# Results of Proficiency Test
## Free and Released
## Formaldehyde in textile
## October 2013

**CONTENTS**

Appendices:

# 1    INTRODUCTION

Since the 1990's, many countries have adopted environmental standards and requirements restricting the use of harmful chemicals in the production of textiles and clothing. Laws and regulations impose some of these standards and requirements. In addition to mandatory environmental standards and requirements for textiles, there are some Ecolabelling schemes imposing environmental requirements for textile products on a voluntary basis. Well known programs are for instance Milieukeur (the Netherlands), Öko-Tex Standard 100 (Germany) and Thai Green Label (Thailand).
Since several years, the Institute for Interlaboratory Studies (iis) organises a proficiency scheme for Free Formaldehyde in textile. Also, this year this scheme is part of the proficiency testing program 2013/2014. In the 2013/2014 program it was decided to extend the Free Formaldehyde proficiency test with a scheme for Released Formaldehyde.
In this interlaboratory study 178 laboratories in 38 different countries participated. See appendix 2 for the number of participating laboratories per country.
In this report, the results of the 2013 proficiency test are presented and discussed.

# 2    SET UP

The Institute for Interlaboratory Studies in Spijkenisse was the organiser of this proficiency test. Sample preparation and analyses of fit for use and homogeneity were subcontracted. In this Proficiency Test, it was decided to use two different samples (#13190 and #13191, each approx. 3 grams) which were treated to find two different concentration levels of Free Formaldehyde. Both samples are also suitable to determine Released Formaldehyde. Participants were requested to report results with one extra figure. These unrounded results were preferably used for the statistical evaluations.

## 2.1   QUALITY SYSTEM

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, has implemented a quality system based on ISO 17043:2010. 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.

## 2.2   PROTOCOL

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

### 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

The two different hosiery fabric textile samples (labelled sample #13190 and #13191) were divided over 180 subsamples of approx. 3 grams.
The homogeneity of both samples was checked on respective 8 and 15 randomly selected samples. The homogeneity testing was performed by a subcontracted ISO17025 accredited laboratory. See the following tables for the test results.

|  | Free Formaldehyde in mg/kg |  | Free Formaldehyde in mg/kg |
|---|---|---|---|
| Sample #13190-1 | 245 | Sample #13191-1 | 46 |
| Sample #13190-2 | 299 | Sample #13191-2 | 49 |
| Sample #13190-3 | 288 | Sample #13191-3 | 48 |
| Sample #13190-4 | 282 | Sample #13191-4 | 50 |
| Sample #13190-5 | 267 | Sample #13191-5 | 48 |
| Sample #13190-6 | 282 | Sample #13191-6 | 44 |
| Sample #13190-7 | 297 | Sample #13191-7 | 46 |
| Sample #13190-8 | 292 | Sample #13191-8 | 45 |
|  | -- | Sample #13191-9 | 49 |
|  | -- | Sample #13191-10 | 45 |
|  | -- | Sample #13191-11 | 48 |
|  | -- | Sample #13191-12 | 47 |
|  | -- | Sample #13191-13 | 45 |
|  | -- | Sample #13191-14 | 46 |
|  | -- | Sample #13191-15 | 47 |

Table 1: homogeneity test results of subsamples #13190 and #13191

From the above test results, the repeatabilities were calculated and compared with 0.3 times the corresponding reproducibility in agreement with the procedure of ISO 13528 (Annex B2) or with the repeatability of the reference method, in the next table:

|  | Free Formaldehyde in mg/kg Sample #13190 | Free Formaldehyde in mg/kg Sample#13191 |
|---|---|---|
| r | 5 | 1 |
| Reference test method | Horwitz | Horwitz |
| 0.3*R(reference test method) | 16 | 4 |

Table 2: repeatabilities of subsamples #13190 and #13191

From the above results of the homogeneity tests, the repeatabilities were calculated. The calculated repeatabilities for samples #13190 and #13191 are both in good agreement with 0.3 times the estimated target reproducibilities, calculated using the Horwitz equation. Therefore, homogeneity of all subsamples was assumed.

In total approx. 3 grams of each of the samples, #13190 and #13191 were sent to the participating laboratories on October 9, 2013.

## 2.5   ANALYSES

The participants were asked to determine on samples #13190 and #13191 the Free Formaldehyde content and the Released Formaldehyde content with the analytical procedures that are routinely used in the laboratory. To get comparable results, detailed report forms were sent together with each set of samples. On the report from the requested Free Formaldehyde content and Released Formaldehyde, including the units was pre-printed. Also a letter of instructions was sent along.

## 3   RESULTS

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

Directly after the deadline, a reminder fax was sent to those laboratories that had not yet reported. Shortly after the deadline, the available results were screened for suspect data. A result was called suspect in case the Huber Elimination Rule (a robust outlier test, see lit.5) found it to be an outlier. The laboratories that produced these suspect data were asked to check the results. Additional or corrected data are placed under 'Remarks' in the result tables in appendix 1. A list of abbreviations used in the tables can be found in appendix 3.

## 3.1   STATISTICS

Statistical calculations were performed as described in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' of January 2010 (iis-protocol, version 3.2).
For the statistical evaluation the *unrounded* (when available) figures were used instead of the rounded results. Results reported as '<…' or '>…" were not used in the statistical evaluation.
Before further calculations, the normality of the distribution of the various data sets per determination was checked by means of the Lilliefors-test. In the case of an anormal distribution, the statistical evaluation should be used with care.

According to ISO 5725 (1986 and 1994, lit.7 and 8) the original results per determination were submitted subsequently to Dixon's and Grubbs' 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. Stragglers are marked by D(0.05) for the Dixon's test, by G(0.05) or DG(0.05) for the Grubbs' test. Both outliers and stragglers were not included in the calculations of averages and standard

deviations. Finally, the reproducibilities were calculated from the standard deviations by multiplying them with a factor of 2.8.

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

## 3.2  GRAPHICS

In order to visualise the data against the reproducibilities from literature, Gauss plots were made, using the sorted data for one determination (see appendix 1). On the Y-axis the reported analysis results are plotted. The corresponding laboratory numbers are under the X-axis. The straight horizontal line presents the consensus value (a trimmed mean). The four striped lines, parallel to the consensus value line, are the +3s, +2s, -2s and -3s target reproducibility limits of the selected standard. Outliers and other data, which were excluded from the calculations, are represented as a cross. Accepted data are represented as a triangle. Furthermore, Kernel Density Graphs were made. This method is producing a smooth density approximation to a set of data that avoids some problems associated with histograms (see appendix 3; nos.14 and 15).

## 3.3  Z-SCORES

To evaluate the performance of the individual participating laboratories the z-scores were calculated.
In order to be able to have an objective evaluation of the performance of the individual participants, it was decided to evaluate this performance against the literature requirements. Therefore, the z-scores were calculated using a target standard deviation. This target standard deviation was calculated from the literature reproducibility by division with 2.8.

The $z_{(target)}$-scores were calculated according to:

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

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

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

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 the fit-for-useness of the reported test result.

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

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

## 4    EVALUATION

During the execution of this proficiency test no problems occurred with the delivery of the samples. Five laboratories did not report any test results and twenty-one other laboratories reported results after the final reporting date.

Finally, the 173 reporting laboratories send in total 378 numerical results. Observed were 13 statistical outlying results, which is 3.4% of the numerical results. In proficiency studies, outlier percentages of 3% - 7.5% are quite normal.

For Free Formaldehyde on sample #13190, a not normal distribution was found. Therefore the statistical evaluation should be used with due care for this determiantion.

In ISO14184-1:11 some information on precision data is given. In table B.1 "approximate accuracy" values are mentioned. These values are probably the calculated repeatability standard deviations. Note also that under table B.1 is mentioned "that the method in this part of ISO14184 uses a different calibration graph from that used in the determination of the above-mentioned results". Therefore it was concluded that reliable reproducibility data cannot be estimated and therefore target reproducibilities estimated from the Horwitz equation were used for evaluation.
Also in ISO14184-2:11 some information on precision data is given. In tables C.1 and C.2 critical differences are given for zero-formaldehyde fabrics and for low-level-formaldehyde fabrics (100 – 400 mg/kg). The given reproducibilities are divided between 'single fabric' and 'multiple fabric'. ". Therefore it was concluded that reliable reproducibility data cannot be estimated and therefore target reproducibilities estimated from the Horwitz equation were used for evaluation.

### 4.1   EVALUATION PER SAMPLE

In this section, the samples #13190 and #13191 are discussed. All statistical results reported on the textile samples are summarised in appendix 1.

**Sample #13190**:

Free Formaldehyde content: This determination was problematic. Four statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the estimated reproducibility calculated using the Horwitz equation.

Released Formaldehyde: This determination was problematic. Only one statistical outlier was observed. However, the calculated reproducibility after rejection of the statistical outlier is not at all in agreement with the estimated reproducibility calculated using the Horwitz equation.

**Sample #13191**:

Free Formaldehyde content: This determination was problematic. Five statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the estimated reproducibility calculated using the Horwitz equation.

Released Formaldehyde: This determination was problematic. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not at all in agreement with the estimated reproducibility calculated using the Horwitz equation.

### 4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the calculated reproducibilities using the Horwitz equation and the reproducibilities as found for the group of participating laboratories. The number of significant results, the average results, the calculated reproducibilities (standard deviation*2.8) and the target reproducibilities (Horwitz equation), are compared in the next table.

| Parameter | unit | n | average | 2.8 * sd | R (target) |
|---|---|---|---|---|---|
| Free Formaldehyde #13190 | mg/kg | 169 | 308 | 84 | 58 |
| Released Formaldehyde #13190 | mg/kg | 11 | 823 | 211 | 134 |
| Free Formaldehyde #13191 | mg/kg | 167 | 83.3 | 29.1 | 19.2 |
| Released Formaldehyde #13191 | mg/kg | 15 | 198 | 62 | 40 |

Table 3: reproducibilities of textile samples #13190 and #13191

From the above tables it can be concluded that, without statistical calculations, the group of participating laboratories does have difficulties with the analysis when compared with the target results calculated with the Horwitz equation. See also the discussions in paragraphs 4.1 and 6.

### 5 COMPARISON WITH THE PREVIOUS PROFICIENCY TESTS

The spreads, present in the results for the two samples with Free Formaldehyde during the present PT, are fully in line with the spreads as observed in previous iis PTs (see below table).

| Parameter | October 2013 | October 2012 | October 2011 | October 2010 | October 2009 | October 2008 |
|---|---|---|---|---|---|---|
| Free Formaldehyde | 27-35% | 23-25% | 31-41% | 21-24% | 24-33% | 19-42% |
| Released Formalde. | 26-27% | n.e. | n.e. | n.e. | n.e. | n.e. |

Table 4: Development of relative reproducibilities over the years

## 6    DISCUSSION

When the results of this interlaboratory study were compared to the Ecolabelling Standards and Requirements for Textiles in EU (table 5), it was noticed that not all participants would make identical decisions about the acceptability of the textiles for the determined parameters when evaluating the test results against the Ecolabel requirements.

| Ecolabel | baby clothes | Öko-Tex 103 no direct skin contact | Öko-Tex 103 in direct skin contact | Decoration material |
|---|---|---|---|---|
| Free Formaldehyde extractable (mg/kg) | <16 | 300 | 75 | 300 |
| Released Formaldehyde (mg/m$^3$) | 0.1 | 0.1 | 0.1 | 0.1 |

Table 5: Ecolabelling Standards and Requirements for Textiles in EU

The method for determination of the Free Formaldehyde is specified in the Standards of the Ecolabelling Institutes.
It should be noticed that ISO14184-1 corresponds to the Japanese method specified in the Japanese Law 112 and is described in the Japanese Standard JIS L1096.

Extractable free formaldehyde:
For sample #13190, Sixty-one laboratories would accept the sample for the categories "Öko-Tex 103 no direct skin contact" and "Decoration material" (<300 mg/kg). The other laboratories would reject this sample for all categories.
For sample #13191, Forty-one laboratories would accept the sample for all categories except for Class 1 (Baby, <16mg/kg). The other laboratories would accept the sample for the categories "Öko-Tex 103 no direct skin contact" and "Decoration material" (<300 mg/kg).

Released Formaldehyde:
No conclusions can be drawn, as the limits mentioned in the Ecolabel Standard have a different unit compared with test method ISO14184-2:11 (mg/m$^3$ vs mg/kg).

**General**

The Free Formaldehyde content and the Released Formaldehyde were determined at two different levels. The spreads observed for the Free Formaldehyde content in this interlaboratory study are in line with the previous round robins. The spreads observed in this interlaboratory study are not caused by just one critical point in the analysis. Consequently, the reproducibilities cannot be improved by only one change in the analysis. Each laboratory has to evaluate its performance in this study and make decisions about necessary corrective actions. Therefore, participation on a regular basis in this scheme could be helpful to improve the performance and thus increase of the quality of the analytical results.

**APPENDIX 1**

Determination of Free Formaldehyde content on sample #13190; results in mg/kg

| lab | method | value | mark | z(targ) | lab | method | value | mark | z(targ) |
|-----|--------|-------|------|---------|-----|--------|-------|------|---------|
| 110 | ISO14184-1 | 381.11 | | 3.51 | 2379 | ISO14184-1 | 295.21 | | -0.62 |
| 213 | ISO14184-1 | 317.2 | | 0.44 | 2380 | ISO14184-1 | 268.00 | | -1.92 |
| 230 | ISO14184-1 | 309.03 | | 0.05 | 2381 | ISO14184-1 | 265.60 | | -2.04 |
| 357 | ISO14184-1 | 337.2 | | 1.40 | 2385 | ISO14184-1 | 229.5 | | -3.77 |
| 551 | ISO14184-1 | 338.36 | C | 1.46 | 2390 | ISO14184-1 | 243.7 | | -3.09 |
| 2102 | INH-443 | 240.9 | | -3.23 | 2410 | ISO14184-1 | 278.0 | | -1.44 |
| 2115 | ISO14184-1 | 287 | | -1.01 | 2413 | ISO14184-1 | 837.91 | ex | 25.47 |
| 2120 | ISO14184-1 | 333.6 | | 1.23 | 2420 | ISO14184-1 | 287.2 | | -1.00 |
| 2121 | ISO14184-1 | 312.1 | | 0.20 | 2425 | ISO14184-1 | 309.72 | | 0.08 |
| 2127 | LFGB B82.02.1 | 319 | | 0.53 | 2426 | ISO14184-1 | 320.45 | | 0.60 |
| 2129 | ISO14184-1 | 256.5 | | -2.48 | 2428 | ISO14184-1 | 303.90 | | -0.20 |
| 2132 | ISO14184-1 | 288.17 | | -0.95 | 2429 | ISO14184-1 | 323.06 | | 0.72 |
| 2135 | ISO14184-1 | 298.9 | | -0.44 | 2432 | ISO14184-1 | 283.10 | | -1.20 |
| 2138 | ISO14184-1 | 293.48 | | -0.70 | 2433 | ISO14184-1 | 321.20 | | 0.63 |
| 2139 | ISO14184-1 | 288.83 | | -0.92 | 2437 | ISO14184-1 | 310 | | 0.09 |
| 2146 | ISO14184-1 | 335.5 | | 1.32 | 2442 | ISO14184-1 | 280.17 | | -1.34 |
| 2165 | ISO14184-1 | 322.44 | | 0.69 | 2452 | ISO14184-1 | 320.20 | | 0.59 |
| 2170 | ISO14184-1 | 309.5 | | 0.07 | 2453 | ISO14184-1 | 329 | | 1.01 |
| 2172 | ISO14184-1 | 329.48 | | 1.03 | 2454 | ISO14184-1 | 314.59 | | 0.32 |
| 2184 | ISO14184-1 | 328.80 | | 1.00 | 2456 | ISO14184-1 | 312 | C | 0.19 |
| 2186 | ISO14184-1 | 308.40 | | 0.02 | 2459 | ISO14184-1 | 348.9 | | 1.96 |
| 2190 | ISO14184-1 | 322 | | 0.67 | 2460 | ISO14184-1 | 293.65 | | -0.69 |
| 2196 | ISO14184-1 | 309.7 | | 0.08 | 2467 | | ----- | | ----- |
| 2197 | ISO14184-1 | 373.5 | | 3.15 | 2468 | ISO14184-1 | 311.5 | | 0.17 |
| 2201 | ISO14184-1 | 335.1 | | 1.30 | 2472 | ISO14184-1 | 328.6 | | 0.99 |
| 2212 | JIS L1041-B | 332.2 | | 1.16 | 2474 | ISO14184-1 | 274.50 | | -1.61 |
| 2213 | | ----- | | ----- | 2475 | ISO14184-1 | 291.7 | | -0.78 |
| 2216 | Jap.Law 112 | 340.5 | | 1.56 | 2476 | ISO14184-1 | 294.7 | | -0.64 |
| 2219 | ISO14184-1 | 374.23 | | 3.18 | 2481 | ISO17226-1 | 342.72 | | 1.67 |
| 2225 | ISO14184-1 | 304.71 | | -0.16 | 2482 | ISO14184-1 | 306.85 | | -0.06 |
| 2226 | ISO14184 | 352.4 | C | 2.13 | 2483 | ISO14184-1 | 334.72 | | 1.28 |
| 2228 | ISO14184-1 | 342.2239 | | 1.64 | 2489 | ISO14184-1 | 283.7 | | -1.17 |
| 2229 | ISO14184-1 | 312.19 | | 0.20 | 2492 | ISO14184-1 | 345.2 | | 1.79 |
| 2230 | ISO14184-1 | 371.45 | | 3.05 | 2493 | ISO14184-1 | 401 | | 4.47 |
| 2232 | ISO14184-1 | 311.58 | | 0.17 | 2495 | ISO14184-1 | 258.9 | | -2.36 |
| 2235 | ISO14184-1 | 330.95 | | 1.10 | 2501 | ISO14184-1 | 317.6 | | 0.46 |
| 2236 | Jap.Law 112 | 358.95 | | 2.45 | 2506 | ISO14184-1 | 290.00 | C | -0.87 |
| 2238 | ISO14184-1 | 305.7 | | -0.11 | 2511 | ISO14184-1 | 281.8 | | -1.26 |
| 2241 | ISO14184-1 | 305.69 | | -0.11 | 2514 | ISO14184-1 | 311.26 | | 0.16 |
| 2245 | ISO14184-1 | 329.43 | | 1.03 | 2515 | | ----- | | ----- |
| 2246 | ISO14184-1 | 283.32 | | -1.19 | 2517 | ISO14184-1 | 319.4 | | 0.55 |
| 2247 | ISO14184-1 | 304.30 | | -0.18 | 2518 | ISO14184-1 | 325.484 | | 0.84 |
| 2255 | ISO14184-1 | 310.0 | | 0.09 | 2519 | ISO14184-1 | 323.5 | | 0.74 |
| 2256 | ISO14184-1 | 330.1 | | 1.06 | 2525 | ISO14184-1 | 299.34 | | -0.42 |
| 2261 | GB/T2912.1 | 278.778 | | -1.41 | 2527 | ISO14184-1 | 335.3 | C | 1.31 |
| 2265 | ISO14184-1 | 269.04 | | -1.87 | 2532 | ISO14184-1 | 323.9 | | 0.76 |
| 2266 | ISO14184-1 | 265.95 | | -2.02 | 2534 | ISO14184-1 | 347.8 | | 1.91 |
| 2269 | ISO14184-1 | 312.772 | | 0.23 | 2535 | ISO14184-1 | 315.95 | | 0.38 |
| 2273 | ISO14184-1 | 304.50 | | -0.17 | 2542 | GB/T2912.1 | 330.11508 | | 1.06 |
| 2275 | ISO14184-1 | 317.68 | | 0.46 | 2546 | ISO14184-1 | 306.815 | | -0.06 |
| 2277 | ISO14184-1 | 305.22166 | | -0.13 | 2549 | ISO14184-1 | 291.9 | | -0.78 |
| 2284 | ISO14184-1 | 327.2 | | 0.92 | 2553 | JIS L1041-B | 423.57 | G(0.05) | 5.55 |
| 2289 | ISO14184-1 | 309.8 | | 0.09 | 2555 | ISO14184-1 | 282 | | -1.25 |
| 2290 | ISO14184-1 | 310.92 | | 0.14 | 2559 | ISO14184 | 261.85 | | -2.22 |
| 2293 | JIS L1041 | 319.8 | | 0.57 | 2561 | ISO14184-1 | 146 | G(0.01) | -7.79 |
| 2294 | ISO14184-1 | 319.43 | | 0.55 | 2562 | ISO14184-1 | 312.04 | | 0.19 |
| 2295 | ISO14184-1 | 336 | C | 1.34 | 2563 | | ----- | | ----- |
| 2296 | ISO14184-1 | 277.79 | | -1.45 | 2566 | ISO14184-1 | 317.44 | | 0.45 |
| 2298 | JIS L1041 | 311.7 | | 0.18 | 2567 | ISO14184-1 | 318.7 | | 0.51 |
| 2303 | ISO14184-1 | 333.2 | | 1.21 | 2573 | ISO14184-1 | 315.33 | | 0.35 |
| 2310 | ISO14184-1 | 270 | | -1.83 | 2576 | ISO14184-1 | 353.33 | | 2.18 |
| 2311 | ISO14184-1 | 267.8 | | -1.93 | 2577 | GB/T2912.1 | 257.8 | | -2.41 |
| 2313 | ISO14184-1 | 274.4 | | -1.62 | 2580 | ISO14184-1 | 295 | | -0.63 |
| 2314 | ISO14184-1 | 265.67 | | -2.04 | 2582 | ISO14184-1 | 290.001 | | -0.87 |
| 2351 | ISO14184-1 | 298.77 | | -0.44 | 2584 | ISO14184-1 | 311.01 | | 0.14 |
| 2356 | ISO14184-1 | 273.15 | | -1.68 | 2587 | ISO14184-1 | 294.22 | | -0.66 |
| 2359 | ISO14184-1 | 310.19 | | 0.10 | 2589 | ISO14184-1 | 312.50 | | 0.21 |
| 2360 | ISO14184-1 | 319.68 | | 0.56 | 2590 | ISO14184-1 | 248.1 | | -2.88 |
| 2361 | INH-2012-3 | 260.55 | | -2.28 | 2591 | ISO14184-1 | 285.9 | | -1.06 |
| 2363 | ISO14184-1 | 302.75 | | -0.25 | 2598 | | ----- | | ----- |
| 2364 | ISO14184-1 | 320 | | 0.58 | 3100 | ISO14184-1 | 304.67 | | -0.16 |
| 2366 | ISO14184-1 | 303.4 | | -0.22 | 3110 | ISO14184-1 | 259.88 | | -2.31 |
| 2367 | ISO14184-1 | 304.50 | | -0.17 | 3116 | ISO14184-1 | 336.34 | | 1.36 |
| 2368 | ISO14184-1 | 278.42 | | -1.42 | 3118 | ISO14184-1 | 320.97 | | 0.62 |
| 2372 | ISO14184-1 | 401.78 | | 4.51 | 3146 | ISO14184-1 | 323.76 | | 0.76 |
| 2375 | ISO14184-1 | 260.5 | | -2.28 | 3150 | ISO14184-1 | 302 | | -0.29 |

| 3153 | ISO14184-1 | 293.60 | | -0.69 |
|------|------------|--------|--------|-------|
| 3154 | ISO14184-1 | 290.45 | | -0.84 |
| 3167 | ISO14184-1 | 303.3 | | -0.23 |
| 3172 | ISO14184-1 | 272.58 | | -1.70 |
| 3176 | ISO14184-1 | 394.3 | | 4.15 |
| 3180 | ISO14184-1 | 210.26 | G(0.05) | -4.70 |
| 3182 | ISO14184-1 | 312.4 | | 0.21 |
| 3185 | ISO14184-1 | 280.9 | | -1.30 |
| 3186 | ISO14184-1 | 262.80 | | -2.17 |
| 3190 | ISO14184-1 | 308.74 | | 0.03 |
| 3192 | LFGB B82.02.1 | 338.8 | | 1.48 |
| 3195 | ISO14184-1 | 309.3 | | 0.06 |
| 3197 | ISO14184-1 | 282.3 | | -1.24 |
| 3198 | ISO14184-1 | 243.68 | | -3.09 |
| 3199 | ISO14184-1 | 316.61 | | 0.41 |
| 3207 | JIS L1041 | 303.6 | | -0.21 |
| 3210 | ISO14184-1 | 314.4 | | 0.31 |
| 3214 | ISO14184-1 | 295.8 | | -0.59 |
| 3220 | ISO14184-1 | 287.23 | | -1.00 |
| 3222 | ISO14184-1 | 307.25 | | -0.04 |
| 3226 | ISO14184-1 | 363.88 | | 2.68 |
| 3228 | ISO14184-1 | 324 | | 0.77 |
| 3232 | ISO14184-1 | 310.65 | | 0.13 |
| 3237 | ISO14184-1 | 283.67 | | -1.17 |
| 3242 | ISO14184-1 | 309.10 | | 0.05 |
| 3248 | ISO14184 | 326 | | 0.86 |

| | | | |
|---|---|---|---|
| normality | not OK | | |
| n | 169 | | |
| outliers | 3 | +1 excl. | |
| mean (n) | 308.03 | | |
| st.dev. (n) | 30.029 | | |
| R(calc.) | 84.08 | | |
| R(Horwitz) | 58.25 | | |

Lab 551   first reported  676.73
Lab 2226  first reported  393.57
Lab 2295  first reported  418
Lab 2456  first reported  412
Lab 2506  first reported  427.97
Lab 2527  first reported  85.27

Lab 2413 result excluded as free formaldehyde is
          same as released formaldehyde result
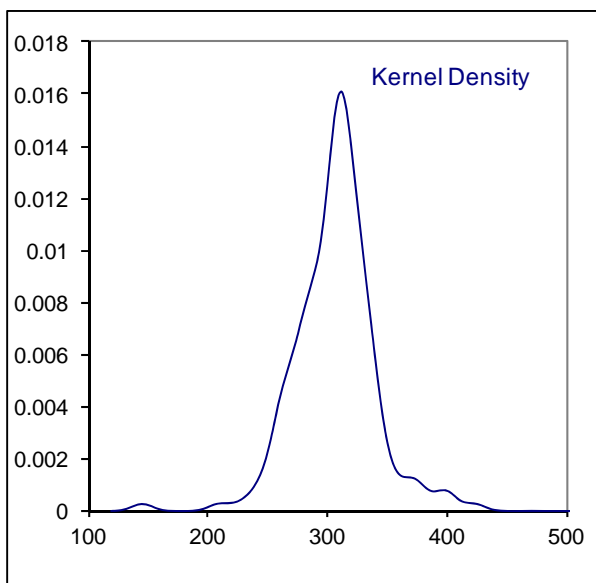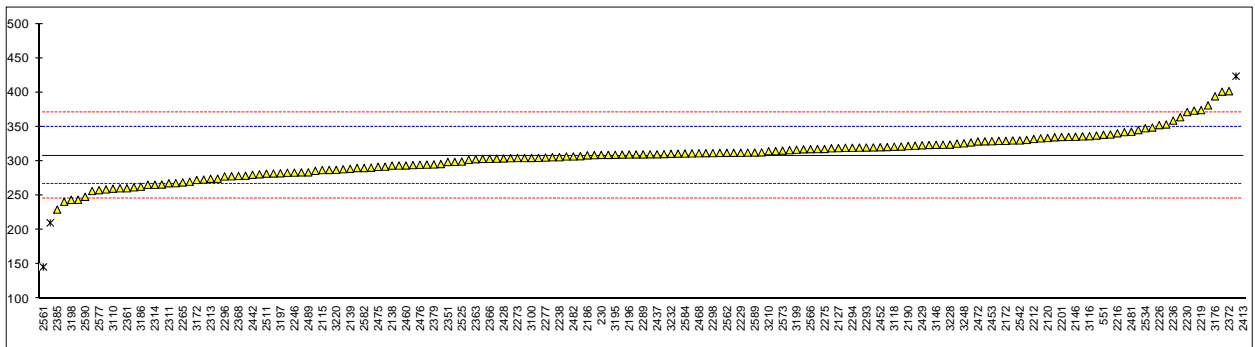




Kernel Density

Determination of Released Formaldehyde content on sample #13190; results in mg/kg

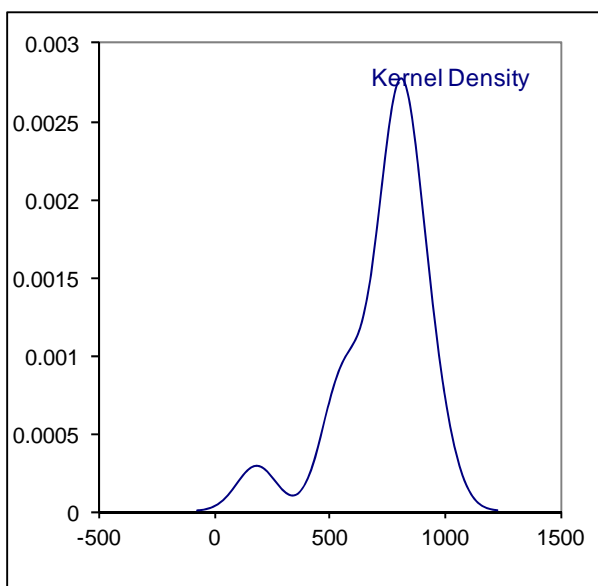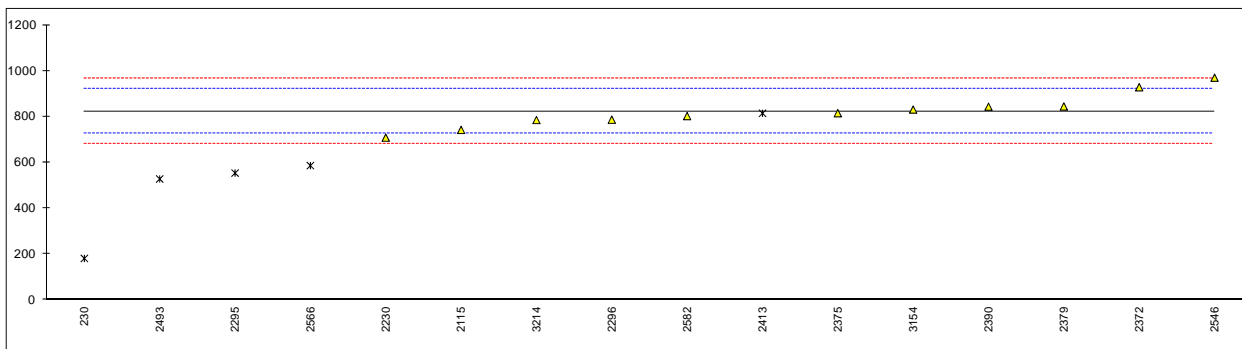| lab | method | value | mark | z(targ) | lab | method | value | mark | z(targ) |
|---|---|---|---|---|---|---|---|---|---|
| 110 | | ----- | | ----- | 2379 | ISO14184-2 | 844.58 | | 0.44 |
| 213 | | ----- | | ----- | 2380 | | ----- | | ----- |
| 230 | ISO14184-2 | 181.16 | G(0.01) | -13.39 | 2381 | | ----- | | ----- |
| 357 | | ----- | | ----- | 2385 | | ----- | | ----- |
| 551 | | ----- | | ----- | 2390 | ISO14184-2 | 843.7 | | 0.42 |
| 2102 | | ----- | | ----- | 2410 | | ----- | | ----- |
| 2115 | ISO14184-2 | 742 | | -1.70 | 2413 | ISO14184-1 | 814.62 | ex | -0.18 |
| 2120 | | ----- | | ----- | 2420 | | ----- | | ----- |
| 2121 | | ----- | | ----- | 2425 | | ----- | | ----- |
| 2127 | | ----- | | ----- | 2426 | | ----- | | ----- |
| 2129 | | ----- | | ----- | 2428 | | ----- | | ----- |
| 2132 | | ----- | | ----- | 2429 | | ----- | | ----- |
| 2135 | | ----- | | ----- | 2432 | | ----- | | ----- |
| 2138 | | ----- | | ----- | 2433 | | ----- | | ----- |
| 2139 | | ----- | | ----- | 2437 | | ----- | | ----- |
| 2146 | | ----- | | ----- | 2442 | | ----- | | ----- |
| 2165 | | ----- | | ----- | 2452 | | ----- | | ----- |
| 2170 | | ----- | | ----- | 2453 | | ----- | | ----- |
| 2172 | | ----- | | ----- | 2454 | | ----- | | ----- |
| 2184 | | ----- | | ----- | 2456 | | ----- | | ----- |
| 2186 | | ----- | | ----- | 2459 | | ----- | | ----- |
| 2190 | | ----- | | ----- | 2460 | | ----- | | ----- |
| 2196 | | ----- | | ----- | 2467 | | ----- | | ----- |
| 2197 | | ----- | | ----- | 2468 | | ----- | | ----- |
| 2201 | | ----- | | ----- | 2472 | | ----- | | ----- |
| 2212 | | ----- | | ----- | 2474 | | ----- | | ----- |
| 2213 | | ----- | | ----- | 2475 | | ----- | | ----- |
| 2216 | | ----- | | ----- | 2476 | | ----- | | ----- |
| 2219 | | ----- | | ----- | 2481 | | ----- | | ----- |
| 2225 | | ----- | | ----- | 2482 | | ----- | | ----- |
| 2226 | | ----- | | ----- | 2483 | | ----- | | ----- |
| 2228 | | ----- | | ----- | 2489 | | ----- | | ----- |
| 2229 | | ----- | | ----- | 2492 | | ----- | | ----- |
| 2230 | ISO14184-2 | 708.49 | | -2.40 | 2493 | ISO14184-2 | 528 | G(0.05) | -6.16 |
| 2232 | | ----- | | ----- | 2495 | | ----- | | ----- |
| 2235 | | ----- | | ----- | 2501 | | ----- | | ----- |
| 2236 | | ----- | | ----- | 2506 | | ----- | | ----- |
| 2238 | | ----- | | ----- | 2511 | | ----- | | ----- |
| 2241 | | ----- | | ----- | 2514 | | ----- | | ----- |
| 2245 | | ----- | | ----- | 2515 | | ----- | | ----- |
| 2246 | | ----- | | ----- | 2517 | | ----- | | ----- |
| 2247 | | ----- | | ----- | 2518 | | ----- | | ----- |
| 2255 | | ----- | | ----- | 2519 | | ----- | | ----- |
| 2256 | | ----- | | ----- | 2525 | | ----- | | ----- |
| 2261 | | ----- | | ----- | 2527 | | ----- | | ----- |
| 2265 | | ----- | | ----- | 2532 | | ----- | | ----- |
| 2266 | | ----- | | ----- | 2534 | | ----- | | ----- |
| 2269 | | ----- | | ----- | 2535 | | ----- | | ----- |
| 2273 | | ----- | | ----- | 2542 | | ----- | | ----- |
| 2275 | | ----- | | ----- | 2546 | ISO14184-2 | 970.03 | | 3.06 |
| 2277 | | ----- | | ----- | 2549 | | ----- | | ----- |
| 2284 | | ----- | | ----- | 2553 | | ----- | | ----- |
| 2289 | | ----- | | ----- | 2555 | | ----- | | ----- |
| 2290 | | ----- | | ----- | 2559 | | ----- | | ----- |
| 2293 | | ----- | | ----- | 2561 | | ----- | | ----- |
| 2294 | | ----- | | ----- | 2562 | | ----- | | ----- |
| 2295 | ISO14184-2 | 554 | G(0.05) | -5.62 | 2563 | | ----- | | ----- |
| 2296 | ISO14184-2 | 786.79 | | -0.76 | 2566 | ISO14184-2 | 586.21 | G(0.05) | -4.95 |
| 2298 | | ----- | | ----- | 2567 | | ----- | | ----- |
| 2303 | | ----- | | ----- | 2573 | | ----- | | ----- |
| 2310 | | ----- | | ----- | 2576 | | ----- | | ----- |
| 2311 | | ----- | | ----- | 2577 | | ----- | | ----- |
| 2313 | | ----- | | ----- | 2580 | | ----- | | ----- |
| 2314 | | ----- | | ----- | 2582 | ISO14184-2 | 802.60 | | -0.43 |
| 2351 | | ----- | | ----- | 2584 | | ----- | | ----- |
| 2356 | | ----- | | ----- | 2587 | | ----- | | ----- |
| 2359 | | ----- | | ----- | 2589 | | ----- | | ----- |
| 2360 | | ----- | | ----- | 2590 | | ----- | | ----- |
| 2361 | | ----- | | ----- | 2591 | | ----- | | ----- |
| 2363 | | ----- | | ----- | 2598 | | ----- | | ----- |
| 2364 | | ----- | | ----- | 3100 | | ----- | | ----- |
| 2366 | | ----- | | ----- | 3110 | | ----- | | ----- |
| 2367 | | ----- | | ----- | 3116 | | ----- | | ----- |
| 2368 | | ----- | | ----- | 3118 | | ----- | | ----- |
| 2372 | ISO14184-2 | 928.40 | | 2.19 | 3146 | | ----- | | ----- |
| 2375 | ISO14184-2 | 815.2 | | -0.17 | 3150 | | ----- | | ----- |
| 3153 | | ----- | | ----- | | | | | |

| | | | |
|------|-----------|--------|-------|
| 3154 | ISO14184-2 | 831.01 | 0.16 |
| 3167 | | ----- | ----- |
| 3172 | | ----- | ----- |
| 3176 | | ----- | ----- |
| 3180 | | ----- | ----- |
| 3182 | | ----- | ----- |
| 3185 | | ----- | ----- |
| 3186 | | ----- | ----- |
| 3190 | | ----- | ----- |
| 3192 | | ----- | ----- |
| 3195 | | ----- | ----- |
| 3197 | | ----- | ----- |
| 3198 | | ----- | ----- |
| 3199 | | ----- | ----- |
| 3207 | | ----- | ----- |
| 3210 | | ----- | ----- |
| 3214 | ISO14184-2 | 785.3 | -0.80 |
| 3220 | | ----- | ----- |
| 3222 | | ----- | ----- |
| 3226 | | ----- | ----- |
| 3228 | | ----- | ----- |
| 3232 | | ----- | ----- |
| 3237 | | ----- | ----- |
| 3242 | | ----- | ----- |
| 3248 | | ----- | ----- |

| | | | |
|-----------|--------|---------|
| normality | OK | |
| n | 11 | |
| outliers | 4 | +1 excl |
| mean (n) | 823.46 | |
| st.dev. (n) | 75.210 | |
| R(calc.) | 210.59 | |
| R(Horwitz) | 134.30 | |

Lab 2413 result excluded as free formaldehyde is
same as released formaldehyde result

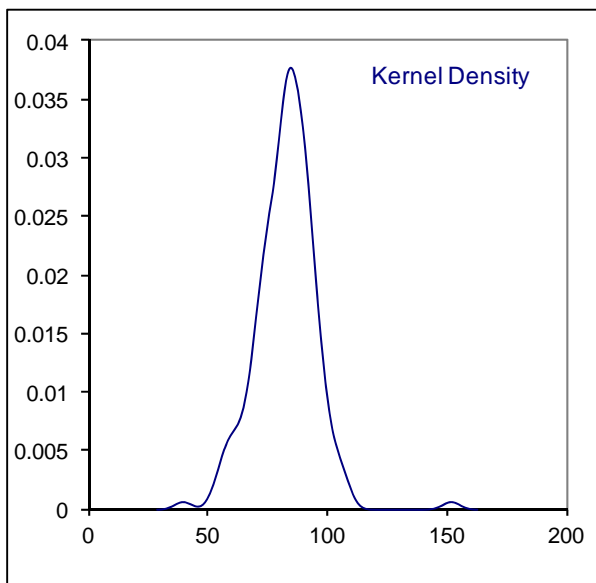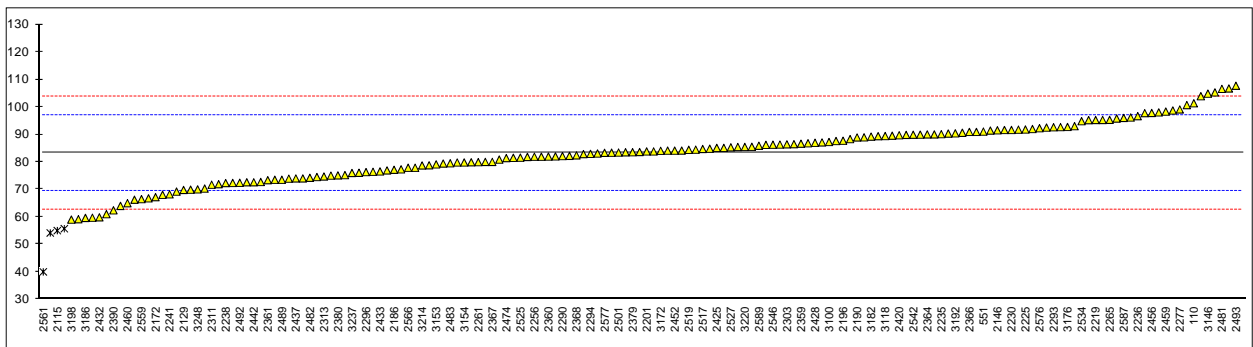## Determination of Free Formaldehyde content on sample #13191; results in mg/kg

| lab | method | value | mark | z(targ) | lab | method | value | mark | z(targ) |
|-----|--------|-------|------|---------|-----|--------|-------|------|---------|
| 110 | ISO14184-1 | 101.32 | | 2.63 | 2379 | ISO14184-1 | 83.53 | | 0.04 |
| 213 | ISO14184-1 | 84.1 | | 0.12 | 2380 | ISO14184-1 | 75.10 | | -1.20 |
| 230 | ISO14184-1 | 68.04 | C | -2.23 | 2381 | ISO14184-1 | 72.60 | | -1.56 |
| 357 | ISO14184-1 | 90.9 | | 1.11 | 2385 | ISO14184-1 | 69.9 | | -1.95 |
| 551 | ISO14184-1 | 91.02 | C | 1.13 | 2390 | ISO14184-1 | 62.4 | | -3.05 |
| 2102 | INH-443 | 70.3 | | -1.90 | 2410 | ISO14184-1 | 83.5 | | 0.03 |
| 2115 | ISO14184-1 | 55 | G(0.01) | -4.13 | 2413 | ISO14184-1 | 151.77 | ex | 10.00 |
| 2120 | ISO14184-1 | 54.15 | G(0.01) | -4.25 | 2420 | ISO14184-1 | 89.7 | C | 0.94 |
| 2121 | | ----- | | ----- | 2425 | ISO14184-1 | 85.10 | | 0.27 |
| 2127 | LFGB B82.02.1. | 80 | | -0.48 | 2426 | ISO14184-1 | 80.85 | | -0.36 |
| 2129 | ISO14184-1 | 69.8 | | -1.97 | 2428 | ISO14184-1 | 86.95 | | 0.54 |
| 2132 | ISO14184-1 | 83.60 | | 0.05 | 2429 | ISO14184-1 | 84.46 | | 0.17 |
| 2135 | ISO14184-1 | 77.3 | | -0.87 | 2432 | ISO14184-1 | 59.84 | | -3.42 |
| 2138 | ISO14184-1 | 86.79 | | 0.51 | 2433 | ISO14184-1 | 76.54 | | -0.98 |
| 2139 | ISO14184-1 | 77.88 | | -0.79 | 2437 | ISO14184-1 | 74 | | -1.36 |
| 2146 | ISO14184-1 | 91.5 | | 1.20 | 2442 | ISO14184-1 | 72.60 | | -1.56 |
| 2165 | ISO14184-1 | 91.73 | | 1.23 | 2452 | ISO14184-1 | 84.1 | C | 0.12 |
| 2170 | ISO14184-1 | 83.8 | | 0.08 | 2453 | ISO14184-1 | 93 | | 1.42 |
| 2172 | ISO14184-1 | 67.18 | | -2.35 | 2454 | ISO14184-1 | 83.34 | | 0.01 |
| 2184 | ISO14184-1 | 92.48 | | 1.34 | 2456 | ISO14184-1 | 97.8 | | 2.12 |
| 2186 | ISO14184-1 | 77.14 | | -0.90 | 2459 | ISO14184-1 | 98.3 | | 2.19 |
| 2190 | ISO14184-1 | 88.9 | | 0.82 | 2460 | ISO14184-1 | 64.99 | | -2.67 |
| 2196 | ISO14184-1 | 87.7 | | 0.64 | 2467 | | ----- | | ----- |
| 2197 | ISO14184-1 | 103.9 | | 3.01 | 2468 | ISO14184-1 | 74.0 | | -1.36 |
| 2201 | ISO14184-1 | 83.8 | | 0.08 | 2472 | ISO14184-1 | 87.1 | | 0.56 |
| 2212 | JIS L1041-B | 91.6 | | 1.21 | 2474 | ISO14184-1 | 81.38 | | -0.28 |
| 2213 | | ----- | | ----- | 2475 | ISO14184-1 | 86.2 | | 0.43 |
| 2216 | Jap.Law 112 | 90.6 | | 1.07 | 2476 | ISO14184-1 | 87.6 | | 0.63 |
| 2219 | ISO14184-1 | 95.25 | | 1.75 | 2481 | ISO17226-1 | 106.56 | | 3.40 |
| 2225 | ISO14184-1 | 91.78 | | 1.24 | 2482 | ISO14184-1 | 74.223 | | -1.32 |
| 2226 | ISO14184 | 106.7 | | 3.42 | 2483 | ISO14184-1 | 79.5 | | -0.55 |
| 2228 | ISO14184-1 | 89.5403 | | 0.91 | 2489 | ISO14184-1 | 73.5 | | -1.43 |
| 2229 | ISO14184-1 | 89.37 | | 0.89 | 2492 | ISO14184-1 | 72.4 | | -1.59 |
| 2230 | ISO14184-1 | 91.61 | | 1.22 | 2493 | ISO14184-1 | 107.7 | | 3.56 |
| 2232 | ISO14184-1 | 78.77 | | -0.66 | 2495 | ISO14184-1 | 76.9 | | -0.93 |
| 2235 | ISO14184-1 | 90.08 | | 0.99 | 2501 | ISO14184-1 | 83.4 | | 0.02 |
| 2236 | Jap.Law 112 | 96.65 | | 1.95 | 2506 | ISO14184-1 | 59.70 | C | -3.44 |
| 2238 | ISO14184-1 | 72.3 | | -1.60 | 2511 | ISO14184-1 | 75.2 | | -1.18 |
| 2241 | ISO14184-1 | 68.21 | | -2.20 | 2514 | ISO14184-1 | 90.31 | | 1.03 |
| 2245 | ISO14184-1 | 96.15 | | 1.88 | 2515 | | ----- | | ----- |
| 2246 | ISO14184-1 | 83.06 | | -0.03 | 2517 | ISO14184-1 | 84.7 | | 0.21 |
| 2247 | ISO14184-1 | 69.20 | | -2.06 | 2518 | ISO14184-1 | 81.4835 | | -0.26 |
| 2255 | ISO14184-1 | 82.0 | | -0.19 | 2519 | ISO14184-1 | 84.4 | | 0.16 |
| 2256 | ISO14184-1 | 81.9 | | -0.20 | 2525 | ISO14184-1 | 81.55 | | -0.25 |
| 2261 | GB/T2912.1 | 79.9 | | -0.49 | 2527 | ISO14184-1 | 85.3 | C | 0.29 |
| 2265 | ISO14184-1 | 95.30 | | 1.75 | 2532 | ISO14184-1 | 55.7 | G(0.05) | -4.03 |
| 2266 | ISO14184-1 | 76.05 | | -1.06 | 2534 | ISO14184-1 | 94.8 | | 1.68 |
| 2269 | ISO14184-1 | 95.780 | | 1.82 | 2535 | ISO14184-1 | 95.26 | | 1.75 |
| 2273 | ISO14184-1 | 73.50 | | -1.43 | 2542 | GB/T2912.1 | 89.88054 | | 0.96 |
| 2275 | ISO14184-1 | 82.84 | | -0.06 | 2546 | ISO14184-1 | 86.26 | | 0.43 |
| 2277 | ISO14184-1 | 99.089 | | 2.31 | 2549 | ISO14184-1 | 84.8 | | 0.22 |
| 2284 | ISO14184-1 | 88.3 | | 0.73 | 2553 | JIS L1041-B | 105.28 | | 3.21 |
| 2289 | ISO14184-1 | 85.5 | | 0.32 | 2555 | ISO14184-1 | 61 | | -3.25 |
| 2290 | ISO14184-1 | 82.11 | | -0.17 | 2559 | ISO14184 | 66.45 | | -2.46 |
| 2293 | JIS L1041 | 92.6 | | 1.36 | 2561 | ISO14184-1 | 40 | G(0.05) | -6.32 |
| 2294 | ISO14184-1 | 82.92 | | -0.05 | 2562 | ISO14184-1 | 89.82 | | 0.95 |
| 2295 | ISO14184-1 | 98 | | 2.15 | 2563 | | ----- | | ----- |
| 2296 | ISO14184-1 | 76.29 | | -1.02 | 2566 | ISO14184-1 | 77.87 | | -0.79 |
| 2298 | JIS L1041 | 91.4 | | 1.18 | 2567 | ISO14184-1 | 98.7 | | 2.25 |
| 2303 | ISO14184-1 | 86.4 | | 0.45 | 2573 | ISO14184-1 | 89.91 | | 0.97 |
| 2310 | ISO14184-1 | 73.9 | | -1.37 | 2576 | ISO14184-1 | 92.26 | | 1.31 |
| 2311 | ISO14184-1 | 71.7 | | -1.69 | 2577 | GB/T2912.1 | 83.3 | | 0.00 |
| 2313 | ISO14184-1 | 74.7 | | -1.25 | 2580 | ISO14184-1 | 81.81 | | -0.22 |
| 2314 | ISO14184-1 | 71.90 | | -1.66 | 2582 | ISO14184-1 | 75.003 | | -1.21 |
| 2351 | ISO14184-1 | 88.93 | | 0.82 | 2584 | ISO14184-1 | 79.78 | | -0.51 |
| 2356 | ISO14184-1 | 95.20 | | 1.74 | 2587 | ISO14184-1 | 96.00 | | 1.86 |
| 2359 | ISO14184-1 | 86.62 | | 0.49 | 2589 | ISO14184-1 | 85.88 | | 0.38 |
| 2360 | ISO14184-1 | 81.94 | | -0.20 | 2590 | ISO14184-1 | 66.74 | | -2.42 |
| 2361 | INH-2012-3 | 73.35 | | -1.45 | 2591 | ISO14184-1 | 74.5 | | -1.28 |
| 2363 | ISO14184-1 | 91.95 | | 1.27 | 2598 | | ----- | | ----- |
| 2364 | ISO14184-1 | 90 | | 0.98 | 3100 | ISO14184-1 | 87.23 | | 0.58 |
| 2366 | ISO14184-1 | 90.9 | | 1.11 | 3110 | ISO14184-1 | 79.87 | | -0.50 |
| 2367 | ISO14184-1 | 80.00 | | -0.48 | 3116 | ISO14184-1 | 76.40 | | -1.01 |
| 2368 | ISO14184-1 | 82.37 | | -0.13 | 3118 | ISO14184-1 | 89.40 | | 0.89 |
| 2372 | ISO14184-1 | 97.75 | | 2.11 | 3146 | ISO14184-1 | 104.83 | | 3.15 |
| 2375 | ISO14184-1 | 72.7 | | -1.55 | 3150 | ISO14184-1 | 64.0 | | -2.82 |

| 3153 | ISO14184-1 | 79.09 | -0.61 |
| 3154 | ISO14184-1 | 79.80 | -0.51 |
| 3167 | ISO14184-1 | 92.67 | 1.37 |
| 3172 | ISO14184-1 | 84.03 | 0.11 |
| 3176 | ISO14184-1 | 92.7 | 1.37 |
| 3180 | ISO14184-1 | 59.16 | -3.52 |
| 3182 | ISO14184-1 | 89.2 | 0.86 |
| 3185 | ISO14184-1 | 79.4 | -0.57 |
| 3186 | ISO14184-1 | 59.63 | -3.45 |
| 3190 | ISO14184-1 | 86.45 | 0.46 |
| 3192 | LFGB B82.02.1 | 90.4 | 1.04 |
| 3195 | ISO14184-1 | 85.1 | 0.27 |
| 3197 | ISO14184-1 | 82.2 | -0.16 |
| 3198 | ISO14184-1 | 59.02 | -3.54 |
| 3199 | ISO14184-1 | 72.34 | -1.60 |
| 3207 | JIS L1041 | 86.3 | 0.44 |
| 3210 | ISO14184-1 | 81.9 | -0.20 |
| 3214 | ISO14184-1 | 78.7 | -0.67 |
| 3220 | ISO14184-1 | 85.44 | 0.31 |
| 3222 | ISO14184-1 | 66.25 | -2.49 |
| 3226 | ISO14184-1 | 100.67 | 2.54 |
| 3228 | ISO14184-1 | 90 | 0.98 |
| 3232 | ISO14184-1 | 84.13 | 0.12 |
| 3237 | ISO14184-1 | 75.97 | -1.07 |
| 3242 | ISO14184-1 | 85.42 | 0.31 |
| 3248 | ISO14184 | 70 | -1.94 |

| | normality | OK | |
| | n | 167 | |
| | outliers | 4 | +1 excl. |
| | mean (n) | 83.28 | |
| | st.dev. (n) | 10.409 | |
| | R(calc.) | 29.14 | |
| | R(Horwitz) | 19.18 | |

Lab 230  first reported 279.91
Lab 551  first reported 182.05
Lab 2420 first reported 31.6
Lab 2452 first reported 41.73
Lab 2506 first reported 126.33
Lab 2527 first reported 335.3

Lab 2413 result excluded as free formaldehyde is
same as released formaldehyde result





Kernel Density

Determination of Released Formaldehyde content on sample #13191; results in mg/kg

| lab | method | value | mark | z(targ) | lab | method | value | mark | z(targ) |
|-----|--------|-------|------|---------|-----|--------|-------|------|---------|
| 110 | | ----- | | ----- | 2379 | ISO14184-2 | 222.69 | | 1.51 |
| 213 | | ----- | | ----- | 2380 | | ----- | | ----- |
| 230 | ISO14184-2 | 181.91 | | -1.30 | 2381 | | ----- | | ----- |
| 357 | | ----- | | ----- | 2385 | | ----- | | ----- |
| 551 | | ----- | | ----- | 2390 | ISO14184-2 | 182.5 | | -1.26 |
| 2102 | | ----- | | ----- | 2410 | | ----- | | ----- |
| 2115 | ISO14184-2 | 173 | | -1.92 | 2413 | ISO14184-1 | 153.42 | ex | -3.27 |
| 2120 | | ----- | | ----- | 2420 | | ----- | | ----- |
| 2121 | ISO14184-1 | 193.3 | | -0.52 | 2425 | | ----- | | ----- |
| 2127 | | ----- | | ----- | 2426 | | ----- | | ----- |
| 2129 | | ----- | | ----- | 2428 | | ----- | | ----- |
| 2132 | | ----- | | ----- | 2429 | | ----- | | ----- |
| 2135 | | ----- | | ----- | 2432 | | ----- | | ----- |
| 2138 | | ----- | | ----- | 2433 | | ----- | | ----- |
| 2139 | | ----- | | ----- | 2437 | | ----- | | ----- |
| 2146 | | ----- | | ----- | 2442 | | ----- | | ----- |
| 2165 | | ----- | | ----- | 2452 | | ----- | | ----- |
| 2170 | | ----- | | ----- | 2453 | | ----- | | ----- |
| 2172 | | ----- | | ----- | 2454 | | ----- | | ----- |
| 2184 | | ----- | | ----- | 2456 | | ----- | | ----- |
| 2186 | | ----- | | ----- | 2459 | | ----- | | ----- |
| 2190 | | ----- | | ----- | 2460 | | ----- | | ----- |
| 2196 | | ----- | | ----- | 2467 | | ----- | | ----- |
| 2197 | | ----- | | ----- | 2468 | | ----- | | ----- |
| 2201 | | ----- | | ----- | 2472 | | ----- | | ----- |
| 2212 | | ----- | | ----- | 2474 | | ----- | | ----- |
| 2213 | | ----- | | ----- | 2475 | | ----- | | ----- |
| 2216 | | ----- | | ----- | 2476 | | ----- | | ----- |
| 2219 | | ----- | | ----- | 2481 | | ----- | | ----- |
| 2225 | | ----- | | ----- | 2482 | | ----- | | ----- |
| 2226 | | ----- | | ----- | 2483 | | ----- | | ----- |
| 2228 | | ----- | | ----- | 2489 | | ----- | | ----- |
| 2229 | | ----- | | ----- | 2492 | | ----- | | ----- |
| 2230 | ISO14184-2 | 186.4 | | -0.99 | 2493 | ISO14184-2 | 175.4 | | -1.75 |
| 2232 | | ----- | | ----- | 2495 | | ----- | | ----- |
| 2235 | | ----- | | ----- | 2501 | | ----- | | ----- |
| 2236 | | ----- | | ----- | 2506 | | ----- | | ----- |
| 2238 | | ----- | | ----- | 2511 | | ----- | | ----- |
| 2241 | | ----- | | ----- | 2514 | | ----- | | ----- |
| 2245 | | ----- | | ----- | 2515 | | ----- | | ----- |
| 2246 | | ----- | | ----- | 2517 | | ----- | | ----- |
| 2247 | | ----- | | ----- | 2518 | | ----- | | ----- |
| 2255 | | ----- | | ----- | 2519 | | ----- | | ----- |
| 2256 | | ----- | | ----- | 2525 | | ----- | | ----- |
| 2261 | | ----- | | ----- | 2527 | | ----- | | ----- |
| 2265 | | ----- | | ----- | 2532 | | ----- | | ----- |
| 2266 | | ----- | | ----- | 2534 | | ----- | | ----- |
| 2269 | | ----- | | ----- | 2535 | | ----- | | ----- |
| 2273 | | ----- | | ----- | 2542 | | ----- | | ----- |
| 2275 | | ----- | | ----- | 2546 | ISO14184-2 | 259.95 | DG(0.05) | 4.09 |
| 2277 | | ----- | | ----- | 2549 | | ----- | | ----- |
| 2284 | | ----- | | ----- | 2553 | | ----- | | ----- |
| 2289 | | ----- | | ----- | 2555 | | ----- | | ----- |
| 2290 | | ----- | | ----- | 2559 | | ----- | | ----- |
| 2293 | | ----- | | ----- | 2561 | | ----- | | ----- |
| 2294 | | ----- | | ----- | 2562 | | ----- | | ----- |
| 2295 | ISO14184-2 | 295 | DG(0.05) | 6.51 | 2563 | | ----- | | ----- |
| 2296 | ISO14184-2 | 211.72 | | 0.76 | 2566 | ISO14184-2 | 194.64 | | -0.42 |
| 2298 | | ----- | | ----- | 2567 | | ----- | | ----- |
| 2303 | | ----- | | ----- | 2573 | | ----- | | ----- |
| 2310 | | ----- | | ----- | 2576 | | ----- | | ----- |
| 2311 | | ----- | | ----- | 2577 | | ----- | | ----- |
| 2313 | | ----- | | ----- | 2580 | | ----- | | ----- |
| 2314 | | ----- | | ----- | 2582 | ISO14184-2 | 218.20 | | 1.20 |
| 2351 | | ----- | | ----- | 2584 | | ----- | | ----- |
| 2356 | | ----- | | ----- | 2587 | | ----- | | ----- |
| 2359 | | ----- | | ----- | 2589 | | ----- | | ----- |
| 2360 | | ----- | | ----- | 2590 | | ----- | | ----- |
| 2361 | | ----- | | ----- | 2591 | | ----- | | ----- |
| 2363 | | ----- | | ----- | 2598 | | ----- | | ----- |
| 2364 | | ----- | | ----- | 3100 | | ----- | | ----- |
| 2366 | | ----- | | ----- | 3110 | | ----- | | ----- |
| 2367 | | ----- | | ----- | 3116 | | ----- | | ----- |
| 2368 | | ----- | | ----- | 3118 | | ----- | | ----- |
| 2372 | ISO14184-2 | 227.72 | | 1.86 | 3146 | | ----- | | ----- |
| 2375 | ISO14184-2 | 225.8 | | 1.73 | 3150 | | ----- | | ----- |

| 3153 | | ----- | ----- |
|------|-----------|---------|--------|
| 3154 | ISO14184-2 | 208.13 | 0.51 |
| 3167 | | ----- | ----- |
| 3172 | | ----- | ----- |
| 3176 | | ----- | ----- |
| 3180 | | ----- | ----- |
| 3182 | | ----- | ----- |
| 3185 | | ----- | ----- |
| 3186 | | ----- | ----- |
| 3190 | | ----- | ----- |
| 3192 | | ----- | ----- |
| 3195 | | ----- | ----- |
| 3197 | | ----- | ----- |
| 3198 | | ----- | ----- |
| 3199 | | ----- | ----- |
| 3207 | | ----- | ----- |
| 3210 | | ----- | ----- |
| 3214 | ISO14184-2 | 209.5 | 0.60 |
| 3220 | | ----- | ----- |
| 3222 | | ----- | ----- |
| 3226 | | ----- | ----- |
| 3228 | | ----- | ----- |
| 3232 | | ----- | ----- |
| 3237 | | ----- | ----- |
| 3242 | | ----- | ----- |
| 3248 | | ----- | ----- |

| | | | | |
|---|---|---|---|---|
| normality | OK | | Lab 2413 result excluded as free formaldehyde is | |
| n | 14 | | same as released formaldehyde result | |
| outliers | 2 | + 1 excl | | |
| mean (n) | 200.78 | | | |
| st.dev. (n) | 19.198 | | | |
| R(calc.) | 53.76 | | | |
| R(Horwitz) | 40.50 | | | |
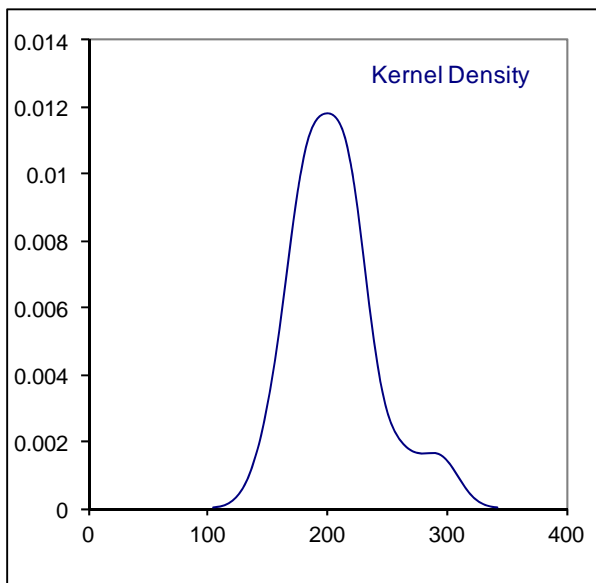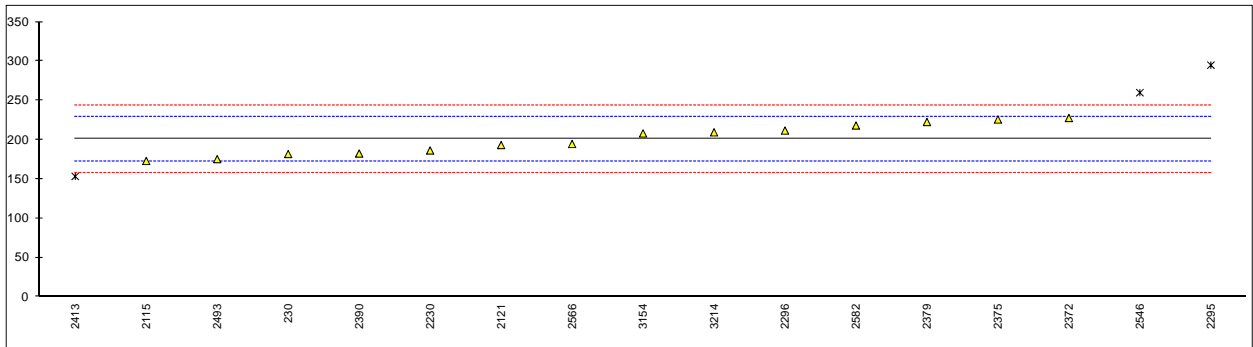
## APPENDIX 2

## Number of participants per country

    7 labs in BANGLADESH
    1 lab in BRAZIL
    1 lab in CAMBODIA, Kingdom of
    1 lab in CROATIA
    1 lab in CZECH REPUBLIC
    1 lab in EGYPT
    3 labs in FINLAND
    6 labs in FRANCE
   15 labs in GERMANY
    1 lab in GREECE
    1 lab in GUATEMALA
   13 labs in HONG KONG
    1 lab in HUNGARY
   14 labs in INDIA
    2 labs in INDONESIA
   10 labs in ITALY
    4 labs in KOREA
    2 labs in MAURITIUS
    3 labs in MEXICO
    1 lab in MOROCCO
    1 lab in NICARAGUA
   46 labs in P.R. of CHINA
    3 labs in PAKISTAN
    1 lab in PHILIPPINES
    2 labs in PORTUGAL
    1 lab in ROMANIA
    2 labs in SINGAPORE
    1 lab in SLOVENIA
    1 lab in SPAIN
    2 labs in SRI LANKA
    1 lab in SWITZERLAND
    4 labs in TAIWAN R.O.C.
    3 labs in THAILAND
    1 lab in THE NETHERLANDS
    2 labs in TUNISIA
    5 labs in TURKEY
    7 labs in U.S.A.
    4 lab in UNITED KINGDOM
    2 labs in VIETNAM

**APPENDIX 3**

**Abbreviations**:

C             = final result after checking of first reported suspect result
D(0.01)    = outlier in Dixon's outlier test
D(0.05)    = straggler in Dixon's outlier test
G(0.01)    = outlier in Grubbs' outlier test
G(0.05)    = straggler in Grubbs' outlier test
DG(0.01)  = outlier in Double Grubbs' outlier test
DG(0.05)  = straggler in Double Grubbs' outlier test
n.a.         = not applicable
n.d.         = not detected
W            = withdrawn

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