IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

MEGA evaluations for the preparation of REACH exposure scenarios for boron and its compounds

1 Introduction

The measured data for workplace exposure evaluated in the following have been gathered and documented in accordance with the principles of the measurement system of the German social accident insurance institutions for exposure assessment (MGU[1], formerly BGMG). The quality of the MGU is upheld by a quality management system that in essence satisfies the requirements of DIN EN ISO 9001. The test laboratories are operated in accordance with DIN EN ISO 17025 “General requirements for the competence of testing and calibration laboratories”.

To measure exposure to boron and its compounds at the workplace, a defined volume of air is sucked by a suitable pump through a membrane filter. For analysis, hazardous substance boron is transferred with a mixture of nitric acid and hydrochloric acid. In accordance with the MGU standard process, boron is determined by ICP mass spectroscopy. The quantification limit is 2 µg/m³. It should be noted that only elemental boron is analysed. Source: Substances and test methods in the MGU (ref. no. 6009). In: IFA-Arbeitsmappe Messung von Gefahrstoffen. 47. Lfg. V/2011. Ed.: Deutsche Gesetzliche Unfallversicherung (DGUV), Berlin. Erich Schmidt, Berlin 2011 – loose-leaf edition.

All the surveyed data in the MGU are brought together in the MEGA exposure database (measured data on exposure to hazardous substances at the workplace). The MEGA^{Pro} software developed by the IFA makes it possible to statistically analyse the data of the MEGA exposure database on the basis of various selection criteria and evaluation strategies.

[1] Gabriel, S.; Koppisch, D.; Range, D.: The MGU – a monitoring system for the collection and documentation of valid workplace exposure data. Gefahrstoffe – Reinhalt. Luft 70 (2010) No. 1/2, pp. 43-49 http://www.dguv.de/ifa, Webcode m200066

2 Data situation and evaluation strategy

2.1 Overview of the measured values collected in the MGU, data period 2000 to 2009

Boron and its compounds

General description	Number of measured values (%)
Total	325
Type of sampling: Stationary	195 (60 %)
Type of sampling: Personal	130 (40 %)
Sampling time ≥ 1 h and exposure time ≥ 6 h (comparable to shift measurements)	271 (83.4 %)
Number of data < quantification limit (Values < quantification limit were adopted in calculations with half their values)	132 (40.6 %)
Examples: Exposure conditions	
Without mechanical ventilation With mechanical ventilation No details	121 146
Without local exhaust ventilation With local exhaust ventilation No details	89 176
General description of measurements of boron and its compounds in: 47 branches of industry and 126 work areas	

2.2 Criteria for inclusion of measured data in the evaluation

- Measured data relating to exposure
- Sampling time ≥ 1 hour
- Exposure time ≥ 6 hours
- Data sets comprising fewer than ten measured data were disregarded.

2.3 Evaluation strategy

The evaluation is performed according to industry groups (Chapter 4) and work area groups (Chapter 5). Selected data groups are differentiated by local exhaust ventilation.

If individual values fall below the measurement method's analytical quantification limit, half the value is adopted in the evaluation.

3 Abbreviations and indices

The following abbreviations and indices are used in the evaluation tables:

+ The distribution value is below the largest analytical quantification limit in the data set.

$ With reference to the given limit value, the percentage of values below the limit value is given.

! The number of measured values below the analytical quantification limit (a. q.) is greater than the number of measured values represented by this cumulative frequency value. No concentration is therefore given for this cumulative frequency value.

* If any single values fell below the measurement method's analytical quantification limit, half of each value was adopted in the evaluation.

4 Statistic evaluations for industry groups

Boron and its compounds, sampling time ≥ 1 h and exposure time ≥ 6 h
Industry groups, general

Branch of industry	Number of measured data	Number of firms	Frequency > number of values %	≤ limit value % $	Concentrations in mg/m³		
					50 per-centile *	90 per-centile *	95 per-centile *
Construction	12	3	0		0.002	0.015	0.07
Chemical industry	11	6	5 45.5		+ 0.008	+ 0.125	+ 0.226
Recycling of electronic scrap	22	5	5 22.7		+ 0.002	0.005	0.009
Electrical engineering	22	18	16 72.7		! a. q.	+ 0.018	+ 0.021
Flat glass, hollow glass	32	6	10 31.3		+ 0.0012	0.017	0.023
Electroplating	48	27	41 85.4		! a. q.	+ 0.01	+ 0.022
Treatment of wood	17	7	8 47.1		+ 0.001	+ 0.028	+ 0.05
Processing and treatment of metals, general	47	23	21 44.7		+ 0.003	+ 0.031	+ 0.050
Manufacture of machinery and vehicles	15	8	7 46.7		+ 0.002	+ 0.015	+ 0.015
Stones and earths, fine mechanics, Glass industry	21	7	2 9.5		+ 0.002	+ 0.061	0.155

4.1 Industry groups: Measurements without local exhaust ventilation

Branch of industry	Number of measured data	Number of firms	Frequency > number of values %	≤ limit value % $	Concentrations in mg/m³		
					50 per-centile *	90 per-centile *	95 per-centile *
Electroplating	14	7	11 78.6		! a. q.	+ 0.0096	+ 0.01
Processing and treatment of metals, general	12	6	2 16.7		+ 0.0045	+ 0.041	+ 0.0778

4.2 Industry groups: Measurements with local exhaust ventilation

Branch of industry	Number of measured data	Number of firms	Frequency < number of values %	≤ limit value % $	Concentrations in mg/m³		
					50 per-centile *	90 per-centile *	95 per-centile *
Electroplating	34	23	30 88.2		! a. q.	+ 0.0151	+ 0.0304
Processing and treatment of metals, general	32	16	18 56.3		! a. q.	+ 0.0246	+ 0.0392

5 Statistical evaluations for work area groups

Boron and its compounds, sampling time ≥ 1 h and exposure time ≥ 6 h
Work area groups: General

Work area	Number of measured data	Number of firms	Frequency < number of values %	≤ limit value % $	Concentrations in mg/m³		
					50 per-centile *	90 per-centile *	95 per-centile *
Filling , weighing, packaging	14	6	3 21.4		+ 0.002	+ 0.043	+ 0.06
Turning, sanding, grinding	36	22	13 36.1		+ 0.002	+ 0.007	0.024
Hard soldering	25	15	15 60		! a. q.	+ 0.037	0.108
Mixing,pressing	38	12	14 36.8		+ 0.002	+ 0.03	0.161
Surface coating	65	38	54 83.1		! a. q.	+ 0.016	+ 0.045
Cleaning	19	9	3 15.8		+ 0.002	+ 0.011	+ 0.023
Welding	12	7	3 25		0.003	0.015	0.024

6 Statistical evaluations for the assignment of work area and industry groups

No statistical evaluation has been performed.

7 Overview lists

No lists have been compiled.