

NWRI CONTRIBUTION NO. 90-111

**Annual Report for the Interlab Prairie Provinces
Quality Assurance Program, Studies PP73-84
(September 1988 to August 1989) for Inorganic
Constituents in Surface Waters.**

H. Alkema

Management Perspective PP73 - PP84

Under the auspices of the Prairie Provinces Water Board, a quality assurance program was initiated for assessing and improving the comparability of water quality data generated by the Federal Water Quality Branch Saskatoon Laboratory (ECS) and the Alberta, Saskatchewan and Manitoba provincial laboratories.

In the first phase of this program, interlab studies are conducted bi-monthly on some 40 parameters involving about 200 analytical procedures.

Twelve studies were sent out in the period from September 1988 to August 1989. These studies dealt with analyses of trace metals, major ions, nutrients, and physical parameters in natural and spiked water samples. The reference water samples are typical of the surface waters found in the various regions.

A number of key analyses were identified to be out of control and promptly brought to the attention of laboratory managers to help improve the quality of their data, and to help them to re-evaluate their internal quality control procedures. However, two laboratories had an excessive number of flagged results and generally failed to make improvements in their weak areas.

Dr. J. Lawrence
Director
Research & Applications Branch

PERSPECTIVE DE GESTION PP73 - PP84

Sur les auspices du Conseil des Eaux des Provinces de Prairie, un programme d'assurance de la qualite a ete initie pour evaluer et ameliorer la comparabilite des resultats d'analyse des eaux de surface fournis par le Division de Qualite des Eaux a Saskatoon et le Laboratoire National de Qualite des Eaux, ainsi que les laboratoires provinciaux de l'Alberta, Saskatchewan, et Manitoba.

Suivant les reglementations de projet de l'assurance de qualite de l'INRE, six etudes d'assurance de la qualite ont ete menees entre Septembre 1988 et Aout 1989 (soit une tous les deux mois). Ces etudes ont ete porte sur l'analyse des composees metalliques a l'etat de trace, des principaux ions, des substances nutritives et des parametres physiques a partir d'un eventail d'echantillons typiques.

Dans ce rapport annuel, on presente et on evalue les donnees que nous ont fournies treize laboratoires (pour la periode precisee) ayant eu a determiner 40 parametres en faisant appel a deux centaines environs de methodes analytiques differentes.

On a constate que les resultats de certaines analyses cles s'écartaient trop des marges d'erreur permises. Les directeurs de laboratoires vises en ont ete informes ce qui leur a permis de se rendre compte qu'ils doivent reevaluer les methodes de controle interne de la qualite et produire des donnees plus exactes. Cependant, il y avait de nombreuses resultats indiquees pour deux laboratoires, et il leur a manque d'ameliorer leurs techniques faibles.

Dr. J. Lawrence
Directeur
Direction de la Recherche et des Applications

ABSTRACT

This compiled report of twelve quality assurance studies evaluates the chemical analysis of surface waters for laboratories in the Prairie Provinces Quality Assurance (PPQA) program. This report, which covers the period from September 1988 to August 1989 (QA studies PP 73 to PP 84), describes the following: study design, treatment of data, performance indicators, and comments on individual laboratory performance.

A single bimonthly study consists of 4 standard reference samples of known values. Half of these samples are for trace metal analysis at two levels. The other half of the samples are analyzed for 25 major ion, nutrient and physical parameters. Altogether, 200 analysis methodologies with their analysis results are tabulated in the data summary. Since other laboratories in other QA programs analyze the same samples, all results are reported in the data summary so that statistical analyses are more accurately made.

Each monthly report, in conclusion, summarizes laboratory performance. Good performance (and compatibility) is indicated by the lack of flagged results. More than several flagged results indicates poorer performance. Results are flagged by two criteria: those that exceed the 10% or 1 Standard Deviation Test, and those that are statistical outliers according to the Grubbs' outlier test.

Generally, analyses were performed well, nevertheless, a number of key analyses were identified to be out of control and promptly brought to the attention of laboratory managers. Two laboratories in the PPQA program had an excessive number of flagged results and have generally failed to make improvements.

RESUME

Ce rapport annuel regroupant douze études sur le contrôle de la qualité (CQ) présente une évaluation de l'analyse chimique des eaux de surface pour les laboratoires des Provinces de Prairie. Dans ce rapport couvrant la période de Septembre 1988 à Août 1989 (études CQ PP73 à PP84), on décrit les aspects suivant du contrôle se la qualité: conception des études, traitement des données, indicateurs d'exactitude et commentaires sur la performance individuelle des laboratoires.

Une étude bimestrielle individuelle porte sur quatre ou cinq échantillons de référence de valeurs connues. On utilise la moitié de ces échantillons pour analyser la teneur en métaux à l'état de trace à deux niveaux. Les laboratoires utilisent l'autre moitié des échantillons pour faire rapport sur 25 principaux ions, des substances nutritives et des paramètres physiques à partir d'un éventail d'échantillons typiques. Environ 200 méthodologies d'analyse et résultats individuelles sont ensuite rassemblés dans un résumé des données. Puisque les autres laboratoires des programmes de contrôle de la qualité analysent les mêmes échantillons, on peut, grâce aux résultats présentés, faire les analyses statistiques plus précises possibles.

A la conclusion de chaque rapport bimestriel, on trouve un résumé de la performance des laboratoires. L'absence de résultats indiqués indique une bonne performance (et la comparabilité des données). S'il y a plusieurs résultats indiqués, c'est que la performance a été plus faibles. On indique aux résultats en fonction de deux critères: s'ils divergent de plus de test de 10% ou le deviation standard et, selon de Grubbs, ils sont des valeurs statistiques rejetées.

On a constaté que les résultats de certaines analyses clés s'écartaient trop des marges d'erreur permises. Les directeurs de laboratoires visés en ont été informés ce qui leur a permis de se rendre compte qu'ils doivent réévaluer les méthodes de contrôle interne de la qualité et produire des données plus exactes. Cependant, deux laboratoires ont un nombre excessif de résultats erronés (indiqués *) et n'ont jamais montré d'amélioration de leurs points faibles.



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MEMORANDUM

NOTE DE SERVICE

H.Alkema\NWRI\336-4929\ha

SECURITY - CLASSIFICATION - DE SÉCURITÉ

OUR FILE/NOTRE RÉFÉRENCE

YOUR FILE/VOTRE RÉFÉRENCE

DATE

February 20, 1989

Distribution

H. Alkema
Quality Assurance Section
National Water Research Institute
Burlington, Ontario

SUBJECT
OBJET

Prairie Provinces Quality Assurance Program (PPQA)

I have enclosed the final report for PP 73-74.

If you have any comments on this report, or any legitimate corrections to the data base, please do not hesitate to communicate them.

Harry A.

H. Alkema

DISTRIBUTION - PPWB

Dr. J.J. Bergman
Supervisor, Provincial Water Laboratory
Saskatchewan Dept. of Health

Dr. F.P. Dieken
Head, Water Analysis Research Station
Alberta Environmental Centre

Mr. E.A. Sorba
Head, Methods and Standards Section
Manitoba, Technical Services Laboratory

Dr. Wo Yuen
Sr. Research Scientist, Analytical Services
Saskatchewan Research Council

Mr. J-G. Zakrevsky
Head, Analytical Services Section
Western Region Water Quality Branch

cc. Mr. G.W. Dunn
Water Quality Specialist
Prairie Province Water Board
Regina, Saskatchewan

Mr. W.D. Gummer
Chief, Water Quality Branch
Western Region
Regina, Saskatchewan

Mr. A.S.Y. Chau
Project Chief, Quality Assurance Project
Research and Applications Branch
NWRI, CCIW
Burlington, Ontario

RESEARCH & APPLICATIONS BRANCH

FINAL REPORT

REPORT NO. RAB 89-04

PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAM

STUDIES 73 AND 74

for September and October 1988

**TRACE METALS, MAJOR IONS, NUTRIENTS
AND PHYSICAL PARAMETERS IN SURFACE WATERS**

by

H. Alkema

**Quality Assurance Section
National Water Research Institute
Burlington, Ontario**

February 1989

Introduction

As part of an on-going study, the Quality Assurance Section, NWRI in Burlington, Ontario, has been sending reference water samples bi-monthly to chemical laboratories participating in the PPWB program. This report summarizes the most recent PPWB interlaboratory quality control studies: PP 73 and 74, for the months September and October, 1988. These two studies dealt with trace metals, major ions, nutrients and physical parameters. The levels were high for metals, and low for major ions.

Study Design

Four water samples were submitted to each laboratory for chemical analyses. Two samples were submitted for trace metals analysis, while the remaining two were submitted for major ions, nutrients and some physical measurements. The following is a breakdown of the four samples:

PP 73 - Sample 1 - 125 ml, DA* for trace metals (3% HNO_3)
Sample 2 - up to 1L, major ions etc., stored at 4°C

PP 74 - Sample 3 - 1L, SE* for trace metals (0.2% HNO_3)
Sample 4 - up to 1L, major ions, etc., stored at 4°C

* for definitions see Appendix 1

Treatment of Data

Each laboratory was asked to perform only those analyses which were routine to their particular laboratory, using the general methodology guidelines listed above. Results for these analyses were recorded on report sheets provided with the QA samples. Upon receipt of the Standard Reporting Sheets, the results were tabulated for each parameter, first for each method reported, and then for all methods combined. These data, and the resulting statistics are presented in the Data Summary. (attached)

Preliminary data summaries (RAB # 88-14), including problematic results, were sent November 2 or 10, and January 26. Each laboratory was given three weeks to notify us of any errors in data transcription, compilation, or flags.

Performance Indicators

In the PPWB QA program, two types of reference samples are used for the accuracy assessment. Reference waters (RMs) and certified reference waters (CRMs) have Design Values for the stable parameters. Also, regional samples are used occasionally as reference samples. The means for the regional samples, and the Design Values (together called the comparator) are used to test each reported result for accuracy.

Percentage deviations from the comparator are used as an indicator for the laboratory head to determine the extent of the discrepancies between the laboratory result and comparator as it applies to his procedures. However, please keep in mind that at low levels, high % deviations are often seen, and may be misleading if interpreted too strictly.

A result which deviates more than the greater of 10% or 1 standard deviation from the comparator is marked with an asterik in the data tables and its value tabulated in the flags table (Table 1). Results reported with an "L" (less than) or flagged with an "R" (rejectable) are not used in the statistical calculations. Performance indicators are fully explained in Appendix II.

Comments on Laboratory Performance

Results accompanied with a 'less than' are difficult to appraise. If a design value or mean is significantly lower than the detection limit given by a particular laboratory, then that detection limit is too high. Such a result is assigned an 'HDL' and is tabulated for each laboratory in Table 1.

If, on the other hand, the detection limit reported is far lower than the mean or design value, then the use of 'less than' is clearly inadequate and the result is flagged low. The magnitude of the deviation from the mean in such a case is taken from the detection limit given.

Attached are two tables listing flagged data by laboratory (Table 1), and listing parameters for which there was a high standard deviation (Table 2). The latter (formerly called a high coefficient of variation) was generated with a new set of criteria to provide a more accurate and more consistent description of difficult to analyse parameters or levels. Your comments will be appreciated.

PPWB laboratories average number of deviations per sample was 2.7

APPENDIX I

Definitions of Types of Metals Analysis

1. DA - Direct Aspiration

Without sample pretreatment, samples are aspirated by Atomic Absorption Spectrophotometry (AAS) or Inductively Coupled (Argon) Plasma (ICAP or ICP). Standards should contain the acid equivalent of the sample.

2. SE - Code for low level analysis

Analysis is carried out by one of the following methods:

1. Solvent extraction sample concentration followed by AAS.
2. Digestion and concentration of aqueous phase followed by ICAP.
3. Digestion of aqueous phase and ICAP analysis.
4. Graphite tube (flameless) AAS.

APPENDIX II

Performance Indicators

1. Circled Results

Results are circled in the data tables when a minor deviation from the comparator has occurred. (The comparator is the design value of the reference sample, or the mean in the case of a biologically active sample.) Circled results are in general greater than or less than 10% from the comparator. At very low levels of analytes or with parameters that are difficult to analyse, a greater deviation than 10% is allowed. Under these conditions, a result is circled when it is outside one standard deviation of the comparator. These circled results, though acceptable values, are a warning to laboratory managers that the parameter analysis should be investigated.

2. Rejectable Results

Each laboratory result is statistically tested to see if it is outlying. Outlying results were caused by non random causes such as a faulty calibration or a transcription error. These outlying results, calculated by the Grubbs' procedure, and indicated in the data tables with an 'R', are noncomparable with the other data for the parameter.

3. A High Co-efficient of Variation (HCV)

Occasionally data for a parameter yields a very high relative standard deviation (RSD). When this HCV is not due to outlying values, it indicates a high variability within the data set. The data in this set is then noncomparable. In such a case, the RSD for the parameter is circled in the data tables and the parameter's noncomparability is noted in the comments.

4. High Detection Limits (HDL)

Each laboratory determines its own detection limits according to its own requirements. When major differences of detection limits occur, the result is flagged with 'HDL' in the data tables. An HDL indicates that low level analysis may not be comparable with the analyses of other laboratories.

* reference : Frank E. Grubbs, Technometrics, 1969, p. 1.

TABLE 1: PRAIRIE PROV LABORATORIES FLAGGED DATA - STUDIES PP 73-74

LAB 1	FLAGS :	SODIUM D I C SULFATE	-22% -22% -12%	MGNESIUM NITRATE	-24% -54%	CHLORIDE MGNESIUM	-21% -21%
LAB 3	FLAGS :	NONE					
LAB 4	FLAGS :	NITRATE	-11%				
LAB 6	FLAGS :	VANADIUM CADMIUM AMMONIA TOT P COBALT MOLYBNUM NITRATE SODIUM PTASSIUM	13% 11% 203% R 292% R -20% 11% 62% 12% 16%	NICKEL CONDUCT SODIUM PTASSIUM NICKEL LEAD AMMONIA TOT P	11% 14% R 56% R 24% -21% -19% 270% R 277% R	STRNTIUM TKN MGNESIUM CHROMIUM STRNTIUM TKN PH CHLORIDE	-64% R 182% 23% -26% -65% R 185% -11% -17%
	HDL :	SULFATE		CHLORIDE			
LAB 8	FLAGS :	NONE					
	HDL :	TKN		ALUMINUM		TKN	

NOTE: A VERY HIGH FREQUENCY OF FLAGGED RESULTS (OR A HIGH %) IS INDICATIVE OF POOR PERFORMANCE. ON THE OTHER HAND, LABS WITH FEW IF ANY FLAGS ARE JUDGED TO HAVE VERY GOOD PERFORMANCE.

ALSO, AN "R" FLAG INDICATES A NON COMPARABLE RESULT, THAT IS, ONE PRODUCED WITH NON RANDOM FACTORS. AN "L" FLAG INDICATES A 'LESS THAN' RESULT LOWER THAN THE COMPARATOR.

TABLE 2: HIGH STANDARD DEVIATION

PARAMETER	LEVEL
BORON	.032 PPM
D O C	1.248 PPM
SILICA	2.378 PPM
IRON	.048 PPM
BORON	.013 PPM
D O C	.425 PPM
SILICA	1.350 PPM

DATA SUMMARY

ACCIDENTS AND PROGRAMS

DATA SUMMARY - FED-PROV & PPMB QA PROGRAMS

STUDY NO. PP 73 - PP 33

PAGE 1

PAGE 2

LAB	SAMPLE 1			SAMPLE 2		
	CO TOT 5X ICP	CO TOT 5X ICP	CO TOT 5X ICP	CO EXT AAS DA	CO EXT AAS DA	CO EXT AAS DA
1	26999 IRON COMMON	27009 CO TOT 5X ICP	27011 CO TOT 5X ICP	27111 CO DIS ICP DA	27301 CO EXT AAS DA	27311 CO EXT ICP DA
2	1.89	1.141	-	-	-	-
3	1.8	-	1.1	-	-	-
6	1.94	-	-	-	-	-
8	1.98	-	-	1.16	-	-
9	1.86	-	-	1.165	-	-
10	1.86	-	-	1.2	-	-
13	1.85	-	-	-	-	-
14	1.82	-	-	-	-	-
15	2.01	-	-	-	-	-
16	1.88	-	1.09	-	-	-
MEAN	1.9342	1.1410	1.1000	1.0900	1.1425	1.1800
STD DEV	5.0998	-	-	-	1.0283	1.0600
REL STD	5.262	-	-	-	2.4	1.050
DES VAL	1.962	-	-	-	-	-
1	28301 NI EXT AAS DA	28311 NI EXT ICP DA	28321 NI EXT ICP DA	28999 NIKEL COMMON	29009 NIKEL COMMON	29011 NIKEL COMMON
2	-	-	-	1.842	0.485	-
3	-	-	-	1.94	-	-
6	-	-	-	1.94	-	-
8	-	-	-	1.97	-	-
9	-	-	-	1.85	-	-
10	-	-	-	1.86	-	-
11	1.86	2.04	-	1.86	-	-
13	-	2.04	-	2.04	-	-
14	-	1.77	-	1.77	-	-
15	-	1.77	-	1.84	-	-
16	-	1.9267	1.9400	1.9072	.4850	.5200
MEAN	1.8600	1.1401	7.3	5.1028	-	-
STD DEV	-	-	-	5.4	-	-
REL STD	-	-	-	1.890	-	-
DES VAL	-	-	-	-	-	-
1	30009 ZN TOT 5X ICP	30011 ZN TOT 5X ICP	30012 ZN TOT 5X ICP	30104 ZN DIS ICP DA	30111 ZN DIS ICP DA	30304 ZN EXT AAS DA
2	-	-	-	-	-	-
3	-	-	-	-	-	-
6	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
11	-	-	-	-	-	-
13	-	-	-	-	-	-
14	-	-	-	-	-	-
15	-	-	-	-	-	-
16	-	-	-	-	-	-
MEAN	.5110	.5000	.4960	.5230	.5030	.4950
STD DEV	-	-	-	-	.0442	.0212
REL STD	-	-	-	-	.8	4.3
DES VAL	-	-	-	-	-	-

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

PAGE 3

STUDY NO. PP 73 PP 33

LAB	SAMPLE 1												SAMPLE 2																
	38311 SR EXT ICP DA			38321 SR EXT ICP DA			42009 STRNTIUM COMMON			42011 NO TOT 5X ICP			42012 NO TOT 5X ICP			42111 NO DIS ICP DA			42121 NO EXT ICP DA			42311 NO EXT ICP DA			42999 MOIBNUM COMMON			48009 CD TOT 5X ICP	
1	-	0.910	0.910	-	3.816	-	-	-	-	-	4.1	-	-	-	3.97	-	-	3.816	0.48	-	3.97	-	-	0.54	-	-			
6	-	-	0.31 R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.1	-	-	-	-	-			
9	-	-	0.88	-	-	-	-	-	-	-	-	-	-	-	3.99	-	-	-	-	-	3.99	-	-	-	-	-			
10	0.879	-	0.83	-	-	-	-	-	-	-	-	-	-	-	3.65	-	-	3.92	-	-	3.92	-	-	-	-	-			
15	-	-	0.879	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.85	-	-	-	-	-			
16	-	-	0.8790	.9100	-	-	-	-	-	-	-	-	-	-	3.8160	4.1000	3.8500	3.8450	3.2051	-	3.9700	3.9700	-	3.9066	.4800	.5400	-	-	
MEAN	STD	DEV	REL STD	DES VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
1	-	-	0.49	-	-	-	-	-	-	-	0.489	-	-	-	0.48	3.838	-	-	-	-	-	-	-	-	-	3.838	-		
3	-	-	0.49	-	-	-	-	-	-	-	0.489	-	-	-	0.49	-	-	4.1	-	-	-	-	-	-	-	3.87	-		
6	-	-	0.49	-	-	-	-	-	-	-	0.49	-	-	-	0.49	-	-	-	-	-	-	-	-	-	-	3.87	-		
8	-	-	0.49	-	-	-	-	-	-	-	0.49	-	-	-	0.49	-	-	-	-	-	-	-	-	-	-	3.87	-		
9	0.51	-	0.460	0.460	-	-	-	-	-	-	0.460	-	-	-	0.460	-	-	-	-	-	3.78	-	-	-	-	-			
10	-	-	0.49	-	-	-	-	-	-	-	0.51	-	-	-	0.51	-	-	-	-	-	-	-	-	-	-	3.78	-		
11	-	-	0.49	-	-	-	-	-	-	-	0.51	-	-	-	0.51	-	-	-	-	-	-	-	-	-	-	3.78	-		
13	-	-	0.474	-	-	-	-	-	-	-	0.474	-	-	-	0.474	-	-	-	-	-	-	-	-	-	3.78	-			
15	-	-	0.474	-	-	-	-	-	-	-	0.483	-	-	-	0.483	-	-	3.82	-	-	-	-	-	-	3.78	-			
16	-	-	0.474	-	-	-	-	-	-	-	0.4890	-	-	-	0.4924	3.8380	4.1000	3.8200	3.8200	-	3.8400	3.8700	-	3.8700	-	-			
MEAN	STD	DEV	REL STD	DES VAL	-	-	-	-	-	-	0.4900	-	-	-	0.4920	-	-	4.0213	-	-	-	-	-	-	3.8400	-			
1	-	-	0.0000	-	-	-	-	-	-	-	0.2555	-	-	-	0.3	-	-	4.3	-	-	-	-	-	-	3.8400	-			
3	0.354	-	-1.0	-	-	-	-	-	-	-	5.2	-	-	-	4.3	-	-	4.86	-	-	-	-	-	-	3.8400	-			
7.3	-	-	-1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8400	-			
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8400	-			
3	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8400	-			
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8400	-			
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8400	-			
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8400	-			
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8400	-			
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8400	-			
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8400	-			
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8400	-			
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8400	-			
MEAN	STD	DEV	REL STD	DES VAL	-	-	-	-	-	-	1.97	-	-	-	-	-	-	1.97	-	-	2.12	-	-	1.97	-	-			
2	2.0000	-	1.9700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.1300	1.9400	2.0467	2.0400	2.0290	2.0290	2.0290	-	-			
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.0707	2.0566	2.1629	2.0400	2.0290	2.0290	2.0290	-	-			
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.9	8.0	-	-	-	-	-	2.040	-		

DATA SUMMARY - FED-PROV & PPMB QA PROGRAMS

STUDY NO. PP 73 FP 33

SAMPLE 2												SAMPLE 3											
LAB	07016 TKN BLK INDOPHE	07021 TKN DIG BER	07023 TKN DIG INDO	07090 NO3+NO2 AA HYD COMMON	07110 NO3+NO2 AA2 CD	07111 NO3+NO2 DIS SPEC	07121 NO3+NO2 AA CD	07390 NITRATE COMMON	07500 NH3 TOT AA BERT	07540 NH3 TOT AA SAL	LAB	07016 TKN BLK INDOPHE	07021 TKN DIG BER	07023 TKN DIG INDO	07090 NO3+NO2 AA HYD COMMON	07110 NO3+NO2 AA2 CD	07111 NO3+NO2 DIS SPEC	07121 NO3+NO2 AA CD	07390 NITRATE COMMON	07500 NH3 TOT AA BERT	07540 NH3 TOT AA SAL		
1	-	-	0.08	-	0.08	-	-	0.29	-	-	1	-	-	-	0.29	-	-	0.05L	-	-	-	-	
2	-	-	-	-	0.058	-	-	0.30	-	-	2	-	-	-	0.30	-	-	0.05L	-	-	-	-	
3	-	-	-	-	-	0.4 *	0.29	-	0.252	-	3	-	-	-	0.252*	-	-	-	-	-	-	-	
4	-	-	-	-	-	-	-	-	0.265	-	4	-	-	-	0.265	-	-	-	-	-	-	-	
5	-	-	-	-	-	-	-	-	-	-	5	-	-	-	0.26	-	-	-	-	-	-	-	
6	-	-	-	-	-	-	-	-	0.26	-	6	-	-	-	0.31	-	-	-	-	-	-	-	
7	-	-	-	-	-	-	-	-	-	-	7	-	-	-	0.31	-	-	-	-	-	-	-	
8	-	-	-	-	-	-	-	-	-	-	8	-	-	-	0.30	-	-	-	-	-	-	-	
9	-	-	-	-	-	-	-	-	-	-	9	-	-	-	0.30	-	-	-	-	-	-	-	
10	-	-	-	-	-	-	-	-	-	-	10	-	-	-	0.30	-	-	-	-	-	-	-	
11	-	-	-	-	-	-	-	-	-	-	11	-	-	-	0.30	-	-	-	-	-	-	-	
12	-	0.09	-	-	-	-	-	-	-	-	12	-	-	-	0.24 *	-	-	-	-	-	-	-	
13	-	-	-	-	-	-	-	-	-	-	13	-	-	-	0.25	-	-	0.25 *	-	-	-	-	
14	-	-	-	-	-	-	-	-	-	-	14	-	-	-	0.30	-	-	0.30 *	-	-	-	-	
15	-	-	-	-	-	-	-	-	-	-	15	-	-	-	0.30	-	-	0.30 *	-	-	-	-	
16	-	-	-	-	-	-	-	-	-	-	16	-	-	-	0.28	-	-	0.28	-	-	-	-	
MEAN	.0900	.0800	-	-	-	-	-	-	-	-	MEAN	.0800	.0700	-	-	-	-	-	-	-	-	-	
STD DEV	-	-	-	-	-	-	-	-	-	-	STD DEV	.1449	.3000	-	-	-	-	-	-	-	-	-	
REL STD	-	-	-	-	-	-	-	-	-	-	REL STD	.3000	.2763	-	-	-	-	-	-	-	-	-	
DES VAL	-	-	-	-	-	-	-	-	-	-	DES VAL	.3000	.2763	-	-	-	-	-	-	-	-	-	
MEAN	.07555	.07557	NH3 DIS AA PHEN	NH3 DIS AA INDO	.07562	NH3 DIS AA EDTA	.07563	NH3 DIS AA INDO	.07565	NH3 DIS AA INDO	MEAN	.07590	NH3 DIS AA AUTO	NH3 DIS AA TURP	.07600	NH3 DIS AA SUL	NH3 DIS AA CALCD	NH3 DIS AA UV	NH3 DIS AA UV	NH3 DIS AA UV	NH3 DIS AA EDTA	NH3 DIS AA UV	NH3 DIS AA EDTA
STD DEV	-	-	-	-	-	-	-	-	-	-	STD DEV	.0001	-	-	.0001	-	-	.029	-	-	-	-	-
REL STD	-	-	-	-	-	-	-	-	-	-	REL STD	-	-	-	-	-	-	.0329	-	-	-	-	-
DES VAL	-	-	-	-	-	-	-	-	-	-	DES VAL	-	-	-	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	
2	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	
3	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	
4	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	
5	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	
6	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	
7	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	
8	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	
9	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	
10	-	0.004	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	
11	-	0.010L	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	
12	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	
13	-	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-	-	-	
14	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-	-	-	
15	-	0.007R	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-	-	
16	-	-	-	-	-	-	-	-	-	-	16	-	0.1 L	0.1 L	-	-	-	-	-	-	-	-	
MEAN	.0040	-	-	-	-	-	-	-	-	-	MEAN	.0010	-	-	-	-	-	-	-	-	-	-	
STD DEV	-	-	-	-	-	-	-	-	-	-	STD DEV	-	-	-	-	-	-	-	-	-	-	-	
REL STD	-	-	-	-	-	-	-	-	-	-	REL STD	-	-	-	-	-	-	-	-	-	-	-	
DES VAL	-	-	-	-	-	-	-	-	-	-	DES VAL	-	-	-	-	-	-	-	-	-	-	-	
MEAN	.07790	.09100	TNN DIS COMMON	COL SP	.09103 PDIS SP	.09105 PDIS SP	.09106 PDIS SP	.09107 PDIS SP	.09108 PDIS SP	.09115 PDIS IC	MEAN	.09107 PDIS SP	NITRATE	FLUORIDE	.09190 TIC	COMMON	POT TITR	ALKALINITY	ALKALINITY	POT TITR	ALKALINITY	POT TITR	
STD DEV	-	-	-	-	-	-	-	-	-	-	STD DEV	.29	-	-	.05	L	0.05 L	0.05 L	39.8	-	-	-	
REL STD	-	-	-	-	-	-	-	-	-	-	REL STD	.329	-	-	.03	L	0.03 L	0.03 L	-	-	-	-	
DES VAL	-	-	-	-	-	-	-	-	-	-	DES VAL	.331	-	-	.05 L	-	0.05 L	0.05 L	-	-	-	-	
1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	
2	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	
3	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	
4	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	
5	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	
6	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	
7	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	
8	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	
9	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	
10	-	0.32	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	
11	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	
12	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	
13	-	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-	-	-	
14	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-	-	-	
15	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-	-	
16	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-	-	-	-	
MEAN	.3180	.1000	-	-	-	-	-	-	-	-	MEAN	.0700	-	-	.0400	-	-	.0580	42.5300	43.0000	42.0000	42.8284	
STD DEV	5.2	5.164	-	-	-	-	-	-	-	-	STD DEV	5.331	-	-	.0500	-	-	.0277	3.71	6.7	-	-	
REL STD	-	5.2	-	-	-	-	-	-	-	-	REL STD	5.331	-	-	.0500	-	-	.0277	3.71	6.7	-	-	
DES VAL	-	.331	-	-	-	-	-	-	-	-	DES VAL	.331	-	-	.0500	-	-	.0277	3.71	6.7	-	-	

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

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LAB	SAMPLE 1			SAMPLE 2			SAMPLE 3			
	ALKLN ^T	ALKLN ^T TIT CON	PH COMMON	ALKLN ^T PH	ALKLN ^T COMMON	HARDNS ^S CALC'D	HARDNS ^S TITR'N	HARDNS ^S CALC'D	HARDNS ^S TITR'N	HARDNS ^S COMMON
1	-	-	43.8	7.2	7.2	41.8	-	-	41.8	-
2	40.3	-	39.8	7.3	7.3	42.8	-	-	42.8	-
3	-	-	40.3	7.9	7.9	42.8	-	-	43.8	-
4	-	-	40.9	7.9	7.9	42.8	-	-	43.8	-
5	-	-	44.0	7.8	7.8	42.8	-	-	43.8	-
6	-	-	44.3	7.0	7.0	42.8	-	-	43.8	-
7	-	-	40.0	7.85	8.0	45.4	-	-	45.4	-
8	-	-	40.0	7.85	7.85	44.8	-	-	44.8	-
9	-	-	43.0	7.65	7.65	42.8	-	-	42.8	-
10	-	41.	41.1	7.66	7.66	43.8	-	-	43.8	-
11	-	-	41.1	7.6	7.6	43.8	-	-	43.8	-
12	-	-	40.3	7.9	7.9	40.4	-	-	40.4	-
13	-	-	48.3	*	7.3	50.4	-	-	50.4	*
14	-	-	42.3	*	7.62	40.4	-	-	40.4	*
15	-	-	42.3	*	7.62	40.4	-	-	40.4	*
16	-	-	40.7	7.7	7.48	41.5	-	-	41.5	-
MEAN	40.3000	41.0000	42.2400	7.6181	7.6181	44.0750	46.7000	43.8000	44.6500	1.2400
STD DEV	-	-	42.6354	7.2918	7.2918	43.6702	43.8385	43.8000	43.1805	0.849
REL STD	-	-	6.2	3.8	3.8	8.3	3.9	-	7.1	6.8
DES VAL	-	-	41.188	-	7.666	-	-	-	44.697	-
MEAN	1.0000	1.2750	1.1500	1.2600	1.2600	1.2700	1.2757	2.8800	3.4000	2.7650
STD DEV	-	16.2	16.2	-	-	1.0	1.749	5.1697	-	3.0915
REL STD	-	-	-	-	-	-	1.278	5.9	-	3.3
DES VAL	-	-	-	-	-	-	-	-	-	-

PAGE 6

DATA SUMMARY - PED-PROV & PPWB QA PROGRAMS

STUDY NO.: PP 73 - PP 33

SAMPLE 2

PAGE 7

LAB	12111 MG DIS ICP	12303 MG UF AAS AUT	12311 MG EXT ICP	12990 MHNESIUM COMMON	14102 SILICA ANSA AAA	14105 SILICA MOLY AAA	14106 SILICA MOLY AA	14107 SILICA MOLY A	14111 SILICA ICP DA	14112 SILICA DCP DA	14190 SILICA COMMON	15313 T P ACL AA SNCL	15315 T P	
1	-	-	-	2.1 *	2.1 *	2.1 *	2.1 *	2.1 *	2.4	-	-	2.4	-	-
2	-	-	-	2.1	2.1	2.1	2.1	2.1	-	-	-	2.4	-	-
3	-	-	-	2.1	2.1	2.1	2.1	2.1	-	-	-	2.4	-	-
5	-	-	-	3.00	3.00	3.00	3.00	3.00	-	-	-	2.4	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	3.20	-	-	-	-	-	-	-	-	-	-	-	-	-
14	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	3.0000	2.1000	3.0000	2.7900	3.5000	2.3667	2.4000	2.4000	1.7400	2.4400	2.3689	-	-	-
STD DEV	9.2828	9.4	-	1.1.6	1.1.6	6.5	6.5	-	61.8	-	64.02	-	-	-
REL STD	-	-	-	-	-	-	-	-	-	-	27.378	-	-	-
VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LAB	15400	15401 T P UV AA ASC	15406 T P UF AA ASC	15409 T P BLK AA ASC	15413 T P ACL AA SNCL	15421 TOT P BLK DIG ASC	15490 SO4 DIS AUTO BA	16304 SO4 DIS AA MTB	16306 SO4 UF AA MTB	16307 SO4 DIS T C	16310 SO4 DIS AA CALM	16311 SO4 DIS IC	-	-
1	-	-	-	-	-	0.001	0.001	0.001	3.4	-	3.1	-	-	-
2	-	-	-	-	-	0.001L	0.001L	0.001L	-	-	3.1	-	-	-
3	-	-	-	-	-	0.003	0.003	0.003	-	-	3.1	-	-	-
4	-	-	-	-	-	-	0.004	0.004	-	-	3.1	-	-	-
5	-	-	-	-	-	-	0.010 R	0.010 R	10 L	3.3	-	-	-	-
6	-	-	-	-	-	-	-	0.010	-	-	3.3	-	-	-
7	-	-	-	-	-	-	-	0.005L	-	3.4	-	-	3.2	3.5
8	-	-	-	-	-	-	-	0.003	-	3.3	-	-	-	-
9	-	-	-	-	-	-	-	0.001	-	4.71 R	-	-	3.07	-
10	-	-	0.010L	-	-	-	-	0.014 *	-	3.	-	-	-	-
11	-	-	-	-	-	-	-	0.2 L	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	.0140	.0045	.0039	.0010	.0030	.0010	.0051	.4000	3.1000	3.1233	3.5000	-	-	-
STD DEV	.001	.0039	.001	.0049	.0030	.0010	.0049	.0049	.0049	.0049	.00681	-	-	-
REL STD	-	-	-	-	-	-	-	-	-	-	5.4	-	-	-
VAL	-	-	-	-	-	-	-	-	-	-	2.2	-	-	-

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

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SAMPLE 2

LAB	SULFATE COMMON	17203 CL DIS AA FE	17204 CL DIS AG TIT	17206 CL DIS AA HG	17208 CL DIS AA HG	17209 CL DIS I C	17210 CL DIS TIT CON	17211 CL DIS IC	17990 CHLORIDE COMMON	19001 K TOT AAS	19005 K TOT ICP	19008 K TOT DCP	19102 K DIS AAS
1	3.1	1.	-	-	-	1.2	-	-	1.2 *	-	-	-	-
2	3.1	-	-	-	1.1	-	-	-	1.2	-	-	-	-
3	3.1	L	2.	L	1.1	-	-	-	1.1	-	-	-	-
4	10.3	1.3	-	-	1.30	-	-	-	1.1	-	-	-	0.6
5	7.3	-	-	-	-	-	-	-	1.3	-	-	-	0.50
6	8.9	-	-	-	-	-	-	-	1.30	-	-	-	-
7	3.2	-	-	-	-	-	-	-	1.2	-	-	-	-
8	3.5	-	-	-	-	-	-	-	1.2	-	-	-	-
9	10.9	-	-	-	-	-	-	-	1.2	-	-	-	-
10	11.1	-	-	-	-	-	-	-	1.2	-	-	-	-
11	11.2	-	-	-	-	-	-	-	1.2	-	-	-	-
12	3.3	R	-	-	-	-	-	-	1.3	-	-	-	-
13	4.71	-	-	-	-	-	-	-	1.34	-	-	-	-
14	3.07	-	-	-	-	-	-	-	1.34	-	-	-	-
15	3.2	-	-	-	-	-	-	-	1.34	-	-	-	-
16	2.	*	-	-	-	-	-	-	1.34	-	-	-	-
MEAN	3.1882	1.1500	-	-	1.2500	1.2000	1.2800	1.2000	1.2309	.4800	.4950	.4850	.5500
STD DEV	3.1659	1.2121	-	-	8.1000	-	5.6	-	8.1044	-	8.071	-	8.0707
REL STD	5.2	18.4	-	-	8.0	-	-	-	8.5	-	1.4	-	12.9
DES VAL	3.273	-	-	-	-	-	-	-	8.267	-	-	-	-
LAB	19103 K DIS FLX PH	19105 K DIS AAS DA	19106 K DIS AAS LI	19107 K DIS FLX PH	19111 K DIS HNO3 AA	19301 K EXT HNO3 AA	19990 PTASSIUM COMMON	20005 CA TOT ICP	20007 CA TOT ICP	20050 CA DIS AAS NO	20100 CA DIS CALC'D	20103 CA DIS AAS	20108 CA DIS UF
1	0.43	-	-	-	0.48	-	-	-	0.43	-	-	-	-
2	0.43	-	-	-	-	-	-	-	0.48	-	-	-	13.1
3	0.5	-	-	-	-	-	-	-	0.5 *	-	-	-	-
4	-	-	-	-	-	-	-	-	0.50	-	-	-	-
5	-	-	-	-	-	-	-	-	0.47	-	-	-	-
6	-	-	-	-	-	-	-	-	0.47	-	-	-	-
7	-	-	-	-	-	-	-	-	0.47	-	-	-	-
8	-	-	-	-	-	-	-	-	0.47	-	-	-	-
9	-	-	-	-	-	-	-	-	0.47	-	-	-	-
10	-	-	-	-	-	-	-	-	0.47	-	-	-	-
11	0.5	-	-	-	-	-	-	-	0.49	-	-	-	-
12	0.4	-	-	-	-	-	-	-	0.49	-	-	-	-
13	0.42	-	-	-	-	-	-	-	0.49	-	-	-	-
14	0.43	-	-	-	-	-	-	-	0.49	-	-	-	-
15	-	0.43	-	-	-	-	-	-	0.49	-	-	-	-
16	-	-	0.43	-	-	-	-	-	0.49	-	-	-	-
MEAN	.4575	.4300	.5000	.4800	.4300	.4700	.4797	.13.3050	.12.1000	11.7000	13.6000	12.7000	13.1000
STD DEV	.0506	-	-	-	-	-	-	-	.0467	2.1	-	-	-
REL STD	11.1	-	-	-	-	-	-	-	.0484	-	-	-	-
DES VAL	-	-	-	-	-	-	-	-	.0484	-	-	5.2	-

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DATA SUMMARY - PED-PROV & PPWB QA PROGRAMS

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SAMPLE 2

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LAB	20110 CA DIS AAS AUT	20111 CA DIS ICP	20311 CA EXT ICP	20990 CALCIUM COMMON
1	13.7	-	-	13.7
2	-	-	-	13.3
3	-	-	-	13.6
4	-	-	-	12.8
5	-	-	-	12.7
6	-	-	-	13.3
7	-	-	-	13.5
8	-	-	-	13.0
9	-	-	-	13.5
10	-	-	-	13.1
11	-	-	-	12.9
12	-	-	-	14.9 *
13	-	-	-	14.9 *
14	-	-	-	14.9 *
15	-	-	-	14.7 *
16	-	-	-	12.1
MEAN	12.8500	14.8000	13.0000	13.1079
STD DEV	1.2121	1.4114	-	1.9068
REL STD	1.7	1.0	-	6.9
DES VAL	-	-	-	12.690

DATA SUMMARY

FEDERAL-PROVINCIAL & PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAMS

STUDY NO.	PP 74	PP 34	DATE:	DATE: 01/10/88		DUE DATE: 31/10/88	TRACE METALS S/E. (IN 0.2% HNO3)	PAGE 10
				SAMPLE	3 SPIKED SAMPLE.			
13009	13105	13111	13302	13311	13322	13999	23002	23011
LAB	AL TOT	AL DIS	AL EXT	AL EXT	AL EXT	ALUMINUM	V TOT	V TOT
	5X ICP	AAS GF	AAS DA	AAS SE	ICP DA	COMMON	5X ICP	5X DCP
1	-	-	-	-	-	-	-	-
2	0.059	-	-	0.048	-	0.048	0.021	-
3	0.054	-	-	0.049	-	0.049	0.020	-
6	-	-	0.2	-	-	0.054	0.02	-
8	-	0.05	-	-	-	0.2	-	-
9	-	0.06	-	-	-	0.05	-	0.022
10	-	0.032	-	-	0.011R	0.06*	-	0.024
14	-	-	-	-	-	0.032*	-	-
15	-	-	-	-	-	0.011R	-	-
16	-	-	-	-	0.092R	0.092R	-	0.029R
MEAN	0.065	0.0320	0.0550	-	-	0.0488	0.0190	-
STD DEV	0.035	-	0.071	-	0.0007	0.0093	0.0057	-
REL STD	6.3	-	12.9	-	1.5	-	3.4	-
DES VAL	-	-	-	-	-	19.1	-	6.1
MEAN	0.0200	-	0.011	-	-	-	-	-
STD DEV	-	0.0117	-	-	-	-	-	-
REL STD	-	7.9	-	-	-	-	-	-
DES VAL	-	0.021	-	-	-	-	-	-
MEAN	0.020	-	0.011	-	-	-	-	-
STD DEV	-	0.0117	-	-	-	-	-	-
REL STD	-	7.9	-	-	-	-	-	-
DES VAL	-	0.021	-	-	-	-	-	-
MEAN	0.020	-	0.011	-	-	-	-	-
STD DEV	-	0.0117	-	-	-	-	-	-
REL STD	-	7.9	-	-	-	-	-	-
DES VAL	-	0.021	-	-	-	-	-	-
MEAN	0.020	-	0.011	-	-	-	-	-
STD DEV	-	0.0110	-	-	-	-	-	-
REL STD	-	5.5	-	-	-	-	-	-
DES VAL	-	0.020	-	-	-	-	-	-

DATA SUMMARY - FED-PROV & PPMB QA PROGRAMS

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PAGE 11

SAMPLE

DATA SUMMARY - PED-PROV & PPWB QA PROGRAMS

אנו מודים לך 34

PAGE 12 SAMPLE 3

30999 ZINC COMMON
30311 ZN EXT TCP DA

38301	38311	38999	42009	42011	42012	42111
SR EXT	SR EXT	STRENTIUM	MO TOR	NO TOR	NO TOR	MO DIS
AAS DA	ICP DA	COMMON	5X ICP	5X ICP	5X DCP	ICP DA

	MEAN	STD DEV	REL STD DES VAL
1	-	-	-
2	-	-	-
3	-	-	-
6	0.04	-	-
8	-	-	-
9	-	-	-
10	-	-	-
11	-	-	-
14	0.032	-	-
15	-	-	-
16	-	-	-
	.0369	.0057	.0065
			19.3 .034

LAB	42311 NO EXT ICP DA	42999 MOLIBDUM COMMON	480 CD AAS	0.	.
1	-	0.017			
2	-	0.018			
3	-	0.02*			
6	-	0.02*			
8	-	0.021*			
9	-	0.021*			
10	-	0.03 R	0.03 R		
11	-	0.03	0.018		
15	0.03	R	0.018		
16	-				
MEAN	-			.0190	
STD	-			.0015	
DEV	-			8.2	
REL STD	-				
RES VAL	-				

	480112	481111	48302	48309	48999	56009	56011
	CD TOT	CD DIS	CD EXT	CD EXT	CADMIUM	BA TOT	BA TOT
	5X DCP	ICP DA	AAS SE	AAS GF	COMMON	5X ICP	5X ICP
-	-	-	0 -0.21	-	0 -0.021	0 -0.023	-
-	-	-	-	-	0 -0.021	0 -0.023	-
-	-	-	-	0 -0.22	0 -0.022	-	-
-	-	-	-	-	0 -0.022	-	-
-	-	-	-	-	0 -0.019	-	-
-	-	-	-	-	0 -0.020	-	-
-	-	-	-	0 -0.023	0 -0.023	-	-
-	-	-	-	-	0 -0.017*	-	-
0.019	-	0 -0.20	-	-	-	-	-
-	-	-	-	-	-	-	-
0.017	-	-	-	-	-	-	-
.0170	.0190	-	.0205	.0225	.0206	.0230	.0222
-	-	.0007	.0007	.0017	.0000	.0000	-
-	-	3 -4	3 -4	8 -3	8 -3	-1 -0	-
-	-	-	-	-	.021	-	-

LAB	56012 BA 5X	TOT DIS ICP DA	56111 BA DIS ICP DA	563 BA ICP
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
6	-	-	-	-
8	-	-	-	-
9	-	-	-	-
10	-	-	-	-
11	-	-	-	-
14	-	-	-	-
15	-	-	-	-
16	-	-	-	-
MEAN	.0330	.0333	.0225	.0225
STD DEV	-	-	.0035	.0035
REL STD	-	-	-	-
DES VAL	-	-	15.7	-

	82009	82011	82012	82104	82302	82309	82999
PB TOT	PB TOT	PB TOT	PB DIS	PB EXT	PB EXT	PB EXT	LEAD
5X ICP	5X ICP	5X ICP	AAS GF	AAS SE	AAS GF	AAS GP	COMMON
-	-	-	-	0.028	-	0.028	-
-	-	-	-	0.026	-	0.026	-
0.026	0.021	0.021	-	-	-	0.021	-
-	-	-	-	-	-	0.029	-
-	-	-	-	-	-	0.026	-
-	-	-	-	0.025	-	0.025	-
-	-	-	0.017	-	-	0.017	-
-	-	-	-	-	-	0.005L	-
-	-	-	0.040R	-	-	-	0.005L
-	-	-	-	-	-	0.040	-
.0260	.0210	.0210	.0170	.0263	.0290	.0241	.0033
-	-	-	-	.0015	-	-	.0033
-	-	-	-	5.8	-	15.8	.026

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO. PP 74 EP 34

SAMPLE 4

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DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.: PP 74 - FP 34

SAMPLE 4

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DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO. PP 74 PP 34

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LAB	SAMPLE 4				SAMPLE 4			
	12107 NG DIS AAS AUT	12111 NG DIS ICP	12303 NG UP AAS AUT	12311 NG EXR ICP	12990 MGSUM COMMON	14102 SILICA ANSA AA	14105 SILICA MOLY AA	14111 SILICA ICP DA
1	2.8	-	2.3	-	2.3 * 2.8	2.1	-	1.4
2	-	-	-	-	2.8	-	-	-
3	-	-	-	-	2.82	1.3	1.37	-
4	-	-	-	-	2.84	-	-	-
5	-	-	-	3.07	-	-	-	-
6	-	-	-	-	3.07	1.2	-	-
7	-	-	-	-	3.07	-	-	-
8	-	-	-	-	2.89	1.27	-	-
9	-	-	-	-	2.9	1.4	-	-
10	-	-	-	-	2.80	-	-	-
11	-	-	-	-	2.80	-	-	-
12	-	3.2	-	-	2.80	-	-	-
13	-	-	-	-	2.80	-	-	-
14	-	3.0	-	-	2.80	-	-	-
15	-	-	-	-	2.49 *	-	-	-
16	-	-	-	-	2.49	-	-	-
MEAN	2.8000	3.1000	2.3000	3.0700	2.8057	2.1000	1.2925	1.3700
STD DEV	-	3.1414	4.6	-	2.326	-	0.830	1.4000
REL STD	-	-	-	-	8.2	-	6.4	-
DES VAL	-	-	-	-	8.915	-	-	-
LAB	15315 TP UV AA SNCL	15401 TP UF AA ASC	15406 TP BLK AA ASC	15409 TP BLK AA ASC	15413 TP ACL AA SNCL	15421 TOT P DIG ASC	15490 TOT BLK COMMON	16304 SO4 DIS AUTO BA
1	-	-	-	-	0.001L	0.001L	0.001L	0.001L
2	-	-	-	-	0.001L	0.001L	0.001L	0.001L
3	-	-	-	0.003L	0.002	0.002	0.002	0.002
4	-	-	-	-	-	0.003L	-	-
5	-	-	-	0.013	0.02 R	0.013	0.013	0.013
6	-	-	-	-	0.013	0.013	0.013	0.013
7	-	0.010L	-	-	-	0.010L	-	-
8	-	-	-	-	-	0.005L	-	-
9	-	-	-	-	-	0.003L	-	-
10	-	-	-	-	-	0.001	-	-
11	-	-	-	-	-	-	0.001	-
12	-	-	-	-	-	-	0.001	-
13	-	-	-	-	-	-	0.001	-
14	-	-	-	-	-	-	0.001	-
15	-	-	-	-	-	-	0.001	-
16	-	0.2 L	-	-	-	0.2 L	-	-
MEAN	-	-	-	-	-	0.0020	-	0.0020
STD DEV	-	-	-	-	-	-	0.0053	0.0053
REL STD	-	-	-	-	-	-	1.3435	1.3435
DES VAL	-	-	-	-	-	-	4.5	4.5

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DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO. - PP 74 - FP 34

SAMPLE 4

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DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO. PP 74 PP 34

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SAMPLE 4

LAB	20110 CA DIS AAS AUT	20111 CA DIS ICP	20311 CA EXT ICP	20990 CALCIUM COMMON
1	13.5	-	-	13.5
2	13.3	-	-	13.3
3	-	-	-	14.0
4	-	-	-	13.9
5	-	-	-	14.4
6	-	-	-	13.2
7	-	-	-	14.0
8	-	-	-	14.0
9	-	-	-	14.5
10	-	-	-	13.85
11	-	-	-	13.85
12	-	-	-	14.9
13	-	-	-	14.9
14	-	-	-	12.3 *
15	-	-	-	15.5
16	-	-	-	12.5 *
MEAN	13.4000	15.2000	14.0000	13.7750
STD DEV	1.414	1.4243	-	1.8907
REL STD	1.1	2.8	-	6.5
DES VAL	-	-	-	14.131
DATES RECEIVED	1 88/10/11 5 89/01/24 9 88/01/07 14 89/01/23	2 88/11/01 6 88/01/27 10 88/10/28 15 88/11/03	3 88/10/24 6 88/01/18 11 88/10/25 16 88/10/06	4 88/11/01 7 88/01/27 12 88/12/30 13 88/11/04

NOTE: ALL CONCENTRATION UNITS ARE EXPRESSED IN MG/L OF EACH ELEMENT IN THE EXCEPTIONS BEING:
 COLOUR IN RELATIVE UNITS, CONDUCTIVITY IN USEC/CM, TURBIDITY IN NTU OR MU, NITROGEN ANALYSES IN %N, ALKALINITY & HARDNESS IN CACO₃, SILICA IN SIO₂, AND SULFATE IN SO₄.



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du Canada

MEMORANDUM

NOTE DE SERVICE

H.Alkema\NWRI\336-4929\ha

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DATE

March 15, 1989

Distribution

H. Alkema
Quality Assurance Section
National Water Research Institute
Burlington, Ontario

SUBJECT
OBJET Prairie Provinces Quality Assurance Program (PPQA)

I have enclosed the final report for PP 75-76.

If you have any comments on this report, or any legitimate corrections to the data base, please do not hesitate to communicate them.

Harry A.

H. Alkema

DISTRIBUTION - PPWB

**Dr. J.J. Bergman
Supervisor, Provincial Water Laboratory
Saskatchewan Dept. of Health**

**Dr. F.P. Dieken
Head, Water Analysis Research Station
Alberta Environmental Centre**

**Mr. E.A. Sorba
Head, Methods and Standards Section
Manitoba, Technical Services Laboratory**

**Dr. Wo Yuen
Sr. Research Scientist, Analytical Services
Saskatchewan Research Council**

**Mr. J-G. Zakrevsky
Head, Analytical Services Section
Western Region Water Quality Branch**

**cc. Mr. G.W. Dunn
Water Quality Specialist
Prairie Province Water Board
Regina, Saskatchewan**

**Mr. W.D. Gummer
Chief, Water Quality Branch
Western Region
Regina, Saskatchewan**

**Mr. A.S.Y. Chau
Project Chief, Quality Assurance Project
Research and Applications Branch
NWRI, CCIW
Burlington, Ontario**

RESEARCH & APPLICATIONS BRANCH

FINAL REPORT

REPORT NO. RAB 89-08

PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAM

STUDIES 75 AND 76

for November and December 1988

**TRACE METALS, MAJOR IONS, NUTRIENTS
AND PHYSICAL PARAMETERS IN SURFACE WATERS**

by

H. Alkema

**Quality Assurance Section
National Water Research Institute
Burlington, Ontario**

March 1989

Introduction

As part of an on-going study, the Quality Assurance Section, NWRI in Burlington, Ontario, has been sending reference water samples bi-monthly to chemical laboratories participating in the PPWB program. This report summarizes the most recent PPWB interlaboratory quality control studies: PP 75 and 76, for the months November and December, 1988. These two studies dealt with trace metals, major ions, nutrients and physical parameters. The levels were from medium to high.

Study Design

Four water samples were submitted to each laboratory for chemical analyses. Two samples were submitted for trace metals analysis, while the remaining two were submitted for major ions, nutrients and some physical measurements. The following is a breakdown of the four samples:

PP 75 - Sample 1 - 125 ml, high level* for trace metals (3% HNO₃)
Sample 2 - up to 1L, major ions etc., stored at 4°C

PP 76 - Sample 3 - 1L, low level* for trace metals (0.2% HNO₃)
Sample 4 - up to 1L, major ions, etc., stored at 4°C

* for definitions see Appendix 1

Treatment of Data

Each laboratory was asked to perform only those analyses which were routine to their particular laboratory, using the general methodology guidelines listed above. Results for these analyses were recorded as required by the Standard Report Sheets provided with the QA samples. Submitted results were tabulated for each parameter, first for each method reported, and then for all methods combined. These data, and the resulting statistics are presented in the Data Summary. (attached)

Preliminary data summaries (RAB # 89-01), including problematic results, were sent January 4, and February 2. Each laboratory was given three weeks to notify us of any errors in data transcription, compilation, or flags.

Performance Indicators

In the PPWB QA program, two types of reference samples are used for the accuracy assessment. Reference waters (RMs) and certified reference waters (CRMs) have Design Values for the stable parameters. Also, regional samples are used occasionally as natural reference samples. The means for the regional samples, and the Design Values for the reference waters are used to test each reported result for accuracy.

Percentage deviations from the reference value are used as an indicator for the laboratory head to determine the extent of the discrepancies between the laboratory result and reference value. However, please keep in mind that at low levels, high % deviations are often seen, and may be misleading if interpreted too strictly.

A result which deviates more than the greater of 10% or 1 standard deviation from the reference value is marked with an asterisk in the data tables and its value tabulated in the flagged data table (Table 1). Results reported with an "L" (less than) or flagged with an "R" (rejectable) are not used in the statistical calculations. Performance indicators are fully explained in Appendix II.

Comments on Laboratory Performance

Results accompanied with a 'less than' are difficult to appraise. If a design value or mean is significantly lower than the detection limit given by a particular laboratory, then that detection limit is too high. Such a result is assigned an 'HDL' and is tabulated for each laboratory in Table 1.

If, on the other hand, the detection limit reported is far lower than the mean or design value, then the use of 'less than' is clearly inadequate and the result is flagged low. The magnitude of the deviation from the mean in such a case is taken from the detection limit given.

Attached are two tables listing flagged data by laboratory (Table 1), and listing parameters for which there was a high standard deviation (Table 2). Formerly called a high coefficient of variation, the standard deviation is generated with standardized criteria that are included with the automated flagging routine. These automated criteria have been in use since March 1988 (Study PP 67), and should provide a more accurate and consistent listing of the difficult to analyse parameters or levels. A listing of the criteria used to indicate high deviation of analysis is available on request. Your comments would be appreciated.

A Unique Problem with Chloride

In Study 76, sample 4, a high standard deviation occurred for chloride and two different means could be observed. One laboratory reported that a high level of bromide would interfere with colorimetric methods. It is assumed in this report that the Ion Chromatography (IC) results are correct, and for this reason the laboratories with colorimetric methodologies reporting high values (310 ppm versus 125) are flagged high. Since the above mentioned sample is a natural prairie water from the Qu'Appel River, those laboratories analysing this type of water need alternate in-house QC methodologies to check for this contingency. The ion balance check fails in this case.

PPWB laboratories average number of deviations per sample was 1.5

TABLE 1: PRAIRIE PROV LABORATORIES FLAGGED DATA - STUDIES PP 75-76

LAB 1	FLAGS :	D O C	1020% R	D I C	-22%	CHLORIDE	137%
LAB 3	FLAGS :	BARIUM CHLORIDE	14% 117%	D O C	36%	D I C	-21%
LAB 4	FLAGS :	BORON	228%	TOT P	-73% L	BORON	29%
LAB 6	FLAGS :	TKN NITRATE HDL : AMMONIA	550% R -21%	TOT P AMMONIA VANADIUM	82% 41%	TKN CHLORIDE MOLYBNUM	45% 102%
LAB 8	FLAGS :	ALUMINUM TKN ZINC	15% 44% 33%	MANGNESE SILICA SILICA MANGNESE	-12% -13% -11%	COPPER COPPER CHLORIDE	-13% -23% 133%
	HDL :	ALUMINUM					

NOTE: A VERY HIGH FREQUENCY OF FLAGGED RESULTS (OR A HIGH %) IS INDICATIVE OF POOR PERFORMANCE. ON THE OTHER HAND, LABS WITH FEW IF ANY FLAGS ARE JUDGED TO HAVE VERY GOOD PERFORMANCE.

ALSO, AN "R" FLAG INDICATES A NON COMPARABLE RESULT, THAT IS, ONE PRODUCED WITH NON RANDOM FACTORS. AN "L" FLAG INDICATES A 'LESS THAN' RESULT LOWER THAN THE COMPARATOR.

TABLE 2: HIGH STANDARD DEVIATION

PARAMETER		LEVEL
BORON	AT	.053 PPM
D O C	AT	1.401 PPM
TOT P	AT	.011 PPM
ALUMINUM	AT	.061 PPM
IRON	AT	.029 PPM
LEAD	AT	.010 PPM
T N DIS	AT	1.841 PPM
CHLORIDE	AT	124.500 PPM

APPENDIX I

Definitions of Types of Metals Analysis

1. HIGH LEVEL ANALYSIS

Usually without sample pretreatment, samples are aspirated by Atomic Absorption Spectrophotometry (AAS), Inductively Coupled (Argon) Plasma or direct coupled plasma (ICAP, ICP, or DCP). Standards should contain the acid equivalent of the sample.

2. LOW LEVEL ANALYSIS

Analysis is carried out by one of the following methods:

1. Solvent extraction sample concentration followed by AAS.
2. Digestion and concentration of aqueous phase followed by ICAP, or DCP.
3. Digestion of aqueous phase and ICAP or DCP analysis.
4. Graphite tube (flameless) AAS.

Updated March 1989.

APPENDIX II

Performance Indicators

1. Flagged Results

As a first indication that analysis results are appreciably deviant from the expected value, each submitted result is tested with the 10% or 1 Standard Deviation Rule. When a result is found to deviate more than 10%, or more than 1 standard deviation when this is greater than 10%, the result is flagged with an asterisk in the data summary and tabled for that laboratory in the Flagged Data Table. Typically at low levels the 10% criteria is too small and the 1 standard deviation criteria effectively indicates deviant analytical results. As performance indicator, the flagged results indicate to laboratory heads that in-house QC procedures and the methodology concerned need to be investigated. Results may still be comparable.

2. Grubbs' Rejectable Results

For every parameter, each laboratory result is statistically tested to see if it is outlying. Outlying results are caused by non random causes such as a faulty calibration or incorrect transcription. These outlying results, calculated by the Grubbs' procedure, and indicated in the data tables with an 'R', are noncomparable with the other data for that parameter.

3. A High Standard Deviation for a Parameter

Occasionally data for a difficult to analyse parameter yields a very high relative standard deviation (RSD). When a high RSD is not due to outlying results, there are noncomparable results within the data set. In such a case, the RSD for that parameter is indicated in Table 2, entitled: High Standard Deviations.

4. High Detection Limits (HDL's)

Each laboratory determines its own detection limits according to its own requirements. When major differences in detection limits occur, an HDL is indicated for the particular laboratory in the Flagged Data Table. An HDL indicates that low level analysis may not be comparable with the analyses of other laboratories.

* reference : Frank E. Grubbs, Technometrics, 1969, p. 1.

DATA SUMMARY

FEDERAL-PROVINCIAL PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO. 35 - PP 75

SAMPLE 1

.0950	.0980	.0979	.9800	.9660	.9933	1.1500
.0071	-	.0055	-	-	.0306	-
.74	-	5.6	-	-	3.1	-
-	-	-	-	-	-	-
121111	823101	82311	82321	82999		
PB DIS	PB EXT	PB EXT	PB EXT	LEAD		
ICCP DA	AAS DA	ICCP DA	ICCP DA	COMMON		
0.482	0.49	-	-	0.488	0.482	
-	-	-	-	-	0.488	
-	0.50	-	-	-	0.50	
0.48	-	-	-	-	0.48	
0.447	0.517	-	0.44	-	0.517	
-	-	-	0.43	-	0.44	
-	-	-	-	-	0.43	
-	-	-	-	-	0.451	
4697	5023	4350	4880	4750		
0197	2.0137	1.0071	1.6	0.284		
4.2	2.7	-	-	6.0		

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWD OA PROGRAMS

STUDY NO. 35 PP 75

SAMPLE 2

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DATA SUMMARY - FED-PROV & PPWB OA PROGRAMS

STUDY NO. pp 35 pp 75

Sample 2

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DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

PAGE 8

	STUDY NO.	PP 35	PP 75	SAMPLE 2
LAB	20007 CA TOT DCP	20050 CA DIS AAS NO	20100 CA DIS CALC'D	20103 CA DIS AAS
1	-	-	-	71.0
2	-	-	71.0	-
3	-	-	69.0	-
5	-	70.4	-	-
6	-	70.4	-	-
7	-	70.4	-	-
8	-	-	-	69.2
9	-	-	-	69.2
10	-	-	-	-
11	-	-	-	-
13	-	-	-	-
14	-	59.7	-	-
15	55.0 R	-	-	-
16	-	-	-	72.0
MEAN	59.7000	70.7000	70.6000	71.0000
STD DEV	-	-	.3464	71.4142
REL STD	-	-	.5	2.0
DES VAL	-	-	-	-

20110
CA DIS
AAS AUT20111
CA DIS
ICP20311
CA EXTR20990
CALCIUM
COMMON

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO. PP 36 PP 76

SAMPLE 3 PAGE 10

LAB	FE TOT 5X DCP	FE DIS AAS GF	26107 PE EXT AAS SE	26111 PE DIS ICP DA	26311 FE EXT ICP DA	26999 IRON COMMON	27003 CO TOT AAS GF	27009 CO TOT 5X ICP	27011 CO TOT 5X ICP	27012 CO TOT 5X DCP	27111 CO EXT ICP DA	27102 CO EXT AAS SE	27311 CO EXT ICP DA
1	-	-	0.029	0.029	-	0.029	-	-	0.011	0.011	-	0.012	-
2	-	-	-	-	0.03	0.032	0.03	0.032	-	-	-	-	-
3	-	-	0.019	0.039	-	0.019*	0.019*	0.019*	-	-	0.014	0.012	-
6	-	-	0.016	-	-	0.029	0.029	0.029	-	-	-	-	0.011
8	-	-	0.016	-	-	0.029	0.029	0.029	-	-	0.011	-	-
9	-	-	0.016	-	-	0.029	0.029	0.029	-	-	0.011	-	-
10	-	-	0.016	-	-	0.029	0.029	0.029	-	-	0.011	-	-
11	-	-	0.016	-	-	0.029	0.029	0.029	-	-	0.011	-	-
14	-	-	0.016	-	-	0.029	0.029	0.029	-	-	0.011	-	-
15	-	-	0.016	-	-	0.029	0.029	0.029	-	-	0.011	-	-
16	-	-	0.016	-	-	0.029	0.029	0.029	-	-	0.011	-	-
MEAN	.0160	.0160	.0260	.0260	.0340	.0295	.0279	.0279	.0110	.0110	.0110	.0120	.0110
STD DEV	-	-	.023	.023	.0071	.0071	.0061	.0061	-	-	.0020	-	-
REL STD	-	-	.023	.023	.020	.020	.022	.022	-	-	.0167	-	-
DES VAL	-	-	-	-	-	-	-	-	-	-	-	-	-
LAB	27999 COBALT COMMON	28002 NI TOT AAS SE	28009 NI TOT 5X ICP	28011 NI TOT 5X ICP	28012 NI TOT 5X DCP	28111 NI DIS ICP DA	28302 NI EXT AAS GF	28309 NI EXT AAS SE	28311 NI EXT ICP DA	28999 NICKEL COMMON	29005 CU TOT AAS SE	29009 CU TOT 5X ICP	29011 CU TOT 5X ICP
1	0.012	0.013	0.013	0.011	-	0.013	-	-	-	0.013	0.013	0.014	0.012
3	0.011	-	-	-	-	-	-	-	-	0.013	0.011	-	-
6	0.011	-	-	-	-	-	-	-	-	0.012	0.012	-	-
8	0.011	-	-	-	-	-	-	-	-	0.012	0.012	-	-
9	0.014*	-	-	-	-	-	-	-	-	0.014	0.014	-	-
10	0.014*	-	-	-	-	-	-	-	-	0.012	0.012	-	-
11	0.012	-	-	-	-	-	-	-	-	0.012	0.012	-	-
15	0.012	-	-	-	-	-	-	-	-	0.012	0.012	-	-
16	0.011	-	-	-	-	-	-	-	-	0.013	0.013	-	-
MEAN	.0114	.0130	.0130	.0110	.0130	.0123	.0021	.0120	.0120	.0123	.0130	.0140	.0120
STD DEV	.0011	-	-	-	-	-	-	-	-	.0013	-	-	-
REL STD	.99	-	-	-	-	-	-	-	-	.0053	-	-	-
DES VAL	.011	-	-	-	-	-	-	-	-	.0013	-	-	-
LAB	29012 ZINC 5X DCP	29107 CU DIS AAS GF	29111 CU DIS ICP DA	29305 CU EXT AAS SE	29308 CU EXT AAS GF	29314 CU EXT ICP DA	29999 COPPER COMMON	30005 ZN TOT AAS SE	30009 ZN TOT 5X ICP	30011 ZN TOT 5X ICP	30012 ZN DIS AAS GP	30107 ZN DIS ICP DA	30111 ZN DIS ICP DA
1	-	-	0.014	0.013	-	-	-	0.014	-	-	-	-	0.016
2	-	-	-	-	-	-	-	0.013	0.015	0.016	-	-	-
3	-	-	-	-	-	-	-	0.013	0.015	0.015	-	-	-
6	-	-	-	-	-	-	-	0.014	-	-	-	-	-
8	-	-	0.011	-	-	-	-	0.011	-	-	-	-	-
9	-	-	0.014	-	-	-	-	0.014	-	-	-	-	-
10	-	-	0.016	-	-	-	-	0.016	-	-	-	-	-
11	-	-	0.016	-	-	-	-	0.015	-	-	-	-	-
14	-	-	0.017	-	-	-	-	0.017	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	.0160	.0130	.0130	.0145	.0150	.0100	.0137	.0150	.0160	.0150	.0180	.0120	.0157
STD DEV	-	-	13.3	14.6	.0021	-	-	16.0	-	-	-	-	3.7
REL STD	-	-	-	-	-	-	-	16.0	-	-	-	-	-
DES VAL	-	-	-	-	-	-	-	.013	-	-	-	-	-

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

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LAB	30304 ZN EXT AAS DA	30305 ZN EXT AAS SE	30311 ZN EXT ICP DA	30999 ZINC COMMON	38009 SR TOT ICP DA	38012 SR TOT DCP DA	38111 SR TOT ICP DA	38311 SR EXT ICP DA	38999 STRONTIUM COMMON	42011 MO TOT 5X	42012 MO TOT 5X	42111 NO DIS ICP DA	42311 NO EXT ICP DA	
1	-	-	-	0.016	-	-	-	-	-	-	-	0.012	-	-
2	0.018	-	-	0.018	0.358	-	-	-	-	-	-	-	-	-
3	-	-	-	0.015	-	-	-	-	-	-	-	-	-	-
6	-	-	0.02	0.015*	-	-	-	-	-	-	-	-	-	-
8	-	-	-	0.015	-	-	-	0.38	-	-	-	0.01	-	-
9	-	-	-	0.016	-	-	-	0.37	-	-	-	0.012	-	-
10	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-
11	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-
14	-	-	-	0.018	-	-	-	-	-	-	-	-	-	-
15	-	-	0.018	0.018	-	0.423	-	-	0.365	-	-	-	-	-
16	-	-	-	0.018	-	-	-	-	0.423*	-	-	-	-	-
MEAN	-	-	-	-	-	-	-	-	0.423*	-	-	-	-	-
STD DEV	-	-	-	-	-	-	-	-	0.423*	-	-	-	-	-
REL STD	-	-	-	-	-	-	-	-	0.423*	-	-	-	-	-
DES STD	-	-	-	-	-	-	-	-	0.423*	-	-	-	-	-

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DATA SUMMARY - FED-PROV & PPWB OA PROGRAMS

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SAMPLE 4

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DATA SUMMARY - PED-PROV & PPWB QA PROGRAMS

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DATA SUMMARY - PED-PROV & PPWB QA PROGRAMS

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SAMPLE 4

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DATA SUMMARY - FED-PROV & PPWB OA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO. FP 36 . PP 76

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SAMPLE 4

LAB	19001 K TOT AAS	19005 K TOT ICP	19008 K TOT DCP	19102 K DIS AAS	19103 K DIS FLM PH	19105 K DIS AAS DA	19106 K DIS AAS LI	19107 K DIS FLM PH	19111 K DIS ICP	19301 K EXT HNO3 AA	19990 PTASSIUM COMMON	20005 CA TOT ICP	20007 CA TOT DCP	
1	-	-	-	-	-	20.0	-	-	-	-	-	-	20.0	-
2	-	-	-	-	-	21.0	-	-	-	-	-	-	21.0	-
3	-	-	-	-	-	21.0	-	-	-	-	-	-	21.0	-
4	-	-	-	-	20.5	-	-	-	-	-	-	-	20.5	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	19.8000	20.4000	20.0000	20.2500	20.6500	18.3000	-	-	20.4000	20.3000	19.5000	20.1571	104.5000	96.0000
STD DEV	-	4.8485	-	1.3536	2.4726	-	-	-	-	-	-	3.7197	.7071	.7
REL STD	-	4.2	-	1.7	2.3	-	-	-	-	-	-	-	-	-
DES VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-

LAB	20050 CA DIS AAS NO	20100 CA DIS CALC'D	20103 CA DIS AAS	20108 CA DIS AAS UP	20110 CA DIS AAS AUT	20111 CA DIS ICP	20311 CA EXT ICP	20990 CALCIUM COMMON
1	-	-	-	-	-	106.	-	-
2	-	-	-	-	105.	-	-	106.
3	-	-	-	-	108.	-	-	105.
4	-	-	-	-	-	-	-	108.
5	-	-	105.	-	-	-	-	109.
6	-	-	105.	105.6	-	-	-	105.
7	-	-	-	-	-	-	106.	106.
8	-	-	-	-	-	-	-	105.
9	-	-	-	-	-	-	-	104.
10	-	-	-	-	-	-	-	104.
11	-	-	-	-	-	-	-	104.
12	-	-	-	-	-	-	-	104.
13	-	-	-	-	-	-	-	104.
14	-	-	-	-	-	-	-	104.
15	-	-	-	-	-	-	-	104.
16	-	-	-	-	-	-	-	104.
MEAN	98.6000	105.0000	108.2000	108.0000	105.5000	108.1000	106.0000	105.3143
STD DEV	-	-	2.3065	-	.7071	1.2728	-	3.8708
REL STD	-	-	2.1	-	.7	1.2	-	3.7
DES VAL	-	-	-	-	-	-	-	-

DATES RECEIVED	1 88/12/04	2 89/01/04	3 88/12/08	4 89/01/10
5 89/01/24	6 88/12/28	6 88/01/19	7 89/01/17	8 89/01/04
9 88/12/21	10 88/12/22	11 88/12/19	12 89/01/04	13 89/01/05
14 88/01/23	15 88/12/21	16 89/01/06	-	-

NOTE: ALL CONCENTRATION UNITS ARE EXPRESSED IN MG/L OF EACH ELEMENT; THE EXCEPTIONS BEING:
 COLOUR IN RELATIVE UNITS; CONDUCTIVITY IN USIE/CM; TURBIDITY IN JTU; OR NITRATE NITROGEN ANALYSES IN "N"; ALKALINITY & HARDNESS IN CACO₃; SILICA IN SiO₂, AND SULFATE IN SO₄.

Research & Applications Branch
National Water Research Institute
867 Lakeshore Road, P.O. Box 5050
Burlington, Ontario
L7N 3E6

June 7, 1989.

To: Participants & Managers in:

Prairie Provinces Quality Assurance Program (PPOA)

I have enclosed the final report for PP 77-78.

If you have any comments on this report, or any legitimate corrections to the data base, please do not hesitate to communicate them.

Harry A.

H. Alkema
Quality Assurance Project

Participants & Managers:

Dr. J.J. Bergman
Sask. Prov. Water Laboratory

Mr. J-G. Zakrevsky
Western Region WQB

Dr. F.P. Dieken
Alberta Water Analysis Res. Sta.

Mr. G.W. Dunn
Prairie Province Water Board

Mr. E.A. Sorba
Manitoba Technical Services Lab

Mr. W.D. Gummer
Western Region WQB

Dr. Wo Yuen
Saskatchewan Research Council

Mr. A.S.Y. Chau
NWRI, CCIW



RESEARCH & APPLICATIONS BRANCH

FINAL REPORT

REPORT NO. RAB 89-10

PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAM

STUDIES 77 AND 78

for January and February 1989

**TRACE METALS, MAJOR IONS, NUTRIENTS
AND PHYSICAL PARAMETERS IN SURFACE WATERS**

by

H. Alkema

**Quality Assurance Section
National Water Research Institute
Burlington, Ontario**

June 1989

Introduction

As part of an on-going study, the Quality Assurance Section, NWRI in Burlington, Ontario, has been sending reference water samples bi-monthly to chemical laboratories participating in the PPWB program. This report summarizes the most recent PPWB interlaboratory quality control studies: PP 77 and 78, for the months January and February, 1989. These two studies dealt with trace metals, major ions, nutrients and physical parameters. The levels were low levels for Metals, and medium to high for major ions.

Study Design

Four water samples were submitted to each laboratory for chemical analyses. Two samples were submitted for trace metals analysis, while the remaining two were submitted for major ions, nutrients and some physical measurements. The following is a breakdown of the four samples:

PP 77 – Sample 1 – 125 ml, high level* for trace metals (3% HNO₃)

Sample 2 – up to 1 L, major ions etc., stored at 4°C

PP 78 – Sample 3 – 1 L, low level* for trace metals (0.2% HNO₃)

Sample 4 – up to 1 L, major ions, etc., stored at 4°C

* for definitions see Appendix 1

Treatment of Data

Each laboratory was asked to perform only those analyses which were routine to their particular laboratory, using the general methodology guidelines listed above. Results for these analyses were recorded as required by the Standard Report Sheets provided with the QA samples. Submitted results were tabulated for each parameter, first for each method reported, and then for all methods combined. These data, and the resulting statistics are presented in the Data Summary. (attached)

Preliminary data summaries (RAB # 89-05), including problematic results, were sent March 1 or March 7, and April 19. Each laboratory was given three weeks to notify us of any errors in data transcription, compilation, or flags.

Performance Indicators

In the PPWB QA program, two types of reference samples are used for the accuracy assessment. Reference waters (RMs) and certified reference waters (CRMs) have Design Values for the stable parameters. Also, regional samples are used occasionally as natural reference samples. The means for the regional samples, and the Design Values for the reference waters are used to test each reported result for accuracy.

Percentage deviations from the reference value are used as an indicator for the laboratory head to determine the extent of the discrepancies between the laboratory result and reference value. However, please keep in mind that at low levels, high % deviations are often seen, and may be misleading if interpreted too strictly.

A result which deviates more than the greater of 10% or 1 standard deviation from the reference value is marked with an asterisk in the data tables and its value tabulated in the flagged data table (Table 1). Results reported with an "L" (less than) or flagged with an "R" (rejectable) are not used in the statistical calculations. Performance indicators are fully explained in Appendix II.

Comments on Laboratory Performance

Results accompanied with a 'less than' are difficult to appraise. If a design value or mean is significantly lower than the detection limit given by a particular laboratory, then that detection limit is too high. Such a result is assigned an 'HDL' and is tabulated for each laboratory in Table 1.

If, on the other hand, the detection limit reported is far lower than the mean or design value, then the use of 'less than' is clearly inadequate and the result is flagged low. The magnitude of the deviation from the mean in such a case is taken from the detection limit given.

Attached are two tables listing flagged data by laboratory (Table 1), and listing parameters for which there was a high standard deviation (Table 2). Formerly called a high coefficient of variation, the standard deviation is generated with standardized criteria that are included with the automated flagging routine. These automated criteria have been in use since March 1988 (Study PP 67), and should provide a more accurate and consistent listing of the difficult to analyze parameters or levels. A listing of the criteria used to indicate high deviation of analysis is available on request. Your comments would be appreciated.

PPWB laboratories average number of deviations per sample was 1.4

APPENDIX I

Definitions of Types of Metals Analysis

1. HIGH LEVEL ANALYSIS

Usually without sample pretreatment, samples are aspirated by Atomic Absorption Spectrophotometry (AAS), Inductively Coupled (Argon) Plasma or direct coupled plasma (ICAP, ICP, or DCP). Standards should contain the acid equivalent of the sample.

2. LOW LEVEL ANALYSIS

Analysis is carried out by one of the following methods:

1. Solvent extraction sample concentration followed by AAS.
2. Digestion and concentration of aqueous phase followed by ICAP, or DCP.
3. Digestion of aqueous phase and ICAP or DCP analysis.
4. Graphite tube (flameless) AAS.

Updated March 1989.

APPENDIX II

Performance Indicators

1. Flagged Results

As a first indication that analysis results are appreciably deviant from the expected value, each submitted result is tested with the 10% or 1 Standard Deviation Rule. When a result is found to deviate more than 10%, or more than 1 standard deviation when this is greater than 10%, the result is flagged with an asterisk in the data summary and tabled for that laboratory in the Flagged Data Table. Typically at low levels the 10% criteria is too small and the 1 standard deviation criteria effectively indicates deviant analytical results. As performance indicator, the flagged results indicate to laboratory heads that in-house QC procedures and the methodology concerned need to be investigated. Results may still be comparable.

2. Grubbs' Rejectable Results

For every parameter, each laboratory result is statistically tested to see if it is outlying. Outlying results are caused by non random causes such as a faulty calibration or incorrect transcription. These outlying results, calculated by the Grubbs' procedure, and indicated in the data tables with an 'R', are noncomparable with the other data for that parameter.

3. A High Standard Deviation for a Parameter

Occasionally data for a difficult to analyse parameter yields a very high relative standard deviation (RSD). When a high RSD is not due to outlying results, there are noncomparable results within the data set. In such a case, the RSD for that parameter is indicated in Table 2, entitled: High Standard Deviations.

4. High Detection Limits (HDL's)

Each laboratory determines its own detection limits according to its own requirements. When major differences in detection limits occur, an HDL is indicated for the particular laboratory in the Flagged Data Table. An HDL indicates that low level analysis may not be comparable with the analyses of other laboratories.

* reference : Frank E. Grubbs, Technometrics, 1969, p. 1.

TABLE 1: PRAIRIE PROV LABORATORIES FLAGGED DATA - STUDIES PP 77-78

LAB 1	FLAGS :	COLOUR	32%	BORON	-95%	SODIUM	-16%
LAB 3	FLAGS :	D I C T N DIS	12% 13%	TKN PH	-11% 12%	COLOUR	-27%
LAB 4	FLAGS :	BORON NITRATE	357% 12%	D I C	16%	TURBIDTY	184% R
LAB 6	FLAGS :	STRNTIUM IRON STRNTIUM NITRATE	-52% R 67% -64% R 14%	D O C COBALT LEAD TOT P	16% 60% 60% 376% R	TOT P ZINC TKN	809% R 43% 72% R
	HDL :	VANADIUM		AMMONIA			
LAB 8	FLAGS :	CHROMIUM	42% R	COPPER MANGNESE	74% R	TKN IRON	-14%
	HDL :	ALUMINUM ZINC					

NOTE: A VERY HIGH FREQUENCY OF FLAGGED RESULTS (OR A HIGH %) IS INDICATIVE OF POOR PERFORMANCE. ON THE OTHER HAND, LABS WITH FEW IF ANY FLAGS ARE JUDGED TO HAVE VERY GOOD PERFORMANCE.

ALSO, AN "R" FLAG INDICATES A NON COMPARABLE RESULT, THAT IS, ONE PRODUCED WITH NON RANDOM FACTORS. AN "L" FLAG INDICATES A 'LESS THAN' RESULT LOWER THAN THE COMPARATOR.

TABLE 2: HIGH STANDARD DEVIATION

PARAMETER		LEVEL
BORON	AT	.047 PPM
ALUMINUM	AT	.040 PPM
VANADIUM	AT	.004 PPM
IRON	AT	.006 PPM
LEAD	AT	.005 PPM
COLOUR	AT	40.889 PPM
BORON	AT	.076 PPM
D O C	AT	6.705 PPM

DATA SUMMARY

FEDERAL-PROVINCIAL & PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAMS

STUDY NO. FP 37 PP 77
SAMPLE 1 SPIKED SAMPLE.

DATE: 01/01/89

DUE DATE: 28/02/89 PAGE 1
TRACE METALS D/A. (IN 3.0% HNO3)

LAB		13009 AL TOT 5X ICP	13030 AL ?	13105 AL DIS AAS GP	13111 AL EXT AAS DA	13302 AL EXT AAS DA	13311 AL EXT ICP DA	13321 AL EXT DCP DA	13999 ALUMINUM COMMON	23009 V TOT 5X ICP	23011 V TOT 5X ICP	23012 V TOT 5X ICP	23111 V-DIS ICP DA
1	2	-	0.479	-	-	0.5	-	-	0.479	0.493	-	-	-
2	3	0.49	-	-	-	0.495	-	0.530	-	0.495	-	0.49	-
6	8	-	-	-	-	0.5	-	-	0.49	-	0.49	-	0.465
9	10	-	-	-	0.76 R	0.44	-	-	0.44	-	-	-	0.49
14	15	-	-	-	-	-	0.47	-	0.67	0.67 *	-	-	-
16	MEAN	-	4.900	4.790	-	4700	4983	4700	5300	6700	5049	4930	4775
STD DEV	STD STD	-	-	-	-	0.0424	0.029	-	-	-	0.0650	-	3.7
REL STD	REL STD	-	-	-	-	9.0	.6	-	-	-	12.514	-	-
DES VAL	DES VAL	-	-	-	-	-	-	-	-	-	-	-	-
LAB		23311 V EXT ICP DA	23321 V EXT ICP DA	23999 VANADIUM COMMON	24004 CR TOT 5X ICP	24009 CR TOT 5X ICP	24011 CR TOT 5X ICP	24012 CR TOT 5X ICP	24111 CR DIS ICP DA	24302 CR EXT AAS DA	24311 CR EXT ICP DA	24321 CR EXT ICP DA	24999 CHROMIUM COMMON
1	3	-	-	0.492	0.493	-	0.053	-	-	-	-	-	25003 Mn TOT 5X ICP
6	8	-	-	-	0.492	0.492	0.050	-	-	-	-	-	0.048
9	10	-	-	-	-	0.75R	-	-	-	-	-	-	-
11	13	-	-	-	-	0.465	-	-	0.042R	0.054	-	-	-
15	16	0.51	-	-	-	0.51	-	-	-	0.054	-	-	-
MEAN	STD DEV	-	5.100	4.920	-	4943	4943	4943	0.0500	0.0490	0.0495	0.0520	0.0510
STD STD	REL STD	-	-	-	-	3.0174	-	-	-	0.007	-	-	0.020
DES DES	VAL VAL	-	-	-	-	3.491	-	-	-	1.4	-	-	3.903
LAB		25004 MN TOT AAS DA	25011 MN TOT 5X ICP	25012 MN DIS AAS DA	25104 MN DIS AAS DA	25111 MN DIS ICP DA	25304 MN EXT AAS DA	25311 MN EXT ICP DA	25321 Manganese COMMON	26009 PE TOT 5X ICP	26011 PE TOT 5X ICP	26012 PE TOT 5X ICP	26104 PE DIS AAS DA
1	2	-	-	-	-	-	0.05	-	-	0.048	0.254	-	-
3	6	0.044	-	-	-	-	0.048	-	0.047	-	-	-	-
8	9	-	-	-	-	-	-	0.04	-	0.044	-	0.24	-
10	11	0.056	-	-	-	0.048	-	-	-	0.044	-	-	-
13	14	-	-	-	-	0.044	-	-	-	0.044	-	-	0.294R
15	16	-	-	-	-	-	-	-	0.04	-	-	-	-
MEAN	STD DEV	-	0.0560	0.0440	0.0610	0.0580	0.0460	0.0490	0.0427	0.0470	0.0488	-	-
STD REL	DEV STD	-	-	-	-	-	0.028	0.014	0.046	-	0.0067	-	-
DES VAL	DES VAL	-	-	-	-	-	6.1	2.9	10.8	-	13.7	-	-

DATA SUMMARY - FED-PROV & PPWB OA PROGRAMS

STUDY NO.	PP 37			PP 77			SAMPLE 1			PAGE 2		
	LAB	PE DIS ICP DA	PE EXT AAS DA	PE EXT ICP DA	PE EXT ICP DA	PE EXT ICP DA	CO EXT ICP DA	CO EXT ICP DA	CO EXT ICP DA	CO EXT ICP DA	CO EXT ICP DA	CO EXT ICP DA
1	26111	26304	26311	26321	26999	27001	27009	27011	27012	27301	27311	27321
2	-	0.25	-	-	0.254	-	0.230	-	-	-	-	-
3	-	0.254	-	0.252	0.254	-	-	0.21	-	-	-	0.225
6	-	-	0.24	-	0.24	-	-	-	-	-	-	-
9	0.255	-	-	-	0.24	-	-	-	-	-	-	-
10	0.235	0.26	0.24	-	0.235	0.26	-	-	-	0.22	0.25	-
11	-	-	-	0.247	-	-	-	-	-	0.202	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	24225	2547	24223	2520	2470	2600	2300	2100	2500	2110	2500	2250
STD DEV	6106	20550	1040	2.0	1.7	3.250	-	-	-	6.0	-	-
REL STD DES VAL	4.4	2.0	-	-	-	-	-	-	-	-	-	-
LAB	27999	28009	28011	28012	28111	28301	28311	28999	29009	29011	29012	29106
	COBALT COMMON	Ni TOT 5X ICP DA	Ni TOT 5X ICP DA	Ni TOT 5X ICP DA	Ni EXT AAS DA	Ni EXT AAS DA	Ni EXT ICP DA	Ni EXT ICP DA	Cu TOT 5X ICP DA	Cu TOT 5X ICP DA	Cu TOT 5X ICP DA	Cu DIS AAS DA
1	0.230	0.225	0.269	0.26	-	-	-	-	0.257	0.269	0.046	-
3	0.225	-	-	0.25	-	-	-	-	0.24	0.26	0.042	-
6	0.221	-	-	-	-	0.247	0.25	-	-	0.24	-	-
8	0.225	-	-	-	-	-	-	-	-	0.24	-	-
9	0.202*	-	-	-	-	-	-	-	-	0.247	-	-
10	0.202*	-	-	-	-	-	-	-	-	0.247	-	-
11	0.26*	-	-	-	-	-	-	-	-	0.28	-	-
13	-	-	-	-	-	-	-	-	-	0.27	-	-
14	0.228	-	-	-	0.29	-	-	0.27	-	0.27	-	-
15	0.225	-	-	-	-	-	-	-	-	0.29	-	-
16	0.225	-	-	-	-	-	-	-	-	0.27	-	-
MEAN	2306	2690	2600	2900	2485	2800	2600	2570	2633	0.460	0.420	0.610
STD DEV	0.0194	-	-	-	0.021	0.021	0.0173	-	0.0155	-	-	-
REL STD DES VAL	8.4	2.27	-	-	0.9	-	6.7	-	5.9	-	-	-
LAB	29111	29306	29311	29321	29999	30009	30011	30012	30104	30111	30304	30321
	CU DIS ICP DA	CU EXT AAS DA	CU EXT ICP DA	CU EXT ICP DA	COPPER, COMMON	COPPER, COMMON	COPPER, COMMON	CU TOT 5X ICP DA	ZN DIS ICP DA	ZN DIS ICP DA	ZN EXT AAS DA	ZN EXT ICP DA
1	-	-	0.05	-	0.045	0.046	0.059	-	-	-	0.06	-
2	-	-	-	0.06 R	-	0.045	-	-	-	-	-	0.056
3	-	-	-	-	-	0.045	-	0.051	-	-	-	-
6	-	-	-	-	-	0.042	-	-	-	-	-	-
9	0.043	-	-	-	-	0.043	-	-	-	0.055	-	-
10	0.045	0.038	0.04	-	-	0.043	-	-	0.054	0.058	0.06	-
11	-	-	-	-	-	0.038*	-	-	-	-	-	-
13	-	-	-	-	-	0.04	-	-	0.070R	-	-	-
14	-	-	-	-	-	0.047	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	0.097R	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	0.0440	0.0440	0.0435	0.0450	0.0457	0.0590	0.0510	-	0.0545	0.0590	0.0553	.0550
STD DEV	0.014	0.065	0.049	0.064	0.064	-	-	-	0.007	0.014	2.4	9.1
REL STD DES VAL	3.2	19.3	11.4	-	14.0	-	-	-	1.3	-	-	-

DATA SUMMARY = FED-PROV & PPWB QA PROGRAMS

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SAMPLE 1

PAGE 3

LAB	AN	DEV	LSTD	VAL
30999 ZINC COMMON	0.059 0.066 0.0651 0.0655 0.0654 0.0658 0.0660 0.070R 0.056 0.097R	- - - - - - - - - -	- - - - - - - - - -	0.
38011 SR TOT ICP DA	0.06 R	-	-	-
380 SR DCP	-	-	-	-

MEAN	.8600	.9006
STD DEV	-.0460	
REL STD	5.1	
DES VAL	.891	
LAB	56111 BA DIS TCP DA	56301 BA EXT AAS DA
1	-	-
2	-	0.478
3	-	-
6	-	-
8	-	-
9	0.45	-
10	0.42	-
11	-	-
13	-	-
14	-	-
15	-	-
16	-	-
		0
MEAN	4.350	4.780
STD DEV	0.212	-
REL STD	4.9	-
DES VAL	4.9	-

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

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SAMPLE 2

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00110 00120 00125

02023

0207

02074 02077

3	5	7	58.3	59.8	70.8
---	---	---	------	------	------

1	0610 DOC CO2	14. 15. 17.			15.7 1.1 7.5
	DDIF	5	0000		

06109	06112	061
DOC UV	DOC OH	DO
CO2 OH	PER IR	CON
-	-	-
-	-	15
-	-	14
-	-	15
-	-	16
-	-	17
-	-	14
-	-	12
-	-	13
14.8	13.9	14
14.8000	13.9000	14
-	-	11
-	-	11
EV		EV
ED		ED
AL		AL

154	06159	06490	07
C AA	DIC AA	D IC	TKA
C 2 PHE	CO2 OH	COMMON	AA
8.8	-	18.8	-
-	-	19.8	*
-	-	20.5	*
-	-	20.7	*
-	-	-	-
-	-	18.2	18.2
-	-	-	15.5
-	-	-	19.0
.8000	18.2000	18.9286	17.642
-	-	-	9.3
-	-	-	17.617

0702 TKN DIG 0 .8 .8
6 BLK SAL 00000

DATA SUMMARY - PED-PROV & PPWB OA PROGRAMS

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SAMPLE 2

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DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO. PP 37 PP 77

SAMPLE 2

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LAB	11103 NA DIS FL PH	11105 NA DIS AAS DA	11107 NA UF FL PH	11111 NA DIS ICP	11311 NA EXT ICP	11990 SODIUM COMMON	12005 MG TOT ICP	12012 MG TOT DCP	12101 MG DIS CALC'D	12102 MG DIS AAS DA	12105 MG UF AAS DA	12106 MG UF AAS DA	12107 MG DIS AAS AUT
1	38.9	-	-	-	-	38.9	-	-	-	-	34.4	-	30.5
2	37.5	-	37.8	-	-	37.8	-	-	-	-	31.6	-	-
3	-	39.0	-	-	36.1	39.0	-	-	33.	31.7	-	-	-
4	-	-	-	-	-	36.1	39.0	31.6	-	31.2	-	-	-
5	-	-	-	-	-	34.7	35.0	-	-	-	-	-	-
6	-	-	-	-	-	34.7	35.0	-	-	-	-	-	-
7	-	-	-	-	-	34.7	35.0	-	-	-	-	-	-
8	-	-	-	-	-	34.7	35.0	-	-	-	-	-	-
9	-	-	-	-	-	34.7	35.0	-	-	-	-	-	-
10	-	-	-	-	-	34.7	35.0	-	-	-	-	-	-
11	-	-	-	-	-	34.7	35.0	-	-	-	-	-	-
12	-	-	-	-	-	34.7	35.0	-	-	-	-	-	-
13	-	-	-	-	-	34.7	35.0	-	-	-	-	-	-
14	-	-	-	-	-	34.7	35.0	-	-	-	-	-	-
15	-	-	-	-	-	34.7	35.0	-	-	-	-	-	-
16	-	-	-	-	-	34.7	35.0	-	-	-	-	-	-
MEAN	38.1333	39.0000	37.8000	38.6500	36.1000	37.2429	31.8000	31.3000	33.0000	30.8250	34.4000	31.6000	30.5000
STD DEV	1.7093	1.9	-	1.4950	1.3	1.9868	1.2828	-	-	1.6500	-	-	-
REL STD	-	-	-	-	-	1.3	1.3	-	-	5.4	-	-	-
DES VAL	-	-	-	-	-	1.3	1.3	-	-	-	-	-	-
LAB	12111 MG DIS ICP	12311 MG EXT ICP	12990 MGSUMUM COMMON	14105 SILICA MOLY AA	14106 SILICA MOLY AA	14107 SILICA MOLY AA	14111 SILICA DCP DA	14112 SILICA DCP DA	14190 SILICA COMMON	15313 ACL AA SNCL	15401 T P UV AA ASC	15406 T P UF AA ASC	15409 T P BLK AA ASC
1	-	-	-	34.4	-	1.	-	-	1.	-	-	-	-
2	-	-	-	30.5	-	1.13	-	-	-	-	-	-	-
3	-	-	-	31.6	-	1.1	-	-	-	-	-	-	-
4	-	-	-	31.7	-	1.1	-	-	-	-	-	-	-
5	-	-	-	33.2	-	1.0	-	-	-	-	-	-	-
6	-	-	-	32.0	-	1.0	-	-	-	-	-	-	-
7	-	-	-	32.0	-	1.0	-	-	-	-	-	-	-
8	-	-	-	32.0	-	1.0	-	-	-	-	-	-	-
9	-	-	-	32.0	-	1.0	-	-	-	-	-	-	-
10	-	-	-	32.0	-	1.0	-	-	-	-	-	-	-
11	-	-	-	32.3	-	1.0	-	-	-	-	-	-	-
12	-	-	-	32.3	-	1.0	-	-	-	-	-	-	-
13	-	-	-	32.3	-	1.0	-	-	-	-	-	-	-
14	-	-	-	32.3	-	1.0	-	-	-	-	-	-	-
15	-	-	-	32.3	-	1.0	-	-	-	-	-	-	-
16	-	-	-	32.3	-	1.0	-	-	-	-	-	-	-
MEAN	32.3000	32.0000	31.7357	1.1125	1.1300	1.0000	1.1000	1.1300	1.1011	-	-	.0030	-
STD DEV	1.0000	-1.0	1.3218	1.0854	1.7	-	10.3	-	7.0	-	-	-	-
REL STD	-	-	4.2333	7.7	-	-	-	-	1.118	-	-	-	-
DES VAL	-	-	31.6333	7.7	-	-	-	-	-	-	-	-	-
LAB	15413 TP ACL AA SNCL	15421 TP BLK DIG ASC	15490 TOT P COMMON	16304 SO4 DIS AUTO BA	16306 SO4 DIS AA MTB	16307 SO4 UF AA MTB	16309 SO4 DIS IC	16310 SO4 DIS AA CALM	16311 SO4 DIS IC	16990 SULFATE COMMON	17203 CL DIS AA FE	17204 CL DIS AG TIR	17206 CL DIS AA HG
1	0.001L 0.002	0.003	0.003	0.001L 0.002	111.	112.	-	115.	-	112.	-	-	55.2
2	-	-	-	0.003L	-	-	109.	-	-	109.	-	-	55.7
3	-	-	-	0.03 R	114.	-	-	-	-	114.	-	-	57.5
4	-	-	-	0.005	-	114.0	-	-	-	114.0	-	55.2	-
5	-	-	-	0.010L	-	110.	-	121.	-	110.	-	56.	-
6	-	-	-	0.005L	-	120.	-	-	-	120.	-	-	53.
7	-	-	-	0.003	-	115.0	-	125.5	-	125.5	-	-	58.0
8	-	-	-	0.002L	-	-	-	-	-	123.	-	-	55.3
9	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	105.	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	.0035	.0030	.0033	112.5000	114.1667	109.0000	120.5000	105.0000	123.0000	115.1923	55.2000	56.0000	56.1000
STD DEV	.0021	.002	.0013	2.1213	1.33714	-	1.25678	-	-	5.8293	-	1.8439	3.3
REL STD	.6	-	.7	1.9	3.0	-	4.4	-	-	5.1	-	-	-
DES VAL	-	-	.003	-	-	-	-	-	-	111.8398	-	-	-

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

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SAMPLE 2

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DATA SUMMARY

FEDERAL-PROVINCIAL E PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO. FP 38 PP 78

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LAB	SAMPLE 3			SAMPLE 4			SAMPLE 5			SAMPLE 6		
	PE DIS ICP DA	PE EXT AAS SE	CO TOT AAS GF	CO TOT AAS SE	CO TOT 5X ICP	CO TOT 5X ICP	CO TOT AAS GF	CO TOT AAS SE	CO TOT 5X ICP	CO TOT 5X ICP	CO TOT AAS GF	CO TOT AAS SE
1	-	0.006	-	0.007	-	-	0.005	-	-	-	0.005	-
2	-	-	-	0.006	0.005	-	-	-	-	-	0.005	0.007
3	-	-	0.02 L	0.010*	-	0.006	-	0.008	-	-	0.008*	-
4	0.01 L	0.003	-	0.01 L	-	-	-	-	-	0.01 L	0.006	-
5	0.010	-	-	0.010*	0.006	-	-	-	-	0.010	0.01 L	-
6	-	-	-	0.004	-	-	-	-	-	-	0.006	-
7	-	-	-	0.005 L	-	-	-	-	-	-	0.005 L	-
8	-	-	-	0.017 R	-	-	-	-	-	-	0.007	-
9	-	-	-	0.004	-	-	-	-	-	-	0.005 L	-
10	-	-	-	0.005 L	-	-	-	-	-	-	0.007	-
11	-	-	-	0.010	-	-	-	-	-	-	0.006	-
12	-	-	-	0.004	-	-	-	-	-	-	0.006	-
13	-	-	-	0.005 L	-	-	-	-	-	-	0.006	-
14	-	-	-	0.010	-	-	-	-	-	-	0.006	-
15	-	-	-	0.004	-	-	-	-	-	-	0.006	-
16	-	-	-	0.005 L	-	-	-	-	-	-	0.006	-
MEAN	.0030	.0080	-	.0067	.0055	.0060	.0050	.0080	.0070	.0100	.0067	.0070
STD DEV	-	.0028	-	.0027	.0007	-	-	-	-	-	.0018	.0000
REL STD	-	.0028	-	.0027	.0007	-	-	-	-	-	.0018	.0000
DES VAL	-	.004	-	.006	-	-	-	-	-	-	.005	-1.0
LAB	280111	28012	28111	28102	28109	28999	29005	29009	29011	29012	29017	29305
	NI TOT 5X ICP	NI TOT 5X ICP	NI DIS ICP DA	NI EXT AAS SE	NI EXT AAS GF	NICKEL COMMON	CU TOT AAS SE	CU TOT 5X ICP	CU TOT 5X ICP	CU TOT 5X ICP	CU DIS AAS GF	CU EXT AAS SE
1	-	-	-	-	-	0.007	-	0.008	-	-	-	-
2	-	-	-	-	-	0.007	0.006	0.007	0.008	-	-	-
3	0.006	-	-	0.01 L	-	0.006	0.006	0.006	0.008	-	-	-
4	-	-	0.008	-	0.006	-	0.006	0.006	0.008	-	-	-
5	-	-	0.008	0.006	-	0.006	-	0.008	-	-	0.009	0.008
6	-	-	0.008	0.006	-	0.006	-	0.008	-	-	0.008	-
7	-	-	0.008	0.006	-	0.006	-	0.008	-	-	0.008	-
8	-	-	0.008	0.006	-	0.006	-	0.008	-	-	0.008	-
9	-	-	0.008	0.006	-	0.006	-	0.008	-	-	0.008	-
10	-	-	0.008	0.006	-	0.006	-	0.008	-	-	0.008	-
11	-	-	0.008	0.006	-	0.006	-	0.008	-	-	0.008	-
12	-	-	0.008	0.006	-	0.006	-	0.008	-	-	0.008	-
13	-	-	0.008	0.006	-	0.006	-	0.008	-	-	0.008	-
14	-	-	0.008	0.006	-	0.006	-	0.008	-	-	0.008	-
15	-	-	0.008	0.006	-	0.006	-	0.008	-	-	0.008	-
16	-	-	0.008	0.006	-	0.006	-	0.008	-	-	0.008	-
MEAN	.0060	.0090	-	.0060	.0060	.0060	.0075	.0080	.0070	.0070	.0085	.0080
STD DEV	-	.0090	-	.0060	.0060	.0060	.0075	.0080	.0070	.0070	.0007	.0000
REL STD	-	.0090	-	.0060	.0060	.0060	.0075	.0080	.0070	.0070	.0007	.0000
DES VAL	-	-	-	-	-	-	-	-	-	-	8.3	-1.0
LAB	29308	29311	29999	30005	30009	30011	30012	30014	30305	30311	30999	38009
	CU EXT AAS GF	CU EXT AAS GF	COPPER COMMON	ZN TOT AAS SE	ZINC COMMON	SR TOT ICP DA						
1	-	-	-	0.008	-	0.007	-	-	-	-	-	0.007
2	-	-	-	0.006	0.007	0.007	0.010	-	-	-	0.007	0.167
3	-	-	0.01	-	-	-	-	-	-	-	0.010*	-
4	-	-	0.01	-	-	-	-	-	-	-	0.010	-
5	-	-	0.01	-	-	-	-	-	-	-	0.010	-
6	-	-	0.01	-	-	-	-	-	-	-	0.010	-
7	-	-	0.01	-	-	-	-	-	-	-	0.010	-
8	-	-	0.01	-	-	-	-	-	-	-	0.010	-
9	-	-	0.01	-	-	-	-	-	-	-	0.010	-
10	-	-	0.01	-	-	-	-	-	-	-	0.010	-
11	-	-	0.01	-	-	-	-	-	-	-	0.010	-
12	-	-	0.01	-	-	-	-	-	-	-	0.010	-
13	-	-	0.01	-	-	-	-	-	-	-	0.010	-
14	-	-	0.01	-	-	-	-	-	-	-	0.010	-
15	-	-	0.01	-	-	-	-	-	-	-	0.010	-
16	-	-	0.01	-	-	-	-	-	-	-	0.010	-
MEAN	.0070	.0100	-	.0079	.0070	.0100	.0080	-	.0080	.0090	.0081	.1670
STD DEV	-	.0070	-	.0011	.0070	.0000	.0000	-	.0000	.0000	.0011	.0000
REL STD	-	.0070	-	.0011	.0070	.0000	.0000	-	.0000	.0000	.0011	.0000
DES VAL	-	-	13.9	-	-	-	-	-	-	-	13.1	.007

DATA SUMMARY - PED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

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SAMPLE 4

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LAB	NO3+NO2 AA HYD			07110 NO3+NO2 AA2 CDB			07111 NO3+NO2 DIS SPEC			07112 NO3+NO2 UF AA CD			07390 NITRATE AA BERT			07540 NH3 TOT AA SAL			07555 NH3 DIS AA PHEN			07557 NH3 DIS AA INDO			07590 AMMONIA COMMON			07601 T N UV AA SUL			07605 T N UV HY SUL			
	MEAN	STD DEV	REL STD DES VAL	MEAN	STD DEV	REL STD DES VAL	MEAN	STD DEV	REL STD DES VAL	MEAN	STD DEV	REL STD DES VAL	MEAN	STD DEV	REL STD DES VAL	MEAN	STD DEV	REL STD DES VAL	MEAN	STD DEV	REL STD DES VAL	MEAN	STD DEV	REL STD DES VAL	MEAN	STD DEV	REL STD DES VAL	MEAN	STD DEV	REL STD DES VAL				
1	-	0.25	-	0.22	-	-	0.22	*	-	0.25	*	-	-	-	-	-	-	-	-	-	0.004	-	-	0.30	-	-	-	-	-					
2	-	0.235	-	0.230	-	-	0.212	*	-	0.215	*	-	0.005L	-	-	-	-	-	-	-	-	0.005L	-	-	0.411	-	-	-	-	-				
3	-	0.230	-	0.230	-	-	0.212	*	-	0.215	*	-	0.005L	-	-	-	-	-	-	-	-	0.005L	-	-	0.411	-	-	-	-	-				
4	0.24	-	-	0.20	-	-	0.18	*	-	0.214	*	-	-	-	-	-	-	-	-	-	0.002L	-	-	0.002L	-	-	-	-	-					
5	0.19	-	-	0.20	-	-	0.18	*	-	0.18	*	-	-	-	-	-	-	-	-	-	0.002L	-	-	0.002L	-	-	-	-	-					
6	0.185	-	-	0.19	-	-	-	-	-	0.185*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.010L	-	-	0.36	-	-				
7	-	0.2	-	0.21	-	-	-	-	-	0.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.28R	-	-	-	-	-				
8	-	0.343R	-	0.21	-	-	-	-	-	0.21	-	-	0.008	-	-	-	-	-	-	-	-	-	-	-	0.21	-	-	-	-	-				
9	-	0.207	-	0.2175	-	-	0.2150	*	-	0.1960	*	0.2102	*	0.0080	-	-	-	-	-	-	-	0.0040	-	-	0.0060	-	-	0.3555	-	-				
10	-	0.2337	-	0.240	-	-	0.2071	*	-	0.0226	*	11.5	*	11.213	-	-	-	-	-	-	-	-	-	-	-	47.1	-	22.1	-	-	-			
11	-	16.5	-	11.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
12	0.375	-	-	0.378	-	-	0.375	*	-	0.378	*	0.3	-	-	-	-	-	-	-	-	0.32	-	-	0.32	-	-	-	-	-					
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
STD DEV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
REL STD DES VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
MEAN	0.3750	-	-	0.3780	-	-	0.3648	*	-	0.3000	*	3100	*	3130	-	-	-	-	-	-	-	0.3700	-	-	0.3233	-	-	29.8700	-	30.0000				
STD DEV	-	-	-	-	-	-	0.4047	-	-	11.2	-	4.6	-	-	-	-	-	-	-	-	-	-	-	-	7.0247	-	4.8	-	-	-				
REL STD DES VAL	-	-	-	-	-	-	11.2	-	-	11.342	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.311	-	-	-	-	-				
MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
STD DEV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
REL STD DES VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
MEAN	1.0111	-	-	1.0112	-	-	1.0190	-	-	1.0301	-	10390	-	10602	-	10645	-	10690	-	11001	-	11005	-	11007	-	NA DIS	-	ICP	-	11102				
STD DEV	-	-	-	1.0111	-	-	1.0190	-	-	1.0301	-	10390	-	10602	-	10645	-	10690	-	11001	-	11005	-	11007	-	NA TOT	-	ICP	-	NA F	-	RAS.		
REL STD DES VAL	-	-	-	1.0111	-	-	1.0190	-	-	1.0301	-	10390	-	10602	-	10645	-	10690	-	11001	-	11005	-	11007	-	NA TOT	-	ICP	-	NA F	-	RAS.		
MEAN	1	-	-	2.87	-	-	30.7	-	-	7.19	-	7.19	-	54.6	-	54.6	-	54.6	-	55.2	-	55.2	-	55.2	-	-	-	-	-	-	-	-	-	-
STD DEV	-	-	-	2.87	-	-	31.1	-	-	8.15	-	8.15	*	55.7	-	55.7	-	55.7	-	56.3	-	56.3	-	56.3	-	-	-	-	-	-	-	-	-	-
REL STD DES VAL	-	-	-	2.87	-	-	28.6	-	-	7.72	-	7.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
MEAN	2	-	-	2.8	-	-	32.2	-	-	7.72	-	7.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
STD DEV	-	-	-	2.8	-	-	30.0	-	-	7.55	-	7.55	-	58.7	-	58.7	-	58.7	-	59.3	-	59.3	-	59.3	-	-	-	-	-	-	-	-	-	
REL STD DES VAL	-	-	-	2.8	-	-	28.8	-	-	7.66	-	7.66	-	55.0	-	55.0	-	55.0	-	56.0	-	56.0	-	56.0	-	-	-	-	-	-	-	-	-	
MEAN	3	-	-	2.8	-	-	31.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
STD DEV	-	-	-	2.8	-	-	32.3	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
REL STD DES VAL	-	-	-	2.8	-	-	30.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
MEAN	4	-	-	2.8	-	-	31.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
STD DEV	-	-	-	2.8	-	-	32.3	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
REL STD DES VAL	-	-	-	2.8	-	-	30.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
MEAN	5	-	-	2.8	-	-	31.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
STD DEV	-	-	-	2.8	-	-	32.3	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
REL STD DES VAL	-	-	-	2.8	-	-	30.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
MEAN	6	-	-	2.8	-	-	31.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
STD DEV	-	-	-	2.8	-	-	32.3	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
REL STD DES VAL	-	-	-	2.8	-	-	30.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
MEAN	7	-	-	2.8	-	-	31.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
STD DEV	-	-	-	2.8	-	-	32.3	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
REL STD DES VAL	-	-	-	2.8	-	-	30.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
MEAN	8	-	-	2.8	-	-	31.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
STD DEV	-	-	-	2.8	-	-	32.3	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
REL STD DES VAL	-	-	-	2.8	-	-	30.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
MEAN	9	-	-	2.8	-	-	31.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
STD DEV	-	-	-	2.8	-	-	32.3	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
REL STD DES VAL	-	-	-	2.8	-	-	30.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
MEAN	10	-	-	2.8	-	-	31.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
STD DEV	-	-	-	2.8	-	-	32.3	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
REL STD DES VAL	-	-	-	2.8	-	-	30.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
MEAN	11	-	-	2.8	-	-	31.0	-	-	7.55	-	7.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
STD DEV	-	-	-	2.8	-	-	32.3	-	-</td																									

DATA SUMMARY - PED-PROV & PPWB QA PROGRAMS

STUDY NO. FP 38 PP 78

SAMPLE 4

LAB	CL DIS I C	17209 CL DIS FIR CON	17210 CL DIS IC	17211 CL DIS IC	17990 CHLORIDE COMMON	19001 K TOT AAS	19005 K TOT ICP	19008 K TOT DCP	19102 K DIS AAS	19103 K DIS FLM PH	19105 K DIS AAS DA	19106 K DIS MAS LI	19107 K DIS FLM PH	19111 K DIS ICP
1	-	26.	-	-	22.8	-	-	-	-	2.8	-	-	-	-
2	23.	-	-	-	23.1	-	-	-	3.1	-	-	-	-	-
3	25.	-	-	-	24.0	-	-	-	2.8	-	-	-	-	-
4	26.	-	-	-	22.5	-	-	3.18	-	-	-	-	-	-
5	-	23.	-	-	23.1	-	-	-	-	-	-	-	-	-
6	-	24.	-	-	23.1	-	-	2.84	-	-	-	-	-	-
7	10.	-	-	-	25.0	-	-	-	-	-	-	-	-	-
8	11.	-	-	-	26.0	-	-	2.91	-	-	-	-	-	-
9	13.	-	-	-	22.	22.	-	-	2.76	-	-	-	-	-
10	14.	-	-	-	22.	22.	-	-	2.76	-	-	-	-	-
11	15.	-	-	-	22.	22.	-	-	2.76	-	-	-	-	-
12	16.	-	-	-	22.	22.	-	-	2.76	-	-	-	-	-
MEAN	25.0000	24.0000	22.0000	23.0214	2.9100	3.0200	2.7600	2.8900	2.9000	3.1000	3.1000	2.8400	2.9500	-
STD DEV	6.7321	-	-	21.3830	-	8.2546	-	4.101	4.1732	-	-	-	-	-
REL STD	6.9	-	-	5.8	-	8.4	-	14.2	6.0	-	-	-	-	-
DES VAL	-	-	-	23.558	-	-	-	-	-	-	-	-	-	-
LAB	19301 K EXT HNO3 AA	19990 POTASSIUM COMMON	20005 CA TOT ICP	20007 CA TOT DCP	20050 CA DIS AAS NO	20100 CA DIS CALC'D	20103 CA DIS AAS	20107 CA DIS AAS UP	20108 CA DIS AAS AUT	20110 CA DIS AAS AUT	20111 CA DIS AAS AUT	20311 CA EXT ICP	20990 CALCIUM COMMON	-
1	-	2.8	-	-	-	-	-	-	16.6	-	16.5	-	16.6	-
2	-	3.184	-	-	-	-	-	-	17.1	-	-	-	-	-
3	-	2.8	-	-	-	-	-	-	16.9	-	-	-	-	-
4	-	2.6	-	-	-	-	-	17.	16.6	-	-	-	-	-
5	-	3.18	-	-	-	-	-	-	-	-	-	-	-	-
6	-	2.85	-	17.5	-	-	-	-	-	-	-	-	-	-
7	2.85	-	3.285	17.5	-	-	-	-	-	-	-	-	-	-
8	-	3.284	17.0	-	-	-	-	-	-	-	-	-	-	-
9	-	3.194	-	-	-	-	-	-	-	-	-	-	-	-
10	-	3.195	-	-	-	-	-	-	-	-	-	-	-	-
11	-	2.91	-	-	-	16.9	-	-	-	-	-	-	-	-
12	-	3.1	-	-	-	-	-	-	-	-	-	-	-	-
13	-	2.76	-	16.0	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	2.8500	2.9307	17.2500	16.0000	16.9000	17.0000	16.5000	16.4583	16.6000	17.1000	16.5000	17.6500	17.4000	16.9143
STD DEV	-	6.1791	2.3536	-	-	-	-	-	2.8	-	-	.0707	-	.5376
REL STD	-	6.1	2.0	-	-	-	-	-	-	-	-	.4	-	.2
DES VAL	-	2.909	-	-	-	-	-	-	-	-	-	-	-	16.966
DATES RECEIVED	15	89/02/01	89/02/03	89/01/25	89/03/03	89/03/03	89/03/03	89/03/28	89/04/17	89/03/30	89/03/02	89/04/13	89/03/02	89/03/02
	15	89/02/27	10	89/02/21	11	89/02/27	13	89/02/21	14	89/04/13	15	89/03/29	16	89/03/28

NOTE : ALL CONCENTRATION UNITS ARE EXPRESSED IN MG/L OF EACH ELEMENT IN USE/CM, THE EXCEPTIONS BEING:
 COLOR IN RELATIVE UNITS, TURBIDITY IN JTU OR NTU, NITROGEN ANALYSES IN "N", ALKALINITY & HARDNESS IN CaCO₃, SILICA IN SiO₂, AND SULFATE IN SO₄.

Research & Applications Branch
National Water Research Institute
867 Lakeshore Road, P.O. Box 5050
Burlington, Ontario
L7N 3E6

6 July, 1989

To: Participants & Managers in:

Prairie Provinces Quality Assurance Program (PPQA)

re: Final Report for QA Studies PP 79-80

I have enclosed the final report for PP 79-80.

If you have any comments on this report, or any legitimate corrections to the data base, please do not hesitate to communicate them.

Harry A

H. Alkema
Quality Assurance Project

Participants & Managers:

Dr. J.J. Bergman
Sask. Prov. Water Laboratory

Mr. J-G. Zakrevsky
Western & Northern Region WQB

Dr. F.P. Dieken
Alberta Water Analysis Res. Sta.

Mr. G.W. Dunn
Prairie Province Water Board

Mr. E.A. Sorba
Manitoba Technical Services Lab

Mr. W.D. Gummer
Western & Northern Region WQB

Dr. Wo Yuen
Saskatchewan Research Council

Mr. A.S.Y. Chau
NWRI, CCIW



Environment
Canada

Environnement
Canada

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RESEARCH & APPLICATIONS BRANCH

FINAL REPORT

REPORT NO. RAB 89-14

PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAM

STUDIES 79 AND 80

for March and April 1989

**TRACE METALS, MAJOR IONS, NUTRIENTS
AND PHYSICAL PARAMETERS IN SURFACE WATERS**

by

H. Alkema

**Quality Assurance Section
National Water Research Institute
Burlington, Ontario**

July 1989

Introduction

As part of an on-going study, the Quality Assurance Section, NWRI in Burlington, Ontario, has been sending reference water samples bi-monthly to chemical laboratories participating in the PPWB program. This report summarizes the most recent PPWB interlaboratory quality control studies: PP 79 and 80, for the months March and April, 1989. These two studies dealt with trace metals, major ions, nutrients and physical parameters. The levels were medium to high levels for metals, and medium levels for major ions.

Study Design

Four water samples were submitted to each laboratory for chemical analyses. Two samples were submitted for trace metals analysis, while the remaining two were submitted for major ions, nutrients and some physical measurements. The following is a breakdown of the four samples:

PP 78 – Sample 1 – 125 ml, high level* for trace metals (3% HNO₃)

Sample 2 – up to 1L, major ions etc., stored at 4°C

PP 80 – Sample 3 – 1L, low level* for trace metals (0.2% HNO₃)

Sample 4 – up to 1L, major ions, etc., stored at 4°C

* for definitions see Appendix 1

Treatment of Data

Each laboratory was asked to perform only those analyses which were routine to their particular laboratory, using the general methodology guidelines listed above. Results for these analyses were recorded as required by the Standard Report Sheets provided with the QA samples. Submitted results were tabulated for each parameter, first for each method reported, and then for all methods combined. These data, and the resulting statistics are presented in the Data Summary. (attached)

Preliminary data summaries (RAB # 89-09), including problematic results, were sent May 1, and June 6. Each laboratory was given three weeks to notify us of any errors in data transcription, compilation, or flags.

Performance Indicators

In the PPWB QA program, two types of reference samples are used for the accuracy assessment. Reference waters (RMs) and certified reference waters (CRMs) have Design Values for the stable parameters. Also, regional samples are used occasionally as natural reference samples. The means for the regional samples, and the Design Values for the reference waters are used to test each reported result for accuracy.

Percentage deviations from the reference value are used as an indicator for the laboratory head to determine the extent of the discrepancies between the laboratory result and reference value. However, please keep in mind that at low levels, high % deviations are often seen, and may be misleading if interpreted too strictly.

A result which deviates more than the greater of 10% or 1 standard deviation from the reference value is marked with an asterisk in the data tables and its value tabulated in the flagged data table (Table 1). Results reported with an "L" (less than) or flagged with an "R" (rejectable) are not used in the statistical calculations. Performance indicators are fully explained in Appendix II.

Comments on Laboratory Performance

Results accompanied with a 'less than' are difficult to appraise. If a design value or mean is significantly lower than the detection limit given by a particular laboratory, then that detection limit is too high. Such a result is assigned an 'HDL' and is tabulated for each laboratory in Table 1.

If, on the other hand, the detection limit reported is far lower than the mean or design value, then the use of 'less than' is clearly inadequate and the result is flagged low. The magnitude of the deviation from the mean in such a case is taken from the detection limit given.

Attached are two tables listing flagged data by laboratory (Table 1), and listing parameters for which there was a high standard deviation (Table 2). Formerly called a high coefficient of variation, the standard deviation is generated with standardized criteria that are included with the automated flagging routine. These automated criteria have been in use since March 1988 (Study PP 67), and should provide a more accurate and consistent listing of the difficult to analyze parameters or levels. A listing of the criteria used to indicate high deviation of analysis is available on request. Your comments would be appreciated.

PPWB laboratories average number of deviations per sample was 3.3

APPENDIX I

Definitions of Types of Metals Analysis

1. HIGH LEVEL ANALYSIS

Usually without sample pretreatment, samples are aspirated by Atomic Absorption Spectrophotometry (AAS), Inductively Coupled (Argon) Plasma or direct coupled plasma (ICAP, ICP, or DCP). Standards should contain the acid equivalent of the sample.

2. LOW LEVEL ANALYSIS

Analysis is carried out by one of the following methods:

1. Solvent extraction sample concentration followed by AAS.
2. Digestion and concentration of aqueous phase followed by ICAP, or DCP.
3. Digestion of aqueous phase and ICAP or DCP analysis.
4. Graphite tube (flameless) AAS.

Updated March 1989.

APPENDIX II

Performance Indicators

1. Flagged Results

As a first indication that analysis results are appreciably deviant from the expected value, each submitted result is tested with the 10% or 1 Standard Deviation Rule. When a result is found to deviate more than 10%, or more than 1 standard deviation when this is greater than 10%, the result is flagged with an asterisk in the data summary and tabled for that laboratory in the Flagged Data Table. Typically at low levels the 10% criteria is too small and the 1 standard deviation criteria effectively indicates deviant analytical results. As performance indicator, the flagged results indicate to laboratory heads that in-house QC procedures and the methodology concerned need to be investigated. Results may still be comparable.

2. Grubbs' Rejectable Results

For every parameter, each laboratory result is statistically tested to see if it is outlying. Outlying results are caused by non random causes such as a faulty calibration or incorrect transcription. These outlying results, calculated by the Grubbs' procedure, and indicated in the data tables with an 'R', are noncomparable with the other data for that parameter.

3. A High Standard Deviation for a Parameter

Occasionally data for a difficult to analyse parameter yields a very high relative standard deviation (RSD). When a high RSD is not due to outlying results, there are noncomparable results within the data set. In such a case, the RSD for that parameter is indicated in Table 2, entitled: High Standard Deviations.

4. High Detection Limits (HDL's)

Each laboratory determines its own detection limits according to its own requirements. When major differences in detection limits occur, an HDL is indicated for the particular laboratory in the Flagged Data Table. An HDL indicates that low level analysis may not be comparable with the analyses of other laboratories.

* reference : Frank E. Grubbs, Technometrics, 1969, p. 1.

TABLE 1: PRAIRIE PROV LABORATORIES FLAGGED RESULTS - STUDIES PP 79-80

LAB 1	FLAGS :	ALUMINUM TKN	-19% -90%	ALUMINUM	26%	IRON	775% R
LAB 3	FLAGS :	D O C	43%	D O C	30%		
LAB 4	FLAGS :	BORON	126%	BORON	90%	TOT P	255% R
LAB 6	FLAGS :	TKN PTASSIUM IRON TKN FLUORIDE CALCIUM	136% R 20% R 56% R 65% -29% 14% R	NITRATE CALCIUM ZINC NITRATE MGNESIUM	18% R 14% R -26% 18% -24% R	CHLORIDE VANADIUM MOLYBNUM AMMONIA PTASSIUM	-33% R 43% 67% R 92% 19%
LAB 8	FLAGS :	IRON NITRATE MGNESIUM PTASSIUM COPPER MGNESIUM CHLORIDE	12% 12% 13% -15% 32% 12% -13% R	COPPER AMMONIA SULFATE CHROMIUM ZINC SILICA PTASSIUM	11% -75% 35% 33% 18% -23% R -16%	LEAD SODIUM CHLORIDE IRON SODIUM SULFATE	13% 15% -16% 25% 12% 62% R
	HDL :	ALUMINUM					

NOTE: A VERY HIGH FREQUENCY OF FLAGGED RESULTS (OR A HIGH %) IS INDICATIVE OF POOR PERFORMANCE. ON THE OTHER HAND, LABS WITH FEW IF ANY FLAGS ARE JUDGED TO HAVE VERY GOOD PERFORMANCE.

ALSO, AN "R" FLAG INDICATES A NON COMPARABLE RESULT, THAT IS, ONE PRODUCED WITH NON RANDOM FACTORS. AN "L" FLAG INDICATES A 'LESS THAN' RESULT LOWER THAN THE COMPARATOR.

TABLE 2:

HIGH STANDARD DEVIATION

PARAMETER		LEVEL
BORON	AT	.042 PPM
D O C	AT	1.256 PPM
VANADIUM	AT	.021 PPM
BORON	AT	.046 PPM
D O C	AT	2.074 PPM
FLUORIDE	AT	.140 PPM

DATA SUMMARY

FEDERAL-PROVINCIAL & PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAMS

STUDY NO.	FP 39		PP 79		DATE: 01/03/89		DUE DATE: 30/04/89		PAGE 1	
	SAMPLE 1	SPiked SAMPLE.								(IN 3.0% HNO3)
LAB	13009 AL Tot 5X ICP	13030 Al DIS ICP DA	13111 Al DIS ICP DA	13302 Al EXT AAS DA	13311 Al EXT ICP DA	13321 Al EXT ICP DA	13999 ALUMINUM COMMON	23009 V TOT 5X ICP	23011 V TOT 5X DCP	23111 V DIS ICP DA
1	-	2.19	-	2.6	-	-	2.19 *	2.26	-	-
2	-	-	-	2.85	-	2.81	2.6	-	-	-
3	-	-	-	-	-	-	2.85	-	-	-
6	2.8	-	-	2.8	-	-	2.8	-	-	-
8	-	-	2.7	-	-	-	2.7	-	-	-
9	-	-	2.44	-	-	-	2.44	-	-	-
10	-	-	-	-	2.59	-	2.59	-	-	-
15	-	-	-	-	-	-	2.71	2.71	-	-
16	-	-	-	-	-	-	-	-	2.24	-
MEAN	2.8000	2.1900	2.5700	2.7500	2.5900	2.8100	2.7100	2.6311	2.2600	2.2400
STD	DEV	REL STD	REL STD	REL STD	REL STD	REL STD	REL STD	REL STD	REL STD	REL STD
LAB	23321 V EXT ICP DA	23999 VANADIUM COMMON	24009 CR TOT 5X ICP	24011 CR TOT 5X ICP	24012 CR TOT 5X DCP	24111 CR DIS ICP DA	24321 CR EXT AAS DA	24999 CHROMIUM COMMON	25003 MN TOT 5X ICP	25011 MN TOT 5X DCP
1	2.32	2.26	0.300	-	-	-	-	0.297	0.263	-
3	-	2.32	2.5	-	0.33	-	-	-	-	-
6	-	2.35	-	-	-	-	-	-	-	-
8	-	2.20	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-
13	-	-	2.46	-	-	-	-	-	-	-
15	-	2.24	-	-	0.318	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-
MEAN	2.3200	2.3329	3.000	.3300	.3180	.2925	.2900	.2935	.2970	.2997
STD	DEV	REL STD	REL STD	REL STD	REL STD	REL STD	REL STD	REL STD	REL STD	REL STD
LAB	25104 MN DIS AAS DA	25111 MN DIS AAS DA	25304 MN EXT AAS DA	25311 MN EXT ICP DA	25321 MN EXT ICP DA	25999 MANGANESE COMMON	26009 FE TOT 5X ICP	26011 FE TOT 5X DCP	26104 FE DIS AAS DA	26111 FE EXT AAS DA
1	-	-	-	-	-	-	1.080	-	-	-
2	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-
9	-	0.26	-	-	0.253	-	-	-	-	-
10	-	0.247	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-
14	0.263	-	-	-	0.27	-	-	-	-	-
15	-	-	-	-	0.277	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-
MEAN	.2630	.2535	.0092	.3.6	.2710	.2723	.2530	.2685	.1.0440	.1.0850
STD	DEV	REL STD	REL STD	REL STD	REL STD	.0040	.0143	.5.3	.0.0085	.1.0212
						4.7	1.5	.262	.8	.6.1

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB OA PROGRAMS

STUDY NO. FP 39 pp 79

SAMPLE 2

4

00110 IONIC & POLARIC 00120 SUM OF CAPTIONS 00121 SUM

02073	02074	02077
FURB	TURB	TURB
HACH	NPLMTRI	HACH FZ

	MAN	DD DEV	LL STD	S VAL
1	2.85	-	-	-
2	2.80	-	-	-
3	2.843	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-
7	-	-	-	-
8	-	-	-	-
9	-	-	-	-
10	-	-	-	-
11	-	-	-	-
12	-	-	-	-
13	-	-	-	-
14	-	-	-	-
15	-	-	-	-
16	-	-	-	-

	MAN	ED DEV	SD
11	-	0.1	0.0
15	-	0.1	1
16	-	0.1	1
	.2000	.1191	.0461
	-	38.70%	.206

- - - -
 - - -
 - - -
 - - -
 - - -
 - - -

06112 DOC PER IR
06119 UV OH
06120 CO2 OH
LAW

07016	TKN-BLK SMM-SAL	07021	TKN-BLK DIG-BER	07090	TKN COMMON
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ପ୍ରକାଶମତ୍ତୁ

0.62 R
0.3 R
0.3 R

	MEAN	STD DEV	STD ERR	VAL
1.0	-	-	-	-
1.5	-	-	-	-
1.6	1.0000	1.4000	1.2000	24.7

	0.20	*
-	-	-
.1200	.1273	
-	.0693	
-	54.4	
-	.126	
-	-	
-	-	
-	-	

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO. FP 39 PP 79

SAMPLE 2

PAGE 5

LAB	07109 NO ₂ AA HYD	07110 NO ₃ +NO ₂ AA CD	07111 NO ₃ +NO ₂ DIS SPEC	07112 NH ₃ TOT AA CD	07390 NITRATE COMMON	07505 NH ₃ TOT AA BERT	07540 NH ₃ DIS AA SAL	07555 NH ₃ DIS AA PHEN	07557 NH ₃ DIS AA INDO	07590 AMMONIA COMMON	07600 T _N PER AUTO	07601 AA SUL
1	-	0.37	0.335	-	0.349	0.335	-	-	-	0.007	0.007	-
2	-	0.359	-	-	0.349	0.359	0.005L	0.005L	-	0.005L	-	0.38
3	-	0.335	-	-	0.335	0.335	-	-	0.009	0.009	-	0.434
4	0.41 R	-	-	0.33	0.41 R	0.33	-	-	0.01	0.01	-	-
5	-	0.39	-	-	0.33 *	0.39 *	-	0.002	-	0.002*	-	-
6	-	0.325	-	-	0.34 *	0.325	0.007L	0.010L	-	0.010L	-	-
7	-	0.34	-	-	0.41 *	0.34 *	-	-	-	0.007L	-	-
8	-	0.33	0.41	-	0.41 *	0.41 *	-	0.012	-	0.012	0.54	-
9	-	0.343	-	-	0.343	-	-	-	-	-	-	-
10	-	0.325	-	-	0.343	-	-	-	-	-	-	-
11	-	0.34	-	-	0.34 *	-	-	-	-	-	-	-
12	-	0.33	-	-	0.33 *	-	-	-	-	-	-	-
13	-	0.343	0.41	-	0.41 *	-	-	-	-	-	-	-
14	-	0.343	-	-	0.343	-	-	-	-	-	-	-
15	-	0.343	-	-	0.343	-	-	-	-	-	-	-
MEAN	3375	3481	3725	3395	3489	3489	-	0.0095	0.0070	0.0080	5400	4070
STD	0.0177	0.0287	0.0530	0.0134	0.0286	0.0286	-	0.0070	0.0038	0.0038	9.4	0.382
REL STD	5.2	8.2	14.2	4.0	8.2	8.2	-	101.0	7.4	47.6	-	-
DES VAL	-	-	-	-	-	-	-	-	-	0.013	-	-
LAB	07605 T _N UV HY SUL	07651 T _N DIS UV AA	07655 T _N DIS UV EDTA	07690 TOT N COMMON	07790 F DIS COMMON	09103 F DIS COL SP	09105 F DIS SP EL	09107 F DIS AUT POT	09108 F DIS SP EL	09115 F DIS AA ALIZ	09190 FLUORIDE COMMON	10101 ALKALI TITR N
1	-	-	-	-	-	-	-	0.52	-	0.56	-	-
2	-	0.457	0.400	-	0.434	0.434	-	-	-	0.56	-	-
3	-	-	-	-	0.400	0.400	0.6	0.561	-	0.561	-	-
4	-	-	-	-	-	-	-	0.60	-	0.60	-	-
5	-	-	-	-	0.43	0.43	-	-	-	0.61	0.61	-
6	-	-	-	-	-	-	-	0.49	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-
8	0.43	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	4300	4570	4000	5400	4202	6000	5967	5405	5600	6100	5801	75.6545
STD	-	-	-	-	0.0303	-	17.6	5.4	-	-	10.598	75.6777
REL STD	-	-	-	-	7.2	-	-	-	-	-	10.563	2.2
DES VAL	-	-	-	-	.518	.417	-	-	-	-	-	-
LAB	10108 ALKALI POT TIT	10109 ALKALI POT TIT	10111 ALKALI POT PRO	10112 ALKALI COMMON	101190 ALKALI COMMON	10301 PH COMMON	10390 HARDNS CALC'D	10602 HARDNS TITR'N	10603 HARDNS CALC'D	10690 HARDNESS COMMON	11001 HARDNESS AA'S	11005 AA'S TITR ICP
1	-	-	-	-	76.6	7.89	106.3	-	-	106.3	-	-
2	-	-	72.5	-	73.9	7.85	103.8	-	-	103.8	-	-
3	-	-	-	-	72.5	7.85	-	-	-	106.	-	-
4	-	-	-	-	74.9	8.04	8.04	-	-	-	-	-
5	-	-	-	-	83.0	8.04	8.00	-	-	-	-	-
6	83.	-	-	-	83.3	8.10	8.1	-	114.	-	-	-
7	-	73.	-	-	73.3	8.06	8.00	-	108.	-	-	-
8	-	-	-	-	75.	7.96	7.96	116.7	-	116.	-	-
9	-	75.	-	-	75.	7.90	7.90	108.	-	108.	-	-
10	-	-	-	-	75.	7.75	7.75	-	-	104.	-	-
11	-	-	-	-	76.3	8.00	8.00	-	-	113.	-	-
12	-	-	-	-	76.3	8.04	8.04	-	-	96.6	-	-
13	-	-	-	-	78.3	7.99	7.99	104.6	-	104.	-	-
14	-	-	-	-	78.3	7.99	7.99	107.5	-	107.5	-	-
15	-	-	-	-	78.	7.99	7.99	-	-	104.	-	-
16	-	-	-	-	78.	7.99	7.99	-	-	107.5	-	-
MEAN	75.0000	78.0000	72.5000	75.0000	75.7133	7.9453	106.4900	111.3000	106.0000	107.3167	15.3000	14.6550
STD	7.0711	9.1	-	-	2.6656	5.3149	3.8184	5.0	3.4	5.2786	1.9550	8.2
REL STD	-	-	-	-	2.4	7.882	7.882	-	-	107.029	-	-
DES VAL	-	-	-	-	75.668	-	-	-	-	-	-	-

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY

FEDERAL-PROVINCIAL & PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAMS

STUDY NO. FP 40 PP 80 DATE: 01/04/89 DUE DATE: 30/04/89 PAGE 8
 SAMPLE 3 CRYOGENIC SAMPLE
 TRACE METALS S/P (IN 0.2% HNO3)

LAB	13009	13030	13105 AL DIS AAS GFP	13111 AL DIS AAS GFP	13302 AL EXT AAS DA	13305 AL EXT AAS SE	13311 AL EXT AAS DA	13322 AL EXT AAS SE	13999 COMMON AAS SE	23002 ALUMINUM COMMON	23009 V TOT 5x ICP	23011 V TOT 5x ICP	23012 V TOT 5x DCP
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	AN	D	DEV	STD	VAT	
1	.0570	.0630	.0690	.0600	.0495	.0200
2	.0028			.0141	.0035	.0093
3	5			23.6	7.1	16.1
4	6					1.050
5	6.7					.0014
6						.0300
7						

23105	23111 V DIS ICP DA	23311 V EXT ICP DA	23999 VANADIUM COMMON	24003 CR TOT AAS SE	24004 CR TOT AAS GP	24009 CR TOT 5X ICP	24011 CR TOT 5X ICP	24012 CR TOT 5X DCP	24111 CR TOT ICP DA	24303 CR EXT AAS SE	24311 CR EXT ICP DA	24999 CHROMIUM COMMON
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		AN	DEV	STD	VAL
1					
3					
6					
8					
9					
10					
11					
14					
15					
16					
AN	.0100	.0220 .0060	.0200 .0059	.0270 .0059	.0310 .0071
DEV					
STD					
VAL					

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	FP	40	PP	80	SAMPLE 3			PAGE 10			
					SR	TOT	ICP DA	SR	TOT	ICP DA	
LAB	30305 ZN EXT AAS SE	30311 ZN EXT ICP DA	30399 ZINC COMMON	38009 SR TOT ICP DA	38012 SR TOT DCP DA	38111 SR DIS ICP DA	38301 SR EXT AAS DA	38999 STRNTIUM COMMON	42009 MO TOT 5X ICP	42011 MO TOT 5X ICP	42012 MO TOT 5X DCP
1	-	-	-	0.034 0.035 0.025*	0.171 0.045*	-	-	-	0.016 0.017	-	-
2	-	-	-	0.035 0.035	-	-	-	0.171 0.18	0.03 R	-	-
3	-	-	-	0.025*	-	-	-	-	-	-	-
6	-	0.04	-	0.045*	-	-	-	-	-	-	-
8	-	-	-	0.035	-	-	-	-	-	-	-
9	-	-	-	0.034	-	-	-	-	-	-	-
10	0.030	-	-	0.034	-	-	-	-	-	-	-
11	-	-	-	0.033	-	-	-	-	-	-	-
14	-	0.036	-	0.036	-	-	-	-	-	-	-
15	-	0.045*	-	0.045*	-	-	-	-	-	-	-
16	-	-	-	0.359R	-	-	-	-	-	-	-
MEAN	.0300	.0380	.0347	.1710	-	.1800	.1800	.1778 .0045 2.5	.0165 .0007 4.3	.0220	.0190 .0014 7.4
STD	DEV	REL STD	DES VAL	7.4	14.6	.034	-	-	-	-	-
LAB	42311 Mo EXT ICP DA	42999 MOLYBNUM COMMON	48002 CD TOT AAS SE	48004 CD TOT 5X ICP	48009 CD TOT 5X ICP	48011 CD TOT 5X ICP	48012 CD TOT 5X DCP	48111 CD DIS AAS SE	48302 CD EXT AAS GF	48309 CD EXT AAS GF	48311 CD EXT ICP DA
1	-	-	0.016	-	-	0.021	-	-	-	-	-
2	-	-	0.017	0.021	-	0.020	-	-	-	-	-
3	-	-	0.03 R	-	-	-	-	-	-	-	-
6	-	-	0.02	-	0.023	-	-	-	-	-	-
8	-	-	0.018	-	-	-	-	-	-	-	-
9	-	-	0.018	-	-	-	-	-	-	-	-
10	-	-	0.02	-	-	-	-	-	-	-	-
11	-	-	0.022*	-	-	-	-	-	-	-	-
14	0.02	-	0.022*	-	-	-	-	-	-	-	-
15	-	-	0.022*	-	-	-	-	-	-	-	-
16	-	-	0.0200	.0188 .0022	.0210 11.8	.0230 .018	.0205 3.4	.0200 3.4	.0240 -	.0200 -	.0220 -
MEAN	STD	DEV	REL STD	DES VAL	-	-	-	-	-	-	-
LAB	56009 Ba TOT 5X ICP	56011 Ba TOT 5X DCP	56012 Ba TOT 5X ICP	56111 Ba DIS ICP DA	56311 Ba EXT ICP DA	56999 BARIUM COMMON	82002 PB TOT AAS SE	82004 PB TOT AAS GF	82009 PB TOT 5X ICP	82011 PB TOT 5X ICP	82012 PB TOT 5X DCP
1	0.022	-	-	-	-	-	0.022	-	-	-	-
2	0.022	-	0.029	-	-	-	0.025	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-
16	-	-	0.040R	-	-	-	0.024	0.024 0.040R	-	-	-
MEAN	STD	DEV	REL STD	DES VAL	-	-	-	-	-	-	-
					.0225	.0240	.0237 -.0031	.0250	.0260	.0270	.0265
					15.7	-	13.3	13.022	-	-	3.8

DATA SUMMARY - FED-PROV & RPWB OA PROGRAMS

STUDY NO. FP 40 PP 80 SAMPLE 3 PAGE 11

LAB	82309 PB EXT AAS GF	82311 PB EXT ICP DA	82999 LEAD COMMON
1	-	-	0.027
2	-	-	0.026
3	-	-	0.025
6	0.029	-	0.027
8	-	-	0.029
9	0.026	-	0.026
10	-	-	0.026
11	-	-	0.025
14	-	-	0.014R
15	-	0.05 L	0.05 L
16	-	-	0.040R
MEAN	.0275	-	.0264
STD	.0021	-	.0013
REL STD	7.7	-	4.9
DES VAL	-	-	.026

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATES RECEIVED	1 89/03/14	2 89/05/01	3 89/03/23	3 89/04/28	4 89/05/02
	5 89/05/01	6 89/03/21	6 89/05/02	7 89/05/05	8 89/05/19
	9 89/04/26	10 89/04/25	11 89/04/25	13 89/05/02	14 89/06/01
	15 89/04/28	16 89/03/29			

NOTE: ALL CONCENTRATION UNITS ARE EXPRESSED IN MG/L OF EACH ELEMENT, THE EXCEPTIONS BEING:
 COLOUR IN RELATIVE UNITS; CONDUCTIVITY IN USEP/CM; TURBIDITY IN JTU OR NTU; NITROGEN
 ANALYSES IN "N"; ALKALINITY & HARDNESS IN CACO₃; SILICA IN SiO₂; AND SULFATE IN SO₄.

Canada Centre for Inland Waters
National Water Research Institute
867 Lakeshore Road, P.O. Box 5050
Burlington, Ontario
L7R 4A6

September 8, 1989.

To: Participants & Managers in:

Prairie Provinces Quality Assurance Program (PPOA)

I have enclosed the final report for PP 81-82.

If you have any comments on this report, or any legitimate corrections to the data base, please do not hesitate to communicate them.

Harry A.

H. Alkema
Quality Assurance Project
Research & Applications Branch

Participants & Managers:

Dr. J.J. Bergman
Sask. Prov. Water Laboratory

Dr. F.P. Dieken
Alberta Water Analysis Res. Sta.

Mr. E.A. Sorba
Manitoba Technical Services Lab

Dr. Wo Yuen
Saskatchewan Research Council

Mr. J-G. Zakrevsky
Western Region WQB

Mr. G.W. Dunn
Prairie Province Water Board

Mr. W.D. Gummer
Western Region WQB

Mr. A.S.Y. Chau
NWRI, CCIW



DISTRIBUTION - PPWB

Dr. J.J. Bergman
Supervisor, Provincial Water Laboratory
Saskatchewan Dept. of Health

Dr. F.P. Dieken
Head, Water Analysis Research Station
Alberta Environmental Centre

Mr. E.A. Sorba
Head, Methods and Standards Section
Manitoba, Technical Services Laboratory

Dr. Wo Yuen
Sr. Research Scientist, Analytical Services
Saskatchewan Research Council

Mr. J-G. Zakrevsky
Head, Analytical Services Section
Western Region Water Quality Branch

cc. Mr. G.W. Dunn
Water Quality Specialist
Prairie Province Water Board
Regina, Saskatchewan

Mr. W.D. Gummer
Chief, Water Quality Branch
Western Region
Regina, Saskatchewan

Mr. A.S.Y. Chau
Project Chief, Quality Assurance Project
Research and Applications Branch
NWRI, CCIW
Burlington, Ontario

RESEARCH & APPLICATIONS BRANCH

FINAL REPORT

REPORT NO. RAB 89-16

PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAM

STUDIES 81 AND 82

for May and June 1989

**TRACE METALS, MAJOR IONS, NUTRIENTS
AND PHYSICAL PARAMETERS IN SURFACE WATERS**

by

H. Alkema

**Quality Assurance Section
National Water Research Institute
Burlington, Ontario**

September 1989

Introduction

As part of an on-going study, the Quality Assurance Section, NWRI in Burlington, Ontario, has been sending reference water samples bi-monthly to chemical laboratories participating in the PPWB program. This report summarizes the most recent PPWB interlaboratory quality control studies: PP 81 and 82, for the months May and June, 1989. These two studies dealt with trace metals, major ions, nutrients and physical parameters. The levels were mainly low.

Study Design

Four water samples were submitted to each laboratory for chemical analyses. Two samples were submitted for trace metals analysis, while the remaining two were submitted for major ions, nutrients and some physical measurements. The following is a breakdown of the four samples:

PP 81 - Sample 1 - 125 ml, high level* for trace metals (3% HNO₃)

Sample 2 - up to 1L, major ions etc., stored at 4°C

PP 82 - Sample 3 - 1L, low level* for trace metals (0.2% HNO₃)

Sample 4 - up to 1L, major ions, etc., stored at 4°C

* for definitions see Appendix 1

Treatment of Data

Each laboratory was asked to perform only those analyses which were routine to their particular laboratory, using the general methodology guidelines listed above. Results for these analyses were recorded as required by the Standard Report Sheets provided with the QA samples. Submitted results were tabulated for each parameter, first for each method reported, and then for all methods combined. These data, and the resulting statistics are presented in the Data Summary. (attached)

Preliminary data summaries (RAB # 89-12), including problematic results, were sent July 5, and August 11. Each laboratory was given three weeks to notify us of any errors in data transcription, compilation, or flags.

Performance Indicators

In the PPWB QA program, two types of reference samples are used for the accuracy assessment. Reference waters (RMs) and certified reference waters (CRMs) have Design Values for the stable parameters. Also, regional samples are used occasionally as natural reference samples. The means for the regional samples, and the Design Values for the reference waters are used to test each reported result for accuracy.

Percentage deviations from the reference value are used as an indicator for the laboratory head to determine the extent of the discrepancies between the laboratory result and reference value. However, please keep in mind that at low levels, high % deviations are often seen, and may be misleading if interpreted too strictly.

A result which deviates more than the greater of 10% or 1 standard deviation from the reference value is marked with an asterisk in the data tables and its value tabulated in the flagged data table (Table 1). Results reported with an "L" (less than) or flagged with an "R" (rejectable) are not used in the statistical calculations. Performance indicators are fully explained in Appendix II.

Comments on Laboratory Performance

Results accompanied with a 'less than' are difficult to appraise. If a design value or mean is significantly lower than the detection limit given by a particular laboratory, then that detection limit is too high. Such a result is assigned 'HDL', and is tabulated for each laboratory in Table 1.

If, on the other hand, the detection limit reported is far lower than the mean or design value, then the use of 'less than' is clearly inadequate and the result is flagged low. The magnitude of the deviation from the mean in such a case is taken from the detection limit given.

Attached are two tables listing flagged data by laboratory (Table 1), and listing parameters for which there was a high standard deviation (Table 2). Formerly called a high coefficient of variation, the standard deviation is generated with standardized criteria that are included with the automated flagging routine. These automated criteria have been in use since March 1988 (Study PP 67), and should provide a more accurate and consistent listing of the difficult to analyze parameters or levels. A listing of the criteria used to indicate high deviation of analysis is available on request. Your comments would be appreciated.

PPWB laboratories average number of deviations per sample was 2.7.

TABLE 1: PRAIRIE PROV LABORATORIES FLAGGED DATA - STUDIES PP 81-82

LAB 1	FLAGS :	TKN SULFATE	-89% L 145% R	SODIUM ZINC	57% 427% R	MGNESIUM	-26%
LAB 3	FLAGS :	TKN D O C	46% -20%	SULFATE SULFATE	-14% -25%	CHLORIDE	19%
LAB 4	FLAGS :	BORON BORON	141% R 73% R	D O C D O C	518% R -86% R	T N DIS T N DIS	12% 35%
LAB 6	FLAGS :	CHROMIUM TOT P HARDNESS TOT P	-15% 900% R 60% R 384% R	TKN PTASSIUM SODIUM PTASSIUM	457% R 65% R 22% 47%	SODIUM TKN MGNESIUM CALCIUM	-22% 223% R 49% R 78% R
	HDL :	AMMONIA VANADIUM ALKLINTY		SULFATE NITRATE SULFATE		CHLORIDE AMMONIA	
LAB 8	FLAGS :	ALUMINUM COPPER MGNESIUM ZINC CHLORIDE	56% R -35% R 14% -33% L 25%	CHROMIUM ZINC CHROMIUM HARDNESS CALCIUM	49% R -27% 69% R 15% 17% R	MANGNESE ALKLINTY COPPER SULFATE MANGNESE	-35% 13% -23% L 88% R
	HDL :	TKN COPPER		ALUMINUM ZINC			

NOTE: A VERY HIGH FREQUENCY OF FLAGGED RESULTS (OR A HIGH %) IS INDICATIVE OF POOR PERFORMANCE. ON THE OTHER HAND, LABS WITH FEW IF ANY FLAGS ARE JUDGED TO HAVE VERY GOOD PERFORMANCE.

ALSO, AN "R" FLAG INDICATES A NON COMPARABLE RESULT, THAT IS, ONE PRODUCED WITH NON RANDOM FACTORS. AN "L" FLAG INDICATES A 'LESS THAN' RESULT LOWER THAN THE REFERENCE VALUE.

TABLE 2: HIGH STANDARD DEVIATION

PARAMETER	LEVEL
BORON	.032 PPM
D O C	1.683 PPM
SODIUM	1.277 PPM
ALUMINUM	.061 PPM
COLOUR	133.111 PPM
BORON	.088 PPM
T N DIS	.192 PPM
ALKLINTY	3.235 PPM

APPENDIX I

Definitions of Types of Metals Analysis

1. HIGH LEVEL ANALYSIS

Usually without sample pretreatment, samples are aspirated by Atomic Absorption Spectrophotometry (AAS), Inductively Coupled (Argon) Plasma or direct coupled plasma (ICAP, ICP, or DCP). Standards should contain the acid equivalent of the sample.

2. LOW LEVEL ANALYSIS

Analysis is carried out by one of the following methods:

1. Solvent extraction sample concentration followed by AAS.
2. Digestion and concentration of aqueous phase followed by ICAP, or DCP.
3. Digestion of aqueous phase and ICAP or DCP analysis.
4. Graphite tube (flameless) AAS.

Updated March 1989.

APPENDIX II

Performance Indicators

1. Flagged Results

As a first indication that analysis results are appreciably deviant from the expected value, each submitted result is tested with the 10% or 1 Standard Deviation Rule. When a result is found to deviate more than 10%, or more than 1 standard deviation when this is greater than 10%, the result is flagged with an asterisk in the data summary and tabled for that laboratory in the Flagged Data Table. Typically at low levels the 10% criteria is too small and the 1 standard deviation criteria effectively indicates deviant analytical results. As performance indicator, the flagged results indicate to laboratory heads that in-house QC procedures and the methodology concerned need to be investigated. Results may still be comparable.

2. Grubbs' Rejectable Results

For every parameter, each laboratory result is statistically tested to see if it is outlying. Outlying results are caused by non random causes such as a faulty calibration or incorrect transcription. These outlying results, calculated by the Grubbs' procedure, and indicated in the data tables with an 'R', are noncomparable with the other data for that parameter.

3. A High Standard Deviation for a Parameter

Occasionally data for a difficult to analyse parameter yields a very high relative standard deviation (RSD). When a high RSD is not due to outlying results, there are noncomparable results within the data set. In such a case, the RSD for that parameter is indicated in Table 2, entitled: High Standard Deviations.

4. High Detection Limits (HDL's)

Each laboratory determines its own detection limits according to its own requirements. When major differences in detection limits occur, an HDL is indicated for the particular laboratory in the Flagged Data Table. An HDL indicates that low level analysis may not be comparable with the analyses of other laboratories.

* reference : Frank E. Grubbs, Technometrics, 1969, p. 1.

DATA SUMMARY

FEDERAL-PROVINCIAL & PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAMS

STUDY NO.	FP 41	PP 81	DATE:	DUE DATE: 30/06/89			PAGE 1 (IN 3.0% HNO3)
				SAMPLE 1	SPiked SAMPLE	D/A.	
LAB	13009 AL Tot 5x ICP	13030 AL DIS AAS DA	13102 AL DIS ICP DA	13111 AL DIS ICP DA	13302 AL EXT AAS DA	13321 AL EXT ICP DA	13999 ALUMINUM COMMON
1	-	0.508	-	-	0.5	-	23004 V TOT 5X ICP
2	-	-	-	-	0.496	0.529	-
3	0.50	-	-	-	0.8	R	-
6	-	-	-	0.50	-	-	-
8	-	-	-	0.45	-	-	-
9	-	-	-	0.46	-	-	-
10	-	-	-	-	-	-	-
15	-	0.460	-	-	-	-	-
16	-	0.50	-	-	-	-	-
19	-	-	-	-	-	-	-
20	-	1.06 R	-	-	-	-	-
21	-	-	-	-	-	-	-
MEAN	.4867	.5080	-	.4700	.4980	.5290	.5540
STD	.0231	-	-	.0265	.0028	-	.0301
REL	4.7	-	-	5.6	.6	-	.513
DES	-	-	-	-	-	-	-
VAL	-	-	-	-	-	-	-
LAB	23321 V EXT ICP DA	23999 VANADIUM COMMON	24004 CR TOT AAS GF	24009 CR TOT 5X ICP	24011 CR TOT 5X ICP	24012 CR TOT 5X DCP	24104 CR DIS AAS DA
1	0.492	0.476	-	0.050	-	-	-
3	0.492	0.492	-	-	-	-	-
6	-	0.48	0.079R	-	0.045	-	-
8	-	0.50	-	-	-	-	-
9	-	0.454	-	-	-	-	-
10	-	-	-	-	-	-	-
13	-	0.51	-	-	-	-	-
15	-	0.350R	-	-	-	-	-
16	-	0.467	-	-	-	-	-
19	-	0.45	-	0.036	-	-	-
20	-	0.551*	-	0.04	-	-	-
21	-	-	-	0.04	-	-	-
MEAN	.4920	.4867	-	.0420	.0450	.0500	.0477
STD	-	.0313	-	.0072	-	-	.0015
REL	6.4	-	-	17.2	-	-	3.2
DES	-	.492	-	-	-	-	-
VAL	-	-	-	-	-	-	-
LAB	25011 MN Tot 5x ICP	25104 MN DIS AAS DA	25111 MN DIS ICP DA	25304 MN EXT AAS DA	25311 MN EXT ICP DA	25321 MN EXT ICP DA	25999 MANGANESE COMMON
1	-	-	-	-	-	-	26009 FE TOT 5X ICP
2	-	-	-	-	-	-	-
3	0.042	-	-	0.048	-	-	-
6	-	-	-	-	0.03	-	-
8	-	-	-	0.048	-	-	-
9	-	-	-	0.044	-	-	-
10	-	-	-	0.04	-	-	-
13	-	0.086R	0.049	-	-	-	-
14	-	-	-	-	-	-	-
15	-	0.062	-	-	-	-	-
16	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-
20	-	0.050	-	-	-	-	-
21	-	-	-	-	-	-	-
MEAN	.0420	.0500	.0470	.0440	.0350	.0071	.2400
STD	-	-	.0026	.0057	.202	-	.2500
REL	-	-	5.6	12.9	-	-	.2600
DES	-	-	-	-	-	-	.2450
VAL	-	-	-	-	-	-	7.9

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	FP 41	PP 81	SAMPLE 1			SAMPLE 2		
			FE EXT AAS DA	FE EXT AAS SE	IRON COMMON	CO TOT 5X ICP DA	CO TOT 5X ICP DA	CO EXT AAS DA
LAB	26304 FE EXT AAS DA	26305 FE EXT AAS SE	26311 FE EXT ICP DA	26321 FE EXT ICP DA	26999 IRON COMMON	27009 CO TOT 5X ICP	27012 CO TOT 5X ICP	27101 CO DIS AAS DA
1	0.27	0.253	-	-	0.246	0.221	-	-
2	-	-	-	0.252	0.253	0.21	-	-
3	-	-	0.24	-	0.24	-	-	-
4	-	-	-	-	0.223	-	-	-
5	-	-	-	-	0.241	-	-	-
6	-	-	-	-	0.241	-	-	-
7	-	-	-	-	0.223	-	-	-
8	-	-	-	-	0.223	-	-	-
9	-	-	-	-	0.252	-	-	-
10	-	-	-	-	0.252	-	-	-
11	-	-	-	-	0.258	0.234	-	-
12	-	-	-	-	0.258	0.234	-	-
13	-	-	-	-	0.258	0.234	-	-
14	-	-	-	-	0.258	0.234	-	-
15	-	-	-	-	0.258	0.234	-	-
16	-	-	-	-	0.258	0.234	-	-
17	-	-	-	-	0.258	0.234	-	-
18	-	-	-	-	0.258	0.234	-	-
19	-	-	-	-	0.258	0.234	-	-
20	-	-	-	-	0.258	0.234	-	-
21	-	-	-	-	0.258	0.234	-	-
MEAN	2615	2410	2300	2520	2474	2283	2100	2000
STD	0.0120	-	0.0141	0.0139	0.0139	0.0067	-	-
REL	4.6	-	6.1	-	5.6	2.9	-	-
STD VAL	-	-	-	-	0.249	-	-	-
LAB	27999 COBALT COMMON	28009 NI TOT 5X ICP	28011 NI TOT 5X ICP	28012 NI TOT 5X ICP	28101 NI DIS AAS DA	28302 NI EXT AAS SE	28311 NI EXT AAS GF	28999 NICKEL COMMON
1	0.221	0.261	0.24	-	-	-	-	-
2	0.219	-	-	-	-	-	-	-
3	0.221	-	-	-	-	-	-	-
4	0.223	-	-	-	-	-	-	-
5	0.223	-	-	-	-	-	-	-
6	0.223	-	-	-	-	-	-	-
7	0.223	-	-	-	-	-	-	-
8	0.223	-	-	-	-	-	-	-
9	0.223	-	-	-	-	-	-	-
10	0.224	-	-	-	-	-	-	-
11	0.240	-	-	-	-	-	-	-
12	0.228	-	-	-	-	-	-	-
13	0.228	-	-	-	-	-	-	-
14	0.228*	-	-	-	-	-	-	-
15	0.228*	-	-	-	-	-	-	-
16	0.234*	-	-	-	-	-	-	-
17	0.234*	-	-	-	-	-	-	-
18	0.234*	-	-	-	-	-	-	-
19	0.234*	-	-	-	-	-	-	-
20	0.234	-	-	-	-	-	-	-
21	0.234	-	-	-	-	-	-	-
MEAN	2230	2650	2400	3100	2750	2547	2500	2400
STD	0.0132	0.046	0.046	-	-	-	-	-
REL	5.9	1.7	-	-	-	3.6	-	-
STD VAL	.228	-	-	-	-	-	-	-
LAB	29012 CU TOT 5X DCP	29106 CU DIS AAS DA	29111 CU DIS ICP DA	29305 CU EXT AAS SE	29311 CU EXT ICP DA	29321 COPPER COMMON	30009 ZINC 5X ICP	30011 ZINC 5X ICP
1	-	-	-	-	-	-	0.045	0.057
2	-	-	-	-	-	-	0.045	-
3	-	-	-	-	-	-	0.045	-
4	-	-	-	-	-	-	0.045	-
5	-	-	-	-	-	-	0.045	-
6	-	-	-	-	-	-	0.045	-
7	-	-	-	-	-	-	0.045	-
8	-	-	-	-	-	-	0.045	-
9	-	-	-	-	-	-	0.045	-
10	-	-	-	-	-	-	0.045	-
11	-	-	-	-	-	-	0.045	-
12	-	-	-	-	-	-	0.045	-
13	-	-	-	-	-	-	0.045	-
14	-	-	-	-	-	-	0.045	-
15	-	-	-	-	-	-	0.045	-
16	-	-	-	-	-	-	0.045	-
17	-	-	-	-	-	-	0.045	-
18	-	-	-	-	-	-	0.045	-
19	-	-	-	-	-	-	0.045	-
20	-	-	-	-	-	-	0.045	-
21	-	-	-	-	-	-	0.045	-
MEAN	0.856R	0.045	0.041	0.054	0.04	0.04	0.045	0.045
STD	-	-	-	-	-	-	0.044*	0.044*
REL	-	-	-	-	-	-	0.044	0.044
STD VAL	-	-	-	-	-	-	0.044	0.044

PAGE 2

27302
CO EXT
AAS DA27301
CO EXT
AAS DA27321
CO EXT
AAS SE29011
CU TOR
5X ICP29009
NICKEL
COMMON29012
ZN TOR
5X ICP30104
ZN DIS
AAS DA30111
ZN DIS
ICP DA

0.045

0.045

0.045

0.045

0.045

0.045

0.045

0.045

0.045

0.045

0.045

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	FP 41	PP 81	SAMPLE 1
LAB	82301 PB EXT AAS DA	82302 PB EXT AAS SE	82311 PB EXT ICP DA
1	0.28	0.304	-
2	-	-	0.275
3	-	-	-
6	0.28	-	-
8	-	-	-
9	-	-	-
10	-	-	0.247
13	-	-	0.25
14	-	-	0.28
15	-	-	0.28
16	-	-	0.280
19	-	-	0.291
20	-	-	0.30
21	-	-	0.24
MEAN	.2800	.3040	.2500
STD DEV	.0000	-	.2750
RBL STD	-1.0	-	-
DES VAL	-	-	.2734
			.0198
			7.2
			.276

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

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DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	FP	42	PP	82	SAMPLE 3			PAGE 12			
					LAB	26009 FE TOT 5X ICP	26011 FE TOT 5X ICP	26107 FE DIS AAS GF	26111 FE EXT AAS SE	26305 FE EXT ICP DA	26311 FE EXT ICP DA
1	0.030	-	-	-	1	0.030	-	-	0.030	-	0.011
2	0.-0.30	-	-	-	2	0.030	-	-	0.028	-	0.-0.10
3	-	0.-0.31	-	-	3	-	-	-	0.031	-	-
6	-	-	-	-	6	-	-	-	0.028	-	-
8	-	-	-	-	8	-	-	-	0.028	-	-
9	-	-	-	-	9	-	-	-	0.028	-	-
10	-	-	-	-	10	-	-	-	0.028	-	-
11	-	-	-	-	11	-	-	-	0.028	-	-
15	-	-	-	-	15	-	-	-	0.026	-	-
16	-	-	-	-	16	-	-	-	0.026*	-	-
19	0.026	-	-	-	19	-	-	-	0.0215*	-	-
20	-	-	-	-	20	-	-	-	0.026	-	-
21	-	-	-	-	21	-	-	-	0.0276	-	-
MEAN	.0287	.0310	.0300	.0328	MEAN	.0290	.0300	.0334	.0110	.0105	.0100
STD	.0023	.0023	.0023	.0032	STD	.0053	.0014	.0028	.0007	.0010	.0100
REL	8.1	8.1	8.1	20.4	REL	4.9	4.9	12.4	6.7	10.0	0.010
DEV	-	-	-	-	DEV	-	-	-	-	-	-
STD	-	-	-	-	STD	-	-	-	-	-	-
DES	-	-	-	-	DES	-	-	-	-	-	-
VAL	-	-	-	-	VAL	-	-	-	-	-	-
LAB	271107 CO DIS AAS GF	271111 CO DIS ICP DA	27302 CO EXT AAS SE	27999 COBALT COMMON	28002 NI TOT AAS SE	28007 NI TOT AAS GF	28011 NI TOT 5X ICP	28012 NI TOT 5X DCP	28107 NI DIS AAS GF	28111 NI DIS ICP DA	28302 NI EXT AAS SE
1	-	-	-	-	1	0.011	0.012	-	0.014	-	-
3	-	-	-	-	3	0.011	0.010	-	0.012	0.011	-
6	-	-	-	-	6	0.011	0.011	-	-	-	-
8	-	-	-	-	8	0.011	0.011	-	-	-	-
9	-	-	-	-	9	0.011	0.011	-	-	-	-
10	-	-	-	-	10	0.012	0.012	-	-	-	-
15	-	-	-	-	15	0.012	0.012	-	-	-	-
16	-	-	-	-	16	0.010	0.009	-	0.012	-	-
19	-	-	-	-	19	0.010	0.016	0.009	-	-	-
20	-	-	-	-	20	0.010	0.010	-	-	-	-
21	0.010	-	-	-	21	0.010	0.0120	.0160	.0117	.0120	.0130
MEAN	.0100	.0103	.0105	.0104	MEAN	.0100	.0110	.0025	-	.0115	.0120
STD	-	-	-	-	STD	-	-	-	-	.0021	.0140
REL	-	-	-	-	REL	-	-	-	-	-	-
DEV	-	-	-	-	DEV	-	-	-	-	-	-
STD	-	-	-	-	STD	-	-	-	-	-	-
DES	-	-	-	-	DES	-	-	-	-	-	-
VAL	-	-	-	-	VAL	-	-	-	-	-	-
LAB	28999 NICKEL COMMON	29003 CU TOT AAS GF	29005 CU TOT AAS SE	29009 CU TOT 5X ICP	29012 CU TOT 5X DCP	29017 CU DIS AAS GF	29111 CU DIS ICP DA	29305 CU EXT AAS SE	29999 COPPER COMMON	30003 ZINC TOT AAS GF	30005 ZINC TOT AAS SE
1	0.014	-	-	0.015	-	-	-	-	0.014	-	-
2	0.012	-	-	0.013	0.013	0.012	-	-	0.014	-	-
3	0.012	-	-	-	-	-	-	-	-	0.013	-
6	0.014	-	-	-	-	-	-	-	-	0.012	-
8	0.014	-	-	-	-	-	-	-	-	0.014	-
9	0.014	-	-	-	-	-	-	-	-	0.015	-
10	0.013	-	-	-	-	-	-	-	-	0.013	-
15	0.012	-	-	-	-	-	-	-	-	0.012	-
16	0.012	-	-	-	-	-	-	-	-	0.013	-
19	0.016	-	-	0.013	-	-	0.013	-	0.014	-	-
20	0.016	-	-	-	-	-	-	-	-	0.012	-
21	0.013	-	-	-	-	-	-	-	-	0.015	-
MEAN	.0124	.0122	.0130	.0137	MEAN	.0120	.0130	.0150	.0137	.0140	.0160
STD	.0020	.0017	.0012	.0017	STD	.0017	.0015	.0015	.0015	.0000	.0011
REL	15.0	8.4	8.4	8.4	REL	11.2	11.2	11.2	11.2	8.5	0.013
DEV	-	-	-	-	DEV	-	-	-	-	-	-
STD	-	-	-	-	STD	-	-	-	-	-	-
DES	-	-	-	-	DES	-	-	-	-	-	-
VAL	-	-	-	-	VAL	-	-	-	-	-	-

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	FP 42		PP 82		SAMPLE 3		PAGE 13	
	LAB	ZN TOT 5X ICP	30011 ZN TOT 5X ICP	30012 ZN TOT 5X DCP	30107 ZN DIS AAS GF	30111 ZN DIS ICP DA	30304 ZN EXT AAS DA	30305 ZN EXT AAS SE
1	0.019R	-	-	-	-	0.017	-	-
2	0.015	0.012	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-
4	-	-	-	-	0.015	-	-	-
5	-	-	-	-	0.017	-	-	-
6	-	-	-	-	-	0.016	-	-
7	-	-	-	-	-	-	0.017	-
8	-	-	-	-	-	-	-	0.012*
9	-	-	-	-	-	-	-	0.015
10	-	-	-	-	-	-	-	0.017
11	-	-	-	-	-	-	-	0.016
12	-	-	-	-	-	-	-	0.018
13	-	-	-	-	-	-	-	0.020R
14	-	-	-	-	-	-	-	0.017
15	-	-	-	-	-	-	-	0.016
16	0.017	-	-	-	-	-	-	0.012
17	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-
MEAN	0.0160	0.0120	-	-	0.0150	0.0160	0.0170	0.0160
STD	0.0014	-	-	-	0.0042	0.0010	0.0010	0.0020
REL STD	8.8	-	-	-	28.3	6.3	6.3	12.7
DES VAL	-	-	-	-	-	-	-	3.61
LAB	42000	42009	42011	42012	42111	42999	48002	48003
	MO TOT 5X ICP	MO TOT 5X ICP	MO TOT 5X ICP	MO DIS 5X DCP	MO DIS ICP DA	MO YBNUM COMMON	CD TOT AAS SE	CD TOT AAS GF
1	-	0.013	-	-	-	0.013	0.010	-
2	-	0.012	0.01	-	-	0.012	0.010	-
3	-	-	-	-	-	0.01	-	-
4	-	-	-	-	-	0.009	-	-
5	-	-	-	-	-	0.01	-	-
6	-	-	-	-	-	0.014*	-	-
7	-	-	-	-	-	0.012	-	-
8	-	-	-	-	-	0.005*	-	-
9	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-
21	0.005L	-	-	-	-	-	-	-
MEAN	-	0.0123	0.0100	0.0140	0.0097	0.0113	0.0100	0.0110
STD	-	0.006	-	-	0.006	0.018	-	-
REL STD	-	4.7	-	-	6.0	15.6	-	-
DES VAL	-	-	-	-	-	0.011	-	-
LAB	48107	48111	48302	48309	48999	56000	56009	56011
	CD DIS ICP DA	CD EXT AAS SE	CD EXT AAS GF	CADMUM COMMON	BA?	BA TOT 5X ICP	BA TOT 5X ICP	BA TOT 5X ICP
1	-	-	-	-	-	0.011	-	-
2	-	-	-	-	-	0.011	-	-
3	-	-	-	-	-	0.010	-	-
4	-	-	-	-	-	0.010	-	-
5	-	-	-	-	-	0.011	-	-
6	-	-	-	-	-	0.011	-	-
7	-	-	-	-	-	0.009	-	-
8	-	-	-	-	-	0.011	-	-
9	-	-	-	-	-	0.011	-	-
10	-	-	-	-	-	0.010	-	-
11	0.011	0.009	-	-	-	0.011	-	-
12	-	-	-	-	-	0.011	-	-
13	-	-	-	-	-	0.011	-	-
14	-	-	-	-	-	0.011	-	-
15	-	-	-	-	-	0.011	-	-
16	-	-	-	-	-	0.011	-	-
17	-	-	-	-	-	0.011	-	-
18	-	-	-	-	-	0.011	-	-
19	-	-	-	-	-	0.011	-	-
20	-	-	-	-	-	0.011	-	-
21	-	-	-	-	-	0.011	-	-
MEAN	0.0110	0.0110	0.0100	0.0100	0.0105	0.0105	0.0105	0.0105
STD	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
REL STD	-	1.0	1.4	1.4	1.4	1.4	1.4	1.4
DES VAL	-	-	-	-	-	2.9	2.9	2.9

DATA SUMMARY - FED-PROV & PPMB QA PROGRAMS

STUDY NO. FP 42 PP 82

SAMPLE 3

LAB	82009 PB TOT 5X ICP	82011 PB TOT 5X ICP	82012 PB TOT 5X DCP	82104 PB DIS AAS GF	82302 PB EXT AAS SE	82309 PB EXT AAS GF	82999 LEAD COMMON
1	-	-	-	-	0.012	-	0.012
2	0.010	0.011	-	-	0.011	-	0.011
3	-	-	-	-	-	-	0.010
6	-	-	-	-	-	-	0.011
8	-	-	-	-	0.011	-	0.011
9	-	-	-	-	-	-	0.011
11	-	-	-	0.009	0.011	-	0.010
14	-	-	-	-	-	-	0.009
15	-	-	0.005R	-	-	-	0.002R
16	0.03 L	-	-	-	-	-	0.005R
19	-	-	-	-	-	-	0.03 L
20	-	-	-	-	-	-	0.010
21	-	-	-	0.009	-	-	0.009
MEAN	.0100	.0110	-	.0090	.0113	.0110	.0104
STD DEV	-	-	-	.0000	.0006	-	.0010
REL STD	-	-	-	-1.0	5.1	-	9.3
DES VAL	-	-	-	-	-	-	.010

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DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB OA PROGRAMS

STUDY NO.	FP	42	PP	82	SAMPLE 4				SAMPLE 4				SAMPLE 4					
					06109 DOC UV CO2 OH	06112 DOC PER IR	06150 D.O.C COMMON	06151 DIC IR COMBUST	06152 DIC UV CO2 IR	06154 DIC AA CO2 PHE	06159 DIC AA CO2 OH	06490 D.I.C COMMON	07005 TKN INDO BL	07010 TKN AA SAL	07015 TKN DIG BERTHEL	07016 TKN BI.K AMM-SAL	07021 TKN BI.K DIG BER	
LAB					10.6	-	-	-	0.5	L	-	0.5	L	-	-	-	0.25	
1	-	-	-	-	8.7 * 9.3 * 13.62 R 13.9 *	-	-	0.2 0.713	-	-	0.2 0.713	-	-	0.273	-	-	-	
2	-	-	-	-	-	-	-	-	-	-	0.6	0.6	-	-	-	0.8 R	-	
3	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
4	-	-	-	-	-	-	-	0.8	-	-	0.8	-	-	-	-	-	-	
5	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
6	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.21	-	
7	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
8	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
9	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
10	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
11	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
12	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
13	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
14	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
15	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
16	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
17	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
18	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
19	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
20	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
21	-	-	-	-	-	-	-	-	-	-	1.0 L	-	-	-	-	0.25	-	
MEAN	9.0000	13.1000	11.6000	11.2028	.8700	.5710	-.6000	.6366	.2550	.2730	.2500	.2500	.2500	.2500	.2500	.2300	.2283	
STD	DEV	REL	STD	VAL	-	19.0	-	56.8	-	-	41.524	-	-	-	-	-	12.3	
MEAN	9.0000	13.1000	11.6000	11.1138	-	-	-	-	-	-	-	-	-	-	-	-	-	
STD	DEV	REL	STD	VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	
MEAN	07090 TKN COMMON	07109 NO3+NO2 AA HYD	07110 NO3+NO2 AA CD	07111 NO3+NO2 DIS SPEC	07112 NO3+NO2 UF AA CD	07390 NITRATE COMMON	07505 NH3 TOT AA BERT	07540 NH3 DIS AA PHEN	07555 NH3 DIS AA SAL	07556 NH3 DIS AA INDO	07557 NH3 DIS AA EDTA	07562 NH3 DIS COMMON	07590 AMMONIA					
STD	DEV	REL	STD	VAL	0.25	-	-	0.044	-	0.044 *	-	-	-	-	0.003	0.003		
REL	STD	DEV	VAL		0.25	-	-	0.06	-	0.047	0.008	0.005L	-	-	-	-	-	
DEV	STD	REL	VAL		0.273	-	-	0.048	-	0.048	-	-	-	-	-	-	0.008	
VAL					0.273	-	-	0.046	-	0.046	-	-	-	-	-	-	0.005L	
MEAN	0.8	R	0.03	L	-	-	-	0.046	-	0.046 L	-	-	-	-	-	-	0.005L	
STD	DEV	REL	STD	VAL	0.25	-	-	0.046	-	0.046	-	-	-	-	-	-	0.005L	
REL	STD	DEV	VAL		0.25	-	-	0.046	-	0.046	-	-	-	-	-	-	0.005L	
DEV	STD	REL	VAL		0.25	-	-	0.046	-	0.046	-	-	-	-	-	-	0.005L	
VAL					0.25	-	-	0.046	-	0.046	-	-	-	-	-	-	0.005L	
MEAN	0.21	*	-	-	-	-	-	0.043	-	0.043 L	-	-	-	-	-	-	0.005L	
STD	DEV	REL	STD	VAL	0.255	-	-	0.043	-	0.043 L	-	-	-	-	-	-	0.005L	
REL	STD	DEV	VAL		0.255	-	-	0.043	-	0.043 L	-	-	-	-	-	-	0.005L	
DEV	STD	REL	VAL		0.255	-	-	0.043	-	0.043 L	-	-	-	-	-	-	0.005L	
VAL					0.255	-	-	0.043	-	0.043 L	-	-	-	-	-	-	0.005L	
MEAN	0.2480		0.3225		0.484		0.0280	0.025		0.0425		0.0085		0.0167		0.0050	0.0030	
STD	DEV	REL	STD	VAL	0.206		0.0106	0.0096		0.049		0.0130		0.0091		0.0050		0.0030
REL	STD	DEV	VAL		0.206		0.0106	0.0096		0.049		0.0130		0.0091		0.0050		0.0030
DEV	STD	REL	VAL		0.206		0.0106	0.0096		0.049		0.0130		0.0091		0.0050		0.0030
VAL					0.206		0.0106	0.0096		0.049		0.0130		0.0091		0.0050		0.0030
MEAN	8.3		32.6		19.9		80.8	11.4		30.6		8.3		54.4		44.7		44.7
STD	DEV	REL	STD	VAL	8.336		32.6	19.9		80.8		8.3		54.4		44.7		44.7
REL	STD	DEV	VAL		8.336		32.6	19.9		80.8		8.3		54.4		44.7		44.7
DEV	STD	REL	VAL		8.336		32.6	19.9		80.8		8.3		54.4		44.7		44.7
VAL					8.336		32.6	19.9		80.8		8.3		54.4		44.7		44.7

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	PP 42	PP 82	SAMPLE 4				SAMPLE 4				SAMPLE 4			
			10606 HARDNESS CALC'D	10690 HARDNESS COMMON AAS	11001 NA TOR ICP	11005 NA TOR ICP	11102 NA F AAS	11103 NA DIS FL PH	11104 NA DIS FLAME	11105 NA DIS AAS DA	11107 NA UF FL PH	11111 NA DIS ICP	11311 NA EXT ICP	11990 SODIUM COMMON
2	7.2	7.25	-	-	-	-	-	4.0	-	-	4.13	-	-	4.0
3	7.2	7.2	-	-	-	-	-	4.1	-	-	-	-	-	4.13
5	12.6	R	-	-	-	-	-	5.	-	-	3.62	-	-	4.1
6	7.5	-	-	-	-	-	-	-	-	-	-	-	-	5.62*
7	8.58	*	-	-	4.2	-	-	-	-	-	-	-	-	4.55
8	7.8	*	-	-	3.92	-	3.6	-	-	-	-	-	-	4.55
9	7.1	-	-	-	-	-	-	-	-	-	-	-	-	3.92*
10	10.2	R	-	-	-	-	-	-	-	-	-	-	-	3.6*
11	6.8	*	-	-	-	-	-	-	-	-	-	-	-	4.60*
13	6.8	*	-	-	-	-	-	-	-	-	-	-	-	4.60
14	6.0	*	-	-	-	-	-	-	-	-	-	-	-	4.0
15	6.0	*	-	-	-	-	-	-	-	-	-	-	-	4.0
16	7.47	-	-	-	3.68	-	-	-	-	-	-	-	-	3.68
19	7.4	-	-	-	-	-	3.95	-	4.2	-	-	-	-	0.62
20	7.6	-	-	-	-	-	-	-	-	-	-	-	-	3.95
21	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	7.20000	7.39117	4.60000	3.93333	4.1833	4.05000	4.20000	3.62000	4.13000	4.00000	4.55000	4.1033	4.3883	-6200
STD DEV	-	-	10.0409	-	6.6	2.603	17.4	1.7	-	-	-1.0	-	9.3	-
REL STD	-	-	19.0	-	6.6	17.4	-	-	-	-	-	-	4.103	-
DES VAL	-	-	17.488	-	-	-	-	-	-	-	-	-	-	-
MEAN	12005	12101 MG DIS CALC'D	12102 MG DIS AAS DA	12106 MG DIS AAS DA	12107 MG DIS AAS AUT	12111 MG DIS ICP	12311 MG EXT ICP	12990 MAGNESIUM COMMON	14000 SILICA SIL?	14090 SILICA SIL?	14102 SILICA ANS A	14103 SILICA MOL SUL	14105 SILICA MOL ASC	-
STD DEV	-	-	-	-	0.67	-	-	-	0.67	-	-	2.53	-	-
REL STD	-	-	1.0	R	0.667	-	-	-	0.667	-	-	-	-	2.3
DES VAL	-	-	-	-	0.62	-	-	-	1.0	R	-	-	-	2.3
MEAN	6.6	-	-	-	-	-	-	-	0.81	-	-	-	-	2.3
STD DEV	-	-	0.7	-	-	-	-	-	0.81	-	-	-	-	2.0
REL STD	-	-	0.63	-	0.6	-	-	-	0.63	-	-	-	-	2.0
DES VAL	-	-	-	-	0.63	-	-	-	0.69	-	-	-	-	-
MEAN	11.9	0.693	-	-	-	-	-	-	0.7	-	-	-	-	-
STD DEV	-	-	-	-	-	-	-	-	0.7	-	-	-	-	-
REL STD	-	-	-	-	-	-	-	-	0.7	-	-	-	-	-
DES VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	21	0.693	-	-	-	-	-	-	0.70	-	-	2.52	-	-
STD DEV	-	-	-	-	-	-	-	-	0.70	-	-	-	-	-
REL STD	-	-	-	-	-	-	-	-	0.70	-	-	-	-	-
DES VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	SAMPLE 82			SAMPLE 4			SAMPLE 19		
	FP	42	PP	14106 SI FIL MOL ASC	14107 SILICA MOL AA	14111 SILICA ICP DA	14190 SILICA COMMON	15301 TP ACL AA ASC	15313 TP ACL AA SNCL
1	-	2.5	-	2.37	-	2.5	-	-	-
2	-	2.37	-	-	-	2.53	-	-	-
3	-	-	-	-	-	2.37	-	-	-
4	-	-	-	-	-	2.3	-	-	-
5	-	-	-	-	-	2.3	-	-	-
6	-	-	-	-	-	2.3	-	-	-
7	-	-	-	-	-	2.3	-	-	-
8	-	-	-	-	-	2.3	-	-	-
9	-	-	-	-	-	2.20	-	-	-
10	-	-	-	-	-	2.07	-	-	-
11	-	-	-	-	-	0.010L	-	-	-
12	-	-	-	-	-	0.006	-	-	-
13	-	-	-	-	-	0.004	-	-	-
14	-	-	-	-	-	0.006	-	-	-
15	-	-	-	-	-	0.006	-	-	-
16	-	-	-	-	-	0.006	-	-	-
17	-	-	-	-	-	0.006	-	-	-
18	-	-	-	-	-	0.006	-	-	-
19	-	-	-	-	-	0.006	-	-	-
20	-	-	-	-	-	0.006	-	-	-
21	-	-	-	-	-	0.006	-	-	-
MEAN	2.3700	2.5000	2.2400	2.3330	2.3330	2.3330	2.3330	2.3330	2.3330
STD DEV	-	-	0.0849	0.1125	0.050	0.050	0.050	0.050	0.050
REL STD	-	-	3.8	4.8	-	-	-	-	-
DES VAL	-	-	-	2.288	-	-	-	-	-
LAB	15490 TOT P COMMON	16206	16303 SO4 TIT THO	16304 SO4 DIS AUTO BA	16306 SO4 DIS AA MTB	16307 SO4 DIS AA MTB	16309 SO4 DIS AA CALM	16310 SO4 DIS AA CALM	16311 SO4 DIS AA CALM
1	0.005 0.005 0.004	-	-	4.9	-	2.1	2.9	-	-
2	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-
5	-	3.2	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	-	0.010L	-	-	-	-	-	-	-
11	-	0.007	-	-	-	-	-	-	-
12	-	0.009	-	-	-	-	-	-	-
13	-	0.007	-	-	-	-	-	-	-
14	-	0.009	-	-	-	-	-	-	-
15	-	0.006	-	-	-	-	-	-	-
16	-	0.006	-	-	-	-	-	-	-
17	-	0.006	-	-	-	-	-	-	-
18	-	0.006	-	-	-	-	-	-	-
19	-	0.02L	-	-	-	-	-	-	-
20	-	0.005	-	-	-	-	-	-	-
21	-	0.007	-	2.0	-	2.89	-	-	-
MEAN	3.2000	2.0000	4.9000	3.1000	2.1000	2.8300	2.8000	2.0000	2.6790
STD DEV	.0015	-	-	-	-	-	-	-	5.8000
REL STD	23.8	-	-	-	-	-	-	-	6.0000
DES VAL	.009	-	-	-	-	-	-	-	5.9471

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DATA SUMMARY - FED-PROV & PPMB QA PROGRAMS

STUDY NO.	FP 42	PP 82	SAMPLE 4			SAMPLE 4			SAMPLE 4			SAMPLE 4			
			CL DIS AA HG	17209 CL DIS IC	17210 CL DIS TIR CON	17211 CL DIS IC	17990 CHLORIDE COMMON	19001 K TOT AAS	19005 K TOT ICP	19102 K DIS AAS	19103 K DIS FLAME	19104 K DIS FLAME PH	19105 K DIS AAS DA	19106 K DIS AAS LI	19107 K DIS FLM PH
1	-	-	4.9	-	-	-	5.4 *	-	-	-	0.29	-	-	-	-
2	-	5.6	-	-	-	-	5.6	-	-	0.3	-	-	-	0.32	
3	-	-	-	-	-	-	5.9	-	-	-	-	-	-	-	
5	-	-	-	-	-	-	6.1	-	-	-	-	-	-	-	
6	-	-	-	-	-	-	7.5 *	-	-	-	-	-	-	-	
7	-	-	-	-	-	-	5.4 *	-	-	-	-	-	-	-	
8	-	-	5.4	-	5.4	-	4.8 *	-	0.30	-	-	-	-	-	
9	-	-	-	-	-	-	6.0	-	-	-	-	-	-	-	
10	-	-	-	-	-	-	5.03	0.28	-	-	-	-	-	0.3	
11	-	-	-	-	-	-	6.7 *	-	-	-	-	-	-	-	
13	-	-	5.03	-	-	-	1. L	5.83 *	0.289	-	-	-	-	0.29	
14	-	-	-	-	-	-	5.7	-	-	-	-	-	-	-	
15	-	-	-	-	-	-	6.2	-	-	-	-	-	-	-	
16	-	-	-	-	-	-	5.7100	.2800	.2963	.3000	.3300	-	-	-	
19	-	-	-	-	-	-	10.5997	-	.0064	.1414	.0608	-	-	-	
20	-	-	-	-	-	-	5.4000	-	2.1	47.1	18.4	-	-	-	
21	-	-	-	-	-	-	10.592	-	-	-	-	-	-	-	
MEAN	5.6000	5.1100	5.2594	5.1	5.4000	-	20005 COMMON HNO3 AA	20005 CA TOT ICP	20050 CA DIS AAS NO	20100 CA DIS CALC'D	20103 CA DIS AAS	20108 CA DIS AAS UF	20110 CA DIS AAS AUT	20111 CA DIS ICP	20311 CALCIUM COMMON
STD DEV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20990 CALCIUM
REL STD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DES VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LAB	19111 K DIS ICP	19301 K EXT HNO3 AA	19990 COMMON HNO3 AA	20003 COMMON HNO3 AA	20005 CA TOT ICP	20050 CA DIS AAS NO	20100 CA DIS CALC'D	20103 CA DIS AAS	20108 CA DIS AAS UF	20110 CA DIS AAS AUT	20111 CA DIS ICP	20311 CALCIUM COMMON	-	-	-
2	-	-	-	-	0.29	-	-	-	-	-	-	-	-	-	1.84
3	-	-	-	-	0.32	-	-	-	-	-	-	-	-	-	1.84
5	-	-	-	-	0.3 *	-	-	-	-	-	-	-	-	-	1.81
6	-	-	-	-	0.20	-	-	-	-	-	-	-	-	-	3.2 R
7	-	-	0.27	-	0.27	-	-	-	-	-	-	-	-	-	1.68 R
8	-	-	-	-	0.30	-	-	1.8	-	-	-	-	-	-	2.10 R
9	-	-	-	-	0.30	-	-	1.68	-	-	-	-	-	-	1.68
10	-	-	-	-	0.26	-	-	-	-	-	-	-	-	-	1.94
11	-	-	0.26	-	0.26	-	-	1.70	-	-	-	-	-	-	1.84
13	-	-	-	-	0.29	-	-	-	-	-	-	-	-	-	1.70
14	-	-	-	-	0.289	-	-	-	-	-	-	-	-	-	1.85
15	-	-	-	-	0.25 *	1.94	-	1.85	-	-	-	-	-	-	1.94
19	-	-	-	-	0.25	-	-	-	-	-	-	-	-	-	1.9
20	-	-	-	-	0.25	-	-	-	-	-	-	-	-	-	1.9
21	-	-	-	-	0.25	-	-	-	-	-	-	-	-	-	1.9
MEAN	.2600	.2700	.2966	1.9400	1.7767	1.7000	-	-	-	1.7967	1.8700	1.8000	1.8203	-	1.8108
STD DEV	-	-	.2507	-	.0874	-	-	-	-	.1106	.0424	-	.0283	-	4.630
REL STD	-	-	17.1	-	4.9	-	-	-	-	6.2	2.3	-	1.6	-	4.799
DES VAL	-	-	.273	-	-	-	-	-	-	-	-	-	-	-	1.799
DATES RECEIVED	15 89/05/19	5 89/07/19	2 89/06/29	3 89/05/11	6 89/05/24	6 89/06/29	3 89/06/30	7 89/08/09	7 89/06/30	13 89/06/28	14 89/07/04	14 89/06/30	14 89/07/04	15 89/06/29	15 89/06/29
	15 89/06/28	15 89/06/28	16 89/06/28	16 89/06/28	16 89/06/28	16 89/06/28	20 89/06/30	20 89/06/30	20 89/06/30	21 89/06/30	21 89/06/30	21 89/06/30	21 89/06/30	21 89/06/30	21 89/06/30

NOTE: ALL CONCENTRATION UNITS ARE EXPRESSED IN MG/L OF EACH ELEMENT, THE EXCEPTIONS BEING:
 COLOUR IN RELATIVE UNITS, CONDUCTIVITY IN USEC/CM, TURBIDITY IN JTU OR NTU, NITROGEN ANALYSES IN "N", ALKALINITY & HARDNESS IN CACO₃, SILICA IN SIC, AND SULFATE IN SO₄.



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Canada Centre for Inland Waters
National Water Research Institute
867 Lakeshore Road, P.O. Box 5050
Burlington, Ontario
L7R 4A6

Your file Votre référence

Our file Notre référence

November 1, 1989.

To: Participants & Managers in:

Prairie Provinces Quality Assurance Program (PPOA)

I have enclosed the final report for PP 83-84.

If you have any comments on this report, or any legitimate corrections to the data base, please do not hesitate to communicate them.

Harry A.

H. Alkema
Quality Assurance Project
Research & Applications Branch

Participants & Managers:

Dr. J.J. Bergman
Sask. Prov. Water Laboratory

Mr. J-G. Zakrevsky
Western & Northern Region WQB

Dr. F.P. Dieken
Alberta Water Analysis Res. Sta.

Mr. G.W. Dunn
Prairie Province Water Board

Mr. E.A. Sorba
Manitoba Technical Services Lab

Mr. A.S.Y. Chau
NWRI, CCIW

Dr. Wo Yuen
Saskatchewan Research Council

Canada

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Dr. J.J. Bergman
Supervisor, Provincial Water Laboratory
Saskatchewan Dept. of Health

Dr. F.P. Dieken
Head, Water Analysis Research Station
Alberta Environmental Centre

Ms. Guat Peng Lee
Head, Analytical Services Section
Western & Northern Region, WQB

Mr. E.A. Sorba
Head, Methods and Standards Section
Manitoba, Technical Services Laboratory

Dr. Wo Yuen
Sr. Research Scientist, Analytical Services
Saskatchewan Research Council

cc. Mr. G.W. Dunn
Water Quality Specialist
Prairie Province Water Board
Regina, Saskatchewan

Mr. J.G. Zakrevsky
Head, Monitoring & Agreements
Western & Northern Region, WQB
Regina, Saskatchewan

Mr. A.S.Y. Chau
Project Chief, Quality Assurance Project
Research and Applications Branch
NWRI, CCIW
Burlington, Ontario

RESEARCH & APPLICATIONS BRANCH

FINAL REPORT

REPORT NO. RAB 89-19

PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAM

STUDIES 83 AND 84

for July and August 1989

**TRACE METALS, MAJOR IONS, NUTRIENTS
AND PHYSICAL PARAMETERS IN SURFACE WATERS**

by

H. Alkema

**Quality Assurance Project
National Water Research Institute
Burlington, Ontario**

October 1989

Introduction

As part of an on-going study, the Quality Assurance Section, NWRI in Burlington, Ontario, has been sending reference water samples bi-monthly to chemical laboratories participating in the PPWB program. This report summarizes the most recent PPWB interlaboratory quality control studies: PP 83 and 84, for the months July and August, 1989. These two studies dealt with trace metals, major ions, nutrients and physical parameters. The concentrations were from medium to high.

Study Design

Four water samples were submitted to each laboratory for chemical analyses. Two samples were submitted for trace metals analysis, while the remaining two were submitted for major ions, nutrients and some physical measurements. The following is a breakdown of the four samples:

PP 83 – Sample 1 – 125 ml, high level* for trace metals (3% HNO₃)

Sample 2 – up to 1L, major ions etc., stored at 4°C

PP 84 – Sample 3 – 1L, low level* for trace metals (0.2% HNO₃)

Sample 4 – up to 1L, major ions, etc., stored at 4°C

* for definitions see Appendix 1

Treatment of Data

Each laboratory was asked to perform only those analyses which were routine to their particular laboratory, using the general methodology guidelines listed above. Results for these analyses were recorded as required by the Standard Report Sheets provided with the QA samples. Submitted results were tabulated for each parameter, first for each method reported, and then for all methods combined. These data, and the resulting statistics are presented in the Data Summary. (attached)

Preliminary data summaries (RAB # 89-15), including problematic results, were sent September 5, and September 28. Each laboratory was given three weeks to notify us of any errors in data transcription, compilation, or flags.

Performance Indicators

In the PPWB QA program, two types of reference samples are used for the accuracy assessment. Reference waters (RMs) and certified reference waters (CRMs) have Design Values for the stable parameters. Also, regional samples are used occasionally as natural reference samples. The means for the regional samples, and the Design Values for the reference waters are used to test each reported result for accuracy.

Percentage deviations from the reference value are used as an indicator for the laboratory head to determine the extent of the discrepancies between the laboratory result and reference value. However, please keep in mind that at low levels, high % deviations are often seen, and may be misleading if interpreted too strictly.

A result which deviates more than the greater of 10% or 1 standard deviation from the reference value is marked with an asterisk in the data tables and its value tabulated in the flagged data table (Table 1). Results reported with an "L" (less than) or flagged with an "R" (rejectable) are not used in the statistical calculations. Performance indicators are fully explained in Appendix II.

Comments on Laboratory Performance

Results accompanied with a 'less than' are difficult to appraise. If a design value or mean is significantly lower than the detection limit given by a particular laboratory, then that detection limit is too high. Such a result is assigned 'HDL', and is tabulated for each laboratory in Table 1.

If, on the other hand, the detection limit reported is far lower than the mean or design value, then the use of 'less than' is clearly inadequate and the result is flagged low. The magnitude of the deviation from the mean in such a case is taken from the detection limit given.

Attached are two tables listing flagged data by laboratory (Table 1), and listing parameters for which there was a high standard deviation (Table 2). Formerly called a high coefficient of variation, the standard deviation is generated with standardized criteria that are included with the automated flagging routine. These automated criteria have been in use since March 1988 (Study PP 67), and should provide a more accurate and consistent listing of the difficult to analyze parameters or levels. A listing of the criteria used to indicate high deviation of analysis is available on request. Your comments would be appreciated.

PPWB laboratories average number of deviations per sample was 2.7

APPENDIX I

Definitions of Types of Metals Analysis

1. HIGH LEVEL ANALYSIS

Usually without sample pretreatment, samples are aspirated by Atomic Absorption Spectrophotometry (AAS), Inductively Coupled (Argon) Plasma or direct coupled plasma (ICAP, ICP, or DCP). Standards should contain the acid equivalent of the sample.

2. LOW LEVEL ANALYSIS

Analysis is carried out by one of the following methods:

1. Solvent extraction sample concentration followed by AAS.
2. Digestion and concentration of aqueous phase followed by ICAP, or DCP.
3. Digestion of aqueous phase and ICAP or DCP analysis.
4. Graphite tube (flameless) AAS.

Updated March 1989.

APPENDIX II

Performance Indicators

1. Flagged Results

As a first indication that analysis results are appreciably deviant from the expected value, each submitted result is tested with the 10% or 1 Standard Deviation Rule. When a result is found to deviate more than 10%, or more than 1 standard deviation when this is greater than 10%, the result is flagged with an asterisk in the data summary and tabled for that laboratory in the Flagged Data Table. Typically at low levels the 10% criteria is too small and the 1 standard deviation criteria effectively indicates deviant analytical results. As performance indicator, the flagged results indicate to laboratory heads that in-house QC procedures and the methodology concerned need to be investigated. Results may still be comparable.

2. Grubbs' Rejectable Results

For every parameter, each laboratory result is statistically tested to see if it is outlying. Outlying results are caused by non random causes such as a faulty calibration or incorrect transcription. These outlying results, calculated by the Grubbs' procedure, and indicated in the data tables with an 'R', are noncomparable with the other data for that parameter.

3. A High Standard Deviation for a Parameter

Occasionally data for a difficult to analyse parameter yields a very high relative standard deviation (RSD). When a high RSD is not due to outlying results, there are noncomparable results within the data set. In such a case, the RSD for that parameter is indicated in Table 2, entitled: High Standard Deviations.

4. High Detection Limits (HDL's)

Each laboratory determines its own detection limits according to its own requirements. When major differences in detection limits occur, an HDL is indicated for the particular laboratory in the Flagged Data Table. An HDL indicates that low level analysis may not be comparable with the analyses of other laboratories.

* reference : Frank E. Grubbs, Technometrics, 1969, p. 1.

TABLE 1: PRAIRIE PROV LABORATORIES FLAGGED RESULTS - STUDIES PP 83-84

LAB 1	FLAGS :	ALUMINUM SILICA MGNESIUM	14% 571% R -16%	LEAD PTASSIUM PTASSIUM	-22% R -21% -15%	D O C HARDNESS CALCIUM	-72% L -12% -12%
LAB 3	FLAGS :	T N DIS	57%	VANADIUM	-17% R	SULFATE	-25% R
LAB 4	FLAGS :	D O C HDL : ALKLINTY	-77%	NITRATE	195% R	T N DIS	22%
LAB 6	FLAGS :	TKN TOT P IRON MOLYBNUM NITRATE TOT P	3100% R 122% 19% -13% 29% 156%	AMMONIA ALUMINUM COBALT CADMIUM AMMONIA PTASSIUM	1528% R 27% -15% -19% 160% R 21%	PH MANGNESE NICKEL TKN MGNESIUM CALCIUM	17% R -15% -19% 1233% R -23% R 12%
LAB 8	FLAGS :	COPPER LEAD	-13% 24%	CHROMIUM SULFATE SILICA	49% R 12%	COBALT ALUMINUM	13%
	HDL :	ALKLINTY TKN					

NOTE: A VERY HIGH FREQUENCY OF FLAGGED RESULTS (OR A HIGH %) IS INDICATIVE OF POOR PERFORMANCE. ON THE OTHER HAND, LABS WITH FEW IF ANY FLAGS ARE JUDGED TO HAVE VERY GOOD PERFORMANCE.

ALSO, AN "R" FLAG INDICATES A NON COMPARABLE RESULT, THAT IS, ONE PRODUCED WITH NON RANDOM FACTORS. AN "L" FLAG INDICATES A 'LESS THAN' RESULT LOWER THAN THE REFERENCE VALUE.

TABLE 2: HIGH STANDARD DEVIATION

PARAMETER		LEVEL
D O C	AT	.725 PPM
T N DIS	AT	.029 PPM
SILICA	AT	.015 PPM
BORON	AT	.031 PPM
D O C	AT	.737 PPM

DATA · SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	FP	43	PP	83	SAMPLE 2		SAMPLE 1		PAGE 4	
					00120 IONIC BALANC %	00125 SUM OF CATIONS	02011 COLOUR APPARE	02021 COLOUR VIS COM	02024 COL TRU SECT	02040 COLOUR COMMON
LAB	1	-2.63	3.58	3.77	-	-	-	0.6	0.6	452.
	2	-2.35	3.887	3.709	5.	L	-	5.	1	448.
	3	0.08	3.724	3.718	5.	L	5.	5.	0.2	-
	4	0.083	3.802	3.796	5.	L	-	5.	0.1	-
	5	-0.76	3.84	3.90	1.	-	-	5.	445.	-
	6	-0.6	3.78	3.82	1.	-	-	5.	446.	-
	7	1.89	3.92	3.76	5.	L	-	5.	445.	0.12
	8	1.09	4.09	3.94	5.	L	-	5.	445.	0.20
	9	-	-	-	5.	L	-	5.	445.	0.2
	10	-	-	-	5.	-	-	5.	445.	0.08
	11	-	-	-	5.	-	-	5.	445.	-
	12	-	-	-	5.	-	-	5.	445.	-
	13	-	-	-	5.	-	-	5.	445.	0.1
	14	-	-	-	5.	-	-	5.	445.	L
	15	-	-	-	5.	-	-	5.	433.	-
	16	-	-	-	5.	-	-	5.	433.	-
	17	-	-	-	5.	-	-	5.	433.	-
	18	-	-	-	5.	-	-	5.	433.	-
	19	-0.25	3.675	3.693	-	-	5.	L	417.	-
	20	-	-	-	5.	L	-	5.	417.	0.1
	21	1.2259	3.8109	3.7896	3.0000	-	2.0000	.6000	2.1500	1520
MEAN	STD	DEV	REL STD	REL STD	1.5836	3.9	2.0851	2.8284	1.8891	1267
STD VAL	REL STD	REL STD	DES VAL	DES VAL	701.1	2.2	94.3	-	14.0861	0.643
								92.5	3.2	50.8
								2.4851	-	30.3
									444.426	-
LAB	1	02077	02081	02090	05100	05105	05106	05190	06009	06101
	2	-	-	-	0.14	-	-	-	0.051	DOC
	3	-	0.17	0.17	0.02	L	-	0.02	TIC	UV
	4	-	-	0.12	-	-	-	1.	COMB	COD
	5	-	-	0.20	-	-	-	-	IR	IR/DIF
	6	-	-	0.2	-	-	-	-	-	-
	7	-	-	0.08	-	-	0.05	1.	-	-
	8	-	-	0.08	-	-	0.05	1.	-	-
	9	0.1	-	0.1	0.010	-	0.01	L	0.010	-
	10	-	-	0.1	0.010	-	-	1.00	-	1.1600
	11	-	-	-	-	-	-	-	-	.4990
	12	-	-	-	-	-	-	-	-	.3745
	13	-	-	-	-	-	-	-	-	76.6
	14	-	-	-	-	-	-	-	-	-
	15	-	-	-	-	-	-	-	-	-
	16	-	-	-	-	-	-	-	-	-
	17	-	-	-	-	-	-	-	-	-
	18	-	-	-	-	-	-	-	-	-
	19	-	-	-	-	-	-	-	-	-
	20	-	-	-	-	-	-	-	-	-
	21	-	-	-	-	-	-	-	-	-
MEAN	STD	DEV	REL STD	REL STD	1.000	.1700	.1410	.0100	.0100	.1.1600
STD VAL	REL STD	REL STD	DES VAL	DES VAL	-	.0477	-	-	.01188	-
						33.8	-	-	-	-
						.1832	-	-	-	-
LAB	1	06107	06150	06151	06152	06154	06490	07005	07015	07021
	2	0.5	0.5	L	0.5	L	0.5	L	TKN BLK INDO BL	TKN BLK DIG BER
	3	-	0.4	L	0.1	L	0.1	L	-	-
	4	-	0.167	*	0.52	-	0.52	-	-	-
	5	-	0.9	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-	-	-
	7	-	-	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	-	-
	9	-	-	-	-	-	-	-	-	-
	10	-	-	-	-	-	-	-	-	-
	11	-	-	-	-	-	-	-	-	-
	12	-	-	-	-	-	-	-	-	-
	13	-	-	-	-	-	-	-	-	-
	14	-	-	-	-	-	-	-	-	-
	15	-	-	-	-	-	-	-	-	-
	16	-	-	-	-	-	-	-	-	-
	17	-	-	-	-	-	-	-	-	-
	18	-	-	-	-	-	-	-	-	-
	19	-	-	-	-	-	-	-	-	-
	20	-	-	-	-	-	-	-	-	-
	21	-	-	-	-	-	-	-	-	-
MEAN	STD	DEV	REL STD	REL STD	.7254	.5200	-	-	.0200	.0250
STD VAL	REL STD	REL STD	DES VAL	DES VAL	.4220	-	-	-	.0071	.0071
					.58	.5292	-	-	.3185	.3185
						-	-	-	-	28.3

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

LAB	07110 NO3+NO2 AA2 CD	07111 NO3 NO2 DIS SPEC	07112 NO3+NO2 UF AA CD	07390 NITRATE COMMON	07505 NH3 TOT AA BERT	07540 NH3 TOT AA SAL	07555 NH3 DIS AA PHEN	07556 NH3 DIS INDO	07557 NH3 DIS AA INDO	07562 NH3 DIS AA EDTA	07590 AMMONIA COMMON	T N UV AA-SUL	07601	
1	0.01	0.019	-	0.019	-	-	-	-	-	0.002	0.002	-	0.1	L
2	0.02	-	0.030	-	0.008	0.005 L	-	-	-	-	0.008	0.005 L	0.045	-
3	0.059 R	-	-	0.030 R	0.008	-	-	-	-	-	0.005	0.004	-	-
4	0.020	-	-	0.059 R	0.005	-	-	-	-	-	0.005	0.004	-	-
5	-	-	0.02	-	0.020	-	-	-	-	-	0.004	0.005	-	-
6	-	-	-	0.02	-	-	-	-	-	-	0.004	0.005	-	-
7	-	-	0.02	-	0.002	-	-	-	-	-	0.004	0.005	-	-
8	0.02	-	-	0.02	-	-	-	-	-	-	0.004	0.005	-	-
9	0.02 L	-	-	0.02 L	-	-	-	-	-	-	0.004	0.005	-	-
11	0.02	-	0.01	-	0.02	-	-	-	-	-	0.004	0.005	-	-
13	-	-	-	0.01	-	-	-	-	-	-	0.004	0.005	-	-
14	0.007	-	0.01	-	0.007	-	-	-	-	-	0.004	0.005	-	-
15	0.007	-	0.02 L	-	0.002 L	-	-	-	-	-	0.004	0.005	-	-
19	0.03	-	0.02	-	0.03	-	-	-	-	-	0.005	0.005	-	-
20	-	0.024	-	0.024	-	-	-	-	-	-	0.005	0.005	-	-
21	-	0.024	-	0.024	-	-	-	-	-	-	0.005	0.005	-	-
MEAN	0.0178	0.0177	0.0250	0.0200	0.0080	-	-	-	-	-	0.0043	0.0043	-	-
STD DEV	0.0083	0.0071	0.0071	0.0076	-	-	-	-	-	-	0.0023	0.0023	-	-
REL STD DES VAL	46.3	40.2	28.3	37.8	0.02634	-	-	-	-	-	51.9	0.00469	-	-
LAB	07602 T N CALC'D	07651 T N DIS UV AA	07655 T N DIS UV EDTA	07690 TOT N COMMON	07790 T N DIS COMMON	09103 F DIS COL SP	09105 F DIS SP EL	09106 F DIS EL POR	09107 F DIS AUT POR	09108 F DIS SP EL	09190 FLUORIDE COMMON	10101 ALKALNTY TITR'N	-	-
1	-	-	-	-	0.045 *	-	-	-	0.01 L	-	0.05 L	1.10	-	-
2	-	-	-	-	0.020	-	-	-	-	-	0.05 L	1.0	-	-
3	-	0.020	0.021	-	0.021	-	-	-	-	-	0.05 L	1.0	-	-
4	-	-	-	-	-	0.1	-	-	-	-	0.05 L	1.0	-	-
5	-	-	-	-	-	-	0.05 L	-	-	-	0.05 L	1.0	-	-
6	-	-	-	-	-	-	0.06 L	-	-	-	0.05 L	1.0	-	-
7	-	-	-	-	-	-	-	0.05 L	-	-	0.05 L	1.0	-	-
8	-	-	-	-	-	-	-	0.06 L	-	-	0.06 L	0.7	-	-
11	-	-	-	-	-	-	-	-	0.1 L	-	0.1 L	0.1	-	-
14	-	-	-	-	-	-	-	-	-	0.05 L	0.5	-	-	
15	0.13	-	-	0.13	-	-	-	-	-	-	0.30 R	-	-	-
19	0.06	-	-	0.06	-	-	-	-	-	-	0.10 L	2.1	-	-
20	-	-	-	-	-	-	-	-	-	-	0.1 L	2.1	-	-
21	-	-	-	-	-	-	-	-	-	-	0.1 L	2.1	-	-
MEAN	0.950	0.0200	-	0.950	0.287	-	-	-	-	-	0.0600	1.4433	-	-
STD DEV	0.0495	-	-	0.0495	0.042	-	-	-	-	-	0.05008	0.5960	-	-
REL STD DES VAL	52.1	-	52.1	49.4	-	-	-	-	-	-	-	41.3	-	-
REL STD DES VAL	52.1	-	52.1	0.0750	-	-	-	-	-	-	-	0.02487	-	-

DATA SUMMARY - FED-PROV & PPMB OA PROGRAMS

STUDY NO.	FP	43	PP	83	SAMPLE 2				SAMPLE 3				PAGE 6			
					10108 ALKLN _T POT TIT	10109 ALKLN _T GRN TIT	10110 ALKLN _T TIT PRO	10111 ALKLN _T TIT PRO	10301 PH COMMON	10302 PH COMMON	10390 PH COMMON	10602 HARDNS CALC'D	10603 HARDNS TITR'N	10606 HARDNS CALC'D	10690 HARDNS COMMON	
1					-0.5	0.2	-0.5	1.0	5.16	-	5.16	138.9	-	-	138.9	
2					-	-	0.2	0.5	5.5	-	5.5	144.0	-	-	144.0	
3					20.	L	-	1.00	5.55	-	5.55	-	-	-	144.1	
4					-	-	0.5	1.00	5.52	R	5.52	147.9	-	-	144.1	
5					-	-	0.1	1.00	5.45	-	5.4	R	-	-	147.9	
6					-	-	-	3.00	5.41	-	5.45	-	-	-	150.9	
7					-	-	-	0.7	5.41	-	5.41	-	-	-	150.0	
8					-	-	-	1.66	5.38	R	5.38	148.9	-	-	146.0	
9					-	-	-	1.67	5.38	R	5.38	140.9	-	-	152.0	
10					-	-	-	2.0	5.34	R	5.34	140.9	-	-	145.9	
11					-	-	-	2.1	5.34	R	5.34	140.9	-	-	143.9	
12					-	-	-	2.1	5.34	R	5.34	143.9	-	-	143.9	
13					-	-	-	2.1	5.34	R	5.34	143.9	-	-	143.9	
14					-	-	-	2.1	5.34	R	5.34	143.9	-	-	143.9	
15					-	-	-	2.1	5.34	R	5.34	143.9	-	-	143.9	
16					-	-	-	2.1	5.34	R	5.34	143.9	-	-	143.9	
17					-	-	-	2.1	5.34	R	5.34	143.9	-	-	143.9	
18					-	-	-	2.1	5.34	R	5.34	143.9	-	-	143.9	
19					-	-	-	2.1	5.34	R	5.34	143.9	-	-	143.9	
20					-	-	-	2.1	5.34	R	5.34	143.9	-	-	143.9	
21					-	-	-	2.1	5.34	R	5.34	143.9	-	-	143.9	
MEAN	3.0000	2.0000	-5.0000	.2000	1.3360	5.4854	5.6000	5.4854	5.6000	5.4936	5.6000	144.8727	148.0000	144.1000	145.2643	
STD	DEV	REL	DES	VAL	-	-	-	77.0391	3.1699	-	3.0	1.661	6.2359	2.8284	-	5.6192
LAB	11001 NA TOT AAS	11005 NA TOT ICP	11102 NA F AAS	11103 NA DIS FL PH	11104 NA DIS FLAME	11105 NA DIS AAS DA	11107 NA UF FL PH	11111 NA DIS ICP	11111 NA EXT ICP	11111 NA EXT ICP	11111 NA EXT ICP	11190 SODIUM COMMON	12005 MG TOR ICP	12101 MG DIS CALC'D	-	
1					-	-	18.0	-	-	-	-	-	18.0	*	-	
2					-	-	22.6	-	-	-	-	-	22.6	*	-	
3					-	-	19.0	-	-	-	-	-	19.0	-	-	
4					-	-	19.	-	-	-	-	-	19.	-	-	
5					-	-	-	-	-	-	-	-	19.	-	-	
6					-	-	-	-	-	-	-	-	19.	-	-	
7					-	-	-	-	-	-	-	-	19.	-	-	
8					-	-	-	-	-	-	-	-	19.	-	-	
9					-	-	-	-	-	-	-	-	19.	-	-	
10					-	-	-	-	-	-	-	-	19.	-	-	
11					-	-	-	-	-	-	-	-	19.	-	-	
12					-	-	-	-	-	-	-	-	19.	-	-	
13					-	-	-	-	-	-	-	-	19.	-	-	
14					-	-	-	-	-	-	-	-	19.	-	-	
15					-	-	-	-	-	-	-	-	19.	-	-	
16					-	-	-	-	-	-	-	-	19.	-	-	
17					-	-	-	-	-	-	-	-	19.	-	-	
18					-	-	-	-	-	-	-	-	19.	-	-	
19					-	-	-	-	-	-	-	-	19.	-	-	
20					-	-	-	-	-	-	-	-	19.	-	-	
21					-	-	-	-	-	-	-	-	19.	-	-	
MEAN	19.0000	20.0000	19.0333	19.8667	19.0000	18.5000	18.8000	19.8500	19.5000	19.2121	1.1	-	19.3714	9.9600	10.0000	
STD	DEV	REL	DES	VAL	-	-	-	-	-	-	-	-	1.0766	.6	-	
					-	-	-	-	-	-	-	-	19.150	-	-	

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	PP 83				SAMPLE 2				SAMPLE 2				PAGE 9	
	FP	43	200050 CA DIS AAS NO	20100 CA DIS CALC'D	20103 CA DIS AAS	20107 CA DIS AAS	20108 CA DIS AAS UF	20110 CA DIS AAS AUT	20111 CA DIS ICP	20115 CA DIS ICP	20311 CA EXT ICP	20990 COMMON CALCIUM		
1	-	-	-	-	-	40.8	-	-	-	-	-	40.8		
2	-	-	-	-	-	-	42.7	-	-	-	-	42.7		
3	-	-	-	-	43.5	-	-	-	-	-	-	43.5		
4	-	-	-	43.	43.4	-	-	-	-	-	-	43.4		
5	-	-	-	-	-	-	-	-	-	-	-	44.5		
6	-	-	-	-	-	-	-	-	-	-	-	44.5		
7	-	-	-	-	-	-	-	-	-	-	-	45.		
8	-	-	-	-	-	-	-	-	-	-	-	45.		
9	-	-	-	-	-	-	-	-	-	-	-	41.		
10	-	-	-	-	-	-	-	-	-	-	-	42.2		
11	-	-	-	-	-	-	-	-	-	-	-	42.2		
12	-	-	-	-	-	-	-	-	-	-	-	43.8		
13	-	-	-	-	-	-	-	-	-	-	-	42.5		
14	-	-	43.8	-	-	-	-	-	-	-	-	42.5		
15	-	-	-	-	-	-	-	-	-	-	-	42.3		
16	45.4	-	-	-	-	-	-	-	-	-	-	42.3		
17	-	-	-	-	-	-	-	-	-	-	-	42.3		
18	-	-	-	-	-	-	-	-	-	-	-	39.0		
19	-	-	-	-	-	-	-	-	-	-	-	42.3		
20	-	-	-	-	-	-	-	-	-	-	-	39.0		
21	-	-	-	-	-	-	-	-	-	-	-	42.3		
MEAN	45.2000	43.8000	43.0000	42.6333	40.8000	40.8500	42.0000	42.3500	42.3000	44.5000	42.7400			
STD DEV	.2828	-	-	1.4154	-	2.6163	-	-	-	-	-	1.6766		
REL STD	.6	-	-	3.3	-	6.4	-	-	-	-	-	3.9		
DES VAL	-	-	-	-	-	-	-	-	-	-	-	42.335		

DATA SUMMARY

FEDERAL-PROVINCIAL & PRAIRIE PROVINCES QUALITY ASSURANCE PROGRAMS

STUDY NO.	FP 44	PP 84	DATE: 01/08/89	DUE DATE: 31/08/89				PAGE 10				
				SAMPLE 3	SPiked SAMPLE.	TRACE METALS -LOW- (IN 0.2% HNO3)	V DIS ICP DA	V TOT 5X ICP	23009 V TOT 5X ICP	23011 V TOT 5X ICP	23111 V DIS ICP DA	23999 VANADIUM COMMON
LAB	13004 AL TOT AAS GF	13009 AL TOT 5X ICP	13030 AL DIS ICP DA	13111 AL EXT AAS DA	13302 AL EXT AAS SE	13305 AL EXT AAS SE	13999 ALUMINUM COMMON	23002 V TOT AAS SE	23009 V TOT AAS SE	23011 V TOT 5X ICP	23111 V DIS ICP DA	23999 VANADIUM COMMON
1	-	-	-	0.051	-	-	0.051	0.051	-	0.021	-	0.021
2	-	-	0.059	-	-	0.050	0.050	0.0174R	0.020	0.02	-	0.0174R
3	-	0.066	-	-	-	0.2	L	0.066*	-	-	-	0.02
6	-	-	-	0.06	-	-	0.06	L	-	-	-	0.02
8	-	-	-	-	-	-	0.06	* 0.091 R	-	-	-	0.02
9	0.091 R	0.0507	-	-	-	-	0.0507 R	0.0507	0.0202	-	-	0.0202
15	-	-	-	-	-	-	0.05	-	-	-	-	-
19	0.05	-	-	-	-	-	0.060 *	-	-	-	-	-
20	0.060	-	-	-	-	-	-	-	-	-	-	-
21	0.0510	-	-	-	-	-	-	-	-	-	-	-
MEAN STD DEV REL STD DES VAL	0.0550 12.9	0.071 13.1	-	-	-	-	-	-	-	-	-	-
LAB	24003 CR TOT AAS SE	24004 CR TOT AAS GF	24009 CR TOT 5X ICP	24011 CR DIS ICP DA	24303 CR EXT AAS SE	24999 CHROMIUM COMMON	25003 MN TOT 5X ICP	25004 MN TOT AAS DA	25009 MN TOT COL BIS	25010 MN TOT 5X ICP	25011 MN TOT 5X ICP	25011 MN TOT 5X ICP
1	0.0251	-	0.024	0.0254	0.024	-	0.024	0.024	0.020	0.021	-	0.0215
3	-	0.041 R	-	-	0.024	-	0.024	0.024	-	-	-	0.018
6	-	0.031	-	-	-	0.026	0.031 R	0.031	-	-	-	-
8	-	-	0.0215	-	0.029	-	0.026	0.026	-	-	-	-
9	-	-	0.029	0.024	-	-	0.029	0.029	-	-	-	-
11	-	-	0.024	-	-	0.029	0.024	0.024	-	-	-	-
15	-	-	0.024	-	-	-	0.024	0.024	-	-	-	-
19	-	-	0.029	-	-	-	0.029	0.029	-	-	-	-
20	-	-	0.024	-	-	-	0.024	0.024	-	-	-	-
21	-	-	0.0240	0.0236	0.0240	0.0260	0.0260	0.0260	0.0230	-	-	-
MEAN STD DEV REL STD DES VAL	0.0251 12.9	0.036 8.4	-	-	-	-	11.9	11.9	12.3	-	-	0.0180
LAB	25107 MN DIS AAS GF	25111 MN DIS ICP DA	25304 MN EXT AAS DA	25311 MN EXT ICP DA	25999 MANGANESE COMMON	26003 FE TOT AAS GF	26005 FE TOT AAS SE	26009 FE TOT AAS SE	26011 FE TOT 5X ICP	26107 FE DIS AAS GF	26111 FE DIS ICP DA	26305 FE EXT AAS SE
1	-	-	0.023	-	0.020	-	0.023	-	0.050	-	-	0.048
2	-	-	-	0.023	-	0.021	0.018*	0.0492	0.0503	0.057	-	-
3	-	-	-	0.023	-	0.021	0.023	-	-	-	-	-
6	-	0.02	-	0.023	-	0.021	0.025*	-	-	-	-	-
8	-	-	0.022	-	-	0.022	0.022	-	-	-	-	-
9	-	-	0.022	-	-	0.023	0.0194	-	0.0494	-	-	0.049
11	-	-	0.022	-	-	0.023	0.028*	0.057	-	-	-	-
15	-	-	0.022	-	-	-	-	-	-	-	-	-
19	-	-	0.023	-	-	-	-	-	-	-	-	-
20	0.028	-	-	-	-	-	-	-	-	-	-	-
21	0.028	-	-	-	-	-	-	-	-	-	-	-
MEAN STD DEV REL STD DES VAL	0.0255 13.9	0.035 6.7	-	0.0230	0.0230	0.0220	0.0570	0.0492	0.0505	0.0570	0.0510	0.0560
				-	-	12.8	-	9	-	-	10.1	0.057
				-	-	0.02123	-	-	-	-	-	1.5

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	PP 44		PP 84		SAMPLE 3		SAMPLE 4		PAGE 12	
	LAB		LAB		LAB		LAB		LAB	
42000	42009	42011	42111	42002	48003	48004	48009	48011	48302	
	MO TOT	MO TOT	MO DIS	CD TOT	CD TOT	CD TOT	CD TOT	CD TOT	CD EXT	
	5X ICP	5X ICP	5X ICP DA	AAS SE	AAS SE	AAS GF	SX ICP	SX ICP	AAS SE	
1	-	0.018	-	0.018	-	-	0.020	-	-	0.021
2	-	0.016	-	0.016 *	0.024	-	0.0185	-	-	-
3	-	0.016	0.016	0.02	0.02	-	0.017	-	-	-
6	-	-	-	0.020	0.020	-	-	0.022	-	0.0231
9	-	-	-	0.0201	0.0201	-	0.0210	-	-	-
11	-	-	-	-	0.015 *	-	-	-	-	-
15	-	-	-	-	0.015 *	-	-	-	-	-
19	-	-	-	-	0.015 *	-	-	-	-	-
21	0.015	-	-	-	-	-	-	-	-	-
MEAN	.0150	.0183	.0160	.0200	.0180	.0204	.0225	.0198	.0220	.0221
STD DEV	-	.0016	.0000	.0021	.0021	.0007	.0013	.0013	-	.0015
STD DEVIATION	-	8.9	-	-1.0	11.7	3.1	-	6.3	-	6.7
VAL	-	-	-	-	.01848	-	-	-	-	-
LAB	48309	48999	56000	56009	56011	56999	82002	82004	82009	82202
	CD EXT	CADMIUM	BA?	BA TOT	BA DIS	BARIUM	PB TOT	PB TOT	PB TOT	PB TOT
	AAS GF	COMMON		5X ICP	5X ICP	COMMON	AAS SE	AAS GF	5X ICP	AAS SE
1	-	0.020	-	0.022	-	0.022	-	-	-	-
2	-	0.0204	-	0.0250	0.022	-	0.0250	0.0244	-	-
3	-	0.017 *	-	-	-	-	0.0250	-	-	-
6	0.021	0.021	-	-	-	0.024	0.024	-	0.0245	0.029
8	-	0.024 *	-	-	-	0.026	0.026	-	-	-
9	-	0.0231	-	-	-	0.026	0.026	0.0086R	0.03	0.022
11	-	0.022	-	0.0241	-	-	0.0241	-	0.025	-
15	-	0.0210	-	-	-	0.026	0.026	0.025	0.025	0.025
19	-	0.022	0.024	-	-	0.024	0.024	-	-	-
21	-	-	-	-	-	-	0.024	-	-	-
MEAN	.0210	.0213	.0240	.0237	.0220	.0250	.0244	.0250	.0245	.0243
STD DEVIATION	-	8.9	-	.0015	.0014	.0239	.015	.0000	-	.0021
VAL	-	.02091	-	6.5	5.7	6.1	6.0	-	-	8.6

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	FP 44			FP 84			SAMPLE 4			SAMPLE 4			PAGE 13		
	LAB	00110 TONIC BALANC %	00120 SUM OF CATIONS	00125 SUM OF ANIONS	02011 COLOUR APPARE	02021 COLOUR VIS COM	02023 COLOUR SPECT	02024 COL TRU SPECT	02040 COLOUR COMMON	02041 CONDUCT SPEC 25	02060 CONDUCT COMMON	02073 TURB HACH	02074 TURB NPMLTRI		
1	-5.83 -3.24	1.86 2.094 2.008	2.09 1.882	5. 5. 5.	L L L	- -	- -	1.7 5. 5.	L L L	231. 230. 228.	0.05 0.1 -	-			
2	-0.94	2.058	2.097	5. 2.15	L 3. 5. 5.	- -	- -	5. 3. 5. 5.	L L L L	227. 233. 225. 224.	0.10 0.1 -	-			
3	-1.64	2.08	2.15	3. 2.04	L L	- -	- -	5. 5. 5.	L L L	218. 215. 220.	0.16 0.1 -	-			
4	-1.03	2.14	2.18	5. 5.	L L	- -	- -	5. 5. 5.	L L L	221. 215. 220.	0.08 0.1 -	-			
5	-4.81	2.29	2.08	5. 5. 5.	L L L	- -	- -	5. 5. 5.	L L L	220. 215. 220.	0.1 0.1 -	-			
6	-1.1	-	-	-	-	-	-	-	-	-	-	-	-		
7	-1.15	-	-	-	-	-	-	-	-	-	-	-	-		
8	-1.19	-	-	-	-	-	-	-	-	-	-	-	-		
9	-1.20	-0.78	2.001	2.033	-	-	-	5. 5. 5.	L L L	209. 209. 209.	-	0.15			
10	-1.21	-	-	-	-	-	-	3.0000 3.0000 3.0000	1.7000 1.7000 1.7000	224.0000 224.0000 224.0000	1.1000 1.0548 1.0548	-			
11	MEAN	-8425	2.0623	4.0000	-	-	-	3.1750 3.1750 3.1750	224.0000 224.0000 224.0000	0.6009 0.6009 0.6009	0.6101 0.6101 0.6101	-			
12	STD DEV	3.1811	2.1161	2.0865	4.4142	-	-	42.9 42.9 42.9	8.3205 8.3205 8.3205	8.3205 8.3205 8.3205	33.5 33.5 33.5	-			
13	REL STD	5.6	4.2	4.2	35.4	-	-	-	-	-	-	-	-		
14	DES VAL	-1.0	-	-	-	-	-	-	-	-	-	-	-		
15	MEAN	-1000	-1200	-1160	-0.0433	-	-	-	-	-	-	-	-		
16	STD DEV	-	-	-	37.3	-	-	-	-	-	-	-	-		
17	REL STD	-	-	-	-	-	-	-	-	-	-	-	-		
18	DES VAL	-	-	-	-	-	-	-	-	-	-	-	-		
19	MEAN	-0.51	0.51	-	-	-	-	6.5	6.5	-	0.035	-	-		
20	STD DEV	-	0.5	-	-	-	-	6.9	6.9	-	-	-	-		
21	REL STD	-	0.611	-	-	-	-	5.32	*	-	-	-	-		
22	DES VAL	-	3.18	R	5.32	-	-	7.0	7.0	-	-	-	-		
23	MEAN	-0.5050	-0.6150	-0.6152	-0.6154	DIC UV DOC CO2 PHE	DIC AA DOC CO2 PHE	0.6490 0.6490 D.I.C COMMON	0.7005 0.7005 TKN INDO BL	0.7016 0.7016 TKN AMM-SAL	0.7090 0.7090 TKN BLK DIG BER	0.7109 0.7109 NO3+NO2 AA HYD	-		
24	STD DEV	-0.0711	-0.7368	-5.3200	-6.9000	DIC TR COMBUST	DIC UV CO2 IR	-	-	-	-	-	-		
25	REL STD	1.4	39.6	-	-	-	-	6.4	6.4	0.5	R	0.5 0.20	0.07 1.0 0.3		
26	DES VAL	-	-	-	-	-	-	6.	6.	0.20	L	-	-		
27	MEAN	-	-	-	-	-	-	-	-	0.04	R	0.13 0.04	0.02 L		
28	STD DEV	-	-	-	-	-	-	-	-	-	R	-	-		
29	REL STD	-	-	-	-	-	-	-	-	-	R	-	-		
30	DES VAL	-	-	-	-	-	-	-	-	-	R	-	-		

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	FP	44	PP	84	SAMPLE 4				SAMPLE 4				SAMPLE 4			
					07110 NO3+NO2 AA2 CD	07111 NO3+NO2 DIS SPEC	07112 NO3+NO2 UF AA CD	07390 NITRATE COMMON	07505 NH3 TOT AA BERT	07540 NH3 TOT AA SAL	07555 NH3 DIS AA PHEN	07557 NH3 DIS AA INDO	07562 NH3 DIS AA EDTA	07590 AMMONIA COMMON	07601 T N UV AA SUL	
LAB	0.05	0.058	-	0.056	0.058	0.056	0.056	0.058	-	-	-	-	0.01	0.01	0.168	L
1	0.05	-	-	-	-	0.05	0.05	0.05	0.005 L	0.005 L	-	-	-	-	0.005 L	0.005 L
2	0.059	0.055	-	-	0.05	0.055	0.059	0.059	-	-	-	0.002 L	-	0.002 R	-	-
3	-	-	-	-	*0.07	*0.05	*0.05	*0.05	-	-	-	0.002 R	-	-	-	-
4	0.06	-	-	-	-	0.06	0.03	0.03	-	-	-	0.004	-	-	0.004	-
5	0.04	-	-	-	-	0.04	0.04	0.04	0.02 L	-	-	-	-	-	0.02 L	-
6	0.05	0.05	0.06	-	-	0.05	0.05	0.05	0.02 L	-	-	-	-	-	0.01 L	-
7	0.059	-	-	-	-	0.059	0.059	0.059	-	-	-	0.009 R	-	-	0.009 R	-
8	0.05	-	-	-	-	0.05	0.05	0.05	-	-	-	0.006 R	-	-	0.006 R	-
9	0.06	-	-	-	-	0.06	0.06	0.06	-	-	-	0.005 L	-	-	0.005 L	-
10	0.05	-	-	-	-	0.061	0.061	0.061	-	-	-	0.005 L	-	-	0.005 L	-
11	0.059	-	-	-	-	0.059	0.059	0.059	-	-	-	0.005 R	-	-	0.005 R	-
12	0.05	-	-	-	-	0.05	0.05	0.05	-	-	-	0.005 L	-	-	0.005 L	-
13	0.06	-	-	-	-	0.061	0.061	0.061	-	-	-	0.005 L	-	-	0.005 L	-
14	0.059	-	-	-	-	0.059	0.059	0.059	-	-	-	0.005 R	-	-	0.005 R	-
15	0.05	-	-	-	-	0.05	0.05	0.05	-	-	-	0.005 L	-	-	0.005 L	-
16	0.059	-	-	-	-	0.059	0.059	0.059	-	-	-	0.005 R	-	-	0.005 R	-
17	0.05	-	-	-	-	0.05	0.05	0.05	-	-	-	0.005 L	-	-	0.005 L	-
18	0.059	-	-	-	-	0.059	0.059	0.059	-	-	-	0.005 R	-	-	0.005 R	-
19	0.05	-	-	-	-	0.05	0.05	0.05	-	-	-	0.005 L	-	-	0.005 L	-
20	0.06	-	-	-	-	0.061	0.061	0.061	-	-	-	0.005 L	-	-	0.005 L	-
21	0.05	-	-	-	-	0.05	0.05	0.05	-	-	-	0.005 R	-	-	0.005 R	-
MEAN	0.0537	0.0597	0.0515	0.0420	0.0530	0.0543	0.0594	0.0594	-	-	-	0.0065	-	-	0.0077	0.0680
STD	0.0068	0.0015	2.6	8.0	8.0	17.3	-	-	-	-	-	0.0035	-	-	41.9	-
REL	12.6	-	-	-	-	-	-	-	-	-	-	54.4	-	-	-	-
DES	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LAB	07602 T N DIS CALC'D	07651 T N DIS UV AA	07655 T N DIS UV EDTA	07690 TOT N COMMON	07790 TOT N COMMON	09103 F DIS COL SP	09105 F DIS SP EL	09106 F DIS EL POT	09107 F DIS AUT POT	09108 F DIS SP EL	09109 FLUORIDE COMMON	10101 ALKALI TITR N				
1	-	-	-	-	-	0.1	L	-	-	0.03	-	0.03	-	0.03	0.03	30.99
2	-	-	0.088	0.060	-	0.068	*	-	-	0.03	-	0.03	-	0.03	0.03	28.7
3	-	-	-	-	-	0.088	*	-	-	0.050 L	-	-	-	0.050 L	0.050 L	29.8
4	-	-	-	-	-	0.060	-	0.1	L	-	0.05	-	0.05	0.05	0.05	28.2
5	-	-	-	-	-	-	-	-	0.05 L	-	-	-	0.05 L	0.05 L	30.6	
6	-	-	-	-	-	-	-	-	0.05 L	-	-	-	0.05 L	0.05 L	31.4	
7	-	-	-	-	-	-	-	-	0.05 L	-	-	-	0.05 L	0.05 L	31.1	
8	-	-	-	-	-	-	-	-	0.05 L	-	-	-	0.05 L	0.05 L	31.8	
9	-	-	-	-	-	-	-	-	0.05 L	-	-	-	0.05 L	0.05 L	31.6	
10	-	-	-	-	-	-	-	-	0.10 L	0.1	L	-	0.10 L	0.10 L	31.6	
11	-	-	-	-	-	-	-	-	0.23 R	-	-	-	0.23 R	0.23 R	-	
12	-	-	-	-	-	-	-	-	0.10 L	-	-	-	0.10 L	0.10 L	-	
13	-	-	-	-	-	-	-	-	0.23 R	-	-	-	0.23 R	0.23 R	-	
14	-	-	-	-	-	-	-	-	0.10 L	-	-	-	0.10 L	0.10 L	-	
15	-	-	-	-	-	-	-	-	0.18	-	-	-	0.18	0.18	-	
16	-	-	-	-	-	-	-	-	0.10	-	-	-	0.10	0.10	-	
17	-	-	-	-	-	-	-	-	0.10	-	-	-	0.10	0.10	-	
18	-	-	-	-	-	-	-	-	0.10	-	-	-	0.10	0.10	-	
19	-	-	-	-	-	-	-	-	0.10	-	-	-	0.10	0.10	-	
20	-	-	-	-	-	-	-	-	0.10	-	-	-	0.10	0.10	-	
21	-	-	-	-	-	-	-	-	0.10	-	-	-	0.10	0.10	-	
MEAN	0.1400	0.0880	0.0600	-	-	-	-	-	-	-	-	.0300	.0300	.0300	.0300	30.955
STD	0.0566	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.6
REL	40.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DES	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	FP	44	PP	84	SAMPLE 4				SAMPLE 5				SAMPLE 6			
					10108 ALKINTY POT TIT	10109 ALKINTY POT TIT	10111 ALKINTY TIT PRO	10190 ALKINTY COMMON	10301 PH	10302 PH COMMON	10390 HARDNSS CALC'D	10602 HARDNSS TITR'N	10603 HARDNSS CALC'D	10606 HARDNSS COMMON	10690 HARDNSS CALC'D	11001 NA TOT AAS
1	-	-	-	-	30.09	7.73	-	7.73	54.1	-	-	54.1	*	-	-	
2	-	-	-	-	28.7	7.64	-	7.64	57.27	-	-	60.6	60.6	-	-	
3	-	-	-	-	29.6	7.63	-	7.83	-	-	-	-	-	-	-	
4	-	-	-	-	29.6	7.64	-	7.88	62.4	-	-	62.4	-	-	-	
5	-	-	-	-	32.	7.88	-	7.9	7.9	-	-	64.7	-	-	-	
6	-	-	-	-	32.6	7.7	-	7.7	7.7	-	-	64.7	-	-	-	
7	-	-	-	-	29.6	7.20	-	7.20	64.7	-	-	64.7	-	-	-	
8	-	-	-	-	29.6	7.44	-	7.44	60.4	-	-	60.4	-	-	-	
9	-	-	-	-	31.1	7.4	-	7.4	66.2	-	-	66.2	-	-	-	
10	-	-	-	-	30.	7.3	-	7.3	62.0	-	-	62.0	-	-	-	
11	-	-	-	-	30.6	7.42	-	7.42	8.0	-	-	62.2	-	-	-	
12	-	-	-	-	31.4	7.42	-	7.42	8.0	-	-	65.6	-	-	-	
13	-	-	-	-	31.1	8.0	-	8.0	8.0	-	-	60.93	-	-	-	
14	-	-	-	-	31.1	7.8	-	7.8	65.6	-	-	60.93	-	-	-	
15	-	-	-	-	30.6	7.8	-	7.8	60.93	-	-	60.93	-	-	-	
16	-	-	-	-	31.8	7.4	-	7.4	60.4	-	-	60.4	-	-	-	
17	-	-	-	-	31.6	7.29	-	7.29	60.4	-	-	60.4	-	-	-	
18	-	-	-	-	30.6	7.29	-	7.29	60.4	-	-	60.4	-	-	-	
19	-	-	-	-	30.1619	7.6153	7.4000	7.6019	61.6500	63.2000	60.6000	61.7867	17.6000	-	-	
20	-	-	-	-	31.2654	7.2536	3.2	3.2508	5.6	1.8	-	5.1	-	-	-	
21	-	-	-	-	31.2658	4.2	-	3.3	3.3	-	-	-	-	-	-	
MEAN	31.0000	30.5333	29.6000	30.1619	7.6153	7.4000	7.6019	7.6019	61.6500	63.2000	60.6000	61.7867	17.6000	-	-	
STD	-	1.2858	-	-	-	-	-	-	-	-	-	-	-	-	-	
REL	-	4.2	-	-	-	-	-	-	-	-	-	-	-	-	-	
DES	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
LAB	11005	11102 NA F AAS	11103 NA DIS FL PH	11104 NA DIS AAS FLAME	11105 NA DIS AAS DA	11107 NA UP FL PH	11111 NA DIS ICP	11111 NA EXT ICP	11111 SODIUM COMMON	11990 SODIUM COMMON	12005 MG TOT ICP	12101 MG DIS CALC'D	12102 MG DIS AAS DA	-	-	
1	-	-	-	-	17.0	-	-	17.4	-	-	-	-	-	-	-	
2	-	-	-	-	20.9	-	-	17.4	-	-	-	-	-	-	-	
3	-	-	-	-	17.7	-	-	17.4	-	-	-	-	-	-	-	
4	-	-	-	-	17.	-	-	17.4	-	-	-	-	-	-	-	
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
MEAN	18.6400	17.6667	18.5333	17.7000	17.4000	17.7000	17.4000	17.4000	17.5000	17.9457	4.0500	3.7550	-	-	-	
STD	-	3.5774	12.0793	11.2	-	-	-	-	4.8	-	-	5.6	1.7	-	2.8	
REL	-	3.3	-	-	-	-	-	-	-	-	-	-	-	-	-	
DES	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
VAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

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DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	EP 44		PP 84		SAMPLE 4		SAMPLE 5		SAMPLE 6		PAGE 16	
	LAB	12105 MG DIS AAS DA	12106 MG DIS AAS DA	12107 MG DIS AAS AUT	12111 MG DIS ICP	12311 MG EXT ICP	12990 MGNISTUN COMMON	14000 SILICA?	14090 SILICA	14102 SILICA ANSA AA	14103 SILICA MOL ASC	14105 SILICA MOL ASC
1	3.2	-	3.5	3.6	-	-	3.2 *	-	-	2.0	-	-
2	-	-	-	-	-	-	3.6	-	-	-	1.8	-
3	-	-	-	-	-	-	3.5	-	-	-	1.8	-
4	-	-	-	-	-	-	3.82 R	-	-	-	1.8	-
5	-	-	-	-	-	4.20	4.1	-	-	-	-	-
6	-	-	-	-	-	-	3.8	-	-	-	-	-
7	-	-	-	-	-	-	3.9	-	-	-	-	-
8	-	-	-	-	-	-	4.1	-	-	-	-	-
9	-	-	-	-	-	-	3.60	-	-	-	-	-
10	-	-	-	-	-	-	4.0	-	-	-	-	-
11	-	-	-	-	-	-	4.00	-	-	-	-	-
12	-	-	-	-	-	-	4.00	-	-	-	-	-
13	-	-	-	-	-	-	3.73	-	-	-	-	-
14	-	-	-	-	-	-	3.60	-	-	-	-	-
15	-	-	-	-	-	-	4.0	-	-	-	-	-
16	-	-	-	-	-	-	3.7	-	-	-	-	-
17	-	-	-	-	-	-	3.7	-	-	-	-	-
18	-	-	-	-	-	-	3.97	-	-	-	-	-
19	-	-	-	-	-	-	3.97	-	-	-	-	-
20	-	-	-	-	-	-	3.97	-	-	-	-	-
21	-	-	-	-	-	-	4.2000	-	-	-	-	-
MEAN	3.2000	-	3.7350	3.6000	3.8100	4.2000	3.7871	1.7200	1.7200	1.8950	1.9100	1.8000
STD DEV	-	-	8.9	-	4.1652	-	7.0	-	-	1.1485	-	-1.0
REL STD DEVS VAL	-	-	-	-	4.3	-	-	-	-	7.8	-	-
1	1.8	-	-	-	1.8	-	-	-	-	0.001 L	0.001	-
2	-	-	-	-	2.0	-	-	-	-	0.0007	0.001 L	-
3	-	-	-	-	1.79	-	-	-	-	-	0.0007 L	-
4	-	-	-	-	1.8	-	-	-	-	-	0.003 L	-
5	-	-	-	-	1.8	-	-	-	-	-	-	-
6	-	-	-	-	1.8	-	-	-	-	-	-	-
7	-	-	-	-	1.8	-	-	-	-	-	-	-
8	-	-	-	-	1.9	-	-	-	-	-	-	-
9	-	-	-	-	1.9	-	-	-	-	-	-	-
10	-	-	-	-	1.58	-	1.58 *	-	-	-	-	-
11	-	-	-	-	1.9	-	1.91	-	-	-	-	-
12	-	-	-	-	1.58	-	0.003 L	-	-	-	-	-
13	-	-	-	-	1.9	-	-	-	-	-	-	-
14	-	-	-	-	1.58	-	-	-	-	-	-	-
15	-	-	-	-	1.58	-	-	-	-	-	-	-
16	-	-	-	-	1.58	-	-	-	-	-	-	-
17	-	-	-	-	1.58	-	-	-	-	-	-	-
18	-	-	-	-	1.58	-	-	-	-	-	-	-
19	-	-	-	-	1.58	-	-	-	-	-	-	-
20	-	-	-	-	1.58	-	-	-	-	-	-	-
21	-	-	-	-	1.58	-	-	-	-	-	-	-
MEAN	1.8000	-	1.7400	-	-	-	-	-	-	.0039	35.6000	-
STD DEV	-	-	1.2263	-	-	-	-	-	-	.0035	89.2	-
REL STD DEVS VAL	-	-	13.0	-	6.0	-	-	-	-	51.4	-	-

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

DATA SUMMARY - FED-PROV & PPWB QA PROGRAMS

STUDY NO.	FP 44	PP 84	SAMPLE 4			SAMPLE 4			PAGE 18
			20100 CA DIS CALC'D	20103 CA DIS AAS	20107 CA DIS AAS	20108 CA DIS AAS UF	20110 CA DIS AAS AUT	20111 CA DIS ICP	
12	-	-	-	-	16.4	-	17.0	-	-
13	-	-	-	-	18.5	-	-	-	-
14	-	20.8	18.7	-	-	-	-	-	-
15	-	-	18.4	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-
17	-	-	18.	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-
MEAN	18.9000	20.8000	18.3667	16.4000	18.4500	17.0000	18.8200	18.3000	19.0000
STD DEV	-	-	1.3512	-	.0707	-	3.5940	-	-
REL STD	-	-	1.9	-	.4	-	3.2	-	-
DES VAL	-	-	-	-	-	-	-	-	5.5
DATES RECEIVED	1 89/08/29 5 89/09/15 9 89/08/31 15 89/08/22	2 89/08/31 6 89/07/25 10 89/---/-- 16 89/---/--	3 89/08/14 6 89/09/12 11 89/08/29 19 89/08/29	3 89/09/08 7 89/09/19 13 89/09/11 20 89/08/31	4 89/09/08 8 89/09/05 14 89/09/16 21 89/09/01				

NOTE: ALL CONCENTRATION UNITS ARE EXPRESSED IN MG/L OF EACH ELEMENT, THE EXCEPTIONS BEING:
 COLOUR IN RELATIVE UNITS, CONDUCTIVITY IN USIE/CM, TURBIDITY IN NTU OR NTU, NITROGEN
 ANALYSES IN "N", ALkalinity & HARDNESS IN CACO₃, SILICA IN SIO₂, AND SULFATE IN SO₄.