Results of Proficiency Test
Migration of Elements EN71-3
Category 1
April 2021

Organized by: Institute for Interlaboratory Studies
Spijkenisse, the Netherlands

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Report: iis21V02A

August 2021

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1 INTRODUCTION

Toy safety is the practice of ensuring that toys, especially those made for children, are safe, usually through the application of set safety standards. In many countries, toys must be able to pass safety tests in order to be sold. Many regions model their safety standards on the EU's EN71 standard, either directly, or through adoption of the ISO8124-3 standard which in itself is modelled on EN71. In Europe, toys must meet the criteria set by the EC Toy Safety Directive (Council Directive 88/378/EEC). This directive has been superseded by Council Directive 2009/48/EC, which applies to toy imports into the EU since 20 July 2011. There is an exception for the chemical requirements under part III of Annex II of this directive. These chemical requirements became into force on 20 July 2013.
The test methods EN71-3:2019 and ISO8124-3:2020 both describe the determination of Migration of Elements (metals that are considered hazardous) when a toy gets into contact with an acid solution (0.07 n HCl, simulating a gastric acid solution).

Since 2010 the Institute for Interlaboratory Studies (iis) organizes a proficiency scheme for Migration of Elements EN71-3 every year. During the annual proficiency testing program 2020/2021, it was decided to continue the proficiency test for the analysis of the Migration of Elements. This year it was decided to publish the proficiency test results for each category separately.
In the interlaboratory study Migration of Elements EN71-3 for category 1 samples 39 laboratories in 20 different countries registered for participation. See appendix 4 for the number of participants per country. In this report the results of the proficiency test of category 1 are presented and discussed. This report is also electronically available through the iis website www.iisnl.com.

2 SET UP

The Institute for Interlaboratory Studies (iis) in Spijkenisse, the Netherlands, was the organizer of this proficiency test (PT). Sample analyzes for fit-for-use and homogeneity testing were subcontracted to an ISO/IEC17025 accredited laboratory.
It was decided to send one sample of 0.5 grams plaster labelled #21565.
The participants were requested to report rounded and unrounded test results. The unrounded test results were preferably used for statistical evaluation.

2.1 ACCREDITATION

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, is accredited in agreement with ISO/IEC17043:2010 (R007), since January 2000, by the Dutch Accreditation Council (Raad voor Accreditatie). This PT falls under the accredited scope. This ensures strict adherence to protocols for sample preparation and statistical evaluation and 100% confidentiality of participant’s data. Feedback from the participants on the reported data is encouraged and customer’s satisfaction is measured on regular basis by sending out questionnaires.

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 is electronically available through the iis website www.iisnl.com, from the FAQ page.

2.3 CONFIDENTIALITY STATEMENT

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

2.4 SAMPLES

A batch of off-white colored plaster was purchased in a local shop. To this batch of plaster the elements Arsenic, Lead and Nickel were added as salts. After mixing thoroughly the batch of plaster was divided over 70 small bags, each filled with 0.5 grams and labelled #21565.
The homogeneity of the subsamples was verified by measuring the **total** content of the elements Lead and Nickel by an in-house method on 8 stratified randomly selected subsamples.

	Lead in mg/kg	Nickel in mg/kg
sample #21565-1	89.9	48.0
sample #21565-2	92.1	47.7
sample #21565-3	84.5	45.1
sample #21565-4	89.3	43.1
sample #21565-5	82.4	43.3
sample #21565-6	79.5	47.3
sample #21565-7	84.8	47.4
sample #21565-8	89.2	48.2

Table 1: homogeneity test results of subsamples #21565

From the above test results the repeatabilities were calculated and compared with 0.3 times the reproducibilities of the reference test method in agreement with the procedure of ISO13528, Annex B2, in the next table.

	Lead in mg/kg	Nickel in mg/kg
r (observed)	12.1	5.9
reference test method	EN71-3:2019	EN71-3:2019
0.3 x R (reference test method)	14.5	7.8

Table 2: evaluation of the repeatabilities of subsamples #21565

The calculated repeatabilities were in agreement with 0.3 times the reproducibilities of the reference test method. Therefore, homogeneity of the subsamples was assumed.

To each of the participating laboratories one sample of 0.5 gram labelled #21565 was sent on March 24, 2021.

2.5 ANALYZES

The participants were requested to determine the migration of nineteen elements applying the analysis procedure that is routinely used in the laboratory. It was requested to use more than 0.1 grams per determination to ensure homogeneity. It was also requested to report if the laboratory was accredited for the determination Migration of Elements and to report some analytical details.

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 results, a detailed report form and a letter of instructions are prepared. On the report form the reporting units are given as well as the reference test methods 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-cts/. The participating laboratories are also requested to confirm the samples 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-cts/. The reported test results are tabulated per determination in appendix 1 and 2 of this report. The laboratories are presented by their code numbers.

Directly after the deadline, a reminder was sent to those laboratories that had not reported test results at that moment. Shortly after the deadline, the available test results were screened for suspect data. A test result was called suspect in case the Huber Elimination Rule (a robust outlier test) found it to be an outlier. The laboratories that produced these suspect data were asked to check the reported test results (no reanalyzes). Additional or corrected test results are used for data analysis and the original test results are placed under 'Remarks' in the result tables in appendix 1. Test results that came in after the deadline were not taken into account in this screening for suspect data and thus these participants were not requested for checks.

3.1 STATISTICS

The protocol followed in the organization of this proficiency test was the one as described for proficiency testing in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' of June 2018 (iis-protocol, version 3.5).
For the statistical evaluation the *unrounded* (when available) figures were used instead of the rounded test results. Test results reported as '<…' or '>…' were not used in the statistical evaluation.
First, the normality of the distribution of the various data sets per determination was checked by means of the Lilliefors-test, a variant of the Kolmogorov-Smirnov test and by the calculation of skewness and kurtosis. Evaluation of the three normality indicators in combination with the visual evaluation of the graphic Kernel density plot, lead to judgement of the normality being either 'unknown', 'OK', 'suspect' or 'not OK'. After removal of outliers, this check was repeated. If a data set does not have a normal distribution, the (results of the) statistical evaluation should be used with due care.

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

According to ISO13528 all (original received or corrected) results per determination were submitted to outlier tests. In the iis procedure for proficiency tests, outliers are detected prior to calculation of the mean, standard deviation and reproducibility. For small data sets, Dixon (up to 20 test results) or Grubbs (up to 40 test results) outlier tests can be used. For larger data sets (above 20 test results) Rosner's outlier test can be used. Outliers are marked by D(0.01) for the Dixon's test, by G(0.01) or DG(0.01) for the Grubbs' test and by R(0.01) for the Rosner's test. Stragglers are marked by D(0.05) for the Dixon's test, by G(0.05) or DG(0.05) for the Grubbs' test and by R(0.05) for the Rosner's test. Both outliers and stragglers were not included in the calculations of averages and standard deviations.

For each assigned value the uncertainty was determined in accordance with ISO13528. Subsequently the calculated uncertainty was evaluated against the respective requirement based on the target reproducibility in accordance with ISO13528. In this PT, the criterion of ISO13528, paragraph 9.2.1. was met for all evaluated tests, therefore, the uncertainty of all assigned values may be negligible and need not be included in the PT report.

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

3.2 GRAPHICS

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

Furthermore, Kernel Density Graphs were made. This is a method for producing a smooth density approximation to a set of data that avoids some problems associated with histograms. Also, a normal Gauss curve (dotted line) was projected over the Kernel Density Graph (smooth line) for reference. The Gauss curve is calculated from the consensus value and the corresponding standard deviation.

3.3 Z-SCORES

To evaluate the performance of the participating laboratories the z-scores were calculated. As it was decided to evaluate the performance of the participants in this proficiency test (PT) against the literature requirements, the z-scores were calculated using a target standard deviation. This results in an evaluation independent of the variation in this interlaboratory study.

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

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

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

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

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

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

4 EVALUATION

During the execution of this proficiency test some problems occurred with the dispatch of the samples due to the COVID-19 pandemic. Therefore, the reporting time on the data entry portal was extended with another week. One participant did not report any test results and three other participants reported the test results after the reporting deadline. Not all laboratories were able to report all elements requested.
Finally, 38 reporting laboratories submitted 197 numerical test results. Observed were 11 outlying test results, which is 5.6%. 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 ELEMENT

In this section the reported test results are discussed per element. The test methods which were used by the various laboratories were taken into account for explaining the observed differences when possible and applicable. These test methods are also in the tables in appendix 1 together with the original data. The abbreviations used in these tables are explained in appendix 5.

EN71-3 method is considered to be the official test method for the determination of Elements migrated from different matrices. In April 2019 the CEN committee published a new version of EN71-3. In this 2019 test method of EN71-3 new precision data are given in table 4 and in table C.1. Table 4 contains precision data from an interlaboratory study. The committee was not able to obtain precision data for all elements for each category via an interlaboratory study. In order to compensate for missing data for certain element and category combinations estimations for the reproducibility have been considered by the committee based on table 4 and input from experts. These precision data are given in table C.1 of EN71-3:19 and are used to evaluate the performance of the group of participants in this PT.

Aluminum: This determination was very problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the suspect data was very large compared with the target reproducibility based on EN71-3:19. Therefore no z-scores were calculated.

Antimony: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in good agreement with the target reproducibility based on EN71-3:19.

Arsenic: This determination was not problematic. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in good agreement with the target reproducibility based on EN71-3:19.

Cadmium: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the target reproducibility based on EN71-3:19.

Lead: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the target reproducibility based on EN71-3:19.

Nickel: This determination was not problematic. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in agreement with the target reproducibility based on EN71-3:19.

Strontium: This determination was not problematic. Four statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in agreement with the target reproducibility based on EN71-3:19.

The concentrations reported for all other Elements were near or below the detection limit. Therefore, no z-scores were calculated. See appendix 2 for the reported test results.

4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the reproducibilities as declared by the reference test method and the reproducibilities as found for the group of participating laboratories. The number of significant test results, the average, the calculated reproducibilities (2.8 * standard deviation) and the target reproducibilities, derived from the official test method EN71-3:2019 are presented in the next table.

Element	unit	n	average	2.8 * sd	R(target)
Aluminum as Al	mg/kg	22	29.0	27.4	(12.2)
Antimony as Sb	mg/kg	19	2.31	0.98	1.94
Arsenic as As	mg/kg	29	2.93	1.07	1.64
Cadmium as Cd	mg/kg	17	0.18	0.07	0.10
Lead as Pb	mg/kg	36	72.4	34.2	40.6
Nickel as Ni	mg/kg	32	19.1	5.4	10.7
Strontium as Sr	mg/kg	31	428	119	180

Table 3: reproducibilities on sample #21565

Without further statistical calculations, it can be concluded that the group of participating laboratories has no difficulties with the determination of the migration of the evaluated elements in plaster in accordance with EN71-3:19.

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

The uncertainties determined in this PT are compared with the relative standard deviations as found in previous years and with the target requirements in the next table.

Element	April 2021	April 2020	April 2019	April 2018	April 2017	April 2016	EN71-3:19 table C.1
Aluminum	34%	17%	29%	20%	23%	20%	15%
Antimony	15%	--	--	--	47%	--	30%
Arsenic	13%	--	--	--	--	32%	20%
Barium	--	--	--	--	--	--	20%
Boron	--	--	--	--	--	--	15%
Cadmium	14%	14%	--	18%	--	--	20%
Chromium *)	--	--	--	--	--	44%	n.a.
Chromium (III)	--	--	--	--	--	--	15%
Chromium (VI)	--	--	--	--	--	--	50%

Element	April 2021	April 2020	April 2019	April 2018	April 2017	April 2016	EN71-3:19 table C.1
Cobalt	--	--	--	--	--	--	15%
Copper	--	--	10%	--	28%	17%	15%
Lead	17%	23%	26%	30%	22%	22%	20%
Manganese	--	10%	--	14%	13%	16%	15%
Mercury	--	--	--	--	--	--	30%
Nickel	10%	--	--	--	--	--	20%
Selenium	--	--	--	--	--	--	15%
Strontium	10%	12%	20%	15%	21%	18%	15%
Tin	--	--	--	--	--	--	20%
Organic Tin	--	--	--	--	--	--	50%
Zinc	--	12%	--	17%	--	--	15%

Table 4: development of uncertainties over the years
*) Chromium total

The performance of the group is in general equal to or better in comparison to the performance in previous years, except Aluminum. The performance is in general also in line with the precision requirements of EN71-3:19 table C.1.

4.4 EVALUATION OF ANALYTICAL DETAILS

A vast majority of the registered participants mentioned that they are ISO/IEC17025 accredited for category 1 determination of Migration of Elements EN71-3.
Furthermore, the participants were asked to provide several analytical details which are listed in appendix 3. Based on the answers given by the participants the following can be summarized:
In EN71-3:19 it is emphasized that maintaining the pH between 1.1 and 1.3 is very important for the migration of the elements. All reporting participants have used a solution with a pH between 1.1 and 1.3 (with or without adjustment of HCl solution) to measure the metals.
All reporting participants mentioned to have used a sample intake of 100 mg or more.
For the migration, (almost) all reporting participants mentioned to have used a volume ratio of 5 mL of HCl solution per 100 mg sample intake.
When the analytical details where investigated separately, it appeared that the effect on the determination of metals in plaster is negligible.

5 DISCUSSION

In this PT it appeared that version of EN71-3:19 has been followed well by most of the participants.

For the plaster sample (#21565, category 1) the influence (e.g. adjusting the pH and a minimum amount of intake) is visible when following the test method correctly. The relative standard deviation of the group for the measured metals, except for Aluminum, is small compared to the relative standard deviation mentioned in EN71-3:19.

6 CONCLUSION

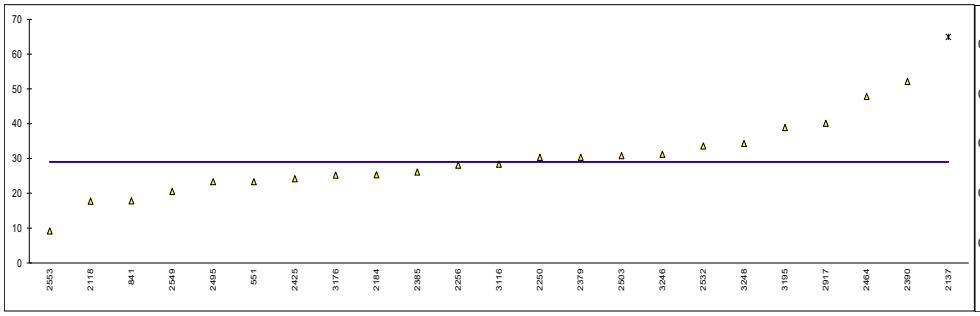
Each participating laboratory should evaluate its performance in this study and decide about any corrective actions if necessary. Therefore, participation on a regular basis in this scheme could be helpful to improve the performance and thus increase of the quality of the analytical results.

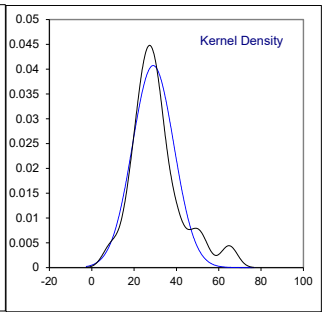
APPENDIX 1

Determination of migration of Aluminum as Al on plaster sample #21565; results in mg/kg

lab	method	value	mark	z(targ)	remarks
551	EN71-3	23.317		-----	
623	EN71-3	not detected		-----	
841	EN71-3	17.8		-----	
2118	EN71-3	17.72		-----	
2129		-----		-----	
2132	EN71-3	<50		-----	
2137	EN71-3	64.9	R(0.05)	-----	
2184	EN71-3	25.3		-----	
2236	EN71-3	<50.0		-----	
2250	EN71-3	30.344		-----	
2256	EN71-3	28.11		-----	
2299		-----		-----	
2365	EN71-3	＜50		-----	
2366	EN71-3	<50		-----	
2375	EN71-3	<50		-----	
2379	EN71-3	30.35		-----	
2385	EN71-3	26.1		-----	
2390	EN71-3	52.12		-----	
2425	EN71-3	24.15		-----	
2429	EN71-3	ND		-----	
2464	EN71-3	47.82		-----	
2495	EN71-3	23.30		-----	
2503	EN71-3	30.81		-----	
2532	EN71-3	33.6		-----	
2549	EN71-3	20.52		-----	
2553	In house	9.18	C	-----	First reported 1.5
2743		-----		-----	
2864		-----		-----	
2917	EN71-3	40.12		-----	
3116	EN71-3	28.33		-----	
3153	EN71-3	<100		-----	
3172	EN71-3	< 50		-----	
3176	EN71-3	25.20		-----	
3185	EN71-3	<100		-----	
3195	EN71-3	38.9		-----	
3214	EN71-3	<100		-----	
3246		31.183		-----	
3248	EN71-3	34.3		-----	
8005		-----		-----	

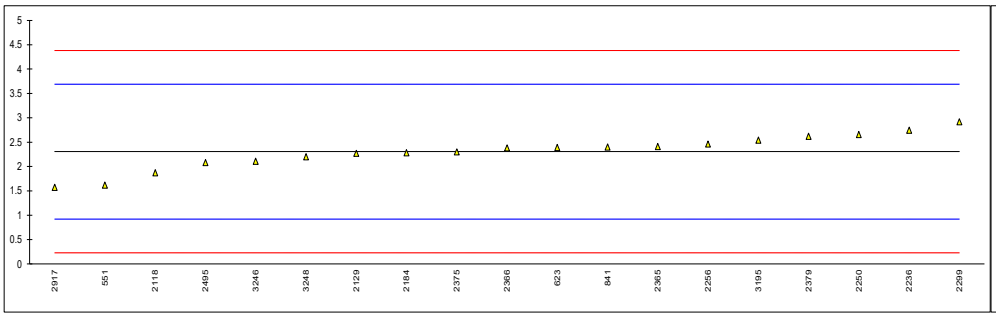
normality	OK	
n	22	
outliers	1	
mean (n)	29.0261	
st.dev. (n)	9.79506	RSD = 34%
R(calc.)	27.4262	
st.dev.(EN71-3:19)	(4.3539)	
R(EN71-3:19)	(12.1910)	

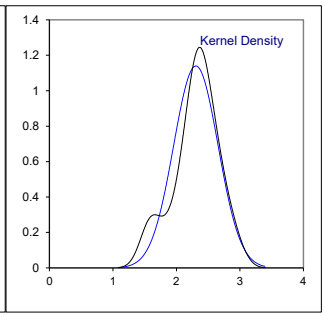




Determination of migration of Antimony as Sb on plaster sample #21565; results in mg/kg

lab	method	value	mark	z(targ)	remarks
551	EN71-3	1.6158		-1.00	
623	EN71-3	2.39		0.12	
841	EN71-3	2.4		0.14	
2118	EN71-3	1.87		-0.63	
2129		2.268		-0.05	
2132	EN71-3	<2.5		-----	
2137		-----		-----	
2184	EN71-3	2.28		-0.04	
2236	EN71-3	2.743		0.63	
2250	EN71-3	2.655		0.51	
2256	EN71-3	2.46		0.22	
2299	NTP324-001-1	2.916		0.88	
2365	EN71-3	2.4075		0.15	
2366	EN71-3	2.38		0.11	
2375	EN71-3	2.3		-0.01	
2379	EN71-3	2.62		0.46	
2385	EN71-3	<2		-----	
2390	EN71-3	n.d		-----	
2425	EN71-3	Not detected		-----	
2429	EN71-3	ND		-----	
2464		-----		-----	
2495	EN71-3	2.08		-0.33	
2503		-----		-----	
2532	EN71-3	Not Detected		-----	
2549	EN71-3	< 5.0		-----	
2553		-----		-----	
2743		-----		-----	
2864	EN71-3	not detected		-----	
2917	EN71-3	1.57		-1.06	
3116	EN71-3	LT2		-----	
3153	EN71-3	<10		-----	
3172	EN71-3	< 10		-----	
3176		-----		-----	
3185	EN71-3	<10		-----	
3195	EN71-3	2.54		0.34	
3214	EN71-3	<10		-----	
3246		2.105		-0.29	
3248	EN71-3	2.2		-0.15	
8005	GB6675/ISO8124-3	LT2		-----	
	normality	OK			
	n	19			
	outliers	0			
	mean (n)	2.3053			
	st.dev. (n)	0.35013	RSD = 15%		
	R(calc.)	0.9804			
	st.dev.(EN71-3:19)	0.69158			
	R(EN71-3:19)	1.9364			

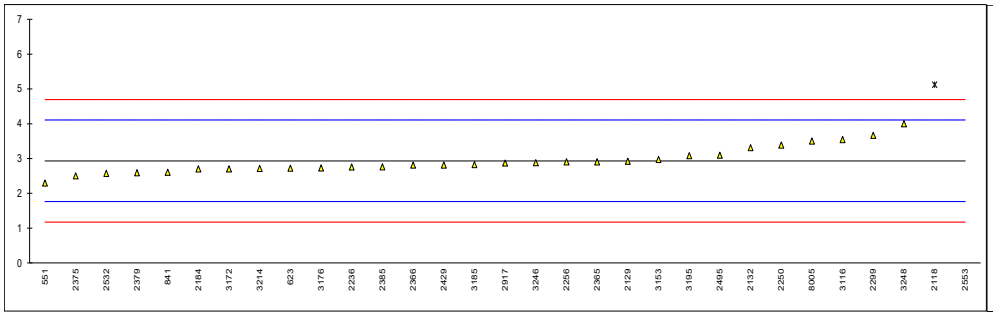


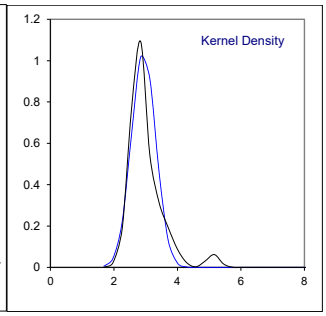


Determination of migration of Arsenic as As on plaster sample #21565; results in mg/kg

lab	method	value	mark	z(targ)	remarks
551	EN71-3	2.2914		-1.09	
623	EN71-3	2.72		-0.36	
841	EN71-3	2.6		-0.57	
2118	EN71-3	5.12	R(0.01)	3.73	
2129		2.919		-0.02	
2132	EN71-3	3.31		0.64	
2137		-----		-----	
2184	EN71-3	2.70		-0.40	
2236	EN71-3	2.755		-0.30	
2250	EN71-3	3.384		0.77	
2256	EN71-3	2.90		-0.06	
2299	NTP324-001-1	3.662		1.24	
2365	EN71-3	2.9012		-0.06	
2366	EN71-3	2.81		-0.21	
2375	EN71-3	2.5		-0.74	
2379	EN71-3	2.59		-0.59	
2385	EN71-3	2.76		-0.30	
2390	EN71-3	n.d		-----	
2425	EN71-3	Not detected		-----	
2429	EN71-3	2.81		-0.21	
2464		-----		-----	
2495	EN71-3	3.093		0.27	
2503		-----		-----	
2532	EN71-3	2.57	C	-0.62	First reported “not detected”
2549	EN71-3	< 2.5		-----	
2553	In house	75	C,R(0.01)	122.83	First reported 0.15
2743		-----		-----	
2864	EN71-3	<10	C	-----	First reported “not detected”
2917	EN71-3	2.87		-0.11	
3116	EN71-3	3.54		1.03	
3153	EN71-3	2.97		0.06	
3172	EN71-3	2.70		-0.40	
3176	EN71-3	2.73		-0.35	
3185	EN71-3	2.82		-0.19	
3195	EN71-3	3.08		0.25	
3214	EN71-3	2.71		-0.38	
3246		2.876		-0.10	
3248	EN71-3	4.0		1.82	
8005	GB6675/ISO8124-3	3.50		0.97	

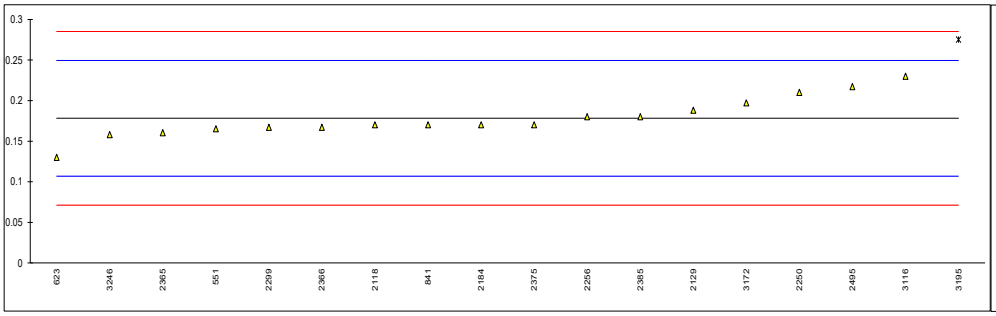
normality	not OK	
n	29	
outliers	2	
mean (n)	2.9335	
st.dev. (n)	0.38137	RSD = 13%
R(calc.)	1.0678	
st.dev.(EN71-3:19)	0.58670	
R(EN71-3:19)	1.6428	

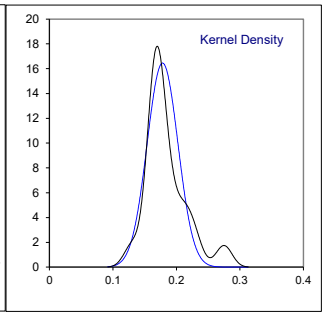




Determination of migration of Cadmium as Cd on plaster sample #21565; results in mg/kg

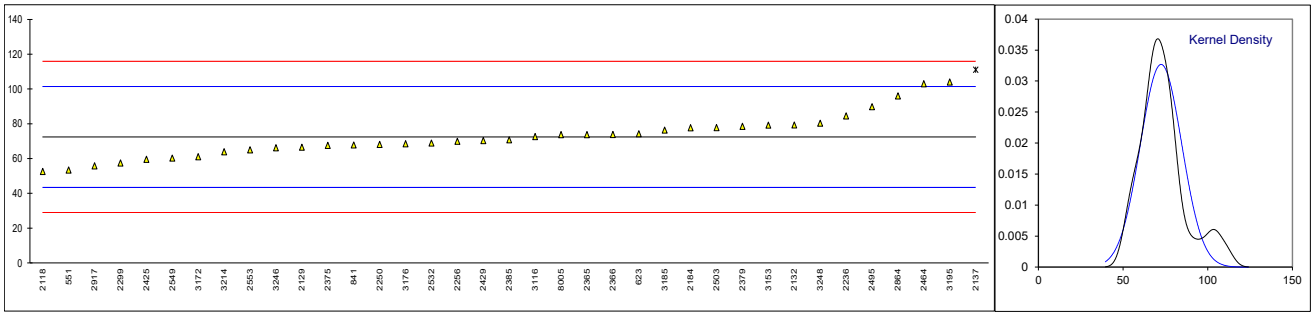
lab	method	value	mark	z(targ)	remarks
551	EN71-3	0.1651		-0.37	
623	EN71-3	0.13		-1.35	
841	EN71-3	0.17		-0.23	
2118	EN71-3	0.17		-0.23	
2129		0.188		0.28	
2132	EN71-3	<0.25		-----	
2137		-----		-----	
2184	EN71-3	0.17		-0.23	
2236	EN71-3	<1.0		-----	
2250	EN71-3	0.210		0.89	
2256	EN71-3	0.18		0.05	
2299	NTP324-001-1	0.167		-0.31	
2365	EN71-3	0.1602		-0.50	
2366	EN71-3	0.167		-0.31	
2375	EN71-3	0.17		-0.23	
2379	EN71-3	Not detected		-----	
2385	EN71-3	0.18		0.05	
2390	EN71-3	n.d		-----	
2425	EN71-3	Not detected		-----	
2429	EN71-3	ND		-----	
2464		-----		-----	
2495	EN71-3	0.217		1.09	
2503		-----		-----	
2532	EN71-3	Not Detected		-----	
2549	EN71-3	< 0.5		-----	
2553		-----		-----	
2743		-----		-----	
2864	EN71-3	not detected		-----	
2917	EN71-3	<1		-----	
3116	EN71-3	0.23		1.45	
3153	EN71-3	<0.5		-----	
3172	EN71-3	0.197		0.53	
3176		-----		-----	
3185	EN71-3	<0.5		-----	
3195	EN71-3	0.275	G(0.05)	2.72	
3214	EN71-3	<0.5		-----	
3246		0.158		-0.57	
3248	EN71-3	<0.5		-----	
8005	GB6675/ISO8124-3	LT2		-----	
	normality	OK			
	n	17			
	outliers	1			
	mean (n)	0.1782			
	st.dev. (n)	0.02424	RSD = 14%		
	R(calc.)	0.0679			
	st.dev.(EN71-3:19)	0.03564			
	R(EN71-3:19)	0.0998			





Determination of migration of Lead as Pb on plaster sample #21565; results in mg/kg

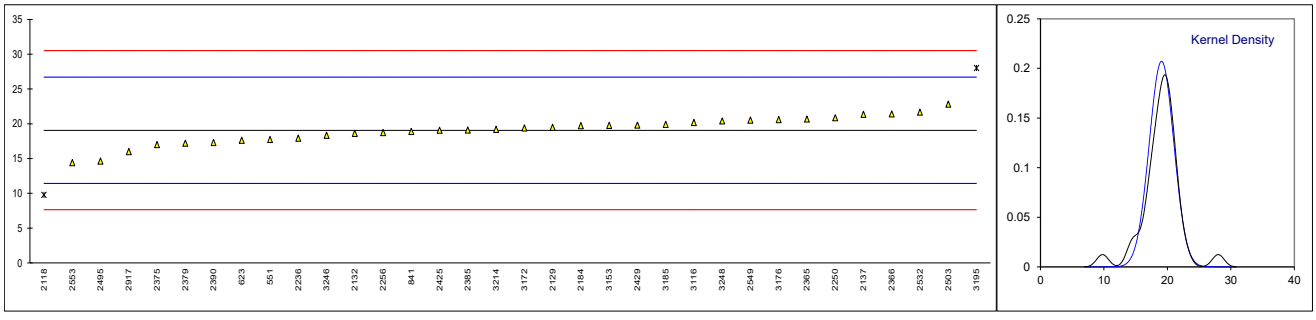
lab	method	value	mark	z(targ)	remarks
551	EN71-3	53.3719		-1.32	
623	EN71-3	74.23		0.12	
841	EN71-3	67.8		-0.32	
2118	EN71-3	52.55		-1.37	
2129		66.51		-0.41	
2132	EN71-3	79.31		0.47	
2137	EN71-3	111	R(0.05)	2.66	
2184	EN71-3	77.67		0.36	
2236	EN71-3	84.47		0.83	
2250	EN71-3	68.136		-0.30	
2256	EN71-3	69.93		-0.17	
2299	NTP324-001-1	57.453		-1.03	
2365	EN71-3	73.7177		0.09	
2366	EN71-3	73.8		0.09	
2375	EN71-3	67.5		-0.34	
2379	EN71-3	78.50		0.42	
2385	EN71-3	70.7		-0.12	
2390	EN71-3	n.d		-----	
2425	EN71-3	59.59		-0.89	
2429	EN71-3	70.3		-0.15	
2464	EN71-3	102.99		2.11	
2495	EN71-3	89.750		1.20	
2503	EN71-3	77.79		0.37	
2532	EN71-3	68.90		-0.24	
2549	EN71-3	60.23		-0.84	
2553	In house	65		-0.51	
2743		-----		-----	
2864	EN71-3	95.98		1.63	
2917	EN71-3	55.77		-1.15	
3116	EN71-3	72.62		0.01	
3153	EN71-3	79.19		0.47	
3172	EN71-3	61.0		-0.79	
3176	EN71-3	68.45	C	-0.27	First reported 123.88
3185	EN71-3	76.3		0.27	
3195	EN71-3	104		2.18	
3214	EN71-3	63.87		-0.59	
3246		66.146		-0.43	
3248	EN71-3	80.3		0.54	
8005	GB6675/ISO8124-3	73.67		0.09	
	normality	OK			
	n	36			
	outliers	1			
	mean (n)	72.4304			
	st.dev. (n)	12.20699	RSD = 17%		
	R(calc.)	34.1796			
	st.dev.(EN71-3:19)	14.48608			
	R(EN71-3:19)	40.5610			



Determination of migration of Nickel as Ni on plaster sample #21565; results in mg/kg

lab	method	value	mark	z(targ)	remarks
551	EN71-3	17.729		-0.35	
623	EN71-3	17.63		-0.38	
841	EN71-3	18.9		-0.04	
2118	EN71-3	9.77	R(0.01)	-2.44	
2129		19.473		0.11	
2132	EN71-3	18.61		-0.12	
2137	EN71-3	21.35		0.60	
2184	EN71-3	19.71		0.17	
2236	EN71-3	17.92		-0.30	
2250	EN71-3	20.853		0.47	
2256	EN71-3	18.71		-0.09	
2299		-----		-----	
2365	EN71-3	20.6705		0.42	
2366	EN71-3	21.4		0.61	
2375	EN71-3	17		-0.54	
2379	EN71-3	17.20		-0.49	
2385	EN71-3	19.1		0.01	
2390	EN71-3	17.3	C	-0.46	First reported n.d.
2425	EN71-3	19.05		0.00	
2429	EN71-3	19.8		0.19	
2464		-----	W	-----	Test result with drawn, reported 26.41
2495	EN71-3	14.63		-1.16	
2503	EN71-3	22.82		0.98	
2532	EN71-3	21.66		0.68	
2549	EN71-3	20.52		0.38	
2553	In house	14.4		-1.22	
2743		-----		-----	
2864		-----		-----	
2917	EN71-3	16.00		-0.80	
3116	EN71-3	20.19		0.29	
3153	EN71-3	19.75		0.18	
3172	EN71-3	19.4		0.09	
3176	EN71-3	20.59		0.40	
3185	EN71-3	19.9		0.22	
3195	EN71-3	28.0	R(0.01)	2.34	
3214	EN71-3	19.19		0.03	
3246		18.331		-0.19	
3248	EN71-3	20.4	C	0.35	First reported 31.8
8005		-----		-----	

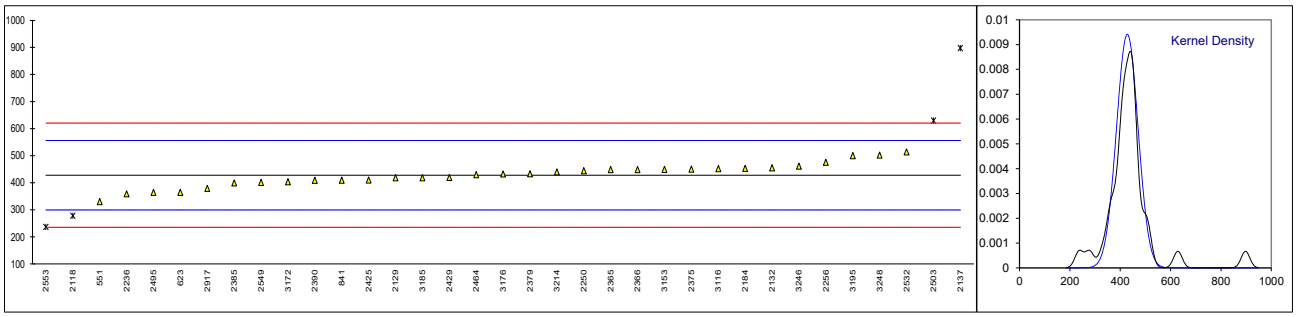
normality	OK	
n	32	
outliers	2	
mean (n)	19.0683	
st.dev. (n)	1.92545	RSD = 10%
R(calc.)	5.3913	
st.dev.(EN71-3:19)	3.81367	
R(EN71-3:19)	10.6783	



Determination of migration of Strontium as Sr on plaster sample #21565; results in mg/kg

lab	method	value	mark	z(targ)	remarks
551	EN71-3	329.896		-1.53	
623	EN71-3	364.48		-0.99	
841	EN71-3	409.3		-0.29	
2118	EN71-3	278.02	R(0.05)	-2.34	
2129		417.93		-0.16	
2132	EN71-3	455.17		0.42	
2137	EN71-3	897.7	R(0.01)	7.31	
2184	EN71-3	453.0		0.39	
2236	EN71-3	359.1		-1.07	
2250	EN71-3	444.349		0.25	
2256	EN71-3	475.15		0.73	
2299		-----		-----	
2365	EN71-3	448.3862		0.32	
2366	EN71-3	448.7		0.32	
2375	EN71-3	450		0.34	
2379	EN71-3	433.05		0.08	
2385	EN71-3	399		-0.45	
2390	EN71-3	408.79		-0.30	
2425	EN71-3	410.0		-0.28	
2429	EN71-3	419.2		-0.14	
2464	EN71-3	429.56		0.02	
2495	EN71-3	364.24		-0.99	
2503	EN71-3	629	R(0.01)	3.13	
2532	EN71-3	513.9		1.34	
2549	EN71-3	401.09		-0.42	
2553	In house	236.69	C,R(0.01)	-2.98	First reported 12.65
2743		-----		-----	
2864		-----		-----	
2917	EN71-3	378.9		-0.77	
3116	EN71-3	452.00		0.37	
3153	EN71-3	449.32		0.33	
3172	EN71-3	403.7		-0.38	
3176	EN71-3	432.55	C	0.07	First reported 856.63
3185	EN71-3	418.2		-0.15	
3195	EN71-3	500		1.12	
3214	EN71-3	439.71		0.18	
3246		460.993		0.51	
3248	EN71-3	501.8		1.15	
8005		-----		-----	

	normality	OK
	n	31
	outliers	4
	mean (n)	428.112
	st.dev. (n)	42.3679
	R(calc.)	118.630
	st.dev.(EN71-3:19)	64.2168
	R(EN71-3:19)	179.807



APPENDIX 2

Determination of migration of Other Elements on plaster sample #21565; results in mg/kg

lab	Ba	B	Cr (III)	Cr (VI)	Co	Cu	Mn	Hg
551	0.7924	Not tested	0.09549	Not tested	0.0689	0.6717	4.0133	1.4794
623	not detected	not detected	0.11	not detected	not detected	not detected	not detected	not detected
841	<2.5	<2.5	<0.2	<0.002	<0.1	<2.5	3.2	<0.1
2118	0.425	2.75	0.04	0.0001	0.02	0.08	2.77	0.01
2129	-----	31.275	-----	-----	-----	-----	-----	-----
2132	<25	<25	<1	<0.005	<0.25	<15	<25	<0.25
2137	-----	-----	-----	-----	-----	-----	-----	-----
2184	<2.5	<10	<1	<0.015	<0.5	<2.5	5.64	<0.5
2236	<2.0	7.171	<2.0	-----	<2.0	<50.0	4.772	<2.0
2250	1.061	<10	0.0771	<0,02	<0,1	<10	5.223	<0,1
2256	ND	5.84	ND	ND	ND	ND	4.97	ND
2299	0.885	-----	0.305	-----	-----	-----	-----	0.151
2365	＜50	＜50	＜5	＜0.01	＜0.5	＜50	＜50	＜0.50
2366	<50	<50	<1	<0.01	<0.5	<50	<50	<0.5
2375	<50	<50	<5	<0.01	<0.5	<50	<50	<0.5
2379	0.74	Not detected	0.18	Not detected	Not detected	Not detected	Not detected	Not detected
2385	0.58	5.40	<0.25	<0.02	<0.25	<0.25	4.30	<0.1
2390	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
2425	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
2429	ND	ND	ND	ND	ND	ND	ND	ND
2464	1.14	-----	1.18	-----	-----	-----	5.87	-----
2495	<5	<5	<1	-----	<1	<5	<5	<0.5
2503	-----	6.258	-----	-----	-----	-----	3.819	-----
2532	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
2549	< 5.0	< 5.0	< 5.0	< 0.02	< 5.0	< 5.0	< 5.0	< 0.5
2553	-----	-----	-----	-----	-----	-----	-----	-----
2743	-----	-----	-----	-----	-----	-----	-----	-----
2864	5.94	7.46	-----	-----	-----	-----	-----	not detected
2917	14.25	----- W	<1	-----	<1	<1	3.72	<1
3116	LT2	LT5	LT1	LT0.002	LT2	LT2	5.54	LT0.15
3153	<10	<50	<5	<0.01	<1	<10	<10	<1
3172	< 50	< 50	< 10	< 0.005	< 5	< 50	< 50	< 5
3176	2.69	6.12	-----	-----	-----	-----	4.93	-----
3185	<10	<50	<5	<0.010	<1.0	<10	<10	<1.0
3195	<5.0	10.4	-----	-----	<0.050	<2.0	6.27	<0.025
3214	<10	<50	<5	NA	<1	<10	<10	<1
3246	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	4.514	Not detected
3248	<10	<100	<1	<0.01	<1	<10	<10	<1
8005	LT2	-----	-----	-----	-----	-----	-----	LT2

Lab 2917; test result withdrawn for Boron, reported 111.45

Determination of migration of Other Elements on plaster sample #21565; results in mg/kg
---continued---

lab	Se	Sn	Org.Sn	Zn	
551	0.02276	0.04389	Not tested	7.8274	
623	not detected	not detected	not detected	not detected	
841	<0.5	<0.025	<0.04	<2.5	
2118	0.03	0.0	not analyzed	0.48	
2129	-----	0.739	not analyzed	-----	
2132	<2.5	Not applicable	<0.72	<250	
2137	-----	-----	-----	-----	
2184	<2.5	<0.2	not detected	<10	
2236	<2.0	<2.0	Not Determined	<50.0	
2250	<5	<0,1	-----	<10	
2256	ND	ND	ND	ND	
2299	0.256	-----	-----	-----	
2365	＜5	＜4.9	＜0.9	＜50	
2366	<5	<0.15	<0.9	<50	
2375	<5	<0.36	-----	<50	
2379	Not detected	Not detected	0.500	Not detected	
2385	<1	<0.08	<0.02	1.73	
2390	n.d	n.d	n.d	n.d	
2425	Not detected	Not detected	Not detected	Not detected	
2429	ND	ND	ND	ND	
2464	-----	-----	-----	3.03	
2495	<1	<0.2	-----	<5	
2503	-----	-----	-----	-----	
2532	Not Detected	Not Detected	Not Detected	Not Detected	
2549	< 5.0	< 2.5	< 0.5	< 5.0	
2553	-----	-----	-----	-----	
2743	-----	-----	-----	-----	
2864	not detected	-----	-----	-----	
2917	<1	<1	-----	-----	W
3116	LT2	LT2	LT0.225	LT5	
3153	<5	<10	<0.3	<100	
3172	< 10	< 50	< 0.05	< 50	
3176	-----	-----	-----	5.40	
3185	<5.0	<0.1	<0.3	<100	
3195	<0.20	0.205	-----	<5.0	
3214	<5	<10	NA	<100	
3246	Not detected	Not detected	Not detected	Not detected	
3248	<10	<0.8	<0.5	<10	
8005	LT2	-----	-----	-----	

Lab 2917 Test result withdrawn for Zinc, reported 78.87

APPENDIX 3

Analytical details for sample #21565

lab	ISO/IEC17025 accredited	Sample intake	Amount of 0.07 mol/L HCl solution used in mL	pH after 1 minute shaking	Was the pH adjusted after 1 minute of shaking	pH after adjustment
551	No	1g	50 mL	1.3	No	
623	---	0.3 g	15	1.2	No	
841	Yes	0.2 grams	10 ml	> 1.3	Yes	< 1.3
2118	Yes	0.1200 g	6	1.25	No	
2129	Yes				---	
2132	Yes	0.1 gram	5 mL	1.54	Yes	1.23
2137	Yes	0.2 g	0.613 mL / 100 mL	1.22	Yes	1.2
2184	Yes	0.1g	5ml	1.28	No	
2236	Yes	0.3023 g	15.0	1.46	Yes	1.28
2250	Yes	0,100 g	5	1,4	Yes	1,2 +-0,1
2256	Yes	104.8 mg	5.24 ml	1.380	Yes	1.141
2299	Yes	0.100 g	5.0 ml	> 6 pH	Yes	pH = 1.1 - 1.3
2365	Yes	0.1g	5mL	1.45	Yes	1.19
2366	Yes	0.2g	10ml	pH 1.50	Yes	pH 1.16
2375	Yes	-	-	-	---	-
2379	Yes	0.5000 g	25 mL	1.23	No	-
2385	Yes	0,48 g	24	1.52	Yes	1.15
2390	Yes	0.2007 g	10ml	8	Yes	1.2
2425	Yes	0.2 gm	10 ml	1.2	No	
2429	Yes	0.2 g	10	1.42	Yes	1.16
2464	Yes	0.100g	5ml	1.29	No	
2495	Yes	0.2g	10mL	1.40	Yes	1.20
2503	Yes	0,1004 g	5	1,3	Yes	1,19
2532	Yes	0.1g	5ml	1.17	No	
2549	Yes	0.25 g	12.5	1.24	No	Not Applicable
2553	Yes	0.4995g	25mL	1.2	No	
2743	---				---	
2864	Yes	0.1g	5ml	2.10	Yes	pH 1.20
2917	---				---	
3116	Yes	0.25g	12.5mL	1.1 and 1.2	No	Not applicable
3153	Yes	0.1g	5mL	1.42	Yes	1.19
3172	Yes	0.2 g	10		No	
3176	Yes	0,1 g	100	1,28	No	
3185	Yes	0.11g	5.5mL	1.45	Yes	1.19
3195	No	0.20 g	10 ml	3.2	Yes	1.2
3214	Yes	0.2 g	10 mL	1.425	Yes	1.275
3246	Yes	1gram/50mL sol.	5mL	1.40	Yes	1.23
3248	No	0.2000 g	10.4	1.40	Yes	1.23
8005	Yes	0.25g	12.5 mL	1.1 and 1.2	No	Not applicable

APPENDIX 4

Number of participants per country

1 lab in	BANGLADESH
1 lab in	BELGIUM
1 lab in	BRAZIL
1 lab in	CANADA
4 labs in	GERMANY
6 labs in	HONG KONG
2 labs in	INDIA
1 lab in	INDONESIA
3 labs in	ITALY
5 labs in	P.R. of CHINA
1 lab in	PAKISTAN
1 lab in	PERU
1 lab in	SLOVENIA
1 lab in	SOUTH KOREA
1 lab in	SRI LANKA
2 labs in	TAIWAN
1 lab in	THAILAND
2 labs in	TURKEY
2 labs in	U.S.A.
2 labs in	VIETNAM

APPENDIX 5

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
W	= test result withdrawn on request of participant
ex	= test result excluded from statistical evaluation
n.a.	= not applicable
n.e.	= not evaluated
n.d.	= not detected

Literature

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5 M. Thompson and R. Wood, J. AOAC Int, 76, 926, (1993)
6 W.J. Youden and E.H. Steiner, Statistical Manual of the AOAC, (1975)
7 P.L. Davies, Fr. Z. Anal. Chem, 331, 513, (1988)
8 J.N. Miller, Analyst, 118, 455, (1993)
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13 Update on the Global Status of Legal Limits on Lead in Paint September 2018, Publication developed by the UN Environment in partnership with WHO and US EPA, the Chair of the Lead Paint Alliance.
14 Council Directive 88/378/EEC
15 Council Directive 2009/48/EC