

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

## Proficiency testing scheme “Inorganic acids 2021”

- **Volatile inorganic acids: hydrochloric acid, HCl and nitric acid, HNO<sub>3</sub>**
- **Non-volatile inorganic acids: phosphoric acid, H<sub>3</sub>PO<sub>4</sub> and sulphuric acid, H<sub>2</sub>SO<sub>4</sub>**

**Summary of laboratory test results****Measurand hydrochloric acid**

Laboratory	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
Unit	mg/m <sup>3</sup>		mg/m <sup>3</sup>		mg/m <sup>3</sup>	
13	1.640	1.6	3.650	0.0	1.950	-3.9 FE
68	1.376	-0.2	3.688	0.1	3.250	0.1
78	1.267	-1.0	3.570	-0.2	3.109	-0.4
80	1.334	-0.5	3.461	-0.5	3.023	-0.6
83	1.432	0.2	3.825	0.5	3.307	0.3
95	1.463	0.4	3.695	0.1	3.613	1.2
100	1.390	-0.1	3.720	0.2	3.380	0.5
126	1.330	-0.6	3.480	-0.5	2.340	-2.7 E
138	1.480	0.5	4.960	3.6 BE	3.600	1.2
148			3.520	-0.4	3.260	0.1
163	1.430	0.1	3.650	0.0	3.470	0.8
177	1.736	2.3 E	3.633	-0.1	3.018	-0.6
178	1.356	-0.4	4.099	1.2	3.845	1.9
208	1.320	-0.6	3.560	-0.3	3.130	-0.3
210	1.460	0.4	4.020	1.0	3.210	0.0
231	1.358	-0.4	3.567	-0.2	3.153	-0.2
243	1.461	0.4	3.801	0.4	3.399	0.5
248	1.492	0.6	0.727	-8.0 BE	4.402	3.7 FE
263	1.385	-0.2	3.642	0.0	3.276	0.2
266	1.390	-0.1	3.640	0.0	3.520	0.9
272	1.095	-2.2 E	3.240	-1.1	2.330	-2.8 E
-	-	--	-	--	-	--
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	Z <=2.0		Z <=2.0		Z <=2.0	
No. of laboratories that submitted results	20		21		21	
Mean	1.410		3.656		3.223	

Laboratory	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
Reproducibility s.d.	0.131		0.193		0.379	
Rel. reproducibility s.d.	9.32 %		5.28 %		11.76 %	
Reference value	1.415		3.726		3.372	
Target s.d.	0.141		0.366		0.322	
Rel. target s.d.	10.00 %		10.00 %		10.00 %	
Lower limit of tolerance	1.128		2.925		2.578	
Upper limit of tolerance	1.692		4.387		3.867	
Type B outliers			2			
Type E outliers	2		2		4	
Type F outliers					2	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	20		19		19	
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$						

## Summary of laboratory test results

### Measurand nitric acid

Laboratory	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
Unit	mg/m <sup>3</sup>		mg/m <sup>3</sup>		mg/m <sup>3</sup>	
13	2.730	1.8	1.630	1.4	1.030	-3.7 BE
68	2.245	-0.3	1.415	-0.1	1.725	0.5
78	2.061	-1.1	1.358	-0.5	1.523	-0.7
80	2.316	0.0	1.383	-0.3	1.540	-0.6
83	2.299	0.0	1.491	0.5	1.622	-0.1
95	2.251	-0.2	1.421	0.0	1.622	-0.1
100	2.190	-0.5	1.270	-1.1	1.530	-0.6
126	1.990	-1.4	1.310	-0.8	0.690	-5.8 BE
138	2.670	1.6	2.130	4.9 BE	1.930	1.8
148			1.370	-0.4	1.690	0.3
163	2.240	-0.3	1.350	-0.5	1.510	-0.8
177	2.722	1.8	1.758	2.3 E	1.916	1.7
178	2.103	-0.9	1.234	-1.3	1.480	-1.0
208	2.150	-0.7	1.350	-0.5	1.550	-0.5
210	2.550	1.0	1.600	1.2	1.480	-1.0
231	2.277	-0.1	1.416	-0.1	1.684	0.3
243	2.457	0.6	1.521	0.7	1.716	0.5
248	2.395	0.4	1.519	0.7	1.976	2.1 E
263	2.272	-0.2	1.411	-0.1	1.659	0.1
266	2.390	0.4	1.470	0.3	1.510	-0.8
272	1.860	-1.9	1.232	-1.4	1.422	-1.3
-	-	--	-	--	-	--
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	Z <=2.0		Z <=2.0		Z <=2.0	
No. of laboratories that submitted results	20		21		21	
Mean	2.308		1.425		1.636	

Laboratory	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
Reproducibility s.d.	0.233		0.134		0.161	
Rel. reproducibility s.d.	10.10 %		9.38 %		9.85 %	
Reference value	2.310		1.470		1.956	
Target s.d.	0.231		0.143		0.164	
Rel. target s.d.	10.00 %		10.00 %		10.00 %	
Lower limit of tolerance	1.847		1.140		1.309	
Upper limit of tolerance	2.770		1.711		1.963	
Type B outliers			1		2	
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)	20		20		19	
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$						

## Summary of laboratory test results

### Measurand phosphoric acid

Laboratory	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
Unit	mg/m <sup>3</sup>		mg/m <sup>3</sup>		mg/m <sup>3</sup>	
13	0.672	2.6 E	1.220	3.1 E	0.512	2.2 E
68	0.635	1.9	1.017	0.9	0.534	2.7 E
78	0.553	0.3	0.976	0.5	0.437	0.4
80	0.538	0.1	0.979	0.5	0.429	0.2
83	0.537	0.0	0.917	-0.2	0.428	0.2
95	0.518	-0.3	0.877	-0.6	0.374	-1.1
100	0.567	0.6	0.982	0.5	0.437	0.4
138	0.490	-0.8	0.920	-0.1	0.400	-0.5
148	0.521	-0.3	0.911	-0.2	0.419	0.0
163	0.580	0.8	1.060	1.4	0.450	0.7
177	0.507	-0.5	0.792	-1.5	0.320	-2.4 E
178	0.446	-1.7	0.692	-2.6 E	0.366	-1.3
208	0.522	-0.2	0.935	0.0	0.415	-0.1
210	0.440	-1.8	0.660	-2.9 E	0.350	-1.7
231	0.525	-0.2	0.947	0.2	0.399	-0.5
243	0.531	-0.1	0.933	0.0	0.431	0.3
248	0.547	0.2	0.958	0.3	0.426	0.2
263	0.538	0.1	0.912	-0.2	0.421	0.0
266	0.540	0.1	0.958	0.3	0.448	0.7
272	0.497	-0.7	0.998	0.7	0.399	-0.5
-	-	--	-	--	-	--
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	Z <=2.0		Z <=2.0		Z <=2.0	
No. of laboratories that submitted results	20		20		20	
Mean	0.535		0.932		0.420	
Reproducibility s.d.	0.053		0.120		0.049	

Laboratory	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
Rel. reproducibility s.d.	9.99 %		12.90 %		11.62 %	
Reference value	0.519		0.922		0.422	
Target s.d.	0.054		0.093		0.042	
Rel. target s.d.	10.00 %		10.00 %		10.00 %	
Lower limit of tolerance	0.428		0.746		0.336	
Upper limit of tolerance	0.642		1.119		0.504	
Type E outliers	1		3		3	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	20		20		20	
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$						

## Summary of laboratory test results

### Measurand sulphuric acid

Laboratory	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
Unit	mg/m <sup>3</sup>		mg/m <sup>3</sup>		mg/m <sup>3</sup>	
13	0.141	0.7	0.040	-0.6	0.088	0.0
68	0.145	1.0	0.043	0.1	0.098	1.1
78	0.134	0.2	0.043	0.0	0.088	0.0
80	0.128	-0.2	0.045	0.6	0.087	-0.1
83	0.124	-0.5	0.038	-1.0	0.081	-0.8
95	0.127	-0.3	0.041	-0.3	0.082	-0.7
100	0.135	0.3	0.047	1.1	0.090	0.2
138	0.120	-0.9	0.038	-1.0	0.082	-0.7
148	0.130	-0.1	0.044	0.4	0.090	0.2
163	0.120	-0.9	0.030	-2.9 E	0.090	0.2
177	0.138	0.5	0.053	2.5 E	0.103	1.7
178	0.110	-1.6	0.035	-1.7	0.076	-1.4
208	0.116	-1.2	0.041	-0.4	0.083	-0.5
210	0.130	-0.1	0.040	-0.6	0.090	0.2
231	0.129	-0.2	0.043	0.1	0.086	-0.2
243	0.130	-0.1	0.044	0.4	0.089	0.1
248	0.158	2.1 E	0.045	0.6	0.090	0.3
263	0.137	0.4	0.051	2.1 E	0.091	0.4
266	0.150	1.4	0.060	4.2 FE	0.091	0.3
272	0.122	-0.7	0.045	0.6	0.086	-0.2
-	-	--	-	--	-	--
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	Z <=2.0		Z <=2.0		Z <=2.0	
No. of laboratories that submitted results	20		20		20	
Mean	0.131		0.042		0.088	
Reproducibility s.d.	0.012		0.005		0.006	



Laboratory	Sample 1	Z score	Sample 2	Z score	Sample 3	Z score
Rel. reproducibility s.d.	8.90 %		12.44 %		6.74 %	
Reference value	0.129		0.045		0.088	
Target s.d.	0.013		0.004		0.009	
Rel. target s.d.	10.00 %		10.00 %		10.00 %	
Lower limit of tolerance	0.105		0.034		0.070	
Upper limit of tolerance	0.157		0.051		0.106	
Type E outliers	1		4			
Type F outliers			1			
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	20		19		20	
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$						

## Summary results

Measurand: hydrochloric acid

Sample: 1

Method: ISO 5725-2

Rel. target s.d.: 10.00% (Limited)

No. of laboratories: 20

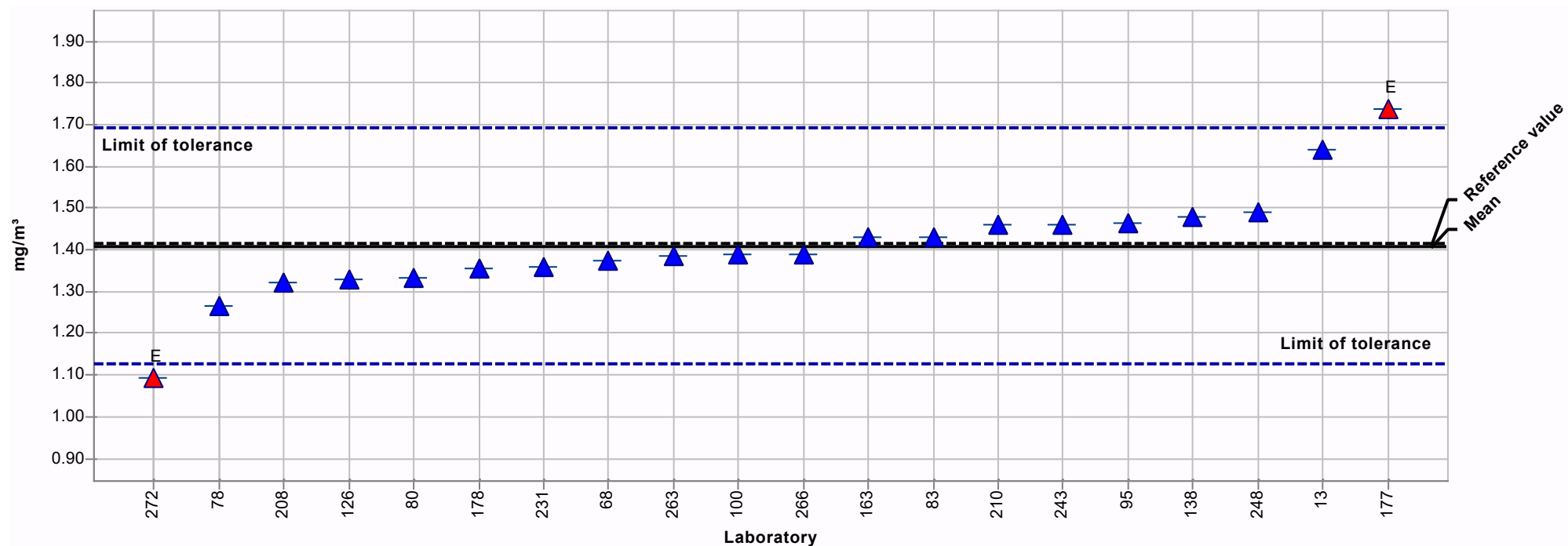
Mean: 1.410 mg/m<sup>3</sup>

Reproducibility s.d.: 0.131 mg/m<sup>3</sup>

Rel. reproducibility s.d.: 9.32%

Reference value: 1.415 mg/m<sup>3</sup>

Range of tolerance: 1.128 - 1.692 mg/m<sup>3</sup> (|Z-Score| <= 2.0)



## Summary results

Measurand: hydrochloric acid

Sample: 2

Method: ISO 5725-2

Rel. target s.d.: 10.00% (Limited)

No. of laboratories: 19

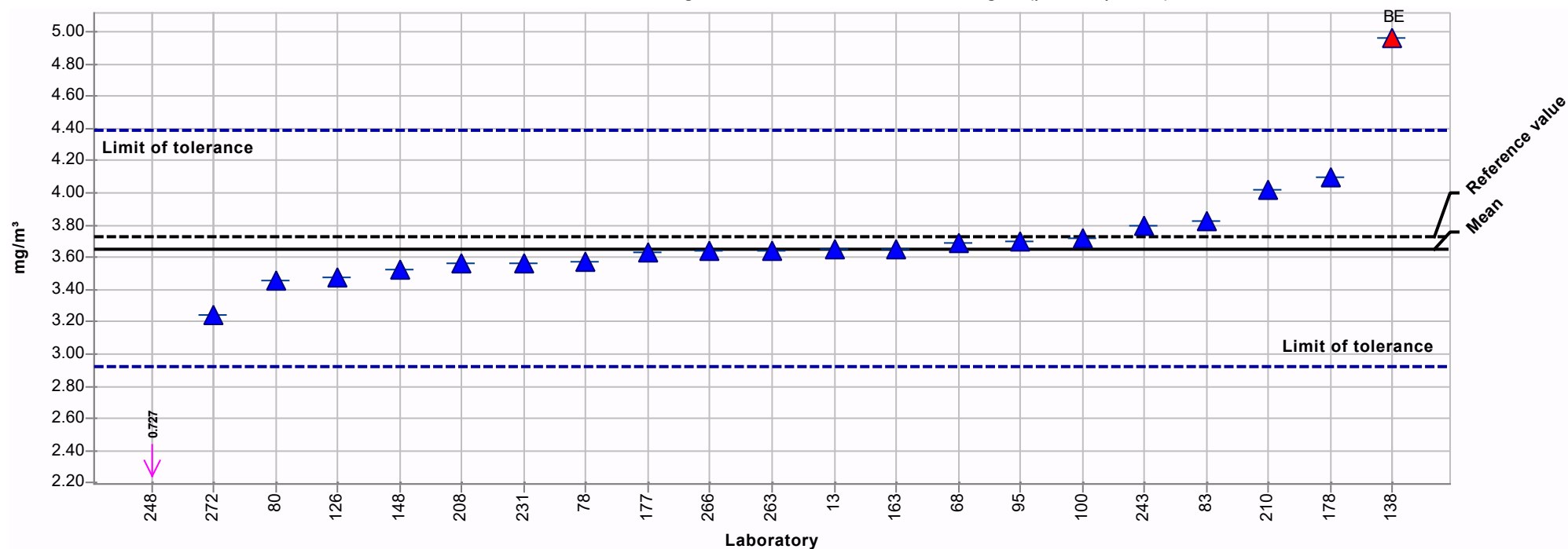
Mean: 3.656 mg/m<sup>3</sup>

Reproducibility s.d.: 0.193 mg/m<sup>3</sup>

Rel. reproducibility s.d.: 5.28%

Reference value: 3.726 mg/m<sup>3</sup>

Range of tolerance: 2.925 - 4.387 mg/m<sup>3</sup> (|Z-Score| ≤ 2.0)



## Summary results

Measurand: hydrochloric acid

Sample: 3

Method: ISO 5725-2

Rel. target s.d.: 10.00% (Limited)

No. of laboratories: 19

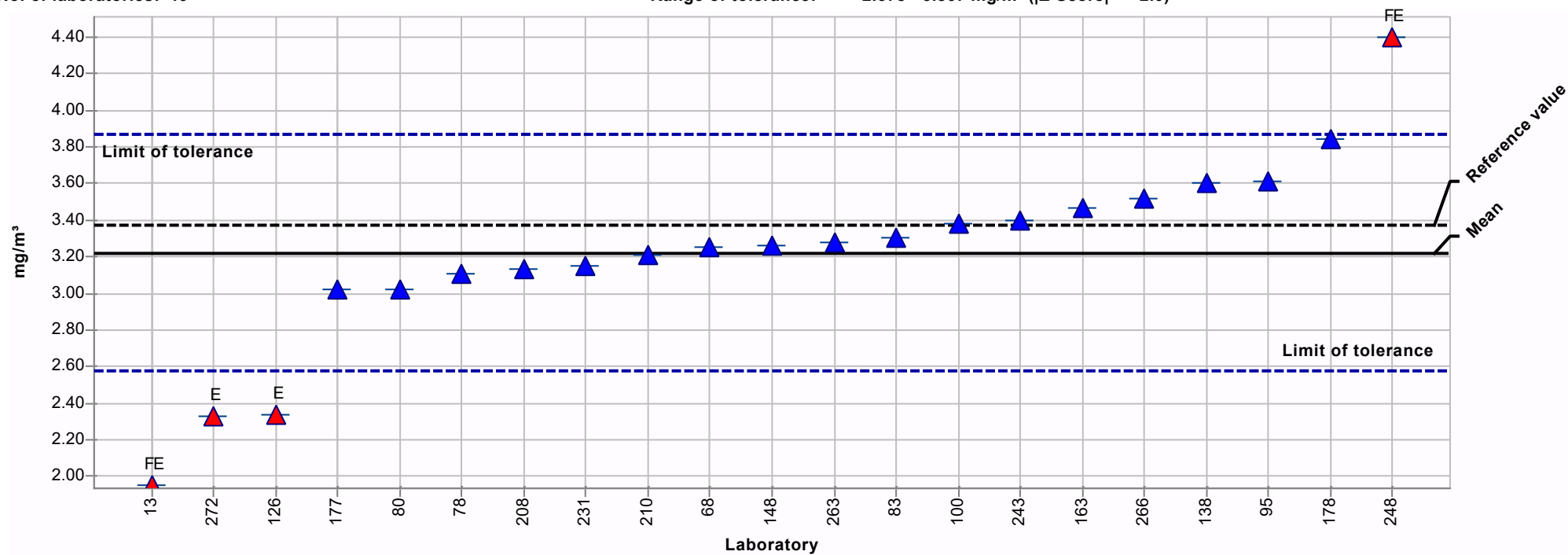
Mean: 3.223 mg/m<sup>3</sup>

Reproducibility s.d.: 0.379 mg/m<sup>3</sup>

Rel. reproducibility s.d.: 11.76%

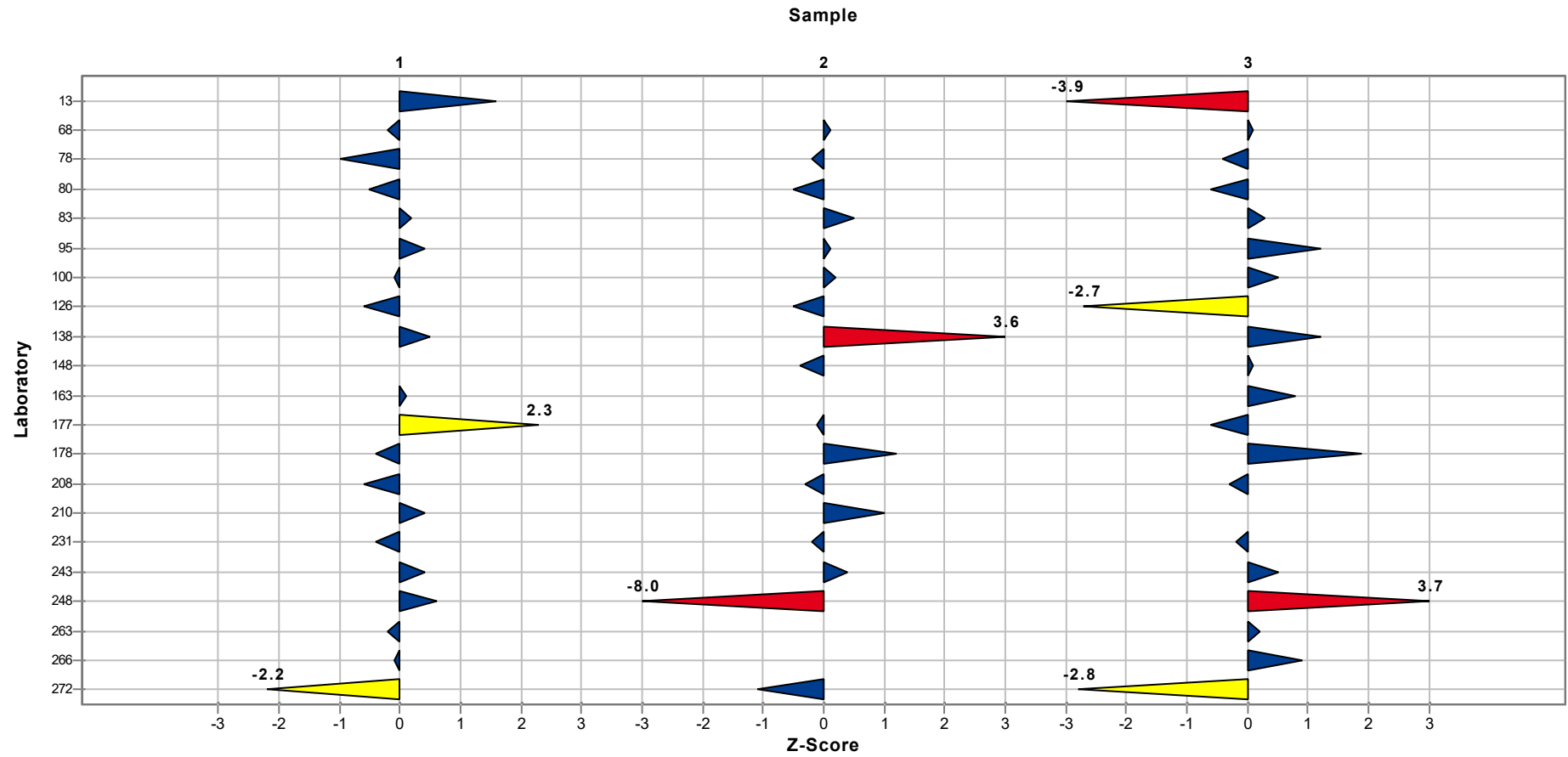
Reference value: 3.372 mg/m<sup>3</sup>

Range of tolerance: 2.578 - 3.867 mg/m<sup>3</sup> (|Z-Score| ≤ 2.0)



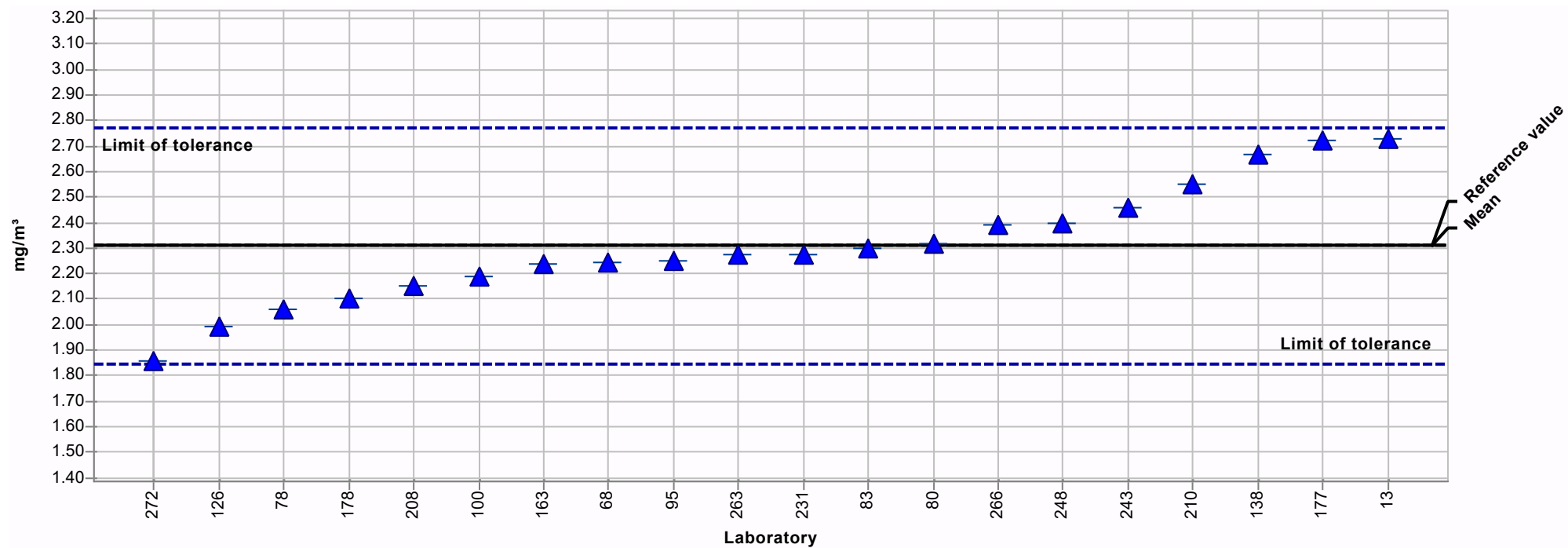
# Analyte chart of Z-Scores

Measurand: hydrochloric acid



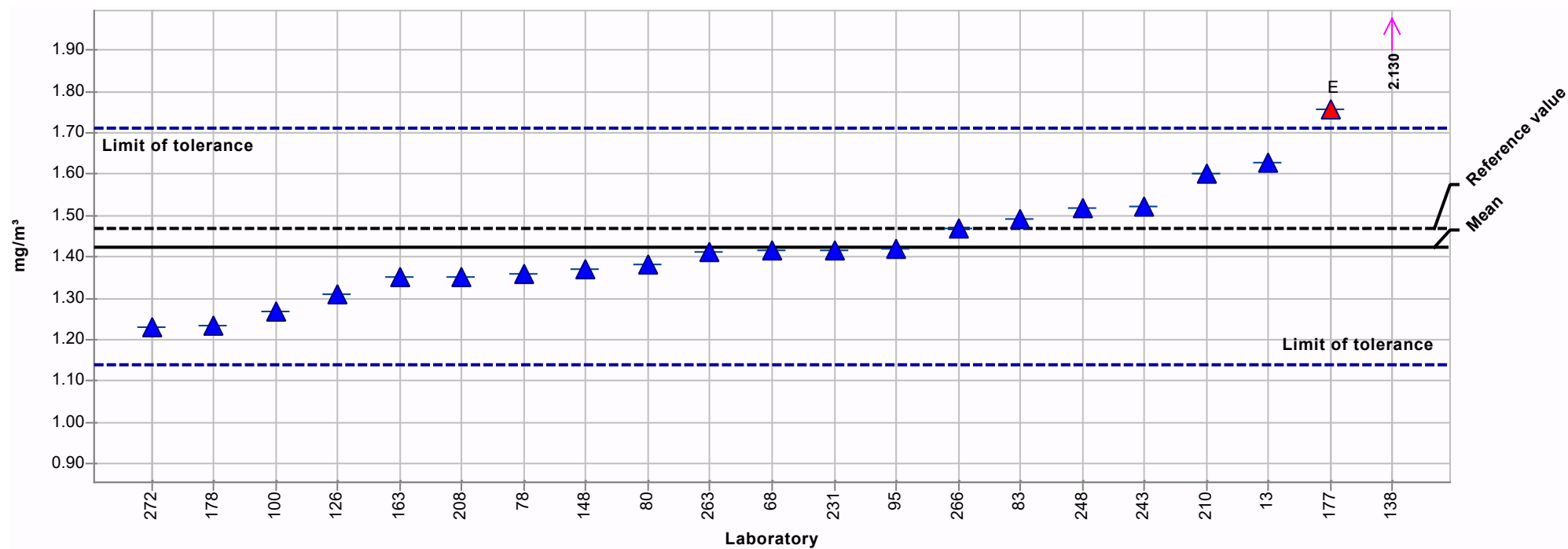
## Summary results

<b>Measurand:</b>	nitric acid	<b>Mean:</b>	2.308 mg/m <sup>3</sup>
<b>Sample:</b>	1	<b>Reproducibility s.d.:</b>	0.233 mg/m <sup>3</sup>
<b>Method:</b>	ISO 5725-2	<b>Rel. reproducibility s.d.:</b>	10.10%
<b>Rel. target s.d.:</b>	10.00% (Limited)	<b>Reference value:</b>	2.310 mg/m <sup>3</sup>
<b>No. of laboratories:</b>	20	<b>Range of tolerance:</b>	1.847 - 2.770 mg/m <sup>3</sup> ( Z-Score  ≤ 2.0)



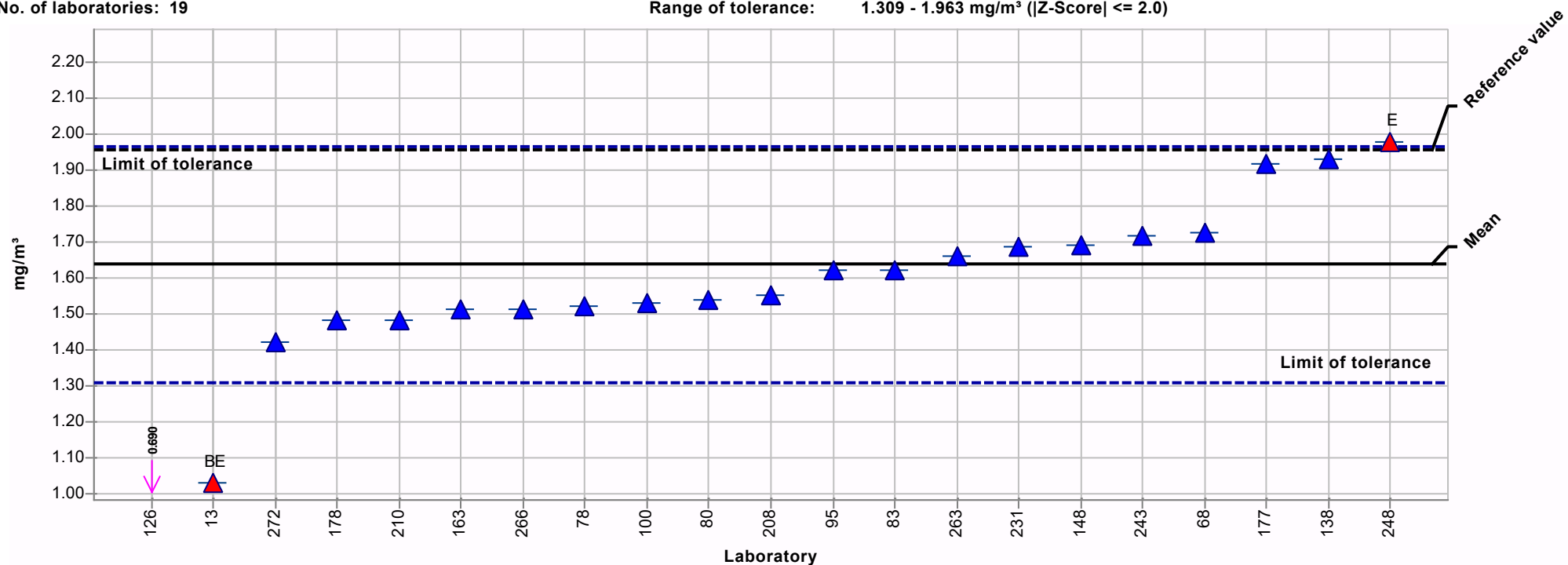
## Summary results

Measurand:	nitric acid	Mean:	1.425 mg/m <sup>3</sup>
Sample:	2	Reproducibility s.d.:	0.134 mg/m <sup>3</sup>
Method:	ISO 5725-2	Rel. reproducibility s.d.:	9.38%
Rel. target s.d.:	10.00% (Limited)	Reference value:	1.470 mg/m <sup>3</sup>
No. of laboratories:	20	Range of tolerance:	1.140 - 1.711 mg/m <sup>3</sup> ( Z-Score  ≤ 2.0)



## Summary results

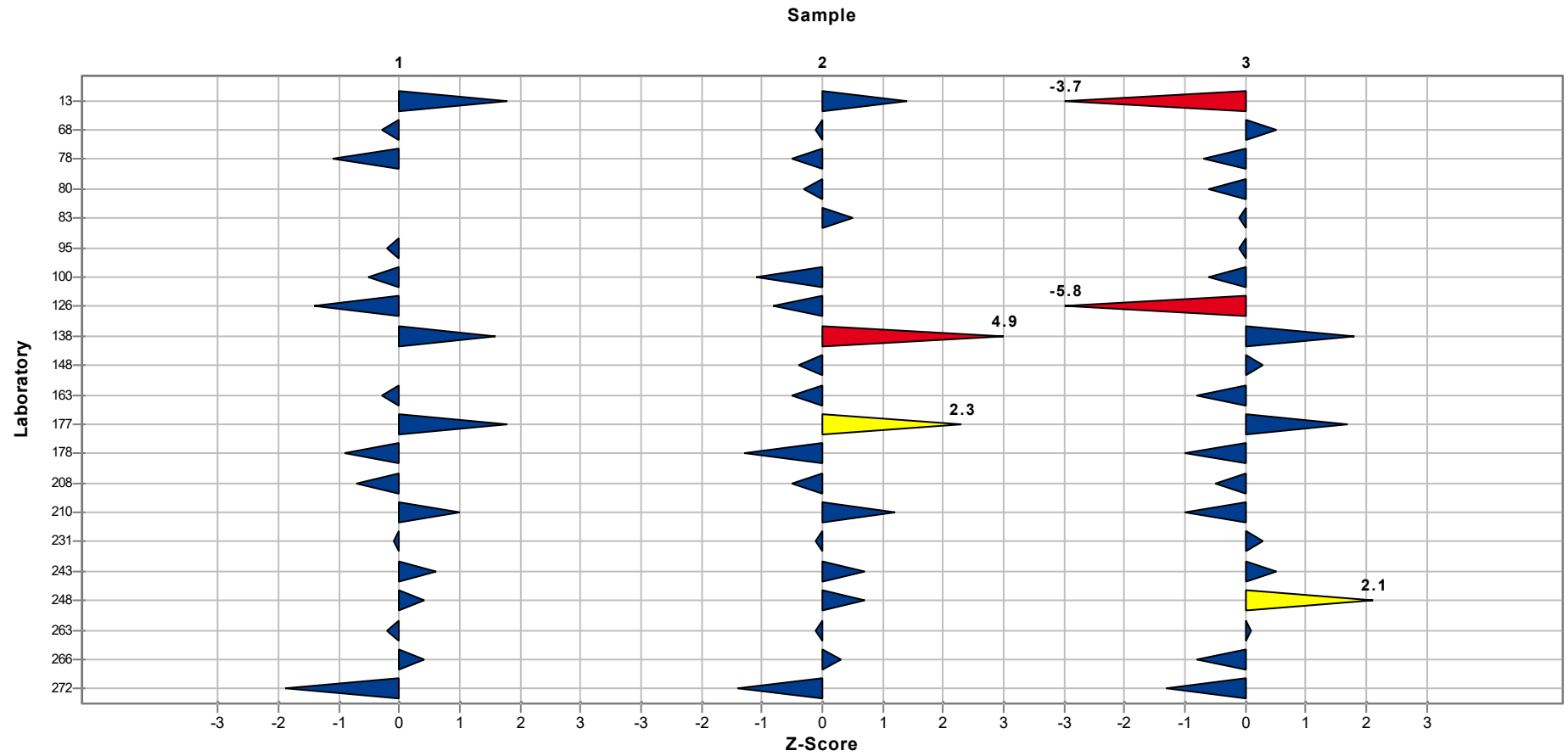
Measurand:	nitric acid	Mean:	1.636 mg/m <sup>3</sup>
Sample:	3	Reproducibility s.d.:	0.161 mg/m <sup>3</sup>
Method:	ISO 5725-2	Rel. reproducibility s.d.:	9.85%
Rel. target s.d.:	10.00% (Limited)	Reference value:	1.956 mg/m <sup>3</sup>
No. of laboratories:	19	Range of tolerance:	1.309 - 1.963 mg/m <sup>3</sup> ( Z-Score  ≤ 2.0)





# Analyte chart of Z-Scores

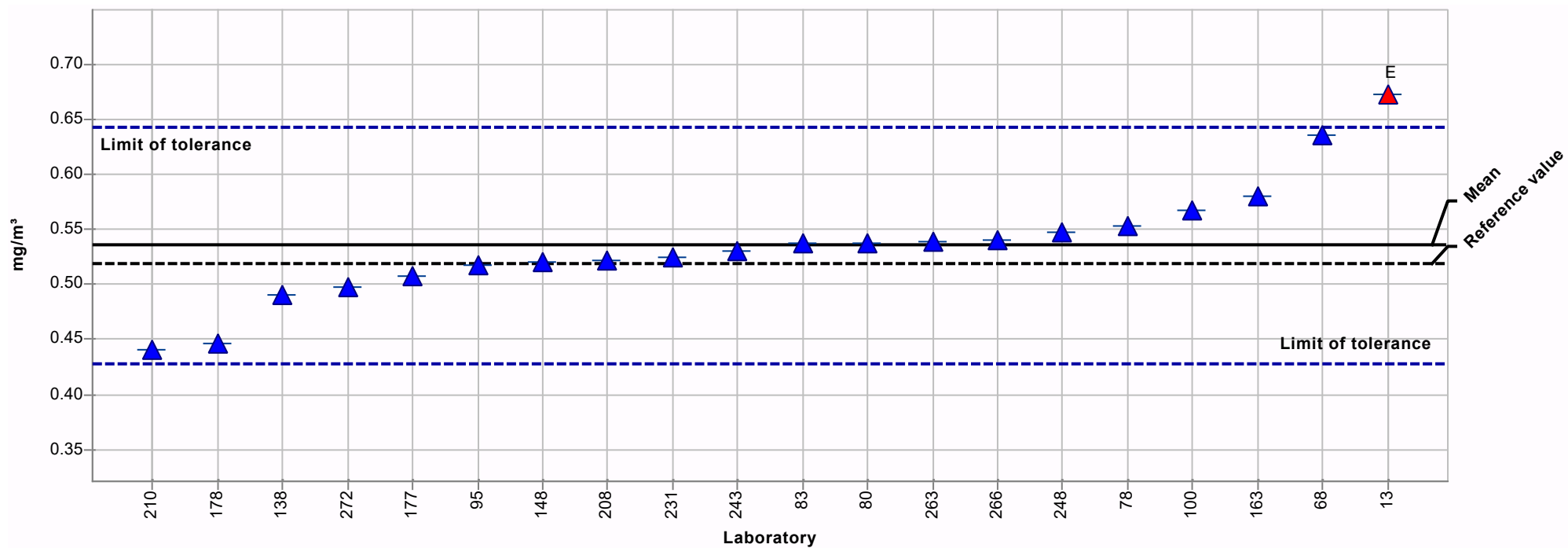
Measurand: nitric acid



## Summary results

**Measurand:** phosphoric acid  
**Sample:** 1  
**Method:** ISO 5725-2  
**Rel. target s.d.:** 10.00% (Limited)  
**No. of laboratories:** 20

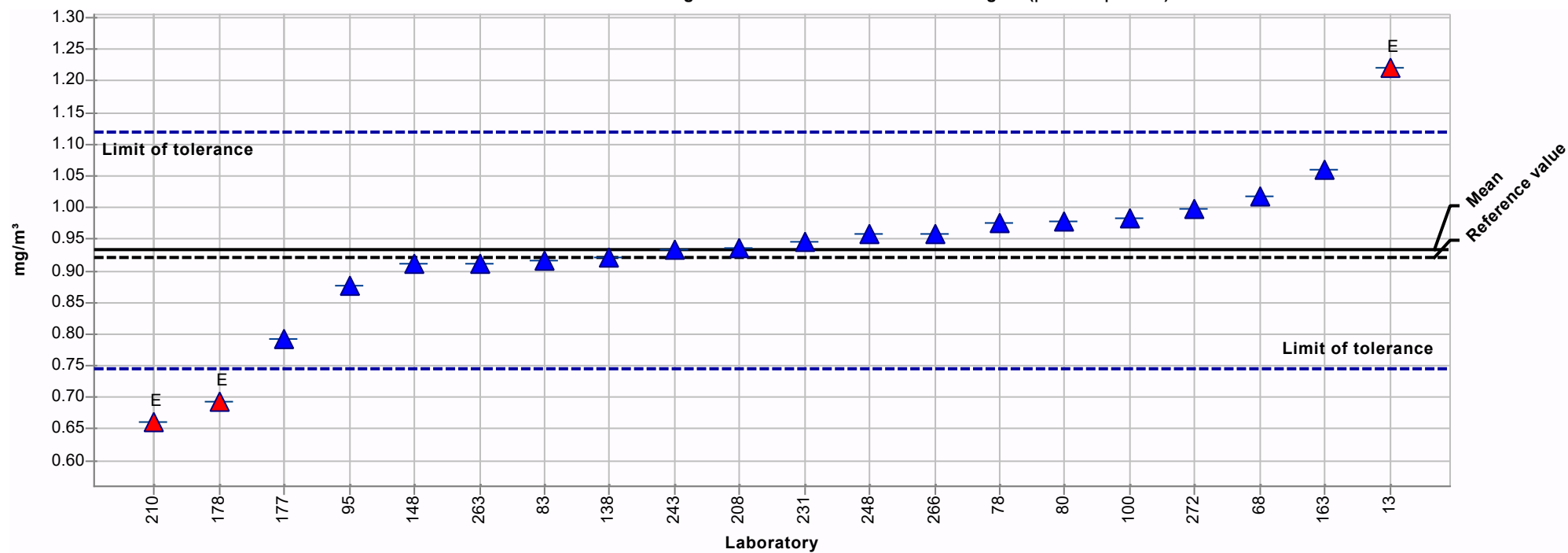
**Mean:** 0.535 mg/m<sup>3</sup>  
**Reproducibility s.d.:** 0.053 mg/m<sup>3</sup>  
**Rel. reproducibility s.d.:** 9.99%  
**Reference value:** 0.519 mg/m<sup>3</sup>  
**Range of tolerance:** 0.428 - 0.642 mg/m<sup>3</sup> (|Z-Score| ≤ 2.0)



## Summary results

**Measurand:** phosphoric acid  
**Sample:** 2  
**Method:** ISO 5725-2  
**Rel. target s.d.:** 10.00% (Limited)  
**No. of laboratories:** 20

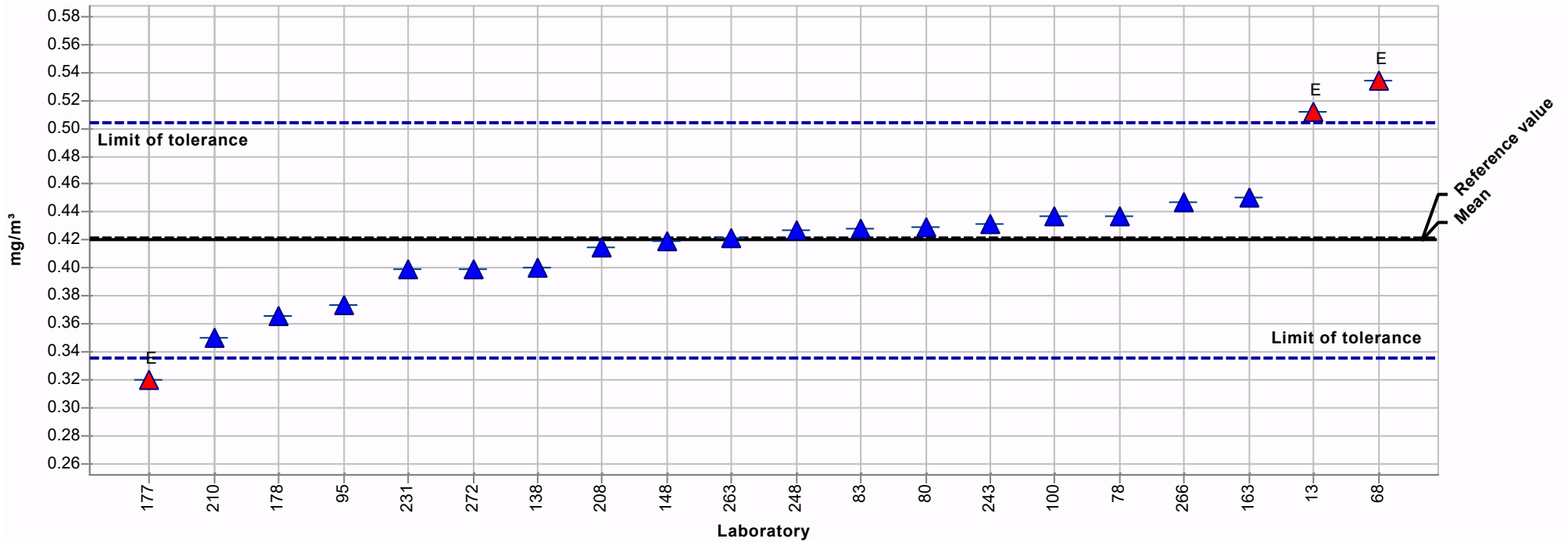
**Mean:** 0.932 mg/m<sup>3</sup>  
**Reproducibility s.d.:** 0.120 mg/m<sup>3</sup>  
**Rel. reproducibility s.d.:** 12.90%  
**Reference value:** 0.922 mg/m<sup>3</sup>  
**Range of tolerance:** 0.746 - 1.119 mg/m<sup>3</sup> (|Z-Score| ≤ 2.0)



## Summary results

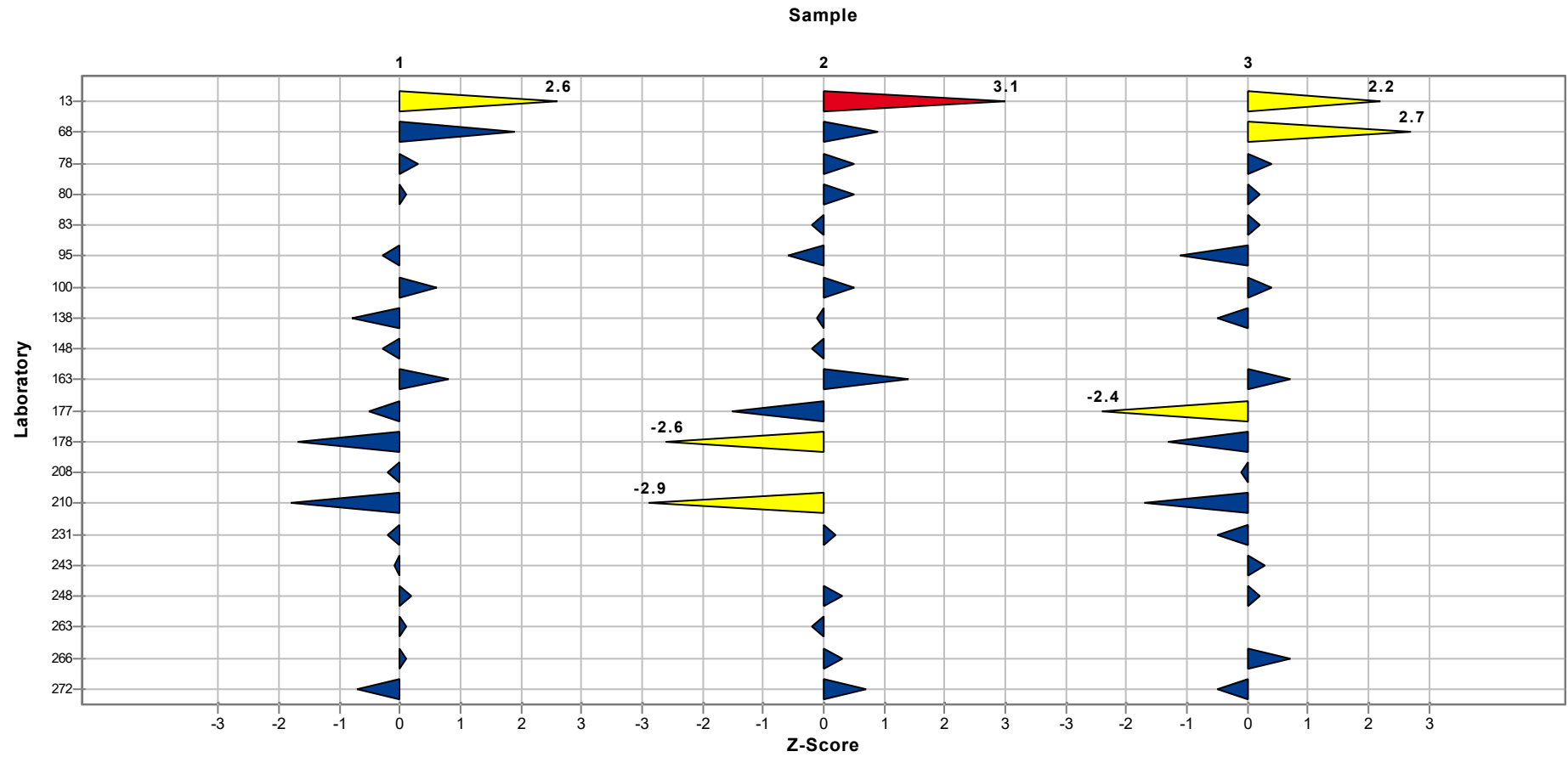
**Measurand:** phosphoric acid  
**Sample:** 3  
**Method:** ISO 5725-2  
**Rel. target s.d.:** 10.00% (Limited)  
**No. of laboratories:** 20

**Mean:** 0.420 mg/m<sup>3</sup>  
**Reproducibility s.d.:** 0.049 mg/m<sup>3</sup>  
**Rel. reproducibility s.d.:** 11.62%  
**Reference value:** 0.422 mg/m<sup>3</sup>  
**Range of tolerance:** 0.336 - 0.504 mg/m<sup>3</sup> (|Z-Score| ≤ 2.0)



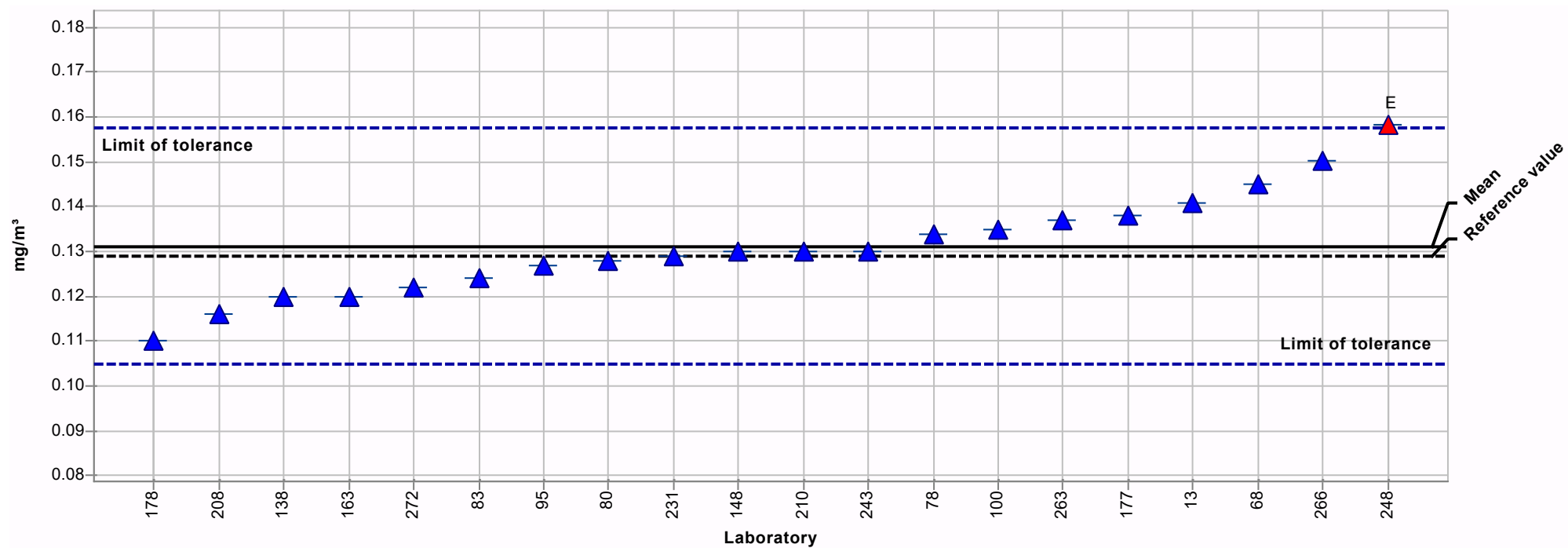
# Analyte chart of Z-Scores

Measurand: phosphoric acid



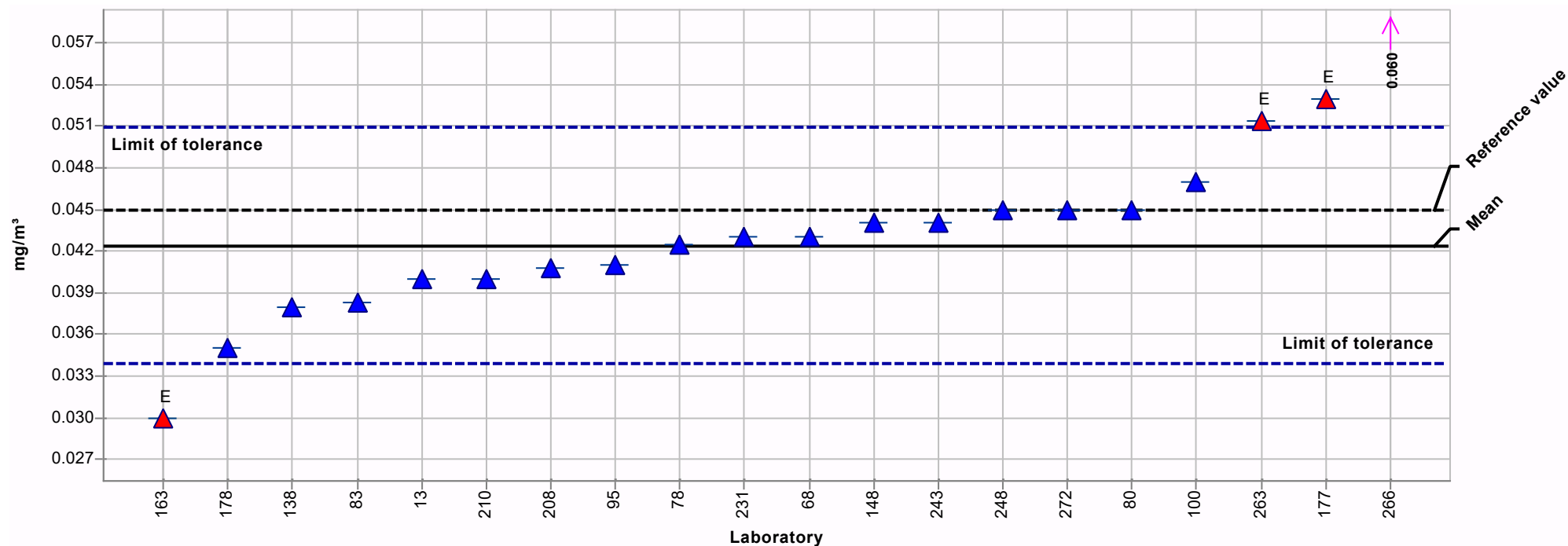
## Summary results

<b>Measurand:</b>	sulphuric acid	<b>Mean:</b>	0.131 mg/m <sup>3</sup>
<b>Sample:</b>	1	<b>Reproducibility s.d.:</b>	0.012 mg/m <sup>3</sup>
<b>Method:</b>	ISO 5725-2	<b>Rel. reproducibility s.d.:</b>	8.90%
<b>Rel. target s.d.:</b>	10.00% (Limited)	<b>Reference value:</b>	0.129 mg/m <sup>3</sup>
<b>No. of laboratories:</b>	20	<b>Range of tolerance:</b>	0.105 - 0.157 mg/m <sup>3</sup> ( Z-Score  <= 2.0)



## Summary results

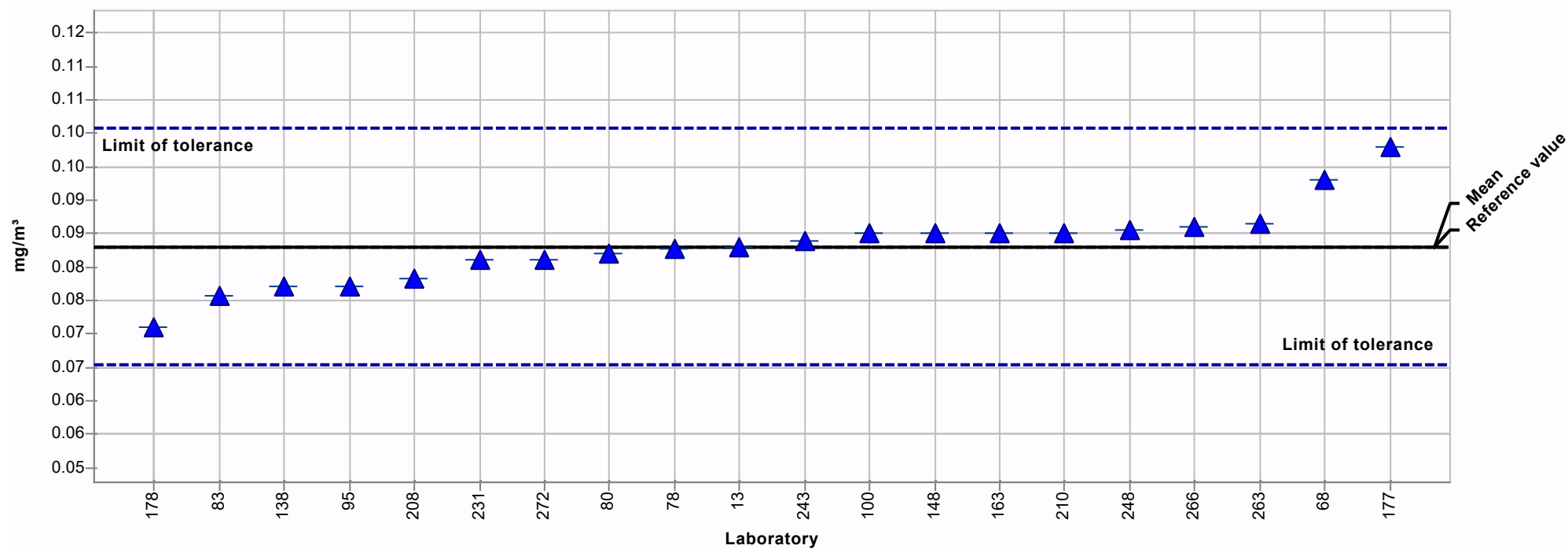
<b>Measurand:</b>	sulphuric acid	<b>Mean:</b>	0.042 mg/m <sup>3</sup>
<b>Sample:</b>	2	<b>Reproducibility s.d.:</b>	0.005 mg/m <sup>3</sup>
<b>Method:</b>	ISO 5725-2	<b>Rel. reproducibility s.d.:</b>	12.44%
<b>Rel. target s.d.:</b>	10.00% (Limited)	<b>Reference value:</b>	0.045 mg/m <sup>3</sup>
<b>No. of laboratories:</b>	19	<b>Range of tolerance:</b>	0.034 - 0.051 mg/m <sup>3</sup> ( Z-Score  ≤ 2.0)



## Summary results

**Measurand:** sulphuric acid  
**Sample:** 3  
**Method:** ISO 5725-2  
**Rel. target s.d.:** 10.00% (Limited)  
**No. of laboratories:** 20

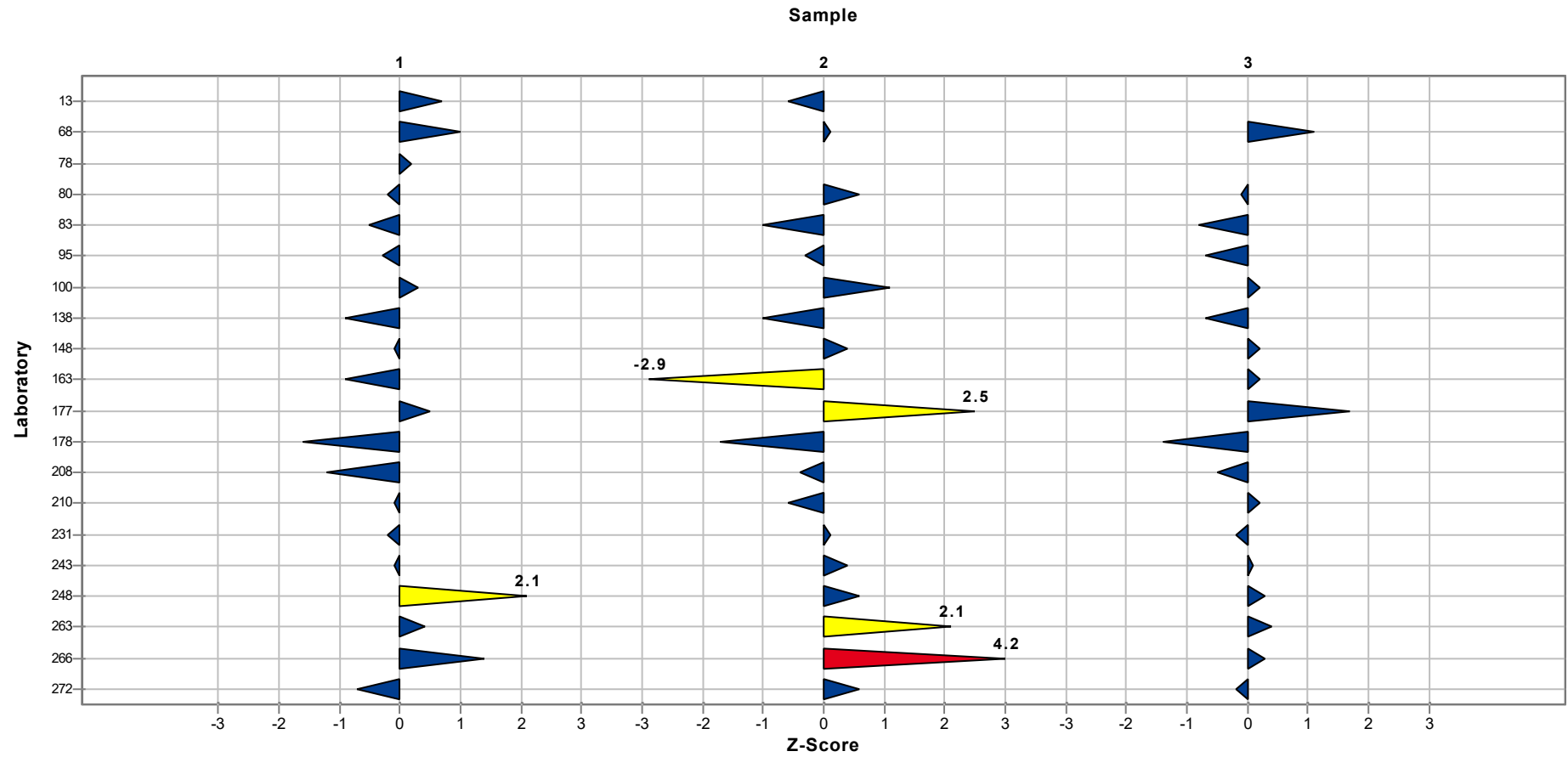
**Mean:** 0.088 mg/m<sup>3</sup>  
**Reproducibility s.d.:** 0.006 mg/m<sup>3</sup>  
**Rel. reproducibility s.d.:** 6.74%  
**Reference value:** 0.088 mg/m<sup>3</sup>  
**Range of tolerance:** 0.070 - 0.106 mg/m<sup>3</sup> (|Z-Score| <= 2.0)





# Analyte chart of Z-Scores

Measurand: sulphuric acid



## Questions and Answers

Participant	Analytical method
13	IC - conductivity detection according to ISO 21438-part 1 and 2
68	IFA-Arbeitsmappe
78	IFA - Arbeitsmappe 6172 und 6173
80	IFA 6172 und IFA 6173
83	X 43-281 / NF EN ISO 10304-1
95	IFA 6173
100	
126	WIWeB AAW 3-5.11.01.14: Bestimmung von Chlorwasserstoff in der Luft in Arbeitsbereichen mittels Ionenchromatographie
138	DGUV 6172 + 6173, IC
148	BGIA 6172 (2007-04), BGIA 6173 (2016-01)
163	NIOSH 7908 and NIOSH 7907. Modified
177	IFA-Arbeitsmappe
178	NIOSH 7907/NIOSH 7908
208	Ion chromatography
210	Ionenchromatographie (isokratisch, SOP 147), BIA 6172 und BIA 6173
231	IFA 6172 / IFA 6173
243	IFA 6172 / IFA 6173
248	Ionenchromatographie
263	IFA 6172 ( HCl und HNO3) und IFA 6173 (H2SO4 und H3PO4)
266	NIOSH 7907/7908
272	IFA-Nr. 6172 / IFA-Nr. 6173

Participant	Desorption solution
13	Water (HNO3 and HCl); 0,35 mM NaHCO3 and 3,1 mM Na2CO3 (H2SO4 and H3PO4)
68	Impr. QFF: Wasser / Desorb. QFF: 3.6 mM Natriumcarbonat-Lsg.
78	Wasser
80	H2SO4 + H3PO4 in c(Na2CO3)= 3,1 mmol/l + c(NaHCO3)=0,36 mmol/l, HCl + HNO3 in VE-Wasser (Reinstwasser)
83	Eau déminéralisée

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Participant	Desorption solution
95	bidest. Wasser
100	Water
126	3,1 mmol/L Na <sub>2</sub> CO <sub>3</sub> , 1,0 mmol/L NaHCO <sub>3</sub> / 2 vol% Aceton
138	Reinstw asser
148	Reinstw asser
163	Carbonate/Bicarbonate
177	Reinstw asser
178	Carbonato sódico 3,2 mM + bicarbonato sódico 1mM
208	UHP w ater
210	Reinstw asser
231	Reinstw asser / 3,1 mmol/l Na <sub>2</sub> CO <sub>3</sub> + 0,35 mmol/l NaHCO <sub>3</sub>
248	Reinstw asser
263	Wasser / Carbonatlösung
266	w ater
272	ultrapure Water

Participant	Desorption volume
13	10 ml
68	Impr. QFF: 10 ml / Desorb. QFF: Verdünnung von 2.5 ml Desorptionslsg./10 ml
78	10 mL
80	H <sub>2</sub> SO <sub>4</sub> + H <sub>3</sub> PO <sub>4</sub> in 4 ml, HCl + HNO <sub>3</sub> in 10 ml
83	30 ml
95	10 mL
100	20 mL
126	10 mL
138	10 bzw . 4 ml
148	30 mL
163	10 ml, 4 ml
177	50 ml bzw . 20 ml
178	10 ml

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Participant	Desorption volume
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208	10 ml
210	10 mL (HCl und HNO <sub>3</sub> ), 4 mL (H <sub>2</sub> SO <sub>4</sub> und H <sub>3</sub> PO <sub>4</sub> )
231	10 ml / 4 ml
248	10 ml (Filter)
263	HCl und HNO <sub>3</sub> : 20 mL / H <sub>2</sub> SO <sub>4</sub> und H <sub>3</sub> PO <sub>4</sub> : 4 mL
266	20 mL
272	10 mL

Participant	Time of desorption	IC-System
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13	15 minutes ultrasonic and 30 minutes cool down	Dionex ICS1100 from Thermo Scientific
68	15 Min. Ultraschallbad, anschl. mind. 30 Min. stehen lassen	930 Compact IC Flex von Metrohm
78	30 min Ultraschall	Metrohm IC
80	Für beide Methoden 15 Minuten Ultraschallbad und 30 Minuten Standzeit	ICS 5000 von Thermo Fisher
83	30 min	ICS 5000
95	45 Min. Ultraschall, 1 h stehen lassen	
100	15 minutes	
126	15 min	Metrohm Compact IC 930
138	15 Minuten im Ultraschallbad, 30 Minuten stehen lassen	Dionex ICS 1100
148	15 min	Methrom IC 930
163	30 min	Dionex IC-3000
177	15 min Ultraschallbad	Dionex ICS 2000
178	15 min	Cromatógrafo iónico Metrohm
208	08/07/2021	Thermo Scientific Dionex ICS-5000 Capillary IC
210	15 min Ultraschall, 30 min stehenlassen bei Raumtemperatur	Dionex/Thermo-Scientific
231	15 min Ultraschallbad, 30 min ruhen lassen	Thermo Aquion
248	15 min Ultraschallbad, 30 min ruhen	Thermo Fisher IC 1100
263	HCl und HNO <sub>3</sub> : 1 h Schüttelapparat / H <sub>2</sub> SO <sub>4</sub> und H <sub>3</sub> PO <sub>4</sub> : bereits eingelegt	Thermo Fisher Aquion, DG, AS-DV Autosampler 5 mL
266	30 minutes	Thermo Dionex ICS-Integrion
272	15 min Ultraschall, danach 30 min stehen gelassen	Dionex ICS 2000

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Participant	Analytical Column	Mobile phase
13	Dionex IonPac AS22 RFIC with AG22 RFIC Guard column	1,4 mM NaHCO <sub>3</sub> and 4,5 mM Na <sub>2</sub> CO <sub>3</sub>
68	Metrosep C 6 - 250/4.0 von Metrohm	3.6 mM Natriumcarbonat-Lsg.
78	Metrosep A Supp 5 250 mm	3,2 mmol/L Na <sub>2</sub> CO <sub>3</sub> & 1,0 mmol/L NaHCO <sub>3</sub>
80	Vorsäule: AG14A, Trennsäule: AS14A	848 mg/l Na <sub>2</sub> CO <sub>3</sub> + 84 mg/l NaHCO <sub>3</sub>
83	AS 18 4mm	KOH
95	AS9-HC + AG9-HC (Vorsäule)	9 mmol Na <sub>2</sub> CO <sub>3</sub>
126	Metrosep A SUPP 5 - 100/4	3,1 mmol/L Na <sub>2</sub> CO <sub>3</sub> , 1,0 mmol/L NaHCO <sub>3</sub> / 2 vol% Aceton
138	Dionex IonPac AS22 4*250 mm	Na <sub>2</sub> CO <sub>3</sub> / NaHCO <sub>3</sub>
148	ASupp5-150	Natriumcarbonat-Natriumhydrogencarbonat
163	Dionex AS11-HC 4 x 200.	KOH 20 mM
177	AS 15	KOH 12-48 mmol/l
178	Metrosep A Supp 5-150/4,0	Carbonato sódico 3,2 mM + bicarbonato sódico 1mM
208	Dionex IonPac AS11	1-60 mM KOH
210	AS 23 Thermo-Scientific	4,2 mmol Na <sub>2</sub> CO <sub>3</sub> -Lsg./1mmol NaHCO <sub>3</sub> -Lsg.
231	Thermo IonPac As22, 250 x 4 mm	1,4 mmol NaHCO <sub>3</sub> + 4,5 mmol Na <sub>2</sub> CO <sub>3</sub>
248	AS 14 A	NaHCO <sub>3</sub> -Na <sub>2</sub> CO <sub>3</sub>
263	IonPac AG23 Vorsäule 4x50mm und IonPac AS23 Trennsäule 4x250mm	Na <sub>2</sub> CO <sub>3</sub> + NaHCO <sub>3</sub>
266	AS22 FAST	Carbonate/Bicarbonate 1,5 / 0,5 (mM)
272	AS 18 Dionex IonPac 2mm	18 - 55 mM KOH innerhalb 15 min

Participant	Flow rate (IC)	Recovery rates	Date of analysis
13	0,3 ml/min	98,5%	13/07/2021
68	0.7 ml/min.	Keine	14./15.07.2021
78	0,7 mL/min		24.06.-25.06.2021
80	1 ml/ Minute	HCl: 0,994, HNO <sub>3</sub> : 1,006, H <sub>2</sub> SO <sub>4</sub> : 0,975, H <sub>3</sub> PO <sub>4</sub> : 1,006	Zeitraum 02.07.2021 - 14.07.2021
83	1 ml/mn		25/06/2021
95	1 mL/min	-	25.06.2021
126	0,7 mL/min	Nicht berücksichtigt	29.06.2021
138	1,2 ml/min		23.07.2021
148	0,7 mL/min		09.07.2021
163	1.1 ml/min	95%	July 27th

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Participant	Flow rate (IC)	Recovery rates	Date of analysis
177	0,3 ml/min	nein	05./06.07.2021
178	0,8 ml/min	0.98	08/07/2021
208	15 µl/min		09/07/2021
210	1,0 mL/Minute	Standards zu 93-100%	07.07.2021
231	1,2 ml/min	96 % - 103 %	24.06.2021
248	1,3 ml/min		19.07.2021
263	1 mL/min	nein	12./13.07.2021
266	1,2 mL/min	>95%	04/08/2021
272	0,25 mL / min	Innerhalb 90 - 100%	28.06.2021