

MEGA evaluations for the preparation of REACH exposure scenarios for diethylene glycol

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 for exposure assessment 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 laboratories are operated in accordance with DIN EN ISO 17025 "General requirements for the competence of testing and calibration laboratories".

To determine the diethylene glycol (CAS No. 111-46-6) contained in the air at the workplace, a defined volume of air is sampled by a pump with a test tube holder through a Dräger activated carbon tube. After desorption with dichloromethan/methanol (7:3) qualitative and quantitative analysis is performed by gas chromatography with a flame ionisation detector. Quantitative analysis is performed with the method of an internal standard. The quantification limit is 0.5 mg/m³ for a sample air volume of 40 L. Source: Ethylenglykol (ref. no. 7408). In: IFA-Arbeitsmappe Messung von Gefahrstoffen. 12. Lfg. IV/1994. Ed.: Deutsche Gesetzliche Unfallversicherung (DGUV), Berlin. Erich Schmidt, Berlin 2011 – loose-leaf edition. Diethylene glycol is analysed and evaluated according to this process.

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 analyse the data of the MEGA exposure database statistically 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

Diethylene glycol (CAS-no.: 111-46-6)
MGU-standard process (VK 0)

The workplace limit value for diethylene glycol in Germany is 44 mg/m³.

General description	Number of measured values (%)
Total	254
Type of sampling:	
stationary	164 (65%)
personal	90 (35%)
Number of data < quantification limit	239 (94%)
Sampling time representative for:	
Exposure time ≥ 6 h	226 (89%)
Exposure time < 6 h	19 (8%)
Examples: Exposure conditions	
Measurement plan:	
Workplace measurements	247 (97%)
Interior measurements	6 (2%)
Situation in industry: Unfavourable	16 (6%)
Reason for measurement: investigation in case of suspected occupational disease	35 (14%)
Without mechanical ventilation	97 (38%)
With mechanical ventilation	120 (47%)
No details	32 (13%)
Without local exhaust ventilation	106 (42%)
With local exhaust ventilation	102 (40%)
No details	46 (18%)

General description of
measurements of diethylene glycol in
63 branches of industry and 122 work areas

2.2 Evaluation strategy

- Data period 2000 to 2011
- Measured data relating to exposure
- Standard method in the MGU
- Sampling is representative for exposure duration.
- Exposure duration ≥ 6 hours or < 6 hours
- If any single values fell below the measurement method's analytical quantification limit (a. q.), half of each value was adopted in the evaluation.
- Data sets comprising fewer than ten measured data were disregarded.
- Workplace measurements
- There was no statistical evaluation based on branches of industry and work areas, as 239 (94%) of the 254 measured values are below the analytical quantification limit.

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
a. q.	Analytical quantification limit
*	If any single values fell below the measurement method's analytical quantification limit (a. q.), half of each value was adopted in the evaluation.
+	The distribution value is below the largest analytical quantification limit (a. q.) in the data set. The quantification limit may deviate from the quantification limit quoted in the introduction, e.g. depending on sampling duration or flow rate.
!	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.
\$	With reference to the given limit value, the percentage of values below the limit value is given.

4 Statistic evaluations for industry groups

Diethylene glycol, data period 2000 to 2011, workplace measurements
Sampling representative for exposure time ≥ 6 h

D.No. = Data set number/ Designation	Number of measured data	Number of firms	Frequency < number of values%	Largest quanti- fication limit in mg/m ³	≤ limit value % \$	Concentrations in mg/m ³		
						50 per- centile *	90 per- centile *	95 per- centile *
Branch of industry								
D No. 7 No limitation	219	128	205 93.6	4	100	! a. q.	! a. q.	+ 1.81

Diethylene glycol, data period 2000 to 2011, workplace measurements
Sampling representative for exposure time < 6 h

D.No. = Data set number/ Designation	Number of measured data	Number of firms	Frequency < number of values%	Largest quanti- fication limit in mg/m ³	≤ limit value % \$	Concentrations in mg/m ³		
						50 per- centile *	90 per- centile *	95 per- centile *
Branch of industry								
D. No. 6 No limitation	19	15	18 94.7	5	100	! a. q.	! a. q.	+ 2.025

5 Statistical evaluations for work area groups

No statistical evaluation has been performed.

6 Further statistical evaluations

No statistical evaluation has been performed.

7 Overview lists

7.1 Branches of industries

Diethylene glycol, data period 2000 to 2011, workplace measurements
Sampling representative for exposure time ≥ 6 h

Industry groups	Number of measured values
Manufacture/processing of coating materials, glue, mastics	3
Manufacture of coating materials (emulsion paints and plaster)	1
Construction, general	1
Clothing trade, general	6
Manufacture of prefabricated cement parts	2
Chemical industry	15
Printing office	10
Iron foundry	1
Electrical engineering, general	13
Vehicle construction	1
Manufacture of fine mechanics, optics	1
Manufacture of windows, doors, facade elements (plastic)	3
Manufacture of windows, wood	1
Manufacture and processing of flat glass	9
Manufacture of aircraft	2
Electroplating	1
Health services	1
Manufacture and processing of glass fibres	7
Manufacture of glass fibre reinforced plastics	1
Wholesale trade with chemicals	1
Wholesale trade with iron and metal haberdashery, electrotechnical products, fixtures and household articles, furniture, sports goods	1
Wholesale trade with fuels, technical oils and fats	2
Wholesale trade with synthetic granules and semi-finished plastic products	1
Manufacture of (technical) rubber products	1
Manufacture and processing of rubber products	5
Manufacture of parts for motor vehicles and engines (automotive supply)	4
Manufacture and processing of hollow glass	1
Processing and treatment of wood	4
Wood fibre and chip board works	2
Interior work, parquet laying (wood floors)	1
Lamination	2
Corrosion protection, re-coating	1
Hospital	1
Plastics and plastic foam, processing	8
Manufacture of plastic sheets, tubes and profiles	2
Manufacture of semi-finished plastic products	3
Light metal foundry	1

Industry groups	Number of measured values
Painting and varnishing	2
Manufacture of machinery and vehicles, general	8
Mechanical engineering	6
Solid forming (drop and open die forges)	3
Manufacture of medical engineering	1
Processing and treatment of metals, general	26
Surface treatment and hardening	1
Manufacture and processing of paper and paperboard	6
Powder coating	1
Repair shop for machinery	4
Grinding shop (metal products)	1
Manufacture of grinding tools and abrasives	2
Textile weaving	2
Preparation of spun textiles, e.g. raw cotton (except asbestos)	1
Manufacture of explosives. pyrotechnics, ammunition	3
Finishing of textiles	14
Transport, shipping, transport companies and similar	1
Processing of liquid coating materials (liquid varnish coating)	14
Manufacture of pharmaceutical dressings	1
Manufacture of wall and floor tiles	2
Total	219

Diethylene glycol, data period 2000 to 2011, workplace measurements
Sampling representative for exposure time < 6 h

Branches of industry	Number of measured values
Waste sorting plant	1
Man-made fibres, manufacture	1
Electrical engineering, general	2
Manufacture and processing of flat glass	2
Electroplating	1
Manufacture and processing of hollow glass	1
Interior work, parquet laying (wood floors)	1
Manufacture of plastic sheets, tubes and profiles	2
Mechanical engineering	1
Processing and treatment of metals, general	1
Manufacture of solar technology	3
Finishing of textiles	1
Manufacture of wall/floor tiles, stove tiles, structural ceramic	2
Total	19

7.2 Work areas

Diethylene glycol, data period 2000 to 2011, workplace measurements
Sampling representative for exposure time ≥ 6 h

Work area plan Work area	Number of measured values
Work area plan 1 General work areas	
Warehouse work, manual, packaged goods (in sacks etc.)	2
Chemical store	1
Barrel storage, filling, decanting	1
Conveying, hydraulic, pumping, general	10
Mixing by hand	1
Closed dry mixer, general	1
Wet (fat) mixer, general	1
Wet mixer, feeding	3
Hot presses	1
Foam-filling of hollow spaces	3
Dryers, continuous (e.g. continuous flow dryers), general	1
Chamber furnace, general	1
Multiple-hearth incinerator, general	1
Continuous kiln, output	1
Smelting furnaces, general	7
Furnace, removal, general	1
Processing, room	1
Forging	3
Separating and processing methods, room	3
Turning, planing	2
Sanding	8
Punching, cutting	4
CNC processing machines	5
Sewing, stuffing	1
Fixing	7
Immersion system	1
Spark erosion	1
Filling station, room	1
Feed regulating scale	1
Installation, general	2
Filling processes, miscellaneous	3
Repair and maintenance, general	2
Technical school, at facilities	1
Test facility	6
Laboratory, room	1
Laboratory, at facilities	3
Work area, miscellaneous	1
Laser beam surface processing	1
Gluing, reaction adhesives	4
Gluing, other processes	2
Surface coating, rolling	1
Surface coating, immersing	1
Surface coating, spraying (e.g. with pressurised air)	4
Surface coating, mechanical, room	1
Surface coating, application with machines	5
Surface coating, powder coating	2
Surface coating, electrostatic application	3
Surface coating, electroplating	2

Work area plan Work area	Number of measured values
Surface coating processes, miscellaneous	6
Vehicles, track (trams, trains, subway)	1
Airport, apron	2
Work area not coded	3
Metal active gas welding (MAG)*)	1
Thermal cutting, mixed cutting process	2
Soldering	1
Soft soldering, rod soldering	1
Soft soldering, wave soldering	1
Wet grinding	11
Pad printing	3
Industrial screenprinting	1
Supply system	1
Paint stripping, chemical	1
Number of analyses for work area plan 1	154
Work area plan 5 Ceramics	
Processing, decoration, hand-painting	1
Processing, decoration, screen printing, mechanical	1
Number of analyses for work area plan 5	2
Work area plan 7 Foundries	
Casting shop, cold-chamber die-casting machine or plant	1
Number of analyses for work area plan 7	1
Work area plan 12 Hollow glass	
Post-treatment, decoration department, room	1
Number of analyses for work area plan 12	1
Work area plan 16 Processing and treatment of wood	
Machines for wood finishing, painting room, spraying station	1
Machines for wood finishing, painting room, manual painting	1
Number of analyses for work area plan 16	2
Work area plan 21 Finishing of textiles	
Printing office, rotary screen printing machine	1
Printing office, transfer printing machine	1
Printing office, other printing machine	1
Dyeing, dyeing unit (pressure vessel)	2
Dyeing, other dyeing machine, unit	2
Chemical finishing, coating, room, general	1
Chemical finishing, coating, other finishing and coating unit	3
Number of analyses for work area plan 21	11
Work area plan 22 Health services	
Bedstead and bedside cabinet disinfection, spraying	1
Bedstead and bedside cabinet disinfection, dispensing area, cleaning and disinfection equipment	1
Number of analyses for work area plan 22	2

Work area plan Work area	Number of measured values
Work area plan 23 Paper and cardboard manufacture, processing	
Raw and finished material processing, de-inking, room, general	1
Ink preparation, room	1
Paper, board and cardboard making, papermaking machine, control room	1
Paper, board and cardboard making, papermaking machine, wire section	1
Paper, board and cardboard making, papermaking machine, size press	1
Paper, board and cardboard making, papermaking machine, winding	1
Number of analyses for work area plan 23	6
Work area plan 25 Manufacture and processing of rubber products	
Curing, steam pipe	2
Subsequent treatment, general	1
Number of analyses for work area plan 25	3
Work area plan 31 Special work areas in the construction industry	
Mixer, open, wet	1
Blasting, wet	1
Floor installation, manual paving	1
Sealing	1
Number of analyses for work area plan 31	4
Work area plan 35 Printing office	
Printing forme production, film developing unit	2
Offset printing, offset printing plate developing machine	1
Rotary flexographic printing machine, unwinding	1
Screen coating	2
Screen exposure	1
Automatic sheet-fed screen printing machines, plant, manual	1
Screen-printing machines, manually operated, general	1
Screen-printing machines, manually operated, manual screen printing	1
Number of analyses for work area plan 35	10
Work area plan 37 Production of concrete products	
Pre- and post-treatment, surface treatment, general	2
Number of analyses for work area plan 37	2
Work area plan 48 Plastics articles, manufacture	
Semi-finished parts production, prepreg production	1
Post-treatment, screen printing	1
Number of analyses for work area plan 48	2
Work area plan 56 Liquid paint coating	
Paint preparation, Dye mixing	2
Workpiece pre-treatment or preparation area, general	1
Paintshop, paint spray walls, general	2
Dip-coating, conventional, with liquid coating materials	6
Electrocoating, anodic, with liquid coating materials	2
Number of analyses for work area plan 56	13
Work area plan 57 Plant and processes of the chemical industry	
Thermal and chemical processes and apparatus, distillation vessels	1
Workplace not coded	2
Number of analyses for work area plan 57	3

Work area plan Work area	Number of measured values
Work area plan 70 Glass	
Screenprinting, manual	2
Insulation glazing units, production, sealing, mechanical	1
Number of analyses for work area plan 70	3
Total	219

Diethylene glycol, data period 2000 to 2011, workplace measurements
Sampling representative for exposure time < 6 h

Work area plan Work area	Number of measured values
Work area plan 1 General work areas	
Semi-finished and finished goods warehouse, room	1
Barrel storage, filling, decanting	1
Autoclave	3
Turning, planing	1
Surface treatment, general	1
Conditioning	1
Material cleaning, general	1
Material cleaning, by wiping with liquids	1
Test facility	1
Casting of electronic/electrical components	1
Number of analyses for work area plan 1	12
Work area plan 5 Ceramics	
Workplace not coded	2
Number of analyses for work area plan 5	2
Work area plan 12 Hollow glass	
Thermometers, laboratory apparatus, neon lamp manufacture, screenprinting	1
Number of analyses for work area plan 12	1
Work area plan 21 Textilveredlung	
Printing office, transfer printing machine	1
Number of analyses for work area plan 21	1
Work area plan 31 Special work areas in the construction industry	
Sealing	1
Number of analyses for work area plan 31	1
Work area plan 48 Plastics articles, manufacture	
Mouldings production, reaction casting	1
Number of analyses for work area plan 48	1
Work area plan 70 Glass	
Screen cleaning (including tools), plant	1
Number of analyses for work area plan 70	1
Total	19

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