



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

Study / Étude #0107
March / Mars 2016

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-2016-01



Environment
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Environnement
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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,
Burlington, ON, Canada, L7S 1A1

March 7, 2016

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

Re: Distribution of the Final Report for **PT Study 0107** (December 2015 to March 2016)

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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Inorganic Environmental Substances

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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 0107 – December 2015 to March 2016

Contributors

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March 2016

IQM-2016-01

Environment Canada Proficiency Testing Program

Glossary of Terms and Definitions

A. Statistics listed in Appendix A - Data Summary

- Assigned Value The Robust Mean of test results for a parameter and sample [1].
- R-Std Dev Robust Standard Deviation [1].
- Acceptable Limits See 'Limits & Flags' and Table 1.
- Warning Limits See 'Limits & Flags' and Table 1.
- Action Limits See 'Limits & Flags' and Table 1.
- N The number of usable test results for calculating the assigned value (all test results except those with a '<' symbol).

B. Calculation of Performance Statistics in Appendix A - Data Summary

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] (see F: Laboratory Evaluations #2).

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

σ^* is the R-Std Dev

See F: Laboratory Evaluations #1.

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 each parameter. 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.

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).

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%).

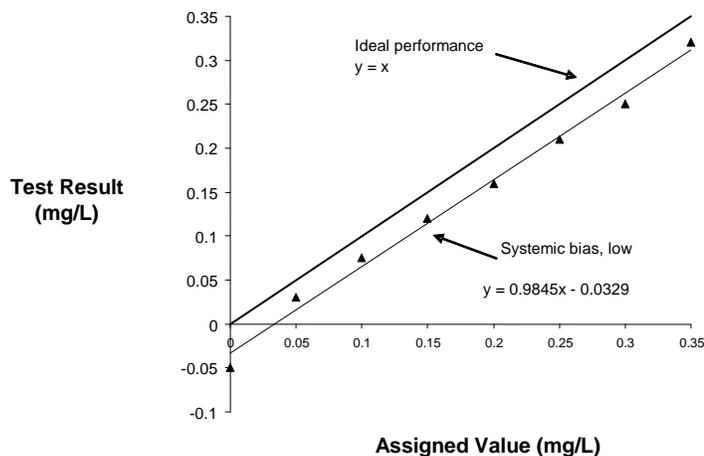


Figure 1: Parameter Performance

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.

Bias Statement: Systemic bias is noted with the 'BIASED HIGH' or 'BIASED LOW' notations. In Table 2 (Laboratory Performance Scores) of each section, systemic biases are calculated as the equivalent of *five* flagged values. See F: Laboratory Evaluations #1.

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. The 'Laboratory Performance Scores' (Table 2 in each section)

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).

D. The 'Laboratory Performance Rating' (Table 2 in each section)

The Laboratory Performance Rating is assigned according to the % Score found in Table 2 of each section. This rating is noted at the bottom of your Laboratory Proficiency Appraisal (see F: Laboratory Evaluations #1).

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

A Five-Year Historical Laboratory Performance Rating is calculated in Table 3 of each section. This rating is based on the median value of participation for the past five years or maximum ten studies.

E. Uncertainty of Assigned Values

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

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

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*.

F. Associated Laboratory Evaluations with the Final Report

1. Laboratory Proficiency Appraisal (see D for definitions of performance).
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: 0107

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
 Biogeochemical Analytical Service Lab, U of Alberta, Edmonton, AB, CA
 Capital District Health Authority, QEII Lab, Halifax, NS, CA
 Department of Fisheries & Oceans, FW 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/QLET, Montréal, QC, CA
 Environnement Québec, CEAEQ, Gouvernement du QC, QC, CA
 INRS (Université du Québec), QC, CA
 Kinectrics Inc., Toronto, ON, CA
 NIWA, Hamilton, NZ
 NRCan, CDN Forest Service, ON Region, Sault Ste. Marie, ON, CA
 Onondaga County, WEP, Syracuse, NY, US
 Ontario Ministry of Environment, Dorset, ON, CA
 Ontario Ministry of Environment, LSB, Etobicoke, ON, CA
 RMB Environmental Laboratories, Inc., Detroit Lakes, MN, US
 South FL Water Mgmt. District Chemist Lab, West Palm Beach, FL, US
 Taiga Environmental Laboratory, Yellowknife, NT, CA
 University of Maryland-Appalachian Lab, Frostburg, MD, US
 US EPA ORD Western Ecology Division, Corvallis, OR, US
 USGS National Water Quality Laboratory (NWQL), Denver, CO, US

26 Laboratories. One laboratory name unpublished.

Program Name: FPTP

Number of Labs: 28

Study Code: 0107

Range of Samples: 1 to 10

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

Lab Code	Systemic Bias			Flagged Results			% Score (Sum of Parameters Biased & Results Flagged)
	No. of Parameters Analyzed	No. of Parameters Biased	Parameters Biased (50%)	No. of Results Reported	No. of Flags Assigned	Results Flagged (50%)	
F003	1	0	0.00	10	0	0.00	0.00
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
F015	1	0	0.00	10	0	0.00	0.00
F021	1	0	0.00	10	0	0.00	0.00
F022	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
F112	1	0	0.00	10	0	0.00	0.00
F131	1	0	0.00	10	0	0.00	0.00
F158	1	0	0.00	10	0	0.00	0.00
F163	1	0	0.00	10	0	0.00	0.00
F207	1	0	0.00	10	0	0.00	0.00
F221	1	0	0.00	10	0	0.00	0.00
F233	1	0	0.00	10	0	0.00	0.00
F304	1	0	0.00	10	0	0.00	0.00
F154	1	0	0.00	10	1	5.00	5.00
F074	1	0	0.00	10	1	5.00	5.00
F011	1	0	0.00	10	1	5.00	5.00
F092	1	0	0.00	10	2	10.00	10.00
F069b	1	0	0.00	10	2	10.00	10.00
F026b	1	0	0.00	10	2	10.00	10.00
F202	1	1	50.00	10	0	0.00	50.00
F324	1	1	50.00	10	0	0.00	50.00
F026	1	1	50.00	10	1	5.00	55.00
F032	1	1	50.00	10	2	10.00	60.00
F113	1	1	50.00	10	6	30.00	80.00

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

Program Name: FFTP

Study Code: 0107

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	
	0098 Summer 2011	0099 Winter 2011	0100 Summer 2012	0101 Winter 2012	0102 Summer 2013	0103 Winter 2013	0104 Summer 2014	0105 Winter 2014	0106	0107 Winter 2015			
F003	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	Very Good
F004	60.0	5.0	0.0	10.0	50.0	0.0	50.0	65.0	0.0	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Very Good	
F011	70.0	15.0	25.0	85.0	90.0	85.0	95.0	65.0	60.0	5.0	67.5	Poor	
F015	5.0	10.0	0.0	5.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	Very Good	
F021	0.0	0.0	0.0	65.0	50.0	0.0	0.0	5.0	0.0	0.0	0.0	Very Good	
F022	15.0	10.0	55.0	5.0	0.0	10.0	0.0	5.0	5.0	0.0	5.0	Very Good	
F026	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	50.0	55.0	0.0	Very Good	
F026b	55.0	0.0	0.0	0.0		15.0	0.0	0.0	5.0	10.0	0.0	Very Good	
F032								15.0	0.0	60.0	15.0	Fair	
F036		0.0	0.0	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		25.0		0.0	0.0	Very Good	
F069b		0.0		5.0		0.0		10.0		10.0	5.0	Very Good	
F074	0.0					5.0	0.0	0.0		5.0	0.0	Very Good	
F092										10.0	10.0	Good	
F112	0.0	15.0	15.0	15.0	10.0	15.0				0.0	15.0	Fair	
F113	75.0	65.0	10.0	5.0	5.0	0.0	10.0	5.6	70.0	80.0	10.0	Good	
F131	0.0				55.0	5.0		0.0		0.0	0.0	Very Good	
F154	0.0	0.0	5.0	0.0	0.0	0.0	5.0	0.0	0.0	5.0	0.0	Very Good	
F158	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	5.0	0.0	0.0	Very Good	
F163				0.0				0.0		0.0	0.0	Very Good	
F202	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	15.0	50.0	0.0	Very Good	
F207	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	Very Good	
F221	0.0	0.0	0.0	0.0	0.0	60.0	0.0	0.0	0.0	0.0	0.0	Very Good	
F233		0.0								0.0	0.0	Very Good	
F304	0.0	0.0		10.0	15.0	55.0	55.0	5.0	5.0	0.0	5.0	Very Good	

Laboratory Performance Rating

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

Program Name: FFTP

Study Code: 0107

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
	0098 Summer 2011	0099 Winter 2011	0100 Summer 2012	0101 Winter 2012	0102 Summer 2013	0103 Winter 2013	0104 Summer 2014	0105 Winter 2014	0106	0107 Winter 2015		
F324	60.0	0.0					5.0	0.0	0.0	50.0	2.5	Very Good
Interlab Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

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	TP107-1	organic spike
2	TP107-2	no spike
3	TP107-3	no spike
4	TP107-4	organic spike
5	TP107-5	no spike
6	TP107-6	inorganic spike
7	TP107-7	inorganic spike
8	TP107-8	inorganic spike
9	TP107-9	organic spike
10	TP107-10	inorganic spike

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

2016-02-22

Study Code: 0107

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

Parameters	TP107-1 Sample 1	TP107-2 Sample 2	TP107-3 Sample 3	TP107-4 Sample 4	TP107-5 Sample 5	TP107-6 Sample 6	TP107-7 Sample 7	TP107-8 Sample 8	TP107-9 Sample 9	TP107-10 Sample 10
Total Phosphorus (mg/L P)	0.0641	0.00268	0.00127	0.608	0.208	0.295	0.125	0.110	0.126	0.417

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	TP107-1	TP107-2	TP107-3	TP107-4	TP107-5	TP107-6	TP107-7	TP107-8	TP107-9	TP107-10	
	LAB RESULT	LAB RESULT	LAB RESULT	LAB RESULT	LAB RESULT	LAB RESULT	LAB RESULT	LAB RESULT	LAB RESULT	LAB RESULT	
F003	0.066	0.003	0.001	0.613	0.208	0.293	0.126	0.11	0.128	0.41	
F004	0.065	<0.002	<0.002	0.607	0.210	0.297	0.126	0.112	0.134	0.422	
F007	0.065	0.002	<0.002	0.61	0.21	0.30	0.128	0.113	0.129	0.426	
F010	0.065	0.0024	0.0009	0.618	0.210	0.296	0.126	0.111	0.120	0.413	
F011	0.067	0.005 WH	0.003	0.604	0.209	0.292	0.128	0.109	0.125	0.404	
F015	0.0628	0.0023	<0.0005	0.611	0.208	0.299	0.129	0.113	0.128	0.416	
F021	0.065	0.003	<0.002	0.597	0.207	0.295	0.128	0.116	0.130	0.411	
F022	0.062	<0.02	<0.02	0.586	0.208	0.294	0.129	0.113	0.126	0.410	
F026	0.068	0.002	<0.001	0.637	0.214	0.336 AH	0.131	0.113	0.132	0.431	
F026b	0.067	<0.02	<0.02	0.583	0.199	0.275 WL	0.115 WL	0.110	0.121	0.407	
F032	0.065	<0.005	<0.005	0.641 WH	0.218	0.303	0.129	0.114	0.129	0.451 WH	
F036	0.067	0.003	<0.000	0.620	0.212	0.304	0.122	0.106	0.123	0.417	
F069	0.065	<0.004	<0.004	0.613	0.216	0.305	0.125	0.11	0.128	0.439	
F069b	0.067	<0.02	<0.02	0.607	0.192 WL	0.283	0.11 AL	0.106	0.122	0.399	
F074	0.063	0.001	<0.001	0.588	0.199	0.283	0.127	0.097 AL	0.123	0.411	
F092	0.063	0.003	<0.0014	0.621	0.203	0.295	0.110 AL	0.101 WL	0.118	0.426	
F112	0.0641	0.00318	0.00068	0.632	0.204	0.295	0.122	0.116	0.133	0.426	
F113	0.064	0.007 AH	<0.004	0.567 WL	0.189 AL	0.272 WL	0.114 WL	0.106	0.123	0.378 AL	
F131	0.062	<0.003	<0.003	0.605	0.207	0.295	0.125	0.111	0.127	0.415	
F154	0.060	0.0029	0.0014	0.616	0.206	0.307	0.118	0.102	0.116 WL	0.427	
F158	0.064	0.003	<0.002	0.596	0.209	0.288	0.122	0.112	0.124	0.408	
F163	0.060	<0.005	<0.005	0.601	0.202	0.292	0.123	0.109	0.123	0.411	
F202	0.067	<0.003	<0.003	0.620	0.214	0.297	0.129	0.116	0.131	0.435	
F207	0.062	0.003	<0.002	0.610	0.209	0.293	0.125	0.111	0.127	0.417	
F221	0.060	0.002	<0.001	0.594	0.205	0.285	0.127	0.109	0.126	0.414	
F233	0.0627	<0.0028	<0.0028	0.604	0.208	0.290	0.123	0.107	0.124	0.411	
F304	0.061	0.001	<0.001	0.605	0.207	0.290	0.122	0.109	0.127	0.414	
F324	0.064	<0.003	<0.003	0.617	0.219	0.311	0.130	0.114	0.133	0.436	
ASSIGNED VALUE *	0.0641	0.00268	0.00127	0.608	0.208	0.295	0.125	0.110	0.126	0.417	
R-STD DEV *	0.00258	0.000858	0.000757	0.0151	0.0059	0.0089	0.0048	0.0041	0.0048	0.0125	
ACCEPTABLE LIMITS(++)*	0.00516	0.001716	-	0.0302	0.0118	0.0178	0.0096	0.0082	0.0096	0.0250	
WARNING LIMITS(+)*	.00516-	.007001716-	.00	.0302-	.0453.0118-	.0177.0178-	.0267.0096-	.0144.0082-	.0123.0096-	.0144.0250-	.0375
ACTION LIMITS(<)*	0.00774	0.002574	-	0.0453	0.0177	0.0267	0.0144	0.0123	0.0144	0.0375	
N *	28	17	5	28	28	28	28	28	28	28	

* 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	135.5	13.5			10			Autoclaved ascorbic
F004	154.0	19.2			8			Autoclaved SnCl2
F007	166.0	18.4			9			Autoclaved ascorbic
F010	135.5	13.5			10			Flow inj. SnCl2
F011	128.5	12.8	WH		10			Autoclaved ascorbic
F015	148.5	16.5			9			Autoclaved ascorbic
F021	144.0	16.0			9			Flow inj. ascorbic
F022	102.5	12.8			8			Block dig. ICP-AES
F026	210.0	23.3			9	5.2	0.0008	Autoclaved SnCl2
F026b	57.5	7.1			8			
F032	195.0	24.3	WH	WH	8	6.7	-0.0042	UV digestion, Colour
F036	144.5	16.0			9			Autoclaved ascorbic
F069	160.0	20.0			8			Acid persulfate dige
F069b	57.5	7.1			8			Alkaline persulfate
F074	59.5	6.6			9			UV digestion
F092	95.0	10.5			9			Autoclaved ascorbic
F112	161.5	16.1			10			Block dig. ascorbic
F113	49.5	5.5			9	-8.3	0.0029	Flow inj. ascorbic
F131	104.0	13.0			8			Autoclaved ascorbic
F154	101.0	10.1			10			Autoclaved ascorbic
F158	96.0	10.6			9			Flow inj. ascorbic
F163	61.5	7.6			8			Autoclaved ascorbic
F202	193.0	24.1			8	2.0	0.0020	manual ascorbic acid
F207	125.0	13.8			9			Flow inj. ascorbic
F221	79.0	8.7			9			Flow inj. ascorbic
F233	77.0	9.6			8			EPA 365.3
F304	82.0	9.1			9			Flow inj. ascorbic
F324	193.0	24.1			8	2.1	0.0038	Autoclaved ascorbic

OVERALL AVERAGE RANK IS 13.8