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

Test Proficiency Testing (PT) Scheme

Diisocyanates on Filters 2026

May - June 2026

Institute for Occupational Safety and Health of the
German Social Accident Insurance (IFA)
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Substances / Measurand per Sample:

A set of four samples with different concentrations of the analytes was sent to the participants:

- two impregnated and spiked filters per sample with all analytes except NDI (six sample carriers in total)
- two impregnated filters only spiked with NDI and
- two blank value filters

Analyte	CAS-No.	Purity	Product No.	Manufacturer
Diphenylmethane 4,4'-diisocyanate (4,4'-MDI)	101-68-8	≥97.5%	L15740.14	Thermo Scientific
Hexamethylene 1,6-diisocyanate (HDI)	822-06-0	≥98.0%	043803.18	Thermo Scientific
Isophorone diisocyanate (IPDI) (mixture of isomers)	4098-71-9	>99,9%	317625	Sigma Aldrich
Naphthylene 1,5-diisocyanate (NDI)	3173-72-6	>98,0 %	N0168	TCI
Tolulene 2,4-diisocyanate (2,4-TDI)	584-84-9	98,7%	DRE-CA17594500	Dr. Ehrenstorfer
Tolulene 2,6-diisocyanate (2,6-TDI)	91-08-7	98,9%	DRE-CA17594600	Dr. Ehrenstorfer
1-(2-Methoxy-phenyl)piperazine (1,2-MP)	35386-24-4	98%	M22601-25G	Sigma Aldrich

Choice of sample carriers:

1.) IFA-Filter (glass fibre filter, diameter 37 mm, impregnated with 1-(2-methoxyphenyl)piperazine (1,2-MP) and acetonitrile), own fabrication

2.) Supelco Orbo 80 filter (glass fibre filter, diameter 37 mm, impregnated with 1-(2-pyridyl)piperazine (1,2-PP) and acetonitrile), Prod. No. 20812-U

Evaluation of the PT scheme:

The PT scheme was evaluated according to DIN ISO 5725-2 using the software PROLab Plus.
The z-score of all participating laboratories is calculated with the aid of the outlier-free mean value and the outlier-free standard deviation. A permissible deviation (s) of ±10% was set.
The "reference values" given are the mean value of the IFA quality assurance samples.
To ensure the homogeneity of the loaded filters the standards according to DIN EN ISO/IEC 17043 Conformity assessment – General requirements for the competence of proficiency testing providers (ISO/IEC 17043:2023) – were taken into account. All filters were spiked and left to dry. Subsequently, ten randomly chosen filters per concentration were taken for homogeneity testing and prepared and analysed according to IFA folder 7670.

The evaluation report contains the following information:

- laboratory means of combined amples and measurands
- graphical presentation of all measurands per combined sample
- z-Scores of all measurands per combined sample
- list of answers given by the participants*
- overview homogeneity test of the IFA quality assurance samples
- laboratory means of all samples and measurands

The **certificate of attendance** will be uploaded as a separate file.

**Please note: we may have adjusted your answers in the report so that laboratory numbers cannot be assigned to the participants.*

Summary of laboratory means

Sample 1.1 / 1.2

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Unit	µg abs./filter		µg abs./filter		µg abs./filter		µg abs./filter	
33	23.60	0.3	6.88	-1.4			18.05	1.3
40	17.98	-2.2 E	6.90	-1.4	2.46	-2.0 E	12.78	-2.0 E
41	21.70	-0.6	6.80	-1.5	3.62	1.8	16.40	0.2
68	25.23	1.0	9.15	1.4	3.58	1.6 C	18.27	1.4
82	22.45	-0.2						
98	23.56	0.3	8.24	0.3	3.02	-0.2	15.98	0.0
111	18.91	-1.8	7.55	-0.6	2.92	-0.5	14.71	-0.8
117	24.60	0.7	8.27	0.3	2.84	-0.8	19.35	2.1 E
131	23.56	0.3	7.73	-0.3	2.93	-0.5	16.17	0.1
138	23.19	0.1	7.96	-0.1	2.62	-1.5	17.50	0.9
151	8.64	-6.2 CE			2.23	-2.7 E	14.23	-1.1
219	24.90	0.8	10.20	2.8 E	3.35	0.9	17.85	1.1
231	22.90	0.0	8.52	0.6	3.25	0.5	16.10	0.0
238	22.15	-0.4	8.84	1.1			13.30	-1.7
243	24.43	0.6	7.99	0.0	3.08	0.0	16.68	0.4
248	22.75	-0.1	6.61	-1.7	3.31	0.8	15.55	-0.3
264	25.75	1.2	11.65	4.6 FE	3.25	0.6	18.80	1.7
294	22.50	-0.2	8.55	0.7	3.30	0.7	14.50	-1.0
327	24.00	0.4	8.90	1.1	4.00	3.0 E	17.50	0.9
330	19.95	-1.3	5.84	-2.7 E			10.89	-3.2 E
334	25.50	1.1	9.00	1.3	6.00	9.5 BE	16.00	0.0
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Statistical method	ISO 5725-2		ISO 5725-2		ISO 5725-2		ISO 5725-2	

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Summary of laboratory means

Sample 1.1 / 1.2

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Assessment	|Z|<=2.0		|Z|<=2.0		|Z|<=2.0		|Z|<=2.0	
No. of laboratories that submitted results	21		19		17		20	
Mean	22.98		8.00		3.08		16.03	
SDPA	2.30		0.80		0.31		1.60	
Rel. SDPA	10.0 %		10.0 %		10.0 %		10.0 %	
Reproducibility s.d.	2.13		1.10		0.45		2.18	
Rel. reproducibility s.d.	9.3 %		13.8 %		14.6 %		13.6 %	
Reference value	21.52		7.74		2.69		15.06	
Upper limit of tolerance	27.58		9.59		3.69		19.24	
Low er limit of tolerance	18.38		6.40		2.46		12.82	
Type B outliers					1			
Type C 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)	20		18		15		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-Score|>3.5	

Summary of laboratory means

Sample 1.1 / 1.2

	2,6-TDI	Z score
Unit	µg abs./filter	
33	2.12	-0.2
40	1.79	-1.7
41	1.99	-0.8
68	2.26	0.5
98	2.59	2.0
111	2.20	0.2
117	2.17	0.0
131	2.13	-0.1
138	1.83	-1.5
219	2.20	0.2
231	2.16	0.0
238	2.03	-0.6
243	2.17	0.1
248	2.02	-0.6
264	2.35	0.9
294	2.05	-0.5
327	2.75	2.7 E
330	2.25	0.4
334	2.00	-0.8
–	–	– –
Statistical method	ISO 5725-2	
Assessment	|Z|<=2.0	
No. of laboratories that submitted results	19	
Mean	2.16	
SDPA	0.22	

Summary of laboratory means

Sample 1.1 / 1.2

	2,6-TDI	Z score
Rel. SDPA	10.0 %	
Reproducibility s.d.	0.23	
Rel. reproducibility s.d.	10.8 %	
Reference value	2.04	
Upper limit of tolerance	2.59	
Low er limit of tolerance	1.73	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	19	

Summary of laboratory means

Sample 2.1 / 2.2

	4,4'-MDI	Z score		HDI	Z score		IPDI	Z score		2,4-TDI	Z score	
Unit	µg abs./filter			µg abs./filter			µg abs./filter			µg abs./filter		
33	2.80	-0.7		2.51	3.6	FE				12.10	1.1	
40	2.99	-0.1					10.02	-1.6		8.82	-1.9	
41	2.98	-0.1					12.95	0.9		11.65	0.7	
68	3.01	0.0		1.92	0.4		12.05	0.2		11.27	0.3	
82	2.92	-0.3										
98	3.90	3.0	E	1.89	0.2		11.54	-0.3		10.53	-0.3	
111	2.46	-1.8		1.90	0.3		10.73	-1.0		9.64	-1.2	
117	3.32	1.0		2.04	1.0		10.85	-0.9		13.55	2.4	E
131	3.07	0.2		1.91	0.3		11.72	-0.1		11.00	0.1	
138	2.67	-1.1		0.11	-9.4	BE	12.52	0.5		9.59	-1.2	
151	2.71	-1.0					9.07	-2.4	E	9.39	-1.4	
219	3.50	1.6		1.20	-3.5	FE	13.90	1.7		12.75	1.7	
231	2.86	-0.5		1.40	-2.5	E	12.50	0.5		10.30	-0.6	
238	2.49	-1.7		1.92	0.3					11.15	0.2	
243	3.00	0.0		1.87	0.1		11.46	-0.3		10.73	-0.2	
248	2.79	-0.7		1.45	-2.2	E	12.10	0.2		9.75	-1.1	
264	3.15	0.5		2.60	4.0	FE	12.50	0.5		12.25	1.2	
294	2.90	-0.4		2.10	1.3		12.00	0.1		9.80	-1.0	
327	3.20	0.6		2.25	2.1	E	14.00	1.8		12.00	1.0	
330	3.49	1.6		1.62	-1.3					6.64	-3.9	FE
334	3.00	0.0		1.00	-4.6	FE	20.00	6.8	BE	11.00	0.1	
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Statistical method	ISO 5725-2			ISO 5725-2			ISO 5725-2			ISO 5725-2		

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Summary of laboratory means

Sample 2.1 / 2.2

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Assessment	|Z|<=2.0		|Z|<=2.0		|Z|<=2.0		|Z|<=2.0	
No. of laboratories that submitted results	21		17		17		20	
Mean	3.01		1.86		11.87		10.91	
SDPA	0.30		0.19		1.19		1.09	
Rel. SDPA	10.0 %		10.0 %		10.0 %		10.0 %	
Reproducibility s.d.	0.35		0.26		1.32		1.28	
Rel. reproducibility s.d.	11.7 %		13.9 %		11.1 %		11.7 %	
Reference value	2.77		1.90		10.58		9.92	
Upper limit of tolerance	3.61		2.23		14.24		13.09	
Low er limit of tolerance	2.41		1.48		9.50		8.73	
Type B outliers			1		1			
Type C outliers								
Type F outliers			4				1	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	21		12		16		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-Score|>3.5	

Summary of laboratory means

Sample 2.1 / 2.2

	2,6-TDI	Z score	
Unit	µg abs./filter		
33	19.80	1.3	
40	15.22	-1.3	
41	17.80	0.2	
68	17.04	-0.3	
98	18.70	0.7	
111	14.20	-1.9	
117	16.80	-0.4	
131	15.66	-1.1	C
138	17.56	0.0	
219	19.30	1.0	
231	16.80	-0.4	
238	20.60	1.8	
243	14.69	-1.6	
248	15.60	-1.1	
264	17.70	0.1	
294	16.50	-0.6	
327	21.50	2.3	E
330	14.42	-1.8	
334	21.00	2.0	
–	–	– –	
Statistical method	ISO 5725-2		
Assessment	|Z|<=2.0		
No. of laboratories that submitted results	19		
Mean	17.51		
SDPA	1.75		

Summary of laboratory means

Sample 2.1 / 2.2

	2,6-TDI	Z score
Rel. SDPA	10.0 %	
Reproducibility s.d.	2.28	
Rel. reproducibility s.d.	13.0 %	
Reference value	15.47	
Upper limit of tolerance	21.02	
Low er limit of tolerance	14.01	
Type C 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)	18	

Summary of laboratory means

Sample 3.1 / 3.2

	4,4'-MDI	Z score		HDI	Z score		IPDI	Z score		2,4-TDI	Z score	
Unit	µg abs./filter			µg abs./filter			µg abs./filter			µg abs./filter		
33	12.80	0.6		17.75	2.2	E				2.74	1.9	
40	10.20	-1.6		10.34	-2.9	E	15.97	-1.9		1.79	-2.2	E
41	11.60	-0.4		13.00	-1.0		20.25	0.3		3.10	3.5	E
68	12.63	0.4		17.44	2.0	E	20.44	0.4		2.29	-0.1	
82	11.82	-0.2										
98	13.91	1.5		15.85	0.9		19.71	0.0		2.16	-0.7	
111	9.62	-2.1	E	14.14	-0.2		18.33	-0.7		2.04	-1.2	
117	13.15	0.9		15.40	0.6		17.70	-1.0		2.70	1.7	
131	12.39	0.2		14.42	-0.1		19.28	-0.2		2.26	-0.2	
138	12.05	0.0		16.20	1.2		21.97	1.2		2.76	2.0	
151	9.37	-2.3	E				15.36	-2.2	E	1.90	-1.7	
219	14.75	2.2	E	20.10	3.9	FE	24.45	2.5	E	3.15	3.6	CE
231	12.85	0.6		12.50	-1.4		20.95	0.7		2.10	-0.9	
238	11.00	-0.9	C	16.20	1.2	C				2.17	-0.6	C
243	12.03	-0.1		13.95	-0.4		18.66	-0.5		2.17	-0.6	
248	11.60	-0.4		13.55	-0.6		20.70	0.6		2.84	2.3	E
264	13.30	1.0		20.85	4.4	FE	21.20	0.8		2.50	0.8	
294	11.50	-0.5		15.50	0.7		20.00	0.2		2.00	-1.3	
327	13.00	0.7		16.00	1.0		23.00	1.7		2.55	1.0	
330	11.52	-0.5		11.34	-2.2	E				1.65	-2.9	E
334	12.00	-0.1		9.00	-3.8	FE	15.50	-2.1	E	2.00	-1.3	
–	–	– –		–	– –		–	– –		–	– –	
Statistical method	ISO 5725-2			ISO 5725-2			ISO 5725-2			ISO 5725-2		

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Summary of laboratory means

Sample 3.1 / 3.2

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Assessment	|Z|<=2.0		|Z|<=2.0		|Z|<=2.0		|Z|<=2.0	
No. of laboratories that submitted results	21		19		17		20	
Mean	12.11		14.49		19.62		2.31	
SDPA	1.21		1.45		1.96		0.23	
Rel. SDPA	10.0 %		10.0 %		10.0 %		10.0 %	
Reproducibility s.d.	1.35		2.14		2.55		0.41	
Rel. reproducibility s.d.	11.1 %		14.8 %		13.0 %		17.6 %	
Reference value	11.31		14.46		17.27		2.18	
Upper limit of tolerance	14.53		17.39		23.54		2.77	
Low er limit of tolerance	9.68		11.59		15.69		1.85	
Type C outliers	1		1				2	
Type F outliers			3					
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	20		15		17		18	
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								

	2,6-TDI	Z score
Unit	µg abs./filter	

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Summary of laboratory means

Sample 3.1 / 3.2

	2,6-TDI	Z score	
33	10.40	1.8	
40	8.37	-0.5	
41	7.89	-1.0	
68	8.86	0.0	
98	10.00	1.3	
111	7.18	-1.8	
117	8.55	-0.3	
131	7.90	-1.0	
138	6.78	-2.3	E
219	10.85	2.3	E
231	9.38	0.6	
238	10.13	1.5	C
243	7.62	-1.4	
248	8.00	-0.9	
264	9.40	0.7	
294	8.10	-0.8	
327	11.00	2.5	E
330	9.37	0.6	
334	9.00	0.2	
–	–	– –	
Statistical method	ISO 5725-2		
Assessment	|Z|<=2.0		
No. of laboratories that submitted results	19		
Mean	8.81		
SDPA	0.88		
Rel. SDPA	10.0 %		

Summary of laboratory means

Sample 3.1 / 3.2

	2,6-TDI	Z score
Reproducibility s.d.	1.23	
Rel. reproducibility s.d.	13.9 %	
Reference value	8.21	
Upper limit of tolerance	10.58	
Low er limit of tolerance	7.05	
Type C 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)	18	

Summary of laboratory means

Sample 4.1 / 4.2

	NDI	Z score	
Unit	µg abs./filter		
33	12.15	0.8	
41	11.65	0.3	
68	11.79	0.5	
98	15.42	3.7	BE
111	9.69	-1.4	
117	11.70	0.4	
131	10.13	-1.0	
138	10.90	-0.3	
219	12.20	0.8	
231	11.95	0.6	
243	10.07	-1.1	
248	9.43	-1.6	C
294	27.50	14.4	BE
327	11.00	-0.2	
334	12.00	0.6	
–	–	– –	
Statistical method	ISO 5725-2		
Assessment	|Z|<=2.0		
No. of laboratories that submitted results	15		
Mean	11.27		
SDPA	1.13		
Rel. SDPA	10.0 %		
Reproducibility s.d.	0.90		

Summary of laboratory means

Sample 4.1 / 4.2

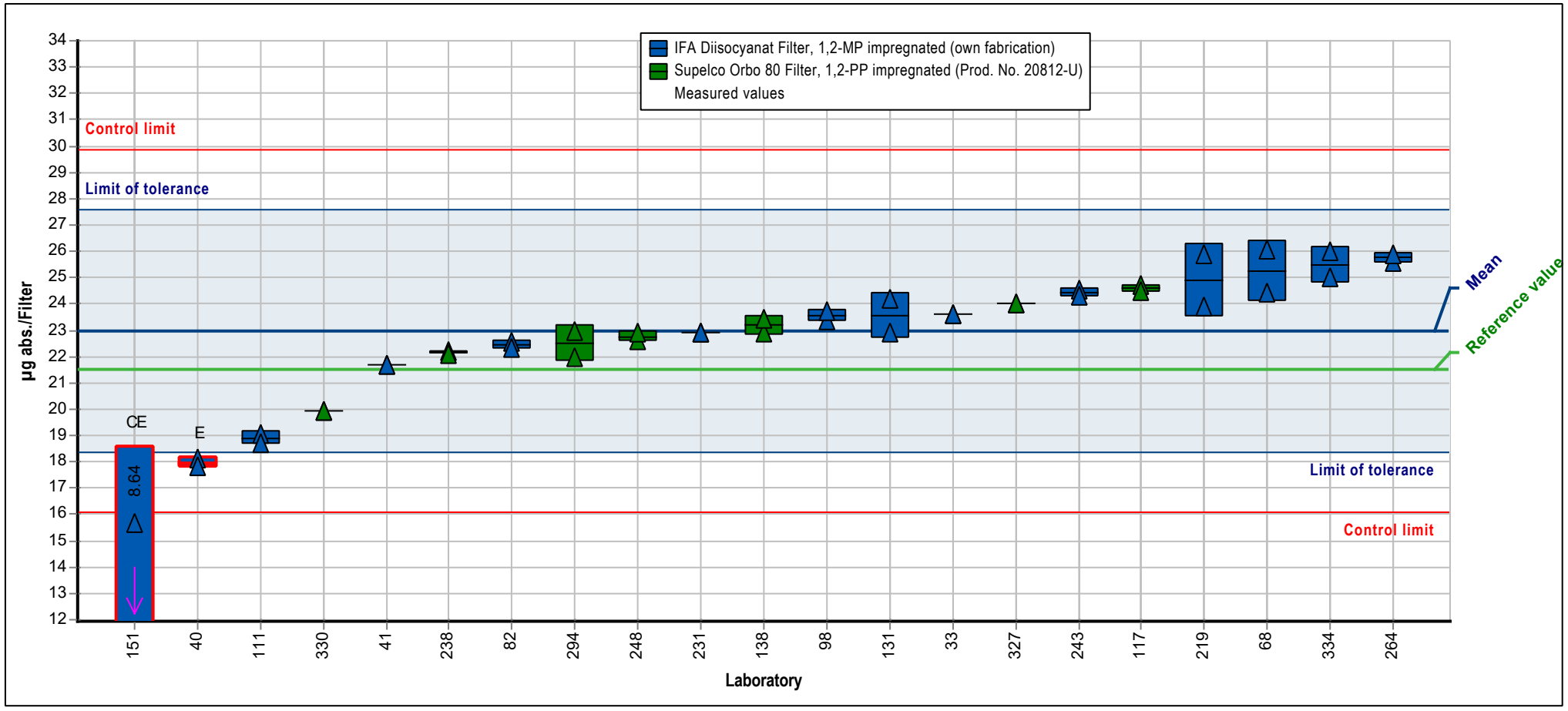
	NDI	Z score
Rel. reproducibility s.d.	8.0 %	
Reference value	11.27	
Upper limit of tolerance	13.52	
Low er limit of tolerance	9.02	
Type B outliers	2	
Type C outliers	1	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	12	
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		

Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	1.1 / 1.2
Measurand:	4,4'-MDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	21

Mean:	22.98 µg abs./Filter
Reproducibility s.d.:	2.13 µg abs./Filter
Rel. reproducibility s.d.:	9.3%
Reference value:	21.52 µg abs./Filter
Range of tolerance:	18.38 - 27.58 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	16.09 and 29.88 µg abs./Filter (|Z-Score| = 3.0)



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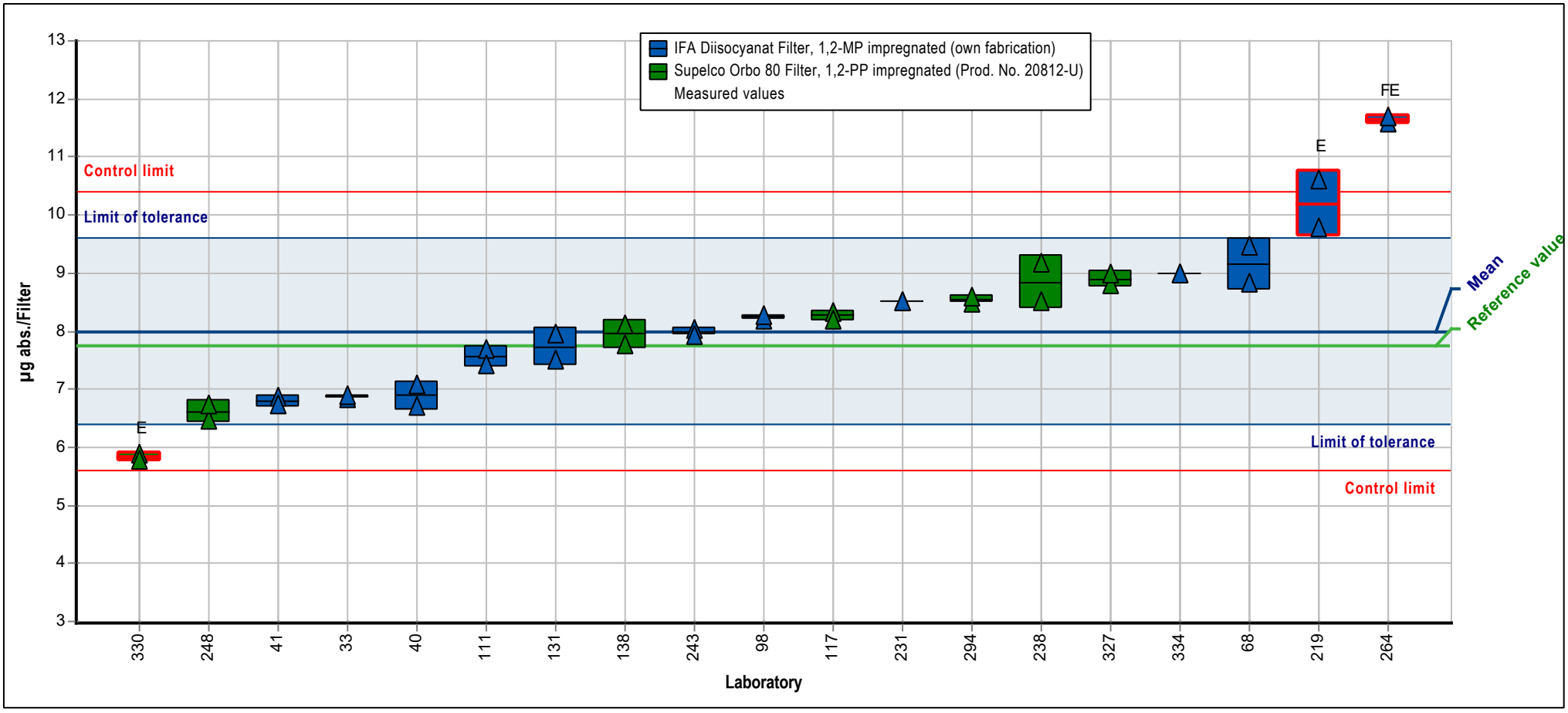
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	1.1 / 1.2
Measurand:	HDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	19

Mean:	8.00 µg abs./Filter
Reproducibility s.d.:	1.10 µg abs./Filter
Rel. reproducibility s.d.:	13.8%
Reference value:	7.74 µg abs./Filter
Range of tolerance:	6.40 - 9.59 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	5.60 and 10.39 µg abs./Filter (|Z-Score| = 3.0)



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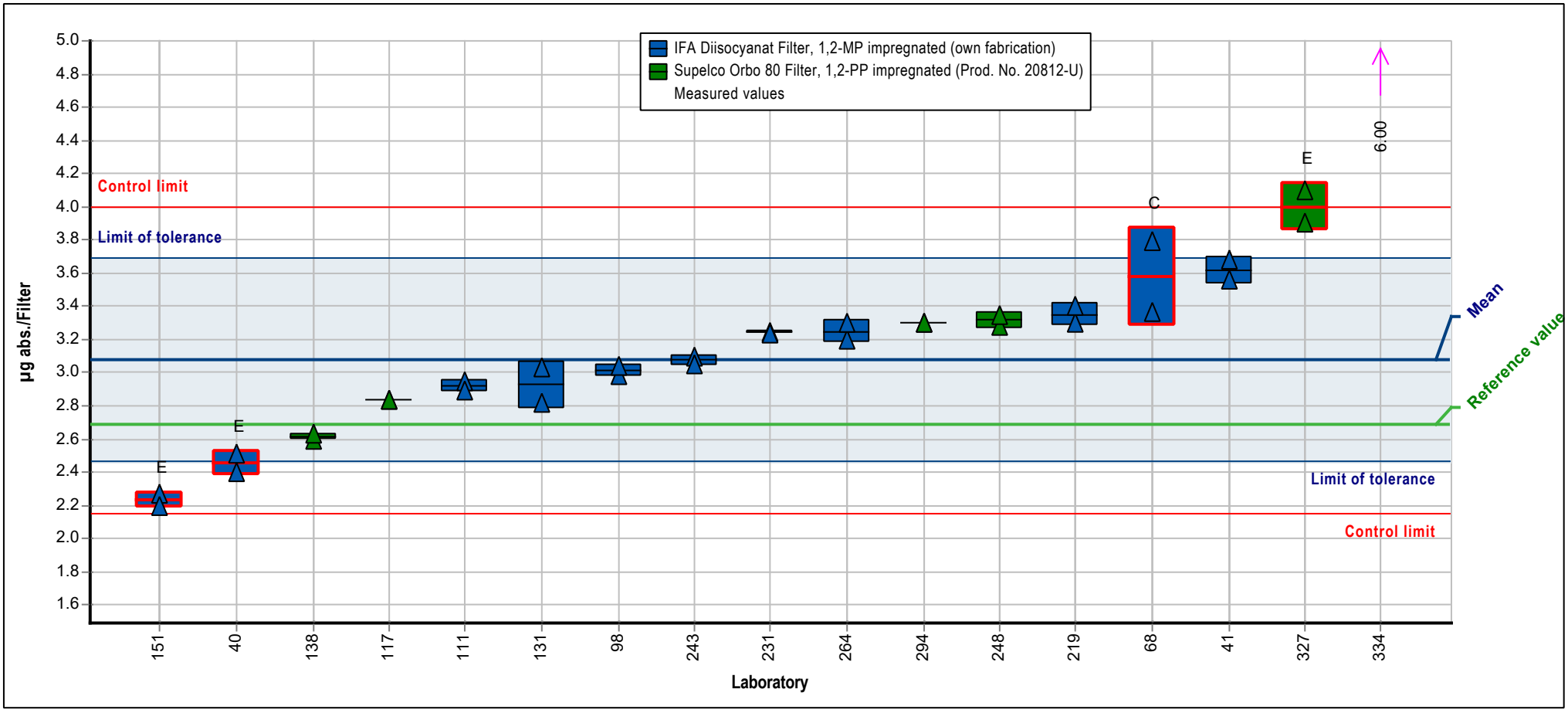
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	1.1 / 1.2
Measurand:	IPDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	17

Mean:	3.08 µg abs./Filter
Reproducibility s.d.:	0.45 µg abs./Filter
Rel. reproducibility s.d.:	14.6%
Reference value:	2.69 µg abs./Filter
Range of tolerance:	2.46 - 3.69 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	2.15 and 4.00 µg abs./Filter (|Z-Score| = 3.0)



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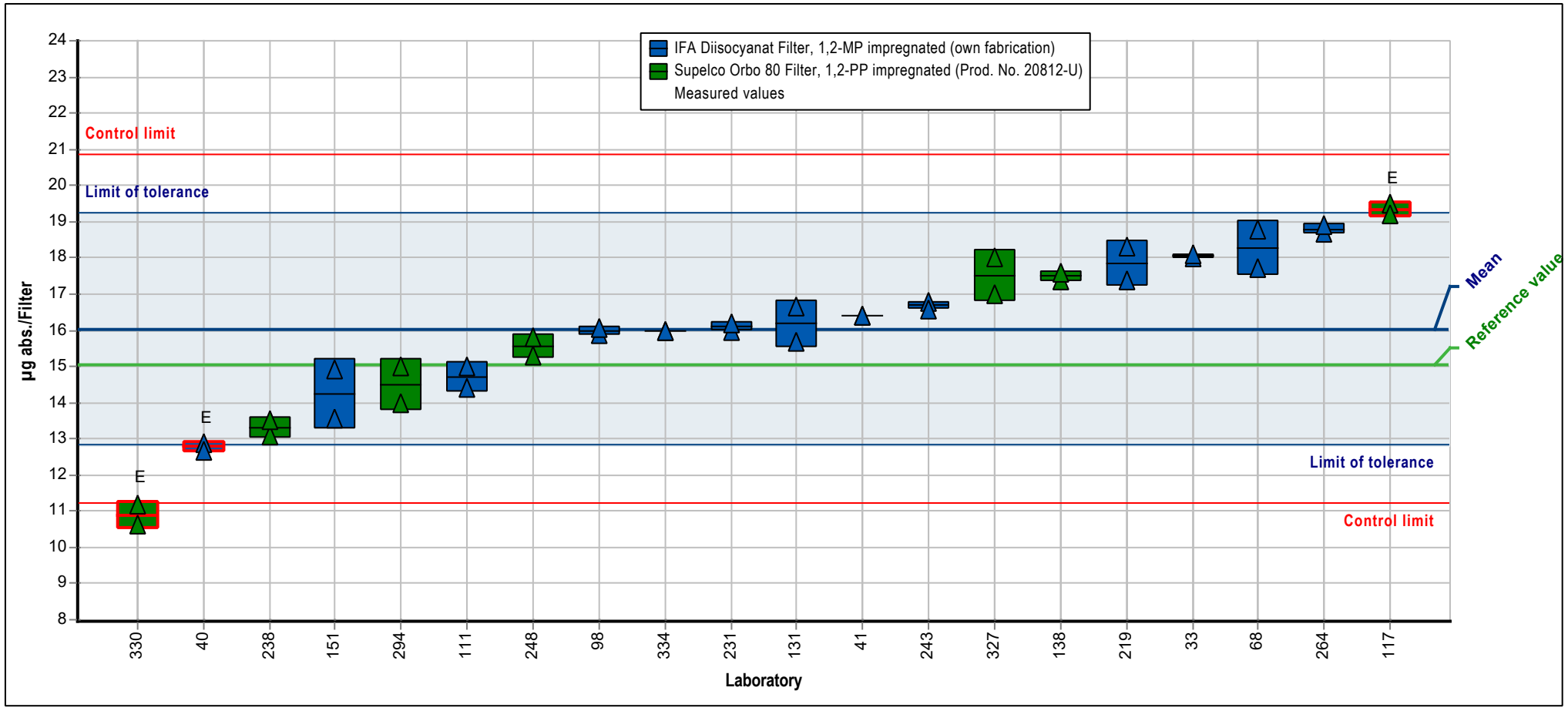
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	1.1 / 1.2
Measurand:	2,4-TDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	20

Mean:	16.03 µg abs./Filter
Reproducibility s.d.:	2.18 µg abs./Filter
Rel. reproducibility s.d.:	13.6%
Reference value:	15.06 µg abs./Filter
Range of tolerance:	12.82 - 19.24 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	11.22 and 20.84 µg abs./Filter (|Z-Score| = 3.0)



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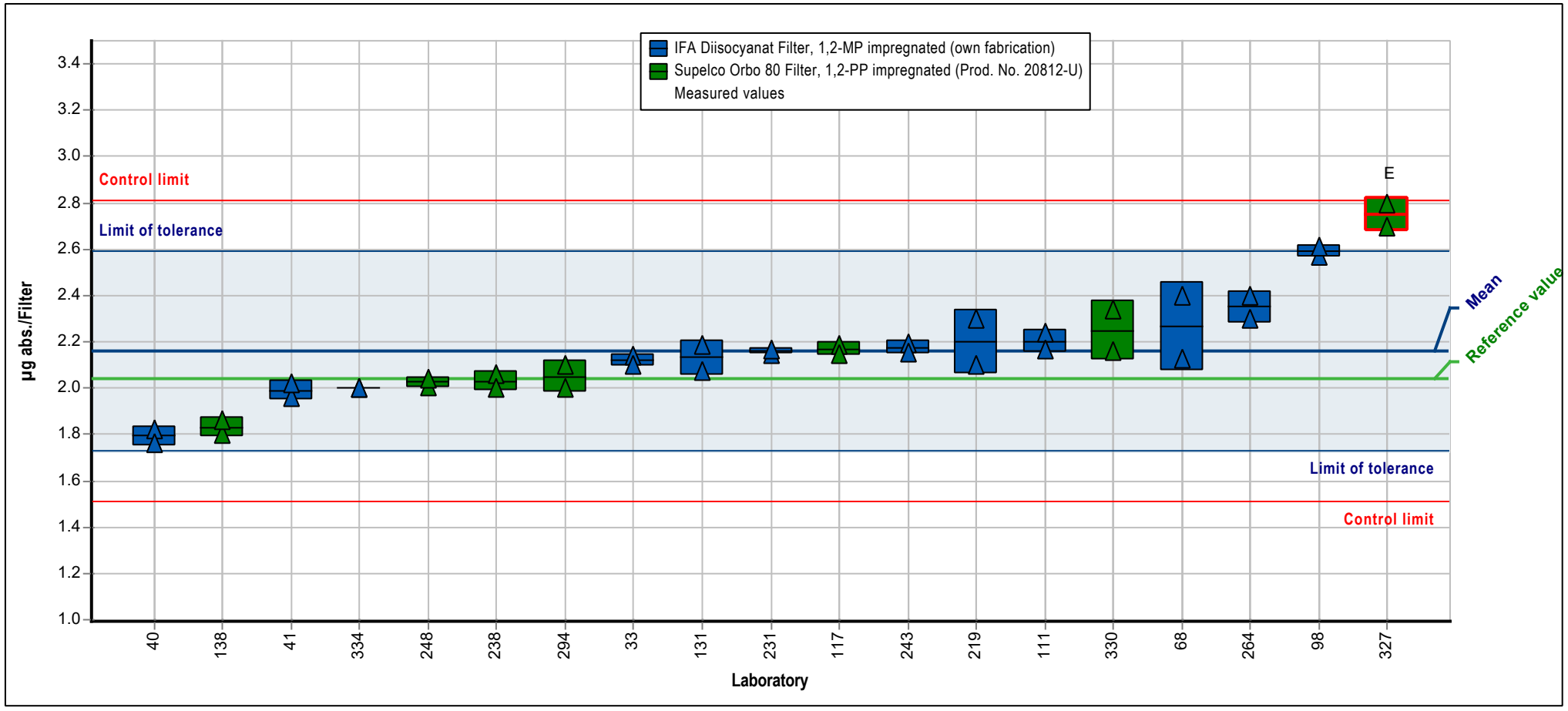
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	1.1 / 1.2
Measurand:	2,6-TDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	19

Mean:	2.16 µg abs./Filter
Reproducibility s.d.:	0.23 µg abs./Filter
Rel. reproducibility s.d.:	10.8%
Reference value:	2.04 µg abs./Filter
Range of tolerance:	1.73 - 2.59 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	1.51 and 2.81 µg abs./Filter (|Z-Score| = 3.0)



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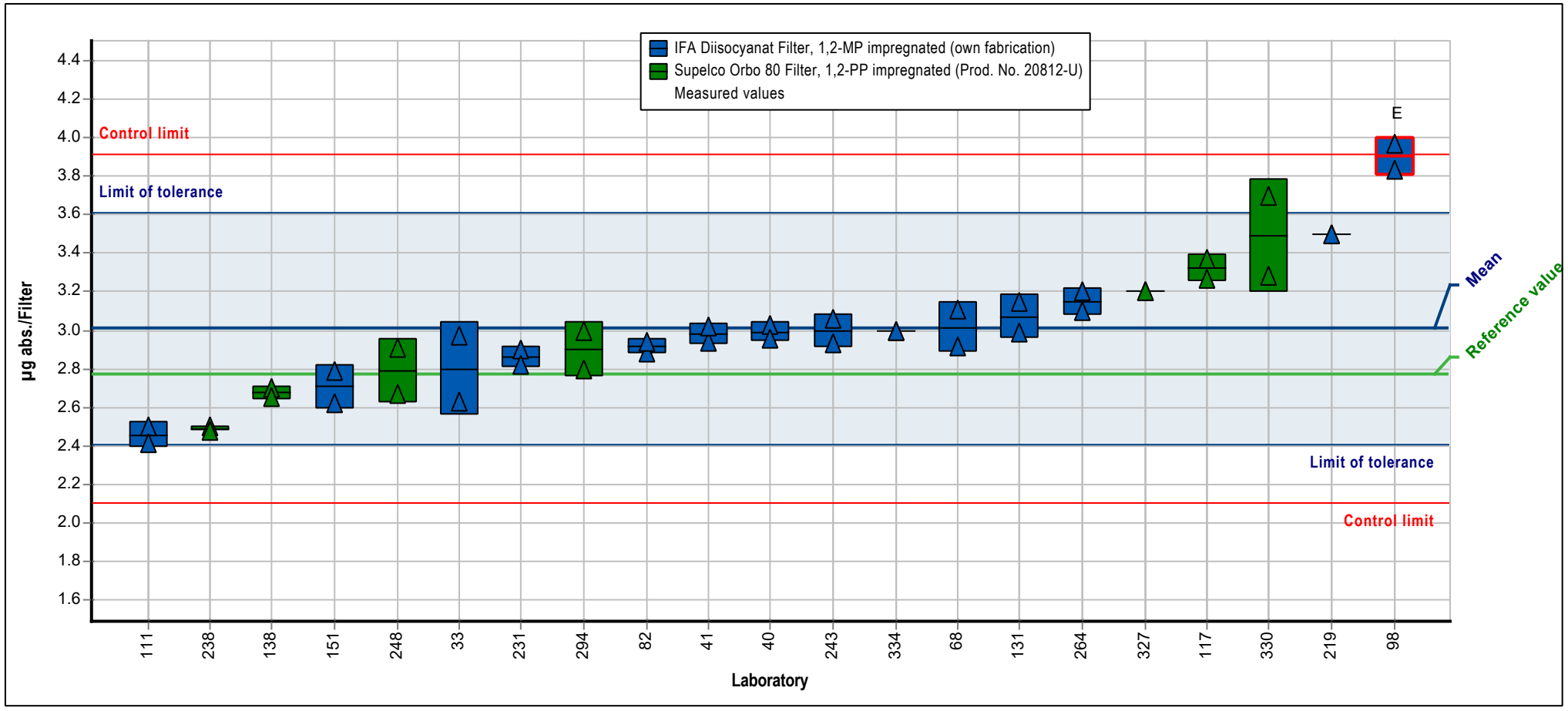
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	2.1 / 2.2
Measurand:	4,4'-MDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	21

Mean:	3.01 µg abs./Filter
Reproducibility s.d.:	0.35 µg abs./Filter
Rel. reproducibility s.d.:	11.7%
Reference value:	2.77 µg abs./Filter
Range of tolerance:	2.41 - 3.61 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	2.11 and 3.91 µg abs./Filter (|Z-Score| = 3.0)



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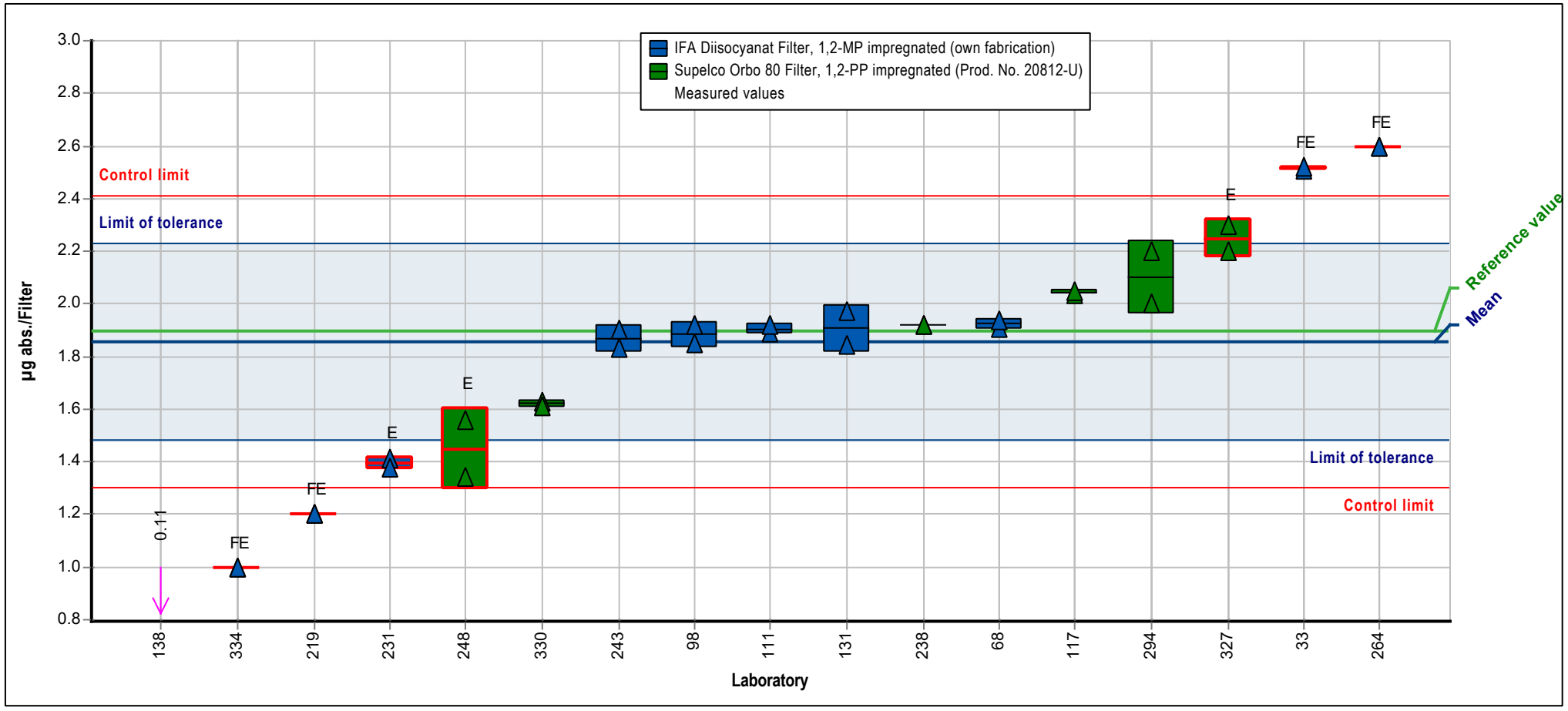
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	2.1 / 2.2
Measurand:	HDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	17

Mean:	1.86 µg abs./Filter
Reproducibility s.d.:	0.26 µg abs./Filter
Rel. reproducibility s.d.:	13.9%
Reference value:	1.90 µg abs./Filter
Range of tolerance:	1.48 - 2.23 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	1.30 and 2.41 µg abs./Filter (|Z-Score| = 3.0)



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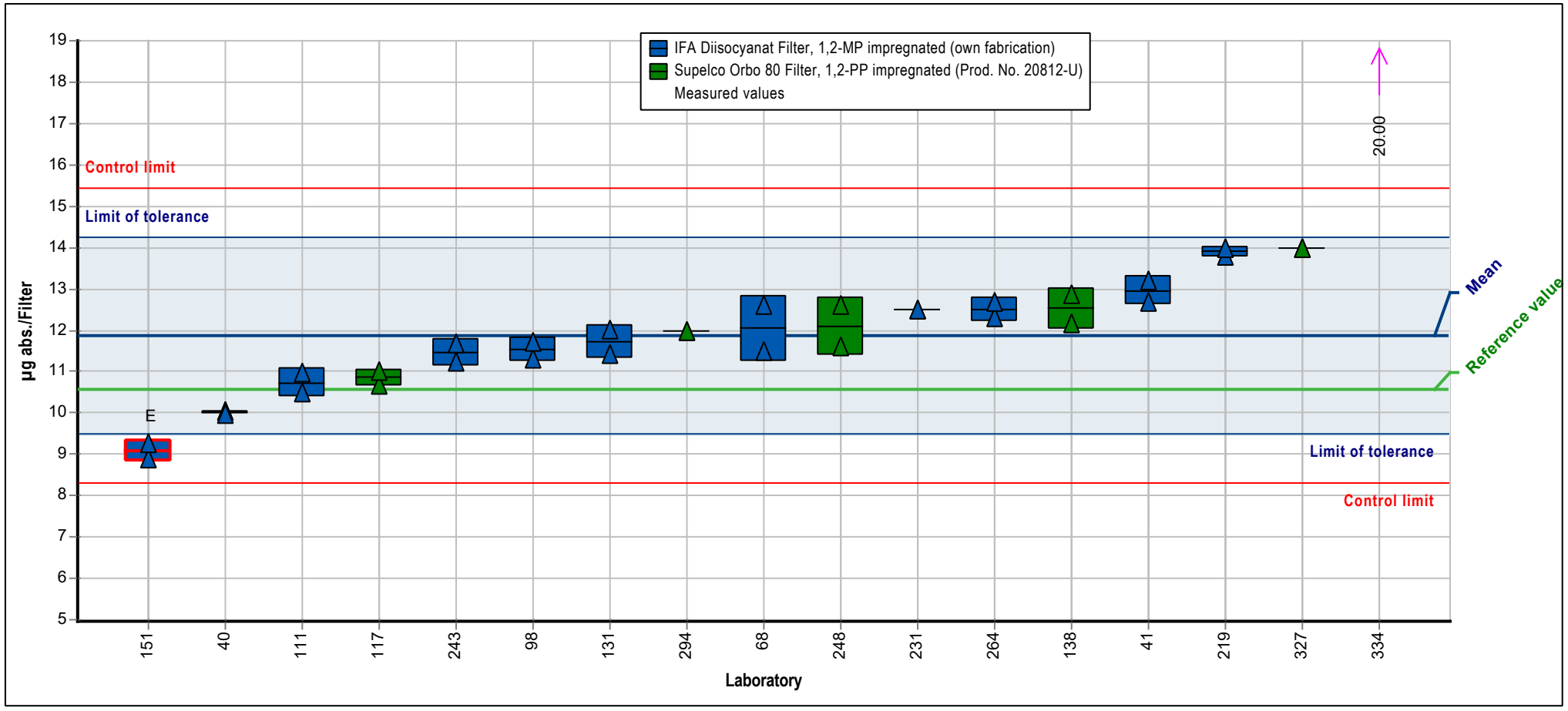
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	2.1 / 2.2
Measurand:	IPDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	17

Mean:	11.87 µg abs./Filter
Reproducibility s.d.:	1.32 µg abs./Filter
Rel. reproducibility s.d.:	11.1%
Reference value:	10.58 µg abs./Filter
Range of tolerance:	9.50 - 14.24 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	8.31 and 15.43 µg abs./Filter (|Z-Score| = 3.0)



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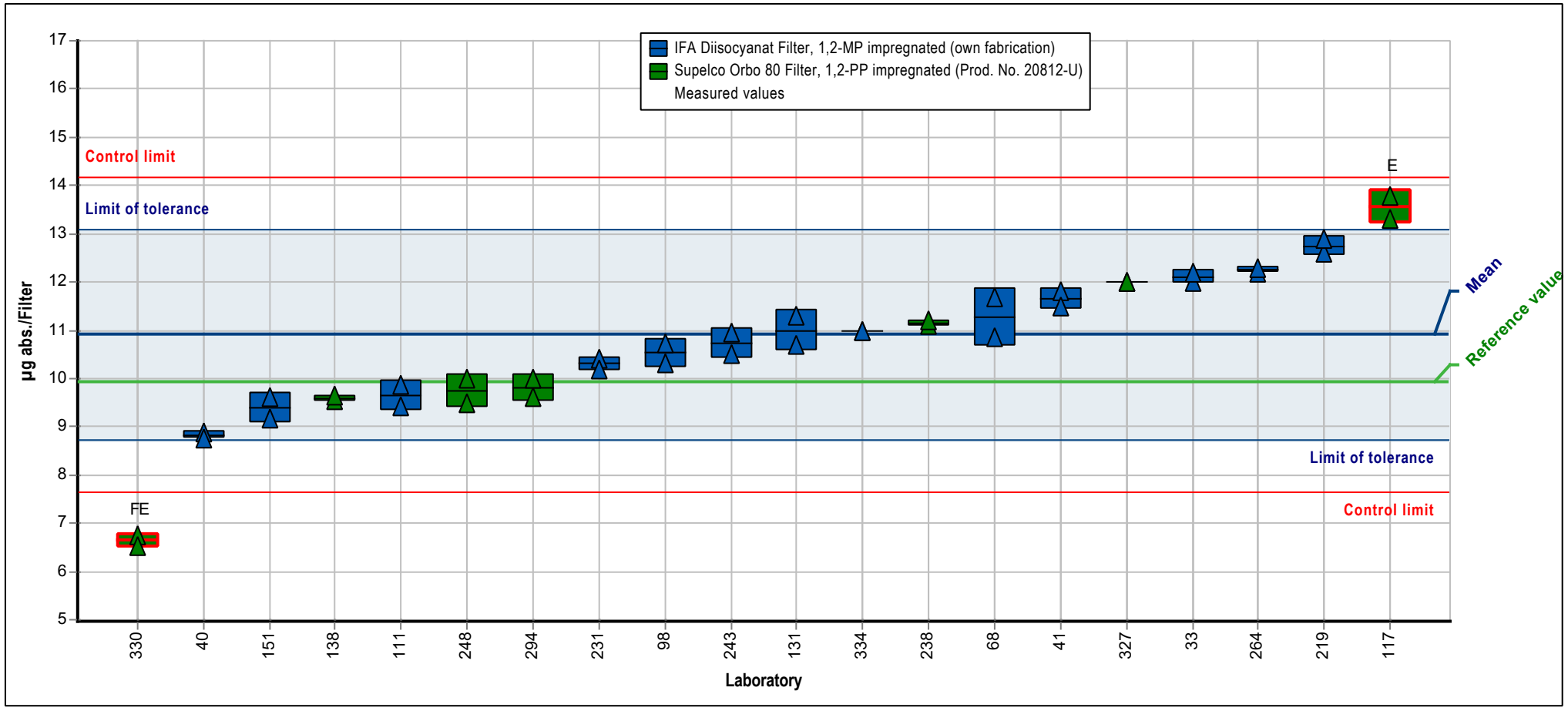
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	2.1 / 2.2
Measurand:	2,4-TDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	20

Mean:	10.91 µg abs./Filter
Reproducibility s.d.:	1.28 µg abs./Filter
Rel. reproducibility s.d.:	11.7%
Reference value:	9.92 µg abs./Filter
Range of tolerance:	8.73 - 13.09 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	7.64 and 14.18 µg abs./Filter (|Z-Score| = 3.0)



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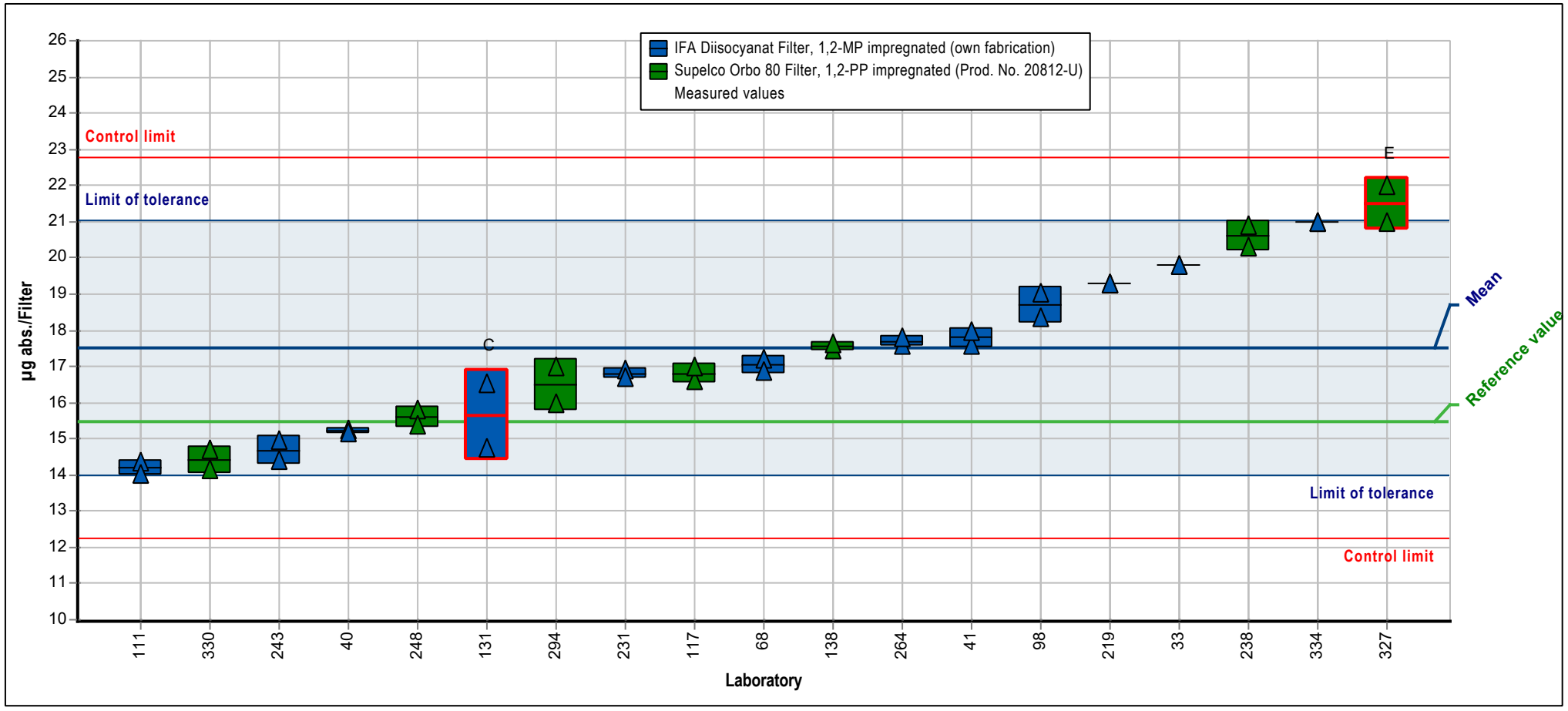
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	2.1 / 2.2
Measurand:	2,6-TDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	19

Mean:	17.51 µg abs./Filter
Reproducibility s.d.:	2.28 µg abs./Filter
Rel. reproducibility s.d.:	13.0%
Reference value:	15.47 µg abs./Filter
Range of tolerance:	14.01 - 21.02 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	12.26 and 22.77 µg abs./Filter (|Z-Score| = 3.0)



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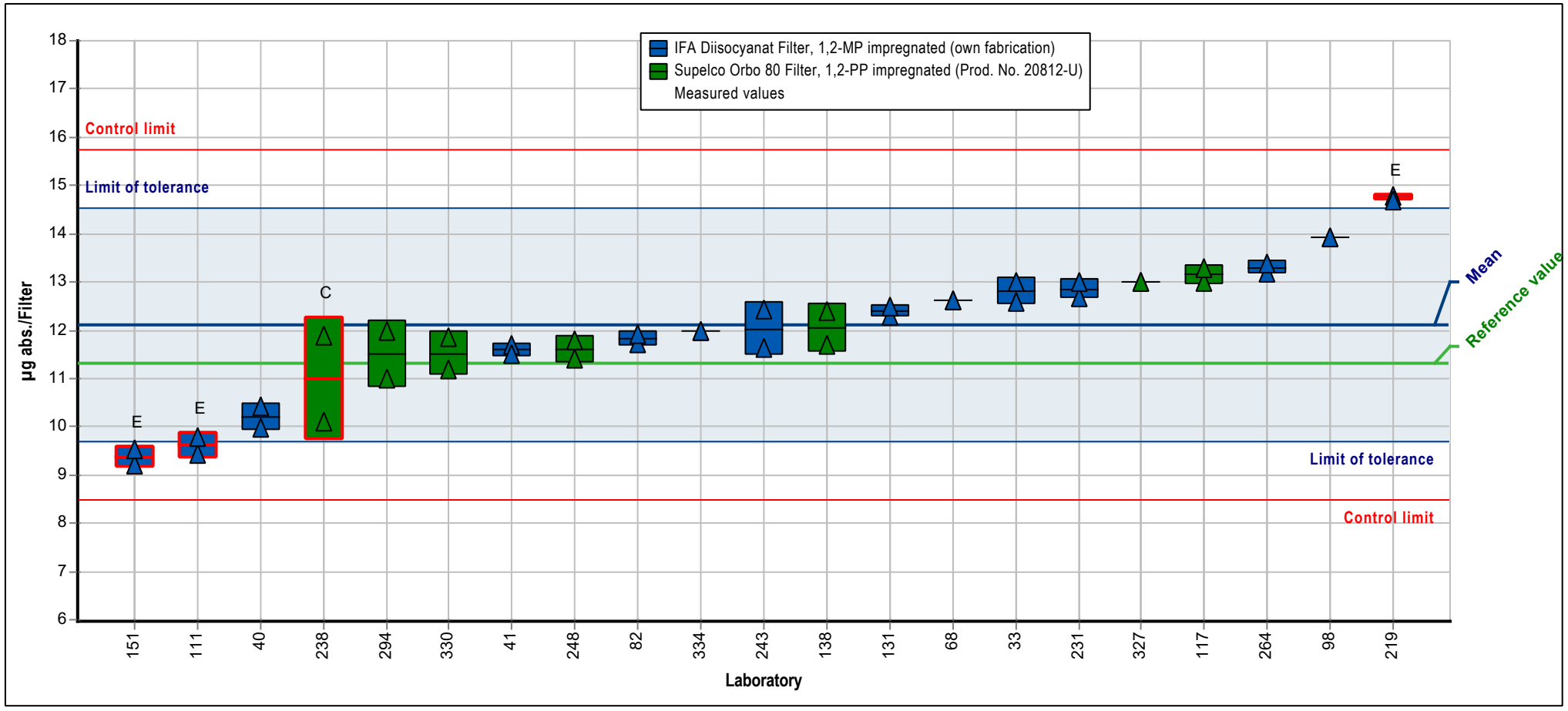
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	3.1 / 3.2
Measurand:	4,4'-MDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	21

Mean:	12.11 µg abs./Filter
Reproducibility s.d.:	1.35 µg abs./Filter
Rel. reproducibility s.d.:	11.1%
Reference value:	11.31 µg abs./Filter
Range of tolerance:	9.68 - 14.53 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	8.47 and 15.74 µg abs./Filter (|Z-Score| = 3.0)



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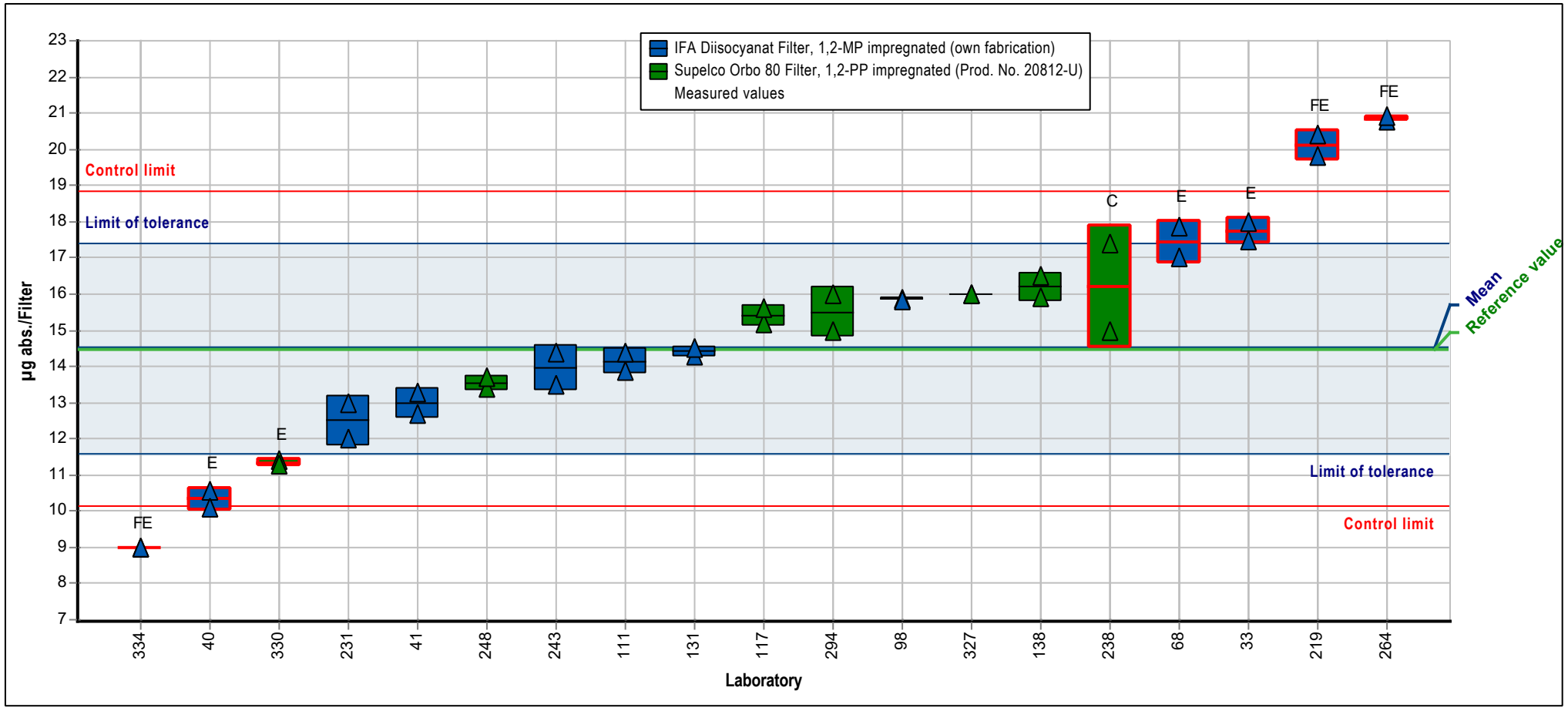
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	3.1 / 3.2
Measurand:	HDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	19

Mean:	14.49 µg abs./Filter
Reproducibility s.d.:	2.14 µg abs./Filter
Rel. reproducibility s.d.:	14.8%
Reference value:	14.46 µg abs./Filter
Range of tolerance:	11.59 - 17.39 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	10.14 and 18.84 µg abs./Filter (|Z-Score| = 3.0)



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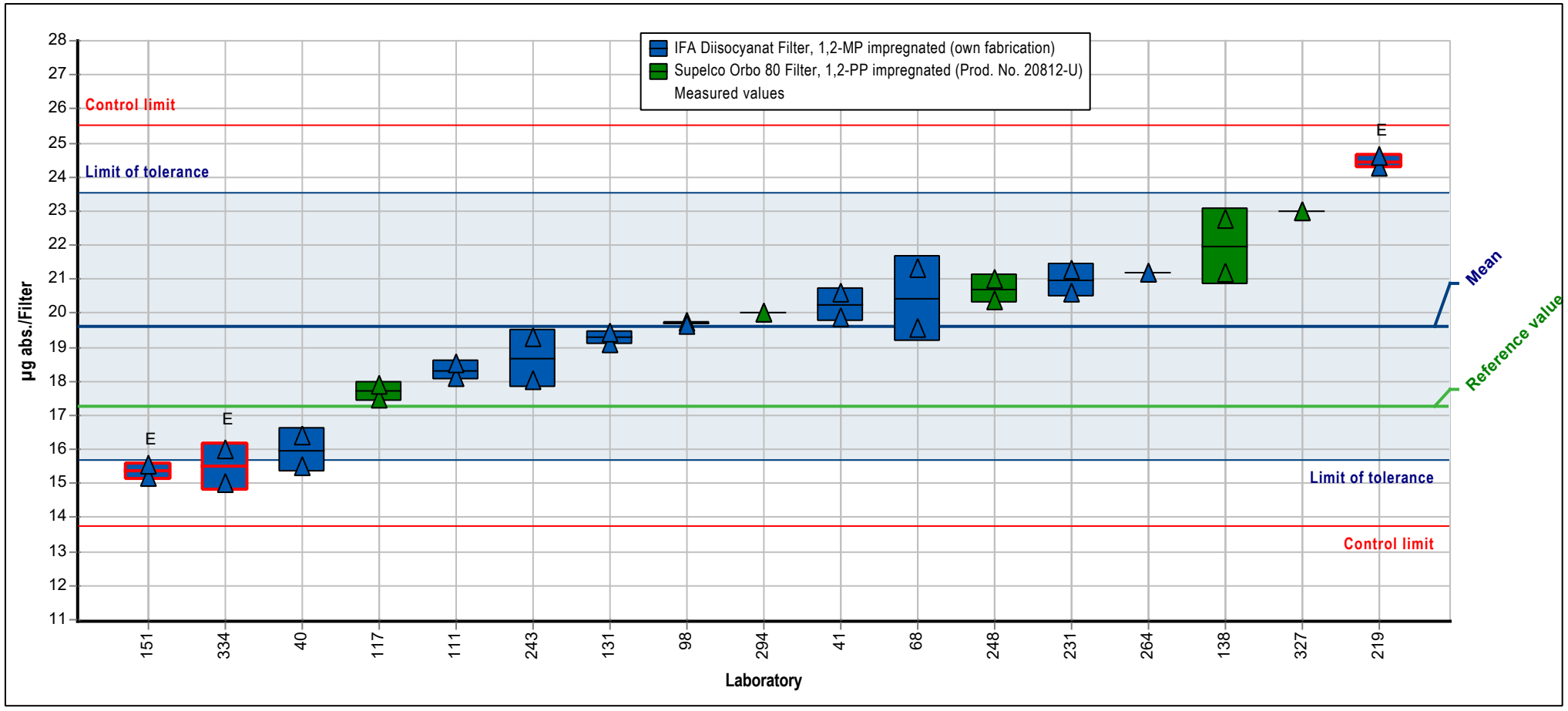
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	3.1 / 3.2
Measurand:	IPDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	17

Mean:	19.62 µg abs./Filter
Reproducibility s.d.:	2.55 µg abs./Filter
Rel. reproducibility s.d.:	13.0%
Reference value:	17.27 µg abs./Filter
Range of tolerance:	15.69 - 23.54 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	13.73 and 25.50 µg abs./Filter (|Z-Score| = 3.0)



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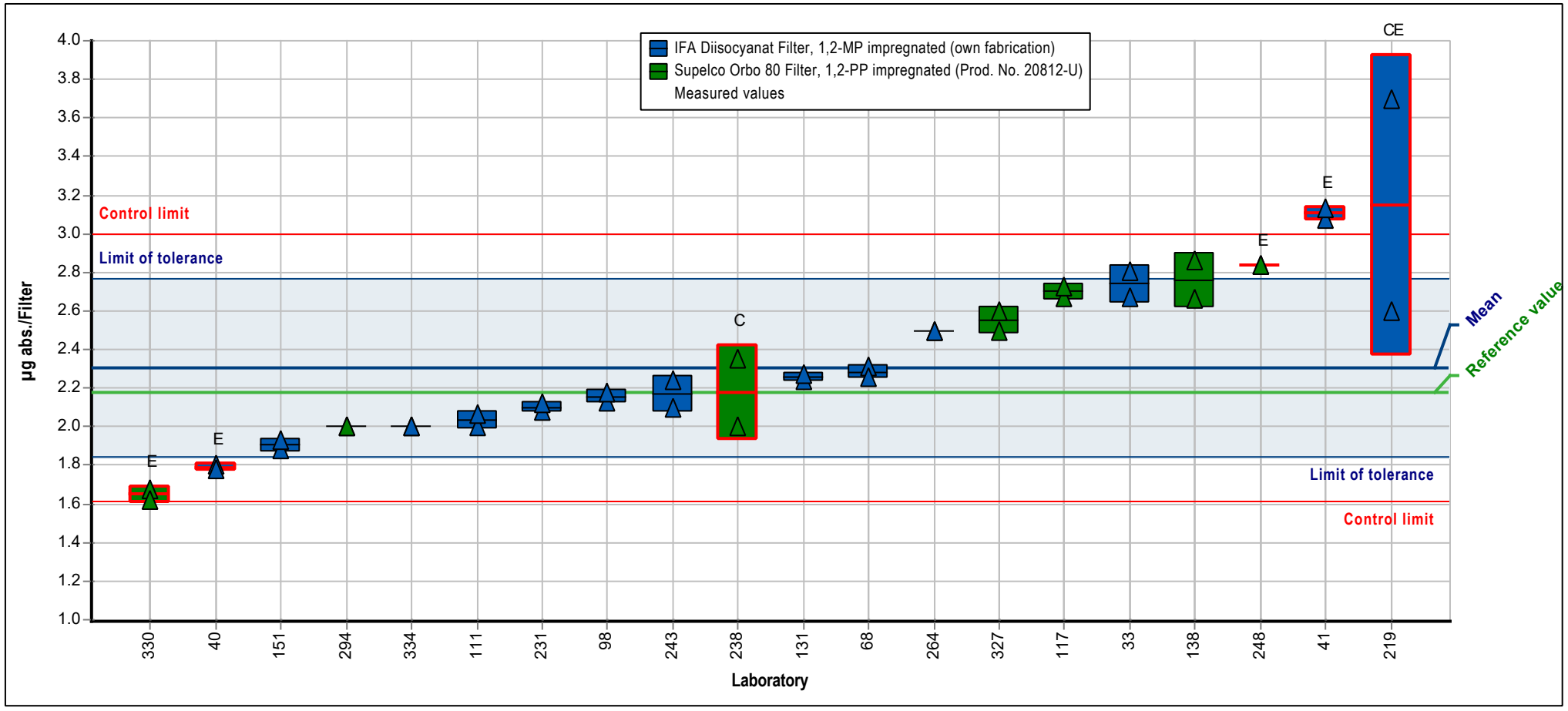
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	3.1 / 3.2
Measurand:	2,4-TDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	20

Mean:	2.31 µg abs./Filter
Reproducibility s.d.:	0.41 µg abs./Filter
Rel. reproducibility s.d.:	17.6%
Reference value:	2.18 µg abs./Filter
Range of tolerance:	1.85 - 2.77 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	1.62 and 3.00 µg abs./Filter (|Z-Score| = 3.0)



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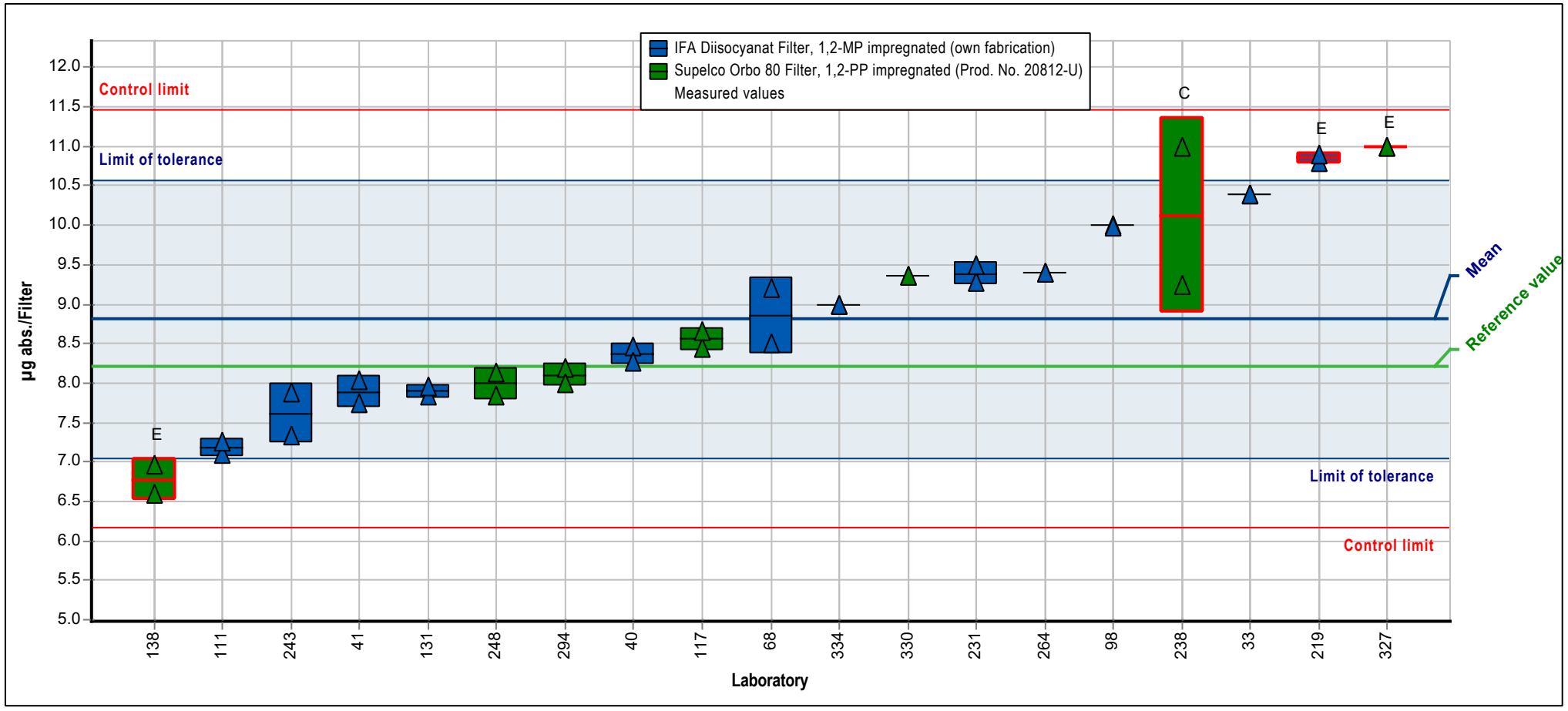
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	3.1 / 3.2
Measurand:	2,6-TDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	19

Mean:	8.81 µg abs./Filter
Reproducibility s.d.:	1.23 µg abs./Filter
Rel. reproducibility s.d.:	13.9%
Reference value:	8.21 µg abs./Filter
Range of tolerance:	7.05 - 10.58 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	6.17 and 11.46 µg abs./Filter (|Z-Score| = 3.0)



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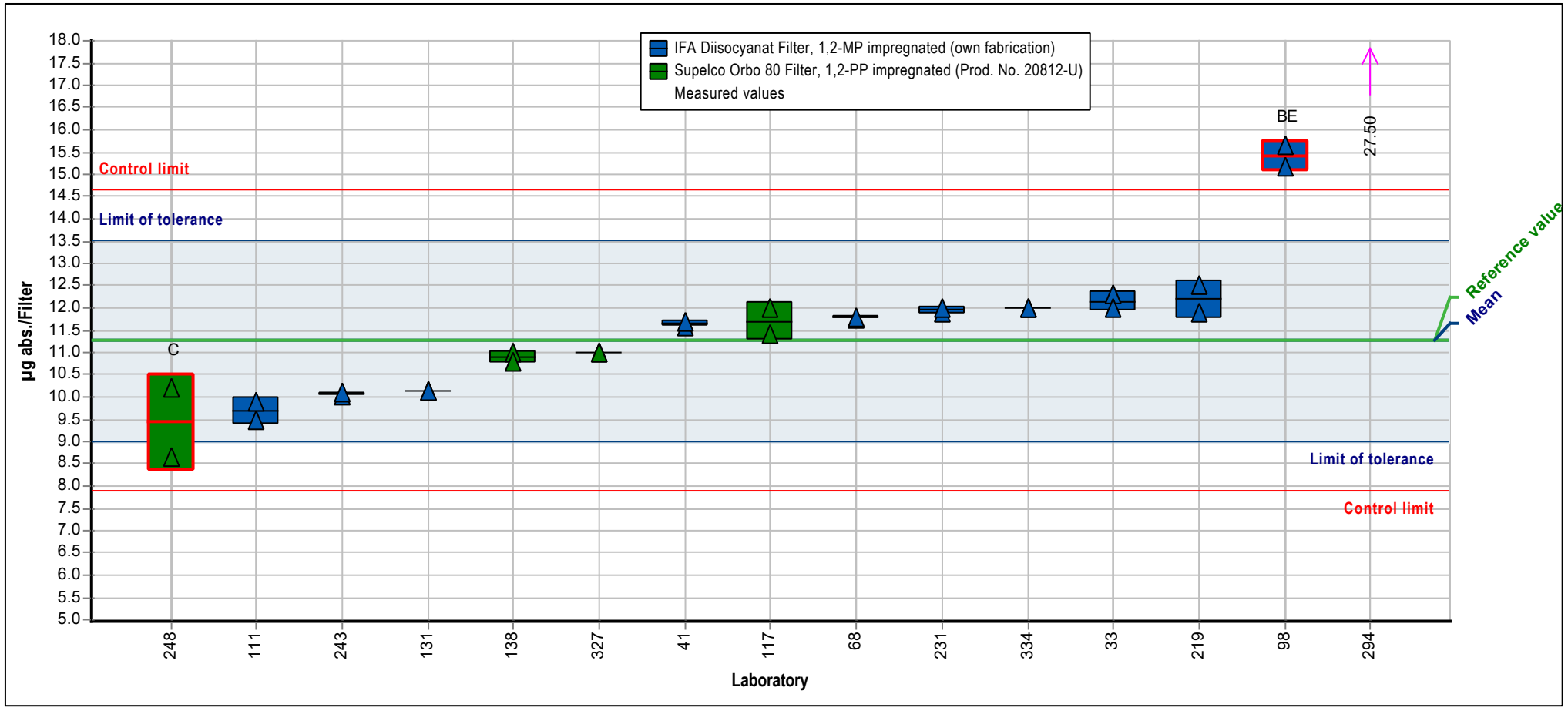
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Summary results

Sample:	4.1 / 4.2
Measurand:	NDI
Statistical method:	ISO 5725-2
Rel. SDPA:	10.0%
Number of laboratories:	15

Mean:	11.27 µg abs./Filter
Reproducibility s.d.:	0.90 µg abs./Filter
Rel. reproducibility s.d.:	8.0%
Reference value:	11.27 µg abs./Filter
Range of tolerance:	9.02 - 13.52 µg abs./Filter (|Z-Score| <= 2.0)
Control limits:	7.89 and 14.65 µg abs./Filter (|Z-Score| = 3.0)



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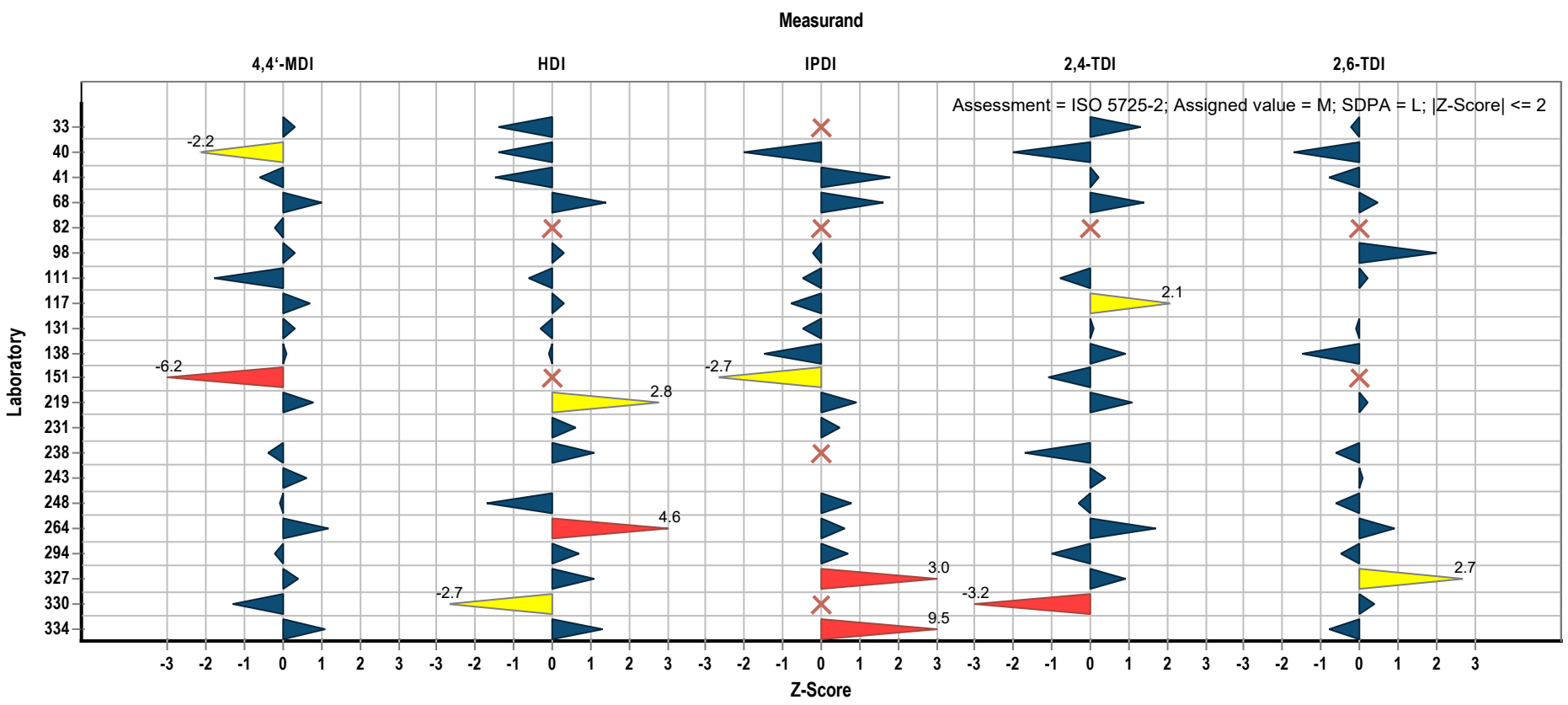
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Sample chart of Z-Scores

Sample: **1.1 / 1.2**



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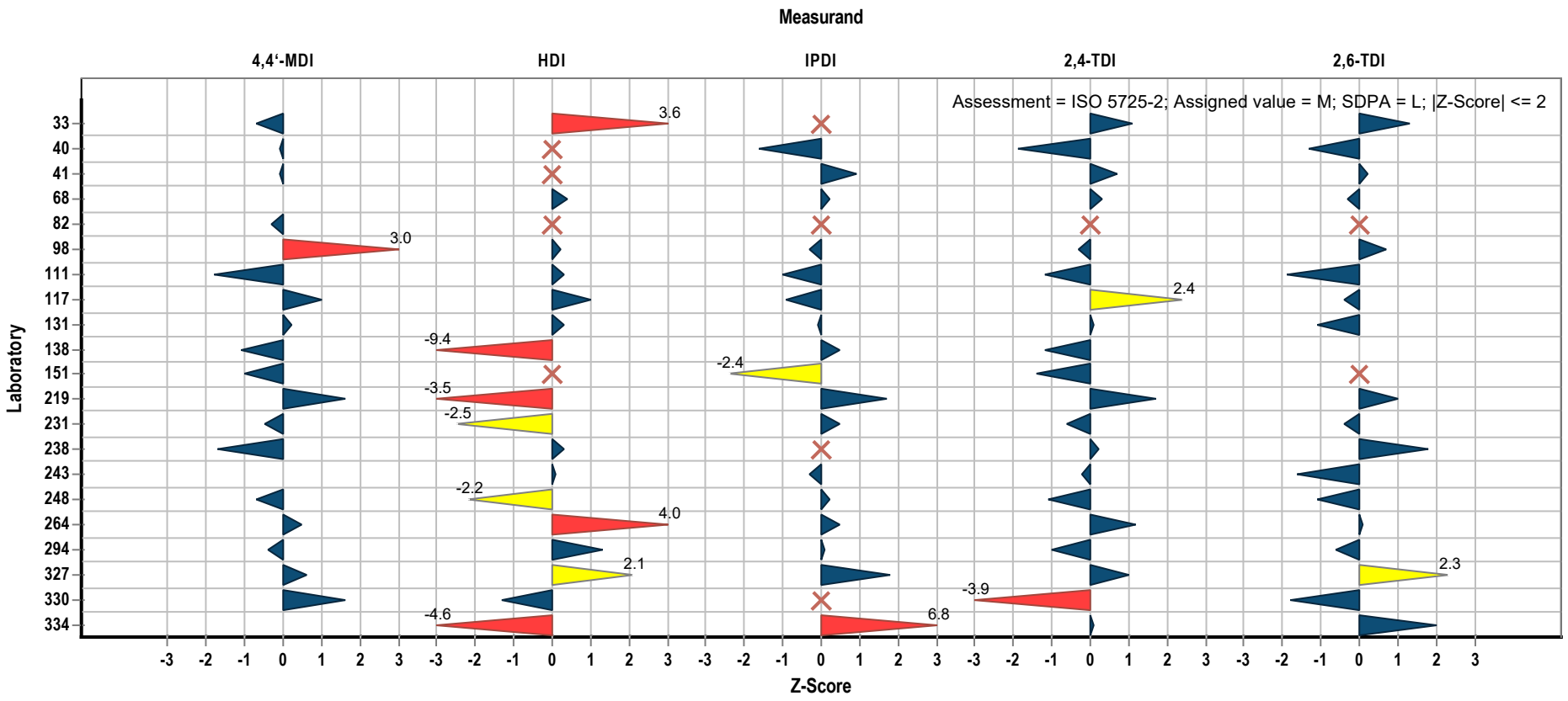
Test Proficiency Testing Scheme Diisocyanates on Filters 2026 - Combined Samples

Sample chart of Z-Scores

Sample: **2.1 / 2.2**



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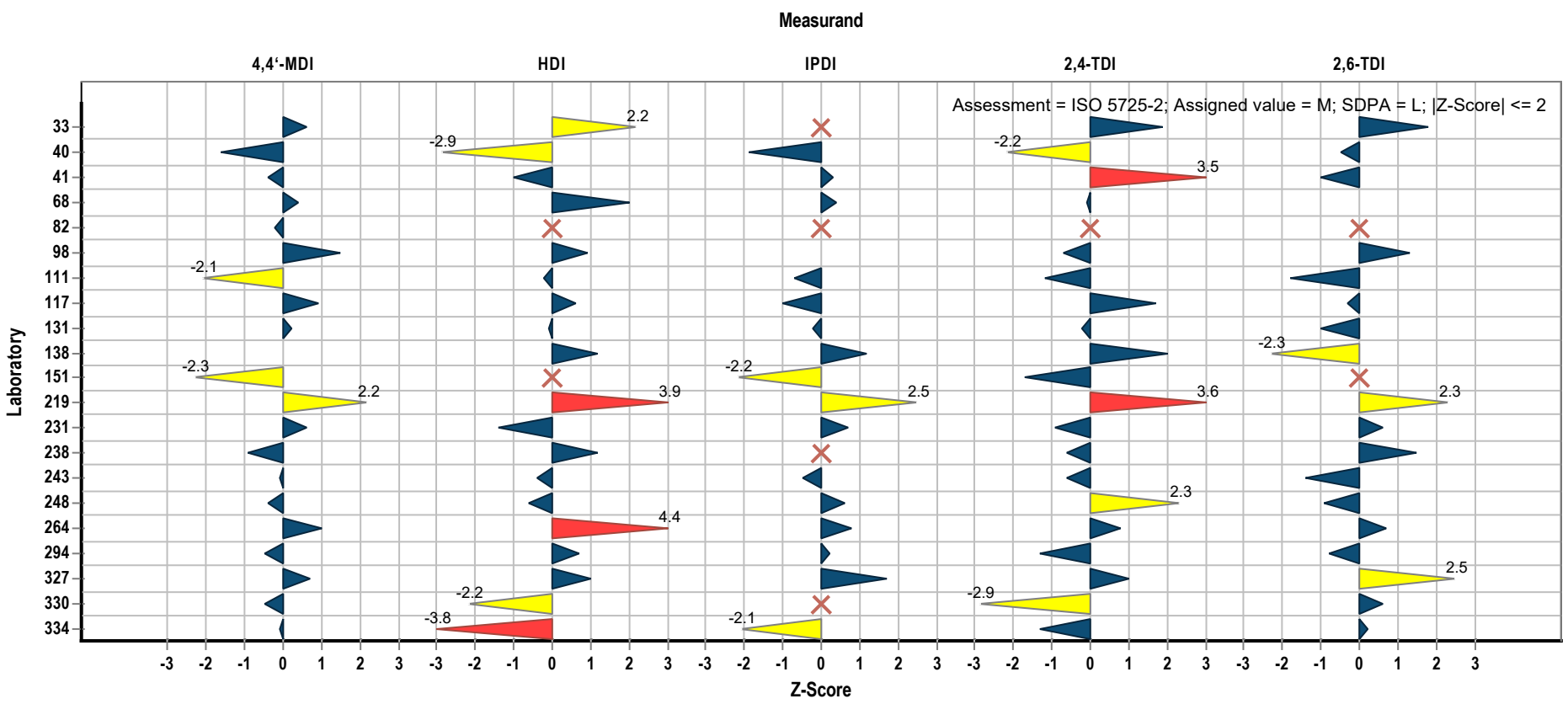
Sample chart of Z-Scores

Sample: **3.1 / 3.2**



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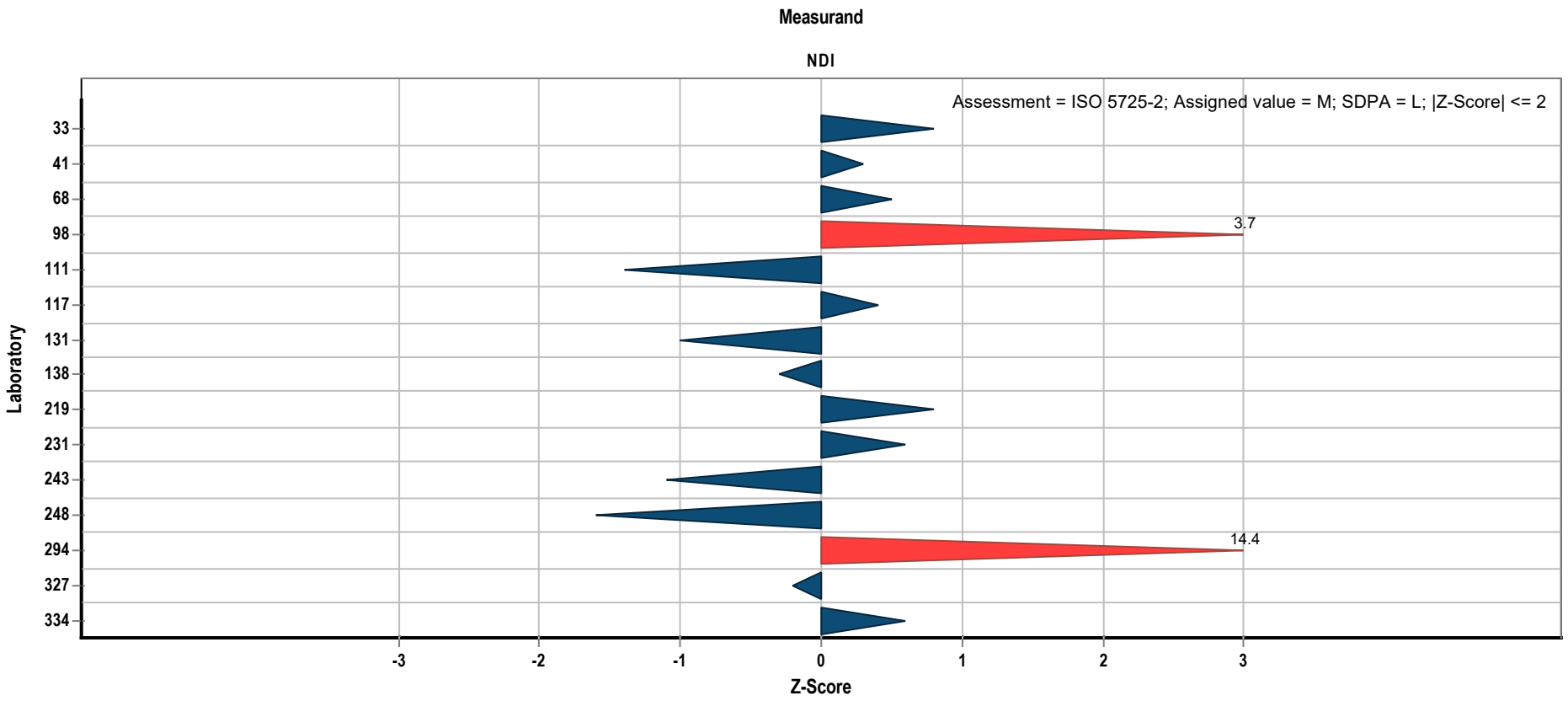
Sample chart of Z-Scores

Sample: **4.1 / 4.2**



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Deutschen Gesetzlichen Unfallversicherung

Participant	Analytical method	Storage after arrival
33	IFA-Arbeitsmappe 7670	Kühlschrank
40	Hausmethode	Kühlschrank
41	Hausmethode	Kühlschrank
68	IFA 7670	Ja
82	in Anlehnung an IFA7670	Kühlschrank 4°C
98	MDHS 25.3 angelehnt	6°C
111		
117	IFA 7670: 2020-04	Kühlschrank
131	IFA 7670	Kühlschrank
138	OSHA 5002	Kühlschrank
151		
219	interne HPLC-MS-Methode	Kühlschrank
231	IFA 7670:2020-04	Kühlschrank
238	HPLC DAD-FLD	room temperature (5 ± 3)°C
243	IFA 7670	Kühlschrank
248	IFA 7670	Kühlschrank
264	HPLC/UV	fridge
294	HPLC/FLD for MDI, HDI, IPDI, TDI ; HPLC/MS for NDI	fridge
327	Analysis according to OSHA 42, 47 and OSHA PV 2034 and 2092	Deep Cooler
330		
334	HPLC-MS	Roomtemperature for approximately 3 days and then fridge until analysis

Participant	Storage time after arrival	Start sample preparation	Desorption solution
33	2 Tage	2 Tage nach Probeneingang	25 mg 1-(2-Methoxyphenyl)piperazin in 250 ml Acetonitril
40	7 Tage	29.04.2026	Acetonitril / UHQ-Wasser (1/1 v/v)

Test proficiency testing scheme for diisocyanates on filters 2026

Questions and Answers

Participant	Storage time after arrival	Start sample preparation	Desorption solution
41	6 Tage	04.05.2026	Acetonitril
68	1 Tag	23.04.2026	gemäss IFA 7670
82	35 Tage	28.05.2026	Lt. IFA Methode
98	14d	6.5.	Methanol mit Essigsäureanhydrid 49:1
117	19 Tage	11.05.2026	ACN
131	<4 Wochen	20.05.2026	25 mg 1,2-MP in 250 mL Acetonitril
138	24.04.2026 - 20.05.2026	20.05.2026	9:1 ACN:DMSO
219	etw a 10 Tage	2026-05-08	Acetonitril
231	24 Stunden	23.04.2026	1,2-MP Lösung
238	1 w eek	29/04/2026	Acetonitrile
243	<4 Wochen	20.05.2026	25 mg 1,2-MP in 250 mL Acetonitril
248	5 Tage	28.04.2026	Acetonitril
264	7 days	28/04/2026	acetonitrile
294	4 w eeks	19.05.2026	Acetonitrile / DMSO 9:1 (v/v)
327	21 days	1h at room temperature	A mixture of Water (50%); Acetonitrile (45%) and Dimethylsulfoxide (5%)
334	29 days	21 May 2026	Acetonitrile

Participant	Volume of desorption solution	Storage time after desorption
33	3	Kühlschrank
40	5 mL	Kühlschrank
41	3	Tiefkühlschrank
68	3	3 Tage im KS für die 1. Bestimmung, danach 4 Wochen im KS für die 2.Bestimmung
82	10 mL	keine Lagerung. Direkt vermessen.
98	5ml	0 - 6d; 6°C
117	5 ml	Kühlschrank
131	6 mL	2 Tage im Kühlschrank
138	2 ml	-

Test proficiency testing scheme for diisocyanates on filters 2026
Questions and Answers

Participant	Volume of desorption solution	Storage time after desorption
219	5ml, danach w eitere Verdünnungen 1 zu 10 und 1 zu 100 in Acetonitril	nein, direkte Anaylse
231	3 ml	Kühlschrank
238	5 mL	1 day
243	6 mL	2 Tage im Kühlschrank
248	3 ml	1 Tag im Kühlschrank
264	5mL	1 month - refrigerator
294	3	2 days in refrigerator
327	4 ml	21 days
334	4 mL per filter, 8 mL in total	1 day and 8 days (re-analysis)

Participant	Date of analysis
33	29.04.2026 und 16.06.2026
40	29.04.2026
41	28.05.2026
68	29.04.2026 / 27.05.2026
82	28.05.2026
98	6.5. bis 13.5.
117	12. /13. 05.2026 // 9.06.2026 (NDI)
131	22.05.2026
138	20.05.2026
219	2025-05-08
231	27.04.2026
238	30/04/2026
243	22.05.2026
248	29.04.2026
264	29/04/2026
294	21.05.2026

Test proficiency testing scheme for diisocyanates on filters 2026
Questions and Answers

Participant	Date of analysis
327	13-14.05.2026
334	22 May 2026 and 29 May 2026

Participant	Chromatography system
33	Agilent HP 1100, binäre Pumpe, DAD und Autosampler
40	Agilent 1260 Infinity II mit DAD und Autosampler
41	Agilent Infinity II
68	HPLC-Anlage von Agilent 1260, Infinity LC System
82	Agilent Quat. Pump G7111B, Col. Comp. G7116A, DAD G7117C, FLD G7121B, Sampler G7129A
98	Shimadzu Prominence-i LC-2030 plus
117	Agilrbt 1260; FLD-Detektor
131	Shimadzu LC-20303D + RF20A
138	Thermo Ultimate 3000
219	Agilent 1290 mit MS Sciex 4500
231	Thermo Vanquish, DAD+FLD, Autosampler
238	HPLC 1260 Agilent
243	Shimadzu LC-20303D + RF20A
248	LPG-3400SD, DAD-3000(RS), WPS-3000(RS)
264	Shimadzu Nexera
294	Agilent HPLC 1100 w ith G1311A quarternary pump, G1392A autosampler, G1321B FLD detector
327	Agilent 1260 Infinity, 1260 Quat Pump, 1260 Vial Sampler, 1260 MCT, 1260 FCD
334	HP Agilent G1322A degasser, HP Agilent 1100 HPLC G1311A Quat Pump, Autosampler, Agilent 1200 HPLC G1316A Column compartment. Coulpled to Agilent LC/MSD G6135C (ESI inlet)

Participant	Refrigerated autosampler
33	nein
40	nein
41	18°C

Participant	Refrigerated autosampler
68	Nein
82	nicht gekühlt
98	nein
117	nein
131	ja, 15 °C
138	-
219	ja, 20°C
231	nein
238	no refrigerated autosampler
243	ja, 15 °C
248	Nein
264	yes - 8°C
327	No
334	No, autosampler at room temperature

Participant	Mobile phase
33	A: 850 ml Acetonitril + 150 ml Methanol + 50 µl Ameisensäure, B: 315 mg Ammoniumformiat in 1000 ml Wasser + 250 µl Ameisensäure
40	30 mmol w ässrige Ammoniumacetatlösung + Eisessig (0,2 mL/L)
41	Wasser/Acetonitril
68	gemäss IFA 7670
82	Gradient, Wasser + 5 mmol/L Ammoniumformiat, Acetonitril, Methanol
98	Acetonitril Gradient mit Natriumacetat-Puffer , 6mmol/l, pH6
117	A: H2O + NH4Ac (0,77 g/l, pH = 6 mit HAc) // B: ACN
131	Eluent [A]: 315 mg Ammoniumformiat in 1 L Reinstw asser + 250 µL Ameisensäure Eluent [B]: 850 mL ACN + 150 mL MeOH + 50 µL Ameisensäure
138	A: 15 µM NH4-Acetat + 500 µl/l ES in H2O, B: ACN, A:B 80:20
219	Wasser / Acetonitril mit 0,05% Ameisensäure
231	Gradiententechnik, A=315mg Ammoniumformiat+250µl Ameisensäure/1l Wasser, B= 850ml Acetonitril+150ml Methanol+50µl Ameisensäure, 0-6min 60%B>>16min 100%B bis 19min

Participant	Mobile phase
	100%B>>24min 60%B bis 32min 60%B
238	0.01m ammonium acetate in 40/06 ACN/w ater
243	Eluent [A]: 315 mg Ammoniumformiat in 1 L Reinstw asser + 250 µL Ameisensäure Eluent [B]: 850 mL ACN + 150 mL MeOH ++ 500 µL Ameisensäure
248	(A)Ammoniumacetat 76% / (B)Acetonitril 24% pH 6,0
264	Buffer acetate / acetonitrile acetic acid
294	Acetonitrile / 0,01 M ammonium acetate buffer (pH 6,2)
327	7,6g/L Ammonium-Acetate in H2O and Acetonitrile
334	A: 10 mM Ammoniumacetate, B: acetonitrile. Time gradient %A: 0 minutes 60%, 15 min. 5%, 18 min. 5%, 18.2 min. 60%, 25 min. 60%

Participant	Flow rate HPLC	Analytical column	Column temperature
33	0,7	Multospher 120 RP18 AQ-3	-
40	0,6 mL/min	Agilent Prontosil 120 EC-C18, 2,7 µm, 100 mm x 4,6 mm	40 °C
41	0,2	Intersil ODS-3	40 °C
68	1.0	PerfectSil Traget ODS-3 5µm, 250mm	30°C
82	0,6 ml/min	Restek Raptor C18, 150mm, 4,6mm ID, 2,7µm, Art.Nr. #9304A65	40°C
98	0,8	Synergy 4µ Hydro-RP 80A, 250x4mm, Phenomenex	25 °C
117	1 ml/min	Agilent XDB C18 1,8 µm 4,6 * 100 mm	40 °C
131	0,35	Nucleosil 5µm, 250x3.0 mm	30
138	0,4 ml/min	Phenyl-X 100x2,1 mm, 2,6 µm	30 °C
219	0,45	C18 50 mm x 2,1 mm	40°C
231	0,70ml/min	PerfectSil Target ODS-3, 5µm, 250*4mm	45°C
238	1.5 mL/min	C18 (Pursuit SHAP)	33°C
243	0.35	Nucleosil 5um, 250x3.0 mm	30
248	1,5	Supelcosil LC-CN	25°C
264	0.8mL/min	Luna Oméga Polar 150*3.0 mm	30°C
294	1,2 mL/min	Sorbax Eclipse C18 250x4,6 mm	25 °C
327	Betw een 0,4-0,8 ml/min	Dr. Maisch: Ultrasep ES DIISO, 5 um	40 °C

Participant	Flow rate HPLC	Analytical column	Column temperature
334	0.2 mL/min	Phenomenex Prodigy 5µ ODS(3), 2.0*150mm	Room temperature

Participant	Wavelength
33	245 nm
40	248 nm
41	245 nm
68	245 nm
82	245 nm
98	242 nm
117	FLD ex 240 Em 380
131	Fluoreszenzdetektor: Ex: 240 nm, Em: 380 nm PDA-Detektor: Wellenlänge: 220 nm, Referenz 450 nm
138	254 nm
219	Massenspektrometer
231	245nm
238	254 nm
243	Fluoreszenzdetektor: Ex: 240 nm, Em: 380 nm PDA-Detektor: Wellenlange: 220 nm, Referenz 450 nm
248	UV 254 nm
264	242nm
294	EX 240 nm, EM 370 nm
327	Excitation 240 nm, Emission 370 nm
334	Mass spectrometry w as used

Participant	Calibration standard
33	aus Einzelstandards hergestellt.
40	aus Einzelstandards hergestellt
41	Einzelstandards verschiedener Hersteller
68	Alle Monomere aus Einzelstandards zu einem Mix hergestellt - Hersteller: Sigma-Aldrich / Fluorochem

Test proficiency testing scheme for diisocyanates on filters 2026
Questions and Answers

Participant	Calibration standard
82	4,4-MDI von Sigma Aldrich, Art-Nr. 256439-50g. Keine Trübung beim Lösen in Dichlormethan, anders als bei anderen Qualitäten
98	Individual Standards, different Origins
117	aus einzelnen Substanzen (Sigma-Aldrich; Supelco)
131	aus Reinsubstanzen hergestellt
138	Einzelstandards
219	Herstellung aus Einzelstandards
231	Einzelstandards nach Einw aage der Reinsubstanzen, danach Summenstandardlösung
238	individual standard (derivative 1,(2-Pyridyl)piperazine ACCU Standard
243	aus Reinsubstanzen hergestellt
248	Einzelstandards (Supelco, Sigma-Aldrich, TCI)
264	individual standards from SIGMA
294	individual standards from TCI, Sigma-Aldrich
334	Individual stocksolutions w as prepared and mixed for calabiration standards.

Participant	Blank values
33	nein
40	Probe 5.1 BW: 0,233 µg abs. MDI, Probe 5.2 BW: 0,194 µg abs. MDI
41	2,4-TDI und IPDI, Abgleich der UV-Spektren ohne Treffer. Blindw ert w urde nicht abgezogen.
68	Nein
82	<0,05 µg pro Filter
98	Ja, bei NDI.
117	ja
131	nein
138	nein
219	nein
231	Es sind keine Blindw erte feststellbar
238	No

Test proficiency testing scheme for diisocyanates on filters 2026

Questions and Answers

Participant	Blank values
243	nein
248	Nein
264	no found
327	No
334	No

Test proficiency testing scheme for diisocyanates on filters 2026

Homogeneity test

Overview of statistical values and results

Sample description	Measurand description	Unit	Mean	s(analytical) [%]	s(sample) [%]	Mode for SDPA	SDPA [%]
Sample 1	Tolulene 2,4-diisocyanate (2,4-TDI)	µg abs./Filter	15.06	0.3	2.0	Manual	10.0
Sample 1	Tolulene 2,6-diisocyanate (2,6-TDI)	µg abs./Filter	2.04	0.2	1.9	Manual	10.0
Sample 1	Diphenylmethane 4,4‘-diisocyanate (4,4‘-MDI)	µg abs./Filter	21.52	0.3	2.0	Manual	10.0
Sample 1	Hexamethylene 1,6-diisocyanate (HDI)	µg abs./Filter	7.74	0.4	1.9	Manual	10.0
Sample 1	Isophorone diisocyanate (IPDI)	µg abs./Filter	2.69	0.1	2.3	Manual	10.0
Sample 2	Tolulene 2,4-diisocyanate (2,4-TDI)	µg abs./Filter	9.92	0.1	1.4	Manual	10.0
Sample 2	Tolulene 2,6-diisocyanate (2,6-TDI)	µg abs./Filter	15.47	0.2	1.3	Manual	10.0
Sample 2	Diphenylmethane 4,4‘-diisocyanate (4,4‘-MDI)	µg abs./Filter	2.77	0.2	1.5	Manual	10.0
Sample 2	Hexamethylene 1,6-diisocyanate (HDI)	µg abs./Filter	1.90	0.4	1.8	Manual	10.0
Sample 2	Isophorone diisocyanate (IPDI)	µg abs./Filter	10.58	0.7	1.5	Manual	10.0
Sample 3	Tolulene 2,4-diisocyanate (2,4-TDI)	µg abs./Filter	2.18	0.3	1.7	Manual	10.0
Sample 3	Tolulene 2,6-diisocyanate (2,6-TDI)	µg abs./Filter	8.20	0.2	2.2	Manual	10.0
Sample 3	Diphenylmethane 4,4‘-diisocyanate (4,4‘-MDI)	µg abs./Filter	11.30	0.2	2.3	Manual	10.0
Sample 3	Hexamethylene 1,6-diisocyanate (HDI)	µg abs./Filter	14.45	0.5	1.9	Manual	10.0
Sample 3	Isophorone diisocyanate (IPDI)	µg abs./Filter	17.31	0.5	2.3	Manual	10.0
Sample 4	Naphthylene 1,5-diisocyanate (NDI)	µg abs./Filter	11.27	0.1	2.1	Manual	10.0

Sample description	Measurand description	Test items	ISO 13528:2022 - test for adequate homogeneity
Sample 1	Tolulene 2,4-diisocyanate (2,4-TDI)	10	Ok
Sample 1	Tolulene 2,6-diisocyanate (2,6-TDI)	10	Ok
Sample 1	Diphenylmethane 4,4‘-diisocyanate (4,4‘-MDI)	10	Ok
Sample 1	Hexamethylene 1,6-diisocyanate (HDI)	10	Ok
Sample 1	Isophorone diisocyanate (IPDI)	10	Ok
Sample 2	Tolulene 2,4-diisocyanate (2,4-TDI)	10	Ok

Test proficiency testing scheme for diisocyanates on filters 2026
Homogeneity test

Overview of statistical values and results

Sample description	Measurand description	Test items	ISO 13528:2022 - test for adequate homogeneity
Sample 2	Tolulene 2,6-diisocyanate (2,6-TDI)	10	Ok
Sample 2	Diphenylmethane 4,4‘-diisocyanate (4,4‘-MDI)	10	Ok
Sample 2	Hexamethylene 1,6-diisocyanate (HDI)	10	Ok
Sample 2	Isophorone diisocyanate (IPDI)	10	Ok
Sample 3	Tolulene 2,4-diisocyanate (2,4-TDI)	10	Ok
Sample 3	Tolulene 2,6-diisocyanate (2,6-TDI)	10	Ok
Sample 3	Diphenylmethane 4,4‘-diisocyanate (4,4‘-MDI)	10	Ok
Sample 3	Hexamethylene 1,6-diisocyanate (HDI)	10	Ok
Sample 3	Isophorone diisocyanate (IPDI)	10	Ok
Sample 4	Naphthylene 1,5-diisocyanate (NDI)	10	Ok

Summary of laboratory test results

Sample 1.1

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Unit	µg abs./filter		µg abs./filter		µg abs./filter		µg abs./filter	
33	23.60	0.3	6.85	-1.5			18.00	1.3
40	18.11	-2.1 E	7.08	-1.2	2.51	-1.9	12.88	-1.9
41	21.70	-0.5	6.88	-1.4	3.68	1.8	16.40	0.3
68	26.06	1.4	9.47	1.8	3.79	2.2 E	18.80	1.8
82	22.58	-0.1						
98	23.40	0.2	8.21	0.2	2.99	-0.4	15.90	0.0
111	19.09	-1.7	7.68	-0.4	2.94	-0.5	15.00	-0.6
117	24.70	0.8	8.33	0.4	2.84	-0.9	19.50	2.2 E
131	22.93	0.0	7.50	-0.6	2.82	-0.9	15.70	-0.2
138	22.92	0.0	8.13	0.1	2.60	-1.6	17.40	0.9
151	1.61	-9.3 BE			2.27	-2.7 E	14.93	-0.7
219	23.90	0.4	9.80	2.2 E	3.30	0.6	17.40	0.9
231	22.90	0.0	8.51	0.6	3.25	0.4	16.00	0.0
238	22.20	-0.3	9.17	1.4			13.10	-1.8
243	24.55	0.7	8.04	0.0	3.10	0.0	16.77	0.5
248	22.60	-0.1	6.47	-1.9	3.28	0.5	15.30	-0.4
264	25.60	1.2	11.60	4.5 FE	3.20	0.3	18.70	1.7
294	22.00	-0.4	8.50	0.6	3.30	0.6	14.00	-1.2
327	24.00	0.5	8.80	1.0	3.90	2.5 E	17.00	0.6
330	19.95	-1.3	5.90	-2.6 E			10.62	-3.3 E
334	25.00	0.9	9.00	1.2	6.00	9.3 BE	16.00	0.0
–	–	– –	–	– –	–	– –	–	– –
Statistical method	ISO 5725-2		ISO 5725-2		ISO 5725-2		ISO 5725-2	

Summary of laboratory test results

Sample 1.1

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Assessment	|Z|<=2.0		|Z|<=2.0		|Z|<=2.0		|Z|<=2.0	
No. of laboratories that submitted results	21		19		17		20	
Mean	22.89		8.02		3.11		15.97	
Reproducibility s.d.	2.05		1.07		0.45		2.19	
Rel. reproducibility s.d.	8.9 %		13.4 %		14.5 %		13.7 %	
SDPA	2.29		0.80		0.31		1.60	
Rel. SDPA	10.0 %		10.0 %		10.0 %		10.0 %	
Reference value	21.52		7.74		2.69		15.06	
Low er limit of tolerance	18.31		6.41		2.49		12.78	
Upper limit of tolerance	27.47		9.62		3.73		19.16	
Type B outliers	1				1			
Type F outliers			1					
No. of measurement values outside of tolerance limits	2		3		4		2	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	20		18		16		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-Score|>3.5	

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Summary of laboratory test results

Sample 1.1

	2,6-TDI	Z score
Unit	µg abs./filter	
33	2.14	-0.1
40	1.82	-1.5
41	1.96	-0.9
68	2.40	1.2
98	2.57	1.9
111	2.24	0.4
117	2.19	0.2
131	2.08	-0.4
138	1.80	-1.6
219	2.10	-0.2
231	2.15	0.0
238	2.06	-0.4
243	2.20	0.2
248	2.01	-0.7
264	2.30	0.7
294	2.00	-0.7
327	2.70	2.6 E
330	2.16	0.0
334	2.00	-0.7
–	–	– –
Statistical method	ISO 5725-2	
Assessment	|Z|<=2.0	
No. of laboratories that submitted results	19	
Mean	2.15	
Reproducibility s.d.	0.23	

Summary of laboratory test results

Sample 1.1

	2,6-TDI	Z score
Rel. reproducibility s.d.	10.5 %	
SDPA	0.22	
Rel. SDPA	10.0 %	
Reference value	2.04	
Low er limit of tolerance	1.72	
Upper limit of tolerance	2.58	
No. of measurement values outside of tolerance limits	1	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	19	

Summary of laboratory test results

Sample 1.2

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Unit	µg abs./filter		µg abs./filter		µg abs./filter		µg abs./filter	
33	23.60	0.4	6.90	-1.3			18.10	1.2
40	17.84	-2.1 E	6.71	-1.6	2.40	-2.3 E	12.67	-2.1 E
41	21.70	-0.4	6.73	-1.6	3.56	1.5	16.40	0.2
68	24.41	0.7	8.83	1.1	3.37	0.8	17.73	1.0
82	22.33	-0.2						
98	23.72	0.4	8.27	0.4	3.04	-0.2	16.06	0.0
111	18.74	-1.8	7.42	-0.7	2.89	-0.7	14.41	-1.0
117	24.50	0.8	8.21	0.3	2.84	-0.9	19.20	1.9
131	24.19	0.6	7.96	0.0	3.03	-0.3	16.64	0.3
138	23.46	0.3	7.78	-0.2	2.63	-1.5	17.61	0.9
151	15.66	-3.1 E			2.20	-2.9 E	13.54	-1.6
219	25.90	1.4	10.60	3.3 E	3.40	0.9	18.30	1.4
231	22.90	0.1	8.52	0.7	3.24	0.4	16.20	0.1
238	22.10	-0.3	8.51	0.7			13.50	-1.6
243	24.31	0.7	7.95	0.0	3.05	-0.2	16.59	0.3
248	22.90	0.1	6.75	-1.5	3.35	0.8	15.80	-0.2
264	25.90	1.4	11.70	4.7 FE	3.30	0.6	18.90	1.7
294	23.00	0.1	8.60	0.8	3.30	0.6	15.00	-0.7
327	24.00	0.6	9.00	1.3	4.10	3.2 E	18.00	1.2
330	19.95	-1.2	5.78	-2.8 E			11.17	-3.1 E
334	26.00	1.4	9.00	1.3	6.00	9.3 BE	16.00	-0.1
–	–	– –	–	– –	–	– –	–	– –
Statistical method	ISO 5725-2		ISO 5725-2		ISO 5725-2		ISO 5725-2	

Summary of laboratory test results

Sample 1.2

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Assessment	|Z|<=2.0		|Z|<=2.0		|Z|<=2.0		|Z|<=2.0	
No. of laboratories that submitted results	21		19		17		20	
Mean	22.72		7.97		3.11		16.09	
Reproducibility s.d.	2.69		1.13		0.46		2.16	
Rel. reproducibility s.d.	11.8 %		14.2 %		14.8 %		13.5 %	
SDPA	2.27		0.80		0.31		1.61	
Rel. SDPA	10.0 %		10.0 %		10.0 %		10.0 %	
Reference value	21.52		7.74		2.69		15.06	
Low er limit of tolerance	18.18		6.38		2.49		12.87	
Upper limit of tolerance	27.26		9.57		3.73		19.31	
Type B outliers					1			
Type F outliers			1					
No. of measurement values outside of tolerance limits	2		3		4		2	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	21		18		16		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-Score|>3.5	

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Summary of laboratory test results

Sample 1.2

	2,6-TDI	Z score
Unit	µg abs./filter	
33	2.10	-0.3
40	1.76	-1.9
41	2.02	-0.7
68	2.13	-0.2
98	2.61	2.0 E
111	2.17	0.0
117	2.15	-0.1
131	2.19	0.1
138	1.86	-1.4
219	2.30	0.6
231	2.17	0.0
238	2.00	-0.8
243	2.15	-0.1
248	2.04	-0.6
264	2.40	1.0
294	2.10	-0.3
327	2.80	2.9 E
330	2.34	0.8
334	2.00	-0.8
–	–	– –
Statistical method	ISO 5725-2	
Assessment	|Z|<=2.0	
No. of laboratories that submitted results	19	
Mean	2.17	
Reproducibility s.d.	0.24	

Summary of laboratory test results

Sample 1.2

	2,6-TDI	Z score
Rel. reproducibility s.d.	11.2 %	
SDPA	0.22	
Rel. SDPA	10.0 %	
Reference value	2.04	
Low er limit of tolerance	1.74	
Upper limit of tolerance	2.61	
No. of measurement values outside of tolerance limits	2	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	19	

Summary of laboratory test results

Sample 2.1

	4,4'-MDI	Z score		HDI	Z score		IPDI	Z score		2,4-TDI	Z score	
Unit	µg abs./filter			µg abs./filter			µg abs./filter			µg abs./filter		
33	2.97	-0.1		2.51	3.0	E				12.00	1.0	
40	3.03	0.0					10.05	-1.5		8.88	-1.8	
41	2.94	-0.2					12.70	0.7		11.80	0.8	
68	2.92	-0.3		1.91	-0.1		11.49	-0.3		10.85	0.0	
82	2.89	-0.4										
98	3.83	2.7	E	1.85	-0.4		11.33	-0.4		10.32	-0.5	
111	2.50	-1.7		1.89	-0.2		10.97	-0.7		9.86	-0.9	
117	3.27	0.9		2.04	0.6		10.70	-1.0		13.30	2.2	E
131	3.15	0.5		1.97	0.2		12.02	0.2		11.30	0.4	
138	2.70	-1.0		0.11	-9.4	BE	12.88	0.9		9.54	-1.2	
151	2.62	-1.3					8.89	-2.5	E	9.16	-1.6	
219	3.50	1.6		1.20	-3.8	FE	13.80	1.7		12.60	1.6	
231	2.90	-0.4		1.41	-2.7	E	12.50	0.6		10.40	-0.4	
238	2.50	-1.7		1.92	0.0					11.10	0.2	
243	2.94	-0.3		1.83	-0.5		11.23	-0.5		10.51	-0.3	
248	2.91	-0.3		1.56	-1.9		12.60	0.6		10.00	-0.8	
264	3.20	0.6		2.60	3.5	FE	12.30	0.4		12.20	1.2	
294	3.00	0.0		2.20	1.4		12.00	0.1		10.00	-0.8	
327	3.20	0.6		2.30	1.9		14.00	1.8		12.00	1.0	
330	3.28	0.9		1.63	-1.5					6.75	-3.8	FE
334	3.00	0.0		1.00	-4.8	FE	20.00	6.9	BE	11.00	0.1	
–	–	– –		–	– –		–	– –		–	– –	
Statistical method	ISO 5725-2			ISO 5725-2			ISO 5725-2			ISO 5725-2		

Summary of laboratory test results

Sample 2.1

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Assessment	|Z|<=2.0		|Z|<=2.0		|Z|<=2.0		|Z|<=2.0	
No. of laboratories that submitted results	21		17		17		20	
Mean	3.01		1.92		11.84		10.89	
Reproducibility s.d.	0.31		0.30		1.32		1.21	
Rel. reproducibility s.d.	10.4 %		15.6 %		11.2 %		11.1 %	
SDPA	0.30		0.19		1.18		1.09	
Rel. SDPA	10.0 %		10.0 %		10.0 %		10.0 %	
Reference value	2.77		1.90		10.58		9.92	
Low er limit of tolerance	2.41		1.54		9.47		8.71	
Upper limit of tolerance	3.61		2.31		14.21		13.06	
Type B outliers			1		1			
Type F outliers			3				1	
No. of measurement values outside of tolerance limits	1		6		2		2	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	21		13		16		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-Score|>3.5	

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Summary of laboratory test results

Sample 2.1

	2,6-TDI	Z score
Unit	µg abs./filter	
33	19.80	1.4
40	15.28	-1.2
41	17.60	0.1
68	17.21	-0.1
98	18.34	0.5
111	14.35	-1.8
117	16.60	-0.5
131	16.56	-0.5
138	17.48	0.0
219	19.30	1.1
231	16.90	-0.3
238	20.90	2.0
243	14.40	-1.7
248	15.80	-0.9
264	17.60	0.1
294	17.00	-0.2
327	21.00	2.0 E
330	14.14	-1.9
334	21.00	2.0 E
–	–	– –
Statistical method	ISO 5725-2	
Assessment	|Z|<=2.0	
No. of laboratories that submitted results	19	
Mean	17.43	
Reproducibility s.d.	2.19	

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Summary of laboratory test results

Sample 2.1

	2,6-TDI	Z score
Rel. reproducibility s.d.	12.6 %	
SDPA	1.74	
Rel. SDPA	10.0 %	
Reference value	15.47	
Low er limit of tolerance	13.95	
Upper limit of tolerance	20.92	
No. of measurement values outside of tolerance limits	2	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	19	

Summary of laboratory test results

Sample 2.2

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Unit	µg abs./filter		µg abs./filter		µg abs./filter		µg abs./filter	
33	2.63	-1.3	2.52	4.1 FE			12.20	1.2
40	2.95	-0.2			9.99	-1.6	8.77	-2.0
41	3.02	0.0			13.20	1.1	11.50	0.5
68	3.11	0.3	1.94	0.9	12.62	0.6	11.70	0.7
82	2.94	-0.2						
98	3.97	3.2 E	1.92	0.7	11.74	-0.1	10.74	-0.2
111	2.41	-2.0	1.92	0.7	10.49	-1.2	9.42	-1.4
117	3.37	1.2	2.05	1.5	11.00	-0.8	13.80	2.6 E
131	2.99	-0.1	1.84	0.3	11.42	-0.4	10.69	-0.2
138	2.65	-1.2	0.11	-9.4 BE	12.16	0.2	9.64	-1.2
151	2.79	-0.7			9.26	-2.2 E	9.62	-1.2
219	3.50	1.6	1.20	-3.3 E	14.00	1.8	12.90	1.8
231	2.82	-0.6	1.38	-2.3 E	12.50	0.5	10.20	-0.7
238	2.48	-1.8	1.92	0.7			11.20	0.2
243	3.06	0.2	1.90	0.7	11.69	-0.2	10.95	0.0
248	2.67	-1.1	1.34	-2.5 E	11.60	-0.3	9.50	-1.3
264	3.10	0.3	2.60	4.6 FE	12.70	0.7	12.30	1.3
294	2.80	-0.7	2.00	1.2	12.00	0.1	9.60	-1.2
327	3.20	0.6	2.20	2.3 E	14.00	1.8	12.00	1.0
330	3.70	2.3 E	1.61	-1.0			6.54	-4.0 FE
334	3.00	0.0	1.00	-4.4 FE	20.00	6.8 BE	11.00	0.1
–	–	– –	–	– –	–	– –	–	– –
Statistical method	ISO 5725-2		ISO 5725-2		ISO 5725-2		ISO 5725-2	

Summary of laboratory test results

Sample 2.2

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Assessment	|Z|<=2.0		|Z|<=2.0		|Z|<=2.0		|Z|<=2.0	
No. of laboratories that submitted results	21		17		17		20	
Mean	3.01		1.79		11.90		10.93	
Reproducibility s.d.	0.39		0.31		1.31		1.34	
Rel. reproducibility s.d.	12.9 %		17.1 %		11.1 %		12.3 %	
SDPA	0.30		0.18		1.19		1.09	
Rel. SDPA	10.0 %		10.0 %		10.0 %		10.0 %	
Reference value	2.77		1.90		10.58		9.92	
Low er limit of tolerance	2.41		1.43		9.52		8.75	
Upper limit of tolerance	3.61		2.14		14.28		13.12	
Type B outliers			1		1			
Type F outliers			3				1	
No. of measurement values outside of tolerance limits	2		8		2		2	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	21		13		16		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-Score|>3.5	

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Summary of laboratory test results

Sample 2.2

	2,6-TDI	Z score	
Unit	µg abs./filter		
33	19.80	1.4	
40	15.17	-1.3	
41	18.00	0.3	
68	16.86	-0.3	
98	19.06	1.0	
111	14.04	-1.9	
117	17.00	-0.2	
131	14.77	-1.5	
138	17.65	0.1	
219	19.30	1.1	
231	16.70	-0.4	
238	20.30	1.7	
243	14.97	-1.4	
248	15.40	-1.1	
264	17.80	0.2	
294	16.00	-0.8	
327	22.00	2.6	E
330	14.70	-1.5	
334	21.00	2.1	E
–	–	– –	
Statistical method	ISO 5725-2		
Assessment	|Z|<=2.0		
No. of laboratories that submitted results	19		
Mean	17.40		
Reproducibility s.d.	2.34		

Summary of laboratory test results

Sample 2.2

	2,6-TDI	Z score
Rel. reproducibility s.d.	13.4 %	
SDPA	1.74	
Rel. SDPA	10.0 %	
Reference value	15.47	
Low er limit of tolerance	13.92	
Upper limit of tolerance	20.88	
No. of measurement values outside of tolerance limits	2	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	19	

Summary of laboratory test results

Sample 3.1

	4,4'-MDI	Z score		HDI	Z score		IPDI	Z score		2,4-TDI	Z score	
Unit	µg abs./filter			µg abs./filter			µg abs./filter			µg abs./filter		
33	13.00	0.8		18.00	2.1	E				2.81	2.2	E
40	10.41	-1.3		10.57	-2.9	E	16.43	-1.6		1.81	-2.2	E
41	11.70	-0.3		13.30	-1.1		20.60	0.5		3.08	3.4	E
68	12.63	0.5		17.01	1.4		19.55	0.0		2.31	0.0	
82	11.72	-0.3										
98	13.91	1.6		15.88	0.7		19.74	0.1		2.13	-0.8	
111	9.43	-2.2	E	13.89	-0.7		18.11	-0.8		2.00	-1.3	
117	13.00	0.8		15.20	0.2		17.50	-1.1		2.67	1.6	
131	12.30	0.2		14.31	-0.4		19.13	-0.3		2.24	-0.3	
138	12.41	0.3		16.49	1.1		22.76	1.6		2.66	1.5	
151	9.22	-2.3	E				15.18	-2.3	E	1.88	-1.8	
219	14.80	2.3	E	19.80	3.3	E	24.30	2.4	E	2.60	1.3	
231	12.70	0.6		12.00	-1.9		20.60	0.5		2.08	-1.0	
238	10.10	-1.6		15.00	0.1					2.00	-1.3	
243	12.43	0.3		14.40	-0.3		19.28	-0.2		2.24	-0.3	
248	11.40	-0.5		13.40	-1.0		20.40	0.4		2.84	2.3	E
264	13.20	1.0		20.80	4.0	FE	21.20	0.8		2.50	0.8	
294	12.00	0.0		16.00	0.8		20.00	0.2		2.00	-1.3	
327	13.00	0.8		16.00	0.8		23.00	1.7		2.60	1.3	
330	11.19	-0.7		11.42	-2.3	E				1.68	-2.7	E
334	12.00	0.0		9.00	-3.9	FE	16.00	-1.9		2.00	-1.3	
–	–	– –		–	– –		–	– –		–	– –	
Statistical method	ISO 5725-2			ISO 5725-2			ISO 5725-2			ISO 5725-2		

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Summary of laboratory test results

Sample 3.1

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Assessment	|Z|<=2.0		|Z|<=2.0		|Z|<=2.0		|Z|<=2.0	
No. of laboratories that submitted results	21		19		17		20	
Mean	12.03		14.86		19.63		2.31	
Reproducibility s.d.	1.39		2.37		2.48		0.39	
Rel. reproducibility s.d.	11.6 %		15.9 %		12.6 %		16.9 %	
SDPA	1.20		1.49		1.96		0.23	
Rel. SDPA	10.0 %		10.0 %		10.0 %		10.0 %	
Reference value	11.31		14.46		17.27		2.18	
Low er limit of tolerance	9.62		11.89		15.71		1.85	
Upper limit of tolerance	14.43		17.84		23.56		2.77	
Type F outliers			2					
No. of measurement values outside of tolerance limits	3		6		2		5	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	21		17		17		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-Score|>3.5								

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Summary of laboratory test results

Sample 3.1

	2,6-TDI	Z score
Unit	µg abs./filter	
33	10.40	1.7
40	8.46	-0.5
41	8.03	-0.9
68	9.20	0.4
98	10.00	1.3
111	7.10	-2.0
117	8.45	-0.5
131	7.84	-1.2
138	6.96	-2.2 E
219	10.80	2.2 E
231	9.28	0.5
238	9.25	0.4
243	7.89	-1.1
248	7.85	-1.1
264	9.40	0.6
294	8.20	-0.8
327	11.00	2.4 E
330	9.37	0.6
334	9.00	0.1
–	–	– –
Statistical method	ISO 5725-2	
Assessment	|Z|<=2.0	
No. of laboratories that submitted results	19	
Mean	8.87	
Reproducibility s.d.	1.16	

Summary of laboratory test results

Sample 3.1

	2,6-TDI	Z score
Rel. reproducibility s.d.	13.1 %	
SDPA	0.89	
Rel. SDPA	10.0 %	
Reference value	8.21	
Low er limit of tolerance	7.09	
Upper limit of tolerance	10.64	
No. of measurement values outside of tolerance limits	3	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	19	

Summary of laboratory test results

Sample 3.2

	4,4'-MDI	Z score		HDI	Z score		IPDI	Z score		2,4-TDI	Z score	
Unit	µg abs./filter			µg abs./filter			µg abs./filter			µg abs./filter		
33	12.60	0.4		17.50	2.0					2.67	1.6	
40	9.99	-1.7		10.10	-3.1	E	15.52	-2.1	E	1.78	-2.3	E
41	11.50	-0.5		12.70	-1.3		19.90	0.2		3.13	3.5	E
68	12.62	0.4		17.87	2.2	E	21.32	0.9		2.26	-0.2	
82	11.93	-0.1										
98	13.92	1.5		15.82	0.8		19.68	0.0		2.18	-0.6	
111	9.80	-1.9		14.39	-0.2		18.55	-0.5		2.07	-1.0	
117	13.30	1.0		15.60	0.7		17.90	-0.9		2.73	1.8	
131	12.48	0.3		14.53	-0.1		19.44	-0.1		2.27	-0.2	
138	11.70	-0.3		15.91	0.9		21.18	0.8		2.86	2.4	E
151	9.53	-2.1	E				15.54	-2.1	E	1.93	-1.6	
219	14.70	2.2	E	20.40	3.9	FE	24.60	2.6	E	3.70	6.0	FE
231	13.00	0.8		13.00	-1.1		21.30	0.9		2.12	-0.8	
238	11.90	-0.1		17.40	1.9					2.35	0.2	
243	11.63	-0.4		13.49	-0.8		18.05	-0.8		2.10	-0.9	
248	11.80	-0.2		13.70	-0.6		21.00	0.7		2.84	2.3	E
264	13.40	1.1		20.90	4.3	FE	21.20	0.8		2.50	0.8	
294	11.00	-0.9		15.00	0.2		20.00	0.2		2.00	-1.3	
327	13.00	0.8		16.00	0.9		23.00	1.7		2.50	0.8	
330	11.85	-0.2		11.27	-2.3	E				1.62	-3.0	E
334	12.00	-0.1		9.00	-3.9	FE	15.00	-2.3	E	2.00	-1.3	
–	–	– –		–	– –		–	– –		–	– –	
Statistical method	ISO 5725-2			ISO 5725-2			ISO 5725-2			ISO 5725-2		

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Summary of laboratory test results

Sample 3.2

	4,4'-MDI	Z score	HDI	Z score	IPDI	Z score	2,4-TDI	Z score
Assessment	|Z|<=2.0		|Z|<=2.0		|Z|<=2.0		|Z|<=2.0	
No. of laboratories that submitted results	21		19		17		20	
Mean	12.08		14.64		19.60		2.31	
Reproducibility s.d.	1.30		2.20		2.63		0.40	
Rel. reproducibility s.d.	10.8 %		15.0 %		13.4 %		17.3 %	
SDPA	1.21		1.46		1.96		0.23	
Rel. SDPA	10.0 %		10.0 %		10.0 %		10.0 %	
Reference value	11.31		14.46		17.27		2.18	
Low er limit of tolerance	9.66		11.71		15.68		1.85	
Upper limit of tolerance	14.49		17.57		23.52		2.77	
Type F outliers			3				1	
No. of measurement values outside of tolerance limits	2		6		4		6	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	21		16		17		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-Score|>3.5								

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Summary of laboratory test results

Sample 3.2

	2,6-TDI	Z score	
Unit	µg abs./filter		
33	10.40	1.7	
40	8.27	-0.7	
41	7.75	-1.3	
68	8.51	-0.4	
98	9.99	1.2	
111	7.27	-1.8	
117	8.66	-0.3	
131	7.96	-1.1	
138	6.60	-2.6	E
219	10.90	2.3	E
231	9.49	0.7	
238	11.00	2.4	E
243	7.34	-1.7	
248	8.14	-0.9	
264	9.40	0.6	
294	8.00	-1.0	
327	11.00	2.4	E
330	9.37	0.5	
334	9.00	0.1	
–	–	– –	
Statistical method	ISO 5725-2		
Assessment	|Z|<=2.0		
No. of laboratories that submitted results	19		
Mean	8.90		
Reproducibility s.d.	1.33		

Summary of laboratory test results

Sample 3.2

	2,6-TDI	Z score
Rel. reproducibility s.d.	14.9 %	
SDPA	0.89	
Rel. SDPA	10.0 %	
Reference value	8.21	
Low er limit of tolerance	7.12	
Upper limit of tolerance	10.68	
No. of measurement values outside of tolerance limits	4	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	19	

Summary of laboratory test results

Sample 4.1

	NDI	Z score	
Unit	µg abs./filter		
33	12.30	1.0	
41	11.60	0.3	
68	11.76	0.5	
98	15.17	3.5	BE
111	9.90	-1.2	
117	11.40	0.2	
131	10.12	-1.0	
138	11.00	-0.2	
219	12.50	1.2	
231	11.90	0.6	
243	10.05	-1.0	
248	10.20	-0.9	
294	28.00	15.0	BE
327	11.00	-0.2	
334	12.00	0.7	
–	–	– –	
Statistical method	ISO 5725-2		
Assessment	|Z|<=2.0		
No. of laboratories that submitted results	15		
Mean	11.21		
Reproducibility s.d.	0.90		
Rel. reproducibility s.d.	8.1 %		
SDPA	1.12		

Summary of laboratory test results

Sample 4.1

	NDI	Z score
Rel. SDPA	10.0 %	
Reference value	11.27	
Low er limit of tolerance	8.97	
Upper limit of tolerance	13.45	
Type B outliers	2	
No. of measurement values outside of tolerance limits	2	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	13	
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		

Summary of laboratory test results

Sample 4.2

	NDI	Z score	
Unit	µg abs./filter		
33	12.00	0.9	
41	11.70	0.6	
68	11.81	0.7	
98	15.67	4.2	BE
111	9.48	-1.4	
117	12.00	0.9	
131	10.15	-0.8	
138	10.80	-0.2	
219	11.90	0.8	
231	12.00	0.9	
243	10.10	-0.9	
248	8.67	-2.2	E
294	27.00	14.4	BE
327	11.00	0.0	
334	12.00	0.9	
–	–	– –	
Statistical method	ISO 5725-2		
Assessment	|Z|<=2.0		
No. of laboratories that submitted results	15		
Mean	11.05		
Reproducibility s.d.	1.13		
Rel. reproducibility s.d.	10.2 %		
SDPA	1.10		

Summary of laboratory test results

Sample 4.2

	NDI	Z score
Rel. SDPA	10.0 %	
Reference value	11.27	
Low er limit of tolerance	8.84	
Upper limit of tolerance	13.26	
Type B outliers	2	
No. of measurement values outside of tolerance limits	3	
No. of laboratories after elimination of outliers type A-D and F (w ithout laboratories that only gave states but no measured values)	13	
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		