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Ecosystem Interlaboratory QA Program Study FP 72 - Trace Metals/Elements in Surface Waters (March & April 1998)

H. Alkema and L. Hjelm

National Laboratory for Environmental Testing
National Water Research Institute
867 Lakeshore Rd, Burlington, ON
Canada L7R 4A6

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no.
98-03

Environment Canada Environnement Canada

National Water Research Institute
867 Lakeshore Road
Burlington, Ontario
L7R 4A6

June 19, 1998

To: Participants of the NWRI Ecosystem Interlaboratory QA Program

Re: Final Report for NWRI Study FP 72 - Trace Metals/Elements 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/Elements. 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.

Harry Alkema
QA Services
NLET/PI&QM/ESRM

Lisa Hjelm
Interlaboratory Study Logistics
NLET/PI&QM/ESRM

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Attachment: Individual Laboratory Appraisal

Canada

National Water Research Institute
National Laboratory for Environmental Testing

Report no. NWRI-QA-98-03

Ecosystem Interlaboratory Quality Assurance Propram
Study FP 72 - Final Report

March and April 1998

An Interlaboratory Quality Assurance Study for Trace Metals/Elements 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 1998

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

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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Appendix B

Data & Evaluation Summary

PARAMETER: 13095 Aluminum ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 5.0000 BASIC ACCEPTABLE ERROR= 5.0000 CONCENTRATION ERROR INCREMENT= 0.1000

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	22.0	23.00	52.0	21.50	<10.0	0.00	16.0	20.00	59.0	26.00	18.0	12.00
F003	21.	17.50	50.	13.50	2.	6.50	15.	16.50	55.	12.50	20.	18.50
F008	21.	17.50	49.	9.50	<10.	0.00	14.	13.00	54.	9.00	16.	4.50
F009	21.	17.50	54.	26.50	<5.	0.00	14.	13.00	58.	23.00	18.	12.00
F010	30. H	29.00	58.	31.00	6.	11.00	20.	22.00	66.	32.00	25. H	24.00
F011	19.4	8.50	58.1	32.00	1.2	1.50	10.9	3.00	57.8	22.00	18.4	15.00
F012	20.	11.50	49.	9.50	2.	6.50	14.	13.00	55.	12.50	20.	18.50
F014	20.9	15.00	51.4	18.00	1.4	3.00	13.0	7.50	56.8	19.00	17.0	8.50
F015	25.	28.00	56.	29.00	<2.	0.00	20.	22.00	63.	29.50	23.	23.00
F019	20.	11.50	47.	7.00	<20.	0.00	<20.	0.00	50.	7.00	<20.	0.00
F022	<10. EL	0.00	46.	5.50	<10.	0.00	<10.	0.00	50.	7.00	<10. L	0.00
F024	14. L	1.00	50.	13.50	<5.	0.00	12.	4.00	65.	31.00	20.	18.50
F025	<100.	0.00	<100.	0.00	<100.	0.00	<100.	0.00	<100.	0.00	<100.	0.00
F026	23.59	25.00	53.19	24.00	2.93	8.00	15.35	19.00	56.22	18.00	20.75	22.00
F031	20.	11.50	50.	13.50	<20.	0.00	<20.	0.00	50.	7.00	<20.	0.00
F032	21.0	17.50	53.1	23.00	<3.	0.00	15.2	18.00	60.1	28.00	18.5	16.00
F032b	20.8	14.00	53.2	25.00	<10.	0.00	14.2	15.00	58.4	25.00	17.9	10.00
F036	16.0	3.50	52.0	21.50	<2.0	0.00	20.0	22.00	60.0	27.00	26.0 H	25.50
F037	14.09 L	2.00	38.84 L	2.00	<1.0	0.00	8.601	1.00	43.76 L	3.00	11.45 L	1.00
F038	20.	11.50	50.	13.50	<5.	0.00	13.	7.50	57.	20.00	18.	12.00
F046	19.4	8.50	50.3	16.00	1.5	4.00	13.5	11.00	57.1	21.00	16.7	7.00
F048	21.1	20.00	51.5	19.00	1.20	1.50	13.4	10.00	58.2	24.00	17.0	8.50
F060	35. EH	31.00	68. EH	34.00	13. EH	13.00	31. VH	27.00	78. EH	33.00	33. EH	27.00
F063	<10. EL	0.00	30. EL	1.00	<10.	0.00	<10.	0.00	30. EL	1.00	<10. L	0.00
F064	31. VH	30.00	57.	30.00	<20.	0.00	28. VH	26.00	63.	29.50	26. H	25.50
F069	19.3	7.00	49.8	11.00	1.54	5.00	12.9	5.00	54.7	10.00	16.3	6.00
F080	24.6	27.00	63.5 H	33.00	10.7 VH	12.00	35.7 EH	28.00	80.6 EH	34.00	40.1 EH	28.00
F093	22.7	24.00	54.5	28.00	<10.0	0.00	10.5	2.00	55.8	17.00	20.6	21.00
F094	21.2	21.00	51.7	20.00	4.7	9.00	22.5 H	24.00	55.6	15.50	18.2	14.00
F095	18.	5.50	46.	5.50	<4.	0.00	13.	7.50	49.	5.00	15.	3.00
F096	21.3	22.00	51.3	17.00	<20.	0.00	<20.	0.00	55.6	15.50	<20.	0.00
F133	18.	5.50	48.	8.00	<1.	0.00	15.	16.50	55.	12.50	16.	4.50
F135	24.	26.00	54.	26.50	5.T	10.00	23. VH	25.00	55.	12.50	20.	18.50
F136	<20.0	0.00	42.8	4.00	<20.0	0.00	<20.0	0.00	45.2 L	4.00	<20.0	0.00
F139	16.	3.50	40. L	3.00	<5.	0.00	13.	7.50	42. L	2.00	14.	2.00
MEDIAN	21.0000		51.3500		2.0000		14.1000		56.0100		18.3000	
1CRIT	6.6000		9.6350		5.0000		5.9100		10.1010		6.3300	
N	29		32		10		26		32		26	
MEAN	21.1166		50.9759		3.7770		16.2481		56.2275		19.5904	
3STDEV	10.5275		14.8963		8.3833		15.0671		20.2180		12.2229	

PARAMETER: 13095 Aluminum ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	94.0	12.50	415.	19.00	240.	17.50	275.	17.00
F003	100.	23.00	410.	15.50	220.	6.50	260.	8.50
F008	99.	20.00	430.	27.50	250.	24.50	290.	27.50
F009	100.	23.00	429.	25.00	245.	22.00	283.	23.50
F010	106.	31.00	439.	31.00	267.	32.00	292.	30.50
F011	91.4	10.00	409.	14.00	235.	13.00	257.	6.00
F012	100.	23.00	422.	23.00	244.	21.00	278.	21.00
F014	94.5	14.00	403.	11.00	248.	23.00	294.	32.00
F015	103.	29.00	440.	32.00	260.	29.50	290.	27.50
F019	90.	8.50	410.	15.50	240.	17.50	260.	8.50
F022	80. L	6.00	380.	6.00	229.	10.00	260.	8.50
F024	100.	23.00	430.	27.50	255.	27.00	275.	17.00
F025	<100.	0.00	250. EL	1.00	70. EL	1.00	290.	27.50
F026	100.17	26.00	425.41	24.00	254.41	26.00	274.42	15.00
F031	90.	8.50	430.	27.50	260.	29.50	280.	22.00
F032	95.0	15.00	412.	17.00	238.	15.00	277.	20.00
F032b	98.6	19.00	420.	21.00	241.	19.00	274.	14.00
F036	114. H	33.00	442.	33.00	282. H	35.00	296.	34.00
F037	73.13 VL	3.00	321.5 VL	3.00	187.6 VL	3.00	201.0 EL	2.00
F038	100.	23.00	430.	27.50	250.	24.50	290.	27.50
F046	94.0	12.50	405.	13.00	232.	11.50	256.	5.00
F048	97.5	18.00	417.3	20.00	239.3	16.00	275.6	19.00
F060	115. H	34.00	432.	30.00	270. H	33.00	295.	33.00
F063	70. VL	2.00	400.	9.50	220.	6.50	260.	8.50
F064	101.	27.00	385.	7.00	232.	11.50	270.	13.00
F069	92.4	11.00	404.	12.00	228.	9.00	261.	11.00
F080	107.	32.00	421.	22.00	257.	28.00	292.	30.50
F093	102.9	28.00	448.2	34.00	262.4	31.00	284.0	25.00
F094	104.	30.00	390.	8.00	226.	8.00	283.	23.50
F095	79. L	5.00	340. VL	4.00	197. VL	5.00	220. VL	3.00
F096	96.2	17.00	414.	18.00	242.	20.00	275.	17.00
F133	96.	16.00	400.	9.50	237.	14.00	265.	12.00
F135	84.	7.00	595. EH	35.00	280. H	34.00	328. VH	35.00
F136	77.3 L	4.00	352.0 L	5.00	194.6 VL	4.00	225.1 VL	4.00
F139	69. VL	1.00	270. EL	2.00	159. EL	2.00	183. EL	1.00
MEDIAN	96.8500		414.0000		240.0000		275.0000	
1CRIT	14.1850		45.9000		28.5000		32.0000	
N	32		33		33		33	
MEAN	94.6906		405.3458		237.5852		271.4582	
3STDEV	29.7473		110.2723		73.8814		64.8322	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	168.50	18.722	9					13305
F003	138.50	13.850	10					
F008	153.00	17.000	9					GF-ICP
F009	185.50	20.611	9					ICP-MS
F010	273.50	27.350	10	H H	BIASED HIGH	5.23	5.8233	ICP-OES
F011	125.00	12.500	10					ICP-MS
F012	159.50	15.950	10					ICP-MS
F014	151.00	15.100	10					ICP-MS
F015	249.50	27.722	9		BIASED HIGH	5.39	3.2708	GFAA-ICP
F019	75.50	10.786	7					ICAP
F022	43.00	7.167	6	EL L L				ICP-AES
F024	162.50	18.056	9	L				
F025	29.50	9.833	3	ELEL	INSUFFICIENT DATA			ICP
F026	207.00	20.700	10					I.C.P. EMISSION
F031	119.50	17.071	7					ICP
F032	169.50	18.833	9					ICP-AES
F032b	162.00	18.000	9					ICP-MS
F036	234.50	26.056	9	H H H	BIASED HIGH	8.20	2.6712	Colourimetry
F037	20.00	2.222	9	L L L L VLVLVLEL	BIASED LOW	-22.76	-1.8343	ICP-MS
F038	167.00	18.556	9					ICPMS
F046	109.50	10.950	10					ICP-MS As Received
F048	156.00	15.600	10					ICP
F060	295.00	29.500	10	EHEHEHVHEHEHH H	BIASED HIGH*	1.82	15.9803	ICP
F063	28.50	4.750	6	ELEL ELL VL	BIASED LOW*	3.21	-26.6002	ICP-AES
F064	199.50	22.167	9	VH VH H				AA
F069	87.00	8.700	10					ICP-MS
F080	274.50	27.450	10	H VHEHEHEH	BIASED HIGH*	-0.91	15.4408	ICP dig conc
F093	210.00	23.333	9					ICP
F094	173.00	17.300	10	H				ICPMS
F095	43.50	4.833	9	L VLVLVL	BIASED LOW	-18.86	1.5703	ICP-USN
F096	126.50	18.071	7					ICP
F133	98.50	10.944	9					ICP-MS
F135	229.50	22.950	10	VH EHH VH				AA-ETA APHA
F136	25.00	4.167	6	L L L VLVL	BIASED LOW	-15.29	-3.8276	DCP
F139	24.00	2.667	9	L L VLELELEL	BIASED LOW	-35.57	4.6048	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 16.528

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F037	20.00	2.222	9	LLLLVLVLVLEL	BIASED LOW	-22.76	-1.8343	ICP-MS
F139	24.00	2.667	9	LLVLELELEL	BIASED LOW	-35.57	4.6048	ICP-MS
F136	25.00	4.167	6	LLLVLVL	BIASED LOW	-15.29	-3.8276	DCP
F063	28.50	4.750	6	ELELELLVL	BIASED LOW*	3.21	-26.6002	ICP-AES
F095	43.50	4.833	9	LVLVLVL	BIASED LOW	-18.86	1.5703	ICP-USN
F022	43.00	7.167	6	ELLL				ICP-AES
F069	87.00	8.700	10					ICP-MS
F025	29.50	9.833	3	ELEL	INSUFFICIENT DATA			ICP
F019	75.50	10.786	7					ICAP
F133	98.50	10.944	9					ICP-MS
F046	109.50	10.950	10					ICP-MS As Received
F011	125.00	12.500	10					ICP-MS
F003	138.50	13.850	10					
F014	151.00	15.100	10					ICP-MS
F048	156.00	15.600	10					ICP
F012	159.50	15.950	10					ICP-MS
F008	153.00	17.000	9					GF-ICP
F031	119.50	17.071	7					ICP
F094	173.00	17.300	10	H				ICPMS
F032b	162.00	18.000	9					ICP-MS
F024	162.50	18.056	9	L				
F096	126.50	18.071	7					ICP
F038	167.00	18.556	9					ICPMS
F002	168.50	18.722	9					13305
F032	169.50	18.833	9					ICP-AES
F009	185.50	20.611	9					ICP-MS
F026	207.00	20.700	10					I.C.P. EMISSION
F064	199.50	22.167	9	VHVHH				AA
F135	229.50	22.950	10	VHEHHVH				AA-ETA APHA
F093	210.00	23.333	9					ICP
F036	234.50	26.056	9	HHH	BIASED HIGH	8.20	2.6712	Colourimetry
F010	273.50	27.350	10	HH	BIASED HIGH	5.23	5.8233	ICP-OES
F080	274.50	27.450	10	HVHEHEHEH	BIASED HIGH*	-0.91	15.4408	ICP dig conc
F015	249.50	27.722	9		BIASED HIGH	5.39	3.2708	GFAA-ICP
F060	295.00	29.500	10	EHEHEHVHEHEHHH	BIASED HIGH*	1.82	15.9803	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 16.528

PARAMETER: 51095 Antimony ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.5000 BASIC ACCEPTABLE ERROR= 0.5000 CONCENTRATION ERROR INCREMENT= 0.0800

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	0.2	2.00	1.9	5.50	0.4	6.50	0.6	6.00	8.7	17.50	1.1 VH	8.00
F009	0.4	8.00	1.8	3.00	0.4	6.50	0.2	5.00	8.3	12.00	0.2	5.50
F011	0.2	2.00	2.	10.50	0.5 EH	8.00	0.1	1.50	8.4	14.00	0.2	5.50
F012	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	9.	20.00	<5.	0.00
F014	<1.0	0.00	2.0	10.50	<1.0	0.00	<1.0	0.00	8.4	14.00	<1.0	0.00
F015	<1.	0.00	2.4	16.00	<1.	0.00	<1.	0.00	9.2	21.00	<1.	0.00
F022	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00
F025	0.2	2.00	2.0	10.50	0.3	2.00	<0.2	0.00	8.4	14.00	0.3	7.00
F031	<3.	0.00	<3.	0.00	<3.	0.00	<3.	0.00	8.	7.00	<3.	0.00
F038	0.24	6.50	1.96	7.00	0.34	4.50	0.11	3.50	8.2	11.00	0.12	4.00
F046	0.22	4.00	1.8	3.00	0.31	3.00	<0.1	0.00	7.6	3.50	0.11	2.50
F048	<1.0	0.00	2.23	15.00	<1.0	0.00	<1.0	0.00	8.76	19.00	<1.0	0.00
F060	<0.3	0.00	1.9	5.50	<0.3	0.00	<0.3	0.00	7.6	3.50	<0.3	0.00
F063	1. VH	9.00	3. EH	18.00	<1.	0.00	<1.	0.00	8.	7.00	<1.	0.00
F069	<1.	0.00	2.0	10.50	<1.	0.00	<1.	0.00	8.7	17.50	<1.	0.00
F080	1.2 VH	10.00	2.5	17.00	<0.5	0.00	0.8 H	7.00	8.1	9.00	<0.5	0.00
F093	2.3 VH	11.00	3.6 EH	19.00	<2.0	0.00	<2.0	0.00	7.4	1.00	<2.0	0.00
F094	<0.4	0.00	2.	10.50	<0.4	0.00	<0.4	0.00	7.9	5.00	<0.4	0.00
F095	35. EH	12.00	<20.	0.00	<20.	0.00	38. EH	8.00	30. EH	23.00	40. EH	9.00
F096	<1.	0.00	1.6	1.00	<1.	0.00	<1.	0.00	7.5	2.00	<1.	0.00
F103	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	8.	7.00	<5.	0.00
F133	0.23	5.00	1.80	3.00	0.28	1.00	0.10	1.50	8.13	10.00	0.05	1.00
F135	<1.	0.00	2.	10.50	<1.	0.00	<1.	0.00	11. EH	22.00	<1.	0.00
F139	0.24	6.50	2.11	14.00	0.34	4.50	0.11	3.50	8.46	16.00	0.11	2.50
MEDIAN	0.2400		2.0000		0.3400		0.1550		8.3000		0.2000	
1CRIT	0.5000		0.6200		0.5000		0.5000		1.1240		0.5000	
N	11		17		6		5		21		7	
MEAN	0.5845		2.0824		0.3483		0.3640		8.3976		0.3057	
3STDEV	1.9119		0.8915		0.1180		-		2.1817		0.9913	

PARAMETER: 51095 Antimony ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	13.5	17.00	26.2	18.00	26.9	13.00	20.	19.50
F009	8.8 VL	1.00	27.	21.00	27.	15.00	19.	15.00
F011	13.1	16.00	26.3	19.00	28.	21.00	18.	8.50
F012	14.	20.50	26.	16.50	27.	15.00	20.	19.50
F014	12.2	9.00	26.6	20.00	28.0	21.00	18.5	10.00
F015	13.	13.50	25.5	13.00	27.6	18.00	18.6	11.00
F022	<10. VL	0.00	25.	11.00	24. L	5.00	23. VH	22.00
F025	12.0	7.50	25.0	11.00	28.0	21.00	19.0	15.00
F031	11. L	3.50	22. L	3.00	22. VL	2.00	15. VL	2.00
F038	12.7	12.00	25.6	14.00	26.7	12.00	18.8	13.00
F046	11.4	5.00	23.2	4.00	23.9 L	4.00	17.0	4.00
F048	13.9	19.00	27.22	22.00	27.8	19.00	19.9	17.50
F060	12.4	11.00	23.6	5.00	24.5	6.00	17.1	5.00
F063	12.	7.50	24.	6.50	25.	7.00	18.	8.50
F069	13.8	18.00	25.7	15.00	27.2	17.00	20.3	21.00
F080	13.0	13.50	24.0	6.50	25.2	8.00	17.5	6.00
F093	11.8	6.00	21.6 L	2.00	22.9 L	3.00	16.8 L	3.00
F094	14.	20.50	25.	11.00	25.5	9.00	19.9	17.50
F095	21. EH	23.00	42. EH	24.00	50. EH	24.00	35. EH	24.00
F096	9.5 VL	2.00	16.6 EL	1.00	16.8 EL	1.00	13.5 VL	1.00
F103	11. L	3.50	26.	16.50	27.	15.00	19.	15.00
F133	12.25	10.00	24.7	8.00	26.0	10.00	17.98	7.00
F135	17. VH	22.00	35. EH	23.00	38. EH	23.00	26. EH	23.00
F139	13.06	15.00	24.90	9.00	26.29	11.00	18.75	12.00
MEDIAN	12.7000		25.2500		26.8000		18.7750	
1CRIT	1.4760		2.4800		2.6040		1.9620	
N	21		22		22		22	
MEAN	12.6957		25.4600		26.5677		19.0059	
3STDEV	4.4242		7.5928		9.0158		6.5403	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	113.00	11.300	10	VH				HYD-ICP
F009	92.00	9.200	10	VL				ICP-MS
F011	106.00	10.600	10	EH				
F012	91.50	18.300	5		BIASED HIGH*	-2.80	1.3490	ICP-MS
F014	84.50	14.083	6					ICP-MS
F015	92.50	15.417	6					GFAA
F022	38.00	12.667	3	VL L VH	INSUFFICIENT DATA			ICP-AES
F025	90.00	10.000	9					AA HYDRIDE
F031	17.50	3.500	5	L L VLVL	BIASED LOW	-20.53	1.0055	ICP
F038	87.50	8.750	10					ICPMS
F046	33.00	3.667	9	L	BIASED LOW	-9.52	-0.0065	ICP-MS As Received
F048	111.50	18.583	6		BIASED HIGH*	4.96	0.2213	ICP
F060	36.00	6.000	6					Hydride - AA
F063	63.50	9.071	7	VHEH				HYDRIDE AA
F069	99.00	16.500	6					Graphite Furnace
F080	77.00	9.625	8	VH H				Hydride Gen ICP
F093	45.00	6.429	7	VHEH L L L				ICP - Hydride
F094	73.50	12.250	6					ICPMS
F095	147.00	18.375	8	EH EHEHEHEHEHEHEH	BIASED HIGH	-73.15	33.2732	ICP-USN
F096	8.00	1.333	6	VLELELVL	BIASED LOW	-40.10	1.5500	Auto hydride AA
F103	57.00	11.400	5	L				GFAA
F133	56.50	5.650	10		BIASED LOW*	-2.60	-0.0779	ICP-MS
F135	123.50	20.583	6	EH VHEHEHEH	BIASED HIGH	43.97	-1.0127	AA-ETA APHA
F139	94.00	9.400	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 10.557

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F096	8.00	1.333	6	VLELELVL	BIASED LOW	-40.10	1.5500	Auto hydride AA
F031	17.50	3.500	5	LLVLVL	BIASED LOW	-20.53	1.0055	ICP
F046	33.00	3.667	9	L	BIASED LOW	-9.52	-0.0065	ICP-MS As Received
F133	56.50	5.650	10		BIASED LOW*	-2.60	-0.0779	ICP-MS
F060	36.00	6.000	6					Hydride - AA
F093	45.00	6.429	7	VHEHLLL				ICP - Hydride
F038	87.50	8.750	10					ICPMS
F063	63.50	9.071	7	VHEH				HYDRIDE AA
F009	92.00	9.200	10	VL				ICP-MS
F139	94.00	9.400	10					ICP-MS
F080	77.00	9.625	8	VHH				Hydride Gen ICP
F025	90.00	10.000	9					AA HYDRIDE
F011	106.00	10.600	10	EH				
F003	113.00	11.300	10	VH				HYD-ICP
F103	57.00	11.400	5	L				GFAA
F094	73.50	12.250	6					ICPMS
F022	38.00	12.667	3	VLLVH	INSUFFICIENT DATA			ICP-AES
F014	84.50	14.083	6					ICP-MS
F015	92.50	15.417	6					GFAA
F069	99.00	16.500	6					Graphite Furnace
F012	91.50	18.300	5		BIASED HIGH*	-2.80	1.3490	ICP-MS
F095	147.00	18.375	8	EHEHEHEHEHEHEHEH	BIASED HIGH	-73.15	33.2732	ICP-USN
F048	111.50	18.583	6		BIASED HIGH*	4.96	0.2213	ICP
F135	123.50	20.583	6	EHVHEHEHEH	BIASED HIGH	43.97	-1.0127	AA-ETA APHA

* 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 10.557

Antimony

PARAMETER: 33095 Arsenic ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.5000 BASIC ACCEPTABLE ERROR= 0.5000 CONCENTRATION ERROR INCREMENT= 0.0800

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	0.3	2.00	6.6	4.00	1.	5.50	0.5	3.50	0.9	2.50	0.3	1.50
F008	<1.	0.00	8.	22.50	1.	5.50	<1.	0.00	1.	5.50	<1.	0.00
F009	0.4	6.00	7.2	12.50	1.1	9.50	0.9	8.50	1.2	13.00	0.9	11.00
F010	0.3	2.00	6.4	3.00	0.9	2.50	0.4	1.50	0.8	1.00	0.3	1.50
F011	<0.2 EL	0.00	7.	9.00	0.6	1.00	0.5	3.50	1.1	9.50	0.6	6.00
F012	<5.	0.00	8.	22.50	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00
F014	<1.0	0.00	7.7	17.00	<1.0	0.00	1.1	13.00	1.4	17.50	1.2	16.00
F015	<5.	0.00	7.8	18.50	1.8 EH	16.00	1.4	14.00	1.1	9.50	0.5	5.00
F019	<1.	0.00	8.	22.50	<1.	0.00	<1.	0.00	2. EH	19.00	<1.	0.00
F022	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00
F025	<0.2 EL	0.00	7.4	14.00	0.9	2.50	0.4	1.50	0.9	2.50	0.4	3.50
F031	<2.	0.00	5. EL	1.00	<2.	0.00	<2.	0.00	<2.	0.00	<2.	0.00
F037	0.3286	4.00	7.122	11.00	1.100	9.50	0.8538	7.00	1.141	12.00	0.8884	10.00
F038	0.3	2.00	7.2	12.50	1.1	9.50	0.9	8.50	1.1	9.50	0.8	8.50
F046	0.41	7.00	7.8	18.50	1.2	13.00	0.98	10.00	1.3	16.00	1.0	12.50
F048	<1.0	0.00	7.86	20.00	1.35	15.00	1.07	11.50	1.27	14.00	1.04	14.50
F060	<0.2 EL	0.00	8.7 H	26.00	1.1	9.50	3.9 EH	15.00	1.1	9.50	0.4	3.50
F063	<1.	0.00	7.	9.00	1.	5.50	<1.	0.00	1.	5.50	<1.	0.00
F064	13. EH	8.00	25. EH	27.00	10. EH	17.00	15. EH	16.00	<1.	0.00	5. EH	17.00
F069	<1.	0.00	6.8	6.00	<1.	0.00	<1.	0.00	<1.	0.00	<1.	0.00
F080	<2.0	0.00	7.5	15.00	<2.0	0.00	<2.0	0.00	<2.0	0.00	<2.0	0.00
F093	<2.0	0.00	6.9	7.00	<2.0	0.00	<2.0	0.00	<2.0	0.00	<2.0	0.00
F094	<0.4	0.00	6.7	5.00	1.	5.50	0.8	5.50	1.	5.50	0.7	7.00
F096	<0.5	0.00	8.1	25.00	1.3	14.00	0.8	5.50	1.4	17.50	0.8	8.50
F103	<2.	0.00	8.0	22.50	<2.	0.00	<2.	0.00	<2.	0.00	<2.	0.00
F133	<1.	0.00	7.	9.00	<1.	0.00	<1.	0.00	1.	5.50	1.	12.50
F135	<2.	0.00	6. L	2.00	<2.	0.00	<2.	0.00	<2.	0.00	<2.	0.00
F139	0.36	5.00	7.56	16.00	1.12	12.00	1.07	11.50	1.29	15.00	1.04	14.50
MEDIAN	0.3443		7.4000		1.1000		0.9000		1.1000		0.8000	
1CRIT	0.5000		1.0520		0.5480		0.5320		0.5480		0.5240	
N	7		25		15		13		17		14	
MEAN	0.3427		7.3737		1.1313		1.1364		1.1295		0.8049	
3STDEV	0.1331		1.8588		0.6518		2.4919		0.4613		0.7316	

PARAMETER: 33095 Arsenic ug/L

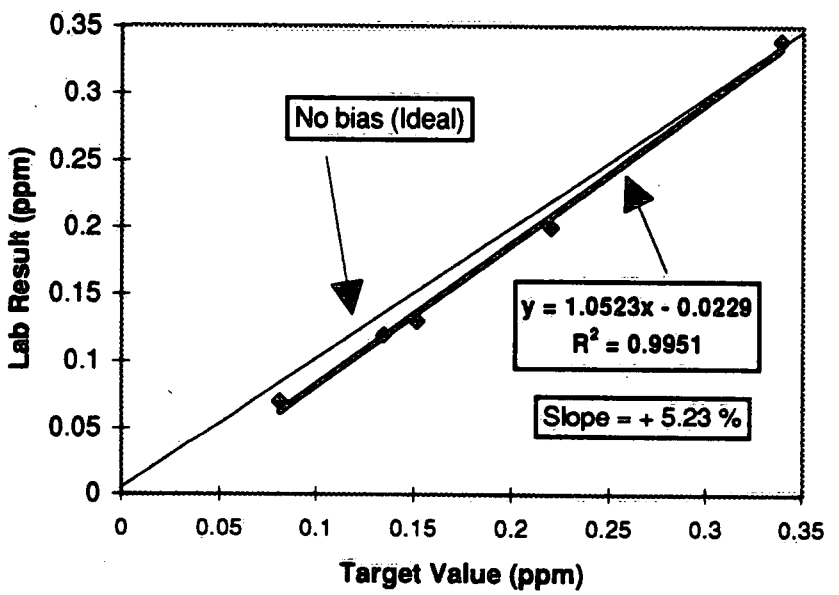
SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	14.2 L	8.00	41.5 L	7.00	43.8	16.00	27.5	11.00
F008	16.	16.00	46.	14.00	43.	13.50	26.	7.50
F009	15.	9.50	45.	12.00	43.	13.50	28.	15.00
F010	13. VL	2.50	31. VL	1.00	33. VL	2.00	20. VL	1.00
F011	17.1	23.00	49.6	20.00	39.6	5.50	27.6	12.00
F012	16.	16.00	47.	17.00	45.	19.00	29.	18.50
F014	15.5	13.00	49.8	21.00	48.5 H	25.00	29.1	20.00
F015	16.7	21.00	43.0	8.00	39.6	5.50	25.4	6.00
F019	16.	16.00	41. L	6.00	40.	8.00	25. L	5.00
F022	16.	16.00	50.	22.00	40.	8.00	30.	21.00
F025	14.0 L	6.50	47.0	17.00	46.0	22.00	28.0	15.00
F031	12. VL	1.00	35. VL	3.00	36. VL	3.00	22. VL	2.50
F037	15.19	12.00	45.08	13.00	43.83	17.00	27.03	9.00
F038	15.	9.50	47.	17.00	45.	19.00	28.	15.00
F046	16.9	22.00	50.7 H	23.00	47.8 H	24.00	30.9 H	23.00
F048	17.36	24.00	51.2 H	24.00	47.3 H	23.00	31.0 H	24.00
F060	20.0 VH	27.00	56.1 VH	27.00	55.8 VH	27.00	33.1 VH	27.00
F063	14. L	6.50	40. VL	4.00	40.	8.00	26.	7.50
F064	21. EH	28.00	64. EH	28.00	59. EH	28.00	37. EH	28.00
F069	15.1	11.00	44.0	10.00	42.5	12.00	27.3	10.00
F080	16.5	20.00	43.5	9.00	43.5	15.00	28.0	15.00
F093	13.1 VL	4.00	40.1 VL	5.00	38.0 L	4.00	24.7 L	4.00
F094	17.6	25.00	44.6	11.00	42.	10.50	30.3	22.00
F096	18.4 H	26.00	51.9 H	26.00	52.0 VH	26.00	32.8 VH	25.00
F103	13.5 L	5.00	47.	17.00	42.	10.50	28.	15.00
F133	16.	16.00	47.	17.00	45.	19.00	29.	18.50
F135	13. VL	2.50	34. VL	2.00	30. VL	1.00	22. VL	2.50
F139	16.10	19.00	51.62 H	25.00	45.90	21.00	32.89 VH	26.00
MEDIAN	16.0000		46.5000		43.2500		28.0000	
1CRIT	1.7400		4.1800		3.9200		2.7000	
N	26		26		26		26	
MEAN	15.6635		45.7192		43.3896		28.0238	
3STDEV	5.0479		15.2063		14.0468		8.5533	

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.

June 1996

NWRI Ecosystem Interlaboratory QA Program

Bias Critical Values
Trace Metals/Elements

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

Table 1 List of participating[†] laboratories in the trace metals/elements portion of interlaboratory study FP 72 (March & April 1998).

Accutest Laboratories Ltd.
AECL Research - ASB, Whiteshell
Aqualta
ASL - Analytical Service Lab Ltd.
Can Test Ltd.
Chemex Environmental Services
City of Calgary - Waterworks
Environment Canada - EPL, Prairie & Northern Region
Environment Canada - EQL, Atlantic
Environment Canada - NWRI, NLET
Environment Canada - Pacific Environmental Science Centre
Enviro-Test Laboratories
Enviro-Test Manitoba Technology Centre
Falconbridge Ltd. - Kidd Creek Division
Falconbridge Ltd. - Sudbury Operations
Fisheries and Oceans Canada - Freshwater Institute
FOOD CONTROL S.A.
Laboratoire de Santé Publique du Québec
Laurentian University - Elliot Lake Field Research Station
Maxxam Analytics
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
New Brunswick Department of the Environment - ASL
Norwest Labs
Ontario Hydro Technologies
Ontario Ministry of Environment and Energy - Dorset
Ontario Ministry of Environment and Energy - Etobicoke
Ontario Ministry of Northern Development and Mines - Geosciences Laboratory
Philip Analytical Services Corporation
Saskatchewan Research Council
TAIGA Environmental Laboratory
Université du Québec - INRS Eau
US Geological Survey - National Water Quality Laboratory
York-Durham Regional Environmental Laboratory

[†] Laboratories select their routine parameters from the series of samples in this study.

Table 2 Laboratory Performance Scores (Study 0072)

Trace Elements in Water

	SYSTEMATIC BIAS			FLAGGED RESULTS			
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 & FLAGGED DATA % SCORE
F002	9	0	0.00	77	1	1.30	0.65
F069	22	0	0.00	159	9	5.66	2.83
F038	23	1	4.35	195	8	4.10	4.23
F003	21	1	4.76	199	12	6.03	5.40
F032	16	0	0.00	128	14	10.94	5.47
F015	19	1	5.26	145	11	7.59	6.42
F080	19	0	0.00	137	19	13.87	6.93
F032b	15	1	6.67	117	9	7.69	7.18
F019	15	0	0.00	104	16	15.38	7.69
F026	8	0	0.00	80	13	16.25	8.12
F133	22	2	9.09	188	21	11.17	10.13
F022	20	0	0.00	131	33	25.19	12.60
F048	22	2	9.09	166	28	16.87	12.98
F060	23	2	8.70	171	30	17.54	13.12
F094	23	1	4.35	199	47	23.62	13.98
F093	19	2	10.53	156	30	19.23	14.88
F049	4	1	25.00	40	2	5.00	15.00
F014	16	2	12.50	118	21	17.80	15.15
F046	21	3	14.29	192	32	16.67	15.48
F011	23	4	17.39	211	30	14.22	15.80
F009	19	4	21.05	166	19	11.45	16.25
F096	21	4	19.05	154	24	15.58	17.32
F024	15	3	20.00	118	19	16.10	18.05
F010	19	4	21.05	175	32	18.29	19.67
F012	20	2	10.00	145	45	31.03	20.52
F036	3	1	33.33	27	3	11.11	22.22
F063	16	0	0.00	128	57	44.53	22.27
F136	12	2	16.67	108	33	30.56	23.61
F103	21	4	19.05	144	45	31.25	25.15
F037	12	3	25.00	106	29	27.36	26.18
F031	12	4	33.33	95	30	31.58	32.46
F008	14	5	35.71	110	35	31.82	33.77
F064	14	4	28.57	120	68	56.67	42.62
F139	20	8	40.00	184	85	46.20	43.10
F025	22	9	40.91	167	105	62.87	51.89
F135	14	7	50.00	104	67	64.42	57.21
F095	19	13	68.42	150	104	69.33	68.88

The parameters were selected from:

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

Table 3 SUMMARY of STUDY-TO-STUDY PERFORMANCE

Trace Elements in Water

LAB CODE	% BIASED PARAMETERS & FLAGGED RESULTS ON STUDIES 0063	0064	0065	0066	0067	0068	0069	0070	0071	0072	MEDIAN SCORE	COMMENTS
F002	4.6	1.8	1.7	-	5.7	0.0	1.4	0.6	0.0	0.6	1.4	GOOD
F003	0.0	2.3	5.8	4.2	6.1	7.8	0.7	1.2	3.1	5.4	3.7	GOOD
F008	8.5	8.2	10.8	6.2	9.1	1.8	2.9	8.5	9.7	33.8	8.5	SATISFACTORY
F009	32.3	43.0	20.5	19.7	24.7	30.9	10.8	22.2	26.4	16.2	23.5	MODERATE
F010	10.5	18.1	13.4	19.5	25.0	12.5	-	20.2	9.6	19.7	18.1	MODERATE
F011	24.1	7.4	17.1	9.9	7.3	3.7	22.7	14.0	10.0	15.8	12.0	SATISFACTORY
F012	-	-	-	-	-	20.6	26.2	28.0	25.1	20.5	25.1	MODERATE
F014	19.1	26.3	25.3	26.3	27.3	26.9	30.9	9.6	19.0	15.1	25.8	MODERATE
F015	3.5	4.7	4.5	5.4	9.9	1.9	5.9	7.0	11.0	6.4	5.6	SATISFACTORY
F019	-	-	-	30.2	20.7	26.6	12.9	14.2	6.8	7.7	14.2	MODERATE
F022	-	-	-	-	-	28.2	-	-	34.3	12.6	28.2	MODERATE
F024	5.1	3.9	3.1	10.8	9.6	10.5	14.4	8.1	16.2	18.1	10.1	SATISFACTORY
F025	11.4	24.0	19.4	20.9	-	-	-	59.0	23.8	51.9	23.8	MODERATE
F026	35.0	4.5	15.5	-	35.5	14.7	28.5	22.2	13.6	8.1	15.5	MODERATE
F031	32.9	22.6	24.9	16.8	29.0	28.3	32.3	32.8	48.6	32.5	30.7	POOR
F032	5.6	5.3	8.0	0.7	1.4	9.4	13.0	3.1	21.8	5.5	5.5	SATISFACTORY
F032b	-	-	-	-	-	5.7	-	-	10.6	7.2	7.2	SATISFACTORY
F036	36.4	27.4	-	-	39.3	53.2	36.8	26.7	37.1	22.2	36.6	POOR
F037	32.5	20.5	39.7	-	20.5	17.0	41.7	25.9	18.7	26.2	25.9	MODERATE
F038	25.9	8.6	28.1	10.4	9.7	4.0	5.4	5.3	4.2	4.2	7.0	SATISFACTORY
F046	15.1	8.5	17.8	10.4	21.3	15.0	15.4	17.4	12.7	15.5	15.2	MODERATE
F048	34.8	15.0	14.7	27.1	2.8	5.2	31.3	11.0	1.9	13.0	13.8	MODERATE
F049	-	-	-	-	-	-	-	-	-	15.0	-	-
F060	23.9	40.2	-	-	-	7.7	-	9.3	4.0	13.1	11.2	SATISFACTORY
F063	-	48.7	-	-	-	22.0	12.8	23.3	14.9	22.3	22.1	MODERATE
F064	-	66.8	-	-	-	21.5	-	-	-	42.6	42.6	POOR
F069	-	10.8	8.3	8.0	17.1	11.4	1.0	3.7	-	2.8	8.2	SATISFACTORY
F080	-	-	20.6	20.0	8.9	26.7	24.6	-	18.0	6.9	20.0	MODERATE
F093	-	-	-	-	17.2	11.8	22.5	17.9	23.3	14.9	17.6	MODERATE
F094	-	-	-	-	45.8	37.3	4.8	6.5	9.8	14.0	11.9	SATISFACTORY
F095	-	-	-	-	7.9	-	-	-	-	68.9	38.4	POOR
F096	-	-	-	-	-	32.2	-	7.4	10.5	17.3	13.9	MODERATE
F103	-	-	-	-	-	39.3	-	-	-	25.1	32.2	POOR
F133	-	-	-	-	-	-	-	54.2	17.0	10.1	17.0	MODERATE
F135	-	-	-	-	-	-	-	-	-	57.2	-	-
F136	-	-	-	-	-	-	-	-	-	23.6	-	-
F139	-	-	-	-	-	-	-	-	-	43.1	-	-
INTERLAB MEDIAN	19.1	15.0	15.5	10.8	17.1	15.0	14.4	14.0	13.6	15.5		

STUDY DATES: 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), 0071(02-SEP-97), 0072(02-MAR-98)

Table 4 Sample design[‡] for the trace metals/elements portion of interlaboratory study FP 72 (March & April 1998).

Sample Number	Sample Name	Type (DA[§]/Low)	Expected Copper Concentration (µg/L)
FP 72 TM-1	TM-FSWana	Low	1.78
FP 72 TM-2	TM-25.2	Low	12.15
FP 72 TM-3	TMRain-95	Low	6.2
FP 72 TM-4	TM-Lnglke B	Low	36.9
FP 72 TM-5	TM-25	Low	27.35
FP 72 TM-6	TM-Lnglke A	DA	48.15
FP 72 TM-7	TMDA-51.2	DA	91.0
FP 72 TM-8	TMDA-54.3	DA	452.0
FP 72 TM-9	TMDA-53	DA	196.5
FP 72 TM-10	TM-25-54	DA	283.0

[‡] All samples are preserved with 0.2% HNO_3.
[§] direct aspiration

Table 5 Summary of Interlaboratory Median Values for Trace Elements in Water - Study 0072

PARAMETER		SAMPLE NUMBER						
		TM-ESWANA SAMPLE 1	TM-25.2 SAMPLE 2	TMRAIN-95 SAMPLE 3	TM-LNGLKEb SAMPLE 4	TM-25 SAMPLE 5	TM-LNGLKEa SAMPLE 6	TMDA-51.2 SAMPLE 7
Aluminum	ug/L	21.000	51.350	2.0000	14.100	56.010	18.300	96.850
Vanadium	ug/L	0.1000	11.000	0.8000	0.1000	16.000	0.1000	48.000
Chromium	ug/L	2.0000	7.5500	0.9000	0.2500	3.6300	0.6000	62.900
Manganese	ug/L	1.0000	14.950	6.1300	15.950	19.000	16.480	83.150
Iron	ug/L	23.050	17.000	23.700	117.500	10.250	125.000	112.595
Cobalt	ug/L	0.0400	13.400	0.2650	0.1800	13.150	0.1300	72.250
Nickel	ug/L	1.0000	10.300	0.9500	109.000	10.400	110.000	67.000
Copper	ug/L	1.7800	12.150	6.2000	36.900	27.350	48.150	91.000
Zinc	ug/L	9.4250	24.000	12.000	8.1450	8.2200	12.500	107.000
Arsenic	ug/L	0.3443	7.4000	1.1000	0.9000	1.1000	0.8000	16.000
Selenium	ug/L	0.3500	5.0000	0.7000	0.8300	1.9000	0.8300	12.000
Strontium	ug/L	110.500	141.500	1.7000	60.000	235.500	60.050	121.500
Molybdenum	ug/L	0.6000	7.5100	0.2000	0.2100	8.8000	0.3100	58.900
Silver	ug/L	0.0500	4.8500	0.2500	-	2.1000	0.0500	12.900
Cadmium	ug/L	0.1500	8.7000	0.5103	0.1400	7.5000	0.1600	25.000
Antimony	ug/L	0.2400	2.0000	0.3400	0.1550	8.3000	0.2000	12.700
Barium	ug/L	20.000	6.0000	0.7400	21.000	64.550	21.795	73.240
Thallium	ug/L	0.2000	6.3900	0.3300	0.0500	-	0.0500	19.800
Lead	ug/L	0.7000	15.000	0.2800	4.0000	22.900	7.4850	71.900
Bismuth	ug/L	-	3.4000	0.8000	0.0500	8.4000	0.1000	15.650
Uranium	ug/L	0.4650	6.1100	0.2840	0.1500	0.0860	0.1500	30.200
Lithium	ug/L	2.2050	4.0000	0.4750	1.0450	6.3050	1.0400	17.250
Beryllium	ug/L	-	3.0000	0.2910	-	7.0000	-	9.2600

		TMDA-54.3 SAMPLE 8	TMDA-53 SAMPLE 9	TM-25-54 SAMPLE 10
Aluminum	ug/L	414.000	240.000	275.000
Vanadium	ug/L	365.000	448.500	227.000
Chromium	ug/L	464.000	370.500	278.500
Manganese	ug/L	280.500	147.000	176.550
Iron	ug/L	398.500	324.000	245.500
Cobalt	ug/L	323.000	175.000	200.000
Nickel	ug/L	362.000	342.000	224.000
Copper	ug/L	452.000	196.500	283.000
Zinc	ug/L	558.500	175.500	342.500
Arsenic	ug/L	46.500	43.250	28.000
Selenium	ug/L	30.000	33.000	19.530
Strontium	ug/L	613.000	403.000	465.500
Molybdenum	ug/L	310.000	202.000	190.700
Silver	ug/L	14.840	17.000	10.400
Cadmium	ug/L	155.550	264.000	98.600
Antimony	ug/L	25.250	26.800	18.775
Barium	ug/L	326.000	341.500	223.500
Thallium	ug/L	27.000	-	16.100
Lead	ug/L	533.500	220.000	330.500
Bismuth	ug/L	19.100	27.950	15.800
Uranium	ug/L	63.400	21.450	37.300
Lithium	ug/L	27.750	36.550	19.600
Beryllium	ug/L	20.000	13.000	15.000

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

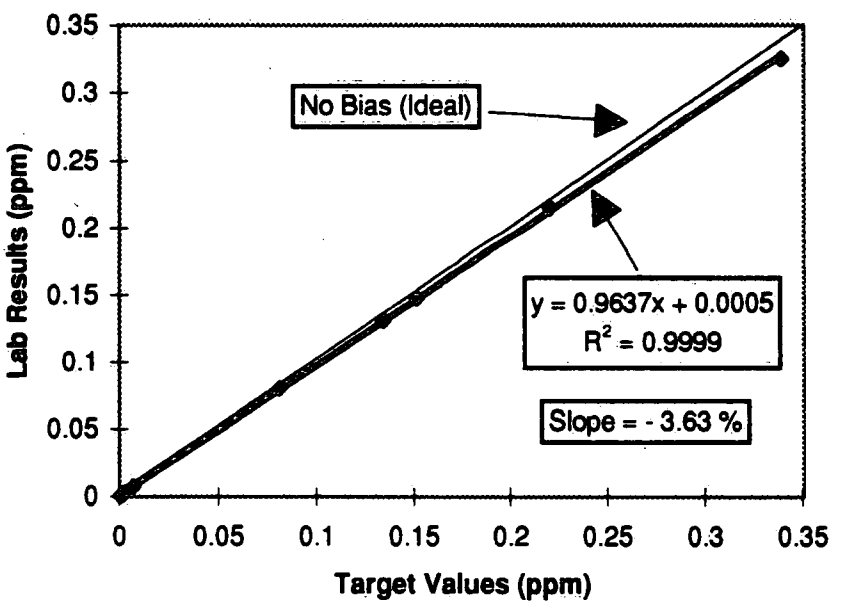
Introduction

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.

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	61.00	6.100	10	L L	BIASED LOW*	-4.33	-0.2498	HYD-ICP
F008	84.50	12.071	7					Hydride
F009	110.50	11.050	10					ICP-MS
F010	18.00	1.800	10	VLVLVLVL	BIASED LOW	-28.95	0.2796	Hydride-AA
F011	89.50	9.944	9	EL				Hydride AA
F012	93.00	18.600	5					ICP-MS
F014	142.50	17.813	8	H				ICP-MS
F015	103.50	11.500	9	EH				GFAA
F019	76.50	12.750	6	EH L L				AA - Hydride
F022	67.00	16.750	4		INSUFFICIENT DATA			ICP-AES
F025	84.50	9.389	9	EL L				AA HYDRIDE
F031	10.50	2.100	5	EL VLVLVLVL	BIASED LOW	-19.14	-0.8279	ICP
F037	104.50	10.450	10					ICP-MS
F038	111.00	11.100	10					ICPMS
F046	169.00	16.900	10	H H H				ICP-MS As Received
F048	170.00	18.889	9	H H H				ICP
F060	171.50	19.056	9	ELH EH VHVHVHVH				Hydride - AA
F063	46.00	6.571	7	L VL				HYDRIDE AA
F064	197.00	21.889	9	EHEHEHEH EHEHEHEHEH	BIASED HIGH	10.96	9.8772	Colorimetric
F069	49.00	9.800	5					Graphite Furnace
F080	74.00	14.800	5					Hydride Gen ICP
F093	24.00	4.800	5	VLVLL L	BIASED LOW	-13.05	0.0138	ICP - Hydride
F094	97.00	10.778	9					ICPMS
F096	173.50	19.278	9	H H VHVH	BIASED HIGH	15.97	-0.0794	Auto hydride AA
F103	70.00	14.000	5	L				GFAA
F133	97.50	13.929	7					ICP-MS
F135	10.00	2.000	5	L VLVLVLVL	BIASED LOW	-31.51	1.6660	AA-HG APHA
F139	165.00	16.500	10	H VH				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 12.361

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F010	18.00	1.800	10	VLVLVLVL	BIASED LOW	-28.95	0.2796	Hydride-AA
F135	10.00	2.000	5	LVLVLVLVL	BIASED LOW	-31.51	1.6660	AA-HG APHA
F031	10.50	2.100	5	ELVLVLVLVL	BIASED LOW	-19.14	-0.8279	ICP
F093	24.00	4.800	5	VLVLLL	BIASED LOW	-13.05	0.0138	ICP - Hydride
F003	61.00	6.100	10	LL	BIASED LOW*	-4.33	-0.2498	HYD-ICP
F063	46.00	6.571	7	LVL				HYDRIDE AA
F025	84.50	9.389	9	ELL				AA HYDRIDE
F069	49.00	9.800	5					Graphite Furnace
F011	89.50	9.944	9	EL				Hydride AA
F037	104.50	10.450	10					ICP-MS
F094	97.00	10.778	9					ICPMS
F009	110.50	11.050	10					ICP-MS
F038	111.00	11.100	10					ICPMS
F015	103.50	11.500	9	EH				GFAA
F008	84.50	12.071	7					Hydride
F019	76.50	12.750	6	EHLL				AA - Hydride
F133	97.50	13.929	7					ICP-MS
F103	70.00	14.000	5	L				GFAA
F080	74.00	14.800	5					Hydride Gen ICP
F139	165.00	16.500	10	HVH				ICP-MS
F022	67.00	16.750	4		INSUFFICIENT DATA			ICP-AES
F046	169.00	16.900	10	HHH				ICP-MS As Received
F014	142.50	17.813	8	H				ICP-MS
F012	93.00	18.600	5					ICP-MS
F048	170.00	18.889	9	HHH				ICP
F060	171.50	19.056	9	ELHEHVHVHVHVH				Hydride - AA
F096	173.50	19.278	9	HHVHVH	BIASED HIGH	15.97	-0.0794	Auto hydride AA
F064	197.00	21.889	9	EHEHEHEHEHEHEHEHEH	BIASED HIGH	10.96	9.8772	Colorimetric

* 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 12.361

PARAMETER: 56095 Barium ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.5000 BASIC ACCEPTABLE ERROR= 1.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	18.9	9.00	5.7	9.50	0.7	3.00	20.9	13.50	63.1	11.00	21.3	13.50
F008	21.	27.50	6.	15.50	<1.	0.00	23.	28.50	71. H	31.00	23.	26.00
F009	19.	12.50	5.6	6.50	<1.	0.00	22.	25.00	67.	25.00	22.	19.50
F010	20.	18.50	6.	15.50	0.7	3.00	21.	16.50	65.	18.50	21.	9.50
F011	18.5	5.50	5.7	9.50	0.9	10.00	17.7 L	3.00	62.1	7.00	23.4	28.00
F012	21.	27.50	7.	27.50	<5.	0.00	23.	28.50	66.	20.50	23.	26.00
F014	20.	18.50	<10.	0.00	<10.	0.00	20.	6.00	64.	13.50	21.	9.50
F015	19.	12.50	6.	15.50	<1.	0.00	21.	16.50	63.	10.00	21.	9.50
F019	21.	27.50	5.	2.50	<2.	0.00	21.	16.50	62.	5.50	21.	9.50
F022	20.	18.50	8. EH	29.00	<5.	0.00	20.	6.00	62.	5.50	22.	19.50
F024	21.	27.50	6.	15.50	<1.	0.00	22.	25.00	69.	28.00	22.	19.50
F025	20.	18.50	<10.	0.00	<10.	0.00	20.	6.00	80. EH	32.00	30. EH	32.00
F031	20.	18.50	6.	15.50	<1.	0.00	21.	16.50	65.	18.50	21.	9.50
F032	20.2	22.50	6.3	23.00	<1.	0.00	22.0	25.00	70.3 H	30.00	22.8	24.00
F032b	20.7	25.00	6.07	19.50	0.771	8.00	23.0	28.50	67.	25.00	23.6	29.00
F037	19.50	15.00	6.445	26.00	<5.0	0.00	21.17	19.00	66.40	22.00	21.79	16.00
F038	19.	12.50	5.66	8.00	0.74	6.00	20.9	13.50	64.4	16.00	22.2	23.00
F046	20.2	22.50	5.9	11.50	0.74	6.00	21.6	22.00	64.7	17.00	22.0	19.50
F048	18.5	5.50	4.08 EL	1.00	<1.0	0.00	20.5	10.00	66.9	23.00	21.3	13.50
F060	20.	18.50	5.9	11.50	0.7	3.00	21.3	21.00	67.0	25.00	21.8	17.00
F063	18.	3.50	6.	15.50	<1.	0.00	17. L	2.00	59. L	3.00	19. L	2.00
F064	30. EH	32.00	11. EH	30.00	<10.	0.00	36. EH	32.00	64.	13.50	25. H	30.00
F069	19.0	12.50	5.56	5.00	<1.	0.00	20.4	9.00	62.2	8.00	20.9	6.00
F080	18.9	9.00	6.4	24.50	<2.5	0.00	21.2	20.00	63.9	12.00	21.7	15.00
F093	20.3	24.00	6.4	24.50	1.1	11.00	21.8	23.00	66.0	20.50	22.1	22.00
F094	18.	3.50	6.2	21.50	0.8	9.00	19.9	4.00	60.9	4.00	20.4	4.00
F095	15. EL	1.00	5.	2.50	<1.	0.00	16. VL	1.00	52. EL	1.00	16. EL	1.00
F096	18.9	9.00	5.6	6.50	<1.	0.00	20.6	11.50	64.2	15.00	21.0	9.50
F103	22.	30.00	7.	27.50	<5.	0.00	23.	28.50	70. H	29.00	23.	26.00
F133	18.70	7.00	5.10	4.00	0.53	1.00	20.6	11.50	62.6	9.00	20.5	5.00
F136	16.5 L	2.00	6.2	21.50	1.9 EH	12.00	20.1	8.00	55.7 VL	2.00	19.7	3.00
F139	22.07	31.00	6.07	19.50	0.74	6.00	27.32 EH	31.00	67.48	27.00	27.48 EH	31.00
MEDIAN	20.0000		6.0000		0.7400		21.0000		64.5500		21.7950	
1CRIT	2.6100		1.7700		1.5000		2.6700		5.2830		2.7177	
N	30		28		10		30		30		30	
MEAN	19.6623		6.0287		0.7891		21.1663		64.7293		21.9323	
3STDEV	3.6267		1.8208		0.3555		5.2573		9.7952		4.7297	

PARAMETER: 56095 Barium ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	72.8	10.00	327.	18.00	339.	12.00	221.	13.00
F008	80. H	30.00	351. H	30.00	368. H	30.00	239. H	28.00
F009	75.	22.50	336.	24.50	354.	25.00	230.	25.00
F010	73.	14.00	323.	15.00	342.	18.00	223.	15.50
F011	68.2	4.00	301. L	3.00	308. VL	3.00	204. L	3.00
F012	76.	25.00	327.	18.00	350.	22.00	229.	22.50
F014	72.9	11.50	312.	6.50	343.	20.00	230.	25.00
F015	72.	6.00	327.	18.00	351.	23.00	225.	18.00
F019	73.	14.00	322.	13.00	340.	14.00	218.	10.50
F022	73.	14.00	320.	11.00	340.	14.00	220.	12.00
F024	78.	28.00	350. H	29.00	365. H	29.00	240. H	29.00
F025	90. EH	31.00	440. EH	32.00	460. EH	32.00	310. EH	32.00
F031	74.	19.50	336.	24.50	356.	27.00	228.	21.00
F032	72.3	7.50	322.	13.00	334.	9.50	227.	19.50
F032b	76.1	26.00	304. L	4.00	319. L	4.00	218.	10.50
F037	73.18	16.00	327.8	20.00	347.1	21.00	214.6	6.00
F038	74.5	21.00	333.	23.00	342.	18.00	229.	22.50
F046	73.3	17.00	325.	16.00	341.	16.00	222.	14.00
F048	99.8 EH	32.00	340.2	28.00	383.2 VH	31.00	285.8 EH	31.00
F060	75.9	24.00	339.	27.00	355.	26.00	230.	25.00
F063	68.	3.00	329.	22.00	340.	14.00	215.	7.00
F064	74.	19.50	317.	10.00	334.	9.50	224.	17.00
F069	70.6	5.00	322.	13.00	336.	11.00	217.	9.00
F080	72.3	7.50	313.	8.00	325.	7.00	216.	8.00
F093	75.0	22.50	337.0	26.00	352.3	24.00	227.0	19.50
F094	76.2	27.00	308.	5.00	321.	5.00	232.	27.00
F095	57. EL	1.00	262. EL	2.00	274. EL	2.00	178. EL	1.00
F096	72.9	11.50	328.	21.00	342.	18.00	223.	15.50
F103	79.	29.00	352. H	31.00	359.	28.00	242. H	30.00
F133	72.7	9.00	312.	6.50	328.	8.00	209.	4.00
F136	66.5 L	2.00	314.4	9.00	322.0	6.00	213.7	5.00
F139	73.37	18.00	243.71 EL	1.00	271.33 EL	1.00	193.13 VL	2.00
MEDIAN	73.2400		326.0000		341.5000		223.5000	
1CRIT	5.8044		20.9700		21.9000		14.8200	
N	30		30		30		30	
MEAN	74.1250		323.9133		340.3534		224.8410	
3STDEV	12.3569		51.6909		59.2897		45.5937	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	112.50	11.250	10					ICP
F008	246.50	27.389	9	H H H H H	BIASED HIGH	7.59	0.1287	GF-ICP
F009	185.50	20.611	9					ICP-MS
F010	144.00	14.400	10					ICP-OES
F011	76.00	7.600	10	L L VLL	BIASED LOW	-9.07	1.0743	
F012	217.50	24.167	9					ICP-MS
F014	110.50	13.813	8					ICP-MS
F015	129.00	14.333	9					ICP
F019	113.00	12.556	9					ICAP
F022	129.50	14.389	9	EH				ICP-AES
F024	230.50	25.611	9	H H H	BIASED HIGH	7.35	-0.5883	
F025	215.50	26.938	8	EHEHEHEHEHEH	BIASED HIGH	37.43	-6.2749	ICP
F031	170.50	18.944	9					ICP
F032	174.00	19.333	9	H				ICP-AES
F032b	179.50	17.950	10	L L				ICP-MS
F037	161.00	17.889	9					ICP-MS
F038	163.50	16.350	10					ICPMS
F046	161.50	16.150	10					ICP-MS As Received
F048	175.00	19.444	9	EL EH VHEH				ICP
F060	198.00	19.800	10					ICP
F063	72.00	8.000	9	L L L				ICP-AES
F064	193.50	21.500	9	EHEH EH H				AA
F069	78.50	8.722	9					ICP
F080	111.00	12.333	9					ICP dig conc
F093	217.00	21.700	10					ICP
F094	110.00	11.000	10					ICPMS
F095	12.50	1.389	9	EL VLELELELELELEL	BIASED LOW	-19.53	-0.9101	ICP-USN
F096	117.50	13.056	9					ICP
F103	259.00	28.778	9	H H H	BIASED HIGH	6.53	0.8580	ICP-OES
F133	65.00	6.500	10		BIASED LOW*	-4.48	0.0639	ICP-MS
F136	70.50	7.050	10	L EH VL L	BIASED LOW*	-4.33	-1.4082	DCP
F139	167.50	16.750	10	EH EH ELELVL				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 15.997

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F095	12.50	1.389	9	ELVLELELELELELEL	BIASED LOW	-19.53	-0.9101	ICP-USN
F133	65.00	6.500	10		BIASED LOW*	-4.48	0.0639	ICP-MS
F136	70.50	7.050	10	LEHVLL	BIASED LOW*	-4.33	-1.4082	DCP
F011	76.00	7.600	10	LLVLL	BIASED LOW	-9.07	1.0743	
F063	72.00	8.000	9	LLL				ICP-AES
F069	78.50	8.722	9					ICP
F094	110.00	11.000	10					ICPMS
F003	112.50	11.250	10					ICP
F080	111.00	12.333	9					ICP dig conc
F019	113.00	12.556	9					ICAP
F096	117.50	13.056	9					ICP
F014	110.50	13.813	8					ICP-MS
F015	129.00	14.333	9					ICP
F022	129.50	14.389	9	EH				ICP-AES
F010	144.00	14.400	10					ICP-OES
F046	161.50	16.150	10					ICP-MS As Received
F038	163.50	16.350	10					ICPMS
F139	167.50	16.750	10	EHEHELELVL				ICP-MS
F037	161.00	17.889	9					ICP-MS
F032b	179.50	17.950	10	LL				ICP-MS
F031	170.50	18.944	9					ICP
F032	174.00	19.333	9	H				ICP-AES
F048	175.00	19.444	9	ELEHVHEH				ICP
F060	198.00	19.800	10					ICP
F009	185.50	20.611	9					ICP-MS
F064	193.50	21.500	9	EHEHEHH				AA
F093	217.00	21.700	10					ICP
F012	217.50	24.167	9					ICP-MS
F024	230.50	25.611	9	HHH	BIASED HIGH	7.35	-0.5883	
F025	215.50	26.938	8	EHEHEHEHEHEH	BIASED HIGH	37.43	-6.2749	ICP
F008	246.50	27.389	9	HHHHH	BIASED HIGH	7.59	0.1287	GF-ICP
F103	259.00	28.778	9	HHH	BIASED HIGH	6.53	0.8580	ICP-OES

* 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 15.997

Barium

PARAMETER: 94095 Beryllium ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.5000 BASIC ACCEPTABLE ERROR= 0.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	<0.05	0.00	2.75	4.00	0.27	2.00	<0.05	0.00	6.94	7.00	<0.2	0.00
F009	<0.5	0.00	2.3 L	2.00	<0.5	0.00	<0.5	0.00	5.7 L	1.00	<0.5	0.00
F010	<0.1	0.00	2.8	7.00	0.2	1.00	<0.1	0.00	7.2	13.50	<0.1	0.00
F011	<0.1	0.00	3.	14.00	0.4	6.00	<0.1	0.00	7.5	18.00	0.1	1.00
F012	<5.	0.00	5. EH	21.00	<5.	0.00	<5.	0.00	10. EH	23.00	<5.	0.00
F015	1. VH	1.00	3.	14.00	<1.	0.00	<1.	0.00	7.	10.00	<1.	0.00
F019	<1.	0.00	3.	14.00	<1.	0.00	<1.	0.00	7.	10.00	<1.	0.00
F022	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	6. L	2.50	<5.	0.00
F025	<1.	0.00	1. EL	1.00	2. EH	7.00	<1.	0.00	6. L	2.50	2. EH	2.00
F032	<0.03	0.00	2.99	10.00	0.291	4.00	<0.03	0.00	7.86	19.00	<0.03	0.00
F032b	<1.	0.00	2.78	5.00	<1.	0.00	<1.	0.00	6.86	6.00	<1.	0.00
F038	<0.5	0.00	2.8	7.00	<0.5	0.00	<0.5	0.00	7.	10.00	<0.5	0.00
F046	<0.1	0.00	3.1	18.00	0.30	5.00	<0.1	0.00	8.0 H	21.00	<0.1	0.00
F048	<1.0	0.00	3.33	19.00	<1.0	0.00	<1.0	0.00	7.95 H	20.00	<1.0	0.00
F060	<0.5	0.00	2.7	3.00	<0.5	0.00	<0.5	0.00	7.0	10.00	<0.5	0.00
F069	<1.	0.00	2.85	9.00	<1.	0.00	<1.	0.00	7.33	17.00	<1.	0.00
F080	<6.	0.00	<6.	0.00	<6.	0.00	<6.	0.00	6.8	5.00	<6.	0.00
F094	<0.5	0.00	3.	14.00	<0.5	0.00	<0.5	0.00	6.3	4.00	<0.5	0.00
F095	<1.	0.00	3.	14.00	<1.	0.00	<1.	0.00	7.	10.00	<1.	0.00
F096	<1.	0.00	2.8	7.00	<1.	0.00	<1.	0.00	7.2	13.50	<1.	0.00
F103	<0.5	0.00	3.0	14.00	<0.5	0.00	<0.5	0.00	7.3	15.50	<0.5	0.00
F133	<0.5	0.00	3.0	14.00	<0.5	0.00	<0.5	0.00	7.3	15.50	<0.5	0.00
F139	<0.01	0.00	3.44	20.00	0.28	3.00	<0.01	0.00	8.40 VH	22.00	<0.01	0.00
MEDIAN OR *TARGET												
CONC.	*0.0100		3.0000		0.2910		*0.0100		7.0000		*0.0100	
1CRIT	0.5000		0.6500		0.5000		0.5000		0.8900		0.5000	
N	1		19		5		0		21		2	
MEAN	1.0000		2.9284		0.3082		-		7.1400		1.0500	
3STDEV	-		0.7048		-		-		1.7763		-	

PARAMETER: 94095 Beryllium ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	9.	8.00	19.8	10.50	13.	11.00	14.8	10.00
F009	7.4 VL	2.00	17. VL	1.00	11. VL	2.50	12. EL	1.00
F010	9.0	8.00	19.2	9.00	12.5	7.00	14.4	5.00
F011	9.8	15.00	20.6	16.50	13.5	13.50	14.6	7.00
F012	12. EH	23.00	21.	20.00	16. VH	23.00	17. H	23.00
F015	9.	8.00	20.	13.50	14.	18.00	16.	19.50
F019	9.	8.00	20.	13.50	14.	18.00	15.	12.50
F022	7. VL	1.00	19.	8.00	13.	11.00	13. L	2.50
F025	11. VH	22.00	18. L	3.00	9. EL	1.00	15.	12.50
F032	8.59	5.00	18.6	6.50	12.2	6.00	14.6	7.00
F032b	8.51	4.00	18. L	3.00	11.2 L	4.00	14.	4.00
F038	9.	8.00	21.	20.00	13.	11.00	16.	19.50
F046	10.1	18.00	20.9	18.00	13.7	16.00	15.8	17.50
F048	10.2	19.00	21.6	23.00	14.6 H	22.00	16.4 H	21.00
F060	9.1	11.00	19.8	10.50	12.9	8.50	14.7	9.00
F069	9.41	14.00	20.6	16.50	13.6	15.00	15.5	15.00
F080	10.4 H	20.00	18.4	5.00	14.2	20.00	14.6	7.00
F094	10.	16.50	18.6	6.50	11.6 L	5.00	15.7	16.00
F095	8. L	3.00	18. L	3.00	11. VL	2.50	13. L	2.50
F096	9.26	12.00	20.	13.50	13.5	13.50	15.0	12.50
F103	9.3	13.00	20.0	13.50	12.9	8.50	15.0	12.50
F133	10.0	16.50	21.0	20.00	14.0	18.00	15.8	17.50
F139	10.67 H	21.00	21.07	22.00	14.47 H	21.00	16.65 H	22.00
MEDIAN OR *TARGET CONC.	9.2600		20.0000		13.0000		15.0000	
1CRIT	1.0256		1.6700		1.2500		1.3700	
N	21		21		21		21	
MEAN	9.3686		19.6938		13.0414		15.0262	
3STDEV	2.5766		3.2007		3.2459		2.8278	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	52.50	7.500	7					
F009	9.50	1.583	6	L L VLVLVLEL	BIASED LOW	-14.41	-0.3617	ICP-MS
F010	50.50	7.214	7					ICP-OES
F011	91.00	11.375	8					
F012	133.00	22.167	6	EH EH EH VHH	BIASED HIGH	-6.89	3.0619	ICP-MS
F015	84.00	12.000	7	VH				ICP
F019	76.00	12.667	6					ICAP
F022	25.00	5.000	5	L VL L				ICP-AES
F025	51.00	6.375	8	ELEH L EHVHL EL				ICP-MS
F032	57.50	8.214	7					ICP-AES
F032b	26.00	4.333	6	L L	BIASED LOW	-11.28	0.2798	ICP-MS
F038	75.50	12.583	6					ICPMS
F046	113.50	16.214	7	H				ICP-MS As Received
F048	124.00	20.667	6	H H H	BIASED HIGH	7.45	0.3014	ICP
F060	52.00	8.667	6					ICP
F069	86.50	14.417	6					ICP-MS
F080	57.00	11.400	5	H				ICP dig conc
F094	62.00	10.333	6	L				ICPMS
F095	35.00	5.833	6	L L VLL				ICP-USN
F096	72.00	12.000	6					ICP
F103	77.00	12.833	6					ICP-OES
F133	101.50	16.917	6					ICP-MS
F139	131.00	18.714	7	VH H H H	BIASED HIGH	6.20	0.4625	ICP-MS

OVERALL AVERAGE
RANK IS 11.253

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F009	9.50	1.583	6	LLVLVLVLEL	BIASED LOW	-14.41	-0.3617	ICP-MS
F032b	26.00	4.333	6	LL	BIASED LOW	-11.28	0.2798	ICP-MS
F022	25.00	5.000	5	LVLL				ICP-AES
F095	35.00	5.833	6	LLVLL				ICP-USN
F025	51.00	6.375	8	ELEHLEHVHLEL				ICP-MS
F010	50.50	7.214	7					ICP-OES
F003	52.50	7.500	7					
F032	57.50	8.214	7					ICP-AES
F060	52.00	8.667	6					ICP
F094	62.00	10.333	6	L				ICPMS
F011	91.00	11.375	8					
F080	57.00	11.400	5	H				ICP dig conc
F015	84.00	12.000	7	VH				ICP
F096	72.00	12.000	6					ICP
F038	75.50	12.583	6					ICPMS
F019	76.00	12.667	6					ICAP
F103	77.00	12.833	6					ICP-OES
F069	86.50	14.417	6					ICP-MS
F046	113.50	16.214	7	H				ICP-MS As Received
F133	101.50	16.917	6					ICP-MS
F139	131.00	18.714	7	VHHHH	BIASED HIGH	6.20	0.4625	ICP-MS
F048	124.00	20.667	6	HHH	BIASED HIGH	7.45	0.3014	ICP
F012	133.00	22.167	6	EHEHEHVHH	BIASED HIGH	-6.89	3.0619	ICP-MS

OVERALL AVERAGE
RANK IS 11.253

Beryllium

PARAMETER: 83095 Bismuth ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.5000 BASIC ACCEPTABLE ERROR= 0.5000 CONCENTRATION ERROR INCREMENT= 0.0800

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F011	<0.1	0.00	3.4	4.00	0.8	3.00	0.2	3.00	8.4	4.00	1.3 EH	3.00
F038	<0.5	0.00	3.	3.00	<0.5	0.00	<0.5	0.00	7.3	3.00	<0.5	0.00
F060	<7.	0.00	<7.	0.00	<7.	0.00	<7.	0.00	<7. L	0.00	<7.	0.00
F093	<2.0	0.00	3.6	5.00	<2.0	0.00	<2.0	0.00	8.8	5.00	<2.0	0.00
F094	0.05	2.00	4.47 H	7.00	0.87	4.00	0.06	1.50	10. H	6.50	<0.05	0.00
F096	<20.	0.00	<20.	0.00	<20.	0.00	<20.	0.00	<20.	0.00	<20.	0.00
F103	<1.	0.00	4.0	6.00	1.0	5.00	<1.	0.00	10.0 H	6.50	<1.	0.00
F133	<0.05	0.00	2.40 L	2.00	0.45	2.00	<0.05	0.00	6.13 EL	2.00	0.05	1.00
F139	0.005	1.00	1.88 EL	1.00	0.41	1.00	0.06	1.50	5.01 EL	1.00	0.10	2.00
MEDIAN OR *TARGET CONC.	*0.0500		3.4000		0.8000		*0.0500		8.4000		*0.1000	
1CRIT	0.5000		0.7320		0.5240		0.5000		1.1320		0.5000	
N	2		5		3		0		4		1	
MEAN	0.0275		3.2800		0.7067		-		7.6575		0.1000	
3STDEV	-		-		-		-		-		-	

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F011	15.5	4.00	19.9	5.00	29.9	5.00	16.	5.00
F038	18. H	6.00	22. H	7.00	30.	6.00	17.	6.50
F060	8. VL	1.00	15. VL	2.00	21. VL	2.00	15.	3.00
F093	15.8	5.00	18.3	4.00	26.0	4.00	15.6	4.00
F094	20.4 VH	8.00	22. H	7.00	30.8 H	7.00	19.2 VH	8.00
F096	<20.	0.00	<20.	0.00	<20. VL	0.00	<20.	0.00
F103	20. VH	7.00	22. H	7.00	32. VH	8.00	17.	6.50
F133	12.53 VL	3.00	16.18 L	3.00	23.43 VL	3.00	11.83 VL	2.00
F139	10.72 VL	2.00	13.96 VL	1.00	18.94 VL	1.00	10.75 VL	1.00
MEDIAN OR *TARGET CONC.	15.6500		19.1000		27.9500		15.8000	
1CRIT	1.7120		1.9880		2.6960		1.7240	
N	6		7		6		6	
MEAN	15.4250		19.3400		26.8550		15.4050	
3STDEV	9.3455		8.1327		11.0545		5.2571	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F011	36.00	4.000	9	EH				
F038	31.50	5.250	6	H H				ICPMS
F060	8.00	2.000	4	L VLVLVL				ICP
F093	27.00	4.500	6					ICP - Hydride
F094	51.00	5.667	9	H H VHH H VH				ICPMS
F096	0.00	*******	0	VL				ICP
F103	46.00	6.571	7	H VHH VH				GFAA
F133	18.00	2.250	8	L EL VLL VLVL				ICP-MS
F139	12.50	1.250	10	EL EL VLVLVLVL				ICP-MS

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

OVERALL AVERAGE
RANK IS 3.898

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F096	0.00	*******	0	VL				ICP
F139	12.50	1.250	10	ELELVLVLVLVL				ICP-MS
F060	8.00	2.000	4	LVLVLVL				ICP
F133	18.00	2.250	8	LELVLLVLVL				ICP-MS
F011	36.00	4.000	9	EH				
F093	27.00	4.500	6					ICP - Hydride
F038	31.50	5.250	6	HH				ICPMS
F094	51.00	5.667	9	HHVHHHVH				ICPMS
F103	46.00	6.571	7	HVHHVH				GFAA

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

OVERALL AVERAGE
RANK IS 3.898

Bismuth

PARAMETER: 48095 Cadmium ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.0000 BASIC ACCEPTABLE ERROR= 1.0000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	<1.0	0.00	8.5	12.00	<1.0	0.00	<1.0	0.00	7.5	17.00	<1.0	0.00
F003	0.1	3.00	8.3	9.00	0.4	2.00	0.1	3.00	7.1	7.00	<1.	0.00
F008	<5.	0.00	7.9	4.00	<5.	0.00	<5.	0.00	7.2	8.50	<5.	0.00
F009	0.1	3.00	8.5	12.00	0.5	9.00	0.1	3.00	7.4	13.50	0.1	2.50
F010	0.2	13.50	8.7	18.00	0.5	9.00	0.4	15.00	7.5	17.00	0.4	14.50
F011	0.2	13.50	8.7	18.00	0.6	15.50	0.1	3.00	7.3	10.00	0.2	12.50
F012	<5.	0.00	12. EH	35.00	<5.	0.00	<5.	0.00	10. EH	35.00	<5.	0.00
F014	0.2	13.50	8.4	10.00	0.4	2.00	0.1	3.00	7.5	17.00	0.1	2.50
F015	<0.2	0.00	8.5	12.00	0.5	9.00	<0.2	0.00	7.7	21.50	<0.2	0.00
F019	<4.	0.00	9.	22.50	<4.	0.00	<4.	0.00	8.	28.50	<4.	0.00
F022	<2.	0.00	9.	22.50	<2.	0.00	<2.	0.00	7.	6.00	<2.	0.00
F024	<1.	0.00	9.	22.50	<1.	0.00	<1.	0.00	8.	28.50	<1.	0.00
F025	<0.2	0.00	8.1	6.50	<0.2	0.00	<0.2	0.00	6.9	4.00	<0.2	0.00
F026	1.70 EH	19.00	9.34	31.00	0.61	17.00	2.01 EH	16.00	8.34	32.00	1.99 EH	17.00
F031	1. EH	18.00	8.	5.00	1.	21.50	<1.	0.00	8.	28.50	1. EH	16.00
F032	<1.	0.00	9.85	34.00	<1.	0.00	<1.	0.00	8.5	33.00	<1.	0.00
F032b	<0.5	0.00	8.54	14.00	<0.5	0.00	<0.5	0.00	7.4	13.50	<0.5	0.00
F037	0.2277	16.00	9.232	28.00	0.5103	12.00	0.1533	10.00	7.891	25.00	0.1624	10.00
F038	0.14	6.50	8.68	16.00	0.47	5.00	0.13	7.50	7.61	20.00	0.14	5.50
F046	0.15	9.50	9.5	32.00	0.49	6.00	0.12	6.00	8.3	31.00	0.14	5.50
F048	<1.0	0.00	9.84	33.00	1.10	23.00	<1.0	0.00	8.70	34.00	<1.0	0.00
F049	0.15	9.50	9.01	25.00	0.52	13.00	0.15	9.00	7.37	12.00	0.15	7.50
F060	<0.5	0.00	9.	22.50	0.6	15.50	<0.5	0.00	7.7	21.50	<0.5	0.00
F063	0.1	3.00	7.6	3.00	0.4	2.00	<0.1	0.00	6.5	3.00	0.1	2.50
F064	<5.	0.00	7. L	1.50	<5.	0.00	<5.	0.00	6. L	1.50	<5.	0.00
F069	<1.	0.00	9.02	26.00	<1.	0.00	<1.	0.00	7.89	24.00	<1.	0.00
F080	<2.5	0.00	9.1	27.00	<2.5	0.00	<2.5	0.00	7.5	17.00	<2.5	0.00
F093	<0.3	0.00	8.8	20.00	<0.3	0.00	<0.3	0.00	7.2	8.50	<0.3	0.00
F094	0.1	3.00	8.6	15.00	0.5	9.00	0.2	12.50	7.5	17.00	0.2	12.50
F095	<1.	0.00	7. L	1.50	1.	21.50	<1.	0.00	6. L	1.50	<1.	0.00
F096	0.2	13.50	8.1	6.50	0.9	20.00	0.3	14.00	7.9	26.00	0.4	14.50
F103	0.14	6.50	8.29	8.00	0.67	18.00	0.13	7.50	7.32	11.00	0.16	9.00
F133	0.1	3.00	8.7	18.00	0.5	9.00	0.1	3.00	8.0	28.50	0.1	2.50
F135	0.3	17.00	13.8 EH	36.00	0.8	19.00	<0.1	0.00	12.8 EH	36.00	<0.1	0.00
F136	0.15	9.50	9.25	29.50	0.55	14.00	0.18	11.00	6.99	5.00	0.15	7.50
F139	0.15	9.50	9.25	29.50	0.45	4.00	0.20	12.50	7.84	23.00	0.19	11.00
MEDIAN	0.1500		8.7000		0.5103		0.1400		7.5000		0.1600	
1CRIT	1.0000		1.4620		1.0000		1.0000		1.3900		1.0000	
N	18		33		22		15		33		16	
MEAN	0.2060		8.8576		0.5850		0.1642		7.6834		0.2308	
3STDEV	0.5989		2.2759		0.5307		0.2475		1.8770		0.6539	

PARAMETER: 48095 Cadmium ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	25.0	18.00	158.	21.00	268.	23.00	99.0	23.50
F003	24.	6.50	156.	19.50	263.	14.50	97.	13.50
F008	30. EH	36.00	174. VH	36.00	297. VH	36.00	113. VH	36.00
F009	25.	18.00	154.	13.00	261.	13.00	95.	10.00
F010	24.7	11.50	156.	19.50	265.	20.00	97.	13.50
F011	24.9	14.50	147.	8.00	246. L	7.00	88. VL	5.00
F012	26.	27.00	140. VL	5.00	234. VL	4.50	89. L	6.50
F014	25.0	18.00	146.	7.00	256.	9.50	101.	29.00
F015	24.	6.50	159.	24.00	271.	26.00	98.	16.00
F019	25.	18.00	159.	24.00	274.	29.00	99.	23.50
F022	23.	4.50	133. VL	2.00	256.	9.50	99.	23.50
F024	27.	30.00	170. H	34.00	290. VH	34.50	100.	28.00
F025	22.6	3.00	141. L	6.00	242. L	6.00	85.3 VL	3.00
F026	26.36	29.00	163.03	29.00	260.88	12.00	98.42	18.00
F031	22. L	2.00	136. VL	4.00	233. VL	3.00	82. VL	2.00
F032	24.6	9.50	155.	15.00	264.	18.00	102.	30.50
F032b	24.9	14.50	155.	15.00	260.	11.00	96.9	12.00
F037	26.28	28.00	163.9	30.00	277.9	32.00	98.78	19.00
F038	24.6	9.50	159.	24.00	266.	21.00	97.3	15.00
F046	27.2	32.50	171. VH	35.00	290. VH	34.50	106. H	32.50
F048	27.2	32.50	164.6	32.00	275.3	30.00	106.0 H	32.50
F049	25.5	22.50	150.	10.00	221. VL	2.00	99.	23.50
F060	25.3	21.00	159.	24.00	270.	25.00	98.9	21.00
F063	23.	4.50	148.	9.00	267.	22.00	89. L	6.50
F064	25.	18.00	135. VL	3.00	234. VL	4.50	86. VL	4.00
F069	25.9	26.00	167. H	33.00	272.	27.00	98.3	17.00
F080	24.7	11.50	152.	11.00	264.	18.00	94.4	8.00
F093	25.5	22.50	162.3	28.00	273.1	28.00	99.7	27.00
F094	27.3	34.00	155.	15.00	264.	18.00	107. H	34.00
F095	20. EL	1.00	122. EL	1.00	204. EL	1.00	75. EL	1.00
F096	25.8	24.00	164.	31.00	277.	31.00	102.	30.50
F103	24.8	13.00	153.	12.00	280.	33.00	94.8	9.00
F133	27.1	31.00	160.5	27.00	269.	24.00	98.8	20.00
F135	28. H	35.00	159.	24.00	263.	14.50	109. VH	35.00
F136	24.5	8.00	155.1	18.00	263.9	16.00	96.1	11.00
F139	25.85	25.00	155.01	17.00	248.37	8.00	99.42	26.00
MEDIAN	25.0000		155.5500		264.0000		98.6000	
1CRIT	2.4400		10.2730		16.7800		6.8560	
N	34		34		34		34	
MEAN	25.2232		154.7482		262.3367		97.2682	
3STDEV	4.1000		28.2426		46.6419		18.0497	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	114.50	19.083	6					48302 48301
F003	78.00	8.667	9					ICP
F008	156.50	26.083	6	EHVHVHVH				GF-ICP
F009	97.00	9.700	10					ICP-MS
F010	151.50	15.150	10					ICP-OES
F011	107.00	10.700	10	L VL				
F012	113.00	18.833	6	EH EH VLVLL				ICP-MS
F014	111.50	11.150	10					ICP-MS
F015	115.00	16.429	7					GFAA-ICP
F019	145.50	24.250	6					ICAP
F022	68.00	11.333	6	VL				ICP-AES
F024	177.50	29.583	6	H VH	BIASED HIGH	9.85	-1.7399	
F025	28.50	4.750	6	L L VL	BIASED LOW	-8.56	-0.9301	ICP-MS
F026	220.00	22.000	10	EH EH EH				I.C.P. EMISSION
F031	100.00	11.111	9	EH EHL VLVLVL				ICP
F032	140.00	23.333	6					ICP-AES
F032b	80.00	13.333	6					ICP-MS
F037	210.00	21.000	10					ICP-MS
F038	130.00	13.000	10					ICPMS
F046	224.50	22.450	10	VHVHH				ICP-MS As Received
F048	217.00	31.000	7	H	BIASED HIGH*	4.30	1.2545	ICP
F049	134.00	13.400	10	VL				
F060	150.50	21.500	7					ICP
F063	55.50	6.167	9	L	BIASED LOW*	-0.35	-1.8315	GFAA-ICP-AES
F064	32.50	5.417	6	L L VLVLVL	BIASED LOW	-11.87	0.0081	AA
F069	153.00	25.500	6	H				Graphite Furnace
F080	92.50	15.417	6					ICP dig conc
F093	134.00	22.333	6					ICP
F094	170.00	17.000	10	H				ICPMS
F095	28.50	4.071	7	L L ELELELEL	BIASED LOW	-22.74	0.3484	ICP-USN
F096	211.00	21.100	10					GFAA-ICP
F103	127.00	12.700	10					GFAA
F133	166.00	16.600	10					ICP-MS
F135	216.50	27.063	8	EH EH H VH	BIASED HIGH*	-0.63	3.7776	AA-ETA APHA
F136	129.50	12.950	10					GFAA 16 FAA 710
F139	165.50	16.550	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 16.326

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F095	28.50	4.071	7	LLELELELEL	BIASED LOW	-22.74	0.3484	ICP-USN
F025	28.50	4.750	6	LLVL	BIASED LOW	-8.56	-0.9301	ICP-MS
F064	32.50	5.417	6	LLVLVLVL	BIASED LOW	-11.87	0.0081	AA
F063	55.50	6.167	9	L	BIASED LOW*	-0.35	-1.8315	GFAA-ICP-AES
F003	78.00	8.667	9					ICP
F009	97.00	9.700	10					ICP-MS
F011	107.00	10.700	10	LVL				
F031	100.00	11.111	9	EHEHLVLVLVL				ICP
F014	111.50	11.150	10					ICP-MS
F022	68.00	11.333	6	VL				ICP-AES
F103	127.00	12.700	10					GFAA
F136	129.50	12.950	10					GFAA 16 FAA 710
F038	130.00	13.000	10					ICPMS
F032b	80.00	13.333	6					ICP-MS
F049	134.00	13.400	10	VL				
F010	151.50	15.150	10					ICP-OES
F080	92.50	15.417	6					ICP dig conc
F015	115.00	16.429	7					GFAA-ICP
F139	165.50	16.550	10					ICP-MS
F133	166.00	16.600	10					ICP-MS
F094	170.00	17.000	10	H				ICPMS
F012	113.00	18.833	6	EHEHVLVLL				ICP-MS
F002	114.50	19.083	6					48302 48301
F037	210.00	21.000	10					ICP-MS
F096	211.00	21.100	10					GFAA-ICP
F060	150.50	21.500	7					ICP
F026	220.00	22.000	10	EHEHEH				I.C.P. EMISSION
F093	134.00	22.333	6					ICP
F046	224.50	22.450	10	VHVHH				ICP-MS As Received
F032	140.00	23.333	6					ICP-AES
F019	145.50	24.250	6					ICAP
F069	153.00	25.500	6	H				Graphite Furnace
F008	156.50	26.083	6	EHVHVHVH				GF-ICP
F135	216.50	27.063	8	EHEHHVH	BIASED HIGH*	-0.63	3.7776	AA-ETA APHA
F024	177.50	29.583	6	HVH	BIASED HIGH	9.85	-1.7399	
F048	217.00	31.000	7	H	BIASED HIGH*	4.30	1.2545	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 16.326

PARAMETER: 24095 Chromium ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.5000 BASIC ACCEPTABLE ERROR= 1.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	2.2	19.00	7.6	18.00	0.6	2.50	0.2	2.00	3.7	17.00	0.2	1.50
F003	1.9	7.50	7.	7.50	0.7	5.00	0.2	2.00	3.3	8.50	1.	6.50
F008	2.	13.50	8.	25.50	<2.	0.00	<2.	0.00	4.	23.50	<2.	0.00
F009	1.8	5.00	7.	7.50	0.7	5.00	0.2	2.00	3.4	10.00	0.3	3.50
F010	1.0	1.50	7.2	11.00	0.6	2.50	0.4	5.00	3.2	6.50	0.2	1.50
F011	1.5	3.00	7.4	12.00	1.	14.50	<0.2	0.00	3.2	6.50	<0.2	0.00
F012	<5.	0.00	8.	25.50	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00
F014	1.9	7.50	6.5	4.00	0.9	11.00	<0.5	0.00	3.3	8.50	<0.5	0.00
F015	2.3	20.00	7.7	21.00	0.9	11.00	<0.5	0.00	4.3	26.00	<0.5	0.00
F019	<6.	0.00	7.	7.50	<6.	0.00	<6.	0.00	<6.	0.00	<6.	0.00
F022	<5.	0.00	8.	25.50	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00
F024	2.	13.50	7.	7.50	<1.	0.00	<1.	0.00	4.	23.50	<1.	0.00
F025	<2.	0.00	<2. EL	0.00	2.	17.50	<2.	0.00	<2. EL	0.00	<2.	0.00
F031	2.	13.50	7.	7.50	1.	14.50	<1.	0.00	4.	23.50	<1.	0.00
F032	1.9	7.50	8.28	29.00	<1.	0.00	<1.	0.00	3.6	12.50	<1.	0.00
F032b	<5.	0.00	7.69	20.00	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00
F037	<1.0	0.00	5.569 L	2.00	<1.0	0.00	<1.0	0.00	1.745 EL	1.00	<1.0	0.00
F038	2.	13.50	7.5	15.00	0.9	11.00	<0.5	0.00	3.7	17.00	<0.5	0.00
F046	1.9	7.50	8.0	25.50	0.81	8.00	<0.2	0.00	3.8	20.00	<0.2	0.00
F048	2.03	17.00	7.50	15.00	<1.0	0.00	<1.0	0.00	3.64	15.00	<1.0	0.00
F060	2.1	18.00	7.6	18.00	0.9	11.00	<0.8	0.00	3.6	12.50	<0.8	0.00
F063	1.6	4.00	5.3 L	1.00	0.8	7.00	0.3	4.00	2.8	2.00	0.3	3.50
F064	17. EH	27.00	51. EH	32.00	42. EH	20.00	54. EH	6.00	47. EH	28.00	101. EH	8.00
F069	1.98	10.00	7.47	13.00	<1.	0.00	<1.	0.00	3.62	14.00	<1.	0.00
F080	2.5	21.00	8.0	25.50	<2.5	0.00	<2.5	0.00	3.7	17.00	<2.5	0.00
F093	3.1	24.00	9.6 H	31.00	2.3	19.00	<0.9	0.00	3.0	3.50	0.9	5.00
F094	4.4 EH	26.00	7.9	22.00	1.1	16.00	<0.4	0.00	3.8	20.00	<0.4	0.00
F095	1.	1.50	6.	3.00	<1.	0.00	<1.	0.00	3.	3.50	1.	6.50
F096	3.4	25.00	7.5	15.00	<2.	0.00	<2.	0.00	3.1	5.00	<2.	0.00
F103	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00
F133	2.0	13.50	7.0	7.50	0.5	1.00	<0.5	0.00	3.5	11.00	<0.5	0.00
F135	3.	23.00	8.	25.50	2.	17.50	<0.5	0.00	4.	23.50	<0.5	0.00
F136	2.0	13.50	7.6	18.00	0.7	5.00	<0.5	0.00	3.8	20.00	<0.5	0.00
F139	2.57	22.00	9.32	30.00	0.90	11.00	<0.5	0.00	4.41	27.00	<0.5	0.00
MEDIAN	2.0000		7.5500		0.9000		0.2500		3.6300		0.6000	
1CRIT	1.5300		1.8630		1.5000		1.5000		1.6278		1.5000	
N	24		30		18		5		26		5	
MEAN	2.2533		7.5310		1.0450		0.2600		3.5950		0.7000	
3STDEV	1.8970		2.3653		1.4798		-		1.1909		-	

PARAMETER: 24095 Chromium ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	62.2	14.00	449.6	7.00	373.3	22.00	276.1	14.00
F003	62.	12.00	460.	16.00	371.	18.50	278.	17.00
F008	70. H	30.50	490.	31.00	390.	31.00	290.	28.50
F009	60.	6.50	450.	8.00	357.	6.50	267.	6.00
F010	62.	12.00	453.	10.00	364.	12.00	273.	10.00
F011	62.4	15.50	469.	22.50	378.	27.00	283.	23.00
F012	63.	19.00	447.	6.00	362.	11.00	272.	8.50
F014	63.0	19.00	373. VL	2.00	317. VL	2.00	250. VL	3.00
F015	70. H	30.50	466.	20.00	373.	20.50	268.	7.00
F019	62.	12.00	458.	14.00	371.	18.50	275.	11.00
F022	60.	6.50	466.	20.00	367.	13.00	280.	20.00
F024	66.	26.50	480.	28.00	380.	28.00	290.	28.50
F025	43. EL	1.00	484.	30.00	373.	20.50	314. VH	30.00
F031	56. L	4.00	414. VL	3.00	342. L	4.00	248. VL	2.00
F032	60.6	9.00	446.	4.50	355.	5.00	282.	22.00
F032b	63.1	21.00	446.	4.50	357.	6.50	272.	8.50
F037	60.28	8.00	451.0	9.00	361.5	10.00	261.2	5.00
F038	63.	19.00	459.	15.00	369.	16.00	280.	20.00
F046	66.3	28.00	475.	26.00	382.	29.50	286.	26.50
F048	62.8	17.00	457.7	13.00	367.1	14.00	277.7	16.00
F060	64.5	24.50	471.	24.00	374.	24.00	284.	24.00
F063	47.4 VL	2.00	465.	18.00	374.	24.00	279.	18.00
F064	148. EH	34.00	574. EH	33.00	525. EH	34.00	395. EH	33.00
F069	62.4	15.50	454.	11.00	360.	8.00	276.	12.50
F080	61.7	10.00	457.	12.00	376.	26.00	276.	12.50
F093	63.9	22.00	466.0	20.00	367.2	15.00	277.4	15.00
F094	72.1 VH	32.00	479.	27.00	382.	29.50	319. VH	31.00
F095	50. VL	3.00	358. EL	1.00	289. VL	1.00	215. VL	1.00
F096	64.5	24.50	463.	17.00	374.	24.00	280.	20.00
F103	66.	26.50	474.	25.00	361.	9.00	286.	26.50
F133	64.0	23.00	482.	29.00	370.	17.00	285.	25.00
F135	73. VH	33.00	570. EH	32.00	460. VH	32.00	334. VH	32.00
F136	58.	5.00	469.	22.50	325. VL	3.00	258. L	4.00
F139	67.47	29.00	648. EH	34.00	517. EH	33.00	402. EH	34.00
MEDIAN	62.9000		464.0000		370.5000		278.5000	
1CRIT	5.1840		29.2500		23.6400		18.1200	
N	32		32		32		32	
MEAN	62.8016		466.1969		373.4406		283.5125	
3STDEV	15.5373		103.4789		101.8151		78.8205	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	117.00	11.700	10					24004
F003	100.50	10.050	10					
F008	183.50	26.214	7	H	BIASED HIGH	5.13	0.5567	GF-ICP
F009	60.00	6.000	10		BIASED LOW*	-3.32	-0.3851	ICP-MS
F010	72.00	7.200	10		BIASED LOW*	-2.05	-0.1857	ICP-OES
F011	124.00	15.500	8					
F012	70.00	14.000	5					ICP-MS
F014	57.00	7.125	8	VLVLVL	BIASED LOW	-17.13	3.6813	ICP-MS
F015	156.00	19.500	8	H				GFAA-ICP
F019	63.00	12.600	5					ICAP
F022	85.00	17.000	5					ICP-AES
F024	155.50	22.214	7					
F025	99.00	19.800	5	EL EL EL VH				ICP
F031	72.00	9.000	8	L VLL VL				ICP
F032	89.50	12.786	7					ICP-AES
F032b	60.50	12.100	5					ICP-MS
F037	35.00	5.833	6	L EL	BIASED LOW*	-2.67	-2.3571	ICP-MS
F038	126.50	15.813	8					ICPMS
F046	171.00	21.375	8					ICP-MS As Received
F048	107.00	15.286	7					ICP
F060	156.00	19.500	8					ICP
F063	83.50	8.350	10	L VL				GFAA-ICP-AES
F064	255.00	25.500	10	EHEHEHEHEHEHEHEHEH	BIASED HIGH	19.10	53.5776	AA
F069	84.00	12.000	7					ICP-MS
F080	124.00	17.714	7					ICP dig conc
F093	154.50	17.167	9	H				ICP
F094	203.50	25.438	8	EH VH VH	BIASED HIGH*	4.39	3.3854	ICPMS
F095	20.50	2.562	8	VLELVLVL	BIASED LOW	-22.64	0.3295	ICP-USN
F096	130.50	18.643	7					ICP
F103	87.00	21.750	4		INSUFFICIENT DATA			ICP-OES
F133	127.00	15.875	8					ICP-MS
F135	218.50	27.313	8	VHEHVHVH	BIASED HIGH	23.01	-1.2244	AA-ETA APHA
F136	91.00	11.375	8	VLL				GFAA 16 DCP 710
F139	220.00	27.500	8	EHEHEH	BIASED HIGH	41.10	-3.4174	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 15.405

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F095	20.50	2.562	8	VLELVLVL	BIASED LOW	-22.64	0.3295	ICP-USN
F037	35.00	5.833	6	LEL	BIASED LOW*	-2.67	-2.3571	ICP-MS
F009	60.00	6.000	10		BIASED LOW*	-3.32	-0.3851	ICP-MS
F014	57.00	7.125	8	VLVLVL	BIASED LOW	-17.13	3.6813	ICP-MS
F010	72.00	7.200	10		BIASED LOW*	-2.05	-0.1857	ICP-OES
F063	83.50	8.350	10	LVL				GFAA-ICP-AES
F031	72.00	9.000	8	LVLLVL				ICP
F003	100.50	10.050	10					
F136	91.00	11.375	8	VLL				GFAA 16 DCP 710
F002	117.00	11.700	10					24004
F069	84.00	12.000	7					ICP-MS
F032b	60.50	12.100	5					ICP-MS
F019	63.00	12.600	5					ICAP
F032	89.50	12.786	7					ICP-AES
F012	70.00	14.000	5					ICP-MS
F048	107.00	15.286	7					ICP
F011	124.00	15.500	8					
F038	126.50	15.813	8					ICPMS
F133	127.00	15.875	8					ICP-MS
F022	85.00	17.000	5					ICP-AES
F093	154.50	17.167	9	H				ICP
F080	124.00	17.714	7					ICP dig conc
F096	130.50	18.643	7					ICP
F060	156.00	19.500	8					ICP
F015	156.00	19.500	8	H				GFAA-ICP
F025	99.00	19.800	5	ELELELVH				ICP
F046	171.00	21.375	8					ICP-MS As Received
F103	87.00	21.750	4		INSUFFICIENT DATA			ICP-OES
F024	155.50	22.214	7					
F094	203.50	25.438	8	EHVHVH	BIASED HIGH*	4.39	3.3854	ICPMS
F064	255.00	25.500	10	EHEHEHEHEHEHEHEHEHEH	BIASED HIGH	19.10	53.5776	AA
F008	183.50	26.214	7	H	BIASED HIGH	5.13	0.5567	GF-ICP
F135	218.50	27.313	8	VHEHVHVH	BIASED HIGH	23.01	-1.2244	AA-ETA APHA
F139	220.00	27.500	8	EHEHEH	BIASED HIGH	41.10	-3.4174	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 15.405

PARAMETER: 27095 Cobalt ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.5000 BASIC ACCEPTABLE ERROR= 1.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	0.1	2.00	12.5	5.50	0.3	5.00	0.1	1.00	12.	6.00	<1.	0.00
F008	<2.	0.00	14.	23.50	<2.	0.00	<2.	0.00	14.	24.50	<2.	0.00
F009	<1.	0.00	12.	4.00	<1.	0.00	<1.	0.00	12.	6.00	<1.	0.00
F010	0.2	3.00	13.0	9.50	<0.1	0.00	0.3	5.50	13.0	13.00	0.3	4.00
F011	<0.1	0.00	13.7	19.50	0.2	2.00	<0.1	0.00	13.5	22.00	<0.1	0.00
F012	<5.	0.00	14.	23.50	<5.	0.00	<5.	0.00	14.	24.50	<5.	0.00
F015	<5.	0.00	13.	9.50	<5.	0.00	<5.	0.00	13.	13.00	<5.	0.00
F019	<5.	0.00	14.	23.50	<5.	0.00	<5.	0.00	15.	28.00	<5.	0.00
F022	<5.	0.00	16. H	29.00	<5.	0.00	<5.	0.00	14.	24.50	<5.	0.00
F024	<1.	0.00	13.	9.50	<1.	0.00	<1.	0.00	13.	13.00	<1.	0.00
F025	<0.3	0.00	12.5	5.50	<0.3	0.00	<0.3	0.00	52. EH	30.00	<0.3	0.00
F032	<2.	0.00	15.4	27.00	<2.	0.00	<2.	0.00	15.1	29.00	<2.	0.00
F032b	<1.	0.00	13.4	15.50	<1.	0.00	<1.	0.00	12.7	8.00	<1.	0.00
F038	<0.1	0.00	13.1	12.00	0.2	2.00	<0.1	0.00	12.9	10.50	<0.1	0.00
F046	<0.1	0.00	13.4	15.50	<0.1	0.00	<0.1	0.00	12.9	10.50	<0.1	0.00
F048	<1.0	0.00	13.4	15.50	<1.0	0.00	<1.0	0.00	13.1	15.00	<1.0	0.00
F060	<0.7	0.00	13.8	21.00	<0.7	0.00	<0.7	0.00	13.3	18.00	<0.7	0.00
F063	0.4	4.00	10.4 L	1.00	0.4	6.50	0.3	5.50	8.3 EL	1.00	0.5	5.00
F064	<5.	0.00	13.	9.50	<5.	0.00	<5.	0.00	12.	6.00	<5.	0.00
F069	<1.	0.00	13.7	19.50	<1.	0.00	<1.	0.00	13.3	18.00	<1.	0.00
F080	<2.5	0.00	13.2	13.00	<2.5	0.00	<2.5	0.00	13.3	18.00	<2.5	0.00
F093	1.1	7.00	15.7 H	28.00	1.8 EH	8.00	<1.0	0.00	13.4	20.00	<1.0	0.00
F094	0.8	5.00	13.4	15.50	0.4	6.50	0.2	4.00	13.2	16.00	0.1	2.00
F095	1.	6.00	11. L	2.50	<1.	0.00	<1.	0.00	10. L	2.50	<1.	0.00
F096	<3.	0.00	<3. EL	0.00	<3.	0.00	<3.	0.00	10.7 L	4.00	<3.	0.00
F103	<10.	0.00	14.	23.50	<10.	0.00	<10.	0.00	14.	24.50	<10.	0.00
F133	<0.02	0.00	13.50	18.00	0.20	2.00	0.16	3.00	13.46	21.00	0.08	1.00
F135	<5.	0.00	11. L	2.50	<5.	0.00	<5.	0.00	10. L	2.50	<5.	0.00
F136	<0.5	0.00	12.7	7.00	<0.5	0.00	<0.5	0.00	12.8	9.00	<0.5	0.00
F139	0.04	1.00	14.84	26.00	0.23	4.00	0.12	2.00	14.33	27.00	0.13	3.00
MEDIAN OR *TARGET CONC.	*0.0400		13.4000		0.2650		0.1800		13.1500		0.1300	
1CRIT	1.5000		2.2140		1.5000		1.5000		2.1990		1.5000	
N	5		27		7		3		28		3	
MEAN	0.5000		13.3422		0.2757		0.1600		12.9996		0.1767	
3STDEV	-		3.1318		0.2555		-		3.6550		-	

PARAMETER: 27095 Cobalt ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	69.	9.00	315.	8.00	169.	6.50	194.	7.00
F008	75.	24.50	340.	26.00	180.	24.50	210.	27.00
F009	68.	5.50	298. L	4.00	164.	4.00	187.	4.00
F010	71.	12.00	317.	9.00	172.	10.00	196.	9.00
F011	75.1	26.00	343.	28.00	186.	27.00	212.	28.00
F012	74.	20.00	322.	14.00	175.	15.50	202.	18.00
F015	74.	20.00	318.	10.00	178.	21.50	199.	13.00
F019	75.	24.50	327.	18.00	178.	21.50	203.	19.00
F022	64. L	3.00	297. L	3.00	160. L	2.00	205.	22.00
F024	74.	20.00	330.	19.50	180.	24.50	200.	15.00
F025	69.9	10.00	311.	7.00	174.	13.50	195.	8.00
F032	72.2	15.00	320.	12.50	173.	11.50	209.	26.00
F032b	71.8	13.00	291. VL	2.00	163. L	3.00	188.	5.00
F038	72.	14.00	323.	15.50	175.	15.50	198.	11.50
F046	75.6	28.00	337.	24.00	181.	26.00	207.	24.00
F048	73.2	17.00	323.2	17.00	175.1	17.00	201.3	17.00
F060	74.7	23.00	331.	21.00	177.	19.50	204.	20.00
F063	67.5	4.00	319.	11.00	173.	11.50	198.	11.50
F064	68.	5.50	352. H	29.00	169.	6.50	185. L	3.00
F069	72.3	16.00	320.	12.50	171.	9.00	200.	15.00
F080	68.9	8.00	309.	6.00	170.	8.00	191.	6.00
F093	75.3	27.00	332.5	22.00	176.7	18.00	200.0	15.00
F094	88.2 EH	30.00	323.	15.50	174.	13.50	224. VH	30.00
F095	56. EL	1.00	251. EL	1.00	135. EL	1.00	155. EL	1.00
F096	73.9	18.00	333.	23.00	177.	19.50	205.	22.00
F103	70.	11.00	330.	19.50	200. VH	28.00	170. EL	2.00
F133	76.0	29.00	341.	27.00	178.5	23.00	205.	22.00
F135	63. VL	2.00	338.	25.00	210. EH	29.00	197.	10.00
F136	74.3	22.00	307.	5.00	166.	5.00	208.	25.00
F139	68.88	7.00	384. EH	30.00	218. EH	30.00	215. H	29.00
MEDIAN OR *TARGET CONC.	72.2500		323.0000		175.0000		200.0000	
1CRIT	5.7450		20.7900		11.9100		13.4100	
N	28		28		28		28	
MEAN	71.6636		323.1321		175.9036		199.4393	
3STDEV	10.2848		42.8929		29.8838		27.6237	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	50.00	5.556	9		BIASED LOW*	-2.57	-0.5713	
F008	150.00	25.000	6		BIASED HIGH	5.05	-0.6795	GF-ICP
F009	27.50	4.583	6	L	BIASED LOW	-7.40	0.5309	ICP-MS
F010	75.00	8.333	9					ICP-OES
F011	152.50	21.786	7					
F012	115.50	19.250	6					ICP-MS
F015	87.00	14.500	6					ICP
F019	134.50	22.417	6		BIASED HIGH*	0.84	1.4144	ICAP
F022	83.50	13.917	6	H L L L				ICP-AES
F024	101.50	16.917	6					
F025	74.00	12.333	6	EH				ICP-MS
F032	121.00	20.167	6					ICP-AES
F032b	46.50	7.750	6	VLL				ICP-MS
F038	81.00	11.571	7					ICPMS
F046	128.00	21.333	6					ICP-MS As Received
F048	98.50	16.417	6					ICP
F060	122.50	20.417	6					ICP
F063	61.00	6.100	10	L EL	BIASED LOW*	-0.77	-1.3863	GFAA-ICP-AES
F064	59.50	9.917	6	H L				AA
F069	90.00	15.000	6					ICP-MS
F080	59.00	9.833	6					ICP dig conc
F093	145.00	18.125	8	H EH				ICP
F094	138.00	13.800	10	EH VH				ICPMS
F095	15.00	2.143	7	L L ELELELEL	BIASED LOW	-22.52	0.1902	ICP-USN
F096	86.50	17.300	5	EL L				ICP
F103	108.50	18.083	6	VHEL				AAS-ICP-OES
F133	146.00	16.222	9					ICP-MS
F135	71.00	11.833	6	L L VL EH				AA-ETA APHA
F136	73.00	12.167	6					GFAA 16 DCP 710
F139	159.00	15.900	10	EHEHH				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 13.951

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F095	15.00	2.143	7	LLELELELEL	BIASED LOW	-22.52	0.1902	ICP-USN
F009	27.50	4.583	6	L	BIASED LOW	-7.40	0.5309	ICP-MS
F003	50.00	5.556	9		BIASED LOW*	-2.57	-0.5713	
F063	61.00	6.100	10	LEL	BIASED LOW*	-0.77	-1.3863	GFAA-ICP-AES
F032b	46.50	7.750	6	VLL				ICP-MS
F010	75.00	8.333	9					ICP-OES
F080	59.00	9.833	6					ICP dig conc
F064	59.50	9.917	6	HL				AA
F038	81.00	11.571	7					ICPMS
F135	71.00	11.833	6	LLVLEH				AA-ETA APHA
F136	73.00	12.167	6					GFAA 16 DCP 710
F025	74.00	12.333	6	EH				ICP-MS
F094	138.00	13.800	10	EHVH				ICPMS
F022	83.50	13.917	6	HLLL				ICP-AES
F015	87.00	14.500	6					ICP
F069	90.00	15.000	6					ICP-MS
F139	159.00	15.900	10	EHEHH				ICP
F133	146.00	16.222	9					ICP-MS
F048	98.50	16.417	6					ICP
F024	101.50	16.917	6					
F096	86.50	17.300	5	ELL				ICP
F103	108.50	18.083	6	VHEL				AAS-ICP-OES
F093	145.00	18.125	8	HEH				ICP
F012	115.50	19.250	6					ICP-MS
F032	121.00	20.167	6					ICP-AES
F060	122.50	20.417	6					ICP
F046	128.00	21.333	6					ICP-MS As Received
F011	152.50	21.786	7					
F019	134.50	22.417	6		BIASED HIGH*	0.84	1.4144	ICAP
F008	150.00	25.000	6		BIASED HIGH	5.05	-0.6795	GF-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 13.951

PARAMETER: 29095 Copper ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.5000 BASIC ACCEPTABLE ERROR= 1.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	1.9	17.00	12.5	23.50	6.1	13.50	39.0	29.50	28.0	27.50	52.0	30.50
F003	1.7	9.50	12.2	18.00	6.1	13.50	37.	21.00	27.6	23.50	49.	23.00
F008	<5.	0.00	10. L	3.50	5.	5.00	40.	32.50	31. H	34.00	52.	30.50
F009	<2.	0.00	12.	12.00	6.4	22.50	37.	21.00	27.	14.00	48.	16.00
F010	0.3	1.00	10.9	5.00	4.8	4.00	36.	12.50	26.	9.50	47.	9.00
F011	1.7	9.50	12.	12.00	7.3	30.00	29.8 VL	4.00	25.5	8.00	47.8	12.50
F012	<5.	0.00	14.	32.00	8. H	31.50	37.	21.00	29.	32.00	51.	29.00
F014	1.5	6.50	11.1	6.00	5.2	6.00	30.7 VL	5.00	24.8	6.00	41.9 L	6.00
F015	0.6	2.00	11.3	7.00	5.8	7.00	37.	21.00	27.	14.00	49.	23.00
F019	<5.	0.00	<5. EL	0.00	<5.	0.00	25. VL	2.00	17. VL	2.00	37. VL	1.00
F022	<5.	0.00	12.	12.00	6.	10.00	36.	12.50	27.	14.00	48.	16.00
F024	1.	3.00	12.	12.00	6.	10.00	37.	21.00	28.	27.50	49.	23.00
F025	23. EH	25.00	16. EH	33.00	21. EH	33.00	71. EH	36.00	52. EH	36.00	66. EH	36.00
F026	5.01 EH	24.00	12.22	19.00	6.13	15.50	38.21	28.00	26.72	11.00	49.36	25.00
F031	<3.	0.00	12.	12.00	6.	10.00	40.	32.50	27.	14.00	55. VH	34.00
F032	1.2	4.00	12.1	17.00	6.5	24.50	39.4	31.00	27.6	23.50	52.6 H	32.00
F032b	<5.	0.00	12.7	26.50	6.61	27.00	36.6	17.00	27.2	17.00	48.2	19.50
F037	<1.0	0.00	9.791 L	2.00	4.401 L	3.00	31.70 L	7.00	22.14 VL	5.00	40.85 VL	4.00
F038	1.8	15.00	12.3	20.00	6.4	22.50	36.1	14.00	27.5	21.50	48.7	21.00
F046	1.8	15.00	12.4	21.50	6.3	19.50	35.0	9.50	27.4	19.50	47.2	10.00
F048	1.50	6.50	12.4	21.50	6.38	21.00	36.4	16.00	28.2	29.00	47.8	12.50
F049	1.71	12.00	12.0	12.00	6.13	15.50	40.5	34.00	27.5	21.50	54.6 VH	33.00
F060	2.	18.00	12.	12.00	6.	10.00	39.	29.50	27.	14.00	48.	16.00
F063	1.7	9.50	9.7 L	1.00	3.8 L	2.00	22. EL	1.00	18.4 VL	3.00	41. VL	5.00
F064	3.	21.50	13.	28.00	8. H	31.50	34.	8.00	26.	9.50	50.	27.00
F069	1.78	13.00	12.7	26.50	6.28	18.00	36.8	18.00	28.3	30.00	47.9	14.00
F080	<5.	0.00	12.5	23.50	6.7	28.00	35.5	11.00	25.4	7.00	48.1	18.00
F093	1.4	5.00	13.2	30.00	6.3	19.50	37.5	26.00	27.4	19.50	49.9	26.00
F094	1.8	15.00	12.6	25.00	6.5	24.50	36.3	15.00	27.3	18.00	48.2	19.50
F095	3.	21.50	10. L	3.50	6.	10.00	31. VL	6.00	22. VL	4.00	40. VL	2.50
F096	2.7	20.00	13.1	29.00	7.2	29.00	37.1	24.00	28.6	31.00	50.1	28.00
F103	<10.	0.00	<10. L	0.00	<10.	0.00	28. VL	3.00	16. EL	1.00	40. VL	2.50
F133	1.7	9.50	12.0	12.00	6.2	17.00	37.4	25.00	27.9	26.00	47.4	11.00
F135	4.T H	23.00	17. EH	34.00	3.T EL	1.00	52. EH	35.00	39. EH	35.00	63. EH	35.00
F136	2.06	19.00	13.3	31.00	6.58	26.00	38.2	27.00	27.8	25.00	44.0	7.00
F139	<5.	0.00	12.	12.00	<5.	0.00	35.	9.50	30.	33.00	46.	8.00
MEDIAN	1.7800		12.1500		6.2000		36.9000		27.3500		48.1500	
1CRIT	1.5168		2.1390		1.7820		3.6240		3.0510		4.2990	
N	23		32		31		34		34		34	
MEAN	2.0243		12.1972		6.1649		36.2709		26.8900		48.3121	
3STDEV	2.8407		3.4301		2.6020		13.1975		10.5152		13.4290	

PARAMETER: 29095 Copper ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	91.0	19.50	461.	24.00	202.	26.00	288.	26.00
F003	68. VL	1.00	454.	21.50	196.	16.50	282.	17.50
F008	100. H	33.00	500. VH	34.00	220. VH	35.00	320. VH	34.00
F009	89.	15.00	448.	14.00	193.	12.50	280.	15.00
F010	88.	11.00	446.	13.00	196.	16.50	276.	11.50
F011	86.2	10.00	439.	8.00	193.	12.50	275.	10.00
F012	92.	25.50	443.	12.00	196.	16.50	282.	17.50
F014	91.6	23.00	389. VL	3.00	178. L	3.00	268.	4.00
F015	92.	25.50	469.	29.00	205.	30.50	294.	29.00
F019	80. VL	5.00	442.	10.00	189.	7.00	273.	8.00
F022	91.	19.50	450.	16.00	198.	21.00	287.	25.00
F024	93.	29.00	470.	30.00	205.	30.50	295.	30.00
F025	135. EH	36.00	562. EH	35.00	251. EH	36.00	342. EH	35.00
F026	88.52	13.00	442.56	11.00	189.54	8.00	273.09	9.00
F031	86.	9.00	440.	9.00	192.	11.00	270.	5.00
F032	84.1 L	8.00	432.	6.00	185.	5.00	278.	14.00
F032b	90.5	17.00	422. L	5.00	187.	6.00	272.	6.50
F037	72.67 VL	2.00	362.0 VL	1.00	161.9 EL	1.00	220.0 EL	1.00
F038	91.	19.50	494. H	33.00	201.	24.50	286.	23.00
F046	92.8	28.00	464.	28.00	201.	24.50	290.	27.00
F048	93.9	31.00	463.3	27.00	203.0	28.00	293.9	28.00
F049	92.3	27.00	476.	31.00	200.	23.00	284.	20.00
F060	89.	15.00	450.	16.00	198.	21.00	281.	16.00
F063	78. VL	4.00	452.	18.50	191.	9.50	277.	13.00
F064	91.	19.50	454.	21.50	206.	32.00	284.	20.00
F069	91.5	22.00	453.	20.00	195.	14.00	284.	20.00
F080	88.2	12.00	438.	7.00	196.	16.50	272.	6.50
F093	91.7	24.00	462.8	25.00	202.4	27.00	286.1	24.00
F094	102. VH	34.00	452.	18.50	197.	19.00	313. VH	33.00
F095	75. VL	3.00	383. VL	2.00	166. EL	2.00	240. VL	2.00
F096	96.0	32.00	480.	32.00	207.	33.00	299.	32.00
F103	82. L	7.00	450.	16.00	191.	9.50	276.	11.50
F133	93.8	30.00	458.	23.00	198.0	21.00	285.	22.00
F135	121. EH	35.00	618. EH	36.00	204.	29.00	390. EH	36.00
F136	81.1 L	6.00	395.4 VL	4.00	178.3 L	4.00	258.5 L	3.00
F139	89.	15.00	463.	26.00	211. H	34.00	296.	31.00
MEDIAN	91.0000		452.0000		196.5000		283.0000	
1CRIT	6.8700		28.5300		13.2000		18.3900	
N	34		34		34		34	
MEAN	89.8497		452.8841		196.1835		284.1350	
3STDEV	24.6863		93.2182		29.8537		51.8396	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	237.00	23.700	10					29305 29306
F003	165.00	16.500	10	VL				
F008	241.50	26.833	9	L H H VHVHVH				GF-ICP
F009	142.00	15.778	9					ICP-MS
F010	93.00	9.300	10					ICP-OES
F011	116.50	11.650	10	VL				
F012	217.00	24.111	9	H				ICP-MS
F014	68.50	6.850	10	VL L VLL	BIASED LOW	-11.77	2.2766	ICP-MS
F015	188.00	18.800	10					GFAA-ICP
F019	35.00	5.000	7	EL VLVLVLVL	BIASED LOW*	0.38	-10.8840	ICAP
F022	146.00	16.222	9					ICP-AES
F024	216.00	21.600	10					
F025	341.00	34.100	10	EHEHEHEHEHEHEHEHEHEH	BIASED HIGH	19.63	15.7242	ICP
F026	163.50	16.350	10	EH				I.C.P. EMISSION
F031	136.50	15.167	9	VH				ICP
F032	165.00	16.500	10	H L				ICP-AES
F032b	141.50	15.722	9	L				ICP-MS
F037	26.00	2.889	9	L L L VLVLVLVLELEL	BIASED LOW	-20.47	0.9211	ICP-MS
F038	214.00	21.400	10	H				ICPMS
F046	202.50	20.250	10					ICP-MS As Received
F048	220.50	22.050	10					ICP
F049	229.00	22.900	10	VH				
F060	167.50	16.750	10					ICP
F063	66.50	6.650	10	L L ELVLVLVL	BIASED LOW*	0.91	-7.0894	GFAA-ICP-AES
F064	218.50	21.850	10	H				AA
F069	195.50	19.550	10					ICP-MS
F080	129.50	14.389	9					ICP dig conc
F093	226.00	22.600	10					ICP
F094	221.50	22.150	10	VH VH				ICPMS
F095	56.50	5.650	10	L VLVLVLVLVLELVL	BIASED LOW	-15.26	-0.2722	ICP-USN
F096	290.00	29.000	10		BIASED HIGH	6.05	-0.4164	ICP
F103	50.50	7.214	7	L VLELVLL	BIASED LOW*	1.71	-10.1911	ICP-OES
F133	196.50	19.650	10					ICP-MS
F135	299.00	29.900	10	H EHELEHEHEHEHEH EH	BIASED HIGH	34.59	-4.3511	AA-ETA APHA
F136	152.00	15.200	10	L VLL L				GFAA 15 FAA 610
F139	168.50	21.063	8	H				ICP-OES

* 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 17.858

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F037	26.00	2.889	9	LLLVLVLVLVLELEL	BIASED LOW	-20.47	0.9211	ICP-MS
F019	35.00	5.000	7	ELVLVLVLVL	BIASED LOW*	0.38	-10.8840	ICAP
F095	56.50	5.650	10	LVLVLVLVLVLELVL	BIASED LOW	-15.26	-0.2722	ICP-USN
F063	66.50	6.650	10	LLELVLVLVL	BIASED LOW*	0.91	-7.0894	GFAA-ICP-AES
F014	68.50	6.850	10	VLLVLL	BIASED LOW	-11.77	2.2766	ICP-MS
F103	50.50	7.214	7	LVLELVLL	BIASED LOW*	1.71	-10.1911	ICP-OES
F010	93.00	9.300	10					ICP-OES
F011	116.50	11.650	10	VL				
F080	129.50	14.389	9					ICP dig conc
F031	136.50	15.167	9	VH				ICP
F136	152.00	15.200	10	LVLLL				GFAA 15 FAA 610
F032b	141.50	15.722	9	L				ICP-MS
F009	142.00	15.778	9					ICP-MS
F022	146.00	16.222	9					ICP-AES
F026	163.50	16.350	10	EH				I.C.P. EMISSION
F032	165.00	16.500	10	HL				ICP-AES
F003	165.00	16.500	10	VL				
F060	167.50	16.750	10					ICP
F015	188.00	18.800	10					GFAA-ICP
F069	195.50	19.550	10					ICP-MS
F133	196.50	19.650	10					ICP-MS
F046	202.50	20.250	10					ICP-MS As Received
F139	168.50	21.063	8	H				ICP-OES
F038	214.00	21.400	10	H				ICPMS
F024	216.00	21.600	10					
F064	218.50	21.850	10	H				AA
F048	220.50	22.050	10					ICP
F094	221.50	22.150	10	VHVH				ICPMS
F093	226.00	22.600	10					ICP
F049	229.00	22.900	10	VH				
F002	237.00	23.700	10					29305 29306
F012	217.00	24.111	9	H				ICP-MS
F008	241.50	26.833	9	LHHVHVHVH				GF-ICP
F096	290.00	29.000	10		BIASED HIGH	6.05	-0.4164	ICP
F135	299.00	29.900	10	HEHELEHEHEHEHEHEH	BIASED HIGH	34.59	-4.3511	AA-ETA APHA
F025	341.00	34.100	10	EHEHEHEHEHEHEHEHEH	BIASED HIGH	19.63	15.7242	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 17.858

Copper

PARAMETER: 26095 Iron ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 2.0000 BASIC ACCEPTABLE ERROR= 2.0000 CONCENTRATION ERROR INCREMENT= 0.0800

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	22.2	12.00	16.6	14.00	24.7	22.00	120.	23.50	10.2	14.00	130.	25.50
F003	23.9	17.00	16.4	13.00	24.1	18.00	116.	15.00	9.6	11.00	134.	31.00
F008	30. VH	26.00	20.	23.00	30. VH	28.50	136. VH	35.00	20. VH	24.00	150. VH	35.00
F009	72. EH	30.00	32. EH	29.00	24.	16.50	161. VH	36.00	34. EH	28.00	172. EH	36.00
F010	23.	15.00	17.	15.00	24.	16.50	117.	17.50	10.	13.00	125.	18.00
F011	27. H	25.00	23. VH	24.50	30. VH	28.50	123.	29.50	18. VH	21.00	130.	25.50
F012	25.	20.00	23. VH	24.50	23.	13.50	74. VL	3.00	20. VH	24.00	96. VL	4.00
F014	11. VL	2.00	<10. VL	0.00	11. VL	3.00	125.	31.50	<10.	0.00	119.	12.00
F015	18. L	4.50	19.	21.50	25.	23.00	123.	29.50	11.	16.50	129.	22.00
F019	22.	10.50	16.	9.00	23.	13.50	118.	19.50	8.	6.50	127.	20.50
F022	25.	20.00	19.	21.50	29. H	27.00	125.	31.50	13. H	20.00	123.	14.00
F024	25.	20.00	18.	19.50	26.	25.00	120.	23.50	11.	16.50	130.	25.50
F025	<10. VL	0.00	<10. VL	0.00	<10. VL	0.00	98. VL	7.50	<10.	0.00	110. L	7.00
F026	22.42	13.00	24.41 VH	26.00	25.46	24.00	106.73	10.00	6.82 L	3.00	117.20	11.00
F031	20.	7.50	15.	7.00	22.	11.50	112.	11.00	8.	6.50	116.	9.50
F032	23.1	16.00	17.5	17.50	26.7	26.00	130. H	34.00	10.3	15.00	142. H	34.00
F032b	<50.	0.00	<50.	0.00	<50.	0.00	117.	17.50	<50.	0.00	125.	18.00
F036	20.0	7.50	16.0	9.00	22.0	11.50	116.	15.00	<8.00	0.00	124.	15.50
F037	26.86 H	24.00	9.200 VL	2.00	10.45 VL	2.00	121.2	28.00	12.84	19.00	130.0	25.50
F038	<30.	0.00	<30.	0.00	<30.	0.00	120.	23.50	<30.	0.00	120.	13.00
F046	37.4 VH	27.00	17.5	17.50	19.8 L	7.00	128.	33.00	18.7 VH	22.00	139. H	33.00
F048	<100.0	0.00	<100.0	0.00	<100.0	0.00	104.4 L	9.00	<100.0	0.00	116.0	9.50
F060	19. L	6.00	14.	5.50	20.	8.50	121.	27.00	8.	6.50	127.	20.50
F063	10. VL	1.00	3. EL	1.00	7. EL	1.00	98. VL	7.50	<1. VL	0.00	106. VL	6.00
F064	42. VH	29.00	25. VH	27.00	36. VH	30.00	118.	19.50	24. VH	26.00	136.	32.00
F069	16.5 VL	3.00	12.9 L	4.00	18.6 L	6.00	114.	12.00	6.67 L	2.00	124.	15.50
F080	24.0	18.00	18.0	19.50	24.3	21.00	119.	21.00	12.3	18.00	131.	30.00
F093	22.9	14.00	17.1	16.00	24.2	19.50	120.6	26.00	9.5	10.00	130.2	29.00
F094	<10. VL	0.00	<10. VL	0.00	<10. VL	0.00	80. VL	4.00	<10.	0.00	90. VL	2.00
F095	18. L	4.50	14.	5.50	20.	8.50	92. VL	6.00	8.	6.50	101. VL	5.00
F096	20.6	9.00	16.3	12.00	23.4	15.00	120.	23.50	6.6 L	1.00	130.	25.50
F103	22.	10.50	16.	9.00	21.	10.00	116.	15.00	8.	6.50	125.	18.00
F133	<10. VL	0.00	10. VL	3.00	<10. VL	0.00	40. EL	2.00	20. VH	24.00	45. EL	1.00
F135	26.	23.00	<5. EL	0.00	18. VL	5.00	90. VL	5.00	8.T	6.50	92. VL	3.00
F136	25.4	22.00	16.1	11.00	24.2	19.50	24.2 EL	1.00	9.96	12.00	130.	25.50
F139	38. VH	28.00	27. VH	28.00	15. VL	4.00	115.	13.00	25. VH	27.00	115.	8.00
MEDIAN	23.0500		17.0000		23.7000		117.5000		10.2500		125.0000	
1CRIT	3.6840		3.2000		3.7360		11.2400		2.6600		11.8400	
N	28		27		28		34		26		34	
MEAN	24.1529		17.5559		22.4611		111.5862		12.5727		122.6294	
3STDEV	19.1727		12.3227		14.0431		55.1047		16.2058		40.0675	

PARAMETER: 26095 Iron ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	116.	27.00	390.	9.50	320.	13.50	250.	23.00
F003	116.	27.00	413.	28.00	330.	23.00	251.	25.00
F008	130. VH	35.00	450. VH	35.00	360. H	35.00	270. H	34.00
F009	122.	31.50	405.	26.00	340.	30.50	256.	28.50
F010	112.	16.50	400.	20.50	324.	18.50	244.	17.00
F011	113.	22.00	382.	7.00	310.	8.00	238.	9.50
F012	91. VL	5.50	278. EL	2.00	219. EL	2.00	173. VL	3.00
F014	104.	9.00	407.	27.00	330.	23.00	248.	20.00
F015	113.	22.00	401.	22.50	326.	20.00	243.	15.50
F019	113.	22.00	399.	19.00	324.	18.50	243.	15.50
F022	126. H	33.00	435. H	34.00	347.	33.00	264.	33.00
F024	120.	30.00	430.	32.00	340.	30.50	260.	32.00
F025	91. VL	5.50	403.	25.00	322.	16.50	238.	9.50
F026	112.19	18.00	393.68	13.00	308.19	7.00	234.16	6.00
F031	110.	14.50	398.	17.00	321.	15.00	235.	7.50
F032	113.	22.00	400.	20.50	319.	12.00	255.	27.00
F032b	122.	31.50	434. H	33.00	343.	32.00	258.	30.50
F036	112.	16.50	396.	14.00	318.	11.00	246.	19.00
F037	106.8	10.00	397.4	15.00	322.0	16.50	239.4	12.00
F038	110.	14.50	390.	9.50	330.	23.00	250.	23.00
F046	113.	22.00	391.	11.00	335.	27.00	252.	26.00
F048	107.3	11.00	402.6	24.00	334.3	26.00	238.5	11.00
F060	116.	27.00	417.	30.00	336.	28.00	256.	28.50
F063	90. VL	4.00	385.	8.00	317.	9.50	235.	7.50
F064	127. H	34.00	401.	22.50	355. H	34.00	283. VH	35.00
F069	109.	12.50	393.	12.00	317.	9.50	240.	13.50
F080	113.	22.00	398.	17.00	332.	25.00	245.	18.00
F093	116.4	29.00	413.1	29.00	329.4	21.00	249.3	21.00
F094	100. L	8.00	380.	6.00	300.	6.00	250.	23.00
F095	92. VL	7.00	320. VL	4.00	260. VL	4.00	195. VL	4.00
F096	168. EH	36.00	424.	31.00	339.	29.00	258.	30.50
F103	113.	22.00	398.	17.00	320.	13.50	240.	13.50
F133	35. EL	1.00	285. VL	3.00	220. EL	3.00	155. EL	2.00
F135	88. VL	3.00	1062. EH	36.00	826. EH	36.00	341. EH	36.00
F136	109.	12.50	346. VL	5.00	275. VL	5.00	221. L	5.00
F139	77. VL	2.00	235. EL	1.00	198. EL	1.00	154. EL	1.00
MEDIAN	112.5950		398.5000		324.0000		245.5000	
1CRIT	10.8476		33.7200		27.7600		21.4800	
N	34		34		34		34	
MEAN	109.5203		392.8170		318.3203		241.5694	
3STDEV	35.3636		108.0488		93.3660		72.8184	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	184.00	18.400	10					26304 26305
F003	208.00	20.800	10					
F008	310.50	31.050	10	VH VHVHVHVHVHVHH H	BIASED HIGH	10.51	5.2020	ICP
F009	292.00	29.200	10	EHEH VHEHEH	BIASED HIGH*	-3.96	27.6248	ICP-MS
F010	167.50	16.750	10					ICP-OES
F011	200.50	20.050	10	H VHVH VH				flame AA
F012	101.50	10.150	10	VH VLVHVLVLELELVL				ICP-MS
F014	127.50	15.938	8	VLVLVL				ICP-MS
F015	197.00	19.700	10	L				ICP
F019	154.50	15.450	10					ICAP
F022	267.00	26.700	10	H H H H				ICP-AES
F024	254.50	25.450	10					
F025	71.00	11.833	6	VLVLVLVL L VL				ICP
F026	131.00	13.100	10	VH L				I.C.P. EMISSION
F031	107.00	10.700	10					ICP
F032	224.00	22.400	10	H H				ICP-AES
F032b	162.50	27.083	6	H				ICP-MS
F036	119.00	13.222	9					Colourimetry
F037	154.00	15.400	10	H VLVL				ICP-MS
F038	106.50	17.750	6					FAAS
F046	225.50	22.550	10	VH L VHH				ICP-MS As Received
F048	90.50	15.083	6	L				ICP
F060	187.50	18.750	10	L				ICP
F063	45.50	5.056	9	VLELELVLVLVLVL	BIASED LOW*	1.67	-17.6607	ICP-AES
F064	289.00	28.900	10	VHVHVH VH H H VH	BIASED HIGH*	1.95	12.2650	AA
F069	90.00	9.000	10	VLL L L				ICP
F080	209.50	20.950	10					ICP dig conc
F093	214.50	21.450	10					ICP
F094	49.00	8.167	6	VLVLVLVL VLL				ICPMS
F095	55.00	5.500	10	L VL VLVLVLVLVL	BIASED LOW	-19.89	0.0745	ICP-USN
F096	212.50	21.250	10	L EH				ICP
F103	135.00	13.500	10					ICP-OES
F133	39.00	4.875	8	VLVLVLELVHELELVLELEL	BIASED LOW	-27.27	-21.5172	ICP-MS
F135	153.50	17.056	9	ELVLVL VLVLEHEHEH				AA-ETA APHA
F136	118.50	11.850	10	EL VLVLL				GFAA 15 FAA 610
F139	113.00	11.300	10	VHVHVL VH VLELELEL				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 17.318

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F133	39.00	4.875	8	VLVLVLELVHELELVLELEL	BIASED LOW	-27.27	-21.5172	ICP-MS
F063	45.50	5.056	9	VLELELVLVLVLVL	BIASED LOW*	1.67	-17.6607	ICP-AES
F095	55.00	5.500	10	LVLVLVLVLVLVL	BIASED LOW	-19.89	0.0745	ICP-USN
F094	49.00	8.167	6	VLVLVLVLVLL				ICPMS
F069	90.00	9.000	10	VLLLL				ICP
F012	101.50	10.150	10	VHVLVHVLVLELELVL				ICP-MS
F031	107.00	10.700	10					ICP
F139	113.00	11.300	10	VHVHVLVHVLELELEL				ICP-MS
F025	71.00	11.833	6	VLVLVLVLLVL				ICP
F136	118.50	11.850	10	ELVLVLL				GFAA 15 FAA 610
F026	131.00	13.100	10	VHL				I.C.P. EMISSION
F036	119.00	13.222	9					Colourimetry
F103	135.00	13.500	10					ICP-OES
F048	90.50	15.083	6	L				ICP
F037	154.00	15.400	10	HVLVL				ICP-MS
F019	154.50	15.450	10					ICAP
F014	127.50	15.938	8	VLVLVL				ICP-MS
F010	167.50	16.750	10					ICP-OES
F135	153.50	17.056	9	ELVLVLVLVLEHEHEH				AA-ETA APHA
F038	106.50	17.750	6					FAAS
F002	184.00	18.400	10					26304 26305
F060	187.50	18.750	10	L				ICP
F015	197.00	19.700	10	L				ICP
F011	200.50	20.050	10	HVHVHVH				flame AA
F003	208.00	20.800	10					
F080	209.50	20.950	10					ICP dig conc
F096	212.50	21.250	10	LEH				ICP
F093	214.50	21.450	10					ICP
F032	224.00	22.400	10	HH				ICP-AES
F046	225.50	22.550	10	VHLVHH				ICP-MS As Received
F024	254.50	25.450	10					
F022	267.00	26.700	10	HHHH				ICP-AES
F032b	162.50	27.083	6	H				ICP-MS
F064	289.00	28.900	10	VHVHVHVHHHVH	BIASED HIGH*	1.95	12.2650	AA
F009	292.00	29.200	10	EHEHVHEHEH	BIASED HIGH*	-3.96	27.6248	ICP-MS
F008	310.50	31.050	10	VHVHVHVHVHVHVHHH	BIASED HIGH	10.51	5.2020	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 17.318

PARAMETER: 82095 Lead ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.5000 BASIC ACCEPTABLE ERROR= 1.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	<2.0	0.00	14.7	10.00	<2.0	0.00	4.2	22.00	23.0	23.00	8.0	25.50
F003	0.7	8.00	13.6	4.00	0.3	6.00	4.1	19.00	21.8	9.50	5. L	2.00
F008	1.	16.00	15.	15.00	<1.	0.00	4.	16.50	23.	23.00	7.	10.00
F009	0.7	8.00	15.	15.00	0.2	1.50	3.8	9.50	21.	6.50	7.2	13.00
F010	0.7	8.00	14.9	11.00	<0.3	0.00	4.3	25.00	22.5	13.50	6.5	8.00
F011	0.8	13.00	15.7	22.50	0.4	9.00	3.9	12.00	22.6	15.00	9.2	33.00
F012	<5.	0.00	16.	27.00	<5.	0.00	5.	28.50	23.	23.00	9.	31.00
F014	<1.0	0.00	16.3	30.50	<1.0	0.00	3.9	12.00	23.7	29.00	7.7	20.00
F015	<0.5	0.00	15.2	19.00	<0.5	0.00	4.2	22.00	22.7	16.50	8.4	29.00
F019	<30.	0.00	<30.	0.00	<30.	0.00	<30.	0.00	30. EH	35.00	<30.	0.00
F022	<5.	0.00	18. H	32.50	<5.	0.00	<5.	0.00	20. L	4.00	9.	31.00
F024	<2.	0.00	15.	15.00	<2.	0.00	3.	3.00	23.	23.00	6.	4.50
F025	0.5	2.50	12.7	3.00	<0.3	0.00	3.5	7.00	19.5 L	2.00	7.1	12.00
F026	-0.99T EL	1.00	19.26 EH	34.00	4.53 EH	10.00	2.52	1.00	23.17	28.00	7.36	15.00
F031	<1.	0.00	18. H	32.50	<1.	0.00	4.	16.50	25.	31.50	8.	25.50
F032	<11.	0.00	15.0	15.00	<11.	0.00	<11.	0.00	25.1	33.00	12.8 EH	34.00
F032b	0.823	14.00	16.3	30.50	<0.5	0.00	4.45	27.00	24.2	30.00	8.29	28.00
F037	0.7225	11.00	13.89	5.00	<0.1 EL	0.00	3.200	5.00	21.26	8.00	6.315	7.00
F038	0.67	6.00	15.	15.00	0.25	4.00	3.91	14.00	21.8	9.50	7.44	17.00
F046	0.72	10.00	14.5	9.00	0.23	3.00	4.2	22.00	19.6 L	3.00	7.8	21.00
F048	<1.0	0.00	15.9	24.00	<1.0	0.00	4.25	24.00	23.1	27.00	7.84	23.00
F049	0.63	5.00	15.6	21.00	0.32	7.00	3.90	12.00	22.9	18.50	7.53	18.00
F060	<2.	0.00	14.	7.50	<2.	0.00	4.	16.50	22.	11.00	7.	10.00
F063	0.5	2.50	16.0	27.00	0.2	1.50	3.0	3.00	23.0	23.00	5.0 L	2.00
F064	<5.	0.00	6. EL	1.00	<5.	0.00	7. EH	31.00	28. EH	34.00	9.	31.00
F069	<1.	0.00	15.7	22.50	<1.	0.00	4.18	20.00	22.4	12.00	7.69	19.00
F093	<0.8	0.00	15.0	15.00	<0.8	0.00	3.6	8.00	22.5	13.50	7.3	14.00
F094	0.78	12.00	16.	27.00	0.38	8.00	4.33	26.00	22.9	18.50	7.83	22.00
F095	5. EH	17.00	15.	15.00	<4.	0.00	6. EH	30.00	23.	23.00	8.	25.50
F096	<1.	0.00	16.	27.00	<1.	0.00	5.	28.50	25.	31.50	8.	25.50
F103	<1.	0.00	13.9	6.00	<1.	0.00	<1. EL	0.00	20.8	5.00	6.0	4.50
F133	<2.	0.00	14.	7.50	<2.	0.00	4.	16.50	21.	6.50	7.	10.00
F135	<1.	0.00	16.	27.00	<1.	0.00	3.T	3.00	23.	23.00	5.T L	2.00
F136	0.95	15.00	15.4	20.00	<0.5	0.00	3.8	9.50	22.7	16.50	7.4	16.00
F139	0.60	4.00	12.04 L	2.00	0.26	5.00	3.33	6.00	16.30 EL	1.00	6.15	6.00
MEDIAN	0.7000		15.0000		0.2800		4.0000		22.9000		7.4850	
1CRIT	1.5000		2.3100		1.5000		1.6500		2.7840		1.8591	
N	15		32		7		29		33		33	
MEAN	0.7197		15.1666		0.3057		4.0017		22.6736		7.3347	
3STDEV	0.4061		3.6989		0.1813		1.8680		4.9445		3.3076	

PARAMETER: 82095 Lead ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	74.0	24.00	537.	19.50	228.	26.00	338.	24.00
F003	69.	8.00	529.	14.00	217.	12.00	327.	15.00
F008	70.	11.00	570. H	33.00	230.	28.50	320.	8.50
F009	67.	6.00	503.	7.00	207.	7.50	311.	6.00
F010	72.	19.50	56. EL	1.00	223.	22.00	336.	22.00
F011	71.9	18.00	525.	13.00	216.	11.00	322.	12.00
F012	73.	21.00	519.	10.00	219.	15.50	321.	10.00
F014	71.4	15.00	533.	17.00	232.	32.00	362. H	33.00
F015	75.8	29.00	540.	22.00	250. VH	34.00	320.	8.50
F019	80. H	35.00	560.	31.50	220.	18.00	340.	26.00
F022	67.	6.00	560.	31.50	214.	10.00	340.	26.00
F024	74.	24.00	555.	30.00	230.	28.50	340.	26.00
F025	62.3 VL	3.00	449. VL	3.00	199. L	4.00	287. VL	3.00
F026	76.93	31.00	539.72	21.00	231.77	31.00	326.79	14.00
F031	76.	30.00	490. L	5.00	240. H	33.00	350.	30.00
F032	70.6	13.00	544.	25.00	220.	18.00	352. H	31.00
F032b	69.8	9.00	520.	11.50	207.	7.50	330.	17.00
F037	65.45 L	4.00	496.3 L	6.00	198.8 L	3.00	285.6 VL	2.00
F038	71.6	16.00	534.	18.00	227.	25.00	337.	23.00
F046	79.0 H	33.00	573. H	34.00	231.	30.00	354. H	32.00
F048	73.1	22.00	543.7	24.00	223.9	23.00	335.8	21.00
F049	74.2	26.00	547.	28.00	222.	21.00	334.	20.00
F060	70.	11.00	530.	15.00	218.	13.50	328.	16.00
F063	75.0	27.00	546.	27.00	204. L	6.00	322.	12.00
F064	74.	24.00	531.	16.00	218.	13.50	342.	28.00
F069	71.8	17.00	520.	11.50	219.	15.50	322.	12.00
F093	72.0	19.50	543.0	23.00	220.0	18.00	331.0	18.00
F094	79.6 H	34.00	537.	19.50	221.	20.00	368. VH	34.00
F095	60. VL	2.00	429. EL	2.00	180. EL	1.00	264. EL	1.00
F096	71.	14.00	545.	26.00	229.	27.00	333.	19.00
F103	75.6	28.00	484. L	4.00	200. L	5.00	290. VL	4.00
F133	70.	11.00	512.	8.00	209.	9.00	315.	7.00
F135	67.	6.00	515.	9.00	192. VL	2.00	293. VL	5.00
F136	77.3	32.00	548.2	29.00	225.7	24.00	343.8	29.00
F139	43.96 EL	1.00		0.00		0.00		0.00
MEDIAN	71.9000		533.5000		220.0000		330.5000	
1CRIT	5.7240		33.4200		14.6100		21.2400	
N	33		32		32		32	
MEAN	71.7388		526.0912		218.5053		327.7809	
3STDEV	12.9377		89.9172		33.7427		55.7269	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	174.00	21.750	8					82302 82301
F003	97.50	9.750	10	L				ICP
F008	161.50	17.944	9	H				GF-ICP
F009	80.00	8.000	10		BIASED LOW	-5.78	-0.0686	ICP-MS
F010	130.00	14.444	9	EL				ICP-OES, GFAA
F011	158.50	15.850	10					
F012	166.00	20.750	8					ICP-MS
F014	188.50	23.563	8	H				ICP-MS
F015	180.00	22.500	8	VH				GFAA-ICP
F019	145.50	29.100	5	EH H	BIASED HIGH*	3.50	1.9878	ICAP
F022	141.00	20.143	7	H L				ICP-AES
F024	154.00	19.250	8					
F025	39.50	4.389	9	L VLVLL VL	BIASED LOW	-14.90	1.5961	ICP-MS
F026	186.00	18.600	10	ELEHEH				I.C.P. EMISSION
F031	204.00	25.500	8	H L H				GFAAS
F032	169.00	24.143	7	EH H				ICP-AES
F032b	174.50	19.389	9					ICP-MS
F037	51.00	5.667	9	EL L L L VL	BIASED LOW	-8.56	-1.2428	ICP-MS
F038	147.50	14.750	10					ICPMS
F046	197.00	19.700	10	L H H H				ICP-MS As Received
F048	188.00	23.500	8					ICP
F049	176.50	17.650	10					
F060	100.50	12.563	8					ICP
F063	131.00	13.100	10	L L				GFAA-ICP-AES
F064	178.50	22.313	8	EL EHEH				AA
F069	129.50	16.188	8					ICP-MS
F093	129.00	16.125	8					ICP
F094	221.00	22.100	10	H VH				ICPMS
F095	116.50	12.944	9	EH EH VLELELEL				ICP-USN
F096	198.50	24.813	8					GFAA-ICP
F103	56.50	8.071	7	EL L L VL				GFAA
F133	75.50	9.438	8					ICP-MS
F135	77.00	9.625	8	L VLVL				AA-ETA APHA
F136	191.00	21.222	9					GFAA 16 FAA 710
F139	25.00	3.571	7	L EL EL	BIASED LOW	-39.55	1.2472	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 16.574

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F139	25.00	3.571	7	LELEL	BIASED LOW	-39.55	1.2472	ICP-MS
F025	39.50	4.389	9	LVLVLLVL	BIASED LOW	-14.90	1.5961	ICP-MS
F037	51.00	5.667	9	ELLLLVL	BIASED LOW	-8.56	-1.2428	ICP-MS
F009	80.00	8.000	10		BIASED LOW	-5.78	-0.0686	ICP-MS
F103	56.50	8.071	7	ELLLVL				GFAA
F133	75.50	9.438	8					ICP-MS
F135	77.00	9.625	8	LVLVL				AA-ETA APHA
F003	97.50	9.750	10	L				ICP
F060	100.50	12.563	8					ICP
F095	116.50	12.944	9	EHEHVLELELEL				ICP-USN
F063	131.00	13.100	10	LL				GFAA-ICP-AES
F010	130.00	14.444	9	EL				ICP-OES, GFAA
F038	147.50	14.750	10					ICPMS
F011	158.50	15.850	10					
F093	129.00	16.125	8					ICP
F069	129.50	16.188	8					ICP-MS
F049	176.50	17.650	10					
F008	161.50	17.944	9	H				GF-ICP
F026	186.00	18.600	10	ELEHEH				I.C.P. EMISSION
F024	154.00	19.250	8					
F032b	174.50	19.389	9					ICP-MS
F046	197.00	19.700	10	LHHH				ICP-MS As Received
F022	141.00	20.143	7	HL				ICP-AES
F012	166.00	20.750	8					ICP-MS
F136	191.00	21.222	9					GFAA 16 FAA 710
F002	174.00	21.750	8					82302 82301
F094	221.00	22.100	10	HVH				ICPMS
F064	178.50	22.313	8	ELEHEH				AA
F015	180.00	22.500	8	VH				GFAA-ICP
F048	188.00	23.500	8					ICP
F014	188.50	23.563	8	H				ICP-MS
F032	169.00	24.143	7	EHH				ICP-AES
F096	198.50	24.813	8					GFAA-ICP
F031	204.00	25.500	8	HLH				GFAAS
F019	145.50	29.100	5	EHH	BIASED HIGH*	3.50	1.9878	ICAP

* 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 16.574

Lead

PARAMETER: 93095 Lithium ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.5000 BASIC ACCEPTABLE ERROR= 0.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F010	5. EH	6.00	3. L	2.50	<1.	0.00	2. VH	5.00	4. EL	1.00	<1.	0.00
F011	1. EL	1.00	4.	7.00	0.5	3.00	0.6	1.00	6.7	9.00	0.8	1.00
F012	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	5. VL	2.00	<5.	0.00
F022	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	7.	11.50	<5.	0.00
F025	<1. EL	0.00	2. EL	1.00	1. H	4.00	<1.	0.00	6.	5.00	<1.	0.00
F038	<1. EL	0.00	4.	7.00	<1.	0.00	<1.	0.00	6.	5.00	<1.	0.00
F048	<1.0 EL	0.00	4.14	10.00	<1.0	0.00	<1.0	0.00	6.61	8.00	<1.0	0.00
F060	1.08 VL	2.00	3.85	4.00	0.35	1.00	0.94	2.00	6.93	10.00	0.91	2.00
F069	<4.	0.00	<4.	0.00	<4.	0.00	<4.	0.00	7.71 VH	13.00	<4.	0.00
F080	3. H	4.50	4.	7.00	<3.	0.00	<3.	0.00	6.	5.00	<3.	0.00
F094	<3.	0.00	4.	7.00	<3.	0.00	<3.	0.00	6.	5.00	<3.	0.00
F095	<1. EL	0.00	3. L	2.50	<1.	0.00	1.	3.00	7.	11.50	2. VH	4.50
F103	3. H	4.50	4.	7.00	<1.	0.00	3. EH	6.00	6.	5.00	2. VH	4.50
F139	1.41 L	3.00	5.13 EH	11.00	0.45	2.00	1.09	4.00	8.62 EH	14.00	1.04	3.00
MEDIAN	2.2050		4.0000		0.4750		1.0450		6.3050		1.0400	
1CRIT	0.6023		0.7100		0.5000		0.5327		0.8483		0.5324	
N	4		9		2		4		12		2	
MEAN	2.1225		3.7767		0.4750		1.2575		6.4125		0.9750	
3STDEV	-		1.2622		-		-		2.0511		-	

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F010	12. EL	1.00	19. EL	1.00	26. EL	1.00	14. EL	1.00
F011	17.5	8.50	28.5	12.00	36.2	6.00	18.7	5.00
F012	15. L	2.00	26.	4.00	35.	4.00	18.	3.50
F022	17.	6.00	27.	5.50	37.	9.00	19.	6.00
F025	17.	6.00	28.	9.00	42. VH	14.00	22. H	14.00
F038	20. VH	13.00	30. H	14.00	40. H	12.00	20.	9.50
F048	18.1	12.00	28.1	11.00	36.8	8.00	20.3	11.00
F060	16.8	4.00	27.5	7.00	39.4 H	11.00	19.4	7.00
F069	17.5	8.50	28.0	9.00	36.3	7.00	19.8	8.00
F080	17.	6.00	22. VL	2.00	29. VL	2.00	16. VL	2.00
F094	18.	10.50	27.	5.50	36.	5.00	21.	12.00
F095	16.	3.00	25. L	3.00	32. VL	3.00	18.	3.50
F103	18.	10.50	28.	9.00	38.	10.00	20.	9.50
F139	20.14 VH	14.00	28.88	13.00	40.28 H	13.00	21.29 H	13.00
MEDIAN	17.2500		27.7500		36.5500		19.6000	
1CRIT	1.5050		2.1350		2.6630		1.6460	
N	12		12		12		12	
MEAN	17.3250		26.9983		36.3317		19.2908	
3STDEV	3.5159		5.4938		9.3407		4.2258	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F010	18.50	2.312	8	EHL VHEL ELELELEL	BIASED LOW	-34.38	1.2164	AA-Flame
F011	53.50	5.350	10	EL				
F012	15.50	3.100	5	VL L	BIASED LOW*	-0.37	-1.6118	ICP-MS
F022	38.00	7.600	5					ICP-AES
F025	53.00	7.571	7	ELELH VHH				ICP
F038	60.50	10.083	6	EL VHH H	BIASED HIGH	10.76	-0.5740	ICPMS
F048	60.00	10.000	6	EL				ICP
F060	50.00	5.000	10	VL H				ICP
F069	45.50	9.100	5	VH				ICP
F080	28.50	4.071	7	H VLVLVL				FAA dig conc
F094	45.00	7.500	6					ICPMS
F095	34.00	4.250	8	ELL VH L VL				ICP-USN
F103	66.00	7.333	9	H EH VH				ICP-OES
F139	90.00	9.000	10	L EH EH VH 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

OVERALL AVERAGE
RANK IS 6.451

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F010	18.50	2.312	8	EHLVHELELELELEL	BIASED LOW	-34.38	1.2164	AA-Flame
F012	15.50	3.100	5	VLL	BIASED LOW*	-0.37	-1.6118	ICP-MS
F080	28.50	4.071	7	HVLVLVL				FAA dig conc
F095	34.00	4.250	8	ELLVHLVL				ICP-USN
F060	50.00	5.000	10	VLH				ICP
F011	53.50	5.350	10	EL				
F103	66.00	7.333	9	HEHVH				ICP-OES
F094	45.00	7.500	6					ICPMS
F025	53.00	7.571	7	ELELHVHH				ICP
F022	38.00	7.600	5					ICP-AES
F139	90.00	9.000	10	LEHEHVHHH				ICP-MS
F069	45.50	9.100	5	VH				ICP
F048	60.00	10.000	6	EL				ICP
F038	60.50	10.083	6	ELVHHH	BIASED HIGH	10.76	-0.5740	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 6.451

PARAMETER: 25095 Manganese ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.5000 BASIC ACCEPTABLE ERROR= 1.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	<10.0	0.00	15.0	21.00	<10.0	0.00	18.0	33.00	21.0	32.00	19.0 H	34.00
F003	1.	6.50	14.2	11.00	5.9	5.00	15.3	14.00	18.	10.00	16.6	22.00
F008	<5.	0.00	15.	21.00	6.	10.00	16.	20.50	20.	29.50	17.	27.50
F009	1.	6.50	14.	9.00	6.2	19.50	15.	10.00	18.	10.00	15.	8.00
F010	1.0	6.50	15.	21.00	6.2	19.50	16.	20.50	19.	19.50	16.	12.00
F011	1.	6.50	14.9	18.00	7.	29.50	13.4 L	6.00	18.2	13.00	17.5	31.00
F012	<5.	0.00	15.	21.00	6.	10.00	17.	31.00	19.	19.50	17.	27.50
F014	<10.	0.00	14.	9.00	<10.0	0.00	15.	10.00	18.	10.00	16.	12.00
F015	<1.	0.00	15.	21.00	6.	10.00	15.	10.00	19.	19.50	17.	27.50
F019	<1.	0.00	13.	4.50	2. EL	2.00	9. VL	3.00	11. VL	3.00	8. VL	3.00
F022	<5.	0.00	16.	32.50	6.	10.00	13. L	5.00	17.	6.00	13. L	5.50
F024	<1.	0.00	16.	32.50	6.	10.00	16.	20.50	20.	29.50	17.	27.50
F025	4. VH	19.00	16.	32.50	9. EH	33.00	21. VH	35.00	23. VH	35.00	20. H	35.50
F026	2.55 H	17.00	14.45	12.00	6.06	14.00	16.61	29.00	18.68	15.00	16.46	18.00
F031	1.0	6.50	13.7	7.00	6.0	10.00	15.1	12.50	17.7	7.00	15.1	10.00
F032	1.0	6.50	16.6	35.00	7.1	31.00	17.9	32.00	21.2	33.00	18.7	33.00
F032b	1.04	12.00	15.1	25.00	6.49	25.00	15.7	16.00	20.	29.50	16.1	15.00
F036	<1.	0.00	14.0	9.00	5.00	3.50	14.0	7.50	18.0	10.00	15.0	8.00
F037	1.279	16.00	15.40	29.00	6.544	27.00	15.82	17.00	19.51	27.00	16.04	14.00
F038	1.	6.50	14.7	15.50	6.1	15.50	15.9	18.00	18.7	16.00	16.	12.00
F046	1.0	6.50	15.6	30.00	6.4	24.00	16.6	28.00	20.0	29.50	17.2	30.00
F048	<1.0	0.00	15.1	25.00	6.34	23.00	16.1	23.00	19.3	25.50	16.6	22.00
F060	1.0	6.50	15.1	25.00	6.3	22.00	16.4	25.00	19.2	23.00	16.6	22.00
F063	<1.	0.00	2. EL	2.00	<1. EL	0.00	3. EL	1.00	5. EL	2.00	4. EL	2.00
F064	<5.	0.00	13.	4.50	6.	10.00	14.	7.50	18.	10.00	18.	32.00
F069	<1.	0.00	14.7	15.50	6.13	17.00	16.0	20.50	18.9	17.00	16.5	19.00
F080	1.0	6.50	14.6	13.50	6.2	19.50	15.6	15.00	18.4	14.00	16.4	17.00
F093	1.1	13.50	15.2	27.50	6.2	19.50	16.5	26.50	19.0	19.50	16.6	22.00
F094	1.1	13.50	15.2	27.50	6.5	26.00	16.5	26.50	19.3	25.50	16.6	22.00
F095	<1.	0.00	12. L	3.00	5.	3.50	12. VL	4.00	15. VL	5.00	13. L	5.50
F096	<2.	0.00	14.8	17.00	6.1	15.50	16.2	24.00	19.1	22.00	16.2	16.00
F103	7. EH	20.00	18. H	36.00	8. H	32.00	20. VH	34.00	22. H	34.00	20. H	35.50
F133	0.73	1.00	14.60	13.50	5.95	6.00	16.93	30.00	19.28	24.00	16.78	25.00
F135	<5.	0.00	16.	32.50	7.T	29.50	22. VH	36.00	25. VH	36.00	10. VL	4.00
F136	1.27	15.00	13.3	6.00	6.68	28.00	15.1	12.50	14.7 VL	4.00	15.0	8.00
F139	3.82 VH	18.00	1.50 EL	1.00	0.09 EL	1.00	3.30 EL	2.00	2.10 EL	1.00	2.74 EL	1.00
MEDIAN	1.0000		14.9500		6.1300		15.9500		19.0000		16.4800	
1CRIT	1.5000		2.3070		1.7778		2.3670		2.5500		2.3988	
N	18		34		31		34		34		33	
MEAN	1.4533		14.3603		6.1095		15.3518		18.2991		15.5145	
3STDEV	2.8133		7.0609		2.7824		8.8080		9.3192		8.8794	

PARAMETER: 25095 Manganese ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	85.0	28.00	285.	24.00	151.	29.50	182.	30.00
F003	60.4 VL	2.00	275.	12.00	143.	9.00	174.	15.00
F008	86.	30.00	288.	29.50	151.	29.50	181.	29.00
F009	79.	9.00	275.	12.00	142.	8.00	171.	9.00
F010	83.	18.00	283.	20.50	147.	17.00	177.	20.00
F011	80.6	12.00	275.	12.00	147.	17.00	173.	13.00
F012	82.	15.00	274.	10.00	144.	10.50	175.	16.00
F014	83.8	21.50	260. L	5.00	145.	12.50	180.	27.00
F015	82.	15.00	280.	18.00	147.	17.00	177.	20.00
F019	75. L	7.00	272.	7.50	139.	6.00	168.	5.50
F022	74. L	6.00	258. L	4.00	140.	7.00	168.	5.50
F024	90. H	32.00	310. VH	33.00	160. H	34.00	190. H	32.00
F025	98. VH	35.00	314. VH	35.00	159. H	32.50	202. VH	35.00
F026	80.14	10.00	271.13	6.00	137.92	4.00	165.49	4.00
F031	73.5 VL	5.00	257. L	3.00	138.	5.00	159. L	3.00
F032	83.3	19.00	283.	20.50	146.	14.00	186.	31.00
F032b	83.8	21.50	281.	19.00	148.	21.50	177.	20.00
F036	78.0	8.00	273.	9.00	154.	31.00	173.	13.00
F037	83.65	20.00	284.2	23.00	148.8	26.00	172.4	11.00
F038	84.	23.00	279.	15.50	147.	17.00	173.	13.00
F046	85.8	29.00	286.	26.00	147.	17.00	179.	23.00
F048	84.8	27.00	283.2	22.00	147.4	20.00	178.3	22.00
F060	84.4	25.00	286.	26.00	148.	21.50	180.	27.00
F063	66. VL	4.00	278.	14.00	137.	3.00	169.	7.00
F064	103. VH	36.00	286.	26.00	164. VH	36.00	172.	10.00
F069	81.6	13.00	279.	15.50	144.	10.50	176.	17.00
F080	80.2	11.00	272.	7.50	145.	12.50	170.	8.00
F093	84.6	26.00	288.3	31.00	148.6	25.00	179.6	25.00
F094	92.8 VH	33.00	287.	28.00	149.	27.50	200. VH	34.00
F095	62. VL	3.00	222. EL	2.00	111. EL	2.00	139. EL	2.00
F096	84.1	24.00	288.	29.50	149.	27.50	180.	27.00
F103	93. VH	34.00	311. VH	34.00	162. H	35.00	196. VH	33.00
F133	86.8	31.00	297.	32.00	148.5	23.50	179.5	24.00
F135	82.	15.00	321. VH	36.00	159. H	32.50	211. EH	36.00
F136	82.1	17.00	279.5	17.00	148.5	23.50	176.1	18.00
F139	1.53 EL	1.00	1.52 EL	1.00	2.04 EL	1.00	1.69 EL	1.00
MEDIAN	83.1500		280.5000		147.0000		176.5500	
1CRIT	6.3990		18.2400		10.2300		12.0030	
N	34		34		34		34	
MEAN	81.6291		280.0097		146.4329		176.4232	
3STDEV	22.9959		48.4875		25.7916		33.1878	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	231.50	28.938	8	H	BIASED HIGH*	1.41	1.4722	25304
F003	106.50	10.650	10	VL				
F008	226.50	25.167	9					GF-ICP
F009	101.00	10.100	10					ICP-MS
F010	174.50	17.450	10					ICP-OES
F011	158.00	15.800	10	L				
F012	160.50	17.833	9					ICP-MS
F014	107.00	13.375	8	L				ICP-MS
F015	158.00	17.556	9					ICP
F019	41.50	4.611	9	ELVLVLVLL	BIASED LOW*	-1.21	-5.9478	ICAP
F022	81.50	9.056	9	L L L L				ICP-AES
F024	251.00	27.889	9	H VHH H				
F025	327.50	32.750	10	VH EHVHVHH VHVHH VH	BIASED HIGH	11.18	2.0232	ICP
F026	129.00	12.900	10	H				I.C.P. EMISSION
F031	69.00	6.900	10	VLL L	BIASED LOW	-8.55	0.0428	ICP
F032	255.00	25.500	10					ICP-AES
F032b	204.50	20.450	10					ICP-MS
F036	99.00	11.000	9					Colourimetry
F037	210.00	21.000	10					ICP-MS
F038	152.00	15.200	10					ICPMS
F046	243.00	24.300	10					ICP-MS As Received
F048	209.50	23.278	9					ICP
F060	223.00	22.300	10					ICP
F063	35.00	4.375	8	ELELELELELVL	BIASED LOW*	3.85	-14.8227	ICP-AES
F064	172.00	19.111	9	VH VH				AA
F069	145.00	16.111	9					ICP-MS
F080	124.50	12.450	10					ICP dig conc
F093	235.50	23.550	10					ICP
F094	263.50	26.350	10	VH VH				ICPMS
F095	30.00	3.333	9	L VLVLL VLELELEL	BIASED LOW	-21.35	-0.7244	ICP-USN
F096	202.50	22.500	9					ICP
F103	327.50	32.750	10	EHH H VHH H VHVHH VH	BIASED HIGH	9.71	2.2403	ICP-OES
F133	210.00	21.000	10					ICP-MS
F135	257.50	28.611	9	VHVHVL VHH EH	BIASED HIGH	15.07	-2.3543	AA-ETA APHA
F136	149.00	14.900	10	VL				GFAA 16 FAA 710
F139	28.00	2.800	10	VHELELELELELELELELEL	BIASED LOW	-100.28	2.2475	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 17.886

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F139	28.00	2.800	10	VHELELELELELELELELEL	BIASED LOW	-100.28	2.2475	ICP-MS
F095	30.00	3.333	9	LVLVLLVLELELEL	BIASED LOW	-21.35	-0.7244	ICP-USN
F063	35.00	4.375	8	ELELELELELVL	BIASED LOW*	3.85	-14.8227	ICP-AES
F019	41.50	4.611	9	ELVLVLVLL	BIASED LOW*	-1.21	-5.9478	ICAP
F031	69.00	6.900	10	VLLL	BIASED LOW	-8.55	0.0428	ICP
F022	81.50	9.056	9	LLLL				ICP-AES
F009	101.00	10.100	10					ICP-MS
F003	106.50	10.650	10	VL				
F036	99.00	11.000	9					Colourimetry
F080	124.50	12.450	10					ICP dig conc
F026	129.00	12.900	10	H				I.C.P. EMISSION
F014	107.00	13.375	8	L				ICP-MS
F136	149.00	14.900	10	VL				GFAA 16 FAA 710
F038	152.00	15.200	10					ICPMS
F011	158.00	15.800	10	L				
F069	145.00	16.111	9					ICP-MS
F010	174.50	17.450	10					ICP-OES
F015	158.00	17.556	9					ICP
F012	160.50	17.833	9					ICP-MS
F064	172.00	19.111	9	VHVH				AA
F032b	204.50	20.450	10					ICP-MS
F037	210.00	21.000	10					ICP-MS
F133	210.00	21.000	10					ICP-MS
F060	223.00	22.300	10					ICP
F096	202.50	22.500	9					ICP
F048	209.50	23.278	9					ICP
F093	235.50	23.550	10					ICP
F046	243.00	24.300	10					ICP-MS As Received
F008	226.50	25.167	9					GF-ICP
F032	255.00	25.500	10					ICP-AES
F094	263.50	26.350	10	VHVH				ICPMS
F024	251.00	27.889	9	HVHHH				
F135	257.50	28.611	9	VHVHVLVHHEH	BIASED HIGH	15.07	-2.3543	AA-ETA APHA
F002	231.50	28.938	8	H	BIASED HIGH*	1.41	1.4722	25304
F025	327.50	32.750	10	VHEHVHVHHVHVHHVH	BIASED HIGH	11.18	2.0232	ICP
F103	327.50	32.750	10	EHHHVHHHVHVHHVH	BIASED HIGH	9.71	2.2403	ICP-OES

* 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 17.886

PARAMETER: 42095 Molybdenum ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.5000 BASIC ACCEPTABLE ERROR= 1.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	0.4	1.50	7.1	6.00	0.2	3.50	0.2	4.00	8.2	6.00	1.	9.00
F009	1.1	10.00	7.	3.50	<1.	0.00	<1.	0.00	8.1	4.00	<1.	0.00
F010	0.7	8.00	7.3	8.00	0.3	8.00	0.6	9.00	9.1	16.00	0.7	8.00
F011	0.6	6.00	7.9	13.50	0.2	3.50	0.2	4.00	9.3	17.00	0.3	5.00
F012	<5.	0.00	9.	18.50	<5.	0.00	<5.	0.00	11. H	22.00	<5.	0.00
F015	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00
F019	<5.	0.00	9.	18.50	<5.	0.00	<5.	0.00	10.	19.00	<5.	0.00
F022	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00
F024	<1.	0.00	<1. EL	0.00	<1.	0.00	<1.	0.00	8.	1.50	<1.	0.00
F025	12. EH	11.00	10. H	21.00	8. EH	9.00	<3.	0.00	10.	19.00	11. EH	10.00
F032	<1.	0.00	6.75	1.00	<1.	0.00	<1.	0.00	8.4	7.00	<1.	0.00
F032b	<5.	0.00	7.56	12.00	<5.	0.00	<5.	0.00	8.69	10.00	<5.	0.00
F038	0.46	3.00	7.11	7.00	0.19	1.00	0.18	2.00	8.43	8.00	0.24	4.00
F046	0.51	5.00	7.0	3.50	0.24	6.50	0.17	1.00	8.1	4.00	0.23	3.00
F048	<1.0	0.00	7.50	9.00	<1.0	0.00	<1.0	0.00	8.78	11.00	<1.0	0.00
F060	<1.	0.00	7.	3.50	<1.	0.00	<1.	0.00	8.	1.50	<1.	0.00
F069	<1.	0.00	7.51	10.50	<1.	0.00	3.15 EH	10.00	8.82	12.00	<1.	0.00
F080	<12.	0.00	<12.	0.00	<12.	0.00	<12.	0.00	<12.	0.00	<12.	0.00
F093	0.8	9.00	7.9	13.50	<0.5	0.00	0.5	8.00	9.0	14.50	0.5	7.00
F094	0.5	4.00	7.51	10.50	0.2	3.50	0.22	6.00	8.91	13.00	0.19	1.00
F095	<6.	0.00	8.	15.50	<6.	0.00	<6.	0.00	9.	14.50	<6.	0.00
F096	<4.	0.00	9.5 H	20.00	<4.	0.00	<4.	0.00	8.1	4.00	<4.	0.00
F103	<5.	0.00	8.	15.50	<5.	0.00	<5.	0.00	10.	19.00	<5.	0.00
F133	0.4	1.50	7.0	3.50	0.2	3.50	0.2	4.00	8.6	9.00	0.2	2.00
F139	0.66	7.00	8.91	17.00	0.24	6.50	0.26	7.00	10.68	21.00	0.32	6.00
MEDIAN	0.6000		7.5100		0.2000		0.2100		8.8000		0.3100	
1CRIT	1.5000		1.8606		1.5000		1.5000		1.9380		1.5000	
N	8		19		7		8		19		8	
MEAN	0.6663		7.7789		0.2257		0.2950		8.9584		0.4363	
3STDEV	0.5869		2.3018		0.1050		0.4527		2.1753		0.7940	

PARAMETER: 42095 Molybdenum ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	59.	14.50	313.	17.50	201.	11.50	192.	17.50
F009	55.	3.00	299.	4.00	200.	9.00	187.	6.00
F010	60.	19.50	317.	22.00	207.	22.50	195.	21.00
F011	57.5	8.00	310.	13.50	198.	7.00	185.	3.50
F012	58.	10.00	289. L	1.00	191.	2.00	180.	1.00
F015	50. VL	1.00	310.	13.50	200.	9.00	190.	10.00
F019	58.	10.00	313.	17.50	203.	17.00	191.	14.50
F022	60.	19.50	320.	24.00	194.	4.00	196.	22.00
F024	57.	7.00	310.	13.50	205.	20.00	190.	10.00
F025	69. EH	25.00	343. EH	25.00	222. EH	24.00	219. EH	25.00
F032	55.2	4.00	300.	5.00	191.	2.00	192.	17.50
F032b	58.6	12.00	306.	7.50	203.	17.00	192.	17.50
F038	59.8	18.00	310.	13.50	202.	13.50	191.	14.50
F046	55.7	5.00	301.	6.00	196.	6.00	185.	3.50
F048	60.5	22.00	314.9	19.00	202.1	15.00	190.7	13.00
F060	58.	10.00	309.	11.00	200.	9.00	190.	10.00
F069	59.7	17.00	316.	21.00	203.	17.00	192.	17.50
F080	58.9	13.00	307.	9.00	207.	22.50	190.	10.00
F093	60.3	21.00	319.1	23.00	204.8	19.00	193.5	20.00
F094	66.7 VH	23.00	315.	20.00	206.	21.00	212. VH	24.00
F095	56.	6.00	308.	10.00	195.	5.00	186.	5.00
F096	52.2 L	2.00	295.	2.00	202.	13.50	190.	10.00
F103	59.	14.50	297.	3.00	191.	2.00	184.	2.00
F133	59.3	16.00	306.	7.50	201.	11.50	189.0	7.00
F139	68.10 VH	24.00	311.06	16.00	235.81 EH	25.00	211.27 VH	23.00
MEDIAN	58.9000		310.0000		202.0000		190.7000	
1CRIT	4.9440		20.0100		13.5300		12.8520	
N	23		23		24		23	
MEAN	58.8043		309.0026		201.0375		191.9335	
3STDEV	9.9770		20.3176		19.4178		20.3107	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	91.00	9.100	10					ICP
F009	39.50	5.643	7					ICP-MS
F010	142.00	14.200	10					ICP-OES
F011	81.00	8.100	10					
F012	54.50	9.083	6	H L				ICP-MS
F015	33.50	8.375	4	VL	INSUFFICIENT DATA			ICP
F019	96.50	16.083	6					ICAP
F022	69.50	17.375	4		INSUFFICIENT DATA			ICP-AES
F024	52.00	10.400	5	EL				
F025	169.00	18.778	9	EHH EH EHEHEHEHEH	BIASED HIGH	8.67	6.3854	ICP
F032	36.50	6.083	6					ICP-AES
F032b	76.00	12.667	6					ICP-MS
F038	84.50	8.450	10					ICPMS
F046	43.50	4.350	10		BIASED LOW*	-2.86	-0.3023	ICP-MS As Received
F048	89.00	14.833	6					ICP
F060	45.00	7.500	6					ICP
F069	105.00	15.000	7	EH				ICP-MS
F080	54.50	13.625	4		INSUFFICIENT DATA			ICP dig conc
F093	135.00	15.000	9					ICP
F094	126.00	12.600	10	VH VH				ICPMS
F095	56.00	9.333	6					ICP-USN
F096	51.50	8.583	6	H L				ICP
F103	56.00	9.333	6					ICP-OES
F133	65.50	6.550	10					ICP-MS
F139	152.50	15.250	10	VH EHVH				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 10.956

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F046	43.50	4.350	10		BIASED LOW*	-2.86	-0.3023	ICP-MS As Received
F009	39.50	5.643	7					ICP-MS
F032	36.50	6.083	6					ICP-AES
F133	65.50	6.550	10					ICP-MS
F060	45.00	7.500	6					ICP
F011	81.00	8.100	10					
F015	33.50	8.375	4	VL	INSUFFICIENT DATA			ICP
F038	84.50	8.450	10					ICPMS
F096	51.50	8.583	6	HL				ICP
F012	54.50	9.083	6	HL				ICP-MS
F003	91.00	9.100	10					ICP
F095	56.00	9.333	6					ICP-USN
F103	56.00	9.333	6					ICP-OES
F024	52.00	10.400	5	EL				
F094	126.00	12.600	10	VHVH				ICPMS
F032b	76.00	12.667	6					ICP-MS
F080	54.50	13.625	4		INSUFFICIENT DATA			ICP dig conc
F010	142.00	14.200	10					ICP-OES
F048	89.00	14.833	6					ICP
F093	135.00	15.000	9					ICP
F069	105.00	15.000	7	EH				ICP-MS
F139	152.50	15.250	10	VHEHVH				ICP-MS
F019	96.50	16.083	6					ICAP
F022	69.50	17.375	4		INSUFFICIENT DATA			ICP-AES
F025	169.00	18.778	9	EHHEHEHEHEHEHEH	BIASED HIGH	8.67	6.3854	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 10.956

PARAMETER: 28095 Nickel ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.5000 BASIC ACCEPTABLE ERROR= 1.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25..2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	<2.0	0.00	10.2	13.00	<2.0	0.00	116.	28.50	10.4	15.00	115.	28.50
F003	<0.2	0.00	9.2	5.00	0.8	3.50	101. L	5.00	9.3	5.00	106.	10.00
F008	<2.	0.00	9.	3.50	<2.	0.00	110.	21.50	10.	10.00	100. L	3.50
F009	<1.	0.00	10.	11.50	<1.	0.00	100. L	3.00	10.	10.00	100. L	3.50
F010	0.6	4.50	10.3	15.50	1.1	10.00	109.	17.00	10.4	15.00	109.	15.50
F011	0.5	3.00	9.5	7.00	1.	8.00	106.	11.00	9.5	6.00	103.	5.00
F012	<5.	0.00	12.	24.00	<5.	0.00	110.	21.50	13. H	26.00	113.	27.00
F014	<10.	0.00	<10.	0.00	<10.	0.00	101. L	5.00	<10.	0.00	104.	6.00
F015	<20.	0.00	<20.	0.00	<20.	0.00	110.	21.50	<20.	0.00	110.	19.50
F019	<10.	0.00	<10.	0.00	<10.	0.00	113.	27.00	<10.	0.00	110.	19.50
F022	<5.	0.00	12.	24.00	<5.	0.00	103.	7.50	10.	10.00	106.	10.00
F024	<1.	0.00	9.	3.50	<1.	0.00	110.	21.50	9.	3.50	110.	19.50
F025	<0.5	0.00	6.7 EL	1.00	0.9	7.00	104.	9.00	10.5	17.50	107.	12.00
F026	7.03 EH	11.00	13.22 H	26.00	1.31	12.00	108.66	15.00	13.50 VH	27.00	108.41	14.00
F032	<2.	0.00	11.5	21.00	<2.	0.00	124. VH	32.00	11.6	25.00	125. VH	31.50
F032b	1.42	9.00	10.3	15.50	<1.	0.00	109.	17.00	10.8	19.50	111.	23.50
F038	0.2	1.00	9.9	9.50	0.8	3.50	107.	13.00	10.4	15.00	110.	19.50
F046	0.34	2.00	9.9	9.50	0.68	1.00	106.	11.00	10.3	12.50	111.	23.50
F048	<1.0	0.00	10.3	15.50	1.08	9.00	107.3	14.00	10.9	21.00	107.1	13.00
F060	<1.	0.00	11.	20.00	<1.	0.00	118. H	30.50	11.	23.50	117.	30.00
F063	<1.	0.00	<1. EL	0.00	<1.	0.00	96. VL	2.00	5. EL	1.00	82. EL	1.00
F064	<5.	0.00	12.	24.00	<5.	0.00	101. L	5.00	11.	23.50	112.	25.00
F069	<1.	0.00	10.	11.50	<1.	0.00	109.	17.00	10.5	17.50	110.	19.50
F080	<12.	0.00	<12.	0.00	<12.	0.00	103.	7.50	<12.	0.00	106.	10.00
F093	1.0	6.00	11.7	22.00	2.0	13.00	111.4	25.00	9.7	7.00	112.1	26.00
F094	1.3	8.00	10.3	15.50	0.8	3.50	112.	26.00	10.8	19.50	110.	19.50
F095	<6.	0.00	8. L	2.00	<6.	0.00	84. EL	1.00	9.	3.50	84. EL	2.00
F096	<8.	0.00	9.6	8.00	<8.	0.00	111.	24.00	8.1 L	2.00	109.	15.50
F103	<20.	0.00	<20.	0.00	<20.	0.00	106.	11.00	<20.	0.00	105.	7.00
F133	0.6	4.50	10.5	18.00	0.8	3.50	116.	28.50	10.3	12.50	115.	28.50
F135	3. H	10.00	14. EH	27.00	3. EH	14.00	126. VH	33.00	15. EH	28.00	125. VH	31.50
F136	<1.0	0.00	9.41	6.00	1.13	11.00	118. H	30.50	9.77	8.00	126. VH	33.00
F139	1.29	7.00	10.84	19.00	0.81	6.00	109.99	19.00	10.97	22.00	105.20	8.00
MEDIAN	1.0000		10.3000		0.9500		109.0000		10.4000		110.0000	
1CRIT	1.5000		2.0280		1.5000		7.9500		2.0340		8.0100	
N	9		25		12		31		26		31	
MEAN	1.1167		10.3868		1.0442		108.5919		10.4131		108.8971	
3STDEV	2.2877		3.4749		0.9920		17.8100		3.3312		21.6175	

PARAMETER: 28095 Nickel ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	68.0	21.00	362.	16.50	342.	17.50	225.	20.50
F003	65.	10.00	373.	25.00	334.	8.50	216.	11.00
F008	64.	7.50	400. VH	33.00	380. VH	33.00	240. H	32.00
F009	64.	7.50	352.	8.00	329.	6.00	215.	10.00
F010	67.	17.00	362.	16.50	342.	17.50	221.	14.00
F011	61.3 L	6.00	339.	3.00	312. L	3.00	211.	5.50
F012	69.	27.00	356.	10.50	339.	13.00	223.	15.00
F014	66.9	15.50	382.	29.50	370. H	31.00	231.	25.50
F015	60. L	5.00	370.	22.00	350.	26.00	230.	23.50
F019	70.	28.00	360.	14.50	340.	14.50	210.	3.50
F022	66.	12.00	375.	26.50	366. H	30.00	237.	29.00
F024	68.	21.00	380.	28.00	350.	26.00	230.	23.50
F025	64.1	9.00	346.	5.00	338.	11.50	219.	12.50
F026	68.75	26.00	355.86	9.00	330.04	7.00	213.58	7.00
F032	66.8	14.00	363.	19.00	342.	17.50	235.	28.00
F032b	66.6	13.00	341.	4.00	322.	4.00	210.	3.50
F038	68.	21.00	368.	21.00	350.	26.00	227.	22.00
F046	68.6	25.00	375.	26.50	351.	28.00	225.	20.50
F048	67.8	19.00	362.5	18.00	342.8	20.00	223.4	16.00
F060	72.	30.00	389. H	32.00	365. H	29.00	238.	30.00
F063	55. VL	2.00	371.	23.00	349.	24.00	224.	17.50
F064	57. VL	3.00	360.	14.50	342.	17.50	214.	8.50
F069	66.9	15.50	357.	12.00	337.	10.00	219.	12.50
F080	65.6	11.00	349.	7.00	340.	14.50	214.	8.50
F093	68.5	24.00	371.7	24.00	344.3	21.00	224.7	19.00
F094	73.4 H	32.00	358.	13.00	338.	11.50	244. H	33.00
F095	52. EL	1.00	284. EL	1.00	264. EL	1.00	172. EL	1.00
F096	67.1	18.00	366.	20.00	345.	22.00	224.	17.50
F103	59. L	4.00	356.	10.50	334.	8.50	211.	5.50
F133	70.6	29.00	382.	29.50	347.	23.00	231.	25.50
F135	73. H	31.00	385.	31.00	376. VH	32.00	239. H	31.00
F136	99.1 EH	33.00	347.	6.00	324.	5.00	233.	27.00
F139	68.16	23.00	304.03 EL	2.00	283.00 EL	2.00	200.64 VL	2.00
MEDIAN	67.0000		362.0000		342.0000		224.0000	
1CRIT	5.4300		23.1300		21.9300		14.8500	
N	31		31		31		31	
MEAN	66.3261		361.8739		341.1013		223.0426	
3STDEV	12.6337		49.3015		51.1198		29.4673	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	160.50	20.063	8					28301 28302
F003	83.00	9.222	9	L				
F008	144.00	18.000	8	L VHVHH				GF-ICP
F009	59.50	7.438	8	L L				ICP-MS
F010	142.50	14.250	10					ICP-OES
F011	57.50	5.750	10	L L	BIASED LOW	-7.26	0.5914	
F012	164.00	20.500	8	H				ICP-MS
F014	112.50	18.750	6	L H				ICP-MS
F015	117.50	19.583	6	L				ICP
F019	107.00	17.833	6					ICAP
F022	149.00	18.625	8	H				ICP-AES
F024	146.50	18.313	8					
F025	84.50	9.389	9	EL				ICP-MS
F026	154.00	15.400	10	EHH VH				I.C.P. EMISSION
F032	188.00	23.500	8	VH VH				ICP-AES
F032b	109.00	12.111	9					ICP-MS
F038	151.50	15.150	10					ICPMS
F046	159.50	15.950	10					ICP-MS As Received
F048	145.50	16.167	9					ICP
F060	225.00	28.125	8	H H H	BIASED HIGH	7.01	-0.0326	ICP
F063	70.50	10.071	7	EL VLELELVL				ICP-AES
F064	121.00	15.125	8	L VL				AA
F069	115.50	14.438	8					ICP-MS
F080	58.50	9.750	6					ICP dig conc
F093	187.00	18.700	10					ICP
F094	181.50	18.150	10	H H				ICPMS
F095	12.50	1.562	8	L EL ELELELELEL	BIASED LOW	-22.25	-0.3721	ICP-USN
F096	127.00	15.875	8	L				ICP
F103	46.50	7.750	6	L				ICP-OES
F133	202.50	20.250	10					ICP-MS
F135	268.50	26.850	10	H EHEHVHEHVHH VHH	BIASED HIGH	7.00	3.5765	AA-ETA APHA
F136	159.50	17.722	9	H VHEH				GFAA
F139	110.00	11.000	10	ELELVL				ICP-MS

OVERALL AVERAGE RANK IS 15.543

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F095	12.50	1.562	8	LELELELELELEL	BIASED LOW	-22.25	-0.3721	ICP-USN
F011	57.50	5.750	10	LL	BIASED LOW	-7.26	0.5914	
F009	59.50	7.438	8	LL				ICP-MS
F103	46.50	7.750	6	L				ICP-OES
F003	83.00	9.222	9	L				
F025	84.50	9.389	9	EL				ICP-MS
F080	58.50	9.750	6					ICP dig conc
F063	70.50	10.071	7	ELVLELELVL				ICP-AES
F139	110.00	11.000	10	ELELVL				ICP-MS
F032b	109.00	12.111	9					ICP-MS
F010	142.50	14.250	10					ICP-OES
F069	115.50	14.438	8					ICP-MS
F064	121.00	15.125	8	LVL				AA
F038	151.50	15.150	10					ICPMS
F026	154.00	15.400	10	EHHVH				I.C.P. EMISSION
F096	127.00	15.875	8	L				ICP
F046	159.50	15.950	10					ICP-MS As Received
F048	145.50	16.167	9					ICP
F136	159.50	17.722	9	HVHEH				GFAA
F019	107.00	17.833	6					ICAP
F008	144.00	18.000	8	LVHVHH				GF-ICP
F094	181.50	18.150	10	HH				ICPMS
F024	146.50	18.313	8					
F022	149.00	18.625	8	H				ICP-AES
F093	187.00	18.700	10					ICP
F014	112.50	18.750	6	LH				ICP-MS
F015	117.50	19.583	6	L				ICP
F002	160.50	20.063	8					28301 28302
F133	202.50	20.250	10					ICP-MS
F012	164.00	20.500	8	H				ICP-MS
F032	188.00	23.500	8	VHVH				ICP-AES
F135	268.50	26.850	10	HEHEHVHEHVHHVHH	BIASED HIGH	7.00	3.5765	AA-ETA APHA
F060	225.00	28.125	8	HHH	BIASED HIGH	7.01	-0.0326	ICP

OVERALL AVERAGE
RANK IS 15.543

Nickel

PARAMETER: 34095 Selenium ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.5000 BASIC ACCEPTABLE ERROR= 0.5000 CONCENTRATION ERROR INCREMENT= 0.0800

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	0.1	1.00	4.6	5.00	0.5	1.50	0.4	1.00	1.5	4.50	0.1 L	1.00
F008	<1.	0.00	6. H	19.00	<1.	0.00	<1.	0.00	3. VH	17.50	<1.	0.00
F009	0.2	2.00	4.9	7.50	0.7	5.50	0.9	5.00	2.	12.00	0.9	5.00
F010	<0.2	0.00	5.3	14.00	0.6	3.50	<0.2 L	0.00	2.0	12.00	<0.2 L	0.00
F011	<1.	0.00	5.8	16.50	<1.	0.00	<1.	0.00	2.6 H	15.00	<1.	0.00
F012	13. EH	5.00	16. EH	23.00	14. EH	11.00	18. EH	7.00	16. EH	19.00	17. EH	7.00
F014	<1.0	0.00	5.5	15.00	<1.0	0.00	<1.0	0.00	1.5	4.50	<1.0	0.00
F015	<1.	0.00	5.1	13.00	<1.	0.00	<1.	0.00	1.8	8.00	<1.	0.00
F022	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00
F025	<0.2	0.00	4.6	5.00	0.5	1.50	<0.2 L	0.00	1.7	7.00	<0.2 L	0.00
F031	<3.	0.00	5.	11.00	<3.	0.00	<3.	0.00	<3.	0.00	<3.	0.00
F037	<1.0	0.00	4.912	9.00	<1.0	0.00	<1.0	0.00	1.583	6.00	<1.0	0.00
F038	<1.	0.00	5.	11.00	<1.	0.00	<1.	0.00	2.	12.00	<1.	0.00
F046	0.35	3.00	5.8	16.50	0.80	7.00	0.83	4.00	2.3	14.00	0.83	4.00
F048	<1.0	0.00	6.10 H	21.00	2.06 VH	10.00	3.66 EH	6.00	2.70 H	16.00	3.26 EH	6.00
F060	<0.1	0.00	4.9	7.50	0.6	3.50	<0.1 L	0.00	1.9	9.50	<0.1 L	0.00
F063	<1.	0.00	5.	11.00	1.	8.50	<1.	0.00	1. L	1.50	<1.	0.00
F069	<1.	0.00	4.3	3.00	1.0	8.50	<1.	0.00	1.0 L	1.50	<1.	0.00
F080	<3.	0.00	6. H	19.00	<3.	0.00	<3.	0.00	<3.	0.00	<3.	0.00
F093	<2.0	0.00	4.0 L	2.00	<2.0	0.00	<2.0	0.00	<2.0	0.00	<2.0	0.00
F094	<0.4	0.00	4.6	5.00	0.7	5.50	0.5	2.50	1.9	9.50	0.5	2.50
F096	<0.5	0.00	2.7 EL	1.00	<0.5	0.00	0.5	2.50	1.4	3.00	0.5	2.50
F103	<5.	0.00	6.4 VH	22.00	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00
F133	<1.	0.00	6. H	19.00	<1.	0.00	<1.	0.00	3. VH	17.50	<1.	0.00
F135	4. EH	4.00	<2. EL	0.00	<2.	0.00	<2.	0.00	<2.	0.00	<2.	0.00
MEDIAN	0.3500		5.0000		0.7000		0.8300		1.9000		0.8300	
1CRIT	0.5000		0.8600		0.5160		0.5264		0.6120		0.5264	
N	3		21		8		5		16		5	
MEAN	1.5167		5.2291		0.9325		1.2780		2.0552		1.1980	
3STDEV	-		1.9304		1.3530		-		1.5140		-	

PARAMETER: 34095 Selenium ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	10.9	5.00	25.9 L	5.00	31.8	11.50	19.	12.00
F008	12.	14.00	32.	18.00	37. H	21.00	32. EH	25.00
F009	12.	14.00	31.	15.00	33.	13.00	20.	16.00
F010	12.6	18.00	25. VL	3.00	30.	7.50	18.	7.50
F011	12.9	19.00	32.7	19.50	38.2 VH	23.00	20.2	18.00
F012	24. EH	25.00	34. H	22.00	36.	17.50	29. VH	24.00
F014	11.9	12.00	32.7	19.50	36.5 H	20.00	19.8	14.00
F015	11.8	11.00	27.7	7.00	29.5 L	6.00	18.4	9.50
F022	20. EH	24.00	30.	13.00	36.	17.50	20.	16.00
F025	11.0	7.00	29.0	10.00	31.0	9.00	18.0	7.50
F031	11.	7.00	24. VL	2.00	26. VL	2.50	14. VL	3.00
F037	12.05	16.00	31.59	16.00	35.34	16.00	19.53	13.00
F038	10. L	4.00	30.	13.00	30.	7.50	20.	16.00
F046	13.9 H	20.00	35.9 VH	24.00	39.0 VH	24.00	22.7 VH	22.00
F048	14.75 VH	22.00	35.2 VH	23.00	36.3 H	19.00	21.7 H	21.00
F060	11.6	10.00	31.6	17.00	34.5	15.00	18.9	11.00
F063	11.	7.00	27. L	6.00	29. L	5.00	17. L	6.00
F069	11.1	9.00	28.4	9.00	31.2	10.00	18.4	9.50
F080	12.	14.00	30.	13.00	34.	14.00	16. VL	4.00
F093	9.4 VL	3.00	25.5 VL	4.00	27.9 VL	4.00	16.3 VL	5.00
F094	12.4	17.00	29.3	11.00	31.8	11.50	20.3	19.00
F096	5.9 VL	2.00	11.6 EL	1.00	14.7 EL	1.00	8.3 VL	2.00
F103	15.7 VH	23.00	39.8 EH	25.00	44.0 VH	25.00	24.5 VH	23.00
F133	14. H	21.00	33. H	21.00	38. VH	22.00	21.	20.00
F135	5. VL	1.00	28.	8.00	26. VL	2.50	8. VL	1.00
MEDIAN	12.0000		30.0000		33.0000		19.5300	
1CRIT	1.4200		2.8600		3.1000		2.0224	
N	23		23		23		23	
MEAN	12.1696		29.9778		32.9583		19.1752	
3STDEV	7.5774		9.5260		11.4365		11.2612	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	47.50	4.750	10	L L	BIASED LOW	-6.36	-0.2721	HYD-ICP
F008	114.50	19.083	6	H VH H EH	BIASED HIGH	11.46	1.4918	Hydride
F009	95.00	9.500	10					ICP-MS
F010	65.50	9.357	7	L L VL				Hydride-AA
F011	111.00	18.500	6	H VH	BIASED HIGH	11.63	-0.1383	
F012	160.50	16.050	10	EHEHEHEHEHEHEHH VH				ICP-MS
F014	85.00	14.167	6	H				ICP-MS
F015	54.50	9.083	6	L				GFAA
F022	70.50	17.625	4	EH	INSUFFICIENT DATA			ICP-AES
F025	47.00	6.714	7	L L				AA HYDRIDE
F031	25.50	5.100	5	VLVLVL				ICP
F037	76.00	12.667	6					ICP-MS
F038	63.50	10.583	6	L				ICPMS
F046	138.50	13.850	10	H VHVHVH				ICP-MS As Received
F048	144.00	16.000	9	H VHEHH EHVHVHH H				ICP
F060	73.50	10.500	7	L L				Hydride - AA
F063	45.00	6.429	7	L L L L				HYDRIDE AA
F069	50.50	7.214	7	L				Graphite Furnace
F080	64.00	12.800	5	H VL				Hydride Gen ICP
F093	18.00	3.600	5	L VLVLVLVL	BIASED LOW	-13.53	-0.5925	ICP - Hydride
F094	83.50	9.278	9					ICPMS
F096	15.00	1.875	8	EL VLELELVL	BIASED LOW	-59.26	0.4502	Auto hydride AA
F103	118.00	23.600	5	VH VHEHVHVH	BIASED HIGH	34.21	-0.6363	GFAA
F133	120.50	20.083	6	H VH H H VH	BIASED HIGH	10.31	0.5189	ICP-MS
F135	16.50	3.300	5	EHEL VL VLVL	BIASED LOW	-20.41	-0.9028	AA-ETA APHA

OVERALL AVERAGE
RANK IS 11.064

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F096	15.00	1.875	8	ELVLELELVL	BIASED LOW	-59.26	0.4502	Auto hydride AA
F135	16.50	3.300	5	EHELVLVLVL	BIASED LOW	-20.41	-0.9028	AA-ETA APHA
F093	18.00	3.600	5	LVLVLVLVL	BIASED LOW	-13.53	-0.5925	ICP - Hydride
F003	47.50	4.750	10	LL	BIASED LOW	-6.36	-0.2721	HYD-ICP
F031	25.50	5.100	5	VLVLVL				ICP
F063	45.00	6.429	7	LLLL				HYDRIDE AA
F025	47.00	6.714	7	LL				AA HYDRIDE
F069	50.50	7.214	7	L				Graphite Furnace
F015	54.50	9.083	6	L				GFAA
F094	83.50	9.278	9					ICPMS
F010	65.50	9.357	7	LLVL				Hydride-AA
F009	95.00	9.500	10					ICP-MS
F060	73.50	10.500	7	LL				Hydride - AA
F038	63.50	10.583	6	L				ICPMS
F037	76.00	12.667	6					ICP-MS
F080	64.00	12.800	5	HVL				Hydride Gen ICP
F046	138.50	13.850	10	HVHVHVH				ICP-MS As Received
F014	85.00	14.167	6	H				ICP-MS
F048	144.00	16.000	9	HVHEHHEHVHVHHH				ICP
F012	160.50	16.050	10	EHEHEHEHEHEHEHHVH				ICP-MS
F022	70.50	17.625	4	EH	INSUFFICIENT DATA			ICP-AES
F011	111.00	18.500	6	HVH	BIASED HIGH	11.63	-0.1383	
F008	114.50	19.083	6	HVHHEH	BIASED HIGH	11.46	1.4918	Hydride
F133	120.50	20.083	6	HVHHHVH	BIASED HIGH	10.31	0.5189	ICP-MS
F103	118.00	23.600	5	VHVHEHVHVH	BIASED HIGH	34.21	-0.6363	GFAA

OVERALL AVERAGE
RANK IS 11.064

PARAMETER: 47095 Silver ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.5000 BASIC ACCEPTABLE ERROR= 0.5000 CONCENTRATION ERROR INCREMENT= 0.0800

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	<0.1	0.00	4.9	12.00	0.2	3.50	<0.1	0.00	2.1	11.50	<1.	0.00
F010	<0.2	0.00	4.6	7.50	<0.2	0.00	<0.2	0.00	2.3	16.50	<0.2	0.00
F011	<0.1	0.00	5.5	18.00	0.3	6.00	<0.1	0.00	2.4	18.00	<0.1	0.00
F012	<3.	0.00	6. H	21.00	<3.	0.00	<3.	0.00	3. H	19.50	<3.	0.00
F015	<0.5	0.00	4.6	7.50	<0.5	0.00	<0.5	0.00	2.	8.00	<0.5	0.00
F022	<5.	0.00	6. H	21.00	<5.	0.00	<5.	0.00	5. EH	21.00	<5.	0.00
F025	<0.1	0.00	3.8 L	3.00	<0.1	0.00	<0.1	0.00	1.5	3.00	<0.1	0.00
F032	<0.6	0.00	5.9 H	19.00	0.7	8.00	<0.6	0.00	1.94	6.00	<0.6	0.00
F037	0.2595	2.00	4.559	5.00	0.3587	7.00	<0.2	0.00	2.071	10.00	<0.2	0.00
F038	<0.01	0.00	4.76	10.00	0.15	1.50	0.01	1.50	2.16	13.00	0.01	1.50
F046	<0.1	0.00	5.2	17.00	0.25	5.00	<0.1	0.00	2.2	14.00	<0.1	0.00
F048	<1.0	0.00	3.90 L	4.00	<1.0	0.00	<1.0	0.00	1.00 VL	1.00	<1.0	0.00
F060	<1.	0.00	5.	15.00	<1.	0.00	<1.	0.00	3. H	19.50	<1.	0.00
F064	<1.	0.00	1.6 EL	1.00	<1.	0.00	<1.	0.00	1.7	4.00	<1.	0.00
F069	<1.	0.00	4.97	13.00	<1.	0.00	<1.	0.00	2.1	11.50	<1.	0.00
F080	<3.	0.00	<3. VL	0.00	<3.	0.00	<3.	0.00	<3.	0.00	<3.	0.00
F093	1.6 EH	3.00	5.0	15.00	1.4 EH	9.00	<0.9	0.00	<0.9 VL	0.00	1.1 EH	3.00
F094	<0.2	0.00	3.3 VL	2.00	<0.2	0.00	<0.2	0.00	1.2 L	2.00	<0.2	0.00
F095	<2.	0.00	6. H	21.00	<2.	0.00	<2.	0.00	2.	8.00	<2.	0.00
F096	<0.5	0.00	4.8	11.00	<0.5	0.00	<0.5	0.00	2.3	16.50	<0.5	0.00
F103	<15.	0.00	<15.	0.00	<15.	0.00	<15.	0.00	<15.	0.00	<15.	0.00
F133	<0.05	0.00	4.75	9.00	0.20	3.50	<0.05	0.00	2.25	15.00	<0.05	0.00
F135	<1.	0.00	5.	15.00	<1.	0.00	<1.	0.00	2.	8.00	<1.	0.00
F139	0.01	1.00	4.59	6.00	0.15	1.50	0.01	1.50	1.73	5.00	0.01	1.50
MEDIAN OR *TARGET CONC.	*0.0500		4.8500		0.2500		*0.0500		2.1000		*0.0500	
1CRIT	0.5000		0.8480		0.5000		0.5000		0.6280		0.5000	
N	1		21		6		2		19		0	
MEAN	0.2595		4.9109		0.3348		0.0100		2.1027		-	
3STDEV	-		2.1038		0.5177		-		1.2596		-	

PARAMETER: 47095 Silver ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	12.	9.50	13. L	8.50	14. VL	6.00	8. VL	4.00
F010	13.6	16.00	14.6	11.00	16.7	11.00	9.7	8.00
F011	15.4 VH	23.00	18.5 VH	24.00	21.2 VH	24.00	11.4	21.00
F012	14.	20.00	17. H	21.50	19. H	21.50	12. H	23.50
F015	11. L	6.00	13. L	8.50	17.	12.50	10.	10.00
F022	10. VL	4.50	5. VL	2.00	12. VL	4.00	10.	10.00
F025	11.4 L	7.00	14.4	10.00	16.0	9.00	9.0 L	5.00
F032	13.7	17.00	16.9 H	20.00	19.2 H	23.00	11.5	22.00
F037	12.21	11.00	14.68	12.00	17.08	14.00	9.572	6.00
F038	12.9	12.00	15.9	15.00	17.8	16.00	10.4	12.50
F046	13.5	15.00	16.4	18.50	18.6	19.50	10.9	17.00
F048	13.4	14.00	10.4 VL	4.00	18.1	18.00	10.4	12.50
F060	14.	20.00	16.	16.50	19. H	21.50	11.	18.50
F064	3.1 EL	1.00	3.2 EL	1.00	4.6 EL	1.00	6.3 VL	2.00
F069	13.9	18.00	17.0 H	21.50	16.0	9.00	10.7	15.00
F080	10. VL	4.50	8. VL	3.00	8. VL	2.00	6. EL	1.00
F093	7.6 VL	2.00	12.6 L	7.00	9.9 VL	3.00	10.6	14.00
F094	9.7 VL	3.00	10.8 VL	5.00	12.6 VL	5.00	7.9 VL	3.00
F095	12.	9.50	15.	13.00	16.	9.00	10.	10.00
F096	13.1	13.00	15.3	14.00	17.7	15.00	11.2	20.00
F103	<15.	0.00	18. VH	23.00	18.	17.00	12. H	23.50
F133	14.10	22.00	16.40	18.50	18.60	19.50	10.88	16.00
F135	14.	20.00	16.	16.50	17.	12.50	11.	18.50
F139	11.68	8.00	12.36 VL	6.00	14.66 L	7.00	9.60	7.00
MEDIAN OR *TARGET								
CONC.	12.9000		14.8400		17.0000		10.4000	
1CRIT	1.4920		1.6472		1.8200		1.2920	
N	21		22		22		21	
MEAN	12.2757		14.0336		16.0427		10.0025	
3STDEV	5.2479		9.4010		8.9197		3.8137	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	55.00	7.857	7	L VLVL				ICP
F010	70.00	11.667	6					ICP-OES
F011	134.00	19.143	7	VHVHVH	BIASED HIGH	24.19	-0.3890	
F012	127.00	21.167	6	H H H H H	BIASED HIGH	7.18	0.7420	ICP-MS
F015	52.50	8.750	6	L L				GFAA
F022	62.50	10.417	6	H EH VLVLVL				ICP-AES
F025	37.00	6.167	6	L L L				ICP-MS
F032	115.00	16.429	7	H H H				ICP-AES
F037	67.00	8.375	8					ICP-MS
F038	83.00	9.222	9					ICPMS
F046	106.00	15.143	7					ICP-MS As Received
F048	53.50	8.917	6	L VL VL				ICP
F060	111.00	18.500	6	H H	BIASED HIGH	7.74	0.1836	ICP
F064	10.00	1.667	6	EL ELELELVL	BIASED LOW	-82.04	1.5582	AA
F069	88.00	14.667	6	H				Graphite Furnace
F080	10.50	2.625	4	VL VLVLVLEL	INSUFFICIENT DATA			FAA dig conc
F093	56.00	7.000	8	EH EH VLEHVLL VL				ICP
F094	20.00	3.333	6	VL L VLVLVLVL	BIASED LOW	-23.50	-0.3331	ICPMS
F095	70.50	11.750	6	H				ICP-USN
F096	89.50	14.917	6					GFAA
F103	63.50	21.167	3	VH H	INSUFFICIENT DATA			ICP-OES
F133	103.50	14.786	7					ICP-MS
F135	90.50	15.083	6					AA-ETA APHA
F139	44.50	4.450	10	VLL	BIASED LOW	-99.22	7.7854	ICP-MS

OVERALL AVERAGE
RANK IS 11.097

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F064	10.00	1.667	6	ELELELELVL	BIASED LOW	-82.04	1.5582	AA
F080	10.50	2.625	4	VLVLVLVLEL	INSUFFICIENT DATA			FAA dig conc
F094	20.00	3.333	6	VLLVLVLVLVL	BIASED LOW	-23.50	-0.3331	ICPMS
F139	44.50	4.450	10	VLL	BIASED LOW	-99.22	7.7854	ICP-MS
F025	37.00	6.167	6	LLL				ICP-MS
F093	56.00	7.000	8	EHEHVLEHVLLVL				ICP
F003	55.00	7.857	7	LVLVL				ICP
F037	67.00	8.375	8					ICP-MS
F015	52.50	8.750	6	LL				GFAA
F048	53.50	8.917	6	LVLVL				ICP
F038	83.00	9.222	9					ICPMS
F022	62.50	10.417	6	HEHVLVLVL				ICP-AES
F010	70.00	11.667	6					ICP-OES
F095	70.50	11.750	6	H				ICP-USN
F069	88.00	14.667	6	H				Graphite Furnace
F133	103.50	14.786	7					ICP-MS
F096	89.50	14.917	6					GFAA
F135	90.50	15.083	6					AA-ETA APHA
F046	106.00	15.143	7					ICP-MS As Received
F032	115.00	16.429	7	HHH				ICP-AES
F060	111.00	18.500	6	HH	BIASED HIGH	7.74	0.1836	ICP
F011	134.00	19.143	7	VHVHVH	BIASED HIGH	24.19	-0.3890	
F103	63.50	21.167	3	VHH	INSUFFICIENT DATA			ICP-OES
F012	127.00	21.167	6	HHHHH	BIASED HIGH	7.18	0.7420	ICP-MS

OVERALL AVERAGE
RANK IS 11.097

PARAMETER: 38095 Strontium ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 2.5000 BASIC ACCEPTABLE ERROR= 2.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	107.	6.00	137.	7.50	1.6	8.50	58.5	7.00	231.	6.00	58.4	5.00
F009	112.	17.00	143.	15.00	1.8	15.00	60.	12.50	242.	16.50	61.	16.00
F010	102.	3.00	128. L	2.00	1.	1.50	54. L	2.00	219. L	2.00	54. L	2.00
F011	118.	21.00	143.	15.00	2.3	20.00	62.3	20.00	264. VH	21.00	62.4	20.00
F015	114.	20.00	144.	18.50	2.	18.00	61.	16.00	244.	18.50	61.	16.00
F022	110.	10.50	143.	15.00	<5.	0.00	60.	12.50	228.	4.00	60.	12.00
F024	125. VH	22.50	160. VH	22.00	1.	1.50	67. H	22.00	270. VH	22.00	66.	21.50
F025	141. EH	24.00	183. EH	24.00	3. EH	21.00	75. EH	24.00	306. EH	24.00	82. EH	24.00
F032	112.	17.00	150.	21.00	1.84	16.00	61.0	16.00	250.	20.00	61.6	19.00
F032b	109.	8.00	140.	9.50	1.74	13.00	59.5	10.00	235.	11.50	59.2	9.00
F038	104.	4.00	135.	5.00	1.6	8.50	57.9	6.00	231.	6.00	58.5	6.50
F046	110.	10.50	142.	13.00	1.6	8.50	57.7	5.00	232.	8.50	59.4	10.00
F048	111.6	15.00	143.1	17.00	1.44	4.00	61.2	19.00	238.8	14.00	61.1	18.00
F060	113.	19.00	144.	18.50	1.7	11.50	60.3	14.00	242.	16.50	59.9	11.00
F063	111.	13.50	141.	11.50	4. EH	22.00	61.	16.00	240.	15.00	61.	16.00
F069	110.	10.50	140.	9.50	1.56	6.00	59.2	9.00	233.	10.00	58.9	8.00
F080	110.	10.50	141.	11.50	1.7	11.50	58.8	8.00	236.	13.00	60.1	13.00
F094	112.	17.00	145.	20.00	1.75	14.00	61.1	18.00	244.	18.50	60.5	14.00
F095	95. VL	1.00	132.	3.00	2.	18.00	47. EL	1.00	225.	3.00	46. EL	1.00
F096	106.	5.00	136.	6.00	1.6	8.50	57.2	4.00	231.	6.00	57.1	4.00
F103	111.	13.50	137.	7.50	2.	18.00	66. H	21.00	235.	11.50	66.	21.50
F133	108.8	7.00	134.8	4.00	1.48	5.00	59.7	11.00	232.	8.50	58.5	6.50
F136	98.9 L	2.00	124.9 VL	1.00	1.1	3.00	54.2	3.00	216.5 L	1.00	56.6	3.00
F139	125. VH	22.50	164. VH	23.00	<10.	0.00	69. VH	23.00	273. VH	23.00	70. VH	23.00
MEDIAN	110.5000		141.5000		1.7000		60.0000		235.5000		60.0500	
1CRIT	8.9800		10.8400		2.5000		5.9500		16.4800		5.9530	
N	22		22		19		22		22		22	
MEAN	110.9227		141.9500		1.7795		60.3000		239.8091		60.5091	
3STDEV	17.9489		23.8110		1.1453		10.4493		40.4614		9.9976	

PARAMETER: 38095 Strontium ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	120.	9.00	612.	12.00	402.	11.00	466.	13.00
F009	121.	11.50	596.	7.00	391.	5.00	451.	6.00
F010	110. L	1.00	562. L	4.00	373. L	3.00	428. L	2.00
F011	128.	20.00	426. EL	1.00	641. EH	24.00	493.	20.00
F015	123.	16.50	626.	18.00	415.	19.00	476.	19.00
F022	123.	16.50	620.	15.50	406.	15.00	470.	16.00
F024	140. VH	22.00	705. VH	22.00	465. VH	21.00	530. VH	21.00
F025	158. EH	24.00	805. EH	24.00	519. EH	23.00	630. EH	24.00
F032	115.	3.00	574.	5.00	375. L	4.00	450.	5.00
F032b	121.	11.50	604.	10.00	402.	11.00	464.	11.00
F038	120.	9.00	620.	15.50	402.	11.00	467.	14.00
F046	122.	13.50	640.	20.00	410.	17.00	471.	17.00
F048	124.6	19.00	632.4	19.00	413.0	18.00	475.8	18.00
F060	124.	18.00	621.	17.00	408.	16.00	468.	15.00
F063	122.	13.50	618.	14.00	401.	9.00	465.	12.00
F069	119.	7.00	614.	13.00	404.	13.00	461.	10.00
F080	120.	9.00	603.	9.00	405.	14.00	457.	9.00
F094	138. VH	21.00	648.	21.00	427.	20.00	545. VH	22.00
F095	111. L	2.00	560. L	3.00	342. VL	1.00	415. VL	1.00
F096	118.	5.50	606.	11.00	395.	7.50	456.	8.00
F103	118.	5.50	591.	6.00	395.	7.50	452.	7.00
F133	122.5	15.00	597.	8.00	392.	6.00	446.	4.00
F136	117.2	4.00	558.0 L	2.00	366.8 L	2.00	436.7	3.00
F139	143. VH	23.00	724. VH	23.00	486. VH	22.00	556. VH	23.00
MEDIAN	121.5000		613.0000		403.0000		465.5000	
1CRIT	9.6400		39.1300		26.5300		30.2800	
N	22		22		22		22	
MEAN	123.1955		615.0637		411.4909		472.0227	
3STDEV	22.9419		118.9631		104.9129		95.2987	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	85.00	8.500	10					ICP
F009	121.50	12.150	10					ICP-MS
F010	22.50	2.250	10	L L L L L L L L	BIASED LOW	-7.88	-0.6870	ICP-OES
F011	182.00	18.200	10	VH ELEH				
F015	179.50	17.950	10					ICP
F022	117.00	13.000	9					ICP-AES
F024	197.50	19.750	10	VHVH H VH VHVHVHVH	BIASED HIGH	15.12	-1.7642	
F025	236.00	23.600	10	EHEHEHEHEHEHEHEHEHEH	BIASED HIGH	32.24	-2.3410	ICP
F032	126.00	12.600	10	L				ICP-AES
F032b	104.50	10.450	10					ICP-MS
F038	85.50	8.550	10					ICPMS
F046	123.00	12.300	10					ICP-MS As Received
F048	161.00	16.100	10					ICP
F060	156.50	15.650	10					ICP
F063	142.50	14.250	10	EH				ICP-AES
F069	96.00	9.600	10					ICP
F080	108.50	10.850	10					ICP dig conc
F094	185.50	18.550	10	VH VH				ICPMS
F095	34.00	3.400	10	VL EL ELL L VLVL	BIASED LOW	-9.74	-2.1862	ICP-USN
F096	65.50	6.550	10					ICP
F103	119.00	11.900	10	H				ICP-OES
F133	75.00	7.500	10					ICP-MS
F136	24.00	2.400	10	L VL L L L	BIASED LOW	-8.20	0.0138	DCP
F139	205.50	22.833	9	VHVH VHVHVHVHVHVHVH	BIASED HIGH	19.55	-3.6393	ICP-OES

OVERALL AVERAGE
RANK IS 12.408

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F010	22.50	2.250	10	LLLLLLLL	BIASED LOW	-7.88	-0.6870	ICP-OES
F136	24.00	2.400	10	LVLLLL	BIASED LOW	-8.20	0.0138	DCP
F095	34.00	3.400	10	VLELELLLVLVL	BIASED LOW	-9.74	-2.1862	ICP-USN
F096	65.50	6.550	10					ICP
F133	75.00	7.500	10					ICP-MS
F003	85.00	8.500	10					ICP
F038	85.50	8.550	10					ICPMS
F069	96.00	9.600	10					ICP
F032b	104.50	10.450	10					ICP-MS
F080	108.50	10.850	10					ICP dig conc
F103	119.00	11.900	10	H				ICP-OES
F009	121.50	12.150	10					ICP-MS
F046	123.00	12.300	10					ICP-MS As Received
F032	126.00	12.600	10	L				ICP-AES
F022	117.00	13.000	9					ICP-AES
F063	142.50	14.250	10	EH				ICP-AES
F060	156.50	15.650	10					ICP
F048	161.00	16.100	10					ICP
F015	179.50	17.950	10					ICP
F011	182.00	18.200	10	VHELEH				
F094	185.50	18.550	10	VHVH				ICPMS
F024	197.50	19.750	10	VHVHHVHVHVHVHVH	BIASED HIGH	15.12	-1.7642	
F139	205.50	22.833	9	VHVHVHVHVHVHVHVHVH	BIASED HIGH	19.55	-3.6393	ICP-OES
F025	236.00	23.600	10	EHEHEHEHEHEHEHEHEHEH	BIASED HIGH	32.24	-2.3410	ICP

OVERALL AVERAGE
RANK IS 12.408

PARAMETER: 81095 Thallium ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.7500 BASIC ACCEPTABLE ERROR= 0.7500 CONCENTRATION ERROR INCREMENT= 0.0800

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	0.195	2.00	6.3	5.00	0.33	3.50	0.011	1.00	0.014	1.00	0.009	1.00
F011	0.2	4.00	6.6	9.00	0.5	6.00	0.2	3.00	0.2	2.00	0.3	3.00
F012	<5.	0.00	7.	11.50	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00
F014	<1.0	0.00	6.3	5.00	<1.0	0.00	<1.0	0.00	<1.0	0.00	<1.0	0.00
F025	<1.	0.00	5. L	2.00	<1.	0.00	<1.	0.00	<1.	0.00	<1.	0.00
F038	0.19	1.00	6.36	7.00	0.33	3.50	<0.05	0.00	<0.05	0.00	<0.05	0.00
F046	0.27	6.00	6.3	5.00	0.31	2.00	0.16	2.00	<0.1	0.00	0.10	2.00
F048	<1.0	0.00	6.42	8.00	<1.0	0.00	<1.0	0.00	<1.0	0.00	<1.0	0.00
F060	<4.	0.00	7.	11.50	<4.	0.00	<4.	0.00	<4.	0.00	<4.	0.00
F069	<0.5	0.00	7.21	13.00	<0.5	0.00	<0.5	0.00	<0.5	0.00	<0.5	0.00
F093	<2.0	0.00	8.0 H	14.00	<2.0	0.00	2.0 EH	4.00	<2.0	0.00	<2.0	0.00
F094	0.2	4.00	6.65	10.00	0.34	5.00	<0.05	0.00	<0.05	0.00	<0.05	0.00
F096	<2.	0.00	2.7 EL	1.00	<2.	0.00	<2.	0.00	<2.	0.00	<2.	0.00
F103	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00
F133	0.20	4.00	6.05	3.00	0.30	1.00	<0.05	0.00	<0.05	0.00	<0.05	0.00
MEDIAN OR *TARGET												
CONC.	0.2000		6.3900		0.3300		*0.0500				*0.0500	
1CRIT	0.7500		1.2012		0.7500		0.7500		0.7500		0.7500	
N	4		12		4		2		2		1	
MEAN	0.1987		6.4325		0.3275		0.1800		0.1070		0.1000	
3STDEV	-		1.6387		-		-		-		-	

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	19.4	5.00	27.3	11.00	0.02	1.00	16.4	9.00
F011	20.5	12.00	28.8	14.00	0.2	2.00	17.	11.50
F012	20.	10.00	27.	7.50	<5.	0.00	18.	13.00
F014	18.7	3.00	25.0	4.00	<1.0	0.00	16.0	5.50
F025	17. L	2.00	23. L	2.00	<1.	0.00	15.	2.50
F038	19.8	7.50	27.4	12.00	<0.05	0.00	16.7	10.00
F046	15.5 EL	1.00	20.6 EL	1.00	<0.1	0.00	13.2 EL	1.00
F048	19.5	6.00	27.2	10.00	<1.0	0.00	16.1	7.50
F060	22.	14.50	27.	7.50	<4.	0.00	17.	11.50
F069	19.8	7.50	27.0	7.50	<0.5	0.00	16.1	7.50
F093	21.6	13.00	30.5 H	15.00	2.0	3.00	19.7 EH	15.00
F094	22.	14.50	27.7	13.00	<0.05	0.00	18.5 H	14.00
F096	20.	10.00	24. L	3.00	<2.	0.00	15.	2.50
F103	20.	10.00	27.	7.50	<10.	0.00	16.	5.50
F133	18.9	4.00	25.9	5.00	<0.05	0.00	15.7	4.00
MEDIAN OR *TARGET								
CONC.	19.8000		27.0000				16.1000	
1CRIT	2.2740		2.8500		0.7500		1.9780	
N	12		13		1		13	
MEAN	19.6000		26.4846		0.2000		16.4231	
3STDEV	3.1796		4.6159		-		2.9632	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	39.50	3.950	10					ICP
F011	66.50	6.650	10					
F012	42.00	10.500	4					ICP-MS
F014	17.50	4.375	4					ICP-MS
F025	8.50	2.125	4	L L L				ICP-MS
F038	41.00	6.833	6					ICPMS
F046	20.00	2.500	8	ELEL EL				ICP-MS As Received
F048	31.50	7.875	4					ICP
F060	45.00	11.250	4					ICP
F069	35.50	8.875	4					Graphite Furnace
F093	64.00	10.667	6	H EH H EH				ICP
F094	60.50	10.083	6	H				ICPMS
F096	16.50	4.125	4	EL L				ICP
F103	23.00	7.667	3					ICP-OES
F133	21.00	3.500	6					ICP-MS

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

OVERALL AVERAGE
RANK IS 6.410

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F025	8.50	2.125	4	LLL				ICP-MS
F046	20.00	2.500	8	ELELEL				ICP-MS As Received
F133	21.00	3.500	6					ICP-MS
F003	39.50	3.950	10					ICP
F096	16.50	4.125	4	ELL				ICP
F014	17.50	4.375	4					ICP-MS
F011	66.50	6.650	10					
F038	41.00	6.833	6					ICPMS
F103	23.00	7.667	3					ICP-OES
F048	31.50	7.875	4					ICP
F069	35.50	8.875	4					Graphite Furnace
F094	60.50	10.083	6	H				ICPMS
F012	42.00	10.500	4					ICP-MS
F093	64.00	10.667	6	HEHHEH				ICP
F060	45.00	11.250	4					ICP

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

OVERALL AVERAGE
RANK IS 6.410

PARAMETER: 92095 Uranium ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.5000 BASIC ACCEPTABLE ERROR= 0.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	0.446	3.00	6.15	8.00	0.284	4.00	0.138	3.00	0.086	4.00	0.139	2.00
F009	<1.	0.00	5.6	2.00	<1.	0.00	<1.	0.00	<1.	0.00	<1.	0.00
F011	0.5	7.00	6.4	12.00	0.3	6.00	0.1	1.00	0.1	6.00	0.2	6.00
F014	<0.5	0.00	5.7	3.00	<0.5	0.00	<0.5	0.00	<0.5	0.00	<0.5	0.00
F024	<0.5	0.00	6.2	9.00	<0.5	0.00	<0.5	0.00	<0.5	0.00	<0.5	0.00
F025	0.4	1.50	5.5	1.00	<0.4	0.00	<0.4	0.00	<0.4	0.00	<0.4	0.00
F038	0.46	4.00	6.24	11.00	0.29	5.00	0.13	2.00	0.08	3.00	0.13	1.00
F046	0.47	5.50	5.9	6.00	0.27	2.00	0.15	5.00	0.07	2.00	0.14	3.00
F048	<1.0	0.00	6.23	10.00	<1.0	0.00	<1.0	0.00	<1.0	0.00	<1.0	0.00
F060	<50.	0.00	<50.	0.00	<50.	0.00	<50.	0.00	<50.	0.00	<50.	0.00
F064	1.0 H	8.00	5.8	5.00	0.9 H	7.00	1.3 EH	7.00	0.6 H	7.00	2.0 EH	7.00
F069	<1.	0.00	6.11	7.00	<1.	0.00	<1.	0.00	<1.	0.00	<1.	0.00
F094	0.47	5.50	6.49	13.00	0.28	3.00	0.15	5.00	0.09	5.00	0.15	4.50
F095	<4.	0.00	<4. EL	0.00	<4.	0.00	<4.	0.00	<4.	0.00	<4.	0.00
F133	0.40	1.50	5.73	4.00	0.25	1.00	0.15	5.00	0.05	1.00	0.15	4.50
MEDIAN	0.4650		6.1100		0.2840		0.1500		0.0860		0.1500	
1CRIT	0.5000		0.8366		0.5000		0.5000		0.5000		0.5000	
N	5		11		5		5		5		5	
MEAN	0.4692		6.0055		0.2848		0.1436		0.0852		0.1558	
3STDEV	-		0.7663		-		-		-		-	

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	30.5	9.50	63.8	8.00	21.3	7.00	39.	11.00
F009	27. L	4.00	58. L	4.00	20.	5.00	35.	5.00
F011	32.3	13.00	67.3	14.00	23.7 H	14.00	38.7	10.00
F014	30.5	9.50	67.1	13.00	23.3 H	13.00	38.3	8.00
F024	30.	7.00	63.	7.00	22.	11.00	36.	6.00
F025	27.1 L	5.00	54.7 VL	3.00	19.6 L	4.00	34.1 L	4.00
F038	31.3	11.00	64.4	10.00	21.7	9.00	39.2	12.00
F046	24.3 VL	3.00	49.3 VL	1.00	15.2 VL	2.00	31.4 VL	3.00
F048	31.6	12.00	65.7	11.00	21.9	10.00	39.3	13.00
F060	<50.	0.00	<50. VL	0.00	<50.	0.00	<50.	0.00
F064	22.7 VL	2.00	59.1 L	5.00	15.9 VL	3.00	28.4 VL	1.00
F069	30.4	8.00	64.0	9.00	21.6	8.00	38.5	9.00
F094	35. VH	14.00	66.	12.00	22.7	12.00	44.3 VH	14.00
F095	21. VL	1.00	53. VL	2.00	8. EL	1.00	29. VL	2.00
F133	29.4	6.00	60.5	6.00	20.7	6.00	36.3	7.00
MEDIAN	30.2000		63.4000		21.4500		37.3000	
1CRIT	2.2820		4.2740		1.7570		2.7080	
N	12		12		12		12	
MEAN	28.9250		61.6083		20.4917		36.2333	
3STDEV	8.6553		13.0999		7.2730		9.6111	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	59.50	5.950	10					
F009	20.00	4.000	5	L L				ICP-MS
F011	89.00	8.900	10	H				
F014	46.50	9.300	5	H				ICP-MS
F024	40.00	8.000	5					
F025	18.50	3.083	6	L VLL L	BIASED LOW	-13.17	0.5669	ICP-MS
F038	68.00	6.800	10					ICPMS
F046	32.50	3.250	10	VLVLVLVL	BIASED LOW	-21.31	0.1608	ICP-MS As Received
F048	56.00	11.200	5		BIASED HIGH*	4.14	-0.0567	ICP
F060	0.00	*******	0	VL	INSUFFICIENT DATA			ICP
F064	52.00	5.200	10	H H EHH EHVLL VLVL				Fluorimetric
F069	41.00	8.200	5					ICP-MS
F094	88.00	8.800	10	VH VH				ICPMS
F095	6.00	1.500	4	EL VLVLELVL	INSUFFICIENT DATA			ICP-USN
F133	42.00	4.200	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 6.276

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F060	0.00	*******	0	VL	INSUFFICIENT DATA			ICP
F095	6.00	1.500	4	ELVLVLELVL	INSUFFICIENT DATA			ICP-USN
F025	18.50	3.083	6	LVLLL	BIASED LOW	-13.17	0.5669	ICP-MS
F046	32.50	3.250	10	VLVLVLVL	BIASED LOW	-21.31	0.1608	ICP-MS As Received
F009	20.00	4.000	5	LL				ICP-MS
F133	42.00	4.200	10					ICP-MS
F064	52.00	5.200	10	HHEHHEHVLLVLVL				Fluorimetric
F003	59.50	5.950	10					
F038	68.00	6.800	10					ICPMS
F024	40.00	8.000	5					
F069	41.00	8.200	5					ICP-MS
F094	88.00	8.800	10	VHVH				ICPMS
F011	89.00	8.900	10	H				
F014	46.50	9.300	5	H				ICP-MS
F048	56.00	11.200	5		BIASED HIGH*	4.14	-0.0567	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 6.276

PARAMETER: 23095 Vanadium ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.5000 BASIC ACCEPTABLE ERROR= 1.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	0.2	2.00	10.8	8.00	0.6	1.00	<0.1	0.00	15.3	11.00	<1.	0.00
F008	<5.	0.00	12.	20.50	<5.	0.00	<5.	0.00	15.	8.00	<5.	0.00
F009	<1.	0.00	10.	4.00	<1.	0.00	1.	3.00	15.	8.00	<1.	0.00
F010	3.5 EH	4.00	10.9	9.50	0.9	5.00	0.4	1.00	16.	16.00	0.3	1.00
F011	<0.1	0.00	11.5	17.00	0.7	3.50	<0.1	0.00	16.6	20.50	<0.1	0.00
F012	<5.	0.00	12.	20.50	<5.	0.00	6. EH	4.00	16.	16.00	6. EH	4.00
F014	<1.0	0.00	10.2	6.50	<1.0	0.00	<1.0	0.00	14.9	6.00	<1.0	0.00
F015	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	10. VL	1.00	<10.	0.00
F019	<5.	0.00	9.	1.50	<5.	0.00	<5.	0.00	14.	4.00	<5.	0.00
F022	<5.	0.00	13.	22.50	<5.	0.00	<5.	0.00	17.	24.00	<5.	0.00
F024	<1.	0.00	10.	4.00	<1.	0.00	<1.	0.00	16.	16.00	<1.	0.00
F025	32. EH	5.00	13.	22.50	15. EH	8.00	38. EH	5.00	45. EH	27.00	10. EH	5.00
F032	<1.	0.00	11.6	18.50	<1.	0.00	<1.	0.00	16.8	22.00	<1.	0.00
F032b	<1.	0.00	10.9	9.50	<1.	0.00	<1.	0.00	16.6	20.50	<1.	0.00
F038	<1.	0.00	11.	12.00	<1.	0.00	<1.	0.00	16.	16.00	<1.	0.00
F046	<0.1	0.00	11.3	15.50	0.65	2.00	<0.1	0.00	16.5	19.00	<0.1	0.00
F048	<1.0	0.00	11.6	18.50	1.22	6.00	<1.0	0.00	17.0	24.00	1.13	2.00
F060	<1.	0.00	11.	12.00	<1.	0.00	<1.	0.00	16.	16.00	<1.	0.00
F063	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10. VL	0.00	<10.	0.00
F069	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	14.1	5.00	<10.	0.00
F080	<2.5	0.00	11.2	14.00	<2.5	0.00	<2.5	0.00	15.6	12.00	<2.5	0.00
F093	1.6	3.00	13.2 H	24.00	2.5 H	7.00	0.7	2.00	15.1	10.00	1.2	3.00
F094	0.1	1.00	11.3	15.50	0.7	3.50	<0.1	0.00	15.8	13.00	<0.1	0.00
F095	<1.	0.00	9.	1.50	<1.	0.00	<1.	0.00	12. VL	2.00	<1.	0.00
F096	<3.	0.00	10.2	6.50	<3.	0.00	<3.	0.00	12.9 L	3.00	<3.	0.00
F103	<5.	0.00	11.	12.00	<5.	0.00	<5.	0.00	17.	24.00	<5.	0.00
F133	<1.	0.00	10.	4.00	<1.	0.00	<1.	0.00	15.	8.00	<1.	0.00
F139	<1.	0.00	21. EH	25.00	<1.	0.00	<1.	0.00	26. EH	26.00	<1.	0.00
MEDIAN OR *TARGET												
CONC.	*0.1000		11.0000		0.8000		*0.1000		16.0000		*0.1000	
1CRIT	1.5060		2.0700		1.5000		1.5000		2.3700		1.5000	
N	3		22		6		3		25		3	
MEAN	1.7667		11.2591		1.1117		2.5667		15.9280		2.7767	
3STDEV	-		2.7801		1.9504		-		7.1852		-	

PARAMETER: 23095 Vanadium ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F003	48.	14.00	371.	19.50	454.	20.00	227.	14.00
F008	51.	23.00	378.	23.00	462.	23.00	235.	23.00
F009	45.	4.50	336. L	3.00	406. VL	2.00	220.	6.50
F010	47.	11.00	363.	12.00	447.	14.00	224.	10.50
F011	46.6	10.00	364.	13.50	445.	12.00	228.	16.00
F012	50.	21.00	371.	19.50	441.	10.00	230.	19.00
F014	47.8	12.00	326. VL	2.00	426.	4.00	224.	10.50
F015	50.	21.00	370.	17.50	450.	16.50	230.	19.00
F019	42. L	3.00	349.	4.00	435.	7.00	219.	4.00
F022	45.	4.50	360.	10.00	412. L	3.00	230.	19.00
F024	48.	14.00	370.	17.50	455.	22.00	230.	19.00
F025	88. EH	28.00	451. EH	28.00	529. EH	27.00	261. VH	27.00
F032	46.5	9.00	359.	7.50	434.	6.00	231.	22.00
F032b	48.8	18.00	364.	13.50	439.	9.00	227.	14.00
F038	50.	21.00	360.	10.00	450.	16.50	220.	6.50
F046	48.3	16.00	366.	15.00	450.	16.50	227.	14.00
F048	51.5	24.00	376.0	22.00	466.3	25.00	235.5	24.00
F060	49.	19.00	373.	21.00	454.	20.00	230.	19.00
F063	20. EL	1.00	360.	10.00	450.	16.50	210. L	2.00
F069	45.3	6.00	359.	7.50	438.	8.00	222.	8.00
F080	45.9	7.00	353.	5.00	446.	13.00	219.	4.00
F093	48.7	17.00	368.8	16.00	443.1	11.00	225.2	12.00
F094	53.9 H	25.00	380.	24.00	465.	24.00	259. VH	26.00
F095	38. VL	2.00	292. EL	1.00	357. EL	1.00	179. EL	1.00
F096	46.2	8.00	355.	6.00	432.	5.00	219.	4.00
F103	60. VH	26.00	400. VH	26.00	480. H	26.00	240.	25.00
F133	48.	14.00	383.	25.00	454.	20.00	223.	9.00
F139	61. VH	27.00	430. EH	27.00	540. EH	28.00	280. EH	28.00
MEDIAN OR *TARGET CONC.	48.0000		365.0000		448.5000		227.0000	
1CRIT	4.2900		23.3100		28.3200		15.0300	
N	26		26		26		26	
MEAN	48.5192		367.1077		448.5923		228.6808	
3STDEV	13.8037		57.0123		67.0873		32.8371	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	89.50	11.188	8					
F008	120.50	20.083	6					GF-ICP
F009	31.00	4.429	7	L VL	BIASED LOW	-8.59	1.7766	ICP-MS
F010	84.00	8.400	10	EH				ICP-OES
F011	92.50	13.214	7					
F012	114.00	14.250	8	EH EH				ICP-MS
F014	41.00	6.833	6	VL				ICP-MS
F015	75.00	15.000	5	VL				ICP
F019	23.50	3.917	6	L	BIASED LOW*	-2.88	-2.5590	ICAP
F022	83.00	13.833	6	L				ICP-AES
F024	92.50	15.417	6					
F025	182.50	18.250	10	EH EHEHEHEHEHEHEHVH				ICP
F032	85.00	14.167	6					ICP-AES
F032b	84.50	14.083	6					ICP-MS
F038	82.00	13.667	6					ICPMS
F046	98.00	14.000	7					ICP-MS As Received
F048	145.50	18.188	8					ICP
F060	107.00	17.833	6					ICP
F063	29.50	7.375	4	VL EL L	INSUFFICIENT DATA			ICP-AES
F069	34.50	6.900	5					ICP
F080	55.00	9.167	6					ICP dig conc
F093	105.00	10.500	10	H H				ICP
F094	132.00	16.500	8	H VH				ICPMS
F095	8.50	1.417	6	VL VLELELEL	BIASED LOW	-20.23	-0.4656	ICP-USN
F096	32.50	5.417	6	L	BIASED LOW*	-3.06	-1.0185	ICP
F103	139.00	23.167	6	VHVHH	BIASED HIGH	7.31	1.8232	ICP-OES
F133	80.00	13.333	6					ICP-MS
F139	161.00	26.833	6	EH EH VHEHEHEH	BIASED HIGH	17.99	6.9645	ICP-OES

* 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 12.877

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F095	8.50	1.417	6	VLVLELELEL	BIASED LOW	-20.23	-0.4656	ICP-USN
F019	23.50	3.917	6	L	BIASED LOW*	-2.88	-2.5590	ICAP
F009	31.00	4.429	7	LVL	BIASED LOW	-8.59	1.7766	ICP-MS
F096	32.50	5.417	6	L	BIASED LOW*	-3.06	-1.0185	ICP
F014	41.00	6.833	6	VL				ICP-MS
F069	34.50	6.900	5					ICP
F063	29.50	7.375	4	VLELL	INSUFFICIENT DATA			ICP-AES
F010	84.00	8.400	10	EH				ICP-OES
F080	55.00	9.167	6					ICP dig conc
F093	105.00	10.500	10	HH				ICP
F003	89.50	11.188	8					
F011	92.50	13.214	7					
F133	80.00	13.333	6					ICP-MS
F038	82.00	13.667	6					ICPMS
F022	83.00	13.833	6	L				ICP-AES
F046	98.00	14.000	7					ICP-MS As Received
F032b	84.50	14.083	6					ICP-MS
F032	85.00	14.167	6					ICP-AES
F012	114.00	14.250	8	EHEH				ICP-MS
F015	75.00	15.000	5	VL				ICP
F024	92.50	15.417	6					
F094	132.00	16.500	8	HVH				ICPMS
F060	107.00	17.833	6					ICP
F048	145.50	18.188	8					ICP
F025	182.50	18.250	10	EHEHEHEHEHEHEHEHVH				ICP
F008	120.50	20.083	6					GF-ICP
F103	139.00	23.167	6	VHVHH	BIASED HIGH	7.31	1.8232	ICP-OES
F139	161.00	26.833	6	EHEHVHEHEHEH	BIASED HIGH	17.99	6.9645	ICP-OES

* 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 12.877

Vanadium

PARAMETER: 30095 Zinc ug/L

NATIONAL WATER RESEARCH INSTITUTE
NATIONAL LAB FOR ENVIRONMENTAL TESTING
BURLINGTON ONTARIO

NWRI Interlab QA for Trace Elements

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 2.0000 BASIC ACCEPTABLE ERROR= 2.0000 CONCENTRATION ERROR INCREMENT= 0.0800

SAMPLE	1 = TM-FSWANA		2 = TM-25.2		3 = TMRAIN-95		4 = TM-LNGLKEb		5 = TM-25		6 = TM-LNGLKEa	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	10.5	23.00	25.5	27.00	12.0	15.00	<10.0	0.00	<10.0	0.00	14.0	29.00
F003	8.6	7.00	21.4	7.50	12.	15.00	8.2	17.00	7.7	8.00	13.	20.50
F008	10.	20.00	30. VH	35.00	10.	4.00	9.	25.50	<10.	0.00	10.	4.50
F009	10.	20.00	27.	30.00	13.	24.00	7.4	9.50	8.9	20.00	12.	12.50
F010	<1. EL	0.00	18. VL	2.00	9.9	2.00	5.0 L	2.00	1.3 EL	1.00	2.8 EL	1.00
F011	8.8	9.00	21.6	9.00	18.8 EH	33.00	6.2	5.00	9.	22.00	11.7	9.00
F012	15. VH	29.00	24.	19.50	12.	15.00	15. EH	32.00	10.	27.50	17. VH	33.50
F014	<10.	0.00	24.	19.50	<10.	0.00	<10.	0.00	11. H	29.00	12.	12.50
F015	9.	11.50	24.	19.50	12.	15.00	7.	7.00	9.	22.00	13.	20.50
F019	10.	20.00	27.	30.00	14.	29.50	8.	14.00	9.	22.00	13.	20.50
F022	9.	11.50	22.	11.50	12.	15.00	9.	25.50	7.	4.50	14.	29.00
F024	8.	3.00	23.	16.00	12.	15.00	7.	7.00	8.	12.50	12.	12.50
F025	13. H	28.00	26.	28.00	14.	29.50	11. H	30.00	10.	27.50	14.	29.00
F026	9.36	16.00	21.66	10.00	11.54	8.00	8.79	23.00	9.39	24.00	13.90	27.00
F031	8.	3.00	21.	5.00	12.	15.00	10.	28.50	7.	4.50	10.	4.50
F032	17.4 VH	31.00	27.2	32.00	13.2	27.00	8.9	24.00	8.5	19.00	13.7	26.00
F032b	16.6 VH	30.00	25.	23.50	12.4	22.00	8.09	16.00	8.3	17.50	12.1	15.00
F037	9.103	15.00	22.75	15.00	11.27	7.00	5.556 L	3.00	8.103	15.00	10.28	7.00
F038	10.	20.00	24.	19.50	12.	15.00	8.	14.00	8.	12.50	13.	20.50
F046	10.8	24.00	27.5	33.00	14.5	31.00	8.5	20.00	12.6 VH	30.00	13.1	24.00
F048	11.3	26.00	25.28	25.00	13.2	27.00	9.80	27.00	9.40	25.00	14.9	31.00
F049	9.	11.50	21.	5.00	11.	6.00	6.	4.00	7.	4.50	10.	4.50
F060	9.1	14.00	25.0	23.50	12.2	21.00	8.3	18.00	8.0	12.50	12.3	16.00
F063	<1. EL	0.00	6. EL	1.00	<1. EL	0.00	<1. EL	0.00	<1. EL	0.00	<1. EL	0.00
F064	24. EH	32.00	29. H	34.00	15. H	32.00	13. EH	31.00	15. EH	32.00	17. VH	33.50
F069	9.49	17.00	23.6	17.00	13.2	27.00	7.64	11.00	8.14	16.00	12.5	17.50
F080	8.7	8.00	22.6	14.00	11.9	10.00	7.7	12.00	7.8	9.50	13.1	24.00
F093	8.4	5.50	22.4	13.00	10.0	4.00	8.5	20.00	7.8	9.50	13.1	24.00
F094	11.	25.00	27.	30.00	13.	24.00	10.	28.50	14. EH	31.00	16. H	32.00
F095	8.	3.00	20. L	3.00	10.	4.00	7.	7.00	7.	4.50	10.	4.50
F096	8.4	5.50	25.3	26.00	12.1	20.00	7.4	9.50	8.3	17.50	11.5	8.00
F103	10.	20.00	22.	11.50	12.	15.00	8.	14.00	8.	12.50	12.	12.50
F133	9.0	11.50	24.3	22.00	13.0	24.00	8.5	20.00	9.8	26.00	12.5	17.50
F135	<20.	0.00	<20. L	0.00	<20.	0.00	<20.	0.00	<20.	0.00	<20.	0.00
F136	12.9 H	27.00	21.4	7.50	11.8	9.00	8.6	22.00	7.6	7.00	11.8	10.00
F139	6. L	1.00	21.	5.00	9. L	1.00	4. VL	1.00	4. VL	2.00	9. L	2.00
MEDIAN	9.4250		24.0000		12.0000		8.1450		8.2200		12.5000	
1CRIT	2.5940		3.7600		2.8000		2.4916		2.4976		2.8400	
N	30		33		31		30		30		31	
MEAN	10.2818		23.7118		12.2003		8.2025		8.6111		12.3703	
3STDEV	7.1503		7.4299		3.7229		4.7385		5.3298		4.6733	

PARAMETER: 30095 Zinc ug/L

SAMPLE	7 = TMDA-51.2		8 = TMDA-54.3		9 = TMDA-53		10 = TM-25-54	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
F002	108.	20.50	552.	13.00	179.	22.50	342.	17.00
F003	103.	13.00	561.	20.00	172.	14.00	338.	13.50
F008	110.	25.50	590.	31.00	190.	31.50	360.	29.00
F009	111.	29.00	587.	29.00	180.	24.50	355.	27.00
F010	102.	11.00	564.	22.00	172.	14.00	342.	17.00
F011	95.6 L	4.00	517.	6.00	160.	3.00	297. VL	3.00
F012	99.	7.00	499. L	4.00	165.	6.00	307. L	4.00
F014	98.5	5.00	498. L	3.00	200. VH	35.00	338.	13.50
F015	107.	18.00	567.	23.00	178.	20.50	344.	22.50
F019	112.	30.50	570.	24.50	182.	26.00	347.	24.00
F022	103.	13.00	520.	8.00	169.	11.00	324.	8.00
F024	110.	25.50	600.	34.00	185.	29.00	360.	29.00
F025	125. VH	36.00	624. H	35.00	191.	33.00	389. VH	34.00
F026	101.21	10.00	538.81	12.00	167.87	8.00	317.55	6.00
F031	94. L	3.00	515.	5.00	165.	6.00	326.	9.50
F032	104.	15.50	553.	15.00	172.	14.00	349.	26.00
F032b	107.	18.00	524.	10.00	165.	6.00	326.	9.50
F037	100.9	9.00	517.4	7.00	163.4	4.00	309.1 L	5.00
F038	110.	25.50	560.	19.00	180.	24.50	330.	11.00
F046	123. VH	35.00	653. VH	36.00	199. H	34.00	393. VH	36.00
F048	119.2 H	34.00	594.7	32.00	200.4 VH	36.00	389.9 VH	35.00
F049	99.	7.00	522.	9.00	168.	9.50	319.	7.00
F060	107.	18.00	553.	15.00	171.	12.00	337.	12.00
F063	99.	7.00	562.	21.00	168.	9.50	340.	15.00
F064	110.	25.50	557.	18.00	178.	20.50	343.	20.00
F069	110.	25.50	586.	28.00	183.	28.00	363.	31.50
F080	103.	13.00	538.	11.00	175.	17.50	343.	20.00
F093	109.6	22.00	588.2	30.00	182.9	27.00	344.0	22.50
F094	118. H	33.00	553.	15.00	175.	17.50	375. H	33.00
F095	83. EL	1.00	438. EL	2.00	137. EL	1.00	263. EL	1.00
F096	112.	30.50	575.	27.00	179.	22.50	348.	25.00
F103	108.	20.50	574.	26.00	176.	19.00	343.	20.00
F133	116.0	32.00	596.	33.00	187.3	30.00	363.	31.50
F135	104.	15.50	556.	17.00	173.	16.00	342.	17.00
F136	85.8 VL	2.00	62.5 EL	1.00	140.6 EL	2.00	273.7 VL	2.00
F139	110.	25.50	570.	24.50	190.	31.50	360.	29.00
MEDIAN	107.0000		558.5000		175.5000		342.5000	
1CRIT	10.4000		46.5200		15.8800		29.2400	
N	34		34		34		34	
MEAN	106.1709		553.5327		175.9432		340.7132	
3STDEV	22.3469		108.1808		34.4337		70.6295	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	167.00	20.875	8					30304 30305
F003	135.50	13.550	10					
F008	206.00	22.889	9	VH				GF-ICP
F009	225.50	22.550	10					ICP-MS
F010	72.00	8.000	9	ELVL L ELEL	BIASED LOW*	1.91	-6.1397	ICP-OES
F011	103.00	10.300	10	EH L VL				
F012	177.50	17.750	10	VH EH VH L L				ICP-MS
F014	117.50	16.786	7	H L VH				ICP-MS
F015	179.50	17.950	10					ICP
F019	241.00	24.100	10					ICAP
F022	137.00	13.700	10					ICP-AES
F024	183.50	18.350	10					
F025	310.00	31.000	10	H H VHH VH	BIASED HIGH	11.86	1.0010	ICP
F026	144.00	14.400	10					I.C.P. EMISSION
F031	84.00	8.400	10	L	BIASED LOW	-7.00	-0.1778	ICP
F032	229.50	22.950	10	VH				ICP-AES
F032b	167.50	16.750	10	VH				ICP-MS
F037	87.00	8.700	10	L L				ICP-MS
F038	181.50	18.150	10					ICPMS
F046	303.00	30.300	10	VH VHVHH VH	BIASED HIGH	16.31	-0.7955	ICP-MS As Received
F048	298.00	29.800	10	H VHVH	BIASED HIGH	8.22	2.6843	ICP
F049	68.00	6.800	10		BIASED LOW	-6.35	-0.5922	
F060	162.00	16.200	10					ICP
F063	53.50	10.700	5	ELELELELELEL				ICP-AES
F064	278.50	27.850	10	EHH H EHEHVH	BIASED HIGH*	-1.56	6.2802	AA
F069	218.50	21.850	10					ICP-MS
F080	139.00	13.900	10					ICP dig conc
F093	177.50	17.750	10					ICP
F094	269.00	26.900	10	EHH H H				ICPMS
F095	31.00	3.100	10	L ELELELEL	BIASED LOW	-22.10	0.3172	ICP-USN
F096	191.50	19.150	10					ICP
F103	171.00	17.100	10					ICP-OES
F133	247.50	24.750	10					ICP-MS
F135	65.50	16.375	4	L	INSUFFICIENT DATA			AA-FL
F136	89.50	8.950	10	H VLELELVL				FAA
F139	122.50	12.250	10	L L VLVLL				ICP-OES

* 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 17.643

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F095	31.00	3.100	10	LELELELEL	BIASED LOW	-22.10	0.3172	ICP-USN
F049	68.00	6.800	10		BIASED LOW	-6.35	-0.5922	
F010	72.00	8.000	9	ELVLLELEL	BIASED LOW*	1.91	-6.1397	ICP-OES
F031	84.00	8.400	10	L	BIASED LOW	-7.00	-0.1778	ICP
F037	87.00	8.700	10	LL				ICP-MS
F136	89.50	8.950	10	HVLELELVL				FAA
F011	103.00	10.300	10	EHLVL				
F063	53.50	10.700	5	ELELELELELEL				ICP-AES
F139	122.50	12.250	10	LLVLVLL				ICP-OES
F003	135.50	13.550	10					
F022	137.00	13.700	10					ICP-AES
F080	139.00	13.900	10					ICP dig conc
F026	144.00	14.400	10					I.C.P. EMISSION
F060	162.00	16.200	10					ICP
F135	65.50	16.375	4	L	INSUFFICIENT DATA			AA-FL
F032b	167.50	16.750	10	VH				ICP-MS
F014	117.50	16.786	7	HLVH				ICP-MS
F103	171.00	17.100	10					ICP-OES
F093	177.50	17.750	10					ICP
F012	177.50	17.750	10	VHEHVHLL				ICP-MS
F015	179.50	17.950	10					ICP
F038	181.50	18.150	10					ICPMS
F024	183.50	18.350	10					
F096	191.50	19.150	10					ICP
F002	167.00	20.875	8					30304 30305
F069	218.50	21.850	10					ICP-MS
F009	225.50	22.550	10					ICP-MS
F008	206.00	22.889	9	VH				GF-ICP
F032	229.50	22.950	10	VH				ICP-AES
F019	241.00	24.100	10					ICAP
F133	247.50	24.750	10					ICP-MS
F094	269.00	26.900	10	EHHHH				ICPMS
F064	278.50	27.850	10	EHHHEHEHVH	BIASED HIGH*	-1.56	6.2802	AA
F048	298.00	29.800	10	HVHVH	BIASED HIGH	8.22	2.6843	ICP
F046	303.00	30.300	10	VHVHVHHVH	BIASED HIGH	16.31	-0.7955	ICP-MS As Received
F025	310.00	31.000	10	HHVHHVH	BIASED HIGH	11.86	1.0010	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 17.643

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