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NOAA National Status and Trends Program Ninth Round Intercomparison Exercise Results for Trace Metals in Marine Sediments and Biological Tissues

S. Willie and S. Berman
Institute for Environmental Research and Technology
National Research Council
Canada

Abstract

This report, prepared by the National Research Council of Canada, summarizes results of the NOAA National Status and Trends Program ninth round intercomparison exercise for trace metals in marine sediments and biological tissues. This exercise is one in a series of annual intercomparisons sponsored by NOAA and EPA for laboratories doing agency-funded chemical analyses. In addition, the exercises have been opened to other laboratories resulting in fifty-three laboratories receiving materials for analysis for the 1995 exercise. The exercise materials were a freeze dried mussel tissue collected in Boston Harbor and a freeze dried marine sediment collected in Nova Scotia. Reference materials NRC CRM BCSS-1 and NIST SRM 1566a were also analyzed as part of the exercise. The elements determined were Al, Cr, Fe, Ni, Cu, Zn, As, Se, Ag, Cd, Sn, Hg and Pb for both matrices, plus Be, Si, Mn, Sb and Tl for sediments. Forty-four sets of results were received.

[Abstract by A. Cantillo, Quality Assurance Project Manager, NOAA National Status and Trends Program.]

Silver Spring, Maryland
November 1995

National Research Council Canada
Conseil national de recherches Canada

Institute for National Measurement Standards
Institut des étalons nationaux de mesure

NRC · CNRC

NOAA/9

Ninth Round Intercomparison for Trace Metals in Marine Sediments and Biological Tissues

Scott Willie and Shier Berman

Prepared for the
Coastal Monitoring and Bioeffects Assessment Division
Office of Ocean Resources Conservation and Assessment
National Oceanic and Atmospheric Administration

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APPENDICES

1. INTRODUCTION

This is the ninth intercomparison exercise for trace metals organized by the National Research Council of Canada (NRC) on behalf of the Coastal Monitoring Branch of the National Oceanic and Atmospheric Administration (NOAA) Office of Ocean Resources, Conservation and Assessment (ORCA). The original purpose of this exercise was to assess the capabilities of a number of NOAA and other laboratories involved in the NOAA National Status and Trends program to analyze marine sediments and biological tissues for trace metals. In 1990 a small number of USEPA and state laboratories was allowed to join the fourth exercise. External participation was further expanded in 1991 with 29 laboratories, including four from Australia, submitting results. In 1992 the number was further expanded to 35 laboratories. In 1993 sixteen Canadian laboratories whose participation was supported by NRC joined the group and last year data was submitted by forty-six laboratories. This year fifty-three sets of samples were sent to NOAA, USEPA, state, Australian and Canadian laboratories and for the first time a Mexican laboratory participated in the exercise.

Participating laboratories, meeting in Silver Spring the annual NOAA quality assurance workshop after the eight intercomparison exercise, had agreed for the ninth study to analyze one sediment and one biological tissue as well as to again analyze the certified reference materials (CRMs) NRC sediment BCSS-1 and NIST oyster tissue SRM 1566a. The test materials distributed by NRC were:

Sediment W, a freeze dried marine sediment collected for NRC from a Nova Scotian harbour.[a]

Tissue X, a freeze dried mussel collected in Boston Harbor, Dorchester Bay, MA and donated by Reenie Parris of NIST.

The participating laboratories were each sent an eight gram sample of each of the two unknowns with the understanding that each participating laboratory would be responsible for procuring its own samples of the recommended CRMs. The participants were also sent data sheets on which to record their results and analytical procedures.

Following a protocol used for the first seven NOAA exercises, each laboratory was requested to perform five replicate analyses on each of the four samples. Again, as last year, the evaluation of the biological tissue would not be based on a hydrofluoric acid digestion, although in order to obtain certified values for Al in NIST SRM 1566a it is required. The list of elements remained the same: Al, Cr, Fe, Ni, Cu, Zn, As, Se, Ag, Cd, Sn, Hg and Pb for both matrices, plus Be, Si, Mn, Sb and Tl for the sediments.

In order to help provide benchmarks of accuracy for Sediment W and Tissue X, NRC also analyzed each of the samples for most of the analytes by two different analytical methods. Where possible, one set of results was produced using isotope dilution inductively coupled plasma mass spectrometry (IDICPMS). This technique, when used correctly, is capable of producing very reliable analytical values. This is not to infer that the NRC laboratory is infallible, however, it does have a long and successful record regarding analysis of marine samples and the production of certified reference materials for trace metal analysis. The ten replicates analyzed by NRC were taken from four separate bottles. This was done in order to validate the interbottle homogeneity of the materials.

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[a] It became obvious during the evaluation of the results that we had inadvertently used the same material for Sample W as for Sample N in NOAA/5. We hope that none of the participants noticed the goof, but it did afford us a valid comparison of progress regarding an "unknown" sample after a four year period.

2. RESULTS

The prepared samples were mailed to the fifty-three laboratories listed in Appendix A in mid-May 1995 with the deadline for receipt of results set at September 11. Forty-four sets of results were received. Sequential numbers were assigned to each responding laboratory upon receipt of its data. Laboratory numbers 45 and 46 were assigned to NRC.

Of the forty-four laboratories, five did not submit data for the biological tissues and four did not submit data for the sediments. Eight laboratories submitted results for the first time. Five of the nine laboratories which did not send results had participated in NOAA/8.

A copy of the tabulated raw data was sent to each participant that had submitted data by the deadline in order to verify that no errors had been made by us in the transposition of numbers. This was not possible for data accepted from a few laboratories in the few days after the original deadline. Several mistakes were caught and changes were made if NRC was at fault. The data used for subsequent evaluation are listed in Appendix B. The data are listed as received with respect to significant figures.

If two or more "less than (<)" values were submitted in a set of replicate results the mean was not calculated and only the "less than" value was used for further data evaluation. To ensure that all laboratories are compared on a rather even basis, sets containing less than four results were not evaluated. A Q test (Dixon's test) was used to determine outliers within a replicate set of data and, when warranted, the laboratory mean and standard deviation were recalculated excluding the outlier. These sets are indicated by an apostrophe adjoining the laboratory number on the graphs and in Appendix B (e.g., 7'). The number of results used for the evaluation is noted next to the laboratory number in Appendix B along with a mean, standard deviation (SD) and relative standard deviation (RSD) calculated by us.

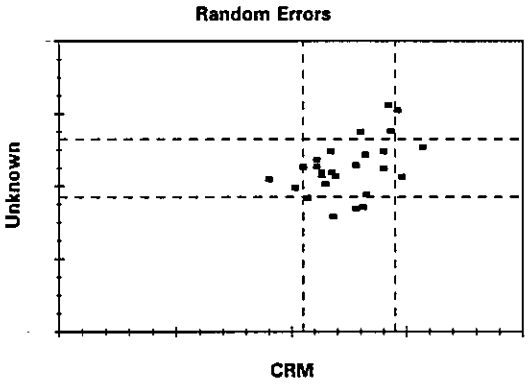
One purpose of the exercise was to arrive at an accepted value for each analyte concentration for each unknown sample in order to evaluate laboratory biases. The overall mean concentration for each metal was calculated from the mean of laboratory replicates and the NRC data. These means were assumed to be normally distributed, which may not be a valid assumption at very low concentrations, but for the purpose of this exercise it is felt to be adequate. A successively applied Student *t* test[2] at the 95 percent confidence level was used to identify outliers. Some very obvious outliers were initially rejected before statistical evaluations.

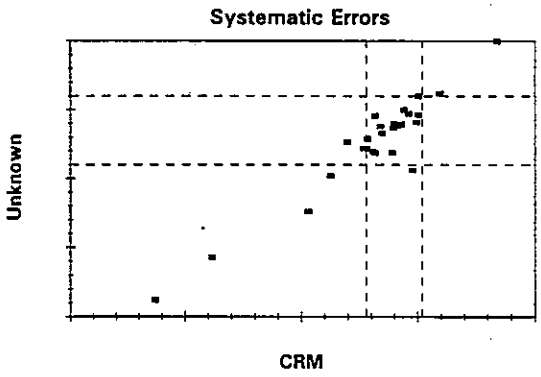
A minimum acceptable range for the analytes in the CRMs was set at either the certified range or ten percent of the certified value, whichever is larger (five percent for Al, Si and Fe in the sediments). In Appendix B and the graphs where this occurred the listed certified value is followed by the acceptable range used for evaluation in parentheses. In one case, the calculated acceptable range for the unknown samples was also very small (an indication of good performance by the group as a whole), and the same criterion of a minimal acceptable range of ten percent was used.

The evaluated replicate data are plotted on the graphs where possible. Means that were outliers from the accepted or certified concentration are indicated by an asterisk following the laboratory number (e.g., 5*). "Less thans" are indicated by a downward arrow head and the reported value. Some high results that if plotted would distort the clarity of the graphs are indicated by an upward arrow head with the mean of the replicates reported. A solid horizontal line represents the accepted mean for an unknown or the certified value of a CRM. The shaded area represents the 95% confidence intervals for these values. A short summary

of results for each set of results is listed above the appropriate graph. All concentrations are expressed in mg/kg on a dry weight basis except for aluminum, iron and silicon in the sediments where the concentrations are in percent.

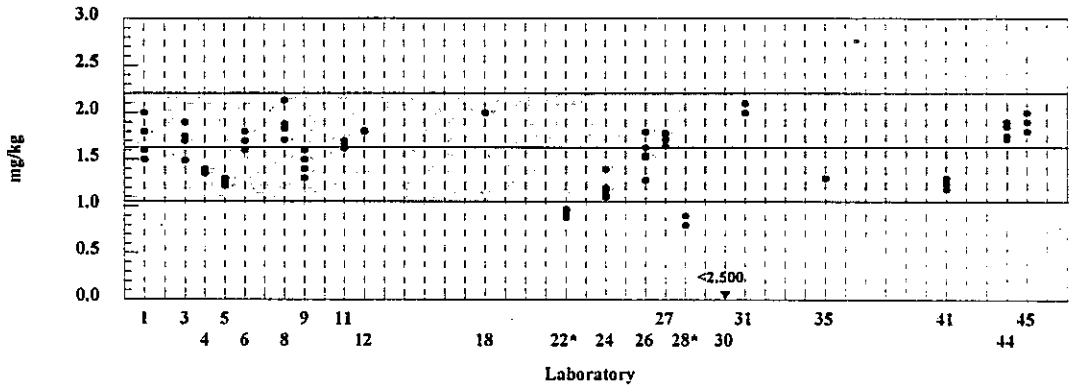
We have also included Youden (or two sample plots) for the sediment and the tissue samples. These plots of the overall mean for the CRM versus the mean for the unknown sample can give useful information when the analyte concentrations of the two samples are similar. If non-systematic or random errors are occurring, the results would be expected to group at random about the intersection of the two means. If, however, systematic errors occur (e.g. a high or low result for both the CRM and the unknown) a predominance of points would be expected to group about a line running from the origin through the intersection of the two means. The latter case is common in intercomparison exercises due to calibration and blank errors. The laboratory number appears to the left of a marker if both of the laboratory results are rejected. Unfortunately, when a group of laboratories report similar rejected results the labels become illegible. The accepted confidence range is indicated by the dashed lines. Examples of Youden plots, demonstrating random and systematic errors respectively, are shown below.





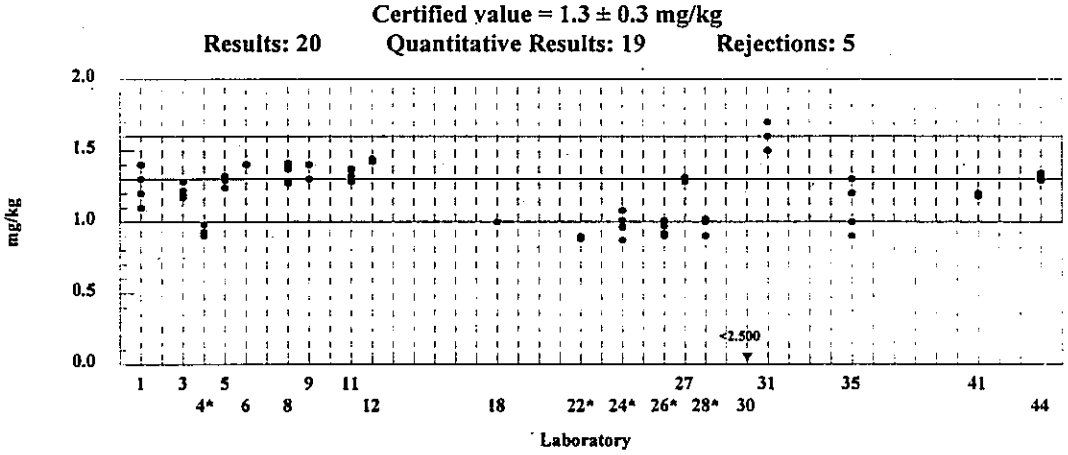
BERYLLIUM
Sediment W

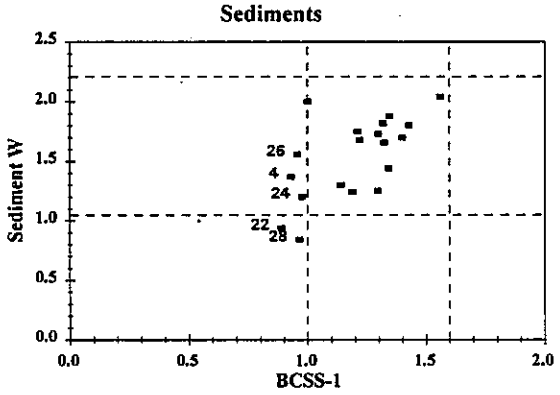
Accepted value = 1.63 ± 0.58 mg/kg
Results: 21 Quantitative Results: 20 Rejections: 2



BERYLLIUM

BCSS-1





This is the third year the determination of Be has been included in the exercise. Twenty labs submitted results for Be, an slight decrease from 22 last year. The calculated confidence interval for Sediment W is ± 36 percent, an improvement from the ± 41 percent of last year and comparable to the ± 27 percent of the year before when differences in concentration are taken into account. Thirteen means (65%) were within ± 20 percent of the accepted mean. Three laboratories submitted results for Be that did not use hydrofluoric acid (HF) in the digestion procedure. Two of these were rejected. The tighter specification for the CRM (± 23 percent) resulted in 5 rejected sets of results. Three of these were from the laboratories which did not use HF in their digestion procedure. The Youden plot displays a tendency towards systematic errors, and an indication which we will see repeated with other analytes that for some reason it is easier to get better values for Sample W than for the CRM.

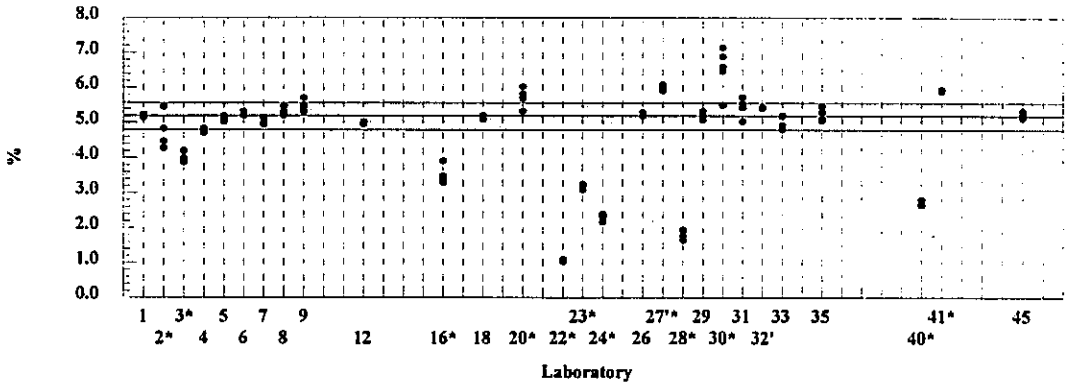
The determination of beryllium was not required in Tissue X.

ALUMINUM

Sediment W

Accepted value = 5.19 ± 0.40 %

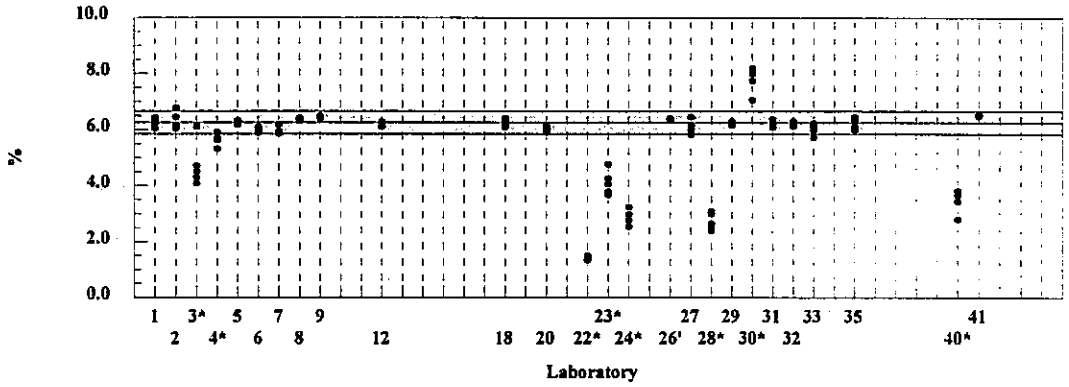
Results: 28 Quantitative Results: 28 Rejections: 12



BCSS-1

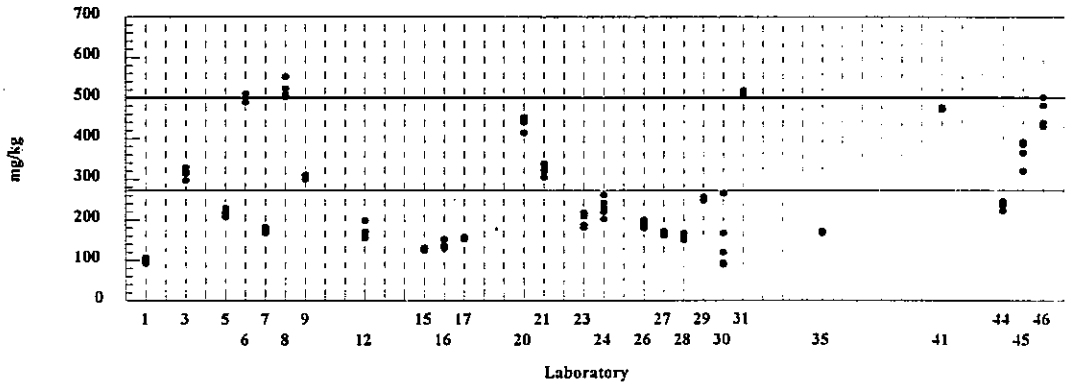
Certified value = 6.26 ± 0.41 %

Results: 26 Quantitative Results: 26 Rejections: 8



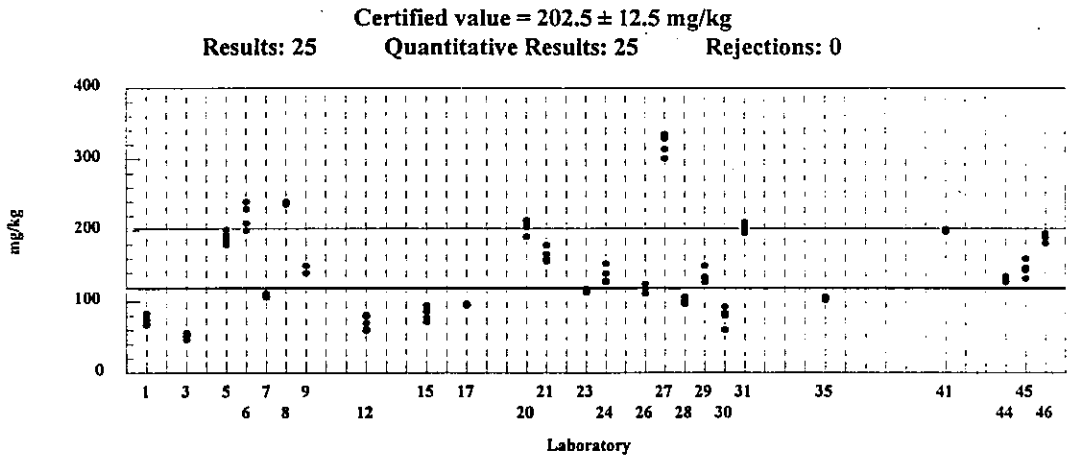
Tissue X

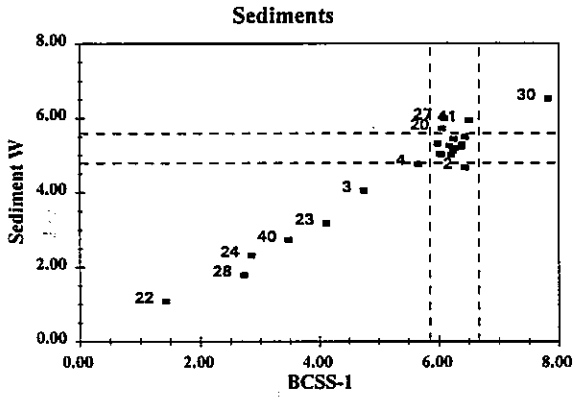
Results: 26 Quantitative Results: 26 Rejections: 0

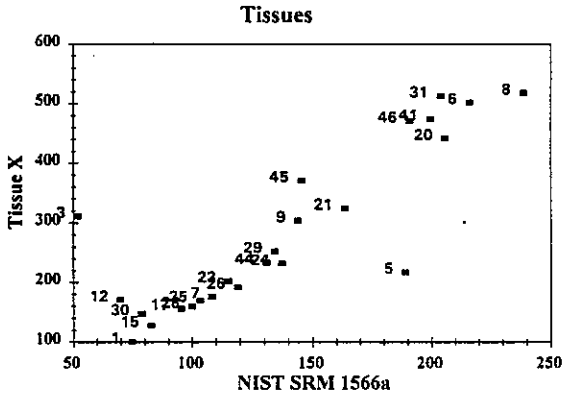


ALUMINUM

NIST SRM 1566a







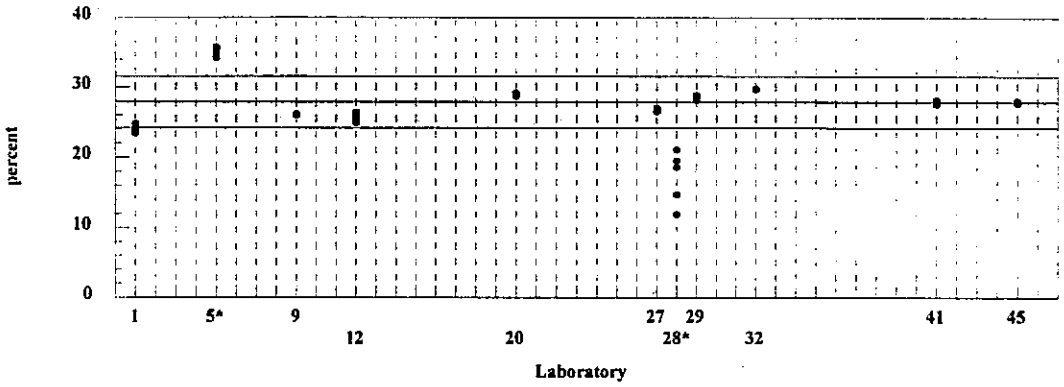
The improvement noted last year for the determination of Al in sediments has been maintained. Twenty-eight labs submitted results, a decrease from 32 last year. We suspect that some labs that do not use HF for the dissolution of the sample are no longer reporting Al results. The accepted confidence interval (CI) which decreased steadily from ± 25 to ± 8 percent from 1991 to 1994 is again ± 8 percent. Fifteen (54%) of the means were within ± 5 percent of the accepted mean. Six of the laboratories did not use HF and all of their results were among the 12 rejected. Of the 26 sets of results received for Al in BCSS-1, 17 labs used HF, five did not and 4 used non-destructive methods. In both sediment samples the majority of the rejected results can probably be attributed to incomplete dissolution of the sediment. The use of HF is obviously beneficial but not always sufficient. All values from non-destructive methods (XRF, INAA) were within the CI.

Performance for the determination of Al in the tissues is always difficult to evaluate and we have not attempted to do so this year. We have earlier noted that the labs would not be evaluated for this analyte because HF is not routinely used by most laboratories for the dissolution of tissues. Our own results (45,46), respectively without and with HF, show dramatically different values. Laboratories 6, 8, 31 and 46 used HF in the digestion and yielded a mean value of about 500 mg/kg (upper horizontal line on graph). The consensus value of the other labs is about 275 mg/kg (lower line). Likewise for SRM 1566a it has been shown in previous exercises that HF is necessary to completely recover all the Al. The horizontal lines are the certified and consensus values as defined above.

SILICON

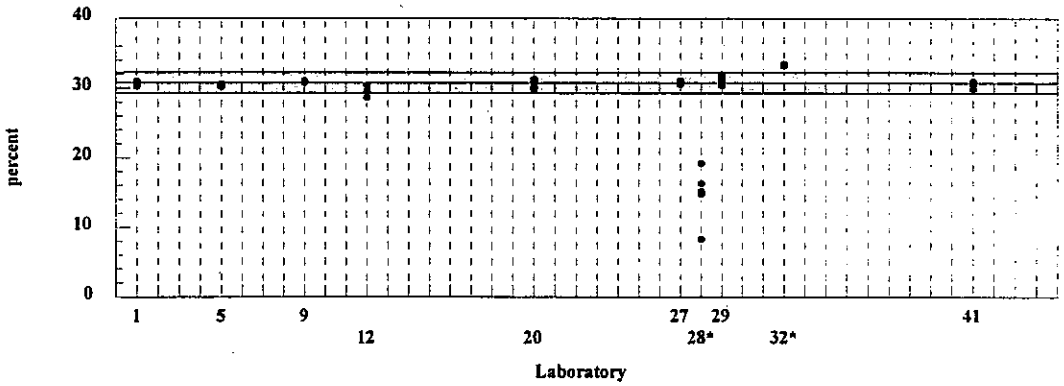
Sediment W

Accepted value = 27.9± 3.6 %
Results: 11 Quantitative Results: 11 Rejections: 2

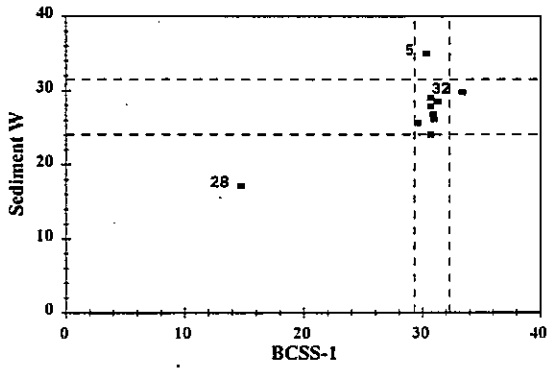


BCSS-1

Certified value = 30.8± 1.0(1.5)%
Results: 10 Quantitative Results: 10 Rejections: 2



Sediments



SILICON

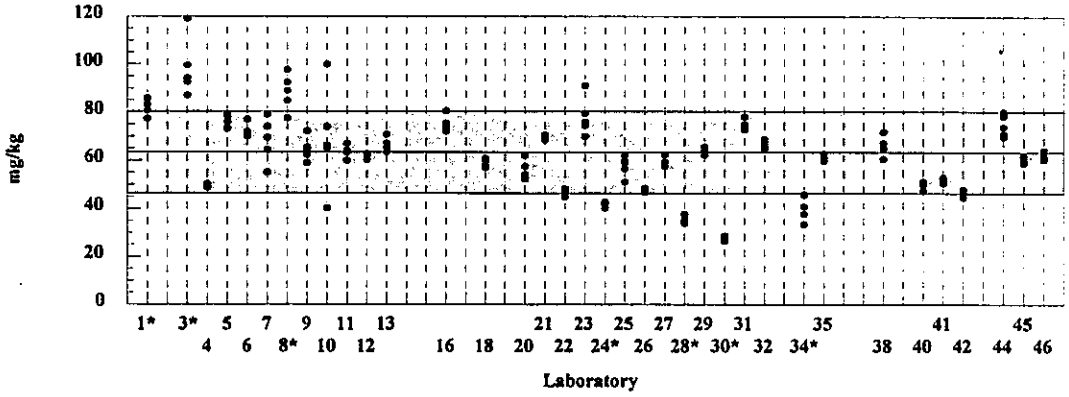
The CI for Si in Sample W was ± 13 percent, an increase from NOAA/8's ± 7 percent, but 7 of the 11 submissions (64%) were within ± 5 percent of the accepted mean. Only one lab (28) did not use HF and its results were low. Results for BCSS-1 are equivalent to those of last year. With the exception of two labs (28 and 32) all the submitted data for BCSS-1 were within less than ± 4 percent the certified value. It appears that most laboratories that attempt Si determinations in sediments perform the analysis very well.

The determination of silicon was not required in Tissue V.

CHROMIUM

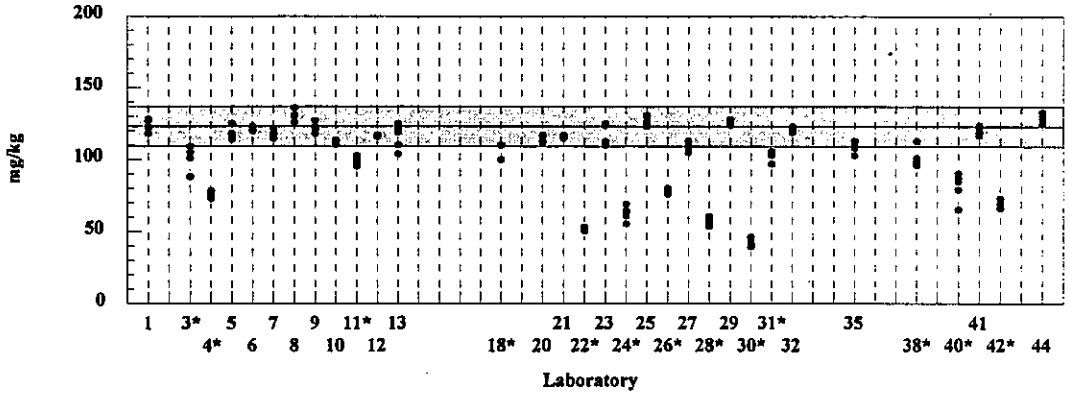
Sediment W

Accepted value = 63.4 ± 17.1 mg/kg
Results: 36 Quantitative Results: 36 Rejections: 7



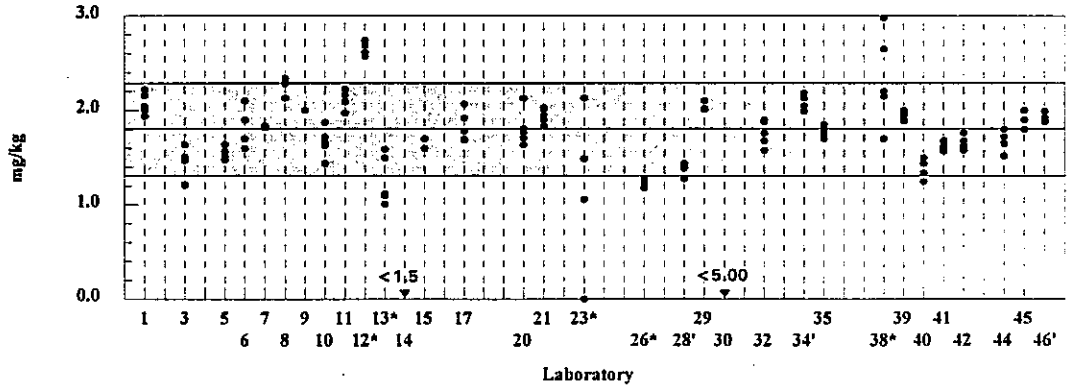
BCSS-1

Certified value = 123 ± 14 mg/kg
Results: 32 Quantitative Results: 32 Rejections: 13



Tissue X

Accepted value = 1.81 ± 0.49 mg/kg
Results: 32 Quantitative Results: 30 Rejections: 5

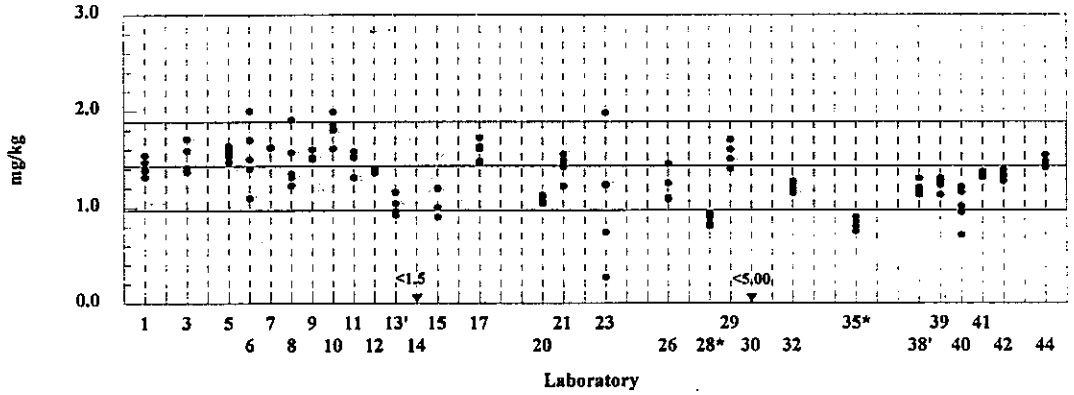


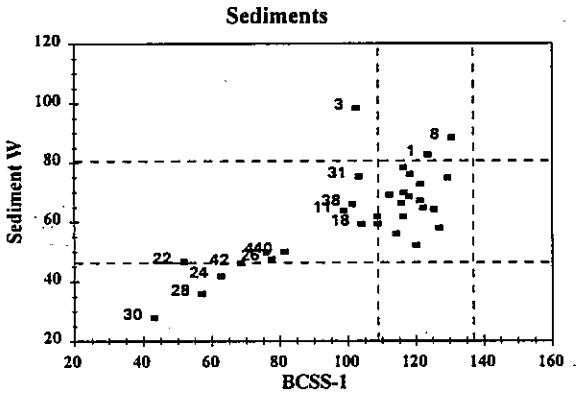
CHROMIUM

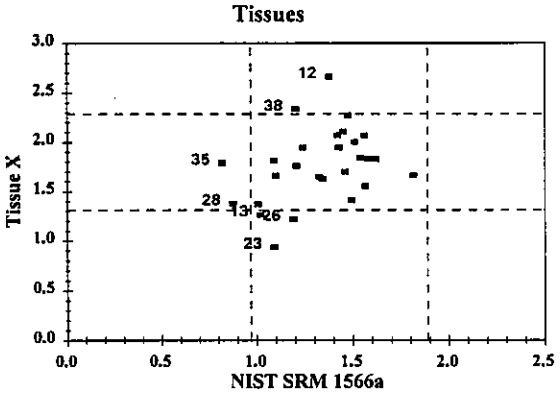
NIST SRM 1566a

Certified value = 1.43 ± 0.46 mg/kg

Results: 29 Quantitative Results: 27 Rejections: 2







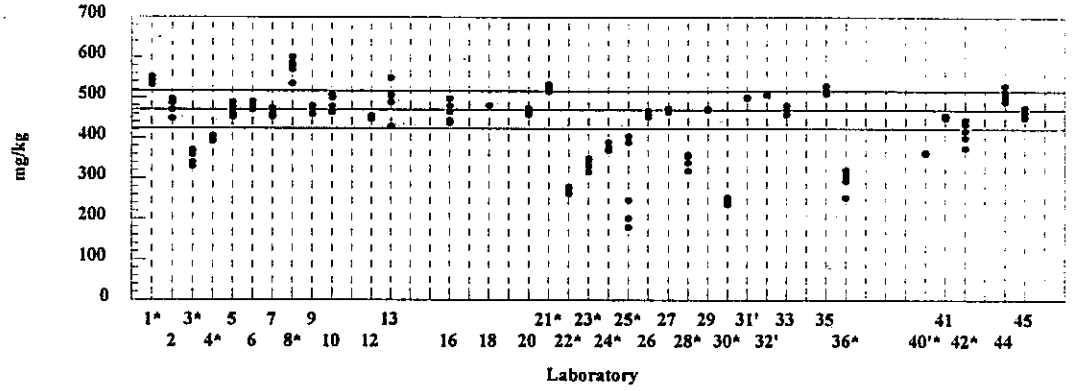
Results for the determination of Cr in the sediment samples show some apparent improvement over past years. The CI for Sample W is ± 27 percent, not much different since NOAA/5, but the rejection rate has dropped from about 30 percent for the last 3 years to 19 percent this time. Still, only 17 of the 32 sets of results (53%) were within ± 20 percent of the accepted mean. Four of the 7 outliers were low and all of these did not use HF in the digestion procedure. The situation is more marked with BCSS-1 where experience has shown that complete digestion is required to get within the certified interval. All 13 outliers were low. The results of 7 labs which didn't use HF were all rejected, but so were those of 6 labs that did. The use of HF is mandatory but not always sufficient. The Youden plot indicates systematic errors and reflects the difficulty in totally dissolving BCSS-1 which contains some chromite.

There is good improvement regarding the determination of Cr in the tissues. The CI has dropped from ± 60 and ± 40 percent in 1993 and 1994 respectively to ± 27 percent. The rejection rate of 17 percent is the same as last year. Twenty-two of the 32 sets of results (69%) were within ± 20 percent of the accepted mean, so there is still good room for improvement. There is no apparent relationship between "success" and dissolution or measuring systems. The results for Cr in SRM 1566a have again improved with the rejection rate decreasing from 17 to 13 to 7 percent from NOAA/7 to NOAA/9. The Youden plot shows little systematic error.

MANGANESE

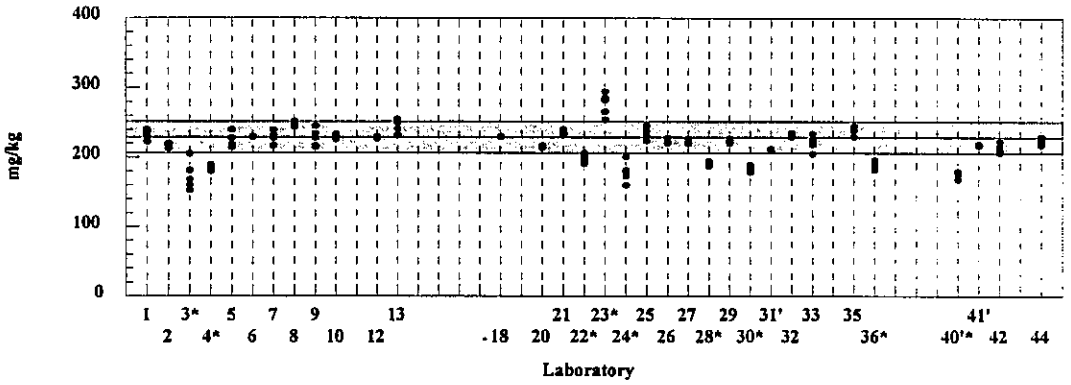
Sediment W

Accepted value = 470 ± 24 (47) mg/kg
Results: 35 Quantitative Results: 35 Rejections: 14

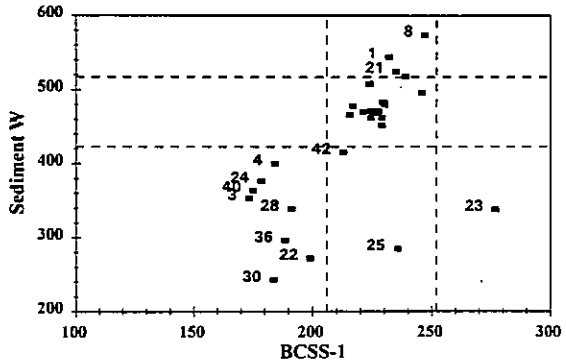


BCSS-1

Certified value = 229 ± 15(23) mg/kg
Results: 33 Quantitative Results: 33 Rejections: 9



Sediments



MANGANESE

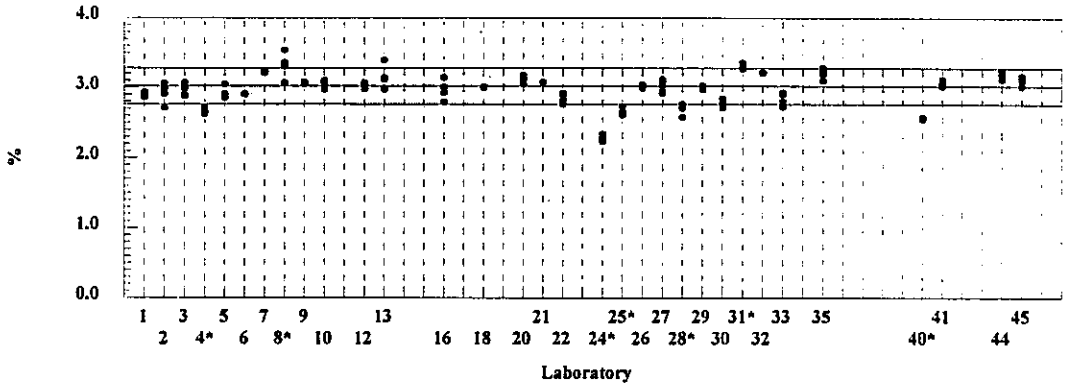
The results for Mn this year are much more closely grouped with a calculated CI of ± 5 percent for Sample W compared to a CI of ± 21 percent for Sample N in NOAA/5. The accepted interval was increased to ± 10 percent for evaluation purposes. Twenty-six of the 35 sets of results (74%) were within ± 20 percent of the accepted mean. Eleven of the 14 rejected sets were low and 7 of these were from labs that did not use HF in the dissolution procedure. The improvement for the analysis of BCSS-1 is not as dramatic. Here the non-use of HF results in 6 of the 8 low results. The Youden plot shows general systematic error.

The determination of manganese was not required in Tissue V.

IRON

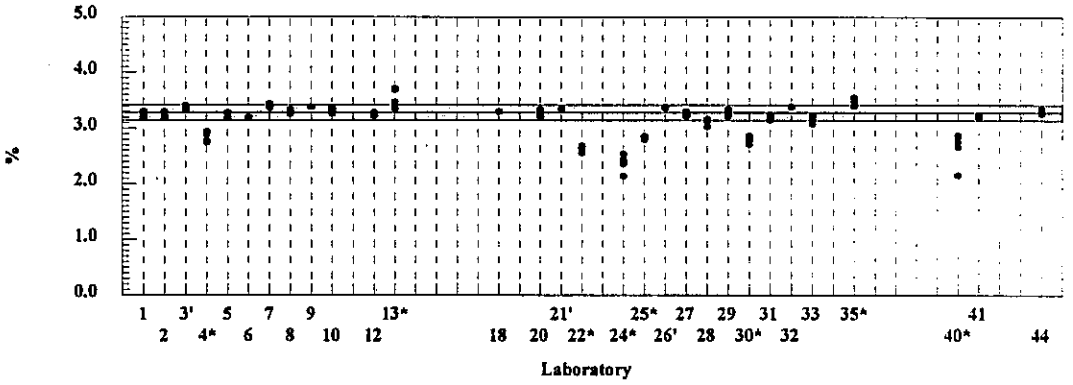
Sediment W

Accepted value = 3.02 ± 0.26 %
Results: 32 Quantitative Results: 32 Rejections: 8



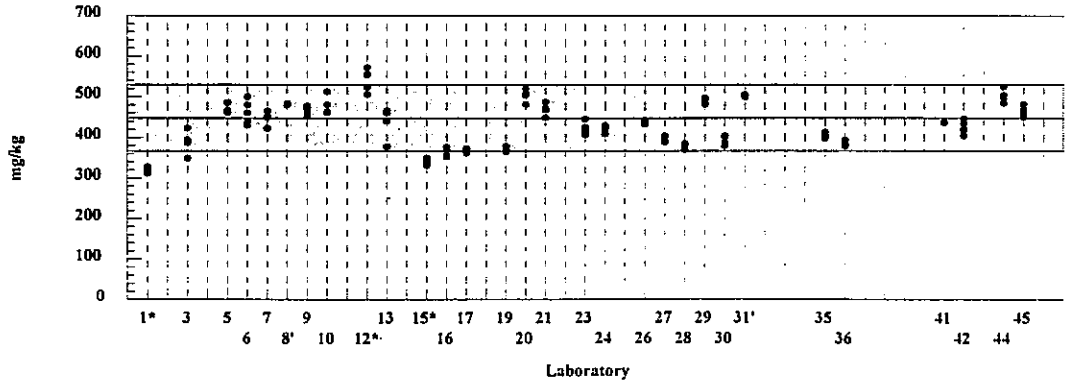
BCSS-1

Certified value = 3.28 ± 0.14(0.16) %
Results: 30 Quantitative Results: 30 Rejections: 8



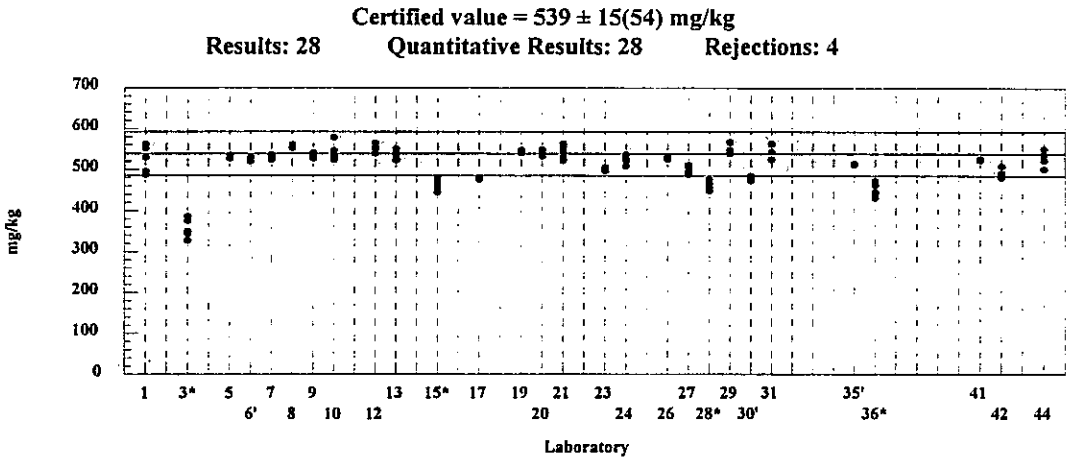
Tissue X

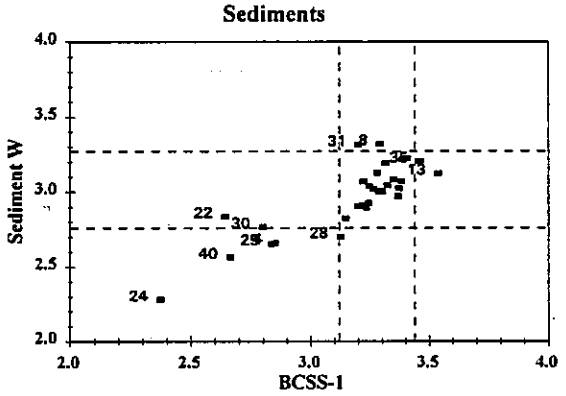
Accepted value = 448 ± 82 mg/kg
Results: 30 Quantitative Results: 30 Rejections: 3

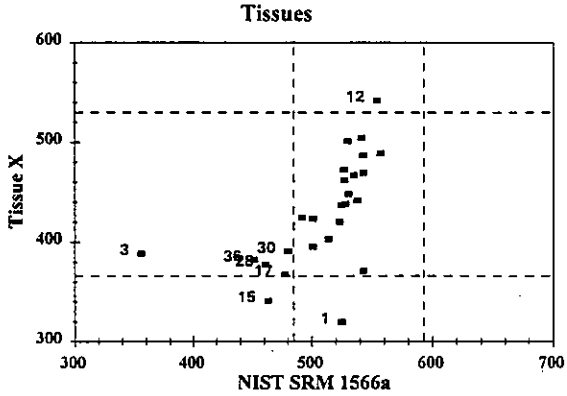


IRON

NIST SRM 1566a







Results for Fe in the sediments are similar to those of previous years. The calculated CI for Sample W is ± 8 percent compared to values of between 5 and 15 percent for the 4 previous exercises. But only eighteen of the 32 sets of results (56%) were within 5 percent of the accepted mean. Three of the 8 rejected sets were high. Of the 5 low values, three were from laboratories which did not use HF. As we proceed to analytes of higher atomic number other dissolution and/or interference problems apparently begin to predominate. For example, 3 of 10 laboratories using FAAS (30 percent) produced unacceptable results for Sediment W while only one of 13 ICPAES values (8 percent) were rejected. For BCSS-1, the certified confidence range was increased to ± 5 percent from ± 4.3 percent for evaluation purposes. Results for BCSS-1 were much like last year. Of the 8 outliers, four didn't use HF, one was measured by FAAS and three by ICPAES. The Youden plot reflects systematic errors.

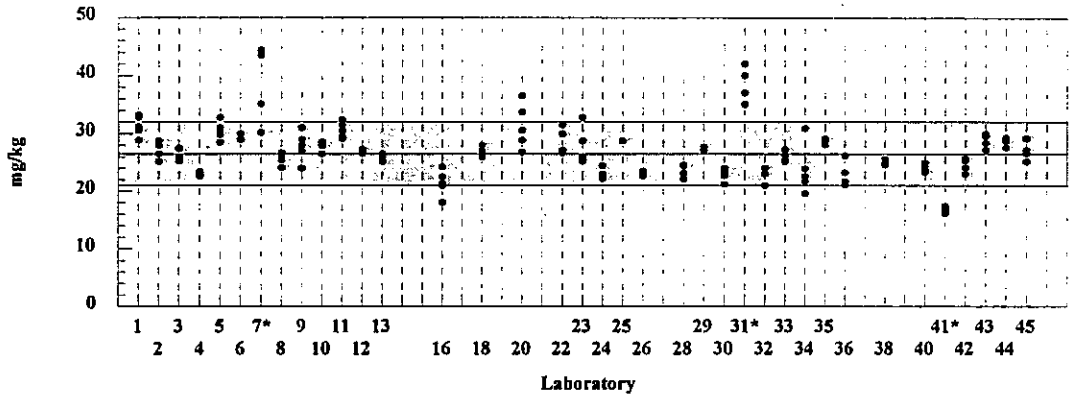
The Fe concentration of Tissue X is no different than that of Tissue V last year. The CIs for the two samples are essentially the same (± 18 and ± 15 percent, respectively). There has, however been an improvement in the acceptance ratio from 82 to 90. Twenty-seven of the 30 sets (90%) are within 20 percent of the accepted mean. There are only 3 rejected sets, one high and two low. The acceptable confidence range for SRM 1566a has been increased to ± 10 percent and as a result the rejection rate is 16 percent, the same as last year. All 4 outliers are low. The Youden plot again displays systematic errors for low results only.

NICKEL

Sediment W

Accepted value = 26.5 ± 5.5 mg/kg

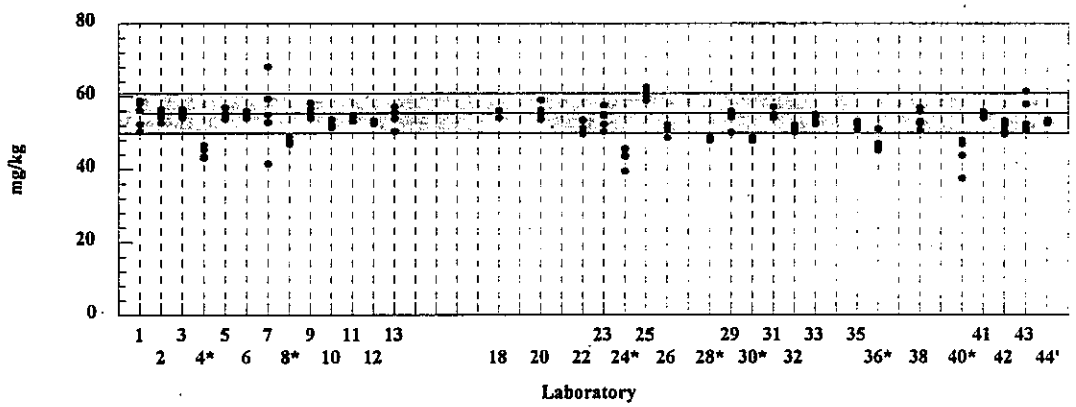
Results: 37 Quantitative Results: 37 Rejections: 3



BCSS-1

Certified value = 55.3 ± 3.6 (5.5) mg/kg

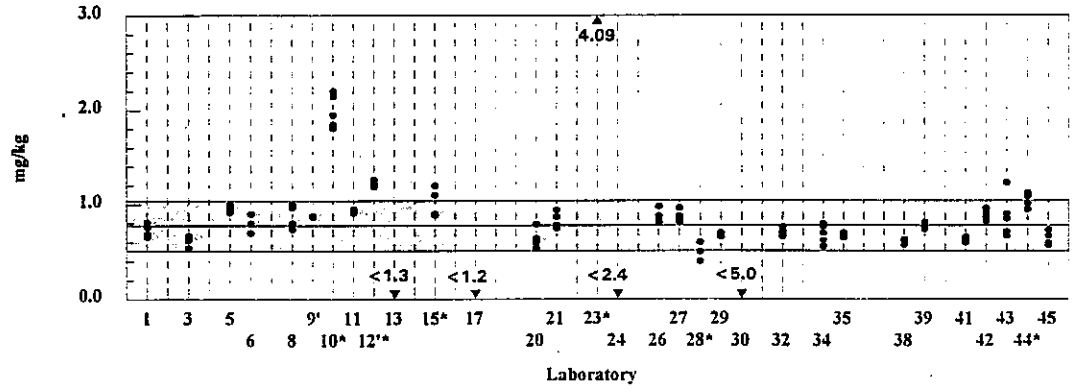
Results: 34 Quantitative Results: 34 Rejections: 7



Tissue X

Accepted value = 0.77 ± 0.27 mg/kg

Results: 32 Quantitative Results: 28 Rejections: 6

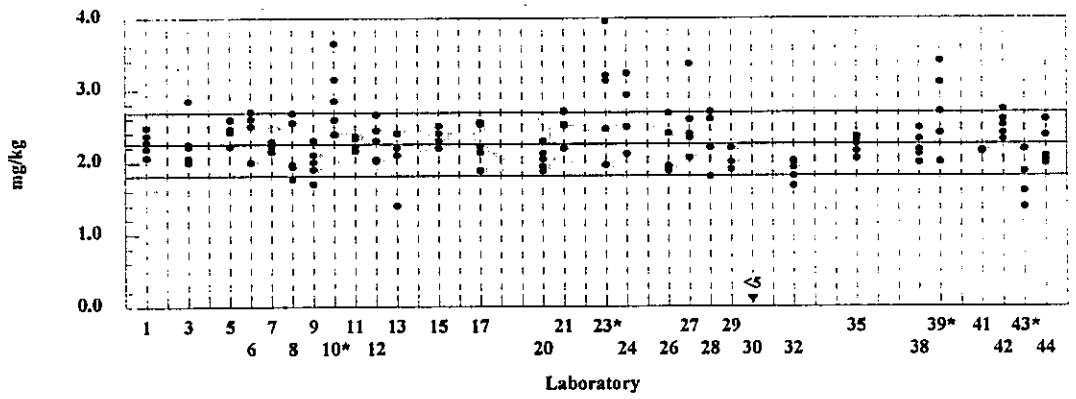


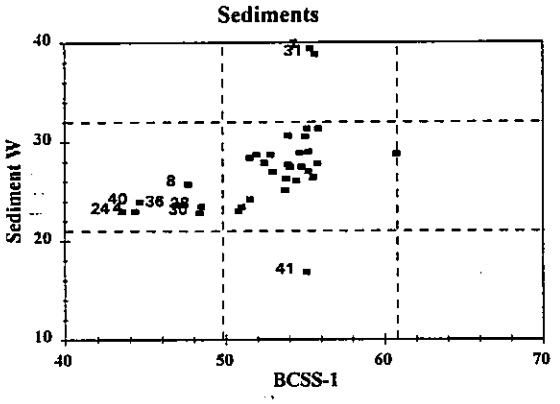
NICKEL

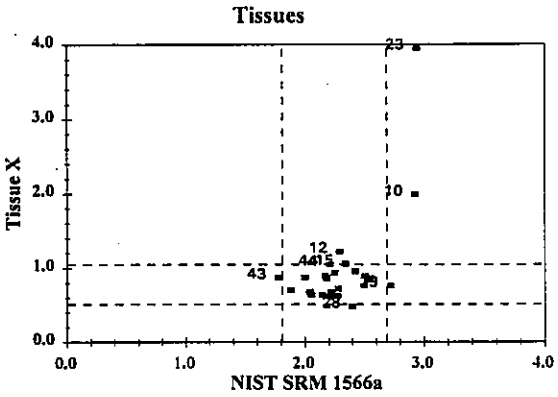
NIST SRM 1566a

Certified value = 2.25 ± 0.44 mg/kg

Results: 30 Quantitative Results: 29 Rejections: 4







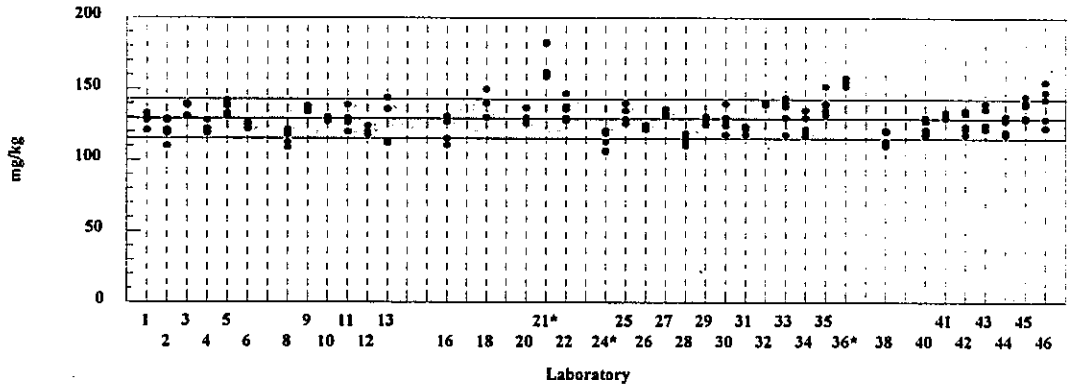
Results for Ni in the sediments have again not changed significantly. The rejection rate remains at 8 percent. Thirty-seven laboratories submitted results for Sediment W with only 3 rejections. The use of HF does not seem to be a factor with this sample. The accepted CI was ± 21 percent with 34 of the sets (92%) within 20 percent of the accepted mean. The acceptable confidence range for BCSS-1 was increased from ± 6.5 to ± 10 percent for the evaluation. There were 7 outliers in 33 submissions, all low. Five of these labs did not use HF. The Youden plot shows an obvious difference between the two sediments. The use of HF is necessary for the CRM but not for Sample W. We will see this tendency again with other trace metals.

The concentration of Ni in the tissues has been similar in the last 3 exercises and the performance of the participants has not varied much. The CI this year is ± 35 percent with 18 of the sets (64%) within 20 percent of the accepted mean. The rejection rate is down from 35 to 21 percent with 6 rejections, 5 of them high. Four of the 5 were measured by ICPMS. Results for Ni in SRM 1566a are also similar to last year's. There were only 4 outliers, 3 high. The Youden plot shows largely random errors.

COPPER

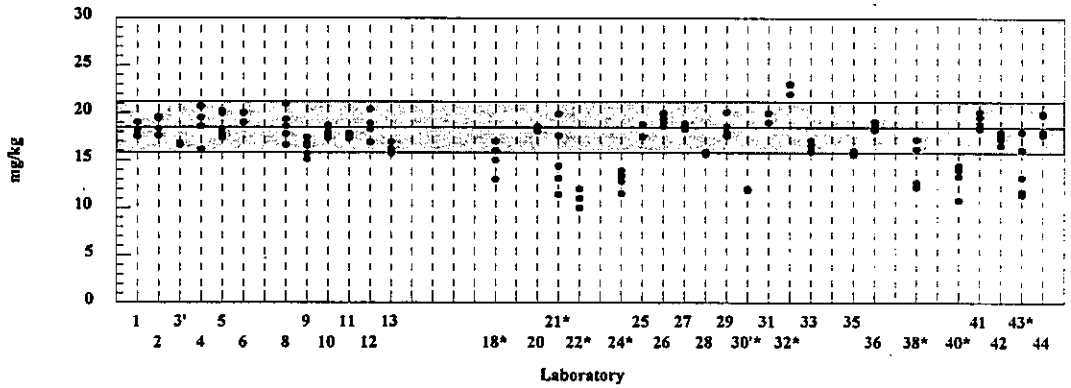
Sediment W

Accepted value = 129 ± 14 mg/kg
Results: 38 Quantitative Results: 38 Rejections: 3



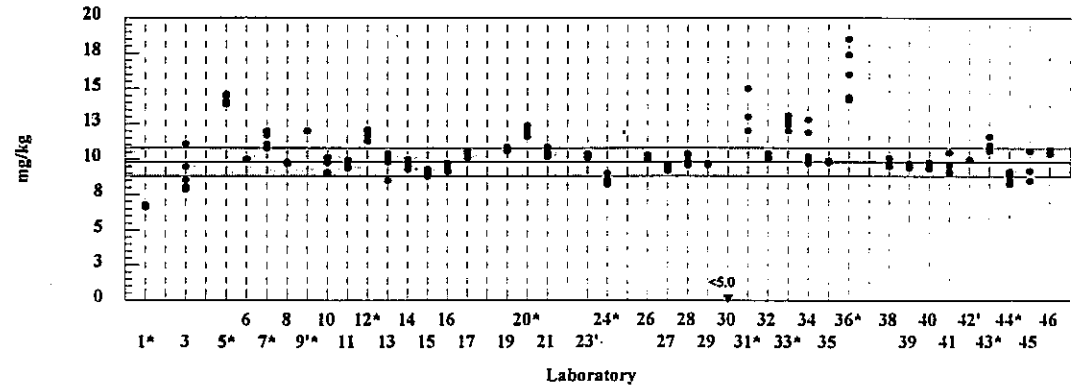
BCSS-1

Certified value = 18.5 ± 2.7 mg/kg
Results: 34 Quantitative Results: 34 Rejections: 8



Tissue X

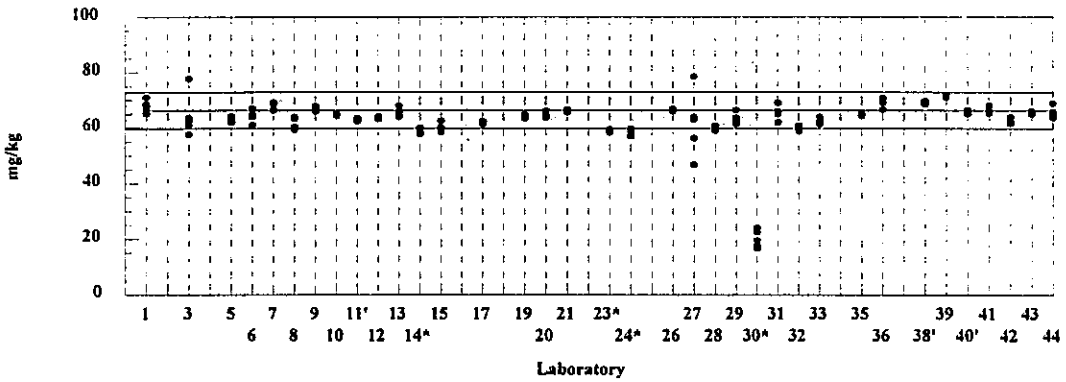
Accepted value = 9.8 ± 1.0 mg/kg
Results: 40 Quantitative Results: 39 Rejections: 12

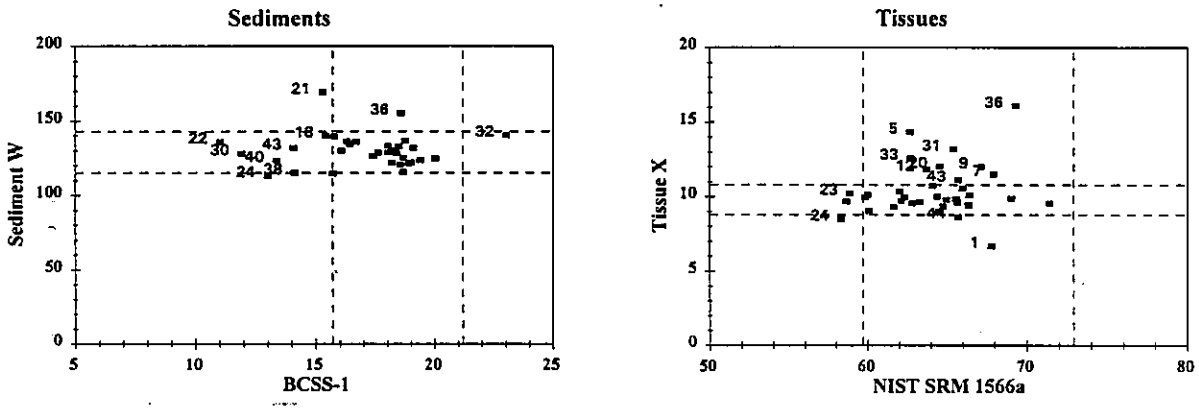


COPPER

NIST SRM 1566a

Certified value = 66.3 ± 4.3(6.6) mg/kg
Results: 36 Quantitative Results: 36 Rejections: 4





An improvement is apparent in the analysis of Cu in Sample W but it may be related to the geological matrix and the rather high concentration of the analyte. The calculated CI is ± 11 percent, the same as for 1994 and 1993 but the rejection rate has dropped to 8 from 22 percent last year. This compares with a CI of ± 20 percent for Sample N in 1991. Thirty-seven of the sets (97%) are within 20 percent of the accepted mean. There were 3 outliers, 2 high. Results for Cu in BCSS-1 are similar to last year. There are 8 rejections, 7 low. Five of these were from labs which did not use HF. The Youden plot demonstrates the difference between the two samples.

Despite the 15-fold lower Cu concentration in Tissue X compared to that of Tissue V last year the CI remains at ± 10 percent with 32 labs (82%) yielding results within 20 percent of the accepted mean. There were 12 rejected sets, 8 high, with no apparent relationship between "success" and measuring systems. Results for SRM 1566a are similar to last year's. The Youden plot shows a tendency towards random errors.

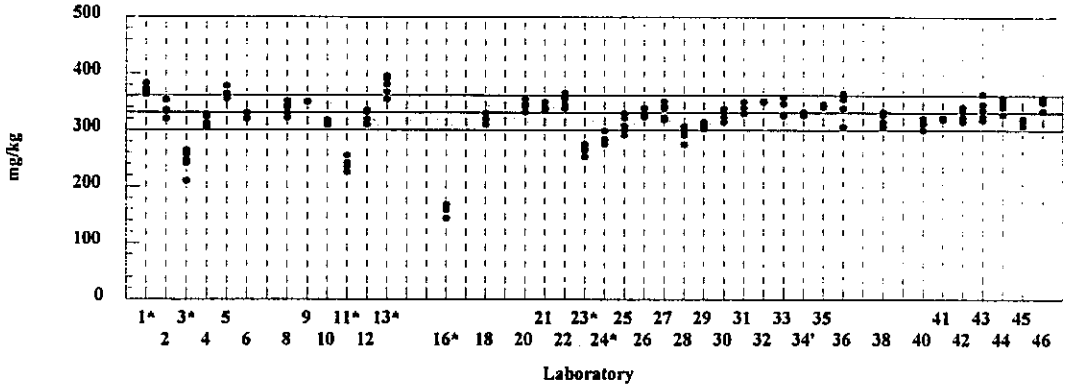
We probably can not expect much better performance for the analysis for Cu in the future.

ZINC

Sediment W

Accepted value = 331 ± 33 mg/kg

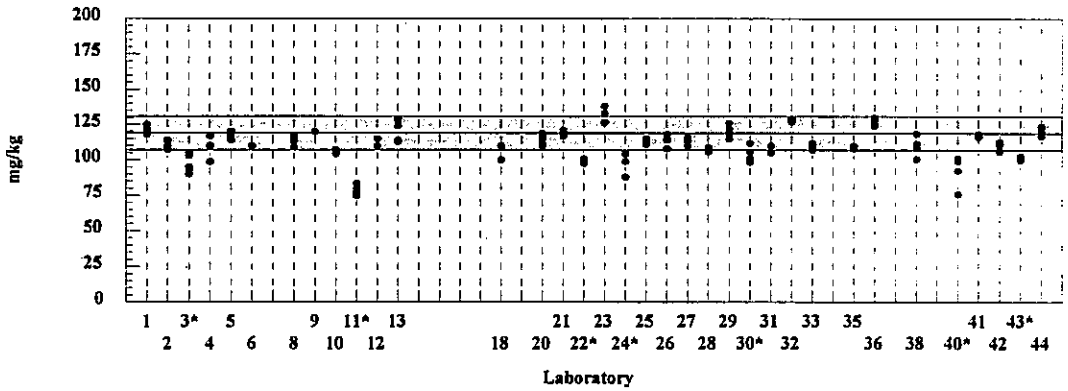
Results: 39 Quantitative Results: 39 Rejections: 7



BCSS-1

Certified value = 119 ± 12 mg/kg

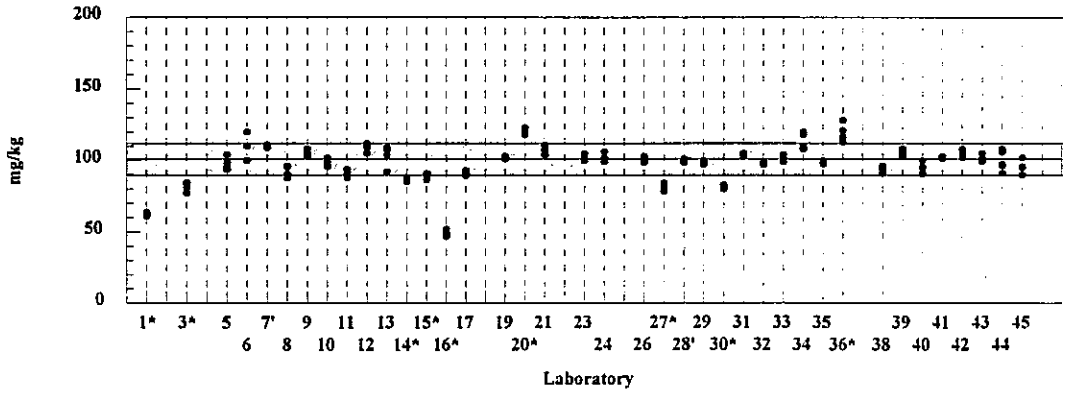
Results: 35 Quantitative Results: 35 Rejections: 7



Tissue X

Accepted value = 101 ± 11 mg/kg

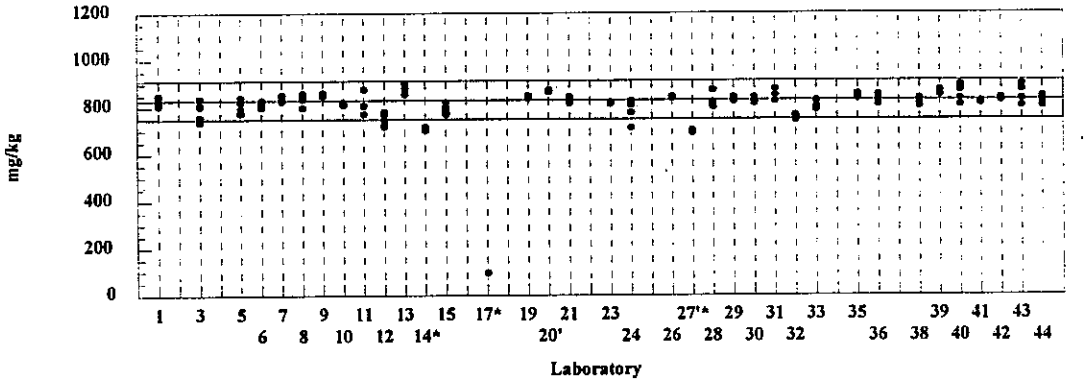
Results: 39 Quantitative Results: 39 Rejections: 9

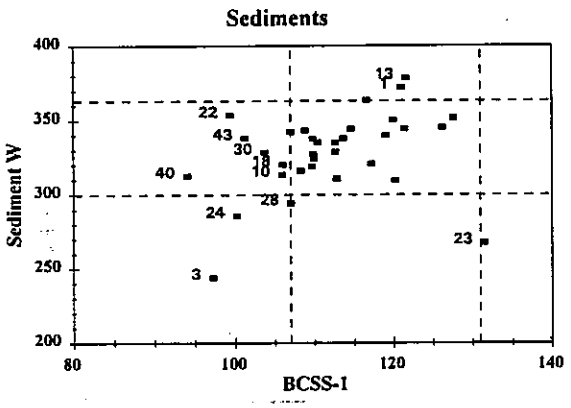


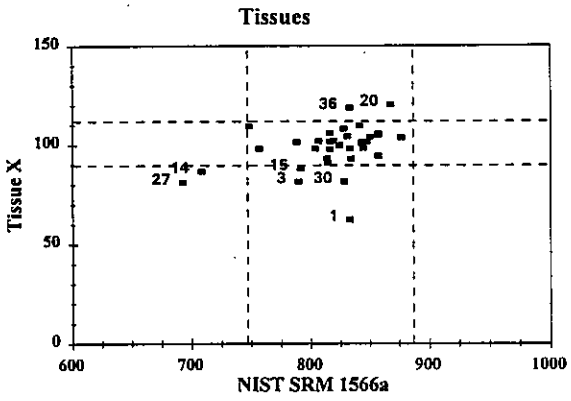
ZINC

NIST SRM 1566a

Certified value = 830 ± 57 (83) mg/kg
Results: 36 Quantitative Results: 36 Rejections: 3







The improvement for zinc in the sediment samples in NOAA/8 has been maintained in NOAA/9. The calculated CI for Zn in Sample W is ± 10 percent with 36 of the sets (92%) within 20 percent of the accepted mean. This compares with a CI of ± 17 percent for Sample N in 1991. There were 7 outliers from 39 submissions, five of which were low. Three of these did not use HF. Likewise for BCSS-1 which had 7 rejections, all low. Five of these did not use HF. The Youden plot shows that errors are largely systematic.

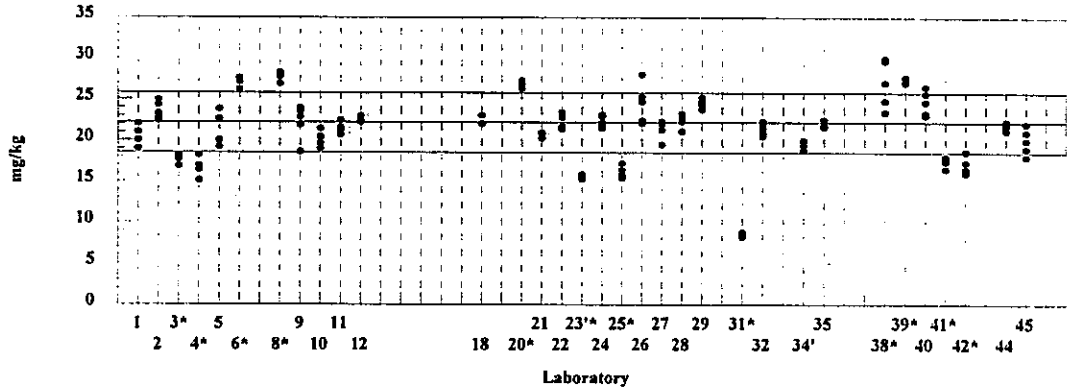
Also, the significant improvement in the determination of Zn in the tissues was maintained. The calculated CI is ± 11 percent with 37 of the sets (95%) within 20 percent of the accepted mean. Nine of 39 submitted results were rejected for Tissue X, 7 low. Of the nine rejections 6 measurements were made by ICPAES, and 3 by FAAS. The acceptable range for Zn in SRM 1566a has been increased to ± 10 percent from the certified range of ± 7 percent. As a result only 3 of the 36 results were rejected. The Youden plot shows some tendency to systematic errors.

As with Cu, we probably can not expect much better performance for the analysis for Zn in the future.

ARSENIC

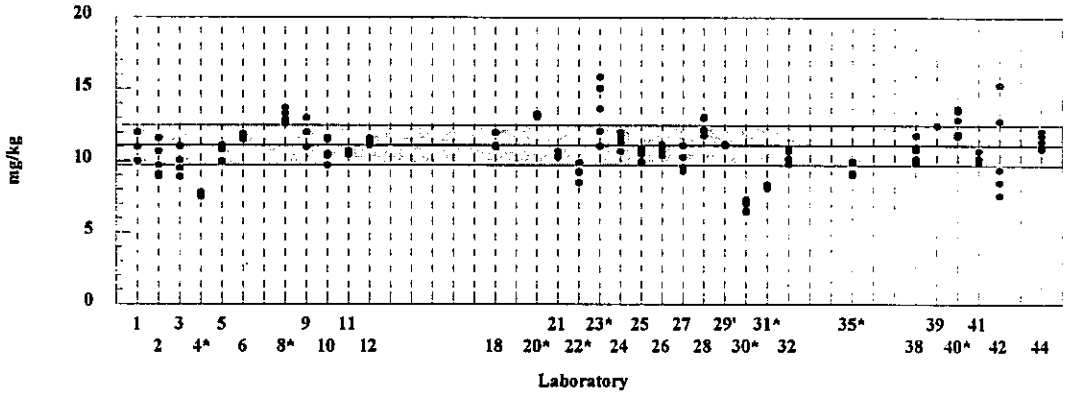
Sediment W

Accepted value = 22.2 ± 3.6 mg/kg
Results: 34 Quantitative Results: 34 Rejections: 12



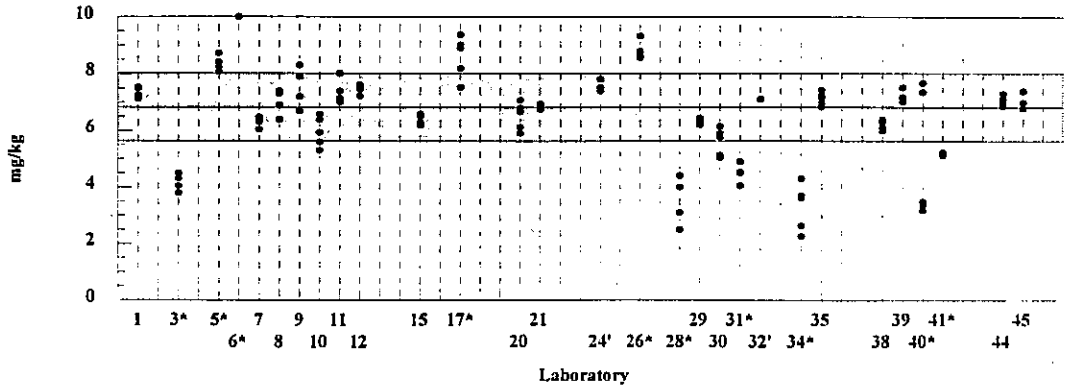
BCSS-1

Certified value = 11.1 ± 1.4 mg/kg
Results: 32 Quantitative Results: 32 Rejections: 9



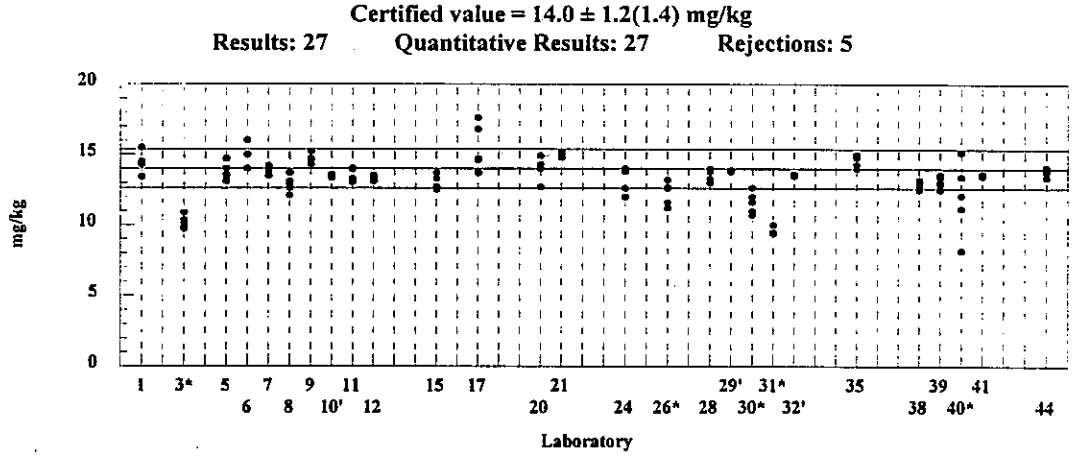
Tissue X

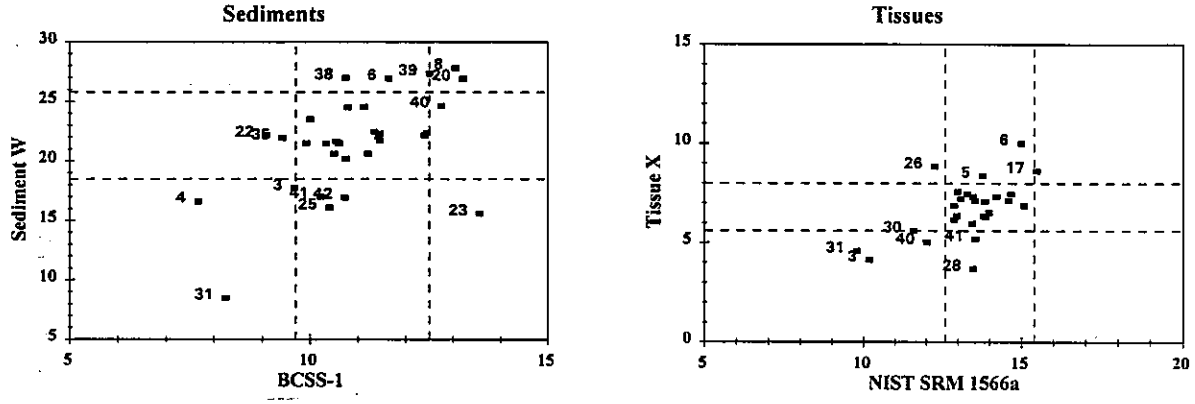
Accepted value = 6.82 ± 1.20 mg/kg
Results: 29 Quantitative Results: 29 Rejections: 10



ARSENIC

NIST SRM 1566a





The calculated acceptable range for arsenic in Sediment W has dropped to ± 16 percent this year. This compares favourably with a CI of ± 29 percent in 1991. Twenty sets (59%) were within 20 percent of the accepted mean. There were 12 outliers from 34 submissions. Of the 12, 6 were measured using GFAAS, and 5 using HGAAS. Performance for the CRM BCSS-1 was worse than last year, returning to that of previous years. There were 9 outliers. The Youden plot displays a tendency to systematic errors. In general, there has been a small but steady improvement since NOAA/5 but the group accuracy remains disappointingly low when compared to other common trace metals.

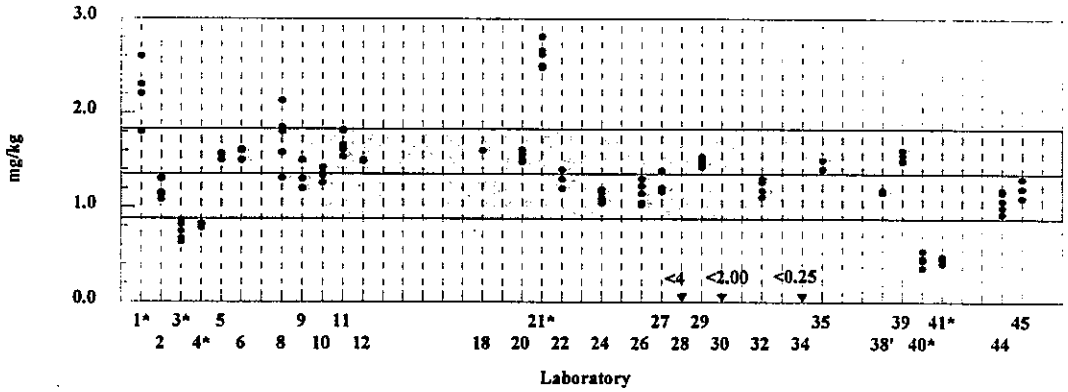
The results for As in Tissue X are disappointing with no great improvement over the last 4 years. The CI is ± 18 percent with 19 of 29 sets of results (66%) within 20 percent of the accepted mean. There were 10 outliers, 4 high and 6 laboratories reported very low results. Of these, 6 were measured by GFAAS, 3 by ICPAES and one by HGAAS. Possible explanations for the difficulties could include incomplete destruction of the arsenobetaine, the As may be lost in the digestion procedure or perhaps calibration is more difficult for this element. Results for SRM 1566a are equivalent to those of last year with 5 of 27 results (19 percent) rejected. The Youden plot displays a tendency to systematic errors (analyte loss, calibration).

Clearly, As is an analyte which requires attention.

SELENIUM

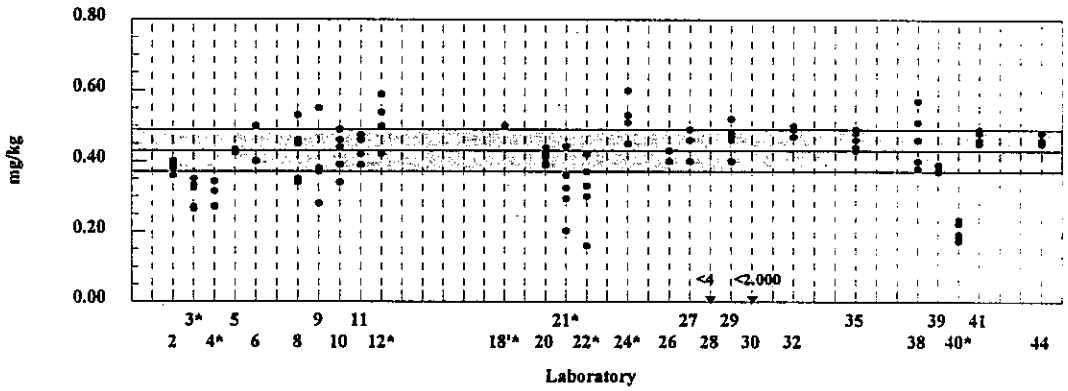
Sediment W

Accepted value = 1.36 ± 0.47 mg/kg
Results: 30 Quantitative Results: 27 Rejections: 6



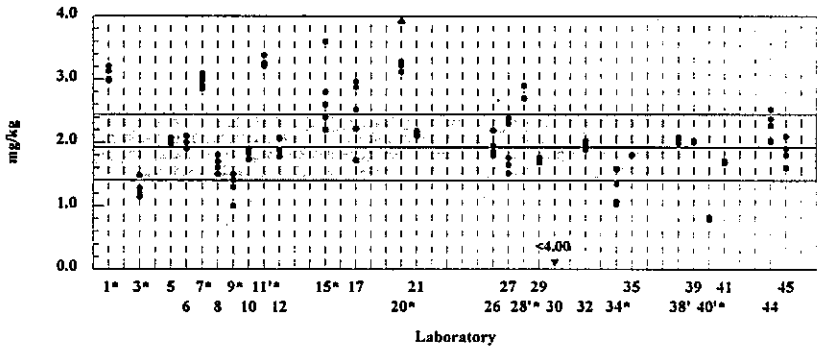
BCSS-1

Certified value = 0.43 ± 0.06 mg/kg
Results: 27 Quantitative Results: 25 Rejections: 8



Tissue X

Accepted value = 1.92 ± 0.52 mg/kg
Results: 27 Quantitative Results: 26 Rejections: 10

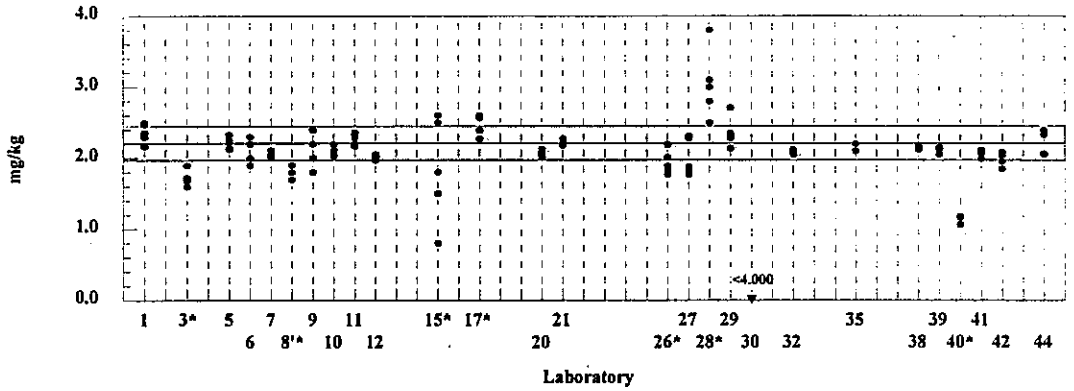


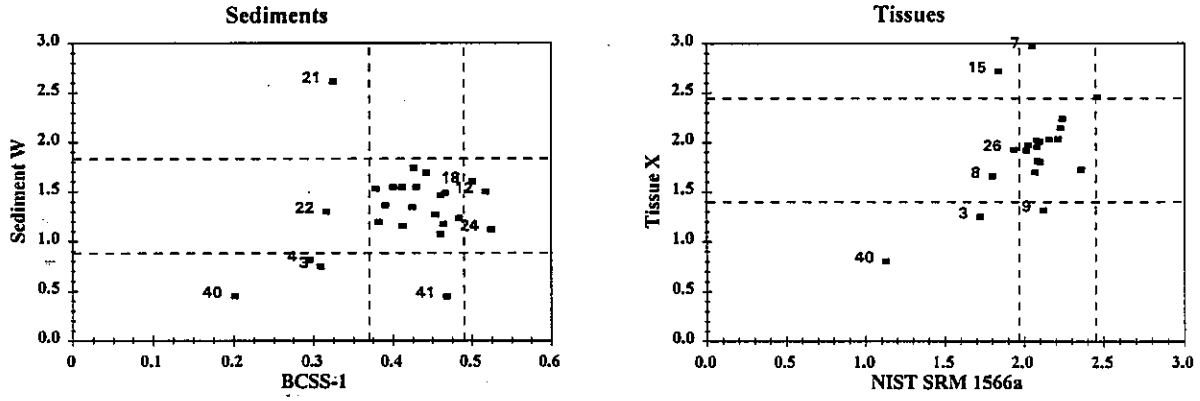
SELENIUM

NIST SRM 1566a

Certified value = 2.21 ± 0.24 mg/kg

Results: 27 Quantitative Results: 26 Rejections: 7





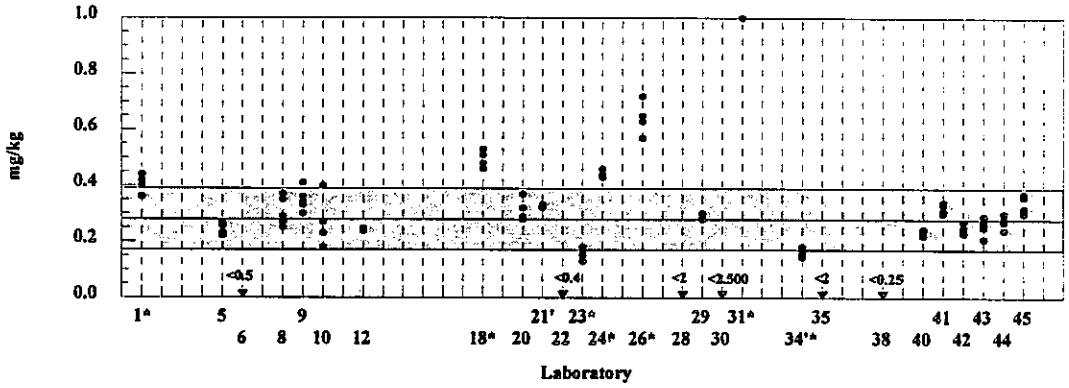
While there is evidence of good improvement over the last 5 years, the analysis of sediments for Se remains difficult for a large number of labs. The calculated CI for Se in Sediment W has dropped to ± 35 percent this year from ± 46 percent last year and compares favourably with a CI of ± 45 percent for Sediment N in 1991. Nineteen sets from 27 submissions (70%) were within 20 percent of the accepted mean. There were only 6 outliers, 2 high. Of the 6, 4 labs used GFAAS for measurement. Laboratory 41 possibly has a mathematical problem. Results for BCSS-1 are comparable to those of previous years with 8 of 25 results rejected. Only 6 of the outliers are greater than 20 percent from the certified value. The Youden plot again displays a tendency to systematic errors

The CI for Se in tissues has dropped continuously over the last 5 years. The calculated CI for Se in Tissue X has dropped to ± 27 percent this year from ± 33 percent last year and ± 42 percent in 1991. Seventeen sets from 26 submissions (65%) were within 20 percent of the accepted mean. There were 10 outliers, 6 high. All the results from the 4 labs that used ICPMS were high. Results for SRM 1566a are somewhat worse than last year but no worse than those of earlier years. The proportion of acceptable results decreased from 82 to 73 percent of the submitted results. But only two of the 26 submitted results are greater than 23 percent from the certified value. The Youden plot indicates systematic errors.

SILVER

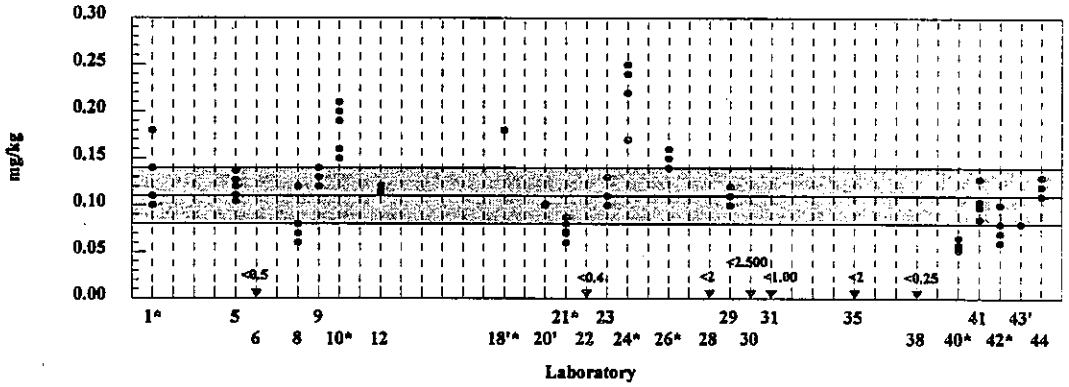
Sediment W

Accepted value = 0.28 ± 0.11 mg/kg
Results: 27 Quantitative Results: 21 Rejections: 7



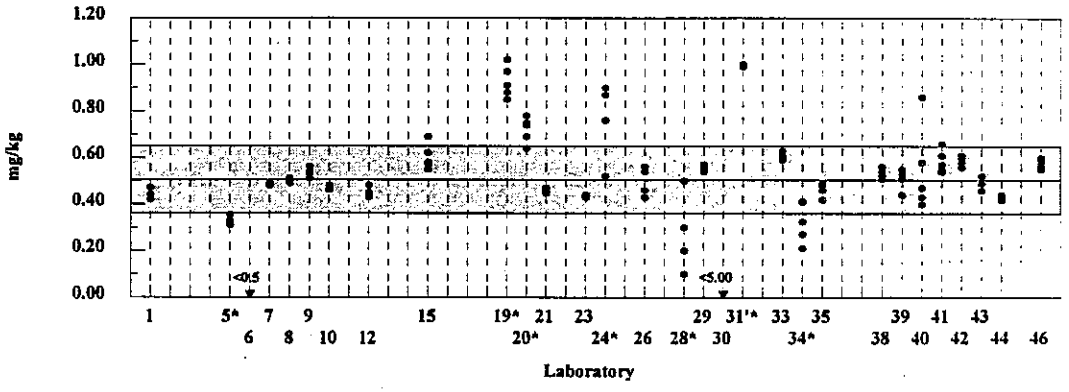
BCSS-1

Certified value = 0.11 ± 0.03 mg/kg
Results: 25 Quantitative Results: 18 Rejections: 8



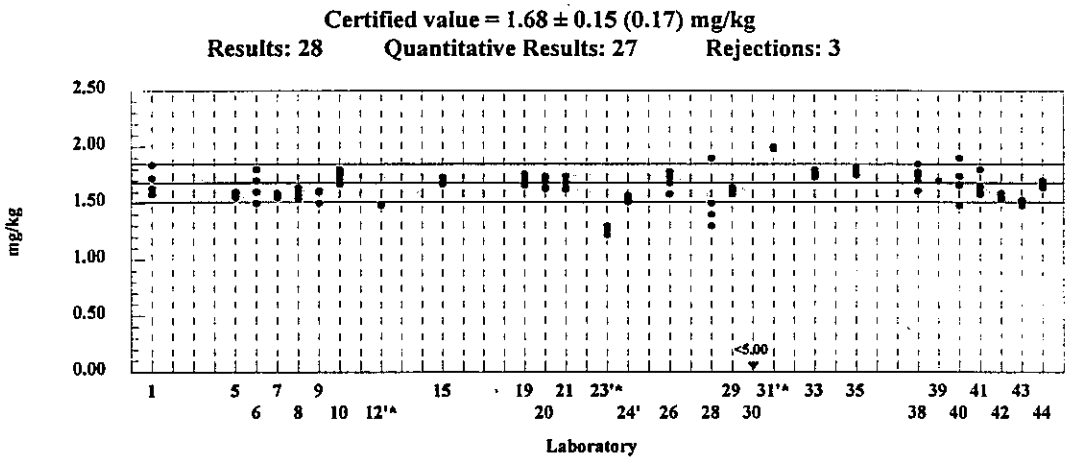
Tissue X

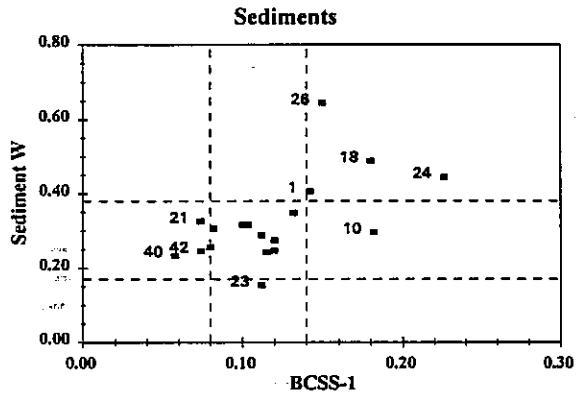
Accepted value = 0.50 ± 0.14 mg/kg
Results: 30 Quantitative Results: 28 Rejections: 7

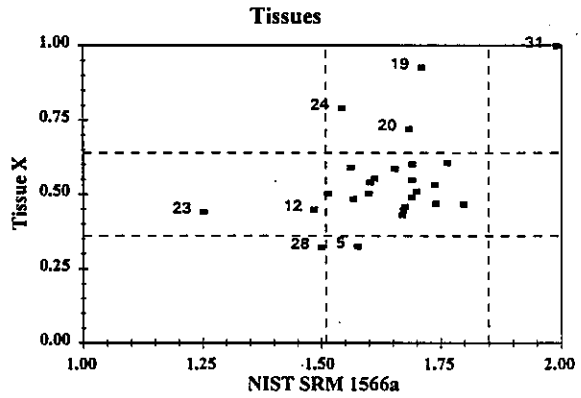


SILVER

NIST SRM 1566a







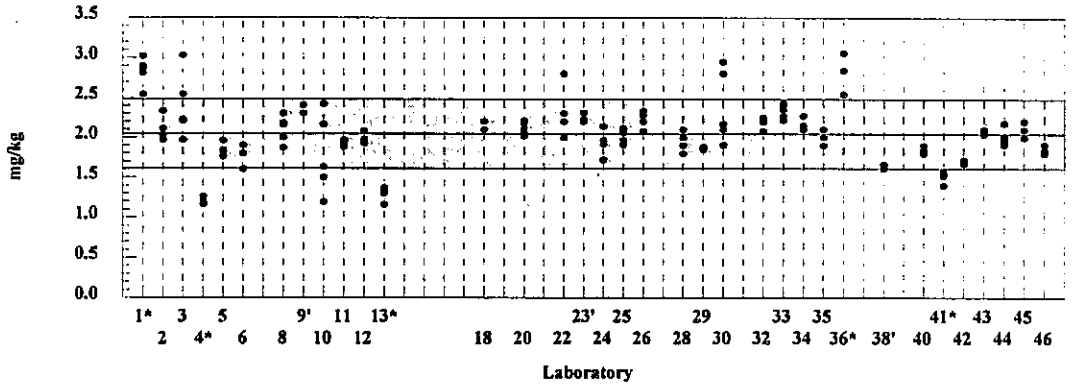
The improvement noted last year for the determination of Ag in sediments has not been maintained. The calculated CI for Ag in Sediment W has risen to ± 39 percent this year from ± 24 percent last year and is comparable with a CI of ± 41 percent in 1993. Only twelve sets from 21 submissions (57%) were within 20 percent of the accepted mean. The Ag concentration is low. There is no apparent relation between measurement method and performance. The results for BCSS-1 are comparable to those of earlier years. As a point of interest, BCSS-1 is now certified for Ag at a concentration less than 10 percent from the overall mean of the calculated accepted means of the last 3 years when it was treated as an "unknown". So the dozen or so labs that have been agreeing with each other over the years have been doing the right thing.

The results for Ag in Tissue X are good. The calculated CI is ± 28 percent this year up from ± 16 percent last year but last year's sample had 5 times the concentration of Ag. Twenty sets from 28 submissions (71%) were within 20 percent of the accepted mean. There were 7 outliers. Results from 3 of the four labs that used FAAS were rejected. As with the sediments, GFAAS appears to be the method of choice but there is also an increased number of ICPMS and ICPAES values. There is a marked improvement for the analysis of Ag in SRM 1566a. The rejection rate has fallen to 11 percent from 27 percent last year. Twenty-six of the 27 submissions are within 14 percent of the certified value. The Youden plot indicates a mixture of random and systematic errors.

CADMIUM

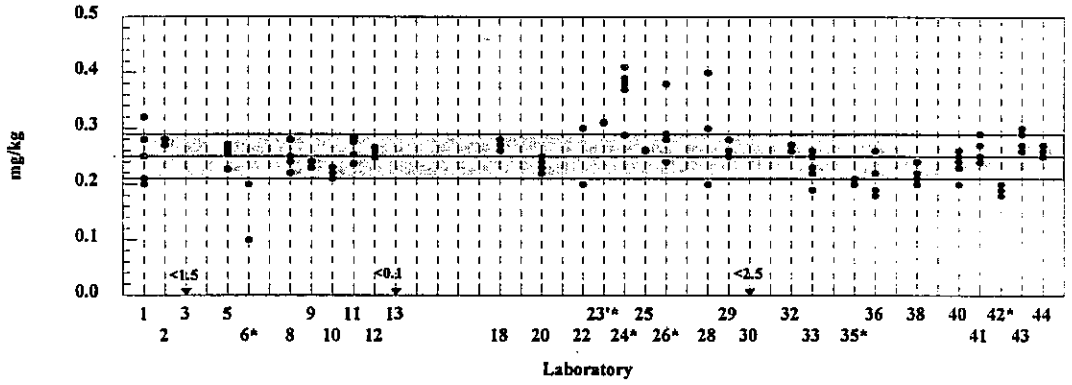
Sediment W

Accepted value = 2.05 ± 0.43 mg/kg
Results: 35 Quantitative Results: 35 Rejections: 5



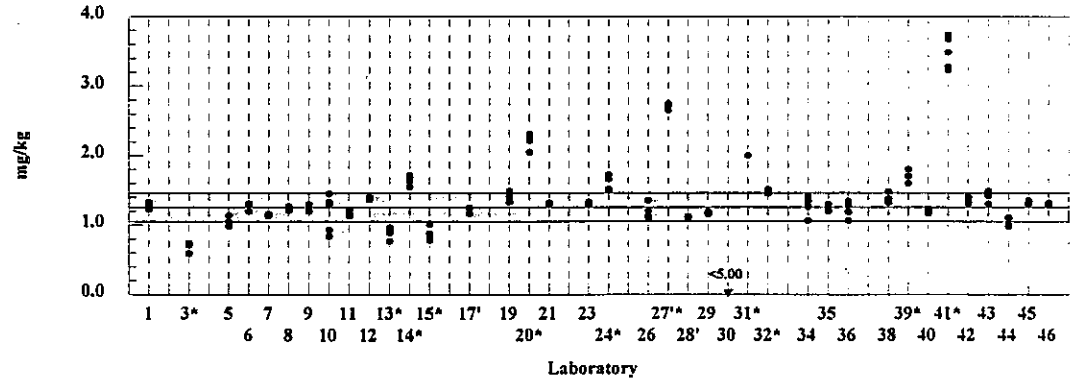
BCSS-1

Certified value = 0.25 ± 0.04 mg/kg
Results: 31 Quantitative Results: 28 Rejections: 6



Tissue X

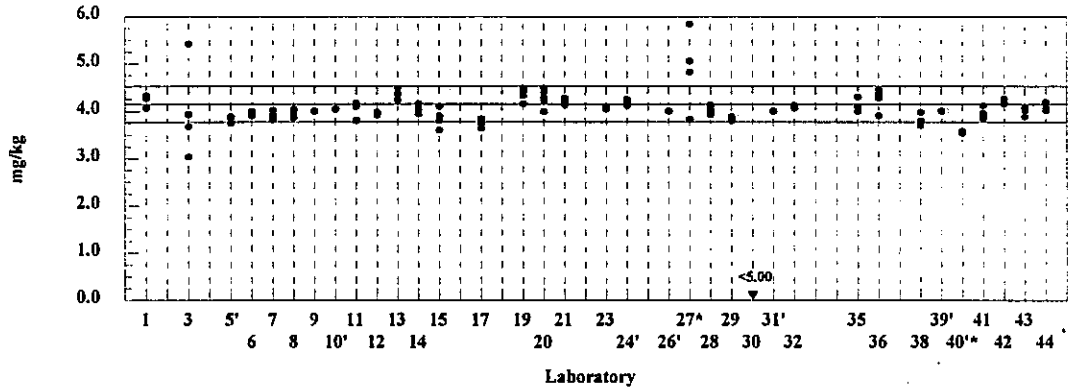
Accepted value = 1.25 ± 0.21 mg/kg
Results: 38 Quantitative Results: 37 Rejections: 11

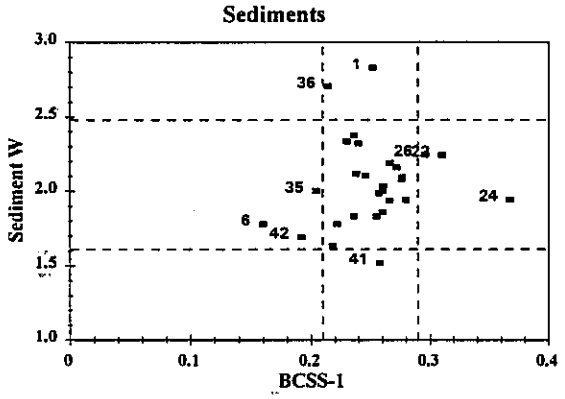


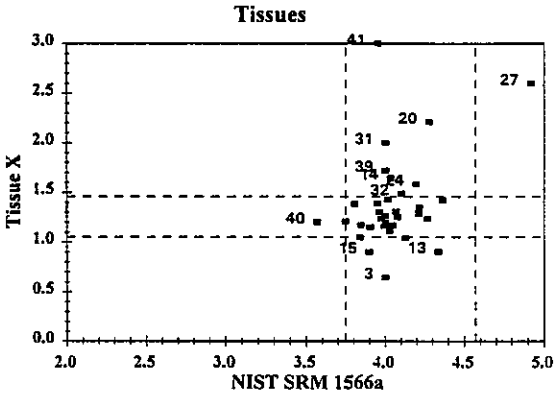
CADMIUM

NIST SRM 1566a

Certified value = 4.15 ± 0.38 (0.42) mg/kg
Results: 35 Quantitative Results: 34 Rejections: 2







The improvement over previous years results noted last year for the determination of Cd in sediments has been maintained. The calculated CI for Cd in Sample W is ± 21 percent with 32 of the sets (91%) within 20 percent of the accepted mean. This compares favourably with a CI of ± 29 percent for Sample N in 1991. There were only 5 outliers from 35 submissions, 2 high and 3 low. Half of the accepted results were determined by GFAAS and most of the others almost equally by ICPMS, ICPAES and FAAS. Results for Cd in BCSS-1 show a good improvement. The proportion of acceptable results has risen to 79 percent from dismal 55 percent last year, restoring a good trend. All but one of the 28 submissions are within 20 percent of the certified value. The Youden plot indicates what looks like a mixture of systematic and random errors.

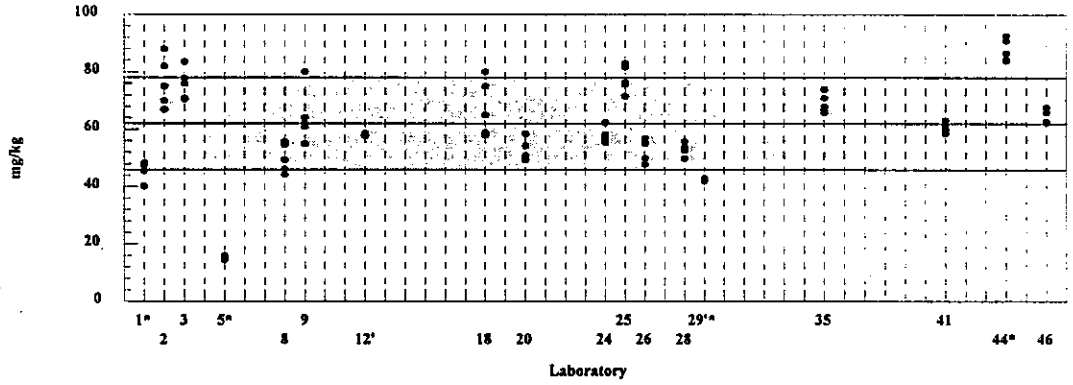
Results for Cd in Tissue X are equivalent to those of the past few years. The calculated CI for Cd is ± 17 percent with 28 of the sets (80%) within 20 percent of the accepted mean. There were 11 outliers in 35 submissions, 6 high and 5 low. The results of four of the 5 labs that used FAAS were high. Also rejected were 4 of the 9 results where ICPAES was used. The acceptance rate for SRM 1566a was 94 percent rising from 86 percent last year. Only one of the 34 submitted values was greater than 18 percent from the certified value. The Youden plot shows largely random errors.

As with Cu and Zn, we probably can not expect much better performance for the analysis for Cd in the future.

TIN

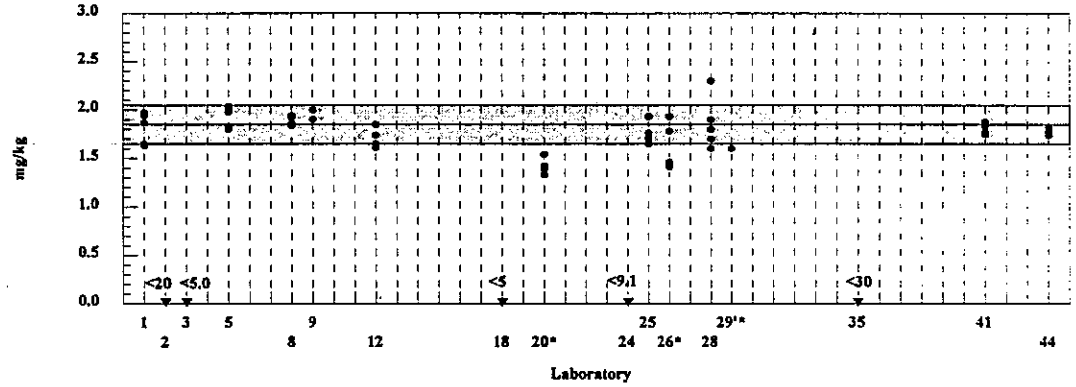
Sediment W

Accepted value = 62.1 ± 16.0 mg/kg
Results: 18 Quantitative Results: 18 Rejections: 4



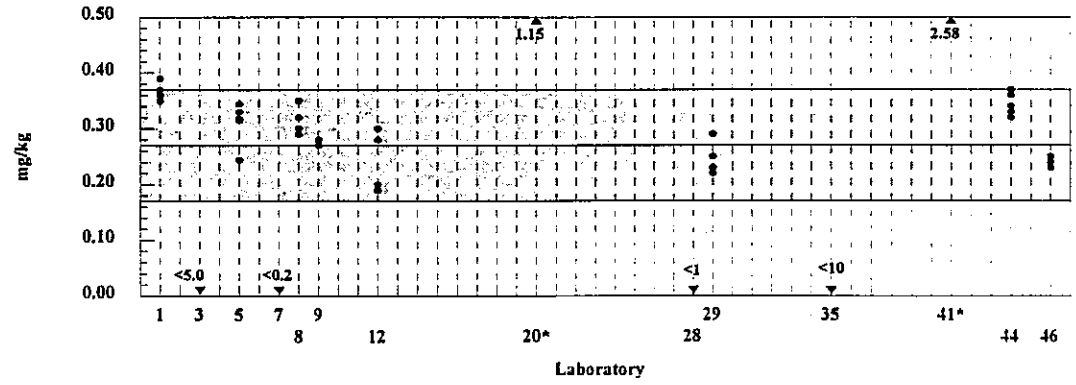
BCSS-1

Certified value = 1.85 ± 0.20 mg/kg
Results: 17 Quantitative Results: 12 Rejections: 3



Tissue X

Accepted value = 0.27 ± 0.10 mg/kg
Results: 14 Quantitative Results: 10 Rejections: 2

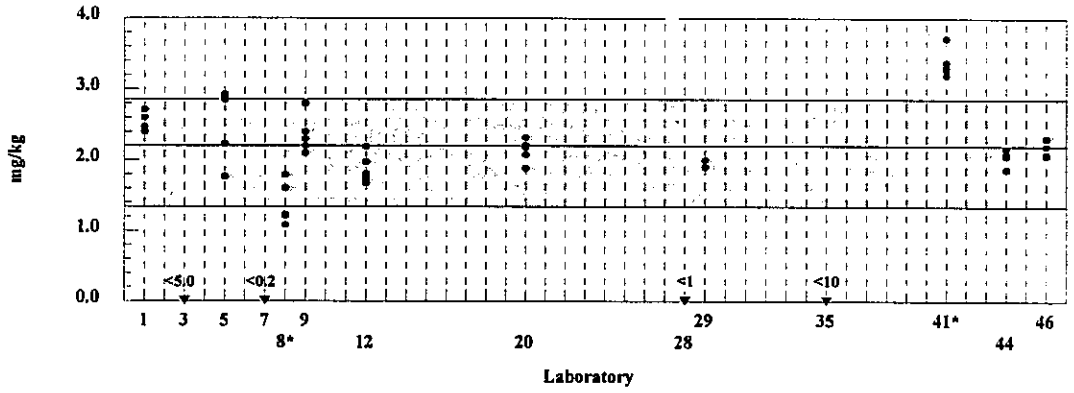


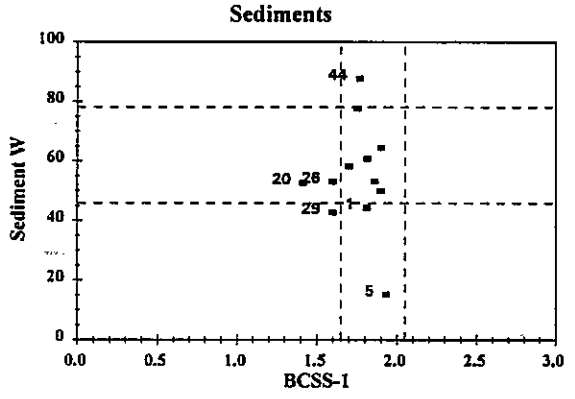
TIN

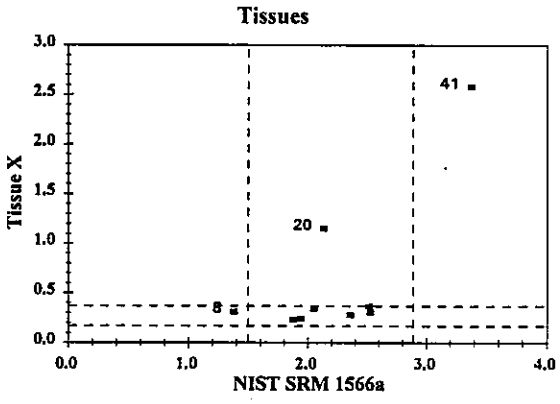
NIST SRM 1566a

Accepted value = 2.20 ± 0.69 mg/kg

Results: 14 Quantitative Results: 10 Rejections: 2







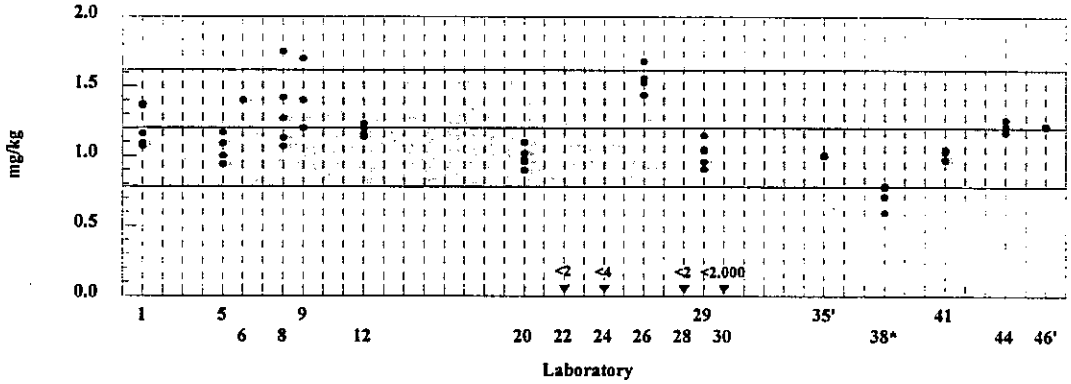
There was some improvement for the determination of Sn in sediments but the analysis remains difficult for may labs. The calculated CI for Sn in Sediment W has dropped to ± 26 percent this year from ± 30 percent last year but is worse than the CI of ± 16 percent for Sediment N in 1991. Eleven sets from 18 submissions (61%) were within 20 percent of the accepted mean. Four sets of results were rejected, 1 high, 3 low. Only 12 laboratories submitted quantitative results for Sn in BCSS-1 and all but 2 of them were within 8 percent of the certified value. The Youden plot indicates that random errors predominate.

There was not much improvement for the determination of Sn in the tissues. Only 10 laboratories submitted quantitative values for Sn in Tissue X. The calculated CI for Sn in tissue has dropped to ± 37 percent this year from ± 49 percent last year but the concentration of the Sn is 5-fold higher this year. Only 6 sets from the 10 submissions (60%) were within 20 percent of the accepted mean. Two sets were rejected, both high. Six of the 8 acceptable results were obtained using ICPMS for the determination. The other 2 labs used GFAAS. There is a problem with inhomogeneity of Sn in SRM 1566a which NIST recognizes. SRM 1566a was treated as an unknown to obtain an accepted value. Ten laboratories submitted quantitative values. There were 2 outliers. Nine of the submitted sets were within 15 percent of the accepted mean. The predominant method of measurement was ICPMS. Performance for Sn in SRM 1566a is not included in the evaluation.

ANTIMONY

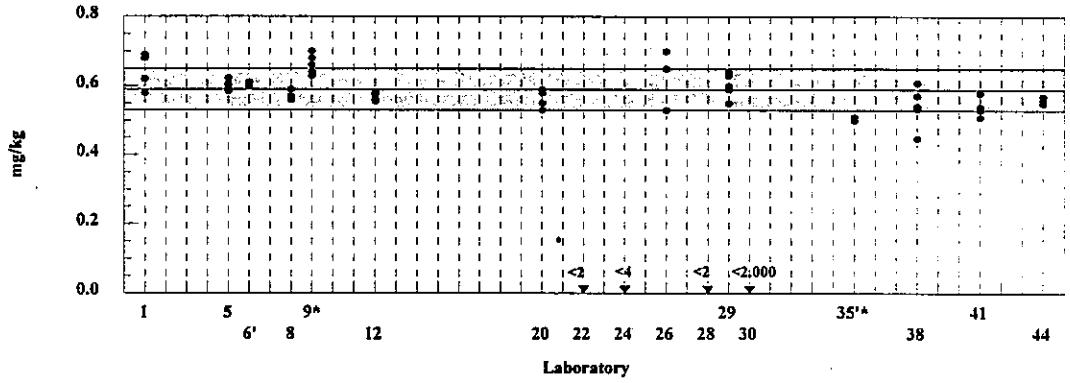
Sediment W

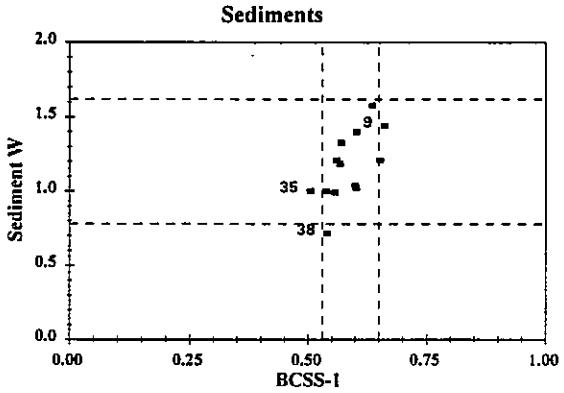
Accepted value = 1.20 ± 0.42 mg/kg
Results: 18 · Quantitative Results: 14 Rejections: 1



BCSS-1

Certified value = 0.59 ± 0.06 mg/kg
Results: 17 Quantitative Results: 13 Rejections: 2





ANTIMONY

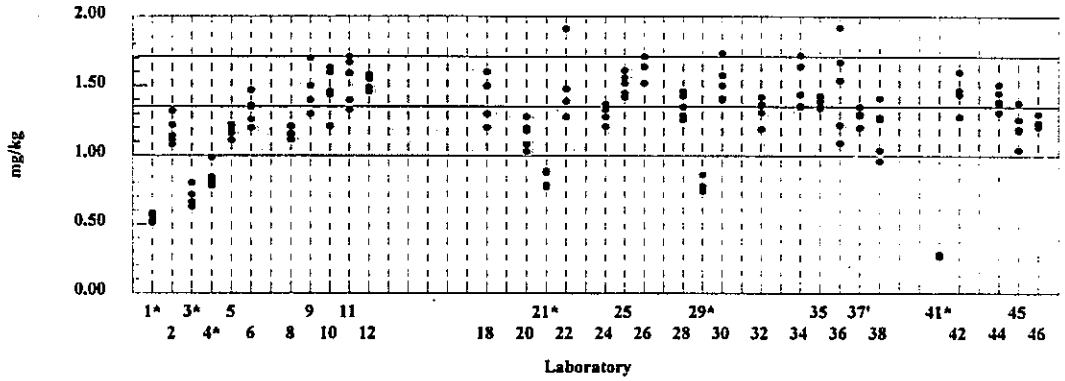
The determination of Sb in the sediments still remains a problem but there is improvement this year. The calculated CI for Sb in Sediment W is ± 35 percent this year, about the same as in past years. But twelve sets from 14 submissions (85%) were within 20 percent of the accepted mean and only one set of results was rejected. Also, results for BCSS-1 are improved with only 2 rejections for 13 submissions. All the submitted means were within 12 percent of the certified value. The Youden plot show a tendency to systematic errors.

The determination of antimony was not required for Tissue X.

MERCURY

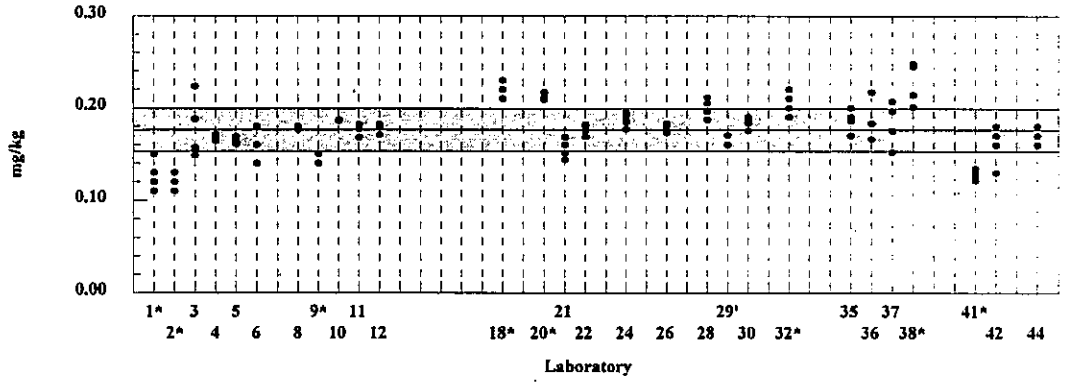
Sediment W

Accepted value = 1.35 ± 0.35 mg/kg
Results: 32 Quantitative Results: 32 Rejections: 6



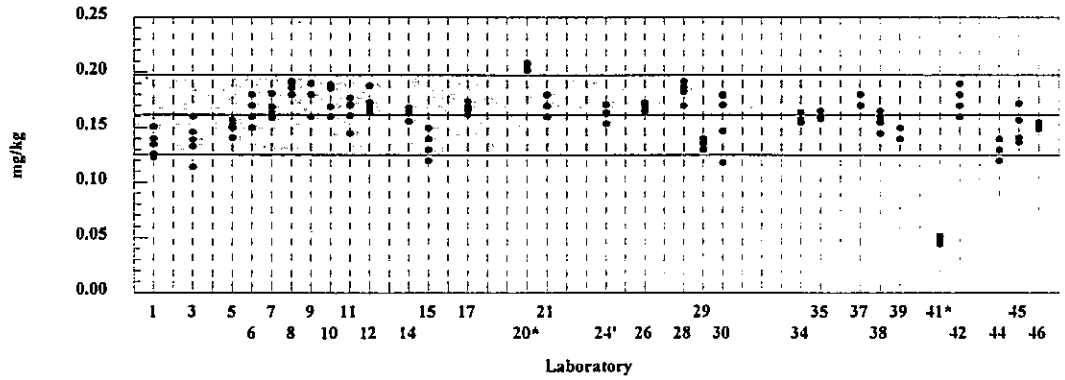
BCSS-1

Accepted value = 0.176 ± 0.023 mg/kg
Results: 28 Quantitative Results: 28 Rejections: 8



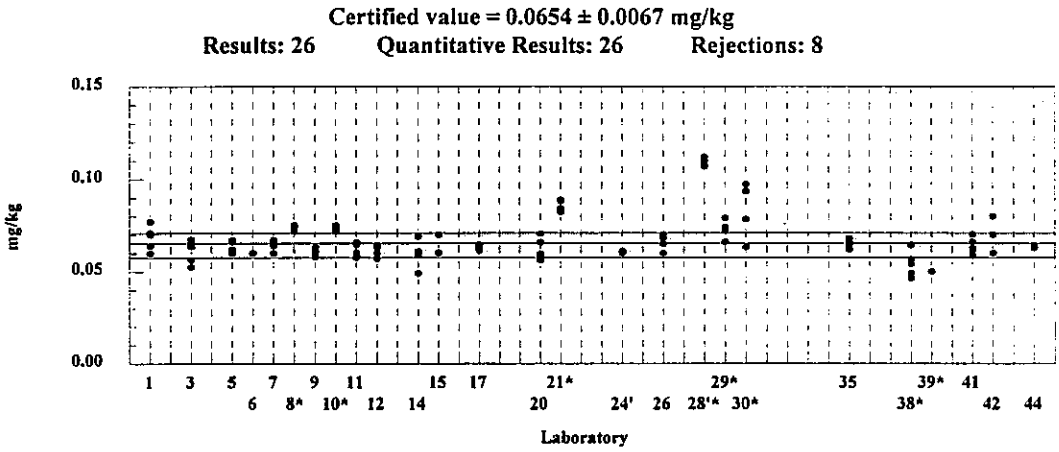
Tissue X

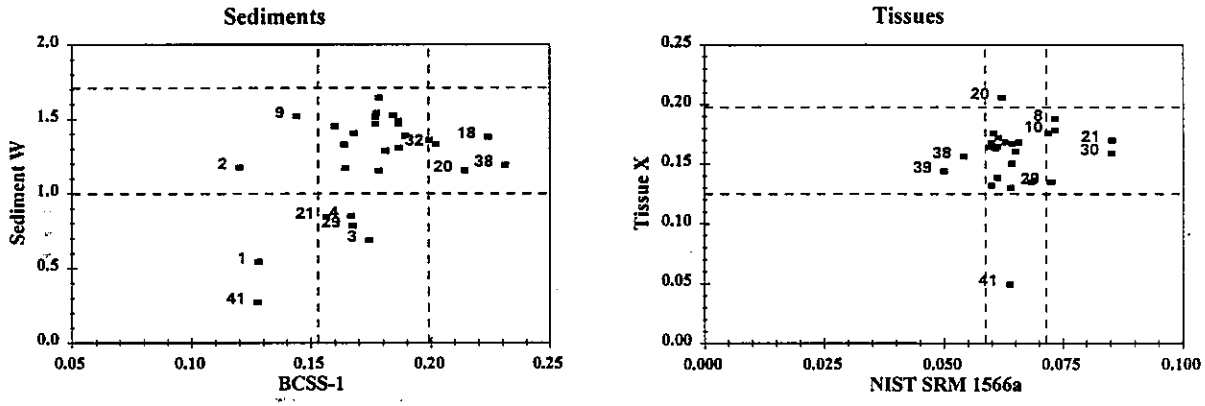
Accepted value = 0.161 ± 0.036 mg/kg
Results: 30 Quantitative Results: 30 Rejections: 2



MERCURY

NIST SRM 1566a





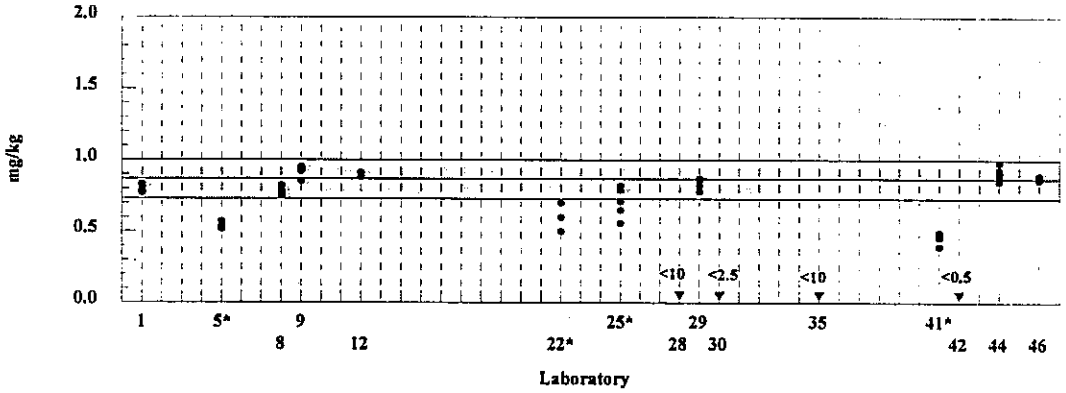
The improvement in the determination of Hg in the sediments has been maintained. The calculated CI for Hg in Sediment W is ± 26 percent this year, about the same as in the past 3 years, and better than the ± 35 percent for Sample N in 1991. Twenty-five sets from 32 submissions (78%) were within 20 percent of the accepted mean. Six sets of results were rejected, all low. Results for BCSS-1 also show improvement. The calculated CI for Hg in BCSS-1 is ± 13 percent this year, dramatically down from the ± 39 to ± 40 percent range of previous years. Twenty-two sets from 28 submissions (79%) were within 20 percent of the accepted mean. There were 8 outliers, 3 high. BCSS-1 is no longer certified for Hg, however, the accepted value has been close to 0.18 mg/kg for the past few years. The Youden plot shows a tendency to systematic errors.

Results for the determination of Hg in the tissues again show improvement. The calculated CI for Hg in Tissue X is ± 22 percent down from ± 29 percent last year. Twenty-five of the sets (93%) are within 20 percent of the accepted mean. There were only 2 outliers in 30 submissions. Performance for SRM 1566a remains about the same. All but 2 sets of results are within 12 percent of the certified value. The Youden plot shows that random errors predominate.

THALLIUM

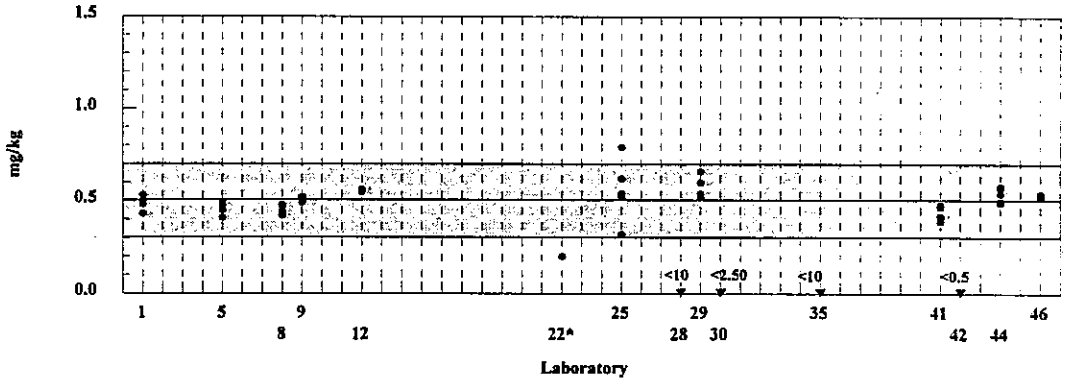
Sediment W

Accepted value = 0.87 ± 0.14 mg/kg
Results: 15 Quantitative Results: 11 Rejections: 4

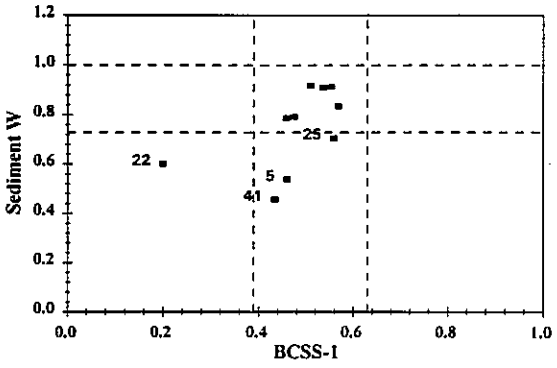


BCSS-1

Accepted value = 0.51 ± 0.12 mg/kg
Results: 15 Quantitative Results: 11 Rejections: 1



Sediments



THALLIUM

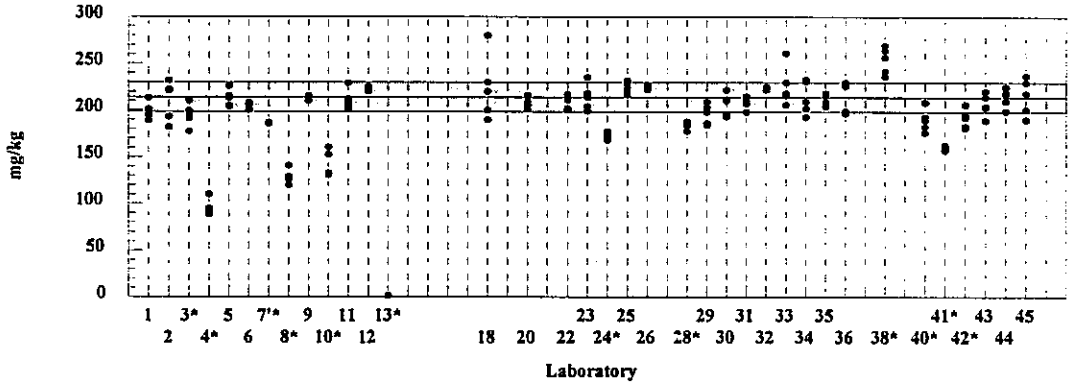
The small number of laboratories that report results for Tl in sediments continue to improve. The calculated CI for Tl in Sediment W has dropped to ± 16 percent this year from ± 32 percent last year and ± 62 percent the year before. Eight sets from 11 submissions (73%) were within 20 percent of the accepted mean. Four sets of results were rejected, all low. Three sets from the 4 labs that used GFAAS were rejected. All accepted labs, save one, used ICPMS to measure the Tl. Thallium is not certified in BCSS-1 but for the past three years the accepted mean has been slightly higher than 0.5 mg/kg. The calculated CI for Tl in BCSS-1 has dropped to ± 24 percent this year from ± 40 percent last year. Ten sets from 11 submissions (91%) were within 20 percent of the accepted mean. The Youden plot shows a tendency to systematic errors.

The determination of thallium was not required for Tissue X.

LEAD

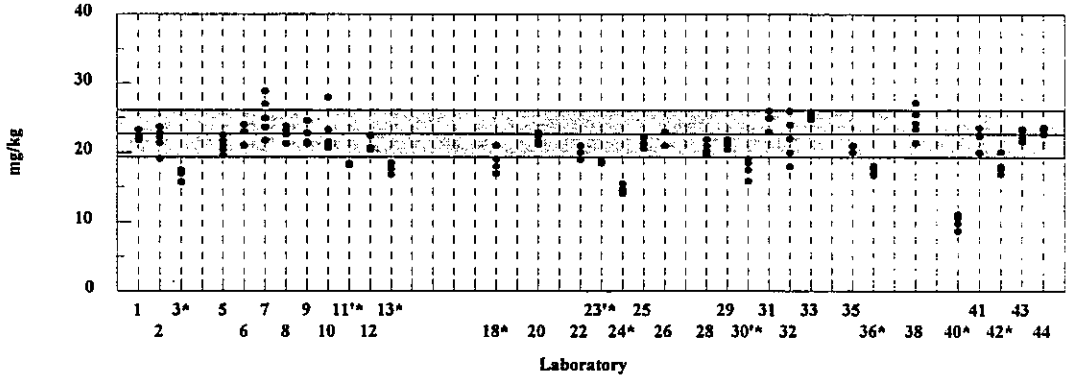
Sediment W

Accepted value = 214 ± 16 mg/kg
Results: 36 Quantitative Results: 36 Rejections: 12



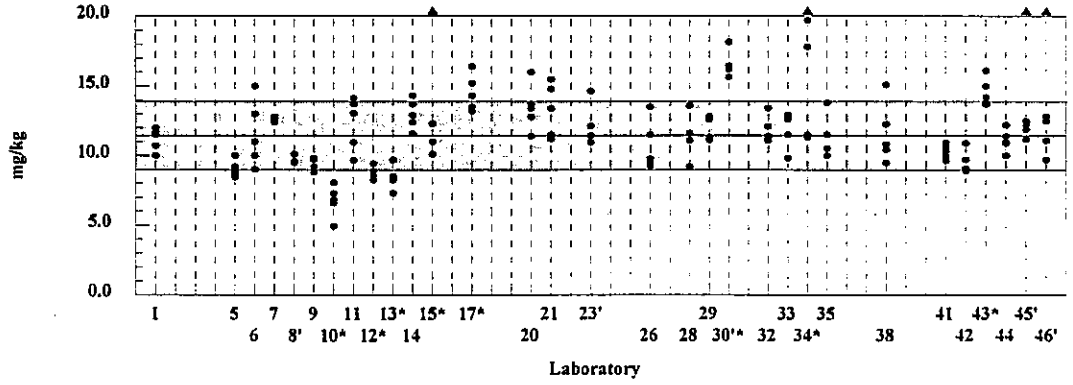
BCSS-1

Certified value = 22.7 ± 3.4 mg/kg
Results: 33 Quantitative Results: 33 Rejections: 10



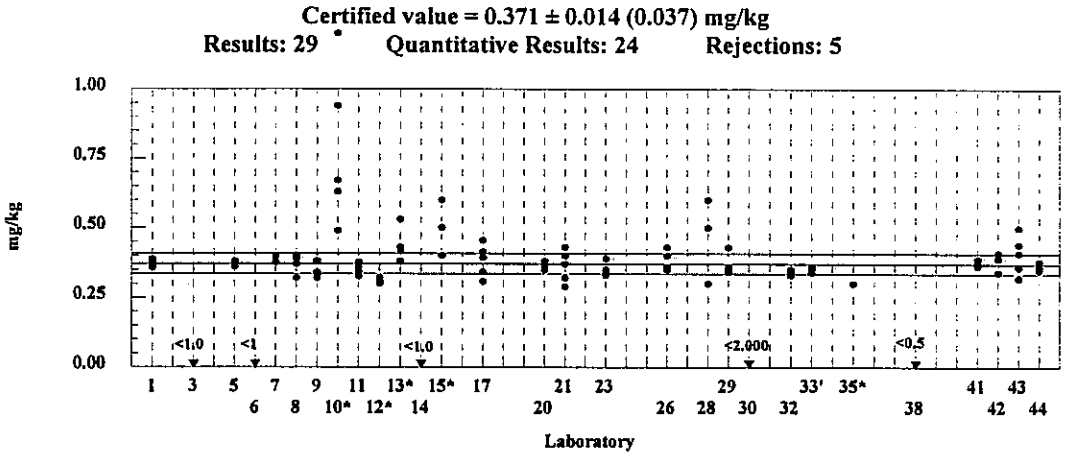
Tissue X

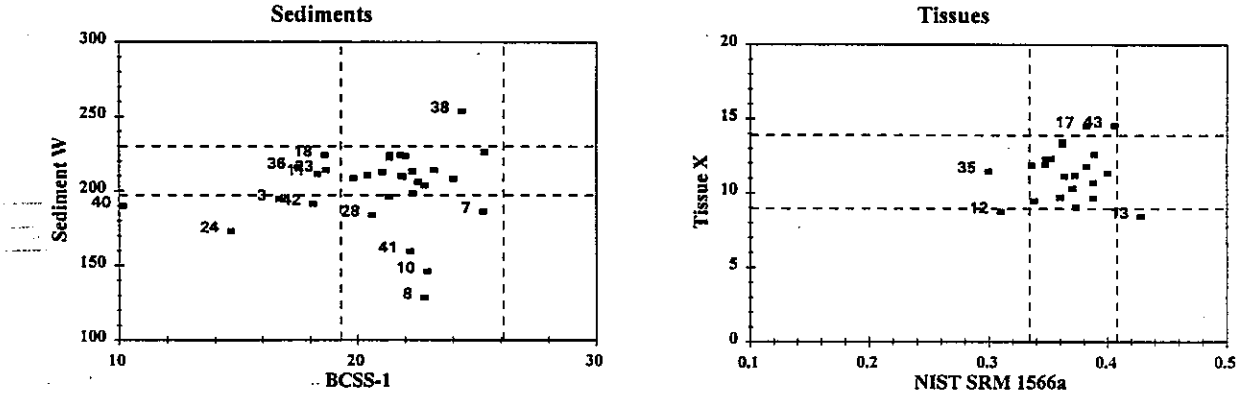
Accepted value = 11.4 ± 2.5 mg/kg
Results: 31 Quantitative Results: 31 Rejections: 8



LEAD

NIST SRM 1566a





Performance for the determination of Pb in the sediments has apparently improved but Sediment W has a relatively high Pb concentration. The calculated CI for Pb in Sample W is ± 7 percent with 31 of the sets (86%) within 20 percent of the accepted mean. This is down from ± 18 percent last year and compares favourably with a CI of ± 22 percent for Sample N in 1991. There were 12 outliers from 36 submissions, 1 high and 11 low. Performance for BCSS-1 is about the same as in previous years. Sixty-seven percent of the submissions were within 15 percent of the certified value. The Youden plot shows random errors. There is room for improvement.

The calculated CI for Pb in Tissue X is ± 22 percent with 26 of the sets (84%) within 20 percent of the accepted mean. This is up from ± 15 percent last year with a sample of much lower concentration. There were 8 outliers, 5 high. Five of the outliers were from the 16 labs which used GFAAS to measure the Pb. It is possible that there was a homogeneity problem with this sample as several laboratories, including NRC, obtained a set of results with one or more fliers. The results for Tissue X were not included in the evaluation of laboratory precision. The acceptable CI for Pb in SRM 1566a was increased to ± 10 percent for the evaluation. The performance was similar to last year's. There were four outliers for the CRM. All but 2 of the submissions were within 16 percent of the certified value. The Youden plot shows random errors.

3. DISCUSSION

The intent of this exercise was to assess the capability of participating laboratories to determine selected trace metals in marine biological tissue and sediment samples. This is best measured through an evaluation of their accuracy and, through some extent, intralaboratory precision. Of the four samples, one sample of each type was a certified reference material (CRM). For these CRMs (except for mercury and thallium in BCSS-1 and tin in NIST SRM 1566a) established means and confidence intervals are known. This knowledge, however, portends an inherent difficulty when using CRMs in intercomparison studies. The answers are known to the participants and there is often a inclination to tend towards "the right answer". However, our experience of the last several years with the NOAA exercises has shown that if this is happening, it is not a significant factor.

The combination of CRMs and unknowns and the substantially increased participation of the last few years have proven to be powerful tools in discerning competence. The key factor, which characterizes and is almost unique to the NOAA exercises, is the provision of a built in mechanism for obtaining reliable values for the concentrations of the analytes in the unknowns.

For each of the two unknown samples an excluded mean and confidence interval for each analyte were calculated from the submitted data. An implication of this approach is that the accuracy evaluation of a laboratory's performance for a particular analyte in a particular matrix is relative to the performances of all accepted laboratories. Thus we get an indication of the type of comparability we may expect if the accepted group were to analyze similar materials. In all cases in this study the calculated mean was not much different and certainly not significantly different from the NRC means for all analytes in both matrices.

If we assume that NRC is competent, there also appears to always be a group of participating laboratories that are equally competent for various analytes in the particular matrices and, if there are sufficient data, an accurate mean can be established along with an appropriate 95 percent confidence interval.

The use of the CRMs is a great aid in this type of exercise because their 95 percent confidence intervals are generally much narrower than those defined in the exercise for the unknowns. Laboratories which produce results within the confidence intervals of both the CRM and the unknown are obvious demonstrators of reliability and comparability for that analyte in the particular matrix at the concentration range in question. Of equal importance is the ability to use the CRMs to discern general trends which might otherwise be lost in the relatively wider confidence intervals calculated for the unknowns.

A system to evaluate laboratory performance for the individual elements in the sediments and biological tissues was established using the following criteria:

- **E** - **Excellent accuracy**: all replicate values are within the established confidence interval.
- **G** - **Good accuracy**: the mean of the replicates is within the established confidence interval but one or more replicates is outside, or a "less than" value has been reported that is not less than the lower confidence limit and not five times greater than the accepted mean.
- **L** - **Low results**: the mean of the replicates is less than the lower confidence limit or the "less than" value reported is below the lower confidence limit.
- **H** - **High results**: the mean of the replicates is greater than the upper confidence limit or the "less than" reported is greater than a factor of five above the accepted or certified value.
- **G** - **Good precision**: the intralaboratory precision is within the criteria for precision listed below in Table I.
- **X** - **Poor precision**: the intralaboratory precision is not within the criteria for precision listed below in Table I.
- **-** - No results.

Results from laboratories which did not submit at least 4 replicates for an analyte have not been evaluated.

Detailed charts of this assessment are tabulated in Appendix C.

Table I

Criteria for Intralaboratory Precision Evaluation

Sample	Expected RSD
Tissues	± 10 percent
Sediments	± 10 percent*

* ± 5 percent for aluminum, silicon and iron in sediments

An indication of the overall laboratory improvement that has occurred since these studies began was our decision to tighten the criteria used to evaluate intralaboratory precision (Table I) for the NOAA/7 study. This more demanding standard reflected an improvement of procedures and

instrumentation compared to the previous NOAA exercises. Last year for NOAA/8, we went a step further and asked laboratories to analyze each replicate on four non-consecutive days. Although it may have been a worthwhile effort this protocol did impose an extra burden on the participants. There was insufficient evidence that this new procedure significantly assisted our evaluation of a laboratory's precision and accuracy and, as a result, we returned to the protocol of the first seven NOAA intercomparisons and asked laboratories to merely submit five replicates values for each sample.

When evaluating precision we cannot ignore that there is some probability that the sample is inhomogeneous. We assume that this would generally be more prevalent in the unknown samples which are not as rigorously processed as the CRMs. The certificate for NIST SRM 1566a acknowledges evidence of tin inhomogeneity in this CRM, which appears to be confirmed by the data (pp 30-31). Although, an evaluation of precision for this sample was listed in Appendix C according to the criteria in Table I, the overall precision rating for the laboratories in Table IV ignored the results for tin in SRM 1566a. There is possibly a homogeneity problem with Pb in Tissue X. This is evident from the data of several laboratories and corroborated by NRC's results (page 38). The results for this sample were also not included in the evaluation of laboratory precision.

The overall assessment based on these criteria and the number of sets of results submitted allowed four distinct categories of accuracy performance to be discernible. These are shown in Table II for the sediments and in Table VI for the biological tissues. In general, **Superior** laboratories submitted results for most analytes within the 95 percent confidence intervals; **Good** laboratories submitted many results within the accepted range with a minimum number of outliers; **Fair** laboratories had some problems with certain elements or did not report results for a number of elements. Laboratories with a high proportion of outliers or "less thans" or which did not submit results for a large number of analytes were categorized as **Others**. It should be noted that the dividing lines between the categories, especially between good and fair, are somewhat diffuse. The last three columns in Tables II and VI compare the number of laboratories in each category for the last four exercises.

A similar evaluation for intralaboratory precision based on the criteria of Table I produced two categories: **Good** and **Fair** (Tables III and VII).

Sediments

Although there have been about the same number of sediment submissions for the last three years such is the turnover of participants that ten laboratories reported sediment data for the first time. Eight were new participants and two laboratories which had submitted only tissue data in previous exercises. Two of the ten laboratories were rated good, six were rated fair and two were rated in the "other" category. Four of the laboratories in the superior category (6,9,20,29) are veterans which have analyzed biological tissues and sediments in at least six previous NOAA exercises.

Table II

Accuracy Evaluation for the Sediments*

	Laboratory Number	NOAA/9	NOAA/8	NOAA/7	NOAA/6	NOAA/5
Superior	5,6,9,12,20,26,29, 44	8	11	8	5	3
Good	1,2,7,8,10,11,18,25 27,32,33,35,38,41,4 3	15	13	12	11	7
Fair	13,21,22,28,30,31,3 4,36,39,42	10	8	12	5	7
Others	3,4,16,23,24,37,40	7	8	10	7	6
Total		40	40	42	28	23

*Laboratories 14,15,17 and 19 did not report results for the sediments

Table III

Intralaboratory Precision Evaluation for the Sediments

	Laboratory Number
Good	1,2,4,5,6,8,9,11,12,13,18,20,21, 22,24,25,26,27,28,29,30,31,32,33, 35,36,39,41,42,43,44
Fair	3,7,10,16,23,34,37,38,40

A listing of the number of quantitative results submitted and the number of rejected means for the laboratories over the past four years is tabulated in Table IV on page 44. The laboratory numbers are this year's designation only. This permits the laboratories to monitor their general performance over this period. Of the twenty-eight laboratories that submitted sediment data for both NOAA/8 and NOAA/9, ten (2,5,6,12,13,26,27,31,36,38) improved their ratings, four of these (5,6,12,26) rose to the superior category. Four laboratories maintained their superior status. Five laboratories descended to good from superior, and one laboratory descended from good to "others". Remember that the rating is relative, and as the group as a whole improves the individual laboratory also must improve in order to retain its former position.

Table IV

Comparison of NOAA/9, NOAA/8, NOAA/7, NOAA/6 and NOAA/5 Laboratory Performance for Sediments

LAB	NOAA/9		NOAA/8		NOAA/7		NOAA/6		NOAA/5	
	Sets	Rej	Sets	Rej	Sets	Rej	Sets	Rej	Sets	Rej
1	35	10	36	6	34	5				
2	24	3	18	8						
3	28	15	28	6	24	18	26	13	25	14
4	24	15	24	13	24	13	24	10	22	8
5	36	3	18	4	28	6	28	4		
6	30	2	15	0	15	2	14	1	11	0
7	12	2			15	4	32	19		
8	34	7	30	5						
9	36	2	36	0	36	1	31	2	23	3
10	24	3	22	4	22	4	18	4		
11	20	4	14	9	2	0	16	7	16	7
12	36	1	30	7	32	19	30	10		
13	16	6	26	16	24	9	22	4	20	10
16	7	2								
18	30	7	32	5						
20	32	5	31	4	32	2	18	1	14	0
21	18	7								
22	32	14								
23	18	10								
24	32	21	24	14	24	13				

LAB	NOAA/9		NOAA/8		NOAA/7		NOAA/6		NOAA/5	
	Sets	Rej	Sets	Rej	Sets	Rej	Sets	Rej	Sets	Rej
25	23	5	28	5	24	3	26	4	19	9
26	32	6	36	10	24	3				
27	20	1	30	13	32	4	32	6	16	10
28	36	18								
29	34	3	30	2	30	2	28	1	24	2
30	31	15								
31	20	7	17	9						
32	26	3	26	1	24	3	26	2	20	4
33	16	0	16	1	18	6				
34	10	3								
35	34	9	31	3	18	4				
36	14	6	14	10	20	8	12	7		
37	2	0					26	7	22	15
38	22	6	28	11	10	4				
39	4	1	4	0	6	0				
40	24	16								
41	36	9	36	9	34	7	30	8	22	14
42	22	8								
43	12	2								
44	32	1	32	0	30	3				

SUPERIOR
GOOD
FAIR
OTHERS

Table V

Comparison of NOAA/9, NOAA/8, NOAA/7, NOAA/6 and NOAA/5 Laboratory Performance for BCSS-1

LAB	NOAA/9		NOAA/8		NOAA/7		NOAA/6		NOAA/5	
	Sets	Rej	Sets	Rej	Sets	Rej	Sets	Rej	Sets	Rej
1	17	2	18	1	17	3				
2	12	2	9	4						
3	14	7	14	2	11	8	11	9	10	9
4	11	8	12	8	13	8	12	7	11	5
5	18	1	9	2	14	0	14	0		
6	16	1	0	-	3	2	0	-	0	-
7	6	0								
8	17	2	15	3						
9	18	2	18	0	18	1	15	2	12	3
10	12	2	11	2	11	0	9	4		
11	10	2	7	6	1	0	6	3	7	5
12	18	1	15	5	16	13	12	8		
13	8	3	13	9	12	7	9	3	10	9
16	0	0								
18	15	6	16	3						
20	17	3	16	1	16	1	9	1	6	0
21	9	3								
22	16	10								
23	9	5								
24	16	13	12	9	12	8				

LAB	NOAA/9		NOAA/8		NOAA/7		NOAA/6		NOAA/5	
	Sets	Rej	Sets	Rej	Sets	Rej	Sets	Rej	Sets	Rej
25	11	1	14	3	12	1	13	2	10	7
26	16	5	18	6	12	2				
27	10	0	15	7	16	2	15	1	9	8
28	18	9								
29	17	1	15	0	15	0	14	0	12	1
30	16	10								
31	10	3	8	3						
32	13	3	13	1	12	1	13	1	10	3
33	8	0	8	0	9	3				
34	0	0								
35	17	6	16	1	9	2				
36	7	3	7	5	10	7	6	6		
37	1	0								
38	11	3	14	5	-	-				
39	2	0	2	0	3	0				
40	12	11								
41	18	1	18	1	17	1	15	3	11	5
42	11	4								
43	6	2								
44	16	0	16	0	15	1				

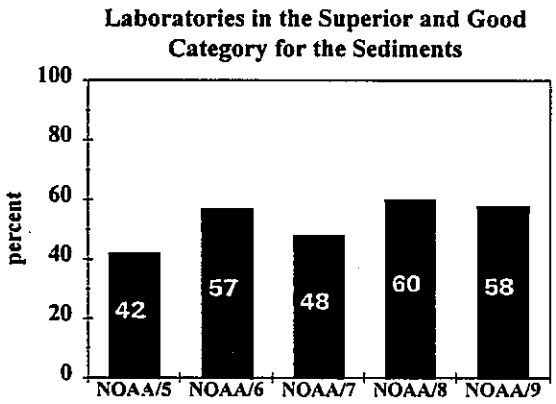
There were 974 sets of results evaluated for the sediments for NOAA/9 compared to 991 sets for NOAA/8, 1004 sets for NOAA/7, 511 sets for NOAA/6 and 407 sets for NOAA/5. The rejection rates were respectively 260 (27%), 264 (27%), 322 (32%), 125 (24%) and 128 (31%) sets.

BCSS-1 has been used as the sediment CRM since NOAA/5 and Table V (page 45) lists the performance of the individual laboratories for this CRM over the five years.

There is still a good number of problems concerning the analysis of marine sediments for trace metals. The following ten analytes present difficulties to at least twenty-five percent of the participants: aluminum, chromium, manganese, iron, arsenic, silver, cadmium, antimony, mercury and lead. Part of this problem, especially with Al, Cr, Mn and Fe, is due to the fact that nine of the participants do not use hydrofluoric acid in their sediment decomposition procedures. Eight of these laboratories ended up in either the fair or other categories. The ninth was good.

The overall categorization for the past five exercises is indicated in Figure 1. About 60 percent of the participants fall into the superior and good categories. This has not changed significantly since 1992 except for NOAA/7 when the participants were challenged with a Mississippi mud with a very low trace metal content. And, as long as a sizable portion of the participants do not use hydrofluoric acid the percentage will never exceed 75 to 80 percent.

Figure 1



The accidental use of the same material for Sample N (NOAA/5) and Sample W this year affords us with a fortuitous opportunity to compare the performance of the participants in 1991 with those of the present exercise. There were twelve analytes in Sample N for which a reliable mean was calculated compared with eighteen in NOAA/9. There were no significant differences between the means obtained for each of the twelve analytes in both exercises.

Table VI compares the uncertainty of the calculated means for the twelve analytes in common at the 95 percent confidence level (one-sided test). In all but three cases (Cr, Se and Sn) the uncertainties have been significantly reduced in this exercise.

Table VI

Comparison of the Uncertainty of the Means for Analytes in NOAA/5 and NOAA/9

Analyte	NOAA/5		NOAA/9		Significant
	N	RSD	N	RSD	
Al	14	12	16	4	Y
Cr	15	12	29	13	N
Mn	15	10	21	2	Y
Fe	16	6	24	4	Y
Cu	24	10	35	5	Y
Zn	24	8	32	5	Y
As	16	14	22	8	Y
Se	12	21	21	17	N
Cd	21	14	30	10	Y
Sn	11	7	14	12	N
Hg	19	17	26	13	Y
Pb	24	11	24	3	Y

Biological Tissues

As with the sediments, the turnover of participants resulted in eight laboratories reporting tissue data for the first time. One of these was rated in the superior group, three were good and four were fair. There were, for the first time, no laboratories in the "other" category. Twenty-eight of the thirty-eight laboratories which submitted data for the tissues are in the superior and good categories.

Table VIII (page 49) shows the number of submitted sets and the number of rejected means for the biological tissue samples over the five exercises from NOAA/5 to NOAA/9. Of the thirty laboratories that submitted tissue data for both NOAA/8 and NOAA/9 eight retained their superior status, ten improved their ratings (four to superior) and six have worse ratings. Of these six four decreased from superior to good. Particular notice should go to laboratories 9, 29 and 44 with an

excellent record over a number of years. Indeed, laboratories 9 and 29 been top performers in all nine exercises. Note also the low number of laboratories in the "other" category.

There were 699 sets of results evaluated for the tissues for NOAA/9, compared to 771 for NOAA/8, 699 for NOAA/7, 368 for NOAA/6 and 317 sets for NOAA/5. The rejection rates were respectively 152 (17%), 143 (19%), 208 (30%), 99 (27%) and 93 (29%) sets. The improvement for the past two exercises can only be partially attributed to the expansion of the acceptable range in NIST SRM 1566a to a minimum of ± 10 percent for six elements (iron, copper, zinc, arsenic, silver, lead). This year, there were 43(13%) rejections for 331 NIST SRM 1566a data sets (not including Al and Sn) compared to 49 (15%) rejections for 324 sets in NOAA/8 (NIST SRM 1566a), 91 (30%) rejections in 301 sets for NOAA/7 (NIST SRM 1566a), 71 (32%) rejections in 224 sets for NOAA/6 (DORM-1) and 82 (50%) rejections in 163 data set for NOAA/5 (NIST SRM 1566a).

Table VIII

Accuracy Evaluation for the Biological Tissues*

	Laboratory Number	NOAA/9	NOAA/8	NOAA/7	NOAA/6	NOAA/5
Superior	1,5,6,7,8,9,11,21, 29,35,38,42,44	13	15	8	7	4
Good	10,12,13,17,19,20, 23,24,26,27,32,33, 39,41,43	15	13	14	9	8
Fair	3,14,15,16,28,30, 31,34,36,40	10	8	8	9	9
Others		0	6	8	5	5
Total		38	42	38	30	26

*Laboratories 2,4,18,22,25 and 37 did not report results for the tissues.

Table VIII

Comparison of NOAA/9, NOAA/8, NOAA/7, NOAA/6 and NOAA/5 Laboratory Performance for Tissues

LAB	NOAA/9		NOAA/8		NOAA/7		NOAA/6		NOAA/5	
	Sets	Rej	Sets	Rej	Sets	Rej	Sets	Rej	Sets	Rej
1	23	4	24	1	26	8				
3	20	8	22	7	21	11	24	5	21	9
5	23	3	10	1	20	7	24	8		
6	22	1	22	2	13	6	10	5	9	1
7	23	2	24	2	23	4	26	7		
8	23	2	22	3						
9	23	2	24	0	25	3	26	5	23	2
10	22	5	19	3	19	5	16	1		
11	18	1	12	1	2	1	16	6	16	7
12	23	7	22	3	21	9				
13	14	4	22	16	20	6	18	6	19	13
14	12	4	10	0	8	3	11	8	10	4
15	22	9	18	1	19	7				
16	3	1								
17	20	4	18	5	20	4	22	6	23	14
19	10	1								
20	23	7	24	3	24	4	20	2	17	1
21	22	1	16	0	21	3	21	6	23	3
23	16	5								

LAB	NOAA/9		NOAA/8		NOAA/7		NOAA/6		NOAA/5	
	Sets	Rej	Sets	Rej	Sets	Rej	Sets	Rej	Sets	Rej
24	16	4	10	4	12	3				
26	22	4	23	5						
27	12	4	18	11	21	7				
28	23	8								
29	23	1	24	1	26	5	24	1	23	0
30	22	10	1	1						
31	12	6	10	5						
32	16	1	14	0						
33	8	1	12	0						
34	10	4								
35	23	3	22	1	8	1				
36	8	3	14	6	20	12	4	2		
38	20	2	22	9	8	2				
39	18	3	4	0	19	1				
40	14	5								
41	23	4	24	6	26	5	26	9	23	15
42	19	0								
43	12	3								
44	23	2	24	0	26	1	26	4	10	0

SUPERIOR
GOOD
FAIR
OTHERS

Table IX

Intralaboratory Precision Evaluation for the Biological Tissues

	Laboratory Number
Good	1,5,6,7,8,9,10,11,12,13,14,16,17,19,20,21,24,26,29,31,32,33,35,36,38,39,41,42,44
Fair	3,15,23,27,28,30,34,40,43

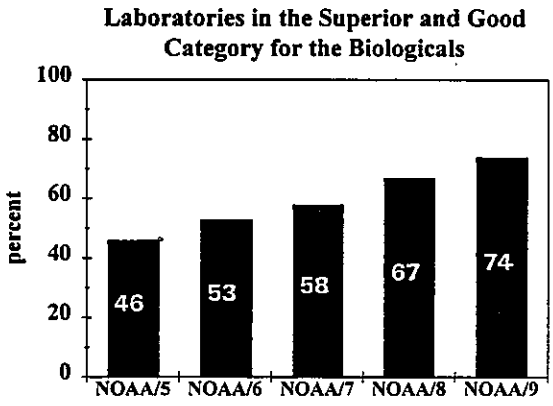
A number of problems remain concerning the analysis of marine tissues for trace metals. The following eight analytes in Tissue X presented difficulties to at least twenty-five percent of the participants that submitted results: nickel, copper, arsenic, selenium, silver, tin, cadmium and lead. Many of the problems are generally related to the low levels of some of these analytes (e.g., tin and lead).

Twenty laboratories that were in the good or superior category for the sediments, also analyzed the tissues and all of these twenty laboratories were also in the good or superior category for the tissues. In general, a laboratory with capabilities for one matrix appears to also do well for another.

The majority of the laboratories satisfied the precision criteria of Table I. But while it is apparent that it is necessary to have acceptable precision in order to have good accuracy, it is obvious that even outstanding precision is not a guarantee of good accuracy.

Figure 2 shows the steady (and heartening) increase in the proportion of participants in the superior and good categories over the past five exercises. Another measure of this improvement is that this year there were no laboratories in the "other" category.

Figure 2



Appendix D summarizes the digestion methods and instrumental techniques used for the determination of the metals. Graphite furnace atomic absorption spectrometry (GFAAS) and inductively coupled plasma (ICPAES) are the most frequently used with flame atomic absorption (FAAS) third. The use of inductively coupled plasma mass spectrometry (ICPMS) is increasing rapidly, overtaking GFAAS for analytes of low concentration in the tissues, and is responsible for the improvement

for some of the analytes like silver and tin. The great majority of laboratories used more than one instrumental method for this exercise. The importance of using the right tool for the job is being more and more recognized by the participants.

The majority of the laboratories also report using closed vessel digestion procedures with microwave heating. The popularity of this decomposition technique has risen steadily over the last few exercises and is certainly a partial cause for the continued improvements.

However, a few laboratories still do not understand the concept of significant figures. We still continue to see trace analysis results reported to 4 and 5 significant figures.

4. CONCLUSIONS

There are a few trends which can be highlighted. There were notable improvements for the determination of chromium, copper, cadmium and tin in the sediments and chromium in the biological tissues. The performance for copper, zinc and cadmium in both matrices has reached a level where, aside from improvements in some individual laboratories, we can not expect much more general improvement from the superior and good performers as a group.

The relatively poor performance with regard to the analysis for arsenic is disturbing and could be a subject for special investigation.

The laboratories that also took part in previous exercises generally improved or maintained their ratings for both the sediments and biological tissues.

The use of BCSS-1 as the CRM for the last five years is a great help in comparing progress over the years, as was the use of SRM 1566a in four of the five years. The accidental use of the same material for Sediment N and for Sediment W was a fortuitous plus. Significant improvement was demonstrated for nine of twelve analytes.

Kudos go to laboratories 5,6,9,29 and 44 for achieving a superior rating for both matrices this year and to laboratories 9, 29 and 44 for the best continual superior performance. Another fifteen laboratories (1,7,8,10,11,12,20,26,27,32,33,35,38,41,43) were in the superior or good category for both tissues and sediments. For the first time over half the participants now do well for both matrices.

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APPENDIX A
Participants in NOAA/9

Academy of Natural Sciences
Benedict Estuarine Research Lab
10545 Mackall Rd
St. Leonard, MD 20685
Dr. Fritz Riedel

Alabama Department of Environmental Management
2204 Parimeter Road
Mobile, AL 36615
Dr. D.I. Wigger

Analytical Services Laboratories Ltd.
1988 Triumph St.
Vancouver, B.C. V5L 1K5
Mr. James Downie

Australian Government Analytical Laboratories
PO Box 385
Pymble, N.S.W. 2073 Australia
Mr. John Dalins

Australian Nuclear Science and Technology Organization
Environmental Science Program
Private Mail Bag 1
Menai, N.S.W. 2234 Australia
Mr. David Hill

Australian Institute of Marine Sciences
Townsville Mail Center
Queensland, Australia 4810
Mr. Frank Tirendi

Battelle Pacific Northwest
1529 W. Sequim Bay Road
Sequim, WA 98382
Dr. Eric Crecelius

BWPC Laboratory
750 Phelps
San Francisco, CA 94124
Mr. Lonnie Butler

California Department of Fish and Game
7711 Sandholt Road
Moss Landing, CA 95039
Dr. M. Stephenson

California Department of Fish and Game
Water Pollution Control Laboratory
2005 Nimbus Rd.
Rancho Cordova, CA 95670
Dr David Crane

Can Test Ltd.
1523 West 3rd. Ave.
Vancouver, B.C. V6J 1J8
Mr. Richard Jornitz

Cat Cove Lab. - Marine Fisheries
Commonwealth of Massachusetts
92 Fort Ave.
Salem, MA 01970
Dr. Jack Schwartz

Central Contra Costa Sanitary District
5019 Imhoff Pl.
Martinez, 94553 CA
Mr. Bhupinder Dhaliwal

City of Jacksonville-Florida
Water Pollution Control
515 West 6th St.
Jacksonville, FL 32206
Mr. Roger Baskin

City of Los Angeles
Environmental Monitoring Division
222 North Sepulveda Blvd. Suite 1600
El Segundo, CA 90245
Ms. Aurora Elayda

City of San Jose/Santa Clara
700 Los Esteros Road
San Jose, CA U.S.A.
Mr. David Tucker

East Bay Municipal Utility District
P.O. Box 24055
Oakland, CA 94623
Ms. Patti Tenbrook

Elemental Research Inc.
267 West Esplanade, Suite 309
North Vancouver, B.C. V7M 1A5
Mr. Robert Brown

I.I.O. Univ Aut of Baja California
Ocean. Quim.
Apdo. 453
Ensenada, B.C. Mexico
Mr. J. V. Macias

Florida Dept. Environmental Regulation
Chemistry Section
2600 Blair Stone Rd.
Tallahassee, FL 32399-2400
Dr. Bill Coppenger

Harvard School of Public Health
Environmental Science and Engineering Program
665 Huntington Ave.
Boston, MA 02115
Dr. Jim Shine

MD Health & Mental Hygiene
201 West Preston St.
Baltimore, MD 21201
Mr. David Sevdalian

Massachusetts Water Research Authority
190 Taft Ave.
Winthrop, MA 02152
Ms. Patricia Sullivan

National Marine Fisheries Service
217 Ft. Johnson Road
Charleston, SC 29412
Dr. Dan Bearden

New Jersey State Department of Health
Environmental and Chemical Laboratory Service
Trenton, New Jersey 08625
Mr. Joseph Mierzwicki

Northwest Fisheries Science Center F/NWC2
2725 Montlake Blvd. East
Seattle, WA 98112-2097
Dr. Cheryl Krone,

NOAA/NOS/ORCA 21
National Status and Trends Program
1305 East-West Hwy
Silver Spring, MD 20910
Dr. Kostas Daskalakis

Old Dominion University
Applied Marine Research Laboratory
1034 West 45th St.
Norfolk, VA 23529
Mr. Adam Abbgy

PA Dept. of Environmental Resources
1500 N 3rd St.
Harrisburg, PA 17105-1467
Mr. Ted Lyter

Patuxent Environmental Science Center
12011 Beech Forest Road
Laurel, MD 20708
Dr. John Moore

Queensland Department of Primary Industries
Agricultural Chemistry Branch
Meiers Road
Indooroopilly, Queensland 4068 Australia
Mr. Glenn Barry

Queensland Department of Primary Industries
665 Fairfield Road
Yeerongpilly Old, Queensland 4105 Australia
Dr. Hugh Mawhinney

Skidaway Institute of Oceanography
10 Ocean Science Circle
Savannah, GA 31411
Dr. Ralph Smith

State of Florida
Department of HRS
1217 Pearl St.
Jacksonville, FL 32202
Ms. Cecelia Kirchmer

State of New Jersey
CN 411
Trenton, NJ 08625-0411
Dr. Stuart Nagourney

Texas A. & M.
Department of Oceanography
College Station, TX 77843-3146
Dr. B. Presley

University of Rhode Island
Narragansett, RI 02882-1197
Dr. John King

University of Mississippi
University, MS 38677
Dr. Jimmy Allgood

Union Sanitary District
Laboratory Services
5072 Benson Road
Union City, CA 94587
Ms. Lynda Taylor

US EPA
960 College Station Rd.
Athens, GA 30605-2720
Mr. William McDaniel

USEPA
27 Tarzwell Drive
Narragansett, RI 02882
Dr. W.S. Boothman

USGS
Branch of Geochemistry
P.O. Box 25046, MS 973
Federal Center
Denver, Colorado 80225-0046
Mr. Rick Sanzolone

USGS
National Water Quality Laboratory
5293-B Ward Rd.
Arvada, CO 80002
Mr Jeff Pritt

USGS
3039 Amwiler Road
Atlanta, GA 30360-2824
Mr. Kent Elrick

**********Results were not received from the following labs**********

Alabama Dept. of Environmental Management
1890-A Dickinson Drive
Montgomery, AL 36109
Mr. John Gable

Canada Department of Fisheries & Oceans
Winnipeg MB, Canada
R3T 2N6
Mr. Lyle Lockhart

NOAA
Northeast Fisheries Center
74 Magruder Rd.
Highlands, NJ 07732
Dr. V.S. Zdanowicz

Quanta Trace Laboratories Inc.
401 - 3700 Gilmore Way
Burnaby, B.C. V5G 4M1
Mr. J. Davidson

SUNY Marine Sciences Research Center
Stony Brook, NY 11794-5000
Mr. David Hirchberg

ToxScan
42 Hangar Way
Watsonville, CA 95076
Mr. Jim Thoits

University of California - Santa Cruz
Institute of Marine Science
Santa Cruz, CA 95064
Dr. Russell Flegal

APPENDIX B

DATA

BERYLLIUM
Sediment W
1.63 ± 0.58 mg/kg

Lab							Mean	SD	RSD
1	5	1.8	1.5	1.5	2.0	1.6	1.7	0.2	12.9
2	0								
3	5	1.75	1.49	1.90	1.70	1.90	1.75	0.17	9.7
4	5	1.35	1.4	1.38	1.36	1.36	1.37	0.02	1.5
5	5	1.30	1.26	1.25	1.22	1.23	1.25	0.03	2.5
6	5	1.6	1.7	1.7	1.8	1.7	1.7	0.1	4.2
7	0								
8	5	2.13	1.84	1.71	1.88	1.83	1.88	0.15	8.2
9	5	1.4	1.4	1.5	1.3	1.6	1.4	0.1	7.9
10	0								
11	5	1.70	1.66	1.62	1.64	1.67	1.66	0.03	1.8
12	4	1.80	1.87	1.81	1.80		1.82	0.03	1.8
13	0								
14	0								
15	0								
16	0								
17	0								
18	5	2	2	2	2	2	2	0	0.0
19	0								
20	0								
21	0								
22*	5	0.884	0.932	0.972	0.962	0.944	0.939	0.034	3.7
23	0								
24	5	1.20	1.40	1.17	1.10	1.13	1.20	0.12	9.8
25	0								
26	5	1.55	1.53	1.8	1.63	1.28	1.56	0.19	12.1
27	5	1.65	1.77	1.71	1.79	1.73	1.73	0.05	3.2
28*	5	0.9	0.8	0.8	0.8	0.9	0.8	0.1	6.5
29	0								
30	5	<2.500	<2.500	<2.500	<2.500	<2.500			
31	5	2.10	2.00	2.10	2.00	2.00	2.04	0.05	2.7
32	0								
33	0								
34	0								
35	5	1.3	1.3	1.3	1.3	1.3	1.3	0.0	0.0
36	0								
37	0								
38	0								
39	0								
40	0								
41	5	1.24	1.30	1.18	1.23	1.26	1.24	0.04	3.5
42	0								
43	0								
44	5	1.72	1.75	1.85	1.88	1.90	1.82	0.08	4.4
45	5	1.8	1.9	2.0	2.0	2.0	1.9	0.1	4.6
46	0								

BERYLLIUM
BCSS-1
1.3 ± 0.3 mg/kg

Lab							Mean	SD	RSD
1	5	1.3	1.1	1.2	1.1	1.4	1.2	0.1	10.7
2	0								
3	5	1.19	1.22	1.17	1.19	1.28	1.21	0.04	3.6
4*	5	0.93	0.98	0.93	0.91	0.90	0.93	0.03	3.3
5	5	1.32	1.32	1.31	1.29	1.24	1.30	0.03	2.6
6	5	1.4	1.4	1.4	1.4	1.3	1.4	0.0	3.2
7	0								
8	5	1.41	1.37	1.28	1.40	1.27	1.35	0.07	4.9
9	5	1.3	1.3	1.3	1.4	1.4	1.3	0.1	4.1
10	0								
11	5	1.36	1.28	1.28	1.37	1.32	1.32	0.04	3.2
12	4	1.44	1.42	1.32	1.43		1.40	0.06	4.0
13	0								
14	0								
15	0								
16	0								
17	0								
18	5	1	1	1	1	1	1	0.00	0.0
19	0								
20	0								
21	0								
22*	5	0.886	0.896	0.897	0.879	0.894	0.890	0.008	0.9
23	0								
24*	5	1.08	1.01	0.96	0.87	0.97	0.98	0.08	7.8
25	0								
26*	5	0.97	0.90	0.92	1.01	0.99	0.96	0.05	4.9
27	5	1.3	1.31	1.28	1.29	1.31	1.30	0.01	1.0
28*	5	1.0	1.0	1.0	0.9	0.9	1.0	0.1	5.7
29	0								
30	5	<2.500	<2.500	<2.500	<2.500	<2.500			
31	5	1.50	1.60	1.70	1.50	1.50	1.56	0.09	5.7
32	0								
33	0								
34	0								
35	5	1.3	1.3	1.2	0.9	1.0	1.1	0.2	15.9
36	0								
37	0								
38	0								
39	0								
40	0								
41	5	1.19	1.18	1.18	1.20	1.19	1.19	0.01	0.7
42	0								
43	0								
44	5	1.33	1.32	1.29	1.34	1.31	1.32	0.02	1.5
45	0								
46	0								

The determination of beryllium was not required in the biologicals

ALUMINUM
Sediment W
5.19 ± 0.40 %

Lab							Mean	SD	RSD
1	5	5.15	5.22	5.14	5.23	5.20	5.19	0.04	0.8
2*	5	5.45	4.83	4.47	4.28	4.27	4.66	0.50	10.7
3*	5	3.87	4.18	4.20	3.94	4.00	4.04	0.15	3.6
4	5	4.7131	4.8277	4.7611	4.7695	4.7067	4.7556	0.0490	1.0
5	5	5.08	5.09	5.19	5.13	5.02	5.10	0.06	1.2
6	5	5.3	5.3	5.3	5.2	5.3	5.3	0.0	0.8
7	5	4.99	5.0	5.1	4.94	5.15	5.04	0.09	1.7
8	5	5.47	5.20	5.24	5.20	5.31	5.28	0.11	2.1
9	5	5.5	5.7	5.5	5.4	5.3	5.5	0.1	2.7
10	0								
11	0								
12	4	4.96	5.02	5.02	5.18		5.05	0.09	1.9
13	0								
14	0								
15	0								
16*	5	3.2793	3.9066	3.3719	3.4761	3.3441	3.4756	0.2512	7.2
17	0								
18	5	5.1	5.1	5.1	5.2	5.1	5.1	0.0	0.9
19	0								
20*	5	5.82	5.73	5.32	6.02	5.68	5.71	0.26	4.5
21	0								
22*	5	1.07	1.03	1.06	1.09	1.10	1.07	0.03	2.6
23*	5	3.2063	3.2418	3.0883	3.2018	3.1695	3.1815	0.0581	1.8
24*	5	2.36	2.40	2.31	2.17	2.33	2.31	0.09	3.8
25	0								
26	5	5.23	5.29	5.19	5.20	5.22	5.23	0.04	0.7
27*	5	5.94	5.91	6.04	6.09	6.75	6.15	0.35	5.6
28*	5	1.92	1.65	1.77	1.65	1.96	1.79	0.14	8.0
29	5	5.16	5.33	5.16	5.20	5.08	5.19	0.09	1.8
30*	5	5.498	6.47	6.599	7.144	6.883	6.519	0.627	9.6
31	5	5.43	5.54	5.04	5.72	5.43	5.43	0.25	4.6
32*	5	5.44	5.42	5.44	5.41	5.32	5.41	0.05	0.9
33	5	4.93	5.18	5.20	4.81	4.93	5.01	0.17	3.4
34	0								
35	5	5.11	5.29	5.06	5.47	5.30	5.25	0.16	3.1
36	0								
37	0								
38	0								
39	0								
40*	5	2.65	2.80	2.68	2.77	2.75	2.73	0.06	2.3
41*	5	5.93	5.89	5.95	5.93	5.95	5.93	0.02	0.4
42	0								
43	0								
44	0								
45	5	5.33	5.19	5.19	5.22	5.14	5.21	0.07	1.4
46	0								

ALUMINUM
BCSS-1
6.26 ± 0.41 %

Lab							Mean	SD	RSD
1	5	6.21	6.42	6.05	6.36	6.38	6.28	0.15	2.4
2	5	6.15	6.04	6.75	6.45	6.77	6.43	0.33	5.2
3*	5	4.71	4.51	4.08	6.12	4.29	4.74	0.81	17.0
4*	5	5.6537	5.742	5.633	5.3256	5.9135	5.6536	0.2141	3.8
5	5	6.33	6.18	6.19	6.21	6.23	6.23	0.06	1.0
6	5	6.1	5.9	6.0	6.0	5.9	6.0	0.1	1.4
7	5	5.89	6.18	6.17	5.86	5.95	6.01	0.15	2.6
8	5	6.36	6.39	6.42	6.42	6.31	6.38	0.05	0.7
9	5	6.4	6.5	6.4	6.5	6.4	6.4	0.1	0.9
10	0								
11	0								
12	4	6.14	6.28	6.11	6.24		6.19	0.08	1.3
13	0								
14	0								
15	0								
16	0								
17	0								
18	5	6.3	6.1	6.4	6.2	6.2	6.2	0.1	1.8
19	0								
20	5	6.14	6.12	6.03	6.01	5.92	6.04	0.09	1.5
21	0								
22*	5	1.34	1.46	1.50	1.44	1.38	1.42	0.06	4.5
23*	5	3.7995	4.0518	4.7650	3.6720	4.2615	4.1100	0.4312	10.5
24*	5	3.23	2.98	2.76	2.54	2.77	2.86	0.26	9.1
25	0								
26*	5	6.40	6.36	6.22	6.35	6.39	6.34	0.07	1.1
27	5	5.83	6.16	6.46	6.03	5.99	6.09	0.24	3.9
28*	5	2.65	2.99	3.08	2.52	2.39	2.73	0.30	10.9
29	5	6.29	6.26	6.30	6.25	6.17	6.26	0.05	0.8
30*	5	7.995	8.107	7.759	8.202	7.057	7.824	0.460	5.9
31	5	6.37	6.10	6.24	6.20	6.29	6.24	0.10	1.6
32	5	6.13	6.23	6.27	6.29	6.31	6.25	0.07	1.1
33	5	6.15	5.98	6.11	6.24	5.73	6.04	0.20	3.3
34	0								
35	5	6.13	5.99	5.99	6.45	6.33	6.18	0.21	3.3
36	0								
37	0								
38	0								
39	0								
40*	5	3.68	3.44	3.82	3.65	2.80	3.48	0.40	11.6
41	5	6.51	6.48	6.53	6.51	6.50	6.51	0.02	0.3
42	0								
43	0								
44	0								
45	0								
46	0								

ALUMINUM
Tissue X
mg/kg

Lab							Mean	SD	RSD
1	5	101	98.7	107.0	92.4	104.0	100.6	5.6	5.5
2	0								
3	4	320	297	329	313		315	14	4.3
4	0								
5	5	215	221	208	214	229	217	8	3.7
6	5	490	510	500	500	510	502	8	1.7
7	5	171	179	168	181	182	176	6	3.6
8	5	523	504	510	502	552	518	21	4.0
9	5	300	300	300	310	310	304	5	1.8
10	0								
11	0								
12	5	171	162	166	198	155	170	17	9.7
13	0								
14	0								
15	5	129	125	131	125	129	128	3	2.0
16	5	131.6	137.2	129.7	151.4	152.6	140.48	10.88	7.7
17	5	155	158	158	153	156	156	2	1.4
18	0								
19	0								
20	5	441	447	453	453	415	442	16	3.6
21	5	334	325	318	305	339	324	13	4.1
22	0								
23	5	218.79	181.91	209.41	187.77	214.29	202.43	16.53	8.2
24	5	262	243	220	203	231	232	22	9.7
25	0								
26	5	193	200	180	186	200	192	9	4.6
27	5	168	172	172	162	166	168	4	2.5
28	5	167	153	151	166	161	160	7	4.6
29	5	249	249	252	257	256	253	4	1.5
30	5	89.85	119.7	167.7	265.6	93.42	147.25	73.10	49.6
31	5	508	510	519	519	510	513	5	1.0
32	0								
33	0								
34	0								
35	5	172	172	170	167	167	170	3	1.5
36	0								
37	0								
38	0								
39	0								
40	0								
41	5	471.17	475.62	473.31	476.01	474.23	474.07	1.95	0.4
42	0								
43	0								
44	5	222	234	223	240	246	233	10	4.5
45	5	385	391	365	392	320	371	30	8.2
46	5	430	439	482	502	501	471	34	7.3

ALUMINUM
SRM 1566a
202.5 ± 12.5 mg/kg

Lab							Mean	SD	RSD
1	5	71.1	74.8	83.3	67.3	77.2	74.7	6.1	8.1
2	0								
3	5	53.6	55.9	46.8	51.9	51.0	51.8	3.4	6.5
4	0								
5	5	187	201	193	180	184	189	8	4.3
6	5	210	200	200	240	230	216	18	8.4
7	5	106	111	108	106	111	108	3	2.3
8	5	240	240	239	237	237	239	2	0.6
9	5	150	150	140	140	140	144	5	3.8
10	0								
11	0								
12	5	69.4	78.7	80.6	61.4	59.3	69.9	9.7	13.9
13	0								
14	0								
15	5	71.4	86.8	85.0	77.0	94.0	82.9	8.8	10.6
16	0								
17	5	96.3	96.3	94.5	95.7	94.6	95.5	0.9	0.9
18	0								
19	0								
20	5	191	214	211	207	205	206	9	4.3
21	5	166	179	156	157	160	164	9	5.8
22	0								
23	5	112.69	117.49	112.81	115.52	117.55	115.21	2.39	2.1
24	5	127	129	139	153	139	137	10	7.5
25	0								
26	5	124	118	124	118	111	119	5	4.5
27	5	301	330	314	329	335	322	14	4.4
28	5	100	101	96.2	96.9	106	100	4	3.9
29	5	127	133	150	134	128	134	9	6.9
30	5	92	83.46	59.85	192.8	79.89	101.60	52.33	51.5
31	5	205	196	211	200	207	204	6	2.9
32	0								
33	0								
34	0								
35	5	102	106	103	102	104	103	2	1.6
36	0								
37	0								
38	0								
39	0								
40	0								
41	5	198.30	199.56	198.01	201.36	200.11	199.47	1.37	0.7
42	0								
43	0								
44	5	131	128	134	127	135	131	4	2.7
45	4	160	147	144	132		146	12	7.9
46	4	193	190	182	193		190	5	2.7

SILICON
Sediment W
27.9 ± 3.6 %

Lab							Mean	SD	RSD
1	5	24	23.4	23.8	24.3	24.8	24.1	0.5	2.2
2	0								
3	0								
4	0								
5*	5	3.58	3.54	3.42	3.45	3.50	3.50	0.06	1.9
6	0								
7	0								
8	0								
9	5	26.1	26.2	26.0	26.1	26.1	26.1	0.1	0.3
10	0								
11	0								
12	4	24.9	25.9	25.4	26.4		25.7	0.6	2.5
13	0								
14	0								
15	0								
16	0								
17	0								
18	0								
19	0								
20	5	29.1	28.7	29.2	29.1	28.9	29.0	0.2	0.7
21	0								
22	0								
23	0								
24	0								
25	0								
26	0								
27	5	27.0	26.8	27.1	26.5	26.6	26.8	0.3	1.0
28*	5	19.5	18.6	14.7	21.1	11.9	17.2	3.8	22.0
29	5	28.6	28.8	28.9	28.1	28.1	28.5	0.4	1.3
30	0								
31	0								
32	5	29.8	29.8	29.8	29.7	29.7	29.8	0.1	0.2
33	0								
34	0								
35	0								
36	0								
37	0								
38	0								
39	0								
40	0								
41	5	27.56	27.96	28.21	27.71	27.92	27.87	0.25	0.9
42	0								
43	0								
44	0								
45	5	27.8	28.1	27.9	27.7	27.7	27.8	0.2	0.6
46	0								

SILICON
BCSS-1
30.8 ± 1.0 (1.5) %

Lab							Mean	SD	RSD
1	5	30.9	30.7	30.4	31.0	30.3	30.7	0.3	1.0
2	0								
3	0								
4	0								
5*	5	3.03	3.05	3.02	3.06	3.00	3.03	0.02	0.8
6	0								
7	0								
8	0								
9	5	31.1	31.1	30.8	30.9	30.9	31.0	0.1	0.4
10	0								
11	0								
12	4	30.4	29.5	29.6	28.7		29.6	0.7	2.4
13	0								
14	0								
15	0								
16	0								
17	0								
18	0								
19	0								
20	5	31.3	29.9	31.1	30.8	30.2	30.7	0.6	1.9
21	0								
22	0								
23	0								
24	0								
25	0								
26	0								
27	5	30.9	30.9	30.9	30.6	31.1	30.9	0.2	0.6
28*	5	16.3	6.3	14.8	15.2	19.2	14.8	4.0	27.1
29	5	30.4	31.0	31.2	32.0	31.7	31.3	0.6	2.0
30	0								
31	0								
32*	5	33.2	33.3	33.4	33.4	33.5	33.6	0.1	0.3
33	0								
34	0								
35	0								
36	0								
37	0								
38	0								
39	0								
40	0								
41	5	31.02	30.89	29.97	30.57	30.94	30.68	0.43	1.4
42	0								
43	0								
44	0								
45	0								
46	0								

The determination of silicon was not required in the biologicals

CHROMIUM
Sediment W
63.4 ± 17.1 mg/kg

Lab							Mean	SD	RSD
1*	5	77.4	85.5	85.9	83.1	80.7	82.5	3.5	4.3
2	0								
3*	5	87.0	99.5	119	94.2	92.6	98.5	12.3	12.5
4	5	48.6	50.0	50.3	49.4	50.3	49.7	0.7	1.5
5	5	78	73.2	73.5	76.0	79.2	76.0	2.7	3.5
6	5	72	72	77	72	70	73	3	3.6
7	5	64.43	79.12	69.45	74.01	55.13	68.43	9.21	13.5
8*	5	77.5	84.8	92.4	89.0	97.7	88.3	7.7	8.7
9	5	62.3	72.2	59.0	64.6	65.5	64.7	4.9	7.5
10	5	73.95	99.89	65.08	66.31	40.17	69.08	21.40	31.0
11	5	67.0	60.0	63.3	64.0	64.2	63.7	2.5	3.9
12	4	62.3	62.7	60.4	60.6		61.5	1.2	1.9
13	5	67.2	70.8	65.5	63.8	63.5	66.2	3.0	4.5
14	0								
15	0								
16	5	73.9	80.6	72.14	75.42	75.12	75.44	3.16	4.2
17	0								
18	5	60	58	60	57	61	59	2	2.8
19	0								
20	5	54.3	52.4	53.1	57.6	62.2	55.9	4.0	7.2
21	5	70.6	68.5	69.5	70.4	69.9	69.8	0.8	1.2
22	5	44.9	45.2	47.2	48.3	47.3	46.6	1.5	3.1
23	5	91.00	79.50	74.60	76.00	70.00	78.22	7.91	10.1
24*	5	42.8	42.5	42.0	40.2	41.5	41.8	1.0	2.4
25	5	62.2	56.5	59.0	59.9	51.1	57.7	4.2	7.3
26	5	46.8	47.7	47.0	48.5	47.7	47.5	0.7	1.4
27	5	59.2	57.6	57.8	62.4	59.5	59.3	1.9	3.2
28*	5	37.8	35.0	36.0	33.9	36.8	35.9	1.5	4.2
29	5	64.4	65.7	64.0	62.3	64.2	64.1	1.2	1.9
30*	5	28.49	26.47	28.66	27.90	27.67	27.84	0.87	3.1
31	5	75.0	78.0	73.0	75.0	75.0	75.2	1.8	2.4
32	5	67	66	68	65	69	67	2	2.4
33	0								
34*	5	33.5	37.8	45.9	40.9	45.7	40.8	5.3	13.0
35	5	60.0	62.8	62.8	61	61.5	61.6	1.2	2.0
36	0								
37	0								
38	5	67.3	64.7	71.9	65.1	60.7	65.9	4.1	6.2
39	0								
40	5	47.35	49.86	50.13	51.31	50.62	49.85	1.50	3.0
41	5	51.82	50.66	52.92	51.94	52.31	51.93	0.83	1.6
42	5	45.0	46.7	48.0	44.6	46.2	46.1	1.4	3.0
43	0								
44	5	70.0	74.0	78.6	80.3	71.1	74.8	4.5	6.1
45	5	59	61	59	60	62	60	1	2.2
46	0								

CHROMIUM
BCSS-1
123 ± 14 mg/kg

Lab							Mean	SD	RSD
1	5	118	122	123	127	128	124	4	3.3
2	0								
3*	5	109	101	109	88	105	102	9	8.5
4*	5	78.2	77.8	76.4	73.0	74.5	76.0	2.2	2.9
5	5	116	118	125	118	114	118	4	3.5
6	5	123	121	120	123	120	121	2	1.2
7	5	117.3	114.7	118.8	121.1	118.0	118.0	2.3	2.0
8	5	126	130	130	131	136	131	4	2.7
9	5	118	121	122	123	127	122	3	2.7
10	5	113.23	112.79	111.05	113.45	110.58	112.22	1.31	1.2
11*	5	95.3	98.6	97.1	100.6	102.6	98.8	2.9	2.9
12	4	116	113	117	116		116	2	1.5
13	5	104	110	125	119	121	116	9	7.4
14	0								
15	0								
16	0								
17	0								
18*	5	100	100	100	110	110	104	5	5.3
19	0								
20	5	116	113	117	113	112	114	2	1.9
21	5	116	117	117	117	116	116	1	0.8
22*	5	50.6	52.7	52.9	51.3	51.9	51.9	1.0	1.9
23	5	110.00	112.50	125.00	123.75	110.00	116.25	7.50	6.5
24*	5	69.0	64.4	63.1	55.4	60.8	62.54	4.99	8.0
25	5	130	124	123	131	127	127	4	2.8
26*	5	80	76.4	78.6	77.1	76.0	77.6	1.7	2.1
27	5	108	108	113	110	105	109	3	2.7
28*	5	56.8	59.0	60.6	53.8	55.3	57.1	2.7	4.8
29	5	125	124	126	128	124	125	2	1.3
30*	5	46.27	46.16	39.61	42.45	41.45	43.19	2.95	6.8
31*	5	105	97.0	103	105	106	103	4	3.5
32	5	121	119	122	123	122	121	2	1.2
33	0								
34	0								
35	5	108	109	103	113	110	109	4	3.4
36	0								
37	0								
38*	5	99	96.1	101.0	98.0	112.7	101.4	6.6	6.5
39	0								
40*	5	84.76	79.22	90.38	87.29	65.35	81.40	9.86	12.1
41	5	122.13	118.59	123.76	117.01	119.25	120.15	2.74	2.3
42*	5	67.1	67.2	66.2	73.0	69.6	68.6	2.8	4.0
43	0								
44	5	125	130	131	133	128	129	3	2.4
45	0								
46	0								

CHROMIUM
Tissue X
1.81 ± 0.49 mg/kg

Lab							Mean	SD	RSD
1	5	1.94	2.22	2.04	2.16	2.00	2.07	0.12	5.6
2	0								
3	5	1.21	1.47	1.51	1.22	1.64	1.41	0.19	13.4
4	0								
5	5	1.48	1.57	1.64	1.56	1.52	1.55	0.06	3.9
6	5	1.8	1.9	1.6	1.7	2.1	1.8	0.2	10.6
7	5	1.82	1.83	1.82	1.84	1.82	1.83	0.01	0.5
8	5	2.28	2.28	2.13	2.34	2.33	2.27	0.08	3.7
9	5	2.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0
10	5	1.44	1.63	1.87	1.66	1.72	1.66	0.16	9.4
11	5	1.97	2.09	2.10	2.22	2.16	2.11	0.09	4.4
12*	5	2.61	2.57	2.72	2.74	2.68	2.66	0.07	2.7
13*	5	1.12	1.10	1.59	1.50	1.01	1.26	0.26	20.7
14	5	<1.5	1.5	1.6	1.6	<1.5			
15	5	1.7	1.6	1.7	1.6	1.7	1.6	0.1	3.4
16	0								
17	5	1.92	2.07	1.69	1.70	1.78	1.83	0.16	8.8
18	0								
19	0								
20	5	1.71	1.64	1.77	1.81	2.13	1.81	0.19	10.4
21	5	2.03	1.84	2.01	1.95	1.90	1.95	0.08	4.0
22	0								
23*	5	1.06	0.00	1.49	2.13	0.00	0.94	0.94	99.9
24	0								
25	0								
26*	5	1.28	1.23	1.18	1.18	1.23	1.22	0.04	3.4
27	0								
28*	5	1.40	1.44	1.28	1.93	1.39	1.49	0.25	17.1
29	5	2.1	2.1	2.1	2.1	2.1	2.1	0.0	0.0
30	5	<5.000	<5.000	<5.000	<5.000	<5.000			
31	0								
32	5	1.68	1.90	1.58	1.88	1.76	1.76	0.13	7.7
33	0								
34*	5	0.88	2.13	1.99	2.18	2.06	1.85	0.54	29.5
35	5	1.85	1.80	1.75	1.85	1.70	1.79	0.07	3.6
36	0								
37	0								
38*	5	2.2	2.15	2.98	1.7	2.65	2.34	0.49	21.1
39	5	2.00	1.89	1.98	1.95	1.90	1.94	0.05	2.5
40	5	1.34	1.44	1.26	1.34	1.50	1.37	0.10	7.1
41	5	1.68	1.57	1.61	1.63	1.63	1.62	0.04	2.4
42	5	1.68	1.59	1.58	1.76	1.63	1.65	0.07	4.5
43	0								
44	5	1.80	1.65	1.72	1.80	1.52	1.70	0.12	6.9
45	5	1.8	2.0	1.9	1.8	1.8	1.9	0.1	4.8
46*	5	1.93	1.90	2.5	1.99	1.88	2.04	0.26	12.8

CHROMIUM
SRM 1566a
1.43 ± 0.46 mg/kg

Lab							Mean	SD	RSD
1	5	1.47	1.32	1.54	1.40	1.38	1.42	0.08	6.0
2	0								
3	5	1.41	1.71	1.59	1.39	1.37	1.49	0.15	10.0
4	0								
5	5	1.47	1.64	1.61	1.57	1.53	1.56	0.07	4.3
6	5	1.5	1.4	1.7	2.0	1.1	1.5	0.3	21.8
7	5	1.62	1.62	1.62	1.62	1.57	1.61	0.02	1.4
8	5	1.23	1.35	1.91	1.31	1.57	1.47	0.27	18.6
9	5	1.5	1.5	1.5	1.6	1.5	1.5	0.0	2.9
10	5	1.99	1.86	1.82	1.61	1.80	1.82	0.14	7.5
11	5	1.53	1.31	1.58	1.52	1.31	1.45	0.13	9.0
12	5	1.39	1.38	1.40	1.36	1.36	1.38	0.02	1.3
13*	5	2.03	1.16	0.96	0.92	1.04	1.22	0.46	37.7
14	5	<1.5	<1.5	<1.5	1.5	<1.5			
15	5	1.0	1.2	1.2	0.9	1.2	1.1	0.1	13.5
16	0								
17	5	1.48	1.63	1.46	1.61	1.72	1.58	0.11	6.9
18	0								
19	0								
20	5	1.06	1.12	1.13	1.11	1.04	1.09	0.04	3.6
21	5	1.55	1.42	1.49	1.46	1.22	1.43	0.13	8.8
22	0								
23	5	1.98	1.24	1.23	0.74	0.27	1.09	0.64	58.4
24	0								
25	0								
26	5	1.45	1.08	1.10	1.25	1.08	1.19	0.16	13.5
27	0								
28*	5	0.80	0.89	0.83	0.92	0.94	0.88	0.06	6.8
29	5	1.7	1.4	1.6	1.5	1.6	1.6	0.1	7.3
30	5	<5.000	<5.000	<5.000	<5.000	<5.000			
31	0								
32	5	1.27	1.20	1.17	1.24	1.15	1.21	0.05	4.1
33	0								
34	0								
35*	5	0.90	0.80	0.85	0.75	0.80	0.82	0.06	7.0
36	0								
37	0								
38*	5	1.203	1.176	1.764	1.299	1.130	1.314	0.259	19.7
39	5	1.30	1.23	1.13	1.27	1.27	1.24	0.07	5.3
40	5	1.01	0.95	1.16	1.21	0.71	1.01	0.20	19.6
41	5	1.35	1.33	1.31	1.37	1.35	1.34	0.02	1.7
42	5	1.31	1.39	1.34	1.27	1.33	1.33	0.04	3.3
43	0								
44	5	1.44	1.48	1.54	1.41	1.43	1.46	0.05	3.5
45	0								
46	0								

MANGANESE
Sediment W
470 ± 24(47)mg/kg

Lab							Mean	SD	RSD
1*	5	541	551	532	551	546	544	8	1.5
2	5	448	486	497	471	488	478	19	4.0
3*	5	358	340	370	330	367	353	17	4.9
4*	5	395	404	404	405	392	400	6	1.5
5	5	476	452	488	467	460	469	14	3.0
6	5	490	480	470	480	490	482	8	1.7
7	5	463.2	465.3	452.6	456.6	473.7	462.3	8.2	1.8
8*	5	535	579	570	600	586	574	24	4.3
9	5	472	473	459	479	472	471	7	1.6
10	5	463.21	466.37	507.89	478.52	499.66	483.13	19.91	4.1
11	0								
12	4	448	449	453	455		451	3	0.7
13	5	549	505	508	489	429	496	44	8.8
14	0								
15	0								
16	5	479.40	497.40	438.06	443.58	464.48	464.58	24.70	5.3
17	0								
18	5	480	480	480	480	480	480	0	0.0
19	0								
20	5	459	474	466	464	468	466	5	1.2
21*	5	516	533	529	524	521	525	7	1.3
23*	5	265	263	274	277	280	272	7	2.7
22*	5	331.50	344.00	345.75	349.50	316.75	337.50	13.42	4.0
24*	5	390	378	371	370	373	376	8	2.2
25*	5	247	390	180	202	405	285	106	37.2
26	5	467	468	453	459	464	462	6	1.3
27	5	472	470	465	473	474	471	4	0.8
28*	5	356.0	319.1	339.1	319.9	359.5	338.5	18.9	5.6
29	5	473	471	470	471	471	471	1	0.2
30*	5	235.8	239.8	253.3	244.2	240.9	242.8	6.6	2.7
31'	5	475	500	501	500	501	495	11	2.3
32'	5	508	507	509	552	509	517	20	3.8
33	5	481	480	461	459	470	470	10	2.2
34	0								
35*	5	516	520	514	530	510	518	8	1.5
36*	5	311	321	303	294	253	296	26	8.8
37	0								
38	0								
39	0								
40'*	5	365.35	373.57	362.72	362.79	364.69	365.82	4.48	1.2
41	5	452.09	454.49	456.99	451.47	451.21	453.25	2.46	0.5
42*	5	376	418	435	402	445	415	27	6.6
43	0								
44	5	530	504	515	500	491	508	15	3.0
45	5	476	464	454	466	452	462	10	2.1
46	0								

MANGANESE
BCSS-1
229 ± 15 (23)mg/kg

Lab							Mean	SD	RSD
1	5	223	230	231	236	240	232	6	2.8
2	5	213	217	216	220	218	217	3	1.2
3*	5	181	153	168	205	160	173	21	11.8
4*	5	185	189	187	180	180	184	4	2
5	5	227	215	240	219	228	226	10	4.3
6	5	230	230	230	230	230	230	0	0.0
7	5	231.8	227.7	239.4	229.1	217.2	229.0	8.0	3.5
8	5	252	245	246	248	244	247	3	1.3
9	5	228	217	234	245	215	228	12	5.4
10	5	225.72	233.14	228.24	233.19	226.70	229.40	3.55	1.5
11	0								
12	4	230	230	228	227		229	2	0.7
13	5	241	232	250	255	251	246	9	3.8
14	0								
15	0								
16	0								
17	0								
18	5	230	230	230	230	230	230	0	0.0
19	0								
20	5	216	215	215	217	214	215	1	0.5
21	5	232	233	240	234	236	235	3	1.3
22*	5	191	200	196	206	202	199	6	2.9
23*	5	254.75	266.25	294.50	286.00	283.00	276.90	16.08	5.8
24*	5	181	173	201	160	178	179	15	8.3
25	5	238	246	231	239	224	236	8	3.6
26	5	226	223	228	221	224	224	3	1.2
27	5	227	227	227	220	222	225	3	1.5
28*	5	191.4	193.2	194.2	190.0	187.3	191.2	2.7	1.4
29	5	226	223	227	224	221	224	2	1.1
30*	5	189.2	181.8	178.5	186.1	183.0	183.7	4.1	2.2
31'	5	212	210	220	212	212	213	4	1.8
32	5	235	234	235	231	230	233	2	1.0
33	5	219	234	225	223	205	221	11	4.8
34	0								
35	5	230	239	240	240	245	239	5	2.3
36*	5	185	191	196	189	182	189	5	2.9
37	0								
38	0								
39	0								
40'*	5	178.06	168.30	179.50	175.10	135.84	167.36	18.14	10.8
41'	5	219.11	213.25	218.15	217.90	218.58	217.40	2.36	1.1
42	5	207	223	207	216	211	213	7	3.2
43	0								
44	5	219	228	218	230	224	224	5	2.4
45	0						ERR	ERR	ERR
46	0						ERR	ERR	ERR

The determination of manganese was not required in the biologicals

IRON
Sediment W
3.02 ± 0.26 %

Lab							Mean	SD	RSD
1	5	2.86	2.93	2.87	2.90	2.90	2.89	0.03	1.0
2	5	2.71	2.97	3.06	2.91	2.98	2.93	0.13	4.5
3	5	2.9	3.02	3.07	2.88	2.98	2.97	0.08	2.7
4*	5	2.6588	2.7120	2.6503	2.6543	2.6204	2.6592	0.0332	1.2
5	5	2.91	2.85	2.87	2.87	3.05	2.91	0.08	2.8
6	5	2.8	2.9	2.9	2.9	2.9	2.9	0.0	1.6
7	5	3.24	3.22	3.22	3.21	3.22	3.22	0.01	0.3
8*	5	3.07	3.31	3.36	3.54	3.31	3.32	0.17	5.1
9	5	3.07	3.08	3.05	3.08	3.06	3.07	0.01	0.4
10	5	2.97	3.04	3.05	3.06	3.10	3.04	0.05	1.6
11	0								
12	4	2.98	3.03	3.05	3.07		3.03	0.04	1.3
13	5	3.3933	3.1110	3.1419	2.9697	2.9925	3.1217	0.1689	5.4
14	0								
15	0								
16	5	2.9274	3.1416	2.7926	2.9890	3.0093	2.9720	0.1271	4.3
17	0								
18	5	3.0	2.9	3.0	3.0	3.0	3.0	0.0	1.5
19	0								
20	5	3.05	3.16	3.11	3.14	3.14	3.12	0.05	1.5
21	5	3.08	3.08	3.08	3.10	3.08	3.08	0.01	0.3
22	5	2.76	2.77	2.83	2.89	2.92	2.83	0.07	2.5
23	0								
24*	5	2.34	2.31	2.28	2.24	2.23	2.28	0.05	2.0
25*	5	2.64	2.61	2.62	2.66	2.73	2.65	0.05	1.8
26	5	2.99	3.04	3.01	3.03	3.04	3.02	0.02	0.7
27	5	2.95	3.08	3.12	3.02	2.92	3.02	0.08	2.8
28*	5	2.705	2.732	2.765	2.678	2.714	2.699	0.071	2.6
29	5	2.97	3.02	3.03	3.02	2.97	3.00	0.03	1.0
30	5	2.840	2.755	2.713	2.790	2.732	2.766	0.050	1.8
31*	5	3.27	3.30	3.36	3.27	3.36	3.31	0.05	1.4
32	5	3.21	3.21	3.22	3.21	3.22	3.21	0.01	0.2
33	5	2.75	2.90	2.93	2.81	2.72	2.82	0.09	3.2
34	0								
35	5	3.29	3.24	3.10	3.20	3.18	3.20	0.07	2.2
36	0								
37	0								
38	0								
39	0								
40*	5	2.56	2.57	2.55	2.58	2.56	2.56	0.01	0.4
41	5	3.08	3.02	3.12	3.06	3.07	3.07	0.04	1.2
42	0								
43	0								
44	5	3.21	3.17	3.12	3.20	3.25	3.19	0.05	1.5
45	5	3.02	3.17	3.09	3.13	3.02	3.09	0.07	2.2
46	0								

IRON
BCSS-1
3.28 ± 0.14 (0.16) %

Lab							Mean	SD	RSD
1	5	3.19	3.18	3.26	3.22	3.30	3.23	0.05	1.7
2	5	3.19	3.20	3.22	3.30	3.30	3.24	0.05	1.7
3*	5	3.34	3.41	3.07	3.33	3.39	3.31	0.14	4.1
4*	5	2.8860	2.9444	2.8845	2.7474	2.7804	2.8485	0.0818	2.9
5	5	3.26	3.18	3.20	3.18	3.28	3.22	0.05	1.5
6	5	3.2	3.2	3.2	3.2	3.2	3.2	0.0	0.0
7	5	3.439	3.39	3.37	3.43	3.40	3.41	0.03	0.8
8	5	3.26	3.28	3.29	3.34	3.28	3.29	0.03	0.9
9	5	3.38	3.38	3.36	3.38	3.40	3.38	0.01	0.3
10	5	3.3	3.35	3.37	3.26	3.33	3.32	0.04	1.3
11	0								
12	4	3.24	3.22	3.24	3.29		3.25	0.03	0.9
13*	5	3.4561	3.3563	3.6877	3.7089	3.4702	3.5358	0.1548	4.4
14	0								
15	0								
16	0								
17	0								
18	5	3.3	3.3	3.3	3.3	3.3	3.3	0.0	0.0
19	0								
20	5	3.21	3.23	3.31	3.34	3.30	3.28	0.06	1.7
21*	5	3.30	3.35	3.35	3.35	3.34	3.34	0.02	0.6
22*	5	2.56	2.69	2.68	2.66	2.62	2.64	0.05	2.0
23	0								
24*	5	2.54	2.39	2.36	2.14	2.44	2.37	0.15	6.2
25*	5	2.84	2.86	2.81	2.80	2.86	2.83	0.03	1.0
26*	5	3.38	3.36	3.22	3.36	3.38	3.34	0.07	2.0
27	5	3.22	3.3	3.28	3.28	3.24	3.26	0.03	1.0
28	5	3.164	3.157	3.148	3.115	3.034	3.124	0.053	1.7
29	5	3.25	3.32	3.34	3.30	3.22	3.29	0.05	1.5
30*	5	2.789	2.798	2.712	2.867	2.820	2.797	0.056	2.0
31	5	3.20	3.15	3.20	3.20	3.25	3.20	0.04	1.1
32	5	3.39	3.39	3.39	3.38	3.38	3.39	0.01	0.2
33	5	3.14	3.08	3.16	3.22	3.14	3.15	0.05	1.6
34	0								
35*	5	3.50	3.45	3.40	3.55	3.40	3.46	0.07	1.9
36	0								
37	0								
38	0								
39	0								
40*	5	2.88	2.67	2.85	2.76	2.16	2.66	0.29	11.0
41	5	3.21	3.24	3.20	3.24	3.22	3.22	0.02	0.6
42	0								
43	0								
44	5	3.31	3.34	3.27	3.30	3.35	3.31	0.03	1.0
45	0								
46	0								

IRON
Tissue X
448 ± 82 mg/kg

Lab							Mean	SD	RSD
1*	5	321	317	328	321	311	320	6	1.9
2	0								
3	5	349	387	394	389	423	388	26	6.8
4	0								
5	5	456	462	462	467	485	472	12	2.6
6	5	480	460	500	440	430	462	29	6.2
7	5	423	452	465	449	450	448	15	3.4
8*	5	484	484	480	482	503	487	9	1.9
9	5	453	468	471	478	465	467	9	2.0
10	5	462.4	481.1	512.83	464.55	512.64	486.70	24.84	5.1
11	0								
12*	5	506	554	556	572	523	542	27	5.0
13	5	460	462	467	441	378	442	37	8.4
14	0								
15*	5	339	332	344	340	350	341	6	1.9
16	5	352.6	368.7	356.7	376.6	369.2	364.8	9.9	2.7
17	5	362	369	373	364	369	367	4	1.2
18	0								
19	5	365	368	366	375	379	371	6	1.6
20	5	507	482	509	520	504	504	14	2.8
21	5	469	472	468	488	450	469	14	2.9
22	0								
23	5	445.39	406.91	423.76	414.89	425.82	423.35	14.44	3.4
24	5	409	416	423	430	424	420	8	1.9
25	0								
26	5	433	443	433	438	443	438	5	1.1
27	5	390	389	392	404	402	395	7	1.8
28	5	381	385	376	376	370	378	6	1.5
29	5	492	492	481	497	482	489	7	1.4
30	5	378.9	401.0	388.0	382.0	404.4	390.9	11.4	2.9
31*	5	521	500	505	500	500	505	9	1.8
32	0								
33	0								
34	0								
35	5	413	400	399	398	405	403	6	1.5
36	5	393	379	384	378	378	382	6	1.7
37	0								
38	0								
39	0								
40	0								
41	5	436.86	438.26	436.91	436.64	437.91	437.12	0.96	0.2
42	5	417	404	421	446	434	424	16	3.8
43	0								
44	5	496	524	486	496	504	501	15	2.9
45	5	450	482	470	457	467	465	12	2.6
46	0								

IRON
SRM 1566a
539 ± 15(54) mg/kg

Lab							Mean	SD	RSD
1	5	551	561	488	496	530	525	32	6.2
2	0								
3*	5	386	343	349	327	375	356	24	6.8
4	0								
5	5	527	527	527	527	535	529	4	0.7
6*	5	520	530	530	530	560	534	15	2.8
7	5	524	536	535	529	528	530	5	0.9
8	5	560	559	559	552	552	556	4	0.7
9	5	527	537	541	534	535	535	6	1.0
10	5	533.56	545.74	532.25	522.82	578.29	542.53	21.59	4.0
11	0								
12	5	564	564	554	550	539	554	10	1.9
13	5	541	539	536	551	523	538	10	1.9
14	0								
15*	5	445	455	474	462	480	463	14	3.0
16	0								
17	5	477	480	476	478	477	478	2	0.3
18	0								
19	5	540	541	541	546	547	543	3	0.6
20	5	538	548	544	544	532	541	6	1.2
21	5	530	544	555	522	563	543	17	3.1
22	0								
23	5	500.50	499.75	497.06	505.17	502.45	500.99	3.03	0.6
24	5	523	509	536	527	521	523	10	1.9
25	0								
26	5	533	528	525	530	525	528	3	0.6
27	5	501	511	509	495	488	501	10	1.9
28*	5	457	449	476	458	467	461	10	2.2
29	5	539	566	548	566	567	557	13	2.3
30*	5	513.9	484.4	473.3	483.7	478.7	486.8	15.8	3.2
31	5	563	525	544	544	544	544	13	2.5
32	0								
33	0								
34	0								
35*	5	515	514	499	512	515	511	7	1.3
36*	5	473	463	447	444	432	452	16	3.6
37	0								
38	0								
39	0								
40	0								
41	5	526.27	523.57	525.69	524.92	526.01	525.09	0.95	0.2
42	5	509	492	481	484	492	492	11	2.2
43	0								
44	5	551	538	523	536	502	530	19	3.5
45	0								
46	0								

NICKEL
Sediment W
26.5 ± 5.5 mg/kg

Lab							Mean	SD	RSD
1	5	28.9	32.8	30.6	31.2	33.2	31.3	1.7	5.6
2	5	25.2	28.8	28.8	28.5	28.0	27.5	1.6	5.7
3	5	25.85	27.37	26.03	25.30	27.53	26.42	0.98	3.7
4	5	23.0	23.3	23.4	22.7	22.6	23.0	0.4	1.5
5	5	29.8	28.5	32.8	31.0	30.5	30.5	1.6	5.2
6	5	29	29	30	29	29	29	0	1.5
7*	5	44.4	30.2	43.5	35.1	43.8	39.4	6.4	16.3
8	5	24.1	26.6	26.7	25.9	25.4	25.7	1.1	4.1
9	5	28	31	29	27	24	28	3	9.3
10	5	28.54	27.88	28.57	28.09	28.46	27.91	0.81	2.9
11	5	29.5	30.5	29.2	31.5	32.4	30.6	1.3	4.4
12	4	27.1	27.3	26.6	26.7		26.9	0.3	1.2
13	5	26.4	26.4	25.9	25.2	26.5	26.1	0.5	2.1
14	0								
15	0								
16	5	20.90	22.50	18.06	24.28	21.39	21.43	2.29	10.7
17	0								
18	5	28	27	26	27	27	27	1	2.6
19	0								
20	5	30.6	36.5	33.7	28.9	26.8	31.3	3.9	12.3
	0								
22	5	26.7	26.7	27.1	31.5	30.0	28.4	2.2	7.8
23	5	26.00	32.75	28.75	25.75	25.25	27.70	3.13	11.3
24	5	24.4	23.0	22.6	22.5	22.2	22.9	0.9	3.8
25	5	28.8	28.8	28.8	28.8	28.8	28.8	0.0	0.0
26	5	22.7	23.4	23.4	23.5	23.4	23.3	0.3	1.4
27	0								
28	5	24.6	24.4	23.2	22.1	23.1	23.5	1.0	4.4
29	5	27.2	27.1	27.6	27.6	27.7	27.4	0.3	1.0
30	5	23.95	22.65	23.11	23.28	21.21	22.84	1.02	4.5
31*	5	35.0	37.0	42.0	40.0	40.0	38.8	2.8	7.2
32	5	23	21	24	24	23	23	1	5.3
33	5	27.1	25.5	26.2	25.2	27.3	26.3	0.9	3.6
34	5	21.7	19.6	23.9	22.6	30.9	23.7	4.3	18.1
35	5	28.5	29.1	28.9	29.0	28.1	28.7	0.4	1.4
36	5	21.7	26.2	23.2	21.1	26.2	23.7	2.4	10.2
37	0								
38	5	25.6	24.8	25.6	24.6	25.0	25.1	0.5	1.8
39	0								
40	5	23.32	23.49	24.33	24.89	23.66	23.94	0.66	2.7
41*	5	17.42	16.19	17.02	16.86	16.54	16.81	0.47	2.8
42	5	25.7	23.0	24.1	25.3	23.0	24.2	1.3	5.2
43	5	29.5	27.2	28.4	29.9	29.5	28.9	1.1	3.8
44	5	29.1	29.3	27.6	28.7	28.8	28.7	0.7	2.3
45	5	26.6	29.2	29.2	27.2	25.2	27.5	1.7	6.3
	0								

NICKEL
BCSS-1
55.3 ± 3.6 (5.5)mg/kg

Lab							Mean	SD	RSD
1	5	50.3	58.7	56.2	58.1	52.3	55.1	3.7	6.7
2	5	52.7	54.2	56.4	55.1	55.5	54.8	1.4	2.6
3	5	56.14	54.11	55.68	55.18	56.40	55.50	0.91	1.6
4*	5	43.5	45.3	46.5	43.1	43.2	44.3	1.5	3.4
5	5	56.9	55.3	53.8	54.1	55.0	55	1	2.2
6	5	56	56	55	55	54	55	1	1.5
7	5	52.8	54.9	59.3	41.5	68.1	55.3	9.7	17.5
8*	5	46.8	48.8	47.8	47.4	47.3	47.6	0.7	1.6
9	5	56.5	54.0	55.2	58.1	55.1	55.8	1.6	2.8
10	5	51.64	52.26	53.62	53.33	51.31	52.43	1.02	1.9
11	5	53.1	54.4	54.7	54.2	53.1	53.9	0.8	1.4
12	4	55.2	52.9	53.2	52.5		53.5	1.2	2.2
13	5	53.8	50.3	55.6	55.4	57.1	54.4	2.6	4.8
14	0								
15	0								
16	0								
17	0								
18	5	56	54	54	56	56	55	1	2.0
19	0								
20	5	55.6	58.9	55.0	56.1	53.6	55.8	2.0	3.5
21	0								
22	5	49.6	53.4	53.2	51.2	50.1	51.5	1.7	3.4
23	5	52.25	50.25	57.50	54.50	55.00	53.90	2.76	5.1
24*	5	45.6	43.4	45.4	39.4	43.8	43.5	2.5	5.7
25	5	58.8	61.2	60.0	61.2	62.5	60.7	1.4	2.3
26	5	52.1	50.7	52.1	48.6	51.4	51.0	1.5	2.8
27	0								
28*	5	48.7	47.8	48.3	48.7	48.7	48.4	0.4	0.8
29	5	55.9	50.0	54.9	54.2	55.2	54.0	2.3	4.3
30*	5	48.65	47.75	48.28	48.59	48.46	48.35	0.36	0.7
31	5	54.0	57.0	55.0	55.0	57.0	55.6	1.3	2.4
32	5	50	51	52	51	50	51	1	1.6
33	5	52.3	55.0	54.4	54.4	52.9	53.8	1.1	2.1
34	0								
35	5	52.2	50.8	52.6	53.0	51.0	51.9	1.0	1.9
36*	5	51	45.9	45.6	46.9	45.1	46.9	2.4	5.1
37	0								
38	5	53.1	50.6	52.4	56.8	55.8	53.7	2.5	4.7
39	0								
40*	5	47.84	43.66	47.24	46.86	37.44	44.61	4.32	9.7
41	5	55.75	54.01	55.23	54.81	55.62	55.08	0.70	1.3
42	5	51.8	49.5	50.4	53.2	52.6	51.5	1.5	3.0
43	5	50.7	52.3	51.1	57.8	61.4	54.7	4.7	8.6
44'	5	52.5	52.5	53.4	56.0	52.8	53.4	1.5	2.8
45	0								
46	0								

NICKEL
Tissue X
0.77 ± 0.27 mg/kg

Lab							Mean	SD	RSD
1	5	0.67	0.81	0.69	0.76	0.66	0.72	0.06	9.0
2	0								
3	4	0.54	0.67	0.65	0.62		0.62	0.06	9.2
4	0								
5	5	0.947	0.973	0.918	1.00	0.947	0.957	0.031	3.2
6	5	0.9	0.7	0.7	0.8	0.7	0.8	0.1	11.8
7	0								
8	5	0.80	0.79	1.00	0.74	0.97	0.86	0.12	13.6
9	5	0.83	0.88	0.87	0.87	0.88	0.87	0.02	2.4
10*	5	2.2	2.15	1.95	1.85	1.81	1.99	0.18	8.8
11	5	0.934	0.949	0.912	0.945	0.920	0.932	0.016	1.7
12*	5	1.00	1.22	1.22	1.26	1.19	1.18	0.10	8.7
13	5	<1.32	<1.30	<1.36	1.400	<1.1			
14	0								
15*	5	1.2	0.89	1.2	1.1	0.9	1.1	0.1	13.6
16	0								
17	5	<1.2	<1.2	<1.2	<1.2	<1.2			
18	0								
19	0								
20	5	0.62	0.59	0.54	0.79	0.64	0.64	0.09	14.8
21	5	0.76	0.75	0.87	0.87	0.94	0.84	0.08	9.1
22	0								
23*	5	3.55	3.72	3.96	4.26	4.95	4.09	0.55	13.5
24	5	<2.46	<2.17	<1.69	<1.52	<1.55			
25	0								
26	5	0.88	0.8	0.98	0.98	0.83	0.89	0.08	9.3
27	5	0.826	0.810	0.961	0.877	0.839	0.863	0.060	7.0
28*	5	0.4	0.4	0.5	0.6	0.5	0.5	0.1	17.4
29	5	0.66	0.68	0.70	0.68	0.66	0.68	0.02	2.5
30	5	<5.000	<5.000	<5.000	<5.000	<5.000			
31	0								
32	5	0.69	0.76	0.71	0.69	0.66	0.70	0.04	5.3
33	0								
34	5	0.792	0.762	0.696	0.553	0.619	0.684	0.099	14.5
35	5	0.70	0.65	0.66	0.70	0.67	0.67	0.03	3.7
36	0								
37	0								
38	5	0.618	0.619	0.575	0.625	0.579	0.603	0.024	4.0
39	5	0.74	0.76	0.81	0.74	0.74	0.76	0.03	4.0
40	0								
41	5	0.655	0.597	0.626	0.641	0.652	0.635	0.024	3.7
42	5	0.96	0.87	0.82	0.89	0.91	0.89	0.05	5.8
43	5	0.90	1.23	0.67	0.85	0.71	0.87	0.22	25.4
44*	5	1.12	1.01	1.09	1.08	0.95	1.05	0.07	6.6
45	5	0.59	0.67	0.73	0.57	0.67	0.65	0.07	10.1
46	0								

NICKEL
SRM 1566a
2.25 ± 0.44 mg/kg

Lab							Mean	SD	RSD
1	5	2.37	2.19	2.48	2.07	2.28	2.28	0.16	7.0
2	0								
3	5	2.06	2.25	2.22	2.0	2.85	2.28	0.34	14.8
4	0								
5	5	2.22	2.43	2.46	2.59	2.42	2.42	0.13	5.5
6	5	2.5	2.7	2.6	2.7	2.0	2.5	0.3	11.7
7	5	2.20	2.23	2.25	2.29	2.15	2.22	0.05	2.4
8	5	1.77	2.68	2.55	1.94	1.97	2.18	0.41	18.6
9	5	2.1	2.0	1.9	2.3	1.7	2.0	0.2	11.2
10*	5	3.65	2.59	3.15	2.39	2.85	2.93	0.50	16.9
11	5	2.16	2.33	2.17	2.22	2.36	2.25	0.09	4.1
12	5	2.04	2.66	2.30	2.02	2.44	2.29	0.27	11.8
13	5	2.4	2.2	1.4	2.2	2.1	2.1	0.4	18.7
14	0								
15	4	2.4	2.5	2.3	2.2		2.3	0.1	4.9
16	0								
17	5	2.14	2.55	2.53	2.22	1.88	2.26	0.28	12.4
18	0								
19	0								
20	5	2.29	1.94	2.04	2.12	1.88	2.05	0.16	7.8
21	5	2.51	2.71	2.70	2.19	2.52	2.53	0.21	8.3
22	0								
23*	5	3.96	3.20	2.46	1.96	3.13	2.94	0.76	26.0
24	5	2.11	3.23	2.49	2.93	2.49	2.65	0.44	16.4
25	0								
26	5	2.40	1.88	2.68	1.95	1.93	2.17	0.35	16.4
27	5	2.34	2.06	2.39	2.59	3.36	2.55	0.49	19.3
28	5	1.8	2.7	2.6	2.2	2.7	2.4	0.4	16.4
29	5	2.2	2.2	2.0	1.9	1.9	2.0	0.2	7.4
30	5	<5.000	<5.000	<5.000	<5.000	<5.000			
31	0								
32	5	1.67	1.92	1.81	1.99	2.02	1.88	0.14	7.6
33	0								
34	0								
35	5	2.05	2.35	2.30	2.15	2.25	2.22	0.12	5.4
36	0								
37	0								
38	5	1.99	2.32	2.17	2.47	2.11	2.21	0.19	8.4
39*	5	3.4	2.7	2.4	3.1	2.0	2.7	0.6	20.4
40	0								
41	5	2.16	2.14	2.15	2.14	2.15	2.15	0.01	0.4
42	5	2.40	2.59	2.31	2.73	2.51	2.51	0.16	6.5
43*	5	1.38	2.18	1.87	1.87	1.60	1.78	0.30	17.1
44	5	1.98	2.37	2.08	2.03	2.59	2.21	0.26	11.8
45	0								
46	0								

COPPER
Sediment W
129 ± 14 mg/kg

Lab							Mean	SD	RSD
1	5	133	129	121	126	132	129	5	3.7
2	5	126	121	119	110	129	121	8	6.3
3	5	136.5	130.4	139.7	131.1	139.4	135.8	4.7	3.4
4	5	120	120	122	119	128	122	4	3.0
5	5	133	138	142	139	131	137	5	3.3
6	5	126	125	122	123	127	125	2	1.7
7	0								
8	5	117.8	121.4	109.0	118.1	112.5	115.8	4.9	4.3
9	5	135	138	137	137	134	136	2	1.2
10	5	127.33	127.66	128.30	130.32	130.30	128.78	1.44	1.1
11	5	126.4	138.9	129.8	119.9	127.8	128.6	6.9	5.3
12	4	118	120	120	124		121	3	2.1
13	5	136	144	113	112	144	130	16	12.4
14	0								
15	0								
16	5	115.2	130.5	110.49	126.97	131.04	122.84	9.41	7.7
17	0								
18	5	130	140	150	150	130	140	10	7.1
19	0								
20	5	129	126	130	137	128	130	4	3.2
21*	5	182	183	159	160	162	169	12	7.2
22	5	128	136	130	138	147	136	7	5.5
23	0								
24*	5	113	121	119	106	107	113	7	6.0
25	5	135	135	129	140	126	133	6	4.2
26	5	123	124	122	125	124	124	1	0.9
27	5	136	133	132	132	131	133	2	1.4
28	5	115.3	118.8	113.9	110.3	114.8	114.6	3.0	2.7
29	5	126	125	130	131	128	128	3	2.0
30	5	127.1	130.1	139.8	124.6	118.2	128.0	7.9	6.2
31	5	118	123	124	122	123	122	2	1.9
32	5	140	140	141	141	139	140	1	0.6
33	5	141	130	138	118	144	134	10	7.8
34	5	120	130	117	122	135	125	7	6.0
35	5	132	152	136	140	139	140	8	5.5
36*	5	156	156	158	152	155	155	2	1.4
37	0								
38	5	111.3	110.1	120.1	121.2	113.1	115.2	5.1	4.5
39	0								
40	5	127.29	119.75	129.90	117.59	121.70	123.25	5.18	4.2
41	5	133.74	132.50	129.92	132.32	130.32	131.76	1.60	1.2
42	5	135	118	124	122	133	126	7	5.8
43	5	136	136	140	126	122	132	8	5.9
44	5	118	120	131	128	128	125	6	4.5
45	5	141	129	130	139	145	137	7	5.1
46	5	148	123	155	143	129	140	13	9.5

COPPER
BCSS-1
18.5 ± 2.7 mg/kg

Lab							Mean	SD	RSD
1	5	17.6	19.0	17.5	19.0	18.2	18.3	0.7	4.0
2	5	17.6	18.3	19.4	19.6	19.6	18.9	0.9	4.8
3*	5	16.81	16.60	15.83	16.6	16.69	16.51	0.39	2.3
4	5	19.5	18.6	20.7	16.1	16.1	18.2	2.1	11.3
5	5	18.3	20.2	17.4	17.8	20.0	19	1	6.9
6	5	20	19	20	20	20	20	0	2.3
7	0								
8	5	17.8	21.0	19.3	16.6	18.6	18.7	1.6	8.8
9	5	15.7	17.4	16.8	15.1	16.5	16.3	0.9	5.6
10	5	17.93	17.71	17.34	18.46	18.72	18.03	0.56	3.1
11	5	17.48	17.86	17.30	17.67	17.80	17.62	0.23	1.3
12	4	18.9	18.3	20.4	16.9		18.6	1.4	7.8
13	5	16.9	15.7	15.9	16.2	15.7	16.1	0.5	3.1
14	0								
15	0								
16	0								
17	0								
18*	5	16	17	13	16	15	15	2	9.8
19	0								
20	5	18.3	18.6	18.3	18.3	18.1	18.3	0.2	1.0
21*	5	13.1	19.9	17.6	14.4	11.4	15.3	3.4	22.5
22*	5	11	11	12	10	11	11	1	6.4
23	0								
24*	5	13.4	12.8	13.3	11.5	13.9	13.0	0.9	7.0
25	5	17.5	17.5	18.8	18.8	17.5	18.0	0.7	4.0
26	5	20.0	19.4	19.0	18.6	19.9	19.4	0.6	3.1
27	5	18.3	18.3	18.6	18.9	18.3	18.5	0.3	1.5
28	5	15.6	15.9	15.8	15.6	15.7	15.7	0.1	0.8
29	5	20.1	18.6	17.7	18.0	17.6	18.4	1.0	5.6
30'*	5	12.65	11.82	11.98	11.99	11.83	12.05	0.34	2.8
31	5	19.0	20.0	19.0	19.0	19.0	19.2	0.4	2.3
32*	5	23	23	23	22	23	23	0	2.0
33	5	16.6	17.1	15.9	16.0	16.5	16.4	0.5	3.0
34	0								
35	5	15.8	15.8	15.6	16.0	15.6	15.8	0.2	1.1
36	5	19.1	18.2	18.7	18.3	18.6	18.6	0.4	1.9
37	0								
38*	5	12.2	17.2	16.2	12.3	12.7	14.1	2.4	16.9
39	0								
40*	5	14.28	13.31	13.94	14.45	10.82	13.36	1.49	11.1
41	5	18.88	18.64	20.13	19.57	18.34	19.09	0.75	3.9
42	5	18.0	17.2	17.8	16.6	17.4	17.4	0.5	3.1
43*	5	13.2	11.7	11.4	16.1	18.0	14.1	2.9	20.4
44	5	17.7	17.8	20.0	18.0	19.8	18.7	1.1	6.1
45	0								
46	0								

COPPER
Tissue X
9.8 ± 1.0 mg/kg

Lab							Mean	SD	RSD
1*	5	6.79	6.62	6.63	6.63	6.79	6.69	0.09	1.3
2	0								
3	5	7.87	11.09	8.08	8.54	9.47	9.01	1.32	14.6
4	0								
5*	5	14.6	14.1	13.9	14.6	14.5	14.3	0.3	2.2
6	5	10	10	10	10	10	10	0	0.0
7*	5	11.1	11.7	10.8	12.0	11.9	11.5	0.5	4.6
8	5	9.8	9.7	9.7	9.8	9.7	9.7	0.1	0.6
9'*	5	12	14	12	12	12	12	1	7.2
10	5	10.11	8.98	8.95	9.75	9.06	9.37	0.53	5.6
11	5	9.46	9.43	9.37	9.61	9.93	9.56	0.23	2.4
12*	5	11.3	12.0	12.1	12.1	11.7	11.8	0.3	2.9
13	5	9.8	10.1	10.4	10.4	8.5	9.8	0.8	8.0
14	5	9.5	9.3	10.0	9.9	9.7	9.7	0.3	3.0
15	5	8.9	8.8	9.0	9.3	9.2	9.0	0.2	2.4
16	5	9.12	9.2	9.74	9.54	9.51	9.42	0.26	2.7
17	5	10.4	10.5	10.2	10.1	10.4	10.3	0.2	1.9
18	0								
19	5	10.6	10.6	10.7	10.8	10.9	10.7	0.1	1.2
20*	5	12.1	12.4	12.1	11.6	11.9	12.0	0.3	2.5
21	5	10.3	10.9	10.5	10.8	10.2	10.5	0.3	2.9
22	0								
23'	5	11.70	10.22	10.41	10.12	10.14	10.52	0.67	6.4
24*	5	9.02	8.24	8.22	8.43	8.60	8.50	0.33	3.9
25	0								
26	5	10.3	10.3	10.0	10.0	10.0	10.1	0.2	1.6
27	5	9.26	9.16	9.48	9.16	9.61	9.33	0.20	2.2
28	5	10.31	9.65	9.56	9.9	10.40	9.96	0.38	3.8
29	5	9.6	9.7	9.6	9.7	9.7	9.7	0.1	0.6
30	5	<5.000	<5.000	<5.000	<5.000	<5.000			
31*	5	12.0	13.0	13.0	15.0	13.0	13.2	1.1	8.3
32	5	10.1	10.2	10.0	10.0	10.4	10.1	0.2	1.7
33*	5	13.1	12.8	12.4	12.6	12.0	12.6	0.4	3.3
34	5	10.2	10.0	9.70	11.9	12.8	10.9	1.4	12.4
35	5	9.75	9.80	9.75	9.90	9.75	9.79	0.07	0.7
36*	5	17.4	16.5	16.0	14.4	14.2	16.1	1.9	11.6
37	0								
38	5	9.70	10.05	10.08	9.50	10.08	9.88	0.27	2.7
39	5	9.6	9.4	9.6	9.7	9.5	9.6	0.1	1.2
40	5	9.67	9.79	9.37	9.66	9.60	9.62	0.15	1.6
41	5	10.48	9.14	8.99	8.97	9.57	9.43	0.63	6.7
42'	5	10.0	9.94	9.95	9.42	9.95	9.85	0.24	2.5
43*	5	11.0	11.6	10.8	11.6	10.6	11.1	0.5	4.1
44*	5	8.28	8.27	9.16	8.57	8.92	8.64	0.39	4.6
45	5	9.2	8.5	8.5	8.5	10.6	9.06	0.91	10.1
46	5	10.7	10.4	10.5	10.4	10.5	10.5	0.1	1.2

COPPER
SRM 1566a
66.3 ± 4.3 (6.6) mg/kg

Lab							Mean	SD	RSD
1	5	68.6	71.0	67.8	66.3	65.2	67.8	2.2	3.3
2	0								
3	5	77.80	60.91	62.50	57.69	63.64	64.51	7.76	12.0
4	0								
5	5	62.8	62.0	64.2	62.1	62.3	62.7	0.9	1.4
6	5	64	65	67	65	61	64	2	3.4
7	5	66.7	68.5	69.0	66.4	69.1	67.9	1.3	1.9
8	5	63.9	63.9	60.3	59.3	63.3	62.1	2.2	3.5
9	5	67.6	67.8	67.1	67.1	66.0	67.1	0.7	1.0
10	5	64.44	65.23	64.57	64.590	64.990	64.76	0.33	0.5
11'	5	66.6	62.6	62.9	63.4	62.4	63.6	1.7	2.7
12	5	64.0	64.1	63.5	63.8	63.2	63.7	0.4	0.6
13	5	65.9	67.9	64.3	65.7	64.0	65.6	1.6	2.4
14*	5	57.8	58.9	58.4	58.1	60.0	58.6	0.9	1.5
15	5	58.5	59.4	59.7	60.3	62.5	60.1	1.5	2.5
16	0								
17	5	62.3	62.2	61.9	62.3	61.4	62.0	0.4	0.6
18	0								
19	5	63.4	64.1	64.1	64.1	64.9	64.1	0.5	0.8
20	5	63.8	66.1	63.9	64.2	64.7	64.5	0.9	1.5
21	5	66.1	65.8	65.9	65.6	66.6	66.0	0.4	0.6
22	0								
23*	5	58.71	58.87	58.33	59.36	59.07	58.87	0.39	0.7
24*	5	59.7	56.9	58.4	57.3	59.3	58.3	1.2	2.1
25	0								
26	5	66.8	66.5	66.0	66.5	66.3	66.4	0.3	0.4
27	5	63.1	63.8	56.2	46.7	78.5	61.7	11.7	18.9
28	5	60.26	59.03	60.79	59.92	59.28	59.86	0.72	1.2
29	5	62.0	63.0	63.7	66.4	61.4	63.3	1.9	3.1
30*	5	22.57	16.63	24.08	19.55	17.594	20.08	3.18	15.9
31	5	66.0	65.0	65.0	62.0	69.0	65.4	2.5	3.8
32	5	60.5	58.8	59.7	60.2	60.8	60.0	0.8	1.3
33	5	63.9	64.0	62.6	61.7	61.4	62.7	1.2	1.9
34	0								
35	5	65.0	64.5	64.8	65.1	65.5	65.0	0.4	0.6
36	5	70.6	66.7	70.8	69.1	69.4	69.3	1.6	2.4
37	0								
38'	5	65.6	69.2	68.8	69.6	68.6	68.4	1.6	2.3
39	5	72	71	71	72	71	71	1	0.8
40'	5	65.42	64.99	66.39	65.90	60.70	64.68	2.29	3.5
41	5	65.33	66.29	68.09	66.25	65.89	66.37	1.04	1.6
42	5	61.6	61.6	62.1	63.9	62.3	62.3	0.9	1.5
43	5	66.1	66.0	65.0	65.2	66.2	65.7	0.6	0.8
44	5	68.9	65.9	63.7	65.2	64.8	65.7	2.0	3.0
45	0								
46	0								

ZINC
Sediment W
331 ± 33 mg/kg

Lab							Mean	SD	RSD
1*	5	363	374	372	383	368	372	7	2.0
2	5	320	354	335	333	333	335	12	3.6
3*	5	210	247	257	241	264	244	21	8.6
4	5	310	305	324	328	312	316	10	3.1
5	5	378	365	362	356	356	363	9	2.5
6	5	330	330	320	320	320	324	5	1.7
7	0								
8	5	344	340	352	322	330	338	12	3.5
9	5	350	350	350	350	350	350	0	0.0
10	5	310.90	317.34	315.09	313.09	309.23	313.13	3.23	1.0
11*	5	255.2	242.4	225.9	234.9	225.5	236.8	12.5	5.3
12	4	332	319	335	310		324	12	3.6
13*	5	381	396	368	355	391	378	17	4.4
14	0								
15	0								
16*	5	163.30	167.90	143.69	159.60	159.00	158.70	9.11	5.7
17	0								
18	5	320	310	330	330	310	320	10	3.1
19	0								
20	5	341	347	355	345	332	344	8	2.4
21	5	336	335	336	341	350	340	6	1.8
22	5	339	346	356	366	360	353	11	3.1
23*	5	276.75	274.76	268.25	264.5	253.25	267.30	9.12	3.4
24*	5	299	285	285	283	276	286	8	2.9
25	5	292	308	300	322	330	310	16	5.0
26	5	339	325	324	324	330	328	6	2.0
27	5	323	339	343	351	319	335	14	4.0
28	6	307.5	300.7	295.4	275.2	291.6	294.1	12.1	4.1
29	5	304	303	315	315	309	309	6	1.9
30	5	314.9	322.9	331.9	337.7	333.3	328.1	9.2	2.8
31	5	350	340	350	330	340	342	8	2.4
32	5	352	350	352	351	352	351	1	0.3
33	5	328	358	347	326	328	337	14	4.3
34*	5	327	330	346	332	328	333	8	2.3
35	5	343	342	341	344	346	343	2	0.6
36	5	355	360	339	306	365	345	24	6.9
37	0								
38	5	305.9	315.6	312.4	326.5	332.8	318.6	10.9	3.4
39	0								
40	5	300.45	315.60	321.35	313.52	311.63	312.51	7.66	2.5
41	5	322.32	319.37	320.91	319.32	320.57	320.50	1.24	0.4
42	5	322	334	341	324	316	327	10	3.1
43	5	364	336	346	325	319	338	18	5.3
44	5	341	343	328	358	350	344	11	3.2
45	5	316	321	319	319	308	317	5	1.6
46	5	358	335	352	334	350	346	11	3.1

ZINC
BCSS-1
119 ± 12 mg/kg

Lab							Mean	SD	RSD
1	5	118	122	119	125	121	121	3	2.3
2	5	107	108	110	113	114	110	3	2.8
3*	5	103	90	93	105	95	97	6	6.7
4	5	117	117	110	98.9	98.6	108	9	8.5
5	5	117	117	115	114	120	117	2	2.0
6	5	110	110	110	110	110	110	0	0.0
7	0								
8	5	109	116	114	117	113	114	3	2.6
9	5	120	120	120	120	120	120	0	0.0
10	5	107.14	105.82	105.33	104.20	107.22	105.94	1.27	1.2
11*	5	83.4	79.9	74.7	78.7	76.3	78.6	3.4	4.3
12	4	110	110	110	115		111	3	2.2
13	5	114	113	124	128	129	122	8	6.3
14	0								
15	0								
16	0								
17	0								
18	5	100	110	100	110	110	106	5	5.2
19	0								
20	5	115	110	112	119	117	115	4	3.2
21	5	117	118	120	119	121	119	2	1.3
22*	5	98.4	99.8	101	97.6	100	99.4	1.4	1.4
23	5	126.25	132.75	136.25	126.75	133.50	131.50	5.03	3.8
24*	5	105	99	105	88	104	100	7	7.2
25	5	115	111	112	112	114	113	2	1.5
26	5	108	108	118	115	114	113	4	4.0
27	5	113	114	110	116	110	113	3	2.3
28	5	107.9	108.9	105.6	105.9	106.9	107.0	1.4	1.3
29	5	115	126	118	120	122	120	4	3.5
30*	5	111.7	101.2	101.4	105.6	98.44	103.7	5.2	5.0
31	5	110	105	110	105	105	107	3	2.6
32	5	127	129	127	128	127	128	1	0.7
33	5	107	112	111	110	109	110	2	1.8
34	0								
35	5	108	109	109	108	110	109	1	0.8
36	5	124	125	130	128	124	126	3	2.1
37	0								
38	5	100.7	116.5	111.4	108.4	109.4	109.7	6.4	5.8
39	0								
40*	5	101.34	92.60	101.21	99.20	75.81	94.03	10.79	11.5
41	5	118.54	116.88	117.33	116.76	116.40	117.18	0.83	0.7
42	5	111	107	106	112	113	110	3	2.8
43*	5	100	102	103	101	100	101	1	1.3
44	5	123	123	117	120	124	121	3	2.4
45	0								
46	0								

ZINC
Tissue X
101 ± 11 mg/kg

Lab							Mean	SD	RSD
1*	5	63.6	63.8	62.7	61.0	61.6	62.5	1.2	2.0
2	0								
3*	4	77.23	80.92	83.83	84.76		81.68	3.39	4.1
4	0								
5	5	93.8	95.9	104	98.2	99.2	98.2	3.8	3.9
6	5	110	100	100	100	120	106	9	8.4
7*	5	103	110	111	109	109	108	3	2.9
8	5	87.6	90.6	95.9	95.6	95.4	93.0	3.7	4.0
9	5	103	108	104	106	108	106	2	2.2
10	5	97.12	98.68	95.77	96.04	101.96	97.91	2.53	2.6
11	5	93.87	91.70	91.30	87.80	90.40	91.01	2.20	2.4
12	5	111	112	110	109	105	109	3	2.5
13	5	107	104	109	107	92	104	7	6.6
14*	5	86.8	86.6	85.3	87.5	88.3	86.9	1.1	1.3
15*	5	86.6	86.7	87.0	89.5	90.9	88.1	1.9	2.2
16*	5	46.70	48.13	51.96	49.27	47.55	48.72	2.04	4.2
17	5	89.3	91.6	92.9	90.1	91.2	91.0	1.4	1.5
18	0								
19	5	101	101	102	102	103	102	1	0.8
20*	5	123	118	120	118	123	120	3	2.1
21	5	110	109	111	107	104	108	3	2.6
22	0								
23	5	100.00	104.79	100.50	100.00	102.75	101.61	2.11	2.1
24	5	99.1	106	101	99.6	102	101.5	2.7	2.7
25	0								
26	5	98.8	100	103	102	101	101.0	1.6	1.6
27*	5	80.7	79.5	83.4	78.4	84.3	81.3	2.5	3.1
28*	5	100	98.6	100	101	118	104	8	7.9
29	5	97	99	100	97	98	98	1	1.3
30*	5	81.55	81.14	83.03	82.66	80.16	81.71	1.16	1.4
31	5	103	105	104	105	103	104	1	1.0
32	5	98	99	98	97	99	98	1	0.9
33	5	104	104	102	101	99	102	2	2.1
34	5	108	110	109	118	120	113	6	4.9
35	5	97.7	97.6	98.4	98.6	99.8	98.4	0.9	0.9
36*	5	117	121	116	113	128	119	6	5.0
37	0								
38	5	93.2	94.8	95.3	91.2	90.9	93.1	2.0	2.2
39	5	104	103	105	108	108	105	2	1.8
40	5	95.42	95.07	91.36	99.72	90.48	94.41	3.69	3.9
41	5	102.71	102.23	101.36	102.97	101.94	102.24	0.64	0.6
42	5	102	102	106	104	108	104	3	2.5
43	5	105	102	100	102	99.2	102	2	2.2
44	5	108	106	91.3	96.3	97.4	99.8	7.0	7.0
45	5	90	96	95	95	102	96	4	4.5
46	0						ERR	ERR	ERR

ZINC
SRM 1566a
830 ± 57 (83) mg/kg

Lab							Mean	SD	RSD
1	5	821	845	850	841	808	833	18	2.1
2	0								
3	5	811	759	805	736	837	790	41	5.2
4	0								
5	5	820	842	775	795	787	804	27	3.4
6	5	800	810	830	820	820	816	11	1.4
7	5	834	840	852	826	854	841	12	1.4
8	5	834	800	836	859	842	834	21	2.6
9	5	847	854	862	862	862	857	7	0.8
10	5	815.74	822.11	811.21	810.02	821.14	816.04	5.53	0.7
11	5	877	805	810	808	772	814	38	4.7
12	5	780	769	745	730	718	748	26	3.5
13	5	880	901	855	864	864	877	18	2.0
14*	5	711	717	712	701	702	709	7	1.0
15	5	770	786	801	779	821	791	20	2.5
16	0								
17*	5	96.3	96.3	94.5	95.7	94.6	95.5	0.9	0.9
18	0								
19	5	837	843	844	847	849	844	5	0.5
20*	5	869	872	865	865	898	874	14	1.6
21	5	816	838	844	823	819	828	12	1.5
22	0								
23	5	816.34	817.66	813.55	819.95	813.73	816.25	2.71	0.3
24	5	778	712	826	809	817	788	46	5.9
25	0								
26	5	840	845	838	845	845	843	3	0.4
27*	5	701	867	691	689	689	727	78	10.8
28	5	816	800	821	813	872	824	28	3.4
29	5	839	824	827	833	842	833	8	0.9
30	5	840.4	840.0	821.3	815.5	823.1	828.1	11.4	1.4
31	5	850	875	875	825	825	850	25	2.9
32	5	758	742	759	761	765	757	9	1.2
33	5	828	822	798	799	787	807	17	2.2
34	0								
35	5	855	849	836	839	843	844	8	0.9
36	5	848	835	820	851	811	833	17	2.1
37	0								
38	5	807	805	836	802	818	814	14	1.7
39	5	850	852	861	870	851	857	9	1.0
40	5	869.05	893.13	834.47	879.26	809.23	857.03	34.41	4.0
41	5	819.47	816.13	820.44	819.19	820.44	819.13	1.77	0.2
42	5	828	826	832	836	831	831	5	0.6
43	5	896	873	832	803	834	848	37	4.3
44	5	832	828	844	813	803	824	16	2.0
45	0								
46	0								

ARSENIC
Sediment W
22.2 ± 3.6 mg/kg

Lab							Mean	SD	RSD
1	5	19	22	20	21	21	21	1	5.5
2	5	24.9	22.7	23.2	24.3	22.4	23.50	1.10	4.7
3*	5	17.65	17.95	16.83	17.95	18.16	17.71	0.52	3.0
4*	5	16.4	15.1	16.9	18.2	16.4	16.6	1.1	6.7
5	5	22.6	19.2	22.6	23.8	20.0	21.6	1.9	9.0
6*	5	27.6	27.1	27.6	26.1	26.2	26.9	0.7	2.7
7	0								
8*	5	27.7	28	28.3	26.9	28.2	27.8	0.6	2.0
9	5	18.6	23.5	21.9	22.8	23.9	22.1	2.1	9.6
10	5	21.41	20.46	20.36	19.02	19.66	20.18	0.90	4.5
11	5	21.55	21.2	21.46	20.68	22.43	21.46	0.64	3.0
12	4	22.4	22.9	22.4	22.2		22.5	0.3	1.3
13	0								
14	0								
15	0								
16	0								
17	0								
18	5	22	23	22	22	22	22	0	2.0
19	0								
20*	5	26.3	26.7	27.3	26.9	27.3	26.9	0.4	1.6
21	5	20.9	20.8	20.7	20.3	20.3	20.6	0.3	1.4
22	5	21.7	21.4	21.4	23.4	22.8	22.1	0.9	4.1
23*	5	17.56	15.45	15.77	15.83	15.29	15.98	0.91	5.7
24	5	23.1	22.2	22.9	21.8	21.5	22.3	0.7	3.1
25*	5	16.4	16.4	15.8	17.2	15.6	16.1	0.7	4.5
26	5	22.4	25.3	24.7	22.1	28.0	24.5	2.4	9.8
27	5	22.0	22.3	19.5	21.3	22.3	21.5	1.2	5.5
28	5	23.2	22.5	22.8	21.1	22.3	22.4	0.8	3.5
29	5	24.7	25.2	23.8	24.7	24.3	24.5	0.5	2.1
30	3	16.09	13.26	15.97			15.11	1.60	10.6
31*	5	8.51	8.78	8.51	8.41	8.22	8.49	0.20	2.4
32	5	21.50	22.00	22.30	20.90	20.50	21.44	0.75	3.5
33	0								
34*	5	25.0	20.0	16.8	19.4	19.9	20.6	2.5	12.1
35	5	21.6	21.8	22.5	21.9	21.9	21.9	0.3	1.5
36	0								
37	0								
38*	5	24.8	27.0	23.4	30.0	29.7	27.0	2.9	10.8
39*	5	27.6	27.2	27.0	27.7	27.1	27.3	0.3	1.1
40	5	26.51	25.67	24.63	23.28	23.02	24.62	1.50	6.1
41*	5	16.55	17.86	18.01	17.54	16.97	17.39	0.61	3.5
42*	5	17.3	16.0	16.5	16.2	18.6	16.9	1.1	6.3
43	0								
44	5	22.0	22.3	21.2	21.7	21.3	21.7	0.5	2.1
45	5	20	18	21	22	19	20	2	7.9
46	0								

ARSENIC
BCSS-1
11.1 ± 1.4 mg/kg

Lab							Mean	SD	RSD
1	5	10	12	12	11	11	11	1	7.5
2	0	10.7	9.1	9.7	11.6	8.9	10.00	1.10	11.0
3	5	10.05	8.91	9.49	11.05	8.876	9.68	0.91	9.4
4*	5	7.48	7.59	7.74	7.80	7.72	7.67	0.13	1.7
5	5	10.8	10.9	9.99	9.93	11.1	10.54	0.54	5.2
6	5	11.9	11.8	11.5	11.5	11.5	11.6	0.2	1.7
7	0								
8*	5	12.7	12.9	13.7	13.3	12.6	13.0	0.5	3.5
9	5	13	13	11	13	12	12	1	7.2
10	5	9.7	11.51	10.51	11.62	10.37	10.74	0.81	7.6
11	5	10.62	10.62	10.56	10.45	10.74	10.60	0.11	1.0
12	4	11.3	11.4	11.1	11.6		11.4	0.2	1.8
13	0								
14	0								
15	0								
16	0								
17	0								
18	5	12	11	11	12	11	11	1	4.8
19	0								
20*	5	13.2	13.3	13.2	13.2	13.1	13.2	0.1	0.5
21	5	10.6	10.7	10.4	10.5	10.3	10.5	0.2	1.5
22*	5	9.9	8.5	8.5	9.3	9.2	9.1	0.6	6.5
23*	5	11.06	12.1	13.66	15.08	15.88	13.56	2.01	14.8
24	5	11.8	11.3	12.0	10.7	11.5	11.5	0.5	4.4
25	5	10.9	9.9	10.5	10.7	10.0	10.4	0.4	4.2
26	5	11.2	10.4	10.7	11.0	10.6	10.8	0.3	3.0
27	5	9.6	11.1	10.3	9.3	9.3	9.9	0.8	7.8
28	5	12.2	13.1	13.0	12.1	11.8	12.4	0.6	4.6
29*	5	11.2	11.1	10.6	11.1	11.1	11.0	0.2	2.2
30*	5	7.182	7.005	6.546	6.443	7.328	6.901	0.390	5.6
31*	5	8.37	8.20	8.34	8.10	8.20	8.24	0.11	1.4
32	5	10.9	10.7	10.1	10.2	9.8	10.3	0.5	4.4
33	0								
34	0								
35*	5	9.00	9.20	9.90	10.0	9.00	9.42	0.49	5.2
36	0								
37	0								
38	5	10.6	11.8	10.2	11.0	9.9	10.7	0.7	6.9
39	5	12.8	12.5	12.5	12.5	12.5	12.6	0.1	1.1
40*	5	12.89	11.91	13.53	13.67	11.76	12.75	0.89	7.0
41	5	10.73	10.24	9.88	10.08	10.17	10.22	0.32	3.1
42	5	15.3	9.4	12.8	8.5	7.6	10.7	3.2	30.1
43	0								
44	5	11.8	11.4	10.9	12.1	11.1	11.5	0.5	4.3
45	0								
46	0								

ARSENIC
Tissue X
6.82 ± 1.20 mg/kg

Lab							Mean	SD	RSD
1	5	7.12	7.52	7.26	7.49	7.24	7.33	0.17	2.4
2	0								
3*	5	4.30	4.04	3.80	4.04	4.48	4.13	0.26	6.4
4	0								
5*	5	8.08	8.41	8.72	8.39	8.22	8.36	0.24	2.9
6*	5	10	10	10	11	10	10	0	4.4
7	5	6.31	6.39	6.05	6.48	6.44	6.33	0.17	2.7
8	5	6.4	6.4	7.4	6.9	7.3	6.9	0.5	6.9
9	5	6.7	7.2	7.2	8.3	7.9	7.5	0.6	6.5
10	5	6.39	6.56	5.31	5.59	5.94	5.96	0.53	8.8
11	5	8.03	7.39	7.00	7.03	7.15	7.32	0.43	5.8
12	5	7.23	7.47	7.51	7.45	7.61	7.45	0.14	1.9
13	0								
14	0								
15	5	6.2	6.6	6.2	6.5	6.3	6.4	0.2	2.7
16	0								
17*	5	7.53	9.02	9.38	8.19	8.91	8.61	0.74	8.6
18	0								
19	0								
20	5	6.68	5.92	6.13	6.82	7.08	6.53	0.49	7.4
21	5	6.92	6.95	6.91	6.79	6.77	6.87	0.08	1.2
22	0								
23	0								
24*	5	8.66	7.52	7.82	7.52	7.41	7.83	0.60	7.6
25	0								
26*	5	9.34	8.8	8.64	8.76	8.56	8.82	0.30	3.4
27	0								
28*	5	4	3.1	4.4	2.5	4.4	3.7	0.8	23.0
29	5	6.45	6.30	6.37	6.23	6.21	6.31	0.10	1.6
30	5	5.907	5.046	6.15	5.133	5.775	5.602	0.488	8.7
31*	5	4.53	4.05	4.90	4.50	4.90	4.58	0.35	7.7
32*	5	7.4	7.1	7.1	7.1	7.1	7.2	0.1	1.9
33	0								
34*	5	3.70	4.30	3.61	2.64	2.26	3.30	0.83	25.2
35	5	6.95	7.15	6.85	7.43	7.25	7.13	0.23	3.3
36	0								
37	0								
38	5	6.1	6.4	6.3	6.0	6.0	6.2	0.2	2.9
39	5	7.52	7.14	7.03	7.18	7.17	7.21	0.18	2.6
40*	5	7.36	3.19	3.49	7.68	3.36	5.02	2.29	45.7
41*	5	5.14	5.13	5.24	5.22	5.19	5.18	0.05	0.9
42	2	4.38	4.52						
43	0								
44	5	6.88	7.13	7.02	7.30	7.07	7.08	0.15	2.2
45	5	7.0	7.4	6.8	7.4	6.8	7.1	0.3	4.3
46	0								

ARSENIC
SRM 1566a
14.0 ± 1.2 (1.4) mg/kg

Lab							Mean	SD	RSD
1	5	14.3	15.5	13.4	14.5	13.4	14.2	0.9	6.2
2	0								
3*	5	9.83	10.14	9.72	10.36	10.86	10.18	0.46	4.5
4	0								
5	5	14.7	13.5	14.0	13.6	13.1	13.8	0.6	4.4
6	5	15	15	14	16	15	15	1	4.7
7	5	13.8	14.2	14.1	13.5	13.5	13.8	0.3	2.4
8	5	12.9	12.1	13.1	13.7	12.6	12.9	0.6	4.6
9	5	14.3	14.7	14.6	15.2	14.6	14.7	0.3	2.2
10*	5	13.57	13.48	13.35	14.24	13.43	13.61	0.36	2.6
11	5	14.02	13.96	13.14	13.28	13.02	13.48	0.47	3.5
12	5	13.3	13.2	13.5	13.4	13.1	13.3	0.2	1.2
13	0								
14	0								
15	5	12.7	12.6	13.3	12.5	13.7	13.0	0.5	4.0
16	0								
17	5	13.7	17.6	14.7	14.6	16.8	15.5	1.6	10.6
18	0								
19	0								
20	5	14.0	14.9	14.3	14.0	12.7	14.0	0.8	5.8
21	5	15.2	15.2	15	14.8	15.2	15.1	0.2	1.2
22	0								
23	0								
24	5	14.0	13.8	12.6	12.6	12.0	13.0	0.9	6.6
25	0								
26*	5	13.2	11.2	12.6	12.7	11.6	12.3	0.8	6.8
27	0								
28	5	13.8	13.3	13.3	13.0	14.0	13.5	0.4	3.0
29*	5	13.9	13.9	13.8	14.2	13.9	13.9	0.2	1.1
30*	5	12.64	12.03	11.63	10.72	10.98	11.60	0.78	6.7
31*	5	9.40	9.60	10.0	10.0	10.0	9.78	0.30	3.1
32*	5	13.5	13.1	13.6	13.5	13.6	13.5	0.2	1.5
33	0								
34	0								
35	5	14.9	14.3	14.0	14.8	15.0	14.6	0.4	2.9
36	0								
37	0								
38	5	12.5	12.7	13.1	13.2	12.9	12.9	0.3	2.2
39	5	13.6	13.4	13.0	12.9	12.5	13.1	0.4	3.3
40*	5	15.17	13.44	8.18	12.10	11.16	12.01	2.62	21.8
41	5	13.58	13.51	13.64	13.49	13.55	13.55	0.06	0.4
42	2	10.4	10.3						
43	0								
44	5	14.1	14.0	14.0	13.8	13.4	13.9	0.3	2.0
45	0								
46	0								

SELENIUM
Sediment W
1.36 ± 0.47 mg/kg

Lab							Mean	SD	RSD
1*	5	1.8	2.6	2.3	2.2	1.8	2.1	0.3	16.1
2	5	1.08	1.15	1.13	1.30	1.31	1.19	0.10	8.8
3*	5	0.6734	0.7449	0.6327	0.8627	0.8163	0.7460	0.0957	12.8
4*	5	0.831	0.816	0.802	0.784	0.825	0.812	0.019	2.3
5	5	1.50	1.57	1.56	1.55	1.55	1.54	0.03	1.7
6	5	1.5	1.5	1.6	1.5	1.6	1.5	0.1	3.6
7	0								
8	5	1.85	2.13	1.31	1.58	1.80	1.73	0.31	17.7
9	5	1.5	1.2	1.3	1.3	1.5	1.4	0.1	9.9
10	5	1.36	1.26	1.35	1.42	1.33	1.34	0.06	4.3
11	5	1.54	1.61	1.66	1.82	1.81	1.69	0.12	7.3
12	4	1.45	1.50	1.50	1.49		1.49	0.02	1.6
13	0								
14	0								
15	0								
16	0								
17	0								
18	5	1.6	1.6	1.6	1.6	1.6	1.6	0.0	0.0
19	0								
20	5	1.48	1.51	1.54	1.57	1.61	1.54	0.05	3.3
21*	5	2.50	2.48	2.66	2.62	2.81	2.61	0.13	5.1
22	5	1.2	1.3	1.4	1.4	1.2	1.3	0.1	7.7
23	0								
24	5	1.19	1.16	1.08	1.10	1.05	1.12	0.06	5.2
25	0								
26	5	1.03	1.30	1.23	1.15	1.05	1.15	0.12	10.0
27	5	1.18	1.17	1.21	1.39	1.39	1.27	0.11	8.9
28	5	<4	<4	<4	<4	<4			
29	5	1.48	1.43	1.45	1.51	1.54	1.48	0.04	3.0
30	5	<2.000	<2.000	<2.000	<2.000	<2.000			
31	0								
32	5	1.11	1.18	1.29	1.30	1.27	1.23	0.08	6.7
33	0								
34	5	<0.25	<0.25	<0.25	<0.25	0.288			
35	5	1.4	1.4	1.5	1.5	1.5	1.5	0.1	3.8
36	0								
37	0								
38*	5	1.16	1.18	1.18	1.26	1.17	1.19	0.04	3.4
39	5	1.55	1.60	1.50	1.50	1.49	1.53	0.05	3.0
40*	5	0.538	0.462	0.448	0.441	0.361	0.450	0.063	14.0
41*	5	0.48	0.45	0.41	0.44	0.45	0.45	0.03	5.6
42	3	0.70	0.73	0.77					
43	0								
44	5	1.00	1.07	0.93	1.18	1.16	1.07	0.11	9.9
45	5	1.2	1.1	1.2	1.2	1.3	1.2	0.1	5.9
46	0								

SELENIUM
BCSS-1
0.43 ± 0.06 mg/kg

Lab							Mean	SD	RSD
1	5	0.69	<0.5	0.5	<0.5	<0.5			
2	5	0.40	0.39	0.38	0.38	0.36	0.38	0.01	3.9
3*	5	0.333	0.2708	0.350	0.2653	0.3236	0.3085	0.0382	12.4
4*	5	0.343	0.315	0.270	0.273	0.273	0.295	0.033	11.1
5	5	0.432	0.433	0.432	0.426	0.425	0.430	0.004	0.9
6	5	0.5	0.4	0.4	0.4	0.4	0.4	0.0	11.2
7	0								
8	5	0.34	0.45	0.46	0.35	0.53	0.43	0.08	18.8
9	5	0.37	0.55	0.28	0.37	0.38	0.39	0.10	25.2
10	5	0.46	0.49	0.39	0.44	0.34	0.42	0.06	14.0
11	5	0.465	0.474	0.460	0.390	0.420	0.442	0.036	8.1
12*	4	0.499	0.421	0.536	0.589		0.512	0.071	13.8
13	0								
14	0								
15	0								
16	0								
17	0								
18*	5	0.5	0.5	0.7	0.5	0.5	0.5	0.1	16.6
19	0								
20	5	0.389	0.423	0.395	0.438	0.412	0.411	0.020	4.9
21*	5	0.360	0.324	0.294	0.202	0.442	0.324	0.088	27.1
22*	5	0.16	0.42	0.37	0.33	0.30	0.32	0.10	31.1
23	0								
24*	4	<0.56	0.53	0.51	0.45	0.60	0.52	0.06	11.5
25	0								
26	5	0.43	0.40	0.40	0.43	0.40	0.41	0.02	4.0
27	5	0.40	0.46	0.49	0.46	0.46	0.45	0.03	7.2
28	5	<4	<4	<4	<4	<4			
29	5	0.48	0.46	0.47	0.52	0.40	0.47	0.04	9.3
30	5	<2.000	<2.000	<2.000	<2.000	<2.000			
31	0								
32	5	0.47	0.49	0.49	0.50	0.47	0.48	0.01	2.8
33	0								
34	0								
35	5	0.49	0.48	0.46	0.43	0.44	0.46	0.03	5.5
36	0								
37	0								
38	5	0.57	0.51	0.46	0.40	0.38	0.46	0.08	16.9
39	5	0.38	0.39	0.38	0.37	0.37	0.38	0.01	2.2
40*	5	0.223	0.183	0.193	0.233	0.173	0.201	0.026	12.9
41	5	0.46	0.49	0.45	0.46	0.48	0.47	0.02	3.5
42	3	0.31	0.29	0.36					
43	0								
44	5	0.46	0.48	0.45	0.45	0.46	0.46	0.01	2.7
45	0								
46	0								

SELENIUM
Tissue X
1.92 ± 0.52 mg/kg

Lab							Mean	SD	RSD
1*	5	2.99	3.21	3.13	3.00	2.98	3.06	0.10	3.4
2	0								
3*	5	1.275	1.146	1.155	1.204	1.480	1.252	0.137	11.0
4	0								
5	5	2.05	1.98	2.00	2.07	2.07	2.03	0.04	2.0
6	5	2.1	2.0	2.1	2.0	1.9	2.0	0.1	4.1
7*	5	2.85	3.02	2.90	3.09	2.98	2.97	0.10	3.2
8	5	1.5	1.6	1.7	1.7	1.8	1.7	0.1	6.9
9*	5	1.0	1.3	1.4	1.5	1.4	1.3	0.2	14.6
10	5	1.90	1.86	1.73	1.74	1.83	1.81	0.07	4.1
11*	5	3.26	3.21	3.25	3.38	3.98	3.42	0.32	9.4
12	5	1.78	2.07	2.07	1.87	2.07	1.97	0.14	7.0
13	0								
14	0								
15*	5	2.4	2.2	2.8	2.6	3.6	2.7	0.5	19.7
16	0								
17	5	2.52	2.22	1.72	2.96	2.88	2.46	0.51	20.7
18	0								
19	0								
20*	5	3.28	4.49	4.18	3.22	3.12	3.66	0.63	17.2
21	5	2.18	2.13	2.11	2.15	2.17	2.15	0.03	1.3
22	0								
23	0								
24	0								
25	0								
26	5	2.19	1.95	1.90	1.83	1.86	1.93	0.16	8.2
27	5	2.30	2.38	1.76	1.65	1.51	1.92	0.39	20.5
28*	5	2.9	2.9	2.9	1.3	2.7	2.5	0.7	27.5
29	5	1.76	1.73	1.69	1.72	1.73	1.73	0.03	1.5
30	5	<4.000	<4.000	<4.000	<4.000	<4.000			
31	0								
32	5	1.94	1.89	2.02	1.99	1.94	1.96	0.05	2.6
33	0								
34*	5	1.35	1.35	1.58	1.03	1.07	1.28	0.23	17.8
35	5	1.8	1.7	1.8	1.8	1.8	1.8	0.0	2.5
36	0								
37	0								
38*	5	2.08	2.37	1.99	1.99	2.06	2.10	0.16	7.5
39	5	2.00	2.03	2.00	2.01	2.01	2.01	0.01	0.6
40*	5	0.784	0.82	0.92	0.80	0.82	0.83	0.05	6.4
41	5	1.68	1.71	1.70	1.69	1.71	1.70	0.01	0.8
42	4	1.85	1.63	1.71	1.85		1.76	0.11	6.2
43	0								
44	5	2.01	2.37	2.27	2.52	2.03	2.24	0.22	9.8
45	5	1.9	1.8	2.1	1.6	1.9	1.9	0.2	9.8
46	0								

SELENIUM
SRM 1566a
2.21 ± 0.24 mg/kg

Lab							Mean	SD	RSD
1	5	2.50	2.48	2.36	2.17	2.30	2.36	0.14	5.7
2	0								
3	5	1.723	1.900	1.600	1.684	1.711	1.724	0.110	6.4
4	0								
5	5	2.14	2.33	2.25	2.13	2.22	2.21	0.08	3.7
6	5	2.2	2.3	2.0	2.0	1.9	2.1	0.2	7.9
7	5	2.04	2.01	2.05	2.05	2.11	2.05	0.04	1.8
8	5	1.9	1.8	2.7	1.7	1.8	2.0	0.4	20.6
9	5	2.4	1.8	2.0	2.2	2.2	2.1	0.2	10.8
10	5	2.11	2.06	2.03	2.03	2.19	2.08	0.07	3.2
11	5	2.17	2.20	2.29	2.36	2.32	2.27	0.08	3.5
12	5	2.05	2.03	1.97	2.05	2.02	2.02	0.03	1.6
13	0								
14	0								
15	5	2.6	1.5	0.8	1.8	2.5	1.8	0.7	39.9
16	0								
17	5	2.39	1.38	2.57	2.27	2.60	2.24	0.50	22.3
18	0								
19	0								
20	5	2.09	2.13	2.01	2.05	2.09	2.07	0.05	2.2
21	5	2.24	2.19	2.18	2.27	2.26	2.23	0.04	1.8
22	0								
23	0								
24	0								
25	0								
26	5	2.01	1.77	1.83	1.89	2.19	1.94	0.17	8.6
27	5	2.31	2.28	1.82	1.88	1.77	2.01	0.26	13.0
28	5	3.8	2.5	3.0	3.1	2.8	3.0	0.5	15.9
29	5	2.14	2.21	2.31	2.35	2.28	2.26	0.08	3.7
30	5	<4.000	<4.000	<4.000	<4.000	<4.000			
31	0								
32	5	2.07	2.05	2.06	2.11	2.12	2.08	0.03	1.5
33	0								
34	0								
35	5	2.1	2.1	2.1	2.1	2.2	2.1	0.0	2.1
36	0								
37	0								
38	5	2.17	2.12	2.17	2.18	2.15	2.16	0.02	1.1
39	5	2.12	2.12	2.15	2.05	2.05	2.10	0.05	2.2
40	5	1.18	1.17	1.07	1.16	1.06	1.13	0.06	5.1
41	5	1.99	2.08	2.11	2.07	2.09	2.07	0.05	2.2
42	4	2.04	1.95	2.08	1.85		1.98	0.10	5.2
43	0								
44	5	2.05	2.06	2.39	2.33	2.37	2.24	0.17	7.6
45	0								
46	0								

SILVER
Sediment W
0.28 ± 0.11 mg/kg

Lab							Mean	SD	RSD
1*	5	0.42	0.41	0.44	0.36	0.40	0.41	0.03	7.3
2	0								
3	0								
4	0								
5	5	0.222	0.231	0.254	0.262	0.267	0.247	0.020	8.0
6	5	<0.5	<0.5	<0.5	<0.5	<0.5			
7	5								
8	5	0.29	0.27	0.25	0.35	0.37	0.31	0.05	16.8
9	5	0.36	0.34	0.30	0.41	0.33	0.35	0.04	11.7
10	5	0.40	0.40	0.27	0.23	0.18	0.30	0.10	33.8
11	0								
12	4	0.245	0.245	0.238	0.242		0.243	0.003	1.4
13	0								
14	0								
15	0								
16	0								
17	0								
18*	5	0.46	0.51	0.48	0.53	0.46	0.49	0.03	6.4
19	0								
20	5	0.29	0.28	0.32	0.37	0.32	0.32	0.04	11.1
21'	5	0.333	0.321	0.456	0.328	0.322	0.352	0.059	16.8
22	5	<0.4	1.4	0.7	<0.4	<0.4	0.66	0.43	65.2
23*	5	0.18	0.16	0.13	0.15	0.15	0.15	0.02	11.8
24*	5	0.46	0.44	0.46	0.43	0.43	0.44	0.02	3.4
25	0								
26*	5	0.57	0.72	0.63	0.65	0.65	0.64	0.05	8.3
27	0								
28	5	<2	<2	<2	<2	<2			
29	5	0.29	0.30	0.28	0.28	0.29	0.29	0.01	2.9
30	5	<2.500	<2.500	<2.500	<2.500	<2.500			
31*	5	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.0
32	0								
33	0								
34'*	5	0.348	0.144	0.161	0.164	0.157	0.199	0.084	42.5
35	5	<2	<2	<2	<2	<2			
36	0								
37	0								
38	5	<0.25	<0.25	<0.25	<0.25	<0.25			
39	0								
40	5	0.222	0.243	0.238	0.244	0.221	0.234	0.011	4.8
41	5	0.31	0.34	0.30	0.30	0.33	0.32	0.02	5.7
42	5	0.25	0.24	0.24	0.23	0.27	0.25	0.02	6.2
43	5	0.25	0.29	0.26	0.27	0.21	0.26	0.03	11.6
44	5	0.30	0.24	0.27	0.28	0.28	0.27	0.02	8.0
45	5	0.30	0.37	0.32	0.36	0.31	0.33	0.03	9.4
46	0								

SILVER
BCSS-1
0.11 ± 0.03 mg/kg

Lab							Mean	SD	RSD
1*	5	0.18	0.14	0.18	0.11	0.10	0.14	0.04	26.5
2	0								
3	0								
4	0								
5	5	0.127	0.111	0.137	0.104	0.120	0.120	0.013	10.8
6	5	<0.5	<0.5	<0.5	<0.5	<0.5			
7	5								
8	5	0.07	0.12	0.08	0.08	0.06	0.08	0.02	27.8
9	5	0.13	0.13	0.14	0.14	0.12	0.13	0.01	6.3
10*	5	0.21	0.16	0.20	0.19	0.15	0.18	0.03	14.2
11	0								
12	4	0.116	0.113	0.113	0.121		0.116	0.004	3.3
13	0								
14	0								
15	0								
16	0								
17	0								
18'*	5	0.18	0.17	0.18	0.18	0.18	0.18	0.00	2.5
19	0								
20'	5	0.10	0.11	0.10	0.10	0.10	0.10	0.00	4.4
21*	5	0.087	0.072	0.080	0.060	0.070	0.074	0.010	13.9
22	5	0.8	<0.4	<0.4	<0.4	<0.4			
23	5	0.10	0.11	0.11	0.13	0.11	0.11	0.01	9.8
24*	5	0.25	0.24	0.25	0.17	0.22	0.23	0.03	14.9
25	0								
26*	5	0.16	0.16	0.14	0.15	0.14	0.15	0.01	6.7
27	0								
28	5	<2	<2	<2	<2	<2			
29	5	0.12	0.10	0.11	0.12	0.11	0.11	0.01	7.5
30	5	<2.500	<2.500	<2.500	<2.500	<2.500			
31	5	<1.00	<1.00	<1.00	<1.00	<1.00			
32	0								
33	0								
34	0								
35	5	<2	<2	<2	<2	<2			
36	0								
37	0								
38	5	<0.25	<0.25	<0.25	<0.25	<0.25			
39	0								
40*	5	0.065	0.058	0.056	0.058	0.052	0.058	0.005	8.2
41	5	0.103	0.128	0.098	0.085	0.104	0.104	0.016	15.1
42*	5	0.08	0.07	0.06	0.06	0.10	0.07	0.02	22.6
43'	5	0.08	0.08	0.08	0.08	0.07	0.08	0.00	5.7
44	5	0.13	0.13	0.11	0.12	0.11	0.12	0.01	8.3
45	0								
46	0								

SILVER
Tissue X
0.50 ± 0.14 mg/kg

Lab							Mean	SD	RSD
1	5	0.44	0.44	0.47	0.42	0.47	0.45	0.02	4.8
2	0								
3	0								
4	0								
5*	5	0.313	0.353	0.310	0.314	0.328	0.324	0.016	5.5
6	5	<0.5	<0.5	<0.5	<0.5	<0.5			
7	5	0.488	0.488	0.481	0.481	0.479	0.483	0.004	0.9
8	5	0.49	0.50	0.51	0.51	0.50	0.50	0.01	1.7
9	5	0.56	0.56	0.54	0.51	0.53	0.54	0.02	3.9
10	5	0.47	0.47	0.48	0.46	0.46	0.47	0.01	1.6
11	0								
12	5	0.44	0.43	0.44	0.48	0.45	0.45	0.02	4.3
13	0								
14	0								
15	5	0.69	0.58	0.62	0.57	0.55	0.60	0.06	9.2
16	0								
17	0								
18	0								
19*	5	0.86	0.88	0.91	0.97	1.02	0.93	0.07	7.4
20*	5	0.78	0.69	0.76	0.74	0.64	0.72	0.06	7.7
21	5	0.455	0.461	0.470	0.469	0.448	0.459	0.010	2.2
22	0								
23	5	0.44	0.43	0.44	0.44	0.44	0.44	0.00	1.0
24*	5	0.90	0.87	0.90	0.76	0.52	0.79	0.16	20.4
25	0								
26	5	0.46	0.43	0.48	0.56	0.54	0.49	0.06	11.5
27	0								
28*	5	0.3	0.2	0.5	0.1	0.5	0.3	0.2	55.9
29	5	0.55	0.56	0.55	0.54	0.57	0.55	0.01	2.1
30	5	<5.000	<5.000	<5.000	<5.000	<5.000			
31'*	5	1.05	1.00	1.00	0.99	1.00	1.01	0.02	2.4
32	0								
33	5	0.61	0.60	0.63	0.59	0.60	0.61	0.02	2.5
34*	5	0.413	0.325	0.411	0.211	0.272	0.326	0.088	26.9
35	5	0.48	0.46	0.48	0.42	0.49	0.47	0.03	6.0
36	0								
37	0								
38	5	0.509	0.520	0.560	0.525	0.540	0.531	0.020	3.7
39	5	0.52	0.51	0.55	0.53	0.44	0.51	0.04	8.2
40	5	0.47	0.86	0.58	0.43	0.40	0.55	0.19	34.2
41	5	0.55	0.54	0.61	0.66	0.57	0.59	0.05	8.4
42	5	0.60	0.61	0.60	0.56	0.58	0.59	0.02	3.4
43	5	0.52	0.52	0.52	0.49	0.46	0.50	0.03	5.3
44	5	0.42	0.42	0.44	0.44	0.43	0.43	0.01	2.3
45	0								
46	5	0.59	0.56	0.58	0.55	0.60	0.58	0.02	3.6

SILVER
SRM 1566a
1.68 ± 0.15 (0.17) mg/kg

Lab							Mean	SD	RSD
1	5	1.72	1.59	1.84	1.58	1.63	1.67	0.11	6.5
2	0								
3	0								
4	0								
5	5	1.58	1.59	1.60	1.55	1.56	1.58	0.02	1.3
6	5	1.7	1.8	1.5	1.5	1.6	1.6	0.1	8.0
7	5	1.55	1.55	1.59	1.58	1.57	1.57	0.02	1.1
8	5	1.57	1.54	1.64	1.64	1.61	1.60	0.04	2.8
9	5	1.5	1.6	1.6	1.6	1.6	1.6	0.0	2.8
10	5	1.67	1.77	1.75	1.71	1.80	1.74	0.05	2.9
11	0								
12'*	5	1.42	1.49	1.48	1.48	1.49	1.47	0.03	2.0
13	0								
14	0								
15	5	1.67	1.67	1.73	1.70	1.68	1.69	0.02	1.3
16	0								
17	0								
18	0								
19	5	1.66	1.69	1.72	1.72	1.76	1.71	0.04	2.2
20	5	1.74	1.64	1.63	1.72	1.69	1.68	0.05	2.9
21	5	1.74	1.69	1.69	1.64	1.62	1.68	0.05	2.8
22	0								
23'*	5	1.59	1.27	1.30	1.22	1.22	1.32	0.15	11.7
24'	5	1.73	1.56	1.51	1.53	1.57	1.58	0.09	5.5
25	0								
26	5	1.68	1.68	1.58	1.78	1.73	1.69	0.07	4.4
27	0								
28	5	1.9	1.4	1.5	1.4	1.3	1.5	0.2	15.6
29	5	1.62	1.58	1.60	1.64	1.62	1.61	0.02	1.4
30	5	<5.000	<5.000	<5.000	<5.000	<5.000			
31'*	5	1.98	2.00	1.90	2.00	1.98	1.97	0.04	2.1
32	0								
33	5	1.80	1.76	1.78	1.73	1.75	1.76	0.03	1.5
34	0								
35	5	1.82	1.82	1.78	1.82	1.75	1.80	0.03	1.8
36	0								
37	0								
38	5	1.70	1.85	1.61	1.78	1.75	1.74	0.09	5.2
39	5	1.7	1.7	1.7	1.7	1.7	1.7	0.0	0.0
40	5	1.9	1.74	1.67	1.66	1.48	1.69	0.15	9.0
41	5	1.64	1.58	1.80	1.65	1.60	1.65	0.09	5.2
42	5	1.54	1.56	1.56	1.59	1.56	1.56	0.02	1.1
43	5	1.53	1.53	1.51	1.48	1.52	1.51	0.02	1.4
44	5	1.66	1.67	1.70	1.68	1.64	1.67	0.02	1.3
45	0								
46	0								

CADMIUM
Sediment W
2.05 ± 0.43 mg/kg

Lab							Mean	SD	RSD
1*	5	2.90	2.54	2.87	2.81	3.02	2.83	0.18	6.3
2	5	2.11	2.03	1.97	2.33	2.02	2.09	0.14	6.8
3	5	2.22	1.97	2.21	2.54	3.03	2.39	0.41	17.1
4*	5	1.18	1.16	1.21	1.26	1.16	1.19	0.04	3.5
5	5	1.84	1.81	1.96	1.76	1.78	1.83	0.06	4.3
6	5	1.8	1.8	1.8	1.9	1.6	1.8	0.1	6.2
7	0								
8	5	2.18	2.16	1.87	2.30	2.00	2.10	0.17	8.0
9*	5	2.4	2.3	2.4	2.4	2.7	2.4	0.2	6.2
10	5	2.16	2.42	1.63	1.50	1.19	1.78	0.50	28.1
11	5	1.88	1.94	1.96	1.93	1.97	1.94	0.04	1.8
12	4	1.93	1.98	1.97	2.08		1.99	0.06	3.2
13*	5	1.37	1.33	1.16	1.30	1.32	1.30	0.08	6.2
14	0								
15	0								
16	0								
17	0								
18	5	2.1	2.2	2.2	2.2	2.1	2.2	0.1	2.5
19	0								
20	5	2.02	2.11	2.18	2.06	2.21	2.12	0.08	3.8
21	0								
22	5	2.0	2.3	2.3	2.2	2.8	2.3	0.3	12.7
23*	5	2.2	1.92	2.22	2.31	2.23	2.18	0.15	6.9
24	5	2.14	1.97	1.72	1.92	1.96	1.94	0.15	7.7
25	5	2.06	1.91	1.97	2.12	2.10	2.03	0.09	4.4
26	5	2.28	2.33	2.20	2.33	2.08	2.24	0.11	4.7
27	0								
28	5	1.8	2.1	1.9	1.9	2.0	1.9	0.1	5.9
29	5	1.85	1.88	1.85	1.87	1.85	1.86	0.01	0.8
30	5	2.948	2.803	2.168	2.099	1.906	2.385	0.461	19.3
31	0								
32	5	2.19	2.08	2.25	2.22	2.20	2.19	0.06	3.0
33	5	2.40	2.27	2.35	2.43	2.22	2.33	0.09	3.8
34	5	2.27	2.12	2.10	2.15	2.11	2.15	0.07	3.2
35	5	2.1	2.0	2.0	1.9	2.0	2.0	0.1	3.5
36*	4	3.06	2.84	2.54	2.54		2.75	0.25	9.2
37	0								
38*	5	2.00	1.61	1.61	1.64	1.66	1.70	0.17	9.8
39	0								
40	5	1.90	1.82	1.84	1.80	1.80	1.83	0.04	2.3
41*	5	1.52	1.57	1.40	1.54	1.56	1.52	0.07	4.5
42	4	1.69	1.69	1.72	1.67		1.69	0.02	1.2
43	5	2.10	2.10	2.06	2.09	2.04	2.08	0.03	1.3
44	5	1.94	1.96	2.18	2.01	1.91	2.00	0.11	5.4
45	5	2.1	2.2	2.1	2.2	2.0	2.1	0.1	3.9
46	5	1.91	1.84	1.80	1.81	1.80	1.83	0.05	2.5

CADMIUM
BCSS-1
0.25 ± 0.04 mg/kg

Lab							Mean	SD	RSD
1	5	0.32	0.20	0.28	0.25	0.21	0.25	0.05	19.7
2	5	0.28	0.28	0.28	0.27	0.27	0.28	0.01	2.0
3	5	<1.5	<1.5	<1.5	<1.5	<1.5			
4	0								
5	5	0.227	0.254	0.261	0.263	0.271	0.255	0.017	6.6
6*	5	0.1	0.2	0.1	0.2	0.2	0.2	0.1	34.2
7	0								
8	5	0.24	0.25	0.22	0.24	0.28	0.25	0.02	8.9
9	5	0.24	0.23	0.23	0.24	0.24	0.24	0.01	2.3
10	5	0.22	0.23	0.21	0.22	0.23	0.22	0.01	3.8
11	5	0.237	0.276	0.253	0.284	0.280	0.266	0.020	7.6
12	4	0.257	0.257	0.248	0.266		0.257	0.007	2.9
13	5	<0.1	0.27	0.090	<0.1	0.520			
14	0								
15	0								
16	0								
17	0								
18	5	0.26	0.27	0.28	0.28	0.27	0.27	0.01	3.1
19	0								
20	5	0.22	0.25	0.23	0.25	0.24	0.24	0.01	5.5
21	0								
22	5	0.300	0.200	0.200	0.200	0.300	0.240	0.055	22.8
23*	5	0.28	0.31	0.31	0.31	0.31	0.30	0.01	4.4
24*	5	0.380	0.390	0.410	0.370	0.288	0.368	0.047	12.8
25	5	0.26	0.26	0.26	0.26	0.26	0.26	0.00	0.0
26*	5	0.24	0.29	0.38	0.28	0.29	0.30	0.05	17.3
27	0								
28	5	0.3	0.2	0.3	0.2	0.4	0.3	0.1	29.9
29	5	0.26	0.25	0.25	0.26	0.28	0.26	0.01	4.7
30	5	<2.500	<2.500	<2.500	<2.500	<2.500			
31	0								
32	5	0.27	0.27	0.27	0.26	0.26	0.27	0.01	2.1
33	5	0.19	0.22	0.25	0.26	0.23	0.23	0.03	11.9
34	0								
35*	5	0.20	0.21	0.20	0.21	0.20	0.20	0.01	2.7
36	4	0.26	0.19	0.18	0.22		0.21	0.04	16.9
37	0								
38	5	0.20	0.21	0.24	0.22	0.22	0.22	0.01	6.8
39	0								
40	5	0.26	0.23	0.24	0.25	0.20	0.24	0.02	9.8
41	5	0.29	0.27	0.24	0.25	0.24	0.26	0.02	8.4
42*	5	0.20	0.19	0.18	0.20	0.19	0.19	0.01	4.4
43	5	0.29	0.26	0.27	0.30	0.26	0.28	0.02	6.6
44	5	0.26	0.26	0.25	0.27	0.26	0.26	0.01	2.7
45	0								
46	0								

CADMIUM
Tissue X
1.25 ± 0.21 mg/kg

Lab							Mean	SD	RSD
1	5	1.25	1.30	1.33	1.23	1.31	1.28	0.04	3.3
2	0								
3*	4	0.71	0.74	0.6	0.59		0.66	0.08	11.5
4	0								
5	5	1.02	1.14	1.04	1.05	0.965	1.05	0.06	5.5
6	5	1.3	1.3	1.3	1.2	1.3	1.3	0.0	3.5
7	5	1.16	1.14	1.16	1.16	1.13	1.15	0.01	1.1
8	5	1.23	1.21	1.25	1.27	1.23	1.24	0.02	1.8
9	5	1.2	1.3	1.3	1.3	1.2	1.3	0.1	4.3
10	5	1.33	0.84	0.93	1.30	1.46	1.17	0.27	22.9
11	5	1.14	1.13	1.17	1.22	1.15	1.16	0.04	3.1
12	5	1.40	1.40	1.38	1.37	1.39	1.39	0.01	0.9
13*	5	0.97	0.93	0.96	0.89	0.77	0.90	0.08	9.0
14*	5	1.63	1.55	1.68	1.72	1.63	1.64	0.06	3.9
15*	5	0.81	0.88	0.78	1.01	1.02	0.90	0.11	12.4
16	0								
17'	5	1.24	1.46	1.25	1.17	1.17	1.26	0.12	9.5
18	0								
19	5	1.33	1.38	1.42	1.48	1.49	1.42	0.07	4.8
20*	5	2.31	2.05	2.22	2.26	2.22	2.21	0.10	4.4
21	5	1.31	1.30	1.30	1.30	1.32	1.31	0.01	0.7
22	0								
23	5	1.29	1.33	1.30	1.30	1.31	1.31	0.02	1.2
24*	5	1.72	1.66	1.52	1.52	1.50	1.58	0.10	6.3
25	0								
26	5	1.10	1.13	1.35	1.20	1.20	1.20	0.10	8.1
27'*	5	2.71	2.74	2.21	2.65	2.75	2.61	0.23	8.7
28'	5	1.10	1.20	1.12	1.10	1.12	1.13	0.04	3.7
29	5	1.18	1.17	1.16	1.16	1.19	1.17	0.01	1.1
30	5	<5.000	<5.000	<5.000	<5.000	<5.000			
31*	5	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.0
32*	5	1.51	1.49	1.50	1.45	1.49	1.49	0.02	1.5
33	0								
34	5	1.28	1.26	1.06	1.35	1.41	1.27	0.13	10.4
35	5	1.25	1.25	1.20	1.30	1.25	1.25	0.04	2.8
36	5	1.06	1.19	1.34	1.31	1.28	1.24	0.11	9.2
37	0								
38	5	1.48	1.36	1.32	1.37	1.38	1.38	0.06	4.3
39*	5	1.7	1.6	1.7	1.8	1.8	1.7	0.1	4.9
40	5	1.23	1.21	1.21	1.17	1.19	1.20	0.02	1.9
41*	5	3.49	3.74	3.68	3.23	3.28	3.48	0.23	6.6
42	5	1.31	1.40	1.32	1.39	1.33	1.35	0.04	3.1
43	5	1.42	1.31	1.48	1.45	1.49	1.43	0.07	5.1
44	5	1.00	1.10	1.11	0.98	1.01	1.04	0.06	5.8
45	5	1.31	1.35	1.33	1.33	1.30	1.32	0.02	1.5
46	5	1.29	1.30	1.32	1.31	1.30	1.30	0.01	0.9

CADMIUM
SRM 1566a
4.15 ± 0.24 (0.42)mg/kg

Lab							Mean	SD	RSD
1	5	4.07	4.27	4.33	4.32	4.08	4.21	0.13	3.1
2	0								
3	5	5.42	3.68	3.93	3.04	3.94	4.00	0.87	21.8
4	0								
5'	5	3.86	3.75	4.40	3.86	3.89	3.95	0.26	6.5
6	5	3.9	3.9	4.0	4.0	4.0	4.0	0.1	1.4
7	5	3.82	3.93	3.87	3.89	4.02	3.91	0.08	1.9
8	5	3.91	3.86	4.01	4.05	4.01	3.97	0.08	2.0
9	5	4.0	4.0	4.1	4.0	4.0	4.0	0.0	1.1
10'	5	4.05	4.01	4.05	4.05	4.04	4.04	0.02	0.4
11	5	4.11	4.10	4.17	3.81	3.80	4.00	0.18	4.5
12	5	3.96	3.95	3.98	3.95	3.92	3.95	0.02	0.5
13	5	4.37	4.48	4.23	4.25	4.35	4.34	0.10	2.3
14	5	4.07	4.16	4.01	3.94	4.00	4.04	0.08	2.1
15	5	4.1	3.9	4.1	3.8	3.6	3.9	0.2	5.1
16	0								
17	5	3.74	3.80	3.64	3.73	3.84	3.75	0.08	2.0
18	0								
19	5	4.16	4.33	4.40	4.45	4.49	4.37	0.13	3.0
20	5	3.99	4.40	4.29	4.22	4.49	4.28	0.19	4.5
21	5	4.19	4.22	4.13	4.26	4.27	4.21	0.06	1.3
22	0								
23	5	4.09	4.05	4.05	4.06	4.09	4.07	0.02	0.5
24'	5	4.23	4.12	4.25	4.59	4.18	4.27	0.18	4.3
25	0								
26'	5	4.00	4.00	4.75	4.00	4.00	4.15	0.34	8.1
27*	5	5.05	5.06	4.82	3.83	5.84	4.92	0.72	14.7
28	5	4.01	3.93	4.14	3.97	4.10	4.03	0.09	2.2
29	5	3.86	3.89	3.87	3.81	3.80	3.85	0.04	1.0
30	5	<5.000	<5.000	<5.000	<5.000	<5.000			
31'	5	4.00	5.00	4.00	4.00	4.00	4.20	0.45	10.6
32	5	4.12	4.07	4.08	4.13	4.11	4.10	0.03	0.6
33	0								
34	0								
35	5	4.00	4.00	4.30	4.00	4.10	4.08	0.13	3.2
36	5	3.91	4.28	4.33	4.45	4.38	4.27	0.21	4.9
37	0								
38	5	3.98	3.70	3.75	3.81	3.80	3.81	0.11	2.8
39'	5	4.0	4.0	3.8	4.0	4.0	4.0	0.1	2.3
40'*	5	3.57	3.54	3.59	3.58	3.29	3.51	0.13	3.6
41	5	3.85	3.89	3.94	4.12	3.97	3.95	0.10	2.6
42	5	4.26	4.19	4.16	4.24	4.23	4.22	0.04	1.0
43	5	4.04	4.02	3.89	4.08	4.05	4.02	0.07	1.8
44	5	4.17	4.20	4.17	4.03	4.08	4.13	0.07	1.7
45	0								
46	0								

TIN
Sediment W
62.1 ± 16.0 mg/kg

Lab							Mean	SD	RSD
1*	5	40.2	47.4	48.3	40.3	45.5	44.3	3.9	8.7
2	5	70	88	75	82	67	76	9	11.3
3	5	70.7	83.5	70.5	75.9	77.8	75.7	5.4	7.2
4	0								
5*	5	15.9	15.6	14.6	14.5	15.0	15.1	0.6	4.1
6	0								
7	0								
8	5	44.2	55.7	54.6	49.3	46.10	50.0	5.1	10.2
9	5	80	64	55	61	62	64	9	14.5
10	0								
11	0								
12'	4	57.8	58.2	53.6	58.5		57.0	2.3	4.0
13	0								
14	0								
15	0								
16	0								
17	0								
18	5	59	60	58	75	65	67	10	14.5
19	0								
20	5	58.5	49.9	49.4	50.9	54.3	52.6	3.8	7.2
21	0								
22	0								
23	0								
24	5	55.5	62.5	57.0	58.3	56.0	57.9	2.8	4.8
25	5	83	76.4	75.8	81.7	71.6	77.7	4.7	6.0
26	5	55.5	56.9	47.9	50.0	55.1	53.1	3.9	7.3
27	0								
28	5	53.8	53.5	55.9	49.9	52.6	53.1	2.2	4.1
29'*	5	42	43	48	43	43	44	2	5.5
30	0								
31	0								
32	0								
33	0								
34	0								
35	5	74	67	68	71	66	69	3	4.7
36	0								
37	0								
38	0								
39	0								
40	0								
41	5	58.66	63.20	59.94	61.62	60.11	60.71	1.75	2.9
42	0								
43	0								
44*	5	92.6	84.5	83.9	90.9	86.6	87.7	3.9	4.4
45	0								
46	5	62.8	62.6	66.0	67.7	62.5	64.3	2.4	3.7

TIN
BCSS-1
1.85 ± 0.20 mg/kg

Lab							Mean	SD	RSD
1	5	1.63	1.65	1.97	1.87	1.94	1.81	0.16	8.9
2	5	<20	<20	<20	<20	<20			
3	5	<5.0	<5.0	<5.0	<5.0	<5.0			
4	0								
5	5	2.04	1.83	2.02	1.80	1.98	1.93	0.11	5.8
6	0								
7	0								
8	5	1.86	1.94	1.92	1.93	1.84	1.90	0.04	2.4
9	5	1.9	1.9	2.0	1.9	1.9	1.9	0.0	2.3
10	0								
11	0								
12	4	1.65	1.74	1.85	1.61		1.71	0.11	6.2
13	0								
14	0								
15	0								
16	0								
17	0								
18	5	<5	<5	<5	<5	<5			
19	0								
20*	5	1.39	1.42	1.33	1.39	1.54	1.41	0.08	5.5
21	0								
22	0								
23	0								
24	5	<9.1	<7.3	<6.6	<4.5	<8.2			
25	5	1.7	1.93	1.65	1.73	1.76	1.75	0.11	6.1
26*	5	1.42	1.93	1.41	1.46	1.78	1.60	0.24	15.0
27	0								
28	5	2.3	1.6	1.9	1.8	1.7	1.9	0.3	14.5
29'*	5	1.6	1.9	1.6	1.6	1.6	1.7	0.1	8.1
30	0								
31	0								
32	0								
33	0								
34	0								
35	5	<30	<30	<30	<30	<30			
36	0								
37	0								
38	0								
39	0								
40	0								
41	5	1.84	1.77	1.75	1.88	1.83	1.81	0.05	2.9
42	0								
43	0								
44	5	1.82	1.75	1.78	1.74	1.75	1.77	0.03	1.9
45	0								
46	0								

TIN
Tissue X
0.27 ± 0.10 mg/kg

Lab							Mean	SD	RSD
1	5	0.37	0.35	0.39	0.36	0.36	0.37	0.02	4.1
2	0								
3	5	<5.0	<5.0	<5.0	<5.0	<5.0			
4	0								
5	5	0.344	0.330	0.315	0.318	0.244	0.310	0.039	12.5
6	0								
7	5	<0.2	<0.2	<0.2	<0.2	<0.2			
8	5	0.32	0.30	0.35	0.30	0.29	0.31	0.02	7.7
9	5	0.28	0.28	0.28	0.28	0.27	0.28	0.00	1.6
10	0								
11	0								
12	5	0.20	0.28	0.19	0.30	0.19	0.23	0.05	23.1
13	0								
14	0								
15	0								
16	0								
17	0								
18	0								
19	0								
20*	5	1.28	1.13	1.21	1.14	1.00	1.15	0.10	9.1
21	0								
22	0								
23	0								
24	0								
25	0								
26	0								
27	0								
28	5	<1	<1	<1	<1	<1			
29	5	0.29	0.23	0.22	0.22	0.25	0.24	0.03	12.2
30	0								
31	0								
32	0								
33	0								
34	0								
35	5	<10	<10	<10	<10	<10			
36	0								
37	0								
38	0								
39	0								
40	0								
41*	5	2.36	2.64	2.71	2.59	2.61	2.58	0.13	5.1
42	0								
43	0								
44	5	0.33	0.37	0.36	0.32	0.34	0.34	0.02	6.0
45	0								
46	5	0.24	0.23	0.25	0.23	0.24	0.24	0.01	3.5

TIN
SRM 1566a
2.20 ± 0.69 mg/kg

Lab							Mean	SD	RSD
1	5	2.40	2.71	2.41	2.47	2.60	2.52	0.13	5.3
2	0								
3	5	<5.0	<5.0	<5.0	<5.0	<5.0			
4	0								
5	5	1.76	2.88	2.86	2.93	2.23	2.53	0.52	20.4
6	0								
7	5	<0.2	<0.2	<0.2	<0.2	<0.2			
8*	5	1.21	1.23	1.60	1.08	1.79	1.38	0.30	21.6
9	5	2.2	2.4	2.8	2.1	2.3	2.4	0.3	11.4
10	0								
11	0								
12	5	1.74	2.19	1.67	1.80	1.97	1.87	0.21	11.1
13	0								
14	0								
15	0								
16	0								
17	0								
18	0								
19	0								
20	5	2.21	2.06	2.18	2.32	1.88	2.13	0.17	7.8
21	0								
22	0								
23	0								
24	0								
25	0								
26	0								
27	0								
28	5	<1	<1	1	1	1			
29	5	1.9	1.9	2.0	1.9	2.0	1.9	0.1	2.8
30	0								
31	0								
32	0								
33	0								
34	0								
35	5	<10	<10	<10	<10	<10			
36	0								
37	0								
38	0								
39	0								
40	0								
41*	5	3.20	3.72	3.38	3.27	3.31	3.38	0.20	6.0
42	0								
43	0								
44	5	2.16	2.07	2.09	1.87	2.06	2.05	0.11	5.3
45	0								
46	0								

ANTIMONY
Sediment W
1.20 ± 0.42 mg/kg

Lab							Mean	SD	RSD
1	5	1.07	1.36	1.09	1.37	1.16	1.21	0.15	12.0
2	0								
3	0								
4	0								
5	5	0.941	1.00	1.00	1.09	1.17	1.04	0.09	8.7
6	5	1.4	1.4	1.4	1.4	1.4	1.4	0.0	0.0
7	0								
8	5	1.07	1.42	1.27	1.75	1.13	1.33	0.27	20.5
9	5	1.7	1.2	1.4	1.2	1.7	1.4	0.3	17.4
10	0								
11	0								
12	4	1.23	1.16	1.20	1.14		1.18	0.04	3.4
13	0								
14	0								
15	0								
16	0								
17	0								
18	0								
19	0								
20	5	1.02	0.98	0.90	1.10	0.96	0.99	0.07	7.5
21	0								
22	5	<2	3	<2	<2	<2			
23	0								
24	5	<4.0	<3.9	<3.9	<3.7	<3.5			
25	0								
26	5	1.56	1.68	1.68	1.44	1.53	1.58	0.10	6.5
27	0								
28	5	<2	<2	<2	<2	<2			
29	5	0.96	1.05	1.04	1.15	0.91	1.02	0.09	9.0
30	5	<2.000	<2.000	<2.000	<2.000	<2.000			
31	0								
32	0								
33	0								
34	0								
35'	4	1.00	1.00	0.98	1.00	1.00	0.99	0.02	1.8
36	0								
37	0								
38*	5	0.772	0.789	0.714	0.706	0.596	0.715	0.076	10.6
39	0								
40	0								
41	5	0.98	1.03	1.05	0.97	0.98	1.00	0.04	3.6
42	3	1.03	1.07	0.82					
43	0								
44	5	1.20	1.20	1.22	1.17	1.26	1.21	0.03	2.7
45	0								
46'	4	1.21	1.22	1.21	1.13	1.21	1.20	0.04	3.1

ANTIMONY
BCSS-1
0.59 ± 0.06 mg/kg

Lab							Mean	SD	RSD
1	5	0.69	0.69	0.58	0.68	0.62	0.65	0.05	7.6
2	0								
3	0								
4	0								
5	5	0.622	0.585	0.606	0.588	0.600	0.600	0.015	2.5
6'	4	0.6	0.6	0.6	0.7	0.6	0.6	0.0	7.2
7	0								
8	5	0.57	0.56	0.59	0.56	0.57	0.57	0.01	2.1
9*	5	0.70	0.64	0.66	0.68	0.63	0.66	0.03	4.3
10	0								
11	0								
12	4	0.561	0.556	0.583	0.576		0.569	0.013	2.2
13	0								
14	0								
15	0								
16	0								
17	0								
18	0								
19	0								
20	5	0.59	0.53	0.53	0.58	0.55	0.56	0.03	5.0
21	0								
22	5	<2	<2	<2	<2	<2			
23	0								
24	5	<4.0	<3.2	<2.9	<2.0	<3.7			
25	0								
26	5	0.53	0.65	0.65	0.65	0.70	0.64	0.06	9.9
27	0								
28	5	<2	<2	<2	<2	<2			
29	5	0.60	0.63	0.55	0.59	0.64	0.60	0.04	5.9
30	5	<2.000	<2.000	<2.000	<2.000	<2.000			
31	0								
32	0								
33	0								
34	0								
35'*	4	0.62	0.50	0.50	0.51	0.51	0.53	0.05	9.8
36	0								
37	0								
38	5	0.534	0.572	0.448	0.609	0.542	0.541	0.060	11.0
39	0								
40	0								
41	5	0.53	0.58	0.54	0.53	0.51	0.54	0.03	4.8
42	2	0.3	0.36						
43	0								
44	5	0.57	0.57	0.55	0.56	0.55	0.56	0.01	1.8
45	0								
46	0								

The determination of antimony was not required in the biologicals

MERCURY
Sediment W
1.35 ± 0.35 mg/kg

Lab							Mean	SD	RSD
1*	5	0.51	0.56	0.58	0.53	0.53	0.54	0.03	5.1
2	5	1.22	1.14	1.11	1.32	1.08	1.17	0.10	8.2
3*	5	0.624	0.6612	0.7140	0.800	0.6285	0.6855	0.0734	10.7
4*	5	0.831	0.983	0.842	0.779	0.803	0.848	0.080	9.4
5	5	1.11	1.16	1.16	1.19	1.22	1.17	0.04	3.5
6	5	1.35	1.36	1.20	1.26	1.47	1.33	0.10	7.8
7	0								
8	5	1.159	1.122	1.114	1.150	1.210	1.15	0.04	3.3
9	5	1.7	1.5	1.4	1.3	1.7	1.52	0.18	11.8
10	5	1.21	1.46	1.60	1.44	1.63	1.47	0.17	11.4
11	5	1.71	1.67	1.33	1.40	1.59	1.54	0.17	10.9
12	4	1.46	1.49	1.55	1.58		1.52	0.05	3.6
13	0								
14	0								
15	0								
16	0								
17	0								
18	5	1.2	1.3	1.3	1.6	1.5	1.4	0.2	11.9
19	0								
20	5	1.18	1.20	1.28	1.08	1.03	1.15	0.10	8.6
21*	5	0.878	0.786	0.876	0.888	0.771	0.840	0.056	6.7
22	5	1.28	1.39	1.48	1.28	1.91	1.47	0.26	17.8
23	0								
24	5	1.21	1.33	1.37	1.33	1.28	1.30	0.06	4.7
25	5	1.56	1.42	1.52	1.45	1.61	1.51	0.08	5.2
26	5	1.64	1.52	1.64	1.71	1.71	1.64	0.08	4.7
27	0								
28	5	1.26	1.43	1.46	1.29	1.35	1.36	0.09	6.4
29*	5	0.76	0.78	0.77	0.86	0.74	0.78	0.05	5.9
30	5	1.409	1.402	1.577	1.734	1.502	1.525	0.137	9.0
31	0								
32	5	1.37	1.19	1.36	1.42	1.31	1.33	0.09	6.6
33	0								
34	5	1.44	1.36	1.35	1.72	1.64	1.50	0.17	11.2
35	5	1.34	1.35	1.42	1.43	1.39	1.39	0.04	2.9
36	5	1.22	1.67	1.54	1.09	1.92	1.49	0.34	22.6
37*	4	1.36	1.20	1.30	1.29	1.79	1.39	0.23	16.8
38	5	1.274	1.263	1.413	1.036	0.959	1.189	0.187	15.7
39	0								
40	0								
41*	5	0.2726	0.2658	0.2813	0.2774	0.2676	0.2729	0.0065	2.4
42	4	1.47	1.44	1.28	1.60		1.45	0.13	9.1
43	0								
44	5	1.39	1.51	1.45	1.37	1.31	1.41	0.08	5.5
45	5	1.26	1.19	1.18	1.38	1.04	1.21	0.12	10.3
46	5	1.21	1.22	1.24	1.30	1.24	1.24	0.03	2.8

MERCURY
BCSS-1
0.176 ± 0.023 mg/kg

Lab							Mean	SD	RSD
1*	5	0.15	0.12	0.11	0.13	0.13	0.13	0.01	11.6
2*	5	0.12	0.11	0.13	0.12	0.12	0.12	0.01	5.9
3	5	0.1548	0.1488	0.1877	0.2233	0.1569	0.1743	0.0313	17.9
4	5	0.171	0.164	0.168	0.167	0.164	0.167	0.003	1.8
5	5	0.162	0.169	0.161	0.167	0.163	0.164	0.003	2.1
6	5	0.16	0.18	0.18	0.16	0.14	0.16	0.02	10.2
7	0								
8	5	0.180	0.176	0.178	0.180	0.177	0.18	0.00	1.0
9*	5	0.15	0.15	0.14	0.14	0.14	0.14	0.01	3.8
10	5	0.186	0.186	0.187	0.187	0.186	0.19	0.00	0.3
11	5	0.178	0.177	0.181	0.168	0.182	0.18	0.01	3.1
12	4	0.171	0.182	0.181	0.179		0.18	0.00	2.8
13	0								
14	0								
15	0								
16	0								
17	0								
18*	5	0.23	0.23	0.21	0.22	0.23	0.22	0.01	4.0
19	0								
20*	5	0.209	0.212	0.217	0.217	0.216	0.214	0.004	1.7
21	5	0.160	0.160	0.168	0.151	0.144	0.157	0.009	5.9
22	5	0.169	0.179	0.179	0.175	0.182	0.177	0.005	2.8
23	0								
24	5	0.186	0.184	0.195	0.177	0.191	0.187	0.007	3.7
25	3	0.106	0.130	0.142					
26	5	0.173	0.180	0.180	0.175	0.183	0.178	0.004	2.3
27	0								
28	5	0.211	0.205	0.197	0.196	0.187	0.199	0.009	4.6
29*	4	0.20	0.17	0.17	0.16	0.17	0.17	0.02	8.7
30	5	0.1897	0.1831	0.1855	0.1753	0.1875	0.1842	0.0056	3.0
31	0								
32*	5	0.22	0.21	0.20	0.19	0.19	0.20	0.01	6.5
33	0								
34	0								
35	5	0.170	0.186	0.200	0.200	0.190	0.189	0.012	6.5
36	5	0.183	0.166	0.183	0.183	0.217	0.186	0.019	10.0
37	4	0.152	0.175	0.196	0.207		0.183	0.024	13.3
38*	5	0.248	0.248	0.214	0.201	0.245	0.231	0.022	9.6
39	0								
40	0								
41*	5	0.1248	0.1216	0.1342	0.1286	0.1291	0.1277	0.0048	3.7
42	5	0.13	0.16	0.18	0.17	0.16	0.16	0.02	11.7
43	0								
44	5	0.16	0.18	0.16	0.17	0.17	0.17	0.01	5.0
45	0								
46	0								

MERCURY
Tissue X
0.161 ± 0.036 mg/kg

Lab							Mean	SD	RSD
1	5	0.123	0.140	0.126	0.151	0.135	0.135	0.011	8.3
2	0								
3	5	0.1141	0.1393	0.16	0.1460	0.1333	0.1385	0.0169	12.2
4	0								
5	5	0.157	0.15	0.151	0.141	0.152	0.150	0.006	3.9
6	5	0.18	0.16	0.18	0.17	0.15	0.17	0.01	7.8
7	5	0.169	0.181	0.169	0.164	0.161	0.167	0.009	5.3
8	5	0.186	0.180	0.190	0.192	0.191	0.188	0.005	2.6
9	5	0.19	0.16	0.19	0.18	0.16	0.18	0.02	8.6
10	5	0.186	0.169	0.160	0.188	0.189	0.178	0.013	7.4
11	5	0.170	0.177	0.171	0.161	0.145	0.165	0.012	7.6
12	5	0.188	0.173	0.169	0.166	0.164	0.172	0.010	5.6
13	0								
14	5	0.168	0.165	0.168	0.156	0.163	0.164	0.005	3.0
15	5	0.12	0.12	0.15	0.13	0.14	0.13	0.01	9.9
16	0								
17	5	0.169	0.162	0.174	0.170	0.166	0.168	0.004	2.7
18	0								
19	0								
20*	5	0.209	0.209	0.203	0.207	0.202	0.206	0.003	1.6
21	5	0.18	0.16	0.16	0.17	0.16	0.17	0.01	5.9
22	0								
23	0								
24*	4	0.317	0.171	0.154	0.164	0.163	0.194	0.069	35.7
25	0								
26	5	0.168	0.165	0.165	0.170	0.173	0.168	0.003	2.0
27	0								
28	5	0.187	0.192	0.183	0.170	0.170	0.180	0.010	5.6
29	5	0.135	0.13	0.137	0.131	0.140	0.135	0.004	3.1
30	5	0.1183	0.1473	0.1794	0.1707	0.1800	0.1591	0.0264	16.6
31	0								
32	0								
33	0								
34	5	0.155	0.155	0.156	0.164	0.158	0.158	0.004	2.4
35	5	0.165	0.160	0.159	0.160	0.158	0.160	0.003	1.7
36	0								
37	4	0.17	0.17	0.18	0.18		0.18	0.01	3.3
38	5	0.156	0.165	0.160	0.155	0.145	0.156	0.007	4.7
39	5	0.15	0.14	0.15	0.14	0.14	0.14	0.01	3.8
40	0								
41*	5	0.0443	0.0518	0.0486	0.0508	0.0511	0.0493	0.0031	6.2
42	4	0.19	0.18	0.17	0.16		0.18	0.01	7.4
43	0								
44	5	0.13	0.13	0.12	0.14	0.13	0.13	0.01	5.4
45	4	0.172	0.157	0.141	0.137		0.152	0.016	10.6
46	5	0.155	0.149	0.153	0.150	0.152	0.152	0.002	1.6

MERCURY
SRM 1566a
0.0654 ± 0.0067 mg/kg

Lab							Mean	SD	RSD
1	5	0.077	0.071	0.060	0.064	0.070	0.068	0.007	9.6
2	0								
3	5	0.0638	0.0660	0.0674	0.0526	0.0563	0.0612	0.0064	10.5
4	0								
5	5	0.066	0.066	0.062	0.067	0.060	0.064	0.003	4.7
6	5	0.06	0.06	0.06	0.06	0.06	0.06	0.00	0.0
7	5	0.065	0.060	0.066	0.067	0.064	0.064	0.003	4.2
8*	5	0.072	0.074	0.074	0.072	0.075	0.073	0.001	1.8
9	5	0.060	0.060	0.058	0.063	0.061	0.060	0.002	3.0
10*	5	0.075	0.072	0.075	0.073	0.072	0.073	0.002	2.1
11	5	0.0576	0.0658	0.0644	0.0602	0.0586	0.0613	0.0036	5.9
12	5	0.063	0.064	0.057	0.060	0.063	0.061	0.003	4.7
13	0								
14	5	0.049	0.059	0.069	0.061	0.060	0.060	0.007	12.0
15	5	0.06	0.06	0.06	0.06	0.07	0.06	0.00	7.2
16	0								
17	5	0.0623	0.0613	0.0636	0.0646	0.0627	0.0629	0.0013	2.0
18	0								
19	0								
20	5	0.0587	0.0561	0.0595	0.0659	0.0705	0.0621	0.0059	9.5
21*	5	0.0842	0.0823	0.0835	0.0888	0.0881	0.0854	0.0029	3.4
22	0								
23	0								
24*	4	0.070	0.060	0.061	0.061	0.061	0.063	0.004	6.6
25	0								
26	5	0.0600	0.0650	0.0680	0.0650	0.0700	0.0656	0.0038	5.8
27	0								
28*	4	0.11	0.107	0.108	0.088	0.112	0.105	0.010	9.2
29*	5	0.072	0.072	0.066	0.074	0.079	0.073	0.005	6.4
30*	5	0.0832	0.0933	0.0782	0.0973	0.0937	0.0851	0.0143	16.8
31	0								
32	0								
33	0								
34	0								
35	5	0.062	0.064	0.066	0.068	0.065	0.065	0.002	3.4
36	0								
37	0	0.063	0.067						
38*	5	0.0541	0.0567	0.0644	0.0464	0.049	0.054	0.007	13.0
39*	5	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.0
40	0								
41	5	0.0586	0.0701	0.0662	0.0612	0.0628	0.0638	0.0045	7.0
42	5	0.06	0.07	0.08	0.08	0.07	0.07	0.01	11.6
43	0								
44	5	0.063	0.064	0.064	0.064	0.064	0.064	0.000	0.7
45	0								
46	0								

THALLIUM
Sediment W
0.87 ± 0.14 mg/kg

Lab							Mean	SD	RSD
1	5	0.76	0.81	0.77	0.77	0.83	0.79	0.03	3.4
2	0								
3	0								
4	0								
5*	5	0.516	0.531	0.539	0.570	0.537	0.539	0.020	3.7
6	0								
7	0								
8	5	0.75	0.82	0.81	0.77	0.78	0.79	0.03	3.7
9	5	0.93	0.92	0.85	0.95	0.94	0.92	0.04	4.3
10	0								
11	0								
12	4	0.92	0.91	0.91	0.88		0.91	0.02	1.9
13	0								
14	0								
15	0								
16	0								
17	0								
18	0								
19	0								
20	0								
21	0								
22*	5	0.6	0.6	0.5	0.7	0.6	0.6	0.1	11.8
23	0								
24	0								
25*	5	0.56	0.65	0.71	0.79	0.82	0.71	0.11	14.9
26	0								
27	0								
28	5	<10	<10	<10	<10	<10			
29	5	0.85	0.87	0.78	0.85	0.82	0.83	0.04	4.2
30	5	<2.500	<2.500	<2.500	<2.500	<2.500			
31	0								
32	0								
33	0								
34	0								
35	5	<10	<10	<10	<10	<10			
36	0								
37	0								
38	0								
39	0								
40	0								
41*	5	0.395	0.456	0.478	0.462	0.492	0.457	0.037	8.1
42	5	<0.5	<0.5	<0.5	<0.5	<0.5			
43	0								
44	5	0.93	0.85	0.88	0.98	0.91	0.91	0.05	5.4
45	0								
46	5	0.89	0.87	0.88	0.86	0.86	0.87	0.01	1.5

THALLIUM
BCSS-1
0.51 ± 0.12 mg/kg

Lab							Mean	SD	RSD
1	5	0.43	0.43	0.50	0.48	0.53	0.47	0.04	9.3
2	0								
3	0								
4	0								
5	5	0.477	0.493	0.409	0.449	0.467	0.459	0.032	7.0
6	0								
7	0								
8	5	0.42	0.48	0.47	0.48	0.44	0.46	0.03	5.9
9	5	0.52	0.51	0.52	0.49	0.51	0.51	0.01	2.4
10	0								
11	0								
12	4	0.552	0.486	0.548	0.563		0.537	0.035	6.5
13	0								
14	0								
15	0								
16	0								
17	0								
18	0								
19	0								
20	0								
21	0								
22*	5	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0
23	0								
24	0								
25	5	0.32	0.62	0.79	0.54	0.52	0.56	0.17	30.5
26	0								
27	0								
28	5	<10	<10	<10	<10	<10			
29	5	0.66	0.52	0.60	0.54	0.52	0.57	0.06	10.7
30	5	<2.500	<2.500	<2.500	<2.500	<2.500			
31	0								
32	0								
33	0								
34	0								
35	5	<10	<10	<10	<10	<10			
36	0								
37	0								
38	0								
39	0								
40	0								
41	5	0.39	0.42	0.48	0.47	0.41	0.43	0.04	9.0
42	5	<0.5	<0.5	<0.5	<0.5	<0.5			
43	0								
44	5	0.54	0.58	0.57	0.50	0.49	0.54	0.04	7.5
45	0								
46	5	0.53	0.53	0.53	0.54	0.54	0.53	0.01	1.0

The determination of thallium was not required in the biologicals

LEAD
Sediment W
214 ± 16 mg/kg

Lab							Mean	SD	RSD
1	5	194	213	189	201	195	198	9	4.6
2	5	182	232	193	222	221	210	21	10.2
3*	5	177.3	191.1	194.8	199.3	210.3	194.6	12.0	6.2
4*	5	88.5	94.7	110	90.6	89.4	94.6	8.9	9.4
5	5	226	215	205	213	204	213	9	4.2
6	5	202	202	200	208	206	204	3	1.6
7*	5	186.6	175.9	186.6	185.6	185.7	184.1	4.6	2.5
8	5	120	129	141	128	126	128	8	6.0
9	5	213	213	215	215	210	213	2	1.0
10*	5	130.68	132.79	160.25	152.82	152.85	145.88	13.28	9.1
11	5	207.86	201.60	229.10	211.60	206.10	211.25	10.61	5.0
12	4	221	220	225	225		223	3	1.2
13*	5	1.42	1.36	1.21	1.36	1.37	1.35	0.08	6.0
14	0								
15	0								
16	0								
17	0								
18	5	190	230	200	280	220	224	35	15.7
19	0								
20	5	209	206	215	216	201	209	6	3.0
21	0								
22	5	200	212	217	202	211	208	7	3.4
23	5	213.70	204.10	199.00	217.90	235.30	214.00	14.07	6.6
24*	5	176	174	168	177	170	173	4	2.2
25	5	223	228	221	232	217	224	6	2.6
26	5	222	227	226	222	224	224	2	1.0
27	0								
28*	5	183.8	177.7	184.3	185.8	187.8	183.9	3.8	2.1
29	5	198	184	186	203	209	196	11	5.5
30	5	210.5	211.6	193.4	195.4	221.6	206.5	11.9	5.8
31	5	198	207	215	210	210	208	6	3.0
32	5	225	222	224	222	224	223	1	0.6
33	5	206	261	216	218	230	226	21	9.4
34	5	231	202	233	209	193	214	18	8.3
35	5	209	216	205	204	215	210	6	3.0
36	5	199	197	228	230	226	216	17	7.6
37	0								
38*	5	269.3	236.3	241.8	263.9	256.7	253.6	14.1	5.6
39	0								
40*	5	176.19	182.38	189.18	208.62	193.04	189.88	12.30	6.5
41*	5	157.22	162.49	158.39	158.84	160.62	159.51	2.07	1.3
42*	5	181	183	192	195	206	191	10	5.3
43	5	220	204	214	203	189	206	12	5.8
44	5	225	210	217	219	199	214	10	4.6
45	5	190	205	256	237	224	222	26	11.7
46	0								

LEAD
BCSS-1
22.7 ± 3.4 mg/kg

Lab							Mean	SD	RSD
1	5	22.4	23.3	22.0	22.1	21.8	22.3	0.6	2.6
2	5	23.7	22.2	19.1	22.8	21.4	21.8	1.7	8.0
3*	5	16.96	17.49	15.79	17.43	15.71	16.68	0.87	5.2
4	0								
5	5	21.7	20.4	22.5	19.6	21.0	21.0	1.1	5.3
6	5	23	23	24	23	21	23	1	4.8
7	5	21.76	26.99	24.96	23.64	28.85	25.24	2.78	11.0
8	5	21.3	23	22.6	23.8	23.3	22.8	0.9	4.1
9	5	21.3	22.8	24.6	21.5	21.3	22.3	1.4	6.4
10	5	27.96	20.70	23.30	21.53	21.07	22.91	2.99	13.1
11*	5	18.18	19.94	18.41	18.40	18.20	18.63	0.74	4.0
12	4	20.7	20.4	22.4	22.5		21.5	1.1	5.1
13*	5	16.8	17.6	18.5	18.4	17.7	17.8	0.7	3.9
14	0								
15	0								
16	0								
17	0								
18*	5	18	17	18	21	19	19	2	8.2
19	0								
20	5	22.9	21.2	21.7	21.2	22.4	21.9	0.8	3.4
21	0								
22	5	20	19	20	19	21	20	1	4.2
23*	5	18.50	18.70	18.80	20.70	18.60	19.06	0.92	4.8
24*	5	14.7	14.6	14.4	14.1	15.5	14.7	0.5	3.6
25	5	22.2	21.4	21.2	20.6	21.3	21.3	0.6	2.7
26	5	23.0	21.0	23.0	21.0	21.0	21.8	1.1	5.0
27	0								
28	5	20.1	21	20.3	19.7	21.9	20.6	0.9	4.2
29	5	21.7	21.9	21.1	20.5	21.4	21.3	0.5	2.6
30*	5	19.07	17.54	15.87	33.05	18.49	20.80	6.95	33.4
31	5	23.0	25.0	26.0	23.0	23.0	24.0	1.4	5.9
32	5	22	18	20	24	26	22	3	14.4
33	5	25.9	25.2	24.8	25.7	24.9	25.3	0.5	1.9
34	0								
35	5	20	21	20	20	21	20	1	2.7
36*	5	17.0	16.7	18.0	18.1	17.6	17.5	0.6	3.5
37	0								
38	5	27.2	25.6	24.2	21.4	23.4	24.4	2.2	9.0
39	0								
40*	5	10.54	10.81	11.11	9.74	8.70	10.18	0.97	9.5
41	5	22.59	22.45	19.97	23.57	22.38	22.19	1.33	6.0
42*	5	20.1	17.7	16.9	17.9	18.0	18.1	1.2	6.6
43	5	23.2	22.3	22.2	21.6	23.4	22.5	0.7	3.3
44	5	23.1	23.1	23.7	22.7	23.4	23.2	0.4	1.6
45	0								
46	0								

LEAD
Tissue X
11.4 ± 2.5 mg/kg

Lab							Mean	SD	RSD
1	5	10.7	10.0	11.7	12.0	11.5	11.2	0.8	7.3
2	0								
3	0								
4	0								
5	5	9.20	10.0	8.71	8.88	8.44	9.05	0.60	6.6
6	5	13	11	15	9	10	12	2	20.8
7	5	12.4	12.8	12.6	12.5	12.7	12.6	0.2	1.3
8'	5	10.1	9.6	9.5	12.9	9.6	10.3	1.5	14.0
9	5	8.8	9.8	9.7	9.8	9.2	9.5	0.4	4.7
10*	5	4.93	6.59	6.86	7.28	8.06	6.74	1.16	17.1
11	5	10.95	14.14	13.71	13.06	9.67	12.31	1.92	15.6
12*	5	8.59	8.89	8.55	8.25	9.41	8.74	0.44	5.0
13*	5	8.42	7.30	8.52	8.25	9.69	8.44	0.85	10.1
14	5	11.6	12.4	13.7	12.9	14.3	13.0	1.1	8.2
15*	5	38.9	11.0	10.1	30.0	12.3	20.5	13.2	64.4
16	0								
17*	5	15.2	16.4	13.2	13.5	14.3	14.5	1.3	9.0
18	0								
19	0								
20	5	12.6	13.4	11.4	13.7	16.0	13.5	1.7	12.4
21	5	11.2	15.5	14.8	13.4	11.5	13.3	1.9	14.5
22	0								
23'	5	14.64	28.38	10.95	11.43	12.13	15.51	7.34	47.3
24	0								
25	0								
26	5	9.25	13.5	11.5	9.75	9.5	10.7	1.8	16.8
27	0								
28	4	11.6	9.2	13.6	11.1		11.4	1.8	15.9
29	5	12.8	11.1	11.3	11.2	12.6	11.8	0.8	7.0
30'*	5	6.561	16.185	16.440	18.148	15.647	14.596	4.568	31.4
31	0								
32	5	11.3	13.4	11.4	11.1	12.1	11.9	0.9	7.9
33	5	12.7	11.5	9.8	12.9	12.6	11.9	1.3	10.8
34*	5	19.7	11.3	21.7	11.5	17.8	16.4	4.8	29.1
35	5	11.5	13.8	10.5	11.5	10.0	11.5	1.5	12.7
36	0								
37	0								
38	5	12.26	9.48	15.09	10.43	10.8	11.61	2.19	18.8
39	0								
40	0								
41	5	10.94	10.60	10.30	9.65	9.97	10.29	0.51	4.9
42	4	9.07	8.92	9.70	10.9		9.65	0.90	9.3
43*	5	13.7	15.0	13.8	14.2	16.1	14.6	1.0	6.9
44	5	10.9	11.4	12.2	11.0	10.0	11.1	0.8	7.2
45'	5	11.2	12.2	12.5	11.9	25.0	14.6	5.9	40.2
46'	5	12.5	21.2	12.8	11.1	9.7	13.5	4.5	33.4

LEAD
SRM 1566a
0.371 ± 0.014(0.037) mg/kg

Lab							Mean	SD	RSD
1	5	0.387	0.357	0.363	0.375	0.380	0.372	0.012	3.3
2	0								
3	5	<1.0	<1.0	<1.0	<1.0	<1.0			
4	0								
5	5	0.372	0.361	0.380	0.377	0.376	0.373	0.007	2.0
6	5	<1	<1	<1	<1	<1			
7	5	0.376	0.397	0.397	0.397	0.376	0.389	0.012	3.0
8	5	0.32	0.32	0.39	0.40	0.37	0.36	0.04	10.6
9	5	0.32	0.32	0.33	0.38	0.34	0.34	0.02	7.4
10*	5	0.67	0.49	0.63	0.94	1.20	0.79	0.28	36.0
11	5	0.326	0.359	0.376	0.359	0.343	0.353	0.019	5.4
12*	5	0.32	0.31	0.32	0.30	0.30	0.31	0.01	3.2
13*	5	0.38	0.42	0.43	0.38	0.53	0.43	0.06	14.3
14	5	<1.0	<1.0	<1.0	<1.0	<1.0			
15*	5	0.5	0.5	0.4	0.4	0.6	0.5	0.1	15.6
16	0								
17	5	0.308	0.414	0.341	0.454	0.393	0.382	0.058	15.2
18	0								
19	0								
20	5	0.37	0.36	0.35	0.35	0.38	0.36	0.01	3.6
21	5	0.43	0.40	0.37	0.32	0.29	0.36	0.06	15.8
22	0								
23	5	0.33	0.34	0.35	0.39	0.33	0.35	0.02	7.2
24	0								
25	0								
26	5	0.36	0.43	0.35	0.40	0.40	0.39	0.03	8.4
27	0								
28	5	0.3	<0.2	0.3	0.6	0.5	0.3	0.2	67.7
29	5	0.35	0.34	0.43	0.43	0.36	0.38	0.04	11.6
30	5	<2.000	<2.000	<2.000	<2.000	<2.000			
31	0								
32	5	0.33	0.35	0.33	0.34	0.33	0.34	0.01	2.7
33'	5	0.42	0.36	0.34	0.34	0.35	0.36	0.03	9.2
34	0								
35*	5	0.30	0.30	0.30	0.30	0.30	0.30	0.00	0.0
36	0								
37	0								
38	5	<0.5	<0.5	<0.5	<0.5	<0.5			
39	0								
40	0								
41	5	0.364	0.367	0.371	0.363	0.387	0.370	0.010	2.6
42	5	0.39	0.41	0.41	0.34	0.39	0.39	0.03	7.4
43	5	0.44	0.5	0.41	0.36	0.32	0.41	0.07	17.2
44	5	0.35	0.35	0.38	0.38	0.36	0.36	0.02	4.2
45	0								
46	0								

Laboratory Evaluation for Sediments

		Lab 1	Lab 2	Lab 3	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 10
Be	Sed W	EX	--	EG	EG	EG	EG	--	EG	EG	--
	BCSS-1	EX	--	EG	LG	EG	EG	--	EG	EG	--
Al	Sed W	EG	LX	LG	GG	EG	EG	EG	EG	EG	--
	BCSS-1	EG	GG	LX	LG	EG	EG	EG	EG	EG	--
Si	Sed W	GG	--	--	--	HG	--	--	--	EG	--
	BCSS-1	EG	--	--	--	EG	--	--	--	EG	--
Cr	Sed W	HG	--	HX	EG	EG	EG	EX	HG	EG	GX
	BCSS-1	EG	--	LG	LG	EG	EG	EG	EG	EG	EG
Mn	Sed W	HG	EG	LG	LG	EG	EG	EG	HG	EG	EG
	BCSS-1	EG	EG	LX	LG	EG	EG	EG	EG	EG	EG
Fe	Sed W	EG	GG	EG	LG	EG	EG	EG	HG	EG	EG
	BCSS-1	EG	EG	EG	LG	EG	EG	EG	EG	EG	EG
Ni	Sed W	GG	EG	EG	EG	GG	EG	HX	EG	EG	EG
	BCSS-1	EG	EG	EG	LG	EG	EG	EX	LG	EG	EG
Cu	Sed W	EG	GG	EG	EG	EG	EG	--	GG	EG	EG
	BCSS-1	EG	EG	EG	EX	EG	EG	--	EG	EG	EG
Zn	Sed W	HG	EG	LG	EG	GG	EG	--	EG	EG	EG
	BCSS-1	EG	EG	LG	GG	EG	EG	--	EG	EG	LG
As	Sed W	EG	EG	LG	LG	EG	HG	--	HG	EG	EG
	BCSS-1	EG	GX	GG	LG	EG	EG	--	HG	EG	EG
Se	Sed W	HX	EG	LX	LX	EG	GG	--	GX	EG	GX
	BCSS-1	--	GG	LX	LX	EG	GG	--	GX	GX	EX
Ag	Sed W	HG	--	--	--	EG	G-	--	EX	EX	EX
	BCSS-1	HX	--	--	--	EX	G-	--	GX	EG	HX
Cd	Sed W	HG	EG	GX	LG	EG	EG	--	EG	EG	GX
	BCSS-1	GX	EG	H-	--	EG	LX	--	EG	EG	EG
Sn	Sed W	LG	GX	GG	--	LG	--	--	GG	GX	--
	BCSS-1	EG	H-	G-	--	EG	--	--	EG	EG	--
Sb	Sed W	EG	--	--	--	EG	EG	--	GX	GX	--
	BCSS-1	EG	--	--	--	EG	EG	--	EG	HG	--
Hg	Sed W	LG	EG	LX	LG	EG	EG	--	EG	EX	EX
	BCSS-1	LX	LG	GX	EG	EG	GG	--	EG	LG	EG
Tl	Sed W	EG	--	--	--	LG	--	--	EG	EG	--
	BCSS-1	EG	--	--	--	EG	--	--	EG	EG	--
Pb	Sed W	GG	GX	LG	LG	EG	EG	LG	LG	EG	LG
	BCSS-1	EG	GG	LG	--	EG	EG	GG	EG	GG	GG

Laboratory Evaluation for Sediments

		Lab 11	Lab 12	Lab 13	Lab 14	Lab 15	Lab 16	Lab 17	Lab 18	Lab 19	Lab 20
Be	Sed W	EG	GG	--	--	--	--	--	EG	--	--
	BCSS-1	EG	GG	--	--	--	--	--	EG	--	--
Al	Sed W	--	EG	--	--	--	LX	--	EG	--	HG
	BCSS-1	--	EG	--	--	--	--	--	EG	--	EG
Si	Sed W	--	EG	--	--	--	--	--	--	--	EG
	BCSS-1	--	EG	--	--	--	--	--	--	--	EG
Cr	Sed W	EG	EG	EG	--	--	EG	--	EG	--	EG
	BCSS-1	LG	EG	GG	--	--	--	--	LG	--	EG
Mn	Sed W	--	EG	GG	--	--	EG	--	EG	--	EG
	BCSS-1	--	EG	EG	--	--	--	--	EG	--	EG
Fe	Sed W	--	EG	GX	--	--	EG	--	EG	--	EG
	BCSS-1	--	EG	HG	--	--	--	--	EG	--	EG
Ni	Sed W	EG	EG	EG	--	--	EX	--	EG	--	EX
	BCSS-1	EG	EG	EG	--	--	--	--	EG	--	EG
Cu	Sed W	EG	EG	EX	--	--	GG	--	EG	--	EG
	BCSS-1	EG	EG	EG	--	--	--	--	LG	--	EG
Zn	Sed W	LG	EG	HG	--	--	LG	--	EG	--	EG
	BCSS-1	LG	EG	EG	--	--	--	--	GG	--	EG
As	Sed W	EG	EG	--	--	--	--	--	EG	--	HG
	BCSS-1	EG	EG	--	--	--	--	--	EG	--	HG
Se	Sed W	EG	EG	--	--	--	--	--	EG	--	EG
	BCSS-1	EG	HX	--	--	--	--	--	HG	--	EG
Ag	Sed W	--	EG	--	--	--	--	--	HG	--	EX
	BCSS-1	--	EG	--	--	--	--	--	HG	--	EG
Cd	Sed W	EG	EG	LG	--	--	--	--	EG	--	EG
	BCSS-1	EG	EG	L-	--	--	--	--	EG	--	EG
Sn	Sed W	--	EG	--	--	--	--	--	GX	--	EG
	BCSS-1	--	GG	--	--	--	--	--	G-	--	LG
Sb	Sed W	--	EG	--	--	--	--	--	--	--	EG
	BCSS-1	--	EG	--	--	--	--	--	--	--	EG
Hg	Sed W	EX	EG	--	--	--	--	--	EX	--	EG
	BCSS-1	EG	EG	--	--	--	--	--	HG	--	HG
Tl	Sed W	--	EG	--	--	--	--	--	--	--	--
	BCSS-1	--	EG	--	--	--	--	--	--	--	--
Pb	Sed W	EG	EG	L-	--	--	--	--	EX	--	EG
	BCSS-1	LG	EG	LG	--	--	--	--	LG	--	EG

Laboratory Evaluation for Sediments

		Lab 21	Lab 22	Lab 23	Lab 24	Lab 25	Lab 26	Lab 27	Lab 28	Lab 29	Lab 30
Be	Sed W	--	LG	--	EG	--	EX	EG	LG	--	G-
	BCSS-1	--	LG	--	LG	--	LG	EG	LG	--	G-
Al	Sed W	--	LG	LG	LG	--	EG	HG	LX	EG	HX
	BCSS-1	--	LG	LX	LX	--	EG	EG	LX	EG	HX
Si	Sed W	--	--	--	--	--	--	EG	LX	EG	--
	BCSS-1	--	--	--	--	--	--	EG	LX	EG	--
Cr	Sed W	EG	EG	EX	LG	EG	EG	EG	LG	EG	LG
	BCSS-1	EG	LG	EG	LG	EG	LG	GG	LG	EG	LG
Mn	Sed W	HG	LG	LG	LG	LX	EG	EG	LG	EG	LG
	BCSS-1	EG	LG	HG	LG	EG	EG	EG	LG	EG	LG
Fe	Sed W	EG	EG	--	LG	LG	EG	EG	LG	EG	EG
	BCSS-1	EG	LG	--	LG	LG	EG	EG	EG	EG	LG
Ni	Sed W	--	EG	GX	EG	EG	EG	--	EG	EG	EG
	BCSS-1	--	EG	EG	LG	GG	GG	--	LG	EG	LG
Cu	Sed W	HG	GG	--	LG	EG	EG	EG	GG	EG	EG
	BCSS-1	LX	LG	--	LG	EG	EG	EG	GG	EG	LG
Zn	Sed W	EG	EG	LG	LG	EG	EG	EG	GG	EG	EG
	BCSS-1	EG	LG	GG	LG	EG	EG	EG	GG	EG	LG
As	Sed W	EG	EG	LG	EG	LG	EG	EG	EG	EG	--
	BCSS-1	EG	LG	HX	EG	EG	EG	GG	EG	EG	LG
Se	Sed W	HG	EG	--	EG	--	EX	EG	G-	EG	G-
	BCSS-1	LX	LX	--	HX	--	EG	EG	H-	EG	G-
Ag	Sed W	EG	G-	LX	HG	--	HG	--	H-	EG	H-
	BCSS-1	LX	G-	EG	HX	--	HG	--	H-	EG	H-
Cd	Sed W	--	GX	EG	EG	EG	EG	--	EG	EG	GX
	BCSS-1	--	GX	HG	HX	EG	HX	--	GX	EG	H-
Sn	Sed W	--	--	--	EG	GG	EG	--	EG	LG	--
	BCSS-1	--	--	--	G-	EG	LX	--	GG	LG	--
Sb	Sed W	--	G-	--	G-	--	GG	--	G-	EG	G-
	BCSS-1	--	G-	--	H-	--	GG	--	G-	EG	G-
Hg	Sed W	LG	GX	--	EG	EG	EG	--	EG	LG	GG
	BCSS-1	GG	EG	--	EG	--	EG	--	GG	EG	EG
Tl	Sed W	--	LX	--	--	LX	--	--	H-	EG	G-
	BCSS-1	--	LG	--	--	GX	--	--	H-	GX	G-
Pb	Sed W	--	EG	GG	LG	EG	EG	--	LG	GG	GG
	BCSS-1	--	GG	LG	LG	EG	EG	--	EG	EG	LG

Laboratory Evaluation for Sediments

		Lab 31	Lab 32	Lab 33	Lab 34	Lab 35	Lab 36	Lab 37	Lab 38	Lab 39	Lab 40
Be	Sed W	EG	--	--	--	EG	--	--	--	--	--
	BCSS-1	GG	--	--	--	EX	--	--	--	--	--
Al	Sed W	EG	EG	EG	--	EG	--	--	--	--	LG
	BCSS-1	EG	EG	GG	--	EG	--	--	--	--	LX
Si	Sed W	--	EG	--	--	--	--	--	--	--	--
	BCSS-1	--	HG	--	--	--	--	--	--	--	--
Cr	Sed W	EG	EG	--	LX	EG	--	--	EG	--	EG
	BCSS-1	LG	EG	--	--	GG	--	--	LG	--	LX
Mn	Sed W	EG	EG	EG	--	GG	LG	--	--	--	LG
	BCSS-1	EG	EG	EG	--	EG	LG	--	--	--	LG
Fe	Sed W	HG	EG	EG	--	EG	--	--	--	--	LG
	BCSS-1	EG	EG	EG	--	HG	--	--	--	--	LX
Ni	Sed W	HG	EG	EG	EX	EG	EX	--	EG	--	EG
	BCSS-1	EG	EG	EG	--	EG	LG	--	EG	--	LG
Cu	Sed W	EG	EG	EG	EG	GG	HG	--	EG	--	EG
	BCSS-1	EG	HG	EG	--	GG	EG	--	LX	--	LX
Zn	Sed W	EG	EG	EG	EG	EG	GG	--	EG	--	EG
	BCSS-1	EG	EG	EG	--	EG	EG	--	GG	--	LX
As	Sed W	LG	EG	--	EG	EG	--	--	HX	HG	GG
	BCSS-1	LG	EG	--	--	LG	--	--	EG	EG	HG
Se	Sed W	--	EG	--	L-	EG	--	--	EG	EG	LX
	BCSS-1	--	GG	--	--	EG	--	--	GX	EG	LX
Ag	Sed W	HG	--	--	LG	H-	--	--	G-	--	EG
	BCSS-1	H-	--	--	--	H-	--	--	G-	--	LG
Cd	Sed W	--	EG	EG	EG	EG	HG	--	EG	--	EG
	BCSS-1	--	EG	GX	--	LG	GX	--	GG	--	GG
Sn	Sed W	--	--	--	--	EG	--	--	--	--	--
	BCSS-1	--	--	--	--	H-	--	--	--	--	--
Sb	Sed W	--	--	--	--	EG	--	--	LX	--	--
	BCSS-1	--	--	--	--	LG	--	--	GX	--	--
Hg	Sed W	--	EG	--	EX	EG	GX	EX	GX	--	--
	BCSS-1	--	HG	--	--	GG	GG	GX	HG	--	--
Tl	Sed W	--	--	--	--	H-	--	--	--	--	--
	BCSS-1	--	--	--	--	H-	--	--	--	--	--
Pb	Sed W	--	EG	GG	GG	EG	EG	--	HG	--	LG
	BCSS-1	--	GX	EG	--	EG	LG	--	GG	--	LG

APPENDIX C
Laboratory Evaluation for Sediments

		Lab 41	Lab 42	Lab 43	Lab 44
Be	Sed W	EG	--	--	EG
	BCSS-1	EG	--	--	EG
Al	Sed W	HG	--	--	--
	BCSS-1	EG	--	--	--
Si	Sed W	EG	--	--	--
	BCSS-1	EG	--	--	--
Cr	Sed W	EG	GG	--	EG
	BCSS-1	EG	LG	--	EG
Mn	Sed W	EG	LG	--	GG
	BCSS-1	EG	EG	--	EG
Fe	Sed W	EG	--	--	EG
	BCSS-1	EG	--	--	EG
Ni	Sed W	LG	EG	EG	EG
	BCSS-1	EG	EG	EG	EG
Cu	Sed W	EG	EG	EG	EG
	BCSS-1	EG	EG	LX	EG
Zn	Sed W	EG	EG	GG	EG
	BCSS-1	EG	EG	LG	EG
As	Sed W	LG	LG	--	EG
	BCSS-1	EG	EX	--	EG
Se	Sed W	LG	--	--	EG
	BCSS-1	EG	--	--	EG
Ag	Sed W	EG	EG	EX	EG
	BCSS-1	EX	LX	EG	EG
Cd	Sed W	LG	EG	EG	EG
	BCSS-1	EG	LG	GG	EG
Sn	Sed W	EG	--	--	HG
	BCSS-1	EG	--	--	EG
Sb	Sed W	EG	--	--	EG
	BCSS-1	GG	--	--	EG
Hg	Sed W	LG	EG	--	EG
	BCSS-1	LG	GX	--	EG
Tl	Sed W	LG	L-	--	EG
	BCSS-1	EG	G-	--	EG
Pb	Sed W	LG	LG	GG	EG
	BCSS-1	EG	LG	EG	EG

Laboratory Evaluation for Biologicals Tissues

		Lab 1	Lab 2	Lab 3	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 10
Al	Tissue X	--	--	--	--	--	--	--	--	--	--
	SRM 1566a	--	--	--	--	--	--	--	--	--	--
Cr	Tissue X	EG	--	GX	--	EG	EX	EG	GG	EG	EG
	SRM 1566a	EG	--	EG	--	EG	GX	EG	EX	EX	GG
Fe	Tissue X	LG	--	EG	--	EG	EG	EG	EG	EG	EG
	SRM 1566a	EG	--	LG	--	EG	EG	EG	EG	EG	EG
Ni	Tissue X	EG	--	EG	--	EG	EX	EG	EX	EG	HG
	SRM 1566a	EG	--	GG	--	EG	GX	EG	GX	GX	HX
Cu	Tissue X	LG	--	EX	--	HG	EG	HG	EG	HG	EG
	SRM 1566a	EG	--	GX	--	EG	EG	EG	EG	EG	EG
Zn	Tissue X	LG	--	LG	--	EG	EG	EG	GG	EG	EG
	SRM 1566a	EG	--	EG	--	EG	EG	EG	EG	EG	EG
As	Tissue X	EG	--	LG	--	HG	HG	EG	EG	GG	GG
	SRM 1566a	GG	--	LG	--	EG	GG	EG	GG	EG	EG
Se	Tissue X	HG	--	LX	--	EG	EG	HG	EG	LX	EG
	SRM 1566a	GG	--	LG	--	EG	GG	EG	LG	EX	EG
Ag	Tissue X	EG	--	--	--	LG	G-	EG	EG	EG	EG
	SRM 1566a	EG	--	--	--	EG	GG	EG	EG	GG	EG
Cd	Tissue X	EG	--	LX	--	GG	EG	EG	EG	EG	GX
	SRM 1566a	EG	--	GX	--	EG	EG	EG	EG	EG	EG
Sn	Tissue X	GG	--	H-	--	EX	--	G-	EG	EG	--
	SRM 1566a	EG	--	G-	--	EX	--	L-	LX	EX	--
Hg	Tissue X	GG	--	GX	--	EG	EG	EG	EG	GG	EG
	SRM 1566a	GG	--	GG	--	EG	EG	EG	HG	EG	HG
Pb	Tissue X	EG	--	--	--	GG	GX	EG	EG	EG	LX
	SRM 1566a	EG	--	G-	--	EG	G-	EG	GX	GG	HX

Laboratory Evaluation for Biologicals Tissues

		Lab 11	Lab 12	Lab 13	Lab 14	Lab 15	Lab 16	Lab 17	Lab 18	Lab 19	Lab 20
Al	Tissue X	--	--	--	--	--	--	--	--	--	--
	SRM 1566a	--	--	--	--	--	--	--	--	--	--
Cr	Tissue X	EG	HG	LX	G-	EG	--	EG	--	--	EX
	SRM 1566a	EG	EG	GG	G-	GX	--	EG	--	--	EG
Fe	Tissue X	--	HG	EG	--	LG	GG	EG	--	EG	EG
	SRM 1566a	--	EG	EG	--	LG	--	GG	--	EG	EG
Ni	Tissue X	EG	HG	G-	--	HX	--	G-	--	--	EX
	SRM 1566a	EG	EX	GX	--	EG	--	EX	--	--	EG
Cu	Tissue X	EG	HG	GG	EG	EG	EG	EG	--	EG	HG
	SRM 1566a	EG	EG	EG	LG	EG	--	EG	--	EG	EG
Zn	Tissue X	GG	EG	EG	LG	LG	LG	EG	--	EG	HG
	SRM 1566a	EG	GG	EG	LG	EG	--	LG	--	EG	EG
As	Tissue X	EG	EG	--	--	EG	--	HG	--	--	EG
	SRM 1566a	EG	EG	--	--	EG	--	GX	--	--	EG
Se	Tissue X	HX	EG	--	--	HX	--	GX	--	--	HX
	SRM 1566a	EG	EG	--	--	LX	--	HG	--	--	EG
Ag	Tissue X	--	EG	--	--	GG	--	--	--	HG	HG
	SRM 1566a	--	LG	--	--	EG	--	--	--	EG	EG
Cd	Tissue X	EG	EG	LG	HG	LX	--	EG	--	EG	HG
	SRM 1566a	EG	EG	EG	EG	GG	--	GG	--	EG	EG
Sn	Tissue X	--	EX	--	--	--	--	--	--	--	HG
	SRM 1566a	--	EG	--	--	--	--	--	--	--	EG
Hg	Tissue X	EG	EG	--	EG	GG	--	EG	--	--	HG
	SRM 1566a	EG	EG	--	GX	EG	--	EG	--	--	EG
Pb	Tissue X	EX	LG	LG	EG	HX	--	HG	--	--	GX
	SRM 1566a	EG	LG	HX	G-	HX	--	GX	--	--	EG

Laboratory Evaluation for Biologicals Tissues

		Lab 21	Lab 22	Lab 23	Lab 24	Lab 25	Lab 26	Lab 27	Lab 28	Lab 29	Lab 30
Al	Tissue X	--	--	--	--	--	--	--	--	--	--
	SRM 1566a	--	--	--	--	--	--	--	--	--	--
Cr	Tissue X	EG	--	LX	--	--	LG	--	GG	EG	G-
	SRM 1566a	EG	--	GX	--	--	EX	--	LG	EG	G-
Fe	Tissue X	EG	--	EG	EG	--	EG	EG	EG	EG	EG
	SRM 1566a	EG	--	EG	EG	--	EG	EG	LG	EG	GG
Ni	Tissue X	EG	--	HX	G-	--	EG	EG	LX	EG	H-
	SRM 1566a	GG	--	HX	GX	--	EX	EX	EX	EG	G-
Cu	Tissue X	EG	--	EG	LG	--	EG	EG	EG	EG	L-
	SRM 1566a	EG	--	LG	LG	--	EG	GX	EG	EG	LX
Zn	Tissue X	EG	--	EG	EG	--	EG	LG	EG	EG	LG
	SRM 1566a	EG	--	EG	GG	--	EG	LG	EG	EG	EG
As	Tissue X	EG	--	--	EG	--	HG	--	LX	EG	LG
	SRM 1566a	EG	--	--	GG	--	LG	--	EG	EG	LG
Se	Tissue X	EG	--	--	--	--	EG	EX	HG	EG	G-
	SRM 1566a	EG	--	--	--	--	LG	EX	HX	GG	G-
Ag	Tissue X	EG	--	EG	HX	--	EX	--	LX	EG	H-
	SRM 1566a	EG	--	LG	GG	--	EG	--	GX	EG	G-
Cd	Tissue X	EG	--	EG	HG	--	EG	HG	EG	EG	G-
	SRM 1566a	EG	--	EG	EG	--	EG	HX	EG	EG	G-
Sn	Tissue X	--	--	--	--	--	--	--	G-	EX	--
	SRM 1566a	--	--	--	--	--	--	--	L-	EG	--
Hg	Tissue X	EG	--	--	EX	--	EG	--	EG	EG	GX
	SRM 1566a	HG	--	--	EG	--	EG	--	HG	HG	HX
Pb	Tissue X	EX	--	GX	--	--	EX	--	EX	EG	HX
	SRM 1566a	GX	--	EG	--	--	GG	--	GX	GX	H-

Laboratory Evaluation for Biologicals Tissues

		Lab 31	Lab 32	Lab 33	Lab 34	Lab 35	Lab 36	Lab 37	Lab 38	Lab 39	Lab 40
Al	Tissue X	--	--	--	--	--	--	--	--	--	--
	SRM 1566a	--	--	--	--	--	--	--	--	--	--
Cr	Tissue X	--	EG	--	EG	EG	--	--	HX	EG	EG
	SRM 1566a	--	EG	--	--	LG	--	--	EG	EG	EX
Fe	Tissue X	EG	--	--	--	EG	EG	--	--	--	--
	SRM1566a	EG	--	--	--	EG	LG	--	--	--	--
Ni	Tissue X	--	EG	--	EX	EG	--	--	EG	EG	--
	SRM 1566a	--	GG	--	--	EG	--	--	EG	HX	--
Cu	Tissue X	HG	EG	HG	GX	EG	HX	--	EG	EG	EG
	SRM 1566a	EG	EG	EG	--	EG	EG	--	EG	EG	EG
Zn	Tissue X	EG	EG	EG	GG	EG	HG	--	EG	EG	EG
	SRM 1566a	EG	GG	EG	--	EG	EG	--	EG	EG	EG
As	Tissue X	LG	EG	--	LX	EG	--	--	EG	EG	LX
	SRM 1566a	LG	EG	--	--	EG	--	--	EG	EG	LX
Se	Tissue X	--	EG	--	LX	EG	--	--	EG	EG	L-
	SRM 1566a	--	EG	--	--	EG	--	--	EG	EG	LG
Ag	Tissue X	HG	--	EG	LX	EG	--	--	EG	EG	EX
	SRM 1566a	HG	--	EG	--	EG	--	--	EG	EG	GG
Cd	Tissue X	HG	HG	--	EX	EG	EG	--	EG	HG	EG
	SRM 1566a	GX	EG	--	--	EG	EG	--	GG	EG	LG
Sn	Tissue X	--	--	--	--	H-	--	--	--	--	--
	SRM 1566a	--	--	--	--	G-	--	--	--	--	--
Hg	Tissue X	--	--	--	EG	EG	--	--	EG	EG	--
	SRM 1566a	--	--	--	--	EG	--	--	LX	LG	--
Pb	Tissue X	--	EG	EX	HX	EX	--	--	GX	--	--
	SRM 1566a	--	EG	EG	--	LG	--	--	G-	--	--

Laboratory Evaluation for Biologicals Tissues

		Lab 41	Lab 42	Lab 43	Lab 44
Al	Tissue X	--	--	--	--
	SRM 1566a	--	--	--	--
Cr	Tissue X	EG	EG	--	EG
	SRM 1566a	EG	EG	--	EG
Fe	Tissue X	EG	EG	--	EG
	SRM 1566a	EG	EG	--	EG
Ni	Tissue X	EG	EG	EX	HG
	SRM 1566a	EG	EG	LX	EX
Cu	Tissue X	EG	EG	HG	LG
	SRM 1566a	EG	EG	EG	EG
Zn	Tissue X	EG	EG	EG	EG
	SRM 1566a	EG	EG	EG	EG
As	Tissue X	LG	--	--	EG
	SRM 1566a	EG	--	--	EG
Se	Tissue X	EG	--	--	EG
	SRM 1566a	EG	GG	--	EG
Ag	Tissue X	GG	EG	EG	EG
	SRM 1566a	EG	EG	EG	EG
Cd	Tissue X	HG	EG	EG	EG
	SRM 1566a	EG	EG	EG	EG
Sn	Tissue X	HG	--	--	EG
	SRM 1566a	HG	--	--	EG
Hg	Tissue X	LG	EG	--	GG
	SRM 1566a	EG	GX	--	EG
Pb	Tissue X	EG	EG	HG	EG
	SRM 1566a	EG	EG	GX	EG

TABLE D-3
Sediment Dissolution Procedures

Lab No.	Sediment Preparation Procedure	Instrumentation
1	-0.5g -HNO_3, HCl -flask and hot plate	ICPMS- Hg,As,Se
	-0.1g -fusion -muffle furnace	ICPMS- Si
	-0.1g -HNO_3, HF, HCl, $HClO_4$ -closed vessel	ICPMS- Be,Al,Cr,Mn,Fe,Ni,Cu,Zn, Ag,Cd,Sn,Sb,Tl,Pb
2	-0.500g -HNO_3, HF, HCl, $HClO_4$ -flask and hot plate	GFAAS- Cd HGICP- Se,As ICPAES- Al,Mn,Fe,Ni,Cu,Zn,Sn,Pb
3	-0.5g -HNO_3, HF, H_2O_2 -flask and hot plate	GFAAS- As,Se ICPAES- Al,Cr,Fe,Ni,Cu,Zn,Cd,Pb
4	-0.25g -HNO_3, HF, H_2O_2, HCl -flask and hot plate	ICPAES- Be,Al,Cr,Mn,Fe,Ni, Cu,Zn,Cd,Pb HGAAS- As,Se
5	-0.6g -HNO_3, HF -flask and hot plate -closed vessel	FAAS- Fe,Mn,Zn GFAAS- Sb,Cr,Pb,Tl,Cd,Sn,Ni,Cu,Ag HGAAS- As,Se ICPAES- Si,Al,Be
6	-0.5000g -HNO_3, HF, HCl, $HClO_4$ -flask and hot plate	FAAS- Al,Ag,Cd HGAAS- As,Se,Sb ICPAES- Be,Cr,Cu,Fe,Ni,Zn,Pb,Mn
7	-0.5g - HNO_3 - microwave heating	XRF- Al,Cr,Mn,Fe,Ni,Pb
8	-0.25g -HNO_3, HF, $HClO_4$ -flask and hot plate	FAAS- Fe,Al GFAAS- Cr,Ag,Se ICPMS- Be,Mn,Fe,Ni,Cu,Zn,As,Ag, Cd,Tl,Pb

Lab No.	Sediment Preparation Procedure	Instrumentation
9	-0.2g -HNO_3, HF, $HClO_4$ -closed vessel in oven at 130°C	GFAAS- Ag,Cd,Se ICPMS- Be,Sb,Sn,Tl
	-0.5g -pressed powder pellet	XRF- Al,As,Cr,Cu,Fe,Mn,Ni,Pb,Si,Zn
10	-0.1-0.2g -HNO_3, HF, HCl, $HClO_4$ -flask and hot plate	FAAS- Cu,Fe,Mn,Zn GFAAS- Ag,Cd,Cr,Ni,Pb HGAAS- As,Se
11	-0.45g -HNO_3, HF -microwave heating	ICPMS- Be,Cr,Ni,Cu,Zn,As,Se,Cd,Pb
12	-0.5g -HNO_3, HF, HCl -closed vessel -heat on steam bath	ICPMS- As,Be,Cd,Cr,Cu,Hg,Ag,Ni,Sb, Se,Sn,Tl ICPAES- Al,Fe,Mn,Si
13	-0.25g -HNO_3, HF, HCl -closed vessel -microwave heating	ICPAES- Cr,Mn,Fe,Ni,Cu,Zn,Cd,Pb
14	NA	
15	NA	
16	-0.2g -HNO_3, Hcl - closed vessel -microwave heating	FAAS-Cu,Zn,Mn,Fe,Al,Ni,Cr
17	NA	
18	-0.50g -HF, HCl, H_2O_2 -flask and hot plate	FAAS- Be,Al,Cr,Mn,Fe,Ni,Cu,Zn, Ag,Cd,Sn,Pb
	-0.25g -HNO_3, HF, HCl, $HClO_4$ -flask and hot plate	HGAAS- As,Se
19	NA	

Lab No.	Sediment Preparation Procedure	Instrumentation
20	-0.5g -HNO_3, HF, $HclO_4$ (HCl- Se,As) -closed vessel - oven at 130°C	FAAS- Al,Cu,Fe,Mn,Si,Zn GFAAS- Sb,Cd,Cr,Ni,Ag,Sn HGAAS- Se,As
21	-0.25g -HNO_3, HF, HCl -closed vessel -microwave heating	FAAS- Cr,Cu,Fe,Mn,Zn GFAAS- Ag,As,Se
22	-0.7g -HNO_3, HCl -flask and hot plate	FAAS- Se ICPMS- Mn,As,Ag,Cd,Sb,Tl,Pb ICPAES- Be,Al,Cr,Fe,Ni,Cu,Zn
23	-0.2g -HNO_3, HF, HCl -microwave heating	GFAAS- Cr,As,Ag,Cd,Pb ICPMS- Zn,Ni,Mn,Al
24	-1.0g -HNO_3, HCl -microwave heating	GFAAS- As,Se ICPAES- Be,Al,Cr,Mn,Fe,Ni,Cu,Zn, Ag,Pb,Sb,Cd,Sn
25	-0.4g -HNO_3, HF, $HClO_4$ -microwave heating	FAAS- Al,Cr,Mn,Fe,Ni,Cu,Zn GFAAS- As,Cd,Sn,Tl,Pb
26	-0.500g -HCl, HF, $HClO_4$ -flask and hot plate	ICPAES- Fe,Al,Mn,Be,Cr,Ni
	-1.00g -HNO_3, HCl -flask and hot plate	FAAS- Cd,Pb GFAAS- As,Se,Ag ICPAES- Cu,Zn,Sn
27	-0.12g -HNO_3, HF -closed vessel -microwave heating	ICPAES- Si,Mn,Cu,Al,Be,Zn,Cr,Fe
	-0.2g -HNO_3, H_2SO_4 -flask and hot plate	HGAAS- As,Se
28	-1.0g -HNO_3, HCl -flask and hot plate	ICPAES- Si,Be,Al,Cr,Mn,Cu, Fe,Ni,Zn,As,Se,Ag,Cd,Sn,Sb,Tl,Pb

Lab No.	Sediment Preparation Procedure	Instrumentation
29	-0.2 -HNO_3, HF, boric acid -closed vessel	FAAS- Mn,Si GFAAS- Ag,As,Cd,Cu,Ni,Pb,Se,Sn,Tl
	-0.2-0.5g	INAA- Al,Cr,Fe,Sb,Zn
30	-0.2g -HNO_3 -closed vessel -microwave heating	GFAAS- As,Se,Fe,Sb ICPAES- Ag,Cd,Zn,Ni,Cu,Mn,Be,Al,Pb
31	-1.0g -HNO_3, HF, HCl -flask and hot plate	FAAS- Fe,Mn,Ag,Be,Al,Cr, Pb,Zn,Ni,Cu GFAAS- As
32	-pressed powder pellet	XRF- Al,Cr,Cu,Fe,Mn,Ni,Pb,Si,Zn
	-0.5g -HNO_3, H_2SO_4, $HClO_4$ -flask and hot plate	HGAAS- As,Se
	- 0.5g -HNO_3, HCl -closed vessel -boiling water bath	GFAAS- Cd
33	-0.2g -HNO_3, HF -closed vessel -microwave heating	ICPMS- Al,Mn,Fe,Ni,Cu,Zn,Pb
34	-0.4g -HNO_3, HCl -closed vessel -microwave heating	FAAS- Cd,Cr,Cu,Pb,Ni,Zn GFAAS- As,Se,Ag
35	-HNO_3, HF, HCl, $HClO_4$ -flask and hot plate	ICPAES- Fe,Mn,Al,Cr,Be
	-0.5g -HCl -flask and hot plate -microwave heating	HGAAS- Sb
	-1.00g -HNO_3, HCl -flask and hot plate	FAAS- Cd,Pb HGAAS- As,Se ICPAES- Sn,Zn,Cu,Ni,Ag,Tl

Lab No.	Sediment Preparation Procedure	Instrumentation
36	-0.5g -HNO_3, HCl -flask and hot plate	GFAAS- Cd ICPAES- Mn,Pb,Fe,Zn,Ni,Cu
37	NA	
38	-0.2-0.5g -HNO_3, HF, HCl -closed vessel -microwave heating	ICPAES- Cr,Cu,Ni,Zn GFAAS- Ag,As,Cd,Pb,Se,Sb
39	-0.25g -HCl -dry ash	HGAAS- Se,As
40	-0.5000g -HNO_3, H_2O_2 -closed vessel -microwave heating	GFAAS- Ag,Se,Cd ICPAES- As,Al,Cr,Cu,Mn,Ni,Pb,Fe,Zn
41	-0.45g -HNO_3, H_2O_2, H_2SO_4, HF, HCl -closed vessel -microwave heating	FAAS-Al,Si,Fe,Mn,Cu,Zn,Be GFAAS-Cr,Ni,As,Se,Ag,Cd,Sn,Sb,Tl,Pb
42	-0.5g -HNO_3, HCl -closed vessel -microwave heating -flask and hot plate	FAAS- Ni,Pb,Cu,Zn,Cr GFAAS- Tl,Ag,Cd HGAAS- As,Se,Sb ICPAES- Mn,Cu,Zn
43	-1g -H_2O_2, HCl -flask and hot plate	FAAS- Cu,Zn GFAAS- Cd,Cr,Ni,Pb,Ag
44	-0.4g -HNO_3, HF, $HClO_4$ -closed vessel -microwave heating	ICPMS-Be,Cr,Mn,Fe,Ni,Cu, Zn,As, Se,Ag,Cd,Sn,Sb,Tl,Pb
45	-0.25g -HNO_3, $HClO_4$, HF -closed vessel -microwave heating	GFAAS-Be,Ni,Cu,As,Ag,Cd,Pb ICPAES-Al,Cr,Mn,Fe HGAAS- Se

Lab No.	Sediment Preparation Procedure	Instrumentation
46	-0.25g -HNO_3,$HClO_4$,HF -closed vessel -microwave heating	IDICPMS- Cr,Ni,Cu,Zn,Cd,Sn,Sb,Tl

TABLE D-2
Tissue Dissolution Procedures

Lab No.	Tissue Preparation Procedure	Instrumentation
1	-0.5g -HNO_3 -closed vessel	ICPMS- Al,Cr,Fe,Ni,Cu,Zn,As,Se,Ag,Cd Sn,Hg,Pb
2	NA	
3	-1.00g -HNO_3, H_2O_2, HCl -flask and hot plate -dry ash	GFAAS- Se,As ICPAES- Al,Cr,Mn,Fe,Ni,Cu,Zn,Cd,Pb
4	NA	
5	-0.6g -HNO_3, HF -flask and hot plate -closed vessel	FAAS- Fe,Mn,Zn GFAAS- Sb,Cr,Pb,Tl,Cd,Sn,Ni,Cu,Ag ICPAES- Si,Al HGAAS-As,Se
6	-0.500g -HNO_3, HF, HCl, $HClO_4$ -flask and hot plate	FAAS- Pb, Ag HGAAS- Se,Sb ICPAES- As,Al,Cr,Fe,Ni,Cu,Zn,Cd
7	-0.5g -HNO_3 -microwave heating	ICPMS- Pb,Cd,Cr,As,Se,Ag,Fe, Zn,Cu,Al,Sn
8	-0.5g - HNO_3 (HF-Al,Fe) -microwave heating	ICPMS- Cr,Ni,Cu,Zn,As, Se,Ag,Cd,Sn, Sb,Hg,Pb FAAS- Al,Fe

Lab No.	Tissue Preparation Procedure	Instrumentation
9	-0.3g -HNO_3, HCl -oven at 130°C	ICPMS- Ag,Al,Cd,Cr,Ni,Pb,Sn
	-0.5g	XRF- As,Cu,Fe,Se,Zn
10	-0.1-0.2g -HNO_3, HF, HCl, $HClO_4$ -flask and hot plate	FAAS- Cu,Fe,Mn,Zn GFAAS- Ag,Cd,Cr,Ni,Pb
	-0.1-0.2g -HNO_3, HCl -$Mg(NO_3)_2$ dry ash	HGAAS- As,Se
11	-0.45g - HNO_3, HF -microwave heating	ICPMS- Cr,Ni,Cu,Zn,As, Se, Cd,Hg,Pb
12	-0.5g -HNO_3, HCl -closed vessel -microwave heating	ICPMS- As,Cd,Cr,Hg,Ni,Pb,Se,Ag,Sn,Cu ICPAES- Al,Zn,Fe
13	-0.5g -HNO_3, HCl -closed vessel -microwave heating	ICPAES- Cr,Fe,Ni,Cu,Zn,Cd,Pb
14	- 1.0g -HNO_3, H_2O_2 -heat on water bath	FAAS- Cd,Cr,Cu,Pb,Zn
15	-2.0g -HNO_3, H_2O_2 -flask and hot plate	ICPMS- As,Cd,Pb,Ni,Se,Ag ICPAES- Al,Cr,Fe,Cu,Zn
16	-1.0g -HNO_3, -flask and hot plate	FAAS- Cu,Zn,Fe,Al
17	-0.5g -HNO_3, HCl -closed vessel -microwave heating	GFAAS- Pb, As, Se ICPAES- Cd,Cr,Cu,Ni,Zn,Al,Fe
18	NA	

Lab No.	Tissue Preparation Procedure	Instrumentation
19	-HNO_3 (+HCl Ag) -microwave heating	FAAS- Fe,Cu,Zn,Ag,Cd
20	-0.5g -HNO_3, $HClO_4$ - closed vessel -oven at 130°C	FAAS- Al,Cd,Cu,Fe,Zn GFAAS- Ag,As,Cd,Cr,Ni,Sn,Se,Pb
21	-0.25g -HNO_3, H_2O_2 -closed vessel -microwave heating	GFAAS- Ag,As,Cd,Cr,Ni,Pb,Se ICPAES- Al,Fe,Cu,Zn
22	NA	
23	-1.0g -HNO_3, H_2O_2, .HCl -flask and hot plate	GFAAS- Ag,Cd,Pb,Cu ICPMS- Cu,Zn,Cr,Ni,Fe,Al
24	-1.0g -HNO_3, H_2SO_4 -flask and hot plate	FAAS- Fe,Ni,Cu,Cd,Zn,Al,Ag GFAAS- As
25	NA	
26	-1.000g -HNO_3, H_2O_2 -flask and hot plate	GFAAS- Cr,Ni,As,Se,Cd,Pb ICPAES- Al,Fe,Cu,Zn,Cd,Pb
27	-0.15g -HNO_3, H_2O_2 -closed vessel -microwave heating	ICPAES- Zn,Ni,Fe,Al,Cu,Cd
	-0.2g -HNO_3, H_2SO_4 -flask and hot plate	HGAAS- As,Se
28	-0.500g -HNO_3, $HClO_4$ -flask and hot plate	ICPAES- Al,Cr,Cu,Fe,Ni,Zn,As,Se,Ag Cd,Sn,Pb
29	-HNO_3 -closed vessel	GFAAS- Ag,Al,As,Cd,Cr,Cu,Ni,Pb,Se,Sn INAA- Fe, Zn

Lab No.	Tissue Preparation Procedure	Instrumentation
30	-0.1g -HNO_3 -closed vessel -microwave heating	GFAAS- Pb,As,Se,Tl,Sb ICPAES- Ag,Cd,Zn,Ni,Cu,Mn,Be,Al
31	-1.0g -HNO_3, HF, HCl -flask and hot plate	FAAS- Al,Zn,Cd,Fe,Ag,Cu GFAAS- As
32	-0.5g -HNO_3, H_2O_2 -flask and hot plate	GFAAS- Pb,Cr,Ni
	-0.5g -HNO_3, H_2SO_4, $HClO_4$	HGAAS- As,Se ICPAES- Cd,Cu,Zn
33	-0.25g -HNO_3, HCl -closed vessel -microwave heating	ICPMS- Cu,Zn,Ag,Pb
34	-0.4g -HNO_3, HCl -closed vessel -microwave heating	FAAS- Cu,Zn GFAAS- As,Cd,Cr,Pb,Ni,Se,Ag
35	-1.0g -HNO_3, H_2O_2 -flask and hot plate	GFAAS- Cd,Pb,Cr,Ni,Ag HGAAS- As,Se ICPAES- Sn,Zn,Cu,Fe,Al
36	-0.5g -HNO_3, H_2SO_4 -flask and hot plate	GFAAS- Cd ICPAES- Mn,Pb,Fe,Zn,Ni,Cu
37	NA	
38	-0.5g -HNO_3, H_2O_2 -flask and hot plate	GFAAS- Ag,As,Cd,Cu,Pb,Ni,Se ICPAES- Cr,Zn
39	-0.25g -HNO_3 -flask and hot plate	FAAS- Zn,Cu GFAAS- Ag,Cd,Ni,Cr,Cu
	-0.25g -HCl -dry ash	HGAAS- As,Se

Lab No.	Tissue Preparation Procedure	Instrumentation
40	-0.5g -HNO_3, H_2O_2 -closed vessel -microwave heating	GFAAS- Cd,Ag,Se ICPAES- As,Cr,Cu,Ni,Pb,Zn
41	-0.4g -HNO_3, H_2O_2, HCl -closed vessel -microwave heating	FAAS- Al,Fe,Cu,Zn GFAAS- Cr,Ni,As,Se,Ag,Cd,Sn,Pb
42	-0.5g -HNO_3, $HClO_4$, HCl -closed vessel -microwave heating	GFAAS- Cr,Ni,Pb,Ag HGAAS- As,Se ICPAES-Fe,Cu,Zn,Cd,Ag
43	-1g -HNO_3, HCl -flask and hot plate	FAAS- Cu,Zn GFAAS- Cd,Cu,Ni,Pb,Ag
44	-0.5g -HNO_3 -closed vessel -microwave heating	ICPMS-Al,Cr,Fe,Ni,Cu,Zn,As Se,Ag,Cd,Sn,Pb
45	-0.25g -HNO_3, H_2O_2 -closed vessel -microwave heating	GFAAS-Cr,Ni,Cu,As,Se, Ag,Cd,Pb ICPAES- Al,Fe,Zn,
46	-0.25g -HNO_3,H_2O_2 -HF (Al) -closed vessel -microwave heating	IDICPMS-Cr,Zn,Ag,Cd,Sn,Pb ICPAES-Al

TABLE D-3
Dissolution Procedures for the Determination of Mercury

Lab No.	Sediment Dissolution	Tissue Dissolution	Instrumentation
1	-0.5g -HNO_3, HCl -flask and hot plate	-0.5g -HNO_3 -closed vessel	ICPMS
2	-0.5g -HNO_3, HCl -flask and hot plate	NA	CVICPAES
3	-0.25g -HNO_3, H_2SO_4 -closed vessel		CVAAS
4	-0.25g -HNO_3, H_2SO_4 -heat on water bath	NA	CVAAS
5	-0.70g -HNO_3, H_2SO_4 -heat to 95°C	-1.30g -HNO_3, H_2SO_4, $KMnO_4$, $K_2S_2O_8$ -heat to 95°C	CVAAS
6	-0.5g -HNO_3, HCl -flask and hot plate		CVAAS
7	NA	-0.5g -HNO_3 -microwave heating	CVAAS
8	-0.25g (0.5g sediments) -HNO_3 -microwave heating		ICPMS (isotope dilution)
9	-0.2g -HNO_3, HF, $HClO_4$ -closed vessel -oven at 130°C	-0.3g -HNO_3, HCl -closed vessel -oven at 130°C	CVAAS
10	-0.25g -HNO_3, H_2SO_4 -flask and hot plate		CVAFS

Lab No.	Sediment Dissolution	Tissue Dissolution	Instrumentation
11	-0.45g -HNO_3, H_2SO_4, $KMnO_4$ -heat on water bath		CVAAS
12	-0.5g -HNO_3, HF, HCl -closed vessel -heat on steam bath	-0.5g -HNO_3, HCl -closed vessel -microwave heating	ICPMS
13	NA		
14	NA	-1.0g -HNO_3, H_2O_2 -flask and hot plate	CVAAS
15	NA	-2g -HNO_3, H_2O_2 -flask and hot plate	CVAAS
16			
17	NA	-0.1g -HNO_3, HCl -closed vessel -microwave heating	CVAFS
18	-0.100g -HNO_3, $Na_2Cr_20_7$ -flask and hot plate	NA	CVAAS
19	NA		
20	-0.5g -HNO_3, $HClO_4$, (HF sediments) -closed vessel -heat in oven to 130°C		CVAAS
21	-0.25g -HNO_3, HF, HCl -closed vessel -microwave heating	-0.25g -HNO_3, H_2O_2 -closed vessel -microwave heating	CVAAS
22	-0.7g -HNO_3, HCl -flask and hot plate	NA	CVAAS
23	NA		

Lab No.	Sediment Dissolution	Tissue Dissolution	Instrumentation
24	-0.2g -HNO_3, HCl, $KMnO_4$ -heat on water bath	-0.2g -HNO_3, H_2SO_4, $KMnO_4$ -heat on water bath	CVAAS
25	-0.4g -HNO_3, HF, $HClO_4$ -microwave heating	NA	CVAAS
26	-0.500g -HNO_3, HCl -flask and hot plate	-1.000g -HNO_3, H_2O_2 -flask and hot plate	CVAAS
27	NA		
28	-1.0g -HNO_3, HCl -flask and hot plate	-0.5g -HNO_3, $HClO_4$ -flask and hot plate	CVAAS
29	-0.2g -HNO_3, HF -closed vessel	-0.2g -HNO_3 -closed vessel	CVAAS
30	-0.2g -HNO_3 -closed vessel -microwave heating	-0.1g -HNO_3 -closed vessel -microwave heating	CVAAS
31	NA		
32	-0.5g -HNO_3, HCl -closed vessel	NA	CVAAS
33	NA		
34	-0.3g -HNO_3, H_2SO_4 -$KMnO_4$, $K_2S_2O_8$ -autoclave heating		CVAAS
35	-1.00g -HNO_3, HCl -flask and hot plate	-HNO_3, H_2O_2 -bromine chloride	CVAAS
36	-0.5g -HNO_3, HCl -flask and hot plate	NA	CVAAS

Lab No.	Sediment Dissolution	Tissue Dissolution	Instrumentation
37	-0.5-1.0g -HNO_3, H_2O_2 -water bath at 95°C	-0.1-0.25g -HNO_3, H_2SO_4 -water bath at 60°C	CVAAS
38	-0.5g -HNO_3, H_2SO_4 -flask and hot plate		CVAAS
39	NA	-0.25g -HNO_3 -flask and hot plate	CVAAS
40	NA		
41	-1.0g -HNO_3, H_2O_2, H_2SO_4, HCl -$KMnO_4$, $K_2S_2O_8$ -flask and hot plate		CVAAS
42	-0.5g -HNO_3, HCl -closed vessel -microwave heating	-0.5g -HNO_3, Hcl, $HClO_4$ -closed vessel -microwave heating	CVAAS
43	NA		
44	-0.4g -HNO_3, HF, $HClO_4$ -closed vessel -microwave heating	-0.5g -HNO_3 -closed vessel -microwave heating	ICPMS
45	-1.0g -HNO_3, H_2SO_4, $HClO_4$ -flask and hot plate		CVAAS
46	-0.25g -HNO_3, H_2O_2 -closed vessel -microwave heating		IDICPMS