<u>**CERTIFIED MAIL # 7008 1830 0002 0847 3676**</u>
<u>**Return Receipt Requested**</u>

July 10, 2009

Ms. Cynthia S. Campbell
Manager, Water Quality Compliance Section
Arizona Department of Environmental Quality
1110 West Washington Street
Phoenix, Arizona 85007-2935

Re: **Mitigation Order on Consent No. P-121-07**
        Monthly Sulfate Monitoring and Trend Analysis

Dear Ms. Campbell:

In accordance with Mitigation Order on Consent Docket No. P-121-07, Freeport-McMoRan Corporation, Copper Queen Branch (CQB) conducted water quality sampling at Naco Water Company (NWC) drinking water supply well NWC-04 from October 2008 to June 2009. CQB previously recommended quarterly monitoring for NWC-04 based on the results of water quality sampling conducted through April 2009[1]. CQB is revising the previous recommendation for quarterly water sampling at NWC-04 to monthly based on information collected in May and June 2009.

The recent sample results indicate that sulfate concentrations in samples from NWC-04 have a high degree of variability over time which, in conjunction with an observed sulfate concentration range between 162 and 210 milligrams per liter, makes trend analysis results difficult to interpret. Therefore, CQB will continue monthly sampling at NWC-04 as a conservative means of characterizing sulfate in this drinking water supply well.

The sample results and trend analysis are described in the enclosed letter by Hydro Geo Chem, Inc. If you have any questions or require anything additional please contact me at 520-432-6206.

Sincerely,

Rebecca A. Sawyer
Senior Environmental Engineer
Copper Queen Branch

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[1] Correspondence from Rebecca Sawyer, Copper Queen Branch, to Cynthia Campbell, ADEQ, Re: Mitigation Order, Docket No. P-121-07 Results of Monthly Sulfate Sampling and Trend Analysis. June 5, 2009.

Enclosure

cc: Bonnie O'Connor, Southwest Utility Management, Inc.
       Michael Jaworski, Freeport-McMoRan Copper Queen Branch
       Ned Hall, Freeport-McMoRan Copper & Gold Inc.
       Sheila Deely, Freeport-McMoRan Copper & Gold Inc.
       Dalva Moellenberg, Gallagher & Kennedy
       Stuart Brown, Bridgewater Group, Inc.
       Jim Norris, Hydro Geo Chem, Inc.

July 9, 2009

Rebecca A. Sawyer
Senior Environmental Engineer
Freeport-McMoRan Copper Queen Branch
36 West Highway 92
Bisbee, Arizona 85603

Re: Mitigation Order on Consent No. P-121-07
Monthly Sulfate Monitoring and Trend Analysis at NWC-04

Dear Ms. Sawyer:

This letter describes and evaluates the results of monthly water sampling and analysis of sulfate in Naco Water Company (NWC) public drinking water supply well NWC-04 conducted pursuant to Section 4 of the Work Plan[1]. As outlined in Section 4 of the Work Plan *"a water supply having a discrete sulfate concentration between 135 milligrams per liter (mg/l) and 250 mg/l will be monitored monthly for four months to determine whether concentrations are increasing and to identify any trend in sulfate concentration over time. Based on the apparent trend in sulfate concentrations, a monitoring schedule will be developed for the supply. If the trend indicates increasing concentrations, an interim action will be selected and an implementation plan will be developed."*

In November 2008, water quality sampling results verified that public drinking water supply well NWC-04 had a discrete sulfate concentration between 135 mg/l and 250 mg/l. NWC-04 was sampled for sulfate monthly from January to June 2009 and a trend analysis was conducted.

Mann-Kendall Analysis

A Mann-Kendall statistical trend analysis was conducted to determine if concentrations of sulfate are increasing, decreasing, or stable over time in samples collected from NWC-04. The Mann-Kendall test is a non-parametric test for identifying trends in time series data. The test compares the relative magnitudes of sample data rather than the data values themselves. One particular benefit of this test is that the data need not conform to any particular statistical distribution. Moreover, the test can be used with a minimum of four rounds of sampling results. The attached Excel based macro[2] was used to process the time series data, perform the trend analysis, and report the results.

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[1] Hydro Geo Chem, Inc. (HGC) 2008. Revision 1, Work Plan to Characterize and Mitigate Sulfate with Respect to Drinking Water Supplies in the Vicinity of the Concentrator Tailing Storage Area, Cochise County, Arizona. July 3, 2008.
[2] State of Wisconsin, 2001. Department of Natural Resources, Chapter NR 700 Appendix A, Mann-Kendall Statistical Test, Form 4400-215.

Mann-Kendall Trend Results

Based on guidance in Gilbert[3], a trend was considered significant if the *"confidence in trend"* metric, (1-p) x 100%, was ≥ 80% which represents a significance level of α = 0.2. A statistically significant trend was not observed (72% confidence level) in the NWC-04 well. The following table provides the results of the sampling. Analytical reports for October 2008 and January through March 2009 are included in the Aquifer Characterization Report[4] and as Appendix D in the First Quarter Groundwater Monitoring Report[5], respectively. Analytical reports for the April through June 2009 sampling will be included in the second quarter monitoring report.

Event	Sample Date	NWC-04
1	10/27/08	162
2	1/22/09	184
3	2/12/09	198
4	3/11/09	197
5	4/23/09	188
6	5/28/09	210
7	6/24/09	169
Mann-Kendall Statistic (S)		5
Probability (p)		0.281
Confidence in Trend (1-p)		72%
Number of Rounds (n)		7
Average		186.86
Standard Deviation		16.88
Coefficient of Variation (CV)		0.090

Trend ≥ 80% Confidence Level	No Trend

Stability Test; if No Trend Exists at 80% Confidence Level	CV ≤ 1 STABLE

The trend analysis indicates that NWC-04 does not have a statistically significant trend and tests "stable" with a coefficient of variation <1; meaning that the Mann-Kendall test could not discern either an up or down trend for the given data. Previously, we recommended that quarterly water sampling at NWC-04 be started in the third quarter of 2009 based on sampling results through April 2009[6]. Subsequent sampling in May and June 2009 indicated sulfate concentrations of 210 mg/L and 169 mg/L, respectively. Trend analysis with data collected through May 2009 indicated a positive trend whereas analysis of the data through June 2009 indicates no trend. The observed variability of the sulfate concentration data makes trend analysis difficult to interpret especially given concentrations up to 210 mg/L which is near the

[3] Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold, New York.
[4] Hydro Geo Chem, Inc., 2009. Aquifer Characterization Report, Task 4 of the Aquifer Characterization Plan Mitigation Order on Consent Docket No. P-121-07, Cochise County, Arizona, Volume I. April 29, 2009.
[5] Hydro Geo Chem, Inc., 2009. First Quarter 2009 Groundwater Monitoring Report, Tasks 1.0 and 2.2 of Aquifer Characterization Plan Mitigation Order on Consent Docket No. P-121-07, Cochise County, Arizona. April 14, 2009.
[6] Correspondence from Dan Simpson and James Norris, Hydro Geo Chem, Inc., to Rebecca Sawyer, Copper Queen Branch. Re: Mitigation Order on Consent No. P-121-07, Monthly Sulfate Monitoring and Trend Analysis at MWC-04. June 5, 2009.
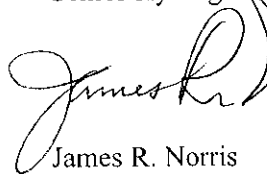
action level of 250 mg/L. For this reason, we recommend continuing monthly water sampling at NWC-04.

If you have any questions about the data analysis or the monitoring recommendation described in this letter, please call.

Sincerely,

Daniel R. Simpson
Senior Hydrogeologist

James R. Norris
Arizona Registered Geologist No. 30842

Attachment

cc: Michael Jaworski, Freeport-McMoRan Copper Queen Branch
Ned Hall, Freeport-McMoRan Copper & Gold Inc.
Sheila Deely, Freeport-McMoRan Copper & Gold Inc.
Dalva Moellenberg, Gallagher & Kennedy
Stuart Brown, Bridgewater Group, Inc.

ATTACHMENT
MANN-KENDALL TREND ANALYSIS

Naco Water Company Sulfate Trend Analysis

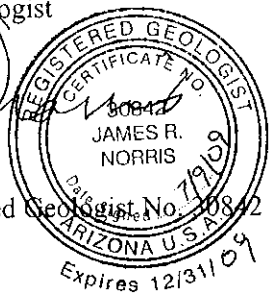| Event	Sample Date	NWC-04					
1	10/27/08	162					
2	1/22/09	184					
3	2/12/09	198					
4	3/11/09	197					
5	4/23/09	188					
6	5/28/09	210					
7	6/24/09	169					
8							
9							
10							
Mann-Kendall Statistic (S)		5	0	0	0	0	0
Probability (p)		0.281	0	0	0	0	0
Confidence in Trend (1-p)		72%	0%	0%	0%	0%	0%
Number of Rounds (n)		7	0	0	0	0	0
Average		186.86	0	0	0	0	0
Standard Deviation		16.88	0	0	0	0	0
Coefficient of Variation (CV)		0.090	0	0	0	0	0

Error Check, If No Errors - Blank			n<4	n<4	n<4	n<4	n<4

Trend ≥ 80% Confidence Level		No Trend	n<4	n<4	n<4	n<4	n<4
Trend ≥ 90% Confidence Level		No Trend	n<4	n<4	n<4	n<4	n<4

Stability Test; If No Trend Exists at 80%		CV <= 1	n<4	n<4	n<4	n<4	n<4
Confidence Level		STABLE	n<4	n<4	n<4	n<4	n<4

THIS BLOCK OF CELLS IS USED TO SEARCH FOR DATA ENTRY ERRORS

DATA ERROR	Event	NWC-04	0	0	0	0	0
CHECKS	1	-1	-1	-1	-1	-1	-1
	2	-1	-1	-1	-1	-1	-1
Checks for data	3	-1	-1	-1	-1	-1	-1
with values less	4	-1	-1	-1	-1	-1	-1
than zero or text	5	-1	-1	-1	-1	-1	-1
(a space is seen	6	-1	-1	-1	-1	-1	-1
as text in Excel).	7	-1	-1	-1	-1	-1	-1
	8	-1	-1	-1	-1	-1	-1
Minus one (-1)	9	-1	-1	-1	-1	-1	-1
shown if no	10	-1	-1	-1	-1	-1	-1
error.	Data Error?	no error	no error	no error	no error	no error	no error

THIS BLOCK OF CELLS USED TO FIND ERRORS IN DATES

DATE ERROR	Sample Date	Text in Date?	Consecutive?	Data w no date?
CHECKS	10/27/08	-1	-1	-1
	1/22/09	-1	-1	-1
Checks include	2/12/09	-1	-1	-1
a test for	3/11/09	-1	-1	-1
consecutive	4/23/09	-1	-1	-1
dates and text.	5/28/09	-1	-1	-1
	6/24/09	-1	-1	-1
Minus one (-1)	BLANK	-1	-1	-1
shown if no	BLANK	-1	-1	-1
error.	BLANK	-1	-1	-1
	Date Error?	no error	no error	no error

Mann Kendall S Values		
Values of n	Smax@0.2	Smax@0.1
4	-4	-6
5	-5	-7
6	-6	-8
7	-7	-10
8	-8	-11
9	-10	-14
10	-11	-16

TEST FOR	Number of Rounds	NWC-04	0	0	0	0	0
INCREASING	4						
OR	5						
DECREASING	6						
TREND @ 80%	7	0					
	8						
If +1, Increasing	9						
If -1, decreasing	10						
If 0, neither.		Neither	Neither	Neither	Neither	Neither	Neither

TEST FOR	Number of Rounds	NWC-04	0	0	0	0	0
INCREASING	4						
OR	5						
DECREASING	6						
TREND @ 90%	7	0					
	8						
If +1, Increasing	9						
If -1, decreasing	10						
If 0, neither.		Neither	Neither	Neither	Neither	Neither	Neither

ATTACHMENT
MANN-KENDALL TREND ANALYSIS

Naco Water Company Sulfate Trend Analysis								Well:	NWC-04	
Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 7	Event 8	Event 9	Event 10	
162	184	198	197	188	210	169				Sum Rows
	1	1	1	1	1	1				6
		1	1	1	1	-1				3
			-1	-1	1	-1				-2
				-1	1	-1				-1
					1	-1				0
						-1				-1
										0
										0
										0
							Mann Kendall Statistic (S) =			5

								Well:		0
Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 7	Event 8	Event 9	Event 10	
										Sum Rows
										0
										0
										0
										0
										0
										0
										0
										0
							Mann Kendall Statistic (S) =			0

								Well:		0
Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 7	Event 8	Event 9	Event 10	
										Sum Rows
										0
										0
										0
										0
										0
										0
										0
										0
							Mann Kendall Statistic (S) =			0

								Well:		0
Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 7	Event 8	Event 9	Event 10	
										Sum Rows
										0
										0
										0
										0
										0
										0
										0
										0
							Mann Kendall Statistic (S) =			0

								Well:		0
Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 7	Event 8	Event 9	Event 10	
										Sum Rows
										0
										0
										0
										0
										0
										0
										0
										0
							Mann Kendall Statistic (S) =			0

								Well:		0
Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 7	Event 8	Event 9	Event 10	
										Sum Rows
										0
										0
										0
										0
										0
										0
										0
										0
							Mann Kendall Statistic (S) =			0