

MEGA evaluations for the preparation of REACH exposure scenarios for chromium(VI) compounds (2000 to 2009) in Germany

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 chromium(VI) exposure at the workplace, a defined volume of air is sucked by a suitable pump through the sampling system fitted with a quartz fibre filter. The chromium(VI) compounds contained in the air are intercepted by the quartz fibre filter. Quantitative analysis is performed with the aid of calibration curves, with the chromate concentration being plotted against extinction (measured at 540 nm). All concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃. The quantification limits (as of 01.01.2010) are 0.005 mg/m³ for a test air volume of 0.42 m³ (personal measurement) and 0.0001 mg/m³ for a test air volume of 45 m³ (stationary measurement). Source: Chromium (ref. no. 6665). In: IFA-Arbeitsmappe Messung von Gefahrstoffen. 37. Lfg. X/2006. Ed.: Deutsche Gesetzliche Unfallversicherung (DGUV), Berlin. Erich Schmidt, Berlin 2011 – loose-leaf edition.

With consideration given to data security, the principles for the statistical evaluation of the data gathered in the MGU are governed by an administrative agreement between the accident insurance institutions (AIs) and the German Social Accident Insurance (DGUV). The process ensures that it is not possible to trace the identity of an insured firm or of an AI; the measured values concerned are otherwise disregarded.

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 2009

		Number of measured values		Number of measured values
Measured values in data period 2000 to 2009	Measured values with reference to exposure:	4583	Thereof below the analytical quantification limit (< AQL):	2996
Sampling	Personal:	2375	Stationary:	2208
Sampling time	≥ 1 h:	4318		
Exposure time	≥ 6 h:	4092	≥ 8 h:	4009
Local exhaust ventilation	No:	1190	Yes:	2952
Action to prevent emission	No:	2854	Yes:	324

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 groups comprising fewer than ten measured data or measured data from fewer than three different accident insurance institutions or from fewer than five different firms are not evaluated (administrative agreement between the accident insurance institutions and DGUV for the purpose of data security).

2.3 Evaluation strategy

- The evaluation was performed on the basis of industry groups (Section 4) and work area groups (Section 5) and broken down further according to type of sampling (stationary or personal) and presence of a local exhaust ventilation device.
- The most important industry group (metalworking and machine manufacture) and the most important work area groups (surface treatment and coating, welding) are considered separately in the same way (Sections 4.4ff and 5.4ff).
- Section 6 then presents overviews showing the distribution of measured data among industries and industry groups as well as among work areas and work area groups.

3 Abbreviations and indices

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

AQL	analytical quantification limit
Number < values	number of measured values below the analytical quantification limit
Arithm. mean	arithmetic mean
SD	arithmetic standard deviation
Geom. mean	geometric mean
GSD	geometric standard deviation
!	The number of measured values below the analytical quantification limit (AQL) is greater than the number of measured values represented by this cumulative frequency value. No concentration is therefore given for this cumulative frequency value.
+	The distribution value is below the largest analytical quantification limit in the data set.

4 Industry groups

4.1 Industry groups (Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Industry group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Total	3755	1458	2535	0.014	0.137	0.00243	4.928	AQL !	0.0027 +	0.015 +	0.0352 +
Waste disposal and cleaning of buildings	12	6	11	0.00265	0.00109	0.00231	1.978	AQL !	AQL !	AQL !	0.0044 +
Construction	118	49	70	0.00886	0.0249	0.0032	3.695	AQL !	0.00575 +	0.0172	0.0294
Education establishments	12	6	7	0.00521	0.012	0.00164	4.196	AQL !	0.0025 +	0.0045 +	0.0202
Chemical industry	49	20	32	0.0177	0.0525	0.00307	6.243	AQL !	0.00565 +	0.0268 +	0.0822
Electrical engineering, fine mechanics, optics	156	80	129	0.00632	0.0158	0.00298	2.705	AQL !	AQL !	0.0104	0.0214
Wood and paper	162	25	150	0.000713	0.00231	0.000108	4.75	AQL !	AQL !	AQL !	0.0025 +
Ceramics	33	5	6	0.00664	0.0101	0.00289	3.67	0.0025 +	0.00775	0.0147	0.0221
Plastic industry	24	16	14	0.00788	0.0158	0.00159	7.586	AQL !	0.005 +	0.0188	0.0436
Processing metals and mechanical engineering	2992	1177	1976	0.0158	0.152	0.00284	4.255	AQL !	0.00315 +	0.016	0.04
Manufacture of metals	117	49	82	0.00956	0.0401	0.0017	6.142	AQL !	0.0025 +	0.0123	0.023

4.2 Industry groups – personal and stationary (Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Industry group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Total (personal)	1918	1021	1343	0.022	0.189	0.00436	3.302	AQL !	0.006 +	0.0242 +	0.0551
Total (stationary)	1837	806	1192	0.00564	0.0282	0.00132	5.617	AQL !	0.0025 +	0.00703 +	0.018
Construction (personal)	75	36	47	0.0122	0.0307	0.00487	3.0267	AQL !	0.0094	0.0225	0.0372
Construction (stationary)	43	25	23	0.00309	0.00391	0.00154	3.73	AQL !	0.0025 +	0.00755	0.0115
Chemical industry (personal)	33	18	20	0.025	0.0629	0.00541	4.694	AQL !	0.0127 +	0.0354 +	0.134
Chemical industry (stationary)	16	6	12	0.00276	0.00395	0.000955	6.446	AQL !	0.0025 +	0.00442 +	0.00904
Electrical engineering, fine mechanics, optics (personal)	93	56	75	0.00592	0.0131	0.0034	2.166	AQL !	AQL !	0.011	0.0164
Electrical engineering, fine mechanics, optics (stationary)	63	41	54	0.0069	0.0192	0.00245	3.437	AQL !	AQL !	0.0032 +	0.0227
Wood and paper (stationary)	154	23	142	0.000621	0.00233	0.0000914	4.132	AQL !	AQL !	AQL !	0.00247 +
Plastic industry (personal)	14	10	8	0.013	0.0193	0.00535	3.882	AQL !	0.0112	0.0382	0.0532
Plastic industry (stationary)	10	7	6	0.000716	0.00085	0.000291	4.62	AQL !	0.00122 +	0.0015 +	0.002 +
Processing metals and mechanical engineering (personal)	1585	837	1109	0.0241	0.207	0.00437	3.364	AQL !	0.006 +	0.025	0.062

Industry group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Processing metals and mechanical engineering (stationary)	1407	645	867	0.00652	0.0318	0.00175	4.649	AQL !	0.0025 +	0.0081	0.021
Manufacture of metals (personal)	53	32	39	0.0166	0.057	0.00448	3.285	AQL !	0.008 +	0.0217	0.0369
Manufacture of metals (stationary)	64	33	43	0.00377	0.0139	0.000757	6.395	AQL !	0.0025 +	0.0042 +	0.0072

4.3 Industry groups – with and without local exhaust ventilation (Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Industry group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Total (with local exhaust ventilation)	2463	1019	1604	0.0116	0.0587	0.00265	4.771	AQL !	0.0041 +	0.016 +	0.039 +
Total (without local exhaust ventilation)	988	482	720	0.018	0.243	0.0018	5.405	AQL !	0.0025 +	0.00972 +	0.0236
Construction (with local exhaust ventilation)	36	20	20	0.0109	0.0198	0.0047	3.281	AQL !	0.0093	0.019	0.0506
Construction (without local exhaust ventilation)	56	26	36	0.00514	0.00742	0.00261	3.478	AQL !	0.0025 +	0.0123	0.0222
Chemical industry (with local exhaust ventilation)	34	13	18	0.0244	0.0621	0.00341	8.853	AQL !	0.0155 +	0.0352 +	0.132
Chemical industry (without local exhaust ventilation)	11	7	10	0.00281	0.00156	0.00247	1.703	AQL !	AQL !	AQL !	0.00528 +
Electrical engineering, fine mechanics, optics (with local exhaust ventilation)	111	63	91	0.00745	0.0184	0.00322	2.782	AQL !	AQL !	0.0119	0.0271
Electrical engineering, fine mechanics, optics (without local exhaust ventilation)	39	24	32	0.00368	0.00465	0.00245	2.647	AQL !	AQL !	0.00439 +	0.0113
Wood and paper (with local exhaust ventilation)	81	8	79	0.000554	0.00134	0.000108	4.622	AQL !	AQL !	AQL !	AQL !
Wood and paper (without local exhaust ventilation)	80	18	70	0.000883	0.00299	0.000108	4.964	AQL !	AQL !	0.00235 +	0.0025 +
Plastic industry (with local exhaust ventilation)	17	11	10	0.00958	0.018	0.00226	7.27	AQL !	0.0056 +	0.0245	0.0511

Industry group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Processing metals and mechanical engineering (with local exhaust ventilation)	2033	847	1304	0.0125	0.0638	0.003	4.161	AQL !	0.00458 +	0.0177	0.041
Processing metals and mechanical engineering (without local exhaust ventilation)	733	372	521	0.0229	0.282	0.00232	4.485	AQL !	0.0025 +	0.0117	0.0288
Manufacture of metals (with local exhaust ventilation)	75	35	50	0.00598	0.0145	0.00148	6.568	AQL !	0.0025 +	0.0135	0.023
Manufacture of metals (without local exhaust ventilation)	25	15	19	0.00282	0.00273	0.00161	4.0697	AQL !	AQL !	0.0055	0.00713

4.4 Processing metals and mechanical engineering (Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Industry group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 per-centile (mg/m ³)	75 per-centile (mg/m ³)	90 per-centile (mg/m ³)	95 per-centile (mg/m ³)
Plant, steel and light metal construction	160	79	98	0.0127	0.0337	0.00374	4.53	AQL !	0.0083	0.028	0.052
Apparatus engineering	123	55	66	0.0179	0.0421	0.00519	4.0734	AQL !	0.011	0.05	0.0922
Vehicle construction	99	31	59	0.007	0.0134	0.00336	3.121	AQL !	0.00617 +	0.0132	0.0271
Electroplating	1174	379	744	0.00836	0.0364	0.00254	4.0807	AQL !	0.0028 +	0.013	0.028
Mechanical engineering and vehicle construction, general	83	33	53	0.0298	0.11	0.00395	4.837	AQL !	0.00507 +	0.0326	0.0534
Mechanical engineering	272	120	196	0.0201	0.0836	0.00317	4.805	AQL !	0.0025 +	0.0208	0.0816
Processing and treatment of metals, general	774	398	565	0.00851	0.0417	0.0026	3.652	AQL !	0.0025 +	0.011	0.0279
Surface treatment and hardening	100	40	57	0.00613	0.00979	0.00283	3.55	AQL !	0.005 +	0.014	0.026
Repair shops	30	12	22	0.0298	0.107	0.00396	6.178	AQL !	0.00517 +	0.025	0.092
Processing of liquid coating materials (liquid varnish coating)	71	15	18	0.23	0.922	0.00505	17.319	0.0025 +	0.035	0.283	1.212

4.5 Processing metals and mechanical engineering – personal and stationary (Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Industry group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 per-centile (mg/m ³)	75 per-centile (mg/m ³)	90 per-centile (mg/m ³)	95 per-centile (mg/m ³)
Plant, steel and light metal construction (personal)	103	66	59	0.0166	0.0407	0.00568	3.38	AQL !	0.0094	0.0351	0.0605
Plant, steel and light metal construction (stationary)	57	32	39	0.00571	0.0115	0.00176	5.457	AQL !	0.0025 +	0.0163	0.0291
Apparatus engineering (personal)	84	45	46	0.0235	0.049	0.00707	4.141	AQL !	0.021	0.0644	0.123
Apparatus engineering (stationary)	39	24	20	0.00588	0.0148	0.00266	3.0607	AQL !	0.00447 +	0.00667	0.0115
Vehicle construction (personal)	68	28	41	0.00848	0.0149	0.00457	2.53	AQL !	0.007	0.0158	0.0276
Vehicle construction (stationary)	31	9	18	0.00376	0.00831	0.00171	3.572	AQL !	0.0025 +	0.00286 +	0.00983
Electroplating (personal)	424	204	295	0.00994	0.0296	0.00408	2.685	AQL !	0.0054 +	0.0166	0.0376
Electroplating (stationary)	750	297	449	0.00747	0.0397	0.00195	4.63	AQL !	0.0025 +	0.0092	0.0215
Manufacture of machinery and vehicles, general (personal)	62	29	36	0.0392	0.126	0.00549	4.691	AQL !	0.00805	0.0476	0.284
Manufacture of machinery and vehicles, general (stationary)	21	13	17	0.00221	0.00129	0.00149	3.498	AQL !	AQL !	0.0025 +	0.00459 +
Mechanical engineering (personal)	191	102	140	0.0265	0.098	0.00477	3.877	AQL !	0.00481 +	0.0349	0.119
Mechanical engineering (stationary)	81	48	56	0.00511	0.0224	0.00121	5.0994	AQL !	0.0025 +	0.00494 +	0.0127

Industry group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Processing and treatment of metals, general (personal)	487	297	368	0.0113	0.0518	0.00372	2.825	AQL !	AQL !	0.017	0.0357
Processing and treatment of metals, general (stationary)	287	169	197	0.00375	0.00983	0.00142	4.28	AQL !	0.0025 +	0.00363 +	0.00972
Surface treatment and hardening (personal)	52	24	35	0.00638	0.01	0.0037	2.455	AQL !	0.005 +	0.0138	0.0254
Surface treatment and hardening (stationary)	48	31	22	0.00586	0.00965	0.00212	4.618	0.0025 +	0.0032 +	0.0152	0.0266
Repair shops (personal)	24	11	17	0.0367	0.119	0.0059	4.573	AQL !	0.013	0.0484	0.109
Processing of liquid coating materials (liquid varnish coating) (personal)	21	11	7	0.735	1.609	0.0663	16.392	0.11	0.573	1.84	1.995
Processing of liquid coating materials (liquid varnish coating) (stationary)	50	10	11	0.0175	0.0517	0.00171	8.132	0.001 +	0.00545	0.032	0.082

4.6 Processing metals and mechanical engineering – with and without local exhaust ventilation (Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Industry group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Plant, steel and light metal construction (with local exhaust ventilation)	88	45	50	0.0136	0.0355	0.00356	5.224	AQL !	0.008	0.0292	0.058
Plant, steel and light metal construction (without local exhaust ventilation)	59	32	41	0.00834	0.0164	0.00354	3.635	AQL !	0.00565 +	0.024	0.0331
Apparatus engineering (with local exhaust ventilation)	75	39	40	0.0161	0.0304	0.00543	3.818	AQL !	0.0103	0.0525	0.0892
Apparatus engineering (without local exhaust ventilation)	37	21	19	0.0245	0.0629	0.00522	5.054	AQL !	0.0163	0.0425	0.106
Vehicle construction (with local exhaust ventilation)	54	22	28	0.00947	0.0172	0.00451	2.809	AQL !	0.00705	0.0186	0.0485
Vehicle construction (without local exhaust ventilation)	39	13	28	0.0044	0.00538	0.00254	3.389	AQL !	0.00266 +	0.0102	0.0133
Electroplating (with local exhaust ventilation)	892	295	533	0.00963	0.0406	0.00274	4.284	AQL !	0.0049 +	0.015	0.0338
Electroplating (without local exhaust ventilation)	213	106	165	0.00453	0.0185	0.00187	3.559	AQL !	AQL !	0.00458 +	0.00911
Manufacture of machinery and vehicles, general (with local exhaust ventilation)	53	28	35	0.0316	0.12	0.00392	4.0144	AQL !	0.00492 +	0.0128	0.133
Manufacture of machinery and vehicles, general (without local exhaust ventilation)	22	9	14	0.00853	0.0144	0.00277	5.689	AQL !	0.00475 +	0.0192	0.0434

Industry group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Mechanical engineering (with local exhaust ventilation)	184	95	131	0.0153	0.0557	0.00297	4.514	AQL !	0.0025 +	0.019	0.0578
Mechanical engineering (without local exhaust ventilation)	56	34	41	0.0144	0.0388	0.00351	4.467	AQL !	0.003 +	0.0184	0.086
Processing and treatment of metals, general (with local exhaust ventilation)	504	257	365	0.00991	0.0497	0.00277	3.738	AQL !	0.0025 +	0.013	0.0328
Processing and treatment of metals, general (without local exhaust ventilation)	205	133	155	0.00504	0.0117	0.00217	3.552	AQL !	AQL !	0.0071 +	0.0225
Surface treatment and hardening (with local exhaust ventilation)	77	32	42	0.00737	0.0108	0.00364	3.315	AQL !	0.00622	0.0243	0.0273
Surface treatment and hardening (without local exhaust ventilation)	21	12	13	0.00191	0.00203	0.00114	3.229	AQL !	0.0025 +	0.0025 +	0.00316 +
Repair shops (with local exhaust ventilation)	16	6	10	0.0488	0.145	0.00684	5.109	AQL !	0.013	0.0588	0.212
Processing of liquid coating materials (liquid varnish coating) (with local exhaust ventilation)	12	11	4	0.209	0.537	0.018	13.384	0.012	0.099	0.2	0.886

5 Work areas

5.1 Work area groups (Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Work area group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 per-centile (mg/m ³)	75 per-centile (mg/m ³)	90 per-centile (mg/m ³)	95 per-centile (mg/m ³)
Total	3755	1458	2535	0.014	0.137	0.00243	4.928	AQL !	0.0027 +	0.015 +	0.0352 +
Drilling, grinding, punching	28	10	22	0.00337	0.00432	0.00216	2.622	AQL !	AQL !	0.00332 +	0.0122
Casting, smelting	18	9	13	0.00108	0.00114	0.000364	5.889	AQL !	0.00237 +	0.0025 +	0.0025 +
Foundries (various work areas)	18	12	13	0.00374	0.00534	0.00215	2.821	AQL !	0.0025 +	0.0066	0.0139
Soldering	10	8	9	0.00221	0.000741	0.00185	2.373	AQL !	AQL !	0.0025 +	0.0025 +
Mixing	26	14	14	0.0118	0.0249	0.00243	8.84	AQL !	0.0079	0.0268	0.0445
Installation	31	17	27	0.00294	0.00505	0.00159	3.397	AQL !	AQL !	0.0025 +	0.00511
Surface treatment, surface coating	1403	488	876	0.00785	0.0331	0.0025	4.0737	AQL !	0.003 +	0.013	0.028
Polishing	27	14	25	0.00295	0.00233	0.00257	1.573	AQL !	AQL !	AQL !	0.00718
Repair and maintenance	19	8	13	0.00744	0.0125	0.00243	6.151	AQL !	0.00447 +	0.0191	0.0301
Sawing	108	21	108	0.000289	0.00072	0.0000741	3.236	AQL !	AQL !	AQL !	AQL !
Sanding	196	120	166	0.0109	0.0802	0.00192	4.0957	AQL !	AQL !	0.00293 +	0.00996
Cutting (varous methods)	173	98	123	0.0116	0.0367	0.00274	4.333	AQL !	0.0025 +	0.0197	0.0555
Welding	1232	631	798	0.0139	0.0516	0.00361	3.975	AQL !	0.006 +	0.023 +	0.0508
Spraying AirMixLess	69	23	18	0.239	0.934	0.00748	14.895	0.0025 +	0.0638	0.295	1.228

5.2 Work area groups – personal and stationary (Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Work area group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Casting, smelting (stationary)	15	8	10	0.000794	0.00102	0.000248	5.431	AQL !	0.00151 +	0.00237 +	0.0025 +
Foundries (various work areas) (stationary)	13	8	9	0.00276	0.0033	0.00174	2.747	AQL !	0.0025 +	0.00425 +	0.0078
Mixing (personal)	11	10	3	0.0237	0.0355	0.00938	4.286	0.00605	0.025	0.0475	0.0809
Mixing (stationary)	15	5	11	0.00314	0.00422	0.0009	8.301	AQL !	0.0025 +	0.0071	0.00948
Installation (personal)	12	10	10	0.00519	0.00768	0.00339	2.136	AQL !	AQL !	0.00714	0.0166
Installation (stationary)	19	12	17	0.00151	0.000998	0.000985	3.426	AQL !	AQL !	0.0025 +	0.0025 +
Surface treatment, surface coating (personal)	533	274	375	0.00889	0.0249	0.00399	2.604	AQL !	0.0051 +	0.016	0.0334
Surface treatment, surface coating (stationary)	870	365	501	0.00721	0.0372	0.00188	4.72	AQL !	0.0025 +	0.0092	0.022
Polishing (personal)	21	10	19	0.00327	0.00255	0.00284	1.567	AQL !	AQL !	AQL !	0.00934
Repair and maintenance (personal)	13	6	10	0.00805	0.0134	0.00422	2.664	AQL !	AQL !	0.0156	0.0292

Work area group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Sawing (stationary)	100	16	100	0.000122	0.000414	0.0000562	1.951	AQL !	AQL !	AQL !	AQL !
Sanding (personal)	133	95	115	0.0149	0.0971	0.0031	2.351	AQL !	AQL !	0.006 +	0.0123
Sanding (stationary)	63	37	51	0.00238	0.00684	0.000697	5.921	AQL !	AQL !	0.0025 +	0.0025 +
Cutting (varous methods) (stationary)	94	61	67	0.00406	0.012	0.00165	3.846	AQL !	0.0025 +	0.00348 +	0.00741
Cutting (varous methods) (personal)	79	55	56	0.0205	0.0515	0.00502	3.964	AQL !	0.0053 +	0.053	0.0869
Welding (personal)	915	541	595	0.0169	0.0588	0.00474	3.428	AQL !	0.008 +	0.027 +	0.056
Welding (stationary)	317	206	203	0.00524	0.0162	0.00164	4.388	AQL !	0.0025 +	0.00679 +	0.023
Spraying AirMixLess (personal)	25	17	9	0.622	1.492	0.0529	14.473	0.0715	0.31	1.6	1.975
Spraying AirMixLess (stationary)	44	11	9	0.0207	0.0549	0.00246	7.507	0.0015 +	0.0097	0.0458	0.0868

5.3 Work area groups – with and without local exhaust ventilation (Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Work area group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 per-centile (mg/m ³)	75 per-centile (mg/m ³)	90 per-centile (mg/m ³)	95 per-centile (mg/m ³)
Casting, smelting (with local exhaust ventilation)	12	6	10	0.00105	0.00118	0.000315	6.531	AQL. !	AQL. !	0.0025 +	0.0025 +
Foundries (various work areas) (with local exhaust ventilation)	12	7	9	0.00386	0.00582	0.00228	2.682	AQL. !	0.0025 +	0.0045 +	0.0118
Mixing (with local exhaust ventilation)	23	11	12	0.0123	0.0263	0.00226	9.684	AQL. !	0.0076	0.0286	0.0467
Installation (without local exhaust ventilation)	17	11	17	0.00193	0.000947	0.00131	3.664	AQL. !	AQL. !	AQL. !	AQL. !
Surface treatment, surface coating (with local exhaust ventilation)	1083	384	633	0.00924	0.0374	0.00277	4.211	AQL. !	0.005 +	0.015	0.0328
Surface treatment, surface coating (without local exhaust ventilation)	250	129	193	0.00308	0.00695	0.00163	3.586	AQL. !	AQL. !	0.0028 +	0.00765 +
Polishing (with local exhaust ventilation)	17	12	16	0.00292	0.00236	0.00256	1.535	AQL. !	AQL. !	AQL. !	0.00392 +
Sawing (with local exhaust ventilation)	62	8	62	0.00023	0.000622	0.0000679	2.844	AQL. !	AQL. !	AQL. !	AQL. !
Sawing (without local exhaust ventilation)	46	15	46	0.00037	0.000834	0.0000833	3.789	AQL. !	AQL. !	AQL. !	AQL. !

Work area group	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Sanding (with local exhaust ventilation)	126	85	115	0.00314	0.0055	0.00184	3.425	AQL. !	AQL. !	AQL. !	0.0057
Sanding (without local exhaust ventilation)	53	37	41	0.00279	0.00265	0.00162	3.917	AQL. !	AQL. !	0.00426 +	0.00873
Cutting (varous methods) (with local exhaust ventilation)	143	83	102	0.00988	0.0343	0.00254	4.189	AQL. !	0.0025 +	0.0154	0.0317
Cutting (varous methods) (without local exhaust ventilation)	25	17	18	0.0229	0.0505	0.00462	5.0127	AQL. !	0.0045 +	0.0625	0.153
Welding (with local exhaust ventilation)	753	416	475	0.0153	0.0574	0.00383	3.995	AQL. !	0.00677 +	0.025 +	0.0554
Welding (without local exhaust ventilation)	360	211	245	0.00909	0.0266	0.00304	3.912	AQL. !	0.0039 +	0.019	0.036
Spraying AirMixLess (with local exhaust ventilation)	21	17	8	0.126	0.41	0.0124	8.225	0.00725	0.059	0.154	0.207

5.4 Work areas
surface treatment, surface coating (electroplating)
(Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 per-centile (mg/m ³)	75 per-centile (mg/m ³)	90 per-centile (mg/m ³)	95 per-centile (mg/m ³)
Loading and unloading station	26	16	23	0.00292	0.00267	0.00212	3.0148	AQL. !	AQL. !	0.00358 +	0.0052
Coating, general	147	68	101	0.0057	0.0179	0.00196	4.342	AQL. !	0.0025 +	0.00856 +	0.016
Coating, gloss chroming	31	21	27	0.0037	0.0048	0.00255	2.0907	AQL. !	AQL. !	0.00394 +	0.015
Coating, gloss chroming, sulfuric acid bath	45	32	32	0.00507	0.0163	0.00179	3.913	AQL. !	0.0025 +	0.0046 +	0.00797
Coating, hard chroming	60	24	22	0.0456	0.139	0.00774	4.817	0.005 +	0.014	0.078	0.29
Coating, hard chroming, mixed acid bath	43	17	17	0.0113	0.0196	0.00415	5.284	0.00325 +	0.0115	0.0274	0.0314
Coating, hard chroming, sulfuric acid bath	242	67	81	0.0125	0.0219	0.00478	4.177	0.0037 +	0.012	0.0346	0.0516
Coating, black chroming	21	12	15	0.00295	0.00206	0.00235	2.164	AQL. !	0.0025 +	0.00646	0.00795
Coating, chroming, general	158	68	106	0.00366	0.00973	0.0015	4.158	AQL. !	0.0025 +	0.00502 +	0.0071
Chromating	72	40	55	0.00533	0.02	0.00204	3.429	AQL. !	AQL. !	0.00394 +	0.0094
Surface treatment, general	44	11	15	0.00539	0.00716	0.00181	6.0378	0.0025 +	0.008 +	0.0146	0.0188
Surface coating, electroplating	188	87	140	0.00461	0.00876	0.00246	3.16	AQL. !	0.0025 +	0.00902	0.0136

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Galvanizing	83	45	68	0.00238	0.00148	0.00195	2.189	AQL. !	AQL. !	0.0025 +	0.0025 +
Preliminary treatment	42	29	31	0.00226	0.00165	0.0013	4.207	AQL. !	0.0025 +	0.0045 +	0.0055
Not electroplating	147	66	81	0.0039	0.00635	0.00175	4.154	AQL. !	0.0025 +	0.00818 +	0.0137

5.5 Work areas
surface treatment, surface coating (electroplating) – personal and stationary
(Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 per-centile (mg/m ³)	75 per-centile (mg/m ³)	90 per-centile (mg/m ³)	95 per-centile (mg/m ³)
Loading and unloading station (stationary)	22	13	19	0.00306	0.00288	0.00213	3.324	AQL !	AQL !	0.00466 +	0.0052
Coating, general (stationary)	77	38	46	0.00602	0.0232	0.00118	5.844	AQL !	0.0025 +	0.00595	0.0105
Coating, general (personal)	70	43	55	0.00534	0.00944	0.00343	2.0621	AQL !	AQL !	0.009 +	0.0185
Coating, gloss chroming (personal)	18	14	17	0.00322	0.00423	0.00241	1.884	AQL !	AQL !	AQL !	0.00425 +
Coating, gloss chroming (stationary)	13	12	10	0.00435	0.00562	0.00277	2.417	AQL !	AQL !	0.00893	0.0145
Coating, gloss chroming, sulfuric acid bath (personal)	13	12	12	0.00259	0.00104	0.00245	1.4	AQL !	AQL !	AQL !	0.00365 +
Coating, gloss chroming, sulfuric acid bath (stationary)	32	23	20	0.00607	0.0193	0.00158	4.924	AQL !	0.0025 +	0.0052	0.0132
Coating, hard chroming (personal)	33	19	9	0.0358	0.0817	0.00865	4.505	0.00635	0.0145	0.0744	0.225
Coating, hard chroming (stationary)	27	14	13	0.0576	0.188	0.00674	5.307	0.0025 +	0.00958	0.0546	0.27

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)			
Coating, hard chroming, mixed acid bath (personal)	16	11	7	0.0138	0.0268	0.00597	3.135	0.004	+	0.011	0.0218	0.0476		
Coating, hard chroming, mixed acid bath (stationary)	27	13	10	0.00992	0.014	0.00334	6.656	0.0025	+	0.0115	0.0266	0.028		
Coating, hard chroming, sulfuric acid bath (personal)	90	40	34	0.0151	0.0207	0.0074	3.181	0.0063		0.016	0.045	0.064		
Coating, hard chroming, sulfuric acid bath (stationary)	152	49	47	0.0109	0.0225	0.00369	4.545	0.0026	+	0.0084	0.0298	0.0408		
Coating, black chroming (stationary)	15	10	10	0.00284	0.00221	0.00215	2.389	AQL	!	0.0025	+	0.00525	0.008	
Coating, chroming, general (personal)	30	20	27	0.00365	0.00491	0.00288	1.65	AQL	!	AQL	!	0.0047	+	0.00655
Coating, chroming, general (stationary)	128	61	79	0.00367	0.0106	0.00129	4.6	AQL	!	0.0025	+	0.00506	+	0.007
Chromating (personal)	18	11	16	0.00319	0.00252	0.00281	1.522	AQL	!	AQL	!	0.004	+	0.0058
Chromating (stationary)	54	33	39	0.00605	0.0231	0.00183	4.0132	AQL	!	0.0025	+	0.00388	+	0.0115
Laser beam surface processing (stationary)	12	8	7	0.0055	0.0134	0.00124	6.072	AQL	!	0.0025	+	0.0025	+	0.0207
Surface treatment, general (personal)	14	6	6	0.0103	0.00798	0.00729	2.498	0.0086	+	0.0145	0.0186	0.0217		

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Surface treatment, general (stationary)	30	9	9	0.0031	0.00551	0.000946	5.725	0.0011 +	0.0025 +	0.008	0.0115
Surface coating, electroplating (personal)	78	48	63	0.00465	0.00682	0.00323	1.97	AQL !	AQL !	0.00928	0.014
Surface coating, electroplating (stationary)	110	64	77	0.00457	0.00995	0.00203	3.906	AQL !	0.0025 +	0.0085	0.013
Galvanizing (personal)	35	22	32	0.00293	0.00185	0.00271	1.378	AQL !	AQL !	AQL !	0.005 +
Galvanizing (stationary)	48	27	36	0.00199	0.000983	0.00154	2.526	AQL !	0.0025 +	0.0025 +	0.0025 +
Preliminary treatment (personal)	11	9	9	0.00311	0.00147	0.0029	1.428	AQL !	AQL !	0.00475 +	0.00585
Preliminary treatment (stationary)	31	23	22	0.00195	0.00162	0.000978	4.797	AQL !	0.0025 +	0.0025 +	0.0055
Not electroplating (personal)	53	33	38	0.0054	0.0068	0.00358	2.215	AQL !	0.005 +	0.0137	0.0184
Not electroplating (stationary)	94	47	43	0.00305	0.00594	0.00116	4.662	0.002 +	0.0025 +	0.006	0.01

5.6 Work areas
surface treatment, surface coating (electroplating) – with and without local exhaust ventilation
(Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 per-centile (mg/m ³)	75 per-centile (mg/m ³)	90 per-centile (mg/m ³)	95 per-centile (mg/m ³)
Loading and unloading station (with local exhaust ventilation)	20	11	19	0.00232	0.000972	0.00181	3.162	AQL !	AQL !	AQL !	0.0025 +
Coating, general (with local exhaust ventilation)	104	51	70	0.00532	0.0189	0.00153	4.982	AQL !	0.0025 +	0.0079	0.0124
Coating, general (without local exhaust ventilation)	27	12	21	0.00789	0.0193	0.00349	2.561	AQL !	AQL !	0.0122	0.0242
Coating, gloss chroming (with local exhaust ventilation)	21	16	19	0.00255	0.0021	0.00211	1.798	AQL !	AQL !	AQL !	0.00402 +
Coating, gloss chroming, sulfuric acid bath (with local exhaust ventilation)	40	28	29	0.00562	0.0172	0.00235	2.936	AQL !	0.0025 +	0.0056	0.0087
Coating, hard chroming (with local exhaust ventilation)	55	22	20	0.0491	0.145	0.00815	4.975	0.00495 +	0.0143	0.081	0.305
Coating, hard chroming, mixed acid bath (with local exhaust ventilation)	40	15	14	0.012	0.0201	0.00431	5.592	0.005 +	0.013	0.028	0.032
Coating, hard chroming, sulfuric acid bath (with local exhaust ventilation)	226	60	72	0.0132	0.0225	0.00511	4.176	0.004 +	0.013	0.0364	0.059
Coating, black chroming (with local exhaust ventilation)	12	7	9	0.00313	0.00214	0.00242	2.472	AQL !	0.0025 +	0.00602	0.00734

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Coating, chroming, general (with local exhaust ventilation)	122	52	84	0.00403	0.011	0.00156	4.177	AQL !	0.0025 +	0.00508 +	0.00699
Coating, chroming, general (without local exhaust ventilation)	31	18	18	0.00239	0.00229	0.0013	3.959	AQL !	0.0025 +	0.00439 +	0.00745
Chromating (with local exhaust ventilation)	38	21	29	0.00757	0.0274	0.00218	3.95	AQL !	AQL !	0.0054	0.0141
Chromating (without local exhaust ventilation)	29	18	22	0.00276	0.00381	0.00174	3.0918	AQL !	AQL !	0.00285 +	0.00368 +
Laser beam surface processing (with local exhaust ventilation)	13	8	10	0.00562	0.0128	0.0019	4.669	AQL !	AQL !	0.0025 +	0.0184
Surface treatment, general (with local exhaust ventilation)	36	6	7	0.00633	0.00759	0.00264	4.628	0.0025 +	0.01 +	0.0162	0.0206
Surface coating, electroplating (with local exhaust ventilation)	150	71	109	0.00511	0.00971	0.00268	3.0731	AQL !	0.0025 +	0.01	0.0175
Surface coating, electroplating (without local exhaust ventilation)	26	19	22	0.00274	0.00204	0.00182	3.498	AQL !	AQL !	0.0043 +	0.00721
Galvanizing (with local exhaust ventilation)	47	29	33	0.00236	0.00188	0.0018	2.328	AQL !	0.0025 +	0.0025 +	0.00413 +
Galvanizing (without local exhaust ventilation)	32	19	31	0.00241	0.000729	0.00213	2.0818	AQL !	AQL !	AQL !	AQL !
Preliminary treatment (with local exhaust ventilation)	26	17	20	0.00223	0.00169	0.00119	4.749	AQL !	AQL !	0.0037 +	0.0055

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Preliminary treatment (without local exhaust ventilation)	13	10	9	0.00242	0.00174	0.00149	3.893	AQL !	0.0025 +	0.00425 +	0.00545
Not electroplating (with local exhaust ventilation)	101	44	48	0.00501	0.00737	0.00254	3.512	0.0025 +	0.005 +	0.0128	0.0179
Not electroplating (without local exhaust ventilation)	44	26	31	0.0014	0.00107	0.000729	4.26	AQL !	0.0025 +	0.0025 +	0.0025 +

5.7 Work areas welding
(Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 per-centile (mg/m ³)	75 per-centile (mg/m ³)	90 per-centile (mg/m ³)	95 per-centile (mg/m ³)
Laser welding	31	23	30	0.00228	0.00107	0.00165	3.406	AQL !	AQL !	AQL !	AQL !
Arc hand welding with covered pencil electrode	99	66	35	0.0519	0.124	0.0108	5.483	0.0073 +	0.0325	0.121	0.274
Arc welding, mixed arc processes	20	13	12	0.00357	0.00499	0.00195	3.22	AQL !	0.0025 +	0.006 +	0.008 +
Metal active gas welding (MAG)	397	205	201	0.0165	0.0498	0.00476	4.204	AQL !	0.011	0.035	0.055
Metal inert gas welding (MIG)	105	61	53	0.0143	0.0318	0.00477	3.886	AQL !	0.0147	0.035	0.0498
Metal welding, mixed welding processes	30	21	20	0.00431	0.00551	0.00208	4.192	AQL !	0.0026 +	0.013 +	0.016 +
Plasma welding	38	27	27	0.00293	0.00633	0.00146	3.171	AQL !	0.0025 +	0.0025 +	0.00341 +
Welding, general	52	31	31	0.0128	0.028	0.00374	4.904	AQL !	0.007	0.0276	0.053
Submerged arc welding	14	11	12	0.00298	0.0022	0.00256	1.657	AQL !	AQL !	0.0042 +	0.0065
Resistance spot welding	17	12	13	0.00374	0.00291	0.00303	1.891	AQL !	AQL !	0.00804	0.0101
Tungsten inert gas welding (TIG)	396	276	345	0.00459	0.0172	0.00238	2.595	AQL !	AQL !	0.00467 +	0.00892 +

5.8 Work areas welding – personal and stationary (Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Laser welding (personal)	18	14	17	0.00253	0.0012	0.00176	3.723	AQL !	AQL !	AQL !	0.005 +
Laser welding (stationary)	13	12	13	0.00195	0.000773	0.0015	3.115	AQL !	AQL !	AQL !	AQL !
Arc hand welding with covered pencil electrode (personal)	76	58	27	0.0601	0.139	0.0121	5.348	0.008 +	0.032	0.15	0.35
Arc hand welding with covered pencil electrode (stationary)	23	18	8	0.0248	0.0348	0.00737	5.841	0.00385 +	0.0315	0.0755	0.0906
Arc welding, mixed arc processes (stationary)	11	7	6	0.00327	0.00662	0.00119	3.872	AQL !	0.0025 +	0.0025 +	0.0117
Metal active gas welding (MAG) (personal)	303	179	147	0.0205	0.0563	0.00656	3.653	0.00405 +	0.015	0.044	0.067
Metal active gas welding (MAG) (stationary)	94	56	54	0.00376	0.00669	0.0017	4.0113	AQL !	0.0025 +	0.00716	0.0116
Metal inert gas welding (MIG) (personal)	70	51	31	0.0203	0.0375	0.00791	3.718	0.0055	0.022	0.041	0.083
Metal inert gas welding (MIG) (stationary)	35	23	22	0.00236	0.00285	0.00174	2.119	AQL !	0.0025 +	0.0025 +	0.0026 +

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Metal welding, mixed welding processes (personal)	17	11	11	0.00623	0.00659	0.00405	2.468	AQL !	0.0067 +	0.0156 +	0.0179 +
Metal welding, mixed welding processes (stationary)	13	12	9	0.00179	0.00188	0.000871	4.744	AQL !	0.0023 +	0.0025 +	0.00415 +
Plasma welding (personal)	17	15	15	0.0049	0.00915	0.00295	2.13	AQL !	AQL !	0.00443 +	0.0128
Plasma welding (stationary)	21	17	12	0.00134	0.00105	0.000829	3.0609	AQL !	0.0025 +	0.0025 +	0.0025 +
Welding, general (personal)	35	22	23	0.015	0.0331	0.00488	3.474	AQL !	0.00715	0.025	0.0925
Welding, general (stationary)	17	12	8	0.00821	0.0118	0.00216	7.937	0.0025 +	0.00675	0.0284	0.0341
Tungsten inert gas welding (TIG) (personal)	329	249	292	0.00449	0.0155	0.00275	1.929	AQL !	AQL !	0.00491 +	0.00944 +
Tungsten inert gas welding (TIG) (stationary)	67	51	53	0.00508	0.0243	0.00115	5.101	AQL !	AQL !	0.0025 +	0.00513 +

**5.9 Work areas welding –
with and without local exhaust ventilation
(Concentrations of chromium(VI) compounds are calculated as chromium trioxide, CrO₃)**

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Laser welding (with local exhaust ventilation)	28	22	27	0.00235	0.00104	0.00183	2.885	AQL !	AQL !	AQL !	AQL !
Arc hand welding with covered pencil electrode (with local exhaust ventilation)	83	54	33	0.0432	0.121	0.00907	4.857	0.006 +	0.0245	0.0917	0.13
Arc hand welding with covered pencil electrode (without local exhaust ventilation)	12	10	1	0.0719	0.101	0.0221	7.469	0.023	0.093	0.166	0.244
Arc welding, mixed arc processes (with local exhaust ventilation)	13	9	9	0.0029	0.00224	0.00196	2.935	AQL !	0.0025 +	0.0057	0.0067
Metal active gas welding (MAG) (with local exhaust ventilation)	269	151	141	0.017	0.0517	0.00435	4.327	AQL !	0.00815	0.0285	0.067
Metal active gas welding (MAG) (without local exhaust ventilation)	92	47	44	0.0113	0.0137	0.00544	3.745	0.0025 +	0.017	0.0346	0.044
Metal inert gas welding (MIG) (with local exhaust ventilation)	70	44	38	0.016	0.0357	0.00533	3.796	AQL !	0.0155	0.036	0.0495
Metal inert gas welding (MIG) (without local exhaust ventilation)	24	18	11	0.0119	0.0247	0.00399	4.271	0.0025 +	0.0097	0.0216	0.0336
Metal welding, mixed welding processes (with local exhaust ventilation)	21	12	14	0.00512	0.00593	0.00314	2.826	AQL !	0.00502 +	0.0142 +	0.0169 +

Work area	Number of measured data	Number of firms	Number < values	Arithm. mean (mg/m ³)	SD	Geom. mean (mg/m ³)	GSD	50 percentile (mg/m ³)	75 percentile (mg/m ³)	90 percentile (mg/m ³)	95 percentile (mg/m ³)
Plasma welding (with local exhaust ventilation)	19	16	15	0.00213	0.00165	0.00156	2.571	AQL !	AQL !	0.0025 +	0.00278 +
Plasma welding (without local exhaust ventilation)	19	11	12	0.00373	0.00885	0.00137	3.879	AQL !	0.0025 +	0.00254 +	0.00475 +
Welding, general (with local exhaust ventilation)	35	23	24	0.0102	0.0229	0.00357	4.0773	AQL !	0.006	0.027	0.0343
Welding, general (without local exhaust ventilation)	14	8	6	0.0118	0.0206	0.00412	5.744	0.006	0.0103	0.0186	0.0373
Tungsten inert gas welding (TIG) (with local exhaust ventilation)	177	135	149	0.00434	0.0112	0.00239	2.782	AQL !	AQL !	0.00537 +	0.0112
Tungsten inert gas welding (TIG) (without local exhaust ventilation)	162	112	147	0.00384	0.0156	0.0022	2.472	AQL !	AQL !	AQL !	0.00446 +

6 Overviews

6.1 Distribution of the measured values of industry groups among industries (n > 9)

Industry group	Industry	Measured values
Construction	Plant and equipment construction (metal)	34
Construction	Container construction	19
Construction	Pipeline construction	16
Construction	Heating, air conditioning, ventilation engineering	15
Chemical industry	Chemical industry	31
Electrical engineering, fine mechanics, optics	Electrical engineering, general	84
Electrical engineering, fine mechanics, optics	Manufacture of hardware, sheet metal and metalware products	57
Wood and paper	Processing and treatment of wood	155
Ceramics	Manufacture of sanitary, technical and chemical-technical electrical ceramic	27
Plastic industry	Plastics and plastic foam, processing	13
Processing metals/Mechanical engineering	Electroplating	1039
Processing metals/Mechanical engineering	Processing and treatment of metals, general	774
Processing metals/Mechanical engineering	Mechanical engineering	272
Processing metals/Mechanical engineering	Apparatus engineering	123
Processing metals/Mechanical engineering	Surface treatment and hardening	100

Industry group	Industry	Measured values
Processing metals/Mechanical engineering	Vehicle construction	99
Processing metals/Mechanical engineering	Manufacture of machinery and vehicles, general	83
Processing metals/Mechanical engineering	Processing of liquid coating materials (liquid varnish coating)	71
Processing metals/Mechanical engineering	Plant engineering and construction, construction of plants	69
Processing metals/Mechanical engineering	Electroplating, manually fed line	54
Processing metals/Mechanical engineering	Electroplating, automatic rack/barrel lines	52
Processing metals/Mechanical engineering	Manufacture of taps and valves	36
Processing metals/Mechanical engineering	Steel construction	36
Processing metals/Mechanical engineering	Electroplating, manually operated rack/barrel line	28
Processing metals/Mechanical engineering	Steel and light metal construction	21
Processing metals/Mechanical engineering	Manufacture of parts for motor vehicles and engines (automotive supply)	18
Processing metals/Mechanical engineering	Manufacture of aircraft	17
Processing metals/Mechanical engineering	Repair shop for machinery	15
Processing metals/Mechanical engineering	Metalworking	13
Processing metals/Mechanical engineering	Repair shop (service shop), general	13
Processing metals/Mechanical engineering	Shipbuilding	10
Processing metals/Mechanical engineering	Grinding shop (metal products)	10
Processing metals/Mechanical engineering	Drop forges	10

Industry group	Industry	Measured values
Manufacture of metals	Iron and steel foundry, mixed	24
Manufacture of metals	Steel foundry	21
Manufacture of metals	Iron foundry	15
Transport	Transport, shipping, transport companies and similar	10

6.2 Distribution of the measured values of the work area groups among work areas (n > 9)

The work areas of the surface treatment, surface coating and welding groups are evaluated separately (see above).

Work area group	Work area	Measured values
Drilling, grinding, punching	Drilling	18
Installation	Installation, general	29
Polishing	Polishing systems	12
Polishing	Polishing	14
Repair and maintenance	Repair and maintenance, in workshop	11
Sawing	Sawing	93
Sanding	Sanding	146
Sanding	Dry sanding	32
Cutting (varous methods)	Blowtorch cutting	19
Cutting (varous methods)	Laser beam cutting	80
Cutting (varous methods)	Plasma smelt cutting, with machines	32
Cutting (varous methods)	Plasma-cutting, general	36
Spraying AirMixLess	Surface coating, spraying (e.g. with pressurised air)	21
Spraying AirMixLess	Workshop rooms, spraying station without special precautions, airless, manual	35
Separating and processing methods	Separating and processing methods, room	11
No assignment to group	Processing, room	31

Work area group	Work area	Measured values
No assignment to group	Staining	17
No assignment to group	Spark erosion	11
No assignment to group	Boiler pressure impregnation	15
No assignment to group	Stationary machines for machining, room, sanding and polishing machines for wood	12
No assignment to group	Control/operating station	12
No assignment to group	Air blasting systems, dry, closed	12
No assignment to group	Technical school, at facilities	13

6.3 Distribution of the measured values of the work area groups among industry groups (n > 9)

Work area group	Industry group	Measured values
Drilling, grinding, punching	Processing metals/Mechanical engineering	26
Casting, smelting	Manufacture of metals	13
Foundries (various work areas)	Manufacture of metals	18
Mixing	Chemical industry	14
Installation	Processing metals/Mechanical engineering	19
Surface treatment, surface coating	Electrical engineering, fine mechanics, optics	32
Surface treatment, surface coating	Ceramics	27
Surface treatment, surface coating	Processing metals/Mechanical engineering	1314
Polishing	Processing metals/Mechanical engineering	24
Repair and maintenance	Processing metals/Mechanical engineering	11
Sawing	Wood and paper	97
Sanding	Electrical engineering, fine mechanics, optics	15
Sanding	Processing metals/Mechanical engineering	154
Cutting (varous methods)	Processing metals/Mechanical engineering	148
Welding	Construction	73
Welding	Chemical industry	15
Welding	Electrical engineering, fine mechanics, optics	76

Work area group	Industry group	Measured values
Welding	Processing metals/Mechanical engineering	1009
Welding	Manufacture of metals	25
Spraying AirMixLess	Processing metals/Mechanical engineering	63
No assignment to group	Construction	15
No assignment to group	Electrical engineering, fine mechanics, optics	10
No assignment to group	Wood and paper	49
No assignment to group	Processing metals/Mechanical engineering	172
No assignment to group	Manufacture of metals	33

6.4 Distribution of the measured values of the work areas among industries (n > 9)

Work area	Industry group	Measured values
Loading and unloading station	Electroplating	26
Processing, room	Processing and treatment of wood	22
Coating, general	Electroplating	147
Coating, gloss chroming	Electroplating, automatic rack/barrel lines	12
Coating, gloss chroming	Electroplating, manually fed line	17
Coating, gloss chroming, mixed acid bath	Electroplating	12
Coating, gloss chroming, sulfuric acid bath	Electroplating	45
Coating, hard chroming	Electroplating, manually fed line	30
Coating, hard chroming	Electroplating, manually operated rack/barrel line	21
Coating, hard chroming, mixed acid bath	Electroplating	43
Coating, hard chroming, sulfuric acid bath	Electroplating	242
Coating, black chroming	Electroplating	21
Coating, chroming, general	Electroplating	158
Coating, finishing with noble metals, general	Electroplating	11
Coating, nickel-plating, general	Electroplating	10
Coating, galvanizing, general	Electroplating	30

Work area	Industry group	Measured values
Coating, galvanizing, acidic	Electroplating	15
Coating, galvanizing, acidic	Electroplating, automatic rack/barrel lines	11
Chromating	Electroplating	72
Flame spraying	Processing and treatment of metals, general	18
Laser welding	Processing and treatment of metals, general	18
Laser beam cutting	Mechanical engineering	17
Laser beam cutting	Processing and treatment of metals, general	41
Arc hand welding with covered pencil electrode	Apparatus engineering	11
Arc hand welding with covered pencil electrode	Processing and treatment of metals, general	24
Arc welding, mixed arc processes	Processing and treatment of metals, general	10
Metal active gas welding (MAG)	Apparatus engineering	31
Metal active gas welding (MAG)	Electrical engineering, general	11
Metal active gas welding (MAG)	Vehicle construction	59
Metal active gas welding (MAG)	Manufacture of machinery and vehicles, general	31
Metal active gas welding (MAG)	Mechanical engineering	54
Metal active gas welding (MAG)	Processing and treatment of metals, general	120
Metal active gas welding (MAG)	Steel construction	20
Metal inert gas welding (MIG)	Plant engineering and construction, construction of plants	15

Work area	Industry group	Measured values
Metal inert gas welding (MIG)	Vehicle construction	14
Metal inert gas welding (MIG)	Mechanical engineering	11
Metal inert gas welding (MIG)	Processing and treatment of metals, general	33
Surface treatment, general	Manufacture of sanitary, technical and chemical-technical electrical ceramic	25
Surface coating, electroplating	Electrical engineering, general	19
Surface coating, electroplating	Electroplating	64
Surface coating, electroplating	Mechanical engineering	11
Surface coating, electroplating	Processing and treatment of metals, general	28
Surface coating, electroplating	Surface treatment and hardening	36
Plasma-cutting, general	Processing and treatment of metals, general	17
Plasma welding	Processing and treatment of metals, general	15
Sawing	Processing and treatment of wood	85
Sanding	Mechanical engineering	24
Sanding	Processing and treatment of metals, general	60
Welding, general	Processing and treatment of metals, general	19
Stationary machines for machining, room, sanding and polishing machines for wood	Processing and treatment of wood	12
Technical school, at facilities	Processing and treatment of metals, general	10

Work area	Industry group	Measured values
Dry sanding	Processing and treatment of metals, general	12
Preliminary treatment, staining, chemical	Electroplating	17
Workshop rooms, spraying station without special precautions, airless, manual	Processing of liquid coating materials (liquid varnish coating)	35
Resistance spot welding	Processing and treatment of metals, general	14
Tungsten inert gas welding (TIG)	Plant and equipment construction (metal)	14
Tungsten inert gas welding (TIG)	Plant engineering and construction, construction of plants	22
Tungsten inert gas welding (TIG)	Apparatus engineering	31
Tungsten inert gas welding (TIG)	Manufacture of hardware, sheet metal and metalware products	11
Tungsten inert gas welding (TIG)	Electrical engineering, general	13
Tungsten inert gas welding (TIG)	Mechanical engineering	64
Tungsten inert gas welding (TIG)	Processing and treatment of metals, general	158
Tungsten inert gas welding (TIG)	Pipeline construction	10