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(MARCH & APRIL 2000)

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NLET-TN00-004

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NLET-TN00-004

Ecosystem Interlaboratory Quality Assurance Program Study FP 76 - Final Report

March and April, 2000

An Interlaboratory Quality Assurance Study for Major Ions & Nutrients and Total Phosphorus in Surface Waters *

by
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Project Information & Quality Management
National Laboratory for Environmental Testing
National Water Research Institute
Burlington, Ontario

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*companion studies: Rain and Soft Waters NLET-TN00-003 and Trace Elements NLET-TN00-005

Management Perspective

Quality assured analytical results are critical when transforming environmental analytical data into useful scientific advice. In the area of water analysis, the NLET branch of NWRI provides a variety of QA products and services geared to assisting EC labs provide quality assured analytical results. One of the most valuable QA services provided is the interlaboratory performance evaluation (PE) studies. The PE studies conducted by NLET fill a parameter and concentration gap not covered by any other PE or proficiency testing (PT) program. Participant labs find the NLET PE studies very useful to improve the quality of their analytical processes, while project leaders use the results of these studies to enable them to better compare data generated from different laboratories, in both the private and public sector. These studies are provided to EC laboratories, affiliate institutions in Canada and the US, and other public and private laboratories for a cost recovery fee.

The PE studies are created using many water types of natural waters and their associated parameter groups as the raw material. The availability of so many different water types in Canada is ideally suited to the preparation of test samples spanning the complete range of available water matrices. Waters range from very soft natural rainwaters, to soft waters found in Ontario, Quebec and British Columbia and to hard surface waters found in the Prairies and Canadian groundwaters. The chemical composition of the natural waters are diverse, and include 50 different parameters for nutrients, minerals and trace elements. Special studies are provided for Total Phosphorus and ambient Mercury.

Evaluations of laboratory performance are timely and complete. Laboratories receive a preliminary report which discloses systematic bias and precision. The final reports, which are also scheduled, provide a complete listing of current and historical performance. Individual performance appraisals indicate areas and parameters where remedial action is required to improve performance. In this way, the PE studies are effective for improved performance of laboratories.

Methodologies and approaches in analytical laboratories change as research and monitoring programs evolve. The PE studies, while large in terms of the number of laboratories being assessed, are flexible enough to respond to these changing requirements. Feedback from laboratories is solicited and assessed on a regular basis, and changes to the studies are implemented to meet these new needs. One recent example of this change is the development of a customised PE study to assess trace elements in natural sediments for the Metals in the Environment (MITE) Program being conducted by Canadian universities. This study is being added to the PE program in the 2000-01 fiscal year.

Perspective de gestion

Il est crucial de disposer de résultats d'analyse ayant subi une assurance de la qualité (AQ) lorsqu'on transforme des données analytiques environnementales en conseils scientifiques utiles. Dans le domaine de l'analyse de l'eau, le LNEE de l'INRE offre une gamme de produits et de services AQ visant à aider les laboratoires d'EC à produire des données d'analyse dont la qualité est assurée. Parmi les services AQ les plus valables figurent les études d'évaluation de la performance (EP) interlaboratoires. Les études EP réalisées par le LNEE comblent une lacune. Aucun autre programme EP ou de vérification de la compétence (VC) n'avait permis de recueillir des données sur les paramètres et les concentrations. Les laboratoires participants estiment que les études EP du LNEE sont très utiles pour améliorer la qualité de leurs processus d'analyse. Les chefs de projet utilisent les résultats de ces études pour les aider à comparer des données provenant de laboratoires différents, privés ou publics. Ces études sont en effet réalisées pour des laboratoires d'EC, des institutions affiliées du Canada et des États-Unis et d'autres laboratoires publics et privés selon la formule de recouvrement des coûts.

Pour les études EP, on utilise comme échantillons bruts de nombreux types d'eau naturelle et leurs paramètres associés. Le grand nombre de types d'eau qui existent au Canada permet de préparer suffisamment d'échantillons d'essai pour couvrir l'éventail complet des matrices d'eau disponibles, allant des eaux de pluie naturelles très douces que l'on trouve en Ontario, au Québec et en Colombie-Britannique aux eaux superficielles dures des Prairies et aux eaux souterraines. La composition chimique des eaux naturelles varie et comporte 50 paramètres différents sur les nutriments, les minéraux et les éléments traces. Des études spéciales portent sur le phosphore total et le mercure ambiant.

Les évaluations de la performance des laboratoires sont exécutées au moment opportun et de façon exhaustive. Les laboratoires reçoivent un rapport provisoire indiquant le biais systématique et le niveau de précision. Les rapports finaux, dont la date de livraison est également fixée, contiennent toutes les données sur la performance tant actuelle qu'antérieure. Les évaluations individuelles de la performance indiquent les secteurs et les paramètres envers lesquels il faut prendre des mesures correctives pour améliorer la performance. Les études EP s'avèrent ainsi efficaces pour améliorer la performance des laboratoires.

À mesure que les programmes de recherche et de suivi évoluent, les méthodologies et les approches utilisées par les laboratoires d'analyse se transforment. Les études EP, bien que vastes, compte tenu du nombre de laboratoires évalués, sont suffisamment souples pour tenir compte des changements. Pour ce faire, on invite régulièrement les laboratoires à communiquer leurs commentaires et on s'en sert pour modifier les études. À titre d'exemple de changement, mentionnons la conception sur mesure d'une étude EP pour évaluer les éléments traces dans les sédiments naturels aux fins du programme Métaux dans l'environnement mis en oeuvre par des universités canadiennes. Cette étude s'ajoute au programme EP au cours de l'année financière 2000-2001.

Abstract

Interlaboratory performance evaluation studies are an important part of assuring the accuracy and integrity of analytic results. NLET provides these PE studies as part of its mandate. The branch provides this service to all EC laboratories and to many affiliated institutions in Canada and the US. Such a wide range of institutions and laboratories, in turn, provides a diversity of data which gives greater credibility to data analysis and laboratory performance statements.

Evaluation of the analytic results is the most visible aspect of PE studies. All results are evaluated for the two important aspects of data - systematic bias and precision. The former is extremely important for comparability of data sets from different origins and the latter, precision, is a measure of the reliability of the data. For the NLET PE studies, systematic bias is tested with the non-parametric method of Youden, and precision is tested against precision functions developed by the quality assurance staff. Both evaluations are totalled to give a performance rating for each laboratory.

Performance ratings for laboratories are given in relative terms. Laboratories are ranked from the best performance to the lowest (the least flagged results to the most flagged). In real terms, good laboratories have few flagged results and the laboratories with poor performance may have half their results flagged. These results are summarised in individual laboratory appraisals which are sent to the lab managers in a timely, expedient manner. This objective, third party performance rating is valued by the laboratory managers and data users alike.

Evaluations include historical listings of performance. With these historical listings laboratories may track their previous performance and see the effectiveness of their remedial action. This unique and highly developed tool helps many laboratories generate more reliable and accurate data.

Résumé

Les études d'évaluation de la performance (EP) interlaboratoires constituent un volet important de l'assurance de l'exactitude et de l'intégrité des résultats d'analyse. Dans le cadre de son mandat, le LNEE offre ce service à tous les laboratoires d'EC et à ses nombreuses institutions affiliées du Canada et des États-Unis. En raison de leur grand nombre, ces institutions et laboratoires fournissent en contrepartie des données diversifiées qui ajoutent à la crédibilité des analyses et des énoncés sur la performance des laboratoires.

L'évaluation des données d'analyse est l'aspect le plus visible des études EP. Elle porte sur deux aspects importants – le biais systématique et la précision. Le premier aspect est essentiel à la comparaison d'ensembles de données de sources différentes; le second aspect permet de mesurer le degré de fiabilité des données. Aux fins des études EP du LNEE, on teste le biais systématique par la méthode non paramétrique de Youden, et la précision, au moyen de fonctions sur la précision mises au point par le personnel chargé de l'assurance de la qualité. Les deux évaluations sont combinées pour coter la performance de chaque laboratoire.

La performance des laboratoires est cotée en termes relatifs. Les laboratoires sont classés du plus performant au moins performant. En termes réels, les laboratoires performants ont un faible nombre de résultats marqués tandis que les laboratoires peu performants peuvent avoir la moitié de leurs résultats marqués. Les évaluations remises dans un délai raisonnable aux gestionnaires de laboratoire contiennent un résumé des données. Cette évaluation objective par une tierce partie est utile tant pour les gestionnaires que pour les utilisateurs des données.

Comme les évaluations contiennent des données sur les performances antérieures, les laboratoires peuvent comparer leur performance avant et après la prise de mesures correctives. Cet outil exceptionnel et perfectionné aide nombre de laboratoires à produire des données plus fiables et plus exactes.

Table of Contents

Introduction 1

Table 1 - List of Participating Laboratories
Major Ions and Nutrients 2

Table 2 - Laboratory Performance Scores - Study FP 76
a) Major Ions and Nutrients 3
b) Total Phosphorus 4

Table 3 - Summary of Study -to - Study Performance
a) Major Ions and Nutrients 5
b) Total Phosphorus 6

Table 4 - Sample Design
a) Major Ions and Nutrients 7
b) Total Phosphorus 8

Table 5 - Summary of Interlaboratory Median Values - Study FP 76
a) Major Ions and Nutrients 9
b) Total Phosphorus 10

Appendix A - Glossary of Terms

Appendix B - Data and Evaluation Summary

NWRI Interlaboratory Quality Assurance Studies

NWRI's interlaboratory quality assurance (QA) studies support a core group of government labs and various environmental programs. The QA program also addresses health issues such as, toxic metal (lead, manganese and mercury) contamination of drinking water. US government agencies as well as the Canadian Metals in the Environment (MITE) program participate in the semi-annual studies along with many global participants. More than 200 labs are invited to participate, with approximately 60 labs completing analyses of the various study matrices.

The primary feature of these studies is the quality of data produced by the participating labs. Lab 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 problem areas within labs, as well participation quantifies lab performance and data quality.

These NWRI studies are an independent client driven QA service. The QA staff appreciates receiving questions and consults on all aspects of the program. In this study there were several inquiries regarding the flagging process and its validity. Over the years, the Institute has developed elaborate and comprehensive criteria which evaluates data for systemic bias and precision. These indicators are, we feel, superior to others currently in use (i.e. Z-scores), and these criteria take advantage of our diverse natural samples used in each study. For more information on flagging, see Appendix A.

NWRI studies run on a voluntary and cost recovery basis, which leads to ongoing interest in study design and sample requirements by lab and program managers. Proposals for contract specialised studies are welcomed.

Table 1 List of participating† laboratories in major ions & nutrients in surface waters and total phosphorus study FP 76 (March & April, 2000).

Accutest Laboratories Ltd.
ALS Chemex
Analytical Service Laboratories Ltd.
City of Calgary
CRD - Water Department Lab
Environment Canada - EPL
Environment Canada - ESC, Atlantic
Environment Canada - NHRC, NQL
Environment Canada - NWRI, NLET
Environment Canada - PESC
Environnement Canada - CSL, Québec
Enviro-Test Laboratories
EPCOR Water Services
Fisheries and Oceans Canada - Freshwater Institute
Laboratoire de Santé Publique du Québec
Laurentian University - Elliot Lake Research Field Station
Maxxam Analytics Inc.
MB Labs Ltd.
Ministère de l'Environnement et de la Faune du Québec - Laval
Ministère de l'Environnement et de la Faune du Québec - Sainte-Foy
Monroe County Environmental Health Lab
Natural Resources Canada - CFS, Ontario
Natural Resources Canada - GSC
New Brunswick Department of the Environment - ASL
Ontario Ministry of the Environment - Dorset
Ontario Ministry of the Environment - Etobicoke
Ontario Ministry of Northern Development and Mines - Geosciences Lab
Ontario Power Technologies
Petroleo Brasileiro S.A.
Queen Elizabeth II Health Sciences Centre
Saskatchewan Health - Provincial Lab
TAIGA Environmental Lab
Thunder Bay Analytical
Tsakalidis, Greece
US EPA, Corvallis
US GS - NWQL
University of Alberta - Department of Biological Sciences
University of Maine - WRI
University of Maryland - Centre for Environmental Science
University of Victoria - Department of Biology

† Labs select their routine parameters for this study

Table 2a Laboratory Performance Scores Study 76 Major Ions & Nutrients

	SYSTEMATIC BIAS			FLAGGED RESULTS			
LAB CODE	# ANALYZED PARAMETERS	# BIASES	% BIASED PARAMETERS	# RESULTS RANKED	# FLAGS ASSIGNED	% RESULTS FLAGGED	AVE. BIAS & FLAGS (%)
F146	2	0	0.00	12	0	0.00	0.00
F139	4	0	0.00	38	2	5.26	2.63
F026	15	0	0.00	150	8	5.33	2.67
F003	20	1	5.00	198	4	2.02	3.51
F015	19	1	5.26	185	5	2.70	3.98
F113	32	2	6.25	320	8	2.50	4.38
F133	14	0	0.00	138	14	10.14	5.07
F038	21	1	4.76	195	16	8.21	6.48
F069	16	1	6.25	139	16	11.51	8.88
F032	18	1	5.56	172	24	13.95	9.75
F048	16	2	12.50	160	18	11.25	11.88
F014	15	1	6.67	131	24	18.32	12.49
F092	19	2	10.53	189	32	16.93	13.73
F002	30	6	20.00	290	22	7.59	13.79
F025	18	0	0.00	169	50	29.59	14.79
F009	20	4	20.00	196	24	12.24	16.12
F022	19	2	10.53	169	40	23.67	17.10
F010	38	8	21.05	354	48	13.56	17.31
F158	20	3	15.00	166	35	21.08	18.04
F064	16	0	0.00	158	58	36.71	18.35
F004	12	4	33.33	118	6	5.08	19.21
F140	6	1	16.67	49	12	24.49	20.58
F037	13	2	15.38	129	34	26.36	20.87
F006	32	6	18.75	286	70	24.48	21.61
F094	21	2	9.52	201	68	33.83	21.68
F141	17	3	17.65	158	44	27.85	22.75
F131	12	4	33.33	120	15	12.50	22.92
F019	13	2	15.38	120	44	36.67	26.03
F036	12	1	8.33	115	54	46.96	27.64
F063	16	3	18.75	155	64	41.29	30.02
F031	14	4	28.57	140	46	32.86	30.71
F144	14	3	21.43	139	81	58.27	39.85
F042	17	5	29.41	157	84	53.50	41.46
F122	1	1	100.00	8	0	0.00	50.00
F094a	4	1	25.00	37	38	102.70	63.85
F159	8	4	50.00	69	76	110.14	80.07

Laboratory parameters are selected from:

Turb	Colour	Sp Cond	pH	DOC	Tot Alk	DIC	NO3 /2	Tot N	Na	Mg
SO4	Cl	K	Ca	NH4	TKN	F	Tot Hard	SiO2	B	

Table 2b Laboratory Performance Scores Study 76 Total Phosphorus

	SYSTEMATIC BIAS			FLAGGED RESULTS			
LAB CODE	# ANALYZED PARAMETERS	# BIASES	%BIASED PARAMETERS	# RESULTS RANKED	# FLAGS ASSIGNED	% RESULTS FLAGGED	AVE. BIAS & FLAGS (%)
F002	1	0	0.00	10	0	0.00	0.00
F003	1	0	0.00	10	0	0.00	0.00
F010	1	0	0.00	8	0	0.00	0.00
F014	1	0	0.00	9	0	0.00	0.00
F022	1	0	0.00	9	0	0.00	0.00
F026	1	0	0.00	10	0	0.00	0.00
F032	1	0	0.00	9	0	0.00	0.00
F036	1	0	0.00	10	0	0.00	0.00
F038	1	0	0.00	9	0	0.00	0.00
F069	1	0	0.00	9	0	0.00	0.00
F072	1	0	0.00	9	0	0.00	0.00
F074	1	0	0.00	10	0	0.00	0.00
F092	1	0	0.00	10	0	0.00	0.00
F113	1	0	0.00	10	0	0.00	0.00
F131	1	0	0.00	10	0	0.00	0.00
F133	1	0	0.00	9	0	0.00	0.00
F141	1	0	0.00	9	0	0.00	0.00
F146	1	0	0.00	10	0	0.00	0.00
F170	1	0	0.00	10	0	0.00	0.00
F004	1	0	0.00	9	0	0.00	0.00
F015	1	0	0.00	9	1	11.11	5.56
F048	1	0	0.00	9	1	11.11	5.56
F063	1	0	0.00	9	1	11.11	5.56
F007	1	0	0.00	8	1	12.50	6.25
F064	1	0	0.00	10	2	20.00	10.00
F025	1	0	0.00	10	4	40.00	20.00
F006	1	0	0.00	9	4	44.44	22.22
F019	1	0	0.00	9	4	44.44	22.22
F094	1	1	100.00	9	2	22.22	61.11
F011	1	0	0.00	7	9	128.57	64.29
F042	1	1	100.00	10	4	40.00	70.00

Laboratory parameters are selected from:
Tot P

Table 3a

Summary of Study-to-Study Performance
Major Ions & Nutrients

% BIASED PARAMETERS & FLAGGED RESULTS ON STUDIES

LAB	0067	0068	0069	0070	0071	0072	0073	0074	0075	0076	MEDIAN	COMMENTS
F002	1.7	4.3	5.4	5.5	14.1	4.0	3.7	21.4	13.6	14.8	5.4	SATISFACTORY
F003	9.3	7.0	15.4	0.5	3.2	3.7	4.6	4.2	1.9	3.7	4.0	GOOD
F004	1.5	12.2	0.9	1.7	1.6	1.6	15.0	1.9	4.5	11.0	1.8	GOOD
F006	25.5	22.6	32.4	20.7	26.7	28.3	23.3	30.4	14.6	23.2	24.4	MODERATE
F009	10.0	1.2	1.3	22.5	2.8	11.2	20.8	3.5	5.8	16.1	7.9	SATISFACTORY
F010	13.5	8.4	-	14.4	24.5	22.0	26.1	10.3	12.5	18.0	14.4	MODERATE
F014	13.1	5.8	13.3	4.7	15.0	13.7	10.0	7.7	10.0	12.5	11.2	SATISFACTORY
F015	20.0	15.6	19.7	20.0	5.0	19.4	13.3	14.5	5.8	4.2	15.1	MODERATE
F019	15.3	3.1	9.2	5.2	2.4	8.1	9.1	18.4	12.7	26.0	9.2	SATISFACTORY
F022	-	13.6	-	14.5	29.3	14.9	-	18.7	16.1	17.1	16.1	MODERATE
F025	-	-	-	14.2	41.2	29.2	25.5	6.9	14.7	14.8	14.8	MODERATE
F026	25.3	10.7	15.7	25.0	11.3	9.7	31.3	0.7	3.0	2.7	11.0	SATISFACTORY
F031	17.1	15.4	18.1	14.3	11.5	19.6	16.4	22.4	8.9	33.1	16.7	MODERATE
F032	5.3	4.3	9.4	5.2	10.1	8.7	8.2	1.4	6.6	9.8	7.4	SATISFACTORY
F036	15.9	20.1	6.4	2.0	1.7	0.4	0.0	0.9	2.3	27.6	2.1	GOOD
F037	17.5	34.3	22.4	34.2	25.8	57.7	36.8	20.1	43.2	20.9	30.0	POOR
F038	12.8	10.6	19.4	27.8	14.7	13.9	6.2	10.6	15.0	6.8	13.4	MODERATE
F042	15.3	7.7	-	13.4	24.7	31.0	19.6	14.0	18.0	44.2	18.0	MODERATE
F048	20.7	19.0	20.8	9.2	24.3	5.8	8.2	5.8	10.1	12.7	11.4	SATISFACTORY
F063	-	1.4	12.2	9.8	8.8	19.5	29.2	8.1	16.2	30.0	12.2	SATISFACTORY
F064	-	14.3	-	-	-	21.6	-	14.8	-	18.4	16.6	MODERATE
F069	18.0	16.4	7.6	4.5	-	2.8	-	-	0.7	8.9	7.6	SATISFACTORY
F092	32.3	31.2	-	26.6	-	13.9	-	11.9	-	14.5	20.6	MODERATE
F094	14.1	36.4	19.3	23.9	5.2	9.0	19.2	12.7	5.0	22.8	16.6	MODERATE
F094a	-	-	-	-	-	-	-	-	32.7	63.9	48.3	POOR
F113	-	-	42.9	28.9	10.6	15.0	4.7	3.3	4.7	4.7	7.6	SATISFACTORY
F131	-	-	-	-	-	-	-	-	-	22.9	-	
F133	-	-	-	7.3	11.3	10.9	5.8	15.8	1.6	5.5	7.3	SATISFACTORY
F139	-	-	-	-	-	49.3	70.4	21.7	20.2	2.6	21.7	MODERATE
F141	-	-	-	-	-	-	9.5	-	28.9	23.5	23.5	MODERATE
F144	-	-	-	-	-	-	45.2	-	-	39.9	42.5	POOR
F146	-	-	-	-	-	-	0.0	7.7	5.0	0.0	2.5	GOOD
F158	-	-	-	-	-	-	-	-	16.1	18.9	17.5	MODERATE
F159	-	-	-	-	-	-	-	-	20.0	71.4	45.7	POOR

INTERLAB	0067	0068	0069	0070	0071	0072	0073	0074	0075	0076
MEDIAN	14.8	13.7	13.3	14.2	11.5	15.0	13.8	11.1	12.5	17.1

STUDY DATES: 0067(05-JUL-1995), 0068(01-MAR-1996), 0069(01-SEP-1996), 0070(03-MAR-1997), 0071(02-SEP-1997), 0072(02-MAR-1998), 0073(01-SEP-1998), 0074(01-MAR-1999), 0075(01-SEP-1999), 0076(01-MAR-2000).

Table 3b

Summary of Study-to-Study Performance
Total Phosphorus

% BIASED PARAMETERS & FLAGGED RESULTS ON STUDIES

LAB	0067	0068	0069	0070	0071	0072	0073	0074	0075	0076	MEDIAN	COMMENTS
F002	27.8	5.0	81.2	5.0	50.0	0.0	0.0	0.0	0.0	0.0	2.5	GOOD
F003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GOOD
F004	5.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GOOD
F006	90.0	14.3	100.0	78.6	22.2	77.8	14.3	14.3	27.8	22.2	25.0	MODERATE
F007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2	0.0	GOOD
F010	20.0	0.0	-	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GOOD
F011	55.0	55.0	0.0	5.0	30.0	-	-	65.0	0.0	64.3	42.5	POOR
F014	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GOOD
F015	5.0	0.0	0.0	0.0	0.0	0.0	12.5	35.0	10.0	5.6	2.5	GOOD
F019	12.5	-	-	-	-	-	-	-	0.0	22.2	12.5	MODERATE
F022	-	0.0	-	5.6	0.0	15.0	-	0.0	0.0	0.0	0.0	GOOD
F025	-	-	-	6.2	0.0	0.0	62.5	0.0	15.0	20.0	6.2	SATISFACTORY
F026	5.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	GOOD
F032	0.0	5.0	6.2	12.5	0.0	5.6	0.0	0.0	0.0	0.0	0.0	GOOD
F036	0.0	70.0	0.0	5.6	10.0	16.7	15.0	10.0	5.6	0.0	7.8	SATISFACTORY
F038	15.0	15.0	0.0	10.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	GOOD
F042	0.0	0.0	-	20.0	0.0	0.0	15.0	5.0	0.0	70.0	0.0	GOOD
F048	10.0	0.0	10.0	75.0	0.0	0.0	11.1	16.7	0.0	5.6	7.8	SATISFACTORY
F063	-	77.8	0.0	7.1	5.6	-	-	0.0	0.0	5.6	5.6	SATISFACTORY
F064	-	95.0	-	-	-	88.9	-	0.0	-	10.0	49.4	POOR
F069	-	-	87.5	78.6	0.0	0.0	68.8	0.0	0.0	0.0	0.0	GOOD
F072	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GOOD
F074	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GOOD
F092	0.0	0.0	-	0.0	-	0.0	-	0.0	-	0.0	0.0	GOOD
F094	5.6	-	-	-	0.0	0.0	81.2	75.0	5.6	61.1	5.6	SATISFACTORY
F113	-	-	25.0	100.0	-	0.0	10.0	10.0	10.0	0.0	10.0	SATISFACTORY
F131	-	-	-	-	-	-	-	-	-	0.0	-	
F133	-	-	-	10.0	5.0	15.0	0.0	0.0	0.0	0.0	0.0	GOOD
F141	-	-	-	-	-	-	0.0	-	0.0	0.0	0.0	GOOD
F146	-	-	-	-	-	-	5.6	5.6	0.0	0.0	2.8	GOOD
F170	-	-	-	-	-	-	-	-	-	0.0	-	

INTERLAB	0067	0068	0069	0070	0071	0072	0073	0074	0075	0076
MEDIAN	5.6	5.0	5.6	5.6	0.0	0.0	5.6	0.0	0.0	0.0

STUDY DATES: 0067(05-JUL-1995), 0068(01-MAR-1996), 0069(01-SEP-1996), 0070(03-MAR-1997), 0071(02-SEP-1997), 0072(02-MAR-1998), 0073(01-SEP-1998), 0074(01-MAR-1999), 0075(01-SEP-1999), 0076(01-MAR-2000).

Table 4a Sample design for major ions & nutrients in ground waters FP 76

Sample Number	Sample Name	Source (Province/State)	Expected Conductance (µS/cm, 25° C)
FP76 MI-1	ION-915	L. Superior Ontario	97
FP76 MI-2	MISSION-96A	Fraser River Mission, B.C.	100
FP76 MI-3	HURON-98	L. Huron Ontario	204
FP76 MI-4	ION-99	Diluted, Souris R. Manitoba	218
FP76 MI-5	RICH-95	Richelieu River Quebec	269
FP76 MI-6	MOIR-01	Moira River Ontario	277
FP76 MI-7	CHIC-94	L. Michigan	296
FP76 MI-8	ONT-99	L. Ontario	301
FP76 MI-9	BATT-01	Battle River Saskatchewan	539
FP76 MI-10	ION-96.2	Grand River Ontario	824

Table 4b Sample design for the Total Phosphorus in water FP 76

Sample Number	Sample Name	Design Value (µg/L)
FP76 TP-1	TP761	0.0013
FP76 TP-2	TP762	0.049
FP76 TP-3	TP763	0.012
FP76 TP-4	TP764	0.067
FP76 TP-5	TP765	0.12
FP76 TP-6	TP766	0.14
FP76 TP-7	TP767	0.18
FP76 TP-8	TP768	0.20
FP76 TP-9	TP769	0.29
FP76 TP-10	TP7610	0.36

Table 5a Summary of Interlaboratory Median Values for Major Ions & Nutrients - Study 76

PARAMETER		ION-915 Sample 1	MISSION-96A Sample 2	HURON-98 Sample 3	ION-99 Sample 4	RICH-95 Sample 5
Ammonia	mg/L N	0.0050	0.0070	0.0188	0.0055	0.0043
Boron	mg/L	0.0100	0.0040	0.0135	0.0270	0.0145
Calcium	mg/L	13.380	13.760	26.100	12.000	27.300
Chloride	mg/L	1.4100	0.8500	6.1400	4.1150	18.500
Colour	Hazen unit	1.5000	6.9000	1.1000	10.500	9.5500
Diss Inorg Carb	mg/L C	10.130	10.090	19.015	14.000	18.200
Diss Org Carb	mg/L C	1.3700	2.0800	1.5700	2.9000	3.2000
Fluoride	mg/L	0.0420	0.0413	0.0800	0.0442	0.1000
Magnesium	mg/L	2.8100	2.6870	7.3500	7.8190	7.9000
Nitrate + Nitrite	mg/L N	0.3436	0.0851	0.2490	0.0160	3.1700
Potassium	mg/L	0.4950	0.6000	0.9000	3.1020	2.3835
Silicates	mg/L SiO2	2.5280	4.6400	1.0800	1.2000	2.3500
Sodium	mg/L	1.3580	2.0000	3.7000	19.500	13.333
Specific Conduct	uS/cm	96.775	100.75	207.50	220.50	272.50
Sulfate	mg/L	3.4400	7.1500	15.686	41.250	18.000
Total Alkalinity	mg/L CaCO3	43.000	42.000	79.500	59.000	76.520
Total Hardness	mg/L	45.550	45.600	96.000	61.900	102.00
Total Kjeldahl N	mg/L N	0.1040	0.0890	0.1400	0.2130	0.3000
Total N	mg/L N	0.4300	0.1475	0.3800	0.2300	3.3726
Turbidity	JTU/NTU	0.0800	0.0645	0.0700	0.1200	0.1050
pH	pH Units	7.7845	7.7800	8.0550	7.9000	8.0200

		MOIR-01 Sample 6	CHIC-94 Sample 7	ONT-99 Sample 8	BATT-01 Sample 9	ION-96.2 Sample 10
Ammonia	mg/L N	0.0086	0.0040	0.0050	0.0430	0.0100
Boron	mg/L	0.0145	0.0210	0.0230	0.0650	0.0540
Calcium	mg/L	45.600	37.500	34.800	40.000	91.480
Chloride	mg/L	7.3700	11.400	20.630	10.900	78.000
Colour	Hazen Unit	13.100	1.0000	1.9000	25.000	13.400
Diss Inorg Carb	mg/L C	29.110	26.250	22.185	44.705	47.485
Diss Org Carb	mg/L C	5.1000	1.5000	1.8800	9.4400	4.0700
Fluoride	mg/L	0.6100	0.8300	0.6300	0.1720	0.1800
Magnesium	mg/L	5.0000	11.240	8.5320	16.500	24.300
Nitrate + Nitrite	mg/L N	0.2900	0.3300	0.4310	0.0440	3.5600
Potassium	mg/L	1.2800	1.2670	1.4985	8.1530	3.9900
Silicates	mg/L SiO2	5.5700	1.7000	1.1080	1.4000	2.4000
Sodium	mg/L	4.9440	5.7000	12.500	52.037	46.400
Specific Conduct	uS/cm	280.50	301.00	306.50	546.50	839.00
Sulfate	mg/L	12.100	23.800	25.600	81.550	106.047
Total Alkalinity	mg/L CaCO3	122.00	112.00	93.160	190.00	205.00
Total Hardness	mg/L	135.00	140.50	121.75	167.00	327.85
Total Kjeldahl N	mg/L N	0.2660	0.1125	0.1905	0.6160	0.4000
Total N	mg/L N	0.5400	0.4200	0.5864	0.6410	3.8591
Turbidity	JTU/NTU	0.1200	0.0800	0.0800	0.1200	0.1150
pH	pH Units	8.2200	8.2090	8.1050	8.4200	8.3800

Table 5b **Summary of Interlaboratory Median Values for Phosphorus - Study 76**

PARAMETER		TP76-1 Sample 1	TP76-2 Sample 2	TP76-3 Sample 3	TP76-4 Sample 4	TP76-5 Sample 5
Total Phosphorus	mg/L P	0.0010	0.0486	0.0114	0.0670	0.1160

		TP76-6 Sample 6	TP76-7 Sample 7	TP76-8 Sample 8	TP76-9 Sample 9	TP76-10 Sample 10
Total Phosphorus	mg/L P	0.1440	0.1800	0.2045	0.2900	0.3610

Appendix A

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 that 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 that 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, 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. These values are open to change with the effort to improve data assessment and in return; the quality of data submitted.

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: If the **lower limit for use of the basic acceptable error** has been set as 10 mg/L, the **basic acceptable error** is 1.0 mg/L and the **target** (median) **value** for a sample is 5 mg/L, then any **reported result** within the range 5 ± 1.0 or 4.0 to 6.0 mg/L would be considered acceptable. The **BAE** would define the acceptable result within the 0-10 mg/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. This allowance is added to the **basic acceptable error** and 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: The **target value** is 21 mg/L, the **BAE** is 1.0, the **LLBAE** is 10 mg/L and the **CEI** 0.1. The acceptable difference is calculated by the equation: (**Target - LLBAE**) x **CEI** + **BAE**. Therefore, (21 - 10) x 0.10 + 1.0 = 2.1. Thus the range 18.9 to 23.1 mg/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 used to determine 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 is dependent upon the range of this number.

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 is required 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 2000

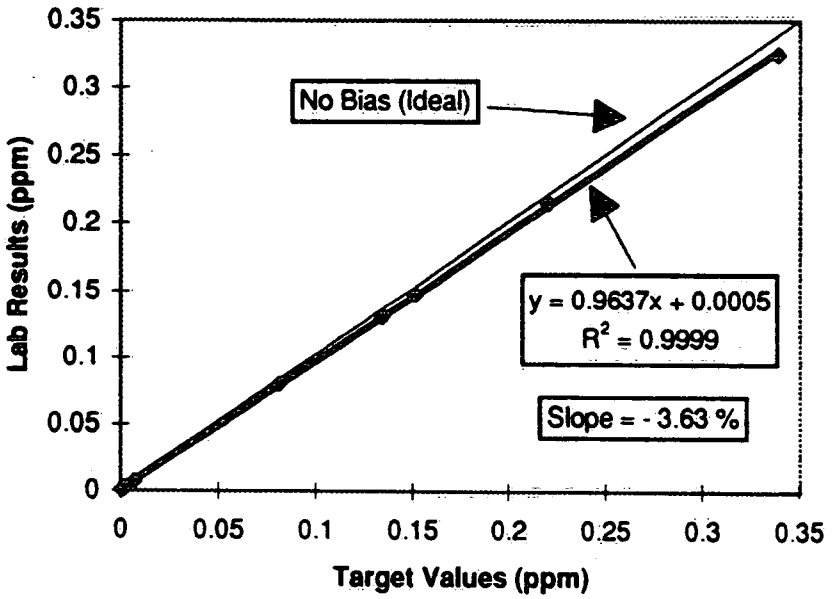
Quantifying Bias in NWRI QA Studies

Systematic bias is a major element in quantifying QA data quality. It is important in qualifying the accuracy of data 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. 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. High precision methodologies and instrumentation like ICPMS yield a very high precision of analysis which may lead to an assessment of very low bias, e.g. 2 or 3%.

Figure 1 **Parameter Performance**



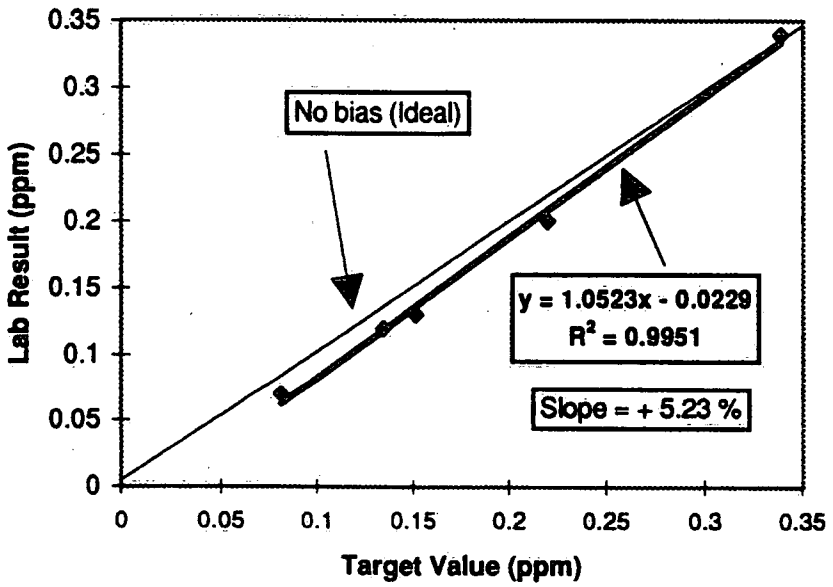
[1] Systematic bias is often identified with the comparison of data to a certified standard.

Parameter Performance Graph and Bias

The parameter performance graph, Figure 1, charts the lab results against the target values for a parameter. Ideal results, showing no bias and no deviating data, would fall on the 45° line labeled 'no bias (ideal)'. In this figure, the lab results have a very high degree of precision as indicated by 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%. The 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. Thus, 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 lab 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.

NWRI Ecosystem Interlaboratory QA Program

Bias Critical Values
Major Ions & Nutrients and Total Phosphorus

Parameter	%
Conductance	2.5
Colour	25
Turbidity	50
pH	5
Total Alkalinity	3
Boron	10
DOC	7.5
DIC	7.5
Nitrate + Nitrite	5
Ammonia	7.5
TKN	10
Total Nitrogen	10
Fluoride	5
Sodium	5
Potassium	5
Silicates	5
Sulfate	5
Chloride	5
Calcium	5
Magnesium	5
Total Hardness	5
Total Phosphorus	5

June 2000

Appendix B

Data & Evaluation Summary

PARAMETER: 00392 Specific Conductance uS/cm

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.0000 BASIC ACCEPTABLE ERROR= 2.0000 CONCENTRATION ERROR INCREMENT= 0.0400

SAMPLE LAB NO	1= ION-915 REPORTED VALUE		2= MISSION-96A REPORTED VALUE		3= HURON-98 REPORTED VALUE		4= ION-99 REPORTED VALUE		5= RICH-95 REPORTED VALUE		6= MOIR-01 REPORTED VALUE		7= CHIC-94 REPORTED VALUE		8= ONT-99 REPORTED VALUE		9= BATT-01 REPORTED VALUE		10= ION-96.2 REPORTED VALUE	
F002	94.1		100.5		207.		222.		276.		286.		303.		308.		547.		843.	
F003	97.2		101.		210.		223.		276.		283.		301.		307.		547.		841.	
F004	98.4		102.		209.		222.		275.		281.		301.		306.		549.		845.	
F006	99.		102.		210.		224.		277.		285.		304.		309.		547.		838.	
F009	98.		101.		208.		222.		274.		281.		301.		307.		547.		841.	
F010	98.		102.		209.		221.		271.		283.		301.		307.		540.		840.	
F014	98.6		102.		206.		218.		266.		276.		292.		299.		552.		845.	
F015	95.		102.		208.		223.		276.		278.		302.		310.		552.		855.	
F019	98.9		103.		210.		222.		275.		283.		303.		311.		552.		848.	
F022	101.		105.		209.		213.		275.		283.		303.		307.		550.		846.	
F025	96.4		99.7		201.		214.		264.		271.		292.		298.		551.		848.	
F026	98.4		101.5		209.		223.		276.		283.		302.		308.		546.		835.	
F031	98.		102.		209.		222.		276.		284.		303.		307.		551.		884.	H
F032	92.		96.		199.		218.		266.		271.		290.		298.		530.		806.	
F036	87.2	EL	80.	EL	188.	VL	199.	EL	249.	VL	257.	VL	274.	VL	282.	VL	507.	VL	751.	VL
F037	96.5		99.7		202.0		215.0		264.0		270.0		288.0		293.0		509.0	VL	763.0	VL
F038	96.		100.		205.		220.		271.		276.		298.		305.		538.		828.	
F042	94.		98.7		189.	VL	203.	VL	8.05	EL	255.	VL	274.	VL	280.	VL	500.3	VL	766.	VL
F048	98.4		101.9		209.		222.		275.		282.		301.		307.		548.		843.	
F063	96.		98.		197.	L	212.		263.		272.		292.		295.		534.		824.	
F069	101.167		101.533		210.		224.		276.667		284.667		303.667		309.333		550.667		842.333	
F092	95.9		99.1		203.7		216.7		267.7		275.1		294.1		297.7		534.5		824.8	
F094	100.		103.		216.		228.		282.		289.		309.		314.		552.		841.	
F113	97.05		99.3		203.5		217.5		268.		279.1		297.4		302.1		538.6		832.8	
F131	92.4		98.3		209.7		224.3		276.6		283.		303.7		307.1		546.		836.2	
F133	95.8		99.5		202.9		218.9		269.5		272.6		295.8		301.8		537.5		829.5	
F141	93.7		96.5		189.	VL	201.	VL	249.	VL	255.	VL	273.	VL	277.	VL	490.	EL	749.	VL
F144	101.		103.		209.		223.		276.		284.		303.		308.		553.		851.	
F158	94.5		95.8		199.		214.		267.		280.		296.		291.	L	519.	L	806.	
F159	95.		98.		194.	L	214.		250.	VL	240.	EL	270.	VL	280.	VL	490.	EL	750.	VL
MEDIAN	96.7750		100.7500		207.5000		220.5000		272.5000		280.5000		301.0000		306.5000		546.5000		839.0000	
1CRIT	5.8310		5.9900		10.2600		10.7800		12.8600		13.1800		14.0000		14.2200		23.8200		35.5200	
N	28		28		28		28		28		28		28		28		27		28	
MEAN	96.7589		100.2512		204.5286		218.3000		269.4810		276.9095		296.1310		301.4655		539.8358		825.7012	
3STDEV	6.9999		6.2088		18.3989		17.5029		24.8209		26.1507		27.0637		26.7567		43.5485		90.4209	

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	195.00	19.500	10					Dip Cell
F003	201.50	20.150	10					US-CM
F004	197.50	19.750	10					2041
F006	249.00	24.900	10		BIASED HIGH*	-0.50	3.9292	Electrode
F009	175.00	17.500	10					Electrode
F010	180.00	18.000	10					Conduct. meter
F014	164.00	16.400	10					PC Titrate
F015	214.50	21.450	10					
F019	247.00	24.700	10		BIASED HIGH*	0.97	0.3756	Conductance
F022	214.00	21.400	10					Electrometry
F025	123.00	12.300	10					Electrode
F026	202.50	20.250	10					Wateranalyses
F031	229.00	22.900	10	H				Conductivity meter
F032	68.00	6.800	10		BIASED LOW	-3.78	1.4421	Conduct 25C
F036	25.00	2.500	10	ELELVLELVLVLVLVLVLVL	BIASED LOW	-9.33	-0.1409	Conduct 25C
F037	77.00	7.700	10	VLVL				V.W.R.
F038	129.50	12.950	10					Meter
F042	36.00	3.600	10	VLVLELVLVLVLVLVL	BIASED LOW	-6.84	-28.6622	Cond. Meter
F048	196.00	19.600	10					Meter
F063	71.00	7.100	10	L	BIASED LOW*	-1.56	-3.9021	auto meter
F069	256.00	25.600	10		BIASED HIGH*	0.12	2.8713	Electrometric
F092	99.00	9.900	10					meter
F094	280.50	28.050	10		BIASED HIGH*	-0.34	7.3116	Cond. Meter
F113	124.00	12.400	10					YSI3200Conduct
F131	191.00	19.100	10					Conductivity meter
F133	111.00	11.100	10					Cond. meter
F141	23.00	2.300	10	VLVLVLVLVLVLELVL	BIASED LOW	-11.60	6.9551	Conductivity
F144	257.00	25.700	10		BIASED HIGH*	1.26	-0.0371	APHA2510B
F158	77.00	7.700	10	L L				
F159	37.00	3.700	10	L VLELVLVLELVL	BIASED LOW	-11.91	8.7123	N 1473

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 2.50

OVERALL AVERAGE
RANK IS 15.500

PARAMETER: 00292 Colour Hazen Unit

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 5.0000 BASIC ACCEPTABLE ERROR= 5.0000 CONCENTRATION ERROR INCREMENT= 0.1500

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	<5.0	5.	<5.0	7.	7.	9.	<5.0	<5.0	21.	11.
F003	2.2	8.3	1.1	11.1	10.1	13.9	1.2	1.9	25.6	13.3
F010	<1.	6.	<1.	8.	8.	11.	<1.	<1.	21.	10.
F014	0.	0. EL	0.	5.	5.	5. EL	0.	0.	20.	5. EL
F031	1.	9.1	1.1	11.9	10.6	13.7	0.6	1.	29.	14.
F032	0.6T	7.8	0.2W	11.	11.	15.	0.8T	1.2	29.8	15.2
F038	<5.	6.	<5.	9.	9.	12.	<5.	<5.	23.	12.
F042	2.	8.	0.	12.	11.	14.	0.	2.	28.	16.
F048	3.3	10.51	2.61	12.47	11.21	14.58	2.01	3.12	29.59	16.13
F063	<2.	5.5	<2.	8.5	8.	10.	<2.	<2.	22.5	13.5
F092	0.	2.	1.	6.	5.	7.5	1.	0.	21.	8.
F094	3.	13. H	5.	13.	13.	18.	3.	5. EH	25.	15.
F141	<1.	9.	<1.	15.	15.	18.	<1.	2.	39. EH	20. H
F158	<2.5	5.0	<2.5	10.0	7.5	12.5	2.5	<2.5	25.0	10.0
MEDIAN	1.5000	6.9000	1.1000	10.5000	9.5500	13.1000	1.0000	1.9000	25.0000	13.4000
1CRIT	5.0000	5.2850	5.0000	5.8250	5.6825	6.2150	5.0000	5.0000	8.0000	6.2600
N	5	12	4	12	11	11	6	6	12	12
MEAN	1.7600	6.8508	1.4525	9.9975	9.6736	12.1073	1.3517	1.8700	25.0408	12.8442
3STDEV	-	6.7663	-	6.5481	5.4206	7.0374	2.0377	2.0505	9.7864	7.5838

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING			BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	20.50	3.417	6							Automated AAII
F003	73.50	7.350	10							PT CO UN
F010	27.50	4.583	6							Colorimetry
F014	12.50	1.250	10	EL	EL	EL	BIASED LOW*	-24.90	-2.3049	HelligeColourMeter
F031	73.50	7.350	10							Spectrophoto
F032	73.50	8.167	9							Colorimetry
F038	37.50	6.250	6							Spec
F042	77.00	7.700	10							Colorimetric
F048	102.00	10.200	10				BIASED HIGH*	11.10	1.2258	visibleSpectros
F063	32.50	5.417	6							auto colour
F092	23.50	2.350	10				BIASED LOW*	-19.64	-1.5966	Helige Aquatester
F094	103.00	10.300	10	H		EH	BIASED HIGH*	-8.05	3.5805	Visual comparison
F141	87.00	12.429	7			EHH	BIASED HIGH	60.17	-1.5279	Colorimetry
F158	40.50	5.786	7							

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 25.00

OVERALL AVERAGE
RANK IS 6.701

PARAMETER: 00192 Turbidity JTU/NTU

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.2000 BASIC ACCEPTABLE ERROR= 0.2500 CONCENTRATION ERROR INCREMENT= 0.1000

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	0.1	0.14	0.1	0.16	0.14	0.15	0.11	0.13	0.17	0.14
F003	0.06	0.06	0.05	0.14	0.13	0.13	0.05	<0.05	0.24	0.17
F004	0.09	0.06	0.1	0.21	0.2	0.32 EH	0.08	0.13	0.38	0.29
F006	0.02	0.03	0.01	0.07	0.04	0.06	0.02	0.03	0.06	0.07
F010	0.1	0.2	0.1	0.2	0.2	0.2	0.2 EH	0.2	0.2	0.2
F015	0.06	0.06	0.05	0.13	0.13	0.09	0.05	0.06	0.10	0.10
F022	<0.01 EL	<0.01	<0.01	0.03	0.03	0.13	<0.01	<0.01	<0.01	0.05
F031	0.08	0.08	0.07	0.12	0.09	0.17	0.08	0.08	0.11	0.15
F032	0.05W	0.05W	0.05W	0.15T	0.07	0.07	0.05W	0.05W	0.1T	0.07T
F038	0.1	<0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	0.1	0.2
F042	0.12	0.13	0.13	0.15	0.18	0.14	0.13	0.11	0.14	0.12
F048	0.05	0.06	0.05	0.1	0.09	0.08	0.06	0.06	0.08	0.1
F092	0.07	0.09	0.07	0.12	0.1	0.11	0.08	0.08	0.13	0.11
F094	0.08	0.06	0.06	0.1	0.08	0.04	0.08	0.02	0.3	0.22
F113	0.053	0.069	0.044	0.11	0.11	0.093	0.056	0.065	0.093	0.095
F122	0.03W	0.05	0.02W	0.09	0.05	0.05	0.04	0.04	0.06	0.06
F133	0.1	0.09	0.07	0.12	0.13	0.14	0.08	0.09	0.13	0.1
F141	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1
F158	0.05	0.06	<0.05	0.07	0.06	0.07	<0.05	0.05	0.11	<0.05
F159	<1.	2.2 EH	<1.	3.2 EH	3.0 EH	4.6 EH	<1.	2.2 EH	9.9 EH	7.5 EH
MEDIAN	0.0800	0.0645	0.0700	0.1200	0.1000	0.1100	0.0800	0.0800	0.1100	0.1100
1CRIT	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
N	13	14	11	17	17	17	12	14	16	17
MEAN	0.0764	0.0864	0.0695	0.1259	0.1118	0.1237	0.0747	0.0875	0.1552	0.1350
3STDEV	0.0586	0.1231	0.0618	0.1151	0.1412	0.1895	0.0747	0.1294	0.2467	0.1820

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	135.00	13.500	10					Nephelometric
F003	86.00	9.556	9					JTU
F004	138.50	13.850	10	EH	BIASED HIGH	387.45	-0.2646	2081
F006	18.50	1.850	10		BIASED LOW*	4.02	-0.0552	NTU
F010	149.50	14.950	10	EH	BIASED HIGH*	-0.01	0.0876	Nephelometry
F015	70.00	7.000	10					neph.
F022	14.50	3.625	4	EL	INSUFFICIENT DATA			Nephelometry
F031	100.00	10.000	10					Turbidity meter
F032	34.00	6.800	5					Colorimetry
F038	70.00	10.000	7					Neph
F042	134.00	13.400	10					Nephelometric
F048	53.50	5.350	10					Hach Turbidimeter
F092	95.00	9.500	10					Turbidity meter
F094	77.00	7.700	10					Nephelometer
F113	63.00	6.300	10					Hach 2100N
F122	19.50	2.438	8		BIASED LOW*	-42.98	-0.0002	HACH 18900
F133	106.50	10.650	10					Nephelometric
F141	14.00	7.000	2		INSUFFICIENT DATA			Turbidimeter
F158	32.50	4.643	7					
F159	127.00	18.143	7	EH EHEHEH EHEHEH	BIASED HIGH	7859.27	-3.2396	ASTM 1889 94

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 50.00

OVERALL AVERAGE
RANK IS 9.101

PARAMETER: 01092 pH pH Units

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 5.5000 BASIC ACCEPTABLE ERROR= 0.2500 CONCENTRATION ERROR INCREMENT= 0.0000

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	7.91	7.91	8.2	8.05	8.2	8.34	8.33	8.25	8.5	8.48
F003	7.74	7.75	8.06	7.86	8.04	8.22	8.18	8.20	8.46	8.43
F006	7.7	7.6	8.	7.8	7.9	8.2	8.1	8.	8.4	8.3
F009	7.84	7.82	8.1	7.94	8.07	8.28	8.26	8.13	8.45	8.41
F010	7.81	7.80	8.07	7.91	8.06	8.27	8.24	8.13	8.43	8.40
F014	7.77	7.76	8.04	7.9	8.02	8.2	8.2	8.07	8.39	8.36
F015	7.26 VL	7.36 VL	7.85	7.60 L	7.83	8.20	8.12	7.96	8.43	8.38
F019	7.9	8.	8.2	8.1	8.2	8.4	8.4	8.2	8.5	8.5
F022	7.51 L	7.46 L	7.93	7.89	7.98	7.94 L	7.95 L	7.94	8.09 EL	0.08 EL
F025	7.5 L	7.5 L	7.7 L	7.6 L	7.7 L	7.9 EL	7.9 L	7.8 L	8.1 EL	8.1 EL
F026	7.77	7.75	8.09	7.87	8.01	8.23	8.23	8.14	8.45	8.42
F031	8.02	7.9	8.11	8.01	8.11	8.32	8.26	8.16	8.5	8.42
F032	7.82	7.87	8.1	7.99	8.12	8.28	8.28	8.18	8.45	8.36
F036	7.62	7.63	7.96	7.78	7.96	8.2	8.16	8.03	8.41	8.38
F037	7.81	7.80	8.08	7.88	8.03	8.24	8.21	8.07	8.43	8.37
F038	7.76	7.81	8.13	7.92	7.97	8.12	8.13	8.12	8.37	8.38
F042	7.79	7.75	8.04	7.91	8.05	8.22	8.24	8.11	8.41	8.28
F048	7.99	7.99	8.25	8.11	8.22	8.4	8.39	8.27	8.57	8.5
F063	7.07 VL	7.11 VL	7.56 EL	7.3 EL	7.58 VL	8.	8.	7.67 EL	8.31	8.29
F064	7.82	7.8	8.1	7.95	8.08	8.28	8.26	8.09	8.44	8.39
F069	8.136 H	7.917	8.017	8.	8.021	8.253	8.208	8.126	8.43	8.382
F092	6.5 EL	6.66 EL	7.27 EL	7.06 EL	7.39 EL	7.9 EL	7.84 L	7.56 EL	8.25	8.24
F094	7.3 VL	7.3 VL	7.8 L	7.5 VL	7.7 L	8.	7.9 L	7.8 L	8.2	8.2
F113	7.84	7.88	8.1	7.96	8.08	8.27	8.25	8.17	8.43	8.41
F131	8.02	8.02	8.21	8.11	8.02	8.26	8.26	8.16	8.38	8.4
F133	7.82	7.82	8.1	7.95	8.1	8.28	8.25	8.12	8.48	8.42
F140	7.779	7.71	8.05	7.89	7.98	8.19	8.24	8.04	8.4	8.32
F141	7.71	7.71	7.99	7.83	7.99	8.19	8.17	8.01	8.35	8.31
F144	7.65	7.67	7.93	7.79	7.95	8.16	8.17	8.06	8.4	8.33
F158	7.9	7.8	8.0	7.9	8.0	8.2	8.2	8.1	8.4	8.4
MEDIAN	7.7845	7.7800	8.0550	7.9000	8.0200	8.2200	8.2090	8.1050	8.4200	8.3800
1CRIT	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
N	28	28	28	27	28	26	28	28	28	27
MEAN	7.7296	7.7206	8.0185	7.8548	7.9911	8.2055	8.1817	8.0656	8.3982	8.3541
3STDEV	0.6611	0.6168	0.4316	0.5140	0.4178	0.2848	0.3507	0.3898	0.2652	0.2377

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	276.00	27.600	10		BIASED HIGH	-7.42	0.7298	pH Meter
F003	176.00	17.600	10					pH ELECTRODE
F006	84.00	8.400	10					Stir
F009	223.00	22.300	10					Stirred
F010	189.50	18.950	10					Stirred electrode
F014	131.50	13.150	10					PC Titrate
F015	79.50	7.950	10	VLVL L				auto. Ph
F019	282.00	28.200	10		BIASED HIGH	-10.18	0.9765	Stirred
F022	55.50	5.550	10	L L L L ELEL	BIASED LOW	-530.78	41.9154	Electrometry
F025	33.50	3.350	10	L L L L L ELL L ELEL	BIASED LOW*	-2.74	-0.0865	Electrode
F026	174.50	17.450	10					Wateranalyses
F031	258.50	25.850	10		BIASED HIGH	-17.12	1.4768	pH meter
F032	228.00	22.800	10					Stirred
F036	96.50	9.650	10					Stirred
F037	160.50	16.050	10					Accumet
F038	139.50	13.950	10					Meter
F042	150.00	15.000	10					Unstirred
F048	292.50	29.250	10		BIASED HIGH	-11.45	1.1068	Stirred
F063	32.50	3.250	10	VLVLELELVL EL	BIASED LOW	99.79	-8.4694	stirred
F064	206.50	20.650	10					pH electrode stir
F069	199.00	19.900	10	H				Electrometric
F092	16.50	1.650	10	ELELELELELELL EL	BIASED LOW	167.50	-14.1677	stir
F094	34.00	3.400	10	VLVLL VLL L L	BIASED LOW	44.05	-3.8805	pH meter
F113	223.50	22.350	10					Beckman350unstir
F131	228.50	22.850	10					Stirred
F133	224.50	22.450	10					electrode
F140	122.50	12.250	10					Stirred
F141	91.50	9.150	10					pH meter
F144	87.50	8.750	10					APHA4500HB
F158	153.00	15.300	10					

* 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 15.500

PARAMETER: 06192 Total Alkalinity mg/L CaCO3

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.0000 BASIC ACCEPTABLE ERROR= 1.5000 CONCENTRATION ERROR INCREMENT= 0.0400

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	39.7 L	39.2	75.4	55.5	72.4	116.4	106.8	88.04	183.5	198.6
F003	42.1	40.6	78.0	58.0	75.8	120.	110.	90.8	189.	204.
F006	44.	43.	81.	60.	78.	125.	114.	95.	193.	209.
F010	43.	43.	84.	61.	80.	129. H	115.	94.	200. H	208.
F014	41.7	42.9	71.6 VL	59.5	70.7 L	116.	113.	85.7 L	187.	200.
F015	43.9	43.3	81.2	60.8	78.5	124.	113.	94.3	193.	208.
F019	44.	40.	78.	56.	76.	118.	108.	92.	182.	198.
F022	40.71	40.43	76.47	57.75	72.94	115.15 L	107.28	82.67 VL	189.15	200.71
F025	46.5 H	45.6 H	86.2 H	65.1 VH	83.1 H	125.	116.	99.1 H	195.	208.
F026	41.865	41.17	79.665	58.74	77.02	122.83	112.81	94.055	192.675	208.39
F031	40.	44.	74. L	54. L	72.	114. L	104. L	89.	178. EL	188. EL
F032	44.	44.5	82.	61.5	79.	125.	116.	96.5	196.	209.
F036	41.9	41.1	78.	57.8	75.1	119.	109.	90.7	185.	200.
F038	43.	42.	78.	60.	73.	119.	111.	82. EL	193.	209.
F042	42.11	41.41	79.56	58.72	76.52	122.	111.	93.16	189.9	203.9
F048	44.8	44.6	82.	60.2	78.6	123.8	113.6	97.2	195.	211.
F063	44.	44.	82.	59.	78.	122.	112.	94.	189.	205.
F064	45.	43.6	76.5	60.4	77.4	121.5	103. VL	94.8	189.	202.3
F069	44.08	43.375	81.53	224. EH	276.667 EH	284.667 EH	303.667 EH	94.72	192.425	207.145
F092	39.14 L	38.7 L	78.88	56.89	76.17	117.28	108.42	93.06	184.95	199.64
F094	43.	42.	81.	60.	77.	122.	112.	94.	190.	206.
F113	40.42	40.12	76.1	56.2	74.04	118.7	107.81	89.34	184.96	199.44
F133	43.	42.	80.	59.	77.	122.	112.	93.	190.	205.
F140	46.	42.5	79.5	59.5	79.	122.	116.	97.5	195.	227. EH
F141	42.	41.	79.	58.	75.	119.	109.	91.	186.	199.
F144	45.	45.	80.	65. VH	75.	125.	115.	95.	192.	205.
F158	42.7	41.5	74.0 L	57.0	71.0 L	120.	111.	92.0	190.	200.
MEDIAN	43.0000	42.0000	79.5000	59.0000	76.5200	122.0000	112.0000	93.1600	190.0000	205.0000
1CRIT	3.1800	3.1400	4.6400	3.8200	4.5208	6.3400	5.9400	5.1864	9.0600	9.6600
N	25	25	25	25	25	25	25	25	25	25
MEAN	42.8794	42.2522	79.0322	59.2640	76.3036	121.1864	111.3488	92.4618	189.8624	204.1650
3STDEV	4.8191	4.6679	7.6431	6.9596	8.2148	9.9503	9.4729	10.2711	11.4682	11.9883

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	31.00	3.100	10	L	BIASED LOW*	-2.17	-2.4470	H2SO4 titration
F003	98.50	9.850	10					ALK T POT
F006	206.00	20.600	10					Titrate0.02N H2SO4
F010	217.50	21.750	10	H H	BIASED HIGH	3.47	-0.0692	Titration conduct.
F014	80.00	8.000	10	VL L L				PC Titrate
F015	199.50	19.950	10					
F019	73.50	7.350	10					Titration
F022	58.00	5.800	10	L VL	BIASED LOW*	-0.54	-3.3383	Titration
F025	252.50	25.250	10	H H H VHH H	BIASED HIGH*	-0.75	5.5066	Titration
F026	156.00	15.600	10					TITROPROCESSOR
F031	42.00	4.200	10	L L L L ELEL	BIASED LOW	-8.56	2.2365	Titration
F032	237.50	23.750	10		BIASED HIGH*	1.96	1.1321	Titration
F036	82.00	8.200	10					Titration
F038	128.00	12.800	10	EL				Colour
F042	128.00	12.800	10					ANC Gran Plot
F048	229.00	22.900	10		BIASED HIGH*	2.22	0.5897	Titrimetric
F063	171.00	17.100	10					autotitrate4.5
F064	147.50	14.750	10	VL				titration digit
F069	228.00	22.800	10	EHEHEHEH	BIASED HIGH	-23.97	97.5115	Endpoint titration
F092	67.00	6.700	10	L L				Autotitrator
F094	159.50	15.950	10					autotitrator
F113	52.00	5.200	10		BIASED LOW*	-1.92	-1.5408	ManTech PC Titrate
F133	147.00	14.700	10					Titrimetric
F140	212.00	21.200	10	EH				Fixed end pt
F141	84.50	8.450	10					Titrimetry
F144	202.00	20.200	10	VH				APHA2320B
F158	90.50	9.050	10	L L				

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 3.00

OVERALL AVERAGE
RANK IS 14.000

PARAMETER: 05091 Boron mg/L

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.0050 BASIC ACCEPTABLE ERROR= 0.0050 CONCENTRATION ERROR INCREMENT= 0.1000

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F010	0.010	0.006	0.015	0.031	0.019	0.016	0.024	0.026	0.068	0.059
F015	0.011	0.004	0.014	0.028	0.014	0.014	0.021	0.022	0.067	0.054
F022	<0.025	<0.025	<0.025	0.025	<0.025	<0.025	<0.025	<0.025	0.06	0.04 L
F038	0.006	0.004	0.013	0.026	0.015	0.015	0.02	0.023	0.06	0.049
F064	<0.002 L	<0.002	0.0074	0.0207	0.0096	0.0087	0.0156	0.0178	0.0538EL	0.0431L
F069	<0.016	<0.016	<0.016	0.0283	<0.016	<0.016	0.024	0.024	0.065	0.052
F094	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	0.06
F133	0.004	0.002	0.01	0.025	0.014	0.013	0.02	0.022	0.063	0.054
F144	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
F158	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
MEDIAN	0.0080	0.0040	0.0130	0.0260	0.0140	0.0140	0.0205	0.0225	0.0640	0.0530
1CRIT	0.0053	0.0050	0.0058	0.0071	0.0059	0.0059	0.0066	0.0068	0.0109	0.0098
N	2	2	3	5	3	3	3	4	6	6
MEAN	0.0080	0.0040	0.0123	0.0265	0.0143	0.0140	0.0203	0.0228	0.0638	0.0519
3STDEV	-	-	-	-	-	-	-	-	0.0094	0.0148

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F010	54.50	5.450	10					ICP OES
F015	39.00	3.900	10					ICP-MS
F022	6.00	2.000	3		L			ICP
F038	31.50	3.150	10					ICPOES
F064	9.00	1.125	8	L	ELL			
F069	25.50	5.100	5					ICP
F094	16.00	8.000	2					ICP-MS
F133	25.50	2.550	10					ICP-MS
F144	0.00	-	0					APHA4500BB
F158	0.00	-	0					

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

OVERALL AVERAGE
RANK IS 3.569

PARAMETER: 06002 Diss Organic Carbon mg/L C

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 2.0000 BASIC ACCEPTABLE ERROR= 0.7500 CONCENTRATION ERROR INCREMENT= 0.1000

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	1.	1.7	1.4	2.5	3.1	5.1	1.	1.3	9.9	3.9
F003	1.3	2.0	1.6	2.9	3.2	5.2	1.5	1.9	9.5	4.3
F004	1.22	1.9	1.39	2.76	3.13	4.94	1.38	1.7	9.44	3.87
F006	1.7	2.3	1.9	3.2	3.5	5.5	1.8	2.2	11. H	4.4
F010	1.2	2.0	1.4	2.8	3.2	5.0	1.3	1.6	9.0	3.8
F014	1.6	2.4	2.	3.5	3.8	5.7	2.2	2.3	10.7	5.3 H
F015	1.3	1.9	1.1	2.8	3.1	4.5	1.1	1.7	9.2	3.5
F019	3. EH	3. EH	3. EH	5. EH	6. EH	9. EH	5. EH	5. EH	17. EH	11. EH
F022	1.11	1.82	0.96	2.83	2.76	4.29	0.55 L	1.06 L	6.81 EL	3.32
F025	1.6	2.	1.5	2.8	3.1	5.1	1.4	1.7	9.5	4.1
F026	1.27	1.872	1.375	2.801	3.059	5.08	1.329	1.725	9.266	3.769
F032	1.2	1.9	1.3	2.8	3.	5.3	1.2	1.6	9.2	3.8
F037	1.4911	2.2709	1.7490	3.3165	3.6381	5.8063	1.7422	2.1696	10.3469	4.9314
F038	1.5	2.1	1.7	2.9	3.3	5.1	1.6	1.9	9.2	4.1
F042	1.3	1.8	1.4	2.7	2.9	4.7	1.4	1.7	8.7	3.7
F048	1.62	2.23	1.99	3.34	3.53	5.57	1.99	2.33	9.85	4.89
F063	1.4	2.1	1.5	3.1	3.4	5.2	1.5	1.9	9.6	4.3
F069	1.408	2.313	1.65	3.153	3.493	5.374	1.584	1.949	9.852	4.361
F092	1.34	2.08	1.57	2.97	3.32	4.92	1.47	1.77	8.92	4.07
F094	1.3	2.1	1.4	2.9	3.2	5.	1.5	1.7	9.2	4.2
F094a	<0.5 EL	2.1	2.	3.	3.1	4.8	2.	1.9	8.9	4.
F113	1.45	2.1	1.58	3.04	3.29	5.14	1.58	1.88	9.57	3.97
F131	1.2469	1.8311	1.3414	2.6823	3.0287	4.7895	1.3521	1.663	9.0324	3.9155
F141	2.	2.	2.	3.	3.	2. EL	2.	4. EH	8.	2. EL
F158	2.1	2.6	2.8 EH	3.9 EH	4.4 EH	7.1 EH	3.2 EH	3.2 VH	12.4 EH	6.9 EH
MEDIAN	1.3700	2.0800	1.5700	2.9000	3.2000	5.1000	1.5000	1.8800	9.4400	4.0700
1CRIT	0.7500	0.7580	0.7500	0.8400	0.8700	1.0600	0.7500	0.7500	1.4940	0.9570
N	22	23	23	23	23	23	23	23	23	23
MEAN	1.4389	2.0747	1.6368	3.0084	3.2952	5.1830	1.6142	1.9907	9.5773	4.2346
3STDEV	0.7394	0.5967	1.0558	0.8525	0.9701	1.6142	1.3443	1.6860	2.6224	2.1669

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	66.00	6.600	10					Shimadzu TOC
F003	137.00	13.700	10					UV DIGESTION
F004	78.00	7.800	10					6104
F006	203.00	20.300	10	H	BIASED HIGH	14.29	-0.0342	PersulfateUV
F010	72.50	7.250	10					Conductivity meter
F014	220.50	22.050	10	H	BIASED HIGH	10.80	0.2814	combustionNDIR
F015	60.00	6.000	10		BIASED LOW*	-1.39	-0.2450	carbon analyser
F019	249.00	24.900	10	EHEHEHEHEHEHEHEHEHEH	BIASED HIGH	72.17	0.9996	Calculation TC IC
F022	24.00	2.400	10	L L EL	BIASED LOW	-24.07	0.0370	Combustion
F025	115.00	11.500	10					IR
F026	77.00	7.700	10					AUTOANALYSER
F032	65.00	6.500	10					Colorimetry
F037	200.00	20.000	10		BIASED HIGH	10.19	0.0978	Persulfate IR
F038	147.50	14.750	10					Combust IR
F042	53.50	5.350	10		BIASED LOW	-7.62	-0.0288	IR Spec.
F048	204.00	20.400	10		BIASED HIGH*	1.50	0.3734	NDIRcombustion
F063	156.00	15.600	10					UV Persulfate
F069	181.00	18.100	10					CatalOxidUV
F092	117.00	11.700	10					CombustionCO2
F094	115.00	11.500	10					Combustion IR
F094a	121.00	13.444	9	EL				Combustion IR
F113	147.00	14.700	10					Dohrmann 8000
F131	55.00	5.500	10		BIASED LOW*	-2.79	-0.1302	PersulfaleUV
F141	123.00	12.300	10	EL EH EL				CombustionIR
F158	238.00	23.800	10	EHEHEHEHEHVHEHEH	BIASED HIGH	25.66	0.6993	

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 7.50

OVERALL AVERAGE
RANK IS 12.952

PARAMETER: 06592 Diss Inorg Carbon mg/L C

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.5000 BASIC ACCEPTABLE ERROR= 0.5000 CONCENTRATION ERROR INCREMENT= 0.1000

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	9.3	9.3	17.8	13.1	17.2	27.2	24.9	20.9	41.9	45.3
F003	10.2	10.2	18.7	14.0	18.1	28.5	26.2	22.1	43.7	46.8
F010	10.3	10.1	18.6	14.0	18.2	30.	28.	24.	46.	50.
F015	10.2	10.1	19.0	14.1	18.2	28.6	26.3	22.1	44.3	47.7
F019	10.	10.	19.	14.	18.	29.	26.	22.	44.	47.
F022	10.19	10.08	19.29	14.29	18.58	29.22	27.03	22.7	45.78	46.88
F025	9.8	9.7	19.2	13.9	18.1	29.6	25.9	22.	46.2	50.4
F026	10.32	10.135	19.61	14.57	18.59	29.235	26.965	23.105	46.12	49.095
F032	9.6	9.2	18.4	13.4	17.2	27.	25.4	21.	43.	46.2
F036	9.88	10.3	19.4	13.6	18.4	27.6	26.	23.2	45.2	48.4
F038	11.4 EH	10.4	21.8 EH	14.9	20.2	32.7 EH	29.8 EH	24.4	49.3 EH	53. EH
F042	10.7	10.7	20.6	14.9	20.6 EH	30.3	27.6	23.1	45.7	49.2
F092	10.27	10.25	19.47	14.37	18.84	29.78	26.94	22.27	44.44	46.98
F094	9.6	9.5	18.	13.4	17.9	27.5	25.	21.4	41.9	45.1
F113	10.07	9.9	19.03	14.14	18.23	29.43	27.06	22.62	44.97	47.27
F141	10.	9.	18.	13.	17.	28.	25.	20.	44.	48.
MEDIAN	10.1300	10.0900	19.0150	14.0000	18.2000	29.1100	26.2500	22.1850	44.7050	47.4850
1CRIT	1.4630	1.4590	2.3515	1.8500	2.2700	3.3610	3.0750	2.6685	4.9205	5.1985
N	14	14	14	13	14	14	14	14	13	14
MEAN	10.0807	9.9404	19.0214	13.9131	18.2671	28.8546	26.3854	22.3211	44.8777	47.8018
3STDEV	0.8635	1.0839	1.9708	1.2278	2.0962	2.8359	2.6567	2.5308	3.0152	4.2346

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	18.00	1.800	10		BIASED LOW*	-4.80	-0.2694	Shimadzu TOC
F003	72.50	7.250	10					INFRARED DETECTION
F010	115.00	11.500	10					Conduct. meter
F015	85.50	8.550	10					carbon analyser
F019	66.50	6.650	10					Acid-IR
F022	101.00	10.100	10					Combustion
F025	84.00	8.400	10					IR
F026	126.00	12.600	10					AUTOANALYSER
F032	28.50	2.850	10		BIASED LOW*	-2.58	-0.4556	Colorimetry
F036	92.50	9.250	10					Colorimetry
F038	157.50	15.750	10	EH EH EHEH EHEH	BIASED HIGH	12.02	-0.2266	Combust IR
F042	142.50	14.250	10	EH	BIASED HIGH*	1.26	0.9184	IR Spec.
F092	111.00	11.100	10					AcidCO2
F094	28.50	2.850	10		BIASED LOW*	-6.03	0.2666	Combustion IR
F113	95.00	9.500	10					Dohrmann 8000
F141	36.00	3.600	10		BIASED LOW*	2.12	-1.4281	CombustionIR

* NOTE: INDICATED BIAS STATEMENT IS FOR CAUTION ONLY AND NOT COUNTED IN STUDY STATISTICS
PERCENT SLOPE USED FOR CAUTION COMPARISON= 7.50

OVERALL AVERAGE
RANK IS 8.500

PARAMETER: 07092 Nitrate + Nitrite mg/L N

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.0200 BASIC ACCEPTABLE ERROR= 0.0200 CONCENTRATION ERROR INCREMENT= 0.0800

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	0.34	0.07	0.25	<0.02	3.14	0.27	0.32	0.43	0.05	3.5
F003	0.346	0.085	0.249	0.011	3.12	0.295	0.331	0.431	0.037	3.74
F004	0.359	0.092	0.263	0.017	3.33	0.308	0.349	0.455	0.048	3.75
F006	0.39 H	0.12 H	0.31 EH	0.04 EH	3.39	0.36 EH	0.42 EH	0.54 EH	0.09 VH	3.94 EH
F009	0.35	0.07	0.24	<0.02	3.27	0.27	0.31	0.43	<0.02 L	3.57
F010	0.30	0.08	0.22	0.02	2.9 L	0.29	0.29	0.39	0.04	2.3 EL
F014	0.34	0.08	0.24	<0.05	3.	0.28	0.33	0.42	<0.05	3.4
F015	0.352	0.088	0.254	0.016	3.30	0.302	0.336	0.446	0.044	3.68
F019	0.34	0.08	0.24	<0.03	3.19	0.27	0.33	0.44	0.05	3.66
F022	0.34	0.081	0.244	0.008	3.307	0.288	0.329	0.437	0.038	3.542
F025	0.329	0.088	0.238	0.014	3.22	0.283	0.321	0.418	0.045	3.62
F026	0.332	0.083	0.241	0.02	3.053	0.282	0.32	0.423	0.044	3.517
F031	0.33	0.09	0.24	0.01	3.1	0.3	0.33	0.45	0.04	3.57
F032	0.356	0.103	0.26	0.031	3.18	0.308	0.342	0.449	0.058	3.58
F036	0.35	0.09	0.252	0.016	3.22	0.308	0.34	0.452	0.048	3.63
F037	0.3436	0.0723	0.2569	<0.05	***** EH	0.2917	0.3260	0.4266	0.0493	***** EH
F038	0.343	0.087	0.249	0.016	3.05	0.296	0.331	0.436	0.044	3.52
F048	0.344	0.086	0.25	0.015	3.13	0.287	0.323	0.457	0.044	3.49
F063	0.39 H	0.14 EH	0.28	<0.10	3.11	0.32	0.36	0.46	0.12 EH	3.54
F064	0.35	0.095	0.24	0.021	3.17	0.28	0.33	0.43	0.042	3.59
F069	0.327	0.076	0.234	0.012	3.084	0.271	0.309	0.409	0.041	3.461
F092	0.336	0.076	0.239	0.011	3.139	0.276	0.324	0.414	0.042	3.356
F094	0.357	0.09	0.259	0.017	3.29	0.295	0.326	0.428	0.037	3.56
F113	0.347	0.088	0.253	0.018	3.161	0.295	0.336	0.444	0.046	3.551
F131	0.3109	0.0749	0.2253	0.0058	2.9689	0.2672	0.2976	0.3905	0.0386	3.3708
F133	0.327	0.08	0.236	<0.010	3.18	0.272	0.315	0.42	<0.010 VL	3.56
F140	0.354	0.0851	0.255	0.0145	3.198	0.303	0.338	0.441	0.0421	3.63
F141	0.34	0.1	0.24	<0.03	3.4	0.28	0.33	0.42	0.04	3.43
F144	0.42 EH	0.34 EH	0.39 EH	0.17 EH	3.16	0.43 EH	0.41 EH	0.54 EH	0.33 EH	3.56
F146	0.354	0.0851	0.255	0.0145	3.198	0.303	0.338	0.441	0.0421	3.63
F158	0.34	0.07	0.22	<0.05	3.25	0.26	0.30	0.41	<0.05	3.53
MEDIAN	0.3436	0.0851	0.2490	0.0160	3.1800	0.2900	0.3300	0.4310	0.0440	3.5600
1CRIT	0.0459	0.0252	0.0383	0.0200	0.2728	0.0416	0.0448	0.0529	0.0219	0.3032
N	29	30	28	20	29	29	29	28	24	29
MEAN	0.3454	0.0868	0.2498	0.0171	3.1831	0.2914	0.3304	0.4324	0.0494	3.5682
3STDEV	0.0482	0.0430	0.0475	0.0214	0.3127	0.0569	0.0598	0.0487	0.0536	0.3517

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	100.00	11.111	9					Ion Chromatography
F003	147.00	14.700	10					Cd REDUCTION
F004	254.00	25.400	10		BIASED HIGH	5.02	0.0014	7110
F006	285.00	28.500	10	H H EHEH EHEHEHVHEH	BIASED HIGH	7.71	0.0413	Auto Anal II
F009	99.00	12.375	8	L				TRAACS
F010	55.50	5.550	10	L EL	BIASED LOW	-24.76	0.0413	Colorimetry
F014	73.50	9.188	8					color Cd column
F015	213.00	21.300	10					ion chromatography
F019	138.00	15.333	9					IC
F022	130.50	13.050	10					UV Vis
F025	126.50	12.650	10					Ion Chromatography
F026	109.50	10.950	10					AUTOANALYSER
F031	138.00	13.800	10					IC
F032	239.50	23.950	10		BIASED HIGH*	-0.13	0.0149	Colorimetry
F036	220.00	22.000	10					Colorimetry
F037	168.50	18.722	9	EH EH				I.C. Waters
F038	148.50	14.850	10					IC
F048	146.00	14.600	10					Ion Chromatography
F063	221.50	24.611	9	H EH EH	BIASED HIGH*	-2.79	0.0494	IC
F064	163.00	16.300	10					IC
F069	53.00	5.300	10		BIASED LOW*	-2.68	-0.0077	Colorimetric
F092	72.50	7.250	10		BIASED LOW*	-3.77	0.0006	Colorimetric
F094	176.50	17.650	10					Colorimetric
F113	185.50	18.550	10					FIA-Lachat 8000
F131	26.00	2.600	10		BIASED LOW	-5.63	-0.0098	FIAautoCdreduct
F133	71.50	8.938	8	VL				IC
F140	196.50	19.650	10					IC
F141	125.00	13.889	9					Ion Chromatog
F144	262.50	26.250	10	EHEHEHEH EHEHEHEH	BIASED HIGH	-5.55	0.1695	APHA410D 4500NO2B
F146	196.50	19.650	10					IC
F158	57.00	7.125	8					

* 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 15.485

PARAMETER: 07192 Ammonia mg/L N

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BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.0050 BASIC ACCEPTABLE ERROR= 0.0050 CONCENTRATION ERROR INCREMENT= 0.1250

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F003	0.001	<0.001	0.020	0.002	0.001	0.001 L	0.002	0.002	0.046	0.004
F004	0.005T	0.005W	0.02	0.005T	0.005T	0.006	0.005T	0.005T	0.043	0.016 EH
F006	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03 L	<0.02
F010	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02 VL	<0.02
F014	<0.010	<0.010	0.016	<0.010	<0.010	<0.010	<0.010	<0.010	0.043	<0.010
F015	0.008	0.007	0.021	0.006	<0.005	<0.005	<0.005	<0.005	0.046	<0.005
F022	<0.01	<0.01	0.01 L	<0.01	<0.01	<0.01	<0.01	<0.01	0.02 VL	<0.01
F025	<0.01	<0.01	0.01 L	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	<0.01
F026	0.0029	0.0017	0.0177	0.0018	0.0036	0.0021	0.0017	0.0017	0.0371	0.0033
F032	0.002W	0.002W	0.016	0.004T	0.002W	0.002W	0.002W	0.002W	0.04	0.002W
F036	0.002W	0.002W	0.022	0.002W	0.002W	0.002W	0.004T	0.004T	0.052	0.004T
F038	<0.005	<0.005	0.012	<0.005	<0.005	<0.005	<0.005	<0.005	0.034	<0.005
F042	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.05	<0.04
F064	0.0153VH	0.0088	0.0236	0.0084	0.005	0.0082	0.0089H	0.0093H	0.0643VH	0.0159EH
F069	<0.002	<0.002	0.013	<0.002	<0.002	<0.002	<0.002	<0.002	0.042	<0.002
F092	0.002	0.004	0.011	0.007	0.002	0.009	0.002	0.007	0.024 VL	<0.001
F094	0.02 EH	0.02 EH	0.041 EH	0.023 EH	0.023 EH	0.024 VH	0.033 EH	0.018 EH	0.073 VH	0.016 EH
F113	0.004	0.002	0.021	0.004	0.003	0.003	0.	0.003	0.048	0.004
F131	0.0023	0.0014	0.0235	0.	0.	0.0241VH	0.	0.0021	0.0623VH	0.
F140	<0.005	<0.005	0.0174	<0.005	<0.005	<0.005	<0.005	<0.005	0.0386	<0.005
F141	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F144	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
F146	<0.005	<0.005	0.0174	<0.005	<0.005	<0.005	<0.005	<0.005	0.0386	<0.005
F158	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MEDIAN	0.0040	0.0040	0.0175	0.0045	0.0033	0.0071	0.0020	0.0040	0.0430	0.0040
1CRIT	0.0050	0.0050	0.0066	0.0050	0.0050	0.0053	0.0050	0.0050	0.0098	0.0050
N	7	5	15	8	6	6	6	7	18	5
MEAN	0.0056	0.0047	0.0181	0.0048	0.0033	0.0087	0.0039	0.0046	0.0438	0.0062
3STDEV	0.0131	-	0.0115	0.0065	0.0044	0.0218	0.0076	0.0075	0.0294	-

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	42.50	4.722	9	L	BIASED LOW	13.82	-0.0025	ALK PHENOL
F004	66.00	7.333	9	EH				7540
F006	4.00	4.000	1	L	INSUFFICIENT DATA			Auto Anal II
F010	1.50	1.500	1	VL	INSUFFICIENT DATA			Colorimetry
F014	18.00	9.000	2		INSUFFICIENT DATA			colorimetric
F015	46.00	9.200	5					colorimetric
F022	3.00	1.500	2	L VL	INSUFFICIENT DATA			UV Vis
F025	18.00	9.000	2	L	INSUFFICIENT DATA			Colorimetric
F026	37.00	3.700	10		BIASED LOW	-9.66	-0.0011	AUTOANALYSER
F032	20.00	6.667	3		INSUFFICIENT DATA			Colorimetry
F036	48.00	9.600	5					Colorimetry
F038	9.00	4.500	2		INSUFFICIENT DATA			Colour
F042	16.50	16.500	1		INSUFFICIENT DATA			Colorimetric
F064	93.50	9.350	10	VH H H VHEH				ISE
F069	15.00	7.500	2		INSUFFICIENT DATA			Colorimetric
F092	40.50	4.500	9	VL	BIASED LOW	-49.54	0.0025	Colorimetric
F094	105.50	10.550	10	EHEHEHEHEHVHEHEHVHEH	BIASED HIGH	29.14	0.0170	Colorimetric
F113	57.50	5.750	10		BIASED LOW	16.80	-0.0017	FIA-Lachat 8000
F131	54.50	5.450	10	VH VH	BIASED LOW	53.80	-0.0028	FIA Salicylate
F140	16.00	8.000	2		INSUFFICIENT DATA			Phenate
F141	0.00	-	0		INSUFFICIENT DATA			Colorimetry
F144	0.00	-	0		INSUFFICIENT DATA			APHA4500NH3C
F146	16.00	8.000	2		INSUFFICIENT DATA			Phenate
F158	0.00	-	0		INSUFFICIENT DATA			

OVERALL AVERAGE RANK IS 6.804

PARAMETER: 07392 Total Kjeldahl N mg/L N

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NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.0400 BASIC ACCEPTABLE ERROR= 0.0400 CONCENTRATION ERROR INCREMENT= 0.1500

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F003	0.065	0.079	0.120	0.213	0.257	0.266	0.083	0.173	0.634	0.389
F006	0.2 EH	0.2 EH	0.2 H	0.2	0.3	0.2	0.2 VH	0.3 EH	0.6	0.4
F014	<0.20	<0.20	0.24 EH	0.33 VH	0.3	0.34 H	<0.20	<0.20	0.52	0.42
F022	0.102	0.12	0.144	0.279 H	0.391 H	0.272	0.107	0.199	0.626	0.452
F025	0.11	0.09	0.14	0.17	0.36	0.19 L	0.14	0.16	0.53	0.35
F032	0.04T L	0.04T EL	0.1	0.2	0.32	0.24	0.06T L	0.2	0.58	0.36
F038	0.08	0.08	0.13	0.21	0.3	0.24	0.11	0.14	0.59	0.38
F063	0.09	0.09	0.12	0.23	0.42 VH	0.29	0.12	0.19	0.59	0.55 VH
F064	0.118	0.066	0.156	0.211	0.283	0.213	0.192 VH	0.209	0.616	0.396
F069	<0.10	<0.10	0.117	0.207	0.26	0.246	<0.10	0.155	0.633	0.345
F092	0.089	0.069	0.135	0.213	0.158 EL	0.26	0.104	0.142	0.598	0.246 VL
F094	0.16 H	0.1	0.14	0.26	0.37	0.33	0.14	0.21	0.66	0.44
F140	0.106		0.172	0.322 VH		0.419 EH		0.269 H	0.879 EH	0.599 EH
F141	0.119	0.089	0.145	0.242	0.356	0.284	0.115	0.191	0.636	0.412
F158	<0.1	<0.1	<0.1	0.3 H	0.3	0.3	0.1	0.1 L	0.7	0.5 H
MEDIAN	0.1040	0.0890	0.1400	0.2130	0.3000	0.2660	0.1125	0.1905	0.6160	0.4000
1CRIT	0.0496	0.0474	0.0550	0.0659	0.0790	0.0739	0.0509	0.0626	0.1264	0.0940
N	10	9	12	13	12	13	10	12	13	13
MEAN	0.1039	0.0870	0.1433	0.2375	0.3164	0.2678	0.1211	0.1865	0.6148	0.4149
3STDEV	0.0742	0.0465	0.0685	0.1169	0.1250	0.1194	0.0864	0.1034	0.1197	0.1708

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	52.00	5.200	10					BLOCK DIGESTION
F006	88.00	8.800	10	EHEHH VHEH				Block Digest
F014	60.50	10.083	6	EHVH H				color Blockdig
F022	94.00	9.400	10	H H				UV Vis
F025	55.50	5.550	10	L				Colorimetric-block
F032	37.00	3.700	10	L EL L	BIASED LOW*	3.38	-0.0373	Colorimetry
F038	46.50	4.650	10					Digest-SIE
F063	83.50	8.350	10	VH VH				micro kjeldahl
F064	72.00	7.200	10	VH				Kjedhal & ISE
F069	31.00	4.429	7					Colorimetric
F092	42.50	4.250	10	EL VL				calcTN NO3-NO2
F094	109.00	10.900	10	H				Colorimetric
F140	91.00	13.000	7	VH EH H EHEH	BIASED HIGH	49.67	-0.0174	Indophenol
F141	92.00	9.200	10					Dig. Colorimetry
F158	62.50	8.929	7	H L H				

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

OVERALL AVERAGE
RANK IS 7.423

PARAMETER: 07293 Total N mg/L N

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NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.0500 BASIC ACCEPTABLE ERROR= 0.0500 CONCENTRATION ERROR INCREMENT= 0.1500

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	0.35 EL	0.1 EL	0.31 EL	0.09 EL	2.98 EL	0.41 EL	0.34 EL	0.45 EL	0.25 EL	3.36
F003	0.428	0.150	0.366	0.225	3.38	0.539	0.412	0.598	0.641	3.89
F004	0.461	0.186	0.399	0.256	3.36	0.543	0.418	0.609	0.654	3.78
F010	0.44	0.16	0.39	0.23	3.5	0.54	0.45	0.60	0.54	4.1
F015	0.43	0.13	0.34	0.22	3.2	0.54	0.41	0.56	0.65	3.7
F025	0.44	0.18	0.38	0.18	3.58	0.47	0.46	0.58	0.57	3.97
F026	0.4415	0.1405	0.3862	0.2889	3.3651	0.5472	0.4157	0.5864	0.6643	3.8682
F038	0.42	0.17	0.38	0.23	3.35	0.54	0.44	0.58	0.63	3.9
F042	0.43	0.14	0.38	0.24	3.42	0.54	0.42	0.62	0.68	3.85
F064	0.468	0.161	0.396	0.232	3.453	0.493	0.522 EH	0.639	0.658	3.986
F092	0.425	0.145	0.374	0.224	3.297	0.536	0.428	0.555	0.64	3.602
F094	0.5 EH	<0.2	0.4	0.3	3.7	0.6	0.5	0.6	0.7	4.
F113	0.431	0.158	0.389	0.271	3.423	0.579	0.453	0.614	0.694	3.928
F131	0.4022	0.1318	0.3617	0.2017	3.2447	0.511	0.4059	0.5453	0.6107	3.7459
F158	0.42	0.14	0.36	0.16	3.50	0.45	0.38	0.53	0.43 VL	3.80
F159	<0.50	<0.50	<0.50	<0.50	3.07	<0.50	<0.50	<0.50 EL	<0.50 L	3.05 EL
MEDIAN	0.4300	0.1475	0.3800	0.2300	3.3726	0.5400	0.4200	0.5864	0.6410	3.8591
1CRIT	0.1070	0.0646	0.0995	0.0770	0.5484	0.1235	0.1055	0.1305	0.1387	0.6214
N	13	12	13	13	14	13	13	13	13	14
MEAN	0.4336	0.1505	0.3771	0.2276	3.3673	0.5252	0.4302	0.5829	0.6202	3.8129
3STDEV	0.0497	0.0444	0.0477	0.0992	0.3850	0.1013	0.0876	0.0806	0.2048	0.5000

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	11.00	1.100	10	ELELELELELELELELEL	BIASED LOW	-10.21	-0.0884	ColormetricUV Dig
F003	74.00	7.400	10					AutoclaveDigest
F004	107.00	10.700	10					7657
F010	104.50	10.450	10					Colorimetry
F015	51.00	5.100	10					colorimetric
F025	89.00	8.900	10					
F026	98.00	9.800	10					Autoclaveautoanaly
F038	81.00	8.100	10					Calc
F042	93.50	9.350	10					Colorimetric
F064	119.00	11.900	10	EH				Calculation
F092	58.00	5.800	10					Persulfatedigest
F094	130.50	14.500	9	EH	BIASED HIGH*	5.32	0.0316	Colorimetric
F113	118.00	11.800	10					Lachat8000K2SO8
F131	38.00	3.800	10		BIASED LOW*	-2.93	-0.0135	FIApersulfdig
F158	41.50	4.150	10	VL	BIASED LOW*	2.42	-0.0693	
F159	3.00	1.500	2	ELL EL	INSUFFICIENT DATA			ASTM D 5176

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

OVERALL AVERAGE
RANK IS 8.060

PARAMETER: 09092 Fluoride mg/L

NATIONAL WATER RESEARCH INSTITUTE
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NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.0200 BASIC ACCEPTABLE ERROR= 0.0200 CONCENTRATION ERROR INCREMENT= 0.1000

SAMPLE	1= ION-915 REPORTED	2= MISSION-96A REPORTED	3= HURON-98 REPORTED	4= ION-99 REPORTED	5= RICH-95 REPORTED	6= MOIR-01 REPORTED	7= CHIC-94 REPORTED	8= ONT-99 REPORTED	9= BATT-01 REPORTED	10= ION-96.2 REPORTED
LAB NO	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE
F003	0.04	0.04	0.08	0.04	0.09	0.60	0.83	0.66	0.19	0.18
F006	<0.05	<0.05	0.07	<0.05	0.09	0.6	0.81	0.63	0.17	0.17
F009	0.04	0.03	0.08	0.04	0.1	0.64	0.86	0.66	0.17	0.2
F010	0.06	0.05	0.12 VH	0.07 H	0.15 VH	0.68	0.90	0.69	0.20	0.23 H
F014	<0.1	<0.1	<0.1	<0.1	<0.1	0.606	0.825	0.606	0.15	0.163
F015	0.03	0.02	0.07	0.03	0.08	0.40 EL	0.90	0.40 EL	0.16	0.17
F019	<0.05	<0.05	<0.05 L	<0.05	0.1	0.68	0.87	0.67	0.22 H	0.18
F022	0.03	0.03	0.07	0.03	0.09	0.61	0.75	0.59	0.12 L	0.12 VL
F025	<0.05	<0.05	0.06	<0.05	0.09	0.65	0.86	0.65	0.16	0.17
F031	0.01 L	0.01 L	0.07	0.02 L	0.08	0.56	0.75	0.57	0.15	0.16
F032	0.08 VH	0.07 H	0.11 H	0.09 VH	0.13 H	0.64	0.86	0.65	0.2	0.2
F037	0.05	0.05	0.09	0.05	0.11	0.62	0.83	0.63	0.18	0.19
F038	0.04	0.04	0.07	0.05	0.09	0.56	0.79	0.61	0.18	0.17
F042	<0.08	<0.08	0.08	<0.08	0.1	0.56	0.76	0.56	<0.08 EL	0.11 VL
F048	0.054	0.049	0.062	0.046	0.101	0.607	0.811	0.604	0.174	0.18
F063	0.09 VH	0.09 EH	0.12 VH	0.09 VH	0.14 H	0.62	0.83	0.63	0.2	0.23 H
F064	0.021	0.021	0.062	0.01 VL	0.083	0.58	0.78	0.58	0.14	0.18
F069	<0.10	<0.10	<0.10	<0.10	<0.10	0.602	0.771	0.629	0.159	0.132 L
F094	0.04	0.04	0.07	0.05	0.1	0.61	0.83	0.63	0.19	0.19
F094a	0.1 VH	0.09 EH	0.13 VH	0.08 VH	0.18 VH	0.72 H	0.97 H	0.74 H	0.24 EH	0.28 EH
F133	0.0439	0.0427	0.0765	0.0423	0.934 EH	0.617	0.8305	0.6285	0.166	0.1755
F141	0.04	0.04	0.08	0.04	0.09	0.61	0.83	0.62	0.16	0.17
F158	<0.1	<0.1	0.1	<0.1	0.1	0.7 H	1.0 EH	0.8 EH	0.2	0.2
MEDIAN	0.0400	0.0400	0.0782	0.0442	0.1000	0.6100	0.8300	0.6300	0.1720	0.1800
1CRIT	0.0220	0.0220	0.0258	0.0224	0.0280	0.0790	0.1010	0.0810	0.0352	0.0360
N	14	13	18	13	18	21	20	21	20	21
MEAN	0.0471	0.0402	0.0822	0.0453	0.1074	0.6168	0.8374	0.6304	0.1760	0.1791
3STDEV	0.0548	0.0386	0.0537	0.0462	0.0755	0.1120	0.1437	0.1212	0.0620	0.0760

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	105.50	10.550	10					AUTO ISE
F006	58.50	8.357	7					Electrode
F009	124.50	12.450	10					Technicon
F010	178.00	17.800	10	VHH VH H	BIASED HIGH	5.89	0.0265	Colori. alizarin
F014	33.50	6.700	5					PC Titrate
F015	54.50	5.450	10	EL EL	BIASED LOW	-12.11	-0.0135	ion chromatography
F019	106.00	17.667	6	L H	BIASED HIGH	5.56	0.0096	IC
F022	46.00	4.600	10	L VL	BIASED LOW*	-4.62	-0.0158	Ion Chromatog
F025	75.00	10.714	7					Electrode
F031	27.00	2.700	10	L L L	BIASED LOW	-6.81	-0.0159	ISE
F032	166.00	16.600	10	VHH H VHH	BIASED HIGH*	-1.09	0.0335	Colorimetry
F037	136.50	13.650	10					Accumet Electrode
F038	77.00	7.700	10					IC
F042	33.50	5.583	6	ELVL				IC
F048	99.00	9.900	10					ISE
F063	163.50	16.350	10	VHEHVHVHH H				IC
F064	41.00	4.100	10	VL	BIASED LOW*	-3.75	-0.0165	IC
F069	31.00	6.200	5	L				ISE
F094	113.50	11.350	10					ISE
F094a	197.50	19.750	10	VHEHVHVHVHH H H EHEH	BIASED HIGH	10.12	0.0530	ISE
F133	118.00	11.800	10	EH				ISE
F141	87.50	8.750	10					Ion Specific Elect
F158	133.50	19.071	7	H EHEH	BIASED HIGH	22.38	-0.0117	

* 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 10.867

PARAMETER: 11091 Sodium mg/L

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.0000 BASIC ACCEPTABLE ERROR= 0.5000 CONCENTRATION ERROR INCREMENT= 0.0400

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	1.49	2.13	3.96	19.4	13.6	5.12	5.93	12.3	52.1	46.7
F003	1.34	1.98	3.70	19.8	13.5	4.80	5.58	12.5	52.3	46.8
F006	1. EL	2.	4.	19.	13.	5.	6.	12.	52.	46.
F009	1.25	1.9	3.85	19.1	12.8	4.85	5.66	12.2	51.8	46.2
F010	1.23	1.82	3.61	20.5	13.72	4.97	5.80	13.12	49.8	42.5 VL
F014	1.45	2.	3.66	19.	12.8	4.81	5.51	12.2	49.4 L	44.8
F015	1.3	1.9	3.7	18.9	13.0	4.9	5.6	12.4	51.5	46.4
F019	1.3	2.	3.9	20.6	13.9	5.	6.	13.3	56.4 VH	49.9 VH
F022	1.31	1.96	3.64	18.8	13.	4.87	5.6	12.4	51.3	46.3
F025	1.3	1.8	3.6	19.3	13.4	4.9	5.7	12.7	53.6	48.2
F026	1.334	1.955	3.675	19.518	13.691	4.889	5.637	12.916	52.11	46.164
F031	1.5	2.	3.8	21.3 H	14.4 H	5.6 EH	5.9	13.7 H	53.	47.7
F032	1.36	2.	3.76	19.5	13.2	4.92	5.68	12.6	51.2	46.4
F036	1.47	1.73	3.41	20.8 H	12.4	4.37 EL	5.39	10.8 EL	49.9	45.4
F037	1.572	2.324 EH	4.145	22.51 EH	15.57 EH	5.495	6.476 EH	14.44 EH	56.68 VH	50.33 VH
F038	1.35	1.89	3.6	19.5	13.6	4.9	5.57	12.4	53.	47.9
F042	1.35	1.98	3.71	20.8 H	14.2	5.04	5.77	13.3	61. EH	50.9 VH
F048	1.399	2.114	3.862	20.315	13.94	5.274	6.263	13.172	56.658 VH	51.524 VH
F063	1.2	1.9	3.53	18.7	12.1 L	4.63	5.23	12.	49.3 L	44.8
F064	1.229	1.029 EL	3.841	20.263	14.234	5.375	6.246	13.609 H	52.369	49.154 H
F069	1.358	2.	3.747	19.617	13.333	4.944	5.731	12.62	52.037	46.323
F092	1.42	2.	3.67	18.6	12.7	4.83	5.67	11.8	48.8 L	44.2
F094	2. EH	2.	4.	20.	13.	5.	6.	13.	52.	47.
F113	1.393	2.01	3.761	18.64	13.02	5.286	5.636	12.35	52.86	46.95
F131	1.364	1.976	3.572	18.381	12.562	4.76	5.443	11.913	47.289 VL	42.691 VL
F133	1.3	2.	3.6	19.2	13.45	4.95	5.9	12.65	54.4	50.1 VH
F139	1.285	1.876	3.645	18.9	12.97	4.908	5.45	12.09	51.4	45.69
F141	1.4	2.02	3.85	19.9	13.5	5.03	5.74	12.7	53.4	50.4 VH
F144	1.4	2.	3.7	19.2	13.6	4.8	5.6	12.6	51.2	46.4
F158	1.5	2.1	3.7	18.8	13.2	5.0	5.8	12.1	52.4	46.6
F159	1.5	2.2	4.6 EH	20.	13.	5.2	6.1	12.	51.	46.
MEDIAN	1.3580	2.0000	3.7000	19.5000	13.3330	4.9440	5.7000	12.5000	52.0370	46.4000
1CRIT	0.5143	0.5400	0.6080	1.2400	0.9933	0.6578	0.6880	0.9600	2.5415	2.3160
N	29	29	29	29	29	29	29	29	29	29
MEAN	1.3674	1.9738	3.7513	19.5846	13.3352	4.9811	5.7554	12.5738	52.2039	46.9794
3STDEV	0.2753	0.2886	0.4362	2.1869	1.4960	0.5658	0.6707	1.5128	5.8992	5.8229

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	214.00	21.400	10					Flame Photoem.
F003	146.00	14.600	10					AA
F006	143.00	14.300	10	EL				ICP
F009	107.50	10.750	10					ICP-MS
F010	135.50	13.550	10	VL				ICP OES
F014	97.50	9.750	10	L				ICP OES
F015	110.50	11.050	10					icp
F019	235.00	23.500	10	VHVH				ICAP
F022	99.50	9.950	10					AAS
F025	147.00	14.700	10					ICP
F026	149.00	14.900	10					Flame AA
F031	257.50	25.750	10	H H EH H	BIASED HIGH*	1.96	0.4258	ICP
F032	157.50	15.750	10					AAS
F036	74.50	7.450	10	H EL EL				AAS
F037	303.00	30.300	10	EH EHEH EHEHVHVH	BIASED HIGH	8.37	0.4561	ICP-MS
F038	142.50	14.250	10					FAES
F042	233.00	23.300	10	H EHVH				ICP OES
F048	268.00	26.800	10	VHVH	BIASED HIGH	10.04	-0.3162	Ion Chromatography
F063	32.50	3.250	10	L L	BIASED LOW*	-4.26	-0.1201	FAA
F064	211.00	21.100	10	EL H H				ICP AES & AAS
F069	169.50	16.950	10					ICP
F092	87.50	8.750	10	L				atomic emission
F094	217.50	21.750	10	EH				ICP-OES
F113	173.00	17.300	10					FAAS-PE5100
F131	49.00	4.900	10	VLVL	BIASED LOW	-9.05	0.3090	FlameAAemiss
F133	177.00	17.700	10	VH				ICP-MS
F139	77.50	7.750	10					ICP OES
F141	228.00	22.800	10	VH				ICP OES
F144	144.50	14.450	10					APHA3500NaD
F158	176.50	17.650	10					
F159	196.00	19.600	10	EH				ASTM D 4191 97

* 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 16.000

PARAMETER: 19091 Potassium mg/L

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.5000 BASIC ACCEPTABLE ERROR= 0.1000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	0.46	0.58	0.85	2.94	2.24	1.16	1.18	1.39	7.76	3.61 L
F003	0.49	0.61	0.89	3.11	2.39	1.25	1.25	1.46	8.00	3.94
F006	0.4	0.6	0.8	3.	2. EL	1. EL	1. EL	1. EL	8.	3.9
F009	0.53	0.63	1.15 VH	3.1	2.4	1.38	1.35	1.55	8.1	4.
F010	0.44	0.53	0.87	3.44 H	2.57	1.27	1.31	1.60	10.53 EH	5.25 EH
F014	0.489	0.582	0.915	2.95	2.3	1.24	1.23	1.45	8.62	4.15
F015	0.4	0.5	0.9	3.1	2.3	1.3	1.3	1.5	8.3	4.0
F019	<1.	<1.	<1.	3.	2. EL	<1. EL	<1. EL	2. EH	8.	4.
F022	0.48	0.58	0.87	3.13	2.34	1.24	1.23	1.45	8.1	4.04
F025	1.1 EH	0.7	0.9	3.	2.3	1.2	1.1 L	1.4	8.2	4.
F026	0.47	0.567	0.849	3.039	2.311	1.201	1.187	1.412	8.176	3.91
F031	0.5	0.6	1.	3.5 VH	2.6 H	1.4	1.4	1.5	8.1	5.3 EH
F032	0.5	0.61	0.9	3.13	2.38	1.28	1.26	1.5	8.04	3.91
F036	0.65 VH	0.58	1.23 EH	3.36 H	2.45	1.29	1.38	1.58	8.12	3.9
F037	0.49	0.613	0.881	3.204	2.459	1.289	1.212	1.521	8.28	3.98
F038	0.51	0.61	0.91	3.15	2.42	1.28	1.27	1.48	8.3	4.07
F042	0.46	0.55	0.81	2.75 L	2.11 L	1.12 L	1.11 L	1.34	6.78 EL	3.58 L
F048	0.496	0.598	0.894	3.139	2.387	1.276	1.286	1.486	8.13	3.956
F063	0.49	0.59	0.84	3.02	2.3	1.17	1.18	1.37	7.75	3.57 L
F064	0.371 L	0.457 L	0.784	3.068	2.327	1.164	1.173	1.444	9.77 EH	4.88 VH
F069	0.494	0.595	0.913	2.973	2.283	1.207	1.173	1.387	7.687	3.76
F092	0.5	0.61	0.92	3.15	2.46	1.33	1.3	1.53	8.43	4.13
F094	0.5	0.6	0.9	3.	2.3	1.3	1.2	1.4	8.1	3.9
F113	0.513	0.619	0.93	3.104	2.375	1.282	1.267	1.509	8.256	3.937
F131	0.535	0.644	0.984	3.423 H	2.635 H	1.425	1.407	1.62	8.779 H	4.458 VH
F133	0.35 L	0.45 EL	0.9	3.05	2.45	1.3	1.35	1.5	8.4	4.2
F139	<1.0	<1.0	1.042 H	3.173	2.42	1.264	1.316	1.497	8.22	3.912
F140	0.441	0.592	0.852	3.03	2.29	1.23	1.19	1.49	8.02	3.84
F141	0.548	0.717 H	0.995	3.12	2.6 H	1.36	1.36	1.53	9.45 VH	3.96
F144	0.5	0.6	0.9	3.3	2.5	1.3	1.3	1.6	9.2 VH	4.6 VH
F158	0.6 H	0.7	1.0	3.3	2.6 H	1.4	1.4	1.6	8.8 H	4.2
F159	0.60 H	0.64	1.1 VH	3.1	2.4	1.4	1.4	1.5	7.7	4.0
MEDIAN	0.4950	0.6000	0.9000	3.1020	2.3835	1.2800	1.2670	1.4985	8.1530	3.9900
1CRIT	0.1000	0.1060	0.1240	0.2561	0.2130	0.1468	0.1460	0.1599	0.5592	0.3094
N	28	28	29	30	29	29	29	30	30	30
MEAN	0.4949	0.5960	0.9195	3.1201	2.3883	1.2718	1.2643	1.4865	8.2929	4.0658
3STDEV	0.1749	0.1452	0.2370	0.3885	0.3395	0.2175	0.2517	0.2162	1.4390	1.0070

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	50.00	5.000	10	L	BIASED LOW	-5.18	-0.0272	Flame Photoem.
F003	138.50	13.850	10					AA
F006	47.00	4.700	10	ELELELEL	BIASED LOW*	0.50	-0.2087	ICP
F009	222.50	22.250	10	VH				ICP-MS
F010	204.50	20.450	10	H EHEH				ICP OES
F014	138.50	13.850	10					ICP-MS
F015	149.00	14.900	10					icp
F019	66.00	13.200	5	ELELELEH				ICAP
F022	129.00	12.900	10					AAS
F025	141.00	14.100	10	EH L				ICP
F026	92.50	9.250	10					Flame AA
F031	245.50	24.550	10	VHH EH				ICP
F032	161.50	16.150	10					AAS
F036	216.50	21.650	10	VH EHH				AAS
F037	187.00	18.700	10					ICP-MS
F038	198.50	19.850	10					FAES
F042	29.50	2.950	10	L L L L ELL	BIASED LOW	-16.68	0.0889	ICP OES
F048	158.00	15.800	10					Ion Chromatography
F063	65.50	6.550	10	L	BIASED LOW	-5.42	-0.0106	FAA
F064	109.50	10.950	10	L L EHVH				ICP AES & AAS
F069	79.50	7.950	10					AA
F092	229.50	22.950	10					atomic emission
F094	125.00	12.500	10					ICP-OES
F113	190.00	19.000	10					FAAS-PE5100
F131	286.00	28.600	10	H H H VH	BIASED HIGH	8.09	0.0327	FlameAAemiss
F133	169.50	16.950	10	L EL				ICP-MS
F139	156.50	19.562	8	H				ICP OES
F140	88.00	8.800	10					ISE
F141	251.50	25.150	10	H H VH	BIASED HIGH	14.02	-0.1348	ICP OES
F144	235.00	23.500	10	VHVH				APHA3500KD
F158	281.50	28.150	10	H H H	BIASED HIGH	6.89	0.0299	
F159	216.00	21.600	10	H VH				ASTM D 4192 97

* 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 16.160

PARAMETER: 14091 Silicates mg/L SiO2

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.1000 BASIC ACCEPTABLE ERROR= 0.0250 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F003	2.53	4.62	1.05	1.20	2.36	5.36	1.68	1.11 L	1.40	2.41
F010	2.45	4.6	1.15	1.25	2.35	5.6	1.75	1.00 L	1.40	2.40
F015	2.6	4.9	1.0	1.2	2.4	5.8	1.7	1.1	1.4	2.5
F022	2.528	4.526	1.089	1.245	2.366	5.472	1.701	1.176	1.484	2.46
F025	2.45	4.68	1.08	1.21	2.24	5.48	1.68	1.1	1.38	2.37
F026	2.445	4.549	1.049	1.194	2.306	5.477	1.657	1.108	1.388	2.315
F032	2.44	4.58	1.03	1.11 EL	2.31	5.44	1.63	1.03	1.34	2.4
F037	2.642	4.768	1.076	1.262	2.481	5.724	1.807	1.219 H	1.469	2.464
F038	2.5	4.6	1.1	1.2	2.3	5.5	1.8	1.1	1.4	2.3
F042	2.55	4.74	1.16	1.29	2.4	5.64	1.93 EH	1.31 EH	1.54 H	2.59 H
F048	2.52	4.69	1.	1.15	2.36	5.57	1.67	1.05	1.36	2.43
F063	2.58	4.58	1.13	1.23	2.37	5.41	1.78	1.16	1.48	2.34
F064	2.58	4.74	1.07	1.187	2.341	5.667	1.675	1.107	1.394	2.35
F069	2.52	4.466	1.039	1.178	2.298	5.362	1.667	1.108	1.375	2.322
F092	2.47	4.64	1.08	1.22	2.35	5.52	1.7	1.13	1.42	2.4
F094	2.7 H	4.6	1.1	1.2	2.3	5.6	1.8	1.2 H	1.5	2.5
F113	2.574	4.687	1.108	1.245	2.425	5.616	1.791	1.171	1.471	2.547
F144	2.8 EH	5.3 EH	1.1	1.5 EH	2.7 EH	6.2 EH	1.8	1.2 H	2. EH	2.8 EH
F158	2.5	4.8	1.0	1.2	2.3	5.6	1.7	1.0 L	1.4	2.4
MEDIAN	2.5280	4.6400	1.0800	1.2000	2.3500	5.5700	1.7000	1.1080	1.4000	2.4000
1CRIT	0.1707	0.2974	0.0838	0.0910	0.1600	0.3532	0.1210	0.0855	0.1030	0.1630
N	17	17	18	17	17	17	17	16	17	17
MEAN	2.5376	4.6647	1.0695	1.2154	2.3539	5.5575	1.7269	1.1293	1.4271	2.4234
3STDEV	0.2037	0.2903	0.1281	0.1005	0.1495	0.3355	0.1652	0.1563	0.1519	0.2271

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					HETEROPOLY BLUE
F010	97.00	9.700	10	L				Colorimetry
F015	117.00	11.700	10					colorimetric
F022	111.50	11.150	10					UV Vis
F025	66.50	6.650	10					Calculation
F026	46.50	4.650	10		BIASED LOW*	-1.95	-0.0020	AUTOANALYSER
F032	35.00	3.500	10	EL	BIASED LOW*	-0.81	-0.0472	Colorimetry
F037	157.00	15.700	10	H	BIASED HIGH*	2.00	0.0456	ICP-MS
F038	79.50	7.950	10					Colour
F042	168.00	16.800	10	EHEHH H	BIASED HIGH*	-1.52	0.1539	Colorimetric
F048	69.00	6.900	10					Autoanalyser
F063	111.00	11.100	10					Colour
F064	89.00	8.900	10					ICP AES & AAS
F069	40.00	4.000	10		BIASED LOW*	-4.30	0.0389	ICP
F092	97.50	9.750	10					Colorimetric
F094	128.00	12.800	10	H H				ICP-OES
F113	145.50	14.550	10					FIA-Lachat 8000
F144	179.50	17.950	10	EHEH EHEHEH H EHEH	BIASED HIGH	10.85	0.0822	APHA4500SiD
F158	77.50	7.750	10	L				

* 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 10.000

PARAMETER: 16092 Sulfate mg/L

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.0000 BASIC ACCEPTABLE ERROR= 0.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	3.4	7.14	15.8	40.6	18.	12.2	23.8	25.6	80.8	106.
F003	3.7	7.9	15.9	42.5	20.4 EH	12.8	24.9	27.0	85.2	112.
F006	<10.	<10.	14. L	39.	19.	14. VH	23.	24.	78.	98. L
F009	2.83	6.9	14.7	38.5	15.7 VL	10.4 L	21.3 L	23.1 L	74. L	98. L
F010	3.5	6.1 L	13.5 VL	39.	16. L	8.7 VL	21. L	24.	74. L	87. EL
F014	3.71	7.29	15.4	41.5	17.7	12.	23.3	25.6	82.4	107.
F015	3.5	7.0	16.	43.	19.	13.	25.	25.	85.	110.
F019	3.5	7.3	15.8	41.4	18.4	12.3	24.6	26.6	83.3	109.
F022	3.56	7.37	15.8	42.6	18.3	12.1	24.6	27.5	81.5	111.
F025	3.6	7.3	15.7	41.3	18.	12.1	24.4	26.3	81.1	107.
F026	3.4125	7.1896	15.8187	42.8453	18.4563	12.1747	24.7209	26.7393	85.7823	98.7343L
F031	3.32	7.15	15.3	40.6	17.7	11.6	24.3	26.2	82.	102.4
F032	3.	6.5	14.5	41.5	17.5	11.5	23.5	25.5	83.	103.
F036	3.25	8.	14.8	41.8	17.8	12.4	23.8	25.9	82.4	109.
F037	3.2422	6.7634	15.6723	40.0644	17.5131	11.2954	22.6620	24.9626	78.6072	103.1110
F038	3.	7.	15.	41.	18.	11.	23.	25.	86.	109.
F042	3.39	7.29	3.02 EL	8.29 EL	3.48 EL	5.95 EL	4.78 EL	5.2 EL	76.8	106.
F048	3.71	6.98	15.066	40.212	17.246	11.77	22.871	25.027	79.931	102.48
F063	4.9 EH	7.4	14.9	38.3 L	17.7	11.9	22.5	24.5	77.8	102.
F064	3.43	7.06	15.85	44.95 H	18.16	11.99	24.41	26.39	85.46	110.44
F069	2.907	6.533	14.657	40.257	16.8	11.267	22.907	24.967	80.453	106.093
F092	3.49	7.11	15.77	41.12	18.05	12.25	23.87	25.81	81.6	108.66
F094	3.34	6.8	15.9	41.9	18.2	12.8	23.5	25.5	81.2	109.
F094a	4.8 EH	8.4 EH	17.1 H	42.3	19.5	15.3 VH	26.3 H	28. H	82.8	112.
F113	3.44	7.24	15.89	42.31	18.26	12.26	24.62	26.51	83.66	109.85
F131	3.188	6.602	14.768	39.355	17.079	11.29	22.892	24.848	77.587	100.637
F133	3.522	7.32	16.19	42.83	18.762	12.405	25.02	26.27	83.18	109.64
F141	4.05	7.43	15.6	41.2	17.7	12.	24.	26.	86.4	106.
F144	2.1 EL	6.6	17.3 H	26.7 EL	16.5	20.6 EH	20.2 VL	20.6 EL	46.5 EL	87.6 EL
F158	4.0	7.3	15.9	43.3	18.4	13.1	24.6	26.8	79.2	104.
MEDIAN	3.4400	7.1500	15.6861	41.2500	18.0000	12.1000	23.8000	25.6000	81.5500	106.0465
1CRIT	0.6464	0.8690	1.3812	2.9150	1.5200	1.1660	1.8680	1.9760	5.3330	6.8028
N	27	27	28	28	28	28	28	28	28	27
MEAN	3.4738	7.1284	15.4029	40.6069	17.8367	12.0679	23.5455	25.4366	81.1700	104.9498
3STDEV	1.1532	1.0695	2.1794	9.0229	2.5432	3.3707	3.6313	4.0735	9.6131	15.4375

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	147.50	14.750	10					Ion Chromatography
F003	264.00	26.400	10	EH	BIASED HIGH*	4.93	0.1195	METHYTHYMOL BLUE
F006	89.50	11.188	8	L VH L				Auto Anal II
F009	38.00	3.800	10	VLL L L L L	BIASED LOW	-7.79	-0.3122	DIONEX
F010	42.50	4.250	10	L VL L VLL L EL	BIASED LOW	-14.95	0.8207	Colori. calmagite
F014	163.00	16.300	10					
F015	226.50	22.650	10					ion chromatography
F019	212.00	21.200	10					IC
F022	221.50	22.150	10					Ion Chromatog
F025	179.00	17.900	10					Ion Chromatography
F026	204.00	20.400	10	L				ION CHROMATOGRAPHY
F031	132.00	13.200	10					IC
F032	103.00	10.300	10					IC
F036	173.50	17.350	10					IC
F037	85.00	8.500	10					I.C. Waters
F038	129.50	12.950	10					IC
F042	53.50	5.350	10	ELELELELELEL	BIASED LOW*	4.18	-12.4402	IC
F048	108.50	10.850	10					Ion Chromatography
F063	112.50	11.250	10	EH L				IC
F064	207.00	20.700	10	H				IC
F069	76.00	7.600	10					IC
F092	166.00	16.600	10					Ion chromatog
F094	170.00	17.000	10					IC
F094a	275.50	27.550	10	EHEHH VHH H	BIASED HIGH*	2.57	1.3288	ICP-OES
F113	217.00	21.700	10					IC-Dionex DX 500
F131	63.00	6.300	10		BIASED LOW*	-4.94	0.0140	DionexAS9 HC
F133	242.00	24.200	10		BIASED HIGH*	2.89	0.0857	IC
F141	188.00	18.800	10					Ion Chromatog
F144	78.00	7.800	10	EL H EL EHVLELELEL				APHA4500SO4D
F158	222.50	22.250	10					

* 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 15.403

PARAMETER: 17092 Chloride mg/L

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.0000 BASIC ACCEPTABLE ERROR= 0.5000 CONCENTRATION ERROR INCREMENT= 0.0600

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	1.34	0.8	6.14	4.	18.	7.08	10.9	20.3	10.3	78.5
F003	1.41	0.92	6.12	4.14	18.0	7.37	11.3	19.9	11.0	74.3
F006	<2.	<2.	4. EL	<2. EL	18.	6. VL	10. L	20.	10.	80.
F009	1.3	0.78	6.	4.	18.8	7.	11.2	20.5	10.5	78.
F010	1.7	0.8	6.	5. H	19.	12. EH	12.	20.	12. H	78.
F014	1.65	1.	7. H	4.64	18.2	8.12	11.4	20.5	10.8	79.5
F015	1.4	0.9	6.6	4.2	20.	8.0	12.	22.	11.	80.
F019	1.41	0.84	6.46	4.17	18.3	7.17	11.2	20.7	10.5	81.7
F022	1.24	0.75	6.2	3.85	17.6	7.4	11.3	20.8	10.9	71.5 L
F025	1.6	0.7	6.4	4.9 H	18.7	7.9	11.5	20.3	11.2	78.7
F026	1.3766	0.8139	6.0678	3.9167	18.4315	7.5598	11.7752	21.3513	10.8991	75.847
F031	1.44	0.86	6.25	4.18	18.2	7.48	11.8	20.8	11.	77.4
F032	1.4	0.8T	6.	4.	18.2	7.	11.	20.2	10.4	76.
F036	1.4	0.83	6.24	4.28	17.8	7.69	11.4	19.9	11.1	75.9
F037	1.4955	0.8653	6.9058	4.3824	19.5003	8.4155H	12.8293H	22.1963	13.1254VH	81.6910
F038	1.3	0.8	6.	3.9	18.7	7.	11.3	21.1	10.9	79.1
F042	1.31	0.83	1.15 EL	0.75 EL	3.67 EL	3.66 EL	2.21 EL	4.11 EL	2.07 EL	77.9
F048	1.46	0.96	6.107	3.978	18.66	7.198	11.154	20.863	10.663	78.195
F063	2.35 EH	1.98 EH	5.77	4.35	16.4 L	6.63	9.89 L	18.1 VL	9.38 L	71. L
F064	1.46	0.92	6.13	4.	18.57	7.27	11.5	20.59	10.95	78.53
F069	1.47	0.91	6.173	4.237	17.647	7.583	10.817	19.837	9.99	77.973
F092	1.3	0.83	6.11	3.7	16.98	7.29	10.8	19.94	9.87	74.35
F094	1.5	0.94	6.31	4.16	18.1	7.52	11.8	21.	11.3	78.9
F094a	<1.	<1.	5.24 L	2.63 VL	18.5	6.57	11.1	20.7	10.5	79.1
F113	1.43	0.86	6.43	4.21	18.84	7.78	11.85	20.63	11.19	80.55
F131	1.323	0.788	5.94	4.	19.025	6.944	11.583	21.384	10.918	69.254 EL
F133	1.385	0.776	6.16	4.043	19.13	7.635	11.565	21.47	10.54	76.26
F141	1.72	1.23	6.19	4.09	18.7	7.34	11.5	21.4	11.	74.5
F144	1.	<1.	6.	2. EL	19.	6. VL	11.	19.	8. EL	78.
F158	2.0 H	1.0	6.8	4.4	19.0	8.0	12.0	21.3	11.2	79.0
F159	12. EH	12. EH	15. EH	11. EH	25. EH	16. EH	14. EH	25. EH	14. EH	73.
MEDIAN	1.4100	0.8500	6.1400	4.1150	18.5000	7.3700	11.4000	20.6300	10.9000	78.0000
1CRIT	0.5246	0.5000	0.8084	0.6869	1.5500	0.8822	1.1240	1.6778	1.0940	5.1200
N	27	26	29	28	29	29	29	29	29	29
MEAN	1.4878	0.9147	6.1291	4.0485	18.4132	7.4809	11.3608	20.5780	10.7285	77.2999
3STDEV	0.6970	0.7037	1.5712	1.6937	2.1419	3.0499	1.7263	2.4933	2.5236	7.7473

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	104.00	10.400	10					Ion Chromatography
F003	135.00	13.500	10					THIOCYANATE
F006	57.50	8.214	7	ELEL VLL				AgNO3 Titration
F009	108.00	10.800	10					DIONEX
F010	206.00	20.600	10	H EH H				Titration conduct.
F014	215.50	21.550	10	H				
F015	239.50	23.950	10					ion chromatography
F019	167.50	16.750	10					IC
F022	103.00	10.300	10	L				Ion Chromatog
F025	199.00	19.900	10	H				Colorimetric
F026	143.00	14.300	10					ION CHROMATOGRAPHY
F031	181.00	18.100	10					IC
F032	94.00	9.400	10					Colorimetry
F036	152.00	15.200	10					IC
F037	270.00	27.000	10	H H VH	BIASED HIGH*	4.28	0.5266	I.C. Waters
F038	131.50	13.150	10					IC
F042	38.00	3.800	10	ELELELELELELEL	BIASED LOW*	1.85	-6.4596	IC
F048	153.50	15.350	10					Ion Chromatography
F063	99.00	9.900	10	EHEH L L VLL L				IC
F064	168.00	16.800	10					IC
F069	133.00	13.300	10					IC
F092	71.00	7.100	10		BIASED LOW*	-4.66	-0.0714	Ion chromatog
F094	209.50	20.950	10					IC
F094a	87.00	10.875	8	L VL				Colorimetric
F113	220.50	22.050	10					IC-Dionex DX 500
F131	128.00	12.800	10	EL				DionexAS9 HC
F133	166.00	16.600	10					IC
F141	195.50	19.550	10					Ion Chromatog
F144	67.00	7.444	9	EL VL EL				APHA4500ClB
F158	258.50	25.850	10	H	BIASED HIGH*	0.77	0.4150	
F159	277.00	27.700	10	EHEHEHEHEHEHEHEHEH	BIASED HIGH	-18.49	8.7148	N 1454

* 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 15.717

PARAMETER: 20091 Calcium mg/L

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.0000 BASIC ACCEPTABLE ERROR= 0.2000 CONCENTRATION ERROR INCREMENT= 0.0500

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	13.3	13.7	26.2	12.1	27.3	45.6	37.7	34.9	40.	91.
F003	13.2	13.5	26.6	11.9	27.7	46.0	37.9	35.2	40.5	94.0
F006	14.	14.	27.	12.	28.	47.	38.	35.	41.	93.
F009	13.6	14.3	28.7 VH	12.9 H	27.2	48.9 H	39.5	34.4	41.9	101.5 VH
F010	13.55	13.93	26.5	12.19	27.7	46.2	37.9	35.0	39.5	92.
F014	13.3	13.8	26.	11.9	26.8	44.6	36.2	34.3	38.6	88.2
F015	13.2	13.4	26.1	12.0	27.4	45.2	37.1	34.3	39.3	90.9
F019	14.3 H	14.2	27.2	12.9 H	28.6	47.2	39.2	37. H	42.7 H	93.
F022	13.3	14.1	26.5	11.9	27.5	47.1	37.5	35.7	39.	89.3
F025	12.4 L	12.7 L	25.5	11.7	27.2	45.8	37.3	34.3	41.	93.9
F026	13.055	13.391	25.996	11.836	27.282	45.113	37.011	34.311	39.135	92.743
F031	14.	14.4	27.2	12.6	29.1 H	48.8 H	39.6 H	36.	41.8	96.9 H
F032	12.8	19.7 EH	25.5	11.5	26.3	43.2	35.9	33.5	39.7	90.6
F036	14.7 VH	12.5 VL	26.6	12.9 H	29.2 H	48.8 H	42.7 EH	35.4	40.1	97.3 H
F037	14.05	14.07	25.41	12.57	28.16	45.64	37.28	37.92 EH	42.21 H	97.1 H
F038	13.3	13.6	25.3	11.6	27.	45.3	37.2	34.6	39.8	89.9
F042	13.	13.4	24.7	11.8	25.7 L	41.6 VL	34.3 VL	32. L	37.4 L	87.7
F048	13.94	13.76	26.94	12.062	27.836	46.449	38.856	35.353	40.678	91.773
F063	13.8	13.7	27.6 H	12.2	28.3	46.2	38.5	35.1	40.5	90.3
F064	14.35 H	14.48	27.99 H	12.35	29.18 H	49.48 VH	40.42 H	37.01 H	41.8	91.48
F069	13.36	13.63	25.78	12.137	27.183	45.077	37.143	34.713	39.343	89.06
F092	13.2	13.5	25.6	11.8	26.9	44.6	36.9	33.6	39.	89.9
F094	13.4	13.8	26.2	12.1	27.3	45.6	37.6	34.9	39.5	90.3
F113	13.38	13.62	24.38 L	11.63	26.24	44.19	35.86	33.04	38.07	108.3 EH
F131	12.449 L	12.725 L	25.36	11.438	26.51	44.08	36.09	33.84	38.83	88.71
F133	12.9	13.75	25.2	11.9	27.3	45.	37.6	34.2	40.	93.
F139	13.63	13.81	26.39	12.21	27.94	46.4	38.33	35.21	40.74	92.1
F141	13.7	14.	27.	25.5 EH	28.2	48.	38.9	36.3	41.5	97.7 H
F144	13.4	14.1	25.9	12.4	27.1	45.6	37.1	34.4	40.4	91.2
F158	12.5 L	12.9 L	24.2 L	11.4	25.4 L	43.0 L	37.4	34.8	39.6	86.5 L
F159	14.	14.	24. L	12.	24. EL	38. EL	33. EL	33.	34. EL	77. EL
MEDIAN	13.3800	13.7600	26.1000	12.0000	27.3000	45.6000	37.5000	34.8000	40.0000	91.4800
1CRIT	0.8190	0.8380	1.4550	0.7500	1.5150	2.4300	2.0250	1.8900	2.1500	4.7240
N	29	29	29	29	29	29	29	29	29	29
MEAN	13.4470	13.7333	26.0981	12.0870	27.3907	45.7327	37.5962	34.8061	40.0312	92.1057
3STDEV	1.4282	1.3019	2.7078	1.1739	2.6028	5.0329	3.7809	2.9217	3.4852	9.9869

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	160.00	16.000	10					Flame AA
F003	179.00	17.900	10					AA
F006	224.50	22.450	10					ICP
F009	250.00	25.000	10	VHH H VH	BIASED HIGH	11.67	-1.8907	ICP-MS
F010	191.00	19.100	10					ICP OES
F014	94.00	9.400	10					ICP OES
F015	117.00	11.700	10					icp
F019	275.50	27.550	10	H H H H	BIASED HIGH*	1.26	1.0065	ICAP
F022	169.50	16.950	10					AAS
F025	120.50	12.050	10	L L				ICP
F026	107.00	10.700	10					Flame AA
F031	276.50	27.650	10	H H H H	BIASED HIGH	6.20	-0.2714	ICP
F032	90.50	9.050	10	EH				AAS
F036	245.00	24.500	10	VHVL H H H EH H				AAS
F037	229.00	22.900	10	EHH H				ICP-MS
F038	104.00	10.400	10					ICPOES
F042	37.00	3.700	10	L VLVLL L	BIASED LOW	-5.04	-0.3095	ICP OES
F048	214.00	21.400	10					Ion Chromatography
F063	211.00	21.100	10	H				FAA
F064	278.50	27.850	10	H H H VHH H	BIASED HIGH*	-0.11	1.6982	ICP AES & AAS
F069	122.00	12.200	10					ICP
F092	78.50	7.850	10					atomic absorp
F094	159.00	15.900	10					ICP-OES
F113	85.00	8.500	10	L EH				FAAS-PE5100
F131	46.00	4.600	10	L L	BIASED LOW*	-2.52	-0.3283	FlameAALaCl3
F133	124.50	12.450	10					ICP-MS
F139	215.00	21.500	10					ICP OES
F141	262.50	26.250	10	EH H	BIASED HIGH*	1.49	2.3777	ICP OES
F144	162.00	16.200	10					APHA3500CaB
F158	61.00	6.100	10	L L L L L L	BIASED LOW*	-4.88	0.2478	
F159	71.00	7.100	10	L ELELEL ELEL	BIASED LOW	-19.24	2.6854	ASTM D 511

* 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 16.000

PARAMETER: 12091 Magnesium mg/L

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.5000 BASIC ACCEPTABLE ERROR= 0.2000 CONCENTRATION ERROR INCREMENT= 0.0500

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F002	2.75	2.62	7.2	7.5	7.8	4.96	11.	8.4	16.3	24.7
F003	2.81	2.67	7.46	7.88	8.01	4.92	11.6	8.67	16.7	25.6
F006	3.	3. EH	8. EH	8.	9. EH	5.	12. H	9.	18. EH	26. H
F009	2.66	2.56	7.7	7.6	7.65	5.1	11.2	8.4	16.4	24.1
F010	2.88	2.75	7.56	7.99	8.08	5.11	11.56	8.56	16.53	24.3
F014	2.8	2.7	7.29	7.64	7.69	4.86	10.9	8.27	15.6	23.4
F015	2.8	2.7	7.5	7.9	7.9	5.0	11.5	8.6	16.6	24.7
F019	2.99	2.76	7.54	8.13	8.1	5.08	11.5	8.72	16.9	24.2
F022	2.72	2.51	7.2	7.67	7.66	4.87	11.1	8.4	16.1	24.1
F025	2.7	2.6	7.3	7.7	8.	5.1	11.6	8.7	16.9	25.3
F026	2.783	2.665	7.537	7.933	8.067	4.993	10.737	8.532	15.915	23.858
F031	3.2 EH	3. EH	7.7	8.2	8.4	5.4	11.7	8.8	16.8	24.7
F032	2.76	2.64	7.28	7.64	7.74	4.86	11.	8.3	16.1	23.9
F036	3.13	2.49	7.54	8.43 H	8.48 H	5.35	12.9 EH	8.63	16.3	25.6
F037	2.84	2.74	7.198	7.711	7.888	4.803	10.71	8.716	16.56	23.77
F038	2.9	2.73	7.35	7.78	7.9	5.02	11.2	8.41	16.3	24.1
F042	2.7	2.59	7.	7.41	7.48	4.8	10.7	8.	15.5	23.1
F048	2.749	2.588	7.35	7.855	7.933	4.942	11.398	8.508	16.605	24.56
F063	2.75	2.66	7.23	7.5	7.59	4.77	10.8	8.17	15.8	22.2 EL
F064	2.842	2.7	7.446	7.903	8.006	5.06	11.414	8.587	16.784	23.754
F069	2.817	2.687	7.332	7.819	7.893	4.973	11.24	8.588	16.31	24.18
F092	2.87	2.73	7.34	7.69	7.79	4.98	11.2	8.45	16.6	24.9
F094	2.9	2.8	7.5	8.	8.1	5.1	11.6	8.7	16.7	25.2
F113	2.755	2.687	7.178	7.552	7.672	4.911	11.03	8.336	16.13	24.58
F131	2.853	2.721	7.35	9.89 EH	7.84	5.01	11.22	8.51	16.44	24.96
F133	2.8	2.77	7.28	7.81	8.19	5.1	11.92	8.75	17.27	26.42 VH
F139	2.879	2.681	7.5	7.88	8.07	5.14	11.11	8.52	16.41	24.14
F141	2.87	2.71	7.51	7.94	8.06	5.1	11.5	8.72	16.8	25.3
F144	2.8	2.6	7.3	7.8	7.9	4.9	11.3	8.5	16.5	24.2
F158	2.68	2.57	7.00	7.53	7.53	4.79	11.0	8.18	15.8	23.8
F159	3.0	2.8	7.8	8.3	8.0	5.5 EH	12. H	9.3 EH	17.	25.
MEDIAN	2.8100	2.6870	7.3500	7.8190	7.9000	5.0000	11.2400	8.5320	16.5000	24.3000
1CRIT	0.3155	0.3094	0.5425	0.5659	0.5700	0.4250	0.7370	0.6016	1.0000	1.3900
N	29	28	28	29	29	29	29	29	29	29
MEAN	2.8320	2.6764	7.4097	7.8373	7.9289	5.0080	11.3117	8.5389	16.4536	24.4828
3STDEV	0.3034	0.2202	0.4893	0.6864	0.6559	0.4251	1.0473	0.5652	1.1474	2.0572

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	91.50	9.150	10					Flame AA
F003	195.50	19.550	10					AA
F006	283.50	28.350	10	EHEH EH H EHH	BIASED HIGH	7.69	-0.0379	ICP
F009	110.50	11.050	10					ICP-MS
F010	225.00	22.500	10					ICP OES
F014	75.50	7.550	10					ICP OES
F015	184.50	18.450	10					icp
F019	242.50	24.250	10					ICAP
F022	68.00	6.800	10		BIASED LOW*	-0.68	-0.1166	AAS
F025	178.50	17.850	10					ICP
F026	138.00	13.800	10					Flame AA
F031	278.50	27.850	10	EHEH	BIASED HIGH*	0.04	0.3726	ICP
F032	76.00	7.600	10					AAS
F036	236.00	23.600	10	H H EH				AAS
F037	124.00	12.400	10					ICP-MS
F038	154.00	15.400	10					ICPOES
F042	21.00	2.100	10		BIASED LOW	-5.39	0.0214	ICP OES
F048	141.00	14.100	10					Ion Chromatography
F063	42.50	4.250	10	EL	BIASED LOW	-8.61	0.3442	FAA
F064	181.00	18.100	10					ICP AES & AAS
F069	147.50	14.750	10					ICP
F092	156.50	15.650	10					atomic absorp
F094	247.00	24.700	10		BIASED HIGH*	3.21	-0.0560	ICP-OES
F113	88.50	8.850	10					FAAS-PE5100
F131	184.00	18.400	10	EH				FlameAALaCl3
F133	233.00	23.300	10	VH				ICP-MS
F139	180.50	18.050	10					ICP OES
F141	233.00	23.300	10					ICP OES
F144	129.00	12.900	10					APHA3500MgB
F158	35.00	3.500	10		BIASED LOW*	-2.09	-0.1292	
F159	279.00	27.900	10	EHH EH	BIASED HIGH*	2.19	0.2503	ASTM D 511-97

* 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 16.000

PARAMETER: 10692 Total Hardness mg/L

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Interlab QA for Major Ions

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 1.0000 BASIC ACCEPTABLE ERROR= 1.0000 CONCENTRATION ERROR INCREMENT= 0.0400

SAMPLE LAB NO	1= ION-915 REPORTED VALUE	2= MISSION-96A REPORTED VALUE	3= HURON-98 REPORTED VALUE	4= ION-99 REPORTED VALUE	5= RICH-95 REPORTED VALUE	6= MOIR-01 REPORTED VALUE	7= CHIC-94 REPORTED VALUE	8= ONT-99 REPORTED VALUE	9= BATT-01 REPORTED VALUE	10= ION-96.2 REPORTED VALUE
F003	44.5	44.7	97.1	62.2	102.	135.	142.	124.	170.	340.
F006	47.	47.	100.	63.	103.	138.	144.	127.	177. H	339.
F015	44.5	44.6	96.0	62.5	100.9	133.5	140.0	121.1	166.5	328.7
F022	44.	45.	96.	61.	100.	137.	138.	123.	163.	322.
F025	42. L	42. L	94.	61.	100.	140.	140.	120.	170.	340.
F031	47.	47.	96.	61.	103.	130.	141.	120.	167.	320.
F032	43.2	60. EH	93.6	60.2	97.6	128. L	135.	118.	165.	325.
F037	46.78	46.42	93.09	63.14	102.80	133.74	137.19	130.58 VH	173.59	340.3
F038	45.2	45.2	93.4	61.	100.	134.	139.	121.	167.	324.
F048	48.	50.4 VH	99.6	68.8 EH	106.	141.6 H	152.8 EH	128.8 H	176.8 H	344.8 H
F063	46.	45.	99.	61.	102.	135.	141.	121.	166.	317.
F064	47.54	47.28	100.55	63.38	105.83	144.39 H	147.93 H	127.78 H	173.49	326.24
F092	44.8	45.	94.1	61.1	99.2	131.9	138.3	118.7	165.7	327.
F094	45.	46.	96.	63.	102.	135.	142.	123.	167.	329.
F133	45.9	45.1	95.1	61.8	101.3	134.4	139.6	121.5	167.	327.
F141	46.	46.1	74.9 EL	71.6 EH	104.	141.	144.	127.	173.	348. H
F144	46.	46.	98.	62.	102.	138.	142.	122.	172.	336.
F158	42.3 L	42.7 L	89.2 L	59.4	94.4 EL	127. L	138.	120.	164.	314.
MEDIAN	45.5500	45.6000	96.0000	61.9000	102.0000	135.0000	140.5000	121.7500	167.0000	327.8500
1CRIT	2.7820	2.7840	4.8000	3.4360	5.0400	6.3600	6.5800	5.8300	7.6400	14.0740
N	16	16	16	16	16	16	16	16	16	16
MEAN	45.3575	45.8438	95.6369	62.2575	101.6019	135.3838	140.8762	122.8675	169.0050	330.3775
3STDEV	4.2088	4.8481	8.1027	5.7979	5.7936	10.9459	8.0995	9.1712	10.9258	24.5217

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	106.00	10.600	10					CALCULATED
F006	149.50	14.950	10	H	BIASED HIGH*	3.83	-0.5719	Calculation
F015	75.50	7.550	10					icp
F022	62.50	6.250	10					ICP
F025	71.50	7.150	10	L L				Calculation
F031	89.00	8.900	10					Titration
F032	43.00	4.300	10	EH L	BIASED LOW*	-2.44	1.2821	Calc AAS
F037	116.00	11.600	10	VH				Calculation
F038	65.00	6.500	10					Calc
F048	172.00	17.200	10	VH EH H EHH H H	BIASED HIGH*	4.78	1.5018	Titrimetric
F063	82.50	8.250	10					calculation
F064	157.00	15.700	10	H H H	BIASED HIGH*	-0.72	5.0219	Calculation
F092	54.50	5.450	10					calc Ca.Mg
F094	107.00	10.700	10					Calculation
F133	84.00	8.400	10					Titrimetric
F141	137.00	13.700	10	ELEH H				ICP OES
F144	118.50	11.850	10					ELOT170
F158	19.50	1.950	10	L L L ELL	BIASED LOW*	-3.37	-1.0201	

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

OVERALL AVERAGE
RANK IS 9.500

FPTP STUDY 0076 DATA SUMMARY 2000-06-01 PAGE 1

PARAMETER: 15092 Total Phosphorus mg/L P

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA
BURLINGTON ONTARIO

NWRI Ecosystem Interlab QA for Total P

LOWER LIMIT FOR USE OF BASIC ACCEPTABLE ERROR= 0.0040 BASIC ACCEPTABLE ERROR= 0.0040 CONCENTRATION ERROR INCREMENT= 0.1000

SAMPLE	1= TP76-1	2= TP76-2	3= TP76-3	4= TP76-4	5= TP76-5	6= TP76-6	7= TP76-7	8= TP76-8	9= TP76-9	10= TP76-10
LAB NO	REPORTED VALUE	REPORTED VALUE	REPORTED VALUE	REPORTED VALUE	REPORTED VALUE	REPORTED VALUE	REPORTED VALUE	REPORTED VALUE	REPORTED VALUE	REPORTED VALUE
F002	0.001	0.052	0.013	0.070	0.120	0.142	0.176	0.204	0.286	0.360
F003	0.0004	0.0505	0.0122	0.0705	0.116	0.149	0.187	0.208	0.304	0.378
F006	<0.002	0.07 EH	0.03 EH	0.08 H	0.13	0.16	0.19	0.21	0.33 H	0.39
F007	<0.010	0.040 L	<0.010	0.060	0.117	0.147	0.177	0.211	0.306	0.383
F010	<0.010	0.045	<0.010	0.060	0.110	0.135	0.175	0.205	0.290	0.365
F011	<0.002	0.004 EL	0.017 H	0.005 EL	0.398 EH	<0.004 EL	0.025 EL	<0.004 EL	0.005 EL	0.023 EL
F014	<0.005	0.052	0.010	0.067	0.12	0.14	0.18	0.20	0.29	0.36
F015	<0.002	0.060 H	0.016	0.071	0.113	0.143	0.175	0.199	0.27	0.35
F019	<0.01	0.04 L	0.01	0.06	0.10 EL	0.12 EL	0.17	0.19 EL	0.27	0.34
F022	<0.005	0.054	0.015	0.071	0.124	0.145	0.189	0.203	0.3	0.345
F025	0.031 EH	0.048	0.008	0.067	0.115	0.156	0.205 EH	0.223 EH	0.339 EH	0.397
F026	0.0003	0.0501	0.0114	0.0694	0.1161	0.1420	0.1771	0.2030	0.2849	0.3568
F032	<0.002	0.048	0.008T	0.068	0.116	0.144	0.180	0.204	0.286	0.356
F036	0.0008T	0.047	0.0108	0.0656	0.112	0.137	0.172	0.208	0.278	0.338
F038	<0.002	0.049	0.011	0.068	0.115	0.144	0.180	0.205	0.291	0.378
F042	0.020 VH	0.530 EH	0.130 EH	0.720 EH	0.121	0.148	0.185	0.206	0.296	0.371
F048	<2.	0.046	0.012	0.052 L	0.130	0.154	0.195	0.200	0.282	0.350
F063	<0.01	0.04 L	0.01	0.07	0.12	0.14	0.18	0.20	0.29	0.39
F064	0.0169VH	0.0520	0.0180H	0.0674	0.1098	0.1566	0.1703	0.2006	0.2776	0.3474
F069	<0.006	0.0501	0.0100	0.0701	0.1207	0.1499	0.1844	0.2111	0.3042	0.3709
F072	<0.003	0.047	0.010	0.064	0.113	0.138	0.180	0.210	0.282	0.337
F074	0.002	0.051	0.012	0.070	0.115	0.145	0.181	0.206	0.292	0.362
F092	0.001	0.051	0.012	0.068	0.117	0.145	0.18	0.206	0.297	0.363
F094	<0.001	0.047	0.01	0.065	0.107	0.128	0.172	0.174 EL	0.25 L	0.347
F113	0.001	0.044	0.011	0.063	0.110	0.135	0.173	0.202	0.292	0.380
F131	0.0016	0.0471	0.0115	0.0659	0.1138	0.1404	0.177	0.2019	0.2915	0.3616
F133	<0.002	0.050	0.013	0.066	0.114	0.140	0.176	0.201	0.285	0.354
F141	<0.002	0.045	0.011	0.063	0.113	0.141	0.173	0.202	0.281	0.349
F146	0.000	0.0486	0.0104	0.0694	0.118	0.147	0.186	0.213	0.300	0.361
F170	0.0022	0.0465	0.0072	0.064	0.114	0.146	0.180	0.207	0.299	0.377
FP004	0.002W	0.049	0.012	0.067	0.118	0.144	0.181	0.208	0.298	0.366
MEDIAN	0.0010	0.0486	0.0114	0.0670	0.1160	0.1440	0.1800	0.2045	0.2900	0.3610
1CRIT	0.0040	0.0085	0.0047	0.0103	0.0152	0.0180	0.0216	0.0241	0.0326	0.0397
N	11	29	27	29	29	28	29	28	29	29
MEAN	0.0043	0.0490	0.0124	0.0666	0.1165	0.1436	0.1794	0.2045	0.2898	0.3616
3STDEV	0.0202	0.0173	0.0125	0.0146	0.0158	0.0186	0.0181	0.0141	0.0420	0.0441

LAB NO.	TOTAL RANK	AVERAGE RANK	NO.SAMPLES RANKED	SUMMARY OF FLAGGING	BIAS STATEMENT	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F002	167.00	16.700	10					K2S208 dig/Color
F003	217.00	21.700	10					TP UNF AAII
F006	261.50	29.056	9	EHEHH H	BIASED HIGH*	4.35	0.0117	AUTO ANAL II
F007	145.50	18.188	8	L				CPQ123E0
F010	78.50	9.812	8					Colorimetry
F011	62.00	8.857	7	ELH ELEHELELELELEL				Auto Colourimetry
F014	132.00	14.667	9					ColorUVdig
F015	129.00	14.333	9	H				colorimetric
F019	27.00	3.000	9	L ELEL EL	BIASED LOW*	-4.76	-0.0061	Colourmetric
F022	198.50	22.056	9					UV Vis
F025	210.00	21.000	10	EH EHEHEH				Auto Ascorbic
F026	139.00	13.900	10					autoanalyser
F032	125.50	13.944	9					Colourimetry
F036	84.50	8.450	10					
F038	156.50	17.389	9					Digestion Color
F042	242.00	24.200	10	VHEHEHEH	BIASED HIGH	-85.96	0.2527	Colorimetric
F048	138.00	15.333	9	L				autoanalyser
F063	133.00	14.778	9	L				auto persulfate
F064	135.00	13.500	10	VH H				Colorimetric
F069	207.00	23.000	9					365.1colorimet
F072	94.00	10.444	9					Lacjat Flow Inj
F074	187.00	18.700	10					UV digest colour
F092	183.50	18.350	10					Spectrophotometric
F094	45.00	5.000	9	ELL	BIASED LOW	-8.14	-0.0007	Colorimetric
F113	102.00	10.200	10					Lachat8000K2SO8
F131	125.50	12.550	10					PersulfateDigest
F133	114.50	12.722	9					Colorimetric
F141	77.00	8.556	9					Digestion Color
F146	189.00	18.900	10					StannousCl
F170	148.00	14.800	10					autoanalyser
FP004	178.00	19.778	9					15423

* 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 15.389

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