Results of Proficiency Test
Migration of elements
March 2011

Organised by: Institute for Interlaboratory Studies
Spijkenisse, the Netherlands

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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 ISO 8124 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 recently been super-seded by Council Directive 2009/48/EC, which will apply to toy imports into the EU as of 20th July 2011. Part 3 of EN71 describes the determination of migration of elements (metals that are considered hazardous) when a toys gets into contact with an acid solution (0.07 n HCl, simulating gastric acid solution)
In this interlaboratory study on migration of certain elements 77 laboratories in 22 different countries participated. See appendix 3 for the number of participants per country.
In this report the results of this proficiency test are presented and discussed.

2 SET UP

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, was the organiser of this proficiency test (PT). Sample preparation and analyses were subcontracted to an ISO17025 accredited laboratory.
This PT was organised for the first time by iis in 2010. Then glass plates were used, of which several did break during sample transport. Therefore some investigations were done to find an alternative material to apply the paint on.
After the issue of the final report of the first PT a questionnaire was sent to the participating laboratories. From the answers (23 of the 64 labratories replied) it became clear that most laboratories (15 labs) preferred to test only the 8 elements mentioned in the ‘old’ Council Directive 88/378/EEC, but other laboratories (8 labs) elements of the ‘new’ Council Directive 2009/48/EC. Therefore it was decided to combine both and to add two ‘new’ elements (nickel and cobalt) in addition to a number of regular elements.
In this PT 2 different samples of paint with different concentrations of arsenic, cadmium, cobalt, mercury, lead, nickel and antimony applied on PVC plates were used. Participants were requested to report both results of migration before (unrounded) and after analytical correction (ac) *cfr* EN71-3.

2.1 QUALITY SYSTEM

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, has implemented a quality system based on ISO guide 43 and ILAC-G13:2007. This ensures 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).

2.3 CONFIDENTIALITY STATEMENT

All data present 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

Two batches with different element compositions were prepared. The samples used in this PT were prepared by a subcontractor by the addition of metal salts to a regular paint. After thorough mixing, the paint was applied to 100 PVC plates per sample. The two batches of samples were tested for homogeneity (by total metal content) on 8 randomly selected samples per batch. The analytical testing was subcontracted to an ISO17025 accredited laboratory. See the following tables for the homogeneity test results.

blue sample	*Total cadmium in mg/kg*	*Total cobalt in mg/kg*	*Total mercury in mg/kg*	*Total lead in mg/kg*
Sample #11010-1	18.4	103	34.5	123
Sample #11010-2	18.9	108	42.6	131
Sample #11010-3	17.4	105	37.7	127
Sample #11010-4	18.1	105	37.7	128
Sample #11010-5	18.2	102	38.2	123
Sample #11010-6	16.7	95	38.6	115
Sample #11010-7	19.7	113	40.8	135
Sample #11010-8	18.5	109	40.2	129

table 1: measured totals for cadmium, cobalt, mercury and lead for homogeneity test of subsamples #11010

pink sample	*Total cadmium in mg/kg*	*Total cobalt in mg/kg*	*Total nickel in mg/kg*	*Total lead in mg/kg*
Sample #11011-1	78.9	2.85	240	107
Sample #11011-2	79.6	2.89	243	108
Sample #11011-3	78.8	2.84	238	105
Sample #11011-4	80.7	2.92	244	109
Sample #11011-5	75.2	2.77	235	102
Sample #11011-6	76.0	2.72	230	101
Sample #11011-7	76.4	2.73	232	102
Sample #11011-8	75.8	2.74	230	102

table 2: measured totals for cadmium, cobalt, nickel and lead for homogeneity test of subsamples #11011

From the test results of tables 1 and 2, the relative repeatability standard deviations were calculated per metal and subsequently compared with the relative repeatability standard deviations as determined by the accredited laboratory on 3 CRMs (ERM-EC680K, ERM-EC681K and NIST 2582)

blue sample	*Total cadmium in mg/kg*	*Total cobalt in mg/kg*	*Total mercury in mg/kg*	*Total lead in mg/kg*
RSDr (observed)	4.9%	5.1%	6.3%	4.7%
RSDr (laboratory)	5.6%	5.5%	7.7%	4.8%

table 3: evaluation of the observed repeatabilities of subsamples #11010

pink sample	*Total cadmium in mg/kg*	*Total cobalt in mg/kg*	*Total nickel in mg/kg*	*Total lead in mg/kg*
RSDr (observed)	2.6%	2.8%	2.4%	2.9%
RSDr (laboratory)	5.6%	5.5%	5.9%	4.8%

table 4: evaluation of the observed repeatabilities of subsamples #11011

Each calculated repeatability standard deviation is less than the corresponding repeatability standard deviation as determined for that metal on the CRMs by the laboratory.
Therefore, homogeneity of the subsamples of #11010 and #11011 was assumed.
Two plastic plates (one of each sample #11010 and #11011) were sent to the participating laboratories on February 16, 2011.

2.5 ANALYSES

The participants were requested to determine the migration of elements in accordance with EN71-3, applying the analysis procedure that is routinely used in the laboratory.
To get comparable results a detailed report form, was sent together with the set of samples.
Both results of migration before and after analytical correction were requested to report. 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.8 and 9) 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.

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 is a method for producing a smooth density approximation to a set of data that avoids some problems associated with histograms (see appendix 3, nr.13-14).

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 require-ments. Therefore, the z-scores were calculated using a target standard deviation.
Due to the lack of precision data in test method EN71-3, the target standard deviation was estimated to be 50% of the analytical correction as specified in paragraph 4.2 of EN71-3. This is justified by the fact that the analytical corrections are based on the uncertainty of the test method and 95% of all results should be within this uncertainty, see appendix D of EN71-3.

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:

| 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 were encountered with sample transport and/or customes clearance. The samples for several laboratories in Germany, Hong Kong, Mexico and P.R. of China arrived close or past the deadline for reporting.
Three laboratories decided not to report any results. Ten other laboratories reported results after the final reporting date.
Finally, the 74 reporting laboratories did report in total 716 numerical results before analytical correction. Observed were 34 statistical outlying results, which is 4.4% of the numerical results. In proficiency studies, outlier percentages of 3% - 7.5% are quite normal.

For the migration of each element a Gaussian distribution was found, except for the migration of barium, chromium and selenium in sample #11010 and antimony, lead, mercury and cobalt in sample #11011, in which case the results of the statistical evaluation should be used with care.

4.1 EVALUATION PER SAMPLE AND PER ELEMENT

In this section, the determination is discussed. All statistical results reported on the samples are summarised in appendix 1. The test results before analytical correction were used for the evaluation as not all laboratories applied the analytical correction in the same way, see the tables in appendix 1 and the discussion in chapter 5.
For arsenic, chromium and selenium in sample #11010 and for antimony, chromium, cobalt, mercury and selenium in sample #11011 concentrations near or below the respective detection limit were reported by the majority of the participating laboratories and therefore no significant conclusions were drawn for these elements.

Sb on #11010: The migration of antimony on this sample, at a low migration level of 18 mg/kg before analytical correction, was not problematic.
Two statistical outliers were observed and three false negative result were reported. The observed reproducibility, after rejection of the statistical outliers, is in good agreement with the target reproducibility estimated from the analytical correction.

Ba on #11010: The migration of barium on this sample was problematic as the reported test results appeared to be bimodally divided. This phenomena may be explained by the fact that barium was not spiked to the paint and therefore the measured barium probably will be from the plastic carrier. Some laboratries may have scraped off more plastic than others.
All barium results reported are low in relation to the limit set for this element and therefore this problem will not be significant in practice.

Cd on #11010: The migration of cadmium on this sample, at a low migration level of 16 mg/kg before analytical correction, was not problematic.
Four statistical outliers were observed. However, the observed reproducibility, after rejection of the statistical outliers, is in good agreement with the target reproducibility estimated from the analytical correction.

Co on #11010: The migration of cobalt on this sample, at a migration level of 90 mg/kg before analytical correction, was problematic.
Only one statistical outlier was observed. However, the observed reproducibility, after rejection of the statistical outlier, is not in agreement with the target reproducibility estimated from the assumed analytical correction of 30%.

Pb on #11010: The migration of lead on this sample, at a migration level of 100 mg/kg before analytical correction, was problematic.
Only two statistical outliers were observed. However, the observed reproducibility, after rejection of the statistical outliers, is not in agreement with the target reproducibility estimated from the analytical correction.

Hg on #11010: The migration of mercury on this sample, at the very low migration level of 7 mg/kg before analytical correction, was very problematic.
Only two statistical outliers were observed. However, the observed reproducibility, after rejection of the statistical outliers, is not at all in agreement with the target reproducibility estimated from the analytical correction.

Ni on #11010: The migration of nickel on this sample, at the very low migration level of 7 mg/kg before analytical correction, was problematic.
Four statistical outliers were observed and the observed reproducibility, after rejection of the statistical outliers, is not in agreement with the target reproducibility estimated from the assumed analytical correction of 30%.

As on #11011: The migration of arsenic on this sample, at a migration level of 25 mg/kg before analytical correction, was not problematic.
Three statistical outliers were observed and one false negative result were reported. The observed reproducibility, after rejection of the statistical outliers, is in good agreement with the target reproducibility estimated from the analytical correction.

Ba on #11011: The migration of barium on this sample, at a migration level of 100 mg/kg before analytical correction, was problematic.
Only two statistical outliers were observed. However, the observed reproducibility, after rejection of the statistical outliers, is not at all in agreement with the target reproducibility estimated from the analytical correction. The larg spread may be explained by the fact that barium was not spiked to the paint and therefore the measured barium probably will be from the plastic carrier. Some laboratries may have scraped off more plastic than others.
All barium results reported are low in relation to the limits set for this element and therefore this problem will not be significant in practice.

Cd on #11011: The migration of cadmium on this sample, at a migration level of 75 mg/kg before analytical correction, was not problematic.

Three statistical outliers were observed. However, the observed reproducibility, after rejection of the statistical outliers, is in good agreement with the target reproducibility estimated from the analytical correction.

Pb on #11011: The migration of lead on this sample, at a migration level of 62 mg/kg before analytical correction, was problematic.
Only two statistical outliers were observed. However, the observed reproducibility, after rejection of the statistical outliers, is not in agreement with the target reproducibility estimated from the analytical correction.

Ni on #11011: The migration of nickel on this sample, at the migration level of 200 mg/kg before analytical correction, was not problematic.
Two statistical outliers were observed. However, the observed reproducibility, after rejection of the statistical outliers, is in good agreement with the target reproducibility estimated from the assumed analytical correction of 30%.

4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the target reproducibilities estimated from the analytical correction 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 (50% of the analytical correction*2.8) are compared in the next table.

Element	*unit*	*n*	*average*	*2.8 * sd*	*R (target)*
Antimony #11010	mg/kg	68	18.2	11.7	15.3
Barium #11010	mg/kg	60	41.6	88.3	17.5
Cadmium #11010	mg/kg	70	16.2	6.3	6.8
Cobalt #11010	mg/kg	45	90.3	44.5	(37.9)*
Lead #11010	mg/kg	72	100.0	50.5	42.0
Mercury #11010	mg/kg	46	6.9	10.7	4.8
Nickel #11010	mg/kg	41	6.8	3.4	(2.8)*
Arsenic #11011	mg/kg	69	24.9	9.4	20.9
Barium #11011	mg/kg	70	100.3	117.0	42.1
Cadmium #11011	mg/kg	71	74.9	23.0	31.4
Lead #11011	mg/kg	72	61.8	33.7	26.0
Nickel #11011	mg/kg	44	196.7	81.9	(82.6)*

table 5: reproducibilities of test results before analytical correction in samples #11010 and #11011

()* the analytical corrections for Cobalt and Nickel were assumed to be 30% in this report.

From the above table it can be concluded that, without statistical calculations, the group of participating laboratories has little or no difficulties with the determination of the migration of elements in accordance with EN 71-3, when compared with the target reproducibilities estimated from the analytical correction. See also the discussions in paragraphs 4.1.

5 DISCUSSION

When the results of this interlaboratory study are compared to the requirements for toys in EU (table 6), it is noticed that some participants would make different decisions then the majority of the group about the acceptability of the paint for the determined parameters.
One laboratory would reject sample #11010 for cadmium (>75 mg/kg after analytical correction, or 107 mg/kg before ac) and two laboratories laboratory would reject sample #11010 for lead (>90 mg/kg after analytical correction, or 129 mg/kg before ac), while 72 laboratories would accept this sample.
One laboratory would reject sample #11011 for cadmium (>75 mg/kg after analytical correction, or 107 mg/kg before ac), while 73 laboratories would accept this sample.

	Sb	As	Ba	Cd	Pb	Hg
Maximum migrated element in mg/kg toy material	60	25	1000	75	90	60

table 6: maximum migration requirements for toys in EU

General

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 raise of the quality of the analytical results.

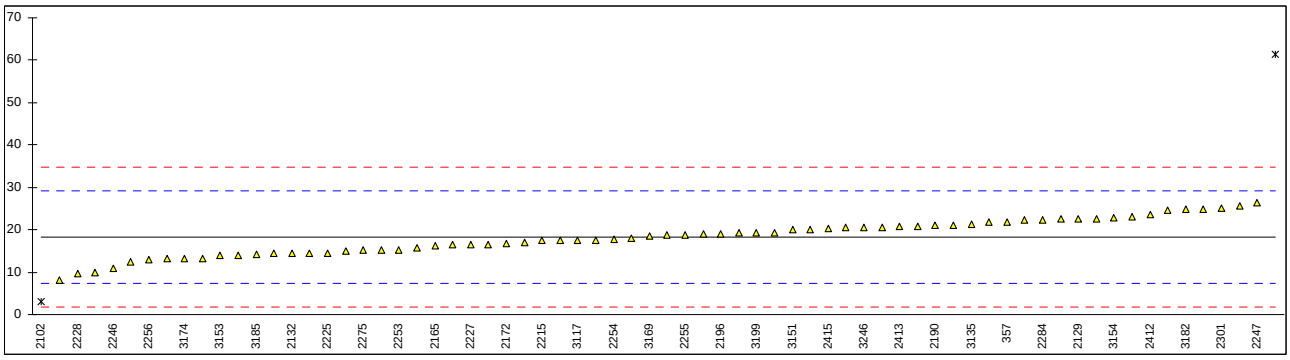
APPENDIX 1

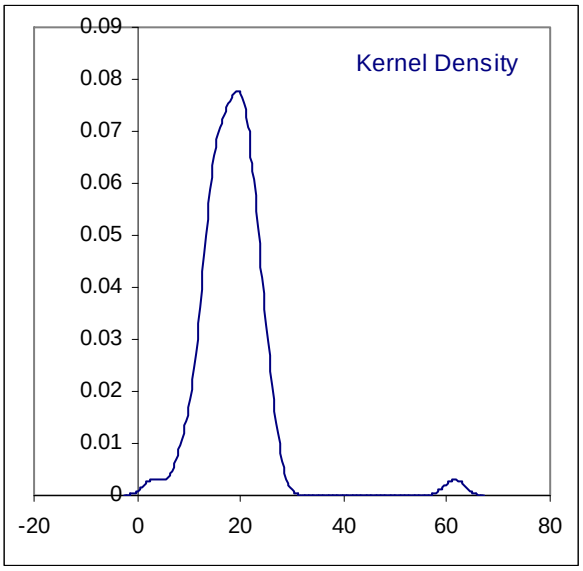
Determination of migration of Antimony on sample #11010; results in mg/kg

lab	method	value	mark	z(targ)	remarks
310	EN71-3	24.5		1.15	
330		<25		<1.24	
357	EN71-3	21.73		0.64	
452		-----		-----	
2102		3.085	G(0.05)	-2.77	
2129	EN71-3	22.588		0.80	
2132	EN71-3	14.375		-0.71	
2146		-----		-----	
2156	EN71-3	23.010		0.87	
2165	EN71-3	16.2		-0.37	
2172	EN71-3	16.80		-0.26	
2179	EN71-3	n.d.		-----	false negative?
2182	EN71-3	22.211		0.73	
2190	EN71-3	21		0.51	
2196		19.101		0.16	
2201	EN71-3	12.37		-1.07	
2215	EN71-3	17.4		-0.15	
2225	EN71-3	14.524		-0.68	
2227	EN71-3	16.500	C	-0.32	first reported 1.480
2228	EN71-3	9.63		-1.57	
2229	EN71-3	24.780		1.20	
2238		16.61		-0.30	
2241		-----		-----	
2246	EN71-3	10.95		-1.33	
2247	ICP/OES	26.297		1.47	
2253	EN71-3	15.342		-0.53	
2254	EN71-3	17.841		-0.07	
2255		18.826		0.11	
2256	EN71-3	12.897		-0.98	
2258	EN71-3	20.9218		0.49	
2266	EN71-3	61.479	G(0.01)	7.90	
2268	EN71-3	19.16		0.17	
2275		15.19		-0.56	
2279	EN71-3	20.417		0.40	
2284	EN71-3	22.4		0.76	
2289	EN71-3	14		-0.77	
2290	EN71-3	n.d.		-----	false negative?
2293	EN71-3	13.310		-0.90	
2294	EN71-3	17.600		-0.12	
2295	EN71-3	19		0.14	
2299	INH-324	18.769		0.10	
2301	EN71-3	25.0		1.24	
2304	EN71-3	22.49		0.78	
2412	EN71-3	23.64		0.99	
2413	ASTM F963	20.908		0.49	
2415	EN71-3	20.210		0.36	
2421	EN71-3	25.62		1.35	
2424	EN71-3	<2.5		<-2.88	false negative?
3100	EN71-3	15.731		-0.46	
3107	EN71-3	8	C	-1.87	first reported 50.700
3110	EN71-3	17.532		-0.13	
3116	EN71-3	14.410		-0.70	
3117	EN71-3	17.540		-0.13	
3122		17		-0.23	
3124	EN71-3	21.1		0.52	
3135	EN71-3	21.3		0.56	
3151	EN71-3	20.08		0.34	
3153	EN71-3	13.900		-0.79	
3154	EN71-3	22.90		0.85	
3159	EN71-3	15.200		-0.55	
3167	EN71-3	20.52		0.42	
3169	EN71-3	18.445		0.04	
3172	EN71-3	17.9		-0.06	
3174	EN71-3	13.294		-0.90	
3182	EN71-3	24.730		1.19	
3185	EN71-3	14.08		-0.76	
3190	EN71-3	14.37		-0.71	
3192	EN71-3	20.13		0.35	
3199	in house	19.166		0.17	
3209	EN71-3	14.910	C	-0.61	first reported 38.462
3218	EN71-3	13.11		-0.94	
3233	EN71-3	22.65		0.81	
3237	EN71-3	16.45		-0.33	
3238	EN71-3	19.25		0.19	
3243	EN71-3	21.7		0.63	

3246	EN71-3	20.495	0.41
3248	EN71-3	10	-1.51

normality	OK
n	68
outliers	2
mean (n)	18.24
st.dev. (n)	4.162
R(calc.)	11.65
R(target)	15.32



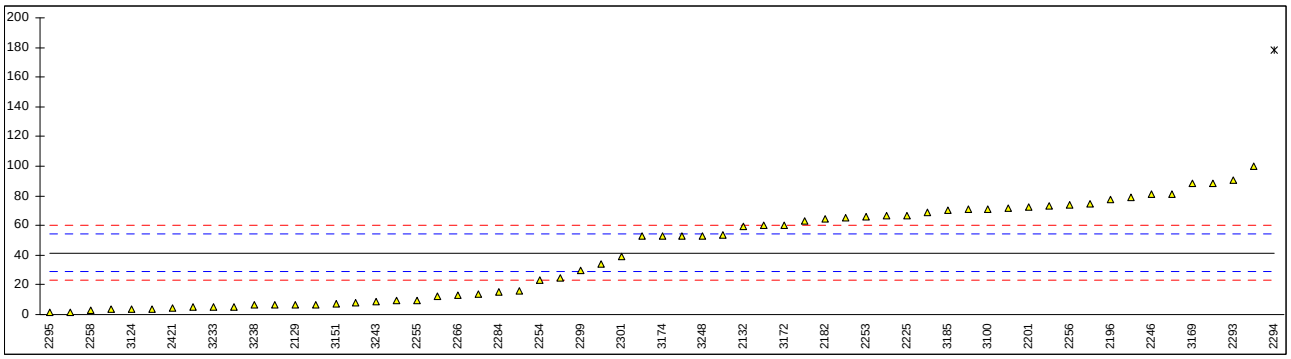


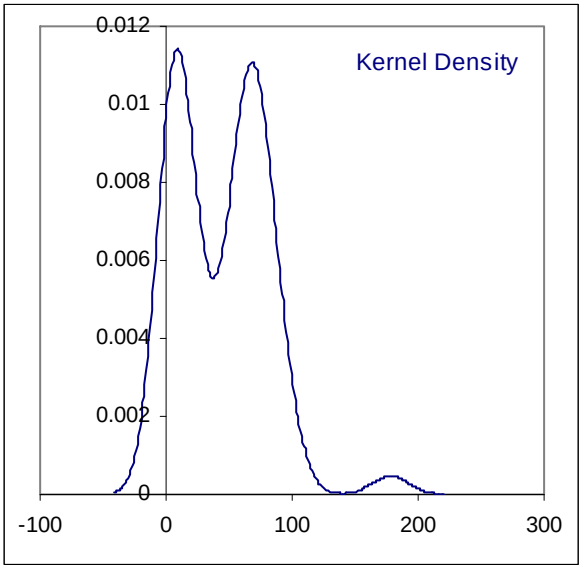
Determination of migration of Barium on sample #11010; results in mg/kg

lab	method	value	mark	z(targ)	remarks
310	EN71-3	9.50		-----	
330		<10		-----	
357	EN71-3	3.37		-----	
452		-----		-----	
2102		-----		-----	
2129	EN71-3	6.732		-----	
2132	EN71-3	59.220		-----	
2146		-----		-----	
2156	EN71-3	5.300		-----	
2165	EN71-3	53.0		-----	
2172	EN71-3	66.31		-----	
2179	EN71-3	1.3		-----	
2182	EN71-3	64.168		-----	
2190	EN71-3	69		-----	
2196		77.212		-----	
2201	EN71-3	72.18		-----	
2215	EN71-3	n.d.		-----	
2225	EN71-3	66.817		-----	
2227	EN71-3	12.440	C	-----	first reported 12.200
2228	EN71-3	33.91		-----	
2229	EN71-3	4.764		-----	
2238		79.01		-----	
2241		-----		-----	
2246	EN71-3	80.89		-----	
2247	ICP/OES	<5		-----	
2253	EN71-3	65.644		-----	
2254	EN71-3	23.295		-----	
2255		9.706		-----	
2256	EN71-3	73.723		-----	
2258	EN71-3	3.2432		-----	
2266	EN71-3	13.228		-----	
2268	EN71-3	<10		-----	
2275		63.13		-----	
2279	EN71-3	3.698		-----	
2284	EN71-3	15.3		-----	
2289	EN71-3	75		-----	
2290	EN71-3	6.849		-----	
2293	EN71-3	90.917		-----	
2294	EN71-3	178.000	G(0.01)	-----	
2295	EN71-3	1.1		-----	
2299	INH-324	29.388		-----	
2301	EN71-3	39.1		-----	
2304	EN71-3	8.050		-----	
2412	EN71-3	n.d.		-----	
2413	ASTM F963	13.997		-----	
2415	EN71-3	n.d.		-----	
2421	EN71-3	4.60		-----	
2424	EN71-3	53.7		-----	
3100	EN71-3	71.188		-----	
3107	EN71-3	100	C	-----	first reported 156.200
3110	EN71-3	52.656		-----	
3116	EN71-3	59.888		-----	
3117	EN71-3	24.650		-----	
3122		<100		-----	
3124	EN71-3	3.51		-----	
3135	EN71-3	81.1		-----	
3151	EN71-3	7.45		-----	
3153	EN71-3	73.224		-----	
3154	EN71-3	71.45		-----	
3159	EN71-3	64.873		-----	
3167	EN71-3	n.d.		-----	
3169	EN71-3	88.118		-----	
3172	EN71-3	60.3		-----	
3174	EN71-3	52.980		-----	
3182	EN71-3	<5.000		-----	
3185	EN71-3	70.05		-----	
3190	EN71-3	88.68		-----	
3192	EN71-3	<5		-----	
3199	in house	<100		-----	
3209	EN71-3	<6.0		-----	
3218	EN71-3	70.96		-----	
3233	EN71-3	5		-----	
3237	EN71-3	15.77		-----	
3238	EN71-3	6.400		-----	
3243	EN71-3	8.82		-----	

3246	EN71-3	6.496	-----
3248	EN71-3	53	-----

normality	not OK
n	60
outliers	1
mean (n)	41.59
st.dev. (n)	31.528
R(calc.)	88.28
R(target)	17.47



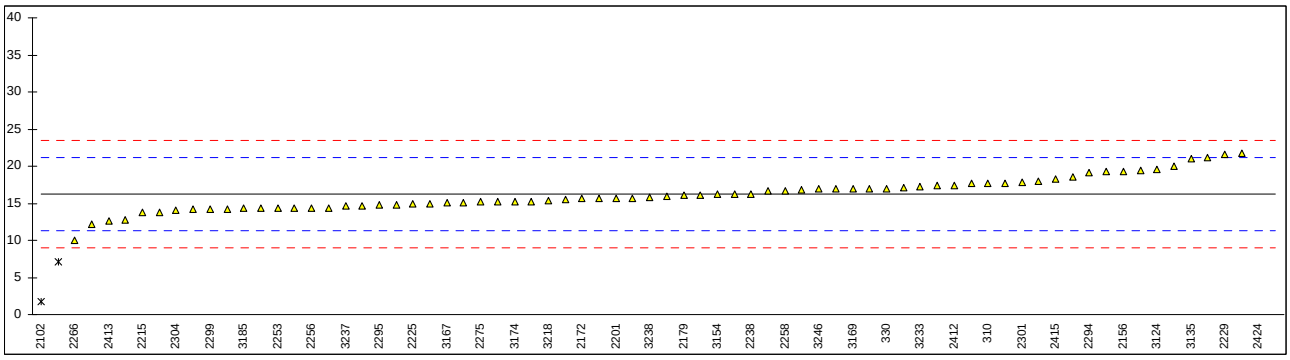


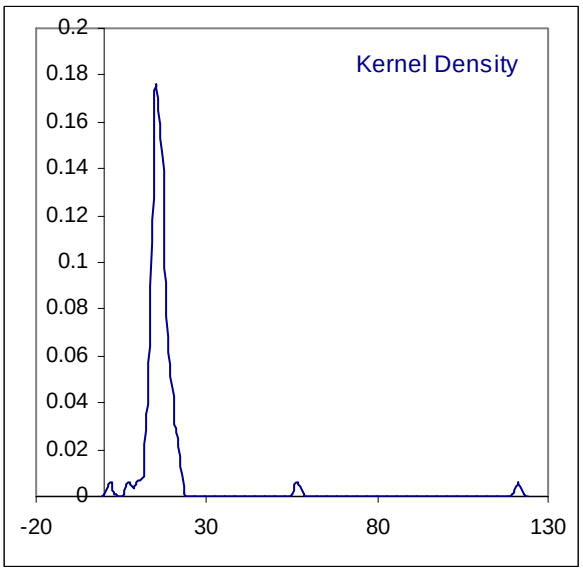
Determination of migration of Cadmium on sample #11010; results in mg/kg

lab	method	value	mark	z(targ)	remarks
310	EN71-3	17.7		0.60	
330		17		0.32	
357	EN71-3	21.16		2.03	
452		-----		-----	
2102		1.750	G(0.01)	-5.95	
2129	EN71-3	19.258		1.24	
2132	EN71-3	14.398		-0.75	
2146		-----		-----	
2156	EN71-3	19.283		1.26	
2165	EN71-3	12.7		-1.45	
2172	EN71-3	15.62		-0.25	
2179	EN71-3	16.1		-0.05	
2182	EN71-3	15.114		-0.46	
2190	EN71-3	16		-0.09	
2196		15.520		-0.29	
2201	EN71-3	15.66		-0.23	
2215	EN71-3	13.7		-1.04	
2225	EN71-3	14.906		-0.54	
2227	EN71-3	12.200	C	-1.65	first reported 0.413
2228	EN71-3	7.15	G(0.05)	-3.73	
2229	EN71-3	21.550		2.19	
2238		16.29		0.03	
2241		-----		-----	
2246	EN71-3	14.19		-0.84	
2247	ICP/OES	15.221		-0.41	
2253	EN71-3	14.368		-0.76	
2254	EN71-3	121.242	G(0.01)	43.14	
2255		13.706		-1.04	
2256	EN71-3	14.377		-0.76	
2258	EN71-3	16.6969		0.19	
2266	EN71-3	9.995		-2.56	
2268	EN71-3	16.80		0.24	
2275		15.17		-0.43	
2279	EN71-3	17.336		0.46	
2284	EN71-3	17.1		0.36	
2289	EN71-3	17		0.32	
2290	EN71-3	14.345		-0.77	
2293	EN71-3	15.717		-0.21	
2294	EN71-3	19.200		1.22	
2295	EN71-3	14.8		-0.59	
2299	INH-324	14.159		-0.85	
2301	EN71-3	17.8	C	0.65	first reported 31.5
2304	EN71-3	14.02		-0.91	
2412	EN71-3	17.45		0.50	
2413	ASTM F963	12.632		-1.48	
2415	EN71-3	18.330		0.86	
2421	EN71-3	19.40		1.30	
2424	EN71-3	56.6	G(0.01)	16.59	
3100	EN71-3	17.708		0.61	
3107	EN71-3	14.820		-0.58	
3110	EN71-3	16.159		-0.03	
3116	EN71-3	14.661		-0.64	
3117	EN71-3	17.610		0.57	
3122		18		0.73	
3124	EN71-3	19.6		1.39	
3135	EN71-3	21.0		1.96	
3151	EN71-3	19.98		1.54	
3153	EN71-3	14.146		-0.86	
3154	EN71-3	16.20		-0.01	
3159	EN71-3	14.369		-0.76	
3167	EN71-3	15.04		-0.49	
3169	EN71-3	16.999		0.32	
3172	EN71-3	15.2		-0.42	
3174	EN71-3	15.216		-0.42	
3182	EN71-3	15.630		-0.25	
3185	EN71-3	14.33		-0.78	
3190	EN71-3	16.24		0.01	
3192	EN71-3	18.56		0.96	
3199	in house	16.695		0.19	
3209	EN71-3	16.983		0.31	
3218	EN71-3	15.40		-0.34	
3233	EN71-3	17.24		0.42	
3237	EN71-3	14.61		-0.66	
3238	EN71-3	15.85		-0.16	
3243	EN71-3	21.8		2.29	

3246	EN71-3	16.924	0.29
3248	EN71-3	15	-0.50

normality	OK
n	70
outliers	4
mean (n)	16.23
st.dev. (n)	2.261
R(calc.)	6.33
R(target)	6.82





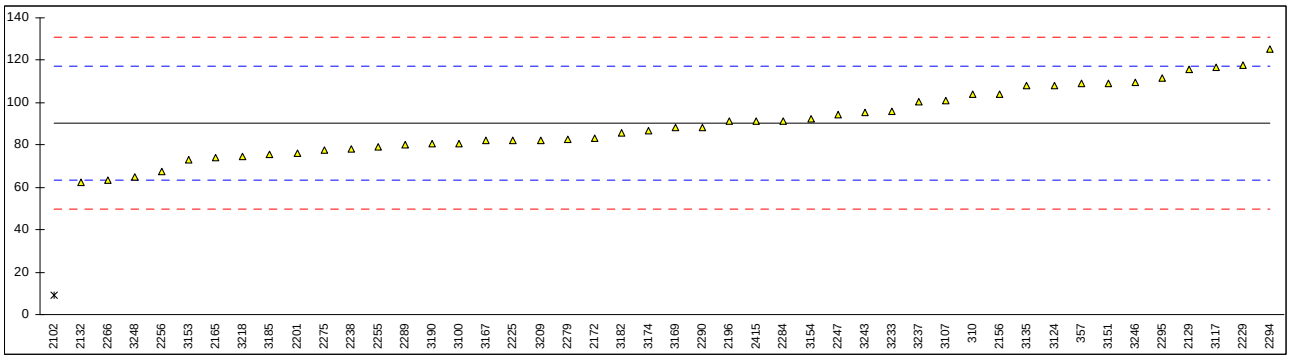
Determination of migration of Cobalt on sample #11010; results in mg/kg

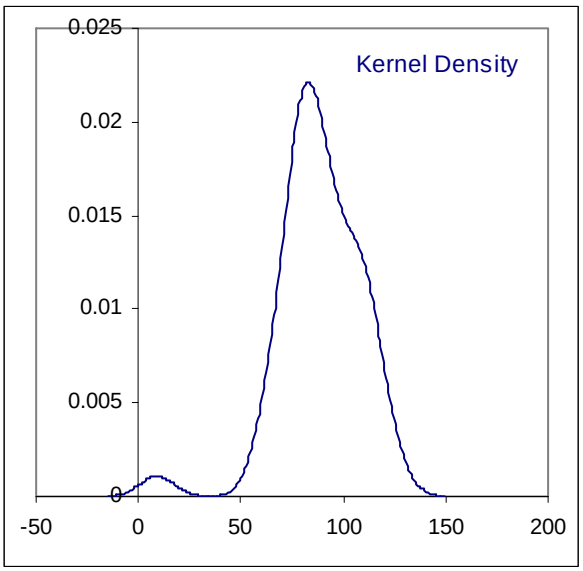
lab	method	value	mark	z(targ)	remarks
310	EN71-3	104		1.02	
330		-----		-----	
357	EN71-3	109.1		1.39	
452		-----		-----	
2102		9.084	G(0.01)	-6.00	
2129	EN71-3	115.825		1.89	
2132	EN71-3	62.475		-2.05	
2146		-----		-----	
2156	EN71-3	104.043		1.02	
2165	EN71-3	73.9		-1.21	
2172	EN71-3	83.26		-0.52	
2179		-----		-----	
2182		-----		-----	
2190		-----		-----	
2196		91.063		0.06	
2201	EN71-3	76.20		-1.04	
2215		-----		-----	
2225	EN71-3	82.337		-0.58	
2227		-----		-----	
2228		-----		-----	
2229	EN71-3	117.700		2.03	
2238		78.20		-0.89	
2241		-----		-----	
2246		-----		-----	
2247	ICP/OES	94.124		0.29	
2253		-----		-----	
2254		-----		-----	
2255		79.146		-0.82	
2256	EN71-3	67.536		-1.68	
2258		-----		-----	
2266	EN71-3	63.316		-1.99	
2268		-----		-----	
2275		77.44		-0.95	
2279	EN71-3	82.468		-0.58	
2284	EN71-3	91.4		0.08	
2289	EN71-3	80		-0.76	
2290	EN71-3	88.490		-0.13	
2293		-----		-----	
2294	EN71-3	125.100		2.57	
2295	EN71-3	111.7		1.58	
2299		-----		-----	
2301		-----		-----	
2304		-----		-----	
2412		-----		-----	
2413		-----		-----	
2415	EN71-3	91.140		0.07	
2421		-----		-----	
2424		-----		-----	
3100	EN71-3	80.872		-0.69	
3107	EN71-3	100.800		0.78	
3110		-----		-----	
3116		-----		-----	
3117	EN71-3	116.500		1.94	
3122		-----		-----	
3124	EN71-3	108		1.31	
3135	EN71-3	108		1.31	
3151	EN71-3	109.3		1.41	
3153	EN71-3	73.130		-1.26	
3154	EN71-3	92.56		0.17	
3159		-----		-----	
3167	EN71-3	82.06		-0.61	
3169	EN71-3	88.331		-0.14	
3172		-----		-----	
3174	EN71-3	86.747		-0.26	
3182	EN71-3	85.680		-0.34	
3185	EN71-3	75.81		-1.07	
3190	EN71-3	80.56		-0.72	
3192		-----		-----	
3199		-----		-----	
3209	EN71-3	82.418		-0.58	
3218	EN71-3	74.46		-1.17	
3233	EN71-3	95.92		0.42	
3237	EN71-3	100.33		0.74	
3238		-----		-----	
3243	EN71-3	95.5		0.39	

3246	EN71-3	109.508	1.42
3248	EN71-3	65	-1.87

normality	OK
n	45
outliers	1
mean (n)	90.25
st.dev. (n)	15.877
R(calc.)	44.46
R(target)	37.91

No analytical correction mentioned in EN71-3, assumed to be 30%



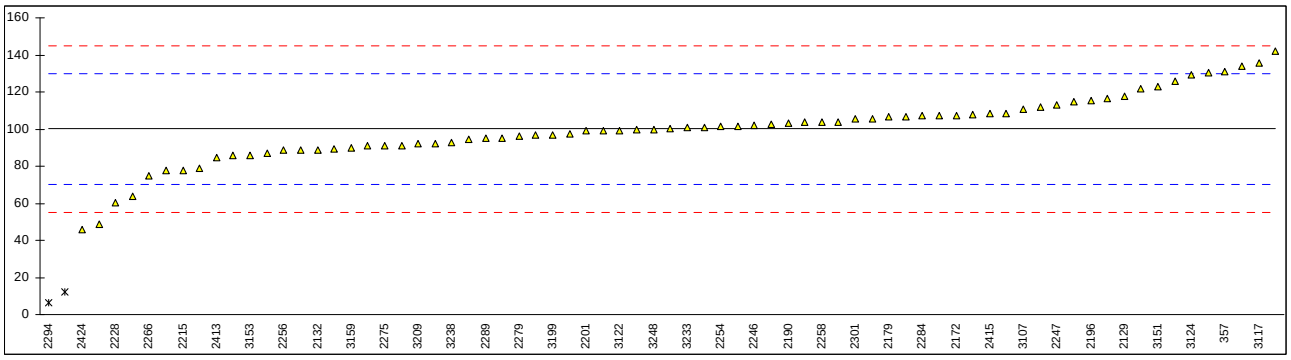


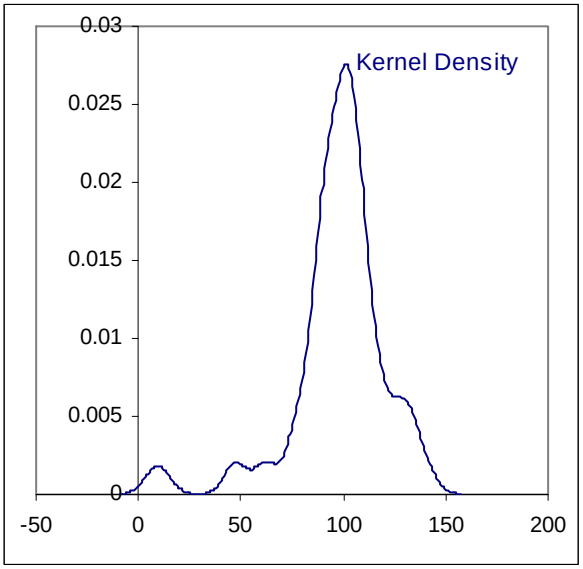
Determination of migration of Lead on sample #11010; results in mg/kg

lab	method	value	mark	z(targ)	remarks
310	EN71-3	87.0		-0.87	
330		134		2.26	
357	EN71-3	131.2		2.08	
452		-----		-----	
2102		12.312	G(0.01)	-5.85	
2129	EN71-3	117.5		1.16	
2132	EN71-3	88.895		-0.74	
2146		-----		-----	
2156	EN71-3	111.667		0.78	
2165	EN71-3	77.6		-1.50	
2172	EN71-3	107.5		0.50	
2179	EN71-3	106.4		0.42	
2182	EN71-3	97.470		-0.17	
2190	EN71-3	103		0.20	
2196		115.081		1.00	
2201	EN71-3	98.88		-0.08	
2215	EN71-3	77.9		-1.48	
2225	EN71-3	90.914		-0.61	
2227	EN71-3	48.900		-3.41	
2228	EN71-3	60.30		-2.65	
2229	EN71-3	125.700		1.71	
2238		106.7		0.44	
2241		-----		-----	
2246	EN71-3	102.3		0.15	
2247	ICP/OES	113.024		0.87	
2253	EN71-3	91.265		-0.58	
2254	EN71-3	101.546		0.10	
2255		79.093		-1.40	
2256	EN71-3	88.417		-0.77	
2258	EN71-3	103.7438		0.25	
2266	EN71-3	74.754		-1.68	
2268	EN71-3	95.10		-0.33	
2275		91.11		-0.59	
2279	EN71-3	96.040		-0.27	
2284	EN71-3	107.2		0.48	
2289	EN71-3	95		-0.34	
2290	EN71-3	116.800		1.12	
2293	EN71-3	101.700		0.11	
2294	EN71-3	6.400	G(0.01)	-6.24	
2295	EN71-3	114.8		0.98	
2299	INH-324	63.873		-2.41	
2301	EN71-3	105.6		0.37	
2304	EN71-3	88.67		-0.76	
2412	EN71-3	107.9		0.52	
2413	ASTM F963	84.452		-1.04	
2415	EN71-3	108.500		0.56	
2421	EN71-3	103.98		0.26	
2424	EN71-3	45.7		-3.62	
3100	EN71-3	98.902		-0.08	
3107	EN71-3	110.600		0.70	
3110	EN71-3	101.044		0.07	
3116	EN71-3	85.548		-0.97	
3117	EN71-3	135.480		2.36	
3122		99		-0.07	
3124	EN71-3	129		1.93	
3135	EN71-3	142		2.80	
3151	EN71-3	123.1		1.54	
3153	EN71-3	86.009		-0.93	
3154	EN71-3	99.50		-0.04	
3159	EN71-3	90.097		-0.66	
3167	EN71-3	94.33		-0.38	
3169	EN71-3	108.624		0.57	
3172	EN71-3	107.3		0.48	
3174	EN71-3	100.315		0.02	
3182	EN71-3	96.606	C	-0.23	first reported 193.600
3185	EN71-3	89.25		-0.72	
3190	EN71-3	102.8		0.18	
3192	EN71-3	130.5		2.03	
3199	in house	96.723		-0.22	
3209	EN71-3	91.908		-0.54	
3218	EN71-3	105.6		0.37	
3233	EN71-3	101.0		0.06	
3237	EN71-3	103.54		0.23	
3238	EN71-3	92.50		-0.50	
3243	EN71-3	92.0		-0.54	

3246	EN71-3	121.923	1.46
3248	EN71-3	100	0.00

normality	OK
n	72
outliers	2
mean (n)	100.03
st.dev. (n)	18.044
R(calc.)	50.52
R(target)	42.01



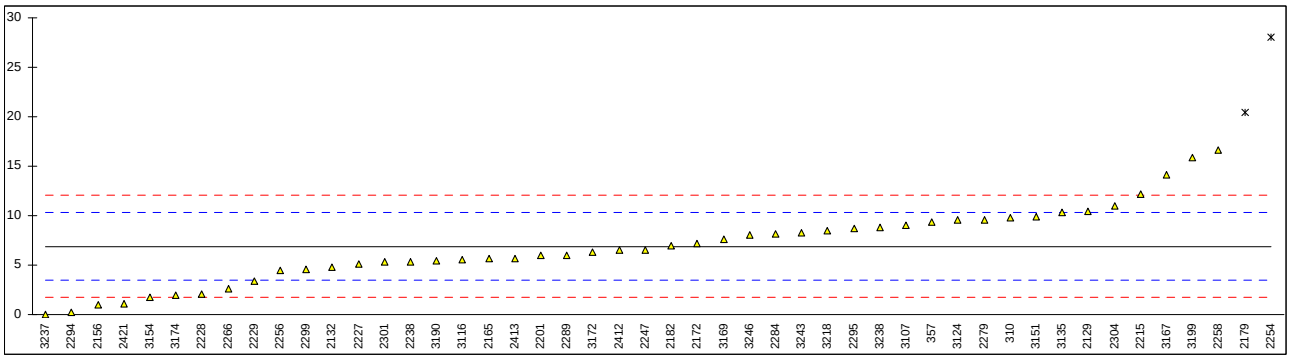


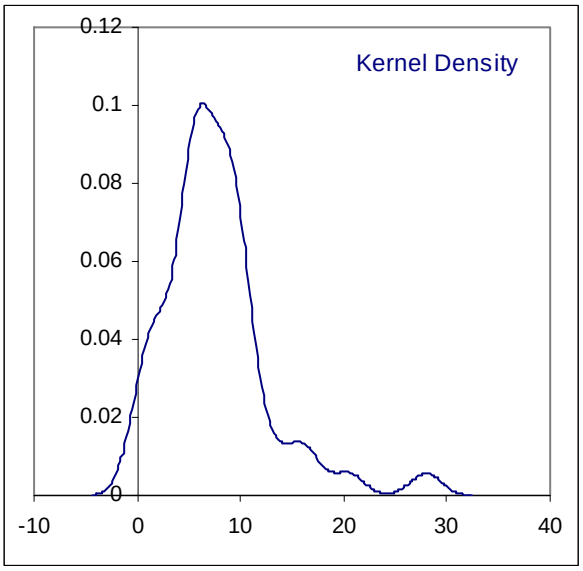
Determination of migration of Mercury on sample #11010; results in mg/kg

lab	method	value	mark	z(targ)	remarks
310	EN71-3	9.80		1.68	
330		<10		-----	
357	EN71-3	9.37		1.44	
452		-----		-----	
2102		-----		-----	
2129	EN71-3	10.415		2.04	
2132	EN71-3	4.738		-1.25	
2146		-----		-----	
2156	EN71-3	1.000		-3.42	
2165	EN71-3	5.6		-0.75	
2172	EN71-3	7.200		0.18	
2179	EN71-3	20.4	G(0.05)	7.83	
2182	EN71-3	7.010		0.07	
2190	EN71-3	<10		-----	
2196		<10		-----	
2201	EN71-3	5.966		-0.54	
2215	EN71-3	12.2		3.08	
2225	EN71-3	<5.000		<-1.10	
2227	EN71-3	5.140	C	-1.02	first reported 16.500
2228	EN71-3	2.06		-2.81	
2229	EN71-3	3.414	C	-2.02	first reported 17.780
2238		5.351		-0.90	
2241		-----		-----	
2246	EN71-3	<10		-----	
2247	ICP/OES	6.530		-0.21	
2253	EN71-3	<5		<-1.10	
2254	EN71-3	27.996	G(0.01)	12.24	
2255		n.d.		-----	
2256	EN71-3	4.417		-1.44	
2258	EN71-3	16.6666		5.67	
2266	EN71-3	2.584		-2.50	
2268	EN71-3	<10		-----	
2275		n.d.		-----	
2279	EN71-3	9.609		1.57	
2284	EN71-3	8.1		0.70	
2289	EN71-3	6		-0.52	
2290	EN71-3	n.d.		-----	
2293	EN71-3	n.d.		-----	
2294	EN71-3	0.200		-3.88	
2295	EN71-3	8.7		1.05	
2299	INH-324	4.565		-1.35	
2301	EN71-3	5.3		-0.93	
2304	EN71-3	11.03		2.40	
2412	EN71-3	6.49		-0.24	
2413	ASTM F963	5.615		-0.74	
2415	EN71-3	n.d.		-----	
2421	EN71-3	1.12		-3.35	
2424	EN71-3	<2.5		<-2.55	
3100	EN71-3	<5		<-1.10	
3107	EN71-3	9.020		1.23	
3110	EN71-3	<5		<-1.10	
3116	EN71-3	5.581		-0.76	
3117		-----		-----	
3122		<5		v	
3124	EN71-3	9.56		1.55	
3135	EN71-3	10.28		1.96	
3151	EN71-3	9.92		1.75	
3153	EN71-3	n.d.		-----	
3154	EN71-3	1.777		-2.97	
3159	EN71-3	<5.000		<-1.10	
3167	EN71-3	14.13		4.20	
3169	EN71-3	7.561	C	0.39	first reported 17.256
3172	EN71-3	6.3		-0.35	
3174	EN71-3	1.978		-2.85	
3182	EN71-3	<5.000		<-1.10	
3185		-----		-----	
3190	EN71-3	5.403		-0.87	
3192		-----		-----	
3199	in house	15.897		5.22	
3209	EN71-3	<6.0		-----	
3218	EN71-3	8.44		0.90	
3233	EN71-3	n.d.		-----	
3237	EN71-3	0.05		-3.97	
3238	EN71-3	8.80		1.10	
3243	EN71-3	8.30		0.81	

3246	EN71-3	8.027	0.66
3248	EN71-3	<5	<-1.10

normality	OK
n	46
outliers	2
mean (n)	6.90
st.dev. (n)	3.810
R(calc.)	10.67
R(target)	4.83





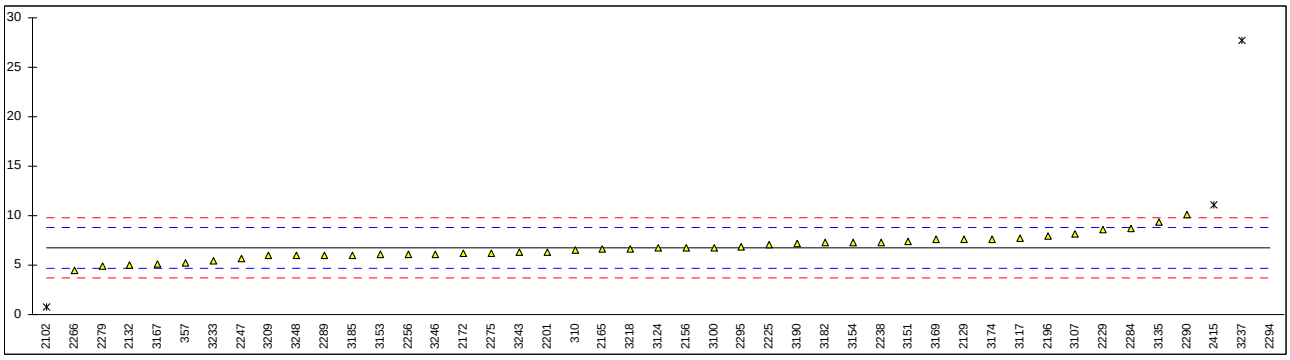
Determination of migration of Nickel on sample #11010; results in mg/kg

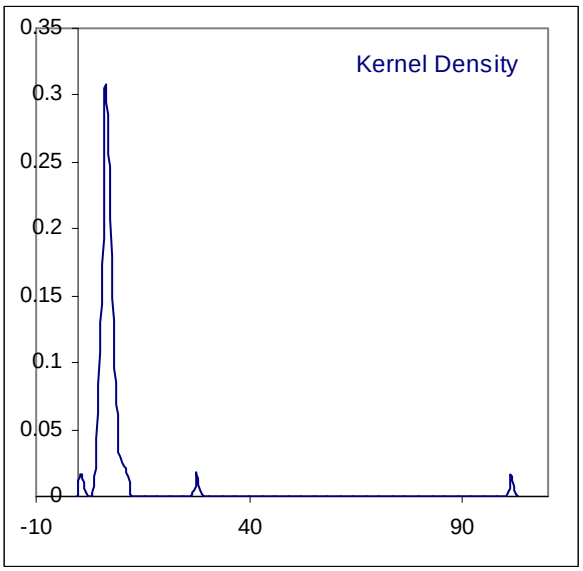
lab	method	value	mark	z(targ)	remarks
310	EN71-3	6.50		-0.25	
330		-----		-----	
357	EN71-3	5.18		-1.55	
452		-----		-----	
2102		0.743	G(0.01)	-5.93	
2129	EN71-3	7.575		0.81	
2132	EN71-3	4.990		-1.74	
2146		-----		-----	
2156	EN71-3	6.716		-0.04	
2165	EN71-3	6.6		-0.15	
2172	EN71-3	6.190		-0.56	
2179		-----		-----	
2182		-----		-----	
2190		-----		-----	
2196		7.922		1.15	
2201	EN71-3	6.358		-0.39	
2215		-----		-----	
2225	EN71-3	7.018		0.26	
2227		-----		-----	
2228		-----		-----	
2229	EN71-3	8.626		1.85	
2238		7.312		0.55	
2241		-----		-----	
2246		-----		-----	
2247	ICP/OES	5.696		-1.04	
2253		-----		-----	
2254		-----		-----	
2255		n.d.		-----	
2256	EN71-3	6.108		-0.64	
2258		-----		-----	
2266	EN71-3	4.486		-2.24	
2268		-----		-----	
2275		6.203		-0.54	
2279	EN71-3	4.920		-1.81	
2284	EN71-3	8.7		1.92	
2289	EN71-3	6		-0.74	
2290	EN71-3	10.125		3.33	
2293		-----		-----	
2294	EN71-3	101.400	G(0.01)	93.41	
2295	EN71-3	6.8		0.04	
2299		-----		-----	
2301		-----		-----	
2304		-----		-----	
2412		-----		-----	
2413		-----		-----	
2415	EN71-3	11.110	G(0.05)	4.30	
2421		-----		-----	
2424		-----		-----	
3100	EN71-3	6.721		-0.03	
3107	EN71-3	8.180		1.41	
3110		-----		-----	
3116		-----		-----	
3117	EN71-3	7.750		0.98	
3122		-----		-----	
3124	EN71-3	6.69		-0.06	
3135	EN71-3	9.4		2.61	
3151	EN71-3	7.44		0.68	
3153	EN71-3	6.101		-0.65	
3154	EN71-3	7.303		0.54	
3159		-----		-----	
3167	EN71-3	5.16		-1.57	
3169	EN71-3	7.561		0.80	
3172		-----		-----	
3174	EN71-3	7.659		0.89	
3182	EN71-3	7.300		0.54	
3185	EN71-3	6.024		-0.72	
3190	EN71-3	7.136		0.38	
3192		-----		-----	
3199		-----		-----	
3209	EN71-3	5.994		-0.75	
3218	EN71-3	6.66		-0.09	
3233	EN71-3	5.45		-1.29	
3237	EN71-3	27.7	C,G(0.01)	20.67	first reported 34
3238		-----		-----	
3243	EN71-3	6.26		-0.49	

3246	EN71-3	6.123	-0.62
3248	EN71-3	6	-0.74

normality	OK
n	41
outliers	4
mean (n)	6.76
st.dev. (n)	1.203
R(calc.)	3.37
R(target)	2.84

No analytical correction mentioned in EN71-3, assumed to be 30%





Determination of migration of Arsenic, Chromium and Selenium on sample #11010; results in mg/kg

lab	method	As	mark	Cr	mark	Se	mark
310	EN71-3	2.60		0.50		<0.1	
330		<25		<10		<25	
357	EN71-3	2.02		<1		<1	
452		-----		-----		-----	
2102		-----		-----		-----	
2129	EN71-3	1.174		0.252		0.139	
2132	EN71-3	2.455		<6.0		<6.0	
2146		-----		-----		-----	
2156	EN71-3	1.638		0.500		2.000	
2165	EN71-3	<2.5		<2.5		<2.5	
2172	EN71-3	<2.5		<5		<5	
2179	EN71-3	0.8		n.d.		4.8	G(0.01)
2182	EN71-3	<2		3.875		<2	
2190	EN71-3	<10		<10		<25	
2196		8.602	G(0.01)	<10		<10	
2201	EN71-3	<2.500		<5.000		<5.000	
2215	EN71-3	n.d.		n.d.		n.d.	
2225	EN71-3	<2.500		<5.000		<5.000	
2227	EN71-3	1.487	C	0.413	C	<2	
2228	EN71-3	3.02		0.87		0.32	
2229	EN71-3	5.664	DG(0.01)	<2.000		<2.0	C
2238		<2.5		<5		<5	
2241		-----		-----		-----	
2246	EN71-3	<10		<10		<10	
2247	ICP/OES	<2.5		<5		<5	
2253	EN71-3	<5		<5		<5	
2254	EN71-3	n.d.		n.d.		n.d.	
2255		n.d.		n.d.		n.d.	
2256	EN71-3	<2		2.216		<2	
2258	EN71-3	2.0896		0.1770		0.8247	
2266	EN71-3	0.404		1.002		0.380	
2268	EN71-3	<10		<10		<10	
2275		2.602		n.d.		n.d.	
2279	EN71-3	n.d.		n.d.		n.d.	
2284	EN71-3	n.d.		n.d.		n.d.	
2289	EN71-3	<2.5		<5		<5	
2290	EN71-3	n.d.		n.d.		n.d.	
2293	EN71-3	n.d.		n.d.		n.d.	
2294	EN71-3	2.400		2.800		9.800	G(0.01)
2295		-----		-----		-----	
2299	INH-324	1.518		1.999		0.421	
2301	EN71-3	1.6		2.2		0.3	
2304	EN71-3	n.d.		n.d.		n.d.	
2412	EN71-3	n.d.		n.d.		n.d.	
2413	ASTM F963	5.321	DG(0.01)	n.d.		n.d.	
2415	EN71-3	n.d.		n.d.		n.d.	
2421	EN71-3	0.90		0.97		0.00	
2424	EN71-3	18.9	G(0.01)	<2.5		<2.5	
3100	EN71-3	<2.5		<5		<5	
3107	EN71-3	2.580		3.260		2.660	
3110	EN71-3	<5		<5		<5	
3116	EN71-3	<2.000		<2.000		<2.000	
3117		-----		-----		-----	
3122		<2.5		<5		<5	
3124	EN71-3	1.53		0.200		0.004	
3135	EN71-3	2.43		-----		0.76	
3151	EN71-3	2.090		0.386		n.d.	
3153	EN71-3	2.876		n.d.		n.d.	
3154	EN71-3	3.83		2.323		-----	
3159	EN71-3	2.562		<5.000		<5.000	
3167	EN71-3	n.d.		n.d.		n.d.	
3169	EN71-3	<2		<5	C	<5	
3172	EN71-3	<10		7.0	G(0.01)	<10	
3174	EN71-3	1.404		2.383		n.d.	
3182	EN71-3	<5.000		<5.000		<5.000	
3185	EN71-3	2.677		-----		-----	
3190	EN71-3	<2.5		<5		<5	
3192		-----		<5		-----	
3199	in house	<2.5		<7.5		<50	
3209	EN71-3	<2.5		<6.0		<6.0	
3218	EN71-3	<2.5		<5		<5	
3233	EN71-3	n.d.		n.d.		n.d.	
3237	EN71-3	23.49	CG(0.01)	0.33		0.86	
3238	EN71-3	n.d.		n.d.		n.d.	
3243	EN71-3	1.18		0.49		-----	

3246	EN71-3	n.d.	0.438	n.d.
3248	EN71-3	<5	<5	<5
	normality	OK	not OK	not OK
	n	25	21	12
	outliers	5	1	2
	mean (n)	1.99	1.31	0.72
	st.dev. (n)	0.803	1.146	0.817
	R(calc.)	2.25	3.21	2.29
	R(target)	(1.68)	(0.55)	(0.61)

Originally reported test results that were revised:

Laboratory 2227: As 12.440 and Cr 5.140

Laboratory 2229: Se 6.086

Laboratory 3169: Cr 17.904

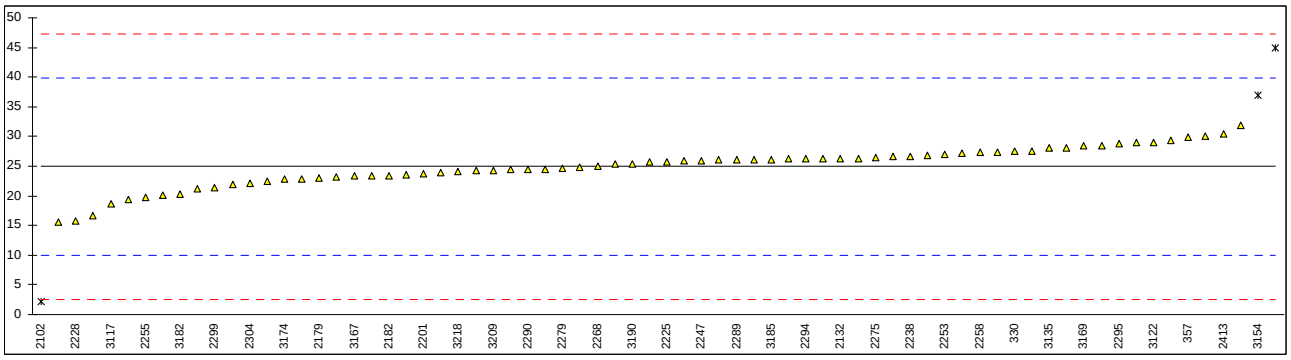
Laboratory 3237: As 16.96

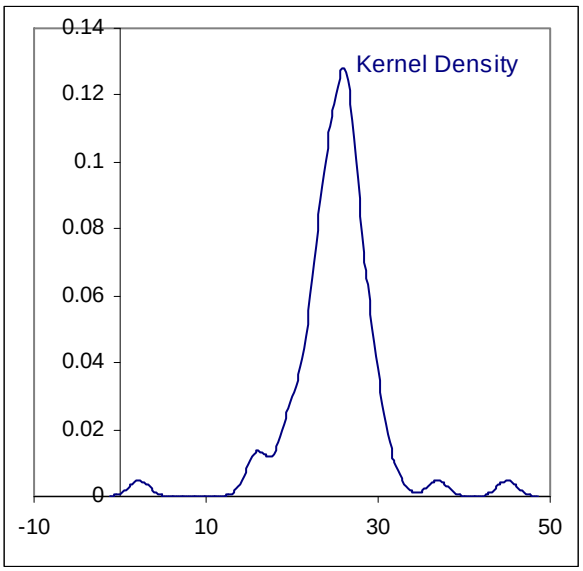
Determination of migration of Arsenic on sample #11011; results in mg/kg

lab	method	value	mark	z(targ)	remarks
310	EN71-3	23.5		-0.19	
330		27.5		0.34	
357	EN71-3	29.82		0.65	
452		-----		-----	
2102		2.227	G(0.01)	-3.04	
2129	EN71-3	25.3		0.05	
2132	EN71-3	26.250		0.18	
2146		-----		-----	
2156	EN71-3	26.543		0.22	
2165	EN71-3	26.0		0.14	
2172	EN71-3	24.51		-0.06	
2179	EN71-3	23.0		-0.26	
2182	EN71-3	23.438		-0.20	
2190	EN71-3	45	G(0.01)	2.68	
2196		28.081		0.42	
2201	EN71-3	23.69		-0.17	
2215	EN71-3	22.4		-0.34	
2225	EN71-3	25.812		0.12	
2227	EN71-3	23.390	C	-0.21	first reported 83.490
2228	EN71-3	15.69		-1.24	
2229	EN71-3	31.950		0.94	
2238		26.64		0.23	
2241		-----		-----	
2246	EN71-3	24.22		-0.09	
2247	ICP/OES	25.941		0.14	
2253	EN71-3	27.066		0.29	
2254	EN71-3	24.465		-0.06	
2255		19.734		-0.69	
2256	EN71-3	25.914		0.13	
2258	EN71-3	27.2917		0.32	
2266	EN71-3	16.670		-1.10	
2268	EN71-3	25.01		0.01	
2275		26.44		0.20	
2279	EN71-3	24.579		-0.05	
2284	EN71-3	27.6		0.36	
2289	EN71-3	26		0.14	
2290	EN71-3	24.470		-0.06	
2293	EN71-3	24.853		-0.01	
2294	EN71-3	26.200		0.17	
2295	EN71-3	28.8		0.52	
2299	INH-324	21.381		-0.47	
2301	EN71-3	26.8	C	0.25	first reported 0.0
2304	EN71-3	22.08		-0.38	
2412	EN71-3	25.71		0.10	
2413	ASTM F963	30.395		0.73	
2415	EN71-3	26.260		0.18	
2421	EN71-3	19.37		-0.74	
2424	EN71-3	<2.5		<-3.00	false negative?
3100	EN71-3	26.240		0.18	
3107	EN71-3	30.160		0.70	
3110	EN71-3	21.205		-0.50	
3116	EN71-3	21.978		-0.39	
3117	EN71-3	18.710		-0.83	
3122		29		0.54	
3124	EN71-3	27.1		0.29	
3135	EN71-3	28.0		0.41	
3151	EN71-3	29.000		0.54	
3153	EN71-3	29.410		0.60	
3154	EN71-3	36.92	G(0.05)	1.60	
3159	EN71-3	27.324		0.32	
3167	EN71-3	23.35		-0.21	
3169	EN71-3	28.383		0.46	
3172	EN71-3	22.8		-0.28	
3174	EN71-3	22.789		-0.29	
3182	EN71-3	20.280		-0.62	
3185	EN71-3	26.10		0.16	
3190	EN71-3	25.30		0.05	
3192		-----		-----	
3199	in house	28.459		0.47	
3209	EN71-3	24.354		-0.08	
3218	EN71-3	24.14		-0.11	
3233	EN71-3	20.19		-0.63	
3237	EN71-3	15.56		-1.25	
3238	EN71-3	23.10		-0.24	
3243	EN71-3	26.2		0.17	

3246	EN71-3	26.029	0.15
3248	EN71-3	24	-0.12

normality	OK
n	69
outliers	3
mean (n)	24.93
st.dev. (n)	3.358
R(calc.)	9.40
R(target)	20.94



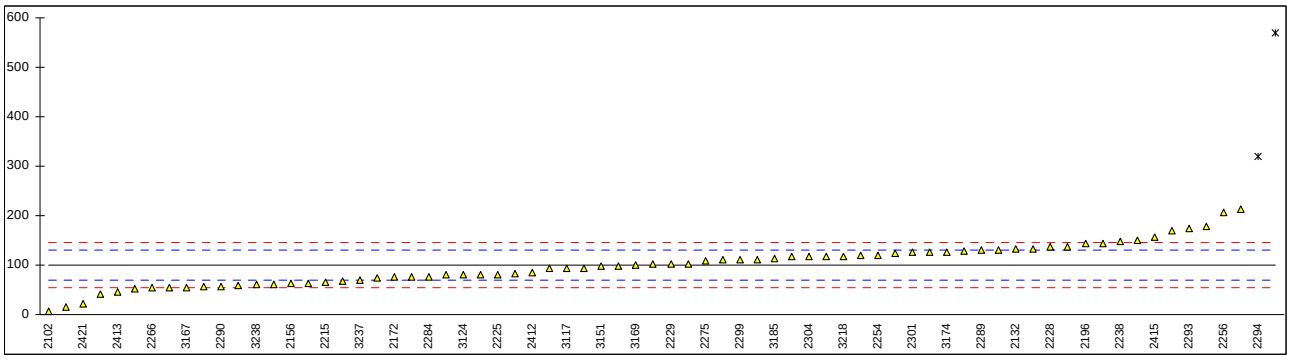


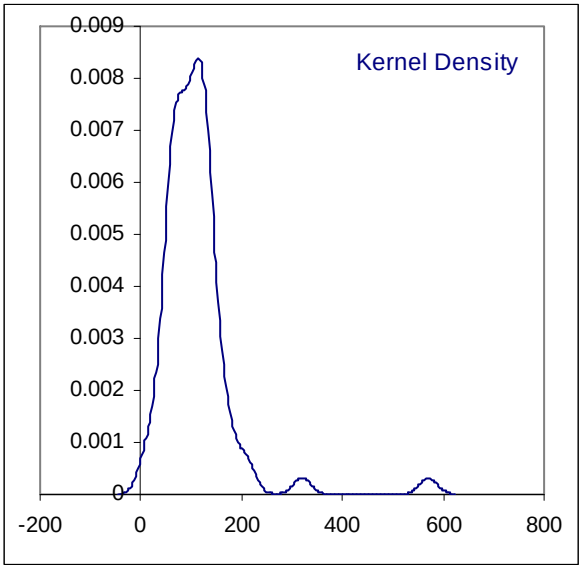
Determination of migration of Barium on sample #11011; results in mg/kg

lab	method	value	mark	z(targ)	remarks
310	EN71-3	75.0		-1.68	
330		68		-2.15	
357	EN71-3	56.17		-2.93	
452		-----		-----	
2102		7.001		-6.20	
2129	EN71-3	92.947		-0.49	
2132	EN71-3	131.715		2.09	
2146		-----		-----	
2156	EN71-3	63.853		-2.42	
2165	EN71-3	138.0		2.51	
2172	EN71-3	75.13		-1.67	
2179	EN71-3	60.3		-2.66	
2182	EN71-3	111.883		0.77	
2190	EN71-3	212		7.43	
2196		142.842		2.83	
2201	EN71-3	123.7		1.56	
2215	EN71-3	65.1		-2.34	
2225	EN71-3	81.126		-1.27	
2227	EN71-3	83.490	C	-1.12	first reported 74.100
2228	EN71-3	136.56		2.41	
2229	EN71-3	102.500		0.15	
2238		147.1		3.11	
2241		-----		-----	
2246	EN71-3	144.2		2.92	
2247	ICP/OES	52.594		-3.17	
2253	EN71-3	127.617		1.82	
2254	EN71-3	120.053		1.32	
2255		59.521		-2.71	
2256	EN71-3	206.950		7.09	
2258	EN71-3	97.8382		-0.16	
2266	EN71-3	53.878		-3.08	
2268	EN71-3	81.04		-1.28	
2275		109.0		0.58	
2279	EN71-3	79.391		-1.39	
2284	EN71-3	76.3		-1.59	
2289	EN71-3	130		1.98	
2290	EN71-3	56.625		-2.90	
2293	EN71-3	172.850		4.83	
2294	EN71-3	320.300	G(0.01)	14.63	
2295	EN71-3	119.1		1.25	
2299	INH-324	111.643		0.76	
2301	EN71-3	125.5		1.68	
2304	EN71-3	116.9		1.11	
2412	EN71-3	85.76		-0.96	
2413	ASTM F963	44.568		-3.70	
2415	EN71-3	156.900		3.77	
2421	EN71-3	21.76		-5.22	
2424	EN71-3	14.8		-5.68	
3100	EN71-3	117.224		1.13	
3107	EN71-3	125.700		1.69	
3110	EN71-3	63.881		-2.42	
3116	EN71-3	169.334		4.59	
3117	EN71-3	94.090		-0.41	
3122		-----		-----	
3124	EN71-3	80.2		-1.33	
3135	EN71-3	178		5.17	
3151	EN71-3	97.56		-0.18	
3153	EN71-3	116.786		1.10	
3154	EN71-3	570.3	C,G(0.01)	31.25	first reported 484.6
3159	EN71-3	130.377		2.00	
3167	EN71-3	55.31		-2.99	
3169	EN71-3	99.238		-0.07	
3172	EN71-3	94.1		-0.41	
3174	EN71-3	126.639		1.75	
3182	EN71-3	54.490		-3.04	
3185	EN71-3	113.10		0.85	
3190	EN71-3	133.0		2.18	
3192	EN71-3	103.1		0.19	
3199	in house	<100		-----	
3209	EN71-3	76.044		-1.61	
3218	EN71-3	117.5		1.15	
3233	EN71-3	102.2		0.13	
3237	EN71-3	69.50		-2.05	
3238	EN71-3	60.00		-2.68	
3243	EN71-3	41.5		-3.91	

3246	EN71-3	150.905	3.37
3248	EN71-3	110	0.65

normality	OK
n	70
outliers	2
mean (n)	100.27
st.dev. (n)	41.794
R(calc.)	117.02
R(target)	42.11



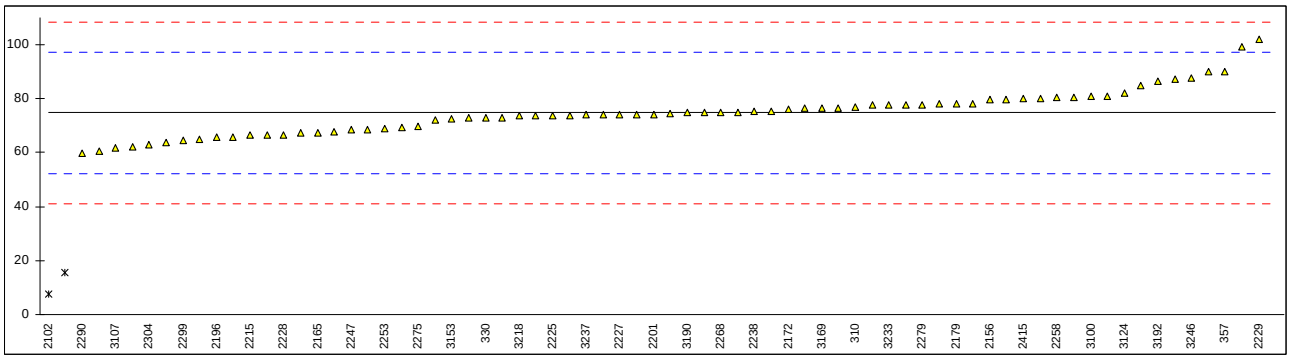


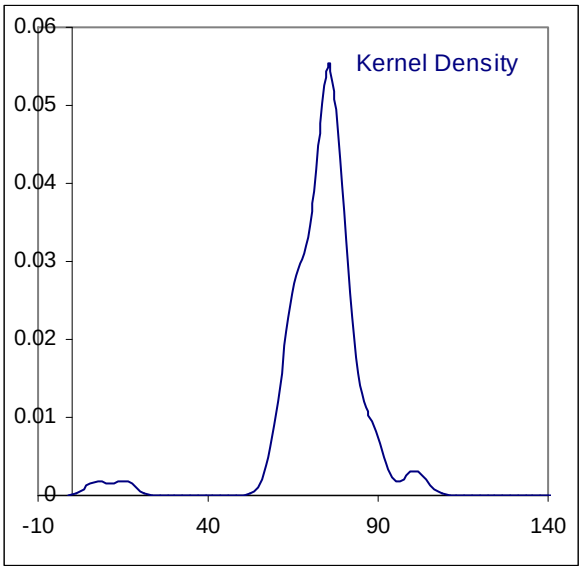
Determination of migration of Cadmium on sample #11011; results in mg/kg

lab	method	value	mark	z(targ)	remarks
310	EN71-3	77.0		0.19	
330		73		-0.17	
357	EN71-3	90.22		1.37	
452		-----		-----	
2102		7.529	G(0.01)	-6.00	
2129	EN71-3	73.845		-0.09	
2132	EN71-3	75.090		0.02	
2146		-----		-----	
2156	EN71-3	79.583		0.42	
2165	EN71-3	67.5		-0.66	
2172	EN71-3	76.32		0.13	
2179	EN71-3	78.0		0.28	
2182	EN71-3	67.763		-0.63	
2190	EN71-3	74		-0.08	
2196		65.821		-0.81	
2201	EN71-3	74.28		-0.05	
2215	EN71-3	66.4		-0.75	
2225	EN71-3	73.814		-0.09	
2227	EN71-3	74.100	C	-0.07	first reported 0.346
2228	EN71-3	66.52		-0.74	
2229	EN71-3	102.200		2.43	
2238		75.20		0.03	
2241		-----		-----	
2246	EN71-3	63.64		-1.00	
2247	ICP/OES	68.566		-0.56	
2253	EN71-3	69.101		-0.51	
2254	EN71-3	561.654	G(0.01)	43.35	
2255		73.563		-0.12	
2256	EN71-3	67.337		-0.67	
2258	EN71-3	80.5039		0.50	
2266	EN71-3	80.244		0.48	
2268	EN71-3	75.05		0.02	
2275		69.62		-0.47	
2279	EN71-3	77.910		0.27	
2284	EN71-3	76.5		0.15	
2289	EN71-3	75		0.01	
2290	EN71-3	59.620		-1.36	
2293	EN71-3	76.605		0.16	
2294	EN71-3	80.700		0.52	
2295	EN71-3	75.2		0.03	
2299	INH-324	64.571		-0.92	
2301	EN71-3	74.6	C	-0.02	first reported 127.8
2304	EN71-3	62.79		-1.08	
2412	EN71-3	77.91		0.27	
2413	ASTM F963	65.866		-0.80	
2415	EN71-3	80.130		0.47	
2421	EN71-3	79.72		0.43	
2424	EN71-3	15.6	G(0.01)	-5.28	
3100	EN71-3	80.890		0.54	
3107	EN71-3	61.950		-1.15	
3110	EN71-3	72.737		-0.19	
3116	EN71-3	66.435		-0.75	
3117	EN71-3	78.250		0.30	
3122		81		0.55	
3124	EN71-3	82.2		0.65	
3135	EN71-3	90.2		1.37	
3151	EN71-3	87.42		1.12	
3153	EN71-3	72.508		-0.21	
3154	EN71-3	84.82		0.89	
3159	EN71-3	60.506		-1.28	
3167	EN71-3	62.01		-1.14	
3169	EN71-3	76.557		0.15	
3172	EN71-3	68.7		-0.55	
3174	EN71-3	69.528		-0.48	
3182	EN71-3	77.810		0.26	
3185	EN71-3	72.23		-0.23	
3190	EN71-3	74.87		0.00	
3192	EN71-3	86.68		1.05	
3199	in house	74.199		-0.06	
3209	EN71-3	73.062		-0.16	
3218	EN71-3	73.54		-0.12	
3233	EN71-3	77.85		0.27	
3237	EN71-3	73.97		-0.08	
3238	EN71-3	78.00		0.28	
3243	EN71-3	99.4		2.19	

3246	EN71-3	87.539	1.13
3248	EN71-3	65	-0.88

normality	OK
n	71
outliers	3
mean (n)	74.86
st.dev. (n)	8.227
R(calc.)	23.03
R(target)	31.44



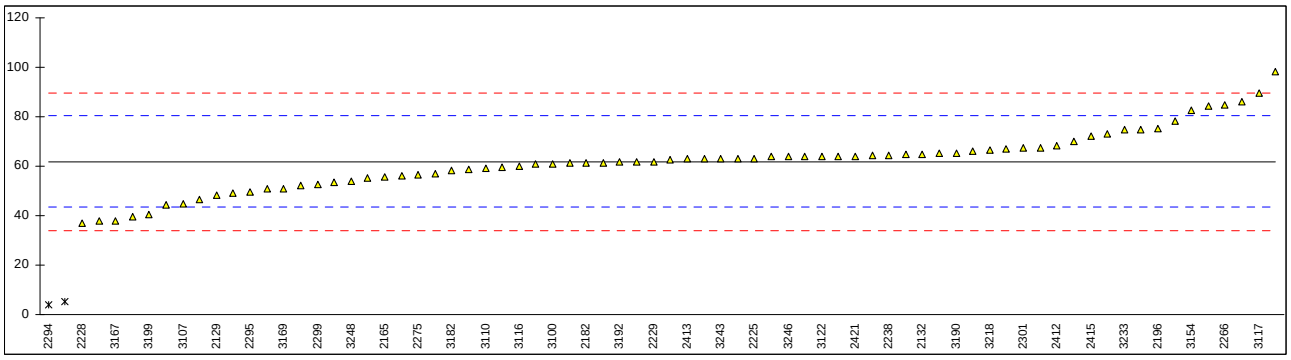


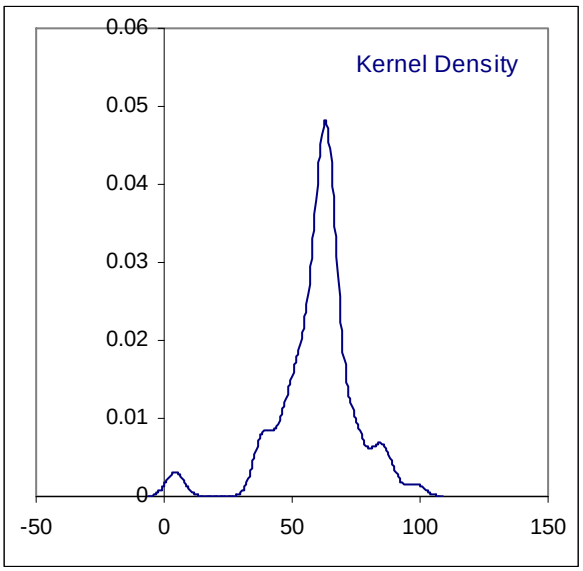
Determination of migration of Lead on sample #11011; results in mg/kg

lab	method	value	mark	z(targ)	remarks
310	EN71-3	61.5		-0.03	
330		70		0.88	
357	EN71-3	61.74		-0.01	
452		-----		-----	
2102		5.076	G(0.01)	-6.12	
2129	EN71-3	48.391		-1.45	
2132	EN71-3	64.945		0.34	
2146		-----		-----	
2156	EN71-3	52.353		-1.02	
2165	EN71-3	55.6		-0.67	
2172	EN71-3	64.06		0.24	
2179	EN71-3	49.0		-1.38	
2182	EN71-3	61.421		-0.04	
2190	EN71-3	75		1.42	
2196		75.112		1.43	
2201	EN71-3	62.74		0.10	
2215	EN71-3	44.2		-1.90	
2225	EN71-3	63.167		0.14	
2227	EN71-3	56.900		-0.53	
2228	EN71-3	37.11		-2.66	
2229	EN71-3	61.810		0.00	
2238		64.53		0.29	
2241		-----		-----	
2246	EN71-3	56.29		-0.60	
2247	ICP/OES	58.647		-0.34	
2253	EN71-3	59.361		-0.27	
2254	EN71-3	67.480		0.61	
2255		37.659		-2.61	
2256	EN71-3	64.628		0.30	
2258	EN71-3	62.8609		0.11	
2266	EN71-3	84.681		2.46	
2268	EN71-3	65.01		0.34	
2275		56.62		-0.56	
2279	EN71-3	65.899		0.44	
2284	EN71-3	73.2		1.23	
2289	EN71-3	63		0.13	
2290	EN71-3	46.645		-1.64	
2293	EN71-3	98.345		3.94	
2294	EN71-3	3.800	G(0.01)	-6.26	
2295	EN71-3	49.4		-1.34	
2299	INH-324	52.745		-0.98	
2301	EN71-3	67.2		0.58	
2304	EN71-3	39.42		-2.42	
2412	EN71-3	68.22		0.69	
2413	ASTM F963	62.841		0.11	
2415	EN71-3	72.250		1.12	
2421	EN71-3	64.07		0.24	
2424	EN71-3	86		2.61	
3100	EN71-3	60.894		-0.10	
3107	EN71-3	44.740		-1.84	
3110	EN71-3	59.005		-0.30	
3116	EN71-3	59.941		-0.20	
3117	EN71-3	89.500		2.98	
3122		64		0.23	
3124	EN71-3	60.7		-0.12	
3135	EN71-3	84.5		2.45	
3151	EN71-3	78.10		1.76	
3153	EN71-3	61.310		-0.06	
3154	EN71-3	82.72		2.25	
3159	EN71-3	53.581		-0.89	
3167	EN71-3	37.85		-2.59	
3169	EN71-3	50.855		-1.18	
3172	EN71-3	63.7		0.20	
3174	EN71-3	63.889		0.22	
3182	EN71-3	58.170		-0.39	
3185	EN71-3	55.10		-0.73	
3190	EN71-3	65.24		0.37	
3192	EN71-3	61.56		-0.03	
3199	in house	40.404		-2.31	
3209	EN71-3	50.696		-1.20	
3218	EN71-3	66.32		0.48	
3233	EN71-3	74.58		1.38	
3237	EN71-3	64.24		0.26	
3238	EN71-3	67.00		0.56	
3243	EN71-3	62.9		0.12	

3246	EN71-3	63.798	0.21
3248	EN71-3	54	-0.84

normality	not OK
n	72
outliers	2
mean (n)	61.82
st.dev. (n)	12.050
R(calc.)	33.74
R(target)	25.97





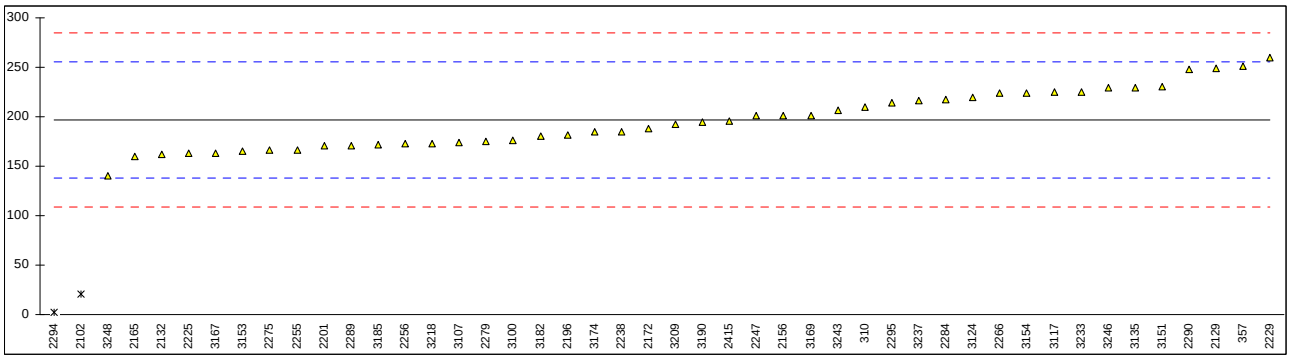
Determination of migration of Nickel on sample #11011; results in mg/kg

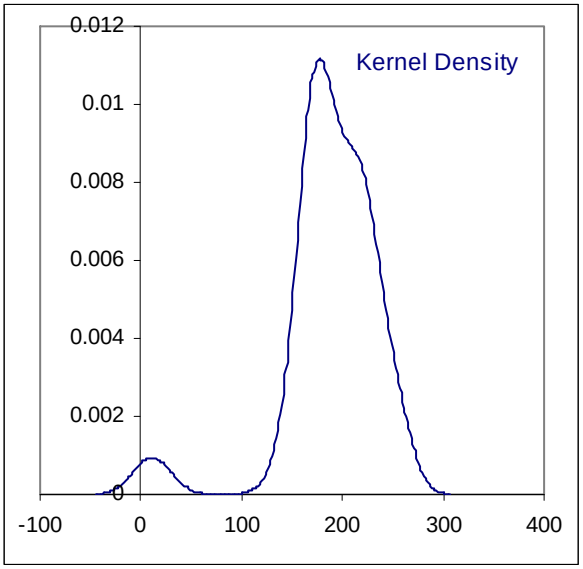
lab	method	value	mark	z(targ)	remarks
310	EN71-3	210		0.45	
330		-----		-----	
357	EN71-3	251.2		1.85	
452		-----		-----	
2102		20.466	G(0.01)	-5.97	
2129	EN71-3	249.35		1.78	
2132	EN71-3	161.935		-1.18	
2146		-----		-----	
2156	EN71-3	201.333		0.16	
2165	EN71-3	159.3		-1.27	
2172	EN71-3	188.1		-0.29	
2179		-----		-----	
2182		-----		-----	
2190		-----		-----	
2196		181.820		-0.51	
2201	EN71-3	170.8		-0.88	
2215		-----		-----	
2225	EN71-3	163.141		-1.14	
2227		-----		-----	
2228		-----		-----	
2229	EN71-3	260.000		2.14	
2238		185.3		-0.39	
2241		-----		-----	
2246		-----		-----	
2247	ICP/OES	201.322	C	0.16	first reported 20.322
2253		-----		-----	
2254		-----		-----	
2255		166.489		-1.03	
2256	EN71-3	173.029		-0.80	
2258		-----		-----	
2266	EN71-3	224.009		0.92	
2268		-----		-----	
2275		166.0		-1.04	
2279	EN71-3	175.475		-0.72	
2284	EN71-3	217.4		0.70	
2289	EN71-3	171		-0.87	
2290	EN71-3	247.750		1.73	
2293		-----		-----	
2294	EN71-3	1.700	G(0.01)	-6.61	
2295	EN71-3	213.7		0.57	
2299		-----		-----	
2301		-----		-----	
2304		-----		-----	
2412		-----		-----	
2413		-----		-----	
2415	EN71-3	195.900		-0.03	
2421		-----		-----	
2424		-----		-----	
3100	EN71-3	175.903		-0.71	
3107	EN71-3	173.800		-0.78	
3110		-----		-----	
3116		-----		-----	
3117	EN71-3	224.70		0.95	
3122		-----		-----	
3124	EN71-3	220		0.79	
3135	EN71-3	229		1.09	
3151	EN71-3	230.1		1.13	
3153	EN71-3	165.752		-1.05	
3154	EN71-3	224.4		0.94	
3159		-----		-----	
3167	EN71-3	163.2		-1.14	
3169	EN71-3	201.605		0.16	
3172		-----		-----	
3174	EN71-3	184.579		-0.41	
3182	EN71-3	180.900		-0.54	
3185	EN71-3	172.0		-0.84	
3190	EN71-3	194.2		-0.09	
3192		-----		-----	
3199		-----		-----	
3209	EN71-3	192.346		-0.15	
3218	EN71-3	173.2		-0.80	
3233	EN71-3	224.7		0.95	
3237	EN71-3	216.06		0.65	
3238		-----		-----	
3243	EN71-3	207		0.35	

3246	EN71-3	228.878	1.09
3248	EN71-3	140	-1.92

normality	OK
n	44
outliers	2
mean (n)	196.74
st.dev. (n)	29.258
R(calc.)	81.92
R(target)	82.63

No analytical correction mentioned in EN71-3, assumed to be 30%





Determination of migration of Antimony, Chromium and Cobalt on sample #11011; results in mg/kg

lab	method	Sb	mark	Cr	mark	Co	mark
310	EN71-3	<0.1		<0.1		0.95	
330		<25		<10		-----	
357	EN71-3	<1		<1		<1	
452		-----		-----		-----	
2102		-----		-----		-----	
2129	EN71-3	0.061		0.0514		0.556	
2132	EN71-3	<6.0		<6.0		<6.0	
2146		-----		-----		-----	
2156	EN71-3	1.000		0.500		1.036	
2165	EN71-3	<2.5		<2.5		<2.5	
2172	EN71-3	<5		<5		<5	
2179	EN71-3	4.9	G(0.01)	n.d.		-----	
2182	EN71-3	<2		<2		-----	
2190	EN71-3	<15		<10		-----	
2196		<10		<10		<10	
2201	EN71-3	<5.000		<5.000		<5.000	
2215	EN71-3	n.d.		n.d.		-----	
2225	EN71-3	<5.000		<5.000		<5.000	
2227	EN71-3	<1	C	<1		-----	
2228	EN71-3	0.005		0.295		-----	
2229	EN71-3	<2.000		<2.000		<2.000	
2238		<5		<5		<5	
2241		-----		-----		-----	
2246	EN71-3	<10		<10		-----	
2247	ICP/OES	<5		<5		<5	
2253	EN71-3	<5		<5		-----	
2254	EN71-3	n.d.		n.d.		-----	
2255		n.d.		n.d.		n.d.	
2256	EN71-3	<2		<2		<2	
2258	EN71-3	0.1416		0.4351		-----	
2266	EN71-3	0.756		0.558		1.671	
2268	EN71-3	<10		<10		-----	
2275		n.d.		n.d.		n.d.	
2279	EN71-3	n.d.		n.d.		n.d.	
2284	EN71-3	n.d.		n.d.		n.d.	
2289	EN71-3	<5		<5		<5	
2290	EN71-3	n.d.		n.d.		n.d.	
2293	EN71-3	n.d.		n.d.		-----	
2294	EN71-3	1.200		0.200		83.300	G(0.01)
2295		-----		-----		-----	
2299	INH-324	0.001		0.384		-----	
2301	EN71-3	0.0	C	4.2	G(0.01)	-----	
2304	EN71-3	n.d.		n.d.		-----	
2412	EN71-3	n.d.		n.d.		-----	
2413	ASTM F963	n.d.		n.d.		-----	
2415	EN71-3	n.d.		n.d.		n.d.	
2421	EN71-3	0.23		0.82		-----	
2424	EN71-3	26.1	G(0.01)	<2.5		-----	
3100	EN71-3	<5		<5		<5	
3107	EN71-3	17.350	G(0.01)	0.310		1.190	
3110	EN71-3	<5		<5		-----	
3116	EN71-3	<2.000		<2.000		-----	
3117		-----		-----		-----	
3122		<5		<5		-----	
3124	EN71-3	0.118		0.146		1.09	
3135	EN71-3	-----		-----		1.79	
3151	EN71-3	0.264		0.130		1.345	
3153	EN71-3	n.d.		n.d.		n.d.	
3154	EN71-3	n.d.		n.d.		5.021	C
3159	EN71-3	<5.000		<5.000		-----	
3167	EN71-3	n.d.		n.d.		n.d.	
3169	EN71-3	<2		<5		<5	
3172	EN71-3	<10		<10		-----	
3174	EN71-3	n.d.		0.329		1.384	
3182	EN71-3	<5.000		<5.000		<5.000	
3185	EN71-3	-----		-----		-----	
3190	EN71-3	<5		<5		<5	
3192	EN71-3	<5		<5		-----	
3199	in house	<6.0		<7.5		-----	
3209	EN71-3	<6.0		<6.0		0.497	
3218	EN71-3	<5		<5		<5	
3233	EN71-3	n.d.		n.d.		1.25	
3237	EN71-3	n.d.		n.d.		1.05	
3238	EN71-3	n.d.		n.d.		-----	
3243	EN71-3	-----		-----		1.25	

3246	EN71-3	n.d.	0.652	1.808
3248	EN71-3	<5	<5	<5
	normality	not OK	OK	not OK
	n	11	13	15
	outliers	3	1	1
	mean (n)	0.34	0.37	1.46
	st.dev. (n)	0.433	0.221	1.056
	R(calc.)	1.21	0.62	2.96
	R(target)	(0.29)	(0.16)	(0.61)

Originally reported test results that were revised:

Laboratory 2227: Sb 23.390

Laboratory 2301: Sb 26.8

Laboratory 3154: Cr 3.106

Determination of migration of Mercury and Selenium on sample #11011; results in mg/kg

lab	method	Hg	mark	Se	mark	
310	EN71-3	0.21		<0.1		
330		<10		<25		
357	EN71-3	<1		<1		
452		-----		-----		
2102		-----		-----		
2129	EN71-3	0.2395		0.054		
2132	EN71-3	<6.0		<6.0		
2146		-----		-----		
2156	EN71-3	1.000		2.000		
2165	EN71-3	<2.5		<2.5		
2172	EN71-3	<5		<5		
2179	EN71-3	n.d.		1.0		
2182	EN71-3	<2		<2		
2190	EN71-3	<10		<25		
2196		<10		<10		
2201	EN71-3	<5.000		<5.000		
2215	EN71-3	n.d.		n.d.		
2225	EN71-3	<5.000		<5.000		
2227	EN71-3	<1		<2		
2228	EN71-3	0.00	ex	0.41		zero is not a real result
2229	EN71-3	<2.000		6.510	G(0.01)	
2238		<5		<5		
2241		-----		-----		
2246	EN71-3	<10		<10		
2247	ICP/OES	<5		<5		
2253	EN71-3	<5		<5		
2254	EN71-3	n.d.		n.d.		
2255		n.d.		n.d.		
2256	EN71-3	<2		<2		
2258	EN71-3	0.3238		1.1181		
2266	EN71-3	0.000		0.474		
2268	EN71-3	<10		<10		
2275		n.d.		n.d.		
2279	EN71-3	n.d.		n.d.		
2284	EN71-3	n.d.		n.d.		
2289	EN71-3	<5		<5		
2290	EN71-3	n.d.		n.d.		
2293	EN71-3	n.d.		n.d.		
2294	EN71-3	n.d.		216.500	G(0.01)	
2295		2.08	G(0.05)	-----		
2299	INH-324	0.357		0.270		
2301	EN71-3	0.4		0.2		
2304	EN71-3	n.d.		n.d.		
2412	EN71-3	n.d.		n.d.		
2413	ASTM F963	n.d.		n.d.		
2415	EN71-3	n.d.		n.d.		
2421	EN71-3	0.37		0.00		
2424	EN71-3	6.95	G(0.01)	<2.5		
3100	EN71-3	<5		<5		
3107	EN71-3	1.530		1.430		
3110	EN71-3	<5		<5		
3116	EN71-3	<2.000		<2.000		
3117		-----		-----		
3122		<5		<5		
3124	EN71-3	0.045		0.004		
3135	EN71-3	0.03		0.78		
3151	EN71-3	n.d.		n.d.		
3153	EN71-3	n.d.		n.d.		
3154	EN71-3	n.d.		n.d.		
3159	EN71-3	<5.000		<5.000		
3167	EN71-3	n.d.		n.d.		
3169	EN71-3	<5		<5		
3172	EN71-3	<10		<10		
3174	EN71-3	n.d.		n.d.		
3182	EN71-3	<5.000		<5.000		
3185	EN71-3	-----		-----		
3190	EN71-3	<5		<5		
3192	EN71-3	-----		-----		
3199	in house	<6.0		<50		
3209	EN71-3	<6.0		<6.0		
3218	EN71-3	<5		<5		
3233	EN71-3	n.d.		n.d.		
3237	EN71-3	n.d.		1.65		
3238	EN71-3	n.d.		n.d.		
3243	EN71-3	0.40		-----		

3246	EN71-3	n.d.	n.d.
3248	EN71-3	<5	<5
	normality	not OK	OK
	n	12	13
	outliers	2	2
	mean (n)	0.41	0.72
	st.dev. (n)	0.439	0.668
	R(calc.)	1.23	1.87
	R(target)	(0.29)	(0.61)

Originally reported test results that were revised:

none

APPENDIX 2

Number of participants per country

1 lab in	AUSTRIA
1 lab in	BANGLADESH
1 lab in	DENMARK
2 labs in	FINLAND
5 labs in	FRANCE
5 labs in	GERMANY
2 labs in	GUATEMALA
8 labs in	HONG KONG
1 lab in	INDIA
1 lab in	ITALY
1 lab in	JAPAN
1 lab in	MALAYSIA
2 labs in	MEXICO
26 labs in	P.R. of CHINA
1 lab in	PERU
2 labs in	SPAIN
2 labs in	THAILAND
2 labs in	THE NETHERLANDS
2 labs in	TURKEY
6 labs in	U.S.A.
2 labs in	UNITED KINGDOM
3 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
fr.	= first reported result
ac	= analytical correction *cfr* EN71-3, paragraph 4.2

Literature:

1 i.i.s. Interlaboratory Studies, Protocol for the Organisation, Statistics & Evaluation, January 2010
2 Council Directive 88/378/EEC
3 Council Directive 2009/48/EC
4 EN71-3 Migration of certain elements
5 Horwitz. Journal of AOAC International Vol. 79 No.3. 1996
6 P.L. Davies. Fr Z. Anal. Chem. 351. 513. (1988)
7 W.J. Conover. Practical; Nonparametric Statistics. J. Wiley&Sons. NY. p.302. (1971)
8 ISO 5725 (1986)
9 ISO 5725 parts 1-6. (1994)
10 ISC7/GF/csteeop/toysinorg/220604 D(04) Assessment of bioavailability of certain elements in toys
11 ISO13528:2005 Statistical methods for use in proficiency testing by interlaboratory comparisons
12 M. Thompson and R. Wood. J. AOAC Int. 76. 926. (1993)
13 Analytical Methods Committee Technical brief, No4 January 2001.
14 The Royal Society of Chemistry 2002, Analyst 2002, 127 page 1359-1364, P.J. Lowthian and M. Thompson (see http://www.rsc.org/suppdata/an/b2/b205600n/).