Results of Proficiency Test
Aviation gasoline
May 2011

August 2011

CONTENTS

Appendices:

1   INTRODUCTION

On request of several participants, the Institute for Interlaboratory Studies decided to organise a new proficiency test for the analysis of Aviation Gasoline during the annual proficiency testing program 2010/2011. In this interlaboratory study 13 laboratories in 11 different countries have participated. See appendix 2 for the number of participants per country. In this report, the results of the Aviation Gasoline proficiency test are presented and discussed. This report is also electronically available through the iis internet site www.iisnl.com.

2   SET UP

The Institute for Interlaboratory Studies (iis) in Spijkenisse, the Netherlands, was the organiser of this proficiency test. It was decided to evaluate the Aviation Gasoline according to the test scope of ASTM D910:11. The analyses for fit-for-use and homogeneity testing were subcontracted. In this proficiency test, the participants received one sample of Aviation Gasoline (Avgas 100LL).
Participants were requested to report rounded and unrounded results. The unrounded results were preferably used for statistical evaluation.

2.1   QUALITY SYSTEM

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, has implemented a quality system based on ISO guide 43, ISO17043:2010 and ILAC-G13:2007. This ensures 100% confidentially of participant's data. Also customer's satisfaction is measured on a regular basis by sending out questionnaires.

2.2   PROTOCOL

The protocol followed in the organization of this proficiency test was the one as described for proficiency testing in the report 'iis Interlaboratory Studies: Protocol for the Organization, Statistics and Evaluation' of January 2010 (iis-protocol, version 3.2), which can be downloaded from www.iisnl.com.

2.3   CONFIDENTIALITY STATEMENT

All data present in this report must be regarded as confidential and for use by the participating companies only. Disclosure of the information in this report is only allowed by means of the entire report. Use of the contents of this report for third parties is only allowed by written permission of the Institute for Interlaboratory Studies. Disclosure of the identity of one or more of the participating companies will be done only after receipt of a written agreement of the companies involved.

2.4 SAMPLES

The necessary sample was obtained from an European supplier. After homogenisation, the material was transferred into 52 brown glass bottles of 1 litre (#11033). The homogeneity of the subsamples #11033 was checked by determination of Density @15°C in accordance with ASTM D4052:09 on 4 stratified randomly selected samples.

	Density @ 15°C in kg/m^3
Sample #11033-1	710.82
Sample #11033-2	710.81
Sample #11033-3	710.82
Sample #11033-4	710.83

table 1: homogeneity test results of subsamples #11033

From the above test results, the repeatability was calculated and compared with 0.3 times the reproducibility of the reference test method which is in agreement with the procedure of ISO 13528, Annex B2 in the next table:

	Density @ 15 °C in kg/m^3
r (sample #11033)	0.02
reference test	D4052:09
0.3*R (reference test)	0.97

table 2: evaluation of repeatability of the subsamples #11033

The calculated repeatability is less than 0.3 times the reproducibility of the corresponding reference method. Therefore, homogeneity of the subsamples #11033 was assumed.

To the participants one 1L bottle with sample #11033 was sent on 4 May, 2011.

2.5 ANALYSIS

The participants were requested to determine on sample #11033: Colour, Copper Strip Corrosion 2 hrs/100 ˚C, Density, Distillation, Existent Gum, Freezing Point, Heat of Combustion (Net), Lead as Pb, Lead as TEL, Lead participate, MON, Potential Gum, Sulphur and Water reaction interface (volume change).
To get comparable results a detailed report form, on which the units were prescribed as well as some of the required standards, was sent together with each set of samples. Also, a letter of instructions and a SDS were added to the package.

3   RESULTS

During four weeks after sample despatch, the results of the individual laboratories were gathered. The original data are tabulated per determination in appendix 1 of this report. The laboratories are presented by their code numbers.

Directly after the deadline, a reminder fax was sent to the laboratories that had not reported results at that moment. Shortly after the deadline, the available results were screened for suspect data. A result was called suspect in case the Huber Elimination Rule (a robust outlier test) found it to be an outlier. The laboratories that produced these suspect data were asked to check the results. Additional or corrected results are used for data analysis and original results are placed under 'Remarks' in the result tables in appendix 1.

3.1   STATISTICS

Statistical calculations were performed as described in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' of January 2010 (iis-protocol, version 3.2).

For the statistical evaluation the *unrounded* (when available) figures were used instead of the rounded results. Results reported as '<…' or '>…' were not used in the statistical evaluation.

First, the normality of the distribution of the various data sets per determination was checked by means of the Lilliefors-test. After removal of outliers, this check was repeated. Not all data sets proved to have a normal distribution, in which cases the statistical evaluation of the results should be used with due care.
In accordance to ISO 5725 (1986 and 1994) the original results per determination were submitted subsequently to Dixon and Grubbs outlier tests. Outliers are marked by D(0.01) for the Dixon test, by G(0.01) or DG(0.01) for the Grubbs test. Stragglers are marked by D(0.05) for the Dixon test, by G(0.05) or DG(0.05) for the Grubbs test. Both outliers and stragglers were not included in the calculations of averages and standard deviations. Finally, the reproducibilities were calculated from the standard deviations by multiplying them with a factor of 2.8.

3.2   GRAPHICS

In order to visualize the data against the reproducibilities from literature, Gauss plots were made, using the sorted data for one determination (see appendix 1). On the Y-axis the reported analysis results are plotted. The corresponding laboratory numbers are under the X-axis.
The straight horizontal line presents the consensus value (a trimmed mean). The four striped lines, parallel to the consensus value line, are the +3s, +2s, -2s and -3s target reproducibility limits of the selected standard. Outliers and other data, which were excluded from the calculations, are represented as a "x". Accepted data are represented as a triangle. Furthermore, Kernel Density Graphs were made. This is a method for

producing a smooth density approximation to a set of data that avoids some problems associated with histograms (see appendix 3; nr.13 and 14).

3.3 Z-SCORES

To evaluate the performance of the participating laboratories the z-scores were calculated. As it was decided to evaluate the performance of the participants in this proficiency test (PT) against the literature requirements, e.g. ASTM reproducibilities, the z-scores were calculated using a target standard deviation. The target standard deviation was calculated from the literature reproducibility by division with 2.8. The z-scores were calculated in accordance with:

$z_{(target)}$ = (result - average of PT) / target standard deviation

The $z_{(target)}$ scores are listed in the result tables in appendix 1.

Absolute values for z<2 are very common and absolute values for z>3 are very rare. Therefore the usual interpretation of z-scores is as follows:

$$| z | < 1 \quad \text{good}$$
$$1 < | z | < 2 \quad \text{satisfactory}$$
$$2 < | z | < 3 \quad \text{questionable}$$
$$3 < | z | \quad \text{unsatisfactory}$$

4 EVALUATION

No problems were encountered during the execution of this proficiency test. One laboratory reported the test results after the final reporting date. All laboratories reported results, but not all laboratories were able to perform all analyses requested. Finally, 13 laboratories did report 163 numerical test results. Observed were 2 outlying test results, which is 1.2%. In proficiency tests, outlier percentages of 3% - 7.5% are quite normal.

4.1 EVALUATION PER TEST

In this section the results are discussed per test. For the Density determination a not normal distribution was found. For many other tests the number of reported test results was too small to determine whether the data set was normally distributed.

Colour: No conclusions were drawn. Only two laboratories reported test results.

Copper Corrosion: No conclusions were drawn. All participants agreed on result 1.

Density @15ºC: This determination was not problematic. No statistical outliers were observed and the calculated reproducibility is in good agreement with the requirements of D4052:09. However, the calculated reproducibility is not in agreement with the much more strict requirements of the previous version D4052:02e1.

Distillation: This determination is not problematic. In total 2 statistical outliers were observed. However, the calculated reproducibilities, after rejecting of the statistical outliers are all in good agreement with the requirements of D86:10a.

Existent Gum: The consensus value was near or below the detection limit. Therefore no significant conclusions were drawn. Also an evaluation was done where reported values '<x' were changed into 'x/2'. The mean value of this second evaluation is nearly the same as the mean of the originally calculation.

Freezing Point.: In this determination no problems have been observed. All reporting participants agreed on a result below -58˚C. This value is the specification for freezing point according to the test scope D910:11.

Heat of Combustion: This determination was very problematic. No statistical outliers were observed. However, the calculated reproducibility is not at all in agreement with the requirements of D3338:09. The small number of test results may (partly) explain the large spread.

Lead as Pb: This determination was problematic. No statistical outliers were observed. However, the calculated reproducibility is not in agreement with the requirements of D3341:05. The small number of test results may (partly) explain the large spread.

Lead as Tel: This determination was problematic. No statistical outliers were observed. However, the calculated reproducibility is not in agreement with the requirements of D3341:05. IIS converted Lead as Pb test results to Lead as Tel test results for laboratories with codes 445, 496, 1047 and 1094, in order to create a more significant evaluation.

Lead participate: No significant conclusions were drawn. Only one laboratory reported a numerical result.

MON: No significant conclusions were drawn. Only two laboratories reported a numerical result.

Potential Gum: No significant conclusions were drawn. Only two laboratories reported a numerical result.

Sulphur: This determination was very problematic. Only three laboratories reported a numerical result between 0.036 %M/M and 0.19 %M/M. However, four other laboratories reported that no sulfur was detectable: <0.0005 %M/M.

Water reaction: This determination may be not problematic. All participants reported 1 or below 1. Actually, the rating numbers 1, 1b, 2, 3 and 4 should be used for appearance according to D1094:07.

4.2   PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the reproducibility as declared by the relevant standard and the reproducibility as found for the group of participating laboratories. The average values, calculated reproducibilities and reproducibilities derived from literature standards (in casu ASTM standards) are compared in the next table.

Parameter	unit	n	mean	2.8 * sd	R (lit)
Colour	-----	2	blue	n.e	n.e
Copper Corrosion 2 hrs/100 ˚C	-----	12	1	n.e	n.e
Density @15˚C	kg/m^3	13	710.9	0.6	3.2
Distillation @ 760 mm Hg	-				
- Initial Boiling Point	˚C	12	36.5	3.5	5.2
- 10% evaporated	˚C	12	63.6	2.7	3.2
- 40% evaporated	˚C	12	97.2	1.4	unknown
- 50% evaporated	˚C	10	104.0	0.6	1.9
- 90% evaporated	˚C	12	126.2	1.9	3.1
- Final Boiling Point	˚C	12	152.4	2.0	6.8
Existent Gum	mg/100ml	11	0.38	0.56	(2.14)
Freezing Point	˚C	9	<-58	n.e	2.5
Heat of Combustion (Net)	MJ/kg	5	43.810	0.204	0.046
Lead as Pb	g/l	7	0.55	0.04	0.03
Lead as Tel	ml/l	7	0.52	0.04	0.03
Lead participate content	mg/100ml	1	n.e	n.e	(1)
MON (lean mixture)	-----	2	103.3	n.e	n.e
Potential Gum	mg/100ml	2	0.9	n.e	(3.0)
Sulphur	%M/M	no consensus value could be determined			
Water reaction interface	ml	9	n.e	n.e	n.e

table 3: performance evaluation sample #11033

*() = near or below the detection limit

Without further statistical calculations, it can be concluded that for several tests there is not a good compliance of the group of participants with the relevant standards. The problematic tests have been discussed in paragraph 4.1.

4.3 COMPARISON OF THE PROFICIENCY TEST WITH PREVIOUS PTS

This proficiency test was organized for the first time by the Institute for Interlaboratory Studies. Therefore no comparison could be made with previous proficiency tests.

APPENDIX 1

Determination of Colour on sample #11033

lab	method	value	mark	z(targ)	remarks
273		-----		-----	
340		-----		-----	
353		-----		-----	
445	D2392	2.4 blue		-----	
447		-----		-----	
463		-----		-----	
496		-----		-----	
631	visual	blue		-----	
1017		-----		-----	
1047		-----		-----	
1094		-----		-----	
1293		-----		-----	
1650		-----		-----	

normality	n.e	
n	2	
outliers	n.e	
mean (n)	n.e	
st.dev. (n)	n.e	
R(calc.)	n.e	
R(D2392:96)	n.e	

Determination of Copper Corrosion on sample #11033

lab	method	value	mark	z(targ)	remarks
273	D130	1a		-----	
340	D130	1a		-----	
353	IP154	1a		-----	
445	D130	1b		-----	
447	D130	1b		-----	
463	D130	1a		-----	
496	D130	1a		-----	
631	D130	1b		-----	
1017	D130	1a		-----	
1047	D130	1		-----	
1094	D130	1b		-----	
1293		-----		-----	
1650	D130	1a		-----	

normality	n.e	
n	12	
outliers	n.e	
mean (n)	1a-1b	
st.dev. (n)	n.e	
R(calc.)	n.e	
R(D130:10)	n.e	

Determination of Density @ 15°C on sample #11033; results in kg/m^3

lab	method	value	mark	z(targ)	remarks
273	D4052	711.1		0.17	
340	D4052	710.81		-0.08	
353	IP365	710.8		-0.09	
445	D4052	711.1		0.17	
447	D4052	710.7		-0.18	
463	D4052	711.11		0.18	
496	D4052	710.74		-0.14	
631	D4052	711.41		0.44	
1017	D4052	711.0		0.08	
1047	D4052	710.6		-0.26	
1094	D4052	710.77		-0.12	
1293	ISO12185	710.82	C	-0.07	First reported 0.7108
1650	D4052	710.81		-0.08	

normality	not OK		
n	13		
outliers	0		
mean (n)	710.905		
st.dev. (n)	0.2234		
R(calc.)	0.626		
R(D4052:09)	3.245		Compare R(4052:02e1) = 0.500

Kernel Density
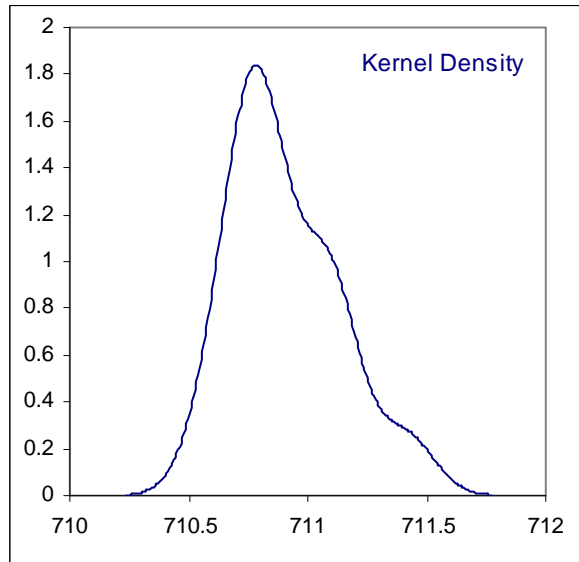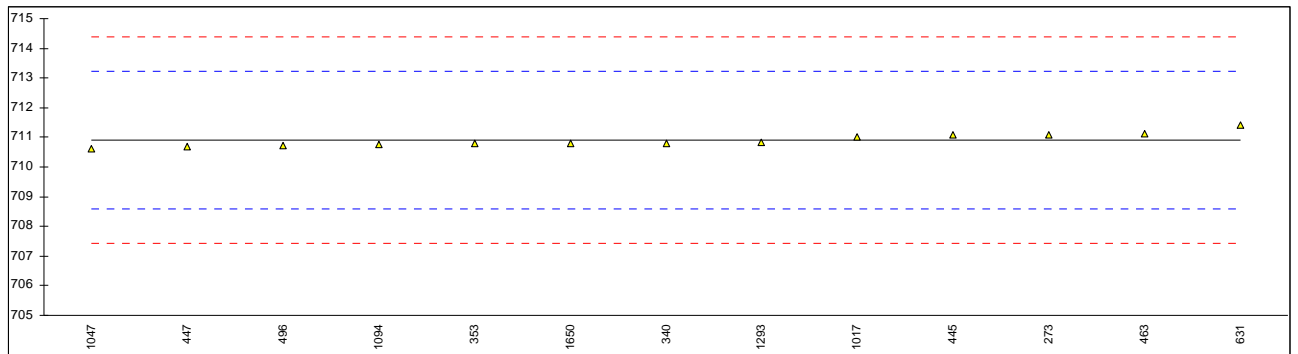
Distillation @ 760 mm Hg (automated + manual) on sample #11033.

lab	method	IBP	mark	z(targ)	10% evap	mark	z(targ)	40% evap	mark	z(targ)
273	D86A	36.0		-0.25	63.3		-0.26	96.5		-----
340	D86A	36.2		-0.14	63.8		0.18	97.5		-----
353	IP123A	36.2		-0.14	62.0		-1.39	97.4		-----
445	D86A	37.3		0.45	65.3		1.49	97.0		-----
447	D86A	34.1		-1.27	62.4		-1.04	97.8		-----
463	D86A	36.9		0.24	63.4		-0.17	97.1		-----
496	D86A	37.1		0.34	62.8		-0.69	97.4		-----
631	D86M	39.0		1.36	63.2		-0.34	96.2		-----
1017	D86A	35.2		-0.68	64.6		0.88	97.4		-----
1047	D86A	37.2		0.40	64.7		0.97	96.8		-----
1094	D86A	35.5		-0.51	64.2		0.53	97.5		-----
1293		-----		-----	-----		-----	-----		-----
1650	D86A	36.8		0.18	63.4		-0.17	97.8		-----
	normality	OK			OK			OK		
	n	12			12			12		
	outliers	0			0			0		
	mean (n)	36.46			63.59			97.20		
	st.dev. (n)	1.238			0.976			0.497		
	R(calc.)	3.46			2.73			1.39		
	R(D86:10a)	5.22			3.20			unknown		

| lab	method	50% evap	mark	z(targ)	90% evap	mark	z(targ)	FBP	mark	z(targ)
273	D86A	103.2	DG(0.05)	-1.24	125.4		-0.70	152.4		0.00
340	D86A	104.0		-0.04	126.9		0.65	153.3		0.37
353	IP123A	104.2		0.25	126.7		0.47	152.5		0.04
445	D86A	103.8		-0.34	126.1		-0.07	153.1		0.29
447	D86A	104.3		0.40	126.1		-0.07	152.1		-0.12
463	D86A	104.1		0.10	125.8		-0.34	150.6		-0.74
496	D86A	103.9		-0.19	126.7		0.47	152.3		-0.04
631	D86M	103.0	* ,DG(0.05)	-1.53	124.7		-1.33	152.5		0.04
1017	D86A	103.9		-0.19	126.1		-0.07	151.8		-0.25
1047	D86A	103.7		-0.49	126.2		0.02	152.9		0.21
1094	D86A	104.1		0.10	126.3		0.11	152.3		-0.04
1293		-----		-----	-----		-----	-----		-----
1650	D86A	104.3		0.40	127.1		0.83	153.0		0.25
	normality	OK			OK			OK		
	n	10			12			12		
	outliers	2			0			0		
	mean (n)	104.03			126.18			152.40		
	st.dev. (n)	0.206			0.666			0.716		
	R(calc.)	0.58			1.86			2.00		
	R(D86:10a)	1.88			3.11			6.78		

* First reported 102.0
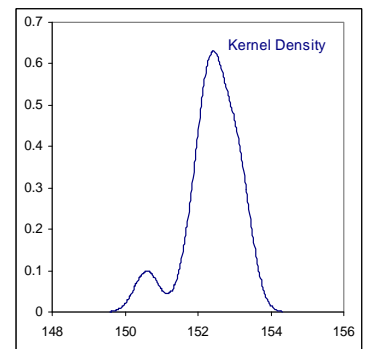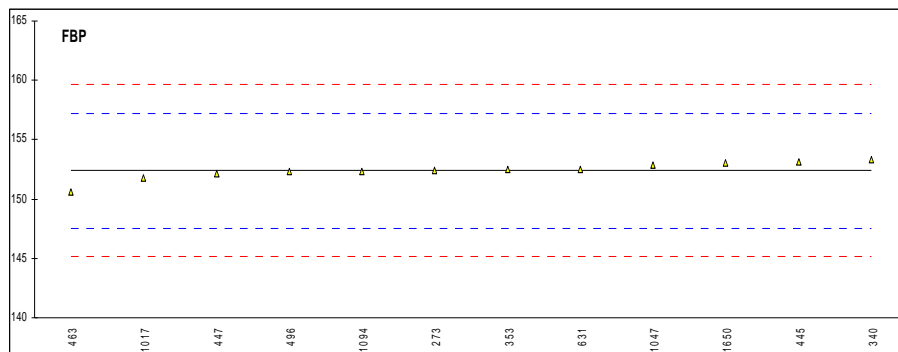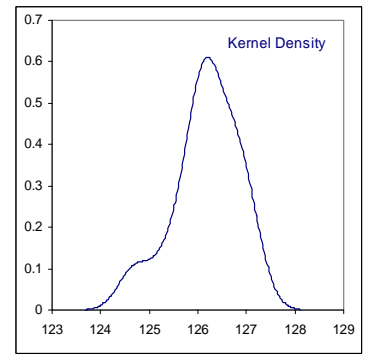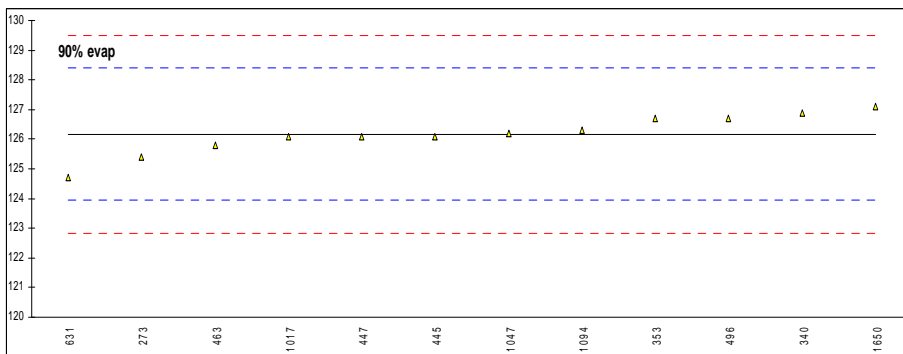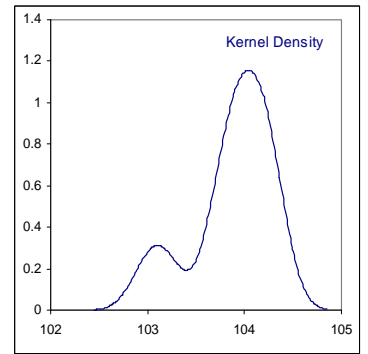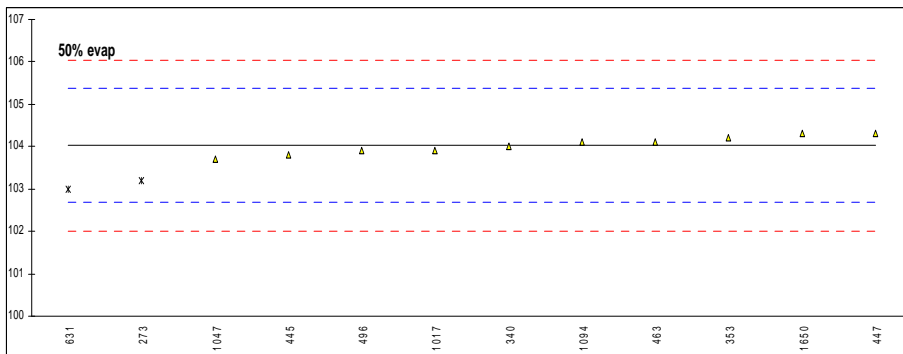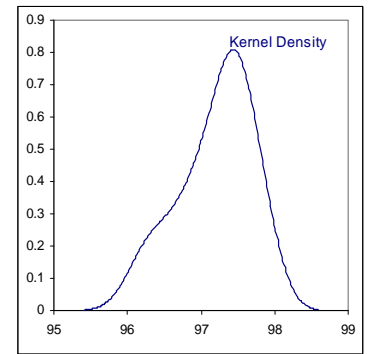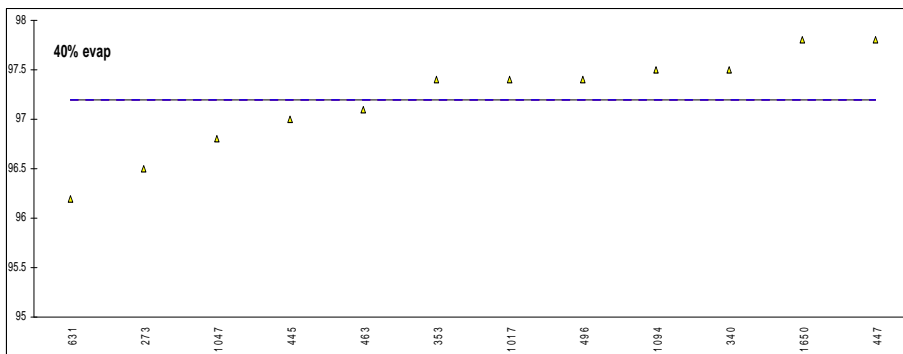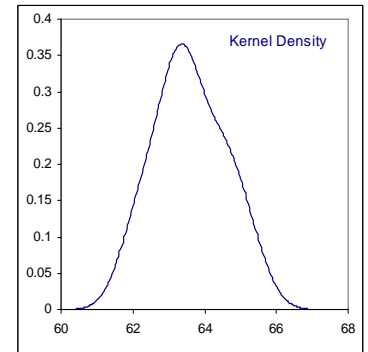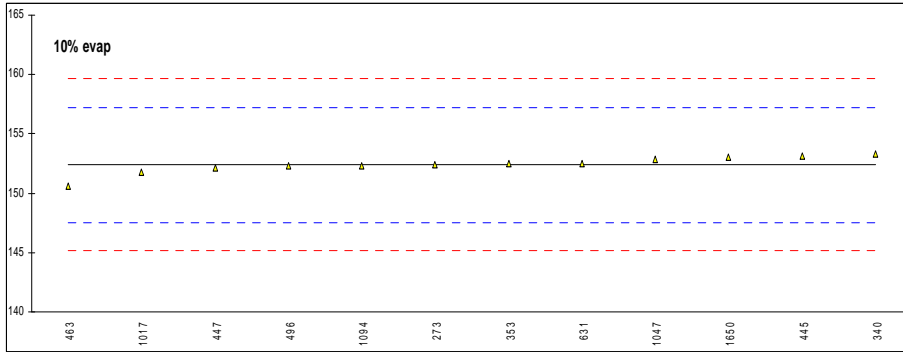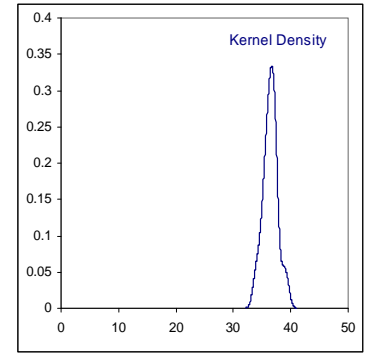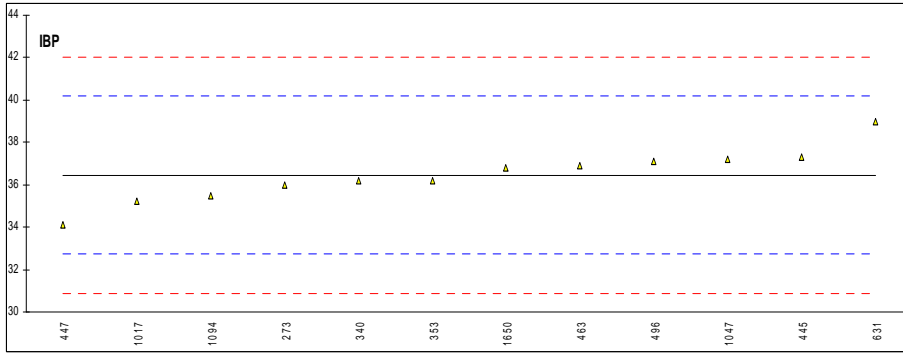
Determination of Existent Gum on sample #11033; results in mg/100ml

lab	method	value	mark	z(targ)	remarks
273	D381	<1		-----	
340	D381	<1		-----	
353	IP131	0	ex	-----	excluded, zero is not a real value
445	D381	<1		-----	
447	D381	0.6		-----	
463	D381	<1		-----	
496	D381	0.1		-----	
631	D381	0.2		-----	
1017	D381	0.3		-----	
1047	D381	<1.0		-----	
1094	D381	<1		-----	
1293		-----		-----	
1650		-----		-----	
	normality	n.e			
	n	4			
	outliers	n.e			
	mean (n)	0.30			
	st.dev. (n)	n.e			
	R(calc.)	n.e			
	R(D381:09)	(2.13)			Application range > 1 mg/100 ml

lab	method	value *	mark	z(targ)	remarks
273	D381	0.5		-----	
340	D381	0.5		-----	
353	IP131	0		-----	
445	D381	0.5		-----	
447	D381	0.6		-----	
463	D381	0.5		-----	
496	D381	0.1		-----	
631	D381	0.2		-----	
1017	D381	0.3		-----	
1047	D381	0.5		-----	
1094	D381	0.5		-----	
1293		-----		-----	
1650		-----		-----	
	normality	not OK			
	n	11			
	outliers	0			
	mean (n)	0.38			
	st.dev. (n)	0.199			
	R(calc.)	0.557			
	R(D381:09)	(2.14)			Application range > 1 mg/100 ml

*) In the calculation of the mean, standard deviation and reproducibility a reported value '<x' was changed into 'x/2'
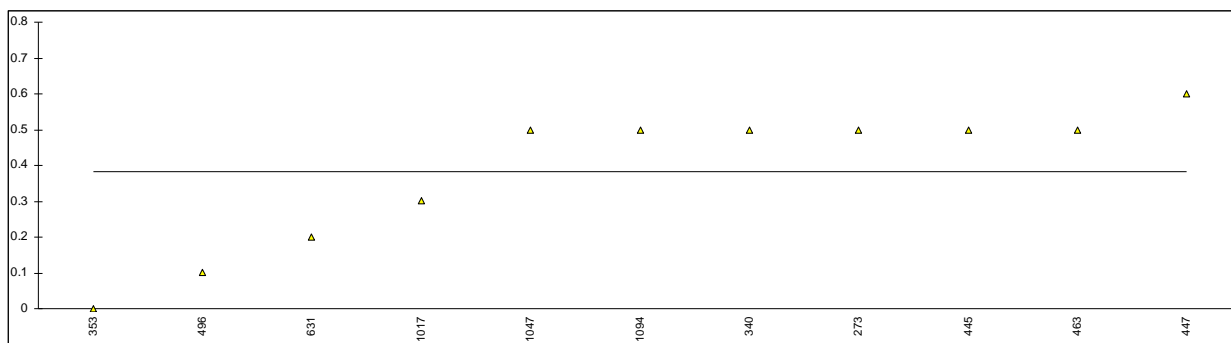
Determination of Freezing Point on sample #11033; results in °C

lab	method	value	mark	z(targ)	remarks
273	D2386	<-60		-----	
340	D2386	<-75		-----	
353	IP16	<-72		-----	
445	IP16	<-70		-----	
447		-----		-----	
463	D2386	<-65		-----	
496	D2386	<-77		-----	
631		-----		-----	
1017		-----		-----	
1047	D2386	<-80		-----	
1094	D2386	<-70		-----	
1293		-----		-----	
1650	D2386	<-71		-----	

normality	n.e	
n	9	
outliers	n.e	
mean (n)	<-60	
st.dev. (n)	n.e	
R(calc.)	n.e	
R(D2386:06)	2.5	

Determination of Heat of Combustion (Net) on sample #11033; results in MJ/kg

lab	method	value	mark	z(targ)	remarks
273		-----		-----	
340	D3338	43.7922		-1.14	
353		-----		-----	
445	D3338	43.711		-6.08	
447		-----		-----	
463		-----		-----	
496		-----		-----	
631	D3338	43.8297		1.14	
1017	D3338	43.80771		-0.20	
1047	D4809	43.914		6.27	
1094		-----		-----	
1293		-----		-----	
1650		-----		-----	

normality	OK
n	5
outliers	0
mean (n)	43.8109
st.dev. (n)	0.07301
R(calc.)	0.2044
R(D3338:09)	0.0460
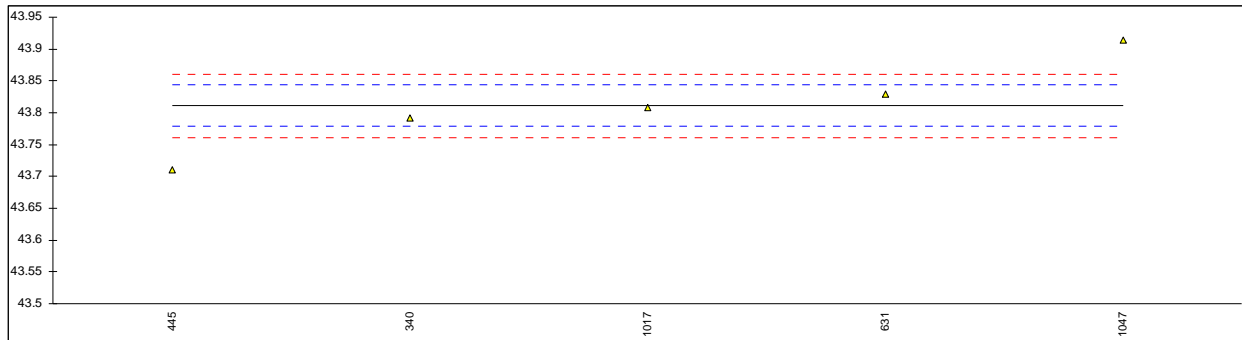
Determination of Lead as Pb on sample #11033; results in g/l

lab	method	value	mark	z(targ)	remarks
273	D3341	0.548		-0.67	
340		-----		-----	
353	IP270	0.550		-0.47	
445	IP270	0.540		-1.45	
447		-----		-----	
463	D3341	0.5399		-1.46	
496	D3341	0.57157		1.65	
631		-----		-----	
1017		-----		-----	
1047	D5059 metA	0.56		0.51	
1094	FAAS	0.574		1.89	
1293		-----		-----	
1650		-----		-----	

normality	OK
n	7
outliers	0
mean (n)	0.5548
st.dev. (n)	0.01407
R(calc.)	0.0394
R(D3341:05)	0.0285
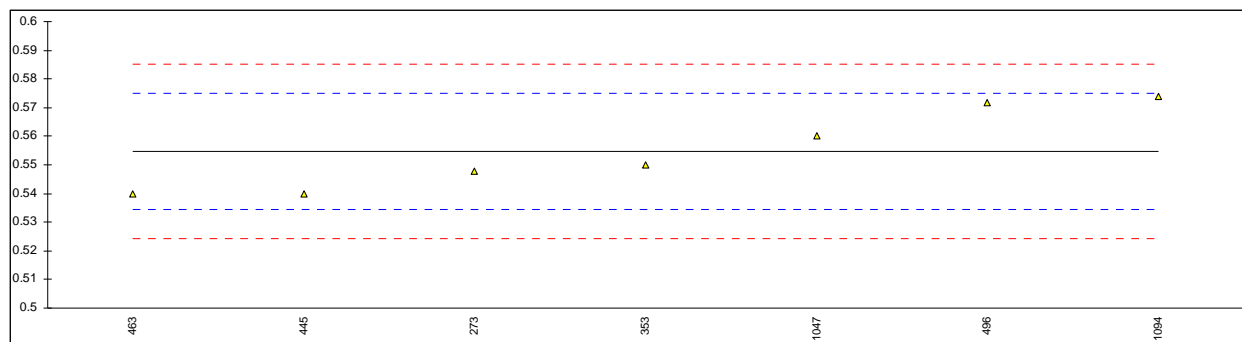
Determination of Lead as Tel on sample #11033; results in ml/l

lab	method	value	mark	z(targ)	remarks
273	D3341	0.518		-0.69	
340		-----		-----	
353	IP270	0.5203		-0.46	
445	D3341	0.511		-1.40	converted by iis
447		-----		-----	
463	D3341	0.5107		-1.43	
496	D3341	0.5407		1.61	converted by iis
631		-----		-----	
1017		-----		-----	
1047	D3341	0.53		0.52	converted by iis
1094	D3341	0.543		1.84	converted by iis
1293		-----		-----	
1650		-----		-----	

normality	OK
n	7
outliers	0
mean (n)	0.5248
st.dev. (n)	0.01333
R(calc.)	0.0373
R(D3341:05)	0.0277
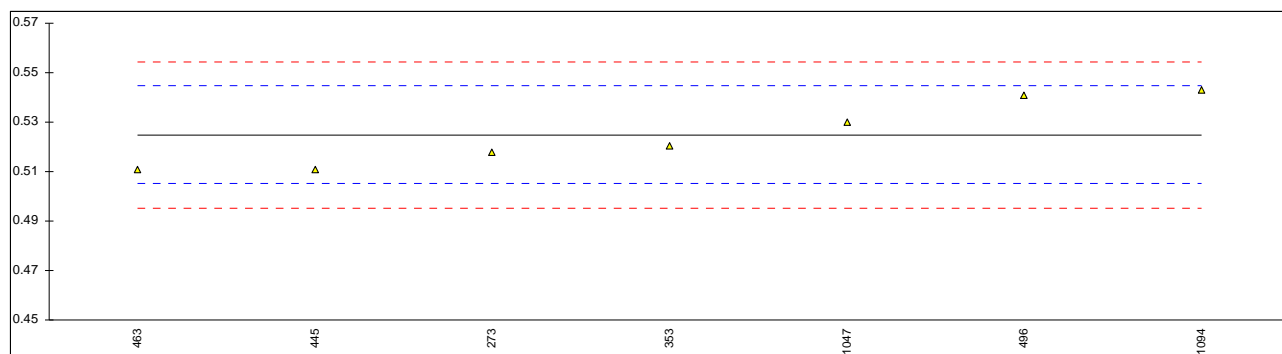
Determination of Lead participate content on sample #11033; results in mg/100ml

lab	method	value	mark	z(targ)	remarks
273	D873	0.3		-----	
340		-----		-----	
353		-----		-----	
445	IP138	<1		-----	
447		-----		-----	
463		-----		-----	
496		-----		-----	
631		-----		-----	
1017		-----		-----	
1047		-----		-----	
1094		-----		-----	
1293		-----		-----	
1650		-----		-----	

normality	n.e	
n	1	
outliers	n.e	
mean (n)	n.e	
st.dev. (n)	n.e	
R(calc.)	n.e	
R(D873:02)	(1)	

Determination of MON (lean mixture) on sample #11033

lab	method	value	mark	z(targ)	remarks
273		-----		-----	
340	D2700	105.1		-----	
353		-----		-----	
445		-----		-----	
447		-----		-----	
463	D2700	>100		-----	
496	D2700	101.6		-----	
631		-----		-----	
1017		-----		-----	
1047		-----		-----	
1094		-----		-----	
1293		-----		-----	
1650		-----		-----	

normality	n.e
n	2
outliers	n.e
mean (n)	103.3
st.dev. (n)	n.e
R(calc.)	n.e
R(D2700:10)	0.9

Determination of Potential Gum on sample #11033; results in mg/100ml

lab	method	value	mark	z(targ)	remarks
273	D873	1.0		-----	
340	D873	<1		-----	
353		-----		-----	
445	IP138	<1		-----	
447		-----		-----	
463		-----		-----	
496		-----		-----	
631	D873	0.8		-----	
1017		-----		-----	
1047	D873	<1.0		-----	
1094		-----		-----	
1293		-----		-----	
1650		-----		-----	

normality	n.e
n	2
outliers	n.e
mean (n)	0.9
st.dev. (n)	n.e
R(calc.)	n.e
R(D873:02)	(3)

Determination of Sulphur content on sample #11033; results in %M/M

lab	method	value	mark	z(targ)	remarks
273		-----		-----	
340	D2622	<0.0001		-----	
353	IP336	0.0531	C	-----	First reported 531.2
445	D5453	0.19		-----	
447	IP490	<0.0001		-----	
463		-----		-----	
496	D2622	<0.0005		-----	
631	D4294	0.0361		-----	
1017		-----		-----	
1047	EN ISO20846	<0.0003		-----	
1094		-----		-----	
1293		-----		-----	
1650		-----		-----	

normality	n.e	
n	3	
outliers	n.e	
mean (n)	(0.09) *	
st.dev. (n)	n.e	
R(calc.)	n.e	
R(D2622:10)	(0.01) *	application range > 3 mg/kg

* See §4.1

Determination of Water reaction interface on sample #11033; results in ml

lab	method	value	mark	z(targ)	remarks
273	D1094	1		-----	
340	D1094	1.0		-----	
353	IP289	1b		-----	
445	D1094	1		-----	
447	D1094	0		-----	
463	D1094	<0.5		-----	
496		-----		-----	
631	D1094	1		-----	
1017	D1094	<0.5		-----	
1047	D1094	0		-----	
1094	D1094	0.0		-----	
1293		-----		-----	
1650	D1094	0.5		-----	

normality	n.e
n	9
outliers	n.e
mean (n)	n.e
st.dev. (n)	n.e
R(calc.)	n.e
R(D1094:05)	n.e

APPENDIX 2

Number of participants per country

1 lab in BELGIUM

1 lab in FRANCE

1 lab in GERMANY

1 lab in IRELAND

1 lab in PHILIPPINES

2 labs in POLAND

1 lab in REPUBLIC OF MACEDONIA

1 lab in SOUTH AFRICA

1 lab in SWEDEN

1 lab in TURKEY

2 labs in UNITED KINGDOM

APPENDIX 3

Abbreviations:

C	= final result after checking of first reported suspect result
D(0.01)	= outlier in Dixon's outlier test
D(0.05)	= straggler in Dixon's outlier test
G(0.01)	= outlier in Grubbs' outlier test
G(0.05)	= straggler in Grubbs' outlier test
DG(0.01)	= outlier in Double Grubbs' outlier test
DG(0.05)	= straggler in Double Grubbs' outlier test
ex	= excluded from calculations
E	= error in calculations
n.e.	= not evaluated
W	= withdrawn
fr.	= first reported
U	= reported in different unit
SDS	= Safety Data Sheet

Literature:

1   iis Interlaboratory Studies, Protocol for the Organisation, Statistics & Evaluation, January 2010
2   ASTM E178-02
3   ASTM E1301-03
4   ISO 5725-86
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7   M. Thompson and R. Wood, J. AOAC Int, 76, 926, (1993)
8   W.J. Youden and E.H. Steiner, Statistical Manual of the AOAC, (1975)
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11   P.L. Davies, Fr. Z. Anal. Chem, 331, 513, (1988)
12   J.N. Miller, Analyst, 118, 455, (1993)
13   Analytical Methods Committee Technical Brief, No4 January 2001
14   The Royal Society of Chemistry 2002, Analyst 2002, 127 page1359-1364, P.J. Lowthian and M. Thompson. (see http://www.rsc.org/suppdata/an/b2/b205600n/)
15   H. Verplaetse and M. Lacourt, Accred Qual Assur (2006) 11:521-522