TECHNICAL MEMORANDUM CH2MHILL

Pre-Feasibility Study Groundwater Sampling Activities Site 21 (Bronson Road Landfill), Indian Head Division-NSWC Indian Head, Maryland

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The remedial investigation (RI) conducted at Site 21 at the Indian Head Division-Naval Surface Warfare Center (IHDIV-NSWC) identified contaminants of concern in groundwater (CH2M HILL, August 2002). Additional data needs were identified during the RI to be addressed before proceeding to the feasibility study (FS). Field activities were conducted to fill these data gaps in a pre-FS investigation, as described in a work plan prepared for the purpose (CH2M HILL, April 2002). This technical memorandum (memo) presents a summary of the groundwater sampling activities and results.

Background

Groundwater sampling conducted at Site 21 during the initial field effort in August 2000 detected constituents of concern in groundwater. In particular, the groundwater sample collected from monitoring well IS21MW02 contained manganese at a concentration of 23,100 micrograms per liter (µg/l) and the groundwater samples collected from IS21MW01 and IS21MW04 contained perchlorate at concentrations of 2 µg/l and 2,000 µg/l, respectively (CH2M HILL, August 2002). It is believed that naturally occurring manganese is being mobilized due to oxidation/reduction (redox) conditions in the subsurface present at Site 21. The source of the perchlorate is unknown.

To ensure that the concentrations of manganese and perchlorate observed in these wells were not anomalous and to aid in the understanding of the hydrogeochemistry of the site, a second round of groundwater sampling was proposed.

Site 21 Groundwater Sampling Activities

CH2MHILL conducted a second round of groundwater sampling at Site 21 in July 2002. Groundwater samples were collected from the four monitoring wells (IS21MW01, IS21MW02, IS21MW03, and IS21MW04) at the site. Samples were analyzed for perchlorate by United States Environmental Protection Agency (EPA) Method 314, Target Analyte List (TAL) inorganics (total and dissolved) by Contract Laboratory Program (CLP) Method ILM04.0, and sulfate by EPA Method 375. Sulfate was included in the analysis to assist in evaluating whether or not natural attenuation is occurring at the site. *In situ* parameters including pH, temperature, conductivity, oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity were measured in the field. Before groundwater sampling, the water level of each well was measured.

Note that, due to the current drought conditions affecting the East Coast, all four monitoring wells had low water levels and were, as a result, purged dry during sampling. *In situ* parameters could only be measured at IS21MW01 and IS21MW04 because the other two wells went dry too quickly. Further, sufficient sample volume for all samples could not be obtained from monitoring wells IS21MW02 and IS21MW03; thus, dissolved metals and sulfate samples could not be obtained from either well, and a total metals sample could not be obtained from IS21MW03.

Results

The analytical results are presented in Table 1. *In situ* parameters for monitoring wells IS21MW01 and IS21MW04 are presented in Table 2.

Perchlorate

Perchlorate was detected in monitoring well IS21MW04 at a concentration of 2,900 µg/l. Perchlorate was not detected in any other well at the site.

Metals

Total manganese was detected at a concentration of 10,900 µg/l in monitoring well IS21MW02, a concentration that is significantly lower than the concentration detected during the September 2000 sampling event (23,100µg/l) but is still more than an order of magnitude higher than the tap water risk-based concentration (RBC) of 730 µg/l (USEPA, 2002). The decrease in concentration may be due to the following:

- Changed hydrogeologic conditions: The water table was lower during the second sampling event, which probably resulted in changes to thegroundwater-flow regime between the two sampling events.
- Possible differences in groundwater geochemistry: Some of the physico-chemical properties such as ORP, pH, and DO were not measured in two of the four wells. Hence, nothing definitive can be said about this possibility.

Except for a few metals such as aluminum, iron, and lead, which show a general increase in total concentrations between the September 2000 and the July 2002 sampling events, no temporal or spatial concentration trends are evidenced by the 2000 and 2002 groundwater sample results. The general increase in total concentration observed for aluminum, iron,

and lead may be due to higher turbidity values measured during the second event (although data are available from only two of the wells). Additionally, in some cases, the concentrations of total metals detected during the July 2002 event exceeded RBCs whereas they did not exceed the RBCs in the September 2000 sampling round. However, only copper and vanadium exceeded their RBCs for the first time in the second round, and both did so in the sample from well IS21MW04, which was excessively turbid in the second sampling round.

Sulfate

Sulfate was detected in the samples collected from monitoring wells IS21MW01 and IS21MW04 at concentrations of 4.5 µg/l and 83 µg/l, respectively. Definite conclusions could not be reached regarding sulfate concentrations because only two wells could be sampled for the analyte. However, the highest concentration from the available data was in the background well (IS21MW04), tentatively suggesting that the concentrations of sulfate in groundwater are being lowered as groundwater moves under the site.

Conclusions

The goals of the investigation were met:

- Analytical results are not anomalous because they are relatively consistent with the results presented in the RI report.
- Further investigation will be needed to identify the source of perchlorate in groundwater at the site.

The data will be incorporated into the Site 21 FS to aid in the evaluation of remedial alternatives.

References

CH2M HILL. April 2002. *Work Plan for Pre-Feasibility Study Field Activities at Site 17 Indian Head Division-NSWC*, Indian Head, Maryland

CH2M HILL. August 2002. *Draft Final Remedial Investigation Report, Sites 11, 13, 17, 21, and 25, Indian Head Division–NSWC,* Indian Head, Maryland.

United States Environmental Protection Agency Region III, Superfund Technical Support Section. April 2002. *Risk-Based Concentration Table.*

Table 1
Detected Compounds in Site 21 Monitoring Well Samples
Site 21 Pre-FS Groundwater Sampling
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS21MW01		IS21MW02		IS21MW03		IS21MW04	
Sample ID	IS21MW01071602		IS21MW02071802		IS21MW03071802		IS21MW04071602	
Sample Date	07/16/02		07/18/02		07/18/02		07/16/02	
Chemical Name								
Explosives (UG/L)								
Perchlorate	4	U	4	U	4	U	2,900	
Total Metals (UG/L)								
Aluminum	5,920		4,700		NA		18,300	
Arsenic	3.5	U	2.5	U	NA		6.6	J
Barium	52.3	J	128	J	NA		71.4	J
Chromium	21.4		29.7		NA		167	
Cobalt	6	J	137		NA		32.4	J
Copper	33.3		36.2		NA		31.2	B
Iron	3,940		30,100		NA		35,600	
Lead	9.8	J	7		NA		20.2	
Magnesium	1,370	B	13,000		NA		2,490	B
Manganese	32.4	B	10,900		NA		384	
Mercury	0.1	U	0.1	U	NA		0.26	
Nickel	16.5	J	29.7	J	NA		92.5	
Potassium	2,390	B	10,800		NA		3,310	B
Selenium	3	UL	4.3	L	NA		3	UL
Sodium	12,700	B	108,000		NA		96,200	
Thallium	4.2	U	4.9	J	NA		4.2	U
Vanadium	13.7	J	16.6	J	NA		52.6	
Zinc	89.9	B	254		NA		86.2	B
Dissolved Metals (UG/L)								
Aluminum	62.7	B	NA		NA		895	
Barium	31.9	J	NA		NA		17.1	J
Chromium	0.8	J	NA		NA		4.7	B
Cobalt	5.1	J	NA		NA		14.9	J
Lead	2.3	J	NA		NA		1.5	U
Manganese	17.5	B	NA		NA		230	
Sodium	12,900	B	NA		NA		94,600	
Wet Chemistry (MG/L)								
Sulfate	4.5		NA		NA		83	

NA - Not analyzed
B - Blank contamination
J - Estimated
L - Biased low
U - Undetected

UL - Undetected, limit biased low

Table 2
***In Situ* Parameters**
Site 21 Pre-FS Groundwater Sampling
IHDIV-NSWC
Indian Head, Maryland

Well	pH	Specific Conductance (mS/cm)	Turbidity (NTU)	ORP (mV)	Dissolved Oxygen (mg/L)	Temperature (^{o}C)
IS17MW01	4.13	0.105	66.3	304	2.4	24.15
IS17MW02	NC	NC	NC	NC	NC	NC
IS17MW03	NC	NC	NC	NC	NC	NC
IS17MW04	5.54	0.508	> 1000	14	0.89	23.9

mS/cm = microsiemens per centimeter
NTU = nephelometric turbidity units
mg/L = milligrams per liter
^{o}C = degrees celsius
mV = millivolts
NC = Not Collected (Dry Well)