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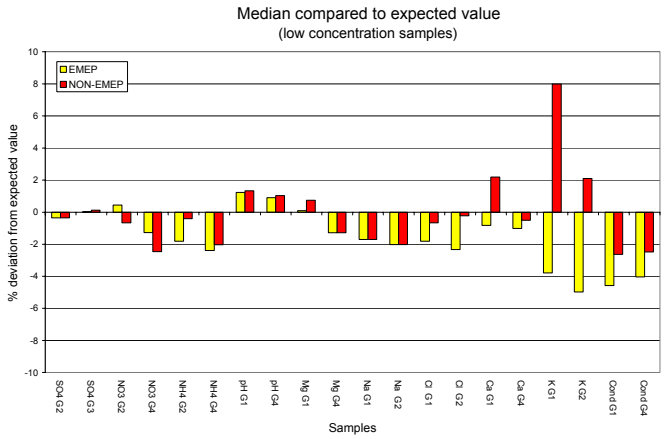
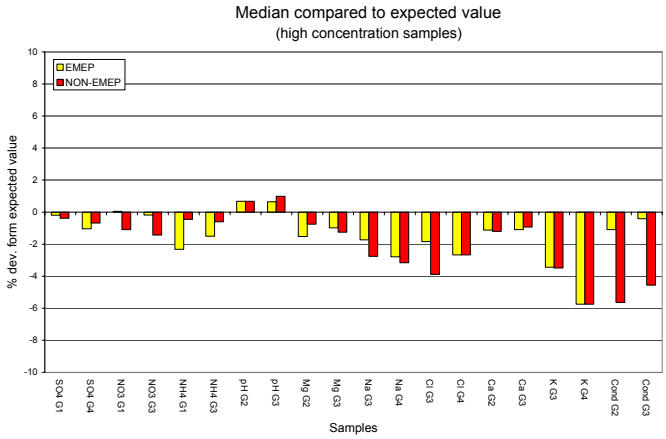
EMEP Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe

The nineteenth intercomparison of analytical methods within EMEP

Hilde Th. Uggerud, Jan Erik Hanssen, Jan Schaug and Jan Erik Skjelmoen





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1. Introduction

32 different laboratories in European countries are performing chemical analysis of air and precipitation samples within EMEP (Co-operative Programme for Monitoring and Evaluation of Long-range Transmission of Air Pollutants in Europe). Since the measurement programme is based on individual national networks, the participating laboratories apply different sampling and analytical methods. Most of the methods used are described in the manual for sampling and chemical analysis (EMEP, 1977; EMEP, 1996).

In order to improve the data comparability and to get a picture of the different laboratories' performance, interlaboratory comparisons are organised by the Chemical Co-ordinating Centre (CCC) at the Norwegian Institute for Air Research (NILU). So far eighteen intercomparisons have been arranged (Hanssen, 1988, 1990; Hanssen et al., 1983; Hanssen and Ladegård, 1984, 1985, 1987; Hanssen and Skjelmoen, 1992, 1994, 1995, 1996, 1997, 2001; Thrane, 1978, 1980a, 1980b, 1981, Uggerud et al., 2001).

This report gives the results of the nineteenth interlaboratory test.

2. Organisation of the intercomparison

The samples for the nineteenth intercomparison (see Table 1) were prepared and distributed to 65 laboratories in July 2001. In addition to the European participants, two laboratories in North America received samples as a part of the co-operation between EMEP and the North American networks for acid deposition. Also nineteen laboratories within the measurement programme ICP-Forest and nine laboratories participating in various other measurement programmes were invited to participate in the eighteenth intercomparison.

Most of the laboratories had returned their results to the CCC within one month after the deadline given as 15 October 2001. A total of 56 laboratories have returned their results. This includes 31 EMEP-laboratories, 14 ICP-Forest laboratories and 11 other laboratories.

The participating laboratories received the theoretical (expected) values shortly after CCC had received the results. The laboratories were then asked to compare their results with the expected ones, and give corrected values if obvious mistakes e.g. misprints had occurred. A few corrections were reported. In those cases the corrected values are used in this report. 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 2a and 2b give the names of the participating laboratories together with the numbers used when presenting the results in tables and figures.

Information received on the analytical methods used is given in Table 3–Table 7.

3. Data handling

The data reported from the participants are presented in Tables 8, 10, 12, 14, 16 and 18-29.

The methods of data analysis are the same as in earlier intercomparisons. The results for the samples 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.

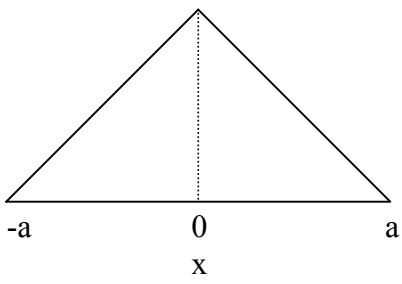
Bar-plots are used for the graphical presentation of the data. Figure 1–Figure 15 are showing the relative deviation from expected value for the different laboratories. There is one plot for each single sample.

Figure 16 gives medians compared to expected value for the results reported by EMEP-laboratories and the other participating laboratories, respectively.

Table 34 presents relative random and relative systematic errors obtained by the different laboratories in the analysis of each parameter in the precipitation samples. The calculation method and assumptions used are given in chapter 3.1 and chapter 3.

3.1 Estimating random errors from laboratory comparisons

Systematic errors or bias in the laboratory analyses give a constant shift in the results from the expected ones at a particular concentration level. It is assumed that laboratories taking part in comparisons will obtain results near the expected ones when this bias is removed, and that the differences between expected and obtained results more often will be close to zero than not. A triangular distribution, based upon this assumption, can be used to quantify the random errors in the laboratory results (Eurachem, 2000).



The triangle distribution is symmetric with a baseline 2a. The height in the triangle will be 1/a when the triangle area equals 1. The standard uncertainty is given by

$$u(x) = \frac{a}{\sqrt{6}} \tag{1}$$

and more than 95 % of the data will be within $\pm 2 \cdot u(x)$. The distance from –a to a (i.e. 2a) is called the range. When applied on the laboratory comparison results, the range equals the distance between the largest and smallest of the four differences between expected and found concentrations. As long as the bias can be assumed to be constant for the samples in the comparison of a specific component, it cannot have an effect on the distance corresponding to 2a. The bias may be dependent upon the concentrations, but can be considered approximate constant for the concentrations used here in the comparison of the main components in precipitation, since the differences between the concentrations are small.

L and T represent the laboratories' and the expected concentrations respectively, and D is the difference. The difference for the lowest concentration is

$$D_1 = L_1 - T_1 \tag{2}$$

and the differences are D_1, D_2, D_3, D_4 in increasing order.

The range is $D_4 - D_1$ and the standard uncertainty for the differences u(D) becomes

$$u(D) = \frac{(D_4 - D_1)}{(2 \cdot \sqrt{6})}. \tag{3}$$

The average expected concentration T for the four samples is given by

$$T = \frac{(T_1 + T_2 + T_3 + T_4)}{4} \tag{4}$$

The relative standard uncertainty, RSD, for 4 samples is given by $\frac{u(D)}{T}$, or

$$RSD = \frac{2 \cdot (D_4 - D_1 \cdot 100)}{\sqrt{6} \cdot (T_1 + T_2 + T_3 + T_4)}\%, \tag{5}$$

and 95 per cent of the laboratory results in this comparison are expected to be within $\pm 2 \cdot RSD$.

If the data quality objectives (DQO) likewise are looked upon as 95 percentiles, then 95 per cent of the laboratory analytical results should not be more than 10 or

15 per cent from the correct values (10 per cent for S and N containing components and 15 per cent for other components).

Correspondingly, the values 2·RSD should therefore be less than 10 or 15 per cent in order to comply with the DQO.

3.2 Estimating systematic errors from laboratory comparisons

An estimation of bias in single measurements requires a long data series, and four samples as we normally have in laboratory comparison, are merely able to give an indication of the bias or a very coarse estimate.

Coarse estimates have been performed here in the cases where the four samples had similar concentrations and where all four laboratory results were either higher or lower than the expected concentrations. The median of the differences D_i, as defined above, was taken as a measure of the bias, B, in these cases.

$$B = \text{median}[D_i] \tag{6}$$

A relative bias, RB, was also calculated based upon the average expected concentration T, as defined in (4).

$$RB = \frac{4 \cdot \text{median}[D_i] \cdot 100}{(T_1 + T_2 + T_3 + T_4)}\% \tag{7}$$

4. Results

4.1 Sulphur dioxide in absorbing solution

Four samples and one blank solution were distributed to the laboratories that use the hydrogen peroxide absorption solution method. The results are given in Table 8 and Figure 1. For those laboratories that report a blank value this has been subtracted from the reported results. The ratios of measured value to expected value are presented in Table 9.

If 70 ml absorbing solution and 3.6 m^3 sampling volume is used, the concentration of SO_2 in the samples correspond to an air concentration in the range 2.49–6.94 μg S m^{-3}.

Six laboratories use hydrogen peroxide absorption solution method for determination of SO_2 in air. Five of these laboratories report intercomparison results. In addition, laboratory 15 analysed the absorption solution samples. Laboratory 17 reports one outlying result for sample A2. Two laboratories report values that deviate between 10-20% from expected value, and two laboratories report values that deviate more than 20%. The relative standard deviation is 5.3-12.8 % when the outlying result is excluded. This is better than last year's results, but the concentrations this year is higher than in the samples distributed last year. The average ratio is presented in Table 9. 4 of 6 laboratories have a ratio between 0.90 and 1.10.

4.2 Sulphur dioxide and nitric acid on impregnated filter

Five impregnated filter samples (including one blank) for determination of sulphur dioxide were analysed by 21 laboratories. The amount of sulphur in these samples corresponds to air concentrations between 0.72-2.24 μg S m^{-3} if 25 m^{-3} is sampled. The value reported for the blank filter was subtracted from the other values before using the data. The results are presented in Table 10 and Figure 2.

Laboratories 33 and 38 report three and four outlying results, respectively. The relative standard deviation is 4.6-8.2% when outlying results are excluded. Three laboratories report values that deviates10-20% away from expected value, while two laboratories report values that deviates more than 20%.

70 values (83%) out of a total of 84 have an error less than 10% when compared to expected value. 8 of the reported values (9.5%) have an error more than 20%. Figure 2 shows that low values occur more often than high values, indicating insufficient extraction of sulphate from the filter or negative matrix effect on the analytical method from the impregnation solution.

The average ratios are presented in Table 11. 17 of 21 laboratories have a ratio between 0.90 and 1.10, which is a quite satisfactory result.

In addition to sulphur dioxide, nitric acid were added to the same impregnated filters for determination of HNO_3-N. The amount of nitrogen in these samples corresponds to air concentrations between 0.46-1.57 μg N m^{-3} if 25 m^3 sampling volume is used. The reported value for the blank sample was subtracted from the other reported values before the data were used. 21 laboratories received impregnated filters for determination of HNO_3-N, 16 laboratories reported results.

The results are presented in Table 12 and Figure 3. Laboratory 33 reports outlying results for three samples. The relative standard deviation is between 4.6-10.8% when outliers are excluded. Three laboratories report values that deviate between 10-20% from expected value and three laboratories report values that deviate more than 20%.

51 values (79.7%) out of a total of 64 deviate less than 10% from expected value. 7 values (10.9%) have an error more than 20% when compared to expected value. Figure 3 shows that also in determination of HNO_3-N, low values occur more often than high values. This may be due to insufficient extraction or negative matrix effect on the analytical method from the impregnation solution.

The average ratios are presented in Table 13. 11 of a total of 16 laboratories have average ratio between 0.90–1.10.

4.3 Nitrogen dioxide in absorbing solution

The four samples distributed are made to represent both absorption solutions and extracts from iodide-impregnated glass filters. The samples contained known amount of sodium nitrite diluted in water. In order to assure sample stability and to give the laboratories the opportunity to use the matrix they use in their daily routine, the distributed samples were to be diluted 1:10. The results should be

reported as the diluted concentrations. The 10 times diluted samples correspond to air concentrations between 3.55-7.8 μg NO_2-N m^{-3}, when 70 ml absorbing solution and 1.4 m^3 is sampled. When 4 ml extraction solution and 0.7 m^{-3} sampling volume is used, the samples correspond to air concentrations between 0.41-0.89 μg NO_2-N m^{-3}.

The results are presented in Table 14 and Figure 4. Laboratory 19 reports outlying results for all four samples. Three laboratories report results that deviate between 10-20% from expected value, while one laboratory reports values that deviate more than 20%. The relative standard deviation is 5.2-6.1% when outliers are excluded. These results are near the results obtained the last time samples of this kind were distributed (EMEP XVII).

The average ratio is presented in Table 15. 18 of 20 laboratories have an average ratio between 0.90 and 1.10, which is a quite satisfactory result.

4.4 Ammonia on impregnated filters

For the first time impregnated filters for determination of ammonia were distributed. 6 impregnated filters inclusive 2 unidentified blank filters were sent to 22 laboratories. 16 laboratories have reported their analytical results. The amount of nitrogen on the filters correspond to air concentrations between 0.24-1.44 μg N m^{-3}, if 25 m^3 sampling volume is used. The two blank values reported by each laboratory were averaged and subtracted from the other values reported before using the data. The results are shown in Table 16 and Figure 5.

Laboratory 135 report 2 outlying results, while laboratory 33 and 19 report 1 outlier each. Seven laboratories report results that deviate between 10-20% from expected value, while five laboratories report values that deviate more than 20%.

36 reported values (56.3%) have an error less than 10% when compared to expected value.

Figure 5 shows that most of the reported data are lower than expected value. Average ratios are presented in Table 17. The ratios are in the range 0.6-1.04. 11 of 16 laboratories have a ratio between 0.90 and 1.10.

4.5 Precipitation

Four precipitation samples were distributed and 2044 single results from 56 laboratories were reported. 31 of the reporting laboratories are within EMEP. Most of these laboratories now perform the full precipitation programme in EMEP.

4.5.1 Sulphate

The results from the determination of sulphate are given in Table 18 and in Figure 6. Outliers are reported only from laboratory 130, which reports outlying results for all four samples. The relative standard deviation is in the region of (5.2-7.6)% when outliers are excluded. This is similar to results obtained in earlier intercomparisons.

Out of 52 reporting laboratories, 11 laboratories report values deviating between 10-20% from expected value and 4 laboratories report values that deviate more than 20%. All 4 laboratories that report values more that 20% away from expected value use ion chromatography as analytical technique. Among the laboratories that report results between 10-20% away from expected value, 2 laboratories use ICP-OES, 1 laboratory use the Thorin method and the rest use ion chromatography.

4.5.2 Nitrate

The results from the determination of nitrate are presented in Table 19 and Figure 7. A total of 54 laboratories reported values of nitrate. Laboratory 117 reports one, laboratory 40 reports three and laboratory 24 reports four outlying results. The relative standard deviation is in the range 5.6-7.3% when outliers are excluded.

5 laboratories report values that deviates 10-20% from expected value and 5 laboratories report values that deviate more than 20%. All laboratories that report outlying results use photometric detection.

4.5.3 Ammonium

The results from the determination of ammonium are presented in Table 20 and Figure 8. A total of 56 laboratories reported results for ammonium. Laboratories 116 and 18 report outlying results for all four samples. Laboratories 118 and 12 report outlying results for three and two samples, respectively. The relative standard deviation is in the range 5.3-8.8%, when outliers are excluded.

18 laboratories report values between 10-20% from expected value and 6 laboratories report values that deviate more than 20%.

4.5.4 pH and strong acid

Table 21 and Figure 9 present the results from pH measurements and determination of strong acid. 54 laboratories have reported results from pH measurements.

Laboratory 40 reports outlying results for all four samples. Laboratory 121 reports two outlying results, while laboratories 113, 115 and 131 report one outlier each. Eight laboratories report values that deviate more than 0.2 pH-units from the expected values. This is better than the results obtained in the last inter-comparison.

In order to obtain realistic standard deviation values, the pH-data are recalculated to $[H^+]$. The results are presented in Table 22. The relative standard deviation varies between 15.3-50.1 %.

6 laboratories have determined strong acid by titration. The results are presented in Table 23. No outlying results were reported.

4.5.5 Chloride

Table 24 and Figure 10 present the results from the determination of chloride. 54 laboratories report values from the determination of chloride. Laboratory 33 reports outlying results for all 4 samples. Laboratories 24, 130, 133 and 22, 38, 177 report 2 and 1 outlying results, respectively. The relative standard deviation is 8.8-29.1% when outlying values are excluded.

22 laboratories report values between 10 and 20% away from the expected value. 19 laboratories report values that deviate more than 20% from the expected value.

4.5.6 Sodium

The results from the determination of sodium are presented in Table 25 and Figure 11. 52 laboratories reported results for sodium. Laboratories 13, 10 and 40 report outlying results for all four solutions. Laboratories 136 and 116 report three and one outlying result, respectively. The relative standard deviation is 5.7-8.1% when outliers are excluded.

12 laboratories report with 10-20% deviation from expected value. 7 laboratories report values that deviate more than 20% from expected value.

4.5.7 Magnesium

Table 26 and Figure 12 show the results for magnesium. A total of 52 laboratories reported magnesium results. Laboratories 136 and 105 are reporting three values that are too high. Laboratories 20 and 115 are reporting two outlying values, while laboratories 34, 111, 121, 124 and 135 report one outlying result each. The relative standard deviation is 6.3-8.8% when outliers are excluded.

Results that deviate 10–20% from expected value, were reported by 13 laboratories. 10 laboratories reported values that deviate more than 20%.

4.5.8 Calcium

The results from determination of calcium are presented in Table 27 and Figure 13. 53 laboratories report results from analysis of calcium. Laboratory 105 reports values that are too high for three of the samples. Laboratories 130 and 34 report two outliers, while laboratories 22, 115, 116 and 136 report one outlying result each. The relative standard deviation is 8.4–14.7 %, when outliers are excluded.

16 laboratories report values that deviate between 10–20 % from expected value. 15 laboratories report values more than 20% away from expected value.

4.5.9 Potassium

Table 28 and Figure 14 presents the results for potassium. Out of a total of 52 laboratories, two laboratories report outlying results. Laboratories 116 and 133 report 4 and 3 outliers respectively. 26 laboratories report results that deviate 10-20% from expected value, while 16 laboratories report values that deviate more than 20%. The relative standard deviation is in the region 11-26% when outliers are excluded.

4.5.10 Conductivity and ion balance

The results from the conductivity measurements are given in Table 29 and Figure 15. Laboratories 133 and 136 report too low results for 3 and 2 samples respectively, while laboratories 105, 113 and 117 report one outlier each.

The standard deviation is in the range 4.8–6.9%, which is about the same as in earlier intercomparisons. Twenty-one values (10.1%) are reported between 10–20% away from expected value. This is similar to results in earlier intercomparisons. Fourteen values (6.8%) that deviate more than 20% from expeected value are reported. This is slightly worse than results in earlier intercomparisons.

Conductivity measurements are mainly used in EMEP for quality control reasons by comparing measured with calculated values when all main ions in the precipitation have been measured. In Table 30 the ratios of the measured to the calculated (from the reported results) are given. As can be seen from inspecting these values, the laboratories10, 19, 22, 105, 115, 117, 130, 133 and 136 report one or more values that are far from 1.

Low concentration ions do not contribute much to the sum of ionic conductivities. By looking at the ratio of measured to calculated conductivity, errors in determination of low concentration ions may not be revealed. To include low concentration ions in the quality control, ion balance control must be used. This ratio should be used as a tool in the quality control system for those laboratories that measure all the main components. The ratios of equivalent concentrations of anions versus equivalent concentrations cations are shown in Table 31. Laboratories 10, 115, 130 and 133 have ratios far from 1 for at least two samples.

5. Conclusions

A total of 56 laboratories participated in the nineteenth intercomparison. 32 of these laboratories are within the EMEP network.

For all the samples analysed the deviations from the theoretical values have been calculated. Figure 16 shows the median values compared to the theoretical values for all the parameters. The median deviations for EMEP laboratories are below 5% for low concentration samples. This is slightly better than last year's results. The median deviations for high concentration samples are below 6%, which is not as good as last year. The median deviations for the other participating laboratories are below 8%, which is an improvement compared to last year’s results. The median deviations for high concentration samples are below 6%, which is about the same as last year's results.

Corresponding to earlier intercomparisons outliers are defined as values that deviate more than two standard deviations from the mean value. Outliers occur for almost all samples and parameters. Out of a total of 2044 single results, 104 are defined as outliers. This is 5.1% of the reported data, which is about the same per cent as in earlier intercomparisons. A total of twenty-four laboratories report outlying results, but five laboratories only are responsible for 48% of the outliers.

These are laboratories 130, 116, 133, 136 and 40, which have nine or more outlying results.

The ratio of the median value to expected value for all parameters are presented in Table 32. As can be seen from this table all parameters except pH and K have median values that are in good agreement with the expected value.

6. References

Eurachem (2000) Quantifying uncertainty in analytical measurements. 2nd ed. URL: http://www.eurachem.bam.de/guides/quam2.pdf

EMEP (1977) Manual for sampling and chemical analysis. Lillestrøm, Norwegian Institute for Air Research (EMEP/CHEM 3/77).

EMEP (1996) Manual for sampling and chemical analysis. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 1/95).

Hanssen, J.E. (1988) The tenth intercomparison of analytical methods within EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 3/88).

Hanssen, J.E. (1990) The eleventh intercomparison of analytical methods within EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 1/90).

Hanssen, J.E., Ladegård, N.E. (1984) The seventh intercomparison of analytical methods within the EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 1/84).

Hanssen, J.E., Ladegård, N.E. (1985) The eighth intercomparison of analytical methods within EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 4/85).

Hanssen, J.E., Ladegård, N.E. (1987) The ninth intercomparison of analytical methods within EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 4/87).

Hanssen, J.E., Ladegård, N.E., Thrane, K.E. (1983) The sixth intercomparison of analytical methods within the EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 2/83).

Hanssen, J.E., Skjelmoen, J.E. (1992) The twelfth intercomparison of analytical methods within EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 7/92).

Hanssen, J.E., Skjelmoen, J.E. (1994) The thirteenth intercomparison of analytical methods within EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 1/94).

Hanssen, J.E., Skjelmoen, J.E. (1995) The fourteenth intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 3/95).

Hanssen, J.E., Skjelmoen, J.E. (1996) The fifteenth intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 2/96).

Hanssen, J.E., Skjelmoen, J.E. (1997) The sixteenth intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 2/97).

Hanssen, J.E., Skjelmoen, J.E. (2001) The seventeenth intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 10/2001).

Thrane, K.E. (1978) Report on the first intercomparison of analytical methods within the EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 2/78).

Thrane, K.E. (1980a) Report on the second and third intercomparison of analytical methods within the EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 1/80).

Thrane, K.E. (1980b) Report on the fourth intercomparison of analytical methods within the EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 5/80).

Thrane, K.E. (1981) The fifth intercomparison of analytical methods within the EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 2/81).

Uggerud, H.Th., Hanssen, J.E. and Skjelmoen, J.E. (2001) The eighteenth intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 11/2001).

Appendix 1

Tables

Table 1: Samples distributed for the nineteenth interlaboratory test.

A.	6 synthetic samples for determination of SO_2, consisting of 0.3% H_2O_2 absorbing solution and containing different concentrations of sulphuric acid. One of the samples was an unidentified blank.
B.	9 KOH-impregnated Whatman 40 filters, comprising 1 blank and 8 filters to which different amounts of sulphuric acid have been added.
C.	4 synthetic samples for determination of NO_2 consisting of sodium nitrite diluted in water.
J.	6 Whatman 40 filters impregnated with 3% oxalic acid, comprising 2 blank and 4 filters to which different amounts of ammonium salt solution have been added.
G.	4 synthetic precipitation samples, containing SO_4^{2-}, NO_3^-, NH_4^+, H^+, Na^+, Mg^{2+} and Cl^-, and Ca^{2+} and K^+.

Table 2a: EMEP laboratories participating in the nineteenth laboratory intercomparison. The numbers in front of the names are used in tables and figures.

Austria	(1)	Umweltbundesamt Zweigstelle Sud, Klagenfurt
Canada	(26)	Meteorological Service of Canada, Toronto
Croatia	(35)	Meteorological and Hydrological Service of Croatia
Czech Republic	(3)	Czech Hydrometeorological Institute, Praha
Denmark	(4)	National Environmental Research Institute. Air Pollution Laboratory
Estonia	(38)	Estonian Environmental Research Centre, Tallinn
European Commission	(30)	Joint Research Centre, Ispra, Environment Institute
Finland	(5)	Finnish Meteorological Institute. Air Quality Department
France	(6)	Laboratories Wolff
Germany	(7)	IfE Leipzig GmbH, Umweltlabor
Germany	(8)	Umweltbundesamt, Messtelle Schauinsland
Hungary	(10)	Institute for Atmospheric Physics
Iceland	(11)	Idntæknistofnun Islands (Technological Inst. of Iceland)
Ireland	(12)	Meteorological Service, Dublin
Italy	(13)	C.N.R. Istituto Inquinamento Atmosferico
Latvia	(33)	Air Pollution Observation Laboratory
Netherlands	(14)	National Institute of Public Health and Environmental Protection (RIVM)
Norway	(15)	Norwegian Institute for Air Research (NILU)
Macedonia	(40)	Hydrometeorological Institute, Skopje
Poland	(16)	Institute of Meteorology and Water Management, Warsaw
Poland	(39)	Environmental Monitoring Laboratory, Institute of Environmental Protection
Portugal	(17)	Direccao Regional do Ambiente e Recursos Naturais do Alentejo, Sines
Romania	(18)	Research and Engineering Institute for Environment
Russian Federation	(22)	Institute of Global Climate and Ecology
Slovakia	(31)	Slovak Hydrometeorological Institute
Slovenia	(36)	Hydrometeorological Institute of Slovenia
Spain	(19)	Centro Nacional de Sanidad Ambiental
Sweden	(20)	Swedish Environmental Research Institute (IVL), Gothenburg
Switzerland	(21)	Swiss Federal Laboratories for Materials Testing (EMPA)
Turkey	(34)	Refik Saydam Institute, Ankara
United Kingdom	(23)	AEA Technology, National Environmental Technology Centre
United States of America	(27)	Illinois State Water Survey
Yugoslavia	(24)	Federal Hydrometeorological Institute, Belgrade

Table 2b: Participating laboratories outside the EMEP network.

Germany	(104)	Hessige Landwirtschafliche
Germany	(105)	Universität des Saarlandes
Sweden	(106)	IVL Svenska Miljöinstitutet AB, Aneboda
Finland	(107)	The Finnish Forest Institute
Germany	(109)	Institut für Bondenkunde und Waldernährung der Universität, Göttingen
Finland	(111)	Finnish Forest Research Institute, Vantaa Research Centre
Germany	(112)	Niedersächsische Forstliche Versuchsanstalt (NVF)
Germany	(113)	Landesforstanstalt Eberswalde, abt. Waldökologie
Italy	(114)	C.N.R. Istituto Italiano di Idrobiologia
Germany	(115)	Bayerische Landesanstalt f. Wald- und Forstwirtshaft
Switzerland	(116)	Institute for Applied Plant Biology
Germany	(117)	Sächsische Landesanstalt für Forsten
Germany	(118)	Forstliche Versuchs-und Forschungsanstalt
Germany	(119)	Landesumweltamt (LUA)
Germany	(121)	Landesamt für Natur und Umwelt
Belgium	(124)	Laboratory of Soil Science
Italy	(126)	APPA Laboratorio Biologico Provinciale
Italy	(130)	Universita degli Studi Siena
China	(131)	Chongqing Institute of Environmental Science and Monitoring
Belarus	(133)	Institute for Problems of Natural Resources Use and Ecology
Germany	(134)	Wissenschaftzentrum für Waldernährung und Wasserhaushalt
China	(135)	Hunan Research Institute of Environmental Protection Science
China	(136)	Guangzhou Research Institute of Environmental Protection

Table 3: Analytical methods used at the participating laboratories for the determination of sulphur dioxide in absorbing solution.

Method	Laboratory
1. Ion chromatography	6, 15, 17, 19, 21, 23

Table 4: Analytical methods used at the participating laboratories for the determination of sulphur dioxide on impregnated filters.

Method	Laboratory
1. Thorin method	33, 16
2. Ion chromatography	3, 4, 5, 8, 11, 12, 13, 15, 19, 20, 22, 23, 31, 34, 36, 38, 131, 135
3. Capillary Ion Analysis	39

Table 5: Analytical methods used at the participating laboratories for determination of nitrate on impregnated filters

Method	Laboratory
1. Reduction to nitrite	16, 33
2. Ion chromatography	3, 4, 5, 8, 11, 13, 15, 19, 20, 22, 31, 34, 36
3. Capillary Ion Analysis	39

Table 6: Analytical method for determination of ammonia on impregnated filters.

Method	Laboratory
1. Spectroscopy	4
2. Chloramine T	16
3. Indophenole	10, 19, 30, 31, 33
4 Ion chromatography	5, 131, 135

Table 7: Analytical method used for NO_2 in absorbing solution.

Method	Laboratory
1. NEDA/Sulphanilamide	3, 4, 10, 15, 16, 19, 20, 22, 23, 31, 33, 34, 35, 39
2. NEDA/Sulphanilic acid	
3. Ion chromatography	36

Table 8: Analytical results for sulphur dioxide in absorbing solution.

SULPHUR DIOXIDE IN ABSORBING SOL.
SAMPLE NO.: A1
THEORETICAL VALUE 0.357
UNIT: µg S/ml

RUN 1:
NUMBER OF LABORATORIES: 6
ARITHMETIC MEAN VALUE: 0.339
MEDIAN: 0.350
STANDARD DEVIATON: 0.044
REL. ST. DEVIATION (%): 12.836

RUN 2:
NUMBER OF LABORATORIES: 6
ARITHMETIC MEAN VALUE: 0.339
MEDIAN: 0.350
STANDARD DEVIATON: 0.044
REL. ST. DEVIATION (%): 12.836

RESULTS IN DECREASING ORDER:

23	0.382	6	0.343
17	0.370	15	0.320
21	0.358	19	0.262

"UNUSED": DATA UNUSED IN RUN 2

SULPHUR DIOXIDE IN ABSORBING SOL.
SAMPLE NO.: A2
THEORETICAL VALUE 0.128
UNIT: µg S/ml

RUN 1:
NUMBER OF LABORATORIES: 6
ARITHMETIC MEAN VALUE: 0.140
MEDIAN: 0.127
STANDARD DEVIATON: 0.034
REL. ST. DEVIATION (%): 24.097

RUN 2:
NUMBER OF LABORATORIES: 5
ARITHMETIC MEAN VALUE: 0.126
MEDIAN: 0.125
STANDARD DEVIATON: 0.007
REL. ST. DEVIATION (%): 5.914

RESULTS IN DECREASING ORDER:

17	0.207 UNUSED	21	0.125
23	0.137	15	0.120
19	0.130	6	0.119

"UNUSED": DATA UNUSED IN RUN 2

SULPHUR DIOXIDE IN ABSORBING SOL.
SAMPLE NO.: A3
THEORETICAL VALUE 0.172
UNIT: µg S/ml

RUN 1:
NUMBER OF LABORATORIES: 6
ARITHMETIC MEAN VALUE: 0.167
MEDIAN: 0.162
STANDARD DEVIATON: 0.009
REL. ST. DEVIATION (%): 5.637

RUN 2:
NUMBER OF LABORATORIES: 6
ARITHMETIC MEAN VALUE: 0.167
MEDIAN: 0.162
STANDARD DEVIATON: 0.009
REL. ST. DEVIATION (%): 5.637

RESULTS IN DECREASING ORDER:

23	0.183	6	0.161
21	0.173	15	0.160
17	0.163	19	0.160

"UNUSED": DATA UNUSED IN RUN 2

SULPHUR DIOXIDE IN ABSORBING SOL.
SAMPLE NO.: A4
THEORETICAL VALUE 0.289
UNIT: µg S/ml

RUN 1:
NUMBER OF LABORATORIES: 6
ARITHMETIC MEAN VALUE: 0.290
MEDIAN: 0.285
STANDARD DEVIATON: 0.024
REL. ST. DEVIATION (%): 8.103

RUN 2:
NUMBER OF LABORATORIES: 6
ARITHMETIC MEAN VALUE: 0.290
MEDIAN: 0.285
STANDARD DEVIATON: 0.024
REL. ST. DEVIATION (%): 8.103

RESULTS IN DECREASING ORDER:

17	0.327	15	0.280
23	0.309	6	0.271
21	0.289	19	0.266

"UNUSED": DATA UNUSED IN RUN 2

Table 9: The ratios of the theoretical values and the results found by the laboratories in the determination of sulphur dioxide in absorbing solutions.

	Measured value / expected value				
	Sample No.				
Lab. no.	A1	A2	A3	A4	Average
6	0.96	0.93	0.93	0.94	0.94
15	0.90	0.94	0.93	0.97	0.93
17	1.04	1.61	0.95	1.13	1.18
19	0.95	2.65	1.21	0.82	1.41
21	1.01	0.99	1.02	1.01	1.01
23	1.07	1.07	1.06	1.07	1.07

Table 10: Analytical results for sulphur dioxide in impregnated filter.

SULPHUR DIOXIDE ON IMPREGNATED FILTER
SAMPLE NO.: B2
THEORETICAL VALUE 18.036
UNIT: µg S/FILTER

RUN 1:
NUMBER OF LABORATORIES: 21
ARITHMETIC MEAN VALUE: 17.086
MEDIAN: 17.670
STANDARD DEVIATON: 2.261
REL. ST. DEVIATION (%): 13.232

RUN 2:
NUMBER OF LABORATORIES: 20
ARITHMETIC MEAN VALUE: 17.475
MEDIAN: 17.685
STANDARD DEVIATON: 1.425
REL. ST. DEVIATION (%): 8.154

RESULTS IN DECREASING ORDER:

36	20.000	39	17.300
131	19.510	22	17.100
31	18.556	34	16.947
5	18.400	8	16.900
20	18.374	4	16.782
13	18.320	19	16.736
23	18.150	15	16.700
12	17.930	11	14.940
135	17.860	33	13.630
16	17.700	38	9.300 UNUSED
3	17.670		

"UNUSED": DATA UNUSED IN RUN 2

SULPHUR DIOXIDE ON IMPREGNATED FILTER
SAMPLE NO.: B3
THEORETICAL VALUE 42.084
UNIT: µg S/FILTER

RUN 1:
NUMBER OF LABORATORIES: 21
ARITHMETIC MEAN VALUE: 40.007
MEDIAN: 40.700
STANDARD DEVIATON: 3.570
REL. ST. DEVIATION (%): 8.923

RUN 2:
NUMBER OF LABORATORIES: 19
ARITHMETIC MEAN VALUE: 40.971
MEDIAN: 41.020
STANDARD DEVIATON: 1.930
REL. ST. DEVIATION (%): 4.710

RESULTS IN DECREASING ORDER:

31	43.706	39	40.700
19	43.414	20	40.254
23	42.850	34	40.004
36	42.500	4	40.002
5	42.400	15	40.000
135	42.260	16	39.950
13	42.160	11	36.940
12	41.880	22	36.400
131	41.300	33	32.010 UNUSED
3	41.020	38	29.700 UNUSED
8	40.700		

"UNUSED": DATA UNUSED IN RUN 2

SULPHUR DIOXIDE ON IMPREGNATED FILTER
SAMPLE NO.: B4
THEORETICAL VALUE 56.112
UNIT: µg S/FILTER

RUN 1:
NUMBER OF LABORATORIES: 21
ARITHMETIC MEAN VALUE: 54.552
MEDIAN: 55.600
STANDARD DEVIATON: 5.150
REL. ST. DEVIATION (%): 9.440

RUN 2:
NUMBER OF LABORATORIES: 19
ARITHMETIC MEAN VALUE: 55.952
MEDIAN: 55.665
STANDARD DEVIATON: 2.781
REL. ST. DEVIATION (%): 4.970

RESULTS IN DECREASING ORDER:

19	60.878	39	55.100
23	59.850	13	54.950
75	59.660	15	54.500
31	59.049	4	54.322
36	57.300	20	54.154
71	57.160	16	53.160
3	56.960	11	51.330
12	56.950	22	50.300
5	56.200	38	41.700 UNUSED
34	55.665	33	40.810 UNUSED
8	55.600		

"UNUSED": DATA UNUSED IN RUN 2

SULPHUR DIOXIDE ON IMPREGNATED FILTER
SAMPLE NO.: B5
THEORETICAL VALUE 24.048
UNIT: µg S/FILTER

RUN 1:
NUMBER OF LABORATORIES: 21
ARITHMETIC MEAN VALUE: 23.003
MEDIAN: 23.534
STANDARD DEVIATON: 2.169
REL. ST. DEVIATION (%): 9.428

RUN 2:
NUMBER OF LABORATORIES: 19
ARITHMETIC MEAN VALUE: 23.552
MEDIAN: 23.690
STANDARD DEVIATON: 1.369
REL. ST. DEVIATION (%): 5.811

RESULTS IN DECREASING ORDER:

23	25.350	12	23.320
36	25.300	75	23.260
71	25.170	34	23.133
31	25.169	16	22.920
15	24.400	8	22.700
19	24.135	4	22.642
5	23.800	11	22.030
13	23.730	22	19.500
39	23.700	33	18.070 UNUSED
3	23.690	38	17.500 UNUSED
20	23.534		

"UNUSED": DATA UNUSED IN RUN 2

Table 11: The ratios of the theoretical values and the results found by the laboratories in the determination of sulphur dioxide on impregnated filters. The reported results are corrected for blank value (B1).

	Measured value / expected value				
	Sample No.				
Lab.No.	B 2	B 3	B 4	B 5	Average
3	0.98	0.97	1.02	0.99	0.99
4	0.93	0.95	0.97	0.94	0.95
5	1.02	1.01	1.00	0.99	1.00
8	0.94	0.97	0.99	0.94	0.96
11	0.83	0.88	0.91	0.92	0.88
12	0.99	1.00	1.01	0.97	0.99
13	1.02	1.00	0.98	0.99	1.00
15	0.93	0.95	0.97	1.01	0.97
16	0.98	0.95	0.95	0.95	0.96
19	0.93	1.03	1.08	1.00	1.01
20	1.02	0.96	0.97	0.98	0.98
22	0.95	0.86	0.90	0.81	0.88
23	1.01	1.02	1.07	1.05	1.04
31	1.03	1.04	1.05	1.05	1.04
33	0.76	0.76	0.73	0.75	0.75
34	0.94	0.95	0.99	0.96	0.96
36	1.11	1.01	1.02	1.05	1.05
38	0.52	0.71	0.74	0.73	0.67
39	0.96	0.97	0.98	0.99	0.97
131	1.08	0.98	1.02	1.05	1.03
135	0.99	1.00	1.06	0.97	1.01

Table 12: Analytical results for nitric acid on impregnated filter.

NITRIC ACID ON IMPREGNATED FILTER
SAMPLE NO.: B2
THEORETICAL VALUE 39.264
UNIT: µg N/FILTER

RUN 1:
NUMBER OF LABORATORIES: 16
ARITHMETIC MEAN VALUE: 37.917
MEDIAN: 38.146
STANDARD DEVIATON: 3.611
REL. ST. DEVIATION (%): 9.524

RUN 2:
NUMBER OF LABORATORIES: 15
ARITHMETIC MEAN VALUE: 38.710
MEDIAN: 38.300
STANDARD DEVIATON: 1.786
REL. ST. DEVIATION (%): 4.613

RESULTS IN DECREASING ORDER:

19	43.503	34	37.992
5	40.500	15	37.900
31	40.134	22	37.730
3	39.770	16	37.510
8	39.200	36	37.200
39	39.000	20	37.080
13	38.630	11	36.200
4	38.300	33	26.020 UNUSED

"UNUSED": DATA UNUSED IN RUN 2

NITRIC ACID ON IMPREGNATED FILTER
SAMPLE NO.: B3
THEORETICAL VALUE 13.088
UNIT: µg N/FILTER

RUN 1:
NUMBER OF LABORATORIES: 16
ARITHMETIC MEAN VALUE: 12.328
MEDIAN: 12.583
STANDARD DEVIATON: 1.418
REL. ST. DEVIATION (%): 11.500

RUN 2:
NUMBER OF LABORATORIES: 14
ARITHMETIC MEAN VALUE: 12.315
MEDIAN: 12.583
STANDARD DEVIATON: 0.922
REL. ST. DEVIATION (%): 7.490

RESULTS IN DECREASING ORDER:

19	15.506 UNUSED	4	12.540
13	13.330	15	12.500
8	13.200	16	12.280
5	13.000	36	12.000
3	12.900	34	11.788
20	12.720	22	10.830
39	12.700	11	10.000
31	12.627	33	9.330 UNUSED

"UNUSED": DATA UNUSED IN RUN 2

NITRIC ACID ON IMPREGNATED FILTER
SAMPLE NO.: B4
THEORETICAL VALUE 11.452
UNIT: µg N/FILTER

RUN 1:
NUMBER OF LABORATORIES: 16
ARITHMETIC MEAN VALUE: 10.522
MEDIAN: 10.764
STANDARD DEVIATON: 1.133
REL. ST. DEVIATION (%): 10.764

RUN 2:
NUMBER OF LABORATORIES: 16
ARITHMETIC MEAN VALUE: 10.522
MEDIAN: 10.764
STANDARD DEVIATON: 1.133
REL. ST. DEVIATION (%): 10.764

RESULTS IN DECREASING ORDER:

19	12.140	31	10.727
13	11.720	15	10.700
8	11.600	4	10.660
5	11.400	36	10.500
3	11.070	22	9.330
20	11.040	34	8.844
16	10.800	11	8.740
39	10.800	33	8.280

"UNUSED": DATA UNUSED IN RUN 2

NITRIC ACID ON IMPREGNATED FILTER
SAMPLE NO.: B5
THEORETICAL VALUE 42.536
UNIT: µg N/FILTER

RUN 1:
NUMBER OF LABORATORIES: 16
ARITHMETIC MEAN VALUE: 41.355
MEDIAN: 42.030
STANDARD DEVIATON: 4.022
REL. ST. DEVIATION (%): 9.725

RUN 2:
NUMBER OF LABORATORIES: 15
ARITHMETIC MEAN VALUE: 42.158
MEDIAN: 42.060
STANDARD DEVIATON: 2.506
REL. ST. DEVIATION (%): 5.943

RESULTS IN DECREASING ORDER:

19	49.001	16	42.000
31	43.894	39	42.000
5	43.000	36	41.200
13	42.970	22	40.930
3	42.950	20	40.160
8	42.800	34	39.346
15	42.500	11	37.560
4	42.060	33	29.310 UNUSED

"UNUSED": DATA UNUSED IN RUN 2

Table 13: The ratios of the theoretical values and the results found by the laboratories in the determination of nitric acid on impregnated filters. The reported results are corrected for blank value (B1).

	Measured / Expected				
	Sample No.				
Lab. No.	B 2	B 3	B 4	B 5	Average
3	1.01	0.99	0.97	1.01	0.99
4	0.98	0.96	0.93	0.99	0.96
5	1.03	0.99	1.00	1.01	1.01
8	1.00	1.01	1.01	1.01	1.01
11	0.92	0.76	0.76	0.88	0.83
12	0.00	0.00	0.00	0.00	0.00
13	0.98	1.02	1.02	1.01	1.01
15	0.97	0.96	0.93	1.00	0.96
16	0.96	0.94	0.94	0.99	0.96
19	1.11	1.18	1.06	1.15	1.13
20	0.94	0.97	0.96	0.94	0.96
22	0.96	0.83	0.81	0.96	0.89
31	1.02	0.96	0.94	1.03	0.99
33	0.66	0.71	0.72	0.69	0.70
34	0.97	0.90	0.77	0.93	0.89
36	0.95	0.92	0.92	0.97	0.94
39	0.99	0.97	0.94	0.99	0.97

Table 14: Analytical results for nitrogen dioxide in absorbing solution.

NITROGEN DIOXIDE IN ABSORBING SOL.
SAMPLE NO.: C1
THEORETICAL VALUE 0.088
UNIT: µg N/ml

RUN 1:
NUMBER OF LABORATORIES: 20
ARITHMETIC MEAN VALUE: 0.151
MEDIAN: 0.087
STANDARD DEVIATON: 0.287
REL. ST. DEVIATION (%): 189.434

RUN 2:
NUMBER OF LABORATORIES: 19
ARITHMETIC MEAN VALUE: 0.087
MEDIAN: 0.087
STANDARD DEVIATON: 0.005
REL. ST. DEVIATION (%): 5.551

RESULTS IN DECREASING ORDER:

19	1.370 UNUSED	22	0.087
39	0.097	34	0.086
23	0.096	35	0.086
3	0.093	38	0.086
12	0.091	10	0.085
15	0.090	36	0.085
131	0.089	24	0.084
135	0.089	4	0.082
16	0.088	33	0.080
20	0.087	31	0.078

"UNUSED": DATA UNUSED IN RUN 2

NITROGEN DIOXIDE IN ABSORBING SOL.
SAMPLE NO.: C2
THEORETICAL VALUE 0.156
UNIT: µg N/ml

RUN 1:
NUMBER OF LABORATORIES: 20
ARITHMETIC MEAN VALUE: 0.255
MEDIAN: 0.155
STANDARD DEVIATON: 0.453
REL. ST. DEVIATION (%): 177.961

RUN 2:
NUMBER OF LABORATORIES: 19
ARITHMETIC MEAN VALUE: 0.153
MEDIAN: 0.154
STANDARD DEVIATON: 0.008
REL. ST. DEVIATION (%): 5.248

RESULTS IN DECREASING ORDER:

19	2.180 UNUSED	15	0.154
23	0.169	16	0.153
12	0.161	20	0.152
24	0.161	38	0.152
34	0.159	10	0.151
22	0.158	36	0.151
131	0.158	4	0.150
39	0.157	31	0.140
135	0.157	33	0.140
35	0.155	3	0.135

"UNUSED": DATA UNUSED IN RUN 2

NITROGEN DIOXIDE IN ABSORBING SOL.
SAMPLE NO.: C3
THEORETICAL VALUE 0.139
UNIT: µg N/ml

RUN 1:
NUMBER OF LABORATORIES: 20
ARITHMETIC MEAN VALUE: 0.221
MEDIAN: 0.136
STANDARD DEVIATON: 0.383
REL. ST. DEVIATION (%): 173.419

RUN 2:
NUMBER OF LABORATORIES: 19
ARITHMETIC MEAN VALUE: 0.135
MEDIAN: 0.136
STANDARD DEVIATON: 0.008
REL. ST. DEVIATION (%): 6.108

RESULTS IN DECREASING ORDER:

19	1.850 UNUSED	20	0.136
12	0.146	38	0.136
22	0.143	4	0.135
39	0.143	16	0.134
135	0.142	36	0.134
23	0.141	131	0.134
35	0.141	34	0.133
24	0.140	33	0.130
10	0.136	31	0.123
15	0.136	3	0.109

"UNUSED": DATA UNUSED IN RUN 2

NITROGEN DIOXIDE IN ABSORBING SOL.
SAMPLE NO.: C4
THEORETICAL VALUE 0.071
UNIT: µg N/ml

RUN 1:
NUMBER OF LABORATORIES: 20
ARITHMETIC MEAN VALUE: 0.124
MEDIAN: 0.071
STANDARD DEVIATON: 0.237
REL. ST. DEVIATION (%): 191.243

RUN 2:
NUMBER OF LABORATORIES: 19
ARITHMETIC MEAN VALUE: 0.071
MEDIAN: 0.071
STANDARD DEVIATON: 0.004
REL. ST. DEVIATION (%): 5.620

RESULTS IN DECREASING ORDER:

19	1.130 UNUSED	35	0.071
3	0.080	33	0.070
131	0.077	38	0.070
12	0.075	10	0.069
39	0.074	4	0.068
22	0.073	24	0.068
23	0.073	36	0.068
15	0.072	16	0.067
135	0.072	34	0.065
20	0.071	31	0.064

"UNUSED": DATA UNUSED IN RUN 2

Table 15: The ratios of the theoretical values and the results found by the laboratories in the determination of nitrogen dioxide in absorbing solutions.

	Measured / Expected				
	Sample No.				
Lab.No.	C1	C2	C3	C4	Average
3	1.05	0.87	0.79	1.13	0.96
4	0.93	0.96	0.97	0.96	0.96
10	0.97	0.97	0.98	0.97	0.97
12	1.03	1.03	1.05	1.06	1.04
15	1.02	0.99	0.98	1.01	1.00
16	1.00	0.98	0.97	0.94	0.97
19	15.57	14.00	13.33	15.90	14.70
20	0.99	0.98	0.98	1.00	0.99
22	0.99	1.01	1.03	1.03	1.02
23	1.09	1.09	1.02	1.03	1.05
24	0.95	1.03	1.01	0.96	0.99
31	0.89	0.90	0.89	0.90	0.89
33	0.91	0.90	0.94	0.98	0.93
34	0.98	1.02	0.96	0.91	0.97
35	0.98	1.00	1.02	1.00	1.00
36	0.97	0.97	0.97	0.96	0.96
38	0.98	0.98	0.98	0.98	0.98
39	1.10	1.01	1.03	1.04	1.05
131	1.01	1.01	0.97	1.08	1.02
135	1.01	1.01	1.02	1.01	1.01

Table 16: Analytical results for ammonia on impregnated filter.

AMMONIA ON IMPREGNATED FILTER
SAMPLE NO.: J2
THEORETICAL VALUE 8.020
UNIT: µg N/FILTER

RUN 1:

NUMBER OF LABORATORIES:	16
ARITHMETIC MEAN VALUE:	6.747
MEDIAN:	7.724
STANDARD DEVIATON:	2.533
REL. ST. DEVIATION (%):	37.537

RUN 2:

NUMBER OF LABORATORIES:	14
ARITHMETIC MEAN VALUE:	7.573
MEDIAN:	7.895
STANDARD DEVIATON:	1.230
REL. ST. DEVIATION (%):	16.236

RESULTS IN DECREASING ORDER:

131	9.080	22	7.593
13	8.850	15	7.470
30	8.510	16	7.165
11	8.415	10	6.764
39	8.160	31	5.165
20	8.080	33	4.980
4	7.935	19	1.246 UNUSED
5	7.855	135	0.685 UNUSED

"UNUSED": DATA UNUSED IN RUN 2

AMMONIA ON IMPREGNATED FILTER
SAMPLE NO.: J3
THEORETICAL VALUE 6.015
UNIT: µg N/FILTER

RUN 1:

NUMBER OF LABORATORIES:	16
ARITHMETIC MEAN VALUE:	5.810
MEDIAN:	5.535
STANDARD DEVIATON:	2.002
REL. ST. DEVIATION (%):	34.458

RUN 2:

NUMBER OF LABORATORIES:	15
ARITHMETIC MEAN VALUE:	5.394
MEDIAN:	5.465
STANDARD DEVIATON:	1.150
REL. ST. DEVIATION (%):	21.323

RESULTS IN DECREASING ORDER:

135	12.055 UNUSED	11	5.465
19	7.438	15	5.430
13	6.630	4	5.405
30	6.310	16	5.315
131	6.010	22	4.972
39	5.820	10	4.574
20	5.700	31	3.215
5	5.605	33	3.014

"UNUSED": DATA UNUSED IN RUN 2

AMMONIA ON IMPREGNATED FILTER
SAMPLE NO.: J4
THEORETICAL VALUE 36.090
UNIT: µg N/FILTER

RUN 1:

NUMBER OF LABORATORIES:	16
ARITHMETIC MEAN VALUE:	31.793
MEDIAN:	33.943
STANDARD DEVIATON:	6.034
REL. ST. DEVIATION (%):	18.979

RUN 2:

NUMBER OF LABORATORIES:	15
ARITHMETIC MEAN VALUE:	32.666
MEDIAN:	34.210
STANDARD DEVIATON:	5.094
REL. ST. DEVIATION (%):	15.593

RESULTS IN DECREASING ORDER:

19	40.093	4	33.675
11	36.745	22	32.842
30	36.370	135	31.545
15	35.480	131	31.380
5	35.455	16	29.045
20	34.760	10	22.138
13	34.690	31	21.565
39	34.210	33	18.699 UNUSED

"UNUSED": DATA UNUSED IN RUN 2

AMMONIA ON IMPREGNATED FILTER
SAMPLE NO.: J5
THEORETICAL VALUE 32.080
UNIT: µg N/FILTER

RUN 1:

NUMBER OF LABORATORIES:	16
ARITHMETIC MEAN VALUE:	29.110
MEDIAN:	30.703
STANDARD DEVIATON:	4.864
REL. ST. DEVIATION (%):	16.709

RUN 2:

NUMBER OF LABORATORIES:	16
ARITHMETIC MEAN VALUE:	29.110
MEDIAN:	30.703
STANDARD DEVIATON:	4.864
REL. ST. DEVIATION (%):	16.709

RESULTS IN DECREASING ORDER:

19	35.705	39	30.611
131	33.190	15	30.590
30	32.720	4	29.565
11	32.645	22	28.728
5	31.555	16	26.675
20	31.260	10	20.361
13	31.250	31	20.215
135	30.795	33	19.902

"UNUSED": DATA UNUSED IN RUN 2

Table 17: The ratios of the theoretical values and the results found by the laboratories in the determination of ammonia on impregnated filters. The reported results are corrected for an average blank value (J1 and J6).

	Measured / Expected				
	Sample No.				
Lab.No.	J2	J3	J4	J5	Average
4	0.99	0.90	0.93	0.92	0.94
5	0.98	0.93	0.98	0.98	0.97
10	0.84	0.76	0.61	0.63	0.71
11	1.05	0.91	1.02	1.02	1.00
13	1.10	1.10	0.96	0.97	1.04
15	0.93	0.90	0.98	0.95	0.94
16	0.89	0.88	0.80	0.83	0.85
19	0.16	1.24	1.11	1.11	0.90
20	1.01	0.95	0.96	0.97	0.97
22	0.95	0.83	0.91	0.90	0.89
30	1.06	1.05	1.01	1.02	1.03
31	0.64	0.53	0.60	0.63	0.60
33	0.62	0.50	0.52	0.62	0.57
39	1.02	0.97	0.95	0.95	0.97
131	1.13	1.00	0.87	1.03	1.01
135	0.09	2.00	0.87	0.96	0.98

Table 18: Analytical results for sulphate in precipitations samples.

SULPHATE
SAMPLE NO.: G1
THEORETICAL VALUE 1.509
UNIT: µg S/ml

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 1.563
MEDIAN: 1.503
STANDARD DEVIATON: 0.371
REL. ST. DEVIATION (%): 23.712

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 1.514
MEDIAN: 1.501
STANDARD DEVIATON: 0.105
REL. ST. DEVIATION (%): 6.925

RESULTS IN DECREASING ORDER:

130	4.080 UNUSED	27	1.501
119	1.850	12	1.500
133	1.812	121	1.500
116	1.809	136	1.500
18	1.724	4	1.499
39	1.617	36	1.497
17	1.610	134	1.494
22	1.582	6	1.493
13	1.580	3	1.492
118	1.550	112	1.490
107	1.540	16	1.483
35	1.539	19	1.481
1	1.530	104	1.480
11	1.524	26	1.470
14	1.523	10	1.468
21	1.523	131	1.463
115	1.520	105	1.457
135	1.520	15	1.450
30	1.518	7	1.430
8	1.517	126	1.430
33	1.513	111	1.420
23	1.511	124	1.400
114	1.510	38	1.380
34	1.509	109	1.380
5	1.506	117	1.357
31	1.504	20	1.254

UNUSED: DATA UNUSED IN RUN 2

SULPHATE
SAMPLE NO.: G2
THEORETICAL VALUE 0.953
UNIT: µg S/ml

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 0.982
MEDIAN: 0.950
STANDARD DEVIATON: 0.227
REL. ST. DEVIATION (%): 23.132

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 0.951
MEDIAN: 0.950
STANDARD DEVIATON: 0.050
REL. ST. DEVIATION (%): 5.223

RESULTS IN DECREASING ORDER:

130	2.550 UNUSED	112	0.950
116	1.173	114	0.950
133	1.048	135	0.950
39	1.014	4	0.948
13	1.010	33	0.948
17	1.010	6	0.943
115	1.000	134	0.943
121	0.990	3	0.940
21	0.974	31	0.936
107	0.974	131	0.936
5	0.973	26	0.933
19	0.973	15	0.930
136	0.973	36	0.928
11	0.972	16	0.927
118	0.970	7	0.924
10	0.969	104	0.920
35	0.967	22	0.902
8	0.965	124	0.900
23	0.965	126	0.900
1	0.960	18	0.899
119	0.960	105	0.899
14	0.959	111	0.899
34	0.955	38	0.890
30	0.951	109	0.890
12	0.950	117	0.875
27	0.950	20	0.841

UNUSED: DATA UNUSED IN RUN 2

SULPHATE
SAMPLE NO.: G3
THEORETICAL VALUE 1.113
UNIT: µg S/ml

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 1.160
MEDIAN: 1.117
STANDARD DEVIATON: 0.274
REL. ST. DEVIATION (%): 23.605

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 1.123
MEDIAN: 1.113
STANDARD DEVIATON: 0.077
REL. ST. DEVIATION (%): 6.830

RESULTS IN DECREASING ORDER:

130	3.020 UNUSED	14	1.113
116	1.420	136	1.112
119	1.380	12	1.110
133	1.249	104	1.110
18	1.206	27	1.108
11	1.196	30	1.108
17	1.193	6	1.104
13	1.190	23	1.101
121	1.180	36	1.101
39	1.165	31	1.100
118	1.160	126	1.100
115	1.150	134	1.098
4	1.148	3	1.093
35	1.136	26	1.090
21	1.134	16	1.088
19	1.133	131	1.083
1	1.130	7	1.078
33	1.130	22	1.072
107	1.130	15	1.070
112	1.130	105	1.056
34	1.128	111	1.050
8	1.127	109	1.040
5	1.126	117	1.029
10	1.122	124	1.000
114	1.120	38	0.990
135	1.120	20	0.983

UNUSED: DATA UNUSED IN RUN 2

SULPHATE
SAMPLE NO.: G4
THEORETICAL VALUE 1.400
UNIT: µg S/ml

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 1.448
MEDIAN: 1.388
STANDARD DEVIATON: 0.355
REL. ST. DEVIATION (%): 24.548

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 1.401
MEDIAN: 1.385
STANDARD DEVIATON: 0.106
REL. ST. DEVIATION (%): 7.574

RESULTS IN DECREASING ORDER:

130	3.850 UNUSED	34	1.385
116	1.836	27	1.384
13	1.670	23	1.381
133	1.664	12	1.380
119	1.550	112	1.380
18	1.502	6	1.379
39	1.498	31	1.376
17	1.489	3	1.373
118	1.460	10	1.372
22	1.459	16	1.371
121	1.440	136	1.371
33	1.423	126	1.370
35	1.423	115	1.360
5	1.415	134	1.357
1	1.410	26	1.352
19	1.407	36	1.348
4	1.404	15	1.340
21	1.404	111	1.330
104	1.400	7	1.328
107	1.400	14	1.325
135	1.400	105	1.318
8	1.399	124	1.300
30	1.398	38	1.290
11	1.391	109	1.270
114	1.390	117	1.249
131	1.390	20	1.142

UNUSED: DATA UNUSED IN RUN 2

Table 19: Analytical results for nitrate in precipitations samples.

NITRATE
SAMPLE NO.: G1
THEORETICAL VALUE 0.698
UNIT: µg N/ml

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 0.714
MEDIAN: 0.694
STANDARD DEVIATON: 0.152
REL. ST. DEVIATION (%): 21.328

RUN 2:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 0.694
MEDIAN: 0.693
STANDARD DEVIATON: 0.051
REL. ST. DEVIATION (%): 7.345

RESULTS IN DECREASING ORDER:

24	1.750 UNUSED	14	0.693
40	0.963	36	0.691
11	0.762	22	0.690
39	0.753	34	0.690
19	0.732	114	0.690
115	0.730	118	0.690
17	0.726	135	0.690
113	0.720	13	0.688
107	0.713	6	0.686
1	0.710	10	0.686
112	0.710	26	0.686
5	0.707	7	0.683
20	0.707	134	0.682
23	0.703	119	0.680
27	0.702	111	0.677
12	0.700	16	0.674
30	0.700	15	0.670
104	0.700	109	0.670
124	0.700	126	0.670
130	0.700	121	0.669
4	0.698	3	0.667
8	0.698	117	0.664
31	0.698	38	0.660
33	0.698	136	0.655
133	0.698	131	0.641
35	0.697	105	0.631
21	0.696	116	0.510

UNUSED: DATA UNUSED IN RUN 2

NITRATE
SAMPLE NO.: G2
THEORETICAL VALUE 0.497
UNIT: µg N/ml

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 0.511
MEDIAN: 0.496
STANDARD DEVIATON: 0.091
REL. ST. DEVIATION (%): 17.846

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 0.490
MEDIAN: 0.494
STANDARD DEVIATON: 0.030
REL. ST. DEVIATION (%): 6.069

RESULTS IN DECREASING ORDER:

24	0.950 UNUSED	21	0.495
117	0.843 UNUSED	26	0.494
40	0.779 UNUSED	104	0.494
11	0.564	31	0.493
112	0.560	23	0.492
130	0.520	33	0.491
13	0.519	38	0.490
39	0.517	114	0.490
17	0.516	115	0.490
35	0.515	6	0.487
19	0.513	111	0.487
113	0.510	15	0.480
5	0.505	119	0.480
107	0.505	14	0.479
30	0.504	134	0.479
10	0.502	136	0.478
20	0.502	3	0.477
8	0.501	7	0.477
1	0.500	36	0.475
4	0.500	16	0.473
12	0.500	22	0.461
118	0.500	109	0.460
124	0.500	126	0.460
135	0.500	131	0.460
34	0.499	105	0.436
27	0.498	133	0.421
121	0.497	116	0.369

UNUSED: DATA UNUSED IN RUN 2

NITRATE
SAMPLE NO.: G3
THEORETICAL VALUE 0.760
UNIT: µg N/ml

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 0.772
MEDIAN: 0.757
STANDARD DEVIATON: 0.152
REL. ST. DEVIATION (%): 19.687

RUN 2:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 0.746
MEDIAN: 0.755
STANDARD DEVIATON: 0.042
REL. ST. DEVIATION (%): 5.624

RESULTS IN DECREASING ORDER:

24	1.750 UNUSED	21	0.756
40	1.150 UNUSED	10	0.754
11	0.841	126	0.750
112	0.820	36	0.749
118	0.800	134	0.749
19	0.793	22	0.748
17	0.786	6	0.747
39	0.782	31	0.747
113	0.780	26	0.746
5	0.772	13	0.743
1	0.770	135	0.740
133	0.769	111	0.736
20	0.768	16	0.735
107	0.768	3	0.734
4	0.764	7	0.734
8	0.762	119	0.730
35	0.762	117	0.725
27	0.761	121	0.721
34	0.761	131	0.721
12	0.760	15	0.720
104	0.760	109	0.710
114	0.760	115	0.700
130	0.760	124	0.700
23	0.759	136	0.693
14	0.758	105	0.675
33	0.758	116	0.606
30	0.757	38	0.590

UNUSED: DATA UNUSED IN RUN 2

NITRATE
SAMPLE NO.: G4
THEORETICAL VALUE 0.563
UNIT: µg N/ml

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 0.566
MEDIAN: 0.551
STANDARD DEVIATON: 0.112
REL. ST. DEVIATION (%): 19.729

RUN 2:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 0.547
MEDIAN: 0.550
STANDARD DEVIATON: 0.036
REL. ST. DEVIATION (%): 6.627

RESULTS IN DECREASING ORDER:

24	1.260 UNUSED	114	0.550
40	0.870 UNUSED	118	0.550
112	0.610	135	0.550
22	0.600	121	0.549
11	0.588	26	0.548
13	0.588	10	0.547
133	0.588	30	0.547
39	0.585	6	0.546
4	0.580	111	0.544
113	0.580	36	0.542
17	0.576	15	0.540
19	0.574	126	0.540
35	0.571	134	0.540
130	0.570	31	0.537
1	0.560	7	0.534
5	0.560	16	0.534
12	0.560	3	0.531
20	0.560	117	0.531
27	0.557	115	0.530
104	0.557	119	0.530
14	0.556	136	0.526
8	0.555	131	0.512
34	0.555	109	0.510
23	0.554	124	0.500
33	0.554	105	0.496
21	0.552	116	0.419
107	0.552	38	0.400

UNUSED: DATA UNUSED IN RUN 2

Table 20: Analytical results for ammonium in precipitations sample.

AMMONIUM
SAMPLE NO.: G1
THEORETICAL VALUE 0.481
UNIT: µg N/ml

RUN 1:
NUMBER OF LABORATORIES: 56
ARITHMETIC MEAN VALUE: 0.466
MEDIAN: 0.473
STANDARD DEVIATON: 0.065
REL. ST. DEVIATION (%): 14.044

RUN 2:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 0.469
MEDIAN: 0.473
STANDARD DEVIATON: 0.031
REL. ST. DEVIATION (%): 6.526

RESULTS IN DECREASING ORDER:

116	0.635 UNUSED	16	0.471	
118	0.622 UNUSED	5	0.470	
6	0.540	15	0.470	
130	0.530	135	0.470	
39	0.521	23	0.469	
112	0.510	22	0.468	
136	0.506	133	0.467	
105	0.501	10	0.466	
113	0.500	7	0.464	
33	0.493	14	0.464	
104	0.491	13	0.462	
34	0.490	38	0.460	
21	0.489	8	0.459	
106	0.483	31	0.458	
30	0.481	121	0.451	
117	0.481	126	0.451	
20	0.480	27	0.450	
109	0.480	19	0.442	
114	0.480	115	0.440	
26	0.479	107	0.436	
4	0.478	3	0.431	
131	0.478	134	0.430	
111	0.477	17	0.422	
1	0.476	119	0.400	
36	0.476	124	0.400	
11	0.475	24	0.373	
35	0.475	12	0.320 UNUSED	
40	0.475	18	0.130 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

AMMONIUM
SAMPLE NO.: G2
THEORETICAL VALUE 0.321
UNIT: µg N/ml

RUN 1:
NUMBER OF LABORATORIES: 56
ARITHMETIC MEAN VALUE: 0.316
MEDIAN: 0.317
STANDARD DEVIATON: 0.042
REL. ST. DEVIATION (%): 13.320

RUN 2:
NUMBER OF LABORATORIES: 55
ARITHMETIC MEAN VALUE: 0.316
MEDIAN: 0.317
STANDARD DEVIATON: 0.043
REL. ST. DEVIATION (%): 13.446

RESULTS IN DECREASING ORDER:

116	0.422 UNUSED	26	0.317	
118	0.414 UNUSED	36	0.317	
124	0.400	1	0.316	
39	0.368	5	0.315	
6	0.360	7	0.313	
130	0.360	11	0.313	
112	0.350	22	0.313	
35	0.349	23	0.313	
34	0.340	15	0.310	
21	0.335	117	0.310	
40	0.335	31	0.307	
131	0.332	136	0.307	
113	0.330	10	0.306	
104	0.328	8	0.305	
16	0.326	14	0.304	
30	0.326	27	0.300	
33	0.325	126	0.300	
4	0.322	107	0.298	
105	0.322	121	0.295	
20	0.320	12	0.290	
38	0.320	17	0.290	
109	0.320	3	0.287	
114	0.320	19	0.284	
135	0.320	134	0.284	
133	0.319	115	0.280	
111	0.318	119	0.260	
106	0.317	24	0.250	
13	0.317	18	0.107 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

AMMONIUM
SAMPLE NO.: G3
THEORETICAL VALUE 0.561
UNIT: µg N/ml

RUN 1:
NUMBER OF LABORATORIES: 56
ARITHMETIC MEAN VALUE: 0.550
MEDIAN: 0.556
STANDARD DEVIATON: 0.065
REL. ST. DEVIATION (%): 11.742

RUN 2:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 0.550
MEDIAN: 0.555
STANDARD DEVIATON: 0.029
REL. ST. DEVIATION (%): 5.302

RESULTS IN DECREASING ORDER:

116	0.726 UNUSED	1	0.555	
118	0.723 UNUSED	35	0.555	
130	0.620	5	0.553	
3	0.598	15	0.550	
6	0.590	38	0.550	
112	0.590	109	0.550	
33	0.588	22	0.549	
13	0.583	117	0.547	
105	0.582	7	0.546	
104	0.578	10	0.546	
16	0.577	14	0.545	
34	0.573	31	0.544	
11	0.571	8	0.540	
21	0.570	40	0.538	
113	0.570	121	0.532	
30	0.567	19	0.526	
20	0.566	3	0.523	
136	0.566	126	0.521	
36	0.565	27	0.520	
106	0.565	107	0.517	
4	0.560	134	0.510	
114	0.560	17	0.505	
135	0.560	12	0.500	
131	0.559	115	0.500	
26	0.558	124	0.500	
23	0.557	119	0.490	
111	0.557	24	0.475	
133	0.556	18	0.197 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

AMMONIUM
SAMPLE NO.: G4
THEORETICAL VALUE 0.281
UNIT: µg N/ml

RUN 1:
NUMBER OF LABORATORIES: 56
ARITHMETIC MEAN VALUE: 0.278
MEDIAN: 0.274
STANDARD DEVIATON: 0.052
REL. ST. DEVIATION (%): 18.608

RUN 2:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 0.274
MEDIAN: 0.274
STANDARD DEVIATON: 0.024
REL. ST. DEVIATION (%): 8.893

RESULTS IN DECREASING ORDER:

12	0.520 UNUSED	111	0.274	
116	0.425 UNUSED	1	0.273	
118	0.359	26	0.272	
40	0.311	7	0.271	
16	0.310	22	0.271	
112	0.310	30	0.271	
39	0.303	15	0.270	
109	0.300	135	0.270	
124	0.300	136	0.270	
31	0.292	8	0.268	
131	0.292	14	0.268	
6	0.290	117	0.268	
104	0.289	10	0.267	
21	0.288	126	0.266	
34	0.287	27	0.260	
13	0.286	38	0.260	
35	0.286	107	0.256	
36	0.284	17	0.252	
11	0.283	121	0.248	
105	0.283	19	0.247	
33	0.282	133	0.245	
5	0.281	3	0.241	
20	0.281	115	0.240	
113	0.280	119	0.230	
114	0.280	130	0.230	
23	0.276	134	0.225	
106	0.276	24	0.220	
4	0.274	18	0.091 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

Table 21: Analytical results for pH in precipitations samples.

PH
SAMPLE NO.: G1
THEORETICAL VALUE 4.125
UNIT: PH UNITS

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 4.175
MEDIAN: 4.180
STANDARD DEVIATON: 0.096
REL. ST. DEVIATION (%): 2.289

RUN 2:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 4.179
MEDIAN: 4.180
STANDARD DEVIATON: 0.066
REL. ST. DEVIATION (%): 1.591

RESULTS IN DECREASING ORDER:

115	4.420	UNUSED	33	4.180
117	4.350		106	4.180
113	4.340		133	4.180
19	4.320		31	4.172
10	4.310		135	4.170
116	4.270		1	4.160
109	4.260		6	4.160
17	4.240		26	4.160
14	4.230		39	4.160
111	4.230		131	4.160
22	4.210		11	4.150
36	4.210		16	4.150
126	4.210		38	4.150
3	4.201		105	4.150
35	4.200		136	4.150
124	4.200		5	4.140
7	4.190		12	4.140
13	4.190		30	4.140
15	4.190		119	4.120
104	4.190		130	4.120
112	4.190		20	4.110
114	4.190		23	4.090
118	4.190		107	4.070
34	4.182		24	4.050
4	4.180		121	4.050
21	4.180		18	4.010
27	4.180		40	3.730 UNUSED

UNUSED: DATA UNUSED IN RUN 2

PH
SAMPLE NO.: G2
THEORETICAL VALUE 4.523
UNIT: PH UNITS

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 4.558
MEDIAN: 4.559
STANDARD DEVIATON: 0.298
REL. ST. DEVIATION (%): 6.531

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 4.570
MEDIAN: 4.560
STANDARD DEVIATON: 0.097
REL. ST. DEVIATION (%): 2.128

RESULTS IN DECREASING ORDER:

113	5.960	UNUSED	3	4.557
36	4.950		1	4.550
19	4.760		104	4.550
115	4.750		131	4.550
133	4.730		136	4.550
116	4.690		5	4.540
112	4.670		11	4.540
10	4.660		26	4.540
14	4.650		39	4.540
35	4.640		105	4.540
17	4.630		12	4.530
111	4.630		30	4.530
22	4.610		114	4.520
106	4.600		6	4.510
124	4.600		16	4.510
13	4.590		135	4.510
15	4.590		20	4.500
34	4.582		38	4.490
7	4.580		119	4.490
118	4.580		33	4.480
126	4.580		24	4.460
4	4.570		23	4.440
21	4.570		107	4.430
130	4.570		18	4.400
27	4.560		117	4.340
31	4.560		40	3.920 UNUSED
109	4.560		121	3.200 UNUSED

UNUSED: DATA UNUSED IN RUN 2

PH
SAMPLE NO.: G3
THEORETICAL VALUE 4.456
UNIT: PH UNITS

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 4.462
MEDIAN: 4.495
STANDARD DEVIATON: 0.261
REL. ST. DEVIATION (%): 5.844

RUN 2:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 4.504
MEDIAN: 4.500
STANDARD DEVIATON: 0.101
REL. ST. DEVIATION (%): 2.241

RESULTS IN DECREASING ORDER:

113	4.880		1	4.490
36	4.870		27	4.490
19	4.700		34	4.489
115	4.680		5	4.480
10	4.610		11	4.480
14	4.580		16	4.480
17	4.570		26	4.480
117	4.560		131	4.480
22	4.530		12	4.470
35	4.530		114	4.470
112	4.530		30	4.460
133	4.530		130	4.460
111	4.520		6	4.450
116	4.520		31	4.450
4	4.510		105	4.450
13	4.510		135	4.450
15	4.510		33	4.440
106	4.510		38	4.440
118	4.510		20	4.430
136	4.510		23	4.390
3	4.504		39	4.390
7	4.500		119	4.390
21	4.500		107	4.380
104	4.500		18	4.350
109	4.500		24	4.320
124	4.500		40	3.890 UNUSED
126	4.500		121	2.830 UNUSED

UNUSED: DATA UNUSED IN RUN 2

PH
SAMPLE NO.: G4
THEORETICAL VALUE 4.187
UNIT: PH UNITS

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 4.208
MEDIAN: 4.230
STANDARD DEVIATON: 0.149
REL. ST. DEVIATION (%): 3.534

RUN 2:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 4.234
MEDIAN: 4.230
STANDARD DEVIATON: 0.066
REL. ST. DEVIATION (%): 1.557

RESULTS IN DECREASING ORDER:

113	4.420		16	4.230
115	4.390		111	4.230
10	4.360		1	4.220
19	4.350		11	4.220
133	4.330		22	4.220
17	4.300		26	4.220
14	4.290		38	4.220
36	4.280		116	4.220
31	4.270		136	4.220
35	4.270		5	4.210
112	4.270		6	4.210
117	4.270		114	4.210
13	4.260		131	4.210
104	4.260		12	4.200
105	4.260		30	4.200
118	4.260		124	4.200
3	4.253		33	4.190
15	4.240		39	4.180
21	4.240		135	4.180
27	4.240		20	4.160
106	4.240		23	4.150
109	4.240		107	4.130
126	4.240		119	4.130
130	4.240		18	4.110
34	4.233		24	4.030
4	4.230		40	3.680 UNUSED
7	4.230		121	3.410 UNUSED

UNUSED: DATA UNUSED IN RUN 2

Table 22: Analytical results for strong acid calculated from pH.

STRONG ACID CALCULATED FROM PH
SAMPLE NO.: G1
THEORETICAL VALUE 75.000
UNIT: µeq/l

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 68.658
MEDIAN: 66.069
STANDARD DEVIATON: 19.513
REL. ST. DEVIATION (%): 28.420

RUN 2:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 66.440
MEDIAN: 66.069
STANDARD DEVIATON: 10.831
REL. ST. DEVIATION (%): 16.302

RESULTS IN DECREASING ORDER:

40	186.209 UNUSED	33	66.069
18	97.724	106	66.069
24	89.125	133	66.069
121	89.125	34	65.766
107	85.114	7	64.565
23	81.283	13	64.565
20	77.625	15	64.565
119	75.858	104	64.565
130	75.858	112	64.565
5	72.444	114	64.565
12	72.444	118	64.565
30	72.444	35	63.096
11	70.795	124	63.096
16	70.795	3	62.951
38	70.795	22	61.660
105	70.795	36	61.660
136	70.795	126	61.660
1	69.183	14	58.884
6	69.183	111	58.884
26	69.183	17	57.544
39	69.183	109	54.954
131	69.183	116	53.703
135	67.608	10	48.978
31	67.298	19	47.863
4	66.069	113	45.709
21	66.069	117	44.668
27	66.069	115	38.019

"UNUSED": DATA UNUSED IN RUN 2

STRONG ACID CALCULATED FROM PH
SAMPLE NO.: G2
THEORETICAL VALUE 30.000
UNIT: µeq/l

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 39.954
MEDIAN: 27.638
STANDARD DEVIATON: 83.182
REL. ST. DEVIATION (%): 208.195

RUN 2:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 28.803
MEDIAN: 27.542
STANDARD DEVIATON: 14.439
REL. ST. DEVIATION (%): 50.131

RESULTS IN DECREASING ORDER:

121	630.957 UNUSED	27	27.542
40	120.226	31	27.542
117	45.709	109	27.542
18	39.811	4	26.915
107	37.154	21	26.915
23	36.308	130	26.915
24	34.674	7	26.303
33	33.113	118	26.303
38	32.359	126	26.303
119	32.359	34	26.182
20	31.623	13	25.704
6	30.903	15	25.704
16	30.903	106	25.119
135	30.903	124	25.119
114	30.200	22	24.547
12	29.512	17	23.442
30	29.512	111	23.442
5	28.840	35	22.909
11	28.840	14	22.387
26	28.840	10	21.878
39	28.840	112	21.380
105	28.840	116	20.417
1	28.184	133	18.621
104	28.184	115	17.783
131	28.184	19	17.378
136	28.184	36	11.220
3	27.733	113	1.096

"UNUSED": DATA UNUSED IN RUN 2

STRONG ACID CALCULATED FROM PH
SAMPLE NO.: G3
THEORETICAL VALUE 35.000
UNIT: µeq/l

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 60.623
MEDIAN: 31.991
STANDARD DEVIATON: 197.210
REL. ST. DEVIATION (%): 325.305

RUN 2:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 33.859
MEDIAN: 31.623
STANDARD DEVIATON: 14.680
REL. ST. DEVIATION (%): 43.355

RESULTS IN DECREASING ORDER:

121	1479.108 UNUSED	7	31.623
40	128.825	21	31.623
24	47.863	104	31.623
18	44.668	109	31.623
107	41.687	124	31.623
23	40.738	126	31.623
39	40.738	3	31.333
119	40.738	4	30.903
20	37.154	13	30.903
33	36.308	15	30.903
38	36.308	106	30.903
6	35.481	118	30.903
31	35.481	136	30.903
105	35.481	111	30.200
135	35.481	116	30.200
30	34.674	22	29.512
130	34.674	35	29.512
12	33.884	112	29.512
114	33.884	133	29.512
5	33.113	117	27.542
11	33.113	17	26.915
16	33.113	14	26.303
26	33.113	10	24.547
131	33.113	115	20.893
34	32.434	19	19.953
1	32.359	36	13.490
27	32.359	113	13.183

"UNUSED": DATA UNUSED IN RUN 2

STRONG ACID CALCULATED FROM PH
SAMPLE NO.: G4
THEORETICAL VALUE 65.000
UNIT: µeq/l

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 67.900
MEDIAN: 58.884
STANDARD DEVIATON: 49.778
REL. ST. DEVIATION (%): 73.310

RUN 2:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 59.012
MEDIAN: 58.884
STANDARD DEVIATON: 9.069
REL. ST. DEVIATION (%): 15.367

RESULTS IN DECREASING ORDER:

121	389.045 UNUSED	16	58.884
40	208.930 UNUSED	111	58.884
24	93.325	34	58.479
18	77.625	15	57.544
107	74.131	21	57.544
119	74.131	27	57.544
23	70.795	106	57.544
20	69.183	109	57.544
39	66.069	126	57.544
135	66.069	130	57.544
33	64.565	3	55.847
12	63.096	13	54.954
30	63.096	104	54.954
124	63.096	105	54.954
5	61.660	118	54.954
6	61.660	31	53.703
114	61.660	35	53.703
131	61.660	112	53.703
1	60.256	117	53.703
11	60.256	36	52.481
22	60.256	14	51.286
26	60.256	17	50.119
38	60.256	133	46.774
116	60.256	19	44.668
136	60.256	10	43.652
4	58.884	115	40.738
7	58.884	113	38.019

"UNUSED": DATA UNUSED IN RUN 2

Table 23: Analytical results for strong acid in precipitations samples.

STRONG ACIDS SAMPLE NO.: G1 THEORETICAL VALUE 75. UNIT: µeq/l RUN 1: NUMBER OF LABORATORIES: 6 ARITHMETIC MEAN VALUE: 93.533 MEDIAN: 77.600 STANDARD DEVIATON: 40.316 REL. ST. DEVIATION (%): 43.103 RUN 2: NUMBER OF LABORATORIES: 6 ARITHMETIC MEAN VALUE: 93.533 MEDIAN: 77.600 STANDARD DEVIATON: 40.316 REL. ST. DEVIATION (%): 43.103 RESULTS IN DECREASING ORDER: 126 165.000 14 72.200 124 115.000 105 71.000 6 83.000 109 55.000 UNUSED: DATA UNUSED IN RUN 2	STRONG ACIDS SAMPLE NO.: G2 THEORETICAL VALUE 30. UNIT: µeq/l RUN 1: NUMBER OF LABORATORIES: 6 ARITHMETIC MEAN VALUE: 34.350 MEDIAN: 28.550 STANDARD DEVIATON: 25.251 REL. ST. DEVIATION (%): 73.511 RUN 2: NUMBER OF LABORATORIES: 6 ARITHMETIC MEAN VALUE: 34.350 MEDIAN: 28.550 STANDARD DEVIATON: 25.251 REL. ST. DEVIATION (%): 73.511 RESULTS IN DECREASING ORDER: 124 80.000 14 28.100 6 38.000 109 28.000 105 29.000 126 3.000 UNUSED: DATA UNUSED IN RUN 2
STRONG ACIDS SAMPLE NO.: G3 THEORETICAL VALUE 35. UNIT: µeq/l RUN 1: NUMBER OF LABORATORIES: 6 ARITHMETIC MEAN VALUE: 39.750 MEDIAN: 33.750 STANDARD DEVIATON: 15.811 REL. ST. DEVIATION (%): 39.775 RUN 2: NUMBER OF LABORATORIES: 6 ARITHMETIC MEAN VALUE: 39.750 MEDIAN: 33.750 STANDARD DEVIATON: 15.811 REL. ST. DEVIATION (%): 39.775 RESULTS IN DECREASING ORDER: 124 70.000 14 32.500 6 43.000 109 32.000 105 35.000 126 26.000 UNUSED: DATA UNUSED IN RUN 2	STRONG ACIDS SAMPLE NO.: G4 THEORETICAL VALUE 65. UNIT: µeq/l RUN 1: NUMBER OF LABORATORIES: 6 ARITHMETIC MEAN VALUE: 69.750 MEDIAN: 64.750 STANDARD DEVIATON: 18.220 REL. ST. DEVIATION (%): 26.122 RUN 2: NUMBER OF LABORATORIES: 6 ARITHMETIC MEAN VALUE: 69.750 MEDIAN: 64.750 STANDARD DEVIATON: 18.220 REL. ST. DEVIATION (%): 26.122 RESULTS IN DECREASING ORDER: 124 105.000 14 62.500 6 71.000 109 58.000 126 67.000 105 55.000 UNUSED: DATA UNUSED IN RUN 2

Table 24: Analytical results for chloride in precipitations samples.

CHLORIDE
SAMPLE NO.: G1
THEORETICAL VALUE 0.203
UNIT: µg Cl/ml

RUN 1:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 0.214
MEDIAN: 0.200
STANDARD DEVIATON: 0.083
REL. ST. DEVIATION (%): 38.790

RUN 2:
NUMBER OF LABORATORIES: 48
ARITHMETIC MEAN VALUE: 0.207
MEDIAN: 0.200
STANDARD DEVIATON: 0.060
REL. ST. DEVIATION (%): 29.153

RESULTS IN DECREASING ORDER:

33	0.483 UNUSED	124	0.200	
130	0.480 UNUSED	31	0.199	
38	0.380	36	0.199	
115	0.380	14	0.198	
112	< 0.370			
133	0.354			
19	< 0.310	27	0.198	
119	0.300	8	0.197	
121	0.282	13	0.197	
40	0.274	134	0.195	
109	< 0.250			
131	0.244	34	0.193	
10	0.240	6	0.192	
11	0.233	35	0.185	
105	0.233	7	0.182	
111	0.223	39	0.181	
12	0.220	30	0.180	
135	0.220	3	0.176	
4	0.217	136	0.175	
16	0.217	1	0.170	
23	0.209	18	0.154	
20	0.208	117	0.150	
17	0.207	116	0.140	
21	0.206	118	0.140	
5	0.204	126	0.130	
26	0.202	107	0.092	
15	0.200	24	0.050	
104	0.200	22	0.043 UNUSED	
114	0.200			

UNUSED: DATA UNUSED IN RUN 2

CHLORIDE
SAMPLE NO.: G2
THEORETICAL VALUE 0.261
UNIT: µg Cl/ml

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 0.261
MEDIAN: 0.255
STANDARD DEVIATON: 0.084
REL. ST. DEVIATION (%): 32.047

RUN 2:
NUMBER OF LABORATORIES: 49
ARITHMETIC MEAN VALUE: 0.246
MEDIAN: 0.252
STANDARD DEVIATON: 0.054
REL. ST. DEVIATION (%): 22.091

RESULTS IN DECREASING ORDER:

33	0.578 UNUSED	20	0.254	
130	0.530 UNUSED	14	0.252	
38	0.440 UNUSED	13	0.250	
115	0.420	15	0.250	
112	< 0.370			
119	0.330	133	0.249	
121	0.320	6	0.247	
131	0.316	36	0.247	
19	< 0.310			
10	0.303	34	0.242	
104	0.293	30	0.240	
40	0.286	114	0.240	
12	0.280	35	0.239	
111	0.278	18	0.231	
31	0.276	7	0.230	
105	0.275	39	0.230	
11	0.273	136	0.226	
135	0.270	3	0.223	
4	0.267	1	0.220	
21	0.267	118	0.200	
5	0.264	117	0.195	
17	0.263	116	0.193	
16	0.261	22	0.177	
134	0.260	126	0.170	
23	0.258	24	0.150	
26	0.258	107	0.149	
8	0.255	109	0.110	
27	0.255	124	0.100	

UNUSED: DATA UNUSED IN RUN 2

CHLORIDE
SAMPLE NO.: G3
THEORETICAL VALUE 0.753
UNIT: µg Cl/ml

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 0.725
MEDIAN: 0.731
STANDARD DEVIATON: 0.093
REL. ST. DEVIATION (%): 12.803

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 0.720
MEDIAN: 0.731
STANDARD DEVIATON: 0.063
REL. ST. DEVIATION (%): 8.803

RESULTS IN DECREASING ORDER:

33	1.040 UNUSED	39	0.731	
133	0.987 UNUSED	112	0.730	
130	0.890	135	0.730	
115	0.840	8	0.724	
18	0.799	6	0.718	
38	0.790	105	0.718	
134	0.790	7	0.717	
4	0.789	34	0.716	
11	0.786	104	0.715	
12	0.770	121	0.708	
119	0.770	3	0.702	
17	0.766	20	0.691	
23	0.758	111	0.691	
131	0.758	136	0.688	
14	0.752	16	0.687	
27	0.752	19	0.686	
30	0.750	109	0.670	
26	0.747	1	0.660	
21	0.745	118	0.640	
5	0.743	117	0.635	
10	0.743	22	0.629	
15	0.740	107	0.615	
114	0.740	124	0.600	
31	0.739	126	0.600	
35	0.735	116	0.591	
36	0.732	40	0.562	
13	0.731	24	0.430 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

CHLORIDE
SAMPLE NO.: G4
THEORETICAL VALUE 0.637
UNIT: µg Cl/ml

RUN 1:
NUMBER OF LABORATORIES: 54
ARITHMETIC MEAN VALUE: 0.611
MEDIAN: 0.620
STANDARD DEVIATON: 0.089
REL. ST. DEVIATION (%): 14.546

RUN 2:
NUMBER OF LABORATORIES: 50
ARITHMETIC MEAN VALUE: 0.611
MEDIAN: 0.620
STANDARD DEVIATON: 0.055
REL. ST. DEVIATION (%): 8.997

RESULTS IN DECREASING ORDER:

33	0.890 UNUSED	30	0.620	
133	0.842 UNUSED	35	0.620	
130	0.750	114	0.620	
115	0.710	5	0.617	
38	0.700	13	0.617	
14	0.674	36	0.613	
11	0.672	8	0.608	
18	0.667	6	0.600	
119	0.660	104	0.597	
12	0.650	7	0.594	
17	0.650	34	0.592	
121	0.647	111	0.590	
105	0.642	16	0.589	
39	0.641	3	0.587	
112	0.640	20	0.576	
23	0.634	19	0.571	
26	0.634	136	0.559	
31	0.632	1	0.550	
27	0.630	40	0.550	
134	0.630	109	0.550	
135	0.630	118	0.540	
10	0.630	124	0.500	
4	0.628	126	0.490	
21	0.623	107	0.486	
131	0.623	116	0.470	
22	0.621	24	0.350 UNUSED	
15	0.620	117	0.345 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

Table 25: Analytical results for sodium in precipitations samples.

SODIUM
SAMPLE NO.: G1
THEORETICAL VALUE 0.427
UNIT: µg Na/ml

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 0.426
MEDIAN: 0.419
STANDARD DEVIATON: 0.053
REL. ST. DEVIATION (%): 12.321

RUN 2:
NUMBER OF LABORATORIES: 48
ARITHMETIC MEAN VALUE: 0.426
MEDIAN: 0.419
STANDARD DEVIATON: 0.034
REL. ST. DEVIATION (%): 8.083

RESULTS IN DECREASING ORDER:

130	0.600 UNUSED	8	0.419	
136	0.550 UNUSED	31	0.417	
105	0.520	16	0.416	
116	0.519	13	0.415	
124	0.500	14	0.415	
107	0.493	104	0.414	
4	0.491	6	0.410	
115	0.480	15	0.410	
17	0.453	38	0.410	
118	0.450	112	0.410	
19	0.449	119	0.410	
20	0.444	131	0.410	
114	0.440	23	0.408	
121	0.440	24	0.408	
21	0.430	35	0.405	
5	0.427	1	0.400	
26	0.427	11	0.400	
7	0.426	117	0.400	
36	0.426	133	0.400	
3	0.424	135	0.400	
39	0.424	22	0.397	
34	0.423	109	0.380	
27	0.422	126	0.380	
12	0.420	111	0.344	
30	0.420	10	0.310 UNUSED	
33	0.420	40	0.265 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

SODIUM
SAMPLE NO.: G2
THEORETICAL VALUE 0.384
UNIT: µg Na/ml

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 0.377
MEDIAN: 0.376
STANDARD DEVIATON: 0.045
REL. ST. DEVIATION (%): 12.079

RUN 2:
NUMBER OF LABORATORIES: 48
ARITHMETIC MEAN VALUE: 0.377
MEDIAN: 0.376
STANDARD DEVIATON: 0.029
REL. ST. DEVIATION (%): 7.799

RESULTS IN DECREASING ORDER:

130	0.520 UNUSED	27	0.376	
116	0.487 UNUSED	24	0.371	
107	0.459	12	0.370	
136	0.456	15	0.370	
115	0.420	16	0.370	
4	0.413	105	0.370	
17	0.410	13	0.368	
20	0.408	23	0.368	
19	0.403	35	0.366	
131	0.403	6	0.365	
121	0.400	104	0.365	
124	0.400	1	0.360	
21	0.395	38	0.360	
34	0.392	112	0.360	
118	0.390	117	0.360	
8	0.386	119	0.360	
5	0.385	22	0.357	
7	0.385	33	0.350	
39	0.384	109	0.350	
26	0.382	135	0.340	
36	0.382	126	0.330	
30	0.380	11	0.320	
114	0.380	133	0.320	
3	0.379	111	0.308	
31	0.377	10	0.260 UNUSED	
14	0.376	40	0.240 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

SODIUM
SAMPLE NO.: G3
THEORETICAL VALUE 0.649
UNIT: µg Na/ml

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 0.637
MEDIAN: 0.636
STANDARD DEVIATON: 0.071
REL. ST. DEVIATION (%): 11.204

RUN 2:
NUMBER OF LABORATORIES: 48
ARITHMETIC MEAN VALUE: 0.637
MEDIAN: 0.636
STANDARD DEVIATON: 0.043
REL. ST. DEVIATION (%): 6.700

RESULTS IN DECREASING ORDER:

136	0.877 UNUSED	27	0.636	
130	0.820 UNUSED	16	0.632	
20	0.747	23	0.632	
115	0.720	15	0.630	
107	0.717	119	0.630	
124	0.700	6	0.628	
4	0.697	35	0.628	
34	0.681	22	0.626	
17	0.670	31	0.624	
118	0.670	1	0.620	
19	0.667	33	0.620	
13	0.665	112	0.620	
7	0.651	116	0.620	
26	0.651	24	0.619	
5	0.650	104	0.619	
30	0.650	117	0.605	
105	0.650	11	0.600	
121	0.650	38	0.600	
36	0.649	135	0.600	
21	0.647	131	0.596	
3	0.645	109	0.580	
39	0.645	126	0.580	
14	0.641	133	0.520	
12	0.640	111	0.511	
114	0.640	10	0.480 UNUSED	
8	0.636	40	0.395 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

SODIUM
SAMPLE NO.: G4
THEORETICAL VALUE 0.682
UNIT: µg Na/ml

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 0.662
MEDIAN: 0.660
STANDARD DEVIATON: 0.068
REL. ST. DEVIATION (%): 10.343

RUN 2:
NUMBER OF LABORATORIES: 48
ARITHMETIC MEAN VALUE: 0.661
MEDIAN: 0.660
STANDARD DEVIATON: 0.038
REL. ST. DEVIATION (%): 5.782

RESULTS IN DECREASING ORDER:

136	0.896 UNUSED	15	0.660	
130	0.850 UNUSED	121	0.660	
115	0.770	23	0.659	
20	0.761	27	0.657	
107	0.745	35	0.657	
17	0.705	8	0.656	
124	0.700	16	0.655	
4	0.690	104	0.652	
13	0.681	112	0.650	
105	0.680	114	0.650	
26	0.679	119	0.650	
19	0.678	31	0.647	
36	0.678	22	0.643	
5	0.677	24	0.641	
34	0.676	1	0.640	
7	0.674	117	0.635	
14	0.673	33	0.630	
21	0.672	11	0.620	
39	0.671	38	0.620	
30	0.670	109	0.620	
118	0.670	133	0.620	
6	0.667	135	0.620	
3	0.665	126	0.600	
116	0.663	111	0.531	
131	0.663	10	0.510 UNUSED	
12	0.660	40	0.423 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

Table 26: Analytical results for magnesium in precipitations samples.

MAGNESIUM
SAMPLE NO.: G1
THEORETICAL VALUE 0.093
UNIT: µg Mg/ml

RUN 1:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 0.095
MEDIAN: 0.093
STANDARD DEVIATON: 0.014
REL. ST. DEVIATION (%): 14.860

RUN 2:
NUMBER OF LABORATORIES: 49
ARITHMETIC MEAN VALUE: 0.094
MEDIAN: 0.093
STANDARD DEVIATON: 0.008
REL. ST. DEVIATION (%): 8.675

RESULTS IN DECREASING ORDER:

119	< 0.150			
136	0.141	UNUSED	19	0.093
105	0.130	UNUSED	21	0.093
20	0.124	UNUSED	35	0.093
135	0.120		111	0.093
34	0.110		23	0.092
130	0.110		24	0.092
116	0.105		36	0.092
40	0.104		104	0.092
131	0.102		113	0.092
133	0.101		39	0.091
11	0.100		1	0.090
17	0.100		12	0.090
107	0.100		15	0.090
114	0.100		30	0.090
124	0.100		38	0.090
			109	0.090
118	0.099		112	0.090
26	0.097		13	0.089
31	0.097		27	0.088
3	0.096		117	0.088
14	0.096		22	0.085
7	0.095		121	0.085
5	0.094		10	0.080
8	0.094		126	0.080
16	0.094		6	0.069
33	0.094		115	0.040 UNUSED
4	0.093			

UNUSED: DATA UNUSED IN RUN 2

MAGNESIUM
SAMPLE NO.: G2
THEORETICAL VALUE 0.155
UNIT: µg Mg/ml

RUN 1:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 0.156
MEDIAN: 0.153
STANDARD DEVIATON: 0.015
REL. ST. DEVIATION (%): 9.680

RUN 2:
NUMBER OF LABORATORIES: 48
ARITHMETIC MEAN VALUE: 0.153
MEDIAN: 0.152
STANDARD DEVIATON: 0.010
REL. ST. DEVIATION (%): 6.271

RESULTS IN DECREASING ORDER:

124	0.200	UNUSED	16	0.152
136	0.195	UNUSED	22	0.152
105	0.190	UNUSED	24	0.152
135	0.190	UNUSED	36	0.152
130	0.180		39	0.152
20	0.172		1	0.150
133	0.168		11	0.150
107	0.166		15	0.150
131	0.166		30	0.150
17	0.165		104	0.150
116	0.165		109	0.150
7	0.162		112	0.150
31	0.160		119	0.150
35	0.160		121	0.150
114	0.160		27	0.148
8	0.159		33	0.147
26	0.159		113	0.144
5	0.157		111	0.143
3	0.156		117	0.143
34	0.156		4	0.142
12	0.155		38	0.140
14	0.155		126	0.140
21	0.155		6	0.138
108	0.155		40	0.133
19	0.154		10	0.130
13	0.153		115	0.120 UNUSED
23	0.153			

MAGNESIUM
SAMPLE NO.: G3
THEORETICAL VALUE 0.186
UNIT: µg Mg/ml

RUN 1:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 0.184
MEDIAN: 0.184
STANDARD DEVIATON: 0.031
REL. ST. DEVIATION (%): 17.115

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 0.185
MEDIAN: 0.184
STANDARD DEVIATON: 0.016
REL. ST. DEVIATION (%): 8.776

RESULTS IN DECREASING ORDER:

34	0.287	UNUSED	39	0.183
135	0.230		116	0.183
136	0.228		22	0.182
105	0.220		33	0.182
130	0.210		104	0.182
17	0.200		1	0.180
20	0.200		11	0.180
124	0.200		15	0.180
107	0.198		24	0.180
133	0.198		30	0.180
131	0.196		109	0.180
31	0.194		112	0.180
7	0.192		126	0.180
35	0.192		27	0.176
8	0.189		113	0.176
26	0.189		6	0.171
5	0.188		111	0.171
14	0.188		38	0.170
3	0.186		114	0.170
12	0.186		117	0.170
13	0.186		119	0.170
21	0.186		4	0.167
19	0.185		40	0.165
118	0.185		10	0.160
16	0.184		115	0.130
23	0.184		121	0.018 UNUSED
36	0.184			

UNUSED: DATA UNUSED IN RUN 2

MAGNESIUM
SAMPLE NO.: G4
THEORETICAL VALUE 0.108
UNIT: µg Mg/ml

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 0.107
MEDIAN: 0.107
STANDARD DEVIATON: 0.014
REL. ST. DEVIATION (%): 12.739

RUN 2:
NUMBER OF LABORATORIES: 48
ARITHMETIC MEAN VALUE: 0.106
MEDIAN: 0.106
STANDARD DEVIATON: 0.008
REL. ST. DEVIATION (%): 7.685

RESULTS IN DECREASING ORDER:

119	< 0.150			
105	0.150	UNUSED	118	0.107
136	0.145	UNUSED	34	0.106
20	0.137	UNUSED	39	0.106
135	0.130		40	0.106
131	0.124		104	0.106
116	0.122		12	0.105
130	0.120		36	0.105
107	0.118		113	0.103
17	0.113		14	0.102
26	0.112		27	0.102
31	0.112		4	0.101
5	0.111		1	0.100
11	0.110		30	0.100
112	0.110		38	0.100
133	0.110		109	0.100
8	0.109		114	0.100
13	0.109		117	0.100
35	0.109		121	0.100
3	0.108		124	0.100
7	0.108		126	0.100
16	0.108			
23	0.108		111	0.099
33	0.108		22	0.093
19	0.107		10	0.090
21	0.107		6	0.084
24	0.107		115	0.060 UNUSED

UNUSED: DATA UNUSED IN RUN 2

Table 27: Analytical results for calcium in precipitations samples.

CALCIUM
SAMPLE NO.: G1
THEORETICAL VALUE 0.230
UNIT: µg Ca/ml

RUN 1:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 0.245
MEDIAN: 0.230
STANDARD DEVIATON: 0.060
REL. ST. DEVIATION (%): 24.472

RUN 2:
NUMBER OF LABORATORIES: 50
ARITHMETIC MEAN VALUE: 0.234
MEDIAN: 0.228
STANDARD DEVIATON: 0.034
REL. ST. DEVIATION (%): 14.680

RESULTS IN DECREASING ORDER:

105	0.530 UNUSED		5	0.228
130	0.400 UNUSED		31	0.228
116	0.378 UNUSED		4	0.227
114	0.340		23	0.227
136	0.336		3	0.226
118	0.310		16	0.226
20	0.292		14	0.225
131	0.272		24	0.223
121	0.270		111	0.223
17	0.260		13	0.222
133	0.258		26	0.221
6	0.256		15	0.220
19	0.253		113	0.220
30	0.250		119	0.220
115	0.250		107	0.218
21	0.240		1	0.210
34	0.240		12	0.210
109	0.240		135	0.210
112	0.240		104	0.209
8	0.239		33	0.207
7	0.236		22	0.205
35	0.236		124	0.200
40	0.236		117	0.190
36	0.231		10	0.180
39	0.231		38	0.170
11	0.230		126	0.160
27	0.230			

UNUSED: DATA UNUSED IN RUN 2

CALCIUM
SAMPLE NO.: G2
THEORETICAL VALUE 0.335
UNIT: µg Ca/ml

RUN 1:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 0.364
MEDIAN: 0.330
STANDARD DEVIATON: 0.169
REL. ST. DEVIATION (%): 46.520

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 0.332
MEDIAN: 0.330
STANDARD DEVIATON: 0.047
REL. ST. DEVIATION (%): 14.266

RESULTS IN DECREASING ORDER:

34	1.310 UNUSED		105	0.330
115	1.020 UNUSED		7	0.328
130	0.470		16	0.328
116	0.455		23	0.325
22	0.452		3	0.323
136	0.437		26	0.321
6	0.402		4	0.320
17	0.395		11	0.320
13	0.361		119	0.320
109	0.360		24	0.317
112	0.350		1	0.310
118	0.350		12	0.310
121	0.350		133	0.306
19	0.349		111	0.305
35	0.348		15	0.300
8	0.344		114	0.300
39	0.341		124	0.300
20	0.340		135	0.300
21	0.339		104	0.299
36	0.336		40	0.296
5	0.334		117	0.294
27	0.334		113	0.280
14	0.333		33	0.279
31	0.333		10	0.250
107	0.333		38	0.240
131	0.331		126	0.240
30	0.330			

UNUSED: DATA UNUSED IN RUN 2

CALCIUM
SAMPLE NO.: G3
THEORETICAL VALUE 0.383
UNIT: µg Ca/ml

RUN 1:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 0.381
MEDIAN: 0.378
STANDARD DEVIATON: 0.046
REL. ST. DEVIATION (%): 12.030

RUN 2:
NUMBER OF LABORATORIES: 49
ARITHMETIC MEAN VALUE: 0.371
MEDIAN: 0.375
STANDARD DEVIATON: 0.031
REL. ST. DEVIATION (%): 8.411

RESULTS IN DECREASING ORDER:

105	0.510 UNUSED		21	0.376
130	0.510 UNUSED		16	0.375
22	0.503 UNUSED		7	0.371
136	0.479 UNUSED		15	0.370
17	0.455		30	0.370
6	0.450		119	0.370
34	0.427		24	0.368
121	0.400		3	0.367
124	0.400		26	0.365
19	0.393		4	0.363
35	0.393		1	0.360
14	0.392		12	0.360
8	0.391		114	0.360
39	0.391		133	0.357
109	0.390		40	0.356
112	0.390		115	0.350
118	0.390		131	0.350
5	0.389		111	0.349
13	0.384		104	0.346
27	0.381		135	0.340
36	0.381		117	0.334
107	0.381		113	0.330
116	0.381		33	0.327
11	0.380		126	0.310
20	0.380		38	0.300
31	0.380		10	0.290
23	0.378			

UNUSED: DATA UNUSED IN RUN 2

CALCIUM
SAMPLE NO.: G4
THEORETICAL VALUE 0.268
UNIT: µg Ca/ml

RUN 1:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 0.278
MEDIAN: 0.265
STANDARD DEVIATON: 0.066
REL. ST. DEVIATION (%): 23.674

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 0.268
MEDIAN: 0.265
STANDARD DEVIATON: 0.035
REL. ST. DEVIATION (%): 13.211

RESULTS IN DECREASING ORDER:

34	0.635 UNUSED		27	0.265
105	0.450 UNUSED		31	0.263
130	0.400		16	0.262
136	0.357		21	0.262
133	0.340		11	0.260
6	0.317		30	0.260
20	0.314		109	0.260
17	0.305		114	0.260
124	0.300		107	0.259
22	0.294		3	0.256
116	0.290		26	0.252
118	0.290		4	0.250
131	0.288		12	0.250
19	0.284		111	0.244
121	0.280		1	0.240
8	0.273		104	0.240
35	0.273		115	0.240
39	0.272		119	0.240
7	0.270		126	0.240
15	0.270		135	0.240
112	0.270		40	0.236
13	0.268		117	0.232
14	0.267		113	0.230
5	0.266		33	0.218
23	0.266		38	0.210
36	0.266		10	0.190
24	0.265			

UNUSED: DATA UNUSED IN RUN 2

Table 28: Analytical results for potassium in precipitations samples.

POTASSIUM
SAMPLE NO.: G1
THEORETICAL VALUE 0.102
UNIT: µg K/ml

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 0.119
MEDIAN: 0.100
STANDARD DEVIATON: 0.079
REL. ST. DEVIATION (%): 66.173

RUN 2:
NUMBER OF LABORATORIES: 50
ARITHMETIC MEAN VALUE: 0.106
MEDIAN: 0.100
STANDARD DEVIATON: 0.028
REL. ST. DEVIATION (%): 26.137

RESULTS IN DECREASING ORDER:

133	0.600 UNUSED	124	0.100
116	0.318 UNUSED	135	0.100
17	0.193	5	0.099
115	0.190	31	0.099
136	0.186	36	0.099
119 <	0.150		
118	0.140	3	0.098
121	0.140	7	0.098
113	0.130	117	0.098
34	0.125	27	0.097
11	0.120	14	0.096
114	0.120	21	0.095
126	0.120	22	0.095
130	0.120	24	0.095
131	0.118	4	0.093
26	0.111	13	0.092
15	0.110	35	0.092
33	0.110	6	0.090
38	0.110	12	0.090
109	0.110	30	0.090
8	0.101	23	0.089
39	0.101	111	0.088
1	0.100	10	0.084
16	0.100	20	0.084
19	0.100	105	0.060
104	0.100	40	0.053
112	0.100	107	0.051

UNUSED: DATA UNUSED IN RUN 2

POTASSIUM
SAMPLE NO.: G2
THEORETICAL VALUE 0.127
UNIT: µg K/ml

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 0.135
MEDIAN: 0.122
STANDARD DEVIATON: 0.055
REL. ST. DEVIATION (%): 40.525

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 0.128
MEDIAN: 0.122
STANDARD DEVIATON: 0.030
REL. ST. DEVIATION (%): 23.502

RESULTS IN DECREASING ORDER:

116	0.458 UNUSED	27	0.122
17	0.215	35	0.122
121	0.210	1	0.120
133	0.200	12	0.120
136	0.198	33	0.120
126	0.180	113	0.120
131	0.169	5	0.117
119 <	0.150		
34	0.150	20	0.117
115	0.150	24	0.117
118	0.150	117	0.117
22	0.140	13	0.116
109	0.140	14	0.115
114	0.140	16	0.115
26	0.137	104	0.115
31	0.131	4	0.113
15	0.130	6	0.111
38	0.130	23	0.111
112	0.130	11	0.110
130	0.130	30	0.110
3	0.129	135	0.110
36	0.128	111	0.105
8	0.127	124	0.100
39	0.126	10	0.098
7	0.124	105	0.080
19	0.123	107	0.077
21	0.122	40	0.062

UNUSED: DATA UNUSED IN RUN 2

POTASSIUM
SAMPLE NO.: G3
THEORETICAL VALUE 0.280
UNIT: µg K/ml

RUN 1:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 0.288
MEDIAN: 0.270
STANDARD DEVIATON: 0.099
REL. ST. DEVIATION (%): 34.485

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 0.272
MEDIAN: 0.270
STANDARD DEVIATON: 0.038
REL. ST. DEVIATION (%): 13.980

RESULTS IN DECREASING ORDER:

133	0.900 UNUSED	109	0.270
116	0.520 UNUSED	130	0.270
126	0.370	13	0.269
17	0.360	27	0.268
136	0.347	117	0.267
34	0.346	6	0.265
121	0.330	19	0.263
22	0.316	12	0.260
115	0.310	30	0.260
11	0.300	104	0.260
118	0.300	113	0.260
26	0.291	24	0.258
36	0.285	5	0.256
1	0.280	16	0.255
15	0.280	23	0.252
38	0.280	20	0.251
112	0.280	135	0.250
114	0.280	4	0.247
131	0.280	21	0.243
8	0.278	105	0.240
14	0.277	119	0.240
39	0.275	111	0.239
3	0.273	10	0.233
35	0.273	107	0.221
7	0.272	124	0.200
31	0.271	40	0.139
33	0.270		

UNUSED: DATA UNUSED IN RUN 2

POTASSIUM
SAMPLE NO.: G4
THEORETICAL VALUE 0.331
UNIT: µg K/ml

RUN 1:
NUMBER OF LABORATORIES: 53
ARITHMETIC MEAN VALUE: 0.328
MEDIAN: 0.312
STANDARD DEVIATON: 0.081
REL. ST. DEVIATION (%): 24.786

RUN 2:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 0.314
MEDIAN: 0.311
STANDARD DEVIATON: 0.035
REL. ST. DEVIATION (%): 11.042

RESULTS IN DECREASING ORDER:

133	0.800 UNUSED	6	0.311
116	0.555 UNUSED	35	0.311
126	0.400	104	0.311
136	0.399	12	0.310
17	0.393	30	0.310
131	0.364	113	0.310
115	0.360	121	0.310
22	0.346	19	0.307
11	0.340	16	0.305
118	0.340	24	0.305
26	0.337	27	0.304
36	0.334	109	0.300
14	0.331	124	0.300
112	0.330	135	0.300
34	0.329	23	0.297
39	0.327	20	0.292
3	0.326	1	0.290
13	0.325	105	0.290
8	0.323	4	0.287
31	0.322	111	0.284
15	0.320	5	0.281
33	0.320	21	0.276
38	0.320	10	0.271
114	0.320	107	0.270
130	0.320	119	0.270
7	0.313	40	0.183
117	0.312		

UNUSED: DATA UNUSED IN RUN 2

Table 29: Analytical results for conductivity in precipitations samples.

CONDUCTIVITY
SAMPLE NO.: G1
THEORETICAL VALUE 42.400
UNIT: µS/cm

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 39.520
MEDIAN: 40.150
STANDARD DEVIATON: 4.825
REL. ST. DEVIATION (%): 12.210

RUN 2:
NUMBER OF LABORATORIES: 50
ARITHMETIC MEAN VALUE: 39.803
MEDIAN: 40.150
STANDARD DEVIATON: 2.758
REL. ST. DEVIATION (%): 6.930

RESULTS IN DECREASING ORDER:

105	51.300 UNUSED	4	40.100	
22	44.700	130	40.100	
1	44.300	19	40.000	
12	43.600	135	40.000	
23	43.000	13	39.700	
31	42.630	6	39.500	
27	42.600	33	39.500	
21	42.530	126	39.300	
10	42.250	111	39.100	
15	42.000	24	39.000	
104	42.000	35	39.000	
117	42.000	106	39.000	
5	41.800	112	39.000	
107	41.600	118	39.000	
3	41.500	124	39.000	
121	41.400	34	38.400	
16	41.000	116	38.380	
20	40.900	11	37.400	
14	40.800	40	37.000	
30	40.700	115	36.000	
7	40.500	119	35.400	
38	40.500	39	34.900	
131	40.500	18	33.700	
109	40.300	36	33.300	
17	40.250	136	30.800	
114	40.200	133	13.600 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

CONDUCTIVITY
SAMPLE NO.: G2
THEORETICAL VALUE 22.700
UNIT: µS/cm

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 22.068
MEDIAN: 22.200
STANDARD DEVIATON: 2.761
REL. ST. DEVIATION (%): 12.510

RUN 2:
NUMBER OF LABORATORIES: 49
ARITHMETIC MEAN VALUE: 22.242
MEDIAN: 22.200
STANDARD DEVIATON: 1.384
REL. ST. DEVIATION (%): 6.224

RESULTS IN DECREASING ORDER:

117	32.000 UNUSED	135	22.200	
22	25.100	111	22.100	
38	25.100	17	22.000	
105	24.200	24	22.000	
1	24.000	106	22.000	
20	24.000	131	22.000	
23	24.000	6	21.900	
104	23.800	13	21.900	
12	23.600	31	21.900	
27	23.300	19	21.800	
33	23.300	130	21.800	
3	23.220	34	21.600	
10	23.130	115	21.400	
15	23.100	116	21.320	
16	23.000	35	21.090	
114	23.000	118	21.000	
121	22.900	124	21.000	
21	22.890	39	20.900	
5	22.800	11	20.800	
4	22.600	112	20.600	
14	22.500	18	20.330	
107	22.500	40	20.000	
109	22.300	119	19.470	
126	22.300	36	17.700	
7	22.200	136	16.500 UNUSED	
30	22.200	133	9.200 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

CONDUCTIVITY
SAMPLE NO.: G3
THEORETICAL VALUE 30.100
UNIT: µS/cm

RUN 1:
NUMBER OF LABORATORIES: 52
ARITHMETIC MEAN VALUE: 29.146
MEDIAN: 29.350
STANDARD DEVIATON: 2.999
REL. ST. DEVIATION (%): 10.290

RUN 2:
NUMBER OF LABORATORIES: 50
ARITHMETIC MEAN VALUE: 29.204
MEDIAN: 29.350
STANDARD DEVIATON: 1.793
REL. ST. DEVIATION (%): 6.141

RESULTS IN DECREASING ORDER:

24	40.000 UNUSED	4	29.300	
22	33.300	135	29.300	
20	31.700	19	29.200	
1	31.400	7	29.050	
12	31.000	30	29.000	
23	31.000	106	29.000	
27	31.000	117	29.000	
33	31.000	118	29.000	
5	30.900	124	29.000	
38	30.600	130	28.900	
3	30.360	6	28.700	
104	30.300	34	28.700	
10	30.260	112	28.600	
131	30.200	115	28.500	
21	30.160	13	28.400	
15	30.100	17	28.250	
16	30.000	39	28.200	
114	30.000	35	27.950	
121	30.000	11	27.700	
31	29.970	40	27.000	
105	29.900	116	26.740	
14	29.800	18	26.250	
126	29.600	119	26.100	
109	29.500	36	25.600	
111	29.500	136	21.800	
107	29.400	133	15.400 UNUSED	

UNUSED: DATA UNUSED IN RUN 2

CONDUCTIVITY
SAMPLE NO.: G4
THEORETICAL VALUE 38.800
UNIT: µS/cm

RUN 1:
NUMBER OF LABORATORIES: 51
ARITHMETIC MEAN VALUE: 36.435
MEDIAN: 37.000
STANDARD DEVIATON: 4.109
REL. ST. DEVIATION (%): 11.277

RUN 2:
NUMBER OF LABORATORIES: 49
ARITHMETIC MEAN VALUE: 37.112
MEDIAN: 37.050
STANDARD DEVIATON: 1.794
REL. ST. DEVIATION (%): 4.834

RESULTS IN DECREASING ORDER:

105	43.200	24	37.000	
22	40.000	106	37.000	
12	39.500	20	36.900	
33	39.200	104	36.900	
1	39.000	130	36.800	
23	39.000	111	36.700	
3	38.800	13	36.600	
27	38.700	6	36.500	
10	38.650	34	36.500	
21	38.550	36	36.500	
38	38.300	112	36.200	
16	38.000	117	36.000	
5	37.900	118	36.000	
114	37.900	124	36.000	
131	37.900	17	35.900	
121	37.800	31	35.730	
14	37.700	35	35.700	
15	37.700	115	35.000	
107	37.500	11	34.900	
109	37.400	39	34.600	
30	37.300	119	33.300	
126	37.300	40	33.000	
135	37.300	18	32.900	
19	37.200	136	27.500 UNUSED	
7	37.050	133	12.200 UNUSED	
4	37.000			

UNUSED: DATA UNUSED IN RUN 2

Table 30: Ratio of the measured to the calculated conductivity in synthetic precipitation samples (G1-G4).

Lab. No.	Measured value / Calculated value				Remark
	Sample No.				
	G1	G2	G3	G4	
1	1.10	1.10	1.09	1.06	
3	1.10	1.08	1.08	1.11	
4	1.02	1.05	1.02	1.01	
5	1.01	1.02	1.05	1.01	
6	0.98	0.94	0.95	0.98	
7	1.06	1.05	1.02	1.03	
8					Conductivity missing
10	1.30	1.20	1.19	1.28	
11	0.90	0.92	0.92	0.94	
12	1.07	1.06	1.06	1.01	
13	1.01	1.01	0.98	1.00	
14	1.11	1.13	1.11	1.12	
15	1.10	1.11	1.07	1.07	
16	1.01	1.01	1.03	1.05	
17	1.09	1.04	1.01	1.05	
18					Report only SO_4^{2-}, NH^{4+} and Cl^-.
19	1.23	1.22	1.18	1.18	Cl^- values < LOD for G1 and G2
20	0.96	1.05	1.04	0.94	
21	1.08	1.05	1.04	1.07	
22	1.19	1.23	1.19	1.07	
23	0.97	0.97	0.97	0.96	
24					SO_4^{2-} missing
26					Conductivity missing
27	1.09	1.07	1.08	1.08	
30	0.98	0.99	0.97	0.99	
31	1.08	1.01	1.00	1.04	
33	0.99	0.96	1.00	1.01	
34	0.98	0.88	0.96	0.98	
35	1.02	1.03	0.99	1.02	
36	0.88	1.11	1.14	1.07	
38	1.01	1.08	1.07	1.08	
39	0.84	0.91	0.86	0.87	
40					SO_4^{2-} missing
104	1.09	1.09	1.06	1.05	
105	1.23	1.11	1.00	1.23	
106					Report only NH_4^+
107	0.91	0.89	0.92	0.90	
109	1.18	1.06	1.06	1.07	Cl^- < LOD for G1
111	1.08	1.12	1.08	1.03	Cl^- < LOD for G1and G2
112	1.01	1.05	1.00	1.03	
113					Missing cond., Na^+, Cl^- and SO_4^{2-}
114	1.03	1.02	1.02	1.02	
115	1.20	1.03	1.15	1.17	
116	1.03	0.99	0.89	0.00	Conductivity missing for G4
117	1.37	1.10	1.11	1.09	
118	0.98	0.95	0.97	1.01	
119	0.81	0.85	0.80	0.80	
121	0.87	0.10	0.06	0.25	
124	1.04	1.00	1.06	0.97	
126	1.07	1.10	1.06	1.06	
130	0.70	0.70	0.71	0.75	
131	1.01	0.99	1.04	1.01	
133	0.32	0.49	0.51	0.35	
134					Conductivity missing
135	1.00	0.97	0.98	0.96	
136	0.74	0.73	0.74	0.73	

Table 31: Ratio of equivalent concentration of anions to the equivalent concentration of cation measured in synthetic precipitation samples.

Lab. No.	Anions / Cations				Remarks
	G1	G2	G3	G4	
1	1.07	1.05	1.04	1.06	
3	1.09	1.02	1.02	1.06	
4	1.05	1.04	1.07	1.08	
5	1.03	1.04	1.03	1.04	
6	1.01	0.94	0.96	1.00	
7	1.04	1.00	1.00	1.00	
8					pH missing
10	1.30	1.30	1.23	1.31	
11	1.08	1.13	1.11	1.07	
12	1.12	1.06	1.06	0.92	
13	1.04	1.19	1.19	1.19	
14	1.14	1.09	1.07	1.09	
15	1.05	1.05	1.01	1.10	
16	1.02	0.97	0.98	1.01	
17	1.19	1.07	1.08	1.14	
18	1.05	1.32	1.67	1.34	Report only SO_4^{2-}, NH^{4+} and Cl^-.
19	1.19	1.10	1.15	1.18	Cl^- values < LOD for G1 and G2
20	0.85	0.90	0.89	0.81	
21	1.06	1.03	1.04	1.06	
22	1.13	0.93	0.96	1.09	
23	0.98	0.97	0.97	0.97	
24					SO_4^{2-} missing
26	1.02	1.00	1.00	1.01	
27	1.09	1.05	1.05	1.07	
30	1.02	1.01	1.01	1.02	
31	1.07	1.03	1.00	1.07	
33	1.13	1.10	1.07	1.10	
34	1.04	0.68	0.93	0.91	
35	1.11	1.07	1.05	1.10	
36	1.09	1.19	1.16	1.06	
38	1.03	1.05	0.92	0.97	
39	1.09	1.02	0.98	1.04	
40					SO_2^{4-} missing
104	1.07	1.03	1.04	1.09	
105	0.85	0.93	0.87	0.92	
106					Report only NH_4^+
107	0.95	0.91	0.95	0.91	
109	1.05	0.92	0.98	0.97	Cl^- < LOD for G1
111	1.11	1.11	1.06	1.07	Cl^- < LOD for G1and G2
112	1.02	1.04	1.07	1.09	
113					Missing cond., Na^+, Cl^- and SO_4^{2-}
114	1.02	1.00	1.03	1.03	
115	1.42	0.91	1.17	1.22	
116	0.98	0.88	0.95	1.00	
117	1.18	1.07	1.03	0.98	
118	0.96	0.95	0.96	1.03	
119	1.30	1.09	1.13	1.11	
121	0.91	0.15	0.09	0.32	
124	1.07	0.90	0.93	0.90	
126	1.10	1.04	1.04	1.04	
130	1.85	1.81	1.63	2.03	
131	0.99	0.96	1.01	0.97	
133	1.13	1.15	1.08	1.23	
134					Missing pH, Mg^+, Na^+, Ca^{2+}, K^+
135	1.06	1.01	1.00	1.01	
136	0.89	0.90	0.86	0.88	

Table 32: The ratio of the median values to the theoretical values for all parameters and samples.

Parameter	Sample No.	Median / Expected
SO4-S	G1	1.00
	G2	1.00
	G3	1.00
	G4	0.99
NO3-N	G1	1.00
	G2	1.00
	G3	1.00
	G4	0.98
NH4-N	G1	0.98
	G2	0.99
	G3	0.99
	G4	0.98
pH (calc.from H^+)	G1	0.88
	G2	0.93
	G3	0.92
	G4	0.91
H	G1	0.88
	G2	0.93
	G3	0.91
	G4	0.90
Mg	G1	1.00
	G2	0.99
	G3	0.99
	G4	0.99
Na	G1	0.98
	G2	0.98
	G3	0.98
	G4	0.97
Cl	G1	0.99
	G2	0.98
	G3	0.97
	G4	0.97
Ca	G1	1.00
	G2	0.98
	G3	0.99
	G4	0.99
K	G1	0.98
	G2	0.96
	G3	0.96
	G4	0.94
Cond.	G1	0.95
	G2	0.98
	G3	0.98
	G4	0.95

Table 33: Analytical methods used for the determination of chemical constituents in precipitation samples.

Constituents	Methods	Laboratory
SO_4	1. Thorin	18
	2. Ion chromatography	1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 26, 27, 30, 31, 33, 34, 35, 36, 38, 104, 105, 107, 111, 114, 115, 116, 118, 119, 121, 124, 130, 131, 133, 134
	3. Capillary electrophoresis	39
	4. ICP-AES	109, 112, 117
	5. FIA	
	6. Turbidimetry	24
NO_3	1 Griess after Cd-red.	24, 112
	2 Ion chromatography	1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 26, 27, 30, 31, 33, 34, 35, 36, 38, 105, 107, 114, 115, 116, 118, 119, 121, 124, 131, 133, 134
	3 UV-method/Photometric	40, 104, 117
	4 Capillary electrophoresis	39
	5 FIA	109, 111, 113,
NH_4	1 Indophenol	10, 17, 18, 19, 20, 24, 34, 35, 39, 40, 112, 114
	2 Berthelot reaction, salycilate	26,
	3 Ion chromatography	1, 5, 7, 8, 12, 13, 15, 21, 22, 23, 30, 31, 36, 107, 115, 119, 121, 124, 131
	4 Flow injection analysis (FIA)	6, 11, 14, 27, 106, 109, 111, 113, 134
	5 Chloramin T	16
	6 Nessler method	105
	7 Kjeldahl	
	8 Photometry	3, 4, 33, 104, 114, 116, 117, 118, 133
H^+	1 Acidimetric titration	14, 124, 126
	2 Alkali titration to spec. pH	6,
Mg	1 Atomic absorption (AAS)	3, 4, 10, 16, 17, 19, 20, 22, 24, 26, 27, 33, 34, 35, 38, 40, 105,116, 121, 124, 133
	2 Ion chromatography	1, 5, 6, 7, 8, 12, 13, 15, 21, 23, 30, 31, 36, 107, 114, 119, 131
	3 ICP-AES	11, 14, 39, 104, 109, 111, 112, 113, 115, 117, 118
Na	1 AES	33, 38, 112, 133
	2 AAS	3, 4, 10, 16, 17, 19, 20, 24, 26, 27, 34, 35, 40, 105, 116, 124
	3 ICP-AES	11, 14, 39, 104, 109, 111, 115, 117, 118,
	4 Ion chromatography	1, 5, 6, 7, 8, 12, 13, 15, 21, 22, 23, 30, 31, 36, 107, 114, 119, 121, 131
Cl	1 Mercury thiocyanate-iron	18, 24, 40
	2 Ion chromatography	1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 26, 27, 30, 31, 33, 34, 35, 36, 38, 104, 105, 107, 111, 114, 115, 116, 118, 119, 121, 124, 131, 133, 134
	3 Capillary electrophoresis	39
	4 Potensiometric method	109, 112
	5 Photometric method	117,
Ca	1 AAS	3, 4, 8,10, 16, 17, 19, 22, 24, 26, 27, 33, 34, 35, 38, 40, 105, 116, 124, 133
	2 ICP-AES	11, 14, 39, 104, 109, 111, 112, 113, 115, 117, 118
	3 Ion chromatography	1, 5, 6, 7, 8, 12, 15, 20, 23, 31, 36, 107, 114, 119, 121, 131
	4 AES	
K	1 AAS	3, 4, 10, 16, 17, 18, 19, 24, 26, 27, 34, 35, 40, 105, 112, 124
	2 Ion chromatography	1, 5, 6, 7, 8, 12, 13, 15, 20, 21, 22, 23, 30, 31, 36, 107, 114, 119, 121, 126, 131
	3 AES	33, 39, 116, 133?
	4 ICP-AES	11, 14, 104, 109, 111, 113, 115, 117, 118

Table 34: Relative random and systematic errors obtained by the different laboratories in the analysis of each parameter in the precipitation samples.

Lab. No.	SO_4-S		NO_3-N		NH_4-N		H^+ calc		Mg	
	Random error %	Systematic error %	Random error %	Systematic error %	Random error %	Systematic error %	Random error %	Systematic error %	Random error %	Systematic error %
1	0	-1	1	-1	0	1	3	7	2	4
3	0	1	1	5	2	9	8	13	1	0
4	1	0	1	-1	1	0	5	10	6	7
5	1	-1	1	-1	1	2	2	4	1	-1
6	0	1	1	2	5	-8	5	0	3	15
7	2	4	1	4	1	3	6	10	2	-3
8	0	-1	1	0	1	5			1	-1
10	2	1	1	-1	0	4	14	31	4	16
11	3	-1	4	-10	2	0	3	6	4	1
12	1	0	0	0	40	11	2	3	1	1
13	7	-6	3	-1	4	0	5	14	2	1
14	3	0	1	1	0	4	7	22	3	-1
15	1	4	2	4	0	3	5	11	1	4
16	0	2	0	4	4	-3	6	0	1	1
17	1	-7	1	-4	3	11	9	22	3	-6
18	9	-8			17	69	10	-22		
19	2	-1	2	-4	0	9	12	35	0	1
20	5	15	1	-1	1	0	2	-5	5	-17
21	1	-1	1	1	1	-2	5	11	0	0
22	4	-1	5	2	0	3	7	11	4	4
23	1	0	1	1	1	2	0	-12	1	1
24			39	-134	5	19	19	-26	2	1
26	1	2	1	2	1	1	4	6	0	-3
27	0	1	1	0	2	6	5	10	2	5
30	0	0	2	0	2	-1	2	2	2	4
31	1	1	2	1	3	4	9	0	1	-3
32										
33	1	-1	1	1	3	-2	10	-1	3	1
34	1	0	1	1	1	-3	5	10	31	-7
35	0	-2	1	-1	3	0	5	18	2	-2
36	1	1	1	3	1	0	7	31	1	2
37										
38	2	9	11	16	2	4	6	3	4	8
39	2	-6	2	-4	2	-9	64	0	0	2
40			8	-47	5	-1	43	-200	10	8
104	1	1	1	0	1	-2	7	13	1	2
105	1	4	2	11	2	-3	8	5	2	-27
106					1	0	4	12		
107	1	-2	2	-1	2	8	3	-16	2	-8
109	2	8	2	7	3	0	14	11	2	4
111	1	5	1	3	0	1	9	12	5	8
112	1	1	3	-9	0	-7	5	19	2	3
113			1	-3	2	-2	6	55	3	6
114	1	0	1	1	0	0	8	4	7	1
115	3	-2	6	3	2	10	20	37	6	37
116	7	-24	4	24	6	-36	13	14	5	-8
117	2	9	25	5	1	3	37	18	3	7
118	1	-4	3	0	8	-28	5	14	2	0
119	11	-17	1	4	3	16	7	-8	31	40
121	2	-3	3	3	1	7	1139	-902	49	6
124	2	8	4	5	16	5	8	8	16	-8
126	2	3	2	4	2	6	8	11	3	8
130	32	-175	2	-1	11	-11	7	3	4	-15
131	1	2	1	7	1	-1	3	5	2	-8
133	7	-16	7	-1	3	2	10	20	3	-7
134	1	1	1	3	2	12				
135	0	0	2	2	1	1	7	-1	7	-23
136	2	0	3	6	4	1	2	8	3	-30

Table 34, cont.

Lab. No.	Na		Cl		Ca		K		Cond.	
	Random error %	Systematic error %	Random error %	Systematic error %	Random error %	Systematic error %	Random error %	Systematic error %	Random error %	Systematic error %
1	1	5	5	14	1	8	8	2	2	-4
3	1	1	2	9	2	4	2	2	2	0
4	4	-7	4	-2	2	5	7	11	3	4
5	0	0	2	1	1	0	9	8	2	1
6	0	3	2	5	6	-19	2	7	3	6
7	1	0	2	7	2	1	3	3	2	4
8	2	2	2	4	1	-3	2	1		
10	4	27	5	-3	6	27	8	18	1	0
11	3	10	2	-7	2	2	7	0	4	9
12	1	2	1	-4	1	7	3	8	1	-3
13	2	1	1	3	5	0	1	5	2	6
14	0	2	4	1	2	0	2	2	2	2
15	1	3	1	3	5	4	4	-1	2	1
16	1	3	7	5	1	2	5	9	2	1
17	0	-5	1	-2	6	-16	6	40	3	6
18			8	0					8	15
19	2		10	8	2	-5	4	5	2	4
20	6	-10	6	7	9	-8	6	11	4	0
21	2	0	2	1	2	0	10	10	1	0
22	1	5	13	22	19	-24	8	-7	2	-7
23	1	3	1	0	1	1	4	11	1	-2
24	2	5	19	47	2	4	4	8	16	
26	0	0	0	1	1	5	1	-4		
27	2	2	1	1	0	0	4	4	1	-1
30	1	1	2	4	4	2	2	9	1	4
31	2	3	3	1	0	1	2	3	4	1
32										
33	3	6	6	-61	4	17	4	4	5	-1
34	3	0	3	6	130	-68	13	-11	4	6
35	1	4	0	4	1	-3	3	4	2	8
36	0	0	2	4	0	0	2	-1	8	14
37										
38	3	7	13	-26	5	24	4	-1	5	
39	1	1	3	5	1	-2	1	1	7	9
40	9	39	23	7	6	10	19	49	4	13
104	1	5	6	4	2	11	4	8	4	0
105	8	0	6	-2	41	-51	1	20	11	-9
106									3	4
107	1	-13	4	27	1	2	2	26	1	2
109	3	10	11	26	4	-3	9	0	2	3
111	6	21	7	3	4	9	6	15	3	4
112	1	5	23	24	2	-3	1	0	2	7
113					6	15	10	7	3	1
114	3	1	2	3	19	5	6	-3	6	8
115	4	-12	9	-27	96	1	13	-14	46	11
116	10	-7	9	25	20	-23	22	-110	15	2
117	2	7	21	20	2	13	3	6	3	7
118	3	-3	5	17	10	-6	6	-10	5	14
119	1	4	7	-10	2	5			1	2
121	3	-1	11	-7	4	-5	20	-21	3	7
124	4	-6	14	31	9	2	15	14	3	3
126	3	11	7	26	9	24	14	-29	2	5
130	3	-32	14	-44	6	-44	6	2	2	2
131	5	3	6	-5	10	-3	8	-12	19	62
133	8	12	22	-38	14	0	106	-230	2	3
134			4	1					7	29
135	3	9	4	0	3	10	6	11	2	-4
136	12	-31	4	11	2	-33	3	-33	2	0

Appendix 2

Figures

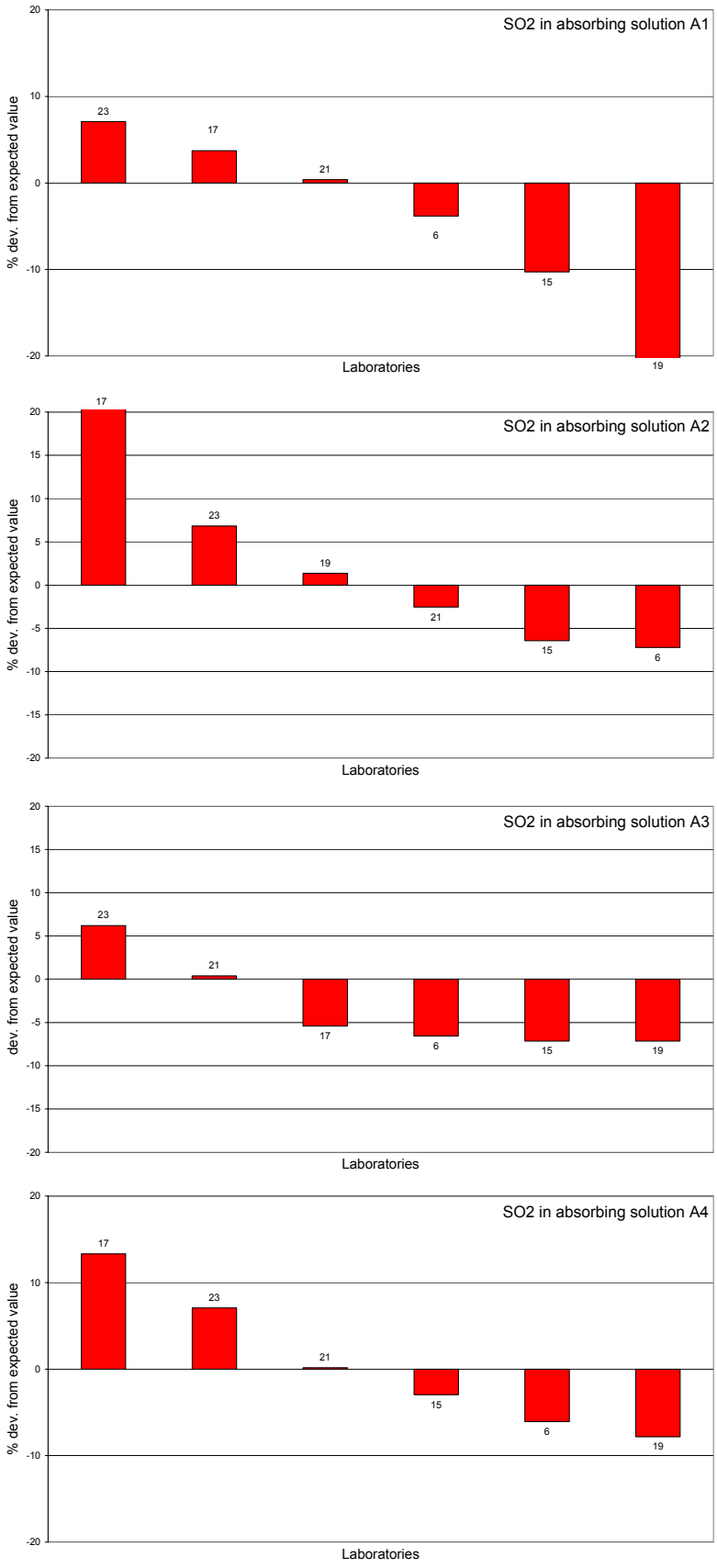


Figure 1: SO_2 in absorbing solution.

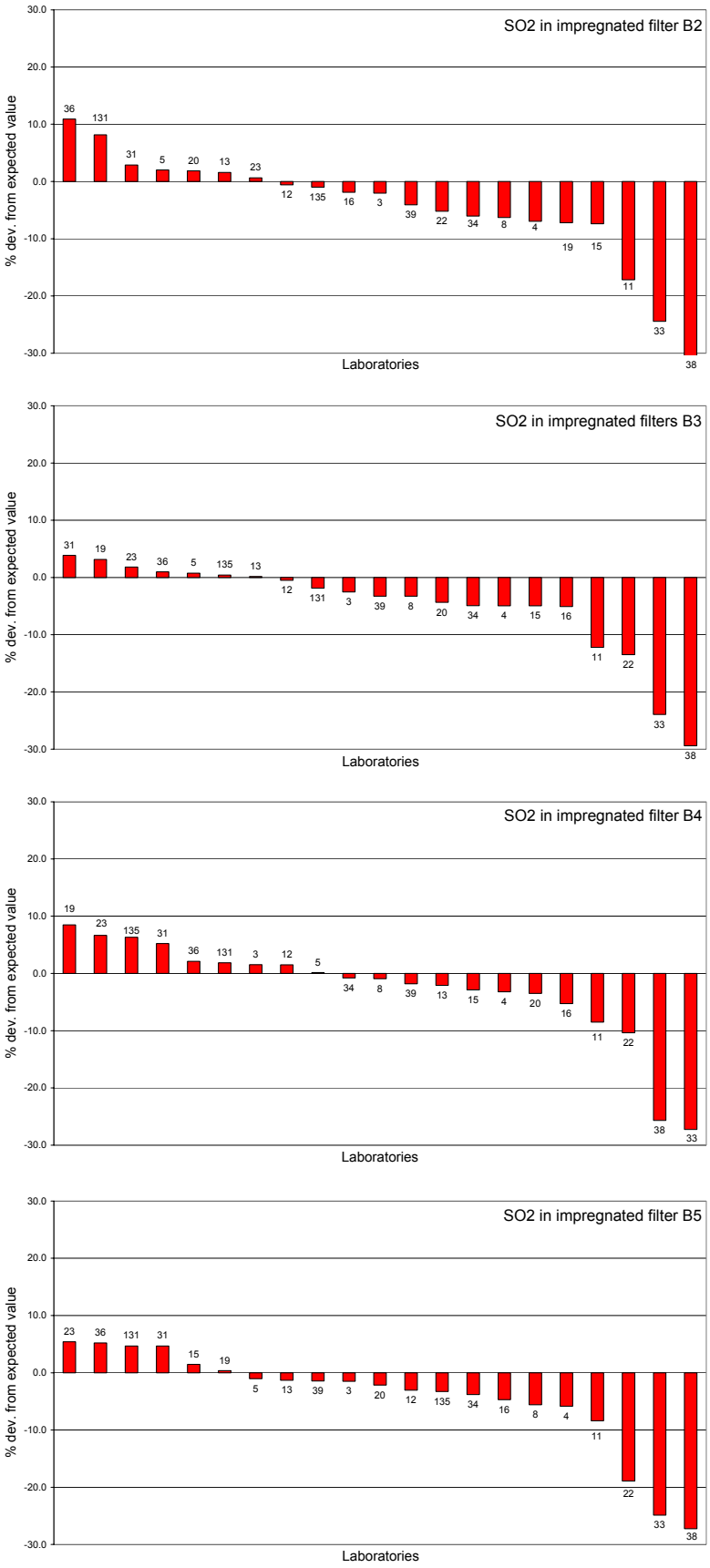


Figure 2: SO_2 in impregnated filter.

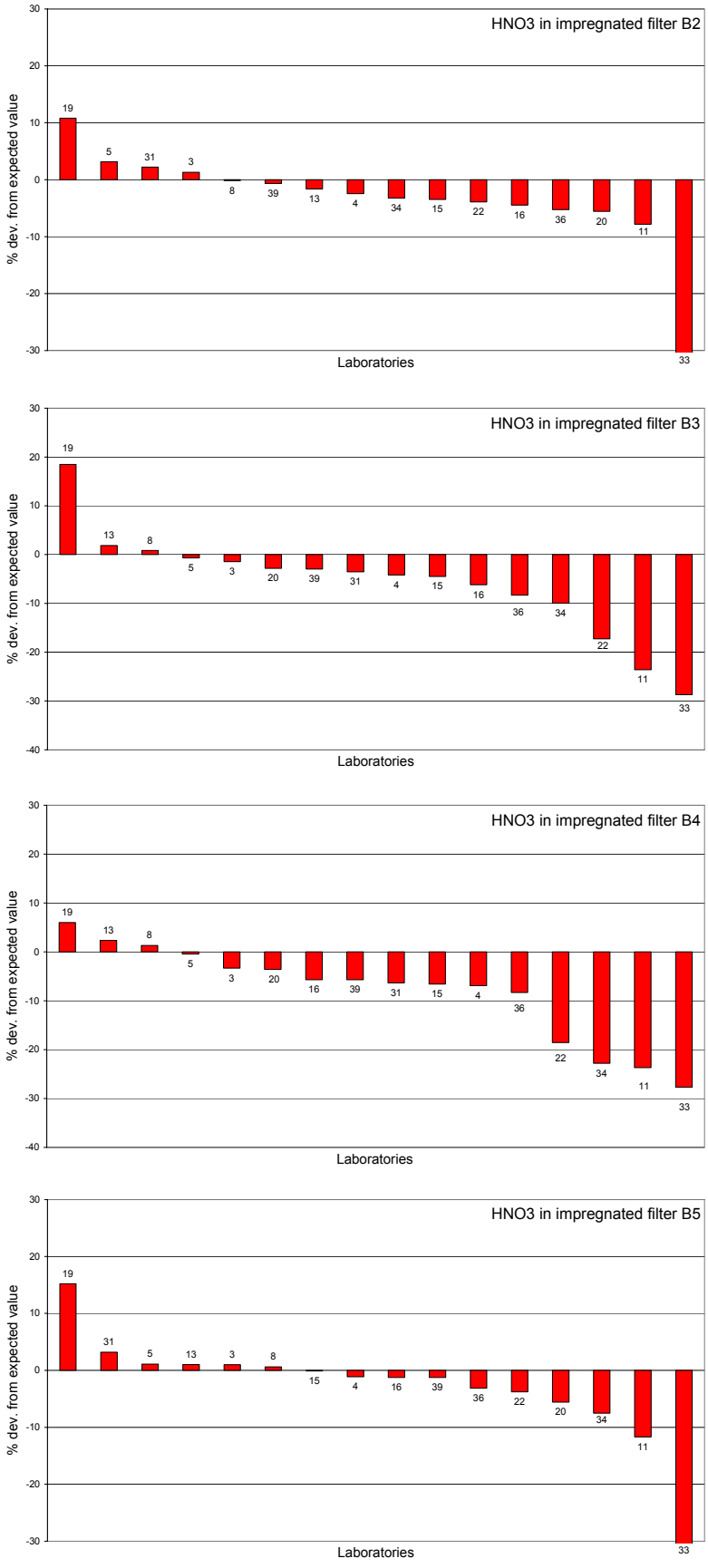


Figure 3: HNO_3 in impregnated filter.

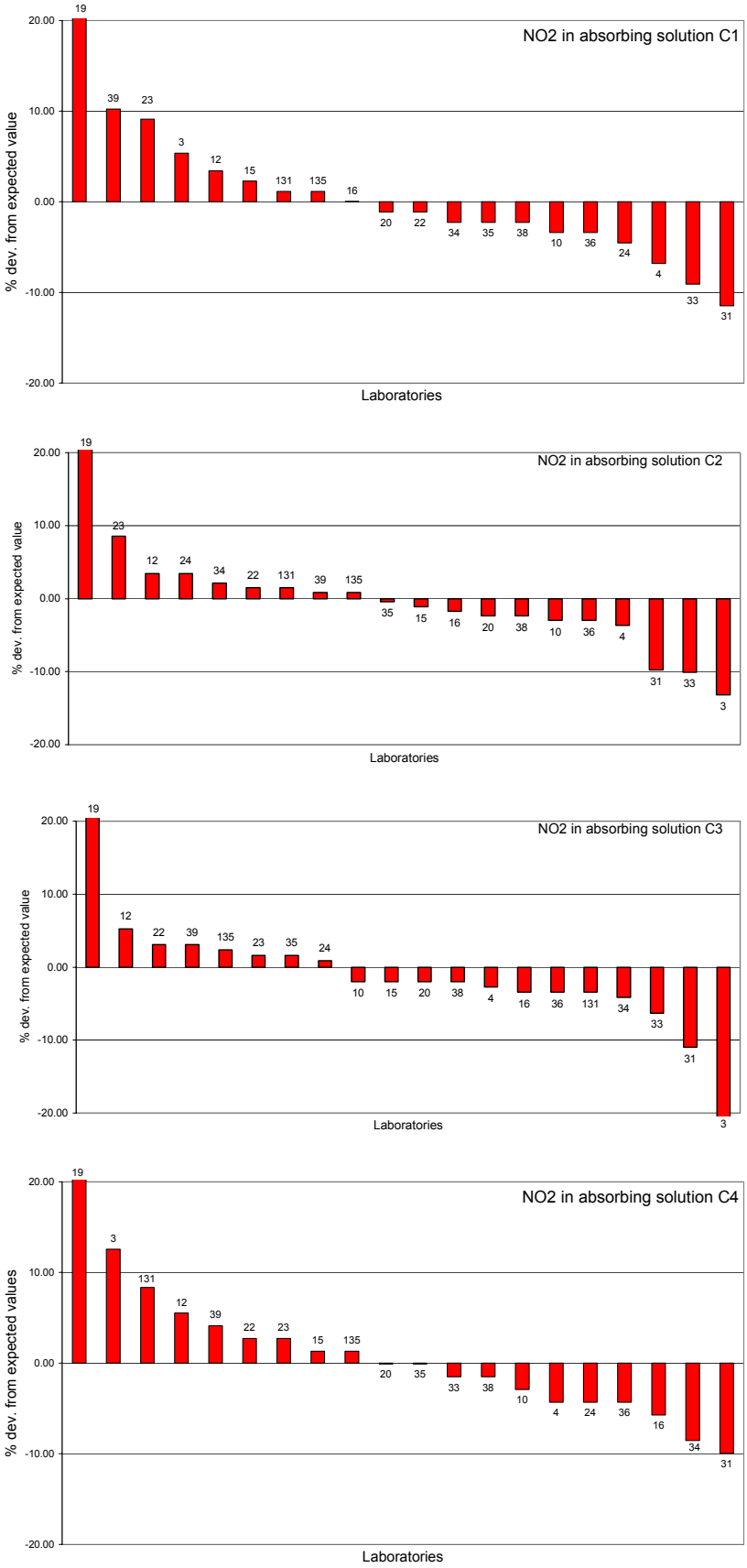


Figure 4: NO_2 in absorbing solution.

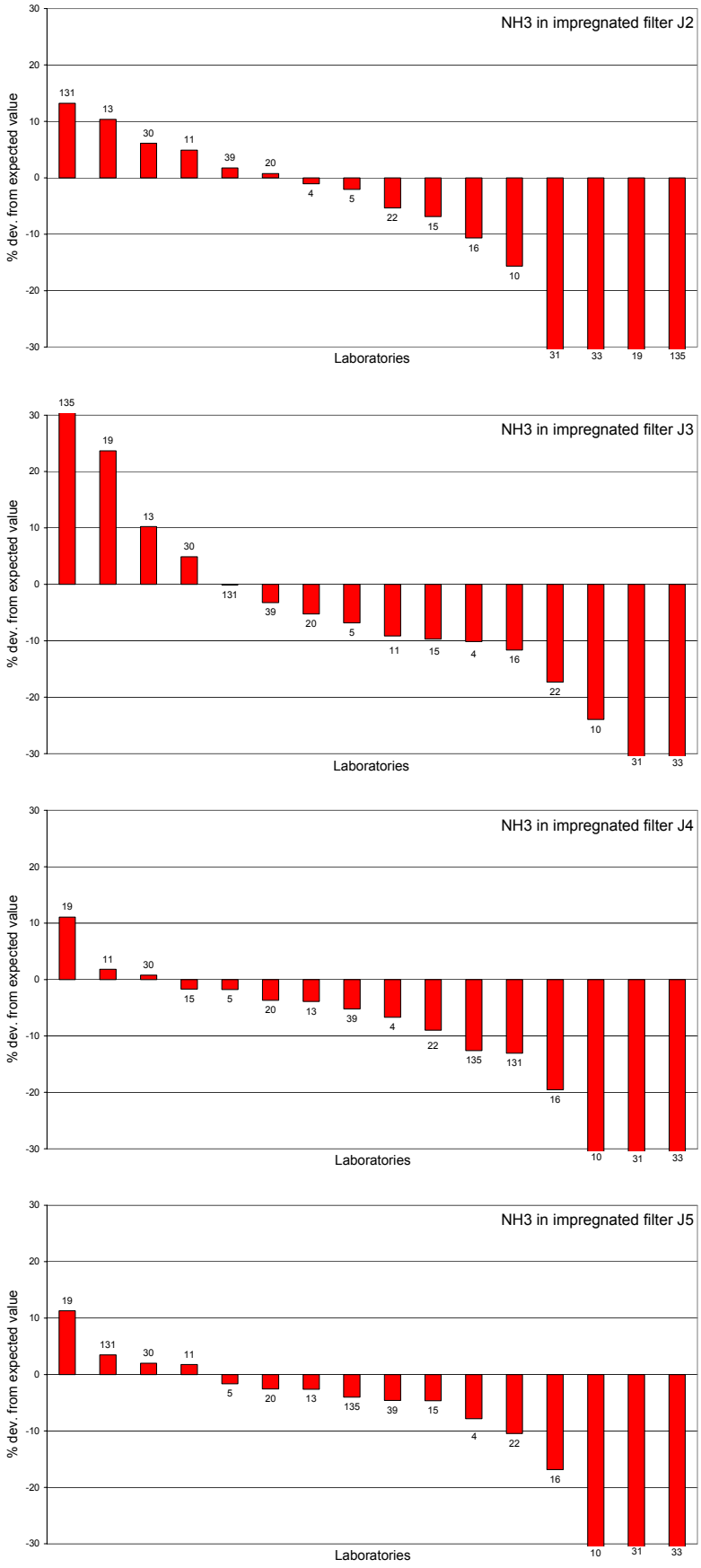


Figure 5: NH_3 in impregnated filter.

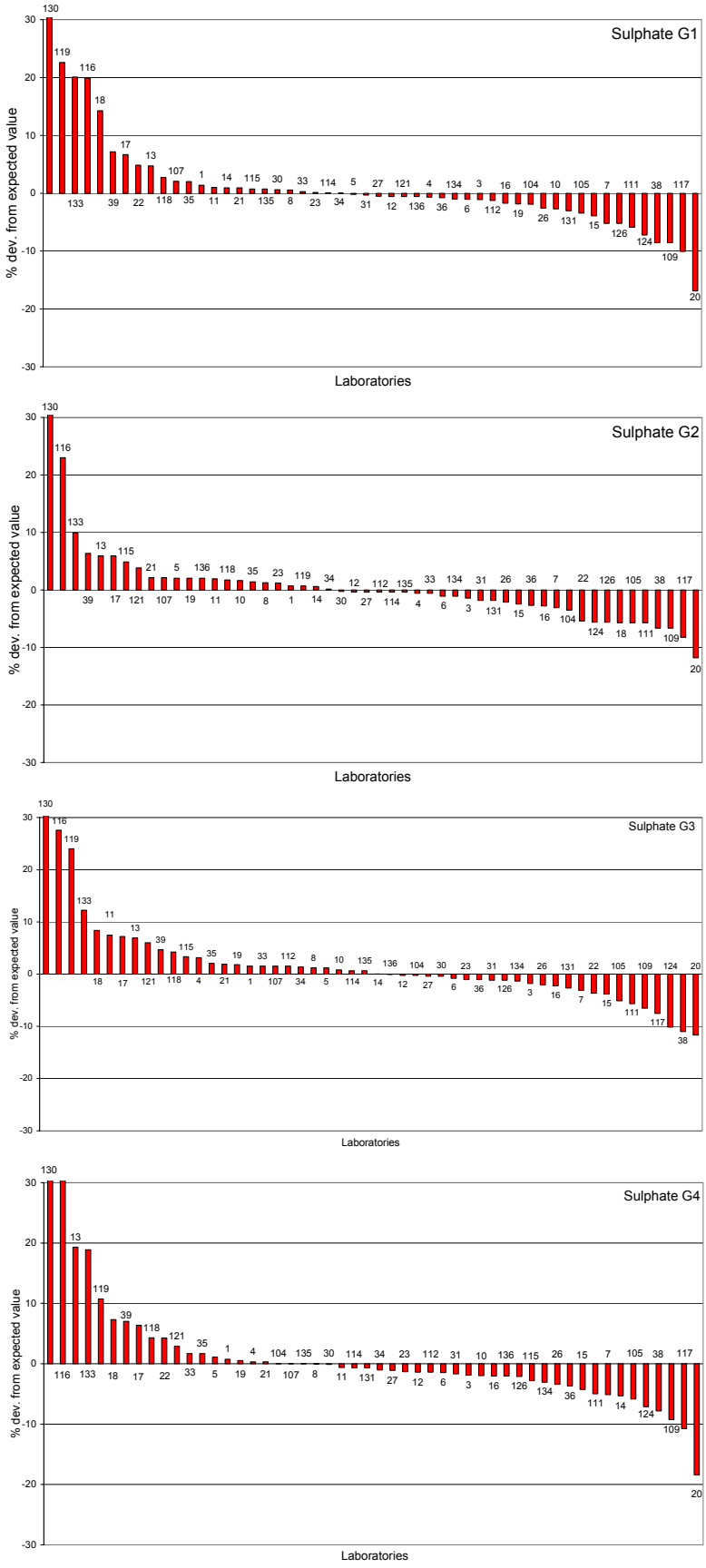


Figure 6: Percent deviation from theoretical value for sulphate.

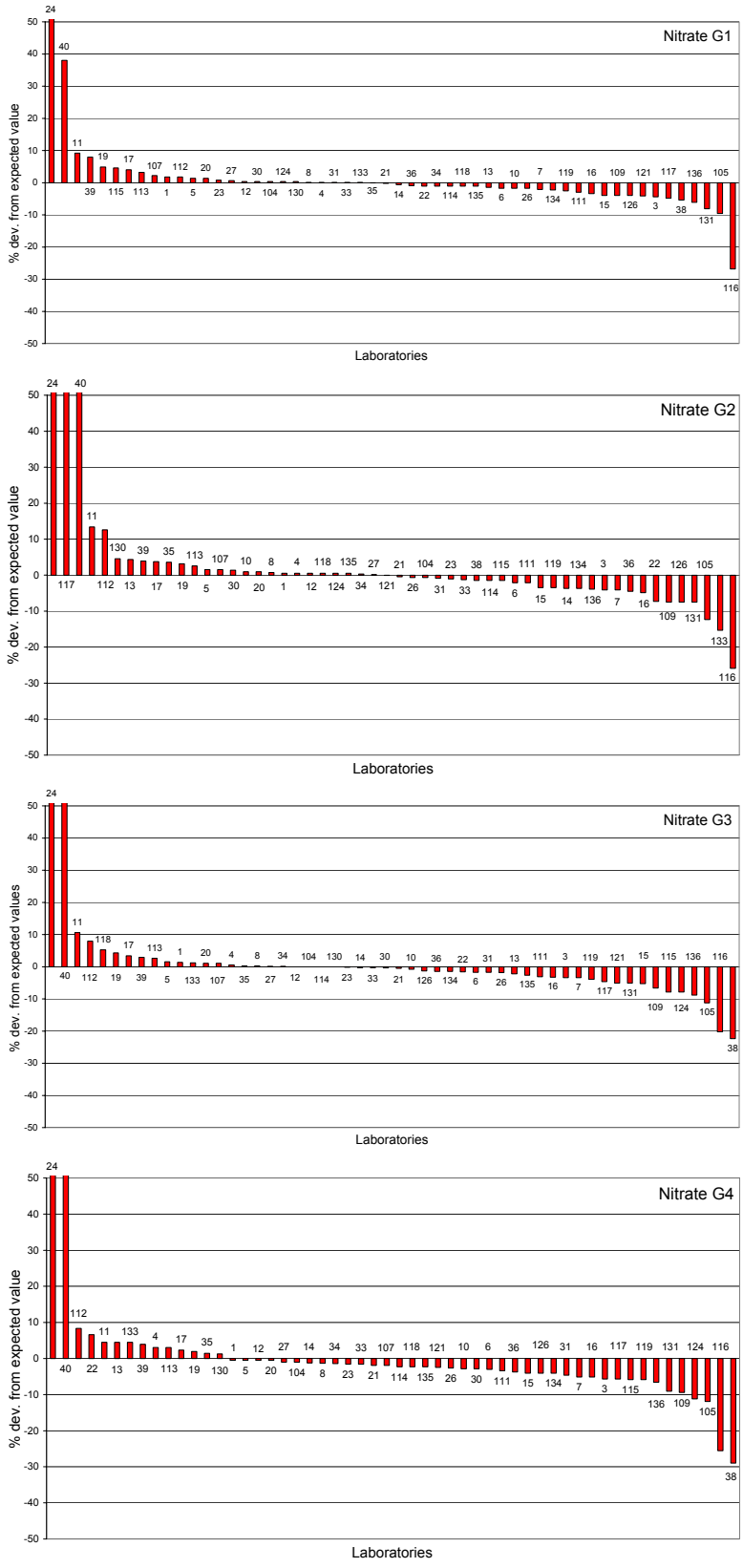


Figure 7: Percent deviation from theoretical value for nitrate.

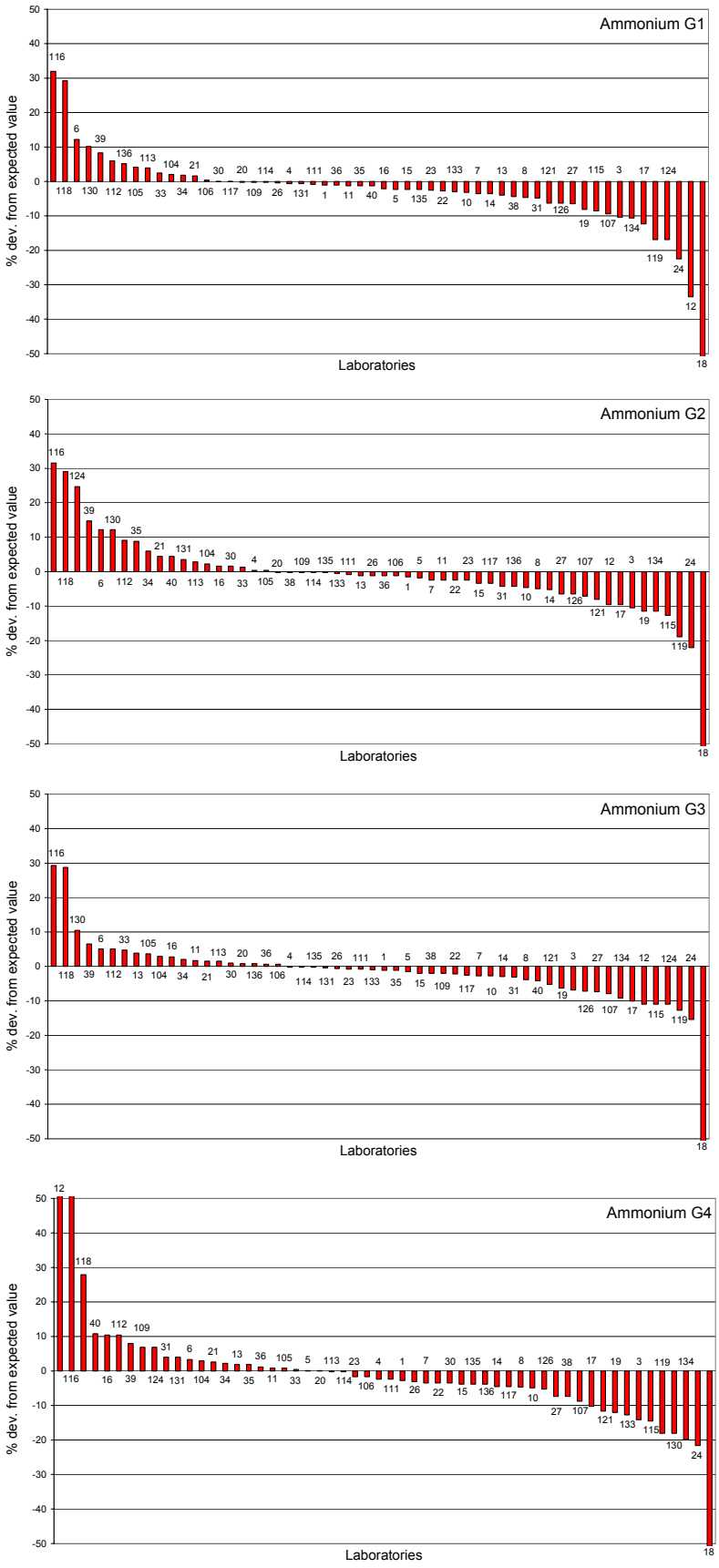


Figure 8: Percent deviation from theoretical value for ammonium.

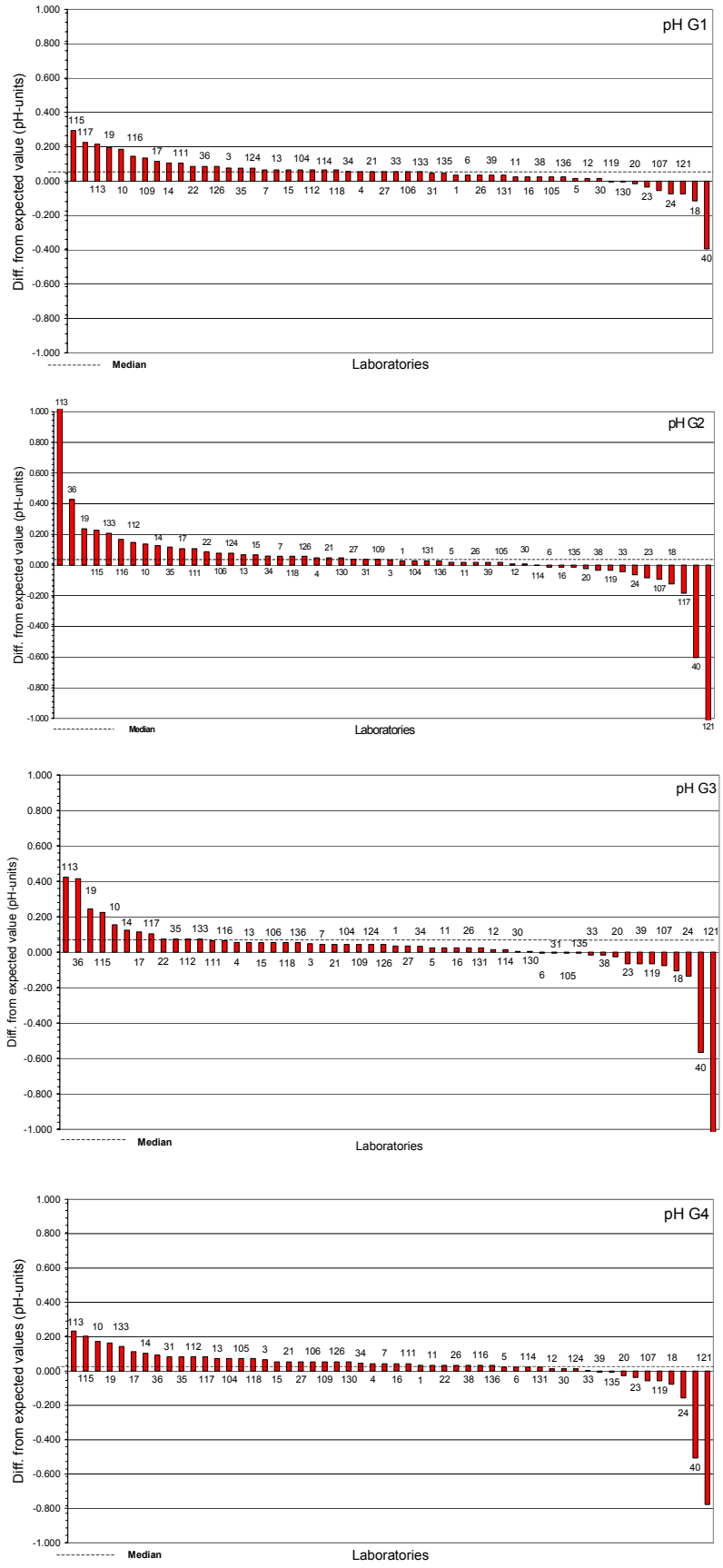


Figure 9: Percent deviation from theoretical value for pH.

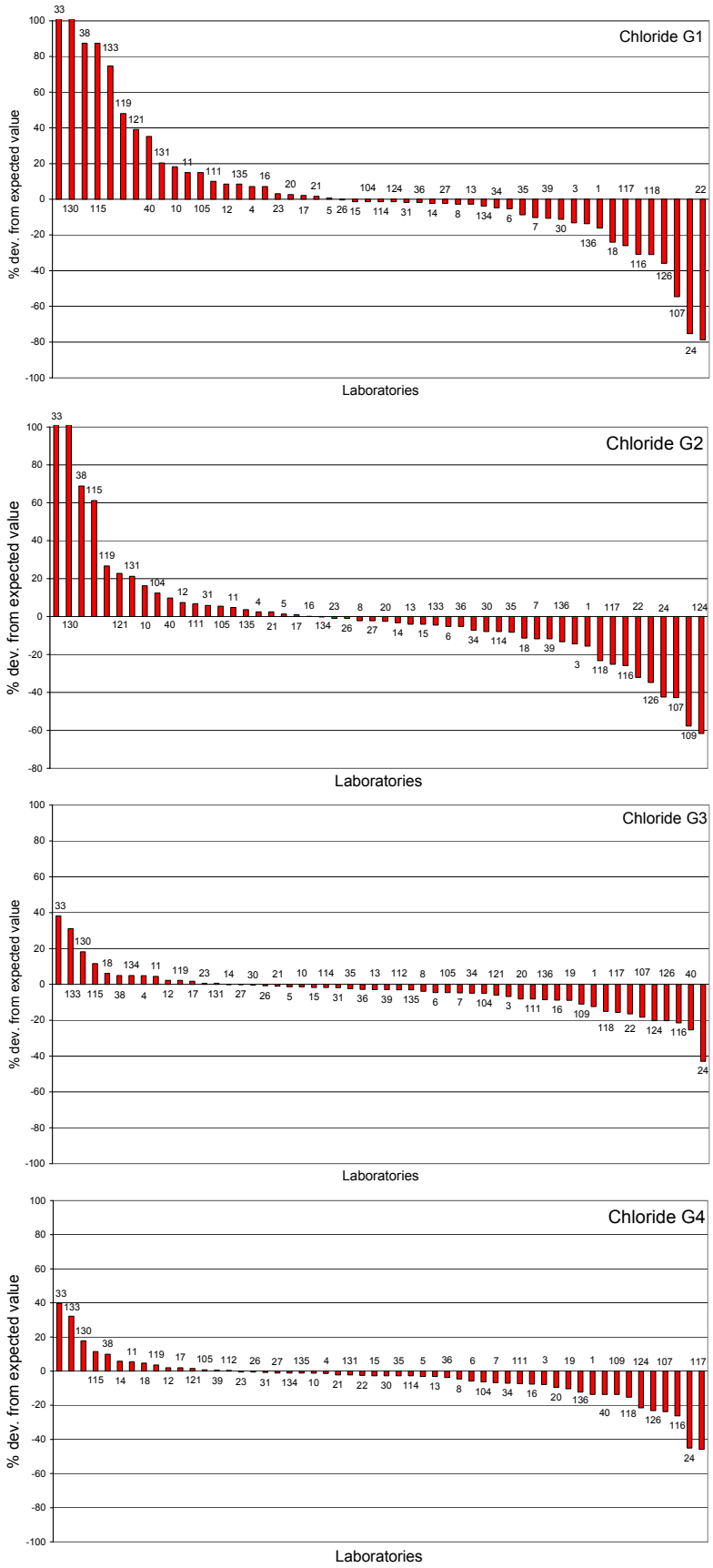


Figure 10: Percent deviation from theoretical value for chloride.

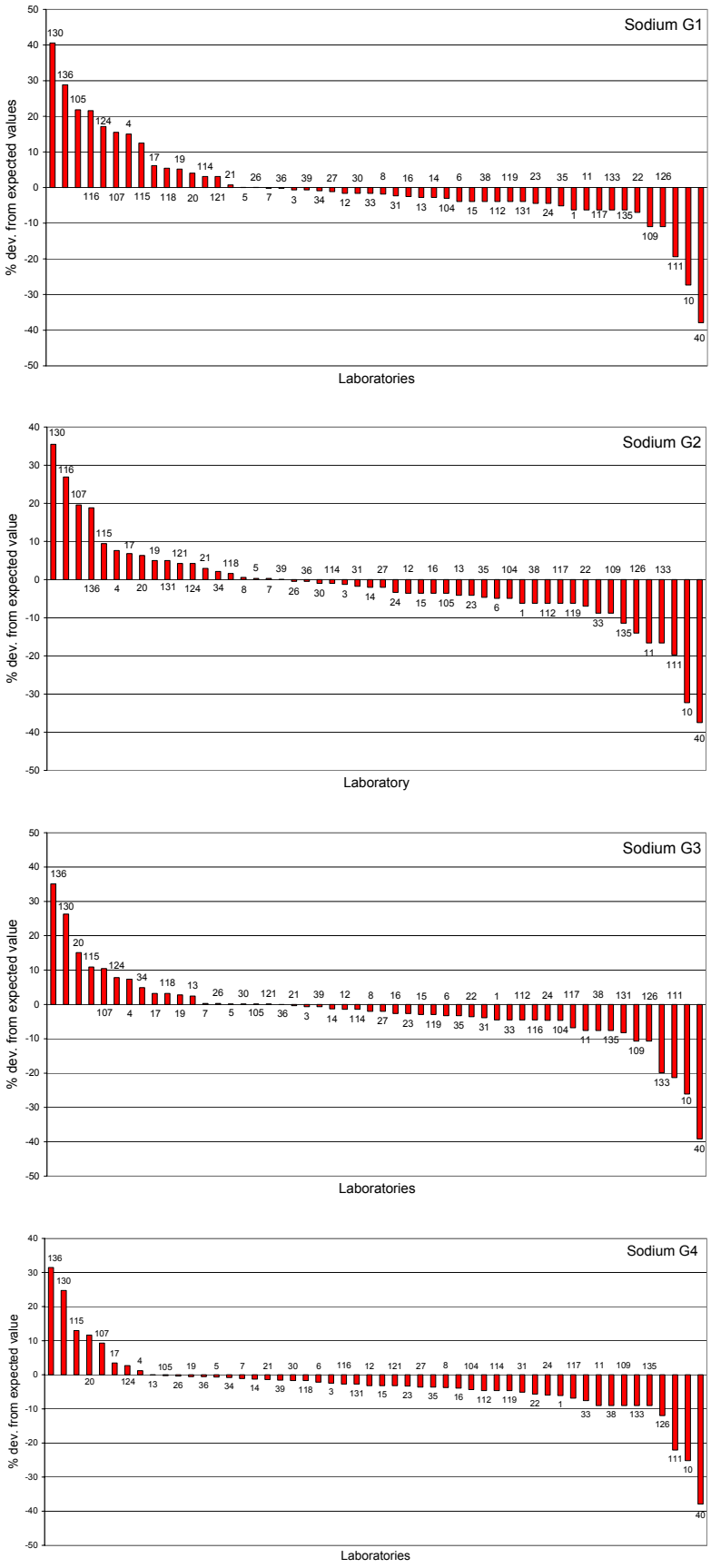


Figure 11: Percent deviation from theoretical value for sodium.

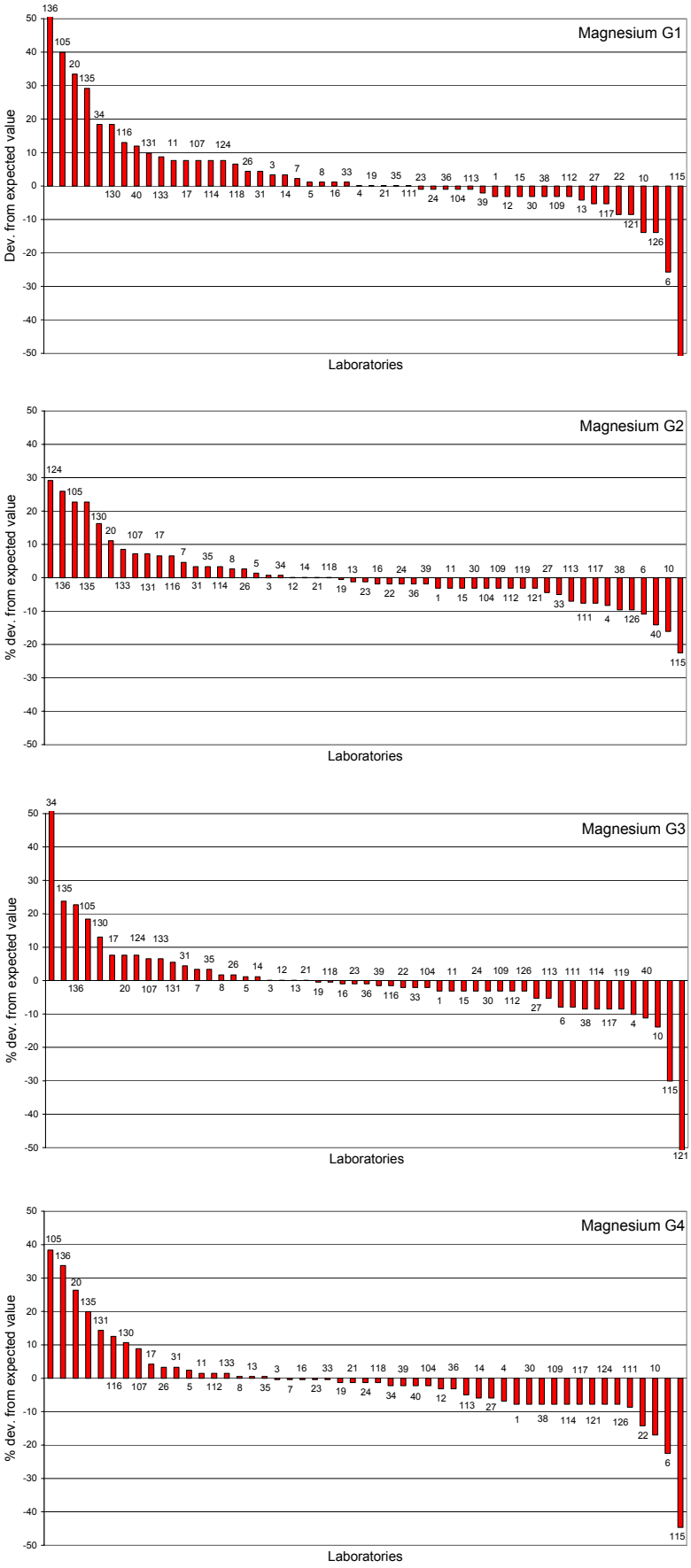


Figure 12: Percent deviation from theoretical value for magnesium.

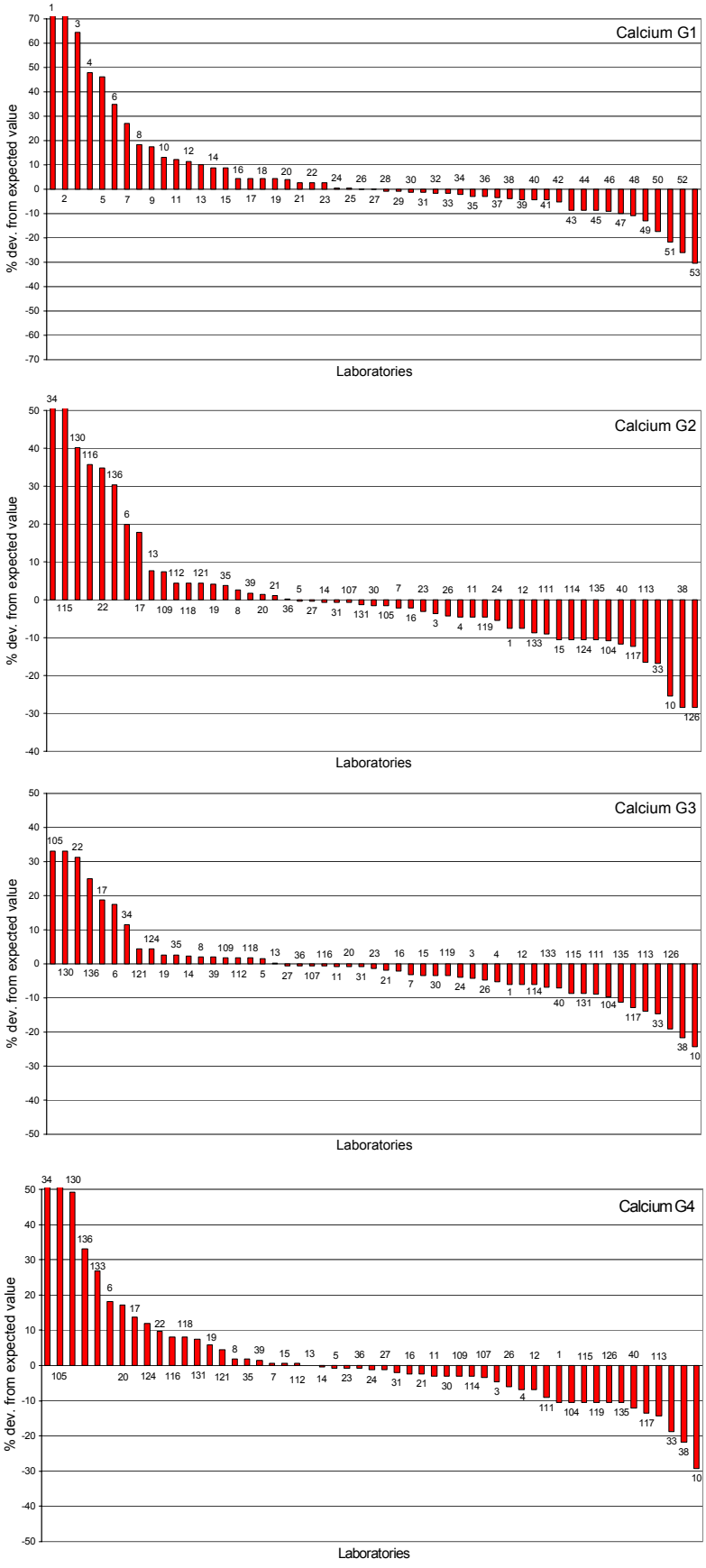


Figure 13: Percent deviation from theoretical value for calcium.

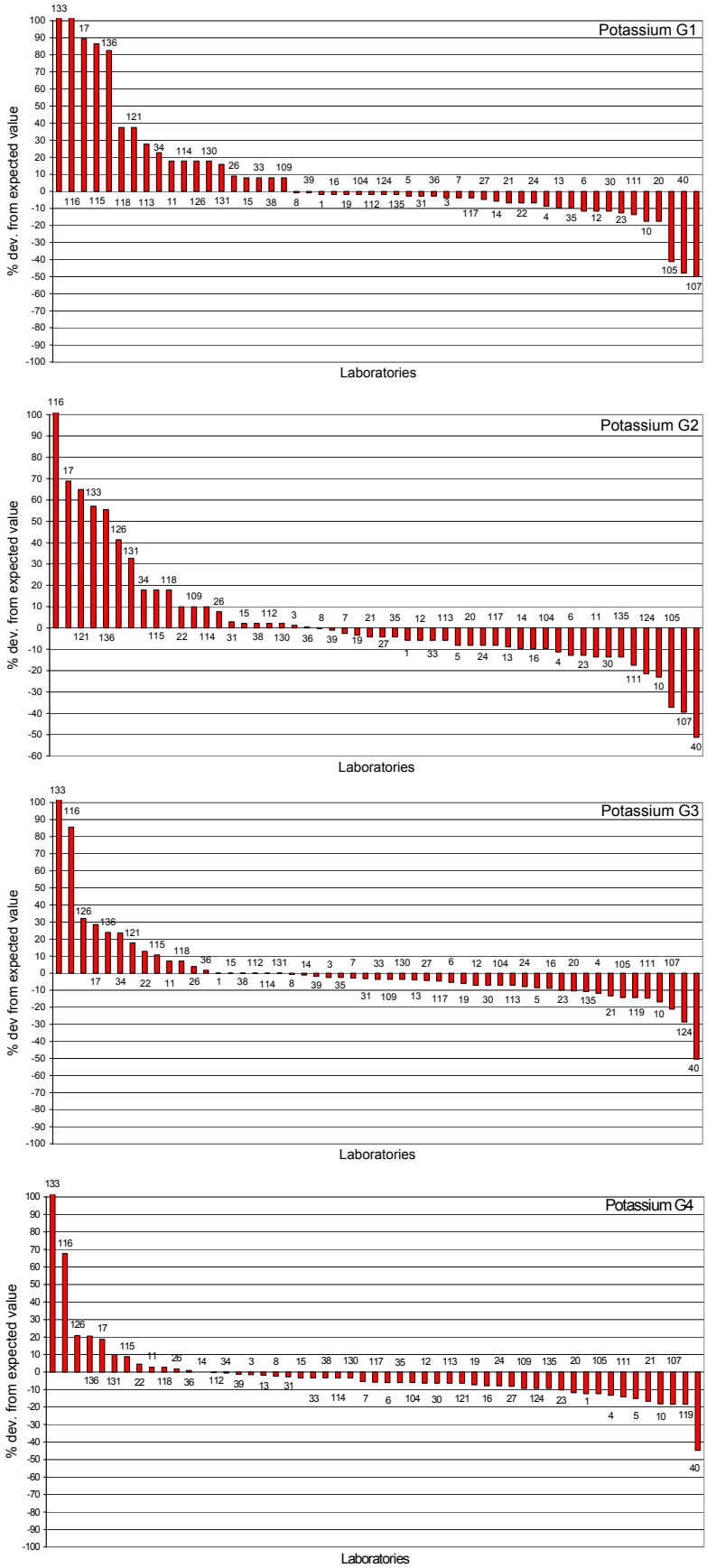


Figure 14: Percent deviation from theoretical value for potassium.

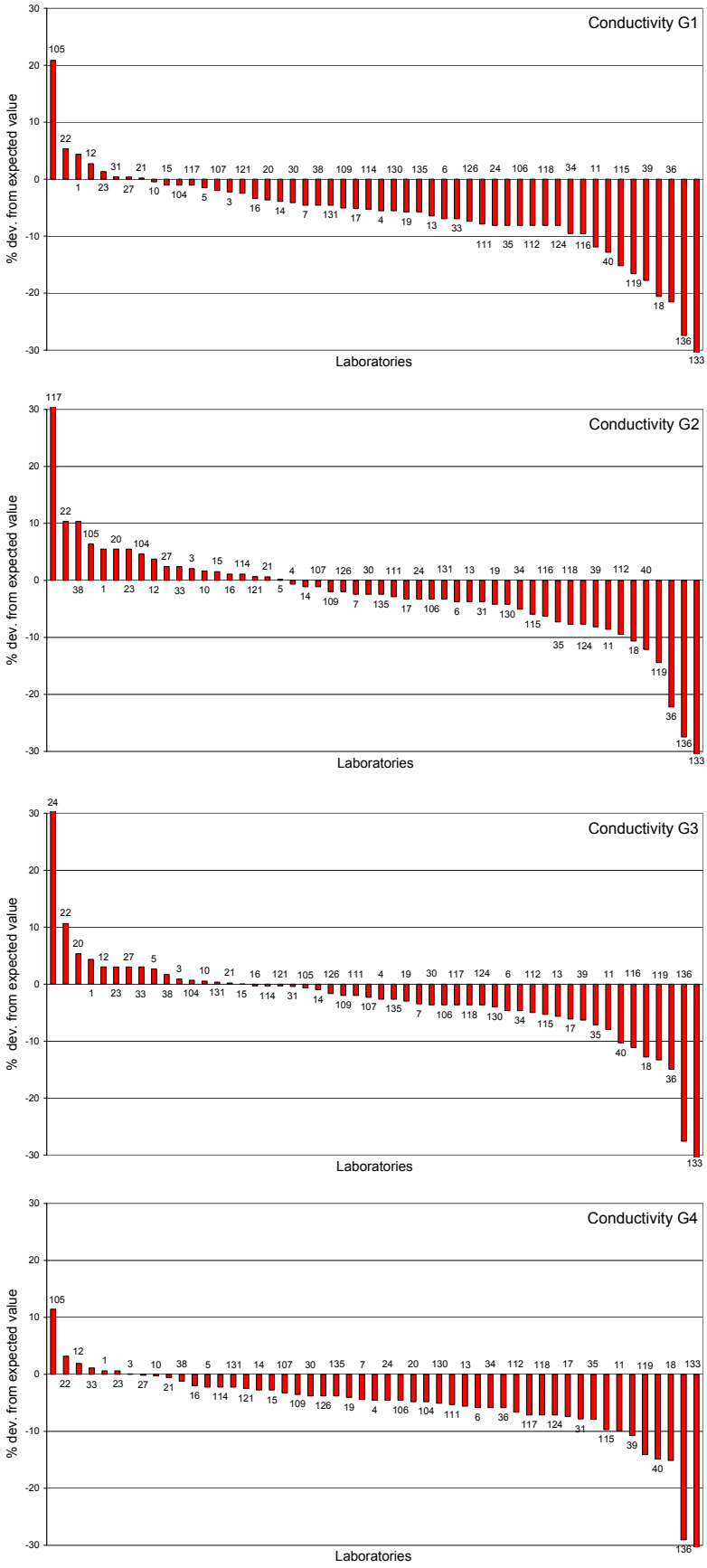


Figure 15: Percent deviation from theoretical value for conductivity.

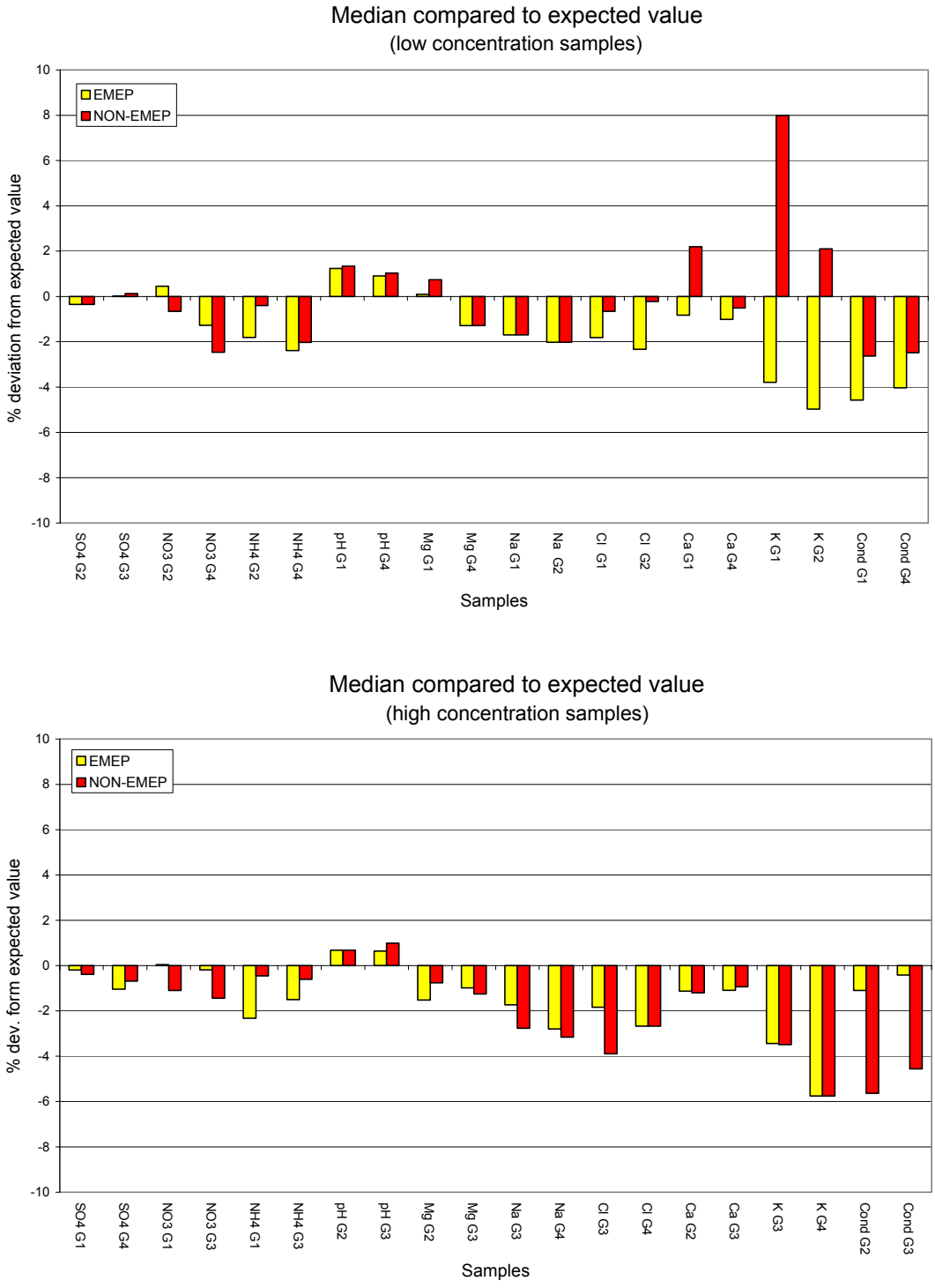


Figure 16: The median compared to theoretical value.