APPENDIX I

GROUNDWATER RESAMPLING RESULTS

IT Corporation
312 Directors Drive
Knoxville, TN 37923-4799
Tel. 865.690.3211
Fax. 865.690.3626

A Member of The IT Group

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Mr. Ellis Pope
U.S. Army Corps of Engineers, Mobile District
Attn: CESAM-EN-GE (Pope)
109 St. Joseph Street
Mobile, Alabama 36602

Contract: Contract No. DACA21-96-D-0018/CK05
Fort McClellan, Alabama

Subject: Groundwater Resampling Results

Dear Mr. Pope:

This letter report summarizes the results of the resampling effort conducted by IT Corporation to evaluate the effect of turbidity on metals concentrations in groundwater at Fort McClellan (FTMC).

At approximately 20 percent of the wells installed by IT at FTMC, the turbidity of the groundwater at the time of sample collection could not be reduced below 20 NTUs. In accordance with the installation-wide sampling and analysis plan (SAP), groundwater samples were collected for chemical analysis after five well volumes were removed from the well, regardless of the turbidity of the water. High turbidity is believed to have caused artificially high metals results in these groundwater samples due to suspended particulates. To determine whether high turbidity caused the elevated metals results, IT resampled five wells (four temporary wells and one permanent well) that previously had high turbidity at the time the original samples were collected. As shown in Table 1, the turbidities of the five wells originally sampled ranged from 211.4 nephelometric turbidity units (NTU) to greater than 1000 NTUs.

For the resampling effort, IT sampled the wells in accordance with procedures outlined in the SAP, however, at purge rates of between 0.1 and 0.5 liters per minute (i.e., low flow). IT used a peristaltic pump at three well locations and a Fultz in-line pump at two locations. The wells were purged until field parameters (pH, temperature, conductivity, and dissolved oxygen) stabilized and turbidity readings were below 10 NTUs.

The results of the low-flow resampling study are presented in Table 1. As shown in Table 1, the low turbidity samples had fewer metals detected and lower metals concentrations overall than the high turbidity groundwater samples. For most metals (except calcium, magnesium, potassium, sodium, and thallium), the concentrations in the low turbidity samples were significantly lower (1-2 orders of magnitude) than in the high turbidity samples. Several metals (beryllium, cadmium, chromium, lead, mercury, and selenium) that were detected in one or more of the high turbidity samples were not detected in the low turbidity samples. Certain metals (i.e., calcium, magnesium, potassium, and sodium), with a few exceptions, showed a slight decrease in the low turbidity samples; however, these metals results were generally within the same order of magnitude as the high turbidity samples.

The low-flow sampling method resulted in fewer detected metals and overall lower metals concentrations. Most metals concentrations decreased significantly using the low-flow procedure. The

study demonstrates that high turbidity at the time of sample collection results in elevated metals concentrations. With the exception of barium (one sample), manganese (one sample), and thallium (two samples), the metals concentrations in the resamples were below SSSLs and/or background concentrations. The barium and manganese results were within the range of background values. IT will discuss the results of this study in the SI reports to strengthen the assertion that high turbidity causes elevated metals results.

In the future, IT will attempt to reduce turbidity below 10 NTUs using the groundwater sampling procedure specified in the SAP. However, if field parameters have not stabilized and turbidity is not less than 10 NTUs after five well volumes have been removed, then the following procedures will be implemented:

- Purging will continue if a decreasing trend is observed in the turbidity readings. The groundwater sample will be collected if turbidity is below 10 NTUs.
- If turbidity is not less than 10 NTUs, then low-flow purging will commence. Purging will continue and water quality parameters will be recorded for a maximum of one well volume.
- If stabilization has not been achieved and/or turbidity remains greater than 10 NTUs, IT will stop purging. IT will allow the well to equilibrate and samples will be collected within 24 hours using a Teflon bailer.

If you have questions, or need further information, please contact me at (770) 663-1429 or Steve Moran at (865) 694-7361.

Sincerely,

Stephen G Moran for
Jeanne A. Yacoub, P.E.
Project Manager

Attachments

Distribution: Lisa Kingsbury, FTMC
Bart Reedy, EPA Region IV
Dennis Druck, CHPPM
Philip Stroud, ADEM
Hugh Vick, Gannett Fleming

Table 1

Metals Concentrations in Groundwater
High Turbidity Samples vs. Low Turbidity Samples
Fort McClellan, Calhoun County, Alabama

Parcel		FTA-145		FTA-145		FTA-145		FTA-145		FTA-151		FTA-151		GSBP-501		GSBP-501		PPMP-173		PPMP-173	
Sample Location		FTA-145-GP06		FTA-145-GP06		FTA-145-GP12		FTA-145-GP12		FTA-151-GP05		FTA-151-GP05		GSBP-501-MW02		GSBP-501-MW02		PPMP-173-GP03		PPMP-173-GP03	
Sample Number		CY3005		CY3005R		CY3012		CY3012R		BJ3005		BJ3005R		BX3004		BX3004R		KF3004		KF3004R	
Sample Date		12-Jan-99		6-Jul-00		18-Dec-98		6-Jul-00		2-Dec-98		5-Jul-00		5-Jan-00		7-Jul-00		17-Feb-99		5-Jul-00	
Turbidity		>1000		3.72		612.40		5.42		309.00		2.82		>1000		8.47		211.40		8.64	
Metal	**Units**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Aluminum	mg/L	5.33E+01	J	1.09E-01		6.81E+01	J	2.95E-01		3.64E+01		1.17E-01		4.93E+01		6.24E-01		1.98E+01		3.08E-01	
Antimony	mg/L	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Arsenic	mg/L	1.06E-02	J	3.20E-03		1.12E-02		ND		1.12E-02		ND		4.51E-02		ND		5.09E-02		ND	
Barium	mg/L	4.15E-01	J	7.50E-02		5.13E-01		4.39E-02		5.16E-01		3.64E-01		2.40E-01		1.76E-02		2.08E-01		3.34E-02	
Beryllium	mg/L	2.80E-03	J	ND		2.90E-03	B	ND		2.20E-03	J	ND		9.20E-03		ND		5.80E-03		ND	
Cadmium	mg/L	ND		ND		ND		ND		ND		ND		1.00E-03	J	ND		7.50E-03		ND	
Calcium	mg/L	1.12E+02	J	7.85E+01		1.86E+01		1.32E+01		6.87E+01		5.04E+01		4.97E+01		4.01E+01		3.61E+01		4.28E+01	
Chromium	mg/L	1.27E-01	J	ND		8.71E-02		ND		7.70E-02		ND		6.70E-02		ND		1.98E-02		ND	
Cobalt	mg/L	1.63E-02	J	2.70E-03		5.18E-02		4.40E-03		3.18E-02	J	ND		2.35E-02	J	ND		6.84E-02		ND	
Copper	mg/L	7.93E-02	J	2.40E-03		9.99E-02		ND		6.52E-02		ND		5.82E-02	J	9.50E-03		4.31E-02		ND	
Iron	mg/L	7.20E+01	J	3.99E+00		9.25E+01	J	1.47E-01		5.64E+01		3.59E-01		7.23E+01		5.62E-01		8.49E+01		6.42E-01	
Lead	mg/L	3.33E-02	J	ND		4.71E-02		ND		3.27E-02		ND		1.87E-01		ND		4.22E-02		ND	
Magnesium	mg/L	6.23E+01	J	3.80E+01		3.42E+01		1.25E+01		3.62E+01		1.47E+01		3.13E+01		2.28E+01		9.14E+00		7.30E+00	
Manganese	mg/L	1.34E+00	J	1.56E+00		1.62E+00		7.55E-01		7.10E-01		1.55E-01		3.67E+00		9.82E-02		1.78E+00		1.09E-02	
Mercury	mg/L	2.50E-04	J	ND		1.40E-04	B	ND		9.30E-05	J	ND		1.30E-03		ND		1.10E-04	J	ND	
Nickel	mg/L	1.08E-01	J	4.70E-03		1.29E-01		2.76E-02		8.12E-02		ND		5.34E-02		5.70E-03		4.37E-01		6.20E-03	
Potassium	mg/L	1.51E+01	J	1.87E+00		1.32E+01		2.45E+00		1.03E+01		1.93E+00		4.65E+00	J	4.72E-01		4.13E+00	J	3.70E-01	
Selenium	mg/L	ND		ND		5.40E-03		ND		ND		ND		ND		ND		ND		ND	
Silver	mg/L	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Sodium	mg/L	1.28E+01		1.16E+01		7.33E+00		6.58E+00		3.37E+01		2.93E+01		2.72E+00	J	2.75E+00		4.29E+00	J	3.48E+00	
Thallium	mg/L	5.00E-03	J	8.80E-03		6.50E-03	B	5.40E-03		ND		ND		ND		ND		ND		ND	
Vanadium	mg/L	9.26E-02	J	ND		4.11E-02	J	ND		5.20E-02		ND		3.06E-01		3.90E-03		3.98E-02	J	ND	
Zinc	mg/L	2.03E-01	J	1.46E-02		3.12E-01		1.36E-02		1.25E-01		ND		2.90E-01		2.03E-02		1.06E+00		1.76E-02	
# of detected metals		19		14		20		12		18		8		19		12		19		10	

Shaded = resample results

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero).
J - Result is greater than stated method detection limit but less than or equal to specified reporting limit.
mg/L - Milligrams per liter
ND - Not detected
Qual - Data validation qualifier