MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to:

To Originator: Chunming Su **From:**

Lab:

Thru: Mark White **Date:**
Kristie Hargrove

Technical Directive No.: EPAGP530 Rev. 1 **Copies:**
Task No.: 1.2H

Sample Site/Project: Fort Riley Green Infrastructure
Date Collected: 6/17 & 6/19/2015 **Sample Set No.:**
Date Received: 6/19/2015 **Sample Matrix:**
Date Analyzed: 6/22 & 6/25/2015 **Analysis Type:**
No. Samples Analyzed: 34 **Sample Preparation:**

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for Ge
Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in A
Capillary Ion Electrophoresis with Indirect UV Detection an

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKS
Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. T
mg/L and 0.031 mg/L respectively. Please note that most samples were diluted to remove
very large chloride peaks. Ortho-phosphate was not analyzed within the 48 hour holding ti

15-LC19

Lynda Callaway

General Parameters

7/21/2015

Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

7011
water
Fluoride & ortho-phosphate
Dilution as necessary

neral Parameters Analyses

queous Samples Using
d Empower 2 Software

OP-276/R4 cited above.
he current MDLs are 0.002
interference from adjacent
me.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 07/21/15

Sample Results

Analytes	Fluoride (F)			**Analytes**	ortho-Phosphate (as P)					
Codes	7782-41-4			**Codes**	70507					
Methods	RSKSOP-276/4			**Methods**	NRMRL-GWERD-05-0					
Unit	mg/L			**Unit**	mg/L					
MDL	0.031			**MDL**	0.002					
QL	0.200			**QL**	0.020					
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**	**Data**	**DF**
A2	7011-1	6/17/2015	6/25/2015	12.4	31	6/22/2015	13.4	21		
A3	7011-2	6/17/2015	6/25/2015	12.1	31	6/22/2015	13.7	21		
A4	7011-3	6/17/2015	6/25/2015	8.81	31	6/22/2015	3.04	2		
A5	7011-4	6/17/2015	6/25/2015	ND	11	6/22/2015	0.198	1		
A6	7011-5	6/17/2015	6/25/2015	BQL (0.618)	11	6/22/2015	0.074	1		
A7	7011-6	6/17/2015	6/25/2015	1.17	3	6/22/2015	0.058	1		
A8	7011-7	6/17/2015	6/25/2015	1.24	3	6/22/2015	0.058	1		
A9	7011-8	6/17/2015	6/25/2015	3.74	6	6/22/2015	0.274	1		
A10	7011-9	6/17/2015	6/25/2015	6.37	6	6/22/2015	0.082	1		
A11	7011-10	6/17/2015	6/25/2015	8.22	6	6/22/2015	0.086	1		
A11	7011-10 Lab dup	6/17/2015	6/25/2015	8.30 (RPD=0.969)	6	6/22/2015	0.086 (RPD=0)	1		
A12	7011-11	6/17/2015	6/25/2015	8.35	6	6/22/2015	0.095	1		
B2	7011-12	6/19/2015	6/25/2015	BQL (2.96)	41	6/22/2015	40.5	21		
B3	7011-13	6/19/2015	6/25/2015	BQL (3.87)	41	6/22/2015	35.9	21		
B4	7011-14	6/19/2015	6/25/2015	BQL (3.38)	41	6/22/2015	34.7	21		
B5	7011-15	6/19/2015	6/25/2015	BQL (4.42)	41	6/22/2015	28.8	21		
B6	7011-16	6/19/2015	6/25/2015	6.27	31	6/22/2015	0.601	1		
B7	7011-17	6/19/2015	6/25/2015	4.03	2	6/22/2015	0.040	1		
B8	7011-18	6/19/2015	6/25/2015	BQL (0.348)	6	6/22/2015	0.031	1		
B9	7011-19	6/19/2015	6/25/2015	1.32	6	6/22/2015	0.095	1		
B10	7011-20	6/19/2015	6/25/2015	2.36	6	6/22/2015	0.073	1		

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Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.031	**MDL**	0.002		
QL	0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
B10	7011-20 Lab dup	6/19/2015	6/25/2015	2.30 (RPD=2.58)	6	6/22/2015	0.071 (RPD=2.78)	1		
B11	7011-21	6/19/2015	6/25/2015	2.80	6	6/22/2015	0.075	1		
B12	7011-22	6/19/2015	6/25/2015	2.34	6	6/22/2015	0.095	1		
C2	7011-23	6/19/2015	6/25/2015	BQL (4.79)	41	6/22/2015	71.3	41		
C3	7011-24	6/19/2015	6/25/2015	BQL (2.60)	31	6/22/2015	30.1	41		
C4	7011-25	6/19/2015	6/25/2015	BQL (4.89)	31	6/22/2015	19.5	41		
C5	7011-26	6/19/2015	6/25/2015	BQL (2.35)	31	6/22/2015	5.15	5		
C6	7011-27	6/19/2015	6/25/2015	4.24	11	6/22/2015	1.16	1		
C7	7011-28	6/19/2015	6/25/2015	BQL (0.199)	2	6/22/2015	0.193	1		
C8	7011-29	6/19/2015	6/25/2015	BQL (0.837)	6	6/22/2015	0.054	1		
C9	7011-30	6/19/2015	6/25/2015	1.87	6	6/22/2015	0.086	1		
C9	7011-30 Lab dup	6/19/2015	6/25/2015	2.03 (RPD=8.21)	6	6/22/2015	0.091 (RPD=5.65)	1		
C10	7011-31	6/19/2015	6/25/2015	3.18	6	6/22/2015	0.217	1		
C11	7011-32	6/19/2015	6/25/2015	8.60	6	6/22/2015	0.436	1		
C12	7011-33	6/19/2015	6/25/2015	4.57	6	6/22/2015	0.270	1		
10-C12	7011-34	6/19/2015	6/25/2015	7.04	6	6/22/2015	0.584	1		

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively.

Notes:

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Analytical Results Report

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Analyst: Lynda Callaway

Report Date: 07/21/15

Sample Results

			Analytes	Fluoride (F)		**Analytes**	ortho-Phosphate (as P)				
			Codes	7782-41-4		**Codes**	70507				
			Methods	RSKSOP-276/4		**Methods**	NRMRL-GWERD-05-0				
			Unit	mg/L		**Unit**	mg/L				
			MDL	0.031		**MDL**	0.002				
			QL	0.200		**QL**	0.020				
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**	**Data**	**DF**

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

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Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	6/22/2015	6/22/2015	-	-	-	BQL (0.014)	-	-			
MB	Nanopure Water Blank	6/22/2015	6/22/2015	-	-	-	BQL (0.013)	-	-			
MB	Nanopure Water Blank	6/22/2015	6/22/2015	-	-	-	BQL (0.014)	-	-			
MB	Nanopure Water Blank	6/22/2015	6/22/2015	-	-	-	BQL (0.013)	-	-			
MB	Nanopure Water Blank	6/25/2015	6/25/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	6/25/2015	6/25/2015	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	6/22/2015	-	-	-	1.70	1.57	108			
SS	ERA 64 Simple Nutrients	2/25/2015	6/22/2015	-	-	-	1.65	1.57	105			
SS	ERA 64 Simple Nutrients	2/25/2015	6/22/2015	-	-	-	1.66	1.57	106			
SS	ERA 64 Simple Nutrients	2/25/2015	6/22/2015	-	-	-	1.55	1.57	98.7			
SS	ERA 64 Minerals	1/21/2015	6/25/2015	3.62	3.47	104	-	-	-			
SS	ERA 64 Minerals	1/21/2015	6/25/2015	3.47	3.47	100	-	-	-			
CCC	Continuing Calibration Check Standard	5/14/2015	6/22/2015	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	5/14/2015	6/22/2015	-	-	-	0.048	0.050	96.0			
CCC	Continuing Calibration Check Standard	5/14/2015	6/22/2015	-	-	-	0.479	0.500	95.8			
CCC	Continuing Calibration Check Standard	5/14/2015	6/22/2015	-	-	-	0.233	0.250	93.2			
CCC	Continuing Calibration Check Standard	5/14/2015	6/22/2015	-	-	-	2.18	2.00	109			
CCC	Continuing Calibration Check Standard	5/14/2015	6/22/2015	-	-	-	0.476	0.500	95.2			
CCC	Continuing Calibration Check Standard	5/14/2015	6/22/2015	-	-	-	0.993	1.00	99.3			
CCC	Continuing Calibration Check Standard	6/17/2015	6/25/2015	0.215	0.200	108	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	6/25/2015	0.987	1.00	98.7	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	6/25/2015	2.01	2.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	6/25/2015	5.06	5.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	6/25/2015	9.62	10.0	96.2	-	-	-			
MS	A2 Spike	6/22 & 6/25/2015	6/22 & 6/25/2015	* 3.68	* 0.400 (3.85)	85.2	* 1.74	* 0.639 (0.990)	111			
MS	B11 Spike	6/22 & 6/25/2015	6/22 & 6/25/2015	* 4.05	* 0.466 (3.23)	111	0.906	0.075 (0.990)	83.9			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 or 0.6 mL of sample to yield spike concentrations of 3.85 and 3.23 mg/L respectively. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated and reported without the dilution factor applied.

Notes:

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Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

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To Originator: Chunming Su **From:**

Lab:

Thru: Mark White **Date:**
Kristie Hargrove

Technical Directive No.: EPAGP530 Rev. 1 **Copies:**
Task No.: 1.2H

Sample Site/Project: Fort Riley Green Infrastructure
Date Collected: 6/23/2015 **Sample Set No.:**
Date Received: 6/24/2015 **Sample Matrix:**
Date Analyzed: 6/24 & 6/30/2015 **Analysis Type:**
No. Samples Analyzed: 33 **Sample Preparation:**

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for Ge
Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in A
Capillary Ion Electrophoresis with Indirect UV Detection an

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKS
Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. T
mg/L and 0.031 mg/L respectively. Please note that most samples were diluted to remove
very large chloride peaks. Ortho-phosphate samples were analyzed within the 48-hour hol

15-LC22

Lynda Callaway

General Parameters

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7012
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Fluoride & ortho-phosphate
Dilution as necessary

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queous Samples Using
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OP-276/R4 cited above.
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Sample Results

Analytes	Fluoride (F)			**Analytes**	ortho-Phosphate (as P)					
Codes	7782-41-4			**Codes**	70507					
Methods	RSKSOP-276/4			**Methods**	NRMRL-GWERD-05-0					
Unit	mg/L			**Unit**	mg/L					
MDL	0.031			**MDL**	0.002					
QL	0.200			**QL**	0.020					
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**	**Data**	**DF**
AC2	7011-1	6/23/2015	6/30/2015	BQL (5.54)	31	6/24/2015	20.4	21		
AC3	7011-2	6/23/2015	6/30/2015	ND	31	6/24/2015	11.9	21		
AC4	7011-3	6/23/2015	6/30/2015	BQL (6.10)	31	6/24/2015	1.91	3		
AC5	7011-4	6/23/2015	6/30/2015	BQL (0.963)	21	6/24/2015	0.122	1		
AC6	7011-5	6/23/2015	6/30/2015	BQL (0.440)	11	6/24/2015	0.064	1		
AC7	7011-6	6/23/2015	6/30/2015	ND	3	6/24/2015	0.037	1		
AC8	7011-7	6/23/2015	6/30/2015	0.732	3	6/24/2015	0.027	1		
AC9	7011-8	6/23/2015	6/30/2015	1.68	6	6/24/2015	0.024	1		
AC10	7011-9	6/23/2015	6/30/2015	6.54	6	6/24/2015	0.044	1		
AC11	7011-10	6/23/2015	6/30/2015	9.59	6	6/24/2015	0.061	1		
AC11	7011-10 Lab dup	6/23/2015	6/30/2015	10.1 (RPD=5.18)	6	6/24/2015	0.062 (RPD=1.63)	1		
AC12	7011-11	6/23/2015	6/30/2015	6.32	6	6/24/2015	0.073	1		
BC2	7011-12	6/23/2015	6/30/2015	10.1	41	6/24/2015	48.9	31		
BC3	7011-13	6/23/2015	6/30/2015	8.96	41	6/24/2015	20.5	31		
BC4	7011-14	6/23/2015	6/30/2015	8.25	41	6/24/2015	13.6	31		
BC5	7011-15	6/23/2015	6/30/2015	BQL (5.61)	41	6/24/2015	6.76	21		
BC6	7011-16	6/23/2015	6/30/2015	ND	31	6/24/2015	0.127	1		
BC7	7011-17	6/23/2015	6/30/2015	ND	3	6/24/2015	0.040	1		
BC8	7011-18	6/23/2015	6/30/2015	BQL (0.468)	6	6/24/2015	0.025	1		
BC9	7011-19	6/23/2015	6/30/2015	BQL (0.766)	6	6/24/2015	0.025	1		
BC10	7011-20	6/23/2015	6/30/2015	1.30	6	6/24/2015	0.052	1		

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Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.031	**MDL**	0.002		
QL	0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
BC10	7011-20 Lab dup	6/23/2015	6/30/2015	1.35 (RPD=3.77)	6	6/24/2015	0.047 (RPD=10.0)	1		
BC11	7011-21	6/23/2015	6/30/2015	1.68	6	6/24/2015	0.060	1		
BC12	7011-22	6/23/2015	6/30/2015	1.37	6	6/24/2015	0.066	1		
CC2	7011-23	6/23/2015	6/30/2015	9.73	41	6/24/2015	50.2	41		
CC3	7011-24	6/23/2015	6/30/2015	BQL (2.07)	31	6/24/2015	16.9	31		
CC4	7011-25	6/23/2015	6/30/2015	ND	31	6/24/2015	4.47	21		
CC5	7011-26	6/23/2015	6/30/2015	ND	31	6/24/2015	4.36	5		
CC6	7011-27	6/23/2015	6/30/2015	BQL (0.531)	11	6/24/2015	1.01	1		
CC7	7011-28	6/23/2015	6/30/2015	ND	3	6/24/2015	0.119	1		
CC7	7011-28 Lab dup	6/23/2015	6/30/2015	ND (RPD=NA)	3	-	-	-		
CC8	7011-29	6/23/2015	6/30/2015	BQL (0.664)	6	6/24/2015	0.031	1		
CC9	7011-30	6/23/2015	6/30/2015	BQL (0.397)	6	6/24/2015	0.020	1		
CC9	7011-30 Lab dup	6/23/2015	-	-	-	6/24/2015	0.022 (RPD=9.52)	1		
CC10	7011-31	6/23/2015	6/30/2015	3.29	6	6/24/2015	0.077	1		
CC11	7011-32	6/23/2015	6/30/2015	3.06	6	6/24/2015	0.102	1		
CC12	7011-33	6/23/2015	6/30/2015	3.31	6	6/24/2015	0.156	1		
CC12	7011-33 Lab dup	6/23/2015	-	-	-	6/24/2015	0.150 (RPD=3.92)	1		

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Sample Results

Analytes	Fluoride (F)			**Analytes**	ortho-Phosphate (as P)						
Codes	7782-41-4			**Codes**	70507						
Methods	RSKSOP-276/4			**Methods**	NRMRL-GWERD-05-0						
Unit	mg/L			**Unit**	mg/L						
MDL	0.031			**MDL**	0.002						
QL	0.200			**QL**	0.020						
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**	**Data**	**DF**	

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

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Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	6/24/2015	6/24/2015	-	-	-	BQL (0.015)	-	-			
MB	Nanopure Water Blank	6/24/2015	6/24/2015	-	-	-	BQL (0.014)	-	-			
MB	Nanopure Water Blank	6/30/2015	6/30/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	6/30/2015	6/30/2015	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	6/24/2015	-	-	-	1.58	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	6/24/2015	-	-	-	1.56	1.57	99.4			
SS	ERA 64 Simple Nutrients	2/25/2015	6/24/2015	-	-	-	1.60	1.57	102			
SS	ERA 64 Minerals	1/21/2015	6/30/2015	3.54	3.47	102	-	-	-			
SS	ERA 64 Minerals	1/21/2015	6/30/2015	3.52	3.47	101	-	-	-			
CCC	Continuing Calibration Check Standard	5/14/2015	6/24/2015	-	-	-	0.047	0.050	94.0			
CCC	Continuing Calibration Check Standard	5/14/2015	6/24/2015	-	-	-	0.965	1.00	96.5			
CCC	Continuing Calibration Check Standard	5/14/2015	6/24/2015	-	-	-	0.495	0.500	99.0			
CCC	Continuing Calibration Check Standard	5/14/2015	6/24/2015	-	-	-	0.235	0.250	94.0			
CCC	Continuing Calibration Check Standard	5/14/2015	6/24/2015	-	-	-	1.03	1.00	103			
CCC	Continuing Calibration Check Standard	6/17/2015	6/30/2015	BQL (0.191)	0.200	95.5	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	6/30/2015	0.930	1.00	93.0	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	6/30/2015	1.96	2.00	98.0	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	6/30/2015	4.92	5.00	98.4	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	6/30/2015	9.61	10.0	96.1	-	-	-			
MS	AC2 Spike	6/24 & 6/30/2015	6/24 & 6/30/2015	* 3.29	* 0.179 (3.85)	80.8	* 1.86	* 0.971 (0.990)	89.8			
MS	BC11 Spike	6/24 & 6/30/2015	6/24 & 6/30/2015	* 3.95	* 0.280 (3.23)	114	0.976	0.060 (0.990)	92.5			

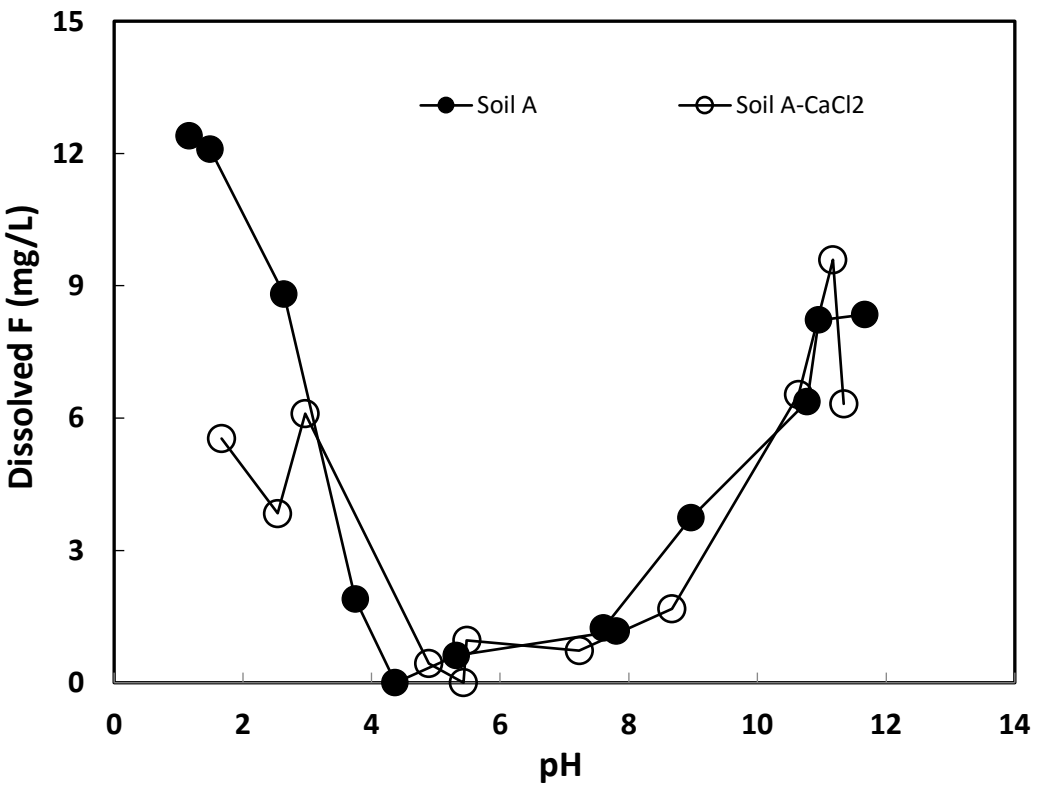
Comments:

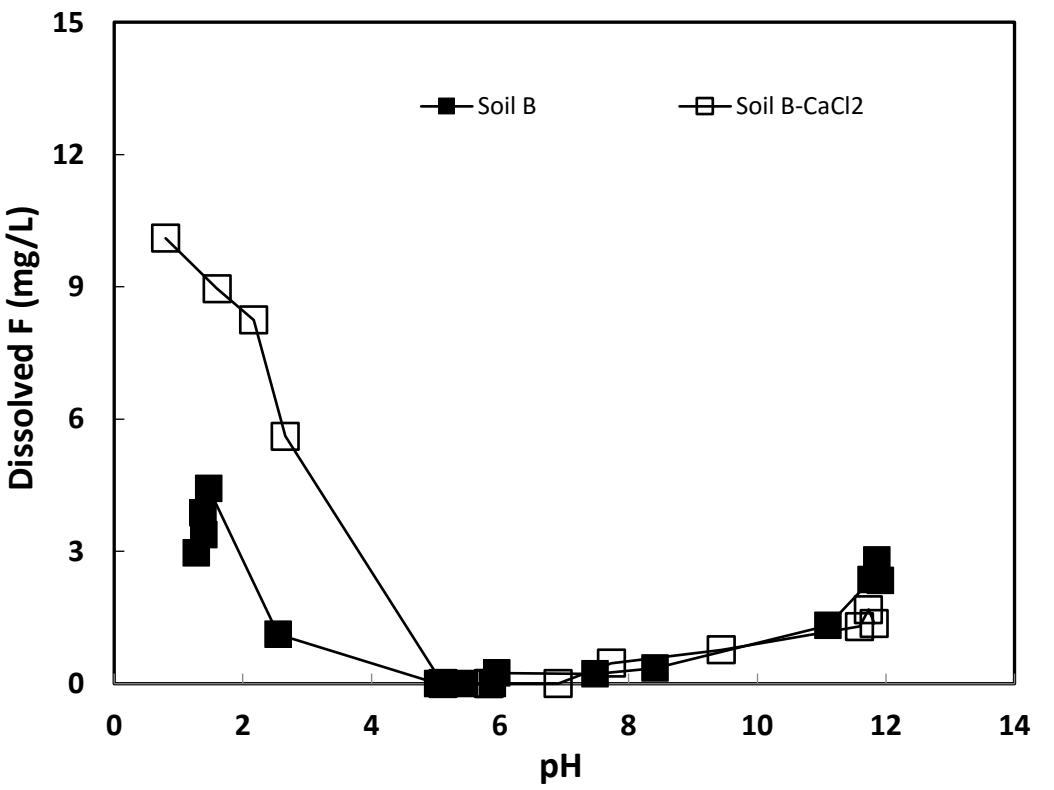
The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 or 0.6 mL of sample to yield spike concentrations of 3.85 and 3.23 mg/L respectively. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated and reported without the dilution factor applied.

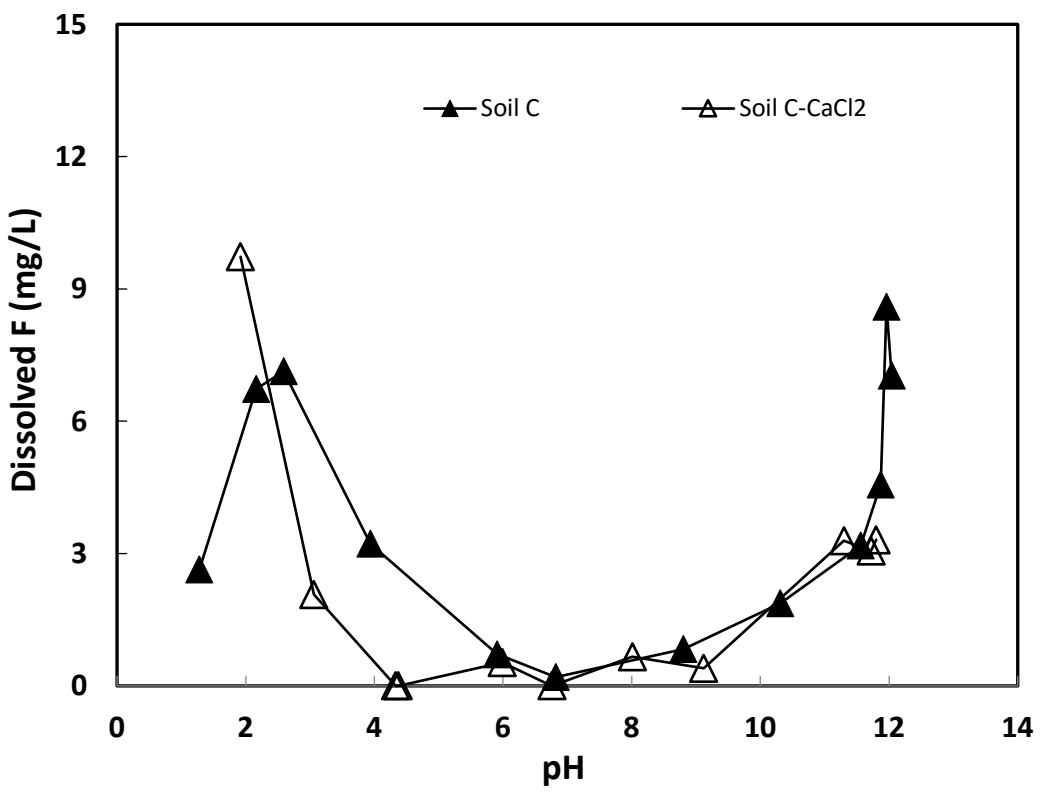
Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

Soil ID	[F] mg/L	pH	comments
A - 2	12.4	1.17	
A - 3	12.1	1.49	
A - 4	8.81	2.64	
A3b	1.89	3.75	new point
A - 5	0	4.37	
A - 6 (BQL)	0.618	5.32	
A - 7	1.17	7.81	
A - 8	1.24	7.61	
A - 9	3.74	8.97	
A - 10	6.37	10.77	
A - 11	8.22	10.95	
A - 12	8.35	11.67	
B-2 (BQL)	2.96	1.28	
B-3 (BQL)	3.87	1.38	
B-4 (BQL)	3.38	1.40	
B-5 (BQL	4.42	1.47	
B2b	1.12	2.55	new point
B3b	0	5.03	new point
B4b	0	5.45	new point
B6b	0	5.88	new point
B-6	0.2371	5.95	
B-7	0.2203	7.48	
B-8 (BQL)	0.348	8.41	
B-9	1.32	11.1	
B-10	2.36	11.77	
B-11	2.8	11.86	
B-12	2.34	11.92	
C-2 (BQL)	2.6383	1.28	
C-3 (BQL)	6.73	2.16	
C-4 (BQL)	7.1318	2.59	
C-5 (BQL)	3.222	3.94	
C-6	0.7192	5.91	
C-7 (BQL)	0.199	6.82	
C-8 (BQL)	0.837	8.80	
C-9	1.87	10.31	
C-10	3.18	11.56	
C-12	4.57	11.87	
C-11	8.6	11.96	
10-C12	7.04	12.04	







Soil ID	fluoride mg/L	measured pH	Comments
AC - 2 (BQL)	5.54	1.67	
Point AC-3 omitt	#N/A	#N/A	
AC4b	3.84	2.54	new point
AC - 4 (BQL)	6.1	2.97	
AC - 6 (BQL)	0.44	4.89	Non detect (ND)
AC - 7	0	5.43	
AC - 5 (BQL)	0.963	5.48	
AC - 8	0.73	7.23	
AC - 9	1.68	8.67	
AC - 10	6.54	10.64	
AC - 11	9.59	11.17	
AC - 12	6.32	11.34	
AC - 3	0	1.92	(ND)
BC - 2	10.10	0.80	
BC - 3	8.96	1.60	
BC - 4	8.25	2.17	
BC - 5 (BQL)	5.61	2.66	
BC4b	0.00	5.11	(ND)new point
BC - 6	0	5.82	ND
BC6b	0.00	5.83	(ND)new point
BC - 7	0	6.90	ND
BC - 8 (BQL)	0.47	7.73	
BC - 9 (BQL)	0.77	9.44	
BC - 10	1.30	11.59	
BC - 11	1.68	11.73	
BC - 12	1.37	11.82	
CC - 2	9.73	1.92	
CC - 3 (BQL)	2.07	3.06	
CC - 4	0	4.33	ND
CC - 5	0	4.37	ND
CC - 6 (BQL)	0.531	5.99	
CC - 7	0	6.76	ND
CC - 8 (BQL)	0.664	8.01	
CC - 9 (BQL)	0.397	9.12	
CC - 10	3.29	11.30	
CC - 11	3.06	11.72	
CC - 12	3.31	11.80	

Table x Soil Characteristics			
	Soil		
	A	B	C
Depth Beneath Matrix (ft)	3 to 5	5 to 7	7 to 9
Total Carbon (TC) %	0.815, 0.952	.517,0.093	0.347, 0.044
Total Inorganic Carbon (TIC) %	0.090, 0.011	0.334, 0.066	0.278, 0.013
Total Organic Carbon (TOC) %	0.725, 0.009	0.183, 0.038	0.069, 0.057
Conductivity uS/cm	295, 1	213, 0	226, 0
Chloride mg/L	7.50, 0.32	8.63, 0.66	5.06, 0.14
Fluroide mg/L	1.48, 0.039	0.97, 0.042	3.20, 0.05
Phosphorous mg/L			
pH (1:2 soil:water)	7.33, 0.06	7.80, 0.03	8.16, 0.03
pH (1:2 soil:0.01 M CaCl2)	7.27, 0.02	7.54, 0.01	7.78, 0.01
Specific Surface Area (m2/g)	28.06	15.93	15.39

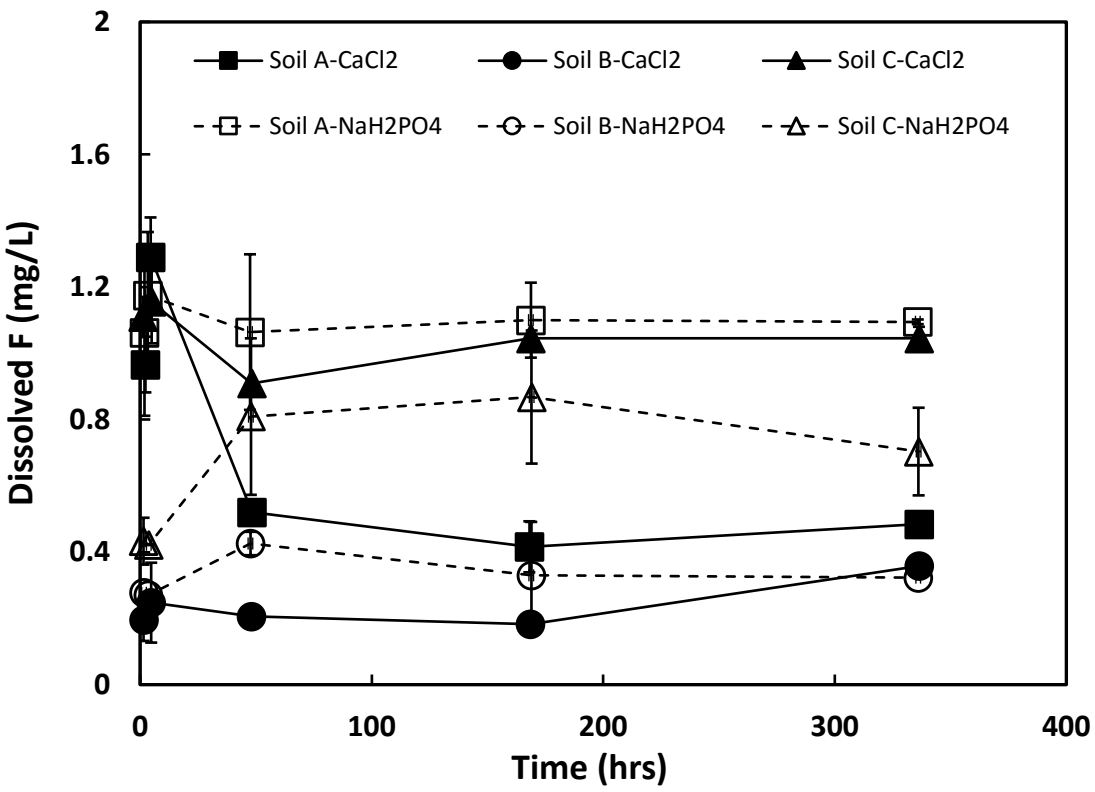
Table x Soil Size Fraction					
Soil	< 2 um-Clay (%)	> 2 um-Silt (%)	> 63 um-Sand (%)	> 2 mm (%)	Soil Type
A	20-22	39-43	37-39	1.5	Loam
B	7	50	43	0.344	Silt-loam
C	5	68-70	25-27	0.157	Silt-loam

Soil/ Sample ID	Mass of Soil Smaple (g)	Date/Time CaCl2 added	pH	time pH taken	Date/Time put in Centrifuge	date/Time filtered	Duration of reaction (start time to filtered time) in hours	Duration of reaction (start time to filtered time) in days	Concentration (copied from raw data)	Fluoride concentration Values only	ortho-phospate	ortho-phosphate values only	pH
A Ca t0	10.0243	6/29/2015 9:33	7.44	6/29/2015 9:41		6/29/2015 11:50	2.28	0.1	0.882	0.882	0.029	0.029	7.44
A Ca t0b	10.06	6/29/2015 9:34	7.47	6/29/2015 9:47		6/29/2015 11:50	2.27	0.1	1.05	1.05	BQL (0.014)	0.014	7.47
A Ca t1	10.0861	6/29/2015 9:35	7.54	6/29/2015 1:30		6/29/2015 14:05	4.50	0.2	1.17	1.17	BQL (0.014)	0.014	7.54
A Ca t1b	10.0988	6/29/2015 9:35	7.31	6/29/2015 1:39		6/29/2015 14:05	4.50	0.2	1.41	1.41	0.026	0.026	7.31
A Ca t2	10.0833	6/29/2015 9:36	7.42	7/1/2015 8:45		7/1/2015 9:50	48.23	2.0	0.491	4.91	0.026	0.026	7.42
A Ca t2b	10.0583	6/29/2015 9:36	7.26	7/1/2015 8:50		7/1/2015 9:52	48.27	2.0	0.549	5.49	BQL (0.016)	0.016	7.26
A Ca t3	10.073	6/29/2015 9:38	7.42	7/6/2015 8:46		7/6/2015 9:43	168.08	7.0	BQL (0.339)	0.339	0.021	0.021	7.42
A Ca t3b	10.088	6/29/2015 9:38	7.26	7/6/2015 8:52		7/6/2015 9:43	168.08	7.0	0.493	0.493	0.031	0.031	7.26
A Ca t4	10.0256	6/29/2015 9:38	7.29	7/13/2015 8:58		7/13/2015 9:59	336.35	14.0	0.449	0.449	0.034	0.034	7.29
A Ca t4b	10.0905	6/29/2015 9:39	7.06	7/13/2015 9:08		7/13/2015 9:59	336.33	14.0	1.04	1.04	0.036	0.036	7.06
B Ca t0	10.034	6/29/2015 10:12	7.44	6/29/2015 10:17		6/29/2015 11:44	1.53	0.1	BQL (0.258)	0.258	BQL (0.016)	0.016	7.44
B Ca t0b	10.084	6/29/2015 10:18	7.40	6/29/2015 10:25		6/29/2015 11:48	1.50	0.1	BQL (0.132)	0.132	BQL (0.018)	0.018	7.4
B Ca t1	10.069	6/29/2015 10:53	7.29	6/29/2015 1:59		6/29/2015 15:40	4.78	0.2	BQL (0.127)	0.127	BQL (0.014)	0.014	7.29
B Cat1b	9.998	6/29/2015 10:53	7.36	6/1/2915 2:06		6/29/2015 15:40	4.78	0.2	BQL (0.368)	0.368	BQL (0.019)	0.019	7.36
B Ca t2	10.012	6/29/2015 10:55	7.76	7/1/2015 9:42		7/1/2015 10:56	48.02	2.0	BQL (0.193)	0.193	BQL (0.019)	0.019	7.76
B Ca t2b	9.991	6/29/2015 10:55	7.67	7/1/2015 9:48		7/1/2015 10:58	48.05	2.0	BQL (0.218)	0.218	BQL (0.014)	0.014	7.67
B Ca t3	10.008	6/29/2015 10:59	7.62	7/6/2015 9:54		7/6/2015 11:30	168.52	7.0	BQL (0.149)	0.149	0.024	0.024	7.62
B Ca t3b	10.061	6/29/2015 10:59	7.21	7/6/2015 10:10		7/6/2015 11:31	168.53	7.0	BQL (0.216)	0.216	0.020	0.02	7.21
B Ca t4	10.044	6/29/2015 10:52	7.45	7/13/2015 10:06		7/13/2015 11:09	336.28	14.0	BQL (0.338)	0.338	0.023	0.023	7.45
B Ca t4b	10.021	6/29/2015 10:52	7.41	7/13/2015 10:09		7/13/2015 11:13	336.35	14.0	BQL (0.378)	0.378	0.022	0.022	7.41
C Ca t0	9.994	6/29/2015 10:26	7.53	6/29/2015 10:32		6/29/2015 11:42	1.27	0.1	1.17	1.17	BQL (0.016)	0.016	7.53
C Ca t0b	10.02	6/29/2015 10:33	7.58	6/29/2015 10:38		6/29/2015 11:43	1.17	0.0	1.05	1.05	BQL (0.014)	0.014	7.58
C Ca t1	10.014	6/29/2015 10:52	7.62	6/29/2015 2:12		6/29/2015 15:48	4.93	0.2	1.03	1.03	BQL (0.017)	0.017	7.62
C Ca t1b	10.052	6/29/2015 10:52	7.62	6/29/2015 2:18		6/29/2015 15:48	4.93	0.2	1.28	1.28	BQL (0.017)	0.017	7.62
C Ca t2	10.023	6/29/2015 10:53	7.76	7/1/2015 9:53		7/1/2015 11:02	48.15	2.0	0.899	0.899	BQL (0.017)	0.017	7.76
C Ca t2b	10.001	6/29/2015 10:53	7.54	7/1/2015 10:00		7/1/2015 11:04	48.18	2.0	0.919	0.919	BQL (0.018)	0.018	7.54
C Ca t3	10.037	6/29/2015 10:54	7.33	7/6/2015 10:20		7/6/2015 11:33	168.65	7.0	1.04	1.04	BQL (0.019)	0.019	7.33
C Ca t3b	10.06	6/29/2015 10:54	7.36	7/6/2015 10:29		7/6/2015 11:35	168.68	7.0	1.05	1.05	BQL (0.019)	0.019	7.36
C Ca t4	10.089	6/29/2015 10:56	7.72	7/13/2015 10:13		7/13/2015 11:14	336.30	14.0	1.08	1.08	BQL (0.019)	0.019	7.72
C Ca t4b	10.022	6/29/2015 10:56	7.62	7/13/2015 10:18		7/13/2015 11:18	336.37	14.0	1.01	1.01	BQL (0.018)	0.018	7.62

Soil/ Sample ID	pH	Fluoride concentration Values only	Duration of reaction (start time to filtered time) in hours
A Ca t0	7.44	0.882	2
A Ca t0b	7.47	1.05	2
A Ca t1	7.54	1.17	5
A Ca t1b	7.31	1.41	5
A Ca t2	7.42	0.491	48
A Ca t2b	7.26	0.549	48
A Ca t3	7.42	0.339	168
A Ca t3b	7.26	0.493	168
A Ca t4	7.29	0.449	336
A Ca t4b	7.06	0.52	336
B Ca t0	7.44	0.258	2
B Ca t0b	7.40	0.132	2
B Ca t1	7.29	0.127	5
B Cat1b	7.36	0.368	5
B Ca t2	7.76	0.193	48
B Ca t2b	7.67	0.218	48
B Ca t3	7.62	0.149	169
B Ca t3b	7.21	0.216	169
B Ca t4	7.45	0.338	336
B Ca t4b	7.41	0.378	336
C Ca t0	7.53	1.17	1
C Ca t0b	7.58	1.05	1
C Ca t1	7.62	1.03	5
C Ca t1b	7.62	1.28	5
C Ca t2	7.76	0.899	48
C Ca t2b	7.54	0.919	48
C Ca t3	7.33	1.04	169
C Ca t3b	7.36	1.05	169
C Ca t4	7.72	1.08	336
C Ca t4b	7.62	1.01	336

	average of duplicates		s
A Ca t0	7.455	0.966	2
A Ca t1	7.425	1.29	5
A Ca t2	7.34	0.52	48
A Ca t3	7.34	0.416	168
A Ca t4	7.175	0.48	336
B Ca t0	7.42	0.195	2
B Ca t1	7.325	0.2475	5
B Ca t2	7.715	0.2055	48
B Ca t3	7.415	0.1825	169
B Ca t4	7.43	0.358	336
C Ca t0	7.555	1.11	1
C Ca t1	7.62	1.155	5
C Ca t2	7.65	0.909	48
C Ca t3	7.345	1.045	169
C Ca t4	7.67	1.05	336

	STDEV
A Ca t0	0.084
A Ca t1	0.12
A Ca t2	0.029
A Ca t3	0.077
A Ca t4	0.0355
B Ca t0	0.063
B Ca t1	0.1205
B Ca t2	0.0125
B Ca t3	0.0335
B Ca t4	0.02
C Ca t0	0.06
C Ca t1	0.125
C Ca t2	0.01
C Ca t3	0.005
C Ca t4	0.035



Soil/ Sample ID	Mass of Soil Smaple (g)	Date/Time CaCl2 added	pH	time pH taken	Date/Time put in Centrifuge	date/Time filtered	Duration of reaction (start time to filtered time) in hours	Duration of reaction (start time to filtered time) in days	Flouride Concentration	Fluoride concentration (values only)	Comments	pH
A Na t0	10.059	6/29/2015 11:12	6.74	6/29/2015 11:15		6/29/2015 12:58	1.77	0.1	1.24	1.24		6.74
A Na t0b	10.035	6/29/2015 11:05	6.74	6/29/2015 11:10		6/29/2015 12:58	1.88	0.1	BQL (0.885)	0.885	BQL	6.74
A Na t1	10.023	6/29/2015 12:32	7.21	6/29/2015 14:27		6/29/2015 15:53	3.35	0.1	1.04	1.04		7.21
A Na t1b	10.016	6/29/2015 12:32	7.14	6/29/2015 14:30		6/29/2015 15:53	3.35	0.1	1.31	1.31		7.14
A Na 2	10.076	6/29/2015 12:33	7.53	7/1/2015 10:20		7/1/2015 12:00	47.45	2.0	BQL (0.898)	0.898	BQL	7.53
A Na t2b	10.048	6/29/2015 12:33	7.66	7/1/2015 10:23		7/1/2015 12:00	47.45	2.0	1.23	1.23		7.66
A Na t3	10.009	6/29/2015 12:35	7.55	7/6/2015 11:56		7/6/2015 13:19	168.73	7.0	1.02	1.02		7.55
A Na t3b	10.097	6/29/2015 12:35	7.40	7/6/2015 12:04		7/6/2015 13:20	168.75	7.0	1.18	1.18		7.4
A Na t4	10.018	6/29/2015 12:30	6.81	7/13/2015 11:00		7/13/2015 12:20	335.83	14.0	1.09	1.09		6.81
A Na t4b	10.009	6/29/2015 12:30	6.58	7/13/2015		7/13/2015	335.85	14.0	1.10	1.1		6.58
B Na t0	10.075	6/29/2015 11:17	6.72	6/29/2015 11:21		6/29/2015 13:00	1.72	0.1	BQL (0.277)	0.277	BQL	6.72
B Na t0b	10.055	6/29/2015	6.76	6/29/2015 11:29		6/29/2015 13:03	1.67	0.1	ND	nd		6.76
B Na t1	10.085	6/29/2015 12:23	7.11	6/29/2015 14:34		6/29/2015 15:57	3.57	0.1	ND	nd		7.11
B Na t1b	10.027	6/29/2015 12:23	7.07	6/29/2015 14:37		6/29/2015 15:57	3.57	0.1	BQL (0.270)	0.27	BQL	7.07
B Na t2	10.000	6/29/2015 12:25	7.48	7/1/2015 10:30		7/1/2015 12:03	47.63	2.0	BQL (0.401)	0.401	BQL	7.48
B Na t2b	10.002	6/29/2015 12:25	7.24	7/1/2015 10:35		7/1/2015 12:04	47.65	2.0	BQL (0.451)	0.451	BQL	7.24
B Na t3	10.068	6/29/2015 12:26	7.37	7/6/2015 12:06		7/6/2015 13:21	168.92	7.0	BQL (0.444)	0.444	BQL	7.37
B Na t3b	10.013	6/29/2015 12:26	7.40	7/6/2015 12:09		7/6/2015 13:22	168.93	7.0	BQL (0.216)	0.216	BQL	7.4
B Na t4	10.100	6/29/2015 12:21	6.76	7/13/2015 11:06		7/13/2015 12:22	336.02	14.0	ND	nd		6.76
B Na t4b	10.029	6/29/2015 12:21	6.73	7/13/2015 11:10		7/13/2015 12:23	336.03	14.0	BQL (0.323)	0.323	BQL	6.73
C Na t0	10.036	6/29/2015 11:31	6.87	6/29/2015 11:37		6/29/2015 13:04	1.55	0.1	BQL (0.383)	0.383	BQL	6.87
C Na t0b	10.030	6/29/2015 11:39	6.90	6/29/2015 11:44		6/29/2015 13:05	1.43	0.1	BQL (0.483)	0.483	BQL	6.9
C Na t1	10.040	6/29/2015 12:14	7.29	6/29/2015 14:40		6/29/2015 15:58	3.73	0.2	BQL (0.422)	0.422	BQL	7.23
C Na t1b	10.009	6/29/2015 12:14	7.23	6/29/2015 14:44		6/29/2015 15:59	3.75	0.2	ND	nd		7.23
C Na t2	9.999	6/29/2015 12:16	7.21	7/1/2015 10:43		7/1/2015 12:05	47.82	2.0	BQL (0.976)	0.976	BQL	7.21
C Na t2b	10.087	6/29/2015 12:16	7.15	7/1/2015 10:49		7/1/2015 12:05	47.82	2.0	BQL (0.642)	0.642	BQL	7.15
C Na t3	10.060	6/29/2015 12:18	7.33	7/6/2015 12:19		7/6/2015 13:23	169.08	7.0	BQL (0.726)	0.726	BQL	7.33
C Na t3b	10.041	6/29/2015 12:18	7.24	7/6/2015 12:24		7/6/2015 13:24	169.10	7.0	BQL (1.01)	1.01	BQL	7.24
C Na t4	10.054	6/29/2015 12:12	7.10	7/13/2015 11:13		7/13/2015 12:24	336.20	14.0	BQL (0.610)	0.61	BQL	7.1
C Na t4b	9.981	6/29/2015 12:12	7.07	7/13/2015 11:19		7/13/2015 12:25	336.22	14.0	BQL (0.797)	0.797	BQL	7.07

A Na t0	10.059	6/29/2015 11:12	6.74	6/29/2015 11:15	6/29/2015 12:58	1.77
A Na t0b	10.035	6/29/2015 11:05	6.74	6/29/2015 11:10	6/29/2015 12:58	1.88
B Na t0	10.075	6/29/2015 11:17	6.72	6/29/2015 11:21	6/29/2015 13:00	1.72
B Na t0b	10.055	6/29/2015	6.76	6/29/2015 11:29	6/29/2015 13:03	1.67
C Na t0	10.036	6/29/2015 11:31	6.87	6/29/2015 11:37	6/29/2015 13:04	1.55
C Na t0b	10.030	6/29/2015 11:39	6.90	6/29/2015 11:44	6/29/2015 13:05	1.43
A Na t1	10.023	6/29/2015 12:32	7.21	6/29/2015 14:27	6/29/2015 15:53	3.35
A Na t1b	10.016	6/29/2015 12:32	7.14	6/29/2015 14:30	6/29/2015 15:53	3.35
B Na t1	10.085	6/29/2015 12:23	7.11	6/29/2015 14:34	6/29/2015 15:57	3.57
B Na t1b	10.027	6/29/2015 12:23	7.07	6/29/2015 14:37	6/29/2015 15:57	3.57
C Na t1	10.040	6/29/2015 12:14	7.29	6/29/2015 14:40	6/29/2015 15:58	3.73
C Na t1b	10.009	6/29/2015 12:14	7.23	6/29/2015 14:44	6/29/2015 15:59	3.75
A Na 2	10.076	6/29/2015 12:33	7.53	7/1/2015 10:20	7/1/2015 12:00	47.45
A Na t2b	10.048	6/29/2015 12:33	7.66	7/1/2015 10:23	7/1/2015 12:00	47.45
B Na t2	10.000	6/29/2015 12:25	7.48	7/1/2015 10:30	7/1/2015 12:03	47.63
B Na t2b	10.002	6/29/2015 12:25	7.24	7/1/2015 10:35	7/1/2015 12:04	47.65
C Na t2	9.999	6/29/2015 12:16	7.21	7/1/2015 10:43	7/1/2015 12:05	47.82
C Na t2b	10.087	6/29/2015 12:16	7.15	7/1/2015 10:49	7/1/2015 12:05	47.82
A Na t3	10.009	6/29/2015 12:35	7.55	7/6/2015 11:56	7/6/2015 13:19	168.73
A Na t3b	10.097	6/29/2015 12:35	7.40	7/6/2015 12:04	7/6/2015 13:20	168.75
B Na t3	10.068	6/29/2015 12:26	7.37	7/6/2015 12:06	7/6/2015 13:21	168.92
B Na t3b	10.013	6/29/2015 12:26	7.40	7/6/2015 12:09	7/6/2015 13:22	168.93
C Na t3	10.060	6/29/2015 12:18	7.33	7/6/2015 12:19	7/6/2015 13:23	169.08
C Na t3b	10.041	6/29/2015 12:18	7.24	7/6/2015 12:24	7/6/2015 13:24	169.10
A Na t4	10.018	6/29/2015 12:30	6.81	7/13/2015 11:00	7/13/2015 12:20	335.83
A Na t4b	10.009	6/29/2015 12:30	6.58	7/13/2015	7/13/2015	335.85
B Na t4	10.100	6/29/2015 12:21	6.76	7/13/2015 11:06	7/13/2015 12:22	336.02
B Na t4b	10.029	6/29/2015 12:21	6.73	7/13/2015 11:10	7/13/2015 12:23	336.03
C Na t4	10.054	6/29/2015 12:12	7.10	7/13/2015 11:13	7/13/2015 12:24	336.20
C Na t4b	9.981	6/29/2015 12:12	7.07	7/13/2015 11:19	7/13/2015 12:25	336.22

Soil/ Sample ID	pH	Fluoride (mg/L)	Duration of reaction (start time to filtered time) in hours	Comments for Fluoride concentration	ortho-Phosphate mg/L	StDev phosphate	ln conc P	1/[P]	STDEV Fluoride
A Na t0	6.74	1.24	1.77		34.7				
A Na t0b	6.74	0.885	1.88	BQL	35.7				
A Na t1	7.21	1.04	3.35		22.8				
A Na t1b	7.14	1.31	3.35		22.5				
A Na 2	7.53	0.898	47.45	BQL	25.1				
A Na t2b	7.66	1.23	47.45		17.9				
A Na t3	7.55	1.02	168.73		14.5				
A Na t3b	7.40	1.18	168.75		15.0				
A Na t4	6.81	1.09	335.83		11.9				
A Na t4b	6.58	1.1	335.85		11.3				
B Na t0	6.72	0.277	1.72	BQL	47.9				
B Na t0b	6.76	nd	1.67		45.7				
B Na t1	7.11	nd	3.57		35.5				
B Na t1b	7.07	0.27	3.57	BQL	33.5				
B Na t2	7.48	0.401	47.63	BQL	29.3				
B Na t2b	7.24	0.451	47.65	BQL	29.9				
B Na t3	7.37	0.444	168.92	BQL	23.8				
B Na t3b	7.40	0.216	168.93	BQL	25.9				
B Na t4	6.76	nd	336.02		20.9				
B Na t4b	6.73	0.323	336.03	BQL	6.41				
C Na t0	6.87	0.383	1.55	BQL	54.6				
C Na t0b	6.90	0.483	1.43	BQL	54.5				
C Na t1	7.29	0.422	3.73	BQL	50.2				
C Na t1b	7.23	nd	3.75		51.0				
C Na t2	7.21	0.976	47.82	BQL	48.0				
C Na t2b	7.15	0.642	47.82	BQL	47.8				
C Na t3	7.33	0.726	169.08	BQL	45.4				
C Na t3b	7.24	1.01	169.10	BQL	45.8				
C Na t4	7.10	0.61	336.20	BQL	42.4				
C Na t4b	7.07	0.797	336.22	BQL	43.0				
		average of duplicates							
A Na t0	6.74	1.06	2	BQL	35.2	3.561046	0.028409	0.25	
A Na t1	7.18	1.18	3		22.7	3.12016	0.04415		0.19
A Na t2	7.60	1.06	47	BQL	21.5	3.068053	0.046512		0.23
A Na t3	7.48	1.10	169		14.75	2.691243	0.067797		0.11
A Na t4	6.70	1.10	336		11.6	2.451005	0.086207		0.01
B Na t 0	6.74	0.277	2	BQL	46.8	3.845883	0.021368		#DIV/0!
B Na t1	7.09	0.27	4	BQL	34.5	3.540959	0.028986		#DIV/0!
B Na t2	7.36	0.426	48	BQL	29.6	3.387774	0.033784		0.04
B Na t3	7.39	0.33	169	BQL	24.9	3.212858	0.040241		0.16
B Na t4	6.75	0.323	336	BQL	13.7	2.614106	0.073233		#DIV/0!
C Na t0	6.89	0.43	1	BQL	54.6	3.999118	0.018332		0.07
C Na t1	7.26	0.42	4	BQL	50.6	3.923952	0.019763		#DIV/0!
C Na t2	7.18	0.81	48	BQL	47.9	3.869116	0.020877		0.24
C Na t3	7.29	0.87	169	BQL	45.6	3.819908	0.02193		0.20
C Na t4	7.09	0.70	336	BQL	42.7	3.754199	0.023419		0.13

BACKGROUND SAMPLES

ID	Chemical/solution description	Experiment use	Volume Chemical added (ml)	volume DI water (ml)	Volume solution added (ml)	measured F- (mg/L)	measured ortho-phosphate (mg/l)	Standard Dev phosphate
A	2.0 M HCl	24 hr pH	3.6	20	N/A	ND	ND	
B	2.0 M HCl	24 hr pH	3.6	20	N/A	ND	ND	
C	1 M NaOH	24 hr pH	2	20	N/A	ND	0.020	
D	1 M NaOH	24 hr pH	2	20	N/A	ND	BQL (0.015)	
E	1 m M NaH2PO4	2 week release	N/A	N/A	20	ND	68.7	
F	1 m M NaH2PO4	2 week release	N/A	N/A	20	ND	66.4	
G	10 mM CaCl2	2 week release	N/A	N/A	20	ND	BQL (0.015)	
H	10 mM CaCl2	2 week release	N/A	N/A	20	ND	BQL (0.014)	
Ft1	10 mg/L F- 1 mM CaCl2	Nanomaterials take 2	N/A	N/A	20	6.56	BQL (0.013)	
Ft1b	10 mg/L F- 1 mM CaCl2	Nanomaterials take 2	N/A	N/A	20	6.32	BQL (0.012)	
t1 F	5 mg/l F- 1 mM C	Nanomaterials take 1			20	1.07	BQL (0.013)	
t1 F2	5 mg/l F- 1 mM C	Nanomaterials take 1			20	1.16	BQL (0.013)	

average of duplicates

A	2.0 M HCl	24 hr pH	ND	ND	
C	1 M NaOH	24 hr pH	ND	0.018	
E	1 mM NaH2PO4	2 week release	ND	67.6	1.6263456
G	10 mM CaCl2	2 week release	ND	0.0145	
Ft1	10 mg/L F- 1 mM CaCl2	Nanomaterials take 2	6.44	0.0125	
t1 F	5 mg/l F- 1 mM CaCl2	Nanomaterials take 1	1.12	0.013	

ID	pH	average pH of soil	stdev	range	ID	pH w/ stdev
A Na t0	6.74	7.14	0.412	0.90	A Na	7.14 +/- 0.412
A Na t4	6.70				B Na	7.06 +/- 0.315
A Na t1	7.18				C Na	7.14 +/- 0.162
A Na t3	7.48				A Ca	7.32 +/- 0.105
A Na t2	7.60				B Ca	7.46 +/- 0.148
B Na t 0	6.74	7.06	0.315	9.65	C Ca	7.57 +/- 0.132
B Na t4	6.75					
B Na t1	7.09					
B Na t2	7.36					
B Na t3	7.39					
C Na t0	6.89	7.14	0.162	0.40		
C Na t4	7.09					
C Na t2	7.18					
C Na t1	7.26					
C Na t3	7.29					
A Ca t4	7.175	7.32	0.105	0.28		
A Ca t2	7.34					
A Ca t3	7.34					
A Ca t1	7.425					
A Ca t0	7.455					
B Ca t0	7.42	7.46	0.148	0.39		
B Ca t1	7.325					
B Ca t3	7.415					
B Ca t4	7.43					
B Ca t2	7.715					
C Ca t3	7.345	7.57	0.132	0.325		
C Ca t0	7.555					
C Ca t1	7.62					
C Ca t2	7.65					
C Ca t4	7.67					

HYDROXYAPATITE DATA (in duplicate)				FERRIHYDRITE DATA				BRUCITE DATA				
ID	pH	End F Concentration Ce (mg/L)	Initial F Concentration C0 (mg/L)	ID	pH	End F Concentration Ce (mg/L)	Initial F Concentration C0 (mg/L)	ID	pH	End F Concentration Ce (mg/L)	Initial F Concentration C0 (mg/L)	comments
1hAP5		0.93	0.42	5Fe5	6.45	0.609	2.26	1Mg5	9.65	0.03	0.42	
1hAP5b		1.11	0.43	5Fe5b	6.26	0.654	2.15	1Mg5b	9.76	0.03	0.43	
2.5hAP5		1.22	1.10	10Fe5	6.24	2.42	4.47	2.5Mg5	9.78	0.03	1.10	
2.5hAP5b		1.16	1.10	10Fe5b	6.36	2.43	4.50	2.5Mg5b	9.75	0.03	1.10	
5hAP5		1.15	2.12	20Fe5	6.29	5.57	8.96	5Mg5	9.7	0.45	2.12	
5hAP5b		1.16	2.18	20Fe5b	6.32	6.07	9.23	5Mg5b	9.79	0.24	2.18	
10hAP5		1.14	4.20	50Fe5	7.4	18.2	23.3	10Mg5	9.82	0.70	4.20	Sample time 5 hours
10hAP5b		1.09	4.37	50Fe5b	7.16	17.9	23.4	10Mg5b	9.83	0.71	4.37	
20hAP5		0.63	8.35	100Fe5	7.19	42.3	49.4	20Mg5	9.83	4.30	8.35	
20hAP5b		0.99	8.43	100Fe5b	7.37	42	49.3	20Mg5b	9.79	4.95	8.43	
50hAP5		9.41	22.40	200Fe5	7.01	84	97.1	50Mg5	9.76	14.80	22.40	
50hAP5b		8.00	22.50	200Fe5b	6.95	85.3	98.8	50Mg5b	9.75	14.50	22.50	
100hAP5		27.00	46.50	500Fe5	7.14	224	243	100Mg5	9.68	31.90	46.50	
100hAP5b		29.80	48.20	500Fe5b	7.14	224	243	100Mg5b	9.68	34.70	48.20	
1hAP24		0.86	0.42	5Fe24	7.01	0.614	2.26	1Mg24	9.87	0.03	0.42	
1hAP24b		1.19	0.43	5Fe24b	7.02	0.871	2.15	1Mg24b	9.88	0.03	0.43	
2.5hAP24		1.15	1.10	10Fe24	6.66	1.87	4.47	2.5Mg24	9.89	0.03	1.10	
2.5hAP24b		1.20	1.10	10Fe24b	6.56	1.8	4.50	2.5Mg24b	9.87	0.03	1.10	
5hAP24		1.22	2.12	20Fe24	6.87	5.14	8.96	5Mg24	9.84	0.64	2.12	
5hAP24b		1.18	2.18	20Fe24b	6.83	5.75	9.23	5Mg24b	9.85	0.71	2.18	
10hAP24		1.12	4.20	50Fe24	6.91	18.3	23.3	10Mg24	9.87	1.57	4.20	
10hAP24b		1.21	4.37	50Fe24b	6.7	19	23.4	10Mg24b	9.85	1.91	4.37	Sample time 24 hours
20hAP24		0.85	8.35	100Fe24	7.03	41.3	49.4	20Mg24	9.82	3.93	8.35	
20hhAP24b		0.94	8.43	100Fe24b	6.87	41.3	49.3	20Mg24b	9.86	3.87	8.43	
50hAP24		8.30	22.40	200Fe24	7.02	86.6	97.1	50Mg24	9.81	13.20	22.40	
50hAP24b		7.03	22.50	200Fe24b	7.01	86.1	98.8	50Mg24b	9.82	12.80	22.50	
100hAP24		21.80	46.50	500Fe24	7.32	228	243	100Mg24	9.74	29.70	46.50	
100hAP24b		20.60	48.20	500Fe24b	7.32	227	243	100Mg24b	9.71	29.90	48.20	
(0.4)1hAP48	7.20	1.22	0.42	5Fe48	7.2	0.599	2.26	1Mg48	9.86	0.03	0.42	
(0.4)1hAP48b	7.15	1.21	0.43	5Fe48b	6.51	0.513	2.15	1Mg48b	9.9	0.03	0.43	
(1.1)2.5hAP48	7.15	1.17	1.10	10Fe48	6.32	1.75	4.47	2.5Mg48	9.92	0.03	1.10	
(1.1)2.5hAP48b	7.15	1.18	1.10	10Fe48b	6.35	1.78	4.50	2.5Mg48b	9.91	0.03	1.10	
(2.2)5hAP48	7.12	1.20	2.12	20Fe48	6.57	4.73	8.96	5Mg48	9.88	0.45	2.12	
(2.2)5hAP48b	7.11	1.23	2.18	20Fe48b	6.49	5.09	9.23	5Mg48b	9.89	0.41	2.18	
(4.5)10hAP48	7.01	1.22	4.20	50Fe48	6.6	17.1	23.3	10Mg48	9.9	1.02	4.20	
(4.5)10hAP48b	7.01	1.05	4.37	50Fe48b	6.49	17	23.4	10Mg48b	9.93	1.41	4.37	
(8.3)20hAP48	9.08	1.43	8.35	100Fe48	6.76	40.5	49.4	20Mg48	9.92	3.30	8.35	
(8.3)20hAP48b	8.30	0.44	8.43	100Fe48b	6.86	40.1	49.3	20Mg48b	9.89	3.36	8.43	
8hAP	7.01	0.97	9.13	200Fe48	7.01	88.1	97.1	50Mg48	9.85	11.10	22.40	Sample time 48 hours
8hAPB	7.28	1.10	9.33	200Fe48b	6.98	88.3	98.8	50Mg48b	9.83	11.20	22.50	
15hAP	7.72	0.98	15.90	500Fe48	7.19	221	243	100Mg48	9.74	26.90	46.50	
15hAPB	7.76	0.08	15.40	500Fe48b	7.12	228	243	100Mg48b	9.75	28.50	48.20	
(22)50hAP48	7.62	6.56	22.40									
(22)50hAP48b	7.56	5.87	22.50									
35hAP	7.58		37.70									
35hAPB	7.83	12.80	37.70									
(45)100hAP48	7.48	22.60	46.50									
(45)100hAP48b	7.46	18.50	48.20									
90.4hAP	8.08	53.50	96.70									
90.4hAPB	7.99	53.80	97.40									

Background F in Apatite (Fluoride released from hydroxyapatite nanomaterial in DI water)

ID	pH	Dissolved F (mg/l)	
DIhap	9	1.08	0.00
DIhapb	8.91	1.14	0.00
DIhap7	6.15	1.19	0.00
DIhap7b	6.07	1.16	0.00

Freundlich $$q = K_F C_e^{\frac{1}{n}}$$

log q=log Kf + (1/n) log Ce

plot log q vs log Ce

x=(C0-Ce)*Volume of liquid

m= mass of sorbant 0.1 gram

volume= 0.02 L

ID	Initial F concentration	End F concentration	Mass sorbed	Mass sorbed per mass sorbent					
HAp Isotherm	C0 (mg/L)	Ce (mg/L)	X (mg)	q=X/m	log q	logCe	Log (KF)	n	
(.4) 1hAP48	0.4	1.2	-0.01582	-0.1582	#NUM!	0.084576278		0.19	2.35
(1.1) 2.5hAP48	1.1	1.2	-0.0015	-0.015	#NUM!	0.070037867		1.56	0.43
(2.2) 5hAP48	2.2	1.2	0.0187	0.187	-0.72816	0.084576278			
(4.5) 10hAP48	4.3	1.1	0.063	0.63	-0.20066	0.054995862			
(8.3) 20hAP48	8.4	0.9	0.14906	1.4906	0.173361	-0.028260409			
8hAP	9.2	1.0	0.16393	1.6393	0.214658	0.014310481			
15hAP	15.7	0.5	0.30245	3.0245	0.480654	#N/A			
(22) 50hAP48	22.5	6.2	0.3247	3.247	0.511482	0.793441133			
35hAP	37.7	12.8	0.498	4.98	0.697229	1.10720997			
(45) 100hAP48	47.4	20.6	0.536	5.36	0.729165	1.312811826			
90.4hAP	97.1	53.7	0.868	8.68	0.93852	1.729569726			
Brucite Isotherm							Log (KF)	n	
1Mg48	0.4	0.0	0.00786	0.0786	-1.10458	-1.508638306		-0.15	2.27
2.5Mg48	1.1	0.0	0.02138	0.2138	-0.66999	-1.508638306		0.70	0.44
5Mg48	2.2	0.4	0.03441	0.3441	-0.46332	-0.367036832			
10Mg48	4.3	1.2	0.0614	0.614	-0.21183	0.084576278			
20Mg48	8.4	3.3	0.1012	1.012	0.005181	0.522444234			
50Mg48	22.5	11.2	0.226	2.26	0.354108	1.047274867			
100Mg48	47.4	27.7	0.393	3.93	0.594393	1.442479769			
Ferrihydrite Isotherm							Log (KF)	n	
5Fe48	2.2	0.6	0.03298	0.3298	-0.48175	-0.254925208		-0.37	2.64
10Fe48	4.5	1.8	0.0544	0.544	-0.2644	0.24674471		0.43	0.38
20Fe48	9.1	4.9	0.0837	0.837	-0.07727	0.691081492			
50Fe48	23.4	17.1	0.126	1.26	0.100371	1.231724383			
100Fe48	49.4	40.3	0.181	1.81	0.257679	1.605305046			
200Fe48	98.0	88.2	0.195	1.95	0.290035	1.945468585			
500Fe48	243.0	224.5	0.37	3.7	0.568202	2.351216345			

Ce	HAP	Brucite	Ferrihydrite
0	0.0	0.0	0.0
0.5	1.2	0.5	0.3
1	1.6	0.7	0.4
1.5	1.9	0.8	0.5
2	2.1	0.9	0.6
2.5	2.3	1.0	0.6
3	2.5	1.1	0.7
3.5	2.7	1.2	0.7
4	2.8	1.3	0.7
4.5	3.0	1.4	0.8
5	3.1	1.4	0.8
5.5	3.2	1.5	0.8
6	3.4	1.5	0.8
6.5	3.5	1.6	0.9
7	3.6	1.6	0.9
7.5	3.7	1.7	0.9
8	3.8	1.7	0.9
8.5	3.9	1.8	1.0
9	4.0	1.8	1.0
9.5	4.1	1.9	1.0
10	4.2	1.9	1.0
10.5	4.3	2.0	1.0
11	4.3	2.0	1.1
11.5	4.4	2.1	1.1
12	4.5	2.1	1.1
12.5	4.6	2.1	1.1
13	4.7	2.2	1.1
13.5	4.7	2.2	1.2
14	4.8	2.2	1.2
14.5	4.9	2.3	1.2
15	5.0	2.3	1.2
15.5	5.0	2.3	1.2
16	5.1	2.4	1.2
16.5	5.2	2.4	1.2
17	5.2	2.4	1.3
17.5	5.3	2.5	1.3
18	5.4	2.5	1.3
18.5	5.4	2.5	1.3
19	5.5	2.6	1.3
19.5	5.5	2.6	1.3
20	5.6	2.6	1.3
20.5	5.7	2.6	1.3
21	5.7	2.7	1.4
21.5	5.8	2.7	1.4
22	5.8	2.7	1.4
22.5	5.9	2.8	1.4
23	5.9	2.8	1.4
23.5	6.0	2.8	1.4
24	6.1	2.8	1.4
24.5	6.1	2.9	1.4
25	6.2	2.9	1.5
25.5	6.2	2.9	1.5
26	6.3	2.9	1.5
26.5	6.3	3.0	1.5
27	6.4	3.0	1.5
27.5	6.4	3.0	1.5
28	6.5	3.0	1.5
28.5	6.5	3.1	1.5
29	6.6	3.1	1.5
29.5	6.6	3.1	1.5
30	6.7	3.1	1.6
30.5	6.7	3.2	1.6
31	6.8	3.2	1.6
31.5	6.8	3.2	1.6
32	6.8	3.2	1.6
32.5	6.9	3.2	1.6
33	6.9	3.3	1.6
33.5	7.0	3.3	1.6
34	7.0	3.3	1.6
34.5	7.1	3.3	1.6
35	7.1	3.3	1.7
35.5	7.2	3.4	1.7
36	7.2	3.4	1.7
36.5	7.2	3.4	1.7
37	7.3	3.4	1.7
37.5	7.3	3.5	1.7
38	7.4	3.5	1.7
38.5	7.4	3.5	1.7
39	7.4	3.5	1.7
39.5	7.5	3.5	1.7
40	7.5	3.6	1.7
40.5	7.6	3.6	1.7
41	7.6	3.6	1.8
41.5	7.6	3.6	1.8
42	7.7	3.6	1.8
42.5	7.7	3.6	1.8
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43.5	7.8	3.7	1.8
44	7.8	3.7	1.8
44.5	7.9	3.7	1.8
45	7.9	3.7	1.8
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47	8.1	3.8	1.8
47.5	8.1	3.8	1.9
48	8.1	3.8	1.9
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49	8.2	3.9	1.9
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50	8.3	3.9	1.9
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52.5	8.5	4.0	1.9
53	8.5	4.0	1.9
53.5	8.5	4.0	1.9
54	8.6	4.1	1.9
54.5	8.6	4.1	2.0
55	8.6	4.1	2.0
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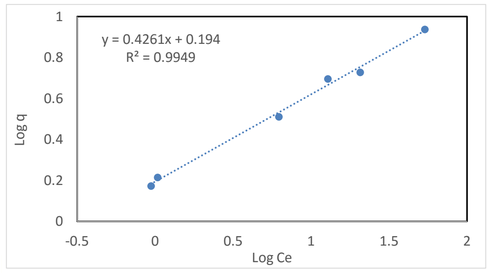

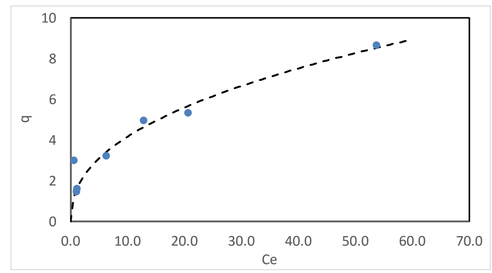

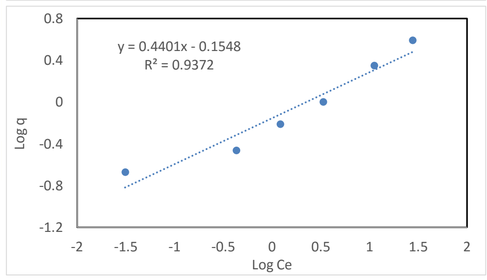

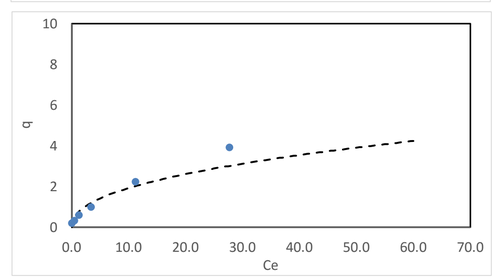

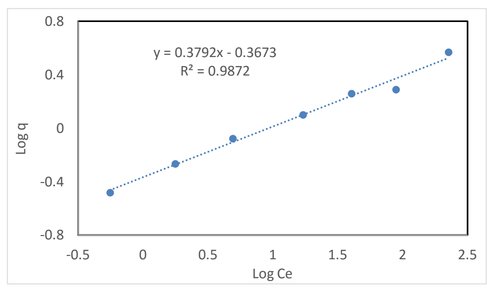

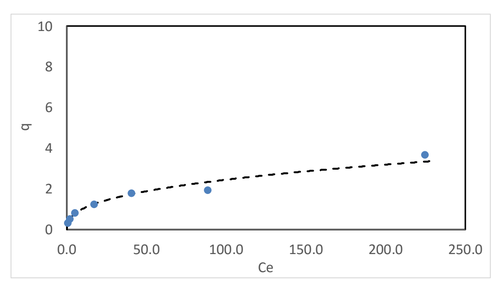

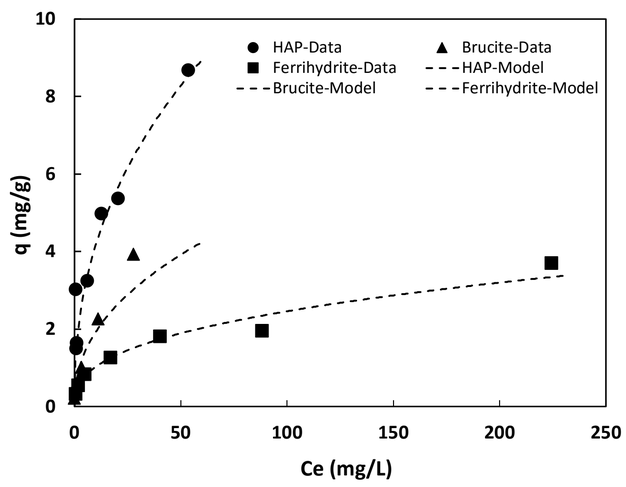

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60	8.9	4.2	2.0
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92	10.7	5.1	2.4
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94	10.8	5.2	2.4
94.5	10.9	5.2	2.4
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96	10.9	5.2	2.4
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218	15.5	7.5	3.3
218.5	15.5	7.5	3.3
219	15.5	7.5	3.3
219.5	15.5	7.5	3.3
220	15.6	7.5	3.3
220.5	15.6	7.5	3.3
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221.5	15.6	7.5	3.3
222	15.6	7.5	3.3
222.5	15.6	7.6	3.3
223	15.7	7.6	3.3
223.5	15.7	7.6	3.3
224	15.7	7.6	3.3
224.5	15.7	7.6	3.3
225	15.7	7.6	3.3
225.5	15.7	7.6	3.3
226	15.7	7.6	3.4
226.5	15.8	7.6	3.4
227	15.8	7.6	3.4
227.5	15.8	7.6	3.4
228	15.8	7.6	3.4
228.5	15.8	7.6	3.4
229	15.8	7.7	3.4
229.5	15.8	7.7	3.4
230	15.9	7.7	3.4

Langmiur

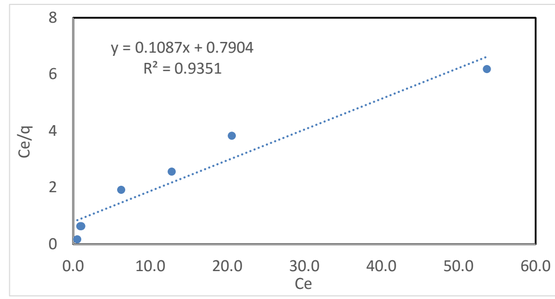
$$q = q_{max}\frac{K_L C_e}{1+K_L C_e}$$

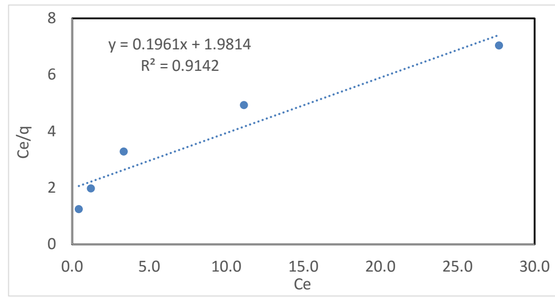
x=(C0-Ce)*Volume of liquid
m= mass of sorbant 0.1 gram
volume= 0.02 L

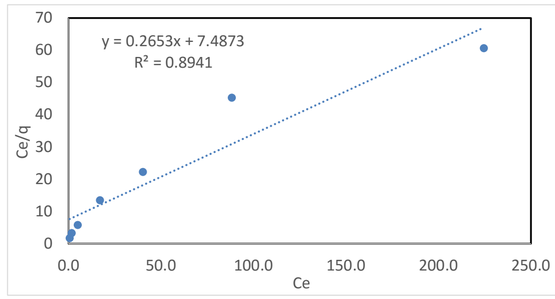
1/q=(1/(qmax*KL))*(1/Ce)+(1/qmax) Ce/q=(1/(qmax*KL))+(Ce/qmax)

Plot Ce/q vs Ce

ID	Initial F concentration	End F concentration	Mass sorbed	Mass sorbed per mass sorbent		KL	qmax
HAp Isotherm	C0 (mg/L)	Ce (mg/L)	X (mg)	q=X/m	Ce/q	0.14	9.20
(.4) 1hAP48	0.4	1.2	-0.01582	-0.1582	-7.68015		
(1.1) 2.5hAP48	1.1	1.2	-0.0015	-0.015	-78.3333		
(2.2) 5hAP48	2.2	1.2	0.0187	0.187	6.497326		
(4.5) 10hAP48	4.3	1.1	0.063	0.63	1.801587		
(8.3) 20hAP48	8.4	0.9	0.14906	1.4906	0.628606		
8hAP	9.2	1.0	0.16393	1.6393	0.630452		
15hAP	15.7	0.5	0.30245	3.0245	0.174409		
(22) 50hAP48	22.5	6.2	0.3247	3.247	1.914075		
35hAP	37.7	12.8	0.498	4.98	2.570281		
(45) 100hAP48	47.4	20.6	0.536	5.36	3.833955		
90.4hAP	97.1	53.7	0.868	8.68	6.180876		
Brucite Isotherm						KL	qmax
1Mg48	0.4	0.0	0.00786	0.0786	0.394402	0.10	5.10
2.5Mg48	1.1	0.0	0.02138	0.2138	0.144995		
5Mg48	2.2	0.4	0.03441	0.3441	1.248184		
10Mg48	4.3	1.2	0.0614	0.614	1.978827		
20Mg48	8.4	3.3	0.1012	1.012	3.290514		
50Mg48	22.5	11.2	0.226	2.26	4.933628		
100Mg48	47.4	27.7	0.393	3.93	7.048346		
Ferrihydrite Isotherm						KL	qmax
5Fe48	2.2	0.6	0.03298	0.3298	1.68587	0.04	3.77
10Fe48	4.5	1.8	0.0544	0.544	3.244485		
20Fe48	9.1	4.9	0.0837	0.837	5.866189		
50Fe48	23.4	17.1	0.126	1.26	13.53175		
100Fe48	49.4	40.3	0.181	1.81	22.26519		
200Fe48	98.0	88.2	0.195	1.95	45.23077		
500Fe48	243.0	224.5	0.37	3.7	60.67568		







Ce	HAP	Brucite	Ferrihydrite	
0	0.0	0.0	0.0	
0.5	0.6	0.2	0.1	
1	1.1	0.5	0.1	
1.5	1.6	0.7	0.2	
2	2.0	0.8	0.2	
2.5	2.4	1.0	0.3	
3	2.7	1.2	0.4	
3.5	3.0	1.3	0.4	
4	3.3	1.4	0.5	
4.5	3.5	1.6	0.5	
5	3.7	1.7	0.6	
5.5	4.0	1.8	0.6	
6	4.2	1.9	0.7	
6.5	4.3	2.0	0.7	
7	4.5	2.1	0.7	
7.5	4.7	2.2	0.8	
8	4.8	2.3	0.8	
8.5	5.0	2.3	0.9	
9	5.1	2.4	0.9	
9.5	5.2	2.5	0.9	
10	5.3	2.5	1.0	
10.5	5.4	2.6	1.0	
11	5.5	2.7	1.1	
11.5	5.6	2.7	1.1	
12	5.7	2.8	1.1	
12.5	5.8	2.8	1.2	
13	5.9	2.9	1.2	
13.5	6.0	2.9	1.2	
14	6.1	3.0	1.2	
14.5	6.1	3.0	1.3	
15	6.2	3.0	1.3	
15.5	6.3	3.1	1.3	
16	6.3	3.1	1.4	
16.5	6.4	3.2	1.4	
17	6.4	3.2	1.4	
17.5	6.5	3.2	1.4	
18	6.6	3.3	1.5	
18.5	6.6	3.3	1.5	
19	6.7	3.3	1.5	
19.5	6.7	3.4	1.5	
20	6.7	3.4	1.6	
20.5	6.8	3.4	1.6	
21	6.8	3.4	1.6	
21.5	6.9	3.5	1.6	
22	6.9	3.5	1.7	
22.5	7.0	3.5	1.7	
23	7.0	3.5	1.7	
23.5	7.0	3.6	1.7	
24	7.1	3.6	1.7	
24.5	7.1	3.6	1.8	
25	7.1	3.6	1.8	
25.5	7.2	3.7	1.8	
26	7.2	3.7	1.8	
26.5	7.2	3.7	1.8	
27	7.2	3.7	1.8	
27.5	7.3	3.7	1.9	
28	7.3	3.7	1.9	
28.5	7.3	3.8	1.9	
29	7.4	3.8	1.9	
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30	7.4	3.8	1.9	
30.5	7.4	3.8	2.0	
31	7.5	3.8	2.0	
31.5	7.5	3.9	2.0	
32	7.5	3.9	2.0	
32.5	7.5	3.9	2.0	
33	7.5	3.9	2.0	
33.5	7.6	3.9	2.0	
34	7.6	3.9	2.1	
34.5	7.6	3.9	2.1	
35	7.6	4.0	2.1	
35.5	7.6	4.0	2.1	
36	7.7	4.0	2.1	
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39	7.8	4.1	2.2	
39.5	7.8	4.1	2.2	
40	7.8	4.1	2.2	
40.5	7.8	4.1	2.2	
41	7.8	4.1	2.2	
41.5	7.8	4.1	2.2	
42	7.8	4.1	2.3	
42.5	7.9	4.1	2.3	
43	7.9	4.1	2.3	
43.5	7.9	4.1	2.3	
44	7.9	4.1	2.3	
44.5	7.9	4.2	2.3	
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46	7.9	4.2	2.3	
46.5	8.0	4.2	2.3	
47	8.0	4.2	2.4	
47.5	8.0	4.2	2.4	
48	8.0	4.2	2.4	
48.5	8.0	4.2	2.4	
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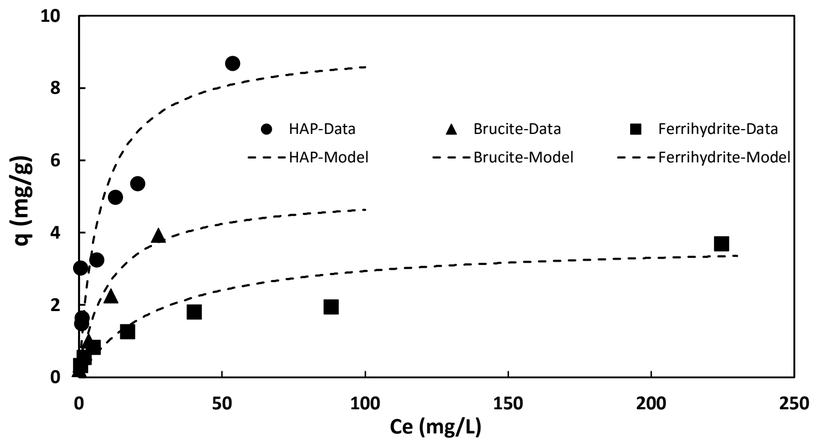
49.5	8.0	4.2	2.4	
50	8.0	4.2	2.4	



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200.5	8.9	4.9	3.3
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201.5	8.9	4.9	3.3
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222.5	8.9	4.9	3.3
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223.5	8.9	4.9	3.3
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224.5	8.9	4.9	3.3
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225.5	8.9	4.9	3.4
226	8.9	4.9	3.4
226.5	8.9	4.9	3.4
227	8.9	4.9	3.4
227.5	8.9	4.9	3.4
228	8.9	4.9	3.4
228.5	8.9	4.9	3.4
229	8.9	4.9	3.4
229.5	8.9	4.9	3.4
230	8.9	4.9	3.4

$$q_e = \frac{K_R C_e}{(1 + a_R C_e^{\beta})} \qquad \ln\left[\left(\frac{K_R C_e}{q_e}\right) - 1\right] = \ln a_R + \beta \ln C_e$$

x=(C0-Ce)*Volume of liquid
m= mass of sorbant 0.1 gram
volume= 0.02 L

ID	Initial F concentration	End F concentration	Mass sorbed	Mass sorbed per mass sorbent			KR	aR	β
HAp Isotherm	C0 (mg/L)	Ce (mg/L)	X (mg)	q=X/m		ln(KrCe/q-1) lnCe			
							3.81	2.02	0.63
(.4) 1hAP48	0.4	1.2	-0.01582	-0.1582	#NUM!	0.194744077			
(1.1) 2.5hAP48	1.1	1.2	-0.0015	-0.015	#NUM!	0.161268148			
(2.2) 5hAP48	2.2	1.2	0.0187	0.187	3.16901	0.194744077			
(4.5) 10hAP48	4.3	1.1	0.063	0.63	1.770216	0.126632651			
(8.3) 20hAP48	8.4	0.9	0.14906	1.4906	0.334903	-0.065071997			
8hAP	9.2	1.0	0.16393	1.6393	0.339928	0.0329511			
15hAP	15.7	0.5	0.30245	3.0245	#N/A	#N/A			
(22) 50hAP48	22.5	6.2	0.3247	3.247	1.84074	1.826965725			
35hAP	37.7	12.8	0.498	4.98	2.175239	2.549445171			
(45) 100hAP48	47.4	20.6	0.536	5.36	2.611873	3.022860941			
90.4hAP	97.1	53.7	0.868	8.68	3.116924	3.982481469			
Brucite Isotherm							1.42	2.71	0.39
1Mg48	0.4	0.0	0.00786	0.0786	#NUM!	-3.473768074			
2.5Mg48	1.1	0.0	0.02138	0.2138	#NUM!	-3.473768074			
5Mg48	2.2	0.4	0.03441	0.3441	-0.26585	-0.845133538			
10Mg48	4.3	1.2	0.0614	0.614	0.588139	0.194744077			
20Mg48	8.4	3.3	0.1012	1.012	1.296661	1.202972304			
50Mg48	22.5	11.2	0.226	2.26	1.788849	2.411439498			
100Mg48	47.4	27.7	0.393	3.93	2.194501	3.321432413			
Ferrihydrite Isotherm							1.67	4.46	0.59
5Fe48	2.2	0.6	0.03298	0.3298	0.598256	-0.586986985			
10Fe48	4.5	1.8	0.0544	0.544	1.487294	0.56815069			
20Fe48	9.1	4.9	0.0837	0.837	2.175757	1.591273942			
50Fe48	23.4	17.1	0.126	1.26	3.073916	2.836150204			
100Fe48	49.4	40.3	0.181	1.81	3.589877	3.696351469			
200Fe48	98.0	88.2	0.195	1.95	4.312548	4.479606963			
500Fe48	243.0	224.5	0.37	3.7	4.609718	5.413875707			

Ce	HAP	Brucite	Ferrihydrite
0	0.0	0.0	0.0
0.5	0.8	0.2	0.2
1	1.3	0.4	0.3
1.5	1.6	0.5	0.4
2	1.9	0.6	0.4
2.5	2.1	0.7	0.5
3	2.3	0.8	0.5
3.5	2.5	0.9	0.6
4	2.6	1.0	0.6
4.5	2.8	1.1	0.6
5	2.9	1.2	0.7
5.5	3.1	1.2	0.7
6	3.2	1.3	0.7
6.5	3.3	1.4	0.8
7	3.4	1.5	0.8
7.5	3.5	1.5	0.8
8	3.6	1.6	0.8
8.5	3.7	1.7	0.9
9	3.8	1.7	0.9
9.5	3.9	1.8	0.9
10	4.0	1.8	0.9
10.5	4.1	1.9	0.9
11	4.2	2.0	1.0
11.5	4.3	2.0	1.0
12	4.3	2.1	1.0
12.5	4.4	2.1	1.0
13	4.5	2.2	1.0
13.5	4.6	2.2	1.0
14	4.6	2.3	1.1
14.5	4.7	2.3	1.1
15	4.8	2.4	1.1
15.5	4.8	2.5	1.1
16	4.9	2.5	1.1
16.5	5.0	2.6	1.1
17	5.0	2.6	1.2
17.5	5.1	2.7	1.2
18	5.2	2.7	1.2
18.5	5.2	2.7	1.2
19	5.3	2.8	1.2
19.5	5.3	2.8	1.2
20	5.4	2.9	1.2
20.5	5.4	2.9	1.3
21	5.5	3.0	1.3
21.5	5.6	3.0	1.3
22	5.6	3.1	1.3
22.5	5.7	3.1	1.3
23	5.7	3.2	1.3
23.5	5.8	3.2	1.3
24	5.8	3.3	1.3
24.5	5.9	3.3	1.4
25	5.9	3.3	1.4
25.5	6.0	3.4	1.4
26	6.0	3.4	1.4
26.5	6.1	3.5	1.4
27	6.1	3.5	1.4
27.5	6.2	3.6	1.4
28	6.2	3.6	1.4
28.5	6.2	3.6	1.4
29	6.3	3.7	1.5
29.5	6.3	3.7	1.5
30	6.4	3.8	1.5
30.5	6.4	3.8	1.5
31	6.5	3.8	1.5
31.5	6.5	3.9	1.5
32	6.5	3.9	1.5
32.5	6.6	4.0	1.5
33	6.6	4.0	1.5
33.5	6.7	4.0	1.6
34	6.7	4.1	1.6
34.5	6.7	4.1	1.6
35	6.8	4.1	1.6
35.5	6.8	4.2	1.6
36	6.9	4.2	1.6
36.5	6.9	4.3	1.6
37	6.9	4.3	1.6
37.5	7.0	4.3	1.6
38	7.0	4.4	1.6
38.5	7.1	4.4	1.6
39	7.1	4.4	1.7
39.5	7.1	4.5	1.7
40	7.2	4.5	1.7
40.5	7.2	4.5	1.7
41	7.2	4.6	1.7
41.5	7.3	4.6	1.7
42	7.3	4.7	1.7
42.5	7.3	4.7	1.7
43	7.4	4.7	1.7
43.5	7.4	4.8	1.7
44	7.4	4.8	1.7
44.5	7.5	4.8	1.8
45	7.5	4.9	1.8
45.5	7.5	4.9	1.8
46	7.6	4.9	1.8
46.5	7.6	5.0	1.8
47	7.6	5.0	1.8
47.5	7.7	5.0	1.8
48	7.7	5.1	1.8
48.5	7.7	5.1	1.8
49	7.8	5.1	1.8
49.5	7.8	5.2	1.8
50	7.8	5.2	1.8
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51	7.9	5.3	1.9
51.5	7.9	5.3	1.9
52	8.0	5.3	1.9
52.5	8.0	5.4	1.9
53	8.0	5.4	1.9
53.5	8.1	5.4	1.9
54	8.1	5.5	1.9
54.5	8.1	5.5	1.9
55	8.1	5.5	1.9
55.5	8.2	5.6	1.9
56	8.2	5.6	1.9
56.5	8.2	5.6	1.9
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57.5	8.3	5.7	2.0
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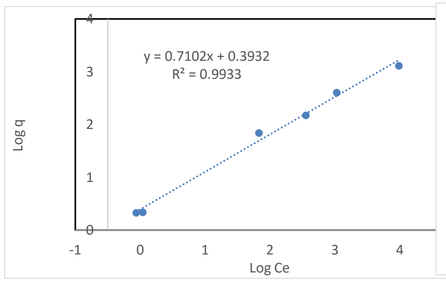

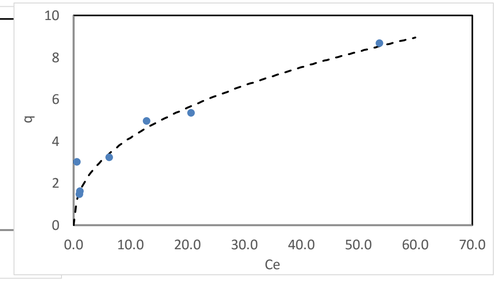

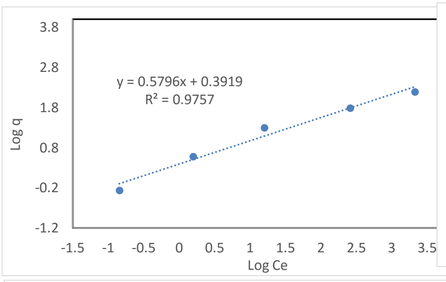

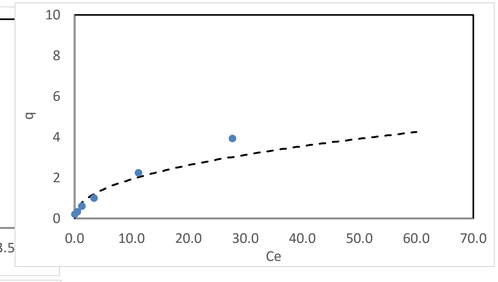

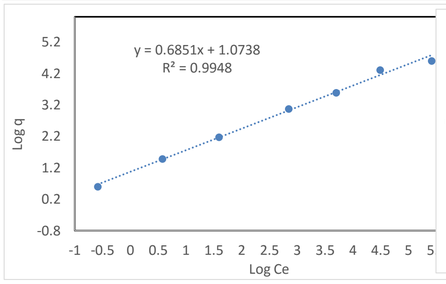

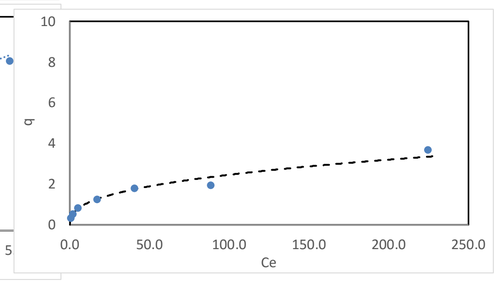

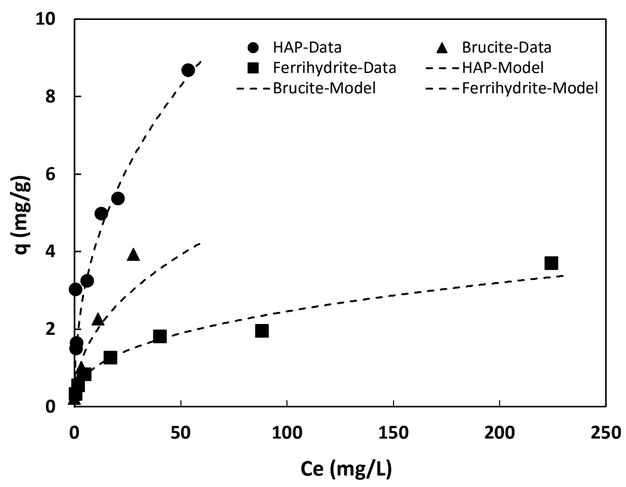

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61	8.5	5.9	2.0
61.5	8.5	5.9	2.0
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62.5	8.6	6.0	2.0
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65.5	8.7	6.2	2.1
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95.5	10.1	7.8	2.4
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96.5	10.2	7.9	2.4
97	10.2	7.9	2.4
97.5	10.2	7.9	2.4
98	10.2	8.0	2.5
98.5	10.2	8.0	2.5
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99.5	10.3	8.0	2.5
100	10.3	8.1	2.5
100.5	10.3	8.1	2.5
101	10.3	8.1	2.5
101.5	10.4	8.1	2.5
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125	11.2	9.3	2.7
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130.5	11.4	9.5	2.8
131	11.4	9.6	2.8
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132	11.5	9.6	2.8
132.5	11.5	9.6	2.8
133	11.5	9.6	2.8
133.5	11.5	9.7	2.8
134	11.5	9.7	2.8
134.5	11.6	9.7	2.8
135	11.6	9.7	2.8
135.5	11.6	9.8	2.8
136	11.6	9.8	2.8
136.5	11.6	9.8	2.8
137	11.6	9.8	2.8

216	13.9	13.1	3.4
215.5	13.9	13.0	3.4
215	13.9	13.0	3.4
214.5	13.9	13.0	3.4
214	13.8	13.0	3.4
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212	13.8	12.9	3.4
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211	13.8	12.9	3.4
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210	13.7	12.8	3.4
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206	13.6	12.7	3.3
205.5	13.6	12.7	3.3
205	13.6	12.6	3.3
204.5	13.6	12.6	3.3
204	13.6	12.6	3.3
203.5	13.6	12.6	3.3
203	13.6	12.6	3.3
202.5	13.5	12.6	3.3
202	13.5	12.5	3.3
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200	13.5	12.5	3.3
199.5	13.5	12.4	3.3
199	13.5	12.4	3.3
198.5	13.4	12.4	3.3
198	13.4	12.4	3.3
197.5	13.4	12.4	3.3
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196.5	13.4	12.3	3.3
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195	13.4	12.3	3.3
194.5	13.3	12.2	3.3
194	13.3	12.2	3.3
193.5	13.3	12.2	3.3
193	13.3	12.2	3.3
192.5	13.3	12.2	3.3
192	13.3	12.1	3.3
191.5	13.3	12.1	3.2
191	13.2	12.1	3.2
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185	13.1	11.9	3.2
184.5	13.1	11.8	3.2
184	13.1	11.8	3.2
183.5	13.0	11.8	3.2
183	13.0	11.8	3.2
182.5	13.0	11.8	3.2
182	13.0	11.7	3.2
181.5	13.0	11.7	3.2
181	13.0	11.7	3.2
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180	12.9	11.7	3.2
179.5	12.9	11.6	3.2
179	12.9	11.6	3.2
178.5	12.9	11.6	3.2
178	12.9	11.6	3.2
177.5	12.9	11.6	3.1
177	12.9	11.5	3.1
176.5	12.8	11.5	3.1
176	12.8	11.5	3.1
175.5	12.8	11.5	3.1
175	12.8	11.5	3.1
174.5	12.8	11.4	3.1
174	12.8	11.4	3.1
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172.5	12.7	11.4	3.1
172	12.7	11.3	3.1
171.5	12.7	11.3	3.1
171	12.7	11.3	3.1
170.5	12.7	11.3	3.1
170	12.7	11.3	3.1
169.5	12.6	11.2	3.1
169	12.6	11.2	3.1
168.5	12.6	11.2	3.1
168	12.6	11.2	3.1
167.5	12.6	11.1	3.1
167	12.6	11.1	3.1
166.5	12.6	11.1	3.1
166	12.5	11.1	3.1
165.5	12.5	11.1	3.1
165	12.5	11.0	3.1
164.5	12.5	11.0	3.0
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158.5	12.3	10.8	3.0
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156	12.2	10.7	3.0
155.5	12.2	10.6	3.0
155	12.2	10.6	3.0
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154	12.2	10.6	3.0
153.5	12.2	10.6	3.0
153	12.2	10.5	3.0
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151	12.1	10.4	2.9
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150	12.1	10.4	2.9
149.5	12.0	10.4	2.9
149	12.0	10.4	2.9
148.5	12.0	10.3	2.9
148	12.0	10.3	2.9
147.5	12.0	10.3	2.9
147	12.0	10.3	2.9
146.5	12.0	10.3	2.9
146	11.9	10.2	2.9
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144	11.9	10.1	2.9
143.5	11.9	10.1	2.9
143	11.8	10.1	2.9
142.5	11.8	10.1	2.9
142	11.8	10.1	2.9
141.5	11.8	10.0	2.9
141	11.8	10.0	2.9
140.5	11.8	10.0	2.9
140	11.7	10.0	2.8
139.5	11.7	9.9	2.8
139	11.7	9.9	2.8
138.5	11.7	9.9	2.8
138	11.7	9.9	2.8
137.5	11.7	9.9	2.8

216.5	13.9	13.1	3.4
217	13.9	13.1	3.4
217.5	13.9	13.1	3.4
218	13.9	13.1	3.4
218.5	13.9	13.2	3.4
219	14.0	13.2	3.4
219.5	14.0	13.2	3.4
220	14.0	13.2	3.4
220.5	14.0	13.2	3.4
221	14.0	13.3	3.4
221.5	14.0	13.3	3.5
222	14.0	13.3	3.5
222.5	14.0	13.3	3.5
223	14.1	13.3	3.5
223.5	14.1	13.3	3.5
224	14.1	13.4	3.5
224.5	14.1	13.4	3.5
225	14.1	13.4	3.5
225.5	14.1	13.4	3.5
226	14.1	13.4	3.5
226.5	14.1	13.5	3.5
227	14.2	13.5	3.5
227.5	14.2	13.5	3.5
228	14.2	13.5	3.5
228.5	14.2	13.5	3.5
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229.5	14.2	13.6	3.5
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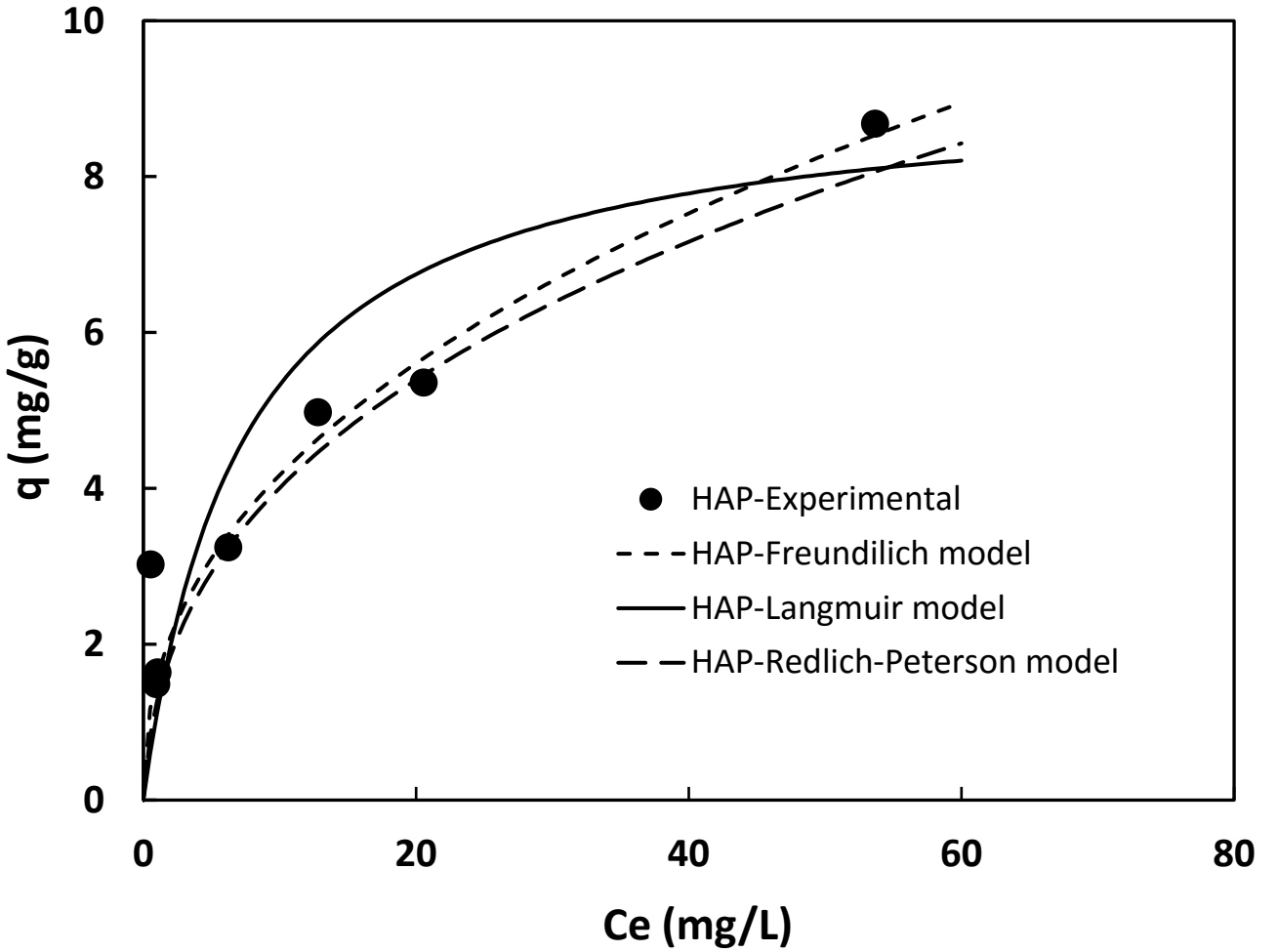
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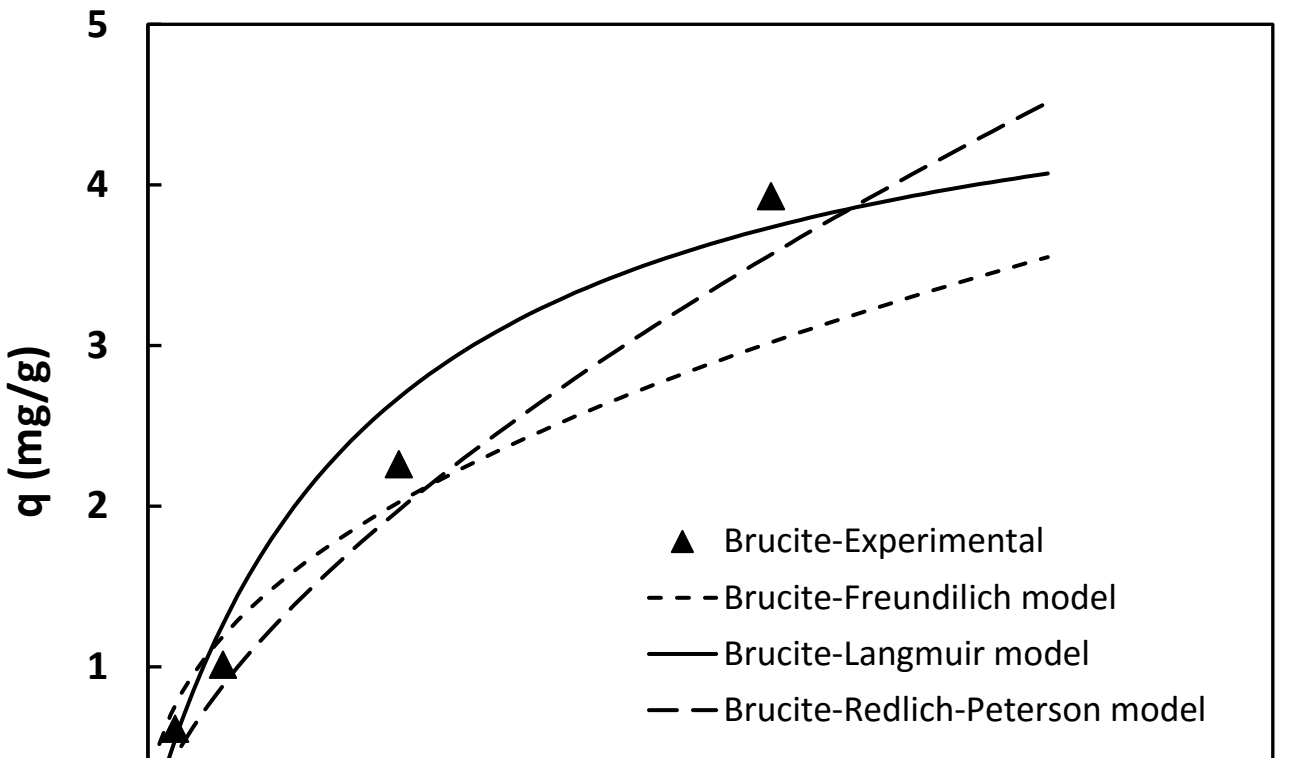
6
4
2
0
q (mg/g)
0
20
40
60
80
Ce (mg/L)
HAP-Experimental
HAP-Freundilich model
HAP-Langmuir model
HAP-Redlich-Peterson model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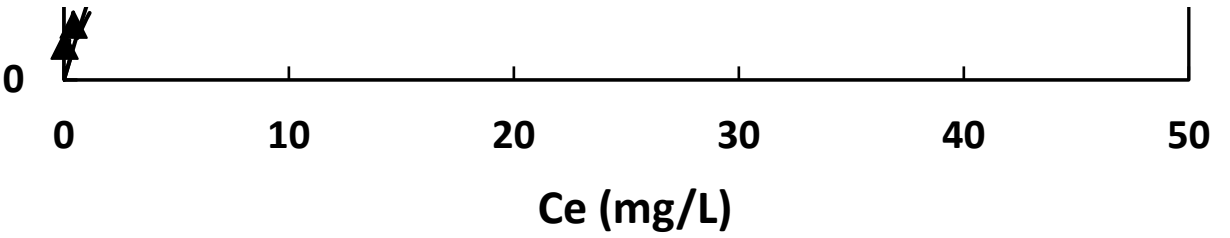
2
1
q (mg/g)
Brucite-Experimental
Brucite-Freundilich model
Brucite-Langmuir model
Brucite-Redlich-Peterson model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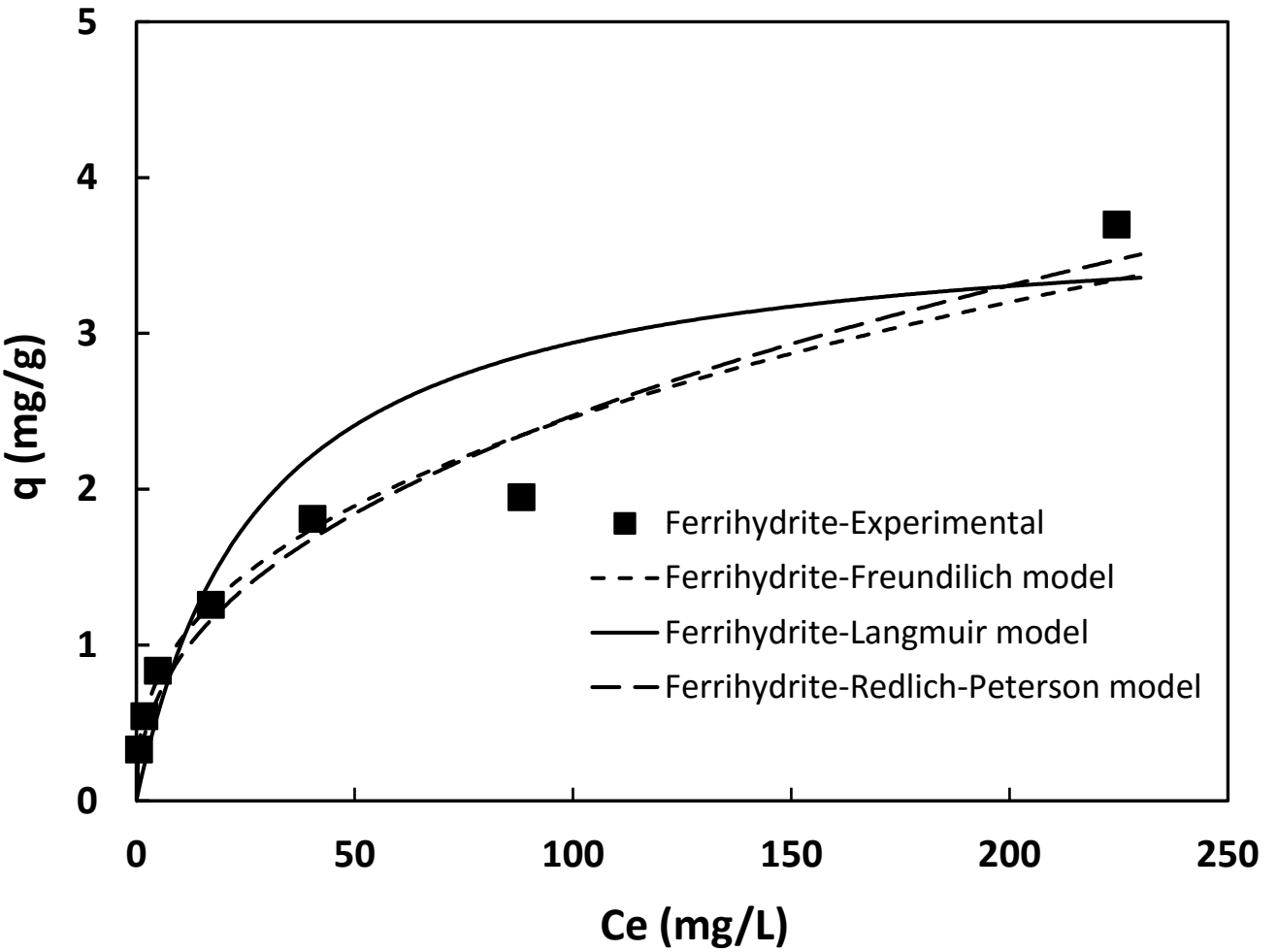
20
30
40
50
Ce (mg/L)


5
4
3
2
1
0
q (mg/g)
0
50
100
150
200
250
Ce (mg/L)
Ferrihydrite-Experimental
Ferrihydrite-Freundilich model
Ferrihydrite-Langmuir model
Ferrihydrite-Redlich-Peterson model

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC01

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 1/14/2016

Technical Directive No.: EPAGP552
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 1/6/2016
Date Analyzed: 1/11 to 1/13/2016
No. Samples Analyzed: 104

Sample Set No.: 7062
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: none

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. The samples were not analyzed within the 48 hour holding time for oP. Dates of collection were not provided. The holding time was discussed with the principal investigator who determined the holding time was not an issue with these samples.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP552

Analyst: Lynda Callaway

Report Date: 01/14/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.039	**MDL**	** 0.002		
QL	** 0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
1hAP5	7062-1	-	1/12/2016	0.925	1	1/11/2016	6.74	11		
1hAP5b	7062-2	-	1/12/2016	1.11	1	1/11/2016	6.78	11		
2.5hAP5	7062-3	-	1/12/2016	1.22	1	1/11/2016	6.18	11		
2.5hAP5b	7062-4	-	1/12/2016	1.16	1	1/11/2016	6.64	11		
5hAP5	7062-5	-	1/12/2016	1.15	1	1/11/2016	3.86	11		
5hAP5b	7062-6	-	1/12/2016	1.16	1	1/11/2016	4.60	11		
10hAP5	7062-7	-	1/12/2016	1.14	2	1/11/2016	1.88	1		
10hAP5b	7062-8	-	1/12/2016	1.09	2	1/11/2016	2.09	1		
20hAP5	7062-9	-	1/13/2016	0.627	1	1/11/2016	0.307	1		
20hAP5b	7062-10	-	1/13/2016	0.993	1	1/11/2016	0.719	1		
20hAP5b	7062-10 Lab dup	-	1/13/2016	0.986 (RPD=0.707)	1	1/11/2016	0.701 (RPD=2.54)	1		
50hAP5	7062-11	-	1/12/2016	9.41	11	1/11/2016	0.313	1		
50hAP5b	7062-12	-	1/12/2016	8.00	11	1/11/2016	0.251	1		
100hAP5	7062-13	-	1/12/2016	27.0	21	1/11/2016	0.161	1		
100hAP5b	7062-14	-	1/12/2016	29.8	21	1/11/2016	0.220	1		
1hAP24	7062-15	-	1/12/2016	0.860	1	1/11/2016	6.62	11		
1hAP24b	7062-16	-	1/12/2016	1.19	1	1/11/2016	5.24	11		
2.5hAP24	7062-17	-	1/12/2016	1.15	1	1/11/2016	4.98	11		
2.5hAP24b	7062-18	-	1/12/2016	1.20	1	1/11/2016	3.78	11		
5hAP24	7062-19	-	1/12/2016	1.22	1	1/11/2016	3.10	11		
5hAP24b	7062-20	-	1/12/2016	1.18	1	1/11/2016	2.70	11		
5hAP24b	7062-20 Lab dup	-	1/12/2016	1.24 (RPD=4.96)	1	1/11/2016	2.85 (RPD=5.41)	11		
10hAP24	7062-21	-	1/12/2016	1.12	4	1/11/2016	1.23	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP552

Analyst: Lynda Callaway

Report Date: 01/14/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.039	**MDL**	** 0.002		
QL	** 0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
10hAP24b	7062-22	-	1/12/2016	1.21	4	1/11/2016	1.15	1		
20hAP24	7062-23	-	1/13/2016	0.853	1	1/11/2016	0.302	1		
20hhAP24b	7062-24	-	1/13/2016	0.939	1	1/11/2016	0.338	1		
50hAP24	7062-25	-	1/12/2016	8.30	11	1/11/2016	0.097	1		
50hAP24b	7062-26	-	1/12/2016	7.03	11	1/11/2016	0.065	1		
100hAP24	7062-27	-	1/12/2016	21.8	21	1/11/2016	0.046	1		
100hAP24b	7062-28	-	1/12/2016	20.6	21	1/11/2016	0.039	1		
1hAP48	7062-29	-	1/12/2016	1.22	1	1/11/2016	3.59	11		
1hAP48b	7062-30	-	1/12/2016	1.21	1	1/11/2016	4.19	11		
1hAP48b	7062-30 Lab dup	-	1/12/2016	1.21 (RPD=0)	1	1/11/2016	4.23 (RPD=0.950)	11		
2.5hAP48	7062-31	-	1/12/2016	1.17	1	1/11/2016	3.66	11		
2.5hAP48b	7062-32	-	1/12/2016	1.18	1	1/11/2016	3.38	11		
5hAP48	7062-33	-	1/12/2016	1.20	1	1/11/2016	2.65	11		
5hAP48b	7062-34	-	1/12/2016	1.23	1	1/11/2016	2.45	11		
10hAP48	7062-35	-	1/12/2016	1.22	4	1/11/2016	1.15	1		
10hAP48b	7062-36	-	1/12/2016	1.05	4	1/11/2016	0.885	1		
20hAP48	7062-37	-	1/13/2016	* 1.43	1	1/11/2016	0.023	1		
20hAP48b	7062-38	-	1/13/2016	* 0.444	1	1/11/2016	0.158	1		
50hAP48	7062-39	-	1/12/2016	6.56	11	1/11/2016	0.062	1		
50hAP48b	7062-40	-	1/12/2016	5.87	11	1/11/2016	0.035	1		
50hAP48b	7062-40 Lab dup	-	1/12/2016	5.90 (RPD=0.510)	11	1/11/2016	0.035 (RPD=0)	1		
100hAP48	7062-41	-	1/12/2016	22.6	21	1/11/2016	0.038	1		
100hAP48b	7062-42	-	1/12/2016	18.5	21	1/11/2016	0.029	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP552

Analyst: Lynda Callaway

Report Date: 01/14/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.039	**MDL**	** 0.002		
QL	** 0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
1F	7062-43	-	1/12/2016	0.423	1	1/11/2016	BQL (0.012)	1		
1Fb	7062-44	-	1/12/2016	0.425	1	1/11/2016	BQL (0.014)	1		
2.5F	7062-45	-	1/12/2016	1.10	1	1/11/2016	BQL (0.012)	1		
2.5Fb	7062-46	-	1/12/2016	1.10	1	1/11/2016	BQL (0.014)	1		
5F	7062-47	-	1/12/2016	2.12	1	1/11/2016	BQL (0.012)	1		
5Fb	7062-48	-	1/12/2016	2.18	1	1/11/2016	BQL (0.014)	1		
10F	7062-49	-	1/12/2016	4.20	2	1/11/2016	BQL (0.013)	1		
10Fb	7062-50	-	1/12/2016	4.37	2	1/11/2016	BQL (0.015)	1		
10Fb	7062-50 Lab dup	-	1/12/2016	4.35 (RPD=0.459)	2	1/11/2016	BQL (0.014) (RPD=NA)	1		
20F	7062-51	-	1/13/2016	8.35	2	1/11/2016	BQL (0.015)	1		
20Fb	7062-52	-	1/13/2016	8.43	2	1/11/2016	BQL (0.016)	1		
50F	7062-53	-	1/13/2016	22.4	6	1/11/2016	0.020	1		
50Fb	7062-54	-	1/13/2016	22.5	6	1/11/2016	0.022	1		
100F	7062-55	-	1/13/2016	46.5	11	1/11/2016	0.031	1		
100Fb	7062-56	-	1/13/2016	48.2	11	1/11/2016	0.030	1		
1000F	7062-57	-	1/13/2016	483	100	1/11/2016	0.242	1		
1000Fb	7062-58	-	1/13/2016	445	100	1/11/2016	0.243	1		
a50hAP48	7062-59	-	1/13/2016	6.58	6	1/11/2016	0.083	1		
a50hAP48b	7062-60	-	1/13/2016	6.29	6	1/11/2016	0.036	1		
a50hAP48b	7062-60 Lab dup	-	1/13/2016	6.56 (RPD=4.20)	6	1/11/2016	0.036 (RPD=0)	1		
a100hAP48	7062-61	-	1/13/2016	19.9	21	1/11/2016	0.061	1		
a100hAP48b	7062-62	-	1/13/2016	19.5	21	1/11/2016	0.058	1		
1Mg5	7062-63	-	1/13/2016	ND	1	1/11/2016	BQL (0.014)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP552

Analyst: Lynda Callaway

Report Date: 01/14/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.039	**MDL**	** 0.002		
QL	** 0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
1Mg5b	7062-64	-	1/13/2016	ND	1	1/11/2016	BQL (0.010)	1		
2.5Mg5	7062-65	-	1/13/2016	ND	1	1/11/2016	BQL (0.014)	1		
2.5Mg5b	7062-66	-	1/13/2016	ND	1	1/11/2016	BQL (0.014)	1		
5Mg5	7062-67	-	1/13/2016	0.448	1	1/11/2016	BQL (0.014)	1		
5Mg5b	7062-68	-	1/13/2016	0.241	1	1/11/2016	BQL (0.014)	1		
10Mg5	7062-69	-	1/13/2016	0.697	1	1/11/2016	BQL (0.011)	1		
10Mg5b	7062-70	-	1/13/2016	0.706	1	1/11/2016	BQL (0.014)	1		
10Mg5b	7062-70 Lab dup	-	1/13/2016	0.675 (RPD=4.49)	1	1/11/2016	BQL (0.011) (RPD=NA)	1		
20Mg5	7062-71	-	1/13/2016	4.30	2	1/11/2016	BQL (0.013)	1		
20Mg5b	7062-72	-	1/13/2016	4.95	2	1/11/2016	BQL (0.010)	1		
50Mg5	7062-73	-	1/13/2016	14.8	6	1/11/2016	BQL (0.014)	1		
50Mg5b	7062-74	-	1/13/2016	14.5	6	1/11/2016	BQL (0.010)	1		
100Mg5	7062-75	-	1/13/2016	31.9	11	1/11/2016	BQL (0.013)	1		
100Mg5b	7062-76	-	1/13/2016	34.7	11	1/11/2016	BQL (0.014)	1		
1Mg24	7062-77	-	1/13/2016	ND	1	1/11/2016	BQL (0.013)	1		
1Mg24b	7062-78	-	1/13/2016	ND	1	1/11/2016	BQL (0.010)	1		
2.5Mg24	7062-79	-	1/13/2016	ND	1	1/11/2016	BQL (0.013)	1		
2.5Mg24b	7062-80	-	1/13/2016	ND	1	1/11/2016	BQL (0.010)	1		
2.5Mg24b	7062-80 Lab dup	-	1/13/2016	ND (RPD=NA)	1	1/11/2016	BQL (0.010) (RPD=NA)	1		
5Mg24	7062-81	-	1/13/2016	0.637	1	1/11/2016	BQL (0.014)	1		
5Mg24b	7062-82	-	1/13/2016	0.712	1	1/11/2016	BQL (0.010)	1		
10Mg24	7062-83	-	1/13/2016	1.57	1	1/11/2016	BQL (0.014)	1		
10Mg24b	7062-84	-	1/13/2016	1.91	1	1/11/2016	BQL (0.010)	1		

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Analyst: Lynda Callaway

Report Date: 01/14/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.039	**MDL**	** 0.002		
QL	** 0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
20Mg24	7062-85	-	1/13/2016	3.93	2	1/11/2016	BQL (0.014)	1		
20Mg24b	7062-86	-	1/13/2016	3.87	2	1/11/2016	BQL (0.010)	1		
50Mg24	7062-87	-	1/13/2016	13.2	6	1/11/2016	BQL (0.014)	1		
50Mg24b	7062-88	-	1/13/2016	12.8	6	1/11/2016	BQL (0.010)	1		
100Mg24	7062-89	-	1/13/2016	29.7	11	1/11/2016	BQL (0.014)	1		
100Mg24b	7062-90	-	1/13/2016	29.9	11	1/11/2016	BQL (0.010)	1		
100Mg24b	7062-90 Lab dup	-	1/13/2016	29.3 (RPD=2.03)	11	1/11/2016	BQL (0.011) (RPD=NA)	1		
1Mg48	7062-91	-	1/13/2016	ND	1	1/11/2016	BQL (0.012)	1		
1Mg48b	7062-92	-	1/13/2016	ND	1	1/11/2016	BQL (0.010)	1		
2.5Mg48	7062-93	-	1/13/2016	ND	1	1/11/2016	BQL (0.014)	1		
2.5Mg48b	7062-94	-	1/13/2016	ND	1	1/11/2016	BQL (0.010)	1		
5Mg48	7062-95	-	1/13/2016	0.452	1	1/11/2016	BQL (0.014)	1		
5Mg48b	7062-96	-	1/13/2016	0.407	1	1/11/2016	BQL (0.013)	1		
10Mg48	7062-97	-	1/13/2016	1.02	1	1/11/2016	BQL (0.014)	1		
10Mg48b	7062-98	-	1/13/2016	1.41	1	1/11/2016	BQL (0.010)	1		
20Mg48	7062-99	-	1/13/2016	3.30	2	1/11/2016	BQL (0.014)	1		
20Mg48b	7062-100	-	1/13/2016	3.36	2	1/11/2016	BQL (0.010)	1		
20Mg48b	7062-100 Lab dup	-	1/13/2016	3.43 (RPD=2.06)	2	1/11/2016	BQL (0.010) (RPD=NA)	1		
50Mg48	7062-101	-	1/13/2016	11.1	6	1/11/2016	BQL (0.014)	1		
50Mg48b	7062-102	-	1/13/2016	11.2	6	1/11/2016	BQL (0.012)	1		
100Mg48	7062-103	-	1/13/2016	26.9	11	1/11/2016	BQL (0.014)	1		
100Mg48b	7062-104	-	1/13/2016	28.5	11	1/11/2016	BQL (0.010)	1		
100Mg48b	7062-104 Lab dup	-	1/13/2016	27.9 (RPD=2.13)	11	1/11/2016	BQL (0.010) (RPD=NA)	1		

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Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.039	**MDL**	** 0.002		
QL	** 0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted. * - Analyzed twice with similar results.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

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Quality Control Data

Analytes	Fluoride (F)			ortho-phosphate as P					
Codes	7782-41-4			70507					
Methods	RSKSOP-276/4			NRMRL-GWERD-05-0					
Unit	mg/L			mg/L					
MDL	0.039			0.002					
QL	0.200			0.020					

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	1/11/2016	1/11/2016	-	-	-	BQL (0.012)	-	-			
MB	Nanopure Water Blank	1/11/2016	1/11/2016	-	-	-	BQL (0.012)	-	-			
MB	Nanopure Water Blank	1/12/2016	1/12/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	1/12/2016	1/12/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	1/13/2016	1/13/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	1/13/2016	1/13/2016	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.59	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.65	1.57	105			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.56	1.57	99.4			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.58	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.59	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.64	1.57	104			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.63	1.57	104			
SS	ERA 67 Minerals	10/27/2015	1/12/2016	2.16	2.12	102	-	-	-			
SS	ERA 67 Minerals	10/27/2015	1/12/2016	2.10	2.12	99.1	-	-	-			
SS	ERA 67 Minerals	10/27/2015	1/13/2016	2.16	2.12	102	-	-	-			
SS	ERA 67 Minerals	10/27/2015	1/13/2016	2.10	2.12	99.1	-	-	-			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.021	0.020	105			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.099	0.100	99.0			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.240	0.250	96.0			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	1.02	1.00	102			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.049	0.050	98.0			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.516	0.500	103			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	2.01	2.00	101			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	1.04	1.00	104			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.047	0.050	94.0			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.092	0.100	92.0			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.234	0.250	93.6			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.054	0.050	108			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.534	0.500	107			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	2.06	2.00	103			
CCC	Continuing Calibration Check Standard	12/1/2015	1/12/2016	BQL (0.193)	0.200	96.5	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/12/2016	1.03	1.00	103	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/12/2016	1.98	2.00	99.0	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/12/2016	4.95	5.00	99.0	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/12/2016	9.96	10.0	99.6	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/12/2016	0.971	1.00	97.1	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	0.208	0.200	104	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	1.06	1.00	106	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	1.95	2.00	97.5	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	4.66	5.00	93.2	-	-	-			

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Analyst: Lynda Callaway

Report Date: 01/14/16

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	9.94	10.0	99.4	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	0.206	0.200	103	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	1.04	1.00	104	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	2.01	2.00	101	-	-	-			
MS	1hAP5 Spike	1/11 & 1/13/2016	1/11 & 1/13/2016	4.88	0.925 (3.85)	103	* 1.55	* 0.613 (0.990)	94.6			
MS	10hAP24 Spike	1/11 & 1/12/2016	1/11 & 1/12/2016	* 4.25	* 0.280 (3.85)	103	2.18	1.23 (0.990)	96.0			
MS	100hAP48 Spike	1/11 & 1/12/2016	1/11 & 1/12/2016	* 4.90	* 1.08 (3.85)	99.2	1.04	0.038 (0.990)	101			
MS	a100hAP48 Spike	1/11 & 1/13/2016	1/11 & 1/13/2016	* 4.76	* 0.948 (3.85)	99.0	1.09	0.061 (0.990)	104			
MS	5Mg24 Spike	1/11 & 1/13/2016	1/11 & 1/13/2016	4.28	0.637 (3.85)	94.6	1.04	BQL (0.014) (0.990)	104			
MS	50Mg48 Spike	1/11 & 1/13/2016	1/11 & 1/13/2016	* 5.22	* 1.85 (3.85)	87.5	1.05	BQL (0.014) (0.990)	105			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes calculated and reported without dilution factors applied.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

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Technica EPAGP555

Analyst: Lynda Callaway

Report D 03/31/16

Sample Results

Analytes	Fluoride (F)				**Analytes**	ortho-Phosphate (as P)			
Codes	7782-41-4				**Codes**	70507			
Methods	RSKSOP-276/4				**Methods**	NRMRL-GWERD-05-0			
Unit	mg/L				**Unit**	mg/L			
MDL	** 0.039				**MDL**	0.002			
QL	** 0.200				**QL**	0.020			
Id Sample	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**	
8hAP	7093-1	-	3/30/2016	0.967	1	3/28/2016	0.135	1	
8hAPB	7093-2	-	3/30/2016	1.10	1	3/28/2016	0.070	1	
15hAP	7093-3	-	3/30/2016	0.980	1	3/28/2016	0.030	1	
15hAPB	7093-4	-	3/30/2016	BQL (0.075)	1	3/28/2016	0.036	1	
35hAP	7093-5	-	3/30/2016	5.38	2	3/28/2016	0.035	1	
35hAPB	7093-6	-	3/30/2016	12.8	2	3/28/2016	0.024	1	
90.4hAP	7093-7	-	3/30/2016	53.5	6	3/28/2016	0.046	1	
90.4hAPB	7093-8	-	3/30/2016	53.8	6	3/28/2016	0.189	1	
90.4hAPB	7093-8 Lab dup	-	3/30/2016	53.6 (RPD=0.372)	6	3/28/2016	0.178 (RPD=5.99)	1	
8F	7093-9	-	3/30/2016	9.13	2	3/28/2016	BQL (0.016)	1	
8Fb	7093-10	-	3/30/2016	9.33	2	3/28/2016	BQL (0.013)	1	
15F	7093-11	-	3/31/2016	15.9	2	3/28/2016	BQL (0.013)	1	
15Fb	7093-12	-	3/31/2016	15.4	2	3/28/2016	BQL (0.014)	1	
35F	7093-13	-	3/31/2016	37.7	6	3/28/2016	0.027	1	
35Fb	7093-14	-	6/19/2015	3/31/2016	37.7	6	3/28/2016	0.027	1
90.4F	7093-15	-	6/19/2015	3/31/2016	96.7	11	3/28/2016	0.053	1
90.4Fb	7093-16	-	6/19/2015	3/31/2016	97.4	11	3/28/2016	0.054	1
90.4Fb	7093-16 Lab dup	-	6/19/2015	3/31/2016	96.7 (RPD=0.721)	11	3/28/2016	0.053 (RPD=1.87)	1

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

1.1

ID	pH	Dissolved F (mg/l)	background [F] subtracted	Stock Soln [F]	Sorbed Fluoride (mg/l)	V soln (ml)	Dissolved P (mg/l)	Time	mass hAP (g)	mass sorbed F- (mg)	sorbed F on hAP (mg/g)	log (sorbed F on hAP (mg/g))	Time F- added	Time Filtered
8hAP	7.01	0.967	-0.143	9.13	8.163	20.8559	0.135	48.2	0.1001	0.170246712	1.700766351		3/21/2016 16:54	3/23/2016 17:05
8hAPB	7.28	1.10	-0.010	9.33	8.230	20.5947	0.070	48.2	0.1003	0.169494381	1.689874187		3/21/2016 16:54	3/23/2016 17:06
15hAP	7.72	0.980	-0.130	15.9	14.920	21.4685	0.030	48.2	0.1005	0.32031002	3.187164378		3/21/2016 16:55	3/23/2016 17:07
15hAPB	7.76	0.08	-1.035	15.4	15.325	20.9015	0.036	48.2	0.1	0.320315488	3.203154875		3/21/2016 16:56	3/23/2016 17:08
35hAP	7.58	5.38	4.270	37.7	32.320	20.155	0.035	48.2	0.1003	0.6514096	6.494612164		3/21/2016 16:57	3/23/2016 17:09
35hAPB	7.83	12.8	11.690	37.7	24.900	20.7327	0.024	48.2	0.0997	0.51624423	5.177976229		3/21/2016 16:58	3/23/2016 17:10
90.4hAP	8.08	53.5	52.390	96.7	43.200	20.9713	0.046	48.2	0.1	0.90596016	9.0596016		3/21/2016 16:59	3/23/2016 17:11
90.4hAPB	7.99	53.8	52.690	97.4	43.600	20.872	0.189	48.2	0.099885714	0.9100192	9.110604119		3/21/2016 17:00	3/23/2016 17:12
90.4hAPB		53.6 (RPD=0.372)	#VALUE!	96.7 (RPD=0.721)			0.178 (RPD=5.99)							
8F		9.13					BQL (0.016)							
8Fb		9.33					BQL (0.013)							
15F		15.9					BQL (0.013)							
15Fb		15.4					BQL (0.014)							
35F		37.7					0.027							
35Fb		37.7					0.027							
90.4F		96.7					0.053							
90.4Fb		97.4					0.054							
90.4Fb		96.7 (RPD=0.721)					0.053 (RPD=1.87)							

Average of Duplicates

ID	pH	Ce [F]	x/m (mg F/g Hap)	stdev x/m	STDEV (Ce)
8hAP	7.145	-0.067	1.70	0.01	0.07
15hAP	7.74	-0.573	3.20	0.01	0.45
35hAP	7.705	7.99	5.84	0.66	3.71
90.4hAP	8.035	52.6	9.09	0.03	0.15

ID	pH	Dissolved F (mg/l)	Dissolved F with background	Stock Soln [F]	Sorbed Fluoride (mg/l)	V soln (ml)	Dissolved P (mg/l)	Time	mass hAP (g)	mass sorbed F- (mg)	sorbed F on hAP (mg/g)	log (sorbed F on hAP (mg	Time F- added	Time Filtered
1hAP48	7.2	1.22	0.1	0.423	0.31	20.0495	3.59	48.3	0.1018	0.006	0.062	-1.210	11/9/2015 12:43	11/11/2015 13:00
1hAP48b	7.15	1.21	0.1	0.425	0.33	20.0689	4.19	48.3	0.1038	0.007	0.063	-1.202	11/9/2015 12:44	11/11/2015 13:02
2.5hAP48	7.15	1.17	0.1	1.10	1.04	20.0511	3.66	48.3	0.1045	0.021	0.200	-0.700	11/9/2015 12:47	11/11/2015 13:04
2.5hAP48b	7.15	1.18	0.1	1.10	1.03	20.0117	3.38	48.3	0.1047	0.021	0.197	-0.706	11/9/2015 12:48	11/11/2015 13:05
5hAP48	7.12	1.20	0.1	2.12	2.03	20.0741	2.65	48.3	0.1033	0.041	0.394	-0.404	11/9/2015 12:49	11/11/2015 13:06
5hAP48b	7.11	1.23	0.1	2.18	2.06	20.0372	2.45	48.3	0.104	0.041	0.397	-0.401	11/9/2015 12:50	11/11/2015 13:07
10hAP48	7.01	1.22	0.1	4.20	4.09	20.0829	1.15	48.3	0.102	0.082	0.805	-0.094	11/9/2015 12:52	11/11/2015 13:08
10hAP48b	7.01	1.05	-0.1	4.37	4.43	20.0385	0.885	48.3	0.1002	0.089	0.886	-0.053	11/9/2015 12:53	11/11/2015 13:09
20hAP48	9.08	1.43	0.3	8.35	8.03	20.0365	0.023	48.2	0.1032	0.161	1.559	0.193	11/9/2015 12:55	11/11/2015 13:10
20hAP48b	8.3	0.444	-0.7	8.43	9.10	20.0546	0.158	48.2	0.1002	0.182	1.821	0.260	11/9/2015 12:56	11/11/2015 13:11
50hAP48	7.62	6.56	5.5	22.4	16.95	20	0.062	48.3	0.1041	0.339	3.256	0.513	11/19/2015 11:07	11/21/2015 11:24
50hAP48b	7.56	5.87	4.8	22.5	17.74	20	0.035	48.3	0.0995	0.355	3.566	0.552	11/19/2015 11:08	11/21/2015 11:25
100hAP48	7.48	22.6	21.5	46.5	25.01	20	0.038	48.3	0.1033	0.500	4.842	0.685	11/19/2015 11:09	11/21/2015 11:26
100hAP48b	7.46	18.5	17.4	48.2	30.81	20	0.029	48.3	0.0994	0.616	6.199	0.792	11/19/2015 11:10	11/21/2015 11:27

KEY
= BQL
= experimental duplicate

BACKGROUND [F] in DI WATER

ID	pH	Dissolved F (mg/l)	Volume HCl adc	V soln (ml)	Dissolved P (r	run duration (h	mass sample (g)	Time Soln added	Time Filtered
DIhap	9	1.08	0.00	20	0.074	5	0.100	1/21/2016 11:24	1/21/2016 16:32
DIhapb	8.91	1.14	0.00	20	0.057	5	0.100	1/21/2016 11:25	1/21/2016 16:33
DIhap7	6.15	1.19	25.00	20	3.52	8	0.100	2/8/2016 9:30	2/8/2016 17:55
DIhap7b	6.07	1.16	25.00	20	4.16	8	0.100	2/8/2016 9:31	2/8/2016 17:56
AVERAGES									
DIhap	9.0	1.1	0	20	0.0655	5	0.1		
DIhap7	6.1	1.2	25	20	3.84	8	0.1		

Average of duplicates

ID	pH	Ce [F] (mg/l)	Ce Background [F] subtracte	STDEV Dissolved F (mg/L)	Sorbed F (mg/l)	V soln (ml)	Dissolved P mg/l)	Time	mass hAP (g)	sorbed F- (mg)	x/m (mg F/g Hap)	log (sorbed F on hAP (mg	Sorbed F- on hAP(mg/g)	STDEV Sorbed F- on hAP(mg/g)
(.4) 1hAP48	7.175	1.22	0.1	0.005		20.06	3.89	48.3	0.1028		0.062	-1.205925286	0.06	0.001
(1.1) 2.5hAP48	7.15	1.18	0.1	0.005		20.03	3.52	48.3	0.1046		0.198	-0.702875157	0.20	0.001
(2.2) 5hAP48	7.115	1.22	0.1	0.015		20.06	2.55	48.3	0.10365		0.396	-0.402646638	0.40	0.001
(4.5) 10hAP48	7.01	1.135	0.0	0.085		20.06	1.0175	48.3	0.1011		0.846	-0.072830251	0.85	0.040
(8.3) 20hAP48	8.69	0.937	0.1	0.493		20.00	0.0905	48.3	0.1017		1.690	0.227831063	1.69	0.131
8hAP	7.145	1.0335	-0.1								1.46572695			
15hAP	7.74	0.5275	-0.6								2.960598913			
(22) 50hAP48	7.59	6.22	5.1	0.345		20.00	0.049	48.3	0.1018		3.411	0.532901664	3.41	0.155
35hAP	7.705	9.09	8.0								5.6093558			
(45) 100hAP48	7.47	20.6	19.4	2.05		20.00	0.0335	48.3	0.10135		5.521	0.74199424	5.52	0.678
90.4hAP	8.035	53.65	52.5								8.852740005			

Freundlich isotherm Data

	log (x/m)i	log Conc. F	Log conc P
1hAP48	-1.205925286	-0.978810701	0.589949601
2.5hAP48	-0.702875157	-1.187086643	0.546542663
5hAP48	-0.402646638	-0.978810701	0.40654018
10hAP48	-0.072830251	-1.602059991	0.007534418
20hAP48	0.227831063	-1	-1.043351421
50hAP48	0.532901664	0.707995746	-1.314258261
100hAP48	0.74199424	1.288696261	-1.474955193

Average of Duplicates

ID	pH	Ce [F]	x/m (mg F/g Hap)
8hAP	7.145	1.0335	1.46572695
15hAP	7.74	0.5275	2.960598913
35hAP	7.705	9.09	5.6093558
90.4hAP	8.035	53.65	8.852740005

freundlichPhosphate K and n Values

K (10^y-int)	0.696786937
n (1/slope)	-1.886792453

langmiur

K	7.762471166
qmax	-1.062699256

48 HOUR EQUILIBRIUM VALUES WITH BACGROUND FLUORIDE SUBTRACTED

ID	pH	Ce, Dissolved F (mg/l)	Ce (Background [F] subtracted)	STDEV Ce (mg/L)	Sorbed Fluoride (mg/l)	V soln (ml)	Dissolved P (mg/l)	Time	mass hAP	mass sorbed F- (mg)	x/m (mg F/g HAp)	log(x/m)	STDEV (x/m)	Time Filtered	
1hAP48	7.2	1.22	0.11		0.423	0.313	20.0495	3.59	48.28333	0.1018	0.006	0.061645319	-1.21	42317.52986	42319.54167
1hAP48b	7.15	1.21	0.1		0.425	0.325	20.0689	4.19	48.3	0.1038	0.007	0.062836151	-1.20	42317.53056	42319.54306
2.5hAP48	7.15	1.17	0.06		1.1	1.04	20.0511	3.66	48.28333	0.1045	0.021	0.199551617	-0.70	42317.53264	42319.54444
2.5hAP48b	7.15	1.18	0.07		1.1	1.03	20.0117	3.38	48.28333	0.1047	0.021	0.196867727	-0.71	42317.53333	42319.54514
5hAP48	7.12	1.2	0.09		2.12	2.03	20.0741	2.65	48.28333	0.1033	0.041	0.394486186	-0.40	42317.53403	42319.54583
5hAP48b	7.11	1.23	0.12		2.18	2.06	20.0372	2.45	48.28333	0.104	0.041	0.396890692	-0.40	42317.53472	42319.54653
10hAP48	7.01	1.22	0.11		4.2	4.09	20.0829	1.15	48.26667	0.102	0.082	0.805284912	-0.09	42317.53611	42319.54722
10hAP48b	7.01	1.05	-0.06		4.37	4.43	20.0385	0.885	48.26667	0.1002	0.089	0.885933683	-0.05	42317.53681	42319.54792
20hAP48	9.08	1.43	0.32		8.35	8.03	20.0365	0.023	48.25	0.1032	0.161	1.559041618	0.19	42317.53819	42319.54861
20hAP48b	8.3	0.444	-0.666		8.43	9.096	20.0546	0.158	48.25	0.1002	0.182	1.820525365	0.26	42317.53889	42319.54931
50hAP48	7.62	6.56	5.45		22.4	16.95	20	0.062	48.28333	0.1041	0.339	3.25648415	0.51	42327.46319	42329.475
50hAP48b	7.56	5.87	4.76		22.5	17.74	20	0.035	48.28333	0.0995	0.355	3.565829146	0.55	42327.46389	42329.47569
100hAP48	7.48	22.6	21.49		46.5	25.01	20	0.038	48.28333	0.1033	0.500	4.842207164	0.69	42327.46458	42329.47639
100hAP48b	7.46	18.5	17.39		48.2	30.81	20	0.029	48.28334	0.0994	0.616	6.199195171	0.79	42327.46528	42329.47708
1F		0.423					20	0.012							
1Fb		0.425					20	0.014							
2.5F		1.1					20	0.012							
2.5Fb		1.1					20	0.014							
5F		2.12					20	0.012							
5Fb		2.18					20	0.014							
10F		4.2					20	0.013							
10Fb		4.37					20	0.015							
20F		8.35					20	0.015							
20Fb		8.43					20	0.016							
50F		22.4					20	0.02							
50Fb		22.5					20	0.022							
100F		46.5					20	0.031							
100Fb		48.2					20	0.03							
1000F		483					20	0.242							
1000Fb		445					20	0.243							

KEY
= BQL
= experimental duplicate

Average of duplicates

ID	pH	Ce, Dissolved F (mg/l)	Ce (Background [F] subtracte	log (Ce)	STDEV Ce (mg/L)	Sorbed F (mg/l)	V soln (ml)	Dissolved P mg/l)	Time	mass hAP	sorbed F- (mg)	x/m (mg F/g HAp)	log(x/m)	STDEV (x/m)	Ce/(x/m)
1hAP48	7.175	1.215	0.105	-0.978810701	0.005	0.319	20.0592	3.89	48.29167	0.1028	0.006398943	0.062240735	-1.205945159	0.000842045	1.687
2.5hAP48	7.15	1.175	0.065	-1.187086643	0.005	1.035	20.0314	3.52	48.28333	0.1046	0.020732598	0.198209672	-0.702885111	0.001897797	0.328
5hAP48	7.115	1.215	0.105	-0.978810701	0.015	2.045	20.05565	2.55	48.28333	0.10365	0.041013528	0.395688439	-0.402648643	0.001700243	0.265
10hAP48	7.01	1.135	0.025	-1.602059991	0.085	4.26	20.0607	1.0175	48.26667	0.1011	0.085454808	0.845609297	-0.073324612	0.057027293	0.030
20hAP48	8.69	0.937	0.025	-1.602059991	0.493	8.563	20.04555	0.0905	48.25	0.1017	0.171654868	1.689783492	0.226527222	0.184896931	0.015
50hAP48	7.59	6.215	5.105	0.707995746	0.345	17.345	20	0.0485	48.28333	0.1018	0.3469	3.411156648	0.53245475	0.218739944	1.497
100hAP48	7.47	20.55	19.44	1.288696261	2.05	27.91	20	0.0335	48.28334	0.10135	0.5582	5.520701167	0.738689338	0.959535422	3.521

BACKGROUND [F] in DI WATER

ID	pH	Ce, Dissolved F (mg/l)	Volume HCl added (ul)	V soln (ml)	Dissolved P (mg/l)	run duration (hrs)	mass sample (g)	Time Soln	Time Filtered
Dlhap	9	1.08	0	20	0.074	5.133333333	0.1	42390.48	42390.69
Dlhapb	8.91	1.14	0	20	0.057	5.133333333	0.1	42390.48	42390.69
Dlhap7	6.15	1.19	25	20	3.52	8.416666667	0.1	42408.4	42408.75
Dlhap7b	6.07	1.16	25	20	4.16	8.416666667	0.1	42408.4	42408.75
AVERAGES									
Dlhap	8.955	1.11	0	20	0.0655	5.133333333	0.1		
Dlhap7	6.11	1.175	25	20	3.84	8.416666667	0.1		

ID	pH	Dissolved F (mg/l)	STDEV Dissolved F (mg/L)	Sorbed F (mg/l)	V soln (ml)	Dissolved P	Time	mass hAP (g)
1hAP5	7.25	1.0175	0.0925		20.02895	6.76	5.8	0.10125
2.5hAP5	7.17	1.19	0.03		20.02315	6.41	5.8	0.1041
5hAP5	7.09	1.155	0.005		20.03045	4.23	5.8	0.10065
10hAP5	6.995	1.115	0.025		20.06265	1.985	5.8	0.1008
20hAP5	7.01	0.81	0.183		20.0371	0.513	5.8	0.1016
50hAP5	6.885	8.705	0.705		20.04175	0.282	5.8	0.103
100hAP5	6.925	28.4	1.4		20.0364	0.1905	5.8	0.1028
1hAP24	7.08	1.025	0.165		20.0466	5.93	24.3	0.09975
2.5hAP24	7.085	1.175	0.025		20.02755	4.38	24.3	0.1001
5hAP24	7.105	1.2	0.02		20.01135	2.9	24.3	0.10305
10hAP24	7.065	1.165	0.045		19.98595	1.19	24.3	0.10295
20hAP24	7.03	0.896	0.043		20.0218	0.32	24.3	0.1022
50hAP24	7.025	7.665	0.635		20.04235	0.081	24.3	0.10325
100hAP24	7.13	21.2	0.6		20.06495	0.0425	24.3	0.1041
1hAP48	7.175	1.215	0.005		20.0592	3.89	48.3	0.1028
2.5hAP48	7.15	1.175	0.005		20.0314	3.52	48.3	0.1046
5hAP48	7.115	1.215	0.015		20.05565	2.55	48.3	0.10365
10hAP48	7.01	1.135	0.085		20.0607	1.0175	48.3	0.1011
20hAP48	8.69	0.937	0.493		20	0.0905	48.3	0.1017
50hAP48	7.59	6.215	0.345		20	0.0485	48.3	0.1018
100hAP48	7.47	20.55	2.05		20	0.0335	48.3	0.10135

Average of duplicates

ID	pH	Dissolved F (mg/l)	STDEV Dissolved F (mg/l)	Second order 1/F	first order ln	Sorbed F (mg/	V soln (ml)	Dissolved P	Time	sorbed F- (	mass hAP	Sorbed F-	percent removal
1000F		464						0.2425	0	0			
1F		0.424	0.001	2.358490566	-0.858022		20	0.013	0	0.008			
1hAP5	7.25	1.0175	0.0925	0.982800983	0.0173486	-0.594	20.029	6.76	5.8	-0.012	0.10125	-0.12	-139.976
1hAP24	7.08	1.025	0.165	0.975609756	0.0246926	-0.601	20.047	5.93	24.3	-0.012	0.09975	-0.12	-141.745
1hAP48	7.175	1.22	0.005	0.819672131	0.1988509	-0.79	20.06	3.89	48.3	-0.016	0.1028	-0.15	-187.736
2.5F		1.1	0	0.909090909	0.0953102		20	0.013	0	0.022			
2.5hAP5	7.17	1.19	0.03	0.840336134	0.1739533	-0.09	20.023	6.41	5.8	-0.002	0.1041	-0.02	-8.18182
2.5hAP24	7.085	1.18	0.025	0.847457627	0.1655144	-0.075	20.028	4.38	24.3	-0.002	0.1001	-0.02	-7.27273
2.5hAP48	7.15	1.18	0.005	0.847457627	0.1655144	-0.07	20.03	3.52	48.3	-0.002	0.1046	-0.01	-7.27273
5F		2.15	0.03	0.465116279	0.7654678		20	0.013	0	0.043			
5hAP5	7.09	1.16	0.005	0.862068966	0.14842	0.995	20.03	4.23	5.8	0.02	0.10065	0.2	46.04651
5hAP24	7.105	1.2	0.02	0.833333333	0.1823216	0.95	20.011	2.9	24.3	0.019	0.10305	0.18	44.18605
5hAP48	7.115	1.22	0.015	0.819672131	0.1988509	0.94	20.06	2.55	48.3	0.019	0.10365	0.18	43.25581
10F		4.29	0.085	0.233100233	1.4562867		20	0.014	0	0.086			
10hAP5	6.995	1.12	0.025	0.892857143	0.1133287	3.17	20.063	1.985	5.8	0.064	0.1008	0.63	73.89277
10hAP24	7.065	1.17	0.045	0.854700855	0.1570037	3.12	19.986	1.19	24.3	0.062	0.10295	0.61	72.72727
10hAP48	7.01	1.135	0.085	0.881057269	0.1266327	3.15	20.06	1.0175	48.3	0.063	0.1011	0.63	73.54312
20F		8.39	0.04	0.119189511	2.1270405		20	0.0155	0	0.168			
20hAP5	7.01	0.81	0.183	1.234567901	-0.210721	7.58	20.037	0.513	5.8	0.152	0.1016	1.49	90.34565
20hAP24	7.03	0.896	0.043	1.116071429	-0.109815	7.494	20.022	0.32	24.3	0.15	0.1022	1.47	89.32062
20hAP48	8.69	0.937	0.493	1.067235859	-0.065072	7.45	20	0.0905	48.3	0.149	0.1017	1.47	88.83194
50F		22.5	0.05	0.044444444	3.1135153		20	0.021	0	0.449			
50hAP5	6.885	8.71	0.705	0.114810563	2.1644718	13.745	20.042	0.282	5.8	0.275	0.103	2.67	61.28889
50hAP24	7.025	7.67	0.635	0.130378096	2.0373166	14.785	20.042	0.081	24.3	0.296	0.10325	2.87	65.91111
50hAP48	7.59	6.22	0.345	0.160771704	1.8277699	16.24	20	0.049	48.3	0.325	0.1018	3.19	72.35556
a50hAP48	7.1	6.44		0.155279503	1.8625285		20	0.0595	48.3				
100F		47.4	0.85	0.021097046	3.8586222		20	0.136	0	0.947			
100hAP5	6.925	28.4	1.4	0.035211268	3.3463891	18.95	20.036	0.1905	5.8	0.38	0.1028	3.69	40.08439
100hAP24	7.13	21.2	0.6	0.047169811	3.0540012	26.15	20.065	0.0425	24.3	0.525	0.1041	5.04	55.27426
100hAP48	7.47	20.6	2.05	0.048543689	3.0252911	26.8	20	0.0335	48.3	0.536	0.10135	5.29	56.54008
a100hAP4	7.06	19.7		0.050761421	2.9806186		20	0.0595	48.3				

Average of duplicates

ID	pH	Dissolved F (mg/l)	STDEV Dissolved F (mg/l)	Second order 1/F conc	first order ln(F conc)	Sorbed F (mg/l)	V soln (ml)	Dissolved P	Time	sorbed F- (mg	mass hAP (g)	Sorbed F- on h	percent removal
1000F		464						0.2425	0	0.000			
1F		0.424	0.001	2.358	-0.858		20.000	0.013	0	0.008			
1hAP5	7.25	1.0175	0.0925	0.983	0.017	-0.594	20.029	6.76	5.8	-0.012	0.10125	-0.12	-139.98
1hAP24	7.08	1.025	0.165	0.976	0.025	-0.601	20.047	5.93	24.3	-0.012	0.09975	-0.12	-141.75
1hAP48	7.175	1.22	0.005	0.820	0.199	-0.79	20.06	3.89	48.3	-0.016	0.1028	-0.15	-187.74
2.5F		1.10	0	0.909	0.095		20.000	0.013	0	0.022			
2.5hAP5	7.17	1.19	0.03	0.840	0.174	-0.090	20.023	6.41	5.8	-0.002	0.1041	-0.02	-8.18
2.5hAP24	7.085	1.18	0.025	0.847	0.166	-0.075	20.028	4.38	24.3	-0.002	0.1001	-0.02	-7.27
2.5hAP48	7.15	1.18	0.005	0.847	0.166	-0.07	20.03	3.52	48.3	-0.002	0.1046	-0.01	-7.27
5F		2.15	0.03	0.465	0.765		20.000	0.013	0	0.043			
5hAP5	7.09	1.16	0.005	0.862	0.148	0.995	20.030	4.23	5.8	0.020	0.10065	0.20	46.05
5hAP24	7.105	1.2	0.02	0.833	0.182	0.950	20.011	2.90	24.3	0.019	0.10305	0.18	44.19
5hAP48	7.115	1.22	0.015	0.820	0.199	0.94	20.06	2.55	48.3	0.019	0.10365	0.18	43.26
10F		4.29	0.085	0.233	1.456		20.000	0.014	0	0.086			
10hAP5	6.995	1.12	0.025	0.893	0.113	3.170	20.063	1.985	5.8	0.064	0.1008	0.63	73.89
10hAP24	7.065	1.17	0.045	0.855	0.157	3.120	19.986	1.19	24.3	0.062	0.10295	0.61	72.73
10hAP48	7.01	1.135	0.085	0.881	0.127	3.15	20.06	1.0175	48.3	0.063	0.1011	0.63	73.54
20F		8.39	0.04	0.119	2.127		20.000	0.0155	0	0.168			
20hAP5	7.01	0.810	0.183	1.235	-0.211	7.580	20.037	0.513	5.8	0.152	0.1016	1.49	90.35
20hAP24	7.03	0.896	0.043	1.116	-0.110	7.494	20.022	0.32	24.3	0.150	0.1022	1.47	89.32
20hAP48	8.69	0.937	0.493	1.067	-0.065	7.45	20.00	0.0905	48.3	0.149	0.1017	1.47	88.83
50F		22.5	0.05	0.044	3.114		20.000	0.021	0	0.449			
50hAP5	6.885	8.71	0.705	0.115	2.164	13.745	20.042	0.282	5.8	0.275	0.103	2.67	61.29
50hAP24	7.025	7.67	0.635	0.130	2.037	14.785	20.042	0.081	24.3	0.296	0.10325	2.87	65.91
50hAP48	7.59	6.22	0.345	0.161	1.828	16.24	20.00	0.049	48.3	0.325	0.1018	3.19	72.36
a50hAP48	7.1	6.44		0.155	1.863		20.00	0.0595	48.3				
100F		47.4	0.85	0.021	3.859		20.000	0.136	0	0.947			
100hAP5	6.925	28.4	1.4	0.035	3.346	18.950	20.036	0.1905	5.8	0.380	0.1028	3.69	40.08
100hAP24	7.13	21.2	0.6	0.047	3.054	26.150	20.065	0.0425	24.3	0.525	0.1041	5.04	55.27
100hAP48	7.47	20.6	2.05	0.049	3.025	26.80	20.00	0.0335	48.3	0.536	0.10135	5.29	56.54
a100hAP48	7.06	19.7		0.051	2.981		20.0	0.0595	48.3				

1F		0.424
1hAP5	7.25	1.0175
1hAP24	7.08	1.025
1hAP48	7.175	1.22
2.5F		1.1
2.5hAP5	7.17	1.19
2.5hAP24	7.085	1.18
2.5hAP48	7.15	1.18
5F		2.15
5hAP5	7.09	1.16
5hAP24	7.105	1.2
5hAP48	7.115	1.22
10F		4.285
10hAP5	6.995	1.12
10hAP24	7.065	1.17
10hAP48	7.01	1.135
20F		8.39
20hAP5	7.01	0.810
20hAP24	7.03	0.896
20hAP48	8.69	0.937
50F		22.45
50hAP5	6.885	8.71
50hAP24	7.025	7.67
50hAP48	7.59	6.22
100F		47.35
100hAP5	6.925	28.4
100hAP24	7.13	21.2
100hAP48	7.47	20.6

ID	pH	Dissolved F (mg/l)	STDEV dissolved F	log dissolved [F]	V soln (ml)	mass dissolved F- (mg)	mass sorbed F (mg)	x/m, mass sorbed F on Mg(OH)2 (mg/g)	log x/m, mass sorbed F on Mg(OH)2 (mg/g)	STDEV x/m	Dissolved P (mg/l)	Time	mass hAP (g)	Time F- added	Time Filtered
1Mg5	9.65	0.03			20.0553	0.001	0.008	0.08	-1.12		0.014	5.3	0.1040	12/9/2015 10:56	12/9/2015 16:16
1Mg5b	9.76	0.03			20.0417	0.001	0.008	0.08	-1.12		0.010	5.3	0.1033	9-Dec	12/9/2015 16:17
2.5Mg5	9.78	0.03			20.0137	0.001	0.021	0.21	-0.68		0.014	5.3	0.1035	12/9/2015 11:01	12/9/2015 16:18
2.5Mg5b	9.75	0.03			20.0433	0.001	0.021	0.21	-0.67		0.014	5.3	0.0999	12/9/2015 11:03	12/9/2015 16:19
5Mg5	9.70	0.448			20.0524	0.009	0.033	0.33	-0.48		0.014	5.3	0.1017	12/9/2015 11:03	12/9/2015 16:20
5Mg5b	9.79	0.241			20.0764	0.005	0.039	0.39	-0.41		0.014	5.3	0.1004	12/9/2015 11:04	12/9/2015 16:21
10Mg5	9.82	0.697			20.097	0.014	0.070	0.68	-0.17		0.011	5.3	0.1024	12/9/2015 11:05	12/9/2015 16:22
10Mg5b	9.83	0.706			20.0907	0.014	0.073	0.72	-0.15		0.014	5.3	0.1023	12/9/2015 11:06	12/9/2015 16:23
20Mg5	9.83	4.30			20.0946	0.086	0.081	0.80	-0.10		0.013	5.3	0.1011	12/9/2015 11:07	12/9/2015 16:24
20Mg5b	9.79	4.95			20.0542	0.099	0.069	0.68	-0.17		0.010	5.3	0.1024	12/9/2015 11:08	12/9/2015 16:25
50Mg5	9.76	14.8			20.0973	0.297	0.151	1.48	0.17		0.014	5.3	0.1020	12/9/2015 11:09	12/9/2015 16:26
50Mg5b	9.75	14.5			20.0799	0.291	0.159	1.53	0.18		0.010	5.3	0.1041	12/9/2015 11:10	12/9/2015 16:27
100Mg5	9.68	31.9			20.0884	0.641	0.289	2.89	0.46		0.013	5.3	0.1000	12/9/2015 11:12	12/9/2015 16:28
100Mg5b	9.68	34.7			20.0785	0.697	0.267	2.66	0.42		0.014	5.3	0.1005	12/9/2015 11:12	12/9/2015 16:29
1Mg24	9.87	0.03			19.9082	0.001	0.008	0.08	-1.11		0.013	25.1	0.1012	12/9/2015 10:28	12/10/2015 11:37
1Mg24b	9.88	0.03			19.8197	0.001	0.008	0.08	-1.12		0.010	25.1	0.104	12/9/2015 10:30	12/10/2015 11:38
2.5Mg24	9.89	0.03			19.9842	0.001	0.021	0.21	-0.68		0.013	25.1	0.1019	12/9/2015 10:32	12/10/2015 11:39
2.5Mg24b	9.87	0.03			20.0408	0.001	0.021	0.21	-0.67		0.010	25.1	0.1009	12/9/2015 10:33	12/10/2015 11:40
5Mg24	9.84	0.637			20.0946	0.013	0.030	0.29	-0.54		0.014	25.1	0.1024	12/9/2015 10:34	12/10/2015 11:41
5Mg24b	9.85	0.712			20.0779	0.014	0.029	0.29	-0.54		0.010	25.1	0.1012	12/9/2015 10:36	12/10/2015 11:42
10Mg24	9.87	1.57			20.0389	0.031	0.053	0.52	-0.28		0.014	25.1	0.1005	12/9/2015 10:37	12/10/2015 11:43
10Mg24b	9.85	1.91			20.1263	0.038	0.049	0.48	-0.32		0.010	25.1	0.1014	12/9/2015 10:38	12/10/2015 11:44
20Mg24	9.82	3.93			20.1143	0.079	0.088	0.84	-0.08		0.014	25.1	0.1048	12/9/2015 10:39	12/10/2015 11:45
20Mg24b	9.86	3.87			20.09	0.078	0.091	0.89	-0.05		0.010	25.1	0.1026	12/9/2015 10:42	12/10/2015 11:46
50Mg24	9.81	13.2			20.1015	0.265	0.183	1.75	0.24		0.014	25.1	0.1042	12/9/2015 10:43	12/10/2015 11:47
50Mg24b	9.82	12.8			20.1145	0.257	0.193	1.90	0.28		0.010	25.1	0.1011	12/9/2015 10:45	12/10/2015 11:48
100Mg24	9.74	29.7			20.1189	0.598	0.332	3.18	0.50		0.014	25.1	0.1046	12/9/2015 10:46	12/10/2015 11:49
100Mg24b	9.71	29.9			20.0928	0.601	0.363	3.52	0.55		0.010	25.1	0.1033	12/9/2015 10:47	12/10/2015 11:50
1Mg48	9.86	0.03		-1.508638306	20	0.001	0.008	0.08	-1.10		0.012	48.7	0.0997	12/9/2015 9:58	12/11/2015 10:39
1Mg48b	9.90	0.03		-1.508638306	19.9983	0.001	0.008	0.08	-1.11		0.010	48.7	0.1018	12/9/2015 9:59	12/11/2015 10:40
2.5Mg48	9.92	0.03		-1.508638306	20.0475	0.001	0.021	0.21	-0.69		0.014	48.7	0.1040	12/9/2015 10:01	12/11/2015 10:41
2.5Mg48b	9.91	0.03		-1.508638306	20.0293	0.001	0.021	0.21	-0.67		0.010	48.6	0.0998	12/9/2015 10:04	12/11/2015 10:42
5Mg48	9.88	0.452		-0.344861565	20.0557	0.009	0.033	0.32	-0.49		0.014	48.6	0.1033	12/9/2015 10:08	12/11/2015 10:43
5Mg48b	9.89	0.407		-0.390405591	20.0547	0.008	0.035	0.35	-0.46		0.013	48.6	0.1013	12/9/2015 10:09	12/11/2015 10:44
10Mg48	9.90	1.02		0.008600172	20.082	0.020	0.064	0.61	-0.21		0.014	48.6	0.1038	12/9/2015 10:09	12/11/2015 10:45
10Mg48b	9.93	1.41		0.149219113	20.0467	0.028	0.059	0.58	-0.23		0.010	48.6	0.1011	12/9/2015 10:10	12/11/2015 10:46
20Mg48	9.92	3.30		0.51851394	20.076	0.066	0.101	0.99	0.00		0.014	48.6	0.1016	12/9/2015 10:11	12/11/2015 10:47
20Mg48b	9.89	3.36		0.526339277	20.0485	0.067	0.101	0.99	0.00		0.010	48.6	0.1024	12/9/2015 10:12	12/11/2015 10:48
50Mg48	9.85	11.1		1.045322979	19.0034	0.211	0.237	2.27	0.36		0.014	48.6	0.1043	12/9/2015 10:13	12/11/2015 10:49
50Mg48b	9.83	11.2		1.049218023	20.0361	0.224	0.226	2.26	0.35		0.012	48.6	0.1000	12/9/2015 10:14	12/11/2015 10:50
100Mg48	9.74	26.9		1.42975228	20.0452	0.539	0.391	3.81	0.58		0.014	48.6	0.1027	12/9/2015 10:16	12/11/2015 10:51
100Mg48b	9.75	28.5		1.45484486	20.0567	0.572	0.392	3.76	0.58		0.010	48.6	0.1043	12/9/2015 10:17	12/11/2015 10:52
1F		0.423			20	0.008					0.012				
1Fb		0.425			20	0.009					0.014				
2.5F		1.10			20	0.022					0.012				
2.5Fb		1.10			20	0.022					0.014				
5F		2.12			20	0.042					0.012				
5Fb		2.18			20	0.044					0.014				
10F		4.20			20	0.084					0.013				
10Fb		4.37			20	0.087					0.015				
20F		8.35			20	0.167					0.015				
20Fb		8.43			20	0.169					0.016				
50F		22.4			20	0.448					0.020				
50Fb		22.5			20	0.450					0.022				
100F		46.5			20	0.930					0.031				
100Fb		48.2			20	0.964					0.030				

KEY	
	= BQL
	= Non Detect

AVERAGE OF DUPLICATES

1Mg5	0.03	0		0.08		
2.5Mg5	0.03	0		0.21		
5Mg5	0.3445	0.1035		0.36		
10Mg5	0.702	0.0045		0.70		
20Mg5	4.63	0.325		0.74		
50Mg5	14.7	0.15		1.50		
100Mg5	33.3	1.4		2.78		
1Mg24	0.03	0.00		0.08		
2.5Mg24	0.03	0		0.21		
5Mg24	0.6745	0.04		0.29		
10Mg24	1.74	0.17		0.50		
20Mg24	3.90	0.03		0.86		
50Mg24	13.0	0.2		1.83		
100Mg24	29.8	0.1		3.35		
1Mg48	0.03	0.00		0.08	0.000614355	
2.5Mg48	0.03	0.00		0.21	0.004328296	
5Mg48	0.430	0.02		0.27	0.013565211	
10Mg48	1.22	0.195		0.48	0.013501718	
20Mg48	3.33	0.03		0.79	0.001491508	
50Mg48	11.2	0.0		1.63	0.008465799	
100Mg48	27.7	0.8		3.03	0.02151599	
1F	0.424	0.001				
2.5F	1.10	0.00				
5F	2.15	0.03				
10F	4.29	0.09				
20F	8.39	0.04				
50F	22.5	0.1				
100F	47.4	0.9				

Freundlich isotherm Data

	log x/m	STDEV log (x/m)	log Conc. F	STDEV log [F]
1Mg48	-1.11	0.003	-1.51	0
2.5Mg48	-0.68	0.009	-1.51	0
5Mg48	-0.57	0.018	-0.37	0.022772013
10Mg48	-0.32	0.010	0.08	0.07030947
20Mg48	-0.10	0.001	0.52	0.003912669
50Mg48	0.21	0.002	1.05	0.001947522
100Mg48	0.48	0.002	1.44	0.01254629

AVERAGE OF DUPLICATES

ID	pH	Dissolved	mass sorbed F on hAP (mg/g)	Time	percent Dissolved F removed	First Order (ln[F])	Second order (1/[F])
1F	0	0.42	0.000	0		-0.85802	2.358491
1Mg5	0	0.03	0.076	5.3	92.69	-3.47377	32.25806
1Mg24	0	0.03	0.077	24.1	92.69	-3.47377	32.25806
1Mg48	0	0.03	0.078	47.6	92.69	-3.47377	32.25806
2.5F	0	1.10		0		0.09531	0.909091
2.5Mg5	0	0.03	0.210	5.3	97.18	-3.47377	32.25806
2.5Mg24	0	0.03	0.211	24.1	97.18	-3.47377	32.25806
2.5Mg48	0	0.03	0.210	47.6	97.18	-3.47377	32.25806
5F	0	2.15		0		0.765468	0.465116
5Mg5	0	0.34	0.357	5.3	83.98	-1.06566	2.902758
5Mg24	0	0.67	0.289	24.1	68.63	-0.39378	1.48258
5Mg48	0	0.43	0.268	47.6	80.02	-0.84513	2.328289
10F	0	4.29		0		1.455121	0.233372
10Mg5	0	0.70	0.700	5.3	83.63	-0.35453	1.425517
10Mg24	0	1.74	0.503	24.1	59.39	0.553885	0.574713
10Mg48	0	1.22	0.481	47.6	71.65	0.194744	0.823045
20F	0	8.39		0		2.127041	0.11919
20Mg5	0	4.63	0.737	5.3	44.87	1.531476	0.216216
20Mg24	0	3.90	0.862	24.1	53.52	1.360977	0.25641
20Mg48	0	3.33	0.788	47.6	60.31	1.202972	0.3003
50F	0	22.45		0		3.111291	0.044543
50Mg5	0	14.65	1.501	5.3	34.74	2.68444	0.068259
50Mg24	0	13.00	1.829	24.1	42.09	2.564949	0.076923
50Mg48	0	11.15	1.631	47.6	50.33	2.411439	0.089686
100F	0	47.35		0		3.857567	0.021119
100Mg5	0	33.30	2.776	5.3	29.67	3.505557	0.03003
100Mg24	0	29.80	3.347	24.1	37.06	3.394508	0.033557
100Mg48	0	27.70	3.031	47.6	41.50	3.321432	0.036101

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC01

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 1/14/2016

Technical Directive No.: EPAGP552
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 1/6/2016
Date Analyzed: 1/11 to 1/13/2016
No. Samples Analyzed: 104

Sample Set No.: 7062
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: none

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. The samples were not analyzed within the 48 hour holding time for oP. Dates of collection were not provided. The holding time was discussed with the principal investigator who determined the holding time was not an issue with these samples.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP552

Analyst: Lynda Callaway

Report Date: 01/14/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.039	**MDL**	** 0.002		
QL	** 0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
1hAP5	7062-1	-	1/12/2016	0.925	1	1/11/2016	6.74	11		
1hAP5b	7062-2	-	1/12/2016	1.11	1	1/11/2016	6.78	11		
2.5hAP5	7062-3	-	1/12/2016	1.22	1	1/11/2016	6.18	11		
2.5hAP5b	7062-4	-	1/12/2016	1.16	1	1/11/2016	6.64	11		
5hAP5	7062-5	-	1/12/2016	1.15	1	1/11/2016	3.86	11		
5hAP5b	7062-6	-	1/12/2016	1.16	1	1/11/2016	4.60	11		
10hAP5	7062-7	-	1/12/2016	1.14	2	1/11/2016	1.88	1		
10hAP5b	7062-8	-	1/12/2016	1.09	2	1/11/2016	2.09	1		
20hAP5	7062-9	-	1/13/2016	0.627	1	1/11/2016	0.307	1		
20hAP5b	7062-10	-	1/13/2016	0.993	1	1/11/2016	0.719	1		
20hAP5b	7062-10 Lab dup	-	1/13/2016	0.986 (RPD=0.707)	1	1/11/2016	0.701 (RPD=2.54)	1		
50hAP5	7062-11	-	1/12/2016	9.41	11	1/11/2016	0.313	1		
50hAP5b	7062-12	-	1/12/2016	8.00	11	1/11/2016	0.251	1		
100hAP5	7062-13	-	1/12/2016	27.0	21	1/11/2016	0.161	1		
100hAP5b	7062-14	-	1/12/2016	29.8	21	1/11/2016	0.220	1		
1hAP24	7062-15	-	1/12/2016	0.860	1	1/11/2016	6.62	11		
1hAP24b	7062-16	-	1/12/2016	1.19	1	1/11/2016	5.24	11		
2.5hAP24	7062-17	-	1/12/2016	1.15	1	1/11/2016	4.98	11		
2.5hAP24b	7062-18	-	1/12/2016	1.20	1	1/11/2016	3.78	11		
5hAP24	7062-19	-	1/12/2016	1.22	1	1/11/2016	3.10	11		
5hAP24b	7062-20	-	1/12/2016	1.18	1	1/11/2016	2.70	11		
5hAP24b	7062-20 Lab dup	-	1/12/2016	1.24 (RPD=4.96)	1	1/11/2016	2.85 (RPD=5.41)	11		
10hAP24	7062-21	-	1/12/2016	1.12	4	1/11/2016	1.23	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP552

Analyst: Lynda Callaway

Report Date: 01/14/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.039	**MDL**	** 0.002		
QL	** 0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
10hAP24b	7062-22	-	1/12/2016	1.21	4	1/11/2016	1.15	1		
20hAP24	7062-23	-	1/13/2016	0.853	1	1/11/2016	0.302	1		
20hhAP24b	7062-24	-	1/13/2016	0.939	1	1/11/2016	0.338	1		
50hAP24	7062-25	-	1/12/2016	8.30	11	1/11/2016	0.097	1		
50hAP24b	7062-26	-	1/12/2016	7.03	11	1/11/2016	0.065	1		
100hAP24	7062-27	-	1/12/2016	21.8	21	1/11/2016	0.046	1		
100hAP24b	7062-28	-	1/12/2016	20.6	21	1/11/2016	0.039	1		
1hAP48	7062-29	-	1/12/2016	1.22	1	1/11/2016	3.59	11		
1hAP48b	7062-30	-	1/12/2016	1.21	1	1/11/2016	4.19	11		
1hAP48b	7062-30 Lab dup	-	1/12/2016	1.21 (RPD=0)	1	1/11/2016	4.23 (RPD=0.950)	11		
2.5hAP48	7062-31	-	1/12/2016	1.17	1	1/11/2016	3.66	11		
2.5hAP48b	7062-32	-	1/12/2016	1.18	1	1/11/2016	3.38	11		
5hAP48	7062-33	-	1/12/2016	1.20	1	1/11/2016	2.65	11		
5hAP48b	7062-34	-	1/12/2016	1.23	1	1/11/2016	2.45	11		
10hAP48	7062-35	-	1/12/2016	1.22	4	1/11/2016	1.15	1		
10hAP48b	7062-36	-	1/12/2016	1.05	4	1/11/2016	0.885	1		
20hAP48	7062-37	-	1/13/2016	* 1.43	1	1/11/2016	0.023	1		
20hAP48b	7062-38	-	1/13/2016	* 0.444	1	1/11/2016	0.158	1		
50hAP48	7062-39	-	1/12/2016	6.56	11	1/11/2016	0.062	1		
50hAP48b	7062-40	-	1/12/2016	5.87	11	1/11/2016	0.035	1		
50hAP48b	7062-40 Lab dup	-	1/12/2016	5.90 (RPD=0.510)	11	1/11/2016	0.035 (RPD=0)	1		
100hAP48	7062-41	-	1/12/2016	22.6	21	1/11/2016	0.038	1		
100hAP48b	7062-42	-	1/12/2016	18.5	21	1/11/2016	0.029	1		

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Analyst: Lynda Callaway

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Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.039	**MDL**	** 0.002		
QL	** 0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
1F	7062-43	-	1/12/2016	0.423	1	1/11/2016	BQL (0.012)	1		
1Fb	7062-44	-	1/12/2016	0.425	1	1/11/2016	BQL (0.014)	1		
2.5F	7062-45	-	1/12/2016	1.10	1	1/11/2016	BQL (0.012)	1		
2.5Fb	7062-46	-	1/12/2016	1.10	1	1/11/2016	BQL (0.014)	1		
5F	7062-47	-	1/12/2016	2.12	1	1/11/2016	BQL (0.012)	1		
5Fb	7062-48	-	1/12/2016	2.18	1	1/11/2016	BQL (0.014)	1		
10F	7062-49	-	1/12/2016	4.20	2	1/11/2016	BQL (0.013)	1		
10Fb	7062-50	-	1/12/2016	4.37	2	1/11/2016	BQL (0.015)	1		
10Fb	7062-50 Lab dup	-	1/12/2016	4.35 (RPD=0.459)	2	1/11/2016	BQL (0.014) (RPD=NA)	1		
20F	7062-51	-	1/13/2016	8.35	2	1/11/2016	BQL (0.015)	1		
20Fb	7062-52	-	1/13/2016	8.43	2	1/11/2016	BQL (0.016)	1		
50F	7062-53	-	1/13/2016	22.4	6	1/11/2016	0.020	1		
50Fb	7062-54	-	1/13/2016	22.5	6	1/11/2016	0.022	1		
100F	7062-55	-	1/13/2016	46.5	11	1/11/2016	0.031	1		
100Fb	7062-56	-	1/13/2016	48.2	11	1/11/2016	0.030	1		
1000F	7062-57	-	1/13/2016	483	100	1/11/2016	0.242	1		
1000Fb	7062-58	-	1/13/2016	445	100	1/11/2016	0.243	1		
a50hAP48	7062-59	-	1/13/2016	6.58	6	1/11/2016	0.083	1		
a50hAP48b	7062-60	-	1/13/2016	6.29	6	1/11/2016	0.036	1		
a50hAP48b	7062-60 Lab dup	-	1/13/2016	6.56 (RPD=4.20)	6	1/11/2016	0.036 (RPD=0)	1		
a100hAP48	7062-61	-	1/13/2016	19.9	21	1/11/2016	0.061	1		
a100hAP48b	7062-62	-	1/13/2016	19.5	21	1/11/2016	0.058	1		
1Mg5	7062-63	-	1/13/2016	ND	1	1/11/2016	BQL (0.014)	1		

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Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.039	**MDL**	** 0.002		
QL	** 0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
1Mg5b	7062-64	-	1/13/2016	ND	1	1/11/2016	BQL (0.010)	1		
2.5Mg5	7062-65	-	1/13/2016	ND	1	1/11/2016	BQL (0.014)	1		
2.5Mg5b	7062-66	-	1/13/2016	ND	1	1/11/2016	BQL (0.014)	1		
5Mg5	7062-67	-	1/13/2016	0.448	1	1/11/2016	BQL (0.014)	1		
5Mg5b	7062-68	-	1/13/2016	0.241	1	1/11/2016	BQL (0.014)	1		
10Mg5	7062-69	-	1/13/2016	0.697	1	1/11/2016	BQL (0.011)	1		
10Mg5b	7062-70	-	1/13/2016	0.706	1	1/11/2016	BQL (0.014)	1		
10Mg5b	7062-70 Lab dup	-	1/13/2016	0.675 (RPD=4.49)	1	1/11/2016	BQL (0.011) (RPD=NA)	1		
20Mg5	7062-71	-	1/13/2016	4.30	2	1/11/2016	BQL (0.013)	1		
20Mg5b	7062-72	-	1/13/2016	4.95	2	1/11/2016	BQL (0.010)	1		
50Mg5	7062-73	-	1/13/2016	14.8	6	1/11/2016	BQL (0.014)	1		
50Mg5b	7062-74	-	1/13/2016	14.5	6	1/11/2016	BQL (0.010)	1		
100Mg5	7062-75	-	1/13/2016	31.9	11	1/11/2016	BQL (0.013)	1		
100Mg5b	7062-76	-	1/13/2016	34.7	11	1/11/2016	BQL (0.014)	1		
1Mg24	7062-77	-	1/13/2016	ND	1	1/11/2016	BQL (0.013)	1		
1Mg24b	7062-78	-	1/13/2016	ND	1	1/11/2016	BQL (0.010)	1		
2.5Mg24	7062-79	-	1/13/2016	ND	1	1/11/2016	BQL (0.013)	1		
2.5Mg24b	7062-80	-	1/13/2016	ND	1	1/11/2016	BQL (0.010)	1		
2.5Mg24b	7062-80 Lab dup	-	1/13/2016	ND (RPD=NA)	1	1/11/2016	BQL (0.010) (RPD=NA)	1		
5Mg24	7062-81	-	1/13/2016	0.637	1	1/11/2016	BQL (0.014)	1		
5Mg24b	7062-82	-	1/13/2016	0.712	1	1/11/2016	BQL (0.010)	1		
10Mg24	7062-83	-	1/13/2016	1.57	1	1/11/2016	BQL (0.014)	1		
10Mg24b	7062-84	-	1/13/2016	1.91	1	1/11/2016	BQL (0.010)	1		

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Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.039	**MDL**	** 0.002		
QL	** 0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
20Mg24	7062-85	-	1/13/2016	3.93	2	1/11/2016	BQL (0.014)	1		
20Mg24b	7062-86	-	1/13/2016	3.87	2	1/11/2016	BQL (0.010)	1		
50Mg24	7062-87	-	1/13/2016	13.2	6	1/11/2016	BQL (0.014)	1		
50Mg24b	7062-88	-	1/13/2016	12.8	6	1/11/2016	BQL (0.010)	1		
100Mg24	7062-89	-	1/13/2016	29.7	11	1/11/2016	BQL (0.014)	1		
100Mg24b	7062-90	-	1/13/2016	29.9	11	1/11/2016	BQL (0.010)	1		
100Mg24b	7062-90 Lab dup	-	1/13/2016	29.3 (RPD=2.03)	11	1/11/2016	BQL (0.011) (RPD=NA)	1		
1Mg48	7062-91	-	1/13/2016	ND	1	1/11/2016	BQL (0.012)	1		
1Mg48b	7062-92	-	1/13/2016	ND	1	1/11/2016	BQL (0.010)	1		
2.5Mg48	7062-93	-	1/13/2016	ND	1	1/11/2016	BQL (0.014)	1		
2.5Mg48b	7062-94	-	1/13/2016	ND	1	1/11/2016	BQL (0.010)	1		
5Mg48	7062-95	-	1/13/2016	0.452	1	1/11/2016	BQL (0.014)	1		
5Mg48b	7062-96	-	1/13/2016	0.407	1	1/11/2016	BQL (0.013)	1		
10Mg48	7062-97	-	1/13/2016	1.02	1	1/11/2016	BQL (0.014)	1		
10Mg48b	7062-98	-	1/13/2016	1.41	1	1/11/2016	BQL (0.010)	1		
20Mg48	7062-99	-	1/13/2016	3.30	2	1/11/2016	BQL (0.014)	1		
20Mg48b	7062-100	-	1/13/2016	3.36	2	1/11/2016	BQL (0.010)	1		
20Mg48b	7062-100 Lab dup	-	1/13/2016	3.43 (RPD=2.06)	2	1/11/2016	BQL (0.010) (RPD=NA)	1		
50Mg48	7062-101	-	1/13/2016	11.1	6	1/11/2016	BQL (0.014)	1		
50Mg48b	7062-102	-	1/13/2016	11.2	6	1/11/2016	BQL (0.012)	1		
100Mg48	7062-103	-	1/13/2016	26.9	11	1/11/2016	BQL (0.014)	1		
100Mg48b	7062-104	-	1/13/2016	28.5	11	1/11/2016	BQL (0.010)	1		
100Mg48b	7062-104 Lab dup	-	1/13/2016	27.9 (RPD=2.13)	11	1/11/2016	BQL (0.010) (RPD=NA)	1		

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Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.039	**MDL**	** 0.002		
QL	** 0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted. * - Analyzed twice with similar results.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

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Quality Control Data

Analytes	Fluoride (F)			ortho-phosphate as P					
Codes	7782-41-4			70507					
Methods	RSKSOP-276/4			NRMRL-GWERD-05-0					
Unit	mg/L			mg/L					
MDL	0.039			0.002					
QL	0.200			0.020					

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	1/11/2016	1/11/2016	-	-	-	BQL (0.012)	-	-			
MB	Nanopure Water Blank	1/11/2016	1/11/2016	-	-	-	BQL (0.012)	-	-			
MB	Nanopure Water Blank	1/12/2016	1/12/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	1/12/2016	1/12/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	1/13/2016	1/13/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	1/13/2016	1/13/2016	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.59	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.65	1.57	105			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.56	1.57	99.4			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.58	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.59	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.64	1.57	104			
SS	ERA 64 Simple Nutrients	2/25/2015	1/11/2016	-	-	-	1.63	1.57	104			
SS	ERA 67 Minerals	10/27/2015	1/12/2016	2.16	2.12	102	-	-	-			
SS	ERA 67 Minerals	10/27/2015	1/12/2016	2.10	2.12	99.1	-	-	-			
SS	ERA 67 Minerals	10/27/2015	1/13/2016	2.16	2.12	102	-	-	-			
SS	ERA 67 Minerals	10/27/2015	1/13/2016	2.10	2.12	99.1	-	-	-			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.021	0.020	105			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.099	0.100	99.0			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.240	0.250	96.0			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	1.02	1.00	102			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.049	0.050	98.0			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.516	0.500	103			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	2.01	2.00	101			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	1.04	1.00	104			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.047	0.050	94.0			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.092	0.100	92.0			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.234	0.250	93.6			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.054	0.050	108			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	0.534	0.500	107			
CCC	Continuing Calibration Check Standard	11/4/2015	1/11/2016	-	-	-	2.06	2.00	103			
CCC	Continuing Calibration Check Standard	12/1/2015	1/12/2016	BQL (0.193)	0.200	96.5	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/12/2016	1.03	1.00	103	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/12/2016	1.98	2.00	99.0	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/12/2016	4.95	5.00	99.0	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/12/2016	9.96	10.0	99.6	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/12/2016	0.971	1.00	97.1	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	0.208	0.200	104	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	1.06	1.00	106	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	1.95	2.00	97.5	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	4.66	5.00	93.2	-	-	-			

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Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	9.94	10.0	99.4	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	0.206	0.200	103	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	1.04	1.00	104	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	1/13/2016	2.01	2.00	101	-	-	-			
MS	1hAP5 Spike	1/11 & 1/13/2016	1/11 & 1/13/2016	4.88	0.925 (3.85)	103	* 1.55	* 0.613 (0.990)	94.6			
MS	10hAP24 Spike	1/11 & 1/12/2016	1/11 & 1/12/2016	* 4.25	* 0.280 (3.85)	103	2.18	1.23 (0.990)	96.0			
MS	100hAP48 Spike	1/11 & 1/12/2016	1/11 & 1/12/2016	* 4.90	* 1.08 (3.85)	99.2	1.04	0.038 (0.990)	101			
MS	a100hAP48 Spike	1/11 & 1/13/2016	1/11 & 1/13/2016	* 4.76	* 0.948 (3.85)	99.0	1.09	0.061 (0.990)	104			
MS	5Mg24 Spike	1/11 & 1/13/2016	1/11 & 1/13/2016	4.28	0.637 (3.85)	94.6	1.04	BQL (0.014) (0.990)	104			
MS	50Mg48 Spike	1/11 & 1/13/2016	1/11 & 1/13/2016	* 5.22	* 1.85 (3.85)	87.5	1.05	BQL (0.014) (0.990)	105			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes calculated and reported without dilution factors applied.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

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Sample Results

			Analytes	Fluoride (F)		**Analytes**	ortho-Phosphate (as P)	
			Codes	7782-41-4		**Codes**	70507	
			Methods	RSKSOP-276/4		**Methods**	NRMRL-GWERD-05-0	
			Unit	mg/L		**Unit**	mg/L	
			MDL	** 0.039		**MDL**	0.002	
			QL	** 0.200		**QL**	0.020	
Id Sample	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**
8hAP	7093-1	-	3/30/2016	0.967	1	3/28/2016	0.135	1
8hAPB	7093-2	-	3/30/2016	1.10	1	3/28/2016	0.070	1
15hAP	7093-3	-	3/30/2016	0.980	1	3/28/2016	0.030	1
15hAPB	7093-4	-	3/30/2016	BQL (0.075)	1	3/28/2016	0.036	1
35hAP	7093-5	-	3/30/2016	5.38	2	3/28/2016	0.035	1
35hAPB	7093-6	-	3/30/2016	12.8	2	3/28/2016	0.024	1
90.4hAP	7093-7	-	3/30/2016	53.5	6	3/28/2016	0.046	1
90.4hAPB	7093-8	-	3/30/2016	53.8	6	3/28/2016	0.189	1
90.4hAPB	7093-8 Lab dup	-	3/30/2016	53.6 (RPD=0.372)	6	3/28/2016	0.178 (RPD=5.99)	1
8F	7093-9	-	3/30/2016	9.13	2	3/28/2016	BQL (0.016)	1
8Fb	7093-10	-	3/30/2016	9.33	2	3/28/2016	BQL (0.013)	1
15F	7093-11	-	3/31/2016	15.9	2	3/28/2016	BQL (0.013)	1
15Fb	7093-12	-	3/31/2016	15.4	2	3/28/2016	BQL (0.014)	1
35F	7093-13	-	3/31/2016	37.7	6	3/28/2016	0.027	1
35Fb	7093-14	- 6/19/2015	3/31/2016	37.7	6	3/28/2016	0.027	1
90.4F	7093-15	- 6/19/2015	3/31/2016	96.7	11	3/28/2016	0.053	1
90.4Fb	7093-16	- 6/19/2015	3/31/2016	97.4	11	3/28/2016	0.054	1
90.4Fb	7093-16 Lab dup	- 6/19/2015	3/31/2016	96.7 (RPD=0.721)	11	3/28/2016	0.053 (RPD=1.87)	1

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

1.1

ID	pH	Dissolved F (mg/l)	background [F] subtracted	Stock Soln [F]	Sorbed Fluoride (mg/l)	V soln (ml)	Dissolved P (mg/l)	Time	mass hAP (g)	mass sorbed F- (mg)	sorbed F on hAP (mg/g)	log (sorbed F on hAP (mg/g))	Time F- added	Time Filtered
8hAP	7.01	0.967	-0.143	9.13	8.163	20.8559	0.135	48.2	0.1001	0.170246712	1.700766351		3/21/2016 16:54	3/23/2016 17:05
8hAPB	7.28	1.10	-0.010	9.33	8.230	20.5947	0.070	48.2	0.1003	0.169494381	1.689874187		3/21/2016 16:54	3/23/2016 17:06
15hAP	7.72	0.980	-0.130	15.9	14.920	21.4685	0.030	48.2	0.1005	0.32031002	3.187164378		3/21/2016 16:55	3/23/2016 17:07
15hAPB	7.76	0.08	-1.035	15.4	15.325	20.9015	0.036	48.2	0.1	0.320315488	3.203154875		3/21/2016 16:56	3/23/2016 17:08
35hAP	7.58	5.38	4.270	37.7	32.320	20.155	0.035	48.2	0.1003	0.6514096	6.494612164		3/21/2016 16:57	3/23/2016 17:09
35hAPB	7.83	12.8	11.690	37.7	24.900	20.7327	0.024	48.2	0.0997	0.51624423	5.177976229		3/21/2016 16:58	3/23/2016 17:10
90.4hAP	8.08	53.5	52.390	96.7	43.200	20.9713	0.046	48.2	0.1	0.90596016	9.0596016		3/21/2016 16:59	3/23/2016 17:11
90.4hAPB	7.99	53.8	52.690	97.4	43.600	20.872	0.189	48.2	0.099885714	0.9100192	9.110604119		3/21/2016 17:00	3/23/2016 17:12
90.4hAPB		53.6 (RPD=0.372)	#VALUE!	96.7 (RPD=0.721)			0.178 (RPD=5.99)							
8F		9.13					BQL (0.016)							
8Fb		9.33					BQL (0.013)							
15F		15.9					BQL (0.013)							
15Fb		15.4					BQL (0.014)							
35F		37.7					0.027							
35Fb		37.7					0.027							
90.4F		96.7					0.053							
90.4Fb		97.4					0.054							
90.4Fb		96.7 (RPD=0.721)					0.053 (RPD=1.87)							

Average of Duplicates			Dissolved P (mg/l)			
ID	pH	Ce [F]		x/m (mg F/g Hap	stdev x/m	STDEV (Ce)
8hAP	7.145	-0.067	0.103	1.70	0.01	0.07
15hAP	7.74	-0.573	0.033	3.20	0.01	0.45
35hAP	7.705	7.99	0.03	5.84	0.66	3.71
90.4hAP	8.035	52.6	0.1	9.09	0.03	0.15

ID	pH	Dissolved F (mg/l)	Dissolved F with background	Stock Soln [F]	Sorbed Fluoride (mg/l)	V soln (ml)	Dissolved P (mg/l)	Time	mass hAP (g)	mass sorbed F- (mg)	sorbed F on hAP (mg/g)	log (sorbed F on hAP (mg	Time F- added	Time Filtered
1hAP48	7.2	1.22	0.1	0.423	0.31	20.0495	3.59	48.3	0.1018	0.006	0.062	-1.210	11/9/2015 12:43	11/11/2015 13:00
1hAP48b	7.15	1.21	0.1	0.425	0.33	20.0689	4.19	48.3	0.1038	0.007	0.063	-1.202	11/9/2015 12:44	11/11/2015 13:02
2.5hAP48	7.15	1.17	0.1	1.10	1.04	20.0511	3.66	48.3	0.1045	0.021	0.200	-0.700	11/9/2015 12:47	11/11/2015 13:04
2.5hAP48b	7.15	1.18	0.1	1.10	1.03	20.0117	3.38	48.3	0.1047	0.021	0.197	-0.706	11/9/2015 12:48	11/11/2015 13:05
5hAP48	7.12	1.20	0.1	2.12	2.03	20.0741	2.65	48.3	0.1033	0.041	0.394	-0.404	11/9/2015 12:49	11/11/2015 13:06
5hAP48b	7.11	1.23	0.1	2.18	2.06	20.0372	2.45	48.3	0.104	0.041	0.397	-0.401	11/9/2015 12:50	11/11/2015 13:07
10hAP48	7.01	1.22	0.1	4.20	4.09	20.0829	1.15	48.3	0.102	0.082	0.805	-0.094	11/9/2015 12:52	11/11/2015 13:08
10hAP48b	7.01	1.05	-0.1	4.37	4.43	20.0385	0.885	48.3	0.1002	0.089	0.886	-0.053	11/9/2015 12:53	11/11/2015 13:09
20hAP48	9.08	1.43	0.3	8.35	8.03	20.0365	0.023	48.2	0.1032	0.161	1.559	0.193	11/9/2015 12:55	11/11/2015 13:10
20hAP48b	8.3	0.444	-0.7	8.43	9.10	20.0546	0.158	48.2	0.1002	0.182	1.821	0.260	11/9/2015 12:56	11/11/2015 13:11
50hAP48	7.62	6.56	5.5	22.4	16.95	20	0.062	48.3	0.1041	0.339	3.256	0.513	11/19/2015 11:07	11/21/2015 11:24
50hAP48b	7.56	5.87	4.8	22.5	17.74	20	0.035	48.3	0.0995	0.355	3.566	0.552	11/19/2015 11:08	11/21/2015 11:25
100hAP48	7.48	22.6	21.5	46.5	25.01	20	0.038	48.3	0.1033	0.500	4.842	0.685	11/19/2015 11:09	11/21/2015 11:26
100hAP48b	7.46	18.5	17.4	48.2	30.81	20	0.029	48.3	0.0994	0.616	6.199	0.792	11/19/2015 11:10	11/21/2015 11:27

KEY
= BQL
= experimental duplicate

BACKGROUND [F] in DI WATER

ID	pH	Dissolved F (mg/l)	Volume HCl adc	V soln (ml)	Dissolved P (r	run duration (h	mass sample (g)	Time Soln added	Time Filtered
DIhap	9	1.08	0.00	20	0.074	5	0.100	1/21/2016 11:24	1/21/2016 16:32
DIhapb	8.91	1.14	0.00	20	0.057	5	0.100	1/21/2016 11:25	1/21/2016 16:33
DIhap7	6.15	1.19	25.00	20	3.52	8	0.100	2/8/2016 9:30	2/8/2016 17:55
DIhap7b	6.07	1.16	25.00	20	4.16	8	0.100	2/8/2016 9:31	2/8/2016 17:56
AVERAGES									
DIhap	9.0	1.1	0	20	0.0655	5	0.1		
DIhap7	6.1	1.2	25	20	3.84	8	0.1		

Average of duplicates

ID	pH	Ce [F] (mg/l)	Ce [F] (mol/L)	Ce Background [F] subtracted	STDEV Dissolved F (mg/l	Sorbed F (mg/g	V soln (ml)	Dissolved P (mg/l)	Ce [P] (mol/L)	Time	mass hAP (g)	sorbed F- (mg)	x/m (mg F/g Hap)	log (sorbed F on hAP (mg/g))	Sorbed F- on hA	STDEV Sorbed F- on hAP(mg/g)
(.4) 1hAP48	7.175	1.22	0.064	0.1	0.005	0.062	20.06	3.89	0.126	48.3	0.1028		0.062	-1.205925286	0.06	0.001
(1.1) 2.5hAP48	7.15	1.18	0.062	0.1	0.005	0.198	20.03	3.52	0.114	48.3	0.1046		0.198	-0.702875157	0.20	0.001
(2.2) 5hAP48	7.115	1.22	0.064	0.1	0.015	0.396	20.06	2.55	0.082	48.3	0.10365		0.396	-0.402646638	0.40	0.001
(4.5) 10hAP48	7.01	1.135	0.060	0.0	0.085	0.846	20.06	1.0175	0.033	48.3	0.1011		0.846	-0.072830251	0.85	0.040
(8.3) 20hAP48	8.69	0.937	0.049	0.1	0.493	1.690	20.00	0.0905	0.003	48.3	0.1017		1.690	0.227831063	1.69	0.131
8hAP	7.145	1.0335	0.054	-0.1		1.46572695		0.103	0.003				1.46572695			
15hAP	7.74	0.5275	0.028	-0.6		2.960598913		0.033	0.001				2.960598913			
(22) 50hAP48	7.59	6.22	0.327	5.1	0.345	5.611	20.00	0.049	0.002	48.3	0.1018		3.411	0.532901664	3.41	0.155
35hAP	7.705	9.09	0.478	8.0		5.6093558		0.03	0.001				5.6093558			
(45) 100hAP48	7.47	20.6	1.082	19.4	2.05	5.521	20.00	0.0335	0.001	48.3	0.10135		5.521	0.74199424	5.52	0.678
90.4hAP	8.035	53.65	2.824	52.5		8.852740005		0.1	0.004				8.852740005			

Freundlich isotherm Data

	log (x/m)i	log Conc. F	Log conc P
1hAP48	-1.205925286	-0.978810701	0.589949601
2.5hAP48	-0.702875157	-1.187086643	0.546542663
5hAP48	-0.402646638	-0.978810701	0.40654018
10hAP48	-0.072830251	-1.602059991	0.007534418
20hAP48	0.227831063	-1	-1.043351421
50hAP48	0.532901664	0.707995746	-1.314258261
100hAP48	0.74199424	1.288696261	-1.474955193

Average of Duplicates

ID	pH	Ce [F]	x/m (mg F/g Hap)
8hAP	7.145	1.0335	1.46572695
15hAP	7.74	0.5275	2.960598913
35hAP	7.705	9.09	5.6093558
90.4hAP	8.035	53.65	8.852740005

48 HOUR EQUILIBRIUM VALUES WITH BACGROUND FLUORIDE SUBTRACTED

ID	pH	Ce, Dissolved F (mg/l)	Ce (Background [F] subtracted)	STDEV Ce (mg/L)	Sorbed Fluoride (mg/l)	V soln (ml)	Dissolved P (mg/l)	Time	mass hAP	mass sorbed F- (mg)	x/m (mg F/g HAp)	log(x/m)	STDEV (x/m)	Time Filtered	
1hAP48	7.2	1.22	0.11		0.423	0.313	20.0495	3.59	48.28333	0.1018	0.006	0.061645319	-1.21	42317.52986	42319.54167
1hAP48b	7.15	1.21	0.1		0.425	0.325	20.0689	4.19	48.3	0.1038	0.007	0.062836151	-1.20	42317.53056	42319.54306
2.5hAP48	7.15	1.17	0.06		1.1	1.04	20.0511	3.66	48.28333	0.1045	0.021	0.199551617	-0.70	42317.53264	42319.54444
2.5hAP48b	7.15	1.18	0.07		1.1	1.03	20.0117	3.38	48.28333	0.1047	0.021	0.196867727	-0.71	42317.53333	42319.54514
5hAP48	7.12	1.2	0.09		2.12	2.03	20.0741	2.65	48.28333	0.1033	0.041	0.394486186	-0.40	42317.53403	42319.54583
5hAP48b	7.11	1.23	0.12		2.18	2.06	20.0372	2.45	48.28333	0.104	0.041	0.396890692	-0.40	42317.53472	42319.54653
10hAP48	7.01	1.22	0.11		4.2	4.09	20.0829	1.15	48.26667	0.102	0.082	0.805284912	-0.09	42317.53611	42319.54722
10hAP48b	7.01	1.05	-0.06		4.37	4.43	20.0385	0.885	48.26667	0.1002	0.089	0.885933683	-0.05	42317.53681	42319.54792
20hAP48	9.08	1.43	0.32		8.35	8.03	20.0365	0.023	48.25	0.1032	0.161	1.559041618	0.19	42317.53819	42319.54861
20hAP48b	8.3	0.444	-0.666		8.43	9.096	20.0546	0.158	48.25	0.1002	0.182	1.820525365	0.26	42317.53889	42319.54931
50hAP48	7.62	6.56	5.45		22.4	16.95	20	0.062	48.28333	0.1041	0.339	3.25648415	0.51	42327.46319	42329.475
50hAP48b	7.56	5.87	4.76		22.5	17.74	20	0.035	48.28333	0.0995	0.355	3.565829146	0.55	42327.46389	42329.47569
100hAP48	7.48	22.6	21.49		46.5	25.01	20	0.038	48.28333	0.1033	0.500	4.842207164	0.69	42327.46458	42329.47639
100hAP48b	7.46	18.5	17.39		48.2	30.81	20	0.029	48.28334	0.0994	0.616	6.199195171	0.79	42327.46528	42329.47708
1F		0.423					20	0.012							
1Fb		0.425					20	0.014							
2.5F		1.1					20	0.012							
2.5Fb		1.1					20	0.014							
5F		2.12					20	0.012							
5Fb		2.18					20	0.014							
10F		4.2					20	0.013							
10Fb		4.37					20	0.015							
20F		8.35					20	0.015							
20Fb		8.43					20	0.016							
50F		22.4					20	0.02							
50Fb		22.5					20	0.022							
100F		46.5					20	0.031							
100Fb		48.2					20	0.03							
1000F		483					20	0.242							
1000Fb		445					20	0.243							

KEY
= BQL
= experimental duplicate

Average of duplicates

ID	pH	Ce, Dissolved F (mg/l)	Ce (Background [F] subtracte	log (Ce)	STDEV Ce (mg/L)	Sorbed F (mg/l)	V soln (ml)	Dissolved P mg/l)	Time	mass hAP	sorbed F- (mg)	x/m (mg F/g HAp)	log(x/m)	STDEV (x/m)	Ce/(x/m)
1hAP48	7.175	1.215	0.105	-0.978810701	0.005	0.319	20.0592	3.89	48.29167	0.1028	0.006398943	0.062240735	-1.205945159	0.000842045	1.687
2.5hAP48	7.15	1.175	0.065	-1.187086643	0.005	1.035	20.0314	3.52	48.28333	0.1046	0.020732598	0.198209672	-0.702885111	0.001897797	0.328
5hAP48	7.115	1.215	0.105	-0.978810701	0.015	2.045	20.05565	2.55	48.28333	0.10365	0.041013528	0.395688439	-0.402648643	0.001700243	0.265
10hAP48	7.01	1.135	0.025	-1.602059991	0.085	4.26	20.0607	1.0175	48.26667	0.1011	0.085454808	0.845609297	-0.073324612	0.057027293	0.030
20hAP48	8.69	0.937	0.025	-1.602059991	0.493	8.563	20.04555	0.0905	48.25	0.1017	0.171654868	1.689783492	0.226527222	0.184896931	0.015
50hAP48	7.59	6.215	5.105	0.707995746	0.345	17.345	20	0.0485	48.28333	0.1018	0.3469	3.411156648	0.53245475	0.218739944	1.497
100hAP48	7.47	20.55	19.44	1.288696261	2.05	27.91	20	0.0335	48.28334	0.10135	0.5582	5.520701167	0.738689338	0.959535422	3.521

BACKGROUND [F] in DI WATER

ID	pH	Ce, Dissolved F (mg/l)	Volume HCl added (ul)	V soln (ml)	Dissolved P (mg/l)	run duration (hrs)	mass sample (g)	Time Soln	Time Filtered
Dlhap	9	1.08	0	20	0.074	5.133333333	0.1	42390.48	42390.69
Dlhapb	8.91	1.14	0	20	0.057	5.133333333	0.1	42390.48	42390.69
Dlhap7	6.15	1.19	25	20	3.52	8.416666667	0.1	42408.4	42408.75
Dlhap7b	6.07	1.16	25	20	4.16	8.416666667	0.1	42408.4	42408.75
AVERAGES									
Dlhap	8.955	1.11	0	20	0.0655	5.133333333	0.1		
Dlhap7	6.11	1.175	25	20	3.84	8.416666667	0.1		

ID	pH	Dissolved F (mg/l)	STDEV Dissolved F (mg/L)	Sorbed F (mg/l)	V soln (ml)	Dissolved P	Time	mass hAP (g)
1hAP5	7.25	1.0175	0.0925		20.02895	6.76	5.8	0.10125
2.5hAP5	7.17	1.19	0.03		20.02315	6.41	5.8	0.1041
5hAP5	7.09	1.155	0.005		20.03045	4.23	5.8	0.10065
10hAP5	6.995	1.115	0.025		20.06265	1.985	5.8	0.1008
20hAP5	7.01	0.81	0.183		20.0371	0.513	5.8	0.1016
50hAP5	6.885	8.705	0.705		20.04175	0.282	5.8	0.103
100hAP5	6.925	28.4	1.4		20.0364	0.1905	5.8	0.1028
1hAP24	7.08	1.025	0.165		20.0466	5.93	24.3	0.09975
2.5hAP24	7.085	1.175	0.025		20.02755	4.38	24.3	0.1001
5hAP24	7.105	1.2	0.02		20.01135	2.9	24.3	0.10305
10hAP24	7.065	1.165	0.045		19.98595	1.19	24.3	0.10295
20hAP24	7.03	0.896	0.043		20.0218	0.32	24.3	0.1022
50hAP24	7.025	7.665	0.635		20.04235	0.081	24.3	0.10325
100hAP24	7.13	21.2	0.6		20.06495	0.0425	24.3	0.1041
1hAP48	7.175	1.215	0.005		20.0592	3.89	48.3	0.1028
2.5hAP48	7.15	1.175	0.005		20.0314	3.52	48.3	0.1046
5hAP48	7.115	1.215	0.015		20.05565	2.55	48.3	0.10365
10hAP48	7.01	1.135	0.085		20.0607	1.0175	48.3	0.1011
20hAP48	8.69	0.937	0.493		20	0.0905	48.3	0.1017
50hAP48	7.59	6.215	0.345		20	0.0485	48.3	0.1018
100hAP48	7.47	20.55	2.05		20	0.0335	48.3	0.10135

Average of duplicates

ID	pH	Dissolved F (mg/l)	STDEV Dissolved F (mg/l)	Second order 1/F	first order ln	Sorbed F (mg/	V soln (ml)	Dissolved P	Time	sorbed F- (	mass hAP	Sorbed F-	percent removal
1000F		464						0.2425	0	0			
1F		0.424	0.001	2.358490566	-0.858022		20	0.013	0	0.008			
1hAP5	7.25	1.0175	0.0925	0.982800983	0.0173486	-0.594	20.029	6.76	5.8	-0.012	0.10125	-0.12	-139.976
1hAP24	7.08	1.025	0.165	0.975609756	0.0246926	-0.601	20.047	5.93	24.3	-0.012	0.09975	-0.12	-141.745
1hAP48	7.175	1.22	0.005	0.819672131	0.1988509	-0.79	20.06	3.89	48.3	-0.016	0.1028	-0.15	-187.736
2.5F		1.1	0	0.909090909	0.0953102		20	0.013	0	0.022			
2.5hAP5	7.17	1.19	0.03	0.840336134	0.1739533	-0.09	20.023	6.41	5.8	-0.002	0.1041	-0.02	-8.18182
2.5hAP24	7.085	1.18	0.025	0.847457627	0.1655144	-0.075	20.028	4.38	24.3	-0.002	0.1001	-0.02	-7.27273
2.5hAP48	7.15	1.18	0.005	0.847457627	0.1655144	-0.07	20.03	3.52	48.3	-0.002	0.1046	-0.01	-7.27273
5F		2.15	0.03	0.465116279	0.7654678		20	0.013	0	0.043			
5hAP5	7.09	1.16	0.005	0.862068966	0.14842	0.995	20.03	4.23	5.8	0.02	0.10065	0.2	46.04651
5hAP24	7.105	1.2	0.02	0.833333333	0.1823216	0.95	20.011	2.9	24.3	0.019	0.10305	0.18	44.18605
5hAP48	7.115	1.22	0.015	0.819672131	0.1988509	0.94	20.06	2.55	48.3	0.019	0.10365	0.18	43.25581
10F		4.29	0.085	0.233100233	1.4562867		20	0.014	0	0.086			
10hAP5	6.995	1.12	0.025	0.892857143	0.1133287	3.17	20.063	1.985	5.8	0.064	0.1008	0.63	73.89277
10hAP24	7.065	1.17	0.045	0.854700855	0.1570037	3.12	19.986	1.19	24.3	0.062	0.10295	0.61	72.72727
10hAP48	7.01	1.135	0.085	0.881057269	0.1266327	3.15	20.06	1.0175	48.3	0.063	0.1011	0.63	73.54312
20F		8.39	0.04	0.119189511	2.1270405		20	0.0155	0	0.168			
20hAP5	7.01	0.81	0.183	1.234567901	-0.210721	7.58	20.037	0.513	5.8	0.152	0.1016	1.49	90.34565
20hAP24	7.03	0.896	0.043	1.116071429	-0.109815	7.494	20.022	0.32	24.3	0.15	0.1022	1.47	89.32062
20hAP48	8.69	0.937	0.493	1.067235859	-0.065072	7.45	20	0.0905	48.3	0.149	0.1017	1.47	88.83194
50F		22.5	0.05	0.044444444	3.1135153		20	0.021	0	0.449			
50hAP5	6.885	8.71	0.705	0.114810563	2.1644718	13.745	20.042	0.282	5.8	0.275	0.103	2.67	61.28889
50hAP24	7.025	7.67	0.635	0.130378096	2.0373166	14.785	20.042	0.081	24.3	0.296	0.10325	2.87	65.91111
50hAP48	7.59	6.22	0.345	0.160771704	1.8277699	16.24	20	0.049	48.3	0.325	0.1018	3.19	72.35556
a50hAP48	7.1	6.44		0.155279503	1.8625285		20	0.0595	48.3				
100F		47.4	0.85	0.021097046	3.8586222		20	0.136	0	0.947			
100hAP5	6.925	28.4	1.4	0.035211268	3.3463891	18.95	20.036	0.1905	5.8	0.38	0.1028	3.69	40.08439
100hAP24	7.13	21.2	0.6	0.047169811	3.0540012	26.15	20.065	0.0425	24.3	0.525	0.1041	5.04	55.27426
100hAP48	7.47	20.6	2.05	0.048543689	3.0252911	26.8	20	0.0335	48.3	0.536	0.10135	5.29	56.54008
a100hAP4	7.06	19.7		0.050761421	2.9806186		20	0.0595	48.3				

Average of duplicates

ID	pH	Dissolved F (mg/l)	STDEV Dissolved F (mg/l)	Second order 1/F conc	first order ln(F conc)	Sorbed F (mg/l)	V soln (ml)	Dissolved P	Time	sorbed F- (mg	mass hAP (g)	Sorbed F- on h	percent removal
1000F		464						0.2425	0	0.000			
1F		0.424	0.001	2.358	-0.858		20.000	0.013	0	0.008			
1hAP5	7.25	1.0175	0.0925	0.983	0.017	-0.594	20.029	6.76	5.8	-0.012	0.10125	-0.12	-139.98
1hAP24	7.08	1.025	0.165	0.976	0.025	-0.601	20.047	5.93	24.3	-0.012	0.09975	-0.12	-141.75
1hAP48	7.175	1.22	0.005	0.820	0.199	-0.79	20.06	3.89	48.3	-0.016	0.1028	-0.15	-187.74
2.5F		1.10	0	0.909	0.095		20.000	0.013	0	0.022			
2.5hAP5	7.17	1.19	0.03	0.840	0.174	-0.090	20.023	6.41	5.8	-0.002	0.1041	-0.02	-8.18
2.5hAP24	7.085	1.18	0.025	0.847	0.166	-0.075	20.028	4.38	24.3	-0.002	0.1001	-0.02	-7.27
2.5hAP48	7.15	1.18	0.005	0.847	0.166	-0.07	20.03	3.52	48.3	-0.002	0.1046	-0.01	-7.27
5F		2.15	0.03	0.465	0.765		20.000	0.013	0	0.043			
5hAP5	7.09	1.16	0.005	0.862	0.148	0.995	20.030	4.23	5.8	0.020	0.10065	0.20	46.05
5hAP24	7.105	1.2	0.02	0.833	0.182	0.950	20.011	2.90	24.3	0.019	0.10305	0.18	44.19
5hAP48	7.115	1.22	0.015	0.820	0.199	0.94	20.06	2.55	48.3	0.019	0.10365	0.18	43.26
10F		4.29	0.085	0.233	1.456		20.000	0.014	0	0.086			
10hAP5	6.995	1.12	0.025	0.893	0.113	3.170	20.063	1.985	5.8	0.064	0.1008	0.63	73.89
10hAP24	7.065	1.17	0.045	0.855	0.157	3.120	19.986	1.19	24.3	0.062	0.10295	0.61	72.73
10hAP48	7.01	1.135	0.085	0.881	0.127	3.15	20.06	1.0175	48.3	0.063	0.1011	0.63	73.54
20F		8.39	0.04	0.119	2.127		20.000	0.0155	0	0.168			
20hAP5	7.01	0.810	0.183	1.235	-0.211	7.580	20.037	0.513	5.8	0.152	0.1016	1.49	90.35
20hAP24	7.03	0.896	0.043	1.116	-0.110	7.494	20.022	0.32	24.3	0.150	0.1022	1.47	89.32
20hAP48	8.69	0.937	0.493	1.067	-0.065	7.45	20.00	0.0905	48.3	0.149	0.1017	1.47	88.83
50F		22.5	0.05	0.044	3.114		20.000	0.021	0	0.449			
50hAP5	6.885	8.71	0.705	0.115	2.164	13.745	20.042	0.282	5.8	0.275	0.103	2.67	61.29
50hAP24	7.025	7.67	0.635	0.130	2.037	14.785	20.042	0.081	24.3	0.296	0.10325	2.87	65.91
50hAP48	7.59	6.22	0.345	0.161	1.828	16.24	20.00	0.049	48.3	0.325	0.1018	3.19	72.36
a50hAP48	7.1	6.44		0.155	1.863		20.00	0.0595	48.3				
100F		47.4	0.85	0.021	3.859		20.000	0.136	0	0.947			
100hAP5	6.925	28.4	1.4	0.035	3.346	18.950	20.036	0.1905	5.8	0.380	0.1028	3.69	40.08
100hAP24	7.13	21.2	0.6	0.047	3.054	26.150	20.065	0.0425	24.3	0.525	0.1041	5.04	55.27
100hAP48	7.47	20.6	2.05	0.049	3.025	26.80	20.00	0.0335	48.3	0.536	0.10135	5.29	56.54
a100hAP48	7.06	19.7		0.051	2.981		20.0	0.0595	48.3				

1F		0.424
1hAP5	7.25	1.0175
1hAP24	7.08	1.025
1hAP48	7.175	1.22
2.5F		1.1
2.5hAP5	7.17	1.19
2.5hAP24	7.085	1.18
2.5hAP48	7.15	1.18
5F		2.15
5hAP5	7.09	1.16
5hAP24	7.105	1.2
5hAP48	7.115	1.22
10F		4.285
10hAP5	6.995	1.12
10hAP24	7.065	1.17
10hAP48	7.01	1.135
20F		8.39
20hAP5	7.01	0.810
20hAP24	7.03	0.896
20hAP48	8.69	0.937
50F		22.45
50hAP5	6.885	8.71
50hAP24	7.025	7.67
50hAP48	7.59	6.22
100F		47.35
100hAP5	6.925	28.4
100hAP24	7.13	21.2
100hAP48	7.47	20.6

average and STDV pH

7.19261905	0.370211069

ID	pH	Dissolved F (mg/l)	STDEV dissolved F	log dissolved [F]	V soln (ml)	mass dissolved F- (mg)	mass sorbed F (mg)	x/m, mass sorbed F on Mg(OH)2 (mg/g)	log x/m, mass sorbed F on Mg(OH)2 (mg/g)	STDEV x/m	Dissolved P (mg/l)	Time	mass hAP (g)	Time F- added	Time Filtered
1Mg5	9.65	0.03			20.0553	0.001	0.008	0.08	-1.12		0.014	5.3	0.1040	12/9/2015 10:56	12/9/2015 16:16
1Mg5b	9.76	0.03			20.0417	0.001	0.008	0.08	-1.12		0.010	5.3	0.1033	9-Dec	12/9/2015 16:17
2.5Mg5	9.78	0.03			20.0137	0.001	0.021	0.21	-0.68		0.014	5.3	0.1035	12/9/2015 11:01	12/9/2015 16:18
2.5Mg5b	9.75	0.03			20.0433	0.001	0.021	0.21	-0.67		0.014	5.3	0.0999	12/9/2015 11:03	12/9/2015 16:19
5Mg5	9.70	0.448			20.0524	0.009	0.033	0.33	-0.48		0.014	5.3	0.1017	12/9/2015 11:03	12/9/2015 16:20
5Mg5b	9.79	0.241			20.0764	0.005	0.039	0.39	-0.41		0.014	5.3	0.1004	12/9/2015 11:04	12/9/2015 16:21
10Mg5	9.82	0.697			20.097	0.014	0.070	0.68	-0.17		0.011	5.3	0.1024	12/9/2015 11:05	12/9/2015 16:22
10Mg5b	9.83	0.706			20.0907	0.014	0.073	0.72	-0.15		0.014	5.3	0.1023	12/9/2015 11:06	12/9/2015 16:23
20Mg5	9.83	4.30			20.0946	0.086	0.081	0.80	-0.10		0.013	5.3	0.1011	12/9/2015 11:07	12/9/2015 16:24
20Mg5b	9.79	4.95			20.0542	0.099	0.069	0.68	-0.17		0.010	5.3	0.1024	12/9/2015 11:08	12/9/2015 16:25
50Mg5	9.76	14.8			20.0973	0.297	0.151	1.48	0.17		0.014	5.3	0.1020	12/9/2015 11:09	12/9/2015 16:26
50Mg5b	9.75	14.5			20.0799	0.291	0.159	1.53	0.18		0.010	5.3	0.1041	12/9/2015 11:10	12/9/2015 16:27
100Mg5	9.68	31.9			20.0884	0.641	0.289	2.89	0.46		0.013	5.3	0.1000	12/9/2015 11:12	12/9/2015 16:28
100Mg5b	9.68	34.7			20.0785	0.697	0.267	2.66	0.42		0.014	5.3	0.1005	12/9/2015 11:12	12/9/2015 16:29
1Mg24	9.87	0.03			19.9082	0.001	0.008	0.08	-1.11		0.013	25.1	0.1012	12/9/2015 10:28	12/10/2015 11:37
1Mg24b	9.88	0.03			19.8197	0.001	0.008	0.08	-1.12		0.010	25.1	0.104	12/9/2015 10:30	12/10/2015 11:38
2.5Mg24	9.89	0.03			19.9842	0.001	0.021	0.21	-0.68		0.013	25.1	0.1019	12/9/2015 10:32	12/10/2015 11:39
2.5Mg24b	9.87	0.03			20.0408	0.001	0.021	0.21	-0.67		0.010	25.1	0.1009	12/9/2015 10:33	12/10/2015 11:40
5Mg24	9.84	0.637			20.0946	0.013	0.030	0.29	-0.54		0.014	25.1	0.1024	12/9/2015 10:34	12/10/2015 11:41
5Mg24b	9.85	0.712			20.0779	0.014	0.029	0.29	-0.54		0.010	25.1	0.1012	12/9/2015 10:36	12/10/2015 11:42
10Mg24	9.87	1.57			20.0389	0.031	0.053	0.52	-0.28		0.014	25.1	0.1005	12/9/2015 10:37	12/10/2015 11:43
10Mg24b	9.85	1.91			20.1263	0.038	0.049	0.48	-0.32		0.010	25.1	0.1014	12/9/2015 10:38	12/10/2015 11:44
20Mg24	9.82	3.93			20.1143	0.079	0.088	0.84	-0.08		0.014	25.1	0.1048	12/9/2015 10:39	12/10/2015 11:45
20Mg24b	9.86	3.87			20.09	0.078	0.091	0.89	-0.05		0.010	25.1	0.1026	12/9/2015 10:42	12/10/2015 11:46
50Mg24	9.81	13.2			20.1015	0.265	0.183	1.75	0.24		0.014	25.1	0.1042	12/9/2015 10:43	12/10/2015 11:47
50Mg24b	9.82	12.8			20.1145	0.257	0.193	1.90	0.28		0.010	25.1	0.1011	12/9/2015 10:45	12/10/2015 11:48
100Mg24	9.74	29.7			20.1189	0.598	0.332	3.18	0.50		0.014	25.1	0.1046	12/9/2015 10:46	12/10/2015 11:49
100Mg24b	9.71	29.9			20.0928	0.601	0.363	3.52	0.55		0.010	25.1	0.1033	12/9/2015 10:47	12/10/2015 11:50
1Mg48	9.86	0.03		-1.508638306	20	0.001	0.008	0.08	-1.10		0.012	48.7	0.0997	12/9/2015 9:58	12/11/2015 10:39
1Mg48b	9.90	0.03		-1.508638306	19.9983	0.001	0.008	0.08	-1.11		0.010	48.7	0.1018	12/9/2015 9:59	12/11/2015 10:40
2.5Mg48	9.92	0.03		-1.508638306	20.0475	0.001	0.021	0.21	-0.69		0.014	48.7	0.1040	12/9/2015 10:01	12/11/2015 10:41
2.5Mg48b	9.91	0.03		-1.508638306	20.0293	0.001	0.021	0.21	-0.67		0.010	48.6	0.0998	12/9/2015 10:04	12/11/2015 10:42
5Mg48	9.88	0.452		-0.344861565	20.0557	0.009	0.033	0.32	-0.49		0.014	48.6	0.1033	12/9/2015 10:08	12/11/2015 10:43
5Mg48b	9.89	0.407		-0.390405591	20.0547	0.008	0.035	0.35	-0.46		0.013	48.6	0.1013	12/9/2015 10:09	12/11/2015 10:44
10Mg48	9.90	1.02		0.008600172	20.082	0.020	0.064	0.61	-0.21		0.014	48.6	0.1038	12/9/2015 10:09	12/11/2015 10:45
10Mg48b	9.93	1.41		0.149219113	20.0467	0.028	0.059	0.58	-0.23		0.010	48.6	0.1011	12/9/2015 10:10	12/11/2015 10:46
20Mg48	9.92	3.30		0.51851394	20.076	0.066	0.101	0.99	0.00		0.014	48.6	0.1016	12/9/2015 10:11	12/11/2015 10:47
20Mg48b	9.89	3.36		0.526339277	20.0485	0.067	0.101	0.99	0.00		0.010	48.6	0.1024	12/9/2015 10:12	12/11/2015 10:48
50Mg48	9.85	11.1		1.045322979	19.0034	0.211	0.237	2.27	0.36		0.014	48.6	0.1043	12/9/2015 10:13	12/11/2015 10:49
50Mg48b	9.83	11.2		1.049218023	20.0361	0.224	0.226	2.26	0.35		0.012	48.6	0.1000	12/9/2015 10:14	12/11/2015 10:50
100Mg48	9.74	26.9		1.42975228	20.0452	0.539	0.391	3.81	0.58		0.014	48.6	0.1027	12/9/2015 10:16	12/11/2015 10:51
100Mg48b	9.75	28.5		1.45484486	20.0567	0.572	0.392	3.76	0.58		0.010	48.6	0.1043	12/9/2015 10:17	12/11/2015 10:52
1F		0.423			20	0.008					0.012				
1Fb		0.425			20	0.009					0.014				
2.5F		1.10			20	0.022					0.012				
2.5Fb		1.10			20	0.022					0.014				
5F		2.12			20	0.042					0.012				
5Fb		2.18			20	0.044					0.014				
10F		4.20			20	0.084					0.013				
10Fb		4.37			20	0.087					0.015				
20F		8.35			20	0.167					0.015				
20Fb		8.43			20	0.169					0.016				
50F		22.4			20	0.448					0.020				
50Fb		22.5			20	0.450					0.022				
100F		46.5			20	0.930					0.031				
100Fb		48.2			20	0.964					0.030				

KEY
= BQL
= Non Detect

AVERAGE OF DUPLICATES

1Mg5	9.71	0.03	0	0.08		
2.5Mg5	9.77	0.03	0	0.21		
5Mg5	9.75	0.3445	0.1035	0.36		
10Mg5	9.83	0.702	0.0045	0.70		
20Mg5	9.81	4.63	0.325	0.74		
50Mg5	9.76	14.7	0.15	1.50		
100Mg5	9.68	33.3	1.4	2.78		
1Mg24	9.88	0.03	0.00	0.08		
2.5Mg24	9.88	0.03	0	0.21		
5Mg24	9.85	0.6745	0.04	0.29		
10Mg24	9.86	1.74	0.17	0.50		
20Mg24	9.84	3.90	0.03	0.86		
50Mg24	9.84	13.0	0.2	1.83		
100Mg24	9.75	29.8	0.1	3.35		
1Mg48	9.88	0.03	0.00	0.08	0.000614355	
2.5Mg48	9.92	0.03	0.00	0.21	0.004328296	
5Mg48	9.89	0.430	0.02	0.27	0.013565211	
10Mg48	9.92	1.22	0.195	0.48	0.013501718	
20Mg48	9.91	3.33	0.03	0.79	0.001491508	
50Mg48	9.84	11.2	0.0	1.63	0.008465799	
100Mg48	9.75	27.7	0.8	3.03	0.02151599	
1F		0.424	0.001			
2.5F		1.10	0.00			
5F		2.15	0.03			
10F		4.29	0.09			
20F		8.39	0.04			
50F		22.5	0.1			
100F		47.4	0.9			

Freundlich isotherm Data

	log x/m	STDEV log (x/m)	log Conc. F	STDEV log [F]
1Mg48	-1.11	0.003	-1.51	0
2.5Mg48	-0.68	0.009	-1.51	0
5Mg48	-0.57	0.018	-0.37	0.022772013
10Mg48	-0.32	0.010	0.08	0.07030947
20Mg48	-0.10	0.001	0.52	0.003912669
50Mg48	0.21	0.002	1.05	0.001947522
100Mg48	0.48	0.002	1.44	0.01254629

Brucite controlled pH with varied [F]

AVERAGE OF DUPLICATES

ID	pH	pH averag	pH STDEV	Dissolved	mass sorbed F on hAP (mg/g)	Time	percent Dissolved F removed	First Order (ln[F])	Second order (1/[F])
1F	0.00			0.42	0.000	0		-0.85802	2.358491
1Mg5	9.71	9.82	0.08	0.03	0.076	5.3	92.69	-3.47377	32.25806
1Mg24	9.88			0.03	0.077	24.1	92.69	-3.47377	32.25806
1Mg48	9.88			0.03	0.078	47.6	92.69	-3.47377	32.25806
2.5F	0.00			1.10		0		0.09531	0.909091
2.5Mg5	9.77	9.85	0.06	0.03	0.210	5.3	97.18	-3.47377	32.25806
2.5Mg24	9.88			0.03	0.211	24.1	97.18	-3.47377	32.25806
2.5Mg48	9.92			0.03	0.210	47.6	97.18	-3.47377	32.25806
5F	0.00			2.15		0		0.765468	0.465116
5Mg5	9.75	9.83	0.06	0.34	0.357	5.3	83.98	-1.06566	2.902758
5Mg24	9.85			0.67	0.289	24.1	68.63	-0.39378	1.48258
5Mg48	9.89			0.43	0.268	47.6	80.02	-0.84513	2.328289
10F	0.00			4.29		0		1.455121	0.233372
10Mg5	9.83	9.87	0.04	0.70	0.700	5.3	83.63	-0.35453	1.425517
10Mg24	9.86			1.74	0.503	24.1	59.39	0.553885	0.574713
10Mg48	9.92			1.22	0.481	47.6	71.65	0.194744	0.823045
20F	0.00			8.39		0		2.127041	0.11919
20Mg5	9.81	9.85	0.04	4.63	0.737	5.3	44.87	1.531476	0.216216
20Mg24	9.84			3.90	0.862	24.1	53.52	1.360977	0.25641
20Mg48	9.91			3.33	0.788	47.6	60.31	1.202972	0.3003
50F	0.00			22.45		0		3.111291	0.044543
50Mg5	9.76	9.81	0.04	14.65	1.501	5.3	34.74	2.68444	0.068259
50Mg24	9.84			13.00	1.829	24.1	42.09	2.564949	0.076923
50Mg48	9.84			11.15	1.631	47.6	50.33	2.411439	0.089686
100F	0.00			47.35		0		3.857567	0.021119
100Mg5	9.68	9.72	0.03	33.30	2.776	5.3	29.67	3.505557	0.03003
100Mg24	9.75			29.80	3.347	24.1	37.06	3.394508	0.033557
100Mg48	9.75			27.70	3.031	47.6	41.50	3.321432	0.036101

pH average of all and STDEV

pH average	STDEV
9.82	0.07

1Mg5	9.71
2.5Mg5	9.77
5Mg5	9.75
10Mg5	9.83
20Mg5	9.81
50Mg5	9.76
100Mg5	9.68
1Mg24	9.88
2.5Mg24	9.88
5Mg24	9.85
10Mg24	9.86
20Mg24	9.84
50Mg24	9.84
100Mg24	9.75

Brucite controlled pH with varied [F]

1Mg48	9.88
2.5Mg48	9.92
5Mg48	9.89
10Mg48	9.92
20Mg48	9.91
50Mg48	9.84
100Mg48	9.75

ID					[F] mg/l
1hAP5	7062-1	-		1/12/2016	0.925
1hAP5b	7062-2	-		1/12/2016	1.11
2.5hAP5	7062-3	-		1/12/2016	1.22
2.5hAP5b	7062-4	-		1/12/2016	1.16
5hAP5	7062-5	-		1/12/2016	1.15
5hAP5b	7062-6	-		1/12/2016	1.16
10hAP5	7062-7	-		1/12/2016	1.14
10hAP5b	7062-8	-		1/12/2016	1.09
50hAP5	7062-11	-		1/12/2016	9.41
50hAP5b	7062-12	-		1/12/2016	8.00
100hAP5	7062-13	-		1/12/2016	27.0
100hAP5b	7062-14	-	#######	1/12/2016	29.8
1hAP24	7062-15	-	#######	1/12/2016	0.860
1hAP24b	7062-16	-	#######	1/12/2016	1.19
2.5hAP24	7062-17	-	#######	1/12/2016	1.15
2.5hAP24b	7062-18	-	#######	1/12/2016	1.20
5hAP24	7062-19	-	#######	1/12/2016	1.22
5hAP24b	7062-20	-	#######	1/12/2016	1.18
5hAP24b	2-20 Lab	-	#######	1/12/2016	4 (RPD=4.96)
10hAP24	7062-21	-	#######	1/12/2016	1.12
10hAP24b	7062-22	-	#######	1/12/2016	1.21
50hAP24	7062-25	-	#######	1/12/2016	8.30
50hAP24b	7062-26	-	#######	1/12/2016	7.03
100hAP24	7062-27	-	#######	1/12/2016	21.8
100hAP24	7062-28	-	#######	1/12/2016	20.6
1hAP48	7062-29	-	#######	1/12/2016	1.22
1hAP48b	7062-30	-	#######	1/12/2016	1.21
1hAP48b	2-30 Lab	-	#######	1/12/2016	21 (RPD=0)
2.5hAP48	7062-31	-	#######	1/12/2016	1.17
2.5hAP48b	7062-32	-	#######	1/12/2016	1.18
5hAP48	7062-33	-	#######	1/12/2016	1.20
5hAP48b	7062-34	-	#######	1/12/2016	1.23
10hAP48	7062-35	-	#######	1/12/2016	1.22
10hAP48b	7062-36	-	#######	1/12/2016	1.05
50hAP48	7062-39	-		1/12/2016	6.56
50hAP48b	7062-40	-		1/12/2016	5.87
50hAP48b	2-40 Lab	-		1/12/2016	) (RPD=0.510)
100hAP48	7062-41	-		1/12/2016	22.6
100hAP48	7062-42	-		1/12/2016	18.5
1F	7062-43	-		1/12/2016	0.423
1Fb	7062-44	-		1/12/2016	0.425
2.5F	7062-45	-		1/12/2016	1.10
2.5Fb	7062-46	-		1/12/2016	1.10
5F	7062-47	-		1/12/2016	2.12
5Fb	7062-48	-		1/12/2016	2.18
10Fb	2-50 Lab	-	#######	1/12/2016	(RPD=0.459)
50F	7062-53	-	#######	1/13/2016	22.4
50Fb	7062-54	-	#######	1/13/2016	22.5
100F	7062-55	-	#######	1/13/2016	46.5
100Fb	7062-56	-	#######	1/13/2016	48.2
1000F	7062-57	-	#######	1/13/2016	483
1000Fb	7062-58	-	#######	1/13/2016	445
a50hAP48	7062-59	-	#######	1/13/2016	6.58
50hAP48	7062-60	-	#######	1/13/2016	6.29
50hAP48	2-60 Lab	-	#######	1/13/2016	6 (RPD=4.20)
100hAP4	7062-61	-	#######	1/13/2016	19.9
100hAP48	7062-62	-	#######	1/13/2016	19.5
1Mg5	7062-63	-	#######	1/13/2016	ND
1Mg5b	7062-64	-	#######	1/13/2016	ND
2.5Mg5	7062-65	-		1/13/2016	ND
2.5Mg5b	7062-66	-		1/13/2016	ND
5Mg5	7062-67	-		1/13/2016	0.448
5Mg5b	7062-68	-		1/13/2016	0.241
10Mg5b	2-70 Lab	-		1/13/2016	5 (RPD=4.49)
50Mg5	7062-73	-		1/13/2016	14.8
50Mg5b	7062-74	-		1/13/2016	14.5
100Mg5	7062-75	-		1/13/2016	31.9
100Mg5b	7062-76	-		1/13/2016	34.7
1Mg24	7062-77	-	#######	1/13/2016	ND
1Mg24b	7062-78	-	#######	1/13/2016	ND
2.5Mg24	7062-79	-	#######	1/13/2016	ND
2.5Mg24b	7062-80	-	#######	1/13/2016	ND
2.5Mg24b	2-80 Lab	-	#######	1/13/2016	D (RPD=NA)
5Mg24	7062-81	-	#######	1/13/2016	0.637
5Mg24b	7062-82	-	#######	1/13/2016	0.712
50Mg24	7062-87	-	#######	1/13/2016	13.2
50Mg24b	7062-88	-	#######	1/13/2016	12.8
100Mg24	7062-89	-	#######	1/13/2016	29.7
100Mg24b	7062-90	-	#######	1/13/2016	29.9
100Mg24b	2-90 Lab	-	#######	1/13/2016	3 (RPD=2.03)
1Mg48	7062-91	-	#######	1/13/2016	ND
1Mg48b	7062-92	-	#######	1/13/2016	ND
2.5Mg48	7062-93	-	#######	1/13/2016	ND

10F	7062-49	-	#######	#######	4.20
10Fb	7062-50	-	#######	#######	4.37
10Mg5	7062-69	-		#######	0.697
10Mg5b	7062-70	-		#######	0.706
10Mg24	7062-83	-	#######	#######	1.57
10Mg24b	7062-84	-	#######	#######	1.91
10Mg48	7062-97	-	#######	#######	1.02
10Mg48b	7062-98	-	#######	#######	1.41

ID					[F]
20F	7062-51	-	#######	#######	8.35
20Fb	7062-52	-	#######	#######	8.43
20Mg5	7062-71	-		#######	4.30
20Mg5b	7062-72	-		#######	4.95
20Mg24	7062-85	-	#######	#######	3.93
20Mg24b	7062-86	-	#######	#######	3.87
20Mg48	7062-99	-	#######	#######	3.30
20Mg48b	7062-100	-		#######	3.36
20hAP5b	7062-10	-		#######	0.993
20hAP5	7062-9	-		#######	0.627
20hAP24	7062-23	-	#######	#######	0.853
20hhAP24	7062-24	-	#######	#######	0.939
20hAP48	7062-37	-		#######	1.43
20hAP48b	7062-38	-		#######	0.444

Brucite 20F

Time	ID	average	stdev	ln [F]	1/[F]
0	20F	8.39	0.04	2.127041	0.11919
5	20Mg5	4.63	0.325	1.531476	0.216216
24	20Mg24	3.90	0.03	1.360977	0.25641
48	20Mg48	3.33	0.03	1.202972	0.3003

Hap 20 F

0	20F	8.39
5	20hAP5	0.810
24	20hAP24	0.896
48	20hAP48	0.937

2.5Mg48b	7062-94	-	#######	1/13/2016	ND
5Mg48	7062-95	-	#######	1/13/2016	0.452
5Mg48b	7062-96	-	#######	1/13/2016	0.407

20Mg48b	2-100 Lab	-		1/13/2016	3 (RPD=2.06)
50Mg48	7062-101	-		1/13/2016	11.1
50Mg48b	7062-102	-		1/13/2016	11.2
100Mg48	7062-103	-		1/13/2016	26.9
100Mg48b	7062-104	-		1/13/2016	28.5
100Mg48b	2-104 Lab	-		1/13/2016	9 (RPD=2.13)

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC06

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Lisa Costantino

Date: 2/3/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway
Lisa Costantino

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 2/1/2016
Date Analyzed: 2/2 & 2/3/2016
No. Samples Analyzed: 58

Sample Set No.: 7069
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: diluted as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. No dates of collection were given, so the 48 hour holding time for oP analysis may or may not have been met.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 02/03/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	** 0.039	**MDL**	0.002
QL	** 0.200	**QL**	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
5Fe5	7069-1	-	2/3/2016	0.609	1	2/2/2016	BQL (0.018)	1
5Fe5b	7069-2	-	2/3/2016	0.654	1	2/2/2016	BQL (0.017)	1
10Fe5	7069-3	-	2/3/2016	2.42	1	2/2/2016	0.021	1
10Fe5b	7069-4	-	2/3/2016	2.43	1	2/2/2016	BQL (0.018)	1
20Fe5	7069-5	-	2/3/2016	5.57	1	2/2/2016	BQL (0.018)	1
20Fe5b	7069-6	-	2/3/2016	6.07	1	2/2/2016	BQL (0.018)	1
50Fe5	7069-7	-	2/3/2016	18.2	3	2/2/2016	BQL (0.018)	1
50Fe5b	7069-8	-	2/3/2016	17.9	3	2/2/2016	BQL (0.017)	1
100Fe5	7069-9	-	2/3/2016	42.3	6	2/2/2016	BQL (0.017)	1
100Fe5b	7069-10	-	2/3/2016	42.0	6	2/2/2016	BQL (0.019)	1
100Fe5b	7069-10 Lab dup	-	2/3/2016	41.2 (RPD=1.92)	6	2/2/2016	BQL (0.017) (RPD=NA)	1
200Fe5	7069-11	-	2/3/2016	84.0	11	2/2/2016	BQL (0.018)	1
200Fe5b	7069-12	-	2/3/2016	85.3	11	2/2/2016	BQL (0.018)	1
500Fe5	7069-13	-	2/3/2016	224	31	2/2/2016	BQL (0.018)	1
500Fe5b	7069-14	-	2/3/2016	224	31	2/2/2016	BQL (0.018)	1
5Fe24	7069-15	-	2/3/2016	0.614	1	2/2/2016	BQL (0.019)	1
5Fe24b	7069-16	-	2/3/2016	0.871	1	2/2/2016	BQL (0.018)	1
10Fe24	7069-17	-	2/3/2016	1.87	1	2/2/2016	BQL (0.018)	1
10Fe24b	7069-18	-	2/3/2016	1.80	1	2/2/2016	BQL (0.019)	1
20Fe24	7069-19	-	2/3/2016	5.14	1	2/2/2016	BQL (0.018)	1
20Fe24b	7069-20	-	2/3/2016	5.75	1	2/2/2016	BQL (0.019)	1
20Fe24b	70469-20 Lab dup	-	2/3/2016	5.53 (RPD=3.90)	1	2/2/2016	BQL (0.018) (RPD=NA)	1
50Fe24	7069-21	-	2/3/2016	18.3	6	2/2/2016	BQL (0.019)	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 02/03/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	** 0.039	**MDL**	0.002
QL	** 0.200	**QL**	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
50Fe24b	7069-22	-	2/3/2016	19.0	6	2/2/2016	BQL (0.015)	1
100Fe24	7069-23	-	2/3/2016	41.3	6	2/2/2016	BQL (0.018)	1
100Fe24b	7069-24	-	2/3/2016	41.3	6	2/2/2016	BQL (0.018)	1
200Fe24	7069-25	-	2/3/2016	86.6	11	2/2/2016	BQL (0.018)	1
200Fe24b	7069-26	-	2/3/2016	86.1	11	2/2/2016	BQL (0.019)	1
500Fe24	7069-27	-	2/3/2016	228	31	2/2/2016	BQL (0.019)	1
500Fe24b	7069-28	-	2/3/2016	227	31	2/2/2016	BQL (0.018)	1
5Fe48	7069-29	-	2/3/2016	0.599	1	2/2/2016	BQL (0.018)	1
5Fe48b	7069-30	-	2/3/2016	0.513	1	2/2/2016	BQL (0.019)	1
5Fe48b	7069-30 Lab dup	-	2/3/2016	0.522 (RPD=1.74)	1	2/2/2016	BQL (0.018) (RPD=NA)	1
10Fe48	7069-31	-	2/3/2016	1.75	1	2/2/2016	BQL (0.018)	1
10Fe48b	7069-32	-	2/3/2016	1.78	1	2/2/2016	0.020	1
20Fe48	7069-33	-	2/3/2016	4.73	1	2/2/2016	BQL (0.018)	1
20Fe48b	7069-34	-	2/3/2016	5.09	1	2/2/2016	BQL (0.018)	1
50Fe48	7069-35	-	2/3/2016	17.1	3	2/2/2016	BQL (0.017)	1
50Fe48b	7069-36	-	2/3/2016	17.0	3	2/2/2016	BQL (0.019)	1
100Fe48	7069-37	-	2/3/2016	40.5	6	2/2/2016	BQL (0.018)	1
100Fe48b	7069-38	-	2/3/2016	40.1	6	2/2/2016	BQL (0.018)	1
200Fe48	7069-39	-	2/3/2016	88.1	11	2/2/2016	BQL (0.019)	1
200Fe48b	7069-40	-	2/3/2016	88.3	11	2/2/2016	BQL (0.018)	1
200Fe48b	7069-40 Lab dup	-	2/3/2016	87.3 (RPD=1.14)	11	2/2/2016	BQL (0.017) (RPD=NA)	1
500Fe48	7069-41	-	2/3/2016	221	41	2/2/2016	BQL (0.019)	1
500Fe48b	7069-42	-	2/3/2016	228	41	2/2/2016	BQL (0.017)	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 02/03/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	** 0.039	**MDL**	0.002
QL	** 0.200	**QL**	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
5FFe	7069-43	-	2/3/2016	2.26	1	2/2/2016	BQL (0.019)	1
5FFeb	7069-44	-	2/3/2016	2.15	1	2/2/2016	BQL (0.019)	1
10FFe	7069-45	-	2/3/2016	4.47	1	2/2/2016	BQL (0.019)	1
10FFeb	7069-46	-	2/3/2016	4.50	1	2/2/2016	BQL (0.018)	1
20FFe	7069-47	-	2/3/2016	8.96	1	2/2/2016	0.021	1
20FFeb	7069-48	-	2/3/2016	9.23	1	2/2/2016	0.021	1
50FFe	7069-49	-	2/3/2016	23.3	3	2/2/2016	0.029	1
50FFeb	7069-50	-	2/3/2016	23.4	3	2/2/2016	0.026	1
50FFeb	7069-50 Lab dup	-	2/3/2016	23.1 (RPD=1.29)	3	2/2/2016	0.027 (RPD=3.77)	1
100FFe	7069-51	-	2/3/2016	49.4	6	2/2/2016	0.035	1
100FFeb	7069-52	-	2/3/2016	49.3	6	2/2/2016	0.039	1
200FFe	7069-53	-	2/3/2016	97.1	11	2/2/2016	0.059	1
200FFeb	7069-54	-	2/3/2016	98.8	11	2/2/2016	0.060	1
500FFe	7069-55	-	2/3/2016	243	31	2/2/2016	0.102	1
500FFeb	7069-56	-	2/3/2016	243	31	2/2/2016	0.134	1
FeDI	7069-57	-	2/3/2016	ND	1	2/2/2016	BQL (0.018)	1
FeDIb	7069-58	-	2/3/2016	ND	1	2/2/2016	BQL (0.017)	1
FeDIb	7069-58 Lab dup	-	2/3/2016	ND (RPD=NA)	1	2/2/2016	BQL (0.019) (RPD=NA)	1

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 02/03/16

Sample Results

Analytes	Fluoride (F)			**Analytes**	ortho-Phosphate (as P)			
Codes	7782-41-4			**Codes**	70507			
Methods	RSKSOP-276/4			**Methods**	NRMRL-GWERD-05-0			
Unit	mg/L			**Unit**	mg/L			
MDL	** 0.039			**MDL**	0.002			
QL	** 0.200			**QL**	0.020			
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

RAW DATA

ID	pH	Ce, (mg F/l)		LogCe, (mg F/l)	Stock Soln [F] (mg/l)	Sorbed Fluoride (mg/l)	V soln (ml)	Dissolved P (mg/l)	Time	mass Fe(OH)3 (g)	mass sorbed F- (mg)	x/m (mg F/ g Fe(OH)3arw)	Log x/m (mg F/ g Fe(OH)3arw)	Ce/qe	STDEV (Ce/qe)	log (Ce/qe)	Time F- added	Time Filtered
5Fe5	6.45	0.609		-0.215382707	2.26	1.65	20.068	BQL (0.018)	7.5	0.1004	0.03	0.33	-0.48	1.85		0.27	1/26/2016 10:37	1/26/2016 18:06
5Fe5b	6.26	0.654		-0.184422252	2.15	1.50	20.177	BQL (0.017)	7.4	0.1018	0.03	0.30	-0.53	2.21		0.34	1/26/2016 10:38	1/26/2016 18:05
10Fe5	6.24	2.42		0.383815366	4.47	2.05	20.1	0.021	7.3	0.1003	0.04	0.41	-0.39	5.89		0.77	1/26/2016 10:47	1/26/2016 18:04
10Fe5b	6.36	2.43		0.385606274	4.50	2.07	20.091	BQL (0.018)	7.2	0.1042	0.04	0.40	-0.40	6.09		0.78	1/26/2016 10:49	1/26/2016 18:03
20Fe5	6.29	5.57		0.745855195	8.96	3.39	20.161	BQL (0.018)	7.1	0.1033	0.07	0.66	-0.18	8.42		0.93	1/26/2016 10:56	1/26/2016 18:02
20Fe5b	6.32	6.07		0.783188691	9.23	3.16	20.07	BQL (0.018)	7.0	0.1034	0.06	0.61	-0.21	9.90		1.00	1/26/2016 10:58	1/26/2016 18:01
50Fe5	7.4	18.2		1.260071388	23.3	5.10	20.154	BQL (0.018)	6.6	0.1000	0.10	1.03	0.01	17.71		1.25	1/26/2016 11:23	1/26/2016 18:00
50Fe5b	7.16	17.9		1.252853031	23.4	5.50	20.057	BQL (0.017)	6.6	0.1012	0.11	1.09	0.04	16.42		1.22	1/26/2016 11:25	1/26/2016 17:59
100Fe5	7.19	42.3		1.626340367	49.4	7.10	20.136	BQL (0.017)	6.4	0.1024	0.14	1.40	0.14	30.30		1.48	1/26/2016 11:33	1/26/2016 17:58
100Fe5b	7.37	42.0		1.62324929	49.3	7.30	20.119	BQL (0.019)	6.4	0.1011	0.15	1.45	0.16	28.91		1.46	1/26/2016 11:34	1/26/2016 17:57
200Fe5	7.01	84.0		1.924279286	97.1	13.10	20.107	BQL (0.018)	6.2	0.1019	0.26	2.58	0.41	32.50		1.51	1/26/2016 11:41	1/26/2016 17:56
200Fe5b	6.95	85.3		1.930949031	98.8	13.50	20.048	BQL (0.018)	6.2	0.1000	0.27	2.71	0.43	31.52		1.50	1/26/2016 11:42	1/26/2016 17:55
500Fe5	7.14	224		2.350248018	243	19.00	20.017	BQL (0.018)	6.0	0.1007	0.38	3.78	0.58	59.31		1.77	1/26/2016 11:51	1/26/2016 17:54
500Fe5b	7.14	224		2.350248018	243	19.00	20.038	BQL (0.018)	6.0	0.1001	0.38	3.80	0.58	58.89		1.77	1/26/2016 11:52	1/26/2016 17:53
5Fe24	7.01	0.614		-0.211831629	2.26	1.65	20.228	BQL (0.019)	24.9	0.1000	0.03	0.33	-0.48	1.84		0.27	1/26/2016 10:39	1/27/2016 11:33
5Fe24b	7.02	0.871		-0.059981845	2.15	1.28	20.182	BQL (0.018)	24.9	0.1018	0.03	0.25	-0.60	3.44		0.54	1/26/2016 10:41	1/27/2016 11:34
10Fe24	6.66	1.87		0.271841607	4.47	2.60	19.909	BQL (0.018)	24.7	0.1002	0.05	0.52	-0.29	3.62		0.56	1/26/2016 10:51	1/27/2016 11:35
10Fe24b	6.56	1.80		0.255272505	4.50	2.70	20.087	BQL (0.019)	24.7	0.1001	0.05	0.54	-0.27	3.32		0.52	1/26/2016 10:53	1/27/2016 11:36
20Fe24	6.87	5.14		0.710963119	8.96	3.82	20.097	BQL (0.018)	24.6	0.1010	0.08	0.76	-0.12	6.76		0.83	1/26/2016 10:58	1/27/2016 11:37
20Fe24b	6.83	5.75		0.759667845	9.23	3.48	20.14	BQL (0.019)	24.6	0.1008	0.07	0.70	-0.16	8.27		0.92	1/26/2016 11:00	1/27/2016 11:38
50Fe24	6.91	18.3		1.26245109	23.3	5.00	20.163	BQL (0.019)	24.2	0.1009	0.10	1.00	0.00	18.32		1.26	1/26/2016 11:27	1/27/2016 11:39
50Fe24b	6.7	19.0		1.278753601	23.4	4.40	20.146	BQL (0.015)	24.2	0.1015	0.09	0.87	-0.06	21.76		1.34	1/26/2016 11:30	1/27/2016 11:40
100Fe24	7.03	41.3		1.615950052	49.4	8.10	20.064	BQL (0.018)	24.1	0.1013	0.16	1.60	0.21	25.74		1.41	1/26/2016 11:35	1/27/2016 11:41
100Fe24b	6.87	41.3		1.615950052	49.3	8.00	20.05	BQL (0.018)	24.1	0.1002	0.16	1.60	0.20	25.80		1.41	1/26/2016 11:36	1/27/2016 11:42
200Fe24	7.02	86.6		1.937517892	97.1	10.50	20.127	BQL (0.018)	23.9	0.1001	0.21	2.11	0.32	41.02		1.61	1/26/2016 11:48	1/27/2016 11:43
200Fe24b	7.01	86.1		1.935003151	98.8	12.70	20.064	BQL (0.019)	24.0	0.1016	0.25	2.51	0.40	34.33		1.54	1/26/2016 11:44	1/27/2016 11:44
500Fe24	7.32	228		2.357934847	243	15.00	20.044	BQL (0.019)	23.9	0.1000	0.30	3.01	0.48	75.83		1.88	1/26/2016 11:52	1/27/2016 11:45
500Fe24b	7.32	227		2.356025857	243	16.00	20.12	BQL (0.018)	23.9	0.1024	0.32	3.14	0.50	72.21		1.86	1/26/2016 11:53	1/27/2016 11:46
5Fe48	7.2	0.599		-0.222573178	2.26	1.66	20.231	BQL (0.018)	50.6	0.1012	0.03	0.33	-0.48	1.80		0.26	1/26/2016 10:42	1/28/2016 13:19
5Fe48b	6.51	0.513		-0.289882635	2.15	1.64	20.113	BQL (0.019)	50.6	0.1004	0.03	0.33	-0.48	1.56		0.19	1/26/2016 10:45	1/28/2016 13:20
10Fe48	6.32	1.75		0.243038049	4.47	2.72	19.981	BQL (0.018)	50.6	0.1007	0.05	0.54	-0.27	3.24		0.51	1/26/2016 10:45	1/28/2016 13:21
10Fe48b	6.35	1.78		0.250420002	4.50	2.72	20.092	0.020	50.5	0.1017	0.05	0.54	-0.27	3.31		0.52	1/26/2016 10:54	1/28/2016 13:22
20Fe48	6.57	4.73		0.674861141	8.96	4.23	20.213	BQL (0.018)	50.3	0.1000	0.09	0.86	-0.07	5.53		0.74	1/26/2016 11:06	1/28/2016 13:23
20Fe48b	6.49	5.09		0.706717782	9.23	4.14	20.095	BQL (0.018)	50.2	0.1004	0.08	0.83	-0.08	6.14		0.79	1/26/2016 11:10	1/28/2016 13:24
50Fe48	6.6	17.1		1.23299611	23.3	6.20	20.276	BQL (0.017)	49.9	0.1014	0.13	1.24	0.09	13.79		1.14	1/26/2016 11:30	1/28/2016 13:25
50Fe48b	6.49	17.0		1.230448921	23.4	6.40	20.063	BQL (0.019)	49.9	0.1003	0.13	1.28	0.11	13.28		1.12	1/26/2016 11:32	1/28/2016 13:26
100Fe48	6.76	40.5		1.607455023	49.4	8.90	20.122	BQL (0.018)	49.8	0.1002	0.18	1.79	0.25	22.66		1.36	1/26/2016 11:36	1/28/2016 13:27
100Fe48b	6.86	40.1		1.603144373	49.3	9.20	20.185	BQL (0.018)	49.8	0.1018	0.19	1.82	0.26	21.98		1.34	1/26/2016 11:37	1/28/2016 13:28
200Fe48	7.01	88.1		1.944975908	97.1	9.00	20.047	BQL (0.019)	49.7	0.1009	0.18	1.79	0.25	49.27		1.69	1/26/2016 11:45	1/28/2016 13:29
200Fe48b	6.98	88.3		1.945960704	98.8	10.50	20.01	BQL (0.018)	49.7	0.1009	0.21	2.08	0.32	42.40		1.63	1/26/2016 11:49	1/28/2016 13:30
500Fe48	7.19	221		2.344392274	243	22.00	20.074	BQL (0.019)	49.6	0.1011	0.44	4.37	0.64	50.59		1.70	1/26/2016 11:55	1/28/2016 13:31
500Fe48b	7.12	228		2.357934847	243	15.00	20.358	BQL (0.017)	49.6	0.1001	0.31	3.05	0.48	74.74		1.87	1/26/2016 11:57	1/28/2016 13:32

BACKGROUND SAMPLES

5FFe		2.26						BQL (0.019)										
5FFeb		2.15						BQL (0.019)										
10FFe		4.47						BQL (0.019)										
10FFeb		4.50						BQL (0.018)										
20FFe		8.96						0.021										
20FFeb		9.23						0.021										
50FFe		23.3						0.029										
50FFeb		23.4						0.026										
100FFe		49.4						0.035										
100FFeb		49.3						0.039										
200FFe		97.1						0.059										
200FFeb		98.8						0.060										
500FFe		243						0.102										
500FFeb		243						0.134										
FeDI	4.78	ND					19.988	BQL (0.018)	49.3	0.1014	#VALUE!						1/26/2016 11:59	1/28/2016 13:18
FeDIb	5.07	ND					20.053	BQL (0.017)	49.3	0.1011	#VALUE!						1/26/2016 11:59	1/28/2016 13:17

AVERAGE OF DUPLICATES

ID	pH	Ce, (mg F/l)	STDEV (Ce)	LogCe, (mg F/l)	Stock Soln [F] (mg/l)	Sorbed Fluoride (mg/l)	V soln (ml)	Dissolved P (mg/l)	Time	mass Fe(OH)3 (g)	mass sorbed F- (mg)	x/m (mg F/ g Fe(OH)3arw)	STDEV (x/m)	Log x/m (mg F/ g Fe(OH)3arw)	Ce/qe	STDEV (Ce/qe)	log (Ce/qe)	Time F- added	Time Filtered
5Fe5	6.355	0.632		-0.200	2.205	1.57	20.123	#DIV/0!	7.5	0.1011	0.032	0.313		-0.505	2.026		0.305		
10Fe5	6.3	2.425		0.385	4.485	2.06	20.096	0.021	7.3	0.1023	0.041	0.405		-0.393	5.990		0.777		
20Fe5	6.305	5.820		0.765	9.095	3.28	20.116	#DIV/0!	7.1	0.1034	0.066	0.637		-0.196	9.158		0.960		
50Fe5	7.28	18.050		1.256	23.350	5.30	20.106	#DIV/0!	6.6	0.1006	0.107	1.059		0.025	17.064		1.232		
100Fe5	7.28	42.150		1.625	49.350	7.20	20.128	#DIV/0!	6.4	0.1018	0.145	1.424		0.154	29.605		1.471		
200Fe5	6.98	84.650		1.928	97.950	13.30	20.078	#DIV/0!	6.2	0.1010	0.267	2.646		0.422	32.007		1.505		
500Fe5	7.14	224.000		2.350	243.000	19.00	20.028	#DIV/0!	6.0	0.1004	0.381	3.790		0.579	59.102		1.772		
5Fe24	7.015	0.743		-0.136	2.205	1.46	20.205	#DIV/0!	24.9	0.1009	0.030	0.293		-0.537	2.640		0.401		
10Fe24	6.61	1.835		0.264	4.485	2.65	19.998	#DIV/0!	24.7	0.1002	0.053	0.529		-0.277	3.471		0.540		
20Fe24	6.85	5.445		0.735	9.095	3.65	20.119	#DIV/0!	24.6	0.1009	0.073	0.728		-0.138	7.516		0.874		
50Fe24	6.805	18.650		1.271	23.350	4.70	20.155	#DIV/0!	24.2	0.1012	0.095	0.936		-0.030	20.036		1.300		
100Fe24	6.95	41.300		1.616	49.350	8.05	20.057	#DIV/0!	24.1	0.1008	0.161	1.603		0.205	25.771		1.411		
200Fe24	7.015	86.350		1.936	97.950	11.60	20.096	#DIV/0!	24.0	0.1009	0.233	2.310		0.362	37.675		1.574		
500Fe24	7.32	227.500		2.357	243.000	15.50	20.082	#DIV/0!	23.9	0.1012	0.311	3.075		0.488	74.020		1.869		
5Fe48	6.855	0.556	0.043	-0.256	2.205	1.65	20.172	#DIV/0!	50.6	0.1008	0.033	0.330	0.002	-0.482	1.684	0.120	0.225		
10Fe48	6.335	1.765	0.021	0.247	4.485	2.72	20.037	0.02	50.5	0.1012	0.054	0.539	0.001	-0.269	3.277	0.035	0.516		
20Fe48	6.53	4.910	0.255	0.691	9.095	4.19	20.154	#DIV/0!	50.3	0.1002	0.084	0.842	0.019	-0.075	5.837	0.305	0.766		
50Fe48	6.545	17.050	0.071	1.232	23.350	6.30	20.170	#DIV/0!	49.9	0.1009	0.127	1.260	0.029	0.100	13.536	0.257	1.131		
100Fe48	6.81	40.300	0.200	1.605	49.350	9.05	20.154	#DIV/0!	49.8	0.1010	0.182	1.806	0.026	0.257	22.321	0.339	1.349		
200Fe48	6.995	88.200	0.100	1.945	97.950	9.75	20.029	#DIV/0!	49.7	0.1009	0.195	1.935	0.147	0.285	45.837	3.432	1.660		
500Fe48	7.155	224.500	3.500	2.351	243.000	18.50	20.216	#DIV/0!	49.6	0.1006	0.373	3.709	0.659	0.562	62.665	12.073	1.789		

Ferrihydrite controlled pH variable F conc.

ID	Ce, (mg F/l)	STDEV (Ce)	LogCe, (mg F/l)	Stock Soln [F] (mg/	x/m (mg F/ g Fe(OH)3	STDEV (x/	Log x/m (n	Ce/qe	STDEV (C	log (Ce/qe)
5Fe48	0.556	0.043	-0.256227906	2.205	0.32999517	0.002057	-0.4815	1.684126	0.119806	0.225273
10Fe48	1.765	0.0212132	0.246729025	4.485	0.538536211	0.001169	-0.26879	3.277479	0.034968	0.515515
20Fe48	4.91	0.2545584	0.690789462	9.095	0.841814213	0.018662	-0.07484	5.837427	0.305327	0.765627
50Fe48	17.05	0.0707107	1.231722516	23.35	1.259973425	0.028593	0.100305	13.53615	0.25689	1.131417
100Fe48	40.3	0.2	1.605299698	49.35	1.805734054	0.026093	0.256631	22.32126	0.338832	1.348669
200Fe48	88.2	0.1	1.945468306	97.95	1.935222993	0.147086	0.285473	45.837	3.432158	1.659995
500Fe48	224.5	3.5	2.35116356	243	3.709439413	0.65879	0.562349	62.66538	12.0728	1.788815

ID	Ce, (mg F/l)	x/m (mg F/ g Fe(OH)3arw)
5Fe48	0.556	0.3299952
10Fe48	1.765	0.5385362
20Fe48	4.91	0.8418142
50Fe48	17.05	1.2599734
100Fe48	40.3	1.8057341
200Fe48	88.2	1.935223
500Fe48	224.5	3.7094394

ID	pH	average pH	Stdev pH	Ce, (mg F/l)	Time	PERCENT REMOV/	ln[F]	1/[F]
Stock				2.205	0		0.79	0.45
5Fe5	6.355	6.74	0.28	0.632	5	71.36054422	-0.46	1.58
5Fe24	7.015			0.743	24	66.32653061	-0.30	1.35
5Fe48	6.855			0.556	48	74.7845805	-0.59	1.80
Stock				4.485	0		1.50	0.22
10Fe5	6.3	6.42	0.14	2.425	5	45.93088071	0.89	0.41
10Fe24	6.61			1.835	24	59.08584169	0.61	0.54
10Fe48	6.335			1.765	48	60.64659978	0.57	0.57
Stock				9.095	0		2.21	0.11
20Fe5	6.305	6.56	0.22	5.820	5	36.00879604	1.76	0.17
20Fe24	6.85			5.445	24	40.13194063	1.69	0.18
20Fe48	6.53			4.910	48	46.01429357	1.59	0.20
Stock				23.35	0		3.15	0.04
50Fe5	7.28	6.88	0.30	18.050	5	22.69807281	2.89	0.06
50Fe24	6.805			18.650	24	20.12847966	2.93	0.05
50Fe48	6.545			17.050	48	26.98072805	2.84	0.06
Stock				49.35	0		3.90	0.02
100Fe5	7.28	7.01	0.20	42.150	5	14.58966565	3.74	0.02
100Fe24	6.95			41.300	24	16.31205674	3.72	0.02
100Fe48	6.81			40.300	48	18.33839919	3.70	0.02
Stock				97.95	0		4.58	0.01
200Fe5	6.98	7.00	0.01	84.650	5	13.5783563	4.44	0.01
200Fe24	7.015			86.350	24	11.84277693	4.46	0.01
200Fe48	6.995			88.200	48	9.954058193	4.48	0.01
Stock				243	0		5.49	0.00
500Fe5	7.14	7.21	0.08	224.000	5	7.818930041	5.41	0.00
500Fe24	7.32			227.500	24	6.378600823	5.43	0.00
500Fe48	7.155			224.500	48	7.613168724	5.41	0.00

average and STD of all pH	
6.83	0.325741

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 02/03/16

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	2/2/2016	2/2/2016	-	-	-	BQL (0.017)	-	-			
MB	Nanopure Water Blank	2/2/2016	2/2/2016	-	-	-	BQL (0.018)	-	-			
MB	Nanopure Water Blank	2/3/2016	2/3/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	2/3/2016	2/3/2016	ND	-	-	-	-	-			
SS	ERA 67 Simple Nutrients	11/4/2015	2/2/2016	-	-	-	2.00	1.95	103			
SS	ERA 67 Simple Nutrients	11/4/2015	2/2/2016	-	-	-	2.03	1.95	104			
SS	ERA 67 Simple Nutrients	11/4/2015	2/2/2016	-	-	-	2.06	1.95	106			
SS	ERA 67 Minerals	10/27/2015	2/3/2016	2.14	2.12	101	-	-	-			
SS	ERA 67 Minerals	10/27/2015	2/3/2016	2.09	2.12	98.6	-	-	-			
CCC	Continuing Calibration Check Standard	11/4/2015	2/2/2016	-	-	-	0.050	0.050	100			
CCC	Continuing Calibration Check Standard	11/4/2015	2/2/2016	-	-	-	0.093	0.100	93.0			
CCC	Continuing Calibration Check Standard	11/4/2015	2/2/2016	-	-	-	0.236	0.250	94.4			
CCC	Continuing Calibration Check Standard	11/4/2015	2/2/2016	-	-	-	0.480	0.500	96.0			
CCC	Continuing Calibration Check Standard	11/4/2015	2/2/2016	-	-	-	0.986	1.00	98.6			
CCC	Continuing Calibration Check Standard	11/4/2015	2/2/2016	-	-	-	0.091	0.100	91.0			
CCC	Continuing Calibration Check Standard	11/4/2015	2/2/2016	-	-	-	2.07	2.00	104			
CCC	Continuing Calibration Check Standard	12/1/2015	2/3/2016	BQL (0.190)	0.200	95.0	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	2/3/2016	1.06	1.00	106	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	2/3/2016	2.08	2.00	104	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	2/3/2016	4.97	5.00	99.4	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	2/3/2016	9.89	10.0	98.9	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	2/3/2016	1.02	1.00	102	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	2/3/2016	1.99	2.00	99.5	-	-	-			
MS	5Fe5 Spike	2/2 & 2/3/2016	2/2 & 2/3/2016	4.65	0.609 (3.85)	105	1.07	BQL (0.018) (0.990)	106			
MS	50Fe24 Spike	2/2 & 2/3/2016	2/2 & 2/3/2016	* 6.57	* 3.05 (3.23)	109	1.07	BQL (0.019) (0.990)	106			
MS	500Fe48 Spike	2/2 & 2/3/2016	2/2 & 2/3/2016	* 9.63	* 5.39 (3.85)	110	0.848	BQL (0.019) (0.990)	83.7			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 or 0.6 mL of sample to yield spike concentrations of 3.85 or 3.23 mg/L respectively. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spike calculation performed without dilution factors applied.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 02/03/16

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC22

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 4/11/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 4/4/2016
Date Analyzed: 4/5, 4/7 & 4/8/2016
No. Samples Analyzed: 35

Sample Set No.: 7094
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: diluted as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 4/5/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.007 mg/L and 0.039 mg/L respectively. No dates of collection were given, so the 48 hour holding time for oP analysis may or may not have been met.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 04/11/16

Sample Results

Analytes	Fluoride (F)	Analytes	ortho-Phosphate (as P)
Codes	7782-41-4	Codes	70507
Methods	RSKSOP-276/4	Methods	NRMRL-GWERD-05-0
Unit	mg/L	Unit	mg/L
MDL	** 0.039	MDL	0.007
QL	** 0.200	QL	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
F1	7094-1	-	4/7/2016	ND	1	4/5/2016	0.066	1
F2	7094-2	-	4/7/2016	ND	1	4/5/2016	BQL (0.017)	1
F3	7094-3	-	4/7/2016	ND	1	1/0/1900	BQL (0.017)	1
F4	7094-4	-	4/7/2016	ND	1	4/5/2016	0.023	1
F5	7094-5	-	4/7/2016	ND	1	4/5/2016	0.020	1
F6	7094-6	-	4/7/2016	ND	1	4/5/2016	0.022	1
F7	7094-7	-	4/7/2016	ND	1	4/5/2016	BQL (0.018)	1
F8	7094-8	-	4/7/2016	0.328	1	4/5/2016	0.020	1
F9	7094-9	-	4/7/2016	2.49	1	4/5/2016	BQL (0.018)	1
F10	7094-10	-	4/7/2016	6.07	1	4/5/2016	BQL (0.019)	1
F10	7094-10 Lab dup	-	4/7/2016	6.07 (RPD=0)	1	4/5/2016	BQL (0.019) (RPD=NA)	1
F11	7094-11	-	4/7/2016	9.77	1	4/5/2016	0.020	1
F12	7094-12	-	4/8/2016	12.9	6	4/5/2016	0.021	1
F13	7094-13	-	4/8/2016	18.4	6	4/5/2016	BQL (0.017)	1
F14	7094-14	-	4/8/2016	21.1	6	4/5/2016	0.120	1
F15	7094-15	-	4/8/2016	24.3	6	4/5/2016	0.030	1
F16	7094-16	-	4/8/2016	26.4	6	4/5/2016	BQL (0.019)	1
F17	7094-17	-	4/8/2016	30.0	6	4/5/2016	BQL (0.019)	1
F18	7094-18	-	4/8/2016	30.8	6	4/5/2016	BQL (0.017)	1
F19	7094-19	-	4/8/2016	34.3	6	4/5/2016	0.021	1
F20	7094-20	-	4/8/2016	35.8	6	4/5/2016	BQL (0.017)	1
F20	7094-20 Lab dup	-	4/8/2016	36.0 (RPD=0.557)	6	4/5/2016	BQL (0.018) (RPD=NA)	1
F21	7094-21	-	4/8/2016	36.7	6	4/5/2016	BQL (0.019)	1
F22	7094-22	-	4/8/2016	35.7	6	4/5/2016	BQL (0.017)	1
F23	7094-23	-	4/8/2016	36.0	6	4/5/2016	BQL (0.016)	1
F24	7094-24	-	4/8/2016	35.5	6	4/5/2016	BQL (0.016)	1
F25	7094-25	-	4/8/2016	36.8	6	4/5/2016	BQL (0.016)	1
F26	7094-26	-	4/8/2016	36.7	6	4/5/2016	BQL (0.016)	1
F27	7094-27	-	4/8/2016	30.3	6	4/5/2016	BQL (0.017)	1
F28	7094-28	-	4/8/2016	17.1	6	4/5/2016	BQL (0.016)	1
F29	7094-29	-	4/8/2016	11.5	6	4/5/2016	BQL (0.016)	1
F29	7094-29 Lab dup	-	4/8/2016	11.5 (RPD=0)	6	-	-	-
F30	7094-30	-	4/8/2016	7.95	1	4/5/2016	BQL (0.013)	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 04/11/16

Sample Results

Analytes	Fluoride (F)	Analytes	ortho-Phosphate (as P)
Codes	7782-41-4	Codes	70507
Methods	RSKSOP-276/4	Methods	NRMRL-GWERD-05-0
Unit	mg/L	Unit	mg/L
MDL	** 0.039	MDL	0.007
QL	** 0.200	QL	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
F30	7094-30 Lab dup	-	4/8/2016	7.80 (RPD=1.90)	1	4/5/2016	BQL (0.013) (RPD=NA)	1
F31	7094-31	-	4/8/2016	6.14	1	4/5/2016	BQL (0.015)	1
F32	7094-32	-	4/8/2016	4.94	1	4/5/2016	BQL (0.011)	1
F33	7094-33	-	4/8/2016	3.94	1	4/5/2016	BQL (0.016)	1
F34	7094-34	-	4/8/2016	2.93	1	4/5/2016	BQL (0.018)	1
F35	7094-35	-	4/8/2016	2.17	1	4/5/2016	BQL (0.015)	1
F35	7094-35 Lab dup	-	4/8/2016	2.12 (RPD=2.33)	1	4/5/2016	BQL (0.016) (RPD=NA)	1

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 4/5/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.007 mg/L and 0.039 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 04/11/16

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.007	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	4/5/2016	4/5/2016	-	-	-	BQL (0.013)	-	-			
MB	Nanopure Water Blank	4/5/2016	4/5/2016	-	-	-	BQL (0.013)	-	-			
MB	Nanopure Water Blank	4/7/2016	4/7/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	4/7/2016	4/7/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	4/8/2016	4/8/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	4/8/2016	4/8/2016	ND	-	-	-	-	-			
SS	ERA 67 Simple Nutrients	11/4/2015	4/5/2016	-	-	-	1.95	1.95	100			
SS	ERA 67 Simple Nutrients	11/4/2015	4/5/2016	-	-	-	1.93	1.95	99.0			
SS	ERA 67 Simple Nutrients	11/4/2015	4/5/2016	-	-	-	1.97	1.95	101			
SS	ERA 66 Minerals	7/1/2015	4/7/2016	1.66	1.70	97.6	-	-	-			
SS	ERA 66 Minerals	7/1/2015	4/7/2016	1.68	1.70	98.8	-	-	-			
SS	ERA 66 Minerals	7/1/2015	4/8/2016	1.69	1.70	99.4	-	-	-			
CCC	Continuing Calibration Check Standard	11/4/2015	4/5/2016	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	11/4/2015	4/5/2016	-	-	-	0.094	0.100	94.0			
CCC	Continuing Calibration Check Standard	11/4/2015	4/5/2016	-	-	-	0.494	0.500	98.8			
CCC	Continuing Calibration Check Standard	11/4/2015	4/5/2016	-	-	-	0.235	0.250	94.0			
CCC	Continuing Calibration Check Standard	11/4/2015	4/5/2016	-	-	-	0.092	0.100	92.0			
CCC	Continuing Calibration Check Standard	11/4/2015	4/5/2016	-	-	-	1.02	1.00	102			
CCC	Continuing Calibration Check Standard	11/4/2015	4/5/2016	-	-	-	0.049	0.050	98.0			
CCC	Continuing Calibration Check Standard	11/4/2015	4/5/2016	-	-	-	2.07	2.00	104			
CCC	Continuing Calibration Check Standard	12/1/2015	4/7/2016	1.00	1.00	100	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/7/2016	BQL (0.194)	0.200	97.0	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/7/2016	2.13	2.00	107	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/7/2016	4.93	5.00	98.6	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/7/2016	9.79	10.0	97.9	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/8/2016	0.966	1.00	96.6	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/8/2016	2.11	2.00	106	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/8/2016	5.05	5.00	101	-	-	-			
MS	F1 Spike	4/5 & 4/7/2016	4/5 & 4/7/2016	3.91	ND (3.85)	102	1.07	0.066 (0.990)	101			
MS	F21 Spike	4/5 & 4/8/2016	4/5 & 4/8/2016	*9.40	* 6.12 (3.23)	102	1.00	BQL (0.019) (0.990)	99.1			

Comments:

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 04/11/16

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.007	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL or 0.6 mL of sample to yield spike concentrations of 3.85 or 3.23 mg/L respectively. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spike calculation performed without dilution factors applied.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC23

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 4/19/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 4/11/2016
Date Analyzed: 4/11 - 4/18/2016
No. Samples Analyzed: 37

Sample Set No.: 7099
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: diluted as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. No dates of collection were given, so the 48 hour holding time for oP analysis may or may not have been met.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 04/19/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	** 0.039	**MDL**	0.002
QL	** 0.200	**QL**	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
F1B	7099-1	-	4/14/2016	ND	1	4/11/2016	0.154	1
F2B	7099-2	-	4/14/2016	ND	1	4/11/2016	0.040	1
F3B	7099-3	-	4/14/2016	ND	1	4/11/2016	0.029	1
F4B	7099-4	-	4/14/2016	ND	1	4/11/2016	0.041	1
F5B	7099-5	-	4/14/2016	ND	1	4/11/2016	0.050	1
F6B	7099-6	-	4/14/2016	ND	1	4/11/2016	0.030	1
F7B	7099-7	-	4/14/2016	ND	1	4/11/2016	0.041	1
F8B	7099-8	-	4/14/2016	ND	1	4/11/2016	0.033	1
F9B	7099-9	-	4/14/2016	ND	1	4/11/2016	0.029	1
F10B	7099-10	-	4/14/2016	0.787	1	4/11/2016	0.022	1
F10B	7099-10 Lab dup	-	4/14/2016	0.750 (RPD=4.81)	1	4/11/2016	0.021 (RPD=4.65)	1
F11B	7099-11	-	4/14/2016	3.73	6	4/11/2016	0.257	1
F12B	7099-12	-	4/14/2016	9.58	6	4/11/2016	0.024	1
F13B	7099-13	-	4/14/2016	16.7	6	4/11/2016	0.037	1
F14B	7099-14	-	4/14/2016	20.9	6	4/11/2016	0.034	1
F15B	7099-15	-	4/14/2016	27.6	6	4/11/2016	0.030	1
F16B	7099-16	-	4/14/2016	30.0	6	4/11/2016	0.023	1
F17B	7099-17	-	4/14/2016	33.2	6	4/11/2016	0.023	1
F18B	7099-18	-	4/14/2016	35.1	6	4/11/2016	0.024	1
F19B	7099-19	-	4/14/2016	36.7	6	4/11/2016	0.023	1
F20B	7099-20	-	4/14/2016	36.0	6	4/11/2016	0.021	1
F20B	7099-20 Lab dup	-	4/14/2016	37.2 (RPD=3.28)	6	4/11/2016	0.022 (RPD=4.65)	1
F21B	7099-21	-	4/14/2016	37.0	6	4/11/2016	0.021	1
F22B	7099-22	-	4/14/2016	36.1	6	4/11/2016	0.024	1
F23B	7099-23	-	4/14/2016	36.4	6	4/11/2016	BQL (0.019)	1
F24B	7099-24	-	4/14/2016	36.9	6	4/11/2016	BQL (0.019)	1
F25B	7099-25	-	4/14/2016	35.8	6	4/11/2016	0.022	1
F26B	7099-26	-	4/14/2016	36.0	6	4/11/2016	BQL (0.018)	1
F27B	7099-27	-	4/14/2016	27.5	6	4/11/2016	0.022	1
F28B	7099-28	-	4/14/2016	15.0	6	4/11/2016	0.022	1
F29B	7099-29	-	4/14/2016	10.5	6	4/11/2016	0.020	1
F30B	7099-30	-	4/14/2016	7.16	2	4/11/2016	0.021	1
F30B	7099-30 Lab dup	-	4/14/2016	7.11 (RPD=0.701)	2	4/11/2016	0.021 (RPD=0)	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 04/19/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	** 0.039	**MDL**	0.002
QL	** 0.200	**QL**	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
F31B	7099-31	-	4/14/2016	5.42	1	4/11/2016	BQL (0.017)	1
F32B	7099-32	-	4/14/2016	4.38	1	4/11/2016	BQL (0.019)	1
F33B	7099-33	-	4/14/2016	3.45	1	4/11/2016	0.020	1
F34B	7099-34	-	4/14/2016	2.55	1	4/11/2016	0.021	1
F35B	7099-35	-	4/14/2016	1.61	1	4/11/2016	0.021	1
35F	7099-36	-	4/18/2016	37.1	6	4/11/2016	0.027	1
35Fb	7099-37	-	4/18/2016	37.3	6	4/11/2016	0.026	1
35Fb	7099-37 Lab dup	-	4/18/2016	37.4 (RPD=0.268)	6	4/11/2016	0.026 (RPD=0)	1

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 04/19/16

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	4/11/2016	4/11/2016	-	-	-	BQL (0.017)	-	-			
MB	Nanopure Water Blank	4/11/2016	4/11/2016	-	-	-	BQL (0.017)	-	-			
MB	Nanopure Water Blank	4/14/2016	4/14/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	4/14/2016	4/14/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	4/18/2016	4/18/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	4/18/2016	4/18/2016	ND	-	-	-	-	-			
SS	ERA 67 Simple Nutrients	11/4/2015	4/11/2016	-	-	-	1.99	1.95	102			
SS	ERA 67 Simple Nutrients	11/4/2015	4/11/2016	-	-	-	1.99	1.95	102			
SS	ERA 67 Simple Nutrients	11/4/2015	4/11/2016	-	-	-	1.98	1.95	102			
SS	ERA 66 Minerals	7/1/2015	4/14/2016	1.65	1.70	97.1	-	-	-			
SS	ERA 66 Minerals	7/1/2015	4/14/2016	1.66	1.70	97.6	-	-	-			
SS	ERA 66 Minerals	7/1/2015	4/18/2016	1.65	1.70	97.1	-	-	-			
CCC	Continuing Calibration Check Standard	11/4/2015	4/11/2016	-	-	-	0.051	0.050	102			
CCC	Continuing Calibration Check Standard	11/4/2015	4/11/2016	-	-	-	0.097	0.100	97.0			
CCC	Continuing Calibration Check Standard	11/4/2015	4/11/2016	-	-	-	0.500	0.500	100			
CCC	Continuing Calibration Check Standard	11/4/2015	4/11/2016	-	-	-	0.238	0.250	95.2			
CCC	Continuing Calibration Check Standard	11/4/2015	4/11/2016	-	-	-	0.093	0.100	93.0			
CCC	Continuing Calibration Check Standard	11/4/2015	4/11/2016	-	-	-	1.02	1.00	102			
CCC	Continuing Calibration Check Standard	11/4/2015	4/11/2016	-	-	-	1.99	2.00	99.5			
CCC	Continuing Calibration Check Standard	12/1/2015	4/14/2016	BQL (0.190)	0.200	95.0	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/14/2016	0.989	1.00	98.9	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/14/2016	2.14	2.00	107	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/14/2016	5.15	5.00	103	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/14/2016	9.89	10.0	98.9	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/18/2016	0.952	1.00	95.2	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	4/18/2016	5.16	5.00	103	-	-	-			
MS	F1B Spike	4/11 & 4/14/2016	4/11 & 4/14/2016	4.00	ND (3.85)	104	1.21	0.154 (0.990)	107			
MS	F21B Spike	4/11 & 4/14/2016	4/11 & 4/14/2016	*9.35	* 6.17 (3.23)	98.5	1.01	0.021 (0.990)	99.9			

Comments:

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 04/19/16

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL or 0.6 mL of sample to yield spike concentrations of 3.85 or 3.23 mg/L respectively. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spike calculation performed without dilution factors applied.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC54

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Lisa Costantino

Date: 6/14/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Lisa Costantino
Lynda Callaway
Kristie Hargrove

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 6/6/2016
Date Analyzed: 6/7, 6/10, 6/13/2016
No. Samples Analyzed: 35

Sample Set No.: 7122
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: diluted as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. No dates of collection were given, so the 48 hour holding time for oP analysis may or may not have been met.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 06/14/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	0.039	**MDL**	0.002
QL	0.200	**QL**	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
Q1	7122-1	-	6/10/2016	24.0	6	6/7/2016	0.191	1
Q2	7122-2	-	6/10/2016	32.1	6	6/7/2016	0.067	1
Q3	7122-3	-	6/10/2016	36.2	6	6/7/2016	0.052	1
Q4	7122-4	-	6/10/2016	36.4	6	6/7/2016	0.040	1
Q5	7122-5	-	6/10/2016	38.8	6	6/7/2016	0.039	1
Q6	7122-6	-	6/10/2016	38.8	6	6/7/2016	0.034	1
Q7	7122-7	-	6/10/2016	38.6	6	6/7/2016	0.035	1
Q8	7122-8	-	6/10/2016	37.8	6	6/7/2016	0.033	1
Q9	7122-9	-	6/10/2016	38.6	6	6/7/2016	0.031	1
Q10	7122-10	-	6/10/2016	38.1	6	6/7/2016	0.027	1
Q10	7122-10 Lab dup	-	6/10/2016	38.4 (RPD=0.784)	6	6/7/2016	0.027 (RPD=0)	1
Q11	7122-11	-	6/10/2016	36.7	6	6/7/2016	0.034	1
Q12	7122-12	-	6/10/2016	36.2	6	6/7/2016	0.026	1
Q13	7122-13	-	6/10/2016	35.9	6	6/7/2016	0.031	1
Q14	7122-14	-	6/10/2016	36.7	6	6/7/2016	0.032	1
Q15	7122-15	-	6/10/2016	37.7	6	6/7/2016	0.031	1
Q16	7122-16	-	6/10/2016	37.6	6	6/7/2016	0.030	1
Q17	7122-17	-	6/10/2016	37.7	6	6/7/2016	0.028	1
Q18	7122-18	-	6/10/2016	36.6	6	6/7/2016	0.030	1
Q19	7122-19	-	6/10/2016	36.3	6	6/7/2016	0.031	1
Q20	7122-20	-	6/10/2016	36.8	6	6/7/2016	0.029	1
Q20	7122-20 Lab dup	-	6/10/2016	36.5 (RPD=0.819)	6	6/7/2016	0.029 (RPD=0)	1
Q21	7122-21	-	6/10/2016	35.9	6	6/7/2016	0.032	1
Q22	7122-22	-	6/10/2016	39.6	6	6/7/2016	0.033	1
Q23	7122-23	-	6/10/2016	35.1	6	6/7/2016	0.031	1
Q24	7122-24	-	6/10/2016	20.3	6	6/7/2016	0.023	1
Q25	7122-25	-	6/10/2016	7.58	6	6/7/2016	0.022	1
Q26	7122-26	-	6/10/2016	3.80	6	6/7/2016	0.022	1
Q27	7122-27	-	6/10/2016	1.94	6	6/7/2016	BQL (0.019)	1
Q28	7122-28	-	6/13/2016	0.667	1	6/7/2016	BQL (0.019)	1
Q29	7122-29	-	6/13/2016	0.338	1	6/7/2016	0.025	1
Q30	7122-30	-	6/13/2016	0.232	1	6/7/2016	BQL (0.018)	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 06/14/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	0.039	**MDL**	0.002
QL	0.200	**QL**	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
Q30	7122-30 Lab dup	-	6/13/2016	0.246 (RPD=5.86)	1	6/7/2016	BQL (0.018) (RPD=NA)	1
Q31	7122-31	-	6/13/2016	BQL (0.195)	1	6/7/2016	BQL (0.018)	1
Q32	7122-32	-	6/13/2016	BQL (0.156)	1	6/7/2016	BQL (0.019)	1
Q33	7122-33	-	6/13/2016	BQL (0.157)	1	6/7/2016	BQL (0.018)	1
QF	7122-34	-	6/10/2016	36.6	6	6/7/2016	0.029	1
QFb	7122-35	-	6/10/2016	36.2	6	6/7/2016	0.072	1
QFb	7122-35 Lab dup	-	6/10/2016	36.4 (RPD=0.551)	6	6/7/2016	0.073 (RPD=1.38)	1

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 06/14/16

Quality Control Data

Analytes	Fluoride (F)			ortho-phosphate as P					
Codes	7782-41-4			70507					
Methods	RSKSOP-276/4			NRMRL-GWERD-05-0					
Unit	mg/L			mg/L					
MDL	0.039			0.002					
QL	0.200			0.020					

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	6/7/2016	6/7/2016	-	-	-	BQL (0.016)	-	-			
MB	Nanopure Water Blank	6/7/2016	6/7/2016	-	-	-	BQL (0.015)	-	-			
MB	Nanopure Water Blank	6/10/2016	6/10/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	6/10/2016	6/10/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	6/13/2016	6/13/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	6/13/2016	6/13/2016	ND	-	-	-	-	-			
SS	ERA 67 Simple Nutrients	11/4/2015	6/7/2016	-	-	-	2.01	1.95	103			
SS	ERA 67 Simple Nutrients	11/4/2015	6/7/2016	-	-	-	2.03	1.95	104			
SS	ERA 67 Simple Nutrients	11/4/2015	6/7/2016	-	-	-	2.04	1.95	105			
SS	ERA 66 Minerals	7/1/2015	6/10/2016	1.73	1.70	102	-	-	-			
SS	ERA 66 Minerals	7/1/2015	6/10/2016	1.72	1.70	101	-	-	-			
SS	ERA 66 Minerals	7/1/2015	6/13/2016	1.73	1.70	102	-	-	-			
CCC	Continuing Calibration Check Standard	4/28/2016	6/7/2016	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	4/28/2016	6/7/2016	-	-	-	0.093	0.100	93.0			
CCC	Continuing Calibration Check Standard	4/28/2016	6/7/2016	-	-	-	0.230	0.250	92.0			
CCC	Continuing Calibration Check Standard	4/28/2016	6/7/2016	-	-	-	1.02	1.00	102			
CCC	Continuing Calibration Check Standard	4/28/2016	6/7/2016	-	-	-	0.050	0.050	100			
CCC	Continuing Calibration Check Standard	4/28/2016	6/7/2016	-	-	-	2.10	2.00	105			
CCC	Continuing Calibration Check Standard	12/1/2015	6/10/2016	BQL (0.184)	0.200	92.0	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/10/2016	0.997	1.00	99.7	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/10/2016	1.98	2.00	99.0	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/10/2016	4.79	5.00	95.8	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/10/2016	9.87	10.0	98.7	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/13/2016	0.212	0.200	106	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/13/2016	9.97	10.0	99.7	-	-	-			
MS	Q1 Spike	6/7 & 6/10/2016	6/7 & 6/10/2016	* 7.13	* 4.00 (3.23)	96.9	1.24	0.191 (0.990)	106			
MS	Q21 Spike	6/7 & 6/10/2016	6/7 & 6/10/2016	* 9.53	* 5.98 (3.23)	110	1.03	0.032 (0.990)	101			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.6 mL of diluted sample to yield spike concentrations of 3.23 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated without multiplying by the dilution factor.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC70

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 7/18/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 7/7/2016
Date Analyzed: 7/13/2016
No. Samples Analyzed: 33

Sample Set No.: 7135
Sample Matrix: water
Analysis Type: Fluoride
Sample Preparation: diluted as necessary

Method(s) Used : RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in RSKSOP-276/R4 cited above. A method detection limit for bromide was determined on 10/27/2015 for fluoride. The current MDL is 0.039 mg/L.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 07/18/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	
Codes	7782-41-4	**Codes**	
Methods	RSKSOP-276/4	**Methods**	
Unit	mg/L	**Unit**	
MDL	* 0.039	**MDL**	
QL	* 0.200	**QL**	

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
Qb1	7135-1	-	7/13/2016	25.3	6			
Qb2	7135-2	-	7/13/2016	33.9	6			
Qb3	7135-3	-	7/13/2016	34.0	6			
Qb4	7135-4	-	7/13/2016	36.8	6			
Qb5	7135-5	-	7/13/2016	35.7	6			
Qb6	7135-6	-	7/13/2016	37.1	6			
Qb7	7135-7	-	7/13/2016	34.6	6			
Qb8	7135-8	-	7/13/2016	34.8	6			
Qb9	7135-9	-	7/13/2016	34.5	6			
Qb10	7135-10	-	7/13/2016	31.9	6			
Qb10	7135-10 Lab dup	-	7/13/2016	34.2 (RPD=6.96)	6			
Qb11	7135-11	-	7/13/2016	36.1	6			
Qb12	7135-12	-	7/13/2016	36.3	6			
Qb13	7135-13	-	7/13/2016	33.2	6			
Qb14	7135-14	-	7/13/2016	37.4	6			
Qb15	7135-15	-	7/13/2016	36.6	6			
Qb16	7135-16	-	7/13/2016	35.4	6			
Qb17	7135-17	-	7/13/2016	33.9	6			
Qb18	7135-18	-	7/13/2016	35.0	6			
Qb19	7135-19	-	7/13/2016	37.4	6			
Qb20	7135-20	-	7/13/2016	34.7	6			
Qb20	7135-20 Lab dup	-	7/13/2016	35.7 (RPD=2.84)	6			
Qb21	7135-21	-	7/13/2016	35.0	6			
Qb22	7135-22	-	7/13/2016	36.1	6			
Qb23	7135-23	-	7/13/2016	35.0	6			
Qb24	7135-24	-	7/13/2016	24.7	6			
Qb25	7135-25	-	7/13/2016	8.74	6			
Qb26	7135-26	-	7/13/2016	3.43	1			
Qb27	7135-27	-	7/13/2016	1.98	1			
Qb28	7135-28	-	7/13/2016	0.734	1			
Qb29	7135-29	-	7/13/2016	BQL (0.155)	1			
Qb30	7135-30	-	7/13/2016	BQL (0.071)	1			

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 07/18/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	
Codes	7782-41-4	**Codes**	
Methods	RSKSOP-276/4	**Methods**	
Unit	mg/L	**Unit**	
MDL	* 0.039	**MDL**	
QL	* 0.200	**QL**	

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
Qb30	7135-30 Lab dup	-	7/13/2016	BQL (0.063) (RPD=NA)	1			
Qb31	7135-31	-	7/13/2016	BQL (0.045)	1			
Qb32	7135-32	-	7/13/2016	ND	1			
Qb33	7135-33	-	7/13/2016	BQL (0.080)	1			

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limit was determined on 10/27/2015 for fluoride. The current MDL is 0.039 mg/L. * MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 07/18/16

Quality Control Data

Analytes	**Fluoride (F)**											
Codes	**7782-41-4**											
Methods	**RSKSOP-276/4**											
Unit	**mg/L**											
MDL	**0.039**											
QL	**0.200**											
QC Sample ID	**Additional ID**	**Date Prepared**	**Date Analyzed**	**Data**	**True Value**	**% REC.**	**Data**	**True Value**	**% REC.**	**Data**	**True Value**	**% REC.**
MB	Nanopure Water Blank	7/13/2016	7/13/2016	ND	-	-						
MB	Nanopure Water Blank	7/13/2016	7/13/2016	ND	-	-						
SS	ERA 68 Minerals	1/13/2016	7/13/2016	1.52	1.56	97.4						
SS	ERA 68 Minerals	1/13/2016	7/13/2016	1.61	1.56	103						
CCC	Continuing Calibration Check Standard	12/1/2015	7/13/2016	0.202	0.200	101						
CCC	Continuing Calibration Check Standard	12/1/2015	7/13/2016	1.00	1.00	100						
CCC	Continuing Calibration Check Standard	12/1/2015	7/13/2016	2.02	2.00	101						
CCC	Continuing Calibration Check Standard	12/1/2015	7/13/2016	5.21	5.00	104						
CCC	Continuing Calibration Check Standard	12/1/2015	7/13/2016	9.80	10.0	98.0						
MS	Qb1 Spike	7/13/2016	7/13/2016	* 7.22	* 4.22 (3.23)	92.9						
MS	Qb21 Spike	7/13/2016	7/13/2016	* 9.13	* 5.83 (3.23)	102						

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.6 mL of sample to yield a spike concentration of 3.23 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated without multiplying by the dilution factor.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC62

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 6/28/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Lisa Costantino
Lynda Callaway
Kristie Hargrove

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 6/14/2016
Date Analyzed: 6/15, 6/22, 6/23/2016
No. Samples Analyzed: 32

Sample Set No.: 7123
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: diluted as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. No dates of collection were given, so the 48 hour holding time for oP analysis may or may not have been met.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 06/28/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	# 0.039	**MDL**	0.002
QL	# 0.200	**QL**	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
H1	7123-1	-	6/22/2016	** ND	6	6/15/2016	0.609	1
H2	7123-2	-	6/22/2016	** ND	6	6/15/2016	1.35	1
H3	7123-3	-	6/22/2016	2.23	6	6/15/2016	1.33	1
H4	7123-4	-	6/22/2016	8.53	6	6/15/2016	1.05	1
H5	7123-5	-	6/22/2016	16.0	6	6/15/2016	0.793	1
H6	7123-6	-	6/22/2016	21.9	6	6/15/2016	0.487	1
H7	7123-7	-	6/22/2016	22.2	6	6/15/2016	0.318	1
H8	7123-8	-	6/22/2016	25.0	6	6/15/2016	0.204	1
H9	7123-9	-	6/22/2016	27.1	6	6/15/2016	0.142	1
H10	7123-10	-	6/22/2016	28.2	6	6/15/2016	0.114	1
H10	7123-10 Lab dup	-	6/22/2016	28.1 (RPD=0.355)	6	6/15/2016	0.110 (RPD=3.57)	1
H11	7123-11	-	6/22/2016	27.2	6	6/15/2016	0.094	1
H12	7123-12	-	6/22/2016	28.5	6	6/15/2016	0.078	1
H13	7123-13	-	-	*	-	-	*	-
H14	7123-14	-	6/22/2016	29.8	6	6/15/2016	0.058	1
H15	7123-15	-	6/22/2016	30.4	6	6/15/2016	0.054	1
H16	7123-16	-	6/22/2016	30.5	6	6/15/2016	0.049	1
H17	7123-17	-	6/22/2016	32.0	6	6/15/2016	0.039	1
H18	7123-18	-	6/22/2016	31.5	6	6/15/2016	0.043	1
H19	7123-19	-	6/22/2016	32.9	6	6/15/2016	0.042	1
H20	7123-20	-	6/22/2016	32.6	6	6/15/2016	0.042	1
H20	7123-20 Lab dup	-	6/22/2016	33.6 (RPD=3.02)	6	6/15/2016	0.040 (RPD=4.88)	1
H21	7123-21	-	6/22/2016	31.8	6	6/15/2016	0.039	1
H22	7123-22	-	6/22/2016	32.8	6	6/15/2016	0.039	1
H23	7123-23	-	6/22/2016	33.7	6	6/15/2016	0.040	1
H24	7123-24	-	6/22/2016	32.8	6	6/15/2016	0.036	1
H25	7123-25	-	6/22/2016	24.3	6	6/15/2016	0.030	1
H26	7123-26	-	6/23/2016	15.3	6	6/15/2016	0.022	1
H27	7123-27	-	6/23/2016	10.9	6	6/15/2016	0.023	1
H28	7123-28	-	6/23/2016	9.76	6	6/15/2016	0.024	1
H28	7123-28 Lab dup	-	6/23/2016	9.76 (RPD=0)	6	-	-	-
H29	7123-29	-	6/22/2016	8.45	1	6/15/2016	0.021	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 06/28/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	# 0.039	**MDL**	0.002
QL	# 0.200	**QL**	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
H30	7123-30	-	6/22/2016	7.73	1	6/15/2016	0.025	1
H30	7123-30 Lab dup	-	-	-	-	6/15/2016	0.024 (RPD=4.08)	1
H31	7123-31	-	6/22/2016	6.50	1	6/15/2016	0.025	1
H32	7123-32	-	6/22/2016	5.68	1	6/15/2016	0.027	1
H33	7123-33	-	6/22/2016	5.02	1	6/15/2016	0.027	1
H33	7123-33 Lab dup	-	6/22/2016	5.00 (RPD=0.399)	1	6/15/2016	0.026 (RPD=3.77)	1

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. * A sample for H13 was not received (spilled prior to log-in). ** H1 and H2 are reported at a 6x dilution to eliminate interference from large adjacent peaks. # MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 06/28/16

Quality Control Data

Analytes	Fluoride (F)			ortho-phosphate as P					
Codes	7782-41-4			70507					
Methods	RSKSOP-276/4			NRMRL-GWERD-05-0					
Unit	mg/L			mg/L					
MDL	0.039			0.002					
QL	0.200			0.020					

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	6/15/2016	6/15/2016	-	-	-	BQL (0.014)	-	-			
MB	Nanopure Water Blank	6/15/2016	6/15/2016	-	-	-	BQL (0.013)	-	-			
MB	Nanopure Water Blank	6/22/2016	6/22/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	6/22/2016	6/22/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	6/23/2016	6/23/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	6/23/2016	6/23/2016	ND	-	-	-	-	-			
SS	ERA 67 Simple Nutrients	11/4/2015	6/15/2016	-	-	-	1.96	1.95	101			
SS	ERA 67 Simple Nutrients	11/4/2015	6/15/2016	-	-	-	1.98	1.95	102			
SS	ERA 67 Simple Nutrients	11/4/2015	6/15/2016	-	-	-	1.99	1.95	102			
SS	ERA 68 Minerals	1/13/2016	6/22/2016	1.54	1.56	98.7	-	-	-			
SS	ERA 68 Minerals	1/13/2016	6/22/2016	1.62	1.56	104	-	-	-			
SS	ERA 68 Minerals	1/13/2016	6/23/2016	1.53	1.56	98.1	-	-	-			
CCC	Continuing Calibration Check Standard	4/28/2016	6/15/2016	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	4/28/2016	6/15/2016	-	-	-	0.092	0.100	92.0			
CCC	Continuing Calibration Check Standard	4/28/2016	6/15/2016	-	-	-	0.227	0.250	90.8			
CCC	Continuing Calibration Check Standard	4/28/2016	6/15/2016	-	-	-	1.02	1.00	102			
CCC	Continuing Calibration Check Standard	4/28/2016	6/15/2016	-	-	-	0.048	0.050	96.0			
CCC	Continuing Calibration Check Standard	4/28/2016	6/15/2016	-	-	-	2.05	2.00	103			
CCC	Continuing Calibration Check Standard	12/1/2015	6/22/2016	BQL (0.186)	0.200	93.0	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/22/2016	1.03	1.00	103	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/22/2016	1.99	2.00	99.5	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/22/2016	5.12	5.00	102	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/22/2016	9.68	10.0	96.8	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/23/2016	0.947	1.00	94.7	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/23/2016	4.76	5.00	95.2	-	-	-			
MS	H1 Spike	6/15 & 6/22/2016	6/15 & 6/22/2016	* 3.18	* ND (3.23)	98.5	1.65	0.609 (0.990)	105			
MS	H21 Spike	6/15 & 6/22/2016	6/15 & 6/22/2016	* 8.45	* 5.30 (3.23)	97.5	1.05	0.039 (0.990)	102			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.6 mL of diluted sample to yield spike concentrations of 3.23 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated without multiplying by the dilution factor.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC64

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 7/6/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 6/20/2016
Date Analyzed: 6/20 & 6/30/2016
No. Samples Analyzed: 33

Sample Set No.: 7127
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: diluted as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. No dates of collection were given, so the 48 hour holding time for oP analysis may or may not have been met.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 07/06/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	* 0.039	**MDL**	* 0.002
QL	* 0.200	**QL**	* 0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
H1b	7127-1	-	6/30/2016	** ND	3	6/20/2016	1.61	2
H2b	7127-2	-	6/30/2016	** ND	3	6/20/2016	2.84	2
H3b	7127-3	-	6/30/2016	0.797	3	6/20/2016	2.10	2
H4b	7127-4	-	6/30/2016	8.12	6	6/20/2016	1.66	1
H5b	7127-5	-	6/30/2016	15.1	6	6/20/2016	1.16	1
H6b	7127-6	-	6/30/2016	21.5	6	6/20/2016	0.747	1
H7b	7127-7	-	6/30/2016	23.3	6	6/20/2016	0.512	1
H8b	7127-8	-	6/30/2016	27.7	6	6/20/2016	0.378	1
H9b	7127-9	-	6/30/2016	27.3	6	6/20/2016	0.261	1
H10b	7127-10	-	6/30/2016	29.0	6	6/20/2016	0.176	1
H10b	7127-10 Lab dup	-	6/30/2016	29.0 (RPD=0)	6	6/20/2016	0.176 (RPD=0)	1
H11b	7127-11	-	6/30/2016	29.9	6	6/20/2016	0.133	1
H12b	7127-12	-	6/30/2016	29.2	6	6/20/2016	0.118	1
H13b	7127-13	-	6/30/2016	30.6	6	6/20/2016	0.130	1
H14b	7127-14	-	6/30/2016	29.1	6	6/20/2016	0.109	1
H15b	7127-15	-	6/30/2016	32.2	6	6/20/2016	0.094	1
H16b	7127-16	-	6/30/2016	31.0	6	6/20/2016	0.092	1
H17b	7127-17	-	6/30/2016	32.8	6	6/20/2016	0.071	1
H18b	7127-18	-	6/30/2016	33.6	6	6/20/2016	0.059	1
H19b	7127-19	-	6/30/2016	32.9	6	6/20/2016	0.051	1
H20b	7127-20	-	6/30/2016	33.4	6	6/20/2016	0.047	1
H20b	7127-20 Lab dup	-	6/30/2016	33.8 (RPD=1.19)	6	6/20/2016	0.045 (RPD=4.35)	1
H21b	7127-21	-	6/30/2016	33.5	6	6/20/2016	0.044	1
H22b	7127-22	-	6/30/2016	34.8	6	6/20/2016	0.044	1
H23b	7127-23	-	6/30/2016	33.3	6	6/20/2016	0.043	1
H24b	7127-24	-	6/30/2016	34.9	6	6/20/2016	0.042	1
H25b	7127-25	-	6/30/2016	27.5	6	6/20/2016	0.035	1
H26b	7127-26	-	6/30/2016	18.1	6	6/20/2016	0.028	1
H27b	7127-27	-	6/30/2016	13.3	6	6/20/2016	0.025	1
H28b	7127-28	-	6/30/2016	11.1	6	6/20/2016	0.025	1
H29b	7127-29	-	6/30/2016	9.42	6	6/20/2016	0.024	1
H30b	7127-30	-	6/30/2016	8.34	6	6/20/2016	0.024	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 07/06/16

Sample Results

Analytes	Fluoride (F)	Analytes	ortho-Phosphate (as P)
Codes	7782-41-4	Codes	70507
Methods	RSKSOP-276/4	Methods	NRMRL-GWERD-05-0
Unit	mg/L	Unit	mg/L
MDL	* 0.039	MDL	* 0.002
QL	* 0.200	QL	* 0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
H30b	7127-30 Lab dup	-	6/30/2016	8.15 (RPD=2.30)	6	6/20/2016	0.025 (RPD=4.08)	1
H31b	7127-31	-	6/30/2016	7.08	1	6/20/2016	0.028	1
H32b	7127-32	-	6/30/2016	6.10	1	6/20/2016	0.029	1
H33b	7127-33	-	6/30/2016	5.47	1	6/20/2016	0.029	1

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. * MDL and QL should be multiplied by the dilution factor for those samples that were diluted. ** Samples H1b & H2b had to be diluted for fluoride analysis due to interfering adjacent peaks.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 07/06/16

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	6/20/2016	6/20/2016	-	-	-	BQL (0.014)	-	-			
MB	Nanopure Water Blank	6/20/2016	6/20/2016	-	-	-	BQL (0.013)	-	-			
MB	Nanopure Water Blank	6/30/2016	6/30/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	6/30/2016	6/30/2016	ND	-	-	-	-	-			
SS	ERA 67 Simple Nutrients	11/4/2015	6/20/2016	-	-	-	2.00	1.95	103			
SS	ERA 67 Simple Nutrients	11/4/2015	6/20/2016	-	-	-	2.03	1.95	104			
SS	ERA 67 Simple Nutrients	11/4/2015	6/20/2016	-	-	-	2.04	1.95	105			
SS	ERA 68 Minerals	1/13/2016	6/30/2016	1.56	1.56	100	-	-	-			
SS	ERA 68 Minerals	1/13/2016	6/30/2016	1.50	1.56	96.2	-	-	-			
CCC	Continuing Calibration Check Standard	4/28/2016	6/20/2016	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	4/28/2016	6/20/2016	-	-	-	0.095	0.100	95.0			
CCC	Continuing Calibration Check Standard	4/28/2016	6/20/2016	-	-	-	0.242	0.250	96.8			
CCC	Continuing Calibration Check Standard	4/28/2016	6/20/2016	-	-	-	1.03	1.00	103			
CCC	Continuing Calibration Check Standard	4/28/2016	6/20/2016	-	-	-	0.052	0.050	104			
CCC	Continuing Calibration Check Standard	4/28/2016	6/20/2016	-	-	-	2.10	2.00	105			
CCC	Continuing Calibration Check Standard	12/1/2015	6/30/2016	BQL (0.199)	0.200	99.5	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/30/2016	1.01	1.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/30/2016	2.09	2.00	105	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/30/2016	5.06	5.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/30/2016	9.66	10.0	96.6	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/30/2016	5.06	5.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	6/30/2016	9.66	10.0	96.6	-	-	-			
MS	H1b Spike	6/20 & 6/30/2016	6/20 & 6/30/2016	* 3.22	* ND (3.85)	83.6	* 1.84	* 0.805 (0.990)	105			
MS	H21b Spike	6/20 & 6/30/2016	6/20 & 6/30/2016	* 8.58	* 5.58 (3.23)	92.9	1.05	0.044 (0.990)	102			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 or 0.6 mL of sample to yield spike concentrations of 3.85 or 3.23 mg/L respectively. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated without multiplying by the dilution factor.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC90

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Kristie Hargrove

Date: 9/1/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Rosie Wallace
Kristie Hargrove
Lynda Callaway
Mark White

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: 8/18/2016
Date Received: 8/23/2016
Date Analyzed: 8/25, 8/30, 8/31/2016
No. Samples Analyzed: 34

Sample Set No.: 7163
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: diluted as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. The 48 hour holding time for oP analysis was not met.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 09/01/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	* 0.039	**MDL**	* 0.002
QL	* 0.200	**QL**	* 0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
M1	7163-1	8/18/2016	8/30/2016	0.209	1	8/25/2016	0.090	1
M2	7163-2	8/18/2016	8/30/2016	2.99	1	8/25/2016	0.028	1
M3	7163-3	8/18/2016	8/30/2016	9.55	6	8/25/2016	0.023	1
M4	7163-4	8/18/2016	8/30/2016	16.6	6	8/25/2016	0.020	1
M5	7163-5	8/18/2016	8/30/2016	21.7	6	8/25/2016	BQL (0.017)	1
M6	7163-6	8/18/2016	8/30/2016	23.7	6	8/25/2016	BQL (0.019)	1
M7	7163-7	8/18/2016	8/30/2016	28.0	6	8/25/2016	BQL (0.017)	1
M8	7163-8	8/18/2016	8/30/2016	28.6	6	8/25/2016	BQL (0.018)	1
M9	7163-9	8/18/2016	8/30/2016	29.6	6	8/25/2016	0.022	1
M10	7163-10	8/18/2016	8/30/2016	30.0	6	8/25/2016	BQL (0.018)	1
M10	7163-10 Lab dup	8/18/2016	8/30/2016	31.0 (RPD=3.28)	6	8/25/2016	BQL (0.016) (RPD=NA)	1
M11	7163-11	8/18/2016	8/30/2016	34.3	6	8/25/2016	BQL (0.019)	1
M12	7163-12	8/18/2016	8/30/2016	28.2	6	8/25/2016	BQL (0.017)	1
M13	7163-13	8/18/2016	8/30/2016	34.2	6	8/25/2016	BQL (0.014)	1
M14	7163-14	8/18/2016	8/30/2016	34.4	6	8/25/2016	BQL (0.019)	1
M15	7163-15	8/18/2016	8/30/2016	32.7	6	8/25/2016	BQL (0.015)	1
M16	7163-16	8/18/2016	8/30/2016	36.4	6	8/25/2016	BQL (0.018)	1
M17	7163-17	8/18/2016	8/30/2016	34.9	6	8/25/2016	BQL (0.017)	1
M18	7163-18	8/18/2016	8/30/2016	35.9	6	8/25/2016	BQL (0.018)	1
M19	7163-19	8/18/2016	8/30/2016	35.7	6	8/25/2016	0.029	1
M20	7163-20	8/18/2016	8/30/2016	36.6	6	8/25/2016	BQL (0.016)	1
M20	7163-20 Lab dup	8/18/2016	8/30/2016	36.3 (RPD=0.823)	6	8/25/2016	BQL (0.017) (RPD=NA)	1
M21	7163-21	8/18/2016	8/31/2016	38.4	6	8/25/2016	BQL (0.017)	1
M22	7163-22	8/18/2016	8/31/2016	34.6	6	8/25/2016	BQL (0.014)	1
M23	7163-23	8/18/2016	8/31/2016	36.5	6	8/25/2016	BQL (0.016)	1
M24	7163-24	8/18/2016	8/31/2016	25.1	6	8/25/2016	BQL (0.015)	1
M25	7163-25	8/18/2016	8/31/2016	21.1	6	8/25/2016	BQL (0.013)	1
M26	7163-26	8/18/2016	8/31/2016	12.5	6	8/25/2016	BQL (0.016)	1
M27	7163-27	8/18/2016	8/31/2016	13.4	6	8/25/2016	BQL (0.017)	1
M28	7163-28	8/18/2016	8/31/2016	11.3	6	8/25/2016	BQL (0.014)	1
M29	7163-29	8/18/2016	8/31/2016	7.02	6	8/25/2016	BQL (0.014)	1
M30	7163-30	8/18/2016	8/31/2016	7.73	6	8/25/2016	BQL (0.016)	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 09/01/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	* 0.039	**MDL**	* 0.002
QL	* 0.200	**QL**	* 0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
M30	7163-30 Lab dup	8/18/2016	8/31/2016	7.64 (RPD=1.17)	6	8/25/2016	BQL (0.016) (RPD=NA)	1
M31	7163-31	8/18/2016	8/31/2016	4.89	6	8/25/2016	BQL (0.016)	1
M32	7163-32	8/18/2016	8/31/2016	4.17	6	8/25/2016	BQL (0.015)	1
M33	7163-33	8/18/2016	8/31/2016	3.88	6	8/25/2016	BQL (0.017)	1
M22 bb	7163-34	8/18/2016	8/31/2016	29.4	6	8/25/2016	BQL (0.016)	1
M22 bb	7163-34 Lab dup	8/18/2016	-	-	-	8/25/2016	BQL (0.016) (RPD=NA)	1

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. * MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 09/01/16

Quality Control Data

Analytes	Fluoride (F)			ortho-phosphate as P					
Codes	7782-41-4			70507					
Methods	RSKSOP-276/4			NRMRL-GWERD-05-0					
Unit	mg/L			mg/L					
MDL	0.039			0.002					
QL	0.200			0.020					

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	8/25/2016	8/25/2016	-	-	-	BQL (0.013)	-	-			
MB	Nanopure Water Blank	8/25/2016	8/25/2016	-	-	-	BQL (0.013)	-	-			
MB	Nanopure Water Blank	8/30/2016	8/30/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/30/2016	8/30/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/31/2016	8/31/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/31/2016	8/31/2016	ND	-	-	-	-	-			
SS	ERA 68 Simple Nutrients	1/15/2016	8/25/2016	-	-	-	3.48	3.37	103			
SS	ERA 68 Simple Nutrients	1/15/2016	8/25/2016	-	-	-	3.52	3.37	104			
SS	ERA 68 Simple Nutrients	1/15/2016	8/25/2016	-	-	-	3.55	3.37	105			
SS	ERA 68 Minerals	1/13/2016	8/30/2016	1.59	1.56	102	-	-	-			
SS	ERA 68 Minerals	1/13/2016	8/30/2016	1.52	1.56	97.4	-	-	-			
SS	ERA 68 Minerals	1/13/2016	8/31/2016	1.60	1.56	103	-	-	-			
CCC	Continuing Calibration Check Standard	4/28/2016	8/25/2016	-	-	-	0.047	0.050	94.0			
CCC	Continuing Calibration Check Standard	4/28/2016	8/25/2016	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	4/28/2016	8/25/2016	-	-	-	0.093	0.100	93.0			
CCC	Continuing Calibration Check Standard	4/28/2016	8/25/2016	-	-	-	0.236	0.250	94.4			
CCC	Continuing Calibration Check Standard	4/28/2016	8/25/2016	-	-	-	1.05	1.00	105			
CCC	Continuing Calibration Check Standard	4/28/2016	8/25/2016	-	-	-	2.13	2.00	107			
CCC	Continuing Calibration Check Standard	7/20/2016	8/30/2016	0.209	0.200	105	-	-	-			
CCC	Continuing Calibration Check Standard	7/20/2016	8/30/2016	1.03	1.00	103	-	-	-			
CCC	Continuing Calibration Check Standard	7/20/2016	8/30/2016	4.96	5.00	99.2	-	-	-			
CCC	Continuing Calibration Check Standard	7/20/2016	8/30/2016	1.96	2.00	98.0	-	-	-			
CCC	Continuing Calibration Check Standard	7/20/2016	8/31/2016	0.215	0.200	108	-	-	-			
CCC	Continuing Calibration Check Standard	7/20/2016	8/31/2016	1.07	1.00	107	-	-	-			
CCC	Continuing Calibration Check Standard	7/20/2016	8/31/2016	9.97	10.0	99.7	-	-	-			
MS	M1 Spike	8/25 & 8/30/2016	8/25 & 8/30/2016	4.20	0.209 (3.85)	104	1.11	0.090 (0.990)	103			
MS	M21 Spike	8/25 & 8/31/2016	8/25 & 8/31/2016	* 9.73	* 6.40 (3.23)	103	1.03	BQL (0.017) (0.990)	102			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 or 0.6 mL of sample to yield spike concentrations of 3.85 or 3.23 mg/L respectively. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated without multiplying by the dilution factor.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC89

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Kristie Hargrove

Date: 9/1/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Rosie Wallace
Kristie Hargrove
Lynda Callaway
Mark White

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: 8/18/2016
Date Received: 8/18/2016
Date Analyzed: 8/18, 8/29 & 8/30/2016
No. Samples Analyzed: 35

Sample Set No.: 7160
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: diluted as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. The 48 hour holding time for oP analysis was met.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 09/01/16

Sample Results

Analytes	Fluoride (F)	Analytes	ortho-Phosphate (as P)
Codes	7782-41-4	Codes	70507
Methods	RSKSOP-276/4	Methods	NRMRL-GWERD-05-0
Unit	mg/L	Unit	mg/L
MDL	* 0.039	MDL	* 0.002
QL	* 0.200	QL	* 0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
M1B	7160-1	8/18/2016	8/30/2016	BQL (0.173)	1	8/18/2016	0.067	1
M2B	7160-2	8/18/2016	8/29/2016	2.43	6	8/18/2016	0.029	1
M3B	7160-3	8/18/2016	8/29/2016	8.49	6	8/18/2016	0.021	1
M4B	7160-4	8/18/2016	8/29/2016	14.4	6	8/18/2016	BQL (0.019)	1
M5B	7160-5	8/18/2016	8/29/2016	19.1	6	8/18/2016	BQL (0.017)	1
M6B	7160-6	8/18/2016	8/29/2016	23.1	6	8/18/2016	BQL (0.016)	1
M7B	7160-7	8/18/2016	8/29/2016	24.1	6	8/18/2016	BQL (0.016)	1
M8B	7160-8	8/18/2016	8/29/2016	25.4	6	8/18/2016	BQL (0.015)	1
M9B	7160-9	8/18/2016	8/29/2016	29.6	6	8/18/2016	BQL (0.016)	1
M10B	7160-10	8/18/2016	8/29/2016	31.3	6	8/18/2016	BQL (0.016)	1
M10B	7160-10 Lab dup	8/18/2016	8/29/2016	30.5 (RPD=2.59)	6	8/18/2016	BQL (0.015) (RPD=NA)	1
M11B	7160-11	8/18/2016	8/29/2016	30.0	6	8/18/2016	BQL (0.016)	1
M12B	7160-12	8/18/2016	8/29/2016	31.1	6	8/18/2016	BQL (0.016)	1
M13B	7160-13	8/18/2016	8/29/2016	28.5	6	8/18/2016	BQL (0.015)	1
M14B	7160-14	8/18/2016	8/29/2016	30.4	6	8/18/2016	BQL (0.016)	1
M15B	7160-15	8/18/2016	8/29/2016	32.4	6	8/18/2016	BQL (0.015)	1
M16B	7160-16	8/18/2016	8/29/2016	33.5	6	8/18/2016	BQL (0.015)	1
M17B	7160-17	8/18/2016	8/29/2016	32.6	6	8/18/2016	BQL (0.016)	1
M18B	7160-18	8/18/2016	8/29/2016	32.6	6	8/18/2016	BQL (0.015)	1
M19B	7160-19	8/18/2016	8/29/2016	34.5	6	8/18/2016	BQL (0.015)	1
M20B	7160-20	8/18/2016	8/29/2016	32.8	6	8/18/2016	BQL (0.017)	1
M20B	7160-20 Lab dup	8/18/2016	8/29/2016	32.9 (RPD=0.304)	6	8/18/2016	BQL (0.016) (RPD=NA)	1
M21B	7160-21	8/18/2016	8/29/2016	33.6	6	8/18/2016	BQL (0.015)	1
M22B	7160-22	8/18/2016	8/29/2016	31.5	6	8/18/2016	BQL (0.011)	1
M23B	7160-23	8/18/2016	8/29/2016	27.9	6	8/18/2016	BQL (0.015)	1
M24B	7160-24	8/18/2016	8/29/2016	29.5	6	8/18/2016	BQL (0.016)	1
M25B	7160-25	8/18/2016	8/29/2016	20.3	6	8/18/2016	BQL (0.015)	1
M26B	7160-26	8/18/2016	8/29/2016	14.6	6	8/18/2016	BQL (0.019)	1
M27B	7160-27	8/18/2016	8/29/2016	14.5	6	8/18/2016	BQL (0.015)	1
M28B	7160-28	8/18/2016	8/30/2016	11.7	6	8/18/2016	BQL (0.017)	1
M29B	7160-29	8/18/2016	8/30/2016	9.37	6	8/18/2016	BQL (0.015)	1
M30B	7160-30	8/18/2016	8/29/2016	8.47	1	8/18/2016	BQL (0.015)	1
M30B	7160-30 Lab dup	8/18/2016	8/29/2016	8.55 (RPD=0.940)	1	8/18/2016	BQL (0.015) (RPD=NA)	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 09/01/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	* 0.039	**MDL**	* 0.002
QL	* 0.200	**QL**	* 0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
M31B	7160-31	8/18/2016	8/29/2016	7.23	1	8/18/2016	BQL (0.014)	1
M32B	7160-32	8/18/2016	8/29/2016	5.10	1	8/18/2016	BQL (0.015)	1
M33B	7160-33	8/18/2016	8/29/2016	4.82	1	8/18/2016	BQL (0.014)	1
FM	7160-34	8/18/2016	8/29/2016	32.5	6	8/18/2016	0.028	1
FMb	7160-35	8/18/2016	8/29/2016	35.0	6	8/18/2016	0.032	1
FMb	7160-35 Lab dup	8/18/2016	8/29/2016	35.1 (RPD=0.285)	6	-	-	-

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. * MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 09/01/16

Quality Control Data

Analytes	Fluoride (F)			ortho-phosphate as P					
Codes	7782-41-4			70507					
Methods	RSKSOP-276/4			NRMRL-GWERD-05-0					
Unit	mg/L			mg/L					
MDL	0.039			0.002					
QL	0.200			0.020					

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	8/18/2016	8/18/2016	-	-	-	BQL (0.013)	-	-			
MB	Nanopure Water Blank	8/18/2016	8/18/2016	-	-	-	BQL (0.012)	-	-			
MB	Nanopure Water Blank	8/29/2016	8/29/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/29/2016	8/29/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/30/2016	8/30/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/30/2016	8/30/2016	ND	-	-	-	-	-			
SS	ERA 68 Simple Nutrients	1/15/2016	8/18/2016	-	-	-	3.34	3.37	99.1			
SS	ERA 68 Simple Nutrients	1/15/2016	8/18/2016	-	-	-	3.35	3.37	99.4			
SS	ERA 68 Simple Nutrients	1/15/2016	8/18/2016	-	-	-	3.37	3.37	100			
SS	ERA 68 Minerals	1/13/2016	8/29/2016	1.64	1.56	105	-	-	-			
SS	ERA 68 Minerals	1/13/2016	8/29/2016	1.53	1.56	98.1	-	-	-			
SS	ERA 68 Minerals	1/13/2016	8/30/2016	1.59	1.56	102	-	-	-			
CCC	Continuing Calibration Check Standard	4/28/2016	8/18/2016	-	-	-	0.090	0.100	90.0			
CCC	Continuing Calibration Check Standard	4/28/2016	8/18/2016	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	4/28/2016	8/18/2016	-	-	-	0.476	0.500	95.2			
CCC	Continuing Calibration Check Standard	4/28/2016	8/18/2016	-	-	-	0.996	1.00	99.6			
CCC	Continuing Calibration Check Standard	4/28/2016	8/18/2016	-	-	-	0.053	0.050	106			
CCC	Continuing Calibration Check Standard	4/28/2016	8/18/2016	-	-	-	2.05	2.00	103			
CCC	Continuing Calibration Check Standard	7/20/2016	8/29/2016	1.97	2.00	98.5	-	-	-			
CCC	Continuing Calibration Check Standard	7/20/2016	8/29/2016	4.82	5.00	96.4	-	-	-			
CCC	Continuing Calibration Check Standard	7/20/2016	8/29/2016	9.44	10.0	94.4	-	-	-			
CCC	Continuing Calibration Check Standard	7/20/2016	8/29/2016	BQL (0.190)	0.200	95.0	-	-	-			
CCC	Continuing Calibration Check Standard	7/20/2016	8/29/2016	2.06	2.00	103	-	-	-			
CCC	Continuing Calibration Check Standard	7/20/2016	8/30/2016	0.209	0.200	105	-	-	-			
CCC	Continuing Calibration Check Standard	7/20/2016	8/30/2016	1.03	1.00	103	-	-	-			
MS	M1B Spike	8/18 & 8/30/2016	8/18 & 8/30/2016	4.08	BQL (0.173) (3.85)	101	1.06	0.067 (0.990)	100			
MS	M21B Spike	8/18 & 8/29/2016	8/18 & 8/29/2016	* 8.90	* 5.60 (3.23)	102	1.00	BQL (0.015) (0.990)	99.5			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 or 0.6 mL of sample to yield spike concentrations of 3.85 or 3.23 mg/L respectively. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated without multiplying by the dilution factor.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

ID	Ce [F]A Data (mg/L)	Comments Column A	Ce [F]B Data (mg/L)	Comments Column B	Average of Duplicates (mg/L)	STDEV	Volume Sample (L)	Mass F per Sample (mg)			
H1	0.0	ND	0.0	ND	0.0	0.0	0.007	0.00			
H2	0.0	ND	0.0	ND	0.0	0.0	0.007	0.00			
H3	2.23		0.797		1.5	0.7	0.007	0.01			
H4	8.53		8.12		8.3	0.2	0.007	0.06			
H5	16.0		15.1		15.6	0.5	0.007	0.11			
H6	21.9		21.5		21.7	0.2	0.007	0.15			
H7	22.2		23.3		22.8	0.6	0.007	0.16			
H8	25.0		27.7		26.4	1.4	0.007	0.18			
H9	27.1		27.3		27.2	0.1	0.007	0.19			
H10	28.2		29.0		28.6	0.4	0.007	0.20	Influent 37 mg/L Fluoride		
H11	27.2		29.9		28.6	1.4	0.007	0.20			
H12	28.5		29.2		28.9	0.4	0.007	0.20			
H13	*	no sample	30.6	no duplicate	30.6	0.0	0.007	0.21			
H14	29.8		29.1		29.5	0.4	0.007	0.21			
H15	30.4		32.2		31.3	0.9	0.007	0.22			
H16	30.5		31.0		30.8	0.3	0.007	0.22			
H17	32.0		32.8		32.4	0.4	0.007	0.23			
H18	31.5		33.6		32.6	1.1	0.007	0.23			
H19	32.9		32.9		32.9	0.0	0.007	0.23		Switched to DI water at end of Sample 18	Is this pore volume part of the sorption phase or desorption phase?
H20	32.6		33.4		33.0	0.4	0.007	0.23			
H21	31.8		33.5		32.7	0.9	0.007	0.23			
H22	32.8		34.8		33.8	1.0	0.007	0.24			
H23	33.7		33.3		33.5	0.2	0.007	0.23			
H24	32.8		34.9		33.9	1.1	0.007	0.24			
H25	24.3		27.5		25.9	1.6	0.007	0.18			
H26	15.3		18.1		16.7	1.4	0.007	0.12	Influent DI water		
H27	10.9		13.3		12.1	1.2	0.007	0.08			
H28	9.76		11.1		10.4	0.7	0.007	0.07			
H29	8.45		9.42		8.9	0.5	0.007	0.06			
H30	7.73		8.34		8.0	0.3	0.007	0.06			
H31	6.50		7.08		6.8	0.3	0.007	0.05			
H32	5.68		6.10		5.9	0.2	0.007	0.04			
H33	5.02		5.47		5.2	0.2	0.007	0.04			

Sum Mass F per Sample (mg)	Influent F Conc. (mg/L)	Total Influent Volume (L)	Influent Mass (mg)	Mass Hap in Column (g)	Mass Quartz Sand (g)
	Sorption Phase			1.022	92.218
2.78	37.00	0.13	4.66		
	Desorption Phase				
2.10	0.00	0.11	0.00		

ID	Ce [F]A Data (mg/L)	Comments Column A	Ce [F]B Data (mg/L)	Comments Column B	Average of Duplicates (mg/L)	STDEV	Volume Sample (L)	ss F per Sample (mg)	columss F per Sample (mg)	column B		
H1	0.0	ND	0.0	ND	0.0	0.0	0.007	0.00	0.00			
H2	0.0	ND	0.0	ND	0.0	0.0	0.007	0.00	0.00			
H3	2.23		0.797		1.5	0.7	0.007	0.01	0.01			
H4	8.53		8.12		8.3	0.2	0.007	0.06	0.06			
H5	16.0		15.1		15.6	0.5	0.007	0.11	0.11			
H6	21.9		21.5		21.7	0.2	0.007	0.15	0.15			
H7	22.2		23.3		22.8	0.6	0.007	0.16	0.16			
H8	25.0		27.7		26.4	1.4	0.007	0.18	0.19			
H9	27.1		27.3		27.2	0.1	0.007	0.19	0.19	Influent 37 mg/L Fluoride		
H10	28.2		29.0		28.6	0.4	0.007	0.20	0.20			
H11	27.2		29.9		28.6	1.4	0.007	0.20	0.21			
H12	28.5		29.2		28.9	0.4	0.007	0.20	0.20			
H13	*	no sample	30.6	no duplicate	30.6	0.0	0.007	0.21	0.21			
H14	29.8		29.1		29.5	0.4	0.007	0.21	0.20			
H15	30.4		32.2		31.3	0.9	0.007	0.22	0.23			
H16	30.5		31.0		30.8	0.3	0.007	0.22	0.22			
H17	32.0		32.8		32.4	0.4	0.007	0.23	0.23			
H18	31.5		33.6		32.6	1.1	0.007	0.23	0.24			
H19	32.9		32.9		32.9	0.0	0.007	0.23	0.23		Switched to DI water at end of Sample 18	Is this pore volume part of the sorption phase or desorption phase?
H20	32.6		33.4		33.0	0.4	0.007	0.23	0.23			
H21	31.8		33.5		32.7	0.9	0.007	0.22	0.23			
H22	32.8		34.8		33.8	1.0	0.007	0.23	0.24			
H23	33.7		33.3		33.5	0.2	0.007	0.24	0.23			
H24	32.8		34.9		33.9	1.1	0.007	0.23	0.24			
H25	24.3		24.5		24.4	0.1	0.007	0.17	0.17			
H26	15.3		16.1		15.7	0.4	0.007	0.11	0.11	Influent DI water		
H27	10.9		10.3		10.6	0.3	0.007	0.08	0.07			
H28	9.76		10.1		9.9	0.2	0.007	0.07	0.07			
H29	8.45		8.42		8.4	0.0	0.007	0.06	0.06			
H30	7.73		8.34		8.0	0.3	0.007	0.05	0.06			
H31	6.50		7.08		6.8	0.3	0.007	0.05	0.05			
H32	5.68		6.10		5.9	0.2	0.007	0.04	0.04			
H33	5.02		5.47		5.2	0.2	0.007	0.04	0.04			

Sum Mass F per Sample (mg)	Influent F Conc. (mg/L)	Total Influent Volume (L)	Influent Mass (mg)
Sorption Phase			
2.78	35.00	0.13	4.41
Desorption Phase			
2.03	0.00	0.11	0.00

Mass Hap in Column (g)	Mass Quartz Sand (g)
1.022	92.218

Sorption process

Total F mass in the effluent	Total F mass in the effluent	average (mg)	stdev
2.78	2.81	2.8	
Total F mass adsorbed insic	Total F mass adsorbed inside column B		
1.63	1.60	1.6	0.0

Sorption capactiy A	Sorption capactiy B	average (mg/g)	stdev
0.0	1.6	1.6	1.58	0.02
Sorption efficiency A	Sorption efficiency B	average (%)	stdev
37.1	36.3	36.7	0.54

Desorption process

Total F mass in the effluent	Total F mass in the effluent column A		
Control for aqueous F le	2.03	2.09	2.1
Corrected from quartz	0.06	0.13	0.1

Desorption capactiy A	Desorption capactiy B	average (mg/g)	stdev
0.0	0.1	0.1	0.09	0.05
0.1	Desorption efficiency A	Desorption efficiency B	average (%)	stdev
	3.7	8.2	5.94	3.20

VB (volume at the BT point) (L)	qB (sorption capactiy at the BT point) (mg/g)
0.03	0.89

VE (volume at the ET point)	qE (sorption capactiy at the EP point)
0.12	1.58

f
0.31

H (bed depth) (cm)	column diametaer (cm)	column crosssection area (cm^2	column volume (cm^3)
30	2.5	4.91	147.26

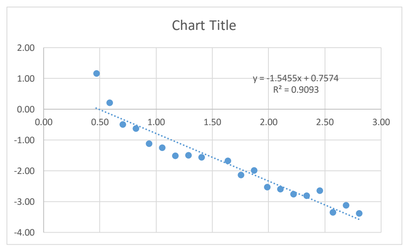
hz (height of the mass transfer zone (cm)
24.41

EBCT (empty bed contact time, cm)
147.26

flow rate (mL/min) (cm^3/min)	flow rate (L/h)
1	0.06

linear flow rate (cm^3/cm^2 min)
0.20

Ce/C0	ln((C0/Ce)-1)	time (min)	time (h)
0.00	#DIV/0!	0	0.00
0.00	#DIV/0!	7	0.12
0.00	#DIV/0!	14	0.23
0.04	3.10	21	0.35
0.24	1.16	28	0.47
0.44	0.22	35	0.58
0.62	-0.49	42	0.70
0.65	-0.62	49	0.82
0.75	-1.11	56	0.93
0.78	-1.25	63	1.05
0.82	-1.50	70	1.17
0.82	-1.49	77	1.28
0.82	-1.55	84	1.40
#N/A	#N/A	91	1.52
0.84	-1.67	98	1.63
0.89	-2.14	105	1.75
0.88	-1.98	112	1.87
0.93	-2.52	119	1.98
0.93	-2.59	126	2.10
0.94	-2.75	133	2.22
0.94	-2.80	140	2.33
0.93	-2.63	147	2.45
0.97	-3.34	154	2.57
0.96	-3.11	161	2.68
0.97	-3.38	168	2.80



slope 1.5455 y-intercept 0.7574

Kt (L / mg h) qt (mg/g)
0.04 1.01

ID	Ce [F]A Data	Comments Column A	Ce [F]B Data	Comments Column B	Average of Duplicates	STDEV	Volume Sample (L)	Mass F per Sample (mg)			
Q1	24.0		25.3		24.7	0.65	0.009	0.22			
Q2	32.1		33.9		33.0	0.9	0.009	0.30			
Q3	36.2		34.0		35.1	1.1	0.009	0.32			
Q4	36.4		36.8		36.6	0.2	0.009	0.33			
Q5	38.8		35.7		37.3	1.55	0.009	0.34			
Q6	38.8		37.1		38.0	0.85	0.009	0.34			
Q7	38.6		34.6		36.6	2	0.009	0.33			
Q8	37.8		34.8		36.3	1.5	0.009	0.33			
Q9	38.6		34.5		36.6	2.05	0.009	0.33	Influent 36 mg/L fluoride		
Q10	38.1		31.9		35.0	3.1	0.009	0.32			
Q11	36.7		36.1		36.4	0.3	0.009	0.33			
Q12	36.2		36.3		36.3	0.05	0.009	0.33			
Q13	35.9		33.2		34.6	1.35	0.009	0.31			
Q14	36.7		37.4		37.1	0.35	0.009	0.33			
Q15	37.7		36.6		37.2	0.55	0.009	0.33			
Q16	37.6		35.4		36.5	1.1	0.009	0.33			
Q17	37.7		33.9		35.8	1.9	0.009	0.32			
Q18	36.6		35.0		35.8	0.8	0.009	0.32			
Q19	36.3		37.4		36.9	0.55	0.009	0.33		Switched to DI water at end of Sample 18	Is this pore volume part of the sorption phase or desorption phase?
Q20	36.8		34.7		35.8	1.05	0.009	0.32			
Q21	35.9		35.0		35.5	0.45	0.009	0.32			
Q22	39.6		36.1		37.9	1.75	0.009	0.34			
Q23	35.1		35.0		35.1	0.05	0.009	0.32			
Q24	20.3		24.7		22.5	2.2	0.009	0.20			
Q25	7.58		8.74		8.2	0.58	0.009	0.07			
Q26	3.80		3.43		3.6	0.185	0.009	0.03	Influent DI water		
Q27	1.94		1.98		2.0	0.02	0.009	0.02			
Q28	0.667		0.734		0.7	0.0335	0.009	0.01			
Q29	0.338		0.16	BQL	0.2	0.0915	0.009	0.00			
Q30	0.232		0.07	BQL	0.2	0.0805	0.009	0.00			
Q31	0.20	BQL	0.05	BQL	0.1	0.075	0.009	0.00			
Q32	0.16	BQL	0.00	ND	0.1	0.078	0.009	0.00			
Q33	0.16	BQL	0.08	BQL	0.1	0.0385	0.009	0.00			

Sum Mass F per Sample (mg)	Influent F Conc. (mg/L)	Total Influent Volume (L)	Influent Mass (mg)	Mass Quartz Sand (g)
Sorption Phase				93
5.75	36.00	0.16	5.83	
Desorption Phase				
1.97	0.00	0.14	0.00	

ID	Ce [F]A Data	Comments Column A	Ce [F]B Data	Comments Column B	Average of Duplicates	STDEV	Volume Sample (L)	Mass F per Sample (mg) column A	Mass F per Sample (mg) column B			
Q1	24.0		25.3		24.7	0.65	0.009	0.22	0.23			
Q2	32.1		33.9		33.0	0.9	0.009	0.30	0.31			
Q3	36.2		34.0		35.1	1.1	0.009	0.32	0.31			
Q4	36.4		36.8		36.6	0.2	0.009	0.33	0.33			
Q5	38.8		35.7		37.3	1.55	0.009	0.34	0.32			
Q6	38.8		37.1		38.0	0.85	0.009	0.34	0.33			
Q7	38.6		34.6		36.6	2	0.009	0.33	0.31			
Q8	37.8		34.8		36.3	1.5	0.009	0.33	0.31			
Q9	38.6		34.5		36.6	2.05	0.009	0.33	0.31			
Q10	38.1		31.9		35.0	3.1	0.009	0.32	0.29	Influent 36 mg/L fluoride		
Q11	36.7		36.1		36.4	0.3	0.009	0.33	0.32			
Q12	36.2		36.3		36.3	0.05	0.009	0.33	0.33			
Q13	35.9		33.2		34.6	1.35	0.009	0.31	0.30			
Q14	36.7		37.4		37.1	0.35	0.009	0.33	0.34			
Q15	37.7		36.6		37.2	0.55	0.009	0.33	0.33			
Q16	37.6		35.4		36.5	1.1	0.009	0.33	0.32			
Q17	37.7		33.9		35.8	1.9	0.009	0.32	0.31			
Q18	36.6		35.0		35.8	0.8	0.009	0.32	0.32			
Q19	36.3		37.4		36.9	0.55	0.009	0.33	0.34		Switched to DI water at end of Sample 18	Is this pore volume part of the sorption phase or desorption phase?
Q20	36.8		34.7		35.8	1.05	0.009	0.33	0.31			
Q21	35.9		35.0		35.5	0.45	0.009	0.32	0.32			
Q22	39.6		36.1		37.9	1.75	0.009	0.36	0.32			
Q23	35.1		35.0		35.1	0.05	0.009	0.32	0.32			
Q24	20.3		24.7		22.5	2.2	0.009	0.18	0.22			
Q25	7.58		8.74		8.2	0.58	0.009	0.07	0.08			
Q26	3.80		3.43		3.6	0.185	0.009	0.03	0.03	Influent DI water		
Q27	1.94		1.98		2.0	0.02	0.009	0.02	0.02			
Q28	0.667		0.734		0.7	0.0335	0.009	0.01	0.01			
Q29	0.338		0.16	BQL	0.2	0.0915	0.009	0.00	0.00			
Q30	0.232		0.07	BQL	0.2	0.0805	0.009	0.00	0.00			
Q31	0.20	BQL	0.05	BQL	0.1	0.075	0.009	0.00	0.00			
Q32	0.16	BQL	0.00	ND	0.1	0.078	0.009	0.00	0.00			
Q33	0.16	BQL	0.08	BQL	0.1	0.0385	0.009	0.00	0.00			

Sum Mass F per Sample (mg)	Influent F Conc. (mg/L)	Total Influent Volume (L)	Influent Mass (mg)	Mass Quartz Sand (g)
Sorption Phase				93
5.74	36.00	0.16	5.83	
Desorption Phase				
1.97	0.00	0.14	0.00	

Sorption process	Total F mass in the effluent column A	Total F mass in the effluent column A	average (mg)	stdev	Sorption capactiy A	Sorption capactiy B	average (mg/g)	stdev	
	5.42	5.29	5.4	0.1	0.00	0.01	0.01	0.00	
	Total F mass adsorbed inside column	Total F mass adsorbed inside column B			Sorption efficiency A	Sorption efficiency B	average (%)	stdev	
	0.41	0.54	0.5	0.1	7.1	9.3	8.21	1.59	

Desorption process	Total F mass in the effluent column A	Total F mass in the effluent column A		
Control for aqueous F	1.97	1.96	2.0	0.0

Field Sample ID	Ce [F]A Data	Comments Column A	Ce [F]B Data	Comments Column B	Average of Duplicates	STDEV	Volume Sample (L)	Mass F per Sample (mg)			
F1	0.000	ND	0.000	ND	0.000	0	0.0071	0.00			
F2	0.000	ND	0.000	ND	0.000	0	0.0071	0.00			
F3	0.000	ND	0.000	ND	0.000	0	0.0071	0.00			
F4	0.000	ND	0.000	ND	0.000	0	0.0071	0.00			
F5	0.000	ND	0.000	ND	0.000	0	0.0071	0.00			
F6	0.000	ND	0.000	ND	0.000	0	0.0071	0.00			
F7	0.000	ND	0.000	ND	0.000	0	0.0071	0.00			
F8	0.328		0.000	ND	0.164	0.164	0.0071	0.00			
F9	2.49		0.00		1.245	1.245	0.0071	0.01			
F10	6.07		0.787		3.429	2.6415	0.0071	0.02			
F11	9.77		3.73		6.750	3.02	0.0071	0.05	influent 36 mg/L Fluoride		
F12	12.9		9.58		11.240	1.66	0.0071	0.08			
F13	18.4		16.7		17.550	0.85	0.0071	0.12			
F14	21.1		20.9		21.000	0.1	0.0071	0.15			
F15	24.3		27.6		25.950	1.65	0.0071	0.18			
F16	26.4		30.0		28.200	1.8	0.0071	0.20			
F17	30.0		33.2		31.600	1.6	0.0071	0.22			
F18	30.8		35.1		32.950	2.15	0.0071	0.23			
F19	34.3		36.7		35.500	1.2	0.0071	0.25			
F20	35.8		36.0		35.900	0.1	0.0071	0.25			
F21	36.7		37.0		36.850	0.15	0.0071	0.26		Switched to DI water at end of Sample 20	Is this pore volume part of the sorption phase or desorption phase?
F22	35.7		36.1		35.900	0.2	0.0071	0.25			
F23	36.0		36.4		36.200	0.2	0.0071	0.26			
F24	35.5		36.9		36.200	0.7	0.0071	0.26			
F25	36.8		35.8		36.300	0.5	0.0071	0.26			
F26	36.7		36.0		36.350	0.35	0.0071	0.26			
F27	30.3		27.5		28.900	1.4	0.0071	0.21			
F28	17.1		15.0		16.050	1.05	0.0071	0.11	Influent DI water		
F29	11.5		10.5		11.000	0.5	0.0071	0.08			
F30	7.95		7.16		7.555	0.395	0.0071	0.05			
F31	6.14		5.42		5.780	0.36	0.0071	0.04			
F32	4.94		4.38		4.660	0.28	0.0071	0.03			
F33	3.94		3.45		3.695	0.245	0.0071	0.03			
F34	2.93		2.55		2.740	0.19	0.0071	0.02			
F35	2.17		1.61		1.890	0.28	0.0071	0.01			

Sum Mass F per Sample (mg)	Influent F Conc. (mg/L)	Total Influent Volume (L)	Influent Mass (mg)
	Sorption Phase		
1.79	36.00	0.14	5.11
	Desorption Phase		
2.13	0.00	0.11	0.00

Mass Fe(OH)3 in Column (g)	Mass Quartz Sand (g)
1	92

Field Sample ID	Ce [F]A Data	Comments Column A	Ce [F]B Data	Comments Column B	Average of Duplicates	STDEV	Volume Sample (L)	Mass F per Sample (mg)	column A ss F per Sample (mg)	column B			
F1	0.000	ND	0.000	ND	0.000	0	0.0071	0.00	0.00				
F2	0.000	ND	0.000	ND	0.000	0	0.0071	0.00	0.00				
F3	0.000	ND	0.000	ND	0.000	0	0.0071	0.00	0.00				
F4	0.000	ND	0.000	ND	0.000	0	0.0071	0.00	0.00				
F5	0.000	ND	0.000	ND	0.000	0	0.0071	0.00	0.00				
F6	0.000	ND	0.000	ND	0.000	0	0.0071	0.00	0.00				
F7	0.000	ND	0.000	ND	0.000	0	0.0071	0.00	0.00				
F8	0.328		0.000	ND	0.164	0.164	0.0071	0.00	0.00				
F9	2.49		0.00		1.245	1.245	0.0071	0.02	0.00				
F10	6.07		0.787		3.429	2.6415	0.0071	0.04	0.01				
F11	9.77		3.73		6.750	3.02	0.0071	0.07	0.03	influent 36 mg/L Fluoride			
F12	12.9		9.58		11.240	1.66	0.0071	0.09	0.07				
F13	18.4		16.7		17.550	0.85	0.0071	0.13	0.12				
F14	21.1		20.9		21.000	0.1	0.0071	0.15	0.15				
F15	24.3		27.6		25.950	1.65	0.0071	0.17	0.20				
F16	26.4		30.0		28.200	1.8	0.0071	0.19	0.21				
F17	30.0		33.2		31.600	1.6	0.0071	0.21	0.24				
F18	30.8		35.1		32.950	2.15	0.0071	0.22	0.25				
F19	34.3		36.7		35.500	1.2	0.0071	0.24	0.26				
F20	35.8		36.0		35.900	0.1	0.0071	0.25	0.26				
F21	36.7		37.0		36.850	0.15	0.0071	0.26	0.26		Switched to DI water at end of Sample 20	Is this pore volume part of the sorption phase or desorption phase?	
F22	35.7		36.1		35.900	0.2	0.0071	0.25	0.26				
F23	36.0		36.4		36.200	0.2	0.0071	0.26	0.26				
F24	35.5		36.9		36.200	0.7	0.0071	0.25	0.26				
F25	36.8		35.8		36.300	0.5	0.0071	0.26	0.25				
F26	36.7		36.0		36.350	0.35	0.0071	0.26	0.26				
F27	30.3		27.5		28.900	1.4	0.0071	0.22	0.20				
F28	17.1		15.0		16.050	1.05	0.0071	0.12	0.11	Influent DI water			
F29	11.5		10.5		11.000	0.5	0.0071	0.08	0.07				
F30	7.95		7.16		7.555	0.395	0.0071	0.06	0.05				
F31	6.14		5.42		5.780	0.36	0.0071	0.04	0.04				
F32	4.94		4.38		4.660	0.28	0.0071	0.04	0.03				
F33	3.94		3.45		3.695	0.245	0.0071	0.03	0.02				
F34	2.93		2.55		2.740	0.19	0.0071	0.02	0.02				
F35	2.17		1.61		1.890	0.28	0.0071	0.02	0.01				

Sum Mass F per Sample (mg)	Influent F Conc. (mg/L)	Total Influent Volume (L)	Influent Mass (mg)
Sorption Phase			
1.79	36.00	0.14	5.11
Desorption Phase			
2.16	0.00	0.11	0.00

Mass Fe(OH)3 in Column (g)	Mass Quartz Sand (g)
1	92

Sorption process

Total F mass in the effluent column	Total F mass in the effluent	average (mg)	stdev
1.79	1.78	1.8	0.0

Total F mass adsorbed inside colum	Total F mass adsorbed inside column B		
3.32	3.33	3.3	0.0

Desorption process

Total F mass in the effluent column	Total F mass in the effluent column A		
Control for aqueous F	2.16	2.10	2.1	0.0
Corrected from quart	0.19	0.14	0.2	0.0

Sorption capactiy A	Sorption capactiy B	average (mg/g)	stdev
3.3	3.3	3.33	0.01

Sorption efficiency A	Sorption efficiency B	average (%)	stdev
64.9	65.2	65.07	0.23

Desorption capactiy A	Desorption capactiy B	average (mg/g)	stdev
0.2	0.1	0.16	0.04

Desorption efficiency A	Desorption efficiency B	average (%)	stdev
5.7	4.1	4.90	1.14

VB (volume at the BT point) (L) qB (sorption capactiy at the BT point) (mg/g)

0.06	2.28

VE (volume at the ET point) qE (sorption capactiy at the EP point)

0.13	3.32

f

0.46

H (bed depth) (cm)	column diametaer (cm)	column crosssection area (cr	column volume (cm^3)
30	2.5	4.91	147.26

hz (height of the mass transfer zone (cm)

22.12

EBCT (empty bed contact time, cm)

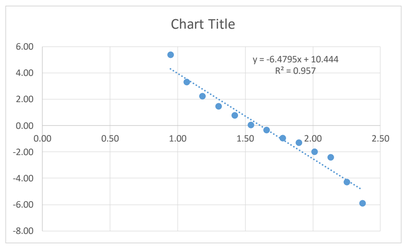
147.26

flow rate (mL/min) (cm^3/min)	flow rate (L/h)
1	0.06

linear flow rate (cm^3/cm^2 min)

0.20

Ce/C0	ln((C0/Ce)-1)	time (min)	time (h)
0	#DIV/0!	0.0	0.00
0	#DIV/0!	7	0.12
0	#DIV/0!	14	0.24
0	#DIV/0!	21	0.36
0	#DIV/0!	28	0.47
0	#DIV/0!	36	0.59
0	#DIV/0!	43	0.71
0	#DIV/0!	50	0.83
0.004555556	5.39	57	0.95
0.034583333	3.33	64	1.07
0.095236111	2.25	71	1.18
0.1875	1.47	78	1.30
0.312222222	0.79	85	1.42
0.4875	0.05	92	1.54
0.583333333	-0.34	99	1.66
0.720833333	-0.95	107	1.78
0.783333333	-1.29	114	1.89
0.877777778	-1.97	121	2.01
0.915277778	-2.38	128	2.13
0.986111111	-4.26	135	2.25
0.997222222	-5.88	142	2.37
1.023611111	#NUM!	149	2.49
0.997222222	-5.88	156	2.60
1.005555556	#NUM!	163	2.72
1.005555556	#NUM!	170	2.84
1.008333333	#NUM!	178	2.96
1.009722222	#NUM!	185	3.08



slope 6.4795 y-intercept 10.4444

Kt (L / mg h) qt (mg/g)

0.18 3.48

Field Sample ID	Ce [F]A Data	Ce [F]B Data	Comments Column B	Average of Duplicates	STDEV	Volume Sample (L)	Mass F per Sample (mg)			
M1	0.209	0.2	BQL	0.2	0.018	0.0072	0.00			
M2	2.99	2.43		2.7	0.28	0.0072	0.02			
M3	9.55	8.49		9.0	0.53	0.0072	0.06			
M4	16.6	14.4		15.5	1.1	0.0072	0.11			
M5	21.7	19.1		20.4	1.3	0.0072	0.15			
M6	23.7	23.1		23.4	0.3	0.0072	0.17			
M7	28.0	24.1		26.1	1.95	0.0072	0.19			
M8	28.6	25.4		27.0	1.6	0.0072	0.19			
M9	29.6	29.6		29.6	0	0.0072	0.21	Influent 35 mg/L Fluoride		
M10	30.0	31.3		30.7	0.65	0.0072	0.22			
M11	34.3	30.0		32.2	2.15	0.0072	0.23			
M12	28.2	31.1		29.7	1.45	0.0072	0.21			
M13	34.2	28.5		31.4	2.85	0.0072	0.23			
M14	34.4	30.4		32.4	2	0.0072	0.23			
M15	32.7	32.4		32.6	0.15	0.0072	0.23			
M16	36.4	33.5		35.0	1.45	0.0072	0.25			
M17	34.9	32.6		33.8	1.15	0.0072	0.24			
M18	35.9	32.6		34.3	1.65	0.0072	0.25			
M19	35.7	34.5		35.1	0.6	0.0072	0.25		Switched to DI water at end of Sample 18	Is this pore volume part of the sorption phase or desorption phase?
M20	36.6	32.8		34.7	1.9	0.0072	0.25			
M21	38.4	33.6		36.0	2.4	0.0072	0.26			
M22	34.6	31.5		33.1	1.55	0.0072	0.24			
M23	36.5	27.9		32.2	4.3	0.0072	0.23			
M24	25.1	29.5		27.3	2.2	0.0072	0.20			
M25	21.1	20.3		20.7	0.4	0.0072	0.15			
M26	12.5	14.6		13.6	1.05	0.0072	0.10	Influent DI Water		
M27	13.4	14.5		14.0	0.55	0.0072	0.10			
M28	11.3	11.7		11.5	0.2	0.0072	0.08			
M29	7.02	9.37		8.2	1.175	0.0072	0.06			
M30	7.73	8.47		8.1	0.37	0.0072	0.06			
M31	4.89	7.23		6.1	1.17	0.0072	0.04			
M32	4.17	5.10		4.6	0.465	0.0072	0.03			
M33	3.88	4.82		4.4	0.47	0.0072	0.03			

Sum Mass F per Sample (mg)	Influent F Conc. (mg/L)	Total Influent Volume (L)	Influent Mass (mg)	Mass Brucite in Column (g)	Mass Quartz Sand (g)
	Sorption Phase			1	92
3.21	35.00	0.13	4.54		
	Desorption Phase				
2.08	0.00	0.11	0.00		

Field Sample ID	Ce [F]A Data	Ce [F]B Data	Comments Column B	Average of Duplicates	STDEV	Volume Sample (L)	is F per Sample (mg)	columss F per Sample (mg)	column B		
M1	0.209	0.2	BQL	0.2	0.018	0.0072	0.00	0.00			
M2	2.99	2.43		2.7	0.28	0.0072	0.02	0.02			
M3	9.55	8.49		9.0	0.53	0.0072	0.07	0.06			
M4	16.6	14.4		15.5	1.1	0.0072	0.12	0.10			
M5	21.7	19.1		20.4	1.3	0.0072	0.16	0.14			
M6	23.7	23.1		23.4	0.3	0.0072	0.17	0.17			
M7	28.0	24.1		26.1	1.95	0.0072	0.20	0.17			
M8	28.6	25.4		27.0	1.6	0.0072	0.21	0.18			
M9	29.6	29.6		29.6	0	0.0072	0.21	0.21	Influent 35 mg/L		
M10	30.0	31.3		30.7	0.65	0.0072	0.22	0.23	Fluoride		
M11	34.3	30.0		32.2	2.15	0.0072	0.25	0.22			
M12	28.2	31.1		29.7	1.45	0.0072	0.20	0.22			
M13	34.2	28.5		31.4	2.85	0.0072	0.25	0.21			
M14	34.4	30.4		32.4	2	0.0072	0.25	0.22			
M15	32.7	32.4		32.6	0.15	0.0072	0.24	0.23			
M16	36.4	33.5		35.0	1.45	0.0072	0.26	0.24			
M17	34.9	32.6		33.8	1.15	0.0072	0.25	0.23			
M18	35.9	32.6		34.3	1.65	0.0072	0.26	0.23			
M19	35.7	34.5		35.1	0.6	0.0072	0.26	0.25		Switched to DI water at end of Sample 18	Is this pore volume part of the sorption phase or desorption phase?
M20	36.6	32.8		34.7	1.9	0.0072	0.26	0.24			
M21	38.4	33.6		36.0	2.4	0.0072	0.28	0.24			
M22	34.6	31.5		33.1	1.55	0.0072	0.25	0.23			
M23	36.5	27.9		32.2	4.3	0.0072	0.26	0.20			
M24	25.1	29.5		27.3	2.2	0.0072	0.18	0.21			
M25	21.1	20.3		20.7	0.4	0.0072	0.15	0.15			
M26	12.5	14.6		13.6	1.05	0.0072	0.09	0.11	Influent DI Water		
M27	13.4	14.5		14.0	0.55	0.0072	0.10	0.10			
M28	11.3	11.7		11.5	0.2	0.0072	0.08	0.08			
M29	7.02	9.37		8.2	1.175	0.0072	0.05	0.07			
M30	7.73	8.47		8.1	0.37	0.0072	0.06	0.06			
M31	4.89	7.23		6.1	1.17	0.0072	0.04	0.05			
M32	4.17	5.10		4.6	0.465	0.0072	0.03	0.04			
M33	3.88	4.82		4.4	0.47	0.0072	0.03	0.03			

Sum Mass F per Sample (mg)	Influent F Conc. (mg/L)	Total Influent Volume (L)	Influent Mass (mg)
Sorption Phase			
3.33	35.00	0.13	4.54
Desorption Phase			
2.11	0.00	0.11	0.00

Mass Brucite in Column (g)	Mass Quartz Sand (g)
1	92

Sorption process

Total F mass in the effluent	Total F mass in the effluent	average (mg)	stdev
3.33	3.09	3.2	
Total F mass adsorbed insic	Total F mass adsorbed inside column B		
1.21	1.45	1.3	0.2

Sorption capactiy A	Sorption capactiy B	average (mg/g)	stdev
0.2	1.2	1.4	1.33 0.17
Sorption efficiency A	Sorption efficiency B	average (%)	stdev
26.7	31.9	29.27	3.68

Desorption process

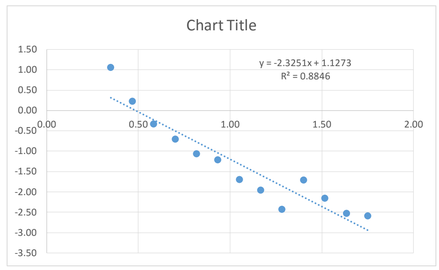
Total F mass in the effluent	Total F mass in the effluent column A		
Control for aqueous f 2.11	2.06	2.1	
Corrected from quart 0.14	0.10	0.1	

Desorption capactiy A	Desorption capactiy B	average (mg/g)	stdev
0.0	0.1	0.1	0.12 0.03
Desorption efficiency A	Desorption efficiency B	average (%)	stdev
11.3	6.6	8.96	3.36

VB (volume at the BT point) (L)	qB (sorption capactiy at the BT point) (mg/g)
0.01	0.48
VE (volume at the ET point)	qE (sorption capactiy at the EP point)
0.12	1.22
f	
0.29	

H (bed depth) (cm)	column diametaer (cm)	column crosssection area (cr	column volume (cm^3)
30	2.5	4.91	147.26
hz (height of the mass transfer zone (cm)			
23.30			
EBCT (empty bed contact time, cm)			
147.26			
flow rate (mL/min) (cm^3/min)	flow rate (L/h)		
1	0.06		
linear flow rate (cm^3/cm^2 min)			
0.20			

Ce/C0	ln((C0/Ce)-1)	time (min)	time (h)	
0.00	#DIV/0!		0	0.00
0.01		5.21	7	0.12
0.08		2.48	14	0.23
0.26		1.06	21	0.35
0.44		0.23	28	0.47
0.58		-0.33	35	0.58
0.67		-0.70	42	0.70
0.74		-1.07	49	0.82
0.77		-1.22	56	0.93
0.85		-1.70	63	1.05
0.88		-1.95	70	1.17
0.92		-2.42	77	1.28
0.85		-1.71	84	1.40
0.90		-2.15	91	1.52
0.93		-2.52	98	1.63
0.93		-2.59	105	1.75
1.00		-6.55	112	1.87
0.96		-3.30	119	1.98
0.98		-3.82	126	2.10
1.00	#N/A		133	2.22
0.99		-4.75	140	2.33
1.03	#N/A		147	2.45
0.94		-2.83	154	2.57
0.92		-2.44	161	2.68

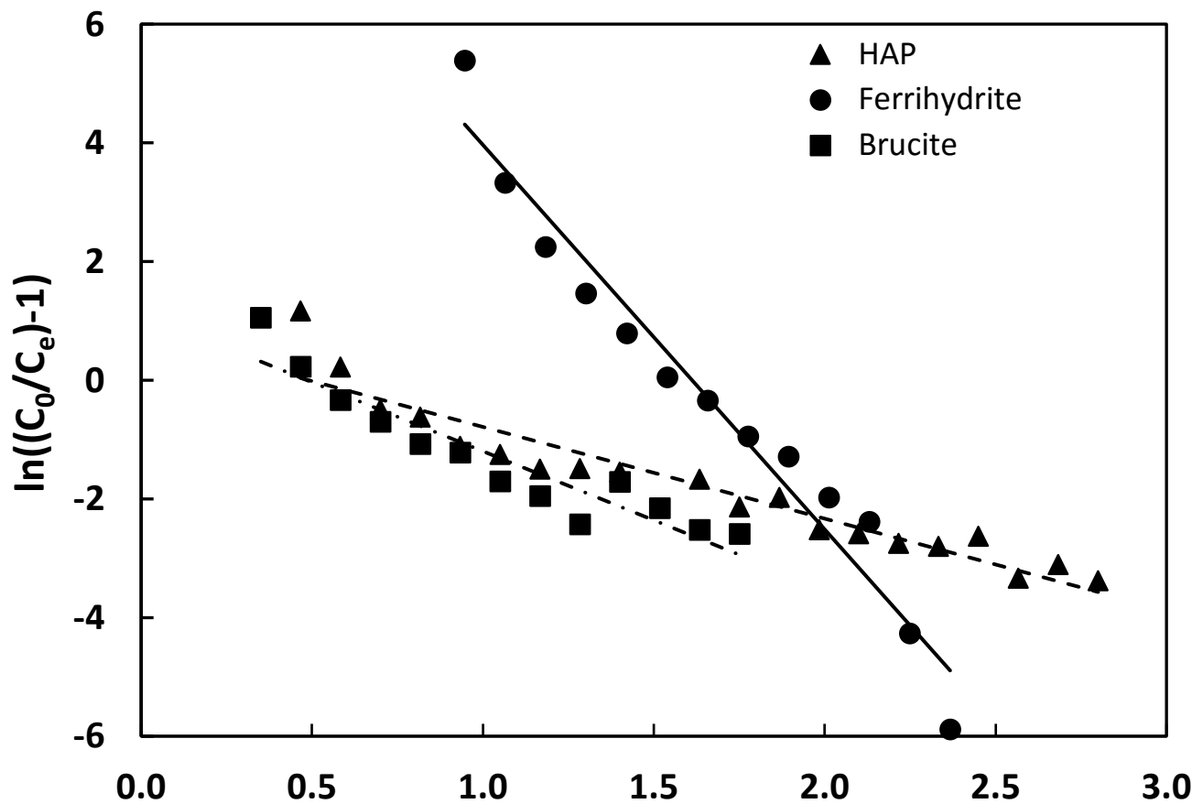


slope 2.3251 y-intercept 1.1273

Kt (L / mg h) qt (mg/g)

0.07 1.02

HAP		Ferrihydrite		Brucite	
ln((C0/Ce)-1)	time (h)	ln((C0/Ce)-	time (h)	ln((C0/Ce)-	time (h)
1.16	0.47	5.386842	0.9468	1.057883	0.35
0.22	0.58	3.329188	1.06515	0.229574	0.466667
-0.49	0.70	2.251315	1.1835	-0.33451	0.583333
-0.62	0.82	1.466337	1.30185	-0.70173	0.7
-1.11	0.93	0.789751	1.4202	-1.06836	0.816667
-1.25	1.05	0.05001	1.53855	-1.2164	0.933333
-1.50	1.17	-0.33647	1.6569	-1.70138	1.05
-1.49	1.28	-0.9486	1.77525	-1.95246	1.166667
-1.55	1.40	-1.2852	1.8936	-2.42309	1.283333
#N/A	1.52	-1.97155	2.01195	-1.71237	1.4
-1.67	1.63	-2.37985	2.1303	-2.15049	1.516667
-2.14	1.75	-4.26268	2.24865	-2.52265	1.633333
-1.98	1.87	-5.88332	2.367	-2.58669	1.75
-2.52	1.98				
-2.59	2.10				
-2.75	2.22				
-2.80	2.33				
-2.63	2.45				
-3.34	2.57				
-3.11	2.68				
-3.38	2.80				



A1:R30Sam	Lab Sample	Date Collected		Date Analyzed	Ce [F] Data	DF	Date Analyzed	Ce [P] Data	DF
F1	7094-1	-		4/7/2016	ND	1	4/5/2016	0.066	1
F2	7094-2	-		4/7/2016	ND	1	4/5/2016	BQL (0.017)	1
F3	7094-3	-		4/7/2016	ND	1	1/0/1900	BQL (0.017)	1
F4	7094-4	-		4/7/2016	ND	1	4/5/2016	0.023	1
F5	7094-5	-		4/7/2016	ND	1	4/5/2016	0.020	1
F6	7094-6	-		4/7/2016	ND	1	4/5/2016	0.022	1
F7	7094-7	-		4/7/2016	ND	1	4/5/2016	BQL (0.018)	1
F8	7094-8	-		4/7/2016	0.328	1	4/5/2016	0.020	1
F9	7094-9	-		4/7/2016	2.49	1	4/5/2016	BQL (0.018)	1
F10	7094-10	-		4/7/2016	6.07	1	4/5/2016	BQL (0.019)	1
F10	4-10 Lab	-		4/7/2016	6.07 (RPD=0)	1	4/5/2016	BQL (0.019) (RPD=NA)	1
F11	7094-11	-		4/7/2016	9.77	1	4/5/2016	0.020	1
F12	7094-12	-		4/8/2016	12.9	6	4/5/2016	0.021	1
F13	7094-13	-		4/8/2016	18.4	6	4/5/2016	BQL (0.017)	1
F14	7094-14	-	6/19/2015	4/8/2016	21.1	6	4/5/2016	0.120	1
F15	7094-15	-	6/19/2015	4/8/2016	24.3	6	4/5/2016	0.030	1
F16	7094-16	-	6/19/2015	4/8/2016	26.4	6	4/5/2016	BQL (0.019)	1
F17	7094-17	-	6/19/2015	4/8/2016	30.0	6	4/5/2016	BQL (0.019)	1
F18	7094-18	-		4/8/2016	30.8	6	4/5/2016	BQL (0.017)	1
F19	7094-19	-		4/8/2016	34.3	6	4/5/2016	0.021	1
F20	7094-20	-		4/8/2016	35.8	6	4/5/2016	BQL (0.017)	1
F20	4-20 Lab	-		4/8/2016	36.0 (RPD=0.557)	6	4/5/2016	BQL (0.018) (RPD=NA)	1
F21	7094-21	-		4/8/2016	36.7	6	4/5/2016	BQL (0.019)	1
F22	7094-22	-		4/8/2016	35.7	6	4/5/2016	BQL (0.017)	1
F23	7094-23	-		4/8/2016	36.0	6	4/5/2016	BQL (0.016)	1
F24	7094-24	-		4/8/2016	35.5	6	4/5/2016	BQL (0.016)	1
F25	7094-25	-		4/8/2016	36.8	6	4/5/2016	BQL (0.016)	1
F26	7094-26	-		4/8/2016	36.7	6	4/5/2016	BQL (0.016)	1
F27	7094-27	-		4/8/2016	30.3	6	4/5/2016	BQL (0.017)	1
F28	7094-28	-		4/8/2016	17.1	6	4/5/2016	BQL (0.016)	1
F29	7094-29	-		4/8/2016	11.5	6	4/5/2016	BQL (0.016)	1
F29	4-29 Lab	-		4/8/2016	11.5 (RPD=0)	6	-	-	-
F30	7094-30	-	6/19/2015	4/8/2016	7.95	1	4/5/2016	BQL (0.013)	1
F30	4-30 Lab	-	6/19/2015	4/8/2016	7.80 (RPD=1.90)	1	4/5/2016	BQL (0.013) (RPD=NA)	1
F31	7094-31	-	6/19/2015	4/8/2016	6.14	1	4/5/2016	BQL (0.015)	1
F32	7094-32	-		4/8/2016	4.94	1	4/5/2016	BQL (0.011)	1
F33	7094-33	-		4/8/2016	3.94	1	4/5/2016	BQL (0.016)	1
F34	7094-34	-		4/8/2016	2.93	1	4/5/2016	BQL (0.018)	1
F35	7094-35	-	6/19/2015	4/8/2016	2.17	1	4/5/2016	BQL (0.015)	1
F35	4-35 Lab	-	6/19/2015	4/8/2016	2.12 (RPD=2.33)	1	4/5/2016	BQL (0.016) (RPD=NA)	1

Field Sample	Lab Sample	Date Collected		Ce [F]B Data	Ce [P]B Data	DF
F1B	7099-1	-		ND	0.154	1
F2B	7099-2	-		ND	0.040	1
F3B	7099-3	-		ND	0.029	1
F4B	7099-4	-		ND	0.041	1
F5B	7099-5	-		ND	0.050	1
F6B	7099-6	-		ND	0.030	1
F7B	7099-7	-		ND	0.041	1
F8B	7099-8	-		ND	0.033	1
F9B	7099-9	-		ND	0.029	1
F10B	7099-10	-		0.787	0.022	1
F10B	9-10 Lab	-		0.750 (RPD=4.81)	0.021 (RPD=4.65)	1
F11B	7099-11	-		3.73	0.257	1
F12B	7099-12	-		9.58	0.024	1
F13B	7099-13	-		16.7	0.037	1
F14B	7099-14	-	#######	20.9	0.034	1
F15B	7099-15	-	#######	27.6	0.030	1
F16B	7099-16	-	#######	30.0	0.023	1
F17B	7099-17	-	#######	33.2	0.023	1
F18B	7099-18	-		35.1	0.024	1
F19B	7099-19	-		36.7	0.023	1
F20B	7099-20	-		36.0	0.021	1
F20B	9-20 Lab	-		37.2 (RPD=3.28)	0.022 (RPD=4.65)	1
F21B	7099-21	-		37.0	0.021	1
F22B	7099-22	-		36.1	0.024	1
F23B	7099-23	-		36.4	BQL (0.019)	1
F24B	7099-24	-		36.9	BQL (0.019)	1
F25B	7099-25	-		35.8	0.022	1
F26B	7099-26	-		36.0	BQL (0.018)	1
F27B	7099-27	-		27.5	0.022	1
F28B	7099-28	-		15.0	0.022	1
F29B	7099-29	-		10.5	0.020	1
F30B	7099-30	-	#######	7.16	0.021	1
F30B	9-30 Lab	-	#######	7.11 (RPD=0.701)	0.021 (RPD=0)	1
F31B	7099-31	-	#######	5.42	BQL (0.017)	1
F32B	7099-32	-		4.38	BQL (0.019)	1
F33B	7099-33	-		3.45	0.020	1
F34B	7099-34	-		2.55	0.021	1
F35B	7099-35	-	#######	1.61	0.021	1
35F	7099-36	-	#######	37.1	0.027	1
35Fb	7099-37	-	#######	37.3	0.026	1
35Fb	9-37 Lab	-		37.4 (RPD=0.268)	0.026 (RPD=0)	1

Field Sample ID	Ce [F]A Data	omments Column	Ce [F]B Data	omments Column	verage of Duplicate	STDEV	mple collection time	Columnmple collection time	Colum	Average Time	STDEV time		Ce [P]B Data	omments Column	Ce [P]A Data	Comments Column B	Average of Duplicates	STDEV
F1	0.000	ND	0.000	ND	0.000	0	6.972	7.23		7.10		0.13	0.154		0.066		0.11	0.044
F2	0.000	ND	0.000	ND	0.000	0	13.94	14.46		14.20		0.26	0.040		0.017	BQL	0.0285	0.0115
F3	0.000	ND	0.000	ND	0.000	0	20.916	21.69		21.30		0.39	0.029		0.017	BQL	0.023	0.006
F4	0.000	ND	0.000	ND	0.000	0	27.89	28.92		28.40		0.52	0.041		0.023		0.032	0.009
F5	0.000	ND	0.000	ND	0.000	0	34.86	36.15		35.51		0.65	0.050		0.020		0.035	0.015
F6	0.000	ND	0.000	ND	0.000	0	41.83	43.38		42.61		0.77	0.030		0.022		0.026	0.004
F7	0.000	ND	0.000	ND	0.000	0	48.804	50.61		49.71		0.90	0.041		0.018	BQL	0.0295	0.0115
F8	0.328		0.000	ND	0.164	0.164	55.78	57.84		56.81		1.03	0.033		0.020		0.0265	0.0065
F9	2.49		0.00		1.245	1.245	62.748	65.07		63.91		1.16	0.029		0.018	BQL	0.0235	0.0055
F10	6.07		0.787		3.429	2.6415	69.72	72.3		71.01		1.29	0.022		0.019	BQL	0.0205	0.0015
F11	9.77		3.73		6.750	3.02	76.692	79.53		78.11		1.42	0.257		0.020		0.1385	0.1185
F12	12.9		9.58		11.240	1.66	83.66	86.76		85.21		1.55	0.024		0.021		0.0225	0.0015
F13	18.4		16.7		17.550	0.85	90.636	93.99		92.31		1.68	0.037		0.017	BQL	0.027	0.01
F14	21.1		20.9		21.000	0.1	97.61	101.22		99.41		1.81	0.034		0.120		0.077	0.043
F15	24.3		27.6		25.950	1.65	104.58	108.45		106.52		1.94	0.030		0.030		0.03	0
F16	26.4		30.0		28.200	1.8	111.55	115.68		113.62		2.06	0.023		0.019	BQL	0.021	0.002
F17	30.0		33.2		31.600	1.6	118.524	122.91		120.72		2.19	0.023		0.019	BQL	0.021	0.002
F18	30.8		35.1		32.950	2.15	125.50	130.14		127.82		2.32	0.024		0.017	BQL	0.0205	0.0035
F19	34.3		36.7		35.500	1.2	132.47	137.37		134.92		2.45	0.023		0.021		0.022	0.001
F20	35.8		36.0		35.900	0.1	139.44	144.6		142.02		2.58	0.021		0.017	BQL	0.019	0.002
F21	36.7		37.0		36.850	0.15	146.41	151.83		149.12		2.71	0.021		0.019	BQL	0.02	0.001
F22	35.7		36.1		35.900	0.2	153.384	159.06		156.22		2.84	0.024		0.017	BQL	0.0205	0.0035
F23	36.0		36.4		36.200	0.2	160.36	166.29		163.32		2.97	0.019	BQL	0.016	BQL	0.0175	0.0015
F24	35.5		36.9		36.200	0.7	167.328	173.52		170.42		3.10	0.019	BQL	0.016	BQL	0.0175	0.0015
F25	36.8		35.8		36.300	0.5	174.30	180.75		177.53		3.22	0.022		0.016	BQL	0.019	0.003
F26	36.7		36.0		36.350	0.35	181.272	187.98		184.63		3.35	0.018	BQL	0.016	BQL	0.017	0.001
F27	30.3		27.5		28.900	1.4	188.24	195.21		191.73		3.48	0.022		0.017	BQL	0.0195	0.0025
F28	17.1		15.0		16.050	1.05	195.216	202.44		198.83		3.61	0.022		0.016	BQL	0.019	0.003
F29	11.5		10.5		11.000	0.5	202.19	209.67		205.93		3.74	0.020		0.016	BQL	0.018	0.002
F30	7.95		7.16		7.555	0.395	209.16	216.9		213.03		3.87	0.021		0.013	BQL	0.017	0.004
F31	6.14		5.42		5.780	0.36	216.13	224.13		220.13		4.00	0.017	BQL	0.015	BQL	0.016	0.001
F32	4.94		4.38		4.660	0.28	223.104	231.36		227.23		4.13	0.019	BQL	0.011	BQL	0.015	0.004
F33	3.94		3.45		3.695	0.245	230.08	238.59		234.33		4.26	0.020		0.016	BQL	0.018	0.002
F34	2.93		2.55		2.740	0.19	237.048	245.82		241.43		4.39	0.021		0.018	BQL	0.0195	0.0015
F35	2.17		1.61		1.890	0.28	244.02	253.05		248.54		4.52	0.021		0.015	BQL	0.018	0.003

Background Data		
35F	37.1	0.027
35Fb	37.3	0.026

Flow Rate ml	Average ect one sample (min)	
Column A	1.045	1.0875 6.972
Column B	1.13	7.3

ID	Ce [F] mg/L
Q1	24.0
Q2	32.1
Q3	36.2
Q4	36.4
Q5	38.8
Q6	38.8
Q7	38.6
Q8	37.8
Q9	38.6
Q10	38.1
Q10	(RPD=0.784)
Q11	36.7
Q12	36.2
Q13	35.9
Q14	36.7
Q15	37.7
Q16	37.6
Q17	37.7
Q18	36.6
Q19	36.3
Q20	36.8
Q20	(RPD=0.819)
Q21	35.9
Q22	39.6
Q23	35.1
Q24	20.3
Q25	7.58
Q26	3.80
Q27	1.94
Q28	0.667
Q29	0.338
Q30	0.232
Q30	6 (RPD=5.86)
Q31	QL (0.195)
Q32	QL (0.156)
Q33	QL (0.157)

ID	Ce [F] mg/L
Qb1	25.3
Qb2	33.9
Qb3	34.0
Qb4	36.8
Qb5	35.7
Qb6	37.1
Qb7	34.6
Qb8	34.8
Qb9	34.5
Qb10	31.9
Qb10	2 (RPD=6.96)
Qb11	36.1
Qb12	36.3
Qb13	33.2
Qb14	37.4
Qb15	36.6
Qb16	35.4
Qb17	33.9
Qb18	35.0
Qb19	37.4
Qb20	34.7
Qb20	7 (RPD=2.84)
Qb21	35.0
Qb22	36.1
Qb23	35.0
Qb24	24.7
Qb25	8.74
Qb26	3.43
Qb27	1.98
Qb28	0.734
Qb29	QL (0.155)
Qb30	QL (0.071)
Qb30	.063) (RPD=NA)
Qb31	QL (0.045)
Qb32	ND
Qb33	QL (0.080)

BACKGROUND

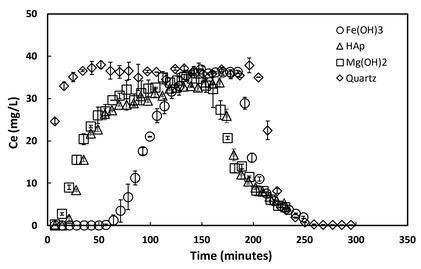
ID	[F]	[P]
QF	36.6	QL (0.018)
QFb	36.2	0.029
QFb	(RPD=0.5	0.072

ID	Ce [F]A Data	Comments Column A	Ce [F]B Data	Comments Column B	Average of Duplicates	STDEV	Sample collection time Column A	Sample collection time Column B	Average Time	STDEV time	Ce [P]B Data	Comments Column A	Ce [P]A Data	Comments Column B	Average of Duplicates	STDEV	Background Data
Q1	24.0		25.3		24.7	0.65	7						0.191				
Q2	32.1		33.9		33.0	0.9	16						0.067				
Q3	36.2		34.0		35.1	1.1	25						0.052				
Q4	36.4		36.8		36.6	0.2	34						0.040				
Q5	38.8		35.7		37.3	1.55	43						0.039				
Q6	38.8		37.1		38.0	0.85	52						0.034				
Q7	38.6		34.6		36.6	2	61						0.035				
Q8	37.8		34.8		36.3	1.5	70						0.033				
Q9	38.6		34.5		36.6	2.05	79						0.031				
Q10	38.1		31.9		35.0	3.1	88						0.027				
Q11	36.7		36.1		36.4	0.3	97						0.034				
Q12	36.2		36.3		36.3	0.05	106						0.026				
Q13	35.9		33.2		34.6	1.35	115						0.031				
Q14	36.7		37.4		37.1	0.35	124						0.032				
Q15	37.7		36.6		37.2	0.55	133						0.031				
Q16	37.6		35.4		36.5	1.1	142						0.030				
Q17	37.7		33.9		35.8	1.9	151						0.028				
Q18	36.6		35.0		35.8	0.8	160						0.030				
Q19	36.3		37.4		36.9	0.55	169						0.031				
Q20	36.8		34.7		35.8	1.05	178						0.029				
Q21	35.9		35.0		35.5	0.45	187						0.032				
Q22	39.6		36.1		37.9	1.75	196						0.033				
Q23	35.1		35.0		35.1	0.05	205						0.031				
Q24	20.3		24.7		22.5	2.2	214						0.023				
Q25	7.58		8.74		8.2	0.58	223						0.022				
Q26	3.80		3.43		3.6	0.185	232						0.022				
Q27	1.94		1.98		2.0	0.02	241						BQL (0.019)				
Q28	0.667		0.734		0.7	0.0335	250						BQL (0.019)				
Q29	0.338		0.16	BQL	0.2	0.0915	259						0.025				
Q30	0.232		0.07	BQL	0.2	0.0805	268						BQL (0.018)				
Q31	0.20	BQL	0.05	BQL	0.1	0.075	277						BQL (0.018)				
Q32	0.16	BQL	0.00	ND	0.1	0.078	286						BQL (0.019)				
Q33	0.16	BQL	0.08	BQL	0.1	0.0385	295										

ID	Ce [F] Data	Ce [P] Data
H1	** ND	0.609
H2	** ND	1.35
H3	2.23	1.33
H4	8.53	1.05
H5	16.0	0.793
H6	21.9	0.487
H7	22.2	0.318
H8	25.0	0.204
H9	27.1	0.142
H10	28.2	0.114
H10	28.1 (RPD=0.355)	0.110 (RPD=3.57)
H11	27.2	0.094
H12	28.5	0.078
H13	*	*
H14	29.8	0.058
H15	30.4	0.054
H16	30.5	0.049
H17	32.0	0.039
H18	31.5	0.043
H19	32.9	0.042
H20	32.6	0.042
H20	33.6 (RPD=3.02)	0.040 (RPD=4.88)
H21	31.8	0.039
H22	32.8	0.039
H23	33.7	0.040
H24	32.8	0.036
H25	24.3	0.030
H26	15.3	0.022
H27	10.9	0.023
H28	9.76	0.024
H28	9.76 (RPD=0)	-
H29	8.45	0.021
H30	7.73	0.025
H30	-	0.024 (RPD=4.08)
H31	6.50	0.025
H32	5.68	0.027
H33	5.02	0.027
H33	5.00 (RPD=0.399)	0.026 (RPD=3.77)

ID	Ce [F]B Data	Ce [P]B Data
H1b	** ND	1.61
H2b	** ND	2.84
H3b	0.797	2.10
H4b	8.12	1.66
H5b	15.1	1.16
H6b	21.5	0.747
H7b	23.3	0.512
H8b	27.7	0.378
H9b	27.3	0.261
H10b	29.0	0.176
H10b	29.0 (RPD=0)	0.176 (RPD=0)
H11b	29.9	0.133
H12b	29.2	0.118
H13b	30.6	0.130
H14b	29.1	0.109
H15b	32.2	0.094
H16b	31.0	0.092
H17b	32.8	0.071
H18b	33.6	0.059
H19b	32.9	0.051
H20b	33.4	0.047
H20b	33.8 (RPD=1.19)	0.045 (RPD=4.35)
H21b	33.5	0.044
H22b	34.8	0.044
H23b	33.3	0.043
H24b	34.9	0.042
H25b	27.5	0.035
H26b	18.1	0.028
H27b	13.3	0.025
H28b	11.1	0.025
H29b	9.42	0.024
H30b	8.34	0.024
H30b	8.15 (RPD=2.30)	0.025 (RPD=4.08)
H31b	7.08	0.028
H32b	6.10	0.029
H33b	5.47	0.029

ID	Ce [F]A Data	Comments Column A	Ce [F]B Data	Comments Column B	Average of Duplicates	STDEV	Sample collection time Column A	Sample collection time Column B	Average Time	STDEV time	Ce [P]B Data	Comments Column A	Ce [P]A Data	Comments Column B	Average of Duplicates	STDEV	Background Data	Flow Rate ml/min	Average	Time To collect one sample (min)
H1	0.0	ND	0.0	ND	0.0	0.0	7	7	7	0.00	1.61		0.609							
H2	0.0	ND	0.0	ND	0.0	0.0	14	13.93	13.965	0.04	2.84		1.35							
H3	2.23		0.797		1.5	0.7	21	20.86	20.93	0.07	2.10		1.33							
H4	8.53		8.12		8.3	0.2	28	27.79	27.895	0.11	1.66		1.05							
H5	16.0		15.1		15.6	0.5	35	34.72	34.86	0.14	1.16		0.793							
H6	21.9		21.5		21.7	0.2	42	41.65	41.825	0.18	0.747		0.487							
H7	22.2		23.3		22.8	0.6	49	48.58	48.79	0.21	0.512		0.318							
H8	25.0		27.7		26.4	1.4	56	55.51	55.755	0.25	0.378		0.204							
H9	27.1		27.3		27.2	0.1	63	62.44	62.72	0.28	0.261		0.142							
H10	28.2		29.0		28.6	0.4	70	69.37	69.685	0.31	0.176		0.114							
H11	27.2		29.9		28.6	1.4	77	76.3	76.65	0.35	0.133		0.094							
H12	28.5		29.2		28.9	0.4	84	83.23	83.615	0.38	0.118		0.078							
H13	*	no sample	30.6	no duplicate	30.6	0.0	91	90.16	90.58	0.42	0.130		*							
H14	29.8		29.1		29.5	0.4	98	97.09	97.545	0.45	0.109		0.058							
H15	30.4		32.2		31.3	0.9	105	104.02	104.51	0.49	0.094		0.054							
H16	30.5		31.0		30.8	0.3	112	110.95	111.475	0.52	0.092		0.049							
H17	32.0		32.8		32.4	0.4	119	117.88	118.44	0.56	0.071		0.039							
H18	31.5		33.6		32.6	1.1	126	124.81	125.405	0.59	0.059		0.043							
H19	32.9		32.9		32.9	0.0	133	131.74	132.37	0.63	0.051		0.042							
H20	32.6		33.4		33.0	0.4	140	138.67	139.335	0.67	0.047		0.042							
H21	31.8		33.5		32.7	0.9	147	145.6	146.3	0.70	0.044		0.039							
H22	32.8		34.8		33.8	1.0	154	152.53	153.265	0.73	0.044		0.039							
H23	33.7		33.3		33.5	0.2	161	159.46	160.23	0.77	0.043		0.040							
H24	32.8		34.9		33.9	1.1	168	166.39	167.195	0.81	0.042		0.036							
H25	24.3		27.5		25.9	1.6	175	173.32	174.16	0.84	0.035		0.030							
H26	15.3		18.1		16.7	1.4	182	180.25	181.125	0.88	0.028		0.022							
H27	10.9		13.3		12.1	1.2	189	187.18	188.09	0.91	0.025		0.023							
H28	9.76		11.1		10.4	0.7	196	194.11	195.055	0.94	0.025		0.024							
H29	8.45		9.42		8.9	0.5	203	201.04	202.02	0.98	0.024		0.021							
H30	7.73		8.34		8.0	0.3	210	207.97	208.985	1.02	0.024		0.025							
H31	6.50		7.08		6.8	0.3	217	214.9	215.95	1.05	0.028		0.025							
H32	5.68		6.10		5.9	0.2	224	221.83	222.915	1.08	0.029		0.027							
H33	5.02		5.47		5.2	0.2	231	228.76	229.88	1.12	0.029		0.027							



Time	HAP A	HAP B
0	0.0	0.0
7	0.0	0.0
14	0.0	0.0
21	2.23	0.797
28	8.53	8.12
35	16.0	15.1
42	21.9	21.5
49	22.2	23.3
56	25.0	27.7
63	27.1	27.3
70	28.2	29.0
77	27.2	29.9
84	28.5	29.2
91	#N/A	30.6
98	29.8	29.1
105	30.4	32.2
112	30.5	31.0
119	32.0	32.8
126	31.5	33.6
133	32.9	32.9
140	32.6	33.4
147	31.8	33.5
154	32.8	34.8
161	33.7	33.3
168	32.8	34.9
175	24.3	27.5
182	15.3	18.1
189	10.9	13.3
196	9.76	11.1
203	8.45	9.42
210	7.73	8.34
217	6.50	7.08
224	5.68	6.10
231	5.02	5.47

Time	Brucite A	Brucite B
0	0.0	0.0
7	0.209	0.2
14	2.99	2.43
21	9.55	8.49
28	16.6	14.4
35	21.7	19.1
42	23.7	23.1
49	28.0	24.1
56	28.6	25.4
63	29.6	29.6
70	30.0	31.3
77	34.3	30.0
84	28.2	31.1
91	34.2	28.5
98	34.4	30.4
105	32.7	32.4
112	36.4	33.5
119	34.9	32.6
126	35.9	32.6
133	35.7	34.5
140	36.6	32.8
147	38.4	33.6
154	34.6	31.5
161	36.5	27.9
168	25.1	29.5
175	21.1	20.3
182	12.5	14.6
189	13.4	14.5
196	11.3	11.7
203	7.02	9.37
210	7.73	8.47
217	4.89	7.23
224	4.17	5.10
231	3.88	4.82

Time	Ferrihydrite A	Ferrihydrite B
0.0	0.0	0.0
7	0.000	0.000
14	0.000	0.000
21	0.000	0.000
28	0.000	0.000
36	0.000	0.000
43	0.000	0.000
50	0.000	0.000
57	0.328	0.000
64	2.49	0.00
71	6.07	0.787
78	9.77	3.73
85	12.9	9.58
92	18.4	16.7
99	21.1	20.9
107	24.3	27.6
114	26.4	30.0
121	30.0	33.2
128	30.8	35.1
135	34.3	36.7
142	35.8	36.0
149	36.7	37.0
156	35.7	36.1
163	36.0	36.4
170	35.5	36.9
178	36.8	35.8
185	36.7	36.0
192	30.3	27.5
199	17.1	15.0
206	11.5	10.5
213	7.95	7.16
220	6.14	5.42
227	4.94	4.38
234	3.94	3.45
241	2.93	2.55
249	2.17	1.61

Time	Quartz A	Quartz B
0.0	0.0	0.0
7	24.0	25.3
16	32.1	33.9
25	36.2	34.0
34	36.4	36.8
43	38.8	35.7
52	38.8	37.1
61	38.6	34.6
70	37.8	34.8
79	38.6	34.5
88	38.1	31.9
97	36.7	36.1
106	36.2	36.3
115	35.9	33.2
124	36.7	37.4
133	37.7	36.6
142	37.6	35.4
151	37.7	33.9
160	36.6	35.0
169	36.3	37.4
178	36.8	34.7
187	35.9	35.0
196	39.6	36.1
205	35.1	35.0
214	20.3	24.7
223	7.58	8.74
232	3.80	3.43
241	1.94	1.98
250	0.667	0.734
259	0.338	0.16
268	0.232	0.07
277	0.20	0.05
286	0.16	0.00
295	0.16	0.08

HAP average	Brucite average	Ferrihydrite average	Quartz average
0.00	0.00	0.00	0.00
0.00	0.19	0.00	24.65
0.00	2.71	0.00	33.00
1.51	9.02	0.00	35.10
8.33	15.50	0.00	36.60
15.55	20.40	0.00	37.25
21.70	23.40	0.00	37.95
22.75	26.05	0.00	36.60
26.35	27.00	0.16	36.30
27.20	29.60	1.25	36.55
28.60	30.65	3.43	35.00
28.55	32.15	6.75	36.40
28.85	29.65	11.24	36.25
#N/A	31.35	17.55	34.55
29.45	32.40	21.00	37.05
31.30	32.55	25.95	37.15
30.75	34.95	28.20	36.50
32.40	33.75	31.60	35.80
32.55	34.25	32.95	35.80
32.90	35.10	35.50	36.85
33.00	34.70	35.90	35.75
32.65	36.00	36.85	35.45
33.80	33.05	35.90	37.85
33.50	32.20	36.20	35.05
33.85	27.30	36.20	22.50
25.90	20.70	36.30	8.16
16.70	13.55	36.35	3.62
12.10	13.95	28.90	1.96
10.43	11.50	16.05	0.70
8.94	8.20	11.00	0.25
8.04	8.10	7.56	0.15
6.79	6.06	5.78	0.12
5.89	4.64	4.66	0.08
5.25	4.35	3.70	0.12
		2.74	
		1.89	

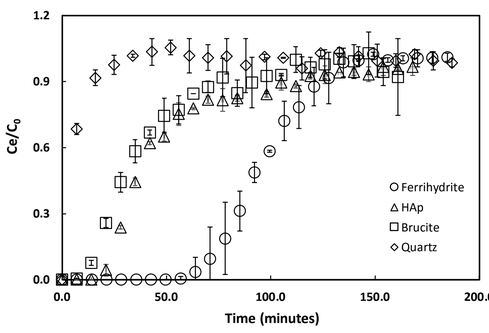
HAP stdev	Brucite stdev	Ferrihydrite stdev	Quartz stdev
0.00	0.00	0.00	0.00
0.00	0.03	0.00	0.92
0.00	0.40	0.00	1.27
0.00	1.01	0.00	1.56
0.00	1.56	0.00	2.19
0.00	1.84	0.00	2.83
0.00	0.42	0.00	1.20
0.00	0.78	0.00	2.83
0.00	1.91	0.23	2.12
0.00	0.14	1.76	2.90
0.00	0.57	3.74	4.38
0.00	1.91	4.27	0.42
0.00	0.49	2.35	0.07
#N/A	4.03	1.20	1.91
0.00	0.49	0.14	0.49
0.00	1.27	0.21	2.33
0.00	0.35	2.05	2.55
0.00	0.57	1.63	2.26
0.00	1.48	2.33	3.04
0.00	0.00	0.85	1.70
0.00	0.57	2.69	0.14
0.00	1.20	3.39	0.21
0.00	1.41	2.19	0.28
0.00	0.28	6.08	0.28
0.00	1.48	3.11	0.99
0.00	2.26	0.57	0.71
0.00	1.98	1.48	0.49
0.00	0.70	0.95	0.28
0.00	0.25	0.69	1.66
0.00	0.15	0.43	0.52
0.00	0.12	0.41	1.65
0.00	0.08	0.30	0.66
0.00	0.12	0.32	0.66
			0.35
			0.27
			0.40

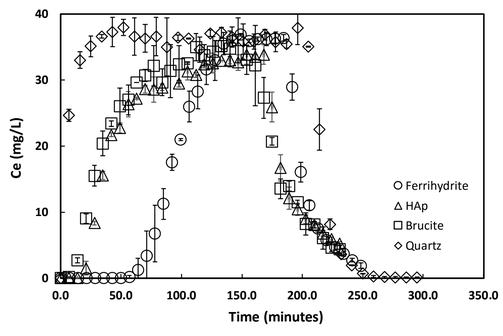
Ce/C0 (average)

HAP	Brucite	Ferrihydrite	quartz
0.00	0.00	0.00	0.00
0.00	0.01	0.00	0.68
0.00	0.08	0.00	0.92
0.00	0.04	0.26	0.00
0.00	0.98	0.03	0.02
0.00	1.03	0.02	0.05
0.00	1.05	0.01	0.01
0.00	1.02	0.02	0.08
0.00	1.01	0.05	0.06
0.00	1.02	0.00	0.00
0.00	0.97	0.02	0.03
0.00	1.01	0.05	0.09
0.00	1.01	0.01	0.06
#N/A	0.90	0.49	0.96
0.00	1.03	0.01	0.08
0.00	1.03	0.03	0.01
0.00	1.01	0.01	0.06
0.00	0.99	0.02	0.05
0.00	0.92	0.04	0.07
0.00	1.02	0.00	0.02
0.00	0.99	0.02	0.08
0.00	1.03	0.03	0.10
0.00	0.98	0.04	0.06
0.00	1.05	0.04	0.09
0.00	0.97	0.04	0.09
0.00	0.63	0.04	0.09
0.00	0.23	0.06	0.02
0.00	0.10	0.05	0.04
0.00	0.01	0.04	0.02
0.00	0.05	0.02	0.08
0.00	0.01	0.02	0.05
0.00	0.01	0.01	0.02
0.00	0.01	0.05	0.02
0.00	0.01	0.02	0.02
0.00	0.01	0.02	0.01
			0.01
			0.02

Ce/C0 (stdev)

HAP	Brucite	Ferrihydrit	quartz
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.03
0.00	0.01	0.00	0.04
0.00	0.02	0.00	0.04
0.00	0.04	0.00	0.01
0.00	0.05	0.00	0.06
0.00	0.01	0.00	0.03
0.00	0.08	0.00	0.08
0.00	0.06	0.01	0.06
0.00	0.00	0.07	0.08
0.00	0.03	0.14	0.12
0.00	0.09	0.16	0.01
0.00	0.06	0.09	0.00
#N/A	0.12	0.05	0.05
0.00	0.08	0.01	0.01
0.00	0.01	0.09	0.02
0.00	0.06	0.10	0.04
0.00	0.05	0.09	0.07
0.00	0.07	0.12	0.03
0.00	0.02	0.07	0.02
0.00	0.08	0.01	0.04
0.00	0.10	0.01	0.02
0.00	0.06	0.01	0.07
0.00	0.17	0.01	0.00
0.00	0.09	0.04	0.09
0.00	0.02	0.03	0.02
0.00	0.04	0.02	0.01
0.00	0.02	0.08	0.00
0.00	0.01	0.06	0.00
0.00	0.05	0.03	0.00
0.00	0.01	0.02	0.00
0.00	0.01	0.02	0.00
0.00	0.01	0.02	0.00
0.00	0.02	0.01	0.00
0.00	0.02	0.01	0.00





ID	Ce [F] Data	Ce [P] Data
M1	0.209	0.090
M2	2.99	0.028
M3	9.55	0.023
M4	16.6	0.020
M5	21.7	BQL (0.017)
M6	23.7	BQL (0.019)
M7	28.0	BQL (0.017)
M8	28.6	BQL (0.018)
M9	29.6	0.022
M10	30.0	BQL (0.018)
M10	31.0 (RPD=3.28)	BQL (0.016) (RPD=NA)
M11	34.3	BQL (0.019)
M12	28.2	BQL (0.017)
M13	34.2	BQL (0.014)
M14	34.4	BQL (0.019)
M15	32.7	BQL (0.015)
M16	36.4	BQL (0.018)
M17	34.9	BQL (0.017)
M18	35.9	BQL (0.018)
M19	35.7	0.029
M20	36.6	BQL (0.016)
M20	36.3 (RPD=0.823)	BQL (0.017) (RPD=NA)
M21	38.4	BQL (0.017)
M22	34.6	BQL (0.014)
M23	36.5	BQL (0.016)
M24	25.1	BQL (0.015)
M25	21.1	BQL (0.013)
M26	12.5	BQL (0.016)
M27	13.4	BQL (0.017)
M28	11.3	BQL (0.014)
M29	7.02	BQL (0.014)
M30	7.73	BQL (0.016)
M30	7.64 (RPD=1.17)	BQL (0.016) (RPD=NA)
M31	4.89	BQL (0.016)
M32	4.17	BQL (0.015)
M33	3.88	BQL (0.017)

Field Sample	Ce [F] Data	Ce [P] Data
M1B	BQL (0.173)	0.067
M2B	2.43	0.029
M3B	8.49	0.021
M4B	14.4	BQL (0.019)
M5B	19.1	BQL (0.017)
M6B	23.1	BQL (0.016)
M7B	24.1	BQL (0.016)
M8B	25.4	BQL (0.015)
M9B	29.6	BQL (0.016)
M10B	31.3	BQL (0.016)
M10B	30.5 (RPD=2.59)	BQL (0.015) (RPD=NA)
M11B	30.0	BQL (0.016)
M12B	31.1	BQL (0.016)
M13B	28.5	BQL (0.015)
M14B	30.4	BQL (0.016)
M15B	32.4	BQL (0.015)
M16B	33.5	BQL (0.015)
M17B	32.6	BQL (0.016)
M18B	32.6	BQL (0.015)
M19B	34.5	BQL (0.015)
M20B	32.8	BQL (0.017)
M20B	32.9 (RPD=0.304)	BQL (0.016) (RPD=NA)
M21B	33.6	BQL (0.015)
M22B	31.5	BQL (0.011)
M23B	27.9	BQL (0.015)
M24B	29.5	BQL (0.016)
M25B	20.3	BQL (0.015)
M26B	14.6	BQL (0.019)
M27B	14.5	BQL (0.015)
M28B	11.7	BQL (0.017)
M29B	9.37	BQL (0.015)
M30B	8.47	BQL (0.015)
M30B	8.55 (RPD=0.940)	BQL (0.015) (RPD=NA)
M31B	7.23	BQL (0.014)
M32B	5.10	BQL (0.015)
M33B	4.82	BQL (0.014)
		0.028
		0.032
		-

BACKGROUND

FM	32.5	33.8
FMb	35.0	
FMb	. (RPD=0.285)	

M22 bb	29.4	QL (0.016)
M22 bb	-	.016) (RPD=NA)

ID	Ce [F]A Data	Comments Column A	Ce [F]B Data	Comments Column B	Average of Duplicates	STDEV	Sample collection time Column A	Sample collection time Column B	Average Time	STDEV time	Ce [P]B Data	Comments Column A	Ce [P]A Data	Comments Column B	Average of Duplicates	STDEV	Background Data	Flow Rate ml/ Average lect one sample (min)
M1	0.209		0.2	BQL	0.191	0.018	7				0.067		0.090					
M2	2.99		2.43		2.710	0.28	14				0.029		0.028					
M3	9.55		8.49		9.020	0.53	21				0.021		0.023					
M4	16.6		14.4		15.500	1.1	28				BQL (0.019)		0.020					
M5	21.7		19.1		20.400	1.3	35				BQL (0.017)		BQL (0.017)					
M6	23.7		23.1		23.400	0.3	42				BQL (0.016)		BQL (0.019)					
M7	28.0		24.1		26.050	1.95	49				BQL (0.016)		BQL (0.017)					
M8	28.6		25.4		27.000	1.6	56				BQL (0.015)		BQL (0.018)					
M9	29.6		29.6		29.600	0	63				BQL (0.016)		0.022					
M10	30.0		31.3		30.650	0.65	70				BQL (0.016)		BQL (0.018)					
M11	34.3		30.0		32.150	2.15	77				BQL (0.016)		BQL (0.019)					
M12	28.2		31.1		29.650	1.45	84				BQL (0.016)		BQL (0.017)					
M13	34.2		28.5		31.350	2.85	91				BQL (0.015)		BQL (0.014)					
M14	34.4		30.4		32.400	2	98				BQL (0.016)		BQL (0.019)					
M15	32.7		32.4		32.550	0.15	105				BQL (0.015)		BQL (0.015)					
M16	36.4		33.5		34.950	1.45	112				BQL (0.015)		BQL (0.018)					
M17	34.9		32.6		33.750	1.15	119				BQL (0.016)		BQL (0.017)					
M18	35.9		32.6		34.250	1.65	126				BQL (0.015)		BQL (0.018)					
M19	35.7		34.5		35.100	0.6	133				BQL (0.015)		0.029					
M20	36.6		32.8		34.700	1.9	140				BQL (0.017)		BQL (0.016)					
M21	38.4		33.6		36.000	2.4	147				BQL (0.015)		BQL (0.017)					
M22	34.6		31.5		33.050	1.55	154				BQL (0.011)		BQL (0.014)					
M23	36.5		27.9		32.200	4.3	161				BQL (0.015)		BQL (0.016)					
M24	25.1		29.5		27.300	2.2	168				BQL (0.016)		BQL (0.015)					
M25	21.1		20.3		20.700	0.4	175				BQL (0.015)		BQL (0.013)					
M26	12.5		14.6		13.550	1.05	182				BQL (0.019)		BQL (0.016)					
M27	13.4		14.5		13.950	0.55	189				BQL (0.015)		BQL (0.017)					
M28	11.3		11.7		11.500	0.2	196				BQL (0.017)		BQL (0.014)					
M29	7.02		9.37		8.195	1.175	203				BQL (0.015)		BQL (0.014)					
M30	7.73		8.47		8.100	0.37	210				BQL (0.015)		BQL (0.016)					
M31	4.89		7.23		6.060	1.17	217				BQL (0.014)		BQL (0.016)					
M32	4.17		5.10		4.635	0.465	224				BQL (0.015)		BQL (0.015)					
M33	3.88		4.82		4.350	0.47	231				BQL (0.014)		BQL (0.017)					
											0.028		0.027					
											0.032		0.026 (RPD=3.77)					
											-							

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 15-LC30

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Lisa Costantino

Date: 8/11/2015

Technical Directive No.: EPAGP530 Rev. 1
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway
Lisa Costantino

Sample Site/Project: Fort Riley Green Infrastructure
Date Collected: unknown
Date Received: 8/6/2015
Date Analyzed: 8/6 & 8/7/2015
No. Samples Analyzed: 40

Sample Set No.: 7023
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: Dilution as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively. The matrix spike for Ct3 did not meet the data quality objective for oP. The matrix spike was prepared and analyzed a second time with 60.5% recovery. A laboratory control spike yielded 104% recovery which indicates a possible matrix interference.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/11/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.031	**MDL**	0.002		
QL	** 0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
At1	7023-1	-	8/7/2015	2.37	1	8/6/2015	BQL (0.018)	1		
At1b	7023-2	-	8/7/2015	2.26	1	8/6/2015	BQL (0.016)	1		
At2	7023-3	-	8/7/2015	1.99	1	8/6/2015	0.021	1		
At2b	7023-4	-	8/7/2015	1.88	1	8/6/2015	BQL (0.019)	1		
At3	7023-5	-	8/7/2015	1.21	1	8/6/2015	BQL (0.016)	1		
At3b	7023-6	-	8/7/2015	1.28	1	8/6/2015	BQL (0.016)	1		
At4	7023-7	-	8/7/2015	0.744	1	8/6/2015	BQL (0.015)	1		
At4b	7023-8	-	8/7/2015	0.960	1	8/6/2015	BQL (0.017)	1		
Mt1	7023-9	-	8/7/2015	3.68	1	8/6/2015	BQL (0.014)	1		
Mt1b	7023-10	-	8/7/2015	3.95	1	8/6/2015	BQL (0.014)	1		
Mt1b	7023-10 Lab dup	-	8/7/2015	3.89 (RPD=1.53)	1	8/6/2015	BQL (0.014) (RPD=NA)	1		
Mt2	7023-11	-	8/7/2015	4.06	1	8/6/2015	BQL (0.014)	1		
Mt2b	7023-12	-	8/7/2015	3.83	1	8/6/2015	BQL (0.015)	1		
Mt3	7023-13	-	8/7/2015	4.27	1	8/6/2015	BQL (0.019)	1		
Mt3b	7023-14	-	8/7/2015	4.42	1	8/6/2015	BQL (0.014)	1		
Mt4	7023-15	-	8/7/2015	4.25	1	8/6/2015	BQL (0.013)	1		
Mt4b	7023-16	-	8/7/2015	4.64	1	8/6/2015	BQL (0.014)	1		
Ct1	7023-17	-	8/7/2015	5.87	5	8/6/2015	BQL (0.013)	1		
Ct1b	7023-18	-	8/7/2015	6.18	5	8/6/2015	BQL (0.016)	1		
Ct2	7023-19	-	8/7/2015	5.74	5	8/6/2015	BQL (0.012)	1		
Ct2b	7023-20	-	8/7/2015	5.88	5	8/6/2015	BQL (0.012)	1		
Ct2b	7023-20 Lab dup	-	8/7/2015	5.91 (RPD=0.509)	5	8/6/2015	BQL (0.017) (RPD=NA)	1		
Ct3	7023-21	-	8/7/2015	6.93	5	8/6/2015	BQL (0.012)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/11/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.031	**MDL**	0.002		
QL	** 0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
Ct3b	7023-22	-	8/7/2015	6.82	5	8/6/2015	BQL (0.012)	1		
Ct4	7023-23	-	8/7/2015	6.51	5	8/6/2015	BQL (0.013)	1		
Ct4b	7023-24	-	8/7/2015	6.03	5	8/6/2015	BQL (0.012)	1		
St1	7023-25	-	8/7/2015	5.51	1	8/6/2015	BQL (0.019)	1		
St1b	7023-26	-	8/7/2015	5.47	1	8/6/2015	BQL (0.017)	1		
St2	7023-27	-	8/7/2015	5.49	1	8/6/2015	BQL (0.017)	1		
St2b	7023-28	-	8/7/2015	5.53	1	8/6/2015	0.020	1		
St3	7023-29	-	8/7/2015	6.72	1	8/6/2015	0.047	1		
St3b	7023-30	-	8/7/2015	6.79	1	8/6/2015	0.032	1		
St3b	7023-30 Lab dup	-	8/7/2015	6.72 (RPD=1.04)	1	8/6/2015	0.031 (RPD=3.17))	1		
St4	7023-31	-	8/7/2015	6.84	1	8/6/2015	0.039	1		
St4b	7023-32	-	8/7/2015	6.93	1	8/6/2015	0.038	1		
Zt1	7023-33	-	8/7/2015	5.93	1	8/6/2015	BQL (0.013)	1		
Zt1b	7023-34	-	8/7/2015	5.99	1	8/6/2015	BQL (0.014)	1		
Zt2	7023-35	-	8/7/2015	5.84	1	8/6/2015	BQL (0.014)	1		
Zt2b	7023-36	-	8/7/2015	6.01	1	8/6/2015	BQL (0.014)	1		
Zt3	7023-37	-	8/7/2015	7.23	1	8/6/2015	BQL (0.014)	1		
Zt3b	7023-38	-	8/7/2015	7.09	1	8/6/2015	BQL (0.014)	1		
Zt4	7023-39	-	8/7/2015	6.94	1	8/6/2015	BQL (0.014)	1		
Zt4b	7023-40	-	8/7/2015	7.15	1	8/6/2015	BQL (0.014)	1		
Zt4b	7023-40 Lab dup	-	8/7/2015	7.17 (RPD=0.279)	1	8/6/2015	BQL (0.014) (RPD=NA)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/11/15

Sample Results

Analytes	Fluoride (F)			**Analytes**	ortho-Phosphate (as P)						
Codes	7782-41-4			**Codes**	70507						
Methods	RSKSOP-276/4			**Methods**	NRMRL-GWERD-05-0						
Unit	mg/L			**Unit**	mg/L						
MDL	** 0.031			**MDL**	0.002						
QL	** 0.200			**QL**	0.020						
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**	**Data**	**DF**	

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

Sample ID	mass of cap + tube	mass sample+cap+ soln	mass sample (g)	volume F-	Ce [F] (copied from raw data)	sorbed F (mg/l)	x/m	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)
At1	16.2696	36.218	0.1022	19.85	2.37	4.07	0.79	7/22/2015 8:02		9.06	7/22/2015 10:43	2.7	BQL (0.018)
At1b	16.2517	36.05	0.1041	19.69	2.26	4.18	0.79	7/22/2015 8:03		8.96	7/22/2015 10:44	2.7	BQL (0.016)
At2	16.125	35.974	0.1008	19.75	1.99	4.45	0.87	7/22/2015 8:15		8.67	7/22/2015 12:15	4.0	0.021
At2b	16.333	36.097	0.1016	19.66	1.88	4.56	0.88	7/22/2015 8:15		8.53	7/22/2015 12:16	4.0	BQL (0.019)
At3	16.297	36.157	0.1002	19.76	1.21	5.23	1.03	7/21/2015 13:45		9.8	7/22/2015 14:21	24.6	BQL (0.016)
At3b	16.292	36.085	0.1029	19.69	1.28	5.16	0.99	7/21/2015 13:46		9.81	7/22/2015 14:22	24.6	BQL (0.016)
At4	16.368	36.165	0.1022	19.69	0.744	5.70	1.10	7/21/2015 13:54		9.91	7/23/2015 13:17	47.4	BQL (0.015)
At4b	16.359	35.08	0.1014	18.62	0.960	5.48	1.01	7/21/2015 13:55		9.72	7/23/2015 13:29	47.6	BQL (0.017)
Mt1	16.3159	36.241	0.1001	19.83	3.68	2.76	0.55	7/22/2015 8:03		9.63	7/22/2015 10:45	2.7	BQL (0.014)
Mt1b	16.4242	35.841	0.1004	19.32	3.95	2.49	0.48	7/22/2015 8:04		9.5	7/22/2015 10:45	2.7	BQL (0.014)
Mt2	16.298	36.018	0.1	19.62	4.06	2.38	0.47	7/22/2015 8:17		9.16	7/22/2015 12:17	4.0	BQL (0.014)
Mt2b	16.372	35.899	0.1005	19.43	3.83	2.61	0.50	7/22/2015 8:17		9.14	7/22/2015 12:18	4.0	BQL (0.015)
Mt3	16.336	36.168	0.1011	19.73	4.27	2.17	0.42	7/21/2015 13:47		9.65	7/22/2015 14:23	24.6	BQL (0.019)
Mt3b	16.294	36.111	0.1039	19.71	4.42	2.02	0.38	7/21/2015 13:48		9.44	7/22/2015 14:24	24.6	BQL (0.014)
Mt4	16.263	35.991	0.1014	19.63	4.25	2.19	0.42	7/21/2015 13:56		9.71	7/23/2015 13:31	47.6	BQL (0.013)
Mt4b	16.365	45.895	0.1014	29.43	4.64	1.80	0.52	7/21/2015 13:56		9.58	7/23/2015 13:33	47.6	BQL (0.014)
Ct1	16.3087	36.16	0.1007	19.75	5.87	0.57	0.11	7/22/2015 8:05		11.3	7/22/2015 10:47	2.7	BQL (0.013)
Ct1b	16.2983	36.073	0.1006	19.67	6.18	0.26	0.05	7/22/2015 8:05		11.46	7/22/2015 10:48	2.7	BQL (0.016)
Ct2	16.277	36.079	0.1007	19.70	5.74	0.70	0.14	7/22/2015 8:19		10.74	7/22/2015 12:19	4.0	BQL (0.012)
Ct2b	16.182	35.949	0.1082	19.66	5.88	0.56	0.10	7/22/2015 8:20		11.02	7/22/2015 12:20	4.0	BQL (0.012)
Ct3	16.364	36.155	0.1007	19.69	6.93	-0.49	-0.10	7/21/2015 13:49		11.36	7/22/2015 14:25	24.6	BQL (0.012)
Ct3b	16.191	35.968	0.1078	19.67	6.82	-0.38	-0.07	7/21/2015 13:50		11.45	7/22/2015 14:26	24.6	BQL (0.012)
Ct4	16.13	35.834	0.1059	19.60	6.51	-0.07	-0.01	7/21/2015 13:58		11.33	7/23/2015 13:34	47.6	BQL (0.013)
Ct4b	16.202	35.779	0.1019	19.48	6.03	0.41	0.08	7/21/2015 13:58		11.44	7/23/2015 13:35	47.6	BQL (0.012)
St1	16.4415	36.192	0.1029	19.65	5.51	0.93	0.18	7/22/2015 8:06		5.68	7/22/2015 10:49	2.7	BQL (0.019)
St1b	16.4432	36.207	0.1001	19.66	5.47	0.97	0.19	7/22/2015 8:07		4.82	7/22/2015 10:50	2.7	BQL (0.017)
St2	16.263	36.212	0.1022	19.85	5.49	0.95	0.18	7/22/2015 8:21		4.76	7/22/2015 12:21	4.0	BQL (0.017)
St2b	16.308	35.902	0.1015	19.49	5.53	0.91	0.17	7/22/2015 8:22		4.15	7/22/2015 12:22	4.0	0.020
St3	16.301	35.917	0.1035	19.51	6.72	-0.28	-0.05	7/21/2015 13:50		5.66	7/22/2015 14:27	24.6	0.047
St3b	16.315	36.058	0.102	19.64	6.79	-0.35	-0.07	7/21/2015 13:51		5.09	7/22/2015 14:28	24.6	0.032
St4	16.324	35.858	0.1005	19.43	6.84	-0.40	-0.08	7/21/2015 13:59		5.4	7/23/2015 13:37	47.6	0.039
St4b	16.307	36.018	0.1022	19.61	6.93	-0.49	-0.09	7/21/2015 13:59		5.32	7/23/2015 13:38	47.7	0.038
Zt1	16.2134	36.304	0.1013	19.99	5.93	0.51	0.10	7/22/2015 8:08		7.37	7/22/2015 10:50	2.7	BQL (0.013)
Zt1b	16.3878	35.915	0.1014	19.43	5.99	0.45	0.09	7/22/2015 8:09		7.66	7/22/2015 10:51	2.7	BQL (0.014)
Zt2	16.267	35.992	0.1044	19.62	5.84	0.60	0.11	7/22/2015 8:23		7.06	7/22/2015 12:23	4.0	BQL (0.014)
Zt2b	16.368	36.234	0.1055	19.76	6.01	0.43	0.08	7/22/2015 8:24		7.06	7/22/2015 12:24	4.0	BQL (0.014)
Zt3	16.335	35.991	0.1001	19.56	7.23	-0.79	-0.15	7/21/2015 13:51		7.44	7/22/2015 14:29	24.6	BQL (0.014)
Zt3b	16.387	36.27	0.1	19.78	7.09	-0.65	-0.13	7/21/2015 13:52		7.65	7/22/2015 14:30	24.6	BQL (0.014)
Zt4	16.04	35.702	0.1012	19.56	6.94	-0.50	-0.10	7/21/2015 14:00		8.2	7/23/2015 13:39	47.6	BQL (0.014)
Zt4b	16.296	36.087	0.1016	19.69	7.15	-0.71	-0.14	7/21/2015 14:01		7.9	7/23/2015 13:40	47.7	BQL (0.014)
Ft1			0		6.56						7/21/2015 14:30		BQL (0.013)
Ft1 b			0		6.32						7/21/2015 14:30		BQL (0.012)
Ft1 average					6.44								

Sample ID	mass of cap + tube	mass sample+cap+ soln	mass sample (g)	volume F-	Ce [F] (copied from raw data)	sorbed F (mg/l)	x/m	Date/time F- added	Date/time pH taken	measured pH			
average at 48 hours (equilibrium)											**47.47**	**#DIV/0!**	
apatite	16.36	35.62	0.10	19.16	0.85	5.59	1.05			9.82	47.60	#DIV/0!	
MgOH2	16.31	40.94	0.10	24.53	4.45	2.00	0.47			9.65	47.64		0.04
Silicon oxide	16.32	35.94	0.10	19.52	6.89	-0.45	-0.09			5.36	47.65	#DIV/0!	
zinc oxide	16.17	35.89	0.10	19.63	7.05	-0.61	-0.12			8.05			
STDEV											0.0917	#DIV/0!	
apatite	0.0045	0.5425	0.0004	0.5376	0.1080	0.1080	0.0457			0.0950	0.0167	#DIV/0!	
MgOH2	0.0510	4.9520	0.0000	4.9010	0.1950	0.1950	0.0493			0.0650	0.0083		0.0005
Silicon oxide	0.0085	0.0800	0.0008	0.0877	0.0450	0.0450	0.0083			0.0400	0.0000	#DIV/0!	
zinc oxide	0.1280	0.1925	0.0002	0.0643	0.1050	0.1050	0.0205			0.1500			

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/11/15

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	8/6/2015	8/6/2015	-	-	-	BQL (0.014)	-	-			
MB	Nanopure Water Blank	8/6/2015	8/6/2015	-	-	-	BQL (0.015)	-	-			
MB	Nanopure Water Blank	8/7/2015	8/7/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/7/2015	8/7/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/7/2015	8/7/2015	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	8/6/2015	-	-	-	1.65	1.57	105			
SS	ERA 64 Simple Nutrients	2/25/2015	8/6/2015	-	-	-	1.58	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	8/6/2015	-	-	-	1.64	1.57	104			
SS	ERA 64 Minerals	1/21/2015	8/7/2015	3.52	3.47	101	-	-	-			
SS	ERA 64 Minerals	1/21/2015	8/7/2015	3.44	3.47	99.1	-	-	-			
CCC	Continuing Calibration Check Standard	5/14/2015	8/6/2015	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	5/14/2015	8/6/2015	-	-	-	0.050	0.050	100			
CCC	Continuing Calibration Check Standard	5/14/2015	8/6/2015	-	-	-	0.495	0.500	99.0			
CCC	Continuing Calibration Check Standard	5/14/2015	8/6/2015	-	-	-	0.234	0.250	93.6			
CCC	Continuing Calibration Check Standard	5/14/2015	8/6/2015	-	-	-	2.13	2.00	107			
CCC	Continuing Calibration Check Standard	6/17/2015	8/7/2015	BQL (0.195)	0.200	97.5	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/7/2015	1.01	1.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/7/2015	4.95	5.00	99.0	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/7/2015	9.98	10.0	99.8	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/7/2015	2.00	2.00	100	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/7/2015	1.09	1.00	109	-	-	-			
MS	At1 Spike	8/6 & 8/7/2015	8/6 & 8/7/2015	6.34	2.37 (3.85)	103	1.04	BQL (0.018) (0.990)	103			
MS	Ct3 Spike	8/6 & 8/7/2015	8/6 & 8/7/2015	* 5.64	* 1.39 (3.85)	110	** 0.565	BQL (0.012) (0.990)	** 55.9			
LCS	Laboratory Control Spike	8/6/2015	8/6/2015	-	-	-	1.03	ND (0.990)	104			

Comments:

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/11/15

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated and reported without the dilution factor applied. ** The matrix spike for Ct3 did not meet the data quality objective for oP. The matrix spike was prepared and analyzed a second time with 60.5% recovery. A laboratory control spike yielded 104% recovery which indicates a possible matrix interference.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 15-LC29

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Lisa Costantino

Date: 8/6/2015

Technical Directive No.: EPAGP530 Rev. 1
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway
Lisa Costantino

Sample Site/Project: Fort Riley Green Infrastructure
Date Collected: 7/21 to 7/30/2015
Date Received: 7/30/2015
Date Analyzed: 7/30 and 8/5/2015
No. Samples Analyzed: 36

Sample Set No.: 7021
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: Dilution as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively. Please note that most samples were diluted to remove interference from adjacent very large chloride peaks. Some samples were analyzed within the 48-hour holding time for oP and some were not.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/06/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.031	**MDL**	0.002		
QL	0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
At1X	7021-1	7/21/2015	8/5/2015	BQL (0.099)	1	7/30/2015	0.045	1		
At1bX	7021-2	7/21/2015	8/5/2015	BQL (0.114)	1	7/30/2015	0.046	1		
Mt1X	7021-3	7/21/2015	8/5/2015	0.689	1	7/30/2015	BQL (0.013)	1		
Mt1bX	7021-4	7/21/2015	8/5/2015	0.697	1	7/30/2015	BQL (0.011)	1		
Ct1X	7021-5	7/21/2015	8/5/2015	BQL (0.197)	1	7/30/2015	BQL (0.010)	1		
Ct1bX	7021-6	7/21/2015	8/5/2015	BQL (0.193)	1	7/30/2015	BQL (0.010)	1		
St1X	7021-7	7/21/2015	8/5/2015	1.08	1	7/30/2015	BQL (0.017)	1		
St1bX	7021-8	7/21/2015	8/5/2015	1.08	1	7/30/2015	BQL (0.016)	1		
Zt1X	7021-9	7/21/2015	8/5/2015	1.15	1	7/30/2015	BQL (0.011)	1		
Zt1bX	7021-10	7/21/2015	8/5/2015	1.13	1	7/30/2015	BQL (0.013)	1		
Zt1bX Lab dup	7021-10 Lab dup	7/21/2015	8/5/2015	1.10 (RPD=2.69)	1	7/30/2015	BQL (0.012) (RPD=NA)	1		
AC4b	7021-11	7/30/2015	8/5/2015	3.84	11	7/30/2015	4.92	4		
BC4b	7021-12	7/30/2015	8/5/2015	ND	31	7/30/2015	0.409	1		
BC6b	7021-13	7/30/2015	8/5/2015	ND	11	7/30/2015	0.092	1		
A3b	7021-14	7/30/2015	8/5/2015	BQL (1.89)	21	7/30/2015	0.495	1		
B2b	7021-15	7/30/2015	8/5/2015	BQL (1.12)	31	7/30/2015	13.2	21		
B3b	7021-16	7/30/2015	8/5/2015	ND	31	7/30/2015	0.683	1		
B4b	7021-17	7/30/2015	8/5/2015	ND	31	7/30/2015	0.361	1		
B6b	7021-18	7/30/2015	8/5/2015	ND	31	7/30/2015	0.114	1		
2At1	7021-19	7/28/2015	8/5/2015	BQL (0.078)	1	7/30/2015	BQL (0.018)	1		
2At1b	7021-20	7/28/2015	8/5/2015	BQL (0.081)	1	7/30/2015	BQL (0.017)	1		
2At1b	7021-20 Lab dup	7/28/2015	8/5/2015	BQL (0.079) (RPD=NA)	1	7/30/2015	BQL (0.013) (RPD=NA)	1		
2At2	7021-21	7/28/2015	8/5/2015	BQL (0.110)	1	7/30/2015	BQL (0.006)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/06/15

Sample Results

Analytes	Fluoride (F)	Analytes	ortho-Phosphate (as P)	
Codes	7782-41-4	Codes	70507	
Methods	RSKSOP-276/4	Methods	NRMRL-GWERD-05-0	
Unit	mg/L	Unit	mg/L	
MDL	0.031	MDL	0.002	
QL	0.200	QL	0.020	

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
2At2b	7021-22	7/28/2015	8/5/2015	BQL (0.067)	1	7/30/2015	BQL (0.012)	1		
2At3	7021-23	7/29/2015	8/5/2015	ND	1	7/30/2015	BQL (0.012)	1		
2At3b	7021-24	7/29/2015	8/5/2015	ND	1	7/30/2015	BQL (0.013)	1		
2At4	7021-25	7/30/2015	8/5/2015	BQL (0.059)	1	7/30/2015	BQL (0.012)	1		
2At4b	7021-26	7/30/2015	8/5/2015	BQL (0.042)	1	7/30/2015	BQL (0.011)	1		
at1	7021-27	7/28/2015	8/5/2015	4.67	1	7/30/2015	BQL (0.016)	1		
at1b	7021-28	7/28/2015	8/5/2015	4.53	1	7/30/2015	BQL (0.012)	1		
at1b	7021-28 Lab dup	7/28/2015	8/5/2015	4.60 (RPD=1.53)	1	-	-	-		
at2	7021-29	7/28/2015	8/5/2015	4.51	1	7/30/2015	BQL (0.012)	1		
at2b	7021-30	7/28/2015	8/5/2015	4.72	1	7/30/2015	BQL (0.012)	1		
at2b	7021-30 Lab dup	7/28/2015	-	-	-	7/30/2015	BQL (0.011) (RPD=NA)	1		
at3	7021-31	7/29/2015	8/5/2015	4.63	1	7/30/2015	BQL (0.012)	1		
at3b	7021-32	7/29/2015	8/5/2015	4.73	1	7/30/2015	BQL (0.011)	1		
at4	7021-33	7/30/2015	8/5/2015	5.12	1	7/30/2015	BQL (0.011)	1		
at4b	7021-34	7/30/2015	8/5/2015	4.66	1	7/30/2015	BQL (0.008)	1		
Ft	7021-35	7/30/2015	8/5/2015	4.93	1	7/30/2015	BQL (0.012)	1		
Ftb	7021-36	7/30/2015	8/5/2015	4.90	1	7/30/2015	BQL (0.012)	1		
Ftb	7021-36 Lab dup	7/30/2015	8/5/2015	4.86 (RPD=0.820)	1	7/30/2015	BQL (0.013) (RPD=NA)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/06/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.031	**MDL**	0.002		
QL	0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

Experiment Description: 1.0 mM CaCl2, 10 mg/L NaF (because of precipitation possibly due to formation of CaF actual F conc is 4.85 ppm)

Sample ID	mass of cap + tube	mass sample+cap+soln	mass sample (g)	volume F-	Ce [F] (copied from raw data)	Ce [F] values	sorbed F (mg/l)	x/m	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)
2At1	16.1768	35.958	0.106	19.6752	BQL (0.078)	0.078	4.84	0.90			3.74			BQL (0.018)
2At1b	16.5109	36.316	0.1005	19.7046	BQL (0.081)	0.081	4.83	0.95			3.57			BQL (0.017)
2At2	16.1876	35.889	0.1021	19.5993	BQL (0.110)	0.110	4.81	0.92			3.66			BQL (0.006)
2At2b	16.3996	36.141	0.1018	19.6396	BQL (0.067)	0.067	4.85	0.94			3.50			BQL (0.012)
2At3	16.318	35.97	0.1003	19.5517	ND	0.030	4.89	0.95			3.71			BQL (0.012)
2At3b	16.3361	36.108	0.1004	19.6715	ND	0.031	4.88	0.96			3.58			BQL (0.013)
2At4	16.1989	36.075	0.1023	19.7738	BQL (0.059)	0.059	4.86	0.94	7/28/2015 14:11		3.53	7/30/2015 14:02	47.9	BQL (0.012)
2At4b	16.4148	36.219	0.1055	19.6987	BQL (0.042)	0.042	4.87	0.91	7/28/2015 14:11		3.30	7/30/2015 14:02	47.9	BQL (0.011)
at1	16.3954	36.135	0.1025	19.6371	4.67	4.670	0.25	0.05			5.68			BQL (0.016)
at1b	16.4148	36.236	0.1023	19.7189	4.53	4.530	0.39	0.07			5.54			BQL (0.012)
at2	16.4993	36.342	0.1018	19.7409	4.51	4.510	0.41	0.08			5.65			BQL (0.012)
at2b	16.2032	35.766	0.1009	19.4619	4.72	4.720	0.20	0.04			5.57			BQL (0.012)
at3	16.2852	36.067	0.1043	19.6775	4.63	4.630	0.29	0.05			5.91			BQL (0.012)
at3b	16.2597	34.873	0.1036	18.5097	4.73	4.730	0.19	0.03			5.70			BQL (0.011)
at4	16.3109	36.032	0.1005	19.6206	5.12	5.120	-0.21	-0.04	7/28/2015 14:16		5.58	7/30/2015 14:03	47.8	BQL (0.011)
at4b	16.1642	35.935	0.1035	19.6673	4.66	4.660	0.26	0.05	7/28/2015 14:17		5.51	7/30/2015 14:03	47.8	BQL (0.008)
Ft					4.93	4.930								BQL (0.012)
Ftb					4.90	4.900								BQL (0.012)
Ft average					4.92									
2Bt1	16.087	35.918	0.1058	19.73	3.59	3.59	1.26	0.23	8/3/2015 10:48		6.52	8/3/2015 12:44		BQL (0.014)
2Bt1b	16.0175	35.846	0.1	19.73	3.43	3.43	1.42	0.28	8/3/2015 10:49		6.26	8/3/2015 12:45		BQL (0.014)
2Bt2	16.2836	36.23	0.1	19.85	4.23	4.23	0.61	0.12	8/3/2015 10:50		5.76	8/3/2015 15:58		BQL (0.015)
2Bt2b	16.2614	36.047	0.1005	19.69	4.12	4.12	0.73	0.14	8/3/2015 10:51		5.7	8/3/2015 16:00		BQL (0.015)
2Bt3	16.2548	35.986	0.0998	19.63	3.6	3.6	1.25	0.24	8/3/2015 11:00		6.74	8/4/2015 11:08		BQL (0.015)
2Bt3b	16.3202	36.006	0.1002	19.59	3.59	3.59	1.26	0.25	8/3/2015 11:00		6.38	8/4/2015 11:09		BQL (0.015)
2Bt4	16.2192	35.863	0.1007	19.54	3.2	3.2	1.65	0.32	8/3/2015 11:12		6.47	8/5/2015 12:10		BQL (0.014)
2Bt4b	16.2299	35.912	0.1001	19.58	2.99	2.99	1.86	0.36	8/3/2015 11:13		6.24	8/5/2015 12:11		BQL (0.014)
2Ct1	16.1622	35.991	0.0998	19.73	4.43	4.43	0.42	0.08	8/3/2015 10:50		6.15	8/3/2015 12:47		0.028
2Ct1b	16.4103	36.164	0.1001	19.65	4.89	4.89	-0.04	-0.01	8/3/2015 10:51		6.12	8/3/2015 12:49		0.05
2Ct2	16.3212	36.069	0.1003	19.65	4.77	4.77	0.08	0.01	8/3/2015 10:52		5.62	8/3/2015 16:02		0.023
2Ct2b	16.3799	36.043	0.1	19.56	4.61	4.61	0.23	0.05	8/3/2015 10:53		5.33	8/3/2015 16:03		0.024
2Ct3	16.3026	36.032	0.1003	19.63	4.99	4.99	-0.15	-0.03	8/3/2015 11:01		6.07	8/4/2015 11:16		0.026
2Ct3b	16.4141	36.143	0.1008	19.63	4.86	4.86	-0.02	0.00	8/3/2015 11:02		6.08	8/4/2015 11:18		0.05
2Ct4	16.22	35.913	0.1007	19.59	5.42	5.42	-0.58	-0.11	8/3/2015 11:14		6.22	8/5/2015 12:12		0.089
2Ct4b	16.3958	35.993	0.1001	19.50	5.72	5.72	-0.88	-0.17	8/3/2015 11:15		5.94	8/5/2015 12:16		0.077
2Dt1	16.2865	36.011	0.1013	19.62	4.25	4.25	0.60	0.12	8/3/2015 10:52		5.4	8/3/2015 12:50		0.029
2Dt1b	16.1148	35.89	0.0998	19.68	4.23	4.23	0.61	0.12	8/3/2015 10:53		5.32	8/3/2015 12:51		0.032
2Dt2	16.2485	35.945	0.1001	19.60	4.38	4.38	0.47	0.09	8/3/2015 10:54		4.95	8/3/2015 16:04		0.04
2Dt2b	16.3209	35.977	0.1005	19.56	4.36	4.36	0.48	0.09	8/3/2015 10:55		4.9	8/3/2015 16:05		0.041
2Dt3	16.1914	35.939	0.1002	19.65	4.05	4.05	0.80	0.16	8/3/2015 11:03		5.47	8/4/2015 11:21		0.041
2Dt3b	16.386	36.076	0.1001	19.59	4.04	4.04	0.81	0.16	8/3/2015 11:04		5.43	8/4/2015 11:23		0.045
2Dt4	16.3899	35.988	0.1008	19.50	3.96	3.96	0.89	0.17	8/3/2015 11:16		5.53	8/5/2015 12:17		0.069
2Dt4b	16.3845	35.957	0.1004	19.47	3.99	3.99	0.86	0.17	8/3/2015 11:17		5.52	8/5/2015 12:18		0.068
2Et1	16.2512	36.046	0.1003	19.69	4.49	4.49	0.36	0.07	8/3/2015 10:53		6.01	8/3/2015 12:52		9.03
2Et1b	16.2975	36.046	0.1008	19.65	4.52	4.52	0.33	0.06	8/3/2015 10:54		5.98	8/3/2015 12:53		8.33
2Et2	16.6358	36.324	0.1004	19.59	4.84	4.84	0.00	0.00	8/3/2015 10:56		5.69	8/3/2015 16:06		9.66
2Et2b	16.4142	36.055	0.1001	19.54	4.72	4.72	0.13	0.02	8/3/2015 10:57		5.72	8/3/2015 16:07		8.83
2Et3	16.2964	35.964	0.1008	19.57	4.3	4.3	0.55	0.11	8/3/2015 11:05		5.87	8/4/2015 11:24		9.93
2Et3b	16.3649	36.081	0.1	19.62	4.48	4.48	0.36	0.07	8/3/2015 11:06		5.89	8/4/2015 11:25		9.35
2Et4	16.3683	35.889	0.0999	19.42	4.46	4.46	0.39	0.07	8/3/2015 11:11		5.98	8/5/2015 12:19		10.5
2Et4b	16.3539	35.994	0.1011	19.54	4.48	4.48	0.36	0.07	3-Aug		5.97	8/5/2015 12:20		10.7
2F					4.85				NA			8/3/2015 13:03		BQL (0.010)
2Fb					4.84				NA			8/3/2015 13:05		BQL (0.016)
2F average					4.845									

Sample ID	mass of cap + tube	mass sample+cap+soln	mass sample (g)	volume F-	Ce [F] (copied from raw data)	Ce [F] values	sorbed F (mg/l)	x/m	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)
Average of duplicates @ 48 hrs														
am-FeOH3	16.30685	36.147	0.1039	19.73625	#DIV/0!	0.0505	4.8645	0.924250925	42213.59097	#DIV/0!	3.415	42215.58472	47.85	#DIV/0!
hematite alpha	16.23755	35.9835	0.102	19.64395	4.89	4.89	0.025	0.004216774	42213.59479	#DIV/0!	5.545	42215.58542	47.775	#DIV/0!
TiO2 B	16.22	35.89	0.10	19.56	3.10	3.10	1.75	0.34	42219.47	#DIV/0!	6.36	42221.51	#DIV/0!	#DIV/0!
TiO2 C	16.31	35.95	0.10	19.54	5.57	5.57	-0.73	-0.14	42219.47	#DIV/0!	6.08	42221.51	#DIV/0!	0.08
TiO2 D	16.39	35.97	0.10	19.48	3.98	3.98	0.87	0.17	42219.47	#DIV/0!	5.53	42221.51	#DIV/0!	0.07
TiO2 E	16.36	35.94	0.10	19.48	4.47	4.47	0.38	0.07	42402.23	#DIV/0!	5.98	42221.51	#DIV/0!	10.60
STDEV														
am-FeOH3	0.10795	0.072	0.0016	0.03755	#DIV/0!	0.0085	0.0085	0.014376375	0	#DIV/0!	0.115	0	0	#DIV/0!
hematite alpha	0.07335	0.0485	0.0015	0.02335	0.23	0.23	0.23	0.044238893	0.000347222	#DIV/0!	0.035	0	0.008333333	#DIV/0!
TiO2 B	0.00535	0.0245	0.0003	0.01945	0.105	0.105	0.105	0.021816983	0.000347222	#DIV/0!	0.115	0.000347222	#DIV/0!	#DIV/0!
TiO2 C	0.0879	0.04	0.0003	0.0476	0.15	0.15	0.15	0.02927829	0.000347222	#DIV/0!	0.14	0.001388889	#DIV/0!	0.006
TiO2 D	0.0027	0.0155	0.0002	0.0126	0.015	0.015	0.015	0.002679245	0.000347222	#DIV/0!	0.005	0.000347222	#DIV/0!	0.0005
TiO2 E	0.0072	0.0525	0.0006	0.0591	0.01	0.01	0.01	0.002151765	182.7670139	#DIV/0!	0.005	0.000347222	#DIV/0!	0.1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/06/15

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	7/30/2015	7/30/2015	-	-	-	BQL (0.013)	-	-			
MB	Nanopure Water Blank	7/30/2015	7/30/2015	-	-	-	BQL (0.010)	-	-			
MB	Nanopure Water Blank	8/5/2015	8/5/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/5/2015	8/5/2015	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	7/30/2015	-	-	-	1.56	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	7/30/2015	-	-	-	1.63	1.57	104			
SS	ERA 64 Simple Nutrients	2/25/2015	7/30/2015	-	-	-	1.59	1.57	101			
SS	ERA 64 Minerals	1/21/2015	8/5/2015	3.49	3.47	101	-	-	-			
SS	ERA 64 Minerals	1/21/2015	8/5/2015	3.51	3.47	101	-	-	-			
CCC	Continuing Calibration Check Standard	5/14/2015	7/30/2015	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	5/14/2015	7/30/2015	-	-	-	0.047	0.050	94.0			
CCC	Continuing Calibration Check Standard	5/14/2015	7/30/2015	-	-	-	1.05	1.00	105			
CCC	Continuing Calibration Check Standard	5/14/2015	7/30/2015	-	-	-	0.241	0.250	96.4			
CCC	Continuing Calibration Check Standard	5/14/2015	7/30/2015	-	-	-	2.05	2.00	103			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	BQL (0.191)	0.200	95.5	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	0.980	1.00	98.0	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	1.94	2.00	97.0	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	4.94	5.00	98.8	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	9.92	10.0	99.2	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	4.94	5.00	98.8	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	9.92	10.0	99.2	-	-	-			
MS	At1X Spike	7/30 & 8/5/2015	7/30 & 8/5/2015	4.48	BQL (0.099) (3.85)	114	1.05	0.045 (0.990)	102			
MS	2At2 Spike	7/30 & 8/5/2015	7/30 & 8/5/2015	4.65	BQL (0.110) (3.85)	118	1.02	BQL (0.006) (0.990)	102			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated and reported without the dilution factor applied.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 15-LC33

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 8/21/2015

Technical Directive No.: EPAGP530 Rev. 1
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure
Date Collected: unknown
Date Received: 8/19/2015
Date Analyzed: 8/19 - 8/21/2015
No. Samples Analyzed: 38

Sample Set No.: 7025
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: Dilution as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/21/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.031	**MDL**	0.002		
QL	** 0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
1t1	7025-1	-	8/20/2015	1.91	1	8/19/2015	0.048	1		
1t1b	7025-2	-	8/20/2015	1.92	1	8/19/2015	0.054	1		
1t2	7025-3	-	8/20/2015	1.27	1	8/19/2015	0.056	1		
1t2b	7025-4	-	8/20/2015	1.27	1	8/19/2015	0.041	1		
1t3	7025-5	-	8/20/2015	0.526	1	8/19/2015	BQL (0.019)	1		
1t3b	7025-6	-	8/20/2015	0.702	1	8/19/2015	BQL (0.018)	1		
1t4	7025-7	-	8/20/2015	0.423	1	8/19/2015	BQL (0.018)	1		
1t4b	7025-8	-	8/20/2015	0.333	1	8/19/2015	BQL (0.018)	1		
2t1	7025-9	-	8/20/2015	ND	1	8/19/2015	BQL (0.015)	1		
2t1b	7025-10	-	8/20/2015	ND	1	8/19/2015	BQL (0.015)	1		
2t1b	7025-10 Lab dup	-	8/20/2015	ND (RPD=NA)	1	8/19/2015	BQL (0.015) (RPD=NA)	1		
2t2	7025-11	-	8/20/2015	ND	1	8/19/2015	BQL (0.015)	1		
2t2b	7025-12	-	8/20/2015	ND	1	8/19/2015	BQL (0.016)	1		
2t3	7025-13	-	8/20/2015	ND	1	8/19/2015	BQL (0.013)	1		
2t3b	7025-14	-	8/20/2015	ND	1	8/19/2015	BQL (0.017)	1		
2t4	7025-15	-	8/20/2015	ND	1	8/19/2015	BQL (0.015)	1		
2t4b	7025-16	-	8/20/2015	ND	1	8/19/2015	BQL (0.016)	1		
3t1	7025-17	-	8/20/2015	5.15	1	8/19/2015	0.023	1		
3t1b	7025-18	-	8/20/2015	4.88	1	8/19/2015	BQL (0.019)	1		
3t2	7025-19	-	8/20/2015	4.92	1	8/19/2015	0.052	1		
3t2b	7025-20	-	8/20/2015	4.91	1	8/19/2015	0.029	1		
3t2b	7025-20 Lab dup	-	8/20/2015	4.88 (RPD=0.613)	1	8/19/2015	0.029 (RPD=0)	1		
3t3	7025-21	-	8/20/2015	4.77	1	8/19/2015	0.030	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/21/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.031	**MDL**	0.002		
QL	** 0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
3t3b	7025-22	-	8/20/2015	4.79	1	8/19/2015	0.022	1		
3t4	7025-23	-	8/20/2015	4.61	1	8/19/2015	0.042	1		
3t4b	7025-24	-	8/20/2015	4.92	1	8/19/2015	0.023	1		
4t1	7025-25	-	8/20/2015	3.48	1	8/19/2015	BQL (0.015)	1		
4t1b	7025-26	-	8/20/2015	3.36	1	8/19/2015	BQL (0.015)	1		
4t1b	7025-26 Lab dup	-	8/20/2015	3.36 (RPD=0)	1	-	-	-		
4t2	7025-27	-	8/20/2015	3.55	1	8/19/2015	BQL (0.015)	1		
4t2b	7025-28	-	8/20/2015	3.50	1	8/19/2015	BQL (0.016)	1		
4t3	7025-29	-	8/20/2015	2.20	1	8/19/2015	BQL (0.014)	1		
4t3b	7025-30	-	8/20/2015	2.37	1	8/19/2015	BQL (0.016)	1		
4t3b	7025-30 Lab dup	-	-	-	-	8/19/2015	BQL (0.016) (RPD=NA)	1		
4t4	7025-31	-	8/20/2015	2.03	1	8/19/2015	BQL (0.015)	1		
4t4b	7025-32	-	8/20/2015	1.97	1	8/19/2015	BQL (0.015)	1		
B6c	7025-33	-	8/20/2015	ND	1	8/19/2015	0.111	1		
B7c	7025-34	-	8/20/2015	ND	1	8/19/2015	0.044	1		
C6c	7025-35	-	8/20/2015	0.233	1	8/19/2015	0.968	1		
AC3c	7025-36	-	8/21/2015	2.69	11	8/19/2015	1.79	1		
5t	7025-37	-	8/20/2015	4.77	1	8/19/2015	0.021	1		
5tb	7025-38	-	8/20/2015	5.14	1	8/19/2015	BQL (0.018)	1		
5tb	7025-38 Lab dup	-	8/20/2015	5.19 (RPD=0.968)	1	8/19/2015	BQL (0.018) (RPD=NA)	1		

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/21/15

Sample Results

			Analytes	Fluoride (F)		**Analytes**	ortho-Phosphate (as P)				
			Codes	7782-41-4		**Codes**	70507				
			Methods	RSKSOP-276/4		**Methods**	NRMRL-GWERD-05-0				
			Unit	mg/L		**Unit**	mg/L				
			MDL	** 0.031		**MDL**	0.002				
			QL	** 0.200		**QL**	0.020				
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**	**Data**	**DF**	

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/21/15

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	8/19/2015	8/19/2015	-	-	-	BQL (0.016)	-	-			
MB	Nanopure Water Blank	8/19/2015	8/19/2015	-	-	-	BQL (0.015)	-	-			
MB	Nanopure Water Blank	8/20/2015	8/20/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/20/2015	8/20/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/21/2015	8/21/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/21/2015	8/21/2015	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	8/19/2015	-	-	-	1.57	1.57	100			
SS	ERA 64 Simple Nutrients	2/25/2015	8/19/2015	-	-	-	1.52	1.57	96.8			
SS	ERA 64 Simple Nutrients	2/25/2015	8/19/2015	-	-	-	1.55	1.57	98.7			
SS	ERA 64 Minerals	1/21/2015	8/20/2015	3.44	3.47	99.1	-	-	-			
SS	ERA 64 Minerals	1/21/2015	8/20/2015	3.43	3.47	98.8	-	-	-			
SS	ERA 64 Minerals	1/21/2015	8/21/2015	3.50	3.47	101	-	-	-			
CCC	Continuing Calibration Check Standard	5/14/2015	8/19/2015	-	-	-	0.020	0.020	100			
CCC	Continuing Calibration Check Standard	5/14/2015	8/19/2015	-	-	-	0.977	1.00	97.7			
CCC	Continuing Calibration Check Standard	5/14/2015	8/19/2015	-	-	-	0.501	0.500	100			
CCC	Continuing Calibration Check Standard	5/14/2015	8/19/2015	-	-	-	0.250	0.250	100			
CCC	Continuing Calibration Check Standard	5/14/2015	8/19/2015	-	-	-	2.04	2.00	102			
CCC	Continuing Calibration Check Standard	6/17/2015	8/20/2015	BQL (0.190)	0.200	95.0	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/20/2015	0.995	1.00	99.5	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/20/2015	2.05	2.00	103	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/20/2015	5.03	5.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/20/2015	9.64	10.0	96.4	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/21/2015	0.203	0.200	102	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/21/2015	5.07	5.00	101	-	-	-			
MS	1t1 Spike	8/19 & 8/20/2015	8/19 & 8/20/2015	3.86	1.91 (1.96)	99.5	1.03	0.048 (0.990)	99.2			
MS	3t3 Spike	8/19 & 8/20/2015	8/19 & 8/20/2015	6.58	4.77 (1.96)	92.3	0.985	0.030 (0.990)	96.5			

Comments:

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/21/15

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 10 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 1.96 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated and reported without the dilution factor applied.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

Experiment description: 5 mg/L NaF 1.0 mM NaCl

Sample ID	mass sample (g)	Date/time F-added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)
1t1		8/11/2015 8:44		9.51	8/11/2015 10:49	2.1	1.91	0.048
1t1b		8/11/2015 8:45		9.92	8/11/2015 10:50	2.1	1.92	0.054
1t2		8/11/2015 8:53		9.39	8/11/2015 12:45	3.9	1.27	0.056
1t2b		8/11/2015 8:54		9.41	8/11/2015 12:46	3.9	1.27	0.041
1t3		8/11/2015 10:28		9.5	8/12/2015 10:44	24.3	0.526	BQL (0.019)
1t3b		8/11/2015 10:29		9.39	8/12/2015 10:45	24.3	0.702	BQL (0.018)
1t4		8/11/2015 10:36		9.88	8/13/2015 10:47	48.2	0.423	BQL (0.018)
1t4b		8/11/2015 10:36		9.76	8/13/2015 10:49	48.2	0.333	BQL (0.018)
2t1		8/11/2015 8:46		3.04	8/11/2015 10:51	2.1	ND	BQL (0.015)
2t1b		8/11/2015 8:47		2.91	8/11/2015 10:52	2.1	ND	BQL (0.015)
2t2		8/11/2015 8:55		2.9	8/11/2015 12:47	3.9	ND	BQL (0.015)
2t2b		8/11/2015 8:56		2.84	8/11/2015 12:49	3.9	ND	BQL (0.016)
2t3		8/11/2015 10:30		2.98	8/12/2015 10:46	24.3	ND	BQL (0.013)
2t3b		8/11/2015 10:31		2.91	8/12/2015 10:47	24.3	ND	BQL (0.017)
2t4		8/11/2015 10:37		3.13	8/13/2015 10:50	48.2	ND	BQL (0.015)
2t4b		8/11/2015 10:37		3.01	8/13/2015 10:51	48.2	ND	BQL (0.016)
3t1		8/11/2015 8:48		7.19	8/11/2015 10:53	2.1	5.15	0.023
3t1b		8/11/2015 8:49		7.15	8/11/2015 10:54	2.1	4.88	BQL (0.019)
3t2		8/11/2015 8:57		7.67	8/11/2015 12:50	3.9	4.92	0.052
3t2b		8/11/2015 8:58		7.28	8/11/2015 12:51	3.9	4.91	0.029
3t3		8/11/2015 10:32		7.24	8/12/2015 10:48	24.3	4.77	0.030
3t3b		8/11/2015 10:33		7.19	8/12/2015 10:49	24.3	4.79	0.022
3t4		8/11/2015 10:38		7.32	8/13/2015 10:55	48.3	4.61	0.042
3t4b		8/11/2015 10:38		7.28	8/13/2015 10:57	48.3	4.92	0.023
4t1		8/11/2015 8:50		9.3	8/11/2015 10:55	2.1	3.48	BQL (0.015)
4t1b		8/11/2015 8:51		9.3	8/11/2015 10:56	2.1	3.36	BQL (0.015)
4t2		8/11/2015 8:59		9.34	8/11/2015 12:53	3.9	3.55	BQL (0.015)
4t2b		8/11/2015 9:00		9.28	8/11/2015 12:54	3.9	3.50	BQL (0.016)
4t3		8/11/2015 10:34		9.36	8/12/2015 10:52	24.3	2.20	BQL (0.014)
4t3b		8/11/2015 10:35		9.3	8/12/2015 10:56	24.4	2.37	BQL (0.016)
4t4		8/11/2015 10:39		9.44	8/13/2015 10:50	48.2	2.03	BQL (0.015)
4t4b		8/11/2015 10:39		9.42	8/13/2015 10:59	48.3	1.97	BQL (0.015)
5t		NA			8/13/2015 11:04		4.77	0.021
5tb		NA			8/13/2015 11:05		5.14	BQL (0.018)
5tb		NA			8/13/2015 11:05		**5.19 (RPD=0.968)**	**. (0.018) (RPD=NA)**

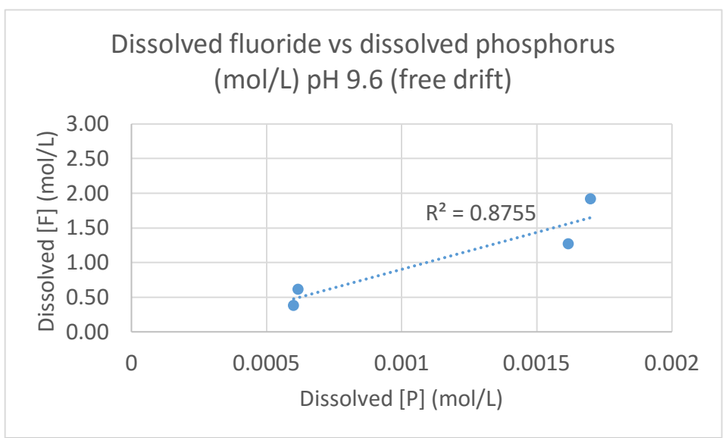
Hydroxyapatite batch tests, pH free drift

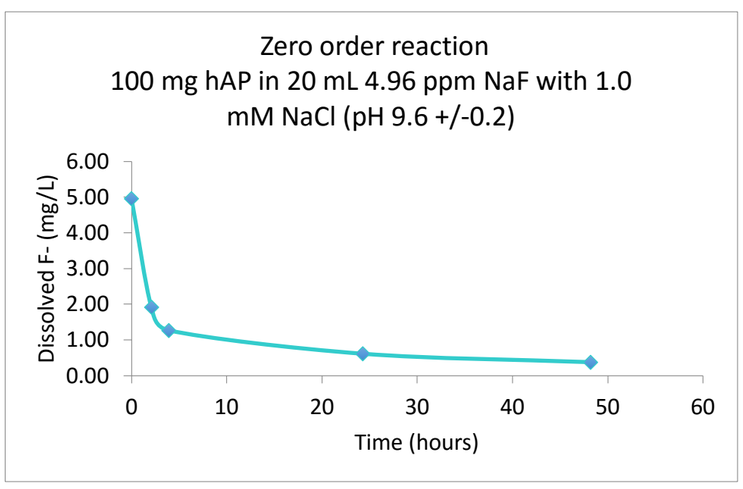
Sample Description: Hydroxyapatite synthesized 200 nm (manufacturer)

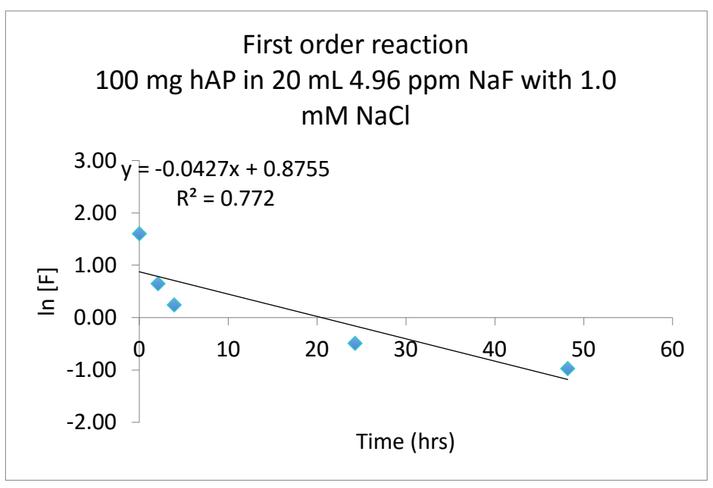
Sample ID	Date/time F- added	date/time filtered	pH	duration of reaction (hours)	Fluoride concentration (copied from raw data)		phospate (copied from raw data)	Phospate values
5t	NA	8/13/2015 11:04		0	4.77		0.021	0.021
5tb	NA	8/13/2015 11:05		0	5.14		BQL (0.018)	0.018
1t1	8/11/2015 8:44	8/11/2015 10:49	9.51	2.1	1.91		0.048	0.048
1t1b	8/11/2015 8:45	8/11/2015 10:50	9.92	2.1	1.92		0.054	0.054
1t2	8/11/2015 8:53	8/11/2015 12:45	9.39	3.9	1.27		0.056	0.056
1t2b	8/11/2015 8:54	8/11/2015 12:46	9.41	3.9	1.27		0.041	0.041
1t3	8/11/2015 10:28	8/12/2015 10:44	9.5	24.3	0.526		BQL (0.019)	0.019
1t3b	8/11/2015 10:29	8/12/2015 10:45	9.39	24.3	0.702		BQL (0.018)	0.018
1t4	8/11/2015 10:36	8/13/2015 10:47	9.88	48.2	0.423		BQL (0.018)	0.018
1t4b	8/11/2015 10:36	8/13/2015 10:49	9.76	48.2	0.333		BQL (0.018)	0.018
5tb	NA	8/13/2015 11:05			**5.19 (RPD=0.968)**		**BQL (0.018) (RPD=NA)**	

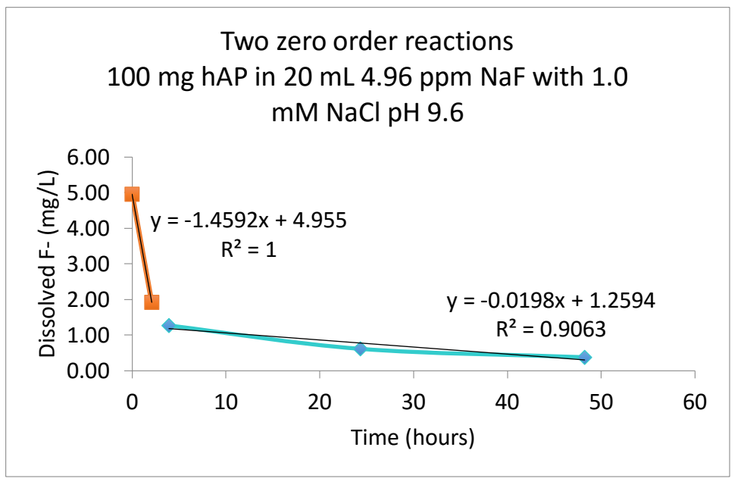
Average of duplicates		mol/L F		mol/L P	Linearized Data ln[F] First order	1/[F] second order
5t	0	4.96	0.26	0.0195		1.60	0.20
1t1	2.1	1.915	0.10	0.051	0.0017	0.65	0.52
1t2	3.9	1.27	0.07	0.0485	0.00161667	0.24	0.79
1t3	24.3	0.614	0.03	0.0185	0.00061667	-0.49	1.63
1t4	48.2	0.378	0.02	0.018	0.0006	-0.97	2.65
					0.00065		

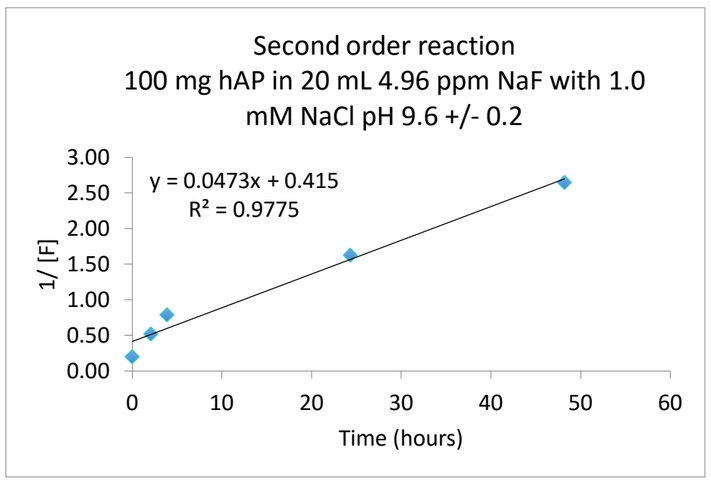
pH average	STDEV
9.6	0.21











Ferrihydrite batch tests, pH free drift

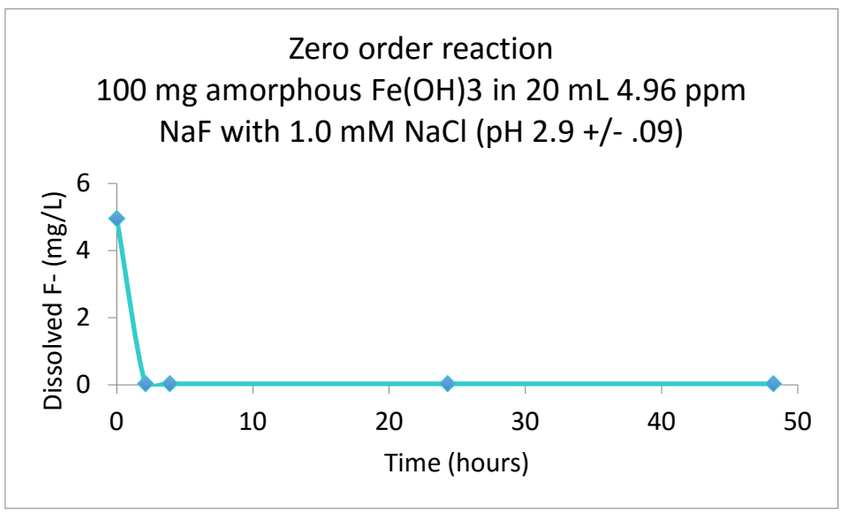
Sample Description: Dr. Su Synthesized

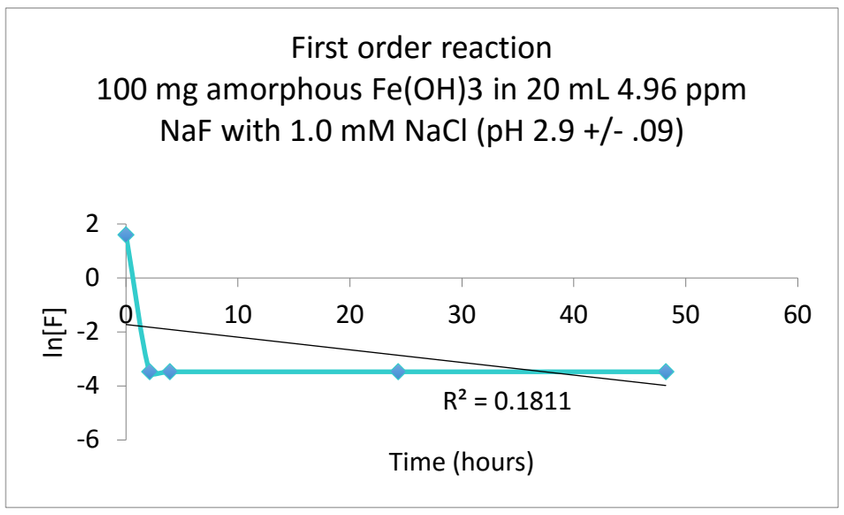
Sample ID	Date/time F- added	date/time filtered	pH	duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)	phosphate values
2t1	##########	##########	3.04	2.1	ND	BQL (0.015)	0.015
2t1b	##########	##########	2.91	2.1	ND	BQL (0.015)	0.015
2t2	##########	##########	2.9	3.9	ND	BQL (0.015)	0.015
2t2b	##########	##########	2.84	3.9	ND	BQL (0.016)	0.016
2t3	##########	##########	2.98	24.3	ND	BQL (0.013)	0.013
2t3b	##########	##########	2.91	24.3	ND	BQL (0.017)	0.017
2t4	##########	##########	3.13	48.2	ND	BQL (0.015)	0.015
2t4b	##########	##########	3.01	48.2	ND	BQL (0.016)	0.016
5t	NA	##########			4.77	0.021	0.021
5tb	NA	##########			5.14	BQL (0.018)	0.018

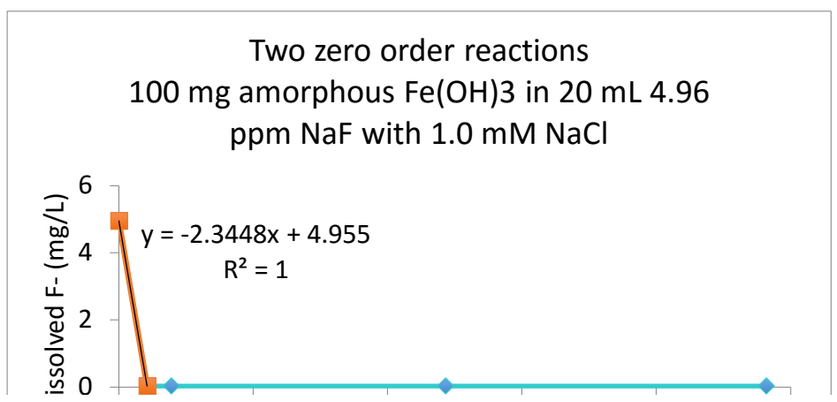
Average of duplicates

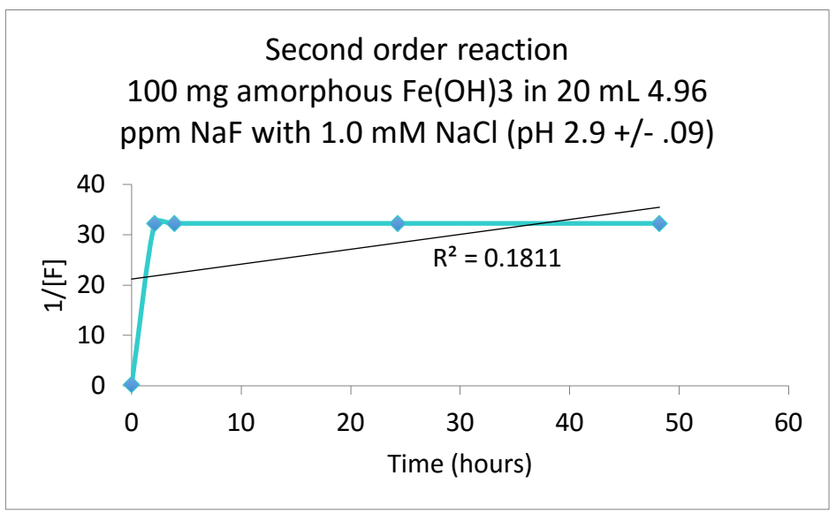
				Linearized Data	
				ln[F] First ord	1/[F] second order
5t	0	4.96	0.015	1.60039717	0.20181635
2t1	2.1	0.031	0.0155	-3.47376807	32.2580645
2t2	3.9	0.031	0.015	-3.47376807	32.2580645
2t3	24.3	0.031	0.0155	-3.47376807	32.2580645
2t4	48.2	0.031	0.0195	-3.47376807	32.2580645

pH average	StDEV
2.965	0.08732125

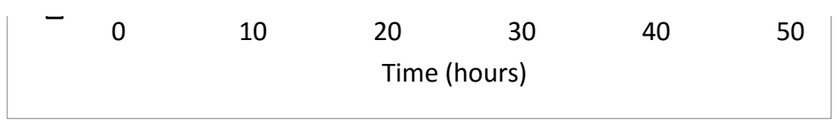








Ferrihydrite batch tests, pH free drift



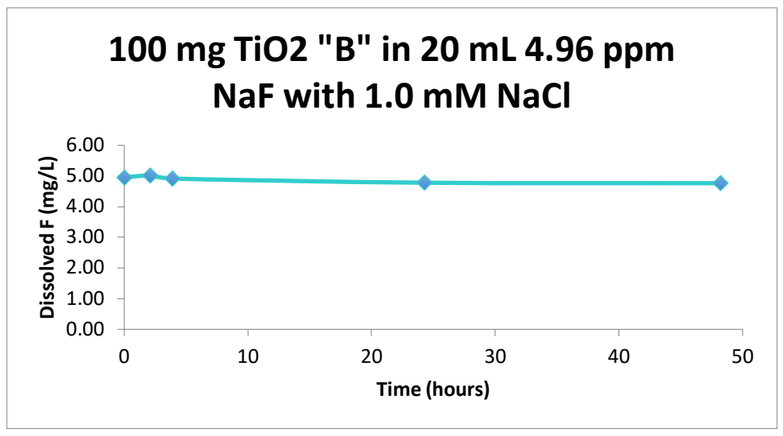
Sample Description: TiO2 (anatase) 10 nm 120 m2/g "B"

Sample ID	Date/time F- added	date/time filtered	pH	duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)	
3t1	8/11/2015 8:48	8/11/2015 10:53	7.19	2.1	5.15	0.023	0.023
3t1b	8/11/2015 8:49	8/11/2015 10:54	7.15	2.1	4.88	BQL (0.019)	0.019
3t2	8/11/2015 8:57	8/11/2015 12:50	7.67	3.9	4.92	0.052	0.052
3t2b	8/11/2015 8:58	8/11/2015 12:51	7.28	3.9	4.91	0.029	0.029
3t3	8/11/2015 10:32	8/12/2015 10:48	7.24	24.3	4.77	0.030	0.03
3t3b	8/11/2015 10:33	8/12/2015 10:49	7.19	24.3	4.79	0.022	0.022
3t4	8/11/2015 10:38	8/13/2015 10:55	7.32	48.3	4.61	0.042	0.042
3t4b	8/11/2015 10:38	8/13/2015 10:57	7.28	48.3	4.92	0.023	0.023
5t	NA	8/13/2015 11:04			4.77	0.021	0.021
5tb	NA	8/13/2015 11:05			5.14	BQL (0.018)	0.018

Average of duplicates

5t	0	4.96		0.0195
3t1	2.1	5.015		0.021
3t2	3.9	4.92		0.0405
3t3	24.3	4.78		0.026
3t4	48.2	4.77		0.0325

pH average	StDEV
7.3	0.2



Brucite Batch Tests pH free drift

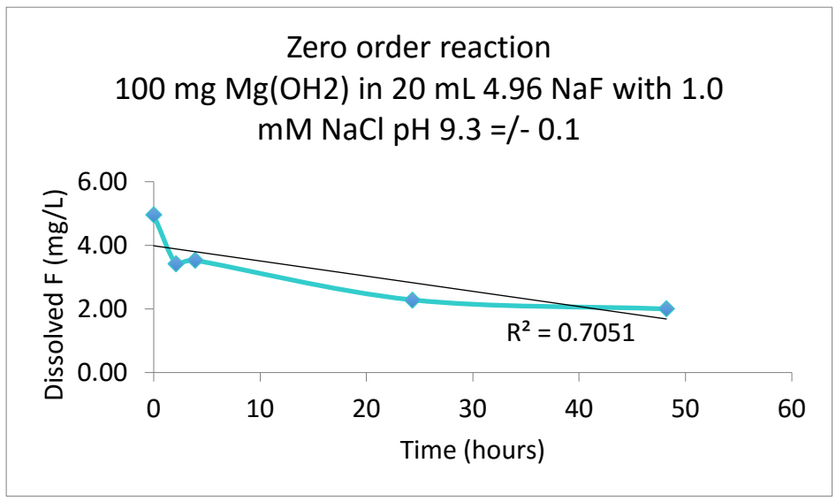
Sample description: Magnesium Hydroxide nanoparticle

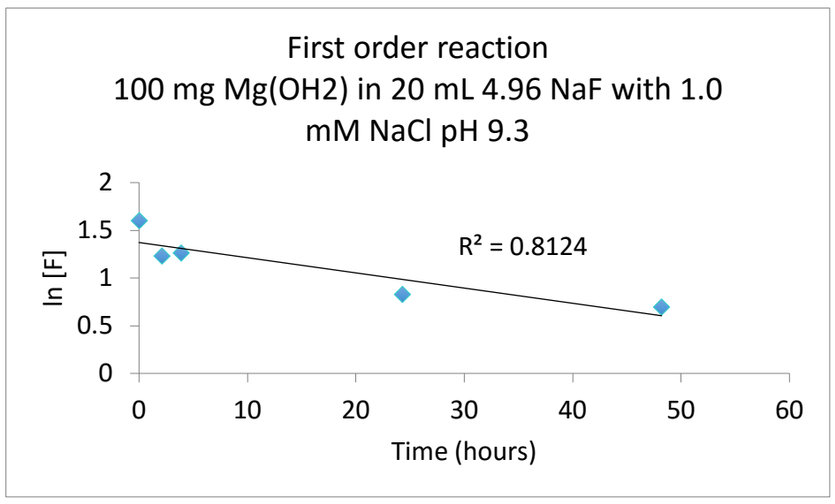
Sample ID	Date/time F added	date/time filtered		duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)	phosphate values
4t1	##########	##########	9.3	2.1	3.48	BQL (0.015)	0.015
4t1b	##########	##########	9.3	2.1	3.36	BQL (0.015)	0.015
4t2	##########	##########	9.34	3.9	3.55	BQL (0.015)	0.015
4t2b	##########	##########	9.28	3.9	3.50	BQL (0.016)	0.016
4t3	##########	##########	9.36	24.3	2.20	BQL (0.014)	0.014
4t3b	##########	##########	9.3	24.4	2.37	BQL (0.016)	0.016
4t4	##########	##########	9.44	48.2	2.03	BQL (0.015)	0.015
4t4b	##########	##########	9.42	48.3	1.97	BQL (0.015)	0.015
5t	NA	##########			4.77	0.021	0.021
5tb	NA	##########			5.14	BQL (0.018)	0.018
5tb	NA	##########			**5.19 (RPD=0.9**	**(0.018) (RPD=NA)**	

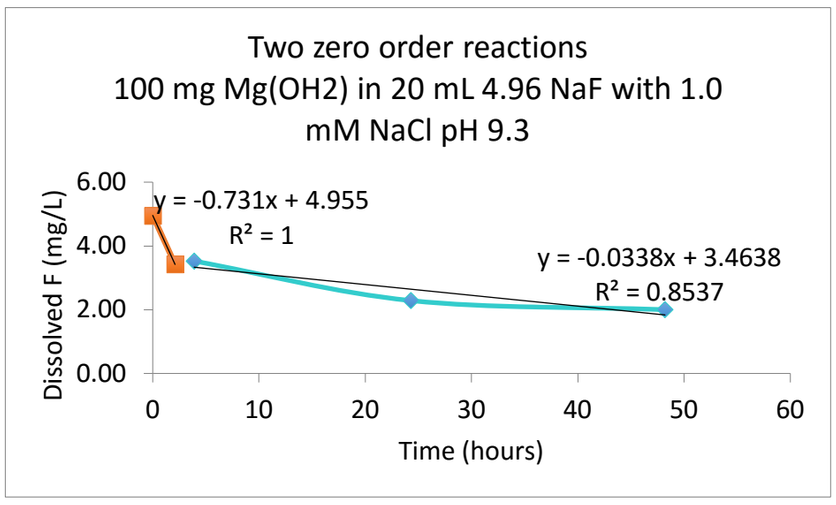
Average of duplicates

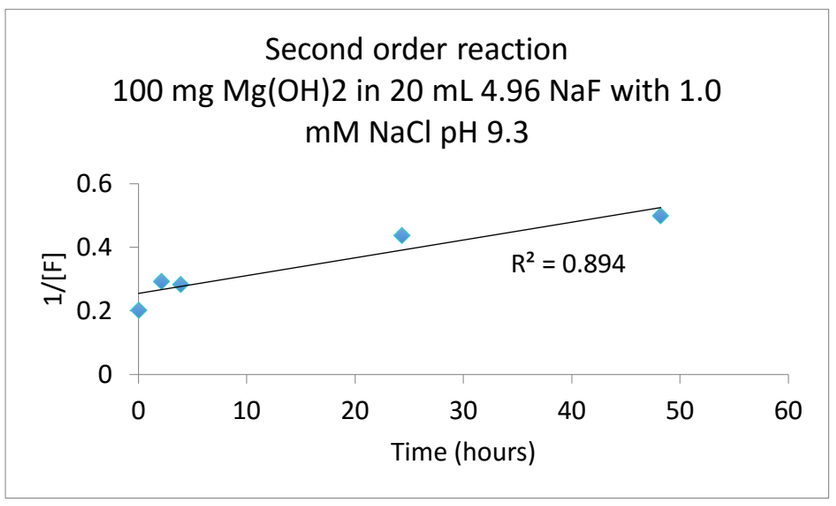
					Linearized Data	
					ln[F] First ord	1/[F] second order
5t			0	4.96	0.0195	1.60039717	0.20181635
4t1			2.1	3.42	0.015	1.22964055	0.29239766
4t2			3.9	3.53	0.0155	1.25988044	0.28368794
4t3			24.3	2.29	0.015	0.82636602	0.43763676
4t4			48.2	2.00	0.015	0.69314718	0.5

pH average	StDEV
9.3	0.1



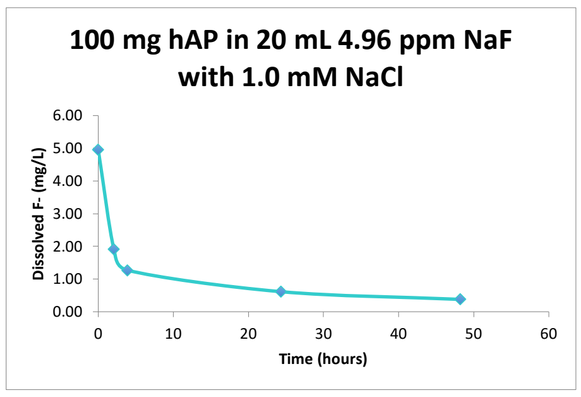


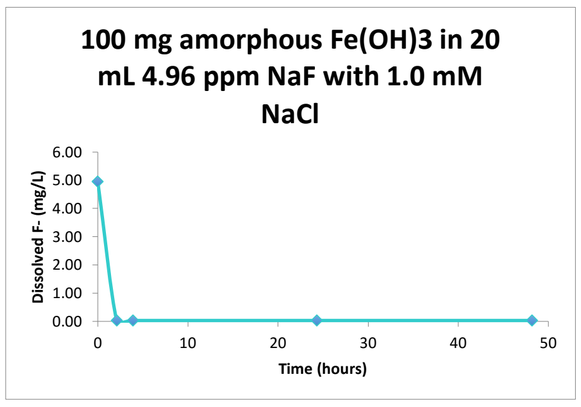


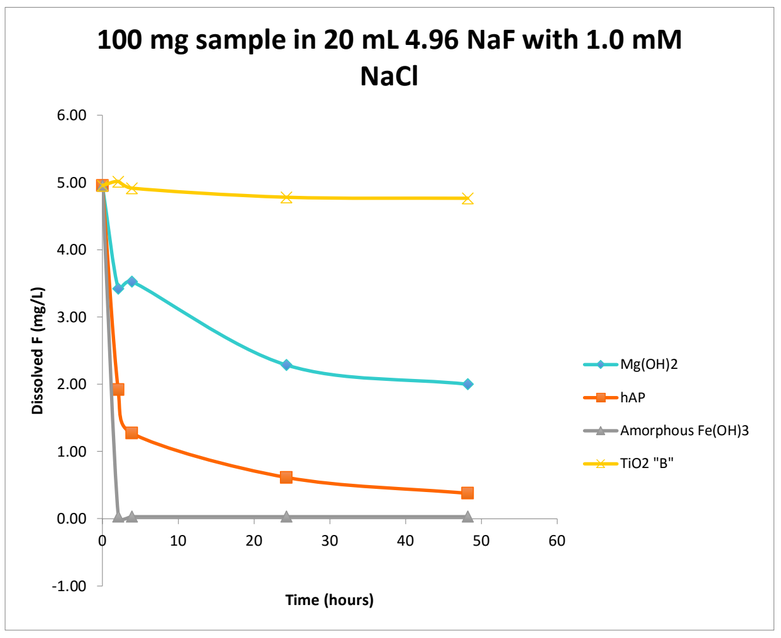


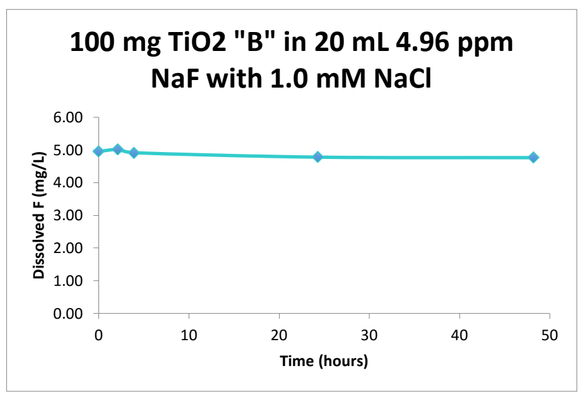
Experiment description pH experiment duplicate sampels re-run 3

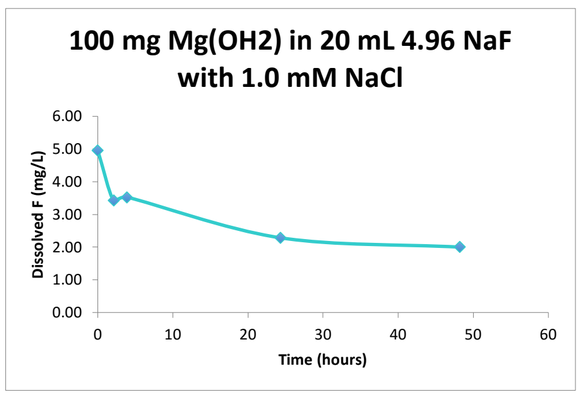
Sample ID (soil)	pH	F- (mg/L)	P (mg/L)
B6c	5.93	ND	0.111
B7c	6.35	ND	0.044
C6c	5.73	0.233	0.968
AC3c	3.08	2.69	1.79


100 mg hAP in 20 mL 4.96 ppm NaF with 1.0 mM NaCl
Dissolved F- (mg/L)
Time (hours)


100 mg amorphous Fe(OH)3 in 20 mL 4.96 ppm NaF with 1.0 mM NaCl
Dissolved F- (mg/L)
Time (hours)


100 mg sample in 20 mL 4.96 NaF with 1.0 mM NaCl
Dissolved F (mg/L)
Time (hours)
Mg(OH)2
hAP
Amorphous Fe(OH)3
TiO2 "B"


100 mg TiO2 "B" in 20 mL 4.96 ppm NaF with 1.0 mM NaCl
Dissolved F (mg/L)
Time (hours)


100 mg Mg(OH2) in 20 mL 4.96 NaF with 1.0 mM NaCl
Dissolved F (mg/L)
Time (hours)

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 15-LC35

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 9/1/2015

Technical Directive No.: EPAGP530 Rev. 1
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure
Date Collected: unknown
Date Received: 9/1/2015
Date Analyzed: 9/1/2015
No. Samples Analyzed: 34

Sample Set No.: 7027
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: Dilution as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 09/01/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.031	**MDL**	** 0.002		
QL	0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
3Ct1	7027-1	-	9/1/2015	5.32	1	9/1/2015	0.098	1		
3Ct1b	7027-2	-	9/1/2015	5.47	1	9/1/2015	0.101	1		
3Ct2	7027-3	-	9/1/2015	5.52	1	9/1/2015	0.156	1		
3Ct2b	7027-4	-	9/1/2015	5.63	1	9/1/2015	0.147	1		
3Ct3	7027-5	-	9/1/2015	5.29	1	9/1/2015	0.175	1		
3Ct3b	7027-6	-	9/1/2015	5.54	1	9/1/2015	0.328	1		
3Ct4	7027-7	-	9/1/2015	5.55	1	9/1/2015	0.459	1		
3Ct4b	7027-8	-	9/1/2015	5.40	1	9/1/2015	0.400	1		
3Dt1	7027-9	-	9/1/2015	5.08	1	9/1/2015	0.139	1		
3Dt1b	7027-10	-	9/1/2015	5.15	1	9/1/2015	0.133	1		
3Dt1b	7027-10 Lab dup	-	9/1/2015	5.08 (RPD=1.37)	1	9/1/2015	0.141 (RPD=5.84)	1		
3Dt2	7027-11	-	9/1/2015	5.06	1	9/1/2015	0.159	1		
3Dt2b	7027-12	-	9/1/2015	5.15	1	9/1/2015	0.134	1		
3Dt3	7027-13	-	9/1/2015	5.07	1	9/1/2015	0.178	1		
3Dt3b	7027-14	-	9/1/2015	5.08	1	9/1/2015	0.166	1		
3Dt4	7027-15	-	9/1/2015	4.58	1	9/1/2015	0.176	1		
3Dt4b	7027-16	-	9/1/2015	4.96	1	9/1/2015	0.190	1		
3Et1	7027-17	-	9/1/2015	5.54	1	9/1/2015	14.7	11		
3Et1b	7027-18	-	9/1/2015	5.38	1	9/1/2015	12.8	11		
3Et2	7027-19	-	9/1/2015	5.63	1	9/1/2015	15.0	11		
3Et2b	7027-20	-	9/1/2015	5.64	1	9/1/2015	14.5	11		
3Et2b	7027-20 Lab dup	-	9/1/2015	5.78 (RPD=2.45)	1	9/1/2015	14.9 (RPD=2.72)	11		
3Et3	7027-21	-	9/1/2015	5.90	1	9/1/2015	15.6	11		
3Et3b	7027-22	-	9/1/2015	5.68	1	9/1/2015	15.8	11		
3Et4	7027-23	-	9/1/2015	5.81	1	9/1/2015	15.5	11		
3Et4b	7027-24	-	9/1/2015	5.81	1	9/1/2015	16.2	11		
3at1	7027-25	-	9/1/2015	4.74	1	9/1/2015	BQL (0.004)	1		
3at1b	7027-26	-	9/1/2015	4.93	1	9/1/2015	BQL (0.019)	1		
3at2	7027-27	-	9/1/2015	4.63	1	9/1/2015	BQL (0.015)	1		
3at2b	7027-28	-	9/1/2015	4.64	1	9/1/2015	BQL (0.016)	1		
3at3	7027-29	-	9/1/2015	4.14	1	9/1/2015	BQL (0.003)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 09/01/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.031	**MDL**	** 0.002		
QL	0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
3at3b	7027-30	-	9/1/2015	4.43	1	9/1/2015	BQL (0.014)	1		
3at3b	7027-30 Lab dup	-	9/1/2015	4.34 (RPD=2.05)	1	9/1/2015	BQL (0.014) (RPD=NA)	1		
3at4	7027-31	-	9/1/2015	4.92	1	9/1/2015	BQL (0.017)	1		
3at4b	7027-32	-	9/1/2015	4.79	1	9/1/2015	BQL (0.015)	1		
3Ft	7027-33	-	9/1/2015	5.47	1	9/1/2015	BQL (0.016)	1		
3Ftb	7027-34	-	9/1/2015	5.32	1	9/1/2015	BQL (0.014)	1		

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 09/01/15

Quality Control Data

Analytes	Fluoride (F)			ortho-phosphate as P					
Codes	7782-41-4			70507					
Methods	RSKSOP-276/4			NRMRL-GWERD-05-0					
Unit	mg/L			mg/L					
MDL	0.031			0.002					
QL	0.200			0.020					

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	9/1/2015	9/1/2015	-	-	-	BQL (0.015)	-	-			
MB	Nanopure Water Blank	9/1/2015	9/1/2015	-	-	-	BQL (0.014)	-	-			
MB	Nanopure Water Blank	9/1/2015	9/1/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	9/1/2015	9/1/2015	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	9/1/2015	-	-	-	1.54	1.57	98.1			
SS	ERA 64 Simple Nutrients	2/25/2015	9/1/2015	-	-	-	1.55	1.57	98.7			
SS	ERA 64 Simple Nutrients	2/25/2015	9/1/2015	-	-	-	1.55	1.57	98.7			
SS	ERA 64 Minerals	1/21/2015	9/1/2015	3.57	3.47	103	-	-	-			
SS	ERA 64 Minerals	1/21/2015	9/1/2015	3.58	3.47	103	-	-	-			
CCC	Continuing Calibration Check Standard	5/14/2015	9/1/2015	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	5/14/2015	9/1/2015	-	-	-	1.04	1.00	104			
CCC	Continuing Calibration Check Standard	5/14/2015	9/1/2015	-	-	-	0.517	0.500	103			
CCC	Continuing Calibration Check Standard	5/14/2015	9/1/2015	-	-	-	0.247	0.250	98.8			
CCC	Continuing Calibration Check Standard	5/14/2015	9/1/2015	-	-	-	2.03	2.00	102			
CCC	Continuing Calibration Check Standard	6/17/2015	9/1/2015	BQL (0.193)	0.200	96.5	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	9/1/2015	1.05	1.00	105	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	9/1/2015	2.05	2.00	103	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	9/1/2015	4.92	5.00	98.4	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	9/1/2015	9.90	10.0	99.0	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	9/1/2015	4.92	5.00	98.4	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	9/1/2015	9.90	10.0	99.0	-	-	-			
MS	3Ct1 Spike	9/1/2015	9/1/2015	9.42	5.32 (3.85)	106	1.04	0.098 (0.990)	95.2			
MS	3Et3 Spike	9/1/2015	9/1/2015	9.87	5.90 (3.85)	103	* 2.42	* 1.42 (0.901)	111			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated and reported without the dilution factor applied.

Notes:

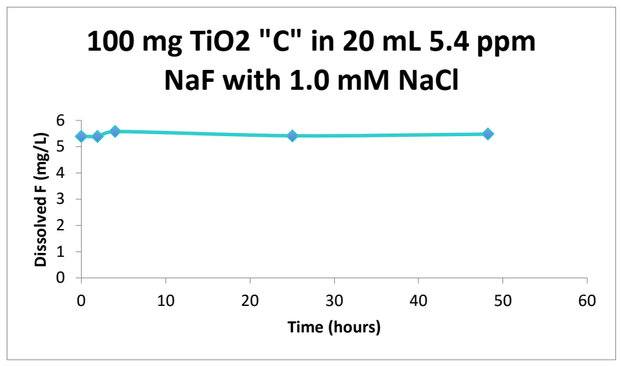
1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

Experiment specifics: TiO2 and FeO3 alpha in 5 mg/L fluoride and 1mM NaCl

Sample ID	mass of cap + tube	mass sample+cap+soln	mass sample (g)	volume F-	Fluoride concentration (copied from raw data)	sorbed F (mg/l)	x/m	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Fluoride concentration values only	phospate (copied from raw data)
3Ct1	16.299	36.133	0.1	19.7	5.32	0.075	0.01	8/12/2015 11:01		7.67	8/12/2015 12:55	1.9		0.098
3Ct1b	16.279	36.069	0.1003	19.7	5.47	-0.075	-0.01	8/12/2015 11:01		7.5	8/12/2015 13:01	2.0		0.101
3Ct2	16.218	36.032	0.1	19.7	5.52	-0.125	-0.02	8/12/2015 11:07		6.32	8/12/2015 15:05	4.0		0.156
3Ct2b	16.303	36.063	0.1002	19.7	5.63	-0.235	-0.05	8/12/2015 11:07		6.27	8/12/2015 15:06	4.0		0.147
3Ct3	16.333	35.975	0.1	19.5	5.29	0.105	0.02	8/12/2015 11:17		7.1	8/13/2015 12:17	25.0		0.175
3Ct3b	16.04	35.799	0.1005	19.7	5.54	-0.145	-0.03	8/12/2015 11:17		6.74	8/13/2015 12:18	25.0		0.328
3Ct4	16.195	35.901	0.1005	19.6	5.55	-0.155	-0.03	8/12/2015 11:18		7.39	8/14/2015 11:30	48.2		0.459
3Ct4b	16.219	35.963	0.1009	19.6	5.40	-0.005	0.00	8/12/2015 11:18		7.15	8/14/2015 11:33	48.2		0.400
3Dt1	16.387	36.171	0.1007	19.7	5.08	0.315	0.06	8/12/2015 11:01		6.35	8/12/2015 13:02	2.0		0.139
3Dt1b	16.292	36.082	0.1008	19.7	5.15	0.245	0.05	8/12/2015 11:02		6.07	8/12/2015 13:03	2.0		0.133
3Dt2	16.314	36.013	0.1006	19.6	5.06	0.335	0.07	8/12/2015 11:08		5.15	8/12/2015 15:08	4.0		0.159
3Dt2b	15.863	35.281	0.1	19.3	5.15	0.245	0.05	8/12/2015 11:09		5.08	8/12/2015 15:09	4.0		0.134
3Dt3	16.259	36.019	0.1002	19.7	5.07	0.325	0.06	8/12/2015 11:19		5.78	8/13/2015 12:19	25.0		0.178
3Dt3b	16.152	35.793	0.1007	19.5	5.08	0.315	0.06	8/12/2015 11:19		5.72	8/13/2015 12:20	25.0		0.166
3Dt4	16.323	35.971	0.1002	19.5	4.58	0.815	0.16	8/12/2015 11:23		6.15	8/14/2015 11:34	48.2		0.176
3Dt4b	16.169	35.815	0.1005	19.5	4.96	0.435	0.08	8/12/2015 11:24		6.02	8/14/2015 11:35	48.2		0.190
3Et1	16.196	35.942	0.1002	19.6	5.54	-0.145	-0.03	8/12/2015 11:03		6.32	8/12/2015 13:07	2.1		14.7
3Et1b	16.401	36.117	0.1	19.6	5.38	0.015	0.00	8/12/2015 11:04		6.29	8/12/2015 13:08	2.1		12.8
3Et2	16.486	36.178	0.1003	19.6	5.63	-0.235	-0.05	8/12/2015 11:10		6.01	8/12/2015 15:10	4.0		15.0
3Et2b	16.207	35.927	0.1001	19.6	5.64	-0.245	-0.05	8/12/2015 11:11		6.03	8/12/2015 15:11	4.0		14.5
3Et3	16.279	35.987	0.1002	19.6	5.90	-0.505	-0.10	8/12/2015 11:20		6.28	8/13/2015 12:21	25.0		15.6
3Et3b	16.195	35.901	0.1008	19.6	5.68	-0.285	-0.06	8/12/2015 11:20		6.29	8/13/2015 12:22	25.0		15.8
3Et4	16.274	35.973	0.1002	19.6	5.81	-0.415	-0.08	8/12/2015 11:24		6.54	8/14/2015 11:36	48.2		15.5
3Et4b	16.085	35.781	0.1005	19.6	5.81	-0.415	-0.08	8/12/2015 11:25		6.51	8/14/2015 11:38	48.2		16.2
3at1	16.156	35.945	0.1002	19.7	4.74	0.655	0.13	8/12/2015 11:05		5.35	8/12/2015 13:09	2.1		BQL (0.004)
3at1b	16.314	36.031	0.1008	19.6	4.93	0.465	0.09	8/12/2015 11:05		5.06	8/12/2015 13:10	2.1		BQL (0.019)
3at2	16.387	36.091	0.1007	19.6	4.63	0.765	0.15	8/12/2015 11:11		4.99	8/12/2015 15:12	4.0		BQL (0.015)
3at2b	16.432	36.133	0.1005	19.6	4.64	0.755	0.15	8/12/2015 11:12		4.82	8/12/2015 15:13	4.0		BQL (0.016)
3at3	16.302	36.024	0.1	19.6	4.14	1.255	0.25	8/12/2015 11:22		5.48	8/13/2015 12:23	25.0		BQL (0.003)
3at3b	16.301	36.132	0.1006	19.7	4.43	0.965	0.19	8/12/2015 11:22		5.37	8/13/2015 12:24	25.0		BQL (0.014)
3at4	16.373	36.142	0.1	19.7	4.92	0.475	0.09	8/12/2015 11:26		5.66	8/14/2015 11:39	48.2		BQL (0.017)
3at4b	16.307	34.778	0.1003	18.4	4.79	0.605	0.11	8/12/2015 11:27		5.52	8/14/2015 11:40	48.2		BQL (0.015)
3Ft					5.47			NA			8/14/2015 11:44			BQL (0.016)
3Ftb					5.32			NA			8/14/2015 11:44			BQL (0.014)
					5.395									

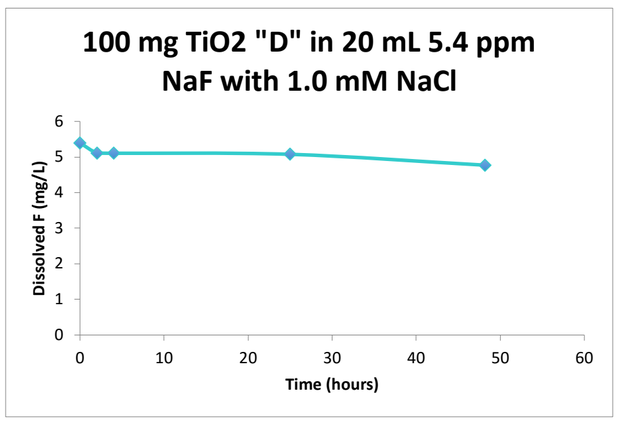
TiO2 (rutile) 10x40 nm 150 m2/g "C"

Sample ID	Date/time F- added	date/time filtered	mass sample (g)	volume F-	Fluoride concentration (copied from raw data)	sorbed F (mg/l)	x/m	pH	duration of reaction (hours)	concentration (copied from raw data)	phospate (copied from raw data)
3Ct1	##########	##########	0.10	19.73	5.32	0.07	0.01	7.67	1.9	5.32	0.098
3Ct1b	##########	##########	0.10	19.69	5.47	-0.08	-0.01	7.5	2.0	5.47	0.101
3Ct2	##########	##########	0.10	19.71	5.52	-0.13	-0.02	6.32	4.0	5.52	0.156
3Ct2b	##########	##########	0.10	19.66	5.63	-0.24	-0.05	6.27	4.0	5.63	0.147
3Ct3	##########	##########	0.10	19.54	5.29	0.11	0.02	7.1	25.0	5.29	0.175
3Ct3b	##########	##########	0.10	19.66	5.54	-0.15	-0.03	6.74	25.0	5.54	0.328
3Ct4	##########	##########	0.10	19.61	5.55	-0.16	-0.03	7.39	48.2	5.55	0.459
3Ct4b	##########	##########	0.10	19.64	5.40	-0.01	0.00	7.15	48.2	5.40	0.400
3Ft	NA	##########								5.47	BQL (0.016)
3Ftb	NA	##########								5.32	BQL (0.014)
					average of duplicates						
3Ft									0	5.395	0.015
3Ct1			0.10	19.71	5.40	0.00	0.00	7.59	1.9	5.395	0.0995
3Ct2			0.10	19.69	5.58	-0.18	-0.04	6.30	4	5.58	0.152
3Ct3			0.10	19.60	5.42	-0.02	0.00	6.92	25	5.42	0.2515
3Ct4			0.10	19.62	5.48	-0.08	-0.02	7.27	48.2	5.48	0.4295
					STDEV						
3Ct1			0.0001	0.02	0.07	0.07	0.01	0.09	0.05	0.07	0.00
3Ct2			0.0001	0.03	0.06	0.06	0.01	0.03	0.01	0.06	0.00
3Ct3			0.0003	0.06	0.13	0.13	0.02	0.18	0.01	0.13	0.08
3Ct4			0.0002	0.02	0.07	0.07	0.01	0.12	0.02	0.07	0.03



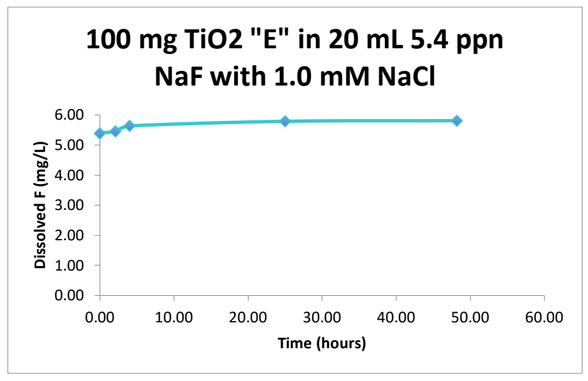
TiO2 (rutile) 30-40 nm 30 m2/g "D)

Sample ID	Date/time F- added	date/time filtered	mass sample (g)	volume F-	Fluoride concentration (copied from raw data)	sorbed F (mg/l)	x/m	pH	duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)
3Dt1	8/12/2015 11:01	8/12/2015 13:02	0.10	19.68	5.08	0.32	0.06	6.35	2.0	5.08	0.139
3Dt1b	8/12/2015 11:02	8/12/2015 13:03	0.10	19.69	5.15	0.24	0.05	6.07	2.0	5.15	0.133
3Dt2	8/12/2015 11:08	8/12/2015 15:08	0.10	19.60	5.06	0.34	0.07	5.15	4.0	5.06	0.159
3Dt2b	8/12/2015 11:09	8/12/2015 15:09	0.10	19.32	5.15	0.24	0.05	5.08	4.0	5.15	0.134
3Dt3	8/12/2015 11:19	8/13/2015 12:19	0.10	19.66	5.07	0.32	0.06	5.78	25.0	5.07	0.178
3Dt3b	8/12/2015 11:19	8/13/2015 12:20	0.10	19.54	5.08	0.32	0.06	5.72	25.0	5.08	0.166
3Dt4	8/12/2015 11:23	8/14/2015 11:34	0.10	19.55	4.58	0.82	0.16	6.15	48.2	4.58	0.176
3Dt4b	8/12/2015 11:24	8/14/2015 11:35	0.10	19.55	4.96	0.44	0.08	6.02	48.2	4.96	0.190
3Ft	NA	8/14/2015 11:44								5.47	BQL (0.016)
3Ftb	NA	8/14/2015 11:44								5.32	BQL (0.014)
					average of duplicates						
3Ft									0	5.395	0.015
3Dt1			0.10	19.69	5.12	0.28	0.05	6.21	2.02	5.12	0.136
3Dt2			0.10	19.46	5.11	0.29	0.06	5.12	4.00	5.11	0.147
3Dt3			0.10	19.60	5.08	0.32	0.06	5.75	25.01	5.08	0.172
3Dt4			0.10	19.55	4.77	0.63	0.12	6.09	48.18	4.77	0.183
					STDEV						
3Dt1			5E-05	0.00305	0.035	0.035	0.00685757	0.14	8.73115E-11	0.035	0.003
3Dt2			0.0003	0.14	0.045	0.045	0.00896636	0.035	8.73115E-11	0.045	0.0125
3Dt3			0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3Dt4			0.00015	0.0016	0.19	0.19	0.03720122	0.065	8.73115E-11	0.19	0.007



TiO2 (anatase) 50 nm APS 160 m2/g "E"

Sample ID	Date/time F- added	date/time filtered	mass sample (g)	volume F-	Fluoride concentration (copied from raw data)	sorbed F (mg/l)	x/m	pH	duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)
3Et1	8/12/2015 11:03	8/12/2015 13:07	0.10	19.65	5.54	-0.15	-0.03	6.32	2.1	5.54	14.7
3Et1b	8/12/2015 11:04	8/12/2015 13:08	0.10	19.62	5.38	0.01	0.00	6.29	2.1	5.38	12.8
3Et2	8/12/2015 11:10	8/12/2015 15:10	0.10	19.59	5.63	-0.24	-0.05	6.01	4.0	5.63	15.0
3Et2b	8/12/2015 11:11	8/12/2015 15:11	0.10	19.62	5.64	-0.25	-0.05	6.03	4.0	5.64	14.5
3Et3	8/12/2015 11:20	8/13/2015 12:21	0.10	19.61	5.90	-0.51	-0.10	6.28	25.0	5.90	15.6
3Et3b	8/12/2015 11:20	8/13/2015 12:22	0.10	19.61	5.68	-0.29	-0.06	6.29	25.0	5.68	15.8
3Et4	8/12/2015 11:24	8/14/2015 11:36	0.10	19.60	5.81	-0.42	-0.08	6.54	48.2	5.81	15.5
3Et4b	8/12/2015 11:25	8/14/2015 11:38	0.10	19.60	5.81	-0.42	-0.08	6.51	48.2	5.81	16.2
3Ft	NA	8/14/2015 11:44								5.47	BQL (0.016)
3Ftb	NA	8/14/2015 11:44								5.32	BQL (0.014)
					average of Duplicates						
3Ft									0.00	5.40	0.015
3Et1			0.10	19.63	5.46	-0.07	-0.01	6.31	2.07	5.46	13.8
3Et2			0.10	19.61	5.64	-0.24	-0.05	6.02	4.00	5.64	14.8
3Et3			0.10	19.61	5.79	-0.40	-0.08	6.29	25.03	5.79	15.7
3Et4			0.10	19.60	5.81	-0.42	-0.08	6.53	48.21	5.81	15.85
					STDEV						
3Et1			0.0001	0.01	0.08	0.08	0.02	0.02	0.00	0.08	0.95
3Et2			0.0001	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.25
3Et3			0.0003	0.00	0.11	0.11	0.02	0.00	0.01	0.11	0.10
3Et4			0.0002	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.35



FeO3-alpha 20-50 nm 50 m2/g

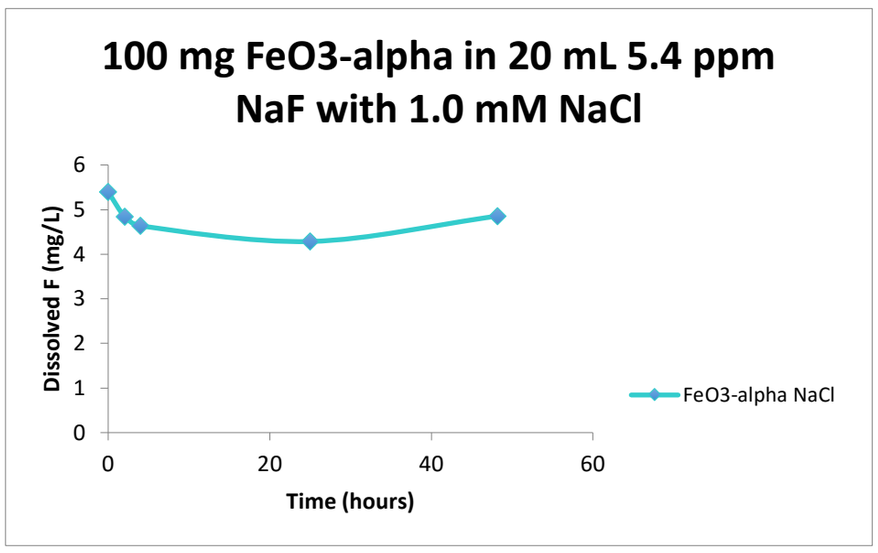
Sample ID	Date/time F-added	date/time filtered	mass sample (g)	volume F-	Fluoride concentration (copied from raw data)	sorbed F (mg/l)	x/m	pH	duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)	
3at1	8/12/2015 11:05	8/12/2015 13:09	0.10	19.69	4.74	0.65	0.13	5.35	2.1	4.74	0.004	[P] BQL
3at1b	8/12/2015 11:05	8/12/2015 13:10	0.10	19.62	4.93	0.47	0.09	5.06	2.1	4.93	0.019	[P] BQL
3at2	8/12/2015 11:11	8/12/2015 15:12	0.10	19.60	4.63	0.77	0.15	4.99	4.0	4.63	0.015	[P] BQL
3at2b	8/12/2015 11:12	8/12/2015 15:13	0.10	19.60	4.64	0.76	0.15	4.82	4.0	4.64	0.016	[P] BQL
3at3	8/12/2015 11:22	8/13/2015 12:23	0.10	19.62	4.14	1.26	0.25	5.48	25.0	4.14	0.003	[P] BQL
3at3b	8/12/2015 11:22	8/13/2015 12:24	0.10	19.73	4.43	0.97	0.19	5.37	25.0	4.43	0.014	[P] BQL
3at4	8/12/2015 11:26	8/14/2015 11:39	0.10	19.67	4.92	0.48	0.09	5.66	48.2	4.92	0.017	[P] BQL
3at4b	8/12/2015 11:27	8/14/2015 11:40	0.10	18.37	4.79	0.61	0.11	5.52	48.2	4.79	0.015	[P] BQL
3Ft	NA	8/14/2015 11:44								5.47	0.016	[P] BQL
3Ftb	NA	8/14/2015 11:44								5.32	0.014	[P] BQL

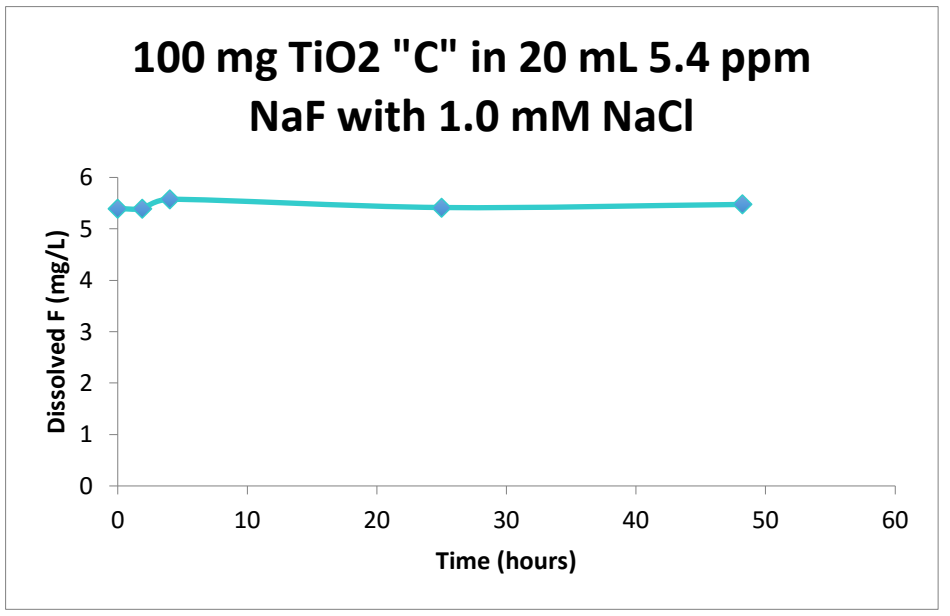
average of duplicates

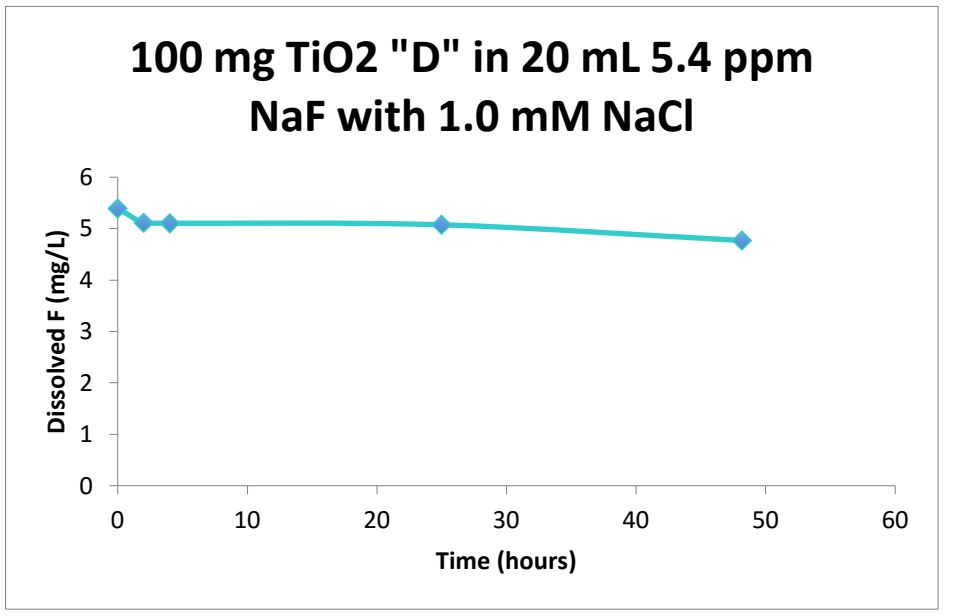
3Ft							0	5.395	0.015
3at1	0.10	19.65	4.84	0.56	0.11	5.21	2.08	4.84	0.01
3at2	0.10	19.60	4.64	0.76	0.15	4.91	4.02	4.64	0.02
3at3	0.10	19.68	4.29	1.11	0.22	5.43	25.03	4.29	0.01
3at4	0.10	19.02	4.86	0.54	0.10	5.59	48.22	4.86	0.02

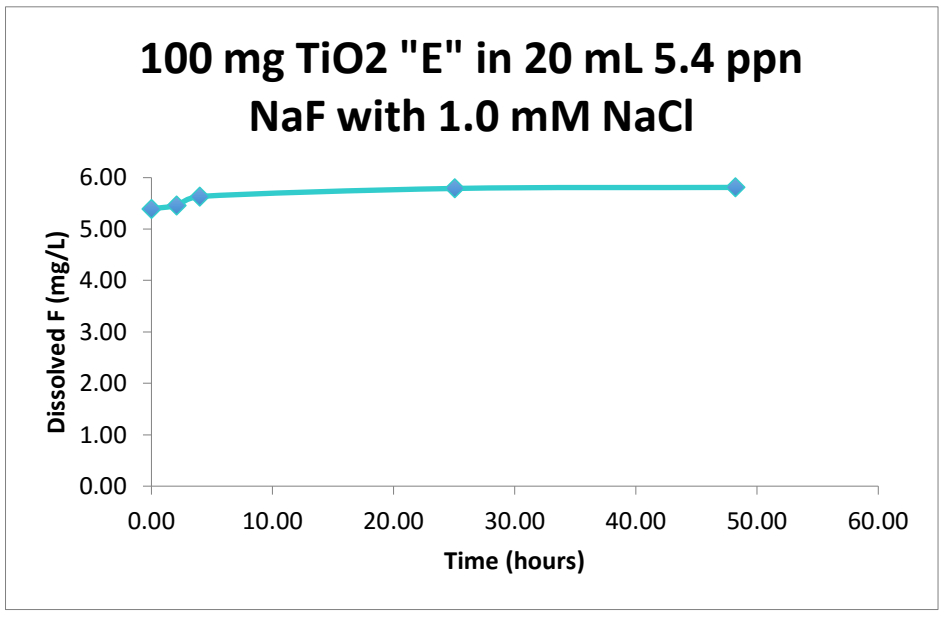
STDEV

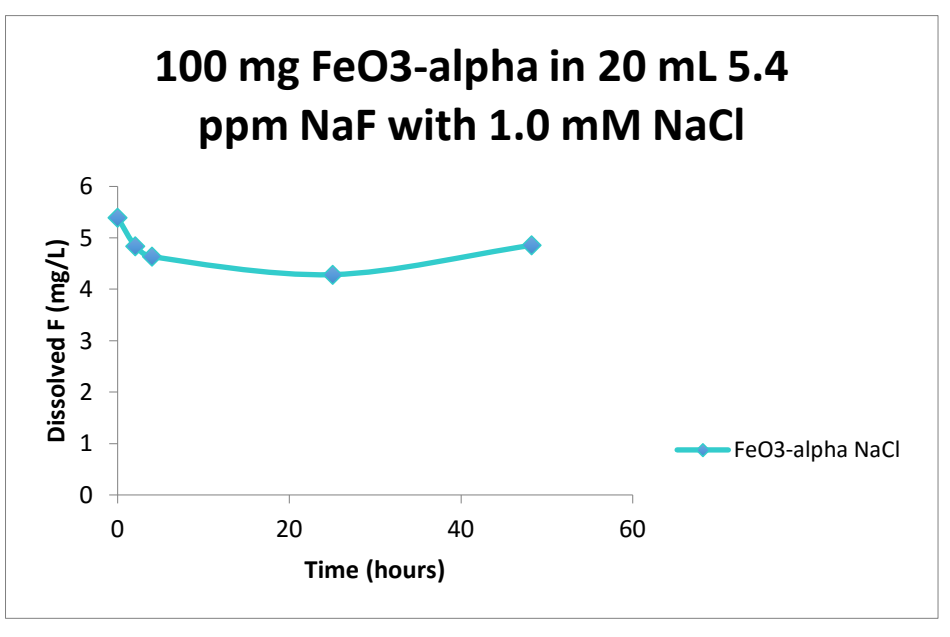
3at1	0.0003	0.04	0.09	0.09	0.02	0.15	0.01	0.09	0.01
3at2	0.0001	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00
3at3	0.0003	0.05	0.15	0.15	0.03	0.06	0.01	0.15	0.01
3at4	0.0001	0.65	0.06	0.06	0.01	0.07	0.00	0.06	0.00




100 mg TiO2 "C" in 20 mL 5.4 ppm NaF with 1.0 mM NaCl
Dissolved F (mg/L)
0
1
2
3
4
5
6
0
10
20
30
40
50
60
Time (hours)


100 mg TiO2 "D" in 20 mL 5.4 ppm NaF with 1.0 mM NaCl
Dissolved F (mg/L)
0
1
2
3
4
5
6
0
10
20
30
40
50
60
Time (hours)


100 mg TiO2 "E" in 20 mL 5.4 ppn NaF with 1.0 mM NaCl
Dissolved F (mg/L)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Time (hours)


100 mg FeO3-alpha in 20 mL 5.4 ppm NaF with 1.0 mM NaCl
Dissolved F (mg/L)
0
1
2
3
4
5
6
0
20
40
60
Time (hours)
FeO3-alpha NaCl

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 15-LC45

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 11/3/2015

Technical Directive No.: EPAGP543
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure, RAP # 502.B

Date Collected: unknown
Date Received: 10/21/2015
Date Analyzed: 10/21 & 10/29/2015
No. Samples Analyzed: 60

Sample Set No.: 7043
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: none

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP543

Analyst: Lynda Callaway

Report Date: 11/03/15

Sample Results

Analytes	Fluoride (F)	Analytes	ortho-Phosphate (as P)	
Codes	7782-41-4	Codes	70507	
Methods	RSKSOP-276/4	Methods	NRMRL-GWERD-05-0	
Unit	mg/L	Unit	mg/L	
MDL	0.039	MDL	** 0.002	
QL	0.200	QL	** 0.020	

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
3hAPt1	7043-1	-	10/29/2015	2.33	1	10/21/2015	0.103	1		
3hAPt1b	7043-2	-	10/29/2015	2.35	1	10/21/2015	0.121	1		
3hAPt2	7043-3	-	10/29/2015	1.88	1	10/21/2015	0.077	1		
3hAPt2b	7043-4	-	10/29/2015	1.75	1	10/21/2015	0.073	1		
3hAPt3	7043-5	-	10/29/2015	1.34	1	10/21/2015	0.026	1		
3hAPt3b	7043-6	-	10/29/2015	1.65	1	10/21/2015	0.025	1		
3hAPt4	7043-7	-	10/29/2015	1.32	1	10/21/2015	0.022	1		
3hAPt4b	7043-8	-	10/29/2015	2.58	1	10/21/2015	0.038	1		
3hAPt4b	7043-8 Lab dup	-	10/29/2015	2.55 (RPD=1.17)	1	-	-	-		
3Afet1	7043-9	-	10/29/2015	ND	1	10/21/2015	BQL (0.013)	1		
3Afet1b	7043-10	-	10/29/2015	BQL (0.084)	1	10/21/2015	BQL (0.013)	1		
3Afet1b	7043-10 Lab dup	-	-	-	-	10/21/2015	BQL (0.014) (RPD=NA)	1		
3Afet2	7043-11	-	10/29/2015	BQL (0.051)	1	10/21/2015	BQL (0.012)	1		
3Afet2b	7043-12	-	10/29/2015	ND	1	10/21/2015	BQL (0.013)	1		
3Afet3	7043-13	-	10/29/2015	ND	1	10/21/2015	BQL (0.014)	1		
3Afet3b	7043-14	-	10/29/2015	ND	1	10/21/2015	BQL (0.012)	1		
3Afet4	7043-15	-	10/29/2015	ND	1	10/21/2015	BQL (0.012)	1		
3Afet4b	7043-16	-	10/29/2015	ND	1	10/21/2015	BQL (0.013)	1		
3Mgt1	7043-17	-	10/29/2015	3.61	1	10/21/2015	BQL (0.012)	1		
3Mgt1b	7043-18	-	10/29/2015	3.56	1	10/21/2015	BQL (0.009)	1		
3Mgt2	7043-19	-	10/29/2015	3.65	1	10/21/2015	BQL (0.013)	1		
3Mgt2b	7043-20	-	10/29/2015	3.39	1	10/21/2015	BQL (0.013)	1		
3Mgt2b	7043-20 Lab dup	-	10/29/2015	3.29 (RPD=2.99)	1	10/21/2015	BQL (0.013) (RPD=NA)	1		
3Mgt3	7043-21	-	10/29/2015	2.65	1	10/21/2015	BQL (0.013)	1		
3Mgt3b	7043-22	-	10/29/2015	2.58	1	10/21/2015	BQL (0.013)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP543

Analyst: Lynda Callaway

Report Date: 11/03/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.039	**MDL**	** 0.002		
QL	0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
3Mgt4	7043-23	-	10/29/2015	2.47	1	10/21/2015	BQL (0.013)	1		
3Mgt4b	7043-24	-	10/29/2015	2.31	1	10/21/2015	BQL (0.013)	1		
3ft1	7043-25	-	10/29/2015	4.97	1	10/21/2015	BQL (0.015)	1		
3ft2	7043-26	-	10/29/2015	5.13	1	10/21/2015	BQL (0.011)	1		
3ft2	7043-26 Lab dup	-	-	-	-	10/21/2015	BQL (0.012) (RPD=NA)	1		
4Bt1	7043-27	-	10/29/2015	4.33	1	10/21/2015	BQL (0.014)	1		
4Bt1b	7043-28	-	10/29/2015	4.34	1	10/21/2015	BQL (0.011)	1		
4Bt2	7043-29	-	10/29/2015	4.48	1	10/21/2015	BQL (0.013)	1		
4Bt2b	7043-30	-	10/29/2015	4.14	1	10/21/2015	BQL (0.012)	1		
4Bt2b	7043-30 Lab dup	-	10/29/2015	4.18 (RPD=0.962)	1	-	-	-		
4Bt3	7043-31	-	10/29/2015	4.32	1	10/21/2015	BQL (0.013)	1		
4Bt3b	7043-32	-	10/29/2015	4.34	1	10/21/2015	BQL (0.012)	1		
4Bt4	7043-33	-	10/29/2015	4.16	1	10/21/2015	BQL (0.012)	1		
4Bt4b	7043-34	-	10/29/2015	4.26	1	10/21/2015	BQL (0.012)	1		
4Ct1	7043-35	-	10/29/2015	4.82	1	10/21/2015	0.049	1		
4Ct1b	7043-36	-	10/29/2015	4.73	1	10/21/2015	0.049	1		
4Ct1b	7043-36 Lab dup	-	-	-	-	10/21/2015	0.049 (RPD=0)	1		
4Ct2	7043-37	-	10/29/2015	4.67	1	10/21/2015	0.071	1		
4Ct2b	7043-38	-	10/29/2015	4.79	1	10/21/2015	0.060	1		
4Ct3	7043-39	-	10/29/2015	4.70	1	10/21/2015	0.096	1		
4Ct3b	7043-40	-	10/29/2015	4.55	1	10/21/2015	0.117	1		
4Ct4	7043-41	-	10/29/2015	4.65	1	10/21/2015	0.181	1		
4Ct4b	7043-42	-	10/29/2015	4.63	1	10/21/2015	0.189	1		
4Ct4b	7043-42 Lab dup	-	10/29/2015	4.90 (RPD=5.67)	1	-	-	-		
4Dt1	7043-43	-	10/29/2015	4.70	1	10/21/2015	0.069	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP543

Analyst: Lynda Callaway

Report Date: 11/03/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.039	**MDL**	** 0.002		
QL	0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
4Dt1b	7043-44	-	10/29/2015	4.81	1	10/21/2015	0.066	1		
4Dt2	7043-45	-	10/29/2015	4.69	1	10/21/2015	0.077	1		
4Dt2b	7043-46	-	10/29/2015	4.83	1	10/21/2015	0.062	1		
4Dt2b	7043-46 Lab dup	-	-	-	-	10/21/2015	0.063 (RPD=1.60)	1		
4Dt3	7043-47	-	10/29/2015	4.96	1	10/21/2015	0.081	1		
4Dt3b	7043-48	-	10/29/2015	5.02	1	10/21/2015	0.080	1		
4Dt4	7043-49	-	10/29/2015	5.05	1	10/21/2015	0.090	1		
4Dt4b	7043-50	-	10/29/2015	4.81	1	10/21/2015	0.098	1		
4Et1	7043-51	-	10/29/2015	5.03	1	10/21/2015	12.5	11		
4Et1b	7043-52	-	10/29/2015	4.83	1	10/21/2015	12.6	11		
4Et1b	7043-52 Lab dup	-	10/29/2015	4.80 (RPD=0.623)	1	-	-	-		
4Et2	7043-53	-	10/29/2015	4.95	1	10/21/2015	13.8	11		
4Et2b	7043-54	-	10/29/2015	4.89	1	10/21/2015	12.7	11		
4Et2b	7043-54 Lab dup	-	-	-	-	10/21/2015	12.9 (RPD=1.56)	11		
4Et3	7043-55	-	10/29/2015	4.77	1	10/21/2015	13.5	11		
4Et3b	7043-56	-	10/29/2015	4.79	1	10/21/2015	14.0	11		
4Et4	7043-57	-	10/29/2015	4.83	1	10/21/2015	13.9	11		
4Et4b	7043-58	-	10/29/2015	4.83	1	10/21/2015	14.7	11		
4Ft1	7043-59	-	10/29/2015	5.19	1	10/21/2015	0.020	1		
4Ft2	7043-60	-	10/29/2015	5.17	1	10/21/2015	BQL (0.015)	1		
4Ft2	7043-60 Lab dup	-	10/29/2015	5.23 (RPD=1.15)	1	10/21/2015	BQL (0.013) (RPD=NA)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP543

Analyst: Lynda Callaway

Report Date: 11/03/15

Sample Results

Analytes	Fluoride (F)			**Analytes**	ortho-Phosphate (as P)						
Codes	7782-41-4			**Codes**	70507						
Methods	RSKSOP-276/4			**Methods**	NRMRL-GWERD-05-0						
Unit	mg/L			**Unit**	mg/L						
MDL	0.039			**MDL**	** 0.002						
QL	0.200			**QL**	** 0.020						
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**	**Data**	**DF**	

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP543

Analyst: Lynda Callaway

Report Date: 11/03/15

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	10/21/2015	10/21/2015	-	-	-	BQL (0.011)	-	-			
MB	Nanopure Water Blank	10/21/2015	10/21/2015	-	-	-	BQL (0.012)	-	-			
MB	Nanopure Water Blank	10/29/2015	10/29/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	10/29/2015	10/29/2015	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	10/21/2015	-	-	-	1.58	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	10/21/2015	-	-	-	1.63	1.57	104			
SS	ERA 64 Simple Nutrients	2/25/2015	10/21/2015	-	-	-	1.60	1.57	102			
SS	ERA 64 Simple Nutrients	2/25/2015	10/21/2015	-	-	-	1.65	1.57	105			
SS	ERA 64 Simple Nutrients	2/25/2015	10/21/2015	-	-	-	1.62	1.57	103			
SS	ERA 66 Minerals	7/1/2015	10/29/2015	1.64	1.70	96.5	-	-	-			
SS	ERA 66 Minerals	7/1/2015	10/29/2015	1.66	1.70	97.6	-	-	-			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	0.236	0.250	94.4			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	0.021	0.020	105			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	0.045	0.050	90.0			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	0.093	0.100	93.0			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	2.03	2.00	102			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	1.05	1.00	105			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	0.490	0.500	98.0			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	0.210	0.200	105	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	1.01	1.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	2.10	2.00	105	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	5.00	5.00	100	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	9.92	10.0	99.2	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	0.200	0.200	100	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	0.986	1.00	98.6	-	-	-			
MS	3hAPt1 Spike	10/21 & 10/29/2015	10/21 & 10/29/2015	6.72	2.33 (3.85)	114	1.18	0.103 (0.990)	109			
MS	4Bt1 Spike	10/21/2015	10/21/2015	-	-	-	1.05	BQL (0.014) (0.990)	105			
MS	3Mgt3 Spike	10/29/2015	10/29/2015	6.63	2.65 (3.85)	103	-	-	-			
MS	4Dt3 Spike	10/21 & 10/29/2015	10/21 & 10/29/2015	8.89	4.96 (3.85)	102	1.16	0.081 (0.990)	109			

Comments:

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP543

Analyst: Lynda Callaway

Report Date: 11/03/15

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration.

Notes:

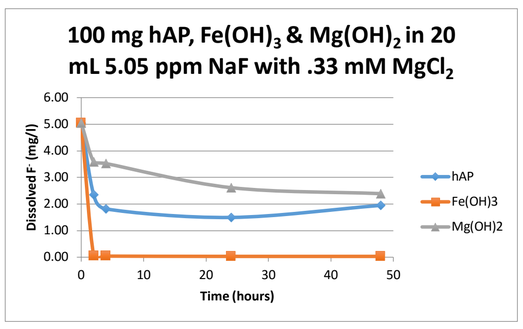
1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

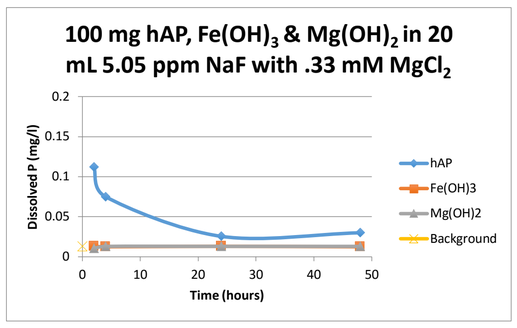
Experiment 12 and 13 specifics: hAP, Fe(OH)3, Mg(OH)2, TiO2 with .33 mM MgCl2

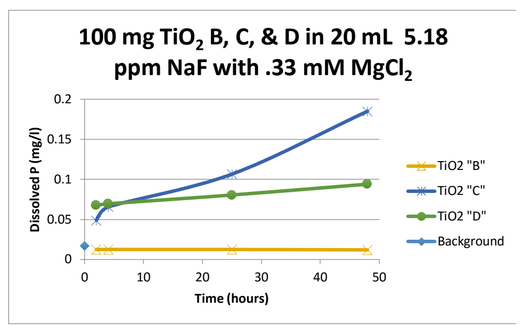
Sample ID	mass of cap + tube	mass sample (g)	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Fluoride concentration (copied from raw data)	Fluoride concentration values only	phospate (copied from raw data)	P (values only)
3hAPt1			9/17/2015 11:59			9/17/2015 14:09	2	2.33		0.103	0.103
3hAPt1b			9/17/2015 12:00			9/17/2015 14:11	2	2.35		0.121	0.121
3hAPt2			9/17/2015 12:05			9/17/2015 15:44	4	1.88		0.077	0.077
3hAPt2b			9/17/2015 12:06			9/17/2015 15:46	4	1.75		0.073	0.073
3hAPt3			9/17/2015 12:10			9/18/2015 11:54	24	1.34		0.026	0.026
3hAPt3b			9/17/2015 12:10			9/18/2015 11:55	24	1.65		0.025	0.025
3hAPt4			9/17/2015 12:14			9/19/2015 12:06	48	1.32		0.022	0.022
3hAPt4b			17-Sep			9/19/2015 12:07	48	2.58		0.038	0.038
3hAPt4b								2.55 (RPD=1.17)		-	
3Afet1			9/17/2015 12:01			9/17/2015 14:14	2	ND	0.031	BQL (0.013)	0.013
3Afet1b			9/17/2015 12:02			9/17/2015 14:16	2	BQL (0.084)	0.084	BQL (0.013)	0.013
3Afet1b								-		BQL (0.014) (RPD=NA)	
3Afet2			9/17/2015 12:07			9/17/2015 15:48	4	BQL (0.051)	0.051	BQL (0.012)	0.012
3Afet2b			9/17/2015 12:07			9/17/2015 15:50	4	ND	0.031	BQL (0.013)	0.013
3Afet3			9/17/2015 12:11			9/18/2015 11:56	24	ND	0.031	BQL (0.014)	0.014
3Afet3b			9/17/2015 12:11			9/18/2015 11:57	24	ND	0.031	BQL (0.012)	0.012
3Afet4			9/17/2015 12:15			9/19/2015 12:09	48	ND	0.031	BQL (0.012)	0.012
3Afet4b			9/17/2015 12:16			9/19/2015 12:08	48	ND	0.031	BQL (0.013)	0.013
3Mgt1			9/17/2015 12:03			9/17/2015 14:18	2	3.61		BQL (0.012)	0.012
3Mgt1b			9/17/2015 12:04			9/17/2015 14:20	2	3.56		BQL (0.009)	0.009
3Mgt2			9/17/2015 12:08			9/17/2015 15:52	4	3.65		BQL (0.013)	0.013
3Mgt2b			9/17/2015 12:09			9/17/2015 15:54	4	3.39		BQL (0.013)	0.013
3Mgt2b								3.29 (RPD=2.99)		BQL (0.013) (RPD=NA)	
3Mgt3			9/17/2015 12:12			9/18/2015 11:58	24	2.65		BQL (0.013)	0.013
3Mgt3b			9/17/2015 12:13			9/18/2015 11:59	24	2.58		BQL (0.013)	0.013
3Mgt4			9/17/2015 12:16			9/19/2015 12:09	48	2.47		BQL (0.013)	0.013
3Mgt4b			9/17/2015 12:17			9/19/2015 12:10	48	2.31		BQL (0.013)	0.013
3ft1			N/A					4.97		BQL (0.015)	0.015
3ft2			N/A					5.13		BQL (0.011)	0.011
3ft2								-		BQL (0.012) (RPD=NA)	
4Bt1			9/29/2015 10:46			9/29/2015 12:30	2	4.33		BQL (0.014)	0.014
4Bt1b			9/29/2015 10:46			9/29/2015 12:30	2	4.34		BQL (0.011)	0.011
4Bt2			9/29/2015 10:49			9/29/2015 14:59	4	4.48		BQL (0.013)	0.013
4Bt2b			9/29/2015 10:49			9/29/2015 14:59	4	4.14		BQL (0.012)	0.012
4Bt2b								4.18 (RPD=0.962)		-	
4Bt3			9/29/2015 11:53			9/30/2015 12:34	25	4.32		BQL (0.013)	0.013
4Bt3b			9/29/2015 11:54			9/30/2015 12:34	25	4.34		BQL (0.012)	0.012
4Bt4			9/29/2015 11:59			10/1/2015 12:18	48	4.16		BQL (0.012)	0.012
4Bt4b			9/29/2015 12:00			10/1/2015 12:18	48	4.26		BQL (0.012)	0.012
4Ct1			9/29/2015 10:46			9/29/2015 12:34	2	4.82		0.049	0.049
4Ct1b			9/29/2015 10:46			9/29/2015 12:34	2	4.73		0.049	0.049
4Ct1b								-		0.049 (RPD=0)	
4Ct2			9/29/2015 10:50			9/29/2015 15:03	4	4.67		0.071	0.071
4Ct2b			9/29/2015 10:51			9/29/2015 15:03	4	4.79		0.060	0.06
4Ct3			9/29/2015 11:54			9/30/2015 12:38	25	4.70		0.096	0.096
4Ct3b			9/29/2015 11:55			9/30/2015 12:38	25	4.55		0.117	0.117
4Ct4			9/29/2015 12:00			10/1/2015 12:22	48	4.65		0.181	0.181
4Ct4b			9/29/2015 12:01			10/1/2015 12:22	48	4.63		0.189	0.189
4Ct4b								4.90 (RPD=5.67)		-	
4Dt1			9/29/2015 10:45			9/29/2015 12:41	2	4.70		0.069	0.069
4Dt1b			9/29/2015 10:44			9/29/2015 12:41	2	4.81		0.066	0.066
4Dt2			9/29/2015 10:51			9/29/2015 15:07	4	4.69		0.077	0.077
4Dt2b			9/29/2015 10:52			9/29/2015 15:07	4	4.83		0.062	0.062
4Dt2b								-		0.063 (RPD=1.60)	
4Dt3			9/29/2015 11:55			9/30/2015 12:46	25	4.96		0.081	0.081
4Dt3b			9/29/2015 11:56			9/30/2015 12:46	25	5.02		0.080	0.08
4Dt4			9/29/2015 12:01			10/1/2015 12:30	48	5.05		0.090	0.09
4Dt4b			9/29/2015 12:02			10/1/2015 12:30	48	4.81		0.098	0.098
4Et1			9/29/2015 10:43			9/29/2015 12:44	2	5.03		12.5	12.5
4Et1b			9/29/2015 10:42			9/29/2015 12:44	2	4.83		12.6	12.6
4Et1b								4.80 (RPD=0.623)		-	
4Et2			9/29/2015 10:53			9/29/2015 15:11	4	4.95		13.8	13.8
4Et2b			9/29/2015 10:53			9/29/2015 15:11	4	4.89		12.7	12.7
4Et2b								-		12.9 (RPD=1.56)	
4Et3			9/29/2015 11:57			9/30/2015 12:50	25	4.77		13.5	13.5
4Et3b			9/29/2015 11:57			9/30/2015 12:50	25	4.79		14.0	14
4Et4			9/29/2015 12:03			10/1/2015 12:34	49	4.83		13.9	13.9
4Et4b			9/29/2015 12:03			10/1/2015 12:34	49	4.83		14.7	14.7
4Ft1			N/A					5.19		0.020	0.02
4Ft2			N/A					5.17		BQL (0.015)	0.015
4Ft2								5.23 (RPD=1.15)		BQL (0.013) (RPD=NA)	

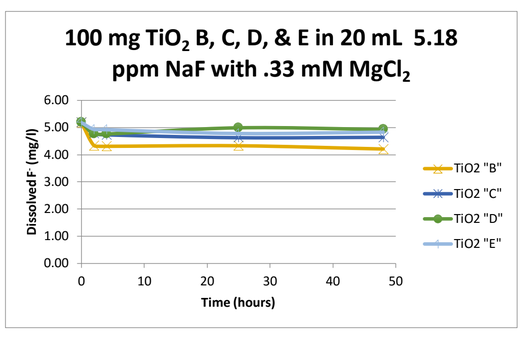
AVERAGES OF DUPLICATES

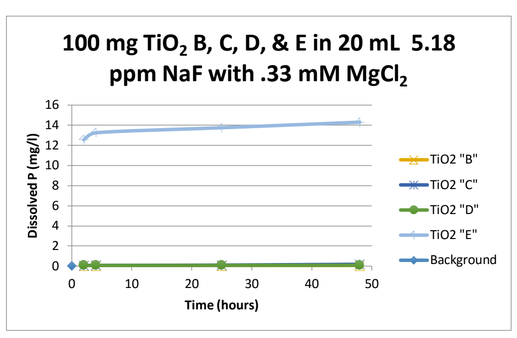
ID	Time (hrs)	F- Conc (mg/l)	PO4 3- (mg/l)
3ft1	0	5.05	0.013
3hAPt1	2	2.34	0.112
3hAPt2	4	1.82	0.075
3hAPt3	24	1.50	0.0255
3hAPt4	48	1.95	0.03
3ft1	0	5.05	0.013
3Afet1	2	0.0575	0.013
3Afet2	4	0.041	0.0125
3Afet3	24	0.031	0.013
3Afet4	48	0.031	0.0125
3ft1	0	5.05	0.013
3Mgt1	2	3.585	0.0105
3Mgt2	4	3.52	0.013
3Mgt3	24	2.62	0.013
3Mgt4	48	2.39	0.013
3ft1	0	5.05	0.013
4Ft1	0	5.18	0.0175
4Bt1	2	4.34	0.0125
4Bt2	4	4.31	0.0125
4Bt4	48	4.21	0.012
4Ft1	0	5.18	0.0175
4Ct1	2	4.775	0.049
4Ct2	4	4.73	0.0655
4Ct3	25	4.63	0.1065
4Ct4	48	4.64	0.185
4Ft1	0	5.18	0.0175
4Dt1	2	4.76	0.0675
4Dt2	4	4.76	0.0695
4Dt3	25	4.99	0.0805
4Dt4	48	4.93	0.094
4Ft1	0	5.18	0.0175
4Et1	2	4.93	12.55
4Et2	4	4.92	13.25
4Et3	25	4.78	13.75
4Et4	48	4.83	14.3
4Ft1	0	5.18	0.0175

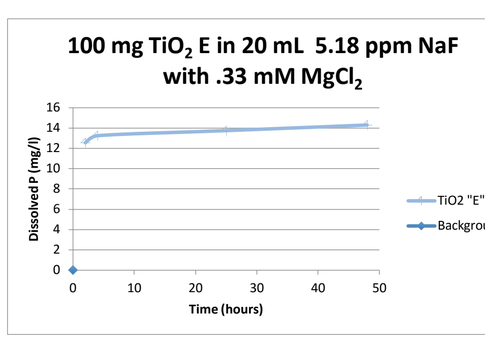












Sample ID	mass of cap + tube	mass sample+cap+ soln	mass sample (g)	volume F-	Ce [F] (copied from raw data)	Ce [F] mg/L	sorbed F (mg/l)	x/m	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)	P (values only)
3hAPt1	14.27	34.3937	0.105	20.0187	2.33	2.33	2.72	0.52	9/17/2015 11:59		8.66	9/17/2015 14:09	2.2	0.103	0.103
3hAPt1b	13.29	33.4496	0.096	20.0636	2.35	2.35	1.98	0.41	9/17/2015 12:00		9.04	9/17/2015 14:11	2.2	0.121	0.121
3hAPt2	14.23	34.3325	0.1025	20	1.88	1.88	2.46	0.48	9/17/2015 12:05		8.89	9/17/2015 15:44	3.7	0.077	0.077
3hAPt2b	13.33	33.3923	0.101	19.9613	1.75	1.75	2.73	0.54	9/17/2015 12:06		9.37	9/17/2015 15:46	3.7	0.073	0.073
3hAPt3	14.22	34.4038	0.1041	20.0797	1.34	1.34	2.80	0.54	9/17/2015 12:10		9.77	9/18/2015 11:54	23.7	0.026	0.026
3hAPt3b	14.23	34.0428	0.1066	19.7062	1.65	1.65	2.67	0.49	9/17/2015 12:10		9.92	9/18/2015 11:55	23.8	0.025	0.025
3hAPt4	14.21	34.332	0.1027	20.0193	1.32	1.32	3.02	0.59	9/17/2015 12:14		9.89	9/19/2015 12:06	47.9	0.022	0.022
3hAPt4b	14.25	34.314	0.1049	19.9591	2.58	2.58	1.58	0.30	17-Sep		9.89	9/19/2015 12:07	47.9	0.038	0.038
3Afet1	14.22	34.0003	0.0979	19.6824	ND	0.031	4.23	0.85	9/17/2015 12:01		3.93	9/17/2015 14:14	2.2	BQL (0.013)	0.013
3Afet1b	14.28	34.2611	0.1004	19.8807	BQL (0.084)	0.084	4.74	0.94	9/17/2015 12:02		3.98	9/17/2015 14:16	2.2	BQL (0.013)	0.013
3Afet2	14.22	34.2696	0.0978	19.9518	BQL (0.051)	0.051	4.68	0.95	9/17/2015 12:07		4.03	9/17/2015 15:48	3.7	BQL (0.012)	0.012
3Afet2b	14.33	34.4364	0.0972	20.0092	ND	0.031	4.64	0.95	9/17/2015 12:07		3.83	9/17/2015 15:50	3.7	BQL (0.013)	0.013
3Afet3	14.28	33.0305	0.1025	18.648	ND	0.031	4.76	0.87	9/17/2015 12:11		3.87	9/18/2015 11:56	23.7	BQL (0.014)	0.014
3Afet3b	14.26	34.3473	0.0975	19.9898	ND	0.031	4.67	0.96	9/17/2015 12:11		3.76	9/18/2015 11:57	23.8	BQL (0.012)	0.012
3Afet4	14.3	34.1732	0.0969	19.7763	ND	0.031	4.52	0.92	9/17/2015 12:15		4.29	9/19/2015 12:09	47.9	BQL (0.012)	0.012
3Afet4b	14.23	34.3332	0.0993	20.0039	ND	0.031	4.62	0.93	9/17/2015 12:16		3.91	9/19/2015 12:08	47.9	BQL (0.013)	0.013
3Mgt1	14.22	33.913	0.1033	19.5897	3.61	3.61	1.02	0.19	9/17/2015 12:03		10.36	9/17/2015 14:18	2.3	BQL (0.012)	0.012
3Mgt1b	14.21	34.0645	0.1056	19.7489	3.56	3.56	1.14	0.21	9/17/2015 12:04		10.48	9/17/2015 14:20	2.3	BQL (0.009)	0.009
3Mgt2	14.24	34.2845	0.1012	19.9433	3.65	3.65	1.16	0.23	9/17/2015 12:08		10.45	9/17/2015 15:52	3.7	BQL (0.013)	0.013
3Mgt2b	13.21	33.3823	0.1006	20.0717	3.39	3.39	1.30	0.26	9/17/2015 12:09		10.47	9/17/2015 15:54	3.8	BQL (0.013)	0.013
3Mgt3	13.46	33.1617	0.104	19.5977	2.65	2.65	2.18	0.41	9/17/2015 12:12		10.5	9/18/2015 11:58	23.8	BQL (0.013)	0.013
3Mgt3b	14.27	34.0896	0.104	19.7156	2.58	2.58	2.38	0.45	9/17/2015 12:13		10.58	9/18/2015 11:59	23.8	BQL (0.013)	0.013
3Mgt4	14.27	34.3882	0.1023	20.0159	2.47	2.47	2.55	0.50	9/17/2015 12:16		10.55	9/19/2015 12:09	47.9	BQL (0.013)	0.013
3Mgt4b	13.26	33.3315	0.1025	19.969	2.31	2.31	2.74	0.53	9/17/2015 12:17		10.61	9/19/2015 12:10	47.9	BQL (0.013)	0.013
3ft1			0	0	4.97				N/A				#VALUE!	BQL (0.015)	0.015
3ft2			0	0	5.13				N/A				#VALUE!	BQL (0.011)	0.011
3ft average					5.05										
4Bt1	14.8032	34.9058	0.1013	20.0013	4.33	4.33	0.85	0.17	9/29/2015 10:46		7.87	9/29/2015 12:30	1.7	BQL (0.014)	0.014
4Bt1b	14.8085	34.9483	0.1003	20.0395	4.34	4.34	0.84	0.17	9/29/2015 10:46		7.66	9/29/2015 12:30	1.7	BQL (0.011)	0.011
4Bt2	14.7732	34.8472	0.1008	19.9732	4.48	4.48	0.70	0.14	9/29/2015 10:49		7.72	9/29/2015 14:59	4.2	BQL (0.013)	0.013
4Bt2b	14.7627	34.8061	0.1032	19.9402	4.14	4.14	1.04	0.20	9/29/2015 10:49		7.6	9/29/2015 14:59	4.2	BQL (0.012)	0.012
4Bt3	14.8347	34.6195	0.1047	19.6801	4.32	4.32	0.86	0.16	9/29/2015 11:53		7.71	9/30/2015 12:34	24.7	BQL (0.013)	0.013
4Bt3b	14.8075	34.6417	0.1054	19.7288	4.34	4.34	0.84	0.16	9/29/2015 11:54		7.61	9/30/2015 12:34	24.7	BQL (0.012)	0.012
4Bt4	13.8075	33.6068	0.1027	19.6966	4.16	4.16	1.02	0.20	9/29/2015 11:59		7.91	10/1/2015 12:18	48.3	BQL (0.012)	0.012
4Bt4b	14.8007	34.422	0.1001	19.5212	4.26	4.26	0.92	0.18	9/29/2015 12:00		7.72	10/1/2015 12:18	48.3	BQL (0.012)	0.012
4Ct1	13.9383	34.0598	0.101	20.0205	4.82	4.82	0.36	0.07	9/29/2015 10:46		7.77	9/29/2015 12:34	1.8	0.049	0.049
4Ct1b	14.8369	34.8803	0.1009	19.9425	4.73	4.73	0.45	0.09	9/29/2015 10:46		7.72	9/29/2015 12:34	1.8	0.049	0.049
4Ct2	14.8255	34.8522	0.1001	19.9266	4.67	4.67	0.51	0.10	9/29/2015 10:50		7.74	9/29/2015 15:03	4.2	0.071	0.071
4Ct2b	14.7786	34.881	0.1032	19.9992	4.79	4.79	0.39	0.08	9/29/2015 10:51		7.7	9/29/2015 15:03	4.2	0.060	0.06
4Ct3	14.8245	34.6329	0.0997	19.7087	4.70	4.70	0.48	0.09	9/29/2015 11:54		7.63	9/30/2015 12:38	24.7	0.096	0.096
4Ct3b	13.7814	33.5806	0.1025	19.6967	4.55	4.55	0.63	0.12	9/29/2015 11:55		7.64	9/30/2015 12:38	24.7	0.117	0.117
4Ct4	13.9391	33.7517	0.1059	19.7067	4.65	4.65	0.53	0.10	9/29/2015 12:00		7.64	10/1/2015 12:22	48.4	0.181	0.181
4Ct4b	14.7907	34.8117	0.1007	19.9203	4.63	4.63	0.55	0.11	9/29/2015 12:01		7.66	10/1/2015 12:22	48.3	0.189	0.189
4Dt1	14.8417	34.9164	0.1035	19.9712	4.70	4.70	0.48	0.09	9/29/2015 10:45		7.43	9/29/2015 12:41	1.9	0.069	0.069
4Dt1b	13.79	33.8877	0.102	19.9957	4.81	4.81	0.37	0.07	9/29/2015 10:44		7.31	9/29/2015 12:41	1.9	0.066	0.066
4Dt2	14.0482	34.1193	0.1004	19.9707	4.69	4.69	0.49	0.10	9/29/2015 10:51		7.24	9/29/2015 15:07	4.3	0.077	0.077
4Dt2b	14.7832	34.8529	0.1019	19.9678	4.83	4.83	0.35	0.07	9/29/2015 10:52		7.15	9/29/2015 15:07	4.3	0.062	0.062
4Dt3	14.8207	34.702	0.1001	19.7812	4.96	4.96	0.22	0.04	9/29/2015 11:55		7.36	9/30/2015 12:46	24.8	0.081	0.081
4Dt3b	14.7812	34.4383	0.1016	19.5555	5.02	5.02	0.16	0.03	9/29/2015 11:56		7.23	9/30/2015 12:46	24.8	0.080	0.08
4Dt4	14.8152	34.7097	0.1045	19.79	5.05	5.05	0.13	0.02	9/29/2015 12:01		7.31	10/1/2015 12:30	48.5	0.090	0.09
4Dt4b	14.7963	34.761	0.1053	19.8594	4.81	4.81	0.37	0.07	9/29/2015 12:02		7.19	10/1/2015 12:30	48.5	0.098	0.098
4Et1	14.7883	34.8604	0.1032	19.9689	5.03	5.03	0.15	0.03	9/29/2015 10:43		7.25	9/29/2015 12:44	2.0	12.5	12.5
4Et1b	14.7881	34.842	0.1017	19.9522	4.83	4.83	0.35	0.07	9/29/2015 10:42		7.22	9/29/2015 12:44	2.0	12.6	12.6
4Et2	14.8188	34.8753	0.1052	19.9513	4.95	4.95	0.23	0.04	9/29/2015 10:53		7.18	9/29/2015 15:11	4.3	13.8	13.8
4Et2b	14.7854	34.0235	0.0994	19.1387	4.89	4.89	0.29	0.06	9/29/2015 10:53		7.17	9/29/2015 15:11	4.3	12.7	12.7
4Et3	14.8211	35.6399	0.1007	20.7181	4.77	4.77	0.41	0.08	9/29/2015 11:57		7.18	9/30/2015 12:50	24.9	13.5	13.5
4Et3b	14.8265	34.6553	0.1005	19.7283	4.79	4.79	0.39	0.08	9/29/2015 11:57		7.15	9/30/2015 12:50	24.9	14.0	14
4Et4	13.8032	33.9741	0.11003	20.06087	4.83	4.83	0.35	0.06	9/29/2015 12:03		7.2	10/1/2015 12:34	48.5	13.9	13.9
4Et4b	13.8137	33.8743	0.1035	19.9571	4.83	4.83	0.35	0.07	9/29/2015 12:03		7.17	10/1/2015 12:34	48.5	14.7	14.7
4Ft1					5.19				N/A					0.020	0.02
4Ft2					5.17				N/A					BQL (0.015)	0.015
4Ft average					5.18										

Sample ID	mass of cap + tube	mass sample+cap+ soln	mass sample (g)	volume F-	Ce [F] (copied from raw data)	Ce [F] mg/L	sorbed F (mg/l)	x/m	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)	P (values only)
Average of duplicates 48 hrs															
Apatite	14.2	34.3	0.1	20.0	2.0	2.0	2.3	0.4	#DIV/0!		9.9	42266.5	47.9	0.0	0.0
Am-Fe(OH)3	14.3	34.3	0.1	19.9	#DIV/0!	0.0	4.6	0.9	#DIV/0!		4.1	42266.5	47.9	#DIV/0!	0.0
Mg(OH)2	13.8	33.9	0.1	20.0	2.4	2.4	2.6	0.5	#DIV/0!		10.6	42266.5	47.9	#DIV/0!	0.0
TiO2 B	14.3	34.0	0.1	19.6	4.2	4.2	1.0	0.2	#DIV/0!		7.8	42278.5	48.3	#DIV/0!	0.0
TiO2 C	14.4	34.3	0.1	19.8	4.6	4.6	0.5	0.1	#DIV/0!		7.7	42278.5	48.4	0.2	0.2
TiO2 D	14.8	34.7	0.1	19.8	4.9	4.9	0.3	0.0	#DIV/0!		7.3	42278.5	48.5	0.1	0.1
TiO2 E	13.8	33.9	0.1	20.0	4.8	4.8	0.4	0.1	#DIV/0!		7.2	42278.5	48.5	14.3	14.3
							STDEV								
Apatite	0.02	0.009	0.0011	0.0301	0.63	0.63	0.72	0.144032518	#DIV/0!		0	0.000347222	0.008333333	0.008	0.008
Am-Fe(OH)3	0.035	0.08	0.0012	0.1138	#DIV/0!	0	0.05	0.004105933	#DIV/0!		0.19	0.000347222	0.016666667	#DIV/0!	0.0005
Mg(OH)2	0.505	0.52835	1E-04	0.02345	0.08	0.08	0.095	0.017437702	#DIV/0!		0.03	0.000347222	0	#DIV/0!	0
TiO2 B	0.4966	0.4076	0.0013	0.0877	0.05	0.05	0.05	0.008103931	#DIV/0!		0.095	0	0.008333333	#DIV/0!	0
TiO2 C	0.4258	0.53	0.0026	0.1068	0.01	0.01	0.01	0.005086753	#DIV/0!		0.01	0	0.008333333	0.004	0.004
TiO2 D	0.00945	0.02565	0.0004	0.0347	0.12	0.12	0.12	0.022581114	#DIV/0!		0.06	0	0.008333333	0.004	0.004
TiO2 E	0.00525	0.0499	0.003265	0.051885	0	0	0	0.00183757	#DIV/0!		0.015	0	0	0.4	0.4

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC33

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 5/5/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 4/18/2016
Date Analyzed: 4/18 & 5/4/2016
No. Samples Analyzed: 40

Sample Set No.: 7101
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: diluted as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. No dates of collection were given, so the 48 hour holding time for oP analysis may or may not have been met.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/05/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	0.039	**MDL**	0.002
QL	0.200	**QL**	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
Ht1	7101-1	-	5/4/2016	5.18	1	4/18/2016	BQL (0.015)	1
Ht1b	7101-2	-	5/4/2016	5.07	1	4/18/2016	BQL (0.006)	1
Ht2	7101-3	-	5/4/2016	5.18	1	4/18/2016	BQL (0.017)	1
Ht2b	7101-4	-	5/4/2016	5.11	1	4/18/2016	BQL (0.014)	1
Ht3	7101-5	-	5/4/2016	5.01	1	4/18/2016	BQL (0.015)	1
Ht3b	7101-6	-	5/4/2016	4.97	1	4/18/2016	BQL (0.010)	1
Ht4	7101-7	-	5/4/2016	5.18	1	4/18/2016	BQL (0.014)	1
Ht4b	7101-8	-	5/4/2016	4.94	1	4/18/2016	BQL (0.014)	1
Mt1	7101-9	-	5/4/2016	5.09	1	4/18/2016	BQL (0.011)	1
Mt1b	7101-10	-	5/4/2016	5.10	1	4/18/2016	BQL (0.014)	1
Mt1b	7101-10 Lab dup	-	5/4/2016	5.05 (RPD=0.985)	1	4/18/2016	BQL (0.013) (RPD=NA)	1
Mt2	7101-11	-	5/4/2016	5.02	1	4/18/2016	BQL (0.012)	1
Mt2b	7101-12	-	5/4/2016	5.00	1	4/18/2016	BQL (0.013)	1
Mt3	7101-13	-	5/4/2016	4.98	1	4/18/2016	BQL (0.017)	1
Mt3b	7101-14	-	5/4/2016	4.91	1	4/18/2016	BQL (0.011)	1
Mt4	7101-15	-	5/4/2016	5.04	1	4/18/2016	BQL (0.011)	1
Mt4b	7101-16	-	5/4/2016	5.43	1	4/18/2016	BQL (0.010)	1
Gt1	7101-17	-	5/4/2016	4.83	1	4/18/2016	BQL (0.012)	1
Gt1b	7101-18	-	5/4/2016	4.66	1	4/18/2016	BQL (0.008)	1
Gt2	7101-19	-	5/4/2016	4.61	1	4/18/2016	BQL (0.012)	1
Gt2b	7101-20	-	5/4/2016	4.73	1	4/18/2016	BQL (0.012)	1
Gt2b	7101-20 Lab dup	-	5/4/2016	4.61 (RPD=2.57)	1	4/18/2016	BQL (0.013) (RPD=NA)	1
Gt3	7101-21	-	5/4/2016	4.43	1	4/18/2016	BQL (0.013)	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/05/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	0.039	**MDL**	0.002
QL	0.200	**QL**	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
Gt3b	7101-22	-	5/4/2016	4.62	1	4/18/2016	BQL (0.004)	1
Gt4	7101-23	-	5/4/2016	4.57	1	4/18/2016	BQL (0.012)	1
Gt4b	7101-24	-	5/4/2016	4.36	1	4/18/2016	BQL (0.015)	1
D1	7101-25	-	5/4/2016	ND	1	4/18/2016	BQL (0.011)	1
D1b	7101-26	-	5/4/2016	ND	1	4/18/2016	BQL (0.011)	1
MD1	7101-27	-	5/4/2016	ND	1	4/18/2016	BQL (0.014)	1
MD1b	7101-28	-	5/4/2016	BQL (0.091)	1	4/18/2016	BQL (0.013)	1
HD1	7101-29	-	5/4/2016	ND	1	4/18/2016	BQL (0.013)	1
HD1b	7101-30	-	5/4/2016	ND	1	4/18/2016	BQL (0.013)	1
HD1b	7101-30 Lab dup	-	5/4/2016	ND (RPD=NA)	1	4/18/2016	BQL (0.012) (RPD=NA)	1
GD1	7101-31	-	5/4/2016	0.333	1	4/18/2016	BQL (0.012)	1
GD1b	7101-32	-	5/4/2016	0.273	1	4/18/2016	BQL (0.010)	1
F	7101-33	-	5/4/2016	5.13	1	4/18/2016	BQL (0.012)	1
Fb	7101-34	-	5/4/2016	5.30	1	4/18/2016	BQL (0.012)	1
ZD1	7101-35	-	5/4/2016	ND	1	4/18/2016	BQL (0.011)	1
ZD1b	7101-36	-	5/4/2016	ND	1	4/18/2016	BQL (0.013)	1
10FZ	7101-37	-	5/4/2016	5.15	1	4/18/2016	BQL (0.015)	1
10FZb	7101-38	-	5/4/2016	4.67	1	4/18/2016	BQL (0.017)	1
10F	7101-39	-	5/4/2016	9.27	1	4/18/2016	BQL (0.016)	1
10Fb	7101-40	-	5/4/2016	9.33	1	4/18/2016	BQL (0.014)	1
10Fb	7101-40 Lab dup	-	5/4/2016	9.51 (RPD=1.91)	1	4/18/2016	BQL (0.013) (RPD=NA)	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/05/16

Sample Results

Analytes	Fluoride (F)			**Analytes**	ortho-Phosphate (as P)			
Codes	7782-41-4			**Codes**	70507			
Methods	RSKSOP-276/4			**Methods**	NRMRL-GWERD-05-0			
Unit	mg/L			**Unit**	mg/L			
MDL	0.039			**MDL**	0.002			
QL	0.200			**QL**	0.020			
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/05/16

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	4/18/2016	4/18/2016	-	-	-	BQL (0.007)	-	-			
MB	Nanopure Water Blank	4/18/2016	4/18/2016	-	-	-	BQL (0.012)	-	-			
MB	Nanopure Water Blank	5/4/2016	5/4/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	5/4/2016	5/4/2016	ND	-	-	-	-	-			
SS	ERA 67 Simple Nutrients	11/4/2015	4/18/2016	-	-	-	1.96	1.95	101			
SS	ERA 67 Simple Nutrients	11/4/2015	4/18/2016	-	-	-	1.96	1.95	101			
SS	ERA 67 Simple Nutrients	11/4/2015	4/18/2016	-	-	-	1.98	1.95	102			
SS	ERA 66 Minerals	7/1/2015	5/4/2016	1.68	1.70	98.8	-	-	-			
SS	ERA 66 Minerals	7/1/2015	5/4/2016	1.73	1.70	102	-	-	-			
CCC	Continuing Calibration Check Standard	11/4/2015	4/18/2016	-	-	-	0.020	0.020	100			
CCC	Continuing Calibration Check Standard	11/4/2015	4/18/2016	-	-	-	0.488	0.500	97.6			
CCC	Continuing Calibration Check Standard	11/4/2015	4/18/2016	-	-	-	0.232	0.250	92.8			
CCC	Continuing Calibration Check Standard	11/4/2015	4/18/2016	-	-	-	1.01	1.00	101			
CCC	Continuing Calibration Check Standard	11/4/2015	4/18/2016	-	-	-	0.049	0.050	98.0			
CCC	Continuing Calibration Check Standard	11/4/2015	4/18/2016	-	-	-	2.04	2.00	102			
CCC	Continuing Calibration Check Standard	12/1/2015	5/4/2016	BQL (0.199)	0.200	99.5	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/4/2016	1.04	1.00	104	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/4/2016	1.97	2.00	98.5	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/4/2016	5.01	5.00	100	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/4/2016	9.86	10.0	98.6	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/4/2016	5.01	5.00	100	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/4/2016	9.86	10.0	98.6	-	-	-			
MS	Ht1 Spike	4/18 & 5/4/2016	4/18 & 5/4/2016	8.90	5.18 (3.85)	96.6	1.03	BQL (0.015) (0.990)	103			
MS	Gt3 Spike	4/18 & 5/4/2016	4/18 & 5/4/2016	8.36	4.43 (3.85)	102	1.03	BQL (0.013) (0.990)	103			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

Sample ID	mass sample (g)	volume F- (mL)	Ce [F] mg/L	sorbed F (mg/l)	x/m (mg/g)	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)	P (values only)
Ht1	0.0999	19.932	5.18	0.04	0.007			8.29			BQL (0.015)	
Ht1b	0.103	19.815	5.07	0.15	0.028			8.04			BQL (0.006)	
Ht2	0.0977	19.935	5.18	0.04	0.007			7.5			BQL (0.017)	
Ht2b	0.1032	19.948	5.11	0.11	0.020			7.82			BQL (0.014)	
Ht3	0.0993	19.854	5.01	0.21	0.041			8.39			BQL (0.015)	
Ht3b	0.0997	19.896	4.97	0.25	0.049			8.36			BQL (0.010)	
Ht4	0.1012	19.972	5.18	0.04	0.007			7.93			BQL (0.014)	
Ht4b	0.1023	19.813	4.94	0.27	0.053			8.15			BQL (0.014)	
Mt1	0.1029	19.887	5.09	0.13	0.024			7.94			BQL (0.011)	
Mt1b	0.0993	19.886	5.10	0.12	0.023			7.91			BQL (0.014)	
Mt2	0.1031	19.967	5.02	0.20	0.038			7.71			BQL (0.012)	
Mt2b	0.0982	19.929	5.00	0.22	0.044			7.74			BQL (0.013)	
Mt3	0.1023	19.907	4.98	0.23	0.046			8.24			BQL (0.017)	
Mt3b	0.1038	19.874	4.91	0.31	0.058			8.28			BQL (0.011)	
Mt4	0.1034	19.864	5.04	0.18	0.034			8.09			BQL (0.011)	
Mt4b	0.0994	19.961	5.43	-0.22	-0.043			8.16			BQL (0.010)	
Gt1	0.0995	19.872	4.83	0.39	0.077			5.42			BQL (0.012)	
Gt1b	0.1013	19.8	4.66	0.56	0.108			5.22			BQL (0.008)	
Gt2	0.1017	20.004	4.61	0.61	0.119			5.45			BQL (0.012)	
Gt2b	0.1024	19.942	4.73	0.48	0.094			5.27			BQL (0.012)	
Gt3	0.1005	19.852	4.43	0.79	0.155			5.6			BQL (0.013)	
Gt3b	0.1032	20.01	4.62	0.60	0.115			5.39			BQL (0.004)	
Gt4	0.1037	19.634	4.57	0.65	0.122			5.81			BQL (0.012)	
Gt4b	0.0996	20.177	4.36	0.86	0.173			5.24			BQL (0.015)	
ACKGROUND												
D1			ND								BQL (0.011)	
D1b			ND								BQL (0.011)	
MD1	0.103		ND								BQL (0.014)	
MD1b	0.1014		BQL (0.091)								BQL (0.013)	
HD1	0.0994		ND								BQL (0.013)	
HD1b	0.103		ND								BQL (0.013)	
GD1	0.1039		0.333								BQL (0.012)	
GD1b	0.1004		0.273								BQL (0.010)	
F		5.22	5.13								BQL (0.012)	
Fb			5.30								BQL (0.012)	
EOLITE DATA											BQL (0.011)	
ZD1			ND									
ZD1b			ND								BQL (0.013)	
10FZ			5.15								BQL (0.015)	
10FZb			4.67								BQL (0.017)	
10F			9.27								BQL (0.016)	
10Fb			9.33								BQL (0.014)	
10Fb			9.51 (RPD=1.91)								BQL (0.013) (RPD=NA)	

GE OF DUPLICATES

Sample ID	mass sample (g)	volume F- (mL)	Ce [F] mg/L	sorbed F (mg/l)	x/m (mg/g)	Date/time F- added	Date/time pH taken	measured pH
Ht1								
Ht2								
Ht3								
Ht4	0.102	19.893	5.060	0.155	0.030	#DIV/0!	#DIV/0!	8.040
Mt1								
Mt2								
Mt3								
Mt4	0.101	19.913	5.235	-0.020	-0.005	#DIV/0!	#DIV/0!	8.125
Gt1								
Gt2								
Gt3								
Gt4	0.102	19.906	4.465	0.750	0.148	#DIV/0!	#DIV/0!	5.525

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC47

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Lisa Costantino

Date: 5/18/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Lisa Costantino
Lynda Callaway
Kristie Hargrove

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 5/10/2016
Date Analyzed: 5/11 & 5/18/2016
No. Samples Analyzed: 34

Sample Set No.: 7108
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: diluted as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. No dates of collection were given, so the 48 hour holding time for oP analysis may or may not have been met.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/18/16

Sample Results

			Analytes	**Fluoride (F)**		**Analytes**	**ortho-Phosphate (as P)**	
			Codes	**7782-41-4**		**Codes**	**70507**	
			Methods	**RSKSOP-276/4**		**Methods**	**NRMRL-GWERD-05-0**	
			Unit	**mg/L**		**Unit**	**mg/L**	
			MDL	**0.039**		**MDL**	**0.002**	
			QL	**0.200**		**QL**	**0.050**	
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**
H2	7108-1	-	5/18/2016	5.00	1	5/11/2016	BQL (0.014)	1
H2b	7108-2	-	5/18/2016	5.15	1	5/11/2016	BQL (0.020)	1
H4	7108-3	-	5/18/2016	4.98	1	5/11/2016	BQL (0.019)	1
H4b	7108-4	-	5/18/2016	5.12	1	5/11/2016	BQL (0.020)	1
H24	7108-5	-	5/18/2016	5.05	1	5/11/2016	BQL (0.017)	1
H24b	7108-6	-	5/18/2016	5.21	1	5/11/2016	BQL (0.025)	1
H48	7108-7	-	5/18/2016	4.95	1	5/11/2016	BQL (0.021)	1
H48b	7108-8	-	5/18/2016	5.09	1	5/11/2016	BQL (0.022)	1
Ha2	7108-9	-	5/18/2016	4.99	1	5/11/2016	BQL (0.015)	1
Ha2b	7108-10	-	5/18/2016	4.83	1	5/11/2016	BQL (0.020)	1
Ha2b	7108-10 Lab dup	-	5/18/2016	4.80 (RPD=0.623)	1	5/11/2016	BQL (0.021) (RPD=NA)	1
Ha4	7108-11	-	5/18/2016	4.72	1	5/11/2016	BQL (0.019)	1
Ha4b	7108-12	-	5/18/2016	4.86	1	5/11/2016	BQL (0.027)	1
Ha24	7108-13	-	5/18/2016	4.68	1	5/11/2016	BQL (0.020)	1
Ha24b	7108-14	-	5/18/2016	4.77	1	5/11/2016	BQL (0.019)	1
Ha48	7108-15	-	5/18/2016	4.67	1	5/11/2016	BQL (0.024)	1
Ha48b	7108-16	-	5/18/2016	4.73	1	5/11/2016	BQL (0.019)	1
M2	7108-17	-	5/18/2016	5.19	1	5/11/2016	BQL (0.028)	1
M2b	7108-18	-	5/18/2016	5.39	1	5/11/2016	BQL (0.020)	1
M4	7108-19	-	5/18/2016	5.11	1	5/11/2016	BQL (0.018)	1
M4b	7108-20	-	5/18/2016	5.24	1	5/11/2016	BQL (0.023)	1
M4b	7108-20 Lab dup	-	5/18/2016	5.24 (RPD=0)	1	5/11/2016	BQL (0.023) (RPD=NA)	1
M24	7108-21	-	5/18/2016	5.14	1	5/11/2016	BQL (0.020)	1
M24b	7108-22	-	5/18/2016	5.27	1	5/11/2016	BQL (0.022)	1
M48	7108-23	-	5/18/2016	5.52	1	5/11/2016	BQL (0.023)	1
M48b	7108-24	-	5/18/2016	5.15	1	5/11/2016	BQL (0.022)	1
G2	7108-25	-	5/18/2016	4.66	1	5/11/2016	BQL (0.021)	1
G2b	7108-26	-	5/18/2016	4.66	1	5/11/2016	BQL (0.022)	1
G4	7108-27	-	5/18/2016	4.77	1	5/11/2016	BQL (0.021)	1
G4b	7108-28	-	5/18/2016	4.69	1	5/11/2016	BQL (0.021)	1
G24	7108-29	-	5/18/2016	4.62	1	5/11/2016	BQL (0.022)	1
G24b	7108-30	-	5/18/2016	4.59	1	5/11/2016	BQL (0.021)	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/18/16

Sample Results

Analytes	**Fluoride (F)**	**Analytes**	**ortho-Phosphate (as P)**
Codes	**7782-41-4**	**Codes**	**70507**
Methods	**RSKSOP-276/4**	**Methods**	**NRMRL-GWERD-05-0**
Unit	**mg/L**	**Unit**	**mg/L**
MDL	**0.039**	**MDL**	**0.002**
QL	**0.200**	**QL**	**0.050**

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
G24b	7108-30 Lab dup	-	5/18/2016	4.62 (RPD=0.652)	1	5/11/2016	BQL (0.024) (RPD=NA)	1
G48	7108-31	-	5/18/2016	4.63	1	5/11/2016	BQL (0.017)	1
G48b	7108-32	-	5/18/2016	4.56	1	5/11/2016	BQL (0.013)	1
F	7108-33	-	5/18/2016	5.16	1	5/11/2016	BQL (0.017)	1
Fb	7108-34	-	5/18/2016	5.23	1	5/11/2016	BQL (0.023)	1
Fb	7108-34 Lab dup	-	5/18/2016	5.28 (RPD=0.952)	1	5/11/2016	BQL (0.021) (RPD=NA)	1

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/18/16

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.050	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	5/11/2016	5/11/2016	-	-	-	BQL (0.019)	-	-			
MB	Nanopure Water Blank	5/11/2016	5/11/2016	-	-	-	BQL (0.018)	-	-			
MB	Nanopure Water Blank	5/18/2016	5/18/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	5/18/2016	5/18/2016	ND	-	-	-	-	-			
SS	ERA 67 Simple Nutrients	11/4/2015	5/11/2016	-	-	-	1.97	1.95	101			
SS	ERA 67 Simple Nutrients	11/4/2015	5/11/2016	-	-	-	1.99	1.95	102			
SS	ERA 67 Simple Nutrients	11/4/2015	5/11/2016	-	-	-	2.00	1.95	103			
SS	ERA 66 Minerals	7/1/2015	5/18/2016	1.70	1.70	100	-	-	-			
SS	ERA 66 Minerals	7/1/2015	5/18/2016	1.66	1.70	97.6	-	-	-			
CCC	Continuing Calibration Check Standard	4/28/2016	5/11/2016	-	-	-	0.100	0.100	100			
CCC	Continuing Calibration Check Standard	4/28/2016	5/11/2016	-	-	-	0.495	0.500	99.0			
CCC	Continuing Calibration Check Standard	4/28/2016	5/11/2016	-	-	-	0.237	0.250	94.8			
CCC	Continuing Calibration Check Standard	4/28/2016	5/11/2016	-	-	-	0.101	0.100	101			
CCC	Continuing Calibration Check Standard	4/28/2016	5/11/2016	-	-	-	1.02	1.00	102			
CCC	Continuing Calibration Check Standard	4/28/2016	5/11/2016	-	-	-	2.06	2.00	103			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	0.208	0.200	104	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	1.01	1.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	2.01	2.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	5.00	5.00	100	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	9.86	10.0	98.6	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	5.00	5.00	100	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	9.86	10.0	98.6	-	-	-			
MS	H2 Spike	5/11 & 5/18/2016	5/11 & 5/18/2016	8.83	5.00 (3.85)	99.5	0.985	BQL (0.014) (0.990)	98.1			
MS	M24 Spike	5/11 & 5/18/2016	5/11 & 5/18/2016	9.10	5.14 (3.85)	103	1.00	BQL (0.020) (0.990)	99.0			
MS	G2 Spike	5/11 & 5/18/2016	5/11 & 5/18/2016	8.32	4.66 (3.85)	95.1	-	-	-			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

Sample ID	mass sample (g)	volume F- (mL)	Ce [F] mg/L	sorbed F (mg/l)	x/m (mg/g)	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)	P (values only)
H2	0.1008	20.131	5.00	0.20	0.04						BQL (0.014)	
H2b	0.0997	20.133	5.15	0.04	0.01						BQL (0.020)	
H4	0.1	20.108	4.98	0.22	0.04						BQL (0.019)	
H4b	0.1034	20.142	5.12	0.08	0.01						BQL (0.020)	
H24	0.0988	20.108	5.05	0.15	0.03						BQL (0.017)	
H24b	0.1	20.061	5.21	-0.01	0.00						BQL (0.025)	
H48	0.1017	19.932	4.95	0.25	0.05			7.66			BQL (0.021)	
H48b	0.1021	19.569	5.09	0.11	0.02			7.5			BQL (0.022)	
Ha2	0.1012	20.119	4.99	0.21	0.04						BQL (0.015)	
Ha2b	0.1023	19.961	4.83	0.37	0.07						BQL (0.020)	
Ha4	0.0995	20.081	4.72	0.48	0.10						BQL (0.019)	
Ha4b	0.1019	20.136	4.86	0.34	0.07						BQL (0.027)	
Ha24	0.1008	20.066	4.68	0.52	0.10						BQL (0.020)	
Ha24b	0.1005	19.746	4.77	0.43	0.08						BQL (0.019)	
Ha48	0.1028	19.895	4.67	0.53	0.10			5.66			BQL (0.024)	
Ha48b	0.0985	19.945	4.73	0.47	0.09			5.42			BQL (0.019)	
M2	0.0998	20.147	5.19	0.00	0.00						BQL (0.028)	
M2b	0.1025	20.074	5.39	-0.19	-0.04						BQL (0.020)	
M4	0.1002	20.141	5.11	0.09	0.02						BQL (0.018)	
M4b	0.1013	20.116	5.24	-0.04	-0.01						BQL (0.023)	
M24	0.0998	20.075	5.14	0.06	0.01						BQL (0.020)	
M24b	0.1	20.039	5.27	-0.07	-0.02						BQL (0.022)	
M48	0.1028	20.008	5.52	-0.32	-0.06			7.68			BQL (0.023)	
M48b	0.1057	20.087	5.15	0.04	0.01			7.83			BQL (0.022)	
G2	0.1038	20.107	4.66	0.54	0.10						BQL (0.021)	
G2b	0.1004	20.111	4.66	0.54	0.11						BQL (0.022)	
G4	0.1037	20.03	4.77	0.43	0.08						BQL (0.021)	
G4b	0.1001	20.012	4.69	0.51	0.10						BQL (0.021)	
G24	0.099	20.036	4.62	0.58	0.12						BQL (0.022)	
G24b	0.1001	20.007	4.59	0.61	0.12						BQL (0.021)	
G48	0.1	20.058	4.63	0.57	0.11			5.53			BQL (0.017)	
G48b	0.101	19.853	4.56	0.64	0.12			5.32			BQL (0.013)	
F		5.20	5.16	0.04							BQL (0.017)	
Fb			5.23	-0.04							BQL (0.023)	

AVERAGES

Sample ID	mass sample (g)	volume F- (mL)	Ce [F] mg/L	sorbed F (mg/l)	x/m (mg/g)	Date/time F- added	Date/time pH taken	measured pH
H48		19.7505	5.02	0.175	0.034	#DIV/0!	#DIV/0!	7.58
Ha48		19.92	4.7	0.495	0.098	#DIV/0!	#DIV/0!	5.54
M48		20.0475	5.335	-0.14	-0.027	#DIV/0!	#DIV/0!	7.755
G48		19.9555	4.595	0.6	0.119	#DIV/0!	#DIV/0!	5.425

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 15-LC30

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Lisa Costantino

Date: 8/11/2015

Technical Directive No.: EPAGP530 Rev. 1
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway
Lisa Costantino

Sample Site/Project: Fort Riley Green Infrastructure
Date Collected: unknown
Date Received: 8/6/2015
Date Analyzed: 8/6 & 8/7/2015
No. Samples Analyzed: 40

Sample Set No.: 7023
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: Dilution as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively. The matrix spike for Ct3 did not meet the data quality objective for oP. The matrix spike was prepared and analyzed a second time with 60.5% recovery. A laboratory control spike yielded 104% recovery which indicates a possible matrix interference.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/11/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.031	**MDL**	0.002		
QL	** 0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
At1	7023-1	-	8/7/2015	2.37	1	8/6/2015	BQL (0.018)	1		
At1b	7023-2	-	8/7/2015	2.26	1	8/6/2015	BQL (0.016)	1		
At2	7023-3	-	8/7/2015	1.99	1	8/6/2015	0.021	1		
At2b	7023-4	-	8/7/2015	1.88	1	8/6/2015	BQL (0.019)	1		
At3	7023-5	-	8/7/2015	1.21	1	8/6/2015	BQL (0.016)	1		
At3b	7023-6	-	8/7/2015	1.28	1	8/6/2015	BQL (0.016)	1		
At4	7023-7	-	8/7/2015	0.744	1	8/6/2015	BQL (0.015)	1		
At4b	7023-8	-	8/7/2015	0.960	1	8/6/2015	BQL (0.017)	1		
Mt1	7023-9	-	8/7/2015	3.68	1	8/6/2015	BQL (0.014)	1		
Mt1b	7023-10	-	8/7/2015	3.95	1	8/6/2015	BQL (0.014)	1		
Mt1b	7023-10 Lab dup	-	8/7/2015	3.89 (RPD=1.53)	1	8/6/2015	BQL (0.014) (RPD=NA)	1		
Mt2	7023-11	-	8/7/2015	4.06	1	8/6/2015	BQL (0.014)	1		
Mt2b	7023-12	-	8/7/2015	3.83	1	8/6/2015	BQL (0.015)	1		
Mt3	7023-13	-	8/7/2015	4.27	1	8/6/2015	BQL (0.019)	1		
Mt3b	7023-14	-	8/7/2015	4.42	1	8/6/2015	BQL (0.014)	1		
Mt4	7023-15	-	8/7/2015	4.25	1	8/6/2015	BQL (0.013)	1		
Mt4b	7023-16	-	8/7/2015	4.64	1	8/6/2015	BQL (0.014)	1		
Ct1	7023-17	-	8/7/2015	5.87	5	8/6/2015	BQL (0.013)	1		
Ct1b	7023-18	-	8/7/2015	6.18	5	8/6/2015	BQL (0.016)	1		
Ct2	7023-19	-	8/7/2015	5.74	5	8/6/2015	BQL (0.012)	1		
Ct2b	7023-20	-	8/7/2015	5.88	5	8/6/2015	BQL (0.012)	1		
Ct2b	7023-20 Lab dup	-	8/7/2015	5.91 (RPD=0.509)	5	8/6/2015	BQL (0.017) (RPD=NA)	1		
Ct3	7023-21	-	8/7/2015	6.93	5	8/6/2015	BQL (0.012)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/11/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.031	**MDL**	0.002		
QL	** 0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
Ct3b	7023-22	-	8/7/2015	6.82	5	8/6/2015	BQL (0.012)	1		
Ct4	7023-23	-	8/7/2015	6.51	5	8/6/2015	BQL (0.013)	1		
Ct4b	7023-24	-	8/7/2015	6.03	5	8/6/2015	BQL (0.012)	1		
St1	7023-25	-	8/7/2015	5.51	1	8/6/2015	BQL (0.019)	1		
St1b	7023-26	-	8/7/2015	5.47	1	8/6/2015	BQL (0.017)	1		
St2	7023-27	-	8/7/2015	5.49	1	8/6/2015	BQL (0.017)	1		
St2b	7023-28	-	8/7/2015	5.53	1	8/6/2015	0.020	1		
St3	7023-29	-	8/7/2015	6.72	1	8/6/2015	0.047	1		
St3b	7023-30	-	8/7/2015	6.79	1	8/6/2015	0.032	1		
St3b	7023-30 Lab dup	-	8/7/2015	6.72 (RPD=1.04)	1	8/6/2015	0.031 (RPD=3.17))	1		
St4	7023-31	-	8/7/2015	6.84	1	8/6/2015	0.039	1		
St4b	7023-32	-	8/7/2015	6.93	1	8/6/2015	0.038	1		
Zt1	7023-33	-	8/7/2015	5.93	1	8/6/2015	BQL (0.013)	1		
Zt1b	7023-34	-	8/7/2015	5.99	1	8/6/2015	BQL (0.014)	1		
Zt2	7023-35	-	8/7/2015	5.84	1	8/6/2015	BQL (0.014)	1		
Zt2b	7023-36	-	8/7/2015	6.01	1	8/6/2015	BQL (0.014)	1		
Zt3	7023-37	-	8/7/2015	7.23	1	8/6/2015	BQL (0.014)	1		
Zt3b	7023-38	-	8/7/2015	7.09	1	8/6/2015	BQL (0.014)	1		
Zt4	7023-39	-	8/7/2015	6.94	1	8/6/2015	BQL (0.014)	1		
Zt4b	7023-40	-	8/7/2015	7.15	1	8/6/2015	BQL (0.014)	1		
Zt4b	7023-40 Lab dup	-	8/7/2015	7.17 (RPD=0.279)	1	8/6/2015	BQL (0.014) (RPD=NA)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/11/15

Sample Results

Analytes	Fluoride (F)			**Analytes**	ortho-Phosphate (as P)						
Codes	7782-41-4			**Codes**	70507						
Methods	RSKSOP-276/4			**Methods**	NRMRL-GWERD-05-0						
Unit	mg/L			**Unit**	mg/L						
MDL	** 0.031			**MDL**	0.002						
QL	** 0.200			**QL**	0.020						
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**	**Data**	**DF**	

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

Sample ID	mass of cap + tube	mass sample+cap+ soln	mass sample (g)	volume F-	Ce [F] (copied from raw data)	sorbed F (mg/l)	x/m	Date/time F-added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)
At1	16.2696	36.218	0.1022	19.85	2.37	4.07	0.79	7/22/2015 8:02		9.06	7/22/2015 10:43	2.7	BQL (0.018)
At1b	16.2517	36.05	0.1041	19.69	2.26	4.18	0.79	7/22/2015 8:03		8.96	7/22/2015 10:44	2.7	BQL (0.016)
At2	16.125	35.974	0.1008	19.75	1.99	4.45	0.87	7/22/2015 8:15		8.67	7/22/2015 12:15	4.0	0.021
At2b	16.333	36.097	0.1016	19.66	1.88	4.56	0.88	7/22/2015 8:15		8.53	7/22/2015 12:16	4.0	BQL (0.019)
At3	16.297	36.157	0.1002	19.76	1.21	5.23	1.03	7/21/2015 13:45		9.8	7/22/2015 14:21	24.6	BQL (0.016)
At3b	16.292	36.085	0.1029	19.69	1.28	5.16	0.99	7/21/2015 13:46		9.81	7/22/2015 14:22	24.6	BQL (0.016)
At4	16.368	36.165	0.1022	19.69	0.744	5.70	1.10	7/21/2015 13:54		9.91	7/23/2015 13:17	47.4	BQL (0.015)
At4b	16.359	35.08	0.1014	18.62	0.960	5.48	1.01	7/21/2015 13:55		9.72	7/23/2015 13:29	47.6	BQL (0.017)
Mt1	16.3159	36.241	0.1001	19.83	3.68	2.76	0.55	7/22/2015 8:03		9.63	7/22/2015 10:45	2.7	BQL (0.014)
Mt1b	16.4242	35.841	0.1004	19.32	3.95	2.49	0.48	7/22/2015 8:04		9.5	7/22/2015 10:45	2.7	BQL (0.014)
Mt2	16.298	36.018	0.1	19.62	4.06	2.38	0.47	7/22/2015 8:17		9.16	7/22/2015 12:17	4.0	BQL (0.014)
Mt2b	16.372	35.899	0.1005	19.43	3.83	2.61	0.50	7/22/2015 8:17		9.14	7/22/2015 12:18	4.0	BQL (0.015)
Mt3	16.336	36.168	0.1011	19.73	4.27	2.17	0.42	7/21/2015 13:47		9.65	7/22/2015 14:23	24.6	BQL (0.019)
Mt3b	16.294	36.111	0.1039	19.71	4.42	2.02	0.38	7/21/2015 13:48		9.44	7/22/2015 14:24	24.6	BQL (0.014)
Mt4	16.263	35.991	0.1014	19.63	4.25	2.19	0.42	7/21/2015 13:56		9.71	7/23/2015 13:31	47.6	BQL (0.013)
Mt4b	16.365	45.895	0.1014	29.43	4.64	1.80	0.52	7/21/2015 13:56		9.58	7/23/2015 13:33	47.6	BQL (0.014)
Ct1	16.3087	36.16	0.1007	19.75	5.87	0.57	0.11	7/22/2015 8:05		11.3	7/22/2015 10:47	2.7	BQL (0.013)
Ct1b	16.2983	36.073	0.1006	19.67	6.18	0.26	0.05	7/22/2015 8:05		11.46	7/22/2015 10:48	2.7	BQL (0.016)
Ct2	16.277	36.079	0.1007	19.70	5.74	0.70	0.14	7/22/2015 8:19		10.74	7/22/2015 12:19	4.0	BQL (0.012)
Ct2b	16.182	35.949	0.1082	19.66	5.88	0.56	0.10	7/22/2015 8:20		11.02	7/22/2015 12:20	4.0	BQL (0.012)
Ct3	16.364	36.155	0.1007	19.69	6.93	-0.49	-0.10	7/21/2015 13:49		11.36	7/22/2015 14:25	24.6	BQL (0.012)
Ct3b	16.191	35.968	0.1078	19.67	6.82	-0.38	-0.07	7/21/2015 13:50		11.45	7/22/2015 14:26	24.6	BQL (0.012)
Ct4	16.13	35.834	0.1059	19.60	6.51	-0.07	-0.01	7/21/2015 13:58		11.33	7/23/2015 13:34	47.6	BQL (0.013)
Ct4b	16.202	35.779	0.1019	19.48	6.03	0.41	0.08	7/21/2015 13:58		11.44	7/23/2015 13:35	47.6	BQL (0.012)
St1	16.4415	36.192	0.1029	19.65	5.51	0.93	0.18	7/22/2015 8:06		5.68	7/22/2015 10:49	2.7	BQL (0.019)
St1b	16.4432	36.207	0.1001	19.66	5.47	0.97	0.19	7/22/2015 8:07		4.82	7/22/2015 10:50	2.7	BQL (0.017)
St2	16.263	36.212	0.1022	19.85	5.49	0.95	0.18	7/22/2015 8:21		4.76	7/22/2015 12:21	4.0	BQL (0.017)
St2b	16.308	35.902	0.1015	19.49	5.53	0.91	0.17	7/22/2015 8:22		4.15	7/22/2015 12:22	4.0	0.020
St3	16.301	35.917	0.1035	19.51	6.72	-0.28	-0.05	7/21/2015 13:50		5.66	7/22/2015 14:27	24.6	0.047
St3b	16.315	36.058	0.102	19.64	6.79	-0.35	-0.07	7/21/2015 13:51		5.09	7/22/2015 14:28	24.6	0.032
St4	16.324	35.858	0.1005	19.43	6.84	-0.40	-0.08	7/21/2015 13:59		5.4	7/23/2015 13:37	47.6	0.039
St4b	16.307	36.018	0.1022	19.61	6.93	-0.49	-0.09	7/21/2015 13:59		5.32	7/23/2015 13:38	47.7	0.038
Zt1	16.2134	36.304	0.1013	19.99	5.93	0.51	0.10	7/22/2015 8:08		7.37	7/22/2015 10:50	2.7	BQL (0.013)
Zt1b	16.3878	35.915	0.1014	19.43	5.99	0.45	0.09	7/22/2015 8:09		7.66	7/22/2015 10:51	2.7	BQL (0.014)
Zt2	16.267	35.992	0.1044	19.62	5.84	0.60	0.11	7/22/2015 8:23		7.06	7/22/2015 12:23	4.0	BQL (0.014)
Zt2b	16.368	36.234	0.1055	19.76	6.01	0.43	0.08	7/22/2015 8:24		7.06	7/22/2015 12:24	4.0	BQL (0.014)
Zt3	16.335	35.991	0.1001	19.56	7.23	-0.79	-0.15	7/21/2015 13:51		7.44	7/22/2015 14:29	24.6	BQL (0.014)
Zt3b	16.387	36.27	0.1	19.78	7.09	-0.65	-0.13	7/21/2015 13:52		7.65	7/22/2015 14:30	24.6	BQL (0.014)
Zt4	16.04	35.702	0.1012	19.56	6.94	-0.50	-0.10	7/21/2015 14:00		8.2	7/23/2015 13:39	47.6	BQL (0.014)
Zt4b	16.296	36.087	0.1016	19.69	7.15	-0.71	-0.14	7/21/2015 14:01		7.9	7/23/2015 13:40	47.7	BQL (0.014)
Ft1			0		6.56						7/21/2015 14:30		BQL (0.013)
Ft1 b			0		6.32						7/21/2015 14:30		BQL (0.012)
Ft1 average					6.44								

Sample ID	mass of cap + tube	mass sample+cap+ soln	mass sample (g)	volume F-	Ce [F] (copied from raw data)	sorbed F (mg/l)	x/m	Date/time F-added	Date/time pH taken	measured pH			
average at 48 hours (equilibrium)											**47.47**	**#DIV/0!**	
apatite	16.36	35.62	0.10	19.16	0.85	5.59	1.05			9.82	47.60	#DIV/0!	
MgOH2	16.31	40.94	0.10	24.53	4.45	2.00	0.47			9.65	47.64		0.04
Silicon oxide	16.32	35.94	0.10	19.52	6.89	-0.45	-0.09			5.36	47.65	#DIV/0!	
zinc oxide	16.17	35.89	0.10	19.63	7.05	-0.61	-0.12			8.05			
STDEV											0.0917	#DIV/0!	
apatite	0.0045	0.5425	0.0004	0.5376	0.1080	0.1080	0.05			0.0950	0.0167	#DIV/0!	
MgOH2	0.0510	4.9520	0.0000	4.9010	0.1950	0.1950	0.05			0.0650	0.0083		0.0005
Silicon oxide	0.0085	0.0800	0.0008	0.0877	0.0450	0.0450	0.01			0.0400	0.0000	#DIV/0!	
zinc oxide	0.1280	0.1925	0.0002	0.0643	0.1050	0.1050	0.02			0.1500			

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/11/15

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	8/6/2015	8/6/2015	-	-	-	BQL (0.014)	-	-			
MB	Nanopure Water Blank	8/6/2015	8/6/2015	-	-	-	BQL (0.015)	-	-			
MB	Nanopure Water Blank	8/7/2015	8/7/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/7/2015	8/7/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/7/2015	8/7/2015	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	8/6/2015	-	-	-	1.65	1.57	105			
SS	ERA 64 Simple Nutrients	2/25/2015	8/6/2015	-	-	-	1.58	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	8/6/2015	-	-	-	1.64	1.57	104			
SS	ERA 64 Minerals	1/21/2015	8/7/2015	3.52	3.47	101	-	-	-			
SS	ERA 64 Minerals	1/21/2015	8/7/2015	3.44	3.47	99.1	-	-	-			
CCC	Continuing Calibration Check Standard	5/14/2015	8/6/2015	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	5/14/2015	8/6/2015	-	-	-	0.050	0.050	100			
CCC	Continuing Calibration Check Standard	5/14/2015	8/6/2015	-	-	-	0.495	0.500	99.0			
CCC	Continuing Calibration Check Standard	5/14/2015	8/6/2015	-	-	-	0.234	0.250	93.6			
CCC	Continuing Calibration Check Standard	5/14/2015	8/6/2015	-	-	-	2.13	2.00	107			
CCC	Continuing Calibration Check Standard	6/17/2015	8/7/2015	BQL (0.195)	0.200	97.5	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/7/2015	1.01	1.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/7/2015	4.95	5.00	99.0	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/7/2015	9.98	10.0	99.8	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/7/2015	2.00	2.00	100	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/7/2015	1.09	1.00	109	-	-	-			
MS	At1 Spike	8/6 & 8/7/2015	8/6 & 8/7/2015	6.34	2.37 (3.85)	103	1.04	BQL (0.018) (0.990)	103			
MS	Ct3 Spike	8/6 & 8/7/2015	8/6 & 8/7/2015	* 5.64	* 1.39 (3.85)	110	** 0.565	BQL (0.012) (0.990)	** 55.9			
LCS	Laboratory Control Spike	8/6/2015	8/6/2015	-	-	-	1.03	ND (0.990)	104			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated and reported without the dilution factor applied. ** The matrix spike for Ct3 did not meet the data quality objective for oP. The matrix spike was prepared and analyzed a second time with 60.5% recovery. A laboratory control spike yielded 104% recovery which indicates a possible matrix interference.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/11/15

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 15-LC29

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Lisa Costantino

Date: 8/6/2015

Technical Directive No.: EPAGP530 Rev. 1
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway
Lisa Costantino

Sample Site/Project: Fort Riley Green Infrastructure
Date Collected: 7/21 to 7/30/2015
Date Received: 7/30/2015
Date Analyzed: 7/30 and 8/5/2015
No. Samples Analyzed: 36

Sample Set No.: 7021
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: Dilution as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively. Please note that most samples were diluted to remove interference from adjacent very large chloride peaks. Some samples were analyzed within the 48-hour holding time for oP and some were not.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/06/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.031	**MDL**	0.002		
QL	0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
At1X	7021-1	7/21/2015	8/5/2015	BQL (0.099)	1	7/30/2015	0.045	1		
At1bX	7021-2	7/21/2015	8/5/2015	BQL (0.114)	1	7/30/2015	0.046	1		
Mt1X	7021-3	7/21/2015	8/5/2015	0.689	1	7/30/2015	BQL (0.013)	1		
Mt1bX	7021-4	7/21/2015	8/5/2015	0.697	1	7/30/2015	BQL (0.011)	1		
Ct1X	7021-5	7/21/2015	8/5/2015	BQL (0.197)	1	7/30/2015	BQL (0.010)	1		
Ct1bX	7021-6	7/21/2015	8/5/2015	BQL (0.193)	1	7/30/2015	BQL (0.010)	1		
St1X	7021-7	7/21/2015	8/5/2015	1.08	1	7/30/2015	BQL (0.017)	1		
St1bX	7021-8	7/21/2015	8/5/2015	1.08	1	7/30/2015	BQL (0.016)	1		
Zt1X	7021-9	7/21/2015	8/5/2015	1.15	1	7/30/2015	BQL (0.011)	1		
Zt1bX	7021-10	7/21/2015	8/5/2015	1.13	1	7/30/2015	BQL (0.013)	1		
Zt1bX Lab dup	7021-10 Lab dup	7/21/2015	8/5/2015	1.10 (RPD=2.69)	1	7/30/2015	BQL (0.012) (RPD=NA)	1		
AC4b	7021-11	7/30/2015	8/5/2015	3.84	11	7/30/2015	4.92	4		
BC4b	7021-12	7/30/2015	8/5/2015	ND	31	7/30/2015	0.409	1		
BC6b	7021-13	7/30/2015	8/5/2015	ND	11	7/30/2015	0.092	1		
A3b	7021-14	7/30/2015	8/5/2015	BQL (1.89)	21	7/30/2015	0.495	1		
B2b	7021-15	7/30/2015	8/5/2015	BQL (1.12)	31	7/30/2015	13.2	21		
B3b	7021-16	7/30/2015	8/5/2015	ND	31	7/30/2015	0.683	1		
B4b	7021-17	7/30/2015	8/5/2015	ND	31	7/30/2015	0.361	1		
B6b	7021-18	7/30/2015	8/5/2015	ND	31	7/30/2015	0.114	1		
2At1	7021-19	7/28/2015	8/5/2015	BQL (0.078)	1	7/30/2015	BQL (0.018)	1		
2At1b	7021-20	7/28/2015	8/5/2015	BQL (0.081)	1	7/30/2015	BQL (0.017)	1		
2At1b	7021-20 Lab dup	7/28/2015	8/5/2015	BQL (0.079) (RPD=NA)	1	7/30/2015	BQL (0.013) (RPD=NA)	1		
2At2	7021-21	7/28/2015	8/5/2015	BQL (0.110)	1	7/30/2015	BQL (0.006)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/06/15

Sample Results

Analytes	Fluoride (F)	Analytes	ortho-Phosphate (as P)	
Codes	7782-41-4	Codes	70507	
Methods	RSKSOP-276/4	Methods	NRMRL-GWERD-05-0	
Unit	mg/L	Unit	mg/L	
MDL	0.031	MDL	0.002	
QL	0.200	QL	0.020	

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
2At2b	7021-22	7/28/2015	8/5/2015	BQL (0.067)	1	7/30/2015	BQL (0.012)	1		
2At3	7021-23	7/29/2015	8/5/2015	ND	1	7/30/2015	BQL (0.012)	1		
2At3b	7021-24	7/29/2015	8/5/2015	ND	1	7/30/2015	BQL (0.013)	1		
2At4	7021-25	7/30/2015	8/5/2015	BQL (0.059)	1	7/30/2015	BQL (0.012)	1		
2At4b	7021-26	7/30/2015	8/5/2015	BQL (0.042)	1	7/30/2015	BQL (0.011)	1		
at1	7021-27	7/28/2015	8/5/2015	4.67	1	7/30/2015	BQL (0.016)	1		
at1b	7021-28	7/28/2015	8/5/2015	4.53	1	7/30/2015	BQL (0.012)	1		
at1b	7021-28 Lab dup	7/28/2015	8/5/2015	4.60 (RPD=1.53)	1	-	-	-		
at2	7021-29	7/28/2015	8/5/2015	4.51	1	7/30/2015	BQL (0.012)	1		
at2b	7021-30	7/28/2015	8/5/2015	4.72	1	7/30/2015	BQL (0.012)	1		
at2b	7021-30 Lab dup	7/28/2015	-	-	-	7/30/2015	BQL (0.011) (RPD=NA)	1		
at3	7021-31	7/29/2015	8/5/2015	4.63	1	7/30/2015	BQL (0.012)	1		
at3b	7021-32	7/29/2015	8/5/2015	4.73	1	7/30/2015	BQL (0.011)	1		
at4	7021-33	7/30/2015	8/5/2015	5.12	1	7/30/2015	BQL (0.011)	1		
at4b	7021-34	7/30/2015	8/5/2015	4.66	1	7/30/2015	BQL (0.008)	1		
Ft	7021-35	7/30/2015	8/5/2015	4.93	1	7/30/2015	BQL (0.012)	1		
Ftb	7021-36	7/30/2015	8/5/2015	4.90	1	7/30/2015	BQL (0.012)	1		
Ftb	7021-36 Lab dup	7/30/2015	8/5/2015	4.86 (RPD=0.820)	1	7/30/2015	BQL (0.013) (RPD=NA)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/06/15

Sample Results

Analytes	Fluoride (F)			**Analytes**	ortho-Phosphate (as P)						
Codes	7782-41-4			**Codes**	70507						
Methods	RSKSOP-276/4			**Methods**	NRMRL-GWERD-05-0						
Unit	mg/L			**Unit**	mg/L						
MDL	0.031			**MDL**	0.002						
QL	0.200			**QL**	0.020						
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**	**Data**	**DF**	

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/06/15

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	7/30/2015	7/30/2015	-	-	-	BQL (0.013)	-	-			
MB	Nanopure Water Blank	7/30/2015	7/30/2015	-	-	-	BQL (0.010)	-	-			
MB	Nanopure Water Blank	8/5/2015	8/5/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/5/2015	8/5/2015	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	7/30/2015	-	-	-	1.56	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	7/30/2015	-	-	-	1.63	1.57	104			
SS	ERA 64 Simple Nutrients	2/25/2015	7/30/2015	-	-	-	1.59	1.57	101			
SS	ERA 64 Minerals	1/21/2015	8/5/2015	3.49	3.47	101	-	-	-			
SS	ERA 64 Minerals	1/21/2015	8/5/2015	3.51	3.47	101	-	-	-			
CCC	Continuing Calibration Check Standard	5/14/2015	7/30/2015	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	5/14/2015	7/30/2015	-	-	-	0.047	0.050	94.0			
CCC	Continuing Calibration Check Standard	5/14/2015	7/30/2015	-	-	-	1.05	1.00	105			
CCC	Continuing Calibration Check Standard	5/14/2015	7/30/2015	-	-	-	0.241	0.250	96.4			
CCC	Continuing Calibration Check Standard	5/14/2015	7/30/2015	-	-	-	2.05	2.00	103			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	BQL (0.191)	0.200	95.5	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	0.980	1.00	98.0	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	1.94	2.00	97.0	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	4.94	5.00	98.8	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	9.92	10.0	99.2	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/5/2015	9.92	10.0	99.2	-	-	-			
MS	At1X Spike	7/30 & 8/5/2015	7/30 & 8/5/2015	4.48	BQL (0.099) (3.85)	114	1.05	0.045 (0.990)	102			
MS	2At2 Spike	7/30 & 8/5/2015	7/30 & 8/5/2015	4.65	BQL (0.110) (3.85)	118	1.02	BQL (0.006) (0.990)	102			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated and reported without the dilution factor applied.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

Experiment Description: 1.0 mM CaCl2, 10 mg/L NaF (because of precipitation possibly due to formation of CaF actual F conc is 4.85 ppm)

Sample ID	mass of cap + tube	mass sample+cap+ soln	mass sample (g)	volume F-	Ce [F] (copied from raw data)	Ce [F] values	sorbed F (mg/l)	x/m	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)
2At1	16.1768	35.958	0.106	19.6752	BQL (0.078)	0.078	4.84	0.90			3.74			BQL (0.018)
2At1b	16.5109	36.316	0.1005	19.7046	BQL (0.081)	0.081	4.83	0.95			3.57			BQL (0.017)
2At2	16.1876	35.889	0.1021	19.5993	BQL (0.110)	0.110	4.81	0.92			3.66			BQL (0.006)
2At2b	16.3996	36.141	0.1018	19.6396	BQL (0.067)	0.067	4.85	0.94			3.50			BQL (0.012)
2At3	16.318	35.97	0.1003	19.5517	ND	0.030	4.89	0.95			3.71			BQL (0.012)
2At3b	16.3361	36.108	0.1004	19.6715	ND	0.031	4.88	0.96			3.58			BQL (0.013)
2At4	16.1989	36.075	0.1023	19.7738	BQL (0.059)	0.059	4.86	0.94	############		3.53	############	47.9	BQL (0.012)
2At4b	16.4148	36.219	0.1055	19.6987	BQL (0.042)	0.042	4.87	0.91	############		3.30	############	47.9	BQL (0.011)
at1	16.3954	36.135	0.1025	19.6371	4.67	4.670	0.25	0.05			5.68			BQL (0.016)
at1b	16.4148	36.236	0.1023	19.7189	4.53	4.530	0.39	0.07			5.54			BQL (0.012)
at2	16.4993	36.342	0.1018	19.7409	4.51	4.510	0.41	0.08			5.65			BQL (0.012)
at2b	16.2032	35.766	0.1009	19.4619	4.72	4.720	0.20	0.04			5.57			BQL (0.012)
at3	16.2852	36.067	0.1043	19.6775	4.63	4.630	0.29	0.05			5.91			BQL (0.012)
at3b	16.2597	34.873	0.1036	18.5097	4.73	4.730	0.19	0.03			5.70			BQL (0.011)
at4	16.3109	36.032	0.1005	19.6206	5.12	5.120	-0.21	-0.04	############		5.58	############	47.8	BQL (0.011)
at4b	16.1642	35.935	0.1035	19.6673	4.66	4.660	0.26	0.05	############		5.51	############	47.8	BQL (0.008)
Ft					4.93	4.930								BQL (0.012)
Ftb					4.90	4.900								BQL (0.012)
Ft average					4.92									
2Bt1	16.087	35.918	0.1058	19.73	3.59	3.59	1.26	0.23	8/3/2015 10:48		6.52	8/3/2015 12:44		BQL (0.014)
2Bt1b	16.0175	35.846	0.1	19.73	3.43	3.43	1.42	0.28	8/3/2015 10:49		6.26	8/3/2015 12:45		BQL (0.014)
2Bt2	16.2836	36.23	0.1	19.85	4.23	4.23	0.61	0.12	8/3/2015 10:50		5.76	8/3/2015 15:58		BQL (0.015)
2Bt2b	16.2614	36.047	0.1005	19.69	4.12	4.12	0.73	0.14	8/3/2015 10:51		5.7	8/3/2015 16:00		BQL (0.015)
2Bt3	16.2548	35.986	0.0998	19.63	3.6	3.6	1.25	0.24	8/3/2015 11:00		6.74	8/4/2015 11:08		BQL (0.015)
2Bt3b	16.3202	36.006	0.1002	19.59	3.59	3.59	1.26	0.25	8/3/2015 11:00		6.38	8/4/2015 11:09		BQL (0.015)
2Bt4	16.2192	35.863	0.1007	19.54	3.2	3.2	1.65	0.32	8/3/2015 11:12		6.47	8/5/2015 12:10		BQL (0.014)
2Bt4b	16.2299	35.912	0.1001	19.58	2.99	2.99	1.86	0.36	8/3/2015 11:13		6.24	8/5/2015 12:11		BQL (0.014)
2Ct1	16.1622	35.991	0.0998	19.73	4.43	4.43	0.42	0.08	8/3/2015 10:50		6.15	8/3/2015 12:47		0.028
2Ct1b	16.4103	36.164	0.1001	19.65	4.89	4.89	-0.04	-0.01	8/3/2015 10:51		6.12	8/3/2015 12:49		0.05
2Ct2	16.3212	36.069	0.1003	19.65	4.77	4.77	0.08	0.01	8/3/2015 10:52		5.62	8/3/2015 16:02		0.023
2Ct2b	16.3799	36.043	0.1	19.56	4.61	4.61	0.23	0.05	8/3/2015 10:53		5.33	8/3/2015 16:03		0.024
2Ct3	16.3026	36.032	0.1003	19.63	4.99	4.99	-0.15	-0.03	8/3/2015 11:01		6.07	8/4/2015 11:16		0.026
2Ct3b	16.4141	36.143	0.1008	19.63	4.86	4.86	-0.02	0.00	8/3/2015 11:02		6.08	8/4/2015 11:18		0.05
2Ct4	16.22	35.913	0.1007	19.59	5.42	5.42	-0.58	-0.11	8/3/2015 11:14		6.22	8/5/2015 12:12		0.089
2Ct4b	16.3958	35.993	0.1001	19.50	5.72	5.72	-0.88	-0.17	8/3/2015 11:15		5.94	8/5/2015 12:16		0.077
2Dt1	16.2865	36.011	0.1013	19.62	4.25	4.25	0.60	0.12	8/3/2015 10:52		5.4	8/3/2015 12:50		0.029
2Dt1b	16.1148	35.89	0.0998	19.68	4.23	4.23	0.61	0.12	8/3/2015 10:53		5.32	8/3/2015 12:51		0.032
2Dt2	16.2485	35.945	0.1001	19.60	4.38	4.38	0.47	0.09	8/3/2015 10:54		4.95	8/3/2015 16:04		0.04
2Dt2b	16.3209	35.977	0.1005	19.56	4.36	4.36	0.48	0.09	8/3/2015 10:55		4.9	8/3/2015 16:05		0.041
2Dt3	16.1914	35.939	0.1002	19.65	4.05	4.05	0.80	0.16	8/3/2015 11:03		5.47	8/4/2015 11:21		0.041
2Dt3b	16.386	36.076	0.1001	19.59	4.04	4.04	0.81	0.16	8/3/2015 11:04		5.43	8/4/2015 11:23		0.045
2Dt4	16.3899	35.988	0.1008	19.50	3.96	3.96	0.89	0.17	8/3/2015 11:16		5.53	8/5/2015 12:17		0.069
2Dt4b	16.3845	35.957	0.1004	19.47	3.99	3.99	0.86	0.17	8/3/2015 11:17		5.52	8/5/2015 12:18		0.068
2Et1	16.2512	36.046	0.1003	19.69	4.49	4.49	0.36	0.07	8/3/2015 10:53		6.01	8/3/2015 12:52		9.03
2Et1b	16.2975	36.046	0.1008	19.65	4.52	4.52	0.33	0.06	8/3/2015 10:54		5.98	8/3/2015 12:53		8.33
2Et2	16.6358	36.324	0.1004	19.59	4.84	4.84	0.00	0.00	8/3/2015 10:56		5.69	8/3/2015 16:06		9.66
2Et2b	16.4142	36.055	0.1001	19.54	4.72	4.72	0.13	0.02	8/3/2015 10:57		5.72	8/3/2015 16:07		8.83
2Et3	16.2964	35.964	0.1008	19.57	4.3	4.3	0.55	0.11	8/3/2015 11:05		5.87	8/4/2015 11:24		9.93
2Et3b	16.3649	36.081	0.1	19.62	4.48	4.48	0.36	0.07	8/3/2015 11:06		5.89	8/4/2015 11:25		9.35
2Et4	16.3683	35.889	0.0999	19.42	4.46	4.46	0.39	0.07	8/3/2015 11:11		5.98	8/5/2015 12:19		10.5
2Et4b	16.3539	35.994	0.1011	19.54	4.48	4.48	0.36	0.07	3-Aug		5.97	8/5/2015 12:20		10.7
2F					4.85				NA			8/3/2015 13:03		BQL (0.010)
2Fb					4.84				NA			8/3/2015 13:05		BQL (0.016)
2F average					4.845									

Sample ID	mass of cap + tube	mass sample+cap+ soln	mass sample (g)	volume F-	Ce [F] (copied from raw data)	Ce [F] values	sorbed F (mg/l)	x/m	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)
Average of duplicates @ 48 hrs														
am-FeOH3	16.30685	36.147	0.1039	19.73625	#DIV/0!	0.0505	4.8645	0.92	42213.59097	#DIV/0!	3.415	42215.58472	47.85	#DIV/0!
hematite alpha	16.23755	35.9835	0.102	19.64395	4.89	4.89	0.025	0.00	42213.59479	#DIV/0!	5.545	42215.58542	47.775	#DIV/0!
TiO2 B	16.22	35.89	0.10	19.56	3.10	3.10	1.75	0.34	42219.47	#DIV/0!	6.36	42221.51	#DIV/0!	#DIV/0!
TiO2 C	16.31	35.95	0.10	19.54	5.57	5.57	-0.73	-0.14	42219.47	#DIV/0!	6.08	42221.51	#DIV/0!	0.08
TiO2 D	16.39	35.97	0.10	19.48	3.98	3.98	0.87	0.17	42219.47	#DIV/0!	5.53	42221.51	#DIV/0!	0.07
TiO2 E	16.36	35.94	0.10	19.48	4.47	4.47	0.38	0.07	42402.23	#DIV/0!	5.98	42221.51	#DIV/0!	10.60
STDEV														
am-FeOH3	0.10795	0.072	0.0016	0.03755	#DIV/0!	0.0085	0.0085	0.01	0	#DIV/0!	0.115	0	0	#DIV/0!
hematite alpha	0.07335	0.0485	0.0015	0.02335	0.23	0.23	0.23	0.04	0.000347222	#DIV/0!	0.035	0	0.008333333	#DIV/0!
TiO2 B	0.00535	0.0245	0.0003	0.01945	0.105	0.105	0.105	0.02	0.000347222	#DIV/0!	0.115	0.000347222	#DIV/0!	#DIV/0!
TiO2 C	0.0879	0.04	0.0003	0.0476	0.15	0.15	0.15	0.03	0.000347222	#DIV/0!	0.14	0.001388889	#DIV/0!	0.006
TiO2 D	0.0027	0.0155	0.0002	0.0126	0.015	0.015	0.015	0.00	0.000347222	#DIV/0!	0.005	0.000347222	#DIV/0!	0.0005
TiO2 E	0.0072	0.0525	0.0006	0.0591	0.01	0.01	0.01	0.00	182.7670139	#DIV/0!	0.005	0.000347222	#DIV/0!	0.1

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 15-LC33

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 8/21/2015

Technical Directive No.: EPAGP530 Rev. 1
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure
Date Collected: unknown
Date Received: 8/19/2015
Date Analyzed: 8/19 - 8/21/2015
No. Samples Analyzed: 38

Sample Set No.: 7025
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: Dilution as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/21/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.031	**MDL**	0.002		
QL	** 0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
1t1	7025-1	-	8/20/2015	1.91	1	8/19/2015	0.048	1		
1t1b	7025-2	-	8/20/2015	1.92	1	8/19/2015	0.054	1		
1t2	7025-3	-	8/20/2015	1.27	1	8/19/2015	0.056	1		
1t2b	7025-4	-	8/20/2015	1.27	1	8/19/2015	0.041	1		
1t3	7025-5	-	8/20/2015	0.526	1	8/19/2015	BQL (0.019)	1		
1t3b	7025-6	-	8/20/2015	0.702	1	8/19/2015	BQL (0.018)	1		
1t4	7025-7	-	8/20/2015	0.423	1	8/19/2015	BQL (0.018)	1		
1t4b	7025-8	-	8/20/2015	0.333	1	8/19/2015	BQL (0.018)	1		
2t1	7025-9	-	8/20/2015	ND	1	8/19/2015	BQL (0.015)	1		
2t1b	7025-10	-	8/20/2015	ND	1	8/19/2015	BQL (0.015)	1		
2t1b	7025-10 Lab dup	-	8/20/2015	ND (RPD=NA)	1	8/19/2015	BQL (0.015) (RPD=NA)	1		
2t2	7025-11	-	8/20/2015	ND	1	8/19/2015	BQL (0.015)	1		
2t2b	7025-12	-	8/20/2015	ND	1	8/19/2015	BQL (0.016)	1		
2t3	7025-13	-	8/20/2015	ND	1	8/19/2015	BQL (0.013)	1		
2t3b	7025-14	-	8/20/2015	ND	1	8/19/2015	BQL (0.017)	1		
2t4	7025-15	-	8/20/2015	ND	1	8/19/2015	BQL (0.015)	1		
2t4b	7025-16	-	8/20/2015	ND	1	8/19/2015	BQL (0.016)	1		
3t1	7025-17	-	8/20/2015	5.15	1	8/19/2015	0.023	1		
3t1b	7025-18	-	8/20/2015	4.88	1	8/19/2015	BQL (0.019)	1		
3t2	7025-19	-	8/20/2015	4.92	1	8/19/2015	0.052	1		
3t2b	7025-20	-	8/20/2015	4.91	1	8/19/2015	0.029	1		
3t2b	7025-20 Lab dup	-	8/20/2015	4.88 (RPD=0.613)	1	8/19/2015	0.029 (RPD=0)	1		
3t3	7025-21	-	8/20/2015	4.77	1	8/19/2015	0.030	1		

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Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	** 0.031	**MDL**	0.002		
QL	** 0.200	**QL**	0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
3t3b	7025-22	-	8/20/2015	4.79	1	8/19/2015	0.022	1		
3t4	7025-23	-	8/20/2015	4.61	1	8/19/2015	0.042	1		
3t4b	7025-24	-	8/20/2015	4.92	1	8/19/2015	0.023	1		
4t1	7025-25	-	8/20/2015	3.48	1	8/19/2015	BQL (0.015)	1		
4t1b	7025-26	-	8/20/2015	3.36	1	8/19/2015	BQL (0.015)	1		
4t1b	7025-26 Lab dup	-	8/20/2015	3.36 (RPD=0)	1	-	-	-		
4t2	7025-27	-	8/20/2015	3.55	1	8/19/2015	BQL (0.015)	1		
4t2b	7025-28	-	8/20/2015	3.50	1	8/19/2015	BQL (0.016)	1		
4t3	7025-29	-	8/20/2015	2.20	1	8/19/2015	BQL (0.014)	1		
4t3b	7025-30	-	8/20/2015	2.37	1	8/19/2015	BQL (0.016)	1		
4t3b	7025-30 Lab dup	-	-	-	-	8/19/2015	BQL (0.016) (RPD=NA)	1		
4t4	7025-31	-	8/20/2015	2.03	1	8/19/2015	BQL (0.015)	1		
4t4b	7025-32	-	8/20/2015	1.97	1	8/19/2015	BQL (0.015)	1		
B6c	7025-33	-	8/20/2015	ND	1	8/19/2015	0.111	1		
B7c	7025-34	-	8/20/2015	ND	1	8/19/2015	0.044	1		
C6c	7025-35	-	8/20/2015	0.233	1	8/19/2015	0.968	1		
AC3c	7025-36	-	8/21/2015	2.69	11	8/19/2015	1.79	1		
5t	7025-37	-	8/20/2015	4.77	1	8/19/2015	0.021	1		
5tb	7025-38	-	8/20/2015	5.14	1	8/19/2015	BQL (0.018)	1		
5tb	7025-38 Lab dup	-	8/20/2015	5.19 (RPD=0.968)	1	8/19/2015	BQL (0.018) (RPD=NA)	1		

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Sample Results

Analytes	Fluoride (F)	Analytes	ortho-Phosphate (as P)	
Codes	7782-41-4	Codes	70507	
Methods	RSKSOP-276/4	Methods	NRMRL-GWERD-05-0	
Unit	mg/L	Unit	mg/L	
MDL	** 0.031	MDL	0.002	
QL	** 0.200	QL	0.020	

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
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Laboratory: General Parameters

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Analyst: Lynda Callaway

Report Date: 08/21/15

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	8/19/2015	8/19/2015	-	-	-	BQL (0.016)	-	-			
MB	Nanopure Water Blank	8/19/2015	8/19/2015	-	-	-	BQL (0.015)	-	-			
MB	Nanopure Water Blank	8/20/2015	8/20/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/20/2015	8/20/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/21/2015	8/21/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	8/21/2015	8/21/2015	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	8/19/2015	-	-	-	1.57	1.57	100			
SS	ERA 64 Simple Nutrients	2/25/2015	8/19/2015	-	-	-	1.52	1.57	96.8			
SS	ERA 64 Simple Nutrients	2/25/2015	8/19/2015	-	-	-	1.55	1.57	98.7			
SS	ERA 64 Minerals	1/21/2015	8/20/2015	3.44	3.47	99.1	-	-	-			
SS	ERA 64 Minerals	1/21/2015	8/20/2015	3.43	3.47	98.8	-	-	-			
SS	ERA 64 Minerals	1/21/2015	8/21/2015	3.50	3.47	101	-	-	-			
CCC	Continuing Calibration Check Standard	5/14/2015	8/19/2015	-	-	-	0.020	0.020	100			
CCC	Continuing Calibration Check Standard	5/14/2015	8/19/2015	-	-	-	0.977	1.00	97.7			
CCC	Continuing Calibration Check Standard	5/14/2015	8/19/2015	-	-	-	0.501	0.500	100			
CCC	Continuing Calibration Check Standard	5/14/2015	8/19/2015	-	-	-	0.250	0.250	100			
CCC	Continuing Calibration Check Standard	5/14/2015	8/19/2015	-	-	-	2.04	2.00	102			
CCC	Continuing Calibration Check Standard	6/17/2015	8/20/2015	BQL (0.190)	0.200	95.0	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/20/2015	0.995	1.00	99.5	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/20/2015	2.05	2.00	103	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/20/2015	5.03	5.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/20/2015	9.64	10.0	96.4	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/21/2015	0.203	0.200	102	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	8/21/2015	5.07	5.00	101	-	-	-			
MS	1t1 Spike	8/19 & 8/20/2015	8/19 & 8/20/2015	3.86	1.91 (1.96)	99.5	1.03	0.048 (0.990)	99.2			
MS	3t3 Spike	8/19 & 8/20/2015	8/19 & 8/20/2015	6.58	4.77 (1.96)	92.3	0.985	0.030 (0.990)	96.5			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 10 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 1.96 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated and reported without the dilution factor applied.

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Laboratory: General Parameters

Tech. Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 08/21/15

Quality Control Data

Analytes	Fluoride (F)			ortho-phosphate as P					
Codes	7782-41-4			70507					
Methods	RSKSOP-276/4			NRMRL-GWERD-05-0					
Unit	mg/L			mg/L					
MDL	0.031			0.002					
QL	0.200			0.020					

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

Experiment description: 5 mg/L NaF 1.0 mM NaCl

Sample ID	mass sample (g)	Date/time F-added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)
1t1		8/11/2015 8:44		9.51	8/11/2015 10:49	2.1	1.91	0.048
1t1b		8/11/2015 8:45		9.92	8/11/2015 10:50	2.1	1.92	0.054
1t2		8/11/2015 8:53		9.39	8/11/2015 12:45	3.9	1.27	0.056
1t2b		8/11/2015 8:54		9.41	8/11/2015 12:46	3.9	1.27	0.041
1t3		8/11/2015 10:28		9.5	8/12/2015 10:44	24.3	0.526	BQL (0.019)
1t3b		8/11/2015 10:29		9.39	8/12/2015 10:45	24.3	0.702	BQL (0.018)
1t4		8/11/2015 10:36		9.88	8/13/2015 10:47	48.2	0.423	BQL (0.018)
1t4b		8/11/2015 10:36		9.76	8/13/2015 10:49	48.2	0.333	BQL (0.018)
2t1		8/11/2015 8:46		3.04	8/11/2015 10:51	2.1	ND	BQL (0.015)
2t1b		8/11/2015 8:47		2.91	8/11/2015 10:52	2.1	ND	BQL (0.015)
2t2		8/11/2015 8:55		2.9	8/11/2015 12:47	3.9	ND	BQL (0.015)
2t2b		8/11/2015 8:56		2.84	8/11/2015 12:49	3.9	ND	BQL (0.016)
2t3		8/11/2015 10:30		2.98	8/12/2015 10:46	24.3	ND	BQL (0.013)
2t3b		8/11/2015 10:31		2.91	8/12/2015 10:47	24.3	ND	BQL (0.017)
2t4		8/11/2015 10:37		3.13	8/13/2015 10:50	48.2	ND	BQL (0.015)
2t4b		8/11/2015 10:37		3.01	8/13/2015 10:51	48.2	ND	BQL (0.016)
3t1		8/11/2015 8:48		7.19	8/11/2015 10:53	2.1	5.15	0.023
3t1b		8/11/2015 8:49		7.15	8/11/2015 10:54	2.1	4.88	BQL (0.019)
3t2		8/11/2015 8:57		7.67	8/11/2015 12:50	3.9	4.92	0.052
3t2b		8/11/2015 8:58		7.28	8/11/2015 12:51	3.9	4.91	0.029
3t3		8/11/2015 10:32		7.24	8/12/2015 10:48	24.3	4.77	0.030
3t3b		8/11/2015 10:33		7.19	8/12/2015 10:49	24.3	4.79	0.022
3t4		8/11/2015 10:38		7.32	8/13/2015 10:55	48.3	4.61	0.042
3t4b		8/11/2015 10:38		7.28	8/13/2015 10:57	48.3	4.92	0.023
4t1		8/11/2015 8:50		9.3	8/11/2015 10:55	2.1	3.48	BQL (0.015)
4t1b		8/11/2015 8:51		9.3	8/11/2015 10:56	2.1	3.36	BQL (0.015)
4t2		8/11/2015 8:59		9.34	8/11/2015 12:53	3.9	3.55	BQL (0.015)
4t2b		8/11/2015 9:00		9.28	8/11/2015 12:54	3.9	3.50	BQL (0.016)
4t3		8/11/2015 10:34		9.36	8/12/2015 10:52	24.3	2.20	BQL (0.014)
4t3b		8/11/2015 10:35		9.3	8/12/2015 10:56	24.4	2.37	BQL (0.016)
4t4		8/11/2015 10:39		9.44	8/13/2015 10:50	48.2	2.03	BQL (0.015)
4t4b		8/11/2015 10:39		9.42	8/13/2015 10:59	48.3	1.97	BQL (0.015)
5t		NA			8/13/2015 11:04		4.77	0.021
5tb		NA			8/13/2015 11:05		5.14	BQL (0.018)
5tb		NA			8/13/2015 11:05		**5.19 (RPD=0.968)**	**. (0.018) (RPD=NA)**

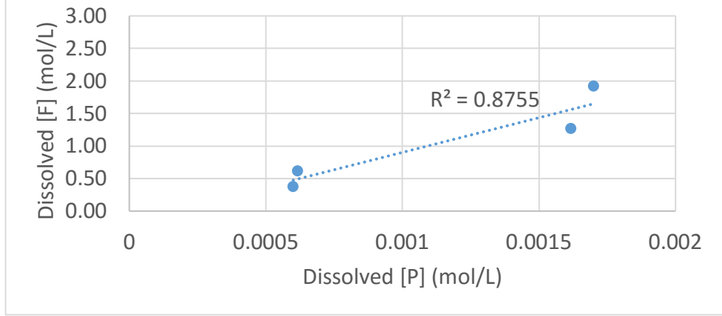
Hydroxyapatite batch tests, pH free drift

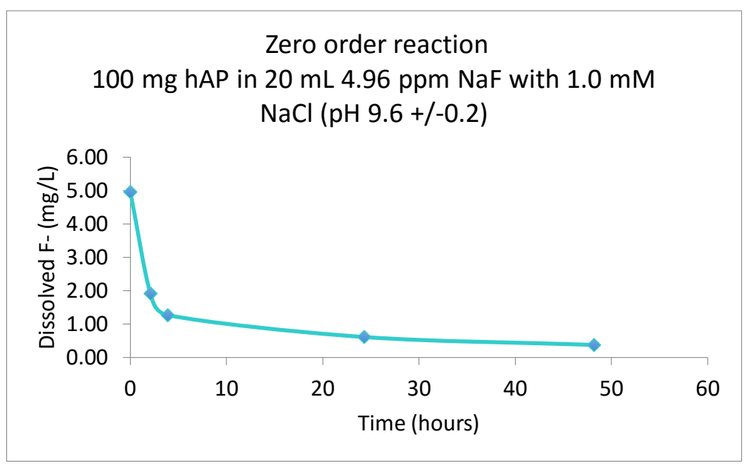
Sample Description: Hydroxyapatite synthesized 200 nm (manufacturer)

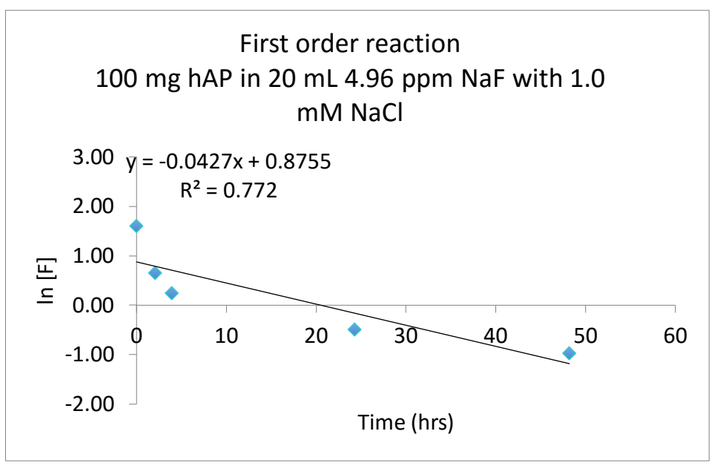
Sample ID	Date/time F- added	date/time filtered	pH	duration of reaction (hours)	Fluoride concentration (copied from raw data)		phospate (copied from raw data)	Phospate values
5t	NA	8/13/2015 11:04		0	4.77		0.021	0.021
5tb	NA	8/13/2015 11:05		0	5.14		BQL (0.018)	0.018
1t1	8/11/2015 8:44	8/11/2015 10:49	9.51	2.1	1.91		0.048	0.048
1t1b	8/11/2015 8:45	8/11/2015 10:50	9.92	2.1	1.92		0.054	0.054
1t2	8/11/2015 8:53	8/11/2015 12:45	9.39	3.9	1.27		0.056	0.056
1t2b	8/11/2015 8:54	8/11/2015 12:46	9.41	3.9	1.27		0.041	0.041
1t3	8/11/2015 10:28	8/12/2015 10:44	9.5	24.3	0.526		BQL (0.019)	0.019
1t3b	8/11/2015 10:29	8/12/2015 10:45	9.39	24.3	0.702		BQL (0.018)	0.018
1t4	8/11/2015 10:36	8/13/2015 10:47	9.88	48.2	0.423		BQL (0.018)	0.018
1t4b	8/11/2015 10:36	8/13/2015 10:49	9.76	48.2	0.333		BQL (0.018)	0.018
5tb	NA	8/13/2015 11:05			**5.19 (RPD=0.968)**		**BQL (0.018) (RPD=NA)**	

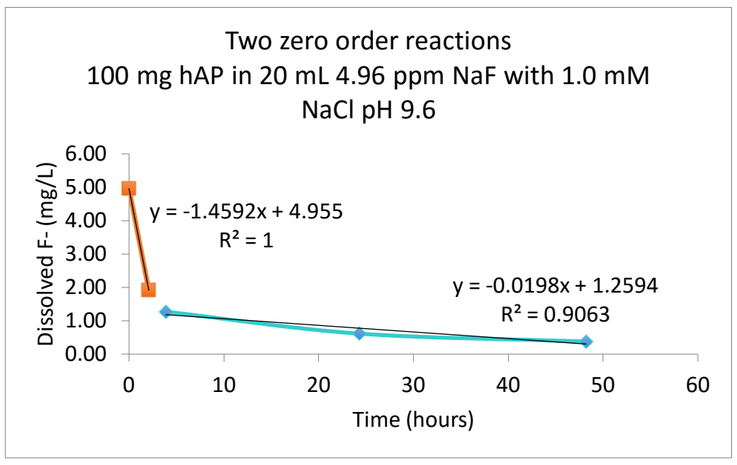
Average of duplicates		mol/L F		mol/L P	Linearized Data ln[F] First order	1/[F] second order
5t	0	4.96	0.26	0.0195	1.60	0.20
1t1	2.1	1.915	0.10	0.051	0.0017	0.65	0.52
1t2	3.9	1.27	0.07	0.0485	0.00161667	0.24	0.79
1t3	24.3	0.614	0.03	0.0185	0.00061667	-0.49	1.63
1t4	48.2	0.378	0.02	0.018	0.0006	-0.97	2.65
					0.00065		

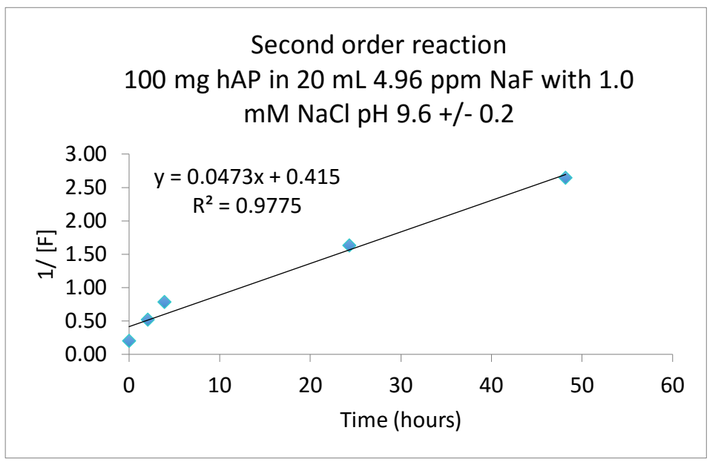
pH average	STDEV
9.6	0.21











Ferrihydrite batch tests, pH free drift

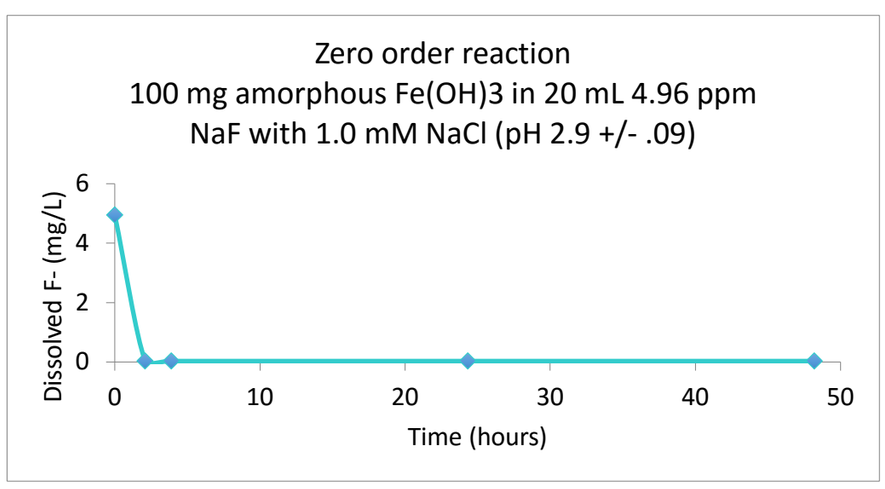
Sample Description: Dr. Su Synthesized

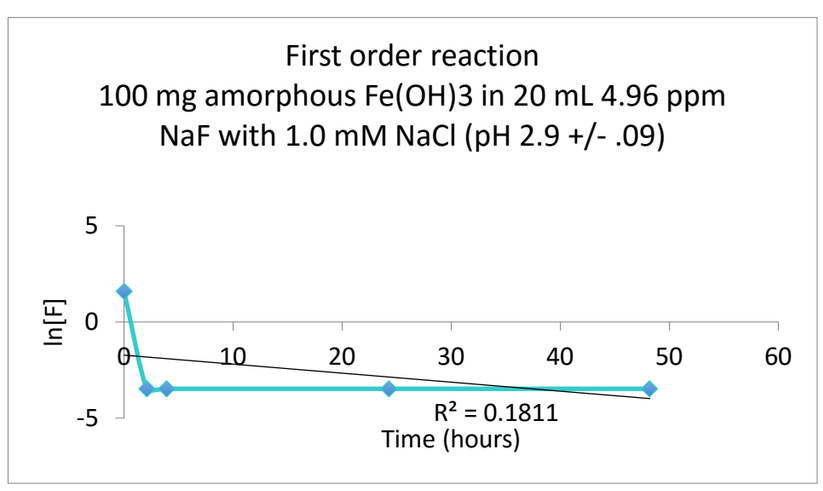
Sample ID	Date/time F- added	date/time filtered	pH	duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)	phosphate values
2t1	8/11/2015 8:46	8/11/2015 10:51	3.04	2.1	ND	BQL (0.015)	0.015
2t1b	8/11/2015 8:47	8/11/2015 10:52	2.91	2.1	ND	BQL (0.015)	0.015
2t2	8/11/2015 8:55	8/11/2015 12:47	2.9	3.9	ND	BQL (0.015)	0.015
2t2b	8/11/2015 8:56	8/11/2015 12:49	2.84	3.9	ND	BQL (0.016)	0.016
2t3	8/11/2015 10:30	8/12/2015 10:46	2.98	24.3	ND	BQL (0.013)	0.013
2t3b	8/11/2015 10:31	8/12/2015 10:47	2.91	24.3	ND	BQL (0.017)	0.017
2t4	8/11/2015 10:37	8/13/2015 10:50	3.13	48.2	ND	BQL (0.015)	0.015
2t4b	8/11/2015 10:37	8/13/2015 10:51	3.01	48.2	ND	BQL (0.016)	0.016
5t	NA	8/13/2015 11:04			4.77	0.021	0.021
5tb	NA	8/13/2015 11:05			5.14	BQL (0.018)	0.018

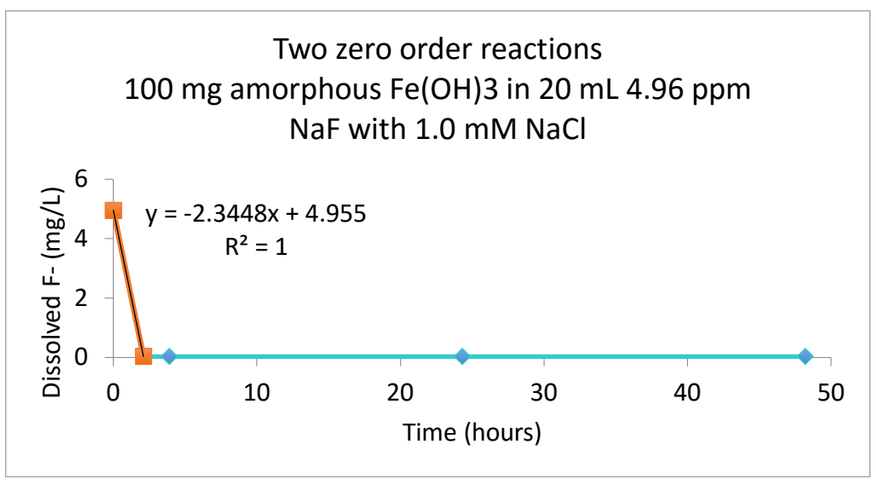
Average of duplicates

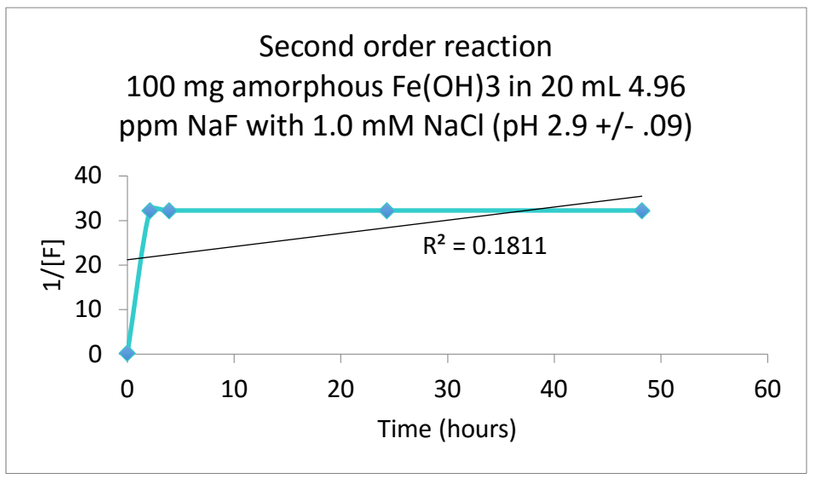
						Linearized Data	
						ln[F] First orde	1/[F] second order
5t				0	4.96	0.015	1.60039717 0.20181635
2t1				2.1	0.031	0.0155	-3.47376807 32.2580645
2t2				3.9	0.031	0.015	-3.47376807 32.2580645
2t3				24.3	0.031	0.0155	-3.47376807 32.2580645
2t4				48.2	0.031	0.0195	-3.47376807 32.2580645

pH average	StDEV
2.965	0.08732125









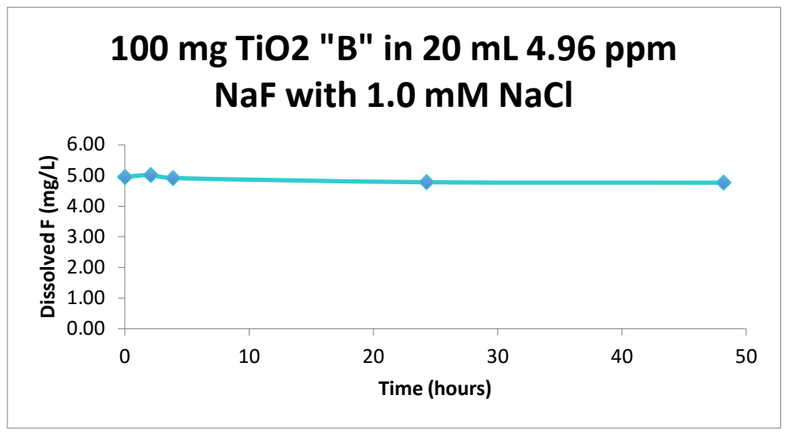
Sample Description: TiO2 (anatase) 10 nm 120 m2/g "B"

Sample ID	Date/time F-added	date/time filtered	pH	duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)	
3t1	8/11/2015 8:48	8/11/2015 10:53	7.19	2.1	5.15	0.023	0.023
3t1b	8/11/2015 8:49	8/11/2015 10:54	7.15	2.1	4.88	BQL (0.019)	0.019
3t2	8/11/2015 8:57	8/11/2015 12:50	7.67	3.9	4.92	0.052	0.052
3t2b	8/11/2015 8:58	8/11/2015 12:51	7.28	3.9	4.91	0.029	0.029
3t3	8/11/2015 10:32	8/12/2015 10:48	7.24	24.3	4.77	0.030	0.03
3t3b	8/11/2015 10:33	8/12/2015 10:49	7.19	24.3	4.79	0.022	0.022
3t4	8/11/2015 10:38	8/13/2015 10:55	7.32	48.3	4.61	0.042	0.042
3t4b	8/11/2015 10:38	8/13/2015 10:57	7.28	48.3	4.92	0.023	0.023
5t	NA	8/13/2015 11:04			4.77	0.021	0.021
5tb	NA	8/13/2015 11:05			5.14	BQL (0.018)	0.018

Average of duplicates

5t	0	4.96	0.0195
3t1	2.1	5.015	0.021
3t2	3.9	4.92	0.0405
3t3	24.3	4.78	0.026
3t4	48.2	4.77	0.0325

pH average	StDEV
7.3	0.2



Brucite Batch Tests pH free drift

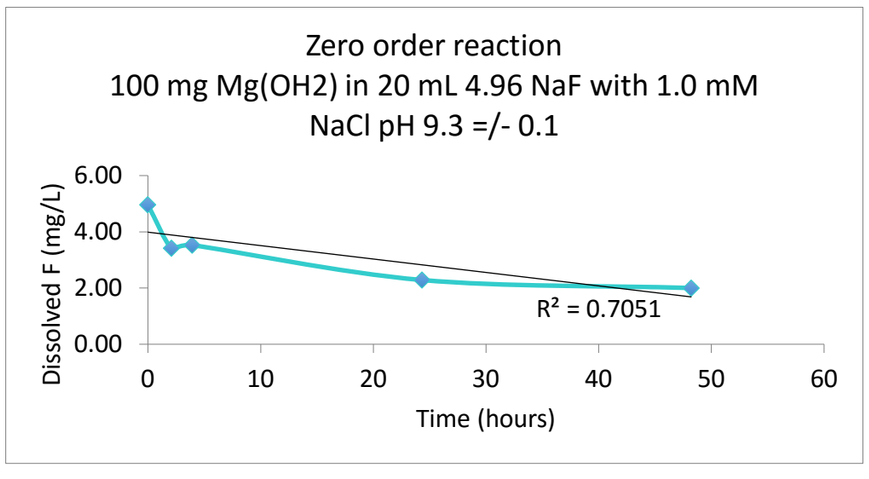
Sample description: Magnesium Hydroxide nanoparticle

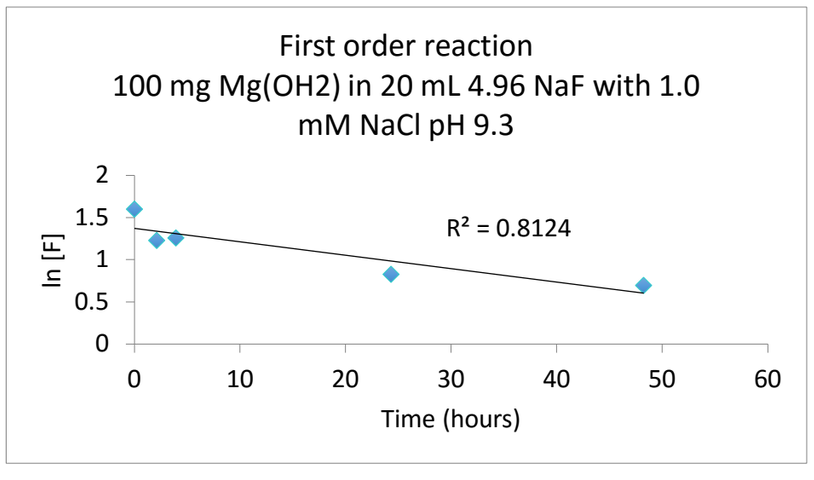
Sample ID	Date/time F-added	date/time filtered		duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)	phosphate values
4t1	8/11/2015 8:50	8/11/2015 10:55	9.3	2.1	3.48	BQL (0.015)	0.015
4t1b	8/11/2015 8:51	8/11/2015 10:56	9.3	2.1	3.36	BQL (0.015)	0.015
4t2	8/11/2015 8:59	8/11/2015 12:53	9.34	3.9	3.55	BQL (0.015)	0.015
4t2b	8/11/2015 9:00	8/11/2015 12:54	9.28	3.9	3.50	BQL (0.016)	0.016
4t3	8/11/2015 10:34	8/12/2015 10:52	9.36	24.3	2.20	BQL (0.014)	0.014
4t3b	8/11/2015 10:35	8/12/2015 10:56	9.3	24.4	2.37	BQL (0.016)	0.016
4t4	8/11/2015 10:39	8/13/2015 10:50	9.44	48.2	2.03	BQL (0.015)	0.015
4t4b	8/11/2015 10:39	8/13/2015 10:59	9.42	48.3	1.97	BQL (0.015)	0.015
5t	NA	8/13/2015 11:04			4.77	0.021	0.021
5tb	NA	8/13/2015 11:05			5.14	BQL (0.018)	0.018
5tb	NA	8/13/2015 11:05			**5.19 (RPD=0.9(**	**(0.018) (RPD=NA)**	

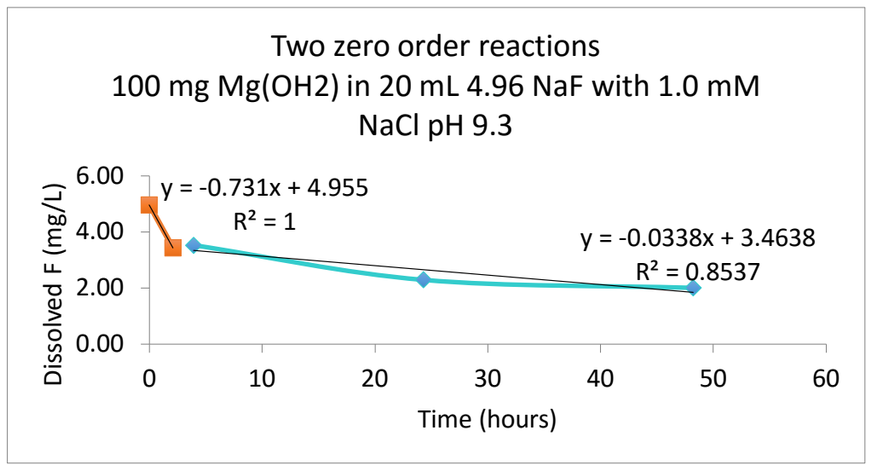
Average of duplicates

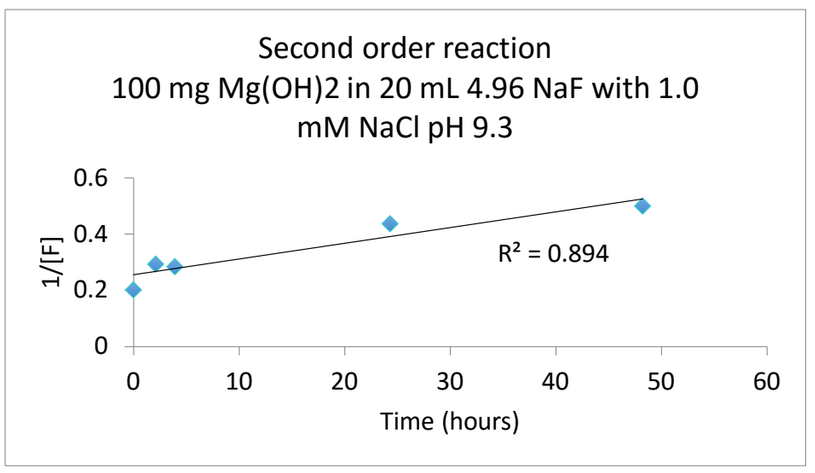
					Linearized Data	
					ln[F] First orde	1/[F] second order
5t	0	4.96		0.0195	1.60039717	0.20181635
4t1	2.1	3.42		0.015	1.22964055	0.29239766
4t2	3.9	3.53		0.0155	1.25988044	0.28368794
4t3	24.3	2.29		0.015	0.82636602	0.43763676
4t4	48.2	2.00		0.015	0.69314718	0.5

pH average	StDEV
9.3	0.1



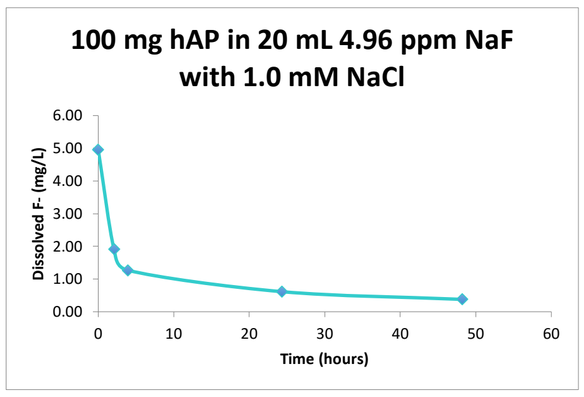


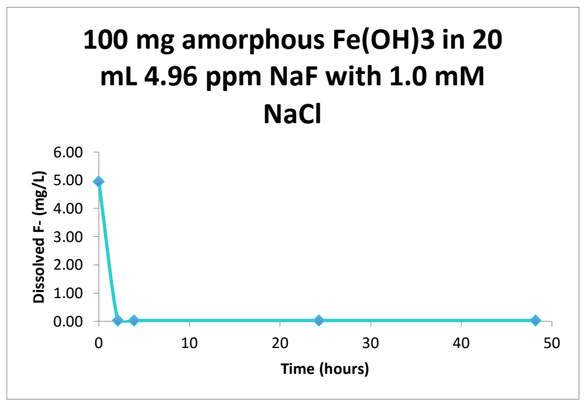


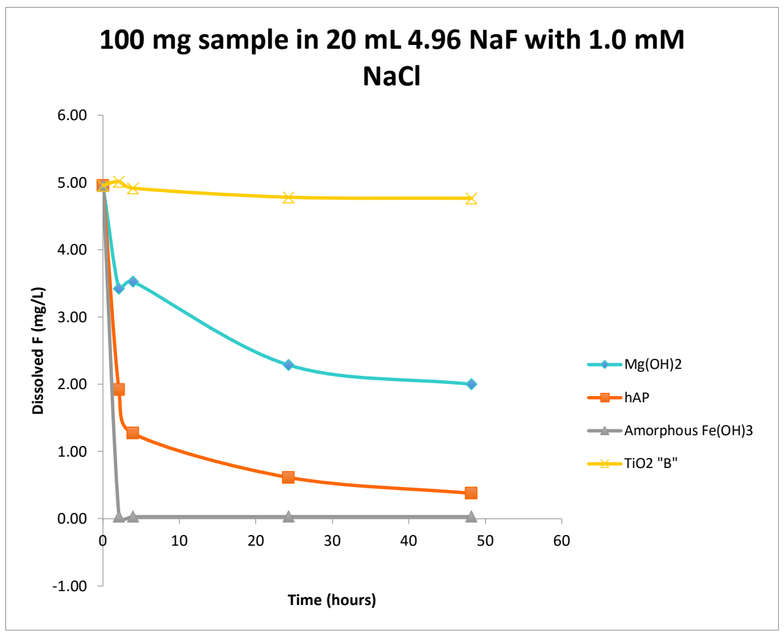


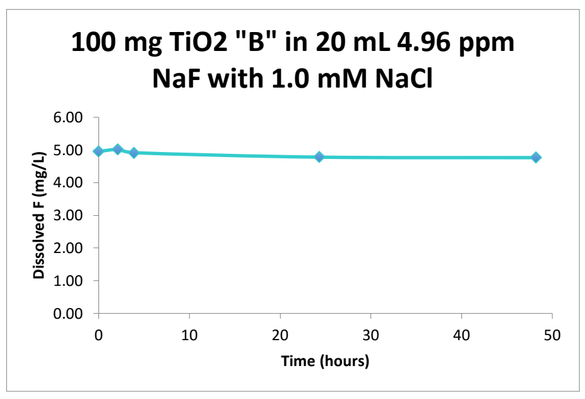
Experiment description pH experiment duplicate sampels re-run 3

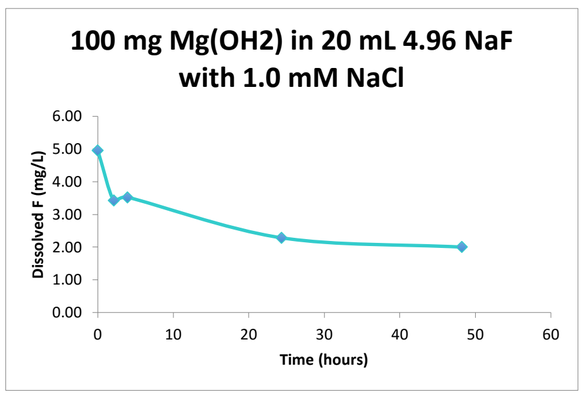
Sample ID (soil)	pH	F- (mg/L)	P (mg/L)
B6c	5.93	ND	0.111
B7c	6.35	ND	0.044
C6c	5.73	0.233	0.968
AC3c	3.08	2.69	1.79


100 mg hAP in 20 mL 4.96 ppm NaF with 1.0 mM NaCl
Dissolved F- (mg/L)
Time (hours)


100 mg amorphous Fe(OH)3 in 20 mL 4.96 ppm NaF with 1.0 mM NaCl
Dissolved F- (mg/L)
Time (hours)


100 mg sample in 20 mL 4.96 NaF with 1.0 mM NaCl
Dissolved F (mg/L)
Time (hours)
Mg(OH)2
hAP
Amorphous Fe(OH)3
TiO2 "B"


100 mg TiO2 "B" in 20 mL 4.96 ppm NaF with 1.0 mM NaCl
Dissolved F (mg/L)
Time (hours)


100 mg Mg(OH2) in 20 mL 4.96 NaF with 1.0 mM NaCl
Dissolved F (mg/L)
Time (hours)

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 15-LC35

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 9/1/2015

Technical Directive No.: EPAGP530 Rev. 1
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure
Date Collected: unknown
Date Received: 9/1/2015
Date Analyzed: 9/1/2015
No. Samples Analyzed: 34

Sample Set No.: 7027
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: Dilution as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 09/01/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.031	**MDL**	** 0.002		
QL	0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
3Ct1	7027-1	-	9/1/2015	5.32	1	9/1/2015	0.098	1		
3Ct1b	7027-2	-	9/1/2015	5.47	1	9/1/2015	0.101	1		
3Ct2	7027-3	-	9/1/2015	5.52	1	9/1/2015	0.156	1		
3Ct2b	7027-4	-	9/1/2015	5.63	1	9/1/2015	0.147	1		
3Ct3	7027-5	-	9/1/2015	5.29	1	9/1/2015	0.175	1		
3Ct3b	7027-6	-	9/1/2015	5.54	1	9/1/2015	0.328	1		
3Ct4	7027-7	-	9/1/2015	5.55	1	9/1/2015	0.459	1		
3Ct4b	7027-8	-	9/1/2015	5.40	1	9/1/2015	0.400	1		
3Dt1	7027-9	-	9/1/2015	5.08	1	9/1/2015	0.139	1		
3Dt1b	7027-10	-	9/1/2015	5.15	1	9/1/2015	0.133	1		
3Dt1b	7027-10 Lab dup	-	9/1/2015	5.08 (RPD=1.37)	1	9/1/2015	0.141 (RPD=5.84)	1		
3Dt2	7027-11	-	9/1/2015	5.06	1	9/1/2015	0.159	1		
3Dt2b	7027-12	-	9/1/2015	5.15	1	9/1/2015	0.134	1		
3Dt3	7027-13	-	9/1/2015	5.07	1	9/1/2015	0.178	1		
3Dt3b	7027-14	-	9/1/2015	5.08	1	9/1/2015	0.166	1		
3Dt4	7027-15	-	9/1/2015	4.58	1	9/1/2015	0.176	1		
3Dt4b	7027-16	-	9/1/2015	4.96	1	9/1/2015	0.190	1		
3Et1	7027-17	-	9/1/2015	5.54	1	9/1/2015	14.7	11		
3Et1b	7027-18	-	9/1/2015	5.38	1	9/1/2015	12.8	11		
3Et2	7027-19	-	9/1/2015	5.63	1	9/1/2015	15.0	11		
3Et2b	7027-20	-	9/1/2015	5.64	1	9/1/2015	14.5	11		
3Et2b	7027-20 Lab dup	-	9/1/2015	5.78 (RPD=2.45)	1	9/1/2015	14.9 (RPD=2.72)	11		
3Et3	7027-21	-	9/1/2015	5.90	1	9/1/2015	15.6	11		
3Et3b	7027-22	-	9/1/2015	5.68	1	9/1/2015	15.8	11		
3Et4	7027-23	-	9/1/2015	5.81	1	9/1/2015	15.5	11		
3Et4b	7027-24	-	9/1/2015	5.81	1	9/1/2015	16.2	11		
3at1	7027-25	-	9/1/2015	4.74	1	9/1/2015	BQL (0.004)	1		
3at1b	7027-26	-	9/1/2015	4.93	1	9/1/2015	BQL (0.019)	1		
3at2	7027-27	-	9/1/2015	4.63	1	9/1/2015	BQL (0.015)	1		
3at2b	7027-28	-	9/1/2015	4.64	1	9/1/2015	BQL (0.016)	1		
3at3	7027-29	-	9/1/2015	4.14	1	9/1/2015	BQL (0.003)	1		

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 09/01/15

Sample Results

Analytes	Fluoride (F)			**Analytes**	ortho-Phosphate (as P)				
Codes	7782-41-4			**Codes**	70507				
Methods	RSKSOP-276/4			**Methods**	NRMRL-GWERD-05-0				
Unit	mg/L			**Unit**	mg/L				
MDL	0.031			**MDL**	** 0.002				
QL	0.200			**QL**	** 0.020				
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**	**Data**	**DF**
3at3b	7027-30	-	9/1/2015	4.43	1	9/1/2015	BQL (0.014)	1		
3at3b	7027-30 Lab dup	-	9/1/2015	4.34 (RPD=2.05)	1	9/1/2015	BQL (0.014) (RPD=NA)	1		
3at4	7027-31	-	9/1/2015	4.92	1	9/1/2015	BQL (0.017)	1		
3at4b	7027-32	-	9/1/2015	4.79	1	9/1/2015	BQL (0.015)	1		
3Ft	7027-33	-	9/1/2015	5.47	1	9/1/2015	BQL (0.016)	1		
3Ftb	7027-34	-	9/1/2015	5.32	1	9/1/2015	BQL (0.014)	1		

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 11/4/2014 for fluoride. The current MDLs are 0.002 mg/L and 0.031 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP530 Rev. 1

Analyst: Lynda Callaway

Report Date: 09/01/15

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.031	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	9/1/2015	9/1/2015	-	-	-	BQL (0.015)	-	-			
MB	Nanopure Water Blank	9/1/2015	9/1/2015	-	-	-	BQL (0.014)	-	-			
MB	Nanopure Water Blank	9/1/2015	9/1/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	9/1/2015	9/1/2015	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	9/1/2015	-	-	-	1.54	1.57	98.1			
SS	ERA 64 Simple Nutrients	2/25/2015	9/1/2015	-	-	-	1.55	1.57	98.7			
SS	ERA 64 Simple Nutrients	2/25/2015	9/1/2015	-	-	-	1.55	1.57	98.7			
SS	ERA 64 Minerals	1/21/2015	9/1/2015	3.57	3.47	103	-	-	-			
SS	ERA 64 Minerals	1/21/2015	9/1/2015	3.58	3.47	103	-	-	-			
CCC	Continuing Calibration Check Standard	5/14/2015	9/1/2015	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	5/14/2015	9/1/2015	-	-	-	1.04	1.00	104			
CCC	Continuing Calibration Check Standard	5/14/2015	9/1/2015	-	-	-	0.517	0.500	103			
CCC	Continuing Calibration Check Standard	5/14/2015	9/1/2015	-	-	-	0.247	0.250	98.8			
CCC	Continuing Calibration Check Standard	5/14/2015	9/1/2015	-	-	-	2.03	2.00	102			
CCC	Continuing Calibration Check Standard	6/17/2015	9/1/2015	BQL (0.193)	0.200	96.5	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	9/1/2015	1.05	1.00	105	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	9/1/2015	2.05	2.00	103	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	9/1/2015	4.92	5.00	98.4	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	9/1/2015	9.90	10.0	99.0	-	-	-			
MS	3Ct1 Spike	9/1/2015	9/1/2015	9.42	5.32 (3.85)	106	1.04	0.098 (0.990)	95.2			
MS	3Et3 Spike	9/1/2015	9/1/2015	9.87	5.90 (3.85)	103	* 2.42	* 1.42 (0.901)	111			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration. * Matrix spikes were calculated and reported without the dilution factor applied.

Notes:

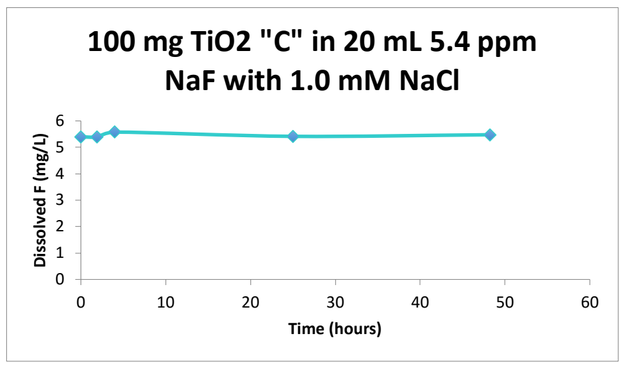
1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

Experiment specifics: TiO2 and FeO3 alpha in 5 mg/L fluoride and 1mM NaCl

Sample ID	mass of cap + tube	mass sample+cap+soln	mass sample (g)	volume F-	Fluoride concentration (copied from raw data)	sorbed F (mg/l)	x/m	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Fluoride concentration values only	phospate (copied from raw data)
3Ct1	16.299	36.133	0.1	19.7	5.32	0.075	0.01	8/12/2015 11:01		7.67	8/12/2015 12:55	1.9		0.098
3Ct1b	16.279	36.069	0.1003	19.7	5.47	-0.075	-0.01	8/12/2015 11:01		7.5	8/12/2015 13:01	2.0		0.101
3Ct2	16.218	36.032	0.1	19.7	5.52	-0.125	-0.02	8/12/2015 11:07		6.32	8/12/2015 15:05	4.0		0.156
3Ct2b	16.303	36.063	0.1002	19.7	5.63	-0.235	-0.05	8/12/2015 11:07		6.27	8/12/2015 15:06	4.0		0.147
3Ct3	16.333	35.975	0.1	19.5	5.29	0.105	0.02	8/12/2015 11:17		7.1	8/13/2015 12:17	25.0		0.175
3Ct3b	16.04	35.799	0.1005	19.7	5.54	-0.145	-0.03	8/12/2015 11:17		6.74	8/13/2015 12:18	25.0		0.328
3Ct4	16.195	35.901	0.1005	19.6	5.55	-0.155	-0.03	8/12/2015 11:18		7.39	8/14/2015 11:30	48.2		0.459
3Ct4b	16.219	35.963	0.1009	19.6	5.40	-0.005	0.00	8/12/2015 11:18		7.15	8/14/2015 11:33	48.2		0.400
3Dt1	16.387	36.171	0.1007	19.7	5.08	0.315	0.06	8/12/2015 11:01		6.35	8/12/2015 13:02	2.0		0.139
3Dt1b	16.292	36.082	0.1008	19.7	5.15	0.245	0.05	8/12/2015 11:02		6.07	8/12/2015 13:03	2.0		0.133
3Dt2	16.314	36.013	0.1006	19.6	5.06	0.335	0.07	8/12/2015 11:08		5.15	8/12/2015 15:08	4.0		0.159
3Dt2b	15.863	35.281	0.1	19.3	5.15	0.245	0.05	8/12/2015 11:09		5.08	8/12/2015 15:09	4.0		0.134
3Dt3	16.259	36.019	0.1002	19.7	5.07	0.325	0.06	8/12/2015 11:19		5.78	8/13/2015 12:19	25.0		0.178
3Dt3b	16.152	35.793	0.1007	19.5	5.08	0.315	0.06	8/12/2015 11:19		5.72	8/13/2015 12:20	25.0		0.166
3Dt4	16.323	35.971	0.1002	19.5	4.58	0.815	0.16	8/12/2015 11:23		6.15	8/14/2015 11:34	48.2		0.176
3Dt4b	16.169	35.815	0.1005	19.5	4.96	0.435	0.08	8/12/2015 11:24		6.02	8/14/2015 11:35	48.2		0.190
3Et1	16.196	35.942	0.1002	19.6	5.54	-0.145	-0.03	8/12/2015 11:03		6.32	8/12/2015 13:07	2.1		14.7
3Et1b	16.401	36.117	0.1	19.6	5.38	0.015	0.00	8/12/2015 11:04		6.29	8/12/2015 13:08	2.1		12.8
3Et2	16.486	36.178	0.1003	19.6	5.63	-0.235	-0.05	8/12/2015 11:10		6.01	8/12/2015 15:10	4.0		15.0
3Et2b	16.207	35.927	0.1001	19.6	5.64	-0.245	-0.05	8/12/2015 11:11		6.03	8/12/2015 15:11	4.0		14.5
3Et3	16.279	35.987	0.1002	19.6	5.90	-0.505	-0.10	8/12/2015 11:20		6.28	8/13/2015 12:21	25.0		15.6
3Et3b	16.195	35.901	0.1008	19.6	5.68	-0.285	-0.06	8/12/2015 11:20		6.29	8/13/2015 12:22	25.0		15.8
3Et4	16.274	35.973	0.1002	19.6	5.81	-0.415	-0.08	8/12/2015 11:24		6.54	8/14/2015 11:36	48.2		15.5
3Et4b	16.085	35.781	0.1005	19.6	5.81	-0.415	-0.08	8/12/2015 11:25		6.51	8/14/2015 11:38	48.2		16.2
3at1	16.156	35.945	0.1002	19.7	4.74	0.655	0.13	8/12/2015 11:05		5.35	8/12/2015 13:09	2.1		BQL (0.004)
3at1b	16.314	36.031	0.1008	19.6	4.93	0.465	0.09	8/12/2015 11:05		5.06	8/12/2015 13:10	2.1		BQL (0.019)
3at2	16.387	36.091	0.1007	19.6	4.63	0.765	0.15	8/12/2015 11:11		4.99	8/12/2015 15:12	4.0		BQL (0.015)
3at2b	16.432	36.133	0.1005	19.6	4.64	0.755	0.15	8/12/2015 11:12		4.82	8/12/2015 15:13	4.0		BQL (0.016)
3at3	16.302	36.024	0.1	19.6	4.14	1.255	0.25	8/12/2015 11:22		5.48	8/13/2015 12:23	25.0		BQL (0.003)
3at3b	16.301	36.132	0.1006	19.7	4.43	0.965	0.19	8/12/2015 11:22		5.37	8/13/2015 12:24	25.0		BQL (0.014)
3at4	16.373	36.142	0.1	19.7	4.92	0.475	0.09	8/12/2015 11:26		5.66	8/14/2015 11:39	48.2		BQL (0.017)
3at4b	16.307	34.778	0.1003	18.4	4.79	0.605	0.11	8/12/2015 11:27		5.52	8/14/2015 11:40	48.2		BQL (0.015)
3Ft					5.47			NA			8/14/2015 11:44			BQL (0.016)
3Ftb					5.32			NA			8/14/2015 11:44			BQL (0.014)
					5.395									

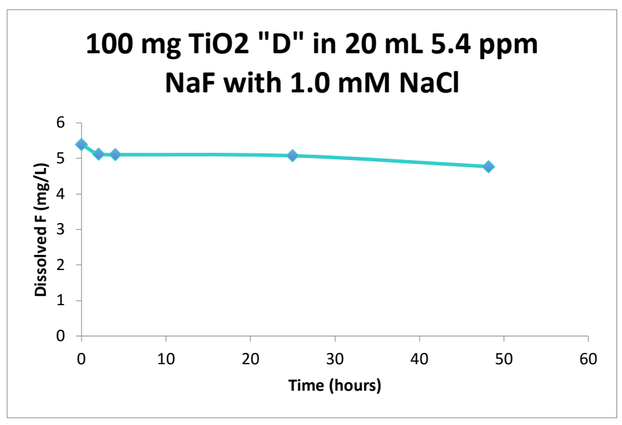
TiO2 (rutile) 10x40 nm 150 m2/g "C"

Sample ID	Date/time F- added	date/time filtered	mass sample (g)	volume F-	Fluoride concentration (copied from raw data)	sorbed F (mg/l)	x/m	pH	duration of reaction (hours)	concentration (copied from raw data)	phospate (copied from raw data)
3Ct1	##########	##########	0.10	19.73	5.32	0.07	0.01	7.67	1.9	5.32	0.098
3Ct1b	##########	##########	0.10	19.69	5.47	-0.08	-0.01	7.5	2.0	5.47	0.101
3Ct2	##########	##########	0.10	19.71	5.52	-0.13	-0.02	6.32	4.0	5.52	0.156
3Ct2b	##########	##########	0.10	19.66	5.63	-0.24	-0.05	6.27	4.0	5.63	0.147
3Ct3	##########	##########	0.10	19.54	5.29	0.11	0.02	7.1	25.0	5.29	0.175
3Ct3b	##########	##########	0.10	19.66	5.54	-0.15	-0.03	6.74	25.0	5.54	0.328
3Ct4	##########	##########	0.10	19.61	5.55	-0.16	-0.03	7.39	48.2	5.55	0.459
3Ct4b	##########	##########	0.10	19.64	5.40	-0.01	0.00	7.15	48.2	5.40	0.400
3Ft	NA	##########								5.47	BQL (0.016)
3Ftb	NA	##########								5.32	BQL (0.014)
					average of duplicates						
3Ft									0	5.395	0.015
3Ct1			0.10	19.71	5.40	0.00	0.00	7.59	1.9	5.395	0.0995
3Ct2			0.10	19.69	5.58	-0.18	-0.04	6.30	4	5.58	0.152
3Ct3			0.10	19.60	5.42	-0.02	0.00	6.92	25	5.42	0.2515
3Ct4			0.10	19.62	5.48	-0.08	-0.02	7.27	48.2	5.48	0.4295
					STDEV						
3Ct1			0.0001	0.02	0.07	0.07	0.01	0.09	0.05	0.07	0.00
3Ct2			0.0001	0.03	0.06	0.06	0.01	0.03	0.01	0.06	0.00
3Ct3			0.0003	0.06	0.13	0.13	0.02	0.18	0.01	0.13	0.08
3Ct4			0.0002	0.02	0.07	0.07	0.01	0.12	0.02	0.07	0.03



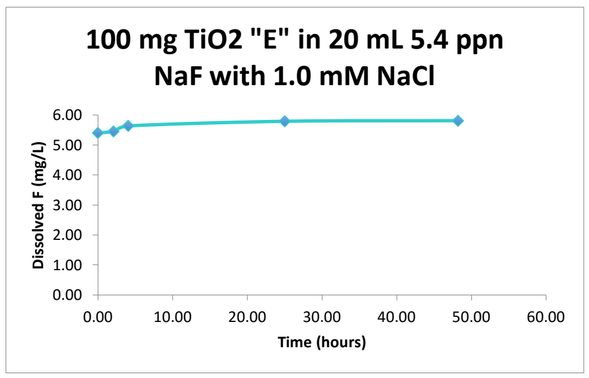
TiO2 (rutile) 30-40 nm 30 m2/g "D)

Sample ID	Date/time F- added	date/time filtered	mass sample (g)	volume F-	Fluoride concentration (copied from raw data)	sorbed F (mg/l)	x/m	pH	duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)
3Dt1	8/12/2015 11:01	8/12/2015 13:02	0.10	19.68	5.08	0.32	0.06	6.35	2.0	5.08	0.139
3Dt1b	8/12/2015 11:02	8/12/2015 13:03	0.10	19.69	5.15	0.24	0.05	6.07	2.0	5.15	0.133
3Dt2	8/12/2015 11:08	8/12/2015 15:08	0.10	19.60	5.06	0.34	0.07	5.15	4.0	5.06	0.159
3Dt2b	8/12/2015 11:09	8/12/2015 15:09	0.10	19.32	5.15	0.24	0.05	5.08	4.0	5.15	0.134
3Dt3	8/12/2015 11:19	8/13/2015 12:19	0.10	19.66	5.07	0.32	0.06	5.78	25.0	5.07	0.178
3Dt3b	8/12/2015 11:19	8/13/2015 12:20	0.10	19.54	5.08	0.32	0.06	5.72	25.0	5.08	0.166
3Dt4	8/12/2015 11:23	8/14/2015 11:34	0.10	19.55	4.58	0.82	0.16	6.15	48.2	4.58	0.176
3Dt4b	8/12/2015 11:24	8/14/2015 11:35	0.10	19.55	4.96	0.44	0.08	6.02	48.2	4.96	0.190
3Ft	NA	8/14/2015 11:44								5.47	BQL (0.016)
3Ftb	NA	8/14/2015 11:44								5.32	BQL (0.014)
					average of duplicates						
3Ft									0	5.395	0.015
3Dt1			0.10	19.69	5.12	0.28	0.05	6.21	2.02	5.12	0.136
3Dt2			0.10	19.46	5.11	0.29	0.06	5.12	4.00	5.11	0.147
3Dt3			0.10	19.60	5.08	0.32	0.06	5.75	25.01	5.08	0.172
3Dt4			0.10	19.55	4.77	0.63	0.12	6.09	48.18	4.77	0.183
					STDEV						
3Dt1			5E-05	0.00305	0.035	0.035	0.00685757	0.14	8.73115E-11	0.035	0.003
3Dt2			0.0003	0.14	0.045	0.045	0.00896636	0.035	8.73115E-11	0.045	0.0125
3Dt3			0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3Dt4			0.00015	0.0016	0.19	0.19	0.03720122	0.065	8.73115E-11	0.19	0.007



TiO2 (anatase) 50 nm APS 160 m2/g "E"

Sample ID	Date/time F-added	date/time filtered	mass sample (g)	volume F-	Fluoride concentration (copied from raw data)	sorbed F (mg/l)	x/m	pH	duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)
3Et1	8/12/2015 11:03	8/12/2015 13:07	0.10	19.65	5.54	-0.15	-0.03	6.32	2.1	5.54	14.7
3Et1b	8/12/2015 11:04	8/12/2015 13:08	0.10	19.62	5.38	0.01	0.00	6.29	2.1	5.38	12.8
3Et2	8/12/2015 11:10	8/12/2015 15:10	0.10	19.59	5.63	-0.24	-0.05	6.01	4.0	5.63	15.0
3Et2b	8/12/2015 11:11	8/12/2015 15:11	0.10	19.62	5.64	-0.25	-0.05	6.03	4.0	5.64	14.5
3Et3	8/12/2015 11:20	8/13/2015 12:21	0.10	19.61	5.90	-0.51	-0.10	6.28	25.0	5.90	15.6
3Et3b	8/12/2015 11:20	8/13/2015 12:22	0.10	19.61	5.68	-0.29	-0.06	6.29	25.0	5.68	15.8
3Et4	8/12/2015 11:24	8/14/2015 11:36	0.10	19.60	5.81	-0.42	-0.08	6.54	48.2	5.81	15.5
3Et4b	8/12/2015 11:25	8/14/2015 11:38	0.10	19.60	5.81	-0.42	-0.08	6.51	48.2	5.81	16.2
3Ft	NA	8/14/2015 11:44								5.47	BQL (0.016)
3Ftb	NA	8/14/2015 11:44								5.32	BQL (0.014)
					average of Duplicates						
3Ft									0.00	5.40	0.015
3Et1			0.10	19.63	5.46	-0.07	-0.01	6.31	2.07	5.46	13.8
3Et2			0.10	19.61	5.64	-0.24	-0.05	6.02	4.00	5.64	14.8
3Et3			0.10	19.61	5.79	-0.40	-0.08	6.29	25.03	5.79	15.7
3Et4			0.10	19.60	5.81	-0.42	-0.08	6.53	48.21	5.81	15.85
					STDEV						
3Et1			0.0001	0.01	0.08	0.08	0.02	0.02	0.00	0.08	0.95
3Et2			0.0001	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.25
3Et3			0.0003	0.00	0.11	0.11	0.02	0.00	0.01	0.11	0.10
3Et4			0.0002	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.35



FeO3-alpha 20-50 nm 50 m2/g

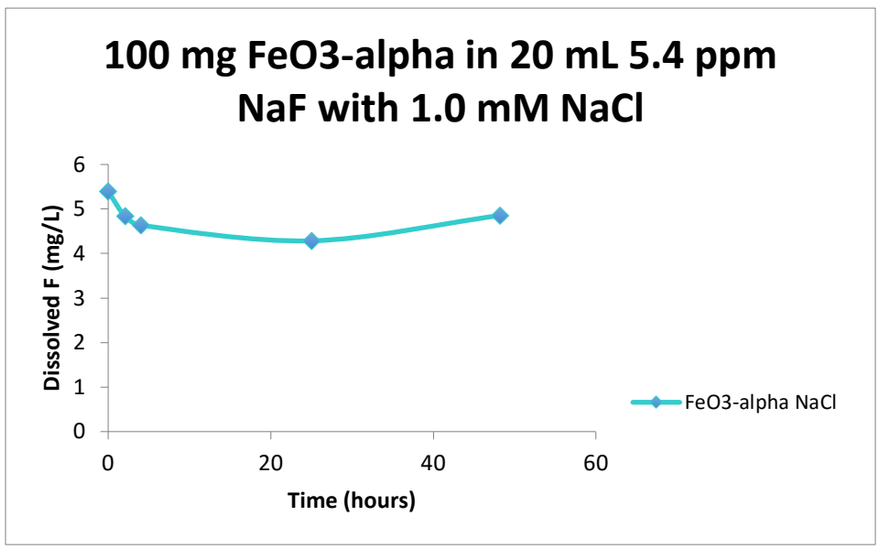
Sample ID	Date/time F-added	date/time filtered	mass sample (g)	volume F-	Fluoride concentration (copied from raw data)	sorbed F (mg/l)	x/m	pH	duration of reaction (hours)	Fluoride concentration (copied from raw data)	phospate (copied from raw data)
3at1	8/12/2015 11:05	8/12/2015 13:09	0.10	19.69	4.74	0.65	0.13	5.35	2.1	4.74	0.004 [P] BQL
3at1b	8/12/2015 11:05	8/12/2015 13:10	0.10	19.62	4.93	0.47	0.09	5.06	2.1	4.93	0.019 [P] BQL
3at2	8/12/2015 11:11	8/12/2015 15:12	0.10	19.60	4.63	0.77	0.15	4.99	4.0	4.63	0.015 [P] BQL
3at2b	8/12/2015 11:12	8/12/2015 15:13	0.10	19.60	4.64	0.76	0.15	4.82	4.0	4.64	0.016 [P] BQL
3at3	8/12/2015 11:22	8/13/2015 12:23	0.10	19.62	4.14	1.26	0.25	5.48	25.0	4.14	0.003 [P] BQL
3at3b	8/12/2015 11:22	8/13/2015 12:24	0.10	19.73	4.43	0.97	0.19	5.37	25.0	4.43	0.014 [P] BQL
3at4	8/12/2015 11:26	8/14/2015 11:39	0.10	19.67	4.92	0.48	0.09	5.66	48.2	4.92	0.017 [P] BQL
3at4b	8/12/2015 11:27	8/14/2015 11:40	0.10	18.37	4.79	0.61	0.11	5.52	48.2	4.79	0.015 [P] BQL
3Ft	NA	8/14/2015 11:44								5.47	0.016 [P] BQL
3Ftb	NA	8/14/2015 11:44								5.32	0.014 [P] BQL

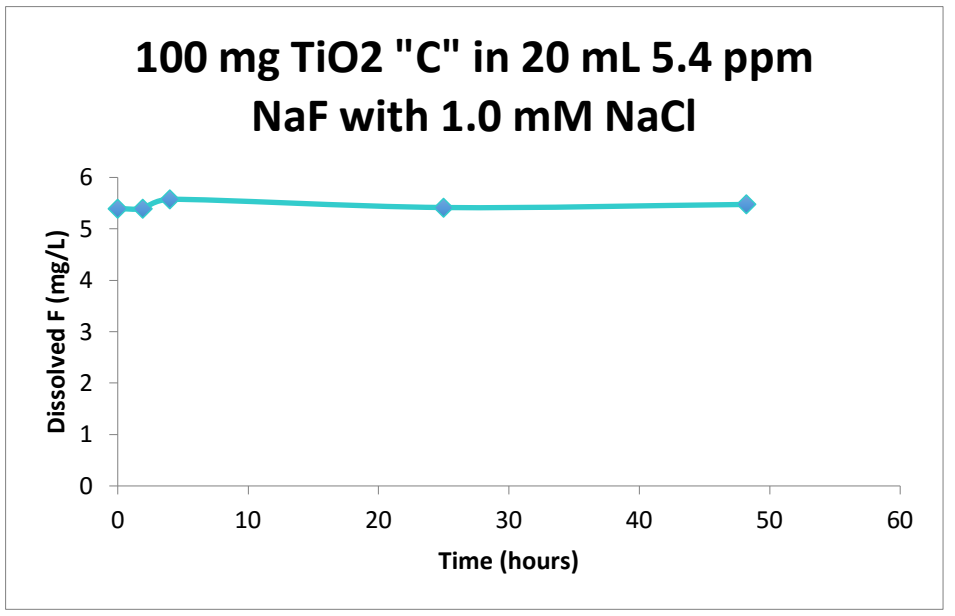
average of duplicates

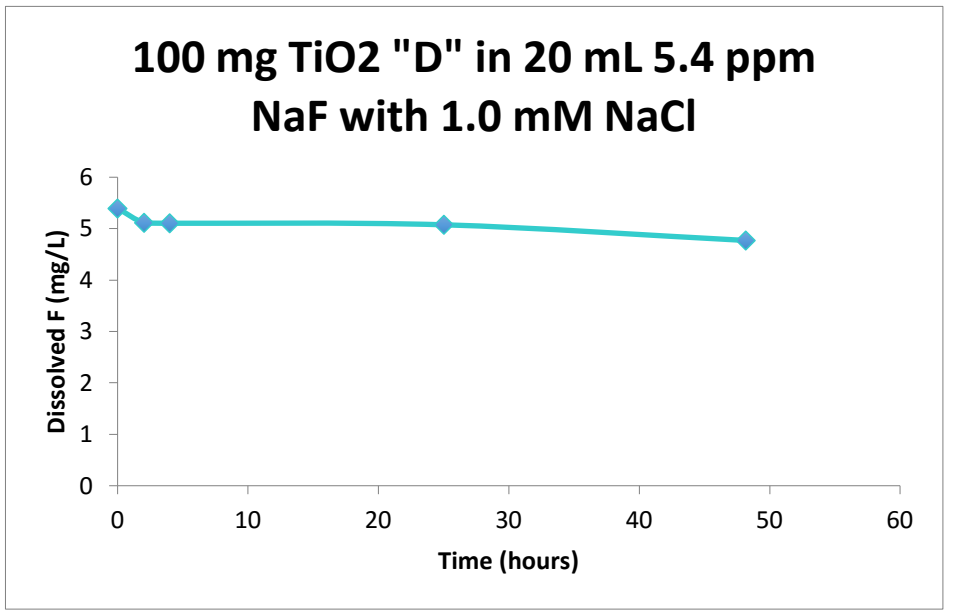
3Ft							0	5.395	0.015
3at1	0.10	19.65	4.84	0.56	0.11	5.21	2.08	4.84	0.01
3at2	0.10	19.60	4.64	0.76	0.15	4.91	4.02	4.64	0.02
3at3	0.10	19.68	4.29	1.11	0.22	5.43	25.03	4.29	0.01
3at4	0.10	19.02	4.86	0.54	0.10	5.59	48.22	4.86	0.02

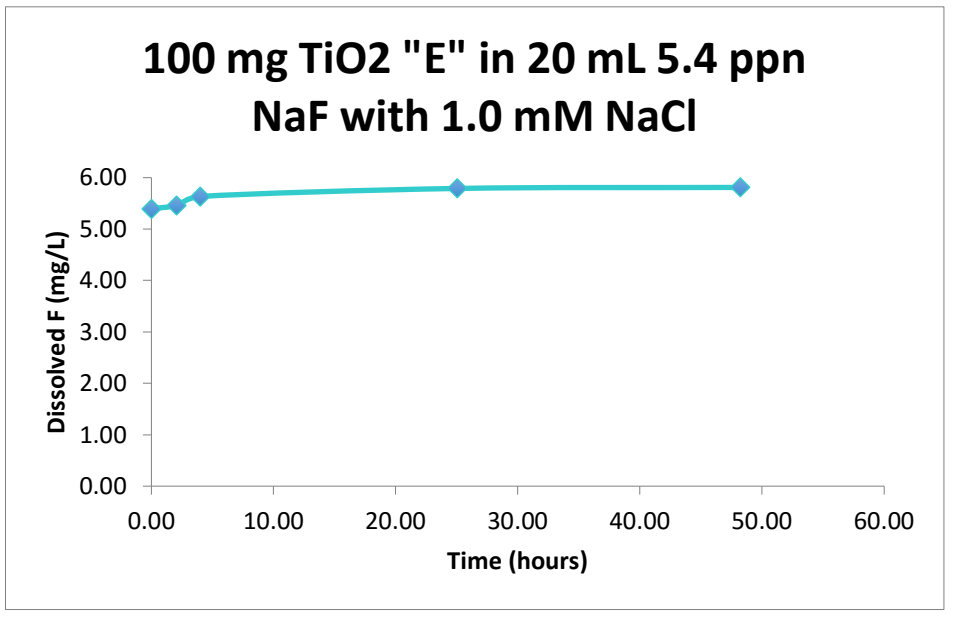
STDEV

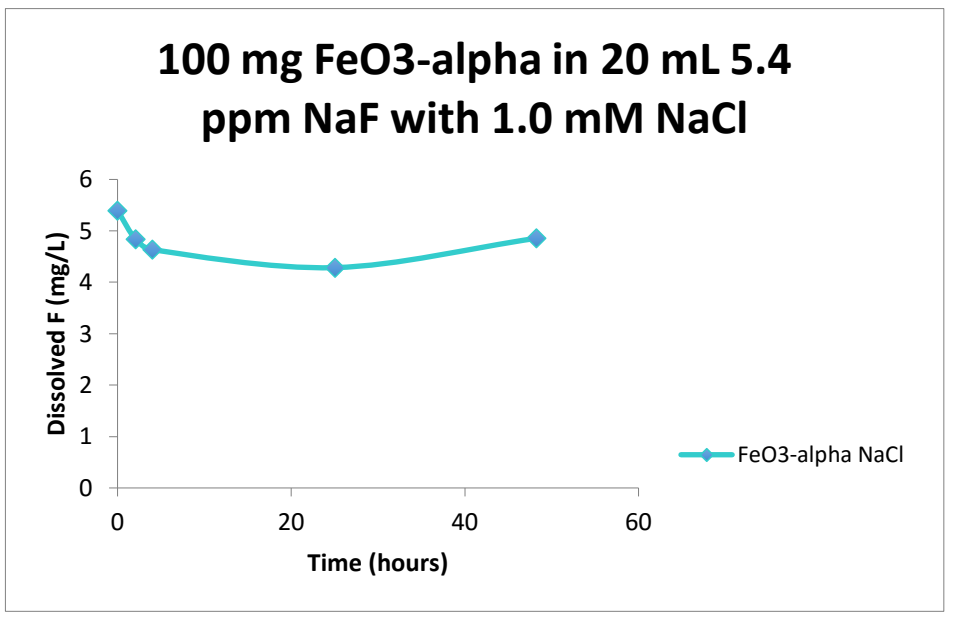
3at1	0.0003	0.04	0.09	0.09	0.02	0.15	0.01	0.09	0.01
3at2	0.0001	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00
3at3	0.0003	0.05	0.15	0.15	0.03	0.06	0.01	0.15	0.01
3at4	0.0001	0.65	0.06	0.06	0.01	0.07	0.00	0.06	0.00




100 mg TiO2 "C" in 20 mL 5.4 ppm NaF with 1.0 mM NaCl
Dissolved F (mg/L)
0
1
2
3
4
5
6
0
10
20
30
40
50
60
Time (hours)


100 mg TiO2 "D" in 20 mL 5.4 ppm NaF with 1.0 mM NaCl
Dissolved F (mg/L)
0
1
2
3
4
5
6
0
10
20
30
40
50
60
Time (hours)


100 mg TiO2 "E" in 20 mL 5.4 ppn NaF with 1.0 mM NaCl
Dissolved F (mg/L)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Time (hours)


100 mg FeO3-alpha in 20 mL 5.4 ppm NaF with 1.0 mM NaCl
Dissolved F (mg/L)
0
1
2
3
4
5
6
0
20
40
60
Time (hours)
FeO3-alpha NaCl

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 15-LC45

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 11/3/2015

Technical Directive No.: EPAGP543
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure, RAP # 502.B

Date Collected: unknown
Date Received: 10/21/2015
Date Analyzed: 10/21 & 10/29/2015
No. Samples Analyzed: 60

Sample Set No.: 7043
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: none

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 3/26/2015 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP543

Analyst: Lynda Callaway

Report Date: 11/03/15

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.039	**MDL**	** 0.002		
QL	0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
3hAPt1	7043-1	-	10/29/2015	2.33	1	10/21/2015	0.103	1		
3hAPt1b	7043-2	-	10/29/2015	2.35	1	10/21/2015	0.121	1		
3hAPt2	7043-3	-	10/29/2015	1.88	1	10/21/2015	0.077	1		
3hAPt2b	7043-4	-	10/29/2015	1.75	1	10/21/2015	0.073	1		
3hAPt3	7043-5	-	10/29/2015	1.34	1	10/21/2015	0.026	1		
3hAPt3b	7043-6	-	10/29/2015	1.65	1	10/21/2015	0.025	1		
3hAPt4	7043-7	-	10/29/2015	1.32	1	10/21/2015	0.022	1		
3hAPt4b	7043-8	-	10/29/2015	2.58	1	10/21/2015	0.038	1		
3hAPt4b	7043-8 Lab dup	-	10/29/2015	2.55 (RPD=1.17)	1	-	-	-		
3Afet1	7043-9	-	10/29/2015	ND	1	10/21/2015	BQL (0.013)	1		
3Afet1b	7043-10	-	10/29/2015	BQL (0.084)	1	10/21/2015	BQL (0.013)	1		
3Afet1b	7043-10 Lab dup	-	-	-	-	10/21/2015	BQL (0.014) (RPD=NA)	1		
3Afet2	7043-11	-	10/29/2015	BQL (0.051)	1	10/21/2015	BQL (0.012)	1		
3Afet2b	7043-12	-	10/29/2015	ND	1	10/21/2015	BQL (0.013)	1		
3Afet3	7043-13	-	10/29/2015	ND	1	10/21/2015	BQL (0.014)	1		
3Afet3b	7043-14	-	10/29/2015	ND	1	10/21/2015	BQL (0.012)	1		
3Afet4	7043-15	-	10/29/2015	ND	1	10/21/2015	BQL (0.012)	1		
3Afet4b	7043-16	-	10/29/2015	ND	1	10/21/2015	BQL (0.013)	1		
3Mgt1	7043-17	-	10/29/2015	3.61	1	10/21/2015	BQL (0.012)	1		
3Mgt1b	7043-18	-	10/29/2015	3.56	1	10/21/2015	BQL (0.009)	1		
3Mgt2	7043-19	-	10/29/2015	3.65	1	10/21/2015	BQL (0.013)	1		
3Mgt2b	7043-20	-	10/29/2015	3.39	1	10/21/2015	BQL (0.013)	1		
3Mgt2b	7043-20 Lab dup	-	10/29/2015	3.29 (RPD=2.99)	1	10/21/2015	BQL (0.013) (RPD=NA)	1		
3Mgt3	7043-21	-	10/29/2015	2.65	1	10/21/2015	BQL (0.013)	1		
3Mgt3b	7043-22	-	10/29/2015	2.58	1	10/21/2015	BQL (0.013)	1		

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Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.039	**MDL**	** 0.002		
QL	0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
3Mgt4	7043-23	-	10/29/2015	2.47	1	10/21/2015	BQL (0.013)	1		
3Mgt4b	7043-24	-	10/29/2015	2.31	1	10/21/2015	BQL (0.013)	1		
3ft1	7043-25	-	10/29/2015	4.97	1	10/21/2015	BQL (0.015)	1		
3ft2	7043-26	-	10/29/2015	5.13	1	10/21/2015	BQL (0.011)	1		
3ft2	7043-26 Lab dup	-	-	-	-	10/21/2015	BQL (0.012) (RPD=NA)	1		
4Bt1	7043-27	-	10/29/2015	4.33	1	10/21/2015	BQL (0.014)	1		
4Bt1b	7043-28	-	10/29/2015	4.34	1	10/21/2015	BQL (0.011)	1		
4Bt2	7043-29	-	10/29/2015	4.48	1	10/21/2015	BQL (0.013)	1		
4Bt2b	7043-30	-	10/29/2015	4.14	1	10/21/2015	BQL (0.012)	1		
4Bt2b	7043-30 Lab dup	-	10/29/2015	4.18 (RPD=0.962)	1	-	-	-		
4Bt3	7043-31	-	10/29/2015	4.32	1	10/21/2015	BQL (0.013)	1		
4Bt3b	7043-32	-	10/29/2015	4.34	1	10/21/2015	BQL (0.012)	1		
4Bt4	7043-33	-	10/29/2015	4.16	1	10/21/2015	BQL (0.012)	1		
4Bt4b	7043-34	-	10/29/2015	4.26	1	10/21/2015	BQL (0.012)	1		
4Ct1	7043-35	-	10/29/2015	4.82	1	10/21/2015	0.049	1		
4Ct1b	7043-36	-	10/29/2015	4.73	1	10/21/2015	0.049	1		
4Ct1b	7043-36 Lab dup	-	-	-	-	10/21/2015	0.049 (RPD=0)	1		
4Ct2	7043-37	-	10/29/2015	4.67	1	10/21/2015	0.071	1		
4Ct2b	7043-38	-	10/29/2015	4.79	1	10/21/2015	0.060	1		
4Ct3	7043-39	-	10/29/2015	4.70	1	10/21/2015	0.096	1		
4Ct3b	7043-40	-	10/29/2015	4.55	1	10/21/2015	0.117	1		
4Ct4	7043-41	-	10/29/2015	4.65	1	10/21/2015	0.181	1		
4Ct4b	7043-42	-	10/29/2015	4.63	1	10/21/2015	0.189	1		
4Ct4b	7043-42 Lab dup	-	10/29/2015	4.90 (RPD=5.67)	1	-	-	-		
4Dt1	7043-43	-	10/29/2015	4.70	1	10/21/2015	0.069	1		

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Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)		
Codes	7782-41-4	**Codes**	70507		
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0		
Unit	mg/L	**Unit**	mg/L		
MDL	0.039	**MDL**	** 0.002		
QL	0.200	**QL**	** 0.020		

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF	Data	DF
4Dt1b	7043-44	-	10/29/2015	4.81	1	10/21/2015	0.066	1		
4Dt2	7043-45	-	10/29/2015	4.69	1	10/21/2015	0.077	1		
4Dt2b	7043-46	-	10/29/2015	4.83	1	10/21/2015	0.062	1		
4Dt2b	7043-46 Lab dup	-	-	-	-	10/21/2015	0.063 (RPD=1.60)	1		
4Dt3	7043-47	-	10/29/2015	4.96	1	10/21/2015	0.081	1		
4Dt3b	7043-48	-	10/29/2015	5.02	1	10/21/2015	0.080	1		
4Dt4	7043-49	-	10/29/2015	5.05	1	10/21/2015	0.090	1		
4Dt4b	7043-50	-	10/29/2015	4.81	1	10/21/2015	0.098	1		
4Et1	7043-51	-	10/29/2015	5.03	1	10/21/2015	12.5	11		
4Et1b	7043-52	-	10/29/2015	4.83	1	10/21/2015	12.6	11		
4Et1b	7043-52 Lab dup	-	10/29/2015	4.80 (RPD=0.623)	1	-	-	-		
4Et2	7043-53	-	10/29/2015	4.95	1	10/21/2015	13.8	11		
4Et2b	7043-54	-	10/29/2015	4.89	1	10/21/2015	12.7	11		
4Et2b	7043-54 Lab dup	-	-	-	-	10/21/2015	12.9 (RPD=1.56)	11		
4Et3	7043-55	-	10/29/2015	4.77	1	10/21/2015	13.5	11		
4Et3b	7043-56	-	10/29/2015	4.79	1	10/21/2015	14.0	11		
4Et4	7043-57	-	10/29/2015	4.83	1	10/21/2015	13.9	11		
4Et4b	7043-58	-	10/29/2015	4.83	1	10/21/2015	14.7	11		
4Ft1	7043-59	-	10/29/2015	5.19	1	10/21/2015	0.020	1		
4Ft2	7043-60	-	10/29/2015	5.17	1	10/21/2015	BQL (0.015)	1		
4Ft2	7043-60 Lab dup	-	10/29/2015	5.23 (RPD=1.15)	1	10/21/2015	BQL (0.013) (RPD=NA)	1		

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Sample Results

Analytes	Fluoride (F)			**Analytes**	ortho-Phosphate (as P)						
Codes	7782-41-4			**Codes**	70507						
Methods	RSKSOP-276/4			**Methods**	NRMRL-GWERD-05-0						
Unit	mg/L			**Unit**	mg/L						
MDL	0.039			**MDL**	** 0.002						
QL	0.200			**QL**	** 0.020						
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**	**Data**	**DF**	

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 3/26/2015 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. ** MDL and QL should be multiplied by the dilution factor for those samples that were diluted.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

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Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	10/21/2015	10/21/2015	-	-	-	BQL (0.011)	-	-			
MB	Nanopure Water Blank	10/21/2015	10/21/2015	-	-	-	BQL (0.012)	-	-			
MB	Nanopure Water Blank	10/29/2015	10/29/2015	ND	-	-	-	-	-			
MB	Nanopure Water Blank	10/29/2015	10/29/2015	ND	-	-	-	-	-			
SS	ERA 64 Simple Nutrients	2/25/2015	10/21/2015	-	-	-	1.58	1.57	101			
SS	ERA 64 Simple Nutrients	2/25/2015	10/21/2015	-	-	-	1.63	1.57	104			
SS	ERA 64 Simple Nutrients	2/25/2015	10/21/2015	-	-	-	1.60	1.57	102			
SS	ERA 64 Simple Nutrients	2/25/2015	10/21/2015	-	-	-	1.65	1.57	105			
SS	ERA 64 Simple Nutrients	2/25/2015	10/21/2015	-	-	-	1.62	1.57	103			
SS	ERA 66 Minerals	7/1/2015	10/29/2015	1.64	1.70	96.5	-	-	-			
SS	ERA 66 Minerals	7/1/2015	10/29/2015	1.66	1.70	97.6	-	-	-			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	0.236	0.250	94.4			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	0.021	0.020	105			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	0.045	0.050	90.0			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	0.093	0.100	93.0			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	2.03	2.00	102			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	1.05	1.00	105			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	0.022	0.020	110			
CCC	Continuing Calibration Check Standard	5/14/2015	10/21/2015	-	-	-	0.490	0.500	98.0			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	0.210	0.200	105	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	1.01	1.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	2.10	2.00	105	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	5.00	5.00	100	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	9.92	10.0	99.2	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	0.200	0.200	100	-	-	-			
CCC	Continuing Calibration Check Standard	6/17/2015	10/29/2015	0.986	1.00	98.6	-	-	-			
MS	3hAPt1 Spike	10/21 & 10/29/2015	10/21 & 10/29/2015	6.72	2.33 (3.85)	114	1.18	0.103 (0.990)	109			
MS	4Bt1 Spike	10/21/2015	10/21/2015	-	-	-	1.05	BQL (0.014) (0.990)	105			
MS	3Mgt3 Spike	10/29/2015	10/29/2015	6.63	2.65 (3.85)	103	-	-	-			
MS	4Dt3 Spike	10/21 & 10/29/2015	10/21 & 10/29/2015	8.89	4.96 (3.85)	102	1.16	0.081 (0.990)	109			

Comments:

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Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration.

Notes:

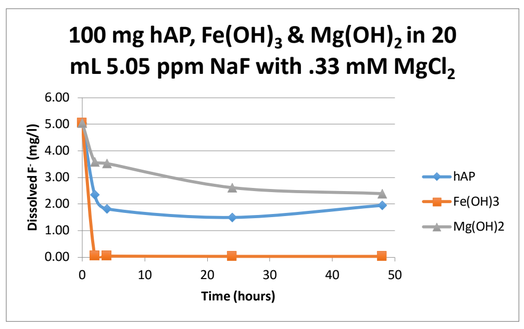
1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

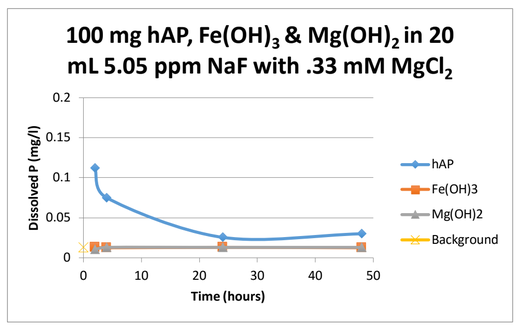
Experiment 12 and 13 specifics: hAP, Fe(OH)3, Mg(OH)2, TiO2 with .33 mM MgCl2

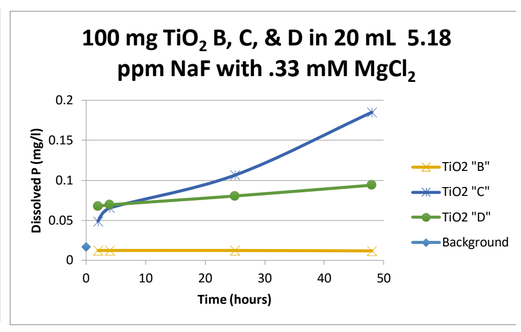
Sample ID	mass of cap + tube	mass sample (g)	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Fluoride concentration (copied from raw data)	Fluoride concentration values only	phospate (copied from raw data)	P (values only)
3hAPt1			9/17/2015 11:59			9/17/2015 14:09	2	2.33		0.103	0.103
3hAPt1b			9/17/2015 12:00			9/17/2015 14:11	2	2.35		0.121	0.121
3hAPt2			9/17/2015 12:05			9/17/2015 15:44	4	1.88		0.077	0.077
3hAPt2b			9/17/2015 12:06			9/17/2015 15:46	4	1.75		0.073	0.073
3hAPt3			9/17/2015 12:10			9/18/2015 11:54	24	1.34		0.026	0.026
3hAPt3b			9/17/2015 12:10			9/18/2015 11:55	24	1.65		0.025	0.025
3hAPt4			9/17/2015 12:14			9/19/2015 12:06	48	1.32		0.022	0.022
3hAPt4b			17-Sep			9/19/2015 12:07	48	2.58		0.038	0.038
3hAPt4b								2.55 (RPD=1.17)		-	
3Afet1			9/17/2015 12:01			9/17/2015 14:14	2	ND	0.031	BQL (0.013)	0.013
3Afet1b			9/17/2015 12:02			9/17/2015 14:16	2	BQL (0.084)	0.084	BQL (0.013)	0.013
3Afet1b								-		BQL (0.014) (RPD=NA)	
3Afet2			9/17/2015 12:07			9/17/2015 15:48	4	BQL (0.051)	0.051	BQL (0.012)	0.012
3Afet2b			9/17/2015 12:07			9/17/2015 15:50	4	ND	0.031	BQL (0.013)	0.013
3Afet3			9/17/2015 12:11			9/18/2015 11:56	24	ND	0.031	BQL (0.014)	0.014
3Afet3b			9/17/2015 12:11			9/18/2015 11:57	24	ND	0.031	BQL (0.012)	0.012
3Afet4			9/17/2015 12:15			9/19/2015 12:09	48	ND	0.031	BQL (0.012)	0.012
3Afet4b			9/17/2015 12:16			9/19/2015 12:08	48	ND	0.031	BQL (0.013)	0.013
3Mgt1			9/17/2015 12:03			9/17/2015 14:18	2	3.61		BQL (0.012)	0.012
3Mgt1b			9/17/2015 12:04			9/17/2015 14:20	2	3.56		BQL (0.009)	0.009
3Mgt2			9/17/2015 12:08			9/17/2015 15:52	4	3.65		BQL (0.013)	0.013
3Mgt2b			9/17/2015 12:09			9/17/2015 15:54	4	3.39		BQL (0.013)	0.013
3Mgt2b								3.29 (RPD=2.99)		BQL (0.013) (RPD=NA)	
3Mgt3			9/17/2015 12:12			9/18/2015 11:58	24	2.65		BQL (0.013)	0.013
3Mgt3b			9/17/2015 12:13			9/18/2015 11:59	24	2.58		BQL (0.013)	0.013
3Mgt4			9/17/2015 12:16			9/19/2015 12:09	48	2.47		BQL (0.013)	0.013
3Mgt4b			9/17/2015 12:17			9/19/2015 12:10	48	2.31		BQL (0.013)	0.013
3ft1			N/A					4.97		BQL (0.015)	0.015
3ft2			N/A					5.13		BQL (0.011)	0.011
3ft2								-		BQL (0.012) (RPD=NA)	
4Bt1			9/29/2015 10:46			9/29/2015 12:30	2	4.33		BQL (0.014)	0.014
4Bt1b			9/29/2015 10:46			9/29/2015 12:30	2	4.34		BQL (0.011)	0.011
4Bt2			9/29/2015 10:49			9/29/2015 14:59	4	4.48		BQL (0.013)	0.013
4Bt2b			9/29/2015 10:49			9/29/2015 14:59	4	4.14		BQL (0.012)	0.012
4Bt2b								4.18 (RPD=0.962)		-	
4Bt3			9/29/2015 11:53			9/30/2015 12:34	25	4.32		BQL (0.013)	0.013
4Bt3b			9/29/2015 11:54			9/30/2015 12:34	25	4.34		BQL (0.012)	0.012
4Bt4			9/29/2015 11:59			10/1/2015 12:18	48	4.16		BQL (0.012)	0.012
4Bt4b			9/29/2015 12:00			10/1/2015 12:18	48	4.26		BQL (0.012)	0.012
4Ct1			9/29/2015 10:46			9/29/2015 12:34	2	4.82		0.049	0.049
4Ct1b			9/29/2015 10:46			9/29/2015 12:34	2	4.73		0.049	0.049
4Ct1b								-		0.049 (RPD=0)	
4Ct2			9/29/2015 10:50			9/29/2015 15:03	4	4.67		0.071	0.071
4Ct2b			9/29/2015 10:51			9/29/2015 15:03	4	4.79		0.060	0.06
4Ct3			9/29/2015 11:54			9/30/2015 12:38	25	4.70		0.096	0.096
4Ct3b			9/29/2015 11:55			9/30/2015 12:38	25	4.55		0.117	0.117
4Ct4			9/29/2015 12:00			10/1/2015 12:22	48	4.65		0.181	0.181
4Ct4b			9/29/2015 12:01			10/1/2015 12:22	48	4.63		0.189	0.189
4Ct4b								4.90 (RPD=5.67)		-	
4Dt1			9/29/2015 10:45			9/29/2015 12:41	2	4.70		0.069	0.069
4Dt1b			9/29/2015 10:44			9/29/2015 12:41	2	4.81		0.066	0.066
4Dt2			9/29/2015 10:51			9/29/2015 15:07	4	4.69		0.077	0.077
4Dt2b			9/29/2015 10:52			9/29/2015 15:07	4	4.83		0.062	0.062
4Dt2b								-		0.063 (RPD=1.60)	
4Dt3			9/29/2015 11:55			9/30/2015 12:46	25	4.96		0.081	0.081
4Dt3b			9/29/2015 11:56			9/30/2015 12:46	25	5.02		0.080	0.08
4Dt4			9/29/2015 12:01			10/1/2015 12:30	48	5.05		0.090	0.09
4Dt4b			9/29/2015 12:02			10/1/2015 12:30	48	4.81		0.098	0.098
4Et1			9/29/2015 10:43			9/29/2015 12:44	2	5.03		12.5	12.5
4Et1b			9/29/2015 10:42			9/29/2015 12:44	2	4.83		12.6	12.6
4Et1b								4.80 (RPD=0.623)		-	
4Et2			9/29/2015 10:53			9/29/2015 15:11	4	4.95		13.8	13.8
4Et2b			9/29/2015 10:53			9/29/2015 15:11	4	4.89		12.7	12.7
4Et2b								-		12.9 (RPD=1.56)	
4Et3			9/29/2015 11:57			9/30/2015 12:50	25	4.77		13.5	13.5
4Et3b			9/29/2015 11:57			9/30/2015 12:50	25	4.79		14.0	14
4Et4			9/29/2015 12:03			10/1/2015 12:34	49	4.83		13.9	13.9
4Et4b			9/29/2015 12:03			10/1/2015 12:34	49	4.83		14.7	14.7
4Ft1			N/A					5.19		0.020	0.02
4Ft2			N/A					5.17		BQL (0.015)	0.015
4Ft2								5.23 (RPD=1.15)		BQL (0.013) (RPD=NA)	

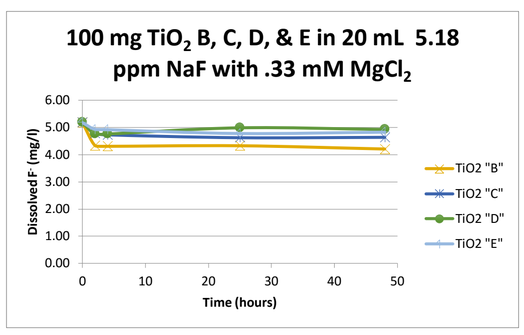
AVERAGES OF DUPLICATES

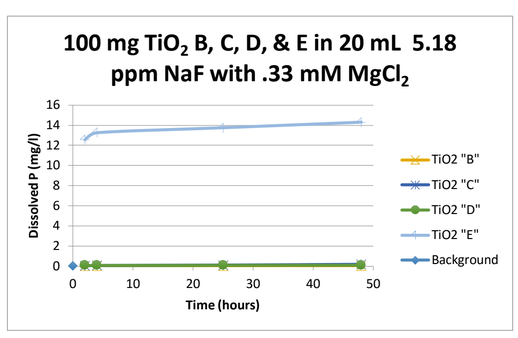
ID	Time (hrs)	F- Conc (mg/l)	PO4 3- (mg/l)
3ft1	0	5.05	0.013
3hAPt1	2	2.34	0.112
3hAPt2	4	1.82	0.075
3hAPt3	24	1.50	0.0255
3hAPt4	48	1.95	0.03
3ft1	0	5.05	0.013
3Afet1	2	0.0575	0.013
3Afet2	4	0.041	0.0125
3Afet3	24	0.031	0.013
3Afet4	48	0.031	0.0125
3ft1	0	5.05	0.013
3Mgt1	2	3.585	0.0105
3Mgt2	4	3.52	0.013
3Mgt3	24	2.62	0.013
3Mgt4	48	2.39	0.013
3ft1	0	5.05	0.013
4Ft1	0	5.18	0.0175
4Bt1	2	4.34	0.0125
4Bt2	4	4.31	0.0125
4Bt3	25	4.33	0.0125
4Bt4	48	4.21	0.012
4Ft1	0	5.18	0.0175
4Ct1	2	4.775	0.049
4Ct2	4	4.73	0.0655
4Ct3	25	4.63	0.1065
4Ct4	48	4.64	0.185
4Ft1	0	5.18	0.0175
4Dt1	2	4.76	0.0675
4Dt2	4	4.76	0.0695
4Dt3	25	4.99	0.0805
4Dt4	48	4.93	0.094
4Ft1	0	5.18	0.0175
4Et1	2	4.93	12.55
4Et2	4	4.92	13.25
4Et3	25	4.78	13.75
4Et4	48	4.83	14.3
4Ft1	0	5.18	0.0175

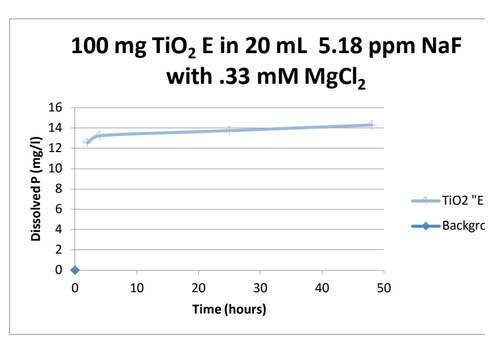












Sample ID	mass of cap + tube	mass sample+cap+ soln	mass sample (g)	volume F-	Ce [F] (copied from raw data)	Ce [F] mg/L	sorbed F (mg/l)	x/m	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)	P (values only)
3hAPt1	14.27	34.3937	0.105	20.0187	2.33	2.33	2.72	0.52	9/17/2015 11:59		8.66	9/17/2015 14:09	2.2	0.103	0.103
3hAPt1b	13.29	33.4496	0.096	20.0636	2.35	2.35	1.98	0.41	9/17/2015 12:00		9.04	9/17/2015 14:11	2.2	0.121	0.121
3hAPt2	14.23	34.3325	0.1025	20	1.88	1.88	2.46	0.48	9/17/2015 12:05		8.89	9/17/2015 15:44	3.7	0.077	0.077
3hAPt2b	13.33	33.3923	0.101	19.9613	1.75	1.75	2.73	0.54	9/17/2015 12:06		9.37	9/17/2015 15:46	3.7	0.073	0.073
3hAPt3	14.22	34.4038	0.1041	20.0797	1.34	1.34	2.80	0.54	9/17/2015 12:10		9.77	9/18/2015 11:54	23.7	0.026	0.026
3hAPt3b	14.23	34.0428	0.1066	19.7062	1.65	1.65	2.67	0.49	9/17/2015 12:10		9.92	9/18/2015 11:55	23.8	0.025	0.025
3hAPt4	14.21	34.332	0.1027	20.0193	1.32	1.32	3.02	0.59	9/17/2015 12:14		9.89	9/19/2015 12:06	47.9	0.022	0.022
3hAPt4b	14.25	34.314	0.1049	19.9591	2.58	2.58	1.58	0.30	17-Sep		9.89	9/19/2015 12:07	47.9	0.038	0.038
3Afet1	14.22	34.0003	0.0979	19.6824	ND	0.031	4.23	0.85	9/17/2015 12:01		3.93	9/17/2015 14:14	2.2	BQL (0.013)	0.013
3Afet1b	14.28	34.2611	0.1004	19.8807	BQL (0.084)	0.084	4.74	0.94	9/17/2015 12:02		3.98	9/17/2015 14:16	2.2	BQL (0.013)	0.013
3Afet2	14.22	34.2696	0.0978	19.9518	BQL (0.051)	0.051	4.68	0.95	9/17/2015 12:07		4.03	9/17/2015 15:48	3.7	BQL (0.012)	0.012
3Afet2b	14.33	34.4364	0.0972	20.0092	ND	0.031	4.64	0.95	9/17/2015 12:07		3.83	9/17/2015 15:50	3.7	BQL (0.013)	0.013
3Afet3	14.28	33.0305	0.1025	18.648	ND	0.031	4.76	0.87	9/17/2015 12:11		3.87	9/18/2015 11:56	23.7	BQL (0.014)	0.014
3Afet3b	14.26	34.3473	0.0975	19.9898	ND	0.031	4.67	0.96	9/17/2015 12:11		3.76	9/18/2015 11:57	23.8	BQL (0.012)	0.012
3Afet4	14.3	34.1732	0.0969	19.7763	ND	0.031	4.52	0.92	9/17/2015 12:15		4.29	9/19/2015 12:09	47.9	BQL (0.012)	0.012
3Afet4b	14.23	34.3332	0.0993	20.0039	ND	0.031	4.62	0.93	9/17/2015 12:16		3.91	9/19/2015 12:08	47.9	BQL (0.013)	0.013
3Mgt1	14.22	33.913	0.1033	19.5897	3.61	3.61	1.02	0.19	9/17/2015 12:03		10.36	9/17/2015 14:18	2.3	BQL (0.012)	0.012
3Mgt1b	14.21	34.0645	0.1056	19.7489	3.56	3.56	1.14	0.21	9/17/2015 12:04		10.48	9/17/2015 14:20	2.3	BQL (0.009)	0.009
3Mgt2	14.24	34.2845	0.1012	19.9433	3.65	3.65	1.16	0.23	9/17/2015 12:08		10.45	9/17/2015 15:52	3.7	BQL (0.013)	0.013
3Mgt2b	13.21	33.3823	0.1006	20.0717	3.39	3.39	1.30	0.26	9/17/2015 12:09		10.47	9/17/2015 15:54	3.8	BQL (0.013)	0.013
3Mgt3	13.46	33.1617	0.104	19.5977	2.65	2.65	2.18	0.41	9/17/2015 12:12		10.5	9/18/2015 11:58	23.8	BQL (0.013)	0.013
3Mgt3b	14.27	34.0896	0.104	19.7156	2.58	2.58	2.38	0.45	9/17/2015 12:13		10.58	9/18/2015 11:59	23.8	BQL (0.013)	0.013
3Mgt4	14.27	34.3882	0.1023	20.0159	2.47	2.47	2.55	0.50	9/17/2015 12:16		10.55	9/19/2015 12:09	47.9	BQL (0.013)	0.013
3Mgt4b	13.26	33.3315	0.1025	19.969	2.31	2.31	2.74	0.53	9/17/2015 12:17		10.61	9/19/2015 12:10	47.9	BQL (0.013)	0.013
3ft1			0	0	4.97				N/A				#VALUE!	BQL (0.015)	0.015
3ft2			0	0	5.13				N/A				#VALUE!	BQL (0.011)	0.011
3ft average					5.05										
4Bt1	14.8032	34.9058	0.1013	20.0013	4.33	4.33	0.85	0.17	9/29/2015 10:46		7.87	9/29/2015 12:30	1.7	BQL (0.014)	0.014
4Bt1b	14.8085	34.9483	0.1003	20.0395	4.34	4.34	0.84	0.17	9/29/2015 10:46		7.66	9/29/2015 12:30	1.7	BQL (0.011)	0.011
4Bt2	14.7732	34.8472	0.1008	19.9732	4.48	4.48	0.70	0.14	9/29/2015 10:49		7.72	9/29/2015 14:59	4.2	BQL (0.013)	0.013
4Bt2b	14.7627	34.8061	0.1032	19.9402	4.14	4.14	1.04	0.20	9/29/2015 10:49		7.6	9/29/2015 14:59	4.2	BQL (0.012)	0.012
4Bt3	14.8347	34.6195	0.1047	19.6801	4.32	4.32	0.86	0.16	9/29/2015 11:53		7.71	9/30/2015 12:34	24.7	BQL (0.013)	0.013
4Bt3b	14.8075	34.6417	0.1054	19.7288	4.34	4.34	0.84	0.16	9/29/2015 11:54		7.61	9/30/2015 12:34	24.7	BQL (0.012)	0.012
4Bt4	13.8075	33.6068	0.1027	19.6966	4.16	4.16	1.02	0.20	9/29/2015 11:59		7.91	10/1/2015 12:18	48.3	BQL (0.012)	0.012
4Bt4b	14.8007	34.422	0.1001	19.5212	4.26	4.26	0.92	0.18	9/29/2015 12:00		7.72	10/1/2015 12:18	48.3	BQL (0.012)	0.012
4Ct1	13.9383	34.0598	0.101	20.0205	4.82	4.82	0.36	0.07	9/29/2015 10:46		7.77	9/29/2015 12:34	1.8	0.049	0.049
4Ct1b	14.8369	34.8803	0.1009	19.9425	4.73	4.73	0.45	0.09	9/29/2015 10:46		7.72	9/29/2015 12:34	1.8	0.049	0.049
4Ct2	14.8255	34.8522	0.1001	19.9266	4.67	4.67	0.51	0.10	9/29/2015 10:50		7.74	9/29/2015 15:03	4.2	0.071	0.071
4Ct2b	14.7786	34.881	0.1032	19.9992	4.79	4.79	0.39	0.08	9/29/2015 10:51		7.7	9/29/2015 15:03	4.2	0.060	0.06
4Ct3	14.8245	34.6329	0.0997	19.7087	4.70	4.70	0.48	0.09	9/29/2015 11:54		7.63	9/30/2015 12:38	24.7	0.096	0.096
4Ct3b	13.7814	33.5806	0.1025	19.6967	4.55	4.55	0.63	0.12	9/29/2015 11:55		7.64	9/30/2015 12:38	24.7	0.117	0.117
4Ct4	13.9391	33.7517	0.1059	19.7067	4.65	4.65	0.53	0.10	9/29/2015 12:00		7.64	10/1/2015 12:22	48.4	0.181	0.181
4Ct4b	14.7907	34.8117	0.1007	19.9203	4.63	4.63	0.55	0.11	9/29/2015 12:01		7.66	10/1/2015 12:22	48.3	0.189	0.189
4Dt1	14.8417	34.9164	0.1035	19.9712	4.70	4.70	0.48	0.09	9/29/2015 10:45		7.43	9/29/2015 12:41	1.9	0.069	0.069
4Dt1b	13.79	33.8877	0.102	19.9957	4.81	4.81	0.37	0.07	9/29/2015 10:44		7.31	9/29/2015 12:41	1.9	0.066	0.066
4Dt2	14.0482	34.1193	0.1004	19.9707	4.69	4.69	0.49	0.10	9/29/2015 10:51		7.24	9/29/2015 15:07	4.3	0.077	0.077
4Dt2b	14.7832	34.8529	0.1019	19.9678	4.83	4.83	0.35	0.07	9/29/2015 10:52		7.15	9/29/2015 15:07	4.3	0.062	0.062
4Dt3	14.8207	34.702	0.1001	19.7812	4.96	4.96	0.22	0.04	9/29/2015 11:55		7.36	9/30/2015 12:46	24.8	0.081	0.081
4Dt3b	14.7812	34.4383	0.1016	19.5555	5.02	5.02	0.16	0.03	9/29/2015 11:56		7.23	9/30/2015 12:46	24.8	0.080	0.08
4Dt4	14.8152	34.7097	0.1045	19.79	5.05	5.05	0.13	0.02	9/29/2015 12:01		7.31	10/1/2015 12:30	48.5	0.090	0.09
4Dt4b	14.7963	34.761	0.1053	19.8594	4.81	4.81	0.37	0.07	9/29/2015 12:02		7.19	10/1/2015 12:30	48.5	0.098	0.098
4Et1	14.7883	34.8604	0.1032	19.9689	5.03	5.03	0.15	0.03	9/29/2015 10:43		7.25	9/29/2015 12:44	2.0	12.5	12.5
4Et1b	14.7881	34.842	0.1017	19.9522	4.83	4.83	0.35	0.07	9/29/2015 10:42		7.22	9/29/2015 12:44	2.0	12.6	12.6
4Et2	14.8188	34.8753	0.1052	19.9513	4.95	4.95	0.23	0.04	9/29/2015 10:53		7.18	9/29/2015 15:11	4.3	13.8	13.8
4Et2b	14.7854	34.0235	0.0994	19.1387	4.89	4.89	0.29	0.06	9/29/2015 10:53		7.17	9/29/2015 15:11	4.3	12.7	12.7
4Et3	14.8211	35.6399	0.1007	20.7181	4.77	4.77	0.41	0.08	9/29/2015 11:57		7.18	9/30/2015 12:50	24.9	13.5	13.5
4Et3b	14.8265	34.6553	0.1005	19.7283	4.79	4.79	0.39	0.08	9/29/2015 11:57		7.15	9/30/2015 12:50	24.9	14.0	14
4Et4	13.8032	33.9741	0.11003	20.06087	4.83	4.83	0.35	0.06	9/29/2015 12:03		7.2	10/1/2015 12:34	48.5	13.9	13.9
4Et4b	13.8137	33.8743	0.1035	19.9571	4.83	4.83	0.35	0.07	9/29/2015 12:03		7.17	10/1/2015 12:34	48.5	14.7	14.7
4Ft1					5.19				N/A					0.020	0.02
4Ft2					5.17				N/A					BQL (0.015)	0.015
4Ft average					5.18										

Sample ID	mass of cap + tube	mass sample+cap+ soln	mass sample (g)	volume F-	Ce [F] (copied from raw data)	Ce [F] mg/L	sorbed F (mg/l)	x/m	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)	P (values only)
Average of duplicates 48 hrs															
Apatite	14.2	34.3	0.1	20.0	2.0	2.0	2.3	0.4	#DIV/0!		9.9	42266.5	47.9	0.0	0.0
Am-Fe(OH)3	14.3	34.3	0.1	19.9	#DIV/0!	0.0	4.6	0.9	#DIV/0!		4.1	42266.5	47.9	#DIV/0!	0.0
Mg(OH)2	13.8	33.9	0.1	20.0	2.4	2.4	2.6	0.5	#DIV/0!		10.6	42266.5	47.9	#DIV/0!	0.0
TiO2 B	14.3	34.0	0.1	19.6	4.2	4.2	1.0	0.2	#DIV/0!		7.8	42278.5	48.3	#DIV/0!	0.0
TiO2 C	14.4	34.3	0.1	19.8	4.6	4.6	0.5	0.1	#DIV/0!		7.7	42278.5	48.4	0.2	0.2
TiO2 D	14.8	34.7	0.1	19.8	4.9	4.9	0.3	0.0	#DIV/0!		7.3	42278.5	48.5	0.1	0.1
TiO2 E	13.8	33.9	0.1	20.0	4.8	4.8	0.4	0.1	#DIV/0!		7.2	42278.5	48.5	14.3	14.3
STDEV															
Apatite	0.02	0.009	0.0011	0.0301	0.63	0.63	0.72	0.14	#DIV/0!		0	0.000347222	0.008333333	0.008	0.008
Am-Fe(OH)3	0.035	0.08	0.0012	0.1138	#DIV/0!	0	0.05	0.00	#DIV/0!		0.19	0.000347222	0.016666667	#DIV/0!	0.0005
Mg(OH)2	0.505	0.52835	1E-04	0.02345	0.08	0.08	0.095	0.02	#DIV/0!		0.03	0.000347222	0	#DIV/0!	0
TiO2 B	0.4966	0.4076	0.0013	0.0877	0.05	0.05	0.05	0.01	#DIV/0!		0.095	0	0.008333333	#DIV/0!	0
TiO2 C	0.4258	0.53	0.0026	0.1068	0.01	0.01	0.01	0.01	#DIV/0!		0.01	0	0.008333333	0.004	0.004
TiO2 D	0.00945	0.02565	0.0004	0.0347	0.12	0.12	0.12	0.02	#DIV/0!		0.06	0	0.008333333	0.004	0.004
TiO2 E	0.00525	0.0499	0.003265	0.051885	0	0	0	0.00	#DIV/0!		0.015	0	0	0.4	0.4

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC33

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Kristie Hargrove

Date: 5/5/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Kristie Hargrove
Lynda Callaway

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 4/18/2016
Date Analyzed: 4/18 & 5/4/2016
No. Samples Analyzed: 40

Sample Set No.: 7101
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: diluted as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. No dates of collection were given, so the 48 hour holding time for oP analysis may or may not have been met.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/05/16

Sample Results

Analytes	Fluoride (F)			**Analytes**	ortho-Phosphate (as P)			
Codes	7782-41-4			**Codes**	70507			
Methods	RSKSOP-276/4			**Methods**	NRMRL-GWERD-05-0			
Unit	mg/L			**Unit**	mg/L			
MDL	0.039			**MDL**	0.002			
QL	0.200			**QL**	0.020			
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**
Ht1	7101-1	-	5/4/2016	5.18	1	4/18/2016	BQL (0.015)	1
Ht1b	7101-2	-	5/4/2016	5.07	1	4/18/2016	BQL (0.006)	1
Ht2	7101-3	-	5/4/2016	5.18	1	4/18/2016	BQL (0.017)	1
Ht2b	7101-4	-	5/4/2016	5.11	1	4/18/2016	BQL (0.014)	1
Ht3	7101-5	-	5/4/2016	5.01	1	4/18/2016	BQL (0.015)	1
Ht3b	7101-6	-	5/4/2016	4.97	1	4/18/2016	BQL (0.010)	1
Ht4	7101-7	-	5/4/2016	5.18	1	4/18/2016	BQL (0.014)	1
Ht4b	7101-8	-	5/4/2016	4.94	1	4/18/2016	BQL (0.014)	1
Mt1	7101-9	-	5/4/2016	5.09	1	4/18/2016	BQL (0.011)	1
Mt1b	7101-10	-	5/4/2016	5.10	1	4/18/2016	BQL (0.014)	1
Mt1b	7101-10 Lab dup	-	5/4/2016	5.05 (RPD=0.985)	1	4/18/2016	BQL (0.013) (RPD=NA)	1
Mt2	7101-11	-	5/4/2016	5.02	1	4/18/2016	BQL (0.012)	1
Mt2b	7101-12	-	5/4/2016	5.00	1	4/18/2016	BQL (0.013)	1
Mt3	7101-13	-	5/4/2016	4.98	1	4/18/2016	BQL (0.017)	1
Mt3b	7101-14	-	5/4/2016	4.91	1	4/18/2016	BQL (0.011)	1
Mt4	7101-15	-	5/4/2016	5.04	1	4/18/2016	BQL (0.011)	1
Mt4b	7101-16	-	5/4/2016	5.43	1	4/18/2016	BQL (0.010)	1
Gt1	7101-17	-	5/4/2016	4.83	1	4/18/2016	BQL (0.012)	1
Gt1b	7101-18	-	5/4/2016	4.66	1	4/18/2016	BQL (0.008)	1
Gt2	7101-19	-	5/4/2016	4.61	1	4/18/2016	BQL (0.012)	1
Gt2b	7101-20	-	5/4/2016	4.73	1	4/18/2016	BQL (0.012)	1
Gt2b	7101-20 Lab dup	-	5/4/2016	4.61 (RPD=2.57)	1	4/18/2016	BQL (0.013) (RPD=NA)	1
Gt3	7101-21	-	5/4/2016	4.43	1	4/18/2016	BQL (0.013)	1
Gt3b	7101-22	-	5/4/2016	4.62	1	4/18/2016	BQL (0.004)	1
Gt4	7101-23	-	5/4/2016	4.57	1	4/18/2016	BQL (0.012)	1
Gt4b	7101-24	-	5/4/2016	4.36	1	4/18/2016	BQL (0.015)	1
D1	7101-25	-	5/4/2016	ND	1	4/18/2016	BQL (0.011)	1
D1b	7101-26	-	5/4/2016	ND	1	4/18/2016	BQL (0.011)	1
MD1	7101-27	-	5/4/2016	ND	1	4/18/2016	BQL (0.014)	1
MD1b	7101-28	-	5/4/2016	BQL (0.091)	1	4/18/2016	BQL (0.013)	1
HD1	7101-29	-	5/4/2016	ND	1	4/18/2016	BQL (0.013)	1
HD1b	7101-30	-	5/4/2016	ND	1	4/18/2016	BQL (0.013)	1
HD1b	7101-30 Lab dup	-	5/4/2016	ND (RPD=NA)	1	4/18/2016	BQL (0.012) (RPD=NA)	1
GD1	7101-31	-	5/4/2016	0.333	1	4/18/2016	BQL (0.012)	1
GD1b	7101-32	-	5/4/2016	0.273	1	4/18/2016	BQL (0.010)	1
F	7101-33	-	5/4/2016	5.13	1	4/18/2016	BQL (0.012)	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/05/16

Sample Results

Analytes	Fluoride (F)	**Analytes**	ortho-Phosphate (as P)
Codes	7782-41-4	**Codes**	70507
Methods	RSKSOP-276/4	**Methods**	NRMRL-GWERD-05-0
Unit	mg/L	**Unit**	mg/L
MDL	0.039	**MDL**	0.002
QL	0.200	**QL**	0.020

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
Fb	7101-34	-	5/4/2016	5.30	1	4/18/2016	BQL (0.012)	1
ZD1	7101-35	-	5/4/2016	ND	1	4/18/2016	BQL (0.011)	1
ZD1b	7101-36	-	5/4/2016	ND	1	4/18/2016	BQL (0.013)	1
10FZ	7101-37	-	5/4/2016	5.15	1	4/18/2016	BQL (0.015)	1
10FZb	7101-38	-	5/4/2016	4.67	1	4/18/2016	BQL (0.017)	1
10F	7101-39	-	5/4/2016	9.27	1	4/18/2016	BQL (0.016)	1
10Fb	7101-40	-	5/4/2016	9.33	1	4/18/2016	BQL (0.014)	1
10Fb	7101-40 Lab dup	-	5/4/2016	9.51 (RPD=1.91)	1	4/18/2016	BQL (0.013) (RPD=NA)	1

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/05/16

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.020	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	4/18/2016	4/18/2016	-	-	-	BQL (0.007)	-	-			
MB	Nanopure Water Blank	4/18/2016	4/18/2016	-	-	-	BQL (0.012)	-	-			
MB	Nanopure Water Blank	5/4/2016	5/4/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	5/4/2016	5/4/2016	ND	-	-	-	-	-			
SS	ERA 67 Simple Nutrients	11/4/2015	4/18/2016	-	-	-	1.96	1.95	101			
SS	ERA 67 Simple Nutrients	11/4/2015	4/18/2016	-	-	-	1.96	1.95	101			
SS	ERA 67 Simple Nutrients	11/4/2015	4/18/2016	-	-	-	1.98	1.95	102			
SS	ERA 66 Minerals	7/1/2015	5/4/2016	1.68	1.70	98.8	-	-	-			
SS	ERA 66 Minerals	7/1/2015	5/4/2016	1.73	1.70	102	-	-	-			
CCC	Continuing Calibration Check Standard	11/4/2015	4/18/2016	-	-	-	0.020	0.020	100			
CCC	Continuing Calibration Check Standard	11/4/2015	4/18/2016	-	-	-	0.488	0.500	97.6			
CCC	Continuing Calibration Check Standard	11/4/2015	4/18/2016	-	-	-	0.232	0.250	92.8			
CCC	Continuing Calibration Check Standard	11/4/2015	4/18/2016	-	-	-	1.01	1.00	101			
CCC	Continuing Calibration Check Standard	11/4/2015	4/18/2016	-	-	-	0.049	0.050	98.0			
CCC	Continuing Calibration Check Standard	11/4/2015	4/18/2016	-	-	-	2.04	2.00	102			
CCC	Continuing Calibration Check Standard	12/1/2015	5/4/2016	BQL (0.199)	0.200	99.5	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/4/2016	1.04	1.00	104	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/4/2016	1.97	2.00	98.5	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/4/2016	5.01	5.00	100	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/4/2016	9.86	10.0	98.6	-	-	-			
MS	Ht1 Spike	4/18 & 5/4/2016	4/18 & 5/4/2016	8.90	5.18 (3.85)	96.6	1.03	BQL (0.015) (0.990)	103			
MS	Gt3 Spike	4/18 & 5/4/2016	4/18 & 5/4/2016	8.36	4.43 (3.85)	102	1.03	BQL (0.013) (0.990)	103			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

Sample ID	mass sample (g)	volume F- (mL)	Ce [F] mg/L	sorbed F (mg/l)	x/m (mg/g)	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)	P (values only)
Ht1	0.0999	19.932	5.18	0.04	0.007			8.29			BQL (0.015)	
Ht1b	0.103	19.815	5.07	0.15	0.028			8.04			BQL (0.006)	
Ht2	0.0977	19.935	5.18	0.04	0.007			7.5			BQL (0.017)	
Ht2b	0.1032	19.948	5.11	0.11	0.020			7.82			BQL (0.014)	
Ht3	0.0993	19.854	5.01	0.21	0.041			8.39			BQL (0.015)	
Ht3b	0.0997	19.896	4.97	0.25	0.049			8.36			BQL (0.010)	
Ht4	0.1012	19.972	5.18	0.04	0.007			7.93			BQL (0.014)	
Ht4b	0.1023	19.813	4.94	0.27	0.053			8.15			BQL (0.014)	
Mt1	0.1029	19.887	5.09	0.13	0.024			7.94			BQL (0.011)	
Mt1b	0.0993	19.886	5.10	0.12	0.023			7.91			BQL (0.014)	
Mt2	0.1031	19.967	5.02	0.20	0.038			7.71			BQL (0.012)	
Mt2b	0.0982	19.929	5.00	0.22	0.044			7.74			BQL (0.013)	
Mt3	0.1023	19.907	4.98	0.23	0.046			8.24			BQL (0.017)	
Mt3b	0.1038	19.874	4.91	0.31	0.058			8.28			BQL (0.011)	
Mt4	0.1034	19.864	5.04	0.18	0.034			8.09			BQL (0.011)	
Mt4b	0.0994	19.961	5.43	-0.22	-0.043			8.16			BQL (0.010)	
Gt1	0.0995	19.872	4.83	0.39	0.077			5.42			BQL (0.012)	
Gt1b	0.1013	19.8	4.66	0.56	0.108			5.22			BQL (0.008)	
Gt2	0.1017	20.004	4.61	0.61	0.119			5.45			BQL (0.012)	
Gt2b	0.1024	19.942	4.73	0.48	0.094			5.27			BQL (0.012)	
Gt3	0.1005	19.852	4.43	0.79	0.155			5.6			BQL (0.013)	
Gt3b	0.1032	20.01	4.62	0.60	0.115			5.39			BQL (0.004)	
Gt4	0.1037	19.634	4.57	0.65	0.122			5.81			BQL (0.012)	
Gt4b	0.0996	20.177	4.36	0.86	0.173			5.24			BQL (0.015)	
ACKGROUND												
D1			ND								BQL (0.011)	
D1b			ND								BQL (0.011)	
MD1	0.103		ND								BQL (0.014)	
MD1b	0.1014		BQL (0.091)								BQL (0.013)	
HD1	0.0994		ND								BQL (0.013)	
HD1b	0.103		ND								BQL (0.013)	
GD1	0.1039		0.333								BQL (0.012)	
GD1b	0.1004		0.273								BQL (0.010)	
F		5.22	5.13								BQL (0.012)	
Fb			5.30								BQL (0.012)	
EOLITE DATA											BQL (0.011)	
ZD1			ND									
ZD1b			ND								BQL (0.013)	
10FZ			5.15								BQL (0.015)	
10FZb			4.67								BQL (0.017)	
10F			9.27								BQL (0.016)	
10Fb			9.33								BQL (0.014)	
10Fb			9.51 (RPD=1.91)								BQL (0.013) (RPD=NA)	

GE OF DUPLICATES

Sample ID	mass sample (g)	volume F- (mL)	Ce [F] mg/L	sorbed F (mg/l)	x/m (mg/g)	Date/time F- added	Date/time pH taken	measured pH
Ht1								
Ht2								
Ht3								
Ht4	0.102	19.893	5.060	0.155	0.030	#DIV/0!	#DIV/0!	8.040
Mt1								
Mt2								
Mt3								
Mt4	0.101	19.913	5.235	-0.020	-0.005	#DIV/0!	#DIV/0!	8.125
Gt1								
Gt2								
Gt3								
Gt4	0.102	19.906	4.465	0.750	0.148	#DIV/0!	#DIV/0!	5.525

MEMORANDUM **(LABORATORY DATA REPORT)**

EPA - General Parameters

In reply refer to: 16-LC47

To Originator: Chunming Su

From: Lynda Callaway

Lab: General Parameters

Thru: Mark White
Lisa Costantino

Date: 5/18/2016

Technical Directive No.: EPAGP555
Task No.: 1.2H

Copies: Chunming Su
Anna R. Wallace
Lisa Costantino
Lynda Callaway
Kristie Hargrove

Sample Site/Project: Fort Riley Green Infrastructure

Date Collected: unknown
Date Received: 5/10/2016
Date Analyzed: 5/11 & 5/18/2016
No. Samples Analyzed: 34

Sample Set No.: 7108
Sample Matrix: water
Analysis Type: Fluoride & oP as P
Sample Preparation: diluted as necessary

Method(s) Used : NRMRL-GWERD-05-0 - Quality Control Procedures for General Parameters Analyses Using Lachat Flow Injection Analyzers (FIA)

RSKSOP-276, Rev. 4 - Determination of Major Anions in Aqueous Samples Using Capillary Ion Electrophoresis with Indirect UV Detection and Empower 2 Software

Comments:

All Quality Control results met the criteria established in NRMRL-GWERD-05-0 and RSKSOP-276/R4 cited above. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively. No dates of collection were given, so the 48 hour holding time for oP analysis may or may not have been met.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/18/16

Sample Results

			Analytes	**Fluoride (F)**		**Analytes**	**ortho-Phosphate (as P)**	
			Codes	**7782-41-4**		**Codes**	**70507**	
			Methods	**RSKSOP-276/4**		**Methods**	**NRMRL-GWERD-05-0**	
			Unit	**mg/L**		**Unit**	**mg/L**	
			MDL	**0.039**		**MDL**	**0.002**	
			QL	**0.200**		**QL**	**0.050**	
Field Sample ID	**Lab Sample ID**	**Date Collected**	**Date Analyzed**	**Data**	**DF**	**Date Analyzed**	**Data**	**DF**
H2	7108-1	-	5/18/2016	5.00	1	5/11/2016	BQL (0.014)	1
H2b	7108-2	-	5/18/2016	5.15	1	5/11/2016	BQL (0.020)	1
H4	7108-3	-	5/18/2016	4.98	1	5/11/2016	BQL (0.019)	1
H4b	7108-4	-	5/18/2016	5.12	1	5/11/2016	BQL (0.020)	1
H24	7108-5	-	5/18/2016	5.05	1	5/11/2016	BQL (0.017)	1
H24b	7108-6	-	5/18/2016	5.21	1	5/11/2016	BQL (0.025)	1
H48	7108-7	-	5/18/2016	4.95	1	5/11/2016	BQL (0.021)	1
H48b	7108-8	-	5/18/2016	5.09	1	5/11/2016	BQL (0.022)	1
Ha2	7108-9	-	5/18/2016	4.99	1	5/11/2016	BQL (0.015)	1
Ha2b	7108-10	-	5/18/2016	4.83	1	5/11/2016	BQL (0.020)	1
Ha2b	7108-10 Lab dup	-	5/18/2016	4.80 (RPD=0.623)	1	5/11/2016	BQL (0.021) (RPD=NA)	1
Ha4	7108-11	-	5/18/2016	4.72	1	5/11/2016	BQL (0.019)	1
Ha4b	7108-12	-	5/18/2016	4.86	1	5/11/2016	BQL (0.027)	1
Ha24	7108-13	-	5/18/2016	4.68	1	5/11/2016	BQL (0.020)	1
Ha24b	7108-14	-	5/18/2016	4.77	1	5/11/2016	BQL (0.019)	1
Ha48	7108-15	-	5/18/2016	4.67	1	5/11/2016	BQL (0.024)	1
Ha48b	7108-16	-	5/18/2016	4.73	1	5/11/2016	BQL (0.019)	1
M2	7108-17	-	5/18/2016	5.19	1	5/11/2016	BQL (0.028)	1
M2b	7108-18	-	5/18/2016	5.39	1	5/11/2016	BQL (0.020)	1
M4	7108-19	-	5/18/2016	5.11	1	5/11/2016	BQL (0.018)	1
M4b	7108-20	-	5/18/2016	5.24	1	5/11/2016	BQL (0.023)	1
M4b	7108-20 Lab dup	-	5/18/2016	5.24 (RPD=0)	1	5/11/2016	BQL (0.023) (RPD=NA)	1
M24	7108-21	-	5/18/2016	5.14	1	5/11/2016	BQL (0.020)	1
M24b	7108-22	-	5/18/2016	5.27	1	5/11/2016	BQL (0.022)	1
M48	7108-23	-	5/18/2016	5.52	1	5/11/2016	BQL (0.023)	1
M48b	7108-24	-	5/18/2016	5.15	1	5/11/2016	BQL (0.022)	1
G2	7108-25	-	5/18/2016	4.66	1	5/11/2016	BQL (0.021)	1
G2b	7108-26	-	5/18/2016	4.66	1	5/11/2016	BQL (0.022)	1
G4	7108-27	-	5/18/2016	4.77	1	5/11/2016	BQL (0.021)	1
G4b	7108-28	-	5/18/2016	4.69	1	5/11/2016	BQL (0.021)	1
G24	7108-29	-	5/18/2016	4.62	1	5/11/2016	BQL (0.022)	1
G24b	7108-30	-	5/18/2016	4.59	1	5/11/2016	BQL (0.021)	1

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Technical Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/18/16

Sample Results

Analytes	**Fluoride (F)**	**Analytes**	**ortho-Phosphate (as P)**
Codes	**7782-41-4**	**Codes**	**70507**
Methods	**RSKSOP-276/4**	**Methods**	**NRMRL-GWERD-05-0**
Unit	**mg/L**	**Unit**	**mg/L**
MDL	**0.039**	**MDL**	**0.002**
QL	**0.200**	**QL**	**0.050**

Field Sample ID	Lab Sample ID	Date Collected	Date Analyzed	Data	DF	Date Analyzed	Data	DF
G24b	7108-30 Lab dup	-	5/18/2016	4.62 (RPD=0.652)	1	5/11/2016	BQL (0.024) (RPD=NA)	1
G48	7108-31	-	5/18/2016	4.63	1	5/11/2016	BQL (0.017)	1
G48b	7108-32	-	5/18/2016	4.56	1	5/11/2016	BQL (0.013)	1
F	7108-33	-	5/18/2016	5.16	1	5/11/2016	BQL (0.017)	1
Fb	7108-34	-	5/18/2016	5.23	1	5/11/2016	BQL (0.023)	1
Fb	7108-34 Lab dup	-	5/18/2016	5.28 (RPD=0.952)	1	5/11/2016	BQL (0.021) (RPD=NA)	1

The data quality objective for precision of sample duplicates is <10 relative percent difference. The data quality objective was met for this set of samples. Method detection limits were determined on 4/8/2016 for oP and 10/27/2015 for fluoride. The current MDLs are 0.002 mg/L and 0.039 mg/L respectively.

Notes:

1. If the parameter was detected above the quantitation limit (**QL**), the numeric result is reported; **BQL** denotes that the parameter was not detected at or above the quantitation limit; **BQL ( )** denotes that the parameter was detected above the method detection limit (**MDL**) but below **QL** and the estimated numeric result is reported in parenthesis; **ND** denotes that the parameter was not detected at all. All the results are corrected with dilution factors (**DF**), if applicable. NA means not applicable.

EPA - General Parameters
Analytical Results Report

Laboratory: General Parameters

Tech. Directive: EPAGP555

Analyst: Lynda Callaway

Report Date: 05/18/16

Quality Control Data

Analytes	Fluoride (F)	ortho-phosphate as P	
Codes	7782-41-4	70507	
Methods	RSKSOP-276/4	NRMRL-GWERD-05-0	
Unit	mg/L	mg/L	
MDL	0.039	0.002	
QL	0.200	0.050	

QC Sample ID	Additional ID	Date Prepared	Date Analyzed	Data	True Value	% REC.	Data	True Value	% REC.	Data	True Value	% REC.
MB	Nanopure Water Blank	5/11/2016	5/11/2016	-	-	-	BQL (0.019)	-	-			
MB	Nanopure Water Blank	5/11/2016	5/11/2016	-	-	-	BQL (0.018)	-	-			
MB	Nanopure Water Blank	5/18/2016	5/18/2016	ND	-	-	-	-	-			
MB	Nanopure Water Blank	5/18/2016	5/18/2016	ND	-	-	-	-	-			
SS	ERA 67 Simple Nutrients	11/4/2015	5/11/2016	-	-	-	1.97	1.95	101			
SS	ERA 67 Simple Nutrients	11/4/2015	5/11/2016	-	-	-	1.99	1.95	102			
SS	ERA 67 Simple Nutrients	11/4/2015	5/11/2016	-	-	-	2.00	1.95	103			
SS	ERA 66 Minerals	7/1/2015	5/18/2016	1.70	1.70	100	-	-	-			
SS	ERA 66 Minerals	7/1/2015	5/18/2016	1.66	1.70	97.6	-	-	-			
CCC	Continuing Calibration Check Standard	4/28/2016	5/11/2016	-	-	-	0.100	0.100	100			
CCC	Continuing Calibration Check Standard	4/28/2016	5/11/2016	-	-	-	0.495	0.500	99.0			
CCC	Continuing Calibration Check Standard	4/28/2016	5/11/2016	-	-	-	0.237	0.250	94.8			
CCC	Continuing Calibration Check Standard	4/28/2016	5/11/2016	-	-	-	0.101	0.100	101			
CCC	Continuing Calibration Check Standard	4/28/2016	5/11/2016	-	-	-	1.02	1.00	102			
CCC	Continuing Calibration Check Standard	4/28/2016	5/11/2016	-	-	-	2.06	2.00	103			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	0.208	0.200	104	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	1.01	1.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	2.01	2.00	101	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	5.00	5.00	100	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	9.86	10.0	98.6	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	5.00	5.00	100	-	-	-			
CCC	Continuing Calibration Check Standard	12/1/2015	5/18/2016	9.86	10.0	98.6	-	-	-			
MS	H2 Spike	5/11 & 5/18/2016	5/11 & 5/18/2016	8.83	5.00 (3.85)	99.5	0.985	BQL (0.014) (0.990)	98.1			
MS	M24 Spike	5/11 & 5/18/2016	5/11 & 5/18/2016	9.10	5.14 (3.85)	103	1.00	BQL (0.020) (0.990)	99.0			
MS	G2 Spike	5/11 & 5/18/2016	5/11 & 5/18/2016	8.32	4.66 (3.85)	95.1	-	-	-			

Comments:

The data quality objective (DQO) for the accuracy of continuing calibration check standards and ERA second source standards is 90-110% recovery. The DQO for the recovery of matrix spike samples is 80-120% recovery. These objectives were met for the standards and spikes in these sample sets. Matrix spikes for fluoride were prepared by adding 20 uL of a 100 mg/L standard into 0.5 mL of sample to yield spike concentrations of 3.85 mg/L. Matrix spikes for oP were prepared by adding 20 uL of a 100 mg/L standard into 2 mL to yield a spike concentration of 0.990 mg/L. Matrix spike recoveries were calculated according to the equation: 100 * (spiked sample concentration (Data) - native sample concentration) / spike concentration.

Notes:

1. **MB** - Method Blank. **CCC** - Continuing Calibration Check. A calibration standard analyzed within the batch of samples. **LCS** - Laboratory Control Spike. A laboratory blank spiked with analytes at known concentrations. **MS** - Matrix Spike. A field sample spiked with known concentrations of analytes. The field sample id is identified. The True Value column for matrix spikes list the unspiked native sample concentration along with the spike concentration in parentheses. **SS** - Samples obtained from second sources are identified by their designated names. **DUP** - Field sample duplicate analysis. A sample selected by the lab analyst to analyze as a duplicate. It is reported in the sample result section. **% REC** - Percent Recovery. Calculated as the percentage of the results to the true values. It equals to % accuracy for CCC.

Sample ID	mass sample (g)	volume F- (mL)	Ce [F] mg/L	sorbed F (mg/l)	x/m (mg/g)	Date/time F- added	Date/time pH taken	measured pH	date/time filtered	duration of reaction (hours)	Ce [PO43-] as P (copied from raw data)	P (values only)
H2	0.1008	20.131	5.00	0.20	0.04						BQL (0.014)	
H2b	0.0997	20.133	5.15	0.04	0.01						BQL (0.020)	
H4	0.1	20.108	4.98	0.22	0.04						BQL (0.019)	
H4b	0.1034	20.142	5.12	0.08	0.01						BQL (0.020)	
H24	0.0988	20.108	5.05	0.15	0.03						BQL (0.017)	
H24b	0.1	20.061	5.21	-0.01	0.00						BQL (0.025)	
H48	0.1017	19.932	4.95	0.25	0.05			7.66			BQL (0.021)	
H48b	0.1021	19.569	5.09	0.11	0.02			7.5			BQL (0.022)	
Ha2	0.1012	20.119	4.99	0.21	0.04						BQL (0.015)	
Ha2b	0.1023	19.961	4.83	0.37	0.07						BQL (0.020)	
Ha4	0.0995	20.081	4.72	0.48	0.10						BQL (0.019)	
Ha4b	0.1019	20.136	4.86	0.34	0.07						BQL (0.027)	
Ha24	0.1008	20.066	4.68	0.52	0.10						BQL (0.020)	
Ha24b	0.1005	19.746	4.77	0.43	0.08						BQL (0.019)	
Ha48	0.1028	19.895	4.67	0.53	0.10			5.66			BQL (0.024)	
Ha48b	0.0985	19.945	4.73	0.47	0.09			5.42			BQL (0.019)	
M2	0.0998	20.147	5.19	0.00	0.00						BQL (0.028)	
M2b	0.1025	20.074	5.39	-0.19	-0.04						BQL (0.020)	
M4	0.1002	20.141	5.11	0.09	0.02						BQL (0.018)	
M4b	0.1013	20.116	5.24	-0.04	-0.01						BQL (0.023)	
M24	0.0998	20.075	5.14	0.06	0.01						BQL (0.020)	
M24b	0.1	20.039	5.27	-0.07	-0.02						BQL (0.022)	
M48	0.1028	20.008	5.52	-0.32	-0.06			7.68			BQL (0.023)	
M48b	0.1057	20.087	5.15	0.04	0.01			7.83			BQL (0.022)	
G2	0.1038	20.107	4.66	0.54	0.10						BQL (0.021)	
G2b	0.1004	20.111	4.66	0.54	0.11						BQL (0.022)	
G4	0.1037	20.03	4.77	0.43	0.08						BQL (0.021)	
G4b	0.1001	20.012	4.69	0.51	0.10						BQL (0.021)	
G24	0.099	20.036	4.62	0.58	0.12						BQL (0.022)	
G24b	0.1001	20.007	4.59	0.61	0.12						BQL (0.021)	
G48	0.1	20.058	4.63	0.57	0.11			5.53			BQL (0.017)	
G48b	0.101	19.853	4.56	0.64	0.12			5.32			BQL (0.013)	
F		5.20	5.16	0.04							BQL (0.017)	
Fb			5.23	-0.04							BQL (0.023)	

AVERAGES

Sample ID	mass sample (g)	volume F- (mL)	Ce [F] mg/L	sorbed F (mg/l)	x/m (mg/g)	Date/time F- added	Date/time pH taken	measured pH
H48		19.7505	5.02	0.175	0.034	#DIV/0!	#DIV/0!	7.58
Ha48		19.92	4.7	0.495	0.098	#DIV/0!	#DIV/0!	5.54
M48		20.0475	5.335	-0.14	-0.027	#DIV/0!	#DIV/0!	7.755
G48		19.9555	4.595	0.6	0.119	#DIV/0!	#DIV/0!	5.425