

Carcinogenic Substances in the Air at Workplaces

Possibilities and Limitations of Exposure
Measurements

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Why is it so important to determine hazardous substances in air?

- Hazardous substances are easier incorporated by lung than by skin. The lung does not have a protective effect like skin.
- Air is working as transport medium for gases, vapour, aerosols or dust into other area.
- This is possible:



DO NOT TOUCH

- Try it, feel free !



DO NOT BREATH

The world record in apnoea diving with normal air is about 12 min.

Technical Rule for Hazardous Substances (TRGS) 402

Identification and Assessment of the Risks from Activities involving Hazardous Substances: Inhalation Exposure

- Basic Requirements for
 - Determination of hazardous substances in the air at workplace
 - Sampling and analytical methods used
 - Assessment of inhalation exposures results
 - Reporting of results
 - Measuring bodies performing inhalation exposure determinations
- List of suitable sampling and analytical methods
- Suitable for the determination of all hazardous substances
There are no special requirements for the determination of carcinogenic or mutagenic substances.

www.baua.de/DE/Angebote/Rechtstexte-und-Technische-Regeln/Regelwerk/TRGS/TRGS-402.html

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Technical Rules for Hazardous Substances	Identification and Assessment of the Risks from Activities involving Hazardous Substances: Inhalation Exposure	TRGS 402
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The Technical Rules for Hazardous Substances (TRGS) reflect the state of technology, occupational safety and health and occupational hygiene as well as other scientific knowledge for activities involving hazardous substances including their classification and labelling. The

Committee on Hazardous Substances (AGS)

establishes the rules and adapts them according to the state of development. The TRGS are announced by the Federal Ministry of Labour and Social Affairs (BMAS) in the Joint Ministerial Gazette (GMBI).

Contents

- 1 Scope
- 2 Definitions
- 3 Instructions relating to the risk assessment
- 4 Procedure for the identification of inhalation exposure
- 5 Assessment of the exposure and the effectiveness of protective measures
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- 7 Documentation
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Annex 1: Requirements for measuring bodies which perform identifications and assessments of exposure, including requirements for reporting

Annex 2: Non-measuring identification methods for exposure

Annex 3: Measuring identification methods

Annex 4: Procedure for the effectiveness check with the help of continuously measuring instruments (continuous monitoring and alarm devices)

Annex 5: Workplace examples and further instructions concerning the application of TRGS 402

- Committee on Hazardous Substances – AGS management - BAuA - www.baua.de -

Necessary Requirements

- The substance to be determined has to be known.
- A sampling and analytical method has to be available.
- The method has to be suitable (validation, e.g. limit of quantification, precision, recovery, specificity, stability of the sample).
- Sampling equipment must be available easily and affordable.



Sampling equipment for dust



Sampling equipment for vapours

Sampling Requirements

- Duration of activity
- Sampling time
- Limit values: shift average value (OEL), short term limit value
- Limit of quantification
- Range of a suitable method: factor 0.1 to 2.0 of the limit value

Is it possible to determine the expected concentration of a hazardous substance in the air in a suitable way?

Example:

- *LoQ: 0.5 µg of a substance on a filter*
- *Typical sampling time for assessing a shift activity: 2 hours*
- *Typical sampling parameters, e.g. 2.0 L/min*
- *When you collect 0.5 µg of a substance with these sampling parameters you will have an air concentration of $(0.07 / (120 \times 3.5) =) 0.16 \mu\text{g}/\text{m}^3$*
- *This method is therefore suitable for OELs higher than approx. 2 µg/m³*

Limits of exposure measurements

Having to fulfil many requirements is a serious limitation itself.

Interaction of the method possibilities, the sampling requirements and the height of the OEL is important for a successful assessment in practice.

- Availability of a suitable method
 - Development of a sampling and analytical method
 - Validation
 - Measuring body and analytical laboratory
 - Disposable capacities
 - Costs
- Short activities
- (very) low limit values

Alternative ?

Calculation of inhalative exposure situations

- Availability of a suitable calculation tool.
- Making sure that the chosen parameters fit adequate to the situation in reality.
- Adaption of the correlation coefficients for the calculation model to validate the calculated results
- Quantitative knowledge of the parameters needed to fulfill the calculation model.

- How will you do that?
- How will you make sure, that the calculated value represents the current situation on-site, making sure, your employees are working safely with, for example, carcinogenic substances?

 Make experimental exposure measurements

Possibilities and Advantages of Exposure Measurements

- The only way of determining the inhalation exposure on-site.
- The Determination of the concentration at workplace includes all parameters influencing the height of the concentration in total, e.g.:
 - Work equipment
 - Procedure (e.g. open, closed, under dust development)
 - Working capacity
 - Established technical safety measures and ventilation
 - Working organisation
- Evaluation of the effectiveness of protective measures
(basic requirement of the ordinance on hazardous substances)
- Identification of emission sources and leakages

Pleading

Plan and perform inhalation exposure measurements.

They are the only possibility to determine the exposure situation of employees and the effectiveness of safety measures on-site.



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