

Round-robin tests for in-house measuring laboratories

**Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung (IFA)
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Results and Evaluation

Inorganic acids 2014

Summary of laboratory means

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	0,910	-2,70 E	0,371	-2,38 E	0,369	-9,17 FE
64	1,490	1,95	1,000	10,53 BE	9,300	10,96 FE
68	1,330	0,66	0,540	1,09	4,920	1,09
138	1,190	-0,46	0,500	0,26	4,910	1,06
151	1,270	0,18	0,490	0,06	4,620	0,41
163	1,274	0,21	0,555	1,39	6,264	4,11 FE
174	1,125	-0,98	0,371	-2,38 E	3,319	-2,52 E
175	0,490	-6,07 BE	0,200	-5,89 FE	1,800	-5,94 FE
188	1,170	-0,62	0,500	0,26	4,400	-0,09
195	1,160	-0,70	0,200	-5,89 FE	1,130	-7,45 FE
201	1,250	0,02	0,464	-0,48	4,280	-0,36
208	1,152	-0,76	0,488	0,02	3,869	-1,28
224	1,241	-0,05	0,484	-0,06	4,416	-0,05
239	1,295	0,38	0,497	0,20	4,629	0,43
255	1,290	0,34	0,493	0,12	4,535	0,22
257	1,630	3,07 E	0,594	2,19 E	5,160	1,63
260	1,248	0,01	0,490	0,06	4,446	0,02
264	1,180	-0,54	0,470	-0,35	4,190	-0,56
-	-	--	-	--	-	--
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	Z <=2,00		Z <=2,00		Z <=2,00	
Mean	1,247		0,487		4,438	
Reproducibility s.d.	0,153		0,058		0,476	
Rel. reproducibility s.d.	12,30 %		11,91 %		10,73 %	
Reference value	1,305		0,505		4,687	
Target s.d.	0,125		0,049		0,444	

	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
Rel. target s.d.:	10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	0,998		0,390		3,550	
Upper limit of tolerance	1,497		0,585		5,326	
Type B outliers	1		1		0	
Type F outliers	0		2		5	
No. of laboratories that submitted results	18		18		18	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	17		15		13	
Explanation of outlier types						
A: Single outlier	Grubbs					
B: Differing laboratory mean	Grubbs					
C: Excessive laboratory s.d.	Cochran					
D: Excluded manually						
E: score outside tolerance limits						
F: Score >3,5						

Summary of laboratory means

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	1,120	-2,61 BE	0,338	-2,01 E	0,271	-9,17 FE
64	1,790	1,81	0,500	1,82	3,740	1,43
68	1,490	-0,17	0,410	-0,31	3,120	-0,47
138	1,540	0,16	0,470	1,11	3,420	0,45
151	1,610	0,63	0,450	0,64	3,510	0,73
163	1,430	-0,56	0,370	-1,25	3,150	-0,37
174	1,578	0,42	0,430	0,17	3,214	-0,18
175	0,610	-5,97 BE	0,180	-5,74 BE	1,300	-6,03 FE
188	1,490	-0,17	0,470	1,11	3,500	0,69
195	0,100	-9,34 BE	0,360	-1,49	0,540	-8,35 FE
201	1,470	-0,30	0,437	0,33	3,450	0,54
208	1,437	-0,52	0,433	0,24	2,853	-1,28
224	1,499	-0,11	0,416	-0,15	3,063	-0,64
239	1,466	-0,32	0,444	0,50	3,492	0,67
255	1,552	0,24	0,445	0,52	3,555	0,86
257	1,410	-0,69	0,383	-0,94	2,860	-1,26
260	1,484	-0,20	0,424	0,02	3,163	-0,34
264	1,480	-0,23	0,410	-0,31	3,000	-0,83
-	-	--	-	--	-	--
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	Z <=2,00		Z <=2,00		Z <=2,00	
Mean	1,515		0,423		3,273	
Reproducibility s.d.	0,094		0,042		0,271	
Rel. reproducibility s.d.	6,19 %		9,95 %		8,27 %	
Reference value	1,647		0,496		3,834	
Target s.d.	0,152		0,042		0,327	

	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
Rel. target s.d.:	10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	1,212		0,338		2,618	
Upper limit of tolerance	1,818		0,508		3,927	
Type B outliers	3		1		0	
Type F outliers	0		0		3	
No. of laboratories that submitted results	18		18		18	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	15		17		15	
Explanation of outlier types						
A: Single outlier	Grubbs					
B: Differing laboratory mean	Grubbs					
C: Excessive laboratory s.d.	Cochran					
D: Excluded manually						
E: score outside tolerance limits						
F: Score >3,5						

Summary of laboratory means

Measurand phosphoric acid

Unit	Sample 1		Sample 2		Sample 3	
	mg/m ³	Z score	mg/m ³	Z score	mg/m ³	Z score
5	0,262	0,57	0,419	1,35	1,102	-0,97
10	0,257	0,37	0,371	0,05	1,150	-0,58
26	0,270	0,90	0,400	0,83	1,280	0,49
42	0,244	-0,15	0,376	0,18	1,244	0,19
64	0,250	0,09	0,380	0,29	1,230	0,08
68	0,250	0,09	0,380	0,29	1,250	0,24
72	0,262	0,58	0,389	0,54	1,274	0,44
74	0,240	-0,31	0,350	-0,52	1,180	-0,33
82	0,265	0,70	0,414	1,21	1,302	0,67
111	0,252	0,17	0,373	0,10	1,260	0,32
121	0,238	-0,39	0,381	0,32	1,238	0,14
130	0,262	0,58	0,350	-0,52	1,230	0,08
138	0,210	-1,52	0,310	-1,60	1,140	-0,66
151	0,240	-0,31	0,370	0,02	1,250	0,24
154	0,233	-0,59	0,359	-0,28	1,200	-0,17
156	0,230	-0,72	0,360	-0,25	1,200	-0,17
163	0,110	-5,56 BE	0,150	-5,94 BE	0,537	-5,60 BE
174	0,265	0,70	0,416	1,27	1,310	0,73
175	0,250	0,09	0,360	-0,25	1,200	-0,17
178	0,256	0,33	0,350	-0,52	1,693	3,87 BE
188	0,220	-1,12	0,320	-1,33	1,090	-1,07
190	0,230	-0,72	0,340	-0,79	1,270	0,40
195	0,490	9,78 BE	0,790	11,40 BE	3,930	22,20 BE
201	0,253	0,21	0,382	0,35	1,270	0,40
208	0,253	0,21	0,369	-0,01	0,983	-1,95 B
224	0,240	-0,31	0,355	-0,38	1,216	-0,04

	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
255	0,231	-0,67	0,346	-0,63	1,170	-0,41
257	0,268	0,82	0,364	-0,14	1,280	0,49
260	0,366	4,77 BE	0,582	5,76 BE	6,150	40,38 BE
264	0,230	-0,72	0,360	-0,25	1,100	-0,99
266	0,260	0,50	0,370	0,02	1,260	0,32
269	0,263	0,62	0,393	0,64	1,260	0,32
-	-	--	-	--	-	--
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	Z <=2,00		Z <=2,00		Z <=2,00	
Mean	0,248		0,369		1,221	
Reproducibility s.d.	0,015		0,025		0,062	
Rel. reproducibility s.d.	6,23 %		6,91 %		5,06 %	
Reference value	0,255		0,382		1,266	
Target s.d.	0,025		0,037		0,122	
Rel. target s.d.:	10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	0,198		0,295		0,976	
Upper limit of tolerance	0,297		0,443		1,465	
Type B outliers	3		3		5	
Type F outliers	0		0		0	
No. of laboratories that submitted results	32		32		32	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	29		29		27	
Explanation of outlier types						
A: Single outlier	Grubbs					
B: Differing laboratory mean	Grubbs					
C: Excessive laboratory s.d.	Cochran					
D: Excluded manually						
E: score outside tolerance limits						
F: Score >3,5						

Summary of laboratory means

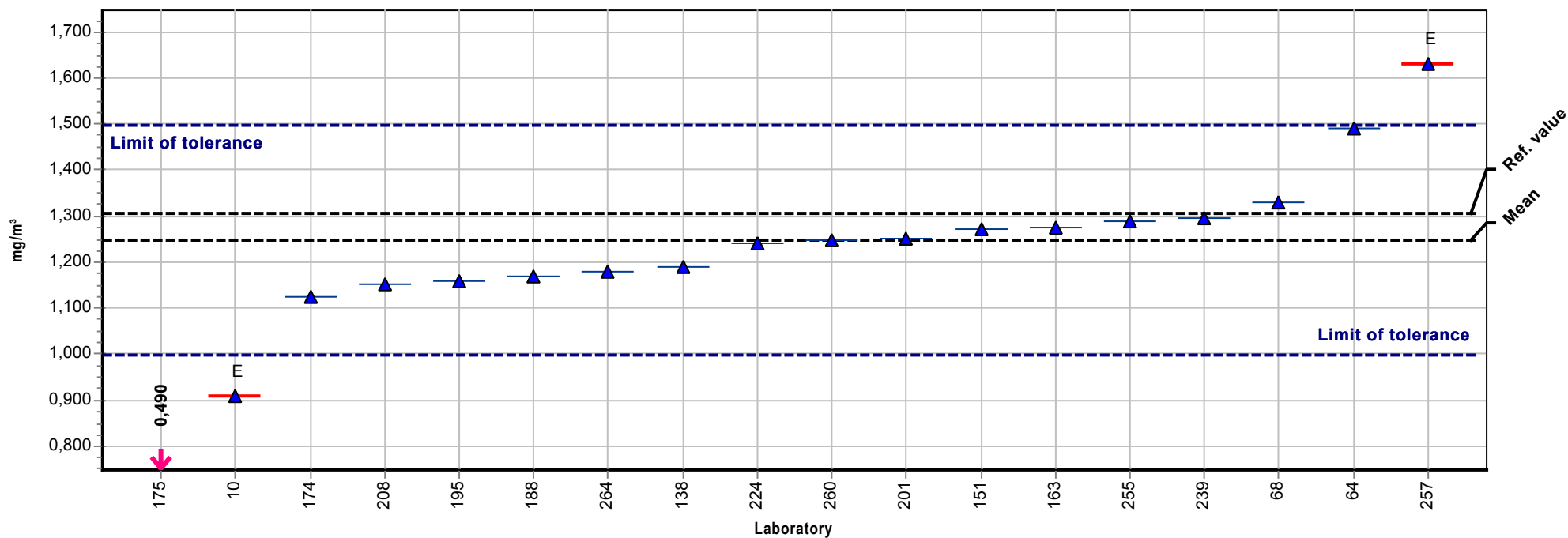
Measurand sulfuric acid

Unit	Sample 1		Sample 2		Sample 3	
	mg/m ³	Z score	mg/m ³	Z score	mg/m ³	Z score
5	0,064	0,17	0,070	1,43	0,104	0,66
10	0,061	-0,29	0,060	-0,17	0,092	-0,65
26	0,070	1,11	0,060	-0,20	0,090	-0,82
42	0,063	0,00	0,063	0,29	0,095	-0,31
64	0,063	0,00	0,062	0,13	0,110	1,22
68	0,060	-0,48	0,060	-0,20	0,090	-0,82
72	0,059	-0,63	0,057	-0,69	0,092	-0,61
74	0,070	1,11	0,060	-0,20	0,090	-0,82
82	0,081	2,86 E	0,104	6,99 BE	0,120	2,24 E
111	0,061	-0,38	0,059	-0,33	0,094	-0,42
121	0,050	-2,06 E	0,050	-1,83	0,086	-1,23
130	0,048	-2,44 E	0,057	-0,67	0,086	-1,26
138	0,070	1,11	0,070	1,43	0,110	1,22
151	0,061	-0,32	0,063	0,29	0,100	0,20
154	0,061	-0,32	0,058	-0,53	0,087	-1,12
156	0,058	-0,79	0,058	-0,53	0,093	-0,51
163	0,022	-6,51 BE	0,023	-6,24 BE	0,038	-6,12 BE
174	0,070	1,11	0,069	1,27	0,119	2,14 E
175	0,062	-0,16	0,061	-0,04	0,099	0,10
178	0,061	-0,32	0,056	-0,85	0,105	0,71
188	0,060	-0,48	0,060	-0,20	0,090	-0,82
190	0,062	-0,16	0,058	-0,53	0,092	-0,61
195	0,080	2,70 E	0,070	1,43	0,110	1,22
201	0,063	-0,08	0,063	0,27	0,100	0,20
208	0,061	-0,32	0,059	-0,36	0,095	-0,31
224	0,060	-0,48	0,059	-0,36	0,094	-0,41

	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
255	0,066	0,48	0,065	0,62	0,113	1,53
257	0,067	0,63	0,091	4,86 FE	0,097	-0,10
260	0,097	5,40 BE	0,096	5,68 FE	1,237	116,19 BE
264	0,050	-2,06 E	0,060	-0,20	0,090	-0,82
266	0,063	0,00	0,061	-0,04	0,094	-0,41
269	0,066	0,48	0,066	0,78	0,104	0,61
-	-	--	-	--	-	--
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	Z <=2,00		Z <=2,00		Z <=2,00	
Mean	0,063		0,061		0,098	
Reproducibility s.d.	0,007		0,005		0,010	
Rel. reproducibility s.d.	11,47 %		7,57 %		9,77 %	
Reference value	0,066		0,066		0,102	
Target s.d.	0,006		0,006		0,010	
Rel. target s.d.:	10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	0,050		0,049		0,078	
Upper limit of tolerance	0,076		0,073		0,118	
Type B outliers	2		2		2	
Type F outliers	0		2		0	
No. of laboratories that submitted results	32		32		32	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	30		28		30	
Explanation of outlier types						
A: Single outlier	Grubbs					
B: Differing laboratory mean	Grubbs					
C: Excessive laboratory s.d.	Cochran					
D: Excluded manually						
E: score outside tolerance limits						
F: Score >3,5						

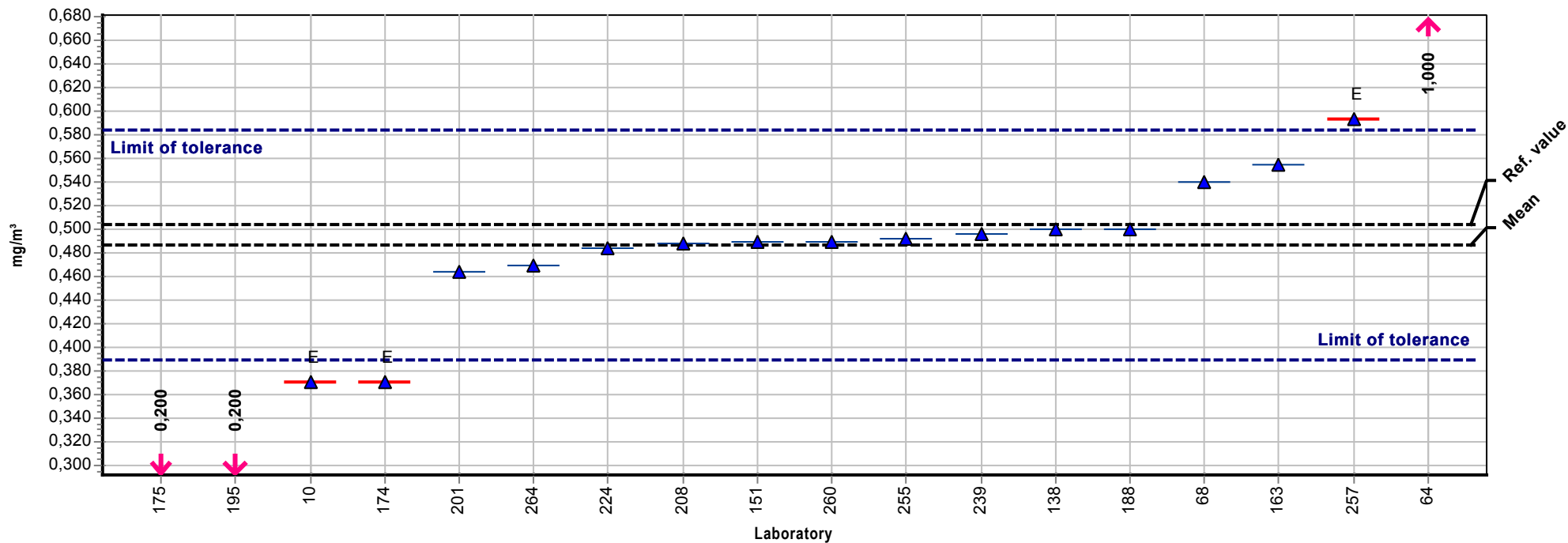
Summary results

Measurand:	hydrochloric acid	Mean:	1,247 mg/m ³
Sample:	1	Reprod. s.d.:	0,153 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	12,30%
Rel. target s.d.:	10,00% (Limited)	Reference value:	1,305 mg/m ³
No. of laboratories:	17	Range of tolerance:	0,998 - 1,497 mg/m ³ (Z-Score <= 2,00)



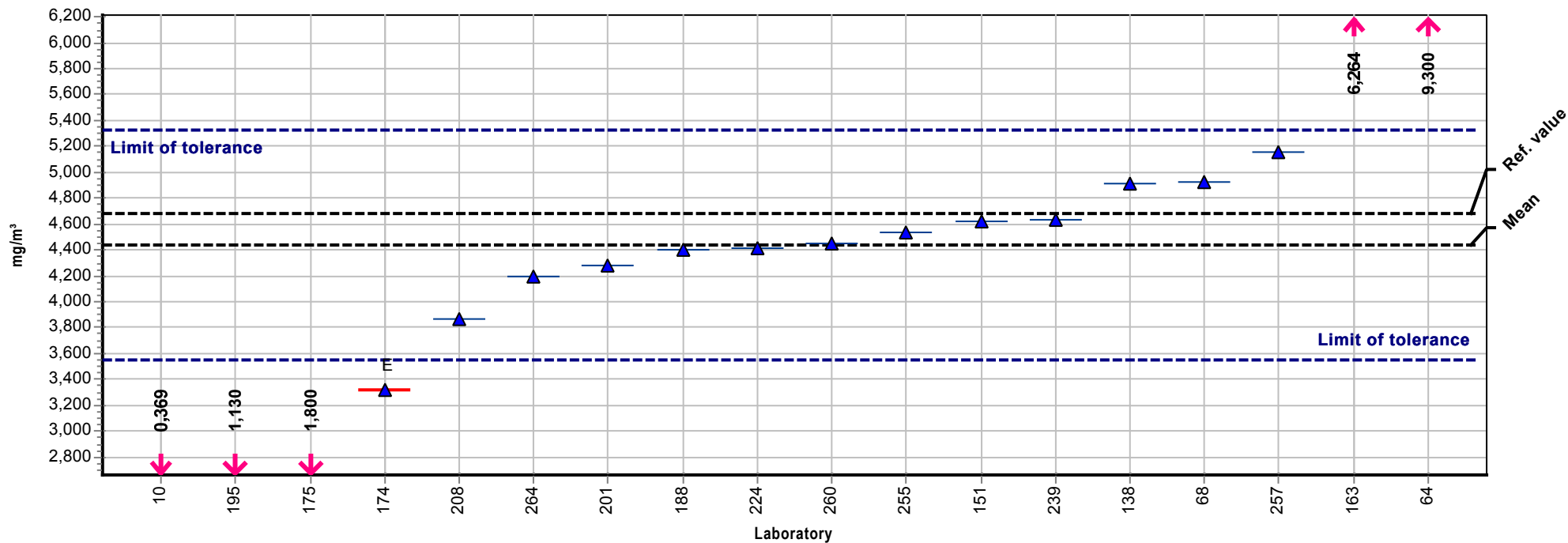
Summary results

Measurand:	hydrochloric acid	Mean:	0,487 mg/m ³
Sample:	2	Reprod. s.d.:	0,058 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	11,91%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,505 mg/m ³
No. of laboratories:	15	Range of tolerance:	0,390 - 0,585 mg/m ³ (Z-Score <= 2,00)



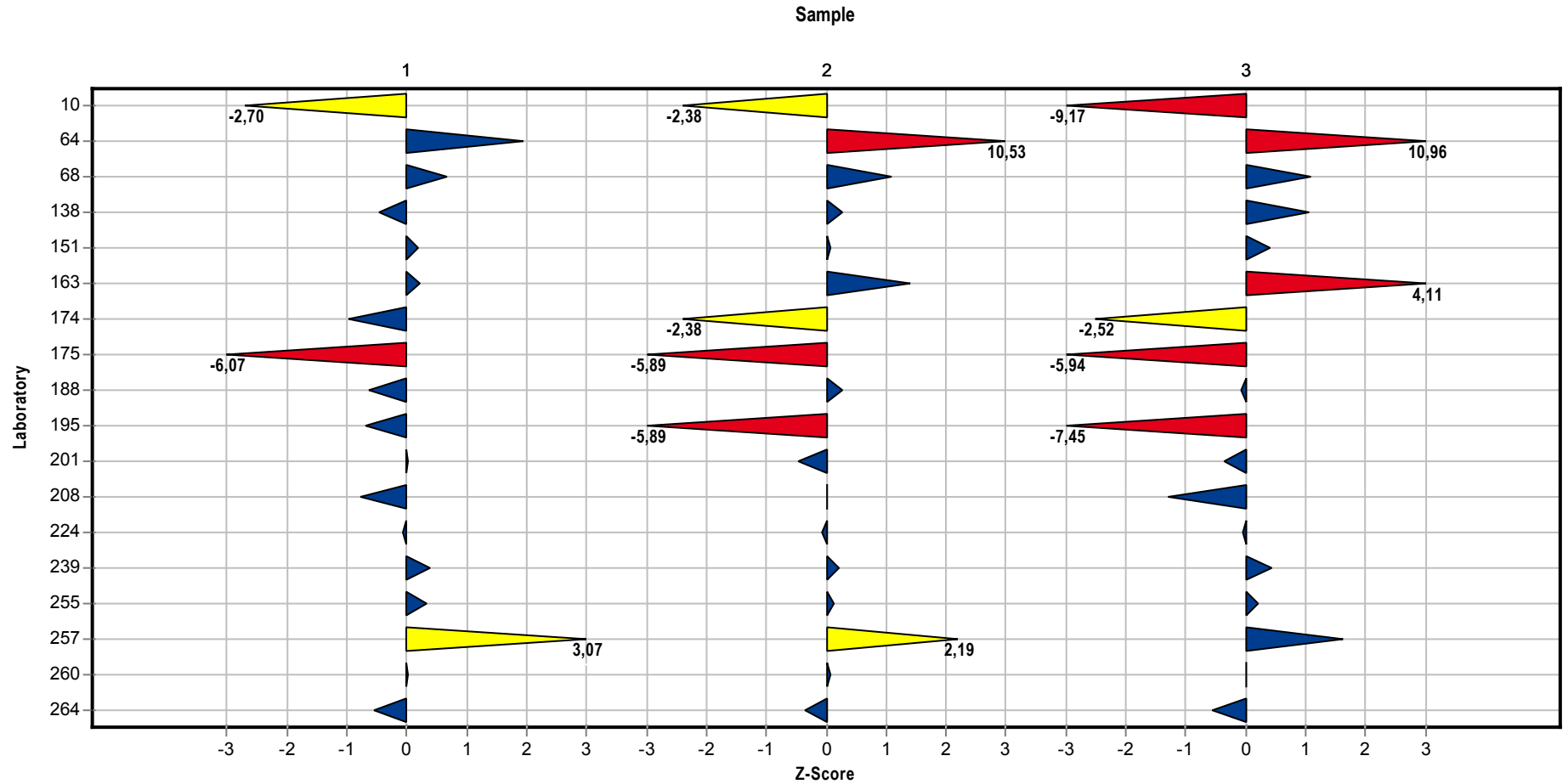
Summary results

Measurand:	hydrochloric acid	Mean:	4,438 mg/m ³
Sample:	3	Reprod. s.d.:	0,476 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	10,73%
Rel. target s.d.:	10,00% (Limited)	Reference value:	4,687 mg/m ³
No. of laboratories:	13	Range of tolerance:	3,550 - 5,326 mg/m ³ (Z-Score <= 2,00)



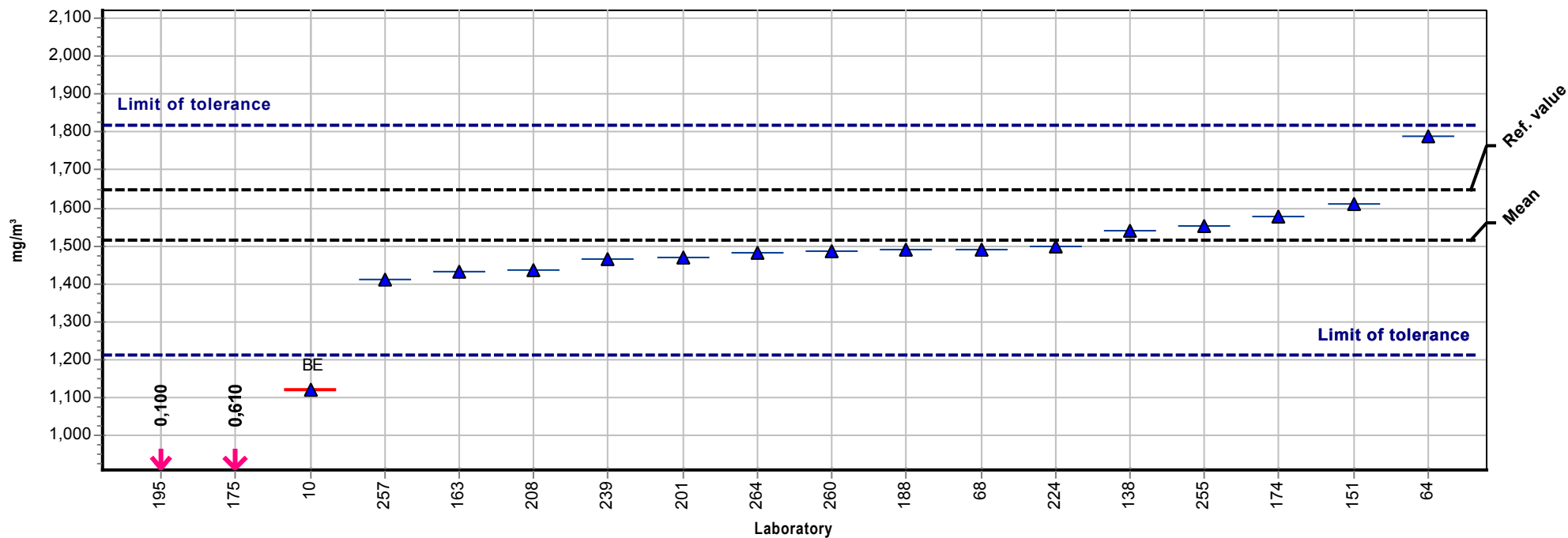
Analyte chart of Z-Scores

Measurand: hydrochloric acid



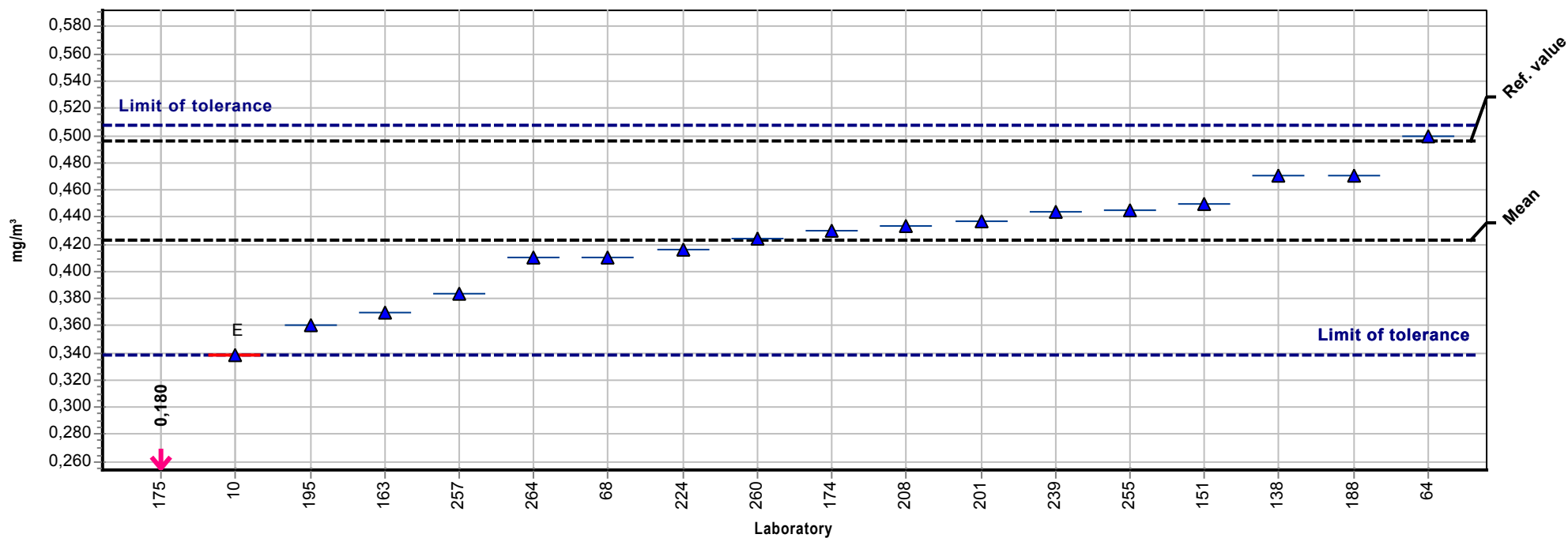
Summary results

Measurand:	nitric acid	Mean:	1,515 mg/m ³
Sample:	1	Reprod. s.d.:	0,094 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	6,19%
Rel. target s.d.:	10,00% (Limited)	Reference value:	1,647 mg/m ³
No. of laboratories:	15	Range of tolerance:	1,212 - 1,818 mg/m ³ (Z-Score <= 2,00)



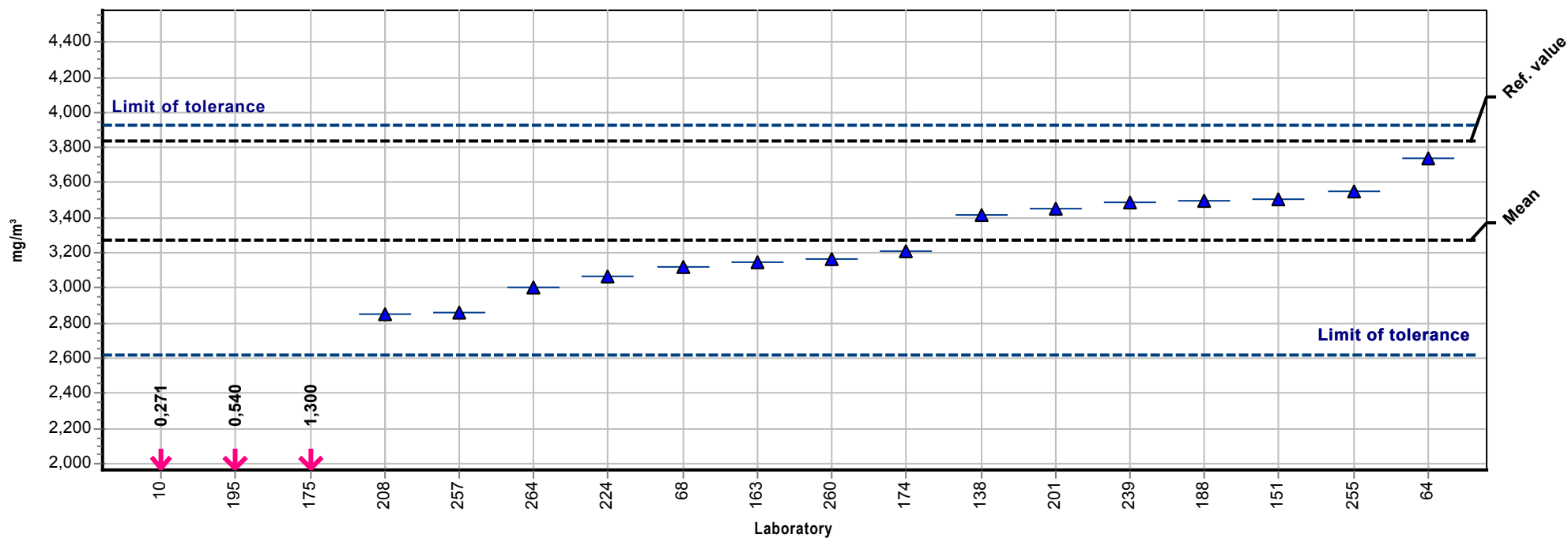
Summary results

Measurand:	nitric acid	Mean:	0,423 mg/m ³
Sample:	2	Reprod. s.d.:	0,042 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	9,95%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,496 mg/m ³
No. of laboratories:	17	Range of tolerance:	0,338 - 0,508 mg/m ³ (Z-Score <= 2,00)



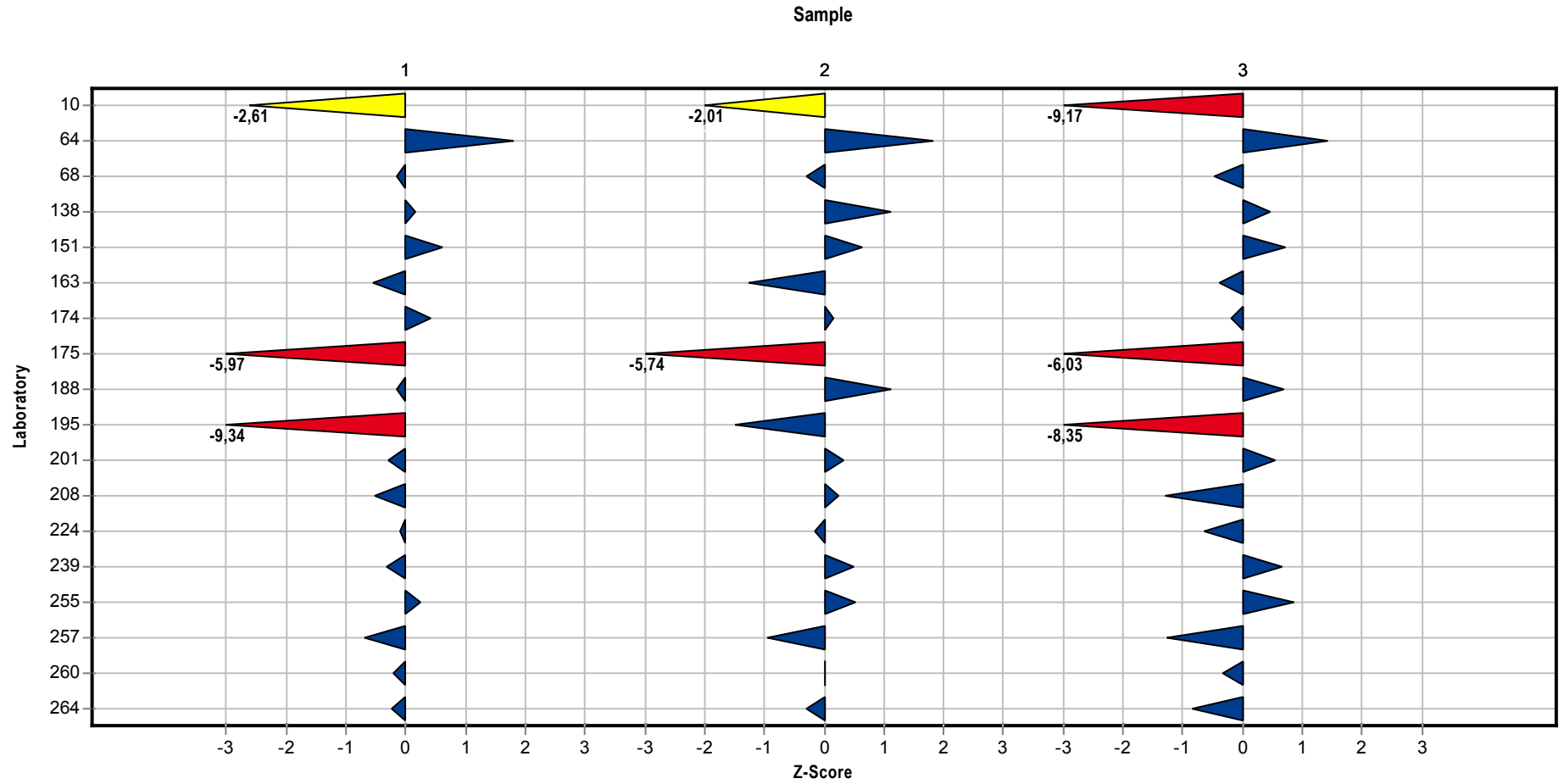
Summary results

Measurand:	nitric acid	Mean:	3,273 mg/m ³
Sample:	3	Reprod. s.d.:	0,271 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	8,27%
Rel. target s.d.:	10,00% (Limited)	Reference value:	3,834 mg/m ³
No. of laboratories:	15	Range of tolerance:	2,618 - 3,927 mg/m ³ (Z-Score ≤ 2,00)



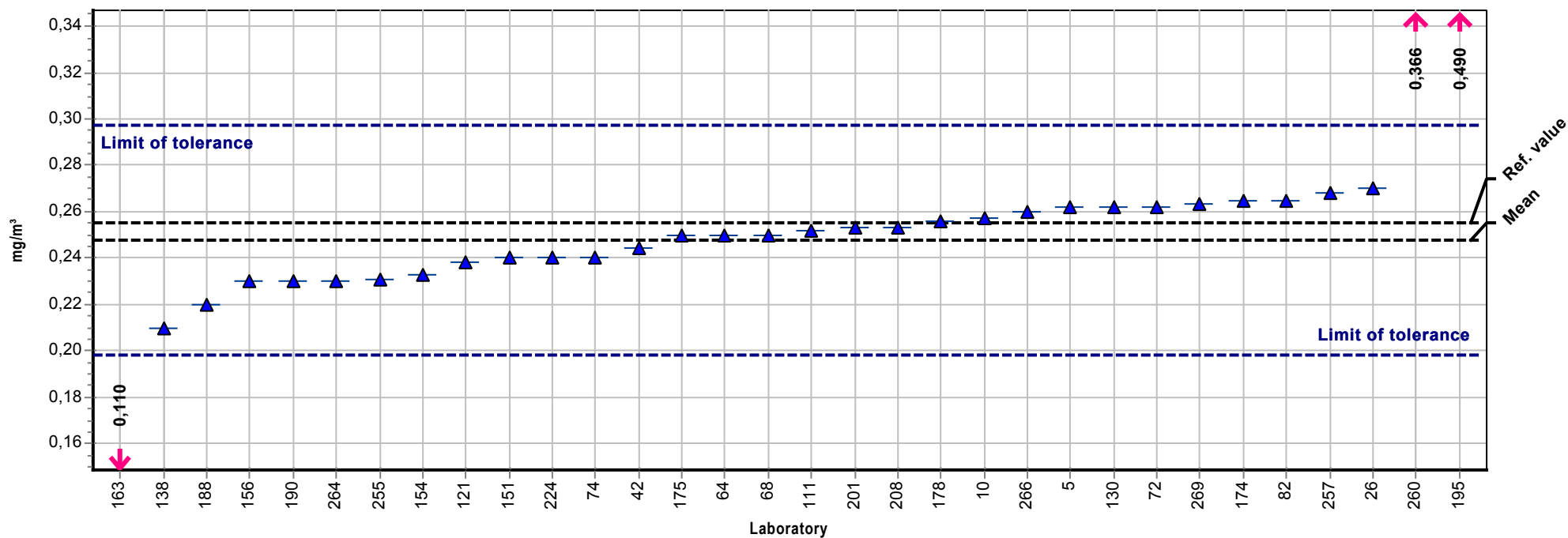
Analyte chart of Z-Scores

Measurand: nitric acid



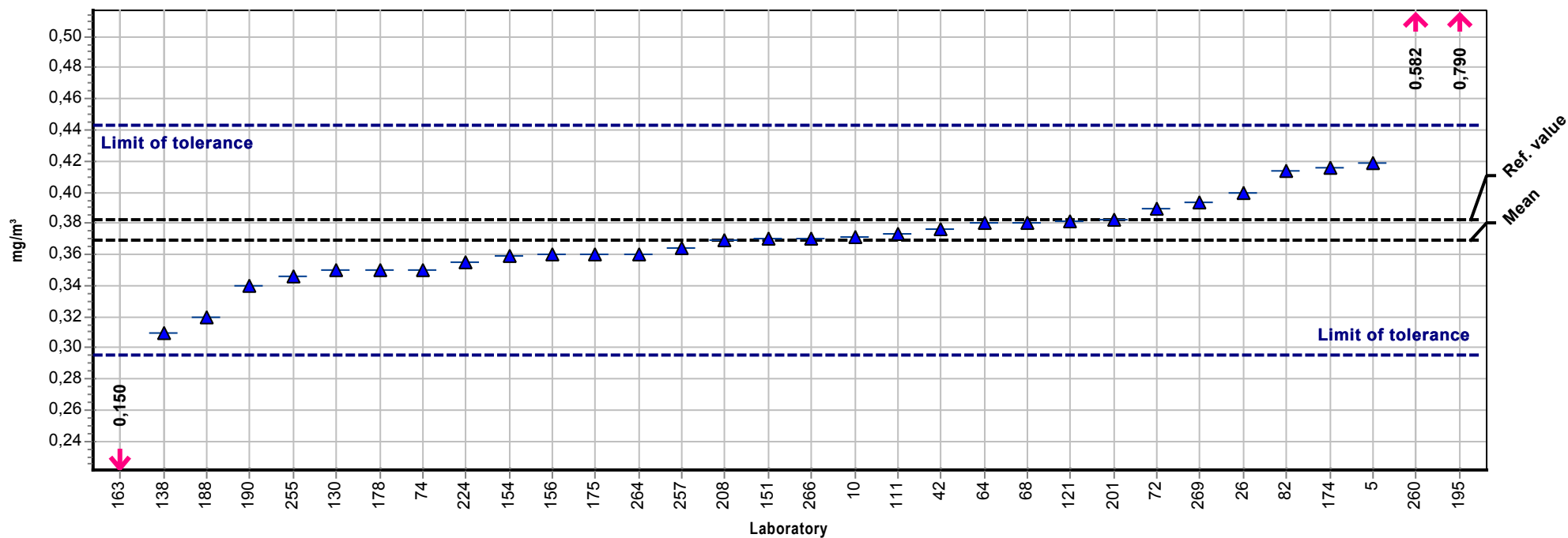
Summary results

Measurand:	phosphoric acid	Mean:	0,248 mg/m ³
Sample:	1	Reprod. s.d.:	0,015 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	6,23%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,255 mg/m ³
No. of laboratories:	29	Range of tolerance:	0,198 - 0,297 mg/m ³ (Z-Score <= 2,00)



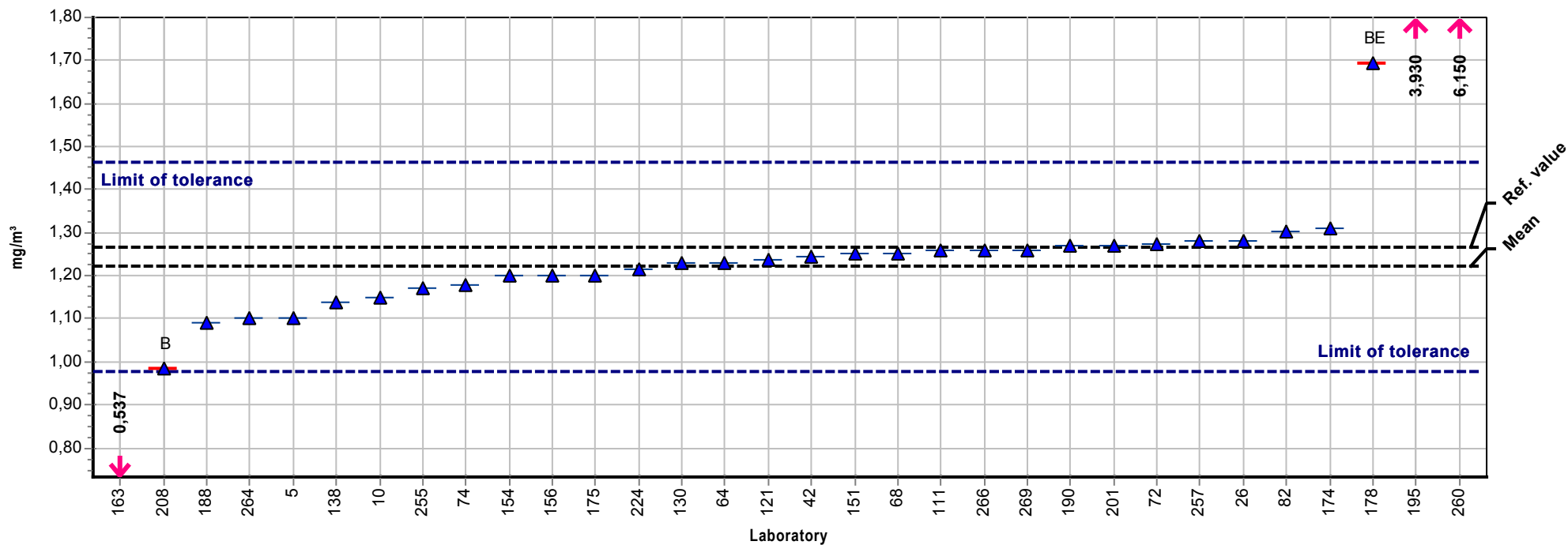
Summary results

Measurand:	phosphoric acid	Mean:	0,369 mg/m ³
Sample:	2	Reprod. s.d.:	0,025 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	6,91%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,382 mg/m ³
No. of laboratories:	29	Range of tolerance:	0,295 - 0,443 mg/m ³ (Z-Score <= 2,00)



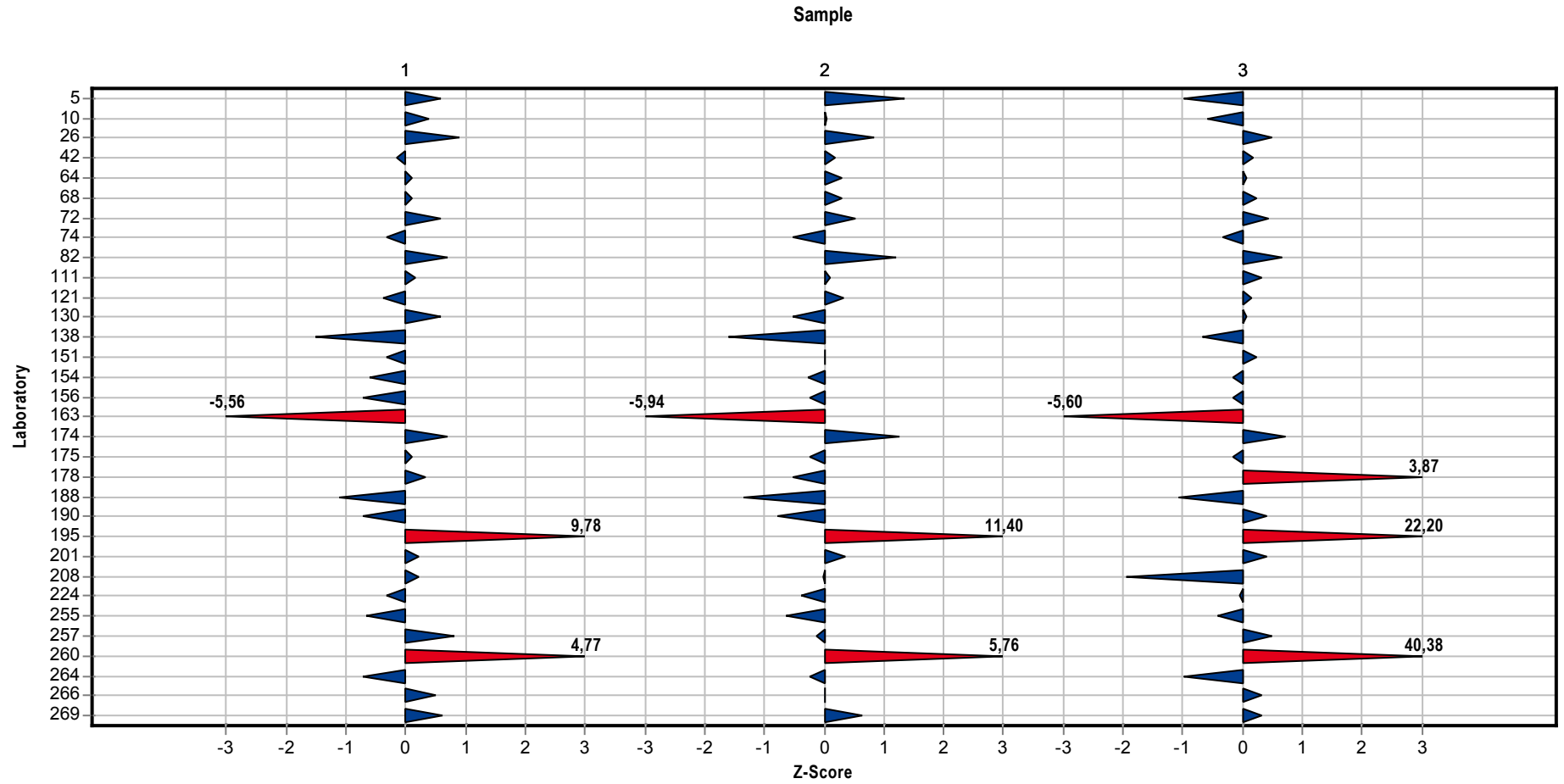
Summary results

Measurand:	phosphoric acid	Mean:	1,221 mg/m ³
Sample:	3	Reprod. s.d.:	0,062 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	5,06%
Rel. target s.d.:	10,00% (Limited)	Reference value:	1,266 mg/m ³
No. of laboratories:	27	Range of tolerance:	0,976 - 1,465 mg/m ³ (Z-Score <= 2,00)



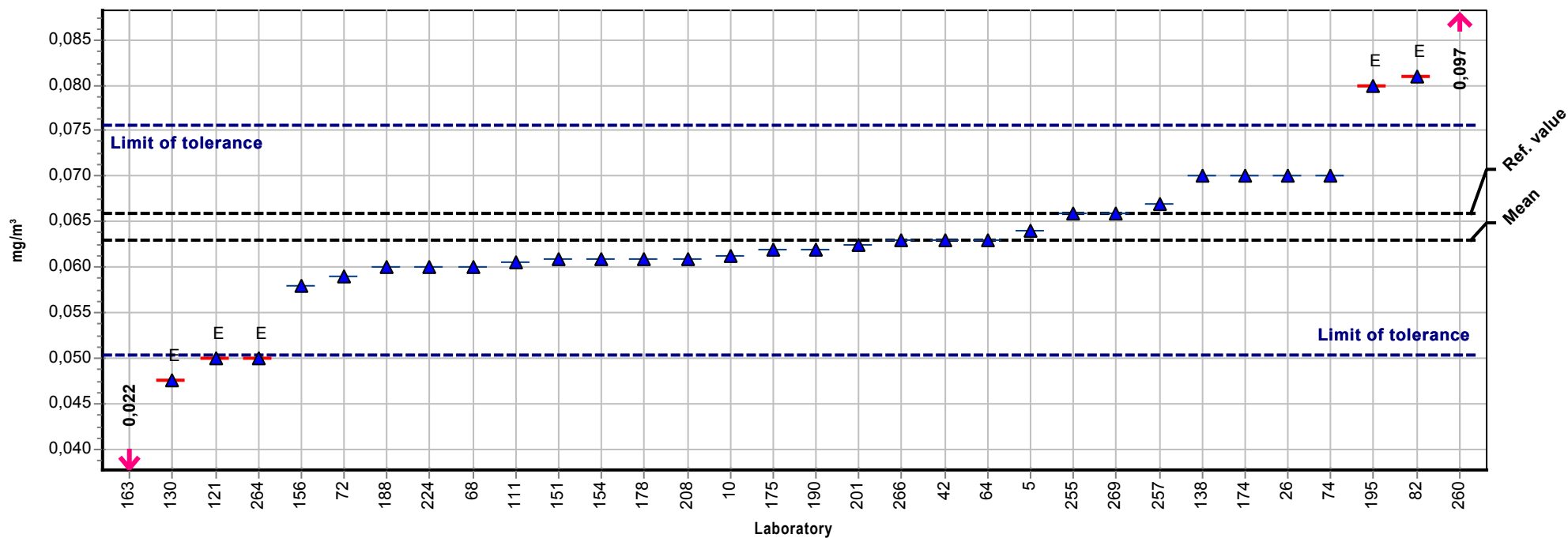
Analyte chart of Z-Scores

Measurand: phosphoric acid



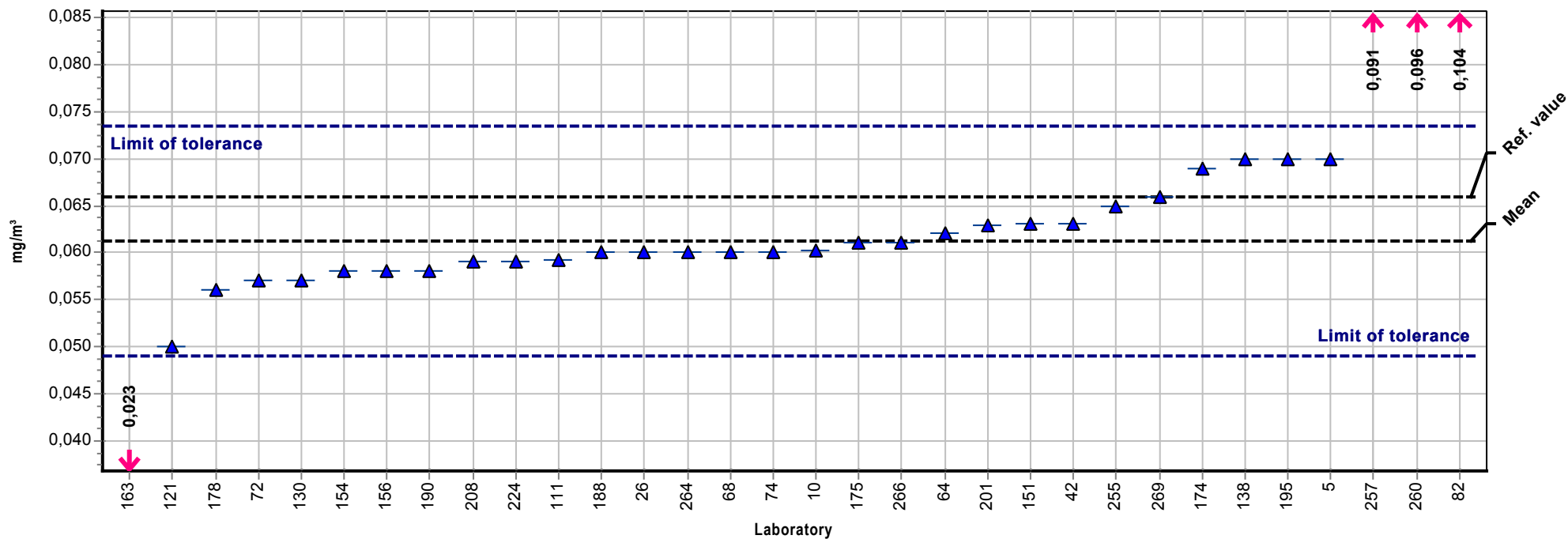
Summary results

Measurand:	sulfuric acid	Mean:	0,063 mg/m ³
Sample:	1	Reprod. s.d.:	0,007 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	11,47%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,066 mg/m ³
No. of laboratories:	30	Range of tolerance:	0,050 - 0,076 mg/m ³ (Z-Score <= 2,00)



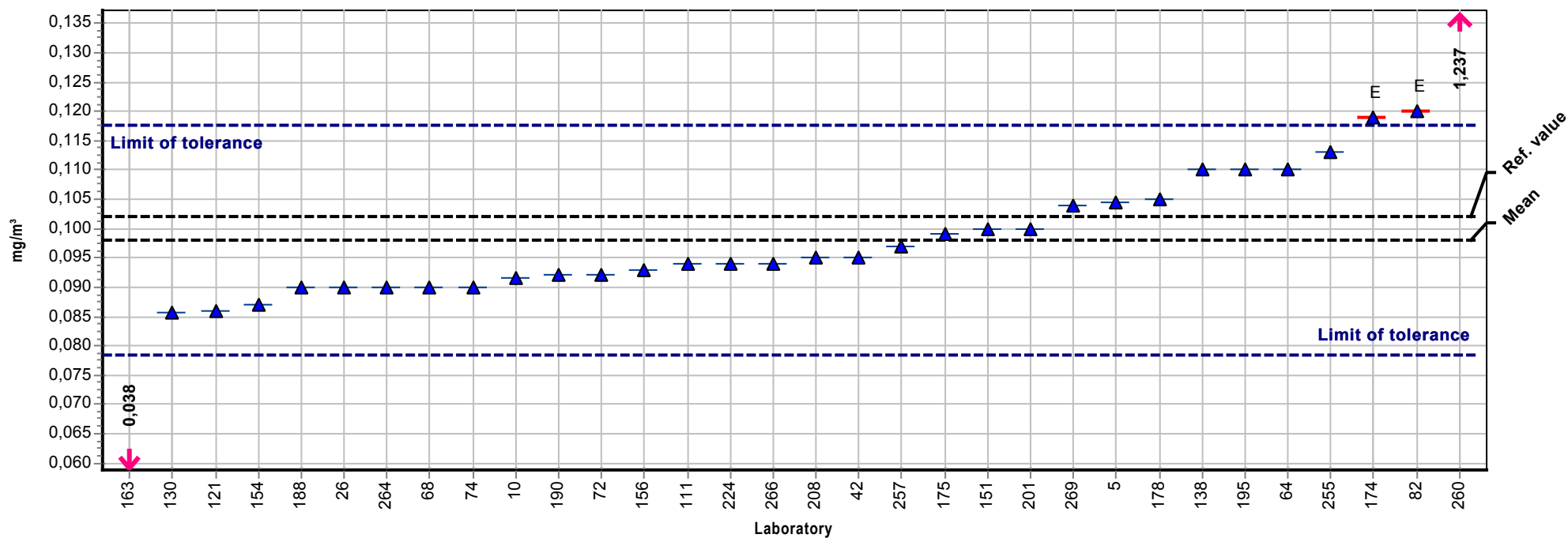
Summary results

Measurand:	sulfuric acid	Mean:	0,061 mg/m ³
Sample:	2	Reprod. s.d.:	0,005 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	7,57%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,066 mg/m ³
No. of laboratories:	28	Range of tolerance:	0,049 - 0,073 mg/m ³ (Z-Score <= 2,00)



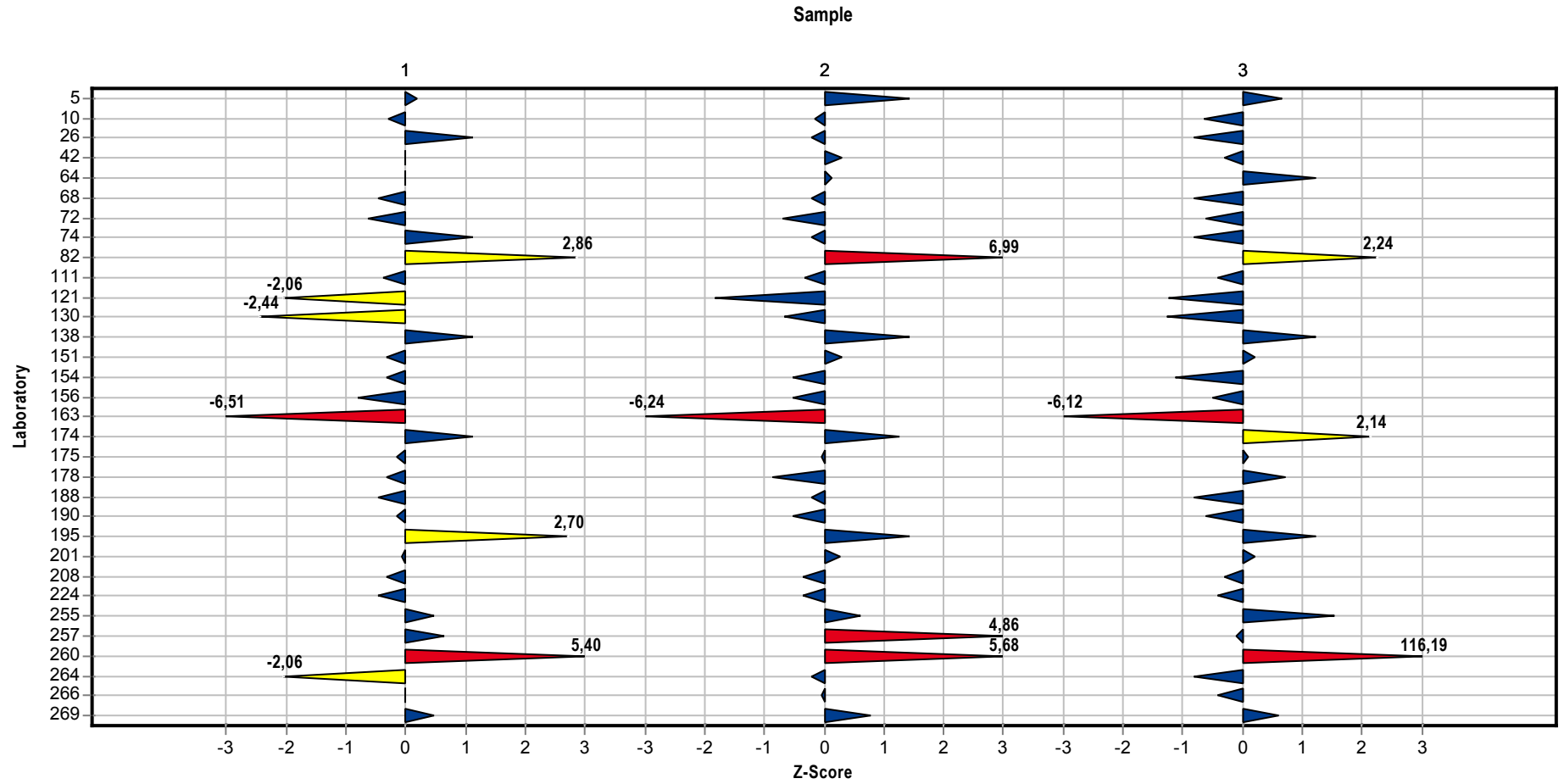
Summary results

Measurand:	sulfuric acid	Mean:	0,098 mg/m ³
Sample:	3	Reprod. s.d.:	0,010 mg/m ³
Method:	ISO 5725-2	Rel. reprod. s.d.:	9,77%
Rel. target s.d.:	10,00% (Limited)	Reference value:	0,102 mg/m ³
No. of laboratories:	30	Range of tolerance:	0,078 - 0,118 mg/m ³ (Z-Score ≤ 2,00)



Analyte chart of Z-Scores

Measurand: sulfuric acid



Questions and Answers

Participant	Analytical method
10	Metropol 009
64	BGIA 6172 (HCl, HNO ₃) und BGIA 6173 (H ₃ PO ₄ und H ₂ SO ₄)
68	NIOSH
138	IC (BGIA 6172 und 6173)
151	Ion chromatography
163	ion Chromatography
174	Metropol 009 (http://www.inrs.fr/inrs-pub/inrs01.nsf/IntranetObject-accesParReference/Metropol%20009/\$File/009.pdf)
178	MTA/MA-060
195	MTA/MA-019/A90
201	IFA Arbeitsmappe 6172 und 6173
208	own method, based on SFS-EN ISO 10304-1, NIOSH, OSHA and DFG methods
224	Ion chromatography
239	NF ISO 21438-2
255	BIA 6172 bzw . BIA 6173
257	ion chromatography
260	Chromatographie ionique
264	Chromatographie ionique
266	Ionic chromatography I-INO-001

Participant	Desorption solution
10	Water
64	Reinstwasser
68	17 ml 0.1m NaHCO ₃ und 18 ml 0.1m Na ₂ CO ₃ /1L H ₂ O
138	Reinstwasser
151	water
163	Carbonate/Bicarbonate
174	CO ₃ / HCO ₃ (eluent)
178	SOLUCION CARBONATO7BICARBONATO SODICO
195	1 mM NaHCO ₃ : 3.5 mM Na ₂ CO ₃

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Participant	Desorption solution
201	Salzsäure + Salpetersäure: H ₂ O, Phosphor- + Schwefelsäure: 3,1 mmol/l Na ₂ CO ₃ /0,35 mmol/l NaHCO ₃
208	w ater
224	Demin w ater
239	w ater
255	Na ₂ CO ₃ (2,4 mmol/L) / NaHCO ₃ (3,0 mmol/L)
257	w ater
260	Ultra pur w ater
264	eau
266	NaHCO ₃ 0,3mM

Participant	Volume of desorption solution	Time of desorption
10	20mL	15 min ; Ultrasonic bath
64	10 ml	30 min
68	Imprägnierte QFF: 10 ml // Desorbierte QFF: Verdünnung von 2 ml Desorptionslösung/10 ml	Einwirkzeit: 1h, kein Ultraschallbad
138	10 ml	15 Minuten
151	10 ml	2 hours, shaker only
163	10 ml	No
174	H ₃ PO ₄ & H ₂ SO ₄ -> 4ml + 2 ml ; HCl & HNO ₃ -> 10 ml	5 minutes (w ith ultrasound)
178	5 ML	
195	5M mL	1 h Orbital shaker
201	HCl+HNO ₃ : 4 ml, H ₃ PO ₄ +H ₂ SO ₄ : 4 ml	HCl+HNO ₃ : 15 min Ultraschall, 30 min stehen,
208	10 ml for HCl/HNO ₃ samples	30 min ultrasonic for filters
224	25 mL	1h
239	15 ml	10 mn, w ith ultrasonic bath
255	20 ml	15 min.
257	25 ml	1 hour
260	20 ml	20 min ultra son
264	10 mL	
266	10mL	15 minutes

Participant	filtration
10	Yes
64	Vorspritzenfilter Nylon 0,45 µm

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Participant	filtration
68	Nein
138	nein
151	Yes
163	Yes
174	PES membrane ; 0.22 µm
178	FILTROS 13 mm PVDFf
195	PTFEsyringe filter
201	Ja, mf
208	yes
224	Yes
239	yes
255	0,45 µm
257	
260	Syring filter 25mm 0.45µm polypropylène membrane
264	
266	20um filter

Participant	Ion Chromatographic System
10	Metrohm
64	ICS 1100 Thermo Fisher Scientific
68	System DX-120, ASRS ULTRA II 4mm, Anionen-Supressor sow ie Reagent-Free System und AS40-Autosampler (alles von Dionex)
138	Shimadzu
151	Dionex DX500 system, GP50 pump, CD20 detector, AS50 autosampler
163	Dionex IC 3000
174	DX 600 / DIONEX
178	DIONEX 120
195	DIONEX ICS-3000
201	Dionex IC DX-120, Dionex pulsed electrochemical detektor, HP 150 ASL
208	Dionex ICS5000
224	Dionex ICS3000 - CD
239	ICS5000, autosampler AS-AP
255	Dionex DX-120
257	thermo fisher

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Participant	Ion Chromatographic System
260	Dionex ICS 1100
264	
266	DIONEX ICS-2000, Suppressor : ASRS-300, 4 mm from Dionex

Participant	Analytical column	Detector
10	Metrosep A Supp 5	Conductivity
64	Thermo Fisher AS14A 250 x 4 mm	Leitfähigkeit
68	IonPac AS 18 von Dionex, Dimensionen: 4x250mm	Leitfähigkeitsmesszelle
138	Knauer SMB-OSMOMETRY 15 DE 157 HML	Leitfähigkeit
151	Dionex AS22	Conductivity
163	AS11-HC with precolumn	Conductivity
174	DIONEX reference ; Column : Ion Pack AS 12 4X200 mm & pre-column Ion Pack AG 12A 4 X 50	ED 50 (electrochemical detector)
178		
195	Ionpack AS14 250 x 4 mm	Conductivity detector
201	Dionex Ion Pac AS 22, 250 x 4 mm	Leitfähigkeit
208	AS15	conductivity
224	AS11-HC	Conductivity
239	AS11HC	conductivity
255	Ion Pac (R) AS 14 4 x 250 mm; Vorsäule: Ion Pac (TM) AG 14	Leitfähigkeitsdetektor
257		conductivity
260	AS9 HC	Dionex AERS 500 4mm
264		
266	IonPac AS12A	conductivity DS6

Participant	Mobile phase	Flow rate	Recovery rate	Date of analysis
10	1mM NaHCO ₃ ; 3,2mM Na ₂ CO ₃	0,7ml/min	no	03/28/14
64	8 mmol Na ₂ CO ₃ und 1 mmol NaHCO ₃	1 ml / min		8.4.2014
68	Wasser reinst	1ml / min	Nein	2./3.4.2014
138	NaHCO ₃ , Na ₂ CO ₃ , NaCN	1 ml/min		28.04.2014
151	4.5 mM Na ₂ CO ₃ / 1.4 mM NaHCO ₃	1.2	no	04/04/2014
163	KOH 21 mM	1 ml/min	No	04/04/2014
174	CO ₃ / HCO ₃	1.2 ml/min		28/03/2014
178		0,93 ml/min		

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Participant	Mobile phase	Flow rate	Recovery rate	Date of analysis
195	1 mM NaHCO ₃ : 3.5 mM Na ₂ CO ₃	1,2 mL/min	90-110	10/04/2014
201	NaCO ₃ /NaHCO ₃	1,2 ml/min		10. +11. 04.2014
208	KOH 7-70 mM gradient	0,012	no for filters	14.4.2014
224	30mM KOH	0.38 ml/min	no	28/04/2014
239	gradient (w ater/ NaOH30mM)	0.3ml/mn	No	28/03/14
255	= Desorptionslösung	1,00 ml/min		27.3. - 2.4.2014
257		0.25 ml/min		21 march
260	Na ₂ CO ₃ 9 mmolaire	1 ml/min	95%	27/03/14
264				31/03/2014
266	Carbonate/Bicarbonate (mM) 2,7/0,3	1,5		April 23rd 2014