Environmental Resources Management

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Mr. Todd Slater
Arkema, Inc.
Manager, Environmental Technologies and Remedial Procurement
Health, Environment and Safety
900 First Avenue
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Subject: Evaluation of Potential Anion Interference in Perchlorate Analyses - Arkema, Inc. Portland Facility
ERM-West Project No. 0020423.60.02

Dear Mr. Slater:

ERM-West, Inc. (ERM) conducted an evaluation of potential anion interference in perchlorate analyses for groundwater samples from the Arkema, Inc., Portland facility (the "Site"). This study was conducted in an attempt to resolve issues regarding the validity of analytical results due to questions on historic data collection from the Site and questions raised in the literature on potential method interferences.

Elevated concentrations of certain anions, especially sulfate and chloride, and high conductivity, are known to interfere with the analysis of perchlorate by United States Environmental Protection Agency (USEPA) Method 314.0, which uses ion chromatography with conductivity detection. For comparison with USEPA Method 314.0, ERM chose a new perchlorate method that uses ion chromatography with tandem mass spectrometry detection (IC/MS-MS) that was reportedly not as affected by the interferences. Severn Trent Laboratories (STL) in Denver, Colorado, has been at the forefront of perchlorate method development and was chosen to construct the test matrix samples and to conduct the analyses.

STL constructed three sets of test matrix samples and analyzed the 15 samples by both USEPA Method 314.0 and IC/MS-MS, as summarized in the attached Table 1. For the test matrix, samples with specified concentrations of perchlorate, chlorate, and/or chloride were

analyzed using both methods. The analytes tested, as well as the results of the analyses, are listed in Table 1. Calculated percent recoveries and Relative Percent Differences between the duplicate results are also provided. The analytical results have also been corrected for the amount of perchlorate that was present in the chlorate solution.

From these results, ERM concludes:

- At perchlorate concentrations less than 2 milligrams per liter (mg/L), concentrations of anions can cause a matrix interference, which may bias the results.

- USEPA Method 314.0 is an acceptable analytical method for groundwater samples with perchlorate concentrations of greater than 2 mg/L in the presence of higher concentrations of anions. However, the method results for several of the test matrix samples showed a high bias with recoveries greater than 120 percent. This high bias should be taken into account during data interpretation.

- High variability and a bias using either method was found at the lowest perchlorate concentration standard that was run (0.02 mg/L) regardless of anion concentration.

Based upon the results of this testing and conditions at the Site, ERM recommends the use of USEPA Method 314.0 for engineering level review of routine groundwater analyses at the Site, with confirmation analysis conducted using IC/MS-MS at a select frequency. The use and interpretation of data should note the potential bias and high variability in the results at concentrations below 2 mg/L and care should be used in the utilization of these data, particularly at the lower concentration ranges.

Please call if you have questions.

Sincerely,

Erik C. Ipsen, P.E.
Project Manager

Maureen C. Leahy, Ph.D.
Program Director

David P. Edwards, P.G.
Principal

ECI/MCL/DPE/dwb/0020423.60.02

Attachment

Table

TABLE 1

Test Matrices for Anion Interference in Perchlorate Analyses
Arkema, Inc.
Portland, Oregon

Test Matrix Samples					Analytical Results				RPD	Analytical Results Corrected for Perchlorate in Chlorate			
Sample ID	Anion Concentration (mg/L)												
	Perchlorate	Chlorate	Chloride	Sulfate	314.0	% Recovery	IC/MS-MS	% Recovery		314.0	% Recovery	IC/MS-MS	% Recovery
Perchlorate 200	200	0	0	0	220	110%	200	100%	10%	na	na	na	na
Perchlorate 20	20	0	0	0	24	120%	21	105%	13%	na	na	na	na
Perchlorate 2	2	0	0	0	2.2	110%	2.1	105%	5%	na	na	na	na
Perchlorate 0.2	0.2	0	0	0	0.22	110%	0.23	115%	4%	na	na	na	na
Perchlorate 0.02	0.02	0	0	0	0.034	170%	0.033	165%	3%	na	na	na	na
Mix 1	200	8000	0	0	260	130%	220	110%	17%	260	130%	220	110%
Mix 2	20	8000	0	0	23	115%	22	110%	4%	22.6	113%	21.6	108%
Mix 3	2	8000	0	0	2.6	130%	2.7	135%	4%	2.2	112%	2.3	117%
Mix 4	0.2	8000	0	0	0.57	285%	0.55	275%	4%	0.21	105%	0.19	95%
Mix 5	0.02	8000	0	0	0.40	2000%	0.41	2050%	2%	0.04	200%	0.05	250%
Mix 6	200	8000	100000	2000	270	135%	240	120%	12%	270	135%	240	120%
Mix 7	20	8000	100000	2000	24	120%	22	110%	9%	23.6	118%	21.6	108%
Mix 8	2	8000	100000	2000	2.5	125%	2.8	140%	11%	2.1	107%	2.4	122%
Mix 9	0.2	8000	100000	2000	0.16	80%	0.57	285%	112%	-0.20	-100%	0.21	105%
Mix 10	0.02	8000	100000	2000	0.33	1650%	0.40	2000%	19%	-0.03	-150%	0.04	200%
Chlorate	na	8000	0	0	na	na	0.36	na	na	na	na	na	na

Recoveries >120% or less than 80%
RPD >15%