Summary of laboratory means

Sample 1

	n-Butyl acetate	Z score	n-Heptane	Z score	Toluene	Z score	p-Xylene	Z score	Ethylbenzene	Z score	1- Butanol	Z score
Unit	mg/m³		mg/m³		mg/m³		mg/m³		mg/m³		mg/m³	
5	68,079	0,30	84,485	0,51	82,365	0,39	107,074	0,30	43,296	-0,04	81,109	0,25
26	75,300	1,40	88,000	0,94	89,400	1,28	112,500	0,83	48,000	1,05	87,900	1,11
72	62,800	-0,49	80,600	0,02	81,800	0,32	105,500	0,15	45,000	0,35	83,800	0,59
78	62,990	-0,47	75,400	-0,62	74,780	-0,57	97,780	-0,59	40,540	-0,67	73,880	-0,67
111	68,000	0,29	75,900	-0,56	77,000	-0,29	97,600	-0,61	42,900	-0,13	74,400	-0,60
138	72,200	0,93	88,600	1,02	85,500	0,78	110,000	0,59	46,000	0,58	85,000	0,74
150	69,200	0,47	81,330	0,11	75,510	-0,48	106,400	0,24	43,600	0,03	79,400	0,03
175	62,000	-0,62	74,000	-0,80	75,000	-0,54	96,000	-0,76	41,000	-0,57	73,000	-0,78
248	65,900	-0,03	79,100	-0,16	77,800	-0,19	104,800	0,09	43,200	-0,06	79,300	0,02
272	57,700	-1,27	83,600	0,40	77,400	-0,24	101,400	-0,24	42,300	-0,27	78,300	-0,11
276	62,600	-0,53	73,600	-0,85	75,500	-0,48	104,000	0,01	42,200	-0,29	74,500	-0,59
–	–	––	–	––	–	––	–	––	–	––	–	––
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	
Mean	66,070		80,420		79,278		103,914		43,458		79,144	
Reproducibility s.d.	5,091		5,357		4,847		5,260		2,176		4,968	
Rel. reproducibility s.d.	7,71 %		6,66 %		6,11 %		5,06 %		5,01 %		6,28 %	
Reference value	67,200		85,200		84,100		103,200		45,400		84,600	
Target s.d.	6,607		8,042		7,928		10,391		4,346		7,914	
Rel. target s.d.	10,00 %		10,00 %		10,00 %		10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	52,856		64,336		63,422		83,131		34,766		63,316	
Upper limit of tolerance	79,284		96,503		95,133		124,697		52,149		94,973	
Type B outliers	0		0		0		0		0		0	
Type F outliers	0		0		0		0		0		0	
No. of laboratories that submitted results	11		11		11		11		11		11	
No. of laboratories after elimination of outliers type A-D and F (without	11		11		11		11		11		11	

	n-Butyl acetate Z score	n-Heptane Z score	Toluene Z score	p-Xylene Z score	Ethylbenzene Z score	1- Butanol Z score
laboratories that only gave states but no measured values)						
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

Sample 2

	i-Butyl acetate	Z score	n-Hexane	Z score	Ethanol	Z score	1-Methoxy-2-propanol	Z score
Unit	mg/m³		mg/m³		mg/m³		mg/m³	
5	53,347	0,15	35,700	0,72	80,747	1,85	52,507	0,71
26	59,200	1,27	37,400	1,23	87,100	2,78 E	58,500	1,93
72	49,900	-0,50	34,700	0,42	67,200	-0,14	52,300	0,66
78	46,530	-1,15	29,850	-1,04	52,730	-2,26 E	43,710	-1,09
111	52,500	-0,01	31,700	-0,48	59,200	-1,31	46,700	-0,48
138	57,800	1,00	36,400	0,93	86,000	2,62 E	52,400	0,68
159			34,000	0,21	63,000	-0,75		
175	51,000	-0,29	31,000	-0,69	62,000	-0,90	44,000	-1,03
248	52,400	-0,03	32,500	-0,24	66,500	-0,24	47,200	-0,38
272	52,400	-0,03	32,100	-0,36	64,700	-0,50	45,400	-0,74
276	50,400	-0,41	31,000	-0,69	60,300	-1,15	47,700	-0,27
–	–	– –	–	– –	–	– –	–	– –
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	
Mean	52,548		33,305		68,134		49,042	
Reproducibility s.d.	3,693		2,485		11,383		4,728	
Rel. reproducibility s.d.	7,03 %		7,46 %		16,71 %		9,64 %	
Reference value	53,600		35,200		69,300		54,900	
Target s.d.	5,255		3,330		6,813		4,904	
Rel. target s.d.	10,00 %		10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	42,038		26,644		54,507		39,233	
Upper limit of tolerance	63,057		39,965		81,761		58,850	
Type B outliers	0		0		0		0	
Type F outliers	0		0		0		0	
No. of laboratories that submitted results	10		11		11		10	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no	10		11		11		10	

	i-Butyl acetate	Z score	n-Hexane	Z score	Ethanol	Z score	1-Methoxy-2-propanol	Z score
measured values)								
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

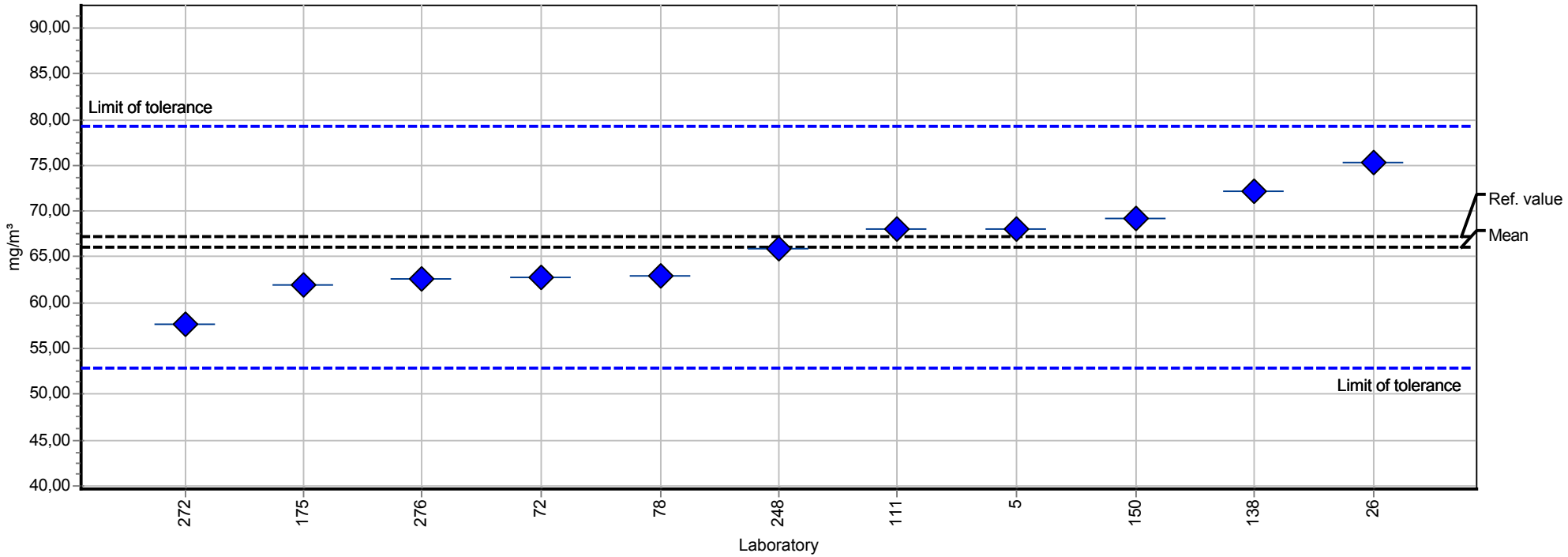
Sample 3

	Benzene	Z score
Unit	mg/m³	
5	0,188	0,94
26	0,190	1,08
72	0,170	-0,08
78	0,164	-0,43
111	0,170	-0,08
138	0,180	0,50
150	0,171	-0,03
175	0,160	-0,67
248	0,174	0,15
272	0,148	-1,37
–	–	– –
Method	ISO 5725-2	
Assessment	|Z|<=2,00	
Mean	0,171	
Reproducibility s.d.	0,013	
Rel. reproducibility s.d.	7,33 %	
Reference value	0,178	
Target s.d.	0,017	
Rel. target s.d.	10,00 %	
Lower limit of tolerance	0,137	
Upper limit of tolerance	0,206	
Type B outliers	0	
Type F outliers	0	
No. of laboratories that submitted results	10	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	10	

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	

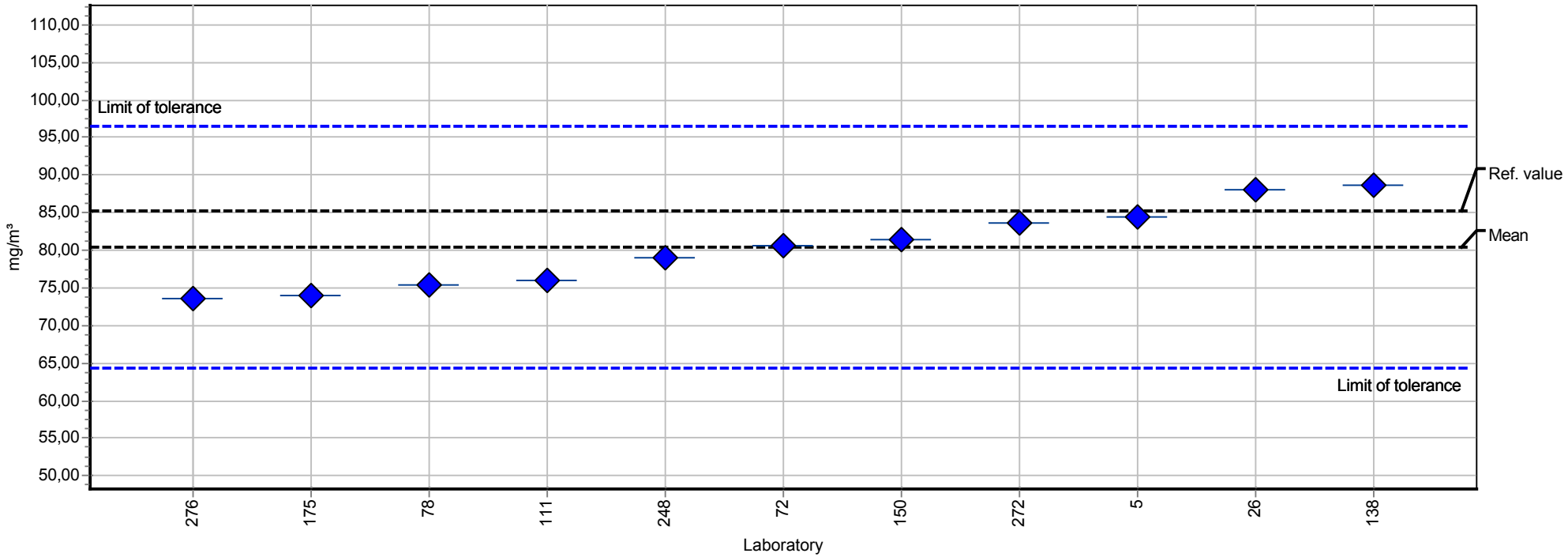
Summary results

Measurand:	**n-Butyl acetate**	**Mean:**	**66,070 mg/m³**
Sample:	**1**	**Reproducibility s.d.:**	**5,091 mg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**7,71%**
No. of laboratories:	**11**	**Reference value:**	**67,200 mg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**52,856 - 79,284 mg/m³ (|Z-Score| <= 2,00)**



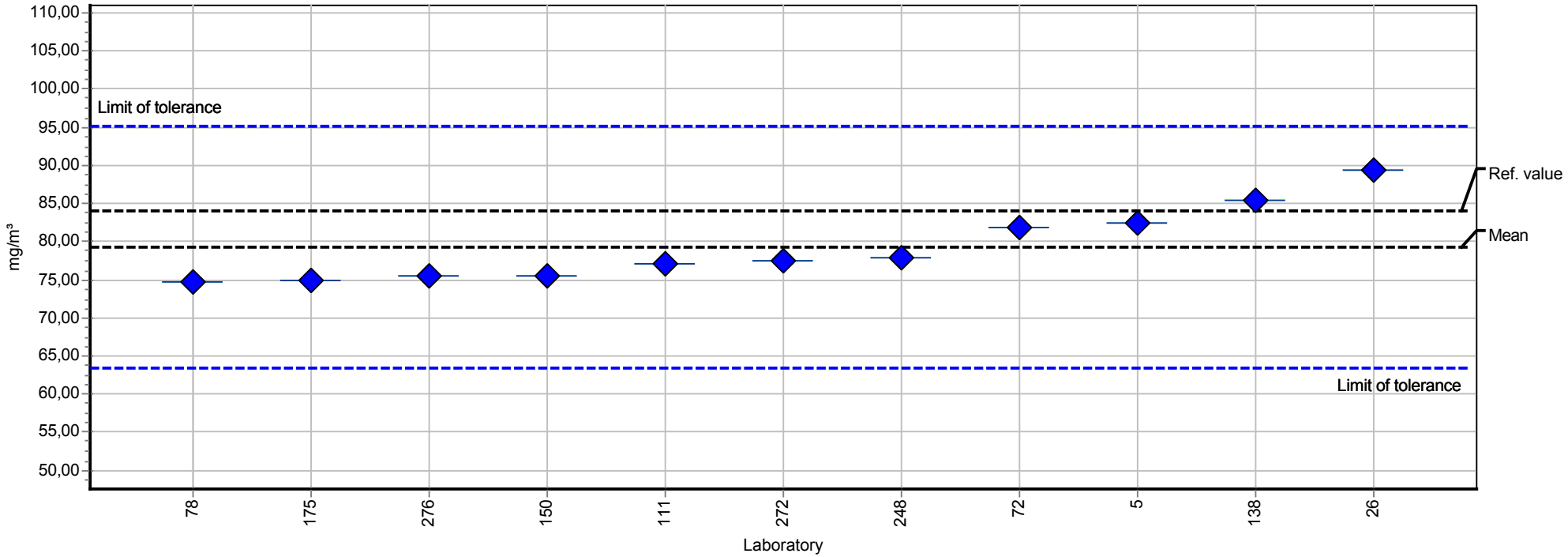
Summary results

Measurand:	**n-Heptane**	**Mean:**	**80,420 mg/m³**
Sample:	**1**	**Reproducibility s.d.:**	**5,357 mg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**6,66%**
No. of laboratories:	**11**	**Reference value:**	**85,200 mg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**64,336 - 96,503 mg/m³ (|Z-Score| <= 2,00)**



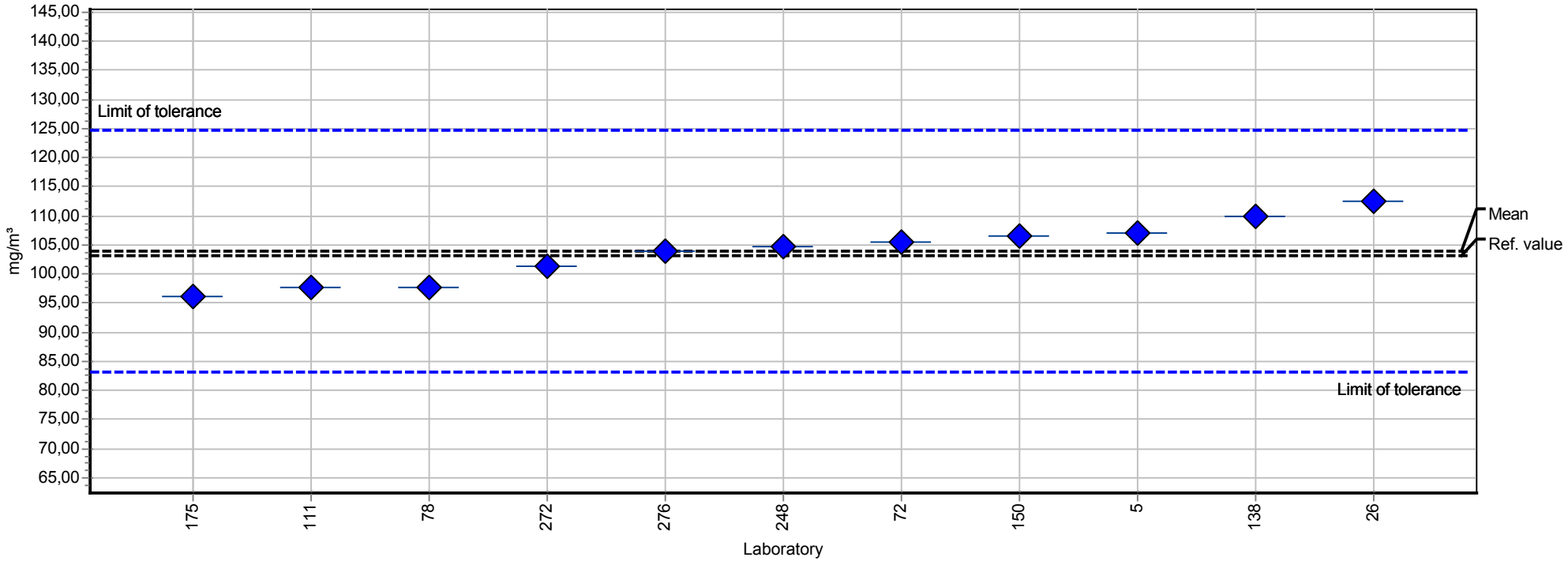
Summary results

Measurand:	**Toluene**	**Mean:**	**79,278 mg/m³**
Sample:	**1**	**Reproducibility s.d.:**	**4,847 mg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**6,11%**
No. of laboratories:	**11**	**Reference value:**	**84,100 mg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**63,422 - 95,133 mg/m³ (|Z-Score| <= 2,00)**



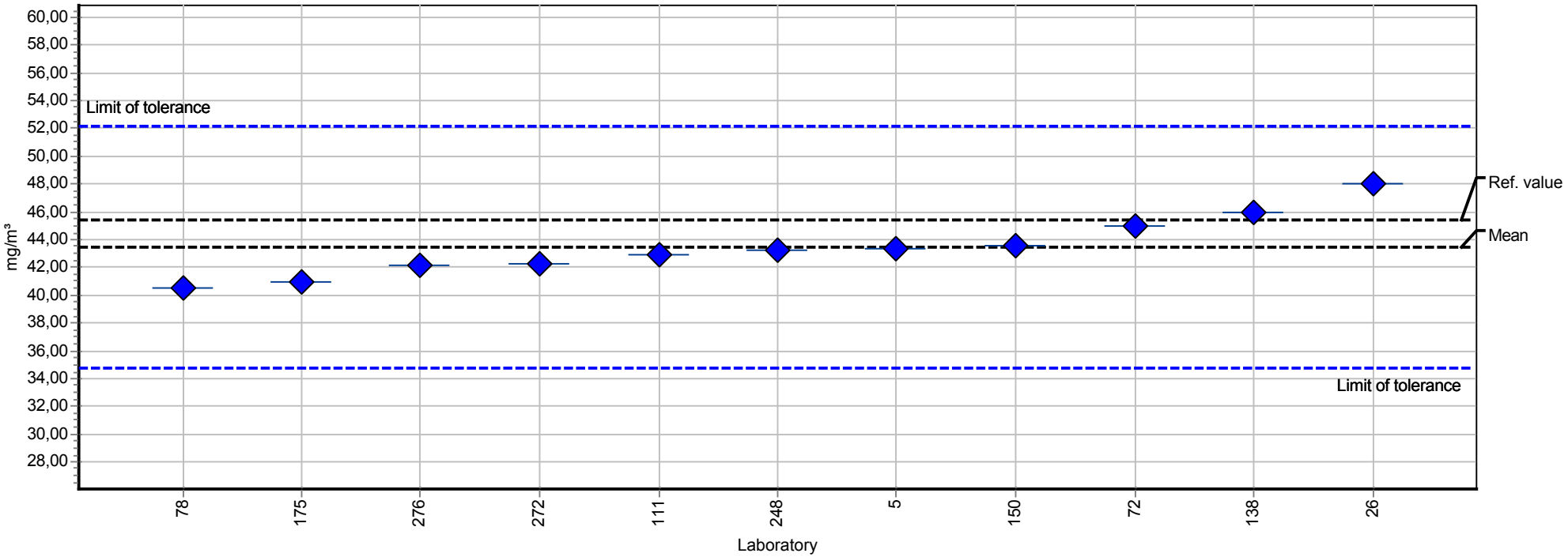
Summary results

Measurand:	**p-Xylene**	**Mean:**	**103,914 mg/m³**
Sample:	**1**	**Reproducibility s.d.:**	**5,260 mg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**5,06%**
No. of laboratories:	**11**	**Reference value:**	**103,200 mg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**83,131 - 124,697 mg/m³ (|Z-Score| <= 2,00)**



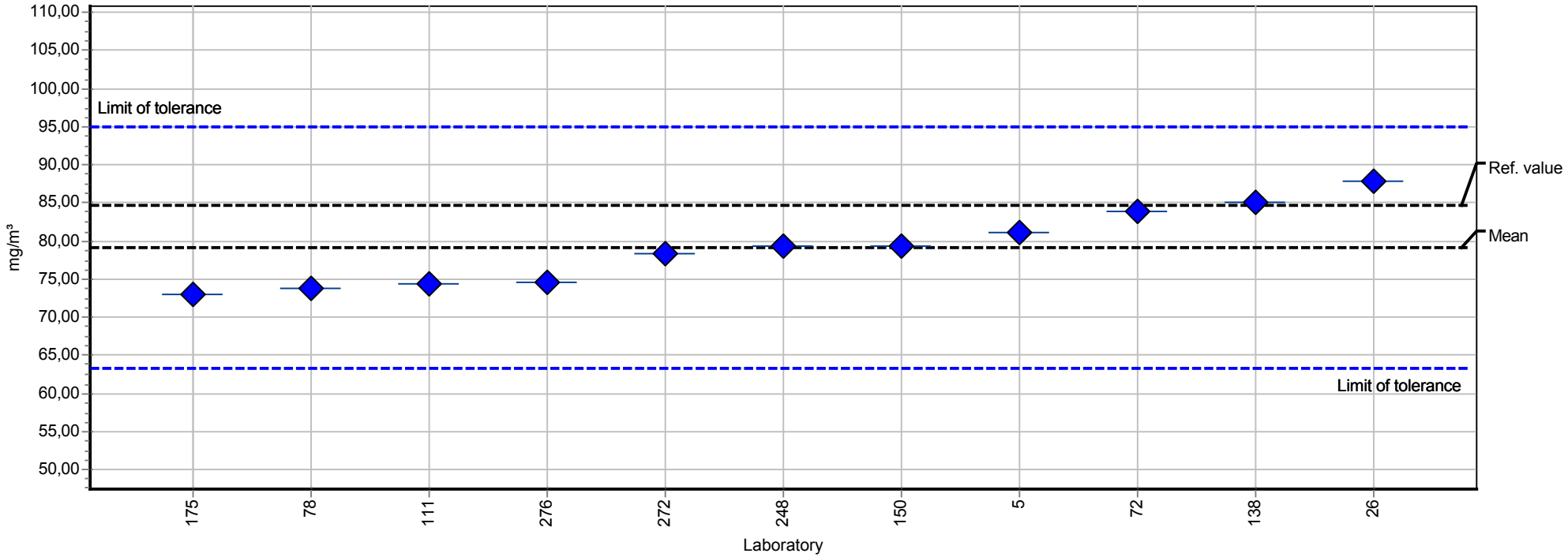
Summary results

Measurand:	**Ethylbenzene**	**Mean:**	**43,458 mg/m³**
Sample:	**1**	**Reproducibility s.d.:**	**2,176 mg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**5,01%**
No. of laboratories:	**11**	**Reference value:**	**45,400 mg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**34,766 - 52,149 mg/m³ (|Z-Score| <= 2,00)**



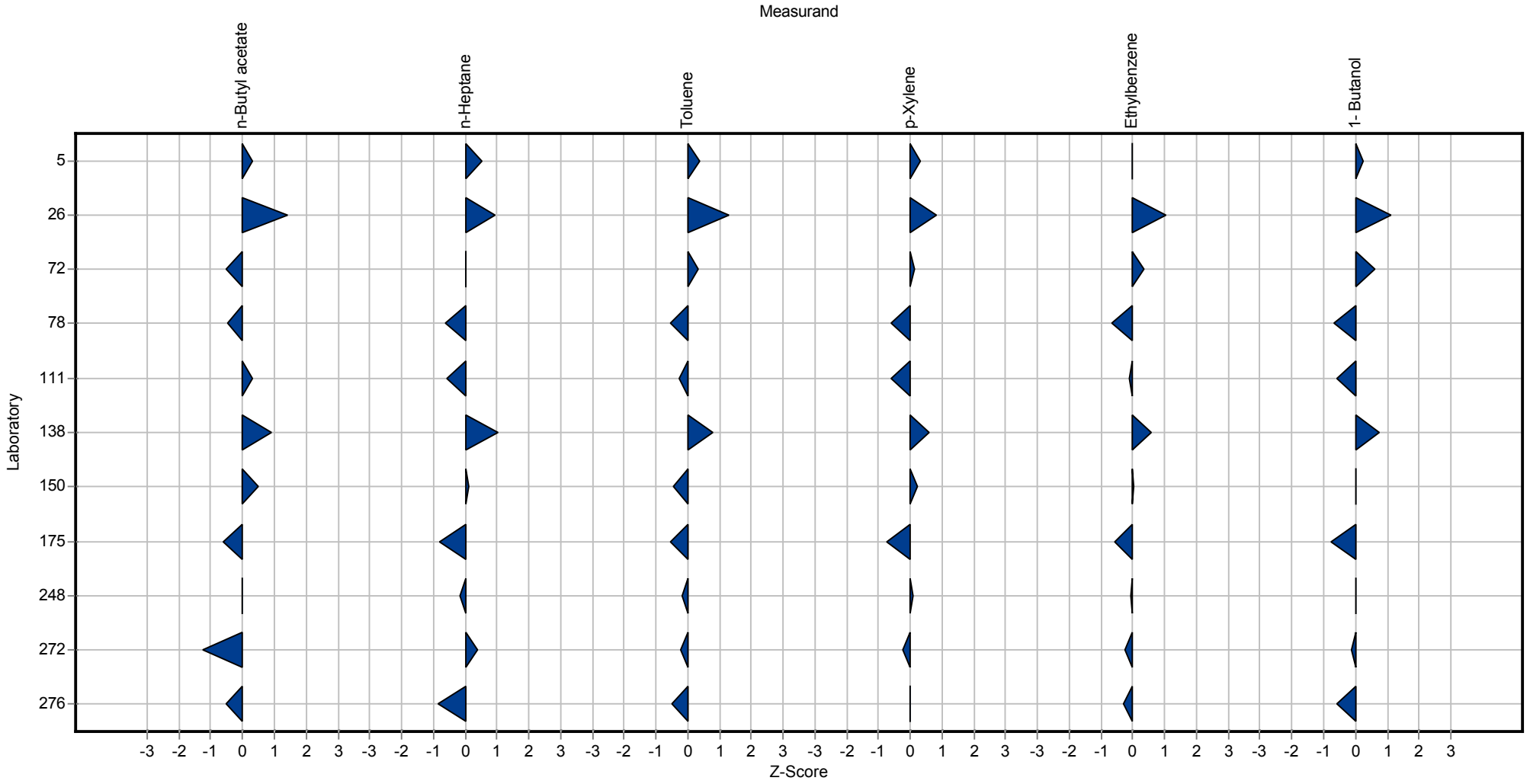
Summary results

Measurand:	**1- Butanol**	**Mean:**	**79,144 mg/m³**
Sample:	**1**	**Reproducibility s.d.:**	**4,968 mg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**6,28%**
No. of laboratories:	**11**	**Reference value:**	**84,600 mg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**63,316 - 94,973 mg/m³ (|Z-Score| <= 2,00)**



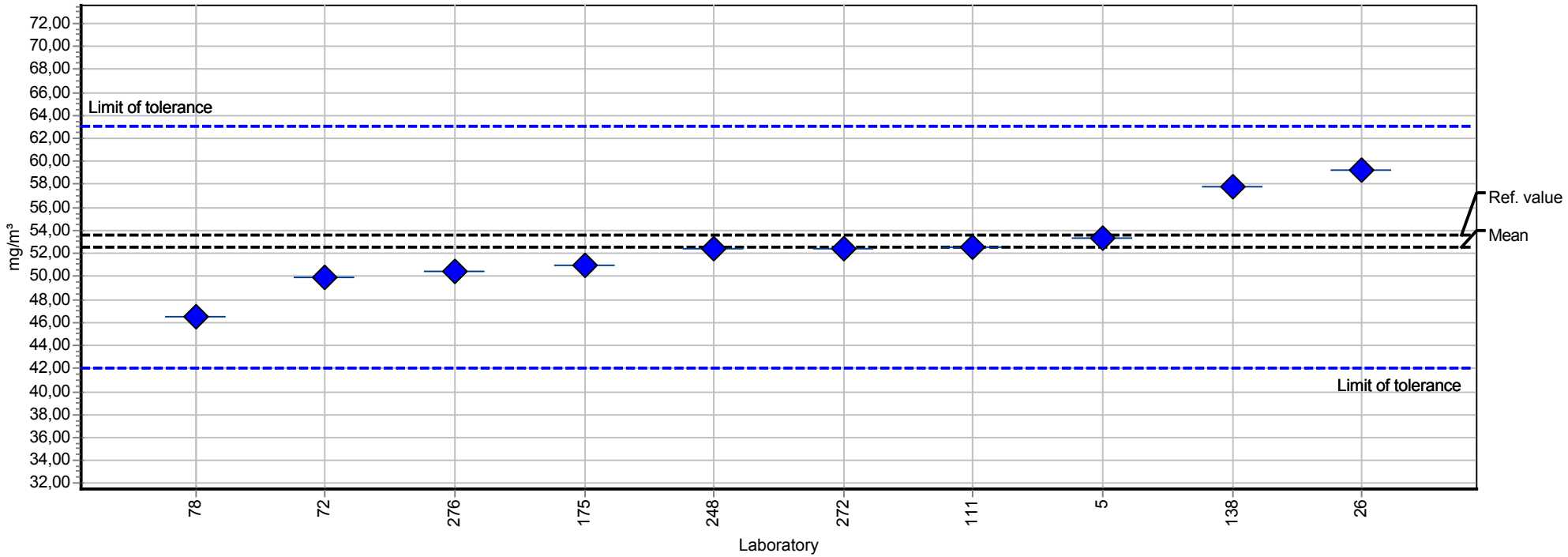
Sample chart of Z-Scores

Sample 1



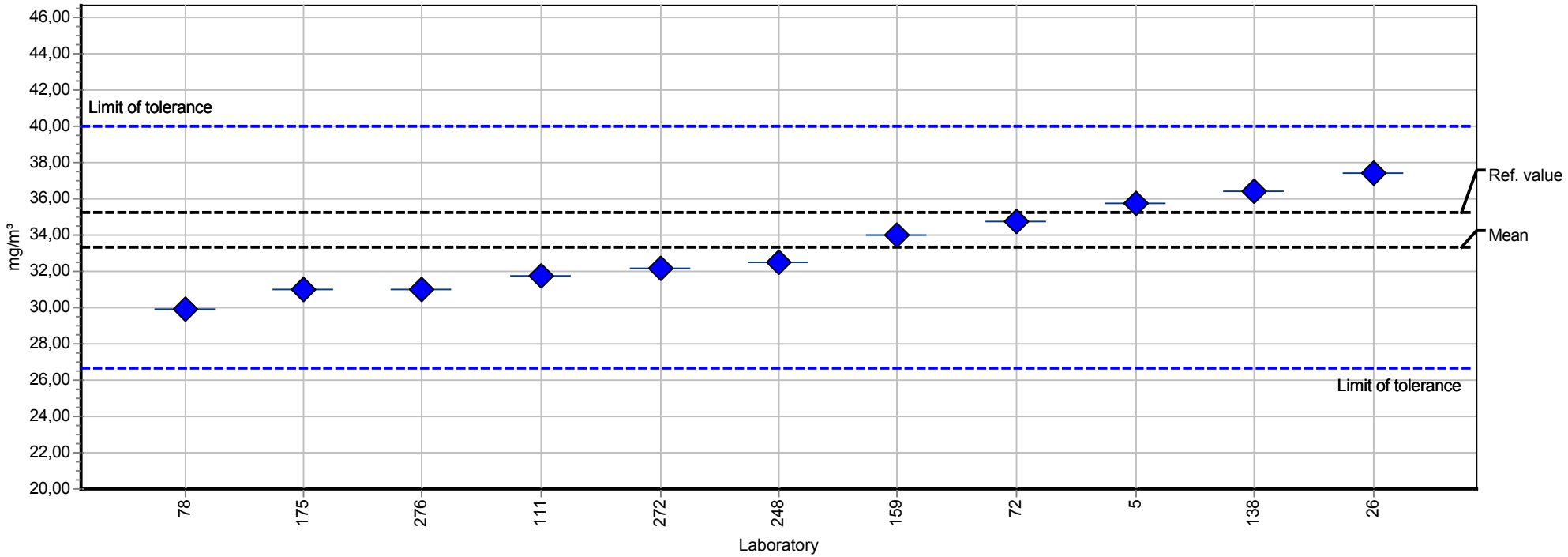
Summary results

Measurand:	**i-Butyl acetate**	**Mean:**	**52,548 mg/m³**
Sample:	**2**	**Reproducibility s.d.:**	**3,693 mg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**7,03%**
No. of laboratories:	**10**	**Reference value:**	**53,600 mg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**42,038 - 63,057 mg/m³ (|Z-Score| <= 2,00)**



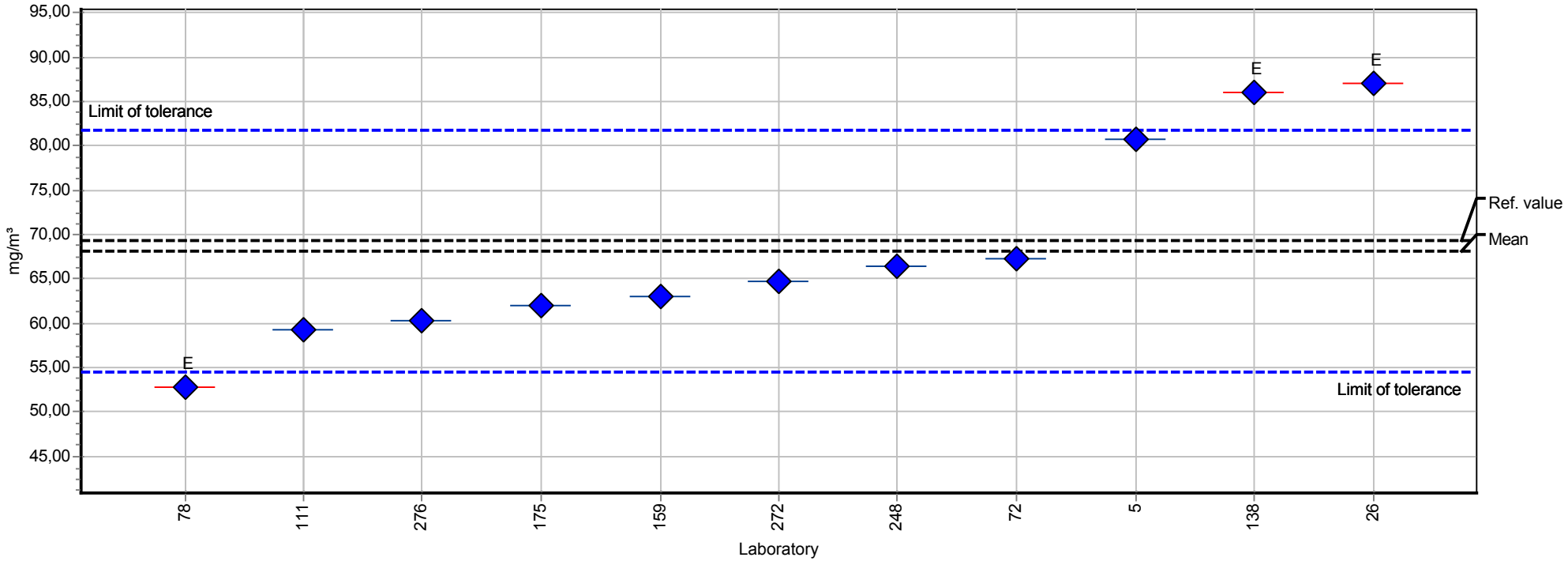
Summary results

Measurand:	**n-Hexane**	**Mean:**	**33,305 mg/m³**
Sample:	**2**	**Reproducibility s.d.:**	**2,485 mg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**7,46%**
No. of laboratories:	**11**	**Reference value:**	**35,200 mg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**26,644 - 39,965 mg/m³ (|Z-Score| <= 2,00)**



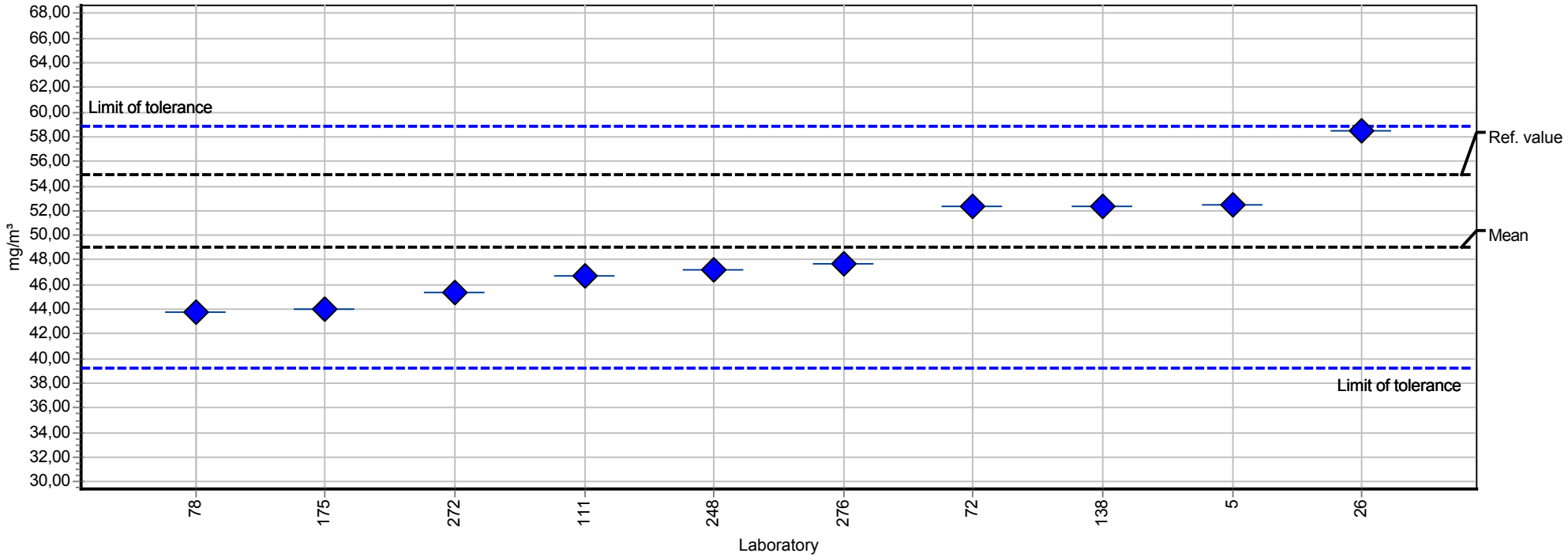
Summary results

Measurand:	**Ethanol**	**Mean:**	**68,134 mg/m³**
Sample:	**2**	**Reproducibility s.d.:**	**11,383 mg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**16,71%**
No. of laboratories:	**11**	**Reference value:**	**69,300 mg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**54,507 - 81,761 mg/m³ (|Z-Score| <= 2,00)**



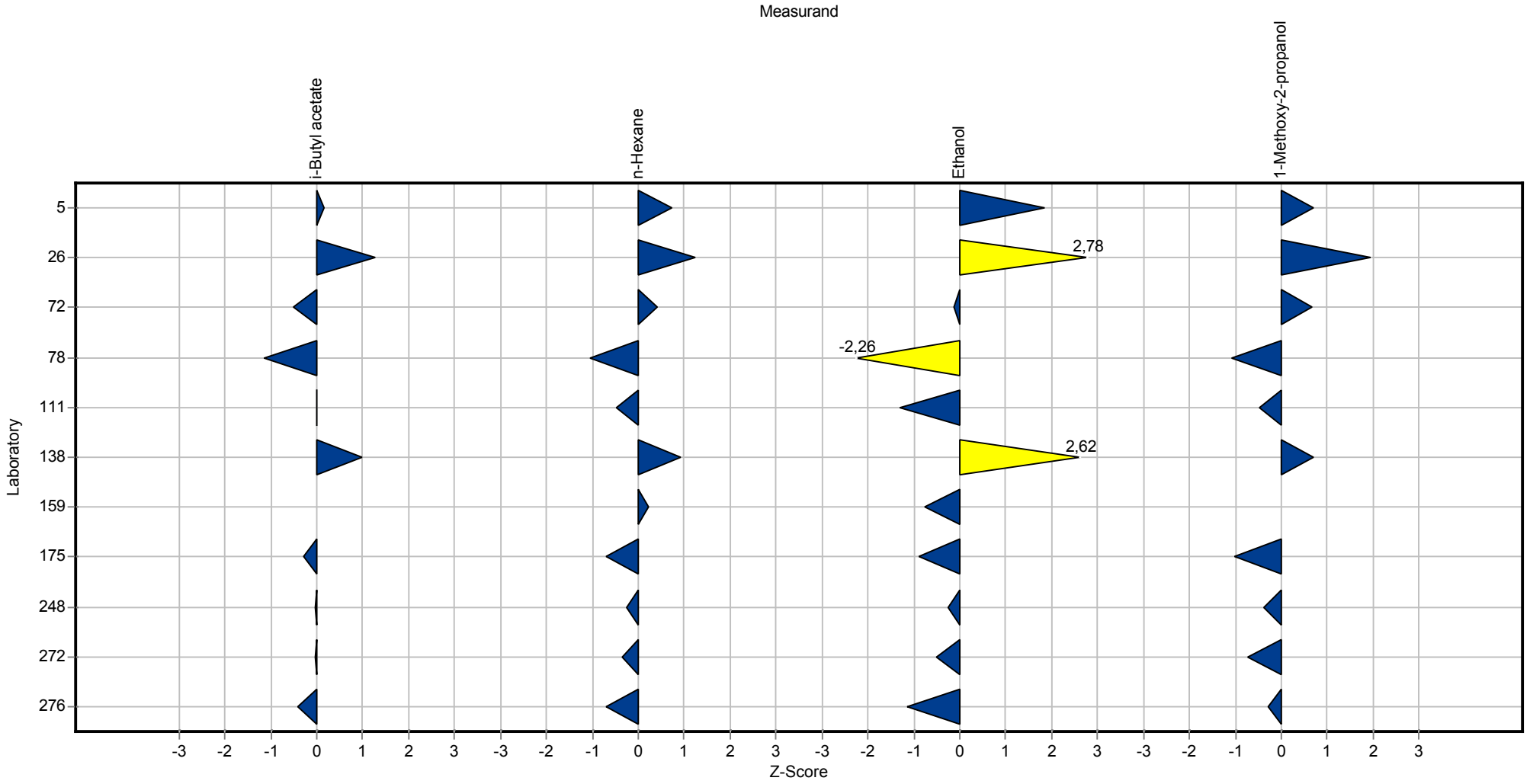
Summary results

Measurand:	**1-Methoxy-2-propanol**	**Mean:**	**49,042 mg/m³**
Sample:	**2**	**Reproducibility s.d.:**	**4,728 mg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**9,64%**
No. of laboratories:	**10**	**Reference value:**	**54,900 mg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**39,233 - 58,850 mg/m³ (|Z-Score| <= 2,00)**



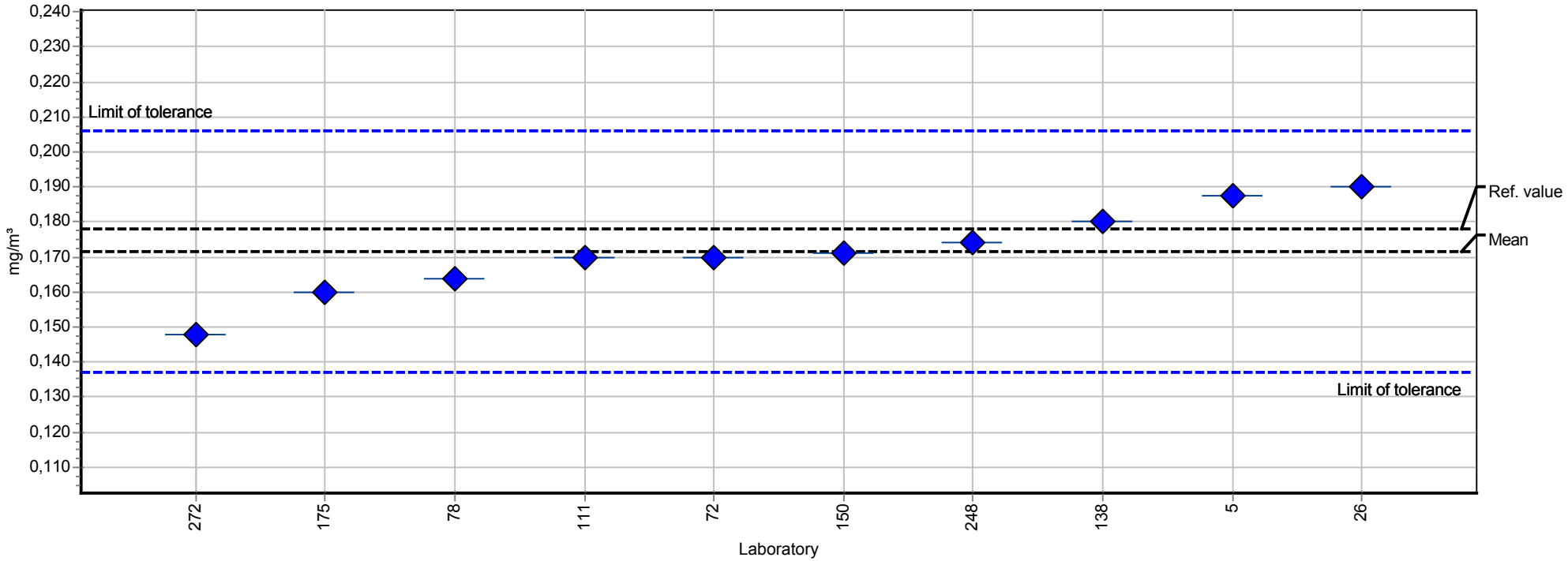
Sample chart of Z-Scores

Sample 2



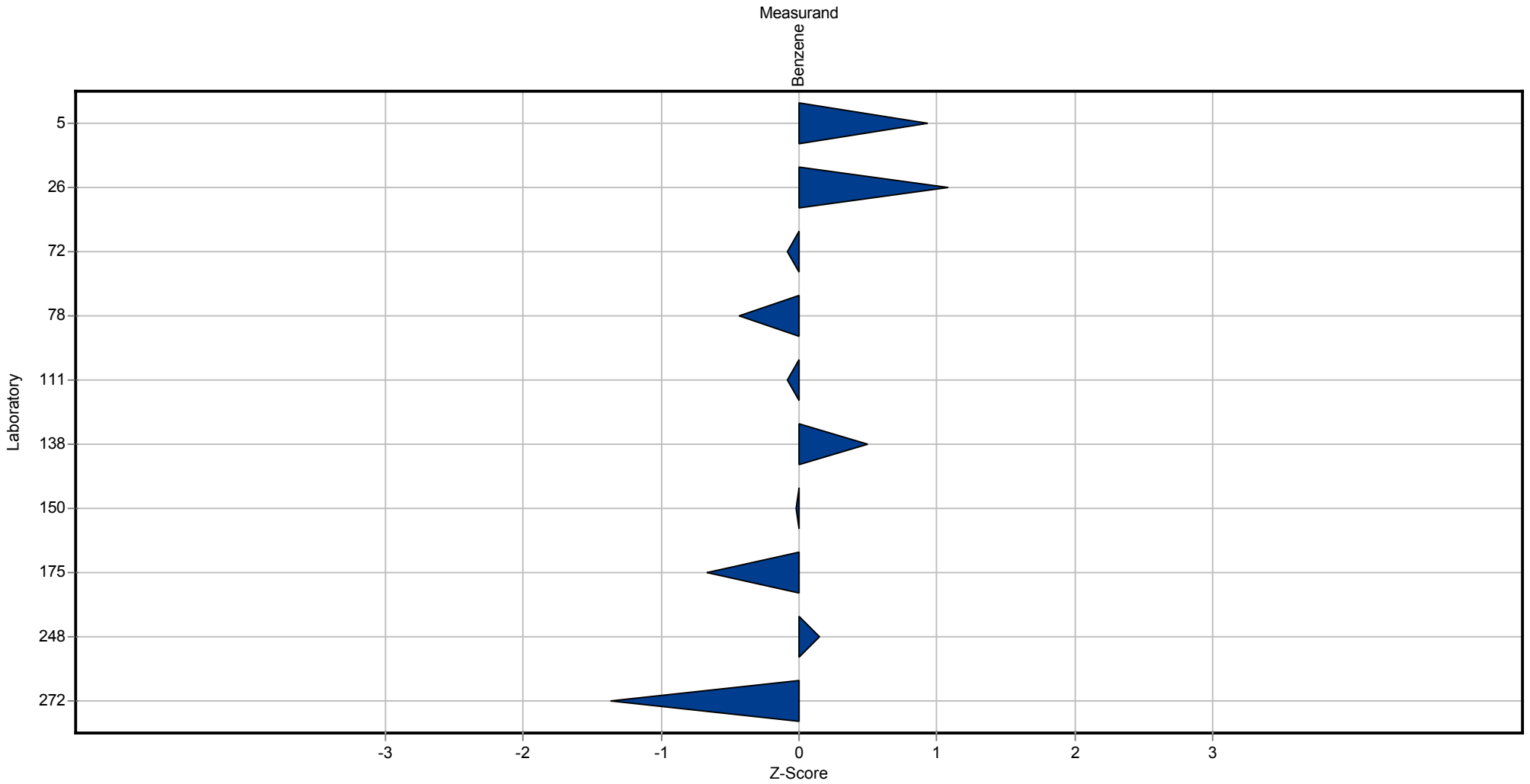
Summary results

Measurand:	**Benzene**	**Mean:**	**0,1714 mg/m³**
Sample:	**3**	**Reproducibility s.d.:**	**0,0126 mg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**7,33%**
No. of laboratories:	**10**	**Reference value:**	**0,1780 mg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**0,1370 - 0,2060 mg/m³ (|Z-Score| <= 2,00)**



Sample chart of Z-Scores

Sample 3



Questions and Answers

Participant	Kind of tube	Kind of pump	Volume flow
5	NIOSH AK	PocketPump, SKC	70 ml/min
26	Aktivkohle	Gil AIr 3 bzw Gil Air 5	0,33 l/min
72	Aktivkohle	SG 350 / SG 4000	333 bzw. 1000 ml/min
78	Aktivkohle Typ B/G	GilAir5 Constant Flow Low Flow Module	ca 0,3L/min
111	Dräger Typ G	SG350, SG4000	0,33 l/min
138	Aktivkohle Dräger Typ G	PCXR 8 (SKC) und GS 312 (Desaga)	0,35 bzw. 0,50 l/min
150	Aktivkohle Typ B/G	GSA SG350	0,33 l/min
159	Aktivkohleröhrchen Typ B/G	GSA SG350 ex	0,33 l/min
175	SKC 226-01	GSA 350 and SKC5000	50 - 350 ml/min
248	SKC Aktivkohleröhrchen Art.-Nr. 226-01	PAS, Typen SG 350 und SG 4000	ca. 0,2 l/min (RUN 1 und Run 2) und ca. 1 l/min (RUN 3)
272	NIOSH, Aktivkohle	GSA SG 2500	0,32 -0,37 l/min
276	Aktivkohle,B	Compur, GSA	70 - 90 ml/min

Participant	Volume flow measurement	Sampling time
5	Defender, BIOS	2h
26	Dry Cal DC Lite	120 Minuten
72	Defender 520 (50-5000 ml/min)	1 h bzw. 2 h
78	Gilibrator 2	1h
111	Drycal	30-120 min
138	Massendurchflussmesser GFM 17-77 (Analyt) bzw. kalibrierte Gasuhr (Desaga)	jeweils 120 Minuten
150	DryCal	1 Stunde(Run 1) bzw. 2 Sunden (Run 3)
159	Durchflussmesser DryCal	1 h
175	TSI 4100	15 min - 120 min
248	Seifenblasenströmungsmesser Gilian	zwischen 15 und 30 Minuten
272	TSI 4100, DryCal	jeweils 120 min
276	Seifenblasenströmungsmesser	2 Std

Participant	Analytical method
5	Hausmethode
26	IFA-Arbeitsmappen; Benzol nach Messverfahren Nr. 1
72	validierte eigene SOP in Anlehnung an IFA Arbeitsmappe

Participant	Analytical method
78	IFA-Arbeitsmappe
111	BGIA
138	BGIA 6265, 7322, 7732, 7733
150	Hausmethoden AA7.1.2 Nr.7, 7.3, 30, 28
159	GC/FID; BGN AA7.1.2 Nr. 37P
175	modified NIOSH
248	OSHA 07 (TÜV Arbeitsblatt AB283077)
272	Prüfgas 1 u. 2: BIA 7732, DFG 3; Prüfgas: 3 DFG 1
276	DFG

Participant	Sample preparation	Carrier gas	Injection
5	Desorption in 1 ml Schwefelkohlenstoff	Helium	Split 1:10
26	tern. Gemisch /3 ml pro Schicht (Benzol CS2)	Helium	splitless 2 µl
72	Benzylalkohol und Gemisch Dichlormethan - Schwefelkohlenstoff - Methanol	Helium 6.0	1 µl
78	Desorption Ternäres Gemisch 20mL, Desorption CS2 5mL	Stickstoff	Split
111	ternäres Gemisch (PG1 und PG2), Kohlenstoffdisulfid (PG3)	Helium	split
138	Ternäres Gemisch, 10 ml	Stickstoff	split
150	Mit ternärem Gemisch bzw. Schwefelkohlenstoff/1ml(B) Phase bzw. 2ml (G) Phase	Helium	split bzw. splitless
159	2ml ternäres Gemisch: Methanol, Schwefelkohlenstoff, Dichlormethan, interner Standard (n-Heptan)	Stickstoff	split
175	CS2+ 2% DMF	N2	2 µl
248	ternäres Gemisch (für 1-Methoxy-2-propanol), CS2 (für Benzol), CS2 + 1 % Phenoxyethanol (übrige Stoffe)	Helium	Split
272	Prüfgas 1 u. 2: ternäres Gemisch, Desorptionsvolumen 10 ml; Prüfgas 3: CS2, Desorptionsvolumen 5 ml	Helium	split
276	CS2	H2	split

Participant	Analytical column	Detector	Data evaluation
5	HP1	FID	ISTD
26	Rtx VMS 60 m x 0,25 mm x 1,4 µm	MSD	interner Standard
72	Phenomenex Zebron ZB-WAX, 30 m x 0,25 mm x0,25 mm	FID	externer Standard, 4 und 6 Pkt. Kalibrierung
78	DB-1(J+W)	FID	interner Standard
111	FS-SE-54-CB-1	MS	interner Standard
138	CP SIL 5 CB und CP WAX 57	FID	externer Standard
150	CPSIL 8CB 50m, 0,32mm id	MSD	interner Standard
159	HP5	FID	interner Standard
175	DB-1 60 m id 0,25 mm, 1 µm	FID	

Round-robin test Organic solvents with sampling 1/2013

Participant	Analytical column	Detector	Data evaluation
248	DB 624, 60m * 0,32 mm df 1,8 µm und DB Wax 60 m * 0,32 mm df 0,5 m	FID	interner Standard
272	DB 5	FID	externer Standard
276	OV 1	FID	interner Standard

Participant	Recovery rate	Date of analysis
5	nein	10.11.2013
26	WFR wurde nicht berücksichtigt (liegt nahe 100%)	22.-24.11.2013
72	0,9 - 0,97	11. - 15.11.2013
78	ja	46KW2013
111		13.11.2013
138	ja	12.11. bis 03.12.2013
150	Ja; 100% für Heptan, 1-Butanol und n-Butylacetat; 93% für Ethylbenzol; 90% für Toluol, 86% für p-Xylol, 84% für Benzol	11.11-13.11.2013
159	98-100%	13.11.2013
175		21 nov 2013
248	100 %, Ausnahmen: Ethanol 86,3 % und 1-Butanol 92,5 %	25. und 26.11.2013
272	nein	13.11.2013
276	ja	12. bis 16.11.2013

Participant	Comments	Suggestions/substances
5		Stoffe aus dem Bereich der Methacrylate und Acrylate. Z.B. Methylmethacrylat, Methylacrylat, Butylmethacrylat, Butylacrylat
26		
72		
78		
111		
138		MEK, MIBK
150		
159		
175		
248	---	----
272		Formaldehyd
276		2-Butanon, Merthylisobutyketon,c-Hexanon