

MEGA evaluations for the preparation of REACH exposure scenarios for lead and its compounds as additives in polyvinyl chloride (PVC)

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 lead exposure at the workplace, a defined volume of air is sucked by a suitable pump through a particle filter (membrane filter). The lead and its compounds contained in collected dust are analysed after wet digestion by atomic absorption spectrometry. The quantification limit is 0.03 mg/m³ for personal measurements with 0.42 m³ sample air volume and 0.001 mg/m³ for stationary measurements with 45 m³ sample air volume. Source: Lead (ref. no. [6310](#)). In: IFA-Arbeitsmappe Messung von Gefahrstoffen. 1. Lfg. VI/89. 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). If individual values fall below the measurement method’s analytical quantification limit, half the value is adopted in the evaluation. The MEGA^{Pro} software developed by the IFA (formerly BGIA) 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 2011

Lead and its compounds with an exposure limit value of 0.1 mg/m³

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

General description	Number of measured values (%)
Total	6759
Type of sampling: Stationary	3419 (50.6 %)
Type of sampling: Personal	3340 (49.4%)
Sampling time ≥ 1 h and exposure time ≥ 6 h (comparable to shift measurements)	5647 (83.5%)
Sampling time < 1 h <u>or</u> exposure time < 6 h	1112 (16.5%)
Number of data < quantification limit (Values < quantification limit were adopted in statistics with half their values)	2274 (33.6%)
Number of data > exposure limit value	1080 (16%)
Number of data ≥ quantification limit and ≤ limit value	3407 (50.4%)
Examples: Exposure conditions	
Without mechanical ventilation	2492
With mechanical ventilation	2985
No details	1194
Without local exhaust ventilation	2201
With local exhaust ventilation	3484
No details	993

General description of lead measurements in 213 branches of industry and 752 work areas

2.2 Criteria for inclusion of measured data in the evaluation

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

2.3 Evaluation strategy

The evaluation was performed on the basis of industry groups (Appendix 1) and work area groups (Appendix 2) and broken down further according to type of sampling (stationary or personal).

3 Abbreviations and indices

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

Frequency < values: Number of measured values below the analytical quantification limit

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

! 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.

Appendix 1

Statistic evaluations for industry groups

Lead and its compounds as additives in PVC, sampling time ≥ 1 h and exposure time ≥ 6 h
 Industry groups, general

D.No. = Data set number/ Designation Branch of industry	Number of measured data	Number of firms	Frequency < number of values %	Number of Alls*	Largest quantifica- tion limit in mg/m ³	\leq limit value % \$	Concentrations in mg/m ³			
							50 per- centile *	75 per- centile *	90 per- centile *	95 per- centile *
D.No. 4 Lead and its compounds with reference to PVC	92	35	20 21.7	7	0.015	95.7	+ 0.0077	0.021	0.0608	0.08
D.No. 8 Lead and its compounds Plastics and plastic foam, processing ; Manufacture of plastic sheets, tubes and profiles; Manufacture of plastic and plastic foam;, Manufacture of films and foils	62	26	15 24.2	7	0.01	98.4	+ 0.0077	0.019	0.0478	0.062
D.No. 9 Lead and its compounds Stabilisers containing lead, utilisation and manufacturing	23	4	2 8.7	2	0.0038	87	0.0086	0.0432	0.141	0.255

* All = social accident insurance institution

Industry groups: Stationary measurements

D.No. = Data set number/ Designation Branch of industry	Number of measured data	Number of firms	Frequency < number of values %	Number of Alls*	Largest quantification limit in mg/m ³	≤ limit value % \$	Concentrations in mg/m ³			
							50 percentile *	75 percentile *	90 percentile *	95 percentile *
D.No. 10 Lead and its compounds Total	32	20	9 28.1	6	0.015	100	+ 0.0054	+ 0.0094	0.0148	0.019
D.No. 11 Lead and its compounds Plastics and plastic foam, processing; Manufacture of plastic sheets, tubes and profiles; Manufacture of plastic and plastic foam; Manufacture of films and foils	23	15	6 26.1	5	0.001	100	0.005	0.01	0.015	0.0184
D.No. 12 Lead and its compounds Stabilisers containing lead, utilisation and manufacturing	5	3	0	2		100				

* All = social accident insurance institution

Industry groups: Personal measurements

D.No. = Data set number/ Designation Branch of industry	Number of measured data	Number of firms	Frequency < number of values %	Number of Alls*	Largest quantification limit in mg/m ³	≤ limit value % \$	Concentrations in mg/m ³			
							50 percentile *	75 percentile *	90 percentile *	95 percentile *
D.No. 13 Lead and its compounds Total	60	28	11 18.3	6	0.01	93.8	+ 0.01	0.035	0.072	0.17
D.No. 14 Lead and its compounds Plastics and plastic foam, processing; Manufacture of plastic sheets, tubes and profiles,; Manufacture of plastic and plastic foam,; Manufacture of films and foils	39	21	9 23.1	6	0.01	97.4	+ 0.0098	0.0323	0.0602	0.071
D.No. 15 Lead and its compounds Stabilisers containing lead, utilisation and manufacturing	18	4	2 11.1	2	0.0038	83.3	0.01	0.0585	0.19	0.343

* All = social accident insurance institution

Industry groups: Measurements with local exhaust ventilation

D.No. = Data set number/ Designation	Number of measured data	Number of firms	Frequency < number of values %	Number of Alls*	Largest quantifi- cation limit in mg/m ³	≤ limit value % \$	Concentrations in mg/m ³			
							50 per- centile *	75 per- centile *	90 per- centile *	95 per- centile *
Branch of industry										
D.No. 19 Lead and its compounds Total	44	22	11 25	7	0.0038	95.5	0.0077	0.023	0.0612	0.0732
D.No. 20 Lead and its compounds Plastics and plastic foam, processing; Manufacture of plastic sheets, tubes and profiles;, Manufacture of plastic and plastic foam;, Manufacture of films and foils	28	16	8 28.6	6	0.003	100	0.0078	0.023	0.0536	0.0612
D.No. 21 Lead and its compounds Stabilisers containing lead, utilisation and manufacturing	13	4	2 15.4	2	0.0038	84.6	0.0077	0.0168	0.199	0.525

Industry groups: Measurements without local exhaust ventilation

D.No. = Data set number/ Designation	Number of measured data	Number of firms	Frequency < number of values %	Number of Alls*	Largest quantifi- cation limit in mg/m ³	≤ limit value % \$	Concentrations in mg/m ³			
							50 per- centile *	75 per- centile *	90 per- centile *	95 per- centile *
Branch of industry										
D.No. 16 Lead and its compounds Total	41	15	7 17.1	5	0.015	95.1	+	0.0213	0.0605	0.0882
D.No. 17 Lead and its compounds Plastics and plastic foam, processing; Manufacture of plastic sheets, tubes and profiles;, Manufacture of plastic and plastic foam;, Manufacture of films and foils	29	12	5 17.2	5	0.0031	96.6	0.0081	0.015	0.0366	0.0719
D.No. 18 Lead and its compounds Stabilisers containing lead, utilisation and manufacturing	10	2	0	2		90	0.032	0.0585	0.072	0.121

* All = social accident insurance institution

Appendix 2

Statistical evaluations for work area groups

Lead and its compounds as additives in PVC, sampling time ≥ 1 h and exposure time ≥ 6 h

Work area groups: General

D.No. = Data set number/ Designation Work area	Number of measured data	Number of firms	Frequency < number of values %	Number of Alls*	Largest quantification limit in mg/m ³	≤ limit value % \$	Concentrations in mg/m ³			
							50 percentile *	75 percentile *	90 percentile *	95 percentile *
D.No. 22 Lead and its compounds Mixing	41	20	4 9.8	6	0.0038	95.1	0.0118	0.033	0.0619	0.0738
D.No. 23 Lead and its compounds Extruder, Processing of moulded parts	31	16	13 41.9	6	0.015	100	+	+	+	0.05
D.No. 24 Lead and its compounds Warehouse, Mill, Weighing, Laboratory	15	10	2 13.3	3	0.003	86.7	0.0079	0.0283	0.171	0.32

* All = social accident insurance institution

Work area groups: Stationary measurements

D.No. = Data set number/ Designation Work area	Number of measured data	Number of firms	Frequency < number of values %	Number of Alls*	Largest quantification limit in mg/m ³	≤ limit value % \$	Concentrations in mg/m ³			
							50 percentile *	75 percentile *	90 percentile *	95 percentile *
D.No. 25 Lead and its compounds Mixing	10	7	1 10	3	0.0006	100	0.0078	0.0123	0.019	0.019
D.No. 26 Lead and its compounds Extruder, Processing of moulded parts	16	12	7 43.8	6	0.015	100	+	+	+	0.0152
D.No. 27 Lead and its compounds Warehouse, Mill, Weighing, Laboratory	3	3	0	2		100				

* All = social accident insurance institution

Work area groups: Personal measurements

D.No. = Data set number/ Designation Work area	Number of measured data	Number of firms	Frequency < number of values %	Number of Alls*	Largest quantification limit in mg/m ³	≤ limit value % \$	Concentrations in mg/m ³			
							50 percentile *	75 percentile *	90 percentile *	95 percentile *
D.No. 28 Lead and its compounds Mixing	31	18	3 59.7	6	0.0038	93.5	0.02	0.039	0.0692	0.117
D.No. 29 Lead and its compounds Extruder, Processing of moulded parts	15	10	6 40	5	0.01	100	+ 0.005	0.0115	0.046	0.0612
D.No. 30 Lead and its compounds Warehouse, Mill, Weighing, Laboratory	12	7	2 16.7	2		83.3	0.01	0.056	0.23	0.35

* All = social accident insurance institution

Work area groups: Measurements with local exhaust ventilation

D.No. = Data set number/ Designation Work area	Number of measured data	Number of firms	Frequency < number of values %	Number of Alls*	Largest quantification limit in mg/m ³	≤ limit value % \$	Concentrations in mg/m ³			
							50 percentile *	75 percentile *	90 percentile *	95 percentile *
D.No. 31 Lead and its compounds Mixing	11	5	0	4		90.9	0.0118	0.039	0.06	0.11
D.No. 32 Lead and its compounds Extruder, Processing of moulded parts	21	10	7 33.3	4	0.015	100	+ 0.065	+ 0.0106	+ 0.0301	0.0386
D.No. 33 Lead and its compounds Warehouse, Mill, Weighing, Laboratory	9	6	0	3		88.9				

* All = social accident insurance institution

Work area groups: Measurements without local exhaust ventilation

D.No. = Data set number/ Designation Work area	Number of measured data	Number of firms	Frequency < number of values %	Number of Allis*	Largest quantification limit in mg/m ³	≤ limit value %	Concentrations in mg/m ³			
							50 percentile *	75 percentile *	90 percentile *	95 percentile *
D.No. 34 Lead and its compounds Mixing	29	15	4 13.8	6	0.0038	96.6	0.018	0.032	0.062	0.0722
D.No. 35 Lead and its compounds Extruder, Processing of moulded parts	5	4	4 80	3	0.001	100				
D.No. 36 Lead and its compounds Warehouse, Mill, Weighing, Laboratory	5	4	2 40	2	0.003	80				

* All = social accident insurance institution