

Analytische Qualitätssicherung Baden-Württemberg

Proficiency Tests UKWIR 1/20 to 5/20
priority substances in surface water -

benzo[a]pyrene, fluoranthene, perfluorooctane sulfonic acid,
perfluorooctanoic acid, cypermethrin, hexabromocyclodecane,
nonylphenol, octylphenol

Stuttgart, July 2020

provided by
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Release of the report: 07 July 2020
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General

This PT was provided by AQS Baden-Württemberg as a subcontractor for wca environment limited, Brunel House, Volunteer Way, Faringdon, Oxfordshire SN7 7YR, United Kingdom on behalf of United Kingdom Water Industry Research (UKWIR).

In three rounds the following determinands were to be measured:

- UKWIR 1/20
 - benzo[a]pyrene
 - fluoranthene
- UKWIR 2/20
 - perfluorooctane sulfonic acid (PFOS)
 - perfluorooctanoic acid (PFOA)
- UKWIR 3/20
 - cypermethrin
- UKWIR 4/20
 - hexabromocyclododecane (HBCDD)
- UKWIR 5/20
 - nonylphenol
 - octylphenol

The PTs were executed and evaluated according to the requirements of ISO 13528: 2015.

PT design

Each participant received the following samples for the PT rounds UKWIR 1/20-4/20:

- 3 spiked samples for the determination of the respective determinands based on a filtered surface water sample in 1000 ml glass bottles with ground glass plug
- 1 blank sample of the filtered surface water

For the PT round UKWIR 5/20 the participants received following samples:

- 3 spiked samples for the determination of the respective determinands based on a filtered and pasteurised effluent of a waste water treatment plant in 1000 ml glass bottles with ground glass plug
- 1 blank sample of the filtered and pasteurised waste water

The concentrations of the analytes of the spiked samples were chosen according to the requirements of UKWIR based on the European Regulation for Environmental Quality Standard (Directive 2008/105/EG on environmental quality standards in the field of water policy).

The samples were cooled directly after preparation and dispatched with freezer packs added to the packages by express service (TNT). Participants were requested to start with the analysis one day after receipt of the samples at the latest.

Analytical methods

The participants were free to choose a suitable method, but the following limits of quantification were required:

Determinand	Required LOQ in µg/l
benzo[a]pyrene	0.0005
fluoranthene	0.0018
PFOS	0.002
PFOA	0.002
cypermethrin	0.0004
HBCDD	0.0092
nonylphenol	0.05
octylphenol	0.01

The samples had to be analysed in duplicate over the complete method (sample preparation and measurement). The participants were asked to submit the results as average values in µg/l with three significant digits.

Evaluation procedure

The statistical evaluation was executed according to ISO 13528:2015 with the combined estimator Hampel/Q-method, a method of robust statistics.

For the PT 1/20 the assigned value x_{pt} was derived from participants' results using the Hampel estimator, for the PTs 3/20 to 4/20 due to the low number of results in UKWIR PT 7/19 we used an arithmetic mean after exclusion of the gross outliers.

The uncertainty of the assigned value was calculated according to ISO 13528:

$$u(x_{pt}) = \frac{1,25 \times s^*}{\sqrt{p}}$$

s^* : standard deviation calculated from the results using the Q-method

p : number of results

For PT 2/20 the assigned value was calculated from the formulation of the sample, the spiked amount plus the median of the blank analyses of the participating laboratories. In this case the uncertainty was calculated from the uncertainties of the weighings plus the uncertainty of the median of blank analyses.

The standard deviation for proficiency assessment σ_{pt} was calculated in accordance with the European QA/QC Directive: $\sigma_{pt} = 0,25 * x_{pt}$.

A z-score was calculated for each measurement result derived from the assigned value x_{pt} and the standard deviation for proficiency assessment σ_{pt} :

$$z = \frac{x - x_{pt}}{\sigma_{pt}}$$

The assessment of the results was as follows:

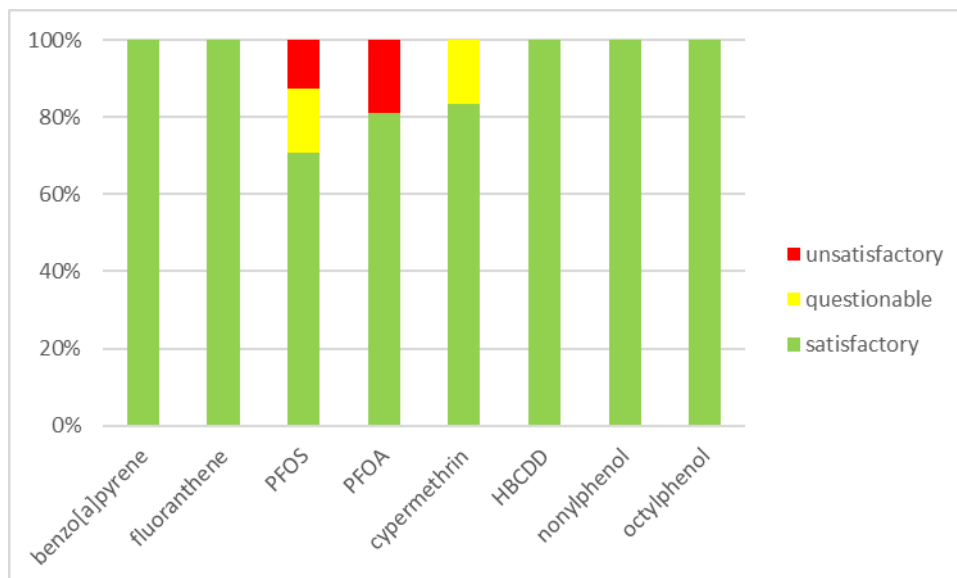
- |z| ≤ 2.0 satisfactory
- 2.0 < |z| < 3.0 questionable
- |z| ≥ 3.0 unsatisfactory

Results of evaluation

Number of participants:

PT round	determinands	number of participants	number of participants reporting results
UKWIR 1/20	benzo[a]pyrene fluoranthene	7	6
UKWIR 2/20	perfluorooctane sulfonic acid (PFOS) perfluorooctanoic acid (PFOA)	8	8
UKWIR 3/20	cypermethrin	6	6
UKWIR 4/20	HBCDD	7	5
UKWIR 5/20	nonylphenol octylphenol	8	4

In the following figure the percentage of satisfactory, questionable and unsatisfactory results are illustrated.



Explanation of tables and graphs in the appendix

The appendix contains the PT data for all parameters and all samples in tables and graphs. For each parameter the following illustrations are given:

Parameter table

In these tables the following values for each concentration level are listed:

- assigned value in µg/l
- expanded uncertainty of the assigned value in %
- standard deviation of the data set in µg/l, calculated using the Q-method (due to the often low number of participants this standard deviation estimate is not very reliable)
- standard deviation for proficiency assessment in µg/l for the calculation of z-scores (25 % of the assigned value)
- rel. standard deviation for proficiency assessment in %
- tolerance limits above and below in µg/l and % (limit for assessment as 'satisfactory')
- number of values in this level
- number of not satisfactory values ('questionable' or unsatisfactory') below and above the assigned value and the percentage of these values in total

Relative standard deviation

The diagrams for the rel. standard deviation vs. the assigned value show the values compared to the fixed standard deviation for proficiency assessment (horizontal line at 25%) and the concentration dependence.

Sample table

In this table all results of the participants are noted together with uncertainties (where reported). For these uncertainties ζ -scores (zeta-scores) are calculated according to the formula

$$\zeta = \frac{x - x_{pt}}{\sqrt{u_{lab}^2 + u_{x_{pt}}^2}}$$

With

x = result of the participant

x_{pt} = assigned value

u_{lab} = participant's standard uncertainty

$u_{x,pt}$ = standard uncertainty of the assigned value

ζ -scores can be used for the plausibility check of measurement uncertainties. The type of assessment is equivalent to that of z-scores, i.e. an absolute value of $\leq 2,0$ can be regarded as 'satisfactory'.

ζ -scores above this value indicate an underestimation of the measurement uncertainty. This table also contains the assigned value and its uncertainty as well as the tolerance limits ($z = \pm 2,0$).

Sample graphs of concentrations

All participants' results, sorted for values, are shown here versus the laboratory codes. The assigned value and its uncertainty as well as the tolerance limits are also included.

z-score graphs

In a similar way the z-scores attributed to the participants' results are shown here versus the laboratory codes.

Graphs of expanded uncertainty

The expanded uncertainty is shown if laboratories reported uncertainties.

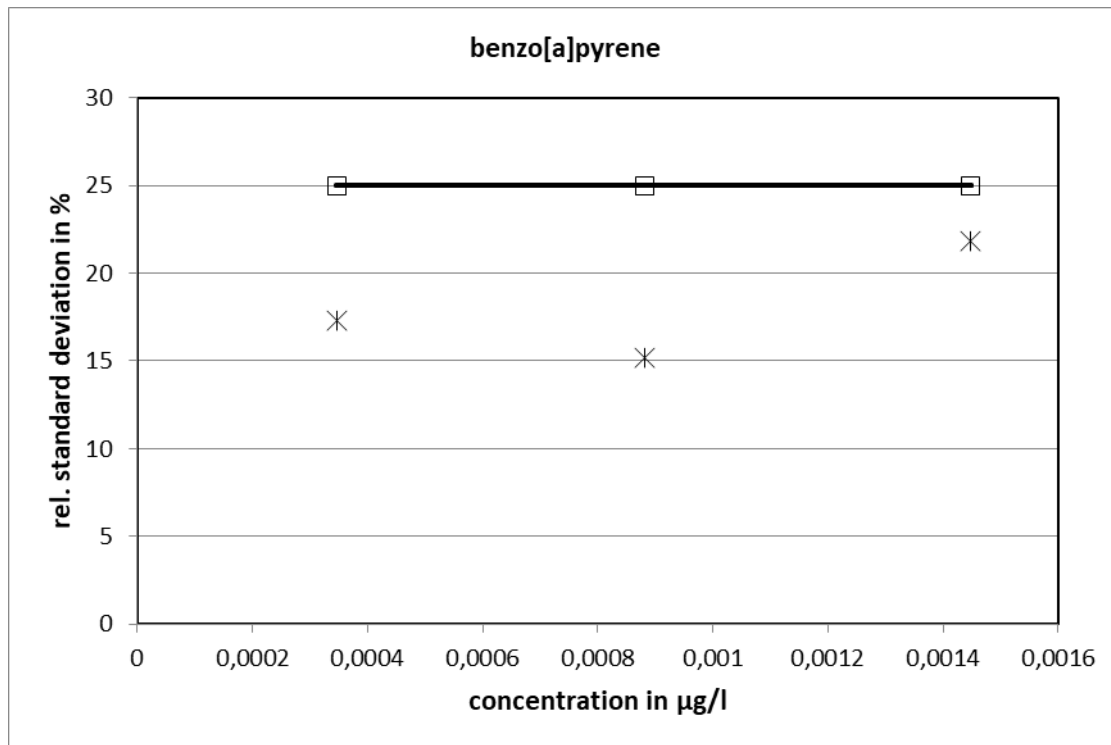
ζ -score graphs

If laboratories reported uncertainties, ζ -scores were calculated and are shown versus the laboratory codes.

UKWIR 1/20

benzo[a]pyrene														
level	assigned value [µg/l]	expanded uncertainty of the assigned value [%]	standard deviation, calculated using robust statistics [µg/l]	standard deviation for proficiency assessment [µg/l]	standard deviation for proficiency assessment [%]	upper tolerance limit [µg/l]	lower tolerance limit [µg/l]	upper tolerance limit [%]	lower tolerance limit [%]	number of results	out below	out above	out [%]	
1	0,0009	15,49	0,0001	0,0002	25,00	0,0013	0,0004	50,00	-50,00	6	0	0	0,0	
2	0,0003	19,32	0,0001	0,0001	25,00	0,0005	0,0002	50,00	-50,00	5	0	0	0,0	
3	0,0014	22,28	0,0003	0,0004	25,00	0,0022	0,0007	50,00	-50,00	6	0	0	0,0	
										sum	17	0	0	0,0

Relative standard deviation

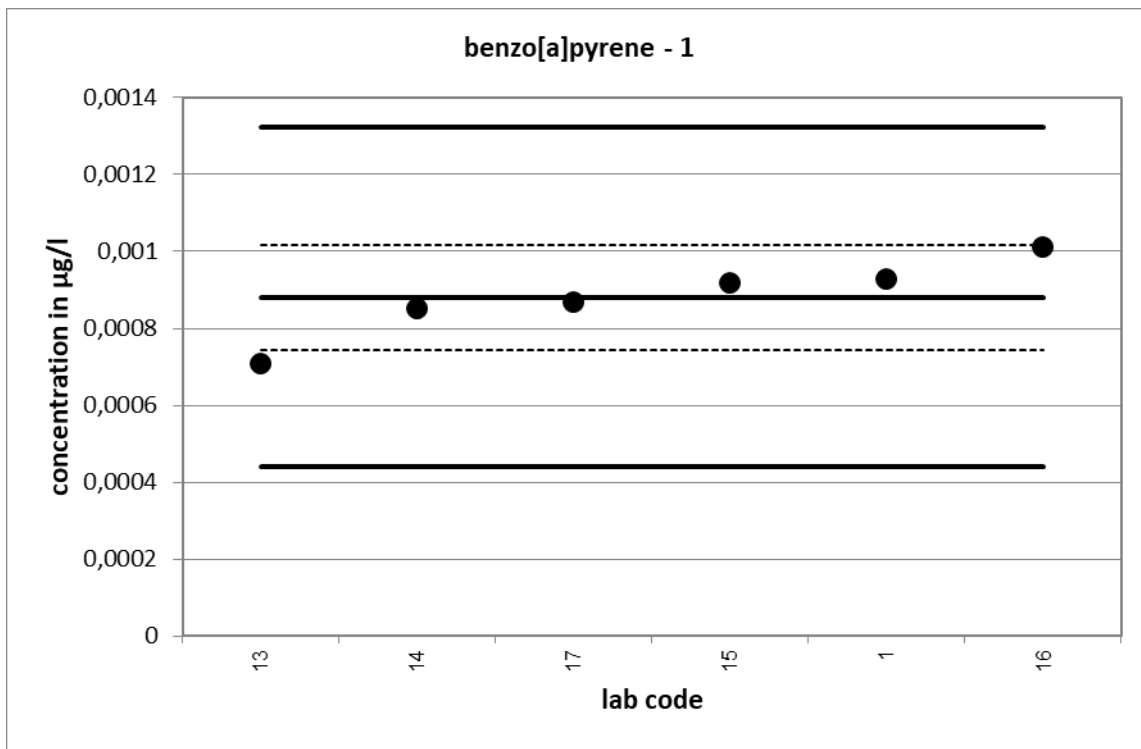


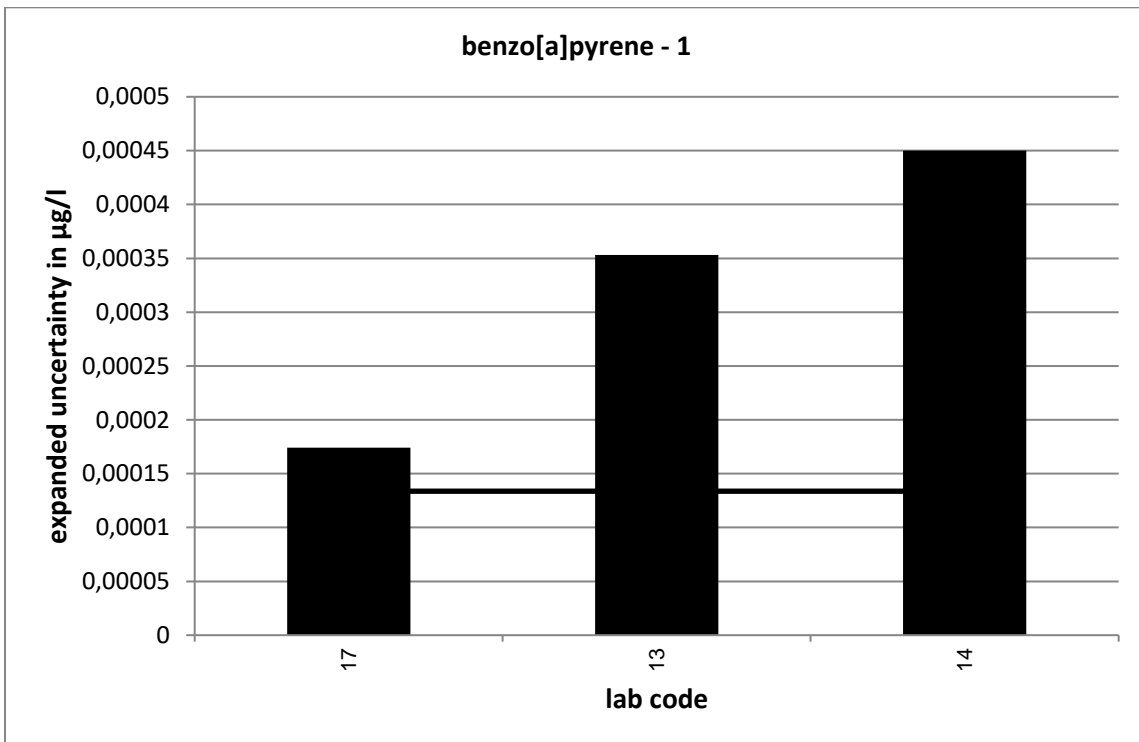
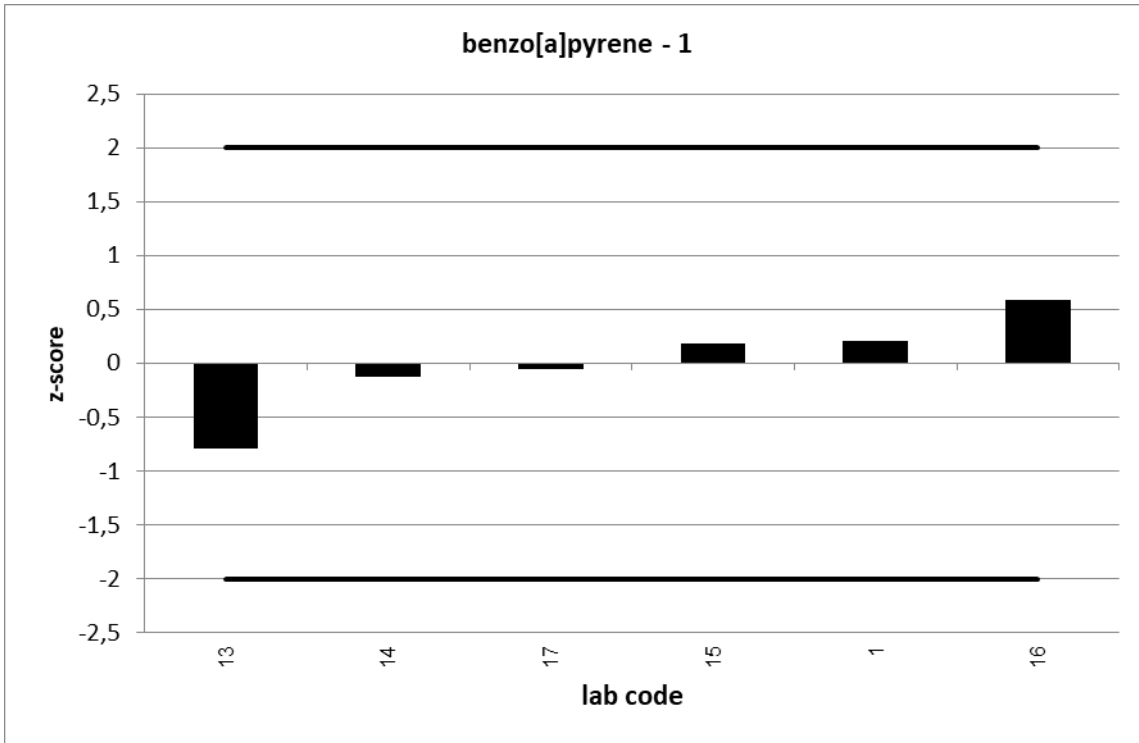
25 % is the value used as standard deviation for proficiency assessment.

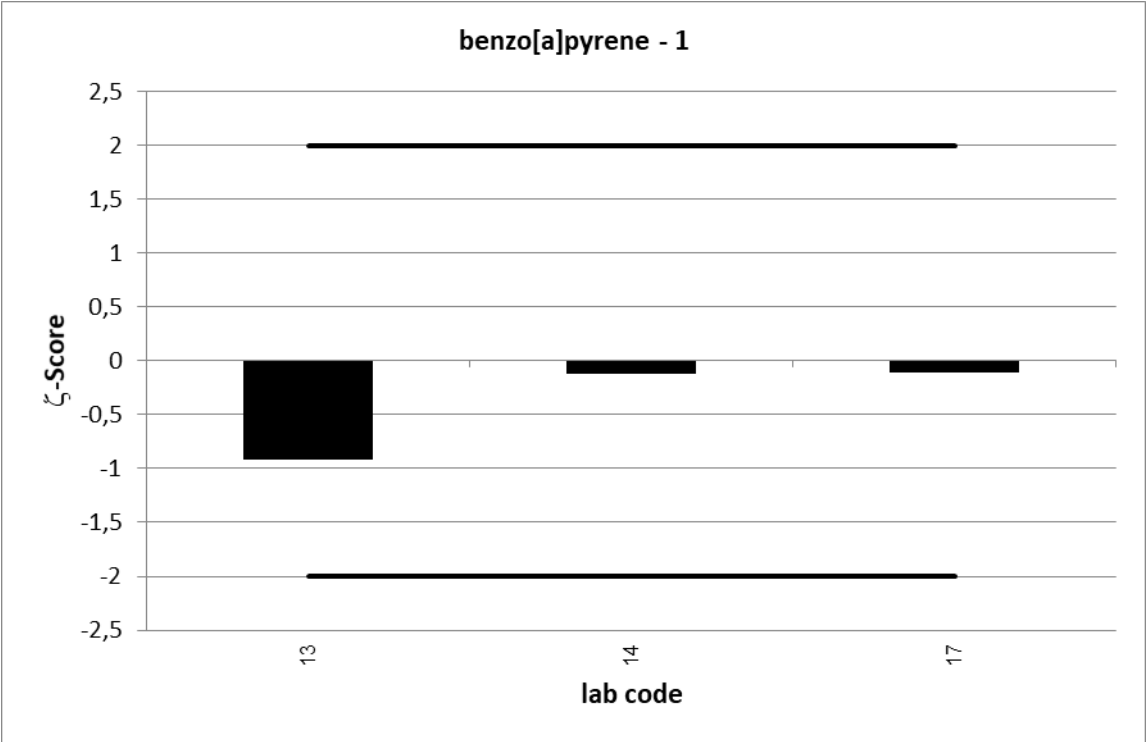
UKWIR PT 1/20		benzo[a]pyrene - 1			
assigned value [$\mu\text{g/l}$]*		0,000881		$\pm 0,0001365$	
upper tolerance limit [$\mu\text{g/l}$]		0,001322			
lower tolerance limit [$\mu\text{g/l}$]		0,0004405			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
1	0,000927			0,2	s
13	0,000707	4E-04	-0,9	-0,8	s
14	0,000853	5E-04	-0,1	-0,1	s
15	0,00092			0,2	s
16	0,00101			0,6	s
17	0,000869	2E-04	-0,1	-0,1	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



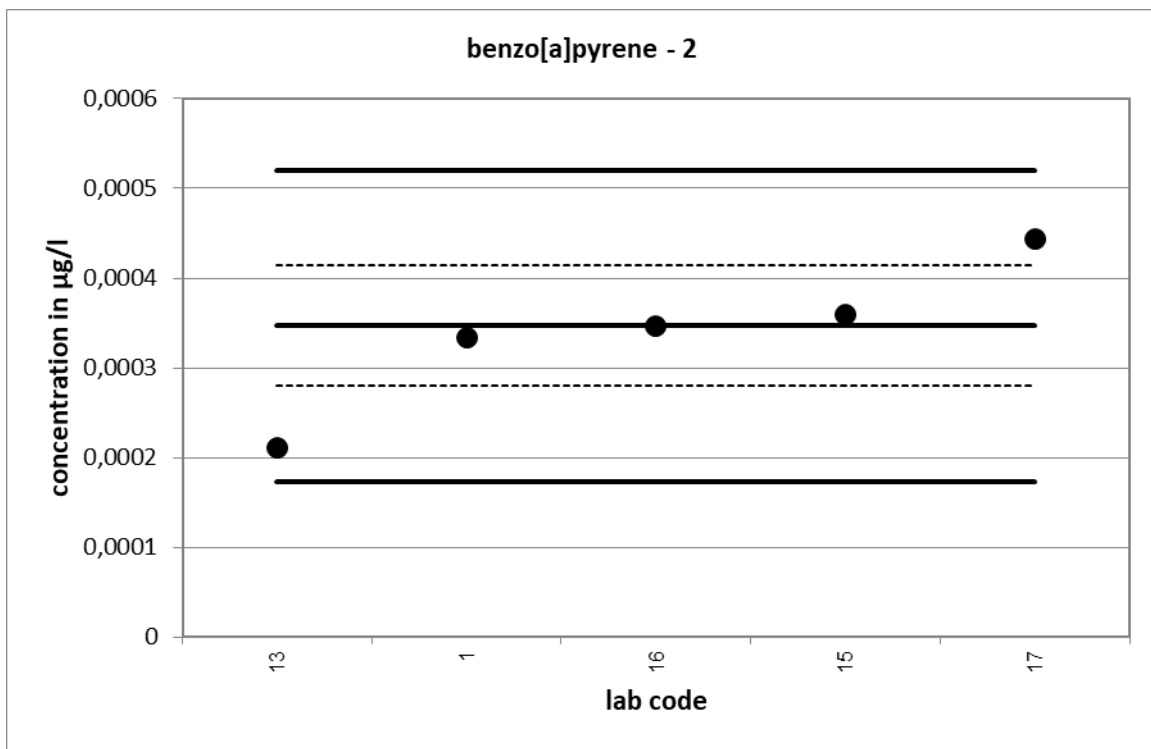


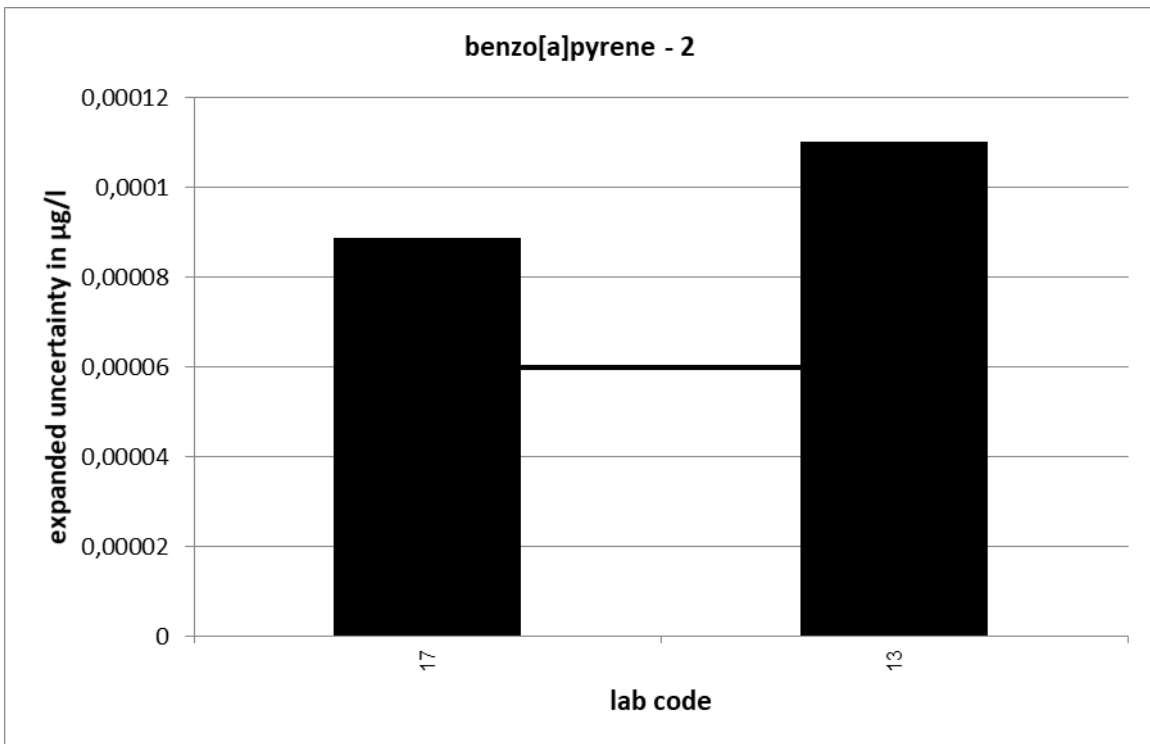
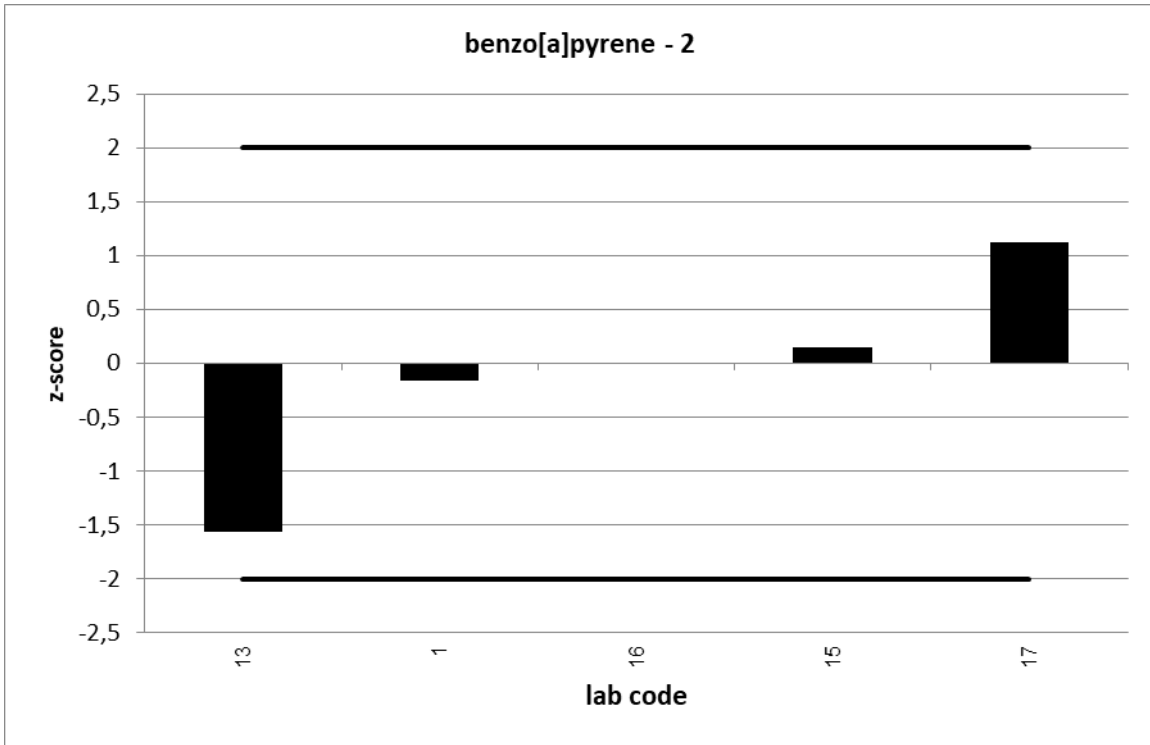


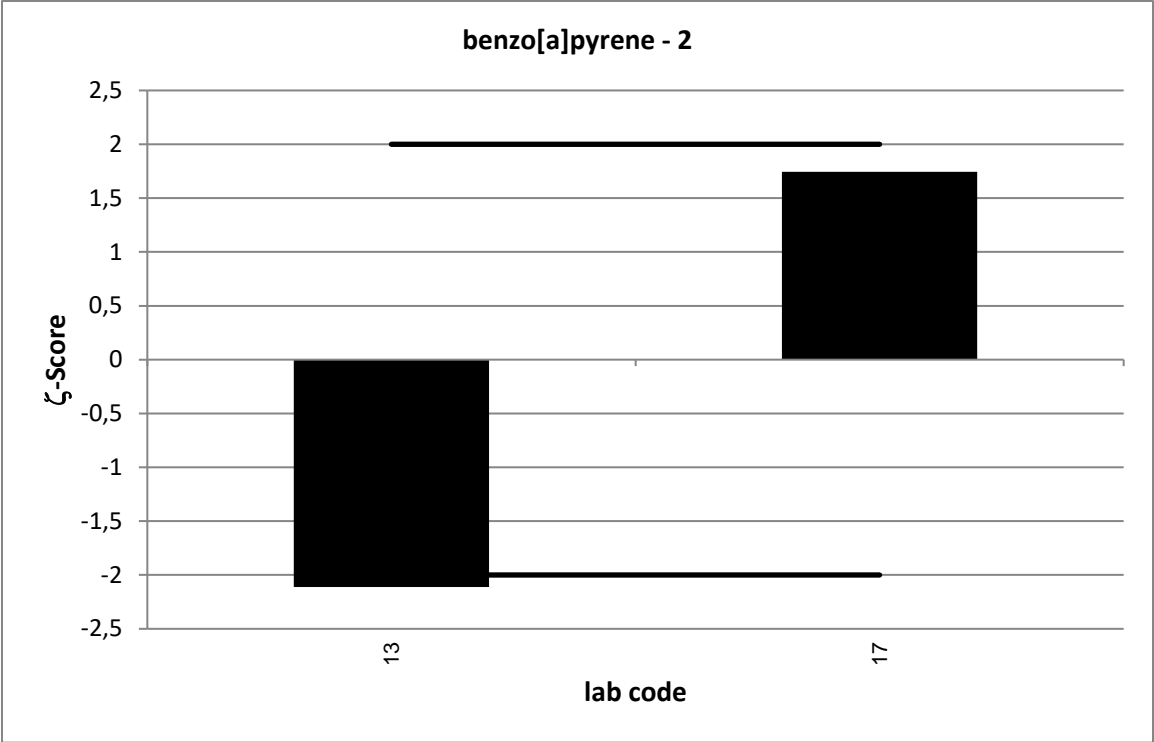
UKWIR PT 1/20		benzo[a]pyrene - 2			
assigned value [$\mu\text{g/l}$]*		0,000347 \pm 0,000067			
upper tolerance limit [$\mu\text{g/l}$]		0,0005205			
lower tolerance limit [$\mu\text{g/l}$]		0,0001735			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
1	0,000333			-0,2	s
13	0,000211	1E-04	-2,1	-1,6	s
15	0,00036			0,1	s
16	0,000347			0,0	s
17	0,000444	9E-05	1,7	1,1	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



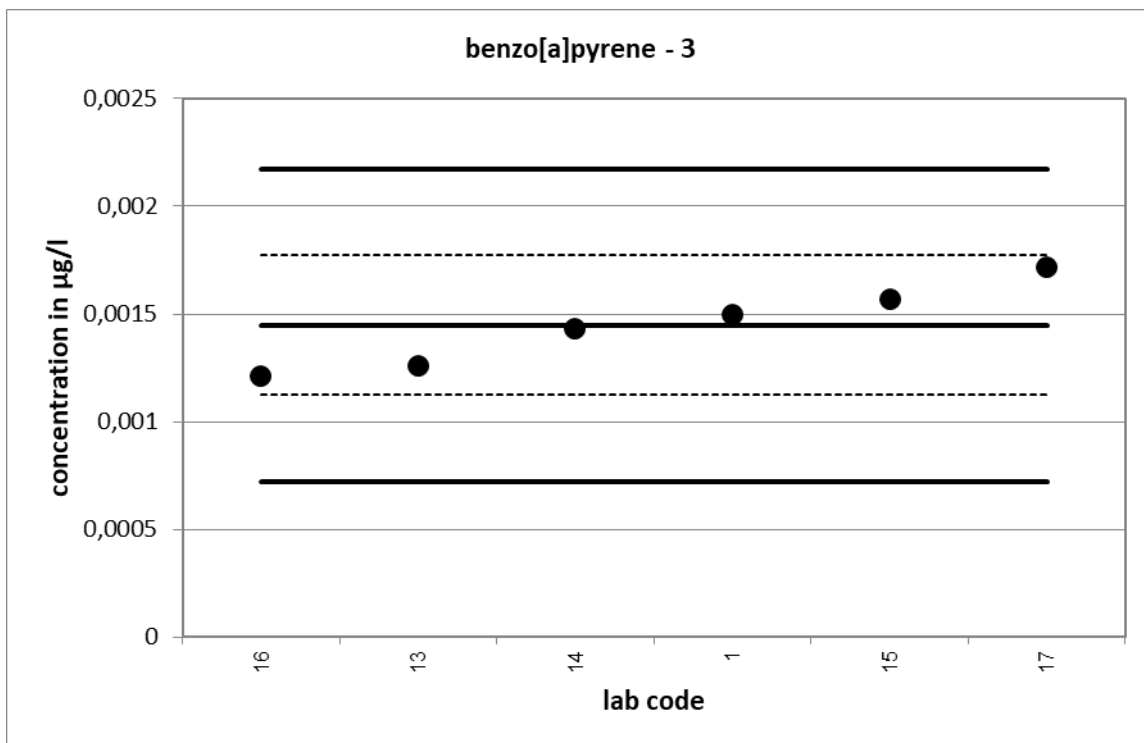


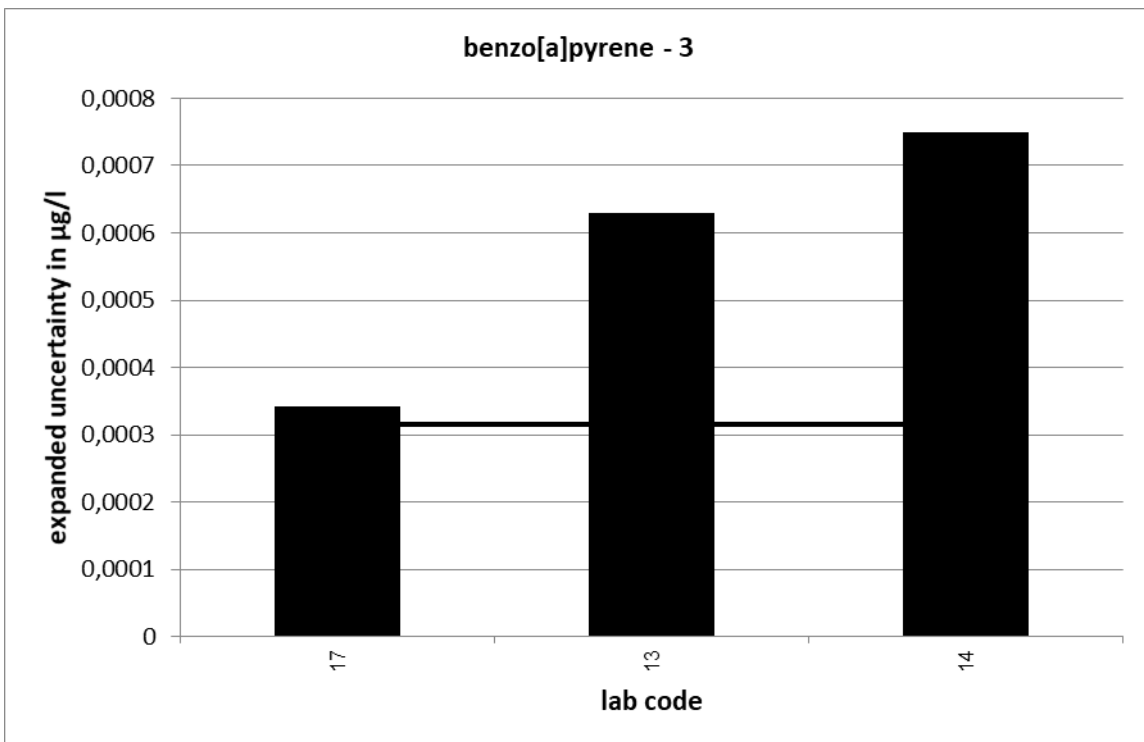
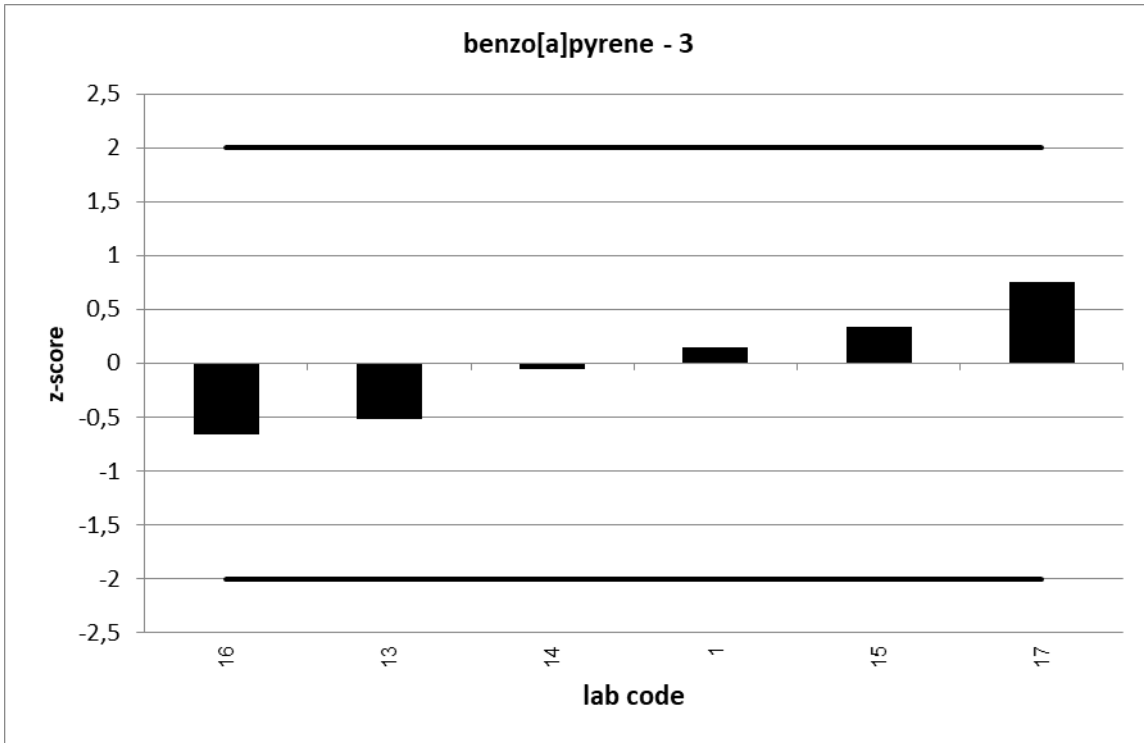


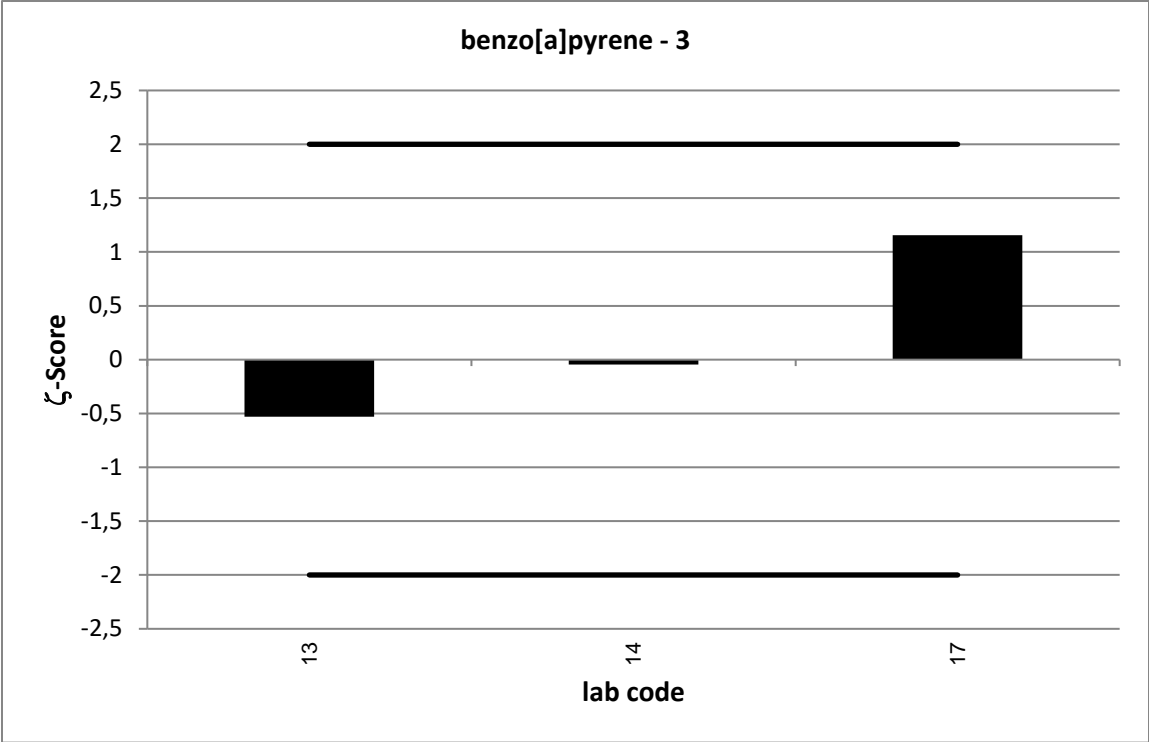
UKWIR PT 1/20		benzo[a]pyrene - 3			
assigned value [$\mu\text{g/l}$]*		0,001448 \pm 0,000323			
upper tolerance limit [$\mu\text{g/l}$]		0,002172			
lower tolerance limit [$\mu\text{g/l}$]		0,000724			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
1	0,0015			0,1	s
13	0,00126	6E-04	-0,5	-0,5	s
14	0,00143	8E-04	0,0	0,0	s
15	0,00157			0,3	s
16	0,00121			-0,7	s
17	0,00172	3E-04	1,2	0,8	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory

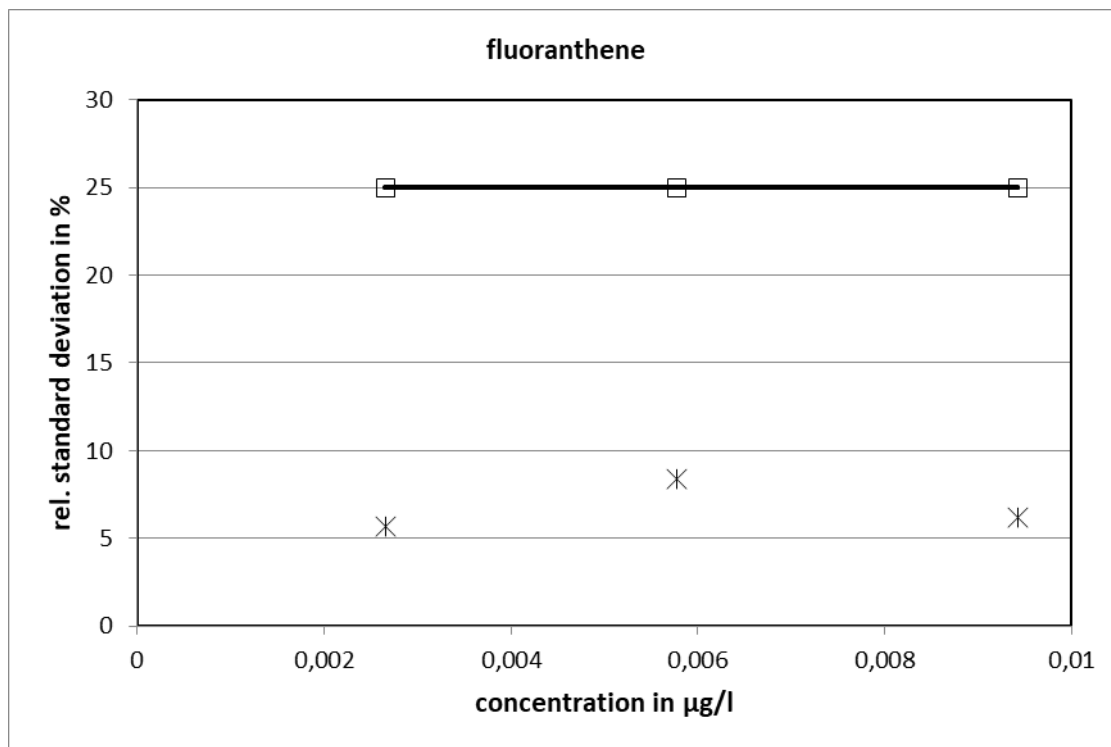






fluoranthene													
level	assigned value [µg/l]	expanded uncertainty of the assigned value [%]	standard deviation, calculated using robust statistics [µg/l]	standard deviation for proficiency assessment [µg/l]	standard deviation for proficiency assessment [%]	upper tolerance limit [µg/l]	lower tolerance limit [µg/l]	upper tolerance limit [%]	lower tolerance limit [%]	number of results	out below	out above	out [%]
1	0,0027	5,83	0,0002	0,0007	25,00	0,0040	0,0013	50,00	-50,00	6	0	0	0,0
2	0,0058	8,56	0,0005	0,0014	25,00	0,0087	0,0029	50,00	-50,00	6	0	0	0,0
3	0,0094	6,31	0,0006	0,0024	25,00	0,0141	0,0047	50,00	-50,00	6	0	0	0,0
										sum	18	0	0,0

Relative standard deviation

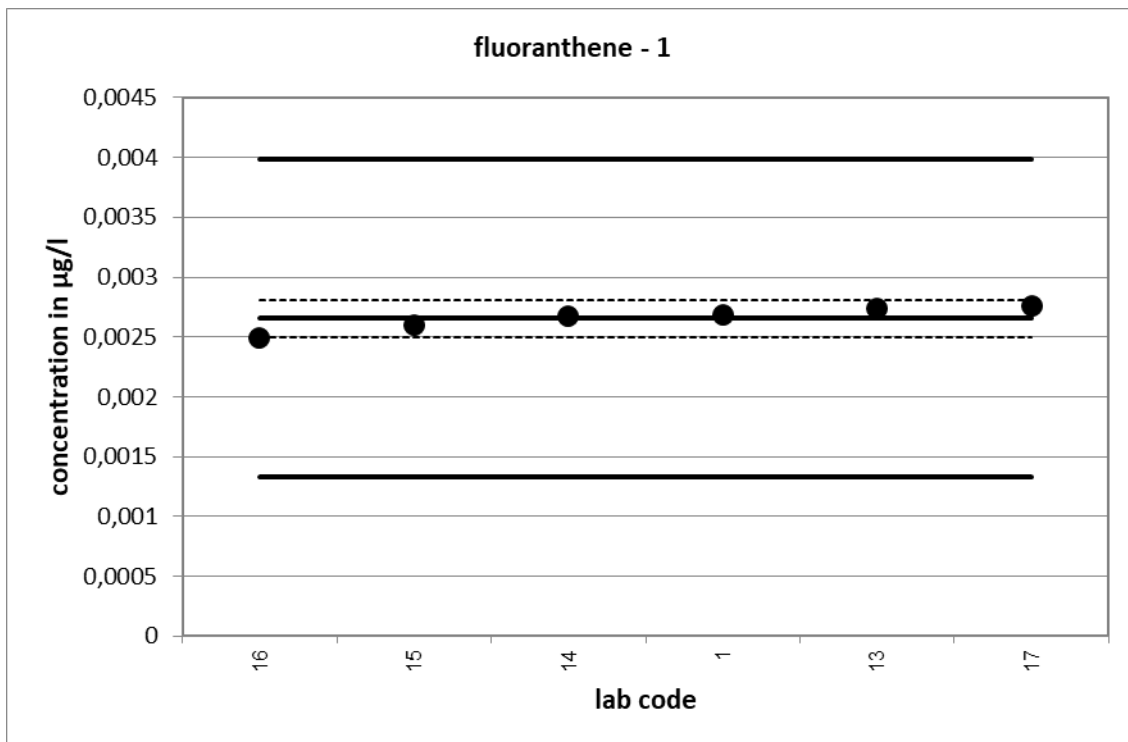


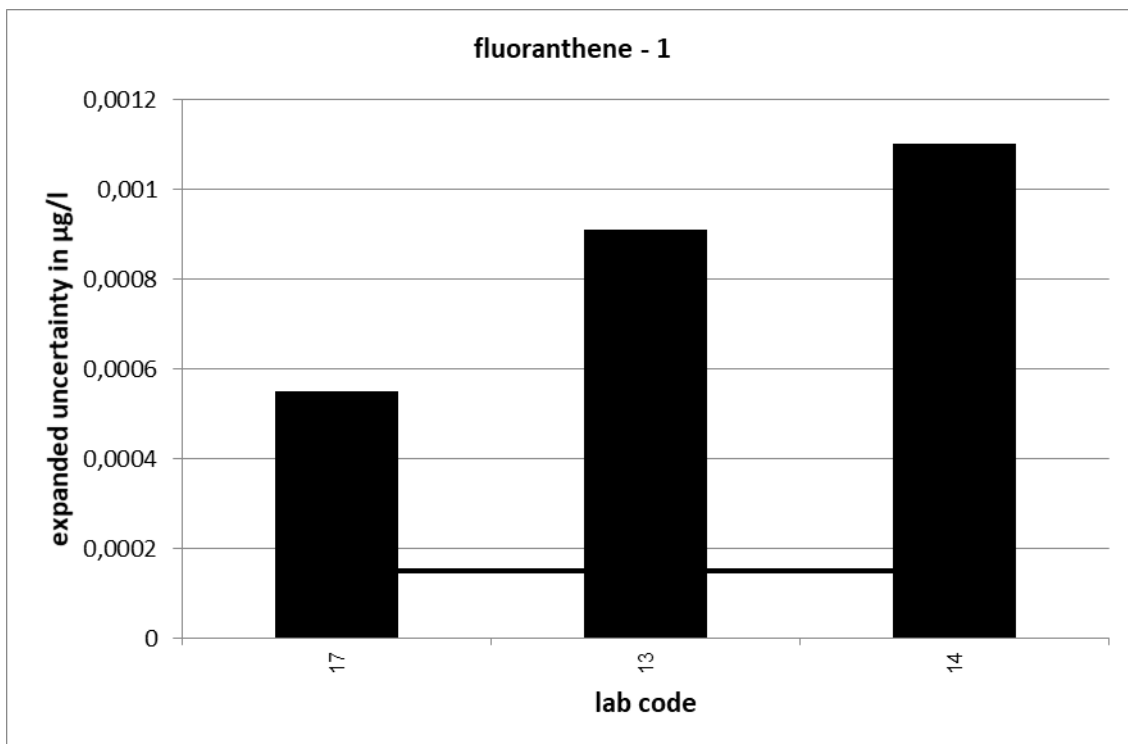
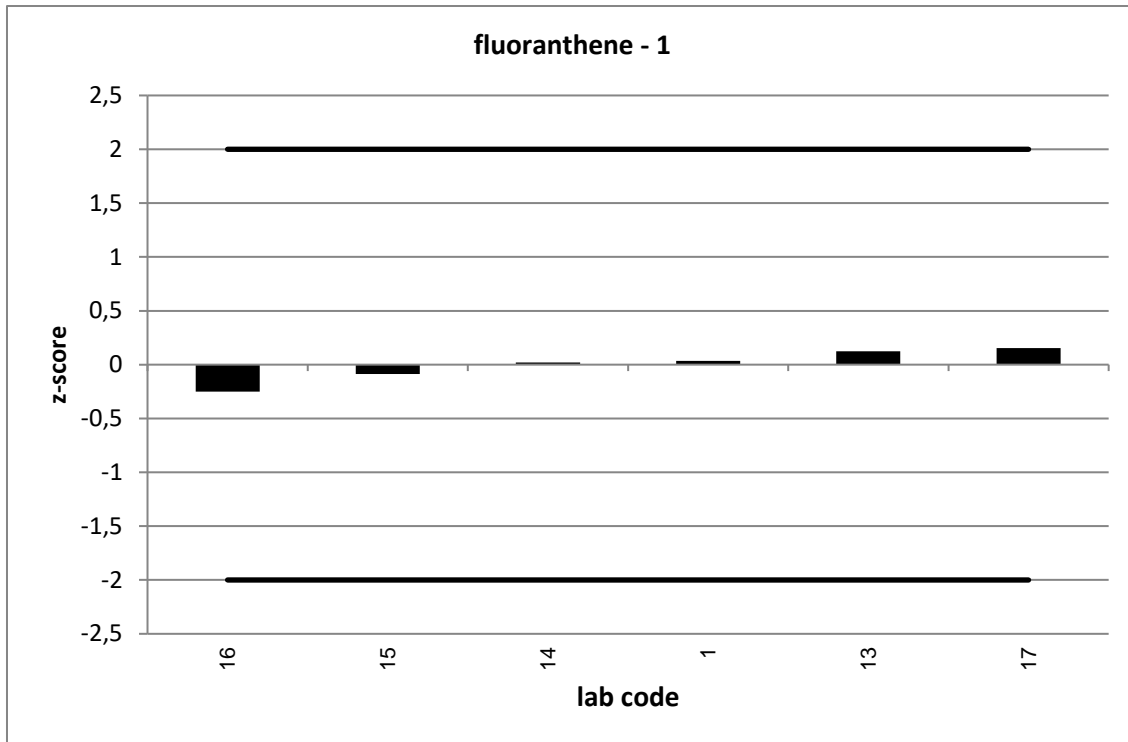
25 % is the value used as standard deviation for proficiency assessment.

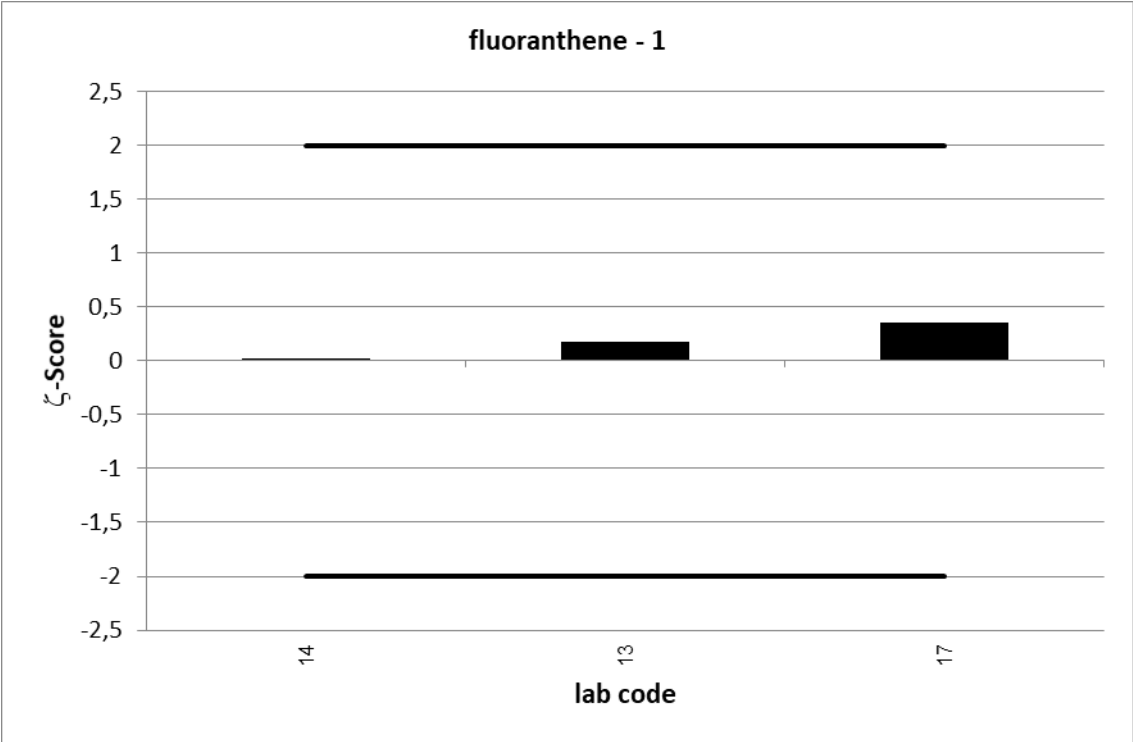
UKWIR PT 1/20		fluoranthene - 1			
assigned value [$\mu\text{g/l}$]*		0,002657		$\pm 0,000155$	
upper tolerance limit [$\mu\text{g/l}$]		0,003986			
lower tolerance limit [$\mu\text{g/l}$]		0,001329			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
1	0,00268			0,0	s
13	0,00274	9E-04	0,2	0,1	s
14	0,00267	0,001	0,0	0,0	s
15	0,0026			-0,1	s
16	0,00249			-0,3	s
17	0,00276	6E-04	0,4	0,2	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



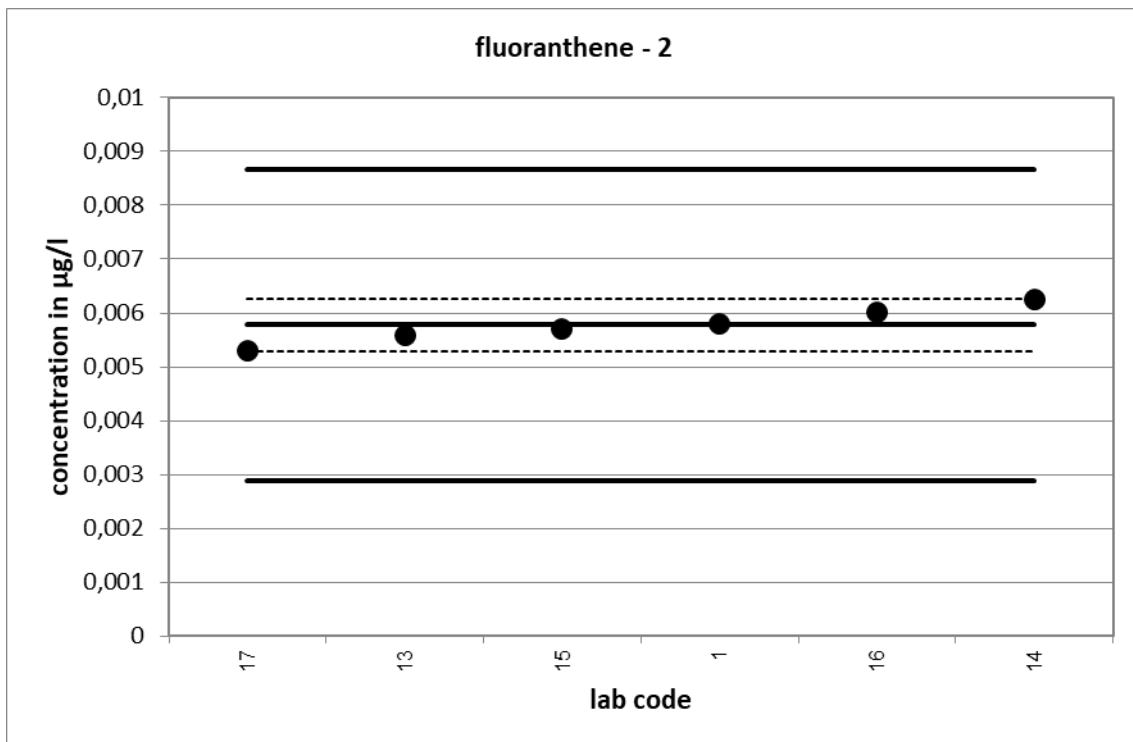


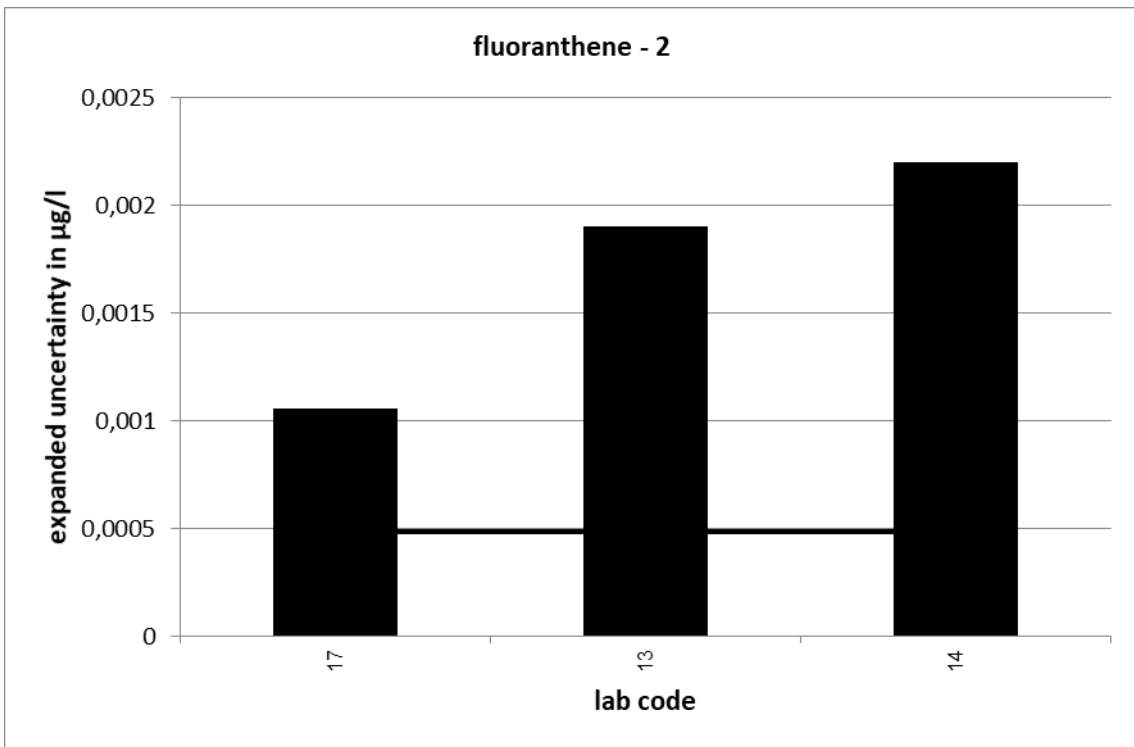
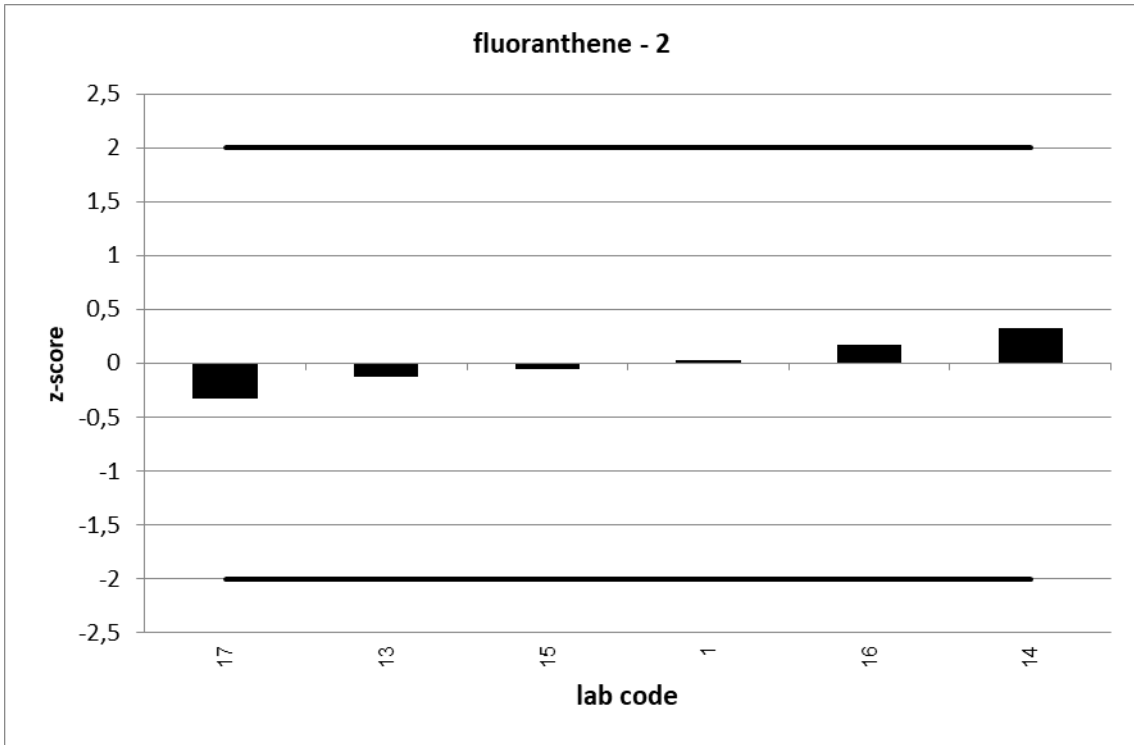


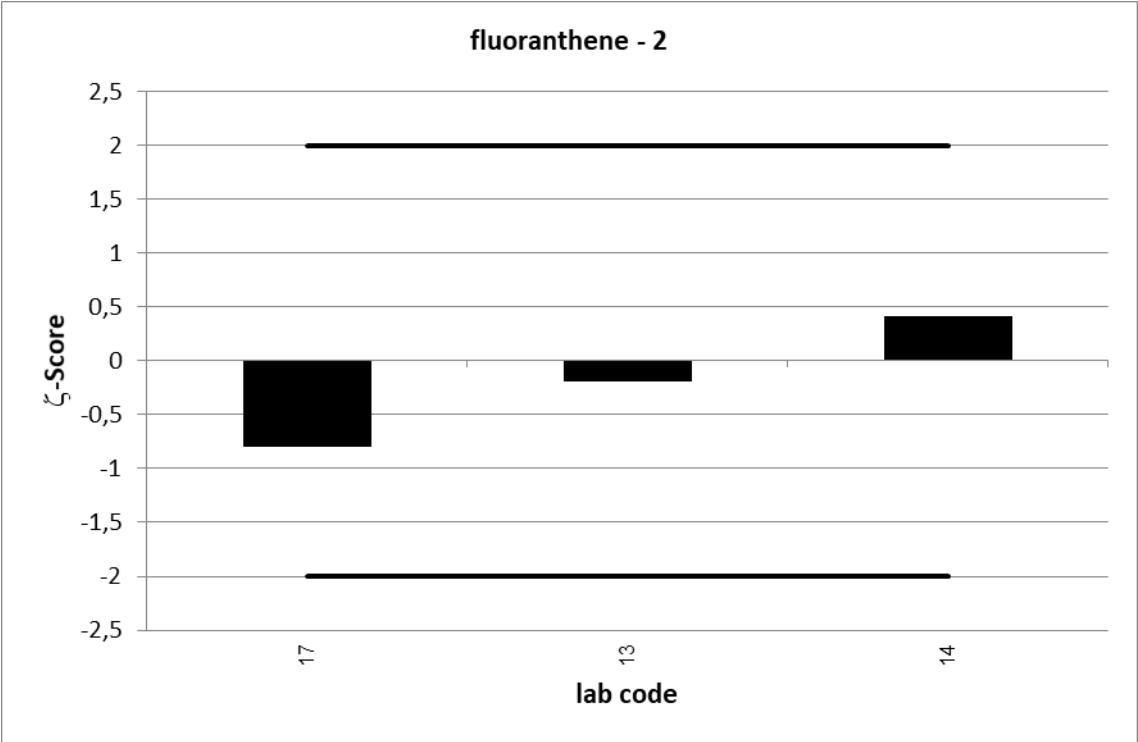
UKWIR PT 1/20		fluoranthene - 2			
assigned value [$\mu\text{g/l}$]*		0,005778 \pm 0,000495			
upper tolerance limit [$\mu\text{g/l}$]		0,008667			
lower tolerance limit [$\mu\text{g/l}$]		0,002889			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
1	0,00581			0,0	s
13	0,00559	0,002	-0,2	-0,1	s
14	0,00624	0,002	0,4	0,3	s
15	0,0057			-0,1	s
16	0,00602			0,2	s
17	0,00531	0,001	-0,8	-0,3	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



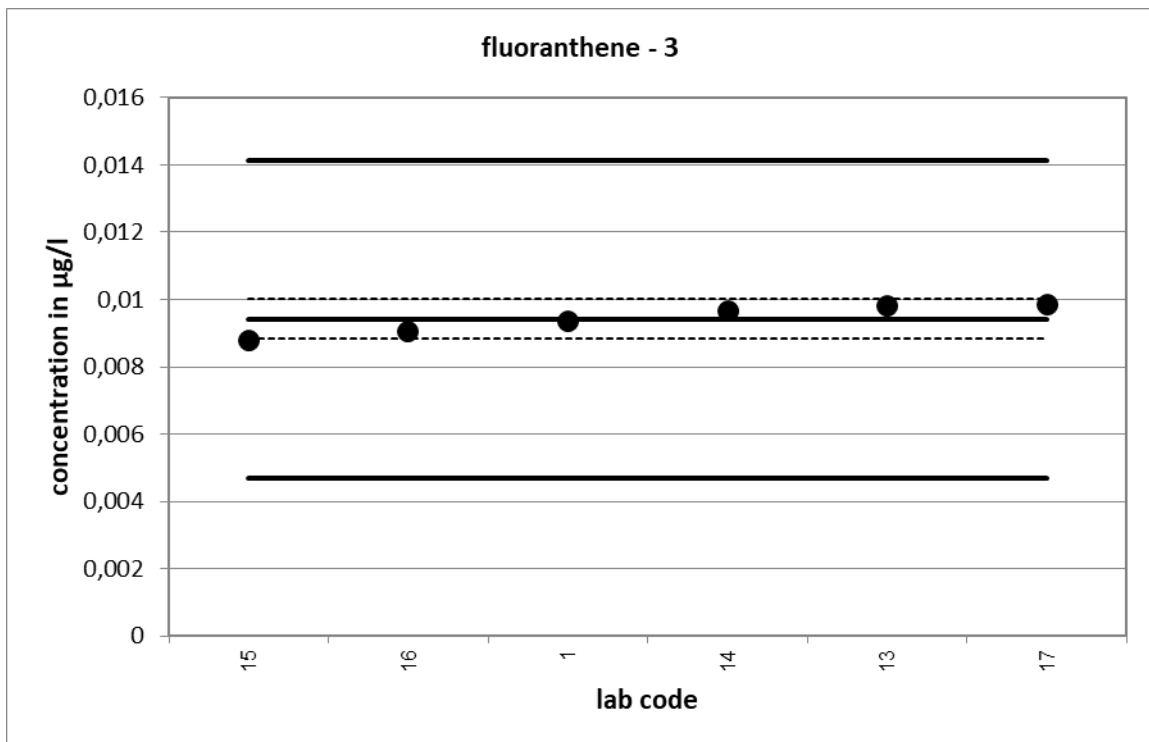


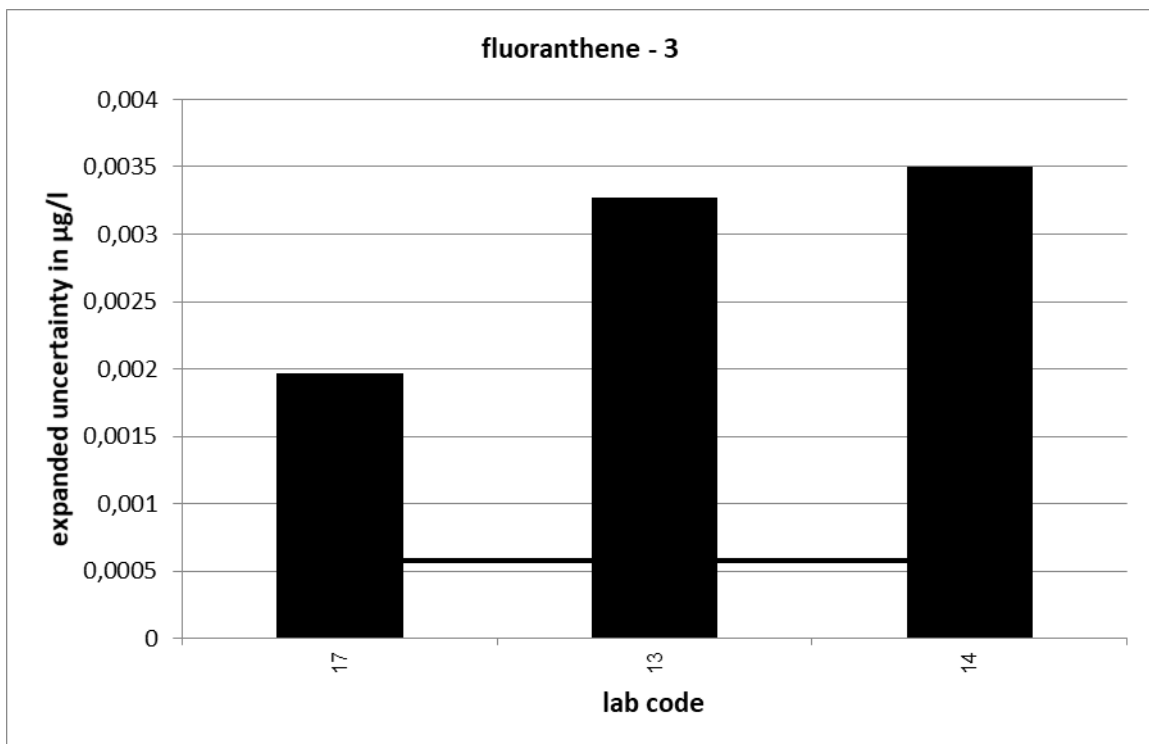
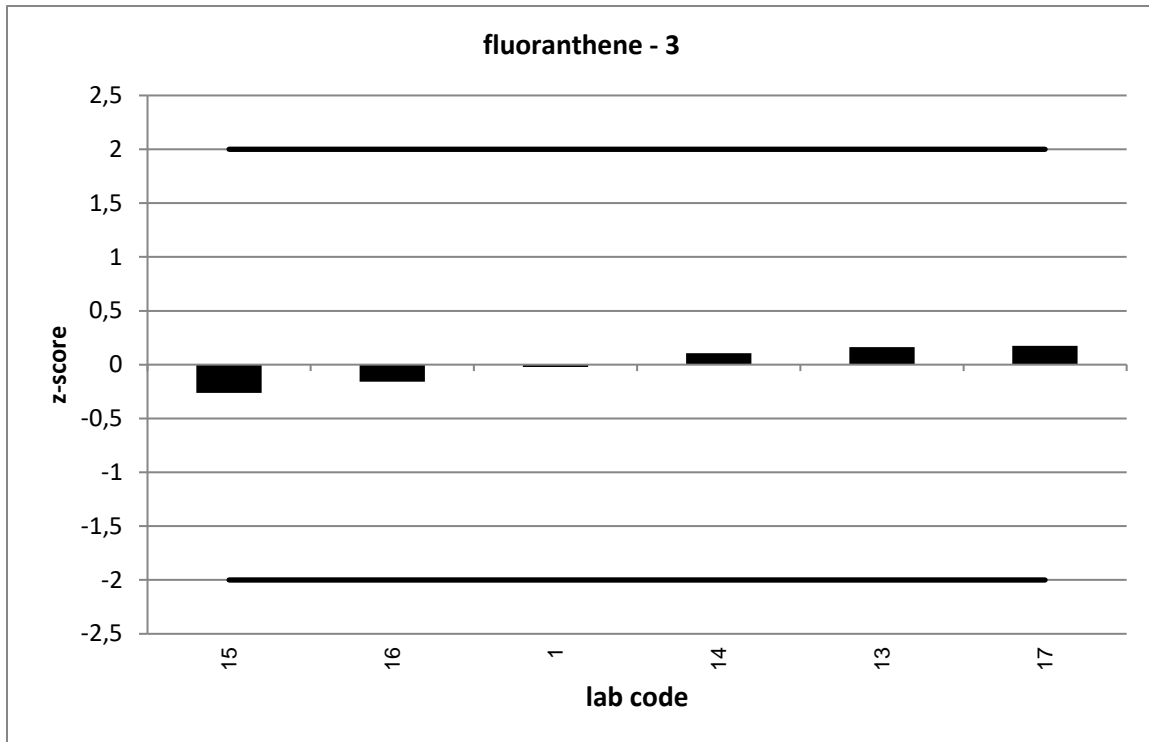


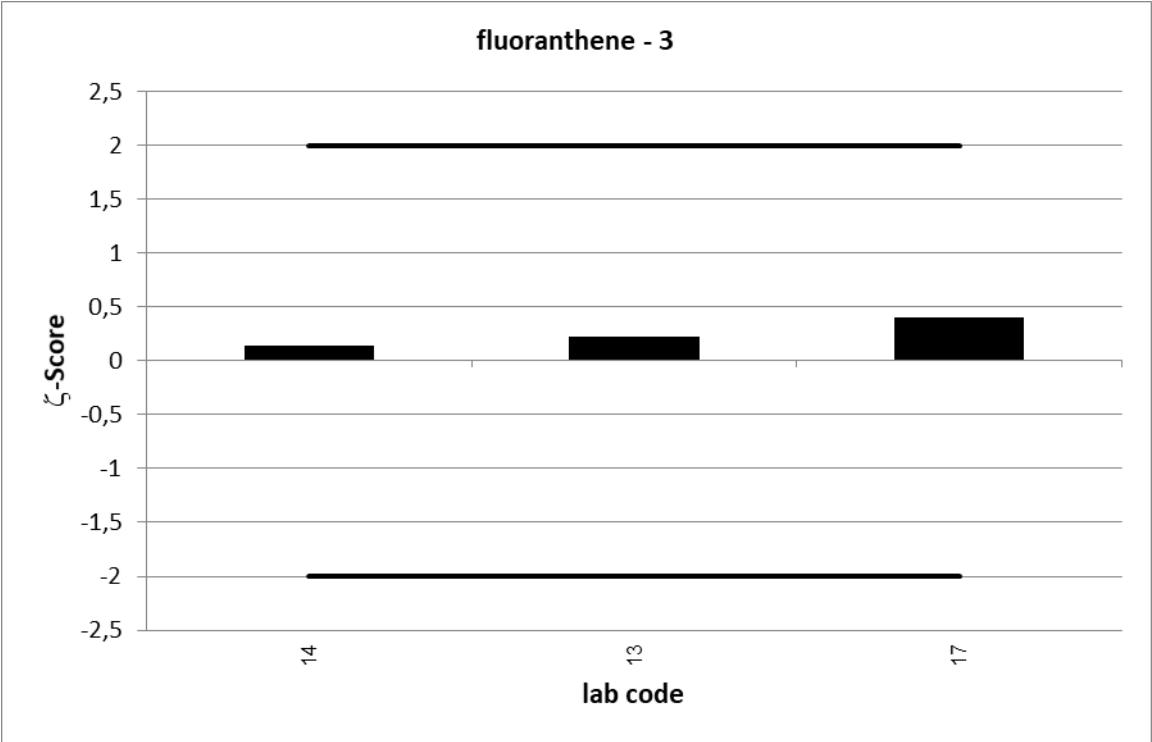
UKWIR PT 1/20		fluoranthene - 3			
assigned value [$\mu\text{g/l}$]*		0,00942 \pm 0,000595			
upper tolerance limit [$\mu\text{g/l}$]		0,01413			
lower tolerance limit [$\mu\text{g/l}$]		0,00471			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
1	0,00937			0,0	s
13	0,0098	0,003	0,2	0,2	s
14	0,00967	0,004	0,1	0,1	s
15	0,0088			-0,3	s
16	0,00905			-0,2	s
17	0,00983	0,002	0,4	0,2	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



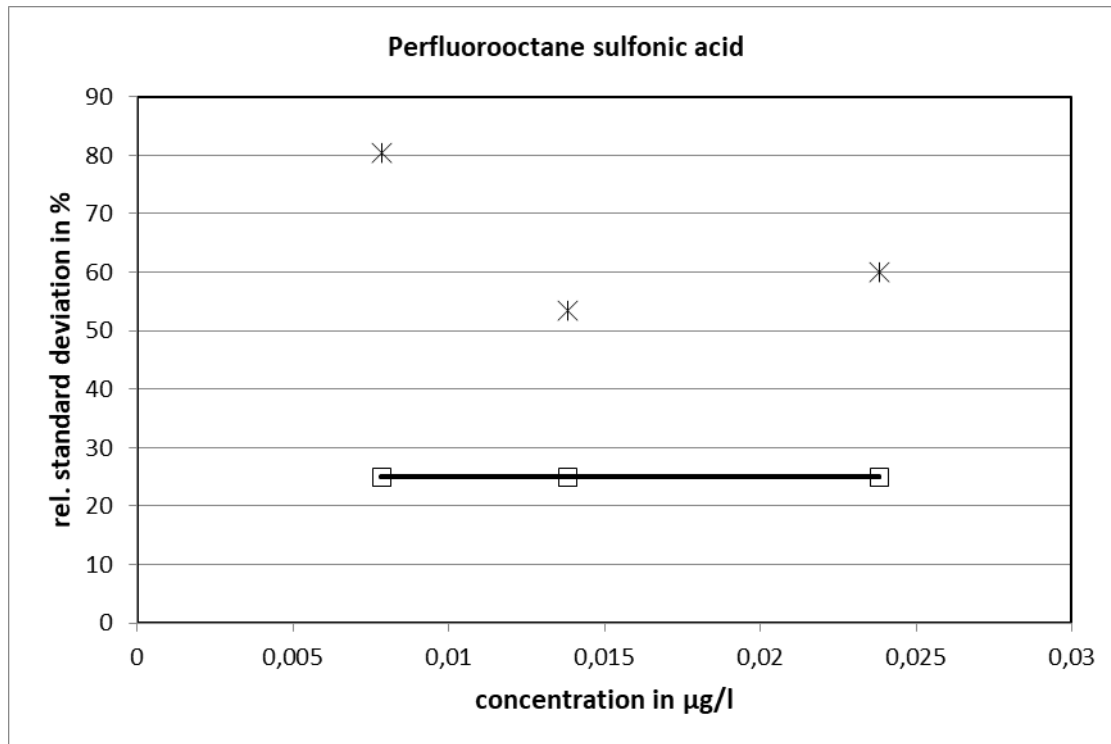




UKWIR 2/20:

Perfluorooctane sulfonic acid														
level	assigned value [µg/l]	expanded uncertainty of the assigned value [%]	standard deviation, calculated using robust statistics [µg/l]	standard deviation for proficiency assessment [µg/l]	standard deviation for proficiency assessment [%]	upper tolerance limit [µg/l]	lower tolerance limit [µg/l]	upper tolerance limit [%]	lower tolerance limit [%]	number of results	out below	out above	out [%]	
1	0,0078	13,05	0,0063	0,0020	25,00	0,0118	0,0039	50,00	-50,00	8	1	2	37,5	
2	0,0138	7,04	0,0074	0,0035	25,00	0,0208	0,0069	50,00	-50,00	8	1	1	25,0	
3	0,0238	4,74	0,0143	0,0060	25,00	0,0357	0,0119	50,00	-50,00	8	2	0	25,0	
										sum	24	4	3	29,2

Relative standard deviation

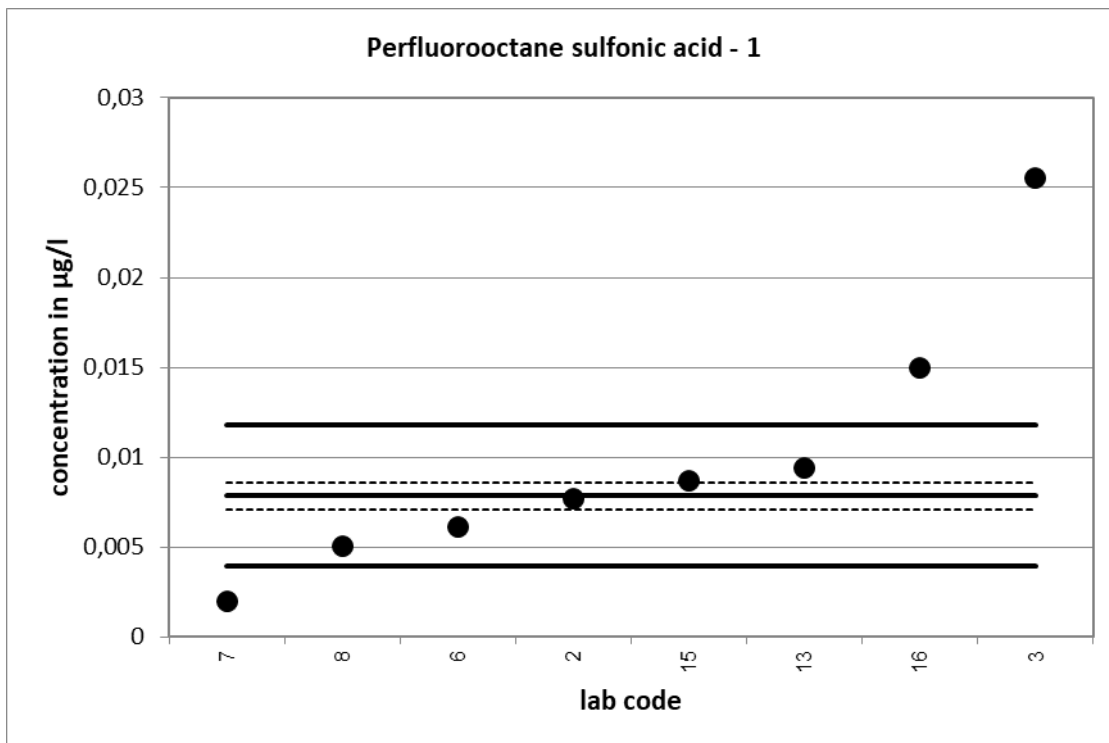


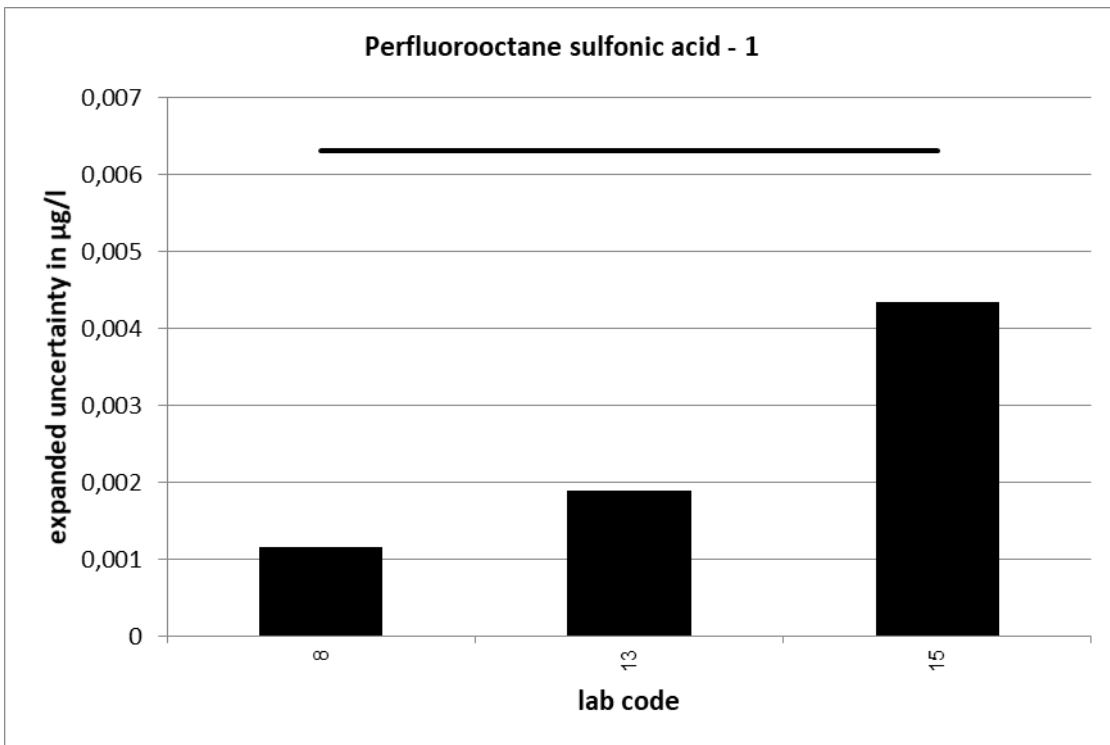
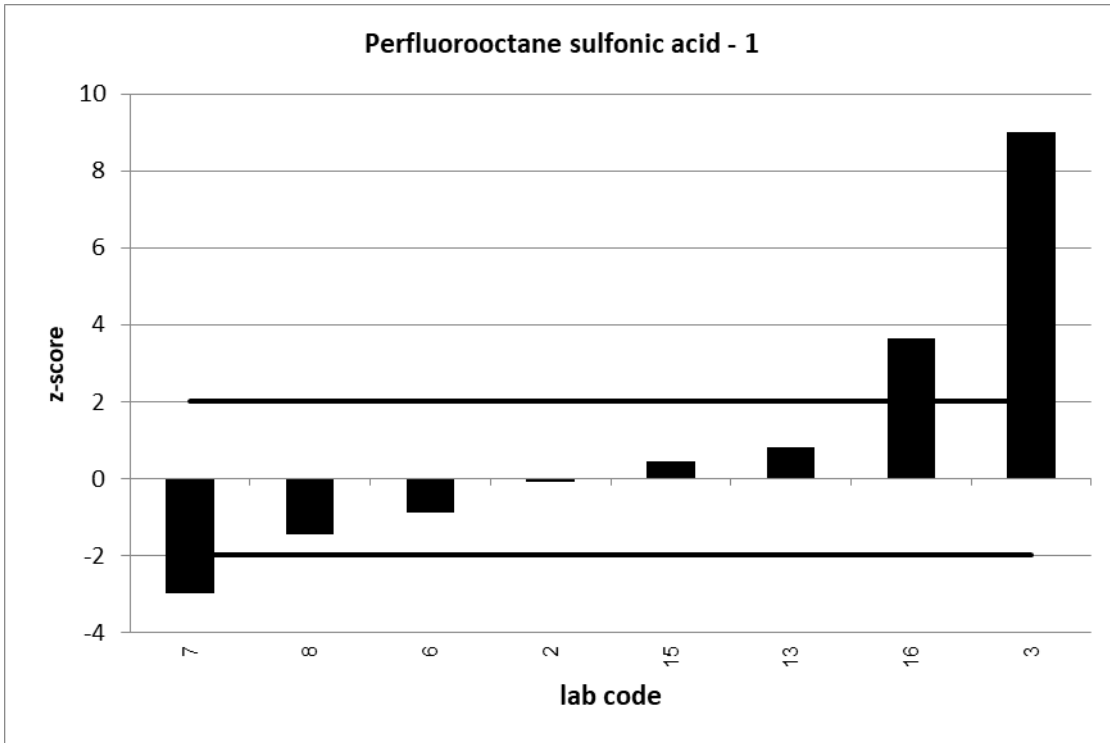
25 % is used as standard deviation for proficiency assessment.

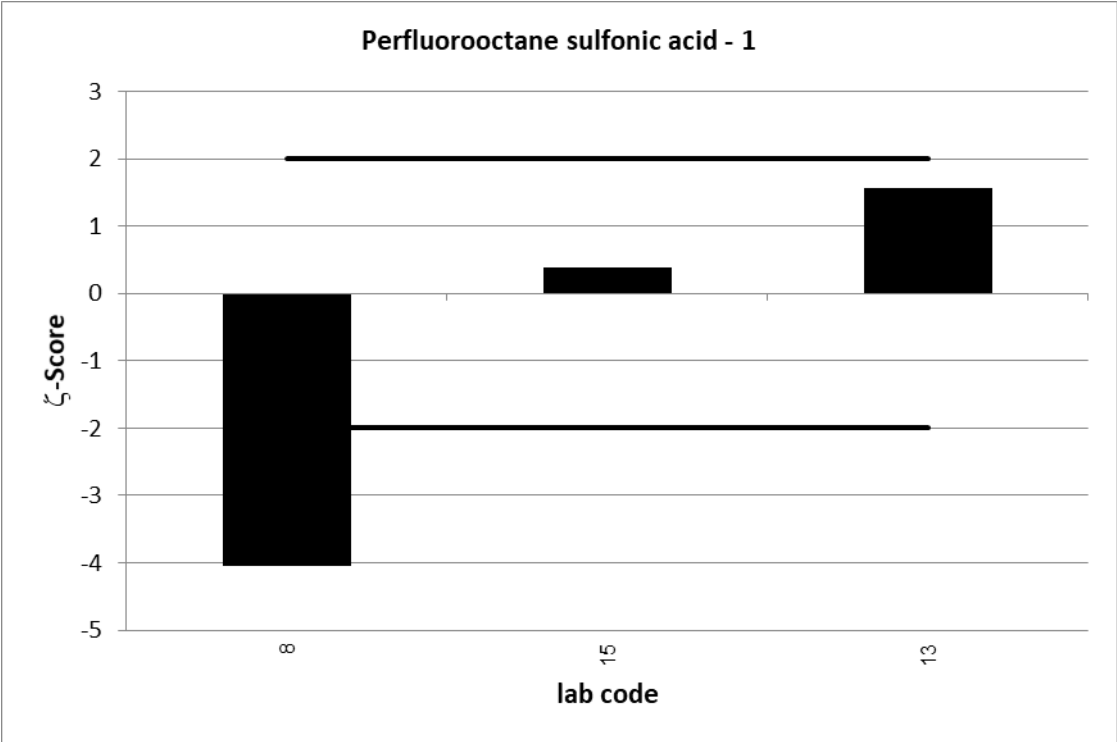
UKWIR PT 2/20		Perfluorooctane sulfonic acid - 1			
assigned value [µg/l]*		0,007843 ± 0,000754			
upper tolerance limit [µg/l]		0,01176			
lower tolerance limit [µg/l]		0,003922			
lab code	result [µg/l]	±	ζ-score	z-score	assessm.**
2	0,00769			-0,1	s
3	0,0255			9,0	u
6	0,0061			-0,9	s
7	0,002			-3,0	u
8	0,00502	0,001	-4,1	-1,4	s
13	0,00943	0,002	1,6	0,8	s
15	0,0087	0,004	0,4	0,4	s
16	0,015			3,7	u

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor k=2 corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



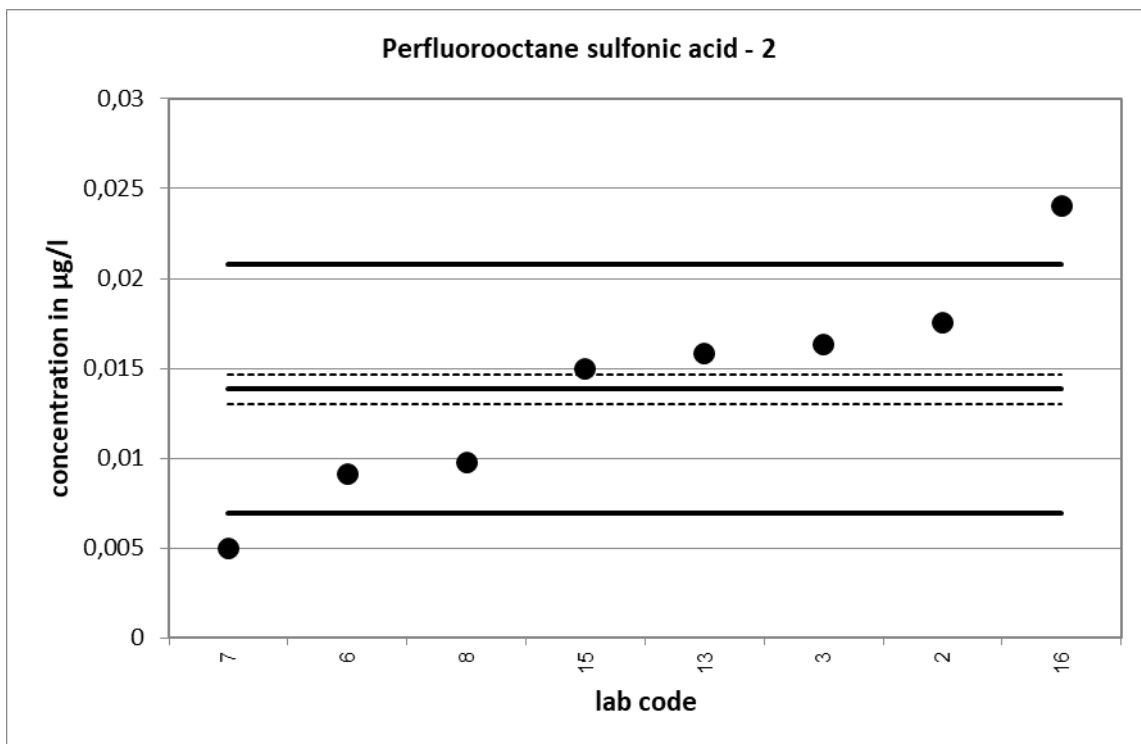


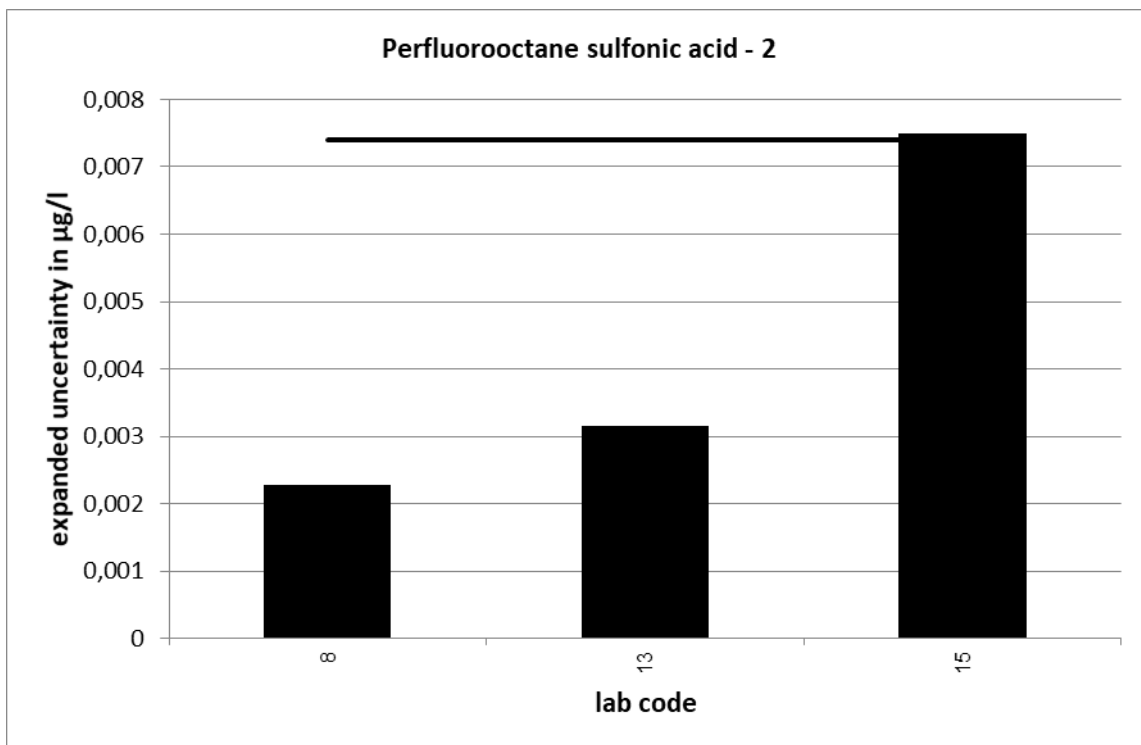
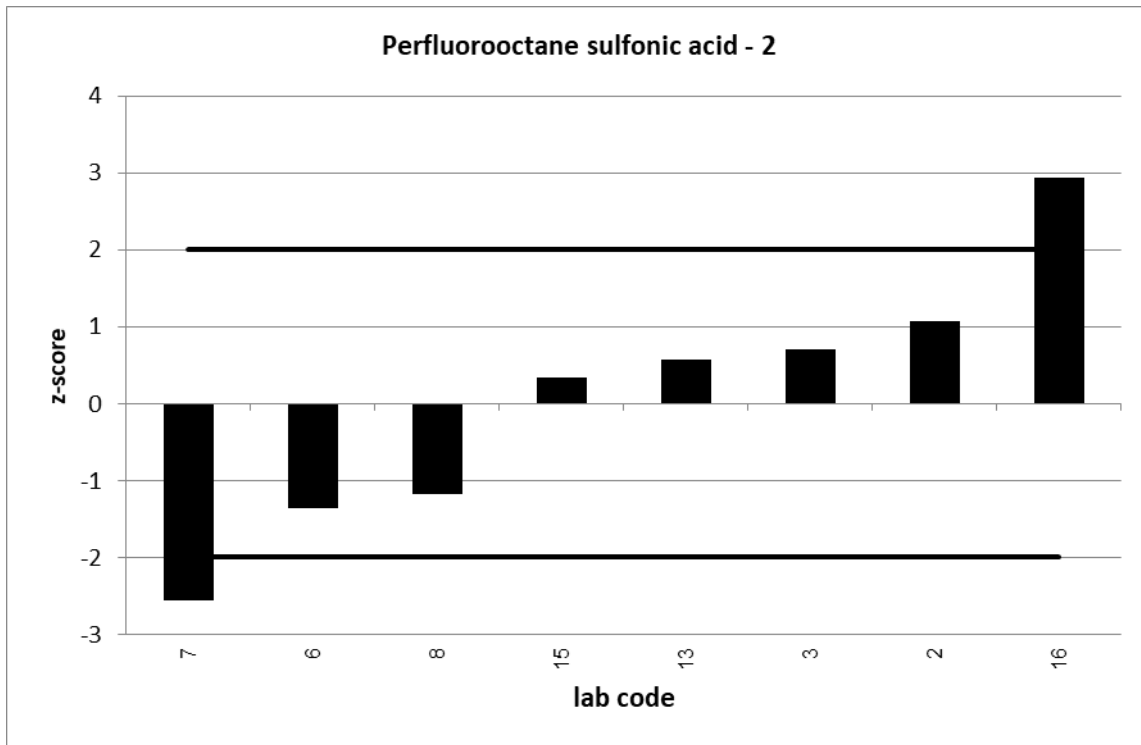


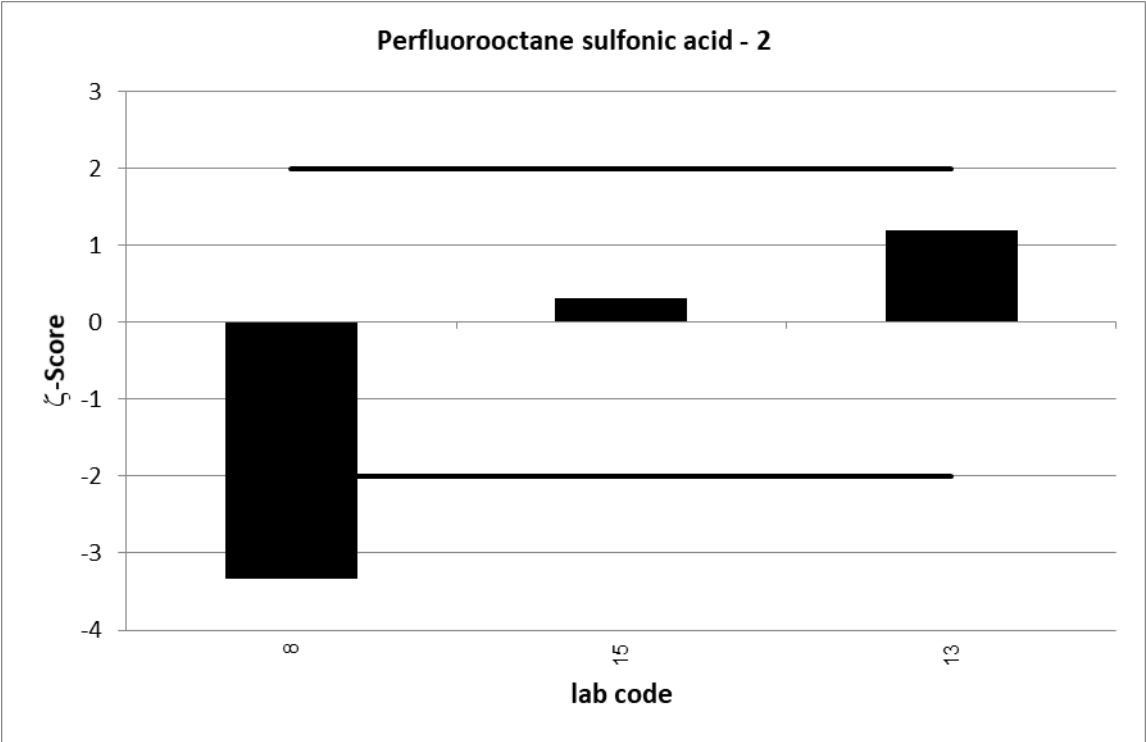
UKWIR PT 2/20		Perfluorooctane sulfonic acid - 2			
assigned value [$\mu\text{g/l}$]*		0,01384 \pm 0,00083			
upper tolerance limit [$\mu\text{g/l}$]		0,02076			
lower tolerance limit [$\mu\text{g/l}$]		0,00692			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
2	0,01755			1,1	s
3	0,0163			0,7	s
6	0,00912			-1,4	s
7	0,005			-2,6	q
8	0,00979	0,002	-3,3	-1,2	s
13	0,0158	0,003	1,2	0,6	s
15	0,015	0,008	0,3	0,3	s
16	0,024			2,9	q

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



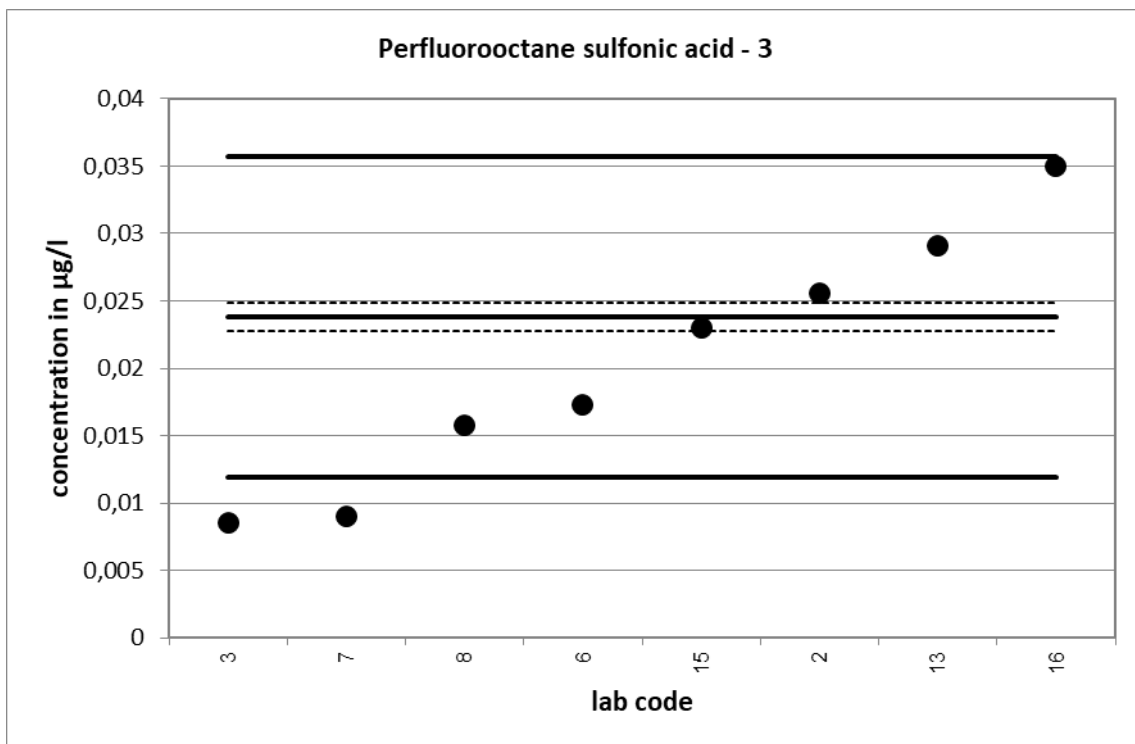


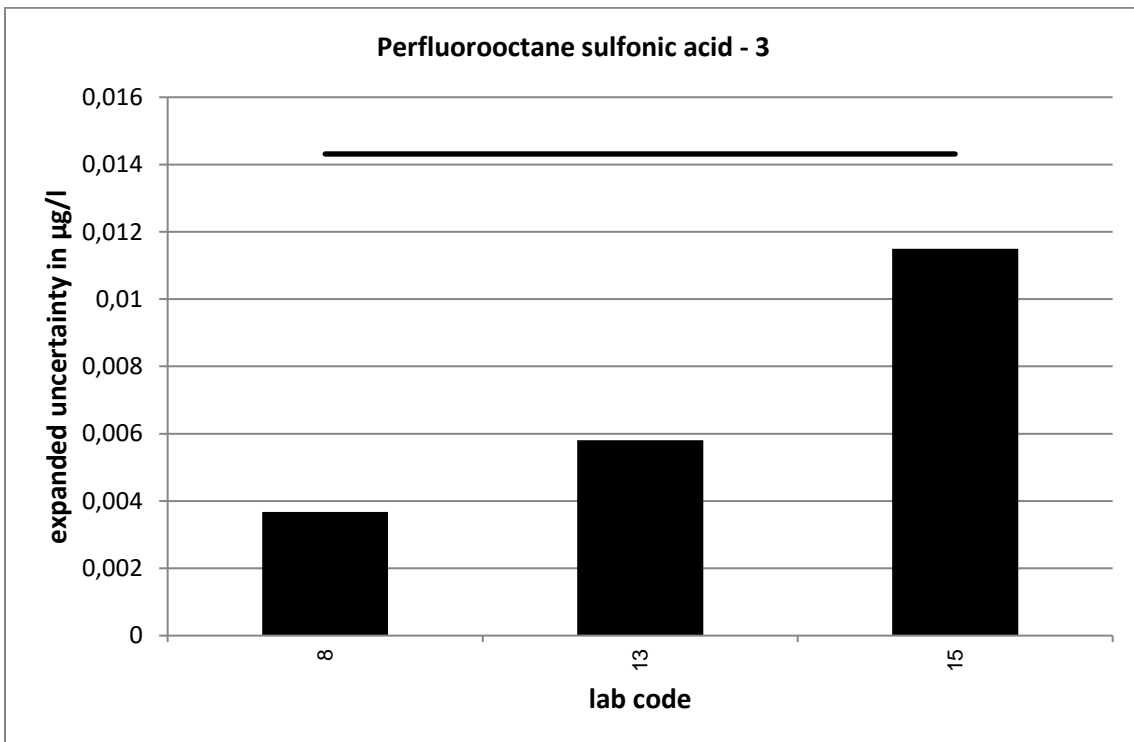
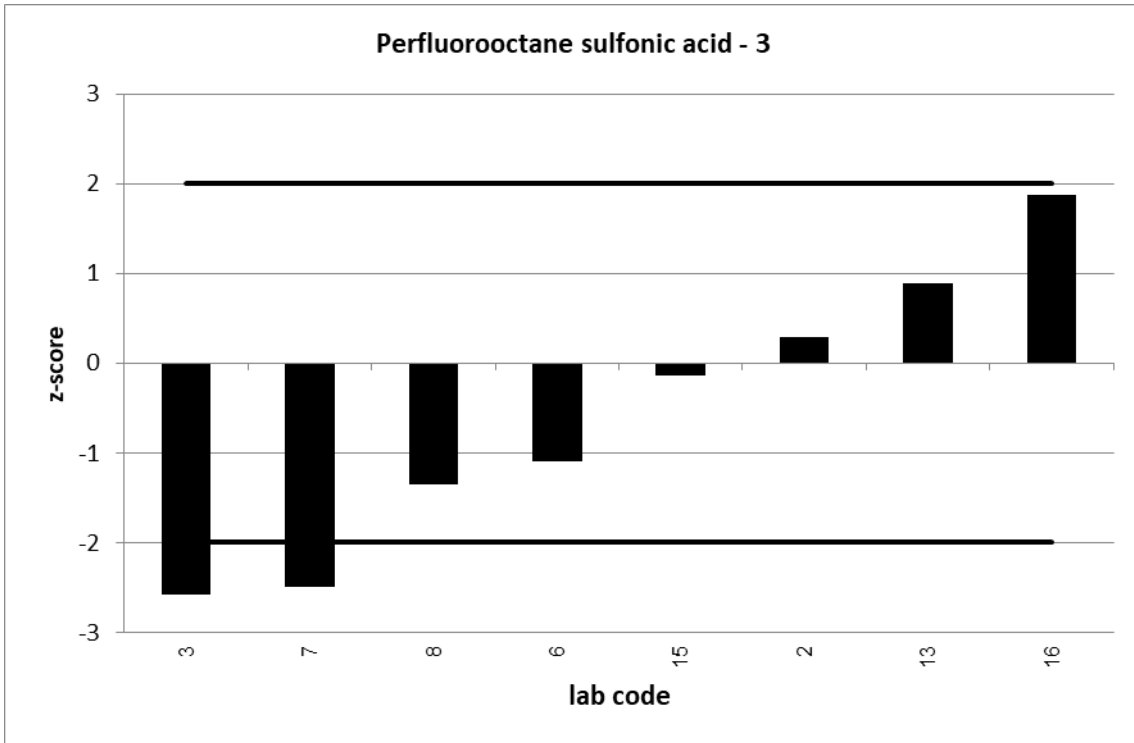


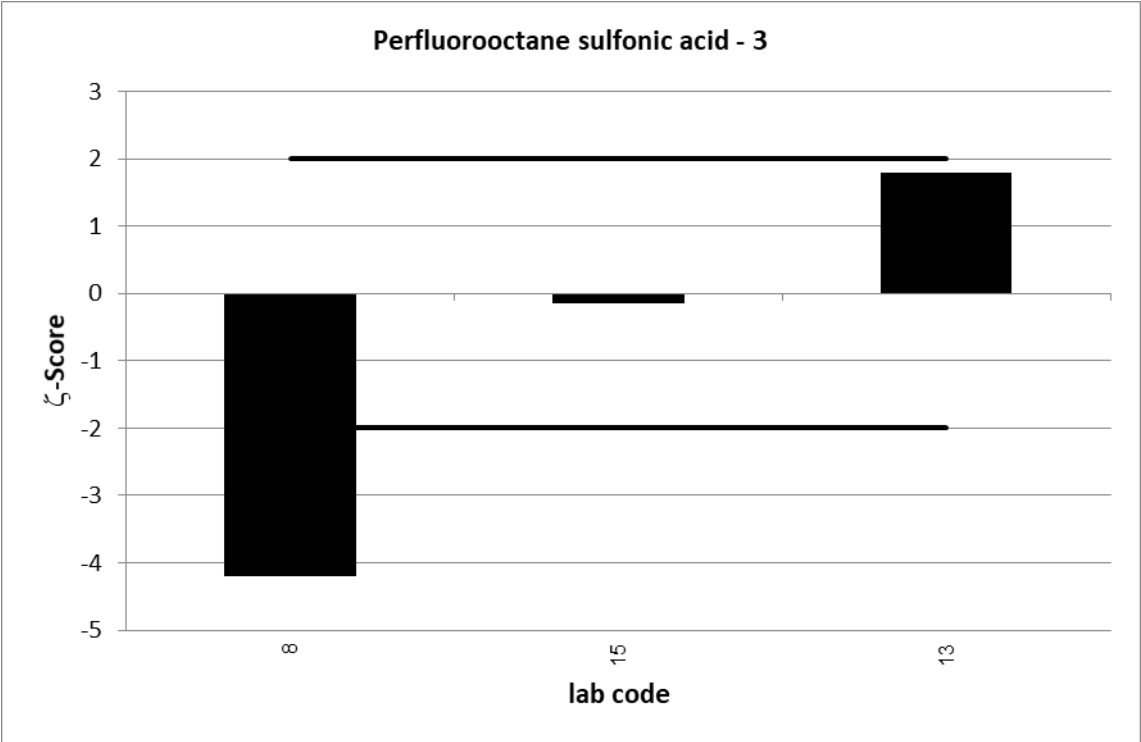
UKWIR PT 2/20		Perfluorooctane sulfonic acid - 3			
assigned value [$\mu\text{g/l}$]*		0,02382 \pm 0,00103			
upper tolerance limit [$\mu\text{g/l}$]		0,03573			
lower tolerance limit [$\mu\text{g/l}$]		0,01191			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
2	0,02558			0,3	s
3	0,0085			-2,6	q
6	0,0173			-1,1	s
7	0,009			-2,5	q
8	0,0158	0,004	-4,2	-1,3	s
13	0,0291	0,006	1,8	0,9	s
15	0,023	0,012	-0,1	-0,1	s
16	0,035			1,9	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory

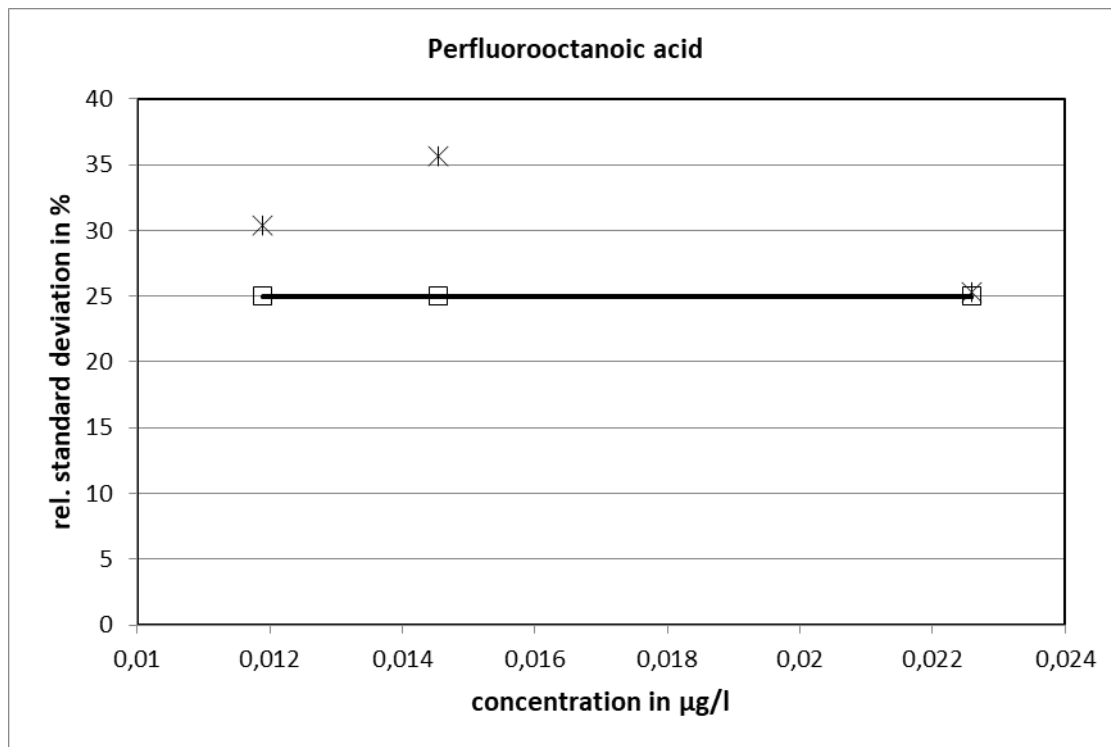






Perfluorooctanoic acid														
level	assigned value [µg/l]	expanded uncertainty of the assigned value [%]	standard deviation, calculated using robust statistics [µg/l]	standard deviation for proficiency assessment [µg/l]	standard deviation for proficiency assessment [%]	upper tolerance limit [µg/l]	lower tolerance limit [µg/l]	upper tolerance limit [%]	lower tolerance limit [%]	number of results	out below	out above	out [%]	
1	0,0119	19,99	0,0036	0,0030	25,00	0,0179	0,0060	50,00	-50,00	7	0	1	14,3	
2	0,0145	14,69	0,0052	0,0036	25,00	0,0218	0,0073	50,00	-50,00	7	0	2	28,6	
3	0,0226	8,48	0,0057	0,0056	25,00	0,0339	0,0113	50,00	-50,00	7	0	1	14,3	
										sum	21	0	4	19,0

Relative standard deviation

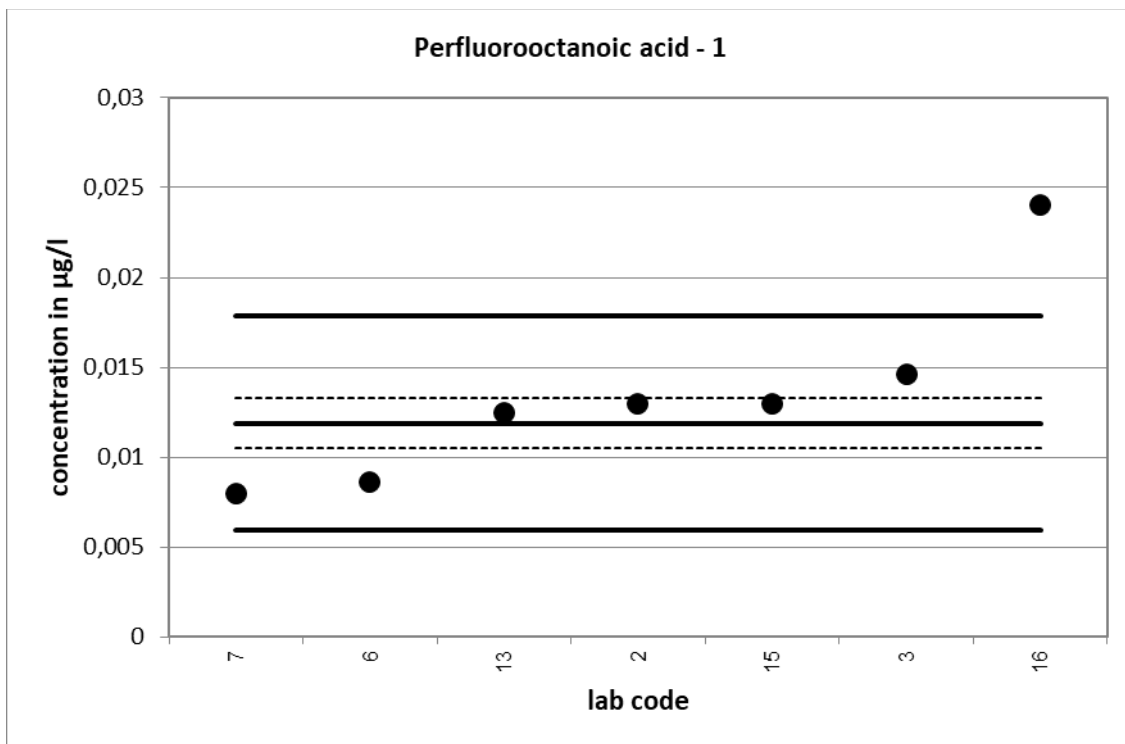


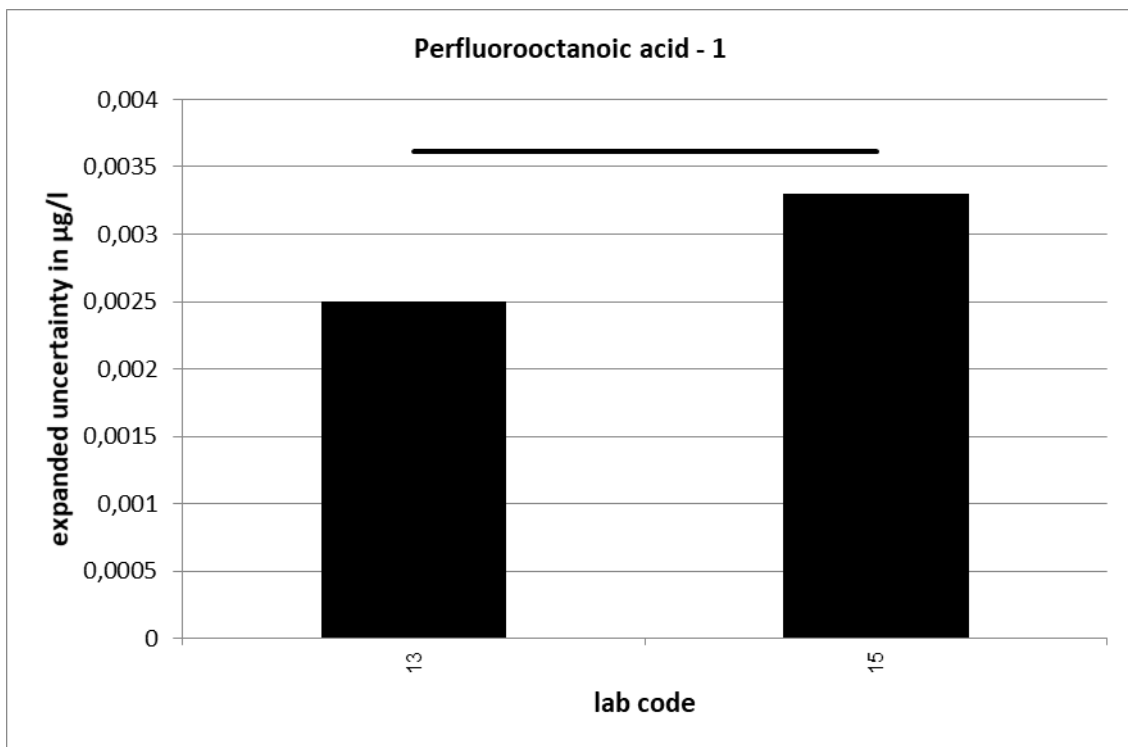
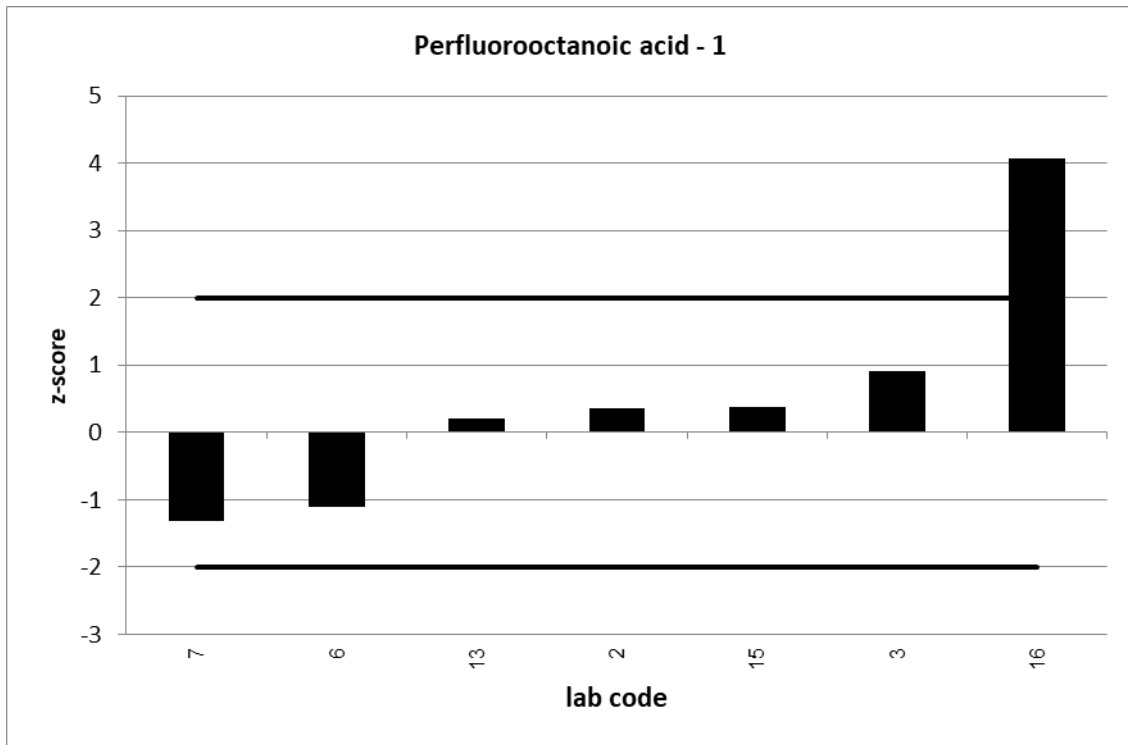
25 % is used as standard deviation for proficiency assessment.

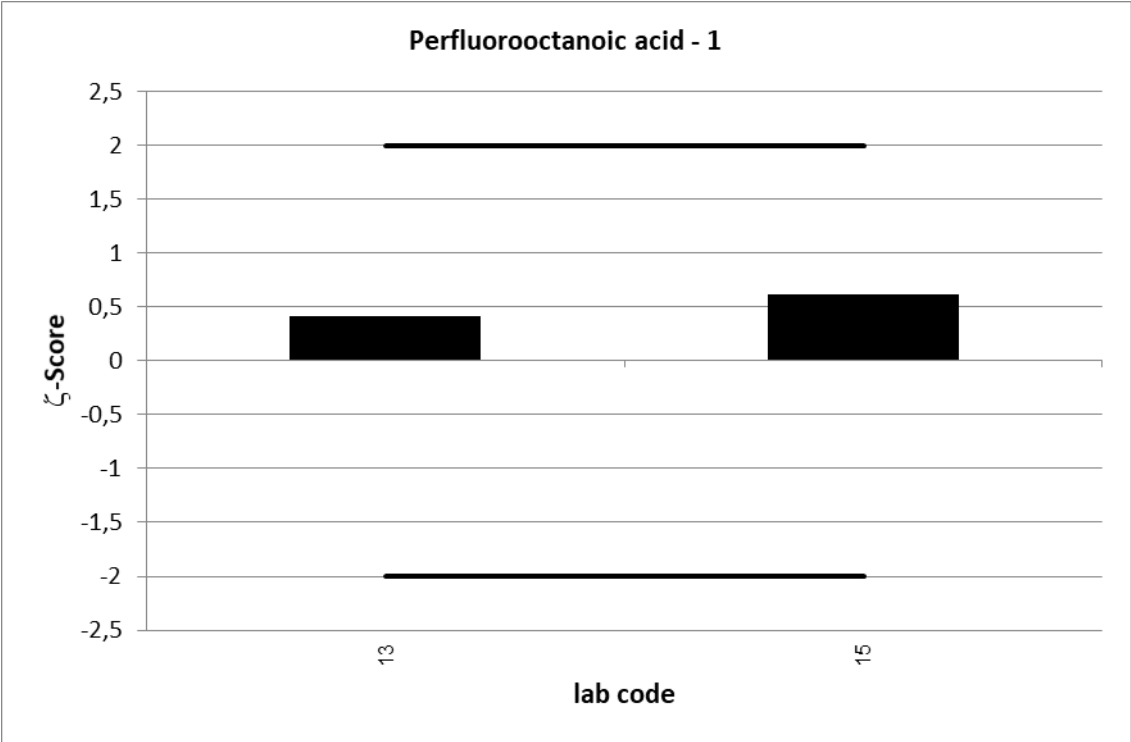
UKWIR PT 2/20		Perfluorooctanoic acid - 1			
assigned value [$\mu\text{g/l}$]*		0,0119 \pm 0,00139			
upper tolerance limit [$\mu\text{g/l}$]		0,01785			
lower tolerance limit [$\mu\text{g/l}$]		0,00595			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
2	0,01296			0,4	s
3	0,0146			0,9	s
6	0,00859			-1,1	s
7	0,008			-1,3	s
13	0,0125	0,003	0,4	0,2	s
15	0,013	0,003	0,6	0,4	s
16	0,024			4,1	u

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



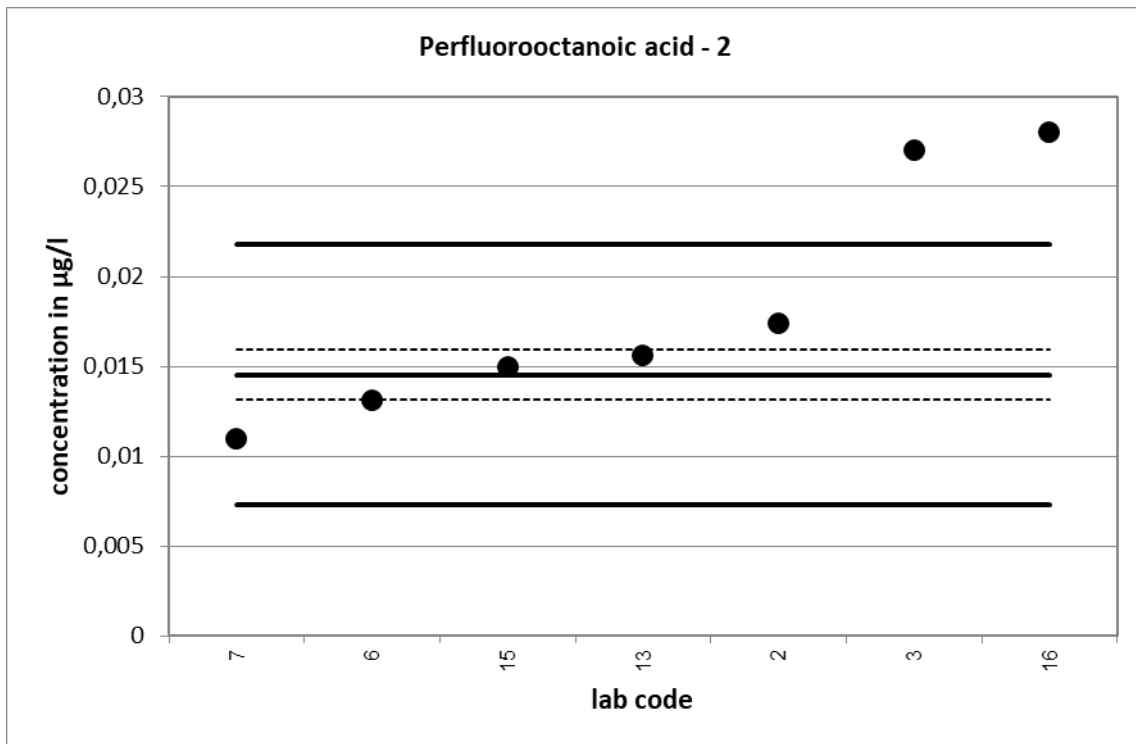


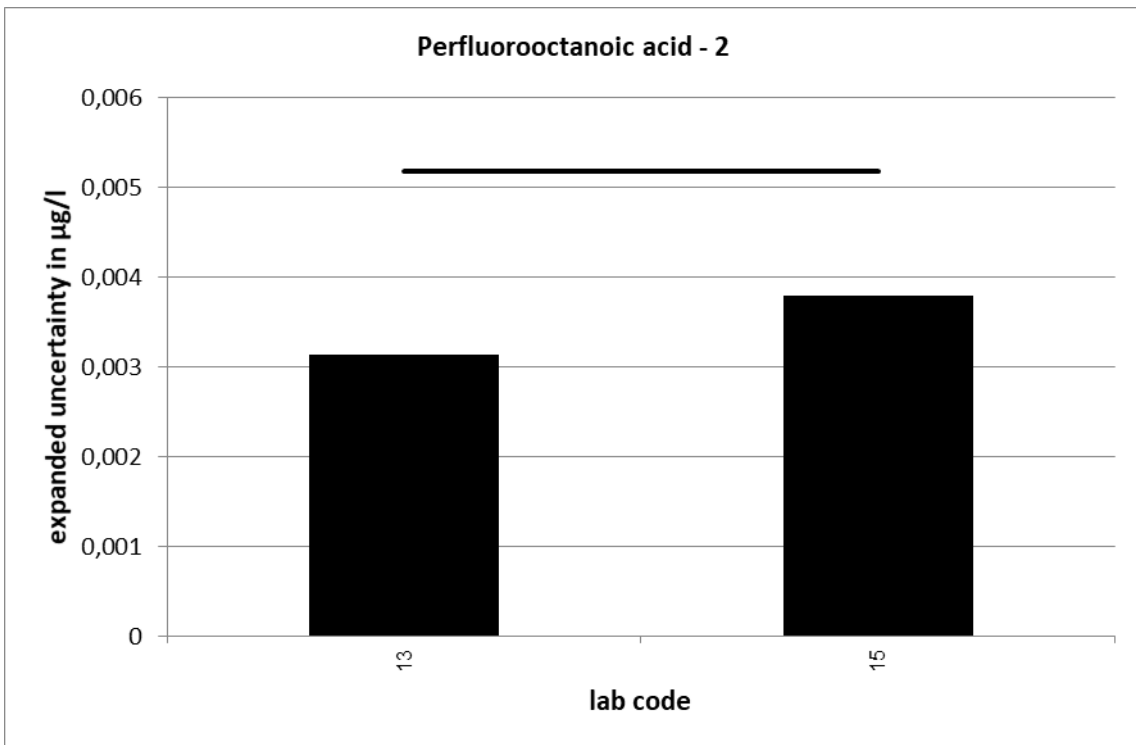
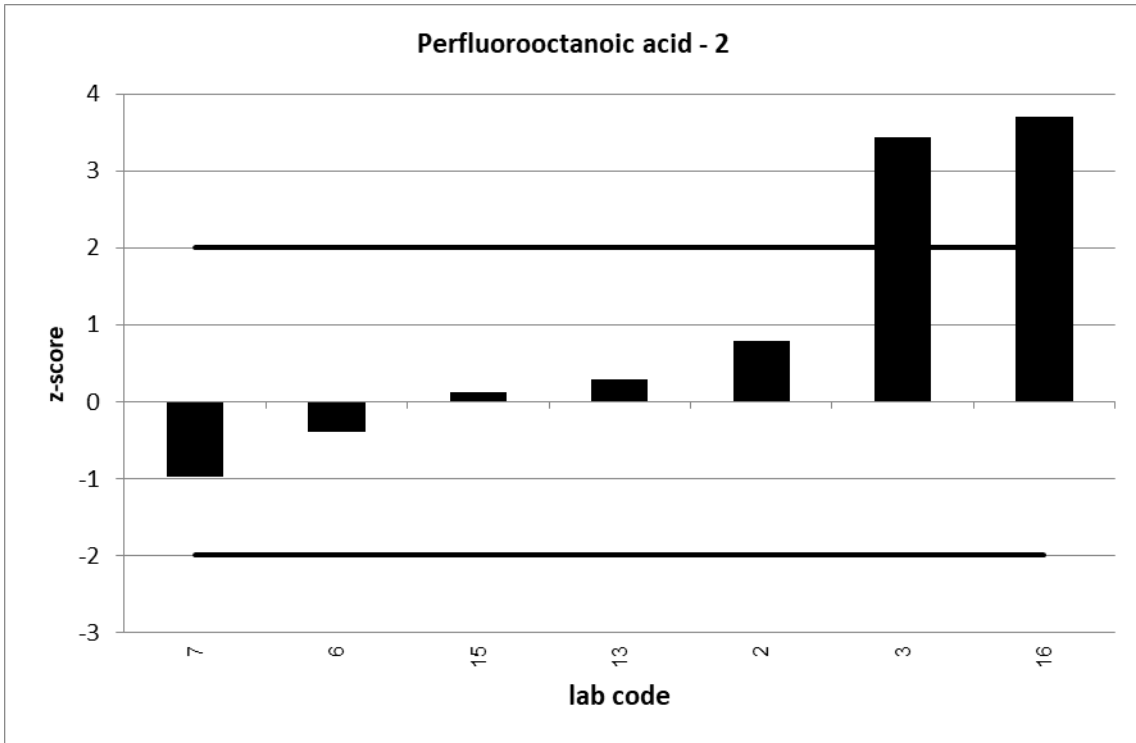


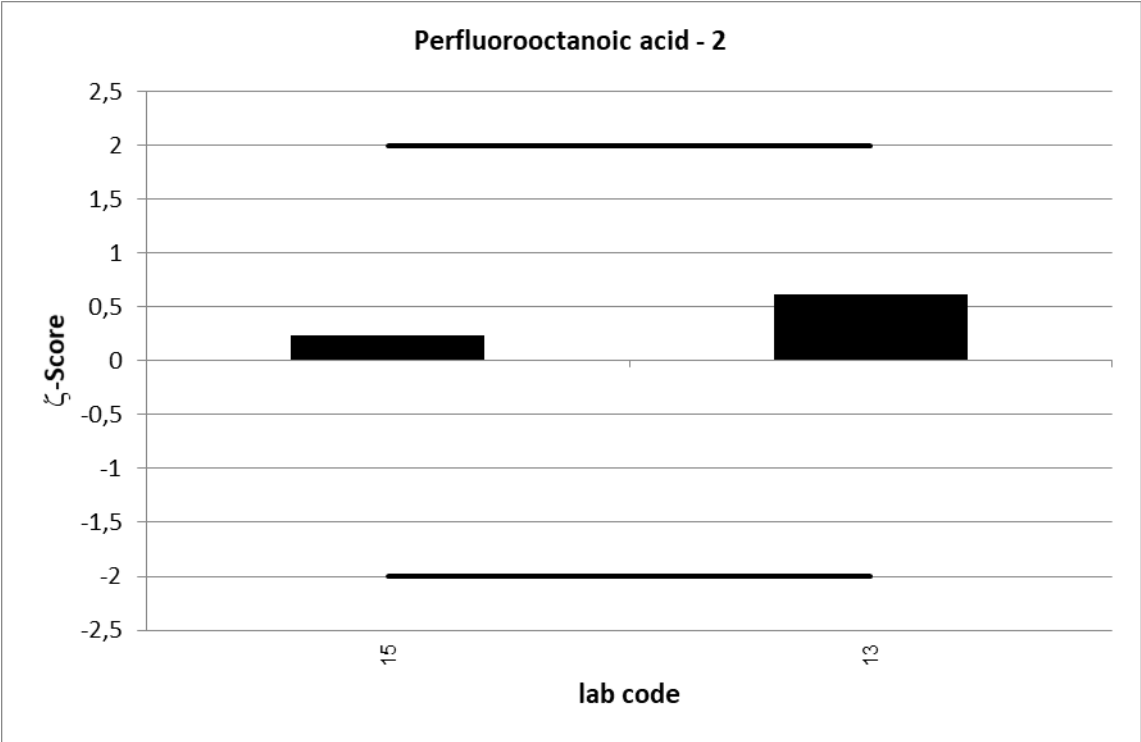
UKWIR PT 2/20		Perfluorooctanoic acid - 2			
assigned value [$\mu\text{g/l}$]*		0,01453 \pm 0,00141			
upper tolerance limit [$\mu\text{g/l}$]		0,0218			
lower tolerance limit [$\mu\text{g/l}$]		0,007267			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
2	0,01741			0,8	s
3	0,027			3,4	u
6	0,0131			-0,4	s
7	0,011			-1,0	s
13	0,0156	0,003	0,6	0,3	s
15	0,015	0,004	0,2	0,1	s
16	0,028			3,7	u

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



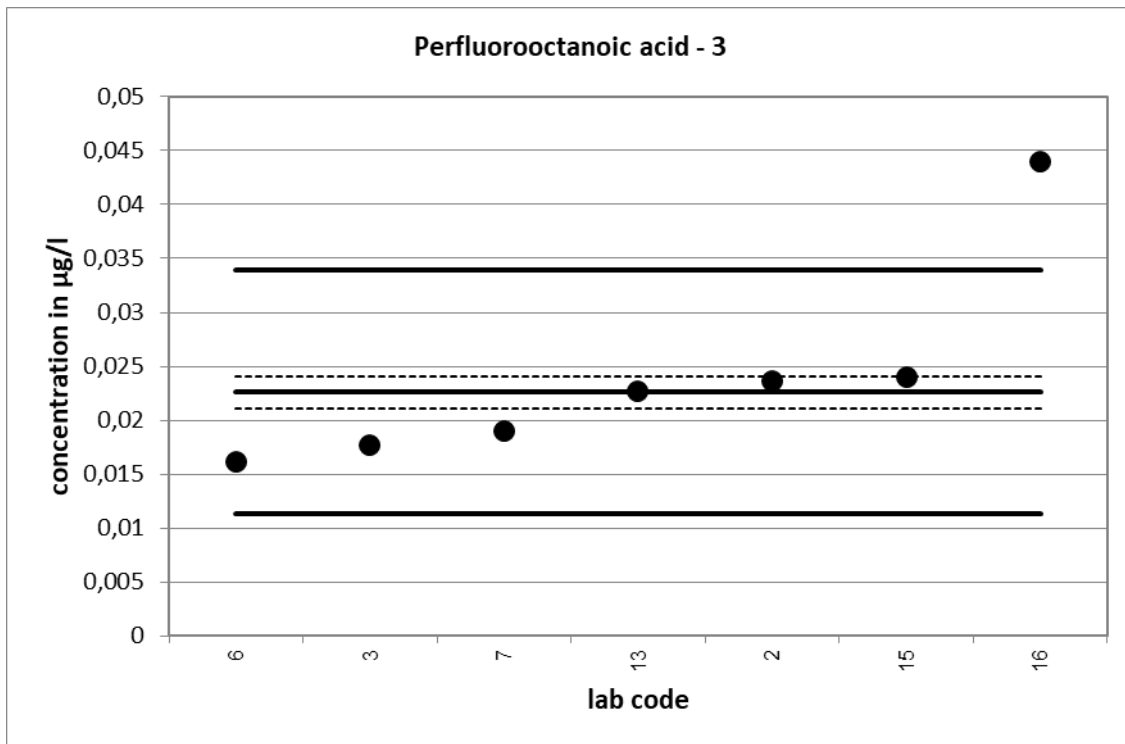


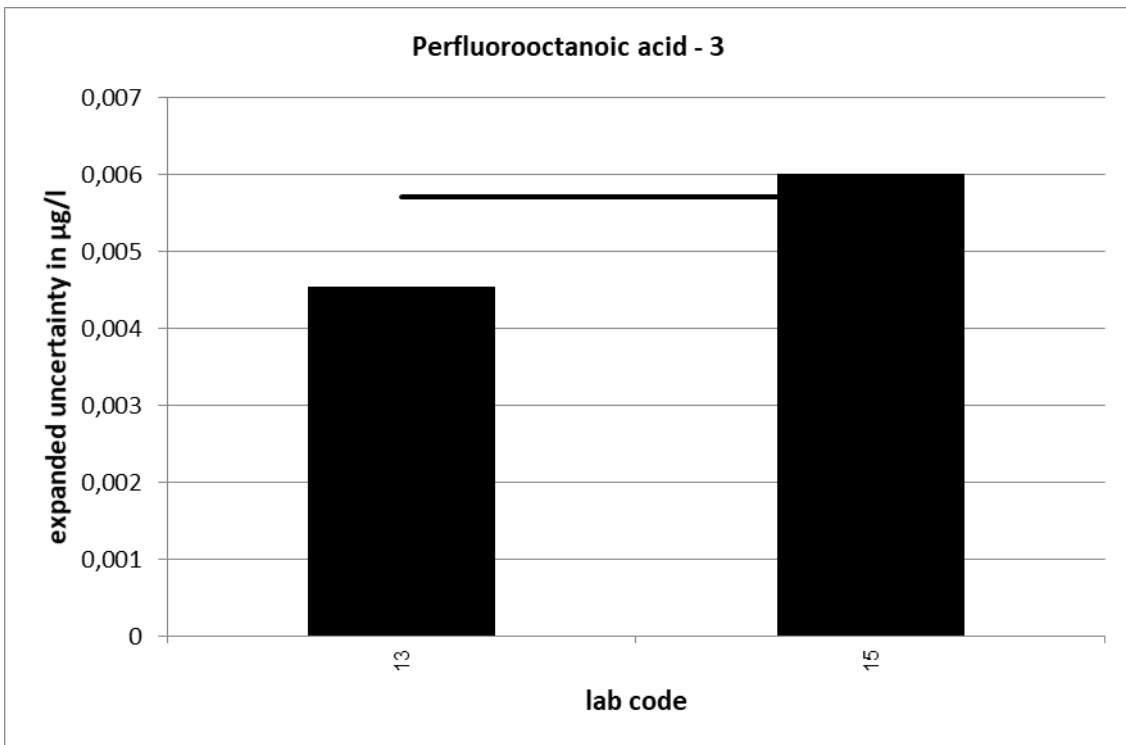
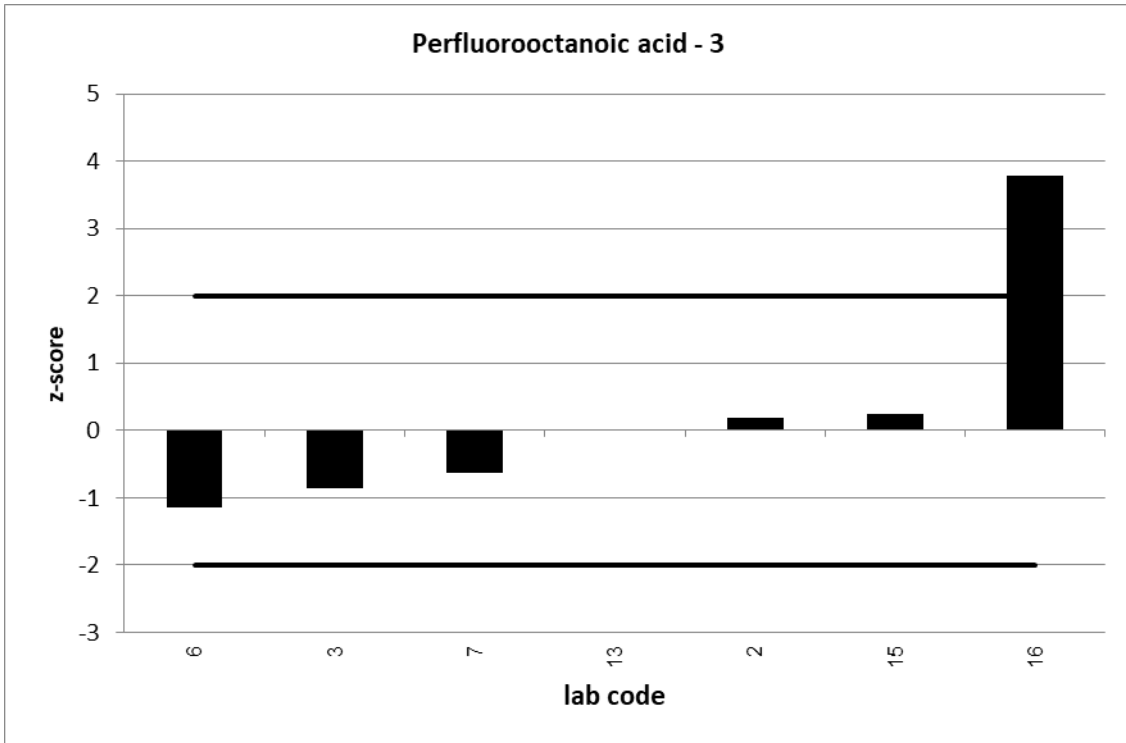


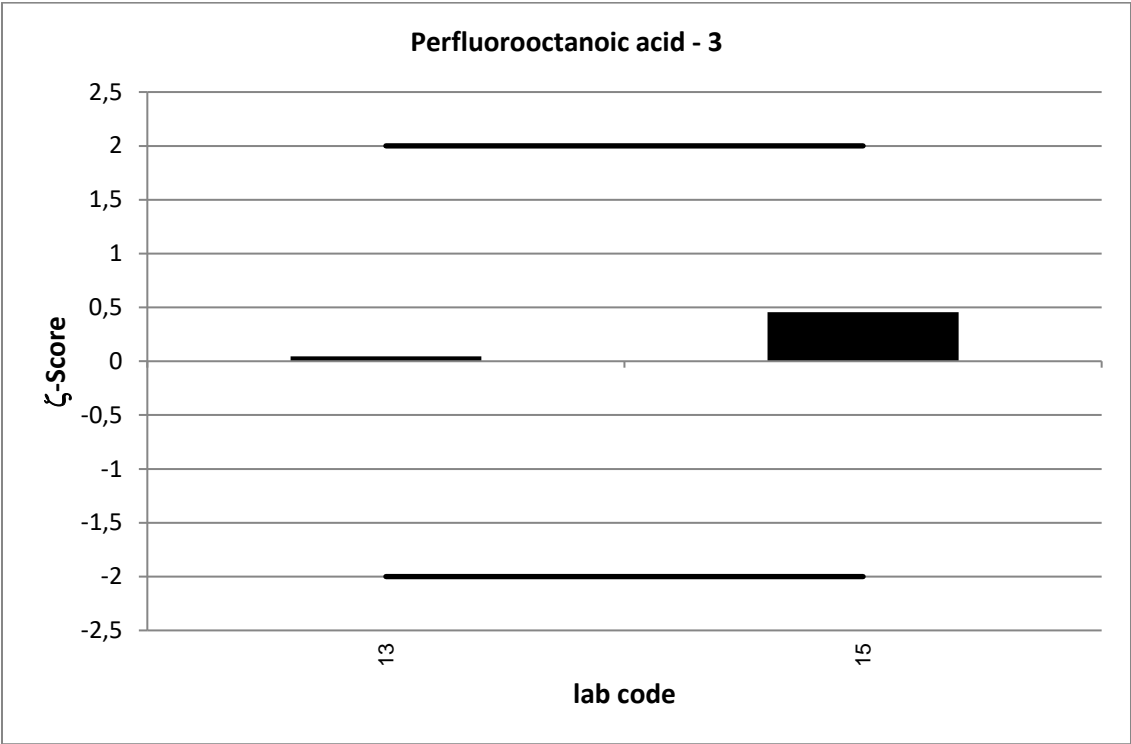
UKWIR PT 2/20		Perfluorooctanoic acid - 3			
assigned value [$\mu\text{g/l}$]*		0,02259 \pm 0,0015			
upper tolerance limit [$\mu\text{g/l}$]		0,03389			
lower tolerance limit [$\mu\text{g/l}$]		0,0113			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
2	0,02368			0,2	s
3	0,0177			-0,9	s
6	0,0161			-1,1	s
7	0,019			-0,6	s
13	0,0227	0,005	0,0	0,0	s
15	0,024	0,006	0,5	0,2	s
16	0,044			3,8	u

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



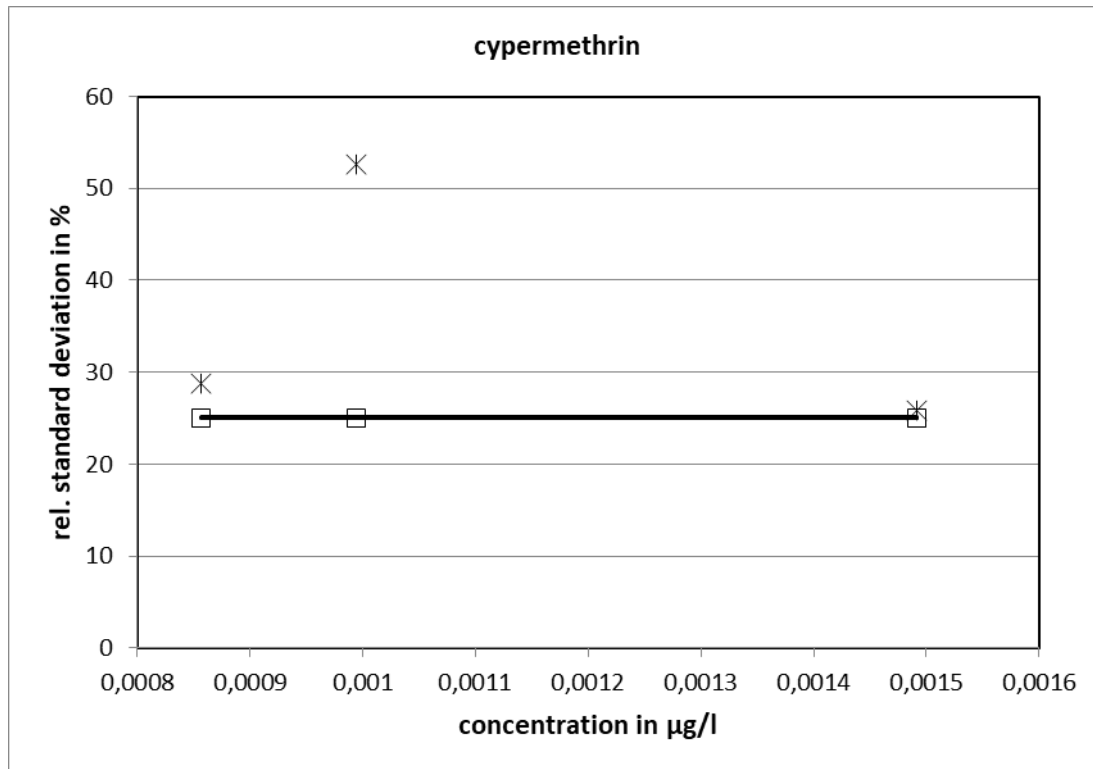




UKWIR 3/20:

cypermethrin														
level	assigned value [µg/l]	expanded uncertainty of the assigned value [%]	standard deviation, calculated using robust statistics [µg/l]	standard deviation for proficiency assessment [µg/l]	standard deviation for proficiency assessment [%]	upper tolerance limit [µg/l]	lower tolerance limit [µg/l]	upper tolerance limit [%]	lower tolerance limit [%]	number of results	out below	out above	out [%]	
1	0,0009	31,10	0,0002	0,0002	25	0,0013	0,0004	50	-50	6	0	1	16,7	
2	0,0010	33,61	0,0005	0,0002	25	0,0015	0,0005	50	-50	6	1	1	33,3	
3	0,0015	22,36	0,0004	0,0004	25	0,0022	0,0007	50	-50	6	0	0	0,0	
										sum	18	1	2	16,7

Relative standard deviation

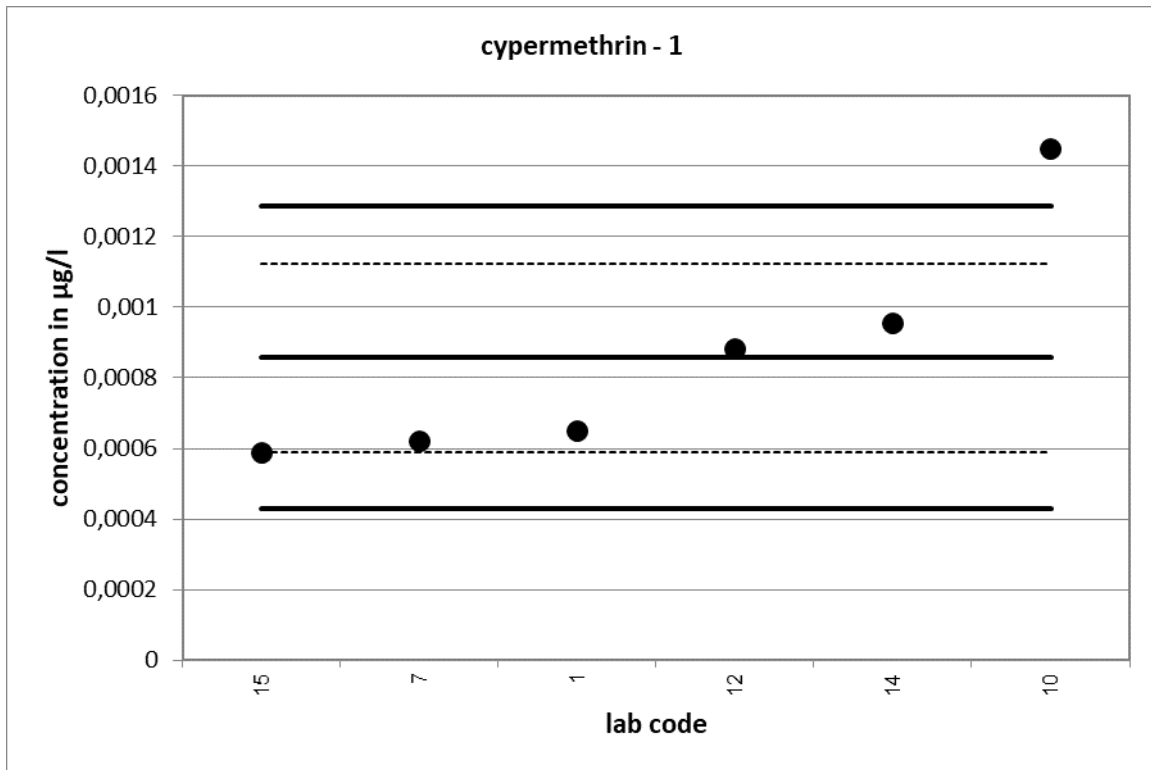


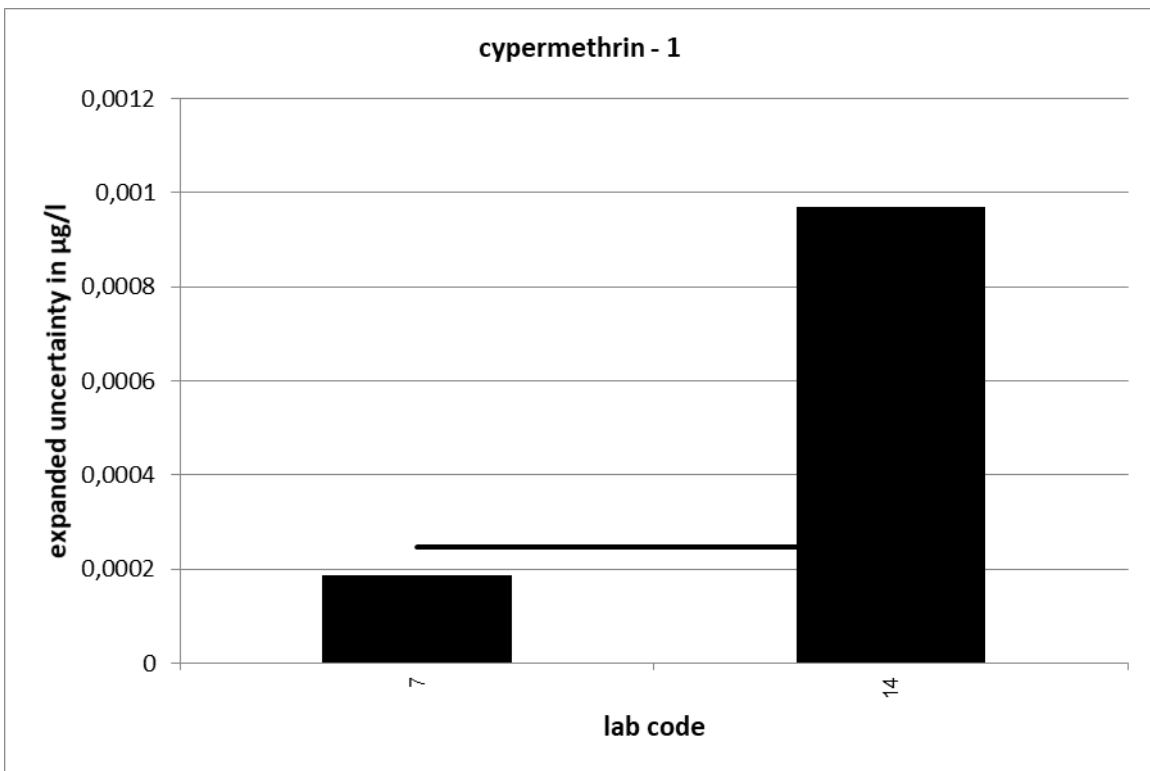
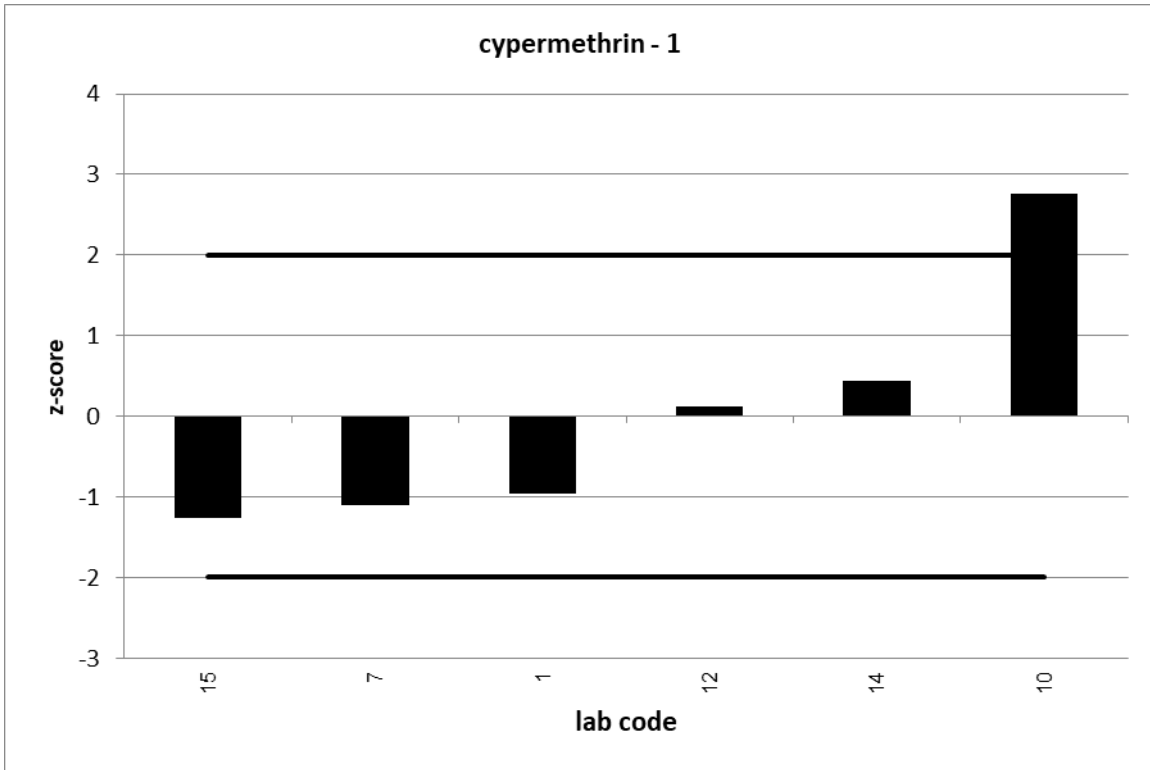
25 % is used as standard deviation for proficiency assessment.

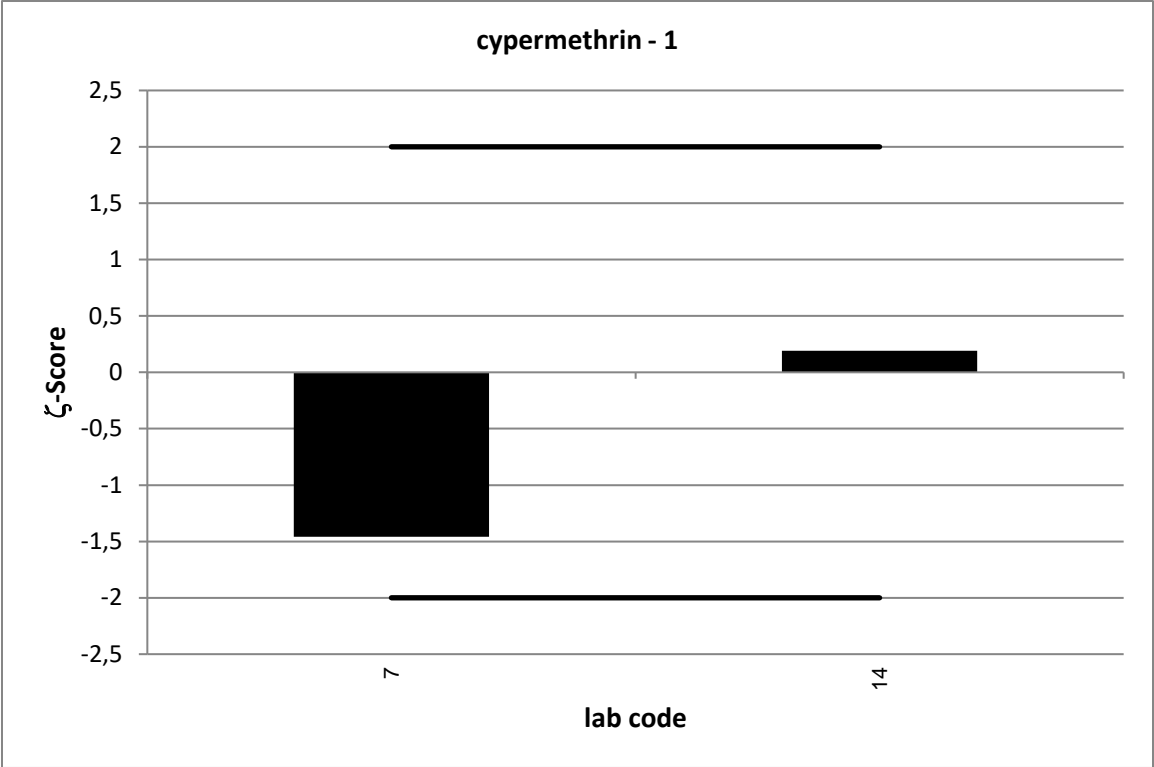
UKWIR PT 3/20		cypermethrin - 1			
assigned value [$\mu\text{g/l}$]*		0,0008572 \pm 0,0002666			
upper tolerance limit [$\mu\text{g/l}$]		0,001286			
lower tolerance limit [$\mu\text{g/l}$]		0,0004286			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm. **
1	0,00065			-1,0	s
7	0,00062	0,000186	-1,5	-1,1	s
10	0,00145			2,8	q
12	0,0008821			0,1	s
14	0,000953	0,00097	0,2	0,4	s
15	0,0005878			-1,3	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



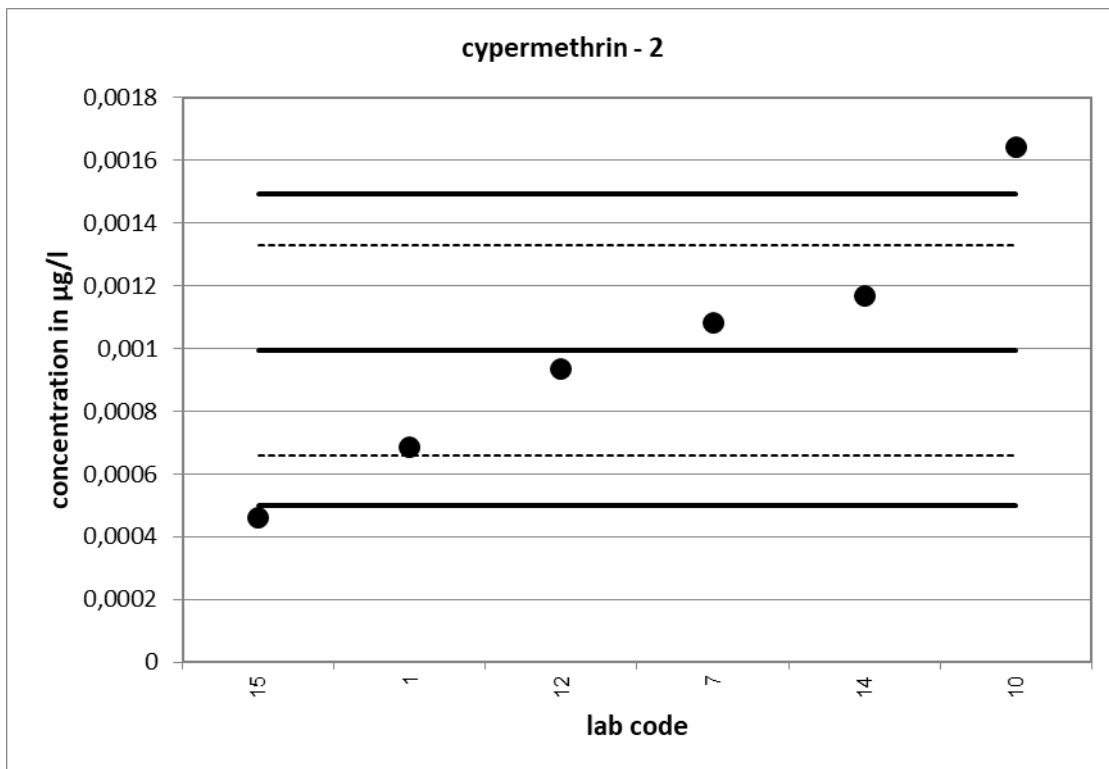


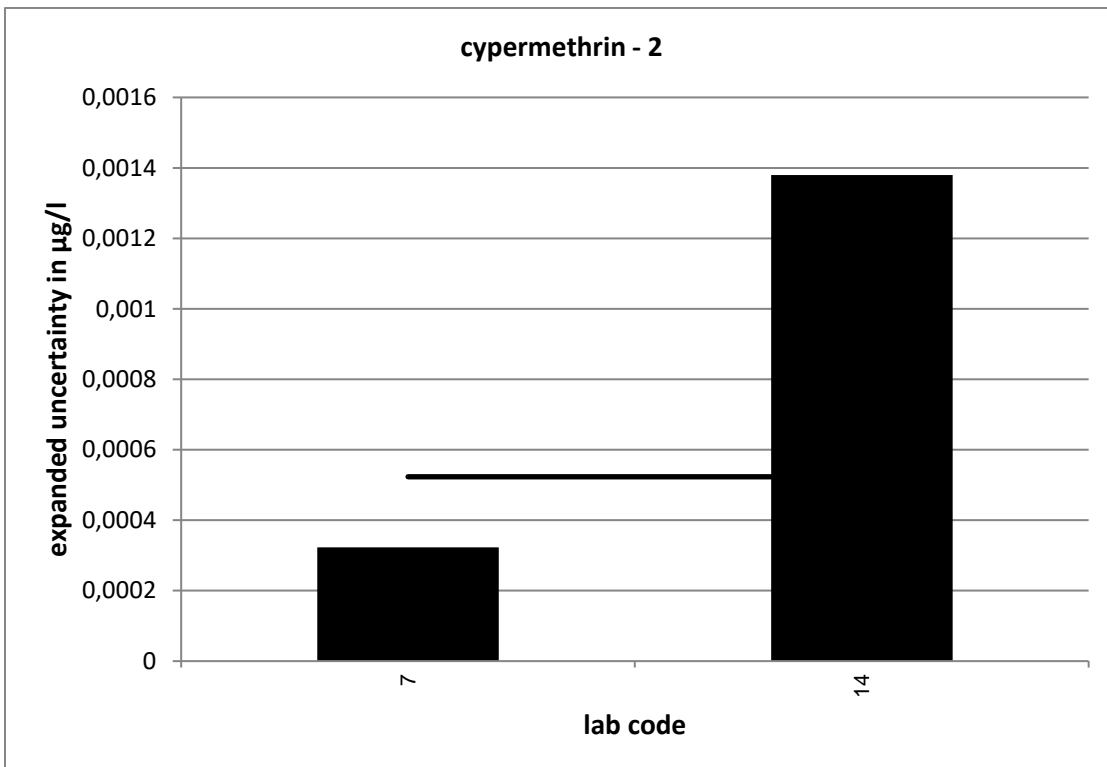
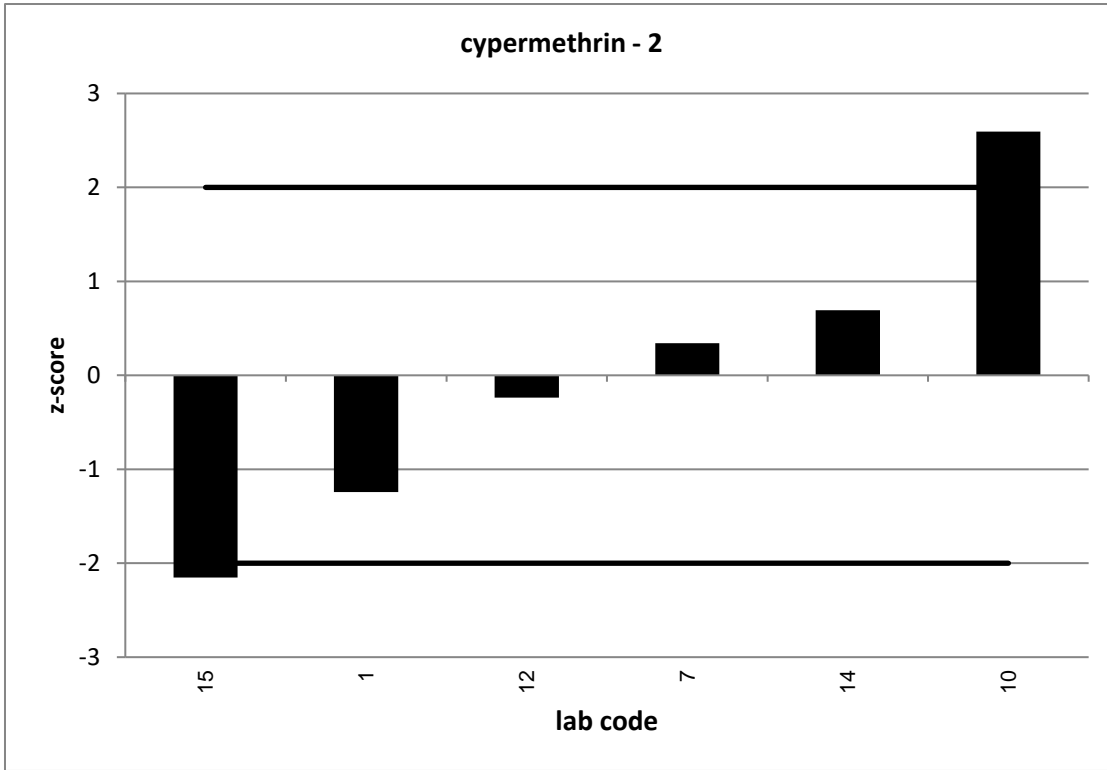


UKWIR PT 3/20		cypermethrin - 2			
assigned value [$\mu\text{g/l}$]*		0,0009948 \pm 0,0003344			
upper tolerance limit [$\mu\text{g/l}$]		0,001492			
lower tolerance limit [$\mu\text{g/l}$]		0,0004974			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm. **
1	0,000686			-1,2	s
7	0,00108	0,0003	0,4	0,3	s
10	0,00164			2,6	q
12	0,000936			-0,2	s
14	0,001167	0,0014	0,2	0,7	s
15	0,0004596			-2,2	q

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



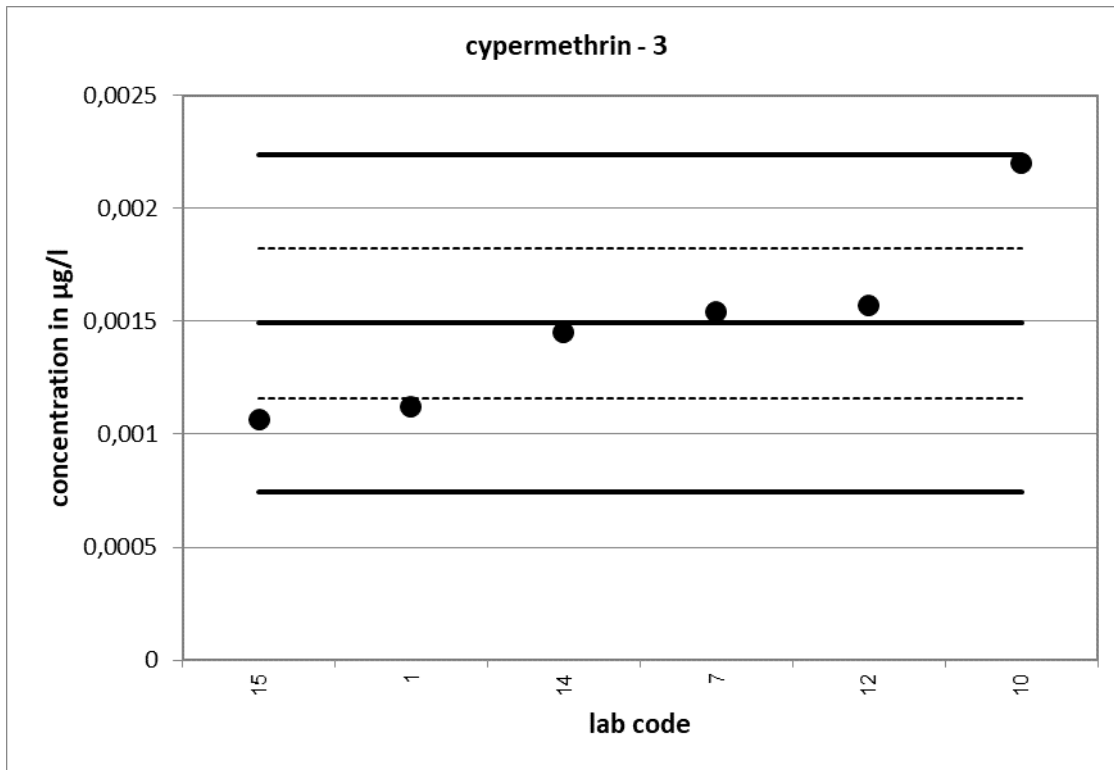


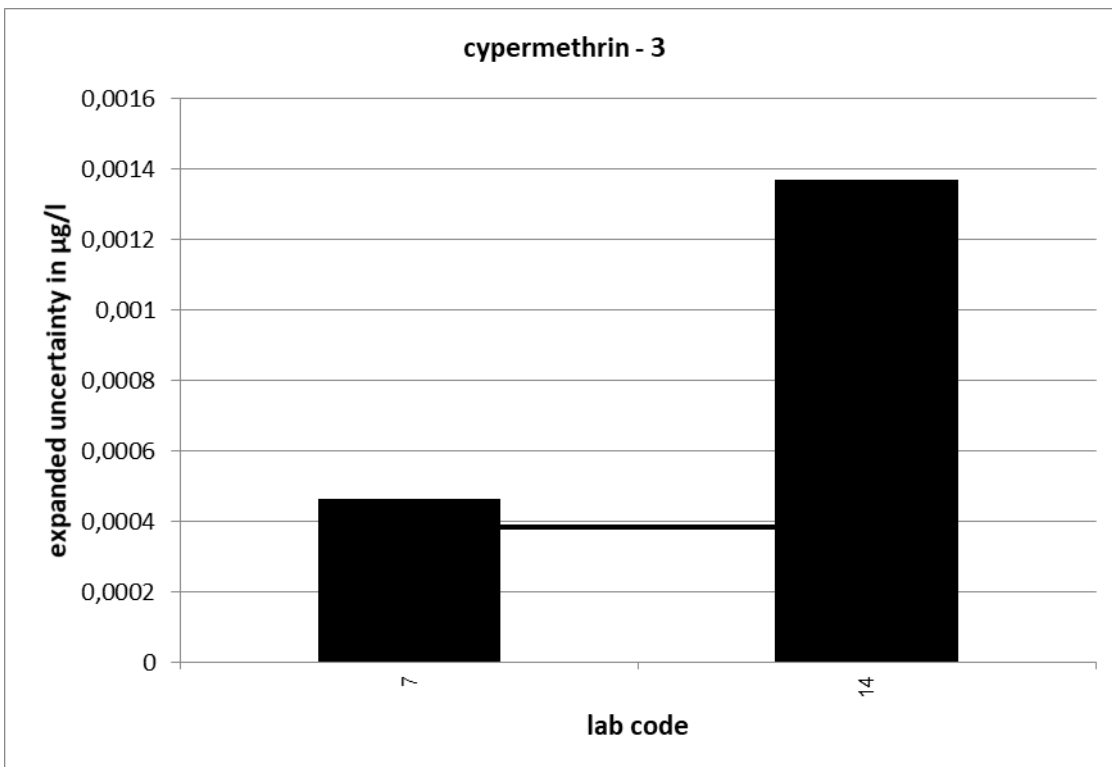
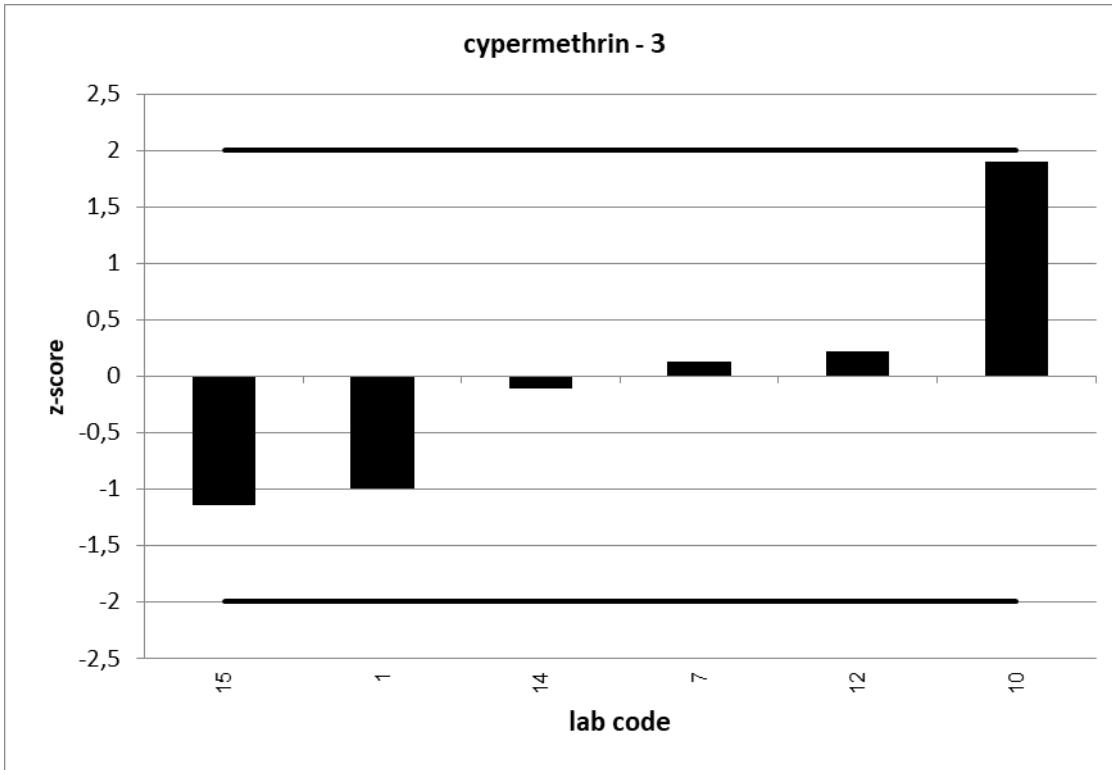


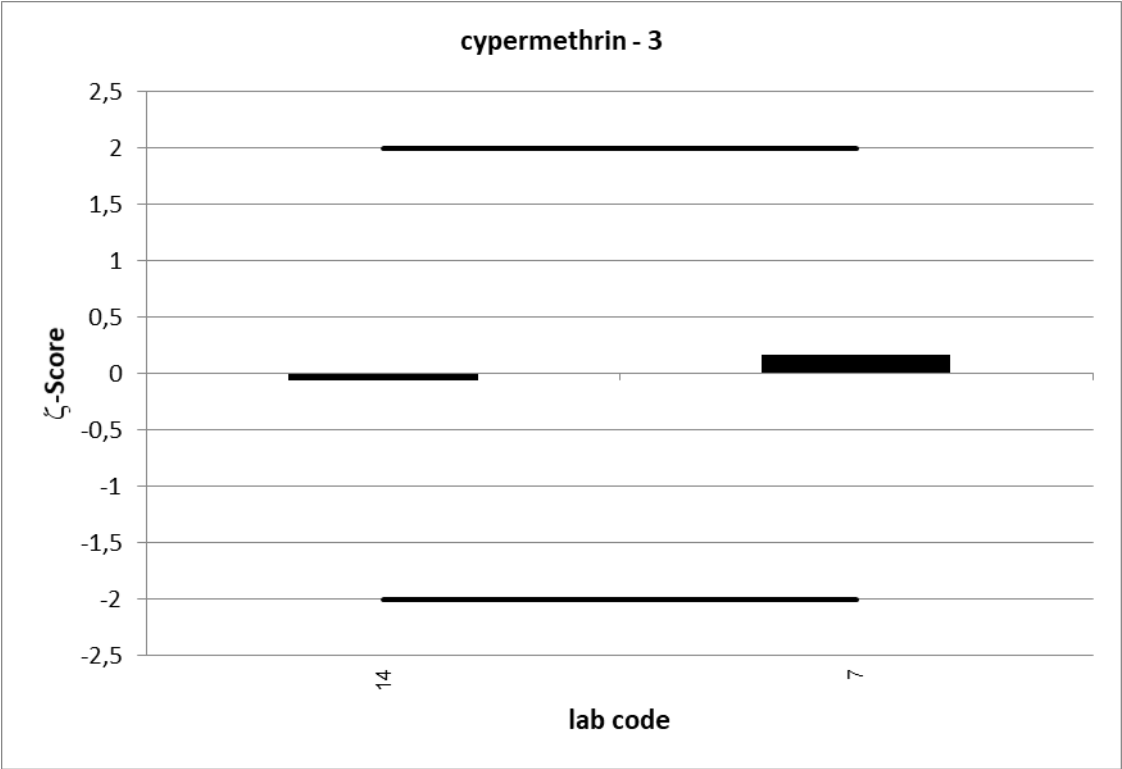
UKWIR PT 3/20		cypermethrin - 3			
assigned value [$\mu\text{g/l}$]*		0,001491 \pm 0,000333			
upper tolerance limit [$\mu\text{g/l}$]		0,002237			
lower tolerance limit [$\mu\text{g/l}$]		0,0007457			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
1	0,00112			-1,0	s
7	0,00154	0,0005	0,2	0,1	s
10	0,0022			1,9	s
12	0,0015723			0,2	s
14	0,001452	0,0014	-0,1	-0,1	s
15	0,0010635			-1,1	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



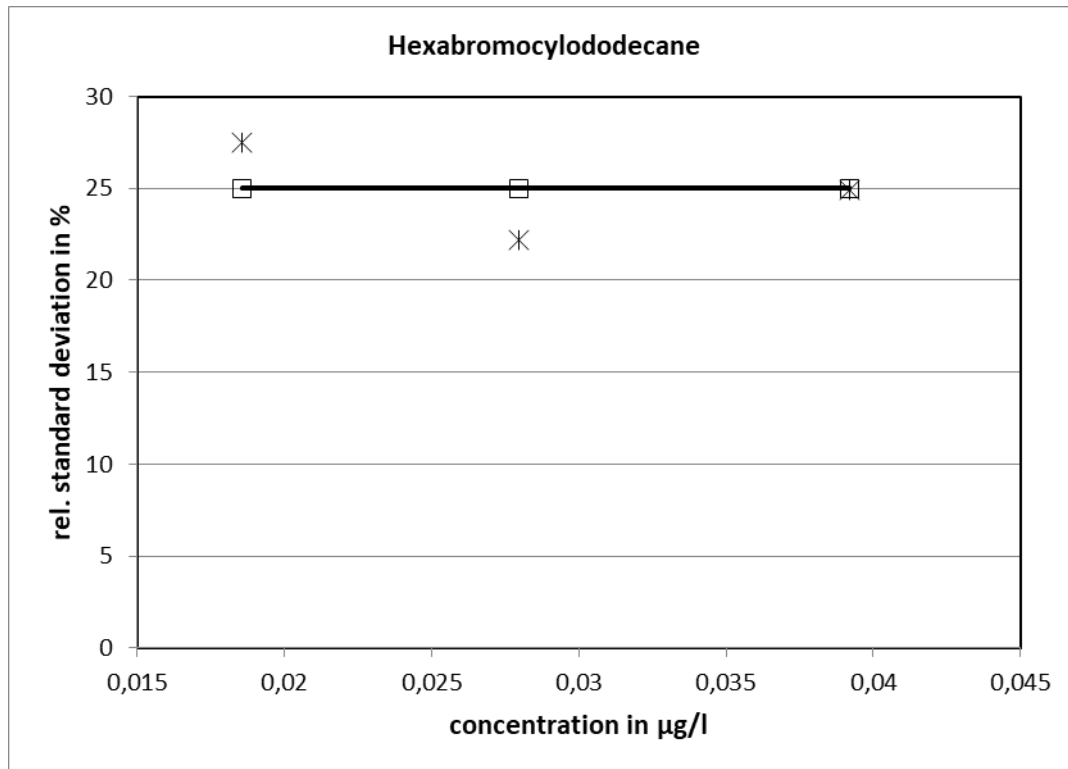




UKWIR 4/20:

Hexabromocyclododecane													
level	assigned value [µg/l]	expanded uncertainty of the assigned value [%]	standard deviation, calculated using robust statistics [µg/l]	standard deviation for proficiency assessment [µg/l]	standard deviation for proficiency assessment [%]	upper tolerance limit [µg/l]	lower tolerance limit [µg/l]	upper tolerance limit [%]	lower tolerance limit [%]	number of results	out below	out above	out [%]
1	0,0186	30,71	0,0051	0,0046	25	0,0279	0,0093	50	-50	5	0	0	0,0
2	0,0280	24,85	0,0062	0,0070	25	0,0419	0,0140	50	-50	5	0	0	0,0
3	0,0392	27,86	0,0098	0,0098	25	0,0588	0,0196	50	-50	5	0	0	0,0
										sum	15	0	0,0

Relative standard deviation

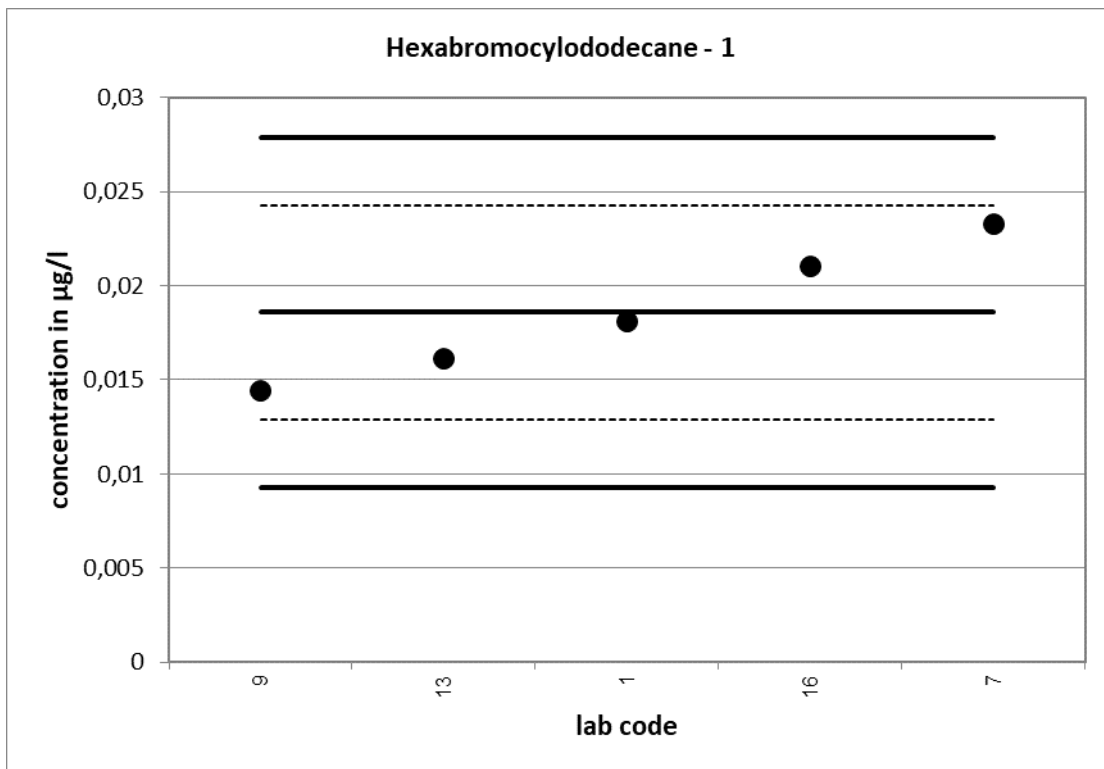


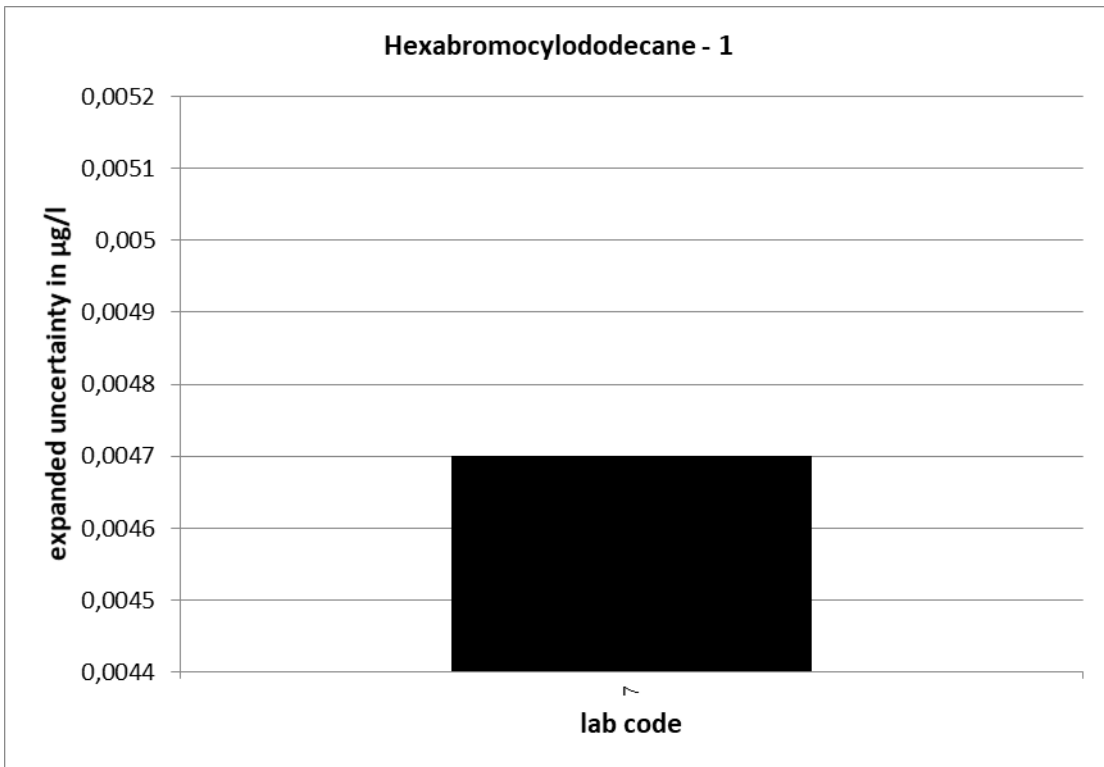
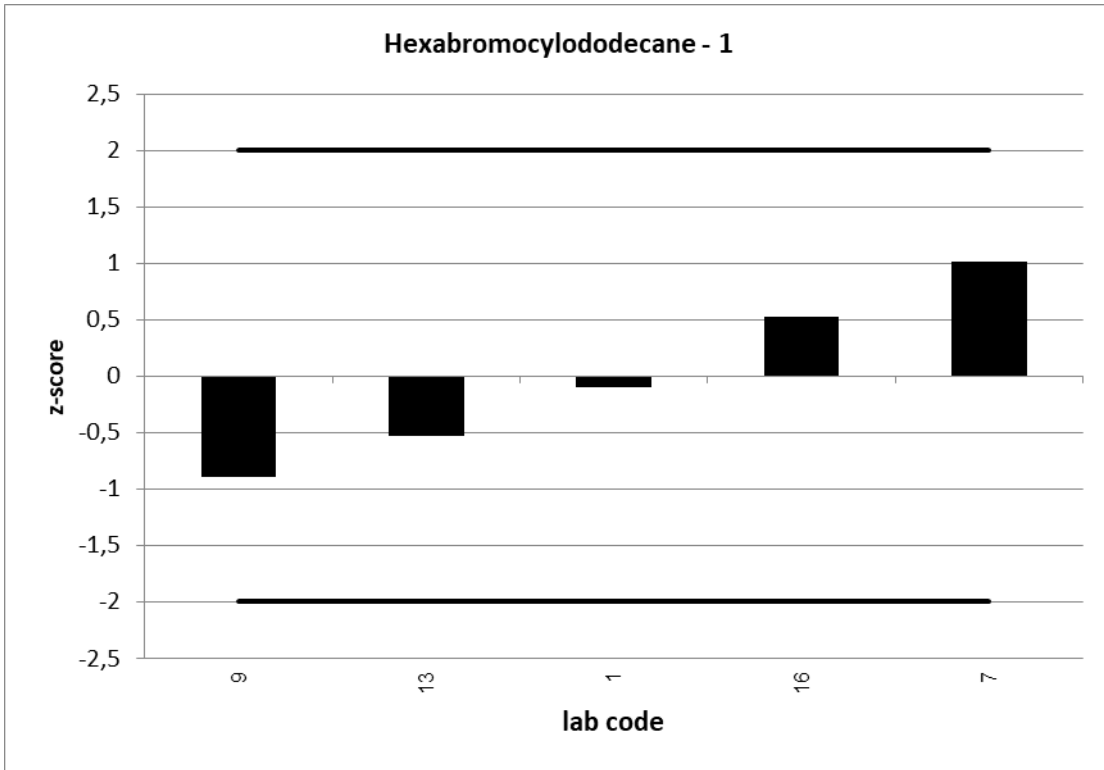
25 % is used as standard deviation for proficiency assessment.

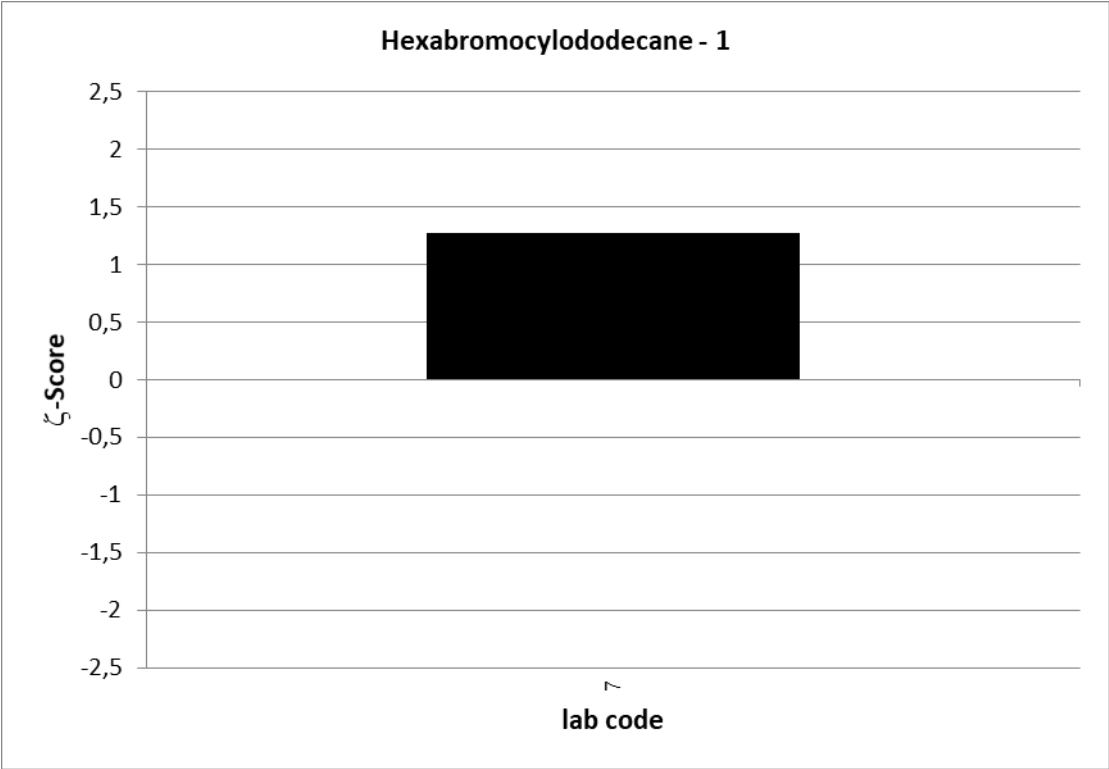
UKWIR PT 4/20		Hexabromocyclododecane - 1			
assigned value [$\mu\text{g/l}$]*		0,01858 \pm 0,00571			
upper tolerance limit [$\mu\text{g/l}$]		0,02787			
lower tolerance limit [$\mu\text{g/l}$]		0,00929			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
1	0,0181			-0,1	s
7	0,0233	0,005	1,3	1,0	s
9	0,0144			-0,9	s
13	0,0161			-0,5	s
16	0,021			0,5	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



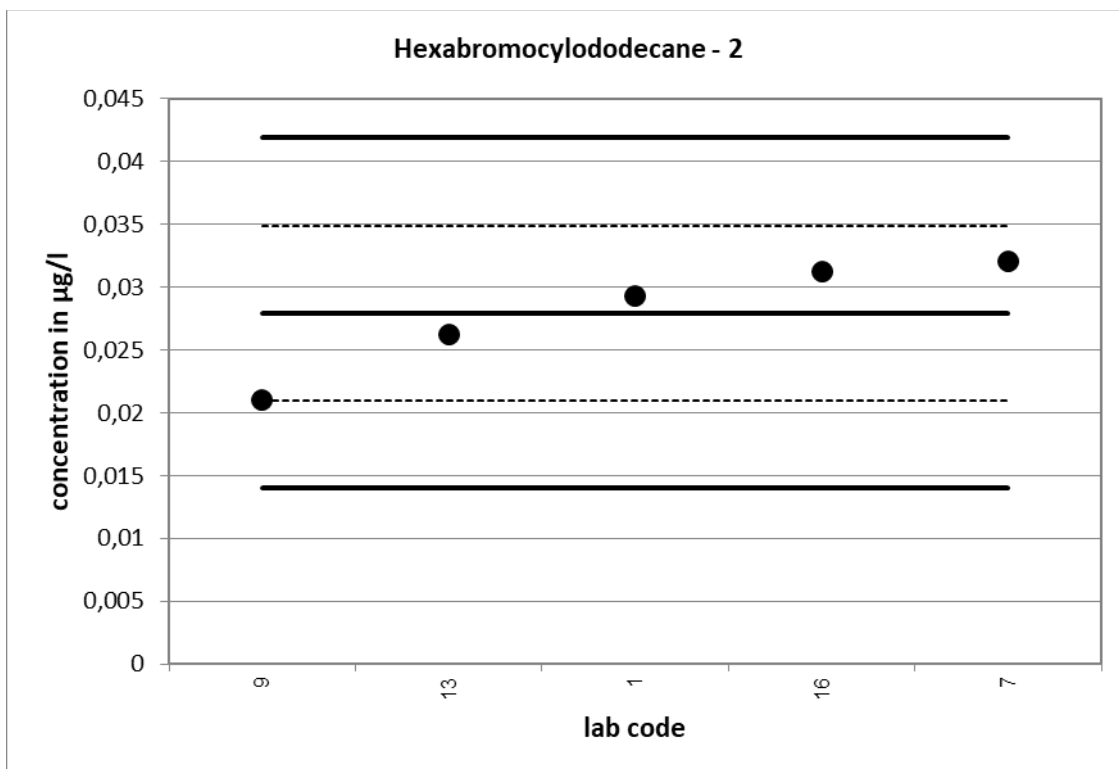


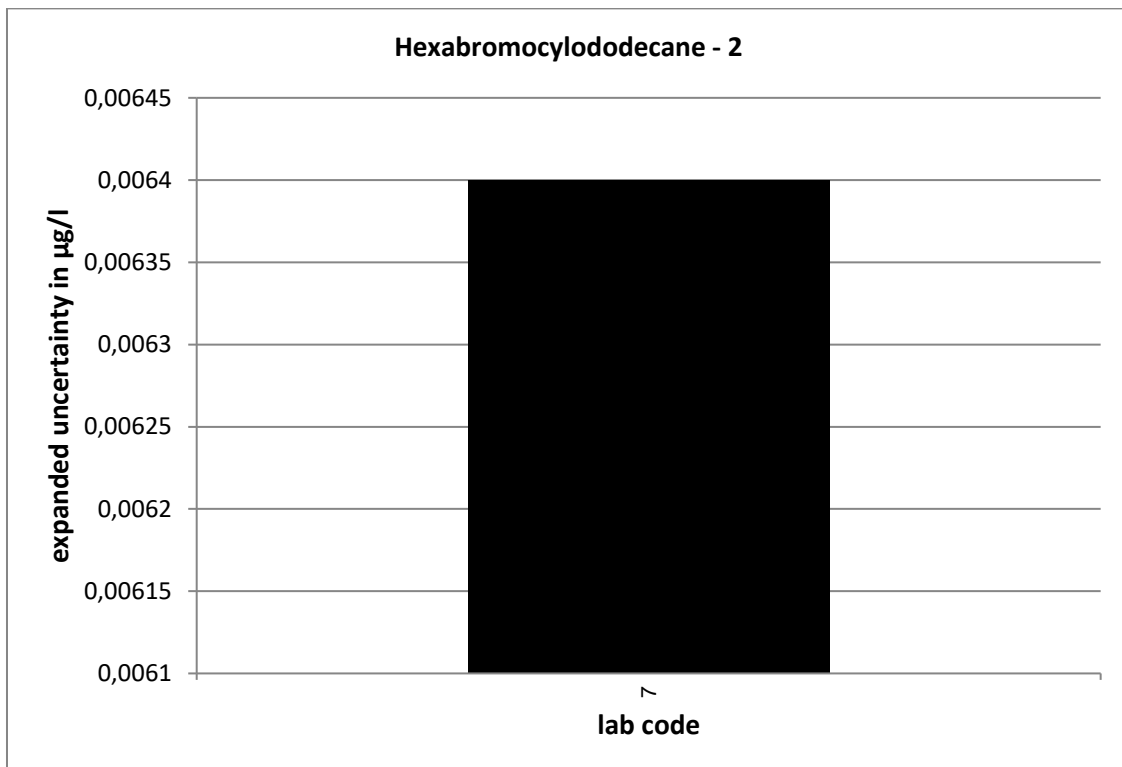
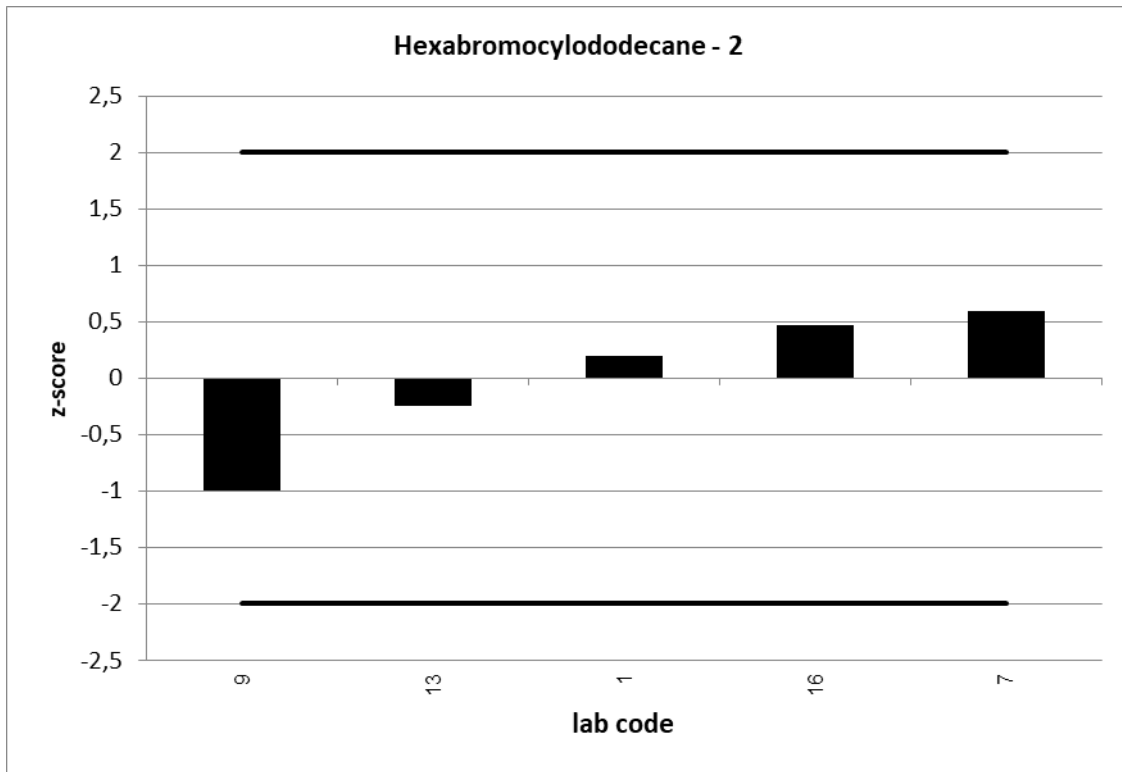


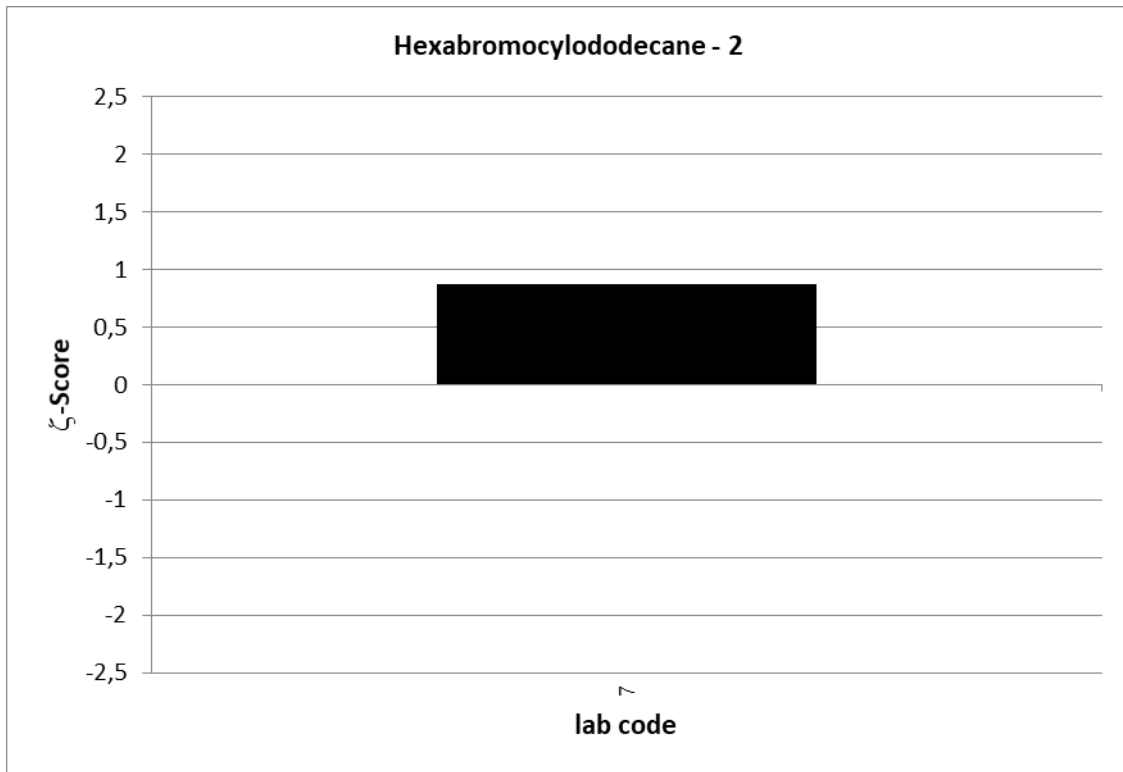
UKWIR PT 4/20		Hexabromocyclododecane - 2			
assigned value [$\mu\text{g/l}$]*		0,02796 \pm 0,00695			
upper tolerance limit [$\mu\text{g/l}$]		0,04194			
lower tolerance limit [$\mu\text{g/l}$]		0,01398			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
1	0,0293			0,2	s
7	0,0321	0,006	0,9	0,6	s
9	0,021			-1,0	s
13	0,0262			-0,3	s
16	0,0312			0,5	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



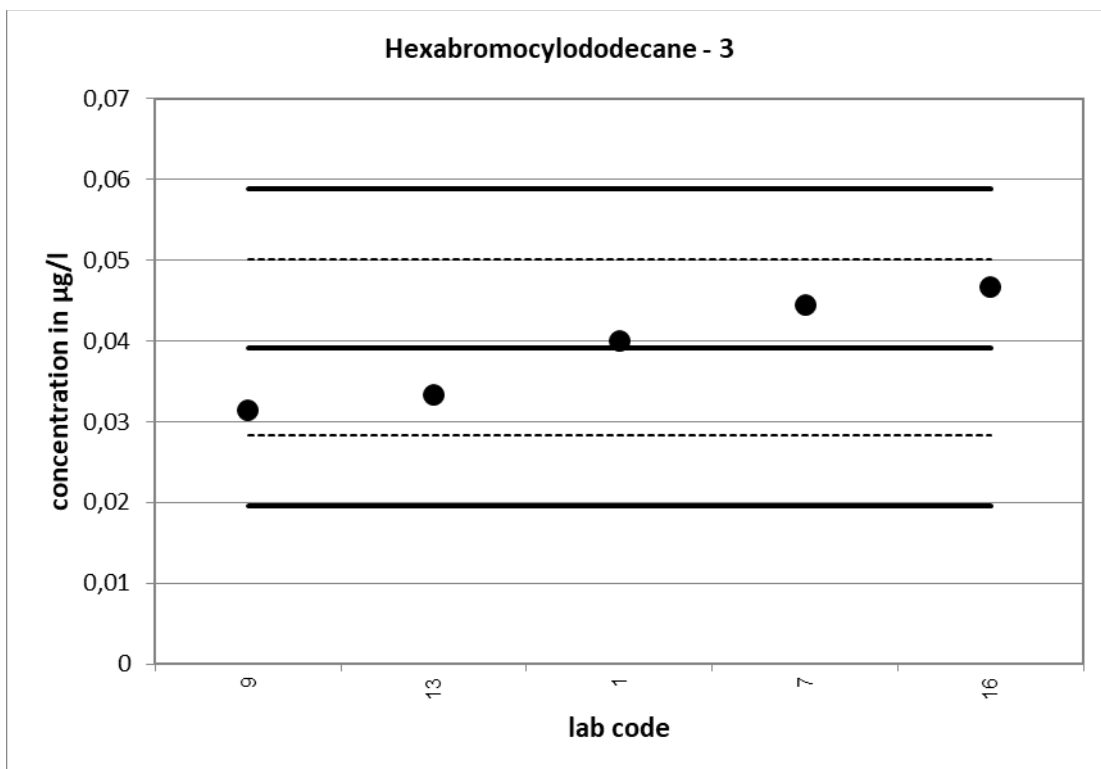


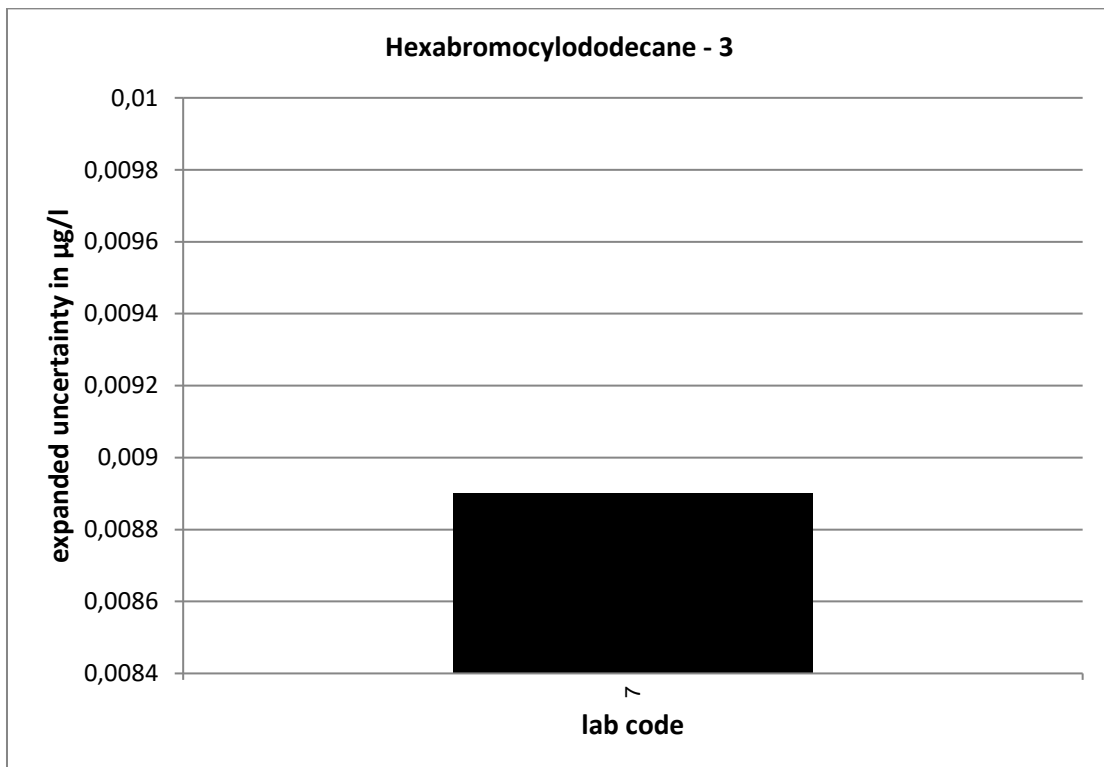
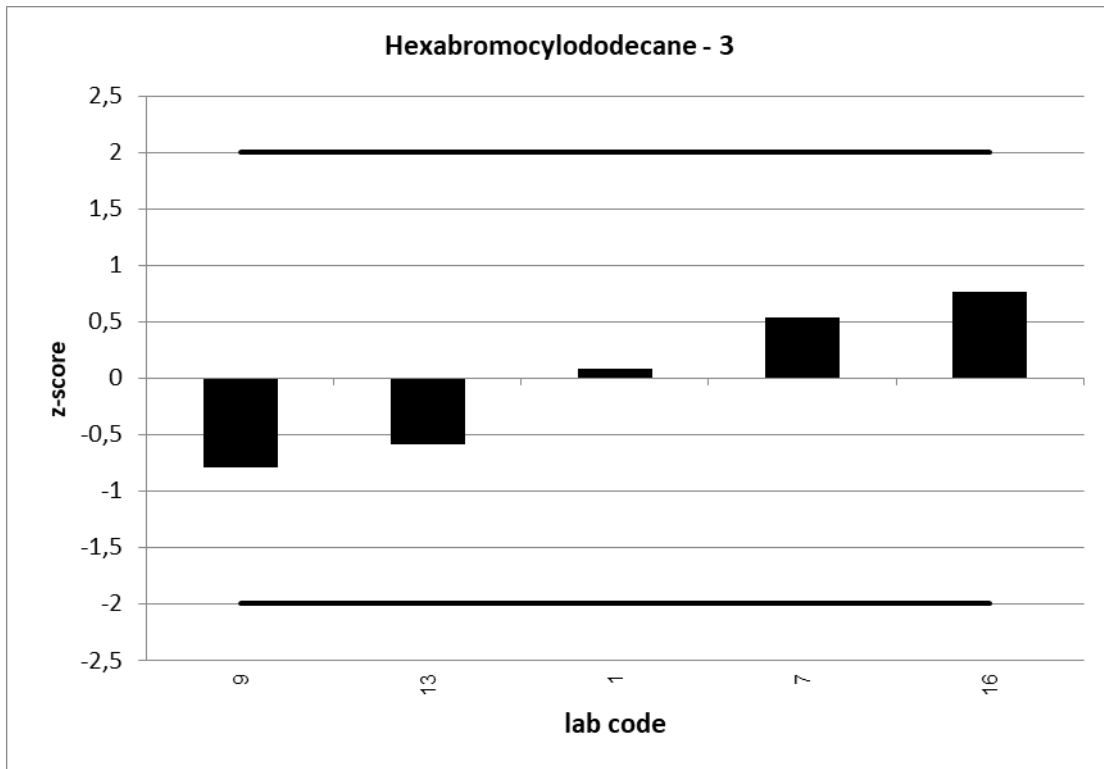


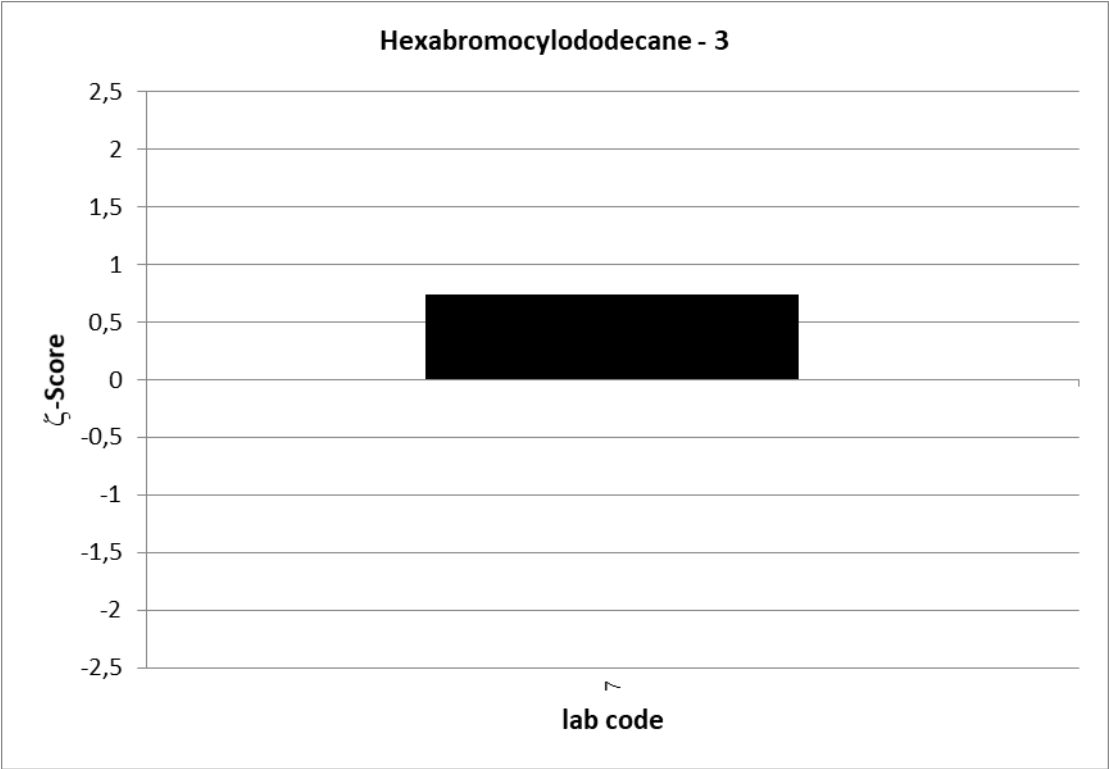
UKWIR PT 4/20		Hexabromocyclododecane - 3			
assigned value [$\mu\text{g/l}$]*		0,03918 \pm 0,01092			
upper tolerance limit [$\mu\text{g/l}$]		0,05877			
lower tolerance limit [$\mu\text{g/l}$]		0,01959			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
1	0,04			0,1	s
7	0,0444	0,009	0,7	0,5	s
9	0,0314			-0,8	s
13	0,0334			-0,6	s
16	0,0467			0,8	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



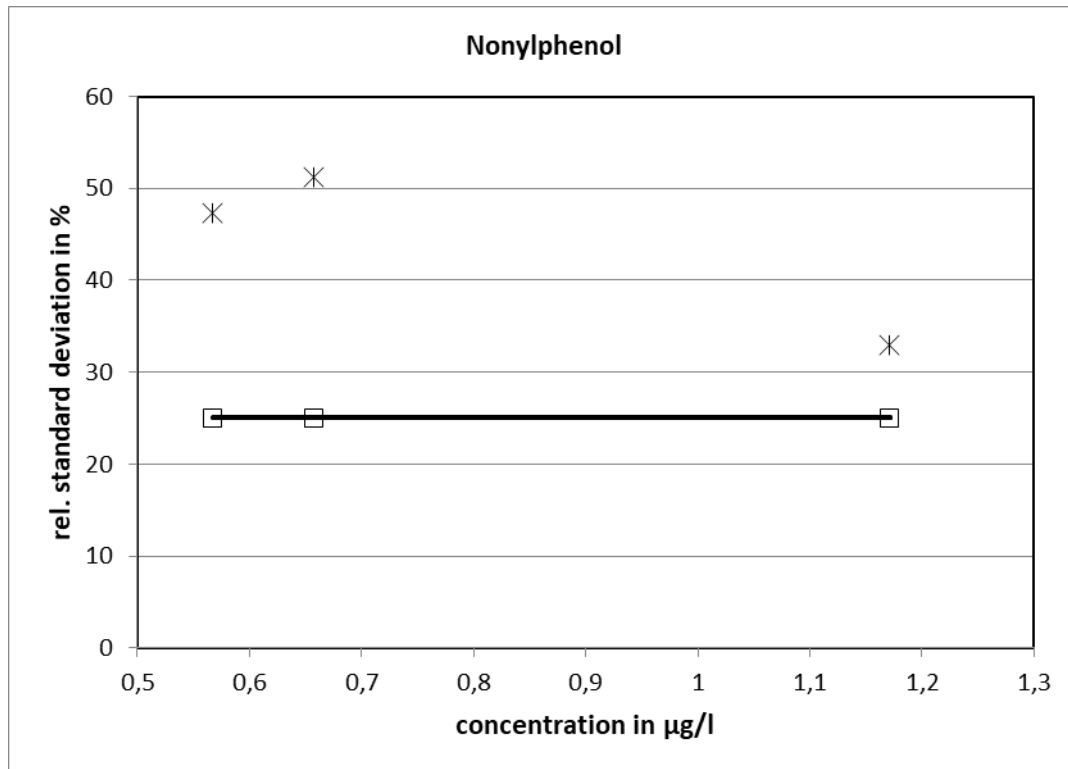




UKWIR 5/20:

Nonylphenol													
level	assigned value [µg/l]	expanded uncertainty of the assigned value [%]	standard deviation, calculated using robust statistics [µg/l]	standard deviation for proficiency assessment [µg/l]	standard deviation for proficiency assessment [%]	upper tolerance limit [µg/l]	lower tolerance limit [µg/l]	upper tolerance limit [%]	lower tolerance limit [%]	number of results	out below	out above	out [%]
1	0,5673	24,22	0,2685	0,1418	25	0,8509	0,2836	50	-50	4	0	0	0,0
2	0,6580	25,34	0,3373	0,1645	25	0,9870	0,3290	50	-50	4	0	0	0,0
3	1,171	16,80	0,3861	0,2928	25	1,757	0,5855	50	-50	4	0	0	0,0
									sum	12	0	0	0,0

Relative standard deviation

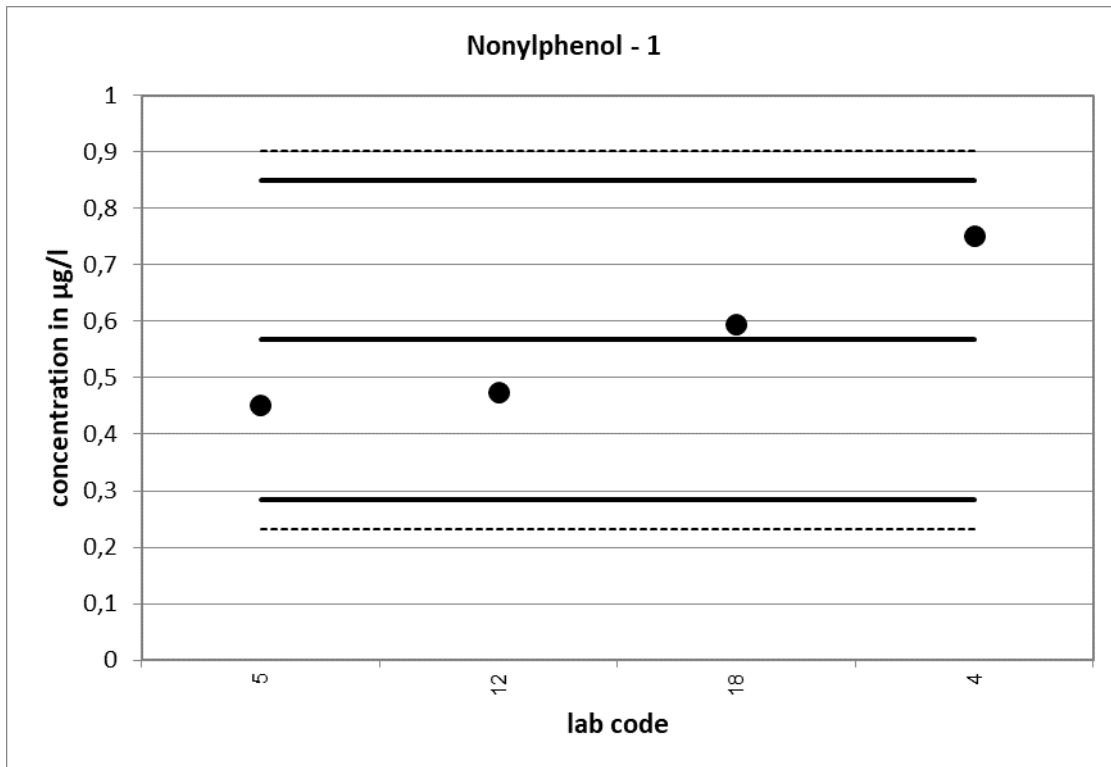


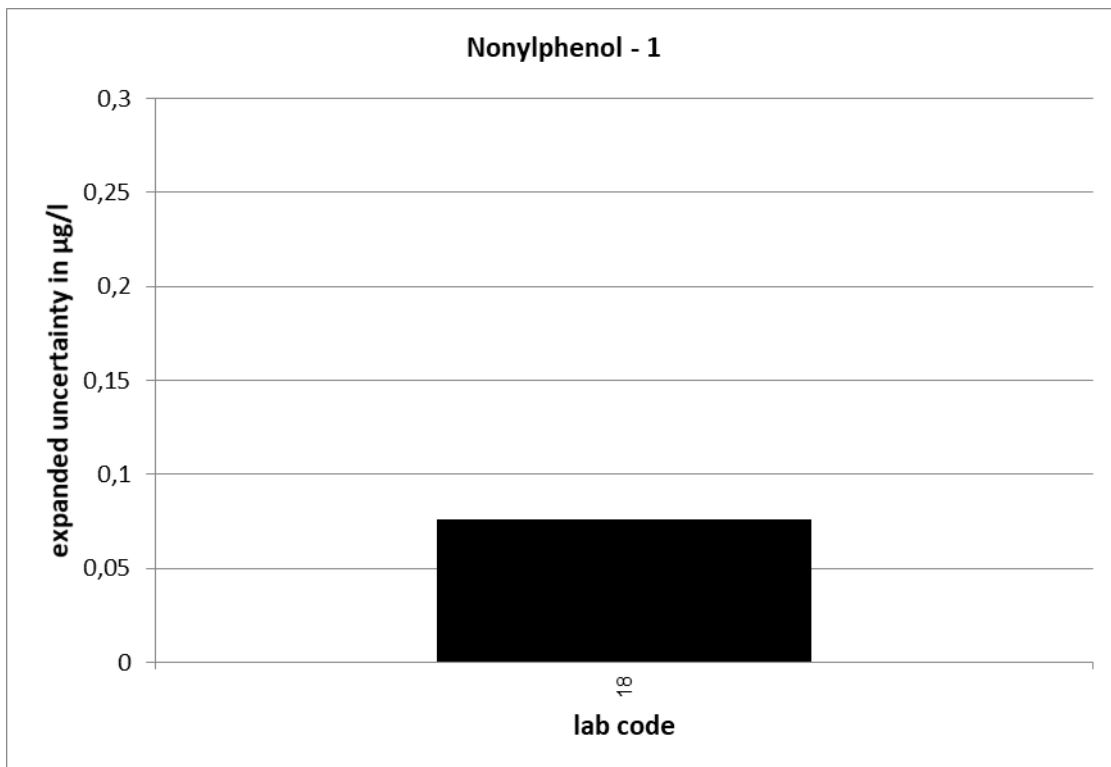
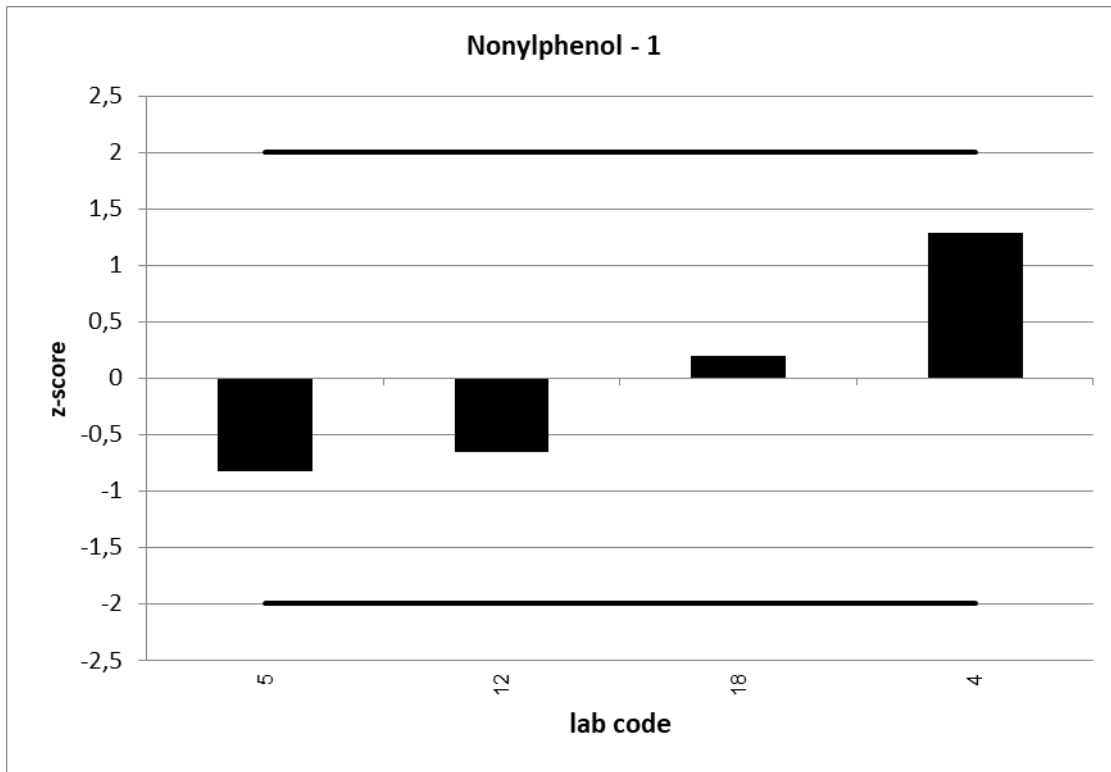
25 % is used as standard deviation for proficiency assessment.

UKWIR PT 5/20		Nonylphenol - 1			
assigned value [$\mu\text{g/l}$]*		0,5673 \pm 0,3356			
upper tolerance limit [$\mu\text{g/l}$]		0,8509			
lower tolerance limit [$\mu\text{g/l}$]		0,2836			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm. **
4	0,75			1,3	s
5	0,45			-0,8	s
12	0,474			-0,7	s
18	0,595	0,0762	0,2	0,2	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



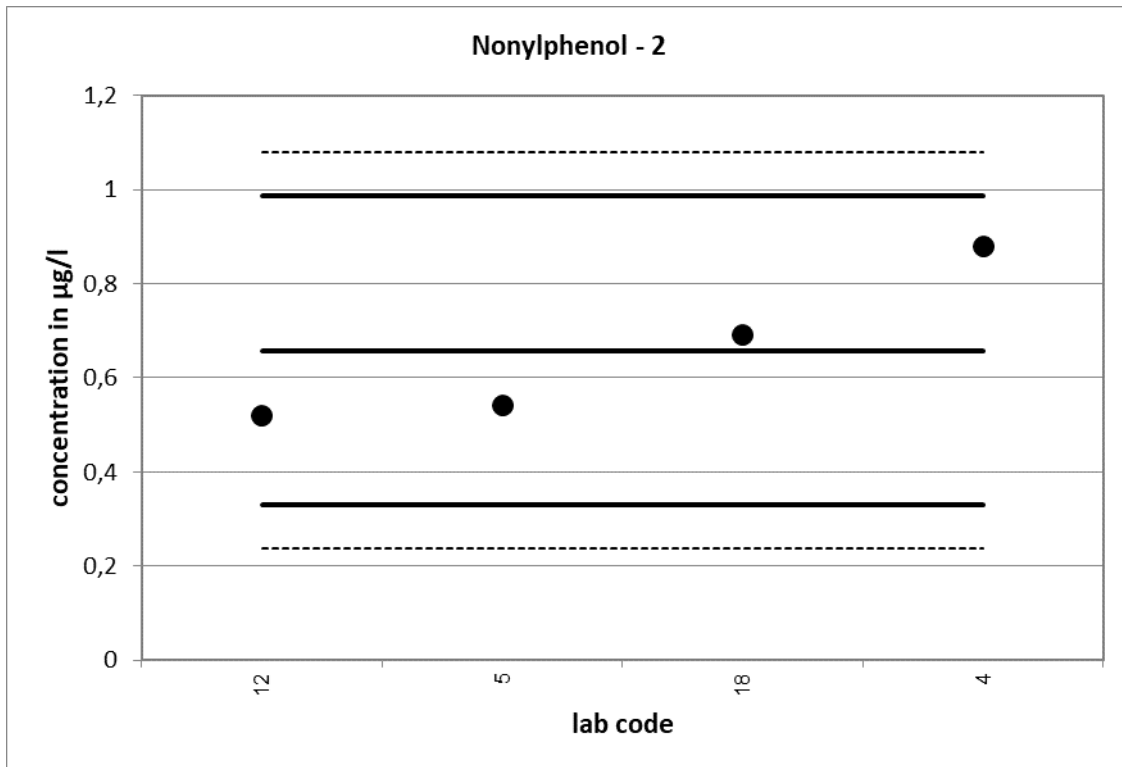


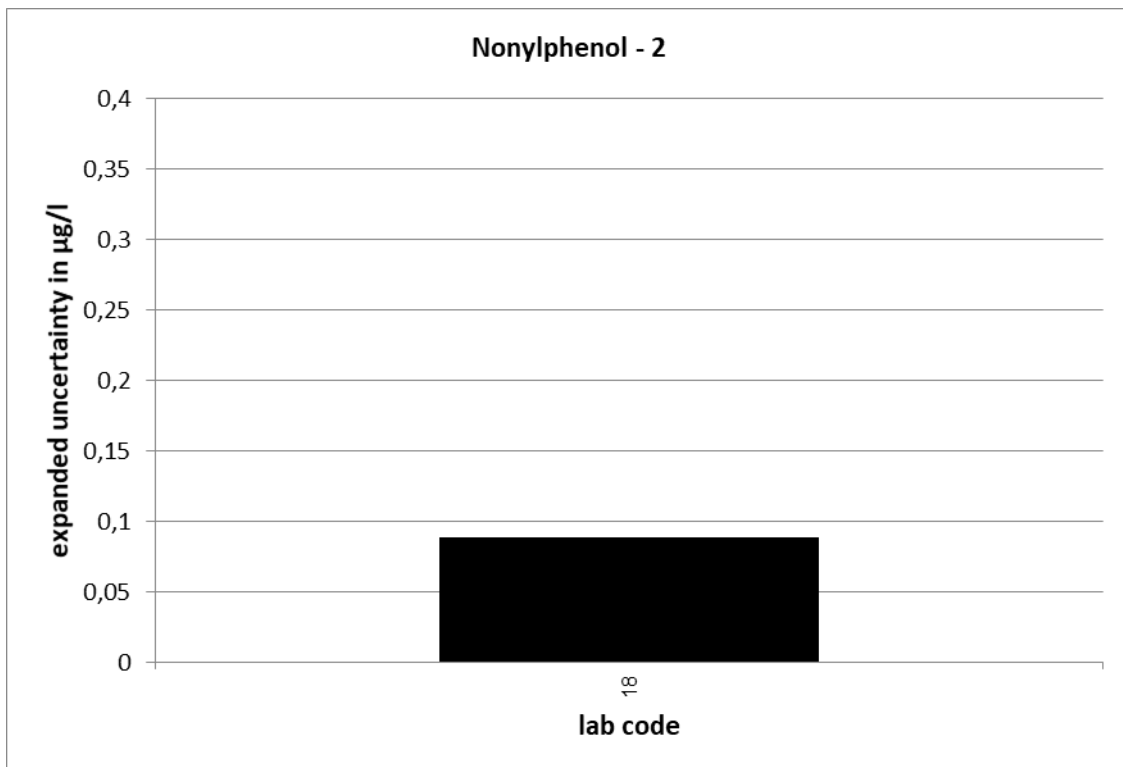
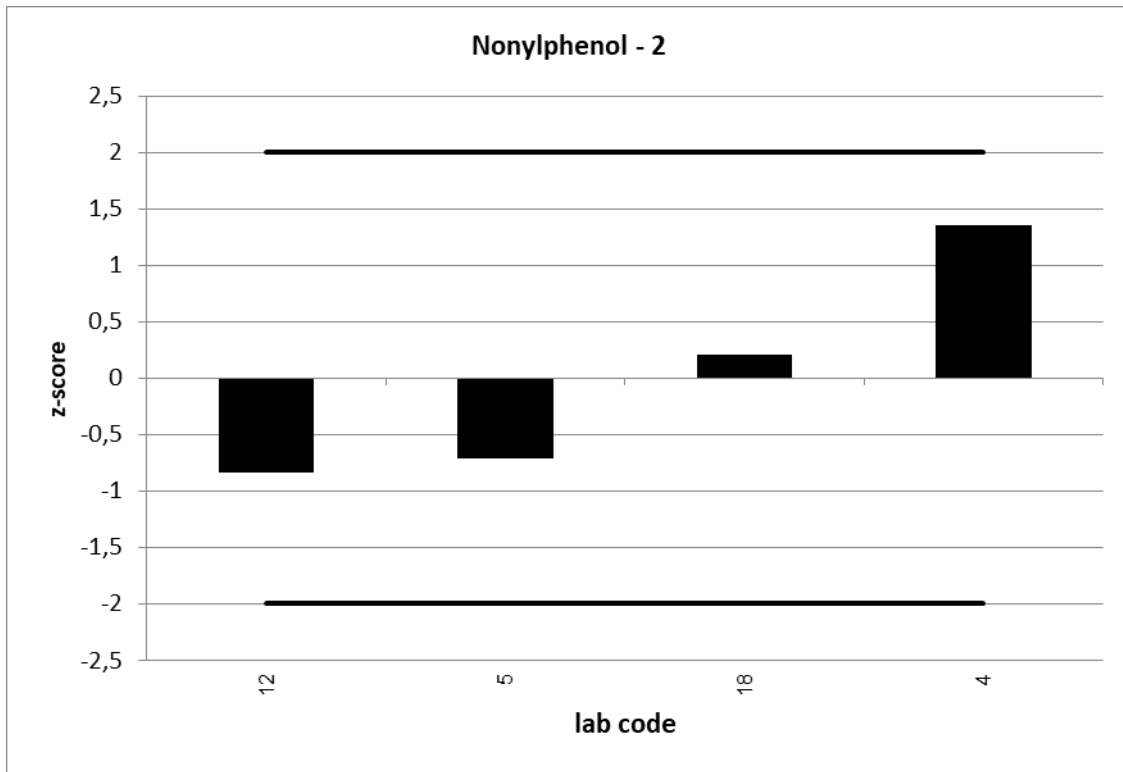


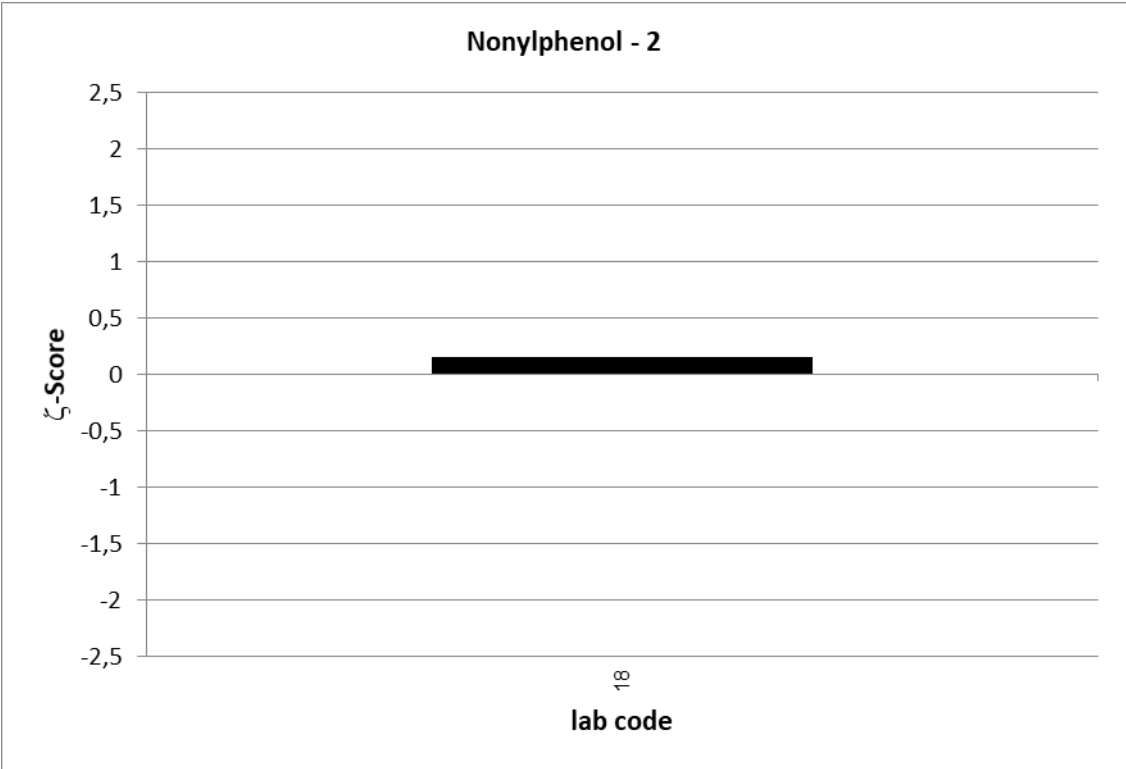
UKWIR PT 5/20		Nonylphenol - 2			
assigned value [$\mu\text{g/l}$]*		0,658 \pm 0,4216			
upper tolerance limit [$\mu\text{g/l}$]		0,987			
lower tolerance limit [$\mu\text{g/l}$]		0,329			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm. **
4	0,88			1,3	s
5	0,54			-0,7	s
12	0,52			-0,8	s
18	0,692	0,0886	0,2	0,2	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



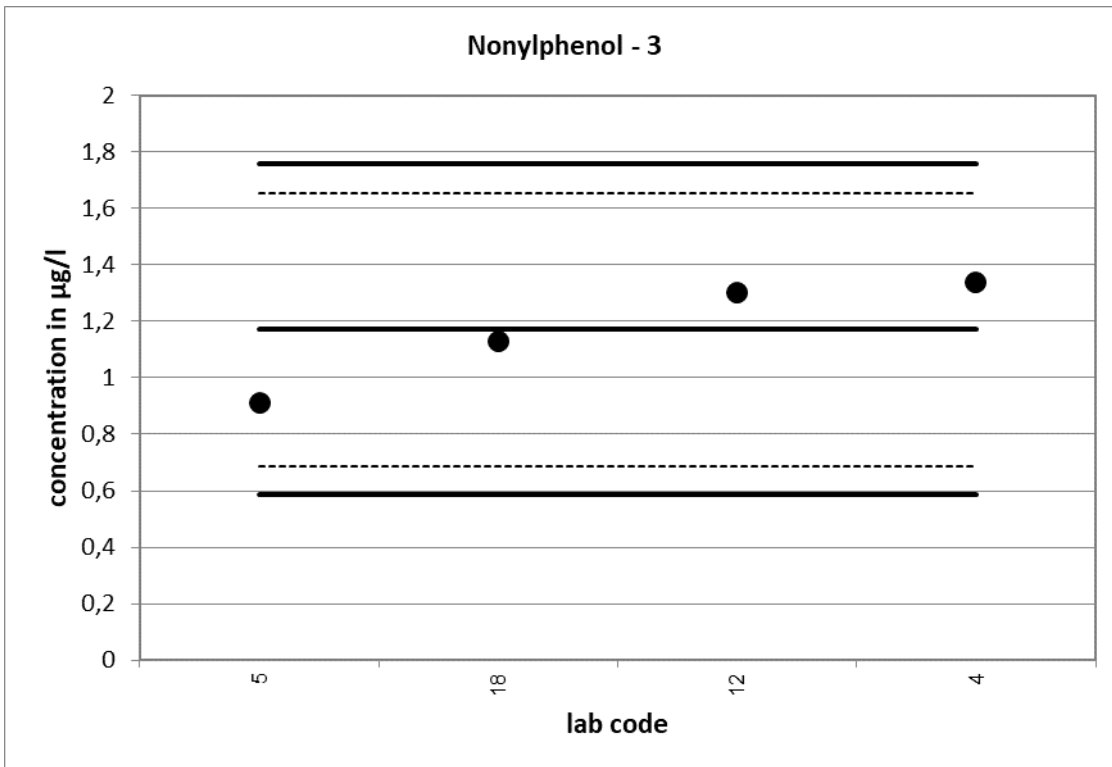


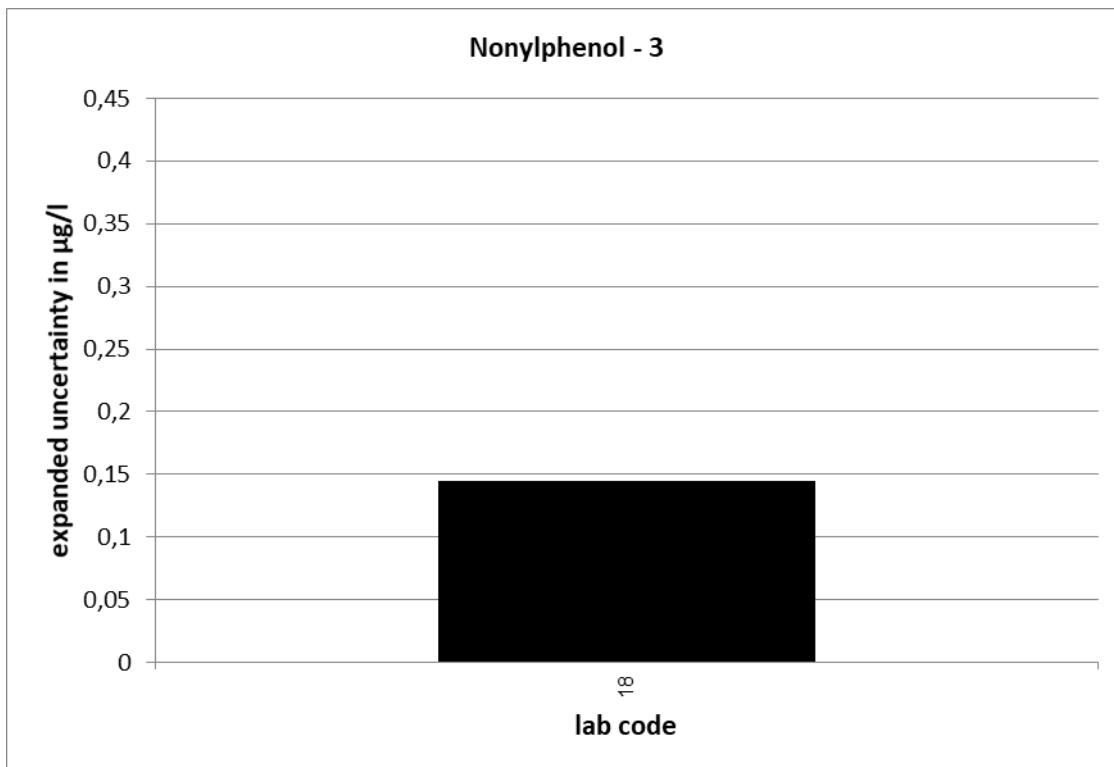
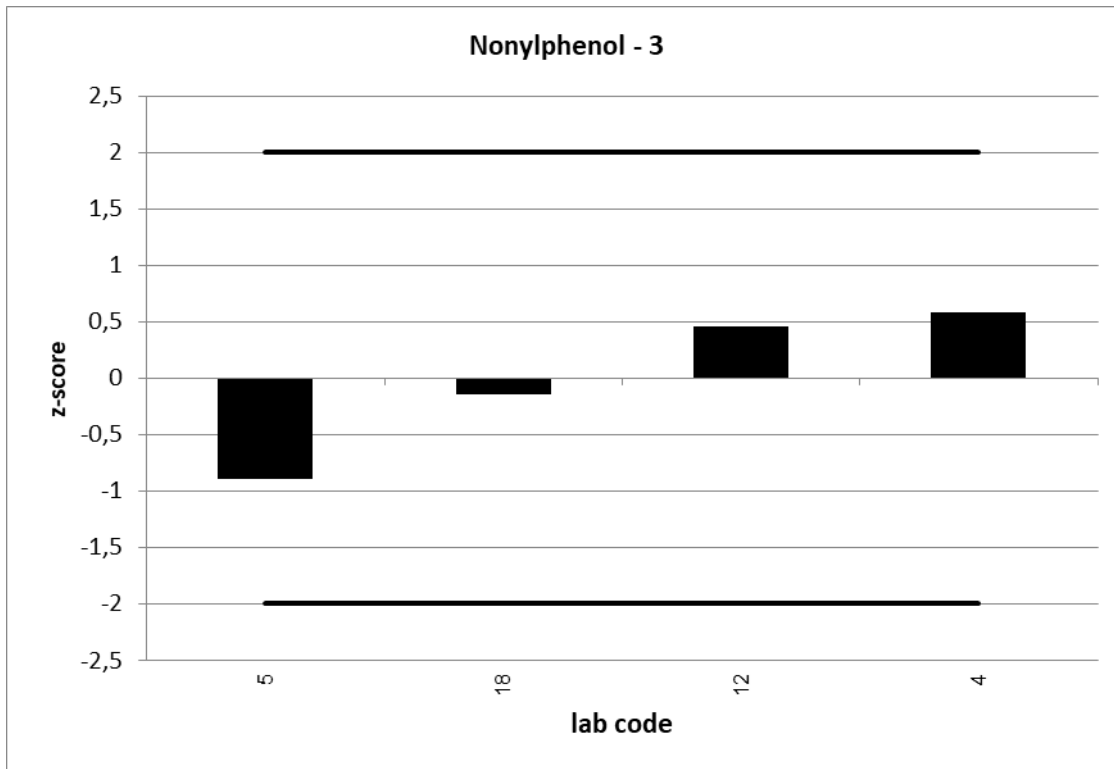


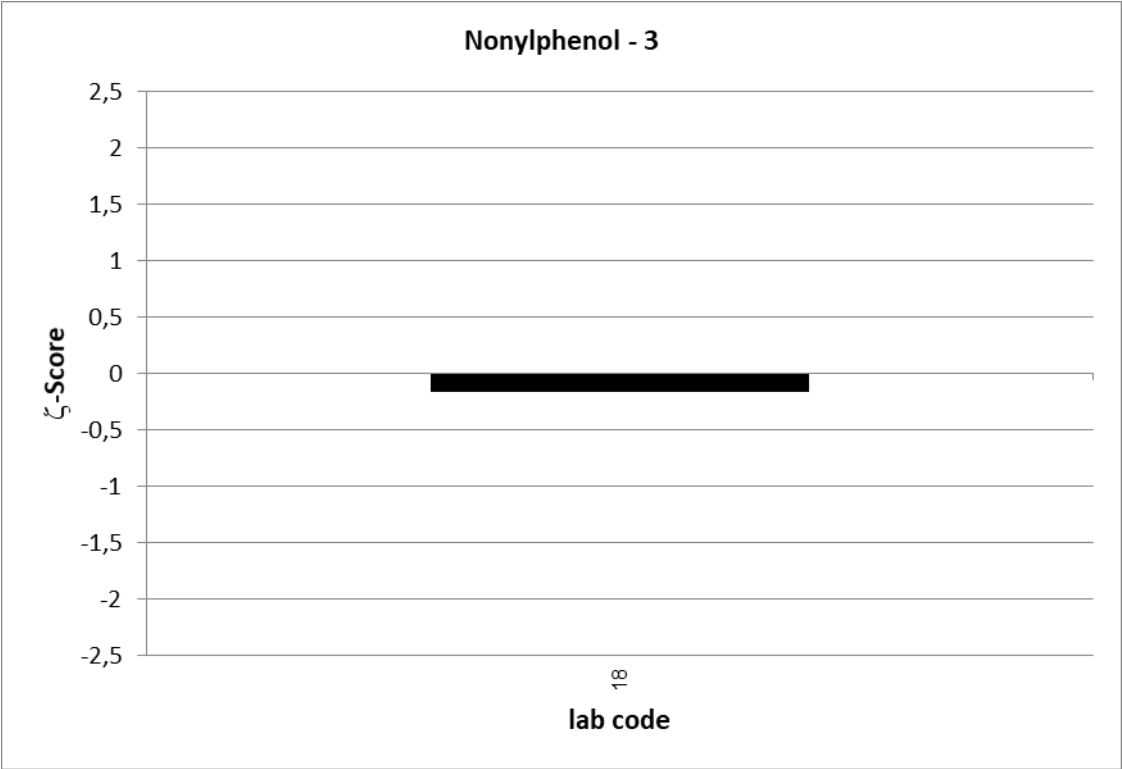
UKWIR PT 5/20		Nonylphenol - 3			
assigned value [$\mu\text{g/l}$]*		1,171 \pm 0,483			
upper tolerance limit [$\mu\text{g/l}$]		1,757			
lower tolerance limit [$\mu\text{g/l}$]		0,5855			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm. **
4	1,34			0,6	s
5	0,91			-0,9	s
12	1,304			0,5	s
18	1,13	0,1446	-0,2	-0,1	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory

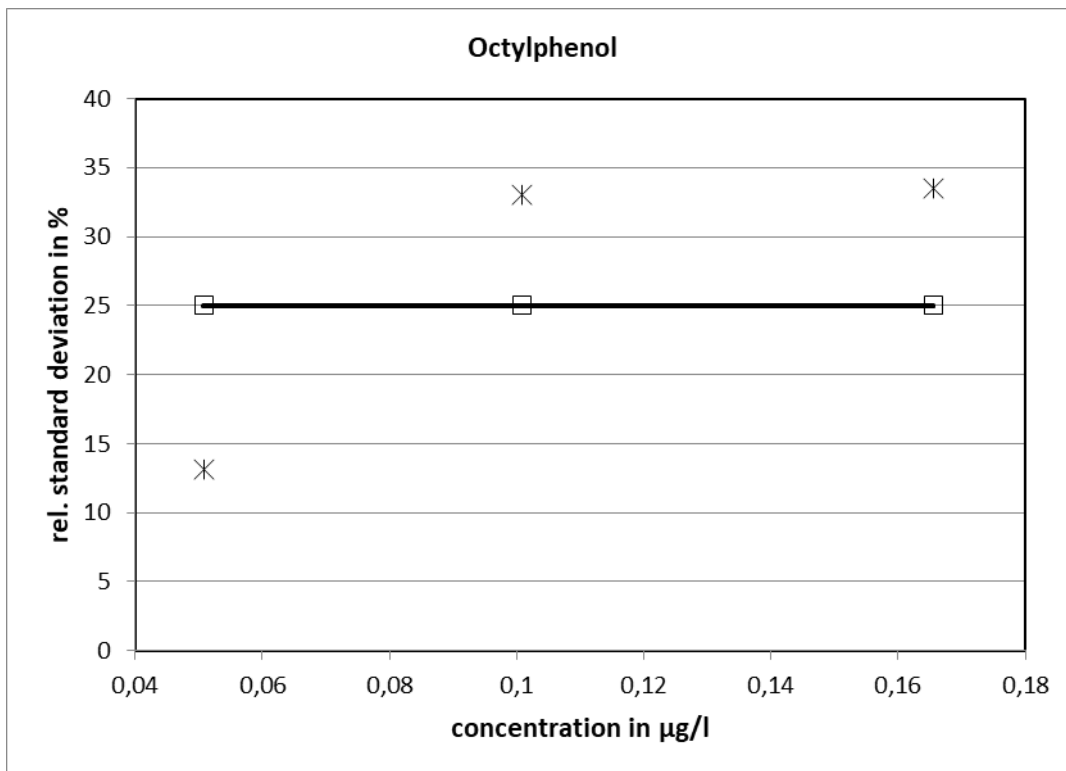






Octylphenol													
level	assigned value [µg/l]	expanded uncertainty of the assigned value [%]	standard deviation, calculated using robust statistics [µg/l]	standard deviation for proficiency assessment [µg/l]	standard deviation for proficiency assessment [%]	upper tolerance limit [µg/l]	lower tolerance limit [µg/l]	upper tolerance limit [%]	lower tolerance limit [%]	number of results	out below	out above	out [%]
1	0,0508	8,95	0,0067	0,0127	25	0,0762	0,0254	50	-50	4	0	0	0,0
2	0,1009	22,87	0,0333	0,0252	25	0,1513	0,0504	50	-50	4	0	0	0,0
3	0,1655	41,90	0,0555	0,0414	25	0,2483	0,0828	50	-50	4	0	0	0,0
										sum	12	0	0,0

Relative standard deviation

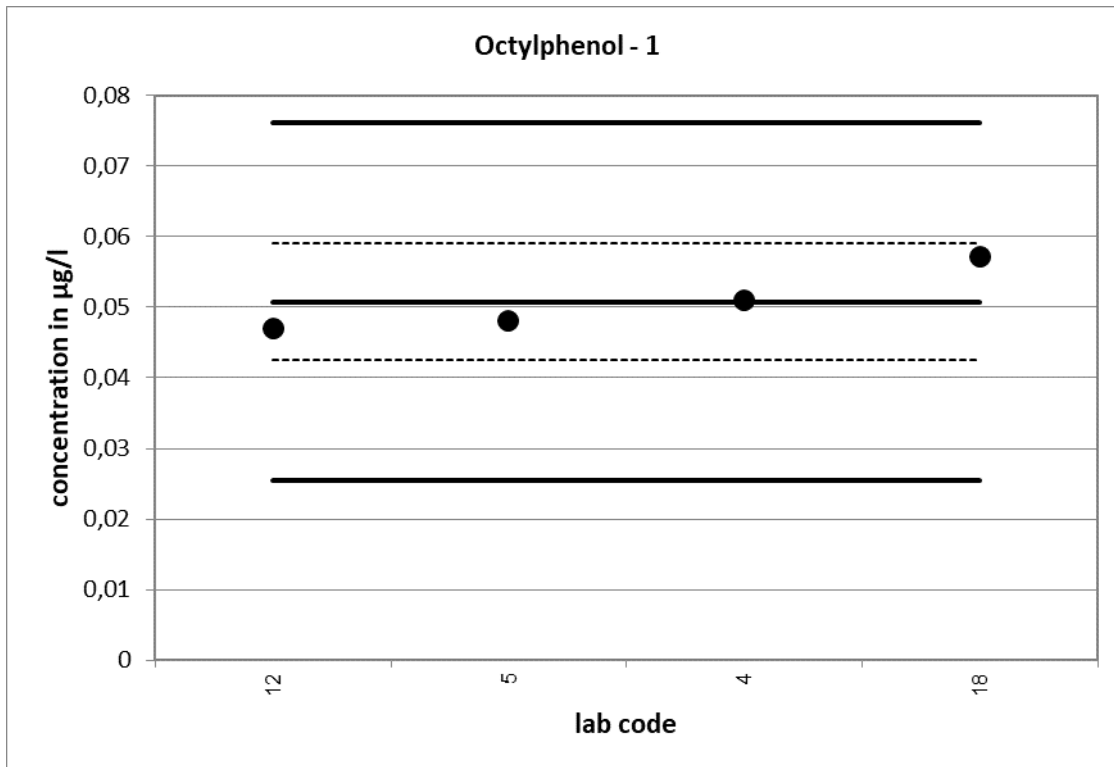


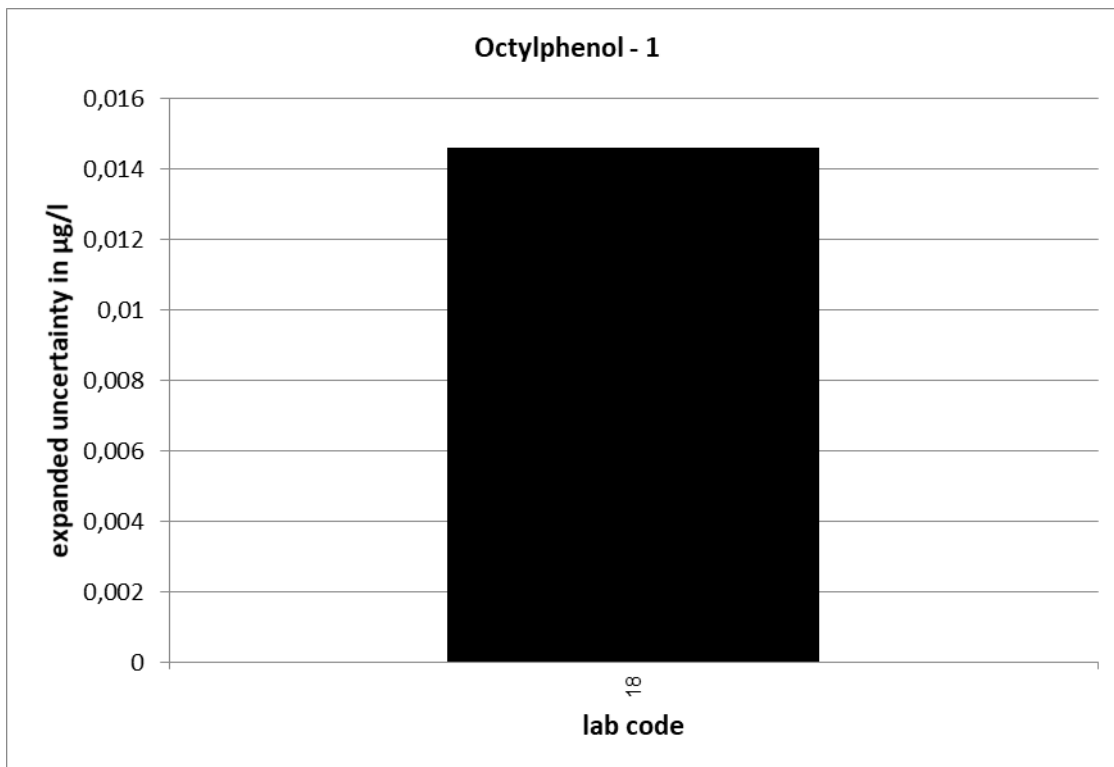
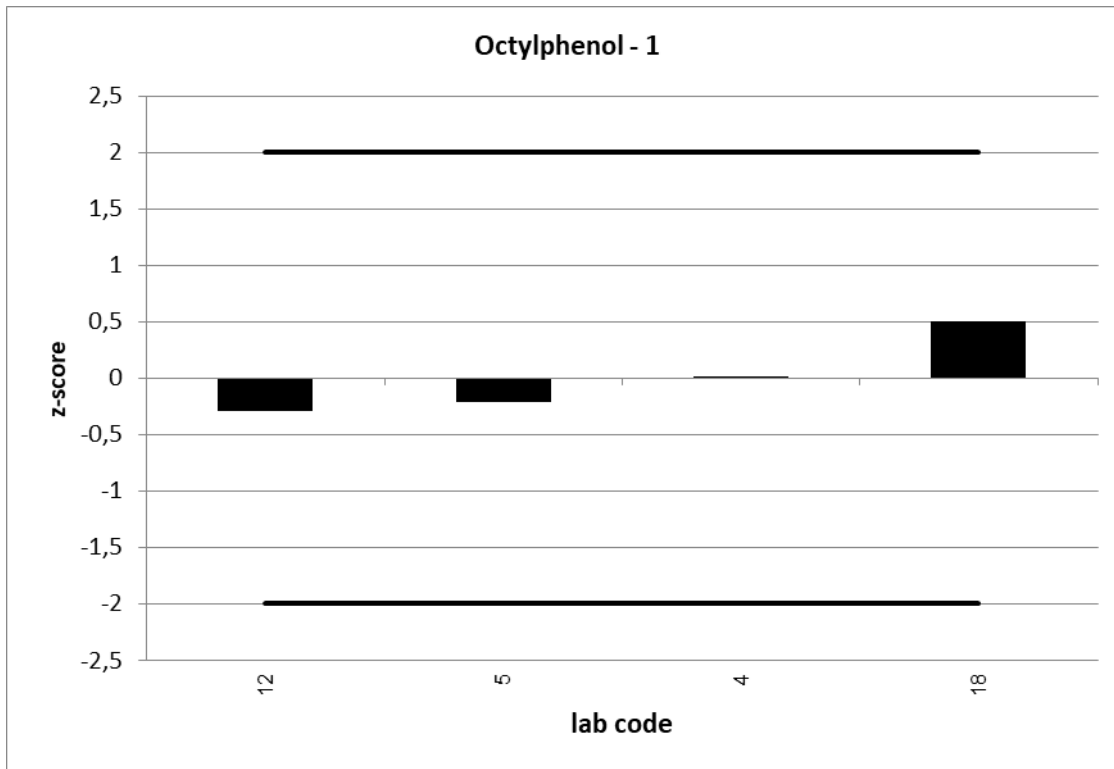
25 % is used as standard deviation for proficiency assessment.

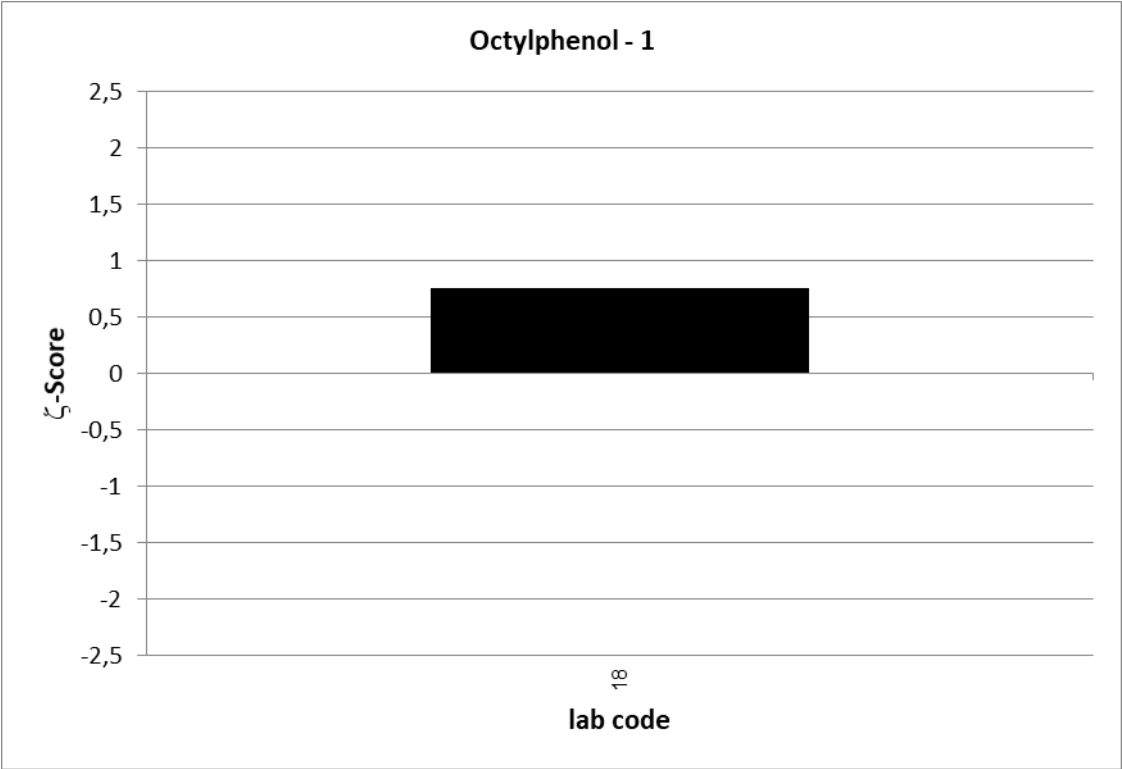
UKWIR PT 5/20		Octylphenol - 1			
assigned value [µg/l]*		0,05078 ± 0,00832			
upper tolerance limit [µg/l]		0,07616			
lower tolerance limit [µg/l]		0,02539			
lab code	result [µg/l]	±	ζ-score	z-score	assessm. **
4	0,051			0,0	s
5	0,048			-0,2	s
12	0,047			-0,3	s
18	0,0571	0,0146	0,8	0,5	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor k=2 corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory



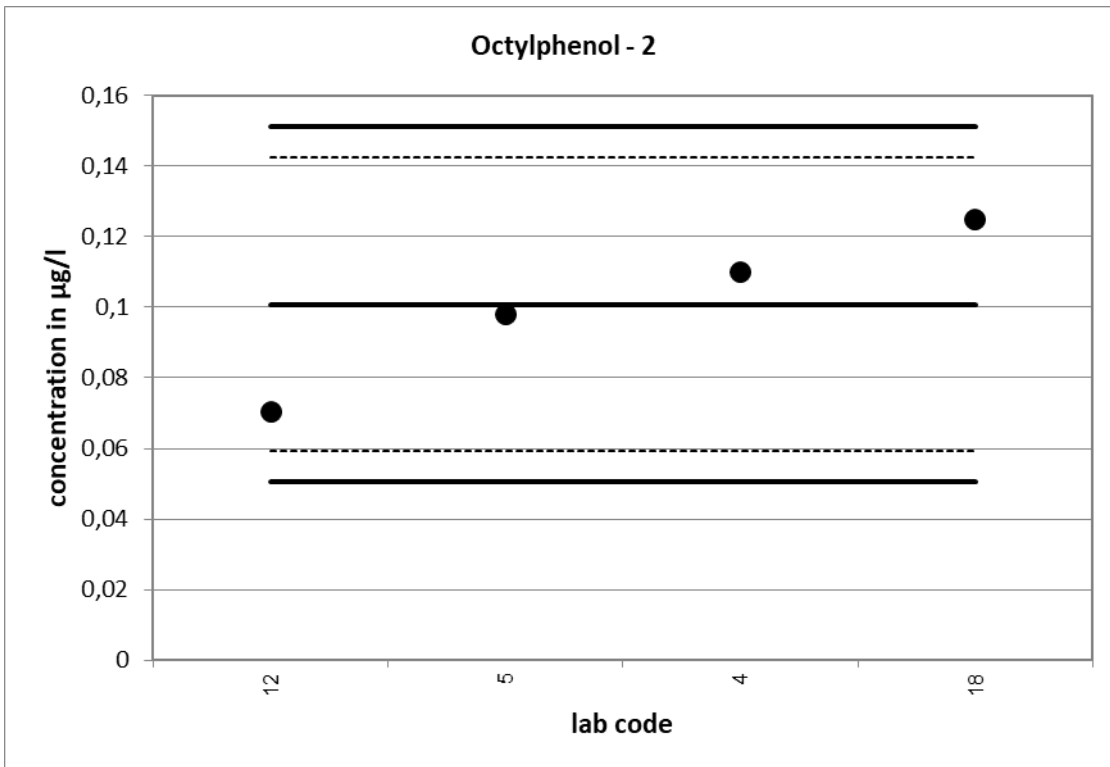


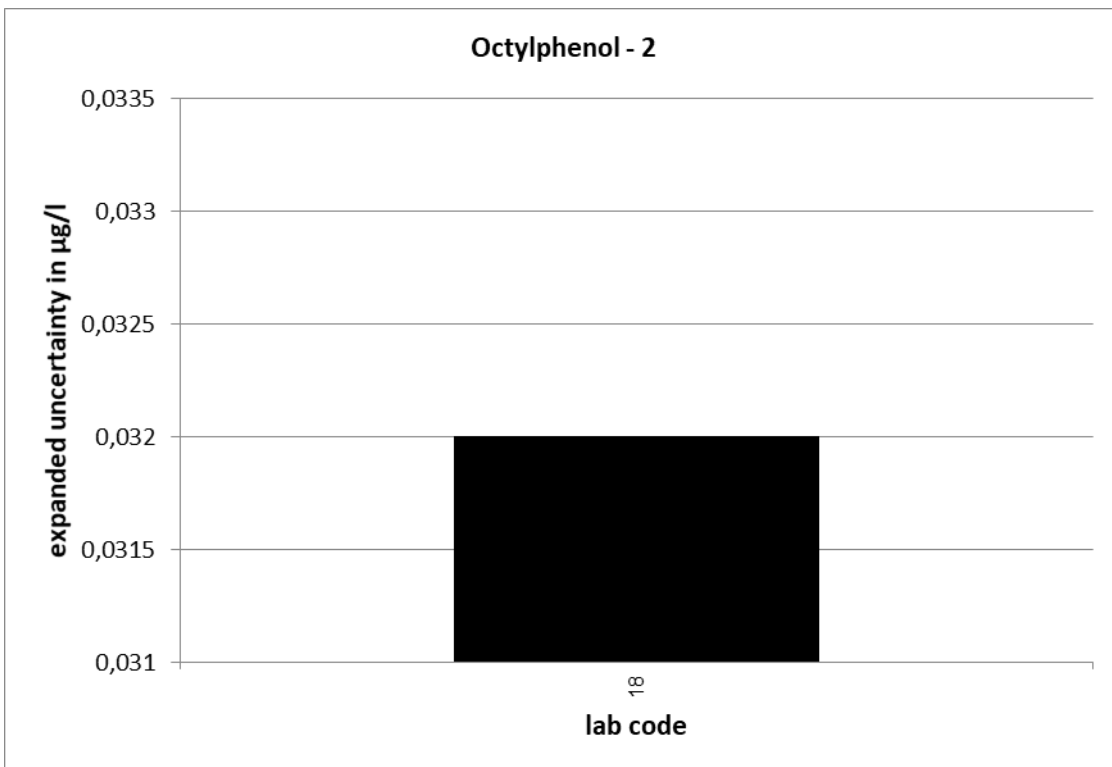
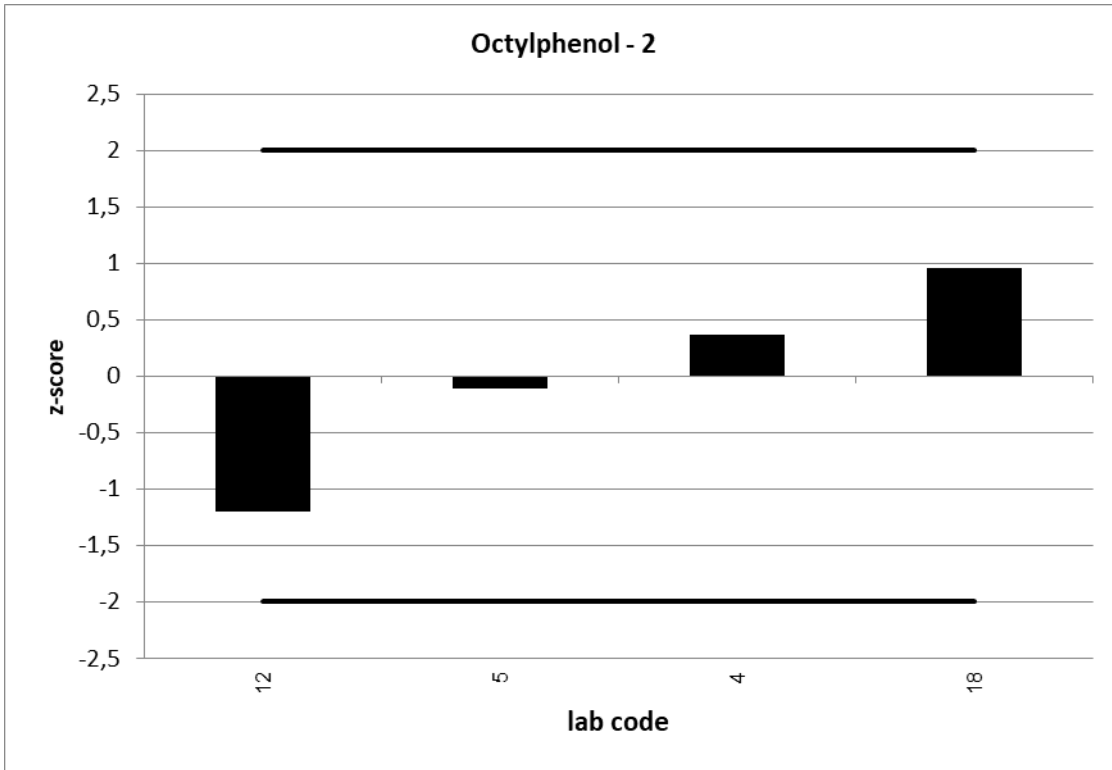


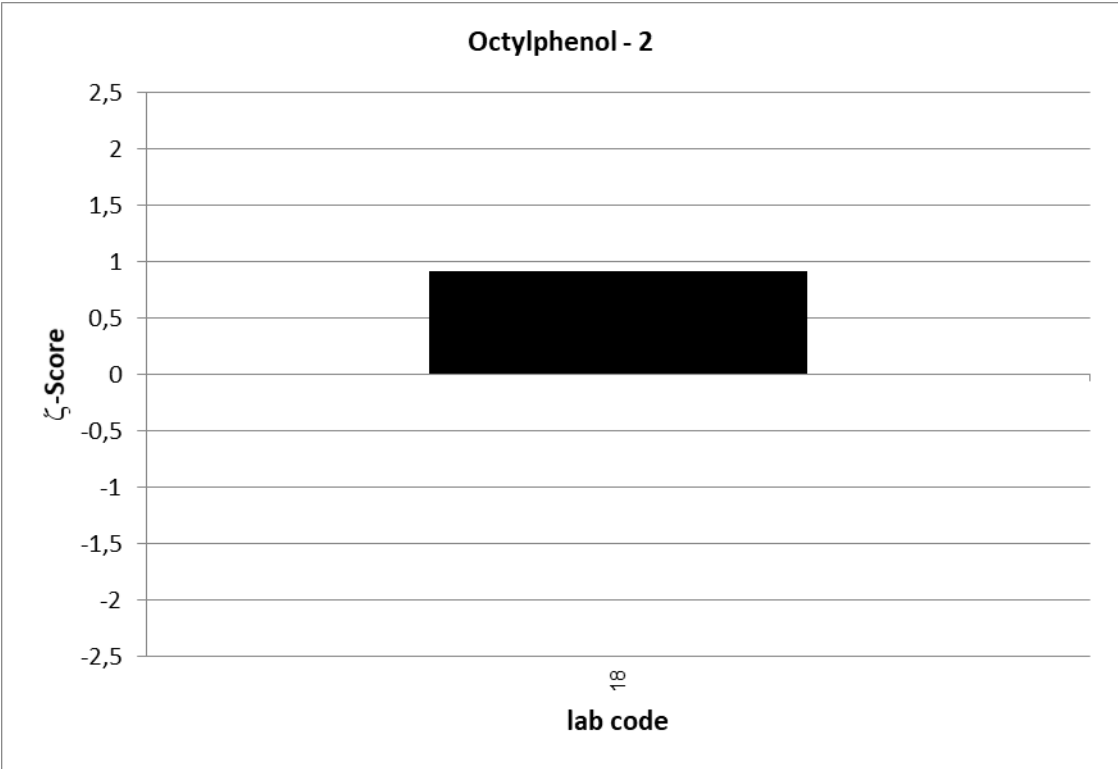
UKWIR PT 5/20		Octylphenol - 2			
assigned value [µg/l]*		0,1009 ± 0,0416			
upper tolerance limit [µg/		0,1513			
lower tolerance limit [µg/		0,05044			
lab code	result [µg/l]	±	ζ-score	z-score	assessm. **
4	0,11			0,4	s
5	0,098			-0,1	s
12	0,0705			-1,2	s
18	0,125	0,032	0,9	1,0	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor k=2 corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory







UKWIR PT 5/20		Octylphenol - 3			
assigned value [$\mu\text{g/l}$]*		0,1655 \pm 0,0693			
upper tolerance limit [$\mu\text{g/l}$]		0,2483			
lower tolerance limit [$\mu\text{g/l}$]		0,08275			
lab code	result [$\mu\text{g/l}$]	\pm	ζ -score	z-score	assessm.**
4	0,177			0,3	s
5	0,156			-0,2	s
12	0,127			-0,9	s
18	0,202	0,0517	0,8	0,9	s

* The stated uncertainty of the assigned value is the expanded uncertainty with a coverage factor $k=2$ corresponding to a confidence level of about 95%

** s = satisfactory, q = questionable, u = unsatisfactory

