Results of Proficiency Test
Dissolved Gas Analysis
November 2018

Organised by: Institute for Interlaboratory Studies
Spijkenisse, the Netherlands

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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 proficiency testing program 2018/2019, 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, 60 laboratories from 31 different countries did register for participation. See appendix 3 for the number of participants per country. In this report the results of the 2018 interlaboratory study on Dissolved Gas Analysis (DGA) in Transformer Oil 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 organiser of this proficiency test (PT). In total one batch of 65 certified syringes was prepared with lot code RN334. The syringes were prepared in two different volumes: 50mL and 100mL. The syringes (True North) were provided by Morgan Schaffer Inc, Quebec, Canada. Each syringe was uniquely numbered and labelled #18234. It was decided to send to each participating laboratory one syringe (50 or 100 mL) without the Morgan Schaffer certificate. 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/IEC 17043:2010 (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 Inc. is ISO 9001 certified and ISO/IEC17025 accredited by ANSI-ASQ.

2.2 PROTOCOL

The protocol followed in the organization of this proficiency test was the one as described for proficiency testing in the report 'iis Interlaboratory Studies: Protocol for the Organization, Statistics and Evaluation' of June 2018 (iis-protocol, version 3.5). 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 one type of Transformer Oil was used for the preparation of the gas tight syringes of 50mL or 100mL. These syringes were subsequently tested by Morgan Schaffer Inc. (Quebec, Canada) in accordance with ASTM Method D3612 and IEC 60567. In total one batch of 65 syringes (30x50mL and 35x100mL) was prepared (lot code RN334). Each syringe was labelled #18234.

The repeatabilities are in agreement for all components with 0.3 times the corresponding reproducibility of the target test method according with the procedure of ISO13528. Therefore, homogeneity of the subsamples #18234 was assumed.

Depending on the registration to each of the participating laboratories a syringe of 50mL or a syringe of 100mL, both labelled #18234, was sent on October 31, 2018. An SDS was added to the sample package.

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 period of the proficiency test.

2.6 ANALYSES

The participants were requested to determine on sample #18234: Hydrogen, Oxygen, Nitrogen, Carbon Monoxide, Carbon Dioxide, Methane, Ethane, Ethene, Ethyn, Propane and Propene. 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 appropriate reference test methods 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 reanalysis). Additional or corrected test results are used for data analysis and the 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 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 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.

According to ISO5725 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. 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 these with a factor of 2.8.

3.2 GRAPHICS

In order to visualize the data against the reproducibilities from literature, Gauss plots were made, using the sorted data for one determination (see appendix 1). On the Y-axis, the reported analysis results are plotted. The corresponding laboratory numbers are 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. The Kernel Density Graph 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 reproducibilities, 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. In some cases, a reproducibility based on former iis proficiency tests could be used.

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:

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

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

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

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

4 EVALUATION

In this proficiency test, no major problems were encountered with the dispatch of the samples. Seven participants did not report any test results at all. Not all participants were able to report all requested components. Finally, 53 participants reported 496 numerical test results. Observed were 25 outlying test results, which is 5.0% of the numerical test results. In proficiency studies, outlier percentages of 3% - 7.5% are quite normal.

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, 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 methods are also in the tables together with the original data. The abbreviations, used in these tables, are listed in appendix 4.

Sample #18234

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

Oxygen: The determination of this component was problematic for a number of laboratories. Six statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in agreement with the requirements of IEC 60567:2011.

Nitrogen: The determination of this component was problematic. Two 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 Monoxide: The determination of this component was problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is not in agreement with the requirements of IEC 60567:2011.

Carbon Dioxide: 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.

Methane: The determination of this component was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of IEC 60567:2011.

Ethane: The determination of this component was problematic. Two 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 not problematic. Two statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in agreement with the requirements of IEC 60567:2011.

Ethyn: The determination of this component was problematic. Two 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. The test results of five participants were excluded. These participants detected Propane. After consulting Morgan Schaffer it became clear that Propane was not present in the sample. Ten other participants agreed on a Propane level <10 µl/L. Therefore, no z-scores were calculated.

Propene: The determination of this component was problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is not in agreement with the requirements of IEC 60567:2011.

4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

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

Component	unit	n	average	2.8 * sd	R(lit)
Hydrogen H_2	µl/L	50	533	147	107
Oxygen O_2	µl/L	46	15499	3358	3100
Nitrogen N_2	µl/L	50	56117	18387	11223
Carbon Monoxide CO	µl/L	52	512	141	102
Carbon Dioxide CO_2	µl/L	48	555	143	111
Methane CH_4	µl/L	52	518	111	104
Ethane C_2H_6	µl/L	51	536	138	107
Ethene C_2H_4	µl/L	50	524	114	105
Ethyn C_2H_2	µl/L	50	510	127	102
Propane C_3H_8	µl/L	10	<10	n.a.	n.a.
Propene C_3H_6	µl/L	9	562	194	112

Table 1: reproducibilities of components on sample #18234

Without further statistical calculations it can be concluded from the overview given in table 1 that for most determinations it is difficult to get 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 2018 WITH PREVIOUS PTS

	November 2018	*November 2017*	*November 2016*	*November 2015*	*November 2014*
Number of reporting labs	53	61	53	45	40
Number of test results reported	496	580	487	401	358
Number of statistical outliers	25	21	57	29	10
Percentage of statistical outliers	5.0%	3.6%	11.7%	7.2%	2.8%

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 compared, expressed as relative standard deviation (RSD) of the PTs, see below table.

Determination	*November 2018*	*November 2017*	*November 2016*	*November 2015*	*November 2014*	*IEC605671*
Hydrogen H_2	10%	15%	10%	21%	24%	7%
Oxygen O_2	8%	12%	13%	19%	18%	7%
Nitrogen N_2	12%	19%	13%	16%	13%	7%
Carbon Monoxide CO	10%	16%	12%	11%	12%	7%
Carbon Dioxide CO_2	9%	15%	16%	12%	17%	7%
Methane CH_4	8%	12%	10%	13%	18%	7%
Ethane C_2H_6	9%	11%	12%	17%	24%	7%
Ethene C_2H_4	8%	12%	12%	12%	29%	7%
Ethyn C_2H_2	9%	11%	12%	11%	35%	7%
Propane C_3H_8	n.e.	11%	9%	n.e.	n.e.	n.e
Propene C_3H_6	12%	n.e.	n.e.	26%	20%	n.e

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

The results of the 2018 PT show an improvement compared to the previous years, but did not meet the strict requirements of the target test method.

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	Average values by Morgan Schaffer in µl/L	Consensus values from participants results in µl/L	Differences in µl/L	Calculated z-scores
Hydrogen H_2	518	533	15	0.39
Oxygen O_2	15600	15499	-101	-0.09
Nitrogen N_2	53200	56117	2917	0.73
Carbon Monoxide CO	517	512	-5	-0.14
Carbon Dioxide CO_2	547	555	8	0.20
Methane CH_4	518	518	0	0.00
Ethane C_2H_6	521	536	15	0.39
Ethene C_2H_4	514	524	10	0.27
Ethyn C_2H_2	519	510	-9	-0.25

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

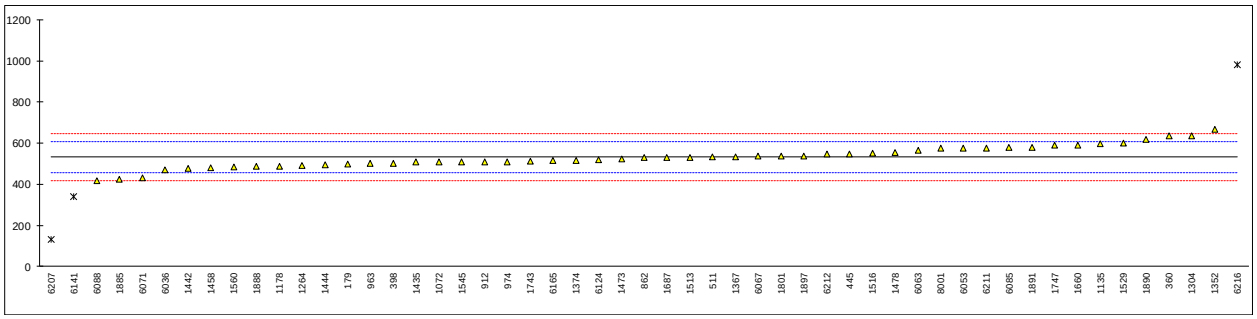
No statistical differences were observed between the test results of the 50mL syringes and the 100mL syringes. Both the averages and the variabilities for each of the components were in line with each other for both type of syringes. Regarding the extraction method used a vast majority of the participants (83%) used “Head Space”.

APPENDIX 1

Determination of Hydrogen (H_2) on sample #18234; results in µl/L

lab	method	value	mark	z(targ)	remarks
179	D3612	499		-0.89	
237		-----		-----	
360	IEC60567	634.2		2.67	
398	IEC60567	503.1		-0.78	
445	IEC60567	546.8	C	0.37	first reported 393.4
511	D3612	533		0.01	
614		-----		-----	
862	IEC60567	531		-0.04	
912	D3612	510	C	-0.60	first reported 229
913		-----		-----	
962		-----		-----	
963	D3612	502.7		-0.79	
974	D3612	510		-0.60	
1072	IEC60567	508.1		-0.65	
1135	IEC60567	597		1.69	
1178	IEC60567	488.6		-1.16	
1264	D3612	490		-1.12	
1304	INH-120	636.2		2.72	
1352	IEC60567	668.0		3.56	
1367	D3612	533.51		0.02	
1374	D3612	516.4		-0.43	
1430		-----		-----	
1435	IEC60567	508		-0.65	
1442	IEC60567	477.0		-1.46	
1444	IEC60567	496.50844		-0.95	
1458	D3612	481		-1.36	
1473	IEC60567	524.5		-0.22	
1478	IEC60567	552.99		0.53	
1513	IEC60567	531.66		-0.03	
1516		550.7		0.47	
1529	IEC60567	600		1.77	
1545	D3612	510	C	-0.60	first reported 314.0
1560	IEC60567	485		-1.25	
1660	IEC60567	590		1.51	
1687	IEC60567	531.1		-0.04	
1720		-----		-----	
1743	IEC60567	511		-0.57	
1747	IEC60567	588.53		1.47	
1801	IEC60567	537.28		0.12	
1885	D3612	425	C	-2.83	first reported 191
1888	IEC60567	486.6		-1.21	
1890	IEC60567	616.90		2.21	
1891	IEC60567	579		1.22	
1897	IEC60567	538		0.14	
6015		-----		-----	
6036	IEC60567	469		-1.67	
6053	IEC60567	576		1.14	
6063	IEC60567	565.40		0.86	
6067	IEC60567	536.315		0.10	
6071		430		-2.70	
6085	D3612	578		1.19	
6088	IEC60567	416.85		-3.04	
6124	IEC60567	521		-0.31	
6141	D3612	338	R(0.05)	-5.12	
6165	IEC60567	516		-0.44	
6207	IEC60567	130.39349	R(0.01)	-10.57	
6211	GB/T17623	576.50		1.15	
6212	D3612	546.647		0.37	
6216	IEC60567	983	R(0.01)	11.83	
8001	IEC60567	574.7		1.10	

normality	OK
n	50
outliers	3
mean (n)	532.70
st.dev. (n)	52.541
R(calc.)	147.11
st.dev.(IEC60567:11)	38.050
R(IEC60567:11)	106.54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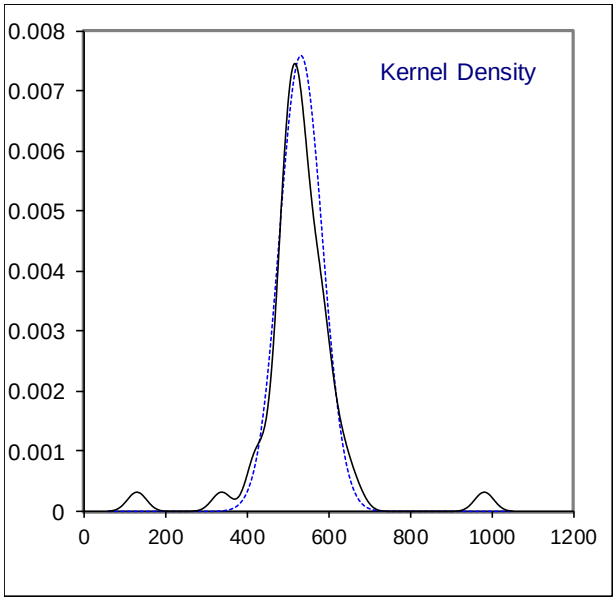
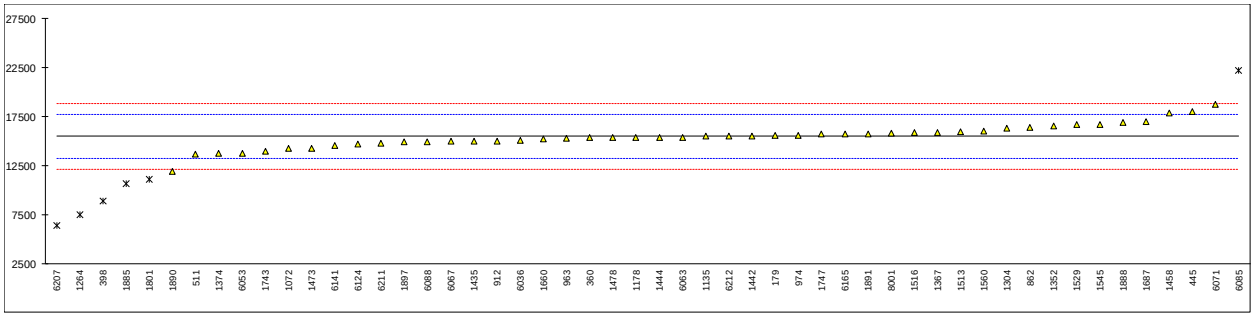
1000
800
600
400
200
0
6207 6141 6088 1885 6071 6036 1442 1458 1560 1888 1178 1264 1444 179 963 398 1435 1072 1545 912 974 1743 6165 1374 6124 1473 862 1687 1513 511 1367 6067 1801 1897 6212 445 1516 1478 6063 8001 6053 6211 6085 1891 1747 1660 1135 1529 1890 360 1304 1352 6216


Kernel Density
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0 200 400 600 800 1000 1200

Determination of Oxygen (O_2) on sample #18234; results in µl/L

lab	method	value	mark	z(targ)	remarks
179	D3612	15585		0.08	
237		-----		-----	
360	IEC60567	15344.2		-0.14	
398	IEC60567	8877	R(0.01)	-5.98	
445	IEC60567	17991.2	C	2.25	first reported 31998
511	D3612	13680		-1.64	
614		-----		-----	
862	IEC60567	16386.9		0.80	
912	D3612	15022	C	-0.43	first reported 5862
913		-----		-----	
962		-----		-----	
963	D3612	15327.9		-0.15	
974	D3612	15600		0.09	
1072	IEC60567	14293.1		-1.09	
1135	IEC60567	15499		0.00	
1178	IEC60567	15365.3		-0.12	
1264	D3612	7545	R(0.01)	-7.18	
1304	INH-120	16326.3		0.75	
1352	IEC60567	16551.0		0.95	
1367	D3612	15886.21		0.35	
1374	D3612	13740.2		-1.59	
1430		-----		-----	
1435	IEC60567	15008		-0.44	
1442	IEC60567	15552.0		0.05	
1444	IEC60567	15403.5		-0.09	
1458	D3612	17891		2.16	
1473	IEC60567	14300.1		-1.08	
1478	IEC60567	15356.13		-0.13	
1513	IEC60567	15993		0.45	
1516		15863.1		0.33	
1529	IEC60567	16700		1.09	
1545	D3612	16737.9		1.12	
1560	IEC60567	16051		0.50	
1660	IEC60567	15225		-0.25	
1687	IEC60567	16984.8		1.34	
1720		-----		-----	
1743	IEC60567	14000		-1.35	
1747	IEC60567	15729.57		0.21	
1801	IEC60567	11146.89	R(0.05)	-3.93	
1885	D3612	10700	C,R(0.05)	-4.33	first reported 11173
1888	IEC60567	16933.3		1.30	
1890	IEC60567	11897		-3.25	
1891	IEC60567	15769		0.24	
1897	IEC60567	14917		-0.53	
6015		-----		-----	
6036	IEC60567	15060		-0.40	
6053	IEC60567	13763		-1.57	
6063	IEC60567	15405.77		-0.08	
6067	IEC60567	14991.49		-0.46	
6071		18731		2.92	
6085	D3612	22249	R(0.01)	6.10	
6088	IEC60567	14924		-0.52	
6124	IEC60567	14718		-0.71	
6141	D3612	14546		-0.86	
6165	IEC60567	15763		0.24	
6207	IEC60567	6419.27820	R(0.01)	-8.20	
6211	GB/T17623	14768.64		-0.66	
6212	D3612	15512.267		0.01	
6216		-----		-----	
8001	IEC60567	15849.3		0.32	

normality	suspect
n	46
outliers	6
mean (n)	15498.74
st.dev. (n)	1199.291
R(calc.)	3358.02
st.dev.(IEC60567:11)	1107.053
R(IEC60567:11)	3099.75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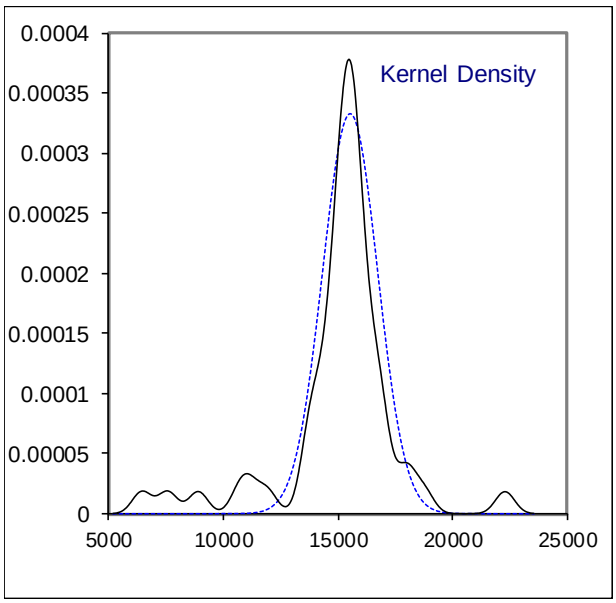
22500
17500
12500
7500
2500
6207 1264 398 1885 1801 1890 511 1374 6053 1743 1072 1473 6141 6124 6211 1897 6088 6067 1435 912 6036 1660 963 360 1478 1178 1444 6063 1135 6212 1442 179 974 1747 6165 1891 8001 1516 1367 1513 1560 1304 862 1352 1529 1545 1888 1687 1458 445 6071 6085


Kernel Density
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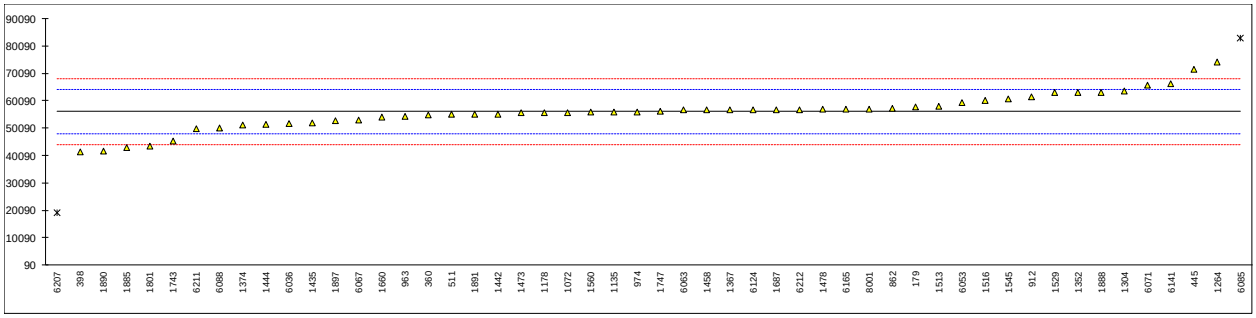
0.0003
0.00025
0.0002
0.00015
0.0001
0.00005
0
5000
10000
15000
20000
25000

Determination of Nitrogen (N_2) on sample #18234; results in µl/L

lab	method	value	mark	z(targ)	remarks
179	D3612	57952		0.46	
237		-----		-----	
360	IEC60567	54869.2		-0.31	
398	IEC60567	41457		-3.66	
445	IEC60567	71556.4	C	3.85	first reported 127287
511	D3612	55099		-0.25	
614		-----		-----	
862	IEC60567	57262.3		0.29	
912	D3612	61474	C	1.34	first reported 23413
913		-----		-----	
962		-----		-----	
963	D3612	54355.3		-0.44	
974	D3612	56062		-0.01	
1072	IEC60567	55765.9		-0.09	
1135	IEC60567	56038		-0.02	
1178	IEC60567	55697.7		-0.10	
1264	D3612	74158		4.50	
1304	INH-120	63535.2		1.85	
1352	IEC60567	63015.0		1.72	
1367	D3612	56836.36		0.18	
1374	D3612	51305.1		-1.20	
1430		-----		-----	
1435	IEC60567	51915		-1.05	
1442	IEC60567	55236.0		-0.22	
1444	IEC60567	51545.9		-1.14	
1458	D3612	56805		0.17	
1473	IEC60567	55685.7		-0.11	
1478	IEC60567	56973.61		0.21	
1513	IEC60567	58025		0.48	
1516		60316.8		1.05	
1529	IEC60567	63000		1.72	
1545	D3612	60728.7		1.15	
1560	IEC60567	55968		-0.04	
1660	IEC60567	54232		-0.47	
1687	IEC60567	56888.9		0.19	
1720		-----		-----	
1743	IEC60567	45500		-2.65	
1747	IEC60567	56369.54		0.06	
1801	IEC60567	43554.18		-3.13	
1885	D3612	42895		-3.30	
1888	IEC60567	63128.1		1.75	
1890	IEC60567	41651		-3.61	
1891	IEC60567	55228		-0.22	
1897	IEC60567	52849		-0.82	
6015		-----		-----	
6036	IEC60567	51767		-1.09	
6053	IEC60567	59455		0.83	
6063	IEC60567	56649.55		0.13	
6067	IEC60567	53152.135		-0.74	
6071		65828		2.42	
6085	D3612	82879	R(0.01)	6.68	
6088	IEC60567	50065		-1.51	
6124	IEC60567	56863		0.19	
6141	D3612	66414		2.57	
6165	IEC60567	56991		0.22	
6207	IEC60567	19225.30000	R(0.01)	-9.20	
6211	GB/T17623	49818.34		-1.57	
6212	D3612	56904.3		0.20	
6216		-----		-----	
8001	IEC60567	57029.4		0.23	

normality	suspect
n	50
outliers	2
mean (n)	56117.41
st.dev. (n)	6566.943
R(calc.)	18387.44
st.dev.(IEC60567:11)	4008.386
R(IEC60567:11)	11223.48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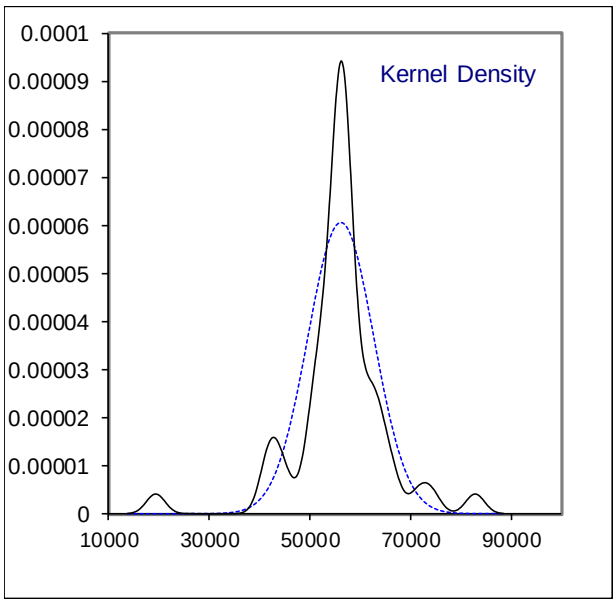
50090
40090
30090
20090
10090
90
6207 398 1890 1885 1801 1743 6211 6088 1374 1444 6036 1435 1897 6067 1660 963 360 511 1891 1442 1473 1178 1072 1560 1135 974 1747 6063 1458 1367 6124 1687 6212 1478 6165 8001 862 179 1513 6053 1516 1545 912 1529 1352 1888 1304 6071 6141 445 1264 6085


Kernel Density
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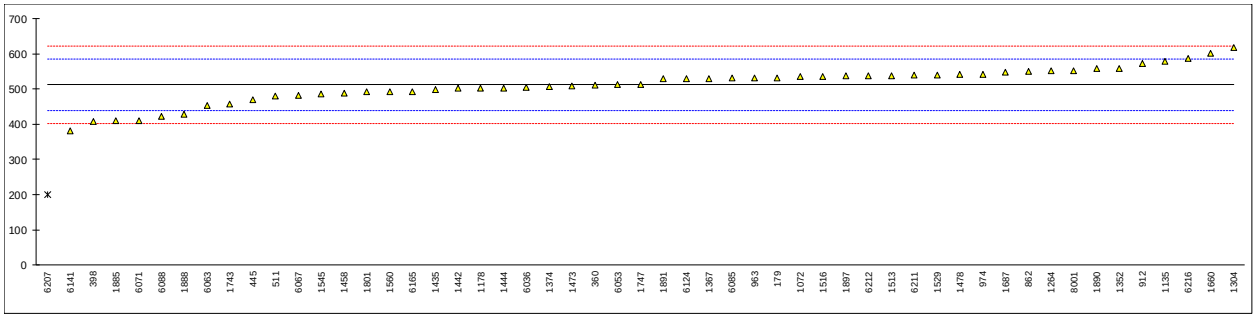
0.00006
0.00005
0.00004
0.00003
0.00002
0.00001
0
10000 30000 50000 70000 90000

Determination of Carbon Monoxide (CO) on sample #18234; results in µl/L

lab	method	value	mark	z(targ)	remarks
179	D3612	532		0.55	
237		-----		-----	
360	IEC60567	511.1		-0.02	
398	IEC60567	408.6		-2.82	
445	IEC60567	469.5	C	-1.16	first reported 419.64
511	D3612	479		-0.90	
614		-----		-----	
862	IEC60567	549.9		1.04	
912	D3612	572	C	1.64	first reported 237
913		-----		-----	
962		-----		-----	
963	D3612	531.80		0.55	
974	D3612	541		0.80	
1072	IEC60567	536.1		0.66	
1135	IEC60567	578		1.81	
1178	IEC60567	502.96		-0.24	
1264	D3612	551		1.07	
1304	INH-120	618.0		2.90	
1352	IEC60567	559.0		1.29	
1367	D3612	530.05		0.50	
1374	D3612	505.7		-0.17	
1430		-----		-----	
1435	IEC60567	499		-0.35	
1442	IEC60567	502.5		-0.26	
1444	IEC60567	503.18089		-0.24	
1458	D3612	489		-0.63	
1473	IEC60567	507.8		-0.11	
1478	IEC60567	540.87		0.79	
1513	IEC60567	538.54		0.73	
1516		536.4		0.67	
1529	IEC60567	540		0.77	
1545	D3612	486.7		-0.69	
1560	IEC60567	492		-0.54	
1660	IEC60567	601		2.44	
1687	IEC60567	547.0		0.96	
1720		-----		-----	
1743	IEC60567	457		-1.50	
1747	IEC60567	512.25		0.01	
1801	IEC60567	491.86		-0.55	
1885	D3612	409	C	-2.81	first reported 132
1888	IEC60567	429.3		-2.26	
1890	IEC60567	558.8		1.28	
1891	IEC60567	530		0.50	
1897	IEC60567	537		0.69	
6015		-----		-----	
6036	IEC60567	505		-0.19	
6053	IEC60567	512		0.00	
6063	IEC60567	453.22		-1.60	
6067	IEC60567	481.185		-0.84	
6071		410		-2.79	
6085	D3612	531		0.52	
6088	IEC60567	421.37		-2.48	
6124	IEC60567	530		0.50	
6141	D3612	381		-3.58	
6165	IEC60567	492		-0.54	
6207	IEC60567	199.52482	R(0.01)	-8.54	
6211	GB/T17623	539.69		0.76	
6212	D3612	538.057		0.72	
6216	IEC60567	586		2.03	
8001	IEC60567	551.7		1.09	

normality	OK
n	52
outliers	1
mean (n)	511.87
st.dev. (n)	50.181
R(calc.)	140.51
st.dev.(IEC60567:11)	36.562
R(IEC60567:11)	102.37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600
500
400
300
200
100
0
6207
6141
398
1885
6071
6088
1888
6063
1743
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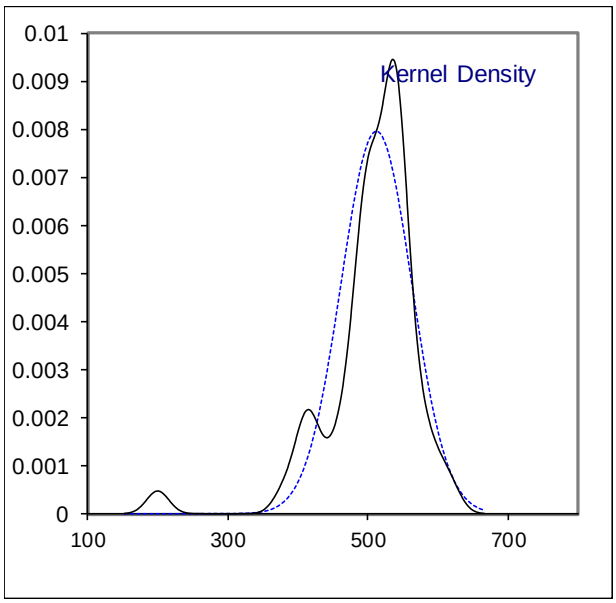
511
6067
1545
1458
1801
1560
6165
1435
1442
1178
1444
6036
1374
1473
360
6053
1747
1891
6124
1367
6085
963
179
1072
1516
1897
6212
1513
6211
1529
1478
974
1687
862
1264
8001
1890
1352
912
1135
6216
1660
1304


Kernel Density
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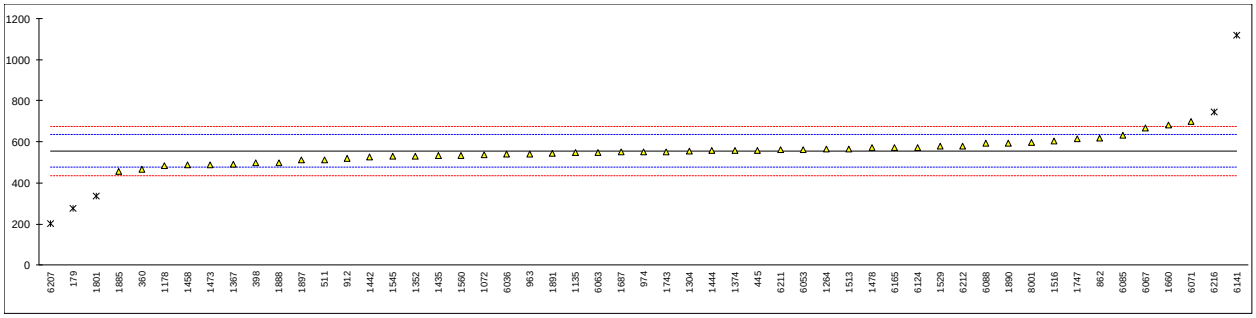
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
100
300
500
700

Determination of Carbon Dioxide (CO_2) on sample #18234; results in µl/L

lab	method	value	mark	z(targ)	remarks
179	D3612	276	R(0.01)	-7.04	
237		-----		-----	
360	IEC60567	466.6		-2.23	
398	IEC60567	497.8		-1.44	
445	IEC60567	559.1	C	0.10	first reported 433.43
511	D3612	513		-1.06	
614		-----		-----	
862	IEC60567	618.2		1.59	
912	D3612	519	C	-0.91	first reported 279
913		-----		-----	
962		-----		-----	
963	D3612	542.2		-0.32	
974	D3612	551		-0.10	
1072	IEC60567	536.2		-0.47	
1135	IEC60567	548		-0.18	
1178	IEC60567	485.6		-1.75	
1264	D3612	564		0.23	
1304	INH-120	554.6		-0.01	
1352	IEC60567	531.0		-0.60	
1367	D3612	493.01		-1.56	
1374	D3612	557.5		0.06	
1430		-----		-----	
1435	IEC60567	533		-0.55	
1442	IEC60567	527.0		-0.71	
1444	IEC60567	556.92388		0.05	
1458	D3612	487		-1.71	
1473	IEC60567	487.6		-1.70	
1478	IEC60567	570.96		0.40	
1513	IEC60567	565		0.25	
1516		603.9		1.23	
1529	IEC60567	580		0.63	
1545	D3612	528.3		-0.67	
1560	IEC60567	534		-0.53	
1660	IEC60567	680		3.15	
1687	IEC60567	550.3		-0.12	
1720		-----		-----	
1743	IEC60567	551		-0.10	
1747	IEC60567	613.34		1.47	
1801	IEC60567	334.57	R(0.05)	-5.56	
1885	D3612	455	C	-2.52	first reported 294
1888	IEC60567	497.9		-1.44	
1890	IEC60567	595.1		1.01	
1891	IEC60567	545		-0.25	
1897	IEC60567	512		-1.08	
6015		-----		-----	
6036	IEC60567	540		-0.38	
6053	IEC60567	563		0.20	
6063	IEC60567	548.58		-0.16	
6067	IEC60567	666.14		2.80	
6071		701		3.68	
6085	D3612	631		1.92	
6088	IEC60567	592.77		0.95	
6124	IEC60567	574		0.48	
6141	D3612	1120	R(0.01)	14.25	
6165	IEC60567	573		0.45	
6207	IEC60567	202.78964	R(0.01)	-8.88	
6211	GB/T17623	561.01		0.15	
6212	D3612	580.968		0.66	
6216	IEC60567	745	R(0.05)	4.79	
8001	IEC60567	597.5		1.07	

normality	suspect
n	48
outliers	5
mean (n)	554.98
st.dev. (n)	51.222
R(calc.)	143.42
st.dev.(IEC60567:11)	39.642
R(IEC60567:11)	111.00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800
600
400
200
0
6207
179
1801
1885
360
1178
1458
1473
1367
398
1888
1897
511
912
1442
1545
1352
1435
1560
1072
6036
963
1891
1135
6063
1687
974
1743
1304
1444
1374
445
6211
6053
1264
1513
1478
6165
6124
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1890
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6085
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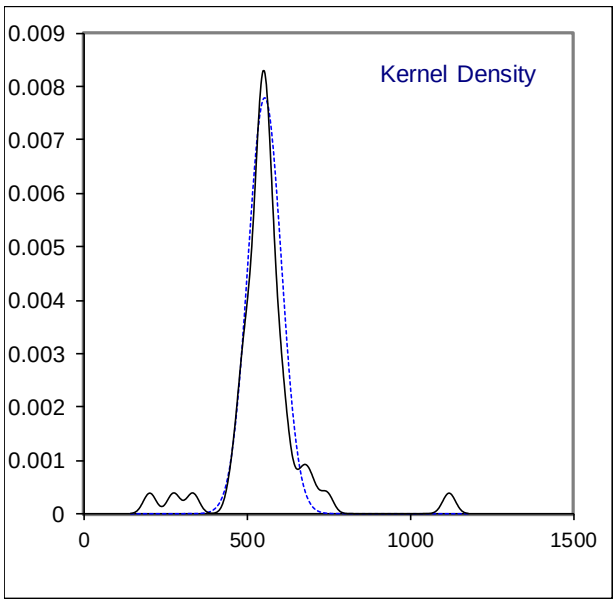
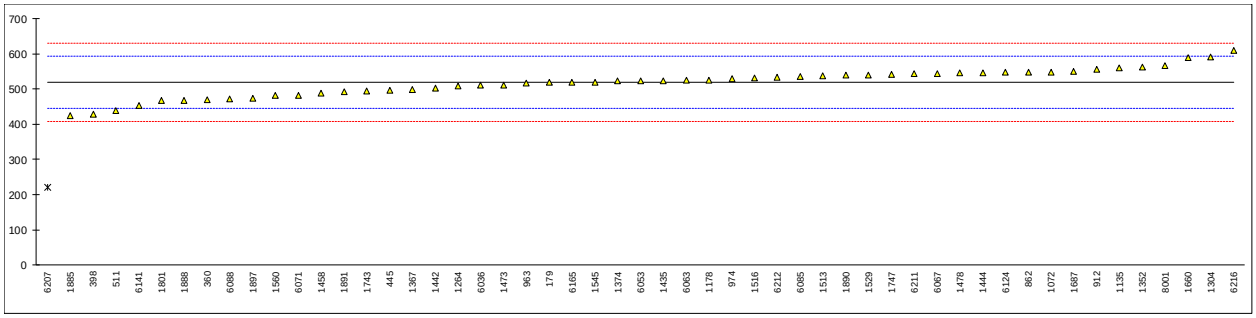
6141


Kernel Density
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0
500
1000
1500

Determination of Methane (CH_4) on sample #18234; results in µl/L

lab	method	value	mark	z(targ)	remarks
179	D3612	519		0.02	
237		-----		-----	
360	IEC60567	469.5		-1.32	
398	IEC60567	428.1		-2.44	
445	IEC60567	496.4	C	-0.59	first reported 467.69
511	D3612	439		-2.14	
614		-----		-----	
862	IEC60567	547.2		0.78	
912	D3612	557	C	1.05	first reported 250
913		-----		-----	
962		-----		-----	
963	D3612	516.00		-0.06	
974	D3612	529		0.29	
1072	IEC60567	548.3		0.81	
1135	IEC60567	561		1.15	
1178	IEC60567	526.17		0.21	
1264	D3612	509		-0.25	
1304	INH-120	591.1		1.97	
1352	IEC60567	563.0		1.21	
1367	D3612	498.49		-0.53	
1374	D3612	522.2		0.11	
1430		-----		-----	
1435	IEC60567	524		0.16	
1442	IEC60567	502.0		-0.44	
1444	IEC60567	546.61044		0.77	
1458	D3612	488		-0.82	
1473	IEC60567	511.7		-0.18	
1478	IEC60567	544.81		0.72	
1513	IEC60567	536.77		0.50	
1516		531.2		0.35	
1529	IEC60567	540		0.59	
1545	D3612	519.1		0.02	
1560	IEC60567	482		-0.98	
1660	IEC60567	589		1.91	
1687	IEC60567	549.2		0.84	
1720		-----		-----	
1743	IEC60567	495		-0.63	
1747	IEC60567	541.65		0.63	
1801	IEC60567	467.36		-1.37	
1885	D3612	425	C	-2.52	first reported 207
1888	IEC60567	468.5		-1.34	
1890	IEC60567	539.3		0.57	
1891	IEC60567	492		-0.71	
1897	IEC60567	473		-1.22	
6015		-----		-----	
6036	IEC60567	510		-0.22	
6053	IEC60567	523		0.13	
6063	IEC60567	525.28		0.19	
6067	IEC60567	543.47		0.68	
6071		483		-0.95	
6085	D3612	536		0.48	
6088	IEC60567	470.89		-1.28	
6124	IEC60567	547		0.78	
6141	D3612	454		-1.74	
6165	IEC60567	519		0.02	
6207	IEC60567	220.77907	R(0.01)	-8.04	
6211	GB/T17623	543.39		0.68	
6212	D3612	532.481		0.38	
6216	IEC60567	609		2.45	
8001	IEC60567	566.2		1.30	

normality	OK
n	52
outliers	1
mean (n)	518.26
st.dev. (n)	39.674
R(calc.)	111.09
st.dev.(IEC60567:11)	37.018
R(IEC60567:11)	103.65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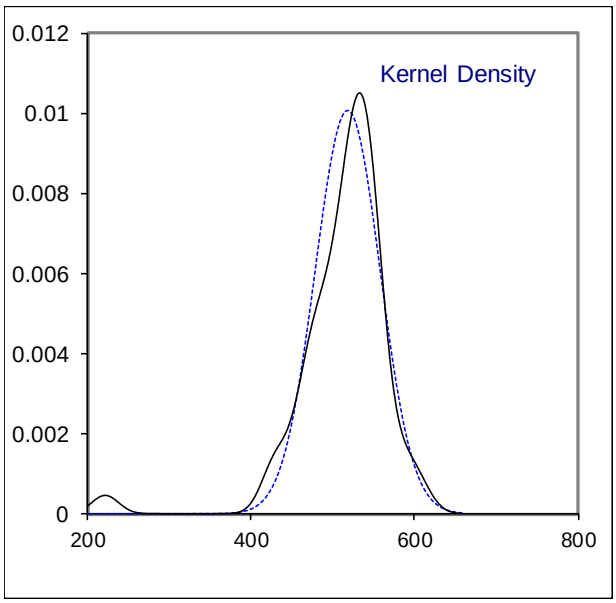
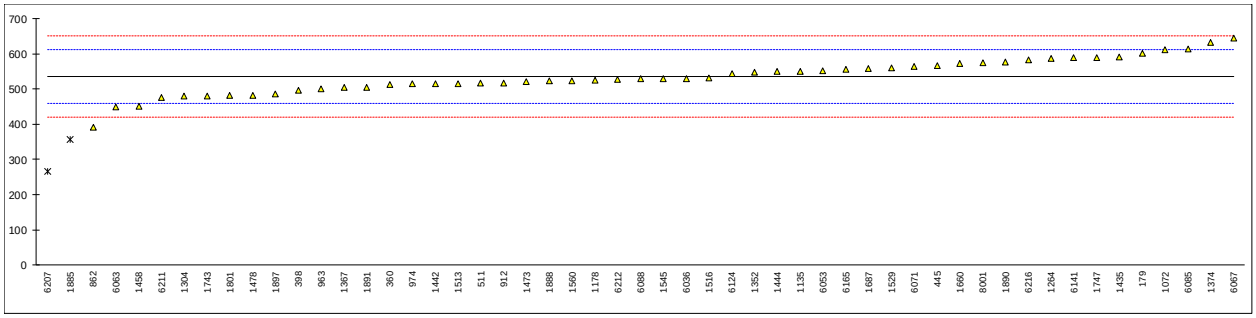
600
500
400
300
200
100
0
6207 1885 398 511 6141 1801 1888 360 6088 1897 1560 6071 1458 1891 1743 445 1367 1442 1264 6036 1473 963 179 6165 1545 1374 6053 1435 6063 1178 974 1516 6212 6085 1513 1890 1529 1747 6211 6067 1478 1444 6124 862 1072 1687 912 1135 1352 8001 1660 1304 6216


Kernel Density
0.012
0.01
0.008
0.006
0.004
0.002
0
200
400
600
800

Determination of Ethane (C_2H_6) on sample #18234; results in µl/L

lab	method	value	mark	z(targ)	remarks
179	D3612	602		1.73	
237		-----		-----	
360	IEC60567	512.0		-0.62	
398	IEC60567	496.4		-1.03	
445	IEC60567	566.6	C	0.80	first reported 528.9
511	D3612	516		-0.52	
614		-----		-----	
862	IEC60567	391.8		-3.76	
912	D3612	517	C	-0.49	first reported 245
913		-----		-----	
962		-----		-----	
963	D3612	500.30		-0.93	
974	D3612	514		-0.57	
1072	IEC60567	611.3		1.97	
1135	IEC60567	550		0.37	
1178	IEC60567	524.93		-0.29	
1264	D3612	587		1.34	
1304	INH-120	480.4		-1.45	
1352	IEC60567	548.0		0.32	
1367	D3612	504.24		-0.83	
1374	D3612	633.2		2.54	
1430		-----		-----	
1435	IEC60567	592		1.47	
1442	IEC60567	515.5		-0.53	
1444	IEC60567	549.34569		0.35	
1458	D3612	452		-2.19	
1473	IEC60567	520.1		-0.41	
1478	IEC60567	482.67		-1.39	
1513	IEC60567	515.91		-0.52	
1516		531.0		-0.13	
1529	IEC60567	560		0.63	
1545	D3612	528.7		-0.19	
1560	IEC60567	524		-0.31	
1660	IEC60567	573		0.97	
1687	IEC60567	557.5		0.56	
1720		-----		-----	
1743	IEC60567	481		-1.43	
1747	IEC60567	588.94		1.39	
1801	IEC60567	481.73		-1.41	
1885	D3612	357	C,R(0.05)	-4.67	first reported 207
1888	IEC60567	523.5		-0.32	
1890	IEC60567	575.7		1.04	
1891	IEC60567	505		-0.81	
1897	IEC60567	486		-1.30	
6015		-----		-----	
6036	IEC60567	529		-0.18	
6053	IEC60567	553		0.45	
6063	IEC60567	449.82		-2.25	
6067	IEC60567	643.955		2.82	
6071		565		0.76	
6085	D3612	613		2.01	
6088	IEC60567	528.52		-0.19	
6124	IEC60567	544		0.21	
6141	D3612	588		1.36	
6165	IEC60567	556		0.53	
6207	IEC60567	265.89513	R(0.01)	-7.05	
6211	GB/T17623	476.54		-1.55	
6212	D3612	527.478		-0.22	
6216	IEC60567	582		1.20	
8001	IEC60567	575.2		1.03	

normality	OK
n	51
outliers	2
mean (n)	535.89
st.dev. (n)	49.110
R(calc.)	137.51
st.dev.(IEC60567:11)	38.278
R(IEC60567:11)	107.18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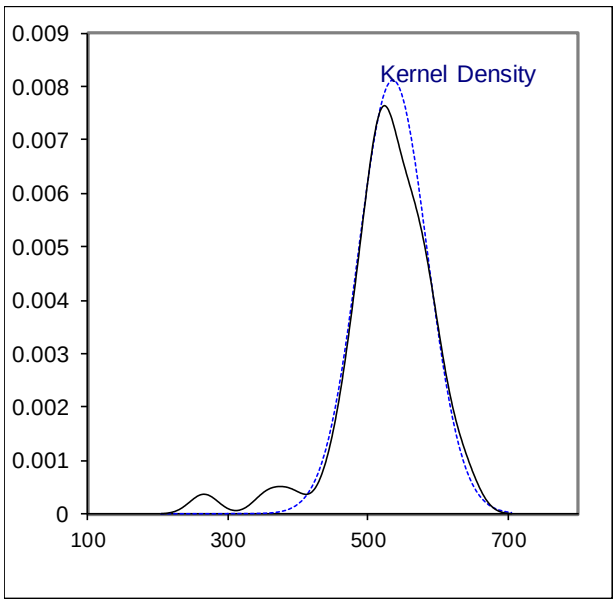
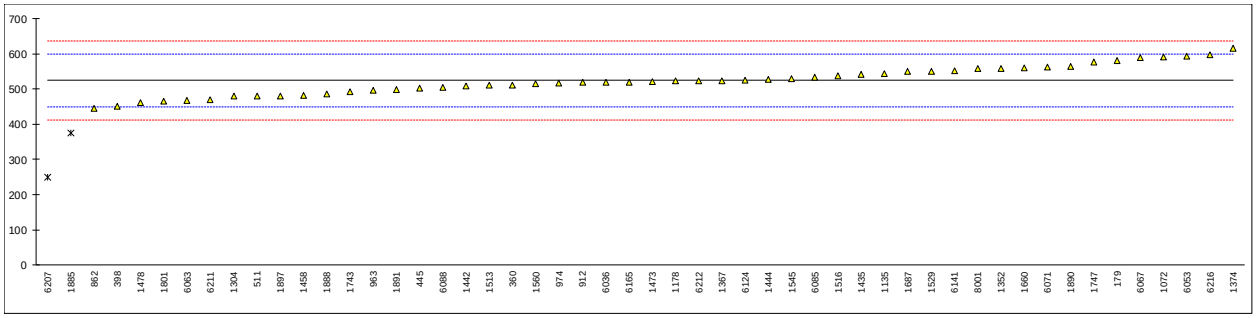
600
500
400
300
200
100
0
6207 1885 862 6053 1458 6211 1304 1743 1801 1478 1897 398 963 1367 1891 360 974 1442 1513 511 912 1473 1888 1560 1178 6212 6088 1545 6036 1516 6124 1352 1444 1135 6053 6165 1687 1529 6071 445 1660 8001 1890 6216 1264 6141 1747 1435 179 1072 6085 1374 6067


Kernel Density
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
100
300
500
700

Determination of Ethene / Ethylene (C_2H_4) on sample #18234; results in µl/L

lab	method	value	mark	z(targ)	remarks
179	D3612	580		1.49	
237		-----		-----	
360	IEC60567	511.5		-0.34	
398	IEC60567	450.4		-1.97	
445	IEC60567	503.3	C	-0.56	first reported 497.3
511	D3612	480		-1.18	
614		-----		-----	
862	IEC60567	444.7		-2.13	
912	D3612	520	C	-0.12	first reported 303
913		-----		-----	
962		-----		-----	
963	D3612	496.10		-0.75	
974	D3612	517		-0.20	
1072	IEC60567	591.7		1.80	
1135	IEC60567	543		0.50	
1178	IEC60567	522.56		-0.05	
1264	D3612	-----	W	-----	first reported 501
1304	INH-120	479.3		-1.20	
1352	IEC60567	559.0		0.92	
1367	D3612	523.99		-0.01	
1374	D3612	615.9		2.44	
1430		-----		-----	
1435	IEC60567	541		0.44	
1442	IEC60567	508.5		-0.42	
1444	IEC60567	528.21157		0.10	
1458	D3612	483		-1.10	
1473	IEC60567	521.9		-0.07	
1478	IEC60567	462.09		-1.66	
1513	IEC60567	509.86		-0.39	
1516		537.8		0.36	
1529	IEC60567	550		0.68	
1545	D3612	529.8		0.15	
1560	IEC60567	515		-0.25	
1660	IEC60567	561		0.98	
1687	IEC60567	549.4		0.67	
1720		-----		-----	
1743	IEC60567	493		-0.84	
1747	IEC60567	576.90		1.40	
1801	IEC60567	466.08		-1.56	
1885	D3612	376	C,R(0.05)	-3.96	first reported 294
1888	IEC60567	486.2		-1.02	
1890	IEC60567	563.8		1.05	
1891	IEC60567	498		-0.70	
1897	IEC60567	481		-1.16	
6015		-----		-----	
6036	IEC60567	520		-0.12	
6053	IEC60567	594		1.86	
6063	IEC60567	467.57		-1.52	
6067	IEC60567	588.39		1.71	
6071		562		1.00	
6085	D3612	533		0.23	
6088	IEC60567	505.27		-0.51	
6124	IEC60567	526		0.04	
6141	D3612	552		0.74	
6165	IEC60567	520		-0.12	
6207	IEC60567	250.35796	R(0.01)	-7.32	
6211	GB/T17623	470.17		-1.45	
6212	D3612	523.346		-0.03	
6216	IEC60567	598		1.97	
8001	IEC60567	557.7		0.89	

normality	OK
n	50
outliers	2
mean (n)	524.37
st.dev. (n)	40.699
R(calc.)	113.96
st.dev.(IEC60567:11)	37.455
R(IEC60567:11)	104.87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600
500
400
300
200
100
0
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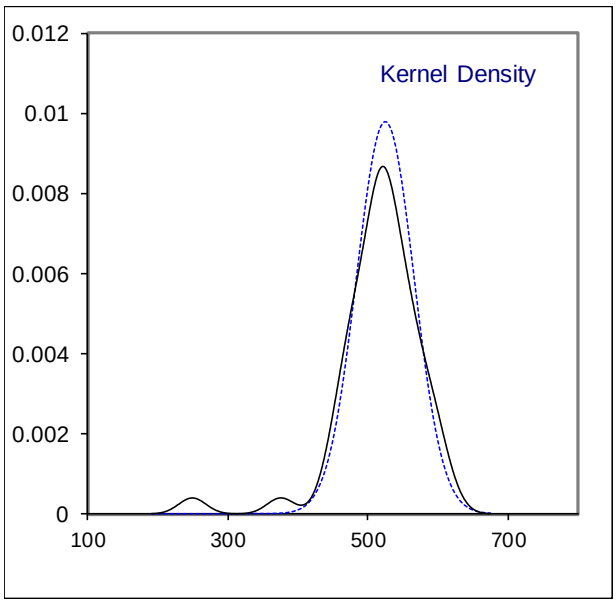
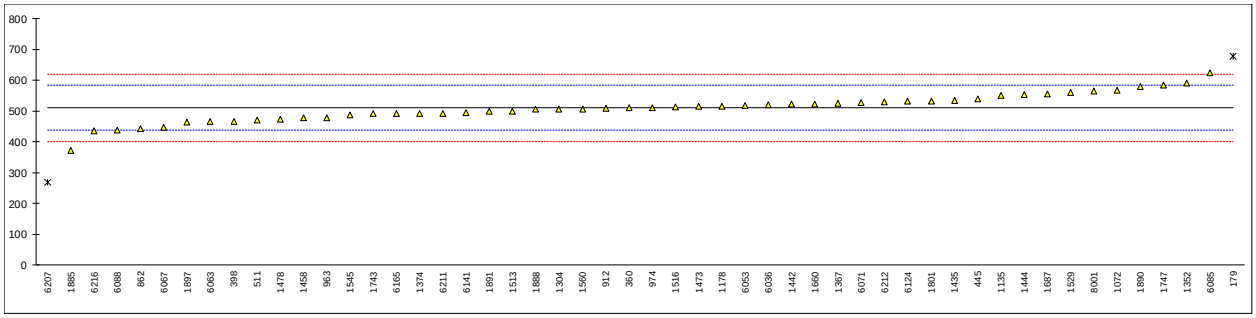

Kernel Density
0.012
0.01
0.008
0.006
0.004
0.002
0
100
300
500
700

Determination of Ethyn /Acetylene (C_2H_2) on sample #18234; results in µl/L

lab	method	value	mark	z(targ)	remarks
179	D3612	677	R(0.05)	4.58	
237		-----		-----	
360	IEC60567	511.0		0.02	
398	IEC60567	466.4		-1.20	
445	IEC60567	539.1	C	0.79	first reported 502.8
511	D3612	470		-1.10	
614		-----		-----	
862	IEC60567	442.5		-1.86	
912	D3612	508	C	-0.06	first reported 186
913		-----		-----	
962		-----		-----	
963	D3612	478.30		-0.87	
974	D3612	512		0.05	
1072	IEC60567	566.9		1.56	
1135	IEC60567	552		1.15	
1178	IEC60567	516.74		0.18	
1264	D3612	-----	W	-----	first reported 482
1304	INH-120	505.7		-0.12	
1352	IEC60567	592.0		2.25	
1367	D3612	525.26		0.41	
1374	D3612	493	C	-0.47	first reported 641.7
1430		-----		-----	
1435	IEC60567	535		0.68	
1442	IEC60567	522.0		0.32	
1444	IEC60567	553.94086		1.20	
1458	D3612	477		-0.91	
1473	IEC60567	515.3		0.14	
1478	IEC60567	474.36		-0.98	
1513	IEC60567	498.50		-0.32	
1516		513.4		0.09	
1529	IEC60567	560		1.37	
1545	D3612	486.4		-0.65	
1560	IEC60567	507		-0.09	
1660	IEC60567	523		0.35	
1687	IEC60567	555.9		1.26	
1720		-----		-----	
1743	IEC60567	492		-0.50	
1747	IEC60567	583.32		2.01	
1801	IEC60567	533.075		0.63	
1885	D3612	372	C	-3.79	first reported 288
1888	IEC60567	505.1		-0.14	
1890	IEC60567	579.3		1.90	
1891	IEC60567	498		-0.33	
1897	IEC60567	463		-1.29	
6015		-----		-----	
6036	IEC60567	520		0.27	
6053	IEC60567	519		0.24	
6063	IEC60567	465.66		-1.22	
6067	IEC60567	447.76		-1.71	
6071		528		0.49	
6085	D3612	624		3.12	
6088	IEC60567	437.97		-1.98	
6124	IEC60567	532		0.60	
6141	D3612	494		-0.44	
6165	IEC60567	492		-0.50	
6207	IEC60567	268.91675	R(0.01)	-6.62	
6211	GB/T17623	493.18		-0.47	
6212	D3612	528.919		0.51	
6216	IEC60567	434.9		-2.07	
8001	IEC60567	564.1		1.48	

normality	suspect
n	50
outliers	2
mean (n)	510.16
st.dev. (n)	45.188
R(calc.)	126.53
st.dev.(IEC60567:11)	36.440
R(IEC60567:11)	102.03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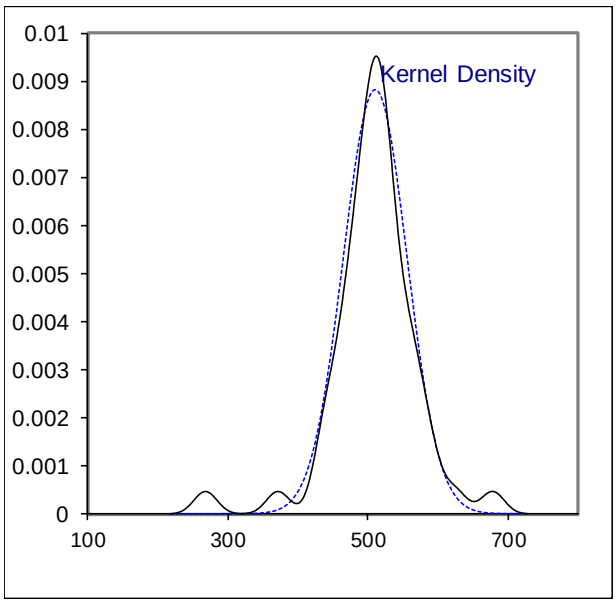
700
600
500
400
300
200
100
0
6207 1885 6216 6088 862 6067 1897 6063 398 511 1478 1458 963 1545 1743 6165 1374 6211 6141 1891 1513 1888 1304 1560 912 360 974 1516 1473 1178 6053 6036 1442 1660 1367 6071 6212 6124 1801 1435 445 1135 1444 1687 1529 8001 1072 1890 1747 1352 6085 179

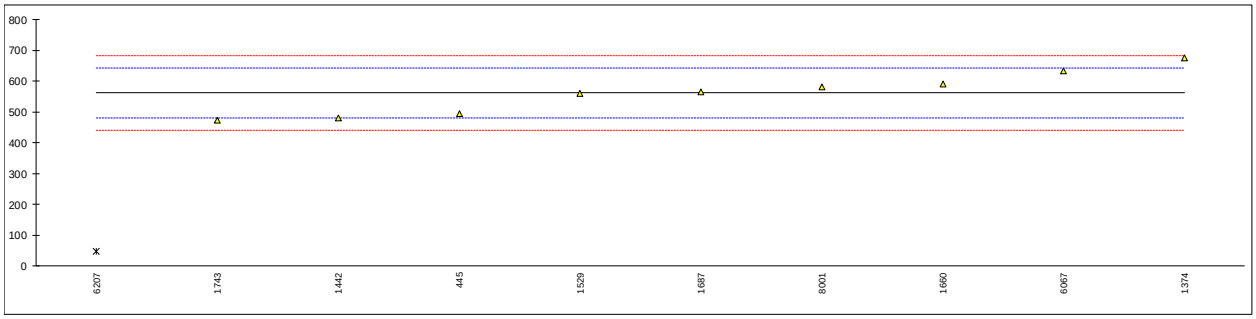

Kernel Density
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
100
300
500
700

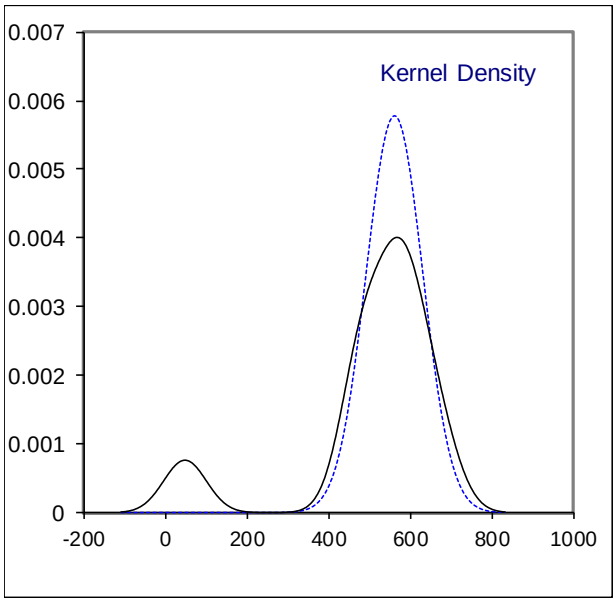
Determination of Propane (C_3H_8) on sample #18234; results in µl/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
360		-----		-----	
398		-----		-----	
445		-----		-----	
511		-----		-----	
614		-----		-----	
862		-----		-----	
912	D3612	540	ex,C	-----	first reported 297, possibly false positive test result? ex see § 4.1
913		-----		-----	
962		-----		-----	
963		-----		-----	
974	D3612	458	ex,C	-----	first reported 518, possibly false positive test result? ex see § 4.1
1072		-----		-----	
1135		-----		-----	
1178		-----		-----	
1264		-----		-----	
1304		-----		-----	
1352	IEC60567	625.0	ex	-----	possibly false positive test result? ex see § 4.1
1367		-----		-----	
1374	D3612	0.5		-----	
1430		-----		-----	
1435		-----		-----	
1442	IEC60567	<1		-----	
1444		-----		-----	
1458		-----		-----	
1473		-----		-----	
1478		-----		-----	
1513		-----		-----	
1516		-----		-----	
1529	IEC60567	0.82		-----	
1545		-----		-----	
1560		-----		-----	
1660	IEC60567	1		-----	
1687	IEC60567	2.0		-----	
1720		-----		-----	
1743	IEC60567	0.16		-----	
1747	IEC60567	Nil		-----	
1801		-----		-----	
1885		-----		-----	
1888		-----		-----	
1890		-----		-----	
1891		-----		-----	
1897		-----		-----	
6015		-----		-----	
6036		-----		-----	
6053		-----		-----	
6063		-----		-----	
6067	IEC60567	0	C	-----	first reported 670.745
6071		-----		-----	
6085	D3612	705	ex	-----	possibly false positive test result? ex see § 4.1
6088		-----		-----	
6124		-----		-----	
6141	D3612	609	ex	-----	possibly false positive test result? ex see § 4.1
6165		-----		-----	
6207	IEC60567	0.0		-----	
6211		-----		-----	
6212	D3612	-----	W	-----	first reported 535.68
6216		-----		-----	
8001	IEC60567	0		-----	
	normality	not OK			
	n	10			
	outliers	0 +5ex			
	mean (n)	<10			
	st.dev. (n)	n.a.			
	R(calc.)	n.a.			
	st.dev.(IEC60567:11)	n.a.			
	R(IEC60567:11)	n.a.			

Determination of Propene (C_3H_6) on sample #18234; results in µl/L

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
360		-----		-----	
398		-----		-----	
445	IEC60567	493.9		-1.69	
511		-----		-----	
614		-----		-----	
862		-----		-----	
912		-----		-----	
913		-----		-----	
962		-----		-----	
963		-----		-----	
974		-----		-----	
1072		-----		-----	
1135		-----		-----	
1178		-----		-----	
1264		-----		-----	
1304		-----		-----	
1352		-----		-----	
1367		-----		-----	
1374	D3612	675.5		2.84	
1430		-----		-----	
1435		-----		-----	
1442	IEC60567	479.5	C	-2.04	first reported 279.5
1444		-----		-----	
1458		-----		-----	
1473		-----		-----	
1478		-----		-----	
1513		-----		-----	
1516		-----		-----	
1529	IEC60567	560		-0.04	
1545		-----		-----	
1560		-----		-----	
1660	IEC60567	591		0.74	
1687	IEC60567	565.8		0.11	
1720		-----		-----	
1743	IEC60567	474		-2.18	
1747	IEC60567	-----	W	-----	first reported Nil
1801		-----		-----	
1885		-----		-----	
1888		-----		-----	
1890		-----		-----	
1891		-----		-----	
1897		-----		-----	
6015		-----		-----	
6036		-----		-----	
6053		-----		-----	
6063		-----		-----	
6067	IEC60567	632.514	C	1.77	first reported 0
6071		-----		-----	
6085		-----		-----	
6088		-----		-----	
6124		-----		-----	
6141		-----		-----	
6165		-----		-----	
6207	IEC60567	48.65925	D(0.01)	-12.79	
6211		-----		-----	
6212		-----		-----	
6216		-----		-----	
8001	IEC60567	581.4		0.50	
	normality	OK			
	n	9			
	outliers	1			
	mean (n)	561.51			
	st.dev. (n)	69.170			
	R(calc.)	193.68			
	st.dev.(IEC60567:11)	40.108			
	R(IEC60567:11)	112.30			


800
700
600
500
400
300
200
100
0
6207
1743
1442
445
1529
1687
8001
1660
6067
1374


Kernel Density
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
-200
0
200
400
600
800
1000

APPENDIX 2

Analytical details

lab	Type of syringe (mL)	Extraction method
179	100	Stripper Column
237	---	---
360	100	Head Space
398	50	Head Space
445	50	Head Space
511	50	Head Space
614	---	---
862	---	---
912	---	---
913	---	---
962	---	---
963	50	Head Space
974	100	Head Space
1072	100	Toepler
1135	50	Head Space
1178	100	Head Space
1264	100	Head Space
1304	50	Head Space
1352	100	TOGA/GC system
1367	100	Head Space
1374	50	Head Space
1430	---	---
1435	50	Head Space
1442	50	Head Space
1444	---	---
1458	100	Stripper Column
1473	50	Head Space
1478	100	Toepler
1513	100	Toepler
1516	50	Head Space
1529	100	Head Space
1545	100	Head Space
1560	100	Head Space
1660	50	Head Space
1687	100	Head Space
1720	---	---
1743	100	Head Space
1747	50	Head Space
1801	50	Head Space
1885	100	Toepler
1888	---	---
1890	100	Head Space
1891	50	Head Space
1897	50	Head Space
6015	---	---
6036	50	Head Space
6053	---	---
6063	100	Toepler
6067	100	Head Space
6071	---	---
6085	50	Head Space
6088	100	Head Space
6124	50	Stripper Column
6141	100	Head Space
6165	50	Head Space
6207	100	Head Space
6211	100	Head Space
6212	100	Head Space
6216	50	Head Space
8001	100	Head Space

APPENDIX 3

Number of participants per country

7 labs in	AUSTRALIA
3 labs in	BELGIUM
1 lab in	BULGARIA
2 labs in	CHINA, People's Republic
1 lab in	CROATIA
1 lab in	FRANCE
3 labs in	GERMANY
1 lab in	GREECE
1 lab in	HONG KONG
3 labs in	INDIA
2 labs in	ITALY
1 lab in	KINGDOM OF BAHRAIN
1 lab in	MALAYSIA
1 lab in	MEXICO
1 lab in	MOROCCO
1 lab in	NETHERLANDS
1 lab in	NIGERIA
1 lab in	PERU
2 labs in	PORTUGAL
1 lab in	QATAR
4 labs in	SAUDI ARABIA
3 labs in	SINGAPORE
2 labs in	SLOVENIA
1 lab in	SOUTH KOREA
5 labs in	SPAIN
1 lab in	SUDAN
1 lab in	SWITZERLAND
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	= possibly an error in calculations
ex	= test result excluded from statistical evaluations
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, June 2018
2 ASTM E178:02
3 ASTM E1301:95(2003)
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7 M. Thompson and R. Wood, J. AOAC Int, 76, 926, (1993)
8 W.J. Youden and E.H. Steiner, Statistical Manual of the AOAC, (1975)
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 P.J. Lowthian and M. Thompson, The Royal Society of Chemistry, Analyst, 127, 1359-1364 (2002)
15 Bernard Rosner, Percentage Points for a Generalized ESD Many-Outlier Procedure, *Technometrics*, 25(2), 165-172, (1983).