


On behalf of the Society of Hair Testing (SoHT), the 4th ethyl glucuronide proficiency test was organized by the University Center of Legal Medicine Geneva-Lausanne in co-operation with MEDICHEM and the BAM (Federal Institute for Materials Research and Testing).

Examination period: **09 November 2011 – 09 January 2012**

For the first time, the fatty acid ethyl esters (FAEE) were included and determined on voluntary basis.

As a specific item of this round the participants were asked to measure two out of three EtG standard solutions additionally and also to report details on their analytical procedures. The full results will be published separately to this report.

Partners of co-operation:

 <p>BAM Bundesanstalt für Materialforschung und -prüfung</p>	<p>BAM Federal Institute for Materials Research and Testing Division 1.2 "Organic Chemical Analysis; Reference Materials" Richard-Willstätter-Strasse 11 D-12489 Berlin (Germany) www.bam.de</p>
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 <p>MEDICHEM[®] DIAGNOSTICA · VERFAHRENTWICKLUNG</p>	<p>MEDICHEM Diagnostica GmbH & Co. KG Kringstraße 3-5 D-71144 Steinenbronn (Germany) www.medicchem.de</p>
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1 ETG – Summary

1.1 Participants in determination of ethyl glucuronide (ETG):

Participating laboratories: 44

Laboratories having reported their results: 34

Number of samples to be analyzed: 4 cut hair samples A (soaked), B (real case), C (real case), D (soaked) and 3 aqueous EtG solutions

1.2 Applied techniques:

GC-MS-NCI:	4	labs
GC-MS/MS-EI:	3	labs
GC-MS/MS-NCI:	2	labs
GC-MS/MS-PCI:	1	labs
GC-MS/MS(+):	1	labs
GC-MS/MS-Cl:	1	labs
LC-MS/MS:	1	lab
LC-MS/MS(+):	1	lab
LC-MS/MS(-):	1	lab
LC-MS/MS-ESI(+):	1	labs
LC-MS/MS-ESI(-):	18	labs
SPE:	15	labs

1.3 Control of homogeneity:

Homogeneity of the samples was assessed under repeatability conditions. The inter-sample variation of EtG was calculated using analysis of variance for samples A, B, C and D, respectively. Samples B and C revealed to be homogenous, with inter-sample variation coefficients below 6% and 13%, respectively. Samples A and D were obtained from sources with higher intrinsic variability of the EtG content. Inter-sample variation coefficients were therefore 24% (sample A) and 26% (sample D).

1.4 Statistical analysis:

Statistical analysis was based on robust estimators (median instead of the mean and interquartile range instead of standard deviation), which display the advantage to be less sensitive to extreme values. It was therefore not necessary to identify and remove the outlier values. All laboratory results were thus considered for calculations.

Results that were lower than the defined limit of quantification (LOQ) were not included in the statistical analysis.

1.5 Z-score:

The performance of each participating laboratory was assessed by Z-score for each hair and solution sample.

Z-score values were calculated as follows:

$$Z = (x - \chi) / IQ_R$$

Where:

x corresponds to the individual laboratory's value.

χ corresponds to the median value obtained from all laboratory means.

IQ_R corresponds to the interquartile range calculated as (Q1, 0.25) - (Q3, 0.75) (the upper quartile minus the lower quartile).

1.6 Decision criteria:

A range of $\chi - 2 * Z < x < \chi + 2 * Z$ was defined as decision criteria for considering a test result x for ethyl glucuronide positive.

Not passed in Sample A: 2 labs (all LC-MS/MS-ESI(-))

Not passed in Sample B: 2 labs (all LC-MS/MS-ESI(-))

Not passed in Sample C: 2 labs (all LC-MS/MS-ESI(-))

Not passed in Sample D: 2 labs (1 LC-MS/MS-ESI(-), 1 GC-MS/MS-NCI)

No quantitative result in Sample A: 4 labs (2 LC-MS/MS, 2 GC-MS/MS)

No quantitative result in Sample B: 2 labs (all LC-MS/MS)

No quantitative result in Sample C: 6 labs (4 LC-MS/MS, 2 GC-MS/MS)

No quantitative result in Sample D: 0 labs

Not passed in Standard solution 1: 2 labs (all LC-MS/MS)

Not passed in Standard solution 2: 4 labs (3 LC-MS/MS, 1 GC-MS/MS-NCI)

Not passed in Standard solution 3: 3 labs (2 LC-MS/MS, 1 GC-MS/MS-PCI)

1.7 Certificates:

Certificates are provided by the EtG & FAEE Proficiency Testing Supervisor:

Dr. rer. nat. Frank Sporkert

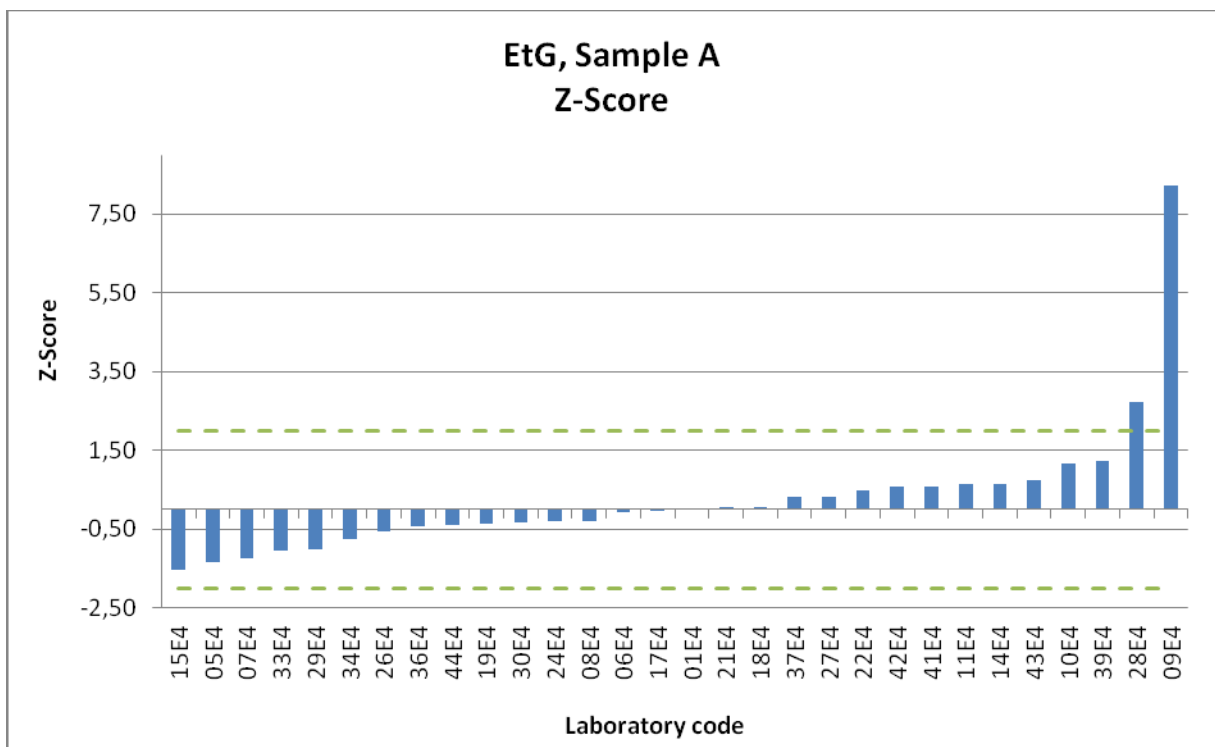
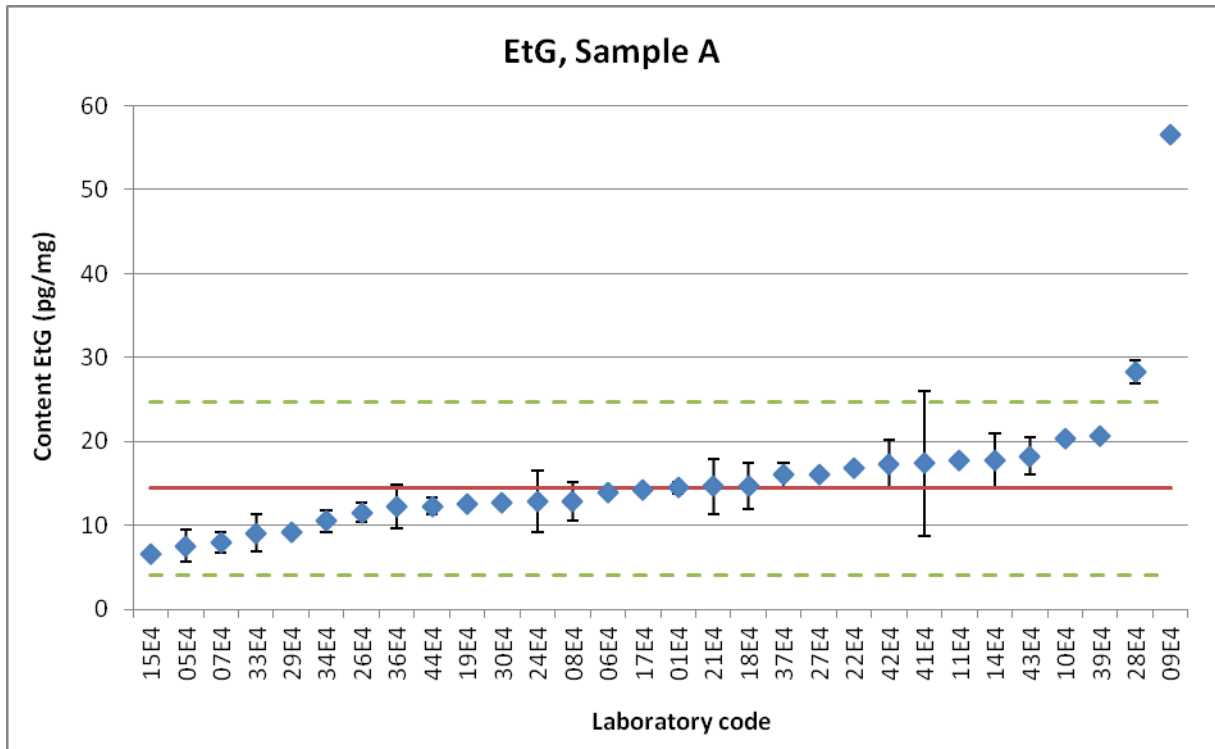
Centre Universitaire Romand de Médecine Légale - UTCF

Rue du Bugnon 21, CH-1011 Lausanne (Switzerland)

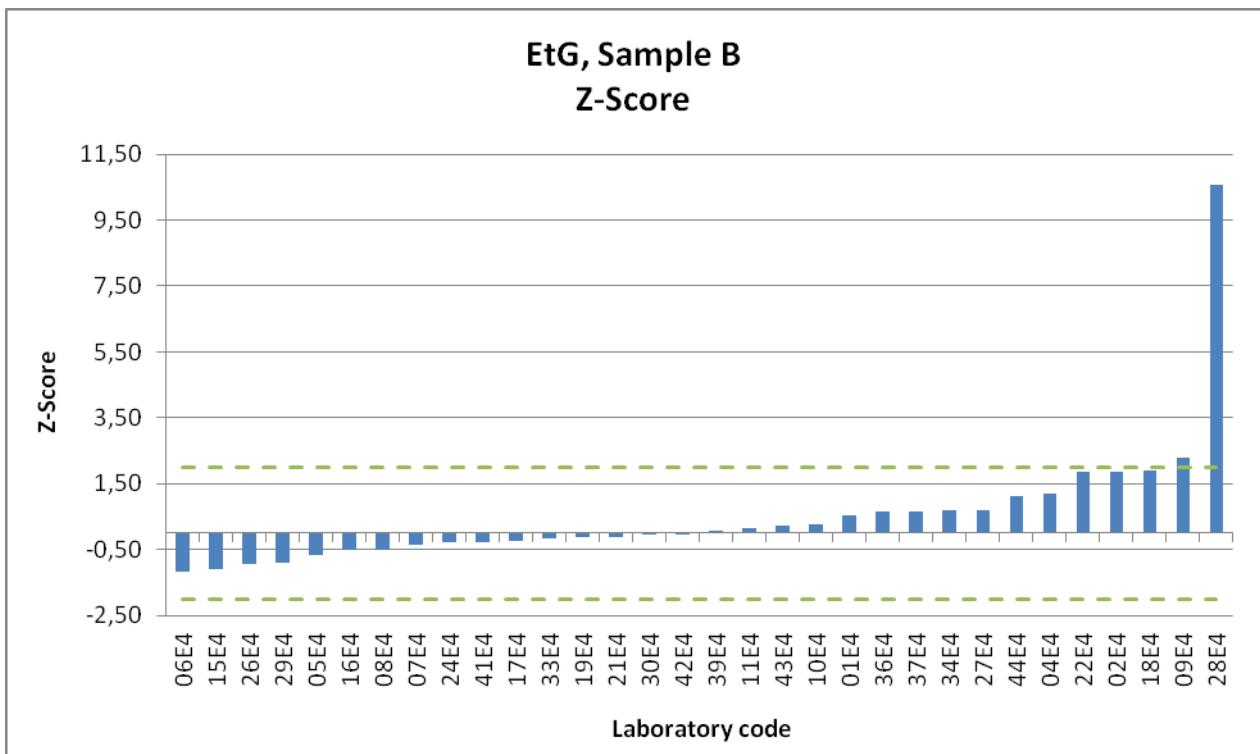
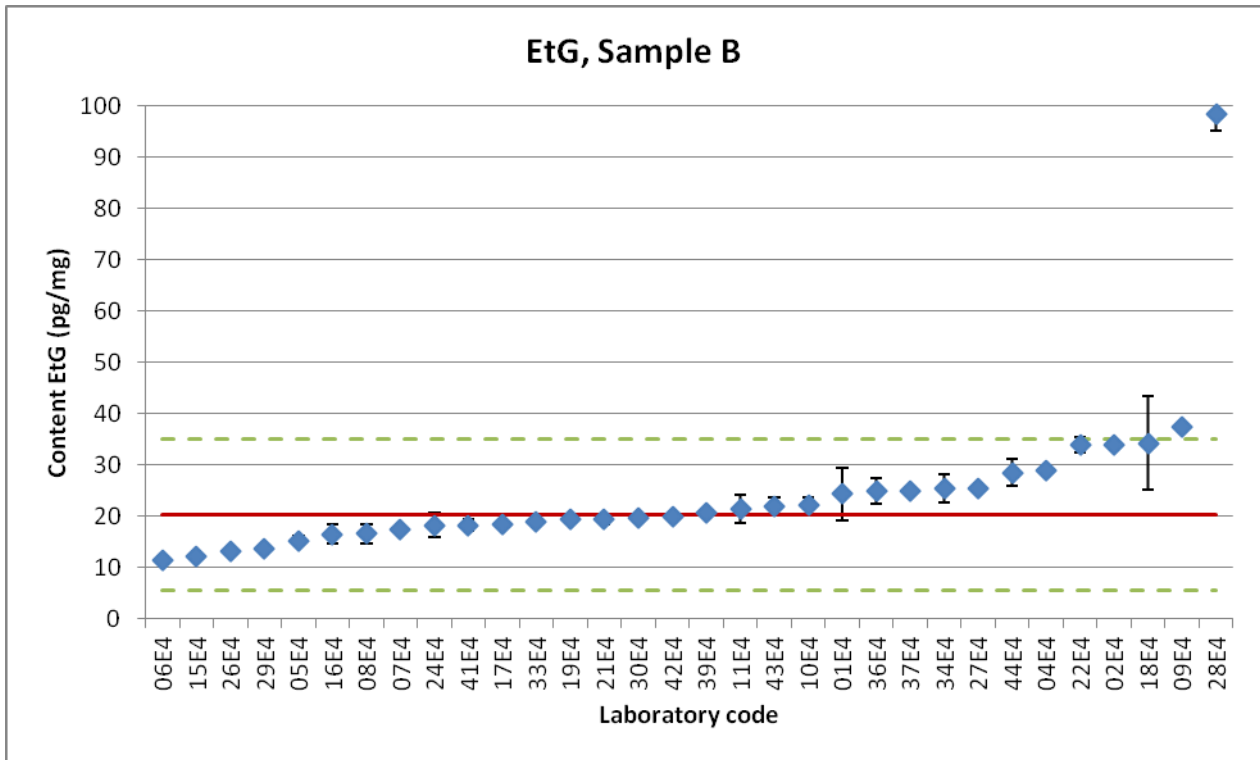
Frank.Sporkert@chuv.ch Fax: +41 (0)21 314 7329

The certificates will attest the participation in the EtG and/or FAEE analyses as well as the successful determination of EtG in the authentic samples B and C according to the acceptance criteria (2 x IQR).

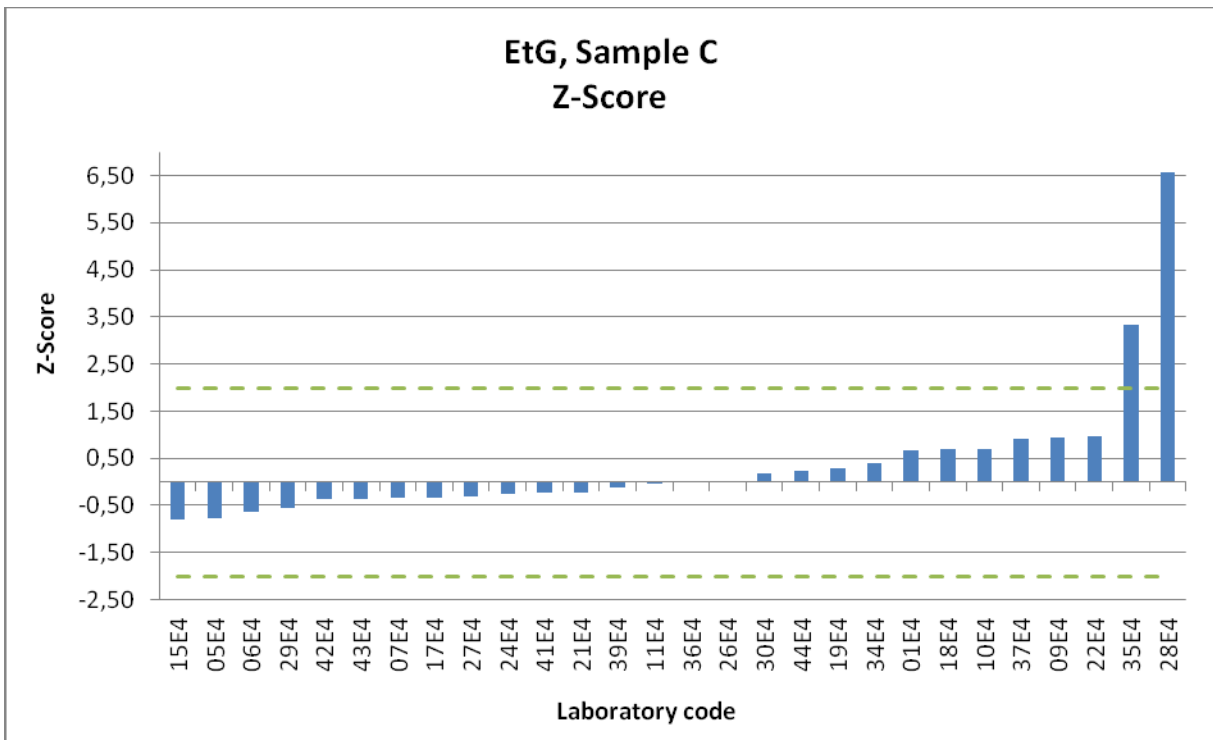
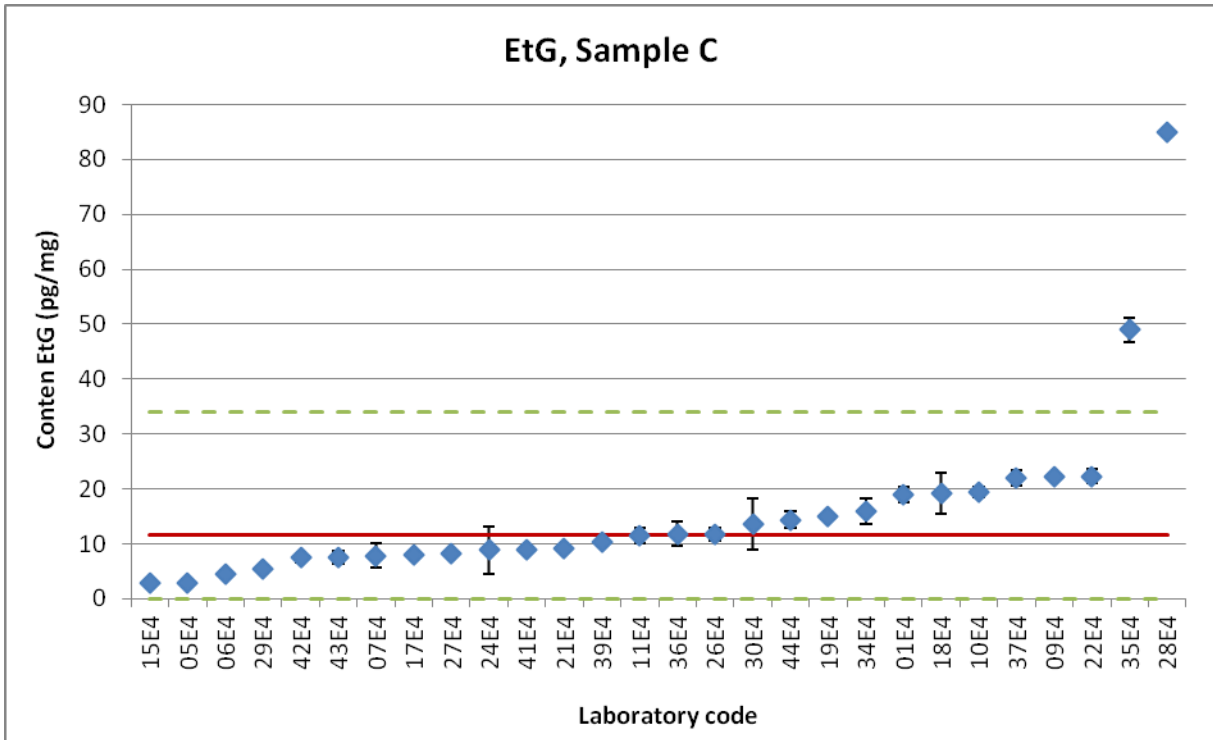
EtG - Sample A					
Lab code	Sample A Average [pg/mg]	Standard deviation [pg/mg]	Diff from Median [pg/mg]	Z-score	passed
01E4	14.50	0.71	0.10	0.02	yes
02E4	ND				
04E4	ND				
05E4	7.59	1.91	-6.81	-1.33	yes
06E4	14.00	0.00	-0.40	-0.08	yes
07E4	7.95	1.20	-6.45	-1.26	yes
08E4	12.85	2.33	-1.55	-0.30	yes
09E4	56.60	-	42.20	8.23	no
10E4	20.40	0.28	6.00	1.17	yes
11E4	17.75	0.21	3.35	0.65	yes
14E4	17.75	3.18	3.35	0.65	yes
15E4	6.60	0.11	-7.80	-1.52	yes
16E4	BLQ				
17E4	14.30	-	-0.10	-0.02	yes
18E4	14.69	2.78	0.29	0.06	yes
19E4	12.55	0.07	-1.85	-0.36	yes
21E4	14.65	3.32	0.25	0.05	yes
22E4	16.85	0.07	2.45	0.48	yes
24E4	12.84	3.63	-1.56	-0.30	yes
26E4	11.55	1.20	-2.85	-0.56	yes
27E4	16.10	-	1.70	0.33	yes
28E4	28.30	1.34	13.90	2.71	no
29E4	9.20	-	-5.20	-1.01	yes
30E4	12.75	0.21	-1.65	-0.32	yes
33E4	9.10	2.26	-5.30	-1.03	yes
34E4	10.50	1.31	-3.90	-0.76	yes
35E4	neg				
36E4	12.25	2.63	-2.15	-0.42	yes
37E4	16.00	1.41	1.60	0.31	yes
39E4	20.70	-	6.30	1.23	yes
41E4	17.40	8.63	3.00	0.59	yes
42E4	17.35	2.90	2.95	0.58	yes
43E4	18.25	2.19	3.85	0.75	yes
44E4	12.30	0.99	-2.10	-0.41	yes
Average	15.8				
SD	8.92				
CV (%)	56.5				
Median	14.4				
Minimum	6.60				
Quartile 25	12.3				
Quartile 75	17.4				
Maximum	56.6				
IQR	5.13				
2 x IQR	10.3				
Accepted range min	4.15				
Accepted range max	24.7				



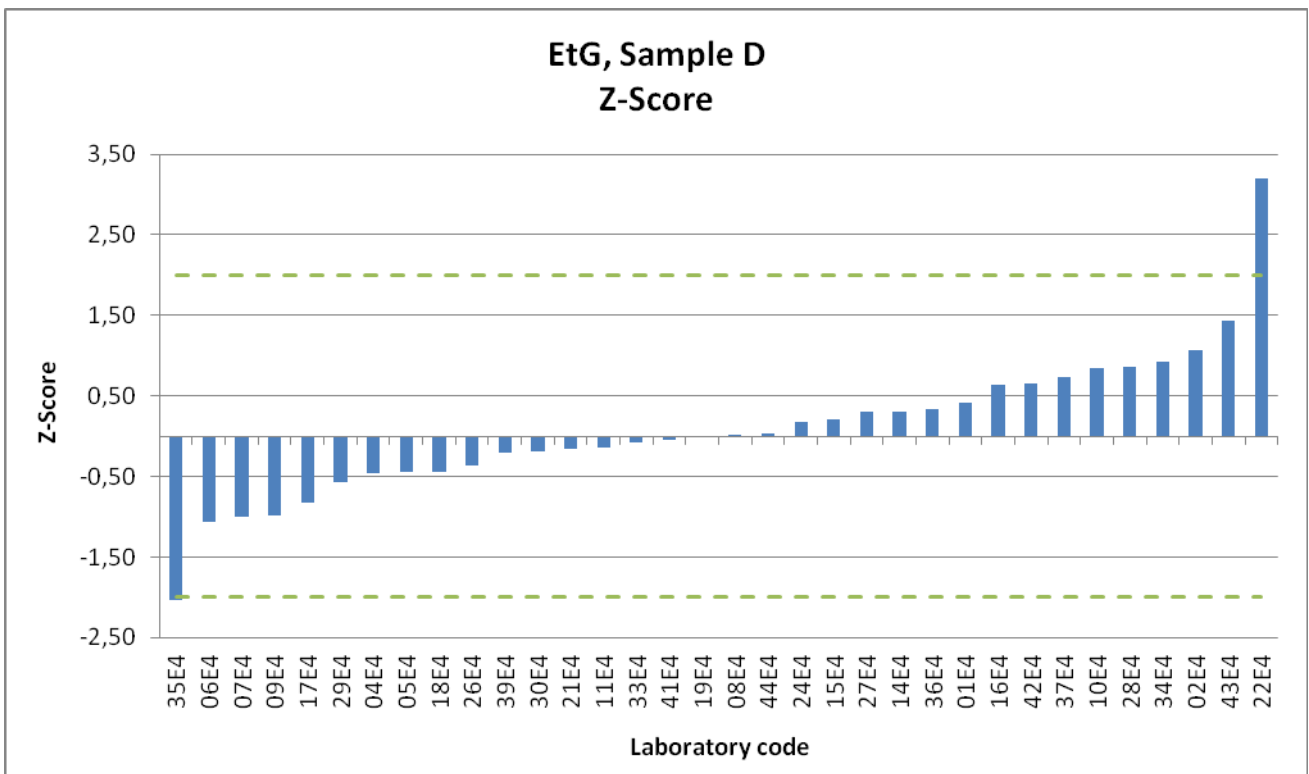
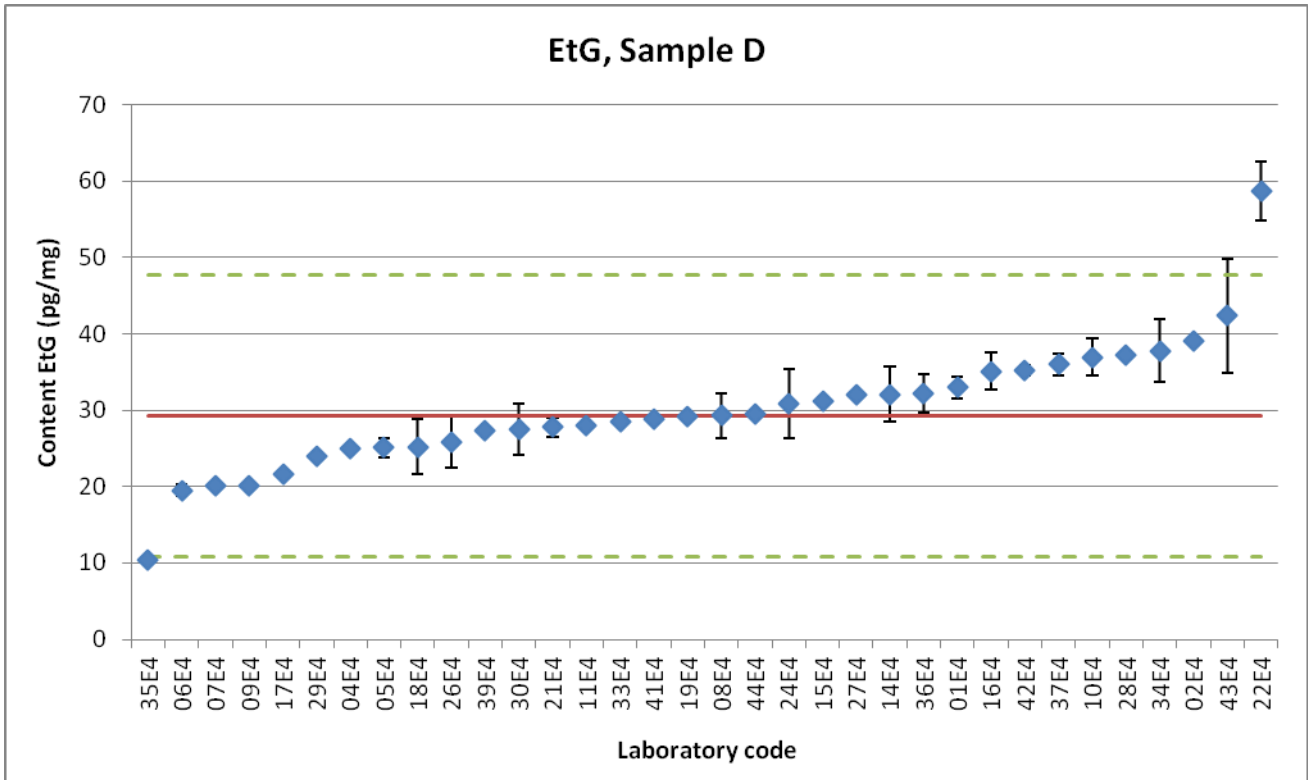
EtG - Sample B					
Lab code	Sample B Average [pg/mg]	Standard deviation [pg/mg]	Diff from Median [pg/mg]	Z-score	passed
01E4	24.33	5.13	4.06	0.55	yes
02E4	34.00		13.73	1.86	yes
04E4	29.00		8.73	1.18	yes
05E4	15.29	0.93	-4.99	-0.67	yes
06E4	11.50	0.71	-8.78	-1.19	yes
07E4	17.55	0.49	-2.73	-0.37	yes
08E4	16.60	1.84	-3.68	-0.50	yes
09E4	37.30		17.03	2.30	no
10E4	22.15	1.63	1.88	0.25	yes
11E4	21.50	2.69	1.23	0.17	yes
14E4	-				
15E4	12.21	0.16	-8.07	-1.09	yes
16E4	16.53	1.94	-3.75	-0.51	yes
17E4	18.40		-1.88	-0.25	yes
18E4	34.24	9.16	13.97	1.89	yes
19E4	19.45	0.07	-0.82	-0.11	yes
21E4	19.45	0.92	-0.82	-0.11	yes
22E4	33.95	1.48	13.68	1.85	yes
24E4	18.30	2.44	-1.98	-0.27	yes
26E4	13.25	0.21	-7.03	-0.95	yes
27E4	25.50		5.23	0.71	yes
28E4	98.33	3.26	78.06	10.57	no
29E4	13.60		-6.68	-0.90	yes
30E4	19.80	0.42	-0.47	-0.06	yes
33E4	19.05	0.21	-1.23	-0.17	yes
34E4	25.50	2.79	5.23	0.71	yes
35E4	neg				
36E4	25.00	2.45	4.73	0.64	yes
37E4	25.00	0.00	4.73	0.64	yes
39E4	20.70		0.43	0.06	yes
41E4	18.30	1.13	-1.98	-0.27	yes
42E4	19.85	0.64	-0.42	-0.06	yes
43E4	21.90	1.70	1.63	0.22	yes
44E4	28.50	2.69	8.23	1.11	yes
Average	24.3				
SD	15.05				
CV (%)	62.1				
Median	20.3				
Minimum	11.5				
Quartile 25	18.1				
Quartile 75	25.5				
Maximum	98.3				
IQR	7.39				
2 x IQR	14.8				
Accepted range min	5.50				
Accepted range max	35.1				



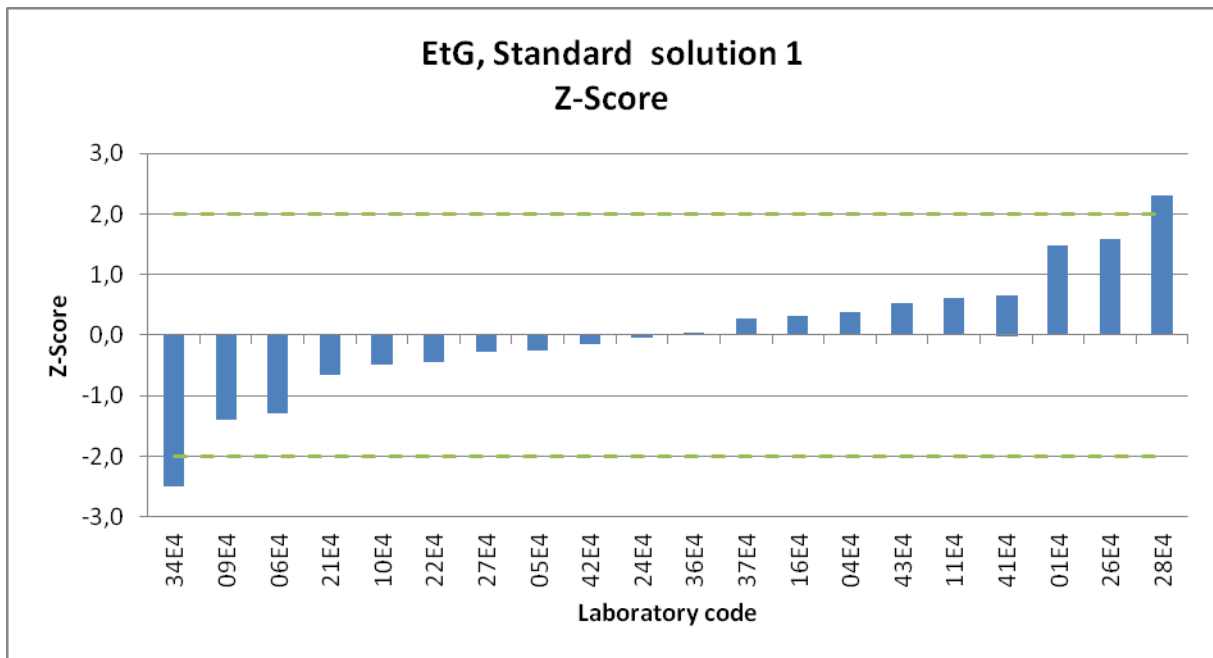
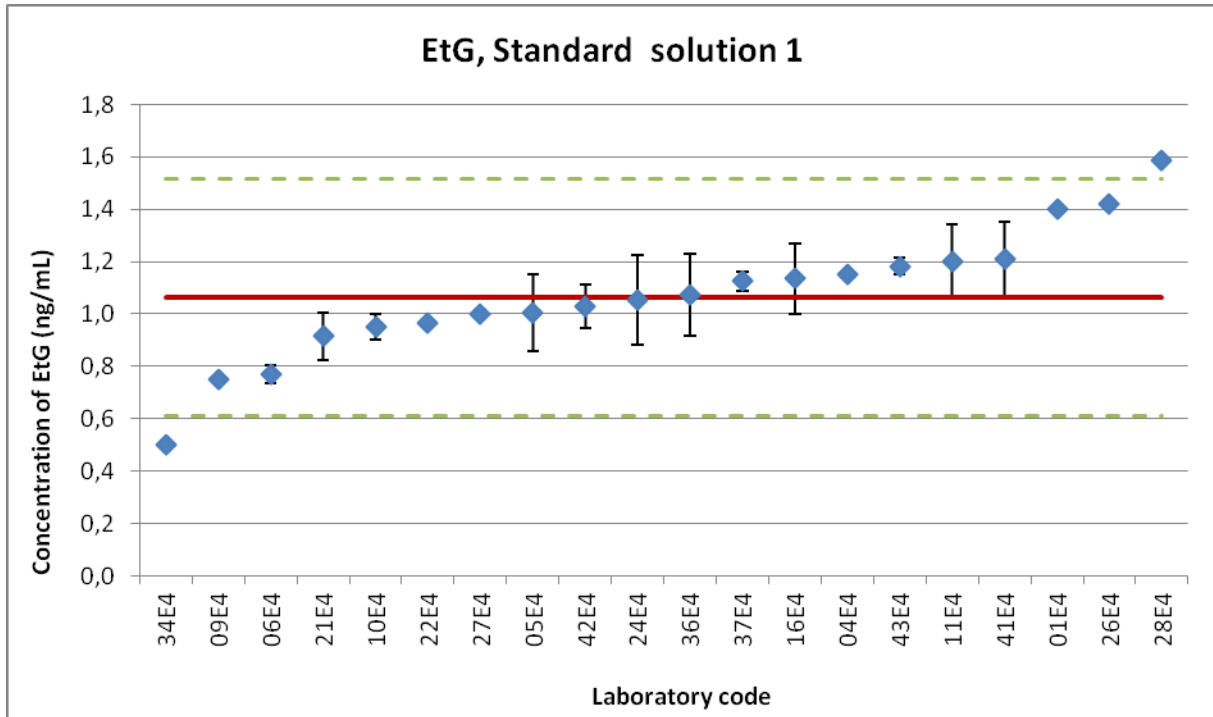
EtG - Sample C						
Lab code	Sample C Average [pg/mg]	Standard deviation [pg/mg]	Diff from Median [pg/mg]	Z-score	passed	
01E4	19.0	1.41	7.35	0.66	yes	
02E4	ND					
04E4	ND					
05E4	2.97		-8.68	-0.78	yes	
06E4	4.50	0.71	-7.15	-0.64	yes	
07E4	7.85	2.19	-3.80	-0.34	yes	
08E4	<8				yes	
09E4	22.2		10.55	0.94	yes	
10E4	19.5	0.92	7.80	0.70	yes	
11E4	11.6	1.34	-0.10	-0.01	yes	
14E4	-					
15E4	2.77	0.01	-8.89	-0.79	yes	
16E4	BLQ				yes	
17E4	7.90		-3.75	-0.34	yes	
18E4	19.3	3.75	7.64	0.68	yes	
19E4	15.0	0.49	3.30	0.30	yes	
21E4	9.24	0.69	-2.41	-0.22	yes	
22E4	22.4	1.34	10.70	0.96	yes	
24E4	8.88	4.31	-2.77	-0.25	yes	
26E4	11.8	1.13	0.15	0.01	yes	
27E4	8.19		-3.46	-0.31	yes	
28E4	85.0		73.35	6.56	no	
29E4	5.40		-6.25	-0.56	yes	
30E4	13.7	4.74	2.00	0.18	yes	
33E4	<7				yes	
34E4	16.0	2.34	4.30	0.38	yes	
35E4	49.0	2.26	37.35	3.34	no	
36E4	11.8	2.22	0.10	0.01	yes	
37E4	22.0	1.41	10.35	0.93	yes	
39E4	10.3		-1.35	-0.12	yes	
41E4	8.99	0.71	-2.66	-0.24	yes	
42E4	7.44	0.88	-4.22	-0.38	yes	
43E4	7.62	1.19	-4.03	-0.36	yes	
44E4	14.4	1.48	2.70	0.24	yes	
Average	15.9					
SD	16.29					
CV (%)	102.7					
Median	11.7					
Minimum	2.77					
Quartile 25	7.89					
Quartile 75	19.1					
Maximum	85.0					
IQR	11.19					
2 x IQR	22.4					
Accepted range min	0.00					
Accepted range max	34.0					



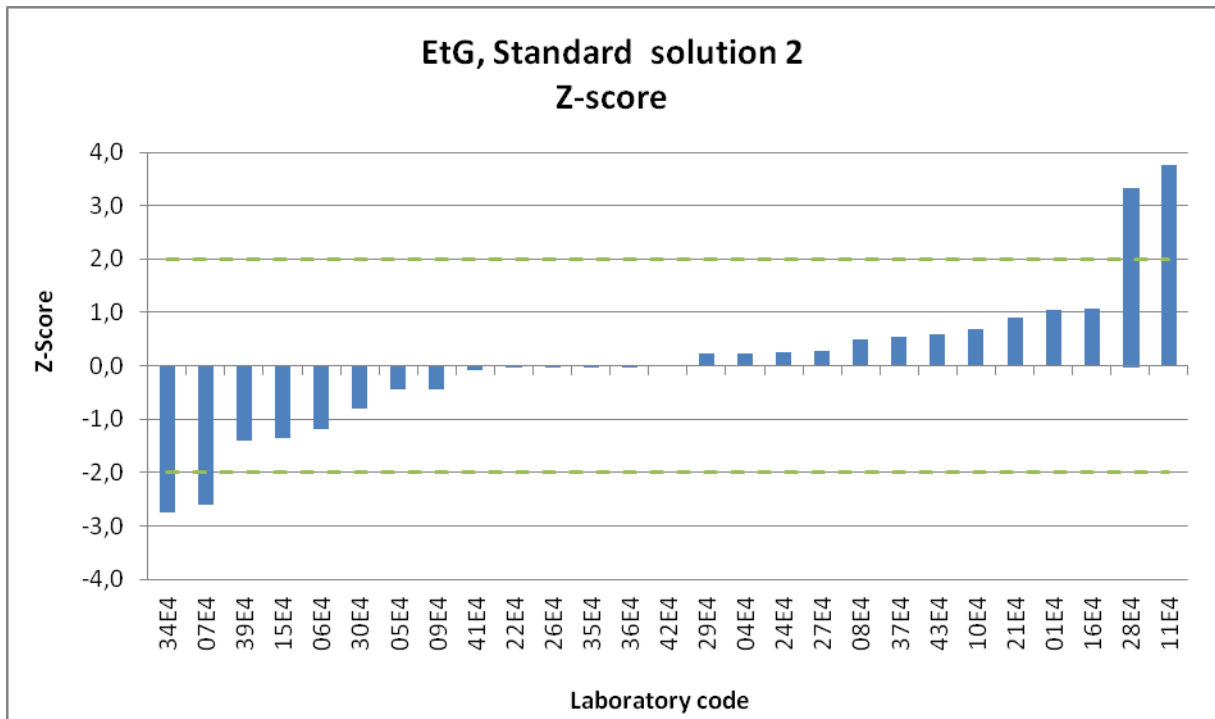
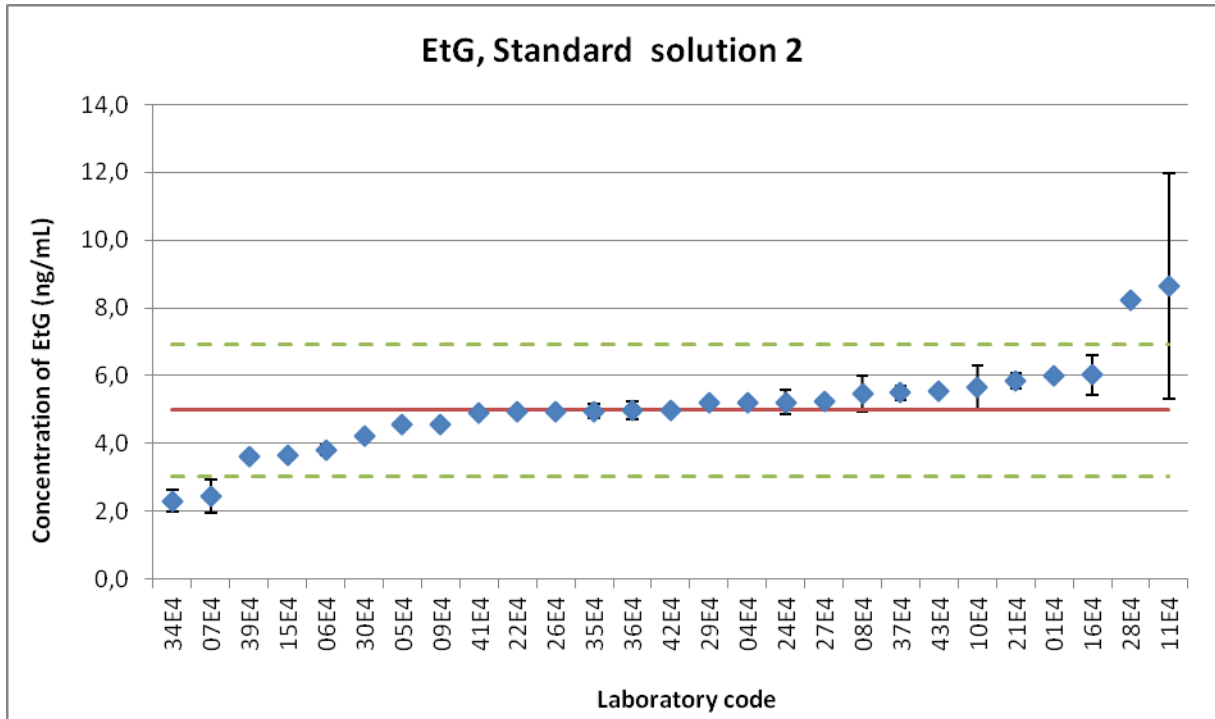
EtG - Sample D					
Lab code	Sample D Average [pg/mg]	Standard deviation [pg/mg]	Diff from Median [pg/mg]	Z-score	passed
01E4	33.00	1.41	3.78	0.41	yes
02E4	39.00		9.78	1.06	yes
04E4	25.00		-4.23	-0.46	yes
05E4	25.10	1.21	-4.13	-0.45	yes
06E4	19.50	0.71	-9.73	-1.06	yes
07E4	20.05	0.07	-9.18	-1.00	yes
08E4	29.30	2.97	0.07	0.01	yes
09E4	20.20		-9.03	-0.98	yes
10E4	36.95	2.47	7.73	0.84	yes
11E4	28.00	0.26	-1.23	-0.13	yes
14E4	32.05	3.61	2.83	0.31	yes
15E4	31.12	0.08	1.90	0.21	yes
16E4	35.11	2.43	5.89	0.64	yes
17E4	21.60		-7.63	-0.83	yes
18E4	25.21	3.63	-4.01	-0.44	yes
19E4	29.15	0.49	-0.07	-0.01	yes
21E4	27.75	1.20	-1.48	-0.16	yes
22E4	58.65	3.89	29.43	3.20	no
24E4	30.85	4.60	1.63	0.18	yes
26E4	25.90	3.39	-3.33	-0.36	yes
27E4	32.00		2.78	0.30	yes
28E4	37.20		7.98	0.87	yes
29E4	24.00		-5.23	-0.57	yes
30E4	27.55	3.32	-1.68	-0.18	yes
33E4	28.50		-0.72	-0.08	yes
34E4	37.80	4.10	8.58	0.93	yes
35E4	10.45	0.21	-18.78	-2.04	no
36E4	32.25	2.50	3.03	0.33	yes
37E4	36.00	1.41	6.78	0.74	yes
39E4	27.30		-1.93	-0.21	yes
41E4	28.85	0.49	-0.37	-0.04	yes
42E4	35.25	0.64	6.03	0.66	yes
43E4	42.35	7.42	13.13	1.43	yes
44E4	29.50	0.42	0.28	0.03	yes
Average	30.1				
SD	8.24				
CV (%)	27.4				
Median	29.2				
Minimum	10.45				
Quartile 25	25.4				
Quartile 75	34.6				
Maximum	58.7				
IQR	9.20				
2 x IQR	18.4				
Accepted range min	10.83				
Accepted range max	47.6				



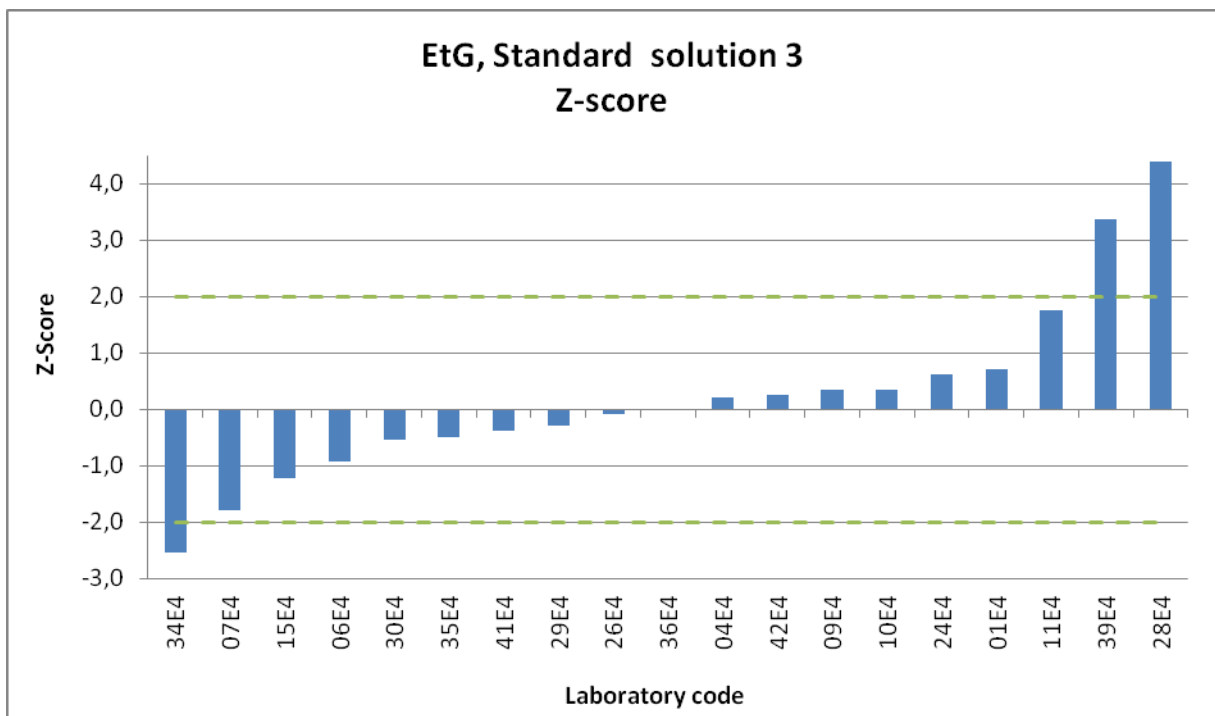
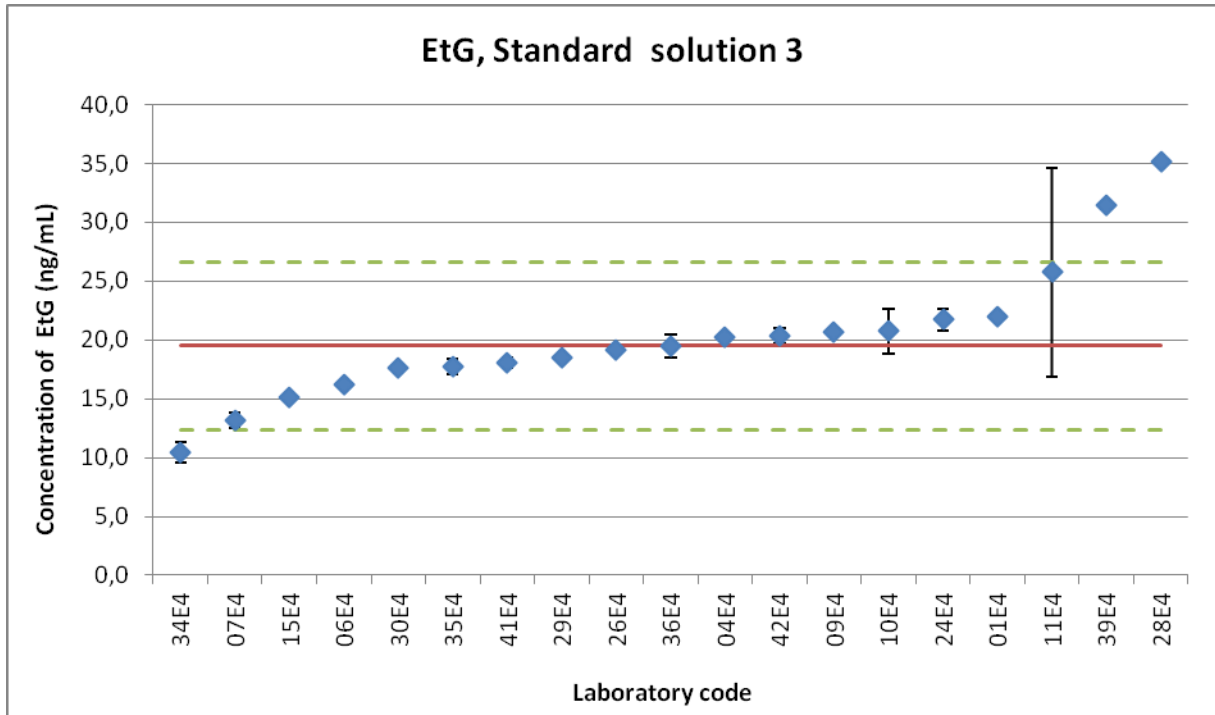
EtG – Standard solution 1					
Lab code	Standard 1 Average [pg/mg]	Standard deviation [pg/mg]	Diff from Median [pg/mg]	Z-score	passed
01E4	1.40		0.34	1.49	yes
02E4	-				
04E4	1.15		0.09	0.38	yes
05E4	1.01	0.15	-0.06	-0.26	yes
06E4	0.77	0.03	-0.29	-1.30	yes
07E4	-				
08E4	-				
09E4	0.75		-0.31	-1.39	yes
10E4	0.95	0.05	-0.11	-0.50	yes
11E4	1.20	0.14	0.14	0.60	yes
14E4	-				
15E4	-				
16E4	1.14	0.13	0.07	0.32	yes
17E4	-				
18E4	-				
19E4	-				
21E4	0.92	0.09	-0.15	-0.66	yes
22E4	0.97	0.01	-0.10	-0.44	yes
24E4	1.06	0.17	-0.01	-0.04	yes
26E4	1.42		0.36	1.58	yes
27E4	1.00		-0.06	-0.28	yes
28E4	1.59		0.52	2.31	no
29E4	-				
30E4	-				
33E4	-				
34E4	0.50	0.01	-0.56	-2.50	no
35E4	-				
36E4	1.07	0.16	0.01	0.04	yes
37E4	1.13	0.04	0.06	0.27	yes
39E4	-				
41E4	1.21	0.14	0.15	0.65	yes
42E4	1.03	0.08	-0.04	-0.16	yes
43E4	1.18	0.03	0.12	0.53	yes
44E4	-				
Average	1.07				
SD	0.24				
CV (%)	22.8				
Median	1.06				
Minimum	0.50				
Quartile 25	0.96				
Quartile 75	1.19				
Maximum	1.59				
IQR	0.23				
2 x IQR	0.45				
Accepted range min	0.61				
Accepted range max	1.52				



EtG – Standard solution 2					
Lab code	Standard 2 Average [pg/mg]	Standard deviation [pg/mg]	Diff from Median [pg/mg]	Z-score	passed
01E4	6.00		1.02	1.05	yes
02E4	-				
04E4	5.20		0.22	0.23	yes
05E4	4.55	0.07	-0.43	-0.44	yes
06E4	3.81	0.14	-1.17	-1.20	yes
07E4	2.45	0.49	-2.53	-2.59	no
08E4	5.46	0.54	0.48	0.50	yes
09E4	4.55		-0.43	-0.44	yes
10E4	5.65	0.66	0.67	0.69	yes
11E4	8.65	3.32	3.67	3.77	no
14E4	-				
15E4	3.66	0.04	-1.32	-1.36	yes
16E4	6.03	0.59	1.05	1.08	yes
17E4	-				
18E4	-				
19E4	-				
21E4	5.86	0.23	0.88	0.90	yes
22E4	4.95	0.07	-0.03	-0.03	yes
24E4	5.22	0.35	0.24	0.24	yes
26E4	4.95		-0.03	-0.03	yes
27E4	5.24		0.26	0.27	yes
28E4	8.23		3.25	3.33	no
29E4	5.20		0.22	0.23	yes
30E4	4.20		-0.78	-0.80	yes
33E4	-				
34E4	2.30	0.33	-2.67	-2.74	no
35E4	4.96	0.19	-0.02	-0.02	yes
36E4	4.97	0.26	0.00	0.00	yes
37E4	5.50	0.21	0.52	0.54	yes
39E4	3.62		-1.36	-1.39	yes
41E4	4.89	0.08	-0.09	-0.09	yes
42E4	4.98	0.04	0.00	0.00	yes
43E4	5.55	0.09	0.57	0.59	yes
44E4	-				
Average	5.06				
SD	1.36				
CV (%)	26.8				
Median	4.98				
Minimum	2.30				
Quartile 25	4.55				
Quartile 75	5.53				
Maximum	8.65				
IQR	0.98				
2 x IQR	1.95				
Accepted range min	3.03				
Accepted range max	6.93				



EtG – Standard solution 3					
Lab code	Standard 3 Average [pg/mg]	Standard deviation [pg/mg]	Diff from Median [pg/mg]	Z-score	passed
01E4	22.00		2.50	0.70	yes
02E4	-				
04E4	20.25		0.75	0.21	yes
05E4	-				
06E4	16.18	0.09	-3.32	-0.93	yes
07E4	13.15	0.64	-6.35	-1.78	yes
08E4	-				
09E4	20.70		1.20	0.34	yes
10E4	20.75	1.91	1.25	0.35	yes
11E4	25.75	8.84	6.25	1.75	yes
14E4	-				
15E4	15.17	0.01	-4.34	-1.22	yes
16E4	-				
17E4	-				
18E4	-				
19E4	-				
21E4	-				
22E4	-				
24E4	21.73	0.95	2.23	0.62	yes
26E4	19.20		-0.30	-0.08	yes
27E4	-				
28E4	35.15		15.65	4.39	no
29E4	18.45		-1.05	-0.29	yes
30E4	17.60		-1.90	-0.53	yes
33E4	-				
34E4	10.44	0.85	-9.06	-2.54	no
35E4	17.75	0.64	-1.75	-0.49	yes
36E4	19.50	0.99	0.00	0.00	yes
37E4	-				
39E4	31.50		12.00	3.37	no
41E4	18.10	0.42	-1.40	-0.39	yes
42E4	20.37	0.68	0.87	0.24	yes
43E4	-				
44E4	-				
Average	20.2				
SD	5.76				
CV (%)	28.5				
Median	19.5				
Minimum	10.44				
Quartile 25	17.7				
Quartile 75	21.2				
Maximum	35.15				
IQR	3.56				
2 x IQR	7.13				
Accepted range min	12.4				
Accepted range max	26.6				



2 FAEE – Summary

2.1 Participants in determination of fatty acid ethyl esters (FAEE):

Participating laboratories: 11

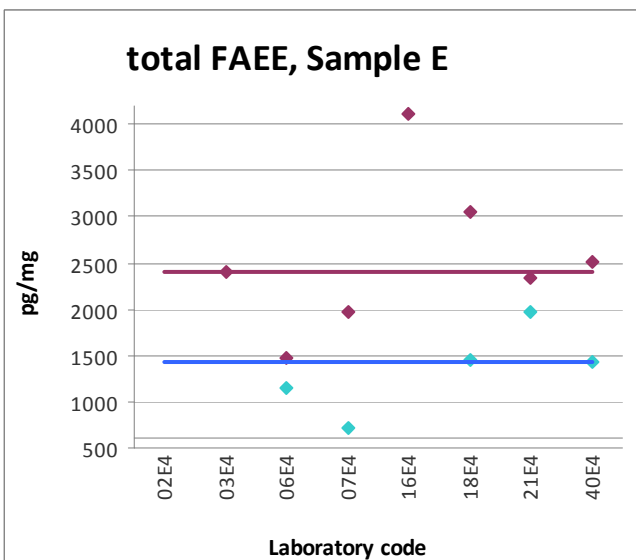
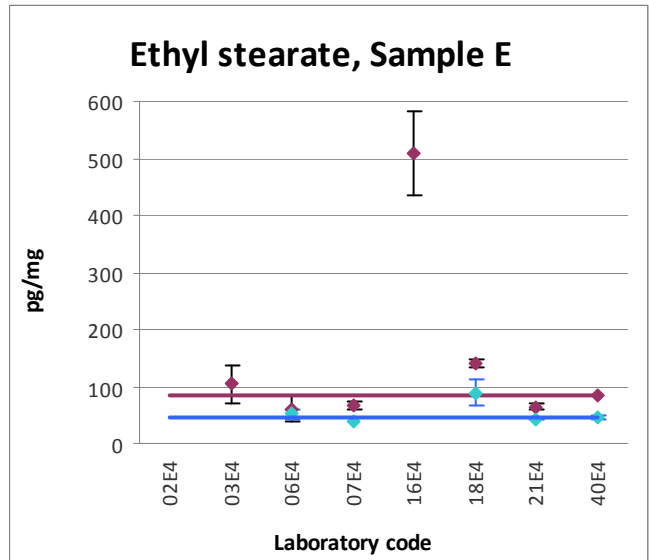
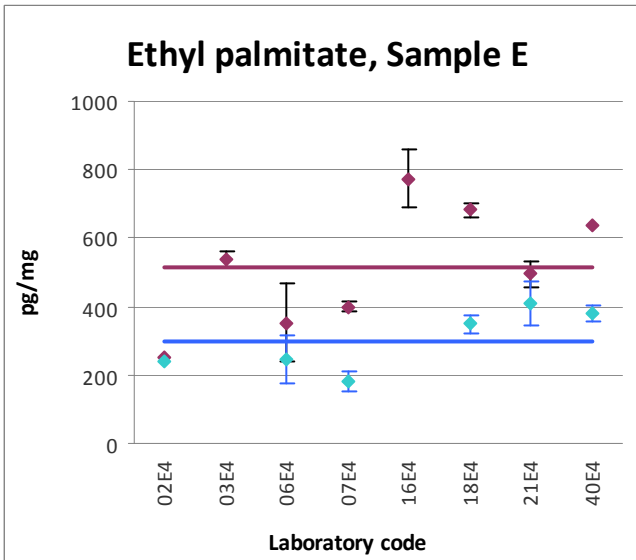
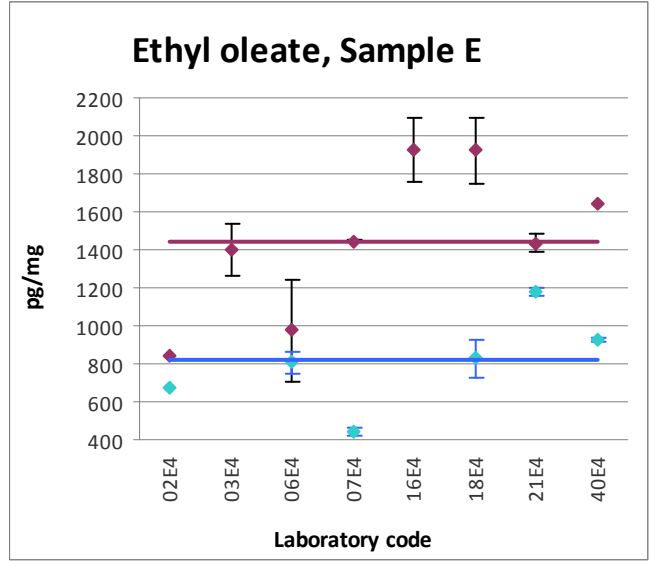
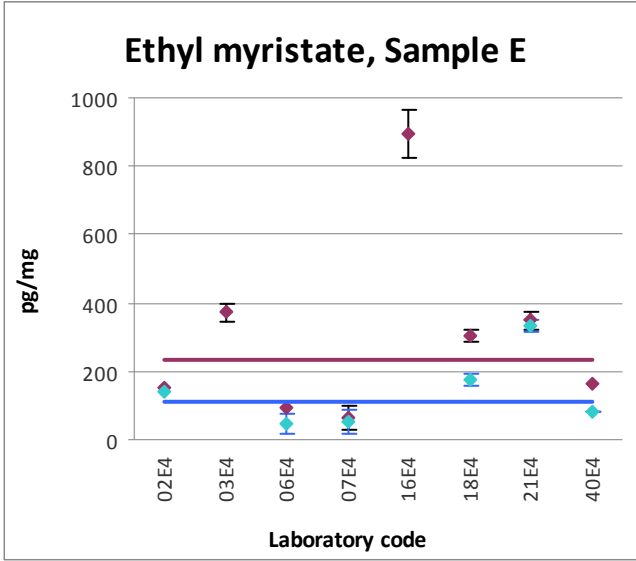
Laboratories having reported their results a) without washing: 08
b) after washing: 06

Number of samples to be analyzed: 2 cut hair samples; 2 vials each

sample E (=B), real case
sample F (=C), real case

FAEE - Sample E (=B) without washing									
[pg/mg]	Ethyl myristate		Ethyl oleate		Ethyl palmitate		Ethyl stearate		FAEE
Lab code	Average	SD	Average	SD	Average	SD	Average	SD	Total
02E4	150.0		840.0		250.0		-		-
03E4	372.5	26.2	1396.0	135.8	539.0	24.0	104.5	33.2	2412
06E4	93.0		975.0	267.1	353.7	111.6	61.0	22.3	1483
07E4	65.0	35.4	1445.0	7.1	400.0	14.1	65.0	7.1	1975
16E4	895.0	70.7	1928.0	165.5	774.0	84.9	508.5	74.2	4106
18E4	302.0	18.2	1922.3	175.7	683.3	19.7	140.7	6.0	3048
21E4	349.0	26.9	1436.0	49.5	495.5	37.5	64.1	4.5	2345
40E4	161.0		1638.0		638.0		83.0		2520
Average	298		1448		517		147		2555
Median	232		1441		517		83		2412
Minimum	65		840		250		61		1483
Maximum	895		1928		774		509		4106

FAEE - Sample E (=B) after washing									
[pg/mg]	Ethyl myristate		Ethyl oleate		Ethyl palmitate		Ethyl stearate		FAEE
Lab code	Average	SD	Average	SD	Average	SD	Average	SD	Total
02E4	140.0		670.0		240.0		-		-
06E4	46.5	30.4	808.5	57.3	244.0	69.3	51.0	8.5	1150
07E4	55.0	35.4	445.0	21.2	180.0	28.3	40.0	0.0	720
18E4	174.7	19.0	830.0	98.6	350.0	26.1	88.0	22.6	1443
21E4	333.0	18.4	1179.0	17.0	409.5	64.3	42.9	0.4	1964
40E4	80.5	0.71	926.5	6.36	381	22.6	46.0	2.83	1434
Average	138		810		301		54		1342
Median	110		819		297		46		1434
Minimum	47		445		180		40		720
Maximum	333		1179		410		88		1964



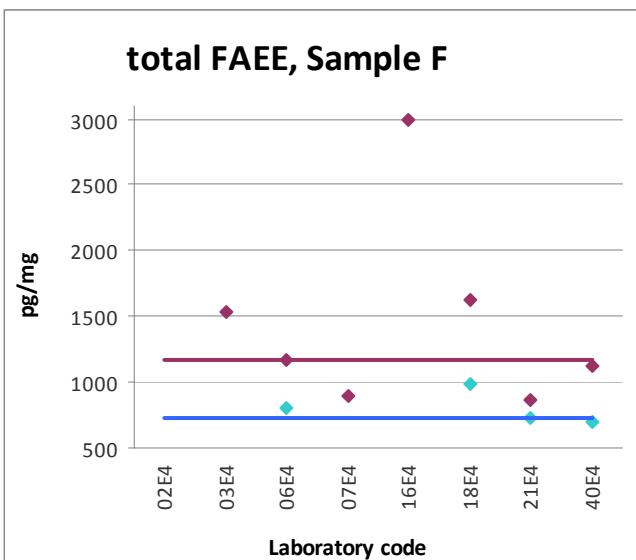
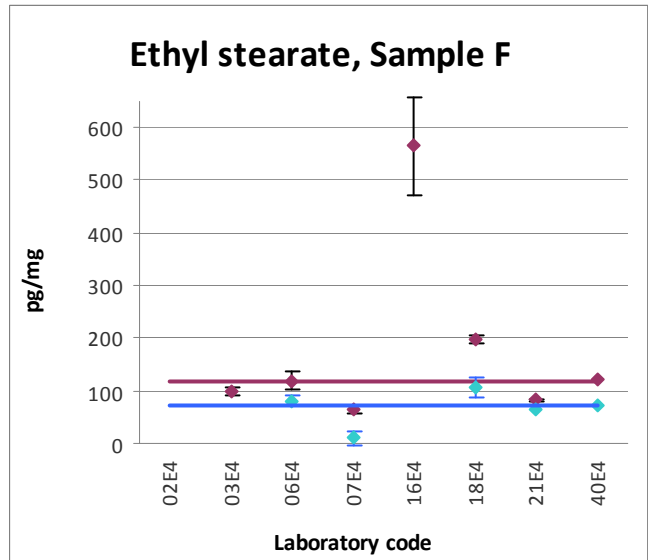
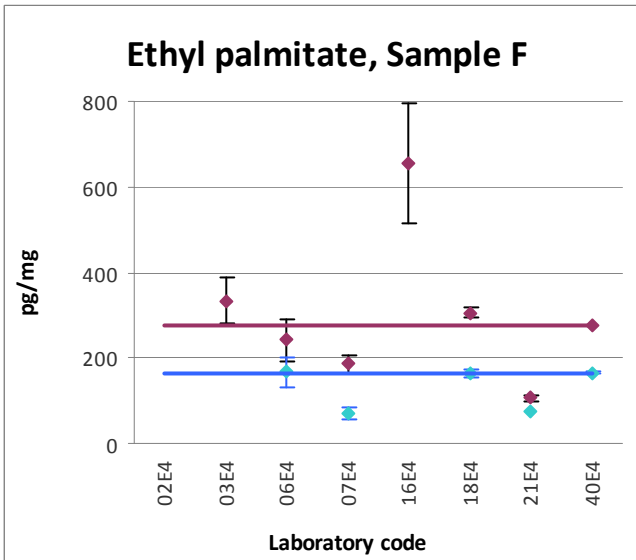
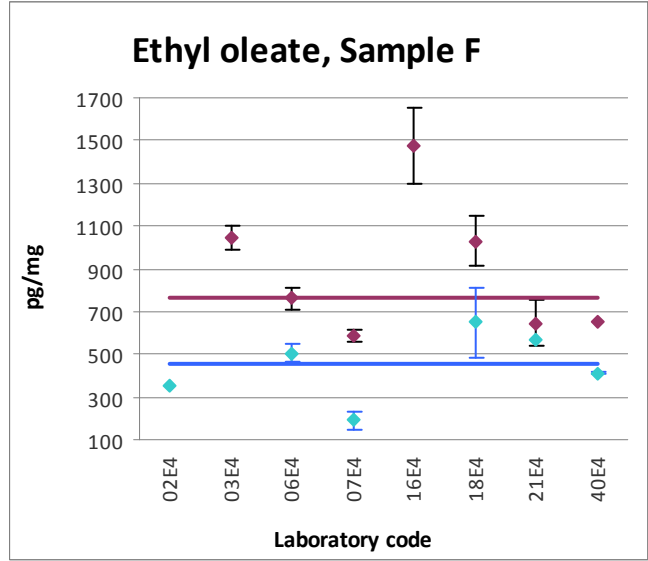
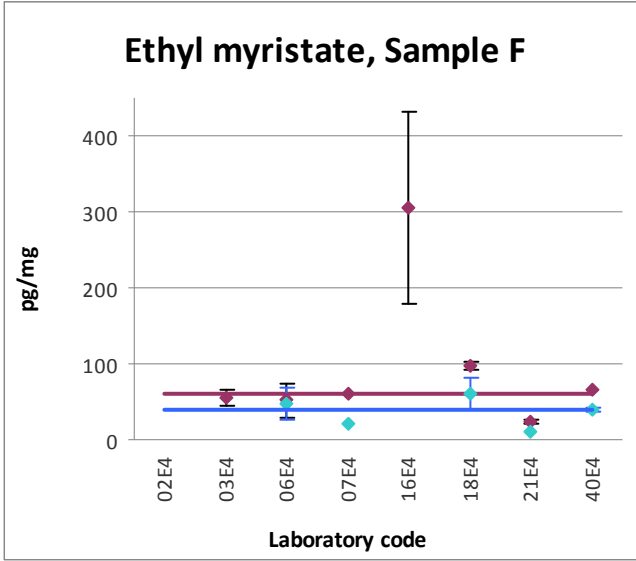
Legend:

- ◆ — results without washing
- ◆ — results after washing

total FAEE Sum total of ethyl myristate, ethyl oleate, ethyl palmitate and ethyl stearate

FAEE - Sample F (=C) without washing									
[pg/mg]	Ethyl myristate		Ethyl oleate		Ethyl palmitate		Ethyl stearate		FAEE
Lab code	Average	SD	Average	SD	Average	SD	Average	SD	Total
02E4	-		-		-		-		-
03E4	55.0	9.9	1044.5	54.4	333.5	54.4	98.5	6.4	1532
06E4	52.3	22.2	761.0	49.5	241.0	48.8	119.3	15.9	1174
07E4	60.0	0.0	590.0	28.3	185.0	21.2	65.0	7.1	900
16E4	305.0	127.3	1474.0	178.2	653.0	140.0	565.5	92.6	2998
18E4	97.3	6.5	1030.3	117.8	306.0	10.0	197.7	7.5	1631
21E4	23.8	3.6	647.0	106.1	106.5	6.4	82.4	2.8	860
40E4	67.0		654.0		276.0		122.0		1119
Average	94		886		300		179		1459
Median	60		761		276		119		1174
Minimum	24		590		107		65		860
Maximum	305		1474		653		566		2998

FAEE - Sample F (=C) after washing									
[pg/mg]	Ethyl myristate		Ethyl oleate		Ethyl palmitate		Ethyl stearate		FAEE
Lab code	Average	SD	Average	SD	Average	SD	Average	SD	Total
02E4	-		350		-		-		-
06E4	47.5	20.5	507	43.1	168	34.6	81.0	8.5	803
07E4	20.0	0.0	190	42.4	70	14.1	10.0	14.1	290
18E4	61.0	20.8	649	166.2	165	9.5	107.7	19.4	982
21E4	9.3		571		76		66.5		723
40E4	40.0	2.83	413	4.24	166	1.41	74	0	693
Average	36		447		129		68		698
Median	40		460		165		74		723
Minimum	9		190		70		10		290
Maximum	61		649		168		108		982



Legend:

- ◆ — results without washing
- ◆ — results after washing

total FAEE Sum total of ethyl myristate, ethyl oleate, ethyl palmitate and ethyl stearate