

# Exposure During Blasting at German Workplaces

Respirable Dust and Quartz

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# Introduction

- Abrasive blasting is a **surface finishing** technique
- **Blasting materials**
  - Sand
  - Metal
  - Glass beads
  - Synthetic materials
  - Aluminium oxide abrasive
  - Natural materials like walnut shells
  - Water
  - Dry-ice
- OSH problems: **dust**, noise, high pressure, explosive atmosphere



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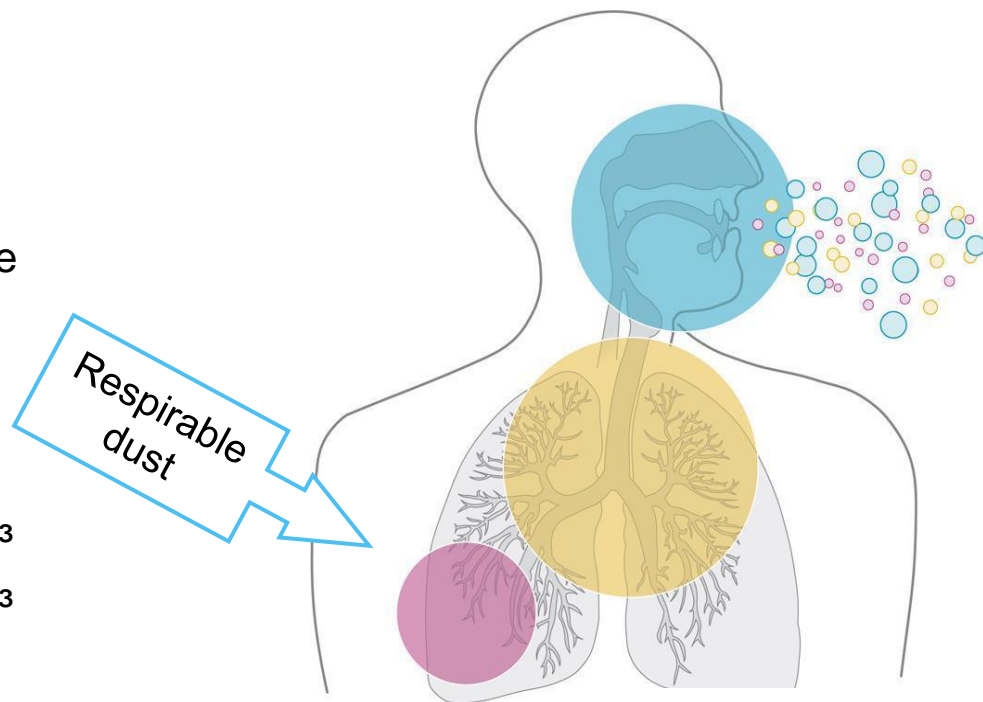
# Hazardous substances in dust during blasting

- **Relevant to OSH**

- Respirable dust fraction
- Quartz (crystalline silicon dioxide) in the respirable dust fraction
- Metals in the respirable dust fraction

- **Limit values in Germany**

- Respirable dust  $1.25 \text{ mg/m}^3$
- Quartz (resp. fraction)  $0.05 \text{ mg/m}^3$

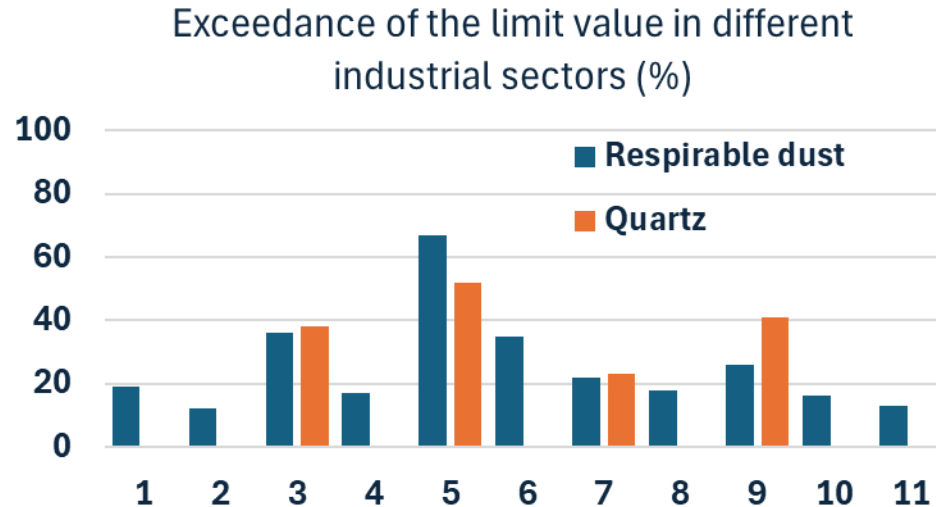


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# MEGA exposure database

- Exposure measurement data from the German exposure database MEGA
- MEGA: **over 4 million measurements** of concentrations of hazardous substances and biological agents at **German workplaces**
- In this study: data from **2000 to 2024**
- Measurements from **personal sampling**
- Groups of data selected according to **industrial sector**, **blasting material** and **RMM**
- Exceedance of the limit value, 95<sup>th</sup> percentile (with upper confidence limit)
- In case of measurement values below the limit of detection **maximum-likelihood methods** are used for estimating the underlying distribution and calculating of percentiles

# Respirable dust and quartz in different industries



## Industrial sectors

- 1 – Machine and vehicle production
- 2 – Metalworking, other branches
- 3 – Iron and steel foundries
- 4 – Non-ferrous metal foundries
- 5 – Construction sector: concrete blasting
- 6 – Construction sector: metal blasting
- 7 – Concrete industry
- 8 – Glass industry
- 9 – Pit and quarry industry
- 10 – Electrical engineering
- 11 – Precision engineering and optical industry

# Blasting in foundries: influence of the blasting material

Blasting material	Hazardous substance	Number of measurements / companies	Values below LOD N / %	Exceedance of the limit value %	95 <sup>th</sup> percentile	upper conf. 95 <sup>th</sup> percentile
					(mg/m <sup>3</sup> )	
Metal	Resp. dust	68 / 41	15 / 22	23	2.9	3.1
	Quartz (resp. fraction)	56 / 35	23 / 41	27	0.29	0.37
Sand	Resp. dust	21 / 13	1 / 5	55	9.3	11.4
	Quartz (resp. fraction)	20 / 12	0	60	0.72	0.88

# Blasting in open or closed machines

Open / Closed machine	Hazardous substance	Number of measurements / companies	Values below LOD N / %	Exceedance of the limit value %	95 <sup>th</sup> percentile	upper conf. 95 <sup>th</sup> percentile
					(mg/m <sup>3</sup> )	
Open	Resp. dust	67 / 40	21 / 31	38	16	20
	Quartz (resp. fraction)	32 / 23	14 / 44	37	0.89	1.3
Closed	Resp. dust	610 / 415	319 / 52	12	2.6	2.8
	Quartz (resp. fraction)	204 / 146	159 / 78	8	0.095	0.13

# Risk Management Measures:

## Blast cabinet

### Automatic blasting





# Blast cabinets and automatic blasting

Open / Closed machine	Hazardous substance	Number of measurements / companies	Values below LOD N / %	Exceedance of the limit value %	95 <sup>th</sup> percentile	upper conf. 95 <sup>th</sup> percentile
					(mg/m <sup>3</sup> )	
Blast cabinet	Resp. dust	37 / 25	6 / 16	22	2.7	3.1
	Quartz (resp. fraction)	29 / 23	10 / 34	26	0.24	0.32
Fettling machine, automatic blasting	Resp. dust	36 / 30	13 / 36	16	2.7	3.3
	Quartz (resp. fraction)	25 / 22	16 / 64	n. a.	n. a.	n. a.

# Conclusion

- For respirable dust and quartz, the exceedance of the limit values is above 10 % even when closed machines, e.g. blast cabinets or full-automated blasting machines are used
- German legislation has already reacted with a limitation for the quartz content of blasting materials:  
The sum of quartz, cristobalite and tridymite may not exceed 2 %
- High quartz exposure is still possible because of the quartz content of the treated material



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**Thank you for**

**your attention.**