Results of Proficiency Test
Transformer Oil
Dissolved Gas Analysis
November 2021

Organized by: Institute for Interlaboratory Studies
Spijkenisse, the Netherlands

Author: ing. G.A. Oosterlaken-Buijs
Correctors: ing. R.J. Starink & ing. M. Meijer
Report: iis21L14

February 2022

CONTENTS

1 INTRODUCTION

Since 2007 the Institute for Interlaboratory Studies (iis) organizes a proficiency scheme for Dissolved Gas Analysis (DGA) in Transformer Oil every year. During the annual proficiency testing program 2021/2022 it was decided to continue the round robin on Transformer Oil Dissolved Gas Analysis (DGA).

In this interlaboratory study 70 laboratories in 38 different countries registered for participation. See appendix 3 for the number of participants per country. In this report the results of the Transformer Oil DGA proficiency test are presented and discussed. This report is also electronically available through the iis website www.iisnl.com.

2 SET UP

The Institute for Interlaboratory Studies (iis) in Spijkenisse, the Netherlands, was the organizer of this proficiency test (PT). The syringes (True North) were provided by Morgan Schaffer Ltd. (Quebec, Canada). Each syringe of 50mL was uniquely numbered and labelled #21244. It was decided to send to each participant one syringe.
The 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 accredited in agreement with ISO/IEC17043:2010 (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 Ltd is ISO/IEC17034 accredited by the ANSI ASQ National Accreditation Board.

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 Organisation, Statistics and Evaluation' of June 2018 (iis-protocol, version 3.5). This protocol is electronically available through 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

One type of Transformer Oil was used for the preparation of the gas tight syringes. A batch of 75 syringes of 50mL with lot code RN472 was prepared by Morgan Schaffer Ltd. (Quebec, Canada). The syringes were uniquely coded and labelled #21244.
Morgan Schaffer Ltd. tested the syringes for homogeneity in accordance with ASTM D3612 and guaranteed that the batch to be homogenous according to their ISO/IEC17034 accreditation. The reported values are given in Table 4 (see paragraph 5).

To each of the participating laboratories a syringe was sent on October 27, 2021. An SDS was added to the sample package.

2.5 STABILITY OF THE SAMPLES

The stability of dissolved gas in Transformer Oil packed in gas tight syringes was checked. The material was found sufficiently stable for the period of the proficiency test.

2.6 ANALYZES

The participants were requested to determine: Hydrogen (H_2), Oxygen (O_2), Nitrogen (N_2), Carbon monoxide (CO), Carbon dioxide (CO_2), Methane (CH_4), Ethane (C_2H_6), Ethene (C_2H_4), Ethyne (C_2H_2), Propane (C_3H_8) and Propene (C_3H_6). Also, some analytical details were requested.

It was explicitly requested to treat the sample as if it was a routine sample and to report the test results using the indicated units on the report form and not to round the test results, but report as much significant figures as possible. It was also requested not to report ‘less than’ test results, which are above the detection limit, because such test results cannot be used for meaningful statistical evaluations.

To get comparable test results a detailed report form and a letter of instructions are prepared. On the report form the reporting units are given as well as the reference test methods (when applicable) that will be used during the evaluation. The detailed report form and the letter of instructions are both made available on the data entry portal www.kpmd.co.uk/sgs-iis/. The participating laboratories are also requested to confirm the sample receipt on this data entry portal. The letter of instructions can also be downloaded from the iis website www.iisnl.com.

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 reanalyzes). Additional or corrected test results are used for data analysis and the original test results are placed under 'Remarks' in the 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 June 2018 (iis-protocol, version 3.5).
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. If a data set does not have a normal distribution, the (results of the) statistical evaluation should be used with due care.

The assigned value is determined by consensus based on the test results of the group of participants after rejection of the statistical outliers and/or suspect data.

According to ISO13528 all (original received or corrected) results per determination were submitted to outlier tests. In the iis procedure for proficiency tests, outliers are detected prior to calculation of the mean, standard deviation and reproducibility. For small data sets, Dixon (up to 20 test results) or Grubbs (up to 40 test results) outlier tests can be used. For larger data sets (above 20 test results) Rosner's outlier test can be used. 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. In this PT, the criterion of ISO13528, paragraph 9.2.1. was met for all evaluated tests, therefore, the uncertainty of all assigned values may be negligible and need not be included in the PT report.

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 (dotted line) was projected over the Kernel Density Graph (smooth line) for reference. The Gauss curve is calculated from the consensus value and the corresponding standard deviation.

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 (derived from e.g. ISO or ASTM test methods), the z-scores were calculated using a target standard deviation. This results in an evaluation independent of the variation in this interlaboratory study.

The target standard deviation was calculated from the literature reproducibility by division with 2.8. In case no literature reproducibility was available, other target values were used, like Horwitz or an estimated reproducibility based on former iis proficiency tests.

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:

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

The $z_{(target)}$ 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. Therefore, the usual interpretation of z-scores is as follows:

	$\lvert z \rvert$	< 1	good
1 <	$\lvert z \rvert$	< 2	satisfactory
2 <	$\lvert z \rvert$	< 3	questionable
3 <	$\lvert z \rvert$		unsatisfactory

4 EVALUATION

In this proficiency test no major problems were encountered with the dispatch of samples. Four participants reported test results after the final reporting date and seven other participants did not report any test results. Not all participants were able to report all components requested.
In total 63 participants reported 606 numerical test results. Observed were 24 outlying test results, which is 4.0%. In proficiency tests outlier percentages of 3% - 7.5% are quite normal.

Not all 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, see also paragraph 3.1.

4.1 EVALUATION PER COMPONENT

In this section the reported test results are discussed per component. The test methods which were used by the various laboratories were taken into account for explaining the observed differences when possible and applicable. These test methods are also in the tables together with the original data in appendix 1. The abbreviations, used in these tables, are explained in appendix 4.

Three laboratories reported deviating test results which were statistical outliers for the Dissolved Gas Analysis for at least three components. As the test results of the Dissolved Gas Analysis are not independent it was decided to exclude the remaining reported test results of these laboratories.

Hydrogen (H_2): This determination was very problematic. Four statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not at all in agreement with the requirements of IEC60567:11.

Oxygen (O_2): This determination was very problematic. Four statistical outliers were observed and two other test results were excluded. The calculated reproducibility after rejection of the suspect data is not at all in agreement with the requirements of IEC60567:11.

Nitrogen (N_2): This determination was very problematic. Three statistical outliers were observed and two other test results were excluded. The calculated reproducibility after rejection of the suspect data is not at all in agreement with the requirements of IEC60567:11.

Carbon monoxide (CO): This determination was very problematic. One statistical outlier was observed and two other test results were excluded. The calculated reproducibility after rejection of the suspect data is not at all in agreement with the requirements of IEC60567:11.

Carbon dioxide (CO_2): This determination was very problematic. No statistical outliers were observed but three test results were excluded. Due to the large difference between the calculated and reference reproducibility it was decided not to calculate z-scores.

Methane (CH_4): This determination was problematic. Two statistical outliers were observed and one other test result was excluded. The calculated reproducibility after rejection of the suspect data is not in agreement with the requirements of IEC60567:11.

Ethane (C_2H_6): This determination was problematic. Three statistical outliers were observed and one other test result was excluded. The calculated reproducibility after rejection of the suspect data is not in agreement with the requirements of IEC60567:11.

Ethene (C_2H_4): This determination was problematic. Four statistical outliers were observed and one other test result was excluded. The calculated reproducibility after rejection of the suspect data is not in agreement with the requirements of IEC60567:11.

Ethyne (C_2H_2): This determination was problematic. Two statistical outliers were observed and two other test results were excluded. The calculated reproducibility after rejection of the suspect data is not in agreement with the requirements of IEC60567:11.

Propane (C_3H_8): This determination was problematic. No statistical outliers were observed but two test results were excluded. The calculated reproducibility after rejection of the suspect data is not in agreement with the requirements of IEC60567:11.

Propene (C_3H_6): This determination was problematic. No statistical outliers were observed but two test results were excluded. The calculated reproducibility after rejection of the suspect data is not in agreement with the requirements of IEC60567:11.

4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the reproducibility as declared by the reference test method and the reproducibility as found for the group of participating laboratories. The number of significant test results, the average, the calculated reproducibility (2.8 * standard deviation) and the target reproducibility derived from reference test method (in casu IEC60567) are presented in the next table.

Component	unit	n	average	2.8 * sd	R(lit)
Hydrogen (H_2)	µL/L	59	56.8	22.1	11.4
Oxygen (O_2)	µL/L	55	15556	6229	3111
Nitrogen (N_2)	µL/L	56	58744	23982	11749

Component	unit	n	average	2.8 * sd	R(lit)
Carbon monoxide (CO)	µL/L	60	50.8	20.8	10.2
Carbon dioxide (CO_2)	µL/L	60	99.4	86.9	(19.9)
Methane (CH_4)	µL/L	60	50.8	15.4	10.2
Ethane (C_2H_6)	µL/L	59	51.6	14.4	10.3
Ethene (C_2H_4)	µL/L	57	51.1	13.1	10.2
Ethyne (C_2H_2)	µL/L	59	51.3	17.7	10.3
Propane (C_3H_8)	µL/L	21	51.7	11.6	10.3
Propene (C_3H_6)	µL/L	19	49.5	11.6	9.9

Table 1: reproducibilities of components on sample #21244

For results between brackets no z-scores are calculated

Without further statistical calculations it can be concluded that for all of the determinations there is not a good compliance of the group of participants with the reference test method. The problematic determinations have been discussed in paragraph 4.1.

4.3 COMPARISON OF THE PROFICIENCY TEST OF NOVEMBER 2021 WITH PREVIOUS PTS

	November 2021	November 2020	November 2019	November 2018	November 2017
Number of reporting laboratories	63	59	45	53	61
Number of test results	606	561	428	496	580
Number of statistical outliers	24	60	44	25	21
Percentage of statistical outliers	4.0%	10.7%	10.3%	5.0%	3.6%

Table 2: comparison with previous proficiency tests

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

The performance of the determinations expressed as relative standard deviation (RSD) of the proficiency tests was compared over the years. The RSDs are given in the next table.

Component	November 2021	November 2020	November 2019	November 2018	November 2017	IEC60567 1
Hydrogen (H_2)	14%	9%	13%	10%	15%	7%
Oxygen (O_2)	14%	13%	13%	8%	12%	7%
Nitrogen (N_2)	15%	8%	11%	12%	19%	7%
Carbon Monoxide (CO)	15%	8%	11%	10%	16%	7%
Carbon Dioxide (CO_2)	31%	19%	18%	9%	15%	7%
Methane (CH_4)	11%	8%	8%	8%	12%	7%
Ethane (C_2H_6)	10%	9%	12%	9%	11%	7%
Ethene (C_2H_4)	9%	9%	9%	8%	12%	7%
Ethyne (C_2H_2)	12%	8%	12%	9%	11%	7%
Propane (C_3H_8)	8%	n.e.	n.e.	n.e.	11%	n.e.
Propene (C_3H_6)	8%	n.e.	11%	12%	n.e.	n.e.

Table 3: comparison of the uncertainties on the various components

In general is the overall performance of the 2021 PT in line with previous PTs except for Carbon Dioxide. It is remarkable that the groups of participants have been consistent in RSD over the last five years, but still are not able to meet the strict requirements of test method IEC605671:11.

5. 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.

Component	Morgan Schaffer in µL/L	iis21L14 in µL/L	Differences in µL/L	Calculated z-scores
Hydrogen (H_2)	52	57	11.4	-1.19
Oxygen (O_2)	15700	15556	3111.2	0.13
Nitrogen (N_2)	57200	58744	11748.9	-0.37
Carbon monoxide (CO)	52	51	10.2	0.33
Carbon dioxide (CO_2)	85	99	19.9	-2.02
Methane (CH_4)	51	51	10.2	0.05
Ethane (C_2H_6)	52	52	10.3	0.12
Ethene (C_2H_4)	51	51	10.2	-0.03
Ethyne (C_2H_2)	52	51	10.3	0.19
Propane (C_3H_8)	53	52	10.3	0.36
Propene (C_3H_6)	51	50	9.9	0.41

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

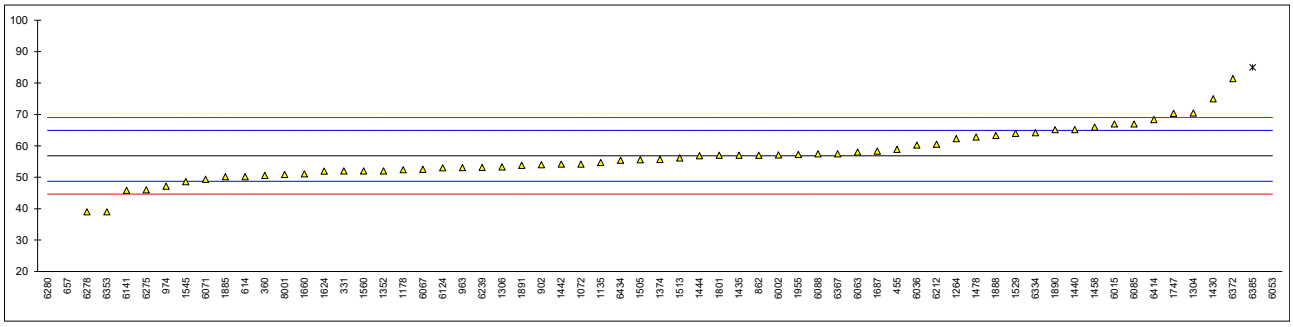
A vast majority (80%) of the reporting participants mentioned that they have used “Head Space” as extraction method. It appeared that in this PT the effect of the used extraction method on the determination of DGA in Transformer Oil is negligible.

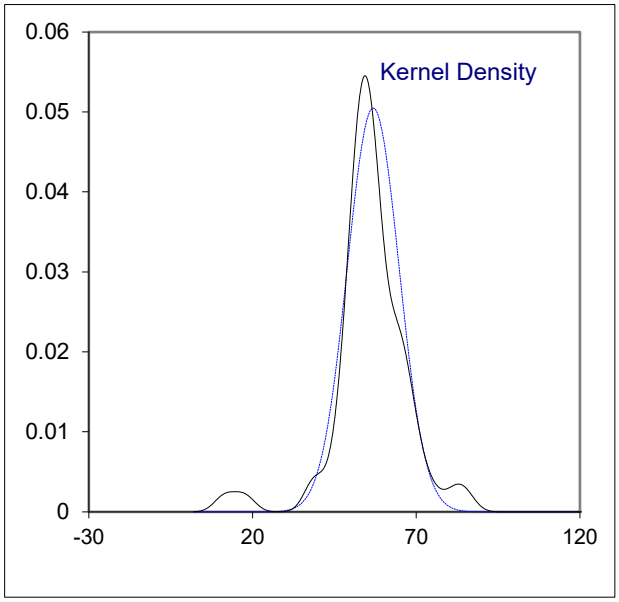
APPENDIX 1

Determination of Hydrogen (H_2) on sample #21244; results in µL/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
331	IEC60567	52		-1.19	
360	IEC60567	50.6		-1.54	
445		-----		-----	
455	IEC60567	58.9		0.51	
511		-----		-----	
614	IEC60567	50.2		-1.63	
657	D3612	17.55	C,R(0.01)	-9.68	first reported 32.47
862	IEC60567	57		0.04	
902	D3612	54		-0.70	
912		-----		-----	
913		-----		-----	
963	D3612	53.1		-0.92	
974	D3612	47.2	C	-2.37	first reported 95.1
975		-----		-----	
1072	IEC60567	54.2		-0.65	
1135	IEC60567	54.7		-0.53	
1178	IEC60567	52.4		-1.09	
1264	D3612	62.3		1.35	
1304	In house	70.45		3.35	
1306	D3612	53.31004		-0.87	
1352	IEC60567	52.0		-1.19	
1374	D3612	55.7		-0.28	
1430	IEC60567	75		4.48	
1435	IEC60567	57		0.04	
1440	D3612	65.18		2.06	
1442	IEC60567	54.2		-0.65	
1444	IEC60567	56.85928		0.01	
1458	D3612	66		2.26	
1478	IEC60567	62.82		1.48	
1505	D3612	55.6		-0.30	
1513	IEC60567	56.18		-0.16	
1529	IEC60567	64		1.77	
1545	D3612	48.6		-2.03	
1560	IEC60567	52		-1.19	
1624	IEC60567	51.99		-1.19	
1660	IEC60567	51.1		-1.41	
1687	IEC60567	58.3		0.36	
1747	IEC60567	70.38		3.34	
1801	IEC60567	56.986		0.04	
1885	D3612	50.19		-1.64	
1888	IEC60567	63.3		1.59	
1890	D3612	65.12		2.04	
1891	IEC60567	53.8		-0.75	
1955	IEC60567	57.28		0.11	
6002	IEC60567	57.1		0.07	
6015	D3612	67.00		2.50	
6036	IEC60567	60.23		0.84	
6053	IEC60567	153	C,R(0.01)	23.69	first reported 102
6063	IEC60567	58.05		0.30	
6067	IEC60567	52.53		-1.06	
6071	IEC60567	49.37		-1.84	
6085	D3612	67		2.50	
6088	IEC60567	57.5		0.16	
6124		53.0		-0.94	
6141	D3612	45.852		-2.70	
6212	D3612	60.549		0.92	
6239	D3612	53.13		-0.91	
6275	IEC60567	46		-2.67	
6278	D3612	39		-4.39	
6280	D3612	11.5	R(0.01)	-11.17	
6334	IEC60567	64.21		1.82	
6353	D3612	39		-4.39	
6367	IEC60567	57.5		0.16	
6372	IEC60567	81.4		6.05	
6385	D3612	85	R(0.05)	6.94	
6414	IEC60567	68.4		2.85	
6434	IEC60567	55.4		-0.35	
8001	IEC60567	50.9		-1.46	

normality	suspect	
n	59	
outliers	4	
mean (n)	56.83	
st.dev. (n)	7.907	RSD = 14%
R(calc.)	22.14	
st.dev.(IEC60567:11)	4.059	
R(IEC60567:11)	11.37	

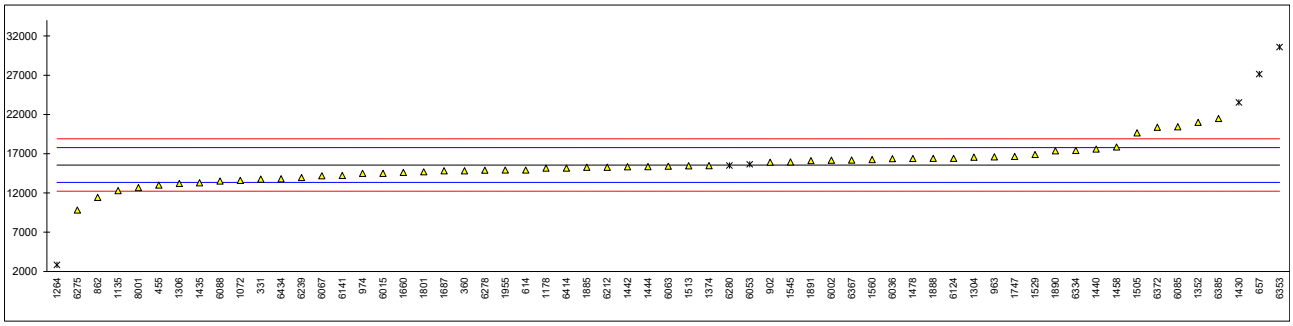


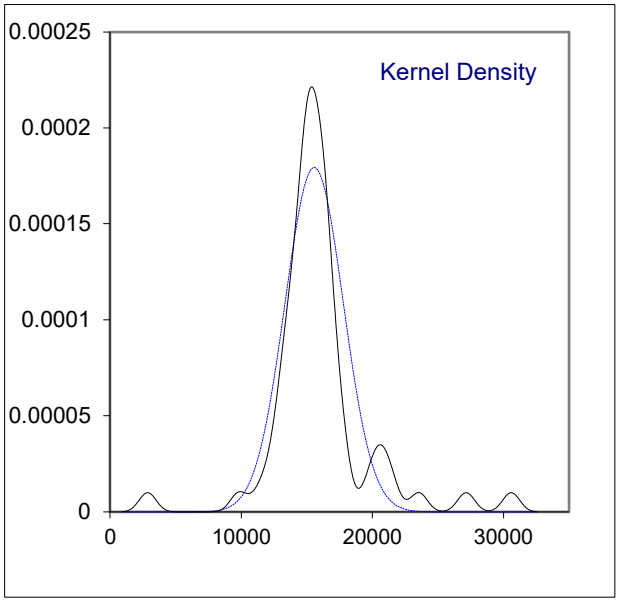


Determination of Oxygen (O_2) on sample #21244; results in µL/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
331	IEC60567	13782		-1.60	
360	IEC60567	14833.2		-0.65	
445		-----		-----	
455	IEC60567	12994.3		-2.31	
511		-----		-----	
614	IEC60567	14925.9		-0.57	
657	D3612	27145.54	C,R(0.01)	10.43	first reported 10095.52
862	IEC60567	11447		-3.70	
902	D3612	15912		0.32	
912		-----		-----	
913		-----		-----	
963	D3612	16596.0		0.94	
974	D3612	14506		-0.95	
975		-----		-----	
1072	IEC60567	13601.8		-1.76	
1135	IEC60567	12301		-2.93	
1178	IEC60567	15162.6		-0.35	
1264	D3612	2849.8	R(0.01)	-11.44	
1304	In house	16565.78		0.91	
1306	D3612	13202.2		-2.12	
1352	IEC60567	21000		4.90	
1374	D3612	15486		-0.06	
1430	IEC60567	23531	R(0.05)	7.18	
1435	IEC60567	13300		-2.03	
1440	D3612	17587		1.83	
1442	IEC60567	15332		-0.20	
1444	IEC60567	15348.3		-0.19	
1458	D3612	17854		2.07	
1478	IEC60567	16391.09		0.75	
1505	D3612	19653.1		3.69	
1513	IEC60567	15458		-0.09	
1529	IEC60567	16900		1.21	
1545	D3612	15953.9		0.36	
1560	IEC60567	16265		0.64	
1624		-----		-----	
1660	IEC60567	14626		-0.84	
1687	IEC60567	14824.6		-0.66	
1747	IEC60567	16647.63		0.98	
1801	IEC60567	14694.443		-0.78	
1885	D3612	15270.98		-0.26	
1888	IEC60567	16401		0.76	
1890	D3612	17363		1.63	
1891	IEC60567	16117.7		0.51	
1955	IEC60567	14925.19		-0.57	
6002	IEC60567	16181		0.56	
6015	D3612	14506.5		-0.94	
6036	IEC60567	16362.4		0.73	
6053	IEC60567	15649	ex	0.08	test result excluded, see paragraph 4.1
6063	IEC60567	15404.18		-0.14	
6067	IEC60567	14194.36		-1.23	
6071		-----		-----	
6085	D3612	20438		4.39	
6088	IEC60567	13531.5		-1.82	
6124		16412.7		0.77	
6141	D3612	14223.2		-1.20	
6212	D3612	15274.467		-0.25	
6239	D3612	13969.40		-1.43	
6275	IEC60567	9819		-5.16	
6278	D3612	14904		-0.59	
6280	D3612	15514	ex	-0.04	test result excluded, see paragraph 4.1
6334	IEC60567	17415.6		1.67	
6353	D3612	30586	R(0.01)	13.53	
6367	IEC60567	16199		0.58	
6372	IEC60567	20374.6		4.34	
6385	D3612	21480		5.33	
6414	IEC60567	15169		-0.35	
6434	IEC60567	13805		-1.58	
8001	IEC60567	12692.1		-2.58	

normality	suspect	
n	55	
outliers	4 + 2ex	
mean (n)	15556.08	
st.dev. (n)	2224.652	RSD = 14%
R(calc.)	6229.03	
st.dev.(IEC60567:11)	1111.149	
R(IEC60567:11)	3111.22	

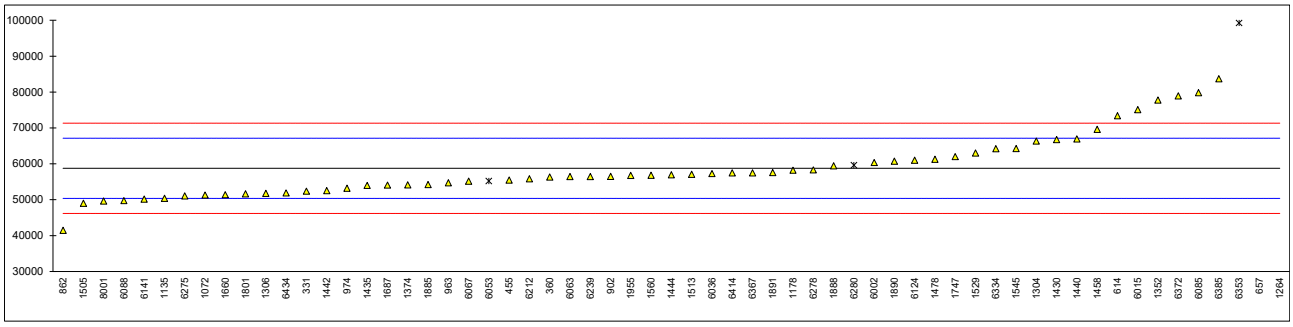


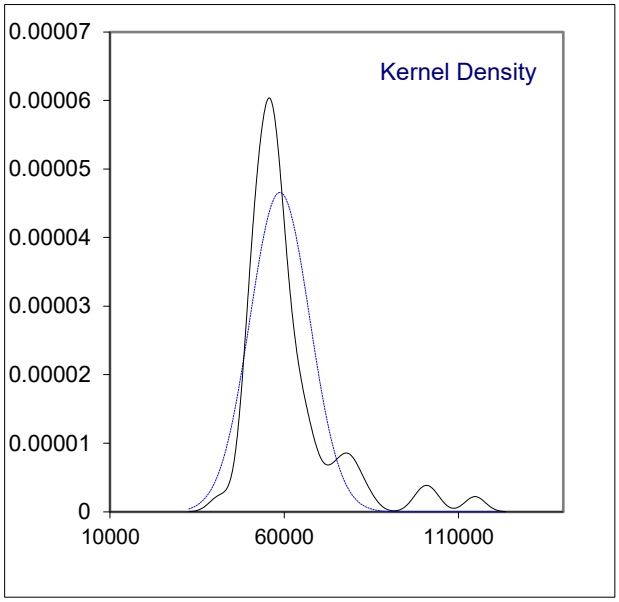


Determination of Nitrogen (N_2) on sample #21244; results in µL/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
331	IEC60567	52371		-1.52	
360	IEC60567	56350.3		-0.57	
445		-----		-----	
455	IEC60567	55457.7		-0.78	
511		-----		-----	
614	IEC60567	73407.6		3.49	
657	D3612	102390.48	C,R(0.01)	10.40	first reported 34507.92
862	IEC60567	41479		-4.11	
902	D3612	56496		-0.54	
912		-----		-----	
913		-----		-----	
963	D3612	54721.1		-0.96	
974	D3612	53208		-1.32	
975		-----		-----	
1072	IEC60567	51293.6		-1.78	
1135	IEC60567	50412		-1.99	
1178	IEC60567	58218.8		-0.13	
1264	D3612	114743	R(0.01)	13.35	
1304	In house	66311.82		1.80	
1306	D3612	51752.6		-1.67	
1352	IEC60567	77790		4.54	
1374	D3612	54150		-1.09	
1430	IEC60567	66737		1.90	
1435	IEC60567	54000		-1.13	
1440	D3612	66958		1.96	
1442	IEC60567	52529		-1.48	
1444	IEC60567	56930.5		-0.43	
1458	D3612	69620		2.59	
1478	IEC60567	61284.13		0.61	
1505	D3612	49006.1		-2.32	
1513	IEC60567	57086		-0.40	
1529	IEC60567	63000		1.01	
1545	D3612	64272.5		1.32	
1560	IEC60567	56844		-0.45	
1624		-----		-----	
1660	IEC60567	51383		-1.75	
1687	IEC60567	54076.1		-1.11	
1747	IEC60567	62022.16		0.78	
1801	IEC60567	51632.591		-1.69	
1885	D3612	54236.84		-1.07	
1888	IEC60567	59455		0.17	
1890	D3612	60740		0.48	
1891	IEC60567	57573.2		-0.28	
1955	IEC60567	56799.17		-0.46	
6002	IEC60567	60366		0.39	
6015	D3612	75090.0		3.90	
6036	IEC60567	57296.2		-0.35	
6053	IEC60567	55212	ex	-0.84	test result excluded, see paragraph 4.1
6063	IEC60567	56444.12		-0.55	
6067	IEC60567	55163.48		-0.85	
6071		-----		-----	
6085	D3612	79823		5.02	
6088	IEC60567	49749.5		-2.14	
6124		61019.4		0.54	
6141	D3612	50171.4		-2.04	
6212	D3612	55846.700		-0.69	
6239	D3612	56464.66		-0.54	
6275	IEC60567	51049		-1.83	
6278	D3612	58305		-0.10	
6280	D3612	59644	ex	0.21	test result excluded, see paragraph 4.1
6334	IEC60567	64219.38		1.30	
6353	D3612	99260	R(0.01)	9.66	
6367	IEC60567	57477		-0.30	
6372	IEC60567	78911.2		4.81	
6385	D3612	83698		5.95	
6414	IEC60567	57476		-0.30	
6434	IEC60567	51873		-1.64	
8001	IEC60567	49634.2		-2.17	

normality	not OK	
n	56	
outliers	3 + 2ex	
mean (n)	58744.33	
st.dev. (n)	8564.939	RSD = 15%
R(calc.)	23981.83	
st.dev.(IEC60567:11)	4196.024	
R(IEC60567:11)	11748.87	

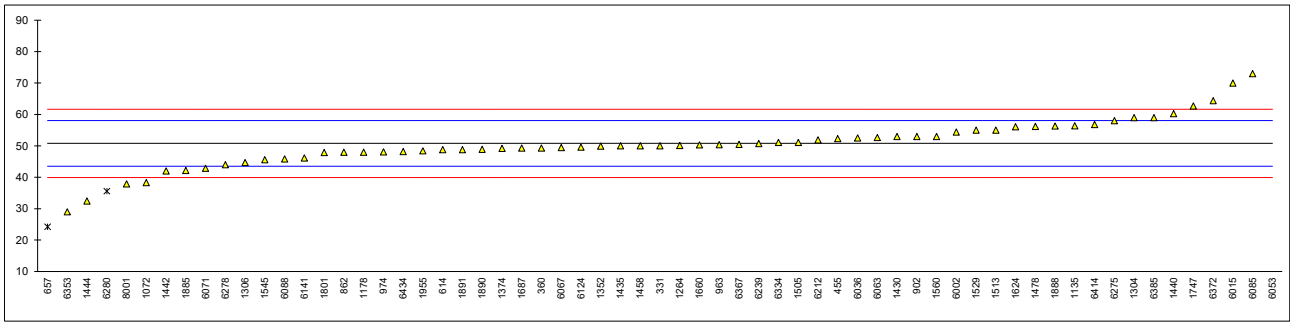


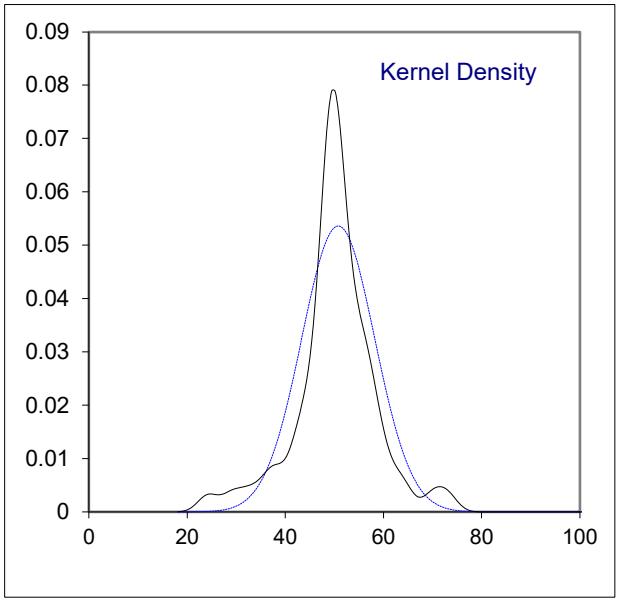


Determination of Carbon monoxide (CO) on sample #21244; results in µL/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
331	IEC60567	50		-0.22	
360	IEC60567	49.3		-0.41	
445		-----		-----	
455	IEC60567	52.3		0.41	
511		-----		-----	
614	IEC60567	48.8		-0.55	
657	D3612	24.25	ex,C	-7.32	first reported 30.21, test result excluded, see paragraph 4.1
862	IEC60567	48		-0.77	
902	D3612	53		0.61	
912		-----		-----	
913		-----		-----	
963	D3612	50.40		-0.11	
974	D3612	48.1	C	-0.74	first reported 98.1
975		-----		-----	
1072	IEC60567	38.3		-3.45	
1135	IEC60567	56.4		1.54	
1178	IEC60567	48.0		-0.77	
1264	D3612	50.1		-0.19	
1304	In house	58.99		2.26	
1306	D3612	44.71150		-1.68	
1352	IEC60567	49.9		-0.25	
1374	D3612	49.2		-0.44	
1430	IEC60567	53		0.61	
1435	IEC60567	50		-0.22	
1440	D3612	60.28		2.61	
1442	IEC60567	42.0		-2.43	
1444	IEC60567	32.44205		-5.06	
1458	D3612	50		-0.22	
1478	IEC60567	56.17		1.48	
1505	D3612	51.1		0.08	
1513	IEC60567	55.02		1.16	
1529	IEC60567	55		1.16	
1545	D3612	45.6		-1.43	
1560	IEC60567	53		0.61	
1624	IEC60567	56.10		1.46	
1660	IEC60567	50.3		-0.14	
1687	IEC60567	49.3		-0.41	
1747	IEC60567	62.71		3.28	
1801	IEC60567	47.915		-0.80	
1885	D3612	42.16		-2.38	
1888	IEC60567	56.3		1.52	
1890	D3612	48.9		-0.52	
1891	IEC60567	48.8		-0.55	
1955	IEC60567	48.44		-0.65	
6002	IEC60567	54.4		0.99	
6015	D3612	70.00		5.29	
6036	IEC60567	52.50		0.47	
6053	IEC60567	186	C,R(0.01)	37.26	first reported 102
6063	IEC60567	52.64		0.51	
6067	IEC60567	49.458		-0.37	
6071	IEC60567	42.89		-2.18	
6085	D3612	73		6.12	
6088	IEC60567	45.85		-1.36	
6124		49.6	C	-0.33	first reported 47.9
6141	D3612	46.161		-1.28	
6212	D3612	51.912		0.31	
6239	D3612	50.74		-0.02	
6275	IEC60567	58		1.98	
6278	D3612	44		-1.87	
6280	D3612	35.6	ex	-4.19	test result excluded, see paragraph 4.1
6334	IEC60567	51.08		0.08	
6353	D3612	29		-6.01	
6367	IEC60567	50.5		-0.08	
6372	IEC60567	64.4		3.75	
6385	D3612	59		2.26	
6414	IEC60567	56.8		1.65	
6434	IEC60567	48.2		-0.72	
8001	IEC60567	37.9		-3.56	

normality	not OK	
n	60	
outliers	1 +2ex	
mean (n)	50.80	
st.dev. (n)	7.441	RSD = 15%
R(calc.)	20.84	
st.dev.(IEC60567:11)	3.629	
R(IEC60567:11)	10.16	

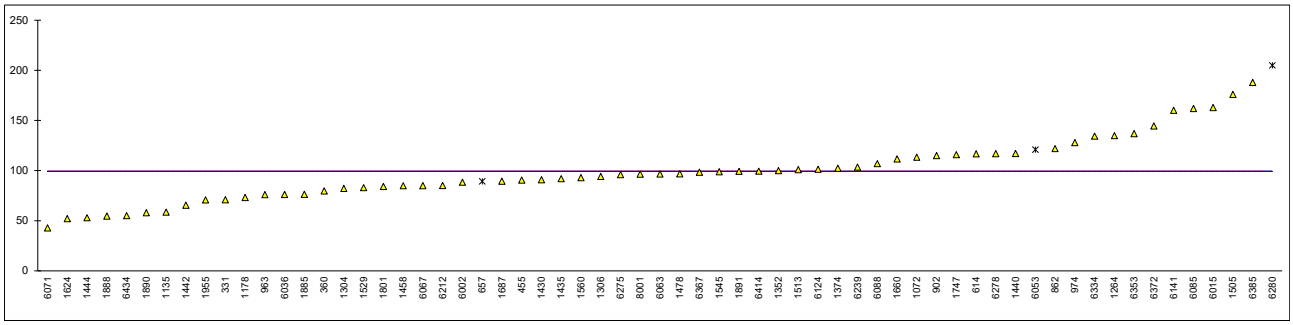


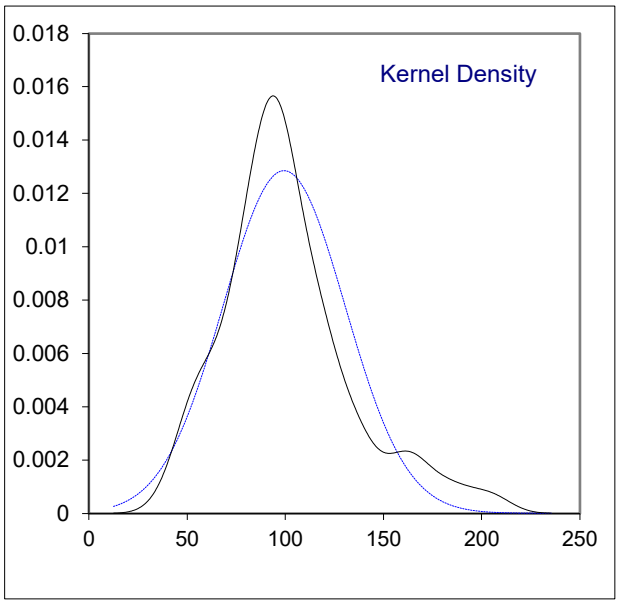


Determination of Carbon dioxide (CO_2) on sample #21244; results in µL/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
331	IEC60567	71		-----	
360	IEC60567	79.8		-----	
445		-----		-----	
455	IEC60567	90.7		-----	
511		-----		-----	
614	IEC60567	116.8		-----	
657	D3612	89.29	ex	-----	test result excluded, see paragraph 4.1
862	IEC60567	122		-----	
902	D3612	115		-----	
912		-----		-----	
913		-----		-----	
963	D3612	76.1		-----	
974	D3612	128.0		-----	
975		-----		-----	
1072	IEC60567	113.5		-----	
1135	IEC60567	58.6		-----	
1178	IEC60567	73.2		-----	
1264	D3612	134.9		-----	
1304	In house	82.24		-----	
1306	D3612	94.23171		-----	
1352	IEC60567	100		-----	
1374	D3612	102.4		-----	
1430	IEC60567	91		-----	
1435	IEC60567	92		-----	
1440	D3612	117.1		-----	
1442	IEC60567	65.6		-----	
1444	IEC60567	53.0874		-----	
1458	D3612	85		-----	
1478	IEC60567	96.81		-----	
1505	D3612	176.0	C	-----	first reported 327
1513	IEC60567	101		-----	
1529	IEC60567	83		-----	
1545	D3612	98.9		-----	
1560	IEC60567	93		-----	
1624	IEC60567	52.19		-----	
1660	IEC60567	111.7		-----	
1687	IEC60567	89.5		-----	
1747	IEC60567	115.99		-----	
1801	IEC60567	84.182		-----	
1885	D3612	76.46		-----	
1888	IEC60567	54.6		-----	
1890	D3612	58.1		-----	
1891	IEC60567	99.4		-----	
1955	IEC60567	70.83		-----	
6002	IEC60567	88.5		-----	
6015	D3612	163.00		-----	
6036	IEC60567	76.33		-----	
6053	IEC60567	121	ex	-----	test result excluded, see paragraph 4.1
6063	IEC60567	96.68		-----	
6067	IEC60567	85.021		-----	
6071	IEC60567	42.89		-----	
6085	D3612	162		-----	
6088	IEC60567	107		-----	
6124		101.4	C	-----	first reported 49.6
6141	D3612	160.245		-----	
6212	D3612	85.164		-----	
6239	D3612	103.54		-----	
6275	IEC60567	96		-----	
6278	D3612	117		-----	
6280	D3612	205	ex	-----	test result excluded, see paragraph 4.1
6334	IEC60567	134.42		-----	
6353	D3612	137		-----	
6367	IEC60567	98.5		-----	
6372	IEC60567	144.6		-----	
6385	D3612	188		-----	
6414	IEC60567	99.5		-----	
6434	IEC60567	55.1		-----	
8001	IEC60567	96.5		-----	

normality	OK	
n	60	
outliers	0 + 3ex	
mean (n)	99.37	
st.dev. (n)	31.032	RSD = 31%
R(calc.)	86.89	
st.dev.(IEC60567:11)	(7.098)	
R(IEC60567:11)	(19.87)	

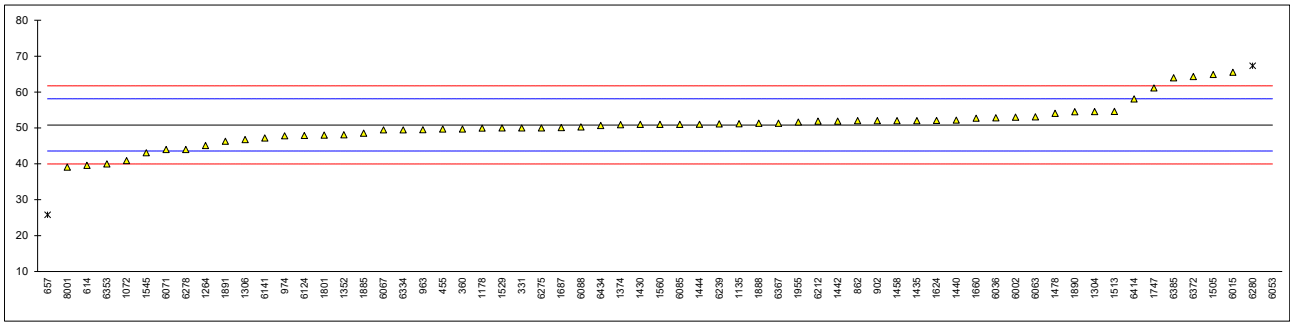


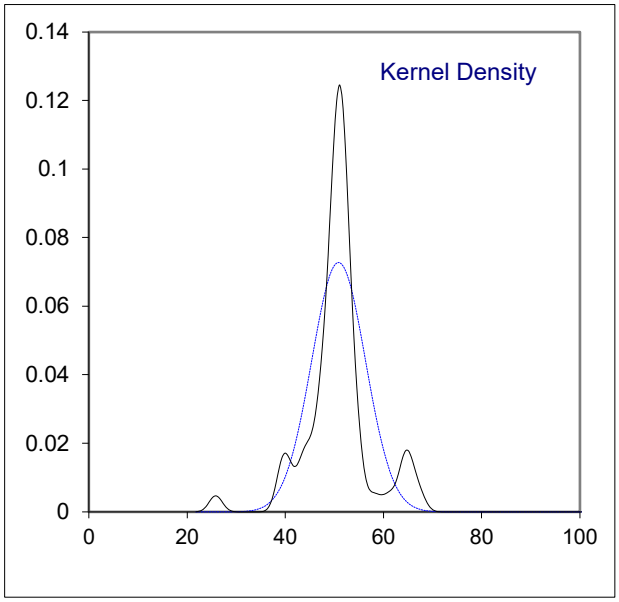


Determination of Methane (CH_4) on sample #21244; results in µL/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
331	IEC60567	50		-0.23	
360	IEC60567	49.7		-0.31	
445		-----		-----	
455	IEC60567	49.7		-0.31	
511		-----		-----	
614	IEC60567	39.6		-3.09	
657	D3612	25.81	C,R(0.01)	-6.89	first reported 28.36
862	IEC60567	52		0.32	
902	D3612	52		0.32	
912		-----		-----	
913		-----		-----	
963	D3612	49.50		-0.37	
974	D3612	47.8	C	-0.84	first reported 96.8
975		-----		-----	
1072	IEC60567	40.9		-2.74	
1135	IEC60567	51.2		0.10	
1178	IEC60567	49.94		-0.25	
1264	D3612	45.1		-1.58	
1304	In house	54.57		1.03	
1306	D3612	46.73164		-1.13	
1352	IEC60567	48.1		-0.75	
1374	D3612	50.9		0.02	
1430	IEC60567	51		0.05	
1435	IEC60567	52		0.32	
1440	D3612	52.19		0.37	
1442	IEC60567	51.9		0.29	
1444	IEC60567	51.00949		0.05	
1458	D3612	52		0.32	
1478	IEC60567	54.06		0.89	
1505	D3612	64.9	C	3.87	first reported 74.9
1513	IEC60567	54.62		1.04	
1529	IEC60567	50		-0.23	
1545	D3612	43.1		-2.13	
1560	IEC60567	51		0.05	
1624	IEC60567	52.11		0.35	
1660	IEC60567	52.7		0.51	
1687	IEC60567	50.1		-0.20	
1747	IEC60567	61.15		2.84	
1801	IEC60567	48.033		-0.77	
1885	D3612	48.55		-0.63	
1888	IEC60567	51.3		0.13	
1890	D3612	54.51		1.01	
1891	IEC60567	46.3		-1.25	
1955	IEC60567	51.65		0.22	
6002	IEC60567	53.0		0.60	
6015	D3612	65.50		4.04	
6036	IEC60567	52.84		0.55	
6053	IEC60567	167	C,R(0.01)	31.99	first reported 103
6063	IEC60567	53.09		0.62	
6067	IEC60567	49.44		-0.38	
6071	IEC60567	44.00		-1.88	
6085	D3612	51		0.05	
6088	IEC60567	50.3		-0.15	
6124		47.9	C	-0.81	first reported 101.4
6141	D3612	47.177		-1.01	
6212	D3612	51.898		0.29	
6239	D3612	51.13		0.08	
6275	IEC60567	50		-0.23	
6278	D3612	44		-1.88	
6280	D3612	67.3	ex	4.53	test result excluded, see paragraph 4.1
6334	IEC60567	49.45		-0.38	
6353	D3612	40		-2.98	
6367	IEC60567	51.3		0.13	
6372	IEC60567	64.3		3.71	
6385	D3612	64		3.63	
6414	IEC60567	58.1		2.00	
6434	IEC60567	50.7		-0.04	
8001	IEC60567	39.1		-3.23	

normality	suspect	
n	60	
outliers	2 +1ex	
mean (n)	50.84	
st.dev. (n)	5.487	RSD = 11%
R(calc.)	15.36	
st.dev.(IEC60567:11)	3.631	
R(IEC60567:11)	10.17	

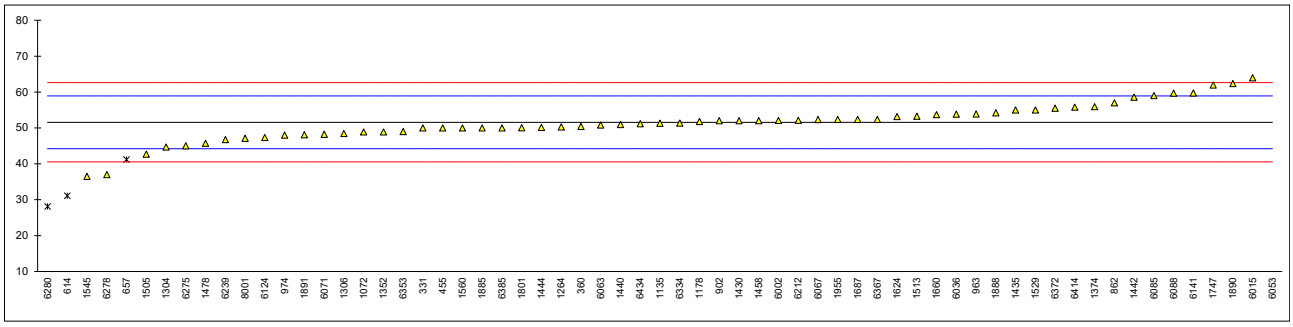


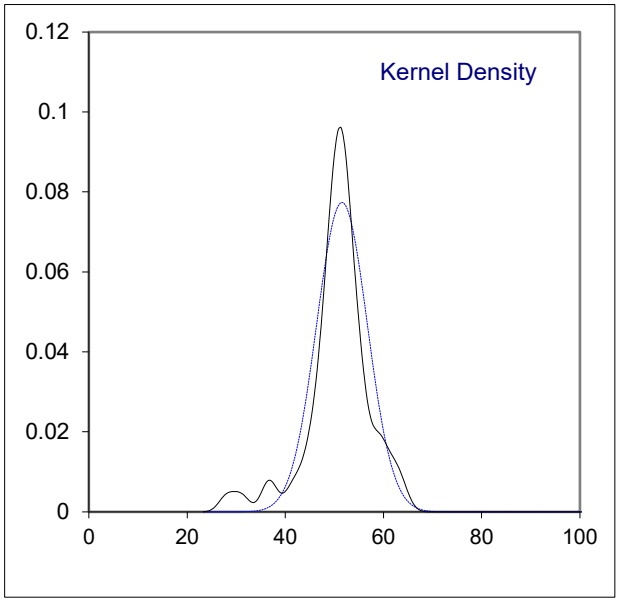


Determination of Ethane (C_2H_6) on sample #21244; results in µL/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
331	IEC60567	50		-0.42	
360	IEC60567	50.4		-0.32	
445		-----		-----	
455	IEC60567	50.0		-0.42	
511		-----		-----	
614	IEC60567	31.1	R(0.05)	-5.56	
657	D3612	41.18	ex	-2.82	test result excluded, see paragraph 4.1
862	IEC60567	57		1.48	
902	D3612	52		0.12	
912		-----		-----	
913		-----		-----	
963	D3612	53.90		0.64	
974	D3612	48.0	C	-0.97	first reported 98.0
975		-----		-----	
1072	IEC60567	48.9		-0.72	
1135	IEC60567	51.3		-0.07	
1178	IEC60567	51.82		0.07	
1264	D3612	50.3		-0.34	
1304	In house	44.68		-1.87	
1306	D3612	48.44795		-0.85	
1352	IEC60567	48.9		-0.72	
1374	D3612	55.9		1.18	
1430	IEC60567	52		0.12	
1435	IEC60567	55		0.93	
1440	D3612	50.93		-0.17	
1442	IEC60567	58.6		1.91	
1444	IEC60567	50.1457		-0.38	
1458	D3612	52		0.12	
1478	IEC60567	45.72		-1.59	
1505	D3612	42.7		-2.41	
1513	IEC60567	53.30		0.47	
1529	IEC60567	55		0.93	
1545	D3612	36.5	C	-4.09	first reported 39.0
1560	IEC60567	50		-0.42	
1624	IEC60567	53.16		0.43	
1660	IEC60567	53.7		0.58	
1687	IEC60567	52.4		0.23	
1747	IEC60567	61.95		2.82	
1801	IEC60567	50.087		-0.40	
1885	D3612	50.00		-0.42	
1888	IEC60567	54.2		0.72	
1890	D3612	62.36		2.93	
1891	IEC60567	48.1		-0.94	
1955	IEC60567	52.36		0.22	
6002	IEC60567	52.1		0.15	
6015	D3612	64.00		3.38	
6036	IEC60567	53.88		0.63	
6053	IEC60567	156	C,R(0.01)	28.36	first reported 105
6063	IEC60567	50.83		-0.20	
6067	IEC60567	52.325		0.21	
6071	IEC60567	48.24		-0.90	
6085	D3612	59		2.02	
6088	IEC60567	59.7		2.21	
6124		47.3	C	-1.16	first reported 46.7
6141	D3612	59.746		2.22	
6212	D3612	52.149		0.16	
6239	D3612	46.74		-1.31	
6275	IEC60567	45		-1.78	
6278	D3612	37	C	-3.95	first reported 35
6280	D3612	28.1	R(0.05)	-6.37	
6334	IEC60567	51.34		-0.06	
6353	D3612	49		-0.70	
6367	IEC60567	52.4		0.23	
6372	IEC60567	55.5		1.07	
6385	D3612	50		-0.42	
6414	IEC60567	55.8		1.15	
6434	IEC60567	51.2		-0.10	
8001	IEC60567	47.1		-1.21	

normality	suspect	
n	59	
outliers	3 + 1ex	
mean (n)	51.56	
st.dev. (n)	5.161	RSD = 10%
R(calc.)	14.45	
st.dev.(IEC60567:11)	3.683	
R(IEC60567:11)	10.31	

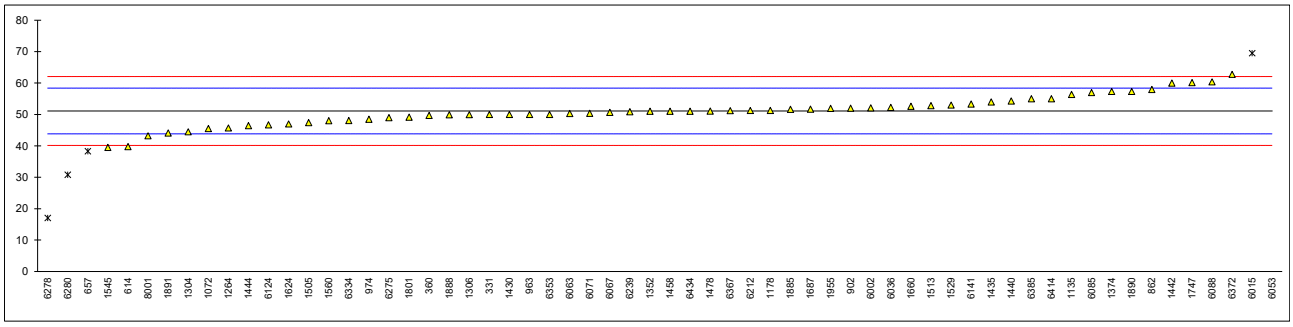


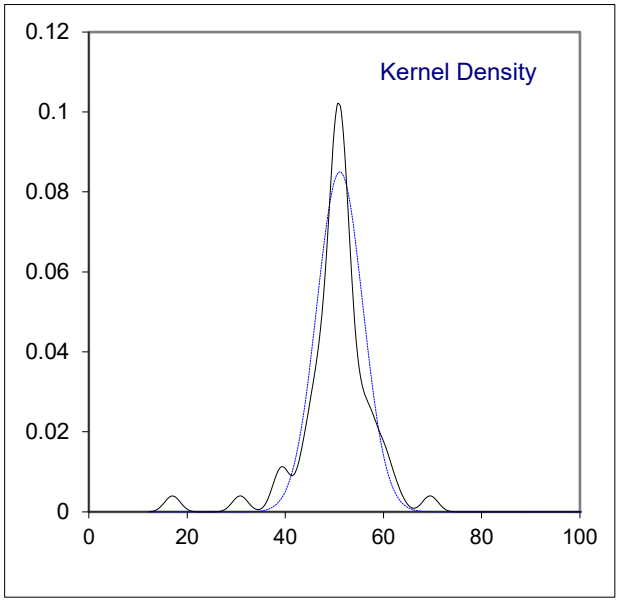


Determination of Ethene (C_2H_4) on sample #21244; results in µL/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
331	IEC60567	50		-0.30	
360	IEC60567	49.7		-0.39	
445		-----		-----	
455		-----		-----	
511		-----		-----	
614	IEC60567	39.8		-3.10	
657	D3612	38.26	ex	-3.52	test result excluded, see paragraph 4.1
862	IEC60567	58		1.89	
902	D3612	52		0.24	
912		-----		-----	
913		-----		-----	
963	D3612	50.00		-0.30	
974	D3612	48.5	C	-0.71	first reported 98.1
975		-----		-----	
1072	IEC60567	45.5		-1.54	
1135	IEC60567	56.4		1.45	
1178	IEC60567	51.31		0.06	
1264	D3612	45.7		-1.48	
1304	In house	44.49		-1.81	
1306	D3612	49.96073		-0.31	
1352	IEC60567	51.0		-0.03	
1374	D3612	57.3		1.70	
1430	IEC60567	50		-0.30	
1435	IEC60567	54		0.79	
1440	D3612	54.33		0.88	
1442	IEC60567	60.0		2.44	
1444	IEC60567	46.45506		-1.27	
1458	D3612	51		-0.03	
1478	IEC60567	51.08		-0.01	
1505	D3612	47.4		-1.02	
1513	IEC60567	52.81		0.47	
1529	IEC60567	53		0.52	
1545	D3612	39.5		-3.18	
1560	IEC60567	48		-0.85	
1624	IEC60567	46.96		-1.14	
1660	IEC60567	52.6		0.41	
1687	IEC60567	51.7		0.16	
1747	IEC60567	60.15		2.48	
1801	IEC60567	49.132		-0.54	
1885	D3612	51.63		0.14	
1888	IEC60567	49.9		-0.33	
1890	D3612	57.31		1.70	
1891	IEC60567	44.1		-1.92	
1955	IEC60567	51.94		0.23	
6002	IEC60567	52.1		0.27	
6015	D3612	69.50	R(0.05)	5.04	
6036	IEC60567	52.26		0.32	
6053	IEC60567	156	C,R(0.01)	28.73	first reported 106
6063	IEC60567	50.30		-0.22	
6067	IEC60567	50.69		-0.11	
6071	IEC60567	50.36		-0.20	
6085	D3612	57		1.61	
6088	IEC60567	60.4		2.55	
6124		46.7	C	-1.21	first reported 47.3
6141	D3612	53.343		0.61	
6212	D3612	51.239		0.04	
6239	D3612	50.86		-0.07	
6275	IEC60567	49		-0.58	
6278	D3612	17	C,R(0.01)	-9.34	first reported 16
6280	D3612	30.8	R(0.05)	-5.56	
6334	IEC60567	48.06		-0.83	
6353	D3612	50		-0.30	
6367	IEC60567	51.2		0.03	
6372	IEC60567	62.8		3.20	
6385	D3612	55		1.07	
6414	IEC60567	55.0		1.07	
6434	IEC60567	51.0		-0.03	
8001	IEC60567	43.2		-2.17	

normality	OK	
n	57	
outliers	4 + 1ex	
mean (n)	51.11	
st.dev. (n)	4.695	RSD = 9%
R(calc.)	13.14	
st.dev.(IEC60567:11)	3.651	
R(IEC60567:11)	10.22	

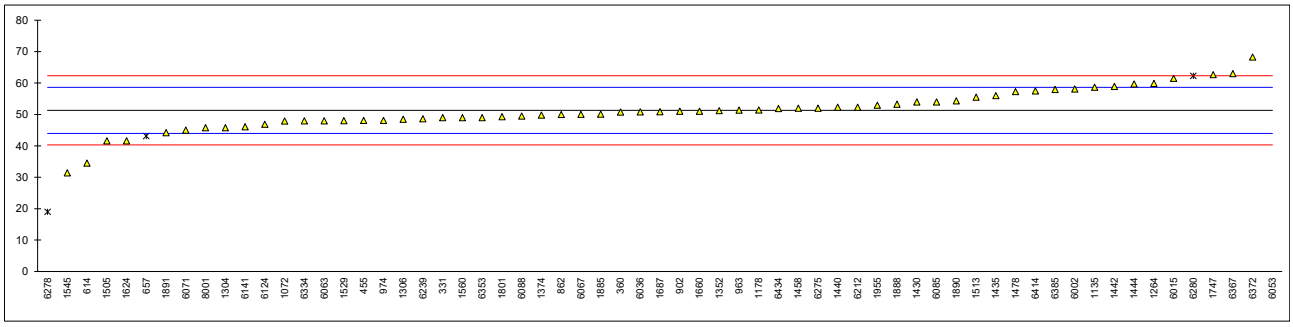


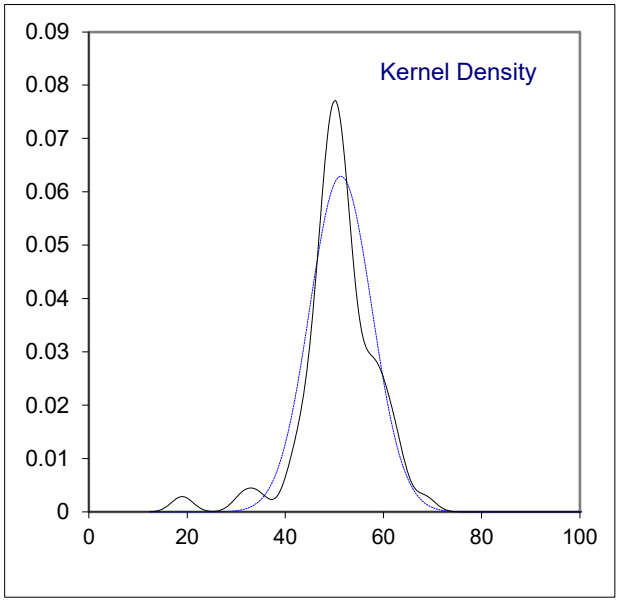


Determination of Ethyne (C_2H_2) on sample #21244; results in µL/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
331	IEC60567	49		-0.63	
360	IEC60567	50.8		-0.14	
445		-----		-----	
455	IEC60567	48.1		-0.87	
511		-----		-----	
614	IEC60567	34.5		-4.58	
657	D3612	43.11	ex	-2.23	test result excluded, see paragraph 4.1
862	IEC60567	50		-0.35	
902	D3612	51		-0.08	
912		-----		-----	
913		-----		-----	
963	D3612	51.40		0.03	
974	D3612	48.1	C	-0.87	first reported 97.4
975		-----		-----	
1072	IEC60567	47.9		-0.93	
1135	IEC60567	58.7		2.02	
1178	IEC60567	51.43		0.04	
1264	D3612	59.9		2.35	
1304	In house	45.82		-1.50	
1306	D3612	48.50009		-0.76	
1352	IEC60567	51.2		-0.03	
1374	D3612	49.8		-0.41	
1430	IEC60567	54		0.74	
1435	IEC60567	56		1.28	
1440	D3612	52.28		0.27	
1442	IEC60567	58.9		2.07	
1444	IEC60567	59.72822		2.30	
1458	D3612	52		0.19	
1478	IEC60567	57.27		1.63	
1505	D3612	41.6		-2.65	
1513	IEC60567	55.52		1.15	
1529	IEC60567	48		-0.90	
1545	D3612	31.4	C	-5.43	first reported 32.6
1560	IEC60567	49		-0.63	
1624	IEC60567	41.62		-2.64	
1660	IEC60567	51.0		-0.08	
1687	IEC60567	50.9		-0.11	
1747	IEC60567	62.68		3.11	
1801	IEC60567	49.297		-0.55	
1885	D3612	50.14		-0.32	
1888	IEC60567	53.3		0.55	
1890	D3612	54.37		0.84	
1891	IEC60567	44.2		-1.94	
1955	IEC60567	52.96		0.45	
6002	IEC60567	58.1		1.86	
6015	D3612	61.50		2.78	
6036	IEC60567	50.81		-0.13	
6053	IEC60567	164	C,R(0.01)	30.76	first reported 103
6063	IEC60567	47.96		-0.91	
6067	IEC60567	50.04		-0.34	
6071	IEC60567	45.0	C	-1.72	first reported 37.06
6085	D3612	54		0.74	
6088	IEC60567	49.5		-0.49	
6124		46.9		-1.20	
6141	D3612	46.095		-1.42	
6212	D3612	52.287		0.27	
6239	D3612	48.63		-0.73	
6275	IEC60567	52		0.19	
6278	D3612	19	C,R(0.01)	-8.81	first reported 17
6280	D3612	62.3	ex	3.00	test result excluded, see paragraph 4.1
6334	IEC60567	47.95		-0.91	
6353	D3612	49		-0.63	
6367	IEC60567	63.0		3.19	
6372	IEC60567	68.3		4.64	
6385	D3612	58		1.83	
6414	IEC60567	57.5		1.69	
6434	IEC60567	51.9		0.16	
8001	IEC60567	45.8		-1.50	

normality	suspect	
n	59	
outliers	2 + 2ex	
mean (n)	51.30	
st.dev. (n)	6.338	RSD = 12%
R(calc.)	17.75	
st.dev.(IEC60567:11)	3.664	
R(IEC60567:11)	10.26	

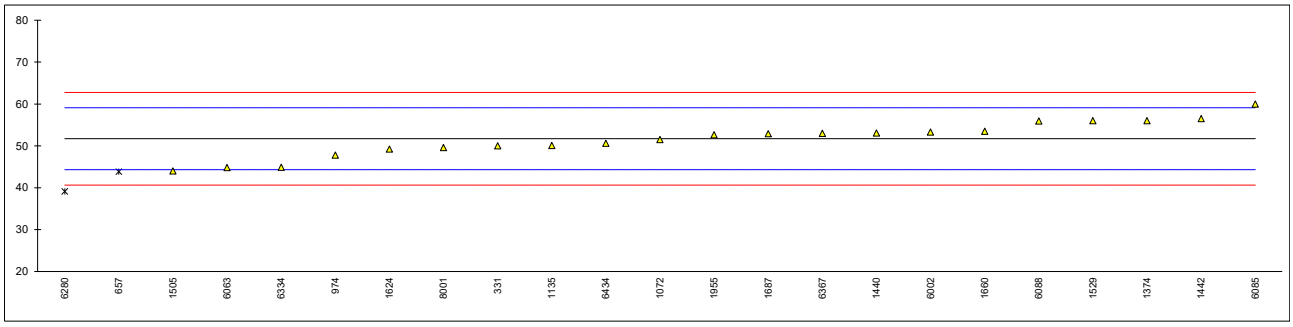


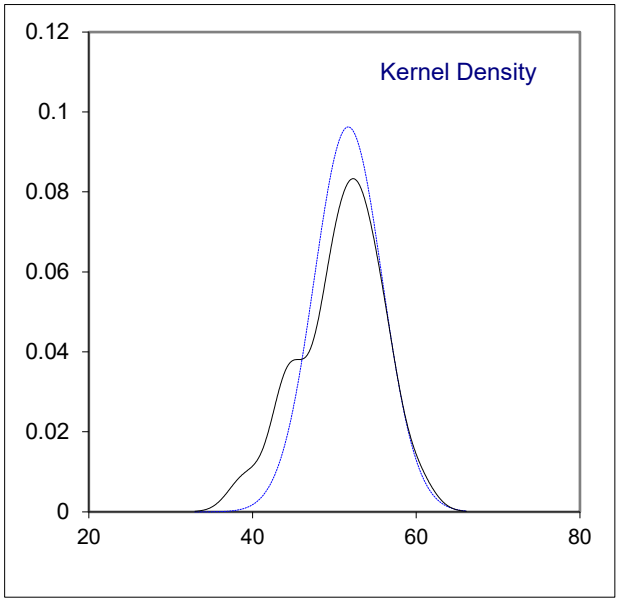


Determination of Propane (C_3H_8) on sample #21244; results in µL/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
331	IEC60567	50		-0.46	
360		-----		-----	
445		-----		-----	
455		-----		-----	
511		-----		-----	
614		-----		-----	
657	D3612	43.85	ex	-2.12	test result excluded, see paragraph 4.1
862		-----		-----	
902		-----		-----	
912		-----		-----	
913		-----		-----	
963		-----		-----	
974	D3612	47.8	C	-1.05	first reported 98.2
975		-----		-----	
1072	IEC60567	51.5		-0.05	
1135	IEC60567	50.1		-0.43	
1178		-----		-----	
1264		-----		-----	
1304		-----		-----	
1306		-----		-----	
1352		-----		-----	
1374	D3612	56		1.17	
1430		-----		-----	
1435		-----		-----	
1440	D3612	53.09		0.38	
1442	IEC60567	56.5		1.30	
1444		-----		-----	
1458		-----		-----	
1478		-----		-----	
1505	D3612	44.0		-2.08	
1513		-----		-----	
1529	IEC60567	56		1.17	
1545		-----		-----	
1560		-----		-----	
1624	IEC60567	49.24		-0.66	
1660	IEC60567	53.5		0.49	
1687	IEC60567	52.9		0.33	
1747		-----		-----	
1801		-----		-----	
1885		-----		-----	
1888		-----		-----	
1890		-----		-----	
1891		-----		-----	
1955	IEC60567	52.66		0.26	
6002	IEC60567	53.3		0.44	
6015		-----		-----	
6036		-----		-----	
6053	IEC60567	NA		-----	
6063	IEC60567	44.82		-1.86	
6067		-----		-----	
6071		-----		-----	
6085	D3612	60		2.25	
6088	IEC60567	55.95		1.15	
6124		-----		-----	
6141		-----		-----	
6212		-----		-----	
6239		-----		-----	
6275		-----		-----	
6278		-----		-----	
6280	D3612	39.1	ex	-3.41	test result excluded, see paragraph 4.1
6334	IEC60567	44.91		-1.84	
6353		-----		-----	
6367	IEC60567	53.0		0.36	
6372		-----		-----	
6385		-----		-----	
6414		-----		-----	
6434	IEC60567	50.6		-0.29	
8001	IEC60567	49.6		-0.57	

normality	OK	
n	21	
outliers	0 + 2ex	
mean (n)	51.69	
st.dev. (n)	4.146	RSD = 8%
R(calc.)	11.61	
st.dev.(IEC60567:11)	3.692	
R(IEC60567:11)	10.34	

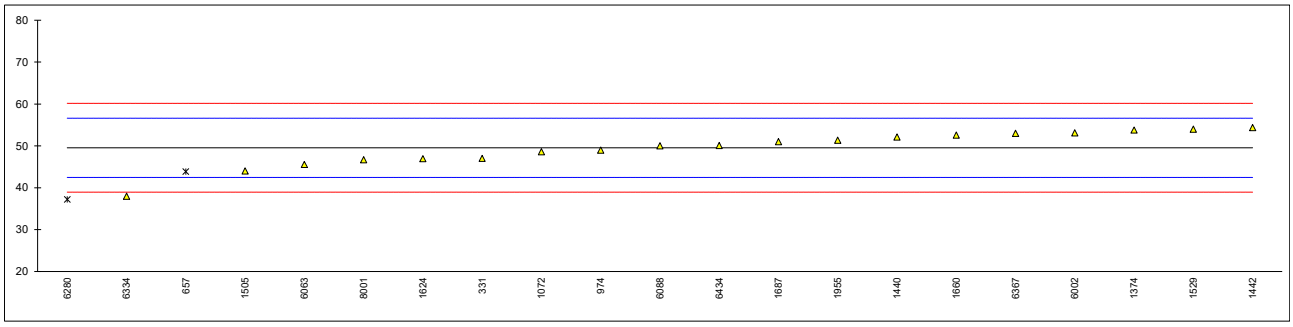


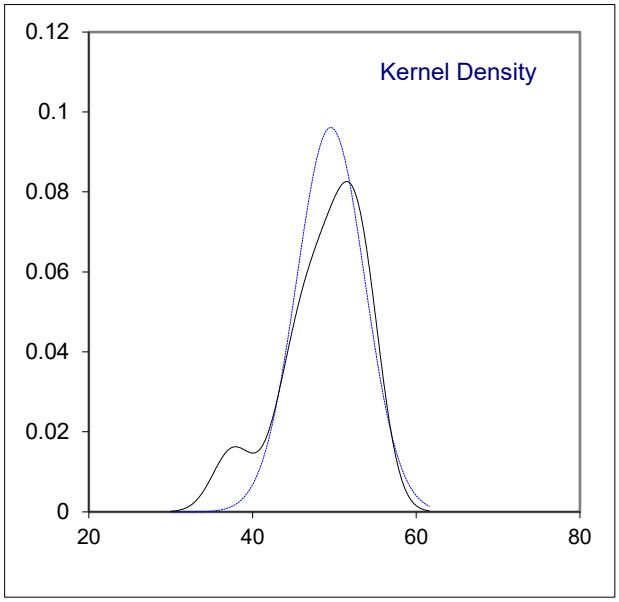


Determination of Propene (C_3H_6) on sample #21244; results in µL/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
331	IEC60567	47		-0.72	
360		-----		-----	
445		-----		-----	
455		-----		-----	
511		-----		-----	
614		-----		-----	
657	D3612	43.87	ex	-1.60	test result excluded, see paragraph 4.1
862		-----		-----	
902		-----		-----	
912		-----		-----	
913		-----		-----	
963		-----		-----	
974	D3612	49.0	C	-0.15	first reported 100.1
975		-----		-----	
1072	IEC60567	48.6		-0.27	
1135		-----		-----	
1178		-----		-----	
1264		-----		-----	
1304		-----		-----	
1306		-----		-----	
1352		-----		-----	
1374	D3612	53.8		1.20	
1430		-----		-----	
1435		-----		-----	
1440	D3612	52.12		0.73	
1442	IEC60567	54.4		1.37	
1444		-----		-----	
1458		-----		-----	
1478		-----		-----	
1505	D3612	44.0		-1.57	
1513		-----		-----	
1529	IEC60567	54		1.26	
1545		-----		-----	
1560		-----		-----	
1624	IEC60567	46.93		-0.74	
1660	IEC60567	52.6		0.86	
1687	IEC60567	51.0		0.41	
1747		-----		-----	
1801		-----		-----	
1885		-----		-----	
1888		-----		-----	
1890		-----		-----	
1891		-----		-----	
1955	IEC60567	51.37		0.52	
6002	IEC60567	53.1		1.01	
6015		-----		-----	
6036		-----		-----	
6053	IEC60567	NA		-----	
6063	IEC60567	45.57		-1.12	
6067		-----		-----	
6071		-----		-----	
6085		-----		-----	
6088	IEC60567	50	C	0.13	first reported 30
6124		-----		-----	
6141		-----		-----	
6212		-----		-----	
6239		-----		-----	
6275		-----		-----	
6278		-----		-----	
6280	D3612	37.2	ex	-3.49	test result excluded, see paragraph 4.1
6334	IEC60567	38		-3.26	
6353		-----		-----	
6367	IEC60567	53.0		0.98	
6372		-----		-----	
6385		-----		-----	
6414		-----		-----	
6434	IEC60567	50.1		0.16	
8001	IEC60567	46.7		-0.80	

normality	suspect	
n	19	
outliers	0 + 2ex	
mean (n)	49.54	
st.dev. (n)	4.153	RSD = 8%
R(calc.)	11.63	
st.dev.(IEC60567:11)	3.539	
R(IEC60567:11)	9.91	





APPENDIX 2 Analytical details

lab	extraction method
179	---
237	---
331	---
360	Head Space
445	---
455	---
511	---
614	ToGas
657	Head Space
862	Head Space
902	Head Space
912	---
913	---
963	Head Space
974	Head Space
975	---
1072	Head Space
1135	---
1178	---
1264	Head Space
1304	Head Space
1306	Head Space
1352	Toepler
1374	Head Space
1430	Head Space
1435	---
1440	Head Space
1442	Head Space
1444	Head Space
1458	Stripper Column
1478	Toepler
1505	Head Space
1513	Toepler
1529	Head Space
1545	Head Space
1560	Head Space
1624	Head Space
1660	Head Space
1687	Head Space
1747	Head Space
1801	Head Space
1885	Head Space
1888	Head Space
1890	Head Space
1891	Head Space
1955	---
6002	Head Space
6015	Head Space
6036	Head Space
6053	Head Space
6063	Toepler
6067	Head Space
6071	Head Space
6085	Head Space
6088	Head Space
6124	Stripper Column
6141	Head Space
6212	Head Space
6239	Head Space
6275	Stripper Column
6278	Vacuum Extraction
6280	Toepler
6334	Head Space
6353	Head Space
6367	Head Space
6372	Head Space
6385	Vacuum Extraction
6414	Head Space
6434	Head Space
8001	Head Space

APPENDIX 3

Number of participants per country

7 labs in AUSTRALIA
3 labs in BELGIUM
1 lab in BULGARIA
1 lab in CANADA
1 lab in CHINA, People's Republic
1 lab in CROATIA
2 labs in FRANCE
3 labs in GERMANY
2 labs in GREECE
1 lab in HONG KONG
2 labs in INDIA
1 lab in INDONESIA
1 lab in IRELAND
1 lab in ISRAEL
1 lab in ITALY
1 lab in KOREA, Republic of
2 labs in MALAYSIA
1 lab in MOROCCO
2 labs in NETHERLANDS
1 lab in NIGERIA
1 lab in NORWAY
1 lab in PERU
1 lab in PHILIPPINES
1 lab in POLAND
1 lab in PORTUGAL
2 labs in QATAR
3 labs in SAUDI ARABIA
3 labs in SINGAPORE
1 lab in SLOVAKIA
2 labs in SLOVENIA
1 lab in SOUTH AFRICA
6 labs in SPAIN
1 lab in SWITZERLAND
3 labs in TURKEY
3 labs in UNITED ARAB EMIRATES
3 labs in UNITED KINGDOM
1 lab in UNITED STATES OF AMERICA
1 lab in URUGUAY

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	= calculation difference between reported test result and result calculated by iis
W	= test result withdrawn on request of participant
ex	= test result excluded from statistical evaluation
n.a.	= not applicable
n.e.	= not evaluated
n.d.	= not detected
fr.	= first reported
f+?	= possibly a false positive test result?
f-?	= possibly a false negative test result?
SDS	= Safety Data Sheet

Literature

1 iis Interlaboratory Studies, Protocol for the Organisation, Statistics & Evaluation, June 2018
2 ISO5725:86
3 ISO5725 parts 1-6:94
4 ISO13528:05
5 M. Thompson and R. Wood, J. AOAC Int, 76, 926, (1993)
6 W.J. Youden and E.H. Steiner, Statistical Manual of the AOAC, (1975)
7 P.L. Davies, Fr. Z. Anal. Chem, 331, 513, (1988)
8 J.N. Miller, Analyst, 118, 455, (1993)
9 Analytical Methods Committee, Technical Brief, No 4, January 2001
10 P.J. Lowthian and M. Thompson, The Royal Society of Chemistry, Analyst, 127, 1359-1364, (2002)
11 W. Horwitz and R. Albert, J. AOAC Int, 79.3, 589-621, (1996)
12 Bernard Rosner, Percentage Points for a Generalized ESD Many-Outlier Procedure, Technometrics, 25(2), 165-172, (1983)