IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

Round-robin tests for

in-house measuring laboratories

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

Round-robin test

„Organic substances with thermodesorption 2015“

Summary of laboratory means

	n-Butyl acetate	Z score	n-Heptane	Z score	Toluene	Z score	n-Octane	Z score	p-Xylene	Z score
Unit	µg/m³		µg/m³		µg/m³		µg/m³		µg/m³	
61	88,91	0,31	91,19	-0,29	80,02	-0,44	107,47	-0,79	51,14	-1,05
68	72,85	-1,55	78,95	-1,60	69,60	-1,68	107,65	-0,77	50,15	-1,23
107	73,20	-1,51	96,40	0,26	77,10	-0,78	108,75	-0,68	52,75	-0,77
108	87,00	0,09	99,25	0,56	87,75	0,49	121,00	0,37	57,50	0,06
135	83,40	-0,33	85,40	-0,91	115,70	3,83 FE	106,50	-0,87	54,40	-0,48
155	101,50	1,77	97,00	0,32	97,50	1,65	130,50	1,18	68,00	1,90
169	85,55	-0,08	96,70	0,29	81,80	-0,22	112,70	-0,34	58,35	0,21
186	83,85	-0,28	91,00	-0,32	83,65	0,00	120,00	0,28	58,20	0,18
189	81,69	-0,53	98,66	0,50	106,31	2,71 CE	113,10	-0,31	56,14	-0,18
190	96,50	1,19	112,00	1,92	81,90	-0,21	126,50	0,84	52,05	-0,89
191	97,70	1,33	113,05	2,03 E	87,35	0,44	134,45	1,52	67,90	1,88
192	73,34	-1,49	84,40	-1,02	74,22	-1,13	110,70	-0,51	50,06	-1,24
198	40,12	-5,35 CE			73,99	-1,16 C			49,92	-1,27 C
199	80,35	-0,68	87,55	-0,68	82,80	-0,10	119,40	0,23	50,40	-1,18
206	82,50	-0,43	80,00	-1,49	74,00	-1,16	95,50	-1,82	54,50	-0,47
207	101,00	1,71	99,50	0,59	92,00	1,00	134,50	1,53	65,50	1,46
208	70,23	-1,85	76,16	-1,89	71,42	-1,46	99,76	-1,45	48,73	-1,47
214	67,50	-2,17 E	94,50	0,06	79,00	-0,56	132,00	1,31	56,50	-0,12
237	80,00	-0,72	76,35	-1,87	77,40	-0,75	105,90	-0,92	53,35	-0,67
249	96,15	1,15	86,40	-0,80	78,65	-0,60	114,50	-0,19	54,25	-0,51
261	87,70	0,17	86,90	-0,75	90,25	0,79	118,50	0,16	58,10	0,16
262	99,25	1,51	111,05	1,82	122,80	4,68 BE	98,90	-1,52	63,35	1,08
263	87,65	0,16	106,90	1,38	96,75	1,56	140,40	2,03 E	62,75	0,98
267	84,00	-0,26	89,00	-0,53	83,00	-0,08	116,00	-0,06	55,00	-0,38

	n-Butyl acetate	Z score	n-Heptane	Z score	Toluene	Z score	n-Octane	Z score	p-Xylene	Z score
273	91,00	0,55	99,00	0,54	94,50	1,29	127,00	0,88	66,00	1,55
274	101,50	1,77	107,50	1,44	100,00	1,95	110,50	-0,53	62,50	0,93
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Method	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	
Mean	86,23		93,96		83,67		116,69		57,16	
Reproducibility s.d.	10,44		11,61		8,83		12,26		6,05	
Rel. reproducibility s.d.	12,11 %		12,36 %		10,56 %		10,51 %		10,59 %	
Reference value	72,90		80,00		76,20		108,40		52,20	
Target s.d.	8,62		9,40		8,37		11,67		5,72	
Rel. target s.d.:	10,00 %		10,00 %		10,00 %		10,00 %		10,00 %	
Low er limit of tolerance	68,98		75,17		66,93		93,35		45,73	
Upper limit of tolerance	103,48		112,76		100,40		140,03		68,59	
Type B outliers					1					
Type C outliers	1				2				1	
Type F outliers					1					
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	25		25		22		25		25	
No. of laboratories that submitted results	26		25		26		25		26	

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	

	Ethylbenzene	Z score		1,2,4-Trimethylbenzene	Z score		2-Ethoxyethyl acetate	Z score	
Unit	µg/m³			µg/m³			µg/m³		
61	49,53	-1,15		44,30	0,18		114,30	5,41	FE
68	51,55	-0,79		37,95	-1,27		56,60	-2,37	E
107	50,25	-1,02		36,80	-1,54		61,00	-1,78	
108	57,00	0,18		42,50	-0,23		68,00	-0,83	
135	53,50	-0,44		41,50	-0,46		67,40	-0,91	
155	67,00	1,97		51,00	1,73		85,50	1,53	
169	58,50	0,45		45,90	0,55		69,45	-0,64	
186	57,70	0,31		43,35	-0,03		67,60	-0,89	
189	53,55	-0,43		44,08	0,13		80,12	0,80	
190	53,15	-0,51		44,45	0,22		95,45	2,87	E
191	57,75	0,32		46,05	0,59		80,00	0,79	
192	48,41	-1,35		35,55	-1,83		24,62	-6,68	FE
198	31,84	-4,31	FE	21,06	-5,16	BE			
199	51,55	-0,79		40,15	-0,77		67,40	-0,91	
206	53,00	-0,53		43,00	-0,11		75,50	0,18	
207	63,50	1,34		47,00	0,81		82,50	1,12	
208	46,79	-1,64		35,71	-1,79		30,20	-5,93	FE
214	55,00	-0,17		36,50	-1,61		63,00	-1,51	
237	52,10	-0,69		40,00	-0,80		69,25	-0,66	
249	53,00	-0,53		42,25	-0,29		76,30	0,29	
261	59,15	0,57		45,80	0,53		73,60	-0,08	
262	61,75	1,03		49,00	1,27		72,00	-0,29	
263	62,45	1,16		45,50	0,46		73,25	-0,12	
267	55,00	-0,17		39,00	-1,03		67,50	-0,90	
273	64,50	1,52		52,50	2,07	E	80,50	0,85	
274	62,50	1,17		56,50	2,99	E	96,50	3,01	E
–	–	– –		–	– –		–	– –	
Method	ISO 5725-2			ISO 5725-2			ISO 5725-2		
Assessment	|Z|<=2,00			|Z|<=2,00			|Z|<=2,00		
Mean	55,98			43,49			74,17		

	Ethylbenzene	Z score	1,2,4-Trimethylbenzene	Z score	2-Ethoxyethyl acetate	Z score
Reproducibility s.d.	5,56		5,69		10,65	
Rel. reproducibility s.d.	9,93 %		13,09 %		14,36 %	
Reference value	51,40		39,00		63,20	
Target s.d.	5,60		4,35		7,42	
Rel. target s.d.:	10,00 %		10,00 %		10,00 %	
Low er limit of tolerance	44,78		34,79		59,34	
Upper limit of tolerance	67,17		52,19		89,01	
Type B outliers			1			
Type F outliers	1				3	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	25		25		22	
No. of laboratories that submitted results	26		26		25	

	4-Methyl-2-Pentanone	Z score		Cumol	Z score
Unit	µg/m³			µg/m³	
61	106,28	0,68		37,28	-1,25
68	92,00	-0,76		37,50	-1,20
107	87,20	-1,24		36,65	-1,40
108	106,00	0,65		41,50	-0,26
135	95,00	-0,46		42,20	-0,09
155	117,00	1,75		49,50	1,62
169	102,75	0,32		47,40	1,13
186	107,00	0,75		43,20	0,14
189	98,50	-0,11		40,38	-0,52
190	110,50	1,10		44,15	0,36
191	99,70	0,02		41,95	-0,15
192	85,60	-1,40		48,83	1,46
198	53,39	-4,64	BE		

	4-Methyl-2-Pentanone	Z score		Cumol	Z score	
199	96,15	-0,34		41,90	-0,16	
206	96,50	-0,31		41,00	-0,37	
207	111,00	1,15		49,00	1,50	
208	85,18	-1,44		35,42	-1,68	
214	76,50	-2,32	E	36,00	-1,55	
237	91,50	-0,81		39,60	-0,70	
249	104,50	0,50		63,55	4,92	BE
261	103,90	0,44		45,25	0,62	
262	98,20	-0,14		43,65	0,25	
263	104,40	0,49		47,15	1,07	
267	97,00	-0,26		40,00	-0,61	
273	111,50	1,20		58,50	3,73	FE
274	102,50	0,30		50,00	1,74	
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Method	ISO 5725-2			ISO 5725-2		
Assessment	|Z|<=2,00			|Z|<=2,00		
Mean	99,54			42,60		
Reproducibility s.d.	9,96			4,76		
Rel. reproducibility s.d.	10,01 %			11,18 %		
Reference value	95,70			40,10		
Target s.d.	9,95			4,26		
Rel. target s.d.:	10,00 %			10,00 %		
Low er limit of tolerance	79,64			34,08		
Upper limit of tolerance	119,45			51,12		
Type B outliers	1			1		
Type F outliers				1		
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	25			23		
No. of laboratories that submitted results	26			25		

Summary of laboratory means

	n-Butyl acetate	Z score	n-Heptane	Z score	Toluene	Z score	n-Octane	Z score	p-Xylene	Z score
Unit	µg/m³		µg/m³		µg/m³		µg/m³		µg/m³	
61	130,34	0,11	58,16	-1,59	79,21	-0,75	70,35	-1,22	67,19	-1,22
68	115,15	-1,07	61,70	-1,08	72,05	-1,58	77,15	-0,37	66,55	-1,30
107	112,70	-1,26	73,45	0,62	79,40	-0,72	74,80	-0,67	72,30	-0,55
108	129,00	0,00	74,05	0,71	89,35	0,44	81,95	0,22	76,95	0,06
135	126,65	-0,18	59,20	-1,44	80,45	-0,60	72,90	-0,91	72,80	-0,48
155	157,00	2,17 E	57,00	-1,76	101,00	1,80	90,50	1,29	90,50	1,83
169	111,60	-1,35	58,20	-1,58	63,60	-2,57 E	64,90	-1,90	66,00	-1,37
186	129,05	0,01	65,05	-0,59	82,85	-0,32	78,10	-0,26	75,95	-0,07
189	127,90	-0,08	69,94	0,12	95,03	1,10	77,52	-0,33	74,12	-0,31
190	134,50	0,43	78,70	1,38	80,45	-0,60	80,25	0,01	67,40	-1,19
191	151,00	1,71	88,70	2,83 E	87,35	0,20	97,30	2,14 E	91,65	1,98
192	106,59	-1,74	60,13	-1,30	72,13	-1,57	70,41	-1,22	64,69	-1,54
198	59,02	-5,42 BE			51,25	-4,01 FE			40,49	-4,71 BE
199	120,70	-0,64	65,60	-0,51	87,65	0,24	79,60	-0,07	65,40	-1,45
206	132,00	0,23	62,50	-0,96	79,50	-0,71	69,00	-1,39	79,50	0,39
207	155,50	2,06 E	76,00	0,99	96,00	1,22	93,00	1,60	89,00	1,64
208	106,56	-1,74	55,72	-1,94	72,10	-1,58	65,97	-1,77	64,80	-1,53
214	107,00	-1,70	76,00	0,99	76,50	-1,06	94,00	1,73	74,00	-0,33
237	123,35	-0,44	58,80	-1,49	79,45	-0,72	70,35	-1,22	71,00	-0,72
249	142,00	1,01	67,80	-0,19	80,30	-0,62	82,65	0,31	71,05	-0,71
261	137,10	0,63	65,05	-0,59	91,30	0,67	79,35	-0,10	79,05	0,34
262	131,70	0,21	85,85	2,42 E	107,05	2,51 E	70,25	-1,24	79,45	0,39
263	136,95	0,62	79,30	1,47	101,20	1,82	100,46	2,53 E	94,60	2,37 E
267	125,00	-0,31	69,50	0,05	85,00	-0,07	78,50	-0,21	74,00	-0,33

	n-Butyl acetate	Z score	n-Heptane	Z score	Toluene	Z score	n-Octane	Z score	p-Xylene	Z score
273	131,50	0,20	79,50	1,50	91,50	0,69	86,00	0,73	88,00	1,51
274	135,00	0,47	77,00	1,14	98,50	1,51	91,00	1,35	91,00	1,90
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Method	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	
Mean	128,98		69,13		85,60		80,16		76,49	
Reproducibility s.d.	14,36		9,66		10,49		10,04		9,79	
Rel. reproducibility s.d.	11,14 %		13,97 %		12,26 %		12,53 %		12,80 %	
Reference value	109,80		58,80		76,50		71,90		69,50	
Target s.d.	12,90		6,91		8,56		8,02		7,65	
Rel. target s.d.:	10,00 %		10,00 %		10,00 %		10,00 %		10,00 %	
Low er limit of tolerance	103,18		55,31		68,48		64,12		61,19	
Upper limit of tolerance	154,78		82,96		102,72		96,19		91,78	
Type B outliers	1								1	
Type C outliers										
Type F outliers					1					
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	25		25		25		25		25	
No. of laboratories that submitted results	26		25		26		25		26	
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										

	Ethylbenzene	Z score		1,2,4-Trimethylbenzene	Z score		2-Ethoxyethyl acetate	Z score	
Unit	µg/m³			µg/m³			µg/m³		
61	97,44	-0,84		167,32	1,12		134,04	-1,20	
68	101,40	-0,47		132,80	-1,17		132,45	-1,30	
107	98,00	-0,79		133,10	-1,15		132,90	-1,27	
108	108,50	0,20		148,50	-0,13		132,50	-1,30	
135	102,25	-0,39		144,95	-0,36		143,50	-0,58	
155	126,50	1,89		175,50	1,67		189,50	2,44	FE
169	95,40	-1,03		136,90	-0,90		125,70	-1,75	
186	108,20	0,17		151,45	0,07		151,15	-0,08	
189	104,90	-0,14		146,50	-0,26		153,30	0,06	
190	99,95	-0,61		142,00	-0,56		182,00	1,95	
191	114,60	0,77		178,15	1,84		196,95	2,93	CE
192	89,07	-1,63		125,14	-1,68		53,02	-6,52	FE
198	49,50	-5,35	BE	71,95	-5,22	CE			
199	97,65	-0,82		142,15	-0,55		141,55	-0,71	
206	111,50	0,48		160,50	0,67		166,50	0,93	
207	123,00	1,56		174,00	1,57		176,50	1,59	
208	91,56	-1,39		131,35	-1,27		65,80	-5,68	FE
214	103,50	-0,27		152,50	0,14		129,00	-1,53	
237	100,50	-0,55		143,25	-0,48		149,75	-0,17	
249	99,40	-0,66		135,00	-1,03		160,50	0,54	
261	112,25	0,55		142,60	-0,52		172,35	1,32	
262	100,70	-0,53		133,40	-1,13		31,10	-7,96	FE
263	121,40	1,41		161,50	0,74		150,80	-0,10	
267	105,00	-0,13		138,00	-0,83		143,50	-0,58	
273	124,00	1,66		169,00	1,23		166,00	0,90	
274	117,50	1,04		184,50	2,26	E	189,00	2,41	E
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Method	ISO 5725-2			ISO 5725-2			ISO 5725-2		
Assessment	|Z|<=2,00			|Z|<=2,00			|Z|<=2,00		
Mean	106,39			150,43			152,31		

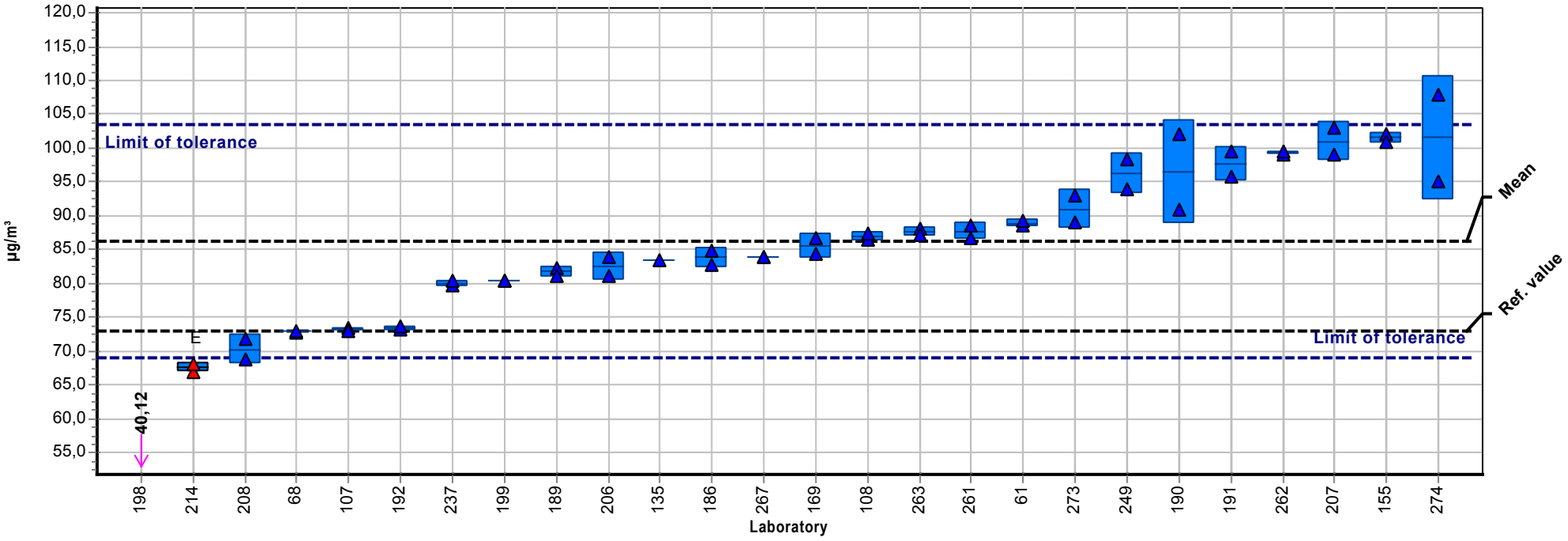
	Ethylbenzene	Z score	1,2,4-Trimethylbenzene	Z score	2-Ethoxyethyl acetate	Z score
Reproducibility s.d.	10,48		17,61		19,16	
Rel. reproducibility s.d.	9,85 %		11,70 %		12,58 %	
Reference value	99,20		135,20		141,40	
Target s.d.	10,64		15,04		15,23	
Rel. target s.d.:	10,00 %		10,00 %		10,00 %	
Low er limit of tolerance	85,11		120,34		121,85	
Upper limit of tolerance	127,66		180,52		182,78	
Type B outliers	1					
Type C outliers			1		1	
Type F outliers					4	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	25		25		20	
No. of laboratories that submitted results	26		26		25	

	4-Methyl-2-Pentanone	Z score	Cumol	Z score
Unit	µg/m³		µg/m³	
61	108,37	0,00	124,23	-0,44
68	97,40	-1,01	113,30	-1,28
107	94,85	-1,25	115,30	-1,13
108	114,50	0,56	126,00	-0,31
135	102,15	-0,58	129,05	-0,07
155	129,00	1,90	147,50	1,35
169	93,50	-1,37	129,40	-0,04
186	111,60	0,30	128,30	-0,13
189	107,75	-0,06	124,65	-0,41
190	114,50	0,56	141,50	0,89
191	108,45	0,01	131,60	0,13
192	87,87	-1,89	142,16	0,94

	4-Methyl-2-Pentanone	Z score		Cumol	Z score	
198	54,50	-4,97	BE			
199	104,40	-0,37		127,25	-0,21	
206	108,50	0,01		130,00	0,00	
207	122,00	1,26		154,50	1,89	
208	91,69	-1,54		122,25	-0,59	
214	85,50	-2,11	E	113,00	-1,31	
237	100,60	-0,72		121,50	-0,65	
249	115,50	0,66		180,00	3,85	BE
261	114,45	0,56		128,65	-0,10	
262	104,35	-0,37		110,00	-1,54	
263	111,80	0,31		140,85	0,84	
267	105,50	-0,27		119,50	-0,81	
273	131,00	2,09	E	140,50	0,81	
274	137,00	2,64	E	158,00	2,16	E
–	–	– –		–	– –	
Method	ISO 5725-2			ISO 5725-2		
Assessment	|Z|<=2,00			|Z|<=2,00		
Mean	108,39			129,97		
Reproducibility s.d.	13,13			13,51		
Rel. reproducibility s.d.	12,11 %			10,39 %		
Reference value	102,50			122,40		
Target s.d.	10,84			13,00		
Rel. target s.d.:	10,00 %			10,00 %		
Low er limit of tolerance	86,71			103,98		
Upper limit of tolerance	130,06			155,96		
Type B outliers	1			1		
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	25			24		
No. of laboratories that submitted results	26			25		

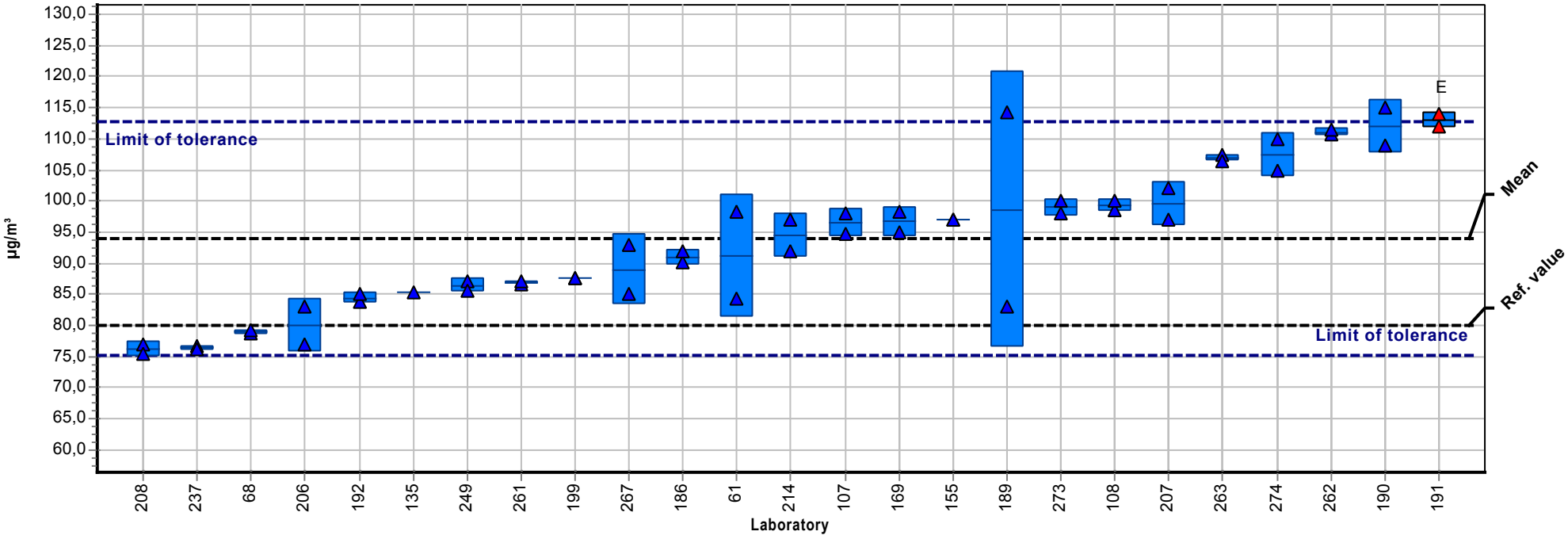
Summary results

Measurand:	**n-Butyl acetate**	**Mean:**	**86,23 µg/m³**
Sample:	**1**	**Reprod. s.d.:**	**10,44 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**12,11%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**72,90 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**68,98 - 103,48 µg/m³ (|Z-Score| <= 2,00)**



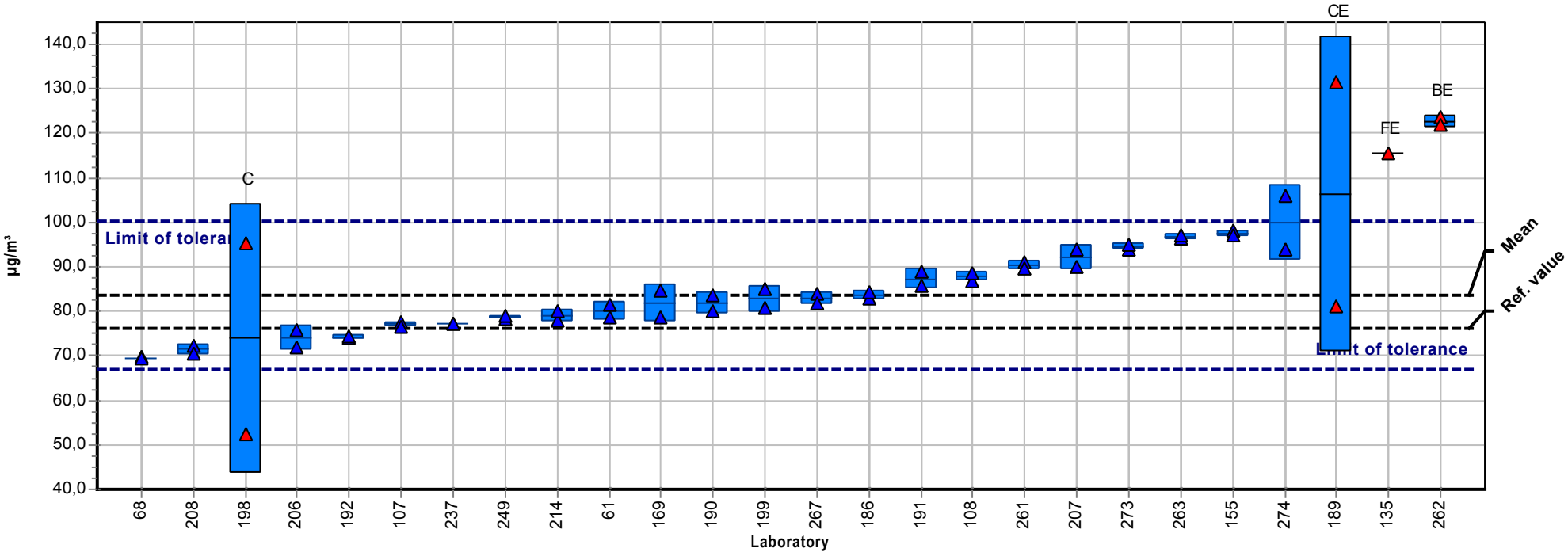
Summary results

Measurand:	**n-Heptane**	**Mean:**	**93,96 µg/m³**
Sample:	**1**	**Reprod. s.d.:**	**11,61 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**12,36%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**80,00 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**75,17 - 112,76 µg/m³ (|Z-Score| <= 2,00)**



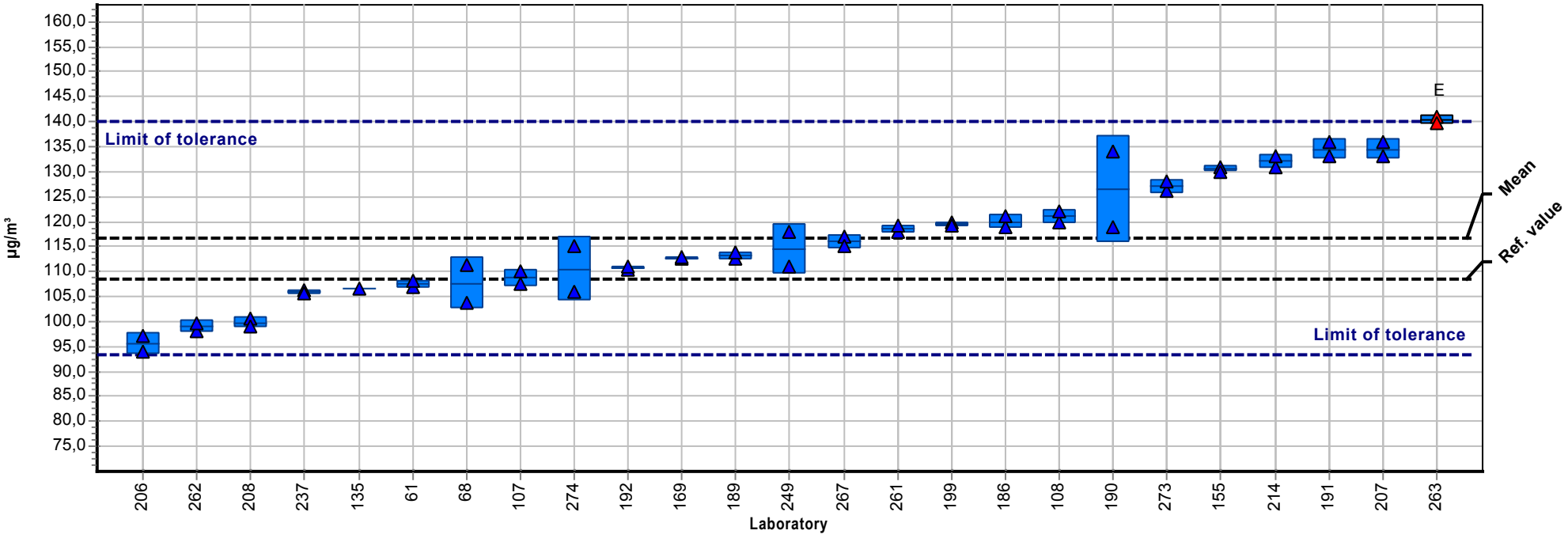
Summary results

Measurand:	**Toluene**	**Mean:**	**83,67 µg/m³**
Sample:	**1**	**Reprod. s.d.:**	**8,83 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**10,56%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**76,20 µg/m³**
No. of laboratories:	**22**	**Range of tolerance:**	**66,93 - 100,40 µg/m³ (|Z-Score| <= 2,00)**



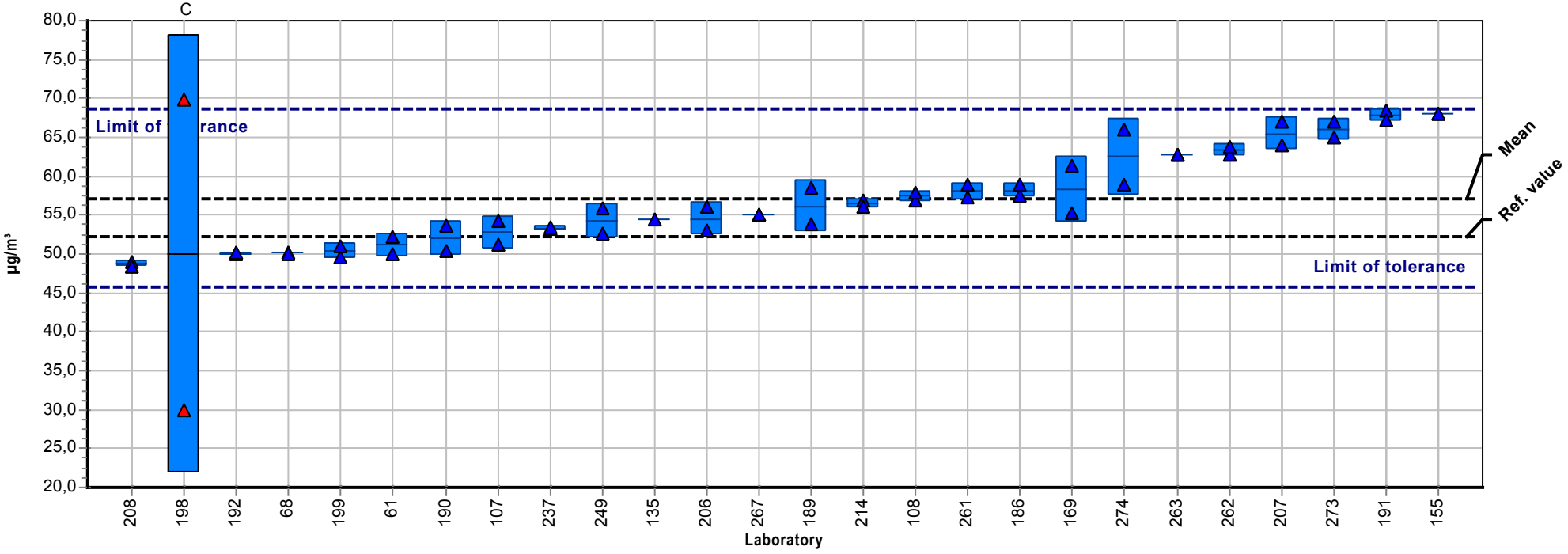
Summary results

Measurand:	**n-Octane**	**Mean:**	**116,69 µg/m³**
Sample:	**1**	**Reprod. s.d.:**	**12,26 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**10,51%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**108,40 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**93,35 - 140,03 µg/m³ (|Z-Score| <= 2,00)**



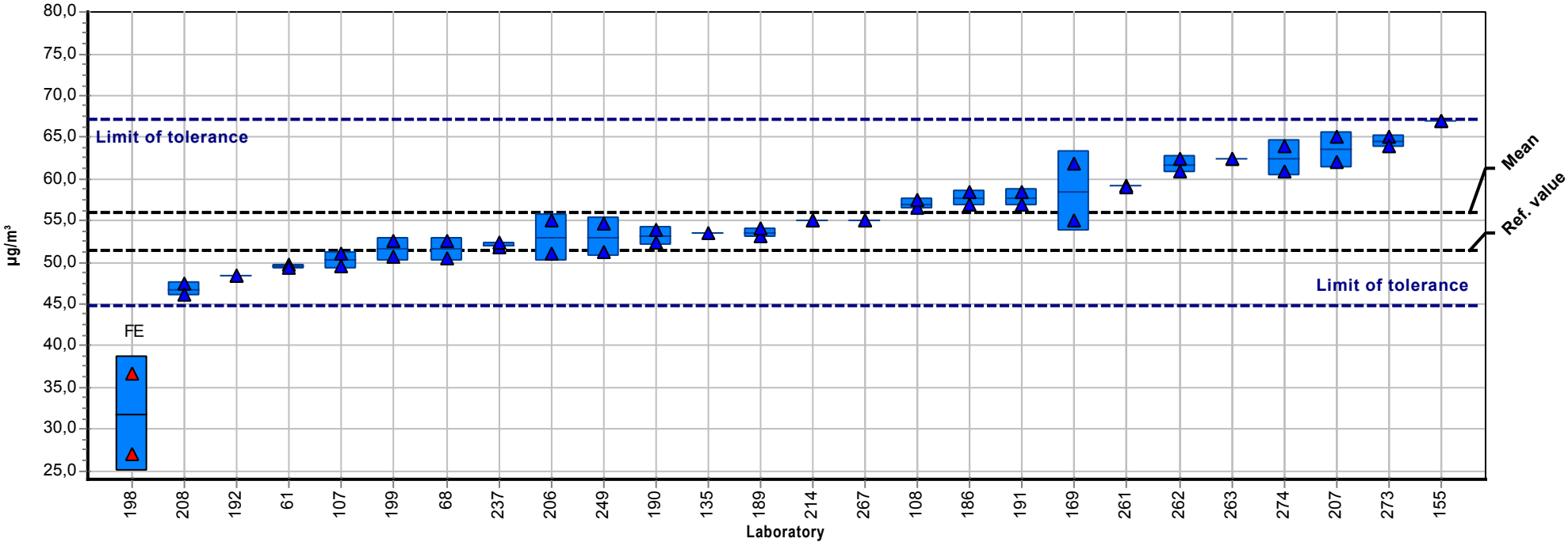
Summary results

Measurand:	**p-Xylene**	**Mean:**	**57,16 µg/m³**
Sample:	**1**	**Reprod. s.d.:**	**6,05 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**10,59%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**52,20 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**45,73 - 68,59 µg/m³ (|Z-Score| <= 2,00)**



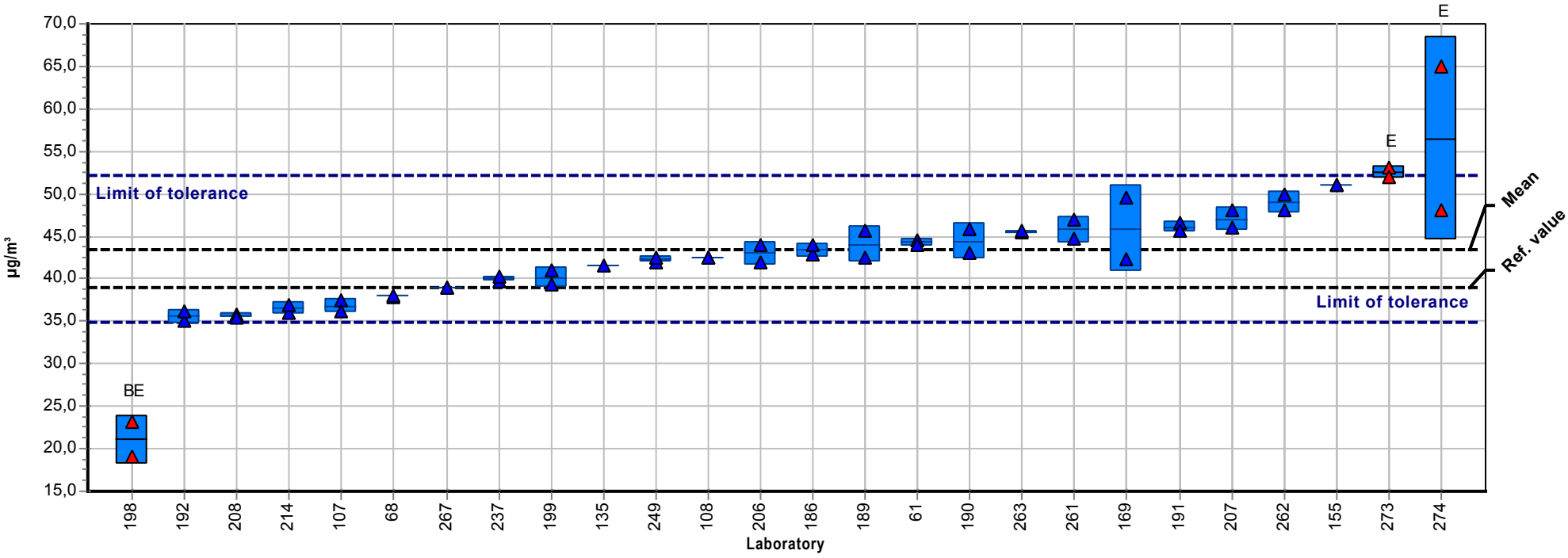
Summary results

Measurand:	**Ethylbenzene**	**Mean:**	**55,98 µg/m³**
Sample:	**1**	**Reprod. s.d.:**	**5,56 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**9,93%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**51,40 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**44,78 - 67,17 µg/m³ (|Z-Score| <= 2,00)**



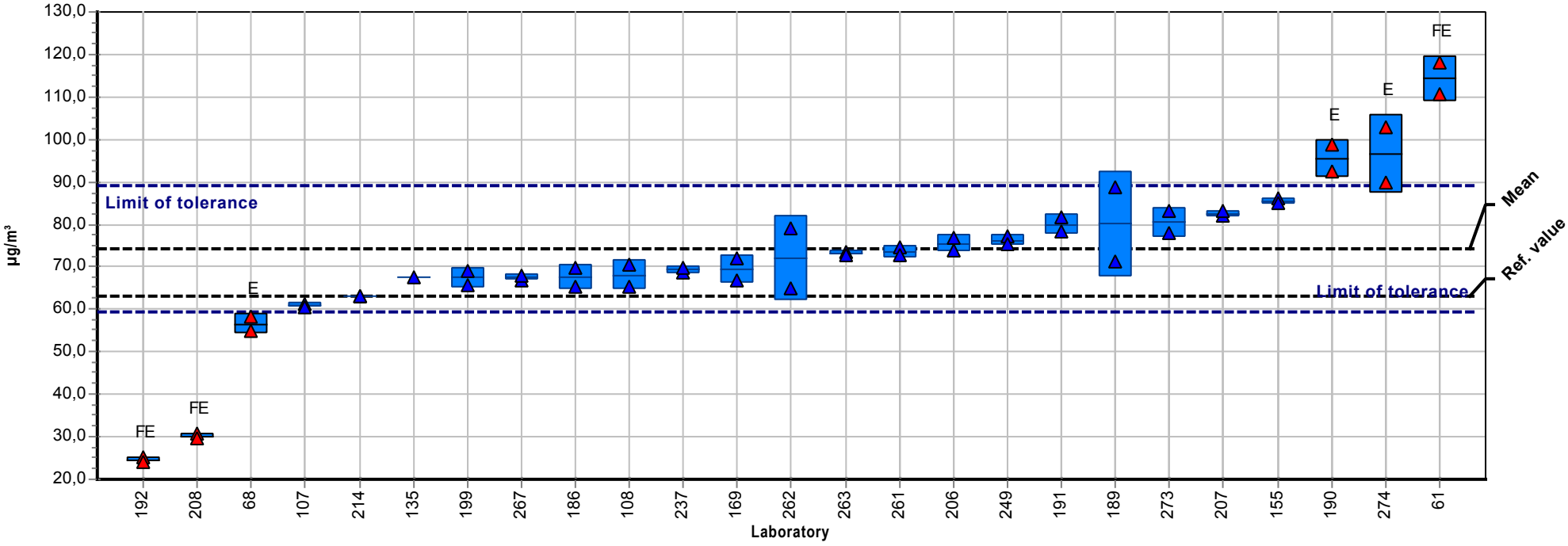
Summary results

Measurand:	**1,2,4-Trimethylbenzene**	**Mean:**	**43,49 µg/m³**
Sample:	**1**	**Reprod. s.d.:**	**5,69 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**13,09%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**39,00 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**34,79 - 52,19 µg/m³ (|Z-Score| <= 2,00)**



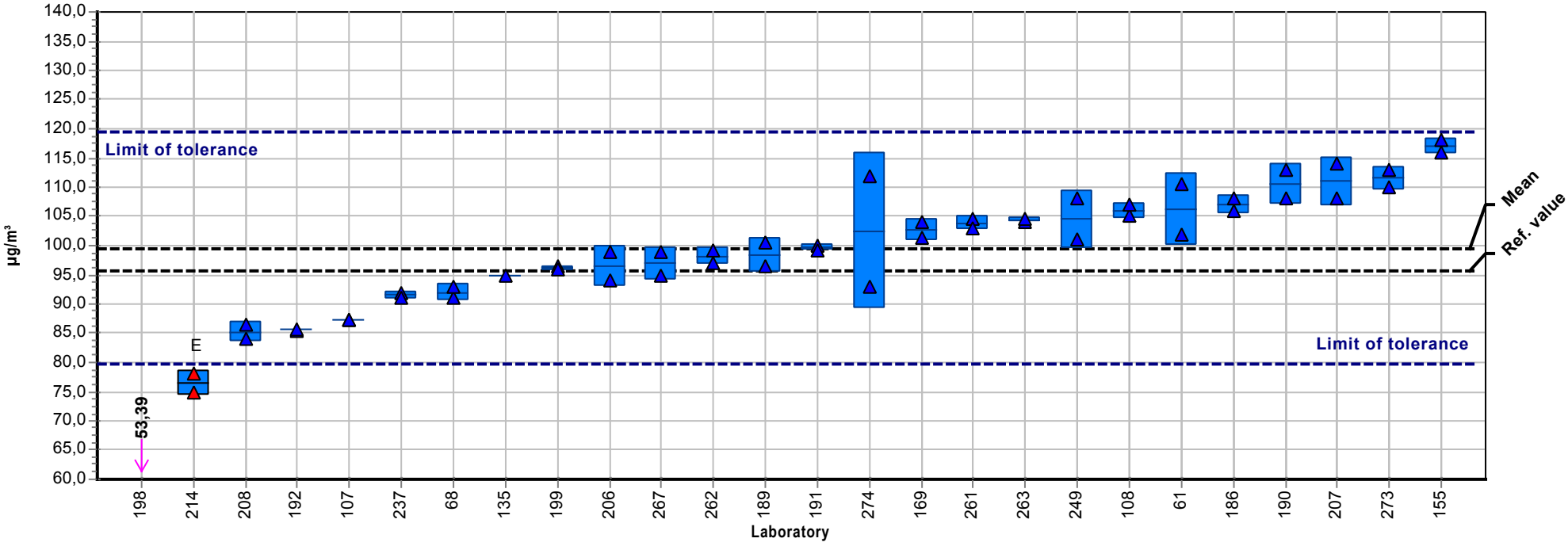
Summary results

Measurand:	**2-Ethoxyethyl acetate**	**Mean:**	**74,17 µg/m³**
Sample:	**1**	**Reprod. s.d.:**	**10,65 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**14,36%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**63,20 µg/m³**
No. of laboratories:	**22**	**Range of tolerance:**	**59,34 - 89,01 µg/m³ (|Z-Score| <= 2,00)**



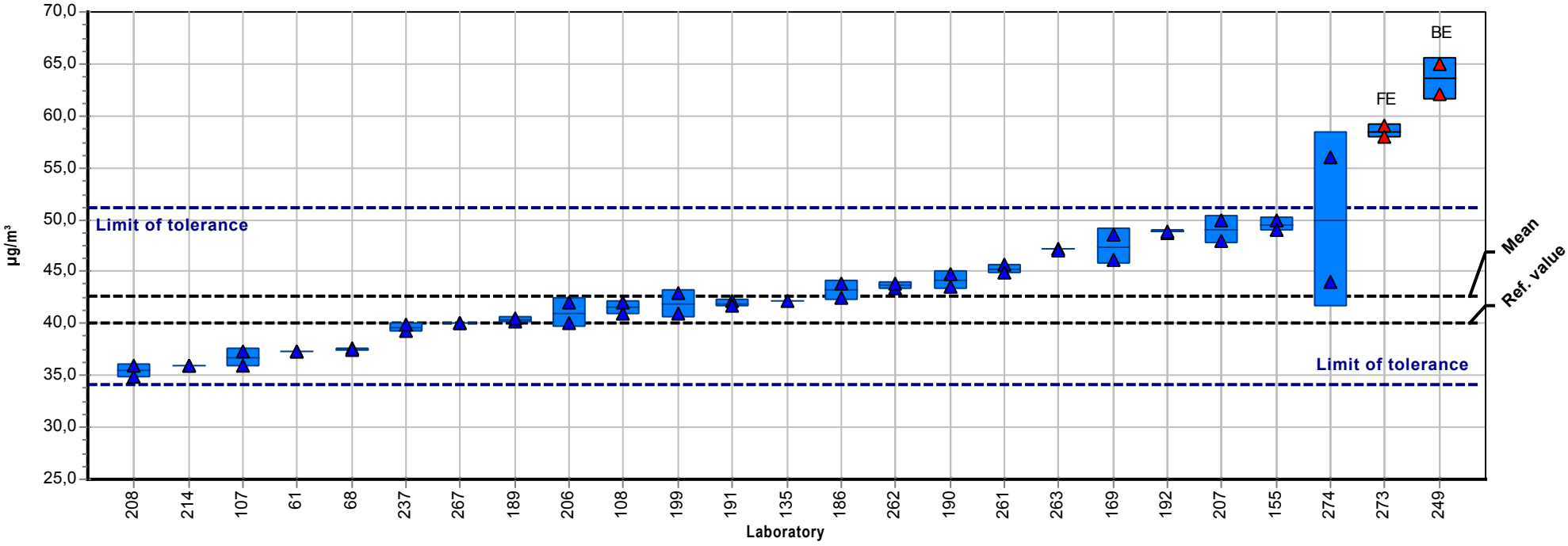
Summary results

Measurand:	**4-Methyl-2-Pentanone**	**Mean:**	**99,54 µg/m³**
Sample:	**1**	**Reprod. s.d.:**	**9,96 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**10,01%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**95,70 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**79,64 - 119,45 µg/m³ (|Z-Score| <= 2,00)**



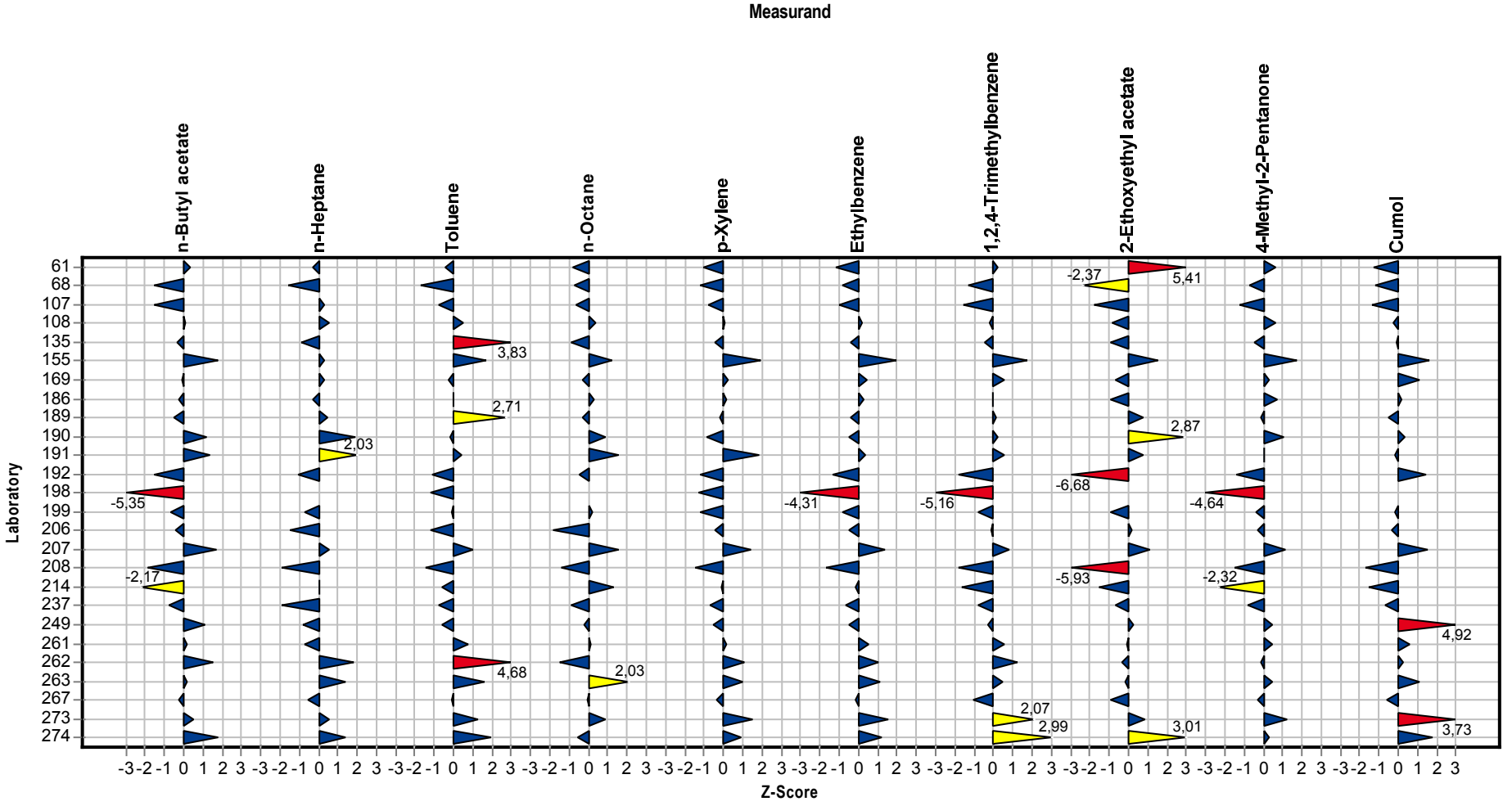
Summary results

Measurand:	**Cumol**	**Mean:**	**42,60 µg/m³**
Sample:	**1**	**Reprod. s.d.:**	**4,76 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**11,18%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**40,10 µg/m³**
No. of laboratories:	**23**	**Range of tolerance:**	**34,08 - 51,12 µg/m³ (|Z-Score| <= 2,00)**



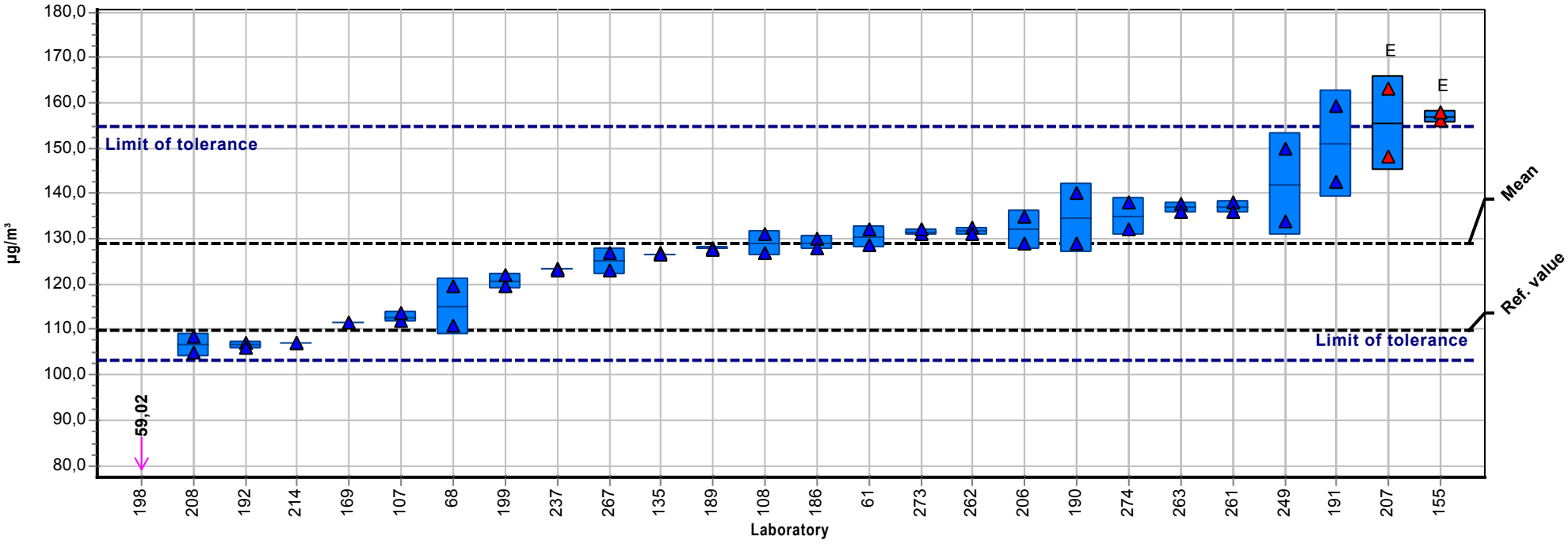
Sample chart of *Z-Scores*

Sample: 1



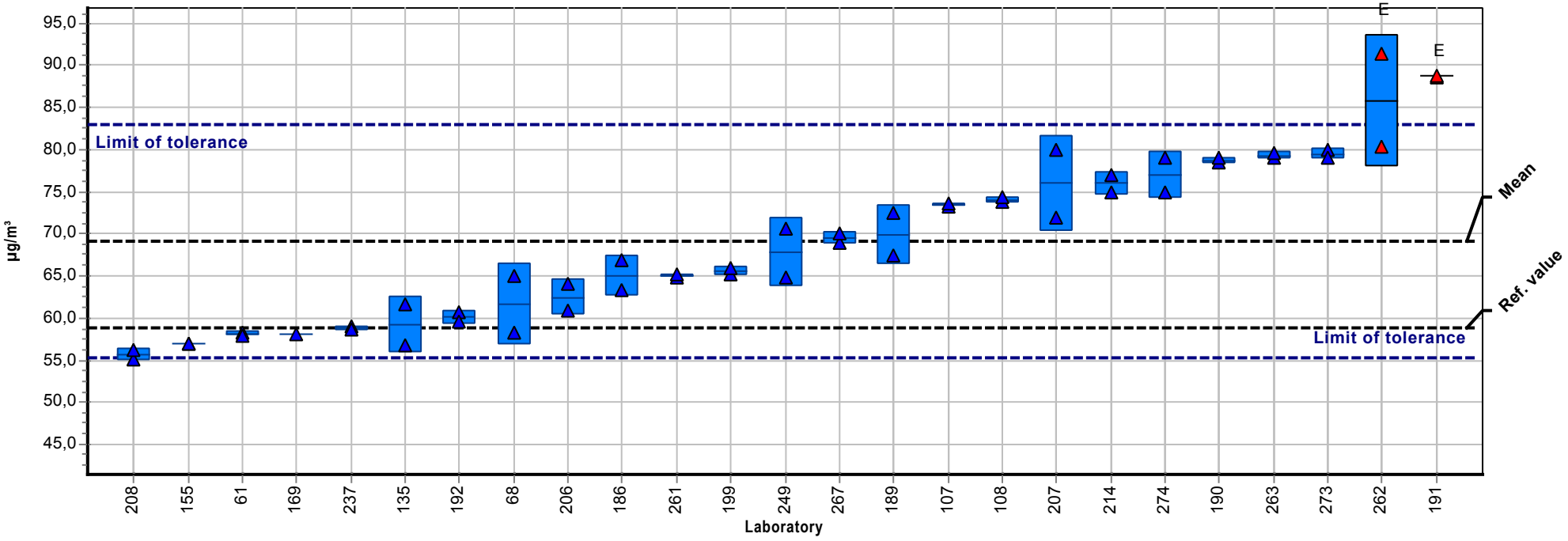
Summary results

Measurand:	**n-Butyl acetate**	**Mean:**	**128,98 µg/m³**
Sample:	**2**	**Reprod. s.d.:**	**14,36 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**11,14%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**109,80 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**103,18 - 154,78 µg/m³ (|Z-Score| <= 2,00)**



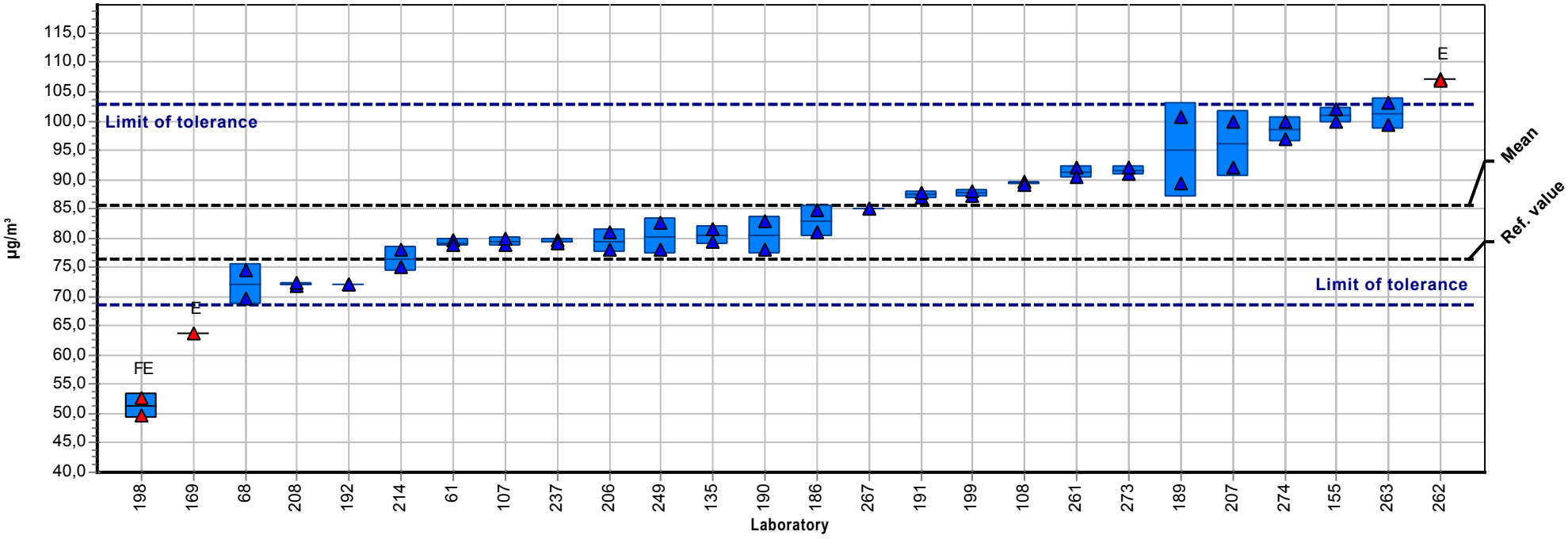
Summary results

Measurand:	**n-Heptane**	**Mean:**	**69,13 µg/m³**
Sample:	**2**	**Reprod. s.d.:**	**9,66 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**13,97%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**58,80 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**55,31 - 82,96 µg/m³ (|Z-Score| <= 2,00)**



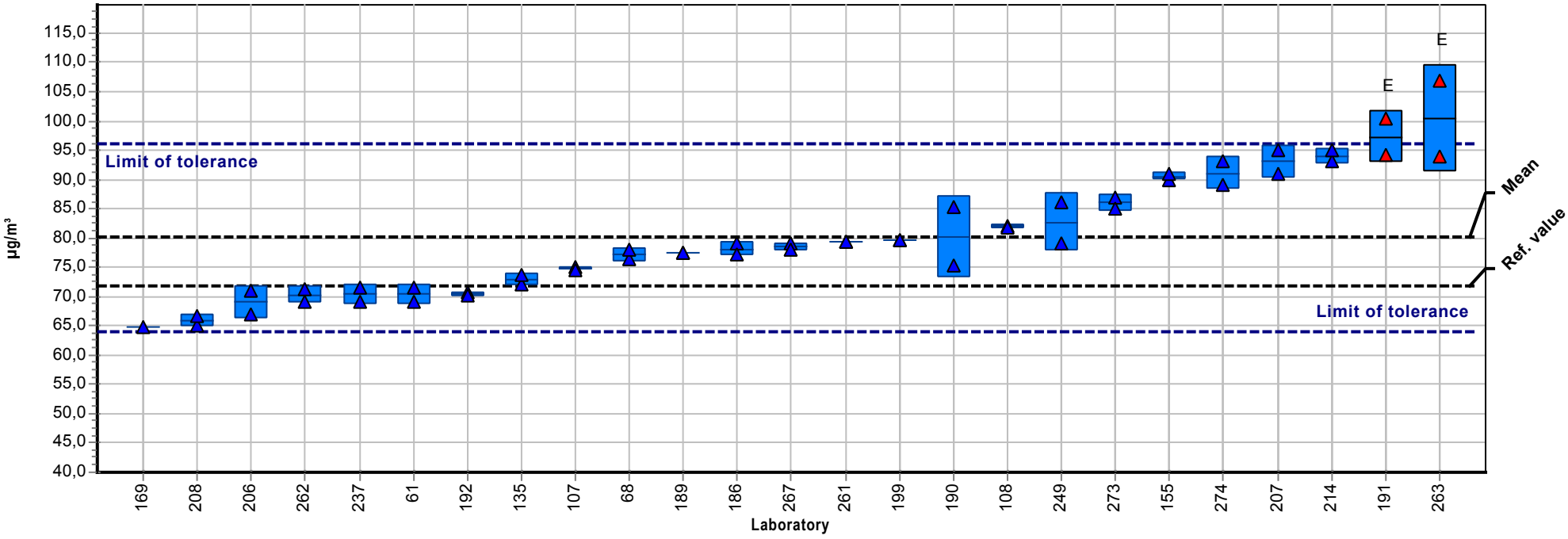
Summary results

Measurand:	**Toluene**	**Mean:**	**85,60 µg/m³**
Sample:	**2**	**Reprod. s.d.:**	**10,49 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**12,26%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**76,50 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**68,48 - 102,72 µg/m³ (|Z-Score| <= 2,00)**



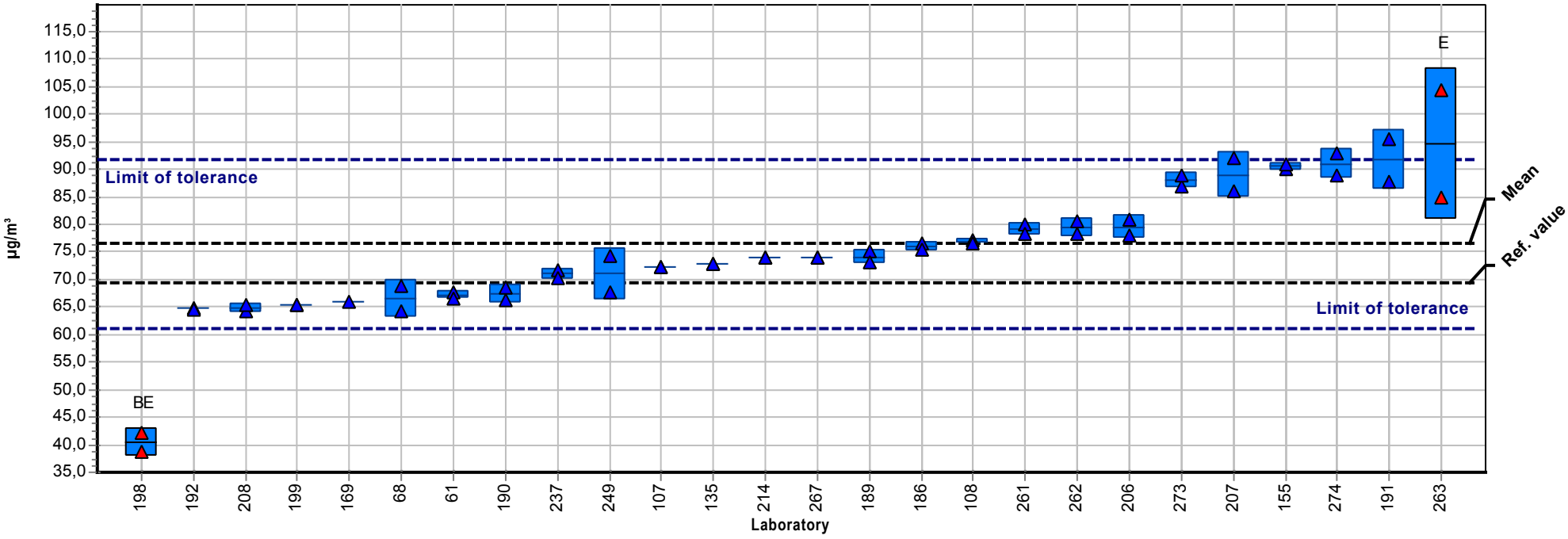
Summary results

Measurand:	**n-Octane**	**Mean:**	**80,16 µg/m³**
Sample:	**2**	**Reprod. s.d.:**	**10,04 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**12,53%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**71,90 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**64,12 - 96,19 µg/m³ (|Z-Score| <= 2,00)**



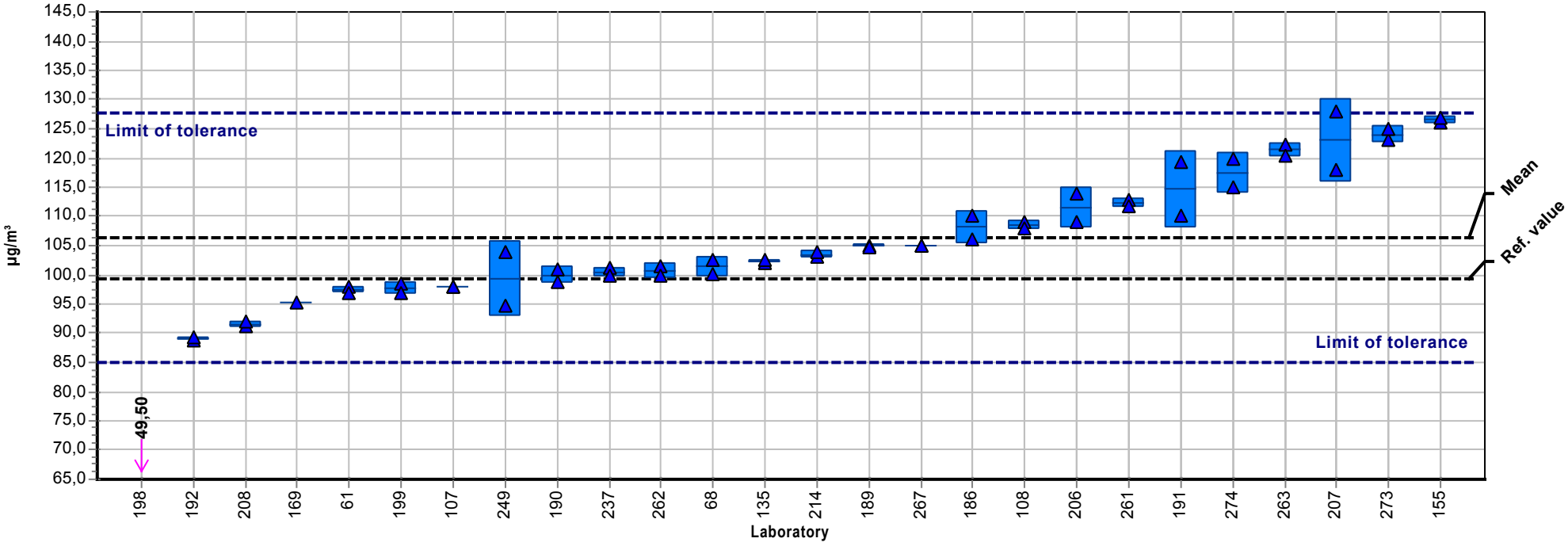
Summary results

Measurand:	**p-Xylene**	**Mean:**	**76,49 µg/m³**
Sample:	**2**	**Reprod. s.d.:**	**9,79 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**12,80%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**69,50 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**61,19 - 91,78 µg/m³ (|Z-Score| <= 2,00)**



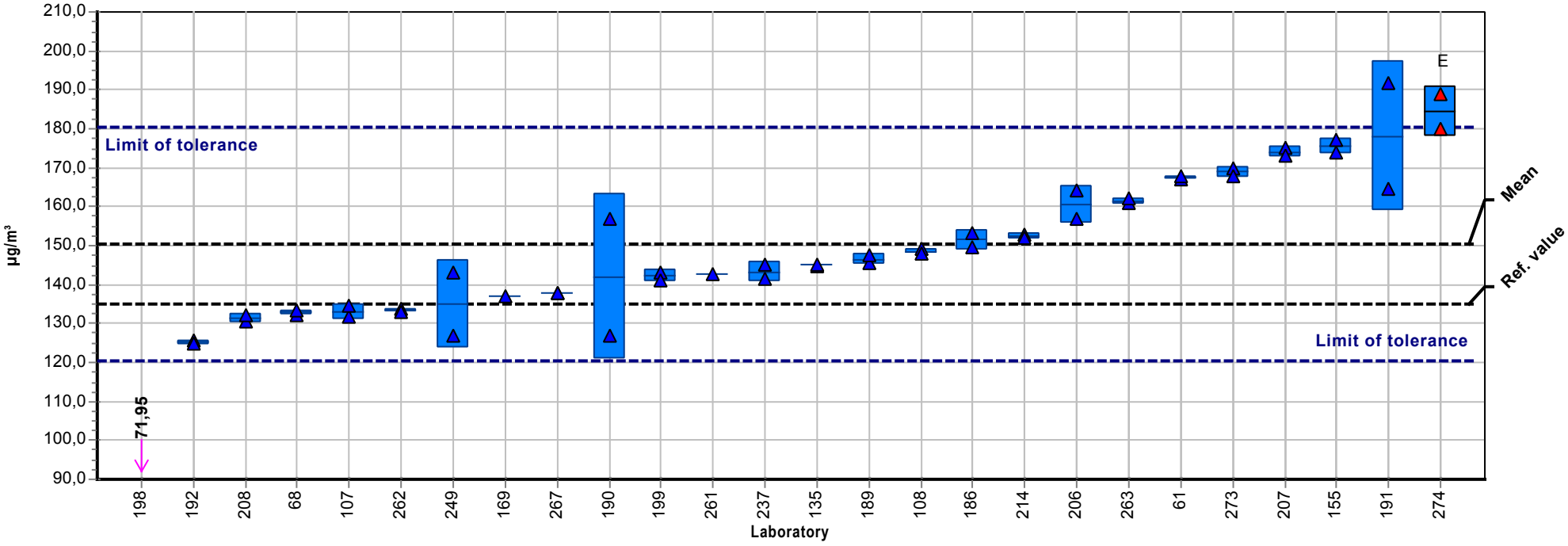
Summary results

Measurand:	**Ethylbenzene**	**Mean:**	**106,39 µg/m³**
Sample:	**2**	**Reprod. s.d.:**	**10,48 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**9,85%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**99,20 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**85,11 - 127,66 µg/m³ (|Z-Score| <= 2,00)**



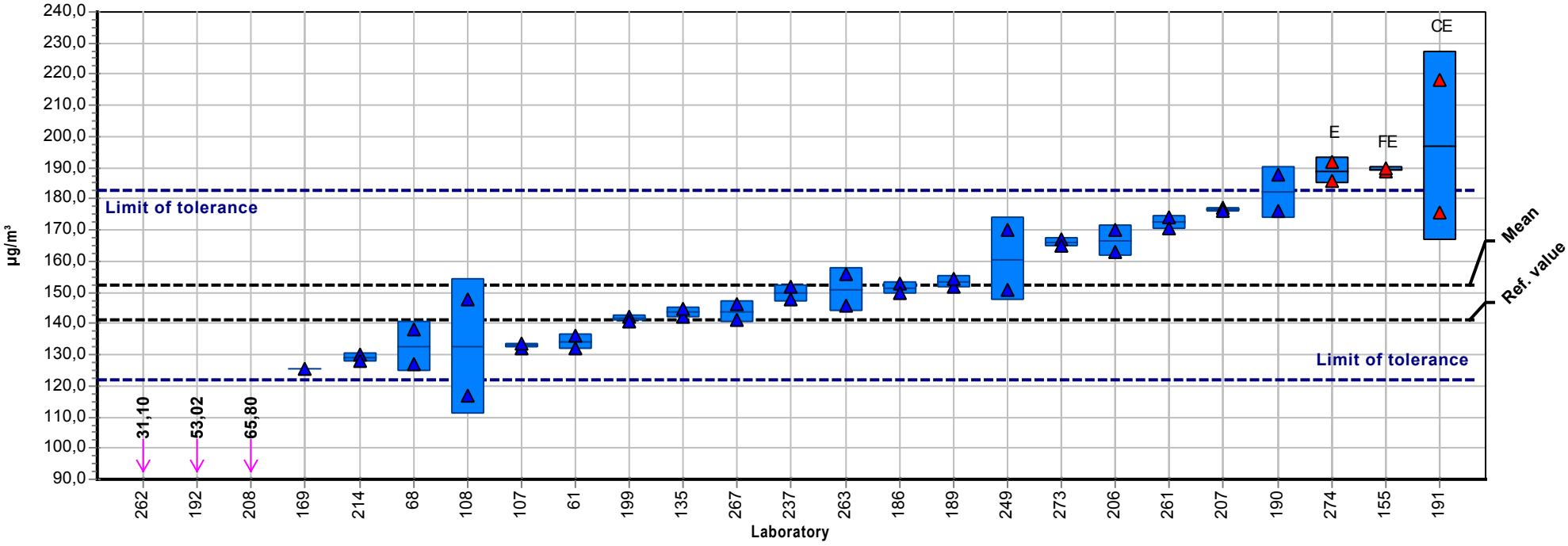
Summary results

Measurand:	**1,2,4-Trimethylbenzene**	**Mean:**	**150,43 µg/m³**
Sample:	**2**	**Reprod. s.d.:**	**17,61 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**11,70%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**135,20 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**120,34 - 180,52 µg/m³ (|Z-Score| <= 2,00)**



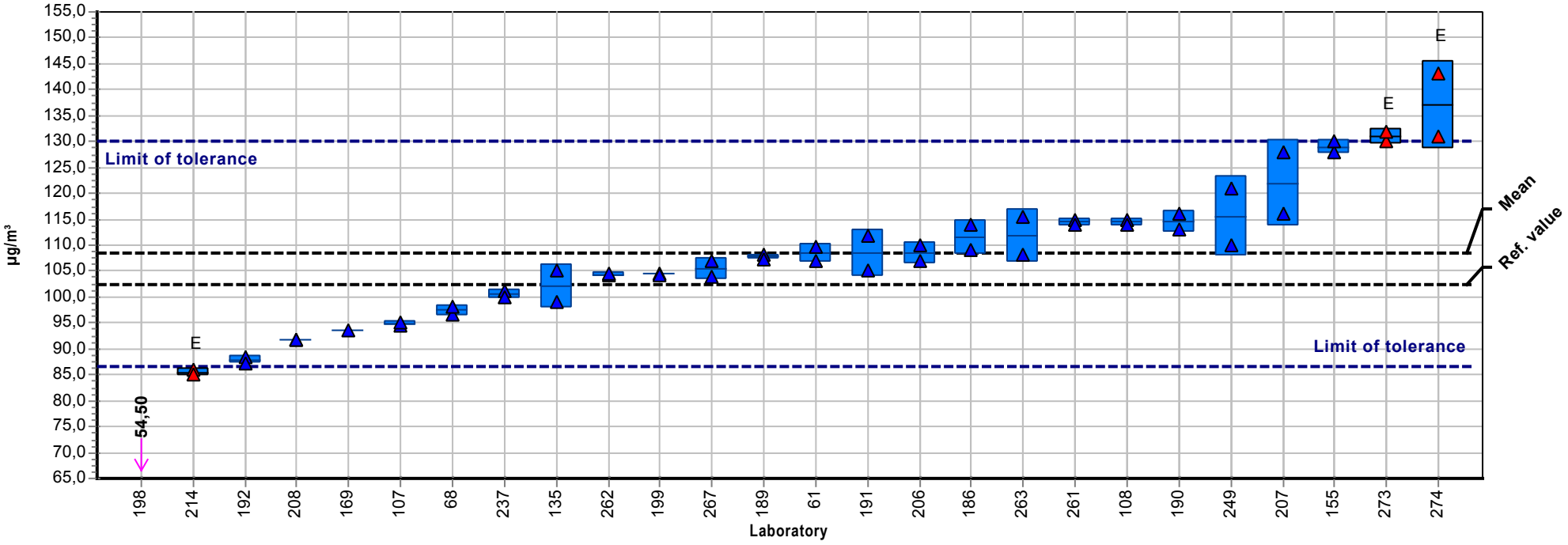
Summary results

Measurand:	**2-Ethoxyethyl acetate**	**Mean:**	**152,31 µg/m³**
Sample:	**2**	**Reprod. s.d.:**	**19,16 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**12,58%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**141,40 µg/m³**
No. of laboratories:	**20**	**Range of tolerance:**	**121,85 - 182,78 µg/m³ (|Z-Score| <= 2,00)**



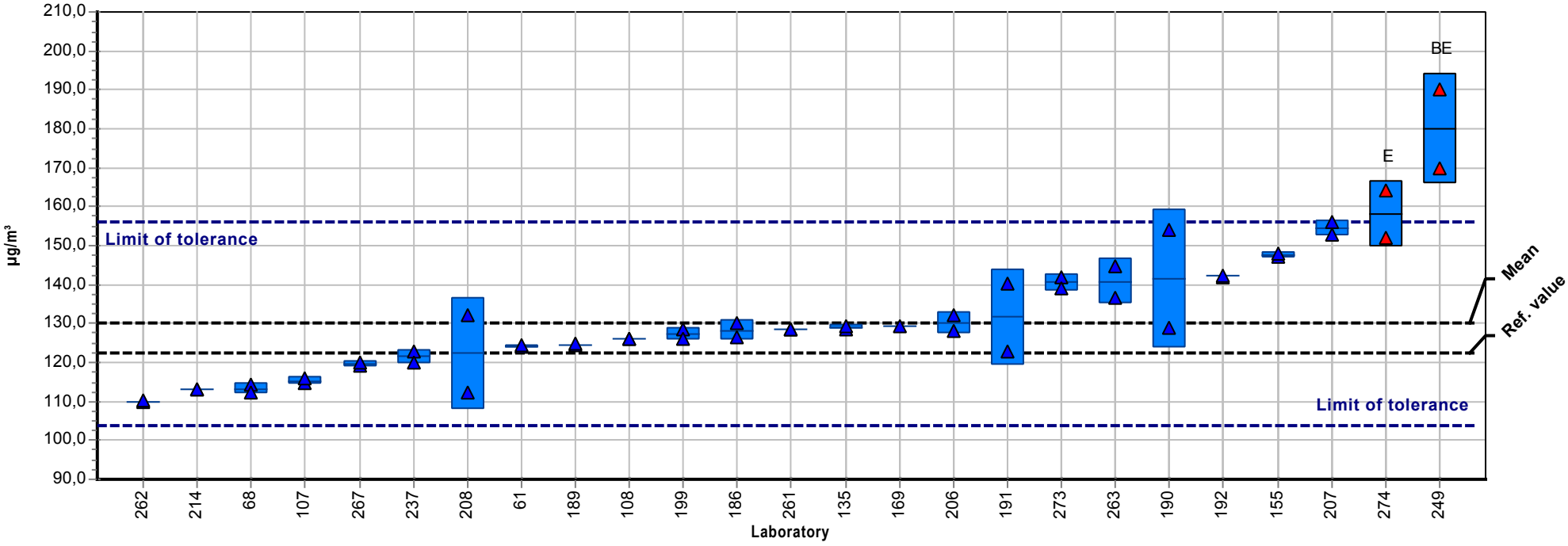
Summary results

Measurand:	**4-Methyl-2-Pentanone**	**Mean:**	**108,39 µg/m³**
Sample:	**2**	**Reprod. s.d.:**	**13,13 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**12,11%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**102,50 µg/m³**
No. of laboratories:	**25**	**Range of tolerance:**	**86,71 - 130,06 µg/m³ (|Z-Score| <= 2,00)**



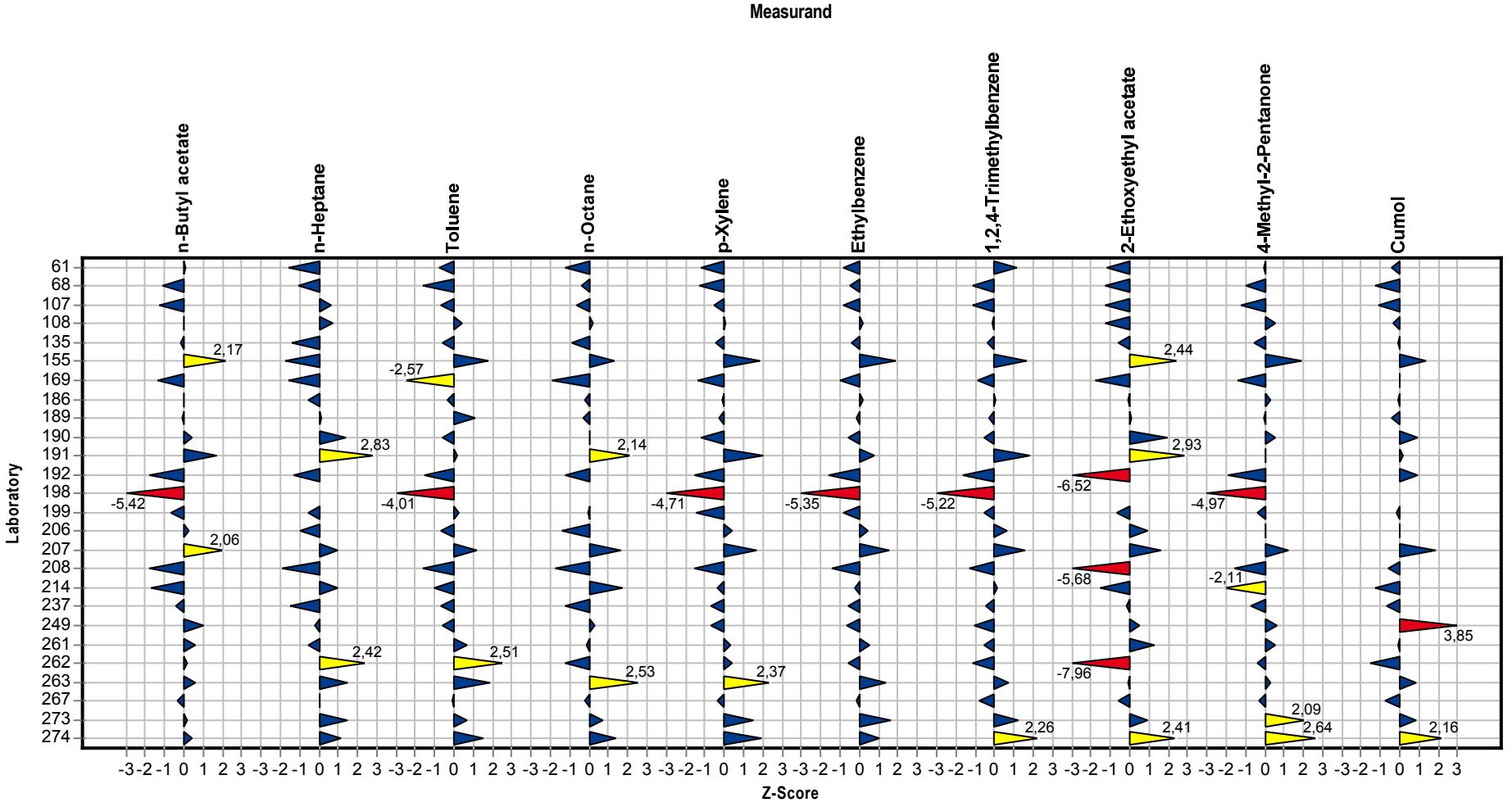
Summary results

Measurand:	**Cumol**	**Mean:**	**129,97 µg/m³**
Sample:	**2**	**Reprod. s.d.:**	**13,51 µg/m³**
Method:	**ISO 5725-2**	**Rel. reprod. s.d.:**	**10,39%**
Rel. target s.d.:	**10,00% (Limited)**	**Reference value:**	**122,40 µg/m³**
No. of laboratories:	**24**	**Range of tolerance:**	**103,98 - 155,96 µg/m³ (|Z-Score| <= 2,00)**



Sample chart of *Z-Scores*

Sample: 2



Questions and Answers

Participant	Kind of tube
61	Tenax TA
68	Tenax TA
107	Tenax TA, Glasröhrchen, TDS3(R)-Container (Supelco)
108	Tenax TA
135	Tenax TA
155	Gerstel Tenax TA
169	Tenax TA
186	TENAX TA
189	Tenax TA
190	Tenax TA
191	tenax
192	Tenax TA
198	Carbotrap 300 (Carbotrap C, Carbotrap B, Carbosieve S-III) glass TD tubes
199	Tenax TA
206	Ten TA
207	Tenax
208	Tenax TA + Carbograph 5 TD
214	Tenax TA
237	Tenax TA
249	Tenax TA
261	Tenax TA
262	Tenax TA
263	Tenax TA
267	TENAX
273	Tenax TA
274	Tenax

Participant	Analytical method	Thermodesorber
61	Ja	Perkin Elmer ATD
68	Nein	Turbomatrix ATD von PerkinElmer
107	Nein (nur in Anlehnung, nicht exakt Abw eichungen insbes. Herstellung der Kalibrier-	Shimadzu TD-20
108	Ja	Cold Trap/ Thermal Desorption Method
135	ja	Perkin Elmer TurboMatrix 650
155	DIN EN ISO 16017-1 und DIN ISO 16000-6	Gerstel TDS-2 mit Gerstel TDS A und KAS 4
169	Ja	TDS2 der Fa. Gerstel
186	Yes	TurboMatrix 650
189	Yes	STD DANI 33.50
190	DIN ISO 16000-6 und DIN EN ISo 16017-1	Turbo Matrix 350 (Perkin Elmer)
191	no	TDSA Gerstel
192	ISO 16000-6	TurboMatrix ATD(PerkinElmer Inc.)
198	YES	Shimadzu TD20
199	nein	UNITY Series2 von Markes
206	Ja	Perkin Elmer Turbomatrix ATD
207	Ja	Markes Unity TD 100
208	in house mod. 16000-6	Markes Unity + Ultra
214	ja	Unity / Ultra von Markes
237	Nein	PE Turbomatrix
249	Nein	Gerstel TDSA
261	Nein	Perkin Elmer ATD350
262	ja	Shimadzu TD20
263	Nein, sondern nach 16000-6	Perkin Elmer TurboMatrix 650 ATD
267	Nein, Interne Methode SOP-B-25	MARKES TD100
273	ISO 16000-6	Direct desportion
274	ISO 16000-6	Direct desportion

Participant	Desorption temperature	Desorption flow	Desorption time
61	300°C	10	15
68	340°C	50 ml/min	20 min

Participant	Desorption temperature	Desorption flow	Desorption time
107	280	60	10
108	240 °C	50	10
135	280°C	23	19
155	15 °C 1min 40°C/min 305 °C 8min	40 ml/min	15 °C 1min 40°C/min 305 °C 8min
169	280°C	100	5
186	280	50	20
189	260ºC	10 ml/min	10
190	280	30	15
191	260	31	10
192	260‹C	30mL/min	10min
198	260°C	60 mL/min	8 minutes
199	250°C	35ml/min	6min
206	260°C	50 ml/min	3 min
207	300	20	8
208	280	50	10
214	300°C	50 ml / min	10 min
237	300 °C	30 mL/ min	10 min
249	280 °C	60	15 min
261	260 °C	30 ml/min	20 min
262	200 °C	60	6 min
263	280	50	10
267	280°C	50ml/min	15min.
273	280	35	20
274	280	35	20

Participant	Cyro trap	Carrier gas	Flow rate
61	-30°C zu 300°C	Helium	10
68	-20°C; 340°C	Helium	15 ml/min
107	-5 dann 285 °C	He	Säulenfluss 1.17 ml/min (27.5 cm/s linear vel constant)
108	-17°C/ 240°C	Helium	

Participant	Cyro trap	Carrier gas	Flow rate
135	-20°C, 300°C	Helium	1,5
155	minus 150 °C 1min 12°C/sec 305 °C 8min	Helim ECD	1 ml/min const Flow
169	-100°C/280°C	Helium	1
186	-30°C to 280°C at 45°C/sec	Helium	2
189	Cryo temperature = -35ºC, Heating temperature = 300ºC	Helium	0.8 ml/min
190	-30 und 300	Helium	2,5
191	-150 / 12°C/min	He	1.34
192	Cryo trap at 5Ž and desorb at 280Ž	Helium	3mL/min
198	-20/250 °C	Helium	1
199	-10°C/300°C	Helium	0,7ml/min
206	-30°C/ 260°C/ 99K/s	Helium	1 ml/min
207	-25	Helium	1,2
208	-10, max 300	He	1,0
214	0°C - 300°C	Helium	1.0 ml/min
237	-20°C/ +270°C	He	ca. 0,5 mL/ min
249	-150°C // 12°C/sec // 280°C, Haltezeit 1 min	Helium	1,2
261	-9 °C und 270 °C	Helium	1,6 ml/min
262	-10; 200°C	Helium	1,5
263	-20 und 280	Helium	1,5
267	-5°C und 300°C	Helium	1.5ml/min.
273	cooling temperature during desorption: -20, heating temperature:310	Helium	1
274		Helium	1

Participant	Analytical column	Detector
61	Kapillarsäule	Clarus 600MS
68	Vocol von Supelco	MS
107	MN Optima 5MS Accent 60Meter 1µm Filmdicke	MS
108	ZB 5, 60 m, 0,25mm, 1µm	MS
135	RTX-200	MSD
155	Agilent HP 5ms 60m x 0,25mm x 0,25µm	Agilent MSD 5975

Participant	Analytical column	Detector
169	DB-5MS	Massenspektrometer
186	Perkin Elite 5MS	FID for quantification MS for Identification
189	HP5 (50 m, 0.2 mm, 0.50 um)	MSD 5972
190	Rxi-5ms 30m x 0,25mm ID x 1.00um df	MS
191	Agilent Ultra 2	MSD
192	HP-VOC(60m length, 0.32mml.d., 1.8ƒÊm film)	MSD
198	Restek Rxi-624Sil MS 30m, 0.25mm ID, 1.4um Film	MSD
199	DB-5.625MS	5975C GC-MS-Triple-Axis
206	60m; 0,25 ID; 0,25µmdf	TOF
207	DB 5	MS
208	HP-1 MS	MSD
214	Agilent CP 9013 Phase VF-ms ID 0,25 mm / Länge 30 m Df 0,25 µm + 10 m EZ Guard	MSD
237	Varian Xms VF	MSD
249	RXI-5 MS, 60m * 0,32mm ID, 3 µm Filmdicke, RESTEK	MSD
261	Elite-VMS 30m PerkinElmer	PerkinElmer Clarus SQ8 S MS
262	FactorFour VF-624, 60 m * 0,25 mm ID, DF 1,40 µm	shimadzu MS QP Ultra EI
263	ZB-1701	MS
267	HP INNOWAX 60m x 0.32mm x 0.5µm	MSD
273	Rtx 200	5975C w ith triple axis
274	Rtx 200	5975C w ith triple axis

Participant	Data evaluation
61	Identifikation über NIST, Quantifizierung über interne Standard Kalibration
68	Identifikation mit MS; Quantifizierung mit entspr. Berechnung in einem Excelfile
107	Identifizierung durch Ret-Zeit-Fenster und SIM-mz und Referenzionenverhältnis; Quantifizierung anhand mz-Fläche, Kalibrierung extern, jede Substanz einzeln d.h. nicht als Toluoläquivalent
108	Ausw ertung über Internen Standard, Identifizierung über Retentionszeit und Massenspektrum
135	externer Standard, RT & Massenspektrum
155	substanzspezifisch, Retentionszeit und Massenspectrum
169	externe Kalibrierung

Participant	Data evaluation
186	External Calibration
189	identification by MSD and confirmed by standard injection for all the compounds, quantification using calibration curve w ith 5 levels of concentration
190	Quantifizierung über Kalibrierkurve und interner Standard, Indentifizierung über MS
191	specific calibration except external standard for n-heptane (n-Octane) and p-Xylene (o-Xylene
192	2-Ethoxyethyl acetate and Cumol w ere calculated by using toluene(TIC) response factor, and others w ere calculated by using their individual response.
198	External standard, SIM quantification, Acuisition Scan & SIM simultaneous
199	Quantifizierung:Kalibrierung der Substanzen von 5 bis 250 µg/m³; Korrektur über interne Standars (Toluol d8; o-Xylol d10; Dodecan d26; Naphthalon d8)/ Identifizierung: GC-MS+ Standards der einzelnen Substanzen
206	Externer Standard
207	EIC Originalreferenzen, eigene + kommerzielle Bibliotheken
208	substance specific
214	manuelle Integration, Identifizierung über MS
237	externe Kalibration mit IS und MSD
249	Quantifizierung über 7-Punkt Kalibrierung, Identifikation über Spektrenbibliotheksvergleich und Retentionszeit.
261	Interner Standard, 5 Punkt-Eichung
262	7 Punkt Kalibration im Arbeitsbereich; Je Substanz 3 m/z
263	Quantifizierung über externe Kalibrierung bezogen auf internen Standard. Identifizierung über MS-Datenbank und externe Kalibrierung
267	Quantifizierung mittels spezifischer Massenfragmente, Indentifizierung mittels NIST Bibliothek
273	scan mode and library search

Participant	Recovery rate	Date of analysis
61	Ja	16.07.2015
68	Nein	22./23.6.2015
107	Nein d.h. Annahme: Standard = Probe daher W=100%	05.06.2015
108	WDF w urde nicht berücksichtigt, da annähernd 100%	06.06.2015
135	nicht erforderlich	18.06.2015
155	nein	10.06.2015
169	nein	9.06.15
186	No	25/06/2015
189	no	9 and 10 July

Participant	Recovery rate	Date of analysis
190	ja	02.07.15 und 14.07.15
191	no	22/06/2015
192	No	04/06/06
198	No	08/06/2015
199	nein	13.07.15
206	Ja	16.6.15
207		17.06.2015
208	no	02.07.2015
214	nein	09.06.2015
237	Nein	11.06.2015
249	Nein, die Standards w urden direkt auf die Röhrchen gegeben, analysiert und anschließend kalibriert.	06:06:2015
261	nein	04-06.-10.06.15
262	ja	9.6.15
263	Nein	15.07.2015 und 16.07.2015
267	ja	24/06/2015
273	No	2015-06-23
274	No	2015-06-25