

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

Proficiency testing scheme

Volatile organic compounds (VOC) with thermal desorption

May 2018

Summary of laboratory means

Sample 1

Unit	1,2,3-Trimethylbenzene Z score	2-Ethoxyethyl acetate Z score	alpha-Pinene Z score	Benzene Z score	Cumene Z score	Ethylbenzene Z score
2	45,61 -1,07	27,91 -3,59 FE	51,08 -1,09	50,22 -1,15	31,15 -1,88	36,46 -1,90
30	60,05 0,70	66,10 0,63	65,30 0,46	62,10 0,15	45,65 0,35	51,90 0,12
52	54,25 -0,01	60,40 0,00	63,50 0,26	66,50 0,64	43,85 0,08	52,75 0,23
55	53,00 -0,16	62,00 0,18	64,00 0,32	61,00 0,03	45,50 0,33	52,00 0,13
60	58,70 0,54	73,90 1,49	115,10 5,90 BE	59,95 -0,08	54,45 1,71	52,00 0,13
68	52,05 -0,28	83,10 2,51 E	58,95 -0,23	54,40 -0,69	38,95 -0,68	50,95 -0,01
73				58,50 -0,24		44,50 -0,85
107	60,65 0,78	85,80 2,80 E	75,90 1,62	76,70 1,76	52,65 1,43	66,10 1,98
120	51,01 -0,41	50,45 -1,10	25,25 -3,91 FE	45,15 -1,71	35,54 -1,20	48,45 -0,33
135	53,55 -0,09	69,20 0,97	58,20 -0,31	56,10 -0,50	47,70 0,67	51,65 0,09
145	37,50 -2,06 CE			65,00 0,47 C		37,50 -1,76
148	43,60 -1,31	66,35 0,66	59,35 -0,19	65,90 0,57	41,25 -0,32	51,05 0,01
151	56,05 0,21	63,70 0,36	76,90 1,73	61,55 0,09	45,05 0,26	50,85 -0,02
169	54,10 -0,03	62,15 0,19	59,30 -0,19	59,70 -0,11	43,00 -0,06	48,80 -0,29
186	15,20 -4,80 BE	60,55 0,02	62,40 0,14	63,05 0,26	148,70 16,20 BE	57,00 0,79
192	55,48 0,14	33,43 -2,98 E	60,66 -0,04	65,12 0,49	53,06 1,49	56,38 0,70
199	40,25 -1,73	42,45 -1,98	57,10 -0,43	54,65 -0,66	35,90 -1,15	44,20 -0,89
202	71,90 2,16 E	62,70 0,25	93,95 3,59 FE	64,35 0,40	45,35 0,31	56,70 0,75
207	59,00 0,58	73,00 1,39	71,50 1,14	77,00 1,79	50,00 1,02	57,50 0,85
208	57,00 0,33	54,50 -0,65	66,50 0,59	55,00 -0,63	39,00 -0,67	45,00 -0,78
237	53,35 -0,12	68,30 0,87	60,85 -0,02	57,40 -0,36	43,05 -0,05	50,95 -0,01
256	49,00 -0,65	37,50 -2,53 E	49,00 -1,32	68,00 0,80	61,00 2,71 CE	59,50 1,11
258	65,45 1,37	54,00 -0,71	66,20 0,56	68,80 0,89	48,10 0,73	57,85 0,90
261	62,65 1,02	68,15 0,85	59,90 -0,13	56,50 -0,46	39,60 -0,58	48,40 -0,34
267	43,50 -1,33		58,00 -0,34	55,50 -0,57	35,50 -1,21	44,50 -0,85
290	62,15 0,96	36,00 -2,69 E	63,60 0,28	58,85 -0,20	51,20 1,21	59,20 1,07
503	41,45 -1,58	62,45 0,23	35,00 -2,85 E	60,30 -0,04	37,10 -0,96	49,05 -0,25

	1,2,3-Trimethylbenzene Z score		2-Ethoxyethyl acetate Z score		alpha-Pinene Z score		Benzene Z score		Cumene Z score		Ethylbenzene Z score	
506	54,00	-0,04	53,50	-0,76	61,50	0,05	56,50	-0,46	38,00	-0,82	46,50	-0,59
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Method	ISO 5725-2		ISO 5725-2		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		Z <=2,00		Z <=2,00	
No. of laboratories that submitted results	27		25		26		28		26		28	
Mean	54,31		60,40		61,07		60,70		43,36		50,99	
Reproducibility s.d.	7,76		13,57		8,95		7,39		6,39		6,68	
Rel. reproducibility s.d.	14,29 %		22,47 %		14,65 %		12,18 %		14,73 %		13,11 %	
Reference value	53,90		58,40		59,60		61,10		39,60		48,50	
Target s.d.	8,15		9,06		9,16		9,10		6,50		7,65	
Rel. target s.d.	15,00 %		15,00 %		15,00 %		15,00 %		15,00 %		15,00 %	
Lower limit of tolerance	38,02		42,28		42,75		42,49		30,35		35,69	
Upper limit of tolerance	70,61		78,52		79,40		78,90		56,37		66,29	
Type B outliers	1				1				1			
Type C outliers	1						1		1			
Type F outliers			1		2							
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	25		24		23		27		24		28	
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												
	m-Xylene Z score		n-Butyl acetate Z score		n-Octane Z score		Toluene Z score					
Unit	µg/m³		µg/m³		µg/m³		µg/m³					

	m-Xylene Z score		n-Butyl acetate Z score		n-Octane Z score		Toluene Z score	
2	101,66	-2,11 E	19,52	-2,08 E	60,09	-1,20	96,50	-0,81 C
30	163,25	0,65	29,60	0,29	81,35	0,74	117,25	0,45
52	161,00	0,55	31,00	0,62	73,00	-0,02	113,50	0,22
55	155,50	0,30	29,00	0,15	76,00	0,25	110,00	0,01
60	137,70	-0,50	26,65	-0,40	71,80	-0,13	102,30	-0,46
68	125,60	-1,04	36,75	1,97	56,30	-1,54	92,25	-1,07
73	138,00	-0,48	28,00	-0,09	68,50	-0,43	102,50	-0,45
107	194,65	2,06 E	35,70	1,72	102,90	2,70 E	141,65	1,93
120	140,55	-0,37	21,16	-1,69	88,44	1,38 C	124,45	0,88
135	155,55	0,30	29,45	0,26	74,25	0,09	107,75	-0,13
145	117,50	-1,40			70,00	-0,29	92,50	-1,05
148	152,00	0,14	29,40	0,24	78,40	0,47	109,00	-0,05
151	154,85	0,27	28,10	-0,06	74,70	0,13	107,80	-0,13
169	166,60	0,80	24,95	-0,80	57,80	-1,41	108,65	-0,07
186	136,90	-0,53	27,80	-0,13	74,65	0,13	106,25	-0,22
192	173,13	1,09	34,38	1,42	86,60	1,22	122,09	0,74
199	123,10	-1,15	26,70	-0,39	69,50	-0,34	86,80	-1,40
202	171,85	1,03	30,20	0,43	80,20	0,63	130,60	1,26
207	173,50	1,11	34,50	1,44	87,00	1,25	124,00	0,86
208	130,00	-0,84	26,50	-0,44	68,00	-0,48	95,50	-0,87
237	157,10	0,37	30,70	0,55	73,80	0,05	108,35	-0,09
256	101,50	-2,12 E	19,00	-2,20 E	50,50	-2,07 E	128,50	1,13 C
258	176,65	1,25	31,90	0,83	87,30	1,28	126,00	0,98
261	125,40	-1,05 C	29,65	0,30	70,40	-0,26	105,60	-0,26
267	133,50	-0,68			69,00	-0,39	97,00	-0,78
290	172,15	1,05	21,50	-1,61	73,05	-0,02	118,80	0,54
503	161,45	0,57					108,65	-0,07
506	141,50	-0,33	27,00	-0,32	69,00	-0,39	97,50	-0,75
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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	28		25		27		28	

	m-Xylene Z score	n-Butyl acetate Z score	n-Octane Z score	Toluene Z score
Mean	148,77	28,36	73,23	109,87
Reproducibility s.d.	23,34	4,74	10,91	13,12
Rel. reproducibility s.d.	15,69 %	16,69 %	14,89 %	11,94 %
Reference value	154,40	27,50	74,30	107,10
Target s.d.	22,32	4,25	10,99	16,48
Rel. target s.d.	15,00 %	15,00 %	15,00 %	15,00 %
Lower limit of tolerance	104,14	19,86	51,26	76,91
Upper limit of tolerance	193,40	36,87	95,20	142,84
Type C outliers	1		1	2
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	27	25	26	26

Summary of laboratory means

Sample 2

Unit	1,2,3-Trimethylbenzene Z score		2-Ethoxyethyl acetate Z score		alpha-Pinene Z score		Benzene Z score		Cumene Z score		Ethylbenzene Z score	
	µg/m³		µg/m³		µg/m³		µg/m³		µg/m³		µg/m³	
2	51,81	-1,85	40,39	-4,00 FE	35,86	-0,92	23,63	-1,10	52,70	-2,53 E	63,24	-2,31 E
30	77,35	0,52	111,20	0,66	43,20	0,26	28,55	0,06	85,40	0,04	96,15	-0,04
52	72,75	0,09	105,00	0,25	42,40	0,13	28,65	0,08	84,95	0,01	101,50	0,33
55	71,00	-0,07	106,00	0,32	44,50	0,47	29,00	0,17	87,50	0,21	98,00	0,08
60	78,90	0,67	125,00	1,57	79,45	6,07 BE	28,25	-0,01	103,75	1,48	96,80	0,00
68	69,35	-0,22	122,50	1,41	42,30	0,12	23,70	-1,08	73,05	-0,93	104,40	0,52
73							26,50	-0,42			75,50	-1,47
107	83,55	1,10	154,05	3,49 FE	53,50	1,91	35,75	1,76	103,85	1,49	128,55	2,19 E
120	61,03	-0,99	67,10	-2,24 E	16,24	-4,06 FE	18,40	-2,33 E	60,12	-1,94	74,02	-1,57
135	73,50	0,16	120,40	1,27	40,90	-0,11	26,50	-0,42	93,15	0,65	99,80	0,21
145	42,50	-2,72 E					37,50	2,17 E			70,00	-1,84
148	62,30	-0,88	120,50	1,28	39,95	-0,26	31,30	0,71	84,10	-0,06	101,50	0,33
151	76,65	0,46	107,50	0,42	51,70	1,62	28,45	0,04	88,40	0,28	98,70	0,13
169	77,30	0,52	115,60	0,95	39,95	-0,26	29,00	0,17	89,55	0,37	101,10	0,30
186	29,85	-3,89 FE	106,75	0,37	41,60	0,00	29,30	0,24	201,10	9,13 BE	109,85	0,90
192	75,47	0,35	56,58	-2,94 E	42,19	0,10	30,05	0,41	104,05	1,51	109,63	0,89
199	55,30	-1,53	67,20	-2,24 E	36,85	-0,76	23,35	-1,16	67,95	-1,33	80,25	-1,14
202	102,15	2,83 E	117,95	1,11	68,25	4,28 FE	30,20	0,45	92,75	0,62	114,00	1,19
207	79,50	0,72	122,50	1,41	47,50	0,95	35,00	1,58	97,50	0,99	109,00	0,84
208	78,00	0,58	91,00	-0,67	43,50	0,31	25,00	-0,78	76,00	-0,70	88,00	-0,60
237	72,80	0,10	115,60	0,95	41,10	-0,08	24,90	-0,80	84,65	-0,02	99,50	0,19
256	67,50	-0,39	80,50	-1,36	35,00	-1,05	31,00	0,64	109,00	1,90	117,50	1,43
258	90,45	1,74	103,85	0,18	49,55	1,28	33,65	1,26	97,10	0,96	116,50	1,36
261	82,80	1,03	106,70	0,37	39,10	-0,40	24,70	-0,85	78,80	-0,48	69,20	-1,90
267	61,00	-1,00			41,00	-0,09	26,50	-0,42	71,00	-1,09	87,50	-0,64
290	83,30	1,07	62,00	-2,58 E	43,35	0,28	26,95	-0,32	98,85	1,10	112,90	1,11
503	45,80	-2,41 E	101,90	0,05 C	21,30	-3,25 E	31,45	0,74	62,45	-1,76	84,20	-0,87 C

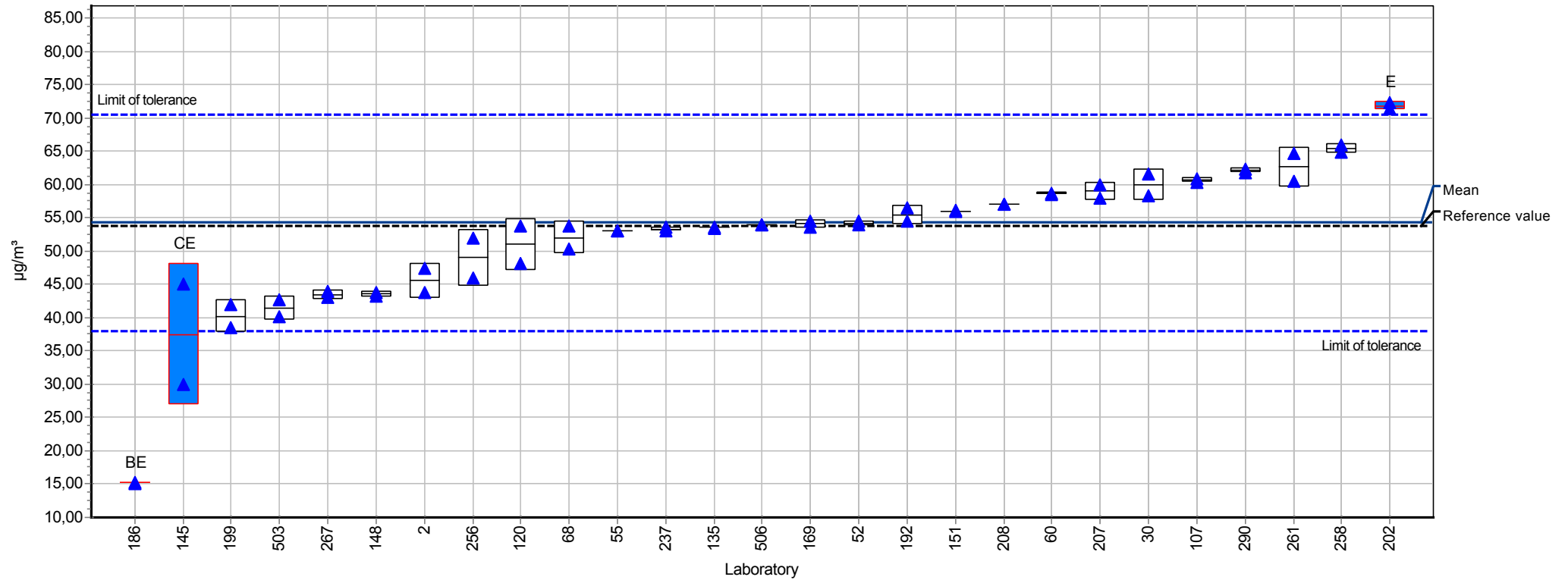
	1,2,3-Trimethylbenzene Z score		2-Ethoxyethyl acetate Z score		alpha-Pinene Z score		Benzene Z score		Cumene Z score		Ethylbenzene Z score	
506	73,00	0,12	93,50	-0,50	40,00	-0,25	25,00	-0,78	75,00	-0,77	90,00	-0,47
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Method	ISO 5725-2		ISO 5725-2		ISO 5725-2		ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	Z <=2,00		Z <=2,00		Z <=2,00		Z <=2,00		Z <=2,00		Z <=2,00	
No. of laboratories that submitted results	27		25		26		28		26		28	
Mean	71,73		101,13		41,58		28,29		84,86		96,78	
Reproducibility s.d.	13,40		21,44		6,47		4,30		14,94		16,53	
Rel. reproducibility s.d.	18,68 %		21,20 %		15,57 %		15,19 %		17,61 %		17,08 %	
Reference value	73,10		99,90		39,90		27,40		78,40		94,80	
Target s.d.	10,76		15,17		6,24		4,24		12,73		14,52	
Rel. target s.d.	15,00 %		15,00 %		15,00 %		15,00 %		15,00 %		15,00 %	
Lower limit of tolerance	50,21		70,79		29,10		19,81		59,41		67,75	
Upper limit of tolerance	93,25		131,47		54,05		36,78		110,32		125,82	
Type B outliers					1				1			
Type C outliers			1								1	
Type F outliers	1		2		2							
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	26		22		23		28		25		27	
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												
	m-Xylene Z score		n-Butyl acetate Z score		n-Octane Z score		Toluene Z score					
Unit	µg/m³		µg/m³		µg/m³		µg/m³					

	m-Xylene Z score		n-Butyl acetate Z score		n-Octane Z score		Toluene Z score	
2	85,19	-2,48 E	42,35	-2,53 E	44,01	-0,91	92,45	-2,28 E
30	143,80	0,41	70,15	0,18	54,25	0,42	146,85	0,30
52	145,50	0,49	75,70	0,72	49,65	-0,18	149,00	0,41
55	142,50	0,34	70,00	0,17	52,00	0,13	143,50	0,15
60	126,10	-0,47	65,60	-0,26	51,40	0,05	132,20	-0,39
68	114,15	-1,05	69,15	0,08	34,20	-2,20 E	115,95	-1,16
73	113,00	-1,11	58,00	-1,01	41,50	-1,24	117,50	-1,09
107	181,80	2,27 E	89,35	2,05 E	70,90	2,60 E	183,45	2,04 E
120	110,00	-1,26	49,45	-1,84	54,45	0,45 C	114,45	-1,23
135	145,30	0,48	73,80	0,54	52,30	0,17	142,85	0,11
145	177,50	2,06 CE			47,50	-0,46	117,50	-1,09
148	143,50	0,39	72,20	0,38	56,05	0,66	146,50	0,29
151	143,00	0,37	68,30	0,00	52,55	0,20	143,15	0,13
169	161,55	1,28	75,05	0,66	48,90	-0,27	149,00	0,41
186	126,00	-0,47	66,95	-0,13	50,55	-0,06	139,10	-0,06
192	158,70	1,14	85,87	1,72	60,02	1,18	160,30	0,94
199	112,90	-1,11	60,00	-0,81	47,20	-0,50	109,35	-1,48
202	163,35	1,37	80,35	1,18	57,90	0,90	177,95	1,78
207	160,50	1,23	80,50	1,19	60,50	1,24	161,00	0,98
208	120,00	-0,77	63,50	-0,47	47,00	-0,52	130,00	-0,50
237	144,95	0,46	73,00	0,46	51,25	0,03	144,55	0,20
256	89,50	-2,27 E	51,50	-1,64	39,00	-1,57	164,50	1,14
258	167,15	1,55	81,50	1,29	62,05	1,44	169,60	1,38
261	110,65	-1,22	68,00	-0,03	46,85	-0,54	120,80	-0,93
267	125,50	-0,49			49,50	-0,20	130,50	-0,47
290	161,85	1,29	52,20	-1,57	50,95	-0,01	159,90	0,92
503	129,95	-0,28 C					145,35	0,23
506	128,00	-0,37	65,00	-0,32	48,00	-0,39	125,00	-0,73
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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	28		25		27		28	

	m-Xylene Z score	n-Butyl acetate Z score	n-Octane Z score	Toluene Z score
Mean	135,56	68,30	51,00	140,44
Reproducibility s.d.	24,50	11,56	7,60	21,78
Rel. reproducibility s.d.	18,07 %	16,93 %	14,90 %	15,51 %
Reference value	139,70	67,90	51,30	140,40
Target s.d.	20,33	10,24	7,65	21,07
Rel. target s.d.	15,00 %	15,00 %	15,00 %	15,00 %
Lower limit of tolerance	94,89	47,81	35,70	98,31
Upper limit of tolerance	176,22	88,79	66,30	182,57
Type C outliers	2		1	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	26	25	26	28

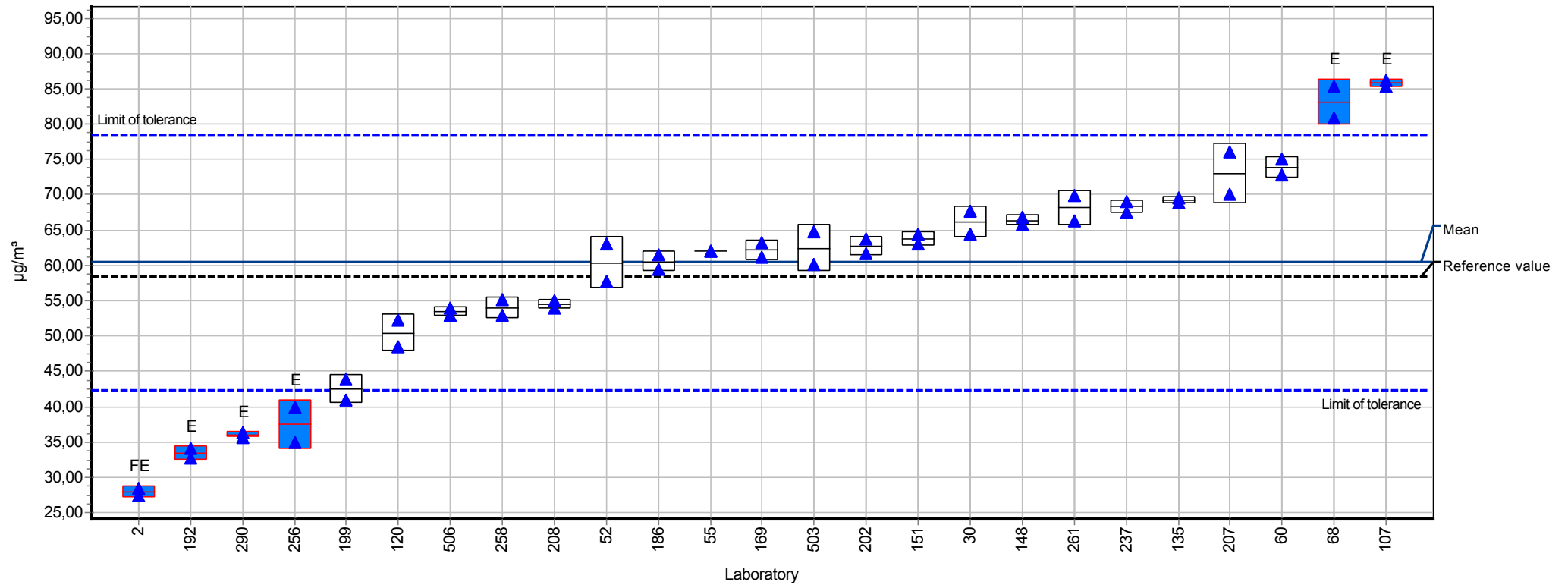
Summary results

Measurand:	1,2,3-Trimethylbenzene	Mean:	54,31 µg/m³
Sample:	1	Reprod. s.d.:	7,76 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	14,29%
Rel.target s.d.:	15,00% (Limited)	Reference value:	53,90 µg/m³
No. of laboratories:	25	Range of tolerance:	38,02 - 70,61 µg/m³ (Z-Score ≤ 2,00)



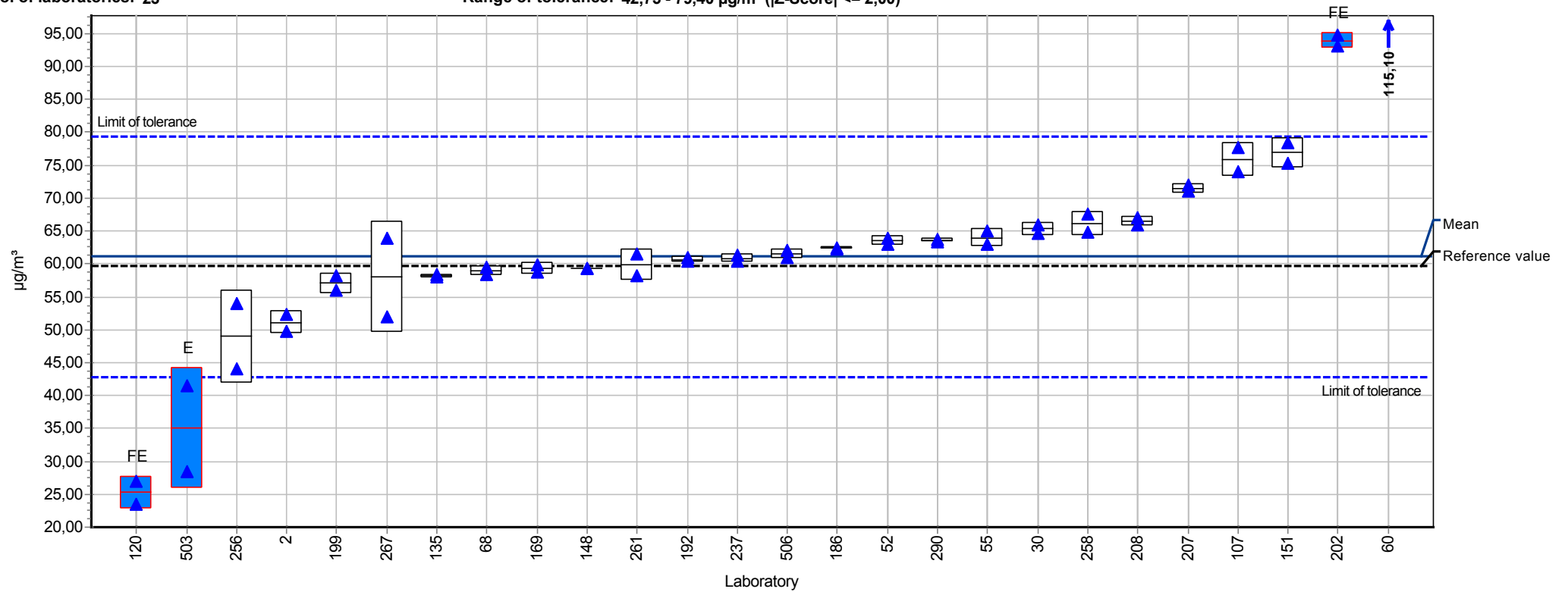
Summary results

Measurand:	2-Ethoxyethyl acetate	Mean:	60,40 µg/m³
Sample:	1	Reprod. s.d.:	13,57 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	22,47%
Rel.target s.d.:	15,00% (Limited)	Reference value:	58,40 µg/m³
No. of laboratories:	24	Range of tolerance:	42,28 - 78,52 µg/m³ (Z-Score ≤ 2,00)



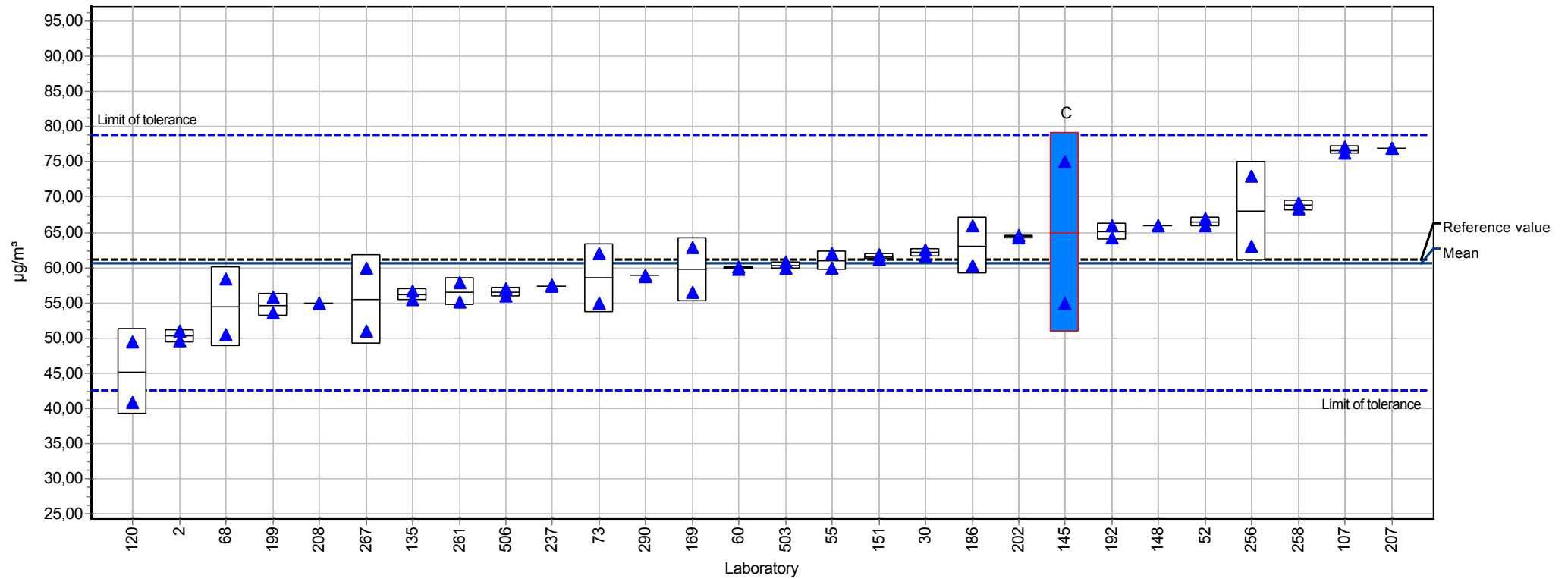
Summary results

Measurand: alpha-Pinene **Mean:** 61,07 µg/m³
Sample: 1 **Reprod. s.d.:** 8,95 µg/m³
Method: ISO 5725-2 **Rel.reprod. s.d.:** 14,65%
Rel.target s.d.: 15,00% (Limited) **Reference value:** 59,60 µg/m³
No. of laboratories: 23 **Range of tolerance:** 42,75 - 79,40 µg/m³ (|Z-Score| ≤ 2,00)



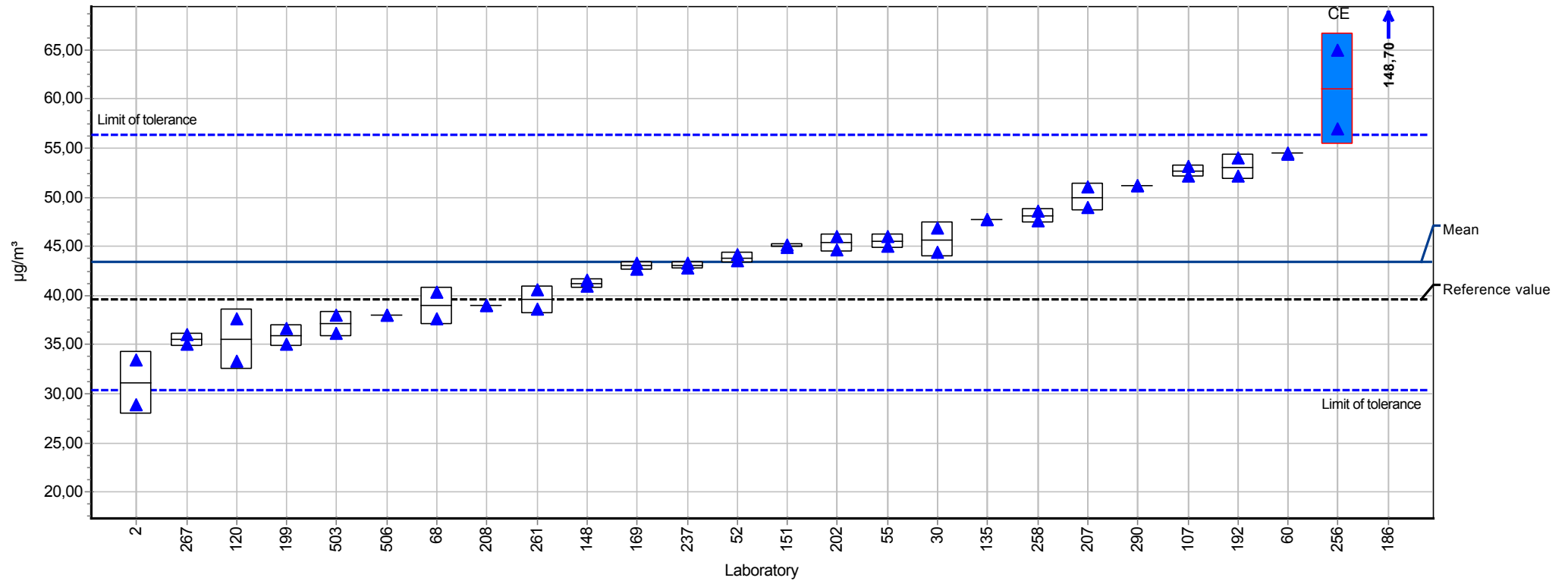
Summary results

Measurand:	Benzene	Mean:	60,70 $\mu\text{g}/\text{m}^3$
Sample:	1	Reprod. s.d.:	7,39 $\mu\text{g}/\text{m}^3$
Method:	ISO 5725-2	Rel.reprod. s.d.:	12,18%
Rel.target s.d.:	15,00% (Limited)	Reference value:	61,10 $\mu\text{g}/\text{m}^3$
No. of laboratories:	27	Range of tolerance:	42,49 - 78,90 $\mu\text{g}/\text{m}^3$ ($Z\text{-Score} \leq 2,00$)



Summary results

Measurand:	Cumene	Mean:	43,36 µg/m³
Sample:	1	Reprod. s.d.:	6,39 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	14,73%
Rel.target s.d.:	15,00% (Limited)	Reference value:	39,60 µg/m³
No. of laboratories:	24	Range of tolerance:	30,35 - 56,37 µg/m³ (Z-Score ≤ 2,00)

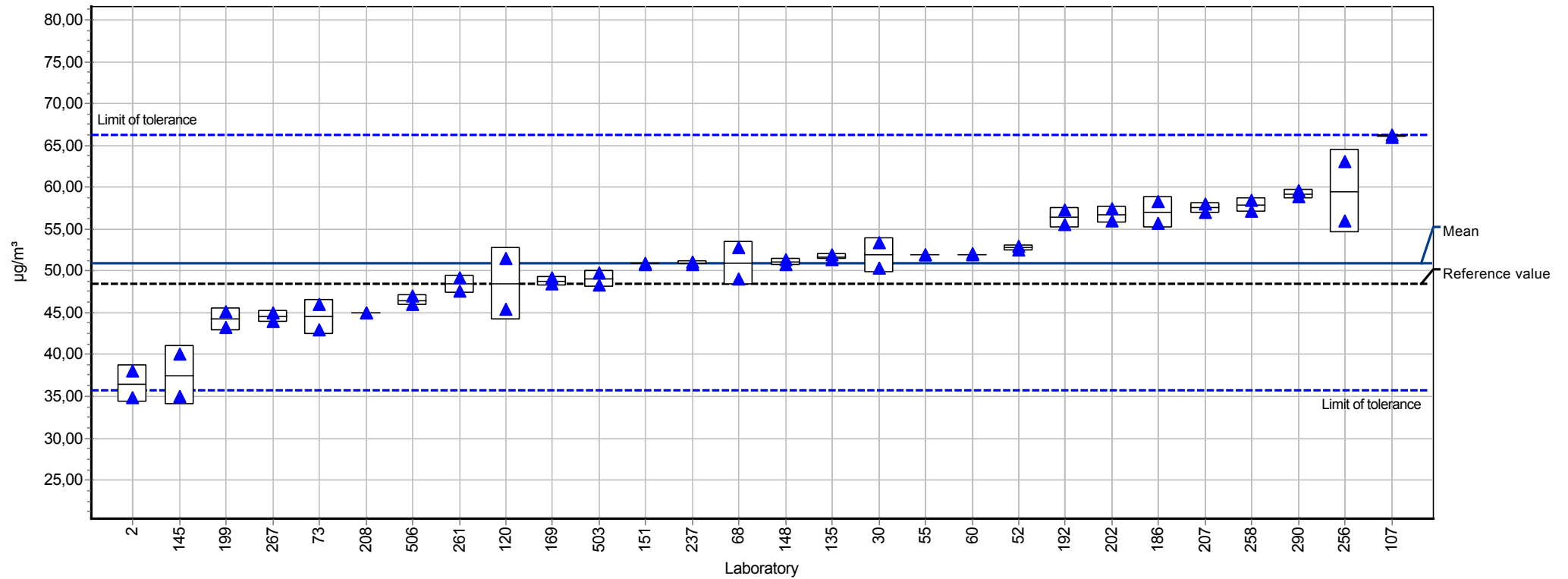


Summary results

Measurand: Ethylbenzene
Sample: 1
Method: ISO 5725-2
Rel.target s.d.: 15,00% (Limited)

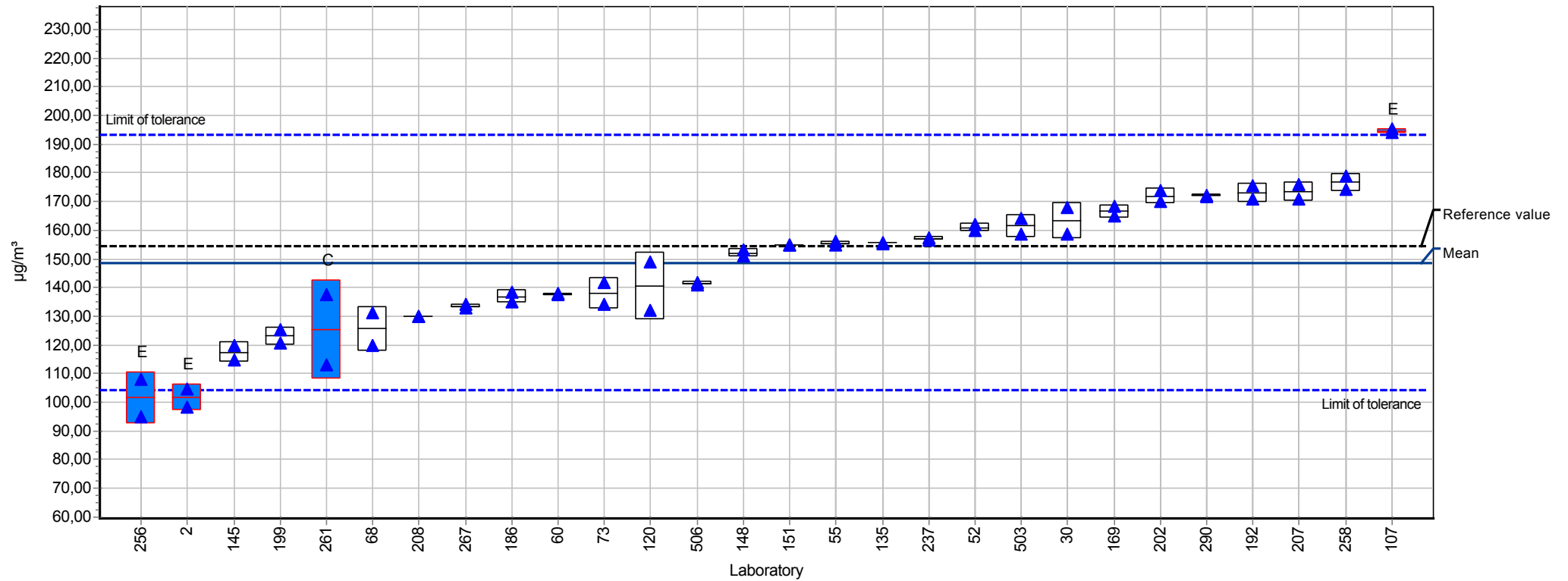
Mean: 50,99 $\mu\text{g}/\text{m}^3$
Reprod. s.d.: 6,68 $\mu\text{g}/\text{m}^3$
Rel.reprod. s.d.: 13,11%
Reference value: 48,50 $\mu\text{g}/\text{m}^3$
Range of tolerance: 35,69 - 66,29 $\mu\text{g}/\text{m}^3$ ($|Z\text{-Score}| \leq 2,00$)

No. of laboratories: 28



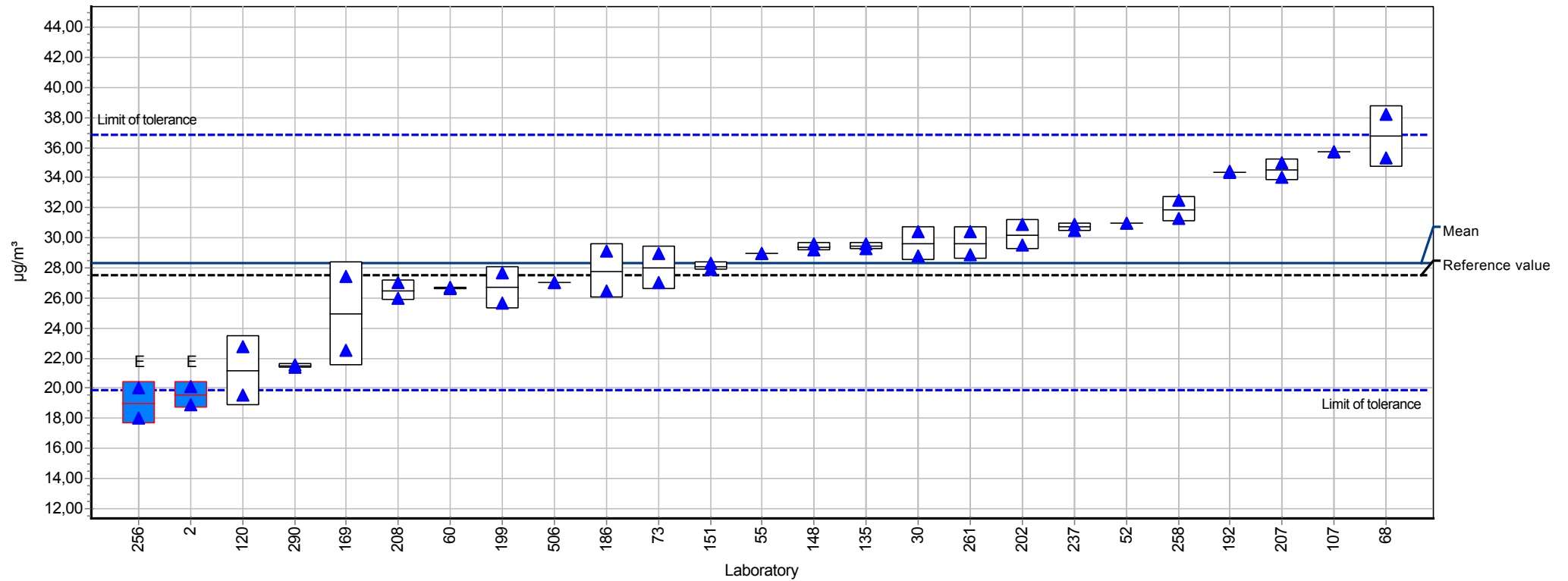
Summary results

Measurand:	m-Xylene	Mean:	148,77 µg/m³
Sample:	1	Reprod. s.d.:	23,34 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	15,69%
Rel.target s.d.:	15,00% (Limited)	Reference value:	154,40 µg/m³
No. of laboratories:	27	Range of tolerance:	104,14 - 193,40 µg/m³ (Z-Score <= 2,00)



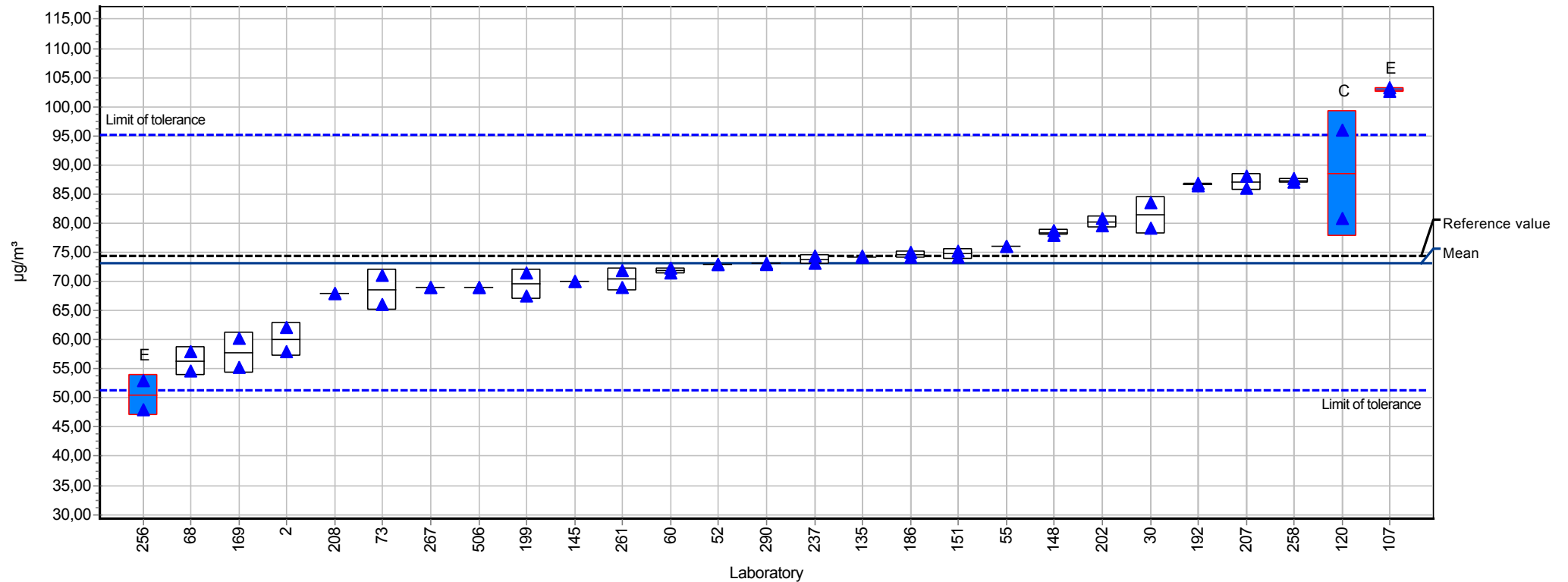
Summary results

Measurand:	n-Butyl acetate	Mean:	28,36 µg/m³
Sample:	1	Reprod. s.d.:	4,74 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	16,69%
Rel.target s.d.:	15,00% (Limited)	Reference value:	27,50 µg/m³
No. of laboratories:	25	Range of tolerance:	19,86 - 36,87 µg/m³ (Z-Score <= 2,00)



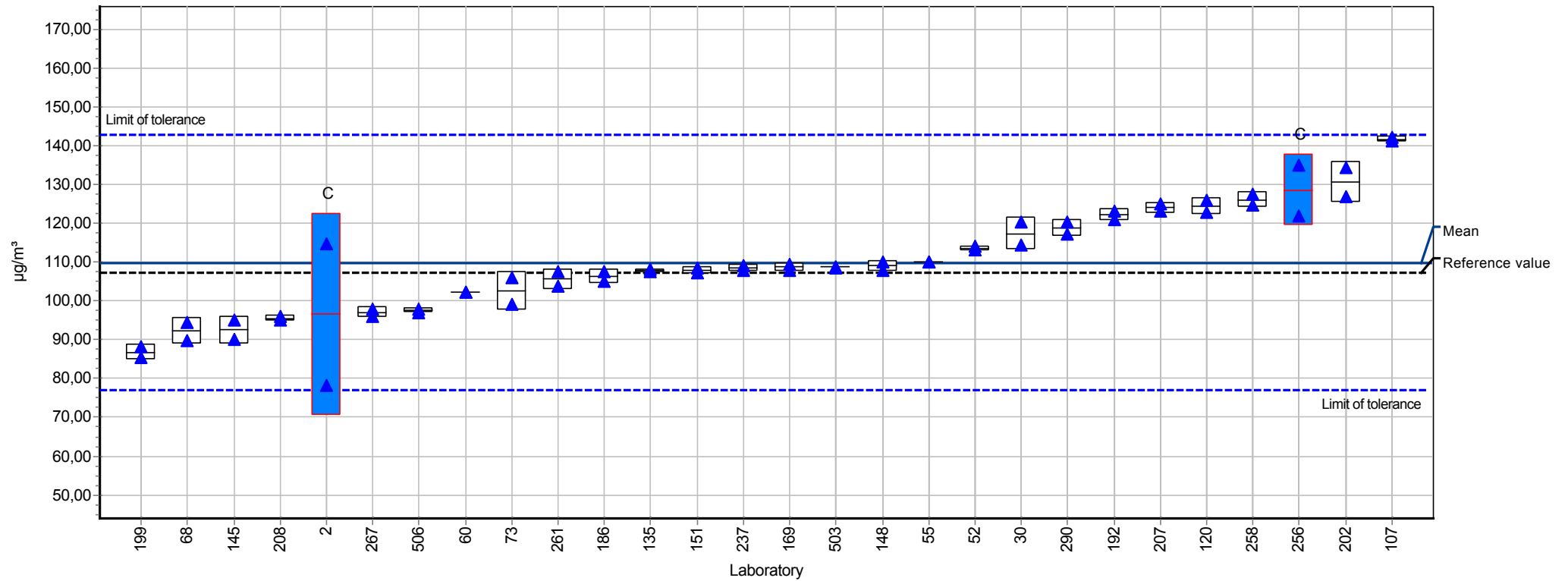
Summary results

Measurand:	n-Octane	Mean:	73,23 µg/m³
Sample:	1	Reprod. s.d.:	10,91 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	14,89%
Rel.target s.d.:	15,00% (Limited)	Reference value:	74,30 µg/m³
No. of laboratories:	26	Range of tolerance:	51,26 - 95,20 µg/m³ (Z-Score ≤ 2,00)



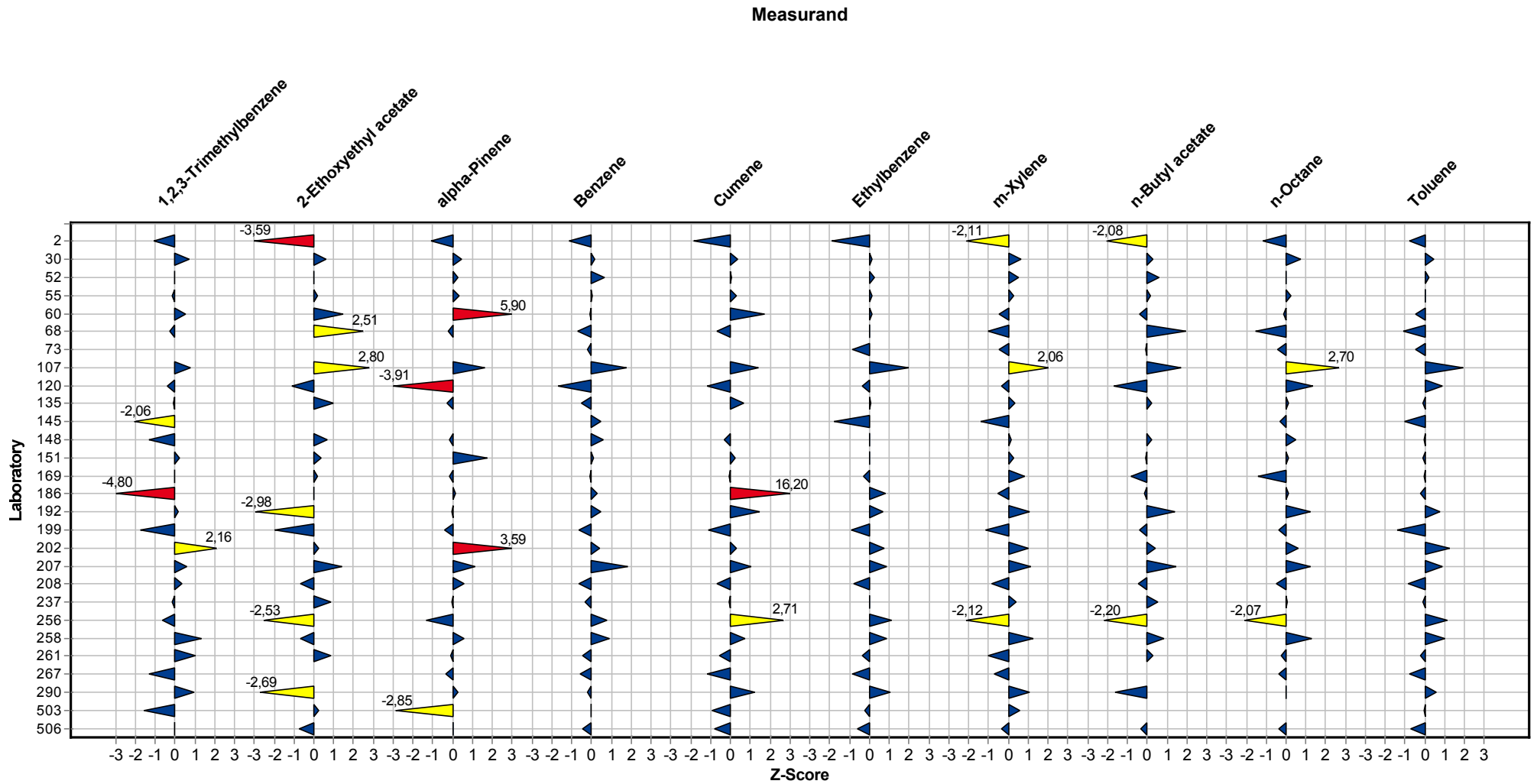
Summary results

Measurand:	Toluene	Mean:	109,87 µg/m³
Sample:	1	Reprod. s.d.:	13,12 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	11,94%
Rel.target s.d.:	15,00% (Limited)	Reference value:	107,10 µg/m³
No. of laboratories:	26	Range of tolerance:	76,91 - 142,84 µg/m³ (Z-Score ≤ 2,00)



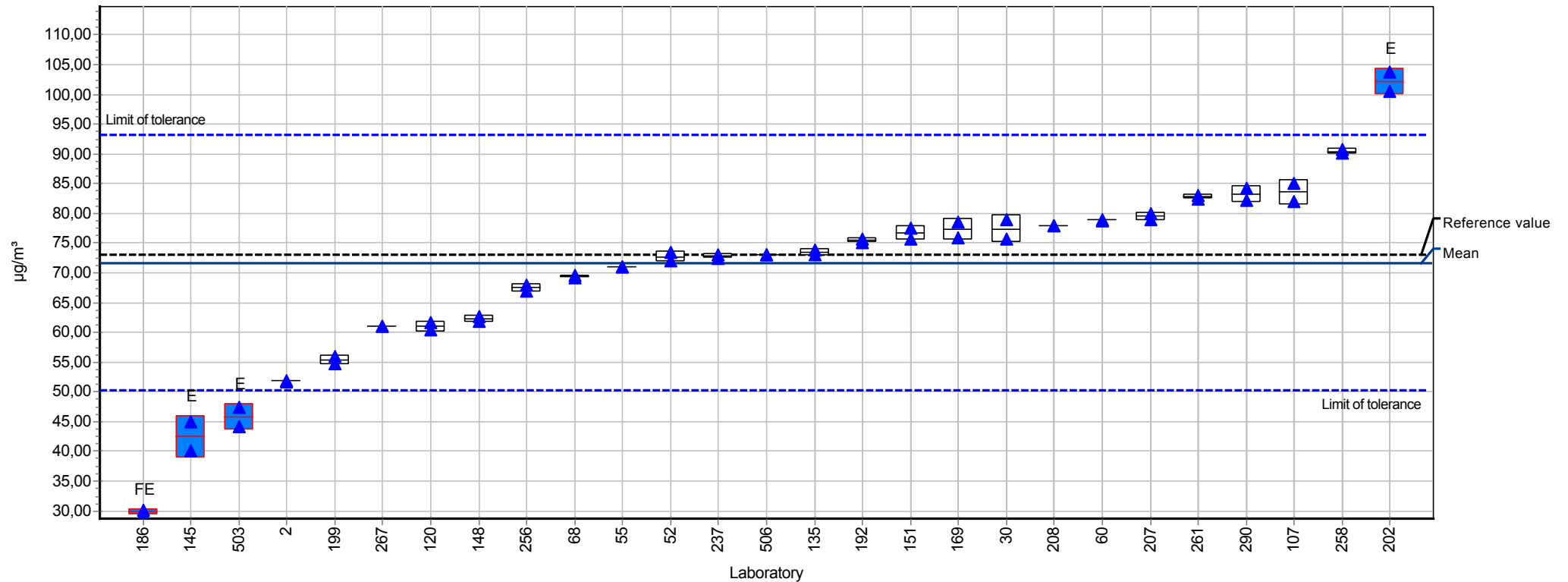
Sample chart of Z-scores

Sample 1



Summary results

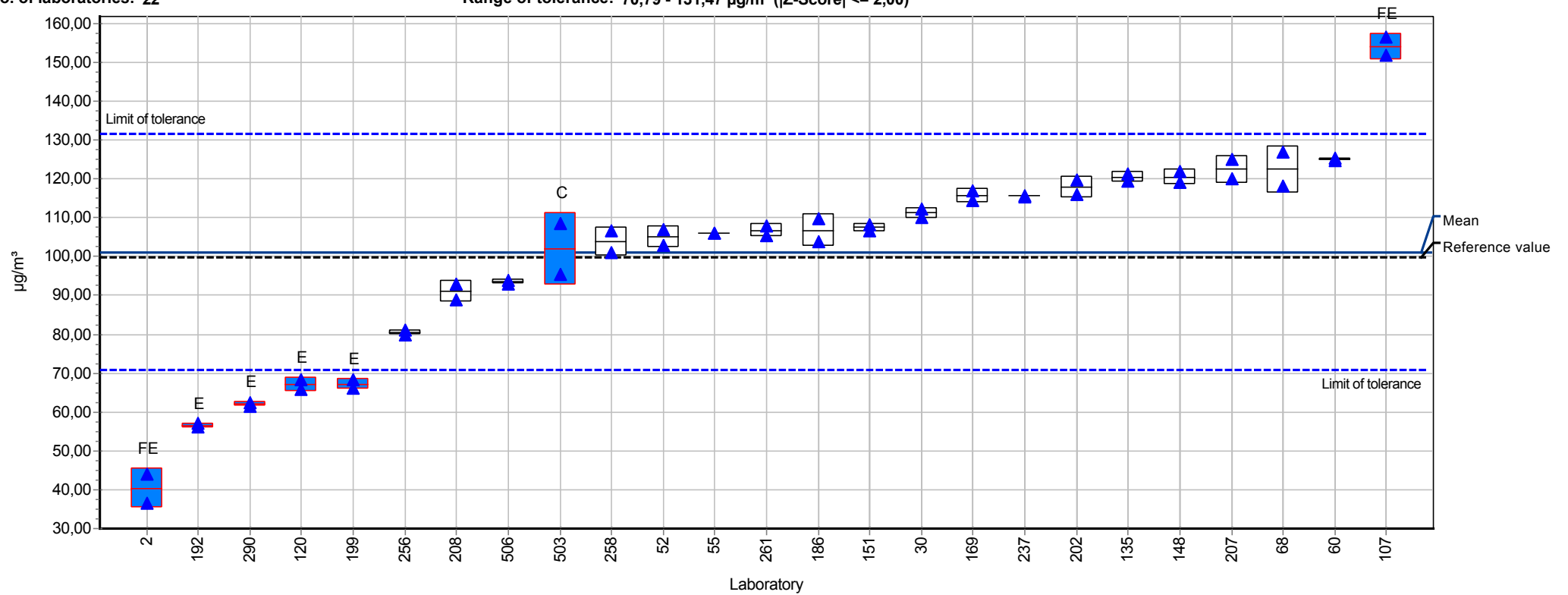
Measurand:	1,2,3-Trimethylbenzene	Mean:	71,73 µg/m³
Sample:	2	Reprod. s.d.:	13,40 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	18,68%
Rel.target s.d.:	15,00% (Limited)	Reference value:	73,10 µg/m³
No. of laboratories:	26	Range of tolerance:	50,21 - 93,25 µg/m³ (Z-Score <= 2,00)



Summary results

Measurand: 2-Ethoxyethyl acetate **Mean:** 101,13 µg/m³
Sample: 2 **Reprod. s.d.:** 21,44 µg/m³
Method: ISO 5725-2 **Rel.reprod. s.d.:** 21,20%
Rel.target s.d.: 15,00% (Limited) **Reference value:** 99,90 µg/m³

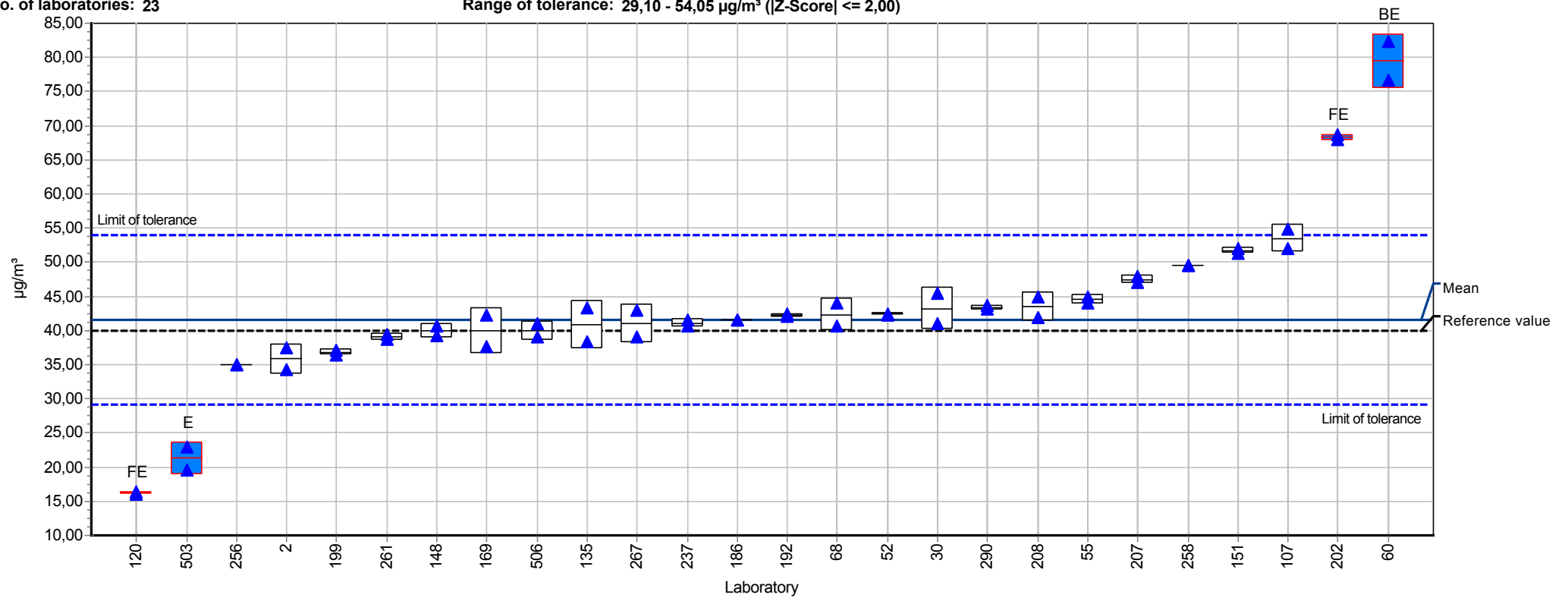
No. of laboratories: 22 **Range of tolerance:** 70,79 - 131,47 µg/m³ ($|Z\text{-Score}| \leq 2,00$)



Summary results

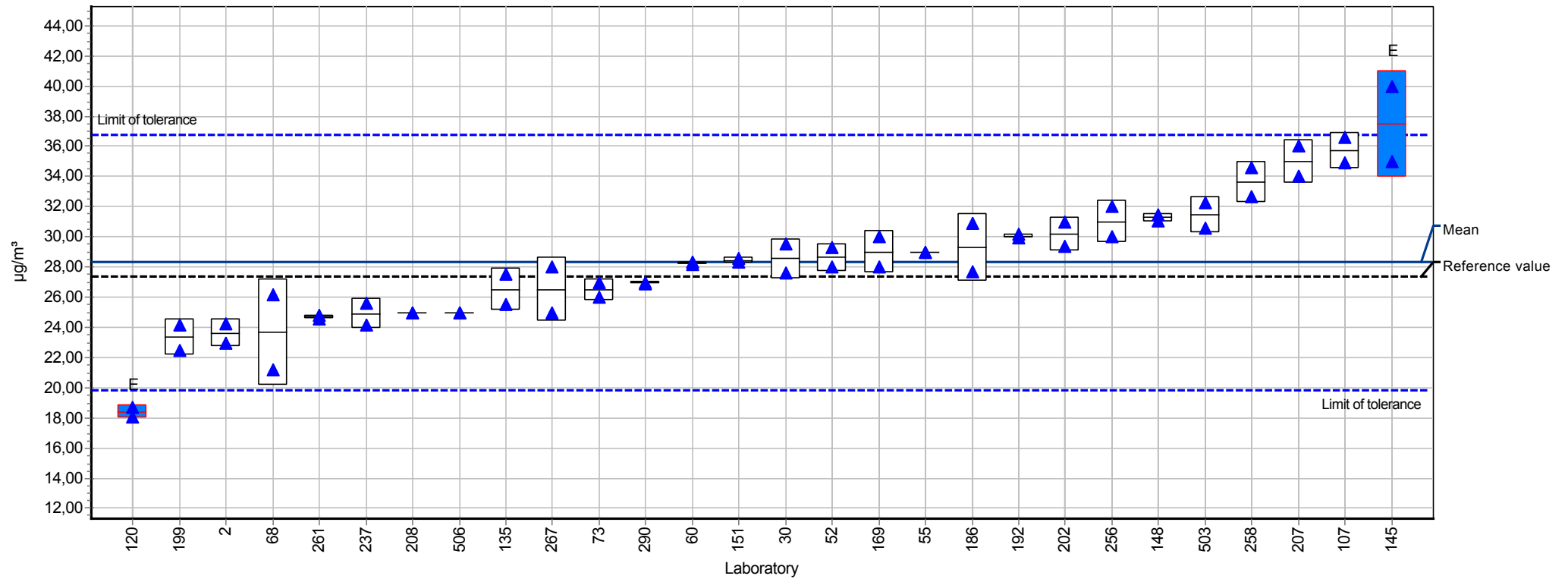
Measurand: alpha-Pinene **Mean:** 41,58 µg/m³
Sample: 2 **Reprod. s.d.:** 6,47 µg/m³
Method: ISO 5725-2 **Rel.reprod. s.d.:** 15,57%
Rel.target s.d.: 15,00% (Limited) **Reference value:** 39,90 µg/m³

No. of laboratories: 23 **Range of tolerance:** 29,10 - 54,05 µg/m³ (|Z-Score| <= 2,00)



Summary results

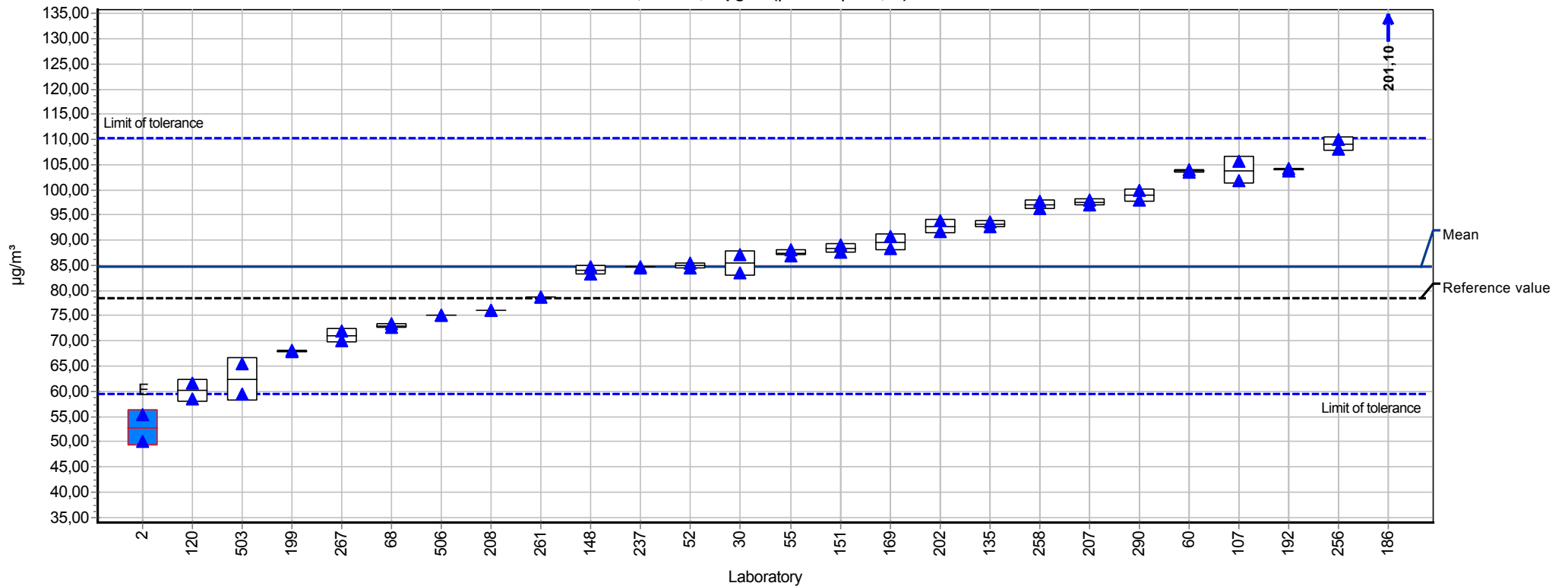
Measurand:	Benzene	Mean:	28,29 µg/m³
Sample:	2	Reprod. s.d.:	4,30 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	15,19%
Rel.target s.d.:	15,00% (Limited)	Reference value:	27,40 µg/m³
No. of laboratories:	28	Range of tolerance:	19,81 - 36,78 µg/m³ (Z-Score <= 2,00)



Summary results

Measurand: Cumene **Mean:** 84,86 µg/m³
Sample: 2 **Reprod. s.d.:** 14,94 µg/m³
Method: ISO 5725-2 **Rel.reprod. s.d.:** 17,61%
Rel.target s.d.: 15,00% (Limited) **Reference value:** 78,40 µg/m³

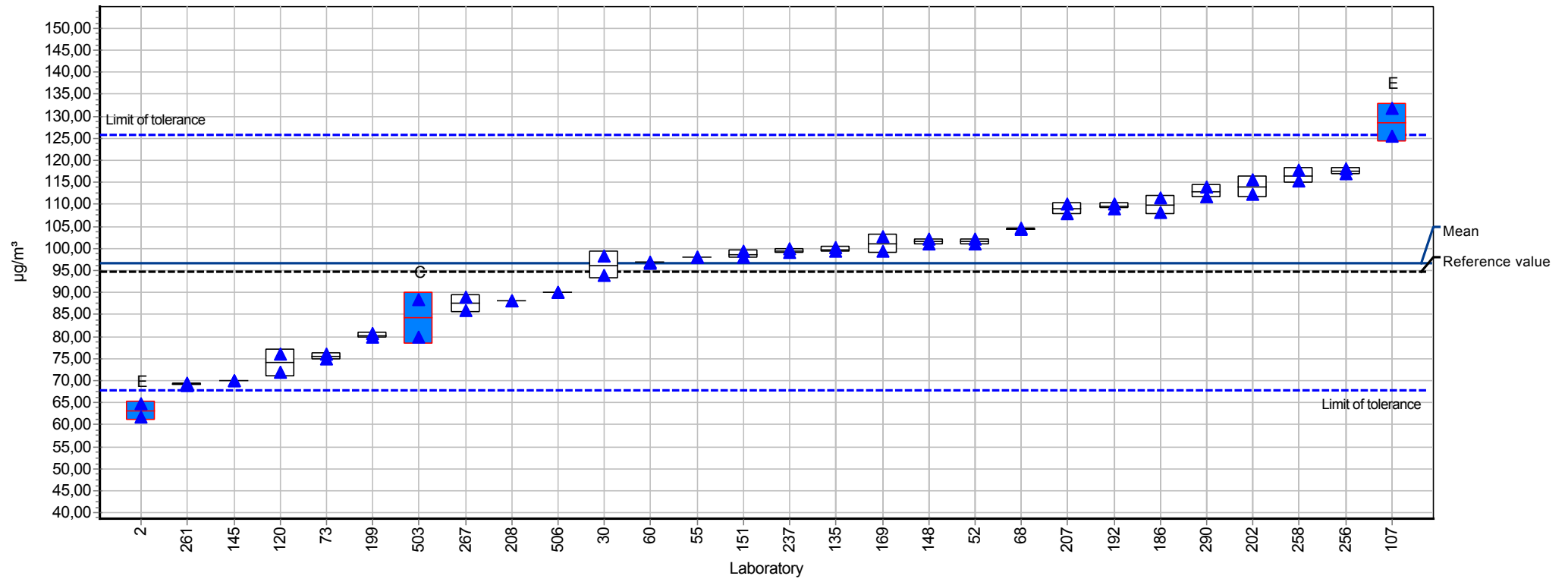
No. of laboratories: 25 **Range of tolerance:** 59,41 - 110,32 µg/m³ (|Z-Score| <= 2,00)



Summary results

Measurand: Ethylbenzene **Mean:** 96,78 µg/m³
Sample: 2 **Reprod. s.d.:** 16,53 µg/m³
Method: ISO 5725-2 **Rel.reprod. s.d.:** 17,08%
Rel.target s.d.: 15,00% (Limited) **Reference value:** 94,80 µg/m³

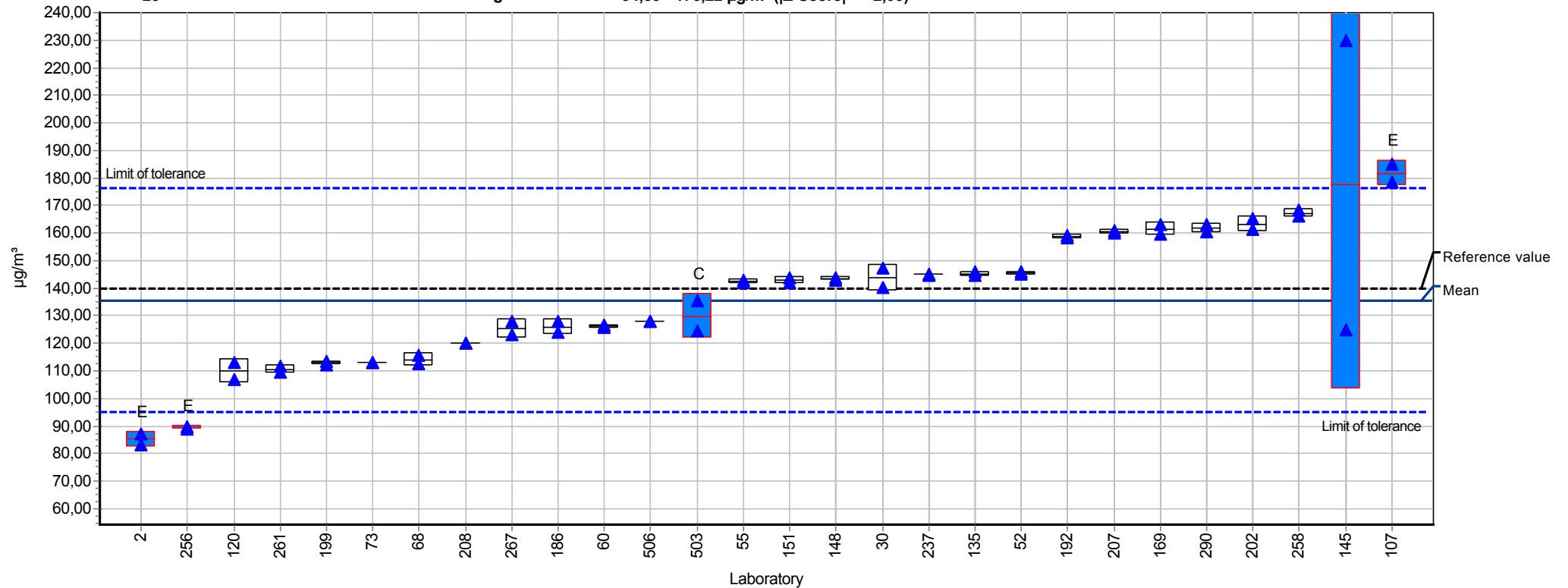
No. of laboratories: 27 **Range of tolerance:** 67,75 - 125,82 µg/m³ (|Z-Score| ≤ 2,00)



Summary results

Measurand: m-Xylene **Mean:** 135,56 µg/m³
Sample: 2 **Reprod. s.d.:** 24,50 µg/m³
Method: ISO 5725-2 **Rel.reprod. s.d.:** 18,07%
Rel.target s.d.: 15,00% (Limited) **Reference value:** 139,70 µg/m³

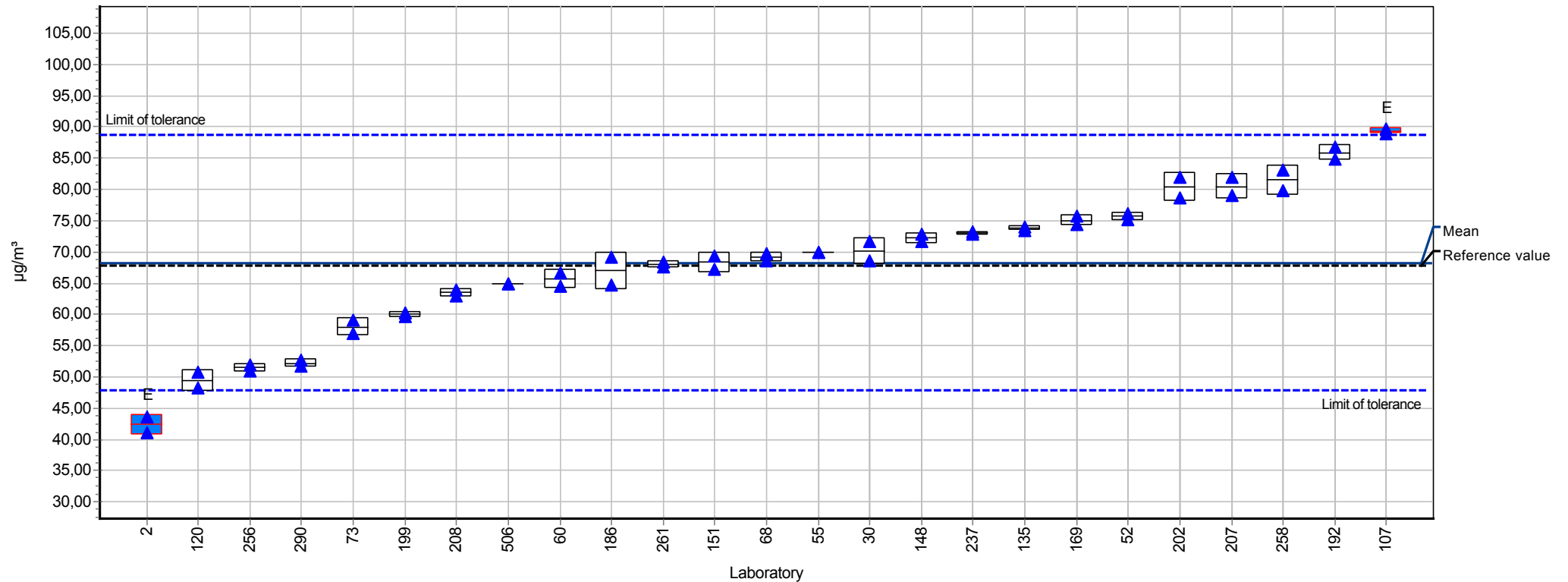
No. of laboratories: 26 **Range of tolerance:** 94,89 - 176,22 µg/m³ (|Z-Score| ≤ 2,00)



Summary results

Measurand: n-Butyl acetate **Mean:** 68,30 µg/m³
Sample: 2 **Reprod. s.d.:** 11,56 µg/m³
Method: ISO 5725-2 **Rel.reprod. s.d.:** 16,93%
Rel.target s.d.: 15,00% (Limited) **Reference value:** 67,90 µg/m³

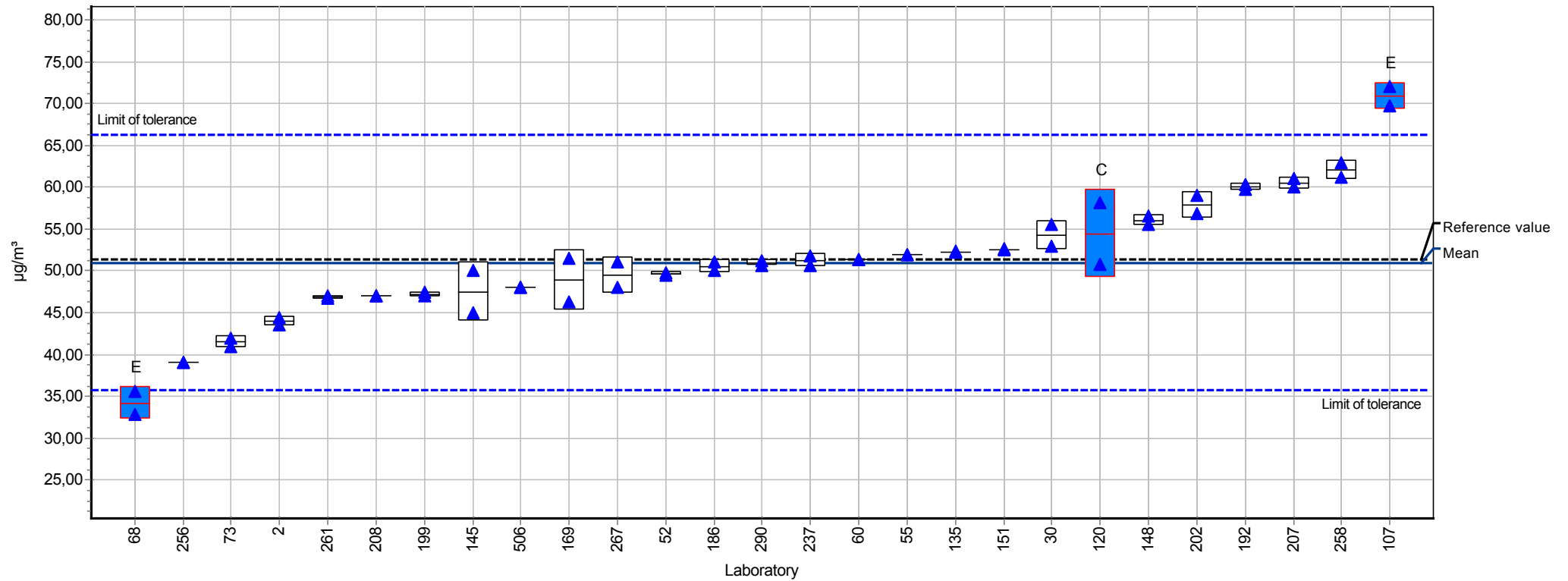
No. of laboratories: 25 **Range of tolerance:** 47,81 - 88,79 µg/m³ (|Z-Score| ≤ 2,00)



Summary results

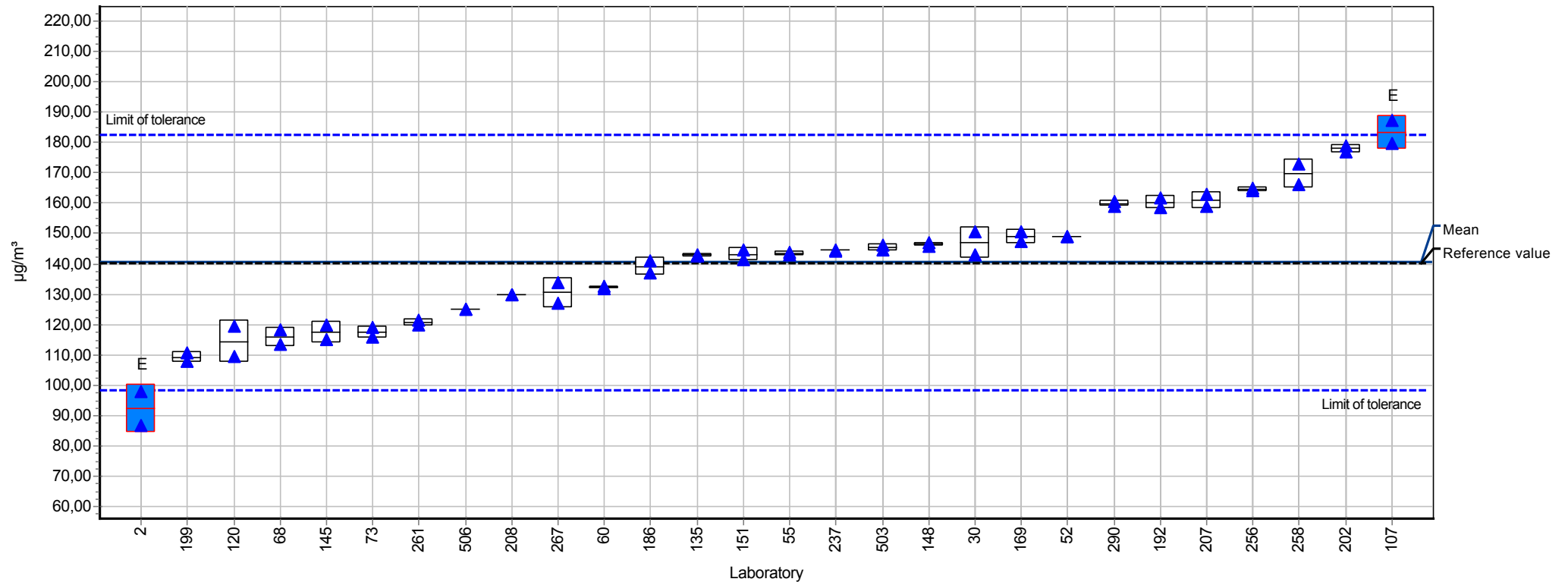
Measurand: n-Octane **Mean:** 51,00 µg/m³
Sample: 2 **Reprod. s.d.:** 7,60 µg/m³
Method: ISO 5725-2 **Rel.reprod. s.d.:** 14,90%
Rel.target s.d.: 15,00% (Limited) **Reference value:** 51,30 µg/m³

No. of laboratories: 26 **Range of tolerance:** 35,70 - 66,30 µg/m³ (|Z-Score| <= 2,00)



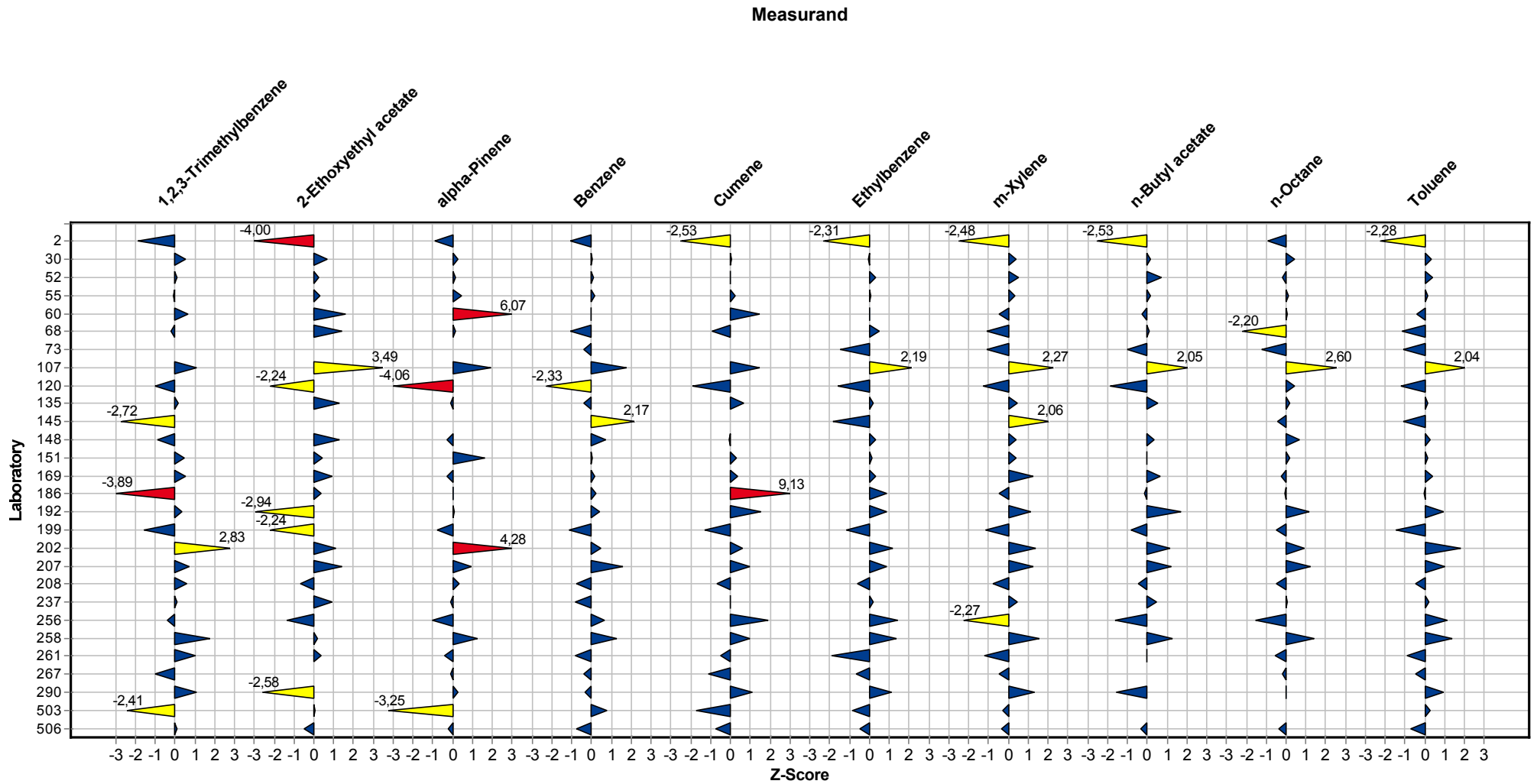
Summary results

Measurand:	Toluene	Mean:	140,44 µg/m³
Sample:	2	Reprod. s.d.:	21,78 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	15,51%
Rel.target s.d.:	15,00% (Limited)	Reference value:	140,40 µg/m³
No. of laboratories:	28	Range of tolerance:	98,31 - 182,57 µg/m³ (Z-Score ≤ 2,00)



Sample chart of Z-scores

Sample 2



Summary of laboratory test results

Sample Blank 1

Unit	1,2,3-Trimethylbenzene	2-Ethoxyethyl acetate	alpha-Pinene	Benzene	Cumene	Ethylbenzene	m-Xylene	n-Butyl acetate	n-Octane	Toluene
Unit	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
2	< 5,00	< 5,00	< 5,00	< 5,00	< 5,00	< 5,00	< 5,00	< 5,00	< 5,00	26,62
30	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	1,60
52	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00
55							1,90			2,60
60	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00
73				< 5,00		< 5,00	< 5,00	< 5,00	< 5,00	< 5,00
107	< 0,00	< 0,00	< 0,00	< 0,00	< 0,00	< 0,00	1,50	< 0,00	3,20	2,40
120	0,54	1,00	1,04	0,57	0,48	0,47	1,46	0,23	1,52	1,28
135	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	1,20	< 1,00	1,40	1,20
145	0,00			0,00		0,00	0,00		0,00	0,00
148	< 1,00	1,10	< 1,00	< 1,00	< 1,00	< 1,00	1,40	1,40	1,90	1,60
151	0,50	1,30	2,90	0,30	3,90	0,20	0,40	1,40	1,70	1,80
169	4,40	5,20	4,20	4,30	4,70	5,40	3,20	5,70	6,60	5,90
186	0,00	0,00	0,00	2,40	0,00	0,70	0,00	0,00	1,00	1,30
192	0,21	0,00	0,17	0,22	0,77	0,67	2,16	0,43	3,33	1,75
199	0,19	0,41	0,39	0,42	0,13	0,23	0,58	0,39	0,73	1,17
202	2,00	5,30	2,20	1,70	0,60	1,30	4,30	2,90	5,30	8,30
207	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00
208			0,20	0,90		0,20	0,60		0,60	1,00
237				0,30						
256	0,00	0,00	0,40	6,50	0,80	1,00	1,70	0,00	3,00	3,30
258				3,00			2,30		4,20	2,00
261	0,30	0,20	0,00	0,50	0,10	0,20	0,40	0,10	0,40	1,00
267	0,00		0,00	1,00	0,00	0,00	0,00	1,00	0,00	0,00
290	0,00	0,00	0,00	2,90	0,00	0,00	4,70	0,00	5,90	3,70
503	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00
506				1,00		0,20	0,60			1,00

Summary of laboratory test results

Sample Blank 2

Unit	1,2,3-Trimethylbenzene	2-Ethoxyethyl acetate	alpha-Pinene	Benzene	Cumene	Ethylbenzene	m-Xylene	n-Butyl acetate	n-Octane	Toluene
	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
2	< 5,00	< 5,00	< 5,00	< 5,00	< 5,00	< 5,00	< 5,00	< 5,00	< 5,00	17,22
30	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	1,10	< 1,00	< 1,00	1,60
52	< 1,00	< 1,00	< 1,00	1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00
55				1,60			2,00	1,00		2,50
60	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00
73				< 5,00		< 5,00	< 5,00	< 5,00	< 5,00	< 5,00
107	< 0,00	< 0,00	< 0,00	< 0,00	< 0,00	< 0,00	1,20	< 0,00	1,60	1,80
120	0,60	0,86	1,02	0,53	0,38	0,40	1,38	0,25	1,59	1,22
135	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	1,10	< 1,00	1,00	< 1,00
145	0,00			5,00		0,00	5,00		0,00	0,00
148	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	1,50	< 1,00	1,40	1,70
151	0,20	0,60	1,90	0,40	3,00	0,40	0,50	0,90	1,30	1,40
169	4,40	4,70	4,10	4,20	4,50	5,40	3,00	5,90	5,70	6,50
186	0,00	0,00	0,00	3,30	0,00	0,70	0,00	0,00	0,00	1,50
192	0,36	0,00	0,27	0,41	0,47	0,70	2,14	0,75	1,82	1,82
199	0,45	0,71	0,35	0,60	0,17	0,41	1,00	0,68	0,78	1,26
202	2,80	5,00	2,00	1,80	0,50	1,00	3,60	3,10	3,80	5,90
207	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00	< 1,00
208	0,30		0,40	0,90	0,10	0,40	0,80	0,50	0,50	1,00
256	0,40	0,40	0,30	5,00	0,40	0,70	1,00	0,00	1,40	2,00
258				2,20			1,80		2,00	2,00
261	0,30	0,20	0,30	0,80	0,10	0,30	0,70	0,40	0,60	1,20
267	0,00		0,00	2,00	0,00	0,00	1,00	3,00	1,00	1,00
290	0,00	0,00	0,00	2,90	0,00	0,00	0,00	0,00	3,50	2,70
503	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00	< 2,00
506				2,00		0,70	1,00			6,00
-	-	-	-	-	-	-	-	-	-	-

Questions and Answers

Participant	Sample carrier	Analytical method	thermodesorber
2	Tenax TA	DIN ISO 16000-6	Atas Optik 4
30	Tenax TA	ISO 16000-6	TD 650 Perkin Elmer
52	Konditioniertes Tenax in Metallröhrchen.	DIN ISO 16000-6	Perkin Elmer, TurboMatrix 650
55	Tenax tubes - Markes	EN 16516	Markes TD-100
60	manufacturer	DIN ISO 16000-6	MARKES
68	Tenax TA	Auf Basis von EN ISO 16000-5 und ISO 16000-6 wurde eigene Labormethode entwickelt	Turbomatrix ATD von PerkinElmer
73	Tenax TA von Supelco	DIN ISO 16000-6	Perkin Elmer TurboMatrix650
107	Tenax TA, Glasröhrchen, TDS3(R)-Container (Supelco)	Nein (nur in Anlehnung, nicht exakt Abweichungen insbes. Herstellung der Kalibrierlösungen)	Shimadzu TD-20
120	Tenax TA	DIN ISO 16000-6	Gerstel TDS3
135	Tenax TA	16000-6	Perkin Elmer TurboMatrix 650
145	Gerstel Tubes, Fuellung	Dow Intern	Gerstel Thermodesorption TDS
148	Tenax TA (Markes)	DIN ISO 16000-6 (2012-11), DIN EN 16516 (2018-01)	Markes TD 100
151	Tenax	ISO 16017-1	Perkin Elmer TD350
169	TenaxTA	16000-6	TDS2 Fa. Gerstel
186	Tenax TA	ISO 16000-6	TurboMatrix 650, Perkin-Elmer
192	glass,Tenax-TA,Markes	ISO 16000-6	TD-100 (Markes)
199	Tenax TA; MARKES	in Anlehnung an DIN ISO 16000-6:2012-11	TD-100 von MARKES
202	TDS-Glasrohr; Tenax (Supelco)	in Anlehnung an DIN ISO 16000-6 (Nov. 2012)	Gerstel TDS3
207	Markes Röhrchen, Tenax	DIN ISO 16000-6	Markes Unity TD 100
208	Tenax TA/Carbograph 5TD, Markes International	In-house method modifeid from ISO16000-6, ISO16017-2	Markes TD100
237	Tenax TA, Markes	Hausmethode	PE Turbomatrix
256	Tenax, Camsco	DIN ISO 16000-6	ATD 650
258	Tenax TA, Markes	ISO 16000-6	Markes TD100
261	Tenax TA, CAMSCO	DIN ISO 16000-6	Perkin Elmer ATD-600
267	Tenax TA	Interne Methode SOP-B-25	MARKES TD100
290	Perkin Elmer Tenax TA Tubes	ISO 16000-6:2011	Perkin Elmer TurboMatrix 350
503	manufacturer	DIN ISO 16017-1	MARKES
506	Tenax TA/Carbograph 5 TD, Markes International	In-house method modified from ISO16000-6, ISO16017-2	Markes TD100

Proficiency testing scheme VOC 2018

Participant	Desorption temperature	Desorption flow	Desorption time	Cryo trap	Carrier gas
2	einstufiges System im Injektor Optik4, 300°C	1,5 ml/min	5 min	keine Kryofokussierung	Helium
30	260 °C	50 +/- 5	15	-30 and 280°C	He
52	280	20	20	-30 auf 280	Helium
55	300 °C	25	10	10°C until 350°C with max heating rate	He
60	300	50	5	-5°C	helium
68	340 °C	50 ml/min	20 min	-20°C / 340°C	Helium
73	280 °C	40 ml/min	30 Min	5°C bis 320°C	Helium
107	230	60	10	-5 dann 285	He
120	30 °C bis 300 °C	180mL/min	16	-150 °C bis 300 °C	Helium
135	280 °C	29	14	-20°C ... 300°C	Helium
145	20 Grad -1min - 60 Grad pro Min 260 Grad -16min	50ml pro Minute	21.17	-150 Grad	Helium
148	280 °C	50	10	-25 / 315°C	Helium
151	280	75	10	-30 to 300	Helium
169	280 °C	50	5	-100°C	Helium
186	280	50 mL/min	20	-30°C to 280°C at 45°C/sec	Helium
192	270 degC	30 ml/min	10 min	Cryo trap at -20 degC and desorb at 280 degC	Helium
199	250 °C	50 mL/min	5 min	25-300 °C	Helium
202	150 °C	80	13	-150°C --> 12°C/s --> 200°C	Helium
207	300	20	8	-25	Helium
208	280	50	10	-20, 300	He
237	300 °C	30	10	-20°C/ +270°C	Helium
256	300 °C	50	5	2 °C / 300 °C	Helium
258	280 °C	20 ml/min	15 min	Cold trap low temp: -30°C; cold trap high temp 300°C	Helium
261	260 °C	30 ml/min	10 min	-8 / 270 °C	Helium
267	280 °C	50ml/min	15 min	-5°C	He
290	280 °C	40 ml/min	20 min	-30 bis 280 °C	Helium 5.0
503	295	100	10	25	helium
506	280	50	10	-20 300	He

Participant	Carrier gas flow	Analytical column	Detector
2	1,5 ml/min	RTX-VMS 60m	MS SCION TQ
30	1	Rxi-5ms 55 m x 0.25 mm x 0.25 µm	FID/MS

Proficiency testing scheme VOC 2018

Participant	Carrier gas flow	Analytical column	Detector
52		Zebron 1	FID und Massenspektrometer
55	1.5	Rxi-5Sil-MS 60 m x 0.25 mmID x 1.0 µm film	Agilent MS
60	1	HP-1MS	MS
68	15 ml/min	Vocol von Supelco	MS
73	1.6 ml/min	DB-1701	FID
107	Säulenfluss 1.17 ml/min (27.5 cm/s linear vel constant)	MN Optima 5MS Accent 60Meter 1µm Filmdicke	MS
120	1,6 ml/min	DB-5MS 60m, 0,25mm, 1,00 µm	Agilent MSD 5977
135	1,5	RTX-200	MSD
145	2ml pro Minnute	DB 624 60m-0.25mm-1.4	FID & MS
148	0,5	Restek Rxi-5Sil MS, 20m x 0,18 mm id x 0,36 µm df	MS
151	1.0	Restek RXi-5SilMS 30m x 0.25mm x 0.5um	FID
169	1	DB-5ms, 60mx0,25mm, 1µm	Massenspektrometer
186	2 mL/min	Elite 5MS	FID for quantification - MS for identification
192	1.3 ml/min	Inert Cap-1 (60m length,0.25 mm daim,1.5 um film)	MSD
199	0,7 mL/min	DB5-5.625	5977A MSD
202	1.3	Rxi-5MS 60m x 250um x 0.5um	Agilent 5975C inert XL MSD
207	1,2	DB 5	MS
208	1 mL/min	HP-5MS UI	MSD
237	0,5	Varian Xms VF	MSD
256	1.2	60m Rtx / 0.25 ID / 1.4um	Massenspektrometer
258	2 ml/min	HP-Ultra 2, 50m x 0.32mm, 0.52µm	Agilent HP5975C
261	1,6 ml/min	Elite-VMS 30m PE	PE Clarus SQ8 S MS
267	1,5 ml/min	HP INNOWAX 60m x 0.32mm x 0.5µm	MSD
290	44 ml/min	HP-Ultra 2 (50m x 0,32mm 0,52µm 5% Phenyl-Methyl-Siloxan)	Agilent MSD 5977B
503	1	RTX-VMS	MS
506	1 ml/min	HP-5MS	MSD

Participant	Data evaluation
2	5-Punkt ISTD Kalibrierung je Wirkstoff 5-50 und 50-250 µg/m³, MS/Spektrum und RT
30	Identification by MS / Calibration by FID
52	Identifiziert mit MS, quantifiziert mit FID

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Participant	Data evaluation
55	8 point calibration curve
68	Identifikation mit MS; Quantifizierung mit entspr. Berechnung in einem Excelfile
73	Kalibrierung mit internem Standard
107	Identifizierung durch Ret-Zeit-Fenster und SIM-mz und Referenzenverhältnis; Quantifizierung anhand mz-Fläche, Kalibrierung extern, jede Substanz einzeln d.h. nicht als Toluoläquivalent
120	SIM / SCAN
135	externer Standard; Massenspektren- und Retentionszeitvergleich
145	FID quantifiziert, MS qualifiziert
148	Identifizierung und Quantifizierung mittels GC-MSD und Toluol-d8 als Interner Standard
151	External calibration
169	externe Kalibrierung
186	External calibration
192	2-Ethoxy ethylacetate and Cumen were calculated by toluene(TIC) response factor,and others were caluclated by using their individual response.
199	externe Kaibrierung
202	Quant: Einzelion extr. aus TIC; externe Kalib. mit 6 Levels; Ident. NIST
207	EIC Originalreferenzen, eigene und kommerzielle Bibliotheken
208	qualitative and quantitative analysis with reference compounds
237	externe Kalibration mit IS und MSD
256	substanzspezifische 5-Punkt-Kalibrierung, Retentionszeit, Massenspektrum
258	Quantification by external standards of components to be determined. Identification by retention times of external standards and MS spectra.
261	Interner Std. , 5 Punkt-Eichung, Fläche
267	Quantifizierung mittels spezifischer Massenfragmente, Identifizierung mittels NIST Bibliothek
290	Auswertung über das Total-Ionen-Chromatogramm / Berechnung mittels Toluol-Äquivalent
506	qualitative and quantitative analysis with reference compounds

Participant	Recovery rate	Date of analysis
2	nein	03.05.2018
30	no	24 May 2018
52	Ja	02.05.2018
55	/	27/04/2018
60	no	03/05/2018
68	Nein	11.6.2018

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Participant	Recovery rate	Date of analysis
73	Nein	02.-03.05.2018
107	Nein	26.04.2018
120	Nein	02.05.2018
135	ja	16.05.2018
145	nicht bestimmt	08/05/2018
148	nein	26.04.2018
151	No	4 May 2018
169	nein	2.05.18
186	No	22/05/2018
192		22 May 2017
199	nein	25.05.2018
202	Nein	30.04.2018 - 04.05.2018
207		03.05.2018
208	no	11.5.2018
237	nein	23.05.2018
256	nein	27.04.2018
258	No	May 22nd and 23rd, 2018
261	nein	15.05.2018
267	Nein	29/05/2018
290	Nein	28.05.2018
503	no	04/05/218
506	no	3.5.2018
