

MEGA evaluations on exposure to 2-butanone oxime

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 determine the 2-butanone oxime (CAS No. 96-29-7) contained in the air at the workplace, a defined volume of air is sucked by a sampling pump with a test tube holder through a chromosorb tube. After extraction with methanol, qualitative and quantitative analysis is performed by gas chromatography with a nitrogen-selective detector (NSD). Quantitative analysis is performed with the method of the external standard. The analytical quantification limit (limit of quantitation LOQ) within this MGU-standard process is 0.2 mg/m³ for a sample air volume of 40 L. Source: 2-Butanonoxim (ref. no. [6398](#)). In: IFA-Arbeitsmappe Messung von Gefahrstoffen. 22. Lfg. III/1999. 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 1998 to 2011

2-Butanone oxime (CAS-no.: 96-29-7)

Measured data relating to exposure, MGU-standard process

In Germany, a workplace limit value for 2-Butanone oxime of 1 mg/m³ has been valid since 19th September 2013.

<i>General description</i>	<i>Number of measured values (%)</i>
Total	289
Type of sampling:	
Stationary	147 (51%)
Personal	142 (49%)
Number of data < quantification limit	167 (58%)
Number of data > limit value	52 (18 %)
Sampling representative for:	
Exposure time ≥ 6 h	248 (86%)
Exposure time < 6 h	35 (12%)
Examples: Exposure conditions	
Measurement plan:	
Workplace measurements	250 (87%)
Interior measurements	39 (13%)
Situation in industry: Unfavourable	11 (4%)
Reason for measurement: investigation in case of suspected occupational disease	11 (4%)
Without mechanical ventilation	88 (30%)
With mechanical ventilation	167 (58%)
No details	34 (12%)
Without local exhaust ventilation	102 (35%)
With local exhaust ventilation	122 (42%)
No details	56 (19%)

General description of measurements of 2-butanone oxime in: 35 branches of industry and 74 work areas

2.2 Criteria for inclusion of measured data in the evaluation

- Data period 1998 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.
- The evaluation is performed according to industry groups (Chapter 4) and work area groups (Chapter 5).
- Owing to the small number of measured values available, a distinction is made between
 - stationary measurements and personal measurements, and
 - measured values with or without local exhaust ventilationfor all data (Chapter 6.1).

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 (limit of quantitation LOQ)
*	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.
**	There are less than five companies in the data set. The data of less than five companies may probably be not sufficient to represent a complete industry group or range.

4 Statistic evaluations for industry groups

2-Butanone oxime, data period 1998 to 2011
Sampling representative for exposure time ≥ 6 h

D.No. = Data set number/ Designation Branch of industry	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 *
D.No. 63 No limitation	248	113	143 57.7	4	84,3	! a. q.	+ 2	+ 3.2
D.No. 31 Manufacture and processing of coating materials	43	28	29 67.4	4	74,4	! a. q.	+ 3	4.46
D.No. 32 Chemical and plastics industry	12	7	8 66.7	0.4	83,3	! a. q.	1.24	2.18
D.No. 33 Electrical engineering and fine mechanics	58	35	37 63.8	0.6	96,6	! a. q.	0.72	0.91
D.No. 35 Processing of metals and mechanical engineering	69	27	42 60.9	1.6	85,5	! a. q.	1.64	3.275
D.No. 36 Interior work, parquet laying (wood floors)	13	6	5 38.5	0.7	69,2	+ 0.6	4.12	5.44
D.No. 38 # Schools and administration	39	3**	14 35.9	0.4	82,1	+ 0.4	# 1.47	# 3.105
D.No. 39 Other branches of industry	14	8	8 57.1	0.5	78,6	! a. q.	3.8	5.3

Measured values above the quantification limit were encountered in classrooms and teachers' staff rooms in which sealing work had previously been undertaken on the windows. A month after the first measurements, the measured values were back below the quantification limit.

2-Butanone oxime, data period 1998 to 2011
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. 64 No limitation	35	28	21 60	3.2	71,4	! a. q.	4	6.25

5 Statistical evaluations for work area groups

2-Butanone oxime, data period 1998 to 2011
Sampling representative for exposure time ≥ 6 h

D.No. = Data set number/ Designation Work area groups	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 *
D.No. 63 No limitation	248	113	143 57.7	4	84,3	! a. q.	+ 2	+ 3.2
D.No. 40 Gluing	18	7	8 44.4	0.4	94,4	+ 0.4	1	1.2
D.No. 41 Surface coating, general	28	20	21 75	0.4	89,3	! a. q.	0.98	2.62
D.No. 42 Brushing/Rolling	26	17	13 50	4	76,9	+ 0.5	+ 3.8	5
D.No. 43 Spraying/Painting	51	35	40 78.4	1.6	94,1	! a. q.	+ 0.8	+ 1.135
D.No. 44 Immersion/Flow coating	34	15	20 58.8	0.5	88,2	! a. q.	1.06	1.29
D.No. 45 # Classrooms/Office	31	3**	11 35.5	0.4	87.1	+ 0.35	# 1.07	# 1.66
D.No. 46 Work area, miscellaneous	60	32	30 50	0.7	70	+ 0.3	3.5	4.7

Measured values above the quantification limit were encountered in classrooms and teachers' staff rooms in which sealing work had previously been undertaken on the windows. A month after the first measurements, the measured values were back below the quantification limit.

2-Butanone oxime, data period 1998 to 2011
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 *
Work area groups								
D.No. 64 No limitation	35	28	21 60	3.2	71,4	! a. q.	4	6.25

6 Further Statistical evaluations

6.1 Differentiation according to mode of sampling and local exhaust ventilation

2-Butanone oxime, data period 1998 to 2011,
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 *
Mode of sampling Local exhaust ventilation								
D.No. 75 personal without local exhaust ventilation	28	18	13 46.4	4	67,9	+ 0.9	4.68	5
D.No. 79 personal with local exhaust ventilation	61	42	38 62.3	1.6	86.9	! a. q.	+ 1.28	2.565
D.No. 73 stationary without local exhaust ventilation	59	22	28 47.5	1.6	89,8	+ 0.25	+ 1.05	2.05
D.No. 77 stationary with local exhaust ventilation	44	33	34 77.3	0.4	100	! a. q.	0.56	0.92

7 Overview lists

7.1 Branch of industry according to industry group

2-Butanone oxime, data period 1998 to 2011,
Sampling representative for exposure time ≥ 6 h

<i>Industry groups</i> <i>Industry</i>	<i>Number of measured values</i>
Manufacture and processing of coating materials	43
Manufacture/processing of coating materials, glue, mastics	6
Manufacture of coating materials (emulsion paints and plaster)	6
Processing of liquid coating materials (liquid varnish coating)	27
Painting and varnishing	4
Chemical and plastics industry	12
Chemical industry	2
Plastics and plastic foam, processing	1
Manufacture of plastic sheets, tubes and profiles	2
Manufacture of plastic foils	3
Manufacture of sealings	4
Electrical engineering and fine mechanics	58
Electrical engineering, general	54
Manufacture of hardware, sheet metal and metalware products	2
Installation, electrical equipment	2
Processing of metals and manufacture of machinery	69
Processing and treatment of metals, general	22
Manufacture of windows, doors, facade elements (metal)	3
Manufacture of machinery and vehicles, general	8
Mechanical engineering	11
Vehicle construction	3
Apparatus engineering	3
Plant engineering and construction, construction of plants	6
Manufacture of parts for motor vehicles and engines (automotive supply)	11
Manufacture of aircraft	1
Plant and equipment construction (metal)	1
Interior work, parquet laying (wood floors)	14
Interior work, parquet laying (wood floors)	14
Schools and administration	39
Secondary school	34
Administration, office spaces	5

<i>Industry groups Industry</i>	<i>Number of measured values</i>
Other industries	14
Manufacture of sanitary, technical and chemical-technical electrical ceramic	2
Manufacture and processing of flat glass	3
Manufacture and processing of technical glass	2
Manufacture of windows, general	3
Printing office	1
Finishing of textiles	1
Wholesale trade with construction material	1
Wholesale trade with optical and fine mechanical products, jewellery	1
Total	248

2-Butanone oxime, data period 1998 to 2011,
Sampling representative for exposure time < 6 h

<i>Industries</i>	<i>Number of measured values</i>
Chemical industry	2
Manufacture and processing of flat glass	1
Processing of liquid coating materials (liquid varnish coating)	5
Processing and treatment of metals, general	1
Mechanical engineering	3
Vehicle construction	2
Electrical engineering, general	8
Finishing of textiles	1
Glazing work (construction and shop work)	1
Painting and varnishing	3
Interior work, parquet laying (wood floors)	6
Wholesale trade with optical and fine mechanical products, jewellery	1
Research and testing institutes and laboratories	1
Total	35

7.2 Work areas according to work area group

2-Butanone oxime, data period 1998 to 2011,
Sampling representative for exposure time ≥ 6 h

<i>Work area groups</i> <i>Work area</i>	<i>Number of measured values</i>
Gluing	18
Finishing work on plastic items, bonding	1
Gluing, room	8
Gluing, reaction adhesives	7
Gluing, other processes	2
Surface treatment, general	28
Workpiece pre-treatment or preparation area, general	1
Painting rooms (liquid coating materials), general	2
Workshop rooms (liquid coating materials), general	1
Other processes (liquid coatings), general	1
Screenprinting, manual	2
Surface coating, manual, room	1
Surface coating, loading and removal stations	1
Surface coating, application with machines	10
Surface coating, electrostatic application	2
Surface coating, casting process	1
Surface treatment, general	3
Surface coating processes, miscellaneous	3
Brushing/Rolling	26
Rolling	3
Surface coating, brushing, rolling	23
Spraying/Painting	51
Paintshop, paint spray walls, pressurised air, manual	1
Paintshop, spraying station, pressurised air, manual	1
Paintshop, spraying station, HVLP, manual	1
Paintshop, spray booth, pressurised air, manual	3
Paintshop, spray booth, pressurised air, automatic	1
Paintshop, spray booth, airless, manual	1
Workshop rooms, paint spray walls, pressurised air, manual	1
Workshop rooms, spraying station, pressurised air, manual	2
Workshop rooms, spraying station without special precautions, airless, manual	1
Compressed-air spraying	1
Electrostatic spraying	1
Surface coating, airless spraying	8
Surface coating, spraying (e.g. with pressurised air)	28
Surface coating, airmix spraying	1

Work area groups Work area	Number of measured values
Immersion/Flow coating	34
Dip-coating, conventional, with liquid coating materials	2
Immersion system	5
Surface coating, flooding	11
Surface coating, immersing	16
Classrooms/Office	31
General classroom	20
Office	11
Work area, miscellaneous	60
Mixers, general	1
Automatic sheet-fed screenprinting machine, line, manual	1
Chemical finishing, coating, coating with doctor blades	1
Sealing	6
Paint drying, air drying (e.g. flash-off stations)	1
Post-treatment of plastic items, cutting	3
Applying	4
Warehouse, general	2
Wet (fat) mixer, general	3
Multiple-hearth incinerator, general	1
Drying processes, miscellaneous	1
Casting processes, miscellaneous	1
Storing, finished parts, room	4
Packaging, dispatch	1
Installation, general	10
Cleaning of containers, manual	2
Inspection, auditing	3
Technical school, at facilities	1
Quality inspection	1
Laboratory, room	2
Work area, miscellaneous	1
Work area not coded	5
Casting of electronic/electrical components	3
Connecting routes (corridors, staircases etc.)	2
Total	248

2-Butanone oxime, data period 1998 to 2011,
Sampling representative for exposure time < 6 h

<i>Work area</i>	<i>Number of measured values</i>
Caulking guns	2
Material cleaning, by brushing	2
Cleaning of facilities	2
Repair and maintenance, in workshop	2
Laboratory, room	1
Gluing, reaction adhesives	1
Surface coating, brushing, rolling	2
Surface coating, screed	1
Surface coating, flooding	1
Surface coating, immersing	1
Surface coating, spraying (e.g. with pressurised air)	7
Adhesives application, coating	1
Printing office, dyeing shop, adhesive processing	1
Sealing	4
Polishing, burnishing, rubbing with wax	1
Levelling out	1
Painting rooms (liquid coating materials), general	1
Paintshop, paint spray walls, general	1
Paintshop, paint spray walls, pressurised air, manual	1
Paintshop, spraying station, pressurised air, manual	1
Paintshop, spraying station, airless, manual	1
Total	35

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