

# Frontier Geosciences Inc.

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*Environmental Research & Specialty Analytical Laboratory*

## National Atmospheric Deposition Program

### Mercury Deposition Network

#### Mercury Analytical Lab 2001 Annual Quality Assurance Report



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4. National Water Research Institute – National Lab For Environmental Testing – FP97 Mercury In Water
5. Analytical Performance Group – DMRQA Study 21 Trace Metals In Surface Waters – November 2001
6. Analytical Products Group – WP Performance Summary – Trace Metals In Surface Waters – May 2001

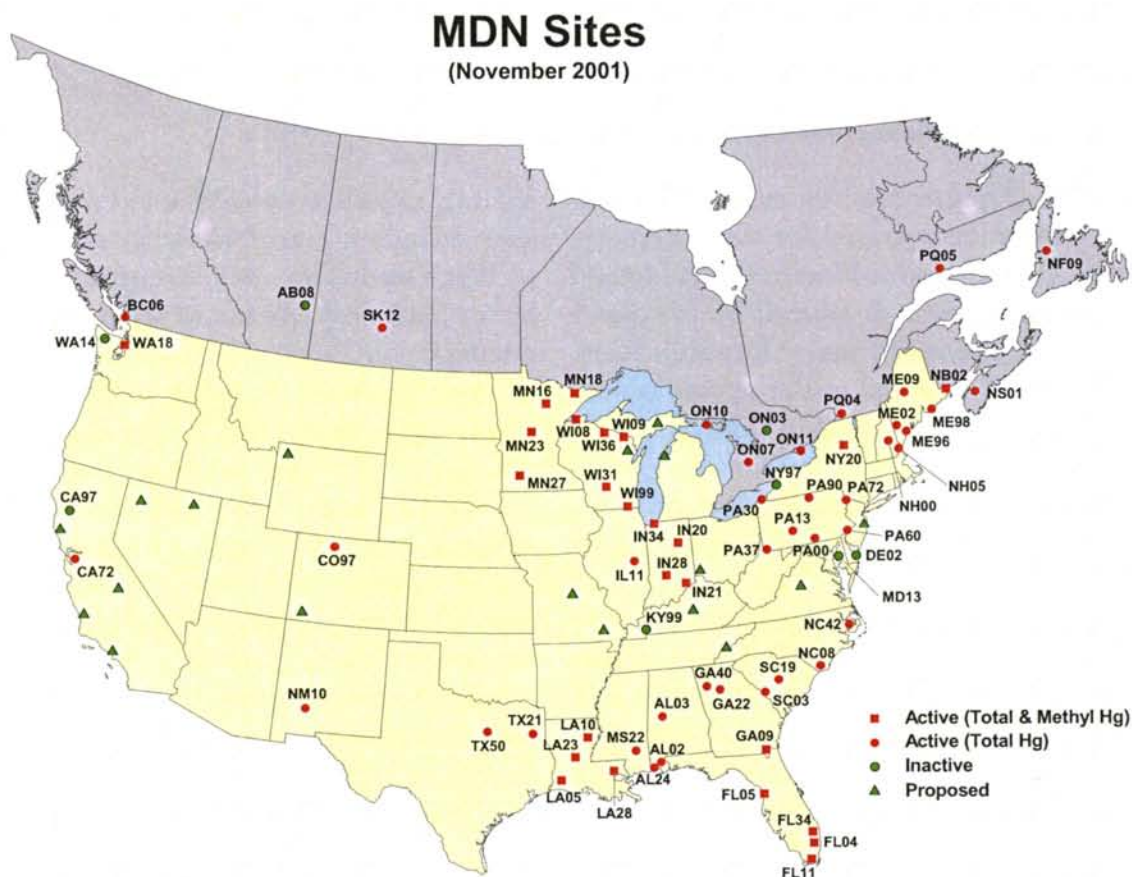
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2. Northern Contaminants QA Program – National Water Research Institute – April 26 2001
3. 15<sup>th</sup> Intercomparison For Trace Elements In Marine Sediments and Biological Tissues – National Research Council Canada – May 2002

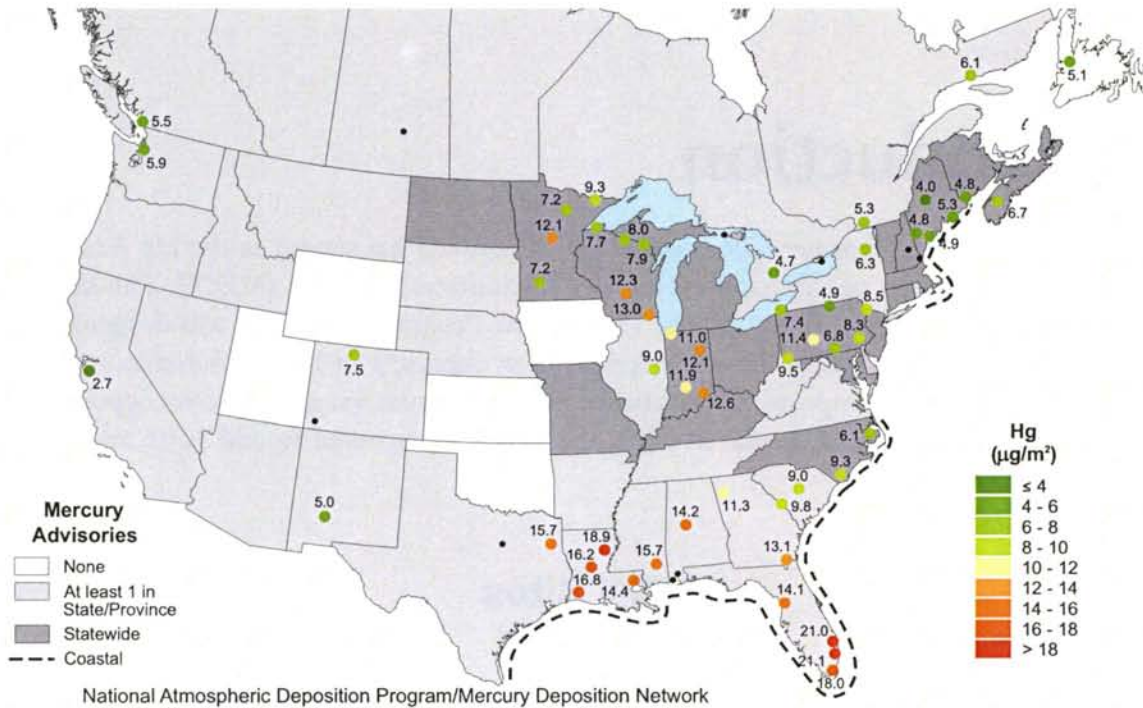


# I. Introduction

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 62 sites in the United States and Canada. In 2002, the MDN is expected to add 10-15 additional new sites.



## 2001 Mercury Deposition and Mercury Advisories for fish and wildlife consumption



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 Beverly van Buuren, 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.

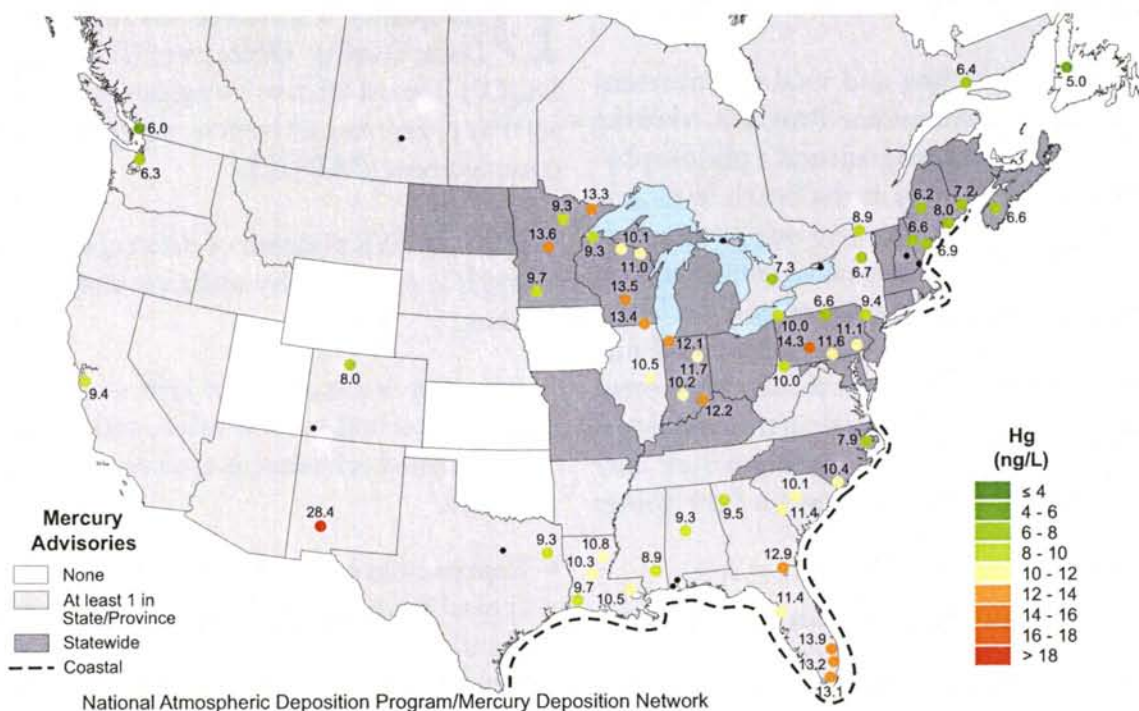
Frontier continued to maintain and demonstrate high quality control standards in 2001. Due to



the addition of new MDN sites, the number of quality control points increased from 945 in 2000 to greater than 1214 quality control measurements in 2001. 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.

### 2001 Mercury Concentration and Mercury Advisories for fish and wildlife consumption



## 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

**B**ottle 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 2001 lab sample bottle blanks is 0.036 ng/Bottle (n=52) with a standard deviation of 0.038ng/Bottle. Control charts are listed in Appendix A.

## B. Reagent Blanks

**R**eagent 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 2001 reagent blanks is 0.053 ng/L (n=320) with a standard deviation of 0.053ng/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 2001 RPD's is 4.96% (n=313) with a standard deviation of 5.3%. Control charts are listed in Appendix A.

## D. Certified Reference Material Samples

**C**ertified 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 DORM-2—a fish tissue.

The mean for 2001 CRMs is 94.8% recovery (n=218) with a standard of 5.8%. All reference samples fell within the designated parameters in 2001. Control charts are listed in Appendix A.

## E. Matrix Spike Samples

**M**atrix 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 2001 matrix spikes is 100.8% recovery (n=310). Control charts are listed in Appendix A.

## F. Performance Test and Interlaboratory Intercomparison Studies

**P**erformance 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 are a few of the Performance Evaluation Studies Frontier reported in 2001:

1. Results Of The USGS Analytical Evaluation Program For Standard Reference Samples Distributed In September 2001
2. Wadsworth Center – New York State Dept. Of Health Environmental Laboratory Program – October 2001
3. Wadsworth Center – New York State Dept. Of Health Environmental Laboratory Program – April 2001
4. National Water Research Institute – National Lab For Environmental Testing – FP97 Mercury In Water
5. Analytical Performance Group – DMRQA Study 21 Trace Metals In Surface Waters – November 2001
6. Analytical Products Group – WP Performance Summary – Trace Metals In Surface Waters – May 2001



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

1. World-Wide Intercomparison Exercise For The Determination Of Trace Elements And MethylMercury In Estuarine Sediment Samples IAEA-405- December 2000 – March 2001
2. Northern Contaminants QA Program – National Water Research Institute – April 26 2001

- a. 15<sup>th</sup> Intercomparison For Trace Elements In Marine Sediments and Biological Tissues – National Research Council Canada – May 2002.

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.

## IV. HAL 2002 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 2001-2002. 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:

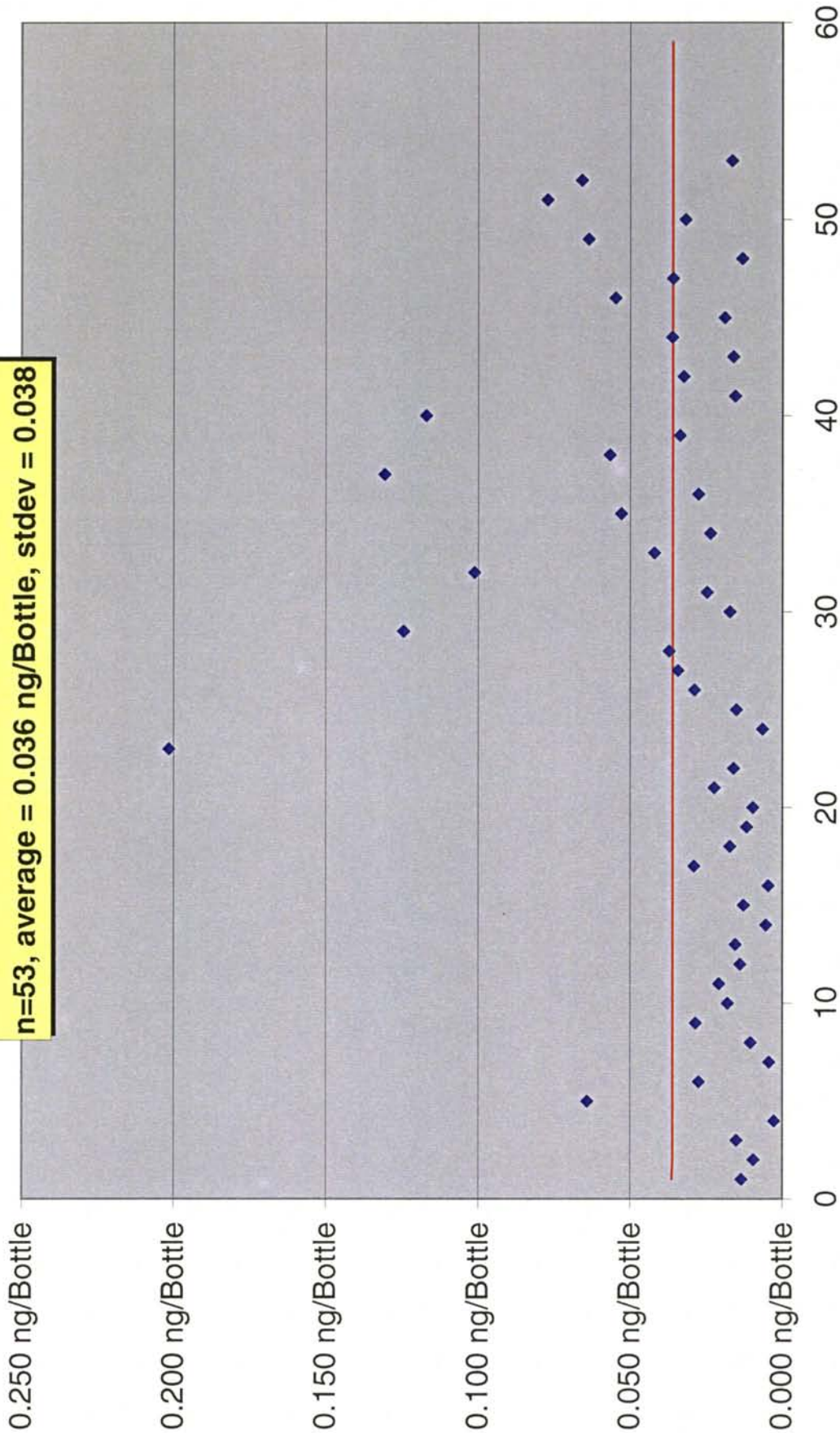
- The HAL will continue to improve our Database in 2001 and will endeavor to expand the Database to include MMHg data.
- The HAL will be significantly upgrading the MDN facilities in order to stay ahead of the projected growth of the Network in 2002. The new facilities for MDN will be dedicated instruments, 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:

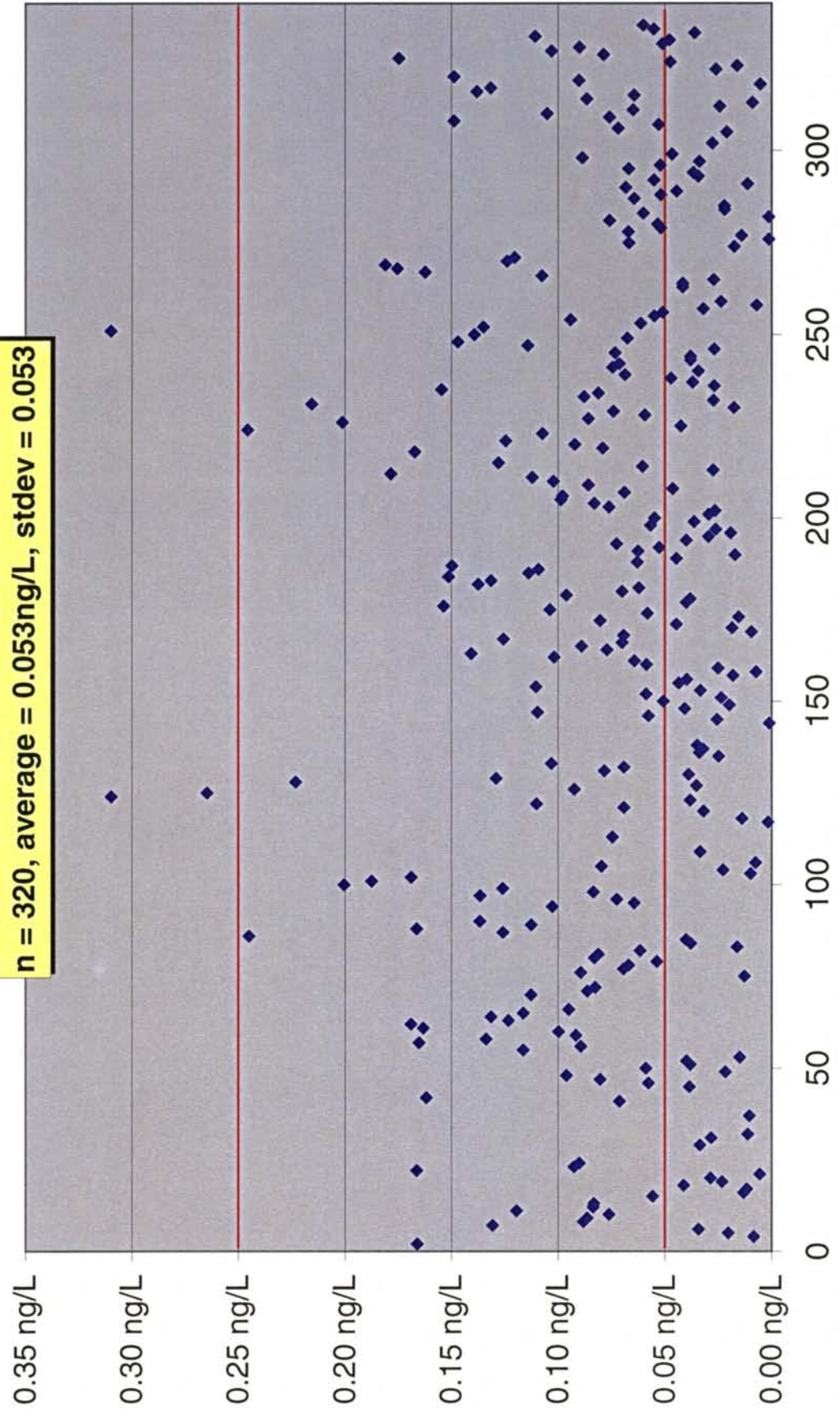
## HAL 2001 Annual QA/QC Control Charts

**MDN 2001**  
**Tot Hg in Cleaned Bottles (w/20 mL 1 % HCL)**  
**n=53, average = 0.036 ng/Bottle, stdev = 0.038**

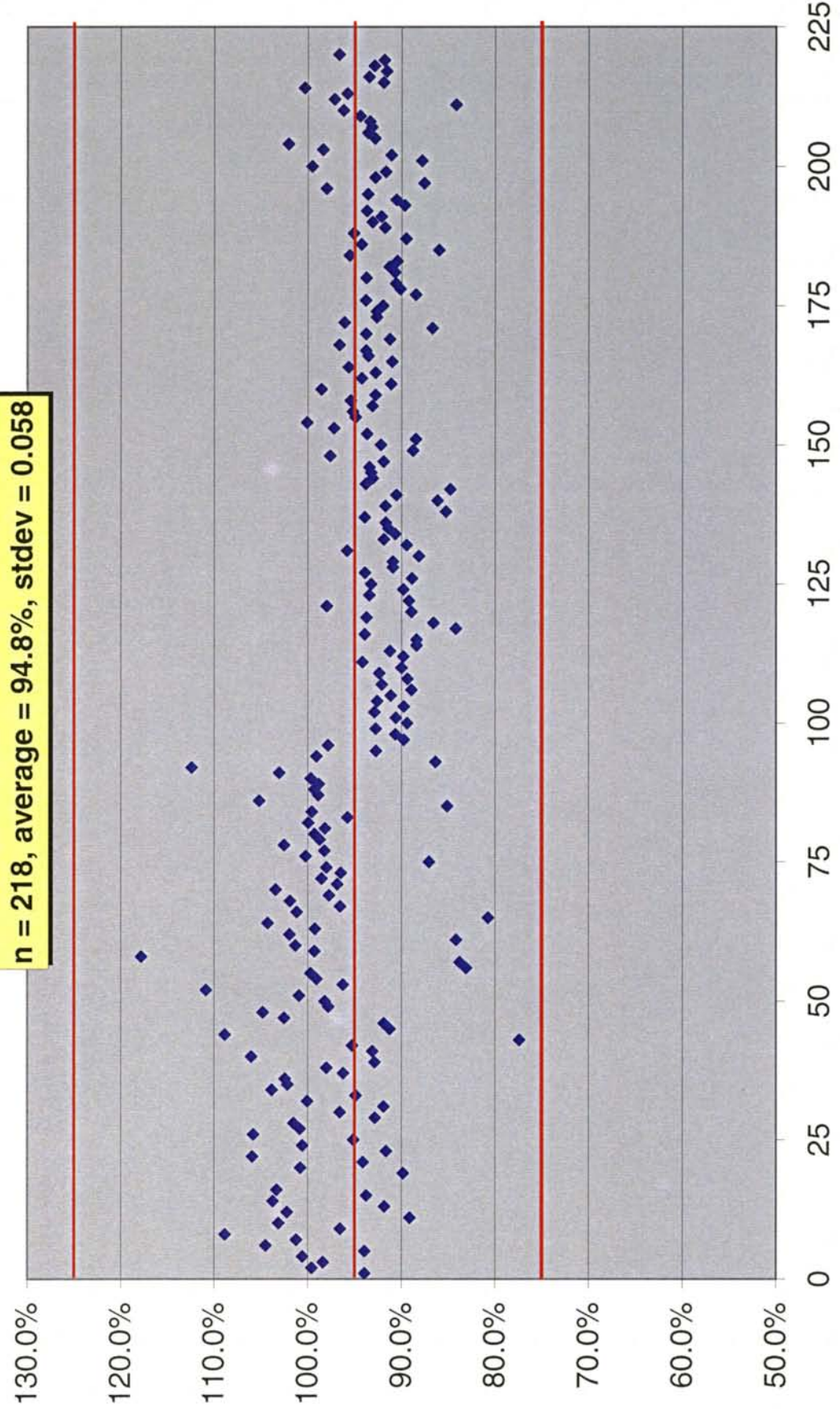




**MDN 2001**  
**THg in 1% BrCl Preservative**  
**n = 320, average = 0.053ng/L, stdev = 0.053**



**MDN 2001  
SRM recovery**  
**n = 218, average = 94.8%, stdev = 0.058**





50.0%

45.0%

40.0%

35.0%

30.0%

25.0%

20.0%

15.0%

10.0%

5.0%

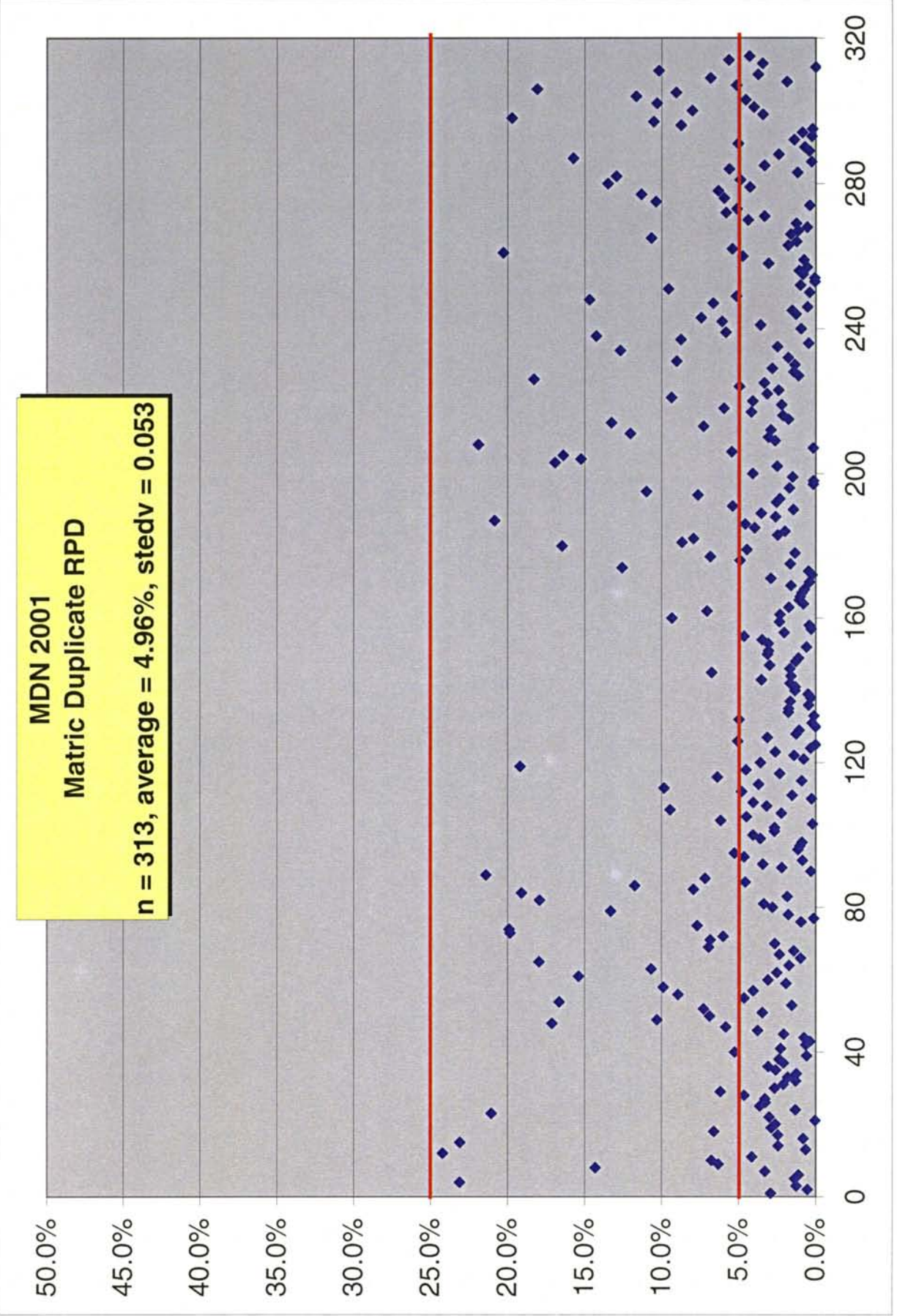
0.0%

MDN 2001

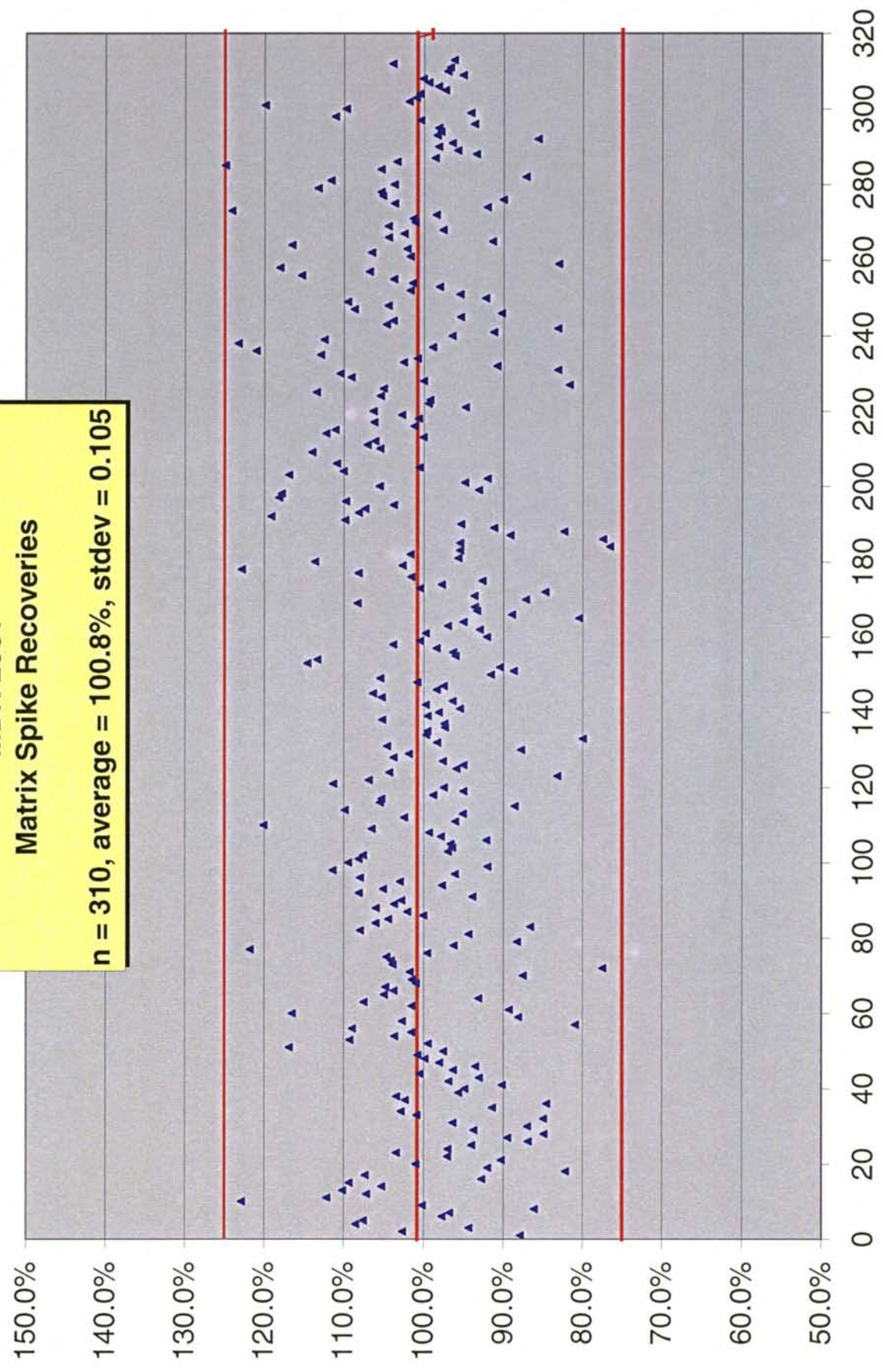
Matric Duplicate RPD

n = 313, average = 4.96%, stedv = 0.053

0 40 80 120 160 200 240 280 320

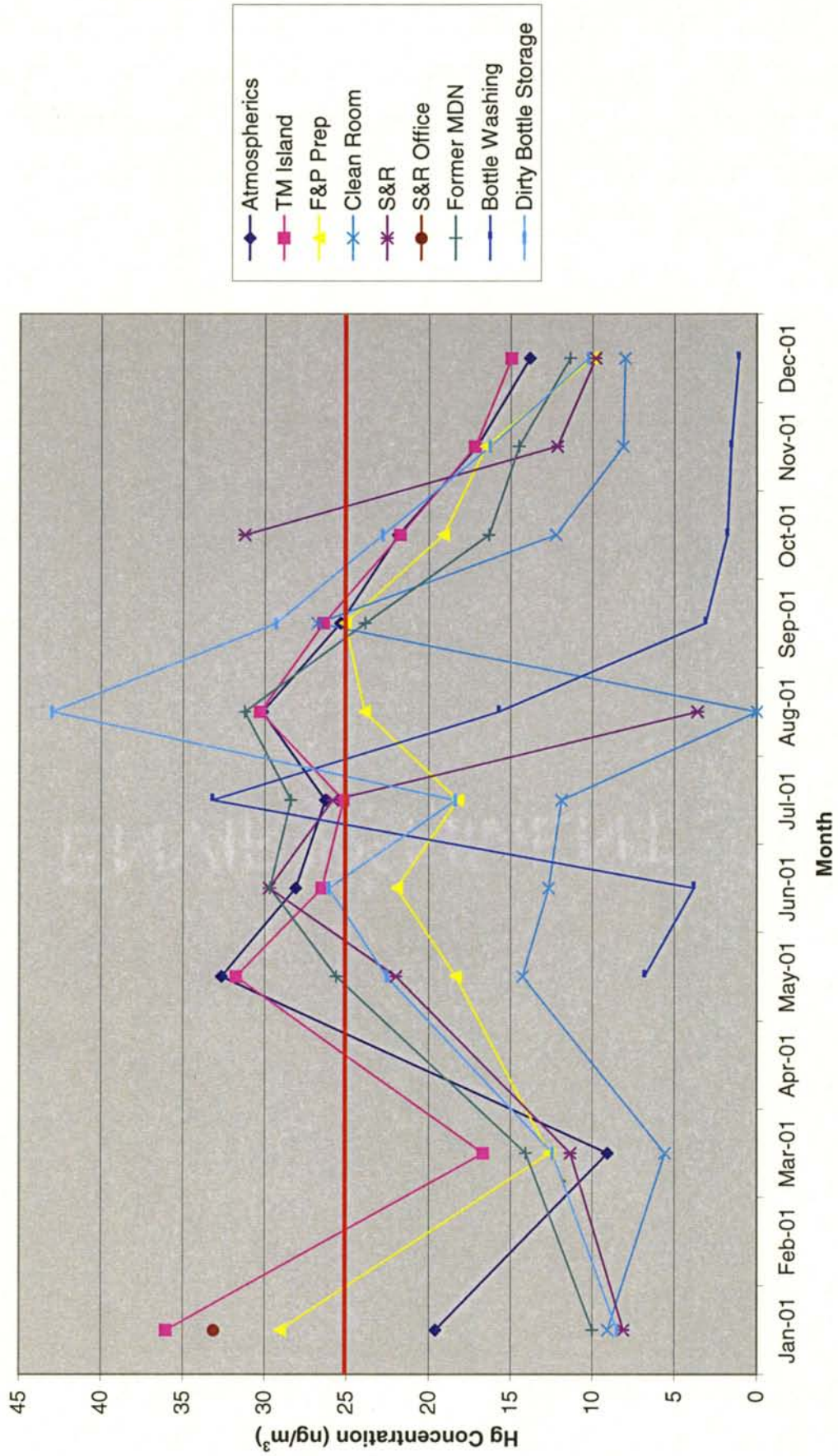


**MDN 2001**  
**Matrix Spike Recoveries**  
**n = 310, average = 100.8%, stdev = 0.105**





FGS Passive Diffusion Air Monitoring - 2001  
Total Mercury (ng/m<sup>3</sup>)





# Appendix B:

## HAL 2001 Quarterly QA/QC Summary Tables

# MDN Quarterly Analysis QC Summary

Quarter 1 of 2001

Analysis	Calibration R	BrCl Blk Conc	SRM		%Rec	Duplicates		RPD	Spikes		Bottle Blanks	
			Conc	%Rec		Bottle ID	RPD		Bottle ID	Rec.	Bottle ID	Conc
2001-001 1/3/2001 CVAFS-5	0.99785	0.044 ng/L	NIST1641d	7.92 ng/mL	99.6%	MDN0283	2.9%	MDN0283	87.9%	MDN0141	0.003 ng/Bottle	
			NIST1641d	7.47 ng/mL	94.0%	MDN0870	0.6%	MDN0870	102.7%	MDN0144	0.004 ng/Bottle	
			NIST1641d	7.82 ng/mL	98.4%	MDN0966	1.3%	MDN0966	94.4%			
2001-002 1/3/2001 CVAFS-4	0.99940	0.021 ng/L	NIST1641d	8.00 ng/mL	100.6%	MDN0123	23.1%	MDN0123	108.5%	MDN0141	0.003 ng/Bottle	
			NIST1641d	7.82 ng/mL	98.4%	MDN0698	1.4%	MDN0698	107.6%	MDN0144	0.004 ng/Bottle	
			NIST1641d	8.31 ng/mL	104.5%	MDN0761	1.1%	MDN0761	97.7%			
2001-003 1/10/2001 CVAFS-5	0.99745	0.102 ng/L	NIST1641d	7.47 ng/mL	94.0%	MDN0672	3.3%	MDN0672	96.8%			
			NIST1641d	8.05 ng/mL	101.3%	MDN0735	14.3%	MDN0735	86.1%			
			NIST1641d	8.65 ng/mL	108.9%	MDN0933	6.3%	MDN0933	100.2%			
2001-004 1/10/2001 CVAFS-4	0.99960	0.093 ng/L	NIST1641d	7.68 ng/mL	96.6%	MDN0154	6.8%	MDN0154	127.2%			
			NIST1641d	8.20 ng/mL	103.2%	MDN0405	4.2%	MDN0405	112.1%			
			NIST1641d	8.65 ng/mL	108.9%	MDN0756	24.2%	MDN0756	107.2%			
2001-005 1/12/2001 CVAFS-4	0.99985	0.040 ng/L	NIST1641d	7.68 ng/mL	96.6%	MDN0148	0.7%	MDN0148	110.2%			
			NIST1641d	8.20 ng/mL	103.2%	MDN0289	2.4%	MDN0289	105.3%			
			NIST1641d	8.20 ng/mL	103.2%	MDN0662	23.1%	MDN0662	109.4%			
2001-006 1/12/2001 CVAFS-5	0.99804	0.022 ng/L	NIST1641d	8.13 ng/mL	102.2%	MDN0850	0.8%	MDN0850	92.7%			
			NIST1641d	7.09 ng/mL	89.2%	MDN0865	2.5%	MDN0865	107.4%			
			NIST1641d	8.25 ng/mL	103.8%	MDN0955	6.6%	MDN0955	82.2%			
2001-007 1/19/2001 CVAFS-5	0.99801	0.019 ng/L	NIST1641d	7.30 ng/mL	91.8%	MDN0491	2.9%	MDN0491	92.0%	MDN0939	0.028 ng/Bottle	
			NIST1641d	8.25 ng/mL	103.8%	MDN0843	2.6%	MDN0843	101.0%			
			NIST1641d	7.30 ng/mL	91.8%	MDN0942		MDN0942	90.3%			
2001-008 1/26/2001 CVAFS-5	0.99866	0.116 ng/L	NIST1641d	8.22 ng/mL	103.3%	MDN0190	3.0%	MDN0190	97.0%			
			NIST1641d	7.46 ng/mL	93.8%	MDN0284	21.1%	MDN0284	103.4%			
			NIST1641d	7.46 ng/mL	93.8%	MDN1742	1.3%	MDN1742	97.0%			
2001-009 1/26/2001 CVAFS-4	0.96942	0.192 ng/L	NIST1641d	11.33 ng/mL	142.6%							
			*NIST1641d									
2001-010 2/2/2001 CVAFS-4	0.99977	0.006 ng/L	NIST1641d	7.14 ng/mL	89.9%	MDN0487	3.6%	MDN0487	119.7%			
			NIST1641d	8.01 ng/mL	100.8%	MDN0760	3.3%	MDN0760	100.2%			
			NIST1641d	8.01 ng/mL	100.8%	MDN0801	3.3%	MDN0801	122.0%			
2001-011 2/2/2001 CVAFS-5	0.99825	0.012 ng/L	NIST1641d	8.42 ng/mL	105.9%	MDN0280	4.6%	MDN0280	109.1%			
			NIST1641d	7.49 ng/mL	94.2%	MDN0285	6.2%	MDN0285	93.7%			
			NIST1641d	7.49 ng/mL	94.2%	MDN0674	2.7%	MDN0674	114.2%			

## MDN Quarterly Analysis QC Summary

Quarter 1 of 2001

<b>2001-012</b>	2/9/2001 CVAFS-4	0.99982	-0.011 ng/L	NIST1641d 7.29 ng/mL	91.7%	MDN0165	2.1%	MDN0165	96.4%	
				NIST1641d 8.00 ng/mL	100.6%	MDN0792	1.3%	MDN0792	85.0%	
						MDN0963	1.8%	MDN0963	100.9%	
<b>2001-013</b>	2/9/2001 CVAFS-5	0.999822	-0.016 ng/L	NIST1641d 8.41 ng/mL	105.8%	MDN0136	1.3%	MDN0136	102.9%	MDN0445 0.013 ng/Bottle
				NIST1641d 7.56 ng/mL	95.2%	MDN0677	2.6%	MDN0677	91.4%	
						MDN0936	3.1%	MDN0936	84.6%	
<b>2001-014</b>	2/23/2001 CVAFS-5	0.99959	0.091 ng/L	NIST1641d 8.02 ng/mL	100.9%	MDN0761	2.1%	MDN0761	102.3%	
				NIST1641d 8.07 ng/mL	101.5%	MDN0953	2.4%	MDN0943	103.4%	
						MDN0953		MDN0953	95.7%	
<b>2001-015</b>	2/23/2001 CVAFS-4	0.99920	0.078 ng/L	NIST1641d 7.38 ng/mL	92.9%	MDN0769	0.6%	MDN0746	94.9%	MDN0166 0.027 ng/Bottle
				NIST1641d 7.68 ng/mL	96.6%	MDN0824	5.3%	MDN0769	90.2%	
						MDN0824		MDN0824	96.9%	
<b>2001-016</b>	2/28/2001 CVAFS-4	0.99983	0.040 ng/L	NIST1641d 7.31 ng/mL	91.9%	MDN0716	2.3%	MDN0716	93.1%	
				NIST1641d 7.96 ng/mL	100.1%	MDN0827	0.6%	MDN0827	100.5%	
						MDN0894	0.4%	MDN0894	96.3%	
<b>2001-017</b>	2/28/2001 CVAFS-5	0.99844	0.018 ng/L	NIST1641d 8.26 ng/mL	103.9%	MDN0409	0.8%	MDN0409	93.5%	
				NIST1641d 7.55 ng/mL	94.9%	MDN0955	2.1%	MDN0955	98.0%	
						MDN1956	3.8%	MDN1956	99.9%	
<b>2001-018</b>	3/9/2001 CVAFS-5	0.99969	0.124 ng/L	NIST1641d 8.15 ng/mL	102.5%	MDN0122	5.8%	MDN0122	100.8%	MDN0745 0.010 ng/Bottle
				NIST1641d 8.12 ng/mL	102.2%	MDN0447	17.1%	MDN0447	97.5%	
						MDN0666	10.3%	MDN0666	116.9%	
						MDN1907	6.9%			
<b>2001-019</b>	3/9/2001 CVAFS-4	0.99906	0.108 ng/L	NIST1641d 7.65 ng/mL	96.3%	MDN0639	3.5%	MDN0639	99.4%	MDN1961 0.064 ng/Bottle
				NIST1641d 7.79 ng/mL	98.0%	MDN0654	7.3%	MDN0654	109.3%	
						MDN1748	1.5%	MDN1748	103.7%	
<b>2001-020</b>	3/15/2001 CVAFS-5	0.99802	0.152 ng/L	NIST1641d 8.43 ng/mL	106.1%	MDN0694	16.6%	MDN0280	101.5%	MDN0147 0.010 ng/Bottle
				NIST1641d 7.39 ng/mL	92.9%	MDN1913	4.6%	MDN0694	109.0%	
						MDN1913		MDN1913	81.0%	
<b>2001-021</b>	3/15/2001 CVAFS-4	0.99977	0.114 ng/L	NIST1641d 7.58 ng/mL	95.3%	MDN0749	8.9%	MDN0749	102.7%	MDN0820 0.015 ng/Bottle
				NIST1641d 7.41 ng/mL	93.2%	MDN0788	4.1%	MDN0788	88.1%	
						MDN1976	9.9%	MDN1976	126.8%	
<b>2001-022</b>	3/23/2001 CVAFS-5	0.99991	0.239 ng/L	NIST1641d 8.65 ng/mL	108.9%	MDN1981	1.9%	MDN1981	89.3%	MDN0187 0.003 ng/Bottle
				*NIST1641d 6.15 ng/mL	77.4%					



## MDN Quarterly Analysis QC Summary

Quarter 1 of 2001

2001-023	3/23/2001 CVAFS-4	0.99946	0.094 ng/L	NIST1641d	MDN0086	3.1%	MDN0086	101.5%	
				7.31 ng/mL					91.9%
				NIST1641d					MDN0442
2001-024	3/30/2001 CVAFS-5	0.99943	-0.009 ng/L	NIST1641d	MDN0632	10.7%	MDN0632	105.0%	
				8.15 ng/mL					102.5%
				NIST1641d					MDN0695
2001-025	3/30/2001 CVAFS-4	0.99994	0.075 ng/L	NIST1641d	MDN1920	1.0%	MDN0794	101.0%	
				7.78 ng/mL					97.9%
				NIST1641d					MDN1939
				7.81 ng/mL	MDN1939	87.5%	MDN1939	87.5%	

Quarterly Mean: 0.99787      0.071 ng/L      0.018 ng/Bottle  
 Std Dev: ±0.00598      ±0.065      ±8.7%      ±9.7%

## MDN Quarterly Analysis QC Summary

Quarter 2 of 2001

Analysis	Calibration R	BrCl Blk Conc	SRM		Duplicates		Spikes		Bottle Blanks	
			Conc	%Rec	Bottle ID	RPD	Bottle ID	Rec.	Bottle ID	Conc
2001-026 CVAFS-5	0.99601	0.073 ng/L	NIST1641d	110.9%	MDN0290	1.4%	MDN0290	101.8%	MDN0815	0.017 ng/Bottle
			8.82 ng/mL	MDN1761	6.9%	MDN1761	77.5%			
			NIST1641d	101.0%	MDN2012	2.7%	MDN2012	103.9%		
2001-027 CVAFS-4	0.99984	0.039 ng/L	NIST1641d	96.3%	MDN0648	6.8%	MDN0648	104.1%		
			7.65 ng/mL	MDN0825	6.0%	MDN0825	104.6%			
			NIST1641d	99.1%	MDN2007	19.9%	MDN2007	99.5%		
2001-028 CVAFS-5	0.99978	0.137 ng/L	NIST1641d	99.7%	MDN1993	19.9%	MDN1993	121.8%		
			7.93 ng/mL	MDN2003	7.7%	MDN2003	96.2%			
2001-029 CVAFS-4	0.99956	0.139 ng/L	NIST1641d	83.8%	MDN1905	1.0%	MDN1905	88.3%		
			6.66 ng/mL	MDN1915	0.1%	MDN1915	83.0%			
			NIST1641d	83.1%	MDN2026	1.8%	MDN2026	94.4%		
2001-030 CVAFS-5	0.99714	-1.726 ng/L	NIST1641d	117.8%						
			9.37 ng/mL							
2001-031 CVAFS-4	0.99972	0.080 ng/L	NIST1641d	101.4%	MDN0258	13.3%	MDN0258	108.0%		
			8.06 ng/mL	MDN0393	2.8%	MDN0393	86.6%			
			NIST1641d	99.3%	MDN0801	3.4%	MDN0801	106.0%		
2001-032 CVAFS-5	0.99787	0.115 ng/L	NIST1641d	102.0%	MDN0769	17.9%	MDN0769	104.4%		
			8.11 ng/mL	MDN0824	1.9%	MDN0824	100.0%			
			NIST1641d	84.2%	MDN0943	19.1%	MDN0943	102.1%		
2001-033 CVAFS-4	0.99602	0.186 ng/L	NIST1641d	104.3%	MDN0177	7.9%	MDN0177	106.0%		
			8.29 ng/mL	MDN0845	11.7%	MDN0845	103.7%			
			NIST1641d	99.3%	MDN2025	4.6%	MDN2025	102.8%		
2001-034 CVAFS-5	0.99691	0.037 ng/L	NIST1641d	101.2%	MDN0498	7.2%	MDN0498	93.9%		
			8.05 ng/mL	MDN0796	21.4%	MDN0796	108.1%			
			NIST1641d	80.8%	MDN0936	0.3%	MDN0936	105.1%		
2001-035 CVAFS-4	0.99860	-0.007 ng/L	NIST1641d	101.9%	MDN0183	2.2%	MDN0183	97.7%	MDN0935	0.021 ng/Bottle
			8.10 ng/mL	MDN0425	3.4%	MDN0425	103.0%			
			NIST1641d	96.6%	MDN2028	0.9%	MDN2028	108.0%		
2001-036 CVAFS-5	0.99929	-0.032 ng/L	NIST1641d	97.8%	MDN0154	4.7%	MDN0154	76.9%	MDN0181	0.014 ng/Bottle
			7.77 ng/mL	MDN0285	5.3%	MDN0285	138.0%			
			NIST1641d	103.5%	MDN1979	1.2%	MDN1979	89.1%		
2001-037 CVAFS-4	0.99982	0.012 ng/L	NIST1641d	96.9%	MDN0820	1.0%	MDN0820	109.5%	MDN0792	0.015 ng/Bottle
			7.70 ng/mL	MDN1731	0.9%	MDN1731	108.2%			
			NIST1641d	98.6%	MDN1975	3.6%	MDN1975	107.6%		

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2001-038	5/12/2001 CVAFS-4	0.99953	-0.009 ng/L	7.79 ng/mL NIST1641d 98.0%	MDN0683 4.1% MDN0844 2.7% MDN0938 2.7%	MDN0683 96.9% MDN0844 96.4% MDN0938 96.7%	MDN0152 0.005 ng/Bottle MDN1913 0.013 ng/Bottle
2001-039	5/12/2001 CVAFS-5	0.99898	0.015 ng/L	6.92 ng/mL NIST1641d 87.1%	MDN0180 0.2% MDN0267 6.2% MDN0864 4.5%	MDN0180 92.2% MDN0267 97.8% MDN0864 99.3%	
2001-040	5/18/2001 CVAFS-5	0.99951	0.072 ng/L	7.81 ng/mL NIST1641d 98.3%	MDN1919 2.2% MDN1951 9.5% MDN2020 3.2%	MDN1919 106.5% MDN1951 125.4% MDN2020 96.1%	MDN0440 0.010 ng/Bottle
2001-041	5/18/2001 CVAFS-4	0.99976	0.222 ng/L	8.15 ng/mL NIST1641d 102.5%	MDN0155 4.1% MDN1956 0.3% MDN2015 1.5%	MDN0155 102.4% MDN1956 95.1% MDN2015 109.9%	
2001-042	5/29/2001 CVAFS-5	0.99909	0.129 ng/L	7.81 ng/mL NIST1641d 98.2%	MDN0102 4.8% MDN0927 9.8% MDN1973 3.7%	MDN0102 88.6% MDN0927 105.5% MDN1973 105.3%	MDN1986 0.005 ng/Bottle
2001-043	5/29/2001 CVAFS-4	0.99951	0.062 ng/L	7.92 ng/mL NIST1641d 99.6%	MDN0430 0.9% MDN0448 6.4% MDN2023 2.3%	MDN0430 98.8% MDN0448 95.0% MDN2023 97.5%	
2001-044	6/5/2001 CVAFS-5	0.99827	0.041 ng/L	7.62 ng/mL NIST1641d 95.8%	MDN0666 4.5% MDN0678 7.2% MDN0765 3.6%	MDN0666 111.3% MDN0678 113.8% MDN0765 83.2%	MDN0984 0.029 ng/Bottle
2001-045	6/5/2001 CVAFS-4	0.99837	0.034 ng/L	8.36 ng/mL NIST1641d 105.2%	MDN0107 0.8% MDN0192 1.4% MDN1735 2.6%	MDN0107 104.3% MDN0192 95.9% MDN1735 95.0%	MDN2002 0.016 ng/Bottle
2001-046	6/10/2001 CVAFS-4	0.99995	-0.020 ng/L	7.86 ng/mL NIST1641d 98.9%	MDN0646 0.3% MDN0804 5.1% MDN0947 5.1%	MDN0646 128.6% MDN0804 103.8% MDN0947 101.9%	MDN0741 0.012 ng/Bottle
2001-047	6/10/2001 CVAFS-5	0.99872	0.112 ng/L	7.90 ng/mL NIST1641d 99.3%	MDN0272 3.2% MDN0285 1.3% MDN1992 1.1%	MDN0272 110.5% MDN0285 104.6% MDN1992 98.3%	
2001-048	6/12/2001 CVAFS-5	0.99959	0.064 ng/L	8.04 ng/mL NIST1641d 112.4%	MDN0497 0.2% MDN1757 0.2%	MDN0497 80.0% MDN1757 99.7%	
2001-049	6/12/2001 CVAFS-4	0.99905	0.037 ng/L	8.19 ng/mL NIST1641d 103.1%	MDN0699 5.0% MDN2024 0.1%	MDN0699 99.5% MDN2024 97.4%	
				6.87 ng/mL NIST1641d 86.4%			
				7.88 ng/mL NIST1641d 99.1%			



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2001-050	6/19/2001 CVAFS-4	0.99854	0.039 ng/L	NIST1641d	MDN0166	1.8%	MDN0166	97.4%	MDN0678	0.018 ng/Bottle				
				7.78 ng/mL							97.9%			
				NIST1641d							MDN1946	1.8%	MDN1946	105.2%
2001-051	6/26/2001 CVAFS-5	0.99982	0.065 ng/L	NIST1641d	MDN1994	0.5%	MDN1994	99.5%						
				7.37 ng/mL							92.8%			
				NIST1641d							MDN0038	1.7%	MDN0038	98.1%
2001-052	6/26/2001 CVAFS-4	0.99986	0.017 ng/L	NIST1641d	MDN0141	0.3%	MDN0141	95.5%	MDN2030	0.022 ng/Bottle				
				7.38 ng/mL							92.8%			
				NIST1641d							MDN0761	0.5%	MDN0761	99.8%
				NIST1641d	MDN1943	1.3%	MDN1943	96.4%						
				7.21 ng/mL							90.7%			
				NIST1641d							MDN0075	1.3%	MDN0075	105.3%
				NIST1641d	MDN0664	1.7%	MDN0664	106.4%						
				7.14 ng/mL							89.8%			
				NIST1641d							MDN1737	3.5%	MDN1737	98.4%
				NIST1641d	MDN1753	1.6%	MDN1753	97.5%						
				7.20 ng/mL							90.6%			
				NIST1641d							MDN0075	4.3%	MDN0075	100.9%
Quarterly Mean:		0.99886	-0.002 ng/L	97.3%		±4.9%				0.015 ng/Bottle				
											±0.00116	±0.350	±7.2%	±10.0%

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Analysis	Calibration		BrCl Blk		SRM		Duplicates		Spikes		Bottle Blanks	
	R		Conc	%Rec	Conc	%Rec	Bottle ID	RPD	Bottle ID	Rec.	Bottle ID	Conc
2001-053 CVAFS-5	7/6/2001 0.99982	0.075 ng/L	NIST1641d	89.8%	7.14 ng/mL	89.8%	MDN0287	6.7%	MDN0287	100.8%		
			NIST1641d		7.36 ng/mL	92.6%	MDN0802	1.7%	MDN0802	105.5%		
			*NIST1641d		7.25 ng/mL	91.2%	MDN2050	3.0%	MDN2050	91.6%		
2001-054 CVAFS-4	7/13/2001 0.99949	0.102 ng/L	NIST1641d	92.1%	7.32 ng/mL	92.1%	MDN0145	1.3%	MDN0145	88.7%	MDN0957	0.037 ng/Bottle
			NIST1641d		7.07 ng/mL	89.0%	MDN0198	1.1%	MDN0198	90.5%		
			NIST1641d		7.35 ng/mL	92.4%	MDN0983	3.1%	MDN0983	114.6%		
2001-056 CVAFS-4	7/13/2001 0.99977	0.088 ng/L	NIST1641d	89.4%	7.11 ng/mL	89.4%	MDN0085	3.1%	MDN0085	113.4%	MDN2132	0.025 ng/Bottle
			NIST1641d		7.49 ng/mL	94.2%	MDN0661	0.6%	MDN0661	96.0%		
			NIST1641d		7.16 ng/mL	90.0%	MDN2048	3.1%	MDN2048	96.3%		
2001-057 CVAFS-5	7/20/2001 0.99980	0.024 ng/L	NIST1641d	89.8%	7.14 ng/mL	89.8%	MDN0020	3.5%	MDN0020	98.4%		
			NIST1641d		7.47 ng/mL	94.0%	MDN0680	4.7%	MDN0680	103.9%		
			NIST1641d		7.03 ng/mL	88.4%	MDN1738	2.1%	MDN1738	100.5%		
2001-058 CVAFS-4	7/27/2001 0.99774	0.099 ng/L	NIST1641d	93.8%	7.25 ng/mL	91.3%	MDN0173	0.3%	MDN0173	92.1%		
			NIST1641d		7.03 ng/mL	88.4%	MDN0442	0.4%	MDN0442	99.8%		
			NIST1641d		7.03 ng/mL	88.4%	MDN0718	2.4%	MDN0718	93.0%		
2001-059 CVAFS-5	7/27/2001 0.99868	0.076 ng/L	NIST1641d	93.8%	7.45 ng/mL	93.8%	MDN0158	9.3%	MDN0158	97.0%	MDN2127	0.125 ng/Bottle
			NIST1641d		6.89 ng/mL	86.6%	MDN0493	2.3%	MDN0493	95.0%		
			NIST1641d		6.69 ng/mL	84.2%	MDN0658	7.1%	MDN0658	80.5%		
2001-060 CVAFS-4	7/30/2001 0.99982	0.124 ng/L	NIST1641d	89.0%	7.07 ng/mL	89.0%	MDN1948	1.8%	MDN1948	88.9%		
			NIST1641d		7.79 ng/mL	98.0%	MDN0439	0.8%	MDN0439	93.3%		
			NIST1641d		7.07 ng/mL	89.0%	MDN0816	1.1%	MDN0816	93.6%		
2001-061 CVAFS-5	7/30/2001 0.99982	0.140 ng/L	NIST1641d	93.5%	7.43 ng/mL	93.5%	MDN1981	1.0%	MDN1981	108.3%		
			NIST1641d		7.09 ng/mL	89.2%	MDN1984	0.9%	MDN1984	87.2%		
			NIST1641d		7.79 ng/mL	98.0%	MDN1948	0.9%	MDN1948	88.9%		
2001-062 CVAFS-4	8/11/2001 0.99849	0.042 ng/L	NIST1641d	89.8%	7.14 ng/mL	89.8%	MDN0171	0.7%	MDN0171	93.7%	MDN1943	0.007 ng/Bottle
			NIST1641d		7.42 ng/mL	93.3%	MDN1931	1.6%	MDN1931	84.7%		
			NIST1641d		7.07 ng/mL	89.0%	MDN1966	0.4%	MDN1966	100.5%		
2001-063 CVAFS-8	7/30/2001 0.99982	0.124 ng/L	NIST1641d	93.5%	7.43 ng/mL	93.5%	MDN0292	2.9%	MDN0292	97.8%		
			NIST1641d		7.09 ng/mL	89.2%	MDN0640	0.2%	MDN0640	92.6%		
			NIST1641d		7.09 ng/mL	89.2%	MDN1956	0.5%	MDN1956	101.6%		
2001-063 CVAFS-8	8/11/2001 0.99849	0.042 ng/L	NIST1641d	93.3%	7.42 ng/mL	93.3%	MDN0091	12.6%	MDN0091	108.2%		
			NIST1641d		7.14 ng/mL	89.8%	MDN2011	1.7%	MDN2011	102.7%		
			NIST1641d		7.07 ng/mL	89.0%	MDN0260	122.9%	MDN0260	122.9%		

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2001-064	8/11/2001 CVAFS-6	0.99961	0.063 ng/L	7.47 ng/mL NIST1641d 93.9%	7.07 ng/mL NIST1641d 88.9%	MDN0758 4.9%	MDN0841 6.8%	MDN0910 1.3%	MDN0758 113.6%	MDN0841 95.7%	MDN0910 101.7%	MDN0940 0.017 ng/Bottle	MDN2140 0.202 ng/Bottle
2001-065	8/17/2001 CVAFS-6	0.99983	0.030 ng/L	7.23 ng/mL NIST1641d 91.0%	7.23 ng/mL NIST1641d 91.0%	MDN2028 4.5%	MDN2055 16.5%	MDN2094 8.7%	MDN2028 95.5%	MDN2055 76.6%	MDN2094 95.5%		
2001-066	8/17/2001 CVAFS-8	0.99916	0.040 ng/L	7.62 ng/mL NIST1641d 95.9%	7.01 ng/mL NIST1641d 88.2%	MDN0964 7.9%	MDN2120 2.5%	MDN2143 2.0%	MDN0964 77.4%	MDN2120 89.2%	MDN2143 82.3%	MDN0911 0.029 ng/Bottle	
2001-068	8/24/2001 CVAFS-4	0.99986	0.037 ng/L	7.31 ng/mL NIST1641d 91.9%	7.11 ng/mL NIST1641d 89.5%	MDN0427 4.0%	MDN1934 4.6%		MDN0427 91.2%	MDN1934 95.3%			
2001-069	8/31/2001 CVAFS-5	0.99953	0.086 ng/L	7.27 ng/mL NIST1641d 91.4%	7.21 ng/mL NIST1641d 90.7%	MDN0497 20.9%	MDN2102 2.6%	MDN2160 3.5%	MDN2102 109.8%	MDN2160 119.1%			
2001-070	8/31/2001 CVAFS-4	0.99974	0.071 ng/L	7.47 ng/mL NIST1641d 94.0%	7.29 ng/mL NIST1641d 91.7%	MDN0192 1.5%	MDN2156 5.4%	MDN2162 2.6%	MDN0192 108.2%	MDN2156 107.4%	MDN2162 103.8%	MDN1956 0.034 ng/Bottle	
2001-071	9/7/2001 CVAFS-5	0.99898	0.100 ng/L	7.29 ng/mL NIST1641d 91.8%	6.78 ng/mL NIST1641d 85.3%	MDN2064 2.3%	MDN2080 7.7%	MDN2174 11.0%	MDN2064 109.8%	MDN2080 118.1%	MDN2174 117.8%		
2001-073	9/14/2001 CVAFS-5	0.99936	0.089 ng/L	7.20 ng/mL NIST1641d 90.6%	6.85 ng/mL NIST1641d 86.2%	MDN0769 1.7%	MDN1741 0.2%	MDN2112 0.1%	MDN0769 93.1%	MDN1741 105.6%	MDN2112 94.8%		
2001-074	9/14/2001 CVAFS-4	0.99874	0.004 ng/L	7.46 ng/mL NIST1641d 93.9%	6.74 ng/mL NIST1641d 84.8%	MDN0123 1.5%	MDN0956 4.1%	MDN2136 28.0%	MDN0123 92.0%	MDN0956 116.9%	MDN2136 133.6%		
2001-075	9/21/2001 CVAFS-5	0.99993	0.113 ng/L	7.40 ng/mL NIST1641d 93.1%	7.42 ng/mL NIST1641d 93.3%	MDN0125 2.5%	MDN0429 16.9%	MDN1745 15.2%	MDN0125 110.1%	MDN0429 100.6%			
2001-076	9/21/2001 CVAFS-4	0.99759	0.071 ng/L	7.43 ng/mL NIST1641d 93.5%	7.43 ng/mL NIST1641d 93.5%	MDN0163 16.4%	MDN0166 5.4%		MDN0163 110.9%	MDN0166 143.7%			
2001-077	9/28/2001 CVAFS-5	0.99876	0.163 ng/L	7.76 ng/mL NIST1641d 97.7%	7.31 ng/mL NIST1641d 91.9%	MDN0957 0.2%	MDN1979 21.9%	MDN1987 2.6%	MDN0957 113.6%	MDN1979 133.7%	MDN1987 114.0%		





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Analysis	Calibration		BrCl Bk Conc	SRM		Duplicates		Spikes		Bottle Blanks		
	R	0.99914		Conc	%Rec	Bottle ID	RPD	Bottle ID	Rec.	Bottle ID	Conc	
2001-079 10/5/2001 CVAFS-5	0.99926	0.087 ng/L	NIST1641d	100.1%	MDN0170	7.3%	MDN0170	100.1%	MDN2144	112.2%	MDN2191	111.1%
			7.96 ng/mL	100.1%	MDN2144	13.3%	MDN2144	112.2%	MDN2191	111.1%		
			NIST1641d	97.2%	MDN2191	1.8%	MDN2191	1.8%	MDN2191	111.1%		
2001-080 10/5/2001 CVAFS-4	0.99926	0.108 ng/L	NIST1641d	95.3%	MDN0287	2.1%	MDN0287	101.2%	MDN0688	106.2%	MDN0718	100.6%
			7.57 ng/mL	95.3%	MDN0688	4.2%	MDN0688	4.2%	MDN0718	100.6%		
			NIST1641d	94.9%	MDN0718	6.0%	MDN0718	6.0%	MDN0718	100.6%		
2001-081 10/12/200 CVAFS-5	0.99938	0.037 ng/L	NIST1641d	95.5%	MDN0490	2.2%	MDN0490	102.8%	MDN0754	106.3%	MDN1710	94.8%
			7.59 ng/mL	95.5%	MDN0754	4.1%	MDN0754	4.1%	MDN1710	94.8%		
			NIST1641d	93.1%	MDN1710	9.4%	MDN1710	9.4%	MDN1959	99.4%		
2001-083 10/13/200 CVAFS-8	0.99844	0.059 ng/L	NIST1641d	92.8%	MDN0256	2.4%	MDN0256	99.2%	MDN0735	105.4%	MDN1923	100.0%
			7.38 ng/mL	92.8%	MDN0735	4.9%	MDN0735	4.9%	MDN1923	100.0%		
			NIST1641d	98.6%	MDN1923	1.4%	MDN1923	1.4%	MDN1923	100.0%		
2001-084 10/13/200 CVAFS-6	0.99923	0.071 ng/L	NIST1641d	95.7%	MDN0439	2.8%	MDN0439	109.1%	MDN0805	110.5%	MDN2146	83.1%
			7.61 ng/mL	95.7%	MDN0805	1.4%	MDN0805	1.4%	MDN2146	83.1%		
			NIST1641d	92.8%	MDN2146	9.0%	MDN2146	9.0%	MDN2146	83.1%		
2001-085 10/13/200 CVAFS-5	0.99957	0.118 ng/L	NIST1641d	91.0%	MDN0747	1.8%	MDN0747	90.8%	MDN0849	76.5%	MDN0975	0.077 ng/Bottle
			7.38 ng/mL	91.0%	MDN0849	2.9%	MDN0849	2.9%	MDN0975	0.077 ng/Bottle		
			NIST1641d	93.6%	MDN0975	1.8%	MDN0975	1.8%	MDN0975	0.077 ng/Bottle		
2001-086 10/13/200 CVAFS-4	0.99964	0.169 ng/L	NIST1641d	93.8%	MDN0020	12.7%	MDN0020	100.8%	MDN0142	112.9%	MDN0820	121.0%
			7.46 ng/mL	93.8%	MDN0142	2.5%	MDN0142	2.5%	MDN0820	121.0%		
			NIST1641d	96.7%	MDN0820	0.5%	MDN0820	0.5%	MDN0820	121.0%		
2001-087 10/14/200 CVAFS-5	0.99976	0.067 ng/L	NIST1641d	91.3%	MDN0493	8.8%	MDN0493	98.9%	MDN0698	123.3%	MDN1761	112.5%
			7.26 ng/mL	91.3%	MDN0698	14.2%	MDN0698	14.2%	MDN1761	112.5%		
			NIST1641d	93.8%	MDN1761	5.8%	MDN1761	5.8%	MDN1761	112.5%		
2001-088 10/14/200 CVAFS-6	0.99886	0.021 ng/L	NIST1641d	96.1%	MDN0741	0.9%	MDN0741	96.5%	MDN0841	91.2%	MDN0864	83.2%
			7.64 ng/mL	96.1%	MDN0841	3.6%	MDN0841	3.6%	MDN0864	83.2%		
			NIST1641d	86.7%	MDN0864	6.1%	MDN0864	6.1%	MDN0864	83.2%		

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2001-090	10/14/2001 CVAFS-8	0.99976	-0.015 ng/L	7.37 ng/mL NIST1641d 92.7%	7.37 ng/mL NIST1641d 92.7%	MDN0145 MDN0397 MDN0663	7.4% 1.3% 1.5%	MDN0145 MDN0397 MDN0663	104.7% 103.8% 95.4%	MDN0102 MDN2094	0.117 ng/Bottle 0.055 ng/Bottle
2001-091	10/17/2001 CVAFS-8	0.99840	0.051 ng/L								
2001-092	10/19/2001 CVAFS-6	0.99961	0.037 ng/L	7.31 ng/mL NIST1641d 92.0%	7.46 ng/mL NIST1641d 93.9%	MDN0125 MDN0275 MDN0732	0.5% 6.7% 14.7%	MDN0125 MDN0275 MDN0732	90.3% 108.7% 104.5%		
2001-093	10/19/2001 CVAFS-5	0.99932	0.148 ng/L	7.17 ng/mL NIST1641d 90.2%	7.04 ng/mL NIST1641d 88.5%	MDN0038 MDN2100	5.2% 0.4%	MDN0038 MDN0940	109.6% 92.2%		
2001-094	10/19/2001 CVAFS-4	0.99931	0.142 ng/L	7.20 ng/mL NIST1641d 90.6%	7.46 ng/mL NIST1641d 93.8%	MDN0667 MDN1753 MDN2133	9.6% 25.0% 0.1%	MDN0667 MDN2133	101.7% 98.0%		
2001-095	10/26/2001 CVAFS-5	0.99990	-0.012 ng/L	7.21 ng/mL NIST1641d 90.7%	7.26 ng/mL NIST1641d 91.3%	MDN0393 MDN0742 MDN9019	0.1% 0.8% 1.1%	MDN0742 MDN9019	101.4% 103.8%		
2001-096	10/26/2001 CVAFS-4	0.99917	0.027 ng/L	7.19 ng/mL NIST1641d 90.5%	7.60 ng/mL NIST1641d 95.6%	MDN0165 MDN0421 MDN2079	0.6% 3.1% 0.8%	MDN0165 MDN0421 MDN2079	115.3% 106.8% 118.1%		
2001-097	11/5/2001 CVAFS-5	0.99948	0.058 ng/L	6.84 ng/mL NIST1641d 86.0%	7.50 ng/mL NIST1641d 94.3%	MDN0429 MDN1989 MDN2070	4.7% 12.8% 5.4%	MDN0429 MDN1989 MDN2070	83.0% 92.0% 101.7%		
2001-098	11/5/2001 CVAFS-5	0.99930	0.046 ng/L	7.56 ng/mL NIST1641d 95.2%	7.12 ng/mL NIST1641d 89.5%	MDN0147 MDN2171 MDN2220	1.8% 1.3% 10.7%	MDN0147 MDN2171 MDN2220	106.5% 102.1% 116.5%		
2001-099	11/9/2001 CVAFS-5	0.99976	0.011 ng/L	7.30 ng/mL NIST1641d 91.8%	7.40 ng/mL NIST1641d 93.1%	MDN0767 MDN0937 MDN2053	1.6% 1.2% 0.6%	MDN0767 MDN0937 MDN2053	91.4% 104.4% 102.6%		
2001-100	11/9/2001 CVAFS-4	0.99985	0.054 ng/L	7.33 ng/mL NIST1641d 92.2%	7.45 ng/mL NIST1641d 93.8%	MDN0148 MDN0678 MDN2124	1.3% 4.4% 3.3%	MDN0148 MDN0678 MDN2124	97.6% 104.5% 101.1%		
2001-101	11/16/2001 CVAFS-5	0.99978	0.045 ng/L	7.20 ng/mL NIST1641d 90.6%	7.13 ng/mL NIST1641d 89.7%	MDN2045 MDN2168	5.8% 5.1%	MDN2045 MDN2168	101.3% 98.5%	MDN0118 MDN0827 MDN0285	0.042 ng/Bottle 0.024 ng/Bottle 0.053 ng/Bottle



# MDN Quarterly Analysis QC Summary

Quarter 4 of 2001

2001-102	11/16/2000 CVAFS-4	0.99940	0.046 ng/L	7.44 ng/mL NIST1641d 93.6%	7.79 ng/mL NIST1641d 98.0%	MDN1924 MDN2226	0.4% 10.4%	MDN0809 MDN1924 MDN2226	124.1% 92.1% 103.7%	
2001-103	11/27/2000 CVAFS-5	0.99975	0.058 ng/L	6.06 ng/mL NIST1641d 87.6%	7.38 ng/mL NIST1641d 92.9%	MDN0930 MDN0959 MDN2039	5.9% 11.3% 6.3%	MDN0930 MDN0959 MDN2039	90.0% 105.2% 105.4%	MDN0964
2001-104	11/27/2000 CVAFS-4	0.99970	0.013 ng/L	7.29 ng/mL NIST1641d 91.7%	7.92 ng/mL NIST1641d 99.6%	MDN0408 MDN0734 MDN2154	4.3% 13.5% 4.9%	MDN0734 MDN2154	113.3% 103.7%	
2001-105	11/30/2000 CVAFS-5	0.99975	0.005 ng/L	6.08 ng/mL NIST1641d 87.8%	7.24 ng/mL NIST1641d 91.1%	MDN0391 MDN0640 MDN0834	12.9% 1.2% 5.6%	MDN0391 MDN0640 MDN0834	111.6% 87.2% 105.4%	
2001-106	11/30/2000 CVAFS-4	0.99904	0.049 ng/L	7.82 ng/mL NIST1641d 98.4%	8.11 ng/mL NIST1641d 102.1%	MDN0635 MDN1909 MDN1991	3.3% 0.3% 15.7%	MDN0635 MDN1909 MDN1991	105.4% 124.9% 103.4%	
2001-107	12/7/2001 CVAFS-5	0.99995	0.110 ng/L	7.44 ng/mL NIST1641d 93.6%	7.38 ng/mL NIST1641d 92.9%	MDN1955 MDN2073 MDN2151	2.4% 0.4% 0.7%	MDN1955 MDN2073 MDN2151	98.6% 93.4% 95.8%	
2001-109	12/12/2000 CVAFS-5	0.99986	0.033 ng/L	7.41 ng/mL NIST1641d 93.2%	7.43 ng/mL NIST1641d 93.4%	MDN0912 MDN2107 MDN2143	5.0% 1.4% 0.3%	MDN0912 MDN2107 MDN2143	98.1% 96.5% 85.6%	
2001-110	12/14/2000 CVAFS-5	0.99992	0.096 ng/L	7.65 ng/mL NIST1641d 96.2%	7.51 ng/mL NIST1641d 94.5%	MDN0772 MDN2052 MDN2069	0.9% 0.2% 8.7%	MDN0772 MDN2052 MDN2069	98.4% 97.9% 98.2%	MDN2131 MDN2231 MDN0870 MDN0974 MDN0172
2001-111	12/14/2000 CVAFS-4	0.99935	0.076 ng/L	6.69 ng/mL NIST1641d 84.2%	7.73 ng/mL NIST1641d 97.2%	MDN0134 MDN0742 MDN2130	10.5% 19.7% 3.4%	MDN0134 MDN0742 MDN2130	93.7% 100.4% 111.1%	MDN0292
2001-112	12/21/2000 CVAFS-5	0.99851	0.060 ng/L	7.98 ng/mL NIST1641d 100.4%	7.62 ng/mL NIST1641d 95.8%	MDN0680 MDN0800 MDN2020	8.0% 4.0% 10.3%	MDN0680 MDN0800 MDN2020	94.1% 109.7% 119.9%	MDN1737
2001-113	12/15/2000 CVAFS-4	0.99954	0.080 ng/L	7.31 ng/mL NIST1641d 91.9%	7.43 ng/mL NIST1641d 93.5%	MDN0199 MDN0487 MDN2142	4.5% 11.7% 9.1%	MDN0199 MDN0487 MDN2142	101.9% 101.0% 100.6%	

## MDN Quarterly Analysis QC Summary

Quarter 4 of 2001

2001-82 CVAFS-4	10/12/200	0.99566	0.070 ng/L	NIST1641d 7.28 ng/mL	91.6%	MDN0794	1.9%	MDN0794	99.4%
				NIST1641d 7.39 ng/mL	92.9%	MDN0909	6.8%	MDN0909	100.1%
						MDN0976	3.7%	MDN0976	95.1%
						MDN3008	10.2%	MDN3008	76.3%
2001-91 CVAFS-8	10/17/200	0.99840	0.051 ng/L	NIST1641d 7.69 ng/mL	96.7%	MDN0849	3.5%	MDN0849	95.2%
				NIST1641d 7.30 ng/mL	91.9%	MDN1983	5.6%	MDN1983	96.7%
						MDN2093	4.3%	MDN2093	103.9%
						MDN2098	5.2%	MDN2098	96.2%
Quarterly Mean:		0.99929	0.061 ng/L		93.3%		5.2%		101.4%
Std Dev:		±0.00077	±0.042		±3.4%		±4.9%		±9.6%
									0.048 ng/Bottle ±0.033

# Appendix C:

## Examples Of Performance Evaluation Sample Results

1. New York Dept. Of Health – Non-Potable Water  
– 7/2000
2. Analytical Products Group – WP June 2000





U.S. Department of the Interior  
U.S. Geological Survey

**RESULTS OF THE U.S. GEOLOGICAL SURVEY'S ANALYTICAL  
EVALUATION PROGRAM FOR STANDARD REFERENCE SAMPLES  
DISTRIBUTED IN SEPTEMBER 2001**

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Open-File Report 02-8

Lab # 245

Table 16. Statistical summary of reported data for standard reference sample HG-33 (mercury)

Hg-33 MERCURY (Hg) in µg/L

SUMMARY	Methods					Method Codes	Statistics
	0	6	8	9	11		
n =	2	1	24	4	1	00 Other	MPV = suspect data
Minimum =	0.935	0.54	0.25	0.285	1.15	06 Inductively coupled plasma/mass spectrometry	
Maximum =	1.22		2.13	1.53		08 Atomic absorption: cold vapor	
Median =			0.490			09 Atomic fluorescence	
F-pseudostigma =			0.325			11 Atomic absorption: hydride	

Lab	Rating	Z-value	Method Codes				
			0	6	8	9	11
1	NR	2.20	--	--	--	1.53	--
10	NR	-0.19	--	--	0.48	--	--
12	NR	0.54	--	--	0.8	--	--
16	NR	0.65	--	--	0.85	--	--
23	NR	-0.15	--	--	0.5	--	--
32	NR	-1.06	--	<0.1	--	--	--
46	NR	-0.57	--	--	0.314	--	--
50	NR	-0.06	--	0.54	--	--	--
59	NR	-0.72	--	--	0.25	--	--
89	NR	-0.70	--	--	0.258	--	--
96	NR	0.42	--	--	0.747	--	--
97	NR	0.95	--	--	0.98	--	--
138	NR	-0.53	--	--	0.332	--	--
142	NR	-0.35	--	--	0.41	--	--
146	NR	-0.12	--	--	0.511	--	--
147	NR	2.11	--	--	--	1.49	--
180	NR	0.31	--	--	0.699	--	--
193	NR	-0.46	--	--	0.362	--	--
198	NR	3.57	--	--	2.13	--	--
212	NR	-0.72	--	--	0.25	--	--
234	NR	0.72	--	--	0.88	--	--
245	NR	1.31	--	--	--	1.14	--
247	NR	-0.62	--	--	0.291	--	--
256	NR	0.84	0.935	--	--	--	--
259	NR	0.06	--	--	0.59	--	--
298	NR	1.49	1.22	--	--	--	--
304	NR	-0.64	--	--	0.285	--	--
307	NR	1.33	--	--	--	--	1.15
328	NR	0.47	--	--	0.77	--	--
331	NR	-0.42	--	--	0.38	--	--
334	NR	-0.35	--	--	0.41	--	--
370	NR	1.08	--	--	1.04	--	--
372	NR	-0.44	--	--	0.37	--	--

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

Page 1 of 4  
 Shipment Date : 23-Jul-2001  
 Closing Date : 07-Sep-2001  
 Score Date : 28-Sep-2001  
 Report Date : 03-Oct-2001

**Proficiency Test Report**

EPA Lab Code : WA01127

Lab : 11662  
 FRONTIER GEOSCIENCES INC  
 414 PONTIUS AVENUE NORTH  
 SEATTLE, WA-98109

Shipment : 245 Non Potable Water Chemistry

Analyte	Unit	Sample ID	Result	Method	Mean/Target	Satisfactory Limits	Score
Sample: Mercury							
Approval Category :	Non Potable Water						
Mercury, Total **	ug/L	4411	8.38	Method Not Specified	9.91	7.38 - 12.4	Satisfactory
<i>142 passed out of 159 reported results.</i>							
Sample: Metals I and II							
Approval Category :	Non Potable Water						
Silver, Total **	ug/L	4411	537	Method Not Specified	555	476 - 636	Satisfactory
<i>155 passed out of 174 reported results.</i>							
Arsenic, Total **	ug/L	4411	99.3	Method Not Specified	97.9	78 - 118	Satisfactory
<i>140 passed out of 162 reported results.</i>							
Barium, Total	ug/L	4411	2160	Method Not Specified	2120	1800 - 2400	Satisfactory
<i>148 passed out of 158 reported results.</i>							
Cadmium, Total **	ug/L	4411	660	Method Not Specified	661	564 - 750	Satisfactory
<i>176 passed out of 181 reported results.</i>							

\*\* indicates NVLAP accredited analyte. Lab Code 200387-0. ELAP is an A2LA accredited Proficiency Testing Provider. Certificate Number 1785.01



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

**Proficiency Test Report**

Lab : 11662      FRONTIER GEOSCIENCES INC  
 414 PONTIUS AVENUE NORTH  
 SEATTLE, WA-98109

EPA Lab Code : WA01127

Shipment Date : 29-Jan-2001  
 Closing Date : 15-Mar-2001  
 Score Date : 04-Apr-2001  
 Report Date : 05-Apr-2001

Shipment : 240      Non Potable Water Chemistry

Analyte	Unit	Sample ID	Result	Method	Mean/Target	Satisfactory Limits	Score
Sample: Mercury							
Approval Category :	Non Potable Water						
Mercury, Total **	ug/L	4011	6.95	Method Not Specified	6.95	5.14 - 8.74	Satisfactory
<i>155 passed out of 171 reported results.</i>							
Sample: Metals I and II							
Approval Category :	Non Potable Water						
Silver, Total **	ug/L	4011	96.8	Method Not Specified	91	77.5 - 104	Satisfactory
<i>148 passed out of 182 reported results.</i>							
Arsenic, Total **	ug/L	4011	299	Method Not Specified	340	283 - 400	Satisfactory
<i>161 passed out of 171 reported results.</i>							
Barium, Total	ug/L	4011	1330	Method Not Specified	1340	1140 - 1520	Satisfactory
<i>158 passed out of 166 reported results.</i>							
Cadmium, Total **	ug/L	4011	85.3	Method Not Specified	82	69.2 - 94.3	Satisfactory
<i>182 passed out of 190 reported results.</i>							

\*\* indicates NVLAP accredited analyte. Lab Code 200387-0. ELAP has applied to A2LA for PT Provider accreditation.



Environment  
Canada

Environnement  
Canada

National Water Research Institute  
National Laboratory for Environmental Testing  
867 Lakeshore Road  
Burlington, Ontario  
L7R 4A6

December 14, 2001

Dear FP 79 Participant:

Enclosed please find the final reports for FP 79 and your individual laboratory appraisals. The invoice for this study is either enclosed or has been mailed to the appropriate department. Thank you to all participants who responded to the third Methods survey. The aim of our surveys is to enhance the relevance of the final reports for our clients.

Should you have any questions or comments regarding this study, please do not hesitate to contact us.

**Happy Holidays to You and Your Family!**

Sincerely,

*Joan*

Joan Blum  
PE Study Co-ordinator  
NWRI / NLET  
Environment Canada  
905-336-4926  
fax: 905-336-8914  
e-mail: joan.blum@cciw.ca

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Environment  
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Laboratory Appraisal for Total Mercury in Water Study No. 79

2001-12-12

Your laboratory code is F138

Mercury

Ideal

The performance of your laboratory is rated as "good"

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Analytical Products Group, Inc.

# PERFORMANCE REPORT

## DMRQA Study 21 Contract Laboratory Report

APG LAB CODE: 4701

FRONTIER GEOSCIENCES INC.

SUITE B

414 PONTIUS AVENUE NORTH

SEATTLE, WA 98109

# DMRQA

*Pursue Perfection... Accept Excellence*

**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: November 12, 2001  
 Study Name: DMRQA 21 for 2001

### Product: Trace Metals

Units: ug/L

Analyte	Reported Lot Number	Reported Value	Assigned Value	Acceptance Range	Z-Score	Test Method	Evaluation	Permittee
Aluminum	30466	500	500	418-583	0	ICP-MSEPA1638	Acceptable	WA0024473
Aluminum	30466	500	500	418-583	0	ICP-MS	Acceptable	ME0100790
Aluminum	30466	500	500	418-583	0	ICP-MS	Acceptable	CA0005550
Arsenic	30466	153	153	125-182	0	ICP-MSEPA1638	Acceptable	WA0024473
Arsenic	30466	153	153	125-182	0	ICP-MS	Acceptable	ME0100790
Arsenic	30466	153	153	125-182	0	ICP-MS	Acceptable	CA0005550
Cadmium	30466	29.1	29.6	24.4-34.9	0.284	ICP-MSEPA1638	Acceptable	WA0024473
Cadmium	30466	29.1	29.6	24.4-34.9	0.284	ICP-MS	Acceptable	ME0100790
Cadmium	30466	29.1	29.6	24.4-34.9	0.284	ICP-MS	Acceptable	CA0005550
Chromium	30466	109	104	88.7-120	0.965	ICP-MSEPA1638	Acceptable	WA0024473
Chromium	30466	109	104	88.7-120	0.965	ICP-MS	Acceptable	ME0100790
Chromium	30466	109	104	88.7-120	0.965	ICP-MS	Acceptable	CA0005550
Copper	30466	119	122	108-137	0.619	ICP-MS	Acceptable	WI0003565
Copper	30466	119	122	108-137	0.619	ICP-MSEPA1638	Acceptable	WA0024473
Copper	30466	119	122	108-137	0.619	ICP-MS	Acceptable	ME0100790
Copper	30466	119	122	108-137	0.619	ICP-MS	Acceptable	CA0005550
Lead	30466	204	199	169-229	0.5	ICP-MSEPA1638	Acceptable	WA0024473
Lead	30466	204	199	169-229	0.5	ICP-MS	Acceptable	ME0100790
Lead	30466	204	199	169-229	0.5	ICP-MS	Acceptable	CA0005550
Mercury	30466	15.1	16.3	12.2-20.3	0.889	CVAFSEPA1631	Acceptable	WA0024473
Mercury	30466	15.1	16.3	12.2-20.3	0.889	CVAFS	Acceptable	UT0020109
Mercury	30466	15.1	16.3	12.2-20.3	0.889	CVAFS	Acceptable	UT0020834
Mercury	30466	15.1	16.3	12.2-20.3	0.889	CVAFS	Acceptable	OH0009580
Mercury	30466	15.1	16.3	12.2-20.3	0.889	CVAFS	Acceptable	MN0000990
Mercury	30466	15.1	16.3	12.2-20.3	0.889	CVAFS	Acceptable	ME0100595
Mercury	30466	15.1	16.3	12.2-20.3	0.889	CVAFS	Acceptable	ME0100790
Mercury	30466	15.1	16.3	12.2-20.3	0.889	CVAFS	Acceptable	CO0020320
Mercury	30466	15.1	16.3	12.2-20.3	0.889	FGS-069CV-AFS	Acceptable	CO0020478
Mercury	30466	15.1	16.3	12.2-20.3	0.889	CVAFS	Acceptable	CA0005053



Analytical Products Group, Inc.

# PERFORMANCE REPORT

WP Performance Summary

May 2001

APG Customer Code: 4701

Frontier Geosciences Inc.  
Suite B

414 Pontius Avenue North  
Seattle, WA 98109





APG Customer 4701  
EPA Lab Code WA01127

Frontier Geosciences Inc.  
414 Pontius Avenue North  
Seattle, WA 98109

Print Date June 28, 2001

Page 10 of 29

WP May 2001

## Performance Summary

Study Closing Date 06/15/2001

APG+ Lot Number: 30339-30340

WP Lot Number: 30305-30306

### Product: Trace Metals

Analyte	Product Level	Analyte Code	Reported Value	Assigned Value	Acceptance Range	Z-Score	Test Method	Evaluation
Aluminum	WP	1	1690	1750	1500-1990	0.62	ICP-MS	Acceptable
Antimony	WP	16	685	738	522-886	0.31	ICP-MS	Acceptable
Antimony	WP	16	536	738	522-886	2.77	AFS	Check for Error
Arsenic	WP	2	384	367	306-431	0.72	CRYO	Acceptable
Arsenic	WP	2	378	367	306-431	0.43	AFS	Acceptable
Arsenic	WP	2	376	367	306-431	0.34	ICP-MS	Acceptable
Barium	WP		1930	2100	1780-2380	1.52	ICP-MS	Acceptable
Beryllium	WP	3	96.7	100	84.2-114	0.45	ICP-MS	Acceptable
Boron	WP		648	657	590-746	0.77	ICP-MS	Acceptable
Cadmium	WP	4	147	148	126-169	0	ICP-MS	Acceptable
Chromium	WP	6	55.5	417	363-473	19.8	COLORIMETRIC	Not Acceptable
Chromium	WP	6	424	417	363-473	0.33	ICP-MS	Acceptable
Cobalt	WP	5	59.9	60	51.2-68.3	0.07	ICP-MS	Acceptable
Copper	WP	7	86.9	81.2	70.4-92.3	1.51	ICP-MS	Acceptable
Iron	WP	8	1400	1500	1330-1690	1.82	ICP-MS	Acceptable
Iron	WP	8	1610	1500	1330-1690	1.65	COLORIMETRIC	Acceptable
Lead	WP	12	135	133	110-155	0.27	ICP-MS	Acceptable
Manganese	WP	10	157	150	133-167	1.25	GRAPHITEFURNAC	Acceptable
Manganese	WP	10	163	150	133-167	2.32	ICP-MS	Check for Error
Mercury	WP	9	3.05	3.26	2.35-4.18	0.68	CVAFS	Acceptable
Molybdenum	WP	74	68.8	68.2	56.1-79.3	0.29	ICP-MS	Acceptable
Nickel	WP	11	132	126	107-145	0.96	ICP-MS	Acceptable
Selenium	WP	13	165	175	136-204	0.44	HG-AFS	Acceptable



# Appendix D:

## Examples Of Laboratory Intercomparison Studies – 2001

1. World-Wide Intercomparison Exercise For The Determination Of Trace Elements And MethylMercury In Estuarine Sediment Samples IAEA-405- December 2000 – March 2001
2. Northern Contaminants QA Program – National Water Research Institute – April 26 2001
3. 15<sup>th</sup> Intercomparison For Trace Elements In Marine Sediments and Biological Tissues – National Research Council Canada – May 2002



Report No. IAEA/AL/127  
IAEA/MEL/70

**WORLD-WIDE INTERCOMPARISON EXERCISE  
FOR THE DETERMINATION OF TRACE ELEMENTS  
AND METHYLMERCURY IN ESTUARINE  
SEDIMENT SAMPLE IAEA-405**

**M. Coquery, S. Azemard and S. J. de Mora**

**December 2000**

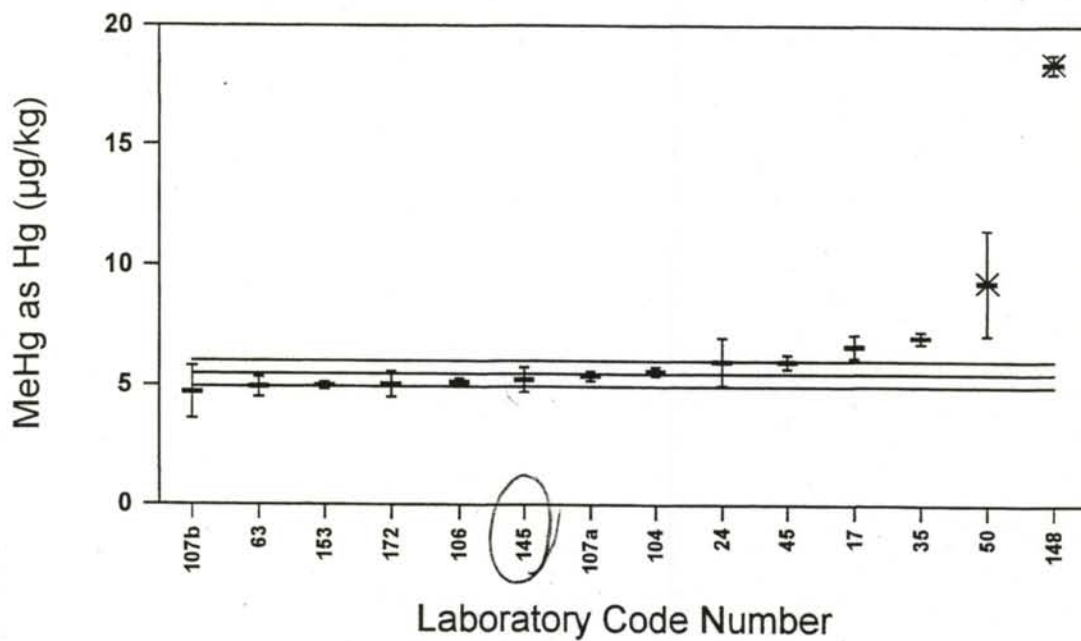
International Atomic Energy Agency  
Marine Environment Laboratory  
B.P. 800  
MC-98012 Monaco

Prepared in collaboration with:





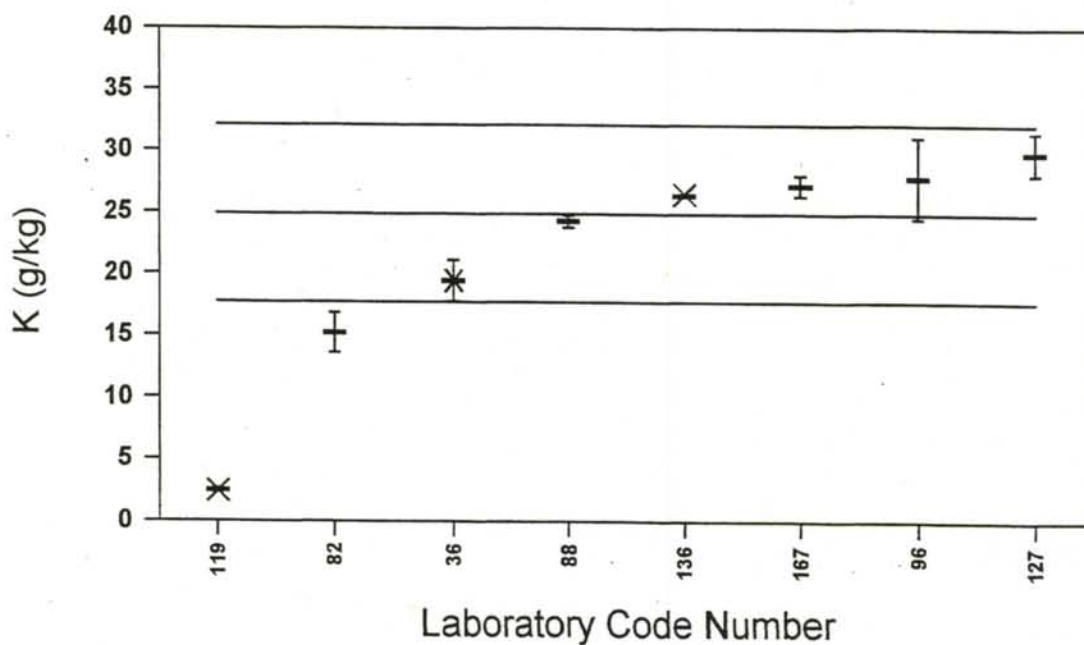
### Methyl mercury - IAEA-405 intercomparison exercise



Error bar = mean  $\pm$  1 SD ; X outlier

Horizontal lines = Recommended value  $\pm$  95% conf. interval ( $5.49 \pm 0.53$  µg/kg)

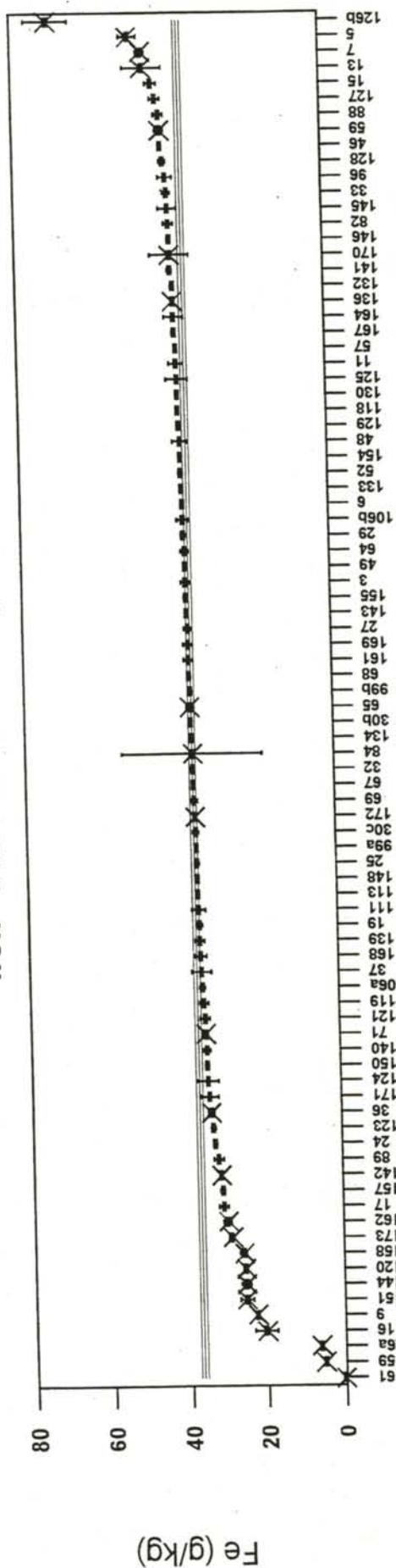
### Potassium - IAEA-405 intercomparison exercise



Error bar = mean  $\pm$  1 SD

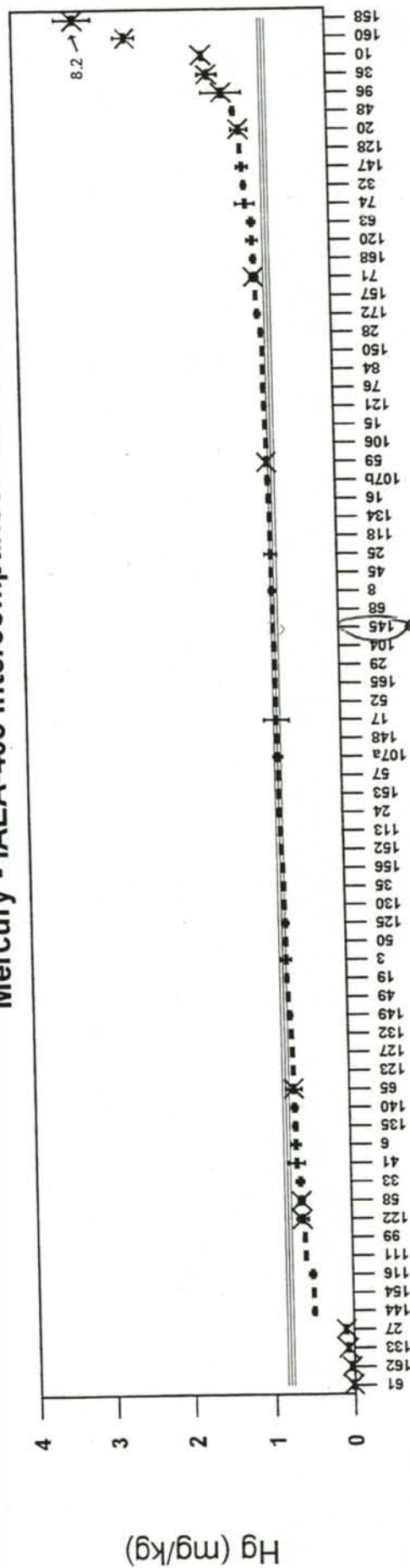
Horizontal lines = Information value  $\pm$  95% conf. interval ( $24.9 \pm 7.2$  g/kg)

### Iron - IAEA-405 intercomparison exercise



### Mercury - IAEA-405 intercomparison exercise

### Mercury - IAEA-405 intercomparison exercise





National Water Research Institute  
867 Lakeshore Road; P.O. Box 5050  
Burlington, Ontario L7R 4A6

April 26, 2001

**TO: Participants of the Northern Contaminants QA Program**

**re: Northern Contaminants Program Interlaboratory Study NCP II-5  
The Analysis of Trace Metals and Methylmercury in Biota**

Dear Participant: **Your confidential Lab Code is: A011**

Attached is a summary of data received for the above-named interlaboratory QA study. Please verify your data as it appears in the summary and notify us if any errors are found. A non-detected compound would be reported as "<x" where x is a specified concentration below which the presence or absence of the particular parameter in that sample could not be determined. A non-analyzed parameter would be identified as "-". If no further results and/or corrections are received by May 15, 2001, this study will be closed and a final report prepared.

Following are some comments and observations on this study. Please note that the means and standard deviations on the attached summary tables have been calculated after rejecting outlying results using Grubb's test at the 5% significance level. These outliers are flagged in red with an "H" or an "L" for high and low results, respectively. Where less than 3 values above the detection limit(s) were reported, means and standard deviations were not calculated.

1. Fifteen laboratories participated in this study. By analyte, the number of laboratories that provided results are as follows:

trace metals (other than Hg).....	14
total mercury.....	13
methylmercury .....	4
total organic mercury.....	4

2. The identity of the test samples were as follows:

- Sample 1 - Narwhal Muktuk - Iqaluit region, Nunavut
- Sample 2 - fillets of landlocked Char - North Lake (5 Mile Lake), Resolute
- Sample 3 - Burbot Liver - Old Crow, Fort Good Hope

The muktuk sample was ground and homogenized under liquid nitrogen and all three tissue samples were stored at -20°C before and after processing. The char





## Trace Metal Results (ug/g) for Sample 1 (Muktuk)

Lab ID	Parameter															
	Al	As	Cd	Cr	Co	Cu	Fe	Hg	Mn	Ni	Pb	Se	Sn	Tl	V	Zn
A005	-	-	-	-	-	-	-	0.41	-	-	-	-	-	-	-	-
A006	0.56	0.96	0.03	1.57	<0.001	0.40	51	0.43	0.36	0.21	0.03	2.53	<0.001	<0.0005	0.01	59
A009	11	1.35	0.04	2.31	<0.03	0.54	82.0	0.422	15.6 H	0.83	0.05	3.87	0.73	<0.02	0.04	51.2
A011	-	0.95	0.026	0.81	<0.01	0.43	74.6	0.48	0.23	0.24	0.020	3.01	<0.030	<0.003	<0.20	52.8
A012	-	1.04	-	-	-	-	-	0.485	-	-	-	3.58	-	-	-	-
A013	<10.00	<1.00	<0.25	3.16	<0.25	<0.75	45.28	0.50	<0.50	0.90	<0.75	-	-	-	<0.50	52.08
A018	-	1.15	0.026	1.73	0.012	0.39	-	0.479	0.395	0.47	0.018	3.61	-	0.001	<0.002	56.3
A019	3.9	1.0	0.03	1.7	<0.03	1.2 H	65.5	0.315	0.6	0.66	0.4 H	3.6	<0.5	<0.2	<0.07	54.4
A020	-	1.17	0.032	-	-	-	-	0.40	-	-	0.025	2.78	-	-	-	-
A021	-	-	<0.3	-	-	0.27	-	0.3	-	-	<0.2	5.1	-	-	-	-
A024	0.31	1.20	<0.05	0.864	<0.05	0.423	21.8	0.328	0.441	0.197	<0.05	4.36	-	-	<0.05	58.6
A025	<30	1.0	<0.1	1.1	<0.1	0.4	53.6	0.390	0.4	0.3	<0.1	3	-	<0.1	<0.1	58
A028	-	0.3517 L	-	0.377	<0.0177	-	-	-	0.751	-	-	-	-	-	-	-
A029	<10	1.25	0.03	1.5	<0.1	0.48	66	-	0.54	0.5	<0.1	4	<0.2	<0.03	<0.5	61.8
A041	<1	1.2	<0.08	0.9	<0.05	0.5	55	0.45	0.5	0.2	<0.1	4.0	<0.1	<0.01	<0.1	60
Mean	3.94	1.12	0.031	1.456	0.012	0.426	57.2	0.415	0.469	0.451	0.029	3.62	0.73	0.001	0.025	56.4
Std Dev	4.98	0.13	0.005	0.784	-	0.078	17.7	0.067	0.151	0.268	0.013	0.72	-	-	-	3.6
Coeff. of Var. (%)	126	12	15	54	-	18	31	16	32	59	45	20	-	-	-	6
No. of results	4	12	7	11	1	10	9	13	10	10	6	12	1	1	2	10
Interlab Median	2.23	1.15	0.03	1.5	0.012	0.423	55.0	0.4	0.441	0.4	0.03	3.605	0.73	0.001	0.025	57.2

## Total Organic Mercury and Methylmercury (as Hg<sup>++</sup>) Results (ug/g)

Lab ID	Total Organic Mercury						Methylmercury (as Hg <sup>++</sup> )		
	Muktuk 1	Sample 2		Burbot Liver 3	Muktuk 1	Sample		Burbot Liver 3	
		Landlocked Char				Landlocked Char			
A005	0.39	0.17	<0.02	-	-	-	-	-	
A006	0.43	0.20	<0.1	-	-	-	-	-	
A009	-	-	-	0.38	0.17	0.02	-	-	
A011	-	-	-	0.442	0.205	0.030	-	-	
A012	-	-	-	0.361	0.169	0.023	-	-	
A013	-	-	-	-	-	-	-	-	
A018	-	-	-	0.196	0.146	0.047	-	-	
A019	-	-	-	-	-	-	-	-	
A020	0.39	0.16	<0.01	-	-	-	-	-	
A021	0.42	0.19	<0.06	-	-	-	-	-	
A024	-	-	-	-	-	-	-	-	
A025	-	-	-	-	-	-	-	-	
A028	-	-	-	-	-	-	-	-	
A029	-	-	-	-	-	-	-	-	
A041	-	-	-	-	-	-	-	-	
Mean	<b>0.408</b>	<b>0.180</b>	-	<b>0.345</b>	<b>0.173</b>	<b>0.030</b>	-	-	
Std Dev	0.021	0.018	-	0.105	0.024	0.012	-	-	
Coeff of Var.(%)	5	10	-	30	14	40	-	-	
No. of results	4	4	0	4	4	4	-	-	
Interlab Median	0.405	0.18	-	0.371	0.170	0.027	-	-	



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# **NRC-CMRC**

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## ***Fifteenth Intercomparison for Trace Elements in Marine Sediments and Biological Tissues***

Scott Willie

Chemical Metrology

NRC Document No. 42768

May 2002

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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

