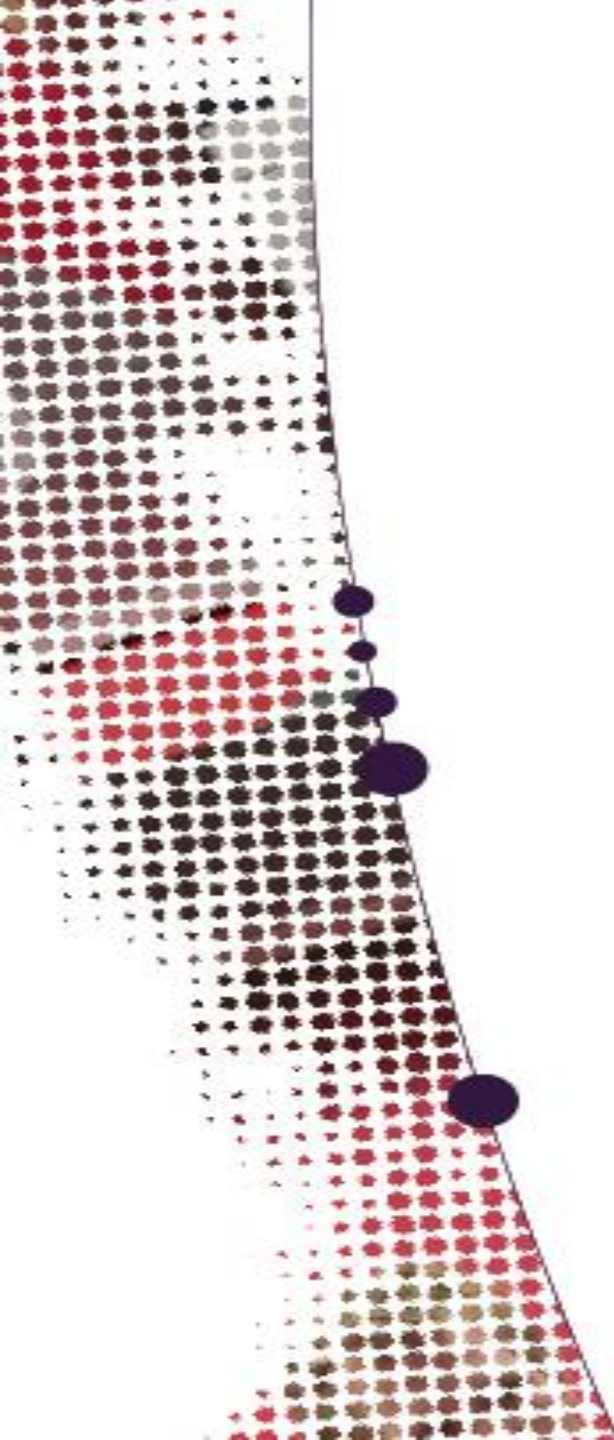
Consequences of future EU-limit and new EN 689 statistical test ($UTL_{95,70}$)

- Non-compliance situations will increase substantially with ~30% (OELV 0.050 mg/m³) or ~50% (OELV 0.025 mg/m³)
- Back at the levels of non-compliance when IMA-DMP started!
- New sampling and analytical techniques will be needed to be able to monitor lower concentrations of RCS/Quartz



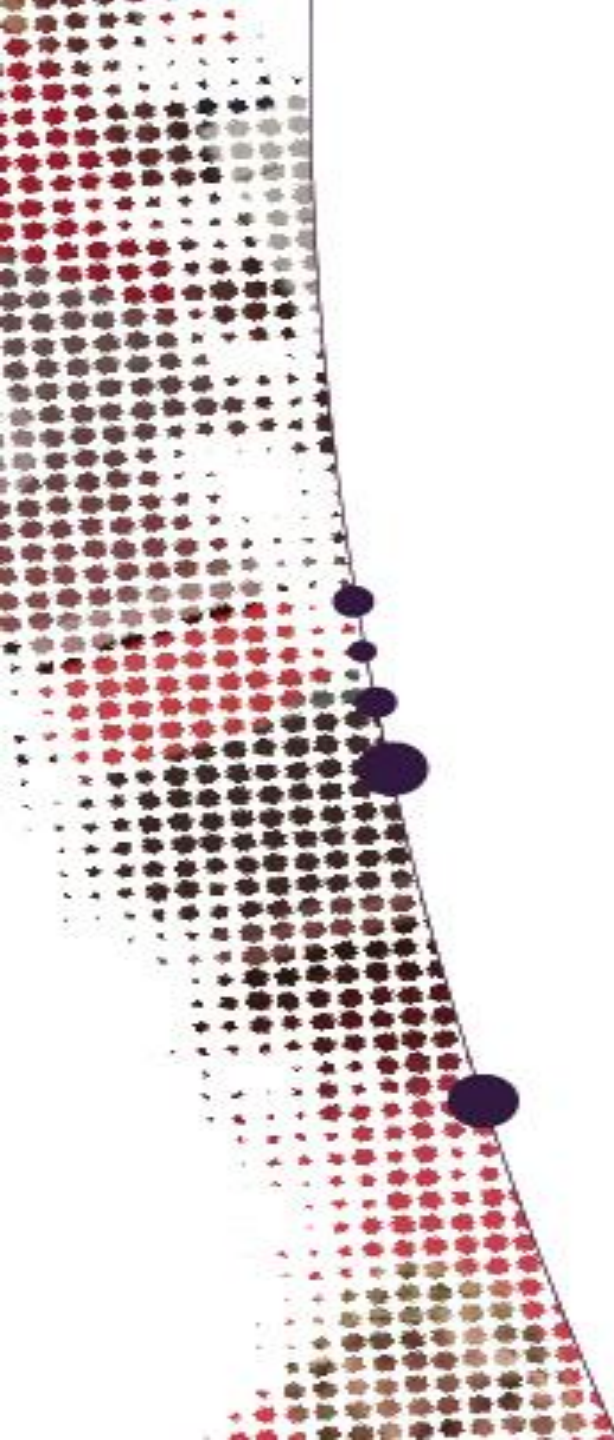
IMA-DMP enabled estimation of number of lung cancer and silicosis cases saved

- Population 42,500 workers, ages 20-65, followed 2000-2040 and annual turnover rates 2%
- Median concentration in 2000 was 0.014 mg/m³ and annual decline was -4.5%
- Predicted 3.5 times more silicosis cases (n=2,451) than lung cancer cases (n=702)
- Decline in exposure prevented 10 times more silicosis cases than lung cancer cases (277 versus 27 cases)
- Risk management measures taken by industrial minerals sector prevented 4% of all lung cancer cases (20% lung cancer cases attributable to RCS) and 12% silicosis cases



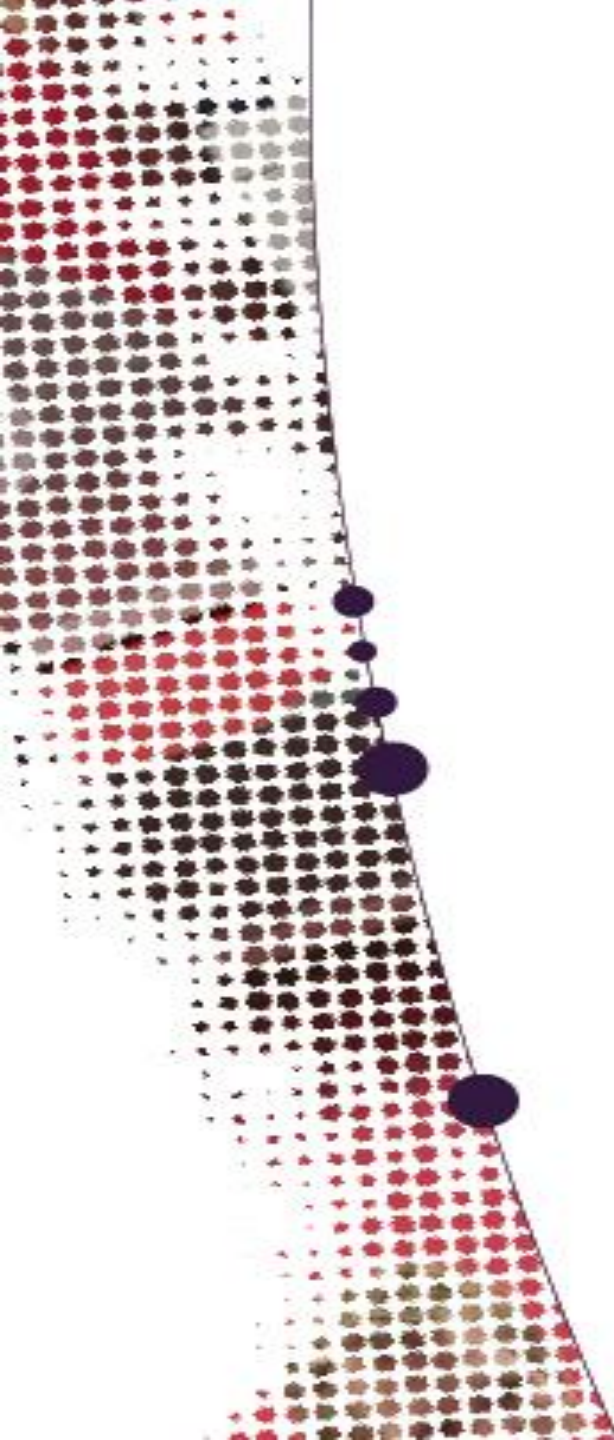
Overall conclusions

- **Largest multi-company multiple-site coordinated dust monitoring programme in Europe** (and probably the world); serves as good example of how hazardous exposures should be periodically monitored and consequently be controlled
- **Data management and quality control** is at a high level
- Result is a **unique, very rich and promising database**, that provides excellent insight in (changes in) occupational exposures to respirable dust and quartz within European industrial minerals producing industry



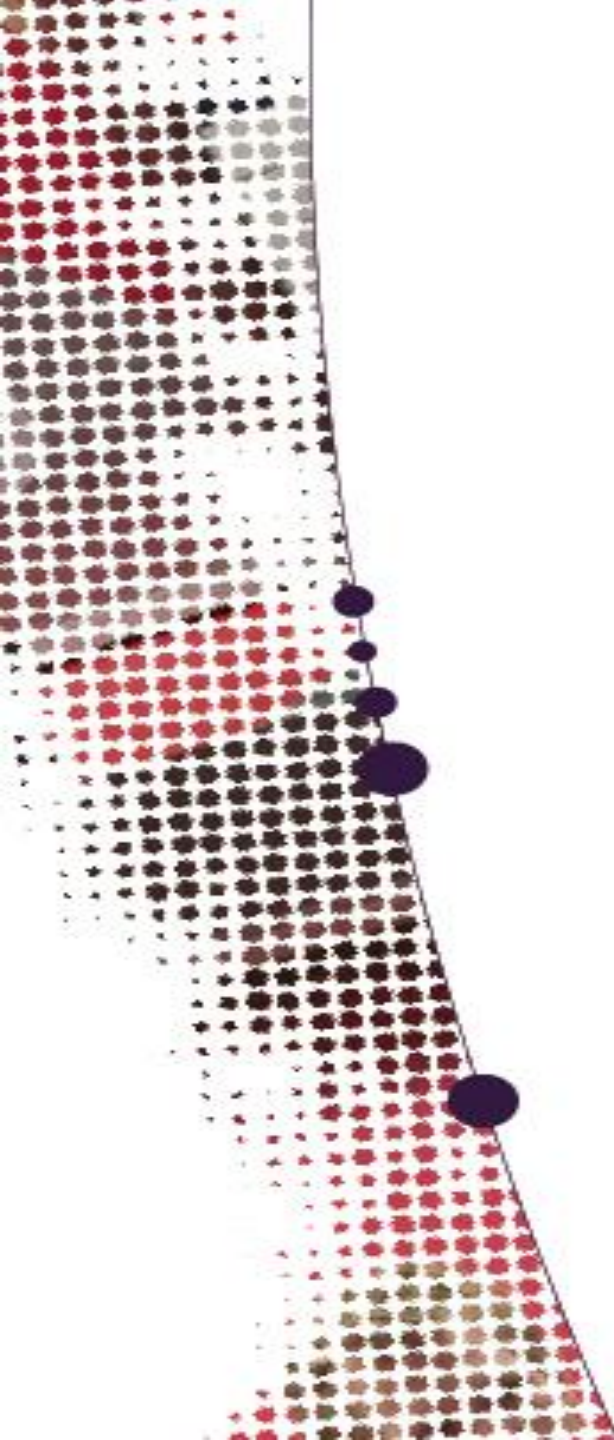
Overall conclusions

- **Statistically significant overall downward trends** in exposure levels for period 2002-2024 both for exposure to respirable dust and quartz of respectively -6% and -4.5% per half year; these trends were however not constant and have been going up and down (economic circumstances)
- **Number of non-compliant cells** for exposure to respirable dust is no longer decreasing during most recent sampling campaigns. For respirable quartz a slight increase in non-compliance has become visible



Overall conclusions

- Median geometric mean respirable dust and quartz concentrations are now at respectively **0.11 mg/m³** and **0.005 mg/m³** and have decreased with respectively factor of ~4 and ~3 since start IMA-DMP
- **Considerable percentage of lung cancer and silicosis** in the Industrial Minerals Industries worker population **prevented**



Epilogue

- **Collaboration** between **industry** and **academia** is always a challenge, but essential in occupational health
- Industry-wide **commitment** to protect **workers health** is a **pre-requisite**
- **Firewalls** are needed to conduct **independent** research
- **Action-oriented research** can be very rewarding and successful, but choose your (industrial) partners carefully

Acknowledgements

- Netherlands Expertise Centre for Occupational Respiratory Disorders (NECORD): Remko Houba
- Institute for Risk Assessment Sciences, Utrecht University: Hicham Zilaout, Nicola Blagrove-Hall and Antonio d'Errico, Lützen Portengen



- Industrial Minerals Association Europe: Florence Lumen, Andy Price and IMA-Europe OSH Working Group

