



Environment Canada Proficiency Testing Program / Environnement Canada Programme d'Essais d'Aptitude

Study / Étude # 0103
March / Mars 2014

Rain and Soft Waters /
Eau de Pluie et Eau Douce,
Major Ions and Nutrients in Water /
Principaux ions et Substances Nutritives dans l'Eau,
Trace Elements in Water /
Éléments Traces dans l'Eau,
Total Phosphorus in Water /
Phosphore Total dans l'Eau,
Turbidity in Water /
Turbidité dans l'Eau,
Total Mercury in Water /
Mercure Total dans l'Eau

C. Tinson and J. Simser
IQM-2014-01



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Information and Quality Management

Emergencies, Operational Analytical Laboratories and Research Support Division
Water Science and Technology Directorate, Environment Canada
867 Lakeshore Road, P.O. Box 5050
Burlington, ON, Canada, L7R 4A6

March 24, 2014

To: Participants of the **Environment Canada Proficiency Testing (PT) Program**

Re: Distribution of the Final Report for **PT Study 0103** (December 2013 to March 2014)

Dear Participant,

We thank you for your co-operation and punctual responses with respect to this study. It is the aim of the PT Program to give prompt evaluations and reports, and effective remedial assistance. Our PT Program is accredited by the American Association for Laboratory Accreditation (A2LA) and conforms to the ISO/IEC 17043:2010 Conformity assessment – General requirements for proficiency testing. The scope of accreditation (A2LA 2867.01) can be viewed on the A2LA website (<http://www.a2la.org/scopepdf/2867-01.pdf>).

This PT Study provides results and evaluations for inorganic parameters in:

- **rain and soft waters (RN)**
- **major ions and nutrients in natural waters (MI)**
- **trace elements in water (TE)**
- **total phosphorus in water (TP)**
- **turbidity in water (TU)**
- **total mercury in water (HG).**

The evaluations include systemic bias and precision, which are included in this final report and individual laboratory proficiency appraisals and summaries of z-scores, which are provided under separate cover.

The flagging criteria, stipulated in ISO 13528:2005, Annex C, are calculated separately for each study. Each laboratory is encouraged to compare its results and evaluations with others. A complete listing of all laboratory results is included in the data summary for each program.



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Laboratory managers are encouraged to discuss the attached report openly with those who manage their programs and those who use their laboratory data.

Systemic bias is a major fault whose root cause can be uncovered. Systemic bias and its degree are given for each parameter in the Data Summary. In the event you disagree with any of our data evaluations, please contact us and we will discuss the item with you.

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

Should you have any questions or comments regarding this study, please contact us at your earliest convenience. Your comments are instrumental to the continued improvement of our PT Program.

Sincerely,

Cheryl Tinson

Study Coordinator

Associated Laboratory Evaluations (2)

- 1) Laboratory Proficiency Appraisal
- 2) Z-Score Summary



Information and Quality Management
Proficiency Testing Program
Inorganic Environmental Substances

Canada

Environment Canada Proficiency Testing Program

Final Report

for

**Rain and Soft Waters
Major Ions and Nutrients in Natural Waters
Trace Elements in Water
Total Phosphorus in Water
Turbidity in Water
Total Mercury in Water**

EC PT Study 0103 – December 2013 to March 2014

Contributors

C. Tinson - Study Coordinator
J. Simser - Quality Assurance Chemist
C. Lam - Sample Design Technologist
H. Agemian - Chief, Information and Quality Management

Information and Quality Management
Water Science and Technology Directorate
Burlington, Ontario, CANADA
<PTstudies@ec.gc.ca>

March 2014

IQM-2014-01

Environment Canada Proficiency Testing Program

Glossary of Terms and Definitions

A. Statistics listed in Data Summary (Appendix A)

- | | |
|----------------------|--|
| 1. Assigned Value | The Robust Mean of test results for a parameter and sample [1] |
| 2. R-Std Dev | Robust Standard Deviation [1] |
| 3. Acceptable Limits | See 'Limits & Flags' and Table 1 |
| 4. Warning Limits | See 'Limits & Flags' and Table 1 |
| 5. Action Limits | See 'Limits & Flags' and Table 1 |
| 6. N | The number of usable test results for calculating the assigned value |

B. Calculation of Performance Statistics (Appendix A)

Laboratory Bias: Laboratory Bias [2] $D = x - X$, where D is the deviation, x is the test result and X is the assigned value. This deviation is normalized with the robust standard deviation (R-Std Dev) and evaluated by the z-score [3].

Limits & Flags: Acceptable Limits/No Flags: When a test result is within 2 R-Std Dev of the assigned value, flags are not assigned (see Table 1 below).

Warning Limits/Warning Flags: When a test result is between 2 and 3 R-Std Dev, the flags 'WH' or 'WL' indicate a WARNING flag, for a high or low result respectively (see Table 1 below).

Action Limits/Action Flags: When a test result deviates by more than 3 R-Std Dev from the assigned value, the flags 'AH' or 'AL' indicate an ACTION flag, high or low respectively (see Table 1 below).

Table 1 Evaluating test results, determining limits and assigning flags [2]

Criteria	Limits	Flags
$\text{Assigned value} \pm 2 \hat{\sigma}^*$	Acceptable Limits	No Flag
$2 \hat{\sigma} - 3 \hat{\sigma}$ from assigned value	Warning Limits	Warning Flag (W)
$> 3 \hat{\sigma}$ from assigned value	Action Limits	Action Flag (A)

* $\hat{\sigma}$ is the R-Std Dev

Systemic Bias: Systemic bias is indicated when a laboratory's test results (ranked by the Youden non-parametric analysis [4] for an individual parameter) are consistently higher or lower than the assigned value. Ranks are assigned to each test result for each sample, from 1 for the lowest, to N for the highest, where N is the number of usable test results. These ranks are totalled for each laboratory (Total Rank), and divided by the number of samples ranked (No. Samples Ranked). **Total Rank** and **Average Rank** for each laboratory are displayed on page 2 of the Data Summary. The **Overall Average Rank** for each parameter is shown at the bottom of the same page. Systemic bias is identified when a laboratory's **Average Rank** falls outside of the 95% confidence interval for the **Overall Average Rank**. Systemic bias may be indicated by the Youden rankings even when the test results have not been flagged (W or A) for deviation from the assigned value.

No. Samples Ranked: This is the number of test results used to determine systemic bias. A laboratory must report results for more than half of the samples in the set to allow for evaluation of bias (not including '<'). There must be ten or more laboratories participating, with sufficient test results reported, to determine systemic bias.

The two measured components of 'systemic' bias are 1) Bias Blank and 2) Bias % Slope. These components are illustrated in Figure 1: Parameter Performance. All 'systemic' biases are correctable with the investigation of the following two analytical components.

1) Bias Blank: The first component is the y-intercept of the linear regression plot (-0.0329 in Figure 1). These bias blanks are stated in the Data Summary and Evaluations for each parameter.

2) Bias % Slope: The second measured component is the % deviation of the laboratory test results versus the assigned values for a parameter. This is calculated as $[(m-1) \times 100]$, where **m** is the slope of the linear regression plot (laboratory test results) and **1** is the slope of the "ideal" line (assigned values). The Bias % Slope in Figure 1 below is minus 1.55 per cent (-1.55%). For most parameters, a Bias % Slope greater than the absolute value of 5 is considered unacceptable and requires action.

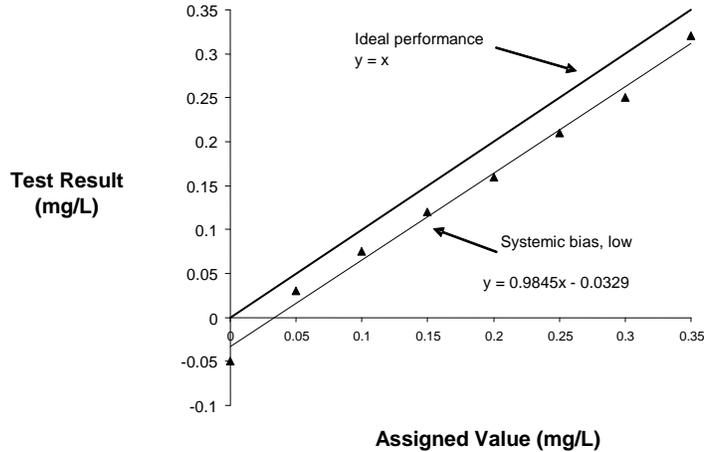


Figure 1: Parameter Performance

Bias Statement: Systemic bias is noted with the 'BIASED HIGH' or 'BIASED LOW' notations. In Table 2 of the Final Report (Laboratory Performance Scores), systemic biases are calculated as the equivalent of *five* flagged values.

Method Coding: Method codes are an important part of quality assurance. These definitions are provided on the Data Reporting Forms to assist with uniform descriptions.

C. Determination of the 'Laboratory Performance Scores' in Table 2

The 'Laboratory Performance Scores' are a combination of 50% **Systemic Bias (parameters biased)** and 50% **Flagged Results**.

- Systemic bias (50%) is calculated as,

$$[(\text{No. of Parameters Biased} / \text{No. of Parameters Analyzed}) \times 100] / 2$$

- Flagged results (50%) is calculated as,

$$[(\text{No. of Flags Assigned} / \text{No. of Results Reported}) \times 100] / 2$$

These percentages are summed to obtain the % Score (Sum of Parameters Biased & Flagged Results)

The Laboratory Performance Rating is assigned according to the % Score.

- Very Good: 0 to 5%;
- Good: >5 to 12.5%;
- Fair: >12.5 to 30%
- Poor: >30%.

D. Uncertainty of Assigned Values

The standard uncertainty (u_x) of the assigned value may be estimated from the statistics presented in the data summary (Appendix A),

$$u_x = 1.25 \times \text{R-Std Dev} / \sqrt{N} \quad [5]$$

This uncertainty is not used in the performance evaluations, but may be of interest to some participants. Reporting details of the measurement uncertainty of any assigned value is a requirement of *ISO/IEC 17043:2010, Conformity assessment – General requirements for proficiency testing*.

E. Associated Laboratory Evaluations with the Final Report

1. Laboratory Proficiency Appraisal (see Table 2 in the Final Report for definitions)
2. Z-Score Summary [3]

References:

- [1] ISO 13528:2005(E), Statistical Methods for the use in Proficiency Testing by Interlaboratory Comparisons, Annex C, Robust Analysis, Section C.1: Algorithm A, p64.
- [2] ISO 13528:2005(E), Statistical Methods for the use in Proficiency Testing by Interlaboratory Comparisons, Calculation of Performance Statistics, Section 7.1.1 and 7.1.2, p18-19.
- [3] ISO 13528:2005(E), Statistical Methods for the use in Proficiency Testing by Interlaboratory Comparisons, z-scores, Section 7.4.1 and 7.4.2, p25-26.
- [4] 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.
- [5] ISO 13528:2005(E), Statistical Methods for the use in Proficiency Testing by Interlaboratory Comparisons, Standard uncertainty u_x of the assigned value , Section 5.6.2, p 9-10.

Section 4 – Total Phosphorus in Water (TP)

Table 1	Participating Laboratories
Table 2	Laboratory Performance Scores
Table 3	Five-Year Historical Laboratory Performance
Table 4	Sample Design
Table 5	Summary of Interlaboratory Robust Means
Appendix A	Data Summary

Program Name: FPTP

Study Code: 0103

Range of Samples: 1 to 10

Table 1 Participating Laboratories in FP PT for Total Phosphorus in Water

Adirondack Lakes Survey Corp., Ray Brook, NY, US
 ALS Environmental (Winnipeg) - Winnipeg, MB, CA
 Bay of Plenty Regional Council, Whakatane, NZ
 Capital District Health Authority, QEII Lab, Halifax, NS, CA
 Department of Fisheries & Oceans, Freshwater Institute, Winnipeg, MB, CA
 Environment Canada, ALET, Moncton, NB, CA
 Environment Canada, NLET, Burlington, ON, CA
 Environment Canada, NLET, Saskatoon, SK, CA
 Environment Canada, PYLET, Vancouver, BC, CA
 Environnement Canada, LEEQ, Montréal, QC, CA
 Environnement Québec, CEAEQ, Gouvernement du QC, QC, CA
 Kinectrics Inc., Toronto, ON, CA
 Minnesota Department of Health, St. Paul, MN, US
 NIWA, Hamilton, NZ
 NRCan, CDN Forestry Service, ON Region, Sault Ste. Marie, ON, CA
 Onondaga County, WEP, Syracuse, NY, US
 Ontario Ministry of Environment, Dorset, ON, CA
 Platte River State Fish Hatchery, Beulah, MI, US
 South FL Water Management District Chemistry Lab, West Palm Beach, FL, US
 TAIGA Environmental Laboratory, Yellowknife, NT, CA
 Universidade da Coruña, A Coruña, ES
 University of Maryland-Appalachian Lab, Frostburg, MD, US
 University of Victoria, Victoria, BC, CA
 US EPA ORD Western Ecology Division, Corvallis, OR, US
 USGS-National Water Quality Laboratory, Denver, CO, US
 Ville de Montréal, Expertise Technique, Montréal, QC, CA

26 Laboratories.

Program Name: FPTP

Number of Labs: 28

Study Code: 0103

Range of Samples: 1 to 10

Table 2 Laboratory Performance Scores - FP PT for Total Phosphorus in Water

<u>Lab Code</u>	Systemic Bias			Flagged Results			<u>% Score (Sum of Parameters Biased & Results Flagged)</u>
	<u>No. of Parameters Analyzed</u>	<u>No. of Parameters Biased</u>	<u>Parameters Biased (50%)</u>	<u>No. of Results Reported</u>	<u>No. of Flags Assigned</u>	<u>Results Flagged (50%)</u>	
F004	1	0	0.00	10	0	0.00	0.00
F007	1	0	0.00	10	0	0.00	0.00
F010	1	0	0.00	10	0	0.00	0.00
F021	1	0	0.00	10	0	0.00	0.00
F036	1	0	0.00	10	0	0.00	0.00
F069	1	0	0.00	10	0	0.00	0.00
F069b	1	0	0.00	10	0	0.00	0.00
F154	1	0	0.00	10	0	0.00	0.00
F158	1	0	0.00	10	0	0.00	0.00
F113	1	0	0.00	10	0	0.00	0.00
F202	1	0	0.00	10	0	0.00	0.00
F207	1	0	0.00	10	0	0.00	0.00
F248	1	0	0.00	10	0	0.00	0.00
F310	1	0	0.00	10	0	0.00	0.00
F131	1	0	0.00	10	1	5.00	5.00
F170	1	0	0.00	10	1	5.00	5.00
F074	1	0	0.00	10	1	5.00	5.00
F015	1	0	0.00	10	1	5.00	5.00
F003	1	0	0.00	10	2	10.00	10.00
F022	1	0	0.00	10	2	10.00	10.00
F183	1	0	0.00	10	2	10.00	10.00
F242	1	0	0.00	5	1	10.00	10.00
F026b	1	0	0.00	10	3	15.00	15.00
F112	1	0	0.00	10	3	15.00	15.00
F026	1	1	50.00	10	0	0.00	50.00
F304	1	1	50.00	10	1	5.00	55.00
F221	1	1	50.00	10	2	10.00	60.00
F011	1	1	50.00	10	7	35.00	85.00

Laboratory Performance Rating

Rating	% Score*
Very Good	0 - 5
Good	> 5 - 12.5
Fair	> 12.5 - 30
Poor	> 30

*Sum of Parameters Biased & Results Flagged

Table 3 Five-Year Historical Laboratory Performance - FP PT for Total Phosphorus in Water

LAB CODE	% Score Per Study (Sum of Parameters Biased & Results Flagged)										MEDIAN	RATING
	0094 Summer 2009	0095 Winter 2009	0096 Summer 2010	0097 Winter 2010	0098 Summer 2011	0099 Winter 2011	0100 Summer 2012	0101 Winter 2012	0102 Summer 2013	0103 Winter 2013		
F003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	Very Good
F004	0.0	0.0	10.0	65.0	60.0	5.0	0.0	10.0	50.0	0.0	7.5	Good
F007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Very Good
F010	0.0	5.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Very Good
F011	30.0	25.0	5.0	0.0	70.0	15.0	25.0	85.0	90.0	85.0	27.5	Fair
F015	0.0	20.0	5.0	15.0	5.0	10.0	0.0	5.0	0.0	5.0	5.0	Very Good
F021	0.0	0.0	5.0	0.0	0.0	0.0	0.0	65.0	50.0	0.0	0.0	Very Good
F022	0.0	0.0	0.0	15.0	15.0	10.0	55.0	5.0	0.0	10.0	7.5	Good
F026	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	Very Good
F026b	0.0	0.0	0.0	0.0	55.0	0.0	0.0	0.0		15.0	0.0	Very Good
F036	0.0	5.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	Very Good
F069		0.0		0.0		0.0		0.0		0.0	0.0	Very Good
F069b		0.0		0.0		0.0		5.0		0.0	0.0	Very Good
F074	20.0	0.0	0.0	0.0	0.0					5.0	0.0	Very Good
F112	5.0	0.0	0.0	0.0	0.0	15.0	15.0	15.0	10.0	15.0	7.5	Good
F113	0.0	0.0	25.0	0.0	75.0	65.0	10.0	5.0	5.0	0.0	5.0	Very Good
F131			0.0		0.0				55.0	5.0	2.5	Very Good
F154	10.0	0.0	20.0	10.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	Very Good
F158		15.0	0.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Very Good
F170	0.0	0.0	80.0	0.0	0.0	0.0	50.0	0.0	0.0	5.0	0.0	Very Good
F183		55.0	10.0	0.0	65.0	70.0	60.0	0.0	0.0	10.0	10.0	Good
F202	10.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Very Good
F207	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Very Good
F221	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0	0.0	Very Good
F242										10.0	10.0	Good
F248	0.0	10.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	Very Good
F304		5.0	0.0	0.0	0.0	0.0		10.0	15.0	55.0	2.5	Very Good

Laboratory Performance Rating

Rating	% Score
Very Good	0 - 5
Good	> 5 - 12.5
Fair	> 12.5 - 30
Poor	> 30

Table 3 Five-Year Historical Laboratory Performance - FP PT for Total Phosphorus in Water

LAB CODE	% Score Per Study (Sum of Parameters Biased & Results Flagged)										MEDIAN	RATING
	0094 Summer 2009	0095 Winter 2009	0096 Summer 2010	0097 Winter 2010	0098 Summer 2011	0099 Winter 2011	0100 Summer 2012	0101 Winter 2012	0102 Summer 2013	0103 Winter 2013		
F310	5.0		0.0		0.0					0.0	0.0	Very Good
Interlab Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5		

Laboratory Performance Rating

Rating	% Score
Very Good	0 - 5
Good	> 5 - 12.5
Fair	> 12.5 - 30
Poor	> 30

Table 4 Sample Design - FP PT for Total Phosphorus in Water

Sample Number	Sample Name	Spike
1	TP103-1	inorganic
2	TP103-2	inorganic
3	TP103-3	none
4	TP103-4	inorganic
5	TP103-5	organic
6	TP103-6	none
7	TP103-7	organic
8	TP103-8	inorganic
9	TP103-9	organic
10	TP103-10	none

Samples are prepared in natural lake and river waters and preserved with 0.2% sulfuric acid. Standard phosphate solutions are prepared with potassium dihydrogen phosphate and sodium β -glycerophosphate for inorganic and organic spikes respectively.

Program Name: FPTP

Range of Samples: 1 to 10

2014-03-07

Study Code: 0103

Table 5 Summary of Interlaboratory Robust Means - FP PT for Total Phosphorus in Water

Parameters	TP103-1 Sample 1	TP103-2 Sample 2	TP103-3 Sample 3	TP103-4 Sample 4	TP103-5 Sample 5	TP103-6 Sample 6	TP103-7 Sample 7	TP103-8 Sample 8	TP103-9 Sample 9	TP103-10 Sample 10
Total Phosphorus (mg/L P)	0.390	0.579	0.00228	0.0257	0.333	0.0137	0.248	0.853	0.138	0.00278

Appendix A

PARAMETER: 15092 Total Phosphorus mg/L P

WATER SCIENCE & TECHNOLOGY
ENVIRONMENT CANADA

FP PT for Total Phosphorus in Water

SAMPLE	1=	2=	3=	4=	5=	6=	7=	8=	9=	10=
LAB NO	TP103-1 LAB RESULT	TP103-2 LAB RESULT	TP103-3 LAB RESULT	TP103-4 LAB RESULT	TP103-5 LAB RESULT	TP103-6 LAB RESULT	TP103-7 LAB RESULT	TP103-8 LAB RESULT	TP103-9 LAB RESULT	TP103-10 LAB RESULT
F003	0.393	0.291 AL	0.0021	0.0264	0.336	0.0141	0.255	0.418 AL	0.142	0.002
F004	0.383	0.567	<0.002	0.027	0.328	0.013	0.255	0.853	0.135	<0.002
F007	0.397	0.586	<0.002	0.025	0.339	0.012	0.251	0.867	0.142	<0.002
F010	0.381	0.568	0.00206	0.0266	0.327	0.0112	0.246	0.859	0.137	0.00249
F011	0.436 WH	0.614	0.006 AH	0.033 AH	0.367 WH	0.025 AH	0.270 WH	0.899	0.154 WH	0.005
F015	0.414	0.613	0.001	0.026	0.356	0.013	0.254	0.89	0.274 AH	0.002
F021	0.393	0.575	<0.002	0.026	0.340	0.013	0.254	0.859	0.137	<0.002
F022	0.359	0.540	<0.02	0.034 AH	0.315	<0.02	0.227 WL	0.777	0.134	<0.02
F026	0.382	0.562	0.0012	0.0255	0.325	0.0129	0.242	0.811	0.134	0.0013
F026b	0.370	0.549	<0.02	0.027	0.325	0.019 WH	0.215 AL	0.788	0.124 WL	<0.02
F036	0.396	0.588	0.001	0.026	0.338	0.014	0.250	0.871	0.143	0.002
F069	0.408	0.610	<0.004	0.024	0.346	0.015	0.257	0.897	0.142	<0.004
F069b	0.411	0.588	<0.01	0.024	0.35	0.013	0.262	0.9	0.145	<0.01
F074	0.382	0.574	0.005 WH	0.026	0.325	0.016	0.244	0.856	0.134	0.005
F112	0.341 WL	0.559	0.00176	0.0275	0.324	0.0150	0.223 WL	0.782	0.115 AL	0.00174
F113	0.388	0.587	<0.004	0.023	0.33	0.016	0.243	0.857	0.133	<0.004
F131	0.386	0.571	<0.010	0.026	0.328	0.018	0.243	0.842	0.135	0.009 AH
F154	0.380	0.585	<0.010	0.024	0.327	0.014	0.243	0.852	0.137	<0.010
F158	0.386	0.576	<0.002	0.024	0.332	0.011	0.247	0.842	0.138	<0.002
F170	0.384	0.592	<0.001	0.026	0.310	0.005 AL	0.249	0.897	0.136	0.001
F183	0.41	0.64 WH	<0.008	0.027	0.34	0.013	0.25	0.95 WH	0.138	<0.008
F202	0.395	0.561	0.003	0.026	0.344	0.016	0.247	0.855	0.140	0.003
F207	0.388	0.588	0.002	0.025	0.335	0.013	0.248	0.861	0.141	<0.002
F221	0.375	0.561	0.002	0.020 AL	0.320	0.011	0.239	0.814	0.124 WL	0.001
F242			0.003	0.029		0.016			0.158 AH	0.003
F248	0.392	0.579	<0.003	0.025	0.335	0.014	0.249	0.844	0.140	<0.003
F304	0.374	0.561	<0.001	0.019 AL	0.319	0.009	0.237	0.842	0.130	<0.001
F310	0.423	0.612	<0.002	0.026	0.350	0.012	0.258	0.879	0.139	0.004
ASSIGNED VALUE *	0.390	0.579	0.00228	0.0257	0.333	0.0137	0.248	0.853	0.138	0.00278
R-STD DEV *	0.0169	0.0243	0.001211	0.00176	0.0126	0.00248	0.0089	0.0403	0.0063	0.001709
ACCEPTABLE LIMITS(+ -) *	0.0338	0.0486	0.002422	0.00352	0.0252	0.00496	0.0178	0.0806	0.0126	0.003418
WARNING LIMITS(+ -) *	.0338- .0507	.0486- .0729	.002422- .00352	.00352- .005	.0252- .0378	.00496- .007	.0178- .0267	.0806- .1209	.0126- .0189	.003418- .005127
ACTION LIMITS(<>) *	0.0507	0.0729	0.003633	0.00528	0.0378	0.00744	0.0267	0.1209	0.0189	0.005127
N *	27	27	12	28	27	27	27	27	28	14

* NOTE: SEE GLOSSARY FOR DEFINITIONS

LAB NO.	TOTAL RANK	AVERAGE RANK	SUMMARY OF FLAGGING	BIAS STATEMENT	NO. SAMPLES RANKED	BIAS % SLOPE	BIAS BLANK	METHOD CODING
F003	133.0	13.3	AL	AL	10			Autoclaved ascorbic
F004	109.0	13.6			8			Autoclaved SnCl2
F007	132.5	16.5			8			Autoclaved ascorbic
F010	108.0	10.8			10			Autoclaved SnCl2
F011	236.5	23.6	WH AH	AHWH	WH	BIASED HIGH	5.3	0.0087
F015	181.0	18.1			10			Autoclaved ascorbic
F021	128.0	16.0			8			Flow inj. ascorbic
F022	46.0	6.5		AH WL	7			ICPAES
F026	66.5	6.6			10	BIASED LOW	-4.1	0.0019
F026b	69.5	8.6		WHAL WL	8			ICP-AES
F036	158.5	15.8			10			Autoclaved ascorbic
F069	162.5	20.3			8			acid persulfate dige
F069b	162.5	20.3			8			b-alkaline persulf d
F074	120.0	12.0		WH	10			UV Dig Molyb Blue As
F112	68.5	6.8		WL WL AL	10			Block dig. ascorbic
F113	99.0	12.3			8			Flow inj. ascorbic
F131	115.0	12.7			9			Autoclaved ascorbic
F154	85.0	10.6			8			Flow inj. ascorbic
F158	85.5	10.6			8			Flow inj. ascorbic
F170	102.0	11.3		AL	9			Autoclaved ascorbic
F183	165.0	20.6		WH WH	8			ICP-MS
F202	148.0	14.8			10			manual ascorbic acid
F207	128.0	14.2			9			Flow inj. ascorbic
F221	41.0	4.1		AL WL	10	BIASED LOW	-3.7	-0.0022
F242	94.5	18.9			5			Block dig. ascorbic
F248	115.5	14.4			8			Flow inj. ascorbic
F304	32.0	4.0		AL	8	BIASED LOW	-1.0	-0.0078
F310	170.5	18.9			9			Inline UV/Persulfate

OVERALL AVERAGE RANK IS 13.3