

**Results of Proficiency Test
Dissolved Gas Analysis
November 2016**

Organised by: Institute for Interlaboratory Studies
Spijkenisse, the Netherlands

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1	INTRODUCTION.....	3
2	SET UP.....	3
2.1	ACCREDITATION.....	3
2.2	PROTOCOL.....	3
2.3	CONFIDENTIALITY STATEMENT.....	3
2.4	SAMPLES.....	4
2.5	STABILITY OF THE SAMPLES.....	4
2.6	ANALYSES.....	4
3	RESULTS.....	5
3.1	STATISTICS.....	5
3.2	GRAPHICS.....	6
3.3	Z-SCORES.....	6
4	EVALUATION.....	7
4.1	EVALUATION PER COMPONENT.....	7
4.2	PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES.....	9
4.3	COMPARISON OF THE PROFICIENCY TEST OF NOVEMBER 2016 WITH PREVIOUS PTS.....	9
4.4	DISCUSSION.....	10

Appendices:

1.	Data and statistical results.....	12
2.	Extraction method used.....	34
3.	Number of participants per country.....	35
4.	Abbreviations and literature.....	36

1 INTRODUCTION

Since 2007 the Institute for Interlaboratory Studies organizes a proficiency test for the analyses on Dissolved Gas Analysis (DGA) in Transformer Oil every year. During the annual program 2016/2017, it was decided to continue the round robin for the analyses on Dissolved Gas Analysis (DGA) in Transformer Oil. In this interlaboratory study on DGA in Transformer Oil, 58 laboratories from 30 different countries did register for participation. See appendix 2 for the number of participants per country. In this report, the test results of the 2016 interlaboratory study on Dissolved Gas Analysis (DGA) in Transformer Oil are presented and discussed. This report can also be downloaded from the iis website www.iisnl.com.

2 SET UP

The Institute for Interlaboratory Studies (iis) in Spijkenisse, the Netherlands, was the organiser of this proficiency test (PT). In total one batch of 68 certified syringes (of 50 mL) was prepared (lot RN192). It was decided to use this year on request of a number of participants a DGA Oil with around 500 ppm of most gases, which is higher than in previous rounds. The syringes were provided by Morgan Schaffer Inc, Quebec, Canada (True North). Each syringe was uniquely numbered and one syringe was sent to each participating laboratory, without the certificate provided by Morgan Schaffer Inc. Participants were requested to report rounded and unrounded test results. The unrounded test results were preferably used for statistical evaluation.

2.1 ACCREDITATION

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, is ISO/IEC 17043 accredited (R007), since January 2000, by the Dutch Accreditation Council (Raad voor Accreditatie). This PT falls under the accredited scope. This ensures strict adherence to protocols for sample preparation and statistical evaluation and 100% confidentiality of participant's data. Feedback from the participants on the reported data is encouraged and customer's satisfaction is measured on regular basis by sending out questionnaires. Morgan Schaffer Inc. is ISO 9001 certified and ISO/IEC17025 accredited by SCC.

2.2 PROTOCOL

The protocol followed in the organisation of this proficiency test was the one as described for proficiency testing in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' of April 2014 (iis-protocol, version 3.3). This protocol can be downloaded from the iis website www.iisnl.com, from the FAQ page.

2.3 CONFIDENTIALITY STATEMENT

All data presented 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

In this proficiency test only one type of sample was used. The 50 mL gas tight syringes with sample material were prepared and subsequently tested by Morgan Schaffer Inc. (Quebec, Canada) in accordance with principles outlined in ASTM Method D3612, Annex A2 and IEC 60567, clause 6.2 (2011).

In total one batch of 68 syringes was prepared (lot RN242). Each syringe was uniquely numbered and a certificate of analysis was provided by Morgan Schaffer Inc. These certificates were not enclosed to the samples and were kept separated after receipt of the samples by iis prior to the dispatch of the samples to the participating laboratories.

The differences between the test results of each syringe are not statistically significant (see paragraph 4.4). And for all components, the repeatability is in agreement with 0.3 times the corresponding reproducibility of the target test method according with the procedure of ISO13528. Therefore, homogeneity of the samples was assumed.

To each of the participating laboratories one syringe of 50 mL (labelled #16254) was sent on November 2, 2016.

2.5 STABILITY OF THE SAMPLES

Morgan Schaffer declares that bulk storage prior to shipping has a shelf life of at least 6 months. This was assumed to be sufficient for the proficiency testing purposes.

2.6 ANALYSES

The participants were requested to determine on sample #16254: Hydrogen, Oxygen, Nitrogen, Carbon Monoxide, Carbon Dioxide, Methane, Ethane, Ethene, Ethyn, Propane and Propene. Also some method details were requested to be reported.

It was explicitly requested to treat the samples as if they were routine samples and to report the test results using the indicated units on the report form and not to round the results more, but report as much significant figures as possible. It was also requested not to report 'less than' results, which are above the detection limit, because such results cannot be used for meaningful statistical calculations.

To get comparable test results a detailed report form, on which the units were prescribed as well as the required reference test methods and a letter of instructions were prepared and made available on the data entry portal www.kpmd.co.uk/sgs-iis/. The laboratories were also requested to confirm the sample receipt on the same data entry portal. A SDS was added to the sample.

3 RESULTS

During five weeks after sample dispatch, the test results of the individual laboratories were gathered via the data entry portal www.kpmd.co.uk/sgs-iis/. The reported test results are tabulated per determination in appendix 1 of this report. The laboratories are presented by their code numbers.

Directly after the deadline, a reminder was sent to those laboratories that had not reported test results at that moment. Shortly after the deadline, the available test results were screened for suspect data. A test 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 reported test results (no reanalysis). Additional or corrected test results are used for data analysis and original test results are placed under 'Remarks' in the test result tables in appendix 1. Test results that came in after the deadline were not taken into account in this screening for suspect data and thus these participants were not requested for checks.

3.1 STATISTICS

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 Organisation, Statistics and Evaluation' of April 2014 (iis-protocol, version 3.3).

For the statistical evaluation the *unrounded* (when available) figures were used instead of the rounded test results. Test 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 a variant of the Kolmogorov-Smirnov test and by the calculation of skewness and kurtosis. Evaluation of the three normality indicators in combination with the visual evaluation of the graphic Kernel density plot, lead to judgement of the normality being either 'unknown', 'OK', 'suspect' or 'not OK'. 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 test results should be used with due care.

According to ISO 5725 the original test results per determination were submitted to Dixon's, Grubbs' and/or Rosner's outlier tests. Outliers are marked by D(0.01) for the Dixon's test, by G(0.01) or DG(0.01) for the Grubbs' test and by R(0.01) for the Rosner's test. Stragglers are marked by D(0.05) for the Dixon's test, by G(0.05) or DG(0.05) for the Grubbs' test and by R(0.05) for the Rosner's test. Both outliers and stragglers were not included in the calculations of averages and standard deviations.

For each assigned value the uncertainty was determined in accordance with ISO13528. Subsequently the calculated uncertainty was evaluated against the respective requirement based on the target reproducibility in accordance with ISO13528. When the uncertainty passed the evaluation, no remarks are made in the report. However, when the uncertainty failed the evaluation it is mentioned in the report and it will have consequences for the evaluation of the test results.

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 test results are plotted. The corresponding laboratory numbers are on 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 reference test method. Outliers and other data, which were excluded from the calculations, are represented as a cross. 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. Also a normal Gauss curve was projected over the Kernel Density Graph for reference.

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, EN or ISO reproducibilities, the z-scores were calculated using a target standard deviation. This results in an evaluation independent of the variation of this interlaboratory study. The target standard deviation was calculated from the literature reproducibility by division with 2.8.

When a laboratory did use a test method with a reproducibility that is significantly different from the reproducibility of the reference test method used in this report, it is strongly advised to recalculate the z-score, while using the reproducibility of the actual test method used, this in order to evaluate whether the reported test result is fit-for-use.

The z-scores were calculated according to:

$$Z_{(\text{target})} = (\text{test result} - \text{average of PT}) / \text{target standard deviation}$$

The $Z_{(\text{target})}$ scores are listed in the test result tables in appendix 1.

Absolute values for $z < 2$ are very common and absolute values for $z > 3$ are very rare.

The usual interpretation of z-scores is as follows:

	$ z < 1$	good
1 <	$ z < 2$	satisfactory
2 <	$ z < 3$	questionable
3 <	$ z $	unsatisfactory

4 EVALUATION

In this proficiency test major problems were encountered during execution.

After dispatch of the samples, a number of participants reported to have received syringes with a small air-bubble and/or with material on the outside of the syringe. Participants were requested to test the sample (syringe) and report the inconvenience on the data reporting platform. During the evaluation of all reported test results, the test results of the laboratories that reported the presence of an air-bubble did not differ at all from the other reported test results.

One participant reported the test results after the final reporting date and five participants did not report any test results at all. Not all participants were able to report all components requested. In total 53 participating laboratories reported 487 numerical results. Observed were 57 outlying results, which is 11.7% of the numerical results. In proficiency studies outlier percentages of 3% - 7.5% are quite normal.

4.1 EVALUATION PER COMPONENT

In this section the results are discussed per component.

Not all original data sets proved to have a normal Gaussian distribution. These are referred to as “not OK” or “suspect”. The statistical evaluation of these data sets should be used with due care.

The test results of the laboratories 912, 1264, 1444, 1898 and 6053 showed a significant number of statistical outliers. As the nine test results are not independent, it was decided to reject all of the test results of these laboratories from the statistical evaluation.

Hydrogen: The determination of this component was problematic. Four statistical outliers were observed and five other test results were excluded. The calculated reproducibility after rejection of suspect data is not in agreement with the strict requirements of IEC 60567:2011.

Oxygen: The determination of this component was very problematic. Eight statistical outliers were observed and four other test results were excluded. The calculated reproducibility after rejection of suspect data is not at all in agreement with the requirements of IEC 60567:2011.

Nitrogen: The determination of this component was very problematic. Six statistical outliers were observed and four other test results were excluded. The calculated reproducibility after rejection of suspect data is not at all in agreement with the requirements of IEC 60567:2011.

Carbon Monoxide: The determination of this component was problematic. Seven statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of IEC 60567:2011.

- Carbon Dioxide: The determination of this component was very problematic. Six statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not at all in agreement with the requirements of IEC 60567:2011.
- Methane: The determination of this component was problematic. Five statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of IEC 60567:2011.
- Ethane: The determination of this component was problematic. Five statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of IEC 60567:2011.
- Ethene: The determination of this component was problematic. Five statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of IEC 60567:2011.
- Ethyn: The determination of this component was problematic. Six statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of IEC 60567:2011.
- Propane: The determination of this component was problematic. Four statistical outliers were observed and three participants probably reported a false negative test result. The calculated reproducibility after rejection of the suspect data is not in agreement with the strict requirements of IEC 60567:2011.
- Propene: Too few analytical test results were received to draw any significant conclusions. Two participants did report a false positive test result.

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 results per component, calculated reproducibilities and reproducibilities from IEC60567 are compared in the next table.

Parameter	unit	n	average	2.8 * sd	R(lit)
Hydrogen H ₂	µl/L	44	515	146	103
Oxygen O ₂	µl/L	35	16031	6011	3206
Nitrogen N ₂	µl/L	37	57303	20293	11461
Carbon Monoxide CO	µl/L	45	512	165	102
Carbon Dioxide CO ₂	µl/L	47	543	240	109
Methane CH ₄	µl/L	46	529	147	106
Ethane C ₂ H ₆	µl/L	48	532	178	106
Ethene C ₂ H ₄	µl/L	48	532	179	106
Ethyn C ₂ H ₂	µl/L	47	516	167	103
Propane C ₃ H ₈	µl/L	10	565	135	113
Propene C ₃ H ₆	µl/L	11	<10	n.a.	n.a.

Table 1: performance of the group on sample #16254

Without further statistical calculations it can be concluded from the overview given in table 1 that there is not a compliance of the performance of the group of participating laboratories with the relevant standard IEC 60567:2011.

The problematic components have been discussed in paragraph 4.1.

4.3 COMPARISON OF THE PROFICIENCY TEST OF NOVEMBER 2016 WITH PREVIOUS PTS

	<i>November 2016</i>	<i>November 2015</i>	<i>November 2014</i>	<i>November 2013</i>	<i>November 2012</i>
Number of reporting labs	53	45	40	33	29
Number of test results reported	487	401	358	293	265
Statistical outliers	57	29	10	10	15
Percentage statistical outliers	11.7%	7.2%	2.8%	3.4%	6.0%

Table 2: comparison of statistical summary parameters with previous proficiency tests

In proficiency tests, outlier percentages of 3% - 7.5% are quite normal.

The performance of the determinations of the proficiency tests was determined by calculating the relative uncertainties. The conclusions are given the following table:

Determination	Nov 2016	Nov 2015	Nov 2014	Nov 2013	Nov 2012	Nov 2011	IEC605671
Hydrogen H ₂	10%	21%	24%	21%	20%	25%	7%
Oxygen O ₂	13%	19%	18%	17%	16%	14%	7%
Nitrogen N ₂	13%	16%	13%	19%	12%	12%	7%
Carbon Monoxide CO	12%	11%	12%	12%	15%	14%	7%
Carbon Dioxide CO ₂	16%	12%	17%	15%	14%	14%	7%
Methane CH ₄	10%	13%	18%	19%	18%	19%	7%
Ethane C ₂ H ₆	12%	17%	24%	23%	18%	25%	7%
Ethene C ₂ H ₄	12%	12%	29%	17%	21%	18%	7%
Ethyn C ₂ H ₂	12%	11%	35%	19%	20%	24%	7%
Propane C ₃ H ₈	9%	n.e.	n.e.	n.e.	n.e.	n.e.	n.e.
Propene C ₃ H ₆	n.e.	26%	20%	n.e.	n.e.	n.e.	n.e.

Table 3: comparison of the relative uncertainties on the various components

Comparing the results of the 2016 round robin to that of previous year(s), the overall performance appears to be much better, except for Carbon Dioxide.

4.4 DISCUSSION

The consensus values as determined in this PT are compared with the average values from the homogeneity testing by Morgan Schaffer in the following table. From this comparison it is clear that all consensus values as determined in this PT are very well in line with the values as determined by Morgan Schaffer after the preparation of the syringes.

Parameter	Average values by Morgan Schaffer in µl/L	Consensus values from participants results in µl/L	Absolute differences in µl/L
Hydrogen H ₂	490	515	+25
Oxygen O ₂	15700	16031	+331
Nitrogen N ₂	57500	57303	-197
Carbon Monoxide CO	527	512	-15
Carbon Dioxide CO ₂	521	543	+22
Methane CH ₄	536	529	-7
Ethane C ₂ H ₆	514	531	+17
Ethene C ₂ H ₄	516	531	+17
Ethyn C ₂ H ₂	503	516	+13

Table 4: comparison of consensus values with values determined by Morgan Schaffer

In the 2012 round robin (iis12L06) a correlation could be found between the methods used by the laboratories and the reported test results.

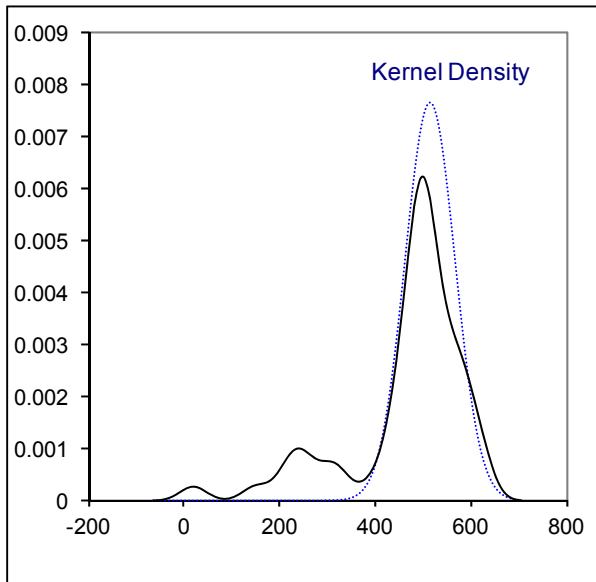
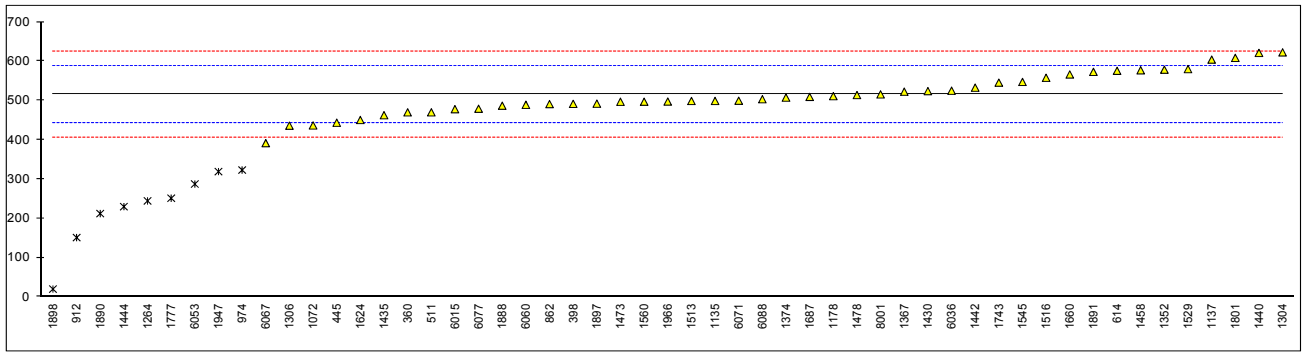
In order to evaluate whether the used test method has again a significant influence on the test results the headspace test results were evaluated separately, see appendix 1.

From the evaluation is noted that for all components the consensus value and the standard deviation for the headspace test results are slightly higher than the consensus value of all test results.

The target reproducibilities as required by IEC 60567 obviously appear to be very hard to meet, even when the concentrations are significant larger than in previous years. Although, the observed reproducibilities are decreasing during the subsequent annual PTs, it is clear that the reproducibility requirements of IEC 60567 are quite strict.

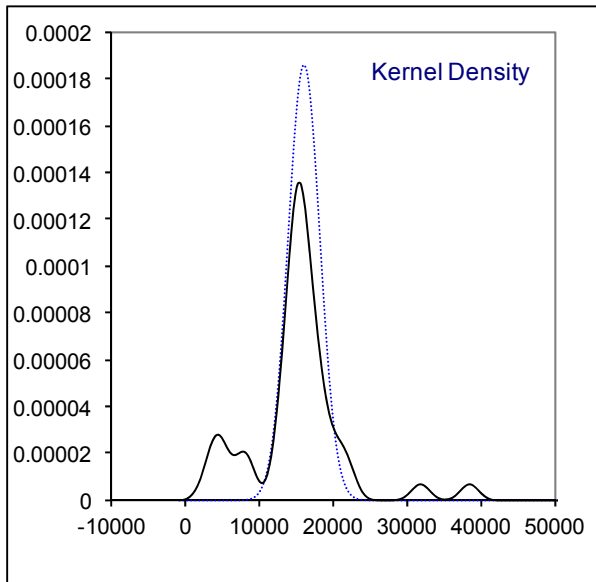
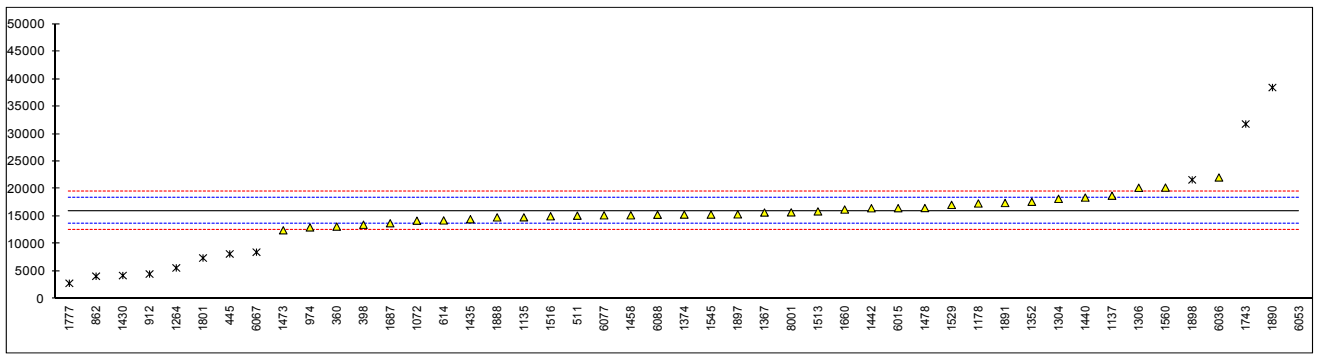
APPENDIX 1**Determination of Hydrogen (H₂) on sample #16254; results in µ/L**

lab	method	value	mark	z(targ)	remarks
179		----		----	
237		----		----	
360	IEC60567	469.9		-1.24	
398	IEC60567	491.5		-0.65	
445	IEC60567	443.5		-1.95	
511	D3612-C	470		-1.23	
614	IEC60567	575.7		1.64	
862	IEC60567	491		-0.66	
912	D3612-C	151	ex	-9.90	Result excluded see §4.1
962		----		----	
963		----		----	
974	D3612	323	R(0.05)	-5.23	
1072	IEC60567	436.59		-2.14	
1135	IEC60567	499.00		-0.45	
1137	D3612	604.153		2.41	
1178	IEC60567	511.21		-0.12	
1264	D3612	244.4	ex	-7.36	Result excluded see §4.1
1304	INH-120	622.6		2.91	
1306	IEC60567	436		-2.16	
1352	D3612	578.5		1.71	
1367	IEC60567	522.5		0.19	
1374	D3612	507.5		-0.22	
1430	IEC60567	524		0.23	
1435	IEC60567	462.67684		-1.43	
1440	D3612	621.22		2.87	
1442	IEC60567	532.75		0.47	
1444		229.75580	ex	-7.76	Result excluded see §4.1
1458	D3612	577	C	1.67	First reported 807
1473	IEC60567	496.86		-0.50	
1478	IEC60567	513.9		-0.04	
1513	IEC60567	498.841		-0.45	
1516	IEC60567	557.9		1.15	
1529	IEC60567	580		1.75	
1545	D3612	547.3		0.87	
1560	IEC60567	497		-0.50	
1624	IEC60567	450.38		-1.77	
1660	IEC60567	566.4		1.38	
1687	IEC60567	509.2		-0.17	
1743	IEC60567	545.553		0.82	
1777	IEC60567	251.3	C,R(0.05)	-7.17	First reported 333.29
1801	IEC60567	608.54		2.53	
1888	IEC60567	486.90		-0.78	
1890	IEC60567	212.15	C,R(0.05)	-8.24	First reported 165.69
1891	IEC60567	573		1.56	
1897	IEC60567	492		-0.64	
1898	D3612	20	ex	-13.46	Result excluded see §4.1
1947	IEC60567	319	R(0.05)	-5.34	
1966	IEC60567	497.4		-0.49	
6015	D3612	478		-1.02	
6036	IEC60567	525		0.26	
6053	IEC60567	287.44	C,ex	-6.19	First reported 10.32. Result excluded see §4.1
6060	GB/T17623	489.12	C	-0.72	First reported 300.62
6063		----		----	
6067	IEC60567	391.55	C	-3.37	First reported 366.35
6071	IEC60567	499.533		-0.43	
6077	D3612	479.04		-0.99	
6088	IEC60567	503.3		-0.33	
8001	IEC60567	515.6		0.00	
					<u>Only Headspace data:</u>
	normality	OK			OK
	n	44			33
	outliers	4 (+5 excl)			4 (+5 excl)
	mean (n)	515.446			518.654
	st.dev. (n)	52.1994			52.7200
	R(calc.)	146.158			147.616
	R(IEC60567:11)	103.089			103.731
					Compare R(Horwitz) = 90.206



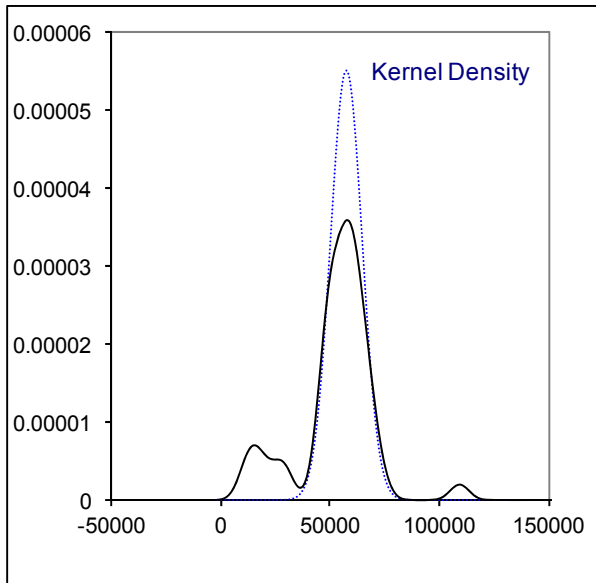
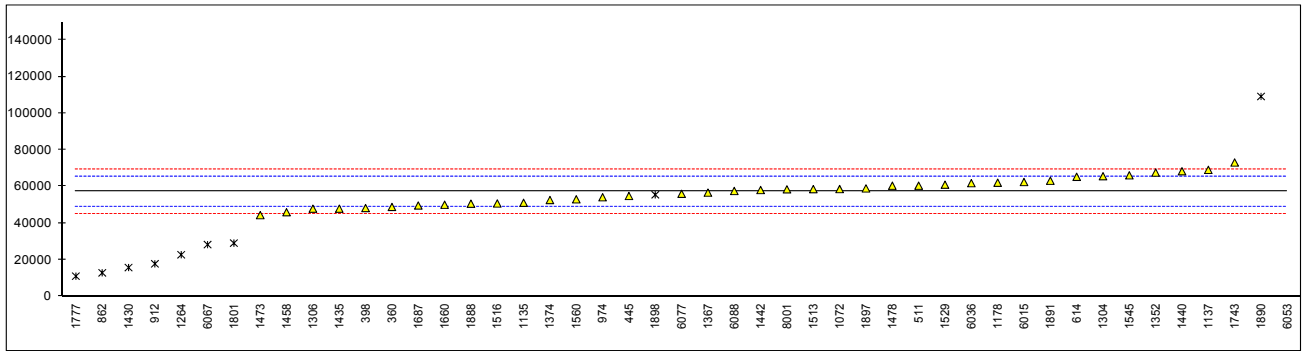
Determination of Oxygen (O₂) on sample #16254; results in µl/L

lab	method	value	mark	z(targ)	remarks
179		----		----	
237		----		----	
360	IEC60567	13154.1		-2.51	
398	IEC60567	13486	C	-2.22	First reported 4761.5
445	IEC60567	8180.32	R(0.01)	-6.86	
511	D3612-C	15137		-0.78	
614	IEC60567	14275.1		-1.53	
862	IEC60567	4125	R(0.01)	-10.40	
912	D3612-C	4516	C,ex	-10.06	First reported 4034. Result excluded see §4.1
962		----		----	
963		----		----	
974	D3612	13004		-2.64	
1072	IEC60567	14223.76		-1.58	
1135	IEC60567	14837.5		-1.04	
1137	D3612	18765	C	2.39	First reported 26126
1178	IEC60567	17358.11		1.16	
1264	D3612	5630.8	ex	-9.08	Result excluded see §4.1
1304	INH-120	18204.2		1.90	
1306	IEC60567	20213		3.65	
1352	D3612	17661.5		1.42	
1367	IEC60567	15712		-0.28	
1374	D3612	15328.3		-0.61	
1430	IEC60567	4246	R(0.01)	-10.29	
1435	IEC60567	14494.5		-1.34	
1440	D3612	18429		2.09	
1442	IEC60567	16483.5		0.40	
1444		----		----	
1458	D3612	15209		-0.72	
1473	IEC60567	12478.15		-3.10	
1478	IEC60567	16529.1		0.44	
1513	IEC60567	15912.000		-0.10	
1516	IEC60567	15026.7		-0.88	
1529	IEC60567	17100		0.93	
1545	D3612	15336.6		-0.61	
1560	IEC60567	20241		3.68	
1624		----		----	
1660	IEC60567	16254		0.20	
1687	IEC60567	13757.6		-1.99	
1743	IEC60567	31804.21	R(0.01)	13.78	
1777	IEC60567	2837	C,R(0.01)	-11.52	First reported 8408.09
1801	IEC60567	7435.88	R(0.05)	-7.51	
1888	IEC60567	14824.60		-1.05	
1890	IEC60567	38438	C,R(0.01)	19.57	First reported 36934
1891	IEC60567	17443		1.23	
1897	IEC60567	15376		-0.57	
1898	D3612	21656	ex	4.91	Result excluded see §4.1
1947		----		----	
1966		----		----	
6015	D3612	16502		0.41	
6036	IEC60567	22085		5.29	
6053	IEC60567	92917.52	C,ex	67.15	First reported 23197.66. Result excluded see §4.1
6060		----		----	
6063		----		----	
6067	IEC60567	8500.68	C,R(0.05)	-6.58	First reported 8033.9
6071		----		----	
6077	D3612	15196.50		-0.73	
6088	IEC60567	15297.9		-0.64	
8001	IEC60567	15734.6		-0.26	
					<u>Only Headspace data:</u>
	normality	OK			OK
	n	35			27
	outliers	8 (+4 excl)			7 (+3 excl)
	mean (n)	16030.58			15996.66
	st.dev. (n)	2146.929			2222.700
	R(calc.)	6011.40			6223.56
	R(IEC60567:11)	3206.12			3199.33
					Compare R(Horwitz) = 1672.32



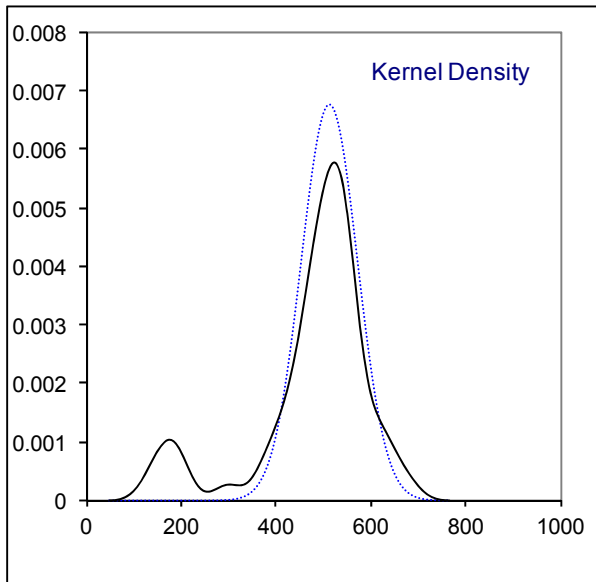
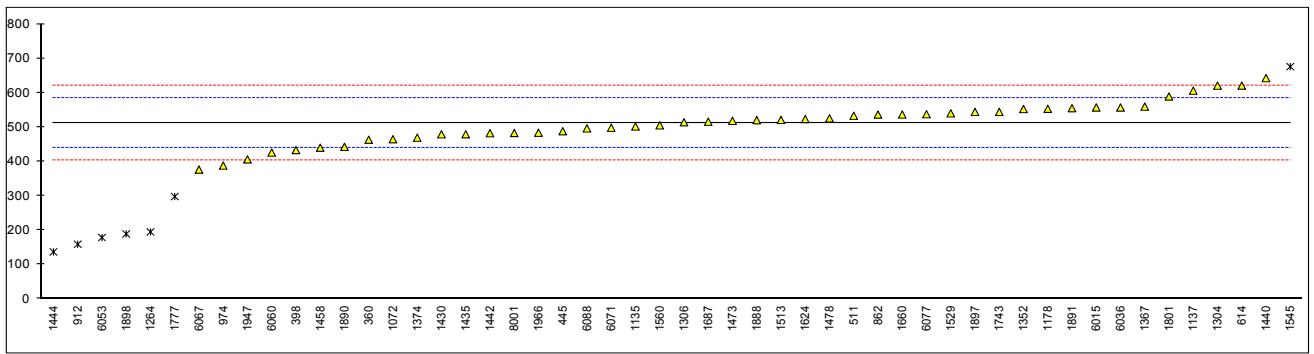
Determination of Nitrogen (N₂) on sample #16254; results in µl/L

lab	method	value	mark	z(targ)	remarks
179		----		----	
237		----		----	
360	IEC60567	48884.0		-2.06	
398	IEC60567	48257	C	-2.21	First reported 26014
445	IEC60567	54866.9		-0.60	
511	D3612-C	60465		0.77	
614	IEC60567	65314.9		1.96	
862	IEC60567	12932	R(0.01)	-10.84	
912	D3612-C	17838	C,ex	-9.64	First reported15586. Result excluded see §4.1
962		----		----	
963		----		----	
974	D3612	54149		-0.77	
1072	IEC60567	58630.24		0.32	
1135	IEC60567	51154.0		-1.50	
1137	D3612	69097		2.88	
1178	IEC60567	62085.18		1.17	
1264	D3612	22775.7	ex	-8.44	Result excluded see §4.1
1304	INH-120	65632.0		2.04	
1306	IEC60567	47916		-2.29	
1352	D3612	67609.5		2.52	
1367	IEC60567	56683		-0.15	
1374	D3612	52646.8		-1.14	
1430	IEC60567	15815	R(0.01)	-10.14	
1435	IEC60567	47931.7		-2.29	
1440	D3612	68339		2.70	
1442	IEC60567	58085		0.19	
1444		----		----	
1458	D3612	46001		-2.76	
1473	IEC60567	44399.68		-3.15	
1478	IEC60567	60448.6		0.77	
1513	IEC60567	58594		0.32	
1516	IEC60567	50769.5		-1.60	
1529	IEC60567	61000		0.90	
1545	D3612	66115.7		2.15	
1560	IEC60567	53043		-1.04	
1624		----		----	
1660	IEC60567	50082		-1.76	
1687	IEC60567	49674.0		-1.86	
1743	IEC60567	73127.02		3.87	
1777	IEC60567	11102	C,R(0.01)	-11.29	First reported 27195.12
1801	IEC60567	29130.15	R(0.05)	-6.88	
1888	IEC60567	50645.0		-1.63	
1890	IEC60567	109155	C,R(0.01)	12.67	First reported 103177
1891	IEC60567	63167		1.43	
1897	IEC60567	58970		0.41	
1898	D3612	55500	ex	-0.44	Result excluded see §4.1
1947		----		----	
1966		----		----	
6015	D3612	62479		1.26	
6036	IEC60567	61830		1.11	
6053	IEC60567	321449.05	C,ex	64.54	First reported 120844.28. Result excluded see §4.1
6060		----		----	
6063		----		----	
6067	IEC60567	28318.90	C,R(0.05)	-7.08	First reported 26606.22
6071		----		----	
6077	D3612	56023.70		-0.31	
6088	IEC60567	57588.1		0.07	
8001	IEC60567	58493.3		0.29	
					<u>Only Headspace data:</u>
	normality	OK			OK
	n	37			29
	outliers	6 (+4 excl)			5 (+3 excl)
	mean (n)	57302.62			57076.47
	st.dev. (n)	7247.487			7269.958
	R(calc.)	20292.96			20355.88
	R(IEC60567:11)	11460.52			11415.29
					Compare R(Horwitz) = 4934.87



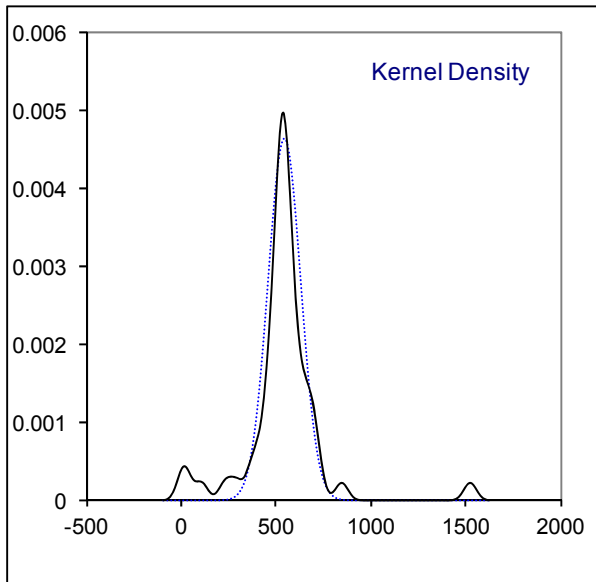
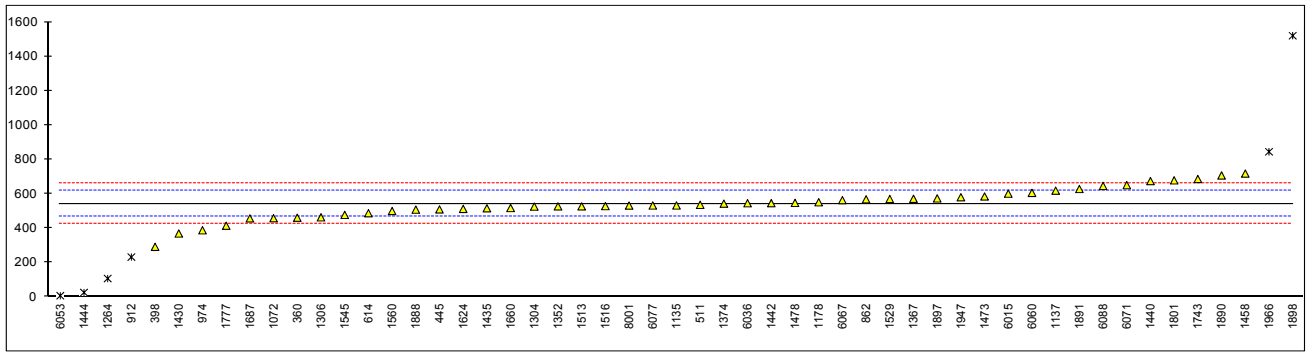
Determination of Carbon Monoxide (CO) on sample #16254; results in µl/L

lab	method	value	mark	z(targ)	remarks
179		----		----	
237		----		----	
360	IEC60567	463.3		-1.32	
398	IEC60567	433.0		-2.15	
445	IEC60567	488.0		-0.65	
511	D3612-C	533		0.58	
614	IEC60567	620.7		2.98	
862	IEC60567	536.3		0.67	
912	D3612-C	159	R(0.01)	-9.65	
962		----		----	
963		----		----	
974	D3612	388		-3.38	
1072	IEC60567	464.72		-1.29	
1135	IEC60567	501.64		-0.27	
1137	D3612	606.049		2.58	
1178	IEC60567	553.21		1.14	
1264	D3612	194.8	R(0.01)	-8.67	
1304	INH-120	620.5		2.98	
1306	IEC60567	514		0.06	
1352	D3612	552.5		1.12	
1367	IEC60567	559.5		1.31	
1374	D3612	469.1		-1.17	
1430	IEC60567	479		-0.89	
1435	IEC60567	479.12394		-0.89	
1440	D3612	642.38		3.58	
1442	IEC60567	482.05		-0.81	
1444		136.83059	R(0.01)	-10.26	
1458	D3612	440	C	-1.96	First reported 734
1473	IEC60567	518.13		0.18	
1478	IEC60567	525.4		0.38	
1513	IEC60567	520.729		0.25	
1516	IEC60567	----		----	
1529	IEC60567	540		0.77	
1545	D3612	675.8	C,R(0.05)	4.49	First reported 704.1
1560	IEC60567	505		-0.18	
1624	IEC60567	523.31		0.32	
1660	IEC60567	536.6		0.68	
1687	IEC60567	515.6		0.11	
1743	IEC60567	544.194		0.89	
1777	IEC60567	298	C,R(0.05)	-5.85	First reported 282.78
1801	IEC60567	589.03		2.12	
1888	IEC60567	520.2		0.23	
1890	IEC60567	442.5		-1.89	
1891	IEC60567	555		1.19	
1897	IEC60567	544		0.88	
1898	D3612	189	R(0.01)	-8.83	
1947	IEC60567	406		-2.89	
1966	IEC60567	483.6		-0.77	
6015	D3612	557		1.24	
6036	IEC60567	557		1.24	
6053	IEC60567	178.48	C,R(0.01)	-9.12	First reported 160.05
6060	GB/T17623	425.84		-2.35	
6063		----		----	
6067	IEC60567	376.31		-3.70	
6071	IEC60567	497.987		-0.37	
6077	D3612	537.47		0.71	
6088	IEC60567	496.1		-0.43	
8001	IEC60567	482.8		-0.79	
					<u>Only Headspace data:</u>
	normality	OK			OK
	n	45			35
	outliers	7			17
	mean (n)	511.686			509.569
	st.dev. (n)	59.0739			61.9232
	R(calc.)	165.407			173.385
	R(IEC60567:11)	102.337			101.914
					Compare R(Horwitz) = 89.647



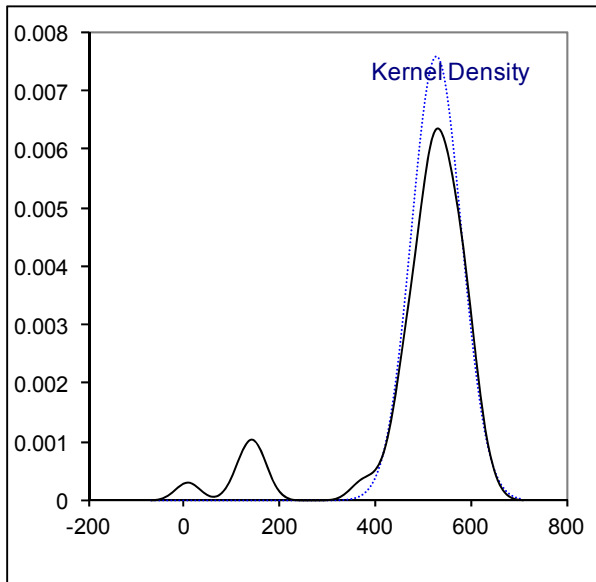
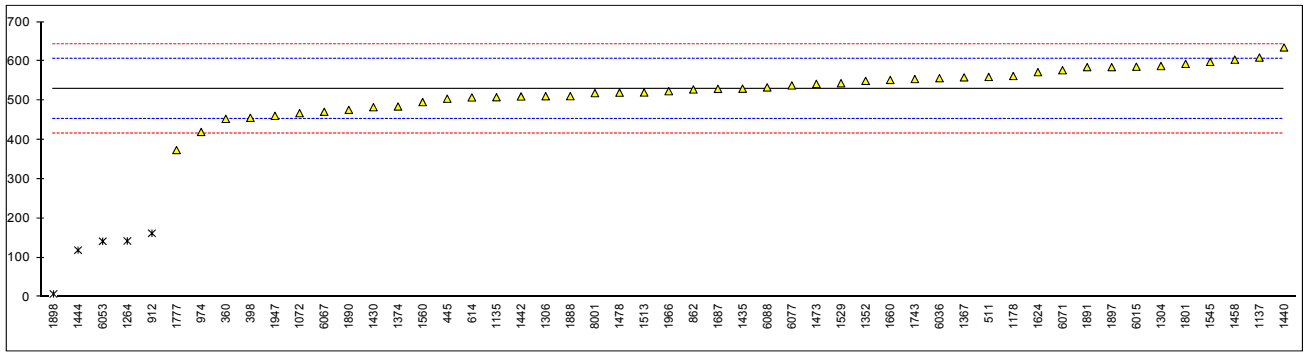
Determination of Carbon Dioxide (CO₂) on sample #16254; results in µ/L

lab	method	value	mark	z(targ)	Remarks
179		----		----	
237		----		----	
360	IEC60567	460.8		-2.12	
398	IEC60567	291.5		-6.48	
445	IEC60567	509.3		-0.87	
511	D3612-C	536		-0.18	
614	IEC60567	487.1		-1.44	
862	IEC60567	568		0.64	
912	D3612-C	232	R(0.05)	-8.02	
962		----		----	
963		----		----	
974	D3612	388		-4.00	
1072	IEC60567	458.11		-2.19	
1135	IEC60567	532.34		-0.28	
1137	D3612	618.432		1.94	
1178	IEC60567	550.84		0.20	
1264	D3612	106.9	R(0.01)	-11.24	
1304	INH-120	525.5		-0.45	
1306	IEC60567	463		-2.06	
1352	D3612	527.0		-0.41	
1367	IEC60567	571		0.72	
1374	D3612	542.7		-0.01	
1430	IEC60567	369		-4.49	
1435	IEC60567	515.75108		-0.70	
1440	D3612	674.0		3.38	
1442	IEC60567	545.65		0.07	
1444		25.40695	R(0.01)	-13.34	
1458	D3612	718		4.51	
1473	IEC60567	584.81		1.08	
1478	IEC60567	547.2		0.11	
1513	IEC60567	527		-0.41	
1516	IEC60567	528.5		-0.37	
1529	IEC60567	570		0.70	
1545	D3612	477.4		-1.69	
1560	IEC60567	500		-1.11	
1624	IEC60567	512.22		-0.79	
1660	IEC60567	517.3		-0.66	
1687	IEC60567	457.1		-2.22	
1743	IEC60567	686.344		3.69	
1777	IEC60567	414.35		-3.32	
1801	IEC60567	678.30		3.49	
1888	IEC60567	507.7		-0.91	
1890	IEC60567	706.9		4.22	
1891	IEC60567	628		2.19	
1897	IEC60567	573		0.77	
1898	D3612	1520	R(0.01)	25.19	
1947	IEC60567	580		0.95	
1966	IEC60567	844.58	C,R(0.05)	7.77	First reported 767.8
6015	D3612	601		1.49	
6036	IEC60567	545		0.05	
6053	IEC60567	6.76	C,R(0.01)	-13.83	First reported 0.16
6060	GB/T17623	605.43		1.61	
6063		----		----	
6067	IEC60567	563.32		0.52	
6071	IEC60567	650.448		2.77	
6077	D3612	532.05		-0.28	
6088	IEC60567	645.8		2.65	
8001	IEC60567	531.7		-0.29	
					<u>Only Headspace data:</u>
	normality	OK			OK
	n	47			37
	outliers	6			3
	mean (n)	543.040			542.866
	st.dev. (n)	85.9404			89.3319
	R(calc.)	240.633			250.129
	R(IEC60567:11)	108.608			108.573
					Compare R(Horwitz) = 94.2924



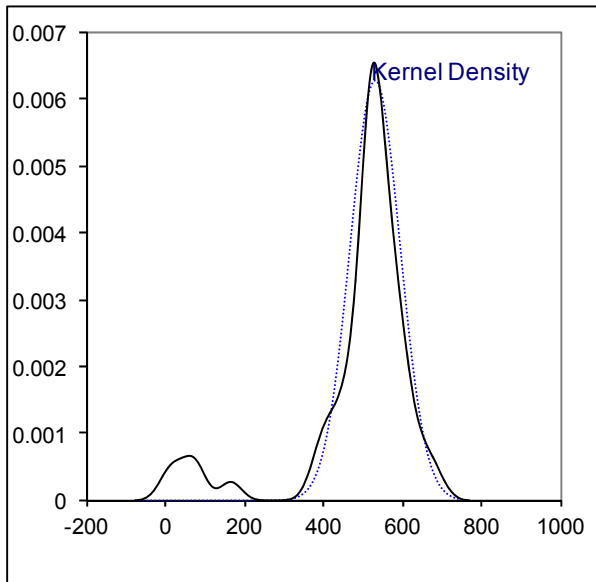
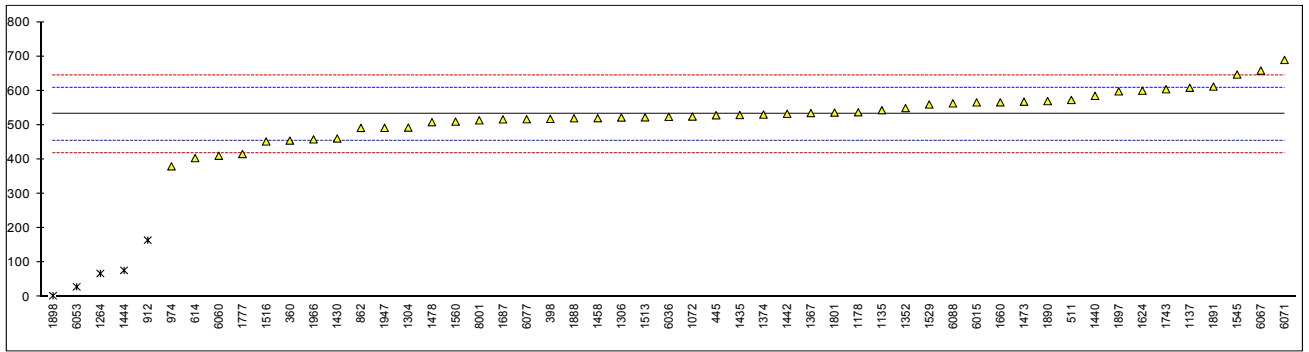
Determination of Methane (CH₄) on sample #16254; results in µ/L

lab	method	value	mark	z(targ)	remarks
179		----		----	
237		----		----	
360	IEC60567	453.3		-2.01	
398	IEC60567	456.0		-1.94	
445	IEC60567	504.6		-0.66	
511	D3612-C	560		0.81	
614	IEC60567	507.9		-0.57	
862	IEC60567	528.2		-0.03	
912	D3612-C	162	C,R(0.01)	-9.72	First reported 230
962		----		----	
963		----		----	
974	D3612	420		-2.89	
1072	IEC60567	467.85		-1.63	
1135	IEC60567	508.50		-0.55	
1137	D3612	609.366		2.11	
1178	IEC60567	562.41		0.87	
1264	D3612	142.4	R(0.01)	-10.23	
1304	INH-120	587.8		1.54	
1306	IEC60567	511		-0.49	
1352	D3612	550.0		0.54	
1367	IEC60567	559		0.78	
1374	D3612	484.8		-1.18	
1430	IEC60567	483		-1.23	
1435	IEC60567	530.16122		0.02	
1440	D3612	635.19		2.80	
1442	IEC60567	510.35		-0.51	
1444		118.98050	R(0.01)	-10.85	
1458	D3612	604		1.97	
1473	IEC60567	542.39		0.34	
1478	IEC60567	520.1		-0.25	
1513	IEC60567	520.452		-0.24	
1516	IEC60567	----		----	
1529	IEC60567	544		0.38	
1545	D3612	598.3		1.82	
1560	IEC60567	496		-0.89	
1624	IEC60567	572.18		1.13	
1660	IEC60567	552.5		0.61	
1687	IEC60567	529.7		0.01	
1743	IEC60567	554.686		0.67	
1777	IEC60567	374	C	-4.11	First reported 360.66
1801	IEC60567	593.37		1.69	
1888	IEC60567	511.1		-0.49	
1890	IEC60567	476.3		-1.41	
1891	IEC60567	585		1.47	
1897	IEC60567	585		1.47	
1898	D3612	7.5	R(0.01)	-13.80	
1947	IEC60567	461		-1.81	
1966	IEC60567	523.8		-0.15	
6015	D3612	586		1.49	
6036	IEC60567	557		0.73	
6053	IEC60567	141.70	C,R(0.01)	-10.25	First reported 98.02
6060	GB/T17623	----		----	
6063		----		----	
6067	IEC60567	471.39		-1.54	
6071	IEC60567	577.162		1.26	
6077	D3612	538.49		0.24	
6088	IEC60567	533.4		0.10	
8001	IEC60567	518.9		-0.28	
					<u>Only Headspace data:</u>
	normality	OK			OK
	n	46			36
	outliers	5			3
	mean (n)	529.471			529.510
	st.dev. (n)	52.6428			56.8185
	R(calc.)	147.400			159.092
	R(IEC60567:11)	105.894			105.902
					Compare R(Horwitz) = 92.287



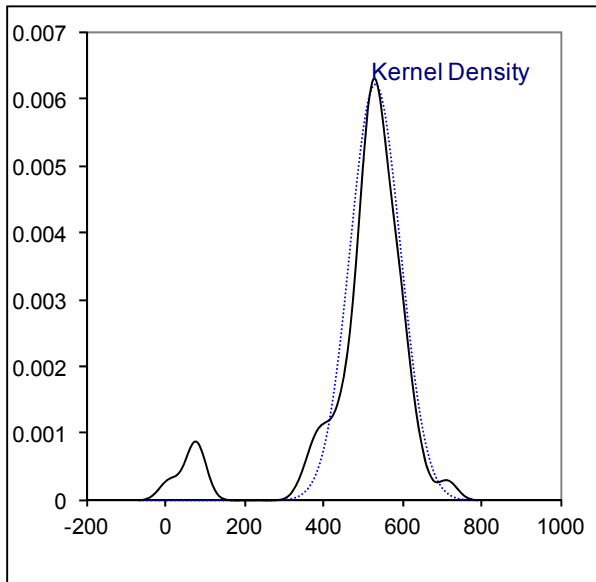
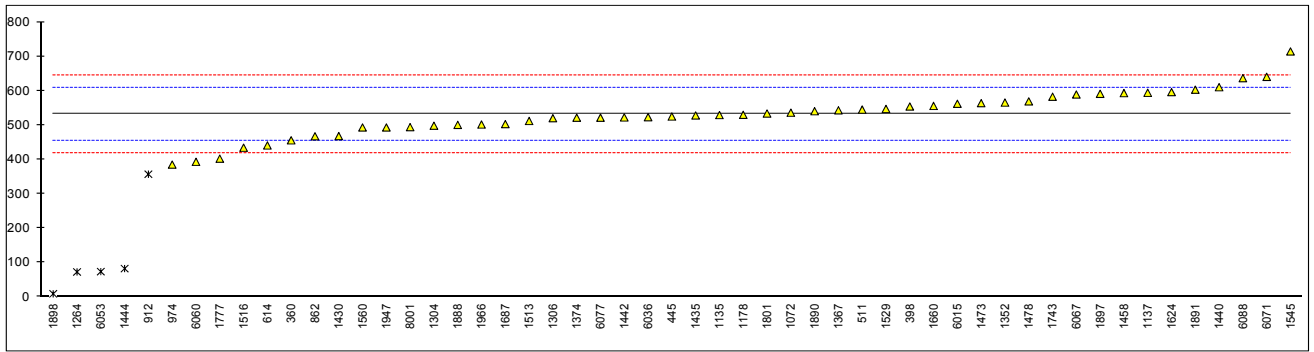
Determination of Ethane (C₂H₆) on sample #16254; results in µl/L

lab	method	value	mark	z(targ)	remarks
179		----		----	
237		----		----	
360	IEC60567	454.8		-2.03	
398	IEC60567	518.0		-0.36	
445	IEC60567	528.6		-0.08	
511	D3612-C	573		1.09	
614	IEC60567	403.8		-3.37	
862	IEC60567	491.8		-1.05	
912	D3612-C	165	C,R(0.01)	-9.66	First reported 253
962		----		----	
963		----		----	
974	D3612	380		-3.99	
1072	IEC60567	524.82		-0.18	
1135	IEC60567	543.36		0.31	
1137	D3612	608.562		2.02	
1178	IEC60567	537.24		0.15	
1264	D3612	68.3	R(0.01)	-12.20	
1304	INH-120	492.7		-1.03	
1306	IEC60567	522		-0.26	
1352	D3612	549.5		0.47	
1367	IEC60567	535		0.09	
1374	D3612	530.7		-0.03	
1430	IEC60567	461		-1.86	
1435	IEC60567	529.15070		-0.07	
1440	D3612	585.06		1.40	
1442	IEC60567	532.9		0.03	
1444		77.18834	R(0.01)	-11.97	
1458	D3612	520		-0.31	
1473	IEC60567	568.17		0.96	
1478	IEC60567	508.5		-0.61	
1513	IEC60567	522.335		-0.25	
1516	IEC60567	452.3		-2.09	
1529	IEC60567	560		0.74	
1545	D3612	647.1		3.04	
1560	IEC60567	510		-0.57	
1624	IEC60567	599.96		1.80	
1660	IEC60567	566.2		0.91	
1687	IEC60567	516.6		-0.40	
1743	IEC60567	604.239		1.91	
1777	IEC60567	415.72		-3.05	
1801	IEC60567	536.37		0.12	
1888	IEC60567	519.8		-0.31	
1890	IEC60567	569.77		1.00	
1891	IEC60567	612		2.11	
1897	IEC60567	598		1.75	
1898	D3612	3.5	R(0.01)	-13.91	
1947	IEC60567	492		-1.05	
1966	IEC60567	458.5		-1.93	
6015	D3612	566		0.90	
6036	IEC60567	524		-0.20	
6053	IEC60567	29.30	C,R(0.01)	-13.23	First reported 27.35
6060	GB/T17623	410.72		-3.19	
6063		----		----	
6067	IEC60567	658.52		3.34	
6071	IEC60567	689.486	C	4.15	First reported 759.791
6077	D3612	516.97		-0.39	
6088	IEC60567	563.2		0.83	
8001	IEC60567	513.8		-0.47	
					<u>Only Headspace data:</u>
	normality	OK			OK
	n	48			37
	outliers	5			3
	mean (n)	531.714			541.548
	st.dev. (n)	63.6226			63.6371
	R(calc.)	178.143			178.184
	R(IEC60567:11)	106.343			108.310
					Compare R(Horwitz) = 92.619



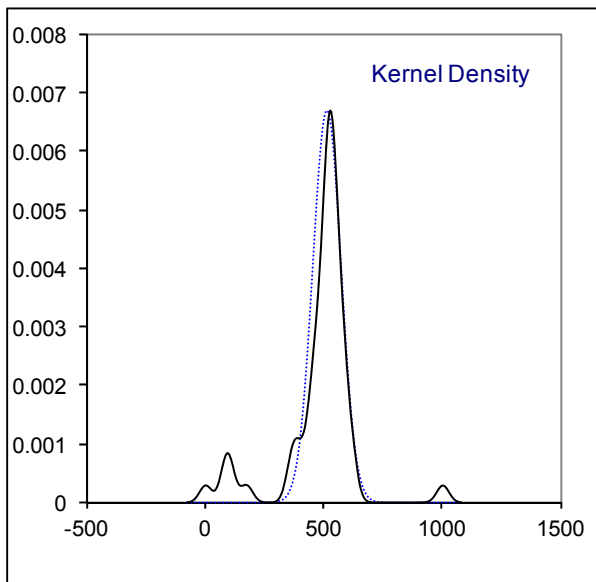
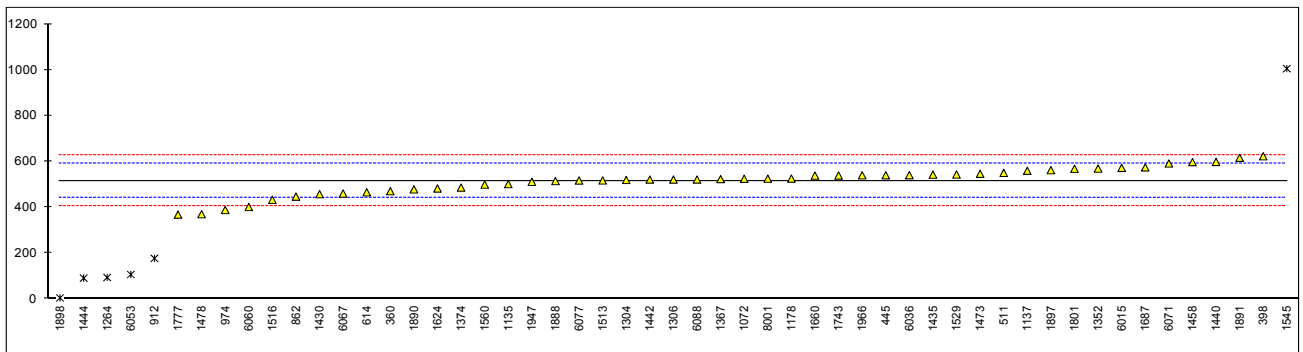
Determination of Ethene / Ethylene (C₂H₄) on sample #16254; results in µ/L

lab	method	value	mark	z(targ)	remarks
179		----		----	
237		----		----	
360	IEC60567	455.7		-2.00	
398	IEC60567	554.0		0.58	
445	IEC60567	524.9		-0.18	
511	D3612-C	545		0.35	
614	IEC60567	440.8		-2.40	
862	IEC60567	467.5		-1.69	
912	D3612-C	357	ex	-4.60	Result excluded see §4.1
962		----		----	
963		----		----	
974	D3612	385		-3.86	
1072	IEC60567	536.07		0.11	
1135	IEC60567	529.11		-0.07	
1137	D3612	593.913		1.63	
1178	IEC60567	529.90		-0.05	
1264	D3612	72.7	R(0.01)	-12.09	
1304	INH-120	498.2		-0.88	
1306	IEC60567	520		-0.31	
1352	D3612	565.5		0.89	
1367	IEC60567	543		0.29	
1374	D3612	521.5		-0.27	
1430	IEC60567	468		-1.68	
1435	IEC60567	528.02488		-0.10	
1440	D3612	610.21		2.06	
1442	IEC60567	522.3		-0.25	
1444		82.46864	R(0.01)	-11.83	
1458	D3612	593		1.61	
1473	IEC60567	563.88		0.84	
1478	IEC60567	568.9		0.98	
1513	IEC60567	511.922		-0.52	
1516	IEC60567	434.1		-2.57	
1529	IEC60567	547		0.40	
1545	D3612	714.2	C	4.80	First reported 727.5
1560	IEC60567	493		-1.02	
1624	IEC60567	595.96		1.69	
1660	IEC60567	555.7		0.63	
1687	IEC60567	502.8		-0.76	
1743	IEC60567	582.548		1.34	
1777	IEC60567	402.32		-3.41	
1801	IEC60567	533.67		0.05	
1888	IEC60567	500.6		-0.82	
1890	IEC60567	540.35		0.22	
1891	IEC60567	603		1.87	
1897	IEC60567	591		1.56	
1898	D3612	9	R(0.01)	-13.76	
1947	IEC60567	493		-1.02	
1966	IEC60567	501.6		-0.80	
6015	D3612	562		0.79	
6036	IEC60567	523		-0.23	
6053	IEC60567	73.52	C,R(0.01)	-12.06	First reported 66.91
6060	GB/T17623	393.12		-3.65	
6063		----		----	
6067	IEC60567	589.04		1.51	
6071	IEC60567	640.370	C	2.86	First reported 729.152
6077	D3612	521.55		-0.27	
6088	IEC60567	636.6		2.76	
8001	IEC60567	494.1		-0.99	
					<u>Only Headspace data:</u>
	normality	OK			suspect
	n	48			37
	outliers	4 (+1 excl)			3
	mean (n)	531.812			537.393
	st.dev. (n)	64.1011			65.0681
	R(calc.)	179.483			182.191
	R(IEC60567:11)	106.362			107.479
					Compare R(Horwitz) = 92.634



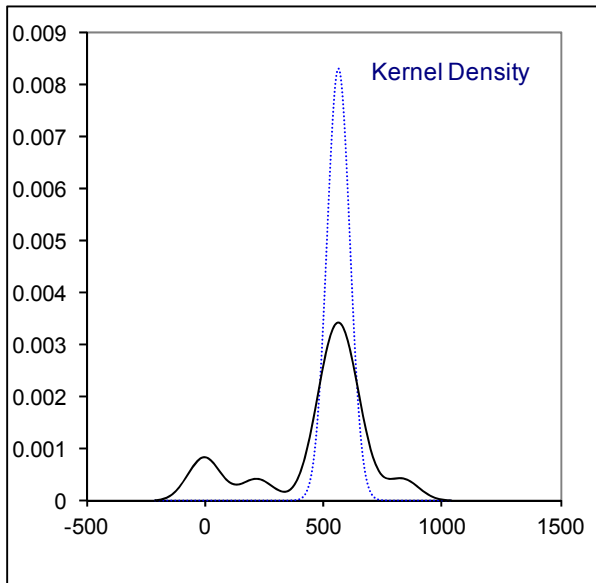
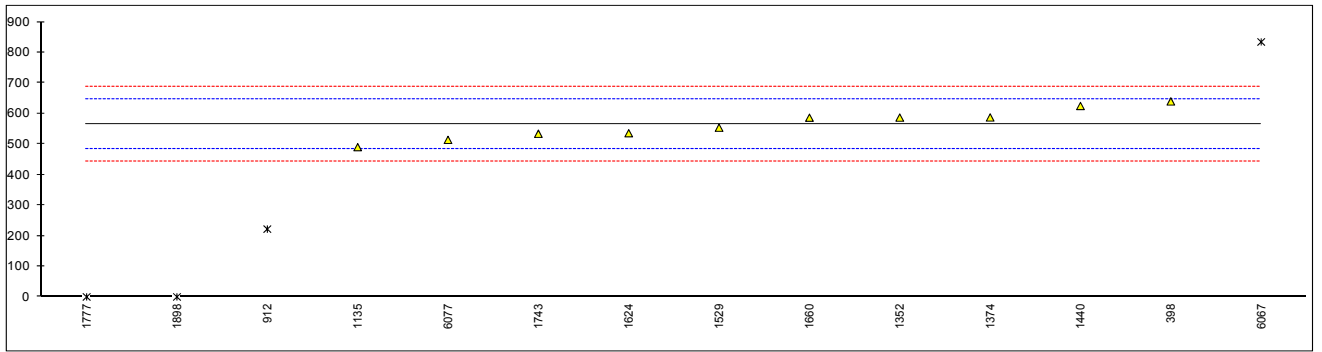
Determination of Ethyn /Acetylene (C₂H₂) on sample #16254; results in µl/L

lab	method	value	mark	z(targ)	remarks
179		----		----	
237		----		----	
360	IEC60567	470.2		-1.24	
398	IEC60567	622.5		2.89	
445	IEC60567	539.9		0.65	
511	D3612-C	550		0.92	
614	IEC60567	465.3		-1.37	
862	IEC60567	446.4		-1.89	
912	D3612-C	177	C,R(0.01)	-9.20	First reported 246
962		----		----	
963		----		----	
974	D3612	388		-3.47	
1072	IEC60567	524.56		0.23	
1135	IEC60567	500.96		-0.41	
1137	D3612	559.301		1.18	
1178	IEC60567	525.25		0.25	
1264	D3612	93.6	R(0.01)	-11.46	
1304	INH-120	519.1		0.09	
1306	IEC60567	521		0.14	
1352	D3612	569.0		1.44	
1367	IEC60567	523		0.19	
1374	D3612	486.0		-0.81	
1430	IEC60567	457		-1.60	
1435	IEC60567	542.39848		0.72	
1440	D3612	598.00		2.23	
1442	IEC60567	520.95		0.14	
1444		90.74001	R(0.01)	-11.54	
1458	D3612	597		2.20	
1473	IEC60567	546.15		0.82	
1478	IEC60567	369.8		-3.97	
1513	IEC60567	517.063		0.03	
1516	IEC60567	432.6		-2.26	
1529	IEC60567	543		0.73	
1545	D3612	1005.2	C,R(0.01)	13.27	First reported 1029.8
1560	IEC60567	499		-0.46	
1624	IEC60567	482.03		-0.92	
1660	IEC60567	538.2		0.60	
1687	IEC60567	574.0		1.57	
1743	IEC60567	538.586		0.61	
1777	IEC60567	368	C	-4.01	First reported 339.99
1801	IEC60567	567.99		1.41	
1888	IEC60567	514.5		-0.04	
1890	IEC60567	478.11		-1.03	
1891	IEC60567	616		2.71	
1897	IEC60567	562		1.25	
1898	D3612	4.3	R(0.01)	-13.88	
1947	IEC60567	511		-0.13	
1966	IEC60567	539.6		0.64	
6015	D3612	572		1.52	
6036	IEC60567	540		0.65	
6053	IEC60567	106.49	C,R(0.01)	-11.11	First reported 71.55
6060	GB/T17623	401.09		-3.12	
6063		----		----	
6067	IEC60567	459.93		-1.52	
6071	IEC60567	591.038		2.04	
6077	D3612	516.87		0.02	
6088	IEC60567	521.1		0.14	
8001	IEC60567	524.8		0.24	
					<u>Only Headspace data:</u>
	normality	OK			suspect
	n	47			36
	outliers	6			4
	mean (n)	515.963			520.818
	st.dev. (n)	59.4947			55.7574
	R(calc.)	166.585			156.121
	R(IEC60567:11)	103.193			104.164
					Compare R(Horwitz) = 90.283



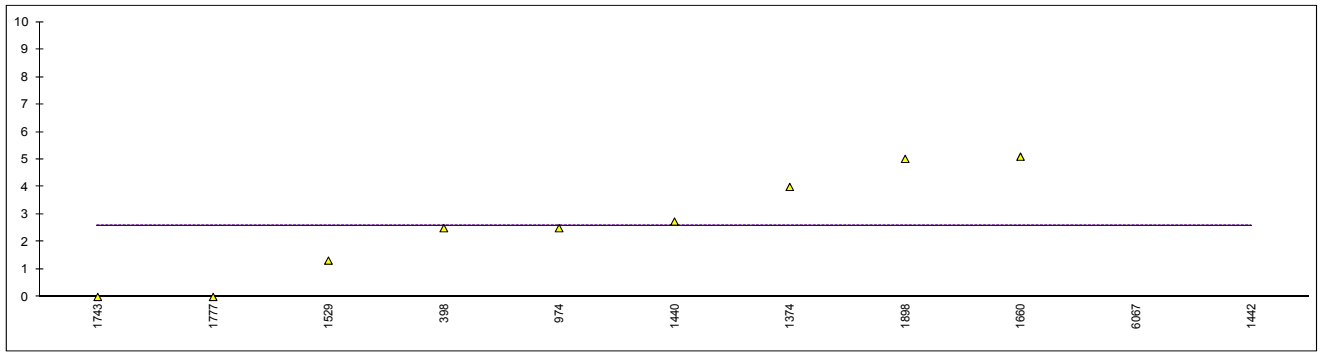
Determination of Propane (C₃H₈) on sample #16254; results in µl/L

lab	method	value	mark	z(targ)	remarks
179		----		----	
237		----		----	
360		----		----	
398	IEC60567	640.0		1.85	
445		----		----	
511		----		----	
614		----		----	
862		----		----	
912	D3612-C	222	C,G(0.05)	-8.50	First reported 326
962		----		----	
963		----		----	
974	D3612	<1		<-13.98	False negative test result?
1072		----		----	
1135	IEC60567	490.19		-1.86	
1137		----		----	
1178		----		----	
1264		----		----	
1304		----		----	
1306		----		----	
1352	D3612	587.0		0.53	
1367		----		----	
1374	D3612	587.5		0.55	
1430		----		----	
1435		----		----	
1440	D3612	625.02		1.48	
1442	IEC60567	<1		<-13.98	False negative test result?
1444		----		----	
1458		----		----	
1473		----		----	
1478		----		----	
1513		----		----	
1516		----		----	
1529	IEC60567	554		-0.28	
1545		----		----	
1560		----		----	
1624	IEC60567	535.77		-0.73	
1660	IEC60567	586.7		0.53	
1687	IEC60567	< 1		<-13.98	False negative test result?
1743	IEC60567	534.076		-0.78	
1777	IEC60567	0	DG(0.05)	-14.00	
1801		----		----	
1888		----		----	
1890		----		----	
1891		----		----	
1897		----		----	
1898	D3612	0	DG(0.05)	-14.00	
1947		----		----	
1966		----		----	
6015		----		----	
6036		----		----	
6053		----		----	
6060		----		----	
6063		----		----	
6067	IEC60567	834.56	C,G(0.01)	6.66	First reported 829.4
6071		----		----	
6077	D3612	514.00		-1.27	
6088		----		----	
8001		----		----	
	normality	OK			
	n	10			
	outliers	4			
	mean (n)	565.426			
	st.dev. (n)	48.0924			
	R(calc.)	134.659			
	R(IEC60567:11)	113.085			Compare R(Horwitz) = 97.584



Determination of Propene (C₃H₆) on sample #16254; results in µ/L

lab	method	value	mark	z(targ)	remarks
179		----		----	
237		----		----	
360		----		----	
398	IEC60567	2.5		----	
445		----		----	
511		----		----	
614		----		----	
862		----		----	
912		----		----	
962		----		----	
963		----		----	
974	D3612	2.5	C	----	First reported 411
1072		----		----	
1135		----		----	
1137		----		----	
1178		----		----	
1264		----		----	
1304		----		----	
1306		----		----	
1352		----		----	
1367		----		----	
1374	D3612	4.00		----	
1430		----		----	
1435		----		----	
1440	D3612	2.74		----	
1442	IEC60567	503.6		----	False positive test result?
1444		----		----	
1458		----		----	
1473		----		----	
1478		----		----	
1513		----		----	
1516		----		----	
1529	IEC60567	1.32		----	
1545		----		----	
1560		----		----	
1624	IEC60567	<1		----	
1660	IEC60567	5.1		----	
1687	IEC60567	< 1		----	
1743	IEC60567	0		----	
1777	IEC60567	0		----	
1801		----		----	
1888		----		----	
1890		----		----	
1891		----		----	
1897		----		----	
1898	D3612	5.021		----	
1947		----		----	
1966		----		----	
6015		----		----	
6036		----		----	
6053		----		----	
6060		----		----	
6063		----		----	
6067	IEC60567	125.92		----	False positive test result?
6071		----		----	
6077		----		----	
6088		----		----	
8001		----		----	
	normality	OK			
	n	11			
	outliers	0			
	mean (n)	<10			
	st.dev. (n)	n.a.			
	R(calc.)	n.a.			
	R(IEC60567:11)	n.a.			



APPENDIX 2**Extraction method used**

lab	Extraction method
179	
237	
360	Headspace
398	Headspace
445	Headspace
511	Headspace
614	ToGas
862	
912	Headspace
962	
963	
974	Headspace
1072	Toepler
1135	Headspace
1137	Headspace
1178	Headspace
1264	Headspace
1304	Headspace
1306	
1352	Toepler
1367	Headspace
1374	Headspace
1430	Headspace
1435	Headspace
1440	Headspace
1442	Headspace
1444	
1458	Stripper Column
1473	Headspace
1478	Toepler
1513	Toepler
1516	Headspace
1529	Headspace
1545	Headspace
1560	Headspace
1624	Headspace
1660	Headspace
1687	Headspace
1743	Headspace
1777	Headspace
1801	Headspace
1888	Headspace
1890	Headspace
1891	Headspace
1897	Headspace
1898	Headspace
1947	Headspace
1966	
6015	Headspace
6036	Headspace
6053	Headspace
6060	Mechanical Oscillation degassing
6063	
6067	Headspace
6071	Headspace
6077	Headspace
6088	Headspace
8001	Headspace

APPENDIX 3

Number of participants per country

6 labs in AUSTRALIA
3 labs in BELGIUM
1 lab in BULGARIA
2 labs in CHINA, Peoples Republic of
1 lab in CROATIA
2 labs in FRANCE
1 lab in GEORGIA
4 labs in GERMANY
1 lab in HONG KONG
1 lab in INDIA
2 labs in ITALY
1 lab in KINGDOM of BAHRAIN
1 lab in MALAYSIA
1 lab in MOROCCO
2 labs in NETHERLANDS
1 lab in NIGERIA
1 lab in PERU
2 labs in PORTUGAL
1 lab in QATAR
2 labs in SAUDI ARABIA
2 labs in SINGAPORE
2 labs in SLOVENIA
1 lab in SOUTH AFRICA
2 labs in SOUTH KOREA
5 labs in SPAIN
1 lab in SWITZERLAND
2 labs in TURKEY
4 labs in UNITED ARAB EMIRATES
2 labs in UNITED KINGDOM
1 lab in UNITED STATES OF AMERICA

APPENDIX 4

Abbreviations:

C	= final test result after checking of first reported suspect test 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
R(0.01)	= outlier in Rosner's outlier test
R(0.05)	= straggler in Rosner's outlier test
E	= probably an error in calculations
ex	= test result excluded from statistical calculations
n.a.	= not applicable
n.e.	= not evaluated
fr.	= first reported
SDS	= Safety Data Sheet

Literature:

- 1 iis Interlaboratory Studies, Protocol for the Organisation, Statistics & Evaluation, April 2014
- 2 ASTM E178:02
- 3 ASTM E1301:03
- 4 ISO13528:05
- 5 ISO 5725:86
- 6 ISO 5725, parts 1-6, 1994
- 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)
- 9 IP 367/84
- 10 DIN 38402 T41/42
- 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.
- 15 Bernard Rosner, Percentage Points for a Generalized ESD Many-Outlier Procedure, *Technometrics*, 25(2), pp. 165-172, (1983).
- 16 Horwitz, R. Albert, J. AOAC Int. 79-3, 589 (1996)