IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

Proficiency testing for in-house and external measuring stations - results and evaluation

Proficiency testing scheme: Aldehydes 2024

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Summary of laboratory test results

Sample 1

Laboratory	Acetaldehyde	Z score	Butyraldehyde	Z score	Formaldehyde	Z score	Propionaldehyde	Z score
Unit	mg/m³		mg/m³		mg/m³		mg/m³	
9	0.940	0.74	0.150	0.21	0.630	0.43	0.190	2.03 E
11	0.829	-0.53	0.110	-2.51 E	0.557	-0.78	0.136	-1.39
13	0.888	0.14	0.155	0.55	0.610	0.10	0.161	0.20
25					0.603	-0.02		
29	0.882	0.08	0.165	1.23	0.629	0.41	0.167	0.58
30	0.923	0.54	0.163	1.10	0.621	0.28	0.165	0.45
45					0.660	0.93		
50	0.918	0.49	0.165	1.23	0.618	0.23	0.154	-0.25
51	0.872	-0.04	0.142	-0.33	0.599	-0.09	0.153	-0.31
56	0.889	0.16	0.146	-0.06	0.606	0.03	0.154	-0.25
60	0.860	-0.18	0.139	-0.54	0.583	-0.36	0.154	-0.23
62	0.779	-1.10	0.145	-0.13	0.528	-1.26	0.150	-0.50
65	0.944	0.78	0.158	0.76	0.611	0.11	0.170	0.77
69	0.751	-1.42			0.679	1.23	0.164	0.36
82					0.619	0.25		
83					0.605	0.01		
94	0.909	0.38	0.153	0.42	0.610	0.10	0.162	0.26
124	0.870	-0.06	0.140	-0.47	0.590	-0.23	0.160	0.13
132	0.879	0.04			0.566	-0.64	0.134	-1.49
141	0.869	-0.07	0.155	0.55	0.616	0.20	0.161	0.20
165	0.928	0.60	0.158	0.76	0.622	0.30	0.171	0.83
167	0.818	-0.66	0.152	0.37	0.539	-1.08	0.161	0.18
186	0.895	0.22	0.151	0.28	0.600	-0.07	0.170	0.77
191	0.910	0.40	0.138	-0.60	0.645	0.68	0.154	-0.25
192	0.842	-0.38	0.153	0.42	0.587	-0.28	0.156	-0.12
207	0.897	0.25	0.146	-0.06	0.607	0.05	0.158	0.01
208	0.873	-0.03	0.148	0.08	0.616	0.20	0.166	0.51
214	0.900	0.28	0.150	0.21	0.610	0.10	0.150	-0.50

Laboratory	Acetaldehyde	Z score	Butyraldehyde	Z score	Formaldehyde	Z score	Propionaldehyde	Z score
219	0.856	-0.22	0.135	-0.81	0.771	2.76 BE	0.159	0.07
226	0.801	-0.85	0.145	-0.15	0.520	-1.39	0.143	-0.91
230	0.875	0.00	0.156	0.62	0.616	0.20	0.162	0.26
238	0.862	-0.15	0.122	-1.69	0.582	-0.37	0.144	-0.88
240	0.937	0.70	0.161	0.96	0.618	0.23	0.165	0.45
248	0.879	0.04	0.132	-1.01	0.630	0.43	0.144	-0.88
256	0.881	0.06	0.152	0.35	0.603	-0.02	0.163	0.32
258	0.921	0.52	0.154	0.49	0.628	0.39	0.164	0.39
261	0.935	0.68			0.611	0.11	0.162	0.26
262	0.733	-1.63	0.148	0.08	0.595	-0.15	0.158	0.01
264	0.860	-0.18	0.120	-1.83	0.590	-0.23	0.130	-1.77
267	0.884	0.09	0.137	-0.70	0.638	0.56	0.168	0.61
277	0.900	0.28	0.150	0.21	0.570	-0.57	0.160	0.13
–	–	– –	–	– –	–	– –	–	– –
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	|Z|<=2.00		|Z|<=2.00		|Z|<=2.00		|Z|<=2.00	
No. of laboratories that submitted results	37		34		41		37	
Mean	0.875		0.147		0.604		0.158	
Reproducibility s.d.	0.050		0.013		0.032		0.011	
Rel. reproducibility s.d.	5.66 %		8.55 %		5.28 %		7.18 %	
Reference value	0.836		0.137		0.541		0.147	
Target s.d.	0.088		0.015		0.060		0.016	
Rel. target s.d.	10.00 %		10.00 %		10.00 %		10.00 %	
Lower limit of tolerance	0.700		0.117		0.483		0.126	
Upper limit of tolerance	1.050		0.176		0.725		0.190	
Type B outliers					1			
Type E outliers			1		1		1	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	37		34		40		37	

Laboratory	Acetaldehyde	Z score	Butyraldehyde	Z score	Formaldehyde	Z score	Propionaldehyde	Z score

Explanation of outlier types

A: Single outlier	Grubbs
B: Differing laboratory mean	Grubbs
C: Excessive laboratory s.d.	Cochran
D: Excluded manually	
E: mean outside tolerance limits	
F: |Z-Score|>3.50	

Summary of laboratory test results

Sample 2

Laboratory	Acetaldehyde	Z score	Butyraldehyde	Z score	Formaldehyde	Z score
Unit	mg/m³		mg/m³		mg/m³	
9	1.080	0.97	0.420	0.67	0.140	-0.93
11	0.923	-0.63	0.301	-2.35 E	0.139	-1.00
13	1.000	0.16	0.418	0.62	0.168	0.88
25					0.153	-0.09
29	1.010	0.26	0.456	1.59	0.164	0.62
30	1.023	0.39	0.426	0.82	0.161	0.43
45					0.190	2.28 E
50	1.020	0.36	0.450	1.43	0.156	0.10
51	0.974	-0.11	0.392	-0.04	0.151	-0.22
56	1.009	0.25	0.403	0.24	0.156	0.10
60	0.972	-0.13	0.406	0.33	0.154	-0.03
62	0.864	-1.23	0.386	-0.19	0.137	-1.13
65	1.040	0.56	0.423	0.75	0.152	-0.16
69	0.958	-0.27			0.205	3.25 BE
82					0.154	-0.05
83					0.153	-0.09
94	1.014	0.30	0.413	0.49	0.154	-0.03
124	0.970	-0.15	0.390	-0.09	0.150	-0.29
132	0.976	-0.09			0.133	-1.40
141	0.961	-0.24	0.400	0.16	0.157	0.17
165	1.031	0.47	0.420	0.67	0.158	0.23
167	0.920	-0.65	0.407	0.34	0.134	-1.30
186	0.999	0.15	0.412	0.47	0.153	-0.09
191	1.036	0.52	0.363	-0.78	0.167	0.81
192	0.958	-0.27	0.403	0.24	0.150	-0.29
207	1.004	0.20	0.387	-0.17	0.156	0.10
208	0.958	-0.27	0.363	-0.78	0.152	-0.16
214	1.030	0.46	0.400	0.16	0.150	-0.29

Laboratory	Acetaldehyde	Z score	Butyraldehyde	Z score	Formaldehyde	Z score
219	0.948	-0.37	0.348	-1.16	0.189	2.24 E
226	0.884	-1.02	0.381	-0.32	0.149	-0.38
230	0.998	0.14	0.413	0.49	0.160	0.36
238	0.954	-0.31	0.321	-1.84	0.142	-0.80
240	1.033	0.49	0.427	0.85	0.155	0.04
248	0.996	0.12	0.353	-1.03	0.163	0.56
256	0.994	0.10	0.391	-0.07	0.156	0.10
258	1.017	0.33	0.406	0.31	0.156	0.10
261	1.042	0.58			0.155	0.04
262	0.893	-0.93	0.435	1.05	0.160	0.36
264	0.930	-0.55	0.310	-2.12 E	0.150	-0.29
267	1.013	0.28	0.358	-0.90	0.161	0.41
277	1.000	0.16	0.400	0.16	0.140	-0.93
–	–	– –	–	– –	–	– –
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	|Z|<=2.00		|Z|<=2.00		|Z|<=2.00	
No. of laboratories that submitted results	37		34		41	
Mean	0.985		0.394		0.154	
Reproducibility s.d.	0.048		0.036		0.012	
Rel. reproducibility s.d.	4.86 %		9.24 %		7.51 %	
Reference value	0.935		0.366		0.140	
Target s.d.	0.098		0.039		0.015	
Rel. target s.d.	10.00 %		10.00 %		10.00 %	
Lower limit of tolerance	0.788		0.315		0.124	
Upper limit of tolerance	1.182		0.472		0.185	
Type B outliers					1	
Type E outliers			2		3	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	37		34		40	

Laboratory	Acetaldehyde	Z score	Butyraldehyde	Z score	Formaldehyde	Z score

Explanation of outlier types

A: Single outlier	Grubbs
B: Differing laboratory mean	Grubbs
C: Excessive laboratory s.d.	Cochran
D: Excluded manually	
E: mean outside tolerance limits	
F: |Z-Score|>3.50	

Summary of laboratory test results

Sample 3

Laboratory	Acetaldehyde	Z score	Formaldehyde	Z score	Propionaldehyde	Z score
Unit	mg/m³		mg/m³		mg/m³	
9	0.390	0.72	0.440	0.26	1.23	0.92
11	0.339	-0.68	0.387	-0.97	0.97	-1.37
13	0.363	-0.02	0.439	0.24	1.16	0.30
25			0.432	0.08		
29	0.371	0.20	0.459	0.70	1.22	0.83
30	0.373	0.25	0.439	0.24	1.17	0.41
45			0.567	3.22 BE		
50	0.383	0.53	0.441	0.29	1.16	0.30
51	0.355	-0.24	0.423	-0.13	1.12	-0.09
56	0.373	0.25	0.441	0.29	1.12	-0.07
60	0.359	-0.14	0.411	-0.42	1.10	-0.24
62	0.325	-1.07	0.383	-1.07	1.08	-0.38
65	0.388	0.66	0.435	0.15	1.22	0.86
69	0.320	-1.21	0.483	1.26	1.07	-0.48
82			0.449	0.48		
83			0.449	0.47		
94	0.377	0.36	0.436	0.17	1.17	0.38
124	0.360	-0.10	0.420	-0.20	1.14	0.12
132	0.352	-0.34	0.396	-0.78	1.04	-0.81
141	0.373	0.25	0.437	0.19	1.13	0.03
165	0.393	0.80	0.443	0.33	1.20	0.62
167	0.339	-0.68	0.381	-1.10	1.16	0.34
186	0.360	-0.10	0.430	0.03	1.20	0.69
191	0.385	0.58	0.456	0.63	1.07	-0.54
192	0.356	-0.21	0.418	-0.25	1.13	0.00
207	0.375	0.31	0.435	0.15	1.13	0.06
208	0.362	-0.05	0.437	0.19	1.18	0.44
214	0.390	0.72	0.450	0.49	1.15	0.21

Laboratory	Acetaldehyde	Z score	Formaldehyde	Z score	Propionaldehyde	Z score
219	0.346	-0.49	0.552	2.87 BE	1.16	0.30
226	0.351	-0.35	0.371	-1.34	1.00	-1.14
230	0.364	0.01	0.439	0.24	1.13	0.02
238	0.353	-0.30	0.411	-0.41	1.03	-0.86
240	0.389	0.69	0.431	0.05	1.16	0.31
248	0.360	-0.10	0.448	0.45	1.01	-1.07
256	0.364	0.01	0.427	-0.04	1.14	0.14
258	0.379	0.42	0.442	0.31	1.17	0.40
261	0.387	0.64	0.431	0.05	1.16	0.29
262	0.318	-1.26	0.419	-0.23	1.14	0.12
264	0.340	-0.65	0.410	-0.44	1.00	-1.12
267	0.380	0.44	0.443	0.34	1.17	0.34
277	0.370	0.17	0.400	-0.67	1.10	-0.24
–	–	– –	–	– –	–	– –
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	|Z|<=2.00		|Z|<=2.00		|Z|<=2.00	
No. of laboratories that submitted results	37		41		37	
Mean	0.364		0.429		1.13	
Reproducibility s.d.	0.020		0.023		0.07	
Rel. reproducibility s.d.	5.46 %		5.42 %		5.85 %	
Reference value	0.349		0.386		1.05	
Target s.d.	0.036		0.043		0.11	
Rel. target s.d.	10.00 %		10.00 %		10.00 %	
Lower limit of tolerance	0.291		0.343		0.90	
Upper limit of tolerance	0.437		0.515		1.35	
Type B outliers			2			
Type E outliers			2			
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	37		39		37	

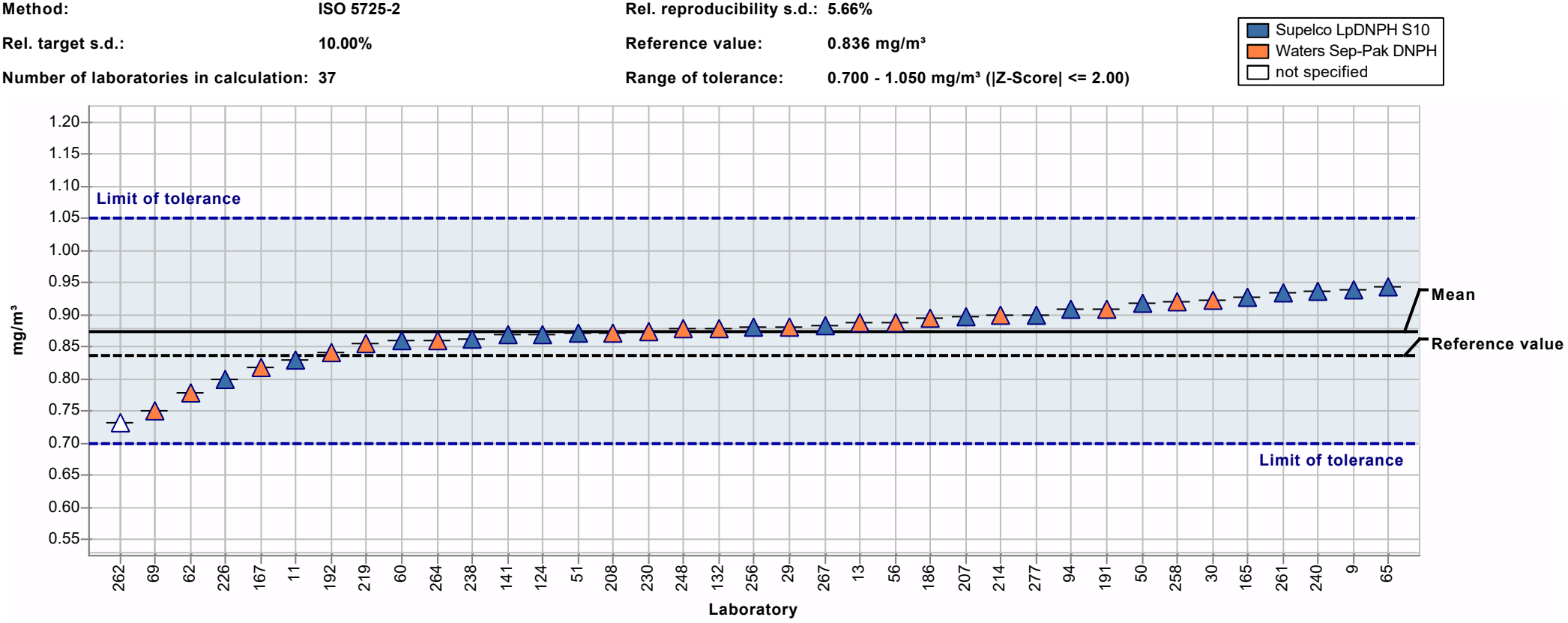
Laboratory	Acetaldehyde	Z score	Formaldehyde	Z score	Propionaldehyde	Z score

Explanation of outlier types

A: Single outlier	Grubbs
B: Differing laboratory mean	Grubbs
C: Excessive laboratory s.d.	Cochran
D: Excluded manually	
E: mean outside tolerance limits	
F: |Z-Score|>3.50	

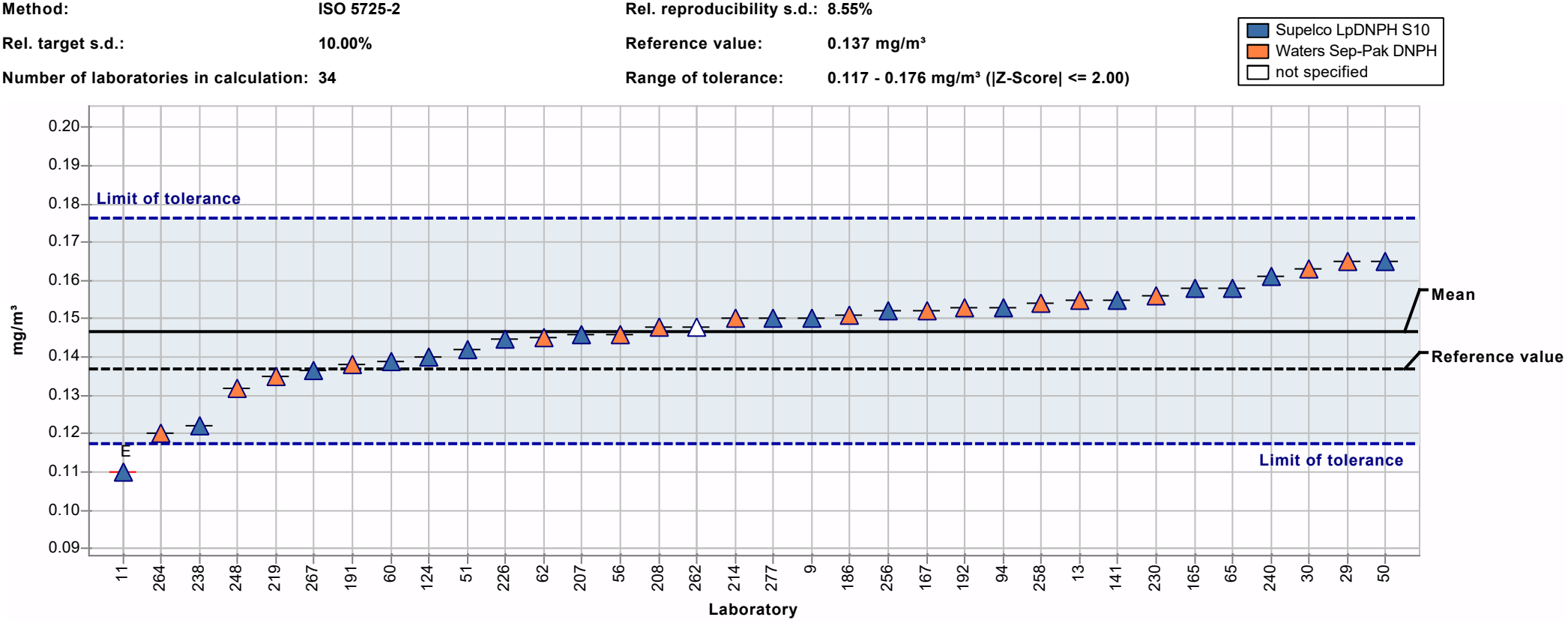
Summary results

Sample:	**1**	**Mean:**	**0.875 mg/m³**
Measurand:	**Acetaldehyde**	**Reproducibility s.d.:**	**0.050 mg/m³**
Method:	**ISO 5725-2**	**Rel. reproducibility s.d.:**	**5.66%**
Rel. target s.d.:	**10.00%**	**Reference value:**	**0.836 mg/m³**
Number of laboratories in calculation:	**37**	**Range of tolerance:**	**0.700 - 1.050 mg/m³ (|Z-Score| <= 2.00)**



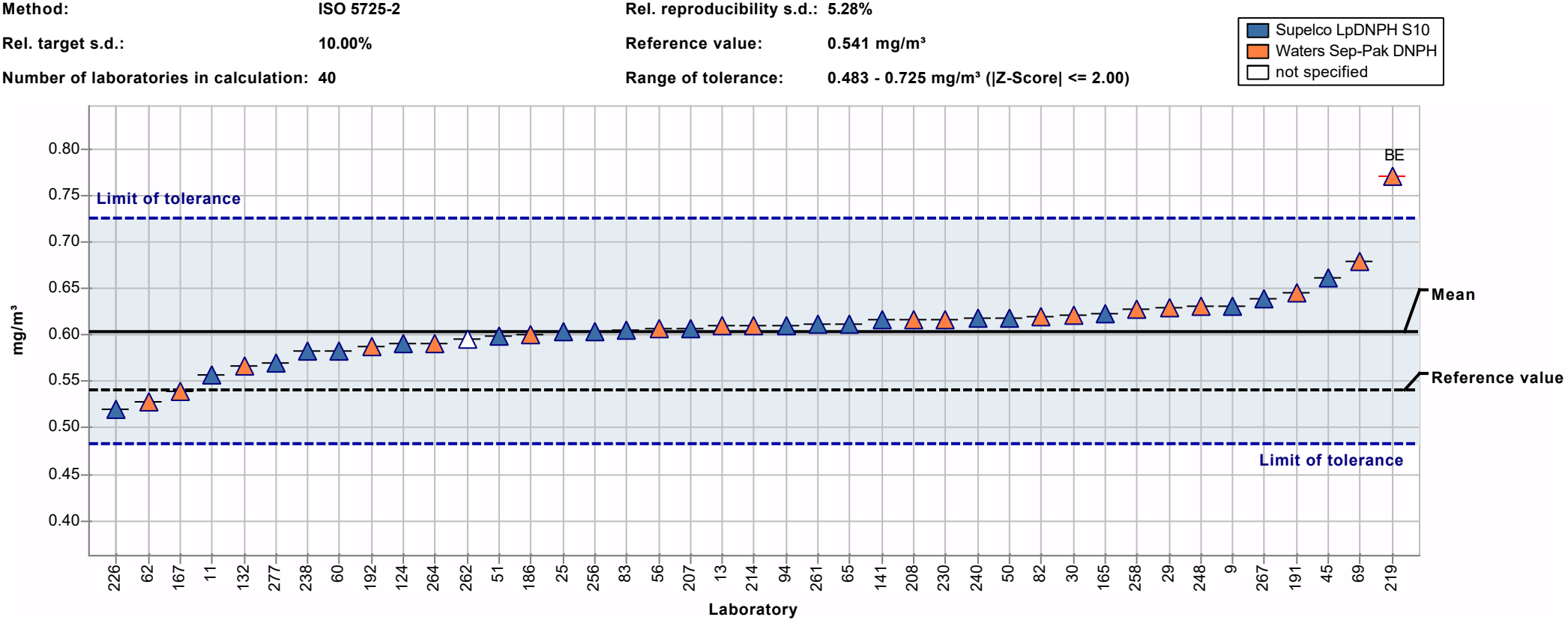
Summary results

Sample:	**1**	**Mean:**	**0.147 mg/m³**
Measurand:	**Butyraldehyde**	**Reproducibility s.d.:**	**0.013 mg/m³**
Method:	**ISO 5725-2**	**Rel. reproducibility s.d.:**	**8.55%**
Rel. target s.d.:	**10.00%**	**Reference value:**	**0.137 mg/m³**
Number of laboratories in calculation:	**34**	**Range of tolerance:**	**0.117 - 0.176 mg/m³ (|Z-Score| <= 2.00)**



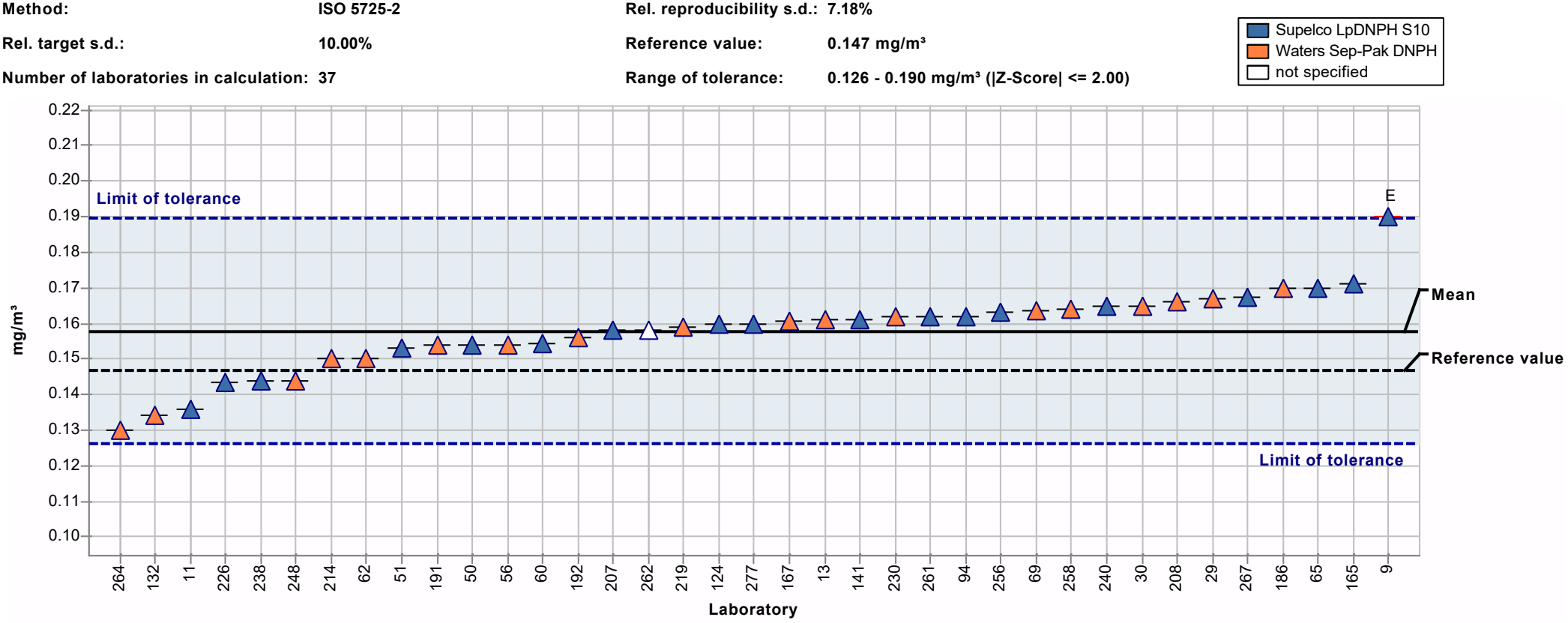
Summary results

Sample:	**1**	**Mean:**	**0.604 mg/m³**
Measurand:	**Formaldehyde**	**Reproducibility s.d.:**	**0.032 mg/m³**
Method:	**ISO 5725-2**	**Rel. reproducibility s.d.:**	**5.28%**
Rel. target s.d.:	**10.00%**	**Reference value:**	**0.541 mg/m³**
Number of laboratories in calculation:	**40**	**Range of tolerance:**	**0.483 - 0.725 mg/m³ (|Z-Score| <= 2.00)**



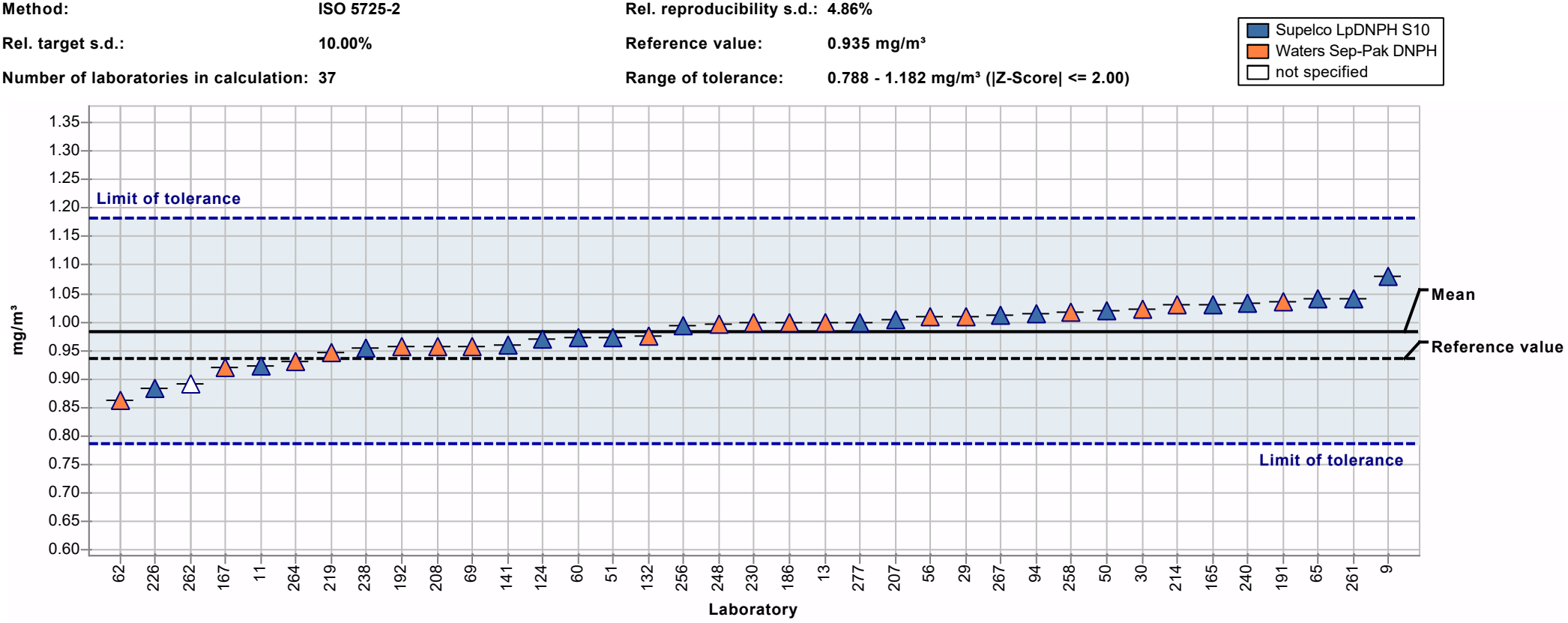
Summary results

Sample:	**1**	**Mean:**	**0.158 mg/m³**
Measurand:	**Propionaldehyde**	**Reproducibility s.d.:**	**0.011 mg/m³**
Method:	**ISO 5725-2**	**Rel. reproducibility s.d.:**	**7.18%**
Rel. target s.d.:	**10.00%**	**Reference value:**	**0.147 mg/m³**
Number of laboratories in calculation:	**37**	**Range of tolerance:**	**0.126 - 0.190 mg/m³ (|Z-Score| <= 2.00)**



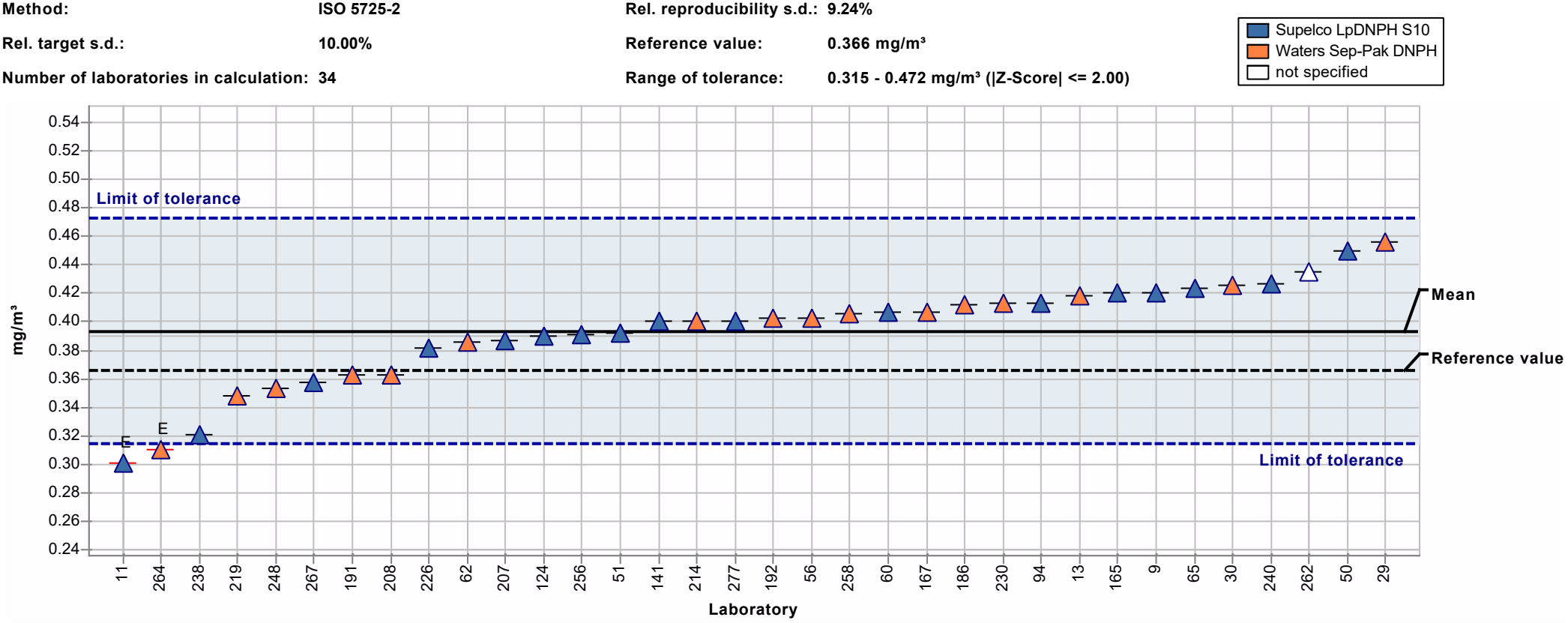
Summary results

Sample:	**2**	**Mean:**	**0.985 mg/m³**
Measurand:	**Acetaldehyde**	**Reproducibility s.d.:**	**0.048 mg/m³**
Method:	**ISO 5725-2**	**Rel. reproducibility s.d.:**	**4.86%**
Rel. target s.d.:	**10.00%**	**Reference value:**	**0.935 mg/m³**
Number of laboratories in calculation:	**37**	**Range of tolerance:**	**0.788 - 1.182 mg/m³ (|Z-Score| <= 2.00)**



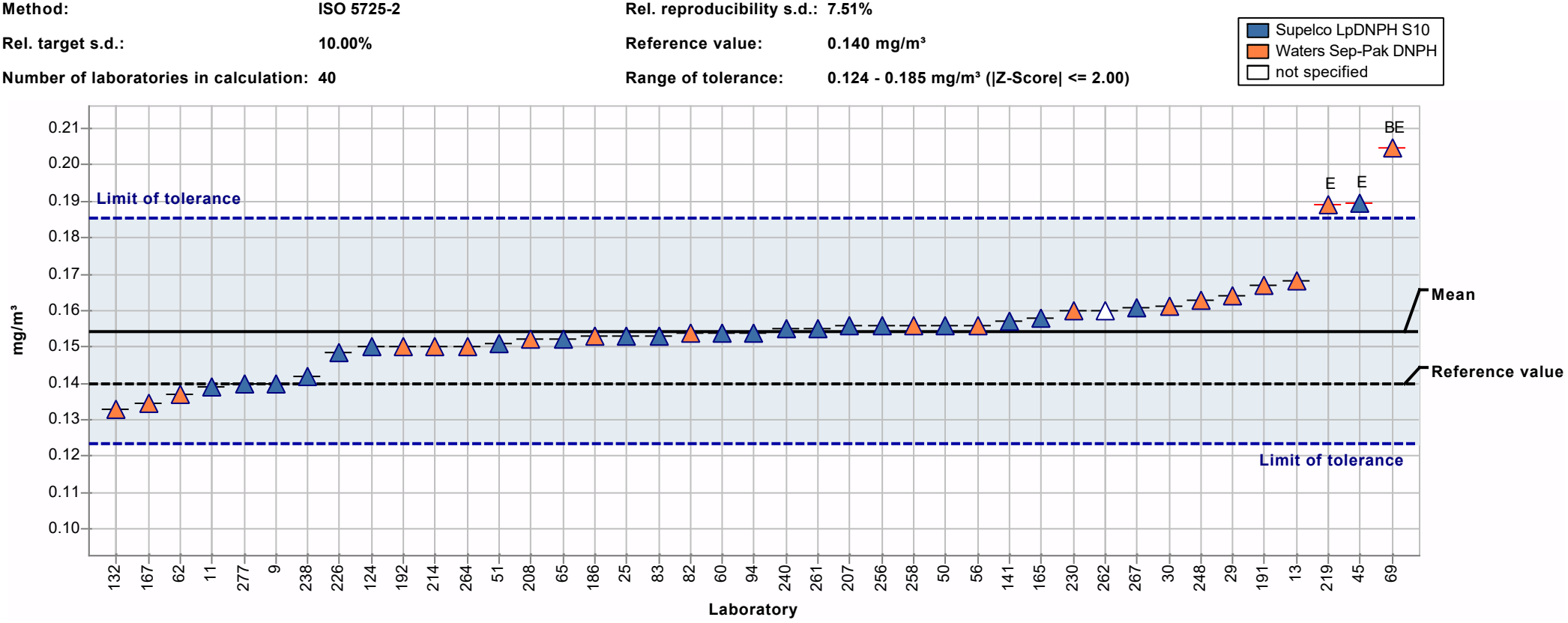
Summary results

Sample:	**2**	**Mean:**	**0.394 mg/m³**
Measurand:	**Butyraldehyde**	**Reproducibility s.d.:**	**0.036 mg/m³**
Method:	**ISO 5725-2**	**Rel. reproducibility s.d.:**	**9.24%**
Rel. target s.d.:	**10.00%**	**Reference value:**	**0.366 mg/m³**
Number of laboratories in calculation:	**34**	**Range of tolerance:**	**0.315 - 0.472 mg/m³ (|Z-Score| <= 2.00)**



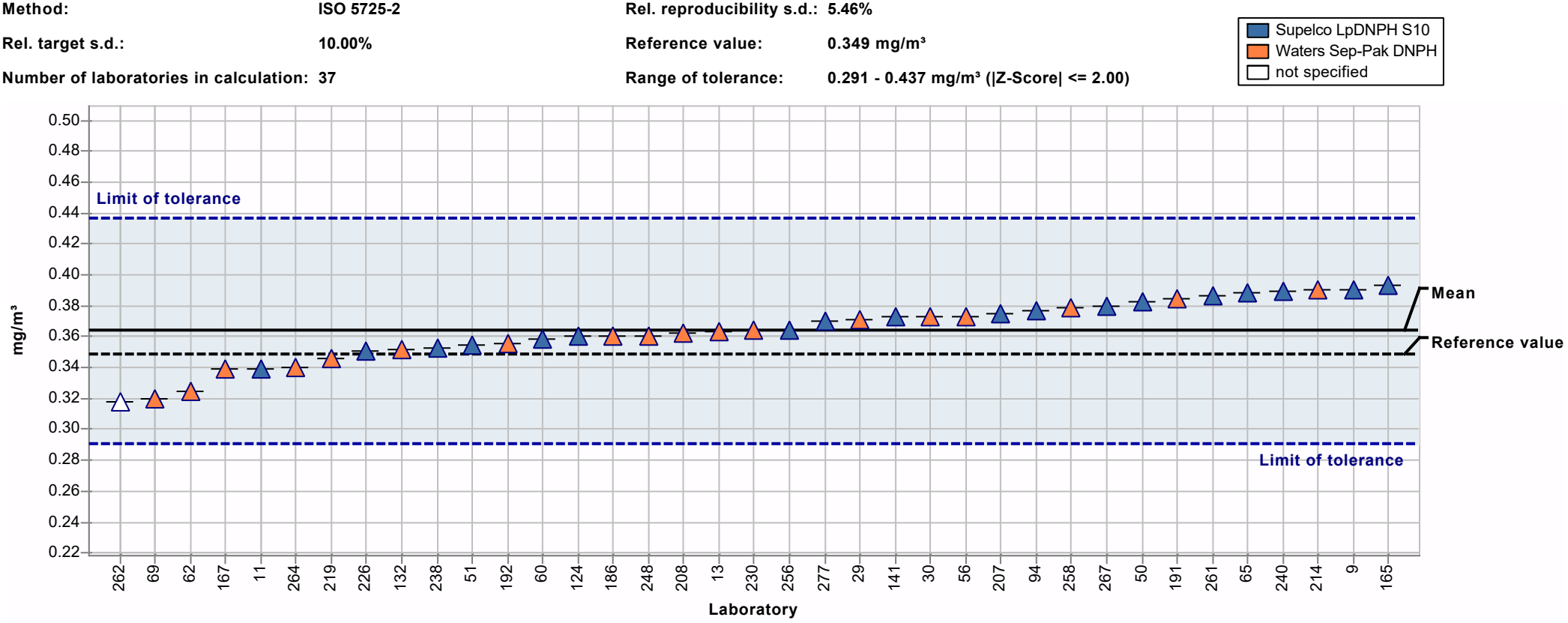
Summary results

Sample:	**2**	**Mean:**	**0.154 mg/m³**
Measurand:	**Formaldehyde**	**Reproducibility s.d.:**	**0.012 mg/m³**
Method:	**ISO 5725-2**	**Rel. reproducibility s.d.:**	**7.51%**
Rel. target s.d.:	**10.00%**	**Reference value:**	**0.140 mg/m³**
Number of laboratories in calculation:	**40**	**Range of tolerance:**	**0.124 - 0.185 mg/m³ (|Z-Score| <= 2.00)**



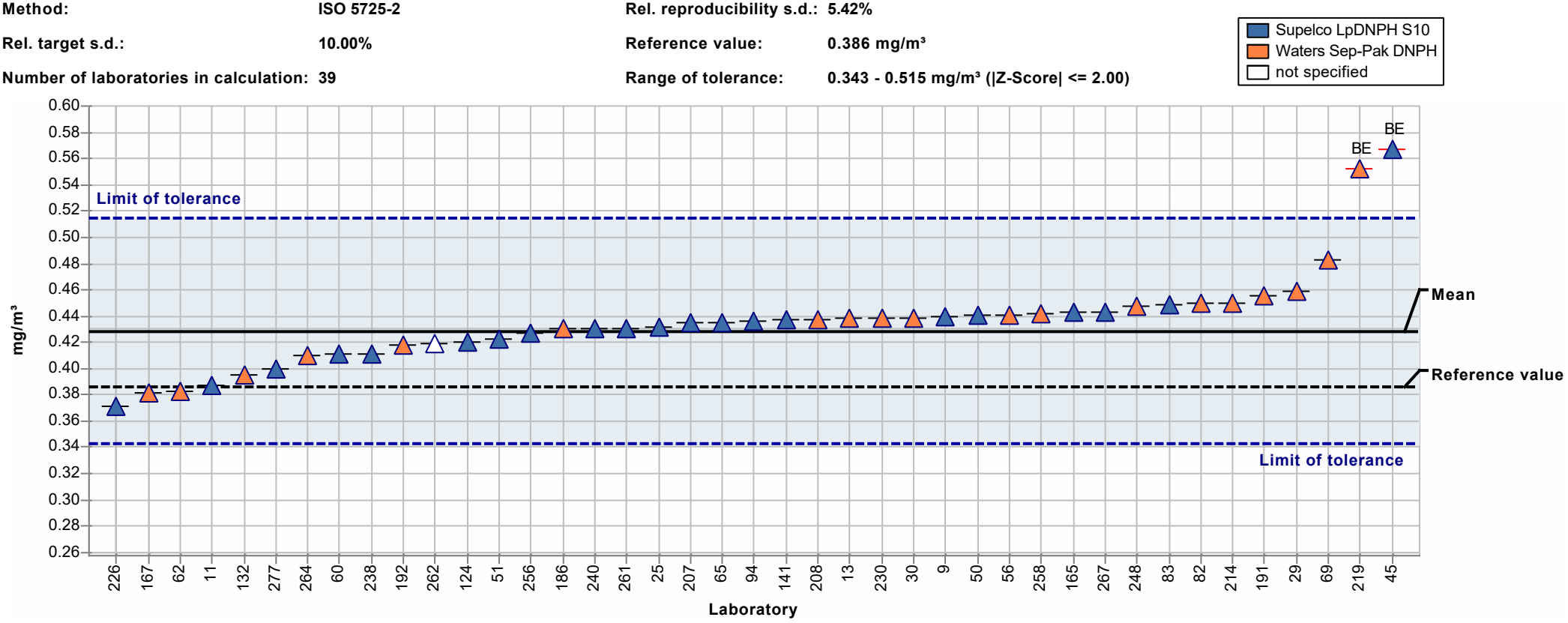
Summary results

Sample:	**3**	**Mean:**	**0.364 mg/m³**
Measurand:	**Acetaldehyde**	**Reproducibility s.d.:**	**0.020 mg/m³**
Method:	**ISO 5725-2**	**Rel. reproducibility s.d.:**	**5.46%**
Rel. target s.d.:	**10.00%**	**Reference value:**	**0.349 mg/m³**
Number of laboratories in calculation:	**37**	**Range of tolerance:**	**0.291 - 0.437 mg/m³ (|Z-Score| <= 2.00)**



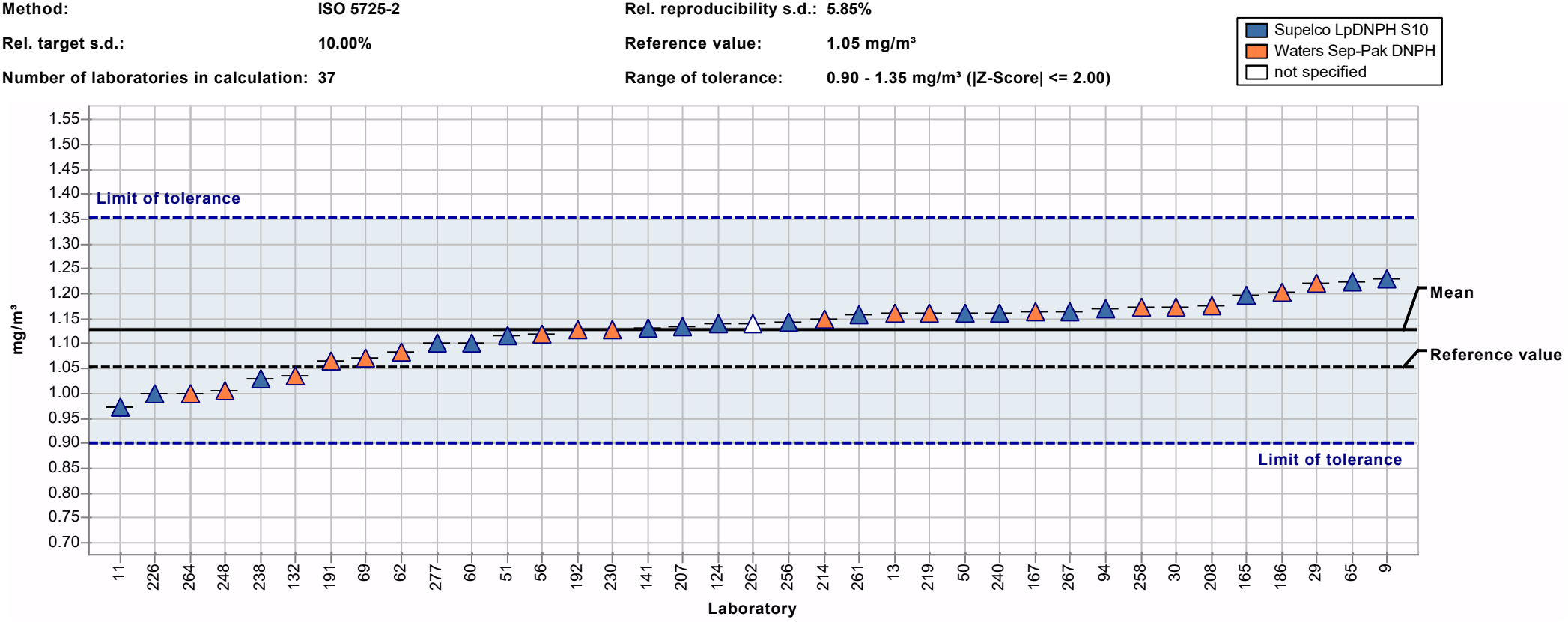
Summary results

Sample:	**3**	**Mean:**	**0.429 mg/m³**
Measurand:	**Formaldehyde**	**Reproducibility s.d.:**	**0.023 mg/m³**
Method:	**ISO 5725-2**	**Rel. reproducibility s.d.:**	**5.42%**
Rel. target s.d.:	**10.00%**	**Reference value:**	**0.386 mg/m³**
Number of laboratories in calculation:	**39**	**Range of tolerance:**	**0.343 - 0.515 mg/m³ (|Z-Score| <= 2.00)**



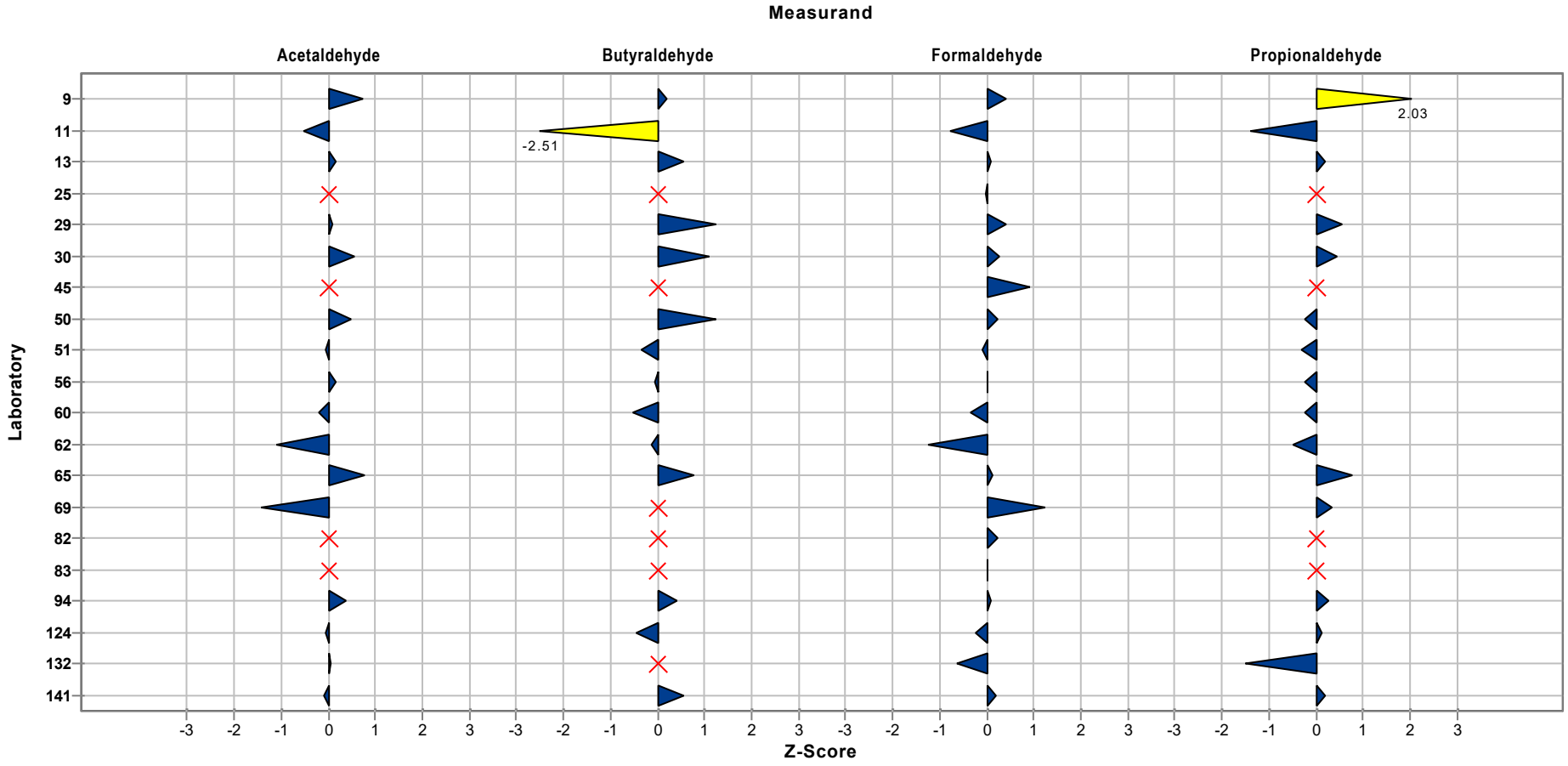
Summary results

Sample:	**3**	**Mean:**	**1.13 mg/m³**
Measurand:	**Propionaldehyde**	**Reproducibility s.d.:**	**0.07 mg/m³**
Method:	**ISO 5725-2**	**Rel. reproducibility s.d.:**	**5.85%**
Rel. target s.d.:	**10.00%**	**Reference value:**	**1.05 mg/m³**
Number of laboratories in calculation:	**37**	**Range of tolerance:**	**0.90 - 1.35 mg/m³ (|Z-Score| <= 2.00)**



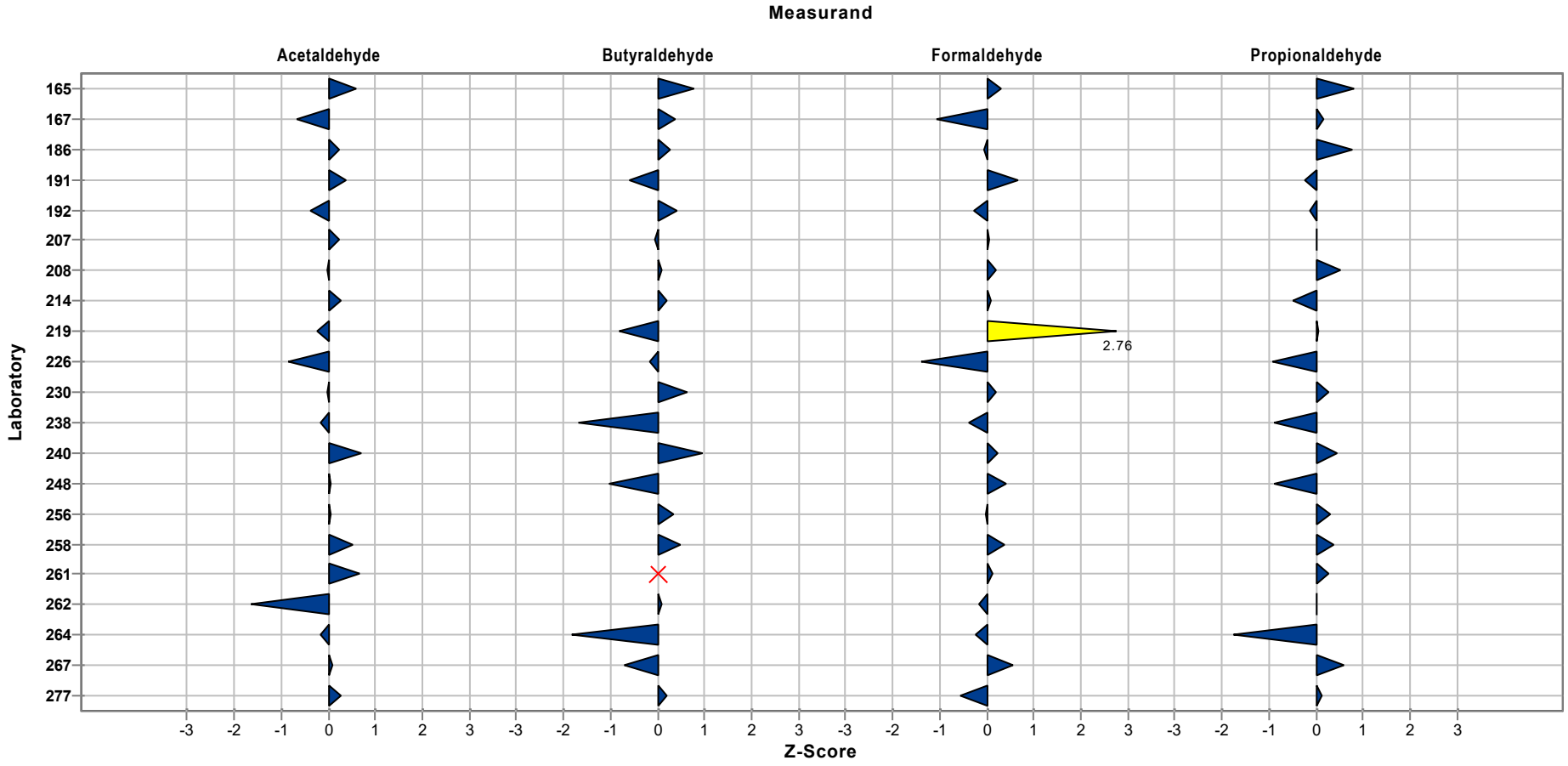
Sample chart of *Z-Scores*

Sample: 1



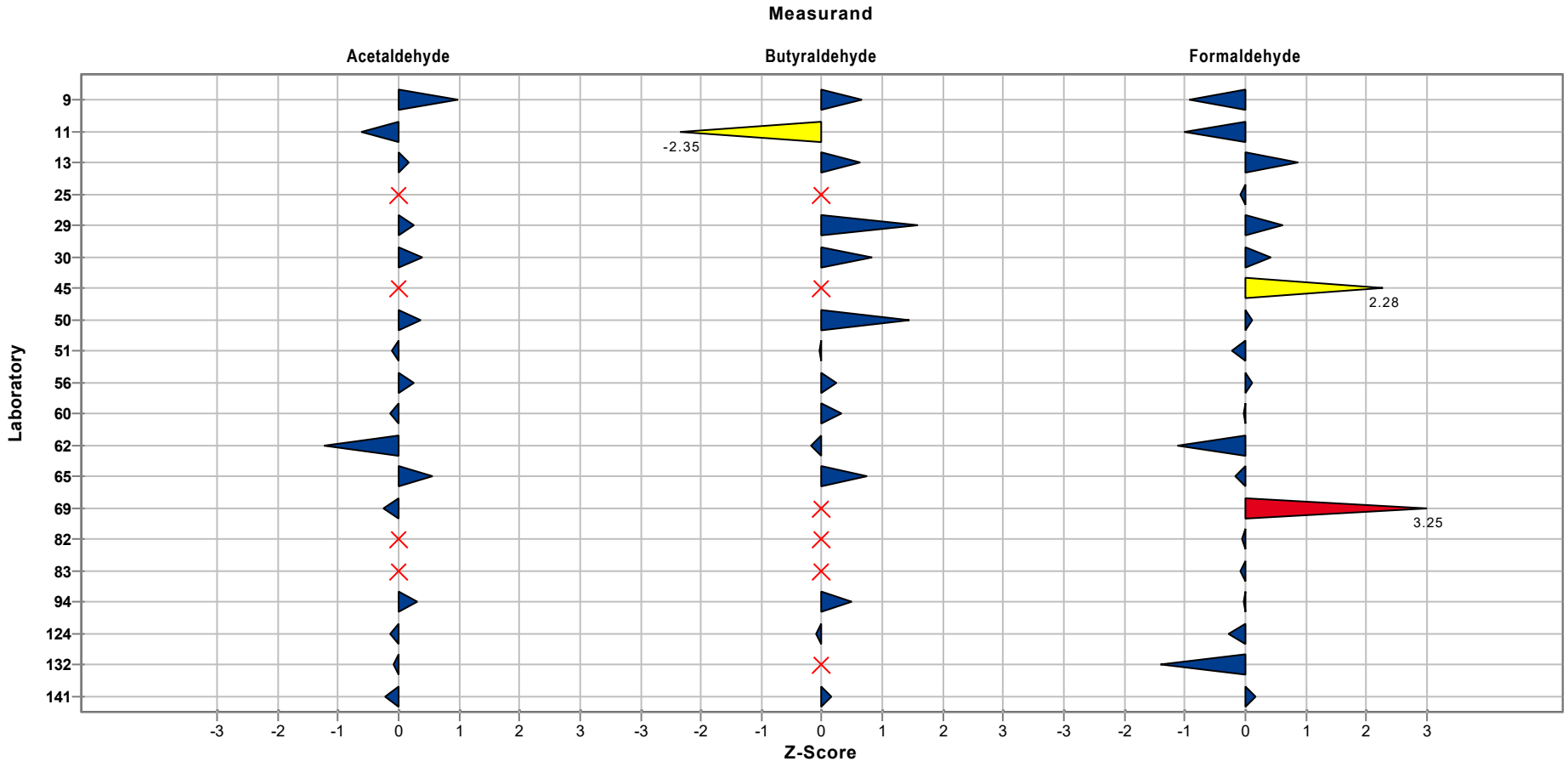
Sample chart of *Z-Scores*

Sample: 1



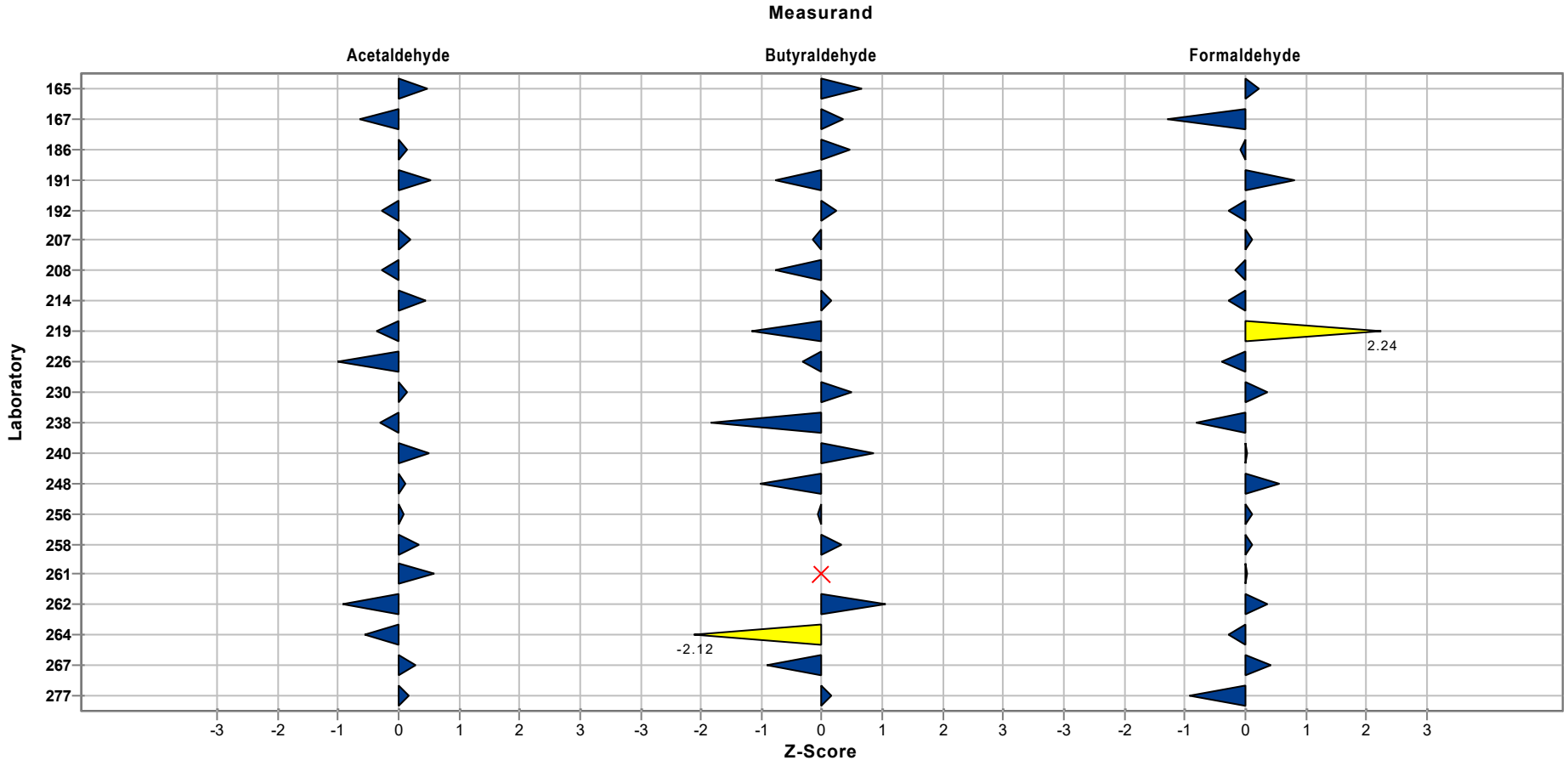
Sample chart of *Z-Scores*

Sample: **2**



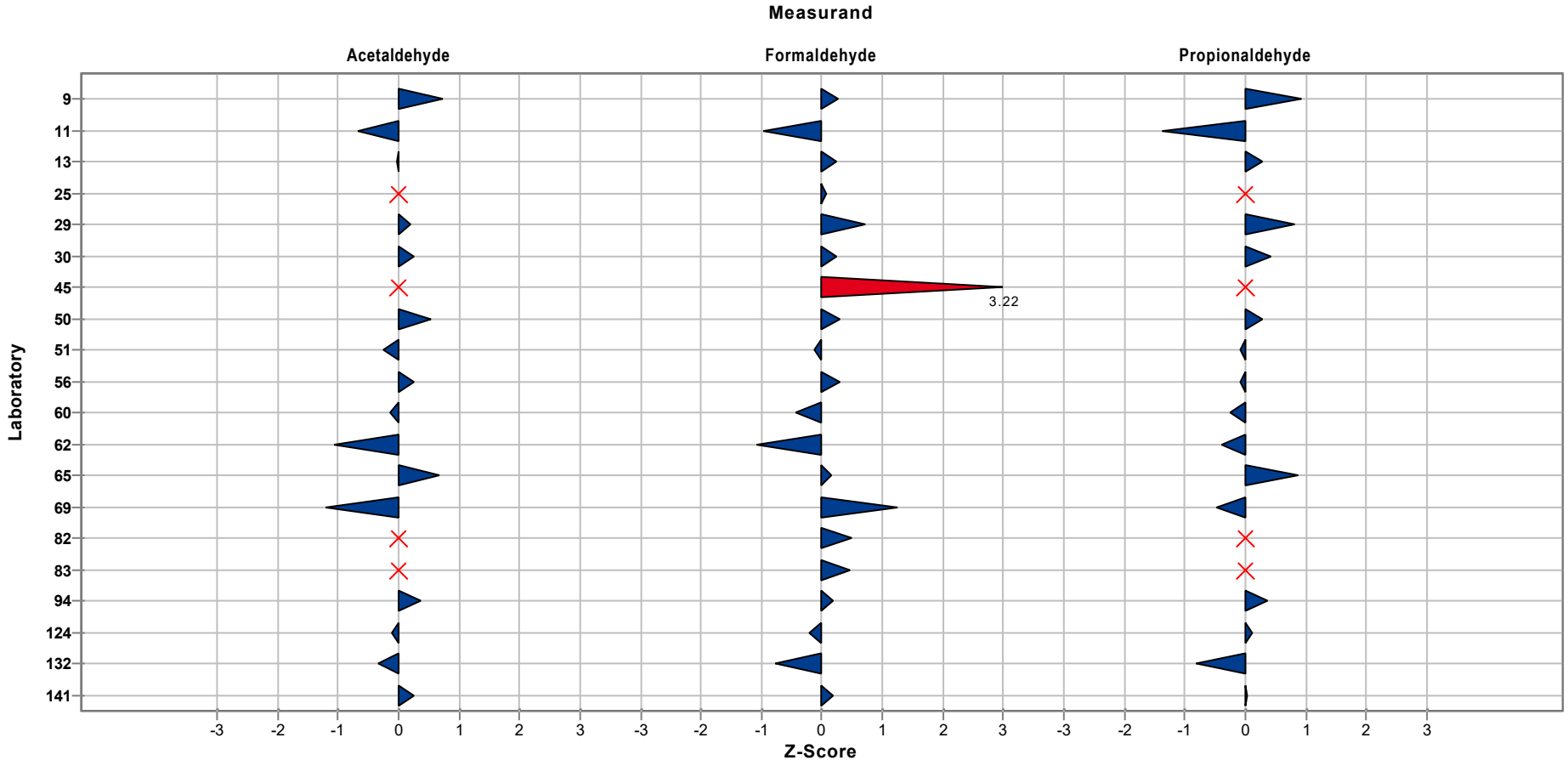
Sample chart of *Z-Scores*

Sample: **2**



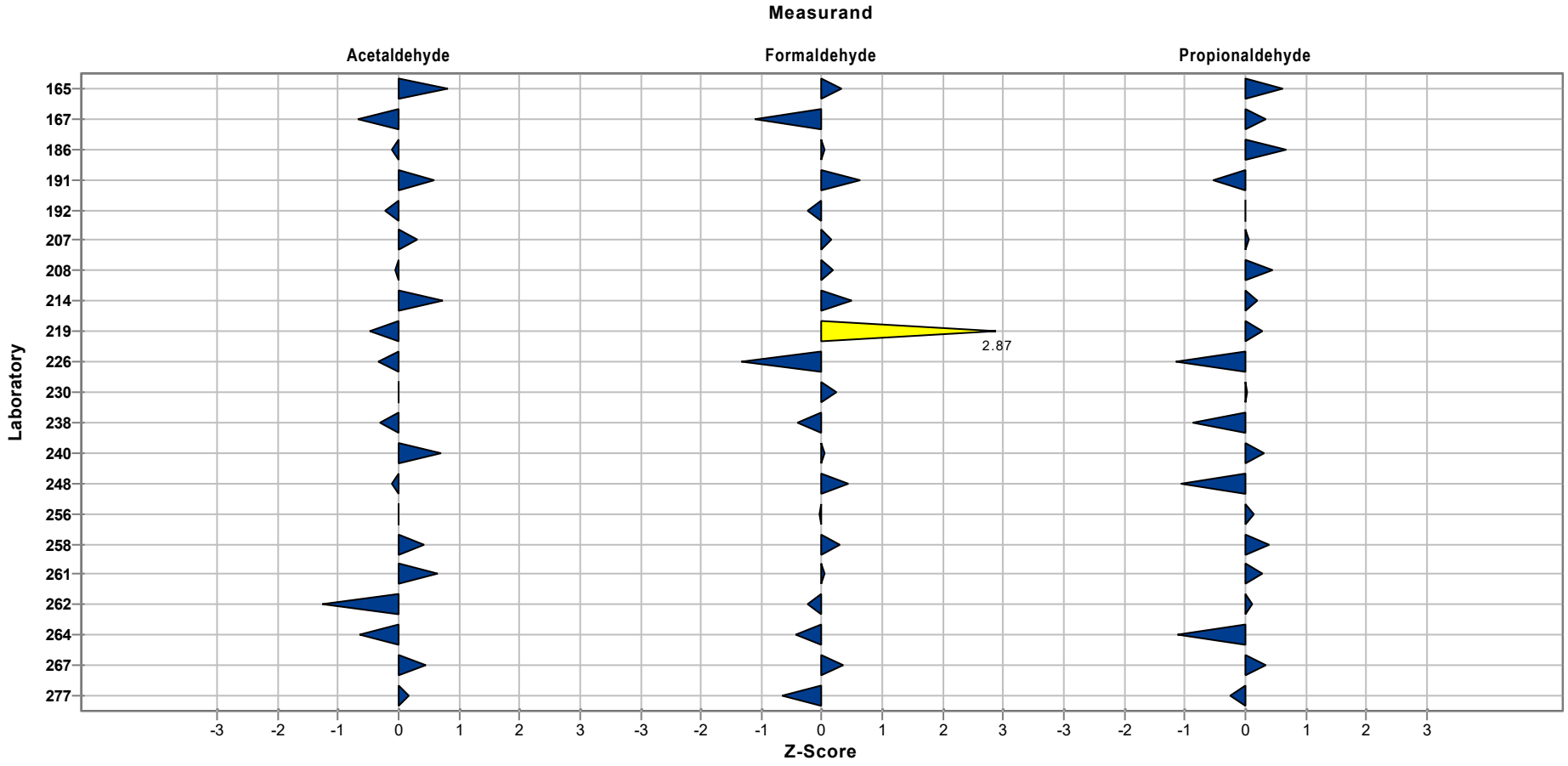
Sample chart of *Z-Scores*

Sample: 3



Sample chart of *Z-Scores*

Sample: 3



Questions and Answers

Participant	Analytical method	Start sample preparation
9	DIN ISO 16000-3:2011, aber mit ESI-MS/MS statt DAD	11.12.2024
11	HPLC according to ISO 16000-3	22/11/2024
13	AIR-ANAL-51 Aldehyden	22/11/2024
25	In Anlehnung an IFA-Arbeitsmappe Kennzahl 6045	14.11.2024
29	ISO 16000-3	21.11.2024
30	ISO 16000-3	05/12/2024 (elution)
45	NIOSH 2016 2016	17/12/2024
50	DIN EN ISO 1600-3:2023-12	18.11.2024
51	Internal method derived from DIN ISO 16000-3:2011	28/11/2024
56	U-HPLC/UV	desorption date 08/11/2024
60	HPLC-DAD	08/11/2024
62	GPLC/UV	19/11/24
65	DIN 16000-5	12.11.2024
69	HPLC	14/11/2024
82	IFA Arbeitsmappe 6045	20.11.2024
83		14/11/2024
94	ISO 16000-3/ EN 16516	19.11.2024
124	HPLC	12/6/2024
132	Intertek Internal method based on ASTM D5197-21	11/20/2024
141	HPLC-DAD	13-11-2024
165	DIN-ISO 16000-3	14/11/2024
167	ISO 16000-3	22.Nov.2024
186	ISO 16000-3	07/11/2024
191	HPLC-UV	14-11-24
192	ISO16000-3	November 14, 2024
207	ISO-16000-3	12.11.2024
208	ISO 16000-3	11/19/2024
214	DIN EN 16516	18.11.2024
219	Hausmethode HPLC-MSMS	21.11.2024

Aldehydes 2024

Participant	Analytical method	Start sample preparation
226	DIN ISO 16000-3:2023	12.11.2024
230	DIN ISO 16000-3 (Stand 2023-12)	07.11.2024
238	HPLC UV	13/11/2024
240	DIN ISO 16000-3	11.11.2024
248	IFA 6045 (11-2007)	11.11.2024
256	In Anlehnung an EPA TO-11A	12.11.2024
258	ISO 16000-3	November 13th, 2024
261	DIN-ISO16000-3_2023	11.11.2024
262	DIN 16000-3:2013	07.11.2024
264	HPLC/UV	18/11/24
267	ISO 16000-3	18/11/2024
277	HPLC-UV Vis	12 November 2024

Participant	Storage time after desorption
9	Autosampler (4°C) bzw. Tiefkühler
11	20 min at room temperature
13	Analysis took place immediately after desorption. Parts of the samples were stored in the refrigerator after desorption in case something went wrong during the analysis.
25	nein
29	nein
30	7 days in refrigerator
45	33 days in freezer
50	Kühlschrank 2 Tage, 3 Wochen
51	45 minutes - room temperature
56	17 days in a freezer
60	1h00 room temperature
62	15 jours (refrigerator)
65	Kühlschrank, ca. eine Woche
69	0 days
82	2 Tage bei 4°C
94	Nein, sie wurden direkt analysiert.
124	6 days in freezer

Participant	Storage time after desorption
132	<24 hours, storage at 8°C
141	less than 24 hours
165	Kühlschrank 4°C bis 20/11/2024
167	30 Min at room temp.
186	No storage, injection on the day
191	between 10 min to 60 min at 4°C
192	No storage after desorption
207	-
208	12 d in refrigerator
214	nein nach Desorption gleich gemessen
219	Kühlschrank
226	nein
230	nein
238	Immediatly
240	Proben wurden nach Desorption direkt analysiert.
248	Ja/2 Tage im Kühlschrank bei < 10°C
256	direkte Analyse
258	3 hours, storage in autosampler at room temperature
261	-20 °C, nachdem sie 2 Tage per Post ungekühlt transportiert wurden
262	direkt vermessen, keine Lagerung
264	<1 day (refrigerator)
267	Extracts analyzed directly after desorption (the same day), autosampler at room temperature
277	5 day refrigerate -8°C

Participant	Date of analysis	Desorption solution	Volume of desorption solution
9	12.12.2024 (Probe 1 und 2) sowie 19.12.2024 (Probe 3)	Acetonitril	5
11	22/11/2024	Acetonitrile	5 mL
13	22/11/2024	Acetonitrile	5 ml
25	14.11.2024	Acetonitril	10 ml
29	21.11.24	Acetonitril	5
30	12/12/2024	Acetonitrile	5

Participant	Date of analysis	Desorption solution	Volume of desorption solution
45	20/12/2024	Acetonitrile	10
50	18.11.2024, 20.11.2024, 06.12.2024	Acetonitril	5
51	28-29/11/2024	CH3CN	5
56	25/11/2024	acétonitrile	5 ml
60	08/11/2024	100% acetonitrile	3
62	02/12/24	acetonitrile	2ml
65	12.11. - 26.11.2024	Acetonitril	5
69	14/11/2024	Acetonitrile	5 ml
82	22.11.2024	Lt. Arbeitsmappe	10
83	20/11/2024	acetonitrile	10
94	19.11.2024	Acetonitril	5 ml
124	12/06/2024 and 12/12/2024	MeCN	20 mL
132	11/20/2024-11/21/2024	Acetonitrile	6 mL
141	14-11-2024	Acetonitril HPLC grade	10 ml
165	20/11/2024	acetonitril	3 mL
167	22.Nov.2024	Acetonitrile	6 mL filled t0 10 mL w ith purified water
186	07/11/2024	Acetonitrile	10mL
191	14-11-2024	ACN	5
192	November 14, 2024	Acetonitrile	5mL
207	12.11.2024	ACN/H2O 60/40 5mmol (NH4)HCO3	5
208	11/19/2024	Acetonitrile	3
214	18.11.2024	Acetonitril	5 ml
219	22.11.2024	Acetonitril	10,0 mL
226	12.11.2024	Acetonitril	2
230	07.11.2024	Acetonitril	10 ml
238	13/11/2024	Acetonitrile	5 mL
240	11.11.2024	Acetonitril	5 mL
248	13.11.24	Acetonitril	5 ml
256	12.11.2024	ACN	2.5 ml
258	November 13th, 2024	Acetonitrile	5 ml
261	11.11.2024-12.11.2024	Acetonitril	Elution mit 2 mL, aufgefüllt auf 5 mL
262	07.11.2024	Acetonitril	5 ml

Aldehydes 2024

Participant	Date of analysis	Desorption solution	Volume of desorption solution
264	18/11/24	Acétonitrile	5 mL
267	18/11/2024	Acetonitrile	5 mL
277	12 November 2024	Solvent Extraction with Acetonitrile	3

Participant	Chromatography system
9	Agilent 1290 Infinity Binary Pump, Sciex API 4000, Agilent 1290 Infinity Autosampler
11	UV-VIS (360 nm)
13	Agilent 1290 system w ith G7104A 1290 Flexible pump, G7117A 1290 DAD FS and G7167 B 1290 multisampler.
25	HPLC 1260 Infinity der Fa. Agilent: Pumpe G1311B, Autosampler: G1329B, Detektor: G1365D MWD VL
29	LPG, DAD, Autosampler
30	Alliance e2695 / PDA 2998
45	Varian HPLC model 9010
50	Agilent: Pumpe: 1200 Binary Pump G1312-64015-RNC Autosampler: 1200 Standard Autosampler G1329-64010-RNC Säulenofen: 1200 TCC SCV Säulenofen G1316-64011-RNC Detektor: 1200 Diode Array Detector G1315-64013-RNC
51	Pump: Agilent 1260 Infinity II G7111B - Detector: Agilent UV 1260 Infinity II G7114A
56	Ultimate 3000 , Thermofisher
60	Agilent 1260 Quat Pump, 1260 DAD VL+
65	Agilent
69	Elite LabChrom Merck Hitachi, Pump L-2130 and Autosampler L-2200
82	Agilent, Quat Pumpe G7111B, Agielnt Autosampler G7129A, Agilent 1260 DAD HS G7117A mit 60mm Flowcell
83	DAD
94	Agilent HPLC 1260 Infinity mit Degasser, Quatpump, ALS ColComp und DAD
124	Shimadzu 2050
132	Waters Alliance 2695 HPLC with 2998 PDA detector
141	Agilent Technologies 1260 Infinity Quaternary; Agilent Technologies 1260 Infinity TCC Diode Array Detector
165	HPLC Agilent 1260-DAD
167	Waters e2695 HPLC
186	Quaternary pump and photodiode array detector
191	WVD
192	Agilent 1260 Infinity II
207	Agilent 1260 Infinity LC DAD

Aldehydes 2024

Participant	Chromatography system
208	Acquity H-class, PDA-detector
214	Agilent 1260 Infinity II, Binäre Pumpe, DAD, Autosampler
219	Agilent 1290, SCIEX TripleQuad 4500
226	Dionex Ultimate 3000
230	Fa. Agilent
238	Quaternaire pump + detecteur UV + passeur multivial Agilent 1260
240	HPLC-Komplettsystem: Shimadzu Prominence-I LC-2030 Plus
248	Pumpe: LPG-3400SD / Detector: DAD-3000(RS) / FLD 3x00(RS) Autosampler: WPS-3000(RS)
256	Agilent 1100 Series; Pumpe: G1311A, Quaternary Pump, Detektor: G1315B, Autosampler: G1313A
258	Waters Acquity H-Class w ith UV detector
261	Shimadzu LC-40D XR Solvent Delivery Pump, SPD-M40 PDA Detector, SIL-40 XR Autosampler
262	LC-MS/MS
264	Shimadzu Nexera iseries
267	Agilent HPLC-DAD 1260
277	Agilent Technologies : G1311A Quaternary Pump; G1329 A Autosampler; G1314B detector 1200 VWD-VL

Participant	Refrigerated autosampler	Analytical column
9	Ja, 4°C	Phenomenex Kinetex 2.6 u C18 50 x 2.10 mm
11	No - Regulated temperature (30 °C)	Phase inverse C18, 2,7µm, diamètre = 4,6mm, L = 15cm, tube Inox
13	18°C	Agilent Extend C18 4,6mm x 150mm 5µm
25	ja, 20 °C	Zorbax Eclipse Plus C18
29	nein	Waters Xbridge Phenyl 3,5µm 4.6x150mm
30	no	Restek Allure AK 4.6 mm 5 µm
45	Yes - 10°C	SUPELCOSIL LC-18 HPLC Column
50	Ja 20°C	Restel Allure AK 5µm, 200*4,6 mm
51	No	J.T. Baker Octadecyl (C18) 250 x 4.6 mm - 5 µm
56	yes	Colonne type RSLC Carbonyl : longueur 100 mm ; diamètre 2,1 mm ; diamètre des particules 2,2 µm.
60	no	Roc C18 5µm 150x4.6mm
65	nein	C-18
69	No	Ascentis RP-Amide 25 cm x 4,6 mm
82	ohne Kühlung	Agilent Poroshell 120, EC-C18, 100mm x 4,6mm, 2,7 µm

Aldehydes 2024

Participant	Refrigerated autosampler	Analytical column
83	yes 10 degrees	c18
94	Nein	Zorbax Eclipse Plus C18, 3.9 x 150 mm, 3.5 um, Agilent
124	no	Restek C18 2.7 micron 150X4.6 mm
132	No	Restek Allure AK
141	no, autosampler at room temperature	Agilent Poroshell 120 EC-C18 50x4.6mm, 2.7µm cat.no. 6999975-902
165	nein	LC18
167	Room temp	Waters Symmetry C18 3,5 µm
186	Yes, 4°C	Acquity UPLC BEH C18, 50*2.1mm, 1.7µm
191	yes at 4°C	Poroshell 120 EC - C18
192	23°C	Inertsil ODS-HL (5µm, 4.6×250nm)
207	-	Phenomenex Kinetex C18, 100*4,6 mm, 2,6 µ, 100A
208	15 °C	HSS C18 2,1x100mm; 1,8 µm
214	Raumtemperatur 23°C	Kinetex C18
219	ja, 20°C	RP-C18
226	nein	Säule Accucore XL 4 µm, C18, 250 x 4,6 mm, Thermo Scientific 74104-254630
230	nein	MZ PAH C18, 5 µm
238	No	SB C18
240	Ja, 10 °C.	C-18-Reverse-Phase-Säule 25 cm x 4,6 mm; 5 µm
248	nein	- Acclaim™ RSLC Carbonyl 2.1 x 150mm - Acclaim™ RSLC Carbonyl 2.1 x 150mm Acclaim™ RSLC Carbonyl 2.1 x 150mm
256	nein	Supelcosil LC-18, 25 cm x 4.6 mm, 5 µm
258	No	Waters Acquity BEH C18, 1.7µm 2.1 x 50 mm
261	ohne Kühlung	C18 (5UM, 25CM X 4.6MM, DISCOVERY, MERCK)
262	nein	Nucleoshell RP 18plaus, 2,7 µm
264	Yes - 8°C	Thermo Acclaim Carbonyl
267	No, room temperature	Waters Symmetry C18, 250 mm x 4.6 mm x 5 µm
277	no	KN15VE181E2G Eurospher II 100-3 C18 3um 150 x 4,6 mm c/Guard

Participant	Mobile phase
9	Phase A: Wasser; Phase B: Acetonitril (jeweils + 0,1 % Ameisensäure)
11	Acetonitrile / Water / Methanol
13	Gradient composition milliQ:Acetonitrile

Participant	Mobile phase
25	Lösung 1: Bidest. Wasser/Acetonitril/Tetrahydrofuran (60/30/10), Lösung 2: Bidest. Wasser/Acetonitril (40/60)
29	A: 50% H2O dest., 40% Acetonitril, 10% Tetrahydrofuran B: Acetonitril
30	Acetonitrile / Water
45	50% water - 50% acetonitrile
50	ACN/H2O, Gradient 60 bis max. 95 % ACN
51	H2O/CH3CN
56	CH3CN/water
60	70% acetonitrile / 30% eau et 100% ACN
62	acetonitrile/waters
65	Reinstwasser / Methanol
69	Acetonitrile-Water
82	Acetonitril /Wasser, 60/40 v/v
83	H20/ACN/THF
94	ACN:H2O, gradient
124	MeOH/MeCN/H2O
132	Acetonitrile and Water
141	45% Water/55% Acetonitril
165	Wasser/Acetonitril 40/60
167	AcN w ith 0,1% phosphoric acid
186	Acetonitrile / Water / Tetrahydrofuran
191	ACN/H2O/THF
192	Water/Acetonitrile
207	ACN/THF 80/20 H2O
208	ACN/THF/water
214	0-2 min 30% ACN / 70% Wasser, 2-23 min zu 55% ACN / 45 % Wasser, 24 min 55% ACN / 45 % Wasser, 24 - 27 min zu 30 % ACN / 70 % Wasser, 27-30 min 30% ACN / 70 % Wasser
219	Wasser, Acetonitril + Ammoniumacetat
226	Reinstwasser/Acetonitril
230	dest. Wasser/Acetonitril, Gradientenprogramm
238	water / acetonitrile
240	60 % Wasser zu 40 % ACN, Gradient gesteigert bis 90 % ACN.
248	A) H2O / (B) ACN / 48% / 52%
256	Startbedingungen: 30% ACN, 60% Wasser, 10% THF

Participant	Mobile phase
258	Acetonitrile/water
261	Acetonitril und Wasser im Gradienten
262	Gradient mit MeOH/H2O und NH4Ac/ACN
264	Acetate buffer/Acetonitrile
267	Acetonitrile/Water
277	Acetonitrile : Water = 20 : 80

Participant	Flow rate HPLC	Wavelength	Column temperature
9	0,5	Entfällt, da MS/MS (ESI) genutzt.	30 °C
11	0.8 ml/min	360 nm	30 °C
13	1,3 ml/min	360 nm	40°C
25	1,5 ml/min	360 nm	40 °C
29	1,5	365	27
30	1.2	360 nm	30°C
45	1,3	360 nm	
50	1,4	360 nm	30 °C
51	1.9	365 nm	25 °C
56	0.45 mL/min	360 nm	28°C
60	1 ml/min	360 nm	30°C
65	1	360	25°C
69	1,5 ml/min	UV-visible 360 nm	40 ºC
82	1,0	354	20°C
83	1,2 ml/mn	360nm	40 degrees
94	1 ml/min	360 nm	30 °C
124	0.8	360 nm	30oC
132	1.2 mL/minute	350 nm for formaldehyde, 360 nm for acetaldehyde and propionaldehyde	30C
141	1 ml/min	250-500 nm	30°C
165	1,3 ml/min	360 nm	25°C
167	1,5 mL/min	360 nm	40 °C
186	0.6mL/min	360 nm	35°C
191	2.4	360	40°C

Participant	Flow rate HPLC	Wavelength	Column temperature
192	1.2mL/min	360nm	40?
207	1,5	360 nm	30°C
208	0,42 ml/min	360 nm	40 °C
214	0,6 ml/min	360 nm	23 °C
219	0,5ml/min	-- mittel MS-Detektor	40°C
226	1	360	40 °C
230	0,5ml/min	362nm	40°C
238	1.4 mL / min	365 nm	35°C
240	1,3 mL/min	360 nm	35 °C
248	0,4	360 nm	28 °C
256	2.3 ml/min, ab 9.1 Minuten 2 ml/min	360 nm	25 °C
258	0.8 ml/min	367 nm	40°C
261	1 ml/min	353 nm (Formaldehyd), 362 nm (Acetaldehyd), 364 nm (Propionaldehyd)	38 °C
262	0,5	kein UV-Detektor	25 °C
264	1 mL/min	360 nm	30°C
267	1.5 mL/min	365 nm	25 °C
277	1	360	40 °C

Participant	Calibration standard	Recovery rate
9	Fertiger Mix (ALDEHYDE/KETONE-DNPH STOCK STANDARD-13, Supelco)	Nein.
11	Ready-to-use mix, Restek	No
13	TO11/IP-6A Aldehyde/Ketone DNPH mix from Sigma-Aldrich	No
25	DNPH-Einzelstandard, Fa. Sigma-Aldrich	nein
29	Supelco CarbMethod 1004 DNPHMix 2	nein
30	Mix solution Supelco DNPH Mix-1	no
45	Ready to use mix - Restek	Yes
50	Carbonyl-DNPH-Mix, LGC	---
51	Custom Carbonyl-DNPH standard - Restek	Yes
56	CPAChem	No
60	Ready-to-use mix from AccuStandard	no
65	Einzelstandards Merck	nein

Participant	Calibration standard	Recovery rate
69	Ready to use mix, Isostandard Material S.L.	No
82	Stammlösung Formaldehyd-DNPH 100 µg/ml, Merck, CRM4M7177	Ja, <98%
83	mix 15µg/ml in acetonitrile	no
94	Aldehyde/Ketone-DNPH TO11/IP-6A Mis, Sigma-Aldrich CRM4M7285	Nein
124	Restek multiplex TO-11A used as calibrrator	No
132	individual DNPH derivatized references	No
141	ready to use standards	yes
165	supelco CRM47285-TO11/IP6A Aldehyde7Ketone-DNPH mix- Lotto ER02132325	nein
167	Individual standards from LGC	Yes
186	Ready-to-use mix from Supelco	No
191	Standard Carbonyl-DNPH Mix1 - ready-to-use from Supelco	no
192	16mix Aldehyde-DNPH manufactured by FUJIFILM Wako Pure Chemical Corporation, and JSAE-Cabin Aldehyde-DNPH 3mix	No
207	Standardmix - ERA-028 Supelco	-
208	Supelco / CRM4M7285	No
214	CARB Carbonyl-DNPH Mix 1 von Supelco CRM47649	nein
219	Fertigmix Supelco über Sigma-Aldrich	nein
226	Mix, Sigma	nein
230	Herstellung aus Einzelstandards, Fa. Supelco	nein
238	Mix 15 Aldehydes 31808 Restek	No
240	Fertiger Mix, CARB Method 1004 DNPH Mix 2, Merck	nein
248	DNPH Mix 13; Fa. neochema	nein
256	fertiger Mix: TO11/IP-6A Aldehyde/Ketone-DNPH Mix (Sigma-Aldrich)	nein
258	Ready to use mix, Supelco TraceCERT CRM4M7285	No
261	Einzelstandards von Neochema	nein
262	Multistandard von Sigma Aldrich	nein
264	Ready-to-use mix - Restek	Yes
267	Ready-to-use mix from Supelco	No
277	Derivatized Carbonyl Compounds Standard 12 analytes at 1000 µg/L in acetonitrile; Agilent Lot. 0006736811	NO