

Round-robin tests for in-house measuring laboratories

**Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung (IFA)
Institute for Occupational Safety and Health of the German Social Accident Insurance**

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Results and Evaluation

**Round-robin test
Inorganic acids, February 2016**

Part 1: volatile acids

Summary of laboratory test results

Measurand hydrochloric acid

	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
Unit	mg/m ³		mg/m ³		mg/m ³	
10	0,621	-0,55	1,540	0,35	3,100	0,38
68	0,580	-1,17	1,380	-0,73	2,710	-0,92
74	0,705	0,73	1,539	0,34	3,328	1,15
78	0,648	-0,14	1,435	-0,36	3,157	0,57
82	0,684	0,41	1,514	0,17	3,097	0,37
83	0,600	-0,87	1,567	0,53	2,830	-0,52
86	0,706	0,75	1,563	0,50	3,015	0,10
90	0,700	0,66	1,560	0,48	3,290	1,02
93	0,669	0,18	1,481	-0,05	3,045	0,20
99	0,690	0,50	1,530	0,28	3,190	0,68
100	0,664	0,11	1,454	-0,23	3,042	0,19
110	0,648	-0,14	1,542	0,36	2,317	-2,24 E
114	0,638	-0,29	1,467	-0,14	3,065	0,27
131	0,646	-0,17	1,442	-0,31	2,730	-0,86
138	0,640	-0,26	1,430	-0,39	3,080	0,32
144	0,716	0,90	1,500	0,08	3,420	1,45
147	0,660	0,05	1,630	0,95	3,070	0,28
151	0,660	0,05	1,460	-0,19	2,020	-3,23 E
174	0,692	0,53	1,470	-0,12	3,252	0,89
177	0,719	0,95	1,638	1,01	4,904	6,42 BE
178	0,570	-1,32	1,580	0,62	2,840	-0,49
195	0,590	-1,02	1,420	-0,46	2,710	-0,92
208	0,640	-0,26	1,420	-0,46	3,170	0,62
222	0,633	-0,36	1,421	-0,45	3,400	1,39
224	0,553	-1,59	1,303	-1,25	2,354	-2,12 E
239	0,692	0,53	1,507	0,13	3,146	0,54
264	0,740	1,26	1,440	-0,32	3,460	1,59

	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
280	0,690	0,50	1,440	-0,32	2,780	-0,69
–	–	–	–	–	–	–
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	28		28		28	
Mean	0,657		1,488		2,986	
Reproducibility s.d.	0,048		0,076		0,347	
Rel. reproducibility s.d.	7,27 %		5,09 %		11,63 %	
Reference value	0,678		1,550		3,210	
Target s.d.	0,066		0,149		0,299	
Rel. SDPA	10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	0,526		1,191		2,389	
Upper limit of tolerance	0,788		1,786		3,583	
Type B outliers					1	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	28		28		27	
No. of laboratories with E outliers					4	
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 >3,5						
L: Differing laboratory mean (Grubbs II)	Grubbs für 2					

Summary of laboratory test results

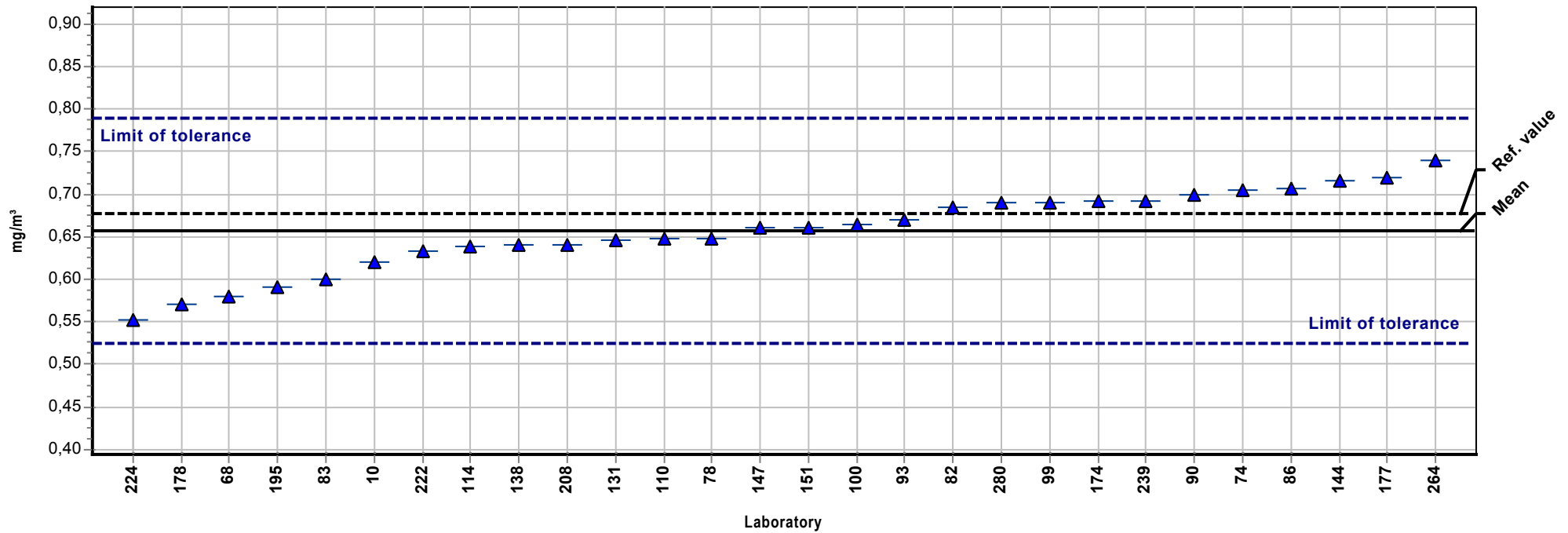
Measurand nitric acid

	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
Unit	mg/m ³		mg/m ³		mg/m ³	
10	0,550	-0,76	2,730	-0,95	1,940	0,03
68	0,530	-1,09	2,930	-0,29	1,720	-1,11
74	0,626	0,52	3,134	0,39	2,100	0,85
78	0,568	-0,46	2,856	-0,53	1,944	0,05
82	0,632	0,62	3,080	0,21	2,157	1,15
83	0,554	-0,69	3,108	0,30	2,066	0,68
86	0,593	-0,04	3,001	-0,05	1,974	0,20
90	0,650	0,92	3,120	0,34	2,590	3,39 E
93	0,617	0,37	2,957	-0,20	1,929	-0,03
99	0,710	1,93	3,170	0,51	2,470	2,77 E
100	0,596	0,01	2,971	-0,15	1,944	0,05
110	0,608	0,22	3,126	0,36	1,443	-2,54 E
114	0,527	-1,14	2,823	-0,64	1,668	-1,38
131	0,580	-0,25	2,926	-0,30	1,780	-0,80
138	0,620	0,42	3,060	0,14	1,870	-0,33
144	0,648	0,89	3,030	0,04	2,130	1,01
147	0,580	-0,25	3,430	1,37	1,830	-0,54
151	0,600	0,08	2,770	-0,82	1,640	-1,52
174	0,608	0,22	2,908	-0,36	1,900	-0,18
177	0,645	0,84	3,114	0,32	2,137	1,05
178	0,530	-1,09	3,560	1,80	1,840	-0,49
195	0,570	-0,42	3,390	1,24	1,690	-1,26
208	0,585	-0,17	2,970	-0,15	1,880	-0,28
222	0,574	-0,35	2,541	-1,58	2,238	1,57
224	0,540	-0,93	2,802	-0,71	1,583	-1,82
239	0,622	0,45	3,080	0,21	1,917	-0,09
264	0,560	-0,59	2,860	-0,52	1,660	-1,42

	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
280	0,640	0,75	3,020	0,01	2,130	1,01
–	–	–	–	–	–	–
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	28		28		28	
Mean	0,595		3,017		1,935	
Reproducibility s.d.	0,044		0,214		0,257	
Rel. reproducibility s.d.	7,34 %		7,08 %		13,27 %	
Reference value	0,669		3,150		2,360	
Target s.d.	0,060		0,302		0,193	
Rel. SDPA	10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	0,476		2,413		1,548	
Upper limit of tolerance	0,714		3,620		2,322	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	28		28		28	
No. of laboratories with E outliers					3	
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 >3,5						
L: Differing laboratory mean (Grubbs II)	Grubbs für 2					

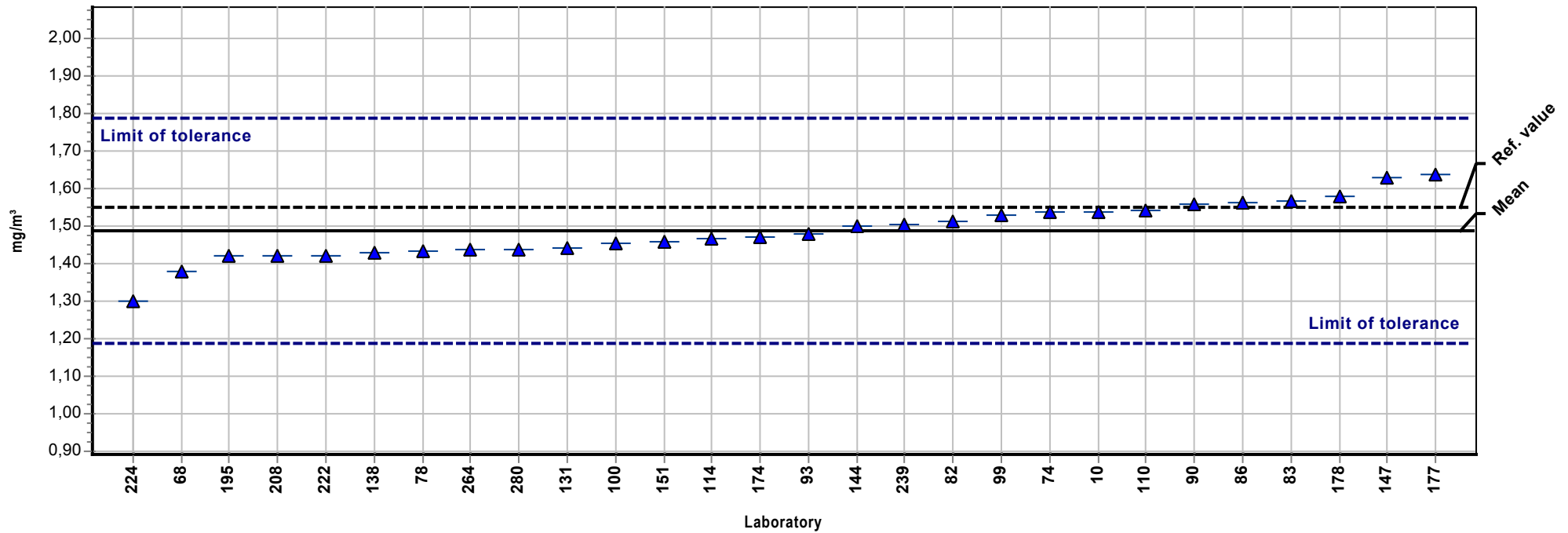
Summary results

Measurand:	hydrochloric acid	Mean:	0,657 mg/m ³
Sample:	1	Reprod. s.d.:	0,048 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	7,27%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,678 mg/m ³
No. of laboratories:	28	Range of tolerance:	0,526 - 0,788 mg/m ³ (Z-Score <= 2,00)



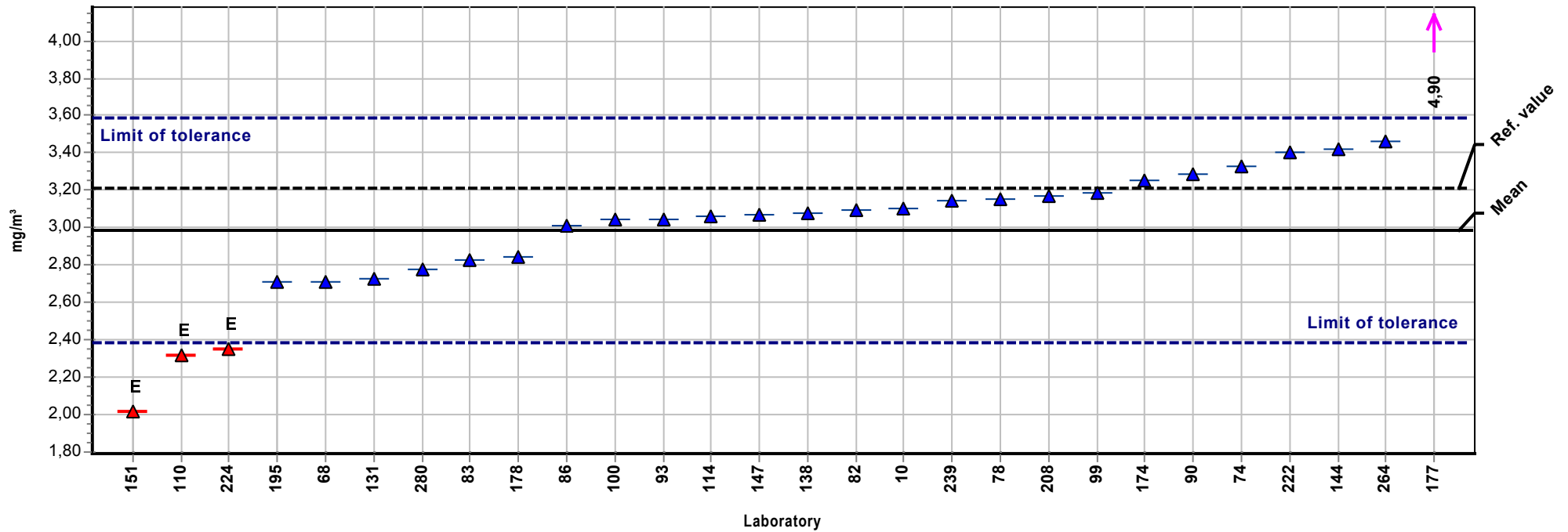
Summary results

Measurand:	hydrochloric acid	Mean:	1,488 mg/m ³
Sample:	2	Reprod. s.d.:	0,076 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	5,09%
Rel. target s.d.:	10,00% (Limited)	Reference value:	1,550 mg/m ³
No. of laboratories:	28	Range of tolerance:	1,191 - 1,786 mg/m ³ (Z-Score <= 2,00)



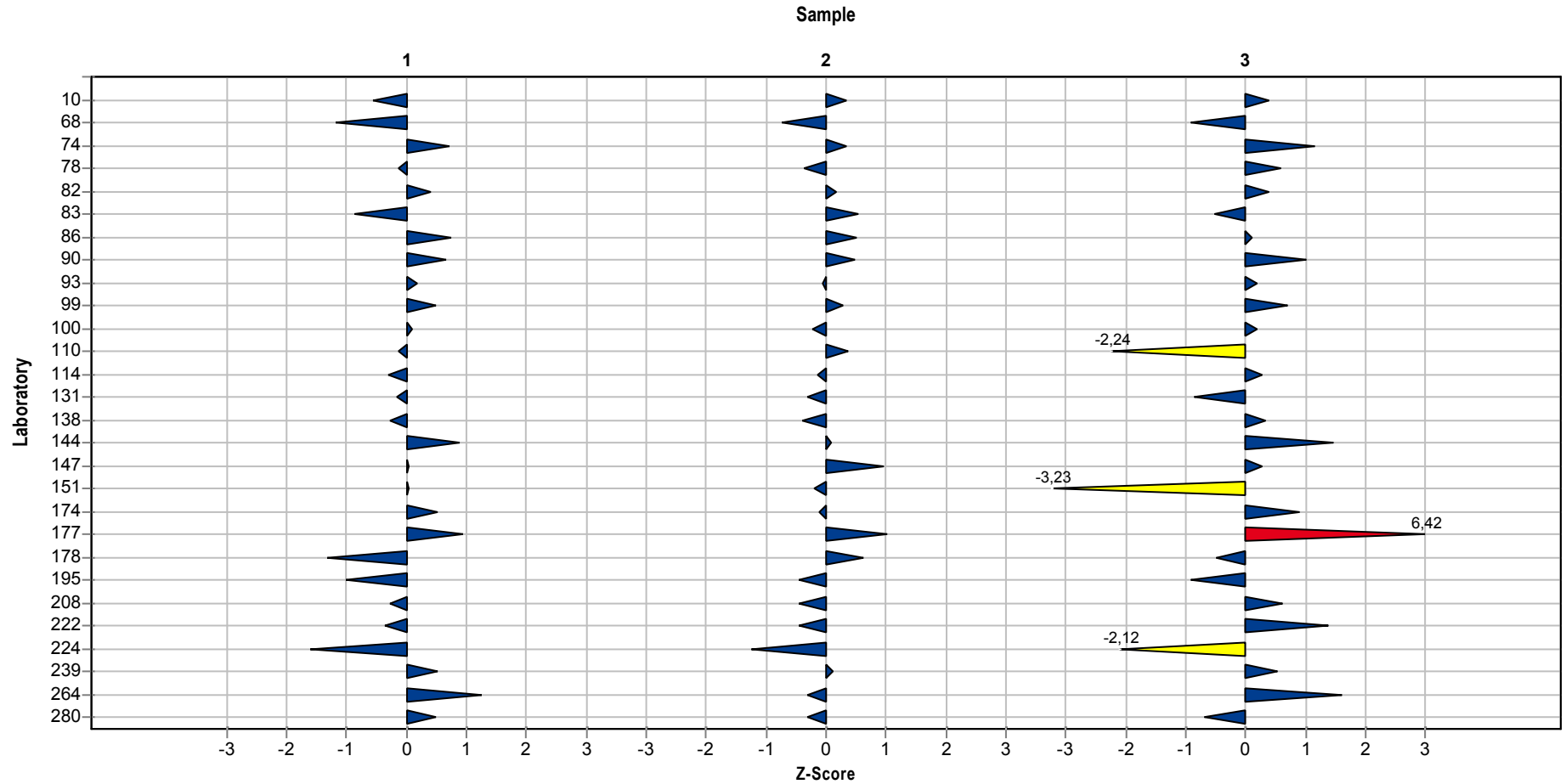
Summary results

Measurand:	hydrochloric acid	Mean:	2,986 mg/m ³
Sample:	3	Reprod. s.d.:	0,347 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	11,63%
Rel. target s.d.:	10,00% (Limited)	Reference value:	3,210 mg/m ³
No. of laboratories:	27	Range of tolerance:	2,389 - 3,583 mg/m ³ (Z-Score <= 2,00)



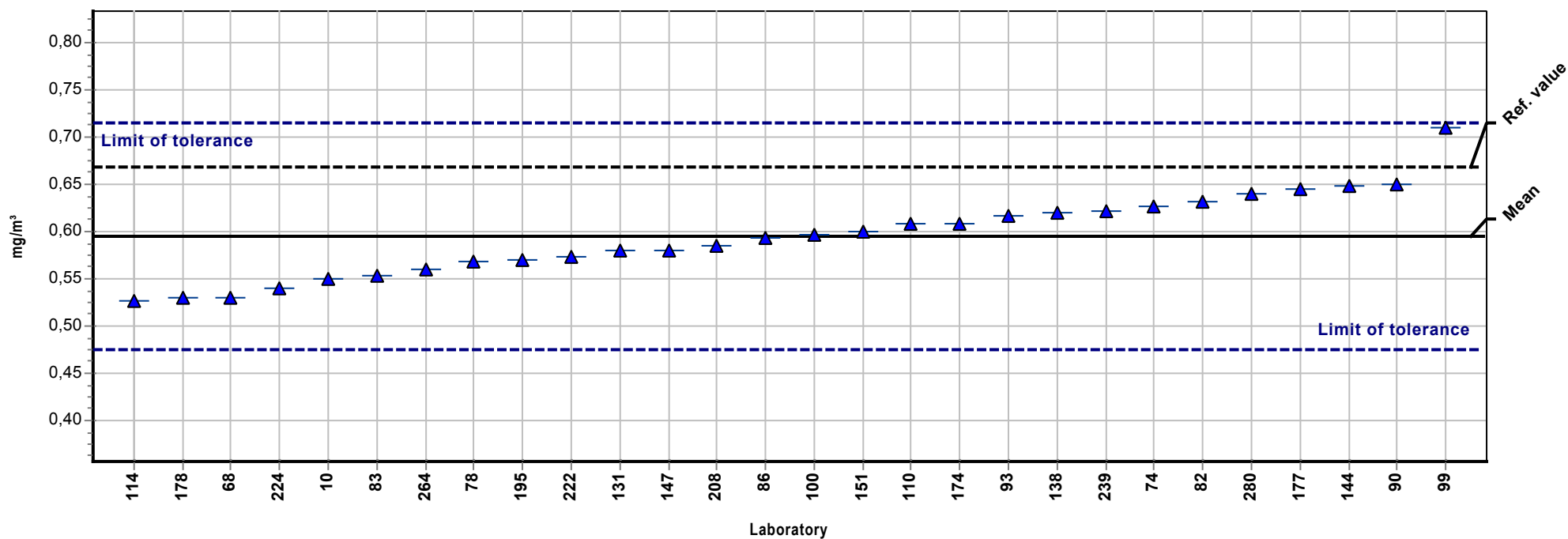
Analyte chart of Z-Score

Measurand: hydrochloric acid



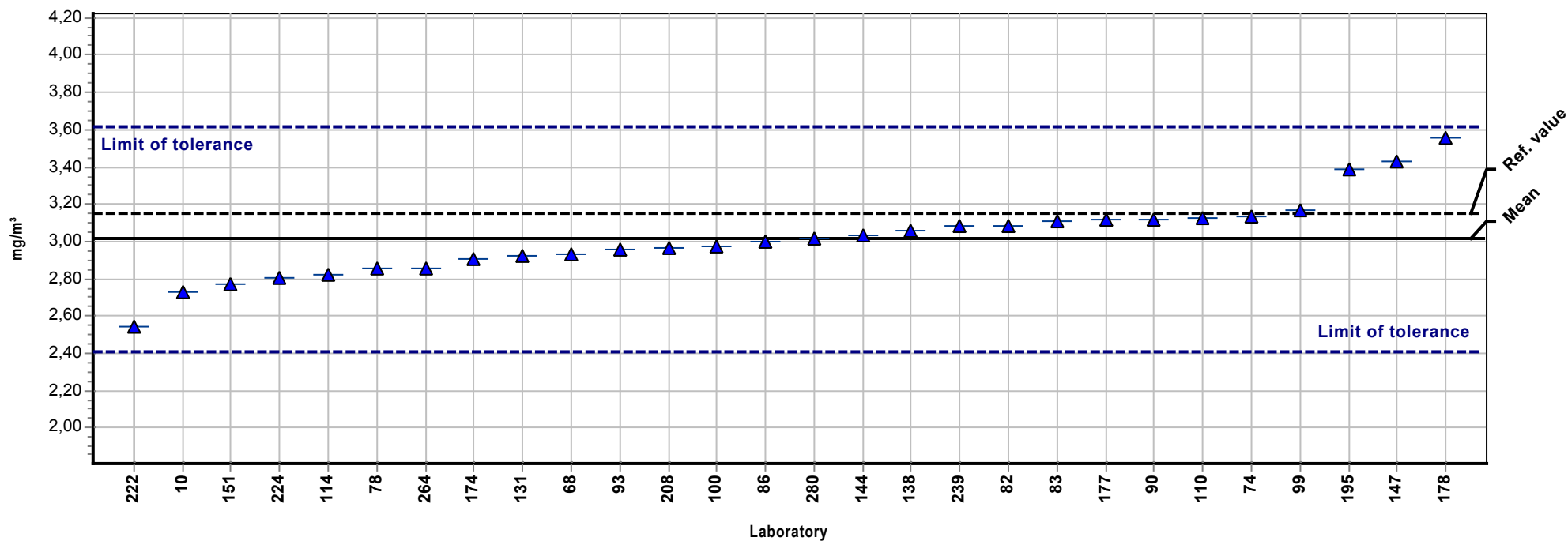
Summary results

Measurand:	nitric acid	Mean:	0,595 mg/m ³
Sample:	1	Reprod. s.d.:	0,044 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	7,34%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,669 mg/m ³
No. of laboratories:	28	Range of tolerance:	0,476 - 0,714 mg/m ³ (Z-Score <= 2,00)



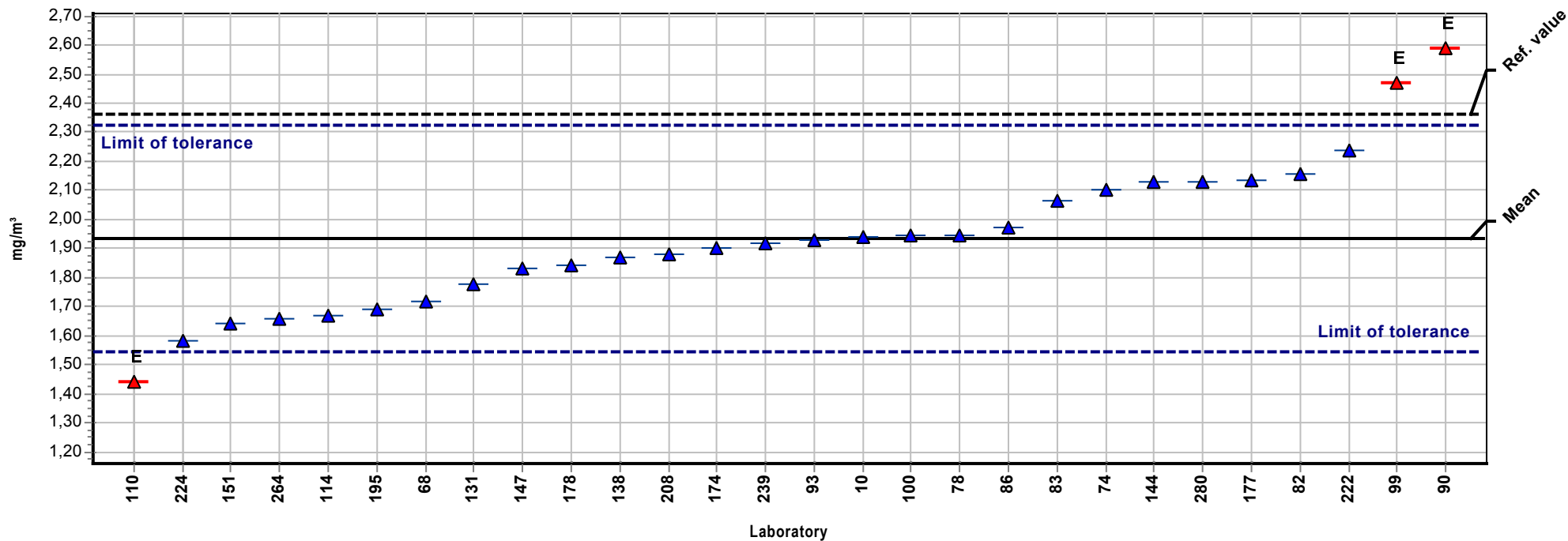
Summary results

Measurand:	nitric acid	Mean:	3,017 mg/m ³
Sample:	2	Reprod. s.d.:	0,214 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	7,08%
Rel. target s.d.:	10,00% (Limited)	Reference value:	3,150 mg/m ³
No. of laboratories:	28	Range of tolerance:	2,413 - 3,620 mg/m ³ (Z-Score <= 2,00)



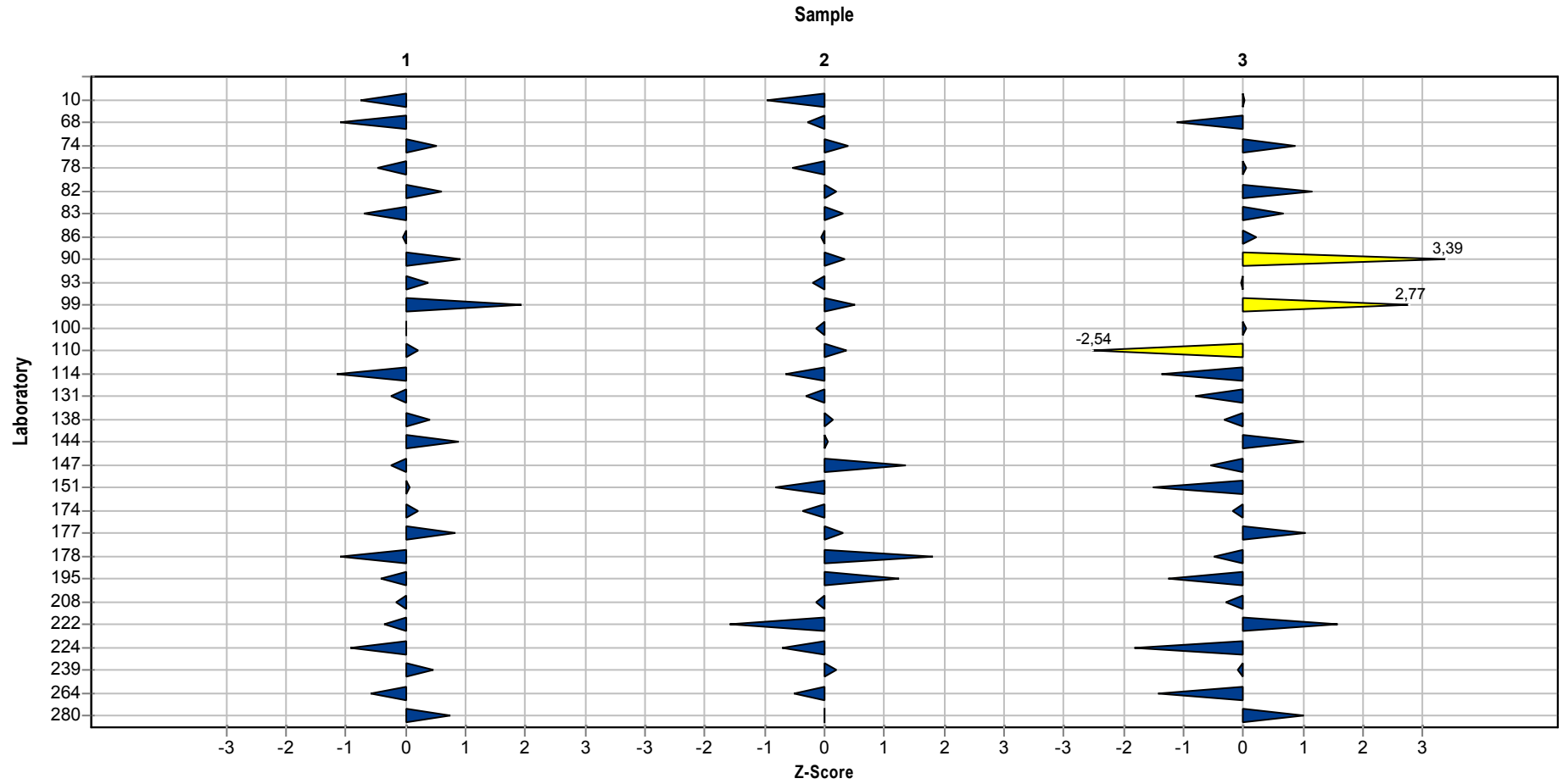
Summary results

Measurand:	nitric acid	Mean:	1,935 mg/m ³
Sample:	3	Reprod. s.d.:	0,257 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	13,27%
Rel. target s.d.:	10,00% (Limited)	Reference value:	2,360 mg/m ³
No. of laboratories:	28	Range of tolerance:	1,548 - 2,322 mg/m ³ (Z-Score <= 2,00)



Analyte chart of Z-Score

Measurand: nitric acid



Questions and Answers

Participant	Analytical method
10	Ion chromatography system
68	NIOSH
72	H2SO4/H3PO4: AA.EZM.45.03
74	HNO3 / HCl: IFA 6172; H2SO4 / H3PO4: IFA 6173
78	IFA6172 / IFA6173
82	Ionenchromatographie
83	ionic chromatography
86	Internal method
90	INRS METROPOL 009 (nouvelle référence M-53)
93	INRS Metropol Method
99	METROPOL 009
100	Ionic Chromatography
110	nach IFA Arbeitsmappe
114	Ionic Chromatography based on NF ISO 21438-1, NF ISO 21438-02, Metropol-53
131	-
138	BGIA- Verfahren 6172 und 6173
144	INRS METROPOL 009
147	International Standard ISO 21438 (volatile acids) and ISO 21438 (non-volatile acids).
151	IC conductivity
174	MetroPol Anions minéraux (http://www.inrs.fr/publications/bdd/metropol/fiche.html?refINRS=METROPOL_53)
177	Ionenchromatographie nach interner Vorschrift
195	MTA/MA-019/A90
208	Own method, based on SFS-EN ISO 10304-1, ISO 21438-1/2/3, NIOSH, OSHA and DFG methods
222	6172 und 6173
224	IC-CD
239	ionic chromatography
264	ionic chromatography
266	IC-UV

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Participant	Desorption solution
10	Aqueous
68	Impr. QFF: Wasser - Desorb. QFF: 3.6mM Natriumcarbonat-Lösung
72	H3PO4/H2SO4 Direktinjektion aus Pufferlsg.
74	lt. Vorgabe IFA 6172 /6173
78	Eluent
82	3,2 mmol Natriumcarbonat + 1 mmol Natriumhydrogencarbonat
83	desionised w ater
86	Water
90	Eau
93	Water
99	Carbonate/bicarbonate de sodium
100	w ater
110	8,0 mmol Na2CO3 + 1,0 mmol NaHCO3
114	DI w ater
131	w ater
138	Carbonatpuffer
144	H2O
147	Water deionized for volatile acids and solution Na2CO3 (3.1 mmol/L) / NaHCO3 (0.35 mmol/L) for non-volatile acids.
151	Water
174	H2O (eluent generator)
177	Reinstw assen
195	1mM NaHCO3 : 3.5 mM Na2CO3
208	w ater for impregnated filters
224	H2Od
239	w ater
264	w ater
266	NaHCO3 0,3mM

Participant	Volume of desorption solution	Desorption time
10	20	10 min
68	Impr. QFF: 10 ml - Desorb. QFF: Verdünnung von 2ml Desorptionslsg./10 ml	15 Min. Ultraschallbad, anschl. mind. 30 Min. stehen lassen
74	HNO3 / HCl: 15ml; H2SO4 / H3PO4: 14ml	15 min. im Ultraschallbad + 30 min. Standzeit

Volatile inorganic acids 1/2016

Participant	Volume of desorption solution	Desorption time
78	10 mL	30 min
82	25 mL	15 min
83	30 ml	20 mn
86	10 ml	1h mecanic agitation
90	20 ml	30 mn agitation mécanique
93	10 ml - 6ml	2 h
99	20 ml	15 min US
100	20	15 min in ultrasonic bath
110	50ml	15min, ja
114	10	10 min with ultrasonic bath
131	samples 1 and 2 : 4 ml, samples 3, 4 and 5 : 10 ml	-
138	4	
144	20	manual agitation (2 min)
147	10 mL for the volatile acids and 4 mL for the non-volatile acids.	30 min in an ultrasonic bath
151	10	90 mins no USB
174	H3PO4 & H2SO4 -> 4ml + 2 ml ; HCl & HNO3 -> 10 ml	10min
177	20 ml bzw . 10 ml	30 min Ultraschallbad
195	5 mL	1 h Orbital shaker
208	10 ml for impregnated filters	45 min ultrasonic bath
224	10	5 min ultrasonic bah
239	15	5 mn
264	10 mL	15 min
266	10mL	15 minutes

Participant	Ion Chromatographic System
10	Conductimetry detector
68	930 Compact IC Flex von Metrohm
72	Dionex ICS 2000, Leitfähigkeitsdetektor
74	Metrohm IC 881 Compact pro: UV / VIS 887 und LF 881
78	Metrohm Compact IC 781, Leitfähigkeit
82	Metrohm 861 Advanced Compact IC

Volatile inorganic acids 1/2016

Participant	Ion Chromatographic System
83	pump : isocratic - detector : conductivity - sampler : AS 40
86	Dionex - DX120
90	Dionex ICS1000 - détection conductimétrique - passeur d'échantillons AS40
93	Metrohm 850 professional IC, conductimetric detector, 858 Sample processor
99	ICS THERMO 1100/Conductimetric detector /AS-DV
100	pump + detector = Metrohm; sampler : 858 Professional Sample Processor
110	Dionex ICS 900 / AS-DV
114	Thermo Scientific ICS5000, conductivity
131	DIONEX ICS-90, dectetor: conductivity
138	DIONEX ICS-1100
144	Pump : DIONEX ICS 3000 - DP / Conductimetric detector / autosampler AS50
147	The Dionex ICS 2100 system w ith eluent generation and conductivity detection. A sampler w as used.
151	Dionex ICS5000+
174	ICS3000/DIONEX - EG eluant generator- electrochemical detector- sampler AS40
177	Dionex ICS 2000
195	DIONEX ICS-3000
208	Dionex ICS5000, AS-AP, conductivity
224	Dionex 2100 ICS
239	conductimetric detector, ASRS 300 2 mm
264	ICS 2000
266	Dionex ICS-2000, Suppressor ASRS-300, 4mm from Dionex

Participant	Analytical column	Mobile phase
10	Metrosep A supp 5 - 250 mm	NaHCO ₃ - Na ₂ CO ₃
68	Metrosep C 6 - 250/4.0 von Metrohm	3.6 mM Natriumcarbonat-Lösung
72	Dionex Ionpac AS11-HC 2x 250 mm	30 mmol KOH
74	A Supp 7	4.0 mmol/l Na ₂ CO ₃ + 2,5% Acetonitril
78	A Supp 5 / 250 mm	3,2 mmol/L Na ₂ CO ₃ + 1,0 mmol/L NaHCO ₃
82	Metrosept A-Supp 5-250	3,2 mmol Natriumcarbonat + 1 mmol Natrium hydrogencarbonat
83		KOH
86	Ion Pac AS14A 4*250mm	Na ₂ CO ₃ 8mM + NaHCO ₃ 1mM

Volatile inorganic acids 1/2016

Participant	Analytical column	Mobile phase
90	colonne Thermo AS23 (4x250 mm) + précolonne AG23 (4x50 mm)	Na ₂ CO ₃ 4.5 mM + NaHCO ₃ 0.8 mM
93	Metrohm Supp 7	Na ₂ CO ₃ - 3.4mM
99	THERMO AS23	Carbonate de sodium/bicarbonate de sodium 4.5/0.8 mM
100	Metrosep A Supp 16 - 250/4.0	Na ₂ CO ₃ 150 mM ; NaOH 15 mM
110	AG 14A / AS 14A	8,0 mmol Na ₂ CO ₃ + 1,0 mmol NaHCO ₃
114	AS15	KOH 34-65 mM gradient
131	IONPAC AS 22A	NA ₂ CO ₃ 4.5 mM + NaHCO ₃ 1.4 mM
138	DIONEX Ion Pac AS22 (4x250mm)	4,5 mmol Na ₂ CO ₃ / 1,4 mmol NaHCO ₃
144	Dionex - AG23 + AS23	4.5mM Na ₂ CO ₃ / 0.8mM NaHCO ₂
147	Pre-column AG15 and column AS 15 Dionex Ionpac	gradient KOH
151	2 mm * 250 mm Dionex AS22	4.8 mM Na ₂ CO ₃ /1.4mM NaHCO ₃
174	Column Ion Pack AS15 4X250 mm & pre-column Ion Pack AG 15 4 X 50	KOH (gradient -EG eluant generator)
177	AS 15	KOH 12-48 mmol/l
195	IONPACK AS14 250 X 4 mm	1mM NaHCO ₃ : 3.5 mM Na ₂ CO ₃
208	AS15	KOH 7-70 mM gradient
224	AS11-HC	30mM hydroxide
239	Dionex ref AS11-HC 2mm	w ater + NaOH 30mM
264	AS 18	KOH
266	IonPac AS12A	Carbonate/Bicarbonate (mM) 2.7/0.3

Participant	Flow rate	Recovery rate	Date of analysis
10	0.7	No	March 10th 2016
68	0.7 ml/min.	Nein	14./15.3.2016
72	0,38 ml/min	-	7.3. - 11.3.2016
74	0.8 ml/min.	Nein	03.03.2016 - 04.03.2016
78	0,7 mL/min	nein	03.03.16 - 09.03.16
82	0,7 mL/Minute		13.03.-18.03.2016
83	1	no	28/04/16
86	1 ml/min	no	02/03/2016
90	1 ml/mn	no	12/03/2016
93	0.8 ml/min	no recovery rate	4/03/2016

Volatile inorganic acids 1/2016

Participant	Flow rate	Recovery rate	Date of analysis
99	1 ml/min	no	04/03/2016
100	0.8	No	Cf. Measured values
110	1,10ml/min		08.04.16 und 12.04.16
114	1.4mL/min	No	01/03/2016
131	1.2 ml/min	no	07/03/2016
138		ja	bis zum 04.04.2016
144	0.5	no	15 and 18/03/2016
147	1,2 mL/min	No	16 and 17 march 2016
151	0.3	No	12/04/2016
174	1,2 mL/min		08 and 09/03/2016
177	0,3 ml/mon		08.04.2016
195	1.2	no	30/03/2016
208	0,012	no	10.3.2016
224	0.38	no	15/04/15
239	0.3	no	08/03/16
264	1		11/04/2016
266	1.5	n/a	4 apr 2016

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Results and Evaluation

**Round-robin test inorganic acids,
February/March 2016**

Part 2: non-volatile acids

Summary of laboratory test results

Measurand phosphoric acid

	Sample 1	Z score	Sample 2	Z score
Unit	mg/m ³		mg/m ³	
1	0,257	0,00	0,771	-0,18
5	0,246	-0,43	0,714	-0,90
6	0,265	0,31	0,783	-0,02
7	0,270	0,50	0,750	-0,44
10	0,232	-0,98	0,602	-2,33 E
68	0,260	0,11	0,970	2,36 E
72	0,272	0,58	0,794	0,12
74	0,232	-0,98	0,705	-1,02
78	0,260	0,11	0,787	0,03
82	0,212	-1,75	0,700	-1,08
83	0,271	0,54	< 0,010	
86	0,224	-1,29	0,640	-1,85
90	0,260	0,11	0,820	0,45
93	0,259	0,07	0,744	-0,52
99	0,260	0,11	0,730	-0,70
100	0,256	-0,04	0,821	0,46
110	0,265	0,31	0,749	-0,46
114	0,253	-0,16	0,783	-0,02
130	0,260	0,11	0,790	0,07
131	0,276	0,74	0,824	0,50
138	0,260	0,11	0,800	0,19
144	0,266	0,35	0,826	0,52
147	0,240	-0,66	0,850	0,83
151	0,264	0,27	0,741	-0,56
174	0,262	0,19	0,818	0,42
177	0,278	0,81	0,809	0,31
178	0,280	0,89	0,760	-0,32
184	0,280	0,89	0,740	-0,57
195	0,290	1,28	0,980	2,49 E
200	0,241	-0,63	0,808	0,30
201	0,259	0,07	0,718	-0,85
208	0,254	-0,12	0,729	-0,71
222	0,257	0,00	1,052	3,40 E
224	0,243	-0,55	0,746	-0,49
264	0,240	-0,66	0,660	-1,59
266	0,262	0,19	0,787	0,03
271	0,262	0,19	0,791	0,08
272	0,250	-0,28	0,720	-0,83
280	0,210	-1,83	0,270	-6,56 BE
505	0,295	1,48	1,012	2,89 E
-	-	--	-	--
Method	ISO 5725-2		ISO 5725-2	
Assessment	Z <=2,00		Z <=2,00	
No. of laboratories that submitted results	40		40	
Mean	0,257		0,785	
Reproducibility s.d.	0,018		0,093	
Rel. reproducibility s.d.	7,15 %		11,88 %	

	Sample 1 Z score	Sample 2 Z score
Reference value	0,267	0,772
Target s.d.	0,026	0,078
Rel. SDPA	10,00 %	10,00 %
Lower limit of tolerance	0,206	0,628
Upper limit of tolerance	0,308	0,942
Type B outliers		1
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	40	38
No. of laboratories with E outliers		6
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\text{-Score} > 3,5$		
L: Differing laboratory mean (Grubbs II)	Grubbs für 2	

Summary of laboratory test results

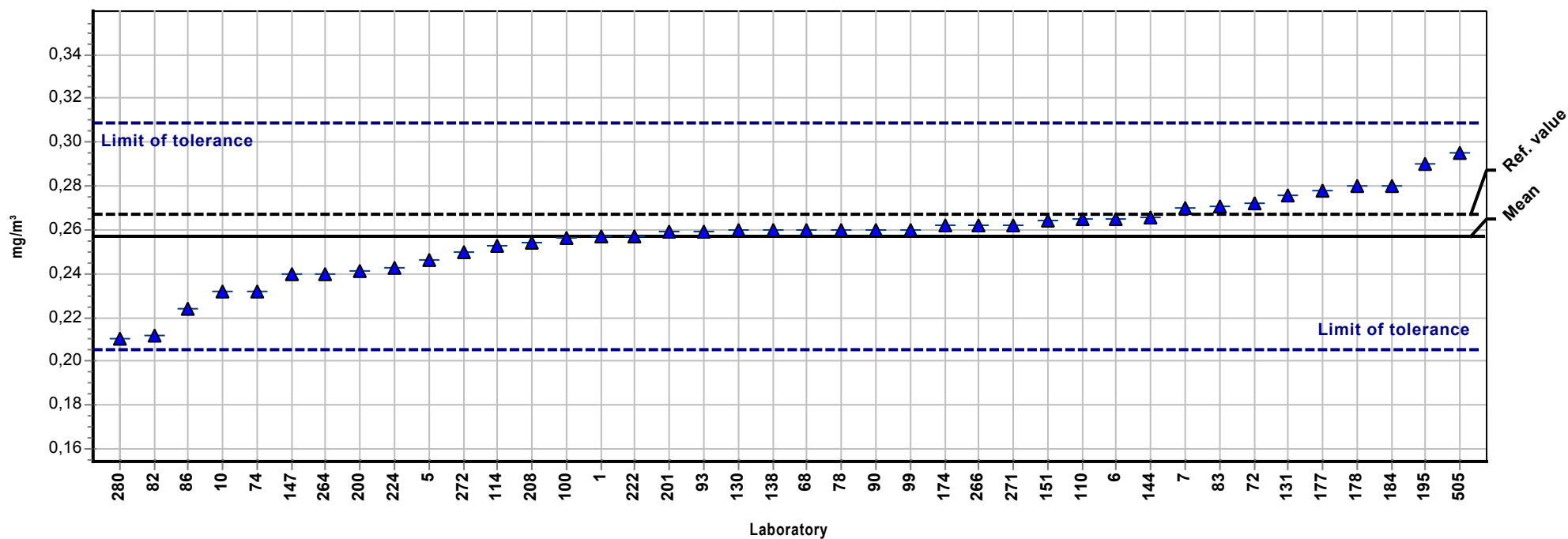
Measurand sulfuric acid

	Sample 1	Z score	Sample 2	Z score
Unit	mg/m ³		mg/m ³	
1	0,1880	0,20	0,0480	0,13
5	0,1803	-0,22	0,0410	-1,34
6	0,1750	-0,51	0,0430	-0,92
7	0,1900	0,31	0,0500	0,56
10	0,1770	-0,40	0,0467	-0,14
68	0,1800	-0,23	0,0500	0,56
72	0,1630	-1,16	0,0390	-1,77
74	0,1990	0,80	0,0500	0,56
78	0,1870	0,15	0,0481	0,15
82	0,1770	-0,40	0,0500	0,56
83	0,1850	0,04	0,0570	2,03 E
86	0,1550	-1,59	0,0420	-1,13
90	0,1900	0,31	0,0500	0,56
93	0,1830	-0,07	0,0450	-0,50
99	0,1900	0,31	0,0600	2,67 E
100	0,1840	-0,02	0,0510	0,77
110	0,1820	-0,13	0,0400	-1,56
114	0,1740	-0,56	0,0430	-0,92
130	0,1900	0,31	0,0480	0,13
131	0,1850	0,04	0,0440	-0,71
138	0,2000	0,85	0,0500	0,56
144	0,1920	0,42	0,0500	0,56
147	0,1800	-0,23	0,0500	0,56
151	0,1890	0,25	0,0460	-0,29
174	0,1790	-0,29	0,0440	-0,71
177	0,1970	0,69	0,0560	1,82
178	0,1900	0,31	0,0700	4,78 BE
184	0,1900	0,31	0,0440	-0,71
195	0,1800	-0,23	0,0500	0,56
200	0,1970	0,69	0,0470	-0,08
201	0,1830	-0,07	0,0460	-0,29
208	0,1890	0,25	0,0480	0,13
222	0,1860	0,09	0,0510	0,77
224	0,1700	-0,78	0,0372	-2,15 E
239	0,1850	0,04	0,0480	0,13
264	0,1700	-0,78	0,0500	0,56
266	0,1800	-0,23	0,0474	0,01
271	0,1860	0,09	0,0510	0,77
272	0,1700	-0,78	0,0400	-1,56
280	0,2000	0,85	0,0100	-7,89 BE
505	0,2100	1,39	0,0460	-0,29
-	-	--	-	--
Method	ISO 5725-2		ISO 5725-2	
Assessment	Z <=2,00		Z <=2,00	
No. of laboratories that submitted results	41		41	
Mean	0,1843		0,0474	
Reproducibility s.d.	0,0105		0,0048	

	Sample 1 Z score	Sample 2 Z score
Rel. reproducibility s.d.	5,67 %	10,12 %
Reference value	0,1920	0,0493
Target s.d.	0,0184	0,0047
Rel. SDPA	10,00 %	10,00 %
Lower limit of tolerance	0,1475	0,0379
Upper limit of tolerance	0,2212	0,0568
Type B outliers		2
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	41	39
No. of laboratories with E outliers		5
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\text{-Score} > 3,5$		
L: Differing laboratory mean (Grubbs II)	Grubbs für 2	

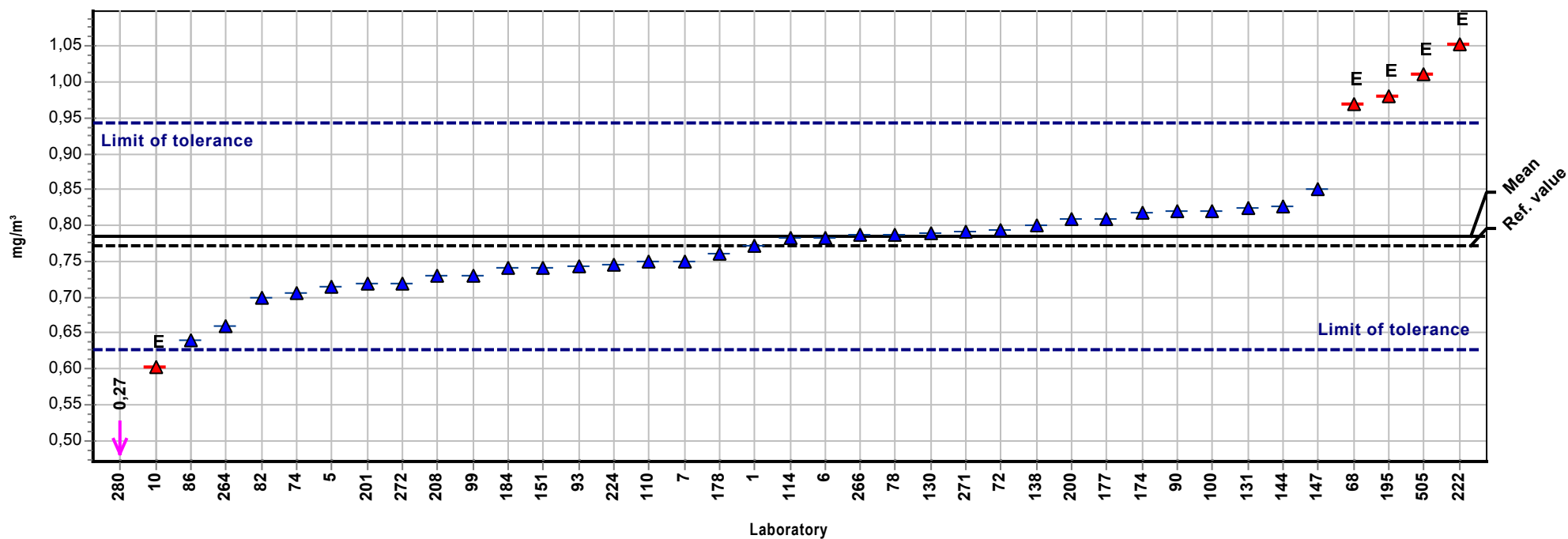
Summary results

Measurand:	phosphoric acid	Mean:	0,257 mg/m ³
Sample:	1	Reprod. s.d.:	0,018 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	7,15%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,267 mg/m ³
No. of laboratories:	40	Range of tolerance:	0,206 - 0,308 mg/m ³ (Z-Score <= 2,00)



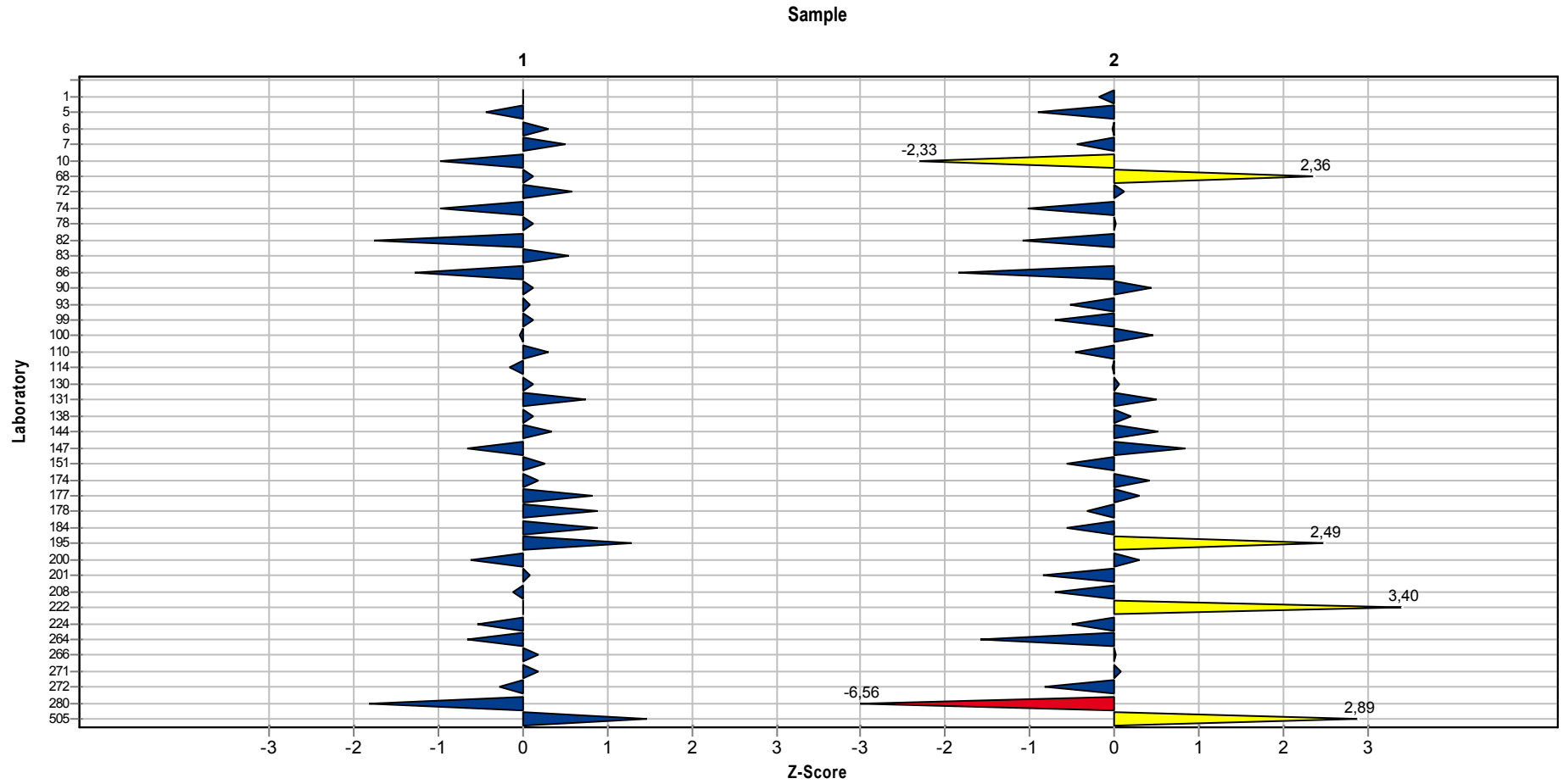
Summary results

Measurand:	phosphoric acid	Mean:	0,785 mg/m ³
Sample:	2	Reprod. s.d.:	0,093 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	11,88%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,772 mg/m ³
No. of laboratories:	38	Range of tolerance:	0,628 - 0,942 mg/m ³ (Z-Score <= 2,00)



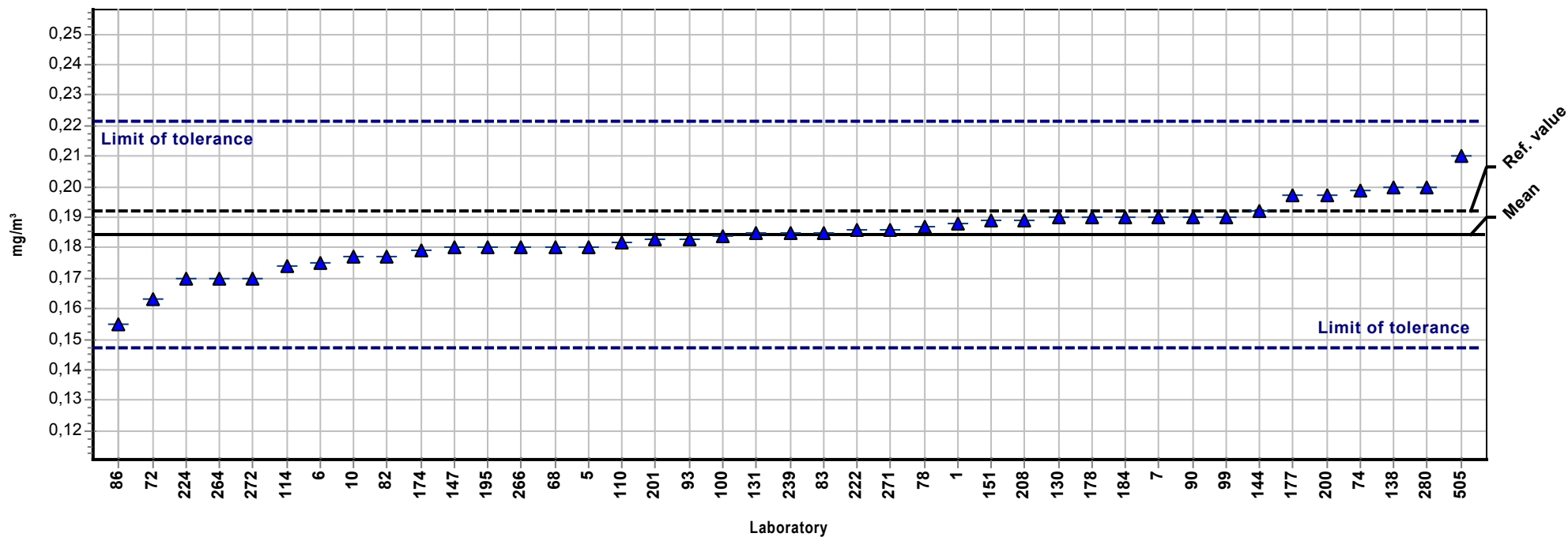
Analyte chart of Z-Score

Measurand: phosphoric acid



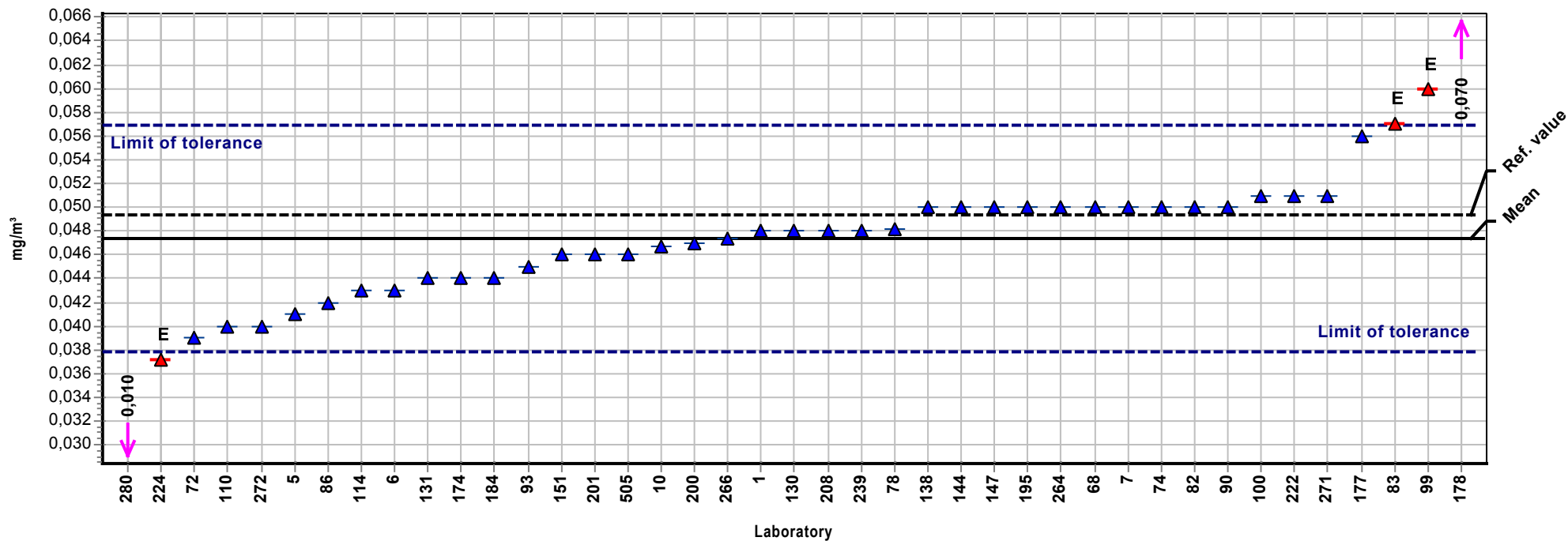
Summary results

Measurand:	sulfuric acid	Mean:	0,1843 mg/m ³
Sample:	1	Reprod. s.d.:	0,0105 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	5,67%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,1920 mg/m ³
No. of laboratories:	41	Range of tolerance:	0,1475 - 0,2212 mg/m ³ (Z-Score <= 2,00)



Summary results

Measurand:	sulfuric acid	Mean:	0,0474 mg/m ³
Sample:	2	Reprod. s.d.:	0,0048 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	10,12%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,0493 mg/m ³
No. of laboratories:	39	Range of tolerance:	0,0379 - 0,0568 mg/m ³ (Z-Score <= 2,00)



Analyte chart of Z-Score

Measurand: sulfuric acid

