FREEPORT-McMoRan
COPPER & GOLD

Copper Queen Branch/Freeport-McMoRan Corporation
36 West Highway 92
Bisbee, Arizona 85603

VIA UPS OVERNIGHT MAIL A372 840 995 9

June 5, 2009

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

RE: **Mitigation Order, Docket No. P-121-07**
        Results of 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) has conducted monthly water quality sampling at NWC-04 from January to April 2009. A trend analysis was conducted and indicates that NWC-04 does not have a statistically significant trend and tests "stable" with a coefficient of variation <1. The enclosed letter from Hydro Geo Chem, Inc. evaluates the results of the water quality sampling and provides recommendations for ongoing monitoring based on the results of the monthly sampling. CQB plans to implement the proposed monitoring schedule in the third quarter monitoring event unless we hear otherwise from Arizona Department of Environmental Quality.

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

Enclosure

June 5, 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 April 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.

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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.

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The attached Excel based macro[2] was used to process the time series data, perform the trend analysis, and report the results.

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 $\geq$ 80% which represents a significance level of α = 0.2. A statistically significant trend was not observed (76% 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 2009 sampling will be included in the second quarter monitoring report.

Event	Sample Date	NWC-04
1	10/27/08	162
2	01/22/09	184
3	02/12/09	198
4	03/11/09	197
5	04/23/09	188
Mann-Kendall Statistic (S)		4
Probability (p)		0.242
Confidence in Trend (1-p)		76%
Number of Rounds (n)		5
Average		185.80
Standard Deviation		14.57
Coefficient of Variation (CV)		0.078

Trend $\geq$ 80% Confidence Level	No Trend

Stability Test; if No Trend Exists at 80% Confidence Level	CV $\leq$ 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. Based on the available data, quarterly monitoring is recommended for NWC-04 beginning with the third quarter 2009.

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[2] State of Wisconsin, 2001. Department of Natural Resources. Chapter NR 700 Appendix A, Mann-Kendall Statistical Test, Form 4400-215.

[3] Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold, New York.

[4] HGC, 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] HGC, 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.

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Please do not hesitate to call us if you have any questions about the data analysis or the monitoring recommendations described in this letter.

Sincerely,

Daniel R. Simpson
Senior Hydrogeologist
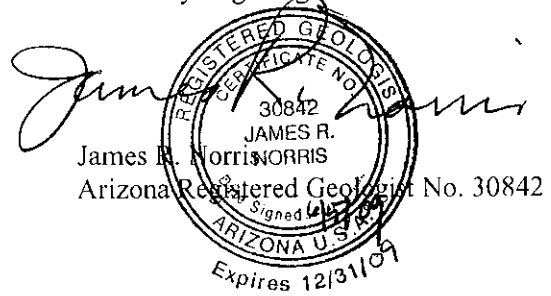
James R. Norris
Arizona Registered Geologist No. 30842

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	01/22/09	184					
3	02/12/09	198					
4	03/11/09	197					
5	04/23/09	188					
6							
7							
8							
9							
10							
Mann-Kendall Statistic (S)		4	0	0	0	0	0
Probability (p)		0.242	0	0	0	0	0
Confidence in Trend (1-p)		76%	0%	0%	0%	0%	0%
Number of Rounds (n)		5	0	0	0	0	0
Average		185.80	0	0	0	0	0
Standard Deviation		14.57	0	0	0	0	0
Coefficient of Variation (CV)		0.078	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	Date	Text in Date?	Consecutive?	Data w no date?
CHECKS	10/27/08	-1	-1	-1
	01/22/09	-1	-1	-1
Checks include	02/12/09	-1	-1	-1
a test for	03/11/09	-1	-1	-1
consecutive	04/23/09	-1	-1	-1
dates and text.	BLANK	-1	-1	-1
	BLANK	-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	0					
DECREASING	6						
TREND @ 80%	7						
	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	0					
DECREASING	6						
TREND @ 90%	7						
	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	Sum Rows
162	184	198	197	188						
	1	1	1	1						4
		1	1	1						3
			-1	-1						-2
				-1						-1
										0
										0
										0
										0
										0
								Mann Kendall Statistic (S) =		4

									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
										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
										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
										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
										0
								Mann Kendall Statistic (S) =		0