



Netherlands Expertise Centre for Occupational Respiratory Disorders

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Achievements and potentials of a long term exposure database on respirable dust and quartz in the industrial minerals industry

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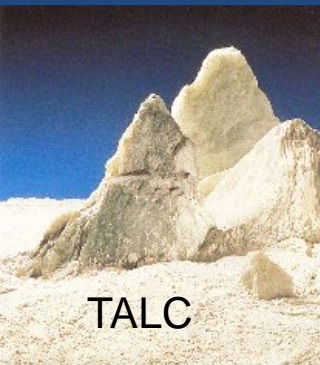


Universiteit Utrecht - Institute for Risk Assessment Sciences



Goals and minerals covered

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



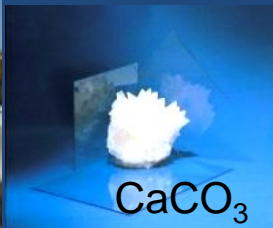
TALC



SILICA



CLAYS



CaCO₃



KAOLIN



FELDSPAR



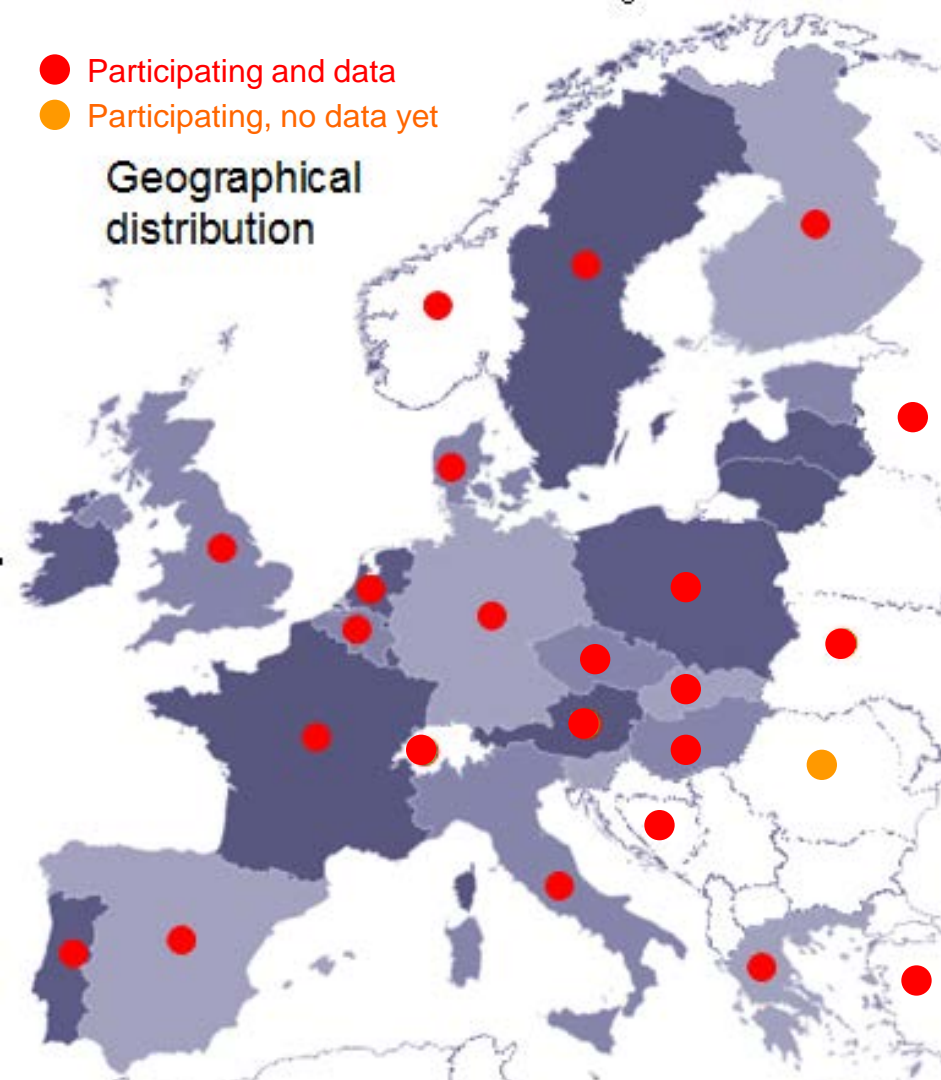
BENTONITE



LIME (STONE)

- Participating and data
- Participating, no data yet

Geographical
distribution



Available data

- N = 27,832
- 23 countries
- 36 companies (163 worksites)
- 29 sampling campaigns
- First data: 2000
- Newest data: winter 2014-2015

One common protocol

- Measurements done on site level
 - By company representatives
 - By external consultants
- Many criteria, some important ones:
 - Workforce is divided into job function groups: 6 samples per job function
 - Unique worker codes
 - Availability of field blanks
 -

Job functions

1	Quarry operator	7	Foreman / plant management staff
2	Crusher operator	8	Maintenance
3	Wet process operator	9	Multi-skilled operator
4	Dry process operator	10	Laboratory worker
5	Miller operator	11	Research and Development
6	Bagging operator	13	Plastification
7	Transport / bulk loading		

IMA-Europe Standardised Dust Monitoring Protocol

Updated version
November 2006

Original authors: Guy Auburtin - Franck Meunier (March 2002)



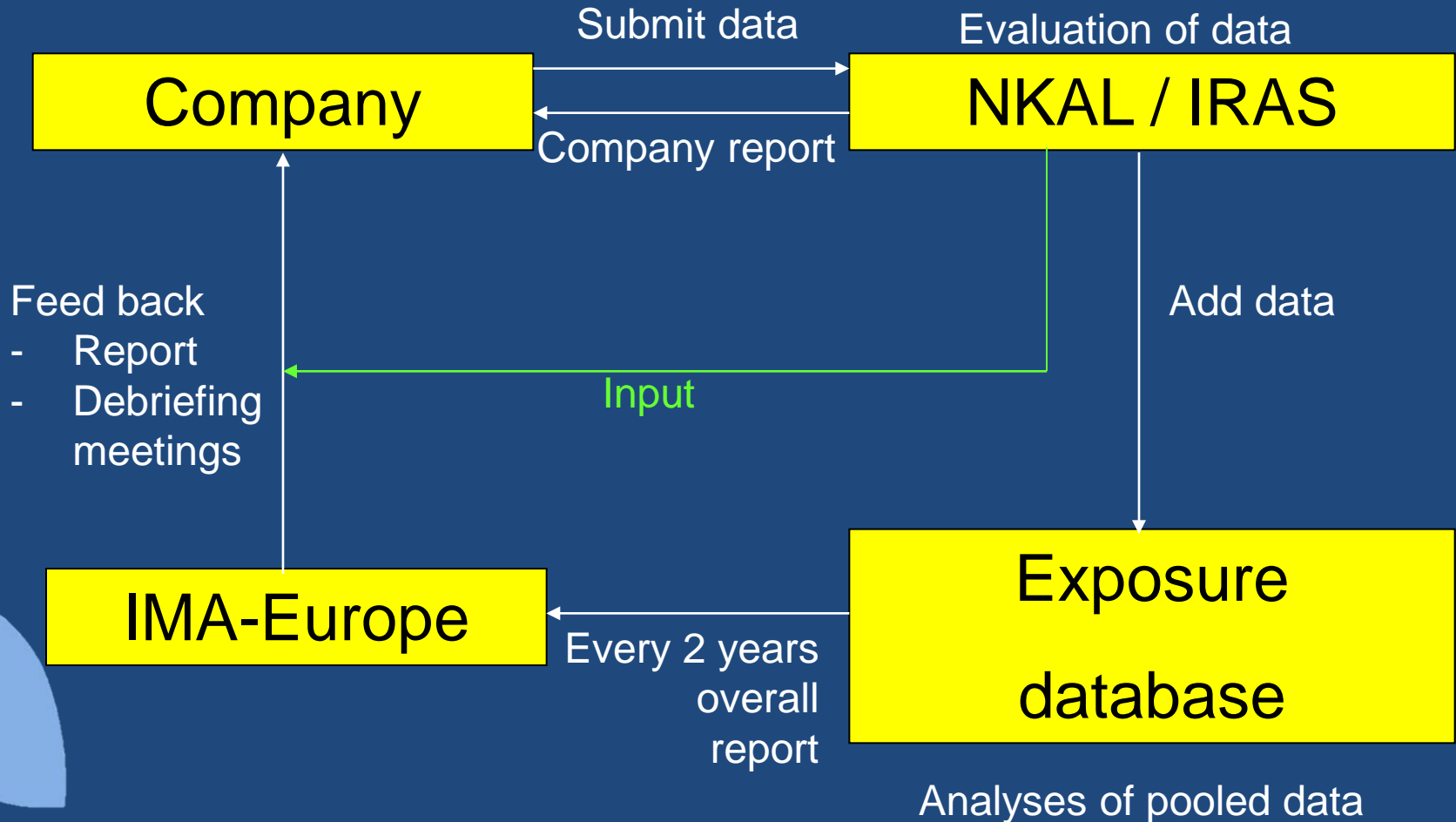
Quality control – collection sheet

1	Company	Country	Site	Mineral	Date	Shift	Weather condition 1	Weather condition 2	Sample ID	Type of Measurement	UNIQUE worker code	Smoking during sampling	Job function	Quarry operator	Crusher operator	Wet process operator	Dry process operator	Miller operator	Bagging operator	Transport worker	Foreman	Maintenance worker	Laboratory	Research and development	Plastification	Other job function	Specify here if other	Total	Comment	Shift length (hours)	personal respiratory protective
2	045	07	150	silica	23-Sep-11	day	dry	not windy	701	Personal	34	active smoking	Transport worker								100%						100%	wheel loader	8,5	no	
3	045	07	150	silica	22-Sep-11	day	dry	windy	45646	Personal	34	active smoking	Transport worker								100%						100%	wheel loader	8,5	no	
4	045	07	150	silica	25-Oct-11	day	wet	not windy	45645	Personal	37	active smoking	Transport worker								100%						100%	fork lift	8,5	no	
5	045	07	150	silica	31-Oct-11	day	dry	not windy	489	Personal	37	active smoking	Transport worker								100%						100%	fork lift/stock count	8,5	no	
6	045	07	150	silica	10-Nov-11	day	dry	not windy	483	Personal	5	active smoking	Transport worker								100%						100%	fork lift (accu pump empty)	8,5	no	

Much information has to be provided for each sample

7	045	07	150	silica	Sampler	Sample collection material	Measured Flow rate at start (l/min)	Measured Flow rate at end (l/min)	Average flow rate (l/min)	Sampling time on	Sampling time off	Sampling duration time (min)	Sampled volume (l)	Filter Weight before Sampling (mg)	Filter Weight after sampling (mg)	Weight collected dust (mg)	Calculated dust concentration (mg/m ³)	8-hours TWA dust concentration (mg/m ³)	Quartz technique	Weight quartz (mg)	Concentration quartz (mg/m ³)	Percentage quartz (%)	8-hours TWA concentration quartz (mg/m ³)
2					Dorr-Oliver 10mm nylon cyclone	Mixed cellulose ester filter, 37mm diameter	1,70	1,70	1,70	7:08	16:00	532	904			0,50	0,553	0,587	Infrared	0,010	0,011	2,0%	0,012
3					Dorr-Oliver 10mm nylon cyclone	Mixed cellulose ester filter, 37mm diameter	1,70	1,70	1,70	7:30	15:51	501	852			0,21	0,247	0,262	Infrared	0,001	0,001	0,5%	0,001
4					Dorr-Oliver 10mm nylon cyclone	Mixed cellulose ester filter, 37mm diameter	1,70	1,70	1,70	7:20	16:00	520	884			1,80	2,036	2,163	Infrared	0,090	0,102	5,0%	0,108
5					Dorr-Oliver 10mm nylon cyclone	Mixed cellulose ester filter, 37mm diameter	1,70	1,70	1,70	7:31	16:00	509	865			0,80	0,925	0,982	Infrared	0,060	0,069	7,5%	0,074

Lines of communication



• Quality control – feedback

After quality control: decision if added to the database

1. No

Rejection of data for IMA-DMP

2. Yes, if

Please improve/modify

3. Yes

Potential further improvements?

Important remarks relevant for the interpretation of the quality of the data:

- No field blanks have been provided together with the data.
- To be able to do any statistics with the data a minimum number of 5 samples per job title is needed (the IMA-DMP protocol prescribes 6 samples per job title per campaign. For the following job titles less than 5 samples were available:
 - Bagging operators
- Incidentally the sampling duration was very short (2 samples < 4 hours)

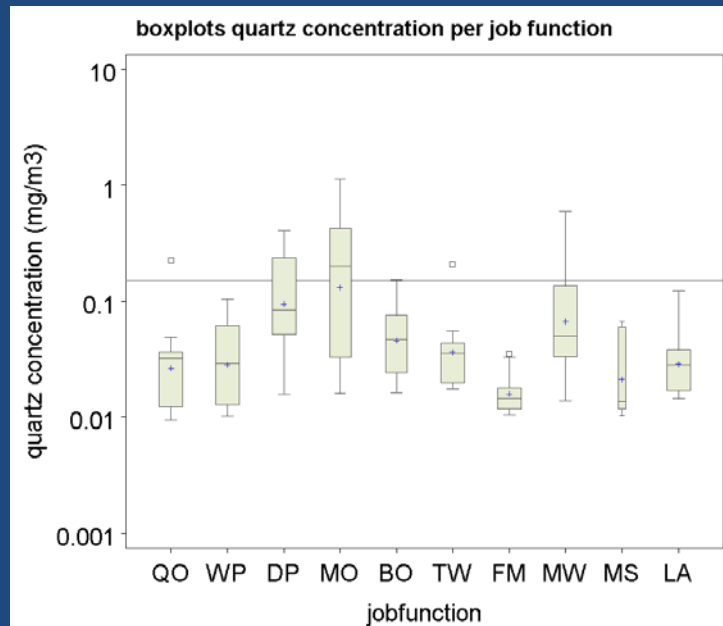
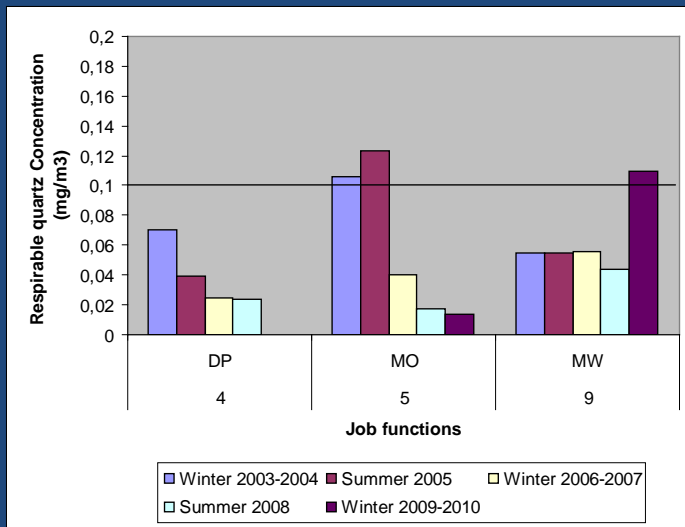
Example

Important issues for future campaigns:

- In future campaigns field blanks should be taken to be able to estimate the correct limit of detection for dust samples and to make decisions if sampling results should be corrected.
- Please provide us with information on the analytical limit of detection
- Whenever possible, collect 6 samples per job title per campaign, with some individuals sampled twice
- Please be alert on the correct sampling duration (ideally 6-8 hours). Avoid very short and very long sampling duration as was found in this dataset.

Company report ingredients

- Feedback on quality control
- Summary and interpretation of sampling results (country OEL)
- Comparison with previous campaigns
- Identification of hot spots



Hot spots: areas of specific concern

- Dust: 2 mg/m³
- Quartz: 0.1 mg/m³

One set of OEL's for all companies
(not country specific)

Exact definition of a hot spot: A job function within a site where:

1. The probability of exceeding the OEL > 5%
2. Not all workers used respiratory protective equipment when exposed to a concentration more than half the OEL (dust: > 1 mg/m³; quartz: > 0.05 mg/m³)

When a job function within a site is identified as a hot spot situation, it can be marked either as a red hot spot, or an orange hot spot:

- Red hot spot: Less than 50% of workers were using respiratory protective equipment
- Orange hot spot: 50% - 99 % of workers were using respiratory protective equipment

Please specify the type of control measures taken to reduce exposure within the hot-spot area and fill in all white areas below

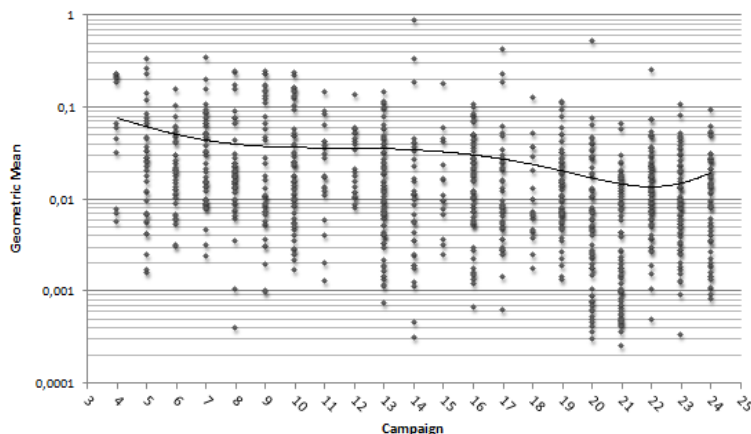
Hierarchy of control measures	Actions taken (yes/no)	Description of control measures	Referral to a specific NEPSI task sheet?	Effectiveness control measures checked by dust sampling? (yes/no)
		Please specify the control measures you have implemented	Please specify on which task guidance sheet (if any) of the good practice guide the implemented control measure was based	
1 Substitution of the process (e.g. wet for dry, automation for manual)				
2 Isolation/enclosure				
3 General or area ventilation				
4 Local exhaust ventilation				
5 Administrative measures (e.g. job rotation, reduced time in high concentration areas)				
6 Process optimisation (e.g. increased use of control measures already in place, increased maintenance, improved process settings)	yes	Optimized maintenance programme on conveyer belts to reduce leakage and to reduce the number of process disturbances	2.1.11	no
7 Improved cleaning & housekeeping				
8 Additional education & training				
9 Personal protective equipment				

Example

Every 2 yrs analysis of full database

Job Title	Trend per campaign (respirable dust)	Trend per campaign (respirable quartz)
All	-5.5%***	-6.0%***
Bagging operator	-7.6%***	-6.9%***
Crusher operator	-3.8%**	-0.7%
Dry process operator	-6.5%***	-6.9%***
Foreman	-5.1%***	+0.7%
Laboratory	-0.8%	-7.7%***
Maintenance worker	-3.5%***	-2.0%
Miller operator	-8.0%***	-4.7%***
Multi-skilled	-6.5%*	-11.3%**
Plastification	-10.5%***	-13.3%***
Quarry operator	-3.5%**	-2.2%
Transport worker	-6.6%**	-5.1%***
Wet process operator	-4.0%*	-0.3%

* Trend statistically significant for $p < 0.05$; ** $P < 0.01$; *** $p < 0.0001$



Mineral	Trend per campaign (respirable dust)	Trend per campaign (respirable quartz)
All	-5.5%***	-6.0%***
Silica	-5.5%***	-1.9%***
Talc	+0.7%	
Clay	-8.4%***	-9.4%***
Mixed minerals	-6.6%***	-5.1%***
Other minerals	-5.3%***	-8.2%***

* Trend statistically significant for $p < 0.01$; ** $p < 0.0001$

IMA-DMP example for other industries?

- Large industry (many companies, many sites)
- Sampling organized on site level
- One protocol for sampling and handling of data

IMA-DMP gives:

- Each individual company exposure information on local level
 - Increasing awareness
 - Sites can take appropriate action on high exposure jobs
- The industry as a whole were they stand with regard to dust and quartz exposure
 - Trends in exposure
 - Possible to discuss with unions & authorities, based on actual data

Arbeidshygiëne – Arbeids- en Bedrijfsgeneeskunde – Longziekten



Epidemiologie - Geneeskunde



Universiteit Utrecht - Institute for Risk Assessment Sciences

