

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

National Atmospheric Deposition Program

Mercury Deposition Network

**Mercury Analytical Lab
2002 Annual Quality Assurance Report**



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3. Analytical Performance Group – WP Performance Summary - Trace Metals In Surface Waters – August 2002
4. Analytical Products Group – DMRQA 22 – Trace Metals In Surface Waters – December 2002
5. Analytical Products Group – WP Performance Summary – April 2002

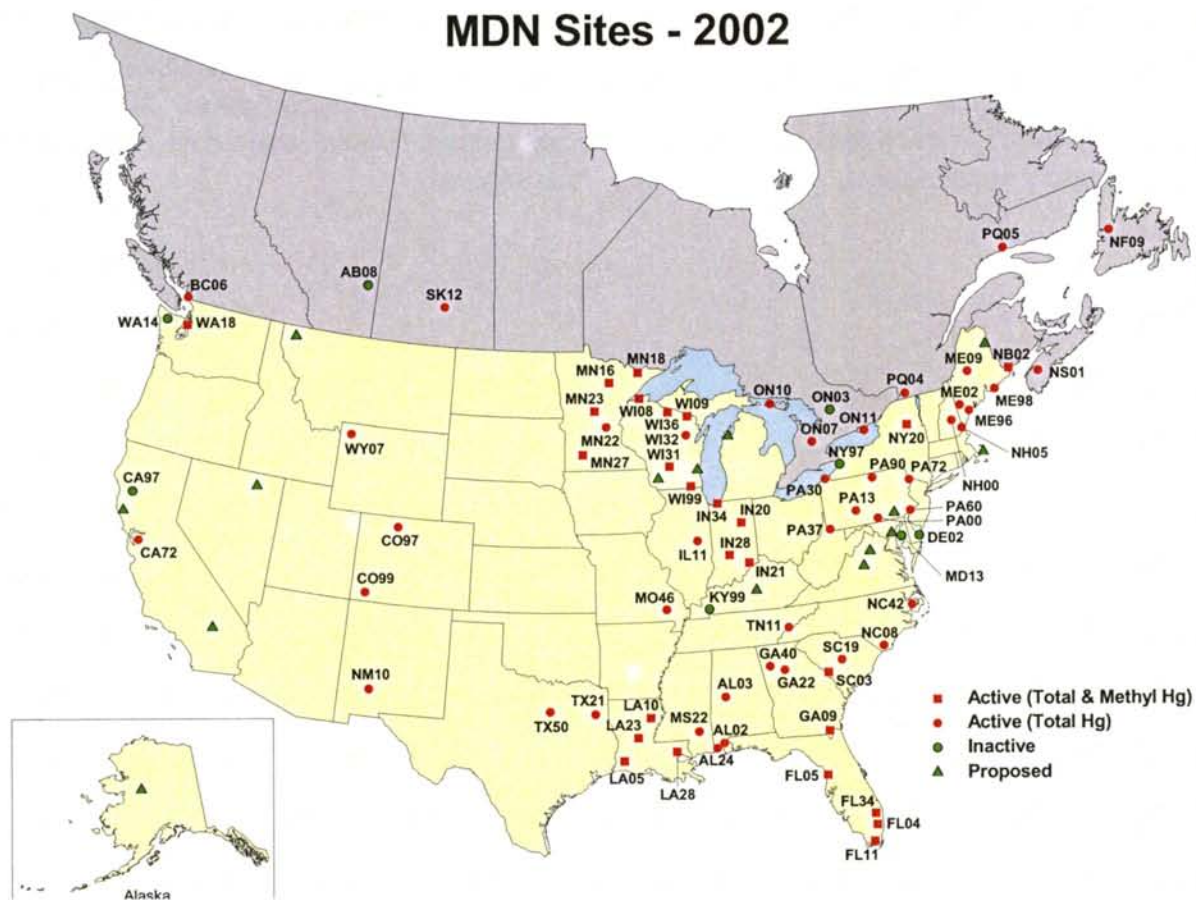
Appendix D: Examples Of Laboratory Intercomparison Studies – 2002

- 1 15th Intercomparison For Trace Elements In Marine Sediments and Biological Tissues – National Research Council Canada – May 2002

Note Frontier participated in many Intercomparisons Studies, however, all those that Frontier was invited to participate in were for Trace Metals, not including mercury. We therefore decided to exclude these from this report. Frontier will be performing two HAL, real rainwater matrix intercomparison studies as was done in 1999.

I. Introduction

Since January of 1996, Frontier Geosciences Inc. (Frontier) has served as the Hg Analytical Lab (HAL) and Site Liaison center for the Mercury Deposition Network (MDN). The MDN, coordinated through the National Atmospheric Deposition Program (NADP), was designed with the primary objective of quantifying the wet deposition of mercury in North America to determine long-term geographic and temporal distributions. The Network has grown to incorporate over 75 sites in the United States and Canada. In 2003, the MDN is expected to add 10-15 additional new sites.



As the HAL, Frontier receives weekly precipitation samples to be analyzed for total mercury. The analytical technique—Modified EPA Method 1631 Revision B—was developed by Nicolas S Bloom, one of Frontier’s Senior Research Scientists. Frontier also served as the referee lab for the Method 1631 final validation study.

Robert Brunette, Project Investigator and HAL Director, oversees Frontier’s involvement in the MDN. He serves as the MDN Liaison, HAL contact for the multiple agencies currently sponsoring the MDN, and as Chair of the Data Management and Analysis Subcommittee for the NADP. His multiple roles require him to provide guidance and direction to all HAL staff, and to maintain his proficiency at all aspects of HAL activities, including MDN site selection and equipment installation, MDN equipment troubleshooting, field and laboratory training, analysis and report writing, as well as research on new MDN initiatives including Trace Metals (in addition to Hg) in Wet Deposition. Mr. Brunette is supported by an analytical laboratory staff skilled in processing incoming samples, analyzing sample sets,

cleaning glassware, shipping weekly field equipment, and entering data. Senior Research Scientist, Eric M. Prestbo, serves as Science Advisor for the HAL, and helps support MDN related research initiatives. The Project Investigator also works closely with Frontier’s Laboratory Manager, Michelle Gauthier, and Will Hagan, Frontier’s Quality Assurance Program Director, to ensure that all quality control (QC) parameters are consistently maintained, and that Frontier’s high standards of professional and scientific quality are met.

Frontier continued to maintain and demonstrate high quality control standards in 2002. Due to the addition of new MDN sites, the number of quality control points increased from 1214 in 2001 to greater than 1500 quality control measurements in 2002. Frontier further demonstrated excellent consistency and reproducibility with Reagent (1% BrCl Preservative) Blanks, Bottle Blanks, Standard Reference Materials, Matrix Duplicates, and Matrix Spikes. All of these parameters are control charted in Appendix A of this report.

II. General Description of Frontier's Quality Assurance Program

A. Quality Assurance and Quality Control

Frontier has a strong and vital commitment to its Quality Assurance Program, viewing quality assurance as a program and a philosophy. We begin quality control at the bench level, and continuously work to improve our processes at the management level. Our management style is to solicit process improvements and problem-solving from our laboratory technicians and analysts, then utilize management to help implement these improvements — rather than the traditional management style of issuing orders which may or may not have much bearing on how things actually work in the laboratory. Our Quality Assurance Program is a system for ensuring that all information, data and interpretation resulting from an analytical procedure are technically sound, statistically valid, and appropriately documented. Our quality control parameters are the mechanisms 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 reproducibility; it is measured by utilizing 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 at least 95% completeness.

III. Quality Control Procedures

A. Bottle Blanks

Bottle blanks are expected to be at or near the method detection limit (MDL). In cases where the blanks are significantly higher, the situation is investigated. Possible contamination sources are researched and identified. Once the problem has been found and corrected, the run is continued. Control charts for bottle blanks are maintained on an ongoing basis, helping to identify trends or anomalies.

The mean for the 2002 lab sample bottle blanks is 0.052 ng/Bottle (n=45) with a standard deviation of 0.066ng/Bottle. Control charts are listed in Appendix A.

B. Reagent Blanks

Reagent blanks consist of 1% (v/v) 0.2N bromine monochloride, 0.2 mL 20% hydroxylamine hydrochloride, and 0.3 mL 20% stannous chloride in 100 mL of reagent water. Reagent blanks are a measure of how much analyte may be found in the bromine monochloride used for oxidizing the samples. Reagent blanks help when researching possible sources of contamination.

The mean for 2002 reagent blanks is 0.069 ng/L (n=305) with a standard deviation of 0.045ng/L. Control charts are listed in Appendix A.

C. Matrix Duplicates

A matrix duplicate 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%, the samples are re-run. If the result is still higher than 25%, then the problem is investigated and possible causes are identified and noted in the report. The mean for 2002 RPD's is 3.60% (n=294) with a standard deviation of 4.2%. Control charts are listed in Appendix A.

D. Certified Reference Material Samples

Certified reference material (CRM) samples are used to compare sample results with a known, certified value. This is a useful tool 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

sample CRM is rerun for more acceptable results. If the percent recovery is within the acceptance range, analysis continues. The CRM used is NIST-1641d - Hg in water.

The mean for 2001 CRMs is 93.4% recovery (n=199) with a standard of 4.2%. All reference samples fell within the designated parameters in 2002. Control charts are listed in Appendix A.

E. Matrix Spike Samples

Matrix spikes are a tool for determining if, and how, the sample matrix interferes with analyte quantification. Matrix spikes help answer two questions:

- 1) Does the analyte in the sample go through the analytical system the same way analyte in the standards does?
- 2) Are we able to carry the analyte throughout the analytical system without significant losses?

Matrix spikes falling within 75-125% recovery are considered valid. Analytical spikes falling outside these parameters must be re-run. If the spike continues to fall outside 75-125% recovery then possible causes must be looked for and identified. The MDN matrix (rainwater) is spiked with 1.00 ng of Hg (II).

The mean for 2002 matrix spikes is 98.8% recovery (n=294). Control charts are listed in Appendix A.

F. Performance Test and Interlaboratory Intercomparison Studies

Performance evaluation and interlaboratory intercomparison studies are a vital part of our Quality Assurance Program. Frontier is a regular participant in studies prepared by the Analytical Products Group, National Water Research Institute (Canada), National Oceanic and Atmospheric Administration (US), National Research Council (Canada), US Geological Survey, the Institute for National Measurement Standards (Canada), and New York State PT samples.

Included in Appendix C area few of the Performance Evaluation Studies Frontier reported in 2002:

1. Wadsworth Center - New York State Dept. Of Health Environmental Laboratory Program - September 2002
2. Wadsworth Center - New York State Dept. Of Health Environmental Laboratory Program - April 2002
3. Analytical Performance Group - WP Performance Summary - Trace Metals In Surface Waters - August 2002
4. Analytical Products Group - DMRQA 22 - Trace Metals In Surface Waters - December 2002
5. Analytical Products Group - WP Performance Summary - April 2002

Included in Appendix D are a few of the Laboratory Intercomparison Studies that Frontier reported in 2001:

1. 15th Intercomparison For Trace Elements In Marine Sediments and Biological Tissues – National Research Council Canada – May 2002.

Note: Frontier participated in many Intercomparisons Studies, however, all those that Frontier was invited to participate in were for Trace Metals, not including mercury. We therefore decided to exclude these from this report.

Frontier will be performing two HAL, real rain-water matrix intercomparison studies as was done in 1999.

Frontier currently holds certifications in seven states, they are: Washington, Wisconsin, Florida, California, New York, New Jersey and Louisiana. We are also pursuing certification status for states where additional Frontier clients reside.

Frontier currently holds certifications in six states, they are: Washington, Wisconsin, Florida, California, New York, New Jersey and Louisiana. We are also pursuing certification status for states where additional Frontier clients reside.

IV. HAL 2003 Outlook

The Mercury Deposition Network continues to gain attention as the largest and longest-running National Hg wet deposition network in North America. Feedback from Sponsors and other interested organizations indicates that the MDN will experience significant growth in 2002-2003. With this growth, the HAL will continue to look for ways to improve the program to ensure the highest quality.

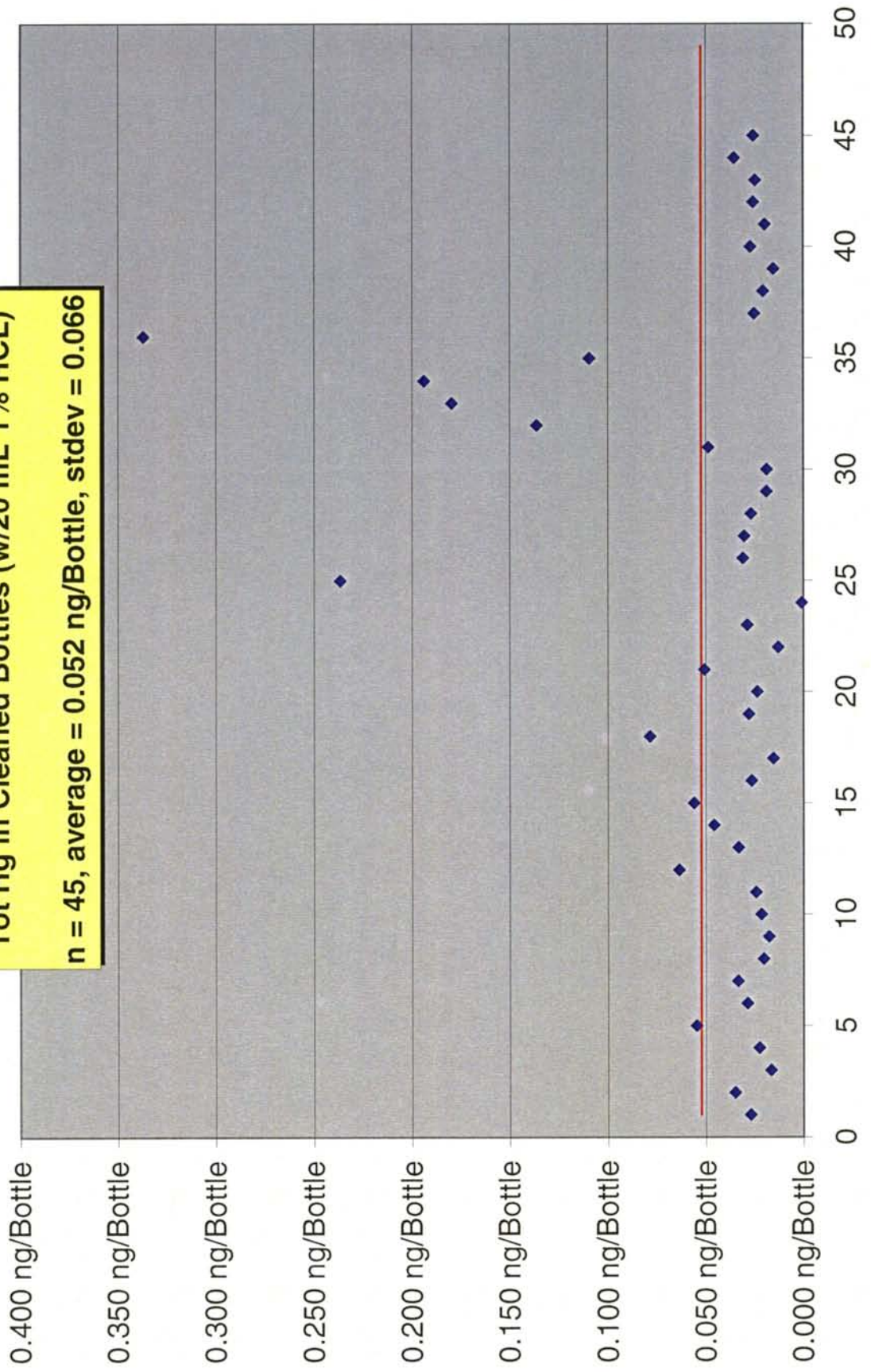
The following are goals the HAL has set to maintain and improve quality throughout 2001-2002:

- The HAL will continue to improve our Database in 2003 and will endeavor to expand the Database to include MMHg data.
- The HAL and PO incorporated dual data entry verification to all database operations for the 4th Qtr of 2002.
- The HAL will be significantly upgrading the MDN facilities in order to stay ahead of the projected growth of the Network in 2002-2003. The HAL was moved to a new, dedicated lab, within the Frontier, early in 2002. The new facilities for MDN will be dedicated instruments, receiving areas, NED and other significant resources that will enable the HAL to keep stride with this growth.
- The HAL will continue trace metals in wet deposition research in 2002. There is a strong indication that there are many sponsors that will want to participate in a Mercury AND Trace Metals program. In 2001, 5 MDN sites were collecting samples for trace metals following the HAL's retrofit and TM SOP.
- The HAL's research in Dry Deposition of Mercury and Trace Metals in sites in the Southern U.S. will continue, likely through 2003. The HAL expects this research to lay the groundwork for a potential non-NADP product for interested MDN sponsors.

Appendix A:

HAL 2002 Annual QA/QC Control Charts

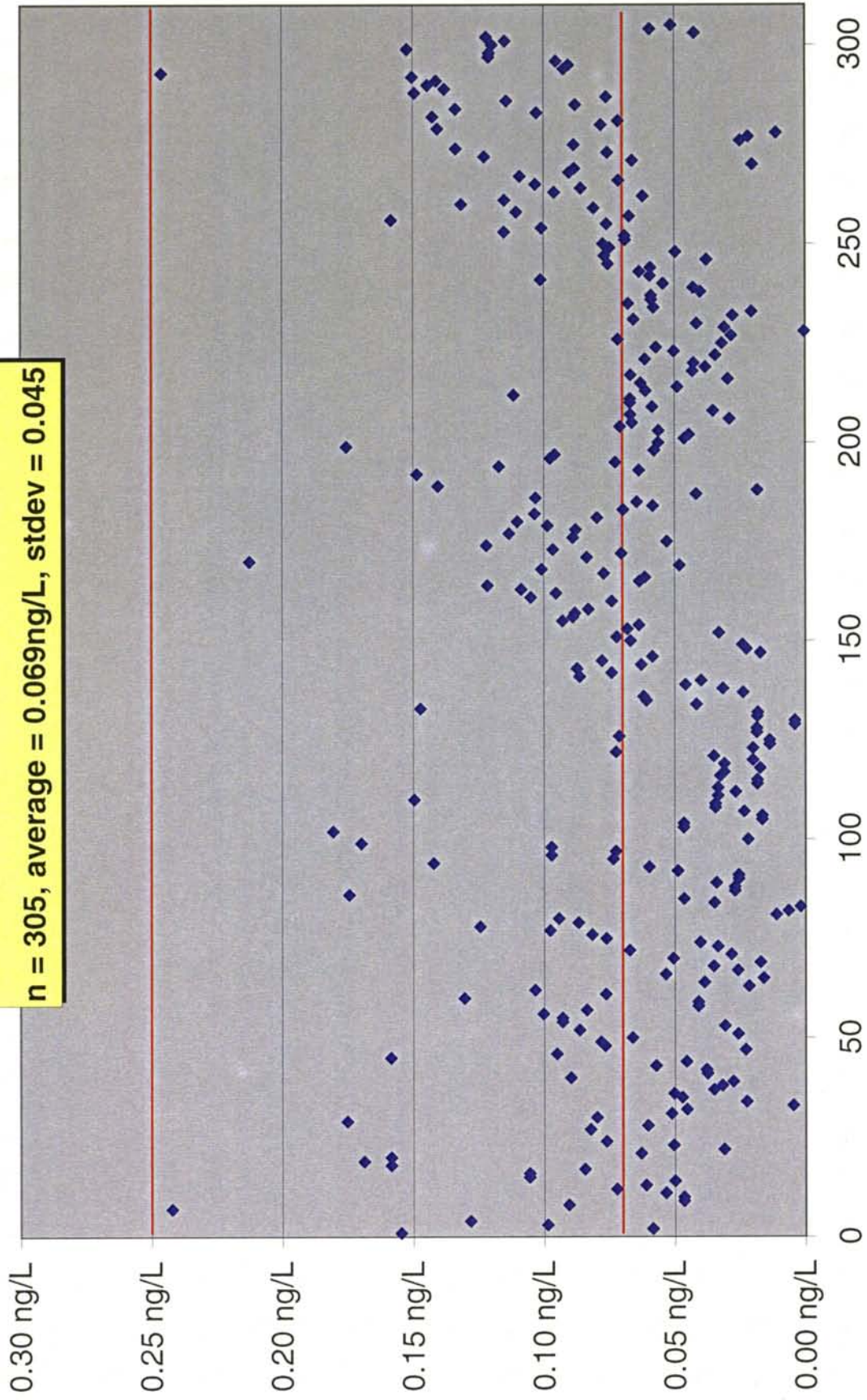
MDN 2002
Tot Hg in Cleaned Bottles (w/20 mL 1% HCL)
n = 45, average = 0.052 ng/Bottle, stdev = 0.066



MDN 2002

THg in 1% BrCl Preservative

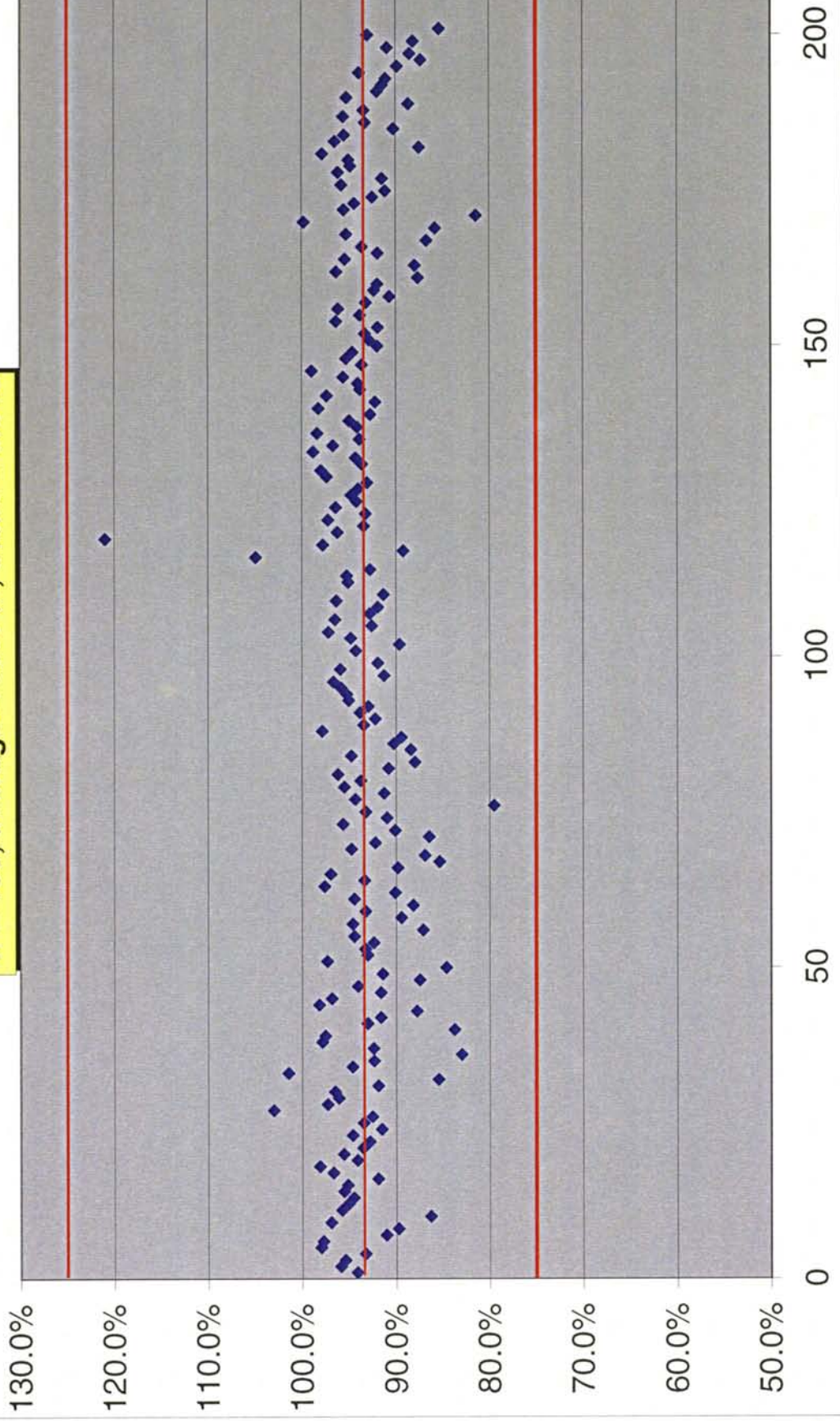
n = 305, average = 0.069ng/L, stdev = 0.045



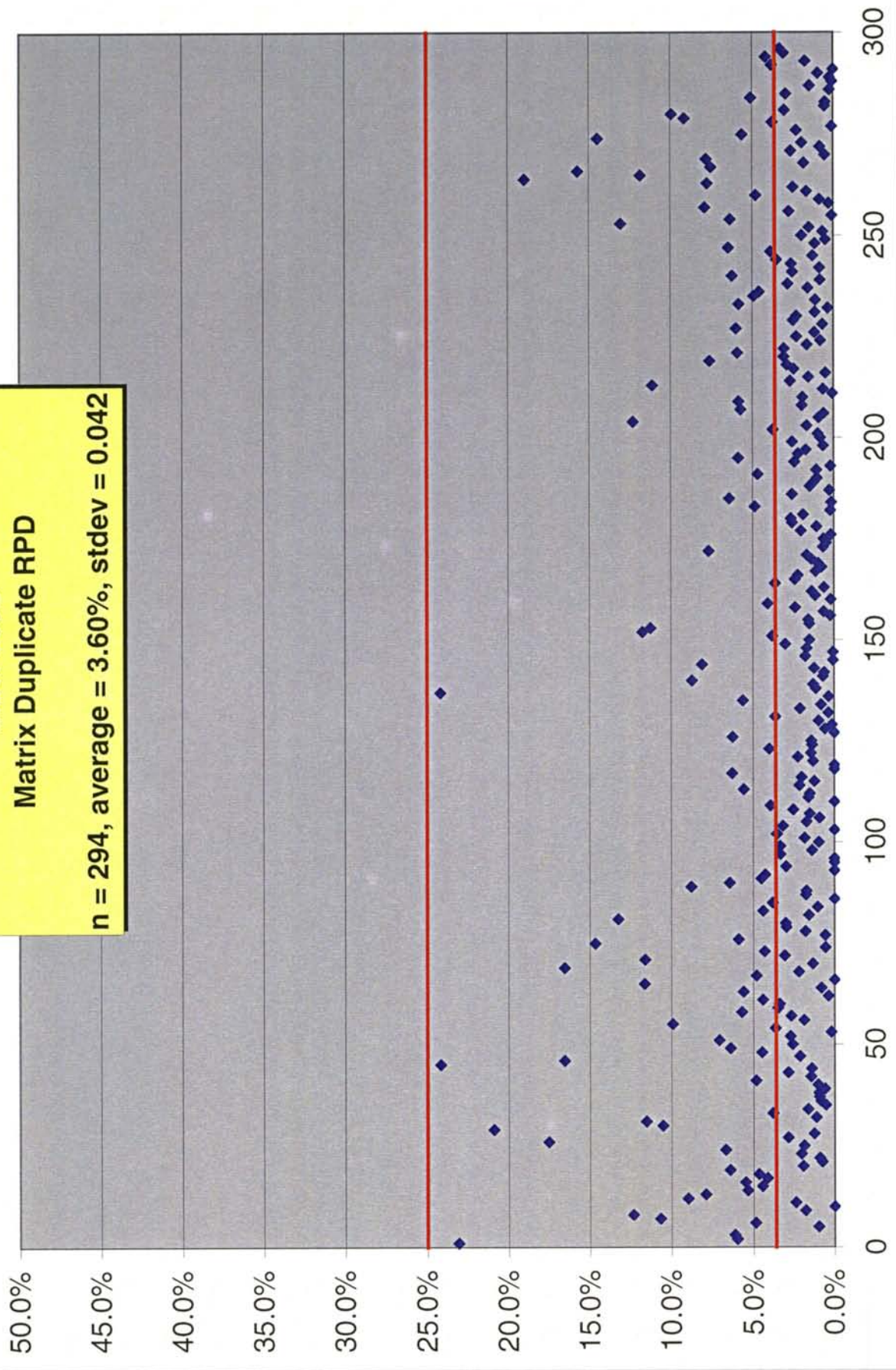
MDN 2002

SRM Recovery

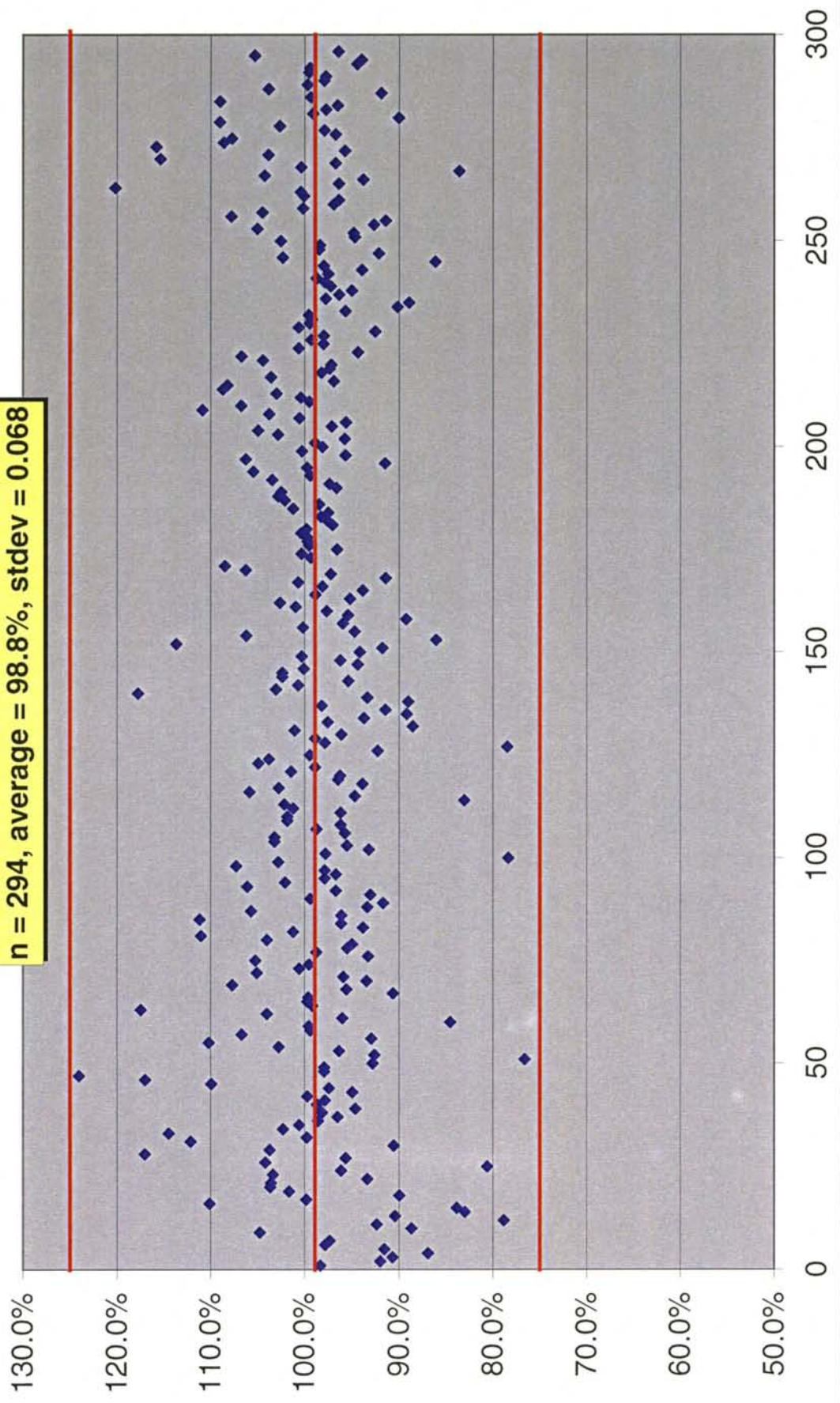
n = 199, average = 93.4 %, stdev = 0.042



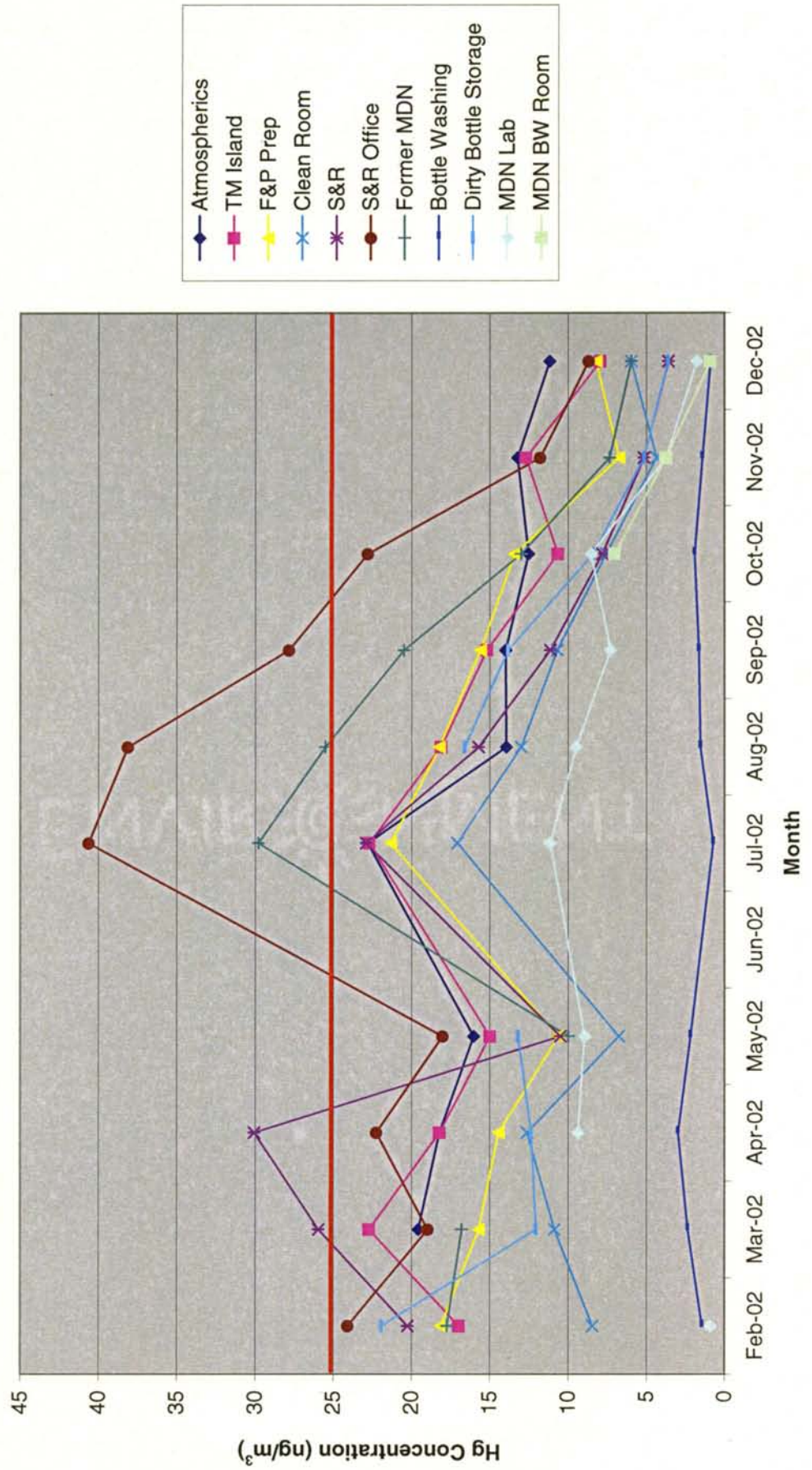
MDN 2002
Matrix Duplicate RPD
n = 294, average = 3.60%, stdev = 0.042



MDN 2002
Matrix Spike Recoveries
n = 294, average = 98.8%, stdev = 0.068



FGS Passive Diffusion Air Monitoring - 2002
Total Mercury (ng/m³)



Appendix B:

HAL 2002 Quarterly QA/QC Summary Tables

MDN Quarterly Analysis QC Summary

Quarter 1 of 2002

Analysis	Calibration R	BrCl Blk Conc	SRM		Duplicates		Spikes		Bottle Blanks	
			Conc	%Rec	Bottle ID	RPD	Bottle ID	Rec.	Bottle ID	Conc
2002-001 CVAFS-5	0.99931	0.104 ng/L	NIST1641d	95.4%	MDN0123	23.1%	MDN0123	98.3%	MDN0123	98.3%
			7.59 ng/mL							
			NIST1641d							
2002-002 CVAFS-4	0.99852	0.104 ng/L	NIST1641d	96.2%	MDN2226	6.2%	MDN2226	90.7%	MDN2226	90.7%
			7.42 ng/mL							
			7.65 ng/mL							
2002-003 CVAFS-1	0.99949	0.049 ng/L	NIST1641d	94.1%	MDN0186	1.0%	MDN0186	91.6%	MDN0186	91.6%
			7.48 ng/mL							
			NIST1641d							
2002-004 CVAFS-6	0.99909	0.061 ng/L	NIST1641d	90.8%	MDN2242	10.7%	MDN2242	97.3%	MDN2242	97.3%
			7.62 ng/mL							
			NIST1641d							
2002-005 CVAFS-1	0.99848	0.099 ng/L	NIST1641d	88.0%	MDN0405	7.9%	MDN0405	90.4%	MDN0405	90.4%
			7.22 ng/mL							
			NIST1641d							
2002-006 CVAFS-6	0.99922	0.162 ng/L	NIST1641d	91.1%	MDN2002	5.4%	MDN2002	83.0%	MDN2002	83.0%
			7.71 ng/mL							
			NIST1641d							
2002-007 CVAFS-5	0.99832	0.048 ng/L	NIST1641d	89.8%	MDN2124	4.5%	MDN2124	83.9%	MDN2124	83.9%
			6.86 ng/mL							
			NIST1641d							
2002-008 CVAFS-4	0.99974	0.023 ng/L	NIST1641d	98.1%	MDN0288	5.5%	MDN0288	110.1%	MDN0288	110.1%
			7.24 ng/mL							
			NIST1641d							
2002-009 CVAFS-5	0.99979	0.163 ng/L	NIST1641d	98.0%	MDN0750	4.7%	MDN0750	90.0%	MDN0750	90.0%
			7.69 ng/mL							
			NIST1641d							
2002-010 CVAFS-12	0.99893	0.059 ng/L	NIST1641d	97.8%	MDN1985	6.4%	MDN1985	101.7%	MDN1985	101.7%
			7.77 ng/mL							
			NIST1641d							
2002-011 CVAFS-5	0.99982	0.025 ng/L	NIST1641d	96.5%	MDN0984	0.8%	MDN0984	103.6%	MDN0984	103.6%
			7.62 ng/mL							
			NIST1641d							
2002-012 CVAFS-1	0.99997	0.039 ng/L	NIST1641d	95.1%	MDN2076	0.9%	MDN2076	93.4%	MDN2076	93.4%
			7.56 ng/mL							
			NIST1641d							
2002-013 CVAFS-1	0.99997	0.039 ng/L	NIST1641d	96.1%	MDN2159	2.1%	MDN2159	103.4%	MDN2159	103.4%
			7.64 ng/mL							
			NIST1641d							
2002-014 CVAFS-5	0.99982	0.025 ng/L	NIST1641d	96.5%	MDN0633	6.7%	MDN0633	96.1%	MDN0633	96.1%
			7.67 ng/mL							
			NIST1641d							
2002-015 CVAFS-5	0.99982	0.025 ng/L	NIST1641d	94.5%	MDN0809	1.9%	MDN0809	80.7%	MDN0809	80.7%
			7.52 ng/mL							
			NIST1641d							
2002-016 CVAFS-1	0.99997	0.039 ng/L	NIST1641d	95.6%	MDN2032	17.5%	MDN2032	104.2%	MDN2032	104.2%
			7.60 ng/mL							
			NIST1641d							
2002-017 CVAFS-1	0.99997	0.039 ng/L	NIST1641d	95.2%	MDN0173	2.9%	MDN0173	95.7%	MDN0173	95.7%
			7.57 ng/mL							
			NIST1641d							
2002-018 CVAFS-1	0.99997	0.039 ng/L	NIST1641d	92.0%	MDN0721	1.3%	MDN0721	117.0%	MDN0721	117.0%
			7.31 ng/mL							
			NIST1641d							
2002-019 CVAFS-1	0.99997	0.039 ng/L	NIST1641d	92.0%	MDN0949	20.9%	MDN0949	103.7%	MDN0949	103.7%
			7.31 ng/mL							
			NIST1641d							
2002-020 CVAFS-1	0.99997	0.039 ng/L	NIST1641d	92.0%	MDN0135	10.5%	MDN0135	90.6%	MDN0135	90.6%
			7.31 ng/mL							
			NIST1641d							
2002-021 CVAFS-1	0.99997	0.039 ng/L	NIST1641d	92.0%	MDN1966	11.6%	MDN1966	112.2%	MDN1966	112.2%
			7.31 ng/mL							
			NIST1641d							
2002-022 CVAFS-1	0.99997	0.039 ng/L	NIST1641d	92.0%	MDN2055	1.1%	MDN2055	99.8%	MDN2055	99.8%
			7.31 ng/mL							
			NIST1641d							
2002-023 CVAFS-1	0.99997	0.039 ng/L	NIST1641d	92.0%	MDN0826	0.035 ng/Bottle	MDN0826	0.035 ng/Bottle	MDN0826	0.035 ng/Bottle
			7.31 ng/mL							
			NIST1641d							

MDN Quarterly Analysis QC Summary

Quarter 1 of 2002

2002-013	2/5/2002 CVAFS-5	0.99980	0.052 ng/L	7.49 ng/mL NIST1641d 94.2%	MDN0272 3.8% MDN0658 1.7% MDN1991 0.6%	MDN0272 114.5% MDN0658 102.3% MDN1991 100.6%
2002-014	2/5/2002 CVAFS-4	0.99998	0.047 ng/L	7.44 ng/mL NIST1641d 93.5%	MDN0155 0.9% MDN0277 1.0% MDN0676 1.0%	MDN0155 98.6% MDN0277 96.5% MDN0676 98.1%
2002-015	2/8/2002 CVAFS-5	0.99981	0.092 ng/L	7.43 ng/mL NIST1641d 93.5%	MDN0274 0.6% MDN0715 1.0% MDN0861 4.8%	MDN0274 94.6% MDN0715 98.7% MDN0861 97.8%
2002-016	2/8/2002 CVAFS-1	0.99984	0.074 ng/L	7.53 ng/mL NIST1641d 94.7%	MDN0669 1.5% MDN0858 2.9% MDN1975 1.4%	MDN0669 99.7% MDN0858 95.0% MDN1975 97.4%
2002-017	2/22/2002 CVAFS-1	0.99993	0.048 ng/L	8.19 ng/mL NIST1641d 103.0%	MDN0927 24.2% MDN1733 16.6% MDN2031 2.2%	MDN0927 110.0% MDN1733 117.0% MDN2031 124.1%
2002-018	2/22/2002 CVAFS-1	0.99858	0.095 ng/L	7.31 ng/mL NIST1641d 91.9%	MDN0668 4.5% MDN1951 6.4% MDN2153 2.6%	MDN0668 97.9% MDN1951 97.9% MDN2153 92.8%
2002-019	3/1/2002 CVAFS-1	0.99899	0.055 ng/L	6.80 ng/mL NIST1641d 85.5%	MDN1740 7.1% MDN1920 2.7% MDN2160 0.2%	MDN1740 76.6% MDN1920 92.6% MDN2160 96.3%
2002-020	3/1/2002 CVAFS-1	0.99921	0.103 ng/L	7.34 ng/mL NIST1641d 92.4%	MDN0113 3.7% MDN0795 10.0% MDN0849 1.9%	MDN0113 102.8% MDN0795 110.2% MDN0849 92.9%
2002-021	3/15/2002 CVAFS-1	0.99910	0.026 ng/L	7.52 ng/mL NIST1641d 94.6%	MDN0295 2.7% MDN0934 5.7% MDN2163 3.5%	MDN0295 106.7% MDN0934 99.4% MDN2163 99.6%
2002-022	3/15/2002 CVAFS-1	0.99852	0.038 ng/L	7.74 ng/mL NIST1641d 97.3%	MDN0774 3.4% MDN2054 4.4% MDN2099 0.4%	MDN0774 84.6% MDN2054 96.0% MDN2099 104.0%
2002-023	3/22/2002 CVAFS-1	0.99939	0.032 ng/L	6.66 ng/mL NIST1641d 83.8%	MDN0132 5.6% MDN2095 0.8% MDN2121 11.7%	MDN0132 117.5% MDN2095 99.2% MDN2121 99.7%
2002-024	3/22/2002 CVAFS-1	0.99876	0.047 ng/L	7.40 ng/mL NIST1641d 93.0%	MDN0144 4.8% MDN0692 2.2% MDN1923 2.2%	MDN0144 99.6% MDN0692 90.7% MDN1923 95.6%
				7.29 ng/mL NIST1641d 91.7%		
				7.27 ng/mL NIST1641d 91.4%		
				6.73 ng/mL NIST1641d 84.7%		
						MDN2142 0.017 ng/Bottle MDN2237 0.022 ng/Bottle

MDN Quarterly Analysis QC Summary

Quarter 1 of 2002

2002-025 CVAFS-1	3/23/2002 0.99972	0.085 ng/L	NIST1641d	MDN0695	16.6%	MDN0695	107.7%
			7.35 ng/mL	MDN1935	1.3%	MDN1935	93.5%
			NIST1641d	MDN2101	11.6%	MDN2101	95.9%
2002-026 CVAFS-1	3/23/2002 0.99848	0.102 ng/L	NIST1641d	MDN0255	3.1%	MDN0255	105.1%
			6.98 ng/mL	MDN0796	4.3%	MDN0796	100.6%
			NIST1641d	MDN2028	0.6%	MDN2028	99.5%
2002-027 CVAFS-1	3/29/2002 0.99981	0.007 ng/L	NIST1641d	MDN0150	14.7%	MDN0150	105.3%
			7.70 ng/mL	MDN0801	5.9%	MDN0801	93.3%
			NIST1641d				
2002-028 CVAFS-1	3/29/2002 0.99969	0.085 ng/L	NIST1641d	MDN0747	0.6%	MDN0747	98.8%
			7.48 ng/mL	MDN0783	1.8%	MDN0783	95.5%
			NIST1641d	MDN0911	3.0%	MDN0911	95.0%
Quarterly Mean:		0.069 ng/L	93.6%	5.2%	98.8%	0.028 ng/Bottle	
Std Dev:		±0.039	±4.2%	±5.4%	±9.2%	±0.011	

MDN Quarterly Analysis QC Summary

Quarter 2 of 2002

2002-039	5/3/2002 CVAFS-1	0.99990	0.027 ng/L	7.41 ng/mL NIST1641d 93.2%	MDN0870 MDN2211 MDN2255	1.5% 5.6% 2.2%	MDN0870 MDN2211 MDN2255	101.2% 102.2% 83.1%	MDN1755	0.013 ng/Bottle
2002-040	5/3/2002 CVAFS-1	0.99921	0.043 ng/L	7.60 ng/mL NIST1641d 95.7%	MDN0181 MDN1921 MDN2095	1.3% 2.0% 6.3%	MDN0181 MDN1921 MDN2095	94.7% 105.9% 102.7%	MDN2060 MDN2168	0.024 ng/Bottle 0.024 ng/Bottle
2002-041	5/10/2002 CVAFS-1	0.99800	0.016 ng/L	7.18 ng/mL NIST1641d 90.3%	MDN0960 MDN2181 MDN2237	1.3% 1.3% 1.3%	MDN0960 MDN2181 MDN2237	93.9% 96.4% 96.3%	MDN0198 MDN1955	0.015 ng/Bottle 0.064 ng/Bottle
2002-042	5/10/2002 CVAFS-1	0.99945	0.036 ng/L	7.78 ng/mL NIST1641d 97.8%	MDN1931 MDN2077 MDN2094	2.3% 1.5% 4.0%	MDN1931 MDN2077 MDN2094	101.4% 98.9% 104.9%		
2002-043	5/17/2002 CVAFS-1	0.99954	0.009 ng/L	7.43 ng/mL NIST1641d 93.4%	MDN0678 MDN0759 MDN2024	1.4% 1.4% 6.3%	MDN0678 MDN0759 MDN2024	103.8% 99.5% 92.3%	MDN2231	0.079 ng/Bottle
2002-044	5/17/2002 CVAFS-1	0.99704	0.030 ng/L	7.03 ng/mL NIST1641d 88.4%	MDN2018		MDN2018	78.5%		
2002-045	5/24/2002 CVAFS-9	0.99979	0.049 ng/L	5.86 ng/mL NIST1641d 73.6%	MDN0159 MDN0710 MDN2032	0.6% 0.1% 1.0%	MDN0159 MDN0710 MDN2032	97.9% 98.9% 96.1%		
2002-046	5/24/2002 CVAFS-1	0.99990	0.039 ng/L	7.50 ng/mL NIST1641d 94.3%	MDN0391 MDN1967 MDN2147	3.6% 0.4% 2.1%	MDN0391 MDN1967 MDN2147	101.1% 88.6% 97.6%		
2002-047	5/31/2002 CVAFS-9	0.99951	0.083 ng/L	7.26 ng/mL NIST1641d 91.3%	MDN0121 MDN0893 MDN2059	0.8% 5.6% 0.4%	MDN0121 MDN0893 MDN2059	93.7% 89.2% 91.5%	MDN2231	0.056 ng/Bottle
2002-048	6/6/2002 CVAFS-1	0.99948	0.066 ng/L	7.59 ng/mL NIST1641d 95.5%	MDN0974 MDN2081 MDN2256	24.2% 1.1% 1.3%	MDN0974 MDN2081 MDN2256	98.2% 89.1% 93.4%		
2002-049	6/7/2002 CVAFS-1	0.99990	0.021 ng/L	7.45 ng/mL NIST1641d 93.8%	MDN0126 MDN1958 MDN3003	8.7% 0.7% 0.6%	MDN0126 MDN1958 MDN3003	117.8% 103.1% 100.7%	MDN2127	0.027 ng/Bottle
2002-050	6/7/2002 CVAFS-9	0.99993	0.057 ng/L	7.13 ng/mL NIST1641d 89.6%	MDN0166 MDN0929 MDN2128	1.3% 8.1% 0.1%	MDN0166 MDN0929 MDN2128	95.4% 102.4% 102.4%		
				7.54 ng/mL NIST1641d 94.8%						
				7.33 ng/mL NIST1641d 92.2%						
				7.46 ng/mL NIST1641d 93.9%						
				7.39 ng/mL NIST1641d 93.0%						
				7.56 ng/mL NIST1641d 95.0%						
				7.57 ng/mL NIST1641d 95.3%						
				7.62 ng/mL NIST1641d 95.8%						

MDN Quarterly Analysis QC Summary

Quarter 2 of 2002

2002-051	6/13/2002 CVAFS-9	0.99902	0.075 ng/L	7.68 ng/mL NIST1641d 7.26 ng/mL	MDN0648 MDN2143 MDN3012	1.8% 0.1% 1.7%	MDN0648 MDN2143 MDN3012	100.1% 94.4% 96.2%
2002-052	6/13/2002 CVAFS-1	0.99960	0.087 ng/L	7.63 ng/mL NIST1641d 7.31 ng/mL	MDN1939 MDN2199 MDN2248	3.0% 1.5% 3.8%	MDN1939 MDN2199 MDN2248	100.3% 94.2% 91.8%
2002-053	6/19/2002 CVAFS-10	0.99984	0.057 ng/L	7.82 ng/mL NIST1641d 7.48 ng/mL	MDN0746 MDN0937 MDN2239	11.8% 11.3% 1.5%	MDN0746 MDN0937 MDN2239	113.7% 86.1% 106.2%
2002-054	6/19/2002 CVAFS-9	0.99985	0.109 ng/L	7.73 ng/mL NIST1641d 7.36 ng/mL	MDN0718 MDN0799 MDN0916	1.6% 0.2% 0.6%	MDN0718 MDN0799 MDN0916	94.7% 100.2% 95.9%
2002-055	6/20/2002 CVAFS-1	0.99964	0.067 ng/L	7.67 ng/mL NIST1641d 7.38 ng/mL	MDN0257 MDN2139 MDN2168	2.4% 4.1% 0.2%	MDN0257 MDN2139 MDN2168	89.3% 95.4% 97.6%
2002-056	6/20/2002 CVAFS-9	0.99937	0.121 ng/L	7.31 ng/mL NIST1641d 7.66 ng/mL	MDN0439 MDN2030 MDN3015	1.2% 1.4% 0.6%	MDN0439 MDN2030 MDN3015	100.9% 102.6% 95.2%
2002-057	6/25/2002 CVAFS-1	0.99975	0.083 ng/L	7.26 ng/mL NIST1641d 5.72 ng/mL 7.56 ng/mL	MDN0284 MDN0647 MDN1755	3.6% 2.4% 2.2%	MDN0284 MDN0647 MDN1755	98.9% 93.8% 98.1%
2002-058	6/25/2002 CVAFS-9	0.99975	0.088 ng/L	7.57 ng/mL NIST1641d 7.38 ng/mL	MDN0290 MDN0823 MDN1941	1.1% 0.8% 1.0%	MDN0290 MDN0823 MDN1941	100.7% 91.4% 97.2%
2002-059	6/27/2002 CVAFS-1	0.99942	0.100 ng/L	11.82 ng/mL NIST1641d 8.34 ng/mL 7.09 ng/mL	MDN0723 MDN1756 MDN2131	1.4% 1.7% 7.7%	MDN0723 MDN1756 MDN2131	106.3% 108.5% 120.8%
2002-060	6/27/2002 CVAFS-9	0.99982	0.098 ng/L	7.77 ng/mL NIST1641d 9.62 ng/mL	MDN0772 MDN1985 MDN2083	0.7% 88.1% 0.7%	MDN0772 MDN1985 MDN2083	99.3% 100.3% 96.6%
Quarterly Mean:	0.99952	0.059 ng/L	93.6%	3.6%	98.4%	±9.4%	0.048 ng/Bottle	±6.8%
Std Dev:	±0.00058	±0.031	±9.2%	±9.4%	±9.4%	±9.4%	±0.056	±6.8%

MDN Quarterly Analysis QC Summary

Quarter 3 of 2002

Analysis	Calibration R	BrCl Blk Conc	SRM		%Rec	Duplicates		Spikes		Bottle Blanks	
			Conc	NIST1641d		Bottle ID	RPD	Bottle ID	Rec.	Bottle ID	Conc
2002-061 7/1/2002 CVAFS-1	0.99985	0.064 ng/L		NIST1641d		MDN1930	0.2%	MDN1930	99.5%	MDN3008	0.021 ng/Bottle
				7.65 ng/mL	96.2%	MDN2094	2.0%	MDN2094	99.7%		
				NIST1641d		MDN2179	1.1%	MDN2179	99.7%		
2002-062 7/1/2002 CVAFS-9	0.99951	0.054 ng/L		NIST1641d		MDN0117	2.6%	MDN0117	100.4%		
				7.73 ng/mL	97.2%	MDN0198	2.7%	MDN0198	99.8%		
				NIST1641d		MDN2224	1.9%	MDN2224	97.0%		
2002-063 7/8/2002 CVAFS-10	0.99988	0.032 ng/L		NIST1641d		MDN0124	0.2%	MDN0124	97.6%		
				7.66 ng/mL	96.4%	MDN0927	4.9%	MDN0927	98.3%		
				NIST1641d		MDN2032	0.2%	MDN2032	97.5%		
2002-064 7/8/2002 CVAFS-9	0.99994	0.110 ng/L		NIST1641d		MDN0791	6.4%	MDN0791	101.2%		
				7.53 ng/mL	94.8%	MDN0918	2.6%	MDN0918	98.5%		
				NIST1641d		MDN2078	0.3%	MDN2078	102.1%		
2002-065 7/10/2002 CVAFS-10	0.99938	0.089 ng/L		NIST1641d		MDN0665	1.5%	MDN0665	102.8%	MDN2091	0.025 ng/Bottle
				7.79 ng/mL	98.0%	MDN2000	1.3%	MDN2000	102.5%		
				NIST1641d		MDN2066	1.1%	MDN2066	96.6%		
2002-066 7/10/2002 CVAFS-9	0.99965	0.096 ng/L		NIST1641d		MDN0163	4.7%	MDN0163	97.4%		
				7.50 ng/mL	94.3%	MDN0640	1.1%	MDN0640	103.5%		
				NIST1641d		MDN0844	0.2%	MDN0844	99.4%		
2002-067 7/15/2002 CVAFS-10	0.99943	0.049 ng/L		NIST1641d		MDN1920	2.4%	MDN1920	105.5%	MDN2224	0.337 ng/Bottle
				7.69 ng/mL	96.7%	MDN2140	5.9%	MDN2140	99.7%		
				NIST1641d		MDN3004	2.2%	MDN3004	91.5%		
2002-068 7/15/2002 CVAFS-9	0.99957	0.055 ng/L		NIST1641d		MDN0490	1.7%	MDN0490	106.3%	MDN0182	0.110 ng/Bottle
				7.55 ng/mL	95.0%	MDN0796	0.7%	MDN0796	95.7%		
				NIST1641d		MDN2230	2.6%	MDN2230	100.3%		
2002-069 7/22/2002 CVAFS-10	0.99895	0.054 ng/L		NIST1641d		MDN0120	0.8%	MDN0120	98.1%		
				7.81 ng/mL	98.2%	MDN0144	1.0%	MDN0144	98.9%		
				NIST1641d		MDN0820	3.8%	MDN0820	95.8%		
2002-070 7/22/2002 CVAFS-9	0.99984	0.082 ng/L		NIST1641d		MDN0709	1.7%	MDN0709	102.8%		
				7.74 ng/mL	97.4%	MDN0858	12.3%	MDN0858	105.0%		
				NIST1641d		MDN1900	0.9%	MDN1900	97.1%		
2002-071 7/24/2002 CVAFS-10	0.99898	0.058 ng/L		NIST1641d		MDN0409	0.6%	MDN0409	95.6%		
				7.40 ng/mL	93.1%	MDN1982	5.7%	MDN1982	100.6%		
				NIST1641d		MDN2185	2.0%	MDN2185	103.8%		

MDN Quarterly Analysis QC Summary

Quarter 3 of 2002

2002-072	7/24/2002 CVAFS-9	0.99937	0.047 ng/L	7.48 ng/mL NIST1641d 94.0%	MDN1735 MDN2081 MDN2101	5.9% 1.9% 0.1%	MDN1735 MDN2081 MDN2101	110.9% 106.8% 99.5%	MDN2271	0.194 ng/Bottle
2002-073	7/31/2002 CVAFS-10	0.99899	0.047 ng/L	7.87 ng/mL NIST1641d 98.9%	MDN0931 MDN2124 MDN3017	0.7% 11.1% 2.7%	MDN0931 MDN2124 MDN3017	100.4% 103.0% 108.7%	MDN3002	0.180 ng/Bottle
2002-074	7/31/2002 CVAFS-9	0.99980	0.047 ng/L	7.44 ng/mL NIST1641d 93.6%	MDN1742 MDN1760 MDN2248	1.6% 0.5% 2.5%	MDN1742 MDN1760 MDN2248	108.2% 96.9% 103.6%	MDN0447	0.136 ng/Bottle
2002-075	8/5/2002 CVAFS-10	0.99932	0.044 ng/L	7.57 ng/mL NIST1641d 95.3%	MDN0172 MDN0824 MDN2192	2.9% 7.6% 3.1%	MDN0172 MDN0824 MDN2192	98.2% 97.4% 97.2%		
2002-076	8/5/2002 CVAFS-9	0.99987	0.024 ng/L	7.38 ng/mL NIST1641d 92.8%	MDN0090 MDN0899 MDN2195	5.9% 3.1% 1.7%	MDN0090 MDN0899 MDN2195	104.4% 106.7% 94.4%		
2002-077	8/8/2002 CVAFS-9	0.99993	0.038 ng/L	7.42 ng/mL NIST1641d 93.3%	MDN0655 MDN0934 MDN2222	0.8% 2.3% 1.2%	MDN0655 MDN0934 MDN2222	100.6% 98.0% 99.3%	MDN2247	0.031 ng/Bottle
2002-078	8/8/2002 CVAFS-10	0.99968	0.062 ng/L	7.64 ng/mL NIST1641d 96.1%	MDN1973 MDN2162 MDN2235	6.0% 0.7% 2.5%	MDN1973 MDN2162 MDN2235	98.0% 92.5% 100.6%	MDN1925	0.049 ng/Bottle
2002-079	8/12/2002 CVAFS-9	0.99990	0.047 ng/L	7.41 ng/mL NIST1641d 93.2%	MDN0289 MDN0831 MDN2084	2.3% 1.2% 0.4%	MDN0289 MDN0831 MDN2084	99.5% 99.2% 99.6%		
2002-080	8/12/2002 CVAFS-10	0.99980	0.072 ng/L	7.34 ng/mL NIST1641d 92.3%	MDN0225 MDN2287 MDN2287	5.8% 1.1% 4.9%	MDN0225 MDN2282 MDN2287	95.7% 90.2% 89.0%	MDN2209	0.015 ng/Bottle
2002-081	8/21/2002 CVAFS-10	0.99956	0.066 ng/L	7.66 ng/mL NIST1641d 96.4%	MDN0417 MDN2152 MDN2175	4.6% 1.6% 2.8%	MDN0417 MDN2152 MDN2175	97.8% 96.3% 95.0%		
2002-082	8/21/2002 CVAFS-9	0.99973	0.055 ng/L	6.99 ng/mL NIST1641d 88.0%	MDN0659 MDN1934 MDN2146	0.8% 6.2% 2.5%	MDN0659 MDN1934 MDN2146	97.2% 97.8% 98.7%	MDN2127 MDN2178	0.019 ng/Bottle 0.019 ng/Bottle
2002-083	8/26/2002 CVAFS-1	0.99947	0.074 ng/L	7.31 ng/mL NIST1641d 91.9%	MDN0933 MDN2147 MDN2261	0.9% 2.6% 3.5%	MDN0933 MDN2147 MDN2261	97.5% 93.9% 98.0%		

MDN Quarterly Analysis QC Summary

Quarter 4 of 2002

Analysis	Calibration R	BrCl Bilk Conc	SRM		Duplicates		Spikes		Bottle Blanks	
			Conc	%Rec	Bottle ID	RPD	Bottle ID	Rec.	Bottle ID	Conc
2002-092 CVAFS-10	10/1/2002 0.99970	0.019 ng/L	NIST1641d	87.5%	MDN0256	7.8%	MDN0256	96.7%	MDN2061	0.020 ng/Bottle
			6.96 ng/mL		MDN0763		MDN0763		115.4%	
			NIST1641d		7.67 ng/mL		MDN0772		103.9%	
2002-093 CVAFS-9	10/1/2002 0.99985	0.097 ng/L	NIST1641d	93.4%	MDN0639	0.8%	MDN0639	95.7%	MDN2061	0.020 ng/Bottle
			7.43 ng/mL		MDN0909		MDN0909		115.8%	
			NIST1641d		7.05 ng/mL		MDN1749		108.6%	
2002-094 CVAFS-9	10/2/2002 0.99953	0.126 ng/L	NIST1641d	95.5%	MDN0493	5.6%	MDN0493	107.8%		
			7.59 ng/mL		MDN2086		MDN2086		96.7%	
			NIST1641d		7.17 ng/mL		MDN2195		97.9%	
2002-095 CVAFS-10	10/2/2002 0.99912	0.093 ng/L	NIST1641d	95.2%	MDN0439	3.8%	MDN0439	102.7%	MDN0292	0.026 ng/Bottle
			7.57 ng/mL		MDN0448		MDN0448		109.0%	
			NIST1641d		7.31 ng/mL		MDN1732		90.0%	
2002-096 CVAFS-10	10/6/2002 0.99968	0.144 ng/L	NIST1641d	91.5%	MDN0746	3.0%	MDN0746	99.1%		
			7.27 ng/mL		MDN1920		MDN1920		97.7%	
			NIST1641d		7.24 ng/mL		MDN2162		96.5%	
2002-097 CVAFS-9	10/6/2002 0.99983	0.179 ng/L	NIST1641d	93.9%	MDN0980	5.1%	MDN0980	109.0%	MDN0691	0.025 ng/Bottle
			7.46 ng/mL		MDN2174		MDN2174		99.4%	
			NIST1641d		7.14 ng/mL		MDN2263		91.9%	
2002-098 CVAFS-10	10/13/200 0.99973	0.093 ng/L	NIST1641d	87.3%	MDN0151	1.5%	MDN0151	103.8%		
			6.94 ng/mL		MDN0667		MDN0667		99.7%	
			NIST1641d		7.03 ng/mL		MDN0844		97.9%	
2002-099 CVAFS-9	10/13/200 0.99982	0.131 ng/L	NIST1641d	90.9%	MDN0688	1.0%	MDN0688	97.8%	MDN2044	0.027 ng/Bottle
			7.23 ng/mL		MDN0983		MDN0983		99.5%	
			NIST1641d		7.01 ng/mL		MDN1932		99.4%	
2002-100 CVAFS-9	10/21/200 0.99945	0.119 ng/L	NIST1641d	93.0%	MDN0483	1.7%	MDN0483	94.4%		
			7.39 ng/mL		MDN0834		MDN0834		94.0%	
			NIST1641d		6.79 ng/mL		MDN0849		105.3%	
Quarterly Mean: Std Dev:	0.99963 ±0.00026	0.111 ng/L ±0.044		91.0% ±3.1%		3.2% ±3.5%		100.8% ±6.5%		0.026 ng/Bottle ±0.005

Appendix C:

Examples Of Performance Evaluation Sample Results

1. Wadsworth Center - New York State Dept. Of Health
Environmental Laboratory Program - September 2002
2. Wadsworth Center - New York State Dept. Of Health
Environmental Laboratory Program - April 2002
3. Analytical Performance Group - WP Performance
Summary - Trace Metals In Surface Waters - August 2002
4. Analytical Products Group - DMRQA 22 - Trace Metals
In Surface Waters - December 2002
5. Analytical Products Group - WP Performance Summary -
April 2002

**WADSWORTH CENTER
NEW YORK STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL LABORATORY APPROVAL PROGRAM**

Proficiency Test Report

Lab Id: 11662 FRONTIER GEOSCIENCES INC
 414 PONTIUS AVENUE NORTH
 EPA Lab Code: SEATTLE, WA-98109
 WA01127 (206) 622-6960
 Director: MS. MICHELLE GAUTHIER

Shipment Date : 22-Jul-2002
 Closing Date : 05-Sep-2002
 Score Date : 24-Sep-2002

This report may contain data that are not covered by the NVLAP accreditation.
 ** indicates NVLAP accredited analyte. Lab Code 200387-0. ELAP is an A2LA accredited Proficiency Testing Provider. Certificate Number 1785.01

Shipment: 255 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Method	Result	Mean/Target	Warning Limits	Acceptance Limits	Score
Sample: Non Potable Water Mercury								
Mercury, Total ** EPA Code: 0009	ug/L	5511	EPA 1631	22.4	24.9	20.9 - 29	18.8 - 31.1	Satisfactory <i>138 passed out of 148 reported results.</i>
Sample: Non Potable Water Metals I and II								
Silver, Total ** EPA Code: 0017	ug/L	5511	EPA 200.8	101	100	90.2 - 110	85.2 - 115	Satisfactory <i>145 passed out of 155 reported results.</i>
Arsenic, Total ** EPA Code: 0002	ug/L	5511	EPA 200.8	319	301	267 - 336	249 - 353	Satisfactory <i>136 passed out of 150 reported results.</i>
Barium, Total EPA Code: N/A	ug/L	5511	EPA 200.8	1490	1490		1280 - 1700	Satisfactory <i>133 passed out of 143 reported results.</i>
Cadmium, Total ** EPA Code: 0004	ug/L	5511	EPA 200.8	248	249	225 - 273	213 - 285	Satisfactory <i>154 passed out of 162 reported results.</i>
Chromium, Total ** EPA Code: 0006	ug/L	5511	EPA 200.8	411	400	365 - 436	348 - 453	Satisfactory <i>141 passed out of 162 reported results.</i>
Copper, Total ** EPA Code: 0007	ug/L	5511	EPA 200.8	527	501	469 - 534	453 - 550	Satisfactory <i>150 passed out of 165 reported results.</i>
Nickel, Total ** EPA Code: 0011	ug/L	5511	EPA 200.8	1060	1010	940 - 1080	905 - 1120	Satisfactory <i>141 passed out of 163 reported results.</i>
Lead, Total ** EPA Code: 0012	ug/L	5511	EPA 200.8	249	250	226 - 274	214 - 285	Satisfactory <i>162 passed out of 173 reported results.</i>

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**WADSWORTH CENTER
NEW YORK STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL LABORATORY APPROVAL PROGRAM**

Proficiency Test Report

Lab Id: 11662 FRONTIER GEOSCIENCES INC
414 PONTIUS AVENUE NORTH
EPA Lab Code: SEATTLE, WA-98109
WA01127 (206) 622-6960
Director: MS. MICHELLE GAUTHIER

Shipment Date : 28-Jan-2002
Closing Date : 15-Mar-2002
Score Date : 02-Apr-2002

This report may contain data that are not covered by the NVLAP accreditation.
** indicates NVLAP accredited analyte. Lab Code 200387-0. ELAP is an A2LA accredited Proficiency Testing Provider. Certificate Number 1785.01

Shipment: 250 Non Potable Water Chemistry

Analyte Name	Units	Sample ID	Method	Result	Mean/Target	Acceptance Limits	Warning Limits	Score
Sample: Non Potable Water Mercury								
Mercury, Total ** EPA Code: 0009	ug/L	5011	EPA 1631 FLUORESCEN	11.6	12.5	10.4 - 14.6	9.35 - 15.6	Satisfactory <i>146 passed out of 156 reported results.</i>
Sample: Non Potable Water Metals I and II								
Silver, Total ** EPA Code: 0017	ug/L	5011	Method Not Specified	471	511	462 - 560	438 - 584	Satisfactory <i>154 passed out of 164 reported results.</i>
Arsenic, Total ** EPA Code: 0002	ug/L	5011	Method Not Specified	650	714	636 - 792	597 - 831	Satisfactory <i>149 passed out of 157 reported results.</i>
Barium, Total EPA Code: N/A	ug/L	5011	Method Not Specified	958	1070	922 - 1230		Satisfactory <i>144 passed out of 151 reported results.</i>
Cadmium, Total ** EPA Code: 0004	ug/L	5011	Method Not Specified	9.45	10.2	8.46 - 11.9	7.61 - 12.7	Satisfactory <i>150 passed out of 175 reported results.</i>
Chromium, Total ** EPA Code: 0006	ug/L	5011	Method Not Specified	502	561	512 - 609	488 - 634	Check For Error <i>165 passed out of 173 reported results.</i>
Copper, Total ** EPA Code: 0007	ug/L	5011	Method Not Specified	583	602	564 - 640	545 - 659	Satisfactory <i>165 passed out of 174 reported results.</i>
Nickel, Total ** EPA Code: N/A	ug/L	5011	Method Not Specified	815	869	808 - 930	777 - 961	Satisfactory <i>166 passed out of 173 reported results.</i>
Lead, Total ** EPA Code: N/A	ug/L	5011	Method Not Specified	1630	1670	1530 - 1800	1470 - 1860	Satisfactory <i>170 passed out of 186 reported results.</i>



Analytical Products Group, Inc.

PERFORMANCE REPORT

WP Performance Summary

August 2002

APG Customer Code: 4701

Frontier Geosciences Inc.

Suite B

414 Pontius Avenue North

Seattle, WA 98109



Laboratory of
EXCELLENCE

Performance Summary

Product: Trace Metals

WP Lot Number: 33625-33626

APG+ Lot Number: 33678-33679

Analyte	Product Level	Analyte Code	Reported Value	Assigned Value	Acceptance Range	Z-Score	Method Code	Method Description	Evaluation
- Aluminum	WP	1000	447	450	374-526	0.119		ICP-MS	Acceptable
- Antimony	WP	1005	806	876	622-1050	0.42		ICP-MS	Acceptable
- Arsenic	WP	1010	624	668	561-782	1.28		HG-AFS	Acceptable
- Arsenic	WP	1010	587	668	561-782	2.29		ICP-MS	Check for Error
- Barium	WP	1015	294	315	274-362	1.66		ICP-MS	Acceptable
- Beryllium	WP	1020	104	108	90.7-122	0.381		ICP-MS	Acceptable
- Boron	WP	1025	425	411	346-497	0.119		ICP-MS	Acceptable
- Cadmium	WP	1030	163	178	151-203	1.62		ICP-MS	Acceptable
- Chromium	WP	1040	645	668	582-755	0.83		ICP-MS	Acceptable
- Cobalt	WP	1050	733	750	660-840	0.565		ICP-MS	Acceptable
- Copper	WP	1055	574	568	516-624	0.221		ICP-MS	Acceptable
- Iron	WP	1070	744	799	705-904	1.84		ICP-MS	Acceptable
- Lead	WP	1075	2200	2260	1990-2520	0.57		ICP-MS	Acceptable
- Manganese	WP	1090	1060	1090	979-1210	0.777		ICP-MS	Acceptable
- Mercury	WP	1095	5.07	5.96	4.39-7.51	1.69	10122802	EPA 1631	Acceptable
- Molybdenum	WP	1100	302	326	279-373	1.53		ICP-MS	Acceptable
- Nickel	WP	1105	2070	2020	1830-2250	0.434		ICP-MS	Acceptable
- Selenium	WP	1140	404	376	296-436	1.62		HG-AFS	Acceptable
- Selenium	WP	1140	345	376	296-436	0.897		ICP-MS	Acceptable
- Silver	WP	1150	545	597	513-684	1.86		ICP-MS	Acceptable
- Strontium	WP		222	242	206-278	1.68		ICP-MS	Acceptable
- Thallium	WP	1165	313	458	368-532	5.02		ICP-MS	Not Acceptable
- Tin	WP	1175	1720	1850	1460-2250	1.07		ICP-MS	Acceptable





Analytical Products Group, Inc.

PERFORMANCE REPORT

WP Performance Summary

April 2002

APG Customer Code: 4701

Frontier Geosciences Inc.
Suite B

414 Pontius Avenue North
Seattle, WA 98109



Product: Trace Metals
 WP Lot Number: 32699-32700
 APG+ Lot Number: 32737-32738

Analyte	Product Level	Analyte Code	Reported Value	Assigned Value	Acceptance Range	Z-Score	Method Code	Method Description	Evaluation
Aluminum	WP	1000	971	1000	852-1150	0.574	10014401	EPA 200.8	Acceptable
Antimony	WP	1005	135	231	154-282	3.92	10014401	EPA 200.8	Not Acceptable
Arsenic	WP	1010	342	303	252-356	2.18		EPA 1632	Check for Error
Arsenic	WP	1010	291	303	252-356	0.747		AFS	Acceptable
Arsenic	WP	1010	304	303	252-356	0		EPA 200.8	Acceptable
Barium	WP	1015	1060	1050	896-1190	0.406		EPA 200.8	Acceptable
Beryllium	WP	1020	96.4	100	83.8-113	0.43		EPA 200.8	Acceptable
Boron	WP	1025	638	656	543-790	0.702		EPA 200.8	Acceptable
Cadmium	WP	1030	175	178	151-203	0.232		EPA 200.8	Acceptable
Chromium	WP	1040	354	348	302-395	0.39		EPA 200.8	Acceptable
Cobalt	WP	1050	474	450	395-505	1.31		EPA 200.8	Acceptable
Copper	WP	1055	180	162	144-181	2.98		EPA 200.8	Check for Error
Iron	WP	1070	626	625	550-709	0.152		EPA 200.8	Acceptable
Iron	WP	1070	633	625	550-709	0.114		COLOR	Acceptable
Lead	WP	1075	845	805	705-902	1.28		EPA 200.8	Acceptable
Manganese	WP	1090	1540	1500	1350-1670	0.566		EPA 200.8	Acceptable
Mercury	WP	1095	7.28	8.16	6.06-10.2	1.25	10122802	EPA 1631	Acceptable
Molybdenum	WP	1100	134	258	220-296	9.84		EPA 200.8	Not Acceptable
Nickel	WP	1105	2080	1890	1720-2110	2.62		EPA 200.8	Check for Error
Selenium	WP	1140	496	502	397-582	0.227		EPA 200.8	Acceptable
Selenium	WP	1140	440	502	397-582	1.59		AFS	Acceptable
Silver	WP	1150	266	262	225-300	0.317		EPA 200.8	Acceptable
Strontium	WP		263	261	222-299	0.155		EPA 200.8	Acceptable





Analytical Products Group, Inc.

PERFORMANCE REPORT

DMRQA

NVLAP
LAB CODE 200384-0

APG Lab Code: 4701
 Frontier Geosciences Inc.
 414 Pontius Avenue North
 Seattle, WA 98109

EPA Lab Code: WA01127

Performance Summary

Print Date: December 02, 2002
 Study Name: DMRQA 22 for 2002

Analyte	Reported Lot		Assigned Value	Acceptance Range	Z-Score	Test Method	Evaluation	Permittee
	Number	Value						
Aluminum	32913	402	400	331-470	0.0431	ICP-MS	Acceptable	Reported Data
Aluminum	32913	402	400	331-470	0.0431	ICP-MS	Acceptable	VA0024678
Aluminum	32913	402	400	331-470	0.0431	ICP-MS	Acceptable	VA0024724
Aluminum	32913	402	400	331-470	0.0431	ICP-MS	Acceptable	NM0024899
Arsenic	32913	190	182	149-215	0.727	ICP-MS	Acceptable	Reported Data
Arsenic	32913	190	182	149-215	0.727	ICP-MS	Acceptable	VA0024678
Arsenic	32913	190	182	149-215	0.727	ICP-MS	Acceptable	VA0024724
Cadmium	32913	115	114	96.5-131	0.176	ICP-MS	Acceptable	Reported Data
Cadmium	33625-33626	163	178	151-203	1.62	ICP-MS	Acceptable	WA0024473
Cadmium	33625-33626	163	178	151-203	1.62	ICP-MS	Acceptable	WA0024473
Cadmium	32913	115	114	96.5-131	0.176	ICP-MS	Acceptable	VA0024678
Cadmium	32913	115	114	96.5-131	0.176	ICP-MS	Acceptable	VA0024724
Cadmium	32913	115	114	96.5-131	0.176	ICP-MS	Acceptable	VA0076805
Chromium	32913	221	223	193-254	0.196	ICP-MS	Acceptable	Reported Data
Chromium	32913	221	223	193-254	0.196	ICP-MS	Acceptable	VA0024678
Chromium	32913	221	223	193-254	0.196	ICP-MS	Acceptable	VA0024724
Chromium	32913	221	223	193-254	0.196	ICP-MS	Acceptable	VA0076805
Cobalt	32913	195	192	168-216	0.371	ICP-MS	Acceptable	Reported Data
Cobalt	32913	195	192	168-216	0.371	ICP-MS	Acceptable	VA0024678
Cobalt	32913	195	192	168-216	0.371	ICP-MS	Acceptable	VA0024724
Copper	32913	164	156	139-174	1.37	ICP-MS	Acceptable	Reported Data
Copper	32913	164	156	139-174	1.37	ICP-MS	Acceptable	WI0003565
Copper	32913	164	156	139-174	1.37	ICP-MS	Acceptable	VA0024678
Copper	32913	164	156	139-174	1.37	ICP-MS	Acceptable	VA0024724
Copper	32913	164	156	139-174	1.37	ICP-MS	Acceptable	VA0076805
Iron	32913	284	320	279-366	2.69	ICP-MS	Acceptable-Check For Error	Reported Data
Iron	32913	284	320	279-366	2.69	ICP-MS	Acceptable-Check For Error	VA0024678
Iron	32913	284	320	279-366	2.69	ICP-MS	Acceptable-Check For Error	VA0024724
Lead	32913	654	644	562-723	0.41	ICP-MS	Acceptable	Reported Data

Appendix D:

Examples Of Laboratory Intercomparison Studies – 2002

1. 15th Intercomparison For Trace Elements In Marine Sediments and Biological Tissues – National Research Council Canada – May 2002

Note: Frontier participated in many Intercomparisons Studies, however, all those that Frontier was invited to participate in were for Trace Metals, not including mercury. We therefore decided to exclude these from this report. Frontier will be performing two HAL, real rainwater matrix intercomparison studies as was done in 1999.



National Research
Council Canada

Conseil national
de recherches Canada

Institute for National
Measurement Standards

Institut des étalons
nationaux de mesure

NRC-CMRC

Fifteenth Intercomparison for Trace Elements in Marine Sediments and Biological Tissues

Scott Willie

Chemical Metrology

NRC Document No. 42768

May 2002

Canada

MERCURY
Sediment 2001
mg/kg

Lab					Mean	SD	RSD
1	3	0.331	0.378	0.381	0.363	0.028	7.7
2	0						
3	3	0.34	0.35	0.33	0.34	0.01	2.9
4	3	0.421	0.432	0.408	0.420	0.012	2.9
5	3	0.35	0.36	0.36	0.36	0.01	1.6
6	3	0.44	0.39	0.36	0.40	0.04	10.2
7	3	0.303	0.3	0.285	0.296	0.010	3.3
8	3	0.37	0.353	0.363	0.362	0.009	2.4
9	3	0.303	0.317	0.327	0.316	0.012	3.8
10	1	0.33					
11	3	0.37	0.385	0.378	0.378	0.008	2.0
12	3	0.344	0.343	0.378	0.355	0.020	5.6
13	0						
14	3	0.357	0.38	0.367	0.3678	0.0112	3.0
15	3	0.374	0.377	0.374	0.375	0.002	0.5
16	3	0.348	0.348	0.348	0.35	0.00	0.0
17	0						
18	3	0.399	0.382	0.355	0.379	0.022	5.9
19	3	0.412	0.408	0.396	0.405	0.008	2.1
20	3	0.398	0.403	0.403	0.401	0.003	0.7
21	3	0.35	0.33	0.38	0.35	0.03	7.1
22	0						

MERCURY
MESS-3
mg/kg

Lab					Mean	SD	RSD
1	3	0.091	0.082	0.089	0.0876	0.0048	5.5
2	0						
3	3	0.09	0.09	0.08	0.09	0.01	6.7
4	3	0.089	0.095	0.091	0.092	0.003	3.3
5	3	0.091	0.091	0.091	0.091	0.000	0.0
6	3	0.098	0.093	0.1	0.097	0.004	3.7
7	3	0.086	0.099	0.088	0.091	0.007	7.7
8	3	0.1	0.093	0.098	0.097	0.004	3.7
9	3	0.089	0.085	0.084	0.0859	0.0025	2.9
10	0						
11	3	0.106	0.087	0.089	0.0938	0.0106	11.3
12	3	0.087	0.087	0.081	0.0850	0.0032	3.8
13	0						
14	3	0.098	0.096	0.098	0.0974	0.0011	1.1
15	3	0.09	0.09	0.089	0.0894	0.0006	0.7
16	3	0.092	0.091	0.091	0.09	0.00	0.6
17	0						
18	3	0.119	0.11	0.123	0.117	0.007	5.7
19	3	0.098	0.105	0.095	0.0993	0.0052	5.2
20	3	0.096	0.096	0.096	0.096	0.000	0.0

MERCURY
Tissue 2001
mg/kg

Lab					Mean	SD	RSD
1	3	3.93	3.99	3.81	3.91	0.09	2.3
2	0						
3	3	3.3	3.4	3.4	3.4	0.1	1.7
4	3	3.8	3.3	3.4	3.5	0.3	7.6
5	3	3	3.03	3.05	3.03	0.03	0.8
6	3	3.26	3.33	3.17	3.25	0.08	2.5
7	3	3.59	3.57	3.61	3.59	0.02	0.6
8	3	3.292	3.126	3.168	3.195	0.086	2.7
9	3	3.37	3.18	3.27	3.27	0.10	2.9
10	2	2.51	2.44		2.48	0.05	2.0
11	3	3.63	3.54	3.5	3.56	0.07	1.9
12	3	3.41	3.42	3.37	3.40	0.03	0.8
13	0						
14	3	2.76	2.695	2.656	2.704	0.053	1.9
15	3	3.26	3.24	3.23	3.24	0.02	0.5
16	3	3.36	3.33	3.35	3.35	0.02	0.5
17	0						
18	3	1.6	1.35	1.44	1.46	0.13	8.7
19	3	3.42	3.34	3.31	3.36	0.06	1.7
20	3	3.33	3.39	3.33	3.35	0.03	1.0
21	0						
22	3	3.44	3.41	3.47	3.44	0.03	0.9

MERCURY
DOLT-2
mg/kg

Lab					Mean	SD	RSD
1	3	2.26	2.3	2.48	2.35	0.12	5.0
2	0						
3	3	2.1	2.1	2.2	2.1	0.1	2.7
4	3	2.1	1.8	2.2	2.0	0.2	10.2
5	3	2.14	2.13	2.14	2.14	0.01	0.3
6	3	2.12	2.26	2.1	2.16	0.09	4.0
7	3	2.21	2.14	2.16	2.17	0.04	1.7
8	3	2.118	2.057	2.128	2.101	0.038	1.8
9	3	2.26	2.12	2.17	2.18	0.07	3.2
10	2	1.51	1.48		1.50	0.02	1.4
11	3	2.33	2.18	2.3	2.27	0.08	3.5
12	3	2.23	2.24	2.23	2.23	0.01	0.3
13	0						
14	3	1.879	1.952	1.877	1.903	0.043	2.2
15	3	2.06	2.08	2.09	2.08	0.02	0.7
16	3	2.11	2.14	2.2	2.15	0.05	2.1
17	0						
18	3	1.94	1.9	2.32	2.05	0.23	11.3
19	3	2.16	2.19	2.12	2.16	0.04	1.6
20	3	2.09	2.09	2.18	2.12	0.05	2.5

