

MDN
Annual QA Report

1997

FRONTIER GEOSCIENCES INC.

414 Pontius Avenue North

Seattle, WA 98109

206-622-6960

fax 206-622-6870

MDN 1997 ANNUAL QA REPORT

Prepared by Toni L. GauthierDickey

Quality Assurance Officer

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I. Introduction

The Mercury Deposition Network (MDN) has been analyzing weekly precipitation samples for total mercury since January of 1996 (contract period began in March, 1996). The study now incorporates 30 sites from around the United States, an increase of 9 since 1996. MDN is expected to add an additional 10 sites, bringing the total to 40 in 1998.

Bob Brunette took over the MDN project from Joe Tokos in March of 1997 and now coordinates all analytical processes from sample receipt to scientific reports. The Atmospheric laboratory technician processes incoming samples and analyzes them on a weekly basis, freeing Mr. Brunette up for client consulting, scientific reports, site liaison and project coordination.

Quality control is adhered to both in the laboratory and in the field. The MDN project saw an increase in quality control points from 301 to 444, which corresponds to the increase in number of sites in 1997 and demonstrates Frontier's commitment to quality assurance. The site liaison, Mr. Brunette, reviews weekly rain gauge charts, verifying chart dates and times. Site equipment failures or procedural errors are addressed quickly and sufficient replacement stocks of field supplies are maintained at Frontier.

Quality control protocols within the laboratory were overseen in 1997 by Frontier's Quality Assurance Officer, Toni GauthierDickey. Analysis records are kept on file in a fireproof cabinet and are readily available for review. In addition, Mr. Brunette prepares quarterly quality assurance reports, with quality control parameters listed in tabular format.

II. A General Description of Frontier's QA/QC

A. QA/QC

Quality Assurance (QA) is a system for ensuring that all information, data and interpretation resulting from an analytical procedure are technically sound, statistically valid and appropriately documented. Quality Control (QC) is the mechanism used to achieve quality assurance.

B. Data Quality Objectives

Data quality is achieved through Frontier's Data Quality Objectives (DQO's). Our DQO's consist of five components: precision, accuracy, representativeness, comparability and completeness (PARCC).

- Precision is a measure of data repeatability; it is measured by using sample replicates.
- Accuracy is a measure of how close the data is to the actual, or real value, and is measured by certified reference materials and matrix spikes.
- Representativeness is a measure of how typical a sample is compared to the sample population. It is achieved by accurate, artifact-free sampling procedures and appropriate sample homogenization.
- Comparability is a measure of how variable one set of data is to another.
- Completeness is a measure of how many data points collected are usable; Frontier strives for 95% completeness.

III. QC Procedures

A. Lab-Run Bottle Blanks

Lab sample bottle blanks are expected to be at or near the method detection limit (MDL). In cases where the blanks are significantly higher than the MDL, the situation is examined. Possible sources of contamination are looked for and identified. Once the problem has been found and corrected, the run continues. Lab blanks are control charted on an ongoing basis, helping to identify trends or anomalies.

The mean average for 1997 lab sample bottle blanks is 0.045 ng/L (n=21). The standard deviation is 0.019 ng/L. Numbers may be found in tabular format in Appendix A, while control charts are listed in Appendix B.

B. BrCl Reagent Blanks

BrCl reagent blanks are a measure of how much analyte may be found in the bromine monochloride used for oxidizing the samples. The BrCl reagent blanks help to narrow down possible sources of contamination.

The mean average for 1997 BrCl blanks is 0.143 ng/L (n=53). The standard deviation is 0.067 ng/L. Numbers may be found in tabular format in Appendix A, while control charts are listed in Appendix B.

C. Replicate Samples

A replicate sample is run with each analytical set. The relative percent difference (RPD) is calculated and is expected to be less than 25%. If the result is higher than 25% then the analysis is re-run. If the result is still higher than 25%,

then the problem is looked into and possible causes are identified and noted on the report.

The mean average for 1997 RPD's is 3.9% (n=152). The standard deviation is 4.52%. One result was out-of-control at 26.4 RPD. Two other sample replicates were run with that set with both results falling within acceptable quality control limits. Numbers may be found in tabular format in Appendix A, while control charts are listed in Appendix B.

D. Reference Samples

Reference samples are a way to compare the sample results with a known, certified value. This is a useful tool for comparing matrix spikes and for validating the analytical curve. The acceptance range for the reference samples is 75-125%. If the percent recovery lies out of this range the problem is identified, corrected and the instrument is recalibrated. If the percent recovery is within the acceptance range the analysis continues.

The mean average for 1997 SRM's is 97.2% recovery (n=78). The standard deviation is 5.8%. All reference samples fell within the designated parameters in 1997. Numbers may be found in tabular format in Appendix A, while control charts are listed in Appendix B.

E. Matrix Spikes

Matrix spikes are a tool for determining if and how the matrix of a sample interferes with the analyte. Matrix spikes tell us two things: does the analyte in the sample go through the analytical system the same way the analyte in the standards does, and are we able to carry analyte through the analytical system without significant losses.

Matrix spikes falling with 75-125% recovery are considered valid. Matrix spikes falling outside these parameters must be rerun. If the spike continues to fall outside of 75-125% recovery then possible causes must be looked for and identified.

The mean average for 1997 matrix spikes is 101.1% recovery (n=140). The standard deviation is 8.1%. There was just one incident of a matrix spike falling outside quality control limits. Numbers may be found in tabular format in Appendix A, while control charts are listed in Appendix B.

G. Quarterly Reports

Once per quarter Mr. Brunette prepares a quality control report, outlining quality control results in tabular format. Trends and anomalies are looked for, and if found, are identified. Possible causes must then be looked for by

examining the original dataset. Conclusions are then summarized and included in the report.

H. Performance Evaluation Studies

Frontier routinely performs outside performance evaluation samples at least twice per year. Studies that Frontier participated in 1997 include EPA's WP037 and WP038 studies, Analytical Products Group, National Water Institute and USGS. Frontier made PE studies a priority in 1997, as is evidenced by the decrease of "check for error" and "unacceptable" results in the EPA studies. Results from the most recent EPA study (WP038) have been included in Appendix B.

IV. 1998 Outlook

MDN experienced a period of change and growth during 1997. Several aspects are still being fine-tuned and will be worked on with the QA Officer in 1998. The 1997 QA Officer is leaving Frontier Geosciences Inc. to pursue other opportunities and the new QA Officer is Beverly Heaphey, formerly lead Aquatics analyst. Ms. Heaphey's extensive analytical experience with mercury will be a great benefit to the MDN project. Ms. GauthierDickey will continue to be available to Ms. Heaphey as a consultant to smooth over the transition and to answer any QA-specific questions.

Other areas that will be undergoing change and improvement in 1998 include:

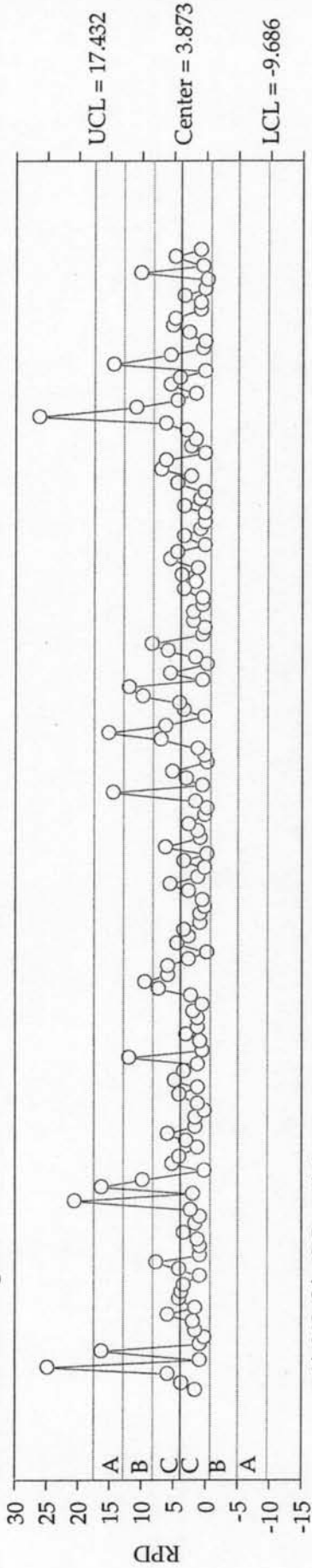
- addition of 10 sites
- bi-annual blind-spike analysis
- weekly control charting of QC samples
- complete implementation of weekly air and water monitoring system started in 1997 (systems are currently monitored, but not on a set schedule)

V. Appendix A
QC Table

VI. Appendix B
Control Charts

Replicate Analysis

I Line Chart
 Range Span: 2
 Control Limits: 3 Sigma



97-1
97-2
97-3
97-5
97-6
97-7
97-8
97-10
97-11
97-12
97-13
97-14 (#4)
97-15 (#5)
97-17 (#4)
97-17 (#4)
97-18 (#4)
97-19 (#5)
97-20 (#4)
97-21 (#4)
97-22 (#4)
97-22 (#4)
97-23 (#4)
97-24 (#5)
97-25 (#4)
97-26 (#5)
97-27 (#4)
97-28 (#5)
97-29 (#5)
97-30 (#4)
97-31 (#4)
97-32 (#5)
97-33 (#4)
97-35 (#5)
97-36 (#4)
97-37 (#4)
97-39 (#4)
97-40 (#5)
97-41 (#4)
97-41.5 (#4)
97-42 (#5)
97-42 (#5)
97-43 (#4)
97-44 (#4)
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97-49 (#5)
97-50 (#4)
97-51 (#4)
97-52 (#5)

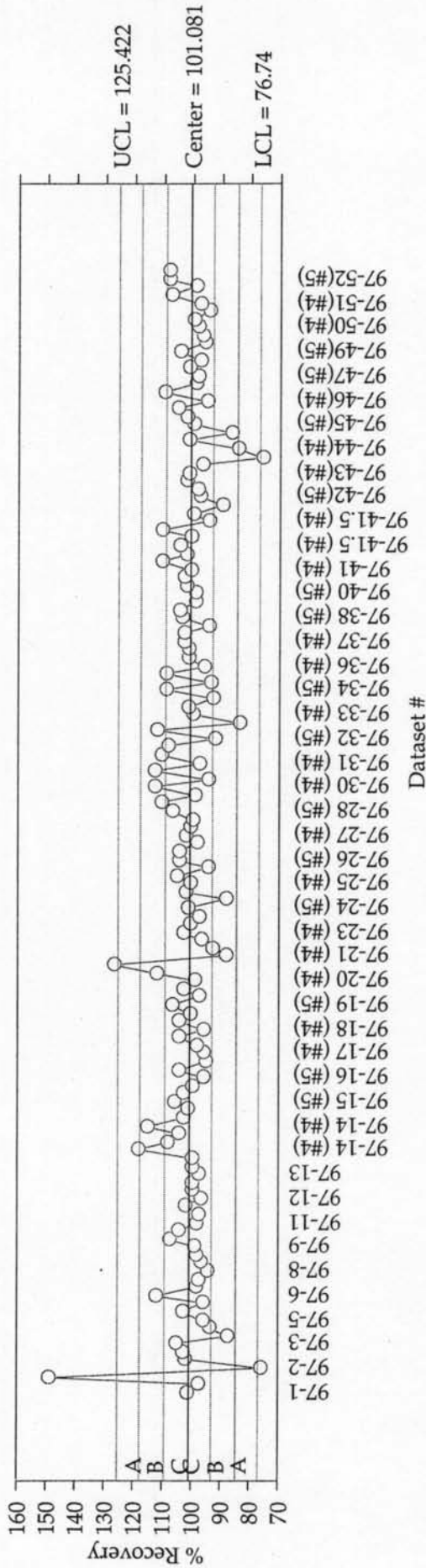
Dataset #

Summary Table for RPD
 Grouping Variable: Dataset #
 Range Span: 2

K Sigma	3.000
Alpha	•
Sigma	4.520
Xbar	3.873
MRbar	4.056
# Obs.	152
# Missing	0

Matrix Spike % Recovery

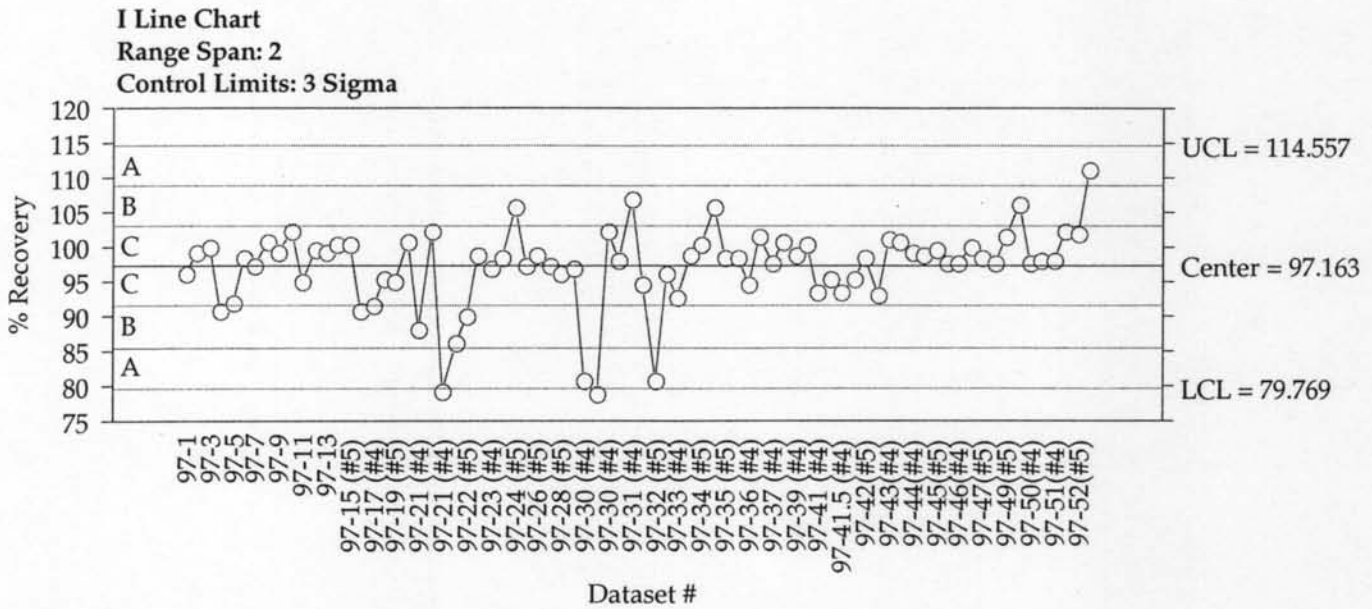
I Line Chart
 Range Span: 2
 Control Limits: 3 Sigma



Summary Table for % Recovery
 Grouping Variable: Dataset #
 Range Span: 2

K Sigma	3.000
Alpha	•
Sigma	8.114
Xbar	101.081
MRbar	8.101
# Obs.	140
# Missing	0

Standard Reference Material % Recovery



Summary Table for % Recovery

Grouping Variable: Dataset #

Range Span: 2

K Sigma	3.000
Alpha	•
Sigma	5.798
Xbar	97.163
MRbar	4.798
# Obs.	78
# Missing	0

VII. Appendix C
EPA WP038 Results

