NATIONAL WATER RESEARCH INSTITUTE

INSTITUT NATIONAL DE RECHERCHE SUR LES EAUX

Ecosystem Interlaboratory QA Program
Study FP70 - Trace Metals in Surface Waters
(March & April 1997)

H. Alkema and L. Hjelm

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Environment Canada Environnement Canada
National Water Research Institute
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June 20, 1997

To: Participants of the NWRI Ecosystem Interlaboratory QA Program

Re: Final Report for NWRI Study FP70 - Trace Metals Portion

Dear Participant:

We would like to thank you for your co-operation and prompt responses with respect to this study. In return, it is the aim of the quality assurance group to give prompt evaluations, reports, and effective remedial assistance.

The Institute is pleased to distribute this final report to the FP participant laboratories. This report includes results and evaluations for a unique series of samples: Trace Metals. The evaluation of results includes an evaluation for systematic bias and precision. The flagging criteria, used to assess precision, are open to change. In order to improve our data assessments and the quality of your data, you may find that these criteria change from study to study. This would be evident in Table 3 - Summary of Study-to-Study Performance. A complete listing of all laboratory results is included so that each laboratory can compare its results and evaluations with other laboratories. For details concerning these evaluations please refer to the attached appendix, Glossary of Terms, or to the Research & Applications Branch QA Manual.

In the data summary tables you will find the tabulation of the degree of bias. It has been difficult to quantify and determine its significance at low values. *In this report we have calculated bias in two components which relate directly to the chemical measurement.* Laboratory heads are encouraged to discuss the attached report openly with those who manage their programs and those who use their laboratory data.

The laboratories listed in this report submitted their data with a confidential laboratory code. This confidentiality is fully respected by our staff. Access to these codes is possible through the relevant laboratories or program authorities.

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

Yours truly,

Harry A.

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Attachment: Individual Laboratory Appraisal

Canada

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LABORATORY for ENVIRONMENTAL TESTING

REPORT NO. NWRI-QA-97-03

ECOSYSTEM INTERLABORATORY QUALITY ASSURANCE PROGRAM

STUDY FP70 - FINAL REPORT

March and April 1997

An Interlaboratory Quality Assurance Study for Trace Metals in Surface Waters *

by

H. Alkema and L. Hjelm

Environmental Standards and Reference Materials
Project Information & Quality Management
National Laboratory for Environmental Testing
National Water Research Institute
Burlington, Ontario

June 1997

*companion studies: Major Ions/Total P; Report NWRI-QA-97-02, and Rain and Soft Waters; Report NWRI-QA-97-01

NWRI Interlaboratory Quality Assurance Studies for Acid Rain and Surface Waters

Major Ions and Nutrients, Trace Metals, Total Phosphorus, and Mercury

The Institute's interlaboratory quality assurance (QA) studies support a core group of government labs and their QA requirements of various environmental programs. These programs include: acid rain research, Great Lakes trans-boundary issues, and issues involving provincial watershed/ecosystem research, monitoring, and jurisdiction. The QA program also addresses health issues, such as, toxic metal (lead, manganese, and mercury) contamination of drinking water.

The QA studies are executed twice a year and accommodate environmental programs in both Canada and the United States of America. The US Environmental Protection Agency, US Geological Survey, and numerous university acid rain programs show a continued interest in this program. More than 200 laboratories are invited to participate on a voluntary basis in each study. Currently, 40 of these labs participate in the various study matrixes. One study consists of five (5) series of ten (10) samples each and includes numerous parameters for analysis. The primary feature of these studies is to report the quality of data produced by the participating laboratories. Laboratory performance is ranked in terms of the number of biased parameters (systematic bias) and flagged results (precision measurement). The reports produced from the client data provide a powerful tool for the diagnosis of problematic analysis. Environmental programs and data users are therefore encouraged to have their labs participate as a means of quantifying laboratory performance and data quality.

As the NWRI studies run on a voluntary and cost recovery basis, laboratories and program managers express an ongoing interest in study design and sample requirements. The program is open to international participation and contractually specialized studies are available.

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Table 1

ENVIRONMENT CANADA
National Water Research Institute

Ecosystem Interlaboratory Quality Assurance Program
PARTICIPATION LIST - Study FP 70 (March & April 1997)

Trace Metals

Accutest Laboratories Ltd.
Alberta Research Council
Aqualta
ASL - Analytical Service Lab Ltd.
Can Test Ltd.
Chemex Environmental Services
Chemex Labs Alberta Inc.
City of Calgary - Waterworks
Environment Canada - EPL, Prairie & Northern Region
Environment Canada - EQL, Atlantic
Environment Canada - ETC, AMD
Environment Canada - NWRI, NLET
Environment Canada - Pacific Environmental Science Centre
Enviro-Test Laboratories
Enviro-Test Manitoba Technology Centre
Falconbridge - Kidd Creek Division
Frontier Geosciences Inc.
Laboratoire de Santé Publique du Québec
Métallurgie Noranda Incorporated
Ministère de l'Environnement et de la Faune du Québec - Laval
Ministère de l'Environnement et de la Faune du Québec - Sainte-Foy
Natural Resources Canada - CFS, Atlantic Region
Natural Resources Canada - CFS, Ontario Region
NB Department of the Environment - ASL
Norwest Labs
Ontario Ministry of Environment and Energy - Dorset
Ontario Ministry of Environment and Energy - Etobicoke
PEI Department of Fisheries and Environment
Philip Analytical Services Corporation
Saskatchewan Research Council
TAIGA Environmental Laboratory
US Geological Survey - NWQL

Note: Laboratories select their routine parameters from the series of samples in this study.

Table 2 Laboratory Performance Scores (Study 0070)

Trace Metals

	BIAS				FLAGS		
LAB CODE	NO. OF PARAMETERS ANALYZED	NO. OF PARAMETERS BIASED	PERCENTAGE OF PARAMETERS BIASED (%)	NO. OF RESULTS RANKED	NO. OF FLAGS ASSIGNED	PERCENTAGE OF RESULTS FLAGGED (%)	SUM OF % BIAS AND % FLAGS SCORE
F002	9	0	0.00	79	1	1.27	1.27
F003	21	0	0.00	202	5	2.48	2.48
F032	16	1	6.25	145	0	0.00	6.25
F069	21	1	4.76	184	5	2.72	7.48
F038	22	1	4.55	203	6	2.96	7.50
F001	21	2	9.52	207	2	.97	10.49
F094	22	2	9.09	198	9	4.55	13.64
F015	19	1	5.26	161	14	8.70	13.96
F096	20	1	5.00	157	15	9.55	14.55
F024	15	1	6.67	137	13	9.49	16.16
F008	14	1	7.14	121	12	9.92	17.06
F060	22	2	9.09	192	16	8.33	17.42
F014	16	2	12.50	134	9	6.72	19.22
F048	21	2	9.52	185	23	12.43	21.96
F013	8	1	12.50	51	7	13.73	26.23
F019	15	1	6.67	110	24	21.82	28.48
F011	21	5	23.81	203	11	5.42	29.23
F093	18	2	11.11	155	34	21.94	33.05
F046	21	6	28.57	192	12	6.25	34.82
F138	18	5	27.78	180	22	12.22	40.00
F010	19	3	15.79	179	44	24.58	40.37
F009	20	4	20.00	184	45	24.46	44.46
F026	8	2	25.00	77	15	19.48	44.48
F063	16	4	25.00	130	28	21.54	46.54
F037	10	1	10.00	86	36	41.86	51.86
F036	3	1	33.33	25	5	20.00	53.33
F012	21	5	23.81	127	41	32.28	56.09
F031	12	4	33.33	102	33	32.35	65.69
F068	2	0	0.00	8	6	75.00	75.00
F089	17	7	41.18	150	55	36.67	77.84
F133	21	14	66.67	190	85	44.74	111.40
F025	22	12	54.55	186	122	65.59	120.14

The following parameters were used in the analysis:

Al	V	Cr	Mn	Fe	Co
Ni	Cu	Zn	As	Se	Sr
Mo	Ag	Cd	Sb	Ba	Pb
U	Li	Be	Tl		

The following parameters were excluded:

Bi

Table 3

SUMMARY OF STUDY-TO-STUDY PERFORMANCE

Trace Metals

LAB CODE	%BIAS PLUS %FLAGS ON STUDIES 0062	0063	0064	0065	0066	0067	0068	0069	0070	MEDIAN SCORE	COMMENTS
F001	12.9	8.0	5.1	10.0	2.5	6.2	1.4	10.5	10.5	8.0	GOOD
F002	22.5	9.2	3.5	3.4	-	11.5	0.0	2.7	1.3	3.5	GOOD
F003	4.9	0.0	4.5	11.6	8.5	12.2	15.5	1.4	2.5	4.9	GOOD
F008	38.6	17.0	16.4	21.6	12.5	18.3	3.6	5.7	17.1	17.0	SATISFACTORY
F009	-	64.7	85.9	41.0	39.4	49.4	61.7	21.6	44.5	46.9	MODERATE
F010	26.6	21.0	36.1	26.7	38.9	50.0	25.0	-	40.4	31.4	MODERATE
F011	22.7	48.3	14.8	35.0	19.7	14.4	7.2	44.3	29.2	22.7	SATISFACTORY
F012	-	-	-	-	-	-	41.8	50.1	56.1	50.1	MODERATE
F013	26.4	29.3	16.8	27.1	15.9	5.1	6.3	9.6	26.2	16.8	SATISFACTORY
F014	50.1	38.1	52.7	50.7	52.5	54.6	53.8	61.8	19.2	52.5	MODERATE
F014b	-	-	-	-	-	-	-	0.0	-	-	-
F014c	-	-	-	-	-	-	-	0.0	-	-	-
F014d	-	-	-	-	-	-	-	0.0	-	-	-
F015	6.6	7.1	9.4	9.1	10.7	19.7	3.8	11.8	14.0	9.4	GOOD
F016	39.3	17.6	73.8	61.0	116.1	-	-	-	-	61.0	POOR
F019	-	-	-	-	60.3	41.4	53.2	25.8	28.5	41.4	MODERATE
F020	15.9	46.4	46.2	41.3	52.8	56.0	-	-	-	46.3	MODERATE
F022	-	-	-	-	-	-	56.4	-	-	-	-
F023	-	42.8	-	-	-	-	-	-	-	-	-
F024	65.0	10.3	7.8	6.2	21.6	19.3	21.0	28.8	16.2	19.3	SATISFACTORY
F025	49.7	22.8	48.0	38.8	41.8	-	-	-	120.1	44.9	MODERATE
F026	30.9	70.0	9.0	31.0	-	71.0	29.4	57.0	44.5	37.7	MODERATE
F030	45.1	49.5	50.3	-	45.1	122.6	28.9	-	-	47.3	MODERATE
F031	-	65.7	45.2	49.7	33.6	58.0	56.6	64.7	65.7	57.3	MODERATE
F032	148.7	11.2	10.7	15.9	1.4	2.8	18.7	25.9	6.3	11.2	SATISFACTORY
F032b	-	-	-	-	-	-	11.3	-	-	-	-
F032c	-	-	-	58.4	-	-	23.8	-	-	41.1	MODERATE
F033	8.1	67.2	110.5	11.9	37.2	10.9	16.5	-	-	16.5	SATISFACTORY
F035	-	111.3	49.8	64.7	50.7	14.1	-	-	-	50.7	MODERATE
F036	-	72.9	54.8	-	-	78.6	106.4	73.6	53.3	73.2	POOR
F037	55.8	65.0	41.0	79.4	-	41.0	34.1	83.3	51.9	53.8	MODERATE
F038	15.0	53.0	17.4	57.6	21.1	19.6	8.2	8.4	7.5	17.4	SATISFACTORY
F039	30.9	-	-	-	-	-	-	-	-	-	-
F040	37.0	-	-	-	-	-	-	-	-	-	-
F042	10.0	0.0	50.0	-	10.0	0.0	-	-	-	10.0	GOOD
F043	48.8	48.5	-	-	64.9	-	13.6	-	-	48.6	MODERATE
F044	5.7	21.0	-	-	-	-	-	-	-	13.4	SATISFACTORY
F045	36.7	-	-	-	-	-	-	-	-	-	-
F046	27.3	30.4	17.0	35.7	20.8	42.7	30.0	30.8	34.8	30.4	MODERATE
F047	67.8	44.2	-	-	-	48.1	-	-	-	48.1	MODERATE
F048	-	69.7	30.0	29.4	54.2	5.7	10.4	62.5	22.0	29.7	MODERATE
F050	-	-	-	80.0	-	-	22.7	53.8	-	53.8	MODERATE
F051	-	-	-	24.7	27.0	8.6	-	-	-	24.7	SATISFACTORY
F052	-	-	-	57.6	-	-	-	-	-	-	-
F055	68.5	112.1	-	136.0	-	-	-	-	-	112.1	POOR
F059	-	-	-	67.4	63.8	-	-	-	-	65.6	POOR
F060	-	47.8	80.4	-	-	-	15.3	-	17.4	32.6	MODERATE
F061	-	-	-	-	105.3	105.9	-	-	-	105.6	POOR
F062	-	88.8	-	73.7	-	-	-	49.2	-	73.7	POOR
F063	-	-	97.5	-	-	-	44.0	25.6	46.5	45.3	MODERATE
F064	-	-	133.6	-	-	-	43.0	-	-	88.3	POOR
F065	-	-	121.8	-	-	-	-	12.9	-	67.3	POOR
F066	-	-	96.0	18.2	-	-	-	-	-	57.1	MODERATE
F067	-	-	48.1	-	-	-	-	-	-	-	-
F068	-	-	91.7	33.3	36.8	52.9	100.0	33.3	75.0	52.9	MODERATE
F069	-	-	21.6	16.6	16.0	34.3	22.8	2.0	7.5	16.6	SATISFACTORY
F071	-	-	-	-	73.0	141.4	-	-	-	107.2	POOR
F072	-	-	-	43.7	-	-	-	-	-	-	-
F075	-	-	22.9	-	-	-	-	-	-	-	-
F076	-	-	2.9	-	2.0	-	-	-	-	2.4	GOOD
F077	-	-	77.6	-	-	-	-	-	-	-	-
F078	-	-	-	41.2	-	-	-	-	-	-	-
F080	-	-	-	41.2	38.3	17.2	54.6	50.7	-	41.2	MODERATE
F081	-	-	-	22.8	-	-	-	-	-	-	-
F082	-	-	-	22.3	-	17.4	-	-	-	19.8	SATISFACTORY
F083	-	-	-	50.0	-	-	-	-	-	-	-
F088	-	-	-	40.0	27.2	-	-	-	-	33.6	MODERATE
F089	-	-	-	-	40.4	-	66.5	-	77.8	66.5	POOR
F091	-	-	-	-	48.7	-	-	-	-	-	-
F093	-	-	-	-	-	29.9	20.4	43.3	33.0	31.5	MODERATE
F094	-	-	-	-	-	91.7	76.1	9.5	13.6	44.9	MODERATE
F095	-	-	-	-	-	15.6	-	-	-	-	-
F095b	-	-	-	-	-	12.3	-	-	-	-	-
F096	-	-	-	-	-	-	66.2	-	14.6	40.4	MODERATE
F097	-	-	-	-	-	.9	-	-	-	-	-
F098	-	-	-	-	-	12.5	-	-	-	-	-
F099	-	-	-	-	-	62.5	-	-	-	-	-
F103	-	-	-	-	-	-	78.6	-	-	-	-
F133	-	-	-	-	-	-	-	-	111.4	-	-
F138	-	-	-	-	-	-	-	-	40.0	-	-
INTERLAB MEDIAN	30.9	44.2	45.2	38.8	37.2	19.7	25.0	25.9	29.2		

STUDY DATES: 0062(06-JAN-93), 0063(05-JUL-93), 0064(05-JAN-94), 0065(05-JUL-94), 0066(04-JAN-95), 0067(05-JUL-95), 0068(01-MAR-96), 0069(01-SEP-96), 0070(03-MAR-97)

Table 4

Trace Metals Sample Design for FP 70
March and April 1997

Sample Number	Sample Name	Type (DA*/Low)	Expected Copper Concentration (ppm)
FP 70 TM-1	FS Wawa	Low	0.034
FP 70 TM-2	TM-24.2D	Low	0.002
FP 70 TM-3	FS Wawa-SP	Low	0.039
FP 70 TM-4	TM-23.2	Low	0.010
FP 70 TM-5	TM-26.2	Low	0.015
FP 70 TM-6	FS Wawa-SP2	DA	0.080
FP 70 TM-7	FS Wawa-SP3	DA	0.240
FP 70 TM-8	TM-52.2	DA	0.225
FP 70 TM-9	TM-53.2D	DA	0.280
FP 70 TM-10	TM-54.2	DA	0.480

* Direct aspiration

Table 5

SUMMARY of Interlaboratory MEDIAN VALUES for Trace Metals - Study 0070

PARAMETER		SAMPLE NUMBER						
		FS-WAWA SAMPLE 1	TM-24.2D SAMPLE 2	WAWA-SP SAMPLE 3	TM-23.2 SAMPLE 4	TM-26.2 SAMPLE 5	WAWA-SP2 SAMPLE 6	WAWA-SP3 SAMPLE 7
Aluminum	mg/L	.0135	.0120	.0155	.0960	.0675	.0540	.1300
Vanadium	mg/L	.0001	.0026	.0024	.0020	.0120	.0370	.0990
Chromium	mg/L	.0011	.0019	.0031	.0065	.0110	.0459	.1040
Manganese	mg/L	.0005	.0032	.0022	.0082	.0168	.0286	.1205
Iron	mg/L	.0090	.0050	.0114	.0130	.0230	.0490	.1160
Cobalt	mg/L	.0005	.0023	.0021	.0073	.0080	.0321	.0847
Nickel	mg/L	.0003	.0020	.0026	.0052	.0100	.0369	.1070
Copper	mg/L	.0311	.0030	.0343	.0098	.0145	.0744	.1240
Zinc	mg/L	.0020	.0075	.0060	.0100	.0294	.0585	.1250
Arsenic	ug/L	1.2000	1.9000	1.5000	8.5500	7.7250	5.6750	12.000
Selenium	ug/L	.4000	1.3000	.4770	4.0000	5.0000	3.1000	7.4000
Strontium	mg/L	.0570	.0270	.0600	.0590	.0998	.1115	.1640
Molybdenum	mg/L	.0001	.0022	.0020	.0050	.0082	.0300	.0694
Silver	ug/L	-	1.4800	.1400	4.0000	7.1000	2.2600	6.1000
Cadmium	mg/L	-	.0016	.0011	.0026	.0067	.0160	.0400
Antimony	ug/L	.1000	1.0000	.2550	2.6800	2.1000	2.6800	5.7000
Barium	mg/L	.0110	.0034	.0130	.0148	.0244	.0430	.1030
Thallium	ug/L	-	1.5000	.2100	3.8100	5.0500	2.7000	5.0200
Lead	mg/L	.0002	.0025	.0037	.0038	.0098	.0530	.1172
Bismuth	ug/L	-	1.0450	.2000	4.2000	4.1000	2.0250	4.4000
Uranium	ug/L	.0400	1.7050	.4720	5.4700	7.6000	6.2400	10.650
Lithium	ug/L	.4200	2.1300	.5660	3.6850	7.0000	3.2500	4.1000
Berylium	ug/L	-	.8000	.1300	1.6000	3.3000	2.0000	3.9500

		TMDA-52.2 SAMPLE 8	TMDA-53.2D SAMPLE 9	TMDA-54.2 SAMPLE 10
Aluminum	mg/L	.3050	.3032	.4600
Vanadium	mg/L	.1470	.2400	.3420
Chromium	mg/L	.1650	.2600	.4300
Manganese	mg/L	.2005	.3015	.3435
Iron	mg/L	.4150	.2800	.3880
Cobalt	mg/L	.1400	.2102	.2755
Nickel	mg/L	.2695	.2670	.3260
Copper	mg/L	.2110	.2610	.4585
Zinc	mg/L	.2500	.3135	.5400
Arsenic	ug/L	26.000	28.050	25.000
Selenium	ug/L	20.650	18.000	15.350
Strontium	mg/L	.2890	.3125	.5880
Molybdenum	mg/L	.2000	.1750	.3020
Silver	ug/L	20.000	15.600	15.100
Cadmium	mg/L	.0918	.1000	.1650
Antimony	ug/L	15.800	13.550	11.250
Barium	mg/L	.1480	.2380	.2610
Thallium	ug/L	17.500	13.100	8.7700
Lead	mg/L	.3700	.3015	.5336
Bismuth	ug/L	13.200	11.200	10.500
Uranium	ug/L	22.800	26.300	62.900
Lithium	ug/L	12.000	9.4000	9.0000
Berylium	ug/L	16.900	9.2700	7.1500

Appendix A

Glossary of Terms
Quantifying Bias in NWRI QA Studies

GLOSSARY OF TERMS

Used for the Evaluation of Interlaboratory Results

Acceptable Deviation: The absolute value of the maximum difference between a result and the target value which will not be flagged.

Bias: Results for a parameter are assessed to be biased by the procedure of Youden when they are consistently ranked to be either higher or lower than the median result. In these interlaboratory studies, for most parameters, a bias of greater than 5% is considered to be excessive. Biases of less than 5% are noted for caution and investigation.

Bias Blank: In the graph for bias % slope, the y-intercept for the laboratory results indicates a systematic blank of analysis. This is the second component of bias.

Bias % Slope: When laboratory results for a parameter are plotted against the target values, the slope as compared to the ideal results (no bias) is considered to be the major component of the degree of bias. For an explanation of Bias % Slope see the following explanation in "Quantifying Bias in NWRI QA Studies".

Erratic: Results for a parameter are evaluated as erratic when both high and low flags are assigned.

Flagged Result: A result is flagged when its value is beyond that of the median (target value) plus or minus the acceptable difference.

Isolated Outlier: A parameter analysis which performs satisfactorily but produces an extreme result. (formerly, 'out of control')

Satisfactory: Fully acceptable, 'good results'.

'W' or 'T' Code: A 'W' or 'T' code may be used with a reported result as described in ASTM. However, in the NWRI QA studies, these codes may result in flagging discrepancies. "Less than" values or negative results are also legitimate when reporting the results. Laboratories should use their usual data reporting protocols insofar as they are compatible with the other laboratories.

The following three terms define the acceptable differences from the median of results (**target value**) that is allowed without a result being flagged either low or high:

- **LLBAE:** Lower Limit for Use of Basic Acceptable Error,
- **BAE:** Basic Acceptable Error, and
- **CEI:** Concentration Error Increment.

In general, for the NWRI QA studies, the values chosen for the **basic acceptable error** and the **concentration error increment** are selected so that good precision may be inferred. Historically, for the Federal-Provincial QA Program, for moderate ranges, this has been achieved with the 10% Deviation Rule.

For a sample whose **target value** is at or below the **lower limit for use of basic acceptable error**, the **basic acceptable error** is used to determine the range of acceptable deviations.

> For example: Suppose that the **lower limit for use of the basic acceptable error** has been set as 10 μg/L and the **basic acceptable error** is 1.0 μg/L, if a **target** (median) **value** for a sample is 5 μg/L, then any **reported result** within the range 5 ± 1.0 or 4.0 to 6.0 μg/L would be considered acceptable. The **BAE** would define the acceptable result within the 0-10 μg/L range.

For results above the **lower limit for use of basic acceptable error**, an allowance is made for the increased variability due to concentration. For almost all substances it appears that the variability of results increases with concentration. The allowance is added to the **basic acceptable error**. It is calculated by multiplying the **concentration error increment** (as a percentage) by the difference between the **target value** and the **lower limit for use of basic acceptable error**.

> For example: A **target value** for a sample may be 21 μg/L, the **BAE** is 1.0, the **LLBAE** is 10 μg/L and the **CEI** 0.1. The acceptable difference is calculated by the equation: **(Target - LLBAE) x CEI + BAE**. For the figures mentioned the answer would be (21 - 10) x 0.10 + 1.0 = 2.1. Thus the range 18.9 to 23.1 μg/L would be considered acceptable and would not be flagged.

The calculated acceptable difference is termed **1 criteria** or **crit**. This value and the value of three standard deviations (**3SD**) are both action criteria in the determination of flags. When the

reported value is subtracted from the **target value**, the difference is then divided by the **1 criteria** value. This produces the number of **1 crit** deviations. The assigned flag depends upon what range this number falls into.

1 Criteria Deviations	Assigned Flag
1 - 1.5	L or H
1.5 - 3SD	VL or VH
> 3SD	EL or EH

In cases where the **3SD** value is lower than that of **1 crit**, only extreme flags (EL or EH) are assigned. A minimum of 6 results are needed for the calculation of **3SD**, otherwise, 2 criteria deviations are used.

References:

1. ASTM, 1983, Volume 11.01, Water 1, Section II, pp. D4210-83.
2. Ranking Laboratories by Round-Robin Tests, W.J. Youden, Precision Measurement and Calibration, H.H. Ku, Editor, NBS Special Publication 300-Volume 1, U.S. Government Printing Office, Washington, D.C., 1969.

June 1996

Quantifying Bias in NWRI QA Studies

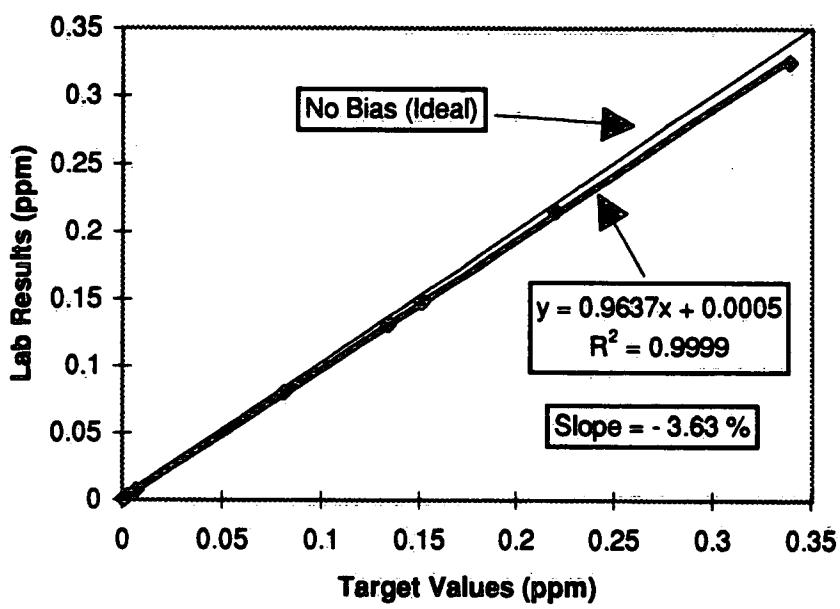
Introduction

Systematic bias as part of the QA data assessment is a major element in quantifying data quality. It is important in qualifying the accuracy of data in a general sense, when the entire set of analysis data may be affected by factors such as calibration, instrument setup, chemical reagent efficiency and purity of blank solutions. The absence of bias is not only very important when assessing data accuracy, but also when merging data sets from different times or locations.

Degree of Bias

In the NWRI QA studies with 10 sample series, systematic bias[1] is assessed non-parametrically by the procedure of Youden. Up until now, the degree of bias has not been calculated for the QA reports. The degree of bias may be parametrically quantified by two parameters taken from the parameter performance chart, as in figure 1. When bias is indicated by the procedure of Youden, the slope and intercept, give the degree of bias. A complication arises from the high precision of methodologies and instrumentation like ICPMS. A very high precision of analysis may lead to an assessment of very low bias, e.g. 2 or 3%.

Figure 1 **Parameter Performance**



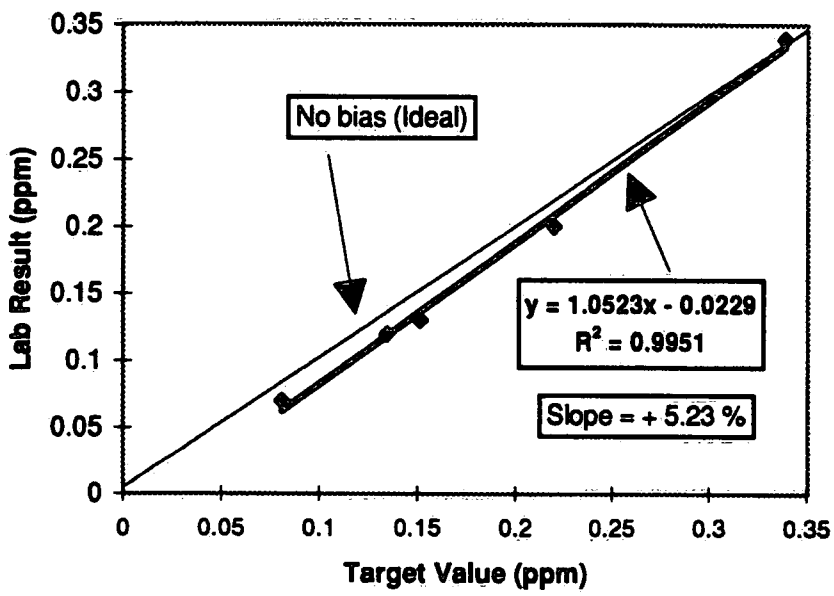
[1] Systematic bias is often identified with the comparison of data to a certified standard.

Parameter Performance Graph and Bias

The parameter performance graph, Figure 1, charts the laboratory results against the target values for a parameter. The ideal results, showing no bias and no deviating data, would fall on the 45° line labeled 'no bias (ideal)'. In this figure, the laboratory results have a very high degree of precision as indicated by the the correlation coefficient (R^2) of 0.9999. The slope of the regression line, as indicated by the equation was 0.9637 and as a percentage calculates to be -3.63%. This slope is one factor in evaluating the degree of bias.

The second contribution of bias, as indicated by the parameter performance graph, is the analysis blank. This blank value is given by the y-intercept, and in this case is indicated to be 0.0005 ppm. These two factors, slope and blank are considered to be the two important considerations in quantifying bias. Preliminary investigation indicates that the slope value is the most important factor and needs to be followed most closely. However, the blank may be contaminated (alternatively the standards) and become the larger factor of the two. The example in Figure 2 is a case in point.

Figure 2 **Parameter Performance**



In this parameter performance graph, we have a worst case situation. The Youden bias for this parameter is indicated as 'biased low'. However, the graph for this parameter and laboratory indicates a positive slope of 5.23%. Upon examining the graph, the regression line indicates a considerably large negative intercept or blank value. In this case it is the blank value that needs to be investigated.

Conclusion

Systematic bias as indicated in the NWRI interlaboratory study by the procedure of Youden has two distinct components. The regression equation as given in the performance graph can quantify these two important factors. Whereas the slope factor may be the most significant of the two, the blank bias factor should also be indicated for the cases where it may be the larger and more meaningful of the two.

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NWRI Ecosystem Interlaboratory QA Program

Bias Critical Values
Trace Metals and Mercury

Parameter	%
Aluminum	5
Vanadium	5
Chromium	5
Manganese	5
Iron	5
Cobalt	5
Nickel	5
Copper	5
Zinc	5
Strontium	5
Molybdenum	5
Cadmium	5
Barium	5
Lead	5
Arsenic	10
Selenium	10
Silver	10
Antimony	10
Bismuth	25
Lithium	10
Beryllium	10
Uranium	10

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Appendix B

Data & Evaluation Summary

PARAMETER: 13091 Aluminum mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0050 BASIC ACCEPTABLE ERROR= .0050 CONCENTRATION ERROR INCREMENT= .1000

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.011	6.50	.012	11.50	.014	7.00	.090	6.50	.064	6.00	.057	20.00
F002	.012	10.50	.012	11.50	.015	11.00	.096	15.00	.067	12.50	.052	11.00
F003	.014	14.00	.014	17.00	.017	15.50	.096	15.00	.067	12.50	.05	8.00
F008	.010	2.50	.011	6.00	.012	2.50	.097	18.50	.065	8.00	.049	6.00
F009	.011	6.50	.012	11.50	.014	7.00	.096	15.00	.085 VH	28.00	.053	12.50
F010	.028 VH	23.00	.014	17.00	.034 EH	23.00	.106	27.00	.073	24.00	.072 VH	27.00
F011	.0107	4.00	.0111	8.00	.0133	5.00	.0897	5.00	.063	4.50	.0483	5.00
F012	<.02	0.00	<.02	0.00	<.02	0.00	.10	22.00	.07	21.50	.06	22.50
F014	.016	18.00	.011	6.00	.0160	13.50	.103	24.50	.074	25.50	.050	8.00
F015	.014	14.00	.01	3.00	.019	19.00	.095	11.00	.066	9.50	.055	17.00
F019	<.02	0.00	<.02	0.00	<.02	0.00	.08 L	3.00	.06	3.00	.04 L	2.00
F024	.018	19.00	.014	17.00	.018	18.00	.10	22.00	.070	21.50	.057	20.00
F025	.013	12.00	.014	17.00	.015	11.00	.097	18.50	.067	12.50	.077 VH	28.00
F026	.0148	16.00	.0141	20.00	.0170	15.50	.0964	17.00	.0677	16.50	.0547	16.00
F031	<.02	0.00	<.02	0.00	<.02	0.00	.09	6.50	.07	21.50	.05	8.00
F032	.014	14.00	.012	11.50	.016	13.50	.094	10.00	.067	12.50	.057	20.00
F036	.024 VH	21.50	.014	17.00	.024 H	21.00	.100	22.00	.074	25.50	.070 VH	26.00
F037	.0060 L	1.00	.0060 L	1.00	.0070 L	1.00	.0490 EL	1.00	.0365 EL	1.00	.0275 EL	1.00
F038	.012	10.50	.012	11.50	.015	11.00	.098	20.00	.068	18.00	.054	15.00
F046	.011	6.50	.011	6.00	.014	7.00	.088	4.00	.063	4.50	.048	4.00
F048	.0115	9.00	.0120	11.50	.0145	9.00	.0956	12.50	.0675	15.00	.0624	24.00
F060	.019	20.00	.016	22.00	.020	20.00	.105	26.00	.066	9.50	.053	12.50
F063	<.01	0.00	<.01	0.00	<.01	0.00	.11	28.00	.07	21.50	.06	22.50
F069	.011	6.50	.0109	4.00	.0131	4.00	.0906	8.00	.0645	7.00	.0504	10.00
F089	.065 EH	24.00	.042 EH	24.00	.046 EH	24.00	.117 EH	29.00	.092 EH	29.00	.081 EH	29.00
F093	.024 VH	21.50	.022 EH	23.00	.025 VH	22.00	.091	9.00	.083 H	27.00	.066 H	25.00
F094	.0157	17.00	.0157	21.00	.0178	17.00	.0956	12.50	.0677	16.50	.0535	14.00
F096	<.02	0.00	<.02	0.00	<.02	0.00	.103	24.50	.069	19.00	.056	18.00
F133	.010	2.50	.009	2.00	.012	2.50	.078 L	2.00	.056 L	2.00	.045	3.00
MEDIAN	.0135		.0120		.0155		.0960		.0675		.0540	
1CRIT	.0058		.0057		.0060		.0141		.0112		.0099	
N	22		22		22		27		27		27	
MEAN	.0148		.0129		.0171		.0956		.0683		.0556	
3STDEV	.0147		.0079		.0149		.0211		.0176		.0245	

PARAMETER: 13091 Aluminum mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.127	8.00	.302	11.50	.292	9.00	.442	5.00
F002	.134	21.00	.305	14.50	.305	16.50	.46	15.50
F003	.13	16.00	.30	8.50	.29	7.50	.45	9.50
F008	.125	6.00	.300	8.50	.312	20.50	.477	21.00
F009	.129	13.00	.305	14.50	.299	11.00	.459	14.00
F010	.146	24.00	.315	21.00	.314	22.00	.476	20.00
F011	.129	13.00	.296	4.00	.296	10.00	.448	7.00
F012	.14	23.00	.33	26.00	.31	18.50	.48	22.50
F014	.124	5.00	.299	6.00	.289	6.00	.444	6.00
F015	.129	13.00	.32	22.50	.31	18.50	.48	22.50
F019	.12	2.50	.28	2.00	.28	3.00	.45	9.50
F024	.13	16.00	.30	8.50	.30	12.50	.46	15.50
F025	.160 VH	28.00	.368 EH	29.00	.371 EH	29.00	.589 EH	29.00
F026	.1285	11.00	.3066	16.00	.3032	15.00	.4607	17.00
F031	.13	16.00	.32	22.50	.32	25.00	.50	28.00
F032	.133	20.00	.314	20.00	.305	16.50	.472	19.00
F036	.152 H	26.00	.332	27.00	.332	28.00	.484	26.50
F037	.161 VH	29.00	.359 EH	28.00	.327	27.00	.481	24.00
F038	.132	19.00	.303	13.00	.288	5.00	.439	4.00
F046	.12	2.50	.30	8.50	.27	2.00	.43	2.00
F048	.128	9.50	.324	24.00	.320	25.00	.482	25.00
F060	.128	9.50	.326	25.00	.318	23.00	.484	26.50
F063	.15 H	25.00	.31	17.50	.32	25.00	.47	18.00
F069	.122	4.00	.302	11.50	.300	12.50	.455	12.50
F089	.153 H	27.00	.313	19.00	.312	20.50	.455	12.50
F093	.137	22.00	.298	5.00	.290	7.50	.449	8.00
F094	.126	7.00	.291	3.00	.285	4.00	.431	3.00
F096	.131	18.00	.310	17.50	.301	14.00	.453	11.00
F133	.112 L	1.00	.264 L	1.00	.256 EL	1.00	.385 EL	1.00
MEDIAN	.1300		.3050		.3032		.4600	
1CRIT	.0175		.0350		.0348		.0505	
N	27		27		27		27	
MEAN	.1331		.3097		.3033		.4619	
3STDEV	.0308		.0460		.0440		.0532	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	91.00	9.100	10					ICP-MS
F002	139.00	13.900	10					A.A.
F003	123.50	12.350	10					ICP-OES
F008	99.50	9.950	10					GF/ICP
F009	133.00	13.300	10	VH				
F010	228.00	22.800	10	VH EH VH	BIASED HIGH*	.41	.0115	ICP
F011	65.50	6.550	10		BIASED LOW*	-2.00	-.0023	
F012	156.00	22.286	7					ICPMS
F014	118.50	11.850	10					ICP MS
F015	150.00	15.000	10					GFAA/ICP
F019	25.00	3.571	7	L L	BIASED LOW*	-1.38	-.0123	ICAP
F024	170.00	17.000	10					ICP-AES
F025	214.00	21.400	10	VHVHEHEHEH				ICP-MS
F026	160.00	16.000	10					ICP
F031	127.50	18.214	7					ICP,no dig.
F032	157.00	15.700	10					ICP AES Ult neb
F036	240.50	24.050	10	VH H VHH	BIASED HIGH	5.08	.0075	E3300A
F037	114.00	11.400	10	L L L ELELELVHEH				GFAA
F038	127.00	12.700	10					ICPMS
F046	47.00	4.700	10		BIASED LOW	-6.11	-.0013	ICPMS
F048	164.50	16.450	10					ICP
F060	194.00	19.400	10					ICP
F063	157.50	22.500	7	H				ICP-AES
F069	80.00	8.000	10					ICP-MS
F089	238.00	23.800	10	EHEHEHEHEHEHH	BIASED HIGH	-8.92	.0349	
F093	170.00	17.000	10	VHEHVH H H				ICP
F094	115.00	11.500	10					ICP-MS
F096	122.00	17.429	7					ICP
F133	18.00	1.800	10	L L L L ELEL	BIASED LOW	-15.25	-.0008	ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 14.345

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F133	18.00	1.800	10	LLLLELEL	BIASED LOW	-15.25	-.0008	ICP-MS
F019	25.00	3.571	7	LL	BIASED LOW*	-1.38	-.0123	ICAP
F046	47.00	4.700	10		BIASED LOW	-6.11	-.0013	ICPMS
F011	65.50	6.550	10		BIASED LOW*	-2.00	-.0023	
F069	80.00	8.000	10					ICP-MS
F001	91.00	9.100	10					ICP-MS
F008	99.50	9.950	10					GF/ICP
F037	114.00	11.400	10	LLLELELELVHEH				GFAA
F094	115.00	11.500	10					ICP-MS
F014	118.50	11.850	10					ICP MS
F003	123.50	12.350	10					ICP-OES
F038	127.00	12.700	10					ICPMS
F009	133.00	13.300	10	VH				
F002	139.00	13.900	10					A.A.
F015	150.00	15.000	10					GFAA/ICP
F032	157.00	15.700	10					ICP AES Ult neb
F026	160.00	16.000	10					ICP
F048	164.50	16.450	10					ICP
F024	170.00	17.000	10					ICP-AES
F093	170.00	17.000	10	VHEHVHHH				ICP
F096	122.00	17.429	7					ICP
F031	127.50	18.214	7					ICP,no dig.
F060	194.00	19.400	10					ICP
F025	214.00	21.400	10	VHVHEHEHEH				ICP-MS
F012	156.00	22.286	7					ICPMS
F063	157.50	22.500	7	H				ICP-AES
F010	228.00	22.800	10	VHEHVH	BIASED HIGH*	.41	.0115	ICP
F089	238.00	23.800	10	EHEHEHEHEHEHH	BIASED HIGH	-8.92	.0349	
F036	240.50	24.050	10	VHHVHH	BIASED HIGH	5.08	.0075	E3300A

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 14.345

Aluminum

PARAMETER: 23091 Vanadium mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0015 BASIC ACCEPTABLE ERROR= .0015 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.0001	1.50	.0027	12.00	.0026	13.00	.0022	15.00	.012	15.50	.037	16.00
F003	<.0001	0.00	.0026	10.00	.0024	10.00	.0020	10.00	.0120	15.50	.037	16.00
F008	<.005	0.00	<.005	0.00	<.005	0.00	<.005	0.00	.011	7.50	.038	20.50
F009	<.0005	0.00	.0026	10.00	.0024	10.00	.0019	5.00	.012	15.50	.035	8.50
F010	.002 H	4.00	.004 EH	17.50	.003	16.50	.005 EH	19.00	.005 EL	2.00	.027 EL	1.00
F011	.0001	1.50	.0026	10.00	.0024	10.00	.002	10.00	.0114	9.00	.0351	10.00
F012	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	.04	24.50
F014	<.001	0.00	.003	15.00	.003	16.50	.002	10.00	.013	22.00	.039	23.00
F015	<.01	0.00	<.01	0.00	<.01	0.00	<.01	0.00	.01	5.00	.04	24.50
F019	<.002	0.00	<.002	0.00	<.002	0.00	<.002	0.00	.009 L	3.50	.034	5.50
F024	<.001	0.00	.002	2.50	.002	3.50	.002	10.00	.012	15.50	.037	16.00
F025	<.001	0.00	.002	2.50	.002	3.50	.001 EL	1.50	.009 L	3.50	.033 L	4.00
F032		0.00	.0024	6.00	.0023	7.50	.0019	5.00	.012	15.50	.036	12.00
F038	<.001	0.00	.003	15.00	.003	16.50	.002	10.00	.012	15.50	.037	16.00
F046	<.0002	0.00	.0025	7.50	.0025	12.00	.0021	14.00	.012	15.50	.037	16.00
F048	<.001	0.00	.0021	5.00	.0020	3.50	.0016	3.00	.0120	15.50	.0370	16.00
F060	<.001	0.00	.003	15.00	.002	3.50	.002	10.00	.012	15.50	.037	16.00
F063	<.01	0.00	<.01	0.00	<.01	0.00	<.01	0.00	<.01	0.00	.03 VL	2.00
F069	<.006	0.00	<.006	0.00	<.006	0.00	<.006	0.00	.0101	6.00	.0343	7.00
F089	<.001	0.00	.002	2.50	.002	3.50	.002	10.00	.011	7.50	.034	5.50
F093	<.002	0.00	.004 EH	17.50	.003	16.50	.003	17.50	.012	15.50	.035	8.50
F094	<.0001	0.00	.0025	7.50	.0023	7.50	.0019	5.00	.0115	10.00	.0354	11.00
F096	<.003	0.00	<.003	0.00	<.003	0.00	.003	17.50	.014	23.00	.038	20.50
F133	<.001	0.00	.002	2.50	.002	3.50	.001 EL	1.50	.001 EL	1.00	.032 L	3.00
F138	.0001	3.00	.0028	13.00	.0028	14.00	.0023	16.00	.0126	21.00	.0386	22.00
MEDIAN	.0001		.0026		.0024		.0020		.0120		.0370	
1CRIT	.0015		.0016		.0016		.0015		.0021		.0036	
N	1		16		18		16		21		22	
MEAN	.0001		.0025		.0024		.0021		.0111		.0357	
3STDEV	-		.0011		.0011		.0011		.0052		.0065	

PARAMETER: 23091 Vanadium mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.099	15.50	.148	14.00	.239	11.00	.343	14.00
F003	.099	15.50	.153	22.00	.252	22.50	.356	22.00
F008	.101	23.00	.154	23.00	.252	22.50	.354	21.00
F009	.095	8.50	.136 L	4.00	.224 L	4.00	.317 L	4.00
F010	.096	10.50	.146	11.00	.240	12.50	.340	11.50
F011	.0993	19.00	.143	8.50	.237	9.00	.336	9.50
F012	.11 EH	25.00	.16 H	25.00	.25	19.50	.37 H	25.00
F014	.100	20.50	.152	20.00	.250	19.50	.349	17.50
F015	.1	20.50	.15	16.50	.25	19.50	.35	19.50
F019	.094	6.50	.142	6.50	.238	10.00	.336	9.50
F024	.099	15.50	.15	16.50	.25	19.50	.35	19.50
F025	.087 EL	1.50	.122 EL	1.00	.214 VL	1.00	.304 VL	1.00
F032	.096	10.50	.144	10.00	.241	14.00	.342	13.00
F038	.099	15.50	.147	12.50	.236	7.50	.333	8.00
F046	.095	8.50	.15	16.50	.24	12.50	.34	11.50
F048	.1002	22.00	.1528	21.00	.2595 H	25.00	.365 H	24.00
F060	.099	15.50	.151	19.00	.247	17.00	.349	17.50
F063	.09 L	3.00	.14	5.00	.22 L	2.50	.32 L	5.00
F069	.0968	12.00	.147	12.50	.244	15.50	.344	15.50
F089	.092	4.00	.134 L	2.50	.226	5.00	.305 VL	2.00
F093	.094	6.50	.142	6.50	.231	6.00	.329	6.00
F094	.0927	5.00	.143	8.50	.236	7.50	.331	7.00
F096	.099	15.50	.150	16.50	.244	15.50	.344	15.50
F133	.087 EL	1.50	.134 L	2.50	.220 L	2.50	.306 VL	3.00
F138	.1045	24.00	.158 H	24.00	.257 H	24.00	.362	23.00
MEDIAN	.0990		.1470		.2400		.3420	
1CRIT	.0074		.0102		.0158		.0219	
N	22		23		23		23	
MEAN	.0973		.1464		.2402		.3392	
3STDEV	.0101		.0189		.0309		.0466	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	127.50	12.750	10					ICP-MS
F003	143.50	15.944	9					ICP-OES
F008	117.50	19.583	6		BIASED HIGH*	4.30	-.0008	ICP
F009	69.50	7.722	9	L L L				
F010	105.50	10.550	10	H EH EHELEL				ICP
F011	96.50	9.650	10					
F012	119.00	23.800	5	EHH H	BIASED HIGH	6.66	.0015	ICPMS
F014	164.00	18.222	9		BIASED HIGH*	2.54	.0005	ICP MS
F015	105.50	17.583	6					ICP
F019	41.50	6.917	6	L				ICAP
F024	118.50	13.167	9					ICP-AES
F025	19.50	2.167	9	ELL L ELELVLVL	BIASED LOW	-11.17	-.0012	ICP-MS
F032	93.50	10.389	9					ICP AES Ult neb
F038	116.50	12.944	9					ICPMS
F046	114.00	12.667	9					ICPMS
F048	135.00	15.000	9	H H				ICP
F060	129.00	14.333	9					ICP
F063	17.50	3.500	5	VLL L L	BIASED LOW	-5.65	-.0032	ICP-AES
F069	68.50	11.417	6					ICP
F089	42.50	4.722	9	L VL	BIASED LOW	-9.35	.0007	
F093	100.50	11.167	9	EH				ICP
F094	69.00	7.667	9					ICP-MS
F096	124.00	17.714	7					ICP
F133	21.00	2.333	9	ELELL ELL L VL	BIASED LOW	-8.96	-.0022	ICP-MS
F138	184.00	18.400	10	H H	BIASED HIGH	6.30	.0001	ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 11.802

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F025	19.50	2.167	9	ELLLELELVLVL	BIASED LOW	-11.17	-.0012	ICP-MS
F133	21.00	2.333	9	ELELLELLLVL	BIASED LOW	-8.96	-.0022	ICP-MS
F063	17.50	3.500	5	VLLLL	BIASED LOW	-5.65	-.0032	ICP-AES
F089	42.50	4.722	9	LVL	BIASED LOW	-9.35	.0007	
F019	41.50	6.917	6	L				ICAP
F094	69.00	7.667	9					ICP-MS
F009	69.50	7.722	9	LLL				
F011	96.50	9.650	10					
F032	93.50	10.389	9					ICP AES Ult neb
F010	105.50	10.550	10	HEHEHELEL				ICP
F093	100.50	11.167	9	EH				ICP
F069	68.50	11.417	6					ICP
F046	114.00	12.667	9					ICPMS
F001	127.50	12.750	10					ICP-MS
F038	116.50	12.944	9					ICPMS
F024	118.50	13.167	9					ICP-AES
F060	129.00	14.333	9					ICP
F048	135.00	15.000	9	HH				ICP
F003	143.50	15.944	9					ICP-OES
F015	105.50	17.583	6					ICP
F096	124.00	17.714	7					ICP
F014	164.00	18.222	9		BIASED HIGH*	2.54	.0005	ICP MS
F138	184.00	18.400	10	HH	BIASED HIGH	6.30	.0001	ICP-MS
F008	117.50	19.583	6		BIASED HIGH*	4.30	-.0008	ICP
F012	119.00	23.800	5	EHHH	BIASED HIGH	6.66	.0015	ICPMS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 11.802

Vanadium

PARAMETER: 24091 Chromium mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0015 BASIC ACCEPTABLE ERROR= .0015 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.0002	2.00	.0020	18.50	.0032	15.00	.0066	15.00	.011	12.50	.046	16.00
F002	<.0002	0.00	.0017	8.50	.0032	15.00	.0065	14.00	.0127	24.00	.0474	23.00
F003	<.0002	0.00	.0017	8.50	.0029	6.50	.0060	6.00	.0106	9.00	.045	13.50
F008	<.002	0.00	.002	18.50	.003	10.00	.007	22.00	.010	4.50	.04 L	2.50
F009	<.0005	0.00	.0016	5.50	.0029	6.50	.0060	6.00	.011	12.50	.044	10.00
F010	.003 VH	4.00	.004 EH	25.00	.006 EH	25.00	.008	25.50	.013	25.50	.050	27.00
F011	<.0002	0.00	.0018	11.00	.003	10.00	.0061	9.50	.0104	7.50	.0439	8.00
F012	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	.05	27.00
F013	<.05	0.00	<.05	0.00	<.05	0.00	<.05	0.00	<.05	0.00	.044	10.00
F014	<.0005	0.00	.0022	22.00	.0038	21.00	.0074	24.00	.0125	23.00	.0483	25.00
F015	<.0005	0.00	.0019	14.00	.0036	20.00	.0069	20.00	.016 EH	27.00	.051 H	29.00
F019	<.006	0.00	<.006	0.00	<.006	0.00	.008	25.50	.011	12.50	.047	21.50
F024	<.001	0.00	.002	18.50	.003	10.00	.006	6.00	.012	21.50	.047	21.50
F025	<.001	0.00	<.001	0.00	<.001 EL	0.00	.003 EL	1.00	.007 EL	1.00	.038 VL	1.00
F031	<.001	0.00	.002	18.50	.003	10.00	.006	6.00	.010	4.50	.040 L	2.50
F032		0.00	.0015	3.50	.0028	4.00	.0058	2.00	.010	4.50	.043	6.00
F037	<.001	0.00	.0014	1.50	.0027	2.00	.0062	11.00	.0113	17.00	.0466	18.50
F038	<.0005	0.00	.0019	14.00	.0028	4.00	.0068	17.50	.0113	17.00	.0466	18.50
F046	<.0002	0.00	.0017	8.50	.0031	13.00	.0064	13.00	.011	12.50	.045	13.50
F048	<.001	0.00	.0015	3.50	.0028	4.00	.0063	12.00	.0110	12.50	.0463	17.00
F060	<.0008	0.00	.0017	8.50	.0035	19.00	.0067	16.00	.0115	20.00	.0468	20.00
F063	<.001	0.00	.002	18.50	.004	23.00	.007	22.00	.012	21.50	.043	6.00
F069	<.001	0.00	.0019	14.00	.0033	17.00	.0068	17.50	.0113	17.00	.0459	15.00
F089	.002 H	3.00	.002	18.50	.003	10.00	.006	6.00	.010	4.50	.043	6.00
F093	<.002	0.00	.003	23.50	.004	23.00	.007	22.00	.011	12.50	.044	10.00
F094	<.0004	0.00	.0016	5.50	.0032	15.00	.0061	9.50	.0104	7.50	.0441	12.00
F096	<.002	0.00	.003	23.50	.004	23.00	.009 EH	27.00	.013	25.50	.050	27.00
F133	<.0005	0.00	.0014	1.50	.0026	1.00	.0059	3.00	.0097	2.00	.0423	4.00
F138	.0001	1.00	.0018	12.00	.0033	18.00	.0068	19.00	.0114	19.00	.048	24.00
MEDIAN OR *TARGET CONC.	*.0002		.0019		.0031		.0065		.0110		.0459	
1CRIT	.0015		.0015		.0016		.0018		.0021		.0042	
N	2		22		23		25		25		27	
MEAN	.0011		.0019		.0032		.0066		.0112		.0455	
3STDEV	-		.0011		.0012		.0018		.0028		.0079	

PARAMETER: 24091 Chromium mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.107	22.50	.172	26.50	.260	16.50	.431	17.00
F002	.1045	16.00	.1612	12.00	.2586	14.00	.425	12.00
F003	.102	12.00	.165	15.00	.258	13.00	.430	15.50
F008	.10	8.50	.17	24.00	.27	25.50	.43	15.50
F009	.100	8.50	.161	11.00	.252	9.00	.424	11.00
F010	.105	18.50	.165	15.00	.260	16.50	.432	18.00
F011	.104	15.00	.159	8.00	.254	10.50	.427	13.50
F012	.11	28.50	.17	24.00	.26	16.50	.44	23.00
F013	.102	12.00	.160	9.50	.251	8.00	.416	7.00
F014	.107	22.50	.169	21.50	.265	22.00	.433	19.00
F015	.109	26.00	.169	21.50	.265	22.00	.446	25.00
F019	.105	18.50	.165	15.00	.263	19.50	.435	20.50
F024	.11	28.50	.17	24.00	.27	25.50	.45	26.50
F025	.084 EL	1.00	.129 EL	1.00	.215 EL	1.00	.382 EL	1.50
F031	.090 VL	2.00	.148 VL	2.00	.250	7.00	.421	9.00
F032	.097	5.00	.154	5.00	.245	4.00	.406	4.50
F037	.1090	26.00	.1723	28.00	.2747	28.00	.4688 H	29.00
F038	.105	18.50	.165	15.00	.254	10.50	.423	10.00
F046	.10	8.50	.16	9.50	.26	16.50	.42	8.00
F048	.1053	21.00	.1675	18.00	.2766	29.00	.455	28.00
F060	.105	18.50	.168	19.50	.263	19.50	.436	22.00
F063	.103	14.00	.168	19.50	.257	12.00	.427	13.50
F069	.102	12.00	.165	15.00	.265	22.00	.435	20.50
F089	.099	6.00	.152 L	4.00	.246	5.00	.382 EL	1.50
F093	.100	8.50	.157	6.00	.244	3.00	.406	4.50
F094	.0964	4.00	.158	7.00	.249	6.00	.409	6.00
F096	.109	26.00	.172	26.50	.268	24.00	.444	24.00
F133	.0939 L	3.00	.149 L	3.00	.236 L	2.00	.393 L	3.00
F138	.1084	24.00	.175	29.00	.273	27.00	.45	26.50
MEDIAN OR *TARGET CONC.	.1040		.1650		.2600		.4300	
1CRIT	.0077		.0113		.0170		.0272	
N	26		27		27		26	
MEAN	.1026		.1634		.2582		.4286	
3STDEV	.0141		.0206		.0280		.0436	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	161.50	16.150	10					ICP-MS
F002	138.50	15.389	9					Graphite
F003	99.00	11.000	9					ICP-OES
F008	131.00	14.556	9	L				GF
F009	80.00	8.889	9					
F010	200.00	20.000	10	VHEHEH				ICP
F011	93.00	10.333	9					
F012	119.00	23.800	5		BIASED HIGH*	.98	.0030	ICPMS
F013	46.50	9.300	5					Cr Ext ICPDA
F014	200.00	22.222	9		BIASED HIGH*	.75	.0015	ICP MS
F015	204.50	22.722	9	EHH	BIASED HIGH*	2.83	.0013	GFAA/ICP
F019	133.00	19.000	7					ICAP
F024	182.00	20.222	9					ICP-AES
F025	7.50	1.071	7	ELELELVLELELELEL	BIASED LOW	-11.69	-.0064	ICP-MS
F031	61.50	6.833	9	L VLVL				ICP,no dig.
F032	38.50	4.278	9		BIASED LOW	-5.58	-.0005	ICP AES Ult neb
F037	161.00	17.889	9	H				GFAA
F038	125.00	13.889	9					ICPMS
F046	103.00	11.444	9					ICPMS
F048	145.00	16.111	9					ICP
F060	163.00	18.111	9					ICP
F063	150.00	16.667	9					GFAA/ICP-AES
F069	150.00	16.667	9					ICP-MS
F089	64.50	6.450	10	H L EL	BIASED LOW	-9.89	.0018	
F093	113.00	12.556	9					ICP
F094	72.50	8.056	9					ICP-MS
F096	226.50	25.167	9	EH	BIASED HIGH*	2.80	.0018	ICP
F133	22.50	2.500	9	L L L L	BIASED LOW	-8.74	-.0004	ICP-MS
F138	199.50	19.950	10					ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 14.194

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F025	7.50	1.071	7	ELELELVLELELELEL	BIASED LOW	-11.69	-.0064	ICP-MS
F133	22.50	2.500	9	LLLL	BIASED LOW	-8.74	-.0004	ICP-MS
F032	38.50	4.278	9		BIASED LOW	-5.58	-.0005	ICP AES Ult neb
F089	64.50	6.450	10	HLEL	BIASED LOW	-9.89	.0018	
F031	61.50	6.833	9	LVLVL				ICP,no dig.
F094	72.50	8.056	9					ICP-MS
F009	80.00	8.889	9					
F013	46.50	9.300	5					Cr Ext ICPDA
F011	93.00	10.333	9					
F003	99.00	11.000	9					ICP-OES
F046	103.00	11.444	9					ICPMS
F093	113.00	12.556	9					ICP
F038	125.00	13.889	9					ICPMS
F008	131.00	14.556	9	L				GF
F002	138.50	15.389	9					Graphite
F048	145.00	16.111	9					ICP
F001	161.50	16.150	10					ICP-MS
F063	150.00	16.667	9					GFAA/ICP-AES
F069	150.00	16.667	9					ICP-MS
F037	161.00	17.889	9	H				GFAA
F060	163.00	18.111	9					ICP
F019	133.00	19.000	7					ICAP
F138	199.50	19.950	10					ICP-MS
F010	200.00	20.000	10	VHEHEH				ICP
F024	182.00	20.222	9					ICP-AES
F014	200.00	22.222	9		BIASED HIGH*	.75	.0015	ICP MS
F015	204.50	22.722	9	EHH	BIASED HIGH*	2.83	.0013	GFAA/ICP
F012	119.00	23.800	5		BIASED HIGH*	.98	.0030	ICPMS
F096	226.50	25.167	9	EH	BIASED HIGH*	2.80	.0018	ICP

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 14.194

PARAMETER: 25091 Manganese mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0015 BASIC ACCEPTABLE ERROR= .0015 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.0004	3.00	.0033	14.50	.0024	16.50	.0083	16.50	.017	19.50	.029	20.50
F002	<.01	0.00	<.01	0.00	<.01	0.00	<.01	0.00	.0165	13.00	.0285	15.00
F003	.0004	3.00	.0033	14.50	.0022	11.00	.0080	9.00	.0162	11.50	.0282	14.00
F008	<.005	0.00	<.005	0.00	<.005	0.00	.009	24.00	.017	19.50	.029	20.50
F009	<.0005	0.00	.0027	2.00	.0015	2.00	.0074	3.00	.0156	5.50	.027	6.50
F010	.002 EH	11.00	.004	22.50	.003	20.50	.009	24.00	.016	9.00	.029	20.50
F011	.0004	3.00	.0032	11.00	.0021	8.00	.0077	6.00	.0156	5.50	.0266	5.00
F012	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	.03	27.50
F013	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	.019	28.50	.030	27.50
F014	<.010	0.00	<.010	0.00	<.010	0.00	<.010	0.00	.019	28.50	.030	27.50
F015	<.001	0.00	.003	6.50	.003	20.50	.009	24.00	.017	19.50	.028	12.00
F019	<.001	0.00	.004	22.50	.003	20.50	.008	9.00	.017	19.50	.029	20.50
F024	<.001	0.00	.003	6.50	.002	6.00	.009	24.00	.017	19.50	.030	27.50
F025	<.001	0.00	.003	6.50	<.001	0.00	.005 EL	1.00	.012 EL	1.00	.024 L	1.00
F026	.0016	10.00	.0034	18.00	.0033	23.00	.0086	18.00	.0166	14.00	.0275	10.00
F031	<.0005	0.00	.0028	3.50	.0017	4.00	.0076	5.00	.0154	4.00	.0249 L	3.00
F032		0.00	.0033	14.50	.0022	11.00	.0083	16.50	.017	19.50	.028	12.00
F036	<.001	0.00	<.004	0.00	<.002	0.00	.008	9.00	.018	27.00	.031	30.00
F038	.0005	6.00	.0033	17.00	.0022	14.00	.0087	20.00	.0171	24.50	.0288	16.50
F046	.0004	3.00	.0032	11.00	.0022	11.00	.0082	13.50	.016	9.00	.028	12.00
F048	<.001	0.00	.0028	3.50	.0016	3.00	.0082	13.50	.0168	15.00	.0292	24.00
F060	.0005	8.00	.0034	19.00	.0023	15.00	.0086	19.00	.0171	24.50	.0288	16.50
F063	<.001	0.00	.004	22.50	.003	20.50	.008	9.00	.017	19.50	.029	20.50
F069	<.001	0.00	.0032	11.00	.0022	11.00	.0082	13.50	.0162	11.50	.0272	9.00
F089	.0005	8.00	.0031	9.00	.0022	11.00	.0075	4.00	.0150	3.00	.0262	4.00
F093	<.002	0.00	.003	6.50	.002	6.00	.008	9.00	.016	9.00	.027	6.50
F094	.0005	8.00	.0033	14.50	.0024	16.50	.0082	13.50	.0159	7.00	.0271	8.00
F096	<.002	0.00	.004	22.50	.002	6.00	.009	24.00	.017	19.50	.029	20.50
F133	<.0000	0.00	.0018 EL	1.00	.0008 EL	1.00	.0064	2.00	.0134 EL	2.00	.0245 L	2.00
F138	.0004	3.00	.0034	20.00	.0024	18.00	.0089	21.00	.0175	26.00	.0296	25.00
MEDIAN	.0005		.0032		.0022		.0082		.0168		.0286	
1CRIT	.0015		.0016		.0015		.0019		.0024		.0031	
N	10		23		21		25		26		28	
MEAN	.0006		.0033		.0023		.0082		.0164		.0282	
3STDEV	.0011		.0011		.0013		.0018		.0028		.0043	

PARAMETER: 25091 Manganese mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.126	26.50	.207	22.50	.299	12.00	.344	16.00
F002	.1210	16.50	.2010	16.00	.2980	11.00	.3430	14.50
F003	.121	16.50	.204	19.00	.305	18.00	.347	19.00
F008	.126	26.50	.210	25.50	.312	24.50	.356	25.50
F009	.113	3.50	.192	6.50	.285	4.00	.331	5.50
F010	.118	10.00	.198	12.00	.297	10.00	.340	12.50
F011	.122	18.50	.190	5.00	.289	8.00	.333	7.00
F012	.12	14.00	.20	14.50	.30	14.00	.35	21.50
F013	.122	18.50	.215 H	30.00	.317	26.00	.365	28.50
F014	.125	24.50	.211	27.50	.312	24.50	.352	23.00
F015	.125	24.50	.208	24.00	.311	23.00	.355	24.00
F019	.119	11.50	.194	9.00	.296	9.00	.338	9.00
F024	.13 H	29.50	.21	25.50	.32	29.00	.37 H	30.00
F025	.114	6.50	.182 L	3.50	.272 VL	2.00	.334	8.00
F026	.1138	5.00	.1974	11.00	.3040	17.00	.3388	10.00
F031	.107 VL	2.00	.180 VL	2.00	.288	7.00	.331	5.50
F032	.120	14.00	.199	13.00	.300	14.00	.343	14.50
F036	.130 H	29.50	.211	27.50	.318	27.00	.356	25.50
F038	.119	11.50	.203	17.50	.306	19.00	.346	17.50
F046	.12	14.00	.20	14.50	.31	22.00	.34	12.50
F048	.1245	23.00	.2058	20.00	.326 H	30.00	.365	28.50
F060	.123	20.50	.206	21.00	.307	20.00	.349	20.00
F063	.123	20.50	.203	17.50	.303	16.00	.346	17.50
F069	.116	8.50	.197	10.00	.300	14.00	.339	11.00
F089	.113	3.50	.182 L	3.50	.281 L	3.00	.302 EL	2.00
F093	.116	8.50	.192	6.50	.286	5.00	.327	3.00
F094	.114	6.50	.193	8.00	.287	6.00	.329	4.00
F096	.124	22.00	.207	22.50	.308	21.00	.350	21.50
F133	.106 VL	1.00	.177 VL	1.00	.267 VL	1.00	.299 EL	1.00
F138	.1284	28.00	.212	29.00	.319	28.00	.361	27.00
MEDIAN	.1205		.2005		.3015		.3435	
1CRIT	.0086		.0134		.0195		.0220	
N	27		28		28		28	
MEAN	.1198		.1998		.3011		.3432	
3STDEV	.0150		.0268		.0362		.0389	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	167.50	16.750	10					ICP-MS
F002	86.00	14.333	6					A.A.
F003	135.50	13.550	10					ICP-OES
F008	166.00	23.714	7		BIASED HIGH*	3.71	.0002	ICP
F009	38.50	4.278	9		BIASED LOW*	-4.24	-.0007	
F010	152.00	15.200	10	EH				ICP
F011	77.00	7.700	10					
F012	91.50	18.300	5					ICPMS
F013	159.00	26.500	6	H	BIASED HIGH	6.04	-.0008	Mn Ext ICPDA
F014	155.50	25.917	6		BIASED HIGH*	2.63	.0018	ICP MS
F015	178.00	19.778	9					ICP
F019	130.50	14.500	9					ICAP
F024	197.50	21.944	9	H H				ICP-AES
F025	29.50	3.688	8	ELELL L VL	BIASED LOW	-5.27	-.0029	ICP-MS
F026	136.00	13.600	10					ICP
F031	36.00	4.000	9	L VLVL	BIASED LOW*	-4.49	-.0023	ICP,no dig.
F032	129.00	14.333	9					ICP AES Ult neb
F036	175.50	25.071	7	H	BIASED HIGH*	4.28	.0012	E3303A
F038	163.50	16.350	10					ICPMS
F046	122.50	12.250	10					ICPMS
F048	160.50	17.833	9	H				ICP
F060	183.50	18.350	10					ICP
F063	163.50	18.167	9					ICP-AES
F069	99.50	11.056	9					ICP-MS
F089	51.00	5.100	10	L L EL	BIASED LOW	-9.78	.0007	
F093	60.00	6.667	9		BIASED LOW*	-4.84	.0002	ICP
F094	92.00	9.200	10					ICP-MS
F096	179.50	19.944	9					ICP
F133	12.00	1.333	9	ELEL ELL VLVLVLEL	BIASED LOW	-11.91	-.0008	ICP-MS
F138	225.00	22.500	10		BIASED HIGH	5.47	.0001	ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 14.270

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F133	12.00	1.333	9	ELELELLVLVLVLEL	BIASED LOW	-11.91	-.0008	ICP-MS
F025	29.50	3.688	8	ELELLLVL	BIASED LOW	-5.27	-.0029	ICP-MS
F031	36.00	4.000	9	LVLVL	BIASED LOW*	-4.49	-.0023	ICP,no dig.
F009	38.50	4.278	9		BIASED LOW*	-4.24	-.0007	
F089	51.00	5.100	10	LLEL	BIASED LOW	-9.78	.0007	
F093	60.00	6.667	9		BIASED LOW*	-4.84	.0002	ICP
F011	77.00	7.700	10					
F094	92.00	9.200	10					ICP-MS
F069	99.50	11.056	9					ICP-MS
F046	122.50	12.250	10					ICPMS
F003	135.50	13.550	10					ICP-OES
F026	136.00	13.600	10					ICP
F002	86.00	14.333	6					A.A.
F032	129.00	14.333	9					ICP AES Ult neb
F019	130.50	14.500	9					ICAP
F010	152.00	15.200	10	EH				ICP
F038	163.50	16.350	10					ICPMS
F001	167.50	16.750	10					ICP-MS
F048	160.50	17.833	9	H				ICP
F063	163.50	18.167	9					ICP-AES
F012	91.50	18.300	5					ICPMS
F060	183.50	18.350	10					ICP
F015	178.00	19.778	9					ICP
F096	179.50	19.944	9					ICP
F024	197.50	21.944	9	HH				ICP-AES
F138	225.00	22.500	10		BIASED HIGH	5.47	.0001	ICP-MS
F008	166.00	23.714	7		BIASED HIGH*	3.71	.0002	ICP
F036	175.50	25.071	7	H	BIASED HIGH*	4.28	.0012	E3303A
F014	155.50	25.917	6		BIASED HIGH*	2.63	.0018	ICP MS
F013	159.00	26.500	6	H	BIASED HIGH	6.04	-.0008	Mn Ext ICPDA

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 14.270

Manganese

PARAMETER: 26091 Iron mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0020 BASIC ACCEPTABLE ERROR= .0020 CONCENTRATION ERROR INCREMENT= .0800

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.011	13.00	.005	8.50	.009	4.50	.010 L	3.50	.023	14.00	.052	21.00
F002	.0080	8.00	.0045	6.00	.0107	10.00	.0125	10.00	.0230	14.00	.050	16.50
F003	.0077	5.00	.0044	5.00	.0090	4.50	.0111	9.00	.0223	12.00	.046	10.00
F008	<.01	0.00	<.01	0.00	.01	8.00	.01 L	3.50	.01 VL	1.50	.05	16.50
F009	.046 VH	18.00	.006	12.00	.048 VH	21.00	.018 VH	20.00	.035 VH	22.50	.077 VH	24.00
F010	.014 VH	14.00	.005	8.50	.013	16.50	.013	12.50	.037 VH	24.00	.049	13.00
F011	<.012	0.00	<.012	0.00	.013	16.50	.016 H	18.00	.035 VH	22.50	.054	22.50
F012	.02 VH	16.00	.06 EH	15.00	.07 EH	22.00	.05 EH	22.00	.08 EH	25.00	.12 EH	27.00
F013	<.1	0.00	<.1	0.00	<.1	0.00	<.1	0.00	<.1	0.00	.049	13.00
F014	<.010	0.00	<.010	0.00	.019 VH	19.00	<.010 L	0.00	.019 L	5.00	.051	19.50
F015	.009	10.50	<.005	0.00	.01	8.00	.013	12.50	.021	9.00	.049	13.00
F019	.006 L	1.50	<.002 L	0.00	.007 VL	1.00	.009 L	1.50	.018 L	4.00	.043 L	4.00
F024	.009	10.50	.005	8.50	.012	14.50	.013	12.50	.026	19.50	.051	19.50
F025	<.01	0.00	<.01	0.00	<.01	0.00	<.01 L	0.00	<.01 VL	0.00	<.01 VL	0.00
F026	.0102	12.00	.0114 VH	14.00	.0114	12.50	.0167 H	19.00	.0246	18.00	.0435	5.00
F031	.007	3.00	.004	2.50	.009	4.50	.011	7.00	.021	9.00	.042 L	3.00
F032	.0072	4.00	.0037	1.00	.010	8.00	.011	7.00	.021	9.00	.045	7.00
F036	<.008	0.00	<.008	0.00	.012	14.50	.014	15.00	.024	16.50	.048	11.00
F038	<.03	0.00	<.03	0.00	<.03	0.00	<.03	0.00	<.03	0.00	<.03 VL	0.00
F046	<.03	0.00	<.03	0.00	<.03	0.00	<.03	0.00	<.03	0.00	.050	16.50
F060	.008	8.00	<.003	0.00	.008 L	2.00	.009 L	1.50	.023	14.00	.045	7.00
F063	<.01	0.00	<.01	0.00	<.01	0.00	<.01 L	0.00	.02	6.50	.04 VL	1.50
F069	.0079	6.00	.0041	4.00	.0114	12.50	.0109	5.00	.0212	11.00	.0451	9.00
F089	.017 VH	15.00	.009 VH	13.00	.017 VH	18.00	.015	17.00	.026	19.50	.054	22.50
F093	.006 L	1.50	.004	2.50	.009	4.50	.011	7.00	.020	6.50	.045	7.00
F094	<.01	0.00	<.01	0.00	<.01	0.00	<.01 L	0.00	.01 VL	1.50	.04 VL	1.50
F096	.008	8.00	.005	8.50	.011	11.00	.013	12.50	.024	16.50	.050	16.50
F133	.0415 VH	17.00	<.010	0.00	.0415 VH	20.00	.0145	16.00	.0170 VL	3.00	.0805 VH	25.00
F138	.0803 EH	19.00	.0052	11.00	.0889 EH	23.00	.0284 EH	21.00	.0307 VH	21.00	.109 EH	26.00
MEDIAN	.0090		.0050		.0114		.0130		.0230		.0490	
1CRIT	.0026		.0022		.0028		.0029		.0037		.0058	
N	16		13		21		19		22		24	
MEAN	.0145		.0056		.0173		.0138		.0242		.0533	
3STDEV	.0350		.0063		.0466		.0123		.0163		.0442	

PARAMETER: 26091 Iron mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.132 H	24.00	.436	23.00	.283	17.00	.388	15.00
F002	.120	18.50	.410	12.00	.278	13.50	.390	17.00
F003	.115	12.00	.425	17.00	.278	13.50	.381	11.00
F008	.11	5.50	.44	26.00	.29	24.00	.39	17.00
F009	.137 VH	26.00	.389	6.00	.265	4.50	.373	7.50
F010	.116	14.50	.415	15.00	.275	11.00	.382	12.00
F011	.133 VH	25.00	.468 VH	28.00	.304	28.00	.428 H	28.00
F012	.19 EH	29.00	.49 EH	29.00	.33 EH	29.00	.47 EH	29.00
F013	.116	14.50	.411	13.00	.285	19.00	.394	20.50
F014	.124	23.00	.437	24.00	.287	20.00	.392	19.00
F015	.122	21.00	.434	22.00	.284	18.00	.394	20.50
F019	.112	8.50	.387	5.00	.270	9.00	.374	9.00
F024	.12	18.50	.43	19.50	.29	24.00	.40	24.00
F025	.04 EL	1.00	.33 EL	1.00	.20 EL	1.00	.33 EL	1.50
F026	.1117	7.00	.3963	10.00	.2770	12.00	.3792	10.00
F031	.104 L	4.00	.381	4.00	.267	6.00	.370	6.00
F032	.113	10.00	.413	14.00	.270	9.00	.373	7.50
F036	.120	18.50	.440	26.00	.288	21.00	.400	24.00
F038	.09 VL	2.50	.36 VL	2.00	.23 EL	2.00	.33 EL	1.50
F046	.12	18.50	.44	26.00	.29	24.00	.40	24.00
F060	.115	12.00	.406	11.00	.280	15.50	.386	14.00
F063	.09 VL	2.50	.37 L	3.00	.25 L	3.00	.35 L	4.00
F069	.115	12.00	.427	18.00	.280	15.50	.385	13.00
F089	.117	16.00	.395	9.00	.269	7.00	.349 L	3.00
F093	.112	8.50	.394	8.00	.265	4.50	.369	5.00
F094	.11	5.50	.39	7.00	.27	9.00	.39	17.00
F096	.123	22.00	.430	19.50	.289	22.00	.398	22.00
F133	.1435 VH	27.00	.4175	16.00	.2940	26.00	.4165	27.00
F138	.1721 EH	28.00	.432	21.00	.296	27.00	.407	26.00
MEDIAN	.1160		.4150		.2800		.3880	
1CRIT	.0111		.0350		.0242		.0329	
N	27		27		27		26	
MEAN	.1190		.4138		.2779		.3869	
3STDEV	.0465		.0742		.0445		.0521	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	143.50	14.350	10	L H				ICP5x
F002	125.50	12.550	10					A.A.
F003	99.00	9.900	10					ICP-OES
F008	102.00	12.750	8	L VL				ICP
F009	161.50	16.150	10	VH VHVHVHVHVH				
F010	141.00	14.100	10	VH VH				ICP
F011	188.50	23.563	8	H VH VHVH H	BIASED HIGH	10.37	.0027	
F012	243.00	24.300	10	VHEHEHEHEHEHEHEHEHEH	BIASED HIGH	6.95	.0480	ICPMS
F013	80.00	16.000	5					Fe Ext ICPDA
F014	129.50	18.500	7	VHL L				ICP MS
F015	134.50	14.944	9					ICP
F019	43.50	4.833	9	L L VLL L L	BIASED LOW*	-4.15	-.0027	ICAP
F024	171.00	17.100	10					ICP-AES
F025	4.50	1.125	4	L VLVLELELELEL	INSUFFICIENT DATA			ICP-AES
F026	119.50	11.950	10	VH H				ICP
F031	49.00	4.900	10	L L	BIASED LOW	-5.83	-.0017	ICP,no dig.
F032	76.50	7.650	10					ICP AES Ult neb
F036	146.50	18.313	8					E3303A
F038	8.00	2.000	4	VLVLVLELEL	INSUFFICIENT DATA			FAAS
F046	109.00	21.800	5		BIASED HIGH	5.08	-.0023	ICPMS
F060	85.00	9.444	9	L L				ICP
F063	20.50	3.417	6	L VLVLL L L	BIASED LOW	-9.01	-.0061	ICP-AES
F069	106.00	10.600	10					ICP
F089	140.00	14.000	10	VHVHVH L				
F093	55.00	5.500	10	L	BIASED LOW*	-4.61	-.0014	ICP
F094	41.50	6.917	6	L VLVL				ICP-MS
F096	158.50	15.850	10					ICP
F133	177.00	19.667	9	VH VH VLVHVH				ICP-MS
F138	223.00	22.300	10	EH EHEHVHEHEH	BIASED HIGH	-5.80	.0416	ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 13.287

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F025	4.50	1.125	4	LVLVLELELELEL	INSUFFICIENT DATA			ICP-AES
F038	8.00	2.000	4	VLVLVLELEL	INSUFFICIENT DATA			FAAS
F063	20.50	3.417	6	LVLVLLLL	BIASED LOW	-9.01	-.0061	ICP-AES
F019	43.50	4.833	9	LLVLLLL	BIASED LOW*	-4.15	-.0027	ICAP
F031	49.00	4.900	10	LL	BIASED LOW	-5.83	-.0017	ICP,no dig.
F093	55.00	5.500	10	L	BIASED LOW*	-4.61	-.0014	ICP
F094	41.50	6.917	6	LVLVL				ICP-MS
F032	76.50	7.650	10					ICP AES Ult neb
F060	85.00	9.444	9	LL				ICP
F003	99.00	9.900	10					ICP-OES
F069	106.00	10.600	10					ICP
F026	119.50	11.950	10	VHH				ICP
F002	125.50	12.550	10					A.A.
F008	102.00	12.750	8	LVL				ICP
F089	140.00	14.000	10	VHVHVHL				
F010	141.00	14.100	10	VHVH				ICP
F001	143.50	14.350	10	LH				ICP5x
F015	134.50	14.944	9					ICP
F096	158.50	15.850	10					ICP
F013	80.00	16.000	5					Fe Ext ICPDA
F009	161.50	16.150	10	VHVHVHVHVHVH				
F024	171.00	17.100	10					ICP-AES
F036	146.50	18.313	8					E3303A
F014	129.50	18.500	7	VHLL				ICP MS
F133	177.00	19.667	9	VHVHVLVHVH				ICP-MS
F046	109.00	21.800	5		BIASED HIGH	5.08	-.0023	ICPMS
F138	223.00	22.300	10	EHEHEHVHEHEH	BIASED HIGH	-5.80	.0416	ICP-MS
F011	188.50	23.563	8	HVHVHVHH	BIASED HIGH	10.37	.0027	
F012	243.00	24.300	10	VHEHEHEHEHEHEHEHEHEH	BIASED HIGH	6.95	.0480	ICPMS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 13.287

Iron

PARAMETER: 27091 Cobalt mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0015 BASIC ACCEPTABLE ERROR= .0015 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.0000	1.00	.0024	12.50	.0022	13.50	.0077	15.00	.0080	11.00	.033	16.50
F003	<.0001	0.00	.0024	12.50	.0020	7.50	.0071	8.50	.0076	4.00	.032	11.50
F008	<.002	0.00	.002	3.50	.002	7.50	.007	5.50	.008	11.00	.034	20.50
F009	<.0005	0.00	.0023	10.50	.0021	11.50	.0073	12.50	.0078	7.00	.030	5.00
F010	.001	3.00	.003	19.00	.002	7.50	.008	19.00	.009	21.00	.034	20.50
F011	<.001	0.00	.0022	8.00	.0019	4.00	.007	5.50	.0075	3.00	.0298	2.00
F012	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	.03	5.00
F015	<.005	0.00	.005 EH	21.00	.007 EH	20.50	.006 EL	1.50	.011 EH	23.00	.039 EH	24.00
F019	<.005	0.00	<.005	0.00	<.005	0.00	.008	19.00	.008	11.00	.032	11.50
F024	<.001	0.00	.002	3.50	.002	7.50	.008	19.00	.008	11.00	.033	16.50
F025	.0055 EH	4.00	.0027	18.00	.0070 EH	20.50	.0071	8.50	.0081	15.00	.0359 H	23.00
F032		0.00	.0025	15.50	.0025	18.00	.0073	12.50	.0081	15.00	.030	5.00
F038	<.0001	0.00	.0023	10.50	.0022	13.50	.0079	16.00	.0081	15.00	.0326	15.00
F046	<.0002	0.00	.0022	8.00	.0021	11.50	.0075	14.00	.0079	8.00	.031	9.50
F048	<.001	0.00	.0017	1.00	.0014	2.00	.0072	10.50	.0077	5.50	.0325	14.00
F060	<.0007	0.00	.0025	15.50	.0023	16.50	.0081	23.00	.0085	18.50	.0336	19.00
F063	<.001	0.00	.002	3.50	.002	7.50	.007	5.50	.008	11.00	.035	22.00
F069	<.001	0.00	.0026	17.00	.0023	16.50	.0080	19.00	.0085	18.50	.0323	13.00
F089	<.001	0.00	.002	3.50	.001 EL	1.00	.007	5.50	.007	1.50	.030	5.00
F093	<.002	0.00	.004 EH	20.00	.003	19.00	.008	19.00	.009	21.00	.031	9.50
F094	<.0001	0.00	.0022	8.00	.0020	7.50	.0072	10.50	.0077	5.50	.0308	8.00
F096	<.003	0.00	<.003	0.00	<.003	0.00	.006 EL	1.50	.009	21.00	.030	5.00
F133	<.0000	0.00	.0020	6.00	.0019	3.00	.0066	3.00	.0070	1.50	.0281 L	1.00
F138	.0000	2.00	.0025	14.00	.0023	15.00	.0081	22.00	.0084	17.00	.0333	18.00
MEDIAN OR *TARGET CONC.	*.0001		.0023		.0021		.0073		.0080		.0321	
1CRIT	.0015		.0015		.0015		.0018		.0019		.0033	
N	2		19		18		20		20		22	
MEAN	.0005		.0024		.0021		.0074		.0081		.0321	
3STDEV	-		.0014		.0009		.0014		.0013		.0052	

PARAMETER: 27091 Cobalt mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.088	19.00	.145	20.00	.211	15.00	.270	8.00
F003	.083	9.00	.142	15.50	.213	17.00	.275	11.50
F008	.09	23.50	.15 H	23.50	.22	21.50	.28	18.00
F009	.078 L	2.00	.133	3.50	.193 L	2.00	.253 L	3.00
F010	.082	7.00	.140	11.50	.209	10.00	.275	11.50
F011	.0845	12.00	.133	3.50	.198	4.00	.265	7.00
F012	.09	23.50	.15 H	23.50	.22	21.50	.29	23.00
F015	.089	22.00	.144	19.00	.222	24.00	.282	21.00
F019	.084	10.50	.139	9.00	.211	15.00	.276	13.00
F024	.086	16.50	.14	11.50	.22	21.50	.28	18.00
F025	.0883	21.00	.138	8.00	.210	11.50	.281	20.00
F032	.080	4.50	.134	5.50	.202	7.00	.263	6.00
F038	.0852	14.00	.142	15.50	.208	8.50	.273	9.50
F046	.082	7.00	.14	11.50	.21	11.50	.28	18.00
F048	.0853	15.00	.1435	18.00	.2105	13.00	.292	24.00
F060	.0881	20.00	.149	21.50	.220	21.50	.287	22.00
F063	.086	16.50	.140	11.50	.211	15.00	.279	16.00
F069	.0849	13.00	.143	17.00	.217	18.00	.278	14.50
F089	.080	4.50	.129 L	2.00	.198	4.00	.243 VL	2.00
F093	.082	7.00	.135	7.00	.198	4.00	.259	4.50
F094	.0793	3.00	.134	5.50	.200	6.00	.259	4.50
F096	.084	10.50	.141	14.00	.208	8.50	.273	9.50
F133	.0739 EL	1.00	.1232 EL	1.00	.1818 EL	1.00	.2330 EL	1.00
F138	.0867	18.00	.149	21.50	.218	19.00	.278	14.50
MEDIAN OR *TARGET CONC.	.0847		.1400		.2102		.2755	
1CRIT	.0065		.0098		.0140		.0179	
N	21		21		22		22	
MEAN	.0841		.1397		.2093		.2727	
3STDEV	.0092		.0154		.0240		.0335	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	131.50	13.150	10					ICP-MS
F003	97.00	10.778	9					ICP-OES
F008	134.50	14.944	9	H				GF/ICP
F009	57.00	6.333	9	L L L				
F010	130.00	13.000	10					ICP
F011	49.00	5.444	9		BIASED LOW*	-4.45	.0001	
F012	96.50	19.300	5	H	BIASED HIGH	6.03	-.0015	ICPMS
F015	176.00	19.556	9	EHEHELEHEH	BIASED HIGH*	2.18	.0029	ICP
F019	89.00	12.714	7					ICAP
F024	125.00	13.889	9					ICP-AES
F025	149.50	14.950	10	EH EH H				ICP-MS
F032	89.00	9.889	9					ICP AES Ult neb
F038	117.50	13.056	9					ICPMS
F046	99.00	11.000	9					ICPMS
F048	103.00	11.444	9					ICP
F060	177.50	19.722	9		BIASED HIGH*	4.44	.0003	ICP
F063	108.50	12.056	9					GFAA/ICP-AES
F069	146.50	16.278	9					ICP-MS
F089	29.00	3.222	9	EL L VL	BIASED LOW	-9.61	.0009	
F093	111.00	12.333	9	EH				ICP
F094	58.50	6.500	9					ICP-MS
F096	70.00	10.000	7	EL				ICP
F133	18.50	2.056	9	L ELELELEL	BIASED LOW	-14.64	.0008	ICP-MS
F138	161.00	16.100	10					ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 11.906

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F133	18.50	2.056	9	LELELELEL	BIASED LOW	-14.64	.0008	ICP-MS
F089	29.00	3.222	9	ELLVL	BIASED LOW	-9.61	.0009	
F011	49.00	5.444	9		BIASED LOW*	-4.45	.0001	
F009	57.00	6.333	9	LLL				
F094	58.50	6.500	9					ICP-MS
F032	89.00	9.889	9					ICP AES Ult neb
F096	70.00	10.000	7	EL				ICP
F003	97.00	10.778	9					ICP-OES
F046	99.00	11.000	9					ICPMS
F048	103.00	11.444	9					ICP
F063	108.50	12.056	9					GFAA/ICP-AES
F093	111.00	12.333	9	EH				ICP
F019	89.00	12.714	7					ICAP
F010	130.00	13.000	10					ICP
F038	117.50	13.056	9					ICPMS
F001	131.50	13.150	10					ICP-MS
F024	125.00	13.889	9					ICP-AES
F008	134.50	14.944	9	H				GF/ICP
F025	149.50	14.950	10	EHEHH				ICP-MS
F138	161.00	16.100	10					ICP-MS
F069	146.50	16.278	9					ICP-MS
F012	96.50	19.300	5	H	BIASED HIGH	6.03	-.0015	ICPMS
F015	176.00	19.556	9	EHEHELEHEH	BIASED HIGH*	2.18	.0029	ICP
F060	177.50	19.722	9		BIASED HIGH*	4.44	.0003	ICP

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 11.906

Cobalt

PARAMETER: 28091 Nickel mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0015 BASIC ACCEPTABLE ERROR= .0015 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.0001	1.50	.0020	11.50	.0025	8.00	.0052	12.50	.010	12.50	.036	11.00
F002	<.0020	0.00	.0020	11.50	.0028	14.50	.0054	15.00	.0103	19.00	.0370	15.50
F003	<.0002	0.00	.0019	6.00	.0024	5.50	.0051	9.50	.0094	7.50	.036	11.00
F008	<.002	0.00	<.002	0.00	.002	2.00	.005	5.50	.010	12.50	.04	25.00
F009	<.0005	0.00	.0019	6.00	.0025	8.00	.0052	12.50	.0095	9.00	.034	6.50
F010	.001	8.00	.002	11.50	.002	2.00	.005	5.50	.010	12.50	.038	19.00
F011	.0005	6.00	.0020	11.50	.0027	11.50	.0052	12.50	.0092	5.50	.0331 L	4.00
F012	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	.04	25.00
F013	<.05	0.00	<.05	0.00	<.05	0.00	<.05	0.00	<.05	0.00	.034	6.50
F014	<.010	0.00	<.010	0.00	<.010	0.00	<.010	0.00	.011	22.00	.038	19.00
F015	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	.04	25.00
F019	<.01	0.00	<.01	0.00	<.01	0.00	<.01	0.00	<.01	0.00	.04	25.00
F024	<.001	0.00	.002	11.50	.003	18.00	.005	5.50	.010	12.50	.037	15.50
F025	.0715 EH	9.00	<.0005 EL	0.00	.0690 EH	20.00	.0163 EH	21.00	.0135 EH	24.00	.0590 EH	28.00
F026	<.002	0.00	<.002	0.00	.0021	4.00	.0055	16.00	.0102	17.00	.0385	21.00
F032		0.00	.0022	17.50	.0025	8.00	.0051	9.50	.010	12.50	.036	11.00
F038	.0001	1.50	.0020	11.50	.0026	10.00	.0056	18.00	.0102	17.00	.0375	17.00
F046	.0003	4.50	.0019	6.00	.0024	5.50	.0050	5.50	.0092	5.50	.032 L	1.00
F048	<.001	0.00	.0015	2.00	<.001 EL	0.00	.0041 EL	1.00	.0089	2.00	.0327 L	2.00
F060	<.001	0.00	.002	11.50	.003	18.00	.006	20.00	.011	22.00	.039	22.00
F063	<.01	0.00	<.01	0.00	<.01	0.00	<.01	0.00	.01	12.50	.04	25.00
F069	<.001	0.00	.0022	17.50	.0029	16.00	.0056	18.00	.0108	20.00	.0368	14.00
F089	<.001	0.00	.001 EL	1.00	.003	18.00	.005	5.50	.009	3.50	.034	6.50
F093	<.002	0.00	.002	11.50	.002	2.00	.005	5.50	.009	3.50	.034	6.50
F094	.0002	3.00	.0016	3.00	.0028	14.50	.0052	12.50	.0094	7.50	.0346	9.00
F096	<.008	0.00	<.008	0.00	<.008	0.00	<.008	0.00	.011	22.00	.038	19.00
F133	.0006	7.00	.0017	4.00	.0027	11.50	.0049	2.00	.0087	1.00	.0328 L	3.00
F138	.0003	4.50	.0021	16.00	.0027	13.00	.0056	18.00	.0102	17.00	.0367	13.00
MEDIAN	.0003		.0020		.0026		.0052		.0100		.0369	
1CRIT	.0015		.0015		.0016		.0017		.0020		.0036	
N	6		15		19		19		22		26	
MEAN	.0005		.0019		.0026		.0052		.0099		.0367	
3STDEV	.0008		.0005		.0010		.0009		.0019		.0072	

PARAMETER: 28091 Nickel mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.107	15.00	.267	12.00	.261	11.50	.315	9.00
F002	.109	20.50	.269	14.00	.267	14.50	.323	13.00
F003	.107	15.00	.273	17.50	.273	21.00	.332	19.00
F008	.10	5.00	.29 H	27.00	.27	17.00	.33	17.50
F009	.099 L	3.00	.253	6.00	.253	6.00	.312	7.00
F010	.105	11.50	.266	11.00	.266	13.00	.325	14.00
F011	.105	11.50	.253	6.00	.247 L	3.00	.311	6.00
F012	.11	24.00	.28	23.00	.28	25.50	.34	25.50
F013	.108	18.00	.277	20.00	.271	19.00	.337	22.00
F014	.109	20.50	.277	20.00	.272	20.00	.333	20.00
F015	.11	24.00	.27	15.50	.27	17.00	.34	25.50
F019	.11	24.00	.26	9.00	.27	17.00	.33	17.50
F024	.11	24.00	.28	23.00	.28	25.50	.34	25.50
F025	.113	27.00	.243 VL	2.00	.213 EL	1.00	.321	12.00
F026	.1000	5.00	.2479 L	3.00	.2554	9.00	.3017 L	3.00
F032	.104	10.00	.261	10.00	.261	11.50	.320	10.50
F038	.107	15.00	.277	20.00	.278	24.00	.339	23.00
F046	.10	5.00	.27	15.50	.25	4.00	.31	5.00
F048	.1033	9.00	.281	25.00	.281	27.00	.340	25.50
F060	.114	28.00	.291 H	28.00	.287 H	28.00	.352 H	28.00
F063	.11	24.00	.28	23.00	.26	10.00	.32	10.50
F069	.108	18.00	.273	17.50	.274	22.00	.328	16.00
F089	.102	7.00	.251 L	4.00	.255	8.00	.294 VL	2.00
F093	.103	8.00	.258	8.00	.254	7.00	.314	8.00
F094	.0988 L	2.00	.253	6.00	.252	5.00	.306	4.00
F096	.106	13.00	.268	13.00	.267	14.50	.327	15.00
F133	.0937 EL	1.00	.2396 VL	1.00	.2402 VL	2.00	.2907 VL	1.00
F138	.108	18.00	.283	26.00	.277	23.00	.334	21.00
MEDIAN	.1070		.2695		.2670		.3260	
1CRIT	.0078		.0176		.0174		.0210	
N	26		26		26		26	
MEAN	.1058		.2677		.2648		.3239	
3STDEV	.0119		.0364		.0332		.0382	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	104.50	10.450	10					ICP-MS
F002	137.50	15.278	9					A.A.
F003	112.00	12.444	9					ICP-OES
F008	111.50	13.938	8	H				GF/ICP
F009	64.00	7.111	9	L				
F010	108.00	10.800	10					ICP
F011	77.50	7.750	10	L L				
F012	123.00	24.600	5		BIASED HIGH*	4.18	.0003	ICPMS
F013	85.50	17.100	5					Ni Ext ICPDA
F014	121.50	20.250	6					ICP MS
F015	107.00	21.400	5		BIASED HIGH*	1.96	.0008	ICP
F019	92.50	18.500	5					ICAP
F024	161.00	17.889	9					ICP-AES
F025	144.00	16.000	9	EHELEHEHEHEH VLEL				ICP-MS
F026	78.00	9.750	8	L L				5 graphite 5 ICP
F032	100.50	11.167	9					ICP AES Ult neb
F038	157.00	15.700	10					ICPMS
F046	57.50	5.750	10	L	BIASED LOW*	-3.72	-.0008	ICPMS
F048	93.50	11.688	8	ELEL L				ICP
F060	205.50	22.833	9	H H H	BIASED HIGH	7.85	-.0002	ICP
F063	105.00	17.500	6					ICP-AES
F069	159.00	17.667	9					ICP-MS
F089	55.50	6.167	9	EL L VL	BIASED LOW	-7.55	.0006	
F093	60.00	6.667	9					ICP
F094	66.50	6.650	10	L	BIASED LOW	-6.01	-.0001	ICP-MS
F096	96.50	16.083	6					ICP
F133	33.50	3.350	10	L ELVLVLVL	BIASED LOW	-10.73	-.0001	ICP-MS
F138	169.50	16.950	10					ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 12.875

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F133	33.50	3.350	10	LELVLVLVL	BIASED LOW	-10.73	-.0001	ICP-MS
F046	57.50	5.750	10	L	BIASED LOW*	-3.72	-.0008	ICPMS
F089	55.50	6.167	9	ELLVL	BIASED LOW	-7.55	.0006	
F094	66.50	6.650	10	L	BIASED LOW	-6.01	-.0001	ICP-MS
F093	60.00	6.667	9					ICP
F009	64.00	7.111	9	L				
F011	77.50	7.750	10	LL				
F026	78.00	9.750	8	LL				5 graphite 5 ICP
F001	104.50	10.450	10					ICP-MS
F010	108.00	10.800	10					ICP
F032	100.50	11.167	9					ICP AES Ult neb
F048	93.50	11.688	8	ELELL				ICP
F003	112.00	12.444	9					ICP-OES
F008	111.50	13.938	8	H				GF/ICP
F002	137.50	15.278	9					A.A.
F038	157.00	15.700	10					ICPMS
F025	144.00	16.000	9	EHELEHEHEHEHVLEL				ICP-MS
F096	96.50	16.083	6					ICP
F138	169.50	16.950	10					ICP-MS
F013	85.50	17.100	5					Ni Ext ICPDA
F063	105.00	17.500	6					ICP-AES
F069	159.00	17.667	9					ICP-MS
F024	161.00	17.889	9					ICP-AES
F019	92.50	18.500	5					ICAP
F014	121.50	20.250	6					ICP MS
F015	107.00	21.400	5		BIASED HIGH*	1.96	.0008	ICP
F060	205.50	22.833	9	HHH	BIASED HIGH	7.85	-.0002	ICP
F012	123.00	24.600	5		BIASED HIGH*	4.18	.0003	ICPMS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 12.875

Nickel

PARAMETER: 29091 Copper mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0015 BASIC ACCEPTABLE ERROR= .0015 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.030	7.50	.0031	19.00	.032	9.00	.0095	13.00	.014	10.00	.074	14.50
F002	.031	13.50	.0029	9.00	.034	14.00	.0098	15.00	.0150	20.50	.072	9.50
F003	.0320	21.00	.0030	14.00	.0354	23.00	.0096	14.00	.0145	14.50	.075	18.00
F008	.032	21.00	<.005	0.00	.036	24.50	.011	25.50	.015	20.50	.078	26.00
F009	.028	2.00	.0027	6.00	.031	5.00	.0088	3.00	.013	4.00	.065 VL	2.50
F010	.032	21.00	.003	14.00	.035	20.00	.010	19.00	.015	20.50	.075	18.00
F011	.0285	3.00	.0030	14.00	.0318	7.00	.009	5.50	.0134	7.00	.0689	5.00
F012	.03	7.50	<.02	0.00	.04 VH	28.00	<.02	0.00	<.02	0.00	.08	27.00
F013	.032	21.00	<.02	0.00	.036	24.50	.012 H	28.00	.016	26.50	.077	25.00
F014	.031	13.50	.0027	6.00	.035	20.00	.010	19.00	.016	26.50	.073	13.00
F015	.032	21.00	.0026	3.50	.035	20.00	.0094	11.50	.0141	13.00	.075	18.00
F019	.029	4.00	<.002	0.00	.029 VL	1.00	.007 EL	1.00	.007 EL	1.00	.072	9.50
F024	.032	21.00	.003	14.00	.035	20.00	.010	19.00	.015	20.50	.076	23.50
F025	.0293	5.00	.0033	21.00	.0302 L	3.00	.0078 L	2.00	.0116 L	2.00	.0650 VL	2.50
F026	.0312	16.00	.003	14.00	.0316	6.00	.0093	9.50	.0145	14.50	.0639 VL	1.00
F031	.037 VH	28.50	.002	1.00	.041 VH	29.00	.011	25.50	.015	20.50	.086 VH	29.00
F032	.032	21.00	.0027	6.00	.034	14.00	.0094	11.50	.014	10.00	.074	14.50
F037	.037 VH	28.50	<.01	0.00	.045 EH	30.00	.030 EH	29.00	.015	20.50	.082 H	28.00
F038	.0318	17.00	.0030	14.00	.0346	16.00	.0101	22.00	.0148	16.00	.0752	20.50
F046	.030	7.50	.0028	8.00	.032	9.00	.0093	9.50	.014	10.00	.069	6.00
F048	.0305	10.00	.0024	2.00	.0330	12.00	.0092	8.00	.0133	6.00	.0729	12.00
F060	.031	13.50	.003	14.00	.034	14.00	.009	5.50	.014	10.00	.072	9.50
F063	.030	7.50	.005 EH	24.00	.030 L	2.00	.010	19.00	.014	10.00	.070	7.00
F069	.0306	11.00	.0036	22.00	.0349	17.00	.0103	24.00	.0151	25.00	.0752	20.50
F089	.0422 EH	30.00	.0056 EH	25.00	.0383 H	27.00	.0113	27.00	.0171 H	28.00	.0753	22.00
F093	.031	13.50	.003	14.00	.032	9.00	.009	5.50	.013	4.00	.072	9.50
F094	.0328	26.00	.0046 H	23.00	.0326	11.00	.0099	16.00	.0176 H	29.00	.0872 VH	30.00
F096	.033	27.00	.003	14.00	.035	20.00	.010	19.00	.015	20.50	.076	23.50
F133	.0279	1.00	.0026	3.50	.0305 L	4.00	.0090	5.50	.0130	4.00	.0667 L	4.00
F138	.0321	25.00	.0032	20.00	.0364	26.00	.0102	23.00	.015	20.50	.0748	16.00
MEDIAN	.0311		.0030		.0343		.0098		.0145		.0744	
1CRIT	.0033		.0016		.0035		.0020		.0023		.0059	
N	28		23		28		27		27		28	
MEAN	.0314		.0031		.0342		.0098		.0144		.0738	
3STDEV	.0060		.0018		.0081		.0026		.0033		.0137	

PARAMETER: 29091 Copper mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.124	14.50	.213	19.50	.255	10.00	.457	15.00
F002	.124	14.50	.213	19.50	.262	17.50	.470	21.50
F003	.127	21.50	.215	21.00	.268	21.00	.467	20.00
F008	.130	26.00	.223	27.50	.272	25.00	.479	24.50
F009	.111 L	2.00	.190 L	2.00	.231 VL	2.50	.406 VL	2.00
F010	.124	14.50	.208	11.50	.256	13.00	.450	10.50
F011	.125	17.50	.205	9.50	.256	13.00	.449	9.00
F012	.13	26.00	.23 H	29.00	.28 H	29.00	.50 H	30.00
F013	.130	26.00	.223	27.50	.273	26.00	.480	26.50
F014	.123	10.00	.212	16.50	.261	15.50	.455	14.00
F015	.13	26.00	.22	25.00	.271	24.00	.48	26.50
F019	.122	7.50	.200	5.00	.255	10.00	.450	10.50
F024	.13	26.00	.21	14.50	.27	23.00	.47	21.50
F025	.122	7.50	.191 L	3.00	.227 VL	1.00	.436	4.00
F026	.1071 EL	1.00	.1848 VL	1.00	.231 VL	2.50	.3992 EL	1.00
F031	.132	29.00	.204	7.50	.337 EH	30.00	.460	16.50
F032	.126	19.50	.212	16.50	.261	15.50	.463	18.50
F037	.133 H	30.00	.235 VH	30.00	.262	17.50	.481	28.00
F038	.126	19.50	.219	24.00	.267	19.00	.452	12.00
F046	.12	5.50	.21	14.50	.25	7.00	.46	16.50
F048	.1239	12.00	.2121	18.00	.2735	27.00	.482	29.00
F060	.123	10.00	.209	13.00	.256	13.00	.453	13.00
F063	.123	10.00	.208	11.50	.248	6.00	.442	7.00
F069	.125	17.50	.217	22.00	.268	21.00	.463	18.50
F089	.124	14.50	.204	7.50	.255	10.00	.437	5.00
F093	.120	5.50	.201	6.00	.245	4.00	.439	6.00
F094	.119	4.00	.205	9.50	.253	8.00	.443	8.00
F096	.129	23.00	.218	23.00	.268	21.00	.471	23.00
F133	.1143 L	3.00	.1964 L	4.00	.2456	5.00	.4319	3.00
F138	.127	21.50	.222	26.00	.275	28.00	.479	24.50
MEDIAN	.1240		.2110		.2610		.4585	
1CRIT	.0089		.0141		.0171		.0289	
N	28		28		28		28	
MEAN	.1244		.2104		.2596		.4574	
3STDEV	.0141		.0283		.0364		.0537	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	132.00	13.200	10					ICP-MS
F002	154.50	15.450	10					A.A.
F003	188.00	18.800	10					ICP-OES
F008	220.50	24.500	9		BIASED HIGH*	4.50	.0003	ICP
F009	31.00	3.100	10	VLL L VLVL	BIASED LOW	-11.36	.0004	
F010	162.00	16.200	10					ICP
F011	90.50	9.050	10					
F012	176.50	25.214	7	VH H H H	BIASED HIGH	9.14	-.0019	ICPMS
F013	231.00	25.667	9	H	BIASED HIGH*	4.64	.0004	Cu Ext IPCDA
F014	154.00	15.400	10					ICP MS
F015	188.50	18.850	10					GFAA/ICP
F019	49.50	5.500	9	VLELEL	BIASED LOW*	-1.19	-.0037	ICAP
F024	203.00	20.300	10					ICP-AES
F025	51.00	5.100	10	L L L VL L VL	BIASED LOW	-6.39	-.0020	ICP-MS
F026	66.50	6.650	10	VLELVLVLEL	BIASED LOW	-13.04	.0013	5 graphite 5 ICP
F031	216.50	21.650	10	VH VH VH EH				ICP,no dig.
F032	147.00	14.700	10					ICP AES Ult neb
F037	241.50	26.833	9	VH EHEH H H VH	BIASED HIGH*	2.40	.0080	ICP
F038	180.00	18.000	10					ICPMS
F046	93.50	9.350	10					ICPMS
F048	136.00	13.600	10					ICP
F060	115.50	11.550	10					ICP
F063	104.00	10.400	10	EHL				GFAA/ICP-AES
F069	198.50	19.850	10					ICP-MS
F089	196.00	19.600	10	EHEHH H				
F093	77.00	7.700	10					ICP
F094	164.50	16.450	10	H H VH				ICP-MS
F096	214.00	21.400	10					ICP
F133	37.00	3.700	10	L L L L	BIASED LOW	-5.64	-.0015	ICP-MS
F138	230.50	23.050	10					ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 15.188

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F009	31.00	3.100	10	VLLLVLVL	BIASED LOW	-11.36	.0004	
F133	37.00	3.700	10	LLLL	BIASED LOW	-5.64	-.0015	ICP-MS
F025	51.00	5.100	10	LLLVLLVL	BIASED LOW	-6.39	-.0020	ICP-MS
F019	49.50	5.500	9	VLELEL	BIASED LOW*	-1.19	-.0037	ICAP
F026	66.50	6.650	10	VLELVLVLEL	BIASED LOW	-13.04	.0013	5 graphite 5 ICP
F093	77.00	7.700	10					ICP
F011	90.50	9.050	10					
F046	93.50	9.350	10					ICPMS
F063	104.00	10.400	10	EHL				GFAA/ICP-AES
F060	115.50	11.550	10					ICP
F001	132.00	13.200	10					ICP-MS
F048	136.00	13.600	10					ICP
F032	147.00	14.700	10					ICP AES Ult neb
F014	154.00	15.400	10					ICP MS
F002	154.50	15.450	10					A.A.
F010	162.00	16.200	10					ICP
F094	164.50	16.450	10	HHVH				ICP-MS
F038	180.00	18.000	10					ICPMS
F003	188.00	18.800	10					ICP-OES
F015	188.50	18.850	10					GFAA/ICP
F089	196.00	19.600	10	EHEHHH				
F069	198.50	19.850	10					ICP-MS
F024	203.00	20.300	10					ICP-AES
F096	214.00	21.400	10					ICP
F031	216.50	21.650	10	VHVHVHEH				ICP,no dig.
F138	230.50	23.050	10					ICP-MS
F008	220.50	24.500	9		BIASED HIGH*	4.50	.0003	ICP
F012	176.50	25.214	7	VHHHH	BIASED HIGH	9.14	-.0019	ICPMS
F013	231.00	25.667	9	H	BIASED HIGH*	4.64	.0004	Cu Ext IPCDA
F037	241.50	26.833	9	VHEHEHHHVH	BIASED HIGH*	2.40	.0080	ICP

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 15.188

Copper

PARAMETER: 30091 Zinc mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0020 BASIC ACCEPTABLE ERROR= .0020 CONCENTRATION ERROR INCREMENT= .0800

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.0016	3.00	.0074	12.00	.0057	9.50	.010	11.00	.028	7.00	.056	5.00
F002	<.01	0.00	<.01	0.00	<.01	0.00	.010	11.00	.029	12.00	.059	17.50
F003	.0015	2.00	.0073	11.00	.0055	8.00	.0109	18.00	.0285	9.00	.057	9.50
F008	<.01	0.00	.01 EH	23.50	.01 VH	23.50	.01	11.00	.03	20.00	.06	22.50
F009	.002	8.00	.0079	14.50	.0062	16.00	.011	20.50	.030	20.00	.058	14.50
F010	.001	1.00	.007	6.00	.006	12.50	.010	11.00	.027	4.50	.056	5.00
F011	.0019	5.50	.0072	10.00	.0054	6.50	.0091	4.00	.0267	2.00	.0518 L	3.00
F012	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	.03	20.00	.06	22.50
F013	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	.027	4.50	.060	22.50
F014	<.010	0.00	<.010	0.00	<.010	0.00	.012	26.50	.031	26.50	.057	9.50
F015	<.002	0.00	.007	6.00	.005	3.50	.009	2.50	.03	20.00	.058	14.50
F019	<.002	0.00	.006	2.00	.004	2.00	.010	11.00	.029	12.00	.059	17.50
F024	<.005	0.00	.008	18.00	.006	12.50	.010	11.00	.030	20.00	.060	22.50
F025	<.0006	0.00	.0055	1.00	.0036 L	1.00	.0071 EL	1.00	.0213 EL	1.00	.0505 L	2.00
F026	.0020	10.00	.0076	13.00	.0061	15.00	.0102	16.00	.0293	15.00	.0568	7.00
F031	<.005	0.00	.007	6.00	.005	3.50	.009	2.50	.027	4.50	.047 EL	1.00
F032	.0019	5.50	.0071	9.00	.0054	6.50	.010	11.00	.029	12.00	.059	17.50
F037	<.01	0.00	<.01	0.00	<.01	0.00	.010	11.00	.027	4.50	.056	5.00
F038	.002	8.00	.008	18.00	.006	12.50	.011	20.50	.032	28.00	.062	27.50
F046	.0029	11.50	.0079	14.50	.0068	18.00	.011	20.50	.030	20.00	.059	17.50
F048	.0029	11.50	.0092	21.50	.0077	21.00	.0117	25.00	.0295	16.00	.0600	22.50
F060	.0020	8.00	.0081	20.00	.0066	17.00	.0108	17.00	.0308	25.00	.0602	26.00
F063	<.01	0.00	<.01	0.00	.010 VH	23.50	.012	26.50	.029	12.00	.057	9.50
F069	<.001	0.00	.0067	3.00	.0057	9.50	.0096	5.50	.0303	24.00	.0574	12.50
F089	.0073 EH	17.00	.0092	21.50	.0083	22.00	.0112	24.00	.0284	8.00	.0574	12.50
F093	.007 EH	16.00	.007	6.00	.006	12.50	.010	11.00	.029	12.00	.057	9.50
F094	.003	13.50	.008	18.00	.007	19.50	.011	20.50	.031	26.50	.063	29.00
F096	.003	13.50	.010 EH	23.50	.007	19.50	.013 EH	28.00	.033	30.00	.062	27.50
F133	.0017	4.00	.0070	6.00	.0052	5.00	.0096	5.50	.0300	20.00	.0600	22.50
F138	.0033	15.00	.0080	16.00	.0175 EH	25.00	.0111	23.00	.0329	29.00	.0634	30.00
MEDIAN	.0020		.0075		.0060		.0100		.0294		.0585	
1CRIT	.0020		.0024		.0023		.0026		.0042		.0065	
N	15		21		23		26		28		28	
MEAN	.0026		.0075		.0064		.0104		.0293		.0582	
3STDEV	.0039		.0023		.0043		.0025		.0045		.0081	

PARAMETER: 30091 Zinc mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.123	13.00	.243	9.00	.301	8.50	.524	7.00
F002	.124	14.00	.245	12.00	.305	11.00	.532	12.00
F003	.122	11.00	.246	13.50	.306	12.00	.531	11.00
F008	.13	24.50	.26	23.00	.32	21.00	.55	18.00
F009	.125	15.50	.254	20.00	.317	18.00	.555	22.00
F010	.121	8.00	.239	6.50	.300	7.00	.525	8.50
F011	.122	11.00	.230	4.00	.290	4.00	.516	5.00
F012	.13	24.50	.26	23.00	.31	13.00	.54	14.50
F013	.129	22.00	.261	25.50	.322	24.00	.562	24.50
F014	.120	6.00	.234	5.00	.304	10.00	.507	4.00
F015	.126	18.00	.251	17.00	.315	16.50	.55	18.00
F019	.126	18.00	.244	11.00	.311	14.00	.540	14.50
F024	.13	24.50	.26	23.00	.32	21.00	.57	28.00
F025	.0970 EL	1.00	.195 EL	1.00	.250 EL	1.00	.453 EL	1.00
F026	.1211	9.00	.2533	19.00	.3266	27.00	.5547	21.00
F031	.105 EL	2.00	.216 VL	2.00	.288	2.00	.502	3.00
F032	.127	20.00	.250	15.50	.315	16.50	.551	20.00
F037	.118	3.00	.243	9.00	.289	3.00	.525	8.50
F038	.131	27.50	.266	28.00	.331	28.00	.567	26.50
F046	.12	6.00	.25	15.50	.32	21.00	.54	14.50
F048	.1283	21.00	.2612	27.00	.323	25.00	.567	26.50
F060	.130	24.50	.261	25.50	.324	26.00	.562	24.50
F063	.126	18.00	.246	13.50	.312	15.00	.540	14.50
F069	.125	15.50	.253	18.00	.321	23.00	.550	18.00
F089	.120	6.00	.228 L	3.00	.293	5.00	.482 L	2.00
F093	.122	11.00	.243	9.00	.301	8.50	.527	10.00
F094	.119	4.00	.239	6.50	.296	6.00	.518	6.00
F096	.131	27.50	.259	21.00	.319	19.00	.560	23.00
F133	.1400 H	30.00	.2800 H	29.00	.3500 H	30.00	.6000 H	29.00
F138	.137 H	29.00	.283 VH	30.00	.345 H	29.00	.612 VH	30.00
MEDIAN	.1250		.2500		.3135		.5400	
1CRIT	.0118		.0218		.0269		.0450	
N	28		28		28		28	
MEAN	.1246		.2491		.3116		.5410	
3STDEV	.0176		.0389		.0406		.0720	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	85.00	8.500	10					ICP-MS
F002	89.50	12.786	7					A.A.
F003	105.00	10.500	10					ICP-OES
F008	187.00	20.778	9	EHVH				ICP
F009	169.00	16.900	10					
F010	70.00	7.000	10		BIASED LOW*	-3.12	-.0008	ICP
F011	55.00	5.500	10	L	BIASED LOW	-5.20	-.0012	
F012	117.50	19.583	6					ICPMS
F013	123.00	20.500	6					Zn Ext ICPDA
F014	87.50	12.500	7					ICP MS
F015	116.00	12.889	9					ICP
F019	102.00	11.333	9					ICAP
F024	180.50	20.056	9					ICP-AES
F025	10.00	1.111	9	L ELELL ELELELEL	BIASED LOW	-17.09	-.0031	ICP-MS
F026	152.00	15.200	10					ICP
F031	26.50	2.944	9	ELELVL	BIASED LOW	-7.45	-.0038	ICP,no dig.
F032	133.50	13.350	10					ICP AES Ult neb
F037	44.00	6.286	7		BIASED LOW*	-3.42	-.0019	ICP
F038	224.50	22.450	10		BIASED HIGH	5.19	.0005	ICPMS
F046	159.00	15.900	10					ICPMS
F048	217.00	21.700	10					ICP
F060	213.50	21.350	10					ICP
F063	132.50	16.563	8	VH				ICP-AES
F069	129.00	14.333	9					ICP-MS
F089	121.00	12.100	10	EH L L				
F093	105.50	10.550	10	EH				ICP
F094	149.50	14.950	10					ICP-MS
F096	232.50	23.250	10	EH EH	BIASED HIGH*	2.90	.0016	ICP
F133	181.00	18.100	10	H H H H				ICP-MS
F138	256.00	25.600	10	EH H VHH VH	BIASED HIGH	12.31	.0006	ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 14.504

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F025	10.00	1.111	9	LELELLELELELEL	BIASED LOW	-17.09	-.0031	ICP-MS
F031	26.50	2.944	9	ELELVL	BIASED LOW	-7.45	-.0038	ICP,no dig.
F011	55.00	5.500	10	L	BIASED LOW	-5.20	-.0012	
F037	44.00	6.286	7		BIASED LOW*	-3.42	-.0019	ICP
F010	70.00	7.000	10		BIASED LOW*	-3.12	-.0008	ICP
F001	85.00	8.500	10					ICP-MS
F003	105.00	10.500	10					ICP-OES
F093	105.50	10.550	10	EH				ICP
F019	102.00	11.333	9					ICAP
F089	121.00	12.100	10	EHLL				
F014	87.50	12.500	7					ICP MS
F002	89.50	12.786	7					A.A.
F015	116.00	12.889	9					ICP
F032	133.50	13.350	10					ICP AES Ult neb
F069	129.00	14.333	9					ICP-MS
F094	149.50	14.950	10					ICP-MS
F026	152.00	15.200	10					ICP
F046	159.00	15.900	10					ICPMS
F063	132.50	16.563	8	VH				ICP-AES
F009	169.00	16.900	10					
F133	181.00	18.100	10	HHHH				ICP-MS
F012	117.50	19.583	6					ICPMS
F024	180.50	20.056	9					ICP-AES
F013	123.00	20.500	6					Zn Ext ICPDA
F008	187.00	20.778	9	EHVH				ICP
F060	213.50	21.350	10					ICP
F048	217.00	21.700	10					ICP
F038	224.50	22.450	10		BIASED HIGH	5.19	.0005	ICPMS
F096	232.50	23.250	10	EHEH	BIASED HIGH*	2.90	.0016	ICP
F138	256.00	25.600	10	EHHVHHVH	BIASED HIGH	12.31	.0006	ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 14.504

Zinc

PARAMETER: 38091 Strontium mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0025 BASIC ACCEPTABLE ERROR= .0025 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.055	3.50	.027	9.50	.059	6.50	.059	10.50	.098	8.50	.114	12.00
F003	.0560	7.00	.0270	9.50	.0600	11.50	.0580	6.00	.0997	10.00	.115	13.00
F009	.057	10.50	.028	14.00	.060	11.50	.059	10.50	.0945	3.00	.106	2.00
F010	.051 L	2.00	.024	1.00	.054 L	1.00	.053 EL	1.00	.088 L	1.00	.101 L	1.00
F011	.0596	16.50	.0261	5.00	.061	14.00	.0609	14.00	.0957	5.00	.109	6.00
F012	.06	18.50	.03	19.50	.06	11.50	.06	13.00	.10	12.00	.12	19.50
F015	.06	18.50	.027	9.50	.063	16.00	.061	15.00	.103	15.00	.118	16.00
F024	.061	20.00	.030	19.50	.065	20.00	.064	20.00	.11 H	20.00	.12	19.50
F025	.059	13.00	.027	9.50	.058	3.00	.059	10.50	.103	15.00	.108	5.00
F032	.056	7.00	.027	9.50	.059	6.50	.058	6.00	.100	12.00	.111	9.50
F038	.0551	5.00	.0273	13.00	.0584	4.00	.0583	8.00	.0949	4.00	.107	4.00
F046	.056	7.00	.026	3.50	.059	6.50	.059	10.50	.10	12.00	.11	7.50
F048	.0595	15.00	.0286	17.00	.0631	17.50	.0617	18.50	.1035	17.00	.1175	15.00
F060	.0596	16.50	.0284	16.00	.0631	17.50	.0616	17.00	.104	18.00	.117	14.00
F063	.057	10.50	.027	9.50	.060	11.50	.058	6.00	.098	8.50	.112	11.00
F069	.0592	14.00	.0281	15.00	.0628	15.00	.0613	16.00	.103	15.00	.119	17.50
F094	.0564	9.00	.0266	6.00	.0591	9.00	.0571	4.00	.0967	6.00	.110	7.50
F096	.055	3.50	.026	3.50	.059	6.50	.057	3.00	.097	7.00	.111	9.50
F133	.0508 L	1.00	.0248	2.00	.0543	2.00	.0569	2.00	.0909 L	2.00	.1063	3.00
F138	.0589	12.00	.0293	18.00	.0637	19.00	.0617	18.50	.105	19.00	.119	17.50
MEDIAN	.0570		.0270		.0600		.0590		.0998		.1115	
1CRIT	.0058		.0040		.0060		.0059		.0083		.0090	
N	18		17		18		18		18		17	
MEAN	.0572		.0271		.0601		.0593		.0993		.1123	
3STDEV	.0071		.0032		.0069		.0050		.0113		.0132	

PARAMETER: 38091 Strontium mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.165	11.00	.282	6.00	.308	8.50	.584	8.50
F003	.168	12.00	.297	13.00	.323	14.00	.603	13.00
F009	.153	3.00	.273	3.00	.296	3.00	.559	2.50
F010	.147 L	1.00	.259 VL	1.00	.285 L	1.00	.535 L	1.00
F011	.169	14.00	.289	10.50	.306	6.00	.584	8.50
F012	.17	15.00	.30	14.50	.32	12.50	.62	18.00
F015	.172	18.50	.302	16.00	.33	16.50	.619	17.00
F024	.18 H	20.00	.31 H	19.00	.35 VH	20.00	.64 H	20.00
F025	.163	9.50	.283	8.00	.292	2.00	.567	5.00
F032	.162	8.00	.283	8.00	.311	10.00	.581	7.00
F038	.156	4.00	.278	4.00	.304	5.00	.559	2.50
F046	.16	6.00	.29	12.00	.32	12.50	.60	12.00
F048	.1686	13.00	.317 H	20.00	.347 VH	19.00	.630 H	19.00
F060	.171	16.50	.300	14.50	.326	15.00	.609	14.00
F063	.163	9.50	.289	10.50	.314	11.00	.586	10.00
F069	.171	16.50	.304	17.00	.330	16.50	.618	16.00
F094	.158	5.00	.279	5.00	.307	7.00	.590	11.00
F096	.161	7.00	.283	8.00	.308	8.50	.573	6.00
F133	.1515 L	2.00	.2658 L	2.00	.2963	4.00	.5619	4.00
F138	.172	18.50	.306	18.00	.332	18.00	.615	15.00
MEDIAN	.1640		.2890		.3125		.5880	
1CRIT	.0122		.0197		.0211		.0376	
N	18		18		18		18	
MEAN	.1641		.2897		.3150		.5922	
3STDEV	.0191		.0360		.0425		.0671	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	84.50	8.450	10					ICP-MS
F003	109.00	10.900	10					ICP-OES
F009	63.00	6.300	10					
F010	11.00	1.100	10	L L ELL L L VLL L	BIASED LOW	-8.92	-.0013	ICP
F011	99.50	9.950	10					
F012	154.00	15.400	10					ICPMS
F015	158.00	15.800	10					ICP
F024	198.00	19.800	10	H H H VHH	BIASED HIGH	9.17	.0000	ICP-AES
F025	80.50	8.050	10					ICP-MS
F032	83.50	8.350	10					ICP AES Ult neb
F038	53.50	5.350	10					ICPMS
F046	89.50	8.950	10					ICPMS
F048	171.00	17.100	10	H VHH	BIASED HIGH	8.42	-.0020	ICP
F060	159.00	15.900	10					ICP
F063	98.00	9.800	10					ICP-AES
F069	158.50	15.850	10					ICP
F094	69.50	6.950	10					ICP-MS
F096	62.50	6.250	10					ICP
F133	24.00	2.400	10	L L L L	BIASED LOW*	-4.50	-.0029	ICP-MS
F138	173.50	17.350	10		BIASED HIGH*	4.86	.0009	ICP-MS

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F010	11.00	1.100	10	LLELLLLVLLL	BIASED LOW	-8.92	-.0013	ICP
F133	24.00	2.400	10	LLLL	BIASED LOW*	-4.50	-.0029	ICP-MS
F038	53.50	5.350	10					ICPMS
F096	62.50	6.250	10					ICP
F009	63.00	6.300	10					
F094	69.50	6.950	10					ICP-MS
F025	80.50	8.050	10					ICP-MS
F032	83.50	8.350	10					ICP AES Ult neb
F001	84.50	8.450	10					ICP-MS
F046	89.50	8.950	10					ICPMS
F063	98.00	9.800	10					ICP-AES
F011	99.50	9.950	10					
F003	109.00	10.900	10					ICP-OES
F012	154.00	15.400	10					ICPMS
F015	158.00	15.800	10					ICP
F069	158.50	15.850	10					ICP
F060	159.00	15.900	10					ICP
F048	171.00	17.100	10	HVHH	BIASED HIGH	8.42	-.0020	ICP
F138	173.50	17.350	10		BIASED HIGH*	4.86	.0009	ICP-MS
F024	198.00	19.800	10	HHHVHH	BIASED HIGH	9.17	.0000	ICP-AES

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 10.500

PARAMETER: 42091 Molybdenum mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0015 BASIC ACCEPTABLE ERROR= .0015 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.0001	3.00	.0022	10.50	.0022	14.00	.0052	13.50	.0087	15.50	.031	17.00
F003	<.0001	0.00	.0022	10.50	.0020	5.50	.0049	5.00	.0085	11.00	.032	20.00
F009	<.0005	0.00	.0014 EL	1.00	.0016 EL	2.00	.0036 EL	2.00	.0062 L	4.00	.027	4.00
F010	.007 EH	6.00	.003 EH	16.00	.002	5.50	.005	8.00	.005 VL	1.00	.027	4.00
F011	.0002	5.00	.0023	13.00	.0021	10.50	.0053	15.00	.009	18.00	.0328	22.00
F012	<.02	0.00	<.02	0.00	<.02	0.00	.02 EH	18.00	<.02	0.00	.03	11.00
F015	<.01	0.00	<.01	0.00	<.01	0.00	<.01	0.00	<.01	0.00	.03	11.00
F019	<.005	0.00	<.005	0.00	<.005	0.00	<.005	0.00	.006 L	3.00	.030	11.00
F024	<.001	0.00	<.001 EL	0.00	<.001 EL	0.00	<.001 EL	0.00	.008	8.00	.026 L	2.00
F025	<.0002	0.00	.0021	7.00	.0009 EL	1.00	.0027 EL	1.00	.0051 VL	2.00	.0220 EL	1.00
F032		0.00	.0019	2.00	.0021	10.50	.0048	4.00	.0087	15.50	.030	11.00
F038	.0001	1.00	.0022	8.00	.0021	10.50	.0051	11.00	.0085	12.00	.0303	15.00
F046	<.0002	0.00	.0020	4.50	.0020	5.50	.0047	3.00	.0078	5.00	.029	6.50
F048	<.001	0.00	.0025	15.00	.0024	16.00	.0055	17.00	.0090	18.00	.0319	19.00
F060	<.001	0.00	.002	4.50	.002	5.50	.005	8.00	.008	8.00	.030	11.00
F069	<.001	0.00	.0022	10.50	.0021	10.50	.0052	13.50	.0086	13.00	.0316	18.00
F089	<.001	0.00	.002	4.50	.002	5.50	.005	8.00	.008	8.00	.030	11.00
F093	<.002	0.00	<.002	0.00	<.002	0.00	.005	8.00	.008	8.00	.029	6.50
F094	.0001	3.00	.0022	10.50	.0021	13.00	.0051	12.00	.0086	14.00	.0306	16.00
F096	<.004	0.00	<.004	0.00	<.004	0.00	<.004	0.00	.009	18.00	.030	11.00
F133	<.0001	0.00	.002	4.50	.002	5.50	.005	8.00	.008	8.00	.027	4.00
F138	.0001	3.00	.0024	14.00	.0023	15.00	.0054	16.00	.0090	20.00	.0323	21.00
MEDIAN	.0001		.0022		.0020		.0050		.0082		.0300	
1CRIT	.0015		.0015		.0015		.0017		.0019		.0032	
N	4		14		14		16		18		20	
MEAN	.0001		.0022		.0020		.0050		.0080		.0297	
3STDEV	-		.0005		.0004		.0012		.0032		.0052	

PARAMETER: 42091 Molybdenum mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.070	15.00	.204	16.00	.176	13.50	.304	15.00
F003	.074	20.00	.215 H	22.00	.188 H	22.00	.322 H	21.00
F009	.067	5.50	.210	20.00	.182	20.00	.331 H	22.00
F010	.064	3.00	.190	4.50	.174	8.50	.302	12.50
F011	.0745	21.00	.206	18.00	.176	13.50	.297	7.00
F012	.07	15.00	.20	12.00	.18	16.50	.31	17.50
F015	.07	15.00	.2	12.00	.17	5.00	.3	10.00
F019	.070	15.00	.199	9.50	.177	15.00	.302	12.50
F024	.070	15.00	.20	12.00	.18	16.50	.31	17.50
F025	.0544 EL	1.00	.159 EL	1.00	.122 EL	1.00	.248 EL	1.00
F032	.069	10.50	.198	7.50	.174	8.50	.299	8.50
F038	.0698	12.00	.202	14.50	.175	11.50	.302	12.50
F046	.066	4.00	.19	4.50	.17	5.00	.29	4.00
F048	.0724	19.00	.2085	19.00	.1805	18.00	.3219 H	20.00
F060	.068	7.50	.198	7.50	.174	8.50	.302	12.50
F069	.0711	18.00	.205	17.00	.181	19.00	.305	16.00
F089	.069	10.50	.189	3.00	.168	3.00	.273 L	3.00
F093	.067	5.50	.195	6.00	.170	5.00	.292	5.00
F094	.0689	9.00	.199	9.50	.174	8.50	.299	8.50
F096	.068	7.50	.202	14.50	.175	11.50	.293	6.00
F133	.061 VL	2.00	.171 EL	2.00	.155 EL	2.00	.265 VL	2.00
F138	.0754 H	22.00	.213	21.00	.185	21.00	.315	19.00
MEDIAN	.0694		.2000		.1750		.3020	
1CRIT	.0056		.0134		.0119		.0195	
N	20		20		20		20	
MEAN	.0690		.1990		.1748		.3002	
3STDEV	.0091		.0269		.0190		.0404	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	133.00	13.300	10					ICP-MS
F003	137.00	15.222	9	H H H				ICP-OES
F009	80.50	8.944	9	ELELELL H				
F010	69.00	6.900	10	EHEH VL				ICP
F011	143.00	14.300	10					
F012	90.00	15.000	6	EH				ICPMS
F015	53.00	10.600	5					ICP
F019	66.00	11.000	6	L				ICAP
F024	71.00	11.833	6	ELELEL L				ICP-AES
F025	16.00	1.778	9	ELELVLELELELELEL	BIASED LOW	-19.90	-.0022	ICP-MS
F032	78.00	8.667	9					ICP AES Ult neb
F038	108.00	10.800	10					ICPMS
F046	42.00	4.667	9		BIASED LOW*	-4.01	-.0001	ICPMS
F048	161.00	17.889	9	H	BIASED HIGH	5.49	-.0003	ICP
F060	73.00	8.111	9					ICP
F069	135.50	15.056	9					ICP-MS
F089	56.50	6.278	9	L				
F093	44.00	6.286	7					ICP
F094	104.00	10.400	10					ICP-MS
F096	68.50	11.417	6					ICP
F133	38.00	4.222	9	VLELELVL	BIASED LOW	-12.82	.0004	ICP-MS
F138	172.00	17.200	10	H	BIASED HIGH*	4.89	.0007	ICP-MS

OVERALL AVERAGE
RANK IS 10.425

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F025	16.00	1.778	9	ELELVLELELELELEL	BIASED LOW	-19.90	-.0022	ICP-MS
F133	38.00	4.222	9	VLELELVL	BIASED LOW	-12.82	.0004	ICP-MS
F046	42.00	4.667	9		BIASED LOW*	-4.01	-.0001	ICPMS
F089	56.50	6.278	9	L				
F093	44.00	6.286	7					ICP
F010	69.00	6.900	10	EHEHVL				ICP
F060	73.00	8.111	9					ICP
F032	78.00	8.667	9					ICP AES Ult neb
F009	80.50	8.944	9	ELELELLH				
F094	104.00	10.400	10					ICP-MS
F015	53.00	10.600	5					ICP
F038	108.00	10.800	10					ICPMS
F019	66.00	11.000	6	L				ICAP
F096	68.50	11.417	6					ICP
F024	71.00	11.833	6	ELELELL				ICP-AES
F001	133.00	13.300	10					ICP-MS
F011	143.00	14.300	10					
F012	90.00	15.000	6	EH				ICPMS
F069	135.50	15.056	9					ICP-MS
F003	137.00	15.222	9	HHH				ICP-OES
F138	172.00	17.200	10	H	BIASED HIGH*	4.89	.0007	ICP-MS
F048	161.00	17.889	9	H	BIASED HIGH	5.49	-.0003	ICP

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 10.425

PARAMETER: 48091 Cadmium mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0010 BASIC ACCEPTABLE ERROR= .0010 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	<.0000	0.00	.0016	9.50	.0011	14.00	.0025	9.00	.0066	12.00	.016	18.00
F002	<.0010	0.00	.0016	9.50	.0011	14.00	.0026	13.50	.0068	16.00	.0153	10.00
F003	<.0001	0.00	.0016	9.50	.0010	5.00	.0023	5.00	.0064	9.00	.015	6.00
F008	<.0005	0.00	.0016	9.50	.0010	5.00	.0025	9.00	.0070	21.50	.016	18.00
F009	<.0005	0.00	.0018	20.00	.0011	14.00	.0027	17.50	.0071	25.00	.016	18.00
F010	<.0003	0.00	.0018	20.00	.0012	20.00	.0027	17.50	.0049 EL	1.00	.016	18.00
F011	<.0001	0.00	.0016	9.50	.0010	5.00	.0025	9.00	.0066	12.00	.0159	13.50
F012	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00
F013	<.005	0.00	<.005	0.00	<.005	0.00	<.005	0.00	.005 L	2.00	.012 EL	1.00
F014	<.0001	0.00	.0016	9.50	.0012	20.00	.0029	23.50	.0076	28.00	.016	18.00
F015	<.0002	0.00	.0016	9.50	.0011	14.00	.0025	9.00	.0069	18.50	.017	25.50
F019	<.004	0.00	<.004	0.00	<.004	0.00	<.004	0.00	.007	21.50	.016	18.00
F024	<.001	0.00	.001 EL	1.00	<.001	0.00	.002	2.00	.007	21.50	.016	18.00
F025	.0004	2.00	.0025 EH	25.00	<.0002 EL	0.00	.0034	27.00	.0055	3.00	.0190 VH	28.00
F026	<.2	0.00	.0018	20.00	.0013	22.00	.0028	22.00	.0071	24.00	.0180 H	27.00
F031	<.001	0.00	.014 EH	26.00	<.001	0.00	.002	2.00	.006	5.50	.013 VL	2.00
F032		0.00	.0016	9.50	.0011	14.00	.0021	4.00	.0066	12.00	.015	6.00
F037	<.0005	0.00	.0016	9.50	.0010	5.00	.0028	21.00	.0084 EH	29.00	.0227 EH	29.00
F038	<.0000	0.00	.0016	16.00	.0011	14.00	.0025	12.00	.0068	17.00	.0159	13.50
F046	<.0000	0.00	.0017	17.00	.0011	14.00	.0027	17.50	.0072	27.00	.017	25.50
F048	<.001	0.00	.0020	23.00	.0014 EH	23.00	.0029	23.50	.0070	21.50	.0163	23.00
F060	<.0005	0.00	.0016	9.50	.0010	5.00	.0026	13.50	.0069	18.50	.0162	22.00
F063	<.001	0.00	.002	23.00	.001	5.00	.003	25.50	.006	5.50	.014 L	3.00
F069	<.001	0.00	.0014	2.00	.0011	14.00	.0024	6.00	.0066	12.00	.0154	11.00
F089	<.001	0.00	.002	23.00	.001	5.00	.003	25.50	.006	5.50	.015	6.00
F093	<.002	0.00	<.002	0.00	<.002	0.00	.002	2.00	.006	5.50	.015	6.00
F094	<.0001	0.00	.0016	9.50	.0010	5.00	.0025	9.00	.0066	12.00	.0150	6.00
F096	<.0001	0.00	.0015	3.00	.0010	5.00	.0027	17.50	.0062	8.00	.0158	12.00
F133	<.0001	0.00	.0016	9.50	.0011	14.00	.0027	17.50	.0067	15.00	.0152	9.00
F138	.0001	1.00	.0018	18.00	.0012	20.00	.0027	17.50	.0071	26.00	.0164	24.00
MEDIAN OR *TARGET												
CONC.	*.0001		.0016		.0011		.0026		.0067		.0160	
1CRIT	.0010		.0010		.0010		.0011		.0013		.0019	
N	2		24		22		26		27		27	
MEAN	.0002		.0017		.0011		.0026		.0066		.0158	
3STDEV	-		.0007		.0002		.0009		.0017		.0034	

PARAMETER: 48091 Cadmium mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.039	11.50	.091	13.50	.098	9.50	.162	10.50
F002	.041	22.50	.092	16.50	.100	15.00	.165	16.00
F003	.040	16.50	.091	13.50	.102	20.00	.164	14.00
F008	.042	27.00	.095	23.50	.103	23.50	.166	19.50
F009	.041	22.50	.096	25.00	.105	25.50	.171	28.00
F010	.039	11.50	.089	8.00	.098	9.50	.162	10.50
F011	.0408	19.00	.0897	11.00	.0968	7.00	.162	10.50
F012	.04	16.50	.09	12.00	.10	15.00	.17	24.50
F013	.037	3.50	.089	8.00	.095	3.50	.161	7.50
F014	.040	16.50	.093	19.00	.102	20.00	.165	16.00
F015	.041	22.50	.095	23.50	.105	25.50	.169	21.50
F019	.038	7.00	.088	5.50	.099	11.00	.162	10.50
F024	.041	22.50	.094	21.00	.10	15.00	.17	24.50
F025	.0339 VL	2.00	.102 VH	29.00	.0937	2.00	.148 VL	2.00
F026	.0427	29.00	.0987 H	28.00	.1124 VH	29.00	.1787 H	29.00
F031	.032 EL	1.00	.077 EL	1.00	.091 L	1.00	.151 L	3.00
F032	.037	3.50	.086	3.00	.096	6.00	.158	5.00
F037	.0418	26.00	.1217 EH	30.00	.1279 EH	30.00	.3232 EH	30.00
F038	.0400	16.50	.0929	18.00	.102	20.00	.166	19.50
F046	.043	30.00	.097	26.00	.11 H	28.00	.17	24.50
F048	.0416	25.00	.0943	22.00	.1025	22.00	.1708	27.00
F060	.0409	20.00	.0938	20.00	.103	23.50	.169	21.50
F063	.038	7.00	.092	16.50	.101	18.00	.165	16.00
F069	.0391	14.00	.0892	10.00	.0994	12.00	.161	7.50
F089	.039	11.50	.083 L	2.00	.095	3.50	.143 EL	1.00
F093	.039	11.50	.088	5.50	.097	8.00	.160	6.00
F094	.0380	7.00	.0875	4.00	.0953	5.00	.157	4.00
F096	.0375	5.00	.0916	15.00	.0997	13.00	.1628	13.00
F133	.0382	9.00	.0890	8.00	.1002	17.00	.1658	18.00
F138	.0424	28.00	.0974	27.00	.107 H	27.00	.17	24.50
MEDIAN OR *TARGET CONC.	.0400		.0918		.1000		.1650	
1CRIT	.0033		.0064		.0069		.0108	
N	28		28		28		28	
MEAN	.0396		.0920		.1006		.1644	
3STDEV	.0058		.0122		.0131		.0186	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	107.50	11.944	9					ICP-MS
F002	133.00	14.778	9					A.A.
F003	98.50	10.944	9					ICP-OES
F008	156.50	17.389	9					GF/ICP
F009	195.50	21.722	9					
F010	116.00	12.889	9	EL				#1-5 GFA
F011	96.50	10.722	9					
F012	68.00	17.000	4		INSUFFICIENT DATA			ICPMS
F013	25.50	4.250	6	L EL	BIASED LOW*	-.98	-.0027	Cd Ext ICPDA
F014	170.50	18.944	9					ICP MS
F015	169.50	18.833	9					GFAA/ICP
F019	73.50	12.250	6					ICAP
F024	125.50	15.688	8	EL				ICP-AES
F025	120.00	13.333	9	EHEL VHVLVH VL				ICP-MS
F026	230.00	25.556	9	H H VHH	BIASED HIGH	8.93	.0001	5 graphite 5 ICP
F031	41.50	5.188	8	EH VLELELL L	BIASED LOW	-11.65	.0015	ICP,no dig.
F032	63.00	7.000	9					ICP AES Ult neb
F037	209.50	23.278	9	EHEH EHEHEH	BIASED HIGH	76.86	-.0111	GFAA
F038	146.50	16.278	9					ICPMS
F046	209.50	23.278	9	H	BIASED HIGH*	4.60	.0006	ICPMS
F048	210.00	23.333	9	EH	BIASED HIGH*	3.08	.0001	ICP
F060	153.50	17.056	9					ICP
F063	119.50	13.278	9	L				GFAA/ICP-AES
F069	88.50	9.833	9					ICP-MS
F089	83.00	9.222	9	L EL				
F093	44.50	6.357	7		BIASED LOW*	-2.83	-.0005	ICP
F094	61.50	6.833	9		BIASED LOW*	-4.81	.0000	ICP-MS
F096	91.50	10.167	9					GFAA
F133	117.00	13.000	9					ICP-MS
F138	213.00	21.300	10	H				ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 14.602

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F013	25.50	4.250	6	LEL	BIASED LOW*	-.98	-.0027	Cd Ext ICPDA
F031	41.50	5.188	8	EHVLELELLL	BIASED LOW	-11.65	.0015	ICP,no dig.
F093	44.50	6.357	7		BIASED LOW*	-2.83	-.0005	ICP
F094	61.50	6.833	9		BIASED LOW*	-4.81	.0000	ICP-MS
F032	63.00	7.000	9					ICP AES Ult neb
F089	83.00	9.222	9	LEL				
F069	88.50	9.833	9					ICP-MS
F096	91.50	10.167	9					GFAA
F011	96.50	10.722	9					
F003	98.50	10.944	9					ICP-OES
F001	107.50	11.944	9					ICP-MS
F019	73.50	12.250	6					ICAP
F010	116.00	12.889	9	EL				#1-5 GFA
F133	117.00	13.000	9					ICP-MS
F063	119.50	13.278	9	L				GFAA/ICP-AES
F025	120.00	13.333	9	EHELVHVLVHVL				ICP-MS
F002	133.00	14.778	9					A.A.
F024	125.50	15.688	8	EL				ICP-AES
F038	146.50	16.278	9					ICPMS
F012	68.00	17.000	4		INSUFFICIENT DATA			ICPMS
F060	153.50	17.056	9					ICP
F008	156.50	17.389	9					GF/ICP
F015	169.50	18.833	9					GFAA/ICP
F014	170.50	18.944	9					ICP MS
F138	213.00	21.300	10	H				ICP-MS
F009	195.50	21.722	9					
F046	209.50	23.278	9	H	BIASED HIGH*	4.60	.0006	ICPMS
F037	209.50	23.278	9	EHEHEHEHEH	BIASED HIGH	76.86	-.0111	GFAA
F048	210.00	23.333	9	EH	BIASED HIGH*	3.08	.0001	ICP
F026	230.00	25.556	9	HHVHH	BIASED HIGH	8.93	.0001	5 graphite 5 ICP

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 14.602

Cadmium

PARAMETER: 56091 Barium mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0015 BASIC ACCEPTABLE ERROR= .0015 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.010	4.50	.0036	17.00	.013	12.00	.015	17.50	.024	9.50	.041	7.00
F003	.0109	9.50	.0034	11.00	.0132	16.00	.0145	10.00	.0246	14.00	.0437	19.50
F008	.012	22.50	.004	20.50	.015	23.00	.016	22.50	.027	24.50	.046	25.50
F009	.012	22.50	.0037	18.00	.014	20.50	.015	17.50	.0255	22.00	.0437	19.50
F010	.011	15.00	.004	20.50	.013	12.00	.015	17.50	.024	9.50	.042	10.50
F011	.0104	7.00	.0034	11.00	.0127	6.00	.0139	5.00	.0231	7.00	.0399	4.00
F012	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	.02 VL	3.00	.04	5.00
F014	.011	15.00	<.010	0.00	.014	20.50	.016	22.50	.027	24.50	.044	23.00
F015	.01	4.50	.001 EL	1.00	.011	2.00	.013	2.50	.024	9.50	.043	14.50
F019	.011	15.00	.004	20.50	.014	20.50	.015	17.50	.025	18.50	.042	10.50
F024	.011	15.00	.003	4.50	.014	20.50	.015	17.50	.026	23.00	.044	23.00
F025	.0070 EL	1.00	.0020 EL	2.00	.0100 EL	1.00	.0100 EL	1.00	.0170 EL	2.00	.0220 EL	1.00
F031	.011	15.00	.003	4.50	.013	12.00	.015	17.50	.025	18.50	.043	14.50
F032	.011	15.00	.0034	11.00	.013	12.00	.015	17.50	.025	18.50	.043	14.50
F037	<.01	0.00	<.01	0.00	<.01 EL	0.00	<.01 EL	0.00	.013 EL	1.00	.032 EL	2.00
F038	.0110	15.00	.0035	14.00	.0130	12.00	.0147	11.00	.0248	16.00	.0421	12.00
F046	.010	4.50	.0031	7.00	.012	3.50	.013	2.50	.023	5.50	.041	7.00
F048	.0112	20.00	.0034	11.00	.0133	17.00	.0149	13.00	.0247	15.00	.0440	23.00
F060	.0114	21.00	.0035	15.50	.0134	18.00	.0150	17.50	.0252	21.00	.0438	21.00
F063	.011	15.00	.003	4.50	.013	12.00	.014	6.50	.024	9.50	.043	14.50
F068		0.00		0.00		0.00		0.00		0.00		0.00
F069	.0106	8.00	.0034	11.00	.0128	7.00	.0144	9.00	.0242	12.00	.0432	17.00
F089	.015 EH	24.00	.0084 EH	23.00	.017 EH	24.00	.018 EH	24.00	.028 H	26.00	.046	25.50
F093	.010	4.50	.003	4.50	.012	3.50	.014	6.50	.023	5.50	.041	7.00
F094	.0109	9.50	.0035	15.50	.0129	8.00	.0143	8.00	.0243	13.00	.0415	9.00
F096	.011	15.00	.004	20.50	.013	12.00	.0148	12.00	.025	18.50	.0435	18.00
F133	.0098	2.00	.0033	8.00	.0121	5.00	.0137	4.00	.0220	4.00	.0394	3.00
MEDIAN	.0110		.0034		.0130		.0148		.0244		.0430	
1CRIT	.0021		.0016		.0022		.0023		.0029		.0040	
N	22		21		22		22		24		23	
MEAN	.0108		.0034		.0131		.0146		.0241		.0419	
3STDEV	.0018		.0014		.0025		.0023		.0062		.0076	

PARAMETER: 56091 Barium mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.101	9.50	.147	12.00	.230	8.50	.261	13.50
F003	.105	21.00	.152	21.00	.243	19.00	.267	19.00
F008	.109	25.00	.159 H	26.00	.251	27.00	.277	25.00
F009	.105	21.00	.154	24.50	.244	21.00	.271	23.00
F010	.101	9.50	.147	12.00	.236	13.00	.260	12.00
F011	.102	12.00	.139	4.50	.223	4.00	.250	5.50
F012	.11	26.50	.16 H	27.00	.25	25.50	.28 H	26.00
F014	.103	14.50	.151	18.50	.241	17.50	.262	15.00
F015	.105	21.00	.152	21.00	.244	21.00	.27	21.00
F019	.101	9.50	.143	8.00	.235	12.00	.257	9.50
F024	.11	26.50	.15	16.50	.25	25.50	.27	21.00
F025	.0715 EL	1.00	.0950 EL	1.00	.157 EL	1.00	.211 EL	1.00
F031	.103	14.50	.151	18.50	.246	24.00	.275	24.00
F032	.104	17.50	.150	16.50	.240	15.50	.266	18.00
F037	.095 L	3.00	.139	4.50	.228	6.00	.257	9.50
F038	.100	6.50	.145	10.00	.230	8.50	.256	8.00
F046	.10	6.50	.14	6.00	.23	8.50	.25	5.50
F048	.1053	24.00	.1525	23.00	.2450	23.00	.314 EH	27.00
F060	.105	21.00	.154	24.50	.244	21.00	.270	21.00
F063	.103	14.50	.149	15.00	.238	14.00	.264	17.00
F068	.097	4.00	.122 EL	2.00	.207 VL	2.00	.246	3.50
F069	.104	17.50	.148	14.00	.241	17.50	.261	13.50
F089	.103	14.50	.143	8.00	.230	8.50	.246	3.50
F093	.099	5.00	.143	8.00	.226	5.00	.252	7.00
F094	.101	9.50	.147	12.00	.234	11.00	.259	11.00
F096	.105	21.00	.152	21.00	.240	15.50	.263	16.00
F133	.0931 L	2.00	.1353 L	3.00	.2185 L	3.00	.2361 L	2.00
MEDIAN	.1030		.1480		.2380		.2610	
1CRIT	.0076		.0103		.0157		.0171	
N	24		25		25		25	
MEAN	.1021		.1466		.2357		.2610	
3STDEV	.0104		.0224		.0302		.0311	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	111.00	11.100	10					ICP-MS
F003	160.00	16.000	10					ICP-OES
F008	241.50	24.150	10	H	BIASED HIGH	5.70	.0007	ICP
F009	209.50	20.950	10		BIASED HIGH*	3.23	.0000	
F010	131.50	13.150	10					ICP
F011	66.00	6.600	10		BIASED LOW	-5.13	.0002	
F012	113.00	18.833	6	VL H H				ICPMS
F014	171.00	19.000	9					ICP MS
F015	118.00	11.800	10	EL				ICP
F019	141.50	14.150	10					ICAP
F024	193.00	19.300	10					ICP-AES
F025	12.00	1.200	10	ELELELELELELELELELEL	BIASED LOW	-26.12	-.0033	ICP-MS
F031	163.00	16.300	10					ICP,no dig.
F032	156.00	15.600	10					ICP AES Ult neb
F037	26.00	4.333	6	ELELELELL	BIASED LOW*	1.96	-.0116	ICP
F038	113.00	11.300	10					ICPMS
F046	56.50	5.650	10		BIASED LOW*	-3.72	-.0006	ICPMS
F048	196.00	19.600	10	EH				ICP
F060	201.50	20.150	10					ICP
F063	122.50	12.250	10					ICP-AES
F068	11.50	2.875	4	ELVL	INSUFFICIENT DATA			IC Dionex
F069	126.50	12.650	10					ICP-MS
F089	181.00	18.100	10	EHEHEHEHH				
F093	56.50	5.650	10		BIASED LOW*	-3.89	-.0003	ICP
F094	106.50	10.650	10					ICP-MS
F096	169.50	16.950	10					ICP
F133	36.00	3.600	10	L L L L	BIASED LOW	-8.95	.0001	ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 13.294

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F025	12.00	1.200	10	ELELELELELELELELELEL	BIASED LOW	-26.12	-.0033	ICP-MS
F068	11.50	2.875	4	ELVL	INSUFFICIENT DATA			IC Dionex
F133	36.00	3.600	10	LLLL	BIASED LOW	-8.95	.0001	ICP-MS
F037	26.00	4.333	6	ELELELELL	BIASED LOW*	1.96	-.0116	ICP
F046	56.50	5.650	10		BIASED LOW*	-3.72	-.0006	ICPMS
F093	56.50	5.650	10		BIASED LOW*	-3.89	-.0003	ICP
F011	66.00	6.600	10		BIASED LOW	-5.13	.0002	
F094	106.50	10.650	10					ICP-MS
F001	111.00	11.100	10					ICP-MS
F038	113.00	11.300	10					ICPMS
F015	118.00	11.800	10	EL				ICP
F063	122.50	12.250	10					ICP-AES
F069	126.50	12.650	10					ICP-MS
F010	131.50	13.150	10					ICP
F019	141.50	14.150	10					ICAP
F032	156.00	15.600	10					ICP AES Ult neb
F003	160.00	16.000	10					ICP-OES
F031	163.00	16.300	10					ICP,no dig.
F096	169.50	16.950	10					ICP
F089	181.00	18.100	10	EHEHEHEHH				
F012	113.00	18.833	6	VLHH				ICPMS
F014	171.00	19.000	9					ICP MS
F024	193.00	19.300	10					ICP-AES
F048	196.00	19.600	10	EH				ICP
F060	201.50	20.150	10					ICP
F009	209.50	20.950	10		BIASED HIGH*	3.23	.0000	
F008	241.50	24.150	10	H	BIASED HIGH	5.70	.0007	ICP

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 13.294

Barium

PARAMETER: 82091 Lead mg/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .0015 BASIC ACCEPTABLE ERROR= .0015 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.0001	3.00	.0025	14.00	.0036	12.50	.0037	10.00	.010	18.00	.051	9.00
F002	<.0020	0.00	.0024	9.50	.0033	7.00	.0038	12.50	.0103	21.00	.0574	24.00
F003	.0005	7.00	.0026	18.50	.0036	12.50	.0036	6.50	.0095	10.00	.053	15.50
F008	<.001	0.00	.0020	4.50	.0040	21.00	.0040	17.50	.0100	18.00	.06 VH	27.50
F009	<.0005	0.00	.0027	20.50	.0039	18.50	.0040	17.50	.0108	23.00	.0595 H	26.00
F010	<.0003	0.00	.0028	23.00	.0040	21.00	.0041	21.50	.0098	14.00	.069 EH	29.00
F011	.0002	5.00	.0024	9.50	.0034	8.50	.0035	4.00	.009	5.50	.0494	5.00
F012	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	<.02	0.00	.05	6.50
F013	<.002	0.00	.0025	14.00	.0038	17.00	.0036	6.50	.0091	8.00	.0439 VL	1.00
F014	<.0010	0.00	.0025	14.00	.0039	18.50	.0042	23.00	.0109	24.00	.0557	22.00
F015	.0009	8.00	.002	4.50	.0047	24.00	.0037	10.00	.0099	15.00	.053	15.50
F019	<.03	0.00	<.03	0.00	<.03	0.00	<.03	0.00	<.03	0.00	.06 VH	27.50
F024	<.002	0.00	.002	4.50	.003	4.00	.004	17.50	.011	25.00	.055	20.00
F025	<.0003	0.00	.0025	14.00	.0058 EH	25.00	.0041	21.50	.0126 H	26.00	.0720 EH	30.00
F026	.0066 VH	10.00	.0022	8.00	.0037	15.00	.0052 EH	24.00	.0096	12.00	.0537	17.00
F031	<.001	0.00	.002	4.50	.003	4.00	.004	17.50	.009	5.50	.052	12.50
F032		0.00		0.00		0.00		0.00		0.00	.051	9.00
F037	<.001	0.00	.0015 EL	1.00	.0021	1.00	.0023 EL	1.00	.0075 L	2.00	.0447 VL	3.00
F038	.0001	3.00	.0025	14.00	.0036	11.00	.0037	10.00	.0097	13.00	.0529	14.00
F046	.0003	6.00	.0027	20.50	.0037	15.00	.0035	4.00	.0090	5.50	.050	6.50
F048	<.001	0.00	.0026	18.50	.0037	15.00	.0038	12.50	.0100	18.00	.0540	18.00
F060	<.002	0.00	.003	24.00	.004	21.00	.004	17.50	.010	18.00	.055	20.00
F063	<.001	0.00	.002	4.50	.003	4.00	.004	17.50	.010	18.00	.055	20.00
F069	<.001	0.00	.0025	14.00	.0034	8.50	.0035	4.00	.0093	9.00	.0514	11.00
F089	.006 VH	9.00	.008 EH	25.00	.011 EH	26.00	.009 EH	25.00	.015 EH	27.00	.059 H	25.00
F093	<.002	0.00	<.002	0.00	.003	4.00	<.002 EL	0.00	.008	3.00	.049	4.00
F094	.0001	3.00	.0025	14.00	.0035	10.00	.0037	8.00	.0095	11.00	.0510	9.00
F096	<.001	0.00	.002	4.50	.003	4.00	.003	2.00	.009	5.50	.052	12.50
F133	<.002	0.00	<.002	0.00	<.002 L	0.00	<.002 EL	0.00	.005 EL	1.00	.044 VL	2.00
F138	.0001	1.00	.0027	22.00	.0040	23.00	.0039	14.00	.0104	22.00	.0558	23.00
MEDIAN	.0002		.0025		.0037		.0038		.0098		.0530	
1CRIT	.0015		.0016		.0016		.0016		.0020		.0046	
N	8		23		24		23		25		28	
MEAN	.0010		.0024		.0037		.0038		.0098		.0537	
3STDEV	.0057		.0009		.0018		.0012		.0030		.0148	

PARAMETER: 82091 Lead mg/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.113	9.00	.364	12.00	.291	11.50	.503	6.00
F002	.126 H	27.00	.368	14.00	.302	16.00	.537	17.00
F003	.120	19.50	.371	17.00	.301	15.00	.542	20.00
F008	.11	6.00	.37	15.50	.29	9.50	.55	24.50
F009	.133 VH	29.00	.406 VH	29.00	.335 VH	29.00	.584 VH	29.00
F010	.124	25.00	.393	27.00	.324 H	26.00	.550	24.50
F011	.116	13.00	.355	7.00	.281 L	4.00	.511	9.00
F012	.11	6.00	.36	8.00	.28 L	3.00	.51	8.00
F013	.101 VL	3.00	.362	9.50	.270 VL	2.00	.517	10.00
F014	.121	23.00	.372	18.00	.304	17.00	.531	15.00
F015	.117	14.50	.34 L	2.00	.29	9.50	.53	13.50
F019	.12	19.50	.37	15.50	.30	14.00	.53	13.50
F024	.12	19.50	.38	20.50	.31	20.00	.54	18.50
F025	.152 EH	30.00	.506 EH	30.00	.400 EH	30.00	.702 EH	30.00
F026	.1175	16.00	.3666	13.00	.3048	18.00	.5363	16.00
F031	.128 H	28.00	.38	20.50	.33 H	27.50	.58 H	28.00
F032	.115	12.00	.363	11.00	.293	13.00	.522	12.00
F037	.1030 VL	4.00	.3923	26.00	.3161	23.00	.5453	22.00
F038	.117	14.50	.353	6.00	.285	6.50	.507	7.00
F046	.12	19.50	.39	23.00	.32	25.00	.55	24.50
F048	.1203	22.00	.391	24.50	.318	24.00	.550	24.50
F060	.122	24.00	.375	19.00	.305	19.00	.540	18.50
F063	.10 VL	1.50	.40 H	28.00	.33 H	27.50	.50 L	3.00
F069	.114	10.50	.362	9.50	.291	11.50	.520	11.00
F089	.118	17.00	.342 L	3.00	.286	8.00	.473 VL	2.00
F093	.110	6.00	.348	4.00	.282	5.00	.501	4.50
F094	.114	10.50	.350	5.00	.285	6.50	.501	4.50
F096	.111	8.00	.387	22.00	.312	21.00	.555	27.00
F133	.1000 VL	1.50	.307 EL	1.00	.253 VL	1.00	.454 EL	1.00
F138	.125	26.00	.391	24.50	.313	22.00	.543	21.00
MEDIAN	.1172		.3700		.3015		.5336	
1CRIT	.0084		.0236		.0195		.0334	
N	27		28		28		28	
MEAN	.1173		.3715		.3017		.5307	
3STDEV	.0211		.0519		.0508		.0732	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	105.00	10.500	10					ICP-MS
F002	148.00	16.444	9	H				A.A.
F003	141.50	14.150	10					ICP-OES
F008	144.00	16.000	9	VH				GF/ICP
F009	221.50	24.611	9	H VHVHVHVH	BIASED HIGH	9.65	.0010	
F010	211.00	23.444	9	EH H	BIASED HIGH*	3.96	.0034	#1-6 GFA
F011	70.50	7.050	10	L	BIASED LOW*	-4.53	-.0001	
F012	31.50	6.300	5	L				ICPMS
F013	71.00	7.889	9	VLVL VL				Pb Ext ICPDA
F014	174.50	19.389	9					ICP MS
F015	116.50	11.650	10	L				GFAA/ICP
F019	90.00	18.000	5	VH				ICAP
F024	149.50	16.611	9					ICP-AES
F025	236.50	26.278	9	EH H EHEHEHEHEH	BIASED HIGH	33.03	.0001	ICP-MS
F026	149.00	14.900	10	VH EH				5 graphite 5 ICP
F031	148.00	16.444	9	H H H				HGAAS,no dig.
F032	57.00	11.400	5					ICP AES Ult neb
F037	83.00	9.222	9	EL ELL VLVL				GFAA
F038	99.00	9.900	10					ICPMS
F046	149.50	14.950	10					ICPMS
F048	177.00	19.667	9					ICP
F060	181.00	20.111	9					ICP
F063	124.00	13.778	9	VLH H L				GFAA/ICP-AES
F069	89.00	9.889	9					ICP-MS
F089	167.00	16.700	10	VHEHEHEHEHH L VL				
F093	30.50	4.357	7	EL	BIASED LOW	-5.95	-.0007	ICP
F094	81.50	8.150	10					ICP-MS
F096	106.50	11.833	9					GFAA
F133	7.50	1.250	6	L ELELVLVLELVLEL	BIASED LOW	-15.13	-.0021	ICP-MS
F138	198.50	19.850	10					ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 14.293

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F133	7.50	1.250	6	LELELVLVLELVLEL	BIASED LOW	-15.13	-.0021	ICP-MS
F093	30.50	4.357	7	EL	BIASED LOW	-5.95	-.0007	ICP
F012	31.50	6.300	5	L				ICPMS
F011	70.50	7.050	10	L	BIASED LOW*	-4.53	-.0001	
F013	71.00	7.889	9	VLVLVL				Pb Ext ICPDA
F094	81.50	8.150	10					ICP-MS
F037	83.00	9.222	9	ELELLVLVL				GFAA
F069	89.00	9.889	9					ICP-MS
F038	99.00	9.900	10					ICPMS
F001	105.00	10.500	10					ICP-MS
F032	57.00	11.400	5					ICP AES Ult neb
F015	116.50	11.650	10	L				GFAA/ICP
F096	106.50	11.833	9					GFAA
F063	124.00	13.778	9	VLHHL				GFAA/ICP-AES
F003	141.50	14.150	10					ICP-OES
F026	149.00	14.900	10	VHEH				5 graphite 5 ICP
F046	149.50	14.950	10					ICPMS
F008	144.00	16.000	9	VH				GF/ICP
F031	148.00	16.444	9	HHH				HGAAS,no dig.
F002	148.00	16.444	9	H				A.A.
F024	149.50	16.611	9					ICP-AES
F089	167.00	16.700	10	VHEHEHEHEHHLVL				
F019	90.00	18.000	5	VH				ICAP
F014	174.50	19.389	9					ICP MS
F048	177.00	19.667	9					ICP
F138	198.50	19.850	10					ICP-MS
F060	181.00	20.111	9					ICP
F010	211.00	23.444	9	EHH	BIASED HIGH*	3.96	.0034	#1-6 GFA
F009	221.50	24.611	9	HVHVHVHVH	BIASED HIGH	9.65	.0010	
F025	236.50	26.278	9	EHHEHEHEHEHEH	BIASED HIGH	33.03	.0001	ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 14.293

Lead

PARAMETER: 33095 Arsenic ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .5000 BASIC ACCEPTABLE ERROR= .5000 CONCENTRATION ERROR INCREMENT= .0800

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	1.2	9.50	1.9	8.00	1.5	10.50	8.4	11.00	7.6	10.50	6.0	18.00
F003	.8	2.00	1.8	4.50	1.0	2.50	7.8	3.00	7.6	10.50	5.1	7.00
F008	2. EH	16.00	2.	12.00	2.	18.00	9.	18.50	8.	17.50	6.	18.00
F009	1.3	13.00	2.1	16.00	1.65	13.00	8.87	16.00	8.0	17.50	6.0	18.00
F010	1.0	4.50	2.2	18.00	1.4	7.50	9.0	18.50	9.5 EH	23.00	5.6	12.00
F011	.9	3.00	1.9	8.00	1.1	5.00	8.7	14.00	7.9	15.00	5.0	4.00
F012	<5.	0.00	<5.	0.00	<5.	0.00	10. H	23.00	7.	3.50	6.	18.00
F014	1.2	9.50	2.0	12.00	1.6	12.00	9.1	22.00	8.4	22.00	6.4	23.00
F015	1.1	7.00	1.9	8.00	1.4	7.50	8.5	12.00	7.7	12.00	5.5	10.50
F025	.7	1.00	1.7	3.00	1.0	2.50	8.0	8.00	7.3	9.00	5.3	9.00
F031	<2.	0.00	<2.	0.00	<2.	0.00	8.	8.00	8.	17.50	5.	4.00
F037	1.08	6.00	1.68	2.00	<1.0	0.00	7.93	5.00	7.24	8.00	5.18	8.00
F038	1.2	9.50	2.0	12.00	1.5	10.50	8.6	13.00	7.8	14.00	5.8	14.00
F046	1.3	13.00	2.1	16.00	1.7	15.50	9.0	18.50	8.3	21.00	6.2	22.00
F048	<1.	0.00	1.90	8.00	2.12 H	19.00	8.71	15.00	7.75	13.00	5.75	13.00
F060	1.3	13.00	2.3	19.00	1.7	15.50	10.3 VH	24.00	11.4 EH	24.00	7.7 EH	24.00
F063	<1.	0.00	<1. EL	0.00	1.	2.50	7. L	1.00	7.	3.50	5.	4.00
F069	<1.	0.00	1.8	4.50	1.4	7.50	9.0	18.50	8.0	17.50	5.9	15.00
F089	<2.	0.00	<2.	0.00	3. EH	20.00	8.	8.00	7.	3.50	6.	18.00
F093	<2.0	0.00	<2.0	0.00	<2.0	0.00	7.1 L	2.00	5.8 EL	1.00	4.3 VL	1.00
F094	1.2	9.50	1.9	8.00	1.4	7.50	8.0	8.00	7.2	7.00	5.5	10.50
F096	<.5 EL	0.00	2.1	16.00	1.8	17.00	7.9	4.00	7.1	6.00	5.0	4.00
F133	1.00	4.50	1.50 EL	1.00	1.00	2.50	8.00	8.00	7.00	3.50	5.00	4.00
F138	1.31	15.00	2.08	14.00	1.67	14.00	9.08	21.00	8.09	20.00	6.17	21.00
MEDIAN	1.2000		1.9000		1.5000		8.5500		7.7250		5.6750	
1CRIT	.5560		.6120		.5800		1.1440		1.0780		.9140	
N	14		17		19		22		22		22	
MEAN	1.1350		1.9447		1.4705		8.4859		7.7036		5.6091	
3STDEV	.4657		.4285		.9853		1.8722		1.7651		1.3736	

PARAMETER: 33095 Arsenic ug/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	12.4	18.00	26.1	15.50	28.1	13.00	25.3	14.50
F003	11.7	7.00	24.6	8.00	27.0	7.00	24.3	9.00
F008	12.	12.50	26.	13.00	27.	7.00	25.	11.50
F009	12.5	19.50	26.7	18.00	29.0	16.00	26.1	18.00
F010	12.	12.50	28.	22.00	28.	11.00	26.	17.00
F011	11.8	9.00	25.4	11.00	29.1	18.50	26.9	21.00
F012	12.	12.50	26.	13.00	29.	16.00	25.	11.50
F014	12.5	19.50	26.3	17.00	29.1	18.50	25.7	16.00
F015	11.0	4.00	20. EL	1.00	25.0 L	1.50	19.5 VL	1.00
F025	10.4 L	3.00	24.4	5.00	28.0	11.00	23.8	7.00
F031	12.	12.50	26.	13.00	28.	11.00	25.	11.50
F037	11.71	8.00	24.51	7.00	27.00	7.00	22.38 L	5.00
F038	12.2	17.00	26.1	15.50	28.6	14.00	25.3	14.50
F046	12.9	21.00	27.1	19.00	31.9 H	23.00	29.4 VH	23.00
F048	12.1	16.00	27.5	20.50	31.0 H	22.00	26.4	19.00
F060	17.4 EH	24.00	36.0 EH	24.00	39.8 EH	24.00	35.3 EH	24.00
F063	10. L	2.00	22. VL	2.00	26.	4.00	20. VL	2.00
F069	13.3	23.00	28.1	23.00	30.7	21.00	27.7 H	22.00
F089	12.	12.50	25.	10.00	29.	16.00	24.	8.00
F093	9.1 EL	1.00	22.7 L	3.00	25.0 L	1.50	21.5 L	4.00
F094	11.5	6.00	24.1	4.00	26.4	5.00	23.7	6.00
F096	11.3	5.00	24.9	9.00	25.9	3.00	21.1 VL	3.00
F133	12.0	12.50	24.5	6.00	27.5	9.00	25.0	11.50
F138	13.0	22.00	27.5	20.50	30.5	20.00	26.8	20.00
MEDIAN	12.0000		26.0000		28.0500		25.0000	
1CRIT	1.4200		2.5400		2.7040		2.4600	
N	22		22		21		22	
MEAN	11.9232		25.6141		28.4190		24.8355	
3STDEV	2.2698		4.6784		4.8139		6.4498	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	128.50	12.850	10					ICP-MS
F003	60.50	6.050	10					Hydride/ICP-OES
F008	144.00	14.400	10	EH				HYDRIDE
F009	165.00	16.500	10					
F010	146.00	14.600	10	EH				Hydride AA
F011	108.50	10.850	10					
F012	97.50	13.929	7	H				ICPMS
F014	171.50	17.150	10					ICP MS
F015	64.50	6.450	10	ELL VL				GFAA/ICP
F025	58.50	5.850	10	L	BIASED LOW*	-2.13	-.4498	AA
F031	77.50	11.071	7					ICP,no dig.
F037	56.00	6.222	9	L				GFAA
F038	134.00	13.400	10					ICPMS
F046	192.00	19.200	10	H VH	BIASED HIGH	12.22	-.2075	ICPMS
F048	145.50	16.167	9	H H				ICP
F060	215.50	21.550	10	VHEHEHEHEHEHEH	BIASED HIGH	42.27	-.4113	AA
F063	21.00	2.625	8	EL L L VL VL	BIASED LOW	-12.86	-.2217	Hydride AA
F069	152.00	16.889	9	H				GFAA
F089	96.00	12.000	8	EH				
F093	13.50	1.929	7	L ELVLELL L L	BIASED LOW	-8.07	-1.1969	ICP-hydride
F094	71.50	7.150	10					ICP-MS
F096	67.00	7.444	9	EL VL				Hydride FAA
F133	62.50	6.250	10	EL				ICP-MS
F138	187.50	18.750	10		BIASED HIGH	7.29	.0023	ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 11.821

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F093	13.50	1.929	7	LELVLELLLL	BIASED LOW	-8.07	-1.1969	ICP-hydride
F063	21.00	2.625	8	ELLLVLVL	BIASED LOW	-12.86	-.2217	Hydride AA
F025	58.50	5.850	10	L	BIASED LOW*	-2.13	-.4498	AA
F003	60.50	6.050	10					Hydride/ICP-OES
F037	56.00	6.222	9	L				GFAA
F133	62.50	6.250	10	EL				ICP-MS
F015	64.50	6.450	10	ELLVL				GFAA/ICP
F094	71.50	7.150	10					ICP-MS
F096	67.00	7.444	9	ELVL				Hydride FAA
F011	108.50	10.850	10					
F031	77.50	11.071	7					ICP,no dig.
F089	96.00	12.000	8	EH				
F001	128.50	12.850	10					ICP-MS
F038	134.00	13.400	10					ICPMS
F012	97.50	13.929	7	H				ICPMS
F008	144.00	14.400	10	EH				HYDRIDE
F010	146.00	14.600	10	EH				Hydride AA
F048	145.50	16.167	9	HH				ICP
F009	165.00	16.500	10					
F069	152.00	16.889	9	H				GFAA
F014	171.50	17.150	10					ICP MS
F138	187.50	18.750	10		BIASED HIGH	7.29	.0023	ICP-MS
F046	192.00	19.200	10	HVH	BIASED HIGH	12.22	-.2075	ICPMS
F060	215.50	21.550	10	VHEHEHEHEHEHEH	BIASED HIGH	42.27	-.4113	AA

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 11.821

PARAMETER: 34095 Selenium ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .5000 BASIC ACCEPTABLE ERROR= .5000 CONCENTRATION ERROR INCREMENT= .0800

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.1	1.00	1.2	7.00	.3	3.00	3.9	8.50	4.7	7.00	3.0	8.50
F003	.3	3.00	1.3	9.50	.4	4.00	4.0	12.00	5.2	17.00	3.1	11.50
F008	<1.	0.00	2. H	16.00	<1.	0.00	5. H	21.00	5.	11.50	3.	8.50
F009	<.5	0.00	1.3	9.50	.6	7.00	4.2	15.00	5.0	11.50	3.4	16.00
F010	.5	4.00	2.5 EH	17.00	.5	6.00	4.5	17.50	5.0	11.50	3.2	13.00
F011	1.0 H	5.00	1.2	7.00	1.0 H	8.00	4.0	12.00	5.5	20.00	3.1	11.50
F012	<5.	0.00	<5.	0.00	<5.	0.00	9. EH	23.00	5.	11.50	8. EH	22.00
F014	<1.0	0.00	1.5	15.00	<1.0	0.00	1.8 VL	1.00	5.8	21.00	4.7 VH	21.00
F015	<1.	0.00	1.4	13.00	<1.	0.00	4.5	17.50	5.3	18.00	3.6	17.00
F025	<.2	0.00	1.2	7.00	.2	1.50	3.7	5.50	4.3	5.50	2.9	5.00
F031	<3.	0.00	<3.	0.00	<3.	0.00	6. VH	22.00	6. H	23.00	4. H	19.00
F037	9.52 EH	6.00	1.36	12.00	10.29 EH	9.00	4.95 H	20.00	5.00	11.50	12.02 EH	23.00
F038	<1.	0.00	1.	2.00	<1.	0.00	4.	12.00	5.	11.50	3.	8.50
F046	<.5	0.00	1.1	4.50	<.5	0.00	3.8	7.00	4.0 L	3.50	3.3	14.00
F048	<1.	0.00	1.44	14.00	<1.	0.00	4.36	16.00	5.31	19.00	3.35	15.00
F060	<.2	0.00	1.0	2.00	.2	1.50	4.0	12.00	5.0	11.50	2.9	5.00
F063	<1.	0.00	1.	2.00	<1.	0.00	4.	12.00	5.	11.50	3.	8.50
F069	<1.	0.00	<1.	0.00	<1.	0.00	3.9	8.50	5.1	16.00	2.9	5.00
F089	<6.	0.00	<6.	0.00	<6.	0.00	<6.	0.00	<6.	0.00	<6.	0.00
F093	<2.0	0.00	<2.0	0.00	<2.0	0.00	2.5 VL	3.00	3.0 VL	2.00	4.1 H	20.00
F094	<.4	0.00	1.1	4.50	<.4	0.00	3.7	5.50	4.3	5.50	2.8	3.00
F096	<.5	0.00	<.5 EL	0.00	<.5	0.00	2.1 VL	2.00	2.7 EL	1.00	1.8 VL	1.00
F133	<1.0	0.00	<1.0	0.00	<1.0	0.00	3.5	4.00	4.0 L	3.50	2.5	2.00
F138	.153	2.00	1.33	11.00	.477	5.00	4.92 H	19.00	5.82	22.00	3.64	18.00
MEDIAN	.4000		1.3000		.4770		4.0000		5.0000		3.1000	
1CRIT	.5000		.5640		.5000		.7800		.8600		.7080	
N	4		16		6		21		21		21	
MEAN	.4882		1.2769		.5462		4.0729		4.8729		3.4995	
3STDEV	-		.7254		.6683		2.4193		1.9119		3.3625	

PARAMETER: 34095 Selenium ug/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	6.8	3.50	19.3	8.00	16.9	4.50	14.9	6.50
F003	7.4	12.50	20.2	11.00	18.4	14.50	15.6	14.00
F008	7.	6.00	19.	5.50	18.	12.00	15.	9.50
F009	7.5	15.00	20.8	13.50	18.4	14.50	16.0	16.50
F010	7.5	15.00	18. L	2.00	17.	6.00	13. L	2.00
F011	7.3	10.50	18.7	4.00	16.9	4.50	14.4	3.00
F012	11. VH	22.00	31. EH	24.00	22. VH	23.00	22. EH	23.00
F014	7.8	17.00	21.5	18.00	19.7	19.00	16.3	19.00
F015	8.4	20.00	22.2	21.00	20.6 H	21.00	17.0	21.00
F025	7.2	9.00	21.0	16.00	17.9	10.00	15.4	13.00
F031	10. VH	21.00	19.	5.50	19.	17.50	15.	9.50
F037	13.75 EH	24.00	20.97	15.00	17.69	8.00	16.48	20.00
F038	8.	18.00	22.	20.00	19.	17.50	16.	16.50
F046	6.8	3.50	18.1 L	3.00	15.8 L	2.00	14.5	4.50
F048	7.4	12.50	20.8	13.50	17.7	9.00	16.1	18.00
F060	7.1	8.00	19.7	9.00	17.6	7.00	15.3	12.00
F063	7.	6.00	20.	10.00	18.	12.00	15.	9.50
F069	7.3	10.50	21.9	19.00	20.4 H	20.00	15.7	15.00
F089	12. EH	23.00	27. EH	23.00	32. EH	24.00	36. EH	24.00
F093	7.5	15.00	21.2	17.00	18.6	16.00	14.9	6.50
F094	6.4	2.00	19.1	7.00	16.7	3.00	14.5	4.50
F096	5.0 VL	1.00	14.5 EL	1.00	12.0 EL	1.00	9.5 EL	1.00
F133	7.0	6.00	20.5	12.00	18.0	12.00	15.0	9.50
F138	8.27	19.00	23.8 H	22.00	20.9 VH	22.00	17.5 H	22.00
MEDIAN	7.4000		20.6500		18.0000		15.3500	
1CRIT	1.0520		2.1120		1.9000		1.6880	
N	22		22		22		22	
MEAN	7.8486		20.6714		18.4177		15.7082	
3STDEV	4.1009		5.9268		4.4757		5.0072	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	57.50	5.750	10		BIASED LOW	-5.17	-.0663	HGAAS
F003	109.00	10.900	10					Hydride/ICP-OES
F008	90.00	11.250	8	H H				HYDRIDE
F009	118.50	13.167	9					
F010	94.00	9.400	10	EH L L				Hydride AA
F011	85.50	8.550	10	H H				
F012	148.50	21.214	7	EH EHVHEHVHEH	BIASED HIGH	27.34	2.0582	ICPMS
F014	131.00	16.375	8	VL VH				ICP MS
F015	148.50	18.563	8	H	BIASED HIGH	10.17	.0740	GFAA/ICP
F025	72.50	8.056	9					AA
F031	117.50	16.786	7	VHH H VH				ICP,no dig.
F037	148.50	14.850	10	EH EHH EHEH				GFAA
F038	106.00	13.250	8					ICPMS
F046	42.00	5.250	8	L L L	BIASED LOW	-11.68	.1673	GFAA
F048	117.00	14.625	8					ICP
F060	68.00	7.556	9					AA
F063	71.50	8.938	8					Hydride AA
F069	94.00	13.429	7	H				GFAA
F089	94.00	23.500	4	EHEHEHEH	INSUFFICIENT DATA			
F093	79.50	11.357	7	VLVLH				ICP-hydride
F094	35.00	4.375	8		BIASED LOW	-6.04	-.2104	ICP-MS
F096	8.00	1.143	7	EL VLELVLVLELELEL	BIASED LOW	-29.32	-.6211	Hydride FAA
F133	49.00	7.000	7	L				ICP-MS
F138	162.00	16.200	10	H H VHH				ICP-MS

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F096	8.00	1.143	7	ELVLELVLVLELELEL	BIASED LOW	-29.32	-.6211	Hydride FAA
F094	35.00	4.375	8		BIASED LOW	-6.04	-.2104	ICP-MS
F046	42.00	5.250	8	LLL	BIASED LOW	-11.68	.1673	GFAA
F001	57.50	5.750	10		BIASED LOW	-5.17	-.0663	HGAAS
F133	49.00	7.000	7	L				ICP-MS
F060	68.00	7.556	9					AA
F025	72.50	8.056	9					AA
F011	85.50	8.550	10	HH				
F063	71.50	8.938	8					Hydride AA
F010	94.00	9.400	10	EHLL				Hydride AA
F003	109.00	10.900	10					Hydride/ICP-OES
F008	90.00	11.250	8	HH				HYDRIDE
F093	79.50	11.357	7	VLVLH				ICP-hydride
F009	118.50	13.167	9					
F038	106.00	13.250	8					ICPMS
F069	94.00	13.429	7	H				GFAA
F048	117.00	14.625	8					ICP
F037	148.50	14.850	10	EHEHHEHEH				GFAA
F138	162.00	16.200	10	HHVHH				ICP-MS
F014	131.00	16.375	8	VLVH				ICP MS
F031	117.50	16.786	7	VHHHVH				ICP,no dig.
F015	148.50	18.563	8	H	BIASED HIGH	10.17	.0740	GFAA/ICP
F012	148.50	21.214	7	EHEHVHEHVHEH	BIASED HIGH	27.34	2.0582	ICPMS
F089	94.00	23.500	4	EHEHEHEH	INSUFFICIENT DATA			

OVERALL AVERAGE
RANK IS 11.406

PARAMETER: 47095 Silver ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .5000 BASIC ACCEPTABLE ERROR= .5000 CONCENTRATION ERROR INCREMENT= .0800

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	<.005	0.00	1.52	14.00	.14	4.50	4.0	11.00	7.1	11.00	2.3	12.00
F003	<.1	0.00	1.5	12.00	.1	1.50	4.1	16.00	7.1	11.00	1.9	1.00
F009	<.5	0.00	1.5	12.00	<.5	0.00	4.0	11.00	6.9	5.00	2.3	12.00
F010	<.3	0.00	1.7	15.00	<.3	0.00	4.9 EH	18.00	8.3 EH	19.00	2.7 EH	17.00
F011	.1	2.00	1.4	6.50	.1	1.50	3.6	4.00	6.8	3.50	2.0	3.00
F012	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	7.	8.00	<5.	0.00
F015	<.5	0.00	1.1	3.00	<.5	0.00	4.	11.00	6.8	3.50	2.1	6.00
F025	<.1	0.00	1.3	4.00	<.1	0.00	3.1 L	2.00	5.1 EL	1.00	2.3	12.00
F032		0.00	1.49	10.00		0.00	3.93	7.00	7.46	16.00	2.26	9.50
F037	<.1	0.00	1.43	8.00	<.1	0.00	4.07	14.00	7.41	15.00	2.26	9.50
F038	.01	1.00	1.48	9.00	.14	4.50	4.08	15.00	7.14	13.00	2.25	8.00
F046	<.02	0.00	1.5	12.00	.11	3.00	3.9	5.50	7.1	11.00	2.1	6.00
F048	<1.	0.00	1.88	16.00	<1.	0.00	2.45 EL	1.00	5.91 L	2.00	<1. EL	0.00
F060	<1.	0.00	1.	1.50	<1.	0.00	4.	11.00	7.	8.00	2.	3.00
F069	<1.	0.00	1.4	6.50	<1.	0.00	3.9	5.50	7.2	14.00	2.1	6.00
F093	1.8 EH	3.00	2.2 EH	17.00	1.0 VH	7.00	3.4	3.00	7.8	18.00	2.4	14.00
F094	<1.	0.00	1.	1.50	<1.	0.00	4.	11.00	7.	8.00	2.	3.00
F096	<1.	0.00	<1.	0.00	1.5 EH	8.00	4.4	17.00	7.5	17.00	2.5	16.00
F133	<.05	0.00	1.32	5.00	.24	6.00	3.96	8.00	6.91	6.00	2.46	15.00
MEDIAN OR *TARGET												
CONC.	*.1000		1.4800		.1400		4.0000		7.1000		2.2600	
1CRIT	.5000		.5784		.5000		.7800		1.0280		.6408	
N	1		14		5		16		17		15	
MEAN	.1000		1.4657		.3260		3.9025		7.0665		2.2220	
3STDEV	-		.5234		-		.8829		1.1665		.4775	

PARAMETER: 47095 Silver ug/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	6.1	9.00	19.6	6.00	15.3	8.00	15.2	12.50
F003	5.6	2.00	18.7	2.00	14.0	2.00	12.5 VL	1.00
F009	6.0	5.00	19.9	9.00	15.6	10.50	15.1	10.00
F010	7.3 EH	19.00	23. EH	19.00	18. EH	19.00	19. EH	19.00
F011	6.1	9.00	19.8	8.00	15.2	7.00	14.5	6.00
F012	7.	18.00	20.	10.50	16.	14.00	16.	17.00
F015	5.7	3.00	19.	4.00	15.	4.00	14.	3.50
F025	6.1	9.00	19.0	4.00	13.4 EL	1.00	12.7 L	2.00
F032	6.16	12.00	20.9	17.00	16.0	14.00	15.7	15.00
F037	6.42	16.00	21.00	18.00	16.25	16.00	15.82	16.00
F038	6.26	14.00	20.1	12.00	15.6	10.50	15.2	12.50
F046	6.1	9.00	19.7	7.00	15.1	6.00	14.6	7.00
F048	4.80 EL	1.00	20.55	16.00	15.65	12.00	15.0	8.50
F060	6.	5.00	20.	10.50	16.	14.00	15.	8.50
F069	6.1	9.00	20.4	14.00	16.4	17.00	15.2	12.50
F093	6.6	17.00	18.2	1.00	15.4	9.00	14.4	5.00
F094	6.	5.00	19.	4.00	15.	4.00	14.	3.50
F096	6.3	15.00	20.2	13.00	15.0	4.00	15.2	12.50
F133	6.18	13.00	20.5	15.00	16.9	18.00	16.1	18.00
MEDIAN OR *TARGET CONC.	6.1000		20.0000		15.6000		15.1000	
1CRIT	.9480		2.0600		1.7080		1.6680	
N	17		17		17		17	
MEAN	6.1600		19.9029		15.5529		14.9247	
3STDEV	.9252		1.9796		1.9763		2.4681	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	88.00	9.778	9					ICP-MS
F003	48.50	5.389	9	VL				ICP-OES
F009	74.50	9.313	8					
F010	145.00	18.125	8	EHEHEHEHEHEHEH	BIASED HIGH	17.12	.1241	GFA
F011	50.50	5.050	10					
F012	67.50	13.500	5					ICPMS
F015	38.00	4.750	8					GFAA
F025	35.00	4.375	8	L EL ELL	BIASED LOW	-9.15	-.2610	ICP-MS
F032	100.50	12.563	8					ICP AES Ult neb
F037	112.50	14.063	8					GFAA
F038	99.50	9.950	10					ICPMS
F046	66.50	7.389	9					ICPMS
F048	56.50	8.071	7	ELL ELEL				ICP
F060	61.50	7.688	8					ICP
F069	84.50	10.563	8					ICP-MS
F093	94.00	9.400	10	EHEHVH				ICP
F094	40.00	5.000	8					ICP-MS
F096	102.50	12.813	8	EH				GFAA
F133	104.00	11.556	9					ICP-MS

OVERALL AVERAGE RANK IS 9.297

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F025	35.00	4.375	8	LELELL	BIASED LOW	-9.15	-.2610	ICP-MS
F015	38.00	4.750	8					GFAA
F094	40.00	5.000	8					ICP-MS
F011	50.50	5.050	10					
F003	48.50	5.389	9	VL				ICP-OES
F046	66.50	7.389	9					ICPMS
F060	61.50	7.688	8					ICP
F048	56.50	8.071	7	ELLELEL				ICP
F009	74.50	9.313	8					
F093	94.00	9.400	10	EHEHVH				ICP
F001	88.00	9.778	9					ICP-MS
F038	99.50	9.950	10					ICPMS
F069	84.50	10.563	8					ICP-MS
F133	104.00	11.556	9					ICP-MS
F032	100.50	12.563	8					ICP AES Ult neb
F096	102.50	12.813	8	EH				GFAA
F012	67.50	13.500	5					ICPMS
F037	112.50	14.063	8					GFAA
F010	145.00	18.125	8	EHEHEHEHEHEHEH	BIASED HIGH	17.12	.1241	GFA

OVERALL AVERAGE
RANK IS 9.297

Silver

PARAMETER: 51095 Antimony ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .5000 BASIC ACCEPTABLE ERROR= .5000 CONCENTRATION ERROR INCREMENT= .0800

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.08	3.00	.98	2.00	.25	4.00	2.5	5.00	2.0	6.00	2.5	3.50
F003	.6 H	7.00	1.2	13.50	.5	8.00	2.7	10.50	2.2	13.50	2.7	12.50
F009	<.5	0.00	2.1 EH	15.00	<.5	0.00	5.2 EH	18.00	3.0 EH	17.00	5.2 EH	18.00
F011	.1	4.00	1.0	6.50	.3	7.00	2.7	10.50	2.1	10.00	2.7	12.50
F012	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00
F014	<1.0	0.00	1.0	6.50	<1.0	0.00	2.9	15.50	2.3	15.50	2.7	12.50
F015	<1.	0.00	1.	6.50	<1.	0.00	2.5	5.00	1.8	2.50	2.7	12.50
F025	.2	6.00	1.0	6.50	.2	1.50	2.4	3.00	2.0	6.00	3.6 H	16.00
F031	<3.	0.00	<3.	0.00	<3.	0.00	4. EH	17.00	4. EH	18.00	4. EH	17.00
F038	.11	5.00	1.02	10.00	.26	5.00	2.66	9.00	2.02	8.00	2.66	9.00
F046	<.2	0.00	.9	1.00	.2	1.50	2.5	5.00	1.8	2.50	2.6	7.00
F048	<1.	0.00	1.13	12.00	<1.	0.00	2.79	13.00	2.1	10.00	2.70	12.50
F060	<.5	0.00	1.0	6.50	<.5	0.00	2.6	7.50	1.9	4.00	2.5	3.50
F063	<1.	0.00	<1.	0.00	<1.	0.00	2. L	1.00	2.	6.00	2. L	1.00
F069	<1.	0.00	1.2	13.50	<1.	0.00	2.9	15.50	2.2	13.50	2.7	12.50
F089	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00
F093	<2.0	0.00	<2.0	0.00	<2.0	0.00	2.8	14.00	2.3	15.50	2.5	3.50
F094	<.4	0.00	1.0	6.50	<.4	0.00	2.6	7.50	2.1	10.00	2.5	3.50
F096	<15.	0.00	<15.	0.00	<15.	0.00	<15.	0.00	<15.	0.00	<15.	0.00
F133	.05	1.00	.99	3.00	.29	6.00	2.22	2.00	1.60	1.00	2.52	6.00
F138	.077	2.00	1.10	11.00	.222	3.00	2.71	12.00	2.15	12.00	2.62	8.00
MEDIAN	.1000		1.0000		.2550		2.6800		2.1000		2.6800	
1CRIT	.5000		.5400		.5000		.6744		.6280		.6744	
N	5		13		5		16		16		16	
MEAN	.1134		1.0477		.2644		2.7175		2.1231		2.7625	
3STDEV	-		.2327		-		1.1238		.8079		1.2204	

PARAMETER: 51095 Antimony ug/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	5.2	6.00	15.0	6.00	12.7	3.00	10.6	5.00
F003	5.5	8.50	15.6	9.00	13.5	9.00	11.3	11.00
F009	10.9 EH	20.00	24.1 EH	20.00	28.1 EH	20.00	23.2 EH	20.00
F011	5.8	15.00	16.8	15.00	13.6	11.00	11.5	12.00
F012	5.	3.00	15.	6.00	13.	4.50	11.	7.00
F014	7.2 VH	19.00	17.0	16.50	14.5	17.00	11.6	13.50
F015	5.7	10.50	15.	6.00	13.	4.50	12.	16.00
F025	6.3	17.00	15.2	8.00	14.3	16.00	11.0	7.00
F031	7. H	18.00	16.	12.50	15.	18.00	13. H	18.00
F038	5.72	12.50	16.0	12.50	14.1	13.50	11.2	10.00
F046	5.5	8.50	14.4	4.00	13.5	9.00	10.0	2.50
F048	5.78	14.00	17.25	19.00	14.12	15.00	11.93	15.00
F060	5.7	10.50	15.7	10.00	13.5	9.00	11.0	7.00
F063	5.	3.00	14. L	3.00	12. L	2.00	10.	2.50
F069	6.1	16.00	16.6	14.00	15.1 H	19.00	12.1	17.00
F089	5.	3.00	17.	16.50	14.	12.00	14. VH	19.00
F093	4.6 L	1.00	13.6 L	2.00	11.8 L	1.00	10.4	4.00
F094	5.4	7.00	15.9	11.00	13.4	7.00	11.1	9.00
F096	<15.	0.00	<15.	0.00	<15.	0.00	<15.	0.00
F133	5.03	5.00	12.75 VL	1.00	13.21	6.00	9.41 L	1.00
F138	5.72	12.50	17.1	18.00	14.1	13.50	11.6	13.50
MEDIAN	5.7000		15.8000		13.5500		11.2500	
1CRIT	.9160		1.7240		1.5440		1.3600	
N	18		18		18		18	
MEAN	5.7028		15.7306		13.7017		11.4072	
3STDEV	1.8461		3.2160		2.2985		2.8914	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	43.50	4.350	10		BIASED LOW	-5.61	-.0213	ICP-MS
F003	102.50	10.250	10	H				Hydride/ICP-OES
F009	148.00	18.500	8	EH EHEHEHEHEHEHEH	BIASED HIGH	78.77	.4880	
F011	103.50	10.350	10					
F012	20.50	5.125	4		INSUFFICIENT DATA			ICPMS
F014	116.00	14.500	8	VH	BIASED HIGH	6.32	.1225	ICP MS
F015	63.50	7.938	8					GFAA/ICP
F025	87.00	8.700	10	H				AA
F031	118.50	16.929	7	EHEHEHH H	BIASED HIGH	-5.04	1.7072	ICP,no dig.
F038	94.50	9.450	10					ICPMS
F046	41.00	4.556	9		BIASED LOW	-6.29	-.0173	ICPMS
F048	110.50	13.813	8					ICP
F060	58.00	7.250	8					AA
F063	18.50	2.643	7	L L L L	BIASED LOW	-9.81	-.2127	Hydride AA
F069	121.00	15.125	8	H	BIASED HIGH	7.67	-.0076	ICP-MS
F089	50.50	12.625	4	VH	INSUFFICIENT DATA			
F093	41.00	5.857	7	L L L				ICP-hydride
F094	61.50	7.688	8					ICP-MS
F096	0.00	-	0		INSUFFICIENT DATA			ICP
F133	32.00	3.200	10	VL L	BIASED LOW	-13.36	.0319	ICP-MS
F138	105.50	10.550	10					ICP-MS

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F096	0.00	-	0		INSUFFICIENT DATA			ICP
F063	18.50	2.643	7	LLLL	BIASED LOW	-9.81	-.2127	Hydride AA
F133	32.00	3.200	10	VLL	BIASED LOW	-13.36	.0319	ICP-MS
F001	43.50	4.350	10		BIASED LOW	-5.61	-.0213	ICP-MS
F046	41.00	4.556	9		BIASED LOW	-6.29	-.0173	ICPMS
F012	20.50	5.125	4		INSUFFICIENT DATA			ICPMS
F093	41.00	5.857	7	LLL				ICP-hydride
F060	58.00	7.250	8					AA
F094	61.50	7.688	8					ICP-MS
F015	63.50	7.938	8					GFAA/ICP
F025	87.00	8.700	10	H				AA
F038	94.50	9.450	10					ICPMS
F003	102.50	10.250	10	H				Hydride/ICP-OES
F011	103.50	10.350	10					
F138	105.50	10.550	10					ICP-MS
F089	50.50	12.625	4	VH	INSUFFICIENT DATA			
F048	110.50	13.813	8					ICP
F014	116.00	14.500	8	VH	BIASED HIGH	6.32	.1225	ICP MS
F069	121.00	15.125	8	H	BIASED HIGH	7.67	-.0076	ICP-MS
F031	118.50	16.929	7	EHEHEHHH	BIASED HIGH	-5.04	1.7072	ICP,no dig.
F009	148.00	18.500	8	EHEHEHEHEHEHEHEH	BIASED HIGH	78.77	.4880	

OVERALL AVERAGE
RANK IS 9.372

Antimony

PARAMETER: 81095 Thallium ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .7500 BASIC ACCEPTABLE ERROR= .7500 CONCENTRATION ERROR INCREMENT= .0800

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	.094	2.00	1.55	7.00	.294	6.00	3.89	8.00	5.19	9.00	2.85	9.00
F012	<5.	0.00	<5.	0.00	<5.	0.00	5. H	12.00	5.	6.50	<5.	0.00
F014	<1.0	0.00	1.5	5.50	<1.0	0.00	4.2	10.00	5.6	11.00	3.0	11.00
F025	<1.	0.00	2. EH	10.00	<1.	0.00	5. H	12.00	8. EH	14.00	1. EL	1.00
F038	<.05	0.00	1.49	4.00	.20	3.00	3.73	7.00	5.00	6.50	2.76	8.00
F046	<.05	0.00	1.5	5.50	.21	4.00	3.6	4.00	4.7	2.00	2.7	6.50
F048	<1.	0.00	1.20	2.00	<1.	0.00	3.58	3.00	4.75	3.00	2.49	4.00
F060	<4.	0.00	<4.	0.00	<4.	0.00	5. H	12.00	6.	12.00	<4.	0.00
F069	<1.	0.00	1.7	9.00	<1.	0.00	3.7	6.00	5.1	8.00	2.7	6.50
F093	<3.0	0.00	<3.0	0.00	3.6 EH	7.00	6.0 EH	14.00	6.4 H	13.00	5.4 EH	12.00
F094	<.05	0.00	1.46	3.00	.18	2.00	3.65	5.00	4.85	4.00	2.57	5.00
F096	<2.	0.00	<2.	0.00	<2.	0.00	3.5	2.00	4.9	5.00	2.3	2.00
F133	<.05	0.00	1.16	1.00	.16	1.00	3.06	1.00	4.22	1.00	2.36	3.00
F138	.045	1.00	1.65	8.00	.215	5.00	4.08	9.00	5.41	10.00	2.94	10.00
MEDIAN OR *TARGET												
CONC.	*.0450		1.5000		.2100		3.8100		5.0500		2.7000	
1CRIT	.7500		.8100		.7500		.9948		1.0940		.9060	
N	2		8		5		12		12		10	
MEAN	.0695		1.5062		.2198		4.0775		5.2417		2.6670	
3STDEV	-		.4194		-		1.7011		1.5046		.6704	

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	5.41	11.00	17.8	9.00	13.7	10.00	8.94	8.00
F012	5.	6.00	17.	6.00	13.	6.00	9.	9.50
F014	5.4	10.00	18.1	10.00	13.5	9.00	9.0	9.50
F025	5.	6.00	22. EH	14.00	18. EH	14.00	12. VH	14.00
F038	5.21	9.00	17.4	7.00	13.1	7.50	8.59	6.00
F046	4.9	3.00	14.5 L	1.00	11.2 L	2.00	7.4	2.00
F048	4.9	3.00	17.6	8.00	13.1	7.50	8.6	7.00
F060	6.	13.00	19.	11.50	15. H	12.00	11. VH	12.00
F069	4.9	3.00	16.0	4.00	10.2 VL	1.00	5.6 VL	1.00
F093	8.2 EH	14.00	20.4 H	13.00	16.0 VH	13.00	11.8 VH	13.00
F094	5.04	8.00	16.9	5.00	12.7	5.00	8.49	5.00
F096	5.	6.00	15.5	3.00	12.0	4.00	8.	4.00
F133	4.51	1.00	15.2 L	2.00	11.4	3.00	7.94	3.00
F138	5.72	12.00	19.0	11.50	14.3	11.00	9.2	11.00
MEDIAN OR *TARGET								
CONC.	5.0200		17.5000		13.1000		8.7700	
1CRIT	1.0916		2.0900		1.7380		1.3916	
N	12		12		12		12	
MEAN	5.2067		17.4917		13.2500		8.9967	
3STDEV	1.0282		4.3757		4.0240		3.5870	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	79.00	7.900	10					ICP-MS
F012	46.00	7.667	6	H				ICPMS
F014	76.00	9.500	8					ICP MS
F025	85.00	10.625	8	EH H EHEL EHEHVH	BIASED HIGH	34.61	-.5416	ICP-MS
F038	58.00	6.444	9					ICPMS
F046	30.00	3.333	9	L L	BIASED LOW	-18.47	.4110	ICPMS
F048	37.50	4.688	8					ICP
F060	72.50	12.083	6	H H VH	BIASED HIGH*	4.95	1.0193	ICP
F069	38.50	4.813	8	VLVL				GFAA
F093	99.00	12.375	8	EHEHH EHEHH VHVH	BIASED HIGH*	1.08	2.6289	ICP
F094	42.00	4.667	9					ICP-MS
F096	26.00	3.714	7					GFAA
F133	16.00	1.778	9	L	BIASED LOW	-12.24	-.0660	ICP-MS
F138	88.50	8.850	10					ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 10.00

OVERALL AVERAGE
RANK IS 6.904

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F133	16.00	1.778	9	L	BIASED LOW	-12.24	-.0660	ICP-MS
F046	30.00	3.333	9	LL	BIASED LOW	-18.47	.4110	ICPMS
F096	26.00	3.714	7					GFAA
F094	42.00	4.667	9					ICP-MS
F048	37.50	4.688	8					ICP
F069	38.50	4.813	8	VLVL				GFAA
F038	58.00	6.444	9					ICPMS
F012	46.00	7.667	6	H				ICPMS
F003	79.00	7.900	10					ICP-MS
F138	88.50	8.850	10					ICP-MS
F014	76.00	9.500	8					ICP MS
F025	85.00	10.625	8	EHHEHELEHEHVH	BIASED HIGH	34.61	-.5416	ICP-MS
F060	72.50	12.083	6	HHVH	BIASED HIGH*	4.95	1.0193	ICP
F093	99.00	12.375	8	EHEHHEHEHHVHVH	BIASED HIGH*	1.08	2.6289	ICP

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 10.00

OVERALL AVERAGE
RANK IS 6.904

PARAMETER: 83095 Bismuth ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .5000 BASIC ACCEPTABLE ERROR= .5000 CONCENTRATION ERROR INCREMENT= .0800

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	<.005	0.00	.99	3.00	.12	1.00	4.2	4.00	4.1	4.00	1.8	2.00
F011	<.1	0.00	1.1	4.00	.2	3.00	4.4	5.00	4.2	5.00	2.0	3.00
F025	3.32 EH	1.00	1.65 H	6.00	4.64 EH	5.00	1.14 EL	1.00	4.28	6.00	3.02 VH	5.00
F038	<.5	0.00	.5 L	1.00	<.5	0.00	2.4 EL	2.00	2.3 EL	1.00	1.7	1.00
F060	<7.	0.00	<7.	0.00	<7.	0.00	<7.	0.00	<7.	0.00	<7.	0.00
F089	<2.	0.00	<2.	0.00	<2.	0.00	5. H	7.00	4.	3.00	<2.	0.00
F093	<2.0	0.00	<2.0	0.00	<2.0	0.00	<2.0 EL	0.00	<2.0 EL	0.00	<2.0	0.00
F094	<.05	0.00	1.11	5.00	.13	2.00	4.45	6.00	4.50	7.00	2.05	4.00
F096	<20.	0.00	<20.	0.00	<20.	0.00	<20.	0.00	<20.	0.00	<20.	0.00
F133	<.05	0.00	.85	2.00	.66	4.00	3.00 VL	3.00	3.78	2.00	3.23 VH	6.00
MEDIAN OR *TARGET												
CONC.	*.0500		1.0450		.2000		4.2000		4.1000		2.0250	
1CRIT	.5000		.5436		.5000		.7960		.7880		.6220	
N	1		4		3		5		5		4	
MEAN	3.3200		1.0125		.3300		3.6900		4.0720		2.2175	
3STDEV	-		-		-		-		-		-	

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	4.2	3.00	13.4	5.00	10.8	4.00	10.5	5.00
F011	4.4	4.00	13.5	6.00	11.2	5.00	10.8	6.00
F025	4.81	6.00	14.04	8.00	13.05 H	8.00	13.50 VH	9.00
F038	3.4 L	1.00	9.6 VL	2.00	6.8 VL	2.00	7.9 VL	2.00
F060	<7.	0.00	<7. EL	0.00	<7. VL	0.00	8. VL	3.00
F089	5.	7.00	14.	7.00	12.	7.00	10.	4.00
F093	<2.0 EL	0.00	8.2 VL	1.00	6.7 VL	1.00	5.9 VL	1.00
F094	4.65	5.00	13.0	4.00	11.6	6.00	11.2	7.00
F096	<20.	0.00	<20.	0.00	21. EH	9.00	<20.	0.00
F133	4.04	2.00	10.61 VL	3.00	10.11	3.00	11.80 H	8.00
MEDIAN OR *TARGET								
CONC.	4.4000		13.2000		11.2000		10.5000	
1CRIT	.8120		1.5160		1.3560		1.3000	
N	5		6		7		7	
MEAN	4.4200		12.3517		10.7943		10.0286	
3STDEV	-		4.9234		5.5292		4.2387	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	31.00	3.444	9					ICP-MS
F011	41.00	4.556	9					
F025	55.00	5.500	10	EHH EHEL VH H VH				ICP-MS
F038	12.00	1.500	8	L ELEL L VLVLVL				ICPMS
F060	3.00	3.000	1	ELVLVL				ICP
F089	35.00	5.833	6	H				
F093	3.00	1.000	3	ELEL ELVLVLVL				ICP-hydride
F094	46.00	5.111	9					ICP-MS
F096	9.00	9.000	1	EH				ICP
F133	33.00	3.667	9	VL VH VL H				ICP-MS

NOTE: BIAS WAS NOT ASSESSED BECAUSE STATISTICS FOR FEWER THAN 10 LABS WERE AVAILABLE

OVERALL AVERAGE
RANK IS 4.123

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F093	3.00	1.000	3	ELELELVLVLVL				ICP-hydride
F038	12.00	1.500	8	LELELLVLVLVL				ICPMS
F060	3.00	3.000	1	ELVLVL				ICP
F001	31.00	3.444	9					ICP-MS
F133	33.00	3.667	9	VLVHVLH				ICP-MS
F011	41.00	4.556	9					
F094	46.00	5.111	9					ICP-MS
F025	55.00	5.500	10	EHHEHELVHHVH				ICP-MS
F089	35.00	5.833	6	H				
F096	9.00	9.000	1	EH				ICP

NOTE: BIAS WAS NOT ASSESSED BECAUSE STATISTICS FOR FEWER THAN 10 LABS WERE AVAILABLE

OVERALL AVERAGE
RANK IS 4.123

Bismuth

PARAMETER: 92095 Uranium ug/L

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BURLINGTON ONTARIO

NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .5000 BASIC ACCEPTABLE ERROR= .5000 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.04	2.50	1.7	6.00	.46	4.00	5.6	10.00	7.6	8.00	6.3	8.00
F003	.036	1.00	1.75	8.00	.474	6.00	5.61	11.00	7.66	10.00	6.48	10.00
F009	<.5	0.00	2.1 EH	12.00	.56	9.00	6.8 EH	13.00	9.3 EH	14.00	7.7 EH	13.00
F010	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	7.	3.00	6.	3.00
F011	<.1	0.00	1.6	4.00	.4	2.00	5.5	8.00	7.4	5.00	6.2	5.00
F014	<.1	0.00	1.8	10.50	.5	7.50	6.3 H	12.00	8.9 H	13.00	6.9	12.00
F024	.4	4.00	1.8	10.50	.7 EH	10.00	5.2	3.50	7.6	8.00	5.9	2.00
F025	<.4	0.00	<.4 EL	0.00	<.4	0.00	2.0 EL	1.00	6.9	2.00	<.4 EL	0.00
F038	.04	2.50	1.78	9.00	.47	5.00	5.55	9.00	7.85	12.00	6.52	11.00
F046	<.1	0.00	1.6	4.00	.5	7.50	5.2	3.50	7.2	4.00	6.2	5.00
F048	<1.	0.00	1.34 EL	1.00	<1.	0.00	5.36	6.00	7.7	11.00	6.38	9.00
F060	<50.	0.00	<50.	0.00	<50.	0.00	<50.	0.00	<50.	0.00	<50.	0.00
F069	<1.	0.00	1.6	4.00	<1.	0.00	5.3	5.00	7.5	6.00	6.2	5.00
F094	<.05	0.00	1.71	7.00	.45	3.00	5.47	7.00	7.60	8.00	6.24	7.00
F133	<.05	0.00	1.46	2.00	.35	1.00	4.67 L	2.00	6.60 L	1.00	5.49 EL	1.00
MEDIAN	.0400		1.7050		.4720		5.4700		7.6000		6.2400	
1CRIT	.5000		.5723		.5000		.7982		.9260		.8444	
N	2		10		8		11		12		11	
MEAN	.0400		1.6800		.4767		5.4327		7.5758		6.3018	
3STDEV	-		.3183		.1297		1.1240		1.4541		.7732	

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	10.7	8.50	23.5	9.00	26.8	10.00	63.5	9.00
F003	10.9	10.00	23.8	11.00	27.5	11.00	64.3	10.00
F009	13.0 VH	14.00	28.5 VH	14.00	32.4 VH	14.00	78. VH	15.00
F010	6. EL	2.00	12. VL	1.00	12. VL	2.00	34. EL	1.00
F011	10.6	7.00	22.8	7.50	26.4	8.00	61.8	5.00
F014	11.2	13.00	24.9 H	13.00	28.3	12.50	66.7	12.00
F024	10.1	4.00	22.	5.00	26.	6.00	65.	11.00
F025	3.5 EL	1.00	12.1 VL	2.00	15.9 VL	3.00	52.3 VL	2.00
F038	11.0	11.00	23.7	10.00	2.79 EL	1.00	62.5	7.00
F046	10.2	5.00	19.4 VL	3.00	22.8 VL	4.00	53.5 VL	3.00
F048	11.1	12.00	24.0	12.00	28.3	12.50	68.4 H	13.00
F060	<50.	0.00	<50.	0.00	<50.	0.00	70. VH	14.00
F069	10.4	6.00	22.8	7.50	26.2	7.00	61.9	6.00
F094	10.7	8.50	22.3	6.00	26.7	9.00	62.9	8.00
F133	9.28 L	3.00	20.1 L	4.00	23.0 VL	5.00	54.0 VL	4.00
MEDIAN	10.6500		22.8000		26.3000		62.9000	
1CRIT	1.1090		1.8380		2.0480		4.2440	
N	12		12		12		13	
MEAN	10.1817		21.7833		24.1583		62.0615	
3STDEV	4.0742		9.8733		14.7659		16.1124	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	75.00	7.500	10					ICP-MS
F003	88.00	8.800	10					ICP-MS
F009	118.00	13.111	9	EH EHEHEHVHVHVHVH	BIASED HIGH	24.08	-.0539	
F010	12.00	2.000	6	ELVLVLEL	BIASED LOW	-50.26	1.5177	ICP
F011	51.50	5.722	9					
F014	105.50	11.722	9	H H H	BIASED HIGH	5.87	.3227	ICP MS
F024	64.00	6.400	10	EH				Colour
F025	11.00	1.833	6	EL EL ELELVLVLVL	BIASED LOW	-13.55	-4.1047	ICP-MS
F038	77.50	7.750	10	EL				ICPMS
F046	39.00	4.333	9	VLVLVL				ICPMS
F048	76.50	9.563	8	EL H				ICP
F060	14.00	14.000	1	VH	INSUFFICIENT DATA			ICP
F069	46.50	5.813	8					ICP-MS
F094	63.50	7.056	9					ICP-MS
F133	23.00	2.556	9	L L ELL L VLVL	BIASED LOW	-13.94	.1010	ICP-MS

OVERALL AVERAGE
RANK IS 7.033

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F025	11.00	1.833	6	ELELELELVLVLVL	BIASED LOW	-13.55	-4.1047	ICP-MS
F010	12.00	2.000	6	ELVLVLEL	BIASED LOW	-50.26	1.5177	ICP
F133	23.00	2.556	9	LLELLLVLVL	BIASED LOW	-13.94	.1010	ICP-MS
F046	39.00	4.333	9	VLVLVL				ICPMS
F011	51.50	5.722	9					
F069	46.50	5.813	8					ICP-MS
F024	64.00	6.400	10	EH				Colour
F094	63.50	7.056	9					ICP-MS
F001	75.00	7.500	10					ICP-MS
F038	77.50	7.750	10	EL				ICPMS
F003	88.00	8.800	10					ICP-MS
F048	76.50	9.563	8	ELH				ICP
F014	105.50	11.722	9	HHH	BIASED HIGH	5.87	.3227	ICP MS
F009	118.00	13.111	9	EHEHEHEHVHVHVHVH	BIASED HIGH	24.08	-.0539	
F060	14.00	14.000	1	VH	INSUFFICIENT DATA			ICP

OVERALL AVERAGE
RANK IS 7.033

PARAMETER: 93095 Lithium ug/L

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NWRI Interlab QA for Trace Metals

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .5000 BASIC ACCEPTABLE ERROR= .5000 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	.46	4.00	2.0	3.00	.51	2.00	3.5	4.00	6.8	4.50	3.2	4.00
F011	.3	1.00	2.0	3.00	.5	1.00	3.4	3.00	6.4	3.00	2.8	2.00
F012	39. EH	5.00	16. EH	8.00	12. EH	5.00	34. EH	10.00	21. EH	11.00	16. EH	9.00
F019	<1.	0.00	3. H	7.00	<1.	0.00	10. VH	9.00	14. VH	9.00	8. VH	8.00
F025	<1.	0.00	<1. EL	0.00	<1.	0.00	2. VL	1.00	6. L	2.00	2. VL	1.00
F038	<1.	0.00	2.	3.00	<1.	0.00	4.	8.00	7.	6.00	3.	3.00
F048	<1.	0.00	2.42	6.00	<1.	0.00	3.92	7.00	7.32	8.00	3.44	6.50
F060	.42	3.00	1.98	1.00	.62	4.00	3.63	5.00	6.80	4.50	3.44	6.50
F068		0.00		0.00		0.00		0.00	5.50 VL	1.00		0.00
F094	<3.	0.00	<3.	0.00	<3.	0.00	3.	2.00	16. VH	10.00	<3.	0.00
F138	.376	2.00	2.26	5.00	.566	3.00	3.74	6.00	7.16	7.00	3.25	5.00
MEDIAN	.4200		2.1300		.5660		3.6850		7.0000		3.2500	
1CRIT	.5000		.5978		.5040		.6911		.8900		.6650	
N	3		6		3		8		9		7	
MEAN	.4187		2.2800		.5653		4.3987		8.6089		3.8757	
3STDEV	-		1.0772		-		6.4123		10.4053		5.0914	

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	4.1	5.00	12.4	7.00	9.4	6.00	8.7	5.00
F011	3.7	3.00	11.5	4.00	8.9	4.00	8.0	3.50
F012	<5.	0.00	9. VL	1.00	8. L	2.50	20. EH	11.00
F019	11. EH	9.00	14. VH	11.00	14. EH	11.00	14. VH	10.00
F025	3. EL	1.50	10. VL	2.00	8. L	2.50	7. VL	2.00
F038	4.	4.00	12.	5.50	10.	8.50	9.	6.00
F048	4.50	8.00	13.0	9.00	10.0	8.50	9.5	9.00
F060	4.46	7.00	12.6	8.00	9.50	7.00	9.15	8.00
F068		0.00	10.07 VL	3.00	7.83 VL	1.00	6.90 VL	1.00
F094	3. EL	1.50	12.	5.50	9.	5.00	8.	3.50
F138	4.36	6.00	13.2 H	10.00	10.1	10.00	9.13	7.00
MEDIAN	4.1000		12.0000		9.4000		9.0000	
1CRIT	.7160		1.1900		1.0340		1.0100	
N	6		9		9		9	
MEAN	4.1867		11.8633		9.2111		9.1644	
3STDEV	.8504		3.2813		2.2867		5.5800	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	44.50	4.450	10					ICP-MS
F011	27.50	2.750	10		BIASED LOW	-5.28	-.1327	
F012	62.50	6.944	9	EHEHEHEHEHEH VLL EH				ICPMS
F019	74.00	9.250	8	H VHVHVHEHVHEHVH	BIASED HIGH	-7.39	5.1465	ICAP
F025	12.00	1.714	7	EL VLL VLELVLL VL	BIASED LOW	-6.95	-1.0097	ICP-AES
F038	44.00	5.500	8					ICPMS
F048	62.00	7.750	8					ICP
F060	54.00	5.400	10					ICP
F068	6.00	1.500	4	VL VLVLVL	INSUFFICIENT DATA			IC Dionex
F094	27.50	4.583	6	VH EL				ICP-MS
F138	61.00	6.100	10	H				ICP-MS

OVERALL AVERAGE
RANK IS 5.278

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F068	6.00	1.500	4	VLVLVLVL	INSUFFICIENT DATA			IC Dionex
F025	12.00	1.714	7	ELVLLVLELVLLVL	BIASED LOW	-6.95	-1.0097	ICP-AES
F011	27.50	2.750	10		BIASED LOW	-5.28	-.1327	
F001	44.50	4.450	10					ICP-MS
F094	27.50	4.583	6	VHEL				ICP-MS
F060	54.00	5.400	10					ICP
F038	44.00	5.500	8					ICPMS
F138	61.00	6.100	10	H				ICP-MS
F012	62.50	6.944	9	EHEHEHEHEHEHVLLEH				ICPMS
F048	62.00	7.750	8					ICP
F019	74.00	9.250	8	HVHVHVHEHVHEHVH	BIASED HIGH	-7.39	5.1465	ICAP

OVERALL AVERAGE
RANK IS 5.278

Lithium

PARAMETER: 94095 Berylium ug/L

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LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= .5000 BASIC ACCEPTABLE ERROR= .5000 CONCENTRATION ERROR INCREMENT= .0600

SAMPLE	1 = FS-WAWA		2 = TM-24.2D		3 = WAWA-SP		4 = TM-23.2		5 = TM-26.2		6 = WAWA-SP2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	<.04	0.00	.80	7.50	.10	1.50	1.6	11.00	3.3	10.50	1.9	3.50
F003	<.05	0.00	.79	4.00	.13	3.50	1.49	6.00	3.24	9.00	2.0	9.00
F009	<.5	0.00	.8	7.50	<.5	0.00	1.55	9.00	3.4	13.00	2.0	9.00
F010	<1.	0.00	<1.	0.00	<1.	0.00	2.	17.00	3.	4.50	2.	9.00
F011	<.1	0.00	.8	7.50	.1	1.50	1.5	7.00	3.1	7.50	1.9	3.50
F012	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00
F015	<1.	0.00	<1.	0.00	<1.	0.00	1. EL	1.50	3.	4.50	2.	9.00
F019	<1.	0.00	<1.	0.00	<1.	0.00	1. EL	1.50	3.	4.50	2.	9.00
F025	<.2	0.00	<.2 EL	0.00	<.2	0.00	8.1 EH	19.00	2.1 EL	1.00	<.2 EL	0.00
F032		0.00	.78	3.00	.13	3.50	1.53	8.00	3.3	10.50	1.92	5.00
F038	<.5	0.00	.8	7.50	<.5	0.00	1.7	15.00	3.5	16.00	2.1	14.00
F046	<.2	0.00	.8	7.50	<.2	0.00	1.6	11.00	3.4	13.00	2.0	9.00
F048	<1.	0.00	1.23 EH	13.00	<1.	0.00	2.01	18.00	3.86	19.00	2.48 EH	18.00
F060	<.5	0.00	.7	1.50	<.5	0.00	1.4	4.00	3.1	7.50	1.7	2.00
F069	<.5	0.00	.97	12.00	<.5	0.00	1.6	11.00	3.5	16.00	2.1	14.00
F089	<.1	0.00	.7	1.50	.2	6.00	1.4	4.00	3.0	4.50	2.0	9.00
F094	<.5	0.00	.8	7.50	<.5	0.00	1.7	15.00	3.4	13.00	2.1	14.00
F096	<1.	0.00	<1.	0.00	<1.	0.00	1.7	15.00	3.5	16.00	2.2	17.00
F133	<.50	0.00	<.50 EL	0.00	<.50	0.00	1.40	4.00	2.55 L	2.00	1.45 EL	1.00
F138	.021	1.00	.855	11.00	.139	5.00	1.65	13.00	3.57	18.00	2.14	16.00
MEDIAN OR *TARGET CONC.	*.0200		.8000		.1300		1.6000		3.3000		2.0000	
1CRIT	.5000		.5180		.5000		.5660		.6680		.5900	
N	1		10		3		16		17		16	
MEAN	.0210		.8195		.1330		1.6144		3.2271		2.0037	
3STDEV	-		.1605		-		.5339		.7764		.3402	

PARAMETER: 94095 Berylium ug/L

SAMPLE	7 = WAWA-SP3		8 = TMDA-52.2		9 = TMDA-53.2D		10 = TMDA-54.2	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F001	3.5	2.50	16.8	9.00	9.5	12.50	7.3	12.00
F003	3.9	9.00	17.1	13.00	9.8	14.50	7.5	14.00
F009	3.7	7.50	16.	5.50	9.1	9.00	7.0	7.00
F010	4.	12.50	16.	5.50	9.	6.50	7.	7.00
F011	3.6	4.50	15.8	4.00	8.9	3.50	6.7	4.50
F012	<5.	0.00	19. H	20.00	10.	17.00	8.	18.50
F015	4.	12.50	17.	12.00	9.	6.50	7.	7.00
F019	4.	12.50	15. L	2.00	9.	6.50	8.	18.50
F025	<.2 EL	0.00	17.3	14.00	9.0	6.50	3.2 EL	1.00
F032	3.63	6.00	16.2	7.00	9.24	10.00	7.04	9.00
F038	4.0	12.50	17.6	16.00	10.0	17.00	7.4	13.00
F046	3.7	7.50	16.9	10.50	9.3	11.00	7.1	10.00
F048	4.35	18.00	17.9	18.00	10.05	19.00	8.8 VH	20.00
F060	3.5	2.50	16.3	8.00	8.9	3.50	6.7	4.50
F069	4.0	12.50	17.5	15.00	9.8	14.50	7.6	15.00
F089	3.6	4.50	15.6	3.00	8.8	2.00	6.0 L	2.50
F094	4.0	12.50	16.9	10.50	9.5	12.50	7.2	11.00
F096	4.1	16.00	17.7	17.00	10.0	17.00	7.7	17.00
F133	3.25	1.00	14.7 L	1.00	8.30	1.00	6.00 L	2.50
F138	4.18	17.00	18.4 H	19.00	10.3 H	20.00	7.69	16.00
MEDIAN OR *TARGET CONC.	3.9500		16.9000		9.2700		7.1500	
1CRIT	.7070		1.4840		1.0262		.8990	
N	16		18		18		18	
MEAN	3.8381		16.7778		9.3828		7.1628	
3STDEV	.6581		2.6145		1.3158		1.6704	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F001	70.00	7.778	9					ICP-MS
F003	82.00	9.111	9					ICP-OES
F009	67.50	8.438	8					
F010	62.00	8.857	7					ICP
F011	43.50	4.833	9		BIASED LOW	-6.13	.0070	
F012	55.50	18.500	3	H	INSUFFICIENT DATA			ICPMS
F015	53.00	7.571	7	EL				ICP
F019	54.50	7.786	7	EL L				ICAP
F025	41.50	8.300	5	EL EHELELEL EL				ICP-MS
F032	62.00	6.889	9					ICP AES Ult neb
F038	111.00	13.875	8					ICPMS
F046	79.50	9.938	8					ICPMS
F048	143.00	17.875	8	EH EH VH	BIASED HIGH*	4.53	.4592	ICP
F060	33.50	4.188	8		BIASED LOW*	-2.56	-.1897	ICP
F069	110.00	13.750	8					ICP
F089	37.00	4.111	9	L	BIASED LOW	-7.93	-.0248	
F094	96.00	12.000	8					ICP-MS
F096	115.00	16.429	7		BIASED HIGH*	4.97	.0761	ICP
F133	12.50	1.786	7	EL L EL L L	BIASED LOW	-11.25	-.2215	ICP-MS
F138	136.00	13.600	10	H H				ICP-MS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F133	12.50	1.786	7	ELLELLL	BIASED LOW	-11.25	-.2215	ICP-MS
F089	37.00	4.111	9	L	BIASED LOW	-7.93	-.0248	
F060	33.50	4.188	8		BIASED LOW*	-2.56	-.1897	ICP
F011	43.50	4.833	9		BIASED LOW	-6.13	.0070	
F032	62.00	6.889	9					ICP AES Ult neb
F015	53.00	7.571	7	EL				ICP
F001	70.00	7.778	9					ICP-MS
F019	54.50	7.786	7	ELL				ICAP
F025	41.50	8.300	5	ELEHELELELEL				ICP-MS
F009	67.50	8.438	8					
F010	62.00	8.857	7					ICP
F003	82.00	9.111	9					ICP-OES
F046	79.50	9.938	8					ICPMS
F094	96.00	12.000	8					ICP-MS
F138	136.00	13.600	10	HH				ICP-MS
F069	110.00	13.750	8					ICP
F038	111.00	13.875	8					ICPMS
F096	115.00	16.429	7		BIASED HIGH*	4.97	.0761	ICP
F048	143.00	17.875	8	EHEHVH	BIASED HIGH*	4.53	.4592	ICP
F012	55.50	18.500	3	H	INSUFFICIENT DATA			ICPMS

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 5.00

OVERALL AVERAGE
RANK IS 9.513

Berylium

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