

MEGA evaluations for the preparation of REACH exposure scenarios for sulfuric acid

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 (MGU¹, 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 sulfuric acid exposure at the work place, a defined volume of air is sucked by a suitable pump through a quartz fibre filter. The particulate acids contained in the air are retained on the filter. To prevent substance loss, the quartz fibre filter is transferred to a sealable polyethylene vessel filled with 4 ml buffer solution ($c(\text{Na}_2\text{CO}_3) = 2.7 \text{ mmol/L}$; $c(\text{NaHCO}_3) = 0.30 \text{ mmol/L}$) immediately after sampling. Qualitative and quantitative analysis are performed by ion chromatography with conductivity detector. For quantitative evaluation, the method of the external standard is used. The quantification limit is 0.005 mg/m^3 with a sample air volume of 420 L. Source: Inorganic acids, particulate: phosphoric acid and sulfuric acid (ref. no. [6173](#)). In: IFA-Arbeitsmappe Messung von Gefahrstoffen. 46. Lfg. XII/2010. 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 2008

Sulfuric acid:

Information on the sampling systems can be found in the IFA work folder (IFA-Arbeitsmappe, in German).

Limit value 0.1 mg/m³ workplace limit

General description	Number of measured values (%)
Total	2314
Type of sampling: Stationary	1652 (71.4 %)
Type of sampling: Personal	662 (28.6 %)
Sampling time ≥ 2 h and exposure time ≥ 8 h	2018 (87 %)
Number of data < quantification limit (Values < quantification limit were adopted in calculations with half their values)	688 (29.7 %)
Number of data > limit value	422 (18.2 %)
Examples: Exposure conditions	
Without mechanical ventilation	615
With mechanical ventilation	1513
No details	
Without local exhaust ventilation	808
With local exhaust ventilation	1310
No details	

General description of measurements of sulfuric acid in:
85 branches of industry and 219 work areas

2.2 Criteria for inclusion of measured data in the evaluation

- Measured data relating to exposure
- Sampling time ≥ 2 hour
- Exposure time ≥ 8 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

Sulfuric acid, sampling time ≥ 2 h and exposure time ≥ 8 h

Industry groups, general

Branch of industry	Number of measured data	Number of firms	Frequency < number of values %	≤ limit value % §	Concentrations in mg/m ³	
					50 percentile *	90 percentile *
Chemistry, plastics, rubber	43	23	18 42	81	+ 0.013	0.147
Foundries	136	48	15 11	79	+ 0.053	0.197
Electroplating	1323	396	370 28	84	+ 0.017	0.18
Processing and treatment of metals	148	64	58 39	94	+ 0.011	+ 0.05
Steel and light metal construction; manufacture of machinery and vehicles; apparatus engineering; manufacture of taps and valves	48	23	23 48	94	+ 0.01	+ 0.05
Electrical engineering, general	67	36	31 46	100	+ 0.011	+ 0.04

4.1 Industry groups: Measurements with and without local exhaust ventilation

Branch of industry	Number of measured data	Number of firms	Frequency < number of values %	≤ limit value % §	Concentrations in mg/m ³	
					50 percentile *	90 percentile *
Chemistry, plastics, rubber with local exhaust ventilation	16	11	7 44	81	+ 0.01	0.18

Chemistry, plastics, rubber with local exhaust ventilation: 3 measured values (19%) over 0.14 mg/m³ in the work areas of drying by rotary kiln and reaction vessels.

Chemistry, plastics, rubber without local exhaust ventilation	19	10	7 37	84	0.02	0.16
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Foundries with local exhaust ventilation	36	17	8 22	92	+ 0.02	0.09
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Foundries with local exhaust ventilation: 9 measured values (25%) at workplaces with synthetic-resin-bound mould sands.

Foundries without local exhaust ventilation	96	33	4 4	74	+ 0.07	0.22
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Foundries without local exhaust ventilation: 51 measured values (53%) at workplaces with synthetic-resin-bound mould sands.

5 Statistical evaluations for work area groups

Sulfuric acid, sampling time ≥ 2 h and exposure time ≥ 8 h
Work area groups: General

Work area	Number of measured data	Number of firms	Frequency < number of values %	\leq limit value % \$	Concentrations in mg/m ³	
					50 percentile *	90 percentile *
Filling	12	6	8 67	100	! a. q.	0.03
Cleaning	23	13	5 22	83	0.02	0.2
Electroplating; staining	108	57	35 32	88	+ 0.014	0.128
Electroplating; degreasing, pickling	86	54	35 41	93	+ 0.012	+ 0.063
Electroplating; copper-plating	72	44	23 32	90	0.014	0.0998
Electroplating; anodisation	345	86	25 7	62	+ 0.055	0.45
Electroplating; waste water treatment	19	16	7 37	90	0.012	0.057

5.1 Work area groups: with and without local exhaust ventilation

Work area	Number of measured data	Number of firms	Frequency < number of values %	\leq limit value % \$	Concentrations in mg/m ³	
					50 percentile *	90 percentile *
Electroplating; anodisation with local exhaust ventilation	153	45	19 12	77	0.028	0.22
Electroplating; anodisation without local exhaust ventilation	166	47	5 3	53	0.09	0.51
Electroplating; staining with local exhaust ventilation	74	36	24 32	87	+ 0.014	0.18
Electroplating; staining without local exhaust ventilation	26	20	8 31	89	0.02	0.11

Electroplating; Staining with local exhaust ventilation: the 5 highest measured values are documented during electrolytic staining.

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.