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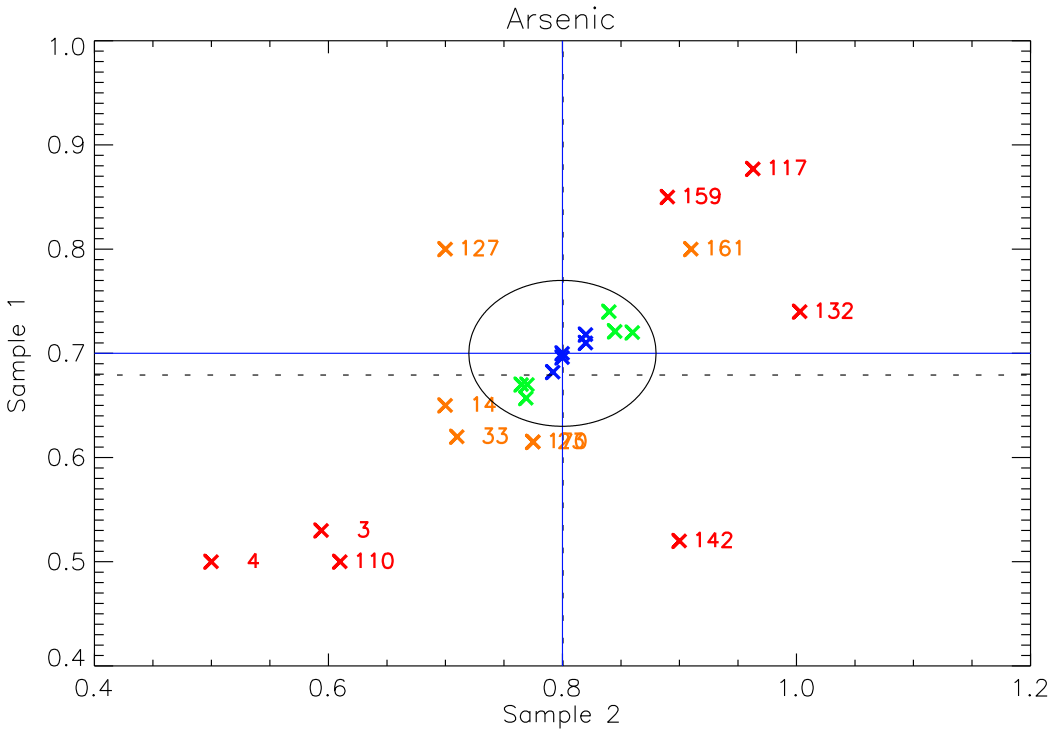
EMEP Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe

Analytical intercomparison of heavy metals in precipitation, 2005 and 2006

Hilde Thelle Uggerud and Anne-Gunn Hjellbrekke



Youden plot of arsenic, 2005

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1. Analytical intercomparison of heavy metals in precipitation, 2005

1.1 Introduction

Heavy metals were included in the EMEP's monitoring programme in 1999. 20 countries are reporting data to the heavy metal database. Since EMEP's measurement programme is based on individual national networks, different sampling and analytical methods are applied by the participating laboratories. In order to ensure data comparability, interlaboratory tests are organized by the Chemical Co-ordinating Centre (CCC) at the Norwegian Institute for Air Research. So far seven intercomparisons have been arranged (Berg and Semb, 1995; Berg and Aas, 2000; Uggerud and Skjelmoen, 2001; Uggerud and Skjelmoen, 2002; Uggerud and Skjelmoen, 2003; Uggerud and Hjellbrekke, 2005).

This report presents results from the eighth analytical intercomparison of heavy metals in precipitation, which was carried out during 2005. Seven heavy metals were included: Pb, Cd, Cu, Zn, As, Cr, and Ni.

1.2 Organization of the intercomparison

The samples for the eighth intercomparison were prepared and distributed to 55 laboratories in July 2005.

A total of 41 laboratories, 19 from the EMEP network, reported results within the end of October 2005. In accordance with the decision of the Steering Body of EMEP, the results are presented in such a way that the different laboratories are identified. Tables A.1.1a and A1.1b give the names of the participating laboratories together with the number used when presenting the results in tables and figures.

Information received on the analytical methods used is given in Table A1.9.

1.3 Intercomparison samples

The four synthetic precipitation samples distributed were made from multi-element standards traceable to NIST-standards. The multi-element standards were conserved with 2.5% HNO_3. The distributed synthetic precipitation samples contained Pb, Cd, Cu, Zn, As, Cr, and Ni in 0.5% HNO_3. Sample H1 and H2 contained concentrations similar to what is normally found in Southern Scandinavia. Sample H3 and H4 contained the elements in concentrations normally found in Central Europe.

All equipment in contact with the samples were soaked in 3% HNO_3 for 4 days. Preparation of the intercomparison samples was carried out in a clean room area.

1.4 Data handling

The data reported from the participants are presented in Tables A1.2-A1.8 and Figures A2.1-A2.7.

1.4.1 Data analysis

The reported values are presented in the tables in decreasing order together with the number of the laboratory. The expected (theoretical) value, the number of results, the arithmetic mean value, the median, the standard deviation and the relative standard deviation in percent are also given. After the first statistical run with all results included, the calculation was repeated with the outliers excluded. The outliers (unused) are defined as the results more than two standard deviations from the mean value in the first run.

1.4.2 Youden plot

Youden plot is a graphical technique, which allows for analysing interlaboratory data, where two samples of equal or similar concentrations have been analysed. The Youden plot visualises systematic errors as well as random errors.

The precipitation samples are made in pairs with similar concentrations and the reported value for one sample is plotted on the x-axis and the reported value of the other sample is plotted on the y-axis. Thus, each point in the plot is representing a pair of results from a single laboratory. Two fully drawn lines represent the expected values of the two samples. Two dotted lines represent the arithmetic mean values in the second statistical run. The lines divide the plot in four quadrants. A 45º-reference line may be drawn through the intercept of the lines representing the expected values.

If the errors are due to random factors, the points will be evenly distributed around the mean value and be situated in all four quadrants of the chart.

If the errors are due to systematic factors, the results will be close to the 45º-reference line, but situated in the upper right or lower left quadrant.

Ellipses with radii corresponding to the data quality objectives within EMEP are drawn in each plot (see table 1). The data points are colour coded as given in Table 1. Drawn arrows indicate points outside the plot area.

Table 1: Youden-plot parameters.

Radii = DQO	**Concentration**
25% accuracy or better	Pb, Ni, Cr, As <1 μg/l, Cd <0.5 μg/l, Zn< 10 μg/l, Cu <2 μg/l
15% accuracy or better	Pb, Ni, Cr, As >1 μg/l, Cd >0.5 μg/l, Zn >10 μg/l, Cu >2 μg/l
Criteria	Colour
Within 0.5*DQO	Blue
Within DQO	Green
Within 2*DQO	Orange
> 2*DQO	Red

The length of the perpendicular from an individual point and to the reference line gives a measure of the random error. The perpendicular intercepts the 45^{o}-reference line at a distance from the origin of the fully drawn lines. This distance is a measure of the systematic error.

Youden plots are presented in Figures A2.1–A2.7.

1.5 Summary

As in earlier intercomparisons, outliers are defined as values that deviate more than two standard deviations from the mean value. Outliers occur for all samples and almost all parameters. Out of a total of 1046 single results, 52 are defined as outliers. This is about 5% of the reported data, which is comparable to earlier intercomparisons.

2. Analytical intercomparison of heavy metals in precipitation, 2006

2.1 Introduction

Heavy metals were included in the EMEP's monitoring programme in 1999. 20 countries are reporting data to the heavy metal database. Since EMEP's measurement programme is based on individual national networks, different sampling and analytical methods are applied by the participating laboratories. In order to ensure data comparability, interlaboratory tests are organized by the Chemical Co-ordinating Centre (CCC) at the Norwegian Institute for Air Research. So far six intercomparisons have been arranged (Berg and Semb, 1995; Berg and Aas, 2000; Uggerud and Skjelmoen, 2001; Uggerud and Skjelmoen, 2002; Uggerud and Skjelmoen, 2003; Uggerud and Hjellbrekke, 2005; Uggerud and Hjellbrekke, this report).

This report presents results from the ninth analytical intercomparison of heavy metals in precipitation, which was carried out during 2006. Seven heavy metals were included: Pb, Cd, Cu, Zn, As, Cr, and Ni.

2.2 Organization of the intercomparison

The samples for the ninth intercomparison were prepared and distributed to 53 laboratories in July 2006.

A total of 33 laboratories, 19 from the EMEP network, reported results within the end of November 2006. In accordance with the decision of the Steering Body of EMEP, the results are presented in such a way that the different laboratories are identified. Tables A3.1a and A3.1b give the names of the participating laboratories together with the number used when presenting the results in tables and figures.

Information received on the analytical methods used is given in Table A3.9.

2.3 Intercomparison samples

The four synthetic precipitation samples distributed were made from multi-element standards traceable to NIST-standards. The multi-element standards were conserved with 2.5% HNO_3. The distributed synthetic precipitation samples contained Pb, Cd, Cu, Zn, As, Cr, and Ni in 0.5% HNO_3. Sample H1 and H2 contained concentrations similar to what is normally found in Southern Scandinavia. Sample H3 and H4 contained the elements in concentrations normally found in Central Europe.

All equipment in contact with the samples were soaked in 3% HNO_3 for 4 days. Preparation of the intercomparison samples was carried out in a clean room area.

2.4 Data handling

The data reported from the participants are presented in Tables A3.2-A3.8 and Figures A4.1-A4.7

2.4.1 Data analysis

The reported values are presented in the tables in decreasing order together with the number of the laboratory. The expected (theoretical) value, the number of results, the arithmetic mean value, the median, the standard deviation and the relative standard deviation in percent are also given. After the first statistical run with all results included, the calculation was repeated with the outliers excluded. The outliers (unused) are defined as the results more than two standard deviations from the mean value in the first run.

2.4.2 Youden plot

Youden plot is a graphical technique, which allows for analysing interlaboratory data, where 2 samples of equal or similar concentrations have been analysed. The Youden plot visualises systematic errors as well as random errors.

The precipitation samples are made in pairs with similar concentrations and the reported value for one sample is plotted on the x-axis and the reported value of the other sample is plotted on the y-axis. Thus, each point in the plot is representing a pair of results from a single laboratory. Two fully drawn lines represent the expected values of the two samples. Two dotted lines represent the arithmetic mean values in the second statistical run. The lines divide the plot in four quadrants. A 45º-reference line may be drawn through the intercept of the lines representing the expected values.

If the errors are due to random factors, the points will be evenly distributed around the mean value and be situated in all four quadrants of the chart.

If the errors are due to systematic factors, the results will be close to the 45º-reference line, but situated in the upper right or lower left quadrant.

Ellipses with radii corresponding to the data quality objectives within EMEP are drawn in each plot (see table 1). The data points are colour coded as given in Table 2. Drawn arrows indicate points outside the plot area.

Table 2: Youden-plot parameters.

Radii = DQO	**Concentration**
25% accuracy or better	Pb, Ni, Cr, As <1 μg/l, Cd <0.5 μg/l, Zn< 10 μg/l, Cu <2 μg/l
15% accuracy or better	Pb, Ni, Cr, As >1 μg/l, Cd >0.5 μg/l, Zn >10 μg/l, Cu >2 μg/l
Criteria	Colour
Within 0.5*DQO	Blue
Within DQO	Green
Within 2*DQO	Orange
> 2*DQO	Red

The length of the perpendicular from an individual point and to the reference line gives a measure of the random error. The perpendicular intercepts the 45º -

reference line at a distance from the origin of the fully drawn lines. This distance is a measure of the systematic error.

Youden plots are presented in Figures A4.1-A4.7.

2.5 Summary

As in earlier intercomparisons, outliers are defined as values that deviate more than two standard deviations from the mean value. Outliers occur for all samples and almost all parameters. Out of a total of 864 single results, 42 are defined as outliers. This is about 5 % of the reported data, which is comparable to earlier intercomparisons.

3. References

Berg, T. and Aas, W. (2000) Analytical intercomparison of heavy metals in precipitation 1999. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 8/2000).

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Appendix 1

Tables and figures, 2005

Table A1.1a: Participating laboratories in the EMEP network, 2005. The numbers in front are used in tables.

No	Laboratory identification
1	Federal Environmental Agency, Austria
2	Flemish Environment Agency, Belgium
3	Czech Hydrometeorological Institute, Czech Republic
4	National Environmental Research Institute. Air Pollution Laboratory, Denmark
5	Finnish Meteorological Institute, Finland
6	Laboratories Wollf, France
8	Umweltbundesamt, Germany
10	Hungarian Meteorological Service, Hungary
14	RIVM Laboratory of Inorganic Analytical Chemistry, The Netherlands
15	The Norwegian Institute for Air Research, Norway
16	Inst. Of Meteorology and Water Management, Poland
23	AEA Technology, National Environmental Techn. Centre, United Kingdom
31	Slovak Hydrometeorological Institute, Slovakia
32	Atmospheric Pollution Research Laboratory, Institute of Physics, Lithuania
33	Environmental Pollution Observ. Centre, Latvia
34	Ministry of Health, Dept. of Environm. Health and Research, Turkey
36	Hydrometeorological Institute of Slovenia, Slovenia
38	Estonian Environmental Research Centre, Estonia
39	Environmental Monitoring Laboratory, Institute of Environmental Protection, Poland

Table A1.1b: Participating laboratories outside the EMEP network, 2005. The number in front of the names is used in tables and figures.

No	Laboratory identification
108	Institut f. Bondenkunde und Standortlehre der TU Dresden, Germany
109	Institut f. Bondenkunde und Waldernährung der Universität, Germany
110	Thüringer Landesanstalt für Landwirtschaft (TTL), Germany
112	Niedersächsische Forstliche Versuchsanstalt (NVF), Germany
114	C.N.R. Istituto Italiano di Idrobiologia, Italy
115	Bayerishe Landesanstalt f. Wald- und Forstwirtschaft, Germany
117	Sächsische Landesanstalt für Forsten, Germany
118	Forstliche Versuchs- und Forschungsanstalt Baden-Württemberg, Germany
120	Landwirtschaftliche Untersuchungs- und Forschungsanstalt (LUFA), Germany
121	Landesamt für Natur und Umwelt, Germany
125	Bayerisches Landesamt für Umweltschutz, Germany
127	Department of Chemistry, Jalan Sultan, Malaysia
129	Ecole Nationale d'Ingenieurs de Sfax, Tunisie
132	Comision Chilena De Energia Nuclear, Chile
141	Pollutants Chemical Analysis Centre, Marine Division, Japan
142	EPLD, Lagor, France
153	Slovenian Forestry Institute, Slovenia
159	CARSO, France
160	Coillte, Newtownmountkennedy, Ireland
161	National Institute of Chemistry, Slovenia
170	Harwell Scientifics, UK
171	Ecole des Mines de Douai, France

Table A1.2: Analytical results for Cr in synthetic precipitation samples, 2005.

Chromium
Sample no.: H1
Theoretical value: 0.700
Unit: µg/l

Run 1:
Number of laboratories: 29
Arithmetic mean value: 0.755
Median: 0.700
Standard deviation 0.226
Rel. st. deviation (%) 29.988

Run 2:
Number of laboratories: 27
Arithmetic mean value: 0.706
Median: 0.700
Standard deviation 0.138
Rel. st. deviation (%) 19.576

Results in decreasing order:

36	1.430 (*)	39	0.700	
132	1.400 (*)	15	0.699	
23	1.025	8	0.690	
170	1.025	31	0.690	
109	0.930	1	0.690	
33	0.830	3	0.634	
153	0.800	115	0.630	
125	0.792	117	0.620	
161	0.780	121	0.610	
110	0.750	14	0.600	
171	0.723	2	0.555	
32	0.700	5	0.529	
4	0.700	159	0.510	
127	0.700	142	0.440	
114	0.700	160	< 20.000	
		129	< 15.000	
		6	< 10.000	
		112	< 1.100	
		38	< 1.000	
		120	< 1.000	
		118	< 0.600	
		34	< 0.250	

Chromium
Sample no.: H2
Theoretical value: 0.600
Unit: µg/l

Run 1:
Number of laboratories: 29
Arithmetic mean value: 0.656
Median: 0.600
Standard deviation 0.201
Rel. st. deviation (%) 30.724

Run 2:
Number of laboratories: 28
Arithmetic mean value: 0.631
Median: 0.600
Standard deviation 0.154
Rel. st. deviation (%) 24.347

Results in decreasing order:

36	1.350 (*)	114	0.600	
14	1.000	31	0.590	
132	0.954	8	0.580	
109	0.900	3	0.576	
170	0.890	1	0.570	
23	0.890	115	0.561	
125	0.676	33	0.550	
110	0.660	121	0.550	
161	0.640	142	0.520	
171	0.614	117	0.513	
15	0.602	4	0.500	
39	0.600	5	0.482	
153	0.600	2	0.437	
32	0.600	159	0.410	
		127	0.600	
		160	< 20.000	
		129	< 15.000	
		6	< 10.000	
		112	< 1.100	
		38	< 1.000	
		120	< 1.000	
		118	< 0.600	
		34	< 0.250	

Chromium
Sample no.: H3
Theoretical value: 7.000
Unit: µg/l

Run 1:
Number of laboratories: 35
Arithmetic mean value: 6.734
Median: 6.790
Standard deviation 0.696
Rel. st. deviation (%) 10.329

Run 2:
Number of laboratories: 32
Arithmetic mean value: 6.813
Median: 6.795
Standard deviation 0.352
Rel. st. deviation (%) 5.171

Results in decreasing order:

38	8.500 (*)	1	6.760	
14	7.600	31	6.740	
125	7.430	117	6.700	
110	7.430	153	6.700	
161	7.400	32	6.700	
127	7.200	114	6.700	
171	7.070	159	6.620	
36	7.060	121	6.600	
33	7.000	132	6.560	
39	7.000	4	6.500	
170	6.920	5	6.480	
23	6.920	15	6.430	
8	6.840	120	6.400	
115	6.830	3	6.120	
142	6.820	108	6.080	
112	6.800	118	4.900 (*)	
109	6.800	34	4.300 (*)	
2	6.790	160	< 20.000	
		129	< 15.000	
		6	< 10.000	

Chromium
Sample no.: H4
Theoretical value: 6.000
Unit: µg/l

Run 1:
Number of laboratories: 35
Arithmetic mean value: 5.774
Median: 5.830
Standard deviation 0.674
Rel. st. deviation (%) 11.676

Run 2:
Number of laboratories: 32
Arithmetic mean value: 5.843
Median: 5.851
Standard deviation 0.438
Rel. st. deviation (%) 7.496

Results in decreasing order:

38	7.300 (*)	1	5.830	
142	6.600	4	5.800	
110	6.440	112	5.800	
125	6.420	31	5.730	
14	6.400	114	5.700	
171	6.310	121	5.700	
161	6.300	32	5.700	
117	6.283	15	5.580	
36	6.280	120	5.500	
127	6.200	23	5.470	
33	6.000	170	5.470	
109	5.970	5	5.410	
39	5.900	3	5.280	
153	5.900	108	4.840	
132	5.900	159	4.690	
8	5.880	34	3.900 (*)	
2	5.873	118	3.900 (*)	
115	5.830	160	< 20.000	
		129	< 15.000	
		6	< 10.000	

Table A1.3: Analytical results for Ni in synthetic precipitation samples, 2005.

Nickel
Sample no.: H1
Theoretical value: 0.700
Unit: µg/l

Run 1:
Number of laboratories: 27
Arithmetic mean value: 0.725
Median: 0.715
Standard deviation 0.268
Rel. st. deviation (%) 36.938

Run 2:
Number of laboratories: 25
Arithmetic mean value: 0.662
Median: 0.700
Standard deviation 0.148
Rel. st. deviation (%) 22.379

Results in decreasing order:

108	1.610 (*)	114	0.700
34	1.400 (*)	32	0.700
110	0.860	8	0.680
132	0.835	170	0.655
3	0.800	23	0.655
112	0.800	33	0.600
14	0.800	5	0.589
161	0.780	159	0.530
125	0.760	39	0.500
36	0.755	117	0.497
15	0.750	142	0.410
121	0.750	2	0.403
115	0.738	4	0.300
171	0.715	129 <	88.000
		6 <	10.000
		160 <	5.000
		153 <	3.600
		127 <	2.000
		120 <	1.000
		38 <	1.000
		1 <	1.000
		118 <	0.700
		109 <	0.100

Nickel
Sample no.: H2
Theoretical value: 0.800
Unit: µg/l

Run 1:
Number of laboratories: 28
Arithmetic mean value: 0.817
Median: 0.770
Standard deviation 0.313
Rel. st. deviation (%) 38.272

Run 2:
Number of laboratories: 26
Arithmetic mean value: 0.742
Median: 0.725
Standard deviation 0.124
Rel. st. deviation (%) 16.689

Results in decreasing order:

38	2.100 (*)	8	0.750
34	1.500 (*)	14	0.700
132	0.958	32	0.700
3	0.900	39	0.700
112	0.900	117	0.695
121	0.880	5	0.689
36	0.865	170	0.685
161	0.850	23	0.685
171	0.831	108	0.680
125	0.827	159	0.620
15	0.820	142	0.610
33	0.800	114	0.600
115	0.793	4	0.500
110	0.790	2	0.460
		129 <	88.000
		6 <	10.000
		160 <	5.000
		153 <	3.600
		127 <	2.000
		120 <	1.000
		1 <	1.000
		118 <	0.700
		109 <	0.100

Nickel
Sample no.: H3
Theoretical value: 7.000
Unit: µg/l

Run 1:
Number of laboratories: 36
Arithmetic mean value: 6.998
Median: 6.800
Standard deviation 1.577
Rel. st. deviation (%) 22.529

Run 2:
Number of laboratories: 35
Arithmetic mean value: 6.769
Median: 6.800
Standard deviation 0.788
Rel. st. deviation (%) 11.646

Results in decreasing order:

160	15.000 (*)	121	6.800
38	8.800	4	6.800
3	8.200	153	6.800
108	7.650	1	6.730
161	7.600	142	6.630
34	7.400	112	6.600
125	7.290	114	6.600
110	7.260	8	6.600
2	7.218	159	6.590
31	7.020	5	6.500
33	7.000	127	6.400
39	7.000	15	6.310
14	7.000	23	6.285
36	6.980	170	6.285
115	6.930	132	5.840
117	6.863	120	5.700
171	6.840	118	5.600
32	6.800	129	4.000
		6 <	10.000
		109 <	0.100

Nickel
Sample no.: H4
Theoretical value: 8.000
Unit: µg/l

Run 1:
Number of laboratories: 36
Arithmetic mean value: 7.811
Median: 7.800
Standard deviation 0.992
Rel. st. deviation (%) 12.696

Run 2:
Number of laboratories: 33
Arithmetic mean value: 7.767
Median: 7.800
Standard deviation 0.637
Rel. st. deviation (%) 8.201

Results in decreasing order:

38	10.400 (*)	121	7.800	
3	9.900 (*)	1	7.740	
39	9.000	171	7.740	
161	8.800	8	7.590	
2	8.503	132	7.550	
34	8.500	117	7.550	
142	8.500	112	7.500	
125	8.450	108	7.480	
31	8.450	15	7.380	
110	8.340	5	7.300	
33	8.300	127	7.300	
14	8.100	159	7.150	
36	8.060	23	7.110	
153	8.000	170	7.110	
114	7.900	118	6.500	
115	7.900	109	6.500	
4	7.900	120	6.500	
32	7.800	129	4.600	(*)
		6 <	10.000	
		160 <	5.000	

Table A1.4: Analytical results for Cu in synthetic precipitation samples, 2005.

Copper
Sample no.: H1
Theoretical value: 1.100
Unit: µg/l

Run 1:
Number of laboratories: 30
Arithmetic mean value: 1.009
Median: 1.055
Standard deviation 0.276
Rel. st. deviation (%) 27.341

Run 2:
Number of laboratories: 28
Arithmetic mean value: 1.070
Median: 1.060
Standard deviation 0.152
Rel. st. deviation (%) 14.170

Results in decreasing order:

32	1.500	5	1.050	
115	1.420	1	1.050	
125	1.220	2	1.027	
36	1.190	3	1.010	
108	1.170	39	1.000	
15	1.150	121	1.000	
34	1.100	112	1.000	
33	1.100	23	0.990	
14	1.100	170	0.990	
16	1.100	142	0.950	
8	1.090	117	0.913	
171	1.090	159	0.860	
31	1.070	132	0.698	
110	1.060	114	0.200	(*)
161	1.060	120	0.100	(*)
		6	< 10.000	
		129	< 10.000	
		160	< 5.000	
		153	< 2.600	
		118	< 2.000	
		38	< 1.000	
		127	< 0.300	
		109	< 0.200	

Copper
Sample no.: H2
Theoretical value: 1.300
Unit: µg/l

Run 1:
Number of laboratories: 32
Arithmetic mean value: 1.347
Median: 1.220
Standard deviation 0.903
Rel. st. deviation (%) 67.023

Run 2:
Number of laboratories: 31
Arithmetic mean value: 1.196
Median: 1.220
Standard deviation 0.311
Rel. st. deviation (%) 25.979

Results in decreasing order:

160	6.000	(*)	5	1.220
108	2.250		23	1.200
33	1.700		39	1.200
36	1.400		1	1.200
125	1.390		161	1.200
142	1.360		170	1.200
32	1.300		3	1.160
16	1.300		117	1.117
14	1.300		121	1.100
110	1.290		159	1.040
31	1.260		38	1.000
171	1.260		112	1.000
8	1.250		132	0.873
115	1.250		120	0.800
15	1.250		34	0.600
2	1.221		114	0.400
			6	< 10.000
			129	< 10.000
			153	< 2.600
			118	< 2.000
			127	< 0.300
			109	< 0.200

Copper
Sample no.: H3
Theoretical value: 8.000
Unit: µg/l

Run 1:
Number of laboratories: 37
Arithmetic mean value: 7.624
Median: 7.630
Standard deviation 2.117
Rel. st. deviation (%) 27.766

Run 2:
Number of laboratories: 35
Arithmetic mean value: 7.548
Median: 7.630
Standard deviation 0.908
Rel. st. deviation (%) 12.024

Results in decreasing order:

160	17.000	(*)	5	7.590
153	9.900		23	7.585
38	8.800		170	7.585
125	8.450		2	7.545
117	8.293		15	7.540
36	8.270		1	7.540
161	8.200		39	7.500
31	8.140		121	7.500
115	8.090		34	7.400
16	8.000		118	7.200
14	7.900		3	6.910
32	7.900		33	6.900
142	7.850		127	6.800
108	7.780		132	6.090
110	7.770		109	5.970
8	7.770		129	5.300
112	7.700		114	5.100
171	7.690		120	0.900 (*)
159	7.630		6	< 10.000

Copper
Sample no.: H4
Theoretical value: 9.000
Unit: µg/l

Run 1:
Number of laboratories: 36
Arithmetic mean value: 8.743
Median: 8.670
Standard deviation 1.057
Rel. st. deviation (%) 12.087

Run 2:
Number of laboratories: 34
Arithmetic mean value: 8.575
Median: 8.660
Standard deviation 0.807
Rel. st. deviation (%) 9.410

Results in decreasing order:

160	12.000	(*)	170	8.670
153	11.200	(*)	15	8.650
38	10.200		2	8.637
142	9.850		114	8.600
125	9.590		171	8.540
31	9.480		121	8.500
36	9.450		1	8.460
117	9.390		5	8.320
161	9.300		39	8.300
115	9.070		118	8.200
16	9.000		159	8.050
14	9.000		34	8.000
112	8.900		33	7.900
108	8.860		3	7.770
110	8.790		127	7.500
8	8.750		109	7.070
32	8.700		120	6.700
23	8.670		132	6.690
			6	< 10.000

Table A1.5: Analytical results for Zn in synthetic precipitation samples, 2005.

Zinc
Sample no.: H1
Theoretical value: 6.000
Unit: µg/l

Run 1:
Number of laboratories: 33
Arithmetic mean value: 6.106
Median: 6.000
Standard deviation 1.605
Rel. st. deviation (%) 26.291

Run 2:
Number of laboratories: 31
Arithmetic mean value: 6.161
Median: 6.000
Standard deviation 1.092
Rel. st. deviation (%) 17.727

Results in decreasing order:

142	10.000 (*)	39	6.000	
121	8.300	171	6.000	
129	8.000	36	5.930	
160	8.000	3	5.900	
125	7.650	117	5.735	
159	7.580	120	5.500	
2	7.408	16	5.500	
14	7.000	112	5.300	
132	6.810	33	5.200	
8	6.800	23	5.190	
115	6.730	170	5.190	
15	6.550	127	4.800	
32	6.400	109	4.700	
1	6.250	118	4.400	
5	6.180	34	4.000	
161	6.000	108	0.500	(*)
114	6.000	153	< 20.000	
		38	< 10.000	
		6	< 10.000	
		110	< 1.000	

Zinc
Sample no.: H2
Theoretical value: 8.000
Unit: µg/l

Run 1:
Number of laboratories: 34
Arithmetic mean value: 7.602
Median: 7.837
Standard deviation 1.657
Rel. st. deviation (%) 21.793

Run 2:
Number of laboratories: 33
Arithmetic mean value: 7.804
Median: 7.863
Standard deviation 1.180
Rel. st. deviation (%) 15.122

Results in decreasing order:

159	10.500	171	7.810	
38	10.300	36	7.800	
125	10.000	5	7.660	
14	9.000	39	7.500	
121	8.900	132	7.400	
15	8.870	33	7.300	
129	8.600	120	7.200	
32	8.400	112	7.200	
3	8.400	16	7.000	
8	8.300	23	6.535	
115	8.130	170	6.535	
1	8.020	127	6.500	
160	8.000	118	6.300	
161	8.000	109	6.170	
114	8.000	34	6.000	
142	7.900	2	5.439	
117	7.863	108	0.920	(*)
		153	< 20.000	
		6	< 10.000	
		110	< 1.000	

Zinc
Sample no.: H3
Theoretical value: 90.000
Unit: µg/l

Run 1:
Number of laboratories: 38
Arithmetic mean value: 86.495
Median: 90.000
Standard deviation 15.241
Rel. st. deviation (%) 17.621

Run 2:
Number of laboratories: 37
Arithmetic mean value: 88.587
Median: 90.000
Standard deviation 8.232
Rel. st. deviation (%) 9.293

Results in decreasing order:

125	108.200	159	90.000	
129	102.000	3	90.000	
6	100.000	14	88.000	
110	99.800	114	88.000	
2	97.850	120	87.300	
160	96.000	5	84.800	
121	95.000	118	84.100	
39	95.000	171	83.790	
38	93.500	112	83.600	
32	92.500	127	81.100	
33	92.100	109	80.870	
15	92.000	36	80.300	
31	92.000	34	80.000	
115	91.600	132	80.000	
8	90.900	153	76.000	
1	90.900	23	74.370	
117	90.770	170	74.370	
16	90.000	142	71.000	
161	90.000	108	9.080	(*)

Zinc
Sample no.: H4
Theoretical value: 115.000
Unit: µg/l

Run 1:
Number of laboratories: 38
Arithmetic mean value: 107.304
Median: 112.500
Standard deviation 25.452
Rel. st. deviation (%) 23.719

Run 2:
Number of laboratories: 36
Arithmetic mean value: 112.776
Median: 113.000
Standard deviation 9.960
Rel. st. deviation (%) 8.832

Results in decreasing order:

125	139.300	3	112.000	
110	133.000	120	111.300	
121	130.000	114	111.000	
6	130.000	33	110.800	
2	123.700	118	107.400	
15	120.000	171	107.230	
38	118.800	112	107.000	
32	118.000	5	106.000	
115	116.100	34	105.000	
1	116.000	127	104.600	
160	116.000	132	104.000	
117	115.030	109	103.300	
39	115.000	36	103.000	
8	115.000	153	100.000	
161	115.000	23	97.180	
16	115.000	170	97.180	
159	115.000	142	96.000	
31	113.000	108	11.620	(*)
14	113.000	129	6.000	(*)

Table A1.6: Analytical results for As in synthetic precipitation samples, 2005.

Arsenic
Sample no.: H1
Theoretical value: 0.700
Unit: µg/l

Run 1:
Number of laboratories: 24
Arithmetic mean value: 0.679
Median: 0.689
Standard deviation 0.101
Rel. st. deviation (%) 14.931

Run 2:
Number of laboratories: 24
Arithmetic mean value: 0.679
Median: 0.689
Standard deviation 0.101
Rel. st. deviation (%) 14.931

Results in decreasing order:

117	0.877	5	0.682
159	0.850	171	0.670
161	0.800	1	0.670
127	0.800	2	0.657
36	0.740	14	0.650
132	0.740	33	0.620
125	0.721	23	0.615
121	0.720	170	0.615
115	0.718	3	0.530
8	0.710	142	0.520
32	0.700	4	0.500
15	0.696	110	0.500
		160	< 20.000
		6	< 5.000
		34	< 3.600
		118	< 2.500
		38	< 1.000

Arsenic
Sample no.: H2
Theoretical value: 0.800
Unit: µg/l

Run 1:
Number of laboratories: 24
Arithmetic mean value: 0.788
Median: 0.796
Standard deviation 0.115
Rel. st. deviation (%) 14.580

Run 2:
Number of laboratories: 23
Arithmetic mean value: 0.800
Median: 0.800
Standard deviation 0.099
Rel. st. deviation (%) 12.408

Results in decreasing order:

132	1.003	5	0.792
117	0.963	23	0.775
161	0.910	170	0.775
142	0.900	1	0.770
159	0.890	2	0.769
121	0.860	171	0.765
125	0.845	33	0.710
36	0.840	14	0.700
115	0.820	127	0.700
8	0.820	110	0.610
15	0.800	3	0.594
32	0.800	4	0.500 (*)
		160	< 20.000
		6	< 5.000
		34	< 3.600
		118	< 2.500
		38	< 1.000

Arsenic
Sample no.: H3
Theoretical value: 5.000
Unit: µg/l

Run 1:
Number of laboratories: 30
Arithmetic mean value: 5.078
Median: 4.890
Standard deviation 1.151
Rel. st. deviation (%) 22.661

Run 2:
Number of laboratories: 29
Arithmetic mean value: 4.901
Median: 4.880
Standard deviation 0.634
Rel. st. deviation (%) 12.935

Results in decreasing order:

34	10.200 (*)	15	4.880
132	6.810	1	4.870
159	5.920	32	4.800
142	5.880	121	4.800
161	5.300	2	4.794
120	5.300	171	4.670
36	5.250	31	4.660
110	5.200	23	4.620
8	5.080	170	4.620
125	5.060	3	4.610
115	5.050	127	4.400
6	5.000	118	4.300
33	5.000	4	4.200
5	4.920	117	3.937
14	4.900	38	3.300
		160	< 20.000

Arsenic
Sample no.: H4
Theoretical value: 6.000
Unit: µg/l

Run 1:
Number of laboratories: 30
Arithmetic mean value: 6.147
Median: 5.915
Standard deviation 1.238
Rel. st. deviation (%) 20.142

Run 2:
Number of laboratories: 29
Arithmetic mean value: 5.976
Median: 5.900
Standard deviation 0.825
Rel. st. deviation (%) 13.809

Results in decreasing order:

34	11.100 (*)	32	5.900
132	8.590	1	5.870
142	7.880	5	5.810
159	6.970	171	5.750
110	6.410	3	5.730
161	6.400	31	5.700
120	6.400	121	5.700
36	6.340	2	5.647
125	6.150	4	5.600
8	6.120	23	5.455
115	6.060	170	5.455
6	6.000	127	5.300
33	6.000	118	5.100
14	5.970	117	4.960
15	5.930	38	4.100
		160	< 20.000

Table A1.7: Analytical results for Cd in synthetic precipitation samples, 2005.

Cadmium
Sample no.: H1
Theoretical value: 0.060
Unit: µg/l

Run 1:
Number of laboratories: 28
Arithmetic mean value: 0.053
Median: 0.060
Standard deviation 0.019
Rel. st. deviation (%) 36.177

Run 2:
Number of laboratories: 25
Arithmetic mean value: 0.055
Median: 0.060
Standard deviation 0.011
Rel. st. deviation (%) 19.697

Results in decreasing order:

114	0.100 (*)	161	0.060	
36	0.076	16	0.060	
125	0.064	5	0.059	
115	0.063	8	0.057	
15	0.062	2	0.055	
3	0.062	142	0.054	
171	0.060	141	0.050	
31	0.060	118	0.040	
33	0.060	23	0.040	
121	0.060	170	0.040	
39	0.060	117	0.036	
4	0.060	14	0.026	
159	0.060	10	0.008	(*)
32	0.060	160	< 20.000	
		129	< 4.000	
		6	< 2.000	
		108	< 0.610	
		110	< 0.200	
		127	< 0.200	
		38	< 0.100	
		120	< 0.100	
		1	< 0.100	
		109	< 0.100	
		153	< 0.070	
		34	< 0.070	
		112	< 0.060	
		132	< 0.050	

Cadmium
Sample no.: H2
Theoretical value: 0.080
Unit: µg/l

Run 1:
Number of laboratories: 29
Arithmetic mean value: 0.074
Median: 0.078
Standard deviation 0.012
Rel. st. deviation (%) 15.870

Run 2:
Number of laboratories: 26
Arithmetic mean value: 0.075
Median: 0.079
Standard deviation 0.009
Rel. st. deviation (%) 11.988

Results in decreasing order:

114	0.100 (*)	8	0.077	
36	0.096	2	0.077	
115	0.086	153	0.070	
125	0.085	32	0.070	
15	0.083	141	0.069	
5	0.081	14	0.069	
4	0.080	132	0.068	
159	0.080	142	0.066	
161	0.080	10	0.063	
16	0.080	121	0.060	
31	0.080	23	0.060	
33	0.080	170	0.060	
39	0.080	118	0.050	(*)
171	0.079	117	0.050	(*)
3	0.078	160	< 20.000	
		129	< 4.000	
		6	< 2.000	
		108	< 0.610	
		110	< 0.200	
		127	< 0.200	
		38	< 0.100	
		120	< 0.100	
		1	< 0.100	
		109	< 0.100	
		34	< 0.070	
		112	< 0.060	

Cadmium
Sample no.: H3
Theoretical value: 0.900
Unit: µg/l

Run 1:
Number of laboratories: 39
Arithmetic mean value: 0.893
Median: 0.873
Standard deviation 0.128
Rel. st. deviation (%) 14.372

Run 2:
Number of laboratories: 37
Arithmetic mean value: 0.868
Median: 0.870
Standard deviation 0.073
Rel. st. deviation (%) 8.382

Results in decreasing order:

108	1.390 (*)	23	0.870	
129	1.300 (*)	142	0.870	
159	1.030	170	0.870	
153	1.030	3	0.865	
4	0.980	31	0.860	
125	0.960	14	0.851	
161	0.920	39	0.850	
115	0.914	121	0.850	
1	0.910	33	0.850	
15	0.907	32	0.850	
34	0.900	141	0.840	
16	0.900	38	0.830	
127	0.900	109	0.830	
120	0.900	2	0.819	
118	0.900	10	0.774	
36	0.890	132	0.752	
5	0.888	117	0.740	
112	0.880	110	0.700	
8	0.879	114	0.700	
171	0.873	160	< 20.000	

Cadmium
Sample no.: H4
Theoretical value: 0.700
Unit: µg/l

Run 1:
Number of laboratories: 37
Arithmetic mean value: 0.674
Median: 0.682
Standard deviation 0.073
Rel. st. deviation (%) 10.873

Run 2:
Number of laboratories: 34
Arithmetic mean value: 0.678
Median: 0.684
Standard deviation 0.052
Rel. st. deviation (%) 7.690

Results in decreasing order:

108	0.880 (*)	112	0.680	
153	0.800	4	0.680	
159	0.750	161	0.680	
142	0.750	32	0.680	
125	0.749	5	0.678	
14	0.719	38	0.670	
15	0.715	141	0.663	
1	0.710	39	0.650	
36	0.704	2	0.641	
31	0.700	3	0.633	
33	0.700	23	0.625	
118	0.700	170	0.625	
16	0.700	34	0.600	
127	0.700	10	0.583	
115	0.698	132	0.570	
120	0.690	117	0.557	
121	0.690	114	0.500	(*)
8	0.686	110	0.500	(*)
171	0.682	160	< 20.000	
		109	< 0.100	

Table A1.8: Analytical results for Pb in synthetic precipitation samples, 2005.

Lead
Sample no.: H1
Theoretical value: 1.300
Unit: µg/l

Run 1:
Number of laboratories: 32
Arithmetic mean value: 1.344
Median: 1.290
Standard deviation 0.516
Rel. st. deviation (%) 38.427

Run 2:
Number of laboratories: 30
Arithmetic mean value: 1.223
Median: 1.270
Standard deviation 0.209
Rel. st. deviation (%) 17.056

Results in decreasing order:

108	3.300	(*)	171	1.280
34	3.000	(*)	8	1.260
120	1.500		117	1.247
142	1.400		5	1.220
132	1.400		23	1.210
3	1.400		170	1.210
32	1.400		33	1.200
125	1.370		161	1.200
1	1.370		16	1.200
36	1.340		14	1.200
110	1.330		127	1.100
159	1.320		121	1.100
15	1.320		2	1.007
31	1.310		114	0.900
118	1.300		4	0.900
115	1.300		10	0.410
			129	< 41.000
			160	< 20.000
			6	< 10.000
			153	< 4.100
			112	< 2.400
			109	< 1.000
			38	< 1.000

Lead
Sample no.: H2
Theoretical value: 1.600
Unit: µg/l

Run 1:
Number of laboratories: 33
Arithmetic mean value: 1.870
Median: 1.600
Standard deviation 1.123
Rel. st. deviation (%) 60.067

Run 2:
Number of laboratories: 31
Arithmetic mean value: 1.603
Median: 1.580
Standard deviation 0.253
Rel. st. deviation (%) 15.775

Results in decreasing order:

10	7.012	(*)	115	1.580
34	5.000	(*)	159	1.580
108	2.700		171	1.550
114	1.900		142	1.550
132	1.850		8	1.540
31	1.730		5	1.510
118	1.700		120	1.500
14	1.700		127	1.500
125	1.680		23	1.480
33	1.680		170	1.480
1	1.660		117	1.470
15	1.630		2	1.462
16	1.600		110	1.460
32	1.600		121	1.400
161	1.600		4	1.300
36	1.600		38	1.100
3	1.600		129	< 41.000
			160	< 20.000
			6	< 10.000
			153	< 4.100
			112	< 2.400
			109	< 1.000

Lead
Sample no.: H3
Theoretical value: 50.000
Unit: µg/l

Run 1:
Number of laboratories: 38
Arithmetic mean value: 48.527
Median: 48.800
Standard deviation 5.055
Rel. st. deviation (%) 10.416

Run 2:
Number of laboratories: 35
Arithmetic mean value: 48.218
Median: 48.800
Standard deviation 2.547
Rel. st. deviation (%) 5.283

Results in decreasing order:

127	64.500	(*)	5	48.800
121	61.000	(*)	15	48.600
117	53.595		31	47.950
161	53.000		3	47.900
159	51.800		108	47.300
125	51.000		142	47.300
112	50.500		8	47.200
1	50.400		171	47.080
2	49.970		110	47.000
118	49.800		16	47.000
14	49.600		36	46.700
33	49.500		109	46.500
34	49.400		6	46.000
153	49.300		23	44.860
4	49.300		170	44.860
115	49.240		10	44.590
120	49.000		132	43.300
114	49.000		129	41.500
32	48.800		38	30.900 (*)
			160	< 20.000

Lead
Sample no.: H4
Theoretical value: 20.000
Unit: µg/l

Run 1:
Number of laboratories: 36
Arithmetic mean value: 20.390
Median: 20.350
Standard deviation 2.581
Rel. st. deviation (%) 12.657

Run 2:
Number of laboratories: 34
Arithmetic mean value: 20.304
Median: 20.350
Standard deviation 1.548
Rel. st. deviation (%) 7.625

Results in decreasing order:

117	30.493	(*)	15	20.330
121	25.000		32	20.300
127	25.000		5	20.100
118	21.200		112	20.000
108	21.200		114	20.000
4	21.100		33	20.000
153	21.100		16	20.000
161	21.000		10	19.940
125	20.800		115	19.490
142	20.800		36	19.400
132	20.800		8	19.200
1	20.700		171	18.840
159	20.700		23	18.525
2	20.620		170	18.525
3	20.600		34	18.500
120	20.500		110	18.200
14	20.500		6	17.000
31	20.370		38	13.200 (*)
			129	< 41.000
			160	< 20.000

Table A1.9: Analytical techniques used at the participating laboratories for the different elements, 2005.

Lab. no.	Elements	Technique
1	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
2	Cr, Ni, Cu, As, Cd, Pb	GF-AAS
	Zn	F-AAS
3	Ni, Cd, Cu, Pb,	GF-AAS
	Cr, As	ICP-MS
	Zn	F-AAS
4	Cr, Ni, As, Cd, Pb	GF-AAS
5	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
6	Cr, Ni, Cu, Zn, Cd, Pb	ICP-AES
	As	GF-AAS
8	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
10	As, Pb	GF-AAS
14	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
15	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
16	Cr, Ni, Cu, Zn, Cd, Pb	GF-AAS
23	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
31	As ,Cr, Ni, Cu, Cd, Pb	GF-AAS
	Zn	F-AAS
32	Cr, Ni, Cu, Zn, As, Cd, Pb	GF-AAS
33	As, Cu, Cd, Cr, Ni, Pb	GF-AAS
	Zn	F-AAS
34	As, Cd, Cu, Ni, Zn	ICP-AES
	Cr, Pb	ICP-HRMS
36	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
38	Cr, Ni, Cu, , Cd, Pb	GF-AAS
	Zn	F-AAS
39	Cr, Ni, Cu, Cd,	GF-AAS
	Zn	F-AAS
109	Cr, Ni, Cu, Zn, Cd, Pb	GF-AAS
110	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
112	Cr, Ni, Cu, Zn, As, Cd, Pb	USN-ICP-MS
114	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-OES
115	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
117	Zn	ICP-OES
	As, Cd, Cr, Cu, Ni, Pb	GF-AAS
118	Cu, Cd, Pb	GF-AAS
	As ,Zn Cr, Ni	ICP-OES
120	Cr, Ni, Cu, As, Cd, Pb	GF-AAS
	Zn	F-AAS
121	Cr, Ni, Cu, Cd, Pb	GF-AAS
	Zn	Voltametry
	As	HG-AAS
125	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
127	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
129	Cr, Ni, Cu, Zn, Cd, Pb	F-AAS (Polarized Zeeman)
132	Cr, Ni, Cu, Zn , Cd	USN-ICP-OES
	Pb	GF-AAS
	As	HG-AAS
141	Cd,	GF-AAS
142	Cr, Ni, Cu, As, Cd, Pb	ICP-MS
	Zn,	ICP-AES
153	Cr, Ni, Cu, As, Cd, Pb	GF-AAS
	Zn	F-AAS
160	Cr, Ni, Cu, Zn, As, Cd, Pb	F-AAS
161	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
170	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
171	Cr, Ni, Cu, As, Cd, Pb	ICP-MS
	Zn	ICP-AES

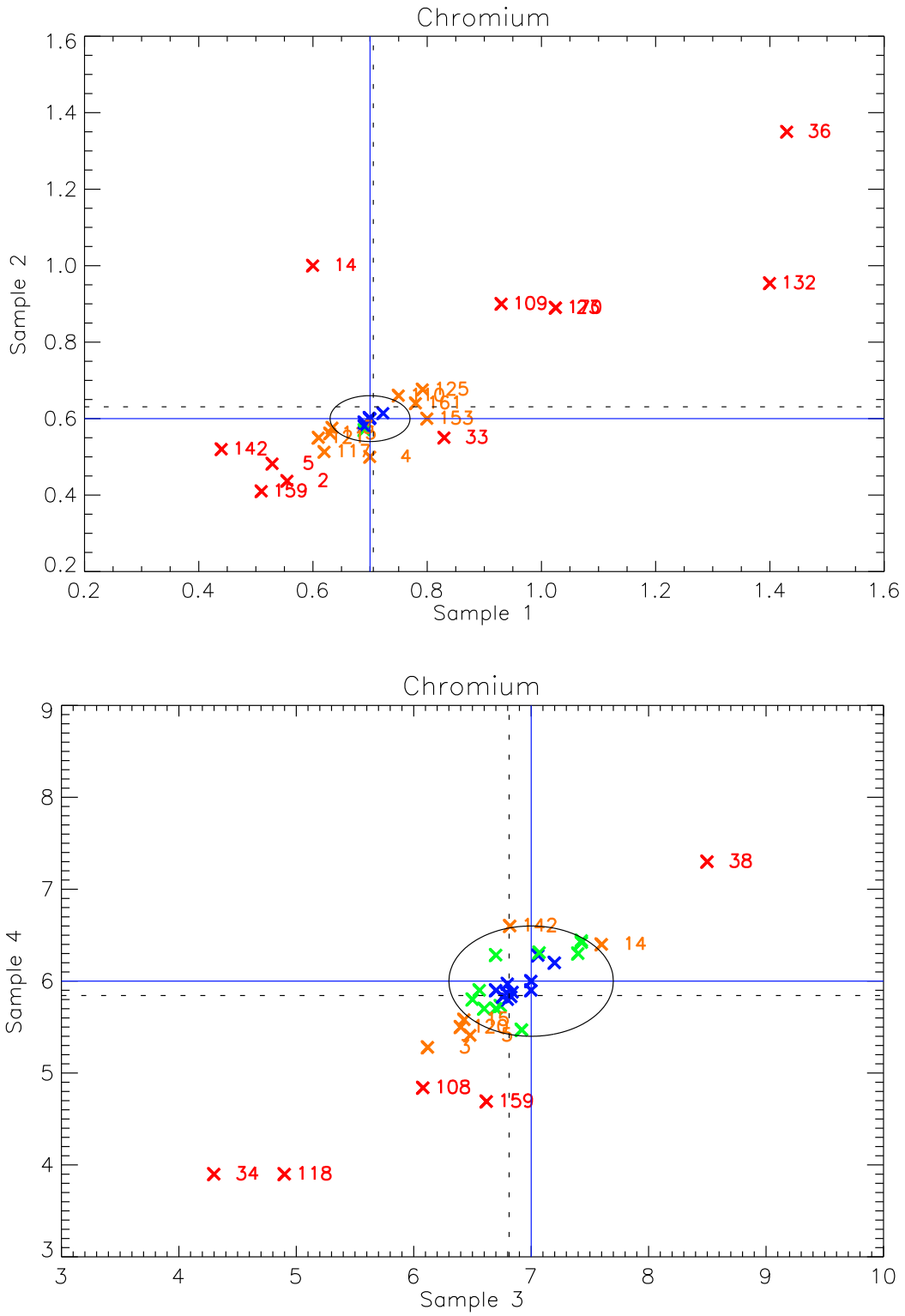

Figure A2.1: Youden plot of chromium, 2005.

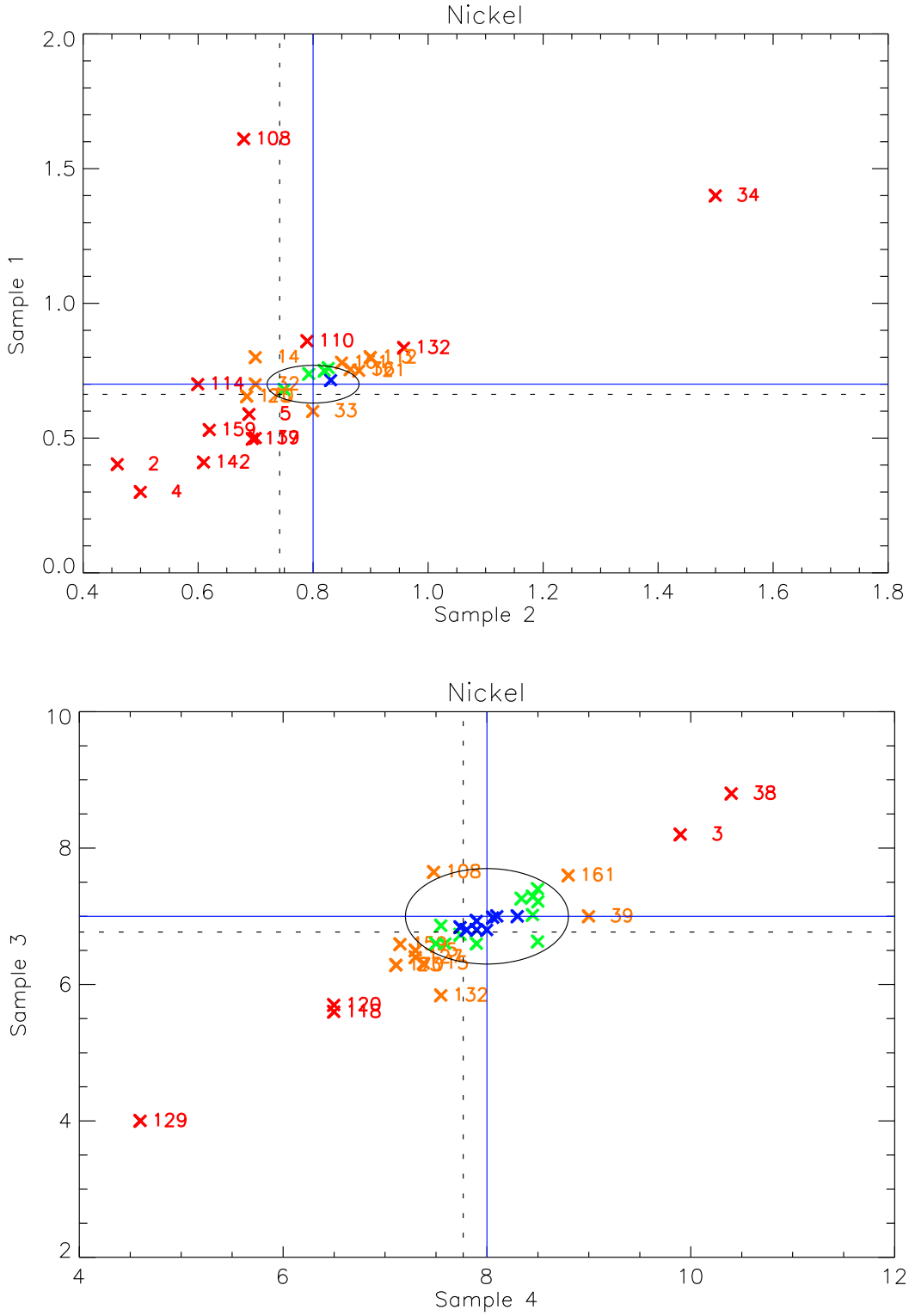

Figure A2.2: Youden plot of nickel, 2005.

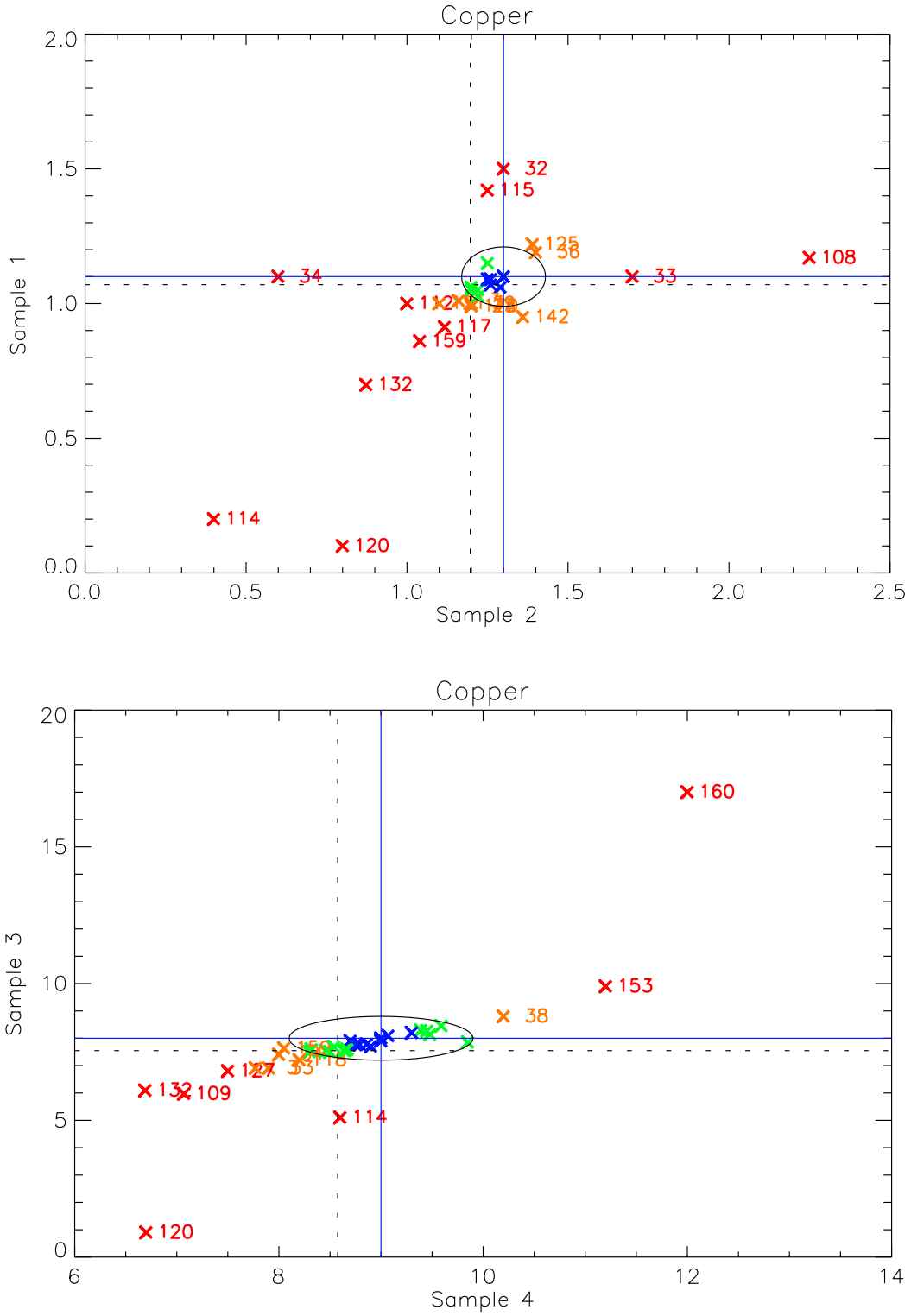

Figure A2.3: Youden plot of copper, 2005.

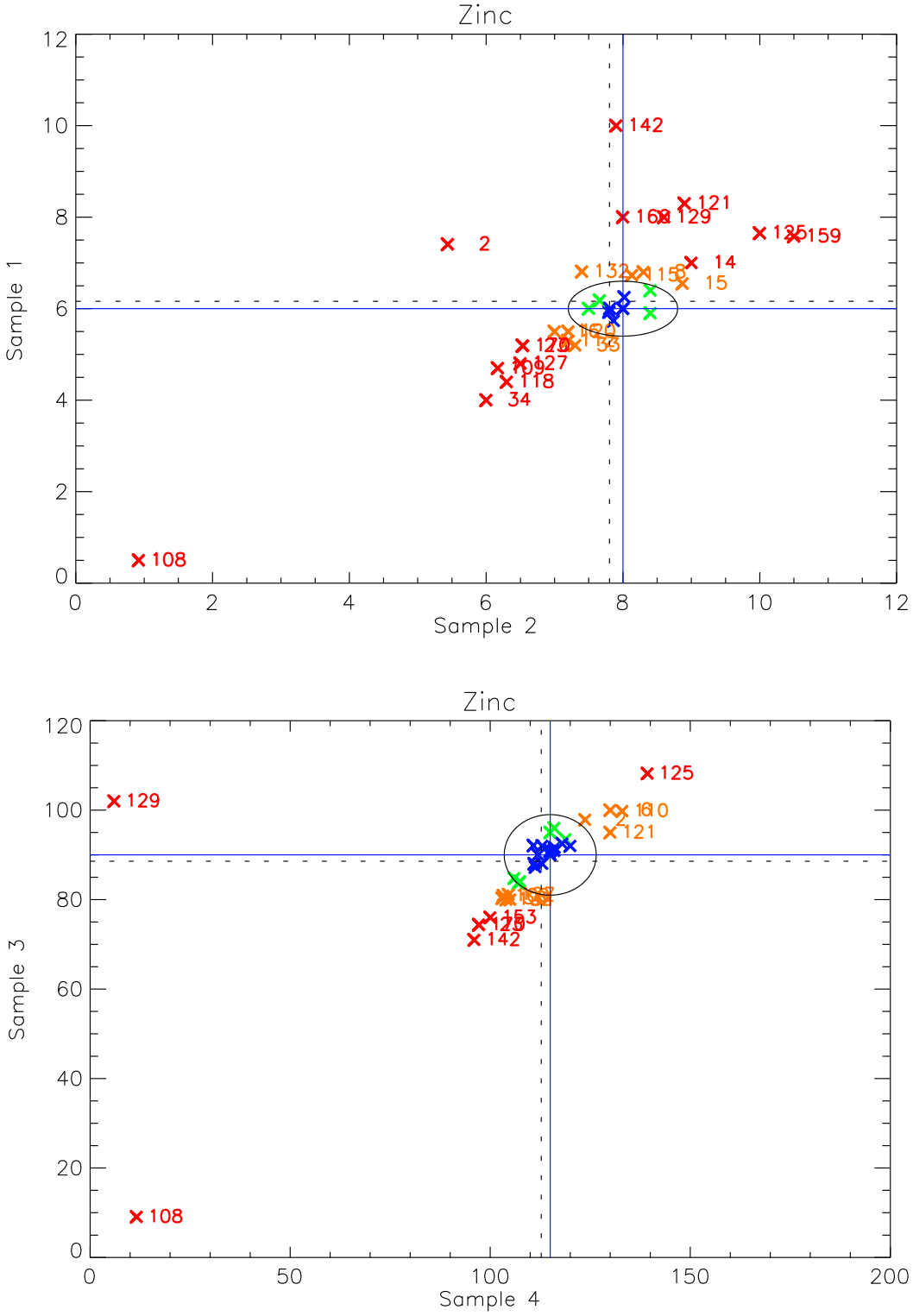

Figure A2.4: Youden plot of zinc, 2005.

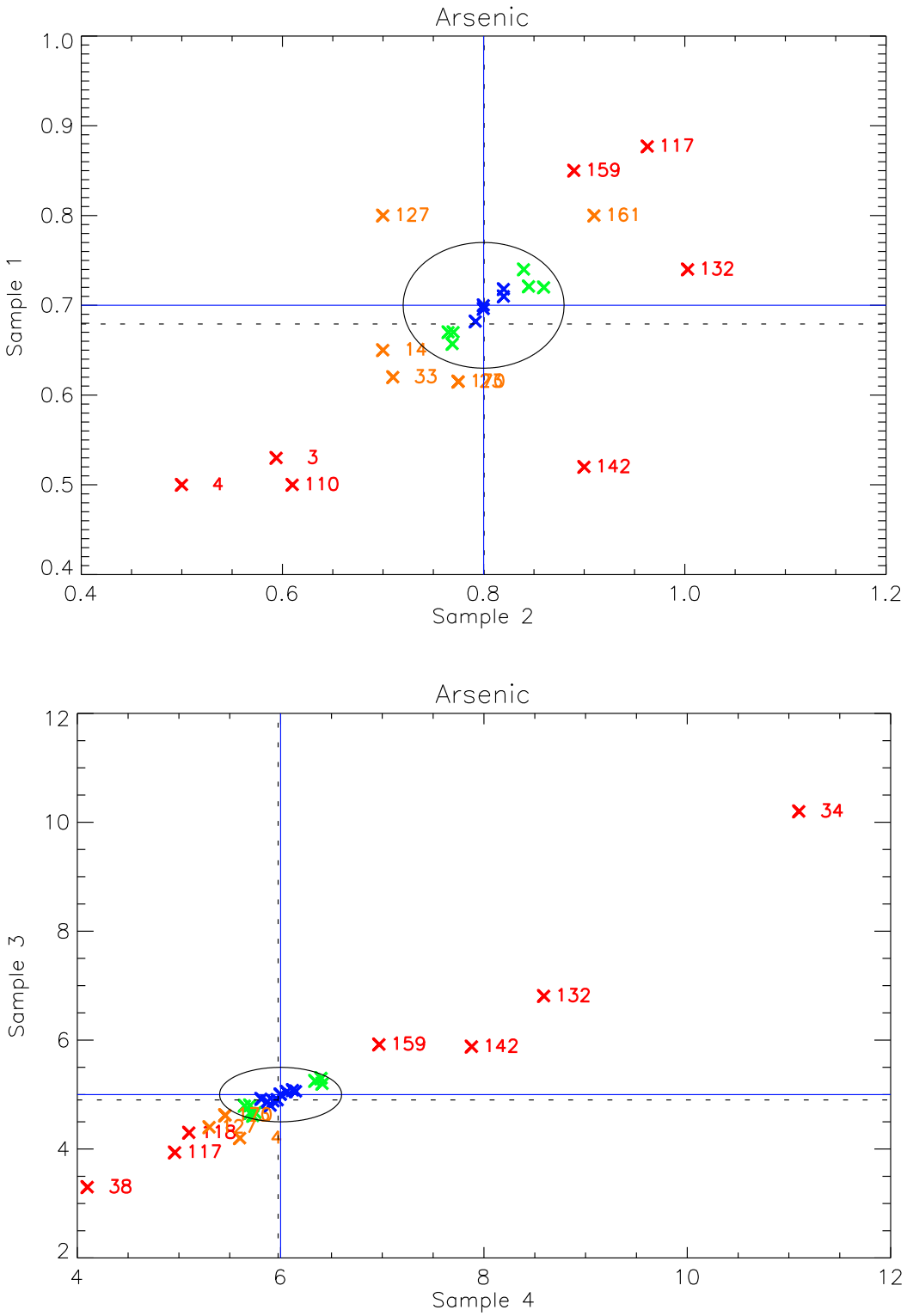

Figure A2.5: Youden plot of arsenic, 2005.

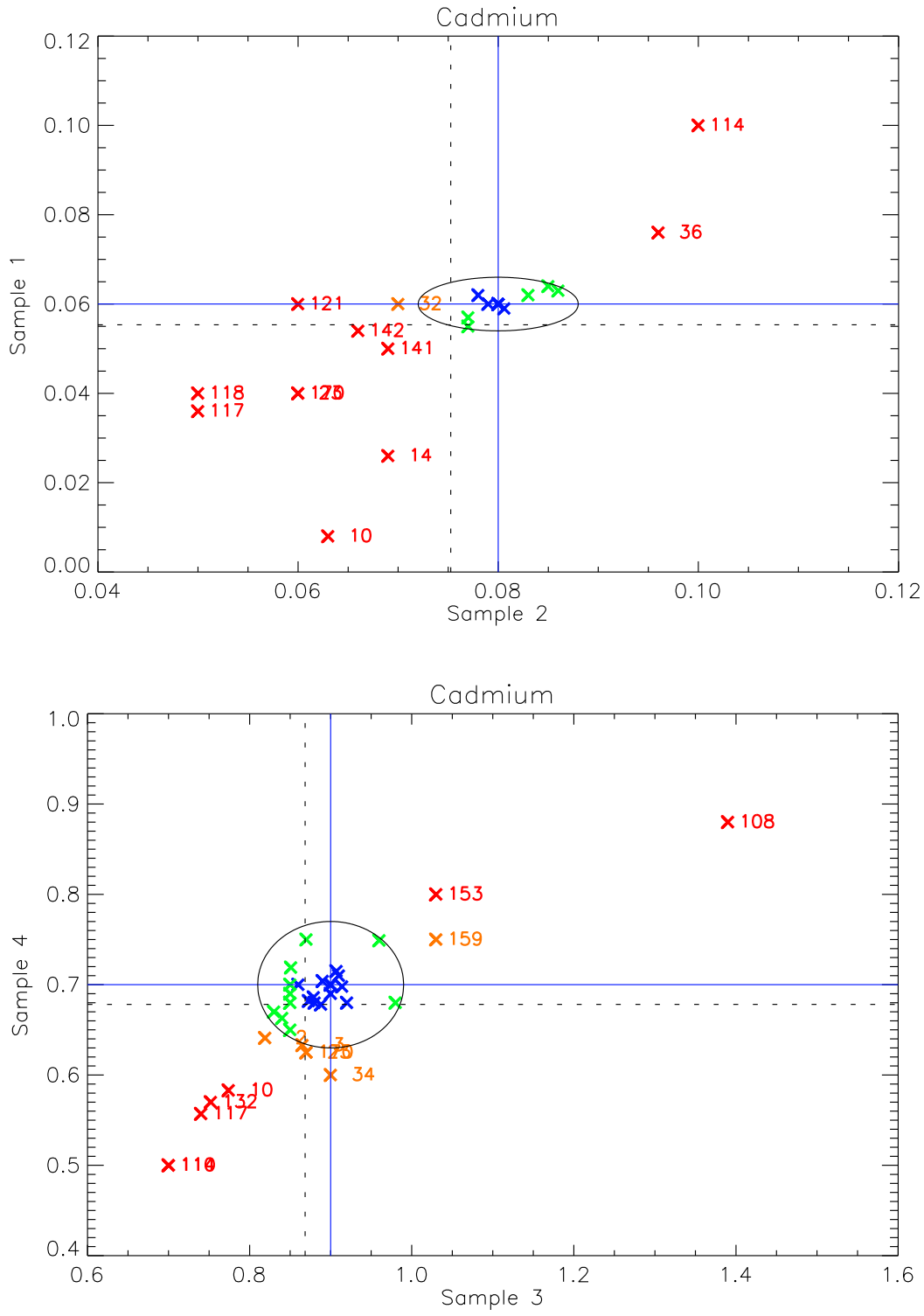

Figure A2.6: Youden plot of cadmium, 2005.

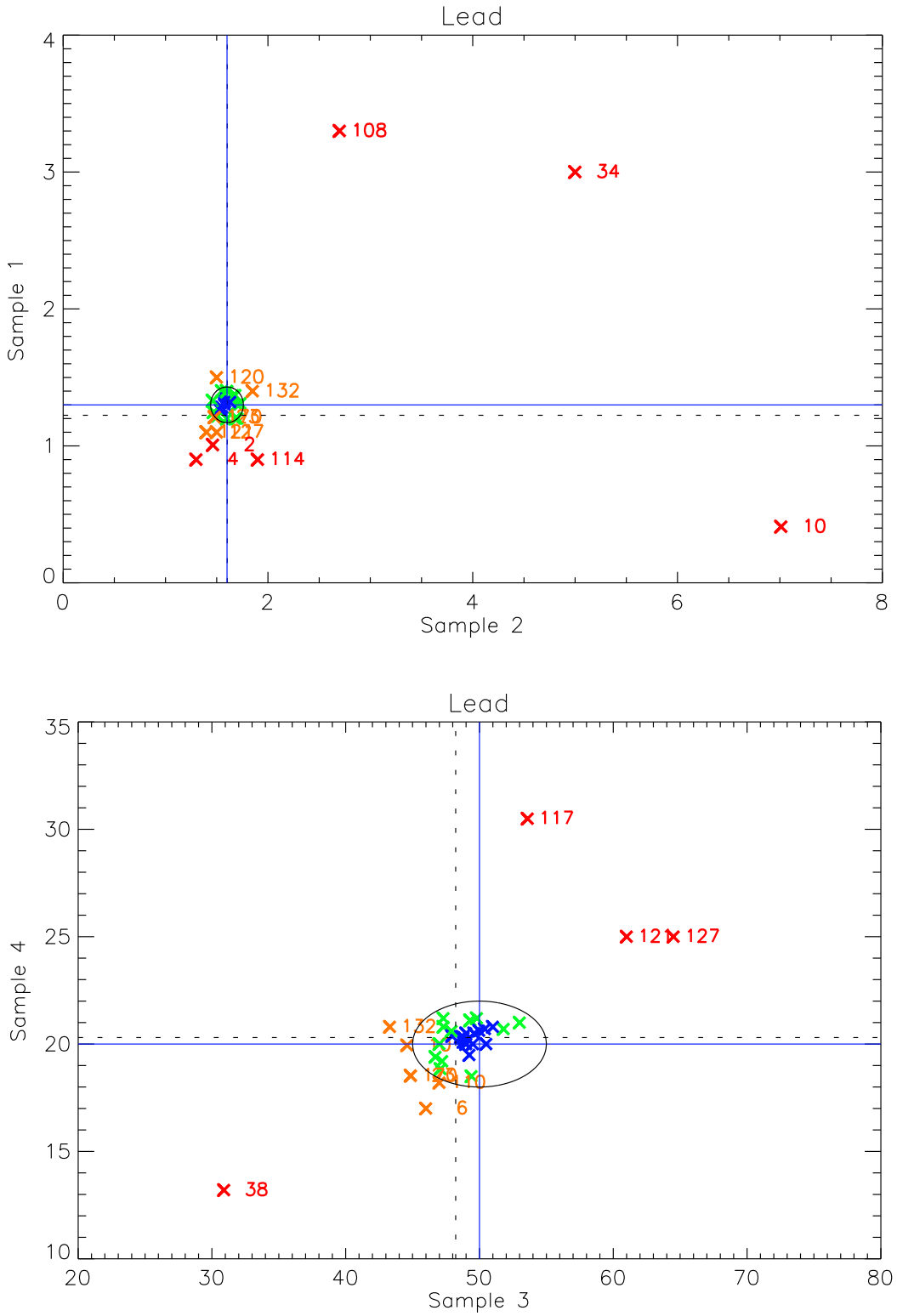

Figure A2.7: Youden plot of lead, 2005.

Appendix 2

Tables and figures, 2006

Table A3.1a: Participating laboratories in the EMEP network, 2006. The numbers in front are used in tables.

No	Laboratory identification
1	Federal Environmental Agency, Austria
2	Flemish Environment Agency, Belgium
3	Czech Hydrometeorological Institute, Czech Republic
4	National Environmental Research Institute. Air Pollution Laboratory, Denmark
5	Finnish Meteorological Institute, Finland
6	Laboratories Wollf, France
7	IfE Leipzig GmbH, Umweltlabor, Germany
8	Umweltbundesamt, Germany
10	Hungarian Meteorological Service, Hungary
13	Istituto Inquinamento Atmosferico (CNR), Italy
14	RIVM Laboratory of Inorganic Analytical Chemistry, The Netherlands
15	The Norwegian Institute for Air Research, Norway
16	Inst. Of Meteorology and Water Management, Poland
23	AEA Technology, National Environmental Techn. Centre, United Kingdom
26	Ontario Ministry of Environment, Canada
32	Atmospheric Pollution Research Laboratory, Institute of Physics, Lithuania
33	Environmental Pollution Observ. Centre, Latvia
36	Hydrometeorological Institute of Slovenia, Slovenia
38	Estonian Environmental Research Centre, Estonia
39	Environmental Monitoring Laboratory, Institute of Environmental Protection, Poland

Table A3.1b: Participating laboratories outside the EMEP network, 2006. The number in front of the names is used in tables and figures.

No	Laboratory identification
109	Institut f. Bondenkunde und Waldernährung der Universität, Germany
110	Thüringer Landesanstalt für Landwirtschaft (TTL), Germany
112	Niedersächsische Forstliche Versuchsanstalt (NVF), Germany
115	Bayerishe Landesanstalt f. Wald- und Forstwirtschaft, Germany
118	Forstliche Versuchs- und Forschungsanstalt Baden-Württemberg, Germany
120	Landwirtschaftliche Untersuchungs- und Forschungsanstalt (LUFA), Germany
121	Landesamt für Natur und Umwelt, Germany
125	Bayerisches Landesamt für Umweltschutz, Germany
127	Department of Chemistry, Jalan Sultan, Malaysia
129	Ecole Nationale d'Ingenieurs de Sfax, Tunisie
141	Pollutants Chemical Analysis Centre, Marine Division, Japan
161	National Institute of Chemistry, Slovenia
168	Université de Bretagne Occidentale, France

Table A3.2: Analytical results for Cr in synthetic precipitation samples, 2006.

Chromium
Sample no.: 1
Theoretical value: 0.500
Unit: µg/l

Run 1:
Number of laboratories: 25
Arithmetic mean value: 0.522
Median: 0.500
Standard deviation 0.193
Rel. st. deviation (%) 36.910

Run 2:
Number of laboratories: 24
Arithmetic mean value: 0.488
Median: 0.500
Standard deviation 0.088
Rel. st. deviation (%) 18.053

Results in decreasing order:

109	1.350 (*)	16	0.500
120	0.600	1	0.500
118	0.600	39	0.500
127	0.600	7	0.494
115	0.566	26	0.470
3	0.555	32	0.460
125	0.552	168	0.430
33	0.550	121	0.400
112	0.530	23	0.390
110	0.530	5	0.352
8	0.520	2	0.348
15	0.511	14	0.250
161	0.500	129	< 15.000
		6	< 10.000
		38	< 1.000
		36	< 0.500

Chromium
Sample no.: 2
Theoretical value: 0.700
Unit: µg/l

Run 1:
Number of laboratories: 26
Arithmetic mean value: 0.671
Median: 0.669
Standard deviation 0.186
Rel. st. deviation (%) 27.751

Run 2:
Number of laboratories: 25
Arithmetic mean value: 0.639
Median: 0.660
Standard deviation 0.091
Rel. st. deviation (%) 14.325

Results in decreasing order:

109	1.470 (*)	1	0.660
125	0.757	33	0.640
110	0.730	26	0.630
112	0.730	32	0.610
115	0.720	36	0.607
8	0.720	118	0.600
15	0.706	120	0.600
161	0.700	23	0.580
16	0.700	168	0.580
127	0.700	2	0.547
39	0.700	5	0.515
7	0.693	121	0.500
3	0.678	14	0.360
		129	< 15.000
		6	< 10.000
		38	< 1.000

Chromium
Sample no.: 3
Theoretical value: 5.000
Unit: µg/l

Run 1:
Number of laboratories: 28
Arithmetic mean value: 4.796
Median: 4.975
Standard deviation 0.494
Rel. st. deviation (%) 10.304

Run 2:
Number of laboratories: 26
Arithmetic mean value: 4.892
Median: 5.000
Standard deviation 0.360
Rel. st. deviation (%) 7.362

Results in decreasing order:

109	5.660	36	4.950	
120	5.600	8	4.890	
110	5.200	1	4.800	
125	5.110	38	4.800	
127	5.100	118	4.700	
39	5.100	115	4.640	
112	5.080	23	4.630	
2	5.072	33	4.580	
14	5.050	5	4.412	
26	5.040	3	4.377	
15	5.010	32	4.300	
161	5.000	168	4.100	
7	5.000	4	3.600	(*)
16	5.000	121	3.500	(*)
		129	< 15.000	
		6	< 10.000	

Chromium
Sample no.: 4
Theoretical value: 7.000
Unit: µg/l

Run 1:
Number of laboratories: 28
Arithmetic mean value: 6.753
Median: 6.945
Standard deviation 0.739
Rel. st. deviation (%) 10.946

Run 2:
Number of laboratories: 25
Arithmetic mean value: 6.706
Median: 6.900
Standard deviation 0.497
Rel. st. deviation (%) 7.419

Results in decreasing order:

109	8.350 (*)	8	6.900	
120	8.300 (*)	38	6.900	
14	7.310	36	6.790	
110	7.290	23	6.620	
2	7.170	118	6.600	
112	7.160	1	6.500	
125	7.040	115	6.430	
26	7.040	5	6.314	
7	7.000	32	6.200	
127	7.000	33	6.190	
161	7.000	3	6.133	
39	7.000	168	5.770	
16	7.000	4	5.300	
15	6.990	121	4.800	(*)
		129	< 15.000	
		6	< 10.000	

Table A3.3: Analytical results for Ni in synthetic precipitation samples, 2006.

Nickel
Sample no.: 1
Theoretical value: 0.800
Unit: µg/l

Run 1:
Number of laboratories: 20
Arithmetic mean value: 0.750
Median: 0.758
Standard deviation 0.101
Rel. st. deviation (%) 13.468

Run 2:
Number of laboratories: 18
Arithmetic mean value: 0.751
Median: 0.758
Standard deviation 0.076
Rel. st. deviation (%) 10.186

Results in decreasing order:

2	0.965	(*)	5	0.756
26	0.840		33	0.750
14	0.840		36	0.716
125	0.834		32	0.710
112	0.830		121	0.700
8	0.810		16	0.700
161	0.800		115	0.654
118	0.800		3	0.650
23	0.790		110	0.570
15	0.760		168	0.530 (*)
			6	< 10.000
			7	< 5.000
			127	< 2.000
			120	< 1.000
			38	< 1.000
			1	< 1.000
			109	< 0.100

Nickel
Sample no.: 2
Theoretical value: 0.900
Unit: µg/l

Run 1:
Number of laboratories: 21
Arithmetic mean value: 0.893
Median: 0.860
Standard deviation 0.263
Rel. st. deviation (%) 29.400

Run 2:
Number of laboratories: 20
Arithmetic mean value: 0.841
Median: 0.851
Standard deviation 0.115
Rel. st. deviation (%) 13.646

Results in decreasing order:

109	1.930	(*)	5	0.842
2	1.007		15	0.840
33	1.000		36	0.803
14	0.970		118	0.800
125	0.936		32	0.800
112	0.930		16	0.800
121	0.900		115	0.729
161	0.900		3	0.710
8	0.890		110	0.700
23	0.880		168	0.530
26	0.860		6	< 10.000
			7	< 5.000
			127	< 2.000
			120	< 1.000
			38	< 1.000
			1	< 1.000

Nickel
Sample no.: 3
Theoretical value: 8.000
Unit: µg/l

Run 1:
Number of laboratories: 28
Arithmetic mean value: 7.657
Median: 7.830
Standard deviation 0.764
Rel. st. deviation (%) 9.980

Run 2:
Number of laboratories: 26
Arithmetic mean value: 7.825
Median: 7.880
Standard deviation 0.471
Rel. st. deviation (%) 6.025

Results in decreasing order:

2	9.039		3	7.800
38	8.800		15	7.740
125	8.290		118	7.700
112	8.070		110	7.680
14	8.060		1	7.600
7	8.000		8	7.590
39	8.000		32	7.500
161	8.000		33	7.420
16	8.000		115	7.360
120	8.000		5	7.336
23	7.930		127	7.200
36	7.910		109	6.660
121	7.900		4	5.500 (*)
26	7.860		168	5.460 (*)
			6	< 10.000

Nickel
Sample no.: 4
Theoretical value: 9.000
Unit: µg/l

Run 1:
Number of laboratories: 28
Arithmetic mean value: 8.790
Median: 8.830
Standard deviation 0.990
Rel. st. deviation (%) 11.268

Run 2:
Number of laboratories: 25
Arithmetic mean value: 8.879
Median: 8.840
Standard deviation 0.478
Rel. st. deviation (%) 5.378

Results in decreasing order:

33	11.620	(*)	23	8.820
2	10.430		110	8.770
38	9.800		36	8.760
125	9.240		109	8.730
112	9.100		118	8.700
26	9.020		8	8.640
7	9.000		32	8.600
120	9.000		1	8.500
121	9.000		3	8.440
161	9.000		5	8.353
16	9.000		115	8.310
39	9.000		127	8.000
15	8.930		4	6.300 (*)
14	8.840		168	6.220 (*)
			6	< 10.000

Table A3.4: Analytical results for Cu in synthetic precipitation samples, 2006.

Copper
Sample no.: 1
Theoretical value: 0.900
Unit: µg/l

Run 1:
Number of laboratories: 24
Arithmetic mean value: 0.926
Median: 0.900
Standard deviation 0.364
Rel. st. deviation (%) 39.323

Run 2:
Number of laboratories: 23
Arithmetic mean value: 0.857
Median: 0.900
Standard deviation 0.145
Rel. st. deviation (%) 16.922

Results in decreasing order:

110	2.500 (*)	33	0.900
32	1.200	8	0.890
39	1.000	36	0.881
26	0.940	7	0.850
125	0.939	5	0.845
112	0.930	23	0.820
15	0.919	115	0.812
14	0.900	13	0.790
161	0.900	3	0.710
16	0.900	2	0.705
121	0.900	168	0.690
127	0.900	120	0.400
		129	< 10.000
		6	< 10.000
		118	< 2.300
		38	< 1.000
		1	< 1.000
		109	< 0.200

Copper
Sample no.: 2
Theoretical value: 1.200
Unit: µg/l

Run 1:
Number of laboratories: 25
Arithmetic mean value: 1.197
Median: 1.180
Standard deviation 0.314
Rel. st. deviation (%) 26.222

Run 2:
Number of laboratories: 24
Arithmetic mean value: 1.138
Median: 1.180
Standard deviation 0.117
Rel. st. deviation (%) 10.239

Results in decreasing order:

110	2.600 (*)	8	1.180
32	1.300	7	1.150
13	1.300	14	1.140
125	1.260	33	1.140
26	1.220	5	1.106
36	1.202	16	1.100
39	1.200	121	1.100
161	1.200	115	1.080
1	1.200	120	1.000
127	1.200	2	0.937
15	1.190	168	0.900
112	1.190	3	0.844
23	1.180	129	< 10.000
		6	< 10.000
		118	< 2.300
		38	< 1.000
		109	< 0.200

Copper
Sample no.: 3
Theoretical value: 7.000
Unit: µg/l

Run 1:
Number of laboratories: 29
Arithmetic mean value: 6.661
Median: 6.800
Standard deviation 0.738
Rel. st. deviation (%) 11.075

Run 2:
Number of laboratories: 26
Arithmetic mean value: 6.750
Median: 6.805
Standard deviation 0.468
Rel. st. deviation (%) 6.936

Results in decreasing order:

110	8.140 (*)	23	6.750	
125	7.640	1	6.700	
33	7.410	121	6.700	
36	7.100	13	6.700	
127	7.100	115	6.590	
26	7.060	14	6.570	
161	7.000	118	6.500	
7	7.000	5	6.423	
16	7.000	38	6.400	
32	7.000	2	6.293	
39	7.000	3	6.004	
15	6.910	168	5.190	
112	6.850	109	5.020	(*)
8	6.810	4	4.500	(*)
120	6.800	129	< 10.000	
		6	< 10.000	

Copper
Sample no.: 4
Theoretical value: 9.000
Unit: µg/l

Run 1:
Number of laboratories: 29
Arithmetic mean value: 8.798
Median: 8.800
Standard deviation 1.542
Rel. st. deviation (%) 17.529

Run 2:
Number of laboratories: 28
Arithmetic mean value: 8.555
Median: 8.745
Standard deviation 0.832
Rel. st. deviation (%) 9.721

Results in decreasing order:

110	15.600 (*)	8	8.690
125	9.720	23	8.660
32	9.500	1	8.600
13	9.300	38	8.600
127	9.200	39	8.500
26	9.110	115	8.500
33	9.090	121	8.400
161	9.000	118	8.400
16	9.000	5	8.362
7	9.000	2	8.105
36	8.990	3	7.745
14	8.960	109	6.970
112	8.870	168	6.520
15	8.850	4	6.100
120	8.800	129	< 10.000
		6	< 10.000

Table A3.5: Analytical results for Zn in synthetic precipitation samples, 2006.

Zinc
Sample no.: 1
Theoretical value: 7.000
Unit: µg/l

Run 1:
Number of laboratories: 26
Arithmetic mean value: 7.791
Median: 7.025
Standard deviation 2.719
Rel. st. deviation (%) 34.895

Run 2:
Number of laboratories: 25
Arithmetic mean value: 7.342
Median: 7.000
Standard deviation 1.501
Rel. st. deviation (%) 20.447

Results in decreasing order:

129	19.000 (*)	121	7.000
168	13.220	161	7.000
125	9.050	16	7.000
26	8.460	3	7.000
2	8.225	39	7.000
15	7.930	120	7.000
32	7.700	112	6.950
13	7.400	36	6.930
33	7.360	115	6.840
14	7.200	7	6.500
8	7.100	5	6.447
127	7.100	109	5.600
23	7.050	118	4.500
		38	< 10.000
		6	< 10.000
		1	< 5.000
		110	< 1.000

Zinc
Sample no.: 2
Theoretical value: 9.000
Unit: µg/l

Run 1:
Number of laboratories: 26
Arithmetic mean value: 9.367
Median: 9.000
Standard deviation 1.754
Rel. st. deviation (%) 18.723

Run 2:
Number of laboratories: 25
Arithmetic mean value: 9.094
Median: 9.000
Standard deviation 1.090
Rel. st. deviation (%) 11.980

Results in decreasing order:

168	16.190 (*)	120	9.000
125	11.700	121	9.000
13	10.500	16	9.000
2	10.340	3	9.000
33	10.190	36	8.890
129	10.000	112	8.870
161	10.000	115	8.630
15	9.730	7	8.550
26	9.250	14	8.500
127	9.200	23	8.430
32	9.200	5	7.979
8	9.100	109	7.000
39	9.000	118	6.300
		38	< 10.000
		6	< 10.000
		1	< 5.000
		110	< 1.000

Zinc
Sample no.: 3
Theoretical value: 110.000
Unit: µg/l

Run 1:
Number of laboratories: 30
Arithmetic mean value: 142.273
Median: 110.000
Standard deviation 168.439
Rel. st. deviation (%) 118.391

Run 2:
Number of laboratories: 29
Arithmetic mean value: 111.903
Median: 110.000
Standard deviation 26.962
Rel. st. deviation (%) 24.094

Results in decreasing order:

13	1023.000 (*)	121	110.000
168	186.500	161	110.000
129	158.000	120	109.000
125	147.000	112	108.670
36	123.000	8	108.000
6	121.000	14	107.900
109	120.600	1	106.000
110	120.000	115	105.400
16	115.000	118	105.000
32	114.000	15	105.000
26	113.100	23	102.270
127	112.300	33	101.890
3	111.000	5	97.444
7	110.000	2	96.120
39	110.000	38	11.000

Zinc
Sample no.: 4
Theoretical value: 120.000
Unit: µg/l

Run 1:
Number of laboratories: 30
Arithmetic mean value: 154.443
Median: 120.000
Standard deviation 199.152
Rel. st. deviation (%) 128.948

Run 2:
Number of laboratories: 29
Arithmetic mean value: 118.424
Median: 120.000
Standard deviation 27.683
Rel. st. deviation (%) 23.376

Results in decreasing order:

13	1199.000 (*)	121	120.000
168	196.600	7	120.000
125	159.000	8	118.000
110	136.000	112	117.300
109	133.870	161	115.000
6	133.000	115	114.800
32	127.000	14	114.600
26	125.800	118	114.400
16	123.000	23	111.370
15	122.000	33	107.300
36	122.000	5	106.651
3	122.000	2	105.800
127	121.800	1	98.000
39	120.000	129	97.000
120	120.000	38	12.000

Table A3.6: Analytical results for As in synthetic precipitation samples, 2006.

Arsenic
Sample no.: H1
Theoretical value: 0.600
Unit: µg/l

Run 1:
Number of laboratories: 21
Arithmetic mean value: 0.578
Median: 0.598
Standard deviation 0.138
Rel. st. deviation (%) 23.895

Run 2:
Number of laboratories: 20
Arithmetic mean value: 0.602
Median: 0.599
Standard deviation 0.086
Rel. st. deviation (%) 14.340

Results in decreasing order:

33	0.840	26	0.590	
2	0.738	14	0.570	
121	0.700	1	0.560	
125	0.686	23	0.540	
32	0.630	7	0.538	
36	0.616	115	0.533	
8	0.608	3	0.519	
127	0.600	4	0.500	
161	0.600	5	0.476	
168	0.600	120	0.100	(*)
15	0.598	6	< 5.000	
		118	< 2.500	
		38	< 1.000	
		110	< 0.500	

Arsenic
Sample no.: H2
Theoretical value: 0.900
Unit: µg/l

Run 1:
Number of laboratories: 21
Arithmetic mean value: 0.858
Median: 0.878
Standard deviation 0.148
Rel. st. deviation (%) 17.256

Run 2:
Number of laboratories: 20
Arithmetic mean value: 0.837
Median: 0.864
Standard deviation 0.115
Rel. st. deviation (%) 13.752

Results in decreasing order:

33	1.280	(*)	14	0.850
125	1.050		23	0.840
121	1.000		115	0.809
26	0.950		127	0.800
36	0.902		7	0.797
161	0.900		168	0.760
8	0.897		3	0.749
1	0.890		5	0.707
2	0.883		4	0.600
32	0.880		120	0.600
15	0.878		6	< 5.000
			118	< 2.500
			38	< 1.000
			110	< 0.500

Arsenic
Sample no.: H3
Theoretical value: 6.000
Unit: µg/l

Run 1:
Number of laboratories: 26
Arithmetic mean value: 5.728
Median: 5.846
Standard deviation 0.550
Rel. st. deviation (%) 9.610

Run 2:
Number of laboratories: 24
Arithmetic mean value: 5.724
Median: 5.846
Standard deviation 0.443
Rel. st. deviation (%) 7.744

Results in decreasing order:

125	7.020	(*)	3	5.843
33	6.520		110	5.810
121	6.200		2	5.760
38	6.100		6	5.720
36	6.020		32	5.700
8	6.010		23	5.610
39	6.000		115	5.510
161	6.000		7	5.390
26	6.000		4	5.300
1	5.900		118	4.900
127	5.900		5	4.764
14	5.860		120	4.700
15	5.850		168	4.550 (*)

Arsenic
Sample no.: H4
Theoretical value: 8.000
Unit: µg/l

Run 1:
Number of laboratories: 26
Arithmetic mean value: 7.774
Median: 7.870
Standard deviation 0.656
Rel. st. deviation (%) 8.432

Run 2:
Number of laboratories: 23
Arithmetic mean value: 7.838
Median: 7.890
Standard deviation 0.435
Rel. st. deviation (%) 5.554

Results in decreasing order:

125	9.250	(*)	14	7.850
38	8.700		120	7.800
33	8.510		127	7.800
121	8.100		1	7.800
32	8.100		15	7.790
26	8.040		2	7.660
8	8.040		7	7.580
3	8.029		23	7.580
6	8.000		115	7.390
161	8.000		4	7.200
39	8.000		5	6.478
110	7.930		118	6.400 (*)
36	7.890		168	6.220 (*)

Table A3.7: Analytical results for Cd in synthetic precipitation samples, 2006.

Cadmium
Sample no.: H1
Theoretical value: 0.060
Unit: µg/l

Run 1:
Number of laboratories: 24
Arithmetic mean value: 0.088
Median: 0.060
Standard deviation 0.123
Rel. st. deviation (%) 139.403

Run 2:
Number of laboratories: 23
Arithmetic mean value: 0.064
Median: 0.060
Standard deviation 0.020
Rel. st. deviation (%) 31.910

Results in decreasing order:

109	0.660 (*)	16	0.060
4	0.150	161	0.060
168	0.071	10	0.058
3	0.071	8	0.058
32	0.070	36	0.057
33	0.070	13	0.056
26	0.070	141	0.055
115	0.066	14	0.053
125	0.063	2	0.052
15	0.060	5	0.052
112	0.060	7	0.051
121	0.060	23	0.041
		129	< 4.000
		6	< 2.000
		110	< 0.200
		127	< 0.200
		120	< 0.100
		38	< 0.100
		1	< 0.100
		118	< 0.040

Cadmium
Sample no.: H2
Theoretical value: 0.070
Unit: µg/l

Run 1:
Number of laboratories: 25
Arithmetic mean value: 0.106
Median: 0.072
Standard deviation 0.157
Rel. st. deviation (%) 147.947

Run 2:
Number of laboratories: 24
Arithmetic mean value: 0.075
Median: 0.071
Standard deviation 0.023
Rel. st. deviation (%) 30.542

Results in decreasing order:

109	0.850 (*)	115	0.070
4	0.170	112	0.070
32	0.090	16	0.070
13	0.088	161	0.070
168	0.081	141	0.070
33	0.080	121	0.070
26	0.080	8	0.069
3	0.076	36	0.066
125	0.073	7	0.064
23	0.073	5	0.061
15	0.073	10	0.049
2	0.072	118	0.040
14	0.072	129	< 4.000
		6	< 2.000
		110	< 0.200
		127	< 0.200
		120	< 0.100
		38	< 0.100
		1	< 0.100

Cadmium
Sample no.: 3
Theoretical value: 0.800
Unit: µg/l

Run 1:
Number of laboratories: 31
Arithmetic mean value: 0.800
Median: 0.797
Standard deviation 0.103
Rel. st. deviation (%) 12.845

Run 2:
Number of laboratories: 30
Arithmetic mean value: 0.784
Median: 0.791
Standard deviation 0.052
Rel. st. deviation (%) 6.662

Results in decreasing order:

109	1.280 (*)	15	0.785
4	0.890	14	0.783
125	0.850	8	0.782
3	0.850	121	0.780
32	0.840	33	0.780
26	0.830	36	0.772
7	0.820	112	0.770
10	0.819	23	0.770
118	0.810	1	0.760
2	0.808	115	0.760
161	0.800	13	0.750
39	0.800	38	0.700
16	0.800	120	0.700
127	0.800	5	0.694
141	0.798	110	0.630
168	0.797	129	< 4.000
		6	< 2.000

Cadmium
Sample no.: 4
Theoretical value: 0.900
Unit: µg/l

Run 1:
Number of laboratories: 31
Arithmetic mean value: 0.902
Median: 0.900
Standard deviation 0.103
Rel. st. deviation (%) 11.372

Run 2:
Number of laboratories: 30
Arithmetic mean value: 0.887
Median: 0.897
Standard deviation 0.056
Rel. st. deviation (%) 6.267

Results in decreasing order:

109	1.370 (*)	168	0.894
4	1.000	15	0.893
3	0.970	8	0.890
32	0.950	112	0.880
125	0.942	13	0.880
2	0.936	14	0.879
7	0.925	1	0.870
10	0.914	141	0.868
26	0.910	36	0.861
23	0.910	121	0.850
118	0.910	115	0.847
33	0.900	38	0.800
161	0.900	120	0.800
16	0.900	5	0.796
127	0.900	110	0.720
39	0.900	129	< 4.000
		6	< 2.000

Table A3.8: Analytical results for Pb in synthetic precipitation samples, 2006.

Lead
Sample no.: 1
Theoretical value: 1.500
Unit: µg/l

Run 1:

Number of laboratories:	28
Arithmetic mean value:	1.488
Median:	1.475
Standard deviation	0.237
Rel. st. deviation (%)	15.929

Run 2:

Number of laboratories:	26
Arithmetic mean value:	1.480
Median:	1.475
Standard deviation	0.176
Rel. st. deviation (%)	11.865

Results in decreasing order:

13	2.200	(*)	8	1.450
26	1.960		33	1.430
32	1.900		115	1.420
16	1.700		168	1.410
15	1.610		39	1.400
112	1.560		161	1.400
7	1.530		5	1.364
23	1.530		3	1.350
14	1.530		36	1.350
125	1.520		38	1.300
2	1.512		4	1.300
110	1.500		121	1.300
1	1.500		10	1.146
127	1.500		120	1.000 (*)
			129	< 41.000
			6	< 10.000
			118	< 1.500
			109	< 1.000

Lead
Sample no.: 2
Theoretical value: 1.800
Unit: µg/l

Run 1:

Number of laboratories:	28
Arithmetic mean value:	1.760
Median:	1.765
Standard deviation	0.268
Rel. st. deviation (%)	15.205

Run 2:

Number of laboratories:	27
Arithmetic mean value:	1.722
Median:	1.760
Standard deviation	0.177
Rel. st. deviation (%)	10.273

Results in decreasing order:

13	2.800	(*)	112	1.760
32	2.000		8	1.740
120	2.000		39	1.700
16	1.900		127	1.700
15	1.900		161	1.700
7	1.860		115	1.690
33	1.860		110	1.670
2	1.822		5	1.633
125	1.810		36	1.630
1	1.800		168	1.620
26	1.800		4	1.500
14	1.800		121	1.400
3	1.790		10	1.335
23	1.770		38	1.300
			129	< 41.000
			6	< 10.000
			118	< 1.500
			109	< 1.000

Lead
Sample no.: 3
Theoretical value: 30.000
Unit: µg/l

Run 1:

Number of laboratories:	31
Arithmetic mean value:	29.200
Median:	29.200
Standard deviation	2.786
Rel. st. deviation (%)	9.541

Run 2:

Number of laboratories:	29
Arithmetic mean value:	29.097
Median:	29.200
Standard deviation	1.892
Rel. st. deviation (%)	6.503

Results in decreasing order:

109	38.690	(*)	112	29.050
10	32.930		1	29.000
2	31.900		121	28.700
33	31.890		115	28.200
13	31.300		8	28.200
32	31.000		127	28.200
118	30.700		16	28.000
125	30.700		39	27.000
3	30.200		120	27.000
14	30.060		5	26.843
161	30.000		36	26.800
7	30.000		110	26.100
26	29.900		6	26.070
38	29.600		168	25.870
15	29.400		4	22.700 (*)
23	29.200		129	< 41.000

Lead
Sample no.: 4
Theoretical value: 45.000
Unit: µg/l

Run 1:

Number of laboratories:	31
Arithmetic mean value:	44.115
Median:	43.800
Standard deviation	4.314
Rel. st. deviation (%)	9.780

Run 2:

Number of laboratories:	30
Arithmetic mean value:	43.617
Median:	43.665
Standard deviation	3.363
Rel. st. deviation (%)	7.710

Results in decreasing order:

109	59.050	(*)	14	43.530
13	51.800		112	43.530
118	48.700		23	43.280
10	48.090		38	42.700
33	47.440		8	42.500
2	47.060		115	42.400
32	47.000		127	42.000
125	45.800		36	41.200
26	45.300		6	41.120
3	45.100		120	40.000
39	45.000		5	39.999
7	45.000		110	39.300
16	45.000		168	39.060
1	44.000		121	37.600
161	44.000		4	37.200
15	43.800		129	< 41.000

Table A3.9: Analytical techniques used at the participating laboratories for the different elements, 2006.

Lab. no.	Elements	Technique
1	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
2	Cr, Ni, Cu, As, Cd, Pb	GF-AAS
	Zn	F-AAS
3	Ni, Cd, Cu, Pb,	GF-AAS
	Cr, As	ICP-MS
	Zn	F-AAS
4	Cr, Ni, Cu, As, Cd, Pb	ICP-MS
5	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
6	Cr, Ni, Cu, Zn, Cd, Pb	ICP-AES
	As	GF-AAS
7	Cr, Ni, Cu, Zn, Cd, Pb	GF-AAS and ICP-MS
	As	HG-CVD-GF-AAS
8	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
10	Cd, Pb	GF-AAS
13	Cd, Cu, Pb, Zn	ASV
14	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
15	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
16	Cr, Ni, Cu, Zn, As, Cd, Pb	GF-AAS
23	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
26	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
32	Cr, Ni, Cu, Zn, As, Cd, Pb	GF-AAS
33	As, Cu, Cd, Pb	GF-AAS
	Zn	F-AAS
36	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
38	Cr, Ni, Cu, , Cd, Pb	GF-AAS
	Zn	F-AAS
39	Cr, Ni, Cu, As, Cd, Pb	GF-AAS
	Zn	F-AAS
109	Cr, Ni, Cu, Zn, Cd, Pb	ICP-MS
110	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
112	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-AES
115	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
118	Cu, Cd, Pb	GF-AAS
	As ,Zn Cr, Ni	ICP-AES
120	Cr, Ni, Cu, As, Cd, Pb	GF-AAS
	Zn	F-AAS
121	As ,Cr, Ni, Cu, Cd, Pb	GF-AAS
	Zn	ICP-AES
125	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
127	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
129	Cr, Ni, Cu, Zn, Cd, Pb	F-AAS (Polarized Zeeman)
141	Cd	GF-AAS
161	Cr, Ni, Cu, Zn, As, Cd, Pb	ICP-MS
168	Cr, Ni, Cu, Zn, As, Cd, Pb	GF-AAS

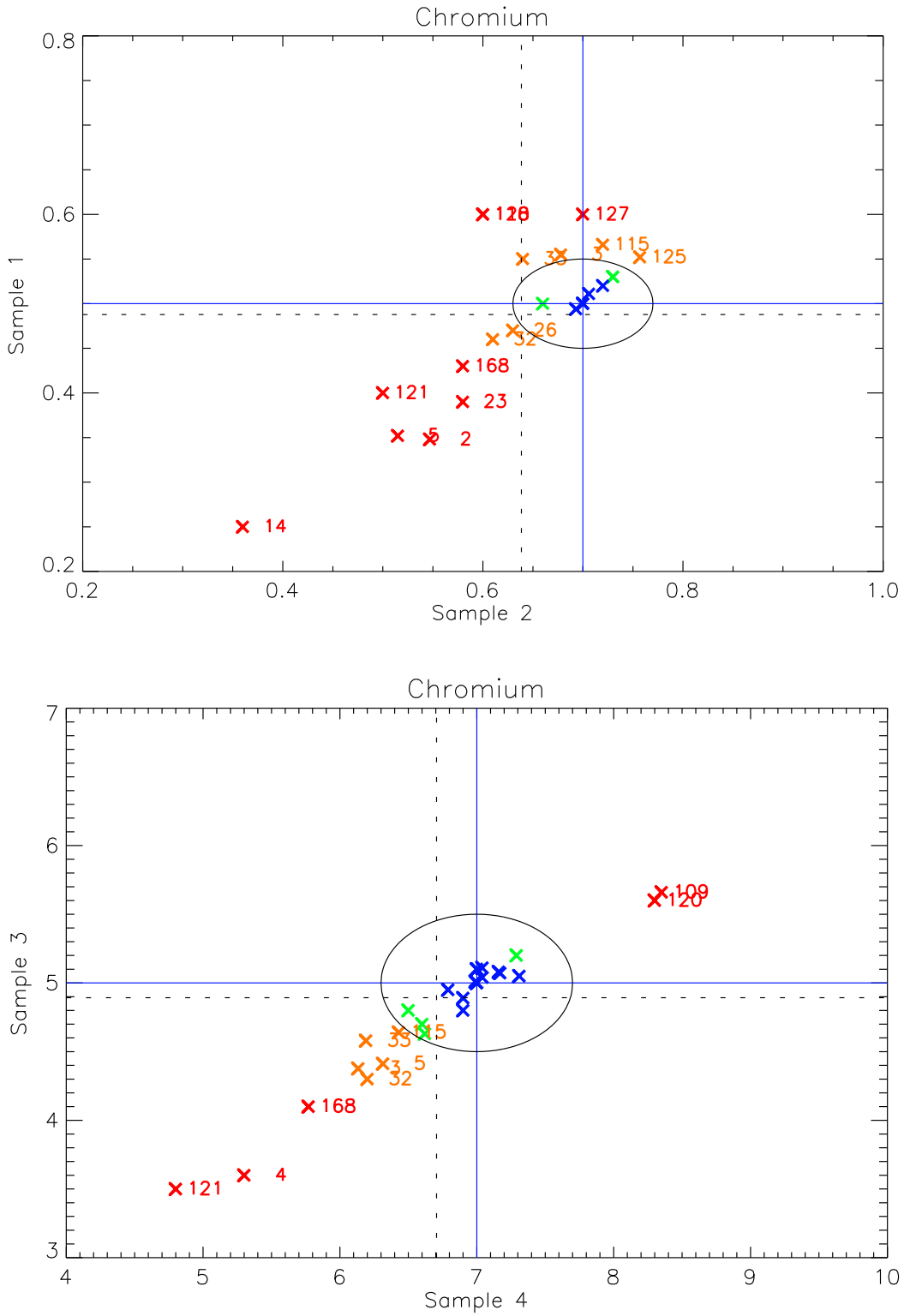

Figure A4.1: Youden plot of chromium, 2006.

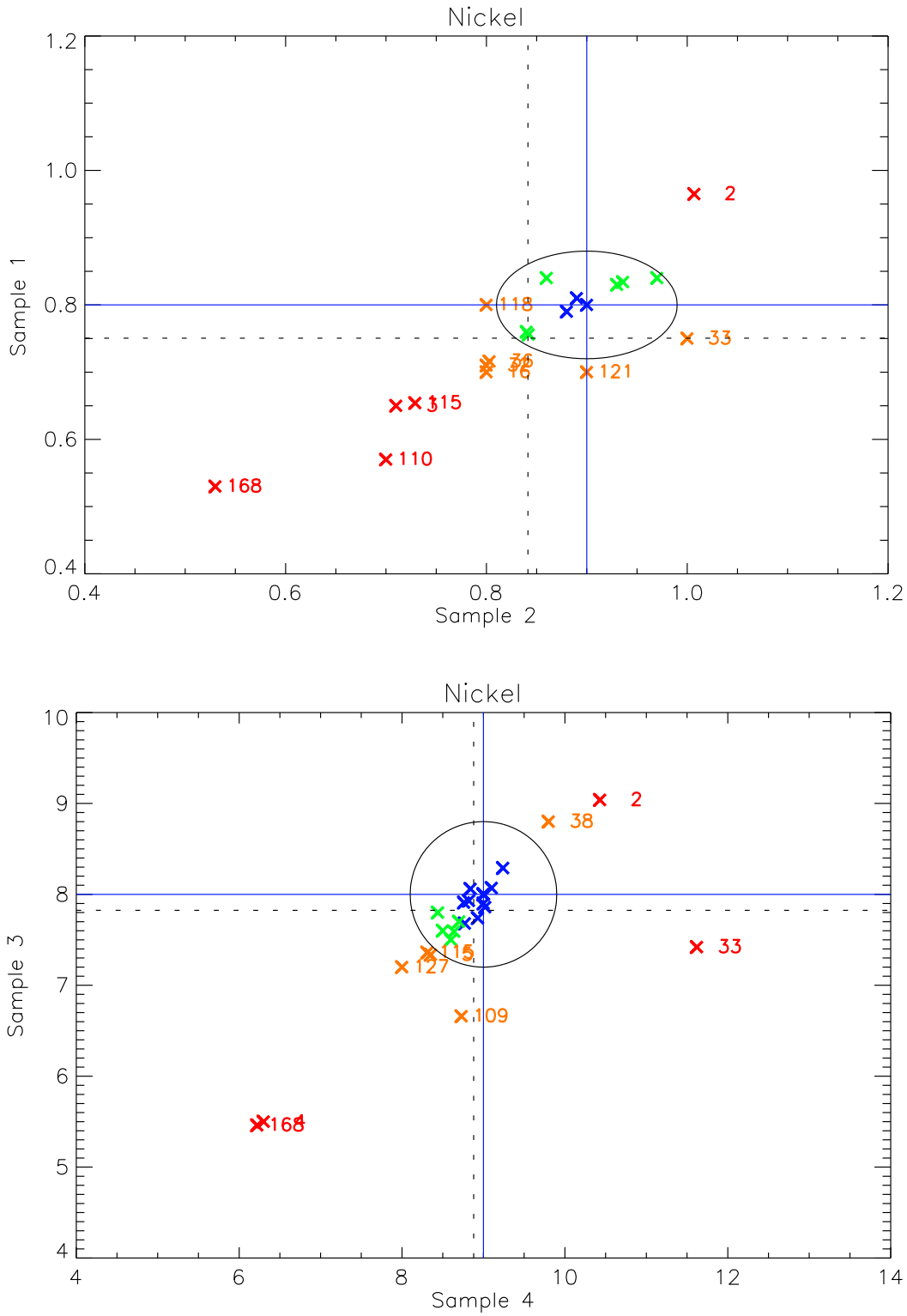

Figure A4.2: Youden plot of nickel, 2006.

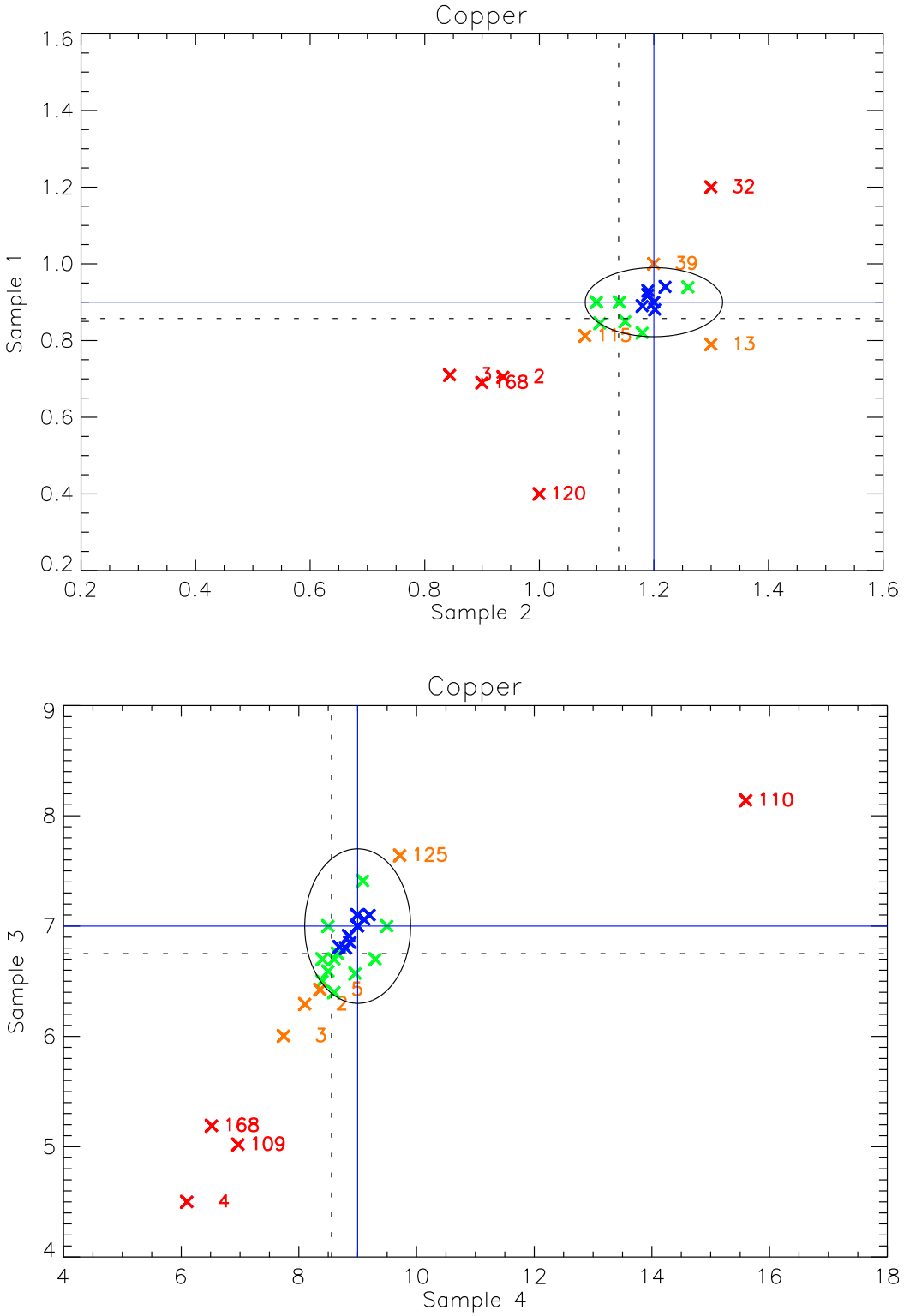

Figure A4.3: Youden plot of copper, 2006.

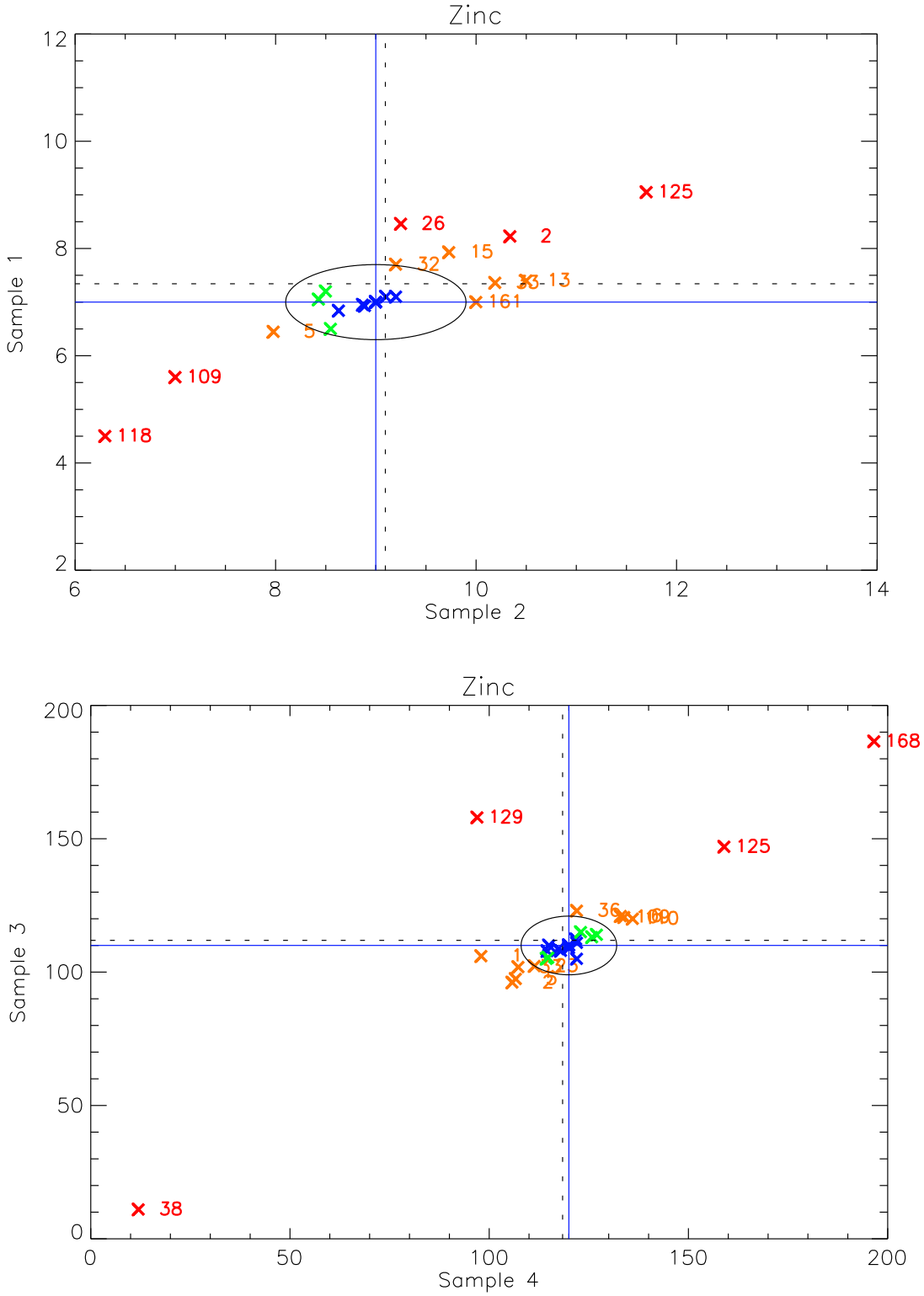

Figure A4.4: Youden plot of zinc, 2006.

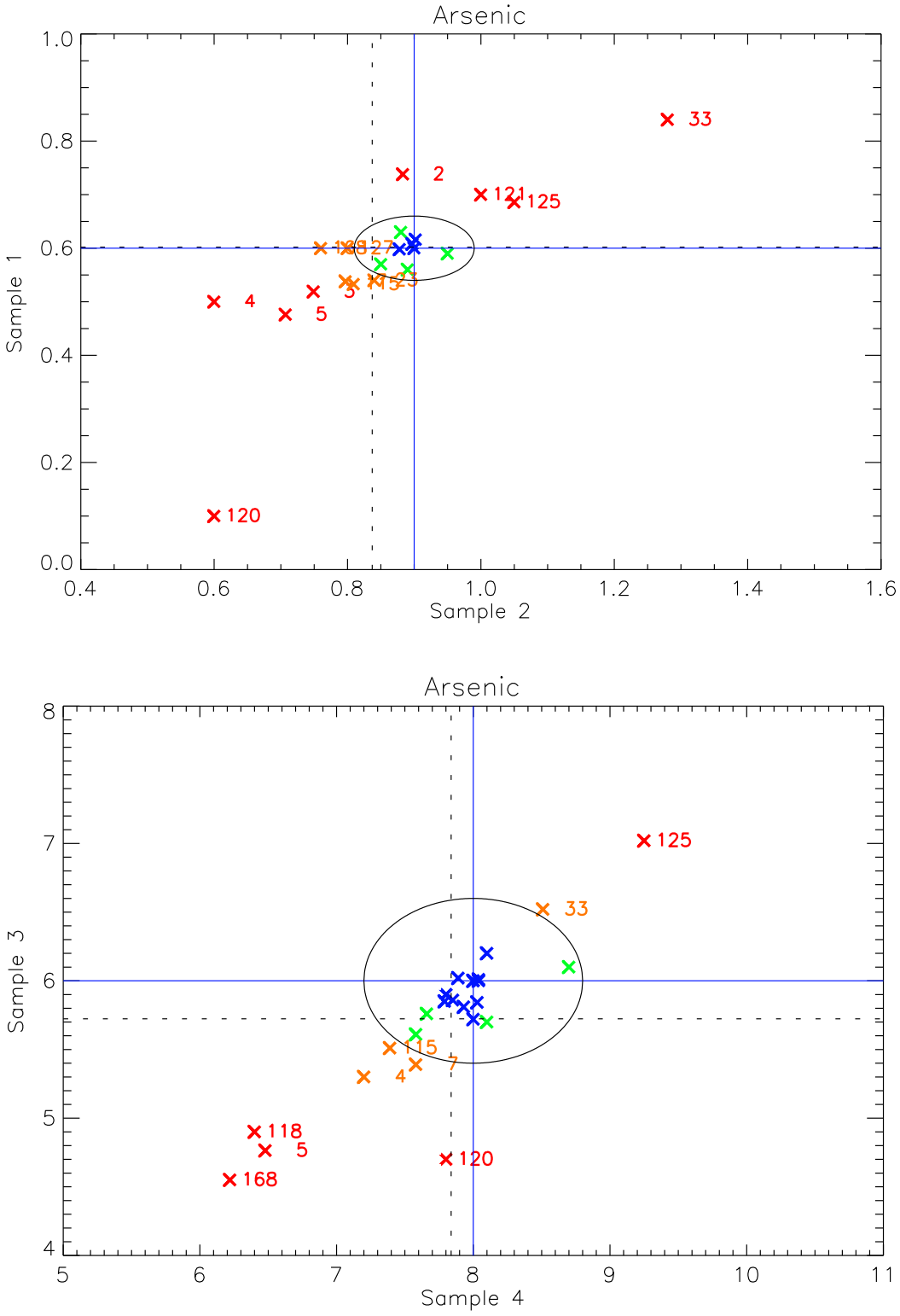

Figure A4.5: Youden plot of arsenic, 2006.

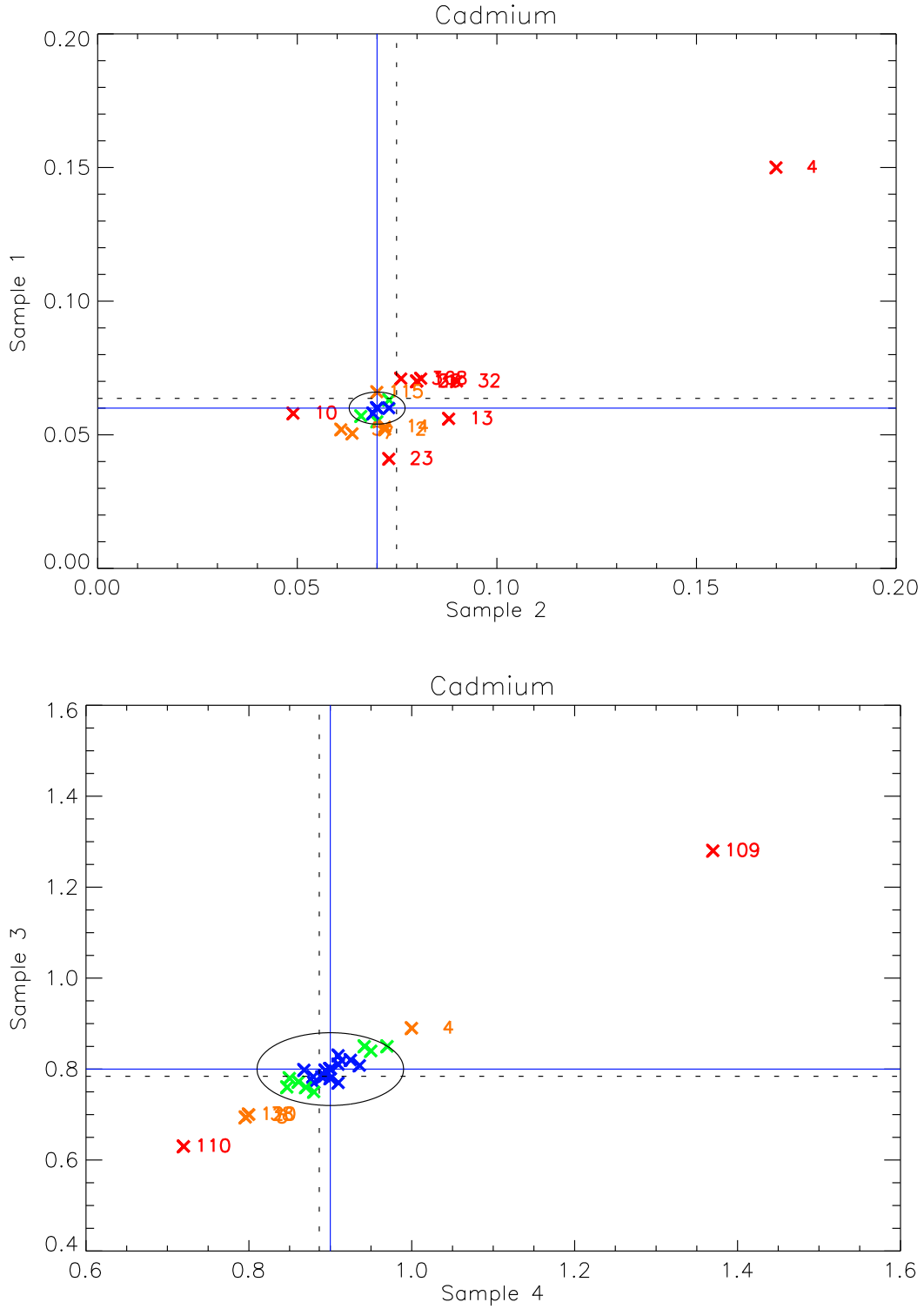

Figure A4.6: Youden plot of cadmium, 2006.

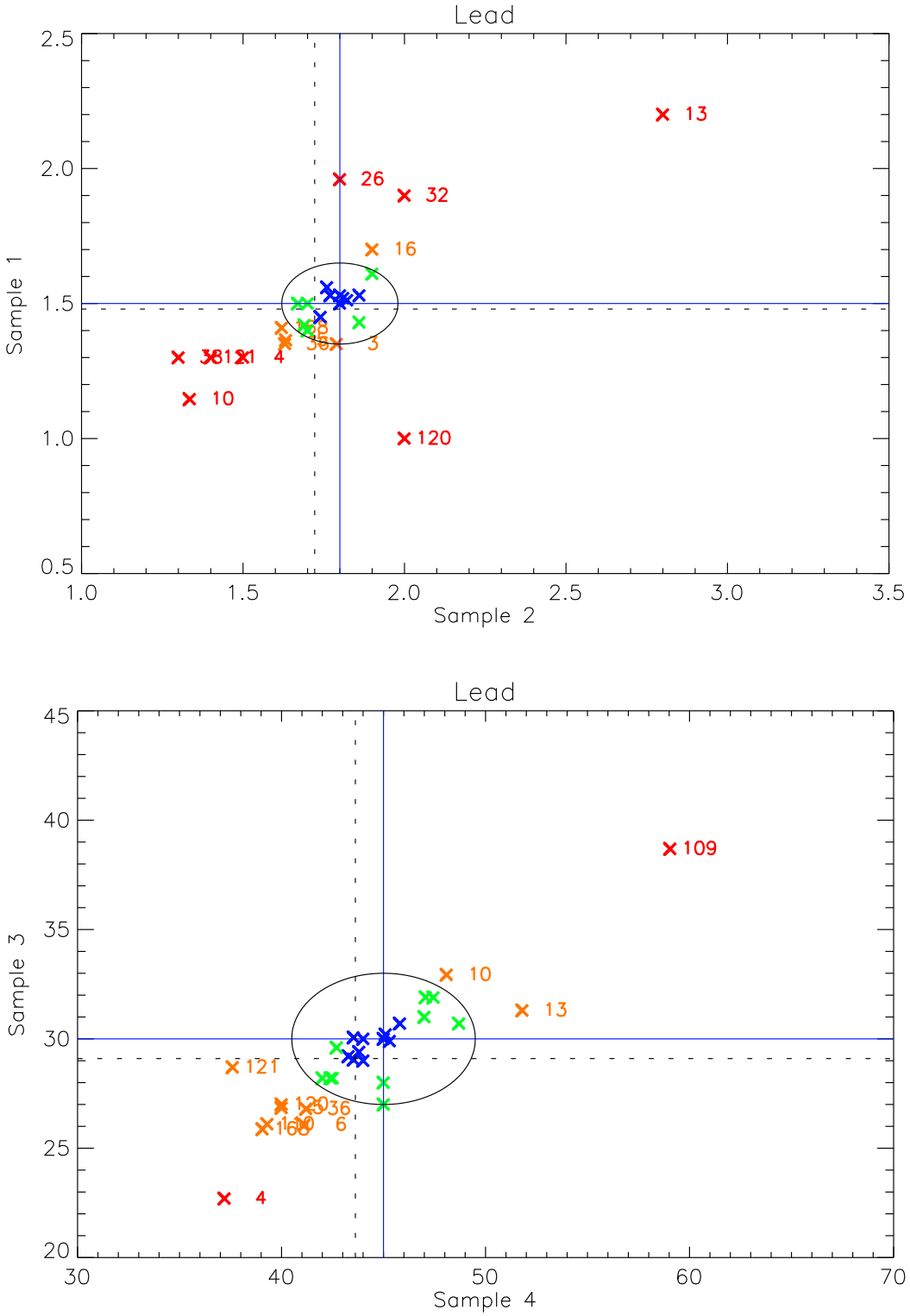

Figure A4.7: Youden plot of lead, 2006.