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Re: RAC IX Contract No. 68-W-98-225
Cooper Drum RD WA No. 247-RDRD-091N
Final Results of HRC Field Pilot Study

Dear Mr. Yunker:

This letter report summarizes the results of the hydrogen release compound (HRC) field pilot study conducted at the Cooper Drum Company Superfund Site (Cooper Drum) located at 9316 South Atlantic Avenue in South Gate, Los Angeles County, California (see Figure 1). The pilot study was conducted in the former Hard Wash Area (HWA), which is believed to be the contaminant source area (see Figure 2). This letter report is organized as follows:

- Section 1.0 provides a background information, including a general description of the site hydrogeology (with an emphasis on the area where the HRC was injected into the shallow aquifer) and the objectives for the pilot-scale field test;
- Section 2.0 describes the field pilot study design parameters and the associated tasks that were performed;
- Section 3.0 presents the results of the field pilot study including conclusions and recommendations; and
- Section 4.0 lists the references cited in this work plan.

1.0 BACKGROUND INFORMATION

The purpose of the field pilot study was to evaluate use of enhanced reductive dechlorination (using HRC) to facilitate the remediation of volatile organic compounds (VOCs) in groundwater. Use of enhanced reductive dechlorination or chemical oxidation to remediate VOC-contaminated groundwater is consistent with the cleanup strategy selected for groundwater in the *Cooper Drum Record of Decision* (ROD) (United States Environmental Protection Agency [EPA], 2002).

The field pilot study is the second step in conducting treatability studies to evaluate both methods (chemical oxidation and enhanced reductive dechlorination) and determine which works best under site conditions. Results from bench-scale tests using the two in situ methods were summarized in a technical

memorandum dated July 7, 2003 (URS, 2003a). The results indicated that enhanced reductive dechlorination was potentially the preferred method for in situ remediation of the contaminants of concern (COCs) identified in the ROD. This conclusion is based on the inability of the chemical oxidation (using potassium permanganate) to treat the chlorinated ethanes, as well as the historical groundwater sampling results that show evidence of anaerobic biodegradation in the on-site plume, and the reduction of trichloroethene (TCE) to cis-1,2-dichloroethene (cis-1,2-DCE) during the reductive dechlorination bench-scale test.

The field pilot study was performed in accordance with the *Cooper Drum Company Superfund Site Pilot-Scale Field Test Treatability Work Plan* (URS, 2003b) and with concurrence from the California Environmental Protection Agency Department of Toxic Substance Control (DTSC). The study was designed using data obtained from the bench-scale test, the Cooper Drum remedial investigation/ feasibility study (RI/FS) (URS, 2002), and groundwater monitoring performed up until May 2003. The design involved injecting HRC into the shallow aquifer and monitoring the contaminated shallow aquifer at Cooper Drum. Additionally, two diagnostic tests were performed in order to better interpret the results of the pilot-scale field test. The diagnostic tests consisted of (1) a bioavailable ferric iron assay for more accurate measurement of the ferrous and ferric iron concentrations, providing a better understanding of the potential for both biotic (biological) and abiotic degradation of VOCs, and (2) use of in-well microbial indicators (also referred to as "bio-traps") which allow for in situ microbial colonization and characterization of microorganisms in the test area. Other requirements associated with the pilot-scale field test include fulfilling the substantive components of the waste discharge requirements (WDR) for the field test, as specified by the California Water Quality Control Board, Los Angeles Region.

1.1 Site Hydrogeology and Contaminant Plume

A detailed description of the site hydrogeology can be found in the Cooper Drum Company RI/FS report (URS, 2002). The estimated lateral extent of VOCs (based on TCE concentrations) in May 2003 in the shallow aquifer at Cooper Drum prior to the field pilot study is presented on Figure 3. A generalized geologic cross-section showing the water-bearing units and vertical extent of groundwater contamination is shown on Figure 4. Shallow groundwater occurs at a depth of approximately 45 to 50 feet below ground surface (bgs). The groundwater flow direction beneath the HWA in the northeast portion of Cooper Drum is south to southeast. On the east side of Cooper Drum along Rayo Avenue, the groundwater flow direction is southerly.

Shallow groundwater beneath Cooper Drum occurs within or is controlled by an area of lower permeability, the near-surface Bellflower Aquiclude, which incorporates a perched aquifer. The perched aquifer is present in the HWA at approximately 35 feet bgs and is at least 5 feet thick. The perched aquifer has been observed to be intermittent (for example, from 1991 to 1996 the perched zone was dry), and the lateral extent has not been confirmed. The Bellflower Aquiclude extends to a depth of approximately 70 feet bgs, where it overlies the Gaspur Aquifer, which extends to a depth of approximately 110 feet bgs. Groundwater with COC concentrations greater than drinking water standards has been found only down to the Gaspur Aquifer just below 100 feet bgs. Finer-grained materials (clays and silts) are present within the upper portion of the Bellflower Aquiclude and the lower portion of the Gaspur

Aquifer, which has minimized the vertical migration of COCs (including 1,4-dioxane) down into the Exposition and deeper aquifers, which are used for drinking water. Municipal groundwater production wells in the vicinity of Cooper Drum draw water from the Gage Aquifer, the deepest of the Lakewood Formation aquifers at approximately 300 feet bgs, as well as from deeper aquifers within the San Pedro Formation. The Exposition Aquifer is the uppermost unit of the deeper aquifer system, and underlies the Gaspur Aquifer. The Exposition Aquifer is one of four water-bearing units within the Upper Pleistocene Lakewood Formation.

The location used for the field pilot study was in the HWA (source area), upgradient of wells EW-2, MW-21, and MW-5, and downgradient of well MW-2 (Figure 5). This area is laterally the center of the groundwater plume and, as shown on Figure 3, is bound by the highest concentrations of VOCs (e.g., in wells EW-1, MW-2, and MW-20). Baseline TCE and cis-1,2-DCE concentrations from December 2003, approximately two weeks prior to the pilot study, are shown on Figure 5. As discussed in the following section, VOC concentration trends in MW-2 and EW-2 had shown indications of reductive dechlorination prior to the pilot study. This was mostly based on the higher concentrations of cis-1,2-DCE and lower concentrations of TCE in these wells, indicating formation of daughter products. At wells further downgradient, the evidence of reductive dechlorination was less obvious. Aquifer material (soil and groundwater) used in both bench-scale tests was collected from MW-20 at 57 to 59 feet bgs.

The field pilot study implemented a barrier-based approach with 15 HRC injection points completed in the area upgradient of EW-2 (see Figure 5). The depth interval targeted for injection was from approximately 45 to 80 feet bgs, where higher TCE concentrations where present. All monitor wells in the shallow aquifer are screened within this interval.

1.2 Field Pilot Study Objectives

The primary objectives of the HRC bench-scale test carried out prior to the field study were to (1) determine if sulfate, as a competing electron acceptor, would interfere with reductive dechlorination of TCE, (2) determine if under optimal conditions (lab conditions) there was a microbial population present in the aquifer material for complete dechlorination of TCE, and (3) compare the performance of HRC and modified HRC (HRC amended with slow-release iron gluconate). Given the high sulfate groundwater conditions it was feared that an undesirable effect of HRC addition would be to reduce sulfate to sulfide, resulting in "sulfide toxicity." The results of the bench-scale test indicated that sulfate reduction did not occur, implying that reductive dechlorination of TCE may be favored over sulfate reduction under site conditions. This argument was supported by the field investigation results presented in the *Cooper Drum Company Superfund Site, Remedial Design Field Sampling and Treatability Bench-Scale Test Results Technical Memorandum* (URS, 2003a). These results, including evaluation of the natural attenuation parameters, indicated that TCE concentrations were decreasing and cis-1,2-DCE concentrations were increasing in the vicinity and downgradient of the source area (i.e., the HWA), probably as a result of reductive dechlorination. Vinyl chloride also was detected in the area, indicating dechlorination of cis-1,2-DCE also may have occurred.

Based on these observations, the objectives of the bench-scale test were met. It was shown that addition of HRC to the sample site soil promoted reductive dechlorination of TCE to cis-1,2-DCE, and further to vinyl chloride (VC), despite presence of high sulfate levels in the test samples. Furthermore, reductions in sulfate concentrations were not observed after HRC addition.

The field pilot study objectives were generally the same as those for the bench-scale test, with the overall goal of determining if enhanced reductive dechlorination using HRC injection was a viable full-scale cleanup strategy for the site groundwater. Whereas the bench-scale test was focused on TCE reduction, the reductive dechlorination of all groundwater COCs was evaluated during the pilot-scale field test. Unlike the bench-scale test, the field pilot study was performed in situ, under actual site conditions, and test results were evaluated using data collected from the site soil and monitor wells.

The field pilot study was expected to be successful provided the following results were obtained (1) concentrations of target VOCs were reduced, (2) field monitoring results indicated reductive dechlorination was occurring, (3) microbial populations were shown to be capable of complete reductive dechlorination of COCs, and (4) sulfide toxicity did not occur.

2.0 DESCRIPTION OF FIELD PILOT STUDY

This section describes the components of the field pilot study including a description of HRC and the contaminant reduction process, site layout, design parameters, HRC delivery, and groundwater monitoring.

2.1 Description of HRC

HRC, provided by Regenesis, is a proprietary polylacetate ester that, upon being deposited into the subsurface, slowly releases lactate. Lactate is metabolized by naturally occurring microorganisms, resulting in the creation of anaerobic aquifer conditions and the production of hydrogen. Naturally occurring microorganisms capable of reductive dechlorination then use the hydrogen to progressively remove chlorine atoms from chlorinated hydrocarbon contaminants (e.g., convert tetrachloroethene [PCE] to TCE to cis-1,2-DCE to VC to ethene). HRC is manufactured as a viscous gel that can be injected into the saturated zone in a grid or barrier configuration. The use of HRC for groundwater remediation offers a comparatively simple and cost-effective remediation alternative for sites that would otherwise require unacceptably long periods of time for natural attenuation or high capital investment and operating expense associated with traditional remediation technologies (e.g., pump and treat).

2.2 Pilot Test Layout

The field pilot study consisted of application of HRC in a barrier configuration. Contaminant concentrations and other natural attenuation parameters were monitored in a specific section of the contaminant plume. The layout of the field pilot study is illustrated on Figure 5, showing HRC injection points and monitor well locations. The HRC barrier was installed immediately upgradient of well EW-2, which was used as the primary well for monitoring the test. A new monitor well (MW-21) was installed directly

south and further downgradient of the pilot-scale test barrier. MW-21 was situated to ensure adequate monitoring of groundwater flow with a more southerly flow direction. Monitor well MW-5 was used to provide an additional downgradient monitoring point, although the long screened interval in this well (which continues into the perched aquifer) made interpretation of its results less applicable. Upgradient monitor well MW-2 was used to monitor VOC concentrations in groundwater flowing into the pilot test HRC barrier. Downgradient wells EW-1 and MW-20 were also monitored as part of the field pilot study monitoring activities.

2.3 Test Design Parameters

The test design parameters developed for the test were prepared by Regenesis based on URS' understanding of the site hydrogeology, data collected during the RI (URS, 2002), and the May 2003 supplemental remedial design (RD) sampling effort (URS, 2003a).

As previously noted, the field pilot test is the second step in the treatability study process and is generally initiated to confirm the feasibility of the method and the design parameters prior to proceeding with a full-scale implementation. The most general field test consists of injecting HRC in a representative portion of the contaminant plume and monitoring groundwater quality in and downgradient of the pilot-scale treatment zone. The field pilot study was anticipated to be performed over an 8- to 12-month period to allow sufficient time for evaluation of competing sulfate versus contaminant reduction (as discussed below).

Although the bench-scale test indicated high sulfate concentrations in the groundwater may not be a concern at the site, competition for hydrogen and associated electrons generated from the HRC was expected to exist between sulfate-reducing bacteria populations and cis-1,2-DCE and VC dechlorinating populations. Because the sulfate-reducing process operates at a higher oxidation-reduction potential (ORP), it will take the electrons preferentially (compared to chlorinated ethenes) from an electron donor source (HRC). Sulfate acts as a competing electron acceptor with the target contaminants, and sulfate demand typically needs to be satisfied before a significant dechlorination process begins (Wiedemeier et. al., 1999).

The accumulation of sulfide from sulfate reduction can result in sulfide toxicity, which has been shown to inhibit dechlorination of chlorinated ethenes, specifically that of the more reduced daughter products, such as cis-1,2-DCE and VC. Sulfide accumulation is influenced by high initial sulfate concentrations, low iron availability, and a rapid increase in available electron donors. Addition of iron salts (for example, iron gluconate) was expected to result in binding of iron with any sulfide generated, and precipitation of the resulting iron-sulfide compounds, thus preventing the accumulation of sulfide where sulfide toxicity may have otherwise posed a problem (Hoeppel, 2001).

During the field pilot study, HRC with slow-release ferrous iron was injected into the groundwater as a preventive measure for the remote possibility that sulfate reduction to sulfide became an issue during the field application. The iron released from this version of HRC, combined with the iron present naturally in the site subsurface, was expected to bind with the sulfide and prevent sulfide toxicity in the aquifer.

There was also a chance that the iron-sulfide compounds would promote abiotic degradation of site COCs

In order to provide adequate reducing capacity to deal with high sulfate concentrations at the site, and to reduce potential sulfide toxicity, the HRC used for the field pilot study consisted of HRC primer and HRC amended with an iron gluconate solution. The amended HRC was used in 10 perimeter injection points, and HRC primer was used in five center injection points (Figure 5). HRC primer, a less viscous version of HRC, was expected to spread over a larger aquifer volume compared to standard HRC, thus helping the aquifer achieve reducing conditions faster. The use of the amended HRC and HRC primer was believed to be beneficial for addressing the high sulfate concentrations at the site.

Based on the existing site conditions and with input from Regenesis, the following parameters were used to estimate system design variables and HRC dose amounts. Design variables and dose amounts are summarized in Table 1.

TABLE 1

Design of Field Pilot Study using HRC Barrier Treatment

Design Feature	Specification
Saturated thickness requiring treatment	35 feet (45 to 80 feet bgs covering the saturated screen interval of well EW-2)
Treatment area	25-foot-long barrier consisting of 3 injection rows
Delivery point spacing and configuration	5 feet-on-center within rows; 5 feet between rows; 3 rows of 5 points; 15 total points
Amended HRC dose rate in lbs/vertical foot of injection	6.0 lbs/foot (210 lbs/point)
HRC primer dose rate in lbs/vertical foot of injection	13.5 lbs/foot (472.5 lbs/point – round to 474 lbs/point)
Amended HRC material requirement	10 points x 35 feet x 6.0 lbs/feet = 2,100 lbs
HRC primer material requirement	5 points x 35 feet x 13.5 lbs/feet = 2,362.5 lbs Round to 2,370 lbs (HRC primer is shipped in 30-lbs. increments)

- Thickness of contaminated saturated zone to be treated: 35 feet (45 to 80 feet bgs).
- Plume area to be treated: 25 feet wide section of the plume upgradient of well EW-2.
- Representative contaminant concentrations: 0.05 milligrams per liter (mg/L) PCE; 0.09 mg/L TCE; 1.3 mg/L cis-1, 2-DCE; and 0.26 mg/L 1,1-DCA (all values based on May 2003 groundwater sample from EW-2).

- Estimated groundwater velocity: up to 148 feet per year. Note that groundwater velocity controls the extent to which new contaminant is brought into the treatment zone. This contaminant loading must be considered when specifying HRC dosing requirements. This velocity is based on hydraulic conductivity values estimated from constant rate pump tests performed on EW-1 and EW-2 (URS, 2002).
- Assumed groundwater geochemistry (for conservative approach): generally aerobic with oxygen less than 5 mg/L and nitrate less than 2 mg/L.
- Competing electron acceptor demand for HRC-supplied electron donor (assumed): potential manganese reduction demand less than 5 mg/L, potential ferric iron reduction demand less than 25 mg/L, potential sulfate reduction demand for amended HRC less than 90 mg/L, and a potential sulfate demand for HRC primer of less than 780 mg/L for a total sulfate demand of 870 mg/L or 30% of the total sulfate concentration of 2,900 mg/L found in well EW-2 in May 2003.

2.4 HRC Delivery to Contaminated Zone

The HRC was applied to the shallow aquifer using a direct push method. Prior to advancement of the injection borings, boring CPT-39 (see Figure 5) was advanced to 100 feet total depth at the northwest corner of the barrier and used to collect CPT sounding data to confirm the lithologic units encountered. The lithologic data was generally consistent with that observed from previously drilled borings (SB-4, SB-1, CPT-4, CPT 15, and CPT-22) in the area of the proposed HRC barrier. After confirming the lithology, which consisted of largely silty sand and sandy silt material, injection of material was performed in 5-foot intervals within the target aquifer zone between 45 to 80 feet bgs. The injection rods were pushed using a CPT rig having a down pressure capacity of approximately 25 tons. The drive rods were pushed to the bottom of the contaminated saturated zone, and HRC was injected as the rods were withdrawn.

The HRC and HRC primer were injected using an HRC 9/1500 Rupe Pump capable of processing a material with a viscosity of 20,000 centipoise at flow rates of 3 to 10 gallons per minute at pressures ranging from 200 pounds per square inch gauge (psig) to 1,500 psig. The total mass of amended HRC injected was 2,100 pounds (30 pounds per injection interval) and the mass of HRC primer was 2,363 pounds (67.5 pounds per injection interval). Although the two materials were injected into separate borings, the total injected mass was based on application to the entire treatment area.

Additionally, the lithologic data from CPT-39 was used to identify depths for collection of soil samples for the bioavailable ferric iron assay. Based on the results from CPT-39, one additional boring was pushed for collection of saturated soil samples from the shallow aquifer at depths of 48, 53, 68, and 80 feet bgs. The bioavailable ferric iron assay diagnostic test was performed by Regenesis as part of the HRC injection. Further assay details are presented in Section 2.5.2.

2.5 Groundwater Monitoring Program

Performance of the field pilot study was evaluated using groundwater monitoring (Section 2.5.1) and two other diagnostic tests conducted by Regenesis (Section 2.5.2). Additionally, approximately four months after initiation of the field pilot study, groundwater samples were also collected for 1,4-dioxane analysis. This semivolatile compound, which was used as a solvent stabilizer in the past, is an emerging contaminant and had not previously been sampled and analyzed for in the groundwater beneath the site and was not included as a site COC in the ROD.

Groundwater Monitoring Program

Six wells (EW-1, EW-2, MW-2, MW-5, MW-20, and new well MW-21) were monitored to validate the HRC-based enhancement of reductive dechlorination processes. The locations of these wells are shown on Figure 5. As shown on this figure, MW-2 is located slightly upgradient of the HRC barrier. The other five wells are downgradient of the HRC barrier. The downgradient wells were expected to provide information about residence time effects. For optimal bacterial population growth, since the treatment target zone has to be in contact with the electron donor for a given length of time, the actual performance may be more evident at downgradient locations for sites with moderate to high groundwater velocity.

An initial or "baseline" round of sampling was performed on December 3 and 4, 2003, to identify groundwater conditions prior to HRC barrier installation. After application of the HRC, groundwater samples were anticipated to be collected every other month (bimonthly) for an eight-month period. After the initial biodegradation and geochemical trends were identified, the monitoring frequency was expected to be decreased to quarterly. Based on the actual results, a total of five post-injection sampling events were performed on February 26 and 27, 2004; April 27 and 28, 2004; July 20 and 21, 2004; November 1 and 2, 2004; and April 19 and 20, 2005 (approximately 2, 4, 7, 10, and 16 months after start of the pilot test).

The monitoring protocol employed standard low-flow groundwater sampling techniques (as specified in the sampling and analysis plan [SAP], URS, 2003c) and included measurement of the parameters outlined in Table 2. Field parameters measured during well purging and sampling were recorded on the field data sheets and are included in Attachment A.

TABLE 2

Groundwater Sampling Matrix

Constituent(s)	Units	Type of Sample	Frequency of Analysis
Chlorinated Volatile Organic Compounds (EPA Method 8260B)	:g/L	grab	B Baseline B Bimonthly through eight months B Quarterly thereafter

TABLE 2

(Continued)

Constituent(s)	Units	Type of Sample	Frequency of Analysis
Total Organic Carbon (EPA Method 9060 Modified)	:g/L	grab	B Baseline B Bimonthly through eight months B Quarterly thereafter
Central Basin WDR Requirements: Total Dissolved Solids, Boron, Sulfate, Chloride	mg/L	grab	B Baseline B Bimonthly through eight months B Quarterly thereafter
Biochemical Oxygen Demand	mg/L	grab	B Baseline B Then biannual
Field Parameters: pH, ORP, Dissolved Oxygen, Temperature, Ferrous Iron	pH units, millivolts, mg/L, degrees Celsius, mg/L	grab	B Baseline B Bimonthly through eight months B Quarterly thereafter
Groundwater Elevation	Feet below msl	in situ	B Baseline B Bimonthly through eight months B Quarterly thereafter
Other Anions including Alkalinity (Nitrate, Nitrite, and Sulfide)	:g/L	grab	B Baseline B Bimonthly through eight months B Quarterly thereafter
Major Cations (Calcium, Magnesium, Potassium, Sodium, Manganese, and Total Iron)	mg/L	grab	B Baseline B Bimonthly through eight months B Quarterly thereafter
End Product Dissolved Gases: Methane, Ethene, Ethane, and Carbon Dioxide	:g/L	grab	B Baseline B Bimonthly through eight months B Quarterly thereafter
Dissolved Hydrogen	nM	grab	B Baseline B Once thereafter during pilot-scale test
HRC-Based Electron Donor: Metabolic Acids (Lactic, Pyruvic, Acetic, Propionic, and Butyric)	mg/L	grab	B Baseline B Bimonthly through eight months B Quarterly thereafter

EPA = United States Environmental Protection Agency
mg/L = milligrams per liter
msl = mean sea level
nM = nano moles
ORP = oxygen reduction potential
WDR = waste discharge requirement
µg/L = micrograms per liter

Other Diagnostics

Two additional diagnostic field tests recommended by Regenesis as part of the field pilot study were conducted prior to and concurrent with the HRC field pilot study. The first test involved the use of in-well microbial indicators (also referred to as "bio-traps"), which allow for in situ microbial colonization and characterization. The bio-traps (composed of beads that provide a solid matrix for colonization) were suspended in monitor wells for approximately four weeks. The microbial population changes were then tracked over time, in control wells and in wells located in areas where HRC was injected into groundwater. A baseline sampling event was performed in the six pilot test monitor wells prior to the HRC injection. The bio-traps were installed in the wells on October 23, 2003, and removed and shipped to Microbial Insights, Inc. (for real time polymerasc chain reaction [PRC] analysis) on November 19, 2003. A second sampling was initiated on January 21, 2004 (approximately one month after injection), and the bio-traps were removed from the six wells on February 25, 2004, and shipped to Microbial Insights, Inc., for analysis. Specifically, the populations of the anaerobic bacterium *Dehalococcoides ethenogenes* (DHC) were determined and tracked over time. According to one study, this bacterium is the "only known organism" that can completely dechlorinate TCE to ethene (Magnuson et al., 2000). Other studies have documented dechlorination of vinyl chloride to ethene by DHC strain 195 (see, for example, He et al., 2002). Therefore, presence of this bacterium in large numbers is an indication that reductive dechlorination of TCE to ethene would likely occur. The analysis was performed by Microbial Insights, Inc., which has indicated that a large population, in the range of 10^3 and 10^4 cells/bead, indicates a high probability for reductive dechlorination of TCE to ethene. Further description of this diagnostic is provided in the work plan (URS, 2003b).

The second diagnostic test involved evaluating site soil for presence of ferric iron, also referred to as "bioavailable iron." The concentration of bioavailable ferric iron in soil is one parameter that can be used to determine the potential for abiotic degradation of organic chemicals. It also may be used to determine the potential for inhibition of reductive dechlorination: bioavailable ferric iron can be reduced to ferrous iron by iron-reducing bacteria, which may compete with reductive dechlorinators for the available electron. The initial round of sampling (in May 2003 for natural attenuation parameters at the site) showed the presence of ferrous iron in the source area wells, indicating iron reduction was occurring. However, these results did not account for any ferrous iron adsorbed to soil. Using the bioavailable ferric iron assay was expected to provide a better estimate of the ferrous iron and ferric iron concentrations. The reduction of ferric iron to ferrous iron is energetically favored over the reduction of cis-1,2-DCE to vinyl chloride, especially when ferric iron is present in more amorphous (less crystalline) forms, such as iron oxides and iron hydroxides (Evans and Koenigsberg, 2001). When bioavailable ferric iron is found to be prevalent at the site, an appropriate response action may have to be selected to prevent the so called "DCE stall," whereby dechlorination is stalled at the DCE production stage. The range of response actions may include addition of sufficient HRC to consume bioavailable ferric iron—allowing for sufficient passage of time so that ferric iron is consumed and reduction of cis-1,2-DCE is initiated—and/or implementation of other remedial action, such as in situ chemical oxidation or use of oxygen release compound (ORC) to address cis-1,2-DCE and vinyl chloride remediation. Although there was not a pre-determined concentration range of bioavailable ferric iron that would indicate favorable biotic/abiotic reductive dechlorination conditions, this parameter was evaluated in conjunction with the other natural attenuation parameters to evaluate inhibition of reductive dechlorination. In this respect, the

bioavailable ferric iron assay was viewed as a complementing/refining component of natural attenuation monitoring.

Two saturated soil samples (at depths of 53 and 68 feet bgs) were collected from CPT-39 on December 15, 2003, and analyzed for bioavailable ferric iron. The soil samples were collected prior to injection of the HRC. The soil samples were collected according to procedures described in Section 6.1 of the SAP (URS, 2003c). The soil samples were analyzed and evaluated by Dr. Pat Evans of Camp Dresser & McKee, Inc, (CDM) using CDM's bioavailable ferric iron assay. The sampling and analysis protocol for this assay is included in the work plan (URS, 2003b). Further background and application of this assay is provided in the protocol.

Analytical Data Quality Summary

The groundwater analytical data collected during the nine groundwater sampling events (six scheduled and three additional events discussed in the following section) between December 2005, and August 5, 2006, has been validated. The data validation reports can be found in the Records Center at EPA Region 9 in San Francisco, California. Data from the completed reports were determined to be acceptable for decision-making purposes, with some estimated data due to sampling and/or laboratory data quality issues. The overall field sampling procedures and analytical laboratory performance met the acceptable data quality guidelines, with the data completeness result exceeding 99 percent.

3.0 EVALUATION OF HRC FIELD PILOT STUDY RESULTS

3.1 Monitoring Results

Sampling results for the six HRC monitor wells are presented in Tables 3 and 4. Table 3 presents results of VOC and 1,4-dioxane analyses from these wells. Note that historic data available for wells sampled prior to the field pilot test, as well as more recent data from 2005 and 2006, are also included in Table 3. Table 4 presents results from all other parameters monitored during and after the pilot scale field test. The results of DHC testing and bioavailable iron assay also are discussed in this section.

Five sampling events were scheduled to be performed after HRC injection. The last sampling event was in April 2005, approximately 16 months after HRC injection. According to Regenesis, the effect of the initial injection could last up to 18 months. Because it appears biostimulation in the area of the test is continuing, results of ongoing monitoring from the HRC test wells also are included in Tables 3 and 4. This includes additional sample dates from November 2005 and March and August 2006. The concentrations over time of select COCs (TCE, cis-1,2-DCE, VC, and 1,1-DCA) reported in groundwater samples from MW-2, EW-2, and MW-21 are shown on Figures 6, 7, and 8, respectively. Concentrations of other parameters commonly used as indicators of anaerobic biodegradation, such as ethene, methane, acetic acid, and dissolved oxygen from these monitor wells, are depicted on Figures 9, 10, and 11, respectively. These wells are within the immediate vicinity (30 feet or less) of the HRC barrier. (Note that MW-5 is screened across the perched aquifer and the shallow aquifer; therefore, data from this well cannot be directly correlated with the pilot study and were not used in the evaluation.)

The significant results of the monitoring are summarized below. Please note that these results were collaborated with a February 3, 2005, memorandum prepared by Regenesis and included here as Attachment B.

- Prior to initiating the field pilot test, significant reductive dechlorination was occurring at the site in the vicinity of wells MW-2 and EW-2. Further downgradient (approximately 100 to 150 feet) in the vicinity of wells EW-1 and MW-20, the reductive dechlorination process appeared to dissipate. This observation was supported by the high cis-1,2-DCE concentrations (as compared to TCE concentrations) in MW-2 and EW-2, indicating contaminant breakdown (i.e., TCE to cis-1,2-DCE). Further downgradient at EW-1 and MW-20, TCE concentrations were higher than cis-1,2-DCE concentrations. Other trends, such as the presence of low concentrations of VC, negative ORP levels, low dissolved oxygen concentrations, and the presence of ferrous iron and acetic acid, further supported the argument for reductive conditions.
- HRC injection further enhanced the reductive dechlorination and biodegradation processes in the vicinity of the HRC barrier. This observation is supported by the decreasing cis-1,2-DCE concentrations and increasing, followed by decreasing, VC concentrations (Figure 7); as well as the initial increase in acetic acid levels, followed by increases in methane and ethene concentrations in EW-2 (Figure 10). Similar observations are made further downgradient, in MW-21, where TCE, cis-1,2-DCE, VC, and even 1,1-DCA concentrations initially increased and then decreased following HRC injection (Figure 8). Methane and ethene concentrations have continued to rise in this well (Figure 11). Surprisingly, similar conclusions, but to a lesser extent, can be made for the upgradient well MW-2 (Figures 6 and 9), which appears to have benefited from being located within the radius of influence of the injection wells.
- The data listed in Table 4 show that total organic carbon (TOC) concentrations have remained high (greater than 20 mg/L) in EW-2, indicating that bioavailable carbon is likely still present in this well. However, TOC levels have now decreased to less than 20 mg/L in MW-2 and MW-21, indicating dechlorination may be slowing down in these wells.
- The bioavailable iron assay indicated considerable ferric iron is available for reduction. However, the rate of iron reduction is apparently slow and therefore it does not serve as an inhibitor for further reductive processes. Rather, iron is likely to have aided in the VOC destruction in two ways: (1) by promoting abiotic reductive processes and (2) by binding any sulfide generated from the reduction of sulfate.
- The baseline and subsequent (two months after HRC injection) microbial (bio-traps) analyses for DHC did not show the presence of this bacterium. This would be consistent with the historically high concentrations or accumulation of cis-1,2-DCE (and relatively low concentrations of VC) prior to the pilot test and during the initial few months of the test. However, based on the previously identified VOC concentration trends in EW-2, MW-21, and MW-2 (see second bullet item above) in the later stages of the field pilot test and the increased concentrations of VC, methane, and ethene in these wells, it is likely the population of the bacteria capable of complete reductive dechlorination of TCE did eventually increase to adequate levels for successful reductive dechlorination. The growth

rate of the DHC bacteria can be slow initially; for example, it could take weeks for the population to double in size.

- The results listed in Table 4 indicate that sulfate concentrations have decreased significantly in EW-2, from 3,000 mg/L to 1,200 mg/L. In the meanwhile, sulfide concentrations in this well increased from less than 1 mg/L to only 8.2 mg/L. Similarly, in MW-21 sulfate concentrations decreased from 4,900 mg/L to 3,700 mg/L, but with no apparent increase in sulfide. (There has also been a slight decrease in sulfate concentrations in MW-2, with no increase in sulfide levels.) It would appear that the iron added with HRC, along with high natural bioavailable ferric iron, has likely been responsible for controlling the production of free sulfide, despite the reduction in sulfate concentrations. In the presence of iron, non-toxic iron sulfide precipitates are produced. Overall, it appears the high sulfate concentrations have not inhibited the reductive dechlorination process from occurring beneath the site.
- 1,1-DCA and 1,2-DCA concentrations remained relatively stable throughout the field pilot test, although some reductions were observed in the pilot study wells (for example, see the 1,1,-DCA results on Figures 6 through 8). Under anaerobic conditions, breakdown of chlorinated ethenes typically occurs before chlorinated ethanes. Specifically, 1,2-DCA, is known to be more effectively destroyed by aerobic bacteria. However, provided the correct microbial consortium for breakdown of chlorinate ethanes is present beneath the site, these compounds may be expected to degrade after the chlorinated ethene mass has been further reduced.
- Recent groundwater sampling results indicate that total VOC concentrations have been significantly reduced in the area of the pilot study (up to 70 % reduction in EW-2). This reduction appears to be continuing even after 32 months, based on the results of the last sampling event (August 2006).
- As previously discussed, analysis of 1,4-dioxane was initiated at the site during the April 2004 sampling event. As shown in Table 3, concentrations ranged from 67 to 710 micrograms per liter (µg/L) in the pilot study wells. Subsequent site-wide sampling has determined this compound to be a COC at the site. Unfortunately, 1,4-dioxane does not degrade under anaerobic conditions and would not be expected to be broken down by HRC addition. This appears to be supported by the results from the pilot test area wells, MW-2, EW-2, and MW-21 (see Table 3). (Note that an in situ chemical oxidation [ISCO] pilot test was implemented in July 2005 in the vicinity of wells EW-1 and MW-20, and the recent COC reductions in these wells [Table 3] are likely the result of ISCO technology.)

3.2 Conclusions and Recommendation

Based on the results of the field pilot study it appears that injection of the HRC primer and HRC amended with an iron gluconate solution may have been a viable full-scale remedy for the source area groundwater remedy at Cooper Drum. However, as a result of the detection of 1,4-dioxane, it appears that a different in situ method, using an advanced chemical oxidation process, will be required to remediate the mix of groundwater contaminants beneath the site, specifically in the source area (HWA), where 1,4-dioxane concentrations are the highest.

Use of an HRC (or other reducing agent) barrier for containment near the leading edge of the groundwater plume, where 1,4-dioxane concentrations are low, may still be a consideration for the full-scale groundwater remedy. An evaluation can be made based on the outcome of the downgradient plume investigation, which was conducted in March 2007.

As noted above, an ISCO pilot study using injection of ozone and hydrogen peroxide was implemented at the site in July 2005. This pilot study was successfully completed in June 2006, and ISCO has been selected for the source area groundwater remediation (URS, 2006). Unlike the ISCO bench-scale test conducted at the site using permanganate (see Section 1.0), use of ozone and hydrogen peroxide produces the hydroxyl radical, a non-selective oxidizing agent which is capable of breaking down chlorinated ethenes, chlorinated ethanes, and 1,4-dioxane.

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If you have any questions or require additional information, please contact me at (916) 679-2049.

Sincerely,

Don Gruber
Task Manager

Enclosures:

Table 1	Design of Field Pilot Study using HRC Barrier Treatment
Table 2	Groundwater Sampling Matrix
Table 3	VOC and 1,4-Dioxane Sampling Results
Table 4	Other Parameters Sampling Results
Figure 1	Site Location Map
Figure 2	Site Layout and Source Areas
Figure 3	Trichloroethene Iospleth Map, May 2003
Figure 4	Geologic Cross-Section C-C'
Figure 5	Field Pilot Test Layout and Baseline TCE Concentrations
Figure 6	COC Concentrations at MW-2
Figure 7	COC Concentrations at EW-2
Figure 8	COC Concentrations at MW-21
Figure 9	Other Parameter Concentrations at MW-2
Figure 10	Other Parameter Concentrations at EW-2
Figure 11	Other Parameter Concentrations at MW-21
Attachment A	Monitor Well Field Sampling Data Sheets
Attachment B	Regenesis Technical Memorandum, February 2005

cc: Lori Parnass, DTSC
Site Repository, South Gate, California
Project File
Chron File

TABLES

TABLE 3

VOC and 1,4-Dioxane Sampling Results
Cooper Drum Company Superfund Site

Location	Date	PCE	TCE	cis-1,2-DCE	1,1-DCE	trans-1,2-DCE	VC	1,1-DCA	1,2-DCA	Benzene	1,2-DCPA	1,4-Dioxane	Other VOCs detected
MW-2	Sep-91	–	207	ND	ND	–	–	–	–	–	–	–	
	Jun-92	–	510	346	7	–	–	–	–	–	–	–	
	Oct-96	<1.0	480	660	19	23	8	100	45	–	–	–	
	Oct-98	<10	640	1100	46	46	14	220	97	27	44	–	1,2,3-Trichloropropane (45), chlorobenzene (5.5)
	Nov-98	<1.0	780	1200	32	34	12	190	82	27	42	–	1,2,3-Trichloropropane (31), chlorobenzene (6), toluene (2)
	Mar-99	<1.0	800	800	10	19	5	52	20	7	12	–	1,2,3-Trichloropropane (13), chlorobenzene (2)
	Oct-00	0.5	290	730	15	47	9	72	30	7	14	–	Acetone (9), chlorobenzene (6), ethylbenzene (6), toluene (2)
	May-03	<25	230	790	29	46	<25	65	<25	<25	<25	–	Bromoform (56)
	Dec-03	<1.0	240	810	13	52	17	75	14	5.1	5.6	–	Toluene (1.6), chlorobenzene (5.6)
	Feb-04	<0.5	220	770	12	48	15	73	19	5.8	6.3	–	Methylcyclohexane (0.63), toluene (1.6), chlorobenzene (6.2)
	Apr-05	<0.5	290	990	10	50	10	86	19	6	6.6	69	Toluene (0.9), chlorobenzene (4.0)
	Jul-04	<2.5	220D	730D	15	46	11	64	<2.5	6.1	5.8	NA	Toluene (1.8J), chlorobenzene (5.4)
	Nov-04	<0.5	270D	790D	19	46JD	23	75D	23	8.2	7.7J	NA	Toluene (0.93), chlorobenzene (4.1), methylcyclohexane (0.66J)
	Apr-05	<0.5	140D(220E)	640D(840E)	11	33JD(38E)	5.8J	61D(61E)	16J	6.2J	5.0J	67	Toluene (0.83J), chlorobenzene (2.6J), methylene chloride (2.6J)
	Nov-05	<0.5	370	900	23	46	21	130	32	16	12	100	Toluene (1.9), chlorobenzene (3.7J)
	Mar-06	<0.5	250D	640D	14	31	15	85	20	10		75	
	Aug-06	<0.5	69D	510D	7.9	26	30	64D	22	6.1	5	79	Toluene (0.83), chlorobenzene (2.5)
MW-5	Jun-92	–	684	90	11	–	–	–	–	–	–	–	
	Oct-96	23	570	440	43	10	7	280	29	–	–	–	
	Oct-98	57	590	580	54	16	14	340	38	13	14	–	1,1,2-Trichlorethane (3.1), 1,2,3-trichloropropane (18), chloro-benzene (37), ethylbenzene (1.3), total xylenes (7.1)
	Nov-98	44	570	670	45	14	11	330	39	13	17	–	1,1,2-Trichloroethane (3), 1,2,3-trichloropropane (20), chloro-benzene (34), ethylbenzene (1), toluene (2), total xylenes (6)
	Mar-99	42	300	300	20	10	9	200	28	11	18	–	1,1,2-Trichloroethane (2), 1,2,3-trichloropropane (20), acetone (5), chlorobenzene (51), ethylbenzene (1), toluene (0.8), total xylenes (3)

TABLE 3

(Continued)

Location	Date	PCE	TCE	cis-1,2-DCE	1,1-DCE	trans-1,2-DCE	VC	1,1-DCA	1,2-DCA	Benzene	1,2-DCPA	1,4-Dioxane	Other VOCs detected
	Oct-00	21	60	100	9	3	3	47	12	3	9	–	1,1,2-Trichloroethane (1), 2-hexanone (59), 4-methyl-2-pentanone (1), chlorobenzene (17), toluene (0.5)
	May-03	10	88	200J	6J	3J	3J	78	9J	<10*	<10*	–	Methylene chloride (4), chlorobenzene (9), bromoform (20)
	Dec-03	13	110	270	7	4.4	3.5	110	8.1	1.5	8.3	–	Acetone (2.2), 1,1,2-trichloroethane (0.7), chlorobenzene (7.2), 1,2,3-trichloropropane (8)
	Feb-04	13	91	210	5.9	4.1	1.9	90	8.2	1.3	7.6	–	1,1,2-Trichloroethane (0.93), chlorobenzene (4.6)
	Apr-04	9.8	88	220	<0.5J	3.3	<0.5	86	7.1	<0.5	7	230	1,1,2-Trichloroethane (0.87), chlorobenzene (4.3)
	Jul-04	12	83D	170D	6	4.1	1.6	86	5.8	1.2	6.7	NA	1,1,2-Trichloroethane (0.72), chlorobenzene (3.6)
	Nov-04	16	100D	220D	8	6	4.1	92D	8.2	1.8	9.3J	NA	1,1,2-Trichloroethane (0.77), chlorobenzene (5.2)
	Apr-05	18	170D(170E)	(360E)	7.6	5	2	170D(130E)	7.1	<0.5	10	170	Toluene (0.31J), chlorobenzene (4.6), 1,1,2-trichloroethane (0.81), methylene chloride (0.90J)
	Nov-05	23	160	270	11	6.1	8.6	150	6.7	2.9	10	190	Chloroethene (0.2J), toluene (0.5J), 1,1,2-trichloroethane (0.7), 1,3-dichloropropane (0.2), chloro-benzene (6.3), 1,2,3-trichloro-propane (11.0), MTBE (1.0)
	Aug-06	7.7	84D	110D	7.8	3.5	1.5	73D	3.5	0.87	4.8	260	1,1,2-Trichloroethane (0.75), chlorobenzene (1.8)
MW-20	Feb-03	5.6	300	110	7.6	5.4	<5.0	32	6.4	–	–	–	
	May-03	<13	520	140	<13	<13	<13	41	<13	<13*	<13*	–	Bromoform (20)
	Dec-03	5.2	570	150	16	7.8	3.6	44	7.6	1.1	4.2	–	Chlorobenzene (5.4), 1,2,3-trichloropropane (3.8)
	Feb-04	4.1	490	140	14	7.3	2.8	39	7.8	0.97	4.1	–	1,1,2-Trichloroethane (0.94), chlorobenzene (4.5)
	Apr-04	5.1	670	180	15	8.9	<0.5	48	8	<0.5	4.9	120	1,1,2-Trichloroethane (0.67), chlorobenzene (5.5)
	Jul-04	4	470D	140D	16	7.6	3	45	7.3	1.1	4.3	NA	Chlorobenzene (3.7)
	Nov-04	5.1	770D	200E	24	11	8.3	58D	12	1.2	5.9J	NA	Chlorobenzene (4.8), methylcyclohexane (0.46J)

TABLE 3

(Continued)

Location	Date	PCE	TCE	cis-1,2-DCE	1,1-DCE	trans-1,2-DCE	VC	1,1-DCA	1,2-DCA	Benzene	1,2-DCPA	1,4-Dioxane	Other VOCs detected
	Apr-05	2.4	120D(570E)	45D(150E)	7.2	4.6	1.9	13D(34E)	7.9	0.68	3.7	180	Toluene (0.20J), chlorobenzene (2.8), acetone (2.2J), methylene chloride (1.70B)
	Nov-05	1.1	130	39	5.4	1.8	0.7	22	3.7	0.3	1.8	98	Dibromomethane (2.0), chlorobenzene (0.9), 1,2,3-trichloropropane (1.8), bromoform (23)
	Aug-06	0.99	140D	26	5	2	<0.5	14	3.9	0.40J	2	71	Chlorobenzene (1.0), bromoform (5.7)
MW-21	Dec-03	2.3	870	370	25	14	5.2	61	17	2.7	9.7	–	Chlorobenzene (3.8), 1,2,3-trichloropropane (7.9)
	Feb-04	2.2	680	330	27	16J	4.9	51	17	2.6	9.3	–	Acetone (12), methyl acetate (4.7), toluene (0.32), chlorobenzene (3.8)
	Apr-04	3	980	490	50J	20	5	80	20	<0.5	11	280	Chlorobenzene (4.9)
	Jul-04	2.8	640D	340D	29	15	5.8	69	17	2.6	8.3	NA	Chlorobenzene (4.2)
	Nov-04	2.1	720D	430D	24	11	64D	59D	21	3	8.2J	NA	Toluene (0.25J), chlorobenzene (3.9), carbon disulfide (1.1), cyclohexane (0.21J), methylcyclohexane (0.52)
	Apr-05	0.43J	180D(450E)	120D(300E)	13J	11	20	18D(32E)	5.8D(10)	1.5	3.3	170	Toluene (0.17J), chlorobenzene (1.6), carbon disulfide (0.29J), methylene chloride (0.94B)
	Nov-05	<0.5	220	120	28	12	18	35	6	1.6	2.6	240	Chlorobenzene (1.0)
	Mar-06	<0.5	390D	280D	19	17	23	50	12	2.7	<0.5	360	
	Aug-06	<0.5	260D	260D	20	19	30D	55D	16	3.5	5.5	280	Chlorobenzene (2.9)
EW-1	Mar-99	<1.0	190	14	1	0.8J	<0.5	1	0.5	<1.0	<1.0	–	1,2,3-Trichloropropane (4), toluene (0.6), total xylenes (1.1)
	Aug-99	8	310	100	21	4	2.7	50	6.3	2	4	–	1,2,3-Trichloropropane (5), acetone (8), chlorobenzene (5)
	Oct-00	5	310	100	20	5	3	45	5	1	3	–	2-Hexanone (12), chlorobenzene (7), toluene (0.5)
	May-03	<13	380	170J	19	7J	3J	46	3J	<13*	<13*	–	Bromoform (24)
	Dec-03	1	480	230	41	9.8	4.1	70	3.7	1.1	1.9	–	Chlorobenzene (2.6), 1,2,3-trichloropropane (0.8)
	Feb-04	1	450	210	39	9J	3.4	65	5.2	1.3	2.5	–	Chlorobenzene (2.5)
	Apr-04	1.7	790	290	<40UJ	10	<0.5R	83	5.5	1.9	<0.5	550	Chlorobenzene (4.1)
	Jul-04	1.9J	600d	230D	39	9.3	3.7	68	5.8	1.7J	3.2	NA	Chlorobenzene (3.7)
	Nov-04	2.9	830D	250E	53E	13	9.7	75E	7.8	2.1	4.2J	NA	Chlorobenzene (5.9)
	Apr-05	1.4	760D(750E)	240D(230E)	34E	7.8	2.5	60D(43E)	4.3	1.2	2.4	410	Toluene (0.19J), chlorobenzene (3.9), methylene chloride (0.94B)
	Nov-05	0.5	140	38	5.7	3.2	0.7	21	1.6	0.2	1.1	250	Chlorobenzene (0.6), 1,2,3-trichloropropane (0.4J)

TABLE 3

(Continued)

Location	Date	PCE	TCE	cis-1,2-DCE	1,1-DCE	trans-1,2-DCE	VC	1,1-DCA	1,2-DCA	Benzene	1,2-DCPA	1,4-Dioxane	Other VOCs detected
	Aug-06	<0.5	120D	61D	6.8	2.3	0.31J	38D	3.4	0.46J	2.2	250	Chlorobenzene (0.53)
EW-2	Dec-00	<1.0	150	170	9	10	1.7	20	5.4	2	3	–	1,2,3-Trichloropropane (6), chlorobenzene (2)
	Mar-01	0.6J	130	110	10J	12	2.4	20	<0.5	2	4	–	1,2,3-Trichloropropane (8), chlorobenzene (1)
	May-03	<50	86	1300J	46J	39J	12J	260	46J	20	<50*	–	Bromoform (87)
	Dec-03	<1.0	16	1200	72	55	13	320	36	15	11	–	Toluene (2.4), chlorobenzene (9), 1,2,3-trichloropropane (5.4)
	Feb-04	<5.0	140	1000	56	44	12	230	39	14	13	–	Acetone (11), methyl acetate (4.4), cyclohexane (0.56), 4-methyl-2-pentanone (3.2), toluene (2.7), chlorobenzene (10)
	Apr-04	<0.5	270	1200	54E	63J	84J	280	48E	20	15	710 (700)	Cyclohexane (0.67), toluene (3.6), chlorobenzene (10), xylenes (0.62)
	Jul-04	<2.0	130D	390D	27	51	460D	250D	39	14	11	NA	Toluene (2.8), chlorobenzene (6.5), xylenes (1.0J)
	Nov-04	<0.5	130D	210D	34E	72JD	1100D	240D	41E	20	15J	700 (610)	Toluene (3.5, 3.6), chlorobenzene (7.5, 7.3), xylenes (1.2, 1.2), ethyl benzene (<0.5, 0.26J), methylene chloride (0.90J, 0.88B)
	Apr-05	<0.5	59D(81E)	94D(140E)	12	48D(66E)	310D(360E)	220D(260E)	24	20	12	530 (560)	Toluene (3.3, 3.1), chlorobenzene (9.3, 7.3), xylenes (0.85, 0.72), ethyl benzene (0.26J, 0.20J), methylene chloride (0.90J, 0.88B)
	Nov-05	<0.5	190	120	25	59	430	250	22	16	11	510	Toluene (2.0), chlorobenzene (4.5), xylenes (0.2), 1,2,3-trichloro-propane (0.3)
	Mar-06	<0.5	42D	20	4.1	42D	190D	200D	16	12	11	550	toluene (1.6), chlorobenzene (3.7)
	Aug-06	<0.5	30D	46D	5.4	40D	110D	200D	21	13	9.1	430	Methyl tert-butly ether (1.1), 6oluene (2.4), chlorobenzene (6.8)

All results in µg/L

D = Detection associated with sample dilution
E = Concentration exceeds upper level of instrument calibration range
J = Estimated value
B = Analyte found in associated method blank as well as in sample
NA = Compound not analyzed

Duplicate value shown in parenthesis.
Estimated and dilution values shown for April 2005 sampling round.

TABLE 4

Other Parameters Sampling Results
Cooper Drum Company Superfund Site

Date	Dec-03	Feb-04	Apr-04	Jul-04	Nov-04	Apr-05	Nov-05	Mar-06	Aug-06	Dec-03	Feb-04	Apr-04	Jul-04	Nov-04	Apr-05	Nov-05	Aug-06
Location	**MW-2**									**MW-5**							
D.O. (mg/L)	0	0.05	0	1.63	2.48	0.36	0.31	3.94	0.42	1.07	1.96	1.58	2.63	2.78	2.09	1	2.25
ORP (mV)	-132	-185	-208	-107	-335	-141	-357.2	-120	-145	93	200	163	-23	8	80	-333.2	-3
Temperature (C)	22.1	22	22.7	22.9	23.3	22.3	21.9	19.8	23	21.2	21.5	22	22.3	22.1	21	21.12	22.5
pH	6.82	6.81	6.82	6.91	6.76	7.1	7.3	7.11	7.1	7.38	7.38	7.4	7.09	7.26	7.5	7.6	7.34
Ferrous Iron (mg/L)	1.9	1.7	2.1	NS	2.0	1.8	2.4	2	2	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Chloride (mg/L)	340	360	360	360	350	320	320	310	250	92	95	86	91	100	100	100	98
Nitrate (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	3.1	4.1	3.8	3.4	3.1	3.7	0.51A3	0.88
Sulfate (mg/L)	5800	6400	5900	6100	5900	5100	5600	5400	5000	360	360	330	330	360	350	300	340
Sulfide (mg/L)	0.61	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Ethene (ng/L)	860	1400	<10,000	880	680J	600	<1000	1100	3400	140	86	<10000	<600	<600	<1000	900J	
Ethane (ng/L)	64	130	<10,000	<600	<600	<1100	<1100	<1100	<1100	31	24	<10000	<600	<600	<1100	<1100	
Methane (µg/L)	68	75	41	34	470DL	5000	8900	12000	5900	27	6	8	4.8	3	5.9	250	
TDS (mg/L)	10000			1000	10000	9000	8700			2100			2100	2100	2000	2100	
BOD (mg/L)	11									6							
Boron (mg/L)	0.49	0.52	0.49	0.51	0.56	0.53	0.52		0.645	1.5	1.7	1.5	1.6	1.6	1.5	1.4	2.04
Calcium (mg/L)	360	370	360	370	379	410	320		337	34	34	32	32	33	36	36	43.2
Magnesium (mg/L)	460	460	470	470	470	400	440		369	25	27	26	25	26	26	23	29.4
Potassium (mg/L)	16	16	16	16	16	14	15		20.7	4.4	5.5	5.00	5.00	4.90	4.70	5.2	5.77
Sodium (mg/L)	1900	1800	2000	1800	1900	1900	2000		1550	6600	6000	680	650	660	740	810	713
Manganese (mg/L)	5.7	5.5	5.6	5.6	5.4	5.4	4.8		5.04	0.66	0.44	0.44	0.45	0.7	2.2	0.4	1.69
Total iron (mg/L)	1.9	1.9	2.00	2.00	2.5	2	1.5		2.37	<0.1	<0.1	<0.1	<0.1	<0.1	0.084J	<0.1	0.054J
Hydrogen (nM)	2.3	NM	<31.5					1.7		0.38	NM	<40					
CO_2 (mg/L)	99	120	17	210	88	180	180	170		58	61	7.73	79	150	110	140	
Alkalinity (mg/L)	1000	1100	1100	1100	1100	1000	1100	1100	1000	1200	1200	1100	1300	1300	1300	1400	1500
TOC (mg/L)	17	23	42	56	34	38	22		18	16	23	32	51	50	40	32	20
Lactic acid (mg/L)	<25	<0.35	<0.1	<0.5	<0.5	<0.5	1.19	1.17		<25	<0.07	2.3	<0.1	<0.5	<0.5	<0.5	
Acetic acid (mg/L)	<1.0	<0.35	<0.1	3.81	5.19	1.07	0.915	1.19		<1.0	<0.07	<0.1	0.6	47.4	0.844	0.575	
Propionic acid (mg/L)	<1.0	<0.35	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5		<1.0	<0.07	<0.1	<0.1	<0.5	<0.5	<0.5	
Butyric acid (mg/L)	<1.0	<0.07	<0.1	<0.5	<0.5	<0.5	<0.5	0.47J		<1.0	<0.07	<0.1	<0.5	<0.5	<0.5	<0.5	
Pyruvic acid (mg/L)	<10	<0.07	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5		<10	<0.07	<0.1	<0.1	<0.5	<0.5	<0.5	
i-Pentanoic acid (mg/L)		<0.07	<0.1								<0.07	<0.1					
n-Pentanoic acid (mg/L)		<0.07	<0.1								<0.07	<0.1					
i-Hexanoic acid (mg/L)		<0.1	<0.1								<0.1	<0.1					
n-Hexanoic acid (mg/L)		<0.1	<0.1								<0.1	<0.1					
n-Heptanoic acid (mg/L)			<0.1									<0.1					

TABLE 4

(Continued)

Date	Dec-03	Feb-04	Apr-04	Jul-04	Nov-04	Apr-05	Nov-05	Mar-06	Aug-06	Dec-03	Feb-04	Apr-04	Jul-04	Nov-04	Apr-05	Nov-05	Mar-06	Aug-06
Location	**MW-20**									**MW-21**								
D.O. (mg/L)	0	0.21	0.79	1.47	1.84	0.24	1.6	3.66	1	0	0.26	0.02	1.26	2.04	0.05	0.58	0.26	0.14
ORP (mV)	-72	-82	-89	-135	-133	-49	18.8	167	-291	-72	-127	-308	-74	-129	-133	-357.9	-121	-137
Temperature (C)	21.8	21.8	28.4	23.9	23.2	22.4	22.48	22.03	24.68	22.2	22.1	23.6	24.0	23.1	21.2	21.79	20.48	22.85
pH	6.83	6.74	6.99	7.05	6.85	7.1	7.43	7.44	7.8	6.95	6.8	6.99	6.66	6.83	7.1	7.44	7.05	6.9
Ferrous Iron (mg/L)	0.9	1.0	1.1	1.0	1.0	1.0	0	0	0	1.0	2.0	1.1	1.1	1.2	1.5	2	1.8	2.2
Chloride (mg/L)	410	420	430	410	440	470	310	310	400	220	230	230	250	260	220	200	220	200
Nitrate (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10	3.5A3	12	8.2	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10
Sulfate (mg/L)	2300	2400	2300	2300	2500	2700	1900	1900	2400	4900	4400	4500	4400	4400	3600	2000	3900	3700
Sulfide (mg/L)	0.57	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.85J
Ethene (ng/L)	340	540	<10000	<600	<600	<1000	<1000		<1000	360	490	<8000	<600	890J	1200	500J	6100	12000
Ethane (ng/L)	33	76	<10000	<600	<600	<1100	<1100		<1100	43	48	<8000	<600	<600	<1100	<1100	<1100	<1100
Methane (µg/L)	33	49	39	28	29	31	40		11	24	38	34	25	27	1900	1400	1800	1600
TDS (mg/L)	4900			5200	5100	5100	4000			770			7800	7400	6600	4000		
BOD (mg/L)	<2									2.7								
Boron (mg/L)	0.69	0.73	0.65	0.64	0.74	0.72				0.59	0.65	0.57	0.65	0.69	0.72	0.93		0.98
Calcium (mg/L)	530	570	600	490	590	610	327	342	459	410	400	380	380	370	350	200		282
Magnesium (mg/L)	220	240	240	210	240	230	152	148	242	310	320	320	310	310	280	170		277
Potassium (mg/L)	11	12	12	10	12	12	17	16.9	15.9	15	16	16	16	16	14	10		18.8
Sodium (mg/L)	5500	5200	580	530	610	710	790	631	481	1400	1300	1500	1400	1400	1400	1000		1260
Manganese (mg/L)	3.7	3.9	3.9	3.5	3.9	4.2	0.307	4.57	0.915	5.1	5.6	5.3	5.1	5	4.9	2.9		4.81
Total iron (mg/L)	0.71	0.83	0.72	0.64	0.92	0.77	<0.1	<0.1	2.74	1.3	2.2	0.79	1.3	2.5	1.4	1.4		2.27
Hydrogen (nM)	1.4	NM	<40							1.6	NM	<40					1.6	
CO_2 (mg/L)	0.55	110	16.2	150	140	150	72			120	180	16.8	180	240	210	210	190	
Alkalinity (mg/L)	820	900	850	930	910	940	770	600	590	1100	1100	1100	1100	1100	1100	920	1200	1200
TOC (mg/L)	7.1	14	26	32	18	25	7.1		7	13	56	37	45	30	31	8.8		15
Lactic acid (mg/L)	<25	<0.07	<0.1	<0.1	<0.5	<0.5	<0.5	NA		<25	<7.0	<0.1	0.36J	<0.5	<0.5	<0.5	<0.5	
Acetic acid (mg/L)	<1.0	0.043	<0.1	0.733	38.7	0.857	<0.5	NA		<1.0	103	<0.1	1.11	14.4	<0.5	0.383J	0.575	
Propionic acid (mg/L)	<1.0	<0.07	<0.1	<0.1	<0.5	<0.5	<0.5	NA		<1.0	<7.0	<0.1	<0.1	<0.5	<0.5	<0.5	<0.5	
Butyric acid (mg/L)	<1.0	<0.07	<0.1	<0.5	<0.5	<0.5	<0.5	NA		<1.0	<7.0	<0.1	<0.5	<0.5	<0.5	<0.5	0.32J	
Pyruvic acid (mg/L)	<10	<0.07	<0.1	<0.1	<0.5	<0.5	<0.5	NA		<10	<7.0	<0.1	<0.1	<0.5	<0.5	<0.5	<0.5	
i-Pentanoic acid (mg/L)		<0.07	<0.1								<7.0	<0.1						
n-Pentanoic acid (mg/L)		<0.07	<0.1								<7.0	<0.1						
i-Hexanoic acid (mg/L)		<0.1	<0.1								<0.1	<0.1						
n-Hexanoic acid (mg/L)		<0.1	<0.1								<0.1	<0.1						
n-Heptanoic acid (mg/L)			0.8									<0.1						

TABLE 4

(Continued)

Date	Dec-03	Feb-04	Apr-04	Jul-04	Nov-04	Apr-05	Nov-05	Mar-06	Aug-06	Dec-03	Feb-04	Apr-04	Jul-04	Nov-04	Apr-05	Nov-05	Mar-06	Aug-06
Location	**EW-1**									**EW-2**								
D.O. (mg/L)	0.03	0	0	1.51	1.86	0	0.57	5.21	1.16	0	0.01	0	1.9	1.06	0.37	0.25	0.4	0.1
ORP (mV)	-159	-139	-149	-112	-175	-130	-277.8	20.7	-295	-181	-356	-382	-254	-405	-328	-404.1	-280.3	-275
Temperature (C)	21.2	21.8	21.9	22.9	22.7	21.6	22.77	22.41	23.11	21.4	22.2	21.9	24.1	22.04	22.2	21.6	20.33	26.6
pH	7.04	6.88	6.89	7.06	6.94	7.2	7.46	7.29	8.4	7.13	6.93	6.88	7.13	6.75	7.1	7.47	7.23	7.15
Ferrous Iron (mg/L)	2.0	2.0	2.1	1.9	2	2.2	0	0	0	2.1	0.0	0.0	0.0	0.0	0.0	0	0	0
Chloride (mg/L)	87	88	86	87	94	100	100	87	76	220	220	250 (250)	250 (260)	250 (260)	240 (260)	270	230	210
Nitrate (mg/L)	<0.10	<0.1	<0.1	<0.1	<0.1	<0.10	0.89A3	2.5	1.2	<0.1	<0.1	<0.1 (<0.1)	<0.1	<0.1 (<0.1)	<0.10 (<0.10)	<0.10	<0.10	<0.10
Sulfate (mg/L)	1800	1700	1600	1700	1900	2400	3200	1900	1900	3000	2400	2700 (2700)	2600 (2700)	2400 (2400)	2100 (2300)	1800	1400	1200
Sulfide (mg/L)	0.66	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	7.4	14 (2.9)	14 (16)	18 (12)	4.9(7.5)	12	7.9	8.2
Ethene (ng/L)	170	320	<10,000	<600	<600	<1100	<1000		<1000	560	840	<8000	10,000	7800 (7600)	18000 (20000)	21000	88000	34000
Ethane (ng/L)	64	150	<10,000	<600	<600	<1000	<1100		<1100	71	96	<8000	<600	<600 (<600)	<1100 (<1100)	<1100	<1100	<1100
Methane (µg/L)	14	29	20	18	21	22	5.1		5	21	14	33	71	150DL (160DL)	9300 (10000)	3300	9700	13000
TDS (mg/L)	3800			3700	3700	4500	5100			5500			6100 (6100)	5800 (5200)	5200 (5100)	4500		
BOD (mg/L)	<2									11								
Boron (mg/L)	0.66	0.71	0.6	0.61	0.7	0.65			0.74	1.1	1.2	1.1 (1.1)	1.1 (1.2)	1.3(1.3)	1.3(1.3)	1.4		1.5
Calcium (mg/L)	270	270	290	310	330	360	364	299	283	210	220	250 (240)	240 (250)	240 (230)	230 (230)	160		128
Magnesium (mg/L)	130	120	120	130	140	180	255	151	148	190	190	(250 (240)	240 (250)	230 (230)	200 (200)	170		121
Potassium (mg/L)	11	12	12	11	12	12	21.3	15.8	16.2	11	13	15 (14)	1.4 (1.5)	1.5 (1.5)	13(13)	12		13
Sodium (mg/L)	7300	6100	630	610	620	870	1100	599	665	1200	1100	1400 (1400)	1300 (1300)	1300 (1300)	1300 (1300)	1300		936
Manganese (mg/L)	2.4	2.1	2.2	2.3	2.4	3.3	1.94	0.361	0.067	2.9	2.8	3.1 (3.1)	3.0(3.0)	2.8 (2.8)	2.9(2.8)	2.2		1.92
Total iron (mg/L)	3	2.3	2.3	2.2	2.1	2.6	0.133	<0.1	<0.1	2.7	0.36	0.097 (0.093)	0.079 (0.082)	0.15 (0.17)	0.19 (0.19)	0.076		0.23
Hydrogen (nM)	1.9	NM	<40							2	NM	<25					1.9	
CO_2 (mg/L)	97	110	14.5	33	130	160	94			110	170	24.8	240	230(310)	350(320)	210	240	
Alkalinity (mg/L)	970	1000	1000	1000	1000	960	790	760	910	1300	1500	1700 (1800)	1900 (1800)	1900 (1900)	1900 (1900)	1900	1800	1900
TOC (mg/L)	4.5	14	27	31	26	26	8.1		9.7	24	60	86 (96)	79(87)	61 (69)	76(82)	51		62
Lactic acid (mg/L)	<25	<0.35	<0.1	<2.0	<0.5	<0.5	<0.5	NA		<25	<7.0	<0.1	0.674	<0.5 (<0.5)	<0.5 (<0.5)	1.54	<0.5	

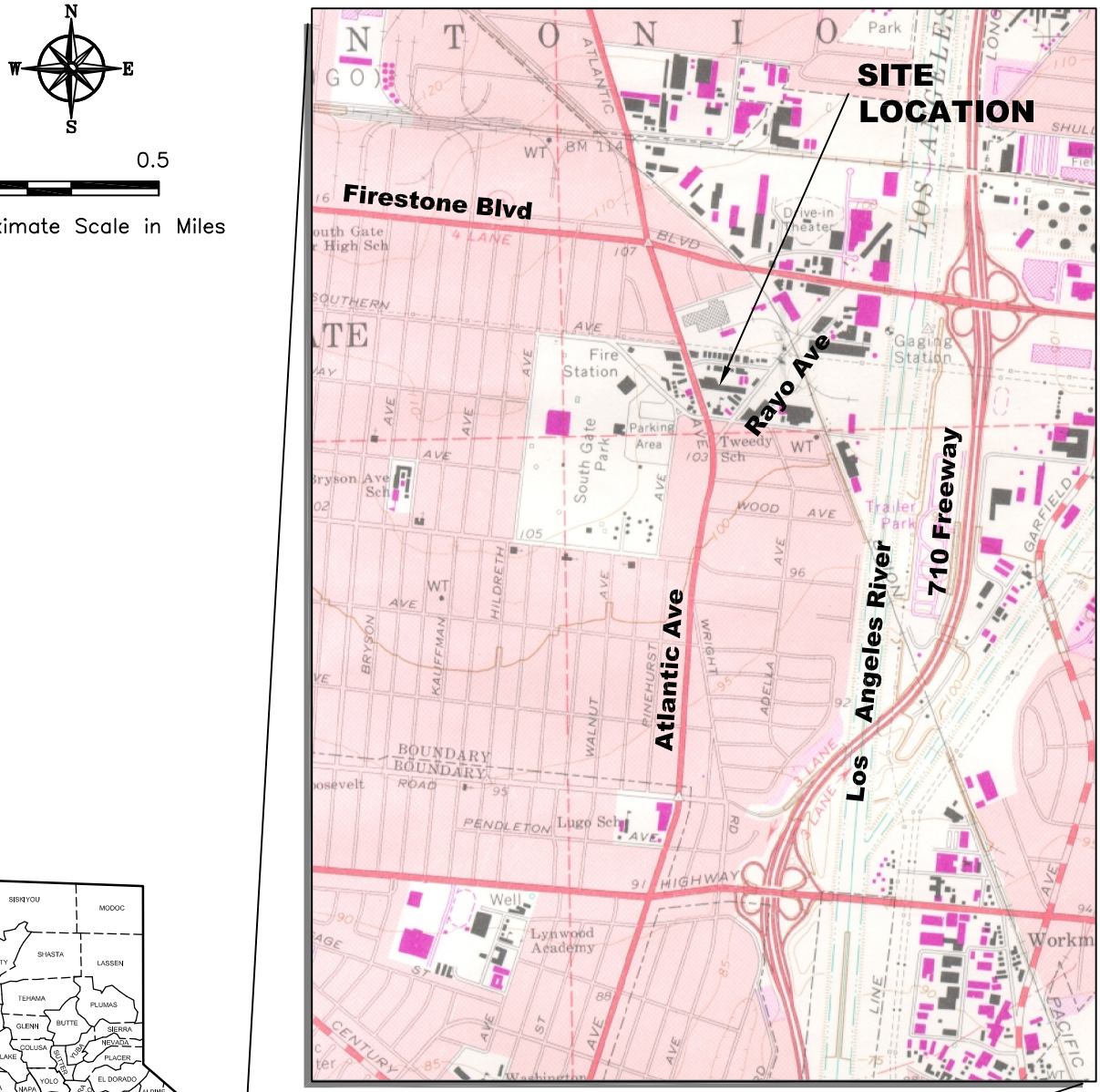
TABLE 4

(Continued)

Date	Dec-03	Feb-04	Apr-04	Jul-04	Nov-04	Apr-05	Nov-05	Mar-06	Aug-06	Dec-03	Feb-04	Apr-04	Jul-04	Nov-04	Apr-05	Nov-05	Mar-06	Aug-06
Acetic acid (mg/L)	<1.0	<0.35	<0.1	12.9	42.7	0.73	0.295J	NA		<1.0	68.8	<0.1	1.02	41.4 (2.4J)	1.11 (1.08)	1.24	1.09	
Propionic acid (mg/L)	<1.0	0.05	<0.1	<2.0	<0.5	<0.5	<0.5	NA		<1.0	<7.0	<0.1	<0.1	<0.5 (<0.5)	<0.5 (<0.5)	<0.5	<0.5	
Butyric acid (mg/L)	<1.0	<0.07	<0.1	<2.0	<0.5	<0.5	<0.5	NA		<1.0	<7.0	0.2	0.195J	<0.5 (<0.5)	<0.5 (<0.5)	<0.5	0.51	
Pyruvic acid (mg/L)	<10	<0.07	<0.1	<2.0	<0.5	<0.5	<0.5	NA		<10	<7.0	<0.1	<0.1	<0.5 (<0.5)	<0.5 (<0.5)	<0.5	<0.5	
i-Pentanoic acid (mg/L)		<0.07	<0.1								<7.0	<0.1						
n-Pentanoic acid (mg/L)		<0.07	0.1								<7.0	0.1						
i-Hexanoic acid (mg/L)		<0.1	<0.1								<0.1	<0.1						
n-Hexanoic acid (mg/L)		<0.1	<0.1								<0.1	<0.1						
n-Heptanoic acid (mg/L)			1.6									0.1						

BOD = biological oxygen demand
C = Celsius
CO_2 = carbon dioxide
D.O. = dissolved oxygen
mg/L = milligrams per liter
mV = millivolts
ng/L = nanograms per liter
nM = nano moles
ORP = oxidation-reduction potential
TDS = total dissolved solids
TOC = total organic carbon

FIGURES



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Sacramento, CA 95833-3200
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FAX: (916) 679-2900

Cooper Drum Superfund Site
South Gate, CA

Figure 1
Site Location Map

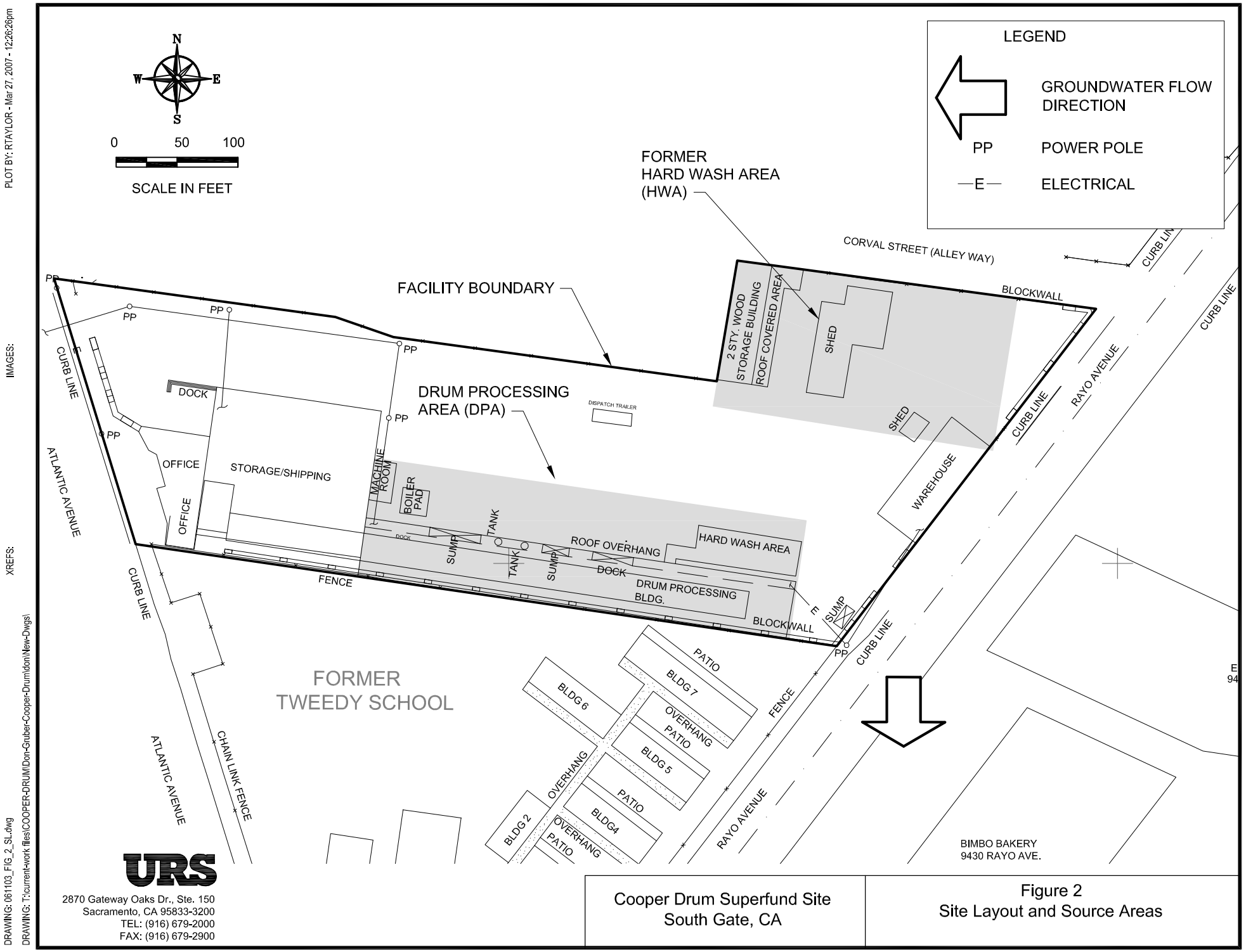

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Figure 2
Site Layout and Source Areas

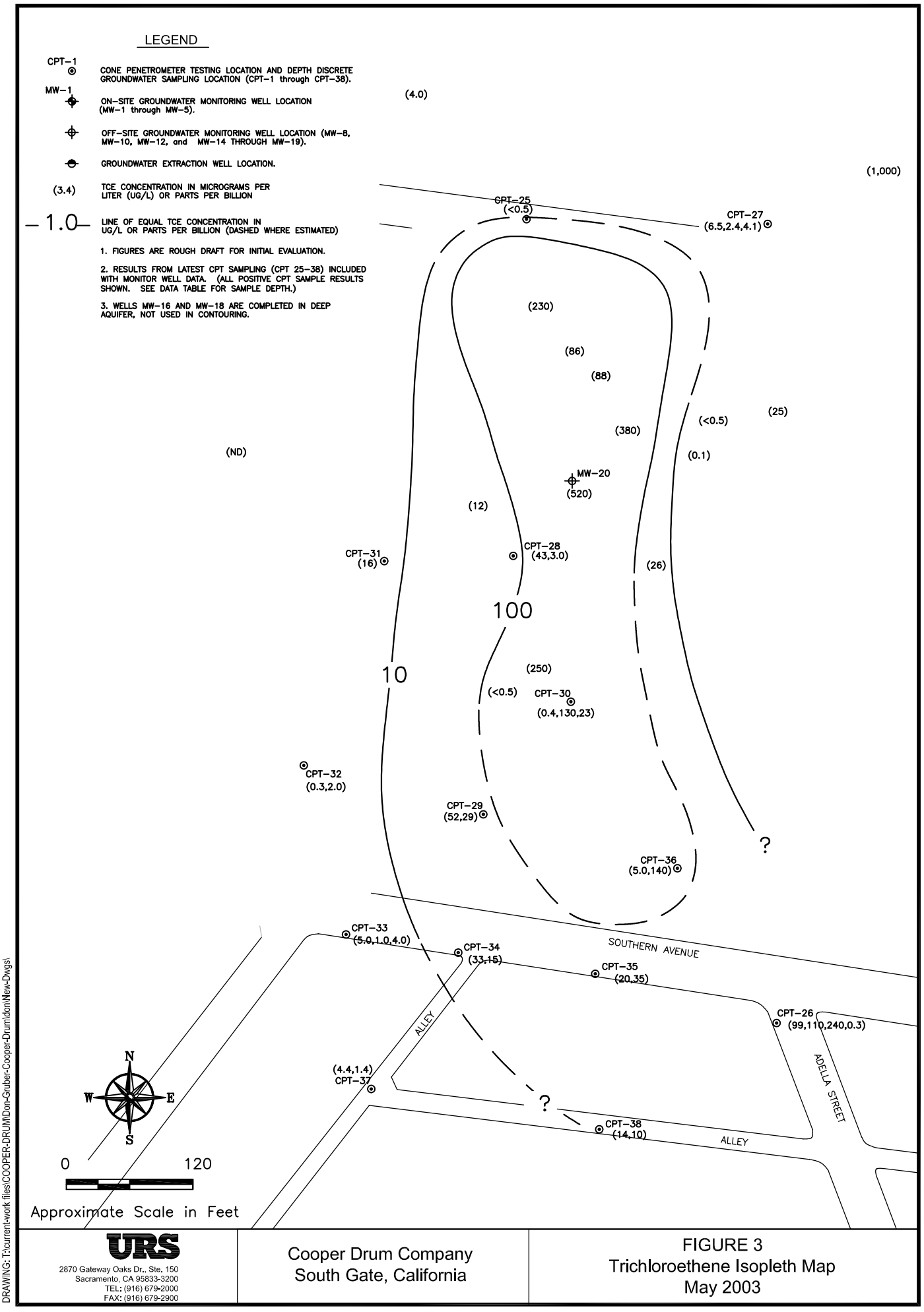

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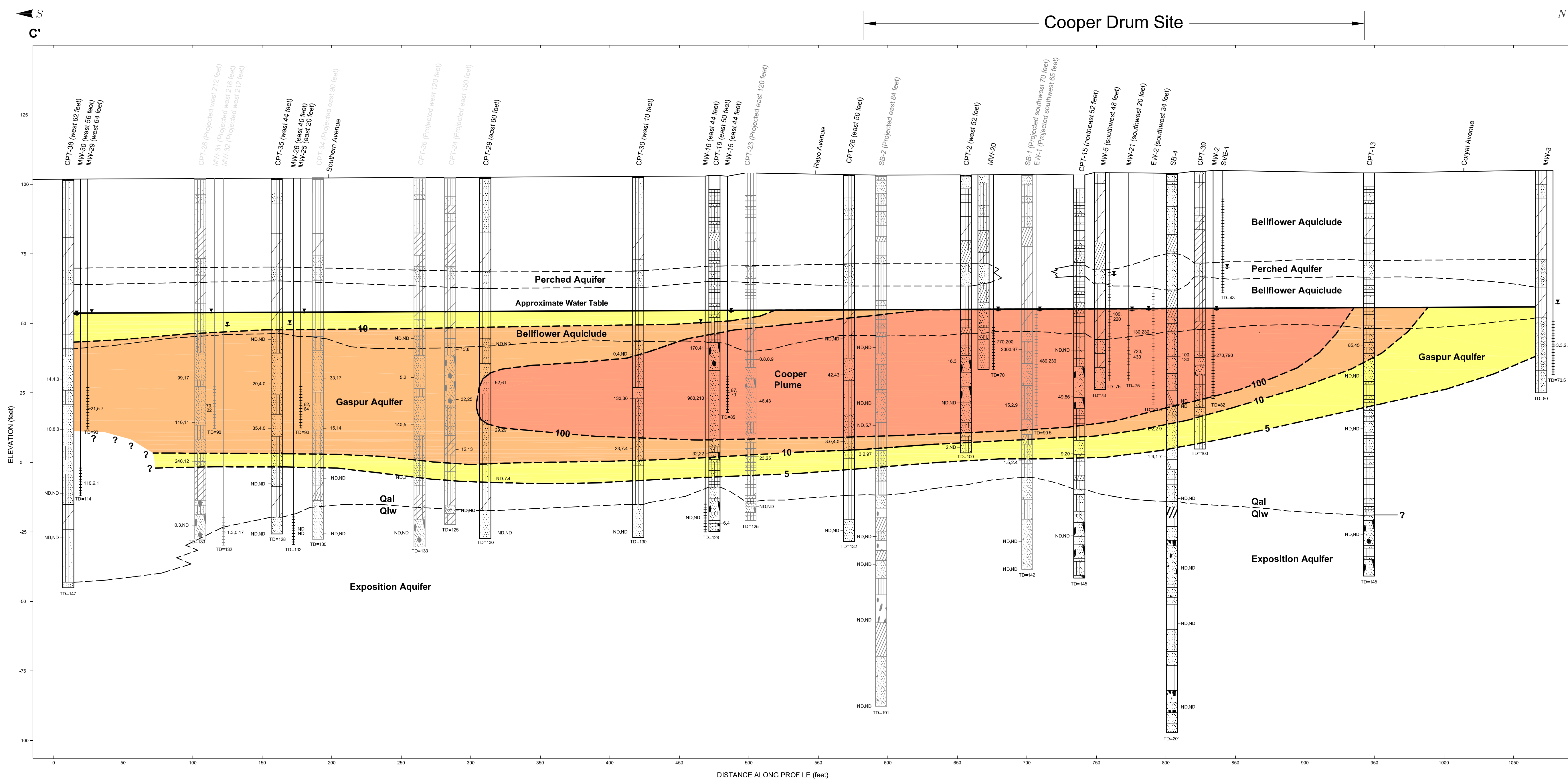
FIGURE 3
Trichloroethene Isopleth Map
May 2003



EXPLANATION:

USCS Silt
USCS Clayey Silt
USCS Well-graded Sand
USCS Poorly-graded Gravel
USCS High Plasticity Clay
USCS Sandy Silt
USCS Silty Clay
USCS Low Plasticity Silty Clay
USCS Poorly-graded Sand with Silt
USCS Well-graded Gravel
USCS Silty Sand
USCS Poorly-graded Sand
Asphalt
USCS Low to High Plasticity Clay
USCS Well-graded Sand with Gravel
USCS Low Plasticity Clay
USCS Poorly-graded Gravelly Sand
Sandstone
USCS Clayey Sand
USCS Poorly-graded Sand with Gravel

TCE

> 5 ug/L - < 10 ug/L
> 10 ug/L - < 100 ug/L
> 100 ug/L - 1,000 ug/L

Note:
Isoconcentration contours were generated using TCE data from wells that are within 60 feet or less of the cross section line.

CPT-1
Borehole Number
Borehole Lithology
Well Construction
Depth-discrete Hydropunch Sampling, TCE,DCE12c results in ppb
83,28
Screened Interval with TCE and DCE12c Results in ppb
Water Level December 2003.

TCE = Trichloroethene
DCE12c = cis-1,2- Dichloroethene
ND = Not Detected
Qal = Recent Alluvium
Qlw = Upper Pleistocare Lakewood Formation

0 50
Horizontal Scale (feet)
Scale: 1" = 50'
Vertical Exaggeration: 2x
Scale: 1" = 25'

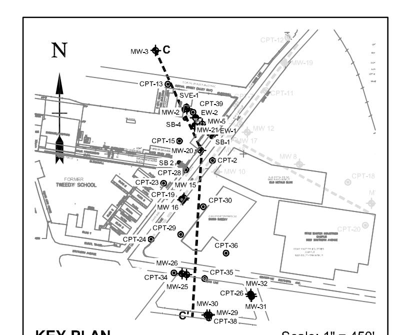


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FIGURE 4
Geologic Cross Section C-C'

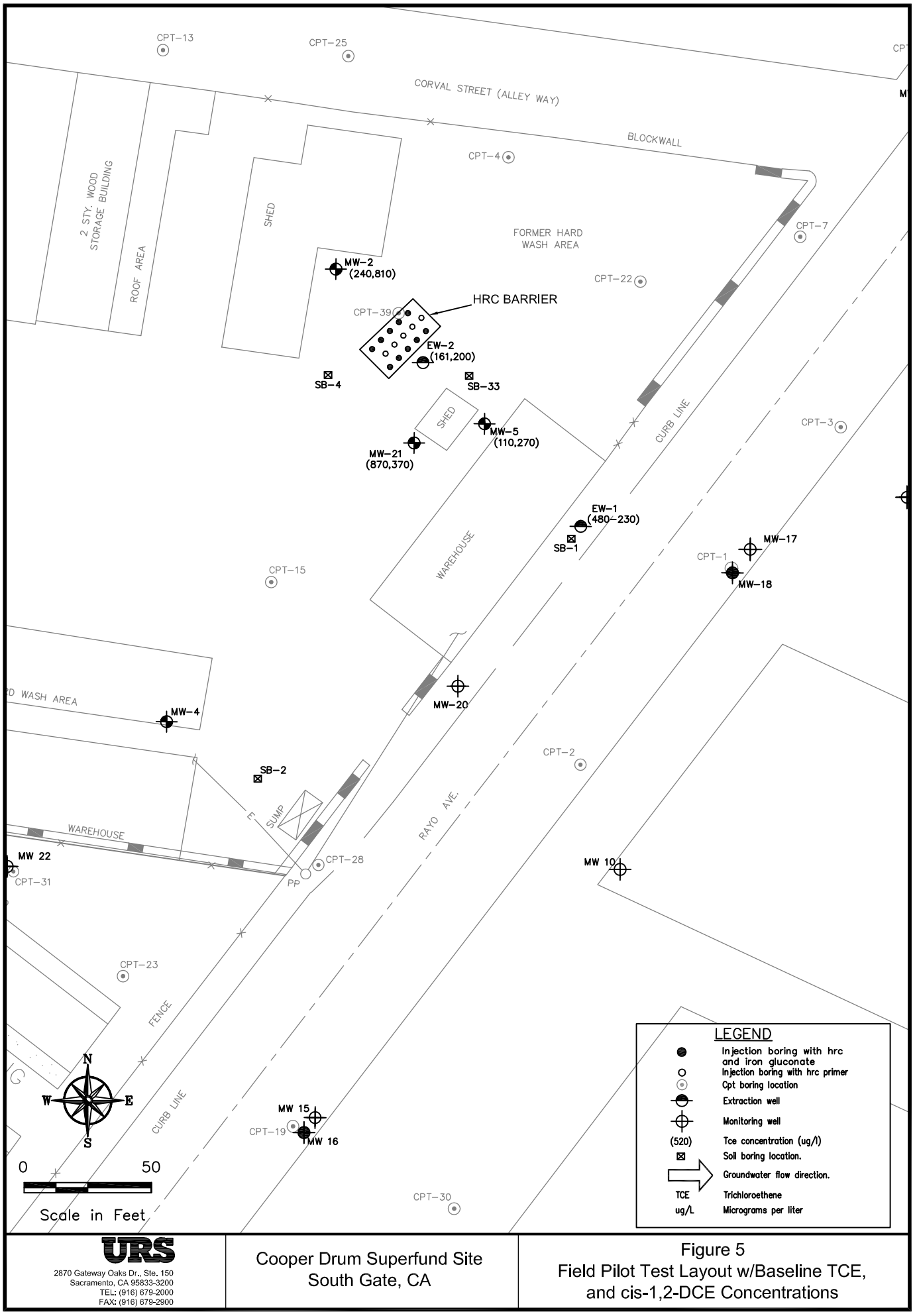

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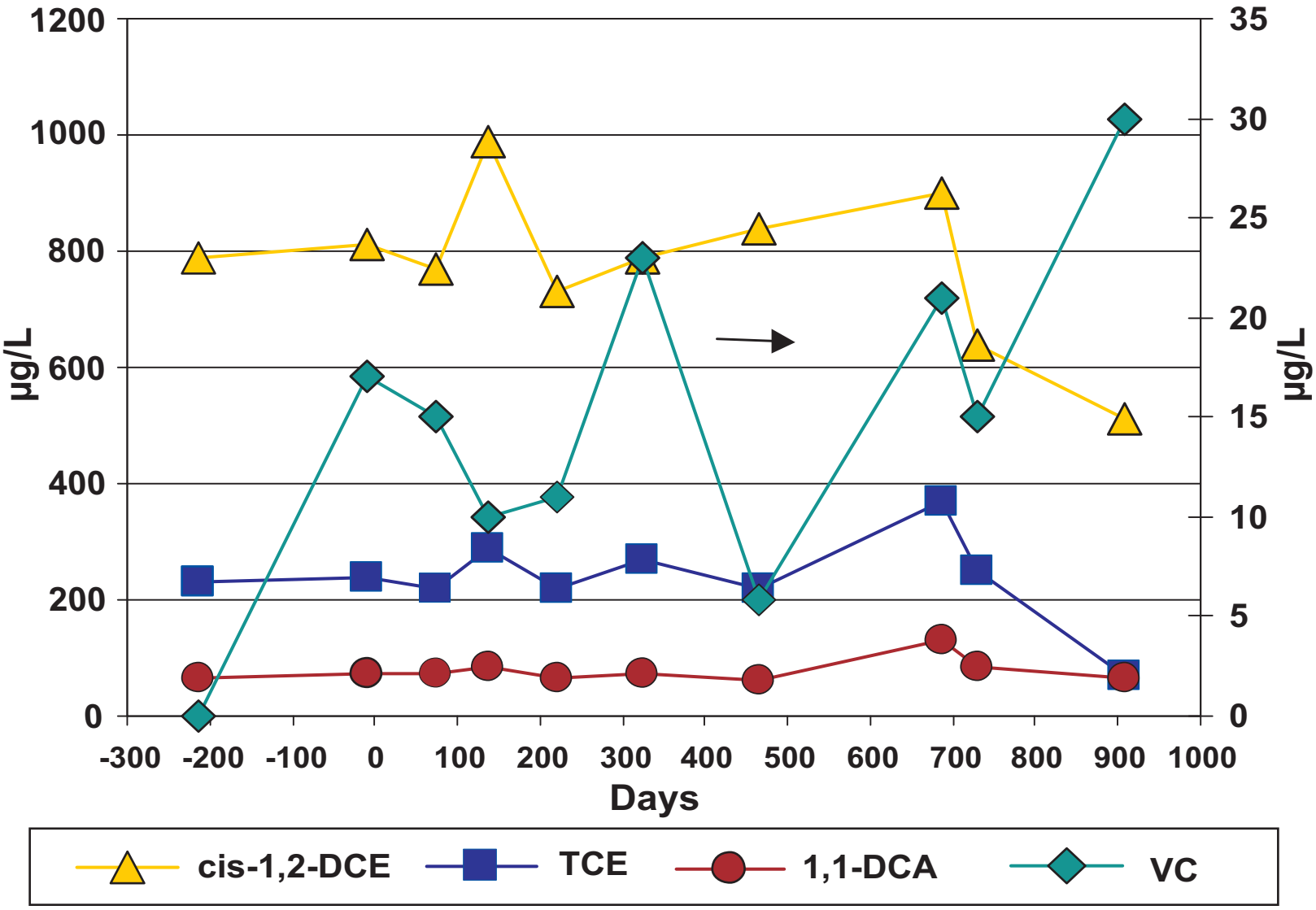
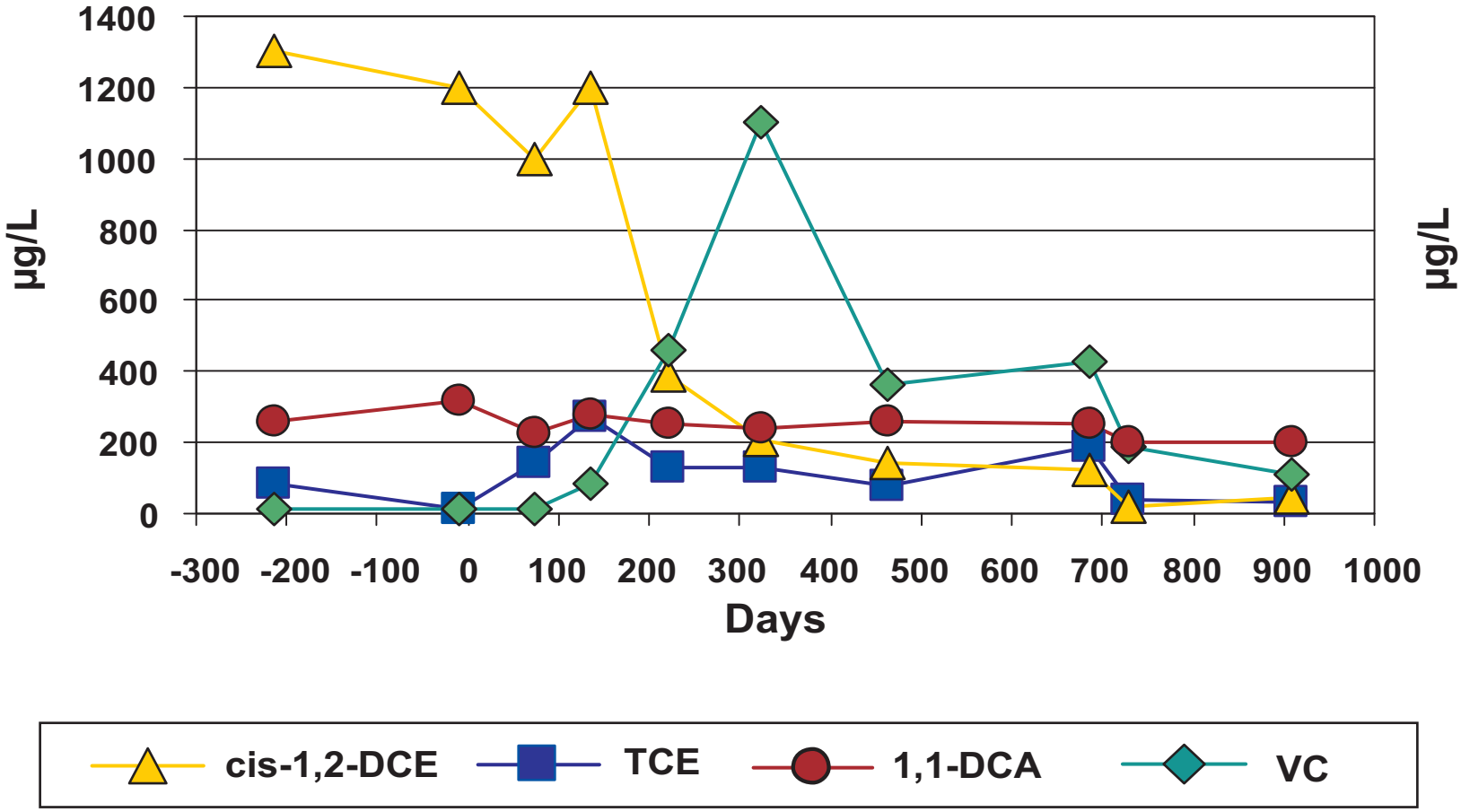
Figure 5
Field Pilot Test Layout w/Baseline TCE, and cis-1,2-DCE Concentrations

Figure 6. MW-2 (25 ft upgradient)



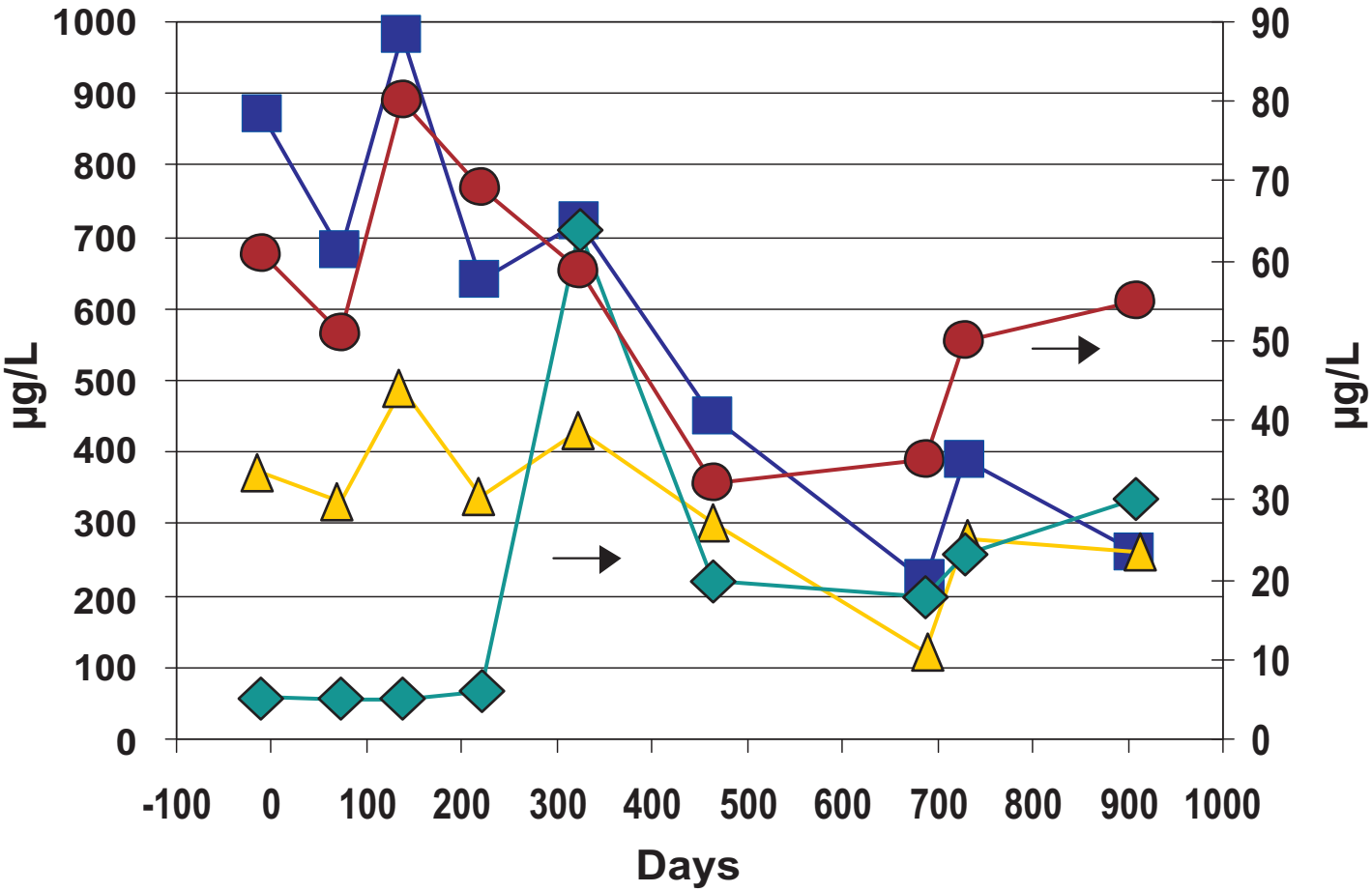
Cooper Drum\03-07-HRC-charts.cdr - VMG 05/22/07 SAC 1

Figure 7. EW-2 (8 ft downgradient)



Cooper Drum\03-07-HRC-charts.cdr - VMG 05/22/07 SAC 2

Figure 8. MW-21 (30 ft downgradient)



Cooper Drum\03-07-HRC-charts.cdr - VMG 05/22/07 SAC 3

Figure 9. MW-2 (25 ft upgradient)

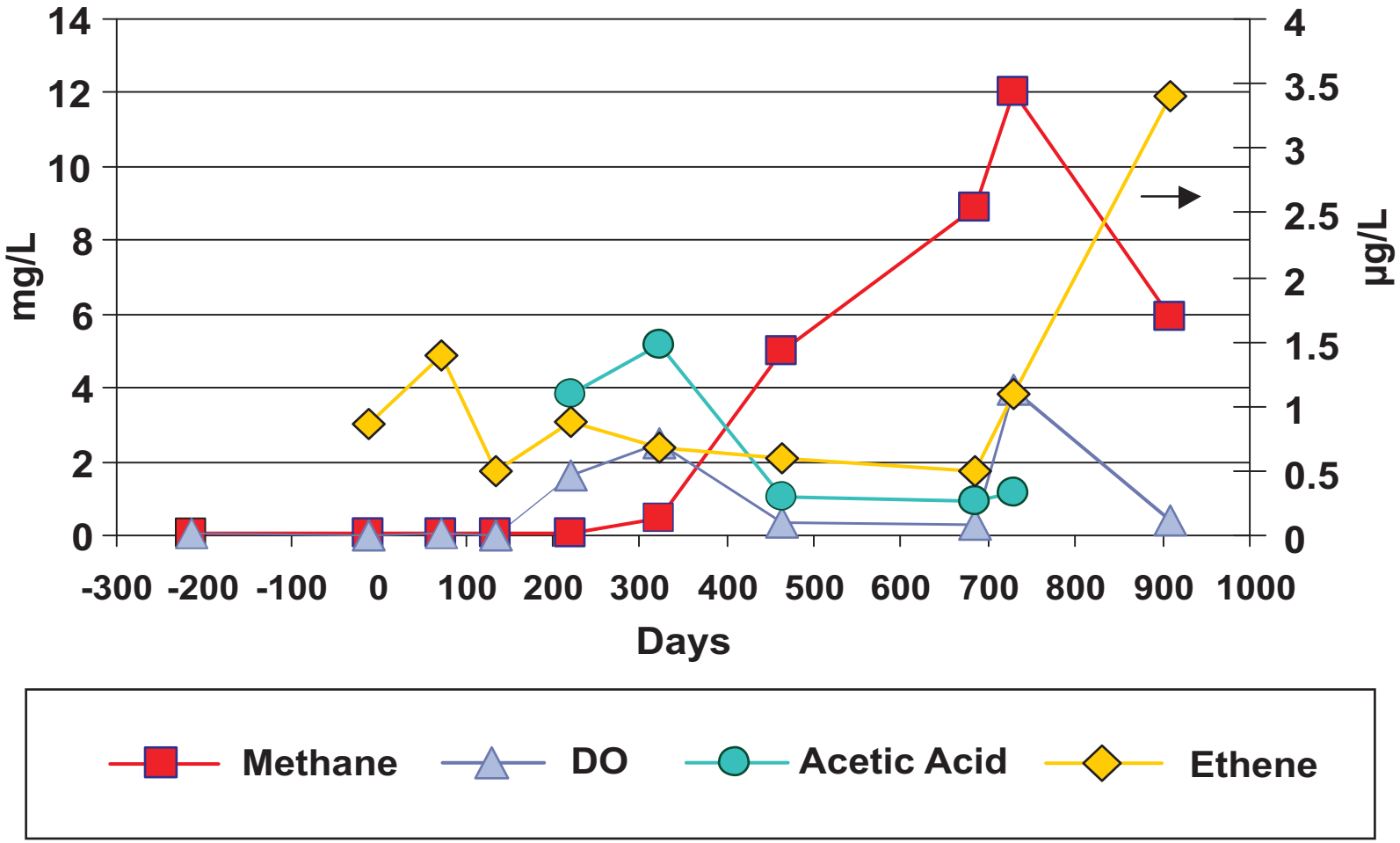
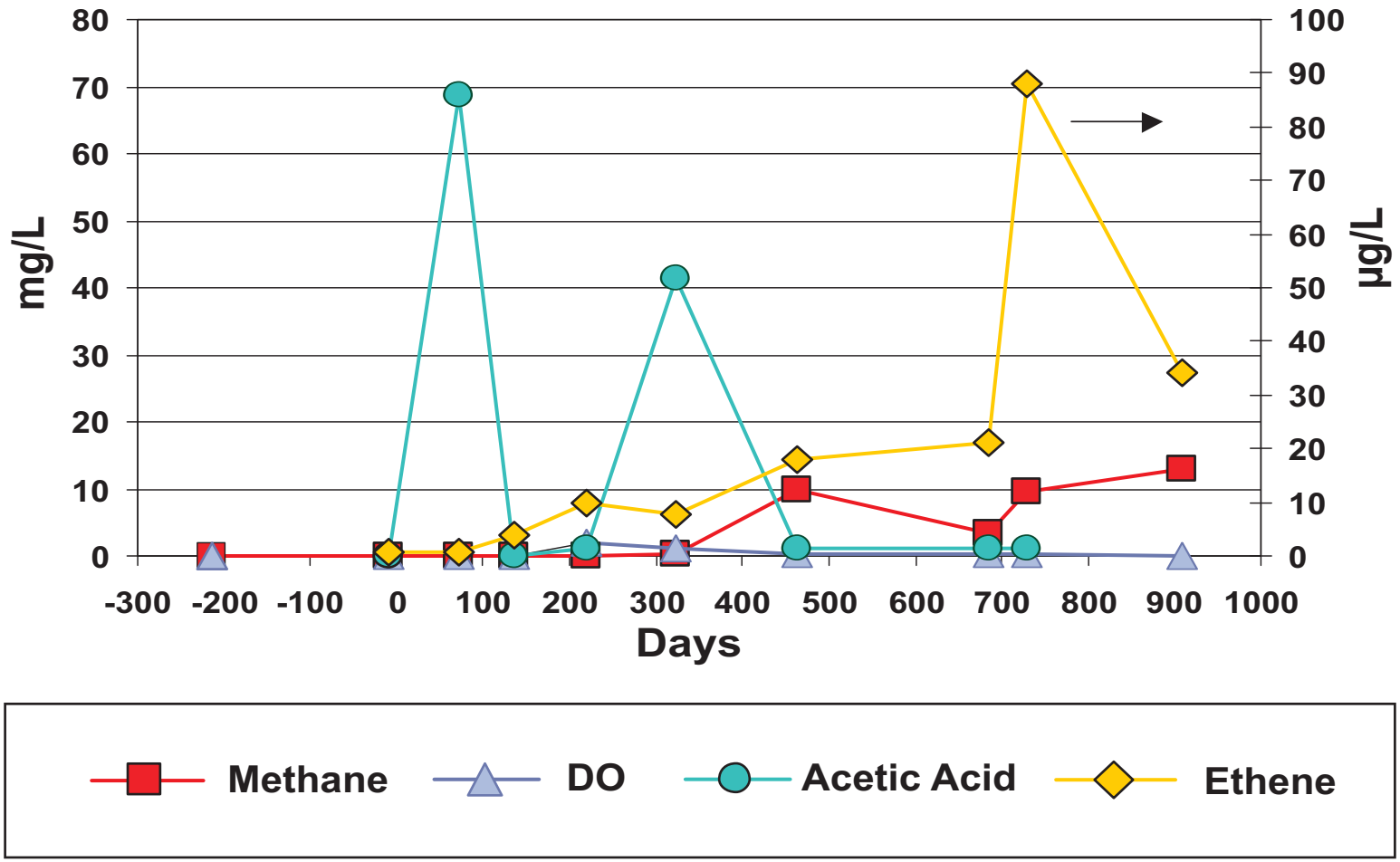
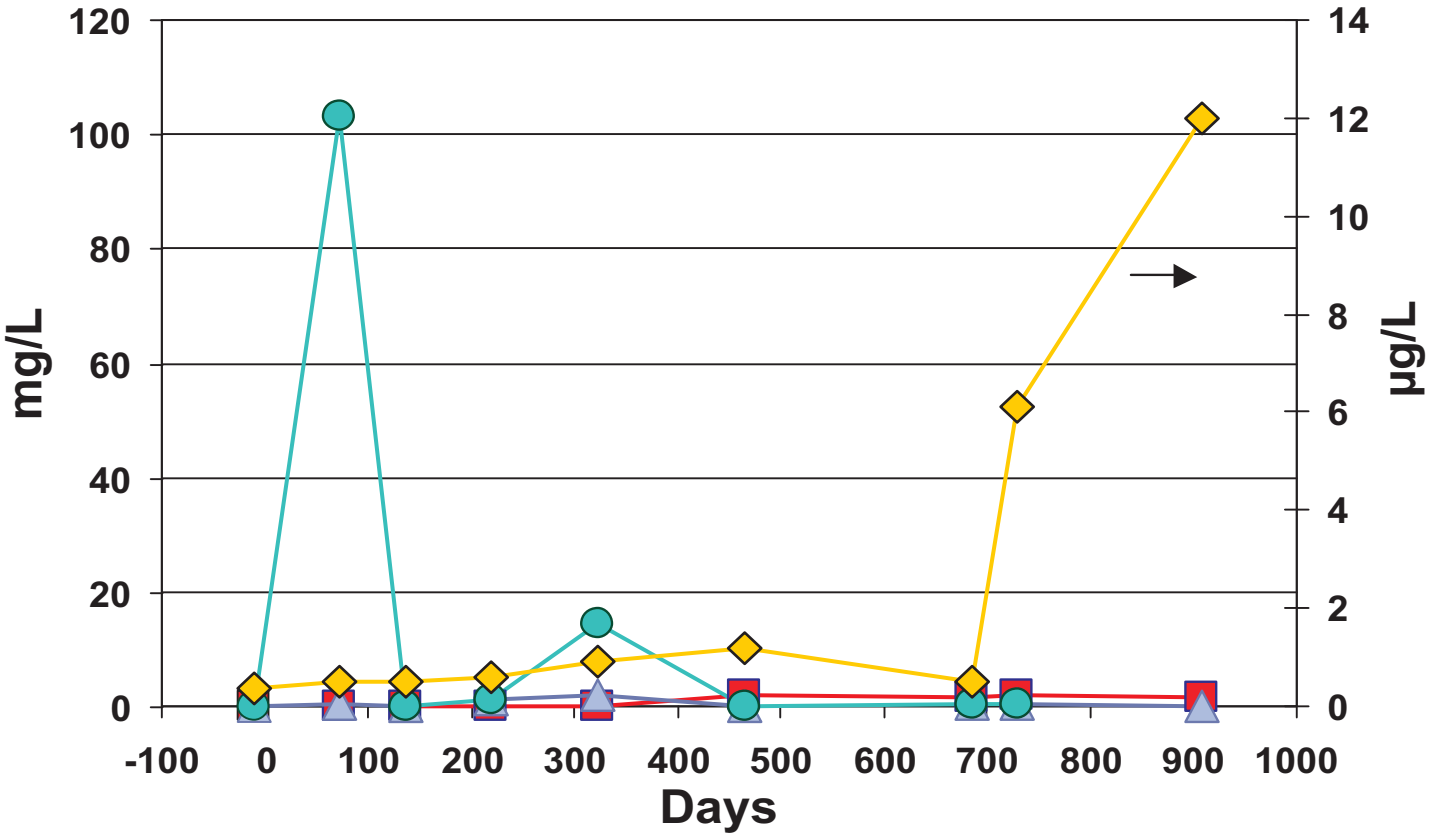


Figure 10. EW-2 (8 ft downgradient)



Cooper Drum\03-07-HRC-charts.cdr - VMG 05/22/07 SAC 5

Figure 11. MW-21 (30 ft downgradient)



ATTACHMENT A

Monitor Well Field
Sampling Data Sheets

URS TDMT Only TDCN: Project #: Loc: 09.35 Type: 35

URS Consultants

Exhibit 5.1-2

MONITORING WELL NO: MW-2

Monitoring Well Sampling Data

Project: Cooper Drum

Location No: MW-2

Sample No(s): 35000

Sampling Date: 12-4-03

Sampling Method:

Sampling Time: 1115

Job No: 18600047.07030

Sampled By: MA DG

Reviewed by: Date:

Weather

Amb. Temp. (°F)

Products obs: ☐ Yes ☐ No

Depth to Product:

Method of Measurement: Interface Probe ☐

Other:

WATER ELEVATION DATA

Method of Measurement: Depth Sounder ☑

Other:

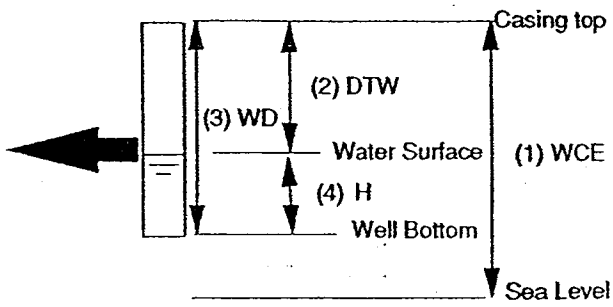
1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 49.56 ft
(from casing top as marked)

3) Well Depth (WD) 82 ft
(from casing top as marked)

4) Height of Water Column (H) 32.44 ft
WD - DTW = H

Screen 50' - 82'



WELL PURGE AND SAMPLING DATA

Single Casing Volume of Water in Well (VW) 21.09 gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC)

Total Volume of Water to Purge (TV) gals
(VW x NC = TV)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	$CV = (23.49) \times [(D/24)^2]$

$CV = \pi [(D/2)/12 \text{ in./ft}]^2 h$ (7.48 gal/cu. ft.)

Purge Method: 2" Grundfos Submersible

Date: 12-4-03 Was Well Pumped Dry? ☐ Yes ☐ No

(mV) ORP	(mg/L) D.O.	Time	Temp °C	Cond. (µmhos)	pH	Turbidity (NTU)	Removed (gal)	Flow Rate ~~L (gal/min)~~	Observations/ Physical Appearance	W.L.
		1022	Begin	purge						
		1027								50.5
		1035					4.0			
-129	0.08	1037	22.0	11.9	6.85	-0.9		1.0	clear	50.
-130	0.02	1041	22.1	11.9	6.84	0.5	6.0	1.0	clear	50.
-131	0.00	1045	22.2	11.7	6.83	2.4	7.0	1.0	clear	50.

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks: Pump set @ 65' bgs. RediFlo controller set to 162.6 Hz.

Note: A complete list of containers and analyses used can be found in the associated sample log.

The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, note which reading applies to the values recorded at sampling.

URS #100 8/92

Monitor Well No: MW-2

URS Consultants

Exhibit 7.4-1

Monitor Well Development Data (Continued)

Project: Cooper Drum
Site No: MW-2
Location No:
Sample No: 35000

Job No: 1B600047.07030
Sampling Date: 12-4-03
Sampling Time: 1115
Sampled By: MA DG
Reviewed By: _____ Date: _____

(mV) ORP	(mg/L) D.O.	Time	Temp °C	Conductivity	pH	NTUs	WL	Removed	(L/min) Flow Rate	Observations
-131	0.00	1049	22.1	11.5	6.82	-5.0	50.05	8.0	1.0	clear
-132	0.00	1053	22.1	11.4	6.82	-5.1	50.05	9.0	1.0	clear
-132	0.00	1057	22.1	11.3	6.82	-5.0	50.05	10.0	1.0	clear
			- parameters stable -							
				Fe II = 1.9 mg/L						

NTU = Nephelometric turbidity units
WL = Water level

TDCN:

Project #: _____ Loc: 09.35 Type: 35

URS Consultants

Exhibit 5.1-2

MONITORING WELL NO: MW-5

Monitoring Well Sampling Data

Project: Cooper Drum

Location No: MW-5

Sample No(s): 35001

Sampling Date: 12-3-03

Sampling Method: _____

Sampling Time: 815

Job No: 18600047.07030

Sampled By: MA DG

Reviewed by: _____ Date: _____

Weather Sunny cool

Amb. Temp. (°F) 55°

WATER ELEVATION DATA

Method of Measurement: Depth Sounder [X]

Other: _____

Products obs: [ ] Yes [ ] No

Depth to Product: _____

Method of Measurement: Interface Probe [ ]

Other: _____

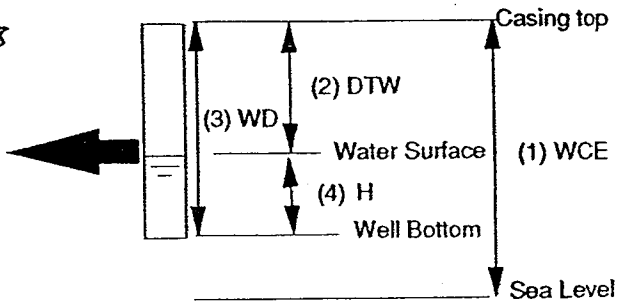
1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 36.14 ft 12-3-03
(from casing top as marked)

3) Well Depth (WD) 75 ft
(from casing top as marked)

4) Height of Water Column (H) 38.99 ft
WD - DTW = H

Screen interval 30-75'



WELL PURGE AND SAMPLING DATA

Single Casing Volume of Water in Well (VW) 25.34 gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) _____

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TV)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = π [(D/2)/12 in./ft]^2 h (7.48 gal/cu. ft.)

Purge Method: 2" Grundfos submersible

Date: 12-3-03 Was Well Pumped Dry? [ ] Yes [ ] No

D.O.	(mV) ORP	Time	Temp °C	Cond. (µmhos)	pH	Turbidity (NTU)	Removed (gal)	Flow Rate (gal/min)	Observations/ Physical Appearance	W.L.
		0727	Begin	purge						
1.44	-30	731	20.5	3.25	7.29	11.4		1.2	clear	36.92
1.24	-65	735	20.9	3.25	7.36	8.5		1.2	clear	37.21
1.14	-46	739	21.1	3.25	7.38	2.4		1.2	clear	37.26
1.11	-3	743	21.2	3.25	7.38	-1.1		1.2	clear	37.27
		744	5 gallons removed							

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks: RediFlo controller set at 142.1 Hz
Pump set @ 65' bgs

Note: A complete list of containers and analyses used can be found in the associated sample log.
The final row of readings should list the time sampling was completed and an estimate ot the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, note which reading applies to the values recorded at sampling.

Monitor Well No: MW-5

URS Consultants

Exhibit 7.4-1

Monitor Well Development Data (Continued)

Project: Cooper Drum
Site No: MW-5
Location No:
Sample No: 35001

Job No: 1860047-07138
Sampling Date: 12-3-03
Sampling Time: 815
Sampled By: MA DG
Reviewed By: _____ Date: _____

(mV) ORP	(mg/L) D.O	Time	Temp °C	Conductivity	pH	NTUs	WL	Removed	L/min Flow Rate	Observations
3.6	1.06	747	21.2	3.25	7.38	-1.5	37.29		1.2	clear
60	1.04	751	21.3	3.25	7.38	-2.7	37.30		1.2	clear
76	0.99	755	21.3	3.25	7.38	-2.4	37.31		1.2	clear
83	1.00	759	21.3	3.25	7.38	-2.4	37.32		1.2	clear
89	1.04	802	21.3	3.25	7.38	-2.3	37.33		1.2	clear
93	1.07	805	21.2	3.25	7.38	-2.1	37.34		1.2	clear
					Ferrous Iron = 0.0 mg/L					

NTU = Nephelometric turbidity units
WL = Water level

URS #94 3/90

URS DATA ONLY TDCN: Project #: Loc: 09.35 Type: 35

URS Consultants

Exhibit 5.1-2

MONITORING WELL NO: MW-20

Monitoring Well Sampling Data

Project: Cooper Drum

Location No: MW-20

Sample No(s): 35002

Sampling Date: 12-4-03

Sampling Method:

Sampling Time:

Job No: 18600047.07030

Sampled By: MA DG

Reviewed by: Date:

Weather

Amb. Temp. (°F)

WATER ELEVATION DATA

Method of Measurement: Depth Sounder ☑

Other:

Products obs: ☐ Yes ☐ No

Depth to Product:

Method of Measurement: Interface Probe ☐

Other:

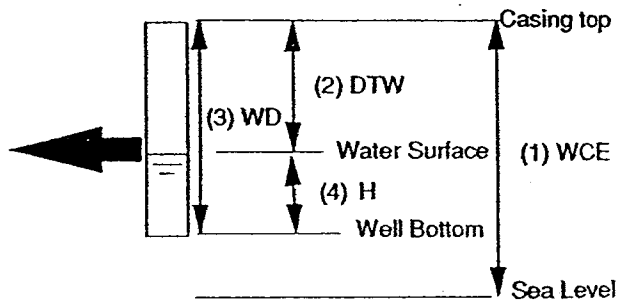
1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 48.04 ft
(from casing top as marked)

3) Well Depth (WD) 70 ft
(from casing top as marked)

4) Height of Water Column (H) 21.96 ft
WD - DTW = H

screen: 55-70



WELL PURGE AND SAMPLING DATA

Single Casing Volume of Water in Well (VW) 14.27 gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC)

Total Volume of Water to Purge (TV) gals
(VW x NC = TV)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	$CV = (23.49) \times [(D/24)^2]$

$CV = \pi [(D/2)/12\ in./ft]^2 h$ (7.48 gal/cu. ft.)

Purge Method: 2" Grundfos submersible

Date: 12-4-03 Was Well Pumped Dry? ☐ Yes ☐ No

(mV) ORP	(mg/L) D.O.	Time	Temp °C	Cond. (umhos)	pH	Turbidity (NTU)	Removed (gal)	Flow Rate (gal/min)	Observations/ Physical Appearance	W.L.
		845	Begin purge							
-82	0.18	854	21.2	5.76	6.93	15.7	3.0	1.3	clear	48.33
-81	0.09	858	21.6	5.77	6.68	22.9	4.0	1.3	clear	48.35
-80	0.03	902	21.6	5.77	6.87	18.5		1.25	clear	48.32
-77	0.00	906	21.7	5.78	6.85	12.9	7.0	1.25	clear	48.36
-76	0.00	910	21.7	5.79	6.85	-4.3	10.0	1.25	clear	48.30

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks: Pump set @ 63' bgs. RediFlo controller set to 162.2 Hz.

Note: A complete list of containers and analyses used can be found in the associated sample log.
The final row of readings should list the time sampling was completed and an estimate ot the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, note which reading applies to the values recorded at sampling.

URS #100 8/92

Monitor Well No: MW-20

URS Consultants

Exhibit 7.4-1

Monitor Well Development Data (Continued)

Project: Cooper Drum
Site No: MW-20
Location No:
Sample No: 35002

Job No: 18600047.07030
Sampling Date: 12-4-03
Sampling Time:
Sampled By: MA DG
Reviewed By: _____ Date: _____

ORP (mV)	D.O. (mg/L)	Time	Temp °C	Conductivity	pH	NTUs	WL	gal Removed	L/min Flow Rate	Observations
-74	0.00	913	21.8	5.79	6.84	-4.3	48.25	11.0	1.25	clear
-72	0.00	916	21.8	5.79	6.83	-4.3	48.25	12.0	1.25	clear
			parameters stable							
				Fe II = 0.9 mg/L						

NTU = Nephelometric turbidity units
WL = Water level

URS Form Only TDCN: Project #: Loc: 09.35 Type: 35

URS Consultants

Exhibit 5.1-2

Monitoring Well Sampling Data

MONITORING WELL NO: MW-21

42 sec/1 L

Project: Cooper Drum

Location No: MW-21

Sample No(s): 35003, 35004, 35005

Sampling Date: 12-3-03

Sampling Method:

Sampling Time: 1200, 1210, 1055

Job No: 18100047-87090

Sampled By: MT DG

Reviewed by: Date:

Weather Sunny, clear

Amb. Temp. (°F) 70°

WATER ELEVATION DATA

Method of Measurement: Depth Sounder ☑

Other:

Products obs: ☐ Yes ☐ No

Depth to Product:

Method of Measurement: Interface Probe ☐

Other:

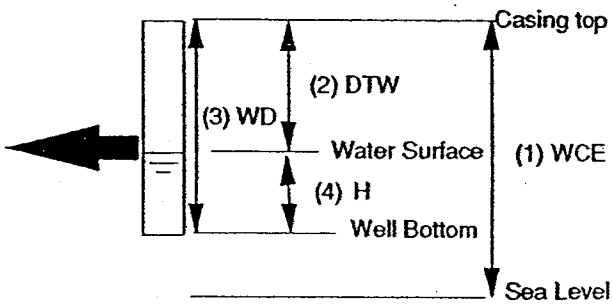
1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 46.73 ft
(from casing top as marked)

3) Well Depth (WD) 75 ft
(from casing top as marked)

4) Height of Water Column (H) 26.27 ft
WD - DTW = H

screen = 55-75



WELL PURGE AND SAMPLING DATA

Single Casing Volume of Water in Well (VW) 17.08 gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC)

Total Volume of Water to Purge (TV) gals
(VW x NC = TV)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	$CV = (23.49) \times [(D/24)^2]$

$CV = \pi [(D/2)/12\ in./ft]^2 h$ (7.48 gal/cu. ft.)

Purge Method: 2" Grundfos submersible

Date: 12-3-03 Was Well Pumped Dry? ☐ Yes ☒ No

ORP (mV)	D.O (mg/L)	Time	Temp °C	Cond. (umhos)	pH	Turbidity (NTU)	Removed (gal)	Flow Rate (gal/min)	Observations/ Physical Appearance	W.L.
		1109	Begin	purge						48.89
-71	0.76	1118	24.6	9.49	6.95	17.6		1.25	clear	48.86
-72	0.21	1122	21.8	9.39	6.94	11.4		1.25	clear	48.86
-72	0.13	1126	21.9	9.26	6.94	16.9		1.25	clear	48.85
-72	0.08	1130	21.9	9.22	6.94	12.2		1.25	clear	48.84
-72	0.02	1134	22.1	9.13	6.95	15.1		1.25	clear	48.84

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks: Pump set @ 65' bgs. RediFlo controller set to 162.1 Hz

Note: A complete list of containers and analyses used can be found in the associated sample log.

The final row of readings should list the time sampling was completed and an estimate ot the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, note which reading applies to the values recorded at sampling.

Monitor Well No: MW-2I

URS Consultants

Exhibit 7.4-1

Monitor Well Development Data (Continued)

Project: Cooper Drum
Site No: MW-2I
Location No:
Sample No: 35003, 35004, 35005

Job No: 18600047.07030
Sampling Date: 12.3.03
Sampling Time: 1200, 1210
Sampled By: MA DG
Reviewed By: _____ Date: _____

(mV) ORP	(mg/L) D.O	Time	Temp °C	Conductivity	pH	NTUs	WL	gal Removed	(L/min) Flow Rate	Observations
-72	0.0	1138	22.2	9.10	6.95	15.8	48.84	12	1.25	clear
					Fe II	= 1.0	mg/L			

NTU = Nephelometric turbidity units
WL = Water level

URS TDMT Only TDCN: _____ Project #: _____ Loc: 09.35 Type: 35

URS Consultants

Exhibit 5.1-2

MONITORING WELL NO: EW-1

Monitoring Well Sampling Data

Project: Cooper Drum

Location No: EW-1

Sample No(s): 35006

Sampling Date: 12-4-03

Sampling Method: _____

Sampling Time: 815

Job No: 18600047.07030

Sampled By: _____

Reviewed by: _____ Date: _____

Weather _____

Amb. Temp. (°F) _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder ☐

Other: _____

Products obs: ☐ Yes ☐ No

Depth to Product: _____

Method of Measurement: Interface Probe ☐

Other: _____

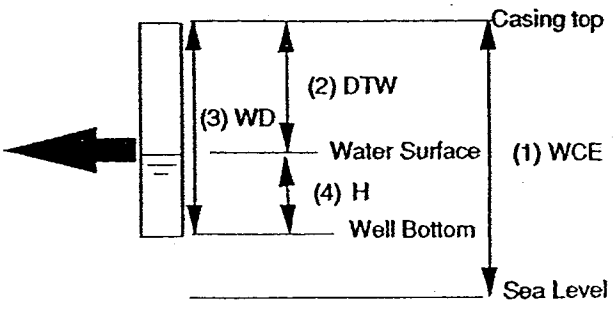
1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 48.33 ft
(from casing top as marked)

3) Well Depth (WD) 90 ft
(from casing top as marked)

4) Height of Water Column (H) 41.67 ft
WD - DTW = H

Screen 48' - 88'



WELL PURGE AND SAMPLING DATA

Single Casing Volume of Water in Well (VW) 62.51 gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) _____

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TV)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	$CV = (23.49) \times [(D/24)^2]$

$CV = \pi [(D/2)/12\ in./ft]^2 h$ (7.48 gal/cu. ft.)

Purge Method: 2" Grundfos submersible

Date: 12-4-03 Was Well Pumped Dry? ☐ Yes ☐ No

ORP (mV)	DO (mg/L)	Time	Temp °C	Cond. (µmhos)	pH	Turbidity (NTU)	Removed (gal)	Flow Rate (gal/min)	Observations/ Physical Appearance	W-L
	D.O.	728	Begin purge							
-142	0.42	734	20.8	4.32	6.76	-2.0		2.0	clear	48.47
-151	0.23	738	21.3	4.32	6.94	-2.7	4.0	2.0	clear	48.47
-155	0.15	742	21.3	4.32	7.00	-3.3		2.0	clear	48.47
-157	0.10	745	21.4	4.33	7.02	-2.9	8.0	2.0	clear	48.47
-158	0.07	748	21.3	4.36	7.03	-3.4		2.0	clear	48.47

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs. RediFlo controller set to 114.8 Hz.

Note: A complete list of containers and analyses used can be found in the associated sample log.

The final row of readings should list the time sampling was completed and an estimate ot the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, note which reading applies to the values recorded at sampling.

URS #100 8/92

Monitor Well No: EW-1

URS Consultants

Exhibit 7.4-1

Monitor Well Development Data (Continued)

Project: Cooper Drum
Site No:
Location No:
Sample No: 35006

Job No: 18600047.07030
Sampling Date: 12-4-03
Sampling Time: 815
Sampled By: MA DG
Reviewed By: _____ Date: _____

(mV) ORP	(mg/L) D.O.	Time	Temp °C	Conductivity	pH	NTUs	WL	gal Removed	L/min Flow Rate	Observations
-159	0.03	752	21.2	4.47	7.04	-2.8	48.47	13	2.0	clear
					Fe II = 2.0		mg/L			

NTU = Nephelometric turbidity units
WL = Water level

URS T&M Only TDCN: Project #: Loc: 09.35 Type: 35

URS Consultants

Exhibit 5.1-2

MONITORING WELL NO: EW-2

Monitoring Well Sampling Data

Project: Cooper Drum

Location No: EW-2

Sample No(s): 35007

Sampling Date: 12-3-03

Sampling Method:

Sampling Time: 940

Job No: 18600047.07030

Sampled By:

Reviewed by: Date:

Weather

Amb. Temp. (°F)

WATER ELEVATION DATA

Method of Measurement: Depth Sounder ☐

Other:

Products obs: ☐ Yes ☐ No

Depth to Product:

Method of Measurement: Interface Probe ☐

Other:

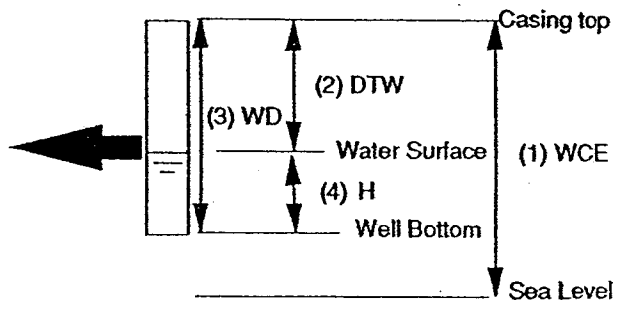
1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 48.60 ft
(from casing top as marked)

3) Well Depth (WD) 83.5 ft
(from casing top as marked)

4) Height of Water Column (H) 34.90 ft
WD - DTW = H

screen 38' - 78'



WELL PURGE AND SAMPLING DATA

Single Casing Volume of Water in Well (VW) 52.35 gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC)

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TV)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	$CV = (23.49) \times [(D/24)^2]$

$CV = \pi [(D/2)/12\ in./ft]^2 h$ (7.48 gal/cu. ft.)

Purge Method: 2" Grundfos submersible

Date: 12-3-03 Was Well Pumped Dry? ☐ Yes ☐ No

(mV) ORP	mg/L D.O.	Time	Temp °C	Cond. (umhos)	pH	Turbidity (NTU)	Removed (gal)	Flow Rate (gal/min)	Observations/ Physical Appearance	W.L.
		905	Begin	Purge						48.82
-174	0.77	908	21.5	6.79	7.19	-4.0		2.1	clear	48.90
-177	0.37	912	21.4	6.92	7.15	-4.4		2.1	clear	48.90
-179	0.19	916	21.4	6.95	7.14	-4.2		2.1	clear	48.92
-180	0.08	920	21.4	7.00	7.13	-4.6		2.1	clear	48.92
-181	0.06	923	21.4	7.02	7.13	-4.5	10.0	2.0	clear	48.90

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks: Pump set @ 65' bgs. Red. Flo controller set to 164.4 Hz

Note: A complete list of containers and analyses used can be found in the associated sample log.
The final row of readings should list the time sampling was completed and an estimate ot the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, note which reading applies to the values recorded at sampling.

Fe^{II} = 2.1 mg/L

URS #100 8/92

Monitor Well No: EW-2

URS Consultants

Exhibit 7.4-1

Monitor Well Development Data (Continued)

Project: Cooper Drum

Site No:

Location No:

Sample No:

Job No: 18600047.07030

Sampling Date:

Sampling Time:

Sampled By:

Reviewed By: Date:

(mV) ORP	mg/L D.O.	Time	Temp °C	Conductivity	pH	NTUs	WL	Removed	L/min Flow Rate	Observations

NTU = Nephelometric turbidity units

WL = Water level

URS #94 3/90

MONITOR WELL NO: MW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Sample No(s): Y1690, 35530

Sampling Date: 2-26-04

Sampling Method:

Sampling Time: 840

Job No: 18600047.03020

Sampler(s): MT RM

Reviewer(s): Date:

Weather:

Ambient Temp. (F):

WATER ELEVATION DATA

Method of Measurement: Depth Sounder

Other:

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

1) Well Casing Elevation (WCE)
(from casing top as marked)
2) Depth to Water Surface (DTW 49.46
(from casing top as marked)
3) Well Depth (WD)
(from casing top as marked)
4) Height of Water Column (H)
(from casing top as marked)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) gals
(CV x H = VW)

Purge Date: 2-26-04

Number of Casing Volumes to Purge (NC) gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) gals
(VW x NC = TC)

Fe^2 (mg/L): 1.7

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
747	Begin Purge									
752	21.1	11.8	6.73	-10.0	-169	1.05	50.20	6.0	1.0	
757	21.9	11.8	6.79	-10.0	-175	0.61	50.18	11.0	1.0	
802	22.0	11.8	6.80	-10.0	-179	0.39	50.20	16.0	1.0	
807	22.1	11.8	6.80	-10.0	-181	0.27	50.20	21.0	1.0	
812	22.1	11.5	6.80	-9.8	-181	0.18	50.20	26.0	1.0	
817	22.1	11.4	6.80	-9.5	-183	0.10	50.20	31.0	1.0	
822	22.0	11.3	6.81	-9.5	-185	0.05	50.20	36.0	1.0	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: MW-5

Monitor Well Sampling Data

Project: Cooper Drum

Location No: _____

Sample No(s): Y1691, 35531

Sampling Date: 2-25-04

Sampling Method: _____

Sampling Time: 850

Job No: 18600047.03020

Sampler(s): MA RM

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

1) Well Casing Elevation (WCE) _____
(from casing top as marked)

2) Depth to Water Surface (DTW 36.25
(from casing top as marked)

3) Well Depth (WD) _____
(from casing top as marked)

4) Height of Water Column (H) _____
(from casing top as marked)

Product Obs: Y (N)

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: 2-25-04

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
800	20.1	3.11	7.28	-5.3	227	4.16	36.95	3.0	0.75	
805	20.3	3.10	7.37	-5.2	223	3.41	36.97	6.75	0.75	
810	20.4	3.12	7.38	-4.7	216	2.60	36.90	10.50	0.75	
815	21.1	3.12	7.37	-5.6	209	2.42	37.08	14.25	0.75	
820	21.6	3.12	7.37	-6.5	204	2.28	37.22	18.0	0.75	
825	21.5	3.12	7.37	-6.0	202	2.07	37.30	21.75	0.75	
830	21.5	3.12	7.37	-6.2	201	2.09	37.32	25.50	0.75	
835	21.5	3.12	7.38	-6.0	200	1.96	37.32	29.25	0.75	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: MW-20

Monitor Well Sampling Data

Project: Cooper Drum

Location No: _____

Sample No(s): 41692, 35532

Sampling Date: 2-26-04

Sampling Method: _____

Sampling Time: 1145

Job No: 18600047-03020

Sampler(s): MM RM

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

1) Well Casing Elevation (WCE) _____
(from casing top as marked)

2) Depth to Water Surface (DTW 48.15
(from casing top as marked)

3) Well Depth (WD) _____
(from casing top as marked)

4) Height of Water Column (H) _____
(from casing top as marked)

Product Obs: Y (N)

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: 2-26-04

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 1.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1038	Begin Purge									
1043	20.5	5.87	6.79	-8.3	-80	4.20	48.25	8.0	1.0	
1048	21.2	5.89	6.75	-10.0	-81	2.09	48.24	13.0	1.0	
1053	21.2	5.89	6.75	-10.0	-82	1.30	48.24	18.0	1.0	
1058	21.2	5.89	6.74	-10.0	-82	0.79	48.24	23.0	1.0	
1103	21.0	5.89	6.74	-9.1	-82	0.52	48.24	28.0	1.0	
1108	21.2	5.89	6.74	-9.5	-82	0.38	48.24	33.0	1.0	
1113	21.7	5.90	6.74	-9.1	-82	0.27	48.24	38.0	1.0	
1118	21.8	5.91	6.74	-7.5	-82	0.21	48.24	43.0	1.0	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: MW-21

Monitor Well Sampling Data

Project: MW-21 Cooper Drum

Location No: _____

Sample No(s): Y1693, 35533

Sampling Date: 2-25-04

Sampling Method: _____

Sampling Time: 1040

Job No: 18600047.03020

Sampler(s): MT RM

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

1) Well Casing Elevation (WCE) _____
(from casing top as marked)

2) Depth to Water Surface (DTW 48.97
(from casing top as marked)

3) Well Depth (WD) _____
(from casing top as marked)

4) Height of Water Column (H) _____
(from casing top as marked)

Product Obs: Y (N)

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	$CV = (23.49) \times [(D/24)^2]$

$CV = 3.14 [(D/2)/12 \text{ in.ft}]^2 h$ (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos Submersible

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: 2-25-04

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 2.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
922	Begin	Purge								
927	20.5	.006	6.70	64.1	-77	13.75	49.03	4.0	1.0	
932	21.2	9.21	6.95	-1.6	-98	9.96	49.05	6.0	1.0	
937	22.1	9.38	6.89	-3.8	-106	9.03	49.05	11.0	1.0	
942	22.3	9.44	6.89	-3.8	-110	8.41	49.05	16.0	1.0	
947	22.4	9.48	6.89	-3.3	-114	7.70	49.05	21.0	1.0	
952	22.4	9.45	6.88	-1.3	-118	7.02	49.05	26.0	1.0	
957	21.9	9.40	6.85	-4.0	-121	2.89	49.05	31.0	1.0	
1002	22.0	9.28	6.83	-3.8	-125	1.69	49.05	36.0	1.0	
1007	22.0	9.23	6.82	-6.3	-125	0.54	49.05	41.0	1.0	
1012	22.0	9.18	6.81	-5.6	-126	0.37	49.05	46.0	1.0	
1017	22.1	9.11	6.80	-5.7	-127	0.26	49.05	51.0	1.0	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs. Pump stopped for 3 min. @ 928.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: EW-1

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Sample No(s): Y1694, 35534

Sampling Date: 2-26-04

Sampling Method:

Sampling Time: 1000

Job No: 18600047.03020

Sampler(s): MA RM

Reviewer(s): Date:

Weather:

Ambient Temp. (F):

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other:

1) Well Casing Elevation (WCE)
(from casing top as marked)
2) Depth to Water Surface (DTW 48.40
(from casing top as marked)
3) Well Depth (WD)
(from casing top as marked)
4) Height of Water Column (H)
(from casing top as marked)

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
(6)	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) _____ gals

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Purge Date: 2-26-04

Was Well Pumped Dry? Y (N)

Fe^2 (mg/L): 2-0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
915	Begin	Purge								
920	20.8	4.49	6.92	-10.0	-141	0.55	48.45	8.0	1.0	
925	21.3	4.50	6.89	-10.0	-139	0.33	48.46	13.0	1.0	
930	21.4	4.49	6.88	-10.0	-140	0.20	48.46	18.0	1.0	
935	21.5	4.48	6.87	-10.0	-141	0.10	48.46	23.0	1.0	
940	21.8	4.49	6.88	-10.0	-141	0.03	48.46	28.0	1.0	
945	21.8	4.48	6.88	-10.0	-140	0.00	48.46	33.0	1.0	
950	21.8	4.49	6.88	-9.5	-139	0.00	48.46	38.0	1.0	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was complete and an estimate of the total valume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which readin applies to the values recorded at sampling

MONITOR WELL NO: EW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Sample No(s): Y1695, Y1696, (Y1697), 35535, 35536, (35537)

Sampling Date: 2-25-04

Sampling Method:

Sampling Time: 1200, 1210,

Job No: 18600047-03020

Sampler(s): MA RM

Reviewer(s): Date:

Weather:

Ambient Temp. (F):

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other:

1) Well Casing Elevation (WCE)
(from casing top as marked) MA 2-25-04

2) Depth to Water Surface (DTW) ~~41.64~~ 48.87
(from casing top as marked)

3) Well Depth (WD)
(from casing top as marked)

4) Height of Water Column (H)
(from casing top as marked)

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
(6)	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) gals
(CV x H = VW)

Purge Date: 2-25-04

Number of Casing Volumes to Purge (NC) gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) gals
(VW x NC = TC)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1114	Begin	Purge								
1117	20.8	6.86	7.02	-6.8	-238	4.77	49.10	3.0	~~1.2~~ MA	
1122	21.9	6.90	7.01	-7.6	-309	1.38	49.11	8.0	1.0	
1127	22.1	6.92	6.98	-8.7	-340	0.68	49.11	13.0	1.0	
1132	22.2	6.94	6.95	-9.0	-347	0.34	49.11	18.0	1.0	
1137	22.3	6.94	6.94	-9.1	-350	0.20	49.11	23.0	1.0	
1142	22.2	6.97	6.93	-9.1	-355	0.03	49.11	28.0	1.0	
1147	22.2	6.97	6.93	-9.2	-356	0.01	49.11	33.0	1.0	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: MW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No: MW-2

Sample No(s): Y16A0, 35550

Sampling Date: 4-28-04

Sampling Method: _____

Sampling Time: 1140

Job No: 18600847.070 30

Sampler(s): MA RM

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: 4-28-04

1) Well Casing Elevation (WCE) _____
(from casing top as marked)

2) Depth to Water Surface (DTW 49.60
(from casing top as marked)

3) Well Depth (WD) _____
(from casing top as marked)

4) Height of Water Column (H) _____
(from casing top as marked)

Product Obs: Y (N)

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) _____ gals

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Purge Date: 4-28-04

Was Well Pumped Dry? Y (N)

Fe^2 (mg/L): 2.1

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1030	Begin	Purge		25.5			49.97	0.5	0.5	
1034	20.6	11.8	6.93	~~11.8~~	-183	3.82	49.95	2.5	0.5	
1039	21.8	11.8	6.87	15.0	-188	1.40	50.04	5.0	0.5	
1044	22.2	11.8	6.85	8.5	-193	0.73	49.96	7.5	0.5	
1049	22.3	11.8	6.84	7.5	-198	0.34	49.96	10.0	0.5	
1054	22.4	11.8	6.83	7.6	-201	0.17	49.95	12.5	0.5	
1059	22.5	11.7	6.82	7.6	-203	0.04	49.95	15.0	0.5	
1104	22.7	11.7	6.82	7.2	-205	0.00	49.95	17.5	0.5	
1109	22.7	11.7	6.82	7.2	-208	0.00	49.95	20.0	0.5	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65 bgs. D.O. did not calibrate during auto cal mode.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: MW-5

Monitor Well Sampling Data

Project: Cooper Drum

Location No: MW-5

Sample No(s): Y1681, 35551

Sampling Date: 4-27-04

Sampling Method: _____

Sampling Time: 815

Job No: 18660047.07030

Sampler(s): MA RM

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

1) Well Casing Elevation (WCE) _____
(from casing top as marked)

2) Depth to Water Surface (DTW 36.23
(from casing top as marked)

3) Well Depth (WD) _____
(from casing top as marked)

4) Height of Water Column (H) _____
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: 4-27-04

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
724	Begin Purge							1.0	1.0	
726	20.8	3.14	7.09	8.9	189	3.57	36.94	3.0	1.0	
731	21.5	3.14	7.29	4.2	180	2.06	37.67	8.0	1.0	
736	21.7	3.15	7.34	3.9	172	1.76	38.01	13.0	1.0	
741	21.7	3.15	7.35	4.4	169	1.62	38.29	18.0	1.0	
746	21.8	3.15	7.37	5.0	167	1.54	38.48	23.0	1.0	
751	21.9	3.15	7.38	5.7	165	1.53	38.78	28.0	1.0	
756	21.9	3.15	7.39	6.0	164	1.56	38.85	33.0	1.0	
801	22.0	3.15	7.40	6.5	163	1.58	38.99	38.0	1.0	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65 bgs. D.O. did not calibrate during Horiba auto calibration.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: MW-20

Monitor Well Sampling Data

Project: Casper Dram
Location No: MW-20
Sample No(s): 41642, 35552
Sampling Date: 4-27-04
Sampling Method: _____
Sampling Time: 1130

Job No: 186000 47-07030
Sampler(s): MA RM
Reviewer(s): _____ Date: _____
Weather: _____
Ambient Temp. (F): _____

WATER ELEVATION DATA
Method of Measurement: Depth Sounder (Y) N
Other: _____

1) Well Casing Elevation (WCE) _____
(from casing top as marked)
2) Depth to Water Surface (DTW 48.30
(from casing top as marked)
3) Well Depth (WD) _____
(from casing top as marked)
4) Height of Water Column (H) _____
(from casing top as marked)

Product Obs: Y (N)
Depth to Product: _____
Method of Measurement: Interface Probe Y N
Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)
Number of Casing Volumes to Purge (NC) _____ gals

Purge Date: 4-27-04
Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 1.1 mg/L

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1045	Begin Purge							2.0	0.65	
1048	24.5	6.00	7.01	47.3	-96	7.42	48.48	3.95	0.65	
1053	25.8	6.01	6.98	26.7	-95	2.33	48.47	7.20	0.65	
1058	27.0	6.02	6.98	18.9	-95	1.64	48.48	10.45	0.65	
1103	27.1	6.04	6.98	16.3	-94	1.26	48.48	13.70	0.65	
1108	27.4	6.05	6.98	14.4	-93	1.11	48.47	16.95	0.65	
1113	27.7	6.04	6.98	13.3	-91	0.95	48.48	20.2	0.65	
1118	27.9	6.05	6.99	11.5	-90	0.89	48.48	23.45	0.65	
1121	28.1	6.05	6.99	10.9	-89	0.82	48.48	25.40	0.65	
1124	28.4	6.04	6.99	10.2	-89	0.79	48.47	27.35	0.65	

INSTRUCTIONS AND COMMENTS
Purging/Sampling Remarks Pump set @ 65 bgs. D.O. did not calibrate during Horiba auto calibration mode.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: MW-21

Monitor Well Sampling Data

Project: Cooper Drum
Location No: MW-21
Sample No(s): Y16A3, 35553
Sampling Date: 4-27-04
Sampling Method: _____
Sampling Time: 1015

Job No: 18600047.07 0030
Sampler(s): MA RM
Reviewer(s): _____ Date: _____
Weather: _____
Ambient Temp. (F): _____

WATER ELEVATION DATA
Method of Measurement: Depth Sounder (Y) N
Other: _____

1) Well Casing Elevation (WCE) _____
(from casing top as marked)
2) Depth to Water Surface (DTW 49.10
(from casing top as marked)
3) Well Depth (WD) _____
(from casing top as marked)
4) Height of Water Column (H) _____
(from casing top as marked)

Product Obs: Y (N)
Depth to Product: _____
Method of Measurement: Interface Probe Y N
Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)
Number of Casing Volumes to Purge (NC) _____ gals

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Purge Date: 4-27-04

Was Well Pumped Dry? Y (N)

Fe^2 (mg/L): 1.1 mg/L

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
931	Begin	Purge					49.17	0.5	0.65	
935	21.8	9.54	6.97	23.7	-238	1.87	49.17	2.6	0.65	
940	23.0	9.69	6.95	10.4	-253	0.78	49.17	5.85	0.65	
945	23.3	9.71	6.96	8.1	-269	0.43	49.17	9.1	0.65	
950	23.5	9.70	6.97	7.5	-287	0.23	49.17	12.35	0.65	
955	23.5	9.68	6.98	7.4	-295	0.14	49.17	15.6	0.65	
1000	23.6	9.64	6.99	7.6	-305	0.06	49.17	18.85	0.65	
1005	23.6	9.63	6.99	7.8	-308	0.02	49.17	22.1	0.65	

INSTRUCTIONS AND COMMENTS
Purging/Sampling Remarks Pump set @ 65 bgs.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: EW-1

Monitor Well Sampling Data

Project: Cooper Drum
Location No: EW-1
Sample No(s): Y16A4, 35554
Sampling Date: 4-28-04
Sampling Method:
Sampling Time: 800

Job No: 186000 47-07030
Sampler(s): MA RM
Reviewer(s): Date:
Weather:
Ambient Temp. (F):

WATER ELEVATION DATA
Method of Measurement: Depth Sounder (Y) N
Other:

Product Obs: Y (N)
Depth to Product:
Method of Measurement: Interface Probe Y N
Other:

1) Well Casing Elevation (WCE)
(from casing top as marked)
2) Depth to Water Surface (DTW 48.49
(from casing top as marked)
3) Well Depth (WD)
(from casing top as marked)
4) Height of Water Column (H)
(from casing top as marked)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
(6)	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) gals
(CV x H = VW)
Number of Casing Volumes to Purge (NC) gals
Total Volume of Water to Purge (TV) gals
(VW x NC = TC)

Purge Date: 4-28-04
Was Well Pumped Dry? Y (N)
Fe^2 (mg/L): 2.1

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
719	Begin Purge							1.0	0.8	
722	20.7	4.61	6.69	1.9	-141	1.39	48.61	2.4	0.8	
727	22.0	4.62	6.81	-2.2	-150	0.59	48.62	6.4	0.8	
732	22.2	4.62	6.85	-1.8	-151	0.31	48.63	10.4	0.8	
737	21.9	4.63	6.87	1.1	-154	0.04	48.66	14.4	0.8	
742	21.7	4.63	6.89	2.5	-153	0.00	48.61	18.4	0.8	
747	21.9	4.64	6.89	3.3	-149	0.00	48.62	22.4	0.8	
750	Power to pump controller lost.									
751	Power restored									
752	21.3	4.62	7.19	4.7	-118	3.65	48.62	26.4	0.8	
755	21.3	4.63	7.09	5.2	-124	2.71	48.63	28.8	0.8	
758	21.1	4.64	6.93	5.5	-127	1.02	48.63	31.2	0.8	

INSTRUCTIONS AND COMMENTS
Purging/Sampling Remarks Pump set @ 65 bgs. D.O. did not calibrate during Horiba auto calibration mode.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was complete and an estimate of the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which readin applies to the values recorded at sampling

MONITOR WELL NO: EW-2

Monitor Well Sampling Data

Project: Cooper Drum
Location No: EW-2
Sample No(s): Y1645, Y1646, Y1647, 35555, 35556, 35557
Sampling Date: 4-28-04
Sampling Method:
Sampling Time: 930, 940

Job No: 18600047.070030
Sampler(s): MA RM
Reviewer(s): Date:
Weather:
Ambient Temp. (F):

WATER ELEVATION DATA
Method of Measurement: Depth Sounder (Y) N
Other:

1) Well Casing Elevation (WCE)
(from casing top as marked)
2) Depth to Water Surface (DTW 48.76
(from casing top as marked)
3) Well Depth (WD)
(from casing top as marked)
4) Height of Water Column (H)
(from casing top as marked)

Product Obs: Y (N)
Depth to Product:
Method of Measurement: Interface Probe Y N
Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
(6)	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) gals
(CV x H = VW)
Number of Casing Volumes to Purge (NC) gals
Total Volume of Water to Purge (TV) gals
(VW x NC = TC)

Purge Date: 4-28-04
Was Well Pumped Dry? Y N
Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
832	Begin	Purge						1.0	0.8	
837	21.5	7.22	6.88	11.1	-360	0.99	48.97	5.0	0.8	
842	22.4	7.31	6.86	3.3	-367	0.15	49.09	9.0	0.8	
847	22.6	7.36	6.86	2.1	-371	0.00	49.08	13.0	0.8	
852	22.8	7.43	6.84	1.5	-375	0.00	48.92	17.0	0.8	
857	22.9	7.47	6.83	1.5	-373	0.00	48.97	21.0	0.8	
902	21.9	7.40	6.85	3.8	-375	0.00	49.17	25.0	0.8	
907	21.7	7.59	6.86	3.0	-378	0.00	49.29	29.0	0.8	
912	21.8	7.64	6.87	2.4	-379	0.00	49.15	33.0	0.8	
917	21.8	7.68	6.88	2.2	-381	0.00	49.15	37.0	0.8	
922	21.9	7.76	6.88	2.0	-382	0.00	49.12	41.0	0.8	

INSTRUCTIONS AND COMMENTS
Purging/Sampling Remarks Pump set @ 65 bgs, D.O. did not calibrate during Horiba auto cal mode.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: MW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No: MW-2

Sample No(s): 36000, YIDB9

Sampling Date: 7-19-04

Sampling Method:

Sampling Time: 1420

Job No: 18600047-07030

Sampler(s): MT RM

Reviewer(s): Date:

Weather:

Ambient Temp. (F):

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other:

1) Well Casing Elevation (WCE)
(from casing top as marked)

2) Depth to Water Surface (DTW) 50.28
(from casing top as marked)

3) Well Depth (WD) 82
(from casing top as marked)

4) Height of Water Column (H) 31.72
(from casing top as marked)

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Single Casing Volume of Water in Well (VW) 20.62 gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) gals

Total Volume of Water ~~to~~ Purged (TV) 37 L ~~gals~~
(VW x NC = TC)

Purge Method: 2" Grundfos submersible

Purge Date: 7-19-04

Was Well Pumped Dry? Y (N)

Fe^2 (mg/L): did not obtain

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1328	Begin	Purge								
1332	21.62	7.60	6.75	18.0	-98	3.86	50.85	4.0	1.0	
1337	22.37	7.64	6.86	130	-77	1.74	50.84	9.0	1.0	
1342	22.59	7.65	6.89	131	-87	1.52	50.84	14.0	1.0	
1347	22.70	7.65	6.91	134	-95	1.58	50.84	19.0	1.0	
1352	22.90	7.64	6.91	136	-100	1.56	50.84	24.0	1.0	
1357	22.93	7.58	6.92	143	-104	1.63	50.84	29.0	1.0	
1402	22.95	7.50	6.91	148	-107	1.63	50.84	34.0	1.0	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: MW-5

Monitor Well Sampling Data

Project: Cooper Drum
Location No: MW-5
Sample No(s): 36002, YIDC1
Sampling Date: 7-21-04
Sampling Method:
Sampling Time: 840

Job No: 18600047-07070
Sampler(s): MA RM
Reviewer(s): Date:
Weather: Sunny, warm
Ambient Temp. (F): 70°

WATER ELEVATION DATA
Method of Measurement: Depth Sounder (Y) N
Other:

Product Obs: Y (N)
Depth to Product:
Method of Measurement: Interface Probe Y N
Other:

1) Well Casing Elevation (WCE)
(from casing top as marked)
2) Depth to Water Surface (DTW) 36.30
(from casing top as marked)
3) Well Depth (WD) 75
(from casing top as marked)
4) Height of Water Column (H) 38.7
(from casing top as marked)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4")	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos Submersible

Single Casing Volume of Water in Well (VW) 25.16 gals
(CV x H = VW)
Number of Casing Volumes to Purge (NC) gals
Total Volume of Water to Purge (TV) 27 L ~~gals~~
(VW x NC = TC)

Purge Date: 7-21-04
Was Well Pumped Dry? Y (N)
Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
734	Begin Purge									
737	20.8	2.91	6.48	183	52	6.89	37.23	2.0	1.0	
742	21.5	2.91	6.90	405	17	4.97	37.42	6.0	0.4	
747	21.7	2.91	6.99	73.8	6	4.42	37.25	8.0	0.4	
752	21.8	2.91	7.03	55.7	-2	3.97	37.23	10.0	0.4	
757	22.1	2.91	7.05	43.2	-8	3.51	37.21	12.0	0.4	
802	22.2	2.91	7.07	36.0	-13	3.20	37.21	14.0	0.4	
805	22.2	2.92	7.07	35.3	-16	3.07	37.21	16.0	0.4	
808	22.2	2.92	7.08	32.7	-18	2.93	37.21	18.0	0.4	
811	22.2	2.92	7.08	33.8	-20	2.81	37.21	20.0	0.4	
814	22.2	2.92	7.09	35.4	-22	2.70	37.21	22.0	0.4	
817	22.3	2.92	7.09	33.4	-23	2.63	37.21	24.0	0.4	

INSTRUCTIONS AND COMMENTS
Purging/Sampling Remarks Pump set @ 65' bgs.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: MW-20

Monitor Well Sampling Data

Project: Cooper Drum

Location No: MW-20

Sample No(s): 36004, YIDC3

Sampling Date: 7-20-04

Sampling Method: _____

Sampling Time: 920

Job No: 18600047.07030

Sampler(s): MA RM

Reviewer(s): _____ Date: _____

Weather: Sunny, hot

Ambient Temp. (F): 80-85

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

1) Well Casing Elevation (WCE) _____
(from casing top as marked)

2) Depth to Water Surface (DTW) 46.14
(from casing top as marked)

3) Well Depth (WD) 75
(from casing top as marked)

4) Height of Water Column (H) 28.86
(from casing top as marked)

Product Obs: Y (N)

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Single Casing Volume of Water in Well (VW) 18.76 gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) _____ gals

Total Volume of Water ~~to~~ Purge (TV) 40 L ~~gals~~
(VW x NC = TC)

Purge Method: 2" Grundfos submersible

Purge Date: 7-20-04

Was Well Pumped Dry? Y (N)

Fe^2 (mg/L): 1.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
824	Begin	Purge								
831	22.2	5.24	7.20	12.6	-48	2.92	48.96	2.5	1.0	
836	23.1	5.27	7.05	-10.0	-80	1.91	48.96	7.5	1.0	
841	23.5	5.28	7.04	-9.8	-94	1.66	48.97	12.5	1.0	
846	23.6	5.28	7.04	4.9	-107	1.56	48.97	17.5	1.0	
851	23.7	5.29	7.04	15.8	-116	1.52	48.96	22.5	1.0	
854	23.8	5.29	7.05	26.3	-121	1.50	48.97	25.5	1.0	
857	23.9	5.28	7.05	32.3	-125	1.49	48.97	28.5	1.0	
900	23.9	5.33	7.05	36.6	-127	1.49	48.97	31.5	1.0	
903	23.9	5.34	7.05	38.3	-132	1.48	48.97	34.5	1.0	
906	23.9	5.34	7.05	41.4	-135	1.47	48.97	37.5	1.0	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs; turbidity reading abnormally on Horiba unit.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: MW-21

Monitor Well Sampling Data

Project: Cooper Drum
Location No: MW-21
Sample No(s): 36005, YIDC4
Sampling Date: 7-21-04
Sampling Method:
Sampling Time: 930

Job No: 186000470730
Sampler(s): MA RM
Reviewer(s): Date:
Weather: Sunny, Warm
Ambient Temp. (F): 70 - 75

WATER ELEVATION DATA
Method of Measurement: Depth Sounder (Y) N
Other:

Product Obs: Y (N)
Depth to Product:
Method of Measurement: Interface Probe Y N
Other:

1) Well Casing Elevation (WCE)
(from casing top as marked)
2) Depth to Water Surface (DTW) 49.55
(from casing top as marked)
3) Well Depth (WD) 75
(from casing top as marked)
4) Height of Water Column (H) 25.45
(from casing top as marked)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) 16.54 gals
(CV x H = VW)
Number of Casing Volumes to Purge (NC) gals

Purge Date: 7-21-04

Was Well Pumped Dry? Y (N)

Total Volume of Water ~~to~~ Purge (TV) 20 L ~~gals~~
(VW x NC = TC)

Fe^2 (mg/L): 1.1

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
846	Begin	purge								
847	21.6	8.02	6.76	137	-35	4.26	49.63	1.0	0.4	
852	22.3	8.58	6.66	-3.6	-46	2.11	49.63	3.0	0.4	
857	22.6	8.68	6.65	-10.0	-51	1.73	49.64	5.0	0.4	
900	23.3	8.65	6.65	-10.0	-56	1.54	49.63	7.0	0.4	
903	23.7	8.60	6.65	-5.3	-60	1.43	49.63	9.0	0.4	
906	23.9	8.50	6.66	7.3	-66	1.35	49.64	11.0	0.4	
909	23.9	8.50	6.66	14.5	-67	1.33	49.63	13.0	0.4	
912	24.0	8.44	6.66	9.2	-70	1.29	49.63	15.0	0.4	
915	24.0	8.40	6.66	9.9	-74	1.26	49.63	17.0	0.4	

INSTRUCTIONS AND COMMENTS
Purging/Sampling Remarks Pump set @ 65' bgs.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: EW-1

Monitor Well Sampling Data

Project: Cooper Drum

Location No: EW-1

Sample No(s): 36010, 41DC9

Sampling Date: 7-20-04

Sampling Method: _____

Sampling Time: 800

Job No: 18600047.07030

Sampler(s): MT RM

Reviewer(s): _____ Date: _____

Weather: Sunny, hot

Ambient Temp. (F): 75° - 80°

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

Product Obs: Y (N)

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

1) Well Casing Elevation (WCE) _____
(from casing top as marked)

2) Depth to Water Surface (DTW) 49.13
(from casing top as marked)

3) Well Depth (WD) 90.5
(from casing top as marked)

4) Height of Water Column (H) 41.37
(from casing top as marked)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
(6)	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos submersible

Single Casing Volume of Water in Well (VW) 60.81 gals
(CV x H = VW)

Purge Date: 7-20-04

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purged (TV) 33 L ~~gals~~
(VW x NC = TC)

Fe^2 (mg/L): 1.9

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
720	Begin Purge									
721	21.5	4.24	6.66	113.0	-63	2.18	49.21	2.0	1.0	
726	22.1	4.24	6.88	-10.0	-76	1.82	49.21	7.0	1.0	
731	22.8	4.24	6.99	-10.0	-86	1.59	49.21	12.0	1.0	
736	22.9	4.24	7.03	-10.0	-94	1.51	49.21	17.0	1.0	
741	22.9	4.24	7.05	-10.0	-103	1.49	49.21	22.0	1.0	
746	22.9	4.24	7.06	-10.0	-110	1.50	49.21	27.0	1.0	
749	22.9	4.24	7.06	-10.0	-112	1.51	49.21	30.0	1.0	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks: Pump set @ 65' bgs. Turbidity reading on Horiba not functioning properly.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: EW-2

Monitor Well Sampling Data

Project: Cooper Drum
Location No: EW-2
Sample No(s): 36012, 36013, 41DD0, 41DD1
Sampling Date: 7-20-04
Sampling Method:
Sampling Time: 1110, 1120

Job No: 18600047.07030
Sampler(s): MA RM
Reviewer(s): Date:
Weather: Sunny, hot
Ambient Temp. (F): 85-90

WATER ELEVATION DATA
Method of Measurement: Depth Sounder (Y) N
Other:

Product Obs: Y (N)
Depth to Product:
Method of Measurement: Interface Probe Y N
Other:

1) Well Casing Elevation (WCE)
(from casing top as marked)
2) Depth to Water Surface (DTW) 49.45
(from casing top as marked)
3) Well Depth (WD) 87
(from casing top as marked)
4) Height of Water Column (H) 37.55
(from casing top as marked)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
(6)	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DAT

Purge Method: 2" Grundfos Submersible

Single Casing Volume of Water in Well (VW) 55.20 gals
(CV x H = VW)
Number of Casing Volumes to Purge (NC) gals

Purge Date: 7-20-04

Was Well Pumped Dry? Y (N)

Total Volume of Water ~~to~~ Purged (TV) 24 L ~~gals~~
(VW x NC = TC)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1005	Begin	purge								
1006	24.6	6.57	7.27	-10.0	-213	5.42	49.53	1.0	0.5	clear, strong od
1011	24.7	6.72	7.17	-10.0	-217	3.93	49.53	~~6.0~~ 3.5	0.5	
1016	24.8	6.78	7.14	-10.0	-221	3.45	49.53	6.0	0.5	
1021	24.9	6.76	7.14	-10.0	-227	3.09	49.53	8.5	0.5	
1026	24.7	6.78	7.14	-10.0	-228	2.84	49.53	11.0	0.5	
1031	24.4	6.82	7.14	-10.0	-234	2.90	49.53	13.5	0.5	
1036	24.5	6.85	7.13	-10.0	-247	2.73	49.53	16.0	0.5	
1041	24.3	6.87	7.13	-10.0	-250	2.09	49.53	18.5	0.5	
1044	24.1	6.89	7.12	-10.0	-254	2.02	49.53	20.0	0.5	
1047	24.1	6.92	7.13	-10.0	-254	1.90	49.53	21.5	0.5	
~~1050~~	~~22.5~~	~~6.88~~	~~7.13~~	~~-10.0~~		~~1.50~~	~~MA 7-20-04~~			

INSTRUCTIONS AND COMMENTS
Purging/Sampling Remarks: Pump set @ 65' bgs. Turbidity reading on Horiba not functioning properly.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be recorded at each well casing volume. In the observations field, not which reading applies to the values recorded at sampling

MONITOR WELL NO: MW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Sample No(s): 36500, YIH05

Sampling Date: 11/2/04

Sampling Method: Direct from dedicated tubing

Sampling Time: 920

Job No: 18600047.03020

Sampler(s): MA/RM/DG

Reviewer(s): Date:

Weather:

Ambient Temp. (F):

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other:

Screened interval: 50 - 82

1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW ft
(from casing top as marked)

3) Well Depth (WD): 82
(from casing top as marked)

4) Height of Water Column (H) ft
(from casing top as marked)

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) gals
(CV x H = VW)

Purge Date: 11/2/04

Number of Casing Volumes to Purge (NC) gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) gals
(VW x NC = TC)

Fe^2 (mg/L): 2.0

	Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
	834	Begin	purge						0.5	0.7	
	836	20.66	11.4	6.82	-10	-318	4.38		1.9	0.7	
	841	21.45	11.3	6.74	-10	-320	2.98		5.4	0.7	
	846	22.71	11.3	6.74	-10	-324	2.16		8.9	0.7	
	851	22.96	11.4	6.74	-10	-329	1.91		12.4	0.7	
*	858	22.52	11.4	6.93	-10	-298	3.28		15.0	0.7	
	901	22.55	11.3	6.81	-10	-322	2.73	49.69	17.1	0.7	
	904	23.27	11.3	6.78	>1000	-329	2.20	49.69	19.2	0.7	
	907	23.32	11.3	6.77	—	-332	2.10	49.69	21.3	0.7	
	910	23.33	11.2	6.76	-10	-333	2.35	49.69	23.4	0.7	
	913	23.26	11.2	6.76	-10	-335	2.48	49.69	25.1	0.7	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs. Pump accidentally stopped @ 855; resume pumping @ 857

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: MW-5

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Sample No(s): 36501, 41H06

Sampling Date: 11/1/04

Sampling Method: Direct from dedicated tubing

Sampling Time: 1145

Job No: 18600047.03020

Sampler(s): MA/RM/DG

Reviewer(s): Date:

Weather:

Ambient Temp. (F):

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other:

Screened interval: 30 - 75

1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 36.49 ft
(from casing top as marked)

3) Well Depth (WD): 75
(from casing top as marked)

4) Height of Water Column (H) 38.51 ft
(from casing top as marked)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) 25.03 gals
(CV x H = VW)

Purge Date: 11/1/04

Number of Casing Volumes to Purge (NC) gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) gals
(VW x NC = TC)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1100	Begin	purge						1.5	1.0	
1103	20.92	3.29	7.36	348	-83	5.49	37.48	4.5	1.0	
1108	21.32	3.28	7.27	289	-46	3.57	37.92	9.5	1.0	
1113	21.70	3.28	7.26	256	-24	3.11	38.23	14.5	1.0	
1118	21.77	3.28	7.26	241	-11	2.96	38.25	17.0	0.5	
1121	21.79	3.28	7.26	235	-5	2.89	38.27	18.5	0.5	
1124	21.94	3.28	7.26	230	-1	2.84	38.30	20.0	0.5	
1127	22.0	3.28	7.26	224	3	2.82	38.31	21.5	0.5	
1130	22.04	3.28	7.26	218	6	2.80	38.33	23.0	0.5	
1133	22.12	3.28	7.26	215	8	2.78	38.35	24.5	0.5	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: MW-20

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Job No: 18600047.03020

Sample No(s): 36502, YIH07

Sampler(s): MA/RM/DG

Sampling Date: 11/1/04

Reviewer(s): Date:

Sampling Method: Direct from dedicated tubing

Weather:

Sampling Time: 845

Ambient Temp. (F):

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other:

Screened interval: 55 - 70

1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW 49.20 ft
(from casing top as marked)

3) Well Depth (WD): 75
(from casing top as marked)

4) Height of Water Column (H) 25.8 ft
(from casing top as marked)

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) 16.77 gals
(CV x H = VW)

Purge Date: 11/1/04

Number of Casing Volumes to Purge (NC) gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) gals
(VW x NC = TC)

Fe^2 (mg/L): 1.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
751	Begin	purge						2.0	0.8	
755	21.94	6.04	6.57	18.8	-124	3.21	49.76	5.2	0.8	
800	22.78	6.08	6.74	18.8	-132	2.47	49.79	9.2	0.8	
805	22.73	6.12	6.80	35.3	-134	2.19	48.0	13.2	0.8	
810	22.64	6.16	6.82	64.5	-134	2.03	49.80	18.2	1.0	
813	22.94	6.16	6.83	80.9	-134	1.96	49.80	21.2	1.0	
816	23.09	6.17	6.84	90.6	-134	1.91	49.80	24.2	1.0	
819	23.12	6.18	6.84	98.5	-134	1.87	49.80	27.2	1.0	
822	23.14	6.18	6.84	110.0	-134	1.85	49.80	30.2	1.0	
825	23.20	6.19	6.85	122	-134	1.84	49.80	33.2	1.0	
828	23.17	6.19	6.85	133	-133	1.84	49.80	36.2	1.0	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be re

MONITOR WELL NO: MW-21

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Sample No(s): 36503, 41H08

Sampling Date: 11/1/04

Sampling Method: Direct from dedicated tubing

Sampling Time: 1045

Job No: 18600047.03020

Sampler(s): MA/RM/DG

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

Screened interval: 55 - 75

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 50.35 ft
(from casing top as marked)

3) Well Depth (WD): 75
(from casing top as marked)

4) Height of Water Column (H) 24.65 ft
(from casing top as marked)

Product Obs: Y (N)

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) 16.02 gals
(CV x H = VW)

Purge Date: 11/1/04

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 1.2

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1005	Begin	purge							0.5	
1007	21.58	8.76	6.91	181.0	-117	4.39	50.41	1.0 est	0.5	
1012	21.96	9.22	6.84	176.0	-120	3.03	50.40	3.5	0.5	
1017	22.88	9.18	6.82	162.0	-124	2.44	50.41	6.0	0.5	
1022	22.87	9.02	6.83	170.0	-126	2.22	50.41	8.5	0.5	
1027	23.01	8.99	6.83	183	-128	2.11	50.40	11.0	0.5	
1030	23.05	8.98	6.83	187	-128	2.08	50.41	13.5	0.5	
1033	23.07	8.97	6.83	193	-129	2.04	50.40	16.0	0.5	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be re

MONITOR WELL NO: EW-1

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Sample No(s): 36504, YIH09

Sampling Date: 11/1/04

Sampling Method: Direct from dedicated tubing

Sampling Time: 1000

Job No: 18600047.03020

Sampler(s): MA/RM/DG

Reviewer(s): Date:

Weather:

Ambient Temp. (F):

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other:

Screened interval: 48.5 - 88.5

1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 49.95 ft
(from casing top as marked)

3) Well Depth (WD): 90.5
(from casing top as marked)

4) Height of Water Column (H) 40.55 ft
(from casing top as marked)

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
(6)	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Single Casing Volume of Water in Well (VW) 59.61 gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) gals

Total Volume of Water to Purge (TV) gals
(VW x NC = TC)

Purge Method: 2" Grundfos submersible pump

Purge Date: 11/1/04

Was Well Pumped Dry? Y (N)

Fe^2 (mg/L): 2.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
905	Begin purge							1.0	0.8	
910	22.35	4.85	6.94	76.2	-170	3.09	50.02	5.0	0.8	
915	22.83	4.84	6.93	44.2	-173	2.44	50.02	9.0	0.8	
920	22.89	4.85	6.93	34.9	-174	2.17	50.03	13.0	0.8	
925	22.85	4.85	6.93	32.6	-174	2.02	50.03	17.0	0.8	
928	22.83	4.85	6.94	31.5	-175	1.96	50.03	19.4	0.8	
931	22.72	4.85	6.94	32.7	-175	1.86	50.02	21.8	0.8	
934	22.75	4.85	6.94	32.5	-175	1.86	50.03	24.2	0.8	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be re

MONITOR WELL NO: EW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Sample No(s): 36505/36506, YIH10/YIH11

Sampling Date: 11/2/04

Sampling Method: Direct from dedicated tubing

Sampling Time: 810, 820

Job No: 18600047.03020

Sampler(s): MA/RM/DG

Reviewer(s): Date:

Weather:

Ambient Temp. (F):

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other:

Screened interval: 38.5 - 78.5

1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 50.21 ft
(from casing top as marked)

3) Well Depth (WD): 87
(from casing top as marked)

4) Height of Water Column (H) 28.29 ft
(from casing top as marked)

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
(6)	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Single Casing Volume of Water in Well (VW) 41.59 gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) gals

Total Volume of Water to Purge (TV) gals
(VW x NC = TC)

Purge Method: 2" Grundfos submersible pump

Purge Date: 11/2/04

Was Well Pumped Dry? Y (N)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
724	Begin	purge						1.0	0.9	strong odor
728	20.21	6.80	6.60	10.2	-359	2.21	50.60	4.6	0.9	
733	21.52	7.08	6.69	-7.8	-391	1.63	50.58	9.1	0.9	
738	21.79	7.11	6.72	-10	-398	1.40	50.59	13.6	0.9	
743	22.04	7.15	6.74	-10	-401	1.25	50.58	18.1	0.9	
748	22.14	7.19	6.74	-10	-403	1.15	50.59	22.6	0.9	
753	22.16	7.19	6.75	-10	-404	1.09	50.59	27.1	0.9	
756	22.04	7.22	6.75	-10	-405	1.06	50.59	31.6	0.9	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: MW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Job No: 18600047.07030

Sample No(s): 37000 (Y1X55)

Sampler(s): MA/RM/DG

Sampling Date: 4-19-05

Reviewer(s): Date:

Sampling Method: Direct from dedicated tubing

Weather: Sunny, mild

Sampling Time: 1150

Ambient Temp. (F): 70°

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other:

Screened interval: 50 - 82

1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 50.31 ft
(from casing top as marked)

3) Well Depth (WD): 82
(from casing top as marked)

4) Height of Water Column (H) 31.69 ft
(from casing top as marked)

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) 20.60 gals
(CV x H = VW)

Purge Date: 4-19-05

Number of Casing Volumes to Purge (NC) NA - low flow gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) NA - low flow gals
(VW x NC = TC)

Fe^2 (mg/L): 1.8

Time	Temp (C)	S/m Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1053	Begin purge								0.6	
1054	20.6	~~7.1~~ 1.1	7.1	-10.0	-120	7.21	50.80	2.0	0.6	
1059	21.1	~~7.1~~ 1.1	7.1	-10.0	-121	6.37	50.70	5.0	0.6	
1104	21.6	1.1	7.1	-10.0	-124	3.25	50.72	8.0	0.6	
1109	22.0	1.1	7.1	-10.0	-128	3.98	50.74	11.0	0.6	
1114	22.1	1.1	7.1	-10.0	-130	3.81	50.73	14.0	0.6	
1119	22.1	1.1	7.1	-10.0	-132	3.66	50.73	17.0	0.6	
1124	22.1	1.1	7.1	-10.0	-133	3.44	50.73	20.0	0.6	
1129	22.1	1.1	7.1	-10.0	-134	0.54	50.72	23.0	0.6	
1134	22.2	1.1	7.1	-10.0	-136	0.36	50.72	26.0	0.6	
1139	22.2	1.1	7.1	-10.0	-137	0.99	50.72	29.0	0.6	
1142	22.2	1.1	7.1	-10.0	-138	0.98	50.73	30.8	0.6	
1145	22.3	1.1	7.1	-10.0	-141	1.47	50.73	32.4	0.6	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks: Pump set @ 65' bgs. Low flow purge/sampling method.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

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MONITOR WELL NO: MW-5

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Job No: 18600047.07030

Sample No(s): 37001 (Y1X56)

Sampler(s): MA/RM/DG

Sampling Date: 4-20-05

Reviewer(s): Date:

Sampling Method: Direct from dedicated tubing

Weather: Sunny, mild

Sampling Time: 1110

Ambient Temp. (F): 70.

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other:

Screened interval: 30 - 75

1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW 36.72 ft
(from casing top as marked)

3) Well Depth (WD): 75
(from casing top as marked)

4) Height of Water Column (H) 38.28 ft
(from casing top as marked)

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) 24.88 gals
(CV x H = VW)

Purge Date: 4-20-05

Number of Casing Volumes to Purge (NC) NA - low flow gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) NA - low flow gals
(VW x NC = TC)

Fe^2 (mg/L): 0

Time	Temp (C)	S/m Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1019	Begin	purge							0.7	
1022	20.1	0.37	7.5	-10.0	31	4.15	37.99	6.0	0.7	
1027	20.2	0.33	7.5	-10.0	47	1.77	38.11	9.5	0.7	
1032	20.8	0.33	7.5	-10.0	55	1.56	38.25	13.0	0.7	
1037	21.0	0.33	7.5	-10.0	65	2.07	38.31	16.5	0.7	
1042	21.1	0.33	7.5	-10.0	73	1.87	38.31	20.0	0.7	
1047	21.0	0.33	7.5	-10.0	77	1.65	38.31	23.5	0.7	
1050	21.0	0.33	7.5	-10.0	80	2.09	38.32	25.6	0.7	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 60' bgs. Horiba not calibrated properly - readings erratic. Low flow samp./purge method.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: MW-20

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Job No: 18600047.07030

Sample No(s): 37002 (Y1X57)

Sampler(s): MA/RM/DG

Sampling Date: 4-19-05

Reviewer(s): Date:

Sampling Method: Direct from dedicated tubing

Weather: Sunny, mild

Sampling Time: 1010

Ambient Temp. (F): 70°

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other:

Screened interval: 55 - 70

1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 48.73 ft
(from casing top as marked)

3) Well Depth (WD): 75
(from casing top as marked)

4) Height of Water Column (H) 26.27 ft
(from casing top as marked)

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) 17.08 gals
(CV x H = VW)

Purge Date: 4-19-05

Number of Casing Volumes to Purge (NC) NA - low flow gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) NA - low flow gals
(VW x NC = TC)

Fe^2 (mg/L): 1.0

Time	Temp (C)	Cond S/m ~~(umhos)~~	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
927	Begin purge									
931	21.1	0.62	7.1	3.3	-46	0.81	48.63	7.0	1.0	clear
936	22.0	0.63	7.1	-3.5	-44	0.48	48.62	12.0	1.0	clear
941	22.4	0.63	7.1	-10.0	-45	0.38	48.92	17.0	1.0	clear
946	22.4	0.63	7.1	-10.0	-46	0.32	48.95	22.0	1.0	clear
951	22.5	0.63	7.1	-10.0	-48	0.30	48.95	27.0	1.0	clear
956	22.4	0.64	7.1	-10.0	-49	0.29	48.95	32.0	1.0	clear

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks: Pump set @ 65' bgs. Low flow purge/sampling method.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: ~~EW-1~~ MW-21

Monitor Well Sampling Data

Project: Cooper Drum

Location No: 3 8

Sample No(s): 37006 (Y1X59)

Sampling Date: 4-20-05

Sampling Method: Direct from dedicated tubing

Sampling Time: 945

Job No: 18600047.07030

Sampler(s): MA/RM/DG

Reviewer(s): _____ Date: _____

Weather: Sunny, mild

Ambient Temp. (F): 70°

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

Screened interval: 55-75 ~~48.5-88.5~~

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW 49.67 ft
(from casing top as marked)

3) Well Depth (WD): ~~90.5~~ 75
(from casing top as marked)

4) Height of Water Column (H) 25.33 ft
(from casing top as marked)

Product Obs: Y (N)

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Single Casing Volume of Water in Well (VW) 16.46 gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) NA - low flow gals

Total Volume of Water to Purge (TV) NA - low flow gals
(VW x NC = TC)

Purge Method: 2" Grundfos submersible pump

Purge Date: 4-20-05

Was Well Pumped Dry? Y (N)

Fe^2 (mg/L): 1.5

Time	Temp (C)	S/m Cond (~~umhos~~)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
855	Begin	purge						1.0	1.0	
856	19.7	0.90	7.1	22.2	-79	8.51	49.72	2.0	1.0	
901	21.2	0.91	7.1	5.5	-94	7.05	49.71	7.0	1.0	
906	21.7	0.89	7.0	6.8	-101	6.32	49.74	12.0	1.0	
911	21.3	0.86	7.1	15.9	-113	5.38	49.77	17.0	1.0	
916	21.2	0.84	7.1	19.4	-118	2.98	49.77	22.0	1.0	
921	21.2	0.81	7.1	24.7	-124	1.36	49.77	27.0	1.0	
926	21.2	0.80	7.1	10.7	-130	0.12	49.77	32.0	1.0	
931	21.2	0.79	7.1	14.5	-132	0.06	49.77	37.0	1.0	
934	21.2	0.78	7.1	26.5	-133	0.05	49.77	40.0	1.0	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks: Pump set @ 65' bgs. Low flow purge/sampling method.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: ~~MW-2T~~ EW-1

Monitor Well Sampling Data

Project: Cooper Drum

Location No: 4 9

Sample No(s): 37003 (Y1X58)

Sampling Date: 4-20-05

Sampling Method: Direct from dedicated tubing

Sampling Time: 1240

Job No: 18600047.07030

Sampler(s): MA/RM/DG

Reviewer(s): _____ Date: _____

Weather: Sunny, mild

Ambient Temp. (F): 70

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

Screened interval: 48.5 - 88.5 ~~55 - 75~~

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 49.32 ft
(from casing top as marked)

3) Well Depth (WD): 90.5 ~~75~~
(from casing top as marked)

4) Height of Water Column (H) 41.18 ft
(from casing top as marked)

Product Obs: Y (N)

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
(6)	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) 31.77 gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) NA - low flow gals

Total Volume of Water to Purge (TV) NA - low flow gals
(VW x NC = TC)

Purge Date: 4-20-05

Was Well Pumped Dry? Y (N)

Fe^2 (mg/L): 2.2

Time	Temp (C)	S/m Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1142	Begin	purge						1.0	0.5	
1145	23.0	0.49	7.2	-10	-113	1.61	49.30	2.5	0.5	
1150	22.0	0.49	7.2	-10	-101	0.71	49.32	5.0	0.5	
1155	22.4	0.49	7.2	-10	-99	0.42	49.32	7.5	0.5	
1200	22.9	0.48	7.2	-10	-100	0.34	49.32	10.0	0.5	
1205	23.1	0.49	7.2	-10	-101	0.29	49.32	12.5	0.5	
1210	23.2	0.48	7.2	-10	-100	0.26	49.32	15.0	0.5	
1215	22.2	0.48	7.2	-10	-115	0.21	49.33	22.5	1.5	
1220	21.8	0.48	7.2	-10	-125	0.07	49.33	30.0	1.5	
1225	21.6	0.48	7.2	-10	-130	0.00	49.33	37.5	1.5	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks: Pump set @ 65' bgs. Low flow sampling/purging method.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: EW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No:

Sample No(s): 37005/37006 (Y1X60/Y1X61)

Sampling Date: 4-19-05

Sampling Method: Direct from dedicated tubing

Sampling Time: 1320 1330

Job No: 18600047.07030

Sampler(s): MA/RM/DG

Reviewer(s): Date:

Weather: Sunny, mild

Ambient Temp. (F): 70'

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other:

Screened interval: 38.5 - 78.5

1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 49.27 ft
(from casing top as marked)

3) Well Depth (WD): 87
(from casing top as marked)

4) Height of Water Column (H) 37.73 ft
(from casing top as marked)

Product Obs: Y (N)

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
(6) D	1.468

$CV = (23.49) \times [(D/24)^2]$

$CV = 3.14 [(D/2)/12 \text{ in.ft}]^2 h$ (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) 56.60 gals
(CV x H = VW)

Purge Date: 4-19-05

Number of Casing Volumes to Purge (NC) NA - low flow gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) NA - low flow gals
(VW x NC = TC)

Fe^2 (mg/L): 0.0

Time	Temp (C)	S/m Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1223	Begin	purge							0.8	
1224	21.2	0.67	7.1	-10.0	-230	6.76	49.54	1.0	0.8	
1229	21.9	0.70	7.0	-10.0	-287	5.63	49.54	5.0	0.8	
1234	22.2	0.70	7.0	-10.0	-295	5.69	49.57	9.0	0.8	
1239	22.2	0.71	7.0	-10.0	-302	0.90	49.55	13.0	0.8	
1244	22.4	0.71	7.1	-10.0	-312	0.44	49.55	17.0	0.8	
1249	22.5	0.71	7.1	-10.0	-317	3.23	49.56	21.0	0.8	
1254	22.5	0.71	7.1	-10.0	-322	3.19	49.55	25.0	0.8	
1259	22.5	0.71	7.1	-10.0	-325	2.85	49.55	29.0	0.8	
1304	22.5	0.71	7.1	-10.0	-326	0.63	49.56	31.4	0.8	
1305	22.5	0.71	7.1	-10.0	-328	0.37	49.55	33.8	0.8	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump set @ 65' bgs. Low flow purge/sampling method.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: MW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No: MW-2

Sample No(s): 37566

Sampling Date: 11/29/05

Sampling Method: Direct from dedicated tubing

Sampling Time: _____

Job No: 18500147.07030

Sampler(s): SL/DG

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder Y N

Other: _____

Screened interval: 50-82 ft

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW 49.67 ft
(from casing top as marked)

3) Well Depth (WD): _____
(from casing top as marked)

4) Height of Water Column (H) _____ ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	$CV = (23.49) \times [(D/24)^2]$

$CV = 3.14 [(D/2)/12 in.ft]^2 h (7.48 gal/cu. Ft.)$

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: _____

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 2.4

Time	Temp (C)	Cond uS/cm (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1240	Start Purge								.8	
1243	20.52	10843	7.32	8	-278.2	0.58	50.07	2.4	.8	
1246	21.10	10927	7.31	5	-300.6	0.58	49.94	4.8	.8	
1249	21.63	11080	7.30	5	-325.4	0.36	49.95	7.2	.8	
1252	21.78	11129	7.30	5	-348.9	0.31	49.95	9.6	.8	
1255	21.90	11149	7.30	5	-357.2	0.31	49.95	12.0	.8	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks _____ Pump @ 65 ft

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was con
and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: ____MW-5___

Monitor Well Sampling Data

Project: **Cooper Drum**

Location No: MW-5 | Job No: 18500147.07030

Sample No(s): 375617 | Sampler(s): **SL/DG**

Sampling Date: 11/29/05 | Reviewer(s): _____ Date: _____

Sampling Method: **Direct from dedicated tubing** | Weather: _____

Sampling Time: _____ | Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder Y N

Other: _____

Screened interval: 30-75 ft

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW 35.84 ft
(from casing top as marked)

3) Well Depth (WD): _____
(from casing top as marked)

4) Height of Water Column (H) _____ ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: **2" Grundfos submersible pump**

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: _____

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond. mS/cm (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1459	Start Purge								.8	
1502	20.36	3338	7.62	120	-316.1	1.05	36.36	2.4	.8	
1505	20.36	3335	7.62	70	-328.1	1.12	36.35	4.8	.8	
1508	20.79	3368	7.60	29	-336.7	0.98	36.36	7.2	.8	
1511	20.98	3383	7.60	20	-339.0	0.92	36.36	9.6	.8	
1514	21.12	3389	7.60	18	-333.2	1.00	36.35	12.0	.8	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks _____ Pump @ 60 ft _____

ote: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be re

MONITOR WELL NO: MW-20

Monitor Well Sampling Data

Project: Cooper Drum

Location No: _____

Sample No(s): 37556

Sampling Date: 11/29/05

Sampling Method: Direct from dedicated tubing

Sampling Time: _____

Job No: 18500147.07030

Sampler(s): SL/DG

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder Y N

Other: _____

Screened interval: 55 - 70

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW 48.02 ft
(from casing top as marked)

3) Well Depth (WD): 70
(from casing top as marked)

4) Height of Water Column (H) _____ ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: _____

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond uS/cm (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
0724	Start purge								708.8	
0727	20.52	5245	7.37	240	175.9	2.03	48.05	x24	.8	
0730	21.19	5313	7.38	210	158.7	1.88	48.05	x48	.8	
0733	21.34	5406	7.39	177	130.2	1.82	48.06	x72	.8	
0736	22.19	5452	7.40	163	100.1	1.78	48.06	x96	.8	
0739	22.32	5490	7.41	165	68.2	1.72	48.06	120	.8	
0742	22.35	5495	7.42	144	48.7	1.70	48.06	144	.8	
0745	22.39	5498	7.42	116	32.2	1.68	48.01	168	.8	
0748	22.41	5496	7.42	117	18.4	1.62	48.01	192	.8	
0751	22.48	5500	7.43	87	18.8	1.60	48.01	216	.8	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump @ 63 ft.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was compl and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: MW-21

Monitor Well Sampling Data

Project: Cooper Drum

Location No: MW-21

Sample No(s): 37568

Sampling Date: 11/29/05

Sampling Method: Direct from dedicated tubing

Sampling Time: _____

Job No: 18500147.07030

Sampler(s): SL/DG

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder Y N

Other: _____

Screened interval: 55-75 ft

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW 48.79 ft
(from casing top as marked)

3) Well Depth (WD): _____
(from casing top as marked)

4) Height of Water Column (H) _____ ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: _____

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 2.0

Time	Temp (C)	Cond µS/cm (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1417	Start pump								.8	
1420	20.57	5731	7.45	39	-311.2	0.94	48.80	2.4	.8	
1423	20.98	5517	7.44	30	-336.1	0.80	48.80	4.8	.8	
1426	21.75	5545	7.44	27	-348.1	0.65	48.80	7.2	.8	
1429	21.79	5520	7.44	26	-357.9	0.58	48.80	9.6	.8	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks _____ Pump @ 65 ft

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was comp and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: EW-1

Monitor Well Sampling Data

Project: Cooper Drum

Location No: _____

Sample No(s): 37560

Sampling Date: 11/29/05

Sampling Method: Direct from dedicated tubing

Sampling Time: _____

Job No: 18500147.07030

Sampler(s): SL/DG

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder Y N

Other: _____

Screened interval: 48.5 - 88.5

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW 48.65 ft
(from casing top as marked)

3) Well Depth (WD): 90.5
(from casing top as marked)

4) Height of Water Column (H) _____ ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: _____

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 6.0

Time	Temp (C)	Cond µS/cm (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1155	Start	Purge							.8	
1158	21.26	6490	7.48	15	-244.9	0.76	48.57	2.4	.8	
1201	21.81	6540	7.48	14	-247.1	0.62	48.58	4.8	.8	
1204	22.50	641	7.46	13	-269.1	0.61	48.58	7.2	.8	
1207	22.77	696	7.46	13	-277.8	0.57	48.58	9.6	.8	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump @ 63 ft

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was com and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: EW-2

Monitor Well Sampling Data

Project: Cooper Drum

ation No: EW-2

nple No(s): 37569

Sampling Date: 11/29/05

Sampling Method: Direct from dedicated tubing

Sampling Time: _____

Job No: 18500147.07030

Sampler(s): SL/DG

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder Y N

Other: _____

Screened interval: 38.5-78.5 ft

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW 48.55 ft
(from casing top as marked)

3) Well Depth (WD): _____
(from casing top as marked)

4) Height of Water Column (H) _____ ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) _____ gals

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Purge Date: _____

Was Well Pumped Dry? Y N

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond uS/cm (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1324	Start Purge								.8	
1327	20.42	6286	7.47	5	-341.1	0.49	48.94	2.4	.8	Odor
1330	20.69	6290	7.47	5	-369.1	0.29	48.96	4.8	.8	
1333	21.32	6372	7.47	4	-394.3	0.27	48.96	7.2	.8	
1336	21.60	6411	7.47	4	-404.1	0.25	48.96	9.6	.8	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks _____ Pump @ 65 ft _____

te: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be re

MONITOR WELL NO: MW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No: MW-2

Sample No(s): 37591

Sampling Date: 3/2/06

Sampling Method: Direct from dedicated tubing

Sampling Time: _____

Job No: _____

Sampler(s): SL/DG

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder Y N

Other: _____

Screened interval: 50-82 ft

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW 49.25 ft
(from casing top as marked)

3) Well Depth (WD): _____
(from casing top as marked)

4) Height of Water Column (H) _____ ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: ~~2" Grundfos submersible pump~~ Waterra

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: _____

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 2.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
0750	19.56	10323	7.11	30	-104.0	2.67	49.57	3	1	
0753	19.63	10292	7.11	32	-113.1	2.64	49.57	6	1	
0756	19.70	10273	7.10	33	-117.9	2.96	49.57	9	1	
0759	19.76	10091	7.11	34	-116.3	4.04	49.57	12	1	
0802	19.81	10049	7.11	35	-118.0	4.03	49.57	15	1	
0805	19.80	10006	7.11	32	-120.0	3.94	49.57	18	1	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks _____ Pump at 65 ft

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was com and an estimate of the total volume of water removed. Water measurements should be re

MONITOR WELL NO: MW-20

Monitor Well Sampling Data

Project: Cooper Drum

Location No: MW-20

Sample No(s): 37581

Sampling Date: 3/1/06

Sampling Method: Direct from dedicated tubing

Sampling Time: 0750

Job No: 18500147.07030

Sampler(s): SL/DG

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

Screened interval: 55 - 70

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 46.83 ft
(from casing top as marked)

3) Well Depth (WD): 70
(from casing top as marked)

4) Height of Water Column (H) _____ ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: 3-1-06

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
0753	20.51	4713	7.48	454	229.2	7.02	47.10	3	1	
0756	21.36	4769	7.49	376	208.5	5.95	47.11	6	1	
0759	21.78	4809	7.47	276	193.1	4.56	47.13	9	1	
0802	21.86	4821	7.46	217	182.5	4.20	47.17	12	1	
0805	21.99	4820	7.45	157	174.6	3.96	47.22	15	1	
0808	22.04	4808	7.45	119	170.8	4.01	47.25	18	1	
0811	22.03	4807	7.45	117	169.4	3.83	47.28	21	1	
0814	22.03	4803	7.44	110	167.0	3.66	47.29	24	1	
@ 55'										
0828	21.83	4712	20.89	238	288.7	21.19				
0832	21.96	4725	21.97		395	19.73				

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump @ 63 ft.

O_3 = 0.0 Collected VOC Sample MW-7C @ 55'

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was compl
and an estimate of the total volume of water removed. Water measurements should be re

MONITOR WELL NO: MW-21

Monitor Well Sampling Data

Project: Cooper Drum

Location No: MW-21

Job No:

Sample No(s): 37593

Sampler(s): SL/DG

Sampling Date: 3/2/06

Reviewer(s): Date:

Sampling Method: Direct from dedicated tubing

Weather:

Sampling Time:

Ambient Temp. (F):

WATER ELEVATION DATA

Method of Measurement: Depth Sounder Y N

Other:

Screened interval: 55-75 ft

1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW 48.42 ft
(from casing top as marked)

3) Well Depth (WD):
(from casing top as marked)

4) Height of Water Column (H) ft
(from casing top as marked)

Product Obs: Y N

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft)

WELL PURGE AND SAMPLING DATA

Purge Method: ~~2" Grundfos submersible pump~~ Waterra 1/2 ID tubing

Single Casing Volume of Water in Well (VW) gals
(CV x H = VW)

Purge Date:

Number of Casing Volumes to Purge (NC) gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) gals
(VW x NC = TC)

Fe^2 (mg/L): 1.8

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1040	20.23	8446	7.07	40	-100.8	0.58	48.47	3	1	
1043	20.35	8382	7.05	53	-107.1	0.50	48.46	6	1	
1046	20.36	8332	7.06	40	-116.3	0.51	48.47	9	1	
1049	20.45	8329	7.06	36	-120.3	0.28	4847	12	1	
1052	20.53	8284	7.05	36	-121.0	0.37	48.47	15	1	
1055	20.49	8279	7.05	40		0.36	48.47	18	1	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump at 65 ft

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was complete and an estimate of the total volume of water removed. Water measurements should be re

MONITOR WELL NO: EW-1

Monitor Well Sampling Data

Project: Cooper Drum

EW-1

Sample No(s): 37585

Sampling Date: 3/1/06

Sampling Method: Direct from dedicated tubing

Sampling Time: _____

Job No: 18500147.07030

Sampler(s): SL/DG

Reviewer(s): _____ Date: _____

Weather: _____

Ambient Temp. (F): _____

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

WATER ELEVATION DATA

Method of Measurement: Depth Sounder Y N

Other: _____

Screened interval: 48.5 - 88.5

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW 48.01 ft
(from casing top as marked)

3) Well Depth (WD): 90.5
(from casing top as marked)

4) Height of Water Column (H) _____ ft
(from casing top as marked)

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: _____

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1248	21.85	4497	7.33	16	9.8	5.70	48.19	3	1	
1251	21.73	4508	7.30	12	14.1	5.50	48.20	6	1	
1254	22.01	4509	7.29	11	16.6	5.45	48.20	9	1	
1257	22.44	4512	7.29	11	19.4	5.38	48.20	12	1	
1300	22.43	4513	7.30	11	18.9	5.29	48.20	15	1	
1303	22.41	4514	7.29	11	20.7	5.21	48.20	18	1	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump @ 63 ft

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was comp and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: EW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No: EW-2

Job No:

Sample No(s): 37594

Sampler(s): SL/DG

Sampling Date: 3/2/06

Reviewer(s): Date:

Sampling Method: Direct from dedicated tubing

Weather:

Sampling Time:

Ambient Temp. (F):

WATER ELEVATION DATA

Method of Measurement: Depth Sounder Y N

Other:

Screened interval: 38.5-78.5 ft

1) Well Casing Elevation (WCE) ft
(from casing top as marked)

2) Depth to Water Surface (DTW 48.15 ft
(from casing top as marked)

3) Well Depth (WD):
(from casing top as marked)

4) Height of Water Column (H) ft
(from casing top as marked)

Product Obs: Y N

Depth to Product:

Method of Measurement: Interface Probe Y N

Other:

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: ~~2" Grundfos submersible pump~~ Waterra

Single Casing Volume of Water in Well (VW) gals
(CV x H = VW)

Purge Date:

Number of Casing Volumes to Purge (NC) gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) gals
(VW x NC = TC)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
0903	20.21	5848	7.24	44	-240.2	0.83	48.69	3	3 l	
0906	20.31	5852	7.24	58	-253.2	0.83	48.70	6	6 l	
0909	20.26	5842	7.24	53	-262.1	0.55	48.70	9	l	
0912	20.29	5846	7.24	41	-269.9	0.45	48.70	12	l	
0915	20.30	5842	7.24	40	~~-27.6~~ -274.2	0.45	48.70	15	l	
0918	20.33	5844	7.23	38	-280.3	0.40	48.70	18	l	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump at 65 ft

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be re

MONITOR WELL NO: MW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No: MW-2

Sample No(s): _____

Sampling Date: 8-28-06

Sampling Method: Direct from dedicated tubing

Sampling Time: 1200

Job No: _____

Sampler(s): SL/DG

Reviewer(s): _____ Date: 8-28-06

Weather: Sunny

Ambient Temp. (F): 88°

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

Screened interval: 50-62'

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 48.78 ft
(from casing top as marked)

3) Well Depth (WD): 81.74
(from casing top as marked)

4) Height of Water Column (H) 32.96 ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) _____ gals

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Purge Method: 2" Grundfos submersible pump

Purge Date: 8-28-06

Was Well Pumped Dry? Y (N)

Fe^2 (mg/L): 1.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1111	Start	Purge						tw		
1114	23.62	9049	7.08	17	-138.5	0.47	48.88	0.3	0.1	
1117	22.84	9131	7.09	28	-149.6	0.33	48.88	0.6		
1120	22.37	9108	7.10	20	-148.8	0.46	48.88	0.9		
1123	22.72	9094	7.10	21	-148.4	0.41	48.88	1.2		
1126	22.99	9094	7.10	19	-147.6	0.41	48.88	1.5		
1129	23.05	9092	7.10	18	-145.1	0.42	48.88	1.8		

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks: Sampled @ 65'

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: MW-5

Monitor Well Sampling Data

Project: Cooper Drum

Location No: MW-5

Sample No(s): _____

Sampling Date: 8/29/06

Sampling Method: Direct from dedicated tubing

Sampling Time: 1000

Job No: _____

Sampler(s): SL/DG

Reviewer(s): _____ Date: 8-29-06

Weather: Hazey

Ambient Temp. (F): 80°

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

Screened interval: 30-75

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 35.54 ft
(from casing top as marked)

3) Well Depth (WD): 74.68
(from casing top as marked)

4) Height of Water Column (H) 39.14 ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) _____ gals

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Purge Date: 8-29-06

Was Well Pumped Dry? Y (N)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
0953	Start	Purge						tw		
0956	21.52	3382	7.33	8	-17.1	2.00	35.93	1.8	0.6	
0959	21.97	3380	7.34	7	-9.2	2.08	35.82	3.6		
1002	22.21	3384	7.34	6	-5.9	2.22	35.76	5.4		
1005	22.50	3387	7.34	6	-3.0	2.25	35.71	7.2	↓	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump @ 65'

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: MW-20

Monitor Well Sampling Data

Project: **Cooper Drum**

Location No: MW-20

Sample No(s): _____

Sampling Date: _____

Sampling Method: **Direct from dedicated tubing**

Sampling Time: _____

Job No: _____

Sampler(s): SL/DG

Reviewer(s): _____ Date: _____

Weather: Sunny

Ambient Temp. (F): 85°F

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

Screened interval:

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 47.20 ft
(from casing top as marked)

3) Well Depth (WD): 68.65
(from casing top as marked)

4) Height of Water Column (H) 21.45 ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
(4)	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: **2" Grundfos submersible pump**

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: 8/28/00

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y N

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 0.0 mg/L

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate mL ~~(L/min)~~	Observations Phys. App.
1126	22.95	5308	7.8	249	-267.8	1.29	47.25	3	1000mL	
1129	23.62	5318	7.8	212	-275.2	1.07	47.27	6	"	
1132	24.05	5319	7.8	198	-281.5	0.96	47.24	9	"	
1135	24.24	5326	7.8	198	-286.4	0.91	"	12	"	
1138	24.48	5333	7.7	173	-285.4	1.05	"	15	"	
1141	24.55	5332	7.7	157	-286.2	1.07	"	18	"	
1144	24.69	5338	7.8	145	-292.4	1.02	"	21	"	
1147	24.68	5343	7.8	130	-291.6	1.00	"	24	"	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump Set at 56'?

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL NO: MW-21

Monitor Well Sampling Data

Project: Cooper Drum

Location No: MW-21

Job No: _____

Sample No(s): _____

Sampler(s): SL/DG

Sampling Date: 8/29/06

Reviewer(s): _____ Date: 8-29-06

Sampling Method: Direct from dedicated tubing

Weather: Hazey

Sampling Time: 0915

Ambient Temp. (F): 76°

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

Screened interval: 55-75

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 47.80 ft
(from casing top as marked)

3) Well Depth (WD): 74.79
(from casing top as marked)

4) Height of Water Column (H) 26.99 ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: 8-29-06

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 2.2

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
0855	start	Purge								
0858	21.27	7882	6.96	12	-178.9	0.47	48.11	1.8	0.6	
0901	21.67	7969	6.95	9	-156.4	0.51	48.05	3.6		
0904	22.47	7931	6.93	9	-146.8	0.32	47.98	5.4		
0907	22.59	7886	6.92	10	-142.8	0.26	47.96	7.2		
0910	22.73	7824	6.91	11	-140.0	0.23	47.99	9.0		
0913	22.80	7750	6.90	11	-137.8	0.20	48.04	10.8		
0916	22.81	7699	6.90	11	-136.7	0.20	48.01	12.6		
0919	22.85	7709	6.90	11	-137.0	0.19	48.04	14.4		

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump @ 63', MW-21 DUP (taken @ well) ID. Mw @ 0920

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be re

MONITOR WELL NO: EW-1 63'

Monitor Well Sampling Data

Project: Cooper Drum

Location No: EW-1

Sample No(s): _____

Sampling Date: _____

Sampling Method: Direct from dedicated tubing

Sampling Time: _____

Job No: _____

Sampler(s): SL/DG

Reviewer(s): _____ Date: _____

Weather: Sunny

Ambient Temp. (F): 92°F

WATER ELEVATION DATA

Method of Measurement: Depth Sounder Y N

Other: _____

Screened interval:

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 47.40 ft
(from casing top as marked)

3) Well Depth (WD): 90.15
(from casing top as marked)

4) Height of Water Column (H) 42.75 ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Number of Casing Volumes to Purge (NC) _____ gals

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Purge Method: 2" Grundfos submersible pump

Purge Date: 8/28/06

Was Well Pumped Dry? Y N

Fe^2 (mg/L): 0.0 mg/L

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate ~~(L/min)~~ mL/min	Observations Phys. App.
1547	24.30	4715	8.1	3	-271.4	1.82	47.40	3	1000	
1550	23.52	4659	8.2	2	-284.4	1.59	"	6	"	
1553	23.79	4661	8.2	2	-290.2	1.51	"	9	"	
1556	23.67	4656	8.3	2	-286.1	1.46	"	12	"	
1559	23.50	4657	8.3	2	-286.5	1.45	47.45	15	"	
1602	23.39	4652	8.3	2	-292.7	1.37	47.46	18	"	
1605	23.26	4657	8.3	1	-291.8	1.26	47.48	21	"	
1608	23.16	4656	8.4	1	-292.3	1.18	"	24	"	
1611	23.11	4657	8.4	1	-295.4	1.16	"	27	"	

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks: Pump Set at 63'

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total volume of water removed. Water measurements should be re

MONITOR WELL NO: EW-2

Monitor Well Sampling Data

Project: Cooper Drum

Location No: EW-2

Sample No(s): _____

Sampling Date: 8/28/06

Sampling Method: Direct from dedicated tubing

Sampling Time: 1330

Job No: _____

Sampler(s): SL/DG

Reviewer(s): _____ Date: 8-28-06

Weather: Sunny

Ambient Temp. (F): 90°

WATER ELEVATION DATA

Method of Measurement: Depth Sounder (Y) N

Other: _____

Screened interval: 38.5 to 78.5

1) Well Casing Elevation (WCE) _____ ft
(from casing top as marked)

2) Depth to Water Surface (DTW) 47.56 ft
(from casing top as marked)

3) Well Depth (WD): 82.77
(from casing top as marked)

4) Height of Water Column (H) 35.21 ft
(from casing top as marked)

Product Obs: Y N

Depth to Product: _____

Method of Measurement: Interface Probe Y N

Other: _____

Well Diameter (in)	Casing Volume (CV)/ft (gals)
2	0.163
4	0.652
6	1.468
D	CV = (23.49) x [(D/24)^2]

CV = 3.14 [(D/2)/12 in.ft]^{2}h (7.48 gal/cu. Ft.)

WELL PURGE AND SAMPLING DATA

Purge Method: 2" Grundfos submersible pump

Single Casing Volume of Water in Well (VW) _____ gals
(CV x H = VW)

Purge Date: 8-28-06

Number of Casing Volumes to Purge (NC) _____ gals

Was Well Pumped Dry? Y (N)

Total Volume of Water to Purge (TV) _____ gals
(VW x NC = TC)

Fe^2 (mg/L): 0.0

Time	Temp (C)	Cond (umhos)	pH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1345	Start Purge							tw		
1348	25.01	5289	7.16	3	-259.4	0.22	48.03	105	.035	Odor
1351	26.40	5322	7.15	2	-265.4	0.16	48.04	210		
1354	26.43	5338	7.15	1	-268.0	0.11	48.02	315		
1357	26.62	5321	7.15	1	-271.9	0.10	48.03	420		
1400	26.60	5330	7.15	1	-274.9	0.10	48.03	525	↓	↓

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks Pump @ 65'

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

ATTACHMENT B

Regenesis
Technical Memorandum,
February 2005

REGENESIS

February 3, 2005

MEMORANDUM

To: Don Gruber
URS

From: David Reilly
Regenesis

Re: Cooper Drum Company Facility, South Gate CA
HRC Pilot Test Evaluation Technical Memorandum

Based on our review of the provided groundwater monitoring data we provide the following comments and answers to questions raised in your e-mail communications.

In general, groundwater monitoring data indicate that HRC has enhanced biodegradation rates in groundwater in the vicinity of the pilot test HRC application. This is supported primarily by decreased cis-1,2-DCE concentrations and increased vinyl chloride (VC), ethene, and CO_2 concentrations in samples collected from Monitoring Well EW-2; and increased VC, ethene, and CO_2 concentrations in samples collected from Monitoring Well MW-21. Stable and/or slightly increasing TCE concentrations in samples collected from Wells EW-2 and MW-21, upgradient Well MW-2, and other wells at the site, indicates a continual source of TCE entering the HRC pilot test application area. Without treatment of this upgradient TCE source, concentrations of TCE and its daughter products will never fully diminish in the HRC pilot test area.

What are your thoughts on continued monitoring? Since HRC releases for up to roughly 1.5 years we would recommend continued monitoring until at least June 2005. You could however limit sampling to Monitoring Wells MW-2, EW-2, EW-1, MW-20, and MW-21 (since MW-5 is not screened in same zone as the HRC treatment interval we would recommend no further monitoring from this well). Based on the presence and upward concentration trend of acetic acid (acetic acid is a direct breakdown product of lactic acid released by HRC) in all monitoring wells downgradient of the HRC application (without significant increase in acetic acid in upgradient Well MW-2), we are seeing the indirect presence of HRC in the downgradient monitoring wells. Continued monitoring will allow us to see if this indirect HRC effect results in continued changes in chemicals of concern (COC), or initiation of COC changes in downgradient monitoring wells where changes have not yet been observed. Changes in COCs in downgradient monitoring wells, and thus determination of the downgradient influence of HRC, will be useful in helping determine potential HRC barrier spacing if a full-scale application were ever performed at the site.

Our thoughts on DHC testing: Yes, additional analysis for DHC would be enlightening. However, based on decreases in cis-1,2-DCE and increases in VC, ethene, and CO_2 concentrations in Well EW-2, and an increase in VC, ethene, and CO_2 in Well MW-21, the DHC strain capable of complete reductive dechlorination of TCE is very likely present at the site.

The analytical method used by Sirem to detect DHC (PCR) is the same method that Microbial Insights (MI) uses. It is only the sampling method that differs. You could collect a groundwater sample from EW-2 (as Sirem recommends) and send to either MI or Sirem for DHC analysis. However, DHC exist and grow on soil particles and tend to be present at lower concentrations in groundwater. We recommend sampling using biotraps since they provide a media in a groundwater monitoring well upon which DHC can cling to and multiply. If you

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orc@regenesis.com • www.regenesis.com

perform additional sampling and DHC analysis, you may want to collect a groundwater sample from EW-2 and send that to MI for analysis, and then place a biotrap in the well, leave it in for a month or so, and then send the biotrap to MI for analysis. This will provide a comparison of the two sampling methods.

Our thoughts on Vinyl Chloride production: Reductive dechlorination results in the sequential biotransformation of PCE to TCE. TCE then proceeds to cis-1,2-DCE and VC. Finally, VC proceeds to ethene and CO_2. Reductive dechlorination is a proven remedial strategy for the destruction of PCE, TCE, DCE and VC in groundwater (Wiedemeier, et al. 1998 and ITRC, 1999). HRC increases the rate and efficiency of reductive dechlorination.

At the Cooper Drum site we would expect VC to eventually decrease on its own, without additional HRC application, predicated that there is no continued influx of TCE and cis-1,2-DCE into the treatment area. Increased ethene and CO_2 concentrations over the pilot test period provide evidence that VC is currently degrading, supporting the above assertion that we would expect VC to eventually decrease. Below we provide some common questions regarding VC production with answers and related references.

One question that is often asked is ***"Will vinyl chloride (VC) accumulate in the subsurface?"***

While the above is a valid question, it should be clarified and supplemented with more relevant questions such as:

- Will VC be formed? And if so, at what concentrations will VC be formed and how long will VC persist?
- Since natural attenuation of the TCE in the site groundwater is already underway, creating measurable concentrations of cis-1,2-DCE, and VC, what does this site data say about the potential formation of VC under an enhanced natural attenuation remediation approach?
- When VC is formed, what is its ultimate fate and would it represent an environmental threat that is greater than the existing contaminant impact?
- Does the possible presence of vinyl chloride represent a realistic environmental threat that is greater than the existing contaminant impact?
- Does the transient presence of VC formed during reductive dechlorination justify the significantly higher remediation costs of other remediation technologies that may still not completely eliminate the chlorinated hydrocarbon impact?

We at Regenesis would answer these questions, based on our experience as well as the combined experience of our industry, in the following ways:

- Yes, vinyl chloride is currently being formed at the Cooper Drum site, and will continue to be formed as the TCE and cis-1,2-DCE breakdown, but most likely the VC will remain at relatively low concentrations and will remain only for a limited period of time before it degrades to ethene and CO_2.
- It is widely recognized that vinyl chloride biodegrades under both anaerobic and aerobic conditions. If vinyl chloride is formed and has a slower biodegradation rate in the center of the treatment area, then as it migrates toward the edge of the treatment area and encounters more aerobic conditions, it will then be biodegraded rapidly. HRC has been used on over 500 sites across the U.S. HRC has never been shown to stimulate a significant or permanent buildup of VC.
- At depths of 45 feet or more to groundwater at the Cooper Drum site, an HRC-supported bioremediation, which results in a stable and shrinking contaminant plume that contains vinyl chloride, represents no greater environmental impact than the existing contaminant plume. We believe a health risk assessment would

confirm this opinion even for relatively elevated vinyl chloride levels. Vinyl chloride may have an MCL that is 10x less than TCE, but without a significant exposure scenario, the incremental increase in health risk posed by the formation of vinyl chloride will be negligible.

Published References Regarding The Vinyl Chloride Issue

As stated in the Interstate Technology and Regulatory Cooperation (ITRC) Work Group manual on Natural Attenuation of Chlorinated Solvents,"One of the most common ***misconceptions*** regarding chlorinated solvents and their natural attenuation is that: More toxic intermediates are likely to accumulate (ITRC, 1999)."

In fact, intermediate by products like VC have been shown to be biodegraded under almost all of the potential conditions found in the subsurface because it can undergo *direct biodegradation under both aerobic and anaerobic conditions* (ITRC, 1999).

This comment is supported by Wiedemeier et.al. 1999 in their discussion of relative degradation rates. In this discussion they comment,

"Although many researchers have commented that reductive dechlorination will result in the accumulation of VC... at many field sites VC accumulation is much lower than cis-DCE... This may occur because vinyl chloride in many chlorinated solvent plumes can migrate to zones that can support direct oxidation of VC either aerobically and/or anaerobically."

Besides reductive dechlorination, both DCE and VC are degradable via direct oxidation and anaerobic oxidation. The following references provide detailed discussions that support the above reasoning.

Bradley, P.M. and F.H. Chapelle. 1996. Anaerobic Mineralization of Vinyl Chloride in Fe(III)-Reducing Aquifer Sediments. Environmental Science and Technology. 30:2084-2086.

Bradley, P.M. and F.H. Chapelle. 1998. Microbial Mineralization of VC and DCE Under Different Terminal Electron Accepting Conditions. Anaerobe. 4:81-87.

Cornuet, T.S., C. Sandefur, W.M. Eliason, S.E. Johnson and C. Serna. 2000. Aerobic and Anaerobic Bioremediation of cis-1,2-Dichloroethene and Vinyl Chloride. 2nd International Conference on Remediation of Chlorinated and Recalcitrant Compounds. Battelle. May 22-25, Monterey, California.

Davis, J. and C.L. Carpenter. 1990. Aerobic Biodegradation of Vinyl Chloride in Groundwater Samples. Applied Environmental Microbiology. 56:3878-3880.

Hartmans, S. and J.A.M. DeBont. 1992. Aerobic Vinyl Chloride Metabolism in Mycobacterium aurum L1. Applied Environmental microbiology. 58:1220-1226.

McCarty, P. and L. Semprini. 1994. Groundwater Treatment for Chlorinated Solvents. Handbook of Bioremediation. Chapter 5. Matthews, T.E. ed. Lewis Publishers, Boca Raton, Florida. p. 257.

McCarty, P.L., M.N. Goltz, G.D. Hopkins, M.E. Dolan, J.P. Allan, B.T. Kawakami, and T.J. Carrothers. 1998. Full-Scale Evaluation of In Situ Cometabolic Degradation of Trichloroethylene in Groundwater Through Toluene Injection. Environmental Science and Technology. 32:88-100.

Wiedemeier, T.H., M.A. Swanson, D.E. Montoux, E.K. Gordon, J.T. Wilson, B.H. Wilson, D.H. Kampbell, P.E. Haas, R.N. Miller, J.E. Hansen and F.H. Chapelle. 1998. Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater. US EPA Office of Research and Development, Washington, DC. EPA/600/R-98/128.

Wiedemeier, T.H., H.S. Rifai, C.J. Newell and J.T. Wilson. 1999. Natural Attenuation of Fuels and Chlorinated Solvents in the Subsurface, John Wiley & Sons, New York, 617 pp.

Interstate Technology and Regulatory Cooperation Work Group. 1999. Natural Attenuation of Chlorinated Solvents in Groundwater: Principles and Practices. http://www.itrcweb.org

Would you consider HRC a success on this site based on what you have observed at other sites? Based on our knowledge that there is a continual source of TCE entering the HRC pilot test area, thus making reduction of TCE difficult, plus the high sulfate concentrations at the site, we would consider the HRC pilot test a success. Other sites have had similar results where evidence of enhanced biodegradation is observed during pilot testing (i.e. cis-1,2-DCE decreases and VC and ethene increases), and have gone on to have successful full-scale applications. Were it not for the presence of non-anaerobically degradable 1,4-dioxane, and potentially other non-anaerobically degradable compounds, we feel that a full-scale HRC remedial design could be formulated and effectively implemented at the site, provided the source area of TCE to groundwater is effectively treated.

Has Regenesis learned anything about this high sulfate site? Based on the only slight decrease in sulfate in Well EW-2, with a corresponding increase in sulfide from <0.5 mg/L to 18 mg/L, one would think that sulfide production may potentially inhibit reductive dechlorination by causing sulfide toxicity to reductive dehlorinating bacteria; however, this was not the case at the Cooper Drum site. The iron added with the HRC, along with high natural bioavailable ferric iron, is likely responsible for reducing the production of sulfide and limiting associated sulfide toxicity. In the presence of iron, non-toxic iron sulfide precipitates are produced.

In general, the high sulfate levels at the site don't appear to be inhibiting reductive dechlorination; however, there is no way of knowing how much faster the reductive dechlorination process would be proceeding given the absence of high sulfate conditions. We would expect that if high sulfate concentrations were not present, HRC would have a greater impact on enhancing reductive dechlorination.

1,1-DCA and 1,2-DCA concentrations have been relatively stable. Would you expect these compounds to breakdown later in the process, maybe after another injection event? Typically breakdown of chlorinated ethenes are observed before chlorinated ethanes. Provided the correct microbial consortium for complete breakdown of chlorinated ethanes is present in the subsurface, these compounds would likely start to breakdown following another injection event after the chlorinated ethene mass has been further reduced.

How much HRC material and how long would it take to get to below the MCL of 5 ug/L? There is no easy way to predict when MCLs could be reached in an enhanced bioremediation project. However, a full-scale HRC application would need to cover the *entire* solvent source area/plume core at the site. A thorough HRC application design evaluation based on current site characterization and groundwater monitoring data would be needed to determine how much HRC material would be required for a full-scale application. Also, it is likely that more than one full-scale application (albeit over a smaller area since the first application would shrink the plume core) would be needed. An educated guess is that it may take 4 to 6 years to reach MCLs, or levels acceptable for Risk-Based Closure. Please see my earlier e-mail dated November 15, 2004, and our proposal to Venus Sedeghi dated January 10, 2002, where we proposed a potential full-scale HRC application.