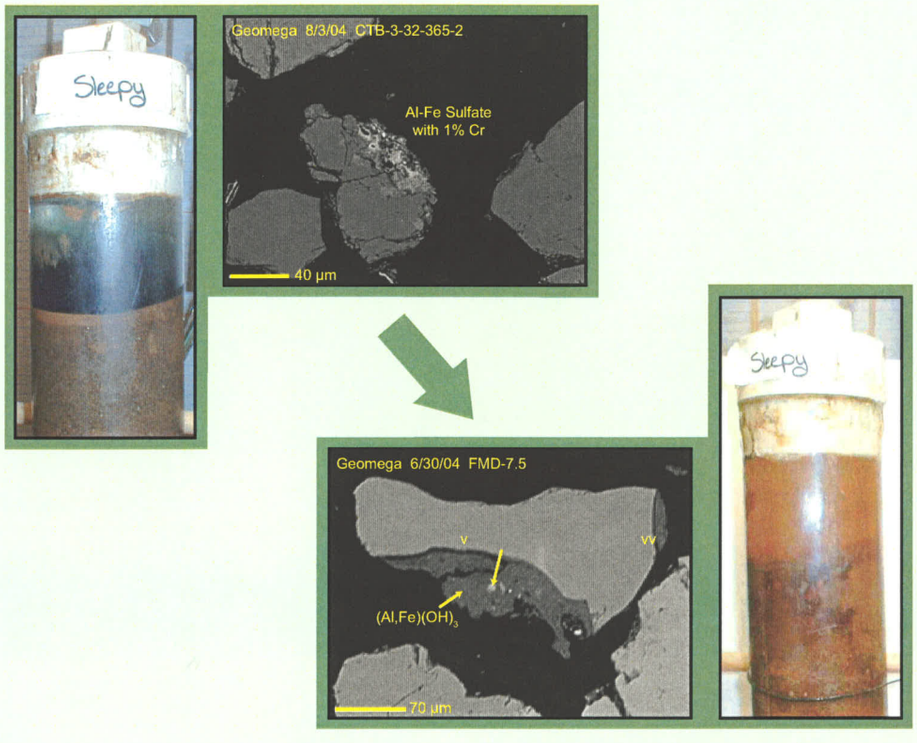
# Olin Wilmington Technical Series

## XXXVII. Conclusion of the Laboratory Column Test Simulating Aquifer Pumping for DAPL Removal




Prepared for:
Olin Corporation
Wilmington, MA Facility
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GEOMEGA

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**Final Report**

# Conclusion of the Laboratory Column Test Simulating Aquifer Pumping for DAPL Removal

December 28, 2004

Prepared for:

**Olin Environmental Management, Inc.**
1186 Lower River Road, NW
Charleston, Tennessee 37310-0248

Prepared by:

**Geomega, Inc**
2995 Baseline Road, Suite 202
Boulder, Colorado 80303

# Executive Summary

## Executive Summary

Two sets of column tests, simulating the hydrogeochemistry of pumping dense aqueous-phase liquid (DAPL) from the Maple Meadow Brook Aquifer at different rates, were undertaken to provide insight into efficacy of pumping DAPL from the aquifer.

These column tests showed that most (>80%) of the estimated aqueous mass of constituents of concern (COC)—specifically, Cl, Cr, $NH_3$, Na, and $SO_4$—can be removed after ~1.5 pore volumes (PV) of groundwater flushing. However, the mass removal becomes less efficient as flushing continues due to ongoing dissolution of acid sulfate precipitates. After 4.7 PV of flushing, one set of column tests was shut down for a period of six weeks to simulate the aquifer response upon cessation of pumping. Subsequent constituent concentrations increased by an average of 55%, indicating that residual solutes in dead-end pore paces and dissolution of precipitates continue to degrade water quality even after apparent attainment of steady state effluent chemistry. During the flushing hiatus, there was extensive visual evidence of sulfide formation and iron reduction in the columns.

During flushing, large volumes of Fe-Cr-Al-$SO_4$ precipitates clogged column plumbing and inhibited flow, necessitating their removal for the column test to continue. Analogously, precipitates may also form in the aquifer setting as acidic DAPL is neutralized, resulting in potential reduction of aquifer porosity and/or flow in the extraction system plumbing.

These tests suggest that significant mass removal during remedial pumping of DAPL from the Maple Meadow Brook Aquifer is possible; however, pumping beyond the first 1.5 PV will probably result in asymptotic mass removal. Further, caution must be taken when interpreting these results, as other column-testing work has shown that column experiments produce less dispersion and faster flushing of COC than field-scale pumping.

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## Text

# 1 Introduction

The removal of dense, aqueous-phase liquid (DAPL) in the Off Property West Ditch Area and concentrated DAPL-like material in the Maple Meadow Brook Aquifer Study Area, via recovery wells is being considered as a possible remedial alternative at the 51 Eames Street Site in Wilmington, Massachusetts. However, experience at other sites with remedial pumping of acidic plumes indicates that such pumping may continue for a long period of time, with gradually decreasing efficacy (e.g., Keely 1989; Travis and Doty 1990). To test the feasibility of remedial pumping of DAPL, and to evaluate the potential efficiency of such pumping, column tests have been performed over the past year on aquifer material collected from the OPWD Study Area. The preliminary results of this study were summarized in Geomega (2004), which also contains detailed discussions of the sample collection, laboratory methods, and experimental data. This document augments the previous report by analyzing all of the accrued data in greater detail and summarizing the final results.

## 1.1 Objectives

The initial column results indicated that a large portion of the estimated solute mass could be removed by pumping (Geomega 2004). However, experience with other acidic groundwater plumes indicates that remediating waters to relatively low numerical standards can take decades or longer (Davis 2003, EPA 1997). Furthermore, the pH of acidic groundwater systems creates conditions that can make the aquifer system recalcitrant to geochemical change, due to mineralogical buffers that require extensive flushing to neutralize (Nicholson et al. 2003, Stollenwerk 1994). Nevertheless, pump-and-treat can remove contaminant mass, aiding in source reduction and hydraulic control, and improving the geochemical environment for natural attenuation (EPA 1996, 1997). The objective of the column tests was to obtain site-specific data that would provide an empirical basis for evaluating and designing a field-scale extraction system at the site with realistic expectations for an end point of pumping.

The specific goals of the experiment were to:

1. Determine key groundwater restoration potential factors (e.g., Figure 1 of EPA 1996), including sorption, and gain insight into potential variations in the flow regime due to changing hydraulic conditions.
2. Evaluate the feasibility of meeting groundwater restoration standards and help define practical remediation goals for the MMBA and the OPWD Study Areas.
3. Provide insight into the timeframe of remedial pumping and, hence, help define realistic remedial expectations.
4. Support decision making relative to the development of, or future refinements to, the remedial pumping system at the site.
5. Provide insight on the interaction of remedial pumping with monitored natural attenuation and other potential remedial alternatives.

## 1.2 Limitations

Direct application of the results of column testing (i.e., assuming one pore volume in the column is equivalent to a pore volume in the field) is overly optimistic due to several factors. These factors include the scale dependence of dispersivity, the greater heterogeneity of field-scale aquifer materials, and the greater overall uncertainty of the extent of the plume in the aquifer system.

Dispersivity, the tendency of solute slugs to diffuse and become less compact, becomes greater in larger systems (McLaughlin and Ruan 2001; Gelhar et al. 1992). This tendency results in column data typically underestimating the duration of remedial flushing of aquifer systems.

All of the aquifer-material cores collected for the columns tended to have a relatively homogeneous lithology. However, the lithology varied greatly between cores. As a result, some of the columns consisted primarily of gravel and cobbles [e.g., column CTB-3 (27-32)], which was not used, because it was simply a collection of >3-cm rocks with no cohesive lithology, while other columns contained mostly fine sands [e.g., column CTB-6 (35-40)]. In column tests, flows in different heterogeneous units have little interaction, while in the field,

flows from these different lithologies will interact, increasing the effects of dispersivity relative to that observed in the laboratory (Huang et al. 1995).

Finally, laboratory systems, by design, are more constrained than field conditions, and the success of extrapolating from the laboratory to field conditions depends in part on the depth and understanding of the field conditions.

Therefore, the actual remedial system will likely be less efficient at mass removal than the column test data indicate, especially at later pore volumes.

# 2 Experimental Methods

For reference purposes, this section presents a brief review of the laboratory procedures used and outlines the methodology of the additional investigative work completed in the study.

## 2.1 Review of Methodology

The design and analytical methods used in this study were described in detail by Geomega (2004).

### 2.1.1 Column Test Design

In summary, the column-test design was based on the anticipated radial pattern of flushing expected from the pumping of an extraction well situated near the low point of a DAPL pool at the base of the aquifer (Figure 1). The column design simulated the pumping of DAPL-saturated material along variable-length flow paths radiating out from the well. The premise was that DAPL saturated soil would first be flushed by entrained diffuse material and then by more dilute overlying groundwater. Aquifer material in the central portion of the pool would be flushed multiple times by material being drawn in from above and from the radial margins of the pool.

The column-test design simulated the dynamic behavior of an actual extraction system and addressed some of the limitations typically associated with column tests; e.g., underestimation of dispersion (Schulin et al. 1987), lack of consideration of the evolution of hydraulic properties during pumping (Blume et al. 2002), and oversimplification of remedial pumping as a one-dimensional system (Logan 1996).

The column tests were constructed from cores of DAPL-saturated aquifer material collected in tact by rotosonic drilling (Geomega 2004). The cores were trimmed and capped in the laboratory to minimize headspace and disturbance, and then re-saturated with DAPL.

To simulate this system, two column test set-ups—the Small Column Complex (SCC) and the Large Column Complex (LCC)—were constructed, each one consisting of three “input” channels and one “output” column (Figures 2 and 3). In the LCC the three input channels consisted of pairs of in-series columns, while in the SCC these were single columns. Influent

was fed through a manifold into the top of each of the four columns. Effluent from the three input columns then entered the output column through side ports near the top of the column, with the entire flow emitting from the bottom of the output column. The net result was that the central column was flushed by approximately 4 pore volumes (PV) of pore water for each PV that passed through the entire apparatus—once by water entering directly into the column and three times by the input-channel effluent water. This design was chosen to create a more realistic estimate of dispersion in these tests and to add some dimensionality to the remedial system. For each complex, an input reservoir fed into the top of each of the three input channels. From the bottom of each channel the water passed into the top of the output column before being collected from the base in a separate (output) reservoir (Figure 3). The influent was allowed to drain constantly from the input reservoir through the columns, so that the entire system of columns within each complex was continuously fed and fully saturated. Each complex was initially saturated with DAPL taken from Port 2 of MP-2, a multi-level piezometer installed at the site. DAPL was replaced in the influent reservoirs with diffuse-layer groundwater (taken from MP-2 Port 9) on 6/27/04 (prior to the start of data collection). The influent reservoirs were switched to overlying groundwater (taken from MP-2 Port 11) for the SCC on 8/9/04 (after 0.9 PV of flushing) and for the LCC on 10/14/04 (after 0.8 PV of flushing).

During the experiment, in-line specific conductivity and manometer readings were taken on a daily basis. Manometer readings and visual inspection of the cores were included to evaluate the hydraulic evolution of the system during pumping. Samples for analytical analysis were initially collected as soon as enough volume was accumulated to conduct the chemical analyses. Thereafter, column effluent was sampled on a biweekly basis. Sampling frequency dropped to a once a week at approximately 3 PV in the LCC and 5.5 PV in the SCC, and to every other week soon thereafter. After the flushing hiatus in the LCC, frequent, high-resolution sampling was resumed.

As the column tests proceeded, maintenance—including minor leak repair[1], pump maintenance, and instrument maintenance—was conducted on a regular basis. The columns were checked daily by Geomega staff during the initial 1.5 pore volumes (including weekends), and at least every other day thereafter. Maintenance was conducted on an as-needed basis. At ~1.5 PV, several columns in both complexes stopped flowing and very large head differences were observed (> 50 cm). These flow problems necessitated the cleaning of inter-column plumbing which was clogged with large amounts of precipitates. The system was shut down for a one-day period for this maintenance.

For reference, each individual column in the complexes was given a nickname (Table 1). The LCC columns were named after each of the Seven Dwarfs from Walt Disney's 1937 adaptation of the story of Snow White (Grimm and Grimm 1812) and the SCC columns were named after each of the Four Musketeers from Richard Lester's 1975 movie based on the novel by Dumas (1844). These nicknames are used throughout the text because "Dopey" is much easier to remember than "CTB-1 (32-37)".

One consideration of this study was that the flow rate through the column apparatus should be as close as possible to actual field conditions. Hence, the flushing rates were controlled and averaged 10 ml/hour, corresponding to a flow velocity of 0.5 cm/day in the input columns and 2 cm/day in the output columns. These rates are slightly higher than the groundwater flow rates that might actually be used in the final remedial extraction system. However, they were considered appropriate given the practicality constraints of completing column tests in a reasonable amount of time (i.e., <1 year).

### 2.1.2 Electron Microprobe Analysis

Prior to flushing, column material solids were analyzed by Electron Microprobe Analysis (EMPA), following the method of Davis et al. (1992). Briefly, the sample was mounted in an epoxy mold, allowed to cure at room temperature, and polished at low speed using kerosene to prevent dissolution of water-soluble phases. The surface of the mold was then cleaned

[1] The columns were checked on a daily basis; therefore, leaks were identified within 24 hours of starting. Each leak had an estimated volume of less than 10 ml. These volumes are small (<1 percent) when compared to the total flow in the system during the test, and can therefore be considered to have minimal effects on the results of the tests.

with isopropyl alcohol and coated with a thin layer of carbon. Metal-bearing particles were identified using a combination of energy dispersion spectrometry (EDS), wavelength dispersion spectrometry (WDS), and backscatter electron image (BEI) detection. Images of sediment particles were obtained using BEI and recorded as photomicrographs. The chemical composition of the sediment was established using EMPA standards, allowing determination of the solid-phase stoichiometry

### 2.1.3 Lithium Tracer

To determine pore volumes and assess the effects of hydrodynamic dispersion, 61.4 mg of lithium chloride (10 mg lithium and 52 mg chloride) was added as a tracer to the initial 2 liters of influent solution at the onset of the column experiment, resulting in a 5 mg/l lithium spike in the influent for each column test. It was assumed that the appearance of lithium in the effluent would signal the initial discharge of added influent (and simultaneously the end of discharge of one pore volume of DAPL).

The maximum concentrations of dissolved lithium measured in samples of the column-test effluent were 3.58 to 3.74 mg/l, and occurred in the first sample at the start of flushing in each test (Figures 4 and 5, Table 2)[2], indicating the presence of lithium in either the DAPL, or the soil matrix, or both. Lithium concentrations steadily decreased as flushing continued until, after several pore volumes, they asymptotically approached stable values of < 0.2 mg/l. In the end, a definitive lithium spike was not apparent in either column test effluent.

## 2.2 Continuation of Experiment

Four additional elements of the experiment have been completed since the Interim Report (Geomega 2004) was released:

1. flushing of columns to additional pore volumes;
2. temporary cessation of flow through the LCC;
3. additional microprobe analysis of column precipitates;

[2] Analytical results for lithium were included in the Interim Report (Geomega 2004, Appendix B), although the test itself was not discussed in that document because the results were only preliminary and still under investigation at that time. At this point, the source of lithium in DAPL is still under investigation.

4. a bromide tracer test.

### 2.2.1 Flushing to Additional Pore Volumes

The columns continued to be flushed to a total of 9.8 PV (SCC) and 6.05 PV (LCC), with the last PV committed to the bromide tracer test.

### 2.2.2 Cessation of Column Flow

To evaluate the effects of a hiatus in pumping, flow through the LCC was shut off for 6 weeks, after 4.7 PV of flushing. The column was not flushing from 2/23/04 to 5/17/04. This cessation was representative of pump breakdown or the completion of pumping.

### 2.2.3 Microprobe Analysis of Column Precipitates

Upon flushing completion, the columns were dismantled and precipitates in the column were analyzed by (EMPA), as described in Section 2.1.2.

### 2.2.4 Bromide tracer

To facilitate the extrapolation of column-test results to actual field conditions, a bromide tracer test was conducted at the end of the experiment (once sulfate concentrations had decreased to non-interfering levels) to more accurately quantify the pore volumes of water that passed through the columns. The test was made with 1000 mg/l influent solution. The bromide tracer was prepared by spiking MP-2 Port 12 water with 30.7 g/L NaBr. The spiked influent water was then introduced into the columns and the effluent was collected daily and monitored for bromide using a bromide-selective, silver-sulfide/silver-bromide electrode (Skoog 1985). Samples were analyzed in weekly batches, with the electrode calibrated to standard solutions of 1, 100, 1,000, and 10,000 mg/l bromide.

# 3 Results

Results of additional analytical testing and data validation reports for these data are included in Appendix A. In general, most data met data quality criteria, and had no qualifying remarks. A small number of the data were “J” qualified due to slightly prolonged holding times. These data were included in our analysis, but only in conjunction with other data, showing the chemical evolution of the system. A few nitrite samples were qualified as “G” because their holding times exceeded acceptable standards. These samples were excluded from the analysis.

## 3.1 Bromide Tracer Results

The bromide breakthrough curve for the SCC (Figure 6, Table 3) includes the effects of water-filled endspace in the columns and the volume of water in tubing, so the pore volume of the column was adjusted to account for these factors. After adjustment for these reservoir effects, the data indicate that the SCC has a pore volume of ~5.5 L and a porosity of 0.30. The results (Appendix B) also indicate that the direct flow into the top of D’Artagnan, the central column in the SCC, was only about 15% of the total flow. The other 85% of the influent entered into the three input columns in roughly equal proportions (i.e., the flows though Aramis, Porthos, and Athos were similar).

The bromide breakthrough curve for the LCC is shown in Figure 7 and Table 3. The overall pore volume in the LCC was ~12 L and the porosity was 0.34. Flow appeared to be evenly distributed between all four column channels (three inflow and the top of the central column).

## 3.2 Column Flushing Results

The prior Interim Report (Geomega 2004) came to several conclusions, including:

1. Pumping 1.5 PV DAPL would be necessary to eliminate DAPL conditions in groundwater.

2. Based on formation of iron precipitates in the column study, physical limitations to aquifer DAPL removal, such as plugging by solids, may render DAPL removal technically impractical over time.

3. There is some uncertainty as to how scale-up to aquifer conditions will affect the estimated remediation rates, indicated by the Bench Scale Test described in the Interim Report. Additionally, the potential for an increase in the release of solutes in the diffuse layer to overlying groundwater due to imposed turbulence in the DAPL, and the duration of the flushing period due to uncertainties in the extent and characteristics of DAPL throughout the system, are unknown.

4. Residual solid phases could be expected to result in elevated concentrations of some solutes for an unknown period.

5. The slower the pump-rate, the better the chance of avoiding perturbations of DAPL that would exacerbate ex-solution of solutes into clean, overlying groundwater, and formation of precipitates.

The latest results support the Interim Report conclusions, with most solutes reaching asymptotic concentrations by the end of the experiment.

Visually, the contents of the columns evolved over the course of the experiment (Figure 8). Initially, the columns were filled with grayish gravel containing green DAPL. As the DAPL began to flush from the system, the iron oxidized (despite the anoxic test conditions), precipitating orange amorphous ferric hydroxide as the pH increased in the columns. When the LCC was shut off during the flushing hiatus, black spots consistent with sulfide mineral formation developed (Figure 8c). These black regions were surrounded by clearer gray areas, consistent with iron reduction in the zones surrounding the spots of sulfide reduction.

## 3.3 Individual Constituent Behavior

The evolution of the column effluent for each constituent is presented in Figures 8 through 19. The data used to prepare these graphs are presented in Appendix A of this report, and in Appendix B of the Interim Report (Geomega 2004). Each figure includes the influent

concentrations from the variable-depth ports in the multilevel piezometer MP-2. This water was used for the column influent water (Geomega 2003). The lower the number following the MP-2 designation, the deeper the port, and thus the closer the port is to the DAPL. Port 2 is in the DAPL, Port 9 is diffuse layer water, and Ports 11 and 12 are overlying groundwater. In addition, many figures show the previously developed (Geomega 1999), empirically-defined, lower limit concentration for DAPL (where applicable). Results of the flushing hiatus in the LCC are presented in Table 4, and updated constituent mass balances are presented in Table 5.

### 3.3.1 pH

As described in the Interim Report (Geomega 2004), the effluent pH rose gradually with pore volumes in both the SCC and the LCC (Figure 9). In the SCC, effluent pH varied between about 5 and 6.5 (averaging 5.7) over the final 6 PV. This mildly acidic pH was achieved after ~4 PV in the SCC and is consistent with the buffering of a system by Al-OH-$SO_4$ minerals (e.g., $AlOHSO_4$).

The LCC effluent pH also increased over the first 4 PV, reached a maximum of 6.1 at ~5 PV, then showed signs of oscillation similar to the SCC. Oscillations continued immediately after the flushing hiatus, then the pH decreased to an average of 4.6 during the final LCC pore volume, a 25% decline from the maximum pH (Table 2).

### 3.3.2 Specific Conductivity (SC)

The specific conductivity of the SCC effluent decreased relatively smoothly over the course of the experiment (Figure 10). The SC in the SCC reached the statistically-defined sub-DAPL condition[3] (20,600 µS/cm) at ~1.6 PV, then leveled off at approximately 740 µS/cm at 6 PV, well above MP-2 Port 11 influent SC of 172 µS/cm. At the end of the test, the SC increased due to the arrival of the NaBr spike for the pore volume determination.

The LCC trend paralleled the SCC trend. The SC in the LCC reached sub-DAPL conditions at ~1.3 PV. After the flushing hiatus, the SC increased by over 75% to an average of

[3] All sub-DAPL constituent concentrations used in this section are based on Geomega (1999).

1,700 µS/cm from 943 µS/cm prior to the cessation of flushing. This increase reflects the flux of ions coming into solution within the LCC during the flushing hiatus.

### 3.3.3 Iron (Fe)

Iron decreased in the SCC effluent from 2,260 mg/l at 0.18 PV to influent (MP-2 Port 11) concentrations (1.07 mg/l) at ~2.5 PV. Iron concentrations in the effluent were below the detection limit of 0.05 mg/l at 4.1 PV (Figure 11). Concentrations continued to be non-detectable through the end of the experiment, with a slight perturbation at the end.

In the LCC, Fe concentrations decreased to below the detection limit of 0.05 mg/l after approximately 3.5 PV, and continued to be non-detectable until the hiatus in flushing. After the hiatus, Fe increased to 1.2 mg/l, probably due to the more reducing conditions that developed when flushing ceased. This hypothesis is supported by the apparent formation of sulfides and dissolution of iron oxide phases (Figure 8). With re-initiation of flushing, Fe concentrations returned to non-detectable levels within half of a pore volume.

### 3.3.4 Sulfate ($SO_4$)

Sulfate concentrations in the SCC decreased gradually throughout the course of the experiment, from 71,400 mg/l at 0.18 PV to sub-DAPL concentrations (16,000 mg/l) at ~1.6PV (Figure 12). After ~5 PV, $SO_4$ concentrations continued to decrease slowly but remained in the 200-400 mg/l range through ~9 PV. $ASO_4$ concentration of 100 mg/l was only achieved after 9.8 PV of flushing in the SCC. The SCC effluent never reached the concentration of the MP-2 Port 11 influent (46.2 mg/l).

A similar decline and eventual leveling-off of $SO_4$ was observed for the LCC. Sub-DAPL concentrations for $SO_4$ were reached at ~1.3 PV. Quasi steady-state concentrations of ~300 mg/l were reached at ~5 PV. After the hiatus in flushing, $SO_4$ concentrations increased 50%, then returned to pre-hiatus conditions or lower after ~5.2 PV.

### 3.3.5 Aluminum (Al)

Aluminum decreased monotonically throughout the course of the experiment (Figure 13) from 2,180 mg/l at 1.8 PV to 0.25 mg/l at ~6.1 PV. After about 6 PV, Al leveled-off near

0.14 mg/l in the SCC, consistent with the buffering of pH and Al concentrations by Al-$SO_4$ minerals. This end concentration is slightly above the MP-2 Port 11 influent concentration of 0.1 mg/l.

After the hiatus in flushing in the LCC, Al increased by ~85% (from 0.81 mg/l to 1.5 mg/l) as the pH declined. The Al concentration leveled off at 1.1 mg/l, and remained elevated above pre-flushing hiatus levels, due to the continued low pH of the system.

### 3.3.6 Ammonia ($NH_3$)

Ammonia behaved similarly to $SO_4$, reaching sub-DAPL concentrations (1,250 mg/l) in the SCC after 1.6 PV of flushing (Figure 14). At ~5.5 PV, ammonia in the SCC became asymptotic at a concentration of approximately 60 mg/l, perhaps reflecting ongoing dissolution of acid-bearing ammonium jarosite [$NH_4Fe_3(OH)_6(SO_4)_2$] phases. Despite this asymptotic behavior, ammonia is one of the most efficiently flushed constituents, with over 100% of its initial aqueous mass being flushed from the system (Table 5).

In the LCC, $NH_3$ increased by a factor of 35 after the re-initiation of flushing (from 3.47 mg/l to 120 mg/l), and remained at concentrations greater than 90 mg/l throughout the rest of the experiment. The possible basis for sustained ammonia levels, after the re-initiation of flushing is discussed further in Section 3.6.1.2 of this report.

### 3.3.7 Calcium (Ca)

Calcium in SCC effluent decreased from 625 mg/l at 0.18 PV to 71.5 mg/l at 4.1 PV (Figure 15). At 6 PV, the Ca concentration in the SCC appeared to equilibrate at ~35 mg/l, above the influent concentration (6.94 mg/l) in the MP-2 Port 11 water.

Upon re-initiation of flushing in the LCC, Ca increased from 18 mg/l to an average of 35 mg/l, and remained above 30 mg/l through the end of the experiment.

### 3.3.8 Chloride (Cl)

Chloride in effluent from the SCC increased from 721 mg/l at 0.18 PV to 10,700 mg/l at 1.1 PV (Figure 16) and then decreased to 219 mg/l after 4 PV. Early-time Cl concentrations

in both complexes appear to be anomalously low, possibly due to analytical interferences with the high levels of $SO_4$ in the DAPL. Chloride in the SCC effluent reached sub-DAPL concentrations (2,800 mg/l) at ~1.6 PV, and leveled off at ~50 mg/l after 5 PV, above the MP-2 Port 11 influent concentration (18 mg/l).

For the LCC, Cl increased from 5,410 mg/l at 0.06 PV to 11,800 mg/l at 0.8 PV (double peak) before decreasing to 468 mg/l at 2.2 PV. Chloride in the LCC effluent reached sub-DAPL concentrations at ~1.4 PV. After the restart of flushing, Cl increased by 35% in the post-hiatus samples.

### 3.3.9 Chromium (Cr)

Chromium concentration behaviors in both complexes (Figure 17) were qualitatively similar to those for Al. The Cr concentrations in the SCC effluent decreased through ~7 PV before leveling-off at ~0.03 mg/l, equal to the MP-2 Port 11 influent concentration of 0.03 mg/l.

In the LCC, Cr increased 54% from 0.11 mg/l to 0.17 mg/l upon restarting the columns after the flushing hiatus, but returned to pre-hiatus levels at 5.2 PV.

### 3.3.10 Magnesium (Mg)

Magnesium concentrations (Figure 18) behaved similarly to those for Al and Cr. Magnesium concentrations in the SCC fell below the sub-DAPL criteria (270 mg/l) at 1.6 PV. Concentrations continued to decrease through ~6 PV, then stabilized at ~3.4 mg/l (more than double the 1.5 mg/l concentration in the MP-2 Port 11 influent).

In the LCC, Mg concentrations fell below the DAPL criteria at 1.3 PV. Upon restarting the columns after the flushing hiatus, Mg concentrations increased 93% from 4.4 mg/l to 8.5 mg/l, then decreased slightly while still remaining above the pre-hiatus concentration.

### 3.3.11 Sodium (Na)

Sodium also behaved similarly to Al, Cr, and Mg, with concentrations decreasing to sub-DAPL conditions (1,700 mg/l) at 2.4 PV in the SCC (Figure 19). After 6 PV through the

SCC, Na leveled off at ~45 mg/l, still well above the MP-2 Port 11 influent value of 19 mg/l. Concentrations spiked during the last 4 samples due to the presence of the NaBr tracer.

Sodium concentrations in the LCC decreased to sub-DAPL conditions at 1.7 PV. Upon restarting the LCC after the flushing hiatus, Na increased 45% from 83 mg/l to 120 mg/l before spiking to 220 mg/l due to the NaBr tracer. Although Na concentrations in both complexes were influenced by the presence of the NaBr tracer at later pore volumes, the long-term behavior of sodium is expected to be analogous to that of Al, Cr, and Mg.

## 3.4 Microprobe results

The Interim Report (Geomega 2004), other geochemical studies in the MMBA (e.g., Geomega 2001), and work at other sites with acidic groundwater plumes (Stollenwerk 1994; Davis 2003; Nicholson et al. 2003) all show that Fe-Al-Cr-OH-$SO_4$ precipitates play an important role in controlling the major ion chemistry, trace ion chemistry, and pH evolution of chemical systems. Electron microprobe analysis of column material from before, during and after flushing shows the chemical evolution of the solid precipitates in the columns.

The condition of the initial DAPL-saturated aquifer material, containing authigenic clay minerals resulting from acid alteration of feldspar minerals in the aquifer matrix (Nicholson 2003) and abundant Cr-Al-$SO_4$ solids with a ~$Al_2CrSO_4(OH)_7$ stoichiometry and a log $k_{sp}$ of ~28 (Geomega 2001), is shown in Figure 20. The authegenic clay minerals contain elevated concentrations of Cr, incorporated from the acidic DAPL during the alteration process (Figure 20a). As formation of clay minerals reduces the system's acidity (thereby raising the pH), other precipitates from the concentrated DAPL start to form. These precipitates are primarily Cr-Al-$SO_4$ minerals (Figure 20b) and Fe-Cr-Al-$SO_4$ minerals (Figure 20c). In general, the Fe-Cr-Al-$SO_4$ precipitates are less common in the DAPL-saturated material than the Cr-Al-$SO_4$ precipitates, probably due to the high solubility of Fe(II) in the acidic DAPL environment.

As described in the Interim Report (Geomega 2004), a large flux of ochre-colored solids (flocculent) was generated during flushing, necessitating cleaning of the column plumbing at

approximately 1.5 PV. Microprobe analyses of this material show that it was primarily Fe-Cr-OH-$SO_4$ minerals (Figure 21). In these precipitates, Cr was primarily associated with Al and $SO_4$ rather than Fe and $SO_4$, consistent with iron oxidation during flushing and previous observations that $Cr^{3+}$ is commonly associated with Fe-OH minerals (Bartlett and James 1979). The presence of Fe-$SO_4$ phases, which play a role in buffering the pH to acidic levels, is characteristic of Fe speciation in acidic systems (Nordstrom and Alpers 1999; Davis et al. 1999; Bigham et al. 1996). The mid-flushing precipitates contain small crystals of NaCl, probably a product formed during sample drying.

The microprobe analysis shows that system neutralization, oxidation, and flushing will generate chemical precipitates that could reduce porosity, control the chemical evolution of the major ions in the system, and buffer pH. Post-flushing column precipitates contain iron oxide minerals with low levels of Cr, Al, and $SO_4$. These minerals occur either as distinct blebs (Figure 22a), as the filling in pores and interstices (Figure 22b), or as potentially pore-blocking rinds on grains (Figure 22c). The chemical evolution of the precipitates from a Cr-Al-$SO_4$ system to a $Fe(OH)_3$ system is reflected in the composition data of the grains (Figure 23). Pre-leaching precipitates had 5 times the Cr and 10 times the $SO_4$ concentrations of post-leaching precipitates. In contrast, post-leaching precipitates had 1 to 2 orders of magnitude more Fe than pre-leaching precipitates. Overall, the lower levels of $SO_4$ and Cr are consistent with these constituents being flushed through the columns.

## 3.5 Mass Removal Calculations

Geomega (2004) concluded that most (>70%) of the aqueous mass of constituents of concern (COC) was removed from the columns over the initial ~1.5 PV, with mass removal becoming substantially less efficient after that point. This conclusion was based on an analysis of the distribution of mass between the aqueous phase and solid phase both in partitioning tests and column tests.

The additional testing allowed a continuation of the mass balance assessment and refinement of previous calculations. The further results were consistent with the initial report, as aqueous mass removal remained inefficient. For example in the SCC, 79% of the cumulative DAPL-defining aqueous mass (the sum of $NH_3$, $SO_4$, Cr, and Cl) was removed at 1.5 PV, but a

further 7 PV of flushing resulted in the removal of only 9% more mass (Figure 24). Similarly, in the LCC, 79% of the cumulative aqueous DAPL-defining mass was removed at 1.5 PV, while another 3.5 PV of flushing removed an additional 9% (Figure 24). An updated estimate of mass flushing from the column tests based on the refined pore volumes and additional data is presented in Table 3. These new results are all within 5% of the calculated values from the initial part of the study, supporting pervious assertions that long-term mass removal efforts would be inefficient.

## 3.6 Chemical Modeling

Geochemical speciation models can provide insight into the chemical controls on solute concentrations that were flushed from the columns (e.g., Stollenwerk 1994; Nordstrom 2002). This understanding is especially important given the relatively high concentrations of normally immobile constituents (e.g., Al, Cr, Fe) and the apparent retardation in the columns of typically mobile constituents (e.g., Na, $SO_4$, Cl, $NH_3$) that were observed in this experiment. Geochemical modeling was used to integrate these data and to provide a more in-depth understanding of the chemical evolution of the columns; specifically, the mineralogical controls on constituent concentration and pH in the column system.

The column system was modeled using Geochemist's Workbench (Bethke 1998) with the thermodynamic data set augmented with additional empirically relevant mineral phases including $CrFe_3(OH)_{12}$ (Barlett and James 1979), $AlOHSO_4$ (Parkhurst 1995) and $Al_2CrSO_4(OH)_7$ observed in DAPL-saturated portions of the Main Street Saddle Area (Geomega 2001). The model allows determination of which minerals are near saturation in the system, evaluation of the predominant aqueous species in solution, and determination of the geochemical effects of the solid-phase system on the aquifer chemistry.

Geochemical modeling results show the importance of precipitates in controlling the solution pH and metal concentrations. In combination with mass balance calculations, the modeling reveals three types of geochemical behavior in the columns. These behaviors are classified as 1) conservatively transported, 2) pH-controlled, and 3) redox-controlled compounds.

### 3.6.1 Conservatively Transported Compounds

Chloride was the only compound that appeared to be conservative. In the mass balance calculations, chloride was nearly 100% associated with the aqueous phase, both in the column mass balances and in the partitioning studies. In addition, after the flushing hiatus in the LCC, chloride concentrations increased by only a small amount (~5%), and rapidly returned to pre-hiatus levels. There were no supersaturated, chloride-containing minerals predicted in the geochemical modeling.

### 3.6.2 pH-Controlled Compounds

Aluminum, Ca, Mg, and $NH_3$ behavior was primarily related to pH. After the hiatus in flushing in the LCC, these constituents increased in concentration, and remained at elevated levels while the pH remained low. In other acidic plumes, the solubility and inter-conversion of Al-$SO_4$ minerals (such as $AlOHSO_4$ and $Al(OH)_3$) has been shown to be an important pH buffer in acidic groundwater systems (Nicholson et al. 2003; Zhu and Burden 2001), buffering the pH to near 4.5. $AlOHSO_4$ and $Al(OH)_3$ were near saturation in many of the column effluents above pH 4, as indicated by saturation indices (SI) that were within one unit of zero (Figure 25). With the presence of both Al-$SO_4$ and -OH phases, the system pH was generally fixed between 4.0 - 5.5. Such a buffered system is likely to remain mildly acidic for many pore volumes (i.e., >30 PV, Stollenwerk 1994).

Calcium and Mg were commonly associated with many clay minerals, and mass balance calculations indicate that a large portion of these materials (>90%) were associated with the solid phase in partitioning tests (Geomega 2004). Ammonia's mass balance is somewhat ambiguous. One partitioning test revealed a significant mass associated with solid phase materials (~50%); however, a second partitioning test revealed almost no mass associated with the solids. Solid phase associations could be due to solid phase substitution of $NH_3$ for K, resulting in ammoniojarosite or ammonioalunite (Dutrizac and Jambor 2000)[4], minerals that form in some acidic, high ammonia environments. If these minerals are present, they do

[4] While ammonia may be associated with the solid phase in the system, other nitrogen-bearing amine compounds are not likely associated with the solid phase because they generally occur as unionized, less polar organic compounds. In addition, their larger molecular diameter impedes their incorporation into mineral structures.

not affect the fact that ammonia is one of the most efficiently flushed constituents from the system (Table 5).

### 3.6.3 Redox-Controlled Compounds

The behavior of Fe, Cr, and $SO_4$ was closely linked to iron oxidation and the resulting decrease in aqueous Fe. At the start of the experiment the redox environment in the columns facilitated near conservative movement through the system, resulting in flushing of most of the aqueous mass. Solid-phase Fe compounds were undersaturated during the initial 1.3 PV of flushing (Figures 26 and 27). However, after ~1.5 PV, these compounds decreased as iron oxide minerals proliferated. At this point, $Fe(OH)_3$ and $CrFe_3(OH)_{12}$ were also near saturation, with Cr solubility controlled by $CrFe_3(OH)_{12}$ solid solution until the end of the experiment, as indicated by the Cr activity remaining near the edge of the $CrFe_3(OH)_{12}$ solubility field through most of the experiment (Figure 28). This hypothesis is supported by the EMPA analysis results, which confirmed the presence of Cr-Fe-OH-$SO_4$ minerals in the mid-flushing precipitates. This result is also consistent with Bartlett and James (1979), who found that there is a continuous solid solution between Fe- and Cr-OH minerals, suggesting that Fe (III) chemistry may control Cr solubility.

After the flushing hiatus in the LCC, aqueous Cr, Fe, and $SO_4$—all associated with Fe(III) minerals—increased by ~50%. This increase is expected with dissolution of Fe(III) minerals due to iron reduction during the hiatus. However, Cr, Fe, and $SO_4$ concentrations decreased to pre-flushing levels within 0.5 PV; with the reinstitution of flushing, iron oxidation allowed re-precipitation of the Fe(III) minerals and associated elements (Figures 26 and 27).

Sulfate is included in the redox-controlled group because of its association with Fe minerals and post-hiatus flushing behavior similar to Fe and Cr. In addition, $SO_4$ concentrations were close to saturation with gypsum and Al-$SO_4$ minerals.

## 3.7 Flow Considerations

Column flow changed little over the additional pore volumes. During the final phase of the experiment, the manometer heads did not change more than 50% in most columns (Figures 29 and 30). The only exceptions were anomalous increasing head differences in

Bashful in the LCC and Porthos in the SCC. After removal of precipitates from the plumbing in both complexes at 1.5 PV, mineral precipitation that prevented flow was not observed again in either complex.

# 4 Summary and Conclusions

Column testing provided insight into the behavior of the aquifer-groundwater system during remedial pumping of the DAPL. Specific conclusions drawn from the experimental results are:

1. Mass removal during initial pumping has the potential to be quite effective, possibly removing at least 70% of the aqueous constituent mass.

2. Beyond 1.5 PV, mass removal is inefficient. Additional flushing results in little incremental mass removal. Constituent concentrations decrease only slowly and, for most elements, approach an asymptotic condition remaining above the influent concentrations.

3. The pH of the DAPL-saturated aquifer will remain low (<5) due to buffering by Al precipitates.

4. The column tests generated a large amount of flocculent due to precipitation of Al, Cr, Fe and $SO_4$ minerals. These precipitates may decrease the effective porosity of the aquifer as the pH changes and oxygenated diffuse layer and overlying groundwater mixes with acidic iron-rich DAPL. In addition, the remedial pumping wells and conveyance/storage system could become clogged if they are not carefully monitored and maintained.

5. When flow through the LCC ceased for 6 weeks, certain constituent concentrations increased by an average of 55%. By analogy, any interruption in remedial pumping may be followed by a period of increased solute concentration in the discharge after the pump(s) is/are restarted.

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# Tables

| Drill hole ID | Sample Depth (ft) | Core Length (inches) | Nickname | Column Complex |
|---|---|---|---|---|
| CTB-1 | 32-37 | 19.5 | Dopey | Large |
| CTB-1 | 37-42 | 37.25 | Bashful | Large |
| CTB-1 | 42-44 | 14.5 | NA | Not Used |
| CTB-3 | 27-32 | 19.25 | NA | Partitioning Test |
| CTB-3 | 32-36.5 | 30.75 | NA | Not Used |
| CTB-4 | 25-30 | 34.25 | D'Artagnan | Small |
| CTB-5 | 25-30 | 44.5 | Doc | Large |
| CTB-5 | 30-35 | 34.875 | Porthos | Small |
| CTB-5 | 35-40 | 24.125 | Happy | Large |
| CTB-6 | 25-30 | 19.75 | Sleepy | Large |
| CTB-6 | 30-35 | 40.75 | Sneezy | Large |
| CTB-6 | 35-40 | 63 | Grumpy | Large |
| CTB-7 | 30-35 | 31.24 | Aramis | Small |
| CTB-7 | 35-40 | 33.75 | Athos | Small |

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Inventories of collected core samples.

**Table**
1

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## Analytical Parameters

| Sample Number | Sample Type | Al (µg/l) | Ca (µg/l) | Cr (µg/l) | Fe (µg/l) | Mg (µg/l) | Na (µg/l) | $NH_3$ (mg/l) | Chloride (mg/l) | Sulfate (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|
| **SD-67** | Pre Hiatus | 810 | 18000 | 110 | 50 | 4400 | 83000 | 3.47 | 70.2 | 389 |
| **SD-68** | Post Hiatus | 1100 | 33000 | 130 | 1200 | 6600 | 97000 | 120 | 74 | 580 |
| **SD-70** | Post Hiatus | 1400 | 41000 | 170 | 130 | 8500 | 120000 | 110 | 73 | 590 |
| **Percent Change[1]** | | **54%** | **106%** | **36%** | **1230%** | **72%** | **31%** | **3214%** | **5%** | **50%** |

## Electrode-measured Parameters

| Sample Number | Sample Type | pH | SC (mS/cm) |
|---|---|---|---|
| **SD-67** | Pre Hiatus | 4.789 | 943 |
| **SD-68** | Post Hiatus | 4.852 | 1555 |
| **SD-69** | Post Hiatus | 4.557 | 1684 |
| **SD-70** | Post Hiatus | 5.451 | 1498 |
| **SD-71** | Post Hiatus | 4.251 | 1672 |
| **SD-72** | Post Hiatus | 4.708 | 1581 |
| **SD-73** | Post Hiatus | 4.556 | 1580 |
| **SD-74** | Post Hiatus | 4.668 | 1678 |
| **SD-75** | Post Hiatus | 4.61 | 1780 |
| **SD-76** | Post Hiatus | 4.485 | 1531 |
| **SD-77** | Post Hiatus | 4.461 | 1838 |
| **SD-78** | Post Hiatus | 4.475 | 1784 |
| **SD-79** | Post Hiatus | 4.501 | 1957 |
| **SD-80** | Post Hiatus | 4.492 | 1780 |
| **Post Hiatus Average** | | **4.621** | **1686** |
| **Percent Difference[2]** | | **-4%** | **79%** |

[1] Percent change is calculated as the average of the 2 post hiatus analytical samples compared to the prehiatus sample

[2] Percent difference is calculated as the average of the 13 post hiatus samples compared to the prehiatus sample

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Effects of flushing hiatus on LCC effluent concentrations.

**Table**
4

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| Consituent | LCC | | SCC | |
|---|---|---|---|---|
| | Aqueous | Total | Aqueous | Total |
| **Al** | 80% | 2% | 81% | 2% |
| **Ca** | 130% | 3% | 146% | 3% |
| **Cl** | 61% | 61% | 51% | 51% |
| **Cr** | 66% | 18% | 73% | 20% |
| **Fe** | 90% | 1% | 99% | 1% |
| **Mg** | 88% | 2% | 87% | 2% |
| **Na** | 91% | 53% | 89% | 52% |
| **$NH_3$** | 102% | 64% | 109% | 68% |
| **$SO_4^{--}$** | 86% | 86% | 102% | 82% |

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Mass removal in DAPL column tests.

**Table**
5

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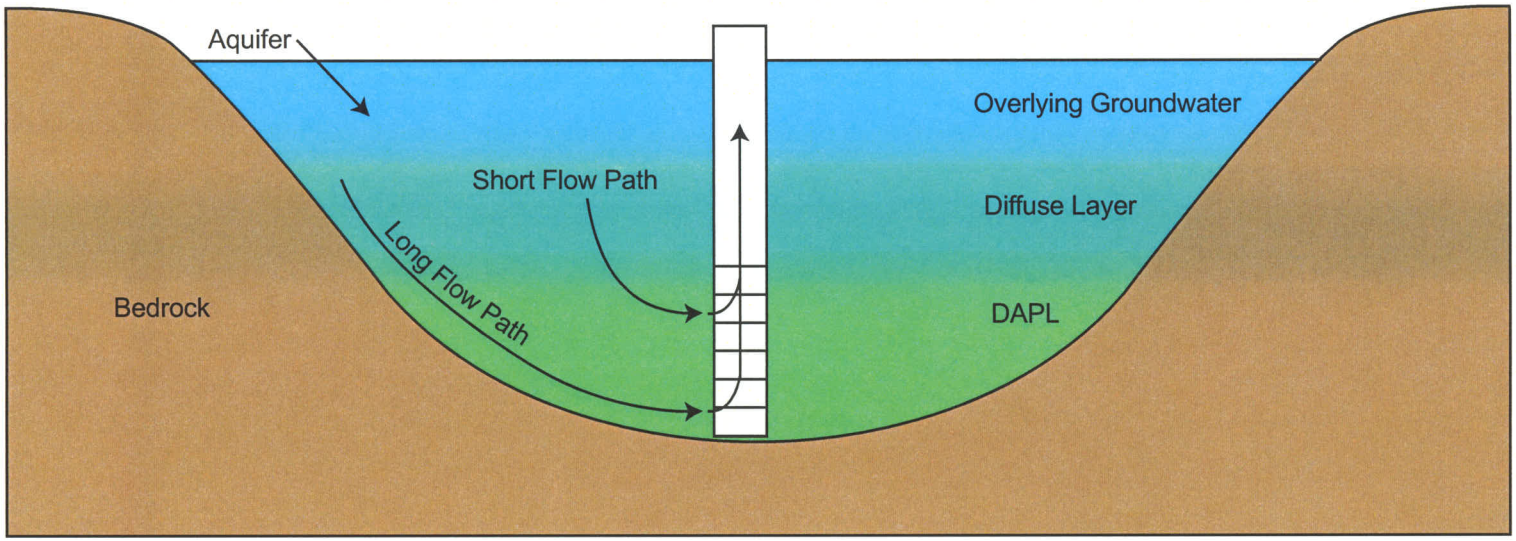
## Figures

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Conceptual model of DAPL extraction.

**Figure**
1

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a)

b)

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Column test set-up at the Geomega laboratory,
a) small column complex, b) large column complex.

**Figure**
2

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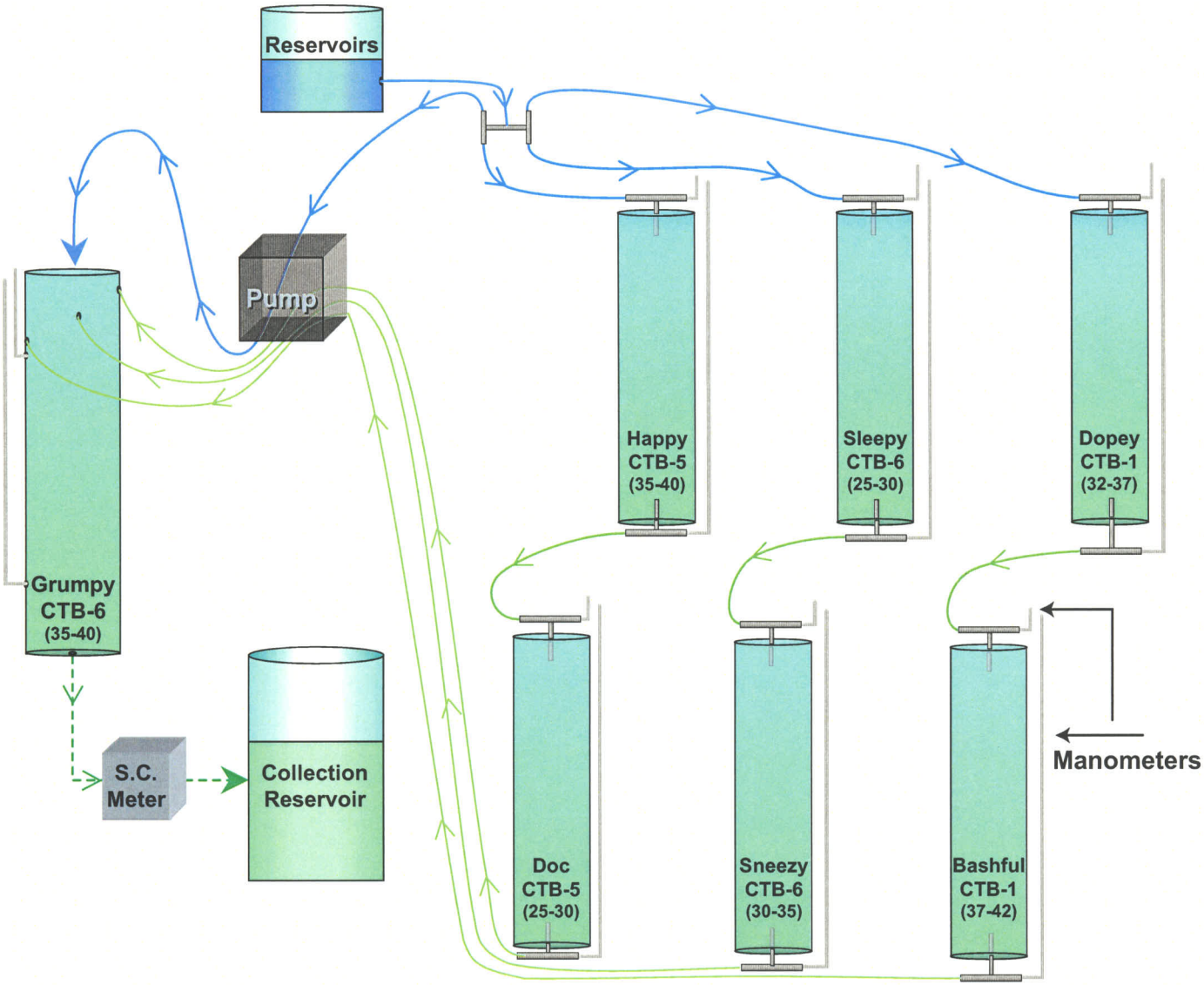


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Schematic of the large column complex.

**Figure**
3

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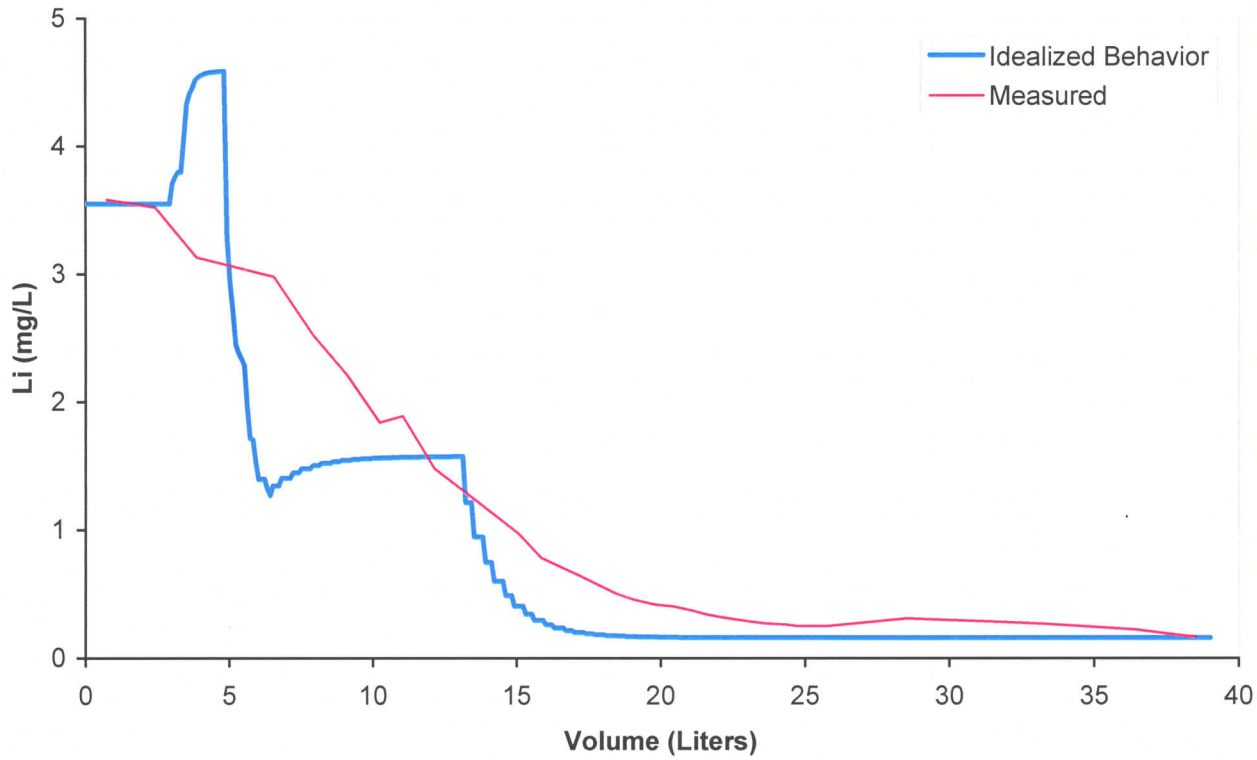


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Lithium results and idealized lithium breakthrough curve for the SCC.

**Figure**
4

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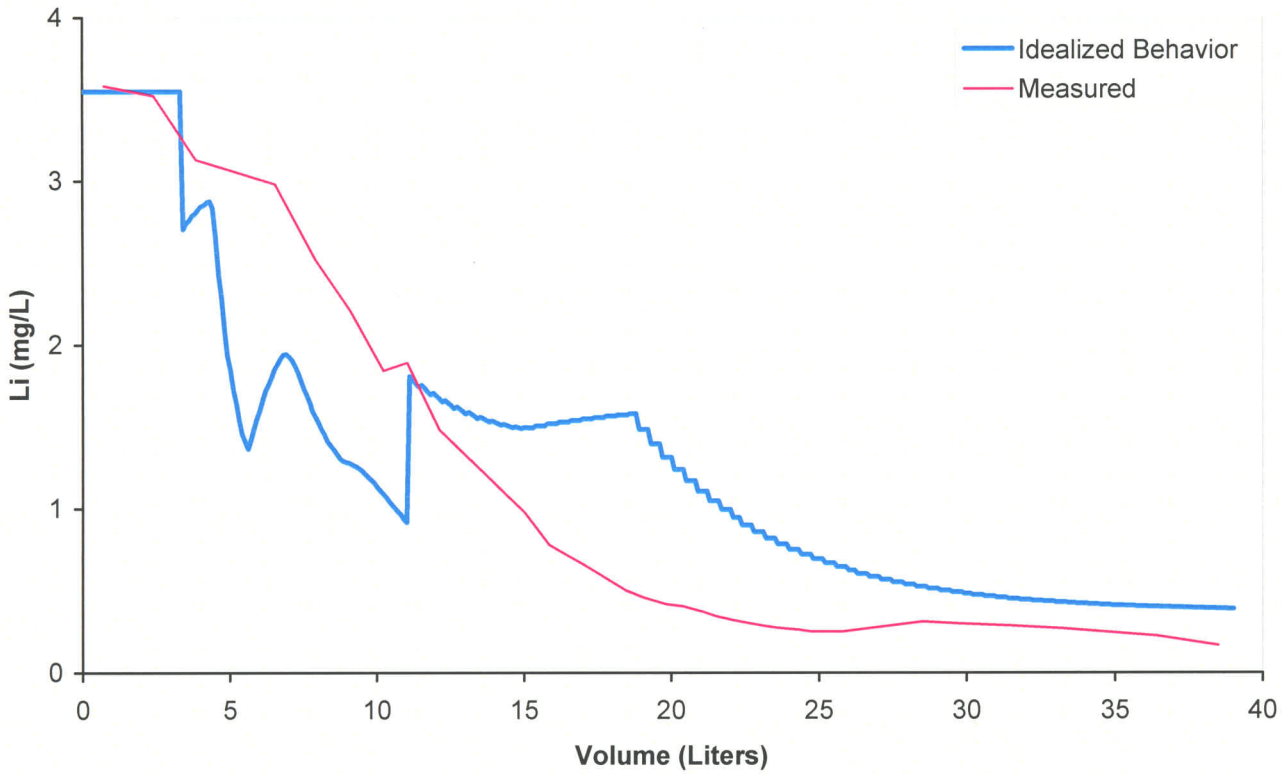


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Lithium results and idealized lithium breakthrough for the LCC.

**Figure**
5

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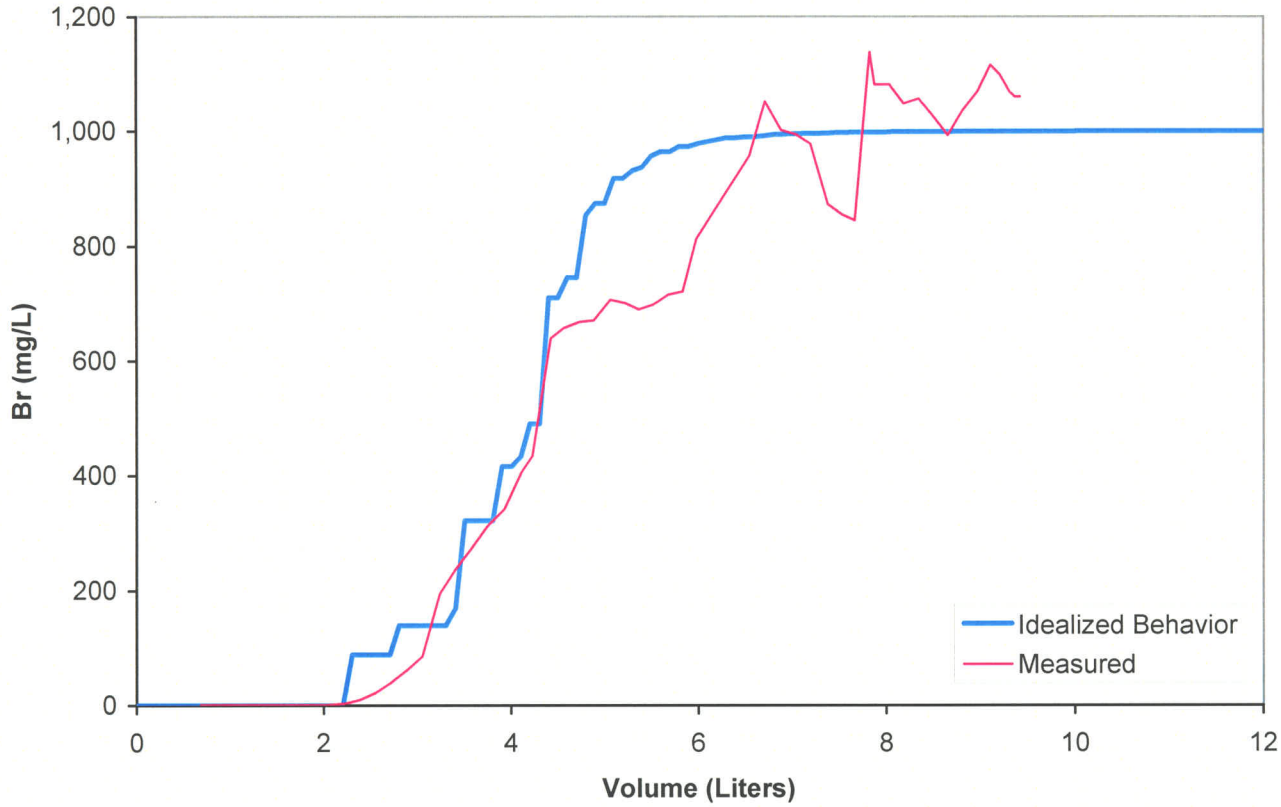


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Bromide tracer results with idealized calibrated breakthrough for the SCC.

**Figure**
6

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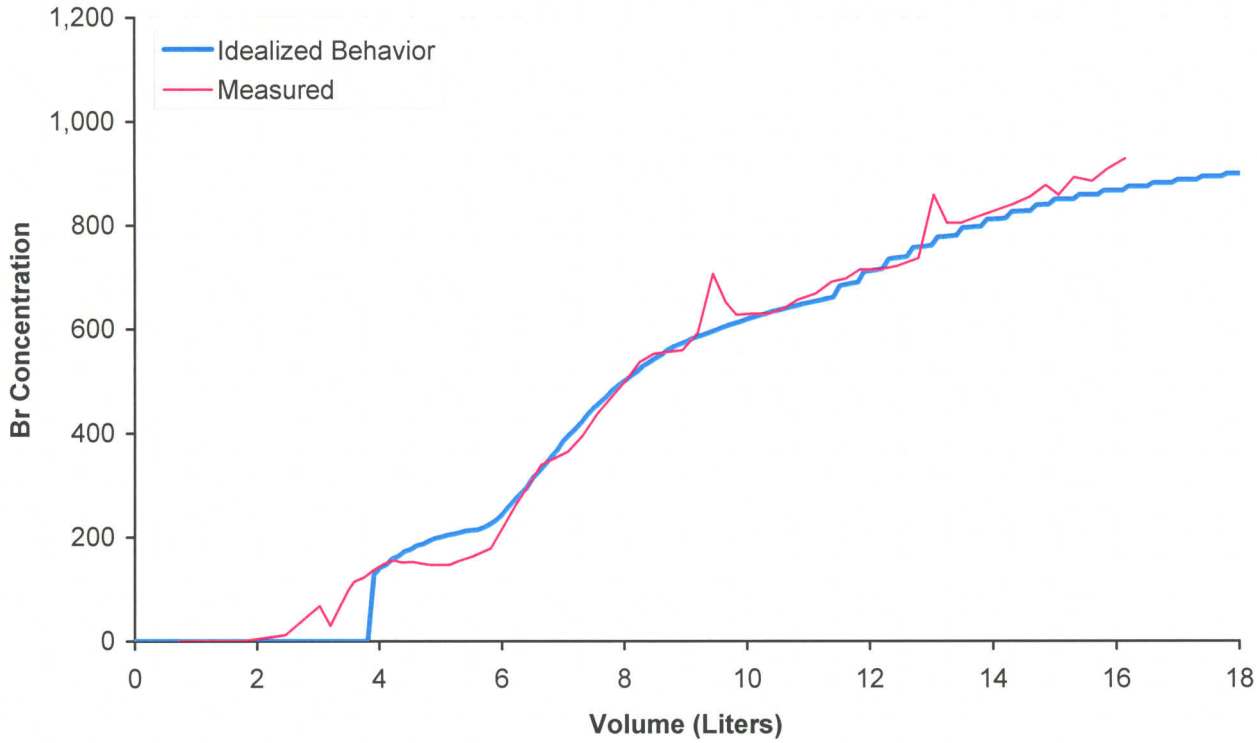


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Bromide breakthrough and ideal model of bromide breakthrough for the LCC.

**Figure**
7

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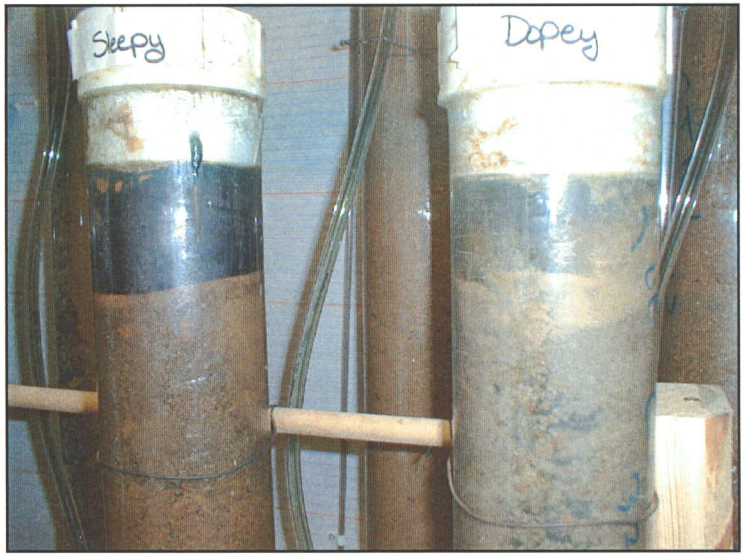
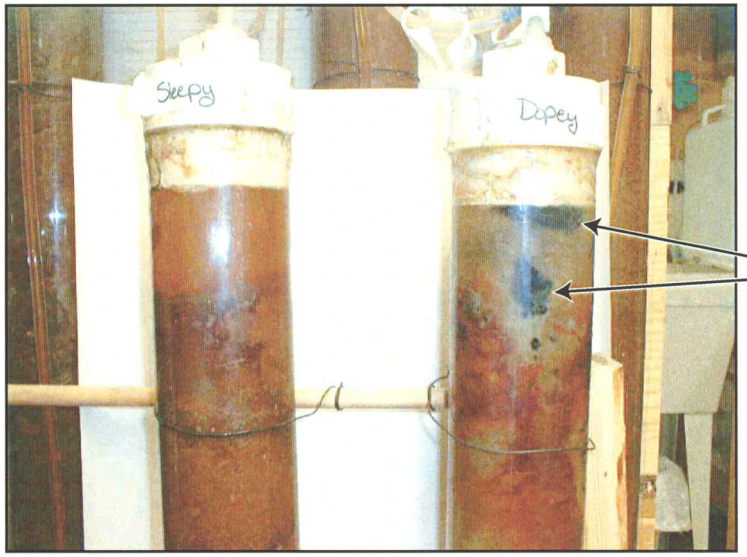
a)




b)

c)

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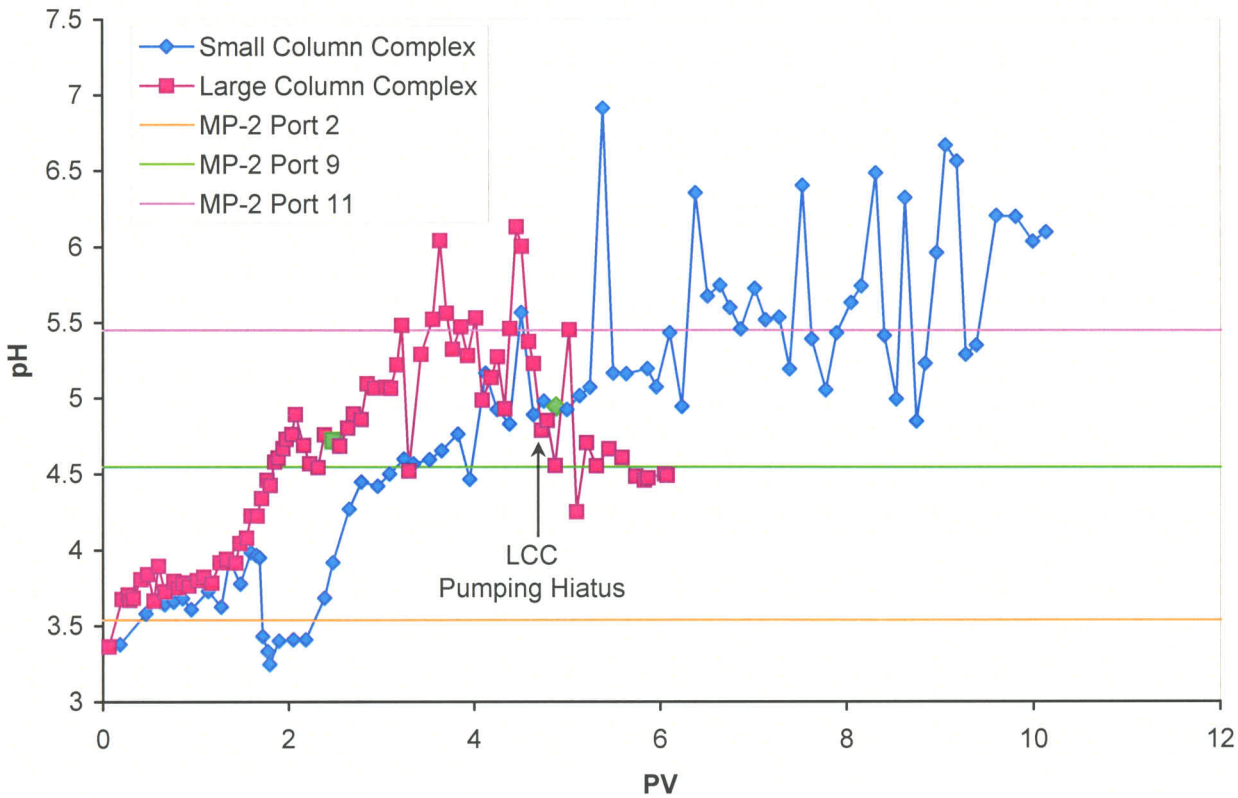
Photos of the LCC columns Sleepy and Dopey a) at the start of the column test, b) after ~1 pore volume, and c) at the end of the flushing hiatus.

**Figure**
8

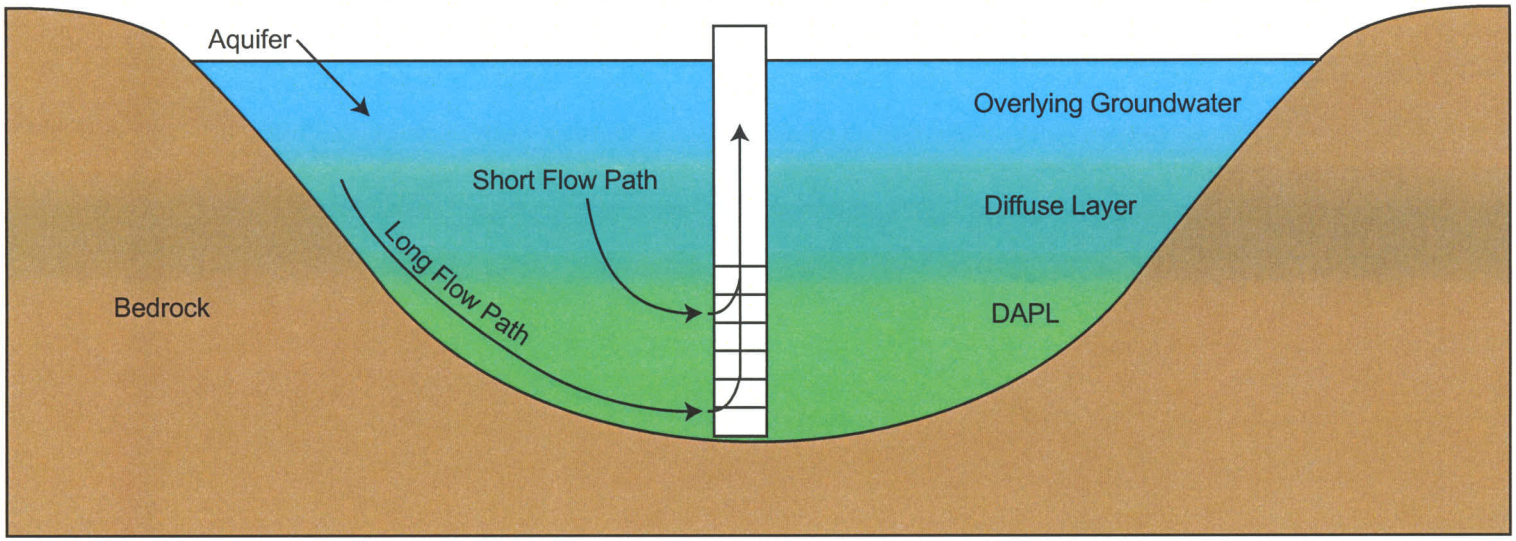
JM o:\Olin\DAPL Report 11-04\Sleepy Dopey.ai




Note: green point indicates the last data point in previous document (Geomega 2004).

| | | |
|---|---|---|
| GEOMEGA<br>12/3/04<br>C03303F<br>Olin | pH in effluent from the LCC and SCC. | **Figure**<br>9 |

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls

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Conceptual model of DAPL extraction.

**Figure**
1

JM o:\Olin\DAPL Report 11-04\DAPL Extraction.ai

a)

b)

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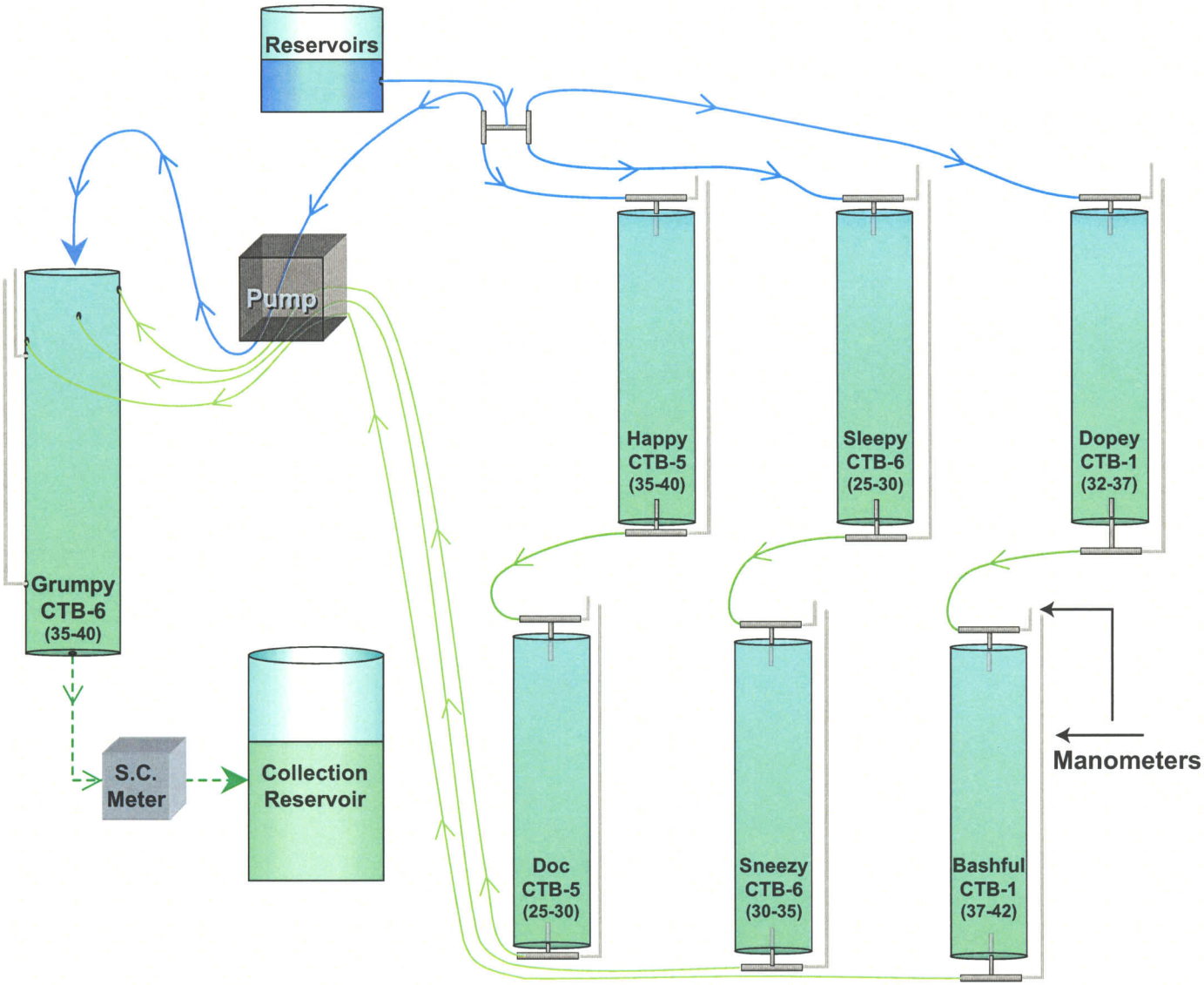
Column test set-up at the Geomega laboratory,
a) small column complex, b) large column complex.

**Figure**
2

JM o:\Olin\DAPL Report 11-04\Column Tests.ai

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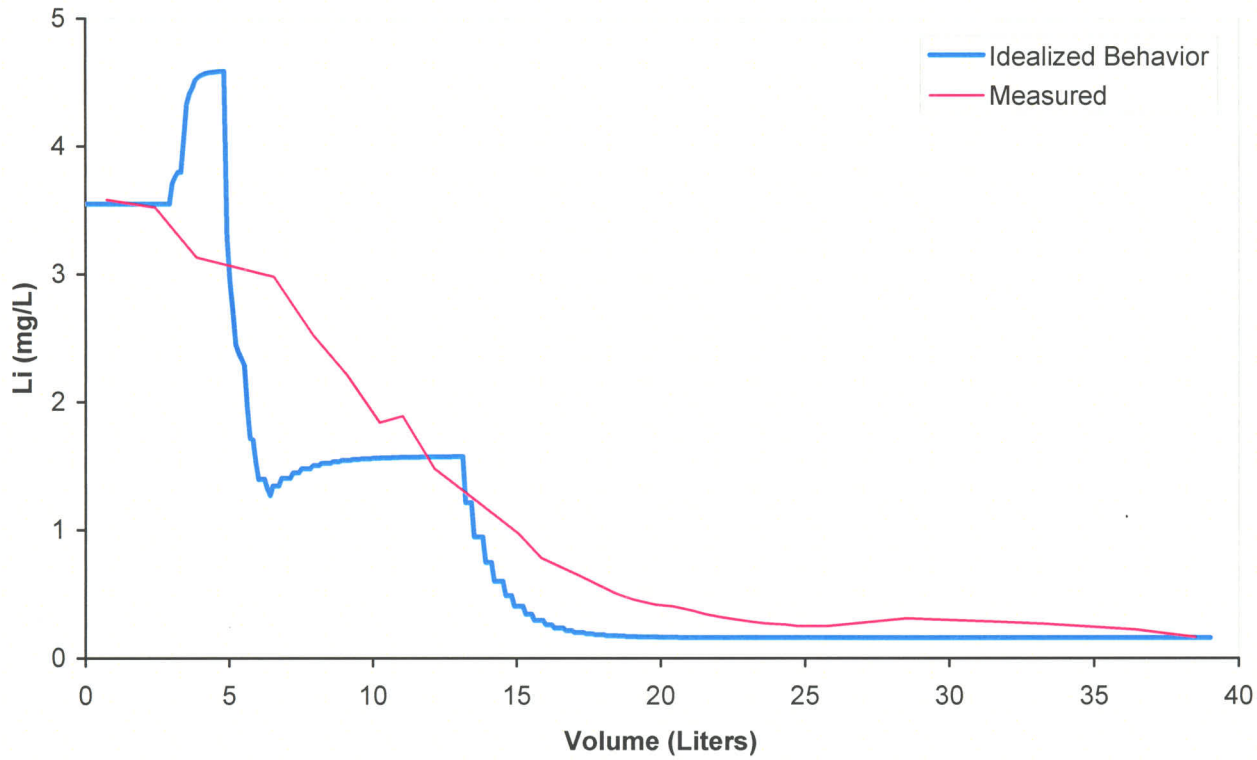
Schematic of the large column complex.

**Figure**
3

JM o:\Olin\DAPL Report 11-04\Schematic.ai

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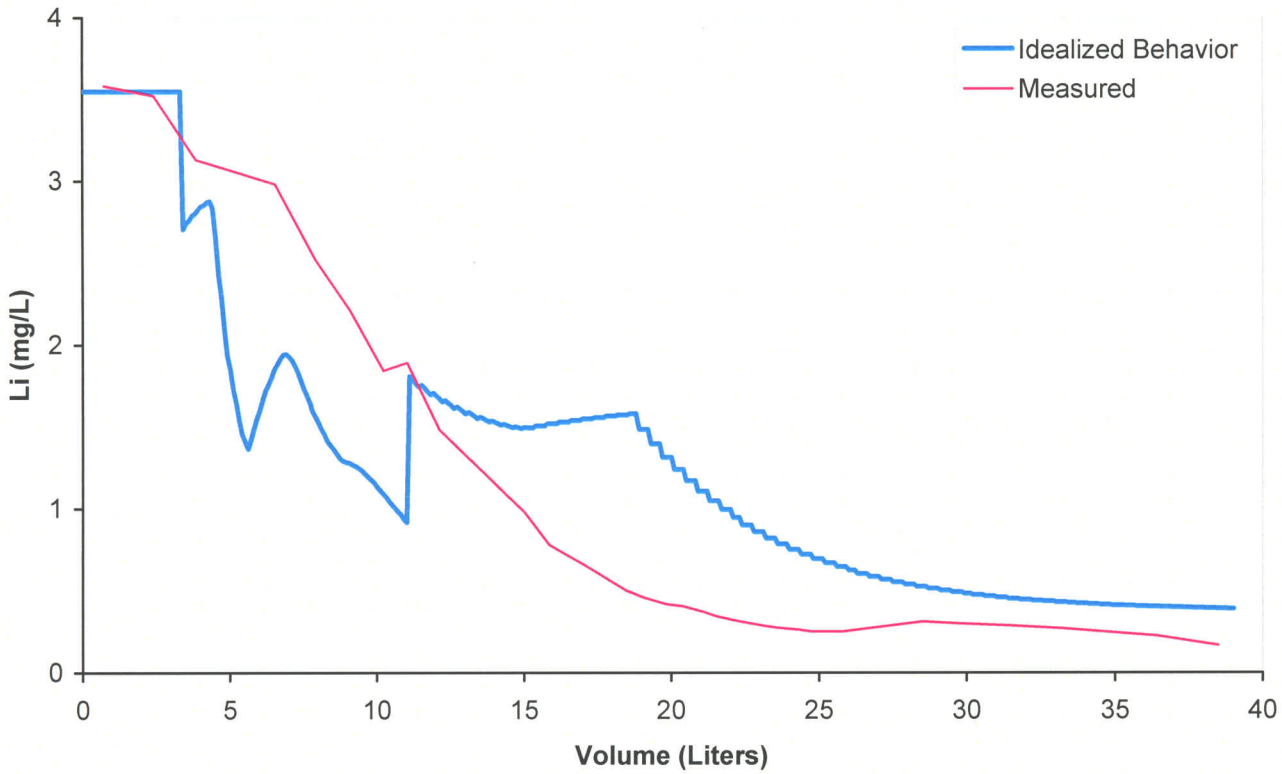
Lithium results and idealized lithium breakthrough curve for the SCC.

**Figure**
4

JM o:\Olin\DAPL Report 11-04\SCC Li.xls

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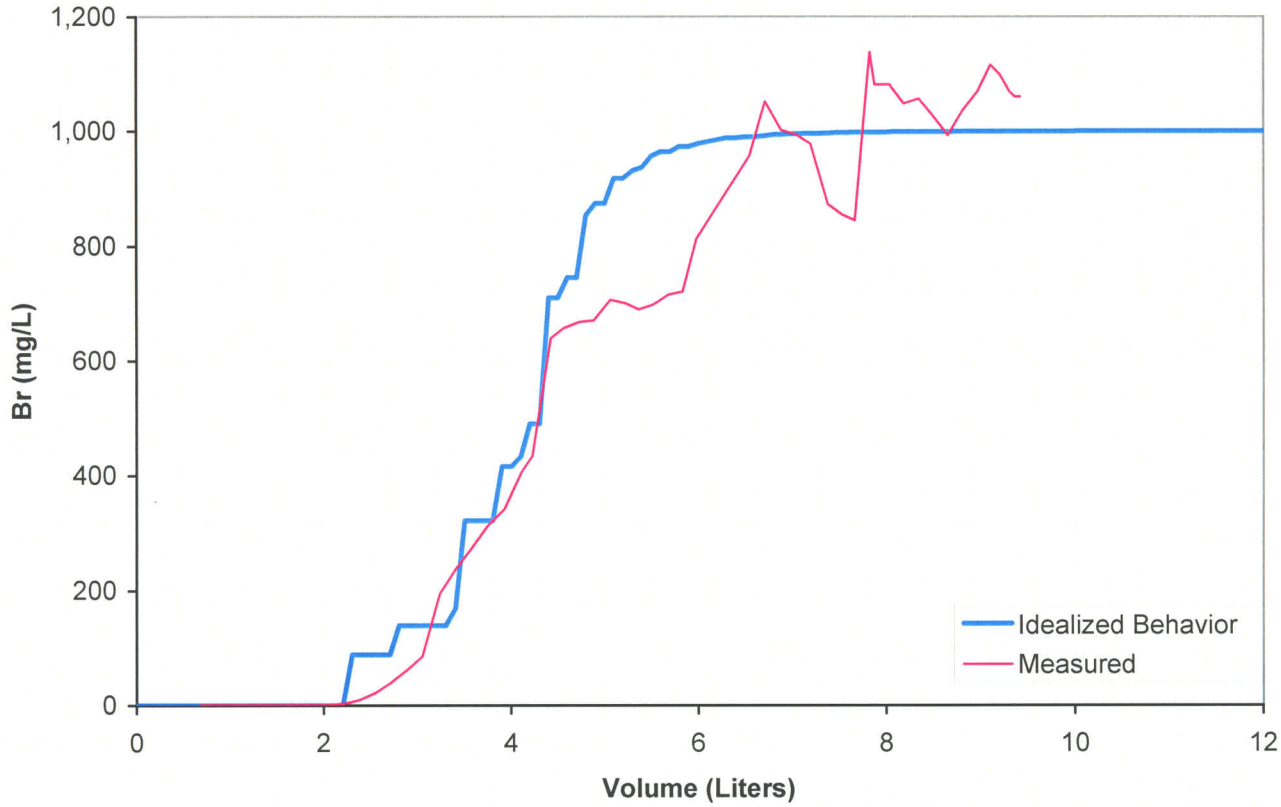
Lithium results and idealized lithium breakthrough for the LCC.

**Figure**
5

JM o:\Olin\DAPL Report 11-04\LCC Li.xls

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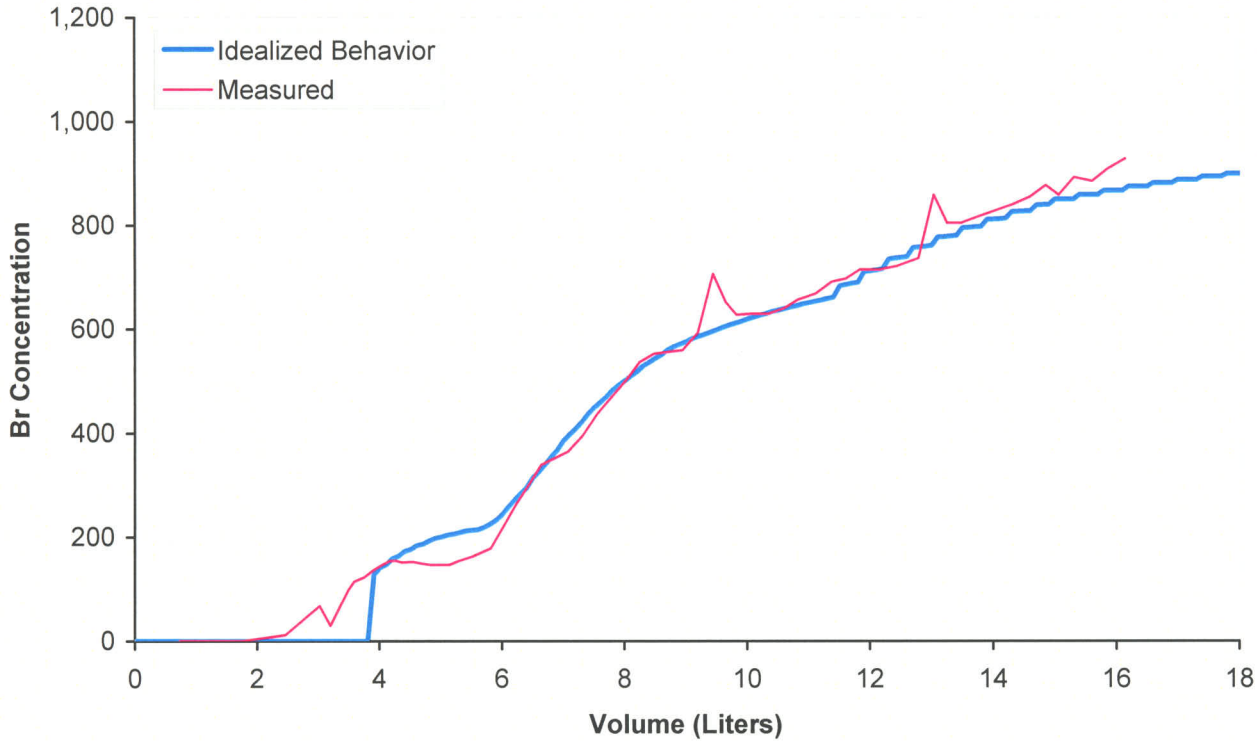
Bromide tracer results with idealized calibrated breakthrough for the SCC.

**Figure**
6

JM o:\Olin\DAPL Report 11-04\FM Bromide.xls

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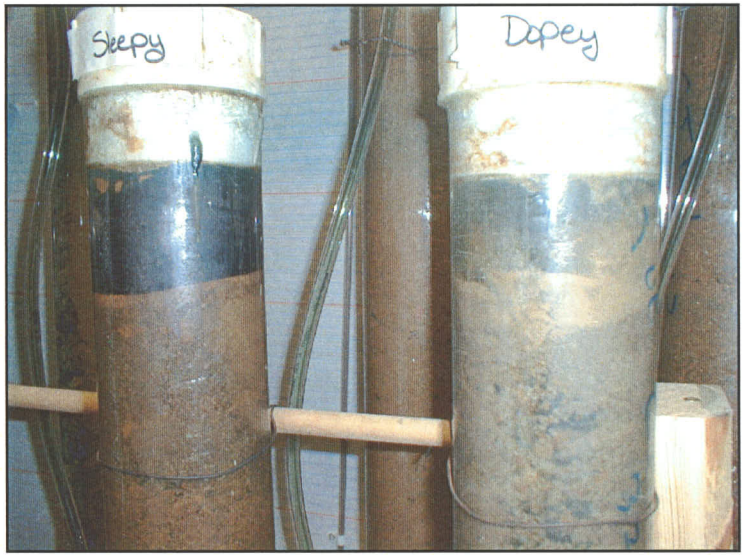
Bromide breakthrough and ideal model of bromide breakthrough for the LCC.

**Figure**
7

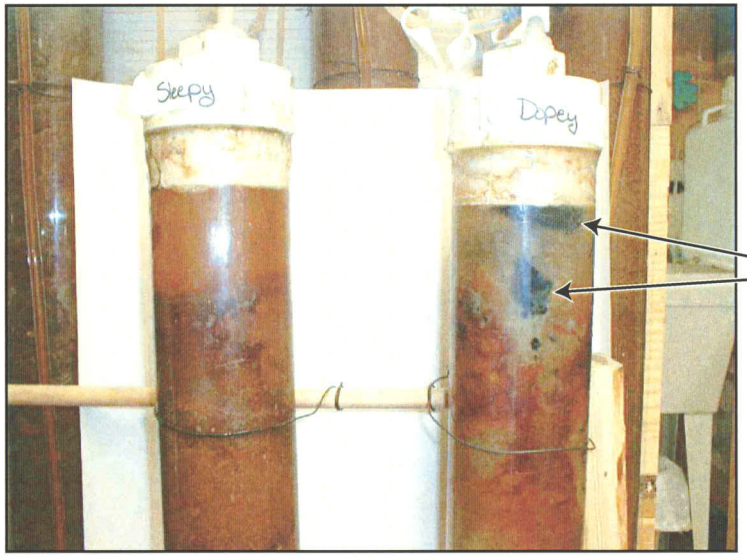
JM o:\Olin\DAPL Report 11-04\SD pore volume calcs calibration.xls

a)




b)

c)

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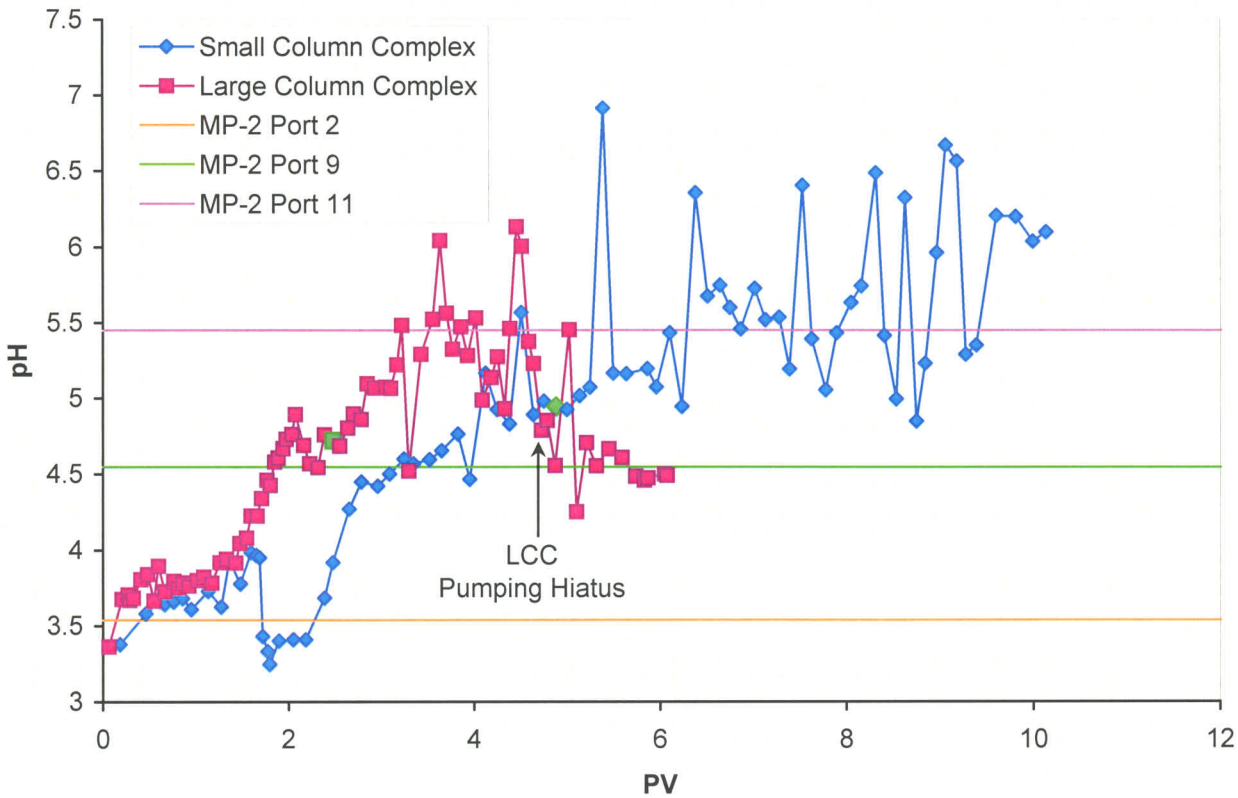
Photos of the LCC columns Sleepy and Dopey a) at the start of the column test, b) after ~1 pore volume, and c) at the end of the flushing hiatus.

**Figure**
8

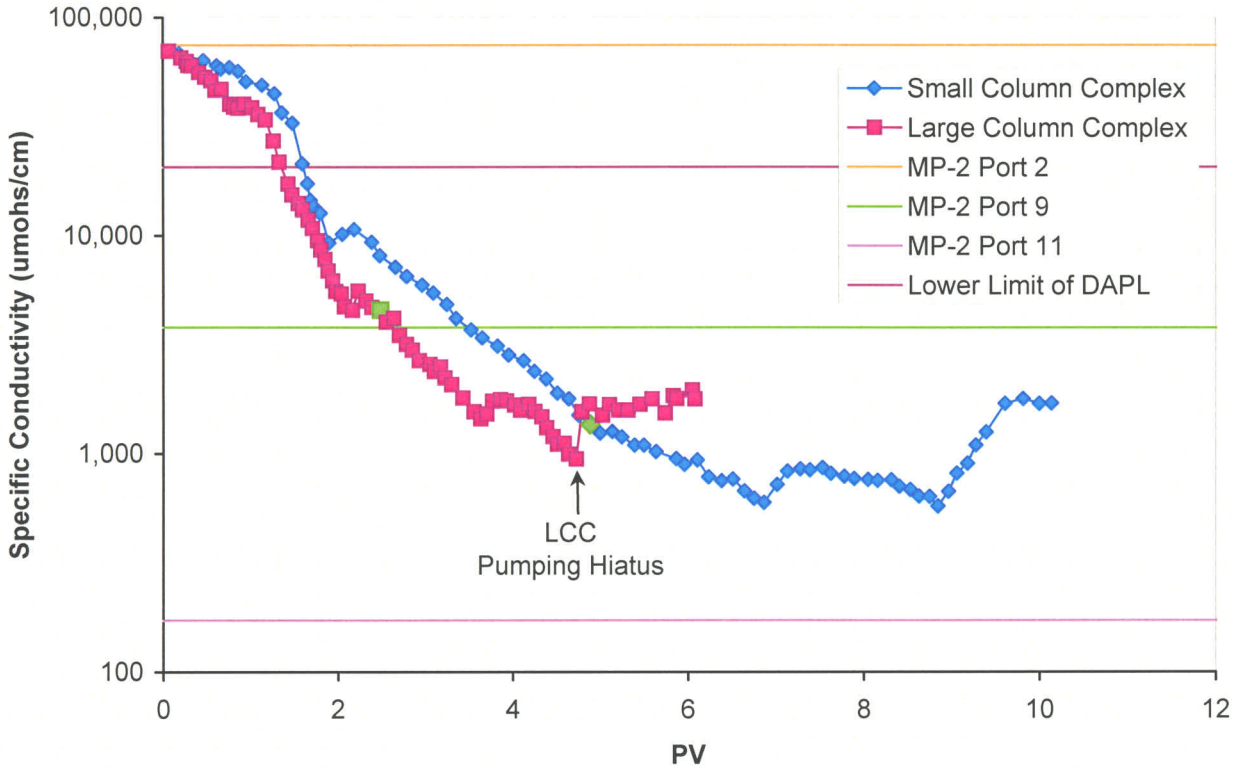
JM o:\Olin\DAPL Report 11-04\Sleepy Dopey.ai




Note: green point indicates the last data point in previous document (Geomega 2004).

| | | |
|---|---|---|
| GEOMEGA<br>12/3/04<br>C03303F<br>Olin | pH in effluent from the LCC and SCC. | **Figure**<br>9 |

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls




Note: green point indicates the last data point in previous document (Geomega 2004).

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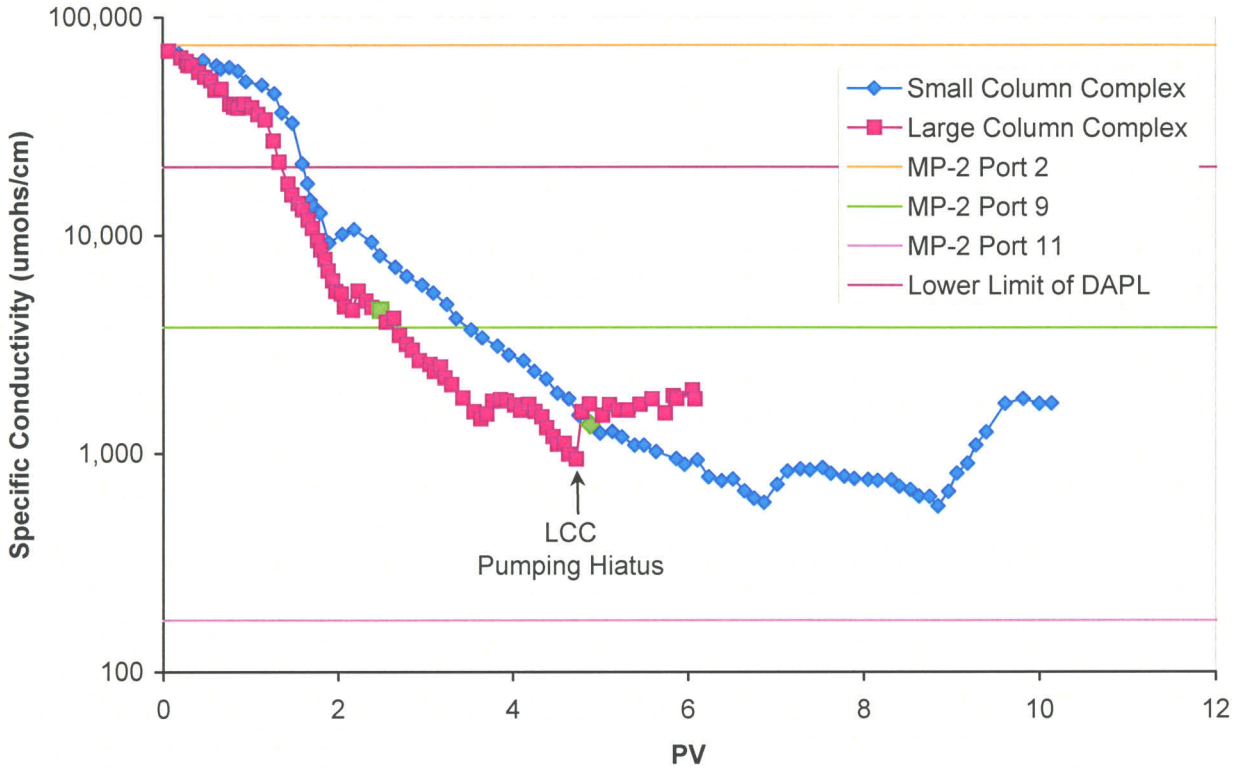
Specific conductivity in effluent from the LCC and SCC.

**Figure**
10

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls




Note: green point indicates the last data point in previous document (Geomega 2004).

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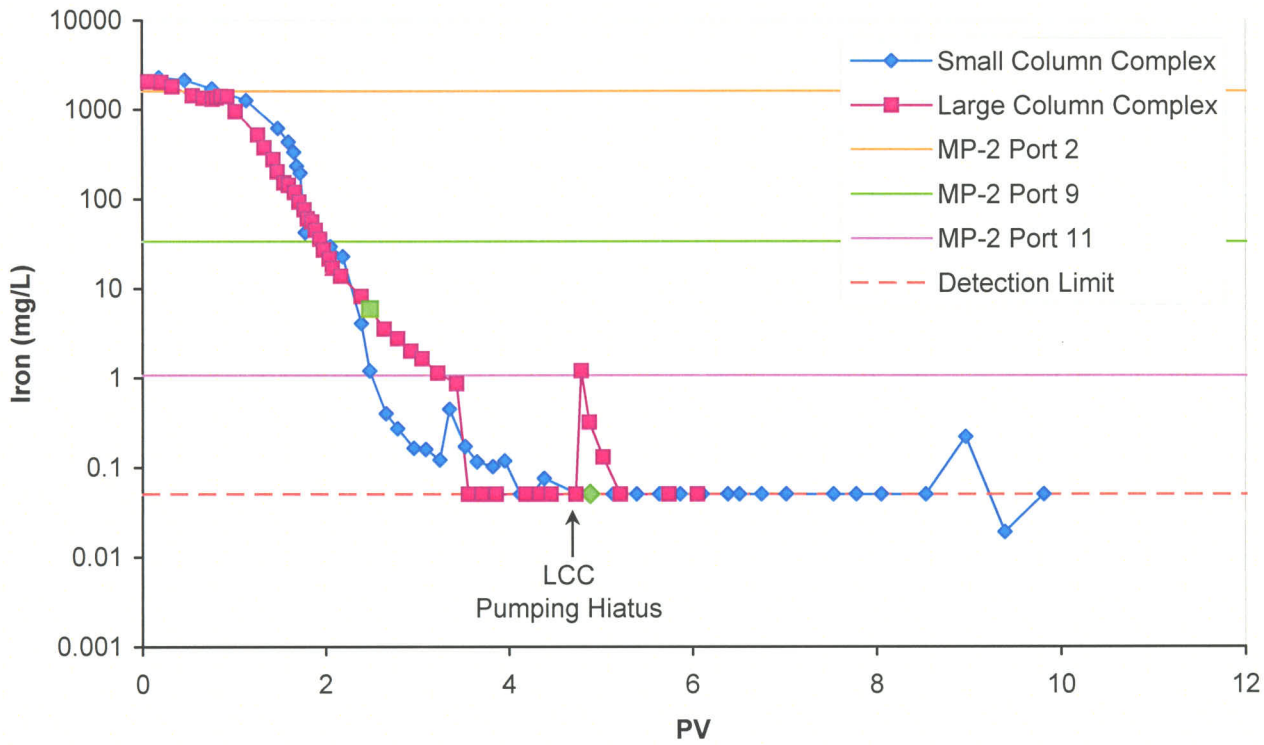
Specific conductivity in effluent from the LCC and SCC.

**Figure**
10

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls




Note: green point indicates the last data point in previous document (Geomega 2004).

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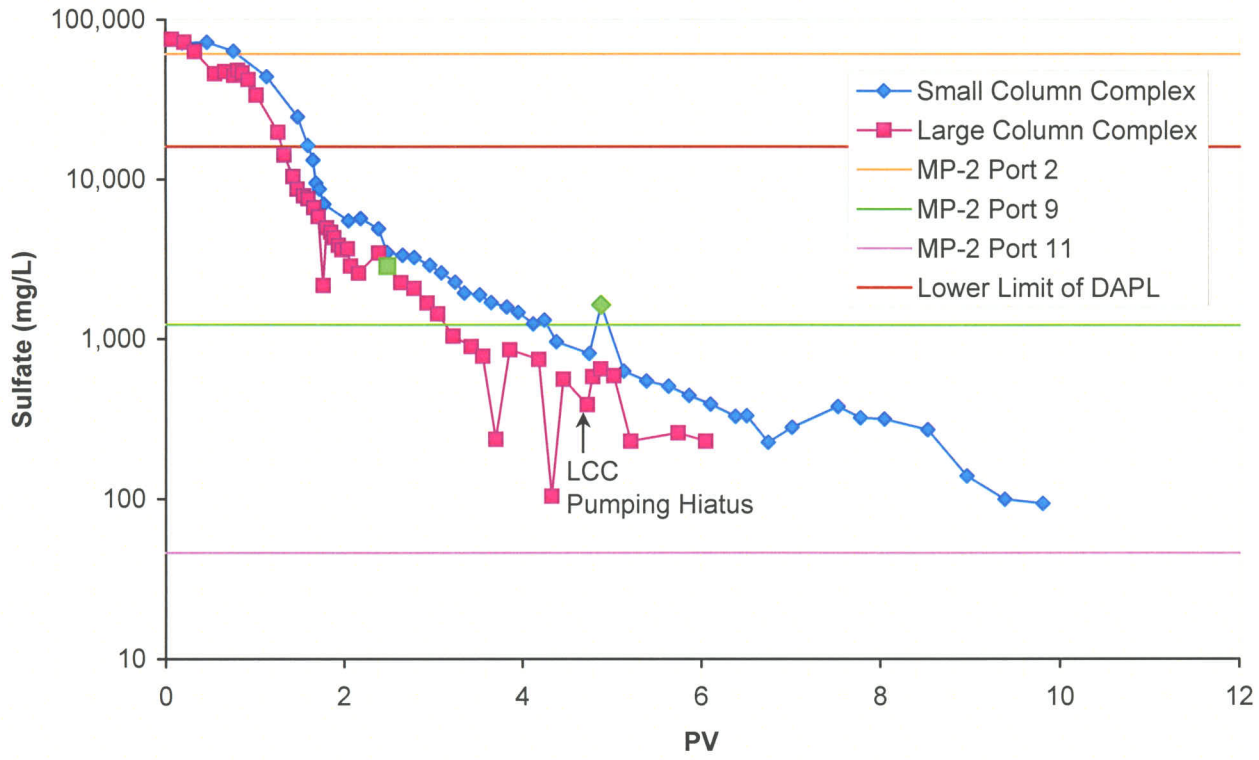
Iron concentration in effluent from the LCC and SCC.

**Figure**
11

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls




Note: green point indicates the last data point in previous document (Geomega 2004).

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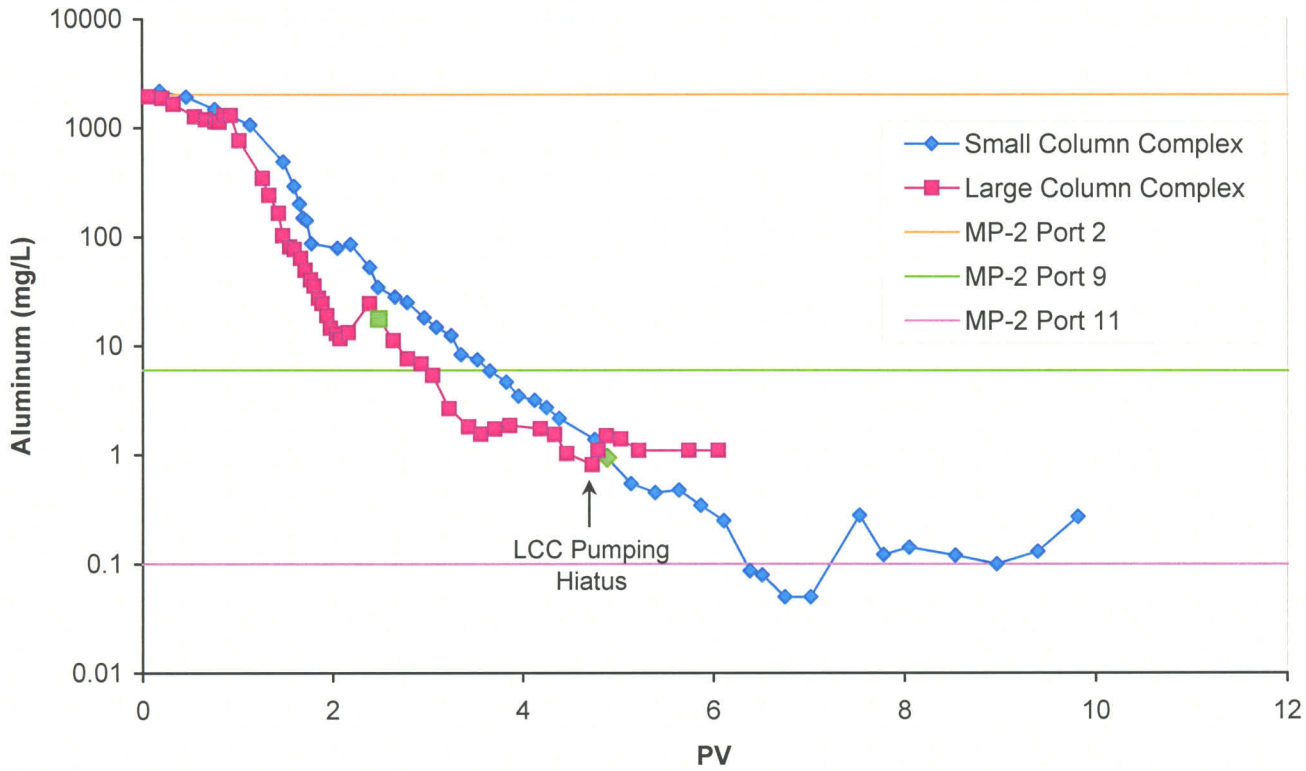
Sulfate concentration in effluent from the LCC and SCC.

**Figure**
12

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls




Note: green point indicates the last data point in previous document (Geomega 2004).

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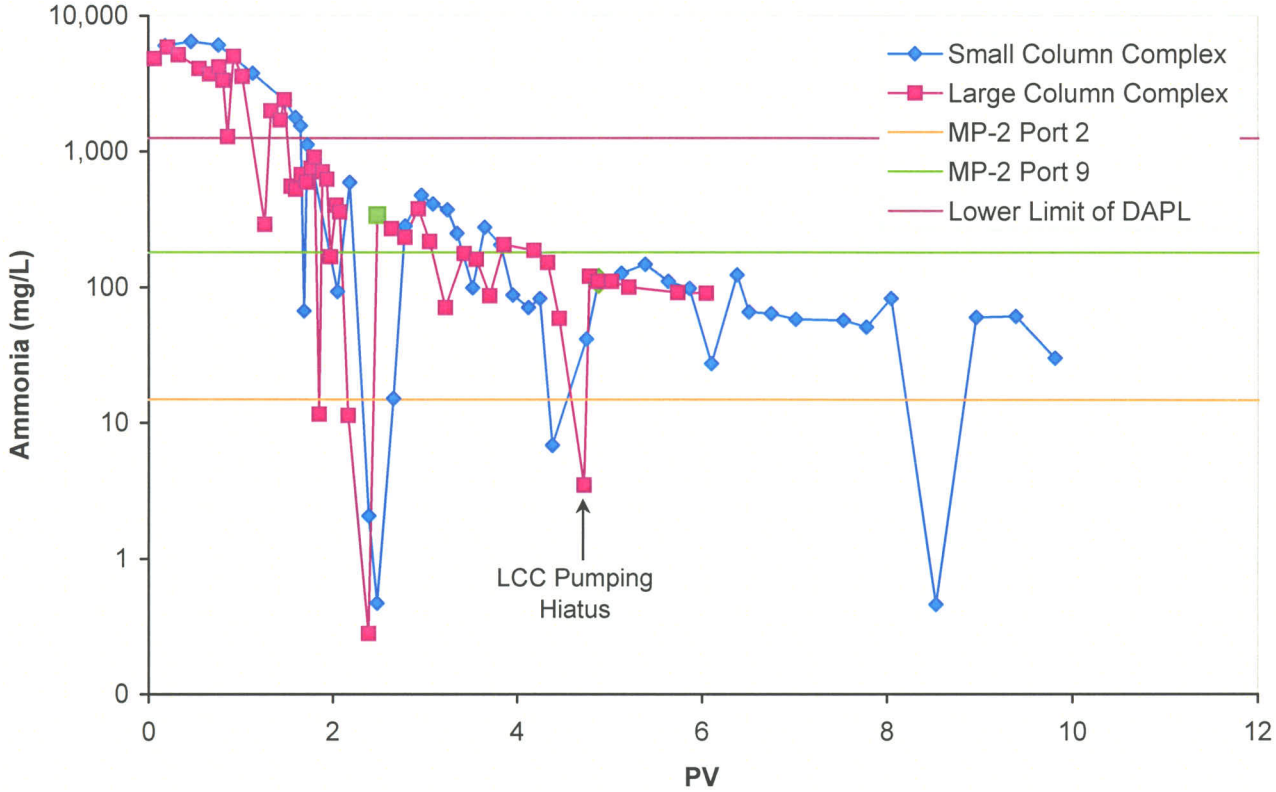
Aluminum concentration in effluent from the LCC and SCC.

**Figure**
13

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls




Note: green point indicates the last data point in previous document (Geomega 2004).

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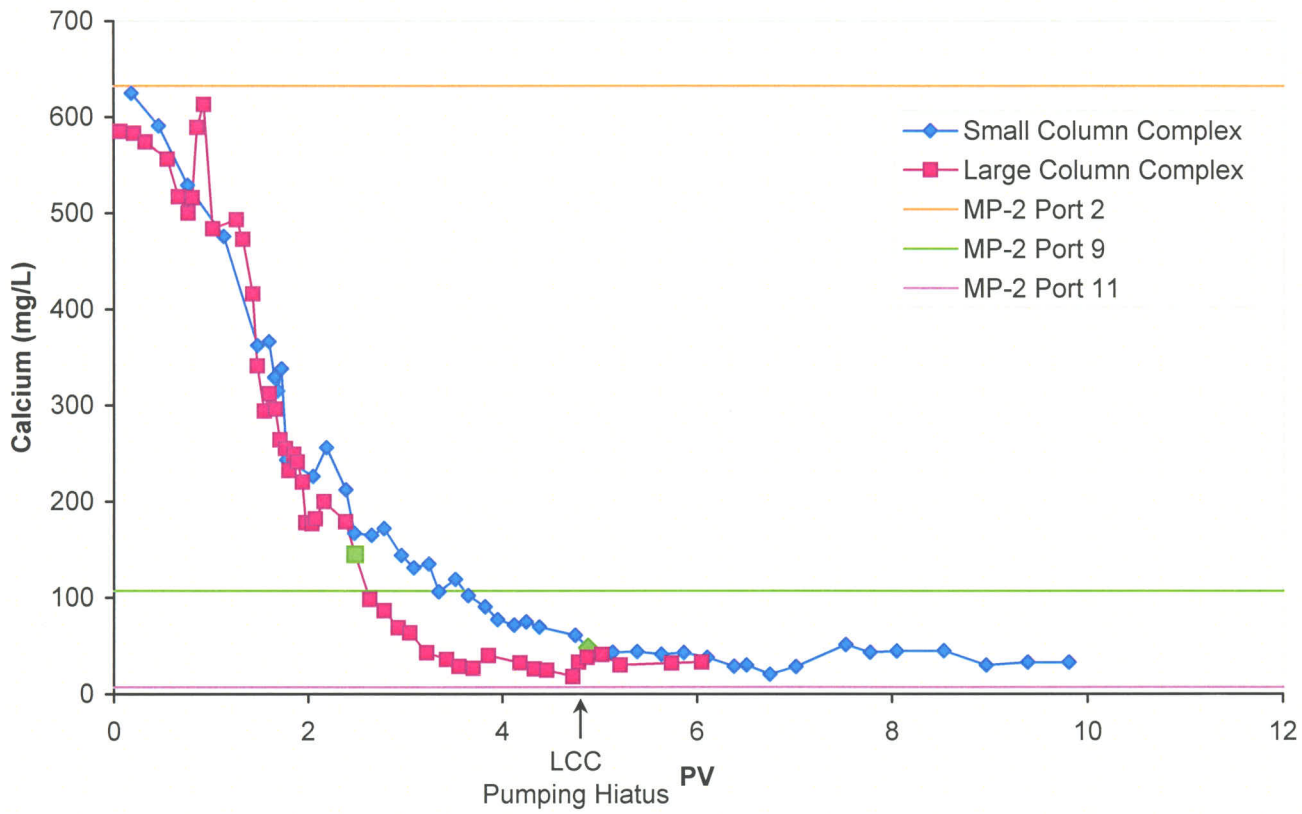
Ammonia concentration in effluent from the LCC and SCC.

**Figure**
14

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls




Note: green point indicates the last data point in previous document (Geomega 2004).

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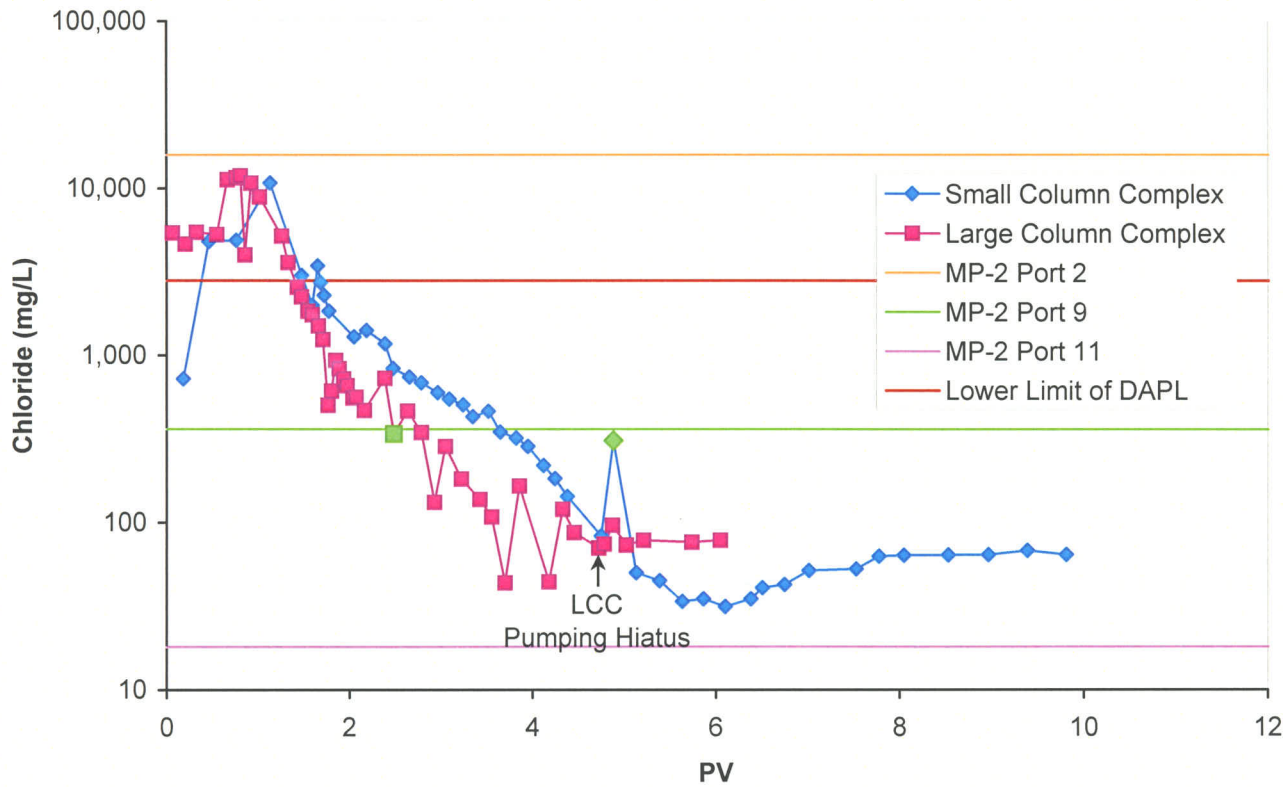
Calcium concentration in effluent from the LCC and SCC.

**Figure**
15

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls




Note: green point indicates the last data point in previous document (Geomega 2004).

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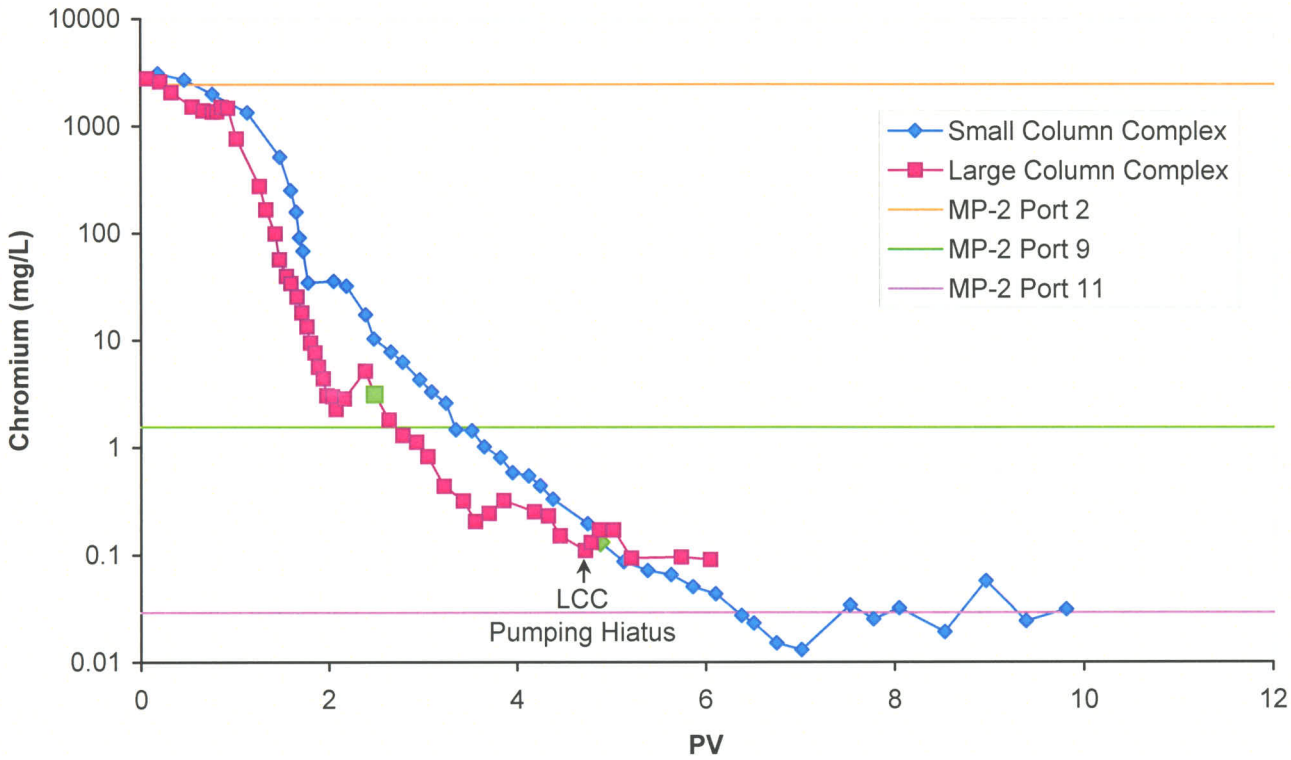
Chloride concentration in effluent from the LCC and SCC.

**Figure**
16

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls




Note: green point indicates the last data point in previous document (Geomega 2004).

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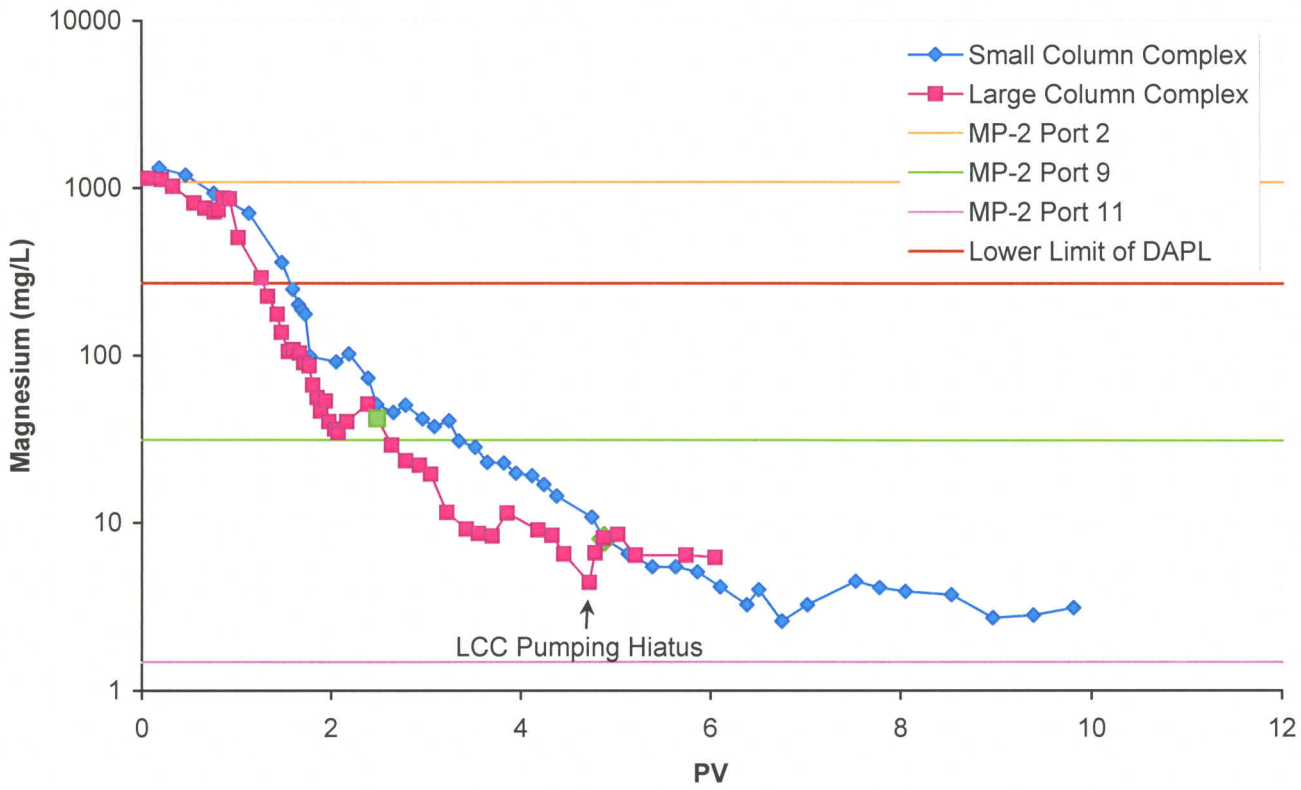
Chromium concentration in effluent from the LCC and SCC.

**Figure**
17

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls




Note: green point indicates the last data point in previous document (Geomega 2004).

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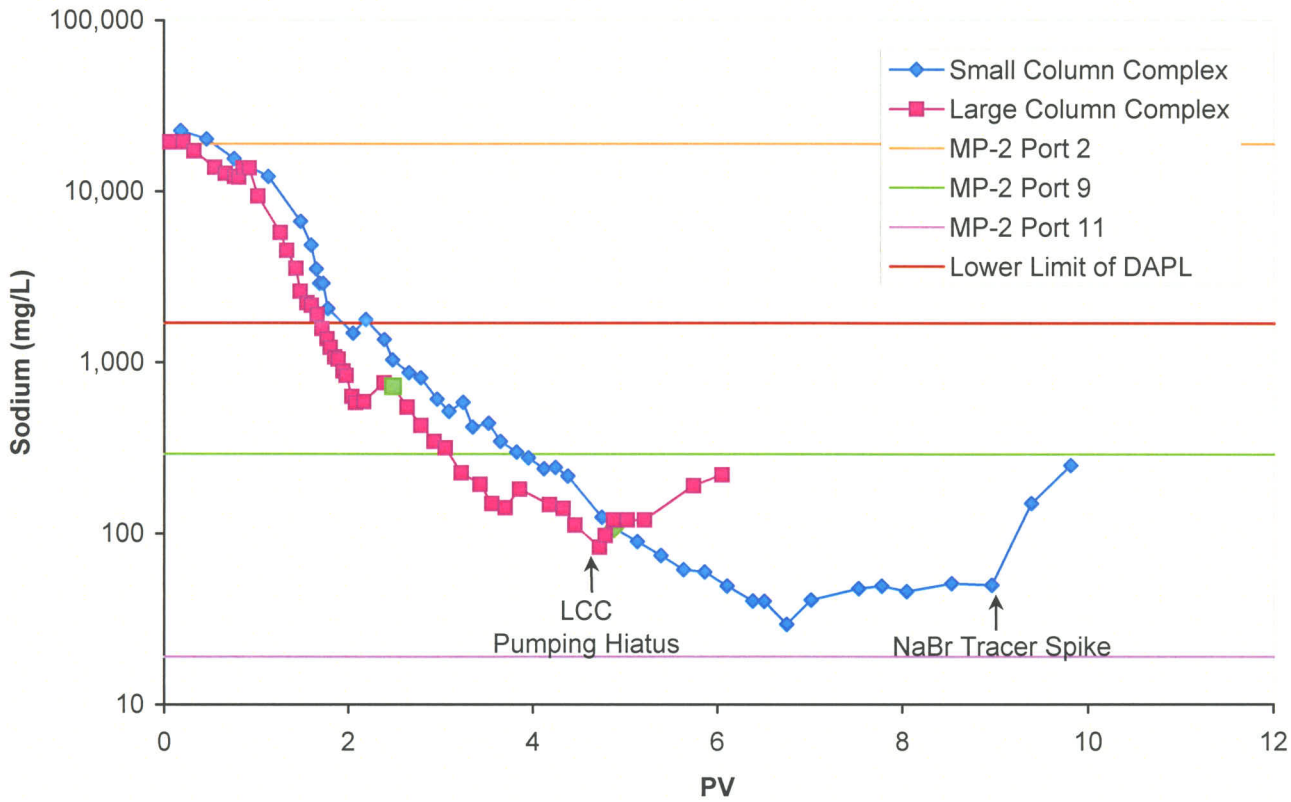
Magnesium concentration in effluent from the LCC and SCC.

**Figure**
18

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls




Note: green point indicates the last data point in previous document (Geomega 2004).

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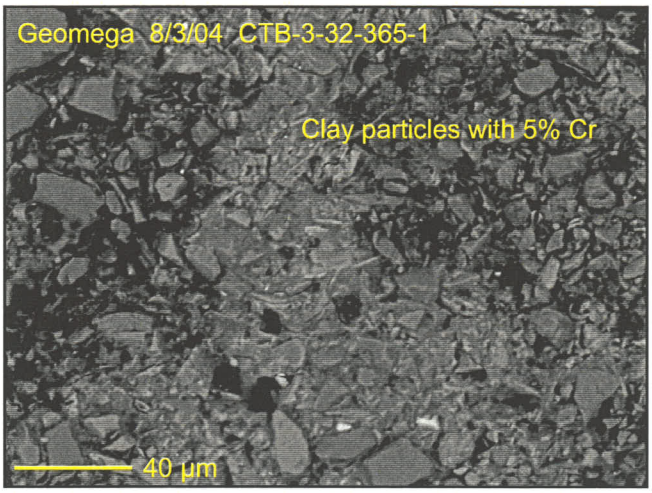
Sodium concentration in effluent from the LCC and SCC.

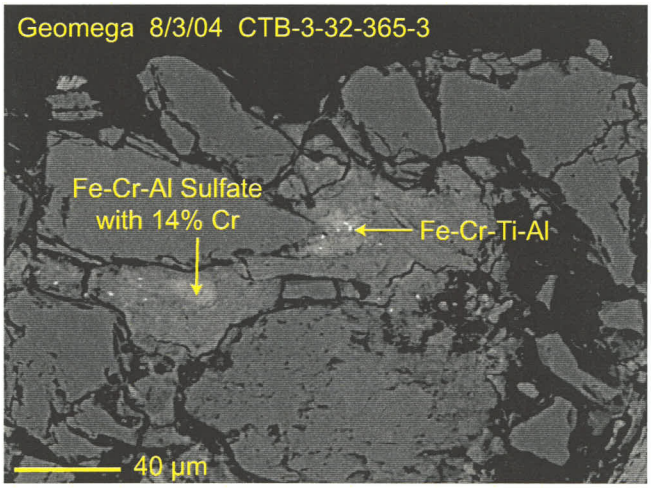
**Figure**
19

JM o:\Olin\DAPL Report 11-04\column_testing_data figures.xls

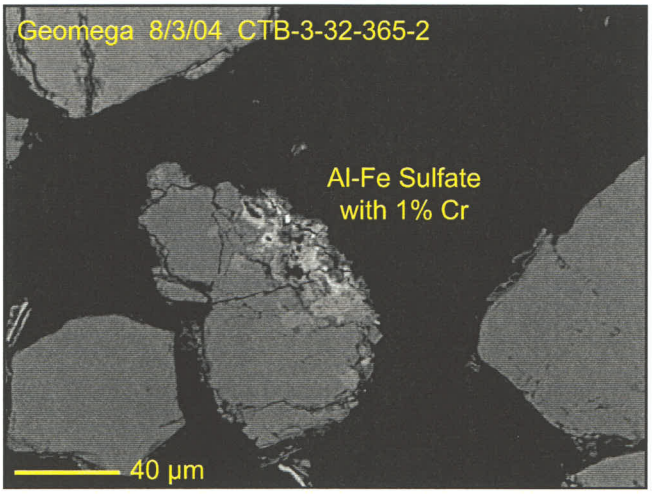
a)




b)




c)

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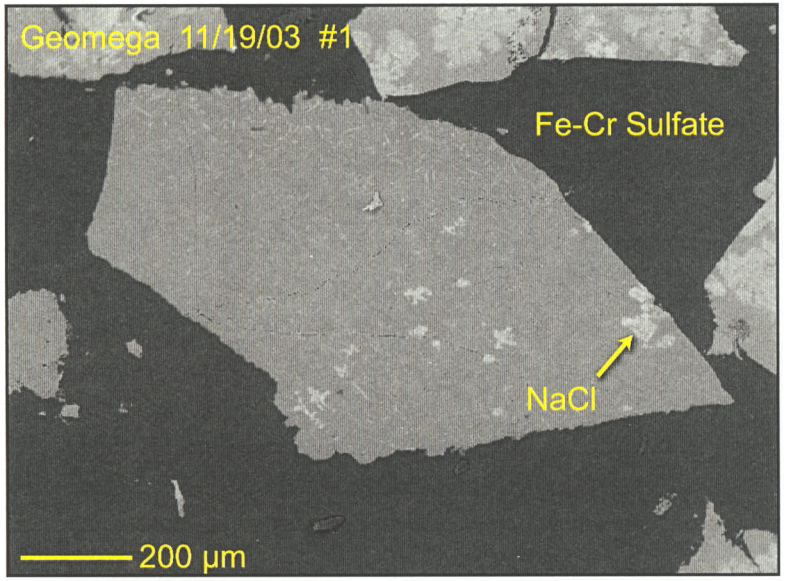
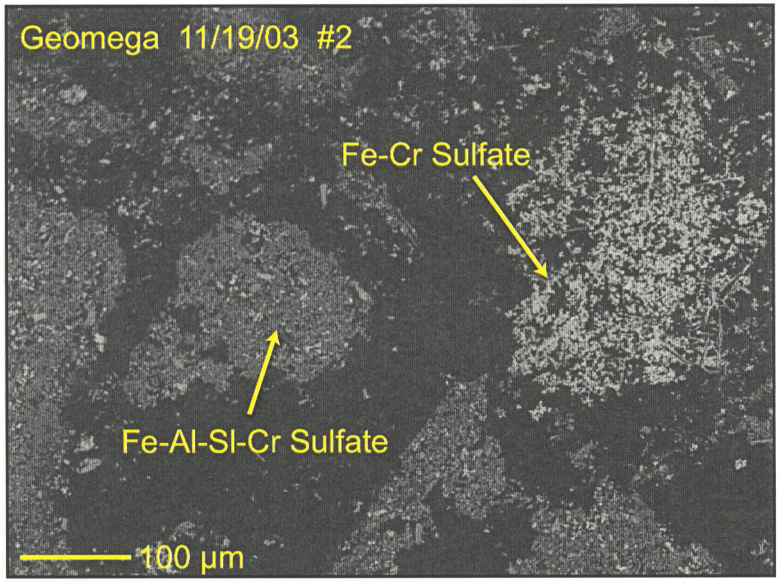
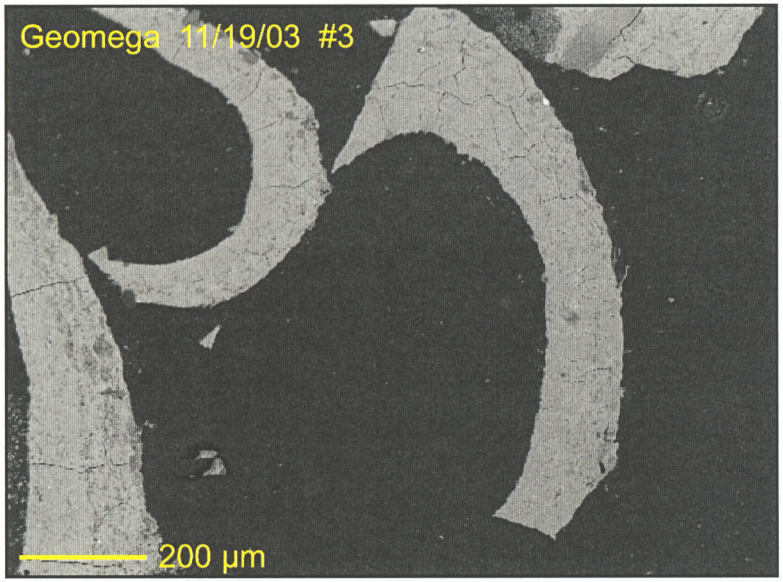
Fe-Cr-Al sulfate cements found in DAPL saturated aquifer material prior to flushing.

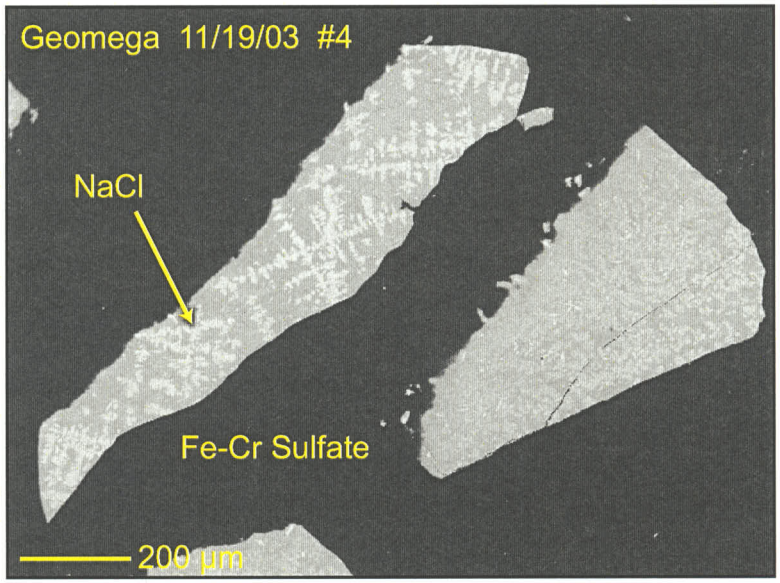
**Figure**
20

JM o:\Olin\DAPL Report 11-04\Prior to Flushing.ai

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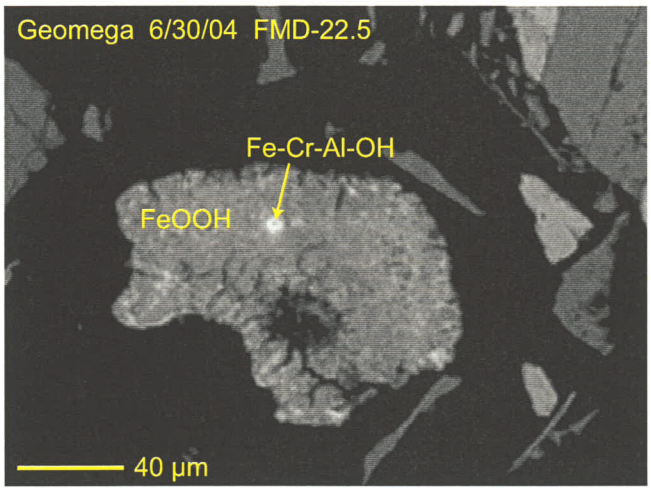
Precipitates (primarily iron, chromium, and aluminum sulfates) collected from intra-column plumbing from the large column complex.

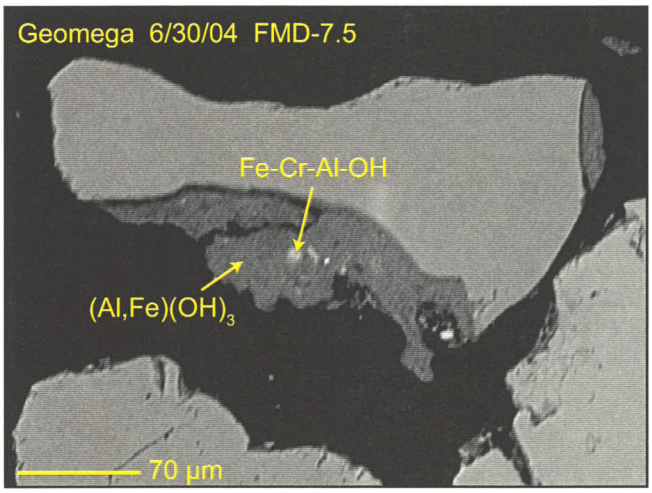
**Figure**
21

JM o:\Olin\DAPL Report 11-04\Micro Photos.ai

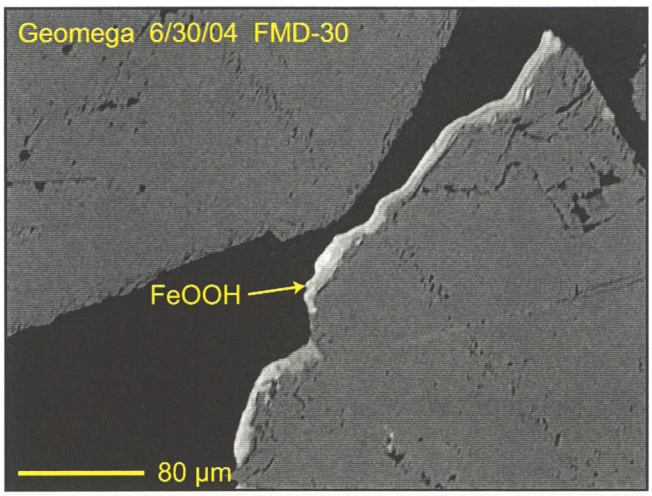
a)




b)

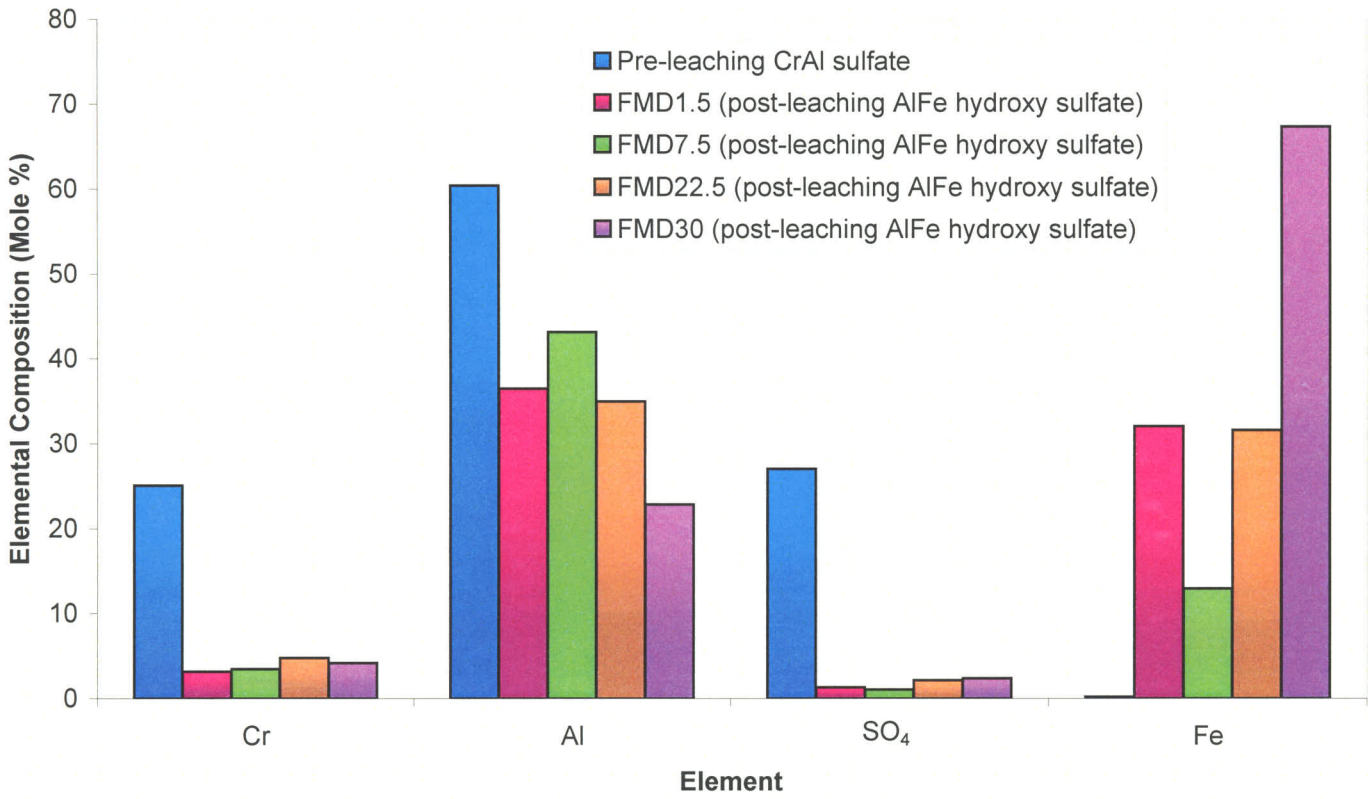



c)




| | | |
|---|---|---|
| GEOMEGA<br>12/1/04<br>C03303F<br>Olin | Post-flushing Fe and Al cements. Sulfate and Cr have largely (though not entirely) been removed during flushing. | **Figure**<br>22 |

JM o:\Olin\DAPL Report 11-04\Post Flushing.ai

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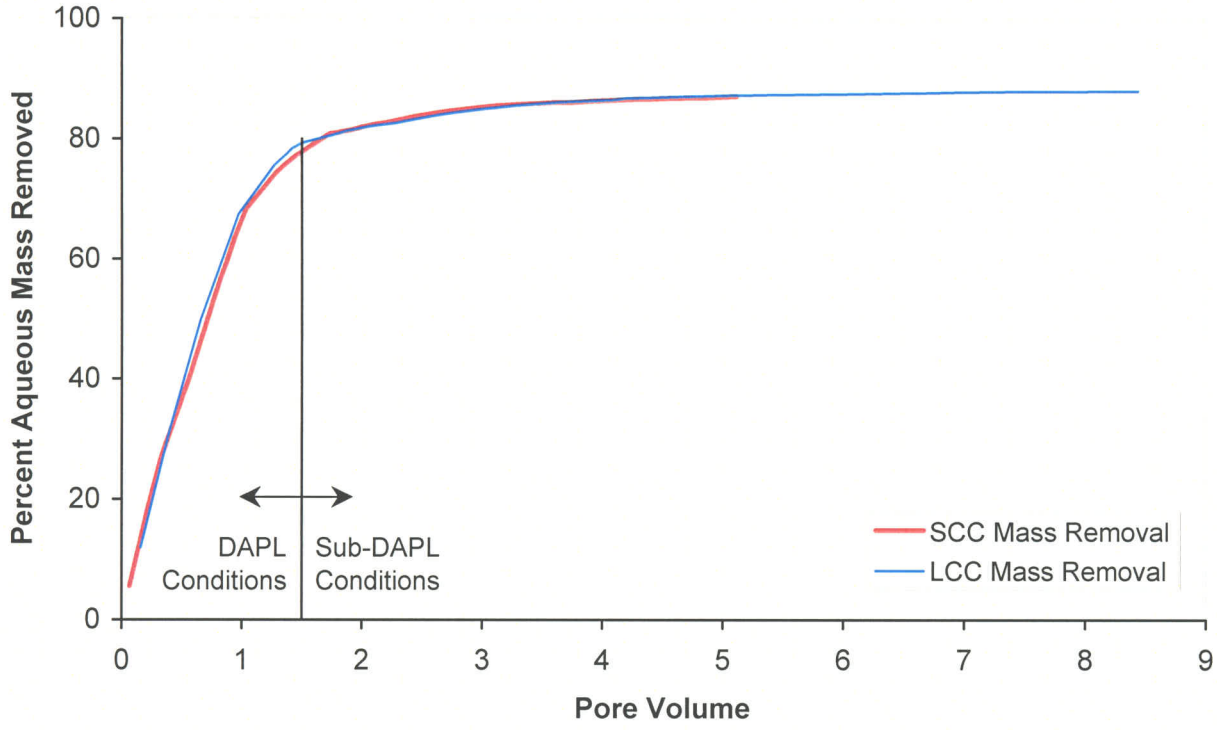
Elemental composition of precipitate materials in the column tests.

**Figure**
23

JM o:\Olin\DAPL Report 11-04\microprobe results.xls

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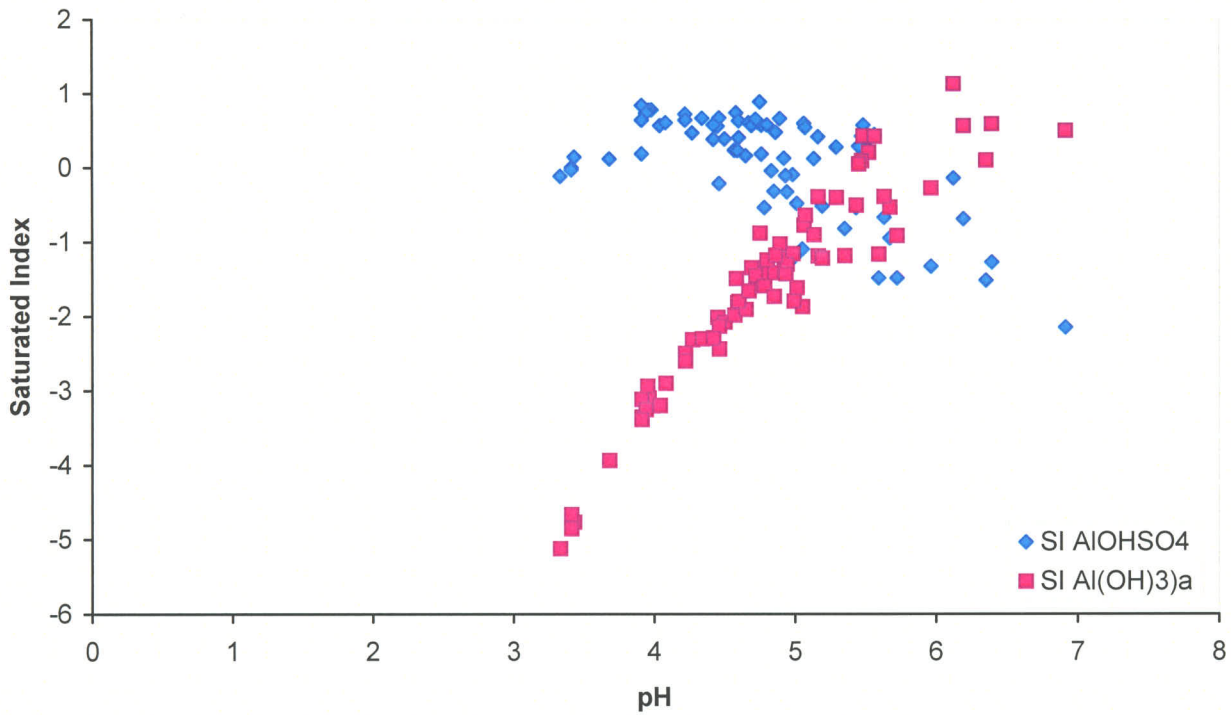
Percent aqueous net sum of Cr, $NH_3$, Cl, and $SO_4$ removed in the SCC and LCC.

**Figure**
24

JM O:\Olin\DAPL Report 11-04\Column Mass Balances.xls

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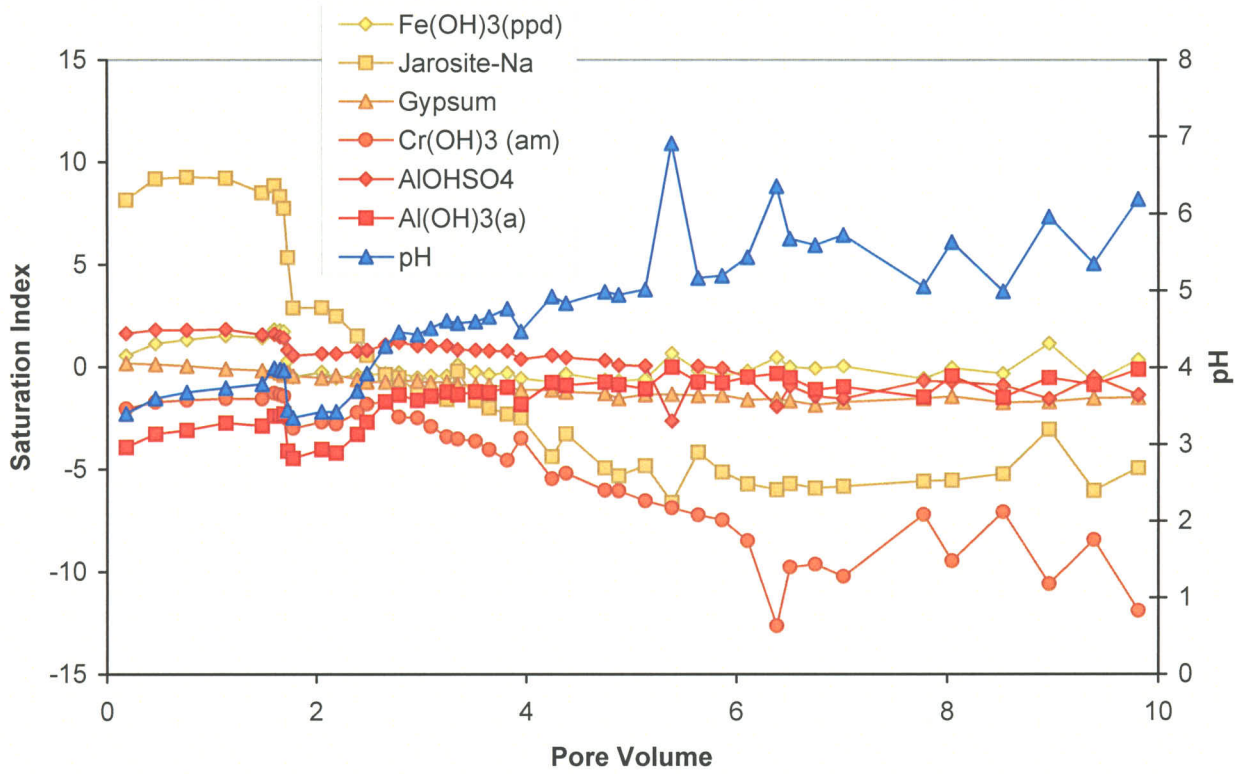
Saturation index of aluminum minerals as a function of pH in SCC and LCC column effluents.

**Figure**
25

JM o:\Olin\DAPL Report 11-04\GWBresults_xtab.xls

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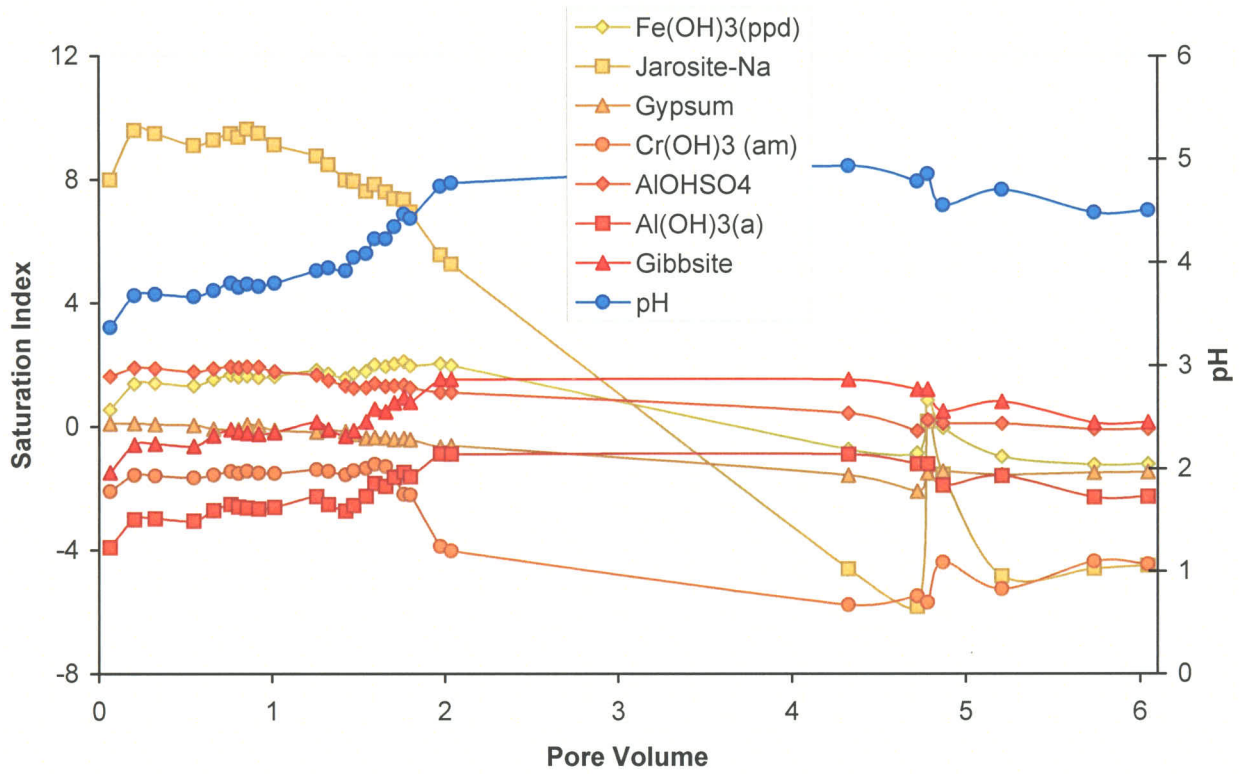
Evolution of iron mineral saturation states in SCC effluent.

**Figure**
26

JM O:\Olin\DAPL Report 11-04\Column_GWB_speciationResults_xtab_wFe31.xls

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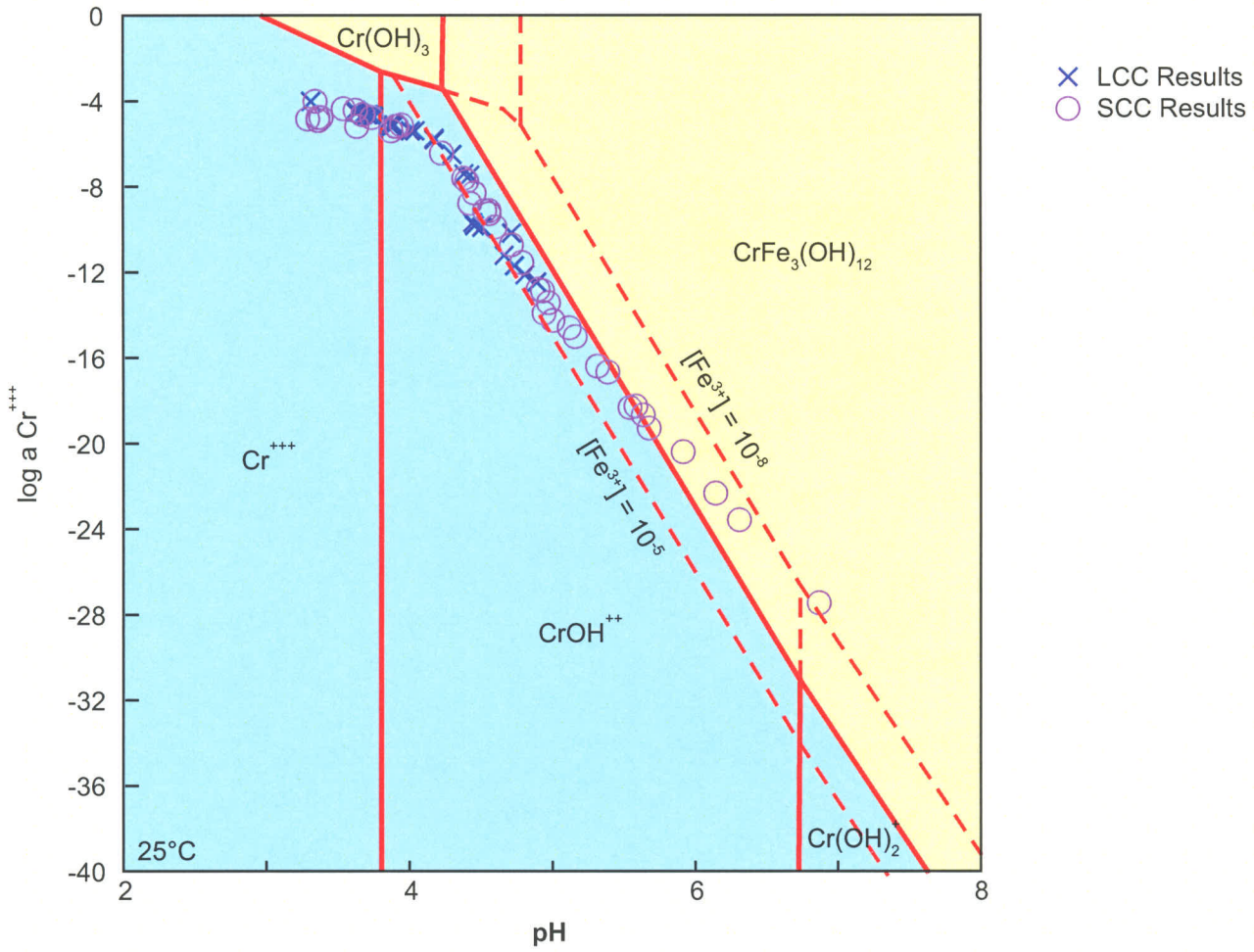
Evolution of iron mineral saturation states in LCC effluent.

**Figure**
27

JM O:\Olin\DAPL Report 11-04\Column GWB speciationResults xtab wFe31.xls

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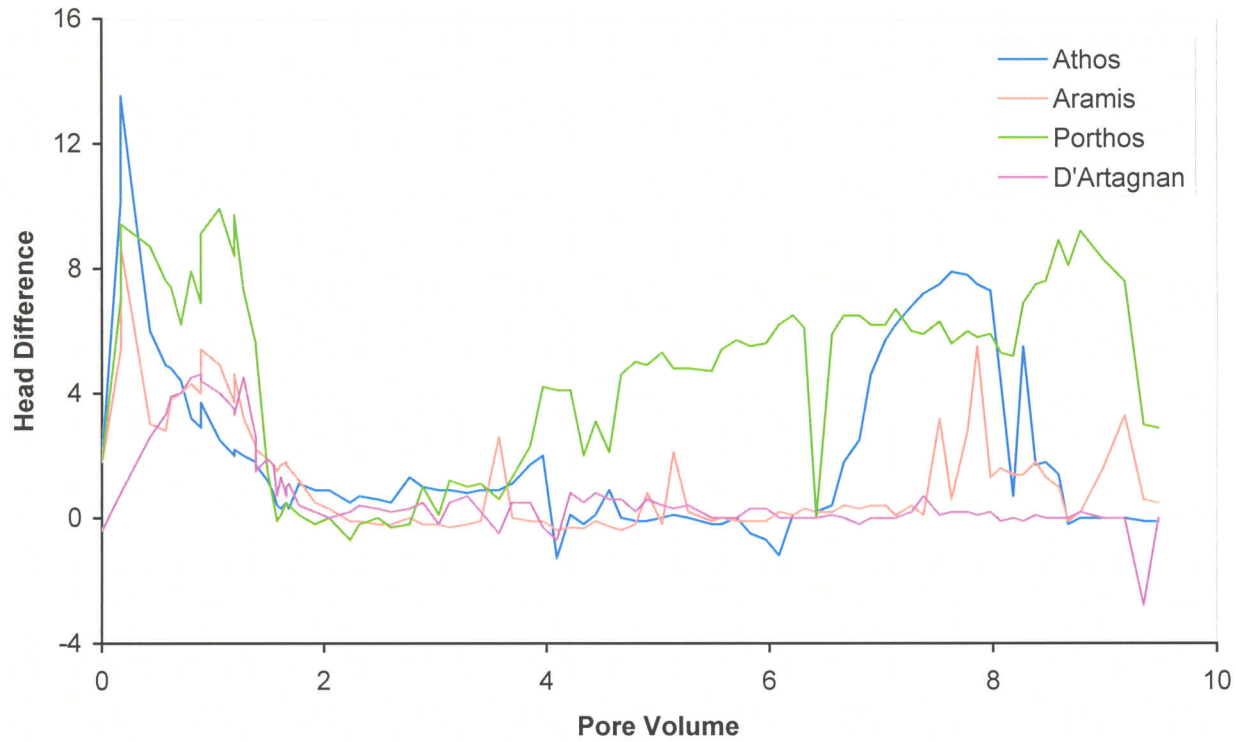
Calculated activity of chromium from geochemical speciation modeling plotted on a Cr(III) solubility diagram with $Fe^{+++}$ present at an activity of $10^{-6}$.

**Figure**
28

JM o:\Olin\DAPL Report 11-04\cr solubility plot.ai

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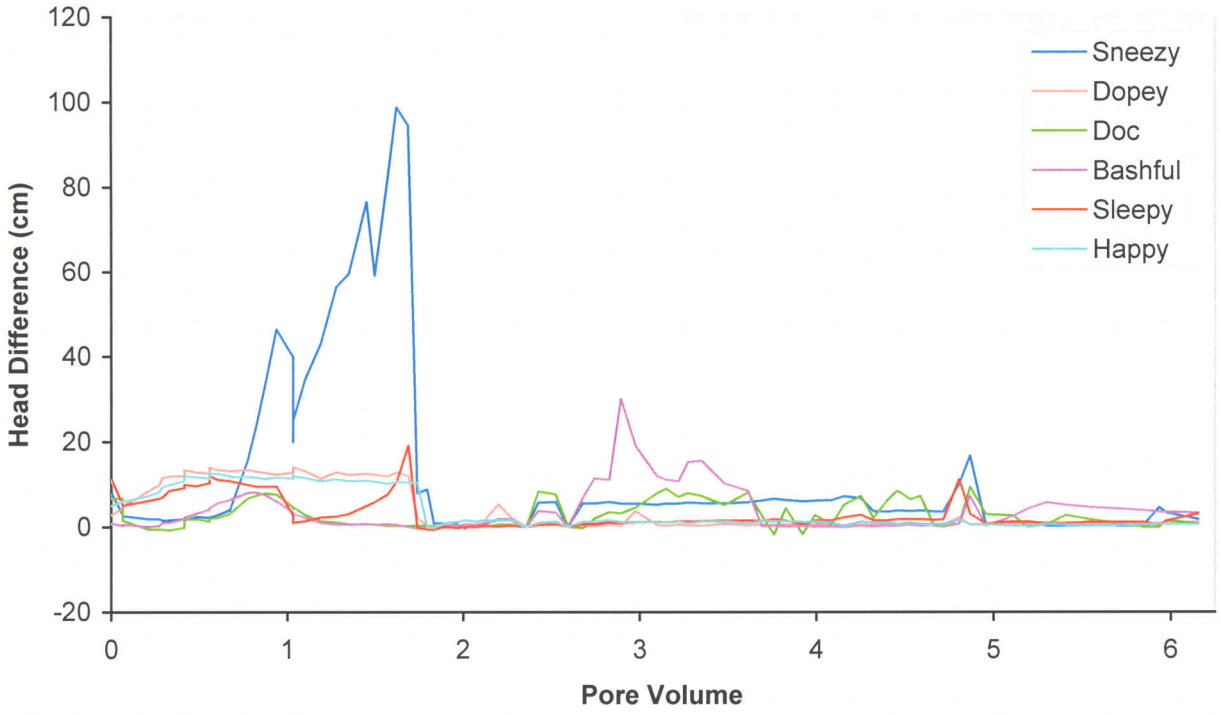
Manometer head difference in the SCC column set.

**Figure**
29

JM O:\Olin\DAPL Report 11-04\Manometer figures.xls




GEOMEGA

12/3/04

C03303F
Olin

Manometer head difference in the LCC column set.

**Figure**
30

JM O:\Olin\DAPL Report 11-04\Manometer figures.xls

# Appendix A

MACTEC

Engineering and Consulting, Inc.
511 Congress Street
P.O. Box 7050
Portland, Maine 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow

From: Chris Ricardi

Date: 11/24/03

Subject: Olin Wilmington – Core Samples

**Data Validation Summary**
**STL Data Set 208072**

This sample set contained results for three water samples identified as Core #1, Core #2, and Core #3 and two soil sample identified as Core #1S and Core #2S. The samples were generated during laboratory tests on June 26, 2003 and analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for selected metals (calcium, aluminum, iron, magnesium, sodium, and chromium) and chemistry parameters including chloride, sulfate, nitrate, nitrite, and ammonia.

The Olin Wilmington QAPP was used as a reference during the review. Metals results were reviewed using the Data Quality Evaluation checklists that were developed for the Olin Wilmington annual and quarterly groundwater monitoring tasks.

**Validation Actions**

With the exception of the items discussed below, results are interpreted to be usable as reported by the laboratory.

The nitrate and nitrite analysis for sample Core #2S (208072-5) was performed one day outside of analytical hold time. Results for nitrate and nitrite in sample Core #2S (208072-5) was qualified estimated (J).

The wet chemistry MS and MS reanalysis percent recoveries for ammonia (0 and 38) are less than the lower control limit. Ammonia was present at a concentration of approximately 2X the spike concentration. Good recovery was reported in the laboratory control sample (LCS) associated with this sample batch indicating that the low recovery was due to a matrix effect. Results for ammonia in the unspiked sample Core #1S (208072-4 is qualified estimated (J).



SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

Revised Results for 208072-1,2,3 Are in this Package on 11/25/03

August 15, 2003

Report Number: 208072

**REVISED**

Dear Alan Peirce,

The revised report for Report Number 208072 is now complete. This revision corrects a transcription error entered into our LIMS database. The transcription error affected both the Metals sample results and reporting limits.

If you should have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

A part of Severn Trent plc

Severn Trent Laboratories, Inc.
STL Westfield • 53 Southampton Road, Westfield, MA 01085
Tel 413 572 4000 Fax 413 572 3707 • www.stl-inc.com

SEVERN

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

07/21/2003

Report Number: 208072

Dear Alan Peirce,

The analysis of your sample(s) submitted on 06/27/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 32


rn Trent Laboratories, Inc.
Westfield • 53 Southampton Road, Westfield, MA 01085
413 572 4000 Fax 413 572 3707 • www.stl-inc.com



A part of Severn Trent plc


## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 208072 |
| Project Location: | Off Property West DI | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

208072 1-5

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( X ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, and C is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes | No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes | No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data? | Yes | No[1] |

**A response to questions D and E below is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| D | Were all QC performance standards and recommendations for the specified methods achieved? | Yes | No[1] |
| E | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes | No[1] |

[1] All NO answers must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 7/22/03

CASE NARRATIVE

Client: Olin Chemical

Report Number: 208072

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

Samples were received on 06/27/03 properly preserved, on ice and in good condition.

**Metals**

**SW846 6010B**

An aqueous matrix was used for both the soil method blank and LCS. A closing ICSA/AB was not performed at the end of the analytical run. The opening ICSA/AB for each instrument run passed with acceptable control criteria.
No other reportable deviations were noted. Per client request, an abridged element list was reported.

The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).

**Inorganic**

**Nitrate**
No reportable deviations

**Nitrite**
No reportable deviations

**Sulfate**
No reportable deviations

**Chloride**
No reportable deviations

**Ammonia**
No reportable deviations

**Subcontracted**

The Specific Gravity [Hydrometer @25] analysis was performed at STL Chicago.



SAMPLE INFORMATION
Date: 07/21/2003

Job Number.: 208072
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001271
Customer Project ID....: OFF PROPERTY WEST DI
Project Description....: Off Property West Ditch

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 208072-1 | Core #1 | Water | 06/26/2003 | 16:00 | 06/27/2003 | 11:00 |
| 208072-2 | Core #2 | Water | 06/26/2003 | 16:00 | 06/27/2003 | 11:00 |
| 208072-3 | Core #3 | Water | 06/26/2003 | 16:00 | 06/27/2003 | 11:00 |
| 208072-4 | Core #1S | Soil | 06/26/2003 | 16:00 | 06/27/2003 | 11:00 |
| 208072-5 | Core #2S | Soil | 06/26/2003 | 16:00 | 06/27/2003 | 11:00 |

# LABORATORY TEST RESULTS

Job Number: 208072 Date: 08/15/2003

CUSTOMER: Olin Chemical PROJECT: OFF PROPERTY WEST DI ATTN: Alan Peirce

Customer Sample ID: Core #1
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Water

Laboratory Sample ID: 208072-1
Date Received.....: 06/27/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 9620 | | 1000 | mg/L | 07/02/03 | rwe |
| EPA300.0 PartA | Sulfate | 38500 | | 2000 | mg/L | 07/02/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 10 | mg/L | 06/28/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 2.0 | mg/L | 06/28/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 3280 | | 20 | mg/L | 07/07/03 | kmm |
| SW846 6010B | Metals Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 330000 | | 40000 | ug/L | 07/11/03 | bpg |
| | Iron (Fe) | 1160000 | | 20000 | ug/L | 07/11/03 | bpg |
| | Magnesium (Mg) | 638000 | | 40000 | ug/L | 07/11/03 | bpg |
| | Sodium (Na) | 11400000 | | 400000 | ug/L | 07/11/03 | bpg |
| SW846 6010B MC | Metals Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 1410000 | | 1000 | ug/L | 07/08/03 | bpg |
| SW846 6010B | Metals Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 1090000 | | 10000 | ug/L | 07/08/03 | bpg |

* In Description = Dry





# LABORATORY TEST RESULTS

Job Number: 208072 Date: 08/15/2003

CUSTOMER: Olin Chemical PROJECT: OFF PROPERTY WEST DI ATTN: Alan Peirce

Customer Sample ID: Core #2
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Water

Laboratory Sample ID: 208072-2
Date Received.....: 06/27/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 10700 | | 1000 | mg/L | 07/02/03 | rwe |
| EPA300.0 PartA | Sulfate | 42000 | | 2000 | mg/L | 07/02/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 10 | mg/L | 06/28/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 2.0 | mg/L | 06/28/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 4020 | | 20 | mg/L | 07/07/03 | kmm |
| SW846 6010B | Metals Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 334000 | | 40000 | ug/L | 07/11/03 | bpg |
| | Iron (Fe) | 1190000 | | 20000 | ug/L | 07/11/03 | bpg |
| | Magnesium (Mg) | 642000 | | 40000 | ug/L | 07/11/03 | bpg |
| | Sodium (Na) | 11500000 | | 400000 | ug/L | 07/11/03 | bpg |
| SW846 6010B MC | Metals Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 1420000 | | 1000 | ug/L | 07/08/03 | bpg |
| SW846 6010B | Metals Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 1100000 | | 10000 | ug/L | 07/08/03 | bpg |

* In Description = Dry Wgt.

LABORATORY TEST RESULTS

Job Number: 208072 Date: 08/15/2003

CUSTOMER: Olin Chemical PROJECT: OFF PROPERTY WEST DI ATTN: Alan Peirce

Customer Sample ID: Core #3
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Water

Laboratory Sample ID: 208072-3
Date Received.....: 06/27/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 21500 | | 670 | mg/L | 07/02/03 | rwe |
| EPA300.0 PartA | Sulfate | 84000 | | 2700 | mg/L | 07/02/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 17 | mg/L | 06/28/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 3.3 | mg/L | 06/28/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 6360 | | 67 | mg/L | 07/07/03 | kmm |
| SW846 6010B | Metals Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 656000 | | 13300 | ug/L | 07/11/03 | bpg |
| | Iron (Fe) | 2320000 | | 6670 | ug/L | 07/11/03 | bpg |
| | Magnesium (Mg) | 1240000 | | 13300 | ug/L | 07/11/03 | bpg |
| | Sodium (Na) | 22400000 | | 133000 | ug/L | 07/11/03 | bpg |
| SW846 6010B MC | Metals Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 2980000 | | 3300 | ug/L | 07/16/03 | rac |
| SW846 6010B | Metals Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 2100000 | | 3340 | ug/L | 07/08/03 | bpg |

* In Description = Dry Wgt.





LABORATORY TEST RESULTS

Job Number: 208072 Date: 07/22/2003

CUSTOMER: Olin Chemical PROJECT: OFF PROPERTY WEST DI ATTN: Alan Peirce

Customer Sample ID: Core #1S
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Soil

Laboratory Sample ID: 208072-4
Date Received.....: 06/27/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride* | 1400 | | 10 | mg/Kg | 07/15/03 | rwe |
| EPA300.0 PartA | Sulfate* | 4810 | | 20 | mg/Kg | 07/15/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N)* | 7 | | 2 | mg/Kg | 07/02/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N)* | ND | U | 0.4 | mg/Kg | 07/02/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N* | 967 | | 44 | mg/Kg | 07/07/03 | kmm |
| % Solids 160.3 | % Solids | 99.4 | | 0.1 | % | 07/01/03 | grb |
| SW846 6010B | Metals Analysis (ICP) | | | | | | |
| | Calcium (Ca)* | 2840 | | 55.3 | mg/Kg | 07/16/03 | rac |
| | Iron (Fe)* | 21700 | | 27.7 | mg/Kg | 07/16/03 | rac |
| | Magnesium (Mg)* | 5400 | | 55.3 | mg/Kg | 07/16/03 | rac |
| | Sodium (Na)* | 2250 | | 553 | mg/Kg | 07/16/03 | rac |
| SW846 6010B MC | Metals Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr)* | 1180 | | 2.77 | mg/Kg | 07/10/03 | bpg |
| SW846 6010B | Metals Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al)* | 8670 | | 27.7 | mg/Kg | 07/10/03 | bpg |

11/26/03

* In Description = Dry Wgt.

LABORATORY TEST RESULTS

Job Number: 208072 Date: 07/22/2003

CUSTOMER: Olin Chemical PROJECT: OFF PROPERTY WEST OF ATTN: Alan Peirce

Customer Sample ID: Core #2S
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Soil

Laboratory Sample ID: 208072-5
Date Received.....: 06/27/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride* | 1770 | | 10 | mg/Kg | 07/15/03 | rwe |
| EPA300.0 PartA | Sulfate* | 6780 | | 20 | mg/Kg | 07/15/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N)* | 6 | | 2 | mg/Kg | 07/02/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N)* | ND | U | 0.4 | mg/Kg | 07/02/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N* | 830 | | 34 | mg/Kg | 07/07/03 | kmm |
| % Solids 160.3 | % Solids | 98.5 | | 0.1 | % | 07/01/03 | grb |
| SW846 6010B | Metals Analysis (ICP) | | | | | | |
| | Calcium (Ca)* | 2150 | | 57.2 | mg/Kg | 07/16/03 | rac |
| | Iron (Fe)* | 13500 | | 28.6 | mg/Kg | 07/16/03 | rac |
| | Magnesium (Mg)* | 3820 | | 57.2 | mg/Kg | 07/16/03 | rac |
| | Sodium (Na)* | 2370 | | 572 | mg/Kg | 07/16/03 | rac |
| SW846 6010B MC | Metals Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr)* | 941 | | 2.86 | mg/Kg | 07/10/03 | bpg |
| SW846 6010B | Metals Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al)* | 6510 | | 28.6 | mg/Kg | 07/10/03 | bpg |

11/22/03

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0484
NY DOH 10843
NH DES 251901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400

# SUBCONTRACTED DATA

SEVERN TRENT STL

# SEVERN TRENT LABORATORIES
# ANALYTICAL REPORT

JOB NUMBER: 218646

Prepared For:

Severn Trent Laboratories
Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

Project: STL Westfield

Attention: Becky Mason

Date: 07/09/2003

Bonnie Stadelmann
Signature

07/09/03
Date


Name: Bonnie M. Stadelmann

Title: Project Manager

E-Mail: bstadelmann@stl-inc.com

STL Chicago
2417 Bond Street
University Park, IL 60466

PHONE: (708) 534-5200
FAX..: (708) 534-5211




STL Chicago
Wet Chemistry Case Narrative

Client: **STL Westfield**
Job Number: **203446** Date Rec'd: 05/17/01

This narrative covers the analysis of the samples in the above Job # for specific gravity.

Samples 218646-1 through 3 were done by hydrometer, ASTM Method D 1298. STL Chicago was sent dilutions of the actual samples, and calculated the specific gravities of the original samples from the following equations:

**218646-1** Specific Gravity of 1/200 dilution = **1.0025**

99.5%(1.0000) + 0.5%(Specific Gravity of neat sample) = 100%(1.0025)

Specific Gravity of neat sample = **1.50**

**218646-2** Specific Gravity of 1/200 dilution = **1.0020**

99.5%(1.0000) + 0.5%(Specific Gravity of neat sample) = 100%(1.0020)

Specific Gravity of neat sample = **1.40**

**218646-3** Specific Gravity of 1/66.667 dilution = **1.0035**

98.5%(1.0000) + 1.5%(Specific Gravity of neat sample) = 100%(1.0035)

Specific Gravity of neat sample = **1.23**

The results for samples **218646-4** and 5 are the averages of three measurements of the weights of the samples divided by the weight of an equal volume of water.

Diane L. Harper
Wet Chemistry Section Manager

7-9-03
Date

TL Chicago is part of Severn Trent Laboratories, Inc.

# LABORATORY TEST RESULTS

Job Number: 218646

Date:07/09/2003

CUSTOMER: Severn Trent Laboratories PROJECT: WESTFIELD 208072 ATTN: Becky Mason

Customer Sample ID: 208072-1
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Water

Laboratory Sample ID: 218646-1
Date Received.....: 06/28/2003
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 1.50 | | | | 0.0001 | 1 | | 89439 | | 07/08/03 1140 | cls |

* In Description = Dry Wgt.



TL Chicago is part of Severn Trent Laboratories, Inc.

# SAMPLE INFORMATION

Date: 07/09/2003

Job Number.: 218646
Customer....: Severn Trent Laboratories
Attn.....: Becky Mason

Project Number.....: 20000230
Customer Project ID....: WESTFIELD 208072
Project Description....: STL Westfield

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 218646-1 | 208072-1 | Water | 06/26/2003 | 16:00 | 06/28/2003 | 10:00 |
| 218646-2 | 208072-2 | Water | 06/26/2003 | 16:00 | 06/28/2003 | 10:00 |
| 218646-3 | 208072-3 | Water | 06/26/2003 | 16:00 | 06/28/2003 | 10:00 |
| 218646-4 | 208072-4 | Soil | 06/26/2003 | 16:00 | 06/28/2003 | 10:00 |
| 218646-5 | 208072-5 | Soil | 06/26/2003 | 16:00 | 06/28/2003 | 10:00 |

STL Chicago is part of Severn Trent Laboratories, Inc.

LABORATORY TEST RESULTS

Job Number: 218646 Date:07/09/2003

CUSTOMER: Severn Trent Laboratories PROJECT: WESTFIELD 208072 ATTN: Becky Mason

Customer Sample ID: 208072-3
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Water

Laboratory Sample ID: 218646-3
Date Received.....: 06/28/2003
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 1.23 | | | | 0.0001 | 1 | | 89439 | | 07/08/03 1150 | cls |

* In Description = Dry Wgt.



TL Chicago is part of Severn Trent Laboratories, Inc.

LABORATORY TEST RESULTS

Job Number: 218646 Date:07/09/2003

CUSTOMER: Severn Trent Laboratories PROJECT: WESTFIELD 208072 ATTN: Becky Mason

Customer Sample ID: 208072-2
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Water

Laboratory Sample ID: 218646-2
Date Received.....: 06/28/2003
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 1.40 | | | | 0.0001 | 1 | | 89439 | | 07/08/03 1145 | cls |

* In Description = Dry Wgt.

TL Chicago is part of Severn Trent Laboratories, Inc.

LABORATORY TEST RESULTS

Job Number: 218646

Date:07/09/2003

CUSTOMER: Severn Trent Laboratories PROJECT: WESTFIELD 208072 ATTN: Becky Mason

Customer Sample ID: 208072-5
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Soil

Laboratory Sample ID: 218646-5
Date Received.....: 06/28/2003
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2710F | Density/Specific Gravity<br>Specific Gravity, Solid | 1.29 | | | | 0.10 | 1 | | 89443 | | 07/08/03 1127 | cls |

* In Description = Dry Wgt.



TL Chicago is part of Severn Trent Laboratories, Inc.

LABORATORY TEST RESULTS

Job Number: 218646

Date:07/09/2003

CUSTOMER: Severn Trent Laboratories PROJECT: WESTFIELD 208072 ATTN: Becky Mason

Customer Sample ID: 208072-4
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Soil

Laboratory Sample ID: 218646-4
Date Received.....: 06/28/2003
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2710F | Density/Specific Gravity<br>Specific Gravity, Solid | 1.42 | | | | 0.10 | 1 | | 89443 | | 07/08/03 1115 | cls |

* In Description = Dry Wgt.

LEVEL I DATA QUALITY EVALUATION
STANDARD OPERATING PROCEDURE AND CHECKLIST
ICP METALS BY METHOD 6010B/200.7

Sr. Review/Date Kim Ricordi 11/23/03
Lab Report # 208072
Project # 63 0003 0008 . 04.02

Calcium, iron, magnesium, chromium, aluminum

## 1.0 Laboratory Deliverable Requirements

**1.1 Laboratory Information**: Was all of the following provided in the laboratory report? Yes [✓] No [ ] N/A [ ] Comments:
Check items received.

☑ Name of Laboratory ☑ Address ☑ Project ID ☑ Phone # ☑ Sample identification – Field and Laboratory
Client Information: ☑ Name ☑ Address ☑ Client Contact (IDs must be cross-referenced)

ACTION: If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** Yes [✓] No [ ] N/A [ ] Comments:

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** Yes [✓] No [ ] N/A [ ] Comments:

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☐ *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** Olin receives and maintains the *original COC.*

**ACTION:** If no, contact lab for submission of copy of completed *COC.*

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## Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 02583

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Olin Corp / Geomega
Address: 2995 Baseline Rd Ste 202
Boulder, CO 80303
Phone: 3034439117 Fax: 3039388123

Project #:
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone / Craig R. Walker

Lab # 208072 Quote # PO#

Shaded areas for office use

Requested Turn Around Time
10 Business Day (Std) ✓
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special instructions)
Analytes:
Cr, Al, Fe, Ca, Mg, Mn
$SO_4$, Cl, Nitrate, Nitrite, Ammonia
Specific Gravity

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Core #1 | GW | CRW | 6/26/03 1600 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | |
| Core #2 | GW | CRW | | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | |
| Core #3 | GW | CRW | | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | |
| Core #1S | S | CRW | | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | |
| Core #2S | S | CRW | | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | |

Sampled by (print): Craig R Walker 6/26/03 1600 Signature: [signature]
Relinquished by: Date: Time: Received by: [signature] Date: 6/26/03 Time: 1600
Relinquished by: Date: Time: Received by: [signature] Date: 6/27/03 Time: 1100
Method of shipment: STL-Westfield

Cooler? (Y) / N Samples Iced? (Y) / N
Temp. @ receipt 1.3 °C
Preservation/pH checked
By: [signature] Date: 6-27-03

Page ____ of ____

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

☑ Method blank results ☑ LCS recoveries ☑ MS/MSD recoveries and RPDs ☑ Laboratory duplicate results (where applicable)

ACTION: If no, contact lab for submission of missing or incomplete information.

## 2.0 Holding Times

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? Holding time for metals is 180 days from sample collection to analysis for both water and soil. Yes [ ] No [✓] N/A [ ] Comments:

NOTE: List samples that exceed hold time with # of days exceeded on checklist

ACTION: If technical holding times are exceeded, qualify all positive results (J) and non-detects (UJ). If grossly exceeded (2X holding time) reject (R) all non-detect results.

## 3.0 Laboratory Method

3.1 Was the correct laboratory method used? Yes [✓] No [ ] N/A [ ] Comments:

| | |
|---|---|
| Water Digestion | 3005A or 3010A or 3020A |
| Soil Digestion | 3050B |
| Metals | 6010B or 200.7 |

ACTION: If no, contact laboratory to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change and to request variance.

3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☑ QAPP ☐ Lab ☐ MADEP Yes [✓] No [ ] N/A [ ] Comments:

NOTE: *Verify that the reported metals match the target list specified on the COC.*





1.5 **Sample Receipt Information (*Cooler Receipt Form present?*):** Yes [✓] No [ ] N/A [ ] Comments:

Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?

☑ Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

☑ Container type noted ☑ sample condition observed ☑ pH verified (where applicable) ☑ Field and lab IDs cross referenced

ACTION: If no, contact lab for submission of missing or incomplete documentation.

1.5.1 Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

1.5.2 Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [ ] No [✓] N/A [ ] Comments:

1.6 **Sample Results Section:** *Was each of the following requirements supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

☑ Field ID and Lab ID ☑ *Date and time collected* ☑ Analyst Initials ☑ *Dilution Factor* ☑ % moisture or solids ☑ *Reporting limits*
☑ *Clean-up method* ☑ Analysis method ☑ *Preparation method* ☑ *Date of preparation/extraction/digestion clean-up and analysis, where applicable*
☑ Matrix ☑ Target analytes and concentrations ☑ Units (soils must be reported in dry weight)

ACTION: If no, contact lab for submission of missing or incomplete information.

1.7 **QA/QC Information:** Was each of the following information supplied in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

**ACTION:** For any blank with positive results, list all contaminants for each method blank including the concentration detected and the flagging level (flagging level = 5x the blank value) and the associated samples and qualifiers.

## 5.0 Laboratory Control Standard

5.1 Was a laboratory control standard run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *A full target, second source LCS is required by MADEP.*
**ACTION:** Call laboratory for LCS form submittal. If data are not available, use professional judgement to evaluate data accuracy associated with that batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

5.3 Is the recovery of any analyte outside of MADEP control limits? Yes [ ] No [✓] N/A [ ] Comments:

| Sample Type | MADEP % Rec |
|---|---|
| Water | 80-120 |
| Soil | within Lab generated limits |

**ACTION:** If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and non-detects results within the batch as (J). If LCS recovery is <30%, positive and non-detect results are rejected (R).

Comments:





**ACTION:** If no, evaluate variation with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If dilutions were required, were dilution factors reported? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact the lab for submission.

## 4.0 Method Blanks

4.1 Is the Method Blank Summary present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call the laboratory for submission of missing data.

4.2 Frequency of Analysis: Was a method blank analyzed for each digestion batch of < 20 field samples? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact laboratory for justification. Consult senior chemist for action needed. Narrate non-compliance.

4.3 Is the method blank less than the PQLs for all target elements? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *MADEP requires the method blank to be matrix matched and digested with the samples*

4.4 Do any method blanks have positive results for metals? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.

**ACTION:** MS/MSD flags only apply to the sample spiked. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit, qualify positive results and non-detects (J).

**6.5** Are any RPDs for MS/MSD recoveries outside of the QC limits? Yes [ ] **No** [ ] N/A [✓] Comments:

**NOTE:** $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where: S = MS sample result, D = MSD sample result

**NOTE:** If dilutions are required due to high sample concentrations, the data are evaluated, but no flags are applied.

**ACTION:** If the RPD exceeds the control limit, qualify positive results and non-detects (J).

## 7.0 Laboratory Duplicate

**7.1** Was a laboratory duplicate sample analyzed? If so, is the Laboratory Duplicate Sample Form present? **Yes** [✓] No [ ] N/A [ ] Comments: The lab did not perform duplicate analyses on project specific samples.

***NOTE:*** *MADEP refers to this sample as a "matrix duplicate".*

**ACTION:** If not analyzed, qualification is not needed. If data is missing, contact laboratory for resubmission of report. Narrate non-compliance.

**7.2** Is the RPD between the result for the laboratory duplicate sample and the result for the parent sample outside of the QA/QC limits? Yes [ ] **No** [ ] N/A [✓] Comments:





## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

**6.1** Were project-specific MS/MSDs ~~collected~~ analyzed? List project samples that were spiked. 4/21/03 **Yes** [ ] No [✓] N/A [ ] Comments:

**ACTION:** If no, contact senior chemist to see if any were specified.

**6.2** Is the Matrix Spike/Matrix Spike Duplicate Recovery Form present? **Yes** [ ] No [ ] N/A [✓] Comments:

**NOTE:** *A full target, second source MS/MSD is required by MADEP.*
**ACTION:** If any matrix spike data are missing, call lab for resubmission.

**6.3** Were matrix spikes analyzed as indicated on the COC and project schedule? **Yes** [ ] No [ ] N/A [✓] Comments:

**ACTION:** If any matrix spike data are missing, call lab for resubmission. If none, no qualification is needed. Narrate non-compliance.

**6.4** Are any metal spike recoveries outside of the QC limits? Yes [ ] **No** [ ] N/A [✓] Comments:

| Sample Type | ***MADEP % Rec*** | QAPP % Rec | Method |
|---|---|---|---|
| Water | *75-125* | N/A | 6010B |
| Water | *N/A* | 70-130 | 200.7 |
| Soil | *75-125* | 75-125 | 6010B |

**NOTE:** $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample result, SR = Sample result, SA = Spike added

**NOTE:** If dilutions are required due to high sample concentrations (> 4X spike), the data are evaluated, but no flags are applied.

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP *(1 per 10)* ☐ *MADEP Option 1 (1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

ACTION: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

## 10.0 Special QA/QC

10.1 Were both total and dissolved metals analysis performed? If so, the dissolved metal concentration should not exceed that of the total metal. Yes [ ] No [✓] N/A [ ] Comments:

ACTION: If results for both total and dissolved are ≥ 5x the PQL **and** the dissolved concentration is 10% higher than the total, flag both results as estimated (J). If total and dissolved concentrations are less than 5x the PQL **and** the **difference** exceeds 2x the PQL, flag both results as estimated (J)





| *MADEP Laboratory Duplicate Sample RPD Criteria:* | QAPP RPD |
|---|---|
| *For aqueous results > 5x RL, RPD must be ± 20%* | 20 |
| *For aqueous results < 5x RL, RPD must be ≤ RL* | 20 |
| *For soil/sediment results > 5x RL, RPD must be ± 35%* | 20 |
| *For soil/sediment results < 5x RL, RPD must be ≤ 2x RL* | 20 |

ACTION: If the RPD exceeds the limits, qualify both positive results and non-detects as estimated and flag them J. Narrate non-compliance

## 8.0 Sampling Accuracy

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:

*NOTE: MADEP does not require the collection of rinsate blanks.*

ACTION: Evaluate rinsate results against blank results to determine if contaminant may be laboratory-derived. If results are not lab-related, qualify according to below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

## 9.0 Field Duplicates

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

chloride, sulfate, nitrate, nitrite, ammonia

**Note:** The following analyses will be evaluated according to the "MADEP QA/QC Guidelines for **Sampling, Data Evaluation and Reporting Activities.**" MADEP, however, may not list QA/QC criteria for every chemical analysis. Where not defined by MADEP, criteria will default to values stipulated in the QAPP. Where the QAPP does not define criteria, QA/QC requirements will default to limits employed by the laboratory.

## 1.0 Laboratory Deliverable Requirements

**1.1 Laboratory Information:** Was all of the following provided in the laboratory report? **Yes** [✓] No [ ] N/A [ ] Comments:
Check items received.

☑ *Name of Laboratory* ☑ *Address* ☑ *Project ID* ☑ *Phone #* ☑ *Sample identification – Field and Laboratory*
Client Information: ☑ *Name* ☑ *Address* ☑ *Client Contact* *(IDs must be cross-referenced)*

ACTION: If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** ***Yes*** [✓] *No* [ ] *N/A* [ ] *Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** ***Yes*** [✓] *No* [ ] *N/A* [ ] *Comments:*

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☐ *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

1.4 **Chain of Custody (COC)** copy present with all documentation completed? **Yes** [✓] No [ ] N/A [ ] Comments:

Does the laboratory report include copies of Chain of Custody forms containing all samples in this SDG?

**NOTE:** Olin receives and maintains the *original* COC.

ACTION: If no, contact lab for submission of copy of missing completed COC.

**1.5 Sample Receipt Information (*Cooler Receipt Form*):** Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?



**OLIN CORPORATION**
**LEVEL I DATA QUALITY EVALUATION – OPTION 1**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**ICP METALS BY METHOD 6010B/200.7**

## 10.0 Application of Validation Qualifiers

Was any of the data qualified? Yes [ ] **No** [✓] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.

## REFERENCES

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw, GA 30144. August 1999

U.S. Environmental Protection Agency (USEPA), 1989. "Region 1 Laboratory Data Validation Functional Guidelines For Evaluating Inorganic Analyses"; Hazardous Site Evaluation Division; February 1989.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Massachusetts Quality Assurance and Quality Control (QA/QC) Requirements." BWSC-CAM, Interim Final Draft, Revision No. 2, 5 October 2001.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Quality Assurance and Quality Control Guidelines for Sampling, Data Evaluation and Reporting Activities," BWSC-CAM, Section VII, Public Comment Draft, Revision No. 0, 21 December 2001.

**1.6 Sample Results Section:** *Was the following information supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

[✓] Field ID and Lab ID [✓] Date and time collected [✓] Analyst Initials [✓] Dilution Factor [✓] % moisture or solids [✓] Reporting limits
[✓] *Clean-up method* [✓] Analysis method [✓] Preparation method [✓] Date of preparation/extraction/digestion clean-up and analysis, where applicable
[✓] Matrix [✓] Target analytes and concentrations [✓] Units (soils must be reported in dry weight)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**1.7 QA/QC Information:** Was the following information provided in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

[✓] Method blank results [✓] LCS recoveries [✓] MS/MSD recoveries and RPDs [✓] Laboratory duplicate results (where applicable)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**2.0** <u>Holding Times</u> Yes [✓] No [ ] N/A [ ] Comments: Nitrate and nitrite analysis of sample Core #25

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? The holding times are as follows: (202072-5) was analyzed one day outside of analytical hold time

28 days = ammonia, chemical oxygen demand, chloride, organic carbon, oil & grease, specific conductance, total organic carbon and sulfate

Alkalinity = 14 days Sulfide, TDS, TSS = 7 days pH = analyze immediately Nitrate nitrogen as N = 48 hrs

Nitrite nitrogen as N = 48 hrs Nitrate + Nitrite as N = 28 days

Results for nitrate and nitrite in sample Core # 25 (202072-5) are qualified estimated (J).

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded qualify results (J). For water samples that are grossly exceeded (>2X hold time) reject (R) all non-detect results. Professional judgment used to qualify soils.

**3.0 Laboratory Method** Yes [✓] No [ ] N/A [ ] Comments:

3.1 Was the correct laboratory method used?

**ACTION:** If no, contact lab to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change or to request variance.





Yes [✓] No [ ] N/A [ ] Comments:

[✓] Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

[✓] Container type noted [✓] Condition observed [✓] pH verified (where applicable) [✓] Field and lab IDs cross referenced

**ACTION:** If no, contact lab for submission of missing or incomplete documentation.

**1.5.1** Were the correct bottles and preservatives used? Yes [✓] No [ ] N/A [ ] Comments:

Ammonia,– 1 Liter polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Oil & Grease – 1 Liter glass/HCL to pH<2,cool to 4°C

Alkalinity – 1 Liter polyethylene/cool to 4°C

Chemical Oxygen Demand – 50 mL polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Chloride, pH, sulfate - 50 mL polyethylene/cool to 4°C

Organic Carbon – 500 mL amber glass bottle/HCl or $H_2SO_4$ to pH<2,cool to 4°C

Sulfide – 50 mL polyethylene/ZnAcetate + NaOH to pH>9, cool to 4°C
Specific conductance, TDS, TSS – 100 mL polyethylene/cool to 4°C

**ACTION:** If no, inform senior chemist. Document justification for change in container/volume (if applicable), qualify positive and non-detect data (J) data if cooler temperature exceeds 10°C. Rejection of data requires professional judgment

**1.5.2** Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

**1.5.3** Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [ ] No [✓] N/A [ ] Comments:

ACTION: If no, document discrepancy in case narrative and contact lab for justification. Consult senior chemist for action needed.

4.3 Is the method blank less than the PQL? (See Section 3.2 for PQLs). Yes [✓] No [ ] N/A [ ] Comments:

4.4 Do any method blanks have positive results for wet chemistry parameters? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

ACTION: If any blank has positive results, list all the concentrations detected and flagging level (flagging level = 5 × blank value) on the checklist. List all affected samples and their qualifiers.

**5.0 Laboratory Control Standards**

5.1 Was a laboratory control standard (LCS) run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, call laboratory for LCS form submittal. If data is not available, use professional judgment to determine qualification actions for data associated with the batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, contact lab for resubmission of missing data.

5.3 Is any wet chemistry analyte LCS recovery outside the control limits? Yes [ ] No [✓] N/A [ ] Comments:





3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☑ QAPP ☐ Lab? Yes [ ] No [✓] N/A [ ] Comments: The lab reported a PQL for sulfate (2 mg/L) that is greater than the QAPP required PQL. All sulfate results are greater than the PQL.

**Note:** *The MADEP QA/QC Guidelines do not yet list PQLs for wet chemistry analyses, therefore all criteria will default to values stipulated in the QAPP*. Where the QAPP does not define criteria, QA/QC requirements default to limits employed by the lab**. Other criteria may also apply.*

| | | | |
|---|---|---|---|
| Ammonia* ☑ = 0.1 mg/ L | Alkalinity** ☐ = 1 mg/L | Bicarbonate Alkalinity** ☐ = 1 mg/L | Carbonate Alkalinity** ☐ = 1 mg/L |
| Nitrate Nitrogen as N* ☑ = .05 mg/L | Nitrite Nitrogen as N* ☑ = .01 mg/L | Chloride* ☑ = 1 mg/L | Hardness * ☐ = 2 mg/L |
| Spec. Cond.** ☐ 3 umhos/cm | Total Organic Carbon** ☐ = 1 mg/L | Oil & Grease* ☐ = 3 mg/L | Sulfate (EPA 300.0)* ☑ = 0.1 mg/L |
| COD:* Low – 20 mg/L | COD* High - 50 mg/L ☐ | TDS* ☐ = 10 mg/L | TSS* ☐ = 5 mg/L |
| pH* ☐ < 2 to > 12 | | | |

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

ACTION: If no, evaluate change with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are the appropriate parameter results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If *dilutions were required, were dilution factors reported?* Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, contact the lab for submission.

**4.0 Method Blanks** Yes [✓] No [ ] N/A [ ] Comments:

4.1 Are the Method Blank Summaries present?

ACTION: If no, call the laboratory for submission of missing data.

4.2 Was a method blank analyzed for each analysis batch of wet chemistry field samples of 20 or less? Yes [✓] No [ ] N/A [ ] Comments:

6.3 Were matrix spikes analyzed at the required frequency of 1 per 20 samples per matrix? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If any matrix spike data is missing, call lab for resubmission.

6.4 Are any wet chemistry analyte spike recoveries outside of the QC limits? Yes [✓] No [ ] N/A [ ] Comments: The MS recovery for ammonia (0) and the reanalysis recovery (30) is below the lower control limit. The results for ammonia in the unspiked sample are qualified estimated (J).

NOTE: $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample result; SR = Sample result; SA = Spike added

**MS/MSD Recovery Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia* (LACHAT) ☑ = 74-125% |
| Chloride*(SM 4500 Cl) ☐= 77-116% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA |
| Oil & Grease* = NA | COD Low* ☐ = 61-142% | COD High* ☐ = 92-109% | Nitrate Nitrogen as N** ☐ = 75-119% |
| Nitrite Nitrogen as N** ☐ = 68-136% | Hardness* ☐ = 70-130% | Sulfate (EPA 300.0)* ☐ = 75-125% | pH* = NA TSS* = NA |

Other parameter(list) _____ % R = _____ ☐ Rec Limits = _____

* = Laboratory Limits ** = Olin QAPP Limits *(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

NOTES: 1) If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.
2) If the MS/MSD was performed by the laboratory on a non-project sample, no qualification is required.

ACTION: MS/MSD flags only apply to the sample spiked. Do not evaluate if sample concentration is > 4X spike. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit but > 30%, qualify both positive results and non-detects (J). If the MS/MSD recovery is < 30% and the sample is non-detect, the results are considered unusable and flagged (R).

ACTION: Laboratory control limits apply when spiked sample results fall within the normal calibration range. If dilutions are required due to high sample concentrations, the data is evaluated, but no flags are applied.

6.5 Are any RPDs for MS/MSD recoveries outside of the QA/QC limits? Yes [ ] No [ ] N/A [✓] Comments: The lab did not perform an MSD analysis on samples from the SDG.

NOTE: $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where S = MS result, D = MSD result





**LCS Limits:**

| | | | |
|---|---|---|---|
| Alkalinity** ☐ = 80-120% | Bicarbonate Alkalinity** ☐ = 80-120% | Carbonate Alkalinity** ☐ = 80-120% | Specific Conductivity *☐ = 80-120% |
| Total Organic Carbon** ☐ = 80-120% | TDS** ☐ = 80-120% | Oil & Grease* ☐ = 80-120% | Ammonia Nitrogen as N* ☑ = 80-120% |
| COD Low* ☐ = 80-120% | COD High* ☐ = 80-120% | Nitrate Nitrogen as N** ☑ = 85-115% | Nitrite Nitrogen as N** ☑ = 75-120% |
| Hardness* ☐ = 85-115% | Chloride* ☑ = 80-120% | Sulfate (EPA 300.0)* ☐ = 75-125% | pH* ☐ = 98-102% TSS* NA |

Other parameter(list) _____ %R = _____ ☐ Rec Limits= _____

Other parameter(list) _____ %R = _____ ☐ Rec Limits = _____

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

ACTION: If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and no-detect results within the batch as (J). If LCS recovery is <10%, non-detect results are rejected (R).

**6.0 Matrix Spikes**

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs analyzed? List project samples that were spiked. Yes [✓] No [ ] N/A [ ] Comments: The lab analyzed core #15 (20P072-4) with an ammonia MS.

ACTION: If no, contact senior chemist to see if any were specified.

6.2 Is the MS/MSD Recovery Form present? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, contact lab for resubmission of missing data.

**ACTION:** Evaluate rinsate results vs. blank results to determine if contaminant may be laboratory-derived. If not lab-related, qualify according to the table below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

**9.0 Field Duplicates**

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP ☐ *MADEP Option 1(1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION**: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

Was any of the data qualified? Yes [✓] **No** [ ] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.





**MS/MSD RPD Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia** (LACHAT) ☐ = 8% |
| Chloride**(SM 4500 Cl) ☐ = 15% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA Total Organic Carbon* = NA |
| COD Low** ☐ = 14% | COD High** ☐ = 16% | Nitrate Nitrogen as N** ☐ 16% | Nitrite Nitrogen as N** ☐ = 16% |
| Oil & Grease* = NA | Hardness* = NA | Sulfate (EPA 300.0)* ☐ = 10% | pH* = NA TSS* = NA |

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

* = Laboratory Limits ** = Olin QAPP Limits

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**7.0 Laboratory Duplicate**

Are the RPDs for the laboratory duplicates <20% unless otherwise specified below? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION**: If the RPD is greater than specified limits, qualify all results for that analyte as estimated (J).

| | | | |
|---|---|---|---|
| Alkalinity* = 4% | Bicarbonate Alkalinity* = 4% | Carbonate alkalinity* = 4% | Oil & Grease* ☐ = 20% |
| pH* ☐ = 3% | Specific Conductivity *☐ = 5% | TSS** ☐ = 6% | TDS** ☐ = 6% |

**8.0 Sampling Accuracy**

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] **No** [ ] N/A [✓] Comments:

**REFERENCES**

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw, GA 30144. August 1999.

STL-Westfield, 2002. "Olin – General Chemistry Control Limits (Soil & Water)," Severn Trent Laboratories, Inc., 53 Southampton Road, Westfield, MA, 01085.

MACTEC

**Engineering and Consulting, Inc.**
511 Congress Street
P.O. Box 7050
Portland, Maine 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow

From: Chris Ricardi

Date: 11/24/03

Subject: Olin Wilmington – Geomega DAPL Column Test Samples

**Data Validation Summary**

This sample set contained results for multiple aqueous samples generated by Geomega from the effluent stream of their laboratory column tests completed on DAPL saturated soil cores collected from the Olin Wilmington site. The samples were generated during testing completed from July through October 2003, and were analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for selected metals (aluminum, calcium, chromium, iron, magnesium, sodium, and lithium) and water chemistry parameters including chloride, sulfate, nitrite, nitrate, and ammonia.

The following sample delivery groups (SDGs) are included in the data validation:

208828, 208920, 208976, 209054, 209127, 209269, 209410, 209515, 209569, 209636, 209675, 209868, 209820, 210042, 209973, 210164, 210235, 210351, 210438, 210585, 210625. The samples from these data sets were combined into a single data group for validation.

The Olin Wilmington QAPP was used as a reference during the review. Metals results were reviewed using the Data Quality Evaluation checklists that were developed for the Olin Wilmington annual and quarterly groundwater monitoring tasks.

**Validation Actions**

With the exception of the results discussed below, results are interpreted to be usable as reported by the laboratory.

Samples in SDG 208828 were submitted to the lab outside of analytical hold time. Geomega requested the lab perform analyses outside of analytical hold time. Sample detections reported are qualified estimated (J), non-detects are qualified (G) to indicate the result would normally be rejected due to grossly exceeded hold time. Samples that are qualified due to exceeded hold time are listed in Table 1.

Several other nitrate results in data sets 210585 and 209820 were also qualified estimated (J) due to exceeded holding tine.

Table 1

| Sample ID | Lab ID | Analyte | Qualifier |
|---|---|---|---|
| SD-1 | 208828-1 | Chloride | J |
| | | Sulfate | J |
| | | Nitrate | J |
| | | Nitrite | G |
| | | Ammonia | J |
| SD-2 | 208828-2 | Sulfate | J |
| | | Nitrate | G |
| | | Nitrite | G |
| SD-5 | 208828-3 | Nitrate | G |
| | | Nitrite | G |
| SD-8 | 208828-4 | Nitrate | G |
| | | Nitrite | G |
| FM-1 | 208828-6 | Chloride | J |
| | | Sulfate | J |
| | | Nitrate | G |
| | | Nitrite | G |
| | | Ammonia | J |
| FM-2 | 208828-7 | Sulfate | J |
| | | Nitrate | G |
| | | Nitrite | G |
| FM-8 | 208828-8 | Nitrate | G |
| | | Nitrite | G |
| SD-31 | 210585-1 | Nitrate | J |
| | | Nitrate | J |
| FM-24 | 209820-2 | Nitrate | J |

Geomega
Good Science
Hard Work
Creative Thinking

# Memorandum

**To:** Chris Ricardi (MACTEC)

**CC:** Margret Hanley (SH&D)

**From:** Dan Stone

**Date:** November 5, 2003

**Re:** Transmittal of Laboratory Analytical Packets

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Per Margret Hanley's request, I am sending you copies of the laboratory analytical packets that we have received for the floc study and the DAPL column-test experiment. The accompanying tables list all of the samples that have been collected to date. Samples highlighted in yellow have been submitted to the lab, but we have not yet received the results. Please feel free to contact me by phone at 303-443-9117 (x101) or by email (*dstone@geomega.com*) if there is anything else you need from us.

Floc Study

| Sample Name | Sample Type | Collected By | Sent to | Date Collected | Date Sent to Lab | Lab Results Received | Data Sent to MACTEC | Source |
|---|---|---|---|---|---|---|---|---|
| BACKFLOCSW-2003 | SW | MACTEC | STL | 6/19/03 | | | | Olin DB |
| BACKFLOC-2003 | SW | MACTEC | STL | 6/19/03 | | | | Olin DB |
| REDFLOCSW-2003 | SW | MACTEC | STL | 6/25/03 | | | | Olin DB |
| REDFLOC-2003 | SW | MACTEC | STL | 6/25/03 | | | | Olin DB |
| WhiteflocSW-2003 | SW | MACTEC | STL | 9/8/03 | | | | Olin DB |
| Whitefloc-2003 | SW | MACTEC | STL | 9/8/03 | | | | Olin DB |
| Red f 4 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 5 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 7 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 8 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 724 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 716 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 78 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 72 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red floc | S | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Bf4 | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf5 | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf7 | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf8 | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf4s | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf5s | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf7s | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf8s | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bfsws | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bfws | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Backfloc | S | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Red Floc | | Geomega | CU microprobe | | 8/4/03 | | | COC |
| Back Floc | | Geomega | CU microprobe | | 8/4/03 | | | COC |
| Wf3 | water | Geomega | STL | | | 11/4/03 | 11/5/03 | STL Results/COC |
| Wf4 | water | Geomega | STL | | | 11/4/03 | 11/5/03 | STL Results/COC |
| Wf5 | water | Geomega | STL | | | 11/4/03 | 11/5/03 | STL Results/COC |
| Wf7 | water | Geomega | STL | | | 11/4/03 | 11/5/03 | STL Results/COC |
| Wf8 | water | Geomega | STL | | | 11/4/03 | 11/5/03 | STL Results/COC |
| Whitefloc | S | Geomega | STL | | | 11/4/03 | 11/5/03 | STL Results/COC |

VOC column test experiment

| Sample Name | Sample Type | Collected By | Sent to | Date Collected | Date Sent to Lab | Lab Results Received | Revised Results Received | Data Sent to MACTEC | Source |
|---|---|---|---|---|---|---|---|---|---|
| SD-1 | GW | Geomega | STL | 7/1/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-2 | GW | Geomega | STL | 7/8/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-5 | GW | Geomega | STL | 7/14/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-8 | GW | Geomega | STL | 7/25/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-10 | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-11 | GW | Geomega | STL | 8/3/03 | 8/3/03 | 8/18/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-12 | GW | Geomega | STL | 8/5/03 | 8/5/03 | 8/21/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-13 | GW | Geomega | STL | 8/7/03 | 8/7/03 | 8/22/03 | 9/8/03 | 11/5/03 | STL Results/COC |
| SD-14 | GW | Geomega | STL | 8/10/03 | 8/11/03 | 8/25/03 | 9/8/03 | 11/5/03 | STL Results/COC |
| SD-15 | GW | Geomega | STL | 8/17/03 | 8/18/03 | 9/4/03 | | 11/5/03 | STL Results/COC |
| SD-18 | GW | Geomega | STL | 8/25/03 | 8/25/03 | 9/10/03 | | 11/5/03 | STL Results/COC |
| SD-19 | GW | Geomega | STL | 8/28/03 | 8/28/03 | 9/11/03 | | 11/5/03 | STL Results/COC |
| SD-20 | GW | Geomega | STL | 9/2/03 | 9/2/03 | 9/15/03 | | 11/5/03 | STL Results/COC |
| SD-21 | GW | Geomega | STL | 9/4/03 | 9/4/03 | 10/1/03 | | 11/5/03 | STL Results/COC |
| SD-22 | GW | Geomega | STL | 9/8/03 | 9/8/03 | 9/30/03 | | 11/5/03 | STL Results/COC |
| SD-23 | GW | Geomega | STL | 9/11/03 | 9/11/03 | 9/30/03 | | 11/5/03 | STL Results/COC |
| SD-24 | GW | Geomega | STL | 9/15/03 | 9/15/03 | 9/30/03 | | 11/5/03 | STL Results/COC |
| SD-25 | GW | Geomega | STL | 9/18/03 | 9/18/03 | 10/2/03 | | 11/5/03 | STL Results/COC |
| SD-26 | GW | Geomega | STL | 9/22/03 | 9/22/03 | 10/2/03 | | 11/5/03 | STL Results/COC |
| SD-27 | GW | Geomega | STL | 9/25/03 | 9/25/03 | 10/15/03 | | 11/5/03 | STL Results/COC |
| SD-28 | GW | Geomega | STL | 9/29/03 | 9/29/03 | 10/15/03 | | 11/5/03 | STL Results/COC |
| SD-29 | GW | Geomega | STL | 10/2/03 | 10/2/03 | 11/5/03 | | 11/5/03 | STL Results |
| SD-30 | GW | Geomega | STL | 10/6/03 | 10/6/03 | 10/23/03 | | 11/5/03 | STL Results/COC |
| SD-31 | GW | Geomega | STL | 10/9/03 | 10/9/03 | 10/24/03 | | 11/5/03 | STL Results/COC |
| SD-32 | GW | Geomega | STL | 10/13/03 | 10/13/03 | 10/28/03 | | 11/5/03 | STL Results/COC |
| SD-33 | GW | Geomega | STL | | | | | | |
| SD-34 | GW | Geomega | STL | | | | | | |
| SD-35 | GW | Geomega | STL | | | | | | |
| SD-37 | GW | Geomega | STL | | | | | | |
| FM-1 | GW | Geomega | STL | 7/1/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-2 | GW | Geomega | STL | 7/8/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-5 | GW | Geomega | STL | 7/14/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-8 | GW | Geomega | STL | 7/22/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-11 | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-12 | GW | Geomega | STL | 8/3/03 | 8/3/03 | 8/18/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-13 | GW | Geomega | STL | 8/5/03 | 8/5/03 | 8/21/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-14 | GW | Geomega | STL | 8/7/03 | 8/7/03 | 8/22/03 | 9/8/03 | 11/5/03 | STL Results/COC |
| FM-15 | GW | Geomega | STL | 8/10/03 | 8/11/03 | 8/25/03 | 9/8/03 | 11/5/03 | STL Results/COC |
| FM-16 | GW | Geomega | STL | 8/17/03 | 8/18/03 | 9/4/03 | | 11/5/03 | STL Results/COC |
| FM-19 | GW | Geomega | STL | 8/25/03 | 8/25/03 | 9/10/03 | | 11/5/03 | STL Results/COC |
| FM-20 | GW | Geomega | STL | 8/28/03 | 8/28/03 | 9/11/03 | | 11/5/03 | STL Results/COC |
| FM-21 | GW | Geomega | STL | 9/2/03 | 9/2/03 | 9/15/03 | | 11/5/03 | STL Results/COC |
| FM-22 | GW | Geomega | STL | 9/4/03 | 9/4/03 | 10/1/03 | | 11/5/03 | STL Results/COC |
| FM-23 | GW | Geomega | STL | 9/8/03 | 9/8/03 | 9/30/03 | | 11/5/03 | STL Results/COC |
| FM-24 | GW | Geomega | STL | 9/11/03 | 9/11/03 | 9/30/03 | | 11/5/03 | STL Results/COC |
| FM-25 | GW | Geomega | STL | 9/15/03 | 9/15/03 | 9/30/03 | | 11/5/03 | STL Results/COC |
| FM-26 | GW | Geomega | STL | 9/18/03 | 9/18/03 | 10/2/03 | | 11/5/03 | STL Results/COC |
| FM-27 | GW | Geomega | STL | 9/22/03 | 9/22/03 | 10/2/03 | | 11/5/03 | STL Results/COC |
| FM-28 | GW | Geomega | STL | 9/25/03 | 9/25/03 | 10/15/03 | | 11/5/03 | STL Results/COC |
| FM-29 | GW | Geomega | STL | 9/29/03 | 9/29/03 | 10/15/03 | | 11/5/03 | STL Results/COC |
| FM-30 | GW | Geomega | STL | 10/2/03 | 10/2/03 | 11/5/03 | | 11/5/03 | STL Results |
| FM-31 | GW | Geomega | STL | 10/6/03 | 10/6/03 | 10/23/03 | | 11/5/03 | STL Results/COC |
| FM-32 | GW | Geomega | STL | 10/9/03 | 10/9/03 | 10/24/03 | | 11/5/03 | STL Results/COC |
| FM-33 | GW | Geomega | STL | 10/13/03 | 10/13/03 | 10/28/03 | | 11/5/03 | STL Results/COC |
| FM-34 | GW | Geomega | STL | | | | | | |
| FM-35 | GW | Geomega | STL | | | | | | |



| Sample Name | Sample Type | Collected By | Sent to | Date Collected | Date Sent to Lab | Lab Results Received | Revised Results Received | Data Sent to MACTEC | Source |
|---|---|---|---|---|---|---|---|---|---|
| FM-36 | GW | Geomega | STL | | | | | | |
| FM-38 | GW | Geomega | STL | | | | | | |
| Core#1 | GW | Geomega | STL | 6/26/03 | 6/26/03 | 7/21/03 | 8/15/03 | 11/5/03 | STL Results/COC |
| Core#2 | GW | Geomega | STL | 6/26/03 | 6/26/03 | 7/21/03 | 8/15/03 | 11/5/03 | STL Results/COC |
| Core#3 | GW | Geomega | STL | 6/26/03 | 6/26/03 | 7/21/03 | 8/15/03 | 11/5/03 | STL Results/COC |
| Core#1S | S | Geomega | STL | 6/26/03 | 6/26/03 | 7/21/03 | | 11/5/03 | STL Results/COC |
| Core#2S | S | Geomega | STL | 6/26/03 | 6/26/03 | 7/21/03 | | 11/5/03 | STL Results/COC |

**1.5 Sample Receipt Information (*Cooler Receipt Form present?*):** Yes [✓] No [ ] N/A [ ] Comments:

Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?

☑ Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

☑ Container type noted ☑ sample condition observed ☑ pH verified (where applicable) ☑ Field and lab IDs cross referenced

**ACTION:** If no, contact lab for submission of missing or incomplete documentation.

**1.5.1** Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

**1.5.2** Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [ ] **No** [✓] N/A [ ] Comments:

**1.6 Sample Results Section:** *Was each of the following requirements supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

☑ Field ID and Lab ID ☑ *Date and time collected* ☑ Analyst Initials ☑ *Dilution Factor* ☑ *% moisture or solids* ☑ *Reporting l*
☑ *Clean-up method* ☑ Analysis method ☑ *Preparation method* ☑ *Date of preparation/extraction/digestion clean-up and analysis, where applic*
☑ Matrix ☑ Target analytes and concentrations ☑ Units (soils must be reported in dry weight)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**1.7 QA/QC Information:** Was each of the following information supplied in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:





Reviewer/Date [illegible] 11/20/
Sr. Review/Date Chris Ricaurte 11/2
Lab Report # see attached
Project # 63 0003 0008.04.02

## 1.0 Laboratory Deliverable Requirements

**1.1 Laboratory Information:** Was all of the following provided in the laboratory report? Yes [✓] No [ ] N/A [ ] Comments:
Check items received.

☑ *Name of Laboratory* ☑ *Address* ☑ *Project ID* ☑ *Phone #* ☑ *Sample identification – Field and Laboratory*
Client Information: ☑ *Name* ☑ *Address* ☑ *Client Contact* *(IDs must be cross-referenced)*

**ACTION:** If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** *Yes [✓] No [ ] N/A [ ] Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** *Yes [✓] No [ ] N/A [ ] Comments:*

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☐ *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** Olin receives and maintains the *original COC.*

**ACTION:** If no, contact lab for submission of copy of completed *COC.*

**ACTION:** If no, evaluate variation with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If dilutions were required, were dilution factors reported? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact the lab for submission.

## 4.0 Method Blanks

4.1 Is the Method Blank Summary present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call the laboratory for submission of missing data.

4.2 Frequency of Analysis: Was a method blank analyzed for each digestion batch of < 20 field samples? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact laboratory for justification. Consult senior chemist for action needed. Narrate non-compliance.

4.3 Is the method blank less than the PQLs for all target elements? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *MADEP requires the method blank to be matrix matched and digested with the samples*

4.4 Do any method blanks have positive results for metals? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:





[✓] Method blank results [✓] LCS recoveries [✓] MS/MSD recoveries and RPDs [✓] Laboratory duplicate results (where applicable)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

## 2.0 Holding Times

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? Holding time for metals is 180 days from sample collection to analysis for both water and soil. Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded, qualify all positive results (J) and non-detects (UJ). If grossly exceeded (2X holding time) reject (R) all non-detect results.

## 3.0 Laboratory Method

3.1 Was the correct laboratory method used? Yes [✓] No [ ] N/A [ ] Comments:

| | |
|---|---|
| Water Digestion | 3005A or 3010A or 3020A |
| Soil Digestion | 3050B |
| Metals | 6010B or 200.7 |

**ACTION:** If no, contact laboratory to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change and to request variance.

3.2 Are the practical quantitation limits the same as those specified by the [✓] SOW [✓] QAPP [ ] Lab [ ] MADEP Yes [ ] No [ ] N/A [ ] Comments: The lab reports PQLs for iron (100 ug/L) and magnesium (200 ug/L) that are greater than the QAPP required PQLs. Results for iron and magnesium are greater than the PQLs.

**NOTE:** *Verify that the reported metals match the target list specified on the COC.*

## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs ~~collected~~ analyzed? List project samples that were spiked. Yes [✓] No [ ] N/A [ ] Comments: The lab analyzed S (208828-1) as a metals MS/MSD

ACTION: If no, contact senior chemist to see if any were specified.

6.2 Is the Matrix Spike/Matrix Spike Duplicate Recovery Form present? Yes [✓] No [ ] N/A [ ] Comments:

NOTE: *A full target, second source MS/MSD is required by MADEP.*
ACTION: If any matrix spike data are missing, call lab for resubmission.

6.3 Were matrix spikes analyzed as indicated on the COC and project schedule? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If any matrix spike data are missing, call lab for resubmission. If none, no qualification is needed. Narrate non-compliance.

6.4 Are any metal spike recoveries outside of the QC limits? Yes [✓] No [ ] N/A [ ] Comments: Unspiked samp concentrations are greater than four t the spike concentration. No further ac required.

| Sample Type | MADEP % Rec | QAPP % Rec | Method |
|---|---|---|---|
| Water | 75-125 | N/A | 6010B |
| Water | N/A | 70-130 | 200.7 |
| Soil | 75-125 | 75-125 | 6010B |

NOTE: $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample result, SR = Sample result, SA = Spike added

NOTE: If dilutions are required due to high sample concentrations (> 4X spike), the data are evaluated, but no flags are applied.





If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

ACTION: For any blank with positive results, list all contaminants for each method blank including the concentration detected and the flagging level (flagging l = 5x the blank value) and the associated samples and qualifiers.

## 5.0 Laboratory Control Standard

5.1 Was a laboratory control standard run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

NOTE: *A full target, second source LCS is required by MADEP.*
ACTION: Call laboratory for LCS form submittal. If data are not available, use professional judgement to evaluate data accuracy associated with that batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, contact lab for resubmission of missing data.

5.3 Is the recovery of any analyte outside of MADEP control limits? Yes [ ] No [✓] N/A [ ] Comments:

| Sample Type | MADEP % Rec |
|---|---|
| Water | 80-120 |
| Soil | within Lab generated limits |

ACTION: If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and non-detects results within the batch as (J). If LCS recovery is <30%, positive and non-detect results are rejected (R).

Comments:

| *MADEP Laboratory Duplicate Sample RPD Criteria:* | QAPP RPD |
|---|---|
| *For aqueous results > 5× RL, RPD must be ± 20%* | 20 |
| *For aqueous results < 5× RL, RPD must be ≤ RL* | 20 |
| *For soil/sediment results > 5× RL, RPD must be ± 35%* | 20 |
| *For soil/sediment results < 5× RL, RPD must be ≤ 2× RL* | 20 |

**ACTION**: If the RPD exceeds the limits, qualify both positive results and non-detects as estimated and flag them J. Narrate non-compliance

## 8.0 Sampling Accuracy

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

**8.1** Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. — Yes [ ] No [✓] N/A [ ] Comments:

**8.2** Do any rinsate blanks have positive results? — Yes [ ] No [ ] N/A [✓] Comments:

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

**ACTION:** Evaluate rinsate results against blank results to determine if contaminant may be laboratory-derived. If results are not lab-related, qualify according to below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

## 9.0 Field Duplicates

**9.1** Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. — Yes [ ] No [✓] N/A [ ] Comments:





**NOTE:** If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.

**ACTION:** MS/MSD flags only apply to the sample spiked. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit, qualify positive results and non-detects (J).

**6.5** Are any RPDs for MS/MSD recoveries outside of the QC limits? — Yes [ ] No [ ] N/A [✓] Comments:

**NOTE:** $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where: S = MS sample result, D = MSD sample result

**NOTE:** If dilutions are required due to high sample concentrations, the data are evaluated, but no flags are applied.

**ACTION:** If the RPD exceeds the control limit, qualify positive results and non-detects (J).

## 7.0 Laboratory Duplicate

**7.1** Was a laboratory duplicate sample analyzed? If so, is the Laboratory Duplicate Sample Form present? — Yes [✓] No [ ] N/A [ ] Comments:

***NOTE:*** *MADEP refers to this sample as a "matrix duplicate".*

**ACTION:** If not analyzed, qualification is not needed. If data is missing, contact laboratory for resubmission of report. Narrate non-compliance.

**7.2** Is the RPD between the result for the laboratory duplicate sample and the result for the parent sample outside of the QA/QC limits? — Yes [ ] No [✓] N/A [ ] Comments:

**10.0 Application of Validation Qualifiers**

Was any of the data qualified? Yes [ ] No [✓] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.

**REFERENCES**

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environme Services, Kennesaw, GA 30144. August 1999

U.S. Environmental Protection Agency (USEPA), 1989. "Region 1 Laboratory Data Validation Functional Guidelines For Evaluating Inorganic Analys Hazardous Site Evaluation Division; February 1989.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Massachusetts Quality Assurance and Quality Cor (QA/QC) Requirements." BWSC-CAM, Interim Final Draft, Revision No. 2, 5 October 2001.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Quality Assurance and Quality Control Guidelines Sampling, Data Evaluation and Reporting Activities," BWSC-CAM, Section VII, Public Comment Draft, Revision No. 0, 21 December 2001.





9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments: Lab duplicate data only.

SOW ☐ QAPP *(1 per 10)* ☐ *MADEP Option 1 (1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION**: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

**10.0 Special QA/QC**

10.1 Were both total and dissolved metals analysis performed? If so, the dissolved metal concentration should not exceed that of the total metal. Yes [ ] No [✓] N/A [ ] Comments:

**ACTION:** If results for both total and dissolved are ≥ 5x the PQL **and** the dissolved concentration is 10% higher than the total, flag both results as estimated (J). If total and dissolved concentrations are less than 5x the PQL **and** the **difference** exceeds 2x the PQL, flag both results as estimated (J)

**Note:** The following analyses will be evaluated according to the "MADEP QA/QC Guidelines for **Sampling, Data Evaluation and Reporting Activities.**" MADE however, may not list QA/QC criteria for every chemical analysis. Where not defined by MADEP, criteria will default to values stipulated in the QAPP. Where the QAPP d not define criteria, QA/QC requirements will default to limits employed by the laboratory.

## 1.0 Laboratory Deliverable Requirements

**1.1 Laboratory Information**: Was all of the following provided in the laboratory report? Yes [✓] No [ ] N/A [ ] Comments:
Check items received.

☑ *Name of Laboratory* ☑ *Address* ☑ *Project ID* ☑ *Phone #* ☑ *Sample identification – Field and Laboratory*
Client Information: ☑ *Name* ☑ *Address* ☑ *Client Contact* *(IDs must be cross-referenced)*

**ACTION**: If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** *Yes [✓] No [ ] N/A [ ] Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** *Yes [✓] No [ ] N/A [ ] Comments:*

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☐ *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed? Yes [✓] No [ ] N/A [ ] Comments:

Does the laboratory report include copies of Chain of Custody forms containing all samples in this SDG?

**NOTE:** Olin receives and maintains the *original* COC.

**ACTION**: If no, contact lab for submission of copy of missing completed COC.

**1.5 Sample Receipt Information (*Cooler Receipt Form*):** Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?



The following SDGs are included in the data validation:

208828, 208920, 208976, 209054, 209127, 209269, 209410, 209515, 209569, 209636, 209675, 209868, 209820, 210042, 209973, 210164, 210235, 210351, 210438, 210585, 210625.

**1.6 Sample Results Section:** *Was the following information supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

[✓] Field ID and Lab ID [✓] Date and time collected [✓] Analyst Initials [✓] Dilution Factor [✓] % moisture or solids [✓]
[✓] *Clean-up method* [✓] Analysis method [✓] Preparation method [✓] Date of preparation/extraction/digestion clean-up and analysis, where appl.
[✓] Matrix [✓] Target analytes and concentrations [✓] Units (soils must be reported in dry weight)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**1.7 QA/QC Information:** Was the following information provided in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

[✓] Method blank results [✓] LCS recoveries [✓] MS/MSD recoveries and RPDs [✓] Laboratory duplicate results (where applicable)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**2.0 Holding Times** Yes [ ] No [✓] N/A [ ] Comments: Samples were s to the lab outside of hold time on request of the cl parameters. The lab run the few hr out of time with

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? The holding times are as follows:

28 days = ammonia, chemical oxygen demand, chloride, organic carbon, oil & grease, specific conductance, total organic carbon and sulfate

Alkalinity = 14 days | Sulfide, TDS, TSS = 7 days | pH = analyze immediately | Nitrate nitrogen as N = 48 hrs

Nitrite nitrogen as N = 48 hrs | Nitrate + Nitrite as N = 28 days

detections were qualified estimated (J) detects outside of hold time were qualified indicating they would have been rejected

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded qualify results (J). For water samples that are grossly exceeded (>2X hold time) reject (R) all non-detect results. Professi judgment used to qualify soils. See attached for list of affected samples.

**3.0 Laboratory Method** Yes [✓] No [ ] N/A [ ] Comments:

3.1 Was the correct laboratory method used?

**ACTION:** If no, contact lab to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change or to request variance.



OLIN-WILMINGTON
LEVEL I DATA QUALITY EVALUATION
STANDARD OPERATING PROCEDURE AND CHECKLIST
WET CHEMISTRY PARAMETERS BY VARIOUS METHODS

Yes [✓] No [ ] N/A [ ] Comments:

[✓] Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

[✓] Container type noted [✓] Condition observed [✓] pH verified (where applicable) [✓] Field and lab IDs cross referenced

**ACTION:** If no, contact lab for submission of missing or incomplete documentation.

**1.5.1** Were the correct bottles and preservatives used? Yes [✓] No [ ] N/A [ ] Comments:

Ammonia,– 1 Liter polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Oil & Grease – 1 Liter glass/HCL to pH<2,cool to 4°C

Alkalinity – 1 Liter polyethylene/cool to 4°C

Chemical Oxygen Demand – 50 mL polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Chloride, pH, sulfate - 50 mL polyethylene/cool to 4°C

Organic Carbon – 500 mL amber glass bottle/HCl or $H_2SO_4$ to pH<2,cool to 4°C

Sulfide – 50 mL polyethylene/ZnAcetate + NaOH to pH>9, cool to 4°C
Specific conductance, TDS, TSS – 100 mL polyethylene/cool to 4°C

**ACTION:** If no, inform senior chemist. Document justification for change in container/volume (if applicable), qualify positive and non-detect data (J) data if cooler temperature exceeds 10°C. Rejection of data requires professional judgment

**1.5.2** Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

**1.5.3** Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [ ] No [✓] N/A [ ] Comments:

**ACTION:** If no, document discrepancy in case narrative and contact lab for justification. Consult senior chemist for action needed.

4.3 Is the method blank less than the PQL? (See Section 3.2 for PQLs). Yes [✓] No [ ] N/A [ ] Comments:

4.4 Do any method blanks have positive results for wet chemistry parameters? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

**ACTION:** If any blank has positive results, list all the concentrations detected and flagging level (flagging level = 5 × blank value) on the checklist. List all affected samples and qualifiers.

## 5.0 Laboratory Control Standards

5.1 Was a laboratory control standard (LCS) run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call laboratory for LCS form submittal. If data is not available, use professional judgment to determine qualification actions for data associated with the batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

5.3 Is any wet chemistry analyte LCS recovery outside the control limits? Yes [ ] No [✓] N/A [ ] Comments:





3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☒ QAPP ☐ Lab? Yes [ ] No [✓] N/A [ ] Comments: The lab reported for sulfate (2 mg/L) that are greater than the QAPP required PQL 0.1 mg/L. All sulfate results are greater than PQL.

**Note:** *The MADEP QA/QC Guidelines do not yet list PQLs for wet chemistry analyses, therefore all criteria will default to values stipulated in the QAPP*. Where the QAPP does not define criteria, QA/QC requirements default to limits employed by the lab**. Other criteria may also apply.*

| | | | |
|---|---|---|---|
| Ammonia* ☐ = 0.1 mg/ L | Alkalinity**☐ = 1 mg/L | Bicarbonate Alkalinity** ☐ = 1 mg/L | Carbonate Alkalinity** ☐ = 1 mg |
| Nitrate Nitrogen as N* ☒ = .05 mg/L | Nitrite Nitrogen as N* ☒ = .01 mg/L | Chloride* ☒ = 1 mg/L | Hardness *☐ = 2 mg/L |
| Spec. Cond.** ☐ 3 umhos/cm | Total Organic Carbon** ☐ = 1 mg/L | Oil & Grease* ☐ = 3 mg/L | Sulfate (EPA 300.0)* ☒ = 0.1 m |
| COD:* Low – 20 mg/L | COD* High - 50 mg/L ☐ | TDS* ☐ = 10 mg/L | TSS* ☐ = 5 mg/L |
| pH* ☐ < 2 to > 12 | | | |

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

**ACTION:** If no, evaluate change with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are the appropriate parameter results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If *dilutions were required, were dilution factors reported?* Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact the lab for submission.

## 4.0 Method Blanks

Yes [✓] No [ ] N/A [ ] Comments:

4.1 Are the Method Blank Summaries present?

**ACTION:** If no, call the laboratory for submission of missing data.

4.2 Was a method blank analyzed for each analysis batch of wet chemistry field samples of 20 or less? Yes [✓] No [ ] N/A [ ] Comments:

6.3 Were matrix spikes analyzed at the required frequency of 1 per 20 samples per matrix? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If any matrix spike data is missing, call lab for resubmission.

6.4 Are any wet chemistry analyte spike recoveries outside of the QC limits? Yes [ ] No [✓] N/A [ ] Comments:

NOTE: $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample re
SR = Sample re
SA = Spike added

**MS/MSD Recovery Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia* (LACHAT) ☐ = 74-125% |
| Chloride*(SM 4500 Cl) ☐= 77-116% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA |
| Oil & Grease* = NA | COD Low* ☐ = 61-142% | COD High* ☐ = 92-109% | Nitrate Nitrogen as N** ☐ = 75-119% |
| Nitrite Nitrogen as N** ☐ = 68-136% | Hardness* ☐ = 70-130% | Sulfate (EPA 300.0)* ☐ = 75-125% pH* = NA | TSS* = NA |

Other parameter(list) _____ % R = _____ ☐ Rec Limits = _____

* = Laboratory Limits ** = Olin QAPP Limits *(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**NOTES:** 1) If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flag
2) If the MS/MSD was performed by the laboratory on a non-project sample, no qualification is required.

**ACTION:** MS/MSD flags only apply to the sample spiked. Do not evaluate if sample concentration is > 4X spike. If the recoveries of the MS and MSD exceed the upper control lir qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit but > 30%, qualify both positive results and non-detects (J). If MS/MSD recovery is < 30% and the sample is non-detect, the results are considered unusable and flagged (R).

**ACTION:** Laboratory control limits apply when spiked sample results fall within the normal calibration range. If dilutions are required due to high sample concentrations, the dat evaluated, but no flags are applied.

6.5 Are any RPDs for MS/MSD recoveries outside of the QA/QC limits? Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where S = MS result
D = MSD result





**LCS Limits:**

| | | | |
|---|---|---|---|
| Alkalinity** ☐ = 80-120% | Bicarbonate Alkalinity** ☐ = 80-120% | Carbonate Alkalinity** ☐ = 80-120% | Specific Conductivity *☐ = 80-120% |
| Total Organic Carbon** ☐ = 80-120% | TDS** ☐ = 80-120% | Oil & Grease* ☐ = 80-120% | Ammonia Nitrogen as N* ☑ = 80-120 |
| COD Low* ☐ = 80-120% | COD High* ☐ = 80-120% | Nitrate Nitrogen as N** ☑ = 85-115% | Nitrite Nitrogen as N** ☑ = 75-120 |
| Hardness* ☐ = 85-115% | Chloride* ☐ = 80-120% | Sulfate (EPA 300.0)* ☑ = 75-125% | pH* ☐ = 98-102% TSS* NA |

Other parameter(list) _____ %R = _____ ☐ Rec Limits= _____

Other parameter(list) _____ %R = _____ ☐ Rec Limits = _____

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**ACTION:** If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and no-detect res within the batch as (J). If LCS recovery is <10%, non-detect results are rejected (R).

## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs analyzed? List project samples that were spiked. Yes [✓] No [ ] N/A [ ] Comments: The lab p MS/MSD analysis on FM-
wet chemistry (210652-2), FM-27 (210642-2) and FM-25

**ACTION:** If no, contact senior chemist to see if any were specified.

6.2 Is the MS/MSD Recovery Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

**ACTION:** Evaluate rinsate results vs. blank results to determine if contaminant may be laboratory-derived. If not lab-related, qualify according to the table below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

**9.0 Field Duplicates**

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments: lab duplicate information only available.

SOW ☐ QAPP ☐ *MADEP Option 1(1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION**: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

Was any of the data qualified? Yes [✓] No [ ] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.





**MS/MSD RPD Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia** (LACHAT) ☐ = 8% |
| Chloride**(SM 4500 Cl) ☐ = 15% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA Total Organic Carbon* = NA |
| COD Low** ☐ = 14% | COD High** ☐ = 16% | Nitrate Nitrogen as N** ☐ 16% | Nitrite Nitrogen as N** ☐ = 16% |
| Oil & Grease* = NA | Hardness* = NA | Sulfate (EPA 300.0)* ☐ = 10% | pH* = NA TSS* = NA |

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

* = Laboratory Limits ** = Olin QAPP Limits

(*MADEP has not yet defined LCS recovery limits for wet chemistry analyses.*)

**7.0 Laboratory Duplicate**

Are the RPDs for the laboratory duplicates <20% unless otherwise specified below? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION**: If the RPD is greater than specified limits, qualify all results for that analyte as estimated (J).

| | | | |
|---|---|---|---|
| Alkalinity* = 4% | Bicarbonate Alkalinity* = 4% | Carbonate alkalinity* = 4% | Oil & Grease* ☐ = 20% |
| pH* ☐ = 3% | Specific Conductivity *☐ = 5% | TSS** ☐ = 6% | TDS** ☐ = 6% |

**8.0 Sampling Accuracy**

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:

The following SDGs are included in the data validation:

208828, 208920, 208976, 209054, 209127, 209269, 209410, 209515, 209569, 209636, 209675, 209868, 209820, 210042, 209973, 210164, 210235, 210351, 210438, 210585, 210625.



**REFERENCES**

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kenne GA 30144. August 1999.

STL-Westfield, 2002. "Olin – General Chemistry Control Limits (Soil & Water)," Severn Trent Laboratories, Inc., 53 Southampton Road, Westfield, MA, 01085.

| Sample ID | Lab ID | Analyte | Qualifier |
|---|---|---|---|
| SD-1 | 208828-1 | chloride | J |
| | | sulfate | J |
| | | nitrate | J |
| | | nitrite | G |
| | | ammonia | J |
| SD-2 | 208828-2 | sulfate | J |
| | | nitrate | G |
| | | nitrite | G |
| SD-5 | 208828-3 | nitrate | G |
| | | nitrite | G |
| SD-8 | 208828-4 | nitrate | G |
| | | nitrite | G |
| FM-1 | 208828-6 | chloride | J |
| | | sulfate | J |
| | | nitrate | G |
| | | nitrite | G |
| | | ammonia | J |
| FM-2 | 208828-7 | sulfate | J |
| | | nitrate | G |
| | | nitrite | G |
| FM-8 | 208828-8 | nitrate | G |
| | | nitrite | G |
| SD-31 | 210585-1 | nitrate | J |
| | | nitrite | J |
| FM-24 | 209820-2 | nitrate | J |

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

08/13/2003

Report Number: 208828

Dear Alan Peirce,

The analysis of your sample(s) submitted on 07/31/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 24

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## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 208828 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

208828 1-10

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| As specified in MADEP Compendium of Analytical Methods (check all that apply): | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, and C is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes | No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes | No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data? | Yes | No[1] |

**A response to questions D and E below is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| D | Were all QC performance standards and recommendations for the specified methods achieved? | Yes | No |
| E | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes | No[1] |

[1] All NO answers must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

Signature: [signature] Position: Laboratory Director

Printed Name: Steven C. Hartmann Date: 8/13/03

## CASE NARRATIVE

Client: OLIN Chemical

Report Number: 208828

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

Samples were received on 07/31/03 properly preserved, on ice and in good condition.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

Method ASTM 1298 (Hydrometer @ 25C) was performed at STL Chicago. The subcontracted laboratory noted no reportable deviations.

### Inorganic

### EPA 300.0 Part A

For method EPA 300 (Nitrate, Nitrite), all the samples had high intrinsic color, turbidity and/or dissolved salts and as a result, required a dilution prior to analyzing on the instrument. The reporting limits have been raised accordingly.

Sample SD-10 and FM-11 had expired holding time prior to laboratory receipt. The analysis was initiated at the request of the client.

### Chloride

Samples SD-10 and FM-11 had expired holding times prior to laboratory receipt. The analysis was initiated at the request of the client.
No reportable deviations.

### Sulfate

Samples SD-1, SD-2, FM-1, FM-2, were analyzed outside of method hold-time. There was insufficient time remaining to perform the analysis within hold-time.
The analysis was initiated at the request of the client.
No reportable deviations.

### Ammonia

Samples SD-10 and FM-11 had expired holding times prior to laboratory receipt.
The analysis was initiated at the request of the client.

Metals

EPA 200.7

Poor matrix spike recoveries were noted for the MS results. The sample concentrations overwhelmed the amount of spike added. The LCS recovered within acceptable control limits.

No reportable deviations.



SAMPLE INFORMATION
Date: 08/13/2003

Job Number..: 208828
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 208828-1 | SD-1 | Water | 07/01/2003 | 09:30 | 07/31/2003 | 10:40 |
| 208828-2 | SD-2 | Water | 07/08/2003 | 14:00 | 07/31/2003 | 10:40 |
| 208828-3 | SD-5 | Water | 07/14/2003 | 14:00 | 07/31/2003 | 10:40 |
| 208828-4 | SD-8 | Water | 07/25/2003 | 12:00 | 07/31/2003 | 10:40 |
| 208828-5 | SD-10 | Water | 07/30/2003 | 10:25 | 07/31/2003 | 10:40 |
| 208828-6 | FM-1 | Water | 07/01/2003 | 09:20 | 07/31/2003 | 10:40 |
| 208828-7 | FM-2 | Water | 07/08/2003 | 13:50 | 07/31/2003 | 10:40 |
| 208828-8 | FM-8 | Water | 07/22/2003 | 10:50 | 07/31/2003 | 10:40 |
| 208828-9 | FM-11 | Water | 07/30/2003 | 10:20 | 07/31/2003 | 10:40 |
| 208828-10 | FM-5 | Water | 07/14/2003 | 13:50 | 07/31/2003 | 10:40 |



SEVERN STL MADEP MA014 RIDOH57 NY DOH 10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000
STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400

MACTEC

Engineering and Consulting, Inc.
511 Congress Street
P.O. Box 7050
Portland, Maine 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow

From: Chris Ricardi

Date: 11/24/03

Subject: Olin Wilmington – Core Samples

**Data Validation Summary**
**STL Data Set 208072**

This sample set contained results for three water samples identified as Core #1, Core #2, and Core #3 and two soil sample identified as Core #1S and Core #2S. The samples were generated during laboratory tests on June 26, 2003 and analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for selected metals (calcium, aluminum, iron, magnesium, sodium, and chromium) and chemistry parameters including chloride, sulfate, nitrate, nitrite, and ammonia.

The Olin Wilmington QAPP was used as a reference during the review. Metals results were reviewed using the Data Quality Evaluation checklists that were developed for the Olin Wilmington annual and quarterly groundwater monitoring tasks.

**Validation Actions**

With the exception of the items discussed below, results are interpreted to be usable as reported by the laboratory.

The nitrate and nitrite analysis for sample Core #2S (208072-5) was performed one day outside of analytical hold time. Results for nitrate and nitrite in sample Core #2S (208072-5) was qualified estimated (J).

The wet chemistry MS and MS reanalysis percent recoveries for ammonia (0 and 38) are less than the lower control limit. Ammonia was present at a concentration of approximately 2X the spike concentration. Good recovery was reported in the laboratory control sample (LCS) associated with this sample batch indicating that the low recovery was due to a matrix effect. Results for ammonia in the unspiked sample Core #1S (208072-4 is qualified estimated (J).



SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

Revised Results for 208072-1,2,3 Are in this Package on 11/25/03

August 15, 2003

Report Number: 208072

**REVISED**

Dear Alan Peirce,

The revised report for Report Number 208072 is now complete. This revision corrects a transcription error entered into our LIMS database. The transcription error affected both the Metals sample results and reporting limits.

If you should have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

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Tel 413 572 4000 Fax 413 572 3707 • www.stl-inc.com

SEVERN

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

07/21/2003

Report Number: 208072

Dear Alan Peirce,

The analysis of your sample(s) submitted on 06/27/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 32


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## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 208072 |
| Project Location: | Off Property West DI | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

208072 1-5

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( X ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, and C is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes | No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes | No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data? | Yes | No[1] |

**A response to questions D and E below is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| D | Were all QC performance standards and recommendations for the specified methods achieved? | Yes | No[1] |
| E | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes | No[1] |

[1] All NO answers must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 7/22/03

SEVERN

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

07/21/2003

Report Number: 208072

Dear Alan Peirce,

The analysis of your sample(s) submitted on 06/27/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 32


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## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 208072 |
| Project Location: | Off Property West DI | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

208072 1-5

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( X ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, and C is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes | No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes | No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data? | Yes | No[1] |

**A response to questions D and E below is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| D | Were all QC performance standards and recommendations for the specified methods achieved? | Yes | No[1] |
| E | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes | No[1] |

[1] All NO answers must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 7/22/03

CASE NARRATIVE

Client: Olin Chemical

Report Number: 208072

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

Samples were received on 06/27/03 properly preserved, on ice and in good condition.

**Metals**

**SW846 6010B**

An aqueous matrix was used for both the soil method blank and LCS. A closing ICSA/AB was not performed at the end of the analytical run. The opening ICSA/AB for each instrument run passed with acceptable control criteria.
No other reportable deviations were noted. Per client request, an abridged element list was reported.

The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).

**Inorganic**

**Nitrate**
No reportable deviations

**Nitrite**
No reportable deviations

**Sulfate**
No reportable deviations

**Chloride**
No reportable deviations

**Ammonia**
No reportable deviations

**Subcontracted**

The Specific Gravity [Hydrometer @25] analysis was performed at STL Chicago.



SAMPLE INFORMATION
Date: 07/21/2003

Job Number.: 208072
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001271
Customer Project ID....: OFF PROPERTY WEST DI
Project Description....: Off Property West Ditch

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 208072-1 | Core #1 | Water | 06/26/2003 | 16:00 | 06/27/2003 | 11:00 |
| 208072-2 | Core #2 | Water | 06/26/2003 | 16:00 | 06/27/2003 | 11:00 |
| 208072-3 | Core #3 | Water | 06/26/2003 | 16:00 | 06/27/2003 | 11:00 |
| 208072-4 | Core #1S | Soil | 06/26/2003 | 16:00 | 06/27/2003 | 11:00 |
| 208072-5 | Core #2S | Soil | 06/26/2003 | 16:00 | 06/27/2003 | 11:00 |

# LABORATORY TEST RESULTS

Job Number: 208072 Date: 08/15/2003

CUSTOMER: Olin Chemical PROJECT: OFF PROPERTY WEST DI ATTN: Alan Peirce

Customer Sample ID: Core #1
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Water

Laboratory Sample ID: 208072-1
Date Received.....: 06/27/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 9620 | | 1000 | mg/L | 07/02/03 | rwe |
| EPA300.0 PartA | Sulfate | 38500 | | 2000 | mg/L | 07/02/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 10 | mg/L | 06/28/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 2.0 | mg/L | 06/28/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 3280 | | 20 | mg/L | 07/07/03 | kmm |
| SW846 6010B | Metals Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 330000 | | 40000 | ug/L | 07/11/03 | bpg |
| | Iron (Fe) | 1160000 | | 20000 | ug/L | 07/11/03 | bpg |
| | Magnesium (Mg) | 638000 | | 40000 | ug/L | 07/11/03 | bpg |
| | Sodium (Na) | 11400000 | | 400000 | ug/L | 07/11/03 | bpg |
| SW846 6010B MC | Metals Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 1410000 | | 1000 | ug/L | 07/08/03 | bpg |
| SW846 6010B | Metals Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 1090000 | | 10000 | ug/L | 07/08/03 | bpg |

* In Description = Dry





# LABORATORY TEST RESULTS

Job Number: 208072 Date: 08/15/2003

CUSTOMER: Olin Chemical PROJECT: OFF PROPERTY WEST DI ATTN: Alan Peirce

Customer Sample ID: Core #2
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Water

Laboratory Sample ID: 208072-2
Date Received.....: 06/27/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 10700 | | 1000 | mg/L | 07/02/03 | rwe |
| EPA300.0 PartA | Sulfate | 42000 | | 2000 | mg/L | 07/02/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 10 | mg/L | 06/28/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 2.0 | mg/L | 06/28/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 4020 | | 20 | mg/L | 07/07/03 | kmm |
| SW846 6010B | Metals Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 334000 | | 40000 | ug/L | 07/11/03 | bpg |
| | Iron (Fe) | 1190000 | | 20000 | ug/L | 07/11/03 | bpg |
| | Magnesium (Mg) | 642000 | | 40000 | ug/L | 07/11/03 | bpg |
| | Sodium (Na) | 11500000 | | 400000 | ug/L | 07/11/03 | bpg |
| SW846 6010B MC | Metals Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 1420000 | | 1000 | ug/L | 07/08/03 | bpg |
| SW846 6010B | Metals Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 1100000 | | 10000 | ug/L | 07/08/03 | bpg |

* In Description = Dry Wgt.

LABORATORY TEST RESULTS

Job Number: 208072 Date: 08/15/2003

CUSTOMER: Olin Chemical PROJECT: OFF PROPERTY WEST DI ATTN: Alan Peirce

Customer Sample ID: Core #3
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Water

Laboratory Sample ID: 208072-3
Date Received.....: 06/27/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 21500 | | 670 | mg/L | 07/02/03 | rwe |
| EPA300.0 PartA | Sulfate | 84000 | | 2700 | mg/L | 07/02/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 17 | mg/L | 06/28/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 3.3 | mg/L | 06/28/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 6360 | | 67 | mg/L | 07/07/03 | kmm |
| SW846 6010B | Metals Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 656000 | | 13300 | ug/L | 07/11/03 | bpg |
| | Iron (Fe) | 2320000 | | 6670 | ug/L | 07/11/03 | bpg |
| | Magnesium (Mg) | 1240000 | | 13300 | ug/L | 07/11/03 | bpg |
| | Sodium (Na) | 22400000 | | 133000 | ug/L | 07/11/03 | bpg |
| SW846 6010B MC | Metals Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 2980000 | | 3300 | ug/L | 07/16/03 | rac |
| SW846 6010B | Metals Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 2100000 | | 3340 | ug/L | 07/08/03 | bpg |

* In Description = Dry Wgt.





LABORATORY TEST RESULTS

Job Number: 208072 Date: 07/22/2003

CUSTOMER: Olin Chemical PROJECT: OFF PROPERTY WEST DI ATTN: Alan Peirce

Customer Sample ID: Core #1S
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Soil

Laboratory Sample ID: 208072-4
Date Received.....: 06/27/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride* | 1400 | | 10 | mg/Kg | 07/15/03 | rwe |
| EPA300.0 PartA | Sulfate* | 4810 | | 20 | mg/Kg | 07/15/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N)* | 7 | | 2 | mg/Kg | 07/02/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N)* | ND | U | 0.4 | mg/Kg | 07/02/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N* | 967 | | 44 | mg/Kg | 07/07/03 | kmm |
| % Solids 160.3 | % Solids | 99.4 | | 0.1 | % | 07/01/03 | grb |
| SW846 6010B | Metals Analysis (ICP) | | | | | | |
| | Calcium (Ca)* | 2840 | | 55.3 | mg/Kg | 07/16/03 | rac |
| | Iron (Fe)* | 21700 | | 27.7 | mg/Kg | 07/16/03 | rac |
| | Magnesium (Mg)* | 5400 | | 55.3 | mg/Kg | 07/16/03 | rac |
| | Sodium (Na)* | 2250 | | 553 | mg/Kg | 07/16/03 | rac |
| SW846 6010B MC | Metals Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr)* | 1180 | | 2.77 | mg/Kg | 07/10/03 | bpg |
| SW846 6010B | Metals Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al)* | 8670 | | 27.7 | mg/Kg | 07/10/03 | bpg |

11/26/03

* In Description = Dry Wgt.

LABORATORY TEST RESULTS

Job Number: 208072 Date: 07/22/2003

CUSTOMER: Olin Chemical PROJECT: OFF PROPERTY WEST OF ATTN: Alan Peirce

Customer Sample ID: Core #2S
Date Sampled.....: 06/26/2003
Time Sampled.....: 16:00
Sample Matrix.....: Soil

Laboratory Sample ID: 208072-5
Date Received.....: 06/27/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride* | 1770 | | 10 | mg/Kg | 07/15/03 | rwe |
| EPA300.0 PartA | Sulfate* | 6780 | | 20 | mg/Kg | 07/15/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N)* | 6 | | 2 | mg/Kg | 07/02/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N)* | ND | U | 0.4 | mg/Kg | 07/02/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N* | 830 | | 34 | mg/Kg | 07/07/03 | kmm |
| % Solids 160.3 | % Solids | 98.5 | | 0.1 | % | 07/01/03 | grb |
| SW846 6010B | Metals Analysis (ICP) | | | | | | |
| | Calcium (Ca)* | 2150 | | 57.2 | mg/Kg | 07/16/03 | rac |
| | Iron (Fe)* | 13500 | | 28.6 | mg/Kg | 07/16/03 | rac |
| | Magnesium (Mg)* | 3820 | | 57.2 | mg/Kg | 07/16/03 | rac |
| | Sodium (Na)* | 2370 | | 572 | mg/Kg | 07/16/03 | rac |
| SW846 6010B MC | Metals Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr)* | 941 | | 2.86 | mg/Kg | 07/10/03 | bpg |
| SW846 6010B | Metals Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al)* | 6510 | | 28.6 | mg/Kg | 07/10/03 | bpg |

11/22/03

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0484
NY DOH 10843
NH DES 251901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400

# SUBCONTRACTED DATA

SEVERN TRENT STL

# SEVERN TRENT LABORATORIES
# ANALYTICAL REPORT

JOB NUMBER: 218646

Prepared For:

Severn Trent Laboratories
Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

Project: STL Westfield

Attention: Becky Mason

Date: 07/09/2003

Bonnie Stadelmann
Signature

07/09/03
Date


Name: Bonnie M. Stadelmann

Title: Project Manager

E-Mail: bstadelmann@stl-inc.com

STL Chicago
2417 Bond Street
University Park, IL 60466

PHONE: (708) 534-5200
FAX..: (708) 534-5211




STL Chicago
Wet Chemistry Case Narrative

Client: **STL Westfield**
Job Number: **203446** Date Rec'd: 05/17/01

This narrative covers the analysis of the samples in the above Job # for specific gravity.

Samples 218646-1 through 3 were done by hydrometer, ASTM Method D 1298. STL Chicago was sent dilutions of the actual samples, and calculated the specific gravities of the original samples from the following equations:

**218646-1** Specific Gravity of 1/200 dilution = **1.0025**

99.5%(1.0000) + 0.5%(Specific Gravity of neat sample) = 100%(1.0025)

Specific Gravity of neat sample = **1.50**

**218646-2** Specific Gravity of 1/200 dilution = **1.0020**

99.5%(1.0000) + 0.5%(Specific Gravity of neat sample) = 100%(1.0020)

Specific Gravity of neat sample = **1.40**

**218646-3** Specific Gravity of 1/66.667 dilution = **1.0035**

98.5%(1.0000) + 1.5%(Specific Gravity of neat sample) = 100%(1.0035)

Specific Gravity of neat sample = **1.23**

The results for samples **218646-4** and 5 are the averages of three measurements of the weights of the samples divided by the weight of an equal volume of water.

Diane L. Harper
Wet Chemistry Section Manager

7-9-03
Date

MACTEC

**Engineering and Consulting, Inc.**
511 Congress Street
P.O. Box 7050
Portland, Maine 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow

From: Chris Ricardi

Date: 11/24/03

Subject: Olin Wilmington – Geomega DAPL Column Test Samples

**Data Validation Summary**

This sample set contained results for multiple aqueous samples generated by Geomega from the effluent stream of their laboratory column tests completed on DAPL saturated soil cores collected from the Olin Wilmington site. The samples were generated during testing completed from July through October 2003, and were analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for selected metals (aluminum, calcium, chromium, iron, magnesium, sodium, and lithium) and water chemistry parameters including chloride, sulfate, nitrite, nitrate, and ammonia.

The following sample delivery groups (SDGs) are included in the data validation:

208828, 208920, 208976, 209054, 209127, 209269, 209410, 209515, 209569, 209636, 209675, 209868, 209820, 210042, 209973, 210164, 210235, 210351, 210438, 210585, 210625. The samples from these data sets were combined into a single data group for validation.

The Olin Wilmington QAPP was used as a reference during the review. Metals results were reviewed using the Data Quality Evaluation checklists that were developed for the Olin Wilmington annual and quarterly groundwater monitoring tasks.

**Validation Actions**

With the exception of the results discussed below, results are interpreted to be usable as reported by the laboratory.

Samples in SDG 208828 were submitted to the lab outside of analytical hold time. Geomega requested the lab perform analyses outside of analytical hold time. Sample detections reported are qualified estimated (J), non-detects are qualified (G) to indicate the result would normally be rejected due to grossly exceeded hold time. Samples that are qualified due to exceeded hold time are listed in Table 1.

Several other nitrate results in data sets 210585 and 209820 were also qualified estimated (J) due to exceeded holding tine.

Table 1

| Sample ID | Lab ID | Analyte | Qualifier |
|---|---|---|---|
| SD-1 | 208828-1 | Chloride | J |
| | | Sulfate | J |
| | | Nitrate | J |
| | | Nitrite | G |
| | | Ammonia | J |
| SD-2 | 208828-2 | Sulfate | J |
| | | Nitrate | G |
| | | Nitrite | G |
| SD-5 | 208828-3 | Nitrate | G |
| | | Nitrite | G |
| SD-8 | 208828-4 | Nitrate | G |
| | | Nitrite | G |
| FM-1 | 208828-6 | Chloride | J |
| | | Sulfate | J |
| | | Nitrate | G |
| | | Nitrite | G |
| | | Ammonia | J |
| FM-2 | 208828-7 | Sulfate | J |
| | | Nitrate | G |
| | | Nitrite | G |
| FM-8 | 208828-8 | Nitrate | G |
| | | Nitrite | G |
| SD-31 | 210585-1 | Nitrate | J |
| | | Nitrate | J |
| FM-24 | 209820-2 | Nitrate | J |

Geomega
Good Science
Hard Work
Creative Thinking

# Memorandum

**To:** Chris Ricardi (MACTEC)

**CC:** Margret Hanley (SH&D)

**From:** Dan Stone

**Date:** November 5, 2003

**Re:** Transmittal of Laboratory Analytical Packets

---

Per Margret Hanley's request, I am sending you copies of the laboratory analytical packets that we have received for the floc study and the DAPL column-test experiment. The accompanying tables list all of the samples that have been collected to date. Samples highlighted in yellow have been submitted to the lab, but we have not yet received the results. Please feel free to contact me by phone at 303-443-9117 (x101) or by email (*dstone@geomega.com*) if there is anything else you need from us.

Floc Study

| Sample Name | Sample Type | Collected By | Sent to | Date Collected | Date Sent to Lab | Lab Results Received | Data Sent to MACTEC | Source |
|---|---|---|---|---|---|---|---|---|
| BACKFLOCSW-2003 | SW | MACTEC | STL | 6/19/03 | | | | Olin DB |
| BACKFLOC-2003 | SW | MACTEC | STL | 6/19/03 | | | | Olin DB |
| REDFLOCSW-2003 | SW | MACTEC | STL | 6/25/03 | | | | Olin DB |
| REDFLOC-2003 | SW | MACTEC | STL | 6/25/03 | | | | Olin DB |
| WhiteflocSW-2003 | SW | MACTEC | STL | 9/8/03 | | | | Olin DB |
| Whitefloc-2003 | SW | MACTEC | STL | 9/8/03 | | | | Olin DB |
| Red f 4 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 5 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 7 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 8 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 724 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 716 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 78 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red f 72 | SW | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Red floc | S | Geomega | STL | 7/24/03 | 7/24/03 | 8/11/03 | 11/5/03 | STL Results/COC |
| Bf4 | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf5 | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf7 | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf8 | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf4s | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf5s | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf7s | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bf8s | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bfsws | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Bfws | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Backfloc | S | Geomega | STL | 7/30/03 | 7/30/03 | 8/12/03 | 11/5/03 | STL Results/COC |
| Red Floc | | Geomega | CU microprobe | | 8/4/03 | | | COC |
| Back Floc | | Geomega | CU microprobe | | 8/4/03 | | | COC |
| Wf3 | water | Geomega | STL | | | 11/4/03 | 11/5/03 | STL Results/COC |
| Wf4 | water | Geomega | STL | | | 11/4/03 | 11/5/03 | STL Results/COC |
| Wf5 | water | Geomega | STL | | | 11/4/03 | 11/5/03 | STL Results/COC |
| Wf7 | water | Geomega | STL | | | 11/4/03 | 11/5/03 | STL Results/COC |
| Wf8 | water | Geomega | STL | | | 11/4/03 | 11/5/03 | STL Results/COC |
| Whitefloc | S | Geomega | STL | | | 11/4/03 | 11/5/03 | STL Results/COC |

VOC column test experiment

| Sample Name | Sample Type | Collected By | Sent to | Date Collected | Date Sent to Lab | Lab Results Received | Revised Results Received | Data Sent to MACTEC | Source |
|---|---|---|---|---|---|---|---|---|---|
| SD-1 | GW | Geomega | STL | 7/1/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-2 | GW | Geomega | STL | 7/8/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-5 | GW | Geomega | STL | 7/14/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-8 | GW | Geomega | STL | 7/25/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-10 | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-11 | GW | Geomega | STL | 8/3/03 | 8/3/03 | 8/18/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-12 | GW | Geomega | STL | 8/5/03 | 8/5/03 | 8/21/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| SD-13 | GW | Geomega | STL | 8/7/03 | 8/7/03 | 8/22/03 | 9/8/03 | 11/5/03 | STL Results/COC |
| SD-14 | GW | Geomega | STL | 8/10/03 | 8/11/03 | 8/25/03 | 9/8/03 | 11/5/03 | STL Results/COC |
| SD-15 | GW | Geomega | STL | 8/17/03 | 8/18/03 | 9/4/03 | | 11/5/03 | STL Results/COC |
| SD-18 | GW | Geomega | STL | 8/25/03 | 8/25/03 | 9/10/03 | | 11/5/03 | STL Results/COC |
| SD-19 | GW | Geomega | STL | 8/28/03 | 8/28/03 | 9/11/03 | | 11/5/03 | STL Results/COC |
| SD-20 | GW | Geomega | STL | 9/2/03 | 9/2/03 | 9/15/03 | | 11/5/03 | STL Results/COC |
| SD-21 | GW | Geomega | STL | 9/4/03 | 9/4/03 | 10/1/03 | | 11/5/03 | STL Results/COC |
| SD-22 | GW | Geomega | STL | 9/8/03 | 9/8/03 | 9/30/03 | | 11/5/03 | STL Results/COC |
| SD-23 | GW | Geomega | STL | 9/11/03 | 9/11/03 | 9/30/03 | | 11/5/03 | STL Results/COC |
| SD-24 | GW | Geomega | STL | 9/15/03 | 9/15/03 | 9/30/03 | | 11/5/03 | STL Results/COC |
| SD-25 | GW | Geomega | STL | 9/18/03 | 9/18/03 | 10/2/03 | | 11/5/03 | STL Results/COC |
| SD-26 | GW | Geomega | STL | 9/22/03 | 9/22/03 | 10/2/03 | | 11/5/03 | STL Results/COC |
| SD-27 | GW | Geomega | STL | 9/25/03 | 9/25/03 | 10/15/03 | | 11/5/03 | STL Results/COC |
| SD-28 | GW | Geomega | STL | 9/29/03 | 9/29/03 | 10/15/03 | | 11/5/03 | STL Results/COC |
| SD-29 | GW | Geomega | STL | 10/2/03 | 10/2/03 | 11/5/03 | | 11/5/03 | STL Results |
| SD-30 | GW | Geomega | STL | 10/6/03 | 10/6/03 | 10/23/03 | | 11/5/03 | STL Results/COC |
| SD-31 | GW | Geomega | STL | 10/9/03 | 10/9/03 | 10/24/03 | | 11/5/03 | STL Results/COC |
| SD-32 | GW | Geomega | STL | 10/13/03 | 10/13/03 | 10/28/03 | | 11/5/03 | STL Results/COC |
| SD-33 | GW | Geomega | STL | | | | | | |
| SD-34 | GW | Geomega | STL | | | | | | |
| SD-35 | GW | Geomega | STL | | | | | | |
| SD-37 | GW | Geomega | STL | | | | | | |
| FM-1 | GW | Geomega | STL | 7/1/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-2 | GW | Geomega | STL | 7/8/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-5 | GW | Geomega | STL | 7/14/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-8 | GW | Geomega | STL | 7/22/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-11 | GW | Geomega | STL | 7/30/03 | 7/30/03 | 8/13/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-12 | GW | Geomega | STL | 8/3/03 | 8/3/03 | 8/18/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-13 | GW | Geomega | STL | 8/5/03 | 8/5/03 | 8/21/03 | 9/4/03 | 11/5/03 | STL Results/COC |
| FM-14 | GW | Geomega | STL | 8/7/03 | 8/7/03 | 8/22/03 | 9/8/03 | 11/5/03 | STL Results/COC |
| FM-15 | GW | Geomega | STL | 8/10/03 | 8/11/03 | 8/25/03 | 9/8/03 | 11/5/03 | STL Results/COC |
| FM-16 | GW | Geomega | STL | 8/17/03 | 8/18/03 | 9/4/03 | | 11/5/03 | STL Results/COC |
| FM-19 | GW | Geomega | STL | 8/25/03 | 8/25/03 | 9/10/03 | | 11/5/03 | STL Results/COC |
| FM-20 | GW | Geomega | STL | 8/28/03 | 8/28/03 | 9/11/03 | | 11/5/03 | STL Results/COC |
| FM-21 | GW | Geomega | STL | 9/2/03 | 9/2/03 | 9/15/03 | | 11/5/03 | STL Results/COC |
| FM-22 | GW | Geomega | STL | 9/4/03 | 9/4/03 | 10/1/03 | | 11/5/03 | STL Results/COC |
| FM-23 | GW | Geomega | STL | 9/8/03 | 9/8/03 | 9/30/03 | | 11/5/03 | STL Results/COC |
| FM-24 | GW | Geomega | STL | 9/11/03 | 9/11/03 | 9/30/03 | | 11/5/03 | STL Results/COC |
| FM-25 | GW | Geomega | STL | 9/15/03 | 9/15/03 | 9/30/03 | | 11/5/03 | STL Results/COC |
| FM-26 | GW | Geomega | STL | 9/18/03 | 9/18/03 | 10/2/03 | | 11/5/03 | STL Results/COC |
| FM-27 | GW | Geomega | STL | 9/22/03 | 9/22/03 | 10/2/03 | | 11/5/03 | STL Results/COC |
| FM-28 | GW | Geomega | STL | 9/25/03 | 9/25/03 | 10/15/03 | | 11/5/03 | STL Results/COC |
| FM-29 | GW | Geomega | STL | 9/29/03 | 9/29/03 | 10/15/03 | | 11/5/03 | STL Results/COC |
| FM-30 | GW | Geomega | STL | 10/2/03 | 10/2/03 | 11/5/03 | | 11/5/03 | STL Results |
| FM-31 | GW | Geomega | STL | 10/6/03 | 10/6/03 | 10/23/03 | | 11/5/03 | STL Results/COC |
| FM-32 | GW | Geomega | STL | 10/9/03 | 10/9/03 | 10/24/03 | | 11/5/03 | STL Results/COC |
| FM-33 | GW | Geomega | STL | 10/13/03 | 10/13/03 | 10/28/03 | | 11/5/03 | STL Results/COC |
| FM-34 | GW | Geomega | STL | | | | | | |
| FM-35 | GW | Geomega | STL | | | | | | |



| Sample Name | Sample Type | Collected By | Sent to | Date Collected | Date Sent to Lab | Lab Results Received | Revised Results Received | Data Sent to MACTEC | Source |
|---|---|---|---|---|---|---|---|---|---|
| FM-36 | GW | Geomega | STL | | | | | | |
| FM-38 | GW | Geomega | STL | | | | | | |
| Core#1 | GW | Geomega | STL | 6/26/03 | 6/26/03 | 7/21/03 | 8/15/03 | 11/5/03 | STL Results/COC |
| Core#2 | GW | Geomega | STL | 6/26/03 | 6/26/03 | 7/21/03 | 8/15/03 | 11/5/03 | STL Results/COC |
| Core#3 | GW | Geomega | STL | 6/26/03 | 6/26/03 | 7/21/03 | 8/15/03 | 11/5/03 | STL Results/COC |
| Core#1S | S | Geomega | STL | 6/26/03 | 6/26/03 | 7/21/03 | | 11/5/03 | STL Results/COC |
| Core#2S | S | Geomega | STL | 6/26/03 | 6/26/03 | 7/21/03 | | 11/5/03 | STL Results/COC |

| Sample ID | Lab ID | Analyte | Qualifier |
|---|---|---|---|
| SD-1 | 208828-1 | chloride | J |
| | | sulfate | J |
| | | nitrate | J |
| | | nitrite | G |
| | | ammonia | J |
| SD-2 | 208828-2 | sulfate | J |
| | | nitrate | G |
| | | nitrite | G |
| SD-5 | 208828-3 | nitrate | G |
| | | nitrite | G |
| SD-8 | 208828-4 | nitrate | G |
| | | nitrite | G |
| FM-1 | 208828-6 | chloride | J |
| | | sulfate | J |
| | | nitrate | G |
| | | nitrite | G |
| | | ammonia | J |
| FM-2 | 208828-7 | sulfate | J |
| | | nitrate | G |
| | | nitrite | G |
| FM-8 | 208828-8 | nitrate | G |
| | | nitrite | G |
| SD-31 | 210585-1 | nitrate | J |
| | | nitrite | J |
| FM-24 | 209820-2 | nitrate | J |

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

08/13/2003

Report Number: 208828

Dear Alan Peirce,

The analysis of your sample(s) submitted on 07/31/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 24

Severn Trent Laboratories, Inc.
STL Westfield • 53 Southampton Road, Westfield, MA 01085
Tel 413 572 4000 Fax 413 572 3707 • www.stlinc.com

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## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 208828 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

208828 1-10

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| As specified in MADEP Compendium of Analytical Methods (check all that apply): | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, and C is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes | No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes | No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data? | Yes | No[1] |

**A response to questions D and E below is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| D | Were all QC performance standards and recommendations for the specified methods achieved? | Yes | No |
| E | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes | No[1] |

[1] All NO answers must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

Signature: [signature] Position: Laboratory Director

Printed Name: Steven C. Hartmann Date: 8/13/03

## CASE NARRATIVE

Client: OLIN Chemical

Report Number: 208828

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

Samples were received on 07/31/03 properly preserved, on ice and in good condition.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

Method ASTM 1298 (Hydrometer @ 25C) was performed at STL Chicago. The subcontracted laboratory noted no reportable deviations.

### Inorganic

### EPA 300.0 Part A

For method EPA 300 (Nitrate, Nitrite), all the samples had high intrinsic color, turbidity and/or dissolved salts and as a result, required a dilution prior to analyzing on the instrument. The reporting limits have been raised accordingly.

Sample SD-10 and FM-11 had expired holding time prior to laboratory receipt. The analysis was initiated at the request of the client.

### Chloride

Samples SD-10 and FM-11 had expired holding times prior to laboratory receipt. The analysis was initiated at the request of the client.
No reportable deviations.

### Sulfate

Samples SD-1, SD-2, FM-1, FM-2, were analyzed outside of method hold-time. There was insufficient time remaining to perform the analysis within hold-time.
The analysis was initiated at the request of the client.
No reportable deviations.

### Ammonia

Samples SD-10 and FM-11 had expired holding times prior to laboratory receipt.
The analysis was initiated at the request of the client.

Metals

EPA 200.7

Poor matrix spike recoveries were noted for the MS results. The sample concentrations overwhelmed the amount of spike added. The LCS recovered within acceptable control limits.

No reportable deviations.



SAMPLE INFORMATION
Date: 08/13/2003

Job Number..: 208828
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 208828-1 | SD-1 | Water | 07/01/2003 | 09:30 | 07/31/2003 | 10:40 |
| 208828-2 | SD-2 | Water | 07/08/2003 | 14:00 | 07/31/2003 | 10:40 |
| 208828-3 | SD-5 | Water | 07/14/2003 | 14:00 | 07/31/2003 | 10:40 |
| 208828-4 | SD-8 | Water | 07/25/2003 | 12:00 | 07/31/2003 | 10:40 |
| 208828-5 | SD-10 | Water | 07/30/2003 | 10:25 | 07/31/2003 | 10:40 |
| 208828-6 | FM-1 | Water | 07/01/2003 | 09:20 | 07/31/2003 | 10:40 |
| 208828-7 | FM-2 | Water | 07/08/2003 | 13:50 | 07/31/2003 | 10:40 |
| 208828-8 | FM-8 | Water | 07/22/2003 | 10:50 | 07/31/2003 | 10:40 |
| 208828-9 | FM-11 | Water | 07/30/2003 | 10:20 | 07/31/2003 | 10:40 |
| 208828-10 | FM-5 | Water | 07/14/2003 | 13:50 | 07/31/2003 | 10:40 |



SEVERN STL MADEP MA014 RIDOH57 NY DOH 10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000
STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400

# LABORATORY TEST RESULTS

Job Number: 208828 Date: 08/13/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-1
Date Sampled.....: 07/01/2003
Time Sampled.....: 09:30
Sample Matrix.....: Water

Laboratory Sample ID: 208828-1
Date Received.....: 07/31/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.1101 | | 0.0001 | Ratio | 08/06/03 | sub |
| EPA300.0 PartA | Chloride | 5410 | J | 500 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 75100 | J | 2000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 25.5 | J | 25 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U G | 5.0 | mg/L | 08/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 4840 | J | 60 | mg/L | 08/04/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1940000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Calcium (Ca) | 585000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Chromium (Cr) | 2750000 | | 1000 | ug/L | 08/11/03 | bpg |
| | Iron (Fe) | 2050000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Magnesium (Mg) | 1140000 | | 20000 | ug/L | 08/11/03 | bpg |
| | Sodium (Na) | 19400000 | | 200000 | ug/L | 08/11/03 | bpg |

11/26/03

* In Description = Dry Wgt.





# LABORATORY TEST RESULTS

Job Number: 208828 Date: 08/13/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-2
Date Sampled.....: 07/08/2003
Time Sampled.....: 14:00
Sample Matrix.....: Water

Laboratory Sample ID: 208828-2
Date Received.....: 07/31/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.1096 | | 0.0001 | Ratio | 08/06/03 | sub |
| EPA300.0 PartA | Chloride | 4620 | J | 500 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 72100 | J | 2000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U G | 25 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U G | 5.0 | mg/L | 08/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 5880 | J | 60 | mg/L | 08/04/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1880000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Calcium (Ca) | 583000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Chromium (Cr) | 2570000 | | 1000 | ug/L | 08/11/03 | bpg |
| | Iron (Fe) | 2010000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Magnesium (Mg) | 1120000 | | 20000 | ug/L | 08/11/03 | bpg |
| | Sodium (Na) | 19400000 | | 200000 | ug/L | 08/11/03 | bpg |

11/26/03

* In Description = Dry Wgt.

# LABORATORY TEST RESULTS

Job Number: 208828 Date: 08/13/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-1
Date Sampled.....: 07/01/2003
Time Sampled.....: 09:30
Sample Matrix.....: Water

Laboratory Sample ID: 208828-1
Date Received.....: 07/31/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.1101 | | 0.0001 | Ratio | 08/06/03 | sub |
| EPA300.0 PartA | Chloride | 5410 | J | 500 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 75100 | J | 2000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 25.5 | J | 25 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U G | 5.0 | mg/L | 08/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 4840 | J | 60 | mg/L | 08/04/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1940000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Calcium (Ca) | 585000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Chromium (Cr) | 2750000 | | 1000 | ug/L | 08/11/03 | bpg |
| | Iron (Fe) | 2050000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Magnesium (Mg) | 1140000 | | 20000 | ug/L | 08/11/03 | bpg |
| | Sodium (Na) | 19400000 | | 200000 | ug/L | 08/11/03 | bpg |

11/26/03

* In Description = Dry Wgt.





# LABORATORY TEST RESULTS

Job Number: 208828 Date: 08/13/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-2
Date Sampled.....: 07/08/2003
Time Sampled.....: 14:00
Sample Matrix.....: Water

Laboratory Sample ID: 208828-2
Date Received.....: 07/31/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.1096 | | 0.0001 | Ratio | 08/06/03 | sub |
| EPA300.0 PartA | Chloride | 4620 | J | 500 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 72100 | J | 2000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U G | 25 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U G | 5.0 | mg/L | 08/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 5880 | J | 60 | mg/L | 08/04/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1880000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Calcium (Ca) | 583000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Chromium (Cr) | 2570000 | | 1000 | ug/L | 08/11/03 | bpg |
| | Iron (Fe) | 2010000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Magnesium (Mg) | 1120000 | | 20000 | ug/L | 08/11/03 | bpg |
| | Sodium (Na) | 19400000 | | 200000 | ug/L | 08/11/03 | bpg |

11/26/03

* In Description = Dry Wgt.

LABORATORY TEST RESULTS

Job Number: 208828

Date: 08/13/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-5
Date Sampled.....: 07/14/2003
Time Sampled.....: 14:00
Sample Matrix.....: Water

Laboratory Sample ID: 208828-3
Date Received.....: 07/31/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.1086 | | 0.0001 | Ratio | 08/06/03 | sub |
| EPA300.0 PartA | Chloride | 5450 | | 500 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 63200 | | 2000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 5170 | | 60 | mg/L | 08/04/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1650000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Calcium (Ca) | 574000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Chromium (Cr) | 2040000 | | 500 | ug/L | 08/11/03 | bpg |
| | Iron (Fe) | 1800000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Magnesium (Mg) | 1020000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Sodium (Na) | 17200000 | | 100000 | ug/L | 08/11/03 | bpg |

* In Description = Dry Wgt.





LABORATORY TEST RESULTS

Job Number: 208828

Date: 08/13/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-8
Date Sampled.....: 07/25/2003
Time Sampled.....: 12:00
Sample Matrix.....: Water

Laboratory Sample ID: 208828-4
Date Received.....: 07/31/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.1068 | | 0.0001 | Ratio | 08/06/03 | sub |
| EPA300.0 PartA | Chloride | 5270 | | 500 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 45700 | | 2000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 4090 | | 20 | mg/L | 08/04/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1270000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Calcium (Ca) | 556000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Chromium (Cr) | 1490000 | | 500 | ug/L | 08/11/03 | bpg |
| | Iron (Fe) | 1420000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Magnesium (Mg) | 813000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Sodium (Na) | 13800000 | | 100000 | ug/L | 08/11/03 | bpg |

* In Description = Dry Wgt.

LABORATORY TEST RESULTS

Job Number: 208828 Date: 08/13/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-10
Date Sampled.....: 07/30/2003
Time Sampled.....: 10:25
Sample Matrix.....: Water

Laboratory Sample ID: 208828-5
Date Received.....: 07/31/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0645 | | 0.0001 | Ratio | 08/06/03 | sub |
| EPA300.0 PartA | Chloride | 11200 | | 500 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 47200 | | 1000 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 3720 | | 20 | mg/L | 08/04/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1190000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Calcium (Ca) | 517000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Chromium (Cr) | 1380000 | | 500 | ug/L | 08/11/03 | bpg |
| | Iron (Fe) | 1330000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Magnesium (Mg) | 756000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Sodium (Na) | 12700000 | | 100000 | ug/L | 08/11/03 | bpg |

* In Description = D





LABORATORY TEST RESULTS

Job Number: 208828 Date: 08/13/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-1
Date Sampled.....: 07/01/2003
Time Sampled.....: 09:20
Sample Matrix.....: Water

Laboratory Sample ID: 208828-6
Date Received.....: 07/31/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.1104 | | 0.0001 | Ratio | 08/06/03 | sub |
| EPA300.0 PartA | Chloride | 721 | | 500 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 71400 | | 2000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 6010 | | 60 | mg/L | 08/04/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 2180000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Calcium (Ca) | 625000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Chromium (Cr) | 3080000 | | 1000 | ug/L | 08/11/03 | bpg |
| | Iron (Fe) | 2260000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Magnesium (Mg) | 1310000 | | 20000 | ug/L | 08/11/03 | bpg |
| | Sodium (Na) | 22600000 | | 200000 | ug/L | 08/11/03 | bpg |

* In Description = Dry Wgt.

LABORATORY TEST RESULTS

Job Number: 208828

Date: 08/13/2003

CUSTOMER: Olin Chemical PROJECT: C033C3F ATTN: Alan Peirce

Customer Sample ID: FM-2
Date Sampled.....: 07/08/2003
Time Sampled.....: 13:50
Sample Matrix.....: Water

Laboratory Sample ID: 208828-7
Date Received.....: 07/31/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.1100 | | 0.0001 | Ratio | 08/06/03 | sub |
| EPA300.0 PartA | Chloride | 4770 | | 500 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 72000 | | 2000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 6440 | | 60 | mg/L | 08/04/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1930000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Calcium (Ca) | 591000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Chromium (Cr) | 2680000 | | 1000 | ug/L | 08/11/03 | bpg |
| | Iron (Fe) | 2110000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Magnesium (Mg) | 1190000 | | 20000 | ug/L | 08/11/03 | bpg |
| | Sodium (Na) | 20200000 | | 200000 | ug/L | 08/11/03 | bpg |

* In Description = Dry Wgt.





LABORATORY TEST RESULTS

Job Number: 208828

Date: 08/13/2003

CUSTOMER: Olin Chemical PROJECT: C033C3F ATTN: Alan Peirce

Customer Sample ID: FM-5
Date Sampled.....: 07/14/2003
Time Sampled.....: 13:50
Sample Matrix.....: Water

Laboratory Sample ID: 208828-10
Date Received.....: 07/31/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0840 | | 0.0001 | Ratio | 08/06/03 | sub |
| EPA300.0 PartA | Chloride | 4860 | | 500 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 63500 | | 2000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 6080 | | 60 | mg/L | 08/04/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1480000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Calcium (Ca) | 529000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Chromium (Cr) | 1960000 | | 500 | ug/L | 08/11/03 | bpg |
| | Iron (Fe) | 1690000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Magnesium (Mg) | 928000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Sodium (Na) | 15500000 | | 100000 | ug/L | 08/11/03 | bpg |

* In Description = Dry Wgt.

# LABORATORY TEST RESULTS

Job Number: 208828 Date: 08/13/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-8
Date Sampled.....: 07/22/2003
Time Sampled.....: 10:50
Sample Matrix.....: Water

Laboratory Sample ID: 208828-8
Date Received.....: 07/31/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0600 | | 0.0001 | Ratio | 08/06/03 | sub |
| EPA300.0 PartA | Chloride | 10700 | | 500 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 43900 | | 1000 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | G 25 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | G 5.0 | mg/L | 08/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 3760 | | 20 | mg/L | 08/04/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1060000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Calcium (Ca) | 476000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Chromium (Cr) | 1320000 | | 500 | ug/L | 08/11/03 | bpg |
| | Iron (Fe) | 1250000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Magnesium (Mg) | 706000 | | 10000 | ug/L | 08/11/03 | bpg |
| | Sodium (Na) | 12200000 | | 100000 | ug/L | 08/11/03 | bpg |

11/20/03

* In Description = Dry Wgt.





# LABORATORY TEST RESULTS

Job Number: 208828 Date: 08/13/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-11
Date Sampled.....: 07/30/2003
Time Sampled.....: 10:20
Sample Matrix.....: Water

Laboratory Sample ID: 208828-9
Date Received.....: 07/31/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0355 | | 0.0001 | Ratio | 08/06/03 | sub |
| EPA300.0 PartA | Chloride | 2990 | | 250 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 24500 | | 500 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 12 | mg/L | 08/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 2.5 | mg/L | 08/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 2370 | | 20 | mg/L | 08/04/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 487000 | | 2500 | ug/L | 08/11/03 | bpg |
| | Calcium (Ca) | 362000 | | 2500 | ug/L | 08/11/03 | bpg |
| | Chromium (Cr) | 509000 | | 250 | ug/L | 08/11/03 | bpg |
| | Iron (Fe) | 610000 | | 2500 | ug/L | 08/11/03 | bpg |
| | Magnesium (Mg) | 359000 | | 5000 | ug/L | 08/11/03 | bpg |
| | Sodium (Na) | 6660000 | | 50000 | ug/L | 08/11/03 | bpg |

* In Description = Dry Wgt.

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

September 4, 2003

Report Number: 208920

**REVISED**

Dear Alan Peirce,

The revised report for the above referenced project is now complete. This revision includes the requested Lithium data.

If you should have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Severn Trent Laboratories, Inc.
STL Westfield • 53 Southampton Road, Westfield, MA 01085
Tel 413-572-4000 Fax 413-572-3707 www.stl-inc.com

## evern Trent Laboratories, Inc.
## ıain of Custody Form

SEVERN TRENT STL

02585
208828

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

• 149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7471
STL-BILLERICA

lient: Olin / Geomega, Inc
ress: 2995 Baseline Rd Ste 202
Boulder, CO 80303
ıone: 3034439117 Fax: 3039388123

Project #: C03303F (Column Study)
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone / Craig Walker

Job#: Quote#: PO#:

Requested Turn Around Time
ısiness Day (Std) ✓
ıisiness Day
r
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Shaded areas for office use
Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Analytes:
- Cr, Al, Fe, Cu, Mg, Na
- $SO_4$, $Cl^-$,
- Nitrate / Nitrite *
- Ammonia *
- Specific Gravity

* Holding times are Expired, however, run analysis. Note - two samples are within hold times!
CRW

ıle Type Codes
Wastewater DW-Drinking water SW-Surfacewater
abwater GW-Groundwater A-Air
ıd / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | Preservative: NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other See Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-1 | GW | CRW | 7-1-03 9:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| D-2 | GW | CRW | 7-8-03 1400 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| D-5 | GW | CRW | 7-14-03 1400 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| D-8 | GW | CRW | 7-25-03 1200 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| D-10 | GW | CRW | 7-30-03 1025 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| EFM-1 | GW | CRW | 7-1-03 920 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| 1-2 | GW | CRW | 7-8-03 1350 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| 1-5 | GW | CRW | 7-14-03 1350 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| 1-8 | GW | CRW | 7-22-03 1050 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| 1-11 | GW | CRW | 7-30-03 1020 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

ıplied by (print): Craig R. Walker 7/30/03 1300 Signature: 7/30/03 1300
ıquished by: Date: Time: Received by: Date: 7/31/03 Time: 1040
ıquished by: Date: Time: Received by: Date: Time:
hod of shipment: Fedex 8358 1232 5324 STL-Westfield

Cooler? (Y) N Samples Iced? (Y) N
Temp @ receipt: 4.7 °C
Preservation/pH checked 7/31/03
By: MB Date: 8/1/03

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy

CASE NARRATIVE

Client: OLIN Chemical

Report Number: 208920

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

Samples were received on 08/05/03 properly preserved, on ice and in good condition.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

Method ASTM 1298 (Hydrometer @ 25C) was performed at STL Chicago. The subcontracted laboratory noted no reportable deviations for this method.

SW846 6010B (Lithium) was performed at STL Pittsburgh. The subcontracted laboratory noted no reportable deviations for this method.

**Inorganic**

**EPA 300.0 Part A**

For method EPA 300 (Nitrate, Nitrite), the samples had high intrinsic color, turbidity and/or dissolved salts and as a result, required a dilution prior to analyzing on the instrument. The reporting limits have been raised accordingly.

For SD-11 and FM-12, due to a sample management error and the short hold time associated with this method, the nitrate and nitrite analysis was performed outside of laboratory hold time.

**Chloride**

No reportable deviations.

**Sulfate**

No reportable deviations.

**Ammonia**

No reportable deviations

**Metals**

EPA 200.7

No reportable deviations.



QUALITY ASSURANCE METHODS

REFERENCES AND NOTES

Report Date: 08/18/2003

Internal Standard: An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process. For GC/MS semi-volatiles and volatiles, internal standards are added to every blank, sample, matrix spike, matrix spike duplicate, matrix spike blank (LCS), and standard. Internal standard responses outside of established limits will adversely affect the quantitation and final concentration of target compounds.

Matrix Spike (MS): An aliquot of a sample (water or soil) fortified (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for matrix interference by measuring recovery. The spiking occurs prior to sample preparation and analysis. Poor spike recovery may indicate a problem with the sample composition.

Laboratory Control Sample (LCS): An aliquot of analyte-free reagent water or sand fortifed (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method efficiency.

Blank: An artificial sample of analyte-free water or solvent, designed to monitor the introduction of contaminates into the analytical process.

Method Dectection Limit (MDL): The minimum concentration of an analyte or compound that can be measured and reported with 99% confidence that the result concentration is greater than zero.

Petroleum Hydrocarbon Comments:

The following comments are specific to Diesel Range Organics (DRO), by GC/FID:

Results for DRO are based on chromatographable portions of the petroleum product. The Carbon Range refers to the approximate chromatographic region covered by the specified petroleum product in straight-chain carbon units between C9-C36.

Quantitation is based on the average response factors for a series of hydrocarbons standards. The sample result from the DRO fraction is independent of the target compound assignment.

Samples yielding chromatographic patterns that do not agree with any of the method targets are reported as "unmatched".

## SAMPLE INFORMATION
Date: 09/04/2003

Job Number.: 208920
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 208920-1 | SD-11 | Water | 08/03/2003 | 16:56 | 08/05/2003 | 10:15 |
| 208920-2 | FM-12 | Water | 08/03/2003 | 16:56 | 08/05/2003 | 10:15 |





## LABORATORY TEST RESULTS
Job Number: 208920
Date: 09/04/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-11
Date Sampled.....: 08/03/2003
Time Sampled.....: 16:56
Sample Matrix.....: Water

Laboratory Sample ID: 208920-1
Date Received.....: 08/05/2003
Time Received.....: 10:15

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0670 | | 0.0001 | Ratio | 08/15/03 | sub |
| EPA300.0 PartA | Chloride | 11500 | | 500 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Sulfate | 44600 | | 1000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/07/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 4190 | | 100 | mg/L | 08/07/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1140000 | | 10000 | ug/L | 08/12/03 | bpg |
| | Calcium (Ca) | 500000 | | 20000 | ug/L | 08/12/03 | bpg |
| | Chromium (Cr) | 1340000 | | 1000 | ug/L | 08/12/03 | bpg |
| | Iron (Fe) | 1300000 | | 10000 | ug/L | 08/12/03 | bpg |
| | Magnesium (Mg) | 717000 | | 20000 | ug/L | 08/12/03 | bpg |
| | Sodium (Na) | 12200000 | | 200000 | ug/L | 08/12/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 2210 | | 50 | ug/L | 08/29/03 | sub |

* In Description = Dry Wgt.

LABORATORY TEST RESULTS

Job Number: 208920

Date: 09/04/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-12
Date Sampled.....: 08/03/2003
Time Sampled.....: 16:56
Sample Matrix.....: Water

Laboratory Sample ID: 208920-2
Date Received.....: 08/05/2003
Time Received.....: 10:15

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 129B | Hydrometer 25 C | 1.0270 | | 0.0001 | Ratio | 08/15/03 | sub |
| EPA300.0 PartA | Chloride | 1990 | | 100 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Sulfate | 16300 | | 500 | mg/L | 08/08/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 5.0 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 1.0 | mg/L | 08/07/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 1770 | | 10 | mg/L | 08/07/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 290000 | | 5000 | ug/L | 08/12/03 | bpg |
| | Calcium (Ca) | 366000 | | 10000 | ug/L | 08/12/03 | bpg |
| | Chromium (Cr) | 249000 | | 500 | ug/L | 08/12/03 | bpg |
| | Iron (Fe) | 429000 | | 5000 | ug/L | 08/12/03 | bpg |
| | Magnesium (Mg) | 248000 | | 10000 | ug/L | 08/12/03 | bpg |
| | Sodium (Na) | 4850000 | | 100000 | ug/L | 08/12/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 1000 | | 50 | ug/L | 08/29/03 | sub |

* In Description = Dry Wt





SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

08/18/2003

Report Number: 208920

Dear Alan Peirce,

The analysis of your sample(s) submitted on 08/05/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 15

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Severn Trent Laboratories, Inc.
STL Westfield • 53 Southampton Road, Westfield, MA 01085
Tel 413 572 4000 Fax 413 572 3707 • www.stl-inc.com

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 208920 |
| Project Location: | MLP Sampling | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

208920-1,2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other (X) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| As specified in MADEP Compendium of Analytical Methods Check all that apply | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, and C is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes | No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes | No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data? | Yes | No[1] |

**A response to questions D and E below is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| D | Were all QC performance standards and recommendations for the specified methods achieved? | Yes | No[1] |
| E | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes | No[1] |

[1] All NO answers must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** Steven Hartmann **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 8/18/03



## CASE NARRATIVE

**Client: OLIN Chemical**

**Report Number: 208920**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

Samples were received on 08/05/03 properly preserved, on ice and in good condition.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

Method ASTM 1298 (Hydrometer @ 25C) was performed at STL Chicago. The subcontracted laboratory reported no notable deviations.

**Inorganic**

**EPA 300.0 Part A**

For method EPA 300 (Nitrate, Nitrite), the samples had high intrinsic color, turbidity and/or dissolved salts and as a result, required a dilution prior to analyzing on the instrument. The reporting limits have been raised accordingly.

For SD-11 and FM-12, due to a sample management error and the short hold time associated with this method, the nitrate and nitrite analysis was performed outside of laboratory hold time.

**Chloride**

No reportable deviations.

**Sulfate**

No reportable deviations.

**Ammonia**

No reportable deviations

**Metals**

**EPA 200.7**

No reportable deviations.

## QUALITY ASSURANCE METHODS
## REFERENCES AND NOTES
Report Date: 08/18/2003

STL WESTFIELD
DATA REPORTING QUALIFIERS AND TERMINOLOGY

A number of data qualifiers are widely used within the environmental testing industry and may be utilized in our data reports. The majority of the qualifiers have evolved from the EPA Contract Laboratory Program (CLP).

Report Comments:
---
All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.

Soil, sediment and sludge sample results are reported on a "dry weight" basis.

Reporting limits are adjusted for sample size used, dilutions and moisture content, if applicable.

The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert.ID# 10843.

STL-Westfield Certifications: MADEP MA014, CT DPH 0494, NH DES 253901-A, NY DOH 10843, RI DOH 57, VT DECWSD.

According to 40CFR Part 136.3, pH, Total Residual Chlorine and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When these parameters are not indicated as field analyses, they were not analyzed immediately, but as soon as possible on laboratory receipt.

Analytical result(s) reported as "ND", indicates that the analyte was analyzed for but "not detected."
Analytical result(s) reported as "TNTC" indicates that the microbiological test was "too numerous to count."

Glossary of Qualifiers:
---
Inorganic Qualifiers (Q-column):
U Indicates that the analyte was analyzed for but not detected.
E Indicates an estimated value due to the presence of interference. When applied to GFAA analysis, indicates the one-point method of addition recovered between 40-85 percent.
B Indicates an estimated result value. The result was measured between the reporting limit and the method detection limit (MDL).

Organic Qualifiers (Q-column):
U Indicates that the compound was analyzed for but not detected.
J Indicates an estimated result value. This qualifier is used when mass spectral data indicated the presence of a compound that meets the identification criteria and the result is less than the specified quantitation limit, but greater than the method detection limit (MDL).
B Indicates that the compound was found in both the sample and its associated laboratory blank. Indicates possible/probable blank contamination and warns the data user to exercise caution when applying the results to this compound.
D Indicates all compounds identified in an analysis at a secondary dilution factor.
E Indicates that the compound in an analysis has exceeded the instrument linear calibration range.

Glossary of Terms:
---
Surrogates (Surrogate Standards): An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but are not normally found in environmental samples. For semi-volatiles and pesticides/Arochlors, surrogate compounds are added to every blank, sample, matrix spike, matrix spiked duplicate, matrix spike blank (LCS), and standard. These compounds are used to evaluate analytical efficiency by measuring recovery. Poor surrogate recovery may indicate a problem with the sample composition.



SEVERN TRENT STL
DEP MA014
JOH57
CTDPH 0494
VT DECWSD
NY DOH 10843
NH DES 253901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

## SAMPLE INFORMATION
Date: 08/18/2003

Job Number.: 208920
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 208920-1 | SD-11 | Water | 08/03/2003 | 16:56 | 08/05/2003 | 10:15 |
| 208920-2 | FM-12 | Water | 08/03/2003 | 16:56 | 08/05/2003 | 10:15 |



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NY DOH 10843
NH DES 253901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
'lerica
geway Rd.
ica, MA 01862
./8) 667-1400
Fax: (978) 667-7871

LABORATORY TEST RESULTS

Job Number: 208920 Date: 08/18/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-11
Date Sampled.....: 08/03/2003
Time Sampled.....: 16:56
Sample Matrix.....: Water

Laboratory Sample ID: 208920-1
Date Received.....: 08/05/2003
Time Received.....: 10:15

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0670 | | 0.0001 | Ratio | 08/15/03 | sub |
| EPA300.0 PartA | Chloride | 11500 | | 500 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Sulfate | 44600 | | 1000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/07/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 4190 | | 100 | mg/L | 08/07/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1140000 | | 10000 | ug/L | 08/12/03 | bpg |
| | Calcium (Ca) | 500000 | | 20000 | ug/L | 08/12/03 | bpg |
| | Chromium (Cr) | 1340000 | | 1000 | ug/L | 08/12/03 | bpg |
| | Iron (Fe) | 1300000 | | 10000 | ug/L | 08/12/03 | bpg |
| | Magnesium (Mg) | 717000 | | 20000 | ug/L | 08/12/03 | bpg |
| | Sodium (Na) | 12200000 | | 200000 | ug/L | 08/12/03 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NY DOH 10843
NH DES 253901-A
NELAP NY10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

LABORATORY TEST RESULTS

Job Number: 208920 Date: 08/18/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-12
Date Sampled.....: 08/03/2003
Time Sampled.....: 16:56
Sample Matrix.....: Water

Laboratory Sample ID: 208920-2
Date Received.....: 08/05/2003
Time Received.....: 10:15

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0270 | | 0.0001 | Ratio | 08/15/03 | sub |
| EPA300.0 PartA | Chloride | 1990 | | 100 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Sulfate | 16300 | | 500 | mg/L | 08/08/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 5.0 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 1.0 | mg/L | 08/07/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 1770 | | 10 | mg/L | 08/07/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 290000 | | 5000 | ug/L | 08/12/03 | bpg |
| | Calcium (Ca) | 366000 | | 10000 | ug/L | 08/12/03 | bpg |
| | Chromium (Cr) | 249000 | | 500 | ug/L | 08/12/03 | bpg |
| | Iron (Fe) | 429000 | | 5000 | ug/L | 08/12/03 | bpg |
| | Magnesium (Mg) | 248000 | | 10000 | ug/L | 08/12/03 | bpg |
| | Sodium (Na) | 4850000 | | 100000 | ug/L | 08/12/03 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
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Fax: (978) 667-7871

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

September 4, 2003

Report Number: 208976

**REVISED**

Dear Alan Peirce,

The revised report for the above referenced project is now complete. This revision includes the requested Lithium data.

If you should have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Severn Trent Laboratories, Inc.
STL Westfield • 53 Southampton Road, Westfield, MA 01085
Tel 413 572 4000 Fax 413 572 3707 • www.stl-inc.com

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## Severn Trent Laboratories, Inc.
### Chain of Custody Form

SEVERN TRENT STL

02590
208920

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Olin / Geomega
Address: 2995 Baseline Rd Ste 202
Boulder, CO 80303
Phone: 3034439117 Fax: 3039388123

Project #: C03803F (Column Study)
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone / Craig R. Walker

Job#: Quote#: PO#:

Shaded areas for office use

**Analysis Requested**
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

**Comments (Special Instructions)**
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$, Cl
- Nitrate and Nitrite
- Ammonia
- Specific gravity

Requested Turn Around Time
10 Business Day (Std) ____ | Rush TAT Requested:
15 Business Day ____ | 24 hrs ____ 72 hrs ____
Other ____ | 48 hrs ____ 5 Day ____

**Regulatory Classification / Special Report Format**
NPDES ____ Drinking Water ____ DEP Form(s) ____
RCRA ____ MCP GW1/S1 ____ MWRA Smart Rpt ____
Other ____ MCP QA/QC Rpt ____

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | Preservative: NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other See Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-11 | GW | CRW | 8/3/03 1658 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-12 | GW | CRW | 8/3/03 1658 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): Craig R. Walker 8/3/03 Signature: [signature] 8/4/03

Relinquished by: Date: Time: Received by: [signature] Date: 8/5/03 Time: 1015

Relinquished by: Date: Time: Received by: Date: Time:

Method of shipment: **STL-Westfield**

Cooler? Y/N Samples Iced?
Temp @ receipt: 4.0 °C
Preservation/pH checked
By: [illegible] Date: 8/5/03



White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

CASE NARRATIVE

Client: OLIN Chemical

Report Number: 208976

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

Samples were received on 08/06/03 properly preserved, on ice and in good condition.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

Method SM18 2710 was performed at STL Chicago. The subcontracted laboratory reported no notable deviations.

SW846 6010B (Lithium) was performed at STL Pittsburgh. The subcontracted laboratory noted no reportable deviations for this method.

**Inorganic**

**EPA 300.0 Part A**
For method EPA 300 (Nitrate, Nitrite), the samples had high intrinsic color, turbidity and/or dissolved salts and as a result, required a dilution prior to analyzing on the instrument. The reporting limits have been raised accordingly.

There were no additional QC deviations/issues reported for this method

**Chloride**
There were no QC deviations/issues reported for this method.

**Sulfate**
There were no QC deviations/issues reported for this method.

**Ammonia**
The RPD for sample 208091-2 recovered outside of the laboratory control limit of ≤20%.
The Matrix spike and LCS analyses recovered within acceptable ranges.
There were no additional QC deviations/issues reported for this method.

**Metals**

**EPA 200.7**
An ICSA/AB solution, which monitors spectral interference, was not performed at the end of the analytical instrument run. This is not a routine requirement in method EPA 200.7, but is found in the MCP method.

The Matrix spike solution is the same source as the calibration standards, however an Initial calibration verification (ICV) standard was analyzed from a secondary source.

There were no additional QC deviations/issues reported for this method.



SAMPLE INFORMATION
Date: 09/04/2003

Job Number.: 208976
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 208976-1 | FM-13 | Water | 08/05/2003 | 13:45 | 08/06/2003 | 10:45 |
| 208976-2 | SD-12 | Water | 08/05/2003 | 13:45 | 08/06/2003 | 10:45 |



SEVERN STL MADEP MA014 RIDOH57 NY DOH 10843 STL Westfield 53 Southampton Rd. Westfield, MA 01085 STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862

# LABORATORY TEST RESULTS

Job Number: 208976

Date: 09/04/2003

CUSTOMER: Olin Chemical | PROJECT: C033D3F | ATTN: Alan Peirce

Customer Sample ID: FM-13
Date Sampled.....: 08/05/2003
Time Sampled.....: 13:45
Sample Matrix.....: Water

Laboratory Sample ID: 208976-1
Date Received.....: 08/06/2003
Time Received.....: 10:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 3420 | | 250 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Sulfate | 13200 | | 500 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 5.0 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 1.0 | mg/L | 08/07/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 1540 | | 10 | mg/L | 08/07/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 200000 | | 5000 | ug/L | 08/14/03 | bpg |
| | Calcium (Ca) | 329000 | | 10000 | ug/L | 08/14/03 | bpg |
| | Chromium (Cr) | 157000 | | 500 | ug/L | 08/14/03 | bpg |
| | Iron (Fe) | 330000 | | 5000 | ug/L | 08/14/03 | bpg |
| | Magnesium (Mg) | 201000 | | 10000 | ug/L | 08/14/03 | bpg |
| | Sodium (Na) | 3520000 | | 100000 | ug/L | 08/14/03 | bpg |
| SM18 2710F | Density/Specific Gravity | | | | | | |
| | Specific Gravity | 1.03 | | 0.10 | * Ratio | 08/18/03 | sub |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 810 | | 50 | ug/L | 08/29/03 | sub |

* In Description = Dry Wgt





# LABORATORY TEST RESULTS

Job Number: 208976

Date: 09/04/2003

CUSTOMER: Olin Chemical | PROJECT: C033D3F | ATTN: Alan Peirce

Customer Sample ID: SD-12
Date Sampled.....: 08/05/2003
Time Sampled.....: 13:45
Sample Matrix.....: Water

Laboratory Sample ID: 208976-2
Date Received.....: 08/06/2003
Time Received.....: 10:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 11800 | | 500 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Sulfate | 48000 | | 1000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/07/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 3350 | | 100 | mg/L | 08/07/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1130000 | | 10000 | ug/L | 08/14/03 | bpg |
| | Calcium (Ca) | 516000 | | 20000 | ug/L | 08/14/03 | bpg |
| | Chromium (Cr) | 1350000 | | 1000 | ug/L | 08/14/03 | bpg |
| | Iron (Fe) | 1350000 | | 10000 | ug/L | 08/14/03 | bpg |
| | Magnesium (Mg) | 738000 | | 20000 | ug/L | 08/14/03 | bpg |
| | Sodium (Na) | 12100000 | | 200000 | ug/L | 08/14/03 | bpg |
| SM18 2710F | Density/Specific Gravity | | | | | | |
| | Specific Gravity | 1.05 | | 0.10 | * Ratio | 08/18/03 | sub |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 2020 | | 50 | ug/L | 08/29/03 | sub |

* In Description = Dry Wgt.

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

08/21/2003

Report Number: 208976

Dear Alan Peirce,

The analysis of your sample(s) submitted on 08/06/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 13

Severn Trent Laboratories, Inc.
STL Westfield • 53 Southampton Road, Westfield, MA 01085
Tel 413 572 4000 Fax 413 572 3707 • www.stl-inc.com

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## MADEP MCP Analytical Method Report Certification Form

Laboratory Name: Severn Trent Laboratory (STL) Westfield Project #: 208976

Project Location: MADEP RTN[1]:

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

208976-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used (As specified in MADEP Compendium of Analytical Methods, check all that apply) | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes | No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes | No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | NA Yes | No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | NA Yes | No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | | |
|---|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes | No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes | No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 8/21/03

## CASE NARRATIVE

**Client: OLIN Chemical**

**Report Number: 208976**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

Samples were received on 08/06/03 properly preserved, on ice and in good condition.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

Method SM18 2710 was performed at STL Chicago. The subcontracted laboratory reported no notable deviations.

**Inorganic**

**EPA 300.0 Part A**
For method EPA 300 (Nitrate, Nitrite), the samples had high intrinsic color, turbidity and/or dissolved salts and as a result, required a dilution prior to analyzing on the instrument. The reporting limits have been raised accordingly.

There were no additional QC deviations/issues reported for this method

**Chloride**
There were no QC deviations/issues reported for this method.

**Sulfate**
There were no QC deviations/issues reported for this method.

**Ammonia**
The RPD for sample 208091-2 recovered outside of the laboratory control limit of ≤20%.
The Matrix spike and LCS analyses recovered within acceptable ranges.
There were no additional QC deviations/issues reported for this method.

**Metals**

**EPA 200.7**
An ICSA/AB solution, which monitors spectral interference, was not performed at the end of the analytical instrument run. This is not a routine requirement in method EPA 200.7, but is found in the MCP method.

The Matrix spike solution is the same source as the calibration standards, however an Initial calibration verification (ICV) standard was analyzed from a secondary source.

There were no additional QC deviations/issues reported for this method.



SAMPLE INFORMATION
Date: 08/21/2003

Job Number.: 208976
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 208976-1 | FM-13 | Water | 08/05/2003 | 13:45 | 08/06/2003 | 10:45 |
| 208976-2 | SD-12 | Water | 08/05/2003 | 13:45 | 08/06/2003 | 10:45 |

# LABORATORY TEST RESULTS

Job Number: 208976 Date: 08/21/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-13
Date Sampled.....: 08/05/2003
Time Sampled.....: 13:45
Sample Matrix.....: Water

Laboratory Sample ID: 208976-1
Date Received.....: 08/06/2003
Time Received.....: 10:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 3420 | | 250 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Sulfate | 13200 | | 500 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 5.0 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 1.0 | mg/L | 08/07/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 1540 | | 10 | mg/L | 08/07/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 200000 | | 5000 | ug/L | 08/14/03 | bpg |
| | Calcium (Ca) | 329000 | | 10000 | ug/L | 08/14/03 | bpg |
| | Chromium (Cr) | 157000 | | 500 | ug/L | 08/14/03 | bpg |
| | Iron (Fe) | 330000 | | 5000 | ug/L | 08/14/03 | bpg |
| | Magnesium (Mg) | 201000 | | 10000 | ug/L | 08/14/03 | bpg |
| | Sodium (Na) | 3520000 | | 100000 | ug/L | 08/14/03 | bpg |
| SM18 2710F | Density/Specific Gravity | | | | | | |
| | Specific Gravity | 1.03 | | 0.10 | * Ratio | 08/18/03 | sub |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
NY DOH 10843
NH DES 253901-A
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Tel: (413) 572-4000
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400

# LABORATORY TEST RESULTS

Job Number: 208976 Date: 08/21/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-12
Date Sampled.....: 08/05/2003
Time Sampled.....: 13:45
Sample Matrix.....: Water

Laboratory Sample ID: 208976-2
Date Received.....: 08/06/2003
Time Received.....: 10:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 11800 | | 500 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Sulfate | 48000 | | 1000 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/07/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/07/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 3350 | | 100 | mg/L | 08/07/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1130000 | | 10000 | ug/L | 08/14/03 | bpg |
| | Calcium (Ca) | 516000 | | 20000 | ug/L | 08/14/03 | bpg |
| | Chromium (Cr) | 1350000 | | 1000 | ug/L | 08/14/03 | bpg |
| | Iron (Fe) | 1350000 | | 10000 | ug/L | 08/14/03 | bpg |
| | Magnesium (Mg) | 738000 | | 20000 | ug/L | 08/14/03 | bpg |
| | Sodium (Na) | 12100000 | | 200000 | ug/L | 08/14/03 | bpg |
| SM18 2710F | Density/Specific Gravity | | | | | | |
| | Specific Gravity | 1.05 | | 0.10 | * Ratio | 08/18/03 | sub |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
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N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7671

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

September 8, 2003

Report Number: 209054

**REVISED**

Dear Client Services,

The revised report for Job Number 209054 is now complete. This revision reports the Lithium analyses for samples FM-14 and SD-13. Due to limited sample volume, the samples were diluted prior to subcontracting to STL Pittsburgh. The reporting limits have been adjusted accordingly.

If you should have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

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## Severn Trent Laboratories, Inc.
### Chain of Custody Form

SEVERN TRENT STL 02592

•53 Southampton Road, Westfield, MA 01085, (P) 413-572-4000, (F) 413-572-3707, STL-WESTFIELD
•149 Rangeway Road, N. Billerica, MA 01862, (P) 978-667-1400, (F) 978-667-7871, STL-BILLERICA

Client: Olin Corp / Geomega
Address: 2995 Baseline Rd Ste 202, Boulder, CO 80303
Phone: 303443-9117 Fax: 303938 8123
Project #: C03303F
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone / Craig R. Walker

Requested Turn Around Time: 10 Business Day (Std) ✓; 15 Business Day; Other; Rush TAT Requested: 24 hrs, 72 hrs, 48 hrs, 5 Day

Regulatory Classification / Special Report Format: NPDES, RCRA, Other; Drinking Water, MCP GW1/S1; DEP Form(s), MWRA Smart Rpt, MCP QA/QC Rpt

Sample Type Codes: WW-Wastewater, DW-Drinking water, SW-Surfacewater, LW-Labwater, GW-Groundwater, A-Air, S-Solid / Soil, SL-Sludge, O-Oil, Z-Other

Analysis Requested: Check analysis and specify method and analytes in comments section. For example: 500-series for drinking water, 600-series for waste water, 8000-series for haz/solid waste. Use comments section to further define.

Comments (Special Instructions): Analytes Cr, Al, Fe, Ca, Mg, Na, $SO_4$, Cl, Nitrate / Nitrite, Ammonia, Specific Gravity

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FM - 13 | GW | CRW | 8-5-03 1:45 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | |
| SD - 12 | ↓ | CRW | ↓ | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | |

Sampled by (print): Craig R Walker 8/5/03
Signature: [signature] 8/5/03
Relinquished by: Date: Time:
Received by: [signature] Date: 8/6/03 Time: 1045
Relinquished by: Date: Time:
Received by: Date: Time:
Method of shipment: STL-Westfield

Cooler: (Y) N Samples Intact: Y N
Temp @ receipt: 4 deg C
Preservation Checked By: [signature] Date: 8/6/03

Page ____ of ____

White = Lab file Yellow = Report copy Pink = Customer copy

CASE NARRATIVE FOR REPORT NUMBER: 209054

Client Name : Olin Chemical

Project Name : C03303F

Date : 9/8/03

---

209054 (1-2) The Lithium analyses were performed at STL Pittsburgh.



SEVERN TRENT STL

Job Number: 209054

LABORATORY TEST RESULTS

Date:09/08/2003

CUSTOMER: Olin Chemical

PROJECT: C03303F

ATTN: Allen Peirce

Customer Sample ID: FM-14
Date Sampled.....: 08/07/2003
Time Sampled.....: 15:50
Sample Matrix.....: Water

Laboratory Sample ID: 209054-1
Date Received.....: 08/08/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q-FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0000 | | | 0.0001 | 1 | Ratio | 16486 | | 08/21/03 | sub |
| EPA300.0 Part A | Chloride | 2700 | | | 500 | 500 | mg/L | 16022 | | 08/08/03 0000 | rke |
| EPA300.0 Part A | Sulfate | 10000 | | | 1000 | 500 | mg/L | 16022 | | 08/08/03 0000 | rke |
| EPA300.0 Part A | Nitrate as N (NO3-N) | 5.0 | U | | 5.0 | 100 | mg/L | 16016 | | 08/08/03 0000 | rke |
| EPA300.0 Part A | Nitrite as N (NO2-N) | 1.0 | U | | 1.0 | 100 | mg/L | 16016 | | 08/08/03 0000 | rke |
| LAC 10/06/8 | Ammonia (NH3), as N | 66.4 | | | 1.0 | 10 | mg/L | 16322 | | 08/18/03 0000 | kmm |
| EPA200.7 | Metal Analysis (ICP) | | | | | | | | | | |
| | Aluminum (Al) | 150000 | * | | 10000 | 10 | ug/L | 16323 | | 08/18/03 1412 | bpg |
| | Calcium (Ca) | 310000 | * | | 20000 | 10 | ug/L | 16323 | | 08/18/03 1412 | bpg |
| | Chromium (Cr) | 91000 | * | | 1000 | 10 | ug/L | 16323 | | 08/18/03 1412 | bpg |
| | Iron (Fe) | 230000 | * | | 10000 | 10 | ug/L | 16323 | | 08/18/03 1412 | bpg |
| | Magnesium (Mg) | 190000 | * | | 20000 | 10 | ug/L | 16323 | | 08/18/03 1412 | bpg |
| | Sodium (Na) | 2900000 | * | | 200000 | 10 | ug/L | 16323 | | 08/18/03 1412 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | | | | | |
| | Lithium (Li) | 700 | | | 500 | 1 | ug/L | 17008 | | 09/02/03 0000 | sub |

* In Description = Dry Wgt.



STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707

STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-6678

SEVERN TRENT STL

Job Number: 209054

LABORATORY TEST RESULTS

Date:09/08/2003

CUSTOMER: Olin Chemical
PROJECT: C03103F
ATTN: Alan Peirce

Customer Sample ID: SD-13
Date Sampled.....: 08/07/2003
Time Sampled.....: 16:00
Sample Matrix.....: Water

Laboratory Sample ID: 209054-2
Date Received.....: 08/08/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | QFLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | LEC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0350 | | | 0.0001 | 1 | Ratio | 16486 | | 08/21/03 | sub |
| EPA300.0 PartA | Chloride | 4000 | | | 500 | 500 | mg/L | 16022 | | 08/08/03 0000 | rwe |
| EPA300.0 PartA | Sulfate | 46000 | | | 1000 | 500 | mg/L | 16022 | | 08/08/03 0000 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 25 | U | | 25 | 500 | mg/L | 16016 | | 08/08/03 0000 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | 5.0 | U | | 5.0 | 500 | mg/L | 16016 | | 08/08/03 0000 | rwe |
| LAC 10T061B | Ammonia (NH3), as N | 1280 | * | | 20 | 200 | mg/L | 16326 | | 08/18/03 0000 | kmm |
| SW846 6010B | Metal Analysis (ICP) | | | | | | | | | | |
| | Aluminum (Al) | 1300000 | * | | 20000 | 100 | ug/L | 16323 | | 08/18/03 1415 | bpg |
| | Calcium (Ca) | 590000 | * | | 40000 | 100 | ug/L | 16323 | | 08/18/03 1415 | bpg |
| | Chromium (Cr) | 1480000 | * | | 2000 | 100 | ug/L | 16323 | | 08/18/03 1415 | bpg |
| | Iron (Fe) | 1400000 | * | | 20000 | 100 | ug/L | 16323 | | 08/18/03 1415 | bpg |
| | Magnesium (Mg) | 870000 | * | | 40000 | 100 | ug/L | 16323 | | 08/18/03 1415 | bpg |
| | Sodium (Na) | 13700000 | * | | 400000 | 100 | ug/L | 16323 | | 08/18/03 1415 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | | | | | |
| | Lithium (Li) | 1800 | | | 100 | 1 | ug/L | 17008 | | 09/02/03 0000 | sub |

* In Description = Dry Wgt.



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Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707

STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-1671

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

08/22/2003

Report Number: 209054

Dear Alan Peirce,

The analysis of your sample(s) submitted on 08/08/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 14

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209054 |
| Project Location: | MLP Sampling C03303F | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
209054 1-2

Sample Matrices: Groundwater Soil/Sediment Drinking Water Other:

| MCP SW-846 Methods Used | | | | | | |
|---|---|---|---|---|---|---|
| | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

Compendium of Analytical Methods Check all that apply

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | NA Yes No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | NA Yes No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** [signature] **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 8/22/03



## MCP CASE NARRATIVE

**Client:** OLIN

**Report Number:** 209054

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

The project samples were received on 08/08/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**SUBCONTRACT**

The Specific Gravity analyses were performed at STL- Chicago.

Due to limited sample volume, client's samples ID as FM-14 was diluted 10X and sample SD-13 was diluted 2X, upon sample receipt at the laboratory. Reporting limits have been raised accordingly.

**Inorganic**

**Nitrate**
There were no QC deviations/issues reported for this method.

**Nitrite**
There were no QC deviations/issues reported for this method.

**Sulfate**
There were no QC deviations/issues reported for this method.

**Chloride**
There were no QC deviations/issues reported for this method.

**Ammonia**
There were no QC deviations/issues reported for this method.

**Metals**

**EPA 200.7**
Poor matrix spike recovery was noted for the MS result for the metals analysis. The sample concentration overwhelmed the amount of spike added. The LCS recovered within acceptable control limits.
There were no additional QC deviations/issues reported for this method.

## SAMPLE INFORMATION
Date: 08/22/2003

Job Number.: 209054
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209054-1 | FN-14 | Water | 08/07/2003 | 15:50 | 08/08/2003 | 10:40 |
| 209054-2 | SD-13 | Water | 08/07/2003 | 16:00 | 08/08/2003 | 10:40 |



SEVERN TRENT STL
EP MA014
DH57
CTDPH 0494
NY DOH 10843
NH DES 253901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400

## LABORATORY TEST RESULTS

Job Number: 209054

Date: 08/22/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-14
Date Sampled.....: 08/07/2003
Time Sampled.....: 15:50
Sample Matrix.....: Water

Laboratory Sample ID: 209054-1
Date Received.....: 08/08/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0000 | | 0.0001 | Ratio | 08/21/03 | sub |
| EPA300.0 PartA | Chloride | 2720 | | 500 | mg/L | 08/08/03 | rwe |
| EPA300.0 PartA | Sulfate | 9520 | | 1000 | mg/L | 08/08/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 5.0 | mg/L | 08/08/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 1.0 | mg/L | 08/08/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 66.4 | | 1.0 | mg/L | 08/18/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 149000 | | 10000 | ug/L | 08/18/03 | bpg |
| | Calcium (Ca) | 315000 | | 20000 | ug/L | 08/18/03 | bpg |
| | Chromium (Cr) | 90800 | | 1000 | ug/L | 08/18/03 | bpg |
| | Iron (Fe) | 231000 | | 10000 | ug/L | 08/18/03 | bpg |
| | Magnesium (Mg) | 187000 | | 20000 | ug/L | 08/18/03 | bpg |
| | Sodium (Na) | 2900000 | | 200000 | ug/L | 08/18/03 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
NY DOH 10843
NH DES 253901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
rica
geway Rd.
ica, MA 01862
el: (978) 667-1400

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL

02593
209054

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Job #: Quote #: PO #:

Client: Olin Corp / Geomega
Address: 2995 Baseline rd Ste 202
Boulder, CO 80303
Phone: 303 443 9117 Fax: 303 938 8123

Project #: C03303F
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone / Craig Walker

Shaded Areas for Office Use

**Analysis Requested**
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

**Comments**
(Special Instructions)

- Ca, Al, Fe, ~~Mn~~ Cr
Mg, Na
- $SO_4$, Cl
- Nitrite + Nitrate
- Ammonia
- Specific Gravity

Requested Turn Around Time
10 Business Day (Std) ✓ | Rush TAT Requested:
15 Business Day ___ | 24 hrs ___ 72 hrs ___
Other ___ | 48 hrs ___ 5 Day ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other See Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FM-14 | GW | BH | 8/7/03 15:50 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| SD-13 | GW | BH | 8/7/03 16:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Preservative

Sampled by (print): Braden Hanna 8/7/03
Signature:
Relinquished by: 8/7 Date: Time:
Received by: Date: 8/7/03 Time:
Relinquished by: Date: Time:
Received by: Date: 8/8/03 Time: 1040
Method of shipment: **STL-Westfield**

Cooler Temp. / N. Sample Leak
Temp of receipt:
Preservation Checked
By: Date:

Page 1 of 1

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STL8245-360 (12/02)

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LABORATORY TEST RESULTS

Job Number: 209054 Date: 08/22/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Petroe

Customer Sample ID: SD-13
Date Sampled.....: 08/07/2003
Time Sampled.....: 16:00
Sample Matrix.....: Water

Laboratory Sample ID: 209054-2
Date Received.....: 08/08/2003
Time Received.....: 10:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0350 | | 0.0001 | Ratio | 08/21/03 | sub |
| EPA300.0 PartA | Chloride | 3980 | | 500 | mg/L | 08/08/03 | rwe |
| EPA300.0 PartA | Sulfate | 46300 | | 1000 | mg/L | 08/08/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/08/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/08/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 1280 | | 20 | mg/L | 08/18/03 | kmn |
| EPA 200.7 | Metal Analysis (ICP) | | | | | 08/18/03 | bpg |
| | Aluminum (Al) | 1300000 | | 20000 | ug/L | 08/18/03 | bpg |
| | Calcium (Ca) | 589000 | | 40000 | ug/L | 08/18/03 | bpg |
| | Chromium (Cr) | 1480000 | | 2000 | ug/L | 08/18/03 | bpg |
| | Iron (Fe) | 1400000 | | 20000 | ug/L | 08/18/03 | bpg |
| | Magnesium (Mg) | 867000 | | 40000 | ug/L | 08/18/03 | bpg |
| | Sodium (Na) | 13700000 | | 400000 | ug/L | 08/18/03 | bpg |

* In Description = Dry Wgt.



STL Westfield
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Tel: (978) 667-1400
Fax: (978) 667-7871

MA DEP MA014
RI DOH 127
CT DPH 0494
NY DOH 10843
NH DES 253901-A

SEVERN TRENT STL

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

September 8, 2003

Report Number: 209127

**REVISED**

Dear Client Services,

The revised report for Job Number 209127 is now complete. This revision reports the Lithium analyses for samples FM-15 and SD-14. Due to limited sample volume, sample FM-15 was diluted prior to subcontracting to STL Pittsburgh. The reporting limit has been adjusted accordingly.

If you should have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

CASE NARRATIVE FOR REPORT NUMBER: 209127

Client Name : Olin Chemical

Project Name : C03303F

Date : 9/8/03

209127 (1-2) The Lithium analyses were performed at STL Pittsburgh.

## SAMPLE INFORMATION
Date: 09/08/2003

Job Number.: 209127
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209127-1 | SD-14 | Water | 08/10/2003 | 16:39 | 08/12/2003 | 11:00 |
| 209127-2 | FM-15 | Water | 08/10/2003 | 16:51 | 08/12/2003 | 11:00 |





## LABORATORY TEST RESULTS
Job Number: 209127
Date: 09/08/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-14
Date Sampled.....: 08/10/2003
Time Sampled.....: 16:39
Sample Matrix.....: Water

Laboratory Sample ID: 209127-1
Date Received.....: 08/12/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0620 | | 0.0001 | Ratio | 08/21/03 | sub |
| EPA300.0 PartA | Chloride | 10700 | | 500 | mg/L | 08/12/03 | rwe |
| EPA300.0 PartA | Sulfate | 42000 | | 1000 | mg/L | 08/12/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/11/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/11/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 5010 | | 100 | mg/L | 08/18/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1300000 | | 5000 | ug/L | 08/18/03 | bpg |
| | Calcium (Ca) | 613000 | | 10000 | ug/L | 08/18/03 | bpg |
| | Chromium (Cr) | 1450000 | | 500 | ug/L | 08/18/03 | bpg |
| | Iron (Fe) | 1390000 | | 5000 | ug/L | 08/18/03 | bpg |
| | Magnesium (Mg) | 862000 | | 10000 | ug/L | 08/18/03 | bpg |
| | Sodium (Na) | 13700000 | | 100000 | ug/L | 08/18/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 1890 | | 50 | ug/L | 08/29/03 | sub |

* In Description = Dry Wgt.

# LABORATORY TEST RESULTS

Job Number: 209127

Date: 09/08/2003

CUSTOMER: Olin Chemical | PROJECT: C03303F | ATTN: Alan Peirce

Customer Sample ID: FM-15
Date Sampled.....: 08/10/2003
Time Sampled.....: 16:51
Sample Matrix.....: Water

Laboratory Sample ID: 209127-2
Date Received.....: 08/12/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0000 | | 0.0001 | Ratio | 08/21/03 | sub |
| EPA300.0 PartA | Chloride | 2280 | | 500 | mg/L | 08/12/03 | rwe |
| EPA300.0 PartA | Sulfate | 8710 | | 1000 | mg/L | 08/12/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/11/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/11/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 1120 | | 10 | mg/L | 08/18/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 141000 | | 5000 | ug/L | 08/18/03 | bpg |
| | Calcium (Ca) | 338000 | | 10000 | ug/L | 08/18/03 | bpg |
| | Chromium (Cr) | 67900 | | 500 | ug/L | 08/18/03 | bpg |
| | Iron (Fe) | 193000 | | 5000 | ug/L | 08/18/03 | bpg |
| | Magnesium (Mg) | 176000 | | 10000 | ug/L | 08/18/03 | bpg |
| | Sodium (Na) | 2890000 | | 100000 | ug/L | 08/18/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 672 | | 500 | ug/L | 08/29/03 | sub |

* In Description = Dr[illegible]





# LABORATORY CHRONICLE

Job Number: 209127

Date: 09/08/2003

CUSTOMER: Olin Chemical | PROJECT: C03303F | ATTN: Alan Peirce

Lab ID: 209127-1 Client ID: SD-14 — Date Recvd: 08/12/2003 Sample Date: 08/10/2003

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | | DILUTION |
|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion,Total (ICAP) | 1 | 16239 | | 08/15/2003 | 0000 | |
| LAC 107061B | Ammonia | 1 | 16340 | | 08/18/2003 | 0000 | 1000 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 16132 | | 08/11/2003 | 0000 | 500 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 16137 | | 08/12/2003 | 0000 | 500 |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 16323 | 16239 | 08/18/2003 | 1418 | 100 |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | 1 | 16898 | | 08/29/2003 | 1337 | |
| | QC Metals Report, Level 2 | 1 | 16330 | | 08/18/2003 | 1532 | |
| | QC Wet Chemistry Report, Level 2 | 1 | 16468 | | 08/21/2003 | 1205 | |
| ASTM 1298 | Specific Gravity | 1 | 16541 | | 08/21/2003 | | |

Lab ID: 209127-2 Client ID: FM-15 — Date Recvd: 08/12/2003 Sample Date: 08/10/2003

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | | DILUTION |
|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion,Total (ICAP) | 1 | 16239 | | 08/15/2003 | 0000 | |
| LAC 107061B | Ammonia | 1 | 16340 | | 08/18/2003 | | 100 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 16132 | | 08/11/2003 | 0000 | 500 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 16137 | | 08/12/2003 | 0000 | 500 |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 16323 | 16239 | 08/18/2003 | 1421 | 10 |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | 1 | 16898 | | 08/29/2003 | 1341 | 10 |
| ASTM 1298 | Specific Gravity | 1 | 16541 | | 08/21/2003 | | |

SEVERN TRENT STL

STL Pittsburgh
450 William Pitt Way
Pittsburgh, PA 15238

Tel: 412 820 8380 Fax: 412 820 2080
www.stl-inc.com

# ANALYTICAL REPORT

PROJECT NO. 209127

STL Westfield

Lot #: C3H270141

SEVERN TRENT LABORATORIES, INC.

Christina M. Kovitch
Project Manager

September 2, 2003

## CASE NARRATIVE
STL Westfield

LOT # C3H270141

**Sample Receiving:**
STL Pittsburgh received samples on August 27, 2003. The cooler was received within the proper temperature range.

If project specific QC was not required for samples contained in this report, when batch QC was completed on these samples, anomalous results will be discussed below.

**Metals:**
There were no problems associated with the analysis.

STL Westfield
53 Southampton Road
Westfield, MA 01085

## SUBCONTRACTING CHAIN OF CUSTODY

| STL Project Manager | VERBAL DUE DATE | FAX DUE DATE | HARDCOPY DUE DATE |
|---|---|---|---|
| Becky Mason | | 9/5/03 | |

| STL JOB No. | Regulatory Methods |
|---|---|
| 209127 | NPDES ____ SW846 ____ SDWA ____ Other ____ |

| TELEPHONE NUMBER | FAX NUMBER | QC REPORT REQUIRED? | PO #: |
|---|---|---|---|
| (413) 572-4000 | (413) 572-3707 | YES NO | 209127 |

| CLIENT SAMPLE ID | LAB ID | COLLECTION DATE & TIME | MATRIX | PARAMETER & METHOD | BOTTLE TYPE | PRESERV. | NET PRICE |
|---|---|---|---|---|---|---|---|
| SD-14 | 127-1 | 8/10/03 1439 | GW | Lithium | pos50ml | HNO3 | |
| FM-15 | 127-2 | 8/10/03 1651 | ↓ | ↓ 200.7 | ↓ | ↓ | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| Samples Relinquished by: | Date & Time | Samples Received by: | Date & Time |
|---|---|---|---|
| [illegible] | 8/26/03 1700 | | |
| Samples Relinquished by: | Date & Time | Samples Received by: | Date & Time |
| | | Patrick R Sauk | 8/27/03 0945 |

**Standard Instructions**

- Please provide the date of analysis
- Please use Lab ID to identify samples on your report
- If QC report is requested, please report the results for the method blank(s), LCS(s), matrix spike(s), duplicates and surrogates as applicable.

| SHIPPING INSTRUCTIONS / COMMENTS: | COOLER TEMP. @ RECEIPT | REPORT DIRECT TO: |
|---|---|---|
| STL Pittsburg | _____ | Project Manager<br>STL Westfield<br>53 Southampton Road<br>Westfield, MA 01085 |
| | _____ Initials | INVOICE DIRECT TO:<br>Accounting<br>STL Westfield<br>53 Southampton Road<br>Westfield, MA 01805 |

DCN:GEF00301.MA
STL-8270 R:12/01

Page 6 of 7

White = Sub Lab Yellow = Report Copy Pink = Accounting

STL WESTFIELD

Client Sample ID: 209127-1

TOTAL Metals

Lot-Sample #...: C3H270141-001 Matrix.....: WATER
Date Sampled...: 08/10/03 Date Received..: 08/27/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3240138 | | | | | | |
| Lithium | 1890 | 50.0 | ug/L | SW846 6010B | 08/28-08/29/03 | FW3371AA |
| | | Dilution Factor: 1 | | Analysis Time..: 13:37 | MS Run #.....: 3240036 | |

STL Westfield
53 Southampton Road
Westfield, MA 01085

## SUBCONTRACTING CHAIN OF CUSTODY

| STL Project Manager | VERBAL DUE DATE | FAX DUE DATE | HARDCOPY DUE DATE |
|---|---|---|---|
| Becky Mason | | 9/5/03 | |

| STL JOB No. | Regulatory Methods |
|---|---|
| 209127 | NPDES ____ SW846 ____ SDWA ____ Other ____ |

| TELEPHONE NUMBER | FAX NUMBER | QC REPORT REQUIRED? | PO #: |
|---|---|---|---|
| (413) 572-4000 | (413) 572-3707 | YES NO | 209127 |

| CLIENT SAMPLE ID | LAB ID | COLLECTION DATE & TIME | MATRIX | PARAMETER & METHOD | BOTTLE TYPE | PRESERV. | NET PRICE |
|---|---|---|---|---|---|---|---|
| SD-14 | 127-1 | 8/10/03 1439 | GW | Lithium | pos50ml | HNO3 | |
| FM-15 | 127-2 | 8/10/03 1651 | ↓ | ↓ 200.7 | ↓ | ↓ | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| Samples Relinquished by: | Date & Time | Samples Received by: | Date & Time |
|---|---|---|---|
| [illegible] | 8/26/03 1700 | | |
| Samples Relinquished by: | Date & Time | Samples Received by: | Date & Time |
| | | Patrick R Sauk | 8/27/03 0945 |

**Standard Instructions**

- Please provide the date of analysis
- Please use Lab ID to identify samples on your report
- If QC report is requested, please report the results for the method blank(s), LCS(s), matrix spike(s), duplicates and surrogates as applicable.

| SHIPPING INSTRUCTIONS / COMMENTS: | COOLER TEMP. @ RECEIPT | REPORT DIRECT TO: |
|---|---|---|
| STL Pittsburg | _____ | Project Manager<br>STL Westfield<br>53 Southampton Road<br>Westfield, MA 01085 |
| | _____ Initials | INVOICE DIRECT TO:<br>Accounting<br>STL Westfield<br>53 Southampton Road<br>Westfield, MA 01805 |

DCN:GEF00301.MA
STL-8270 R:12/01

Page 6 of 7

White = Sub Lab Yellow = Report Copy Pink = Accounting

STL WESTFIELD

Client Sample ID: 209127-1

TOTAL Metals

Lot-Sample #...: C3H270141-001 Matrix.....: WATER
Date Sampled...: 08/10/03 Date Received..: 08/27/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3240138 | | | | | | |
| Lithium | 1890 | 50.0 | ug/L | SW846 6010B | 08/28-08/29/03 | FW3371AA |
| | | Dilution Factor: 1 | | Analysis Time..: 13:37 | MS Run #.....: 3240036 | |

STL WESTFIELD

Client Sample ID: 209127-2

TOTAL Metals

Lot-Sample #...: C3H270141-002 Matrix.....: WATER
Date Sampled...: 08/10/03 Date Received..: 08/27/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3240138 | | | | | | |
| Lithium | 67.2 | 50.0 | ug/L | SW846 6010B | 08/28-08/29/03 | FW34A1AA |
| | | Dilution Factor: 1 | | Analysis Time..: 13:41 | MS Run #.....: 3240036 | |

MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 209127**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

The project samples were received on 08/12/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**SUBCONTRACT**
SW846 6010B (Lithium) was performed at STL Pittsburgh. The subcontracted laboratory noted no reportable deviations for this method.

The Specific Gravity analyses were performed at STL- Chicago. Please refer to STL Chicago's case narrative for further details.

Due to limited sample volume, client's samples ID as FM-15 was diluted 10X with laboratory reagent water, upon sample receipt at the laboratory. Reporting limits have been raised accordingly.

**Inorganic**

**Nitrate, Nitrite**
**EPA 300.0 Part A**
For method EPA 300 (Nitrate, Nitrite), the samples had high intrinsic color, turbidity and/or dissolved salts and as a result required a dilution prior to analyzing on the instrument. The reporting limits have been raised accordingly.

There were no QC deviations/issues reported for this method.

**Sulfate**
There were no QC deviations/issues reported for this method.

**Chloride**
There were no QC deviations/issues reported for this method.

**Ammonia**
There were no QC deviations/issues reported for this method.

**Metals**

**EPA 200.7**
Poor matrix spike recovery was noted for the MS result for the metals analysis due to the sample concentration overwhelming the amount of spike added. The LCS recovered within acceptable control limits.
There were no additional QC deviations/issues reported for this method.

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

08/25/2003

Report Number: 209127

Dear Alan Peirce,

The analysis of your sample(s) submitted on 08/12/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 14

'ern Trent Laboratories, Inc.
Westfield • 53 Southampton Road, Westfield, MA 01085
413 572 4000 Fax 413 572 3707 • www.stl-inc.com

A part of Severn Trent plc

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209127 |
| Project Location: | C03303F | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
209127 1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP Analytical Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| As specified in MADEP Compendium of Analytical Methods Check all that apply | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes No[1] NA |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | NA Yes No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 8/26/03

MCP CASE NARRATIVE

Client: OLIN

Report Number: 209127

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

The project samples were received on 08/12/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**SUBCONTRACT**

The Specific Gravity analyses were performed at STL- Chicago. Please refer to STL Chicago's case narrative for further details.

Due to limited sample volume, client's samples ID as FM-15 was diluted 10X with laboratory reagent water, upon sample receipt at the laboratory. Reporting limits have been raised accordingly.

**Inorganic**

**Nitrate, Nitrite**

**EPA 300.0 Part A**
For method EPA 300 (Nitrate, Nitrite), the samples had high intrinsic color, turbidity and/or dissolved salts and as a result required a dilution prior to analyzing on the instrument. The reporting limits have been raised accordingly.

There were no QC deviations/issues reported for this method.

**Sulfate**
There were no QC deviations/issues reported for this method.

**Chloride**
There were no QC deviations/issues reported for this method.

**Ammonia**
There were no QC deviations/issues reported for this method.

**Metals**

**EPA 200.7**
Poor matrix spike recovery was noted for the MS result for the metals analysis due to the sample concentration overwhelming the amount of spike added. The LCS recovered within acceptable control limits.
There were no additional QC deviations/issues reported for this method.



STL Chicago
Wet Chemistry Case Narrative

Client: STL Westfield
Job #: 219783

Date Rec'd: 08/13/03

This narrative covers the analysis of the samples in the above job number for specific gravity by hydrometer, ASTM Method D 1298. The EPA has not established a holding time for this test. Refer to the Laboratory Chronicle Page for dates of sampling, receipt, and analysis. Sample 2 was diluted 10X with laboratory water prior to receipt at STL Chicago, but since the measured specific gravity was 1.0000, no correction was made for the dilution.

Diane L. Harper
Wet Chemistry Section Manager

8-22-03
Date

## SAMPLE INFORMATION
Date: 08/25/2003

Job Number.: 209127
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID...,: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209127-1 | SD-14 | Water | 08/10/2003 | 16:39 | 08/12/2003 | 11:00 |
| 209127-2 | FM-15 | Water | 08/10/2003 | 16:51 | 08/12/2003 | 11:00 |



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
NY DOH 10843
NH DES 253901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400

## LABORATORY TEST RESULTS

Job Number: 209127
Date: 08/25/2003

CUSTOMER: Olin Chemical
PROJECT: C03303F
ATTN: Alan Peirce

Customer Sample ID: SD-14
Date Sampled.....: 08/10/2003
Time Sampled.....: 16:39
Sample Matrix.....: Water

Laboratory Sample ID: 209127-1
Date Received.....: 08/12/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0620 | | 0.0001 | Ratio | 08/21/03 | sub |
| EPA300.0 PartA | Chloride | 10700 | | 500 | mg/L | 08/12/03 | rwe |
| EPA300.0 PartA | Sulfate | 42000 | | 1000 | mg/L | 08/12/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/11/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/11/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 5010 | | 100 | mg/L | 08/18/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1300000 | | 5000 | ug/L | 08/18/03 | bpg |
| | Calcium (Ca) | 613000 | | 10000 | ug/L | 08/18/03 | bpg |
| | Chromium (Cr) | 1450000 | | 500 | ug/L | 08/18/03 | bpg |
| | Iron (Fe) | 1390000 | | 5000 | ug/L | 08/18/03 | bpg |
| | Magnesium (Mg) | 862000 | | 10000 | ug/L | 08/18/03 | bpg |
| | Sodium (Na) | 13700000 | | 100000 | ug/L | 08/18/03 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
NY DOH 10843
NH DES 253901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Billerica
Rangeway Rd.
Billerica, MA 01862
Tel: (978) 667-1400

STL WESTFIELD

Client Sample ID: 209127-2

TOTAL Metals

Lot-Sample #...: C3H270141-002 Matrix.....: WATER
Date Sampled...: 08/10/03 Date Received..: 08/27/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3240138 | | | | | | |
| Lithium | 67.2 | 50.0 | ug/L | SW846 6010B | 08/28-08/29/03 | FW34A1AA |
| | | Dilution Factor: 1 | | Analysis Time..: 13:41 | MS Run #.....: 3240036 | |

MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 209127**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

The project samples were received on 08/12/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**SUBCONTRACT**
SW846 6010B (Lithium) was performed at STL Pittsburgh. The subcontracted laboratory noted no reportable deviations for this method.

The Specific Gravity analyses were performed at STL- Chicago. Please refer to STL Chicago's case narrative for further details.

Due to limited sample volume, client's samples ID as FM-15 was diluted 10X with laboratory reagent water, upon sample receipt at the laboratory. Reporting limits have been raised accordingly.

**Inorganic**

**Nitrate, Nitrite**
**EPA 300.0 Part A**
For method EPA 300 (Nitrate, Nitrite), the samples had high intrinsic color, turbidity and/or dissolved salts and as a result required a dilution prior to analyzing on the instrument. The reporting limits have been raised accordingly.

There were no QC deviations/issues reported for this method.

**Sulfate**
There were no QC deviations/issues reported for this method.

**Chloride**
There were no QC deviations/issues reported for this method.

**Ammonia**
There were no QC deviations/issues reported for this method.

**Metals**

**EPA 200.7**
Poor matrix spike recovery was noted for the MS result for the metals analysis due to the sample concentration overwhelming the amount of spike added. The LCS recovered within acceptable control limits.
There were no additional QC deviations/issues reported for this method.

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

08/25/2003

Report Number: 209127

Dear Alan Peirce,

The analysis of your sample(s) submitted on 08/12/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 14

'ern Trent Laboratories, Inc.
Westfield • 53 Southampton Road, Westfield, MA 01085
413 572 4000 Fax 413 572 3707 • www.stl-inc.com

A part of Severn Trent plc

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209127 |
| Project Location: | C03303F | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
209127 1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP Analytical Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| As specified in MADEP Compendium of Analytical Methods Check all that apply | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes No[1] NA |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | NA Yes No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 8/26/03

MCP CASE NARRATIVE

Client: OLIN

Report Number: 209127

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

The project samples were received on 08/12/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**SUBCONTRACT**

The Specific Gravity analyses were performed at STL- Chicago. Please refer to STL Chicago's case narrative for further details.

Due to limited sample volume, client's samples ID as FM-15 was diluted 10X with laboratory reagent water, upon sample receipt at the laboratory. Reporting limits have been raised accordingly.

**Inorganic**

**Nitrate, Nitrite**

**EPA 300.0 Part A**
For method EPA 300 (Nitrate, Nitrite), the samples had high intrinsic color, turbidity and/or dissolved salts and as a result required a dilution prior to analyzing on the instrument. The reporting limits have been raised accordingly.

There were no QC deviations/issues reported for this method.

**Sulfate**
There were no QC deviations/issues reported for this method.

**Chloride**
There were no QC deviations/issues reported for this method.

**Ammonia**
There were no QC deviations/issues reported for this method.

**Metals**

**EPA 200.7**
Poor matrix spike recovery was noted for the MS result for the metals analysis due to the sample concentration overwhelming the amount of spike added. The LCS recovered within acceptable control limits.
There were no additional QC deviations/issues reported for this method.



STL Chicago
Wet Chemistry Case Narrative

Client: STL Westfield
Job #: 219783

Date Rec'd: 08/13/03

This narrative covers the analysis of the samples in the above job number for specific gravity by hydrometer, ASTM Method D 1298. The EPA has not established a holding time for this test. Refer to the Laboratory Chronicle Page for dates of sampling, receipt, and analysis. Sample 2 was diluted 10X with laboratory water prior to receipt at STL Chicago, but since the measured specific gravity was 1.0000, no correction was made for the dilution.

Diane L. Harper
Wet Chemistry Section Manager

8-22-03
Date

## SAMPLE INFORMATION
Date: 08/25/2003

Job Number.: 209127
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID...,: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209127-1 | SD-14 | Water | 08/10/2003 | 16:39 | 08/12/2003 | 11:00 |
| 209127-2 | FM-15 | Water | 08/10/2003 | 16:51 | 08/12/2003 | 11:00 |



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
NY DOH 10843
NH DES 253901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400

## LABORATORY TEST RESULTS

Job Number: 209127
Date: 08/25/2003

CUSTOMER: Olin Chemical
PROJECT: C03303F
ATTN: Alan Peirce

Customer Sample ID: SD-14
Date Sampled.....: 08/10/2003
Time Sampled.....: 16:39
Sample Matrix.....: Water

Laboratory Sample ID: 209127-1
Date Received.....: 08/12/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0620 | | 0.0001 | Ratio | 08/21/03 | sub |
| EPA300.0 PartA | Chloride | 10700 | | 500 | mg/L | 08/12/03 | rwe |
| EPA300.0 PartA | Sulfate | 42000 | | 1000 | mg/L | 08/12/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/11/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/11/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 5010 | | 100 | mg/L | 08/18/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1300000 | | 5000 | ug/L | 08/18/03 | bpg |
| | Calcium (Ca) | 613000 | | 10000 | ug/L | 08/18/03 | bpg |
| | Chromium (Cr) | 1450000 | | 500 | ug/L | 08/18/03 | bpg |
| | Iron (Fe) | 1390000 | | 5000 | ug/L | 08/18/03 | bpg |
| | Magnesium (Mg) | 862000 | | 10000 | ug/L | 08/18/03 | bpg |
| | Sodium (Na) | 13700000 | | 100000 | ug/L | 08/18/03 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
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Tel: (413) 572-4000
Billerica
Rangeway Rd.
Billerica, MA 01862
Tel: (978) 667-1400

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

02627

•53 Southampton Road, Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD

•149 Rangeway Road, N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Job#: Quote#: PO#:

Client: Olin / Geomega
Address: 2995 Baseline Rd Ste 202, Boulder, CO 80303
Phone: 3034439117 Fax: 3039388123

Project #: C03303F
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone

Shaded areas for office use

**Analysis Requested**
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

**Comments (Special Instructions)**

Cr, Al, Fe, Ca, Mg, Na
$SO_4$, $Cl^-$
Nitrate
Nitrite
Ammonia
Specific Gravity

Requested Turn Around Time
10 Business Day (Std) ___ | Rush TAT Requested: 24 hrs ___ 72 hrs ___
15 Business Day ___ | 48 hrs ___ 5 Day ___
Other ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-14 | GW | CW | 8-10-03 16:39 | | | 1 | 1 | | | | | | | 1 | | | | | | | | | | | | | |
| FM-15 | GW | CW | 8-10-03 16:51 | | | 1 | 1 | | | | | | | 1 | | | | | | | | | | | | | |

Sampled by (print): Craig R. Walker
Signature: [signature] 8/11/03 1900

Relinquished by: Date: Time:
Received by: [signature] Date: Time:

Relinquished by: Date: Time:
Received by: [signature] Date: 8/12/03 Time: 11:00

Method of shipment:

**STL-Westfield**

Cooler: Y / N Samples iced: Y / N
Temp. of receipt: 2.2 °C
Preservation pH checked: Y / N
By: [illegible] Date: 8/12/03

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245-360 (12/02)

---

LABORATORY TEST RESULTS

Job Number: 209127 Date: 08/25/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-15
Date Sampled.....: 08/10/2003
Time Sampled.....: 16:51
Sample Matrix.....: Water

Laboratory Sample ID: 209127-2
Date Received.....: 08/12/2003
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0000 | | 0.0001 | Ratio | 08/21/03 | sub |
| EPA300.0 PartA | Chloride | 2280 | | 500 | mg/L | 08/12/03 | rwe |
| EPA300.0 PartA | Sulfate | 8710 | | 1000 | mg/L | 08/12/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/11/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/11/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 1120 | | 10 | mg/L | 08/18/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 141000 | | 5000 | ug/L | 08/18/03 | bpg |
| | Calcium (Ca) | 338000 | | 10000 | ug/L | 08/18/03 | bpg |
| | Chromium (Cr) | 67900 | | 500 | ug/L | 08/18/03 | bpg |
| | Iron (Fe) | 193000 | | 5000 | ug/L | 08/18/03 | bpg |
| | Magnesium (Mg) | 176000 | | 10000 | ug/L | 08/18/03 | bpg |
| | Sodium (Na) | 2890000 | | 100000 | ug/L | 08/18/03 | bpg |

* In Description = Dry Wgt.



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MADEP MA014
RIDOH57
CTDPH 0494
NY DOH 10843
NH DES 253901-A
SEVERN TRENT STL

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

09/04/2003

Report Number: 209269

Dear Alan Peirce,

The analysis of your sample(s) submitted on 08/19/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 18

ern Trent Laboratories, Inc.
Westfield • 53 Southampton Road, Westfield, MA 01085
el 413 572 4000 Fax 413 572 3707 • www.stl-inc.com

A part of Severn Trent plc

## MADEP MCP Analytical Method Report Certification Form

Laboratory Name: Severn Trent Laboratory (STL) Westfield Project #: 209269

Project Location: MADEP RTN[1]:

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

209269-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( x ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes N/A No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | N/A Yes No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 9/8/03

MCP CASE NARRATIVE

Client: OLIN

Report Number: 209269

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

The project samples were received on 08/19/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

Due to limited sample volume, sample ID as FM-16 required a base dilution of 10x prior to any analysis. The reporting limit has been adjusted accordingly.

**Subcontracted**

The ASTM 1298 Hydrometer analysis was performed at STL-Chicago. Please refer to the separate case narrative for more information.

The lithium analysis was performed at STL- Pittsburgh. There were no QC deviations/issues reported for this method.

**Inorganic**

**Chloride**

There were no QC deviations/issues reported for this method.

**Sulfate**

There were no QC deviations/issues reported for this method.

**Nitrite and Nitrate**
The samplesFM-16 and SD-15 had a high intrinsic color, turbidity and/or dissolved salts. As a result, the samples were diluted in order to dilute out the matrix interference.
There were no QC deviations/issues reported for this method.

**Ammonia**

There were no QC deviations/issues reported for this method.

**Metals EPA 200.7**

There were no QC deviations/issues reported for this method.

CASE NARRATIVE
STL Westfield

LOT # C3H270136

**Sample Receiving:**
STL Pittsburgh received samples on August 27, 2003. The cooler was received within the proper temperature range.

If project specific QC was not required for samples contained in this report, when batch QC was completed on these samples, anomalous results will be discussed below.

**Metals:**
There were no problems associated with the analysis.

MCP CASE NARRATIVE

Client: OLIN

Report Number: 209269

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

The project samples were received on 08/19/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

Due to limited sample volume, sample ID as FM-16 required a base dilution of 10x prior to any analysis. The reporting limit has been adjusted accordingly.

**Subcontracted**

The ASTM 1298 Hydrometer analysis was performed at STL-Chicago. Please refer to the separate case narrative for more information.

The lithium analysis was performed at STL- Pittsburgh. There were no QC deviations/issues reported for this method.

**Inorganic**

**Chloride**

There were no QC deviations/issues reported for this method.

**Sulfate**

There were no QC deviations/issues reported for this method.

**Nitrite and Nitrate**
The samplesFM-16 and SD-15 had a high intrinsic color, turbidity and/or dissolved salts. As a result, the samples were diluted in order to dilute out the matrix interference.
There were no QC deviations/issues reported for this method.

**Ammonia**

There were no QC deviations/issues reported for this method.

**Metals EPA 200.7**

There were no QC deviations/issues reported for this method.

CASE NARRATIVE
STL Westfield

LOT # C3H270136

**Sample Receiving:**
STL Pittsburgh received samples on August 27, 2003. The cooler was received within the proper temperature range.

If project specific QC was not required for samples contained in this report, when batch QC was completed on these samples, anomalous results will be discussed below.

**Metals:**
There were no problems associated with the analysis.

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209410 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

209410-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used As specified in MADEP Compendium of Analytical Methods (CAM) | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( X ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | (Yes) No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | (Yes) No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes (N/A) No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes (N/A) No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | (Yes) No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | (Yes) No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** Steven Hartmann **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 9/10/03



## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 209410**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

The project samples were received on 08/26/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**

The ASTM 1298 Hydrometer analysis was performed at STL-Chicago. Please refer to the separate case narrative for more information.

The lithium analysis was performed at STL- Pittsburgh. There were no QC deviations/issues reported for this method.

**Inorganic**

**Chloride**

There were no QA/QC deviations or issues reported for this method.

**Sulfate**

There were no QA/QC deviations or issues reported for this method.

**Nitrite and Nitrate**

The samples SD-18 and FM-19 had a high intrinsic color, turbidity and/or dissolved salts. As a result, the samples were diluted in order to dilute out the matrix interference.

There were no additional QA/QC deviations or issues reported for this method.

**Ammonia**

There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**

There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 09/10/2003

Job Number.: 209410
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: MLP SAMPLING
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209410-1 | SD-18 | Water | 08/25/2003 | 10:50 | 08/26/2003 | 09:45 |
| 209410-2 | FM-19 | Water | 08/25/2003 | 11:00 | 08/26/2003 | 09:45 |



SEVERN STL
MADEP MA014
RIDOH57
NY DOH 10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862

## LABORATORY TEST RESULTS
Job Number: 209410
Date: 09/10/2003

CUSTOMER: Olin Chemical | PROJECT: MLP SAMPLING | ATTN: Alan Peirce

Customer Sample ID: SD-18
Date Sampled.....: 08/25/2003
Time Sampled.....: 10:50
Sample Matrix.....: Water

Laboratory Sample ID: 209410-1
Date Received.....: 08/26/2003
Time Received.....: 09:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0290 | | 0.0001 | Ratio | 09/09/03 | sub |
| EPA300.0 PartA | Chloride | 5160 | | 250 | mg/L | 08/26/03 | rwe |
| EPA300.0 PartA | Sulfate | 19700 | | 500 | mg/L | 08/26/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 12 | mg/L | 08/26/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 2.5 | mg/L | 08/26/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 290 | | 20 | mg/L | 09/03/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 343000 | | 5000 | ug/L | 08/28/03 | bpg |
| | Calcium (Ca) | 493000 | | 10000 | ug/L | 08/28/03 | bpg |
| | Chromium (Cr) | 272000 | | 500 | ug/L | 08/28/03 | bpg |
| | Iron (Fe) | 520000 | | 5000 | ug/L | 08/28/03 | bpg |
| | Magnesium (Mg) | 290000 | | 10000 | ug/L | 08/28/03 | bpg |
| | Sodium (Na) | 5730000 | | 100000 | ug/L | 08/28/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 974 | | 50 | ug/L | 08/29/03 | sub |

* In Description = Dry Wgt.



SEVERN STL
MADEP MA014
RIDOH57
NY DOH 10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
L Billerica
9 Rangeway Rd.
N. Billerica, MA 01862

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209410 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

209410-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used As specified in MADEP Compendium of Analytical Methods (CAM) | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( X ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | (Yes) No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | (Yes) No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes (N/A) No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes (N/A) No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | (Yes) No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | (Yes) No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** Steven Hartmann **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 9/10/03



## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 209410**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

The project samples were received on 08/26/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**

The ASTM 1298 Hydrometer analysis was performed at STL-Chicago. Please refer to the separate case narrative for more information.

The lithium analysis was performed at STL- Pittsburgh. There were no QC deviations/issues reported for this method.

**Inorganic**

**Chloride**

There were no QA/QC deviations or issues reported for this method.

**Sulfate**

There were no QA/QC deviations or issues reported for this method.

**Nitrite and Nitrate**

The samples SD-18 and FM-19 had a high intrinsic color, turbidity and/or dissolved salts. As a result, the samples were diluted in order to dilute out the matrix interference.

There were no additional QA/QC deviations or issues reported for this method.

**Ammonia**

There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**

There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 09/10/2003

Job Number.: 209410
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: MLP SAMPLING
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209410-1 | SD-18 | Water | 08/25/2003 | 10:50 | 08/26/2003 | 09:45 |
| 209410-2 | FM-19 | Water | 08/25/2003 | 11:00 | 08/26/2003 | 09:45 |



SEVERN STL
MADEP MA014
RIDOH57
NY DOH 10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862

## LABORATORY TEST RESULTS
Job Number: 209410
Date: 09/10/2003

CUSTOMER: Olin Chemical | PROJECT: MLP SAMPLING | ATTN: Alan Peirce

Customer Sample ID: SD-18
Date Sampled.....: 08/25/2003
Time Sampled.....: 10:50
Sample Matrix.....: Water

Laboratory Sample ID: 209410-1
Date Received.....: 08/26/2003
Time Received.....: 09:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0290 | | 0.0001 | Ratio | 09/09/03 | sub |
| EPA300.0 PartA | Chloride | 5160 | | 250 | mg/L | 08/26/03 | rwe |
| EPA300.0 PartA | Sulfate | 19700 | | 500 | mg/L | 08/26/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 12 | mg/L | 08/26/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 2.5 | mg/L | 08/26/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 290 | | 20 | mg/L | 09/03/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 343000 | | 5000 | ug/L | 08/28/03 | bpg |
| | Calcium (Ca) | 493000 | | 10000 | ug/L | 08/28/03 | bpg |
| | Chromium (Cr) | 272000 | | 500 | ug/L | 08/28/03 | bpg |
| | Iron (Fe) | 520000 | | 5000 | ug/L | 08/28/03 | bpg |
| | Magnesium (Mg) | 290000 | | 10000 | ug/L | 08/28/03 | bpg |
| | Sodium (Na) | 5730000 | | 100000 | ug/L | 08/28/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 974 | | 50 | ug/L | 08/29/03 | sub |

* In Description = Dry Wgt.



SEVERN STL
MADEP MA014
RIDOH57
NY DOH 10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
L Billerica
9 Rangeway Rd.
N. Billerica, MA 01862

## STL Chicago
## Wet Chemistry Case Narrative

Client: STL Westfield
Job #: 219929

Date Rec'd: 08/20/03

This narrative covers the analysis of the samples in the above job number for specific gravity by hydrometer, ASTM Method D 1298. The EPA has not established a holding time for this test. Refer to the Laboratory Chronicle Page for dates of sampling, receipt, and analysis. Sample 1 was diluted 10X with laboratory water prior to receipt at STL Chicago, but since the measured specific gravity was 1.0000, no correction was made for the dilution.

Diane L. Harper
Wet Chemistry Section Manager

8-25-03
Date

SAMPLE INFORMATION
Date: 09/04/2003

Job Number.: 209269
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209269-1 | FM-16 | Water | 08/17/2003 | 12:47 | 08/19/2003 | 10:15 |
| 209269-2 | SD-15 | Water | 08/17/2003 | 12:42 | 08/19/2003 | 10:15 |

# LABORATORY TEST RESULTS

Job Number: 209269

Date: 09/04/2003

CUSTOMER: Olin Chemical | PROJECT: C03303F | ATTN: Alan Peirce

Customer Sample ID: FM-16
Date Sampled.....: 08/17/2003
Time Sampled.....: 12:47
Sample Matrix.....: Water

Laboratory Sample ID: 209269-1
Date Received.....: 08/19/2003
Time Received.....: 10:15

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0000 | | 0.0001 | Ratio | 08/21/03 | sub |
| EPA300.0 PartA | Chloride | 1840 | | 100 | mg/L | 08/19/03 | rwe |
| EPA300.0 PartA | Sulfate | 7000 | | 200 | mg/L | 08/19/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 5.0 | mg/L | 08/19/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 1.0 | mg/L | 08/19/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 780 | | 10 | mg/L | 08/25/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 86500 | | 10000 | ug/L | 08/25/03 | bpg |
| | Calcium (Ca) | 243000 | | 20000 | ug/L | 08/25/03 | bpg |
| | Chromium (Cr) | 34400 | | 1000 | ug/L | 08/25/03 | bpg |
| | Iron (Fe) | 42200 | | 10000 | ug/L | 08/25/03 | bpg |
| | Magnesium (Mg) | 98300 | | 20000 | ug/L | 08/25/03 | bpg |
| | Sodium (Na) | 2060000 | | 200000 | ug/L | 08/25/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 543 | | 500 | ug/L | 08/29/03 | sub |

* In Description = Dry Wgt.





# LABORATORY TEST RESULTS

Job Number: 209269

Date: 09/04/2003

CUSTOMER: Olin Chemical | PROJECT: C03303F | ATTN: Alan Peirce

Customer Sample ID: SD-15
Date Sampled.....: 08/17/2003
Time Sampled.....: 12:42
Sample Matrix.....: Water

Laboratory Sample ID: 209269-2
Date Received.....: 08/19/2003
Time Received.....: 10:15

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0500 | | 0.0001 | Ratio | 08/21/03 | sub |
| EPA300.0 PartA | Chloride | 8840 | | 500 | mg/L | 08/19/03 | rwe |
| EPA300.0 PartA | Sulfate | 33500 | | 1000 | mg/L | 08/19/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 25 | mg/L | 08/19/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 5.0 | mg/L | 08/19/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 3570 | | 20 | mg/L | 08/25/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 761000 | | 10000 | ug/L | 08/25/03 | bpg |
| | Calcium (Ca) | 484000 | | 20000 | ug/L | 08/25/03 | bpg |
| | Chromium (Cr) | 753000 | | 1000 | ug/L | 08/25/03 | bpg |
| | Iron (Fe) | 943000 | | 10000 | ug/L | 08/25/03 | bpg |
| | Magnesium (Mg) | 505000 | | 20000 | ug/L | 08/25/03 | bpg |
| | Sodium (Na) | 9370000 | | 200000 | ug/L | 08/25/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 1480 | | 50 | ug/L | 08/29/03 | sub |

* In Description = Dry Wgt.

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

09/10/2003

Report Number: 209410

Dear Alan Peirce,

The analysis of your sample(s) submitted on 08/26/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 15

Severn Trent Laboratories, Inc.
STL Westfield • 53 Southampton Road, Westfield, MA 01085
Tel 413 572 4000 Fax 413 572 3707 • www.stl-inc.com

A part of Severn Trent plc

## Severn Trent Laboratories, Inc.
### Chain of Custody Form

SEVERN TRENT STL 02594

•53 Southampton Road, Westfield, MA 01085, (P) 413-572-4000, (F) 413-572-3707, STL-WESTFIELD
•149 Rangeway Rd, N. Billerica, MA 01, (P) 978-667-1400, (F) 978-667-787, STL-BILLERICA

Client: Olin Corp / Geomega
Address: 2995 Baseline Rd Ste 202, Boulder CO 80303
Phone: 3034439117 Fax: 3039388123

Project #: C03303F
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone / Craig R Walker

Date: 8/18/03 Page: 1 PO:

Shaded area is for office use

Requested Turn Around Time
10 Business Day (Std) ✓
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Analysis:
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4^{2-}$, $Cl^-$
- Nitrate
- Nitrite
- Ammonia
- specific gravity

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | Preservative: NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4°C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other See Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FM-16 | GW | CRW | 8/17/03 12:47 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| SD-15 | GW | CRW | 8/17/03 12:42 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): Craig R. Walker
Signature: [signature] 8/18/03 8/18/03 1700

Relinquished by: Date: Time:
Received by: [signature] Date: Time:

Relinquished by: Date: Time:
Received by: [signature] 8/18/03 Date: Time: 10:15

Method of shipment: STL-Westfield

Cooler: Y / N Samples
Temp @ receipt
Preservation pH checked
By: Date:



White = Lab file Yellow = Report copy Pink = Customer copy

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209410 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

209410-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used As specified in MADEP Compendium of Analytical Methods (CAM) | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( X ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | (Yes) No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | (Yes) No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes (N/A) No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes (N/A) No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | (Yes) No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | (Yes) No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** Steven Hartmann **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 9/10/03



## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 209410**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

The project samples were received on 08/26/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**

The ASTM 1298 Hydrometer analysis was performed at STL-Chicago. Please refer to the separate case narrative for more information.

The lithium analysis was performed at STL- Pittsburgh. There were no QC deviations/issues reported for this method.

**Inorganic**

**Chloride**

There were no QA/QC deviations or issues reported for this method.

**Sulfate**

There were no QA/QC deviations or issues reported for this method.

**Nitrite and Nitrate**

The samples SD-18 and FM-19 had a high intrinsic color, turbidity and/or dissolved salts. As a result, the samples were diluted in order to dilute out the matrix interference.

There were no additional QA/QC deviations or issues reported for this method.

**Ammonia**

There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**

There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 09/10/2003

Job Number.: 209410
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: MLP SAMPLING
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209410-1 | SD-18 | Water | 08/25/2003 | 10:50 | 08/26/2003 | 09:45 |
| 209410-2 | FM-19 | Water | 08/25/2003 | 11:00 | 08/26/2003 | 09:45 |



SEVERN STL
MADEP MA014
RIDOH57
NY DOH 10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862

## LABORATORY TEST RESULTS
Job Number: 209410
Date: 09/10/2003

CUSTOMER: Olin Chemical | PROJECT: MLP SAMPLING | ATTN: Alan Peirce

Customer Sample ID: SD-18
Date Sampled.....: 08/25/2003
Time Sampled.....: 10:50
Sample Matrix.....: Water

Laboratory Sample ID: 209410-1
Date Received.....: 08/26/2003
Time Received.....: 09:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0290 | | 0.0001 | Ratio | 09/09/03 | sub |
| EPA300.0 PartA | Chloride | 5160 | | 250 | mg/L | 08/26/03 | rwe |
| EPA300.0 PartA | Sulfate | 19700 | | 500 | mg/L | 08/26/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 12 | mg/L | 08/26/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 2.5 | mg/L | 08/26/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 290 | | 20 | mg/L | 09/03/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 343000 | | 5000 | ug/L | 08/28/03 | bpg |
| | Calcium (Ca) | 493000 | | 10000 | ug/L | 08/28/03 | bpg |
| | Chromium (Cr) | 272000 | | 500 | ug/L | 08/28/03 | bpg |
| | Iron (Fe) | 520000 | | 5000 | ug/L | 08/28/03 | bpg |
| | Magnesium (Mg) | 290000 | | 10000 | ug/L | 08/28/03 | bpg |
| | Sodium (Na) | 5730000 | | 100000 | ug/L | 08/28/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 974 | | 50 | ug/L | 08/29/03 | sub |

* In Description = Dry Wgt.



SEVERN STL
MADEP MA014
RIDOH57
NY DOH 10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
L Billerica
9 Rangeway Rd.
N. Billerica, MA 01862

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

02595
209410

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 Rangeway Rd
N. Billerica, MA 01
(P) 978-667-140
(F) 978-667-787
STL-BILLERICA

Job#: Quote#: PO#:

Client: Olin / Geomega
Address: 2995 Baseline Rd Ste 202
Boulder, CO 80303
Phone: 3034439117 Fax: 3039388123

Project #: C03303F (Coldiron Study)
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone / Craig R Walker

Shaded areas for office use

**Analysis Requested**
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

**Comments** (Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg / Na
- Li
- $SO_4$, $Cl^-$
- Nitrate
- Nitrite
- Ammonia
- Specific Gravity

Requested Turn Around Time
10 Business Day (Std) ✓
15 Business Day
Other
Rush TAT Requested:
24 hrs 72 hrs
48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other See Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-18 | GW | CRW | 8-25-03 10:50 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | ✓ |
| FM-19 | GW | CRW | 8-25-03 11:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | ✓ |

Sampled by (print): CR Walker 8/25/03 1500
Signature: CR Walker 8/25/03 1500
Relinquished by: Date: Time:
Received by: Mark Bogue 8/26/03 0945
Relinquished by: Date: Time:
Received by: Date: Time:
Method of shipment: STL-Westfield

Cooler: Y / N Samples Iced: Y
Temp @ receipt:
Preservation pH checked:
By: Date:

cust. seals

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245-360 (12/02)

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LABORATORY TEST RESULTS

Job Number: 209410 Date: 09/10/2003

CUSTOMER: Olin Chemical PROJECT: MLP SAMPLING ATTN: Alan Peirce

Customer Sample ID: FM-19
Date Sampled.....: 08/25/2003
Time Sampled.....: 11:00
Sample Matrix.....: Water

Laboratory Sample ID: 209410-2
Date Received.....: 08/26/2003
Time Received.....: 09:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0060 | | 0.0001 | Ratio | 09/09/03 | sub |
| EPA300.0 PartA | Chloride | 1290 | | 100 | mg/L | 08/26/03 | rwe |
| EPA300.0 PartA | Sulfate | 5520 | | 200 | mg/L | 08/26/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 5.0 | mg/L | 08/26/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 1.0 | mg/L | 08/26/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 92.7 | | 10 | mg/L | 09/03/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 79100 | | 500 | ug/L | 08/28/03 | bpg |
| | Calcium (Ca) | 226000 | | 1000 | ug/L | 08/28/03 | bpg |
| | Chromium (Cr) | 35600 | | 50 | ug/L | 08/28/03 | bpg |
| | Iron (Fe) | 29300 | | 500 | ug/L | 08/28/03 | bpg |
| | Magnesium (Mg) | 91400 | | 1000 | ug/L | 08/28/03 | bpg |
| | Sodium (Na) | 1480000 | | 10000 | ug/L | 08/28/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 405 | | 50 | ug/L | 08/29/03 | sub |

* In Description = Dry Wgt.



STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000

STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-7400

MADEP MA014
RIDOH57
CT PH0141
NY DOH 10843
NY DES 255001-A
SEVERN TRENT STL

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

09/11/2003

Report Number: 209515

Dear Alan Peirce,

The analysis of your sample(s) submitted on 08/29/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann
Laboratory Director

Total number of pages in this report: 17

vern Trent Laboratories, Inc.
Westfield • 53 Southampton Road, Westfield, MA 01085
413 572 4000 Fax 413 572 3707 • www.stl-inc.com

A part of Severn Trent plc

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209515 |
| Project Location: | C03303F | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( X ) | 7470A/1A ( ) | Other ( X ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| As specified in MADEP Compendium Method Quality Control Requirements | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes N/A No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes N/A No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** _____ **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 9/12/03

MCP CASE NARRATIVE

Client: OLIN

Report Number: 209515

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

The project samples were received on 08/29/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago. Please refer to the separate case narrative for more information.

The lithium analysis was performed at STL- Pittsburgh. An ICSA/AB solution, which monitors spectral interference, was not performed at the end of the analytical instrument run as per method 6010MCP. An initial ICSA/AB standard was performed and met all criteria established in 6010MCP. A LCS/LCSD was performed on this job for precision and accuracy measurements, instead of an MS/MSD. The LCS/LCSD recovered within MCP control criteria. There were no additional QA/QC deviations or issues reported for this method.

**Inorganic**

**Chloride**
There were no QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrite and Nitrate**
The samples SD-19 and FM-20 had a high intrinsic color, turbidity and/or dissolved salts. As a result, the samples were diluted in order to dilute out the matrix interference. Reporting limits have been adjusted accordingly.There were no additional QA/QC deviations or issues reported for this method.

**Ammonia**
There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
Poor matrix spike recovery was noted for the MS result for the Iron analysis. The sample concentration overwhelmed the amount of spike added. The LCS recovered within acceptable control limits.
There were no additional QA/QC deviations or issues reported for this method.



CASE NARRATIVE
STL Westfield

LOT # C3I020109

**Sample Receiving:**
STL Pittsburgh received samples on August 30, 2003. The cooler was received within the proper temperature range.

If project specific QC was not required for samples contained in this report, when batch QC was completed on these samples, anomalous results will be discussed below.

**Metals:**
There were no problems associated with the analysis.

## SAMPLE INFORMATION
Date: 09/11/2003

Job Number.: 209515
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209515-1 | SD-19 | Water | 08/28/2003 | 15:47 | 08/29/2003 | 10:50 |
| 209515-2 | FM-20 | Water | 08/28/2003 | 15:25 | 08/29/2003 | 10:50 |



SEVERN STL MADEP MA014 RIDOH57 NY DOH 10843 STL Westfield 53 Southampton Rd. Westfield, MA 01085 STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862

## LABORATORY TEST RESULTS

Job Number: 209515 Date: 09/11/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-19
Date Sampled.....: 08/28/2003
Time Sampled.....: 15:47
Sample Matrix.....: Water

Laboratory Sample ID: 209515-1
Date Received.....: 08/29/2003
Time Received.....: 10:50

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0220 | | 0.0001 | Ratio | 09/09/03 | sub |
| EPA300.0 PartA | Chloride | 3590 | | 250 | mg/L | 08/30/03 | rwe |
| EPA300.0 PartA | Sulfate | 14200 | | 500 | mg/L | 08/30/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 12 | mg/L | 08/30/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 2.5 | mg/L | 08/30/03 | rwe |
| LAC 1070618 | Ammonia (NH3), as N | 1990 | | 20 | mg/L | 09/03/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 240000 | | 2500 | ug/L | 09/08/03 | bpg |
| | Calcium (Ca) | 473000 | | 5000 | ug/L | 09/08/03 | bpg |
| | Chromium (Cr) | 165000 | | 250 | ug/L | 09/08/03 | bpg |
| | Iron (Fe) | 373000 | | 2500 | ug/L | 09/08/03 | bpg |
| | Magnesium (Mg) | 225000 | | 5000 | ug/L | 09/08/03 | bpg |
| | Sodium (Na) | 4510000 | | 50000 | ug/L | 09/08/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 779 | | 50 | ug/L | 09/04/03 | sub |

* In Description = Dry Wgt.



SEVERN STL MADEP MA014 RIDOH57 NY DOH 10843 STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

02597
209515

•53 Southampton Road, Westfield, MA 01085, (P) 413-572-4000, (F) 413-572-3707, STL-WESTFIELD
•149 Rangeway Road, N. Billerica, MA 01862, (P) 978-667-1400, (F) 978-667-7871, STL-BILLERICA

Job#: Quote#: PO#:

Client: Olin / Geomega
Address: 2995 Baseline Rd Ste 202, Boulder, CO 80303
Phone: 303 443 9117 Fax: 303 938 8120

Project #: C03303F (Column Study)
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone / Craig Walker

Requested Turn Around Time
0 Business Day (Std) X
5 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES, RCRA, Other, Drinking Water, MCP GW1/S1, DEP Form(s), MWRA Smart Rpt, MCP QA/QC Rpt

Shaded areas for office use.
Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- Li
- $SO_4$, $Cl^-$
- nitrate
- nitrite
- ammonia
- specific gravity

Sample Type Codes
AW-Wastewater DW-Drinking water SW-Surfacewater
W-Labwater GW-Groundwater A-Air
-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other See comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-19 | GW | CRW | 8-28-03 15:47 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-20 | GW | CRW | 8-28-03 15:25 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): Craig R Walker 8/28/03 1700 Signature:
Relinquished by: Date: Time: Received by: Monte Bryce Date: 8/29/03 Time: 1050
Relinquished by: Date: Time: Received by: Date: Time:
Method of shipment: STL-Westfield

Cooler: Y N Samples Iced: Y N
Temp @ receipt: °C
Preservation pH checked:
By: Date:

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy

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LABORATORY TEST RESULTS

Job Number: 209515 Date: 09/11/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Belfrc

Customer Sample ID: FM-20
Date Sampled.....: 08/28/2003
Time Sampled.....: 15:25
Sample Matrix.....: Water

Laboratory Sample ID: 209515-2
Date Received.....: 08/29/2003
Time Received.....: 10:50

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0060 | | 0.0001 | Ratio | 09/09/03 | sub |
| EPA300.0 PartA | Chloride | 1410 | | 100 | mg/L | 08/30/03 | rwe |
| EPA300.0 PartA | Sulfate | 5710 | | 200 | mg/L | 08/30/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 5.0 | mg/L | 08/30/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 1.0 | mg/L | 08/30/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 588 | | 12 | mg/L | 09/03/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | 09/08/03 | bpg |
| | Aluminum (Al) | 85800 | | 500 | ug/L | 09/08/03 | bpg |
| | Calcium (Ca) | 256000 | | 1000 | ug/L | 09/08/03 | bpg |
| | Chromium (Cr) | 32200 | | 50 | ug/L | 09/08/03 | bpg |
| | Iron (Fe) | 22800 | | 500 | ug/L | 09/08/03 | bpg |
| | Magnesium (Mg) | 102000 | | 1000 | ug/L | 09/08/03 | bpg |
| | Sodium (Na) | 1780000 | | 10000 | ug/L | 09/08/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | 09/04/03 | sub |
| | Lithium (Li) | 397 | | 50 | ug/L | | |



* In Description = Dry Wgt.

STL Westfield, 53 Southampton Rd., Westfield, MA 01085, Tel: (413) 572-4000
STL Billerica, 149 Rangeway Rd., N. Billerica, MA 01862, Tel: (978) 667-1400

MADEP MA014 RIDOH67 NY DOH 10843 SEVERN STT

SEVERN TRENT STL

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

09/15/2003

Report Number: 209569

Dear Alan Peirce,

The analysis of your sample(s) submitted on 09/03/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: CR 9/15/03

Total number of pages in this report: 16

# ANALYTICAL REPORT

JOB NUMBER: 209569

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 09/15/2003

Signature

Date 9/16/03

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209569 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]

209569-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( x ) | 7470A/1A ( ) | Other ( x ) |
| As specified in MADEP Compendium of Analytical Methods (check all that apply) | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | (Yes) No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | (Yes) No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | (Yes) N/A No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes (N/A) No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | (Yes) No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes (No[1]) |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

Signature: Steven Hartmann Position: Laboratory Director

Printed Name: Steven C. Hartmann Date: 9/15/03



## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 209569**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

The project samples were received on 09/03/03; the samples arrived in good condition, properly preserved and on ice.

**SW846 6010B**

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

**Inorganic**

**Chloride**
There were no QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrite and Nitrate**
The samples SD-20 and FM-21 had a high intrinsic color, turbidity and/or dissolved salts. As a result, the samples were diluted in order to dilute out the matrix interference. Reporting limits have been adjusted accordingly. There were no additional QA/QC deviations or issues reported for this method.

**Ammonia**
There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 09/15/2003

Job Number.: 209569
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209569-1 | SD-20 | Water | 09/02/2003 | 11:50 | 09/03/2003 | 10:30 |
| 209569-2 | FM-21 | Water | 09/02/2003 | 11:50 | 09/03/2003 | 10:30 |





## LABORATORY TEST RESULTS
Job Number: 209569
Date: 09/15/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-20
Date Sampled.....: 09/02/2003
Time Sampled.....: 11:50
Sample Matrix.....: Water

Laboratory Sample ID: 209569-1
Date Received.....: 09/03/2003
Time Received.....: 10:30

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0170 | | 0.0001 | Ratio | 09/09/03 | sub |
| EPA300.0 PartA | Chloride | 2550 | | 250 | mg/L | 09/03/03 | rwe |
| EPA300.0 PartA | Sulfate | 10400 | | 500 | mg/L | 09/03/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 5.0 | mg/L | 09/03/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 1.0 | mg/L | 09/03/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 1700 | | 20 | mg/L | 09/10/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 165000 | | 5000 | ug/L | 09/09/03 | bpg |
| | Calcium (Ca) | 416000 | | 10000 | ug/L | 09/09/03 | bpg |
| | Chromium (Cr) | 98900 | | 500 | ug/L | 09/09/03 | bpg |
| | Iron (Fe) | 274000 | | 5000 | ug/L | 09/09/03 | bpg |
| | Magnesium (Mg) | 176000 | | 10000 | ug/L | 09/09/03 | bpg |
| | Sodium (Na) | 3550000 | | 100000 | ug/L | 09/09/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 655 | | 50 | ug/L | 09/08/03 | sub |

* In Description = Dry Wgt.

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT **STL**

02596
209569

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD

N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Job#: Quote#: PO#:

Client: Olin/Geomega Inc.
Address: 3995 Baseline Rd.
Boulder CO 80303
Phone: 3034439117 Fax: 3039388123

Project #: C03303F column study
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone / Andrew Nicholson

Requested Turn Around Time
Business Day (Std) ✓ | Rush TAT Requested: 24 hrs ___ 72 hrs ___
Business Day ___ | 48 hrs ___ 5 Day ___
Other ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Shaded areas for office use.

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Analytes:
3 bottles of each sample ID are identical
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$, Cr.
Nitrate / Nitrite *
Ammonia *
Specific gravity
- Li - added by phone call from Geomega/Andrew 9/3/03 RCW

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
AW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-2D | GW | JW SJM | 9-2-03 11:50 | | | 3 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-21 | GW | JW SJM | 9-2-03 11:50 | | | 3 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): JASON WHITE Date: 9/2/03 Signature: [signature]

Relinquished by: JASON WHITE Date: 9/2/03 Time:

Received by: [signature] Date: 9-3-03 Time: 1030

Relinquished by: Date: Time: 16:30

Received by: Date: Time:

Method of shipment: FEDEX

**STL-Westfield**

Cooler? (Y) N: Samples Iced? (Y)
Temp @ receipt: 4.0
Preservation/pH checked: ✓
By: [initials] Date: 9/5/03

Page ____ of ____

White = Lab file Yellow = Report copy Pink = Customer copy
STL8245-360 (12/02)

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LABORATORY TEST RESULTS

Job Number: 209569 Date: 09/15/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-21
Date Sampled.....: 09/02/2003
Time Sampled.....: 11:50
Sample Matrix.....: Water

Laboratory Sample ID: 209569-2
Date Received.....: 09/03/2003
Time Received.....: 10:30

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0040 | | 0.0001 | Ratio | 09/09/03 | sub |
| EPA300.0 PartA | Chloride | 1170 | | 100 | mg/L | 09/03/03 | rwe |
| EPA300.0 PartA | Sulfate | 4930 | | 200 | mg/L | 09/03/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 2.5 | mg/L | 09/03/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.50 | mg/L | 09/03/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 2.07 | | 0.10 | mg/L | 09/10/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 52800 | | 1000 | ug/L | 09/09/03 | bpg |
| | Calcium (Ca) | 212000 | | 2000 | ug/L | 09/09/03 | bpg |
| | Chromium (Cr) | 17400 | | 100 | ug/L | 09/09/03 | bpg |
| | Iron (Fe) | 4050 | | 1000 | ug/L | 09/09/03 | bpg |
| | Magnesium (Mg) | 73000 | | 2000 | ug/L | 09/09/03 | bpg |
| | Sodium (Na) | 1360000 | | 20000 | ug/L | 09/09/03 | bpg |
| SW846 6010B | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 360 | | 50 | ug/L | 09/08/03 | sub |

* In Description = Dry Wgt.



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MADEP MA014
RIDOH57
NY DOH 10843

SEVERN TRENT STL

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53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

10/01/2003

Report Number: 209636

Dear Alan Peirce,

The analysis of your sample(s) submitted on 09/05/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: JW 10-1-03

Total number of pages in this report: 16

# ANALYTICAL REPORT

JOB NUMBER: 209636

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 10/01/2003

RMace
Signature

10/1/03
Date

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209636 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
209636-1-2

Sample Matrices: Groundwater ✓ Soil/Sediment Drinking Water Other:

| MCP SW-846 Methods Used As Specified in MADEP Compendium of Analytical Methods (Check all that apply) | | | | | | |
|---|---|---|---|---|---|---|
| | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes ✓ No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes ✓ No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes N/A ✓ No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes N/A ✓ No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes ✓ No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes N/A ✓ No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** [signature] **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 10-1-03



## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 209636**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 09/05/03; the samples arrived in good condition, properly preserved and on ice.

Due to insufficient sample volume sample SD-21 required a 2X dilution prior to analysis and sample FM-22 required a 4X dilution. These dilutions were incorporated into the final results.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**Inorganic**

**Chloride**
There were no QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrite**
There were no QA/QC deviations or issues reported for this method.

**Nitrate**
There were no QA/QC deviations or issues reported for this method.

**Ammonia**
There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 10/01/2003

Job Number..: 209636
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209636-1 | SD-21 | Water | 09/04/2003 | 14:10 | 09/05/2003 | 09:48 |
| 209636-2 | FM-22 | Water | 09/04/2003 | 14:10 | 09/05/2003 | 09:48 |



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MADEP MA014
RIDOH57
CTDPH 0494
NY DOH 10843
NH DES 253901-A
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53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

## LABORATORY TEST RESULTS
Job Number: 209636
Date: 10/01/2003

CUSTOMER: Olin Chemical | PROJECT: C03303F | ATTN: Alan Peirce

Customer Sample ID: SD-21
Date Sampled.....: 09/04/2003
Time Sampled.....: 14:10
Sample Matrix.....: Water

Laboratory Sample ID: 209636-1
Date Received.....: 09/05/2003
Time Received.....: 09:48

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0030 | | 0.0001 | Ratio | 09/09/03 | sub |
| EPA300.0 PartA | Chloride | 2240 | | 100 | mg/L | 09/05/03 | rwe |
| EPA300.0 PartA | Sulfate | 8710 | | 200 | mg/L | 09/05/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 5.0 | mg/L | 09/05/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 1.0 | mg/L | 09/05/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 2400 | | 72 | mg/L | 09/10/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 103000 | | 10000 | ug/L | 09/10/03 | bpg |
| | Calcium (Ca) | 341000 | | 20000 | ug/L | 09/10/03 | bpg |
| | Chromium (Cr) | 56700 | | 1000 | ug/L | 09/10/03 | bpg |
| | Iron (Fe) | 201000 | | 10000 | ug/L | 09/10/03 | bpg |
| | Magnesium (Mg) | 137000 | | 20000 | ug/L | 09/10/03 | bpg |
| | Sodium (Na) | 2600000 | | 200000 | ug/L | 09/10/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 256 | | 100 | ug/L | 09/25/03 | sub |

* In Description = Dry Wgt.



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STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
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# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

02598
209636

•53 Southampton Road
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(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Job#: Quote#: PO#:

Client: Olin / Geomega
Address: 2995 Baseline Rd.
Boulder, CO 80303
Phone: 3034439117 Fax: 3039388123

Project #: C03303F column study
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone / Andrew Nicholson

Requested Turn Around Time
10 Business Day (Std) ✓ | Rush TAT Requested:
15 Business Day ___ | 24 hrs ___ 72 hrs ___
Other ___ | 48 hrs ___ 5 Day ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$, Cr
Nitrate / Nitrite
Ammonia
specf. gravity
Lithium

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-[redacted]21 | GW | JW SJM | 9.4.03 14:10 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-22 | GW | JW SJM | 9.4.03 14:10 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): JASON WHITE 9/4/03 16:25 Signature: Jason White

Relinquished by: Date: Time: Received by: Date: Time:

Relinquished by: Date: Time: Received by: Date: Time:

Method of shipment: Fedex STL-Westfield

Received by: 9-5-03 0948

Cooler? ✓ N Samples iced? ✓ N
Temp @ receipt:
Preservation pH checked:
By: Date:

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy

---

LABORATORY TEST RESULTS

Job Number: 209636 Date: 10/01/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Pierce

Customer Sample ID: FM-22
Date Sampled.....: 09/04/2003
Time Sampled.....: 14:10
Sample Matrix.....: Water

Laboratory Sample ID: 209636-2
Date Received.....: 09/05/2003
Time Received.....: 09:48

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0000 | | 0.0001 | Ratio | 09/09/03 | sub |
| EPA300.0 PartA | Chloride | 835 | | 40 | mg/L | 09/05/03 | rwe |
| EPA300.0 PartA | Sulfate | 3500 | | 80 | mg/L | 09/05/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 2.0 | mg/L | 09/05/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.40 | mg/L | 09/05/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 0.47 | | 0.40 | mg/L | 09/10/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 34700 | | 400 | ug/L | 09/11/03 | bpg |
| | Calcium (Ca) | 167000 | | 800 | ug/L | 09/11/03 | bpg |
| | Chromium (Cr) | 10300 | | 40 | ug/L | 09/11/03 | bpg |
| | Iron (Fe) | 1200 | | 400 | ug/L | 09/11/03 | bpg |
| | Magnesium (Mg) | 50900 | | 800 | ug/L | 09/11/03 | bpg |
| | Sodium (Na) | 1030000 | | 8000 | ug/L | 09/11/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP), Subcontracted | | | | | | |
| | Lithium (Li) | ND | U | 200 | ug/L | 09/25/03 | sub |

* In Description = Dry Wgt.



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Tel: (978) 667-1400
Fax: (978) 667-7871

MADEP MA014
RIDOH 77
CT PH-0494
NY DOH 10843
NH DES 253901-A

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Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

09/30/2003

Report Number: 209675

Dear Alan Peirce,

The analysis of your sample(s) submitted on 09/09/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: 9/30/03

Total number of pages in this report: 16

# ANALYTICAL REPORT

JOB NUMBER: 209675

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 09/30/2003

Signature

Date 9/30/03

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

# MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209675 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
209675-1-2

Sample Matrices: Groundwater Soil/Sediment Drinking Water Other:

| MCP SW-846 Methods used As specified in MADEP Compendium of Analytical Methods (Check all that apply) | | | | | | |
|---|---|---|---|---|---|---|
| | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes ✓ No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes ✓ No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes N/A ✓ No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes N/A ✓ No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes No[1] ✓ |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes No[1] N/A ✓ |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** [signature] **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 9/30/03



## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 209675**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 09/09/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**Inorganic**

**Chloride**
The MS sample had a chloride value that was outside of the working calibration range; therefore no duplicate or spike information is available. The LCS recovered within acceptable limits.

There were no additional QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrite**
The nitrite and chloride peaks in the MS co-eluted because of the high chloride concentration; therefore no duplicate or spike information is available. The LCS recovered within acceptable limits.

There were no QA/QC additional deviations or issues reported for this method.

**Nitrate**
There were no QA/QC deviations or issues reported for this method.

**Ammonia**
There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 09/30/2003

Job Number.: 209675
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 2000034B
Customer Project ID....: C0330F
Project Description....: C0330F

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209675-1 | SD-22 | Water | 09/08/2003 | 14:50 | 09/09/2003 | 10:30 |
| 209675-2 | FM-23 | Water | 09/08/2003 | 14:50 | 09/09/2003 | 10:30 |



SEVERN TRENT STL
ADEP MA014
RIDOH57
CTDPH 0494
NY DOH 10843
NH DES 253901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400

## LABORATORY TEST RESULTS
Job Number: 209675
Date: 09/30/2003

CUSTOMER: Olin Chemical
PROJECT: C0330F
ATTN: Alan Peirce

Customer Sample ID: SD-22
Date Sampled.....: 09/08/2003
Time Sampled.....: 14:50
Sample Matrix.....: Water

Laboratory Sample ID: 209675-1
Date Received.....: 09/09/2003
Time Received.....: 10:30

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0150 | | 0.0001 | Ratio | 09/16/03 | sub |
| EPA300.0 PartA | Chloride | 1840 | | 100 | mg/L | 09/09/03 | rwe |
| EPA300.0 PartA | Sulfate | 7900 | | 200 | mg/L | 09/09/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 2.5 | mg/L | 09/09/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.50 | mg/L | 09/09/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 553 | | 6.0 | mg/L | 09/10/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 80900 | | 2500 | ug/L | 09/15/03 | bpg |
| | Calcium (Ca) | 294000 | | 5000 | ug/L | 09/15/03 | bpg |
| | Chromium (Cr) | 39500 | | 250 | ug/L | 09/15/03 | bpg |
| | Iron (Fe) | 152000 | | 2500 | ug/L | 09/15/03 | bpg |
| | Magnesium (Mg) | 105000 | | 5000 | ug/L | 09/15/03 | bpg |
| | Sodium (Na) | 2230000 | | 50000 | ug/L | 09/15/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 499 | | 50 | ug/L | 09/25/03 | sub |

* In Description = Dry Wgt.



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# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

02599
209675

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Olin / Geomega
Address: 2915 Baseline Rd
Boulder, CO 80303
Phone: 3034439117 Fax: 3039388123

Project #: C03303F colm. study
Project Manager: Dan Stone
Work ID: Dan Stone / Andrew Nicholson
Contact:

Requested Turn Around Time
Business Day (Std) ✓
Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Shaded areas for office use
Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$ Cr
Nitrate / Nitrite
Ammonia
Specific Gravity
Lithium

Sample Type Codes
W-Wastewater DW-Drinking water SW-Surfacewater
W-Labwater GW-Groundwater A-Air
Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-22 | GW | JW SJM | 9-8-03 14:50 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-23 | GW | JW SJM | 9-8-03 14:50 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): JASON WHITE 9/8/03 16:15 Signature: Jason White

Relinquished by: Date: Time: Received by: Date: Time:

Relinquished by: Date: Time: Received by: Date: 9/9/03 Time: 10:30

Method of shipment: FedeX

STL-Westfield

Cooler: (Y) N Samples Iced: (Y) N
Temp. of Cooler: 2 °C
Preservation/pH Checked: Y / N
By: Date: 9/9/03

Cost-Seals

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245.350/12/02

LABORATORY TEST RESULTS

Job Number: 209675 Date: 09/30/2003

CUSTOMER: olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-23
Date Sampled.....: 09/08/2003
Time Sampled.....: 14:50
Sample Matrix.....: Water

Laboratory Sample ID: 209675-2
Date Received.....: 09/09/2003
Time Received.....: 10:30

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0080 | | 0.0001 | Ratio | 09/16/03 | sub |
| EPA300.0 PartA | Chloride | 741 | | 50 | mg/L | 09/09/03 | rwe |
| EPA300.0 PartA | Sulfate | 3360 | | 100 | mg/L | 09/09/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 0.50 | mg/L | 09/09/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 09/09/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 15.0 | | 0.10 | mg/L | 09/10/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 28300 | | 500 | ug/L | 09/16/03 | bpg |
| | Calcium (Ca) | 165000 | | 1000 | ug/L | 09/16/03 | bpg |
| | Chromium (Cr) | 7810 | | 50 | ug/L | 09/16/03 | bpg |
| | Iron (Fe) | 399 | | 100 | ug/L | 09/15/03 | bpg |
| | Magnesium (Mg) | 45700 | | 200 | ug/L | 09/15/03 | bpg |
| | Sodium (Na) | 867000 | | 10000 | ug/L | 09/16/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 252 | | 50 | ug/L | 09/25/03 | sub |

* In Description = Dry Wgt.



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N. Billerica, MA 01862
Tel: (978) 667-1400

MADEP MA014
RIDOH57
CTDPH0494
NY DOH 10843
NH DES 253901-A
SEVERN TRENT STL

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

09/30/2003

Report Number: 209820

Dear Alan Peirce,

The analysis of your sample(s) submitted on 09/12/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: 9/30/03

Total number of pages in this report: 17

# ANALYTICAL REPORT

JOB NUMBER: 209820

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 09/30/2003

Signature

Date 9/30/03

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

# MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209820 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
209820-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used As specified in MADEP Compendium of Analytical Methods (check all that apply) | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other (x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes ✓ No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes ✓ No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes NA ✓ No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes NA ✓ No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes No ✓ |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes No[1] NA ✓ |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

Signature: [signature] for  Position: Laboratory Director

Printed Name: Steven C. Hartmann  Date: 9/30/03



## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 209820**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 09/12/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**Inorganic**

**Chloride**
There were no QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrite**
The MS recovered high and outside the control limits of 75-125%. The LCS had acceptable recovery therefore no further action was taken.

There were no additional QA/QC deviations or issues reported for this method.

**Nitrate**
The Nitrate result is derived from the subtraction of the manually determined NO2 from a combined nitrate-nitrite (NOx) result that is determined by the Lachat automated flow injection method. The NOx was analyzed, within hold-time, from a client supplied acid preserved container.

There were no additional QA/QC deviations or issues reported for this method.

**Ammonia**
There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 09/30/2003

Job Number.: 209820
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20001390
Customer Project ID....: C03303F
Project Description....: MLP Sampling

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209820-1 | SD-23 | Water | 09/11/2003 | 14:00 | 09/12/2003 | 09:40 |
| 209820-2 | FM-24 | Water | 09/11/2003 | 14:00 | 09/12/2003 | 09:40 |



SEVERN TRENT STL
DEP MA014
OH57
DPH 0494
VT DECWSD
NY DOH 10843
NH DES 253901-A
NELAP NY10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
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N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

## LABORATORY TEST RESULTS

Job Number: 209820 Date: 09/30/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: SD-23
Date Sampled.....: 09/11/2003
Time Sampled.....: 14:00
Sample Matrix.....: Water

Laboratory Sample ID: 209820-1
Date Received.....: 09/12/2003
Time Received.....: 09:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0080 | | 0.0001 | Ratio | 09/16/03 | sub |
| EPA300.0 PartA | Chloride | 1750 | | 50 | mg/L | 09/24/03 | rwe |
| EPA300.0 PartA | Sulfate | 7600 | | 200 | mg/L | 09/26/03 | kmm |
| SM18 4500NO2 B | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 09/12/03 | kmm |
| LAC 107061B | Ammonia (NH3), as N | 525 | | 20 | mg/L | 09/17/03 | kmm |
| LAC 107041A | Nitrate as N (NO3-N) | 0.24 | | 0.05 | mg/L | 09/16/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 76800 | | 2500 | ug/L | 09/19/03 | bpg |
| | Calcium (Ca) | 312000 | | 5000 | ug/L | 09/19/03 | bpg |
| | Chromium (Cr) | 34000 | | 250 | ug/L | 09/19/03 | bpg |
| | Iron (Fe) | 142000 | | 2500 | ug/L | 09/19/03 | bpg |
| | Magnesium (Mg) | 108000 | | 5000 | ug/L | 09/19/03 | bpg |
| | Sodium (Na) | 2150000 | | 50000 | ug/L | 09/19/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 456 | | 50 | ug/L | 09/25/03 | sub |

* In Description = Dry Wgt.



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Tel: (413) 572-4000
Fax: (413) 572-3707
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ngeway Rd.
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# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

02600
209820

•53 Southampton Road, Westfield, MA 01085, (P) 413-572-4000, (F) 413-572-3707, STL-WESTFIELD
•149 Rangeway Road, N. Billerica, MA 01862, (P) 978-667-1400, (F) 978-667-7871, STL-BILLERICA

Job#: Quote#: PO#:

Client: OLIN / GEOMEGA
Address: 2995 BASELINE ROAD, ST 202, BOULDER CO 80303
Phone: 303-443-4117 Fax: 303-938-8123
Project #: 03303 F COLUMN STUDY
Project Manager: DAN STONE
Work ID:
Contact: DAN STONE / ANDREW NICHOLSON

Requested Turn Around Time
10 Business Day (Std) ✓ | Rush TAT Requested: 24 hrs ___ 72 hrs ___
15 Business Day ___ | 48 hrs ___ 5 Day ___
Other ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
ANALYTES.
-Cr, Al, Fe, Ca, Mg, Na
-SO4 Cr
NITRATE/NITRITE
AMMONIA
SPECIFIC GRAVITY
LITHIUM

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-23 | GW | JAM | 9/11/03 14:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | ✓ | |
| FM-24 | GW | JAM | 9/11/03 14:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | ✓ | |

Sampled by (print): SUSAN McCAFFERY 9/11/03 15:30 Signature:
Relinquished by: Date: Time: Received by: Date: Time: 9/12/03 0940
Relinquished by: Date: Time: Received by: Date: Time:
Method of shipment: FEDEX
STL-Westfield

Cooler: (Y) N Samples Iced: (Y) N
Temp @ receipt: 8.1°C
Preservation/pH checked: Y/N
By: Date: 9/12/03

Page ____ of ____

White = Lab file Yellow = Report copy Pink = Customer copy
STL 8245-360 (12/02)

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LABORATORY TEST RESULTS

Job Number: 209820 Date: 09/30/2003
CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Reirce

Customer Sample ID: FM-24
Date Sampled.....: 09/11/2003
Time Sampled.....: 14:00
Sample Matrix.....: Water

Laboratory Sample ID: 209820-2
Date Received.....: 09/12/2003
Time Received.....: 09:40

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0050 | | 0.0001 | Ratio | 09/16/03 | sub |
| EPA300.0 PartA | Chloride | 684 | | 50 | mg/L | 09/24/03 | rwe |
| EPA300.0 PartA | Sulfate | 3250 | | 100 | mg/L | 09/24/03 | rwe |
| SM18 4500NO2 B | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 09/12/03 | kmm |
| LAC 107061B | Ammonia (NH3), as N | 282 | | 20 | mg/L | 09/17/03 | kmm |
| LAC 107041A | Nitrate as N (NO3-N) | ND | U | 0.05 | mg/L | 09/16/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 25200 | | 500 | ug/L | 09/19/03 | bpg |
| | Calcium (Ca) | 172000 | | 1000 | ug/L | 09/19/03 | bpg |
| | Chromium (Cr) | 6240 | | 50 | ug/L | 09/19/03 | bpg |
| | Iron (Fe) | 270 | | 50.0 | ug/L | 09/22/03 | bpg |
| | Magnesium (Mg) | 50500 | | 1000 | ug/L | 09/19/03 | bpg |
| | Sodium (Na) | 809000 | | 10000 | ug/L | 09/19/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 230 | | 50 | ug/L | 09/25/03 | sub |

9/12/03

* In Description = Dry Wgt.



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MADEP MA014
RI00027
CTDPH 0494
NY DOH 10843
NH DES 253901-A
SEVERN TRENT STL

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STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

09/30/2003

Report Number: 209868

Dear Alan Peirce,

The analysis of your sample(s) submitted on 09/16/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: JCW 9/30/03

Total number of pages in this report: 17

# ANALYTICAL REPORT

JOB NUMBER: 209868

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 09/30/2003

RC Mason
Signature

Date 9/30/03

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

# MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209868 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
209868-1-2

Sample Matrices: **Groundwater** Soil/Sediment Drinking Water Other:

| MCP SW-846 Methods Used (Specified in MADEP Compendium of Analytical Methods - Check all that apply) | | | | | | |
|---|---|---|---|---|---|---|
| | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes ✓ No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes ✓ No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes N/A ✓ No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes N/A ✓ No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes ✓ No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes No[1] N/A ✓ |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** [signature] **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 9/30/03



## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 209868**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 09/16/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**Inorganic**

**Chloride**
There were no QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrite**
There were no QA/QC deviations or issues reported for this method.

**Nitrate**
There were no QA/QC deviations or issues reported for this method.

**Ammonia**
There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 09/30/2003

Job Number.: 209868
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: C0330F
Project Description....: C0330F

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209868-1 | SD-24 | Water | 09/15/2003 | 14:30 | 09/16/2003 | 10:35 |
| 209868-2 | FM-25 | Water | 09/15/2003 | 14:30 | 09/16/2003 | 10:35 |



SEVERN TRENT STL
DEP MA014
DH57
DPH 0494
VT DECWSD
NY DOH 10843
NH DES 253901-A
NELAP NY10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

## LABORATORY TEST RESULTS
Job Number: 209868 Date: 09/30/2003

CUSTOMER: Olin Chemical PROJECT: C0330F ATTN: Alan Peirce

Customer Sample ID: SD-24
Date Sampled.....: 09/15/2003
Time Sampled.....: 14:30
Sample Matrix.....: Water

Laboratory Sample ID: 209868-1
Date Received.....: 09/16/2003
Time Received.....: 10:35

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0500 | | 0.0001 | Ratio | 09/18/03 | sub |
| EPA300.0 PartA | Chloride | 1500 | | 50 | mg/L | 09/25/03 | rwe |
| EPA300.0 PartA | Sulfate | 6660 | | 200 | mg/L | 09/26/03 | kmm |
| SM18 4500NO2 B | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 09/17/03 | kmm |
| LAC 107061B | Ammonia (NH3), as N | 670 | | 6.0 | mg/L | 09/22/03 | kmm |
| LAC 107041A | Nitrate as N (NO3-N) | ND | U | 0.05 | mg/L | 09/16/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 63800 | | 2500 | ug/L | 09/19/03 | bpg |
| | Calcium (Ca) | 296000 | | 5000 | ug/L | 09/19/03 | bpg |
| | Iron (Fe) | 119000 | | 2500 | ug/L | 09/19/03 | bpg |
| | Magnesium (Mg) | 103000 | | 5000 | ug/L | 09/19/03 | bpg |
| | Sodium (Na) | 1910000 | | 50000 | ug/L | 09/19/03 | bpg |
| | Chromium (Cr) | 25500 | | 250 | ug/L | 09/19/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 415 | | 50 | ug/L | 09/25/03 | sub |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NY DOH 10843
NH DES 253901-A
NELAP NY10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
Billerica
ngeway Rd.
rica, MA 01862
/8) 667-1400
.... (978) 667-7871

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

02601

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: OLIN / GEOMEGA
Address: 2995 BASELINE RD
BOULDER CO 80303
Phone: 303-443-4117 Fax: 303-938-8123

Project #: CO3303F COLM. STUDY
Project Manager: DAN STONE
Work ID: DAN STONE / ANDREW NICHOLSON
Contact:

Job#: 209868 Quote#: PO#:

Requested Turn Around Time
10 Business Day (Std) ✓ Rush TAT Requested:
15 Business Day ___ 24 hrs ___ 72 hrs ___
Other ___ 48 hrs ___ 5 Day ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
800-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

ANALYTES:
-Cr, Al, Fe, Ca, Mg, Na
-$SO_4$ Cr
NITRATE/NITRITE
AMMONIA
SPECIFIC GRAVITY
LITHIUM

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FD-24 | GW | SJM | 9/15/03 14:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-25 | GW | SJM | 9/15/03 14:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): SUSAN MCCAFFERY 9/15/03 15:30 Signature:

Relinquished by: Date: Time: Received by: Date: Time:

Relinquished by: Date: Time: Received by: Date: 9/16/03 Time: 1035

Method of shipment: FEDEX

STL-Westfield

Cooler: Y / N Samples Iced: Y / N
Temp. @ receipt: 4.7
Preservation checked:
By: Date:

Page ____ of ____

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245-360 (12/02)

LABORATORY TEST RESULTS

Job Number: 209868 Date: 09/30/2003

CUSTOMER: Olin Chemical PROJECT: CO3303F ATTN: Alan Peirce

Customer Sample ID: FM-25
Date Sampled.....: 09/15/2003
Time Sampled.....: 14:30
Sample Matrix.....: Water

Laboratory Sample ID: 209868-2
Date Received.....: 09/16/2003
Time Received.....: 10:35

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0000 | | 0.0001 | Ratio | 09/18/03 | sub |
| EPA300.0 PartA | Chloride | 598 | | 50 | mg/L | 09/25/03 | rwe |
| EPA300.0 PartA | Sulfate | 2910 | | 100 | mg/L | 09/25/03 | rwe |
| SM18 4500NO2 B | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 09/17/03 | kmn |
| LAC 107061B | Ammonia (NH3), as N | 475 | | 6.0 | mg/L | 09/22/03 | kmn |
| LAC 107041A | Nitrate as N (NO3-N) | ND | U | 0.05 | mg/L | 09/16/03 | kmn |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 18300 | | 500 | ug/L | 09/19/03 | bpg |
| | Calcium (Ca) | 144000 | | 1000 | ug/L | 09/19/03 | bpg |
| | Iron (Fe) | 164 | | 50.0 | ug/L | 09/22/03 | bpg |
| | Magnesium (Mg) | 41700 | | 1000 | ug/L | 09/19/03 | bpg |
| | Sodium (Na) | 608000 | | 10000 | ug/L | 09/19/03 | bpg |
| | Chromium (Cr) | 4280 | | 50 | ug/L | 09/19/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 202 | | 50 | ug/L | 09/25/03 | sub |

* In Description = Dry Wgt.



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Fax: (413) 572-3707

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MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD

NY DOH 10843
NH DES 253901-A
NELAP NY10843

SEVERN TRENT STL

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

10/02/2003

Report Number: 209973

Dear Alan Peirce,

The analysis of your sample(s) submitted on 09/19/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: JTW 10-2-03

Total number of pages in this report: 17

# ANALYTICAL REPORT

JOB NUMBER: 209973

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 10/02/2003

Signature

Date 10/2/03

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 209973 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
209973-1-2

Sample Matrices: **Groundwater** Soil/Sediment Drinking Water **Other:**

| MCP SW-846 Methods Used | | | | | | |
|---|---|---|---|---|---|---|
| | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

Assessment to MADEP Compendium of Analytical Methods Check all that apply

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | | | |
|---|---|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes | | No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes | | No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes | N/A | No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes | N/A | No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | | | |
|---|---|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes | | No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes | N/A | No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** [signature] for **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 10-2-03


SEVERN TRENT STL

MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NY DOH 10843
NH DES 253901-A
NELAP NY10843

STL Westfield
53 Southampton Rd,
Westfield, MA 01085
Tel:(413)572-4000
Fax:(413)572-3707

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149 Rangeway Rd
N.Billerica, MA 01862
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Fax:(978)667-7871


## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 209973**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 09/19/03; the samples arrived in good condition and on ice. The samples arrived unpreserved and were preserved upon arrival at the laboratory.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**Inorganic**

**Chloride**
There were no QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrite**
There were no QA/QC deviations or issues reported for this method.

**Nitrate**
The batch QC sample recovered high (126%) and outside the control limits of 75-125%. The LCS analysis recovered within the acceptable range.

There were no additional QA/QC deviations or issues reported for this method.

**Ammonia**
There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
The batch QC sample for Sodium recovered low (69%) and outside of the control limits of 70-130%. The LCS analysis recovered within the acceptable range.

There were no additional QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 10/02/2003

Job Number.: 209973
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: C0330F
Project Description....: C0330F

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 209973-1 | SD-25 | Water | 09/18/2003 | 14:30 | 09/19/2003 | 10:00 |
| 209973-2 | FM-26 | Water | 09/18/2003 | 14:30 | 09/19/2003 | 10:00 |





## LABORATORY TEST RESULTS
Job Number: 209973
Date: 10/02/2003

CUSTOMER: Olin Chemical | PROJECT: C0330f | ATTN: Alan Peirce

Customer Sample ID: SD-25
Date Sampled.....: 09/18/2003
Time Sampled.....: 14:30
Sample Matrix.....: Water

Laboratory Sample ID: 209973-1
Date Received.....: 09/19/2003
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0030 | | 0.0001 | Ratio | 09/30/03 | sub |
| EPA300.0 PartA | Chloride | 1240 | | 50 | mg/L | 09/25/03 | rwe |
| EPA300.0 PartA | Sulfate | 5870 | | 200 | mg/L | 09/30/03 | rwe |
| SM18 4500NO2 B | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 09/19/03 | kmm |
| LAC 107061B | Ammonia (NH3), as N | 592 | | 12 | mg/L | 09/29/03 | kmm |
| LAC 107041A | Nitrate as N (NO3-N) | ND | U | 0.05 | mg/L | 09/19/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 49500 | | 2500 | ug/L | 09/26/03 | bpg |
| | Calcium (Ca) | 264000 | | 5000 | ug/L | 09/26/03 | bpg |
| | Chromium (Cr) | 18100 | | 250 | ug/L | 09/26/03 | bpg |
| | Iron (Fe) | 93100 | | 2500 | ug/L | 09/26/03 | bpg |
| | Magnesium (Mg) | 90100 | | 5000 | ug/L | 09/26/03 | bpg |
| | Sodium (Na) | 1570000 | | 50000 | ug/L | 09/26/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 403 | | 50 | ug/L | 09/29/03 | sub |

* In Description = Dry Wgt.

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

02602
209973

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Olin / Geomega
Address: 2995 Baseline Rd.
Boulder, CO 80303
Phone: 303-443-9117 Fax: 303-938-8123

Project #: C03303F colm. study
Project Manager: Dan Stone
Work ID: Dan Stone / Andrew Nicholson
Contact:

Job#: Quote#: PO#:

Shaded areas for office use

Requested Turn Around Time
0 Business Day (Std) ✓
5 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$, Cr
Nitrate / Nitrite
Ammonia
Specific Gravity
Lithium

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
W-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | Preservative: NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-25 | GW | | 9/18/03 14:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-26 | GW | | 9/18/03 14:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): JASON WHITE 9/18/03 15:45
Signature: Jason White

Relinquished by: Date: Time:
Received by: Date: 9/19/03 Time: 1000

Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment: FEDEX

STL-Westfield

Cooler: Y N Samples Iced: Y N
Temp: 4.0°C
Preservation pH checked:
By: Date:

Page_____ of _____

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245-360 (12/02)

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LABORATORY TEST RESULTS

Job Number: 209973 Date: 10/02/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Paiva

Customer Sample ID: FM-26
Date Sampled.....: 09/18/2003
Time Sampled.....: 14:30
Sample Matrix.....: Water

Laboratory Sample ID: 209973-2
Date Received.....: 09/19/2003
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0000 | | 0.0001 | Ratio | 09/30/03 | sub |
| EPA300.0 PartA | Chloride | 546 | | 50 | mg/L | 09/25/03 | rwe |
| EPA300.0 PartA | Sulfate | 2610 | | 100 | mg/L | 09/25/03 | rwe |
| SM18 4500NO2 B | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 09/19/03 | kmm |
| LAC 107061B | Ammonia (NH3), as N | 410 | | 12 | mg/L | 09/29/03 | kmm |
| LAC 107041A | Nitrate as N (NO3-N) | ND | U | 0.05 | mg/L | 09/19/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | 09/26/03 | bpg |
| | Aluminum (Al) | 14900 | | 100 | ug/L | 09/26/03 | bpg |
| | Calcium (Ca) | 131000 | | 200 | ug/L | 09/26/03 | bpg |
| | Chromium (Cr) | 3300 | | 10 | ug/L | 09/26/03 | bpg |
| | Iron (Fe) | 159 | | 100 | ug/L | 09/26/03 | bpg |
| | Magnesium (Mg) | 37600 | | 200 | ug/L | 09/26/03 | bpg |
| | Sodium (Na) | 516000 | | 2000 | ug/L | 09/26/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 202 | | 50 | ug/L | 09/29/03 | sub |



* In Description = Dry Wgt.

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53 Southampton Rd.
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N. Billerica, MA 01862
Tel: (978) 667-1400

NY DOH 10843
MADEP MA014
RIDOH67
SEVERN STL

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

10/02/2003

Report Number: 210042

Dear Alan Peirce,

The analysis of your sample(s) submitted on 09/23/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: JTC 10-2-03

Total number of pages in this report: 16

# ANALYTICAL REPORT

JOB NUMBER: 210042

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 10/02/2003

Signature

Date 10/2/03

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

# MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 210042 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
210042-1-2

Sample Matrices: Groundwater ✓ Soil/Sediment Drinking Water Other:

| MCP SW-846 Methods used | | | | | | |
|---|---|---|---|---|---|---|
| | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| As specified in MADEP Compendium of Analytical Methods (Check all that apply) | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes ✓ No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes ✓ No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes N/A ✓ No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes N/A ✓ No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes No[1] ✓ |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes N/A ✓ No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** [signature] **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 10-3-03


SEVERN TRENT STL

MADEP MA014
RIDOH57 NY DOH 10843
CTDPH 0494 NH DES 253901-A
VT DECWSD NELAP NY10843

STL Westfield
53 Southampton Rd,
Westfield, MA 01085
Tel:(413)572-4000
Fax:(413)572-3707

STL Billerica
149 Rangeway Rd
N.Billerica, MA 01862
Tel:(978)667-1400
Fax:(978)667-7871


## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 210042**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 09/23/03; the samples arrived in good condition and on ice. The samples arrived unpreserved and were preserved upon arrival at the laboratory.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**Inorganic**

**Chloride**
There were no QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrate**
There were no QA/QC deviations or issues reported for this method.

**Nitrite**
The batch QC sample recovered high (136%) and outside the control limits of 75-125%. The LCS analysis recovered within the acceptable range.

There were no additional QA/QC deviations or issues reported for this method.

**Ammonia**
There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 10/02/2003

Job Number.: 210042
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: C0330F
Project Description....: C0330F

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 210042-1 | SD 26 | Water | 09/22/2003 | 14:00 | 09/23/2003 | 10:00 |
| 210042-2 | FM 27 | Water | 09/22/2003 | 14:00 | 09/23/2003 | 10:00 |



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
NY DOH 10843
NH DES 253901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

## LABORATORY TEST RESULTS
Job Number: 210042
Date: 10/02/2003

CUSTOMER: Olin Chemical | PROJECT: C0330F | ATTN: Alan Peirce

Customer Sample ID: SD 26
Date Sampled.....: 09/22/2003
Time Sampled.....: 14:00
Sample Matrix.....: Water

Laboratory Sample ID: 210042-1
Date Received.....: 09/23/2003
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0050 | | 0.0001 | Ratio | 09/30/03 | sub |
| EPA300.0 PartA | Chloride | 504 | | 100 | mg/L | 09/25/03 | rwe |
| EPA300.0 PartA | Sulfate | 2170 | | 200 | mg/L | 09/25/03 | rwe |
| SM18 4500NO2 B | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 09/23/03 | kmm |
| LAC 107061B | Ammonia (NH3), as N | 747 | | 12 | mg/L | 09/29/03 | kmm |
| LAC 107041A | Nitrate as N (NO3-N) | ND | U | 0.05 | mg/L | 09/23/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 40500 | | 2500 | ug/L | 09/26/03 | bpg |
| | Calcium (Ca) | 255000 | | 5000 | ug/L | 09/26/03 | bpg |
| | Chromium (Cr) | 13400 | | 250 | ug/L | 09/26/03 | bpg |
| | Iron (Fe) | 76400 | | 2500 | ug/L | 09/26/03 | bpg |
| | Magnesium (Mg) | 86400 | | 5000 | ug/L | 09/26/03 | bpg |
| | Sodium (Na) | 1370000 | | 50000 | ug/L | 09/26/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 369 | | 50 | ug/L | 09/29/03 | sub |

* In Description = Dry Wgt.



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NH DES 253901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Billerica
Rangeway Rd.
Billerica, MA 01862
(978) 667-1400

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT **STL** 02604

•53 Southampton Road, Westfield, MA 01085, (P) 413-572-4000, (F) 413-572-3707 STL-WESTFIELD
•149 Rangeway Road, N. Billerica, MA 01862, (P) 978-667-1400, (F) 978-667-7871 STL-BILLERICA

Client: Olin / Geomega
Address: 2995 Baseline Rd. Boulder, CO 80303
Phone: Fax:

Project #: C03303F colm. study
Project Manager: Dan Stone
Work ID: Dan Stone / Andrew Nicholson
Contact:

Job#: 03-1706 Quote# PO#

Shaded areas for office use

**Analysis Requested**
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
800-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

**Comments (Special Instructions)**

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$
Nitrate / Nitrite
Ammonia
Specific Gravity
Lithium
Cl added per phone call w/ Andrew Nicholson 9/25 RM

Requested Turn Around Time
10 Business Day (Std) ✓ | Rush TAT Requested:
15 Business Day | 24 hrs | 72 hrs
Other | 48 hrs | 5 Day

Regulatory Classification / Special Report Format
NPDES | Drinking Water | DEP Form(s)
RCRA | MCP GW1/S1 | MWRA Smart Rpt
Other | MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | Preservative: NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD 26 | GW | | 9/22/03 14:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM 27 | GW | | 9/22/03 14:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

MB 9/25/03

Sampled by (print): JASON WHITE 9/22/03 15:40 Signature: Jason White
Relinquished by: Date: Time: Received by: Date: 9/23/03 Time: 1000
Relinquished by: Date: Time: Received by: Date: Time:
Method of shipment: Fedex
**STL-Westfield**

Cooler? (Y) N; Samples Iced? (Y) N
Temp @ receipt: 2.0 °C
Preservation pH checked?
By: Date: 9/25/03

Page_____ of _____

White = Lab file Yellow = Report copy Pink = Customer copy
STL 8245-360 (12/02)

---

LABORATORY TEST RESULTS

Job Number: 210042 Date: 10/02/2003

CUSTOMER: Olin Chemical ATTN: Alan Peirce

PROJECT: C03303F

Customer Sample ID: FM 27
Date Sampled.....: 09/22/2003
Time Sampled.....: 14:00
Sample Matrix.....: Water

Laboratory Sample ID: 210042-2
Date Received.....: 09/23/2003
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0030 | | 0.0001 | Ratio | 09/30/03 | sub |
| EPA300.0 PartA | Chloride | 505 | | 50 | mg/L | 09/25/03 | rwe |
| EPA300.0 PartA | Sulfate | 2280 | | 100 | mg/L | 09/25/03 | rwe |
| SM18 4500NO2 B | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 09/23/03 | kmm |
| LAC 107061B | Ammonia (NH3), as N | 372 | | 12 | mg/L | 09/29/03 | kmm |
| LAC 107041A | Nitrate as N (NO3-N) | ND | U | 0.05 | mg/L | 09/23/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 12500 | | 2500 | ug/L | 09/29/03 | bpg |
| | Calcium (Ca) | 135000 | | 5000 | ug/L | 09/29/03 | bpg |
| | Chromium (Cr) | 2590 | | 250 | ug/L | 09/29/03 | bpg |
| | Iron (Fe) | 121 | | 50.0 | ug/L | 09/26/03 | bpg |
| | Magnesium (Mg) | 4070 | | 5000 | ug/L | 09/29/03 | bpg |
| | Sodium (Na) | 582000 | | 50000 | ug/L | 09/29/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 183 | | 50 | ug/L | 09/29/03 | sub |



* In Description = Dry Wgt.

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Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707

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149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

NADEP MA014
RIDOH57
CTDPH 0484
NY DOH 10843
NH DES 253901-A

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

10/15/2003

Report Number: 210164

Dear Alan Peirce,

The analysis of your sample(s) submitted on 09/26/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: SH 10/16/03

Total number of pages in this report: 17

# ANALYTICAL REPORT

JOB NUMBER: 210164

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 10/15/2003

Signature

Date 10/16/03

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 210164 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
210164-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| As specified in MADEP Compendium of Analytical Methods | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | (Yes) No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | (Yes) No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes (N/A) No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes (N/A) No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes (No[1]) |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes (N/A) No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** Steven Hartmann **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 10/16/03


SEVERN TRENT STL

MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NY DOH 10843
NH DES 253901-A
NELAP NY10843

STL Westfield
53 Southampton Rd,
Westfield, MA 01085
Tel:(413)572-4000
Fax:(413)572-3707

STL Billerica
149 Rangeway Rd
N.Billerica, MA 01862
Tel:(978)667-1400
Fax:(978)667-7871


## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 210164**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 09/26/03; the samples arrived in good condition and on ice. The samples arrived unpreserved and were preserved upon arrival at the laboratory.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**Inorganic**

**Chloride**
There were no QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrate**
There were no QA/QC deviations or issues reported for this method.

**Nitrite**
There were no QA/QC deviations or issues reported for this method.

**Ammonia**
There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
The MS sample (210144-1D) for sodium recovered low (52%) and outside the control limits of 70-130%. The sample concentration was approximately 6x the spike concentration. Calcium, Iron, Magnesium, Sodium and Chromium recovered outside of the RPD limit of 20% for sample 210144-1D. All LCS analyses recovered within acceptable limits.

There were no additional QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 10/15/2003

Job Number.: 210164
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: C0330F
Project Description....: C0330F

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 210164-1 | SD-27 | Water | 09/25/2003 | 15:00 | 09/26/2003 | 10:15 |
| 210164-2 | FM-28 | Water | 09/25/2003 | 15:00 | 09/26/2003 | 10:15 |



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RIDOH57
NY DOH 10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400

## LABORATORY TEST RESULTS
Job Number: 210164 Date: 10/15/2003

CUSTOMER: Olin Chemical PROJECT: C0330F ATTN: Alan Peirce

Customer Sample ID: SD-27
Date Sampled.....: 09/25/2003
Time Sampled.....: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 210164-1
Date Received.....: 09/26/2003
Time Received.....: 10:15

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0020 | | 0.0001 | Ratio | 09/30/03 | sub |
| EPA300.0 PartA | Chloride | 611 | | 100 | mg/L | 09/27/03 | rwe |
| EPA300.0 PartA | Sulfate | 4990 | | 400 | mg/L | 10/03/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 0.50 | mg/L | 09/27/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 1.0 | mg/L | 09/27/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 904 | | 12 | mg/L | 09/29/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 232000 | | 2000 | ug/L | 10/06/03 | bpg |
| | Iron (Fe) | 60400 | | 1000 | ug/L | 10/06/03 | bpg |
| | Magnesium (Mg) | 66200 | | 2000 | ug/L | 10/06/03 | bpg |
| | Sodium (Na) | 1220000 | | 20000 | ug/L | 10/06/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 35500 | | 250 | ug/L | 10/02/03 | bpg |
| | Chromium (Cr) | 9410 | | 25 | ug/L | 10/02/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 342 | | 50 | ug/L | 10/10/03 | sub |

* In Description = Dry Wgt.



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# Severn Trent Laboratories, Inc.
## Chain of Custody Form

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02605
210164

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Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Olin / Geomega
Address: 2995 Baseline Rd.
Boulder, CO 80303
Phone: Fax:

Project #: C03303F calm. study
Project Manager: Dan Stone
Work ID: Dan Stone / Andrew Nichdson
Contact:

USBA: Quote#: PO#:

Shaded areas for office use

**Analysis Requested**
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

**Comments**
(Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$ / cl
Nitrate / Nitrite
Ammonia
Specific Gravity
Lithium

Requested Turn Around Time
Business Day (Std) ✓ | Rush TAT Requested:
Business Day ____ | 24 hrs ____ 72 hrs ____
Other ____ | 48 hrs ____ 5 Day ____

**Regulatory Classification / Special Report Format**
NPDES ____ Drinking Water ____ DEP Form(s) ____
RCRA ____ MCP GW1/S1 ____ MWRA Smart Rpt ____
Other ____ MCP QA/QC Rpt ____

Sample Type Codes
W-Wastewater DW-Drinking water SW-Surfacewater
L-Labwater GW-Groundwater A-Air
Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other ____ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-27 | GW | | 9/25/03 15:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-28 | GW | | 9/25/03 15:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

9/26/03

Sampled by (print): JASON WHITE 9/25/03 16:10 Signature: Jason White
Relinquished by: Date: Time: Received by: Date: 9/26/03 Time: 1:05
Relinquished by: Date: Time: Received by: Date: Time:
Method of shipment: FEDEX 8358 1232 5151 **STL-Westfield**

Cooler: 2 Ice: samples accep. (Y) N:
Temp. on receipt: 4.1 °C
Preservation Verified
By: DATE:

Page____ of ____

White = Lab file Yellow = Report copy Pink = Customer copy
STL 8245-360 (12/02)

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LABORATORY TEST RESULTS

Job Number: 210164 Date: 10/15/2003

CUSTOMER: Olin Chemical PROJECT: C0330F ATTN: Alan Petrce

Customer Sample ID: FM-28
Date Sampled.....: 09/25/2003
Time Sampled.....: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 210164-2
Date Received.....: 09/26/2003
Time Received.....: 10:15

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0000 | | 0.0001 | Ratio | 09/30/03 | sub |
| EPA300.0 PartA | Chloride | 430 | | 100 | mg/L | 09/27/03 | rwe |
| EPA300.0 PartA | Sulfate | 1950 | | 200 | mg/L | 09/27/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 0.50 | mg/L | 09/27/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 1.0 | mg/L | 09/27/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 249 | | 12 | mg/L | 09/29/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 106000 | | 200 | ug/L | 10/06/03 | bpg |
| | Iron (Fe) | 447 | | 100 | ug/L | 10/06/03 | bpg |
| | Magnesium (Mg) | 30900 | | 200 | ug/L | 10/06/03 | bpg |
| | Sodium (Na) | 417000 | | 2000 | ug/L | 10/06/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 8340 | | 250 | ug/L | 10/03/03 | bpg |
| | Chromium (Cr) | 1470 | | 25 | ug/L | 10/03/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 161 | | 50 | ug/L | 10/10/03 | sub |

* In Description = Dry Wgt.



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Westfield, MA 01085
Tel: (413) 572-4000

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149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400

MADEP MA014
RIDOH57
NY DOH 10843

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SEVERN TRENT STL

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Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

10/15/2003

Report Number: 210235

Dear Alan Peirce,

The analysis of your sample(s) submitted on 09/30/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: SH 10/16/03

Total number of pages in this report: 17

# ANALYTICAL REPORT

JOB NUMBER: 210235

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 10/15/2003

Signature

Date 10/16/03

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 210235 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
210235-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used (As specified in MADEP Compendium of Analytical Methods check all that apply) | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes N/A No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes N/A No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes N/A No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

Signature: Steven Hartmann Position: Laboratory Director

Printed Name: Steven C. Hartmann Date: 10/16/03



## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 210235**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 09/30/03; the samples arrived in good condition and on ice. The samples arrived unpreserved and were preserved upon arrival at the laboratory.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**Inorganic**

**Chloride**
There were no QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrate**
There were no QA/QC deviations or issues reported for this method.

**Nitrite**
There were no QA/QC deviations or issues reported for this method.

**Ammonia**
There was no recovery noted for the MS/MSD sample chosen for batch QC. The LCS recovered within acceptable control criteria. No further action was required.

There were no additional QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 10/15/2003

Job Number.: 210235
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: C0330F
Project Description....: C0330F

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 210235-1 | SD-28 | Water | 09/29/2003 | 15:00 | 09/30/2003 | 10:05 |
| 210235-2 | FM-29 | Water | 09/29/2003 | 15:00 | 09/30/2003 | 10:05 |



SEVERN STL
MADEP MA014
RIDOH57
NY DOH 10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400

## LABORATORY TEST RESULTS
Job Number: 210235
Date: 10/15/2003

CUSTOMER: Olin Chemical | PROJECT: C0330F | ATTN: Alan Peirce

Customer Sample ID: SD-28
Date Sampled.....: 09/29/2003
Time Sampled.....: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 210235-1
Date Received.....: 09/30/2003
Time Received.....: 10:05

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0060 | | 0.0001 | Ratio | 10/13/03 | sub |
| EPA300.0 PartA | Chloride | 931 | | 50 | mg/L | 10/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 4680 | | 100 | mg/L | 10/01/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 0.50 | mg/L | 10/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 10/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 11.5 | | 0.10 | mg/L | 10/06/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 27500 | | 500 | ug/L | 10/13/03 | bpg |
| | Calcium (Ca) | 249000 | | 5000 | ug/L | 10/07/03 | bpg |
| | Iron (Fe) | 56000 | | 2500 | ug/L | 10/07/03 | bpg |
| | Sodium (Na) | 1070000 | | 50000 | ug/L | 10/07/03 | bpg |
| | Chromium (Cr) | 7630 | | 50 | ug/L | 10/13/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Magnesium (Mg) | 55800 | | 2000 | ug/L | 10/14/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 318 | | 50 | ug/L | 10/10/03 | sub |

* In Description = Dry Wgt.



SEVERN STL
MADEP MA014
RIDOH57
NY DOH 10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Billerica
angeway Rd.
illerica, MA 01862
Tel: (978) 667-1400

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

02621

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Olin / Geomega
Address: 2995 Baseline Rd.
Boulder, CO 80303
Phone: Fax:

Project #: C03303F colm. study
Project Manager: Dan Stone
Work ID: Dan Stone / Andrew Nicholson
Contact:

Job# Quote# PO#

Requested Turn Around Time
10 Business Day (Std) ✓ | Rush TAT Requested:
15 Business Day ___ | 24 hrs ___ 72 hrs ___
Other ___ | 48 hrs ___ 5 Day ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- SO4/Cl added per email 9/30/03
Nitrate / Nitrite
Ammonia
Specific Gravity
Lithium

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-28 | GW | | 9/29/03 15:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-29 | GW | | 9/29/03 15:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): JASON WHITE 9/29/03 16:15 Signature: Jason White

Relinquished by: Date: Time: Received by: Date: Time:

Relinquished by: Date: Time: Received by: 9/30/03 1005

Method of shipment: FedEX

STL-Westfield

Cooler: (Y) N Samples Iced? (Y) N
Temp @ receipt: 2.8 °C
Preservation/pH checked
By: Date:

Page ____ of ____

White = Lab file Yellow = Report copy Pink = Customer copy

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LABORATORY TEST RESULTS

Job Number: 210235 Date: 10/15/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-29
Date Sampled.....: 09/29/2003
Time Sampled.....: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 210235-2
Date Received.....: 09/30/2003
Time Received.....: 10:05

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0010 | | 0.0001 | Ratio | 10/13/03 | sub |
| EPA300.0 PartA | Chloride | 462 | | 100 | mg/L | 10/01/03 | rwe |
| EPA300.0 PartA | Sulfate | 1900 | | 200 | mg/L | 10/01/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 1.0 | mg/L | 10/01/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.20 | mg/L | 10/01/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 98.6 | | 10 | mg/L | 10/06/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 7470 | | 250 | ug/L | 10/07/03 | bpg |
| | Calcium (Ca) | 119000 | | 500 | ug/L | 10/07/03 | bpg |
| | Iron (Fe) | 170 | | 50.0 | ug/L | 10/13/03 | bpg |
| | Sodium (Na) | 440000 | | 5000 | ug/L | 10/07/03 | bpg |
| | Chromium (Cr) | 1440 | | 25 | ug/L | 10/07/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Magnesium (Mg) | 28200 | | 200 | ug/L | 10/14/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 149 | | 50 | ug/L | 10/10/03 | sub |

* In Description = Dry Wgt.



STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400

STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000

NY DOH 10843
NH DES 253601-A
MADEP MA014
RIDOH57
CTDOH 0484

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

10/23/2003

Report Number: 210438

Dear Alan Peirce,

The analysis of your sample(s) submitted on 10/07/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: SH 10/23/03

Total number of pages in this report: 16

# ANALYTICAL REPORT

JOB NUMBER: 210438

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 10/23/2003

Signature

Date: 10/23/03

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 210438 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
210438-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used As specified in MADEP Compendium of Analytical Methods (Check all that apply) | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | (Yes) No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | (Yes) No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes (N/A) No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes (N/A) No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes (No[1]) |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes (N/A) No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** Steven Hartmann **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 10/23/03



## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 210438**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 10/07/03; the samples arrived in good condition and on ice. The samples arrived unpreserved and were preserved upon arrival at the laboratory.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**Inorganic**

**Chloride**
There were no QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrate**
There were no QA/QC deviations or issues reported for this method.

**Nitrite**
There were no QA/QC deviations or issues reported for this method.

**Ammonia**
There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
Poor matrix spike recovery was noted for the MS result for Sodium. The sample concentration overwhelmed the amount of spike added. The LCS recovered within acceptable control limits.

There were no additional QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 10/23/2003

Job Number.: 210438
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: C0330F
Project Description....: C0330F

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 210438-1 | SD-30 | Water | 10/06/2003 | 15:30 | 10/07/2003 | 11:07 |
| 210438-2 | FM-31 | Water | 10/06/2003 | 15:30 | 10/07/2003 | 11:07 |



SEVERN TRENT STL
ADEP MA014
RIDOH57
CTDPH 0494
NY DOH 10843
NH DES 253901-A
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
145 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7671

## LABORATORY TEST RESULTS

Job Number: 210438 Date: 10/23/2003

CUSTOMER: Olin Chemical PROJECT: C0330F ATTN: Alan Peirce

Customer Sample ID: SD-30
Date Sampled.....: 10/06/2003
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 210438-1
Date Received.....: 10/07/2003
Time Received.....: 11:07

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0020 | | 0.0001 | Ratio | 10/13/03 | sub |
| EPA300.0 PartA | Chloride | 722 | | 50 | mg/L | 10/08/03 | rwe |
| EPA300.0 PartA | Sulfate | 3870 | | 100 | mg/L | 10/08/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 0.50 | mg/L | 10/08/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 10/08/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 623 | | 10 | mg/L | 10/10/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 220000 | | 2000 | ug/L | 10/14/03 | bpg |
| | Iron (fe) | 35800 | | 1000 | ug/L | 10/14/03 | bpg |
| | Magnesium (Mg) | 53200 | | 2000 | ug/L | 10/14/03 | bpg |
| | Sodium (Na) | 887000 | | 20000 | ug/L | 10/14/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 19000 | | 1000 | ug/L | 10/14/03 | bpg |
| | Chromium (Cr) | 4360 | | 100 | ug/L | 10/14/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 283 | | 50 | ug/L | 10/21/03 | sub |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
NY DOH 10843
NH DES 253901-A
STL Westfield
53 Southampton Rd.
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Tel: (413) 572-4000
Billerica
Rangeway Rd.
Billerica, MA 01862
Tel: (978) 667-1400

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

02622

Client: Olin / Geomega
Address: 8495 Baseline Dr. Boulder CO 80303
Phone: 303-443-9117 Fax: 303-938-8123

Project #: CO3303F colm. study
Project Manager: Dan Stone
Work ID: Dan Stone / Andrew Nicholson
Contact: " / "

Requested Turn Around Time: 10 Business Day (Std) ✓ | Rush TAT Requested: 5 Business Day ___ 24 hrs ___ 72 hrs ___ Other ___ 48 hrs ___ 5 Day ___

Regulatory Classification: NPDES ___ Drinking Water ___ RCRA ___ MCP GW1/S1 ___ Other ___

Special Report Format: DEP Form(s) ___ MWRA Smart Rpt ___ MCP QA/QC Rpt ___

Sample Type Codes: WW-Wastewater, DW-Drinking water, SW-Surfacewater, W-Labwater, GW-Groundwater, A-Air, S-Solid / Soil, SL-Sludge, O-Oil, Z-Other

Job Number: 210438
Shaded areas for office use

Check analysis and specify method and analyses in comments section.
For example:
500-series for drinking water
800-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

| Sample ID | Sample Type | Sampler's initials | Date Collected | Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-30 | GW | JW | 10/6/03 | 15:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-31 | GW | JW | 10/6/03 | 15:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Preservative

Analysis Requested

Comments (Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$, Cl
Nitrate
Nitrite
Ammonia
Specific Gravity
Lithium

Sampled by (print): JASON WHITE
Signature: [signature]
Relinquished by: [signature] Date: 10/6/03 Time: 17:30
Received by: [signature] Date: 10/6/03 Time: 17:30
Relinquished by: [signature] Date: 10/7/03 Time: 1100
Received by: [signature] Date: 10/7/03 Time: 1100
Method of shipment: FedEx
STL-Westfield

Cooler Temp. ___ N Samples Lab? Y N
Temp @ Receipt: ___
Preservation Checked: ___
By: ___ Date: ___

Page ___ of ___

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245 (2011/12/02)

53 Southampton Road, Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

149 Rangeway Road, N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

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LABORATORY TEST RESULTS

Job Number: 210438 Date: 10/23/2003

CUSTOMER: Olin Chemical PROJECT: CO330F ATTN: Alan Peirce

Customer Sample ID: FM-31
Date Sampled.....: 10/06/2003
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 210438-2
Date Received.....: 10/07/2003
Time Received.....: 11:07

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0010 | | 0.0001 | Ratio | 10/13/03 | sub |
| EPA300.0 PartA | Chloride | 320 | | 20 | mg/L | 10/08/03 | rwe |
| EPA300.0 PartA | Sulfate | 1590 | | 40 | mg/L | 10/08/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 1.0 | mg/L | 10/08/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.20 | mg/L | 10/08/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 204 | | 10 | mg/L | 10/10/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 90500 | | 200 | ug/L | 10/14/03 | bpg |
| | Iron (Fe) | 102 | | 100 | ug/L | 10/14/03 | bpg |
| | Magnesium (Mg) | 22800 | | 200 | ug/L | 10/14/03 | bpg |
| | Sodium (Na) | 298000 | | 2000 | ug/L | 10/14/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 4650 | | 100 | ug/L | 10/14/03 | bpg |
| | Chromium (Cr) | 808 | | 10 | ug/L | 10/14/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 130 | | 50 | ug/L | 10/21/03 | sub |

* In Description = Dry Wgt.



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STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

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53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
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Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

10/24/2003

Report Number: 210585

Dear Alan Peirce,

The analysis of your sample(s) submitted on 10/10/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: SH 10/24/03

Total number of pages in this report: 17

# ANALYTICAL REPORT

JOB NUMBER: 210585

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 10/24/2003

Signature

Date 10/27/03

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 210585 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
210585-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| As specified MADEP Compendium of Analytical Methods Certification Form | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | (Yes) No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | (Yes) No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes (N/A) No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes (N/A) No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes (No[1]) |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes (N/A) No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** Steven Hartmann **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 10/24/03



## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 210585**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 10/10/03; the samples arrived in good condition and on ice. The samples arrived unpreserved and were preserved upon arrival at the laboratory.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**Inorganic**

**Chloride**
There were no QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrate**
Due to a sample management error the nitrate analysis for SD-31 and FM-32 were analyzed over holding time.

There were no QA/QC deviations or issues reported for this method.

**Nitrite**
Due to a sample management error the nitrite analysis for SD-31 and FM-32 were analyzed over holding time.

There were no QA/QC deviations or issues reported for this method.

**Ammonia**
There were no QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 10/24/2003

Job Number.: 210585
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: C0330F
Project Description....: C0330F

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 210585-1 | SD-31 | Water | 10/09/2003 | 14:00 | 10/10/2003 | 10:15 |
| 210585-2 | FM-32 | Water | 10/09/2003 | 14:00 | 10/10/2003 | 10:15 |



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53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

## LABORATORY TEST RESULTS
Job Number: 210585
Date: 10/24/2003

CUSTOMER: Olin Chemical PROJECT: C0330F ATTN: Alan Peirce

Customer Sample ID: SD-31
Date Sampled.....: 10/09/2003
Time Sampled.....: 14:00
Sample Matrix.....: Water

Laboratory Sample ID: 210585-1
Date Received.....: 10/10/2003
Time Received.....: 10:15

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0030 | | 0.0001 | Ratio | 10/13/03 | sub |
| EPA300.0 PartA | Chloride | 657 | | 50 | mg/L | 10/10/03 | rwe |
| EPA300.0 PartA | Sulfate | 3630 | | 100 | mg/L | 10/10/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 0.50 | mg/L | 10/12/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 10/12/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 167 | | 2.0 | mg/L | 10/22/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 178000 | | 1000 | ug/L | 10/23/03 | bpg |
| | Iron (Fe) | 27000 | | 500 | ug/L | 10/23/03 | bpg |
| | Sodium (Na) | 835000 | | 10000 | ug/L | 10/23/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 14600 | | 500 | ug/L | 10/21/03 | bpg |
| | Chromium (Cr) | 3040 | | 50 | ug/L | 10/21/03 | bpg |
| | Magnesium (Mg) | 40200 | | 1000 | ug/L | 10/23/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 271 | | 50 | ug/L | 10/21/03 | sub |

* In Description = Dry Wgt.



4/20/03

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Westfield, MA 01085
Tel: (413) 572-4000
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Fax: (978) 667-7871

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

02606
210585

53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

) Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Olin / Geomega
Address: 2995 Baseline Dr.
Boulder, CO 80303
Phone: 3034139117 Fax: 3039388123

Project #: C03303F calm. study
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone / Andrew Nicholson

Requested Turn Around Time
0 Business Day (Std) ____ | Rush TAT Requested:
5 Business Day ____ | 24 hrs ____ 72 hrs ____
Other ____ | 48 hrs ____ 5 Day ____

Regulatory Classification / Special Report Format
NPDES ____ Drinking Water ____ DEP Form(s) ____
RCRA ____ MCP GW1/S1 ____ MWRA Smart Rpt. ____
Other ____ MCP QA/QC Rpt. ____

Analysis Requested
Check analysis and specify method and analytes in comments section..
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$, Cl
Nitrate
Nitrite
Ammonia
Specific Gravity
Lithium

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
W-Labwater GW-Groundwater A-Air
-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-31 | GW | JW | 10/9/03 14:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-32 | GW | JW | 10/9/03 14:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): JASON WHITE 10/9/03 15:30 Signature: [signature]

Relinquished by: Date: Time: Received by: [signature] Date: 10/10/03 Time: 1015

Relinquished by: Date: Time: Received by: Date: Time:

Method of shipment: Fedex

STL-Westfield

Page ____ of ____

White = Lab file Yellow = Report copy Pink = Customer copy

LABORATORY TEST RESULTS

Job Number: 210585 Date: 10/24/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-32
Date Sampled.....: 10/09/2003
Time Sampled.....: 14:00
Sample Matrix.....: Water

Laboratory Sample ID: 210585-2
Date Received.....: 10/10/2003
Time Received.....: 10:15

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | O | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0000 | | 0.0001 | Ratio | 10/13/03 | sub |
| EPA300.0 PartA | Chloride | 285 | | 20 | mg/L | 10/10/03 | rwe |
| EPA300.0 PartA | Sulfate | 1470 | | 40 | mg/L | 10/10/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 1.0 | mg/L | 10/12/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.20 | mg/L | 10/12/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 87.3 | | 1.0 | mg/L | 10/22/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 77000 | | 100 | ug/L | 10/23/03 | bpg |
| | Iron (Fe) | 118 | | 50.0 | ug/L | 10/23/03 | bpg |
| | Sodium (Na) | 276000 | | 1000 | ug/L | 10/23/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 3460 | | 100 | ug/L | 10/21/03 | bpg |
| | Chromium (Cr) | 587 | | 10 | ug/L | 10/21/03 | bpg |
| | Magnesium (Mg) | 19800 | | 200 | ug/L | 10/23/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 130 | | 50 | ug/L | 10/21/03 | sub |

* In Description = Dry Wgt.



STL Westfield
53 Southampton Rd.
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Tel: (413) 572-4000
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NH DES 253901-A
NELAP NY10843

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www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

10/28/2003

Report Number: 210625

Dear Alan Peirce,

The analysis of your sample(s) submitted on 10/14/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: JKW 10-28-03

Total number of pages in this report: 17

# ANALYTICAL REPORT

JOB NUMBER: 210625

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 10/28/2003

Signature

Date 10/28/03

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

# MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | Severn Trent Laboratory (STL) Westfield | Project #: | 210625 |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
210625-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other (x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| As specified in MADEP Compendium of Analytical Methods | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | | | |
|---|---|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | ✓Yes | | No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | ✓Yes | | No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes | ✓N/A | No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes | ✓N/A | No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | | | |
|---|---|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes | ✓No[1] | |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes | ✓N/A | No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** [signature] **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 10-28-03


SEVERN TRENT STL

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NH DES 253901-A
NELAP NY10843

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Westfield, MA 01085
Tel:(413)572-4000
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## MCP CASE NARRATIVE

**Client: OLIN**

**Report Number: 210625**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 10/14/03; the samples arrived in good condition and on ice. The samples arrived unpreserved and were preserved upon arrival at the laboratory.

**The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**Inorganic**

**Chloride**
There were no QA/QC deviations or issues reported for this method.

**Sulfate**
There were no QA/QC deviations or issues reported for this method.

**Nitrate**
There were no QA/QC deviations or issues reported for this method.

**Nitrite**
There were no QA/QC deviations or issues reported for this method.

**Ammonia**
The RPD for the batch QC sample recovered high (45%) and outside the control limit of 20%. There were no additional QA/QC deviations or issues reported for this method.

**Metals EPA 200.7**
Poor matrix spike recovery was noted for the MS result for sodium. The sample concentration overwhelmed the amount of spike added. The LCS recovered within acceptable control limits.

There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 10/28/2003

Job Number.: 210625
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: C0330F
Project Description....: C0330F

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 210625-1 | SD-32 | Water | 10/13/2003 | 15:30 | 10/14/2003 | 10:30 |
| 210625-2 | FM-33 | Water | 10/13/2003 | 15:30 | 10/14/2003 | 10:30 |



SEVERN TRENT STL
MADEP MA014
RIDOH57
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Fax: (978) 667-7871

## LABORATORY TEST RESULTS
Job Number: 210625
Date: 10/28/2003

CUSTOMER: Olin Chemical | PROJECT: C0330F | ATTN: Alan Peirce

Customer Sample ID: SD-32
Date Sampled.....: 10/13/2003
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 210625-1
Date Received.....: 10/14/2003
Time Received.....: 10:30

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 1.0040 | | 0.0001 | Ratio | 10/27/03 | sub |
| EPA300.0 PartA | Chloride | 556 | | 50 | mg/L | 10/14/03 | rwe |
| EPA300.0 PartA | Sulfate | 3680 | | 100 | mg/L | 10/14/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 0.50 | mg/L | 10/14/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 10/14/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 401 | | 2.0 | mg/L | 10/22/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 177000 | | 1000 | ug/L | 10/20/03 | bpg |
| | Iron (Fe) | 21400 | | 500 | ug/L | 10/20/03 | bpg |
| | Sodium (Na) | 628000 | | 10000 | ug/L | 10/20/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 13000 | | 1000 | ug/L | 10/17/03 | bpg |
| | Chromium (Cr) | 2970 | | 100 | ug/L | 10/17/03 | bpg |
| | Magnesium (Mg) | 36300 | | 2000 | ug/L | 10/17/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 260 | | 50 | ug/L | 10/21/03 | sub |

* In Description = Dry Wgt.



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53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
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arica, MA 01862
978) 667-1400
Fax: (978) 667-7871

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT **STL**

02625

Client: Olin/Geomega
Address: 2495 Baseline Dr. Boulder, CO 80303
Phone: 303-413-7117 Fax: 303-938-6123

Project #: CO3303F olin study
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone/Andrew Nicholson

Requested Turn Around Time: 10 Business Day (Std) ___ | Rush TAT Requested: 15 Business Day ___ | 24 hrs ___ | 72 hrs ___ | Other ___ | 48 hrs ___ | 5 Day ___

Regulatory Classification: NPDES ___ | Drinking Water ___ | RCRA ___ | MCP GW1/S1 ___ | Other ___

Special Report Format: DEP Form(s) ___ | MWRA Smart Rpt ___ | MCP QA/QC Rpt ___

Sample Type Codes: WW-Wastewater, DW-Drinking water, SW-Surfacewater, LW-Labwater, GW-Groundwater, A-Air, S-Solid / Soil, SL-Sludge, O-Oil, Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Collected | Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-32 | GW | JW | 10/13/03 | 15:20 | | | 3 | P | | | | | | | V | | | | | | | | | | | | V | V |
| FM-33 | GW | JW | 10/13/03 | 15:30 | | | 3 | P | | | | | | | V | | | | | | | | | | | | V | V |

Preservative

Analysis Requested: Check analysis and specify method and analytes in comments section. For example: 500-series for drinking water; 600-series for waste water; 8000-series for haz/solid waste. Use comments section to further define.

Comments (Special Instructions):
Analytes:
- Cr, Al, Fe, Mg, Na
- $SO_4$, Cl
Nitrate
Nitrite
Ammonia
Specific Gravity
Lithium
Ca added per customer request
Kw/field

Sampled by (print): JASON WHITE 10/13/03 16:20
Signature:
Relinquished by: Date: Time:
Received by: Date: Time:
Relinquished by: Date: Time:
Received by: Date: 10/14/03 Time: 1030
Method of shipment: FedEX

STL-Westfield

Page ___ of ___

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8345-3601 (12/97)

•53 Southampton Road, Westfield, MA 01085, (P) 413-572-4000, (F) 413-572-3707, STL-WESTFIELD
•149 Rangeway Road, N. Billerica, MA 01862, (P) 978-667-1400, (F) 978-667-7871, STL-BILLERICA

---

LABORATORY TEST RESULTS

Job Number: 210625 Date: 10/28/2003

CUSTOMER: Olin Chemical PROJECT: CO330F ATTN: Alan Peirce

Customer Sample ID: FM-33
Date Sampled.....: 10/13/2003
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 210625-2
Date Received.....: 10/14/2003
Time Received.....: 10:30

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Hydrometer 25 C | 0.9990 | | 0.0001 | Ratio | 10/27/03 | sub |
| EPA300.0 PartA | Chloride | 219 | | 20 | mg/L | 10/15/03 | rwe |
| EPA300.0 PartA | Sulfate | 1250 | | 40 | mg/L | 10/15/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 1.0 | mg/L | 10/15/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.20 | mg/L | 10/15/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 70.4 | | 1.0 | mg/L | 10/22/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 71500 | | 200 | ug/L | 10/20/03 | bpg |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 10/24/03 | bpg |
| | Sodium (Na) | 239000 | | 2000 | ug/L | 10/20/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 3180 | | 100 | ug/L | 10/17/03 | bpg |
| | Chromium (Cr) | 548 | | 10 | ug/L | 10/17/03 | bpg |
| | Magnesium (Mg) | 19100 | | 200 | ug/L | 10/17/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 124 | | 50 | ug/L | 10/21/03 | sub |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DEQWSD
NY DOH 10843 NH DES 253901-A NELAP NY10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871

MACTEC

Engineering and Consulting, Inc.
511 Congress Street
P.O. Box 7050
Portland, Maine 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow

From: Chris Ricardi

Date: 12/15/03

Subject: Olin Wilmington – Geomega DAPL Column Test Samples

**Data Validation Summary**
**Sets 211282 and 211441**

This sample set contained results for four aqueous samples generated by Geomega from the effluent stream of their laboratory column tests completed on DAPL saturated soil cores collected from the Olin Wilmington site. The samples were identified as SD-40, FM-41, SD-42, and FM-43. The samples were generated during testing completed during November 2003, and were analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for selected metals (aluminum, calcium, chromium, iron, magnesium, sodium, and lithium) and water chemistry parameters including chloride, sulfate, nitrite, nitrate, and ammonia.

The Olin Wilmington QAPP was used as a reference during the review. Results were reviewed using the Data Quality Evaluation checklists that were developed for the Olin Wilmington annual and quarterly groundwater monitoring tasks.

**Validation Actions**

No data quality issues were identified during validation and the results are interpreted to be usable as reported by the laboratory.



SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

12/04/2003

Report Number: 211441

Dear Alan Peirce,

The analysis of your sample(s) submitted on 11/18/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: SH 12/5/03

Total number of pages in this report: 16

# ANALYTICAL REPORT

JOB NUMBER: 211441

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 12/04/2003

Signature

Date 12/5/03


Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707




## MADEP MCP Analytical Method Report Certification Form

Laboratory Name: **Severn Trent Laboratory (STL) Westfield** Project #: **211441**

Project Location: MADEP RTN[1]:

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
211441-1-2

Sample Matrices: **Groundwater** Soil/Sediment Drinking Water Other:

| MCP SW-846 Methods Used Assessed in MADEP Compendium of Analytical Methods (check all that apply) | | | | | | |
|---|---|---|---|---|---|---|
| | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes N/A No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes N/A No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes N/A No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** Steven Hartmann **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 12/4/03

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL 02613

•53 Southampton Road, Westfield, MA 01085, (P) 413-572-4000, (F) 413-572-3707, STL-WESTFIELD
•149 Rangeway Road, N. Billerica, MA 01862, (P) 978-667-1400, (F) 978-667-7871, STL-BILLERICA

Client: Olin / Geomega
Address: 2995 Baseline Dr. Boulder, CO 80303
Phone: 3034439117 Fax: 3039383123

Project #: C03303F colm. study
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone / Andrew Nicholson

Job# 211441 Quote# PO#

Shaded areas for office use.

Requested Turn Around Time: 10 Business Day (Std) X; 15 Business Day; Other; Rush TAT Requested: 24 hrs, 72 hrs, 48 hrs, 5 Day

Regulatory Classification / Special Report Format: NPDES, RCRA, Other; Drinking Water, MCP GW1/S1; DEP Form(s), MWRA Smart Rpt, MCP QA/QC Rpt

Analysis Requested: Check analysis and specify method and analytes in comments section. For example: 500-series for drinking water, 600-series for waste water, 8000-series for haz/solid waste. Use comments section to further define.

Comments (Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$, Cl
Nitrate / Nitrite
Ammonia
Specific Gravity
Lithium

Sample Type Codes: WW-Wastewater, DW-Drinking water, SW-Surfacewater, LW-Labwater, GW-Groundwater, A-Air, S-Solid / Soil, SL-Sludge, O-Oil, Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-42 | GW | JW | 11/17/03 15:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | ✓ | |
| FM-43 | GW | JW | 11/17/03 15:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | ✓ | |

MD 11/18/03

Sampled by (print): JASON WHITE 11/17/03 15:30 Signature: Jason White

Relinquished by: " " Date: 11/17/03 Time: 17:00 Received by: [signature] Date: 11/18/03 Time: 0945

Relinquished by: Date: Time: Received by: Date: Time:

Method of shipment: STL-Westfield

Cooler: Y / N; Samples iced: Y / N
Temp @ receipt: 3.8°C
Preservation pH checked:
By: Date:

Page_____ of _____

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245-360 (12/02)

## MCP CASE NARRATIVE

**Client: Olin**

**Report Number: 211441**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 11/18/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

The lithium analysis was performed at STL- Chicago. There were no QA/QC deviations or issues reported for this method.

**Metals**
**EPA 200.7**
There were no QA/QC deviations or issues reported for this method.

**Inorganic**
**EPA 300.0 (Nitrate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrite)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Chloride)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Sulfate)**
There were no QA/QC deviations or issues reported for this method.

**LAC 107061B (Ammonia)**
There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 12/04/2003

Job Number.: 211441
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: C0330F
Project Description....: C0330F

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 211441-1 | SD-42 | Water | 11/17/2003 | 15:30 | 11/18/2003 | 09:45 |
| 211441-2 | FM-43 | Water | 11/17/2003 | 15:30 | 11/18/2003 | 09:45 |



SEVERN TRENT STI
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NY DOH 10843
NH DES 253901-A
NELAP NY10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

## LABORATORY TEST RESULTS

Job Number: 211441

Date: 12/04/2003

CUSTOMER: Olin Chemical | PROJECT: C0330F | ATTN: Alan Peirce

Customer Sample ID: SD-42
Date Sampled.....: 11/17/2003
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 211441-1
Date Received.....: 11/18/2003
Time Received.....: 09:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 129B | Spec. Grav.(Hydrometer 25 C) | 1.0020 | | 0.0001 | Ratio | 12/02/03 | sub |
| EPA300.0 PartA | Chloride | 346 | | 100 | mg/L | 11/21/03 | rwe |
| EPA300.0 PartA | Sulfate | 2080 | | 200 | mg/L | 11/21/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 0.50 | mg/L | 11/18/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 11/18/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 233 | | 2.0 | mg/L | 11/25/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 86500 | | 100 | ug/L | 11/26/03 | bpg |
| | Iron (Fe) | 2740 | | 50.0 | ug/L | 11/26/03 | bpg |
| | Sodium (Na) | 427000 | | 1000 | ug/L | 11/26/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 7610 | | 50.0 | ug/L | 12/01/03 | rac |
| | Chromium (Cr) | 1300 | | 5.0 | ug/L | 12/01/03 | rac |
| | Magnesium (Mg) | 23500 | | 100 | ug/L | 12/01/03 | rac |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 267 | | 50.0 | ug/L | 11/24/03 | sub |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NY DOH 10843
NH DES 253901-A
NELAP NY10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
Rangeway Rd.
lerica, MA 01862
78) 667-1400
(978) 667-7871

LABORATORY TEST RESULTS

Job Number: 211441

Date: 12/04/2003

CUSTOMER: Olin Chemical | PROJECT: C033DF | ATTN: Alan Peirce

Customer Sample ID: FM-43
Date Sampled.....: 11/17/2003
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 211441-2
Date Received.....: 11/18/2003
Time Received.....: 09:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 1.0000 | | 0.0001 | Ratio | 12/02/03 | sub |
| EPA300.0 PartA | Chloride | 44.7 | | 10 | mg/L | 11/18/03 | rwe |
| EPA300.0 PartA | Sulfate | 547 | | 20 | mg/L | 11/18/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 0.50 | mg/L | 11/18/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 11/18/03 | rwe |
| LAC 1070618 | Ammonia (NH3), as N | 147 | | 1.0 | mg/L | 11/25/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 43900 | | 100 | ug/L | 11/26/03 | bpg |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 11/26/03 | bpg |
| | Sodium (Na) | 74200 | | 1000 | ug/L | 11/26/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 449 | | 50.0 | ug/L | 12/01/03 | rac |
| | Chromium (Cr) | 71 | | 5.0 | ug/L | 12/01/03 | rac |
| | Magnesium (Mg) | 5440 | | 100 | ug/L | 12/01/03 | rac |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 66.2 | | 50.0 | ug/L | 11/24/03 | sub |

* In Description = Dry Wgt.



SEVERN TRENT STL

MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD

NY DOH 10843
NH DES 253901-A
NELAP NY10843

STL Westfield
53 Southampton Rd.
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Tel: (413) 572-4000
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SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

12/04/2003

Report Number: 211282

Dear Alan Peirce,

The analysis of your sample(s) submitted on 11/11/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: SH 12/4/03

Total number of pages in this report: 17

# ANALYTICAL REPORT

JOB NUMBER: 211282

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 12/04/2003

Signature

Date 12/5/03


Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707




## MADEP MCP Analytical Method Report Certification Form

Laboratory Name: **Severn Trent Laboratory (STL) Westfield** Project #: **211282**

Project Location: MADEP RTN[1]:

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
211282-1-2

Sample Matrices: **Groundwater** Soil/Sediment Drinking Water Other:

| MCP SW-846 Methods Used | | | | | | |
|---|---|---|---|---|---|---|
| | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

Compounds/ Analytical Methods (check all that apply)

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | (Yes) No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | (Yes) No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes (N/A) No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes (N/A) No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes (No[1]) |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes (N/A) No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 12/4/03

MCP CASE NARRATIVE

Client: Olin

Report Number: 211282

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 11/11/03; the samples arrived in good condition, properly preserved and on ice.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago.

The lithium analysis was performed at STL- Pittsburgh. There were no QA/QC deviations or issues reported for this method.

**Metals**

**EPA 200.7**
Poor matrix spike recovery was noted for the MS result for Calcium. The sample concentration overwhelmed the amount of spike added. The LCS recovered within acceptable control limits.

There were no additional QA/QC deviations or issues reported for this method.

**Inorganic**

**EPA 300.0 (Nitrate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrite)**
There were no QA/QC deviations or issues reported for this method.



**EPA 300.0 (Chloride)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Sulfate)**
There were no QA/QC deviations or issues reported for this method.

**LAC 107061B (Ammonia)**
There were no QA/QC deviations or issues reported for this method.

SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD
NY DOH 10843 NH DES 253901-A NELAP NY10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871

## SAMPLE INFORMATION
Date: 12/04/2003

Job Number.: 211282
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: C0330F
Project Description....: C0330F

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 211282-1 | SD-40 | Water | 11/10/2003 | 15:30 | 11/11/2003 | 09:45 |
| 211282-2 | FM-41 | Water | 11/10/2003 | 15:30 | 11/11/2003 | 09:45 |



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## LABORATORY TEST RESULTS
Job Number: 211282 Date: 12/04/2003

CUSTOMER: Olin Chemical PROJECT: C0330F ATTN: Alan Peirce

Customer Sample ID: SD-40
Date Sampled.....: 11/10/2003
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 211282-1
Date Received.....: 11/11/2003
Time Received.....: 09:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 1.0000 | | 0.0001 | Ratio | 11/13/03 | sub |
| EPA300.0 PartA | Chloride | 464 | | 10 | mg/L | 11/12/03 | rwe |
| EPA300.0 PartA | Sulfate | 2260 | | 200 | mg/L | 11/12/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 0.50 | mg/L | 11/12/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 11/12/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 270 | | 2.0 | mg/L | 11/18/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 98000 | | 100 | ug/L | 11/19/03 | bpg |
| | Iron (Fe) | 3530 | | 50.0 | ug/L | 11/19/03 | bpg |
| | Magnesium (Mg) | 29100 | | 100 | ug/L | 11/19/03 | bpg |
| | Sodium (Na) | 544000 | | 5000 | ug/L | 11/20/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 11200 | | 50.0 | ug/L | 11/18/03 | bpg |
| | Chromium (Cr) | 1800 | | 5.0 | ug/L | 11/18/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | | |
| | Lithium (Li) | 285 | | 50 | ug/L | 11/19/03 | sub |

* In Description = Dry Wgt.



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# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL 02612

•53 Southampton Road, Westfield, MA 01085, (P) 413-572-4000, (F) 413-572-3707 STL-WESTFIELD
•149 Rangeway Road, N. Billerica, MA 01862, (P) 978-667-1400, (F) 978-667-7871 STL-BILLERICA

Client: Olin/Geomega
Address: 2995 Baseline Dr. Boulder, CO 80303
Phone: 3034439117 Fax: 3039388123
Project #: C03303F calm. study
Project Manager: Dan Stone
Work ID:
Contact: Dan Stone/Andrew Nicholson

Job#: 211282 Quote#: PO#:

Shaded areas for office use

Requested Turn Around Time: 10 Business Day (Std) X; 15 Business Day; Other; Rush TAT Requested: 24 hrs; 72 hrs; 48 hrs; 5 Day

Regulatory Classification / Special Report Format: NPDES; Drinking Water; DEP Form(s); RCRA; MCP GW1/S1; MWRA Smart Rpt; Other; MCP QA/QC Rpt

Analysis Requested: Check analysis and specify method and analytes in comments section. For example: 500-series for drinking water, 600-series for waste water, 8000-series for haz/solid waste. Use comments section to further define.

Comments (Special Instructions)

Sample Type Codes: WW-Wastewater, DW-Drinking water, SW-Surfacewater, LW-Labwater, GW-Groundwater, A-Air, S-Solid / Soil, SL-Sludge, O-Oil, Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-40 | GW | JW | 11/10/03 15:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-41 | GW | JW | 11/10/03 15:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$, Cl
Nitrate/Nitrite
Ammonia
Specific Gravity
Lithium

MB 11/11/03

Sampled by (print): JASON WHITE 11/10/03 15:30 Signature: Jason White

Relinquished by: " Date: 11/10/03 Time: 17:00 Received by: Date: Time:

Relinquished by: Date: Time: Received by: Date: Time: 11/11/03 0945

Method of shipment: STL-Westfield

Cooler? Y N Samples iced? Y N
Temp @ receipt
Preservation (s) checked
By: Date:

Page____ of ____

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

---

LABORATORY TEST RESULTS

Job Number: 211282 Date: 12/04/2003

CUSTOMER: Olin Chemical PROJECT: C03303F ATTN: Alan Peirce

Customer Sample ID: FM-41
Date Sampled.....: 11/10/2003
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 211282-2
Date Received.....: 11/11/2003
Time Received.....: 09:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 0.9990 | | 0.0001 | Ratio | 11/13/03 | sub |
| EPA300.0 PartA | Chloride | 49.9 | | 10 | mg/L | 11/12/03 | rwe |
| EPA300.0 PartA | Sulfate | 630 | | 20 | mg/L | 11/12/03 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | ND | U | 0.50 | mg/L | 11/12/03 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 11/12/03 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 126 | | 2.0 | mg/L | 11/18/03 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | 11/19/03 | bpg |
| | Calcium (Ca) | 43300 | | 100 | ug/L | 11/19/03 | bpg |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 11/19/03 | bpg |
| | Magnesium (Mg) | 6520 | | 100 | ug/L | 11/19/03 | bpg |
| | Sodium (Na) | 89500 | | 1000 | ug/L | 11/19/03 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | 11/18/03 | bpg |
| | Aluminum (Al) | 541 | | 50.0 | ug/L | 11/18/03 | bpg |
| | Chromium (Cr) | 86 | | 5.0 | ug/L | 11/18/03 | bpg |
| EPA 200.7 | Metals Analysis (ICP) Subcontracted | | | | | 11/19/03 | sub |
| | Lithium (Li) | 68 | | 50 | ug/L | | |

* In Description = Dry Wgt.



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MADEP MA014, RIDOH 57, CT PH-0104, VT DECWSD
NY DOH 10843, NH DES 253901-A, NELAP NY10843

SEVERN TRENT STL

Yes [✓] No [ ] N/A [ ] Comments:

[✓] Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

[✓] Container type noted [✓] Condition observed [✓] pH verified (where applicable) [✓] Field and lab IDs cross referenced

**ACTION:** If no, contact lab for submission of missing or incomplete documentation.

**1.5.1** Were the correct bottles and preservatives used? Yes [✓] No [ ] N/A [ ] Comments:

✓ Ammonia,– 1 Liter polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Oil & Grease – 1 Liter glass/HCL to pH<2,cool to 4°C

Alkalinity – 1 Liter polyethylene/cool to 4°C

Chemical Oxygen Demand – 50 mL polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

✓ Chloride, pH, sulfate - 50 mL polyethylene/cool to 4°C

Organic Carbon – 500 mL amber glass bottle/HCl or $H_2SO_4$ to pH<2,cool to 4°C

Sulfide – 50 mL polyethylene/ZnAcetate + NaOH to pH>9, cool to 4°C
Specific conductance, TDS, TSS – 100 mL polyethylene/cool to 4°C

**ACTION:** If no, inform senior chemist. Document justification for change in container/volume (if applicable), qualify positive and non-detect data (J) data if cooler temperature exceeds 10°C. Rejection of data requires professional judgment

**1.5.2** Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

**1.5.3** Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [ ] No [✓] N/A [ ] Comments:





Reviewer/Date [illegible] 12/1/03
Sr. Review/Date Chris Rigendi 12/25/0
Lab Report # 211282 and 211441
Project # 63 [illegible] 8.04-02

specific gravity, chloride, sulfate, nitrate, nitrite, ammonia

**Note:** The following analyses will be evaluated according to the "MADEP QA/QC Guidelines for **Sampling, Data Evaluation and Reporting Activities.**" MADEP, however, may not list QA/QC criteria for every chemical analysis. Where not defined by MADEP, criteria will default to values stipulated in the QAPP. Where the QAPP does not define criteria, QA/QC requirements will default to limits employed by the laboratory.

## 1.0 Laboratory Deliverable Requirements

**1.1 Laboratory Information**: Was all of the following provided in the laboratory report? Check items received. Yes [✓] No [ ] N/A [ ] Comments:

[✓] *Name of Laboratory* [✓] *Address* [✓] *Project ID* [✓] *Phone #* [✓] *Sample identification – Field and Laboratory*

Client Information: [✓] *Name* [✓] *Address* [✓] *Client Contact* *(IDs must be cross-referenced)*

**ACTION**: If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** *Yes [✓] No [ ] N/A [ ] Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** *Yes [✓] No [ ] N/A [ ] Comments:*

[✓] *Narrative serves as an exception report for the project and method QA/QC performance.* [ ] *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed? Yes [✓] No [ ] N/A [ ] Comments:

Does the laboratory report include copies of Chain of Custody forms containing all samples in this SDG?

**NOTE:** Olin receives and maintains the *original* COC.

**ACTION**: If no, contact lab for submission of copy of missing completed COC.

**1.5 Sample Receipt Information (*Cooler Receipt Form*):** Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?

3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☑ QAPP ☐ Lab? Yes [ ] No [✓] N/A [ ] Comments: The lab reported a P for sulfate (2mg/L) that is greater than the QAPP requ PQL of 0.1 mg/L. All sulfate results are greater the the PQL. No further action required.

**Note:** *The MADEP QA/QC Guidelines do not yet list PQLs for wet chemistry analyses, therefore all criteria will default to values stipulated in the QAPP*. Where the QAPP does not define criteria, QA/QC requirements default to limits employed by the lab**. Other criteria may also apply.*

| | | | |
|---|---|---|---|
| Ammonia* ☑ = 0.1 mg/ L | Alkalinity** ☐ = 1 mg/L | Bicarbonate Alkalinity** ☐ = 1 mg/L | Carbonate Alkalinity** ☐ = 1 mg/L |
| Nitrate Nitrogen as N* ☑ = .05 mg/L | Nitrite Nitrogen as N* ☑ = .01 mg/L | Chloride* ☑ = 1 mg/L | Hardness * ☐ = 2 mg/L |
| Spec. Cond.** ☐ 3 umhos/cm | Total Organic Carbon** ☐ = 1 mg/L | Oil & Grease* ☐ = 3 mg/L | Sulfate (EPA 300.0)* ☒ = 0.1 mg/L |
| COD:* Low – 20 mg/L | COD* High - 50 mg/L ☐ | TDS* ☐ = 10 mg/L | TSS* ☐ = 5 mg/L |
| pH* ☐ < 2 to > 12 | | | |

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

**ACTION**: If no, evaluate change with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are the appropriate parameter results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If *dilutions were required, were dilution factors reported?* Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact the lab for submission.

**4.0 Method Blanks** Yes [✓] No [ ] N/A [ ] Comments:

4.1 Are the Method Blank Summaries present?

**ACTION**: If no, call the laboratory for submission of missing data.

4.2 Was a method blank analyzed for each analysis batch of wet chemistry field samples of 20 or less? Yes [✓] No [ ] N/A [ ] Comments:





**1.6 Sample Results Section:** *Was the following information supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

☑ Field ID and Lab ID ☑ Date and time collected ☑ Analyst Initials ☑ Dilution Factor ☑ % moisture or solids ☑ Reporting limits
☑ *Clean-up method* ☑ Analysis method ☑ Preparation method ☑ Date of preparation/extraction/digestion clean-up and analysis, where applicable
☑ Matrix ☑ Target analytes and concentrations ☑ Units (soils must be reported in dry weight)

**ACTION**: If no, contact lab for submission of missing or incomplete information.

**1.7 QA/QC Information:** Was the following information provided in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

☑ Method blank results ☑ LCS recoveries ☑ MS/MSD recoveries and RPDs ☑ Laboratory duplicate results (where applicable)

**ACTION**: If no, contact lab for submission of missing or incomplete information.

**2.0 Holding Times** Yes [ ] No [✓] N/A [ ] Comments:

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? The holding times are as follows:

✓ 28 days = ammonia, chemical oxygen demand, chloride, organic carbon, oil & grease, specific conductance, total organic carbon and sulfate

Alkalinity = 14 days Sulfide, TDS, TSS = 7 days pH = analyze immediately ✓ Nitrate nitrogen as N = 48 hrs

✓ Nitrite nitrogen as N = 48 hrs Nitrate + Nitrite as N = 28 days

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded qualify results (J). For water samples that are grossly exceeded (>2X hold time) reject (R) all non-detect results. Professional judgment used to qualify soils.

**3.0 Laboratory Method** Yes [✓] No [ ] N/A [ ] Comments:

3.1 Was the correct laboratory method used?

**ACTION**: If no, contact lab to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change or to request variance.

**LCS Limits:**

| | | | |
|---|---|---|---|
| Alkalinity** ☐ = 80-120% | Bicarbonate Alkalinity** ☐ = 80-120% | Carbonate Alkalinity** ☐ = 80-120% | Specific Conductivity *☐ = 80-120% |
| Total Organic Carbon** ☐ = 80-120% | TDS** ☐ = 80-120% | Oil & Grease* ☐ = 80-120% | Ammonia Nitrogen as N* ☐ = 80-120% |
| COD Low* ☐ = 80-120% | COD High* ☐ = 80-120% | Nitrate Nitrogen as N** ☑ = 85-115% | Nitrite Nitrogen as N** ☑ = 75-120% |
| Hardness* ☐ = 85-115% | Chloride* ☑ = 80-120% | Sulfate (EPA 300.0)* ☑ = 75-125% | pH* ☐ = 98-102% TSS* NA |

Other parameter(list) _____ %R = _____ ☐ Rec Limits= _____

Other parameter(list) _____ %R = _____ ☐ Rec Limits = _____

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**ACTION:** If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and no-detect results within the batch as (J). If LCS recovery is <10%, non-detect results are rejected (R).

## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs analyzed? List project samples that were spiked. Yes [ ] No [✓] N/A [ ] Comments:

**ACTION:** If no, contact senior chemist to see if any were specified.

6.2 Is the MS/MSD Recovery Form present? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.





**ACTION:** If no, document discrepancy in case narrative and contact lab for justification. Consult senior chemist for action needed.

4.3 Is the method blank less than the PQL? (See Section 3.2 for PQLs). Yes [✓] No [ ] N/A [ ] Comments:

4.4 Do any method blanks have positive results for wet chemistry parameters? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

**ACTION:** If any blank has positive results, list all the concentrations detected and flagging level (flagging level = 5 × blank value) on the checklist. List all affected samples and their qualifiers.

## 5.0 Laboratory Control Standards

5.1 Was a laboratory control standard (LCS) run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call laboratory for LCS form submittal. If data is not available, use professional judgment to determine qualification actions for data associated with the batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

5.3 Is any wet chemistry analyte LCS recovery outside the control limits? Yes [ ] No [✓] N/A [ ] Comments:

**MS/MSD RPD Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia** (LACHAT) ☐ = 8% |
| Chloride**(SM 4500 Cl) ☐ = 15% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA Total Organic Carbon* = NA |
| COD Low** ☐ = 14% | COD High** ☐ = 16% | Nitrate Nitrogen as N** ☐ 16% | Nitrite Nitrogen as N** ☐ = 16% |
| Oil & Grease* = NA | Hardness* = NA | Sulfate (EPA 300.0)* ☐ = 10% | pH* = NA TSS* = NA |

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

* = Laboratory Limits ** = Olin QAPP Limits

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**7.0 Laboratory Duplicate**

Are the RPDs for the laboratory duplicates <20% unless otherwise specified below? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If the RPD is greater than specified limits, qualify all results for that analyte as estimated (J).

| | | | |
|---|---|---|---|
| Alkalinity* = 4% | Bicarbonate Alkalinity* = 4% | Carbonate alkalinity* = 4% | Oil & Grease* ☐ = 20% |
| pH* ☐ = 3% | Specific Conductivity *☐ = 5% | TSS** ☐ = 6% | TDS** ☐ = 6% |

**8.0 Sampling Accuracy**

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:





6.3 Were matrix spikes analyzed at the required frequency of 1 per 20 samples per matrix? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If any matrix spike data is missing, call lab for resubmission.

6.4 Are any wet chemistry analyte spike recoveries outside of the QC limits? Yes [ ] No [ ] N/A [✓] Comments:

NOTE: $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample result, SR = Sample result, SA = Spike added

**MS/MSD Recovery Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia* (LACHAT) ☐ = 74-125% |
| Chloride*(SM 4500 Cl) ☐= 77-116% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA |
| Oil & Grease* = NA | COD Low* ☐ = 61-142% | COD High* ☐ = 92-109% | Nitrate Nitrogen as N** ☐ = 75-119% |
| Nitrite Nitrogen as N** ☐ = 68-136% | Hardness* ☐ = 70-130% | Sulfate (EPA 300.0)* ☐ = 75-125% | pH* = NA TSS* = NA |

Other parameter(list) _____ % R = _____ ☐ Rec Limits = _____

* = Laboratory Limits ** = Olin QAPP Limits *(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**NOTES:** 1) If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.
2) If the MS/MSD was performed by the laboratory on a non-project sample, no qualification is required.

**ACTION:** MS/MSD flags only apply to the sample spiked. Do not evaluate if sample concentration is > 4X spike. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit but > 30%, qualify both positive results and non-detects (J). If the MS/MSD recovery is < 30% and the sample is non-detect, the results are considered unusable and flagged (R).

**ACTION:** Laboratory control limits apply when spiked sample results fall within the normal calibration range. If dilutions are required due to high sample concentrations, the data is evaluated, but no flags are applied.

6.5 Are any RPDs for MS/MSD recoveries outside of the QA/QC limits? Yes [ ] No [ ] N/A [✓] Comments:

**NOTE:** $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where S = MS result, D = MSD result

**REFERENCES**

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kenn GA 30144. August 1999.

STL-Westfield, 2002. "Olin – General Chemistry Control Limits (Soil & Water)," Severn Trent Laboratories, Inc., 53 Southampton Road, Westfield, MA, 01085.



OLIN-WILMINGTON
LEVEL I DATA QUALITY EVALUATION
STANDARD OPERATING PROCEDURE AND CHECKLIST
WET CHEMISTRY PARAMETERS BY VARIOUS METHODS

**ACTION:** Evaluate rinsate results vs. blank results to determine if contaminant may be laboratory-derived. If not lab-related, qualify according to the table below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

**9.0 Field Duplicates**

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP ☐ *MADEP Option 1(1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION**: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

Was any of the data qualified? Yes [ ] No [✓] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.

**1.5 Sample Receipt Information (*Cooler Receipt Form present?*):** Yes [✓] No [ ] N/A [ ] Comments:

Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?

☑ Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

☑ Container type noted ☑ sample condition observed ☑ pH verified (where applicable) ☑ Field and lab IDs cross referenced

**ACTION:** If no, contact lab for submission of missing or incomplete documentation.

**1.5.1** Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

**1.5.2** Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [ ] No [✓] N/A [ ] Comments:

**1.6 Sample Results Section:** *Was each of the following requirements supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

☑ Field ID and Lab ID ☑ *Date and time collected* ☑ Analyst Initials ☑ *Dilution Factor* ☑ % moisture or solids ☑ *Reporting limits*
☑ *Clean-up method* ☑ Analysis method ☑ *Preparation method* ☑ *Date of preparation/extraction/digestion clean-up and analysis, where applicable*
☑ Matrix ☑ Target analytes and concentrations ☑ Units (soils must be reported in dry weight)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**1.7 QA/QC Information:** Was each of the following information supplied in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:





Reviewer/Date [illegible] 12/11/03
Sr. Review/Date [illegible] 12/15/03
Lab Report # 211282 and 211441
Project # 63000 3 00008.04.02

calcium, iron, magnesium, sodium, aluminum, chromium + lithium.

**1.0 Laboratory Deliverable Requirements**

**1.1 Laboratory Information:** Was all of the following provided in the laboratory report? Check items received. Yes [✓] No [ ] N/A [ ] Comments:

☑ *Name of Laboratory* ☑ *Address* ☑ *Project ID* ☑ *Phone #* ☑ *Sample identification – Field and Laboratory*
Client Information: ☑ *Name* ☑ *Address* ☑ *Client Contact* *(IDs must be cross-referenced)*

**ACTION:** If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** *Yes [✓] No [ ] N/A [ ] Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** *Yes [✓] No [ ] N/A [ ] Comments:*

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☐ *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** Olin receives and maintains the *original COC.*

**ACTION:** If no, contact lab for submission of copy of completed *COC.*

**ACTION:** If no, evaluate variation with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If dilutions were required, were dilution factors reported? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact the lab for submission.

## 4.0 Method Blanks

4.1 Is the Method Blank Summary present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call the laboratory for submission of missing data.

4.2 Frequency of Analysis: Was a method blank analyzed for each digestion batch of < 20 field samples? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact laboratory for justification. Consult senior chemist for action needed. Narrate non-compliance.

4.3 Is the method blank less than the PQLs for all target elements? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *MADEP requires the method blank to be matrix matched and digested with the samples*

4.4 Do any method blanks have positive results for metals? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:





☑ Method blank results ☑ LCS recoveries ☑ MS/MSD recoveries and RPDs ☑ Laboratory duplicate results (where applicable)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

## 2.0 Holding Times

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? Holding time for metals is 180 days from sample collection to analysis for both water and soil. Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded, qualify all positive results (J) and non-detects (UJ). If grossly exceeded (2X holding time) reject (R) all non-detect results.

## 3.0 Laboratory Method

3.1 Was the correct laboratory method used? Yes [✓] No [ ] N/A [ ] Comments:

| | |
|---|---|
| Water Digestion | 3005A or 3010A or 3020A |
| Soil Digestion | 3050B |
| Metals | 6010B or 200.7 |

**ACTION:** If no, contact laboratory to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change and to request variance.

3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☑ QAPP ☐ Lab ☐ MADEP Yes [ ] No [✓] N/A [ ] Comments: The lab reported for aluminum (50 µg/L) and chromium (5 µg/L) that are less than the QAPP required PQLs. No further action required

**NOTE:** *Verify that the reported metals match the target list specified on the COC.*

## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

**6.1** Were project-specific MS/MSDs ~~collected~~ analyzed? List project samples that were spiked. (W) 12/11/03 — Yes [ ] No [✓] N/A [ ] Comments:

**ACTION:** If no, contact senior chemist to see if any were specified.

**6.2** Is the Matrix Spike/Matrix Spike Duplicate Recovery Form present? — Yes [ ] No [ ] N/A [✓] Comments:

**NOTE:** *A full target, second source MS/MSD is required by MADEP.*
**ACTION:** If any matrix spike data are missing, call lab for resubmission.

**6.3** Were matrix spikes analyzed as indicated on the COC and project schedule? — Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If any matrix spike data are missing, call lab for resubmission. If none, no qualification is needed. Narrate non-compliance.

**6.4** Are any metal spike recoveries outside of the QC limits? — Yes [ ] No [ ] N/A [✓] Comments:

| Sample Type | *MADEP % Rec* | QAPP % Rec | Method |
|---|---|---|---|
| Water | *75-125* | N/A | 6010B |
| Water | *N/A* | 70-130 | 200.7 |
| Soil | *75-125* | 75-125 | 6010B |

**NOTE:** $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample result, SR = Sample result, SA = Spike added

**NOTE:** If dilutions are required due to high sample concentrations (> 4X spike), the data are evaluated, but no flags are applied.





If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

**ACTION:** For any blank with positive results, list all contaminants for each method blank including the concentration detected and the flagging level (flagging level = 5x the blank value) and the associated samples and qualifiers.

## 5.0 Laboratory Control Standard

**5.1** Was a laboratory control standard run with each analytical batch of 20 samples or less? — Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *A full target, second source LCS is required by MADEP.*
**ACTION:** Call laboratory for LCS form submittal. If data are not available, use professional judgement to evaluate data accuracy associated with that batch.

**5.2** Is a LCS Summary Form present? — Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

**5.3** Is the recovery of any analyte outside of MADEP control limits? — Yes [ ] No [✓] N/A [ ] Comments: (W) 12/11/03

| Sample Type | *MADEP % Rec* |
|---|---|
| Water | *80-120* |
| Soil | within Lab generated limits |

**ACTION:** If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and non-detects results within the batch as (J). If LCS recovery is <30%, positive and non-detect results are rejected (R).

Comments:

| *MADEP Laboratory Duplicate Sample RPD Criteria:* | QAPP RPD |
|---|---|
| *For aqueous results > 5× RL, RPD must be ± 20%* | 20 |
| *For aqueous results < 5× RL, RPD must be ≤ RL* | 20 |
| *For soil/sediment results > 5× RL, RPD must be ± 35%* | 20 |
| *For soil/sediment results < 5× RL, RPD must be ≤ 2× RL* | 20 |

**ACTION:** If the RPD exceeds the limits, qualify both positive results and non-detects as estimated and flag them J. Narrate non-compliance

## 8.0 Sampling Accuracy

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

**8.1** Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

**8.2** Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

**ACTION:** Evaluate rinsate results against blank results to determine if contaminant may be laboratory-derived. If results are not lab-related, qualify according to below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

## 9.0 Field Duplicates

**9.1** Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:





**NOTE:** If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.

**ACTION:** MS/MSD flags only apply to the sample spiked. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit, qualify positive results and non-detects (J).

**6.5** Are any RPDs for MS/MSD recoveries outside of the QC limits? Yes [ ] No [ ] N/A [✓] Comments:

**NOTE:** $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where: S = MS sample result, D = MSD sample result

**NOTE:** If dilutions are required due to high sample concentrations, the data are evaluated, but no flags are applied.

**ACTION:** If the RPD exceeds the control limit, qualify positive results and non-detects (J).

## 7.0 Laboratory Duplicate

**7.1** Was a laboratory duplicate sample analyzed? If so, is the Laboratory Duplicate Sample Form present? Yes [ ] No [✓] N/A [ ] Comments:

***NOTE:*** *MADEP refers to this sample as a "matrix duplicate".*

**ACTION:** If not analyzed, qualification is not needed. If data is missing, contact laboratory for resubmission of report. Narrate non-compliance.

**7.2** Is the RPD between the result for the laboratory duplicate sample and the result for the parent sample outside of the QA/QC limits? Yes [ ] No [ ] N/A [✓] Comments:

**10.0 Application of Validation Qualifiers**

Was any of the data qualified? Yes [ ] No [✓] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.

**REFERENCES**

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw, GA 30144. August 1999

U.S. Environmental Protection Agency (USEPA), 1989. "Region 1 Laboratory Data Validation Functional Guidelines For Evaluating Inorganic Analyses"; Hazardous Site Evaluation Division; February 1989.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Massachusetts Quality Assurance and Quality Control (QA/QC) Requirements." BWSC-CAM, Interim Final Draft, Revision No. 2, 5 October 2001.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Quality Assurance and Quality Control Guidelines for Sampling, Data Evaluation and Reporting Activities," BWSC-CAM, Section VII, Public Comment Draft, Revision No. 0, 21 December 2001.





**9.2** Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP *(1 per 10)* ☐ *MADEP Option 1 (1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

**9.3** Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION**: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

**10.0 Special QA/QC**

**10.1** Were both total and dissolved metals analysis performed? If so, the dissolved metal concentration should not exceed that of the total metal. Yes [ ] No [✓] N/A [ ] Comments:

**ACTION:** If results for both total and dissolved are ≥ 5x the PQL **and** the dissolved concentration is 10% higher than the total, flag both results as estimated (J). If total and dissolved concentrations are less than 5x the PQL **and** the **difference** exceeds 2x the PQL, flag both results as estimated (J)

MACTEC

Engineering and Consulting, Inc.
511 Congress Street
P.O. Box 7050
Portland, Maine 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow
From: Chris Ricardi
Date: 4/22/04
Subject: Olin Wilmington – Geomega DAPL Column Test Samples

**Data Validation Summary**

This sample set contains results for aqueous samples generated by Geomega from the effluent stream of their laboratory column tests completed on DAPL saturated soil cores collected from the Olin Wilmington site. Previous column test samples generated prior to January 2004 were reviewed and reported in November 2003 and January 2004. The samples in this data set were generated during continued testing completed from January through March 2004, and were analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for selected metals (aluminum, calcium, chromium, iron, magnesium, sodium, and lithium) and water chemistry parameters including chloride, sulfate, nitrite, nitrate, and ammonia. Specific gravity was also determined.

The following sample delivery groups (SDGs) are included in this data validation group:

| STL Data Set | Sample ID | Date Generated |
|---|---|---|
| 212731 | SD-59 | 1/26/04 |
| 212731 | FM-59 | 1/26/04 |
| 212846 | SD-61 | 02/02/04 |
| 212846 | FM-61 | 02/02/04 |
| 213046 | SD-63 | 02/09/04 |
| 213046 | FM-63 | 02/09/04 |
| 213354 | SD-67 | 02/23/04 |
| 213354 | FM-67 | 02/23/04 |
| 213665 | FM-71 | 03/08/04 |
| 213720 | FM-71 | 03/22/04 |
| 214000 | FM-75 | 03/22/04 |

The Olin Wilmington QAPP was used as a reference during the review. Metals and water chemistry results were reviewed using the Data Quality Evaluation checklists that were developed for the Olin Wilmington annual and quarterly groundwater monitoring tasks.

All samples in this data set were generated during bench tests. Field QC samples including field blanks and field duplicates were not collected as part of this study. Matrix spike analyses were completed for ammonia using FM-75 and FM-63. Matrix spike analyses for sulfate, chloride, nitrite, and nitrate were completed using FM-71. Batch QC spikes were provided for all parameters.

With the exception of items discussed below, results are interpreted to be usable as reported by the laboratory.

**Validation Actions**

The matrix spike/matrix spike duplicate (MS/MSD) and relative percent difference (RPDs) for ammonia in samples FM-63 (213046-2) (43) and FM-75 (214000-1) (27) exceed the project limit of eight. Results for ammonia in samples FM-63 and FM-75 were qualified estimated (J). These results indicate that some variability would be expected for ammonia in all samples.

## SAMPLE INFORMATION
Date: 02/10/2004

Job Number.: 212731
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 212731-1 | SD-59 | Water | 01/26/2004 | 15:30 | 01/27/2004 | 09:55 |
| 212731-2 | FM-59 | Water | 01/26/2004 | 15:30 | 01/27/2004 | 09:55 |



SEVERN TRENT ST
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NELAP FL E87912 TOX
NY DOH 10843
NH DES 253901-A
NELAP NY10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

## SAMPLE INFORMATION
Date: 02/18/2004

Job Number.: 212846
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 212846-1 | SD-61 | Water | 02/02/2004 | 15:10 | 02/03/2004 | 09:50 |
| 212846-2 | FM-61 | Water | 02/02/2004 | 15:10 | 02/03/2004 | 09:50 |



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NELAP FL E87912 TOX
NY DOH 10843
NH DES 253901-A
NELAP NY10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
ngeway Rd.
ica, MA 01862
) 667-1400
8) 667-7871

# LABORATORY TEST RESULTS

Job Number: 212731

Date: 02/10/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TEST1 | ATTN: Alan Peirce

Customer Sample ID: SD-59
Date Sampled.....: 01/26/2004
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 212731-1
Date Received.....: 01/27/2004
Time Received.....: 09:55

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 0.9990 | | 0.0001 | Ratio | 02/04/04 | sub |
| EPA300.0 PartA | Chloride | 44.1 | | 10 | mg/L | 01/28/04 | rwe |
| EPA300.0 PartA | Sulfate | 744 | | 20 | mg/L | 01/28/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.390 | | 0.050 | mg/L | 01/28/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 01/28/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 186 | | 2.0 | mg/L | 02/03/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1740 | | 50.0 | ug/L | 02/04/04 | bpg |
| | Calcium (Ca) | 32100 | | 100 | ug/L | 02/04/04 | bpg |
| | Chromium (Cr) | 252 | | 5.0 | ug/L | 02/04/04 | bpg |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 02/04/04 | bpg |
| | Magnesium (Mg) | 9050 | | 100 | ug/L | 02/04/04 | bpg |
| | Sodium (Na) | 147000 | | 1000 | ug/L | 02/04/04 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NELAP FL E87912 TOX
NY DOH 10843
NH DES 253901-A
NELAP NY10843
nelac
STL Westfield
53 Southampton Rd.
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149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

# LABORATORY TEST RESULTS

Job Number: 212731

Date: 02/10/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TEST1 | ATTN: Alan Peirce

Customer Sample ID: FM-59
Date Sampled.....: 01/26/2004
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 212731-2
Date Received.....: 01/27/2004
Time Received.....: 09:55

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 1.0000 | | 0.0001 | Ratio | 02/04/04 | sub |
| EPA300.0 PartA | Chloride | 52.6 | | 10 | mg/L | 01/28/04 | rwe |
| EPA300.0 PartA | Sulfate | 380 | | 20 | mg/L | 01/28/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.153 | | 0.050 | mg/L | 01/28/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 01/28/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 56.8 | | 2.0 | mg/L | 02/03/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 278 | | 50.0 | ug/L | 02/04/04 | bpg |
| | Calcium (Ca) | 51200 | | 100 | ug/L | 02/04/04 | bpg |
| | Chromium (Cr) | 34 | | 5.0 | ug/L | 02/04/04 | bpg |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 02/04/04 | bpg |
| | Magnesium (Mg) | 4460 | | 100 | ug/L | 02/04/04 | bpg |
| | Sodium (Na) | 47600 | | 1000 | ug/L | 02/04/04 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NELAP FL E87912 TOX
NY DOH 10843
NH DES 253901-A
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53 Southampton Rd.
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149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

## SAMPLE INFORMATION
Date: 02/10/2004

Job Number.: 212731
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 212731-1 | SD-59 | Water | 01/26/2004 | 15:30 | 01/27/2004 | 09:55 |
| 212731-2 | FM-59 | Water | 01/26/2004 | 15:30 | 01/27/2004 | 09:55 |



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD
NELAP FL E87912 TOX NY DOH 10843 NH DES 253901-A NELAP NY10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871

## LABORATORY TEST RESULTS
Job Number: 212731 Date: 02/10/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TESTI ATTN: Alan Peirce

Customer Sample ID: SD-59
Date Sampled.....: 01/26/2004
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 212731-1
Date Received.....: 01/27/2004
Time Received.....: 09:55

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 0.9990 | | 0.0001 | Ratio | 02/04/04 | sub |
| EPA300.0 PartA | Chloride | 44.1 | | 10 | mg/L | 01/28/04 | rwe |
| EPA300.0 PartA | Sulfate | 744 | | 20 | mg/L | 01/28/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.390 | | 0.050 | mg/L | 01/28/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 01/28/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 186 | | 2.0 | mg/L | 02/03/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1740 | | 50.0 | ug/L | 02/04/04 | bpg |
| | Calcium (Ca) | 32100 | | 100 | ug/L | 02/04/04 | bpg |
| | Chromium (Cr) | 252 | | 5.0 | ug/L | 02/04/04 | bpg |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 02/04/04 | bpg |
| | Magnesium (Mg) | 9050 | | 100 | ug/L | 02/04/04 | bpg |
| | Sodium (Na) | 147000 | | 1000 | ug/L | 02/04/04 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
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STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862 (978) 667-1400 (978) 667-7871

# LABORATORY TEST RESULTS

Job Number: 212731

Date: 02/10/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TEST1 | ATTN: Alan Peirce

Customer Sample ID: FM-59
Date Sampled.....: 01/26/2004
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 212731-2
Date Received.....: 01/27/2004
Time Received.....: 09:55

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 1.0000 | | 0.0001 | Ratio | 02/04/04 | sub |
| EPA300.0 PartA | Chloride | 52.6 | | 10 | mg/L | 01/28/04 | rwe |
| EPA300.0 PartA | Sulfate | 380 | | 20 | mg/L | 01/28/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.153 | | 0.050 | mg/L | 01/28/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 01/28/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 56.8 | | 2.0 | mg/L | 02/03/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 278 | | 50.0 | ug/L | 02/04/04 | bpg |
| | Calcium (Ca) | 51200 | | 100 | ug/L | 02/04/04 | bpg |
| | Chromium (Cr) | 34 | | 5.0 | ug/L | 02/04/04 | bpg |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 02/04/04 | bpg |
| | Magnesium (Mg) | 4460 | | 100 | ug/L | 02/04/04 | bpg |
| | Sodium (Na) | 47600 | | 1000 | ug/L | 02/04/04 | bpg |

* In Description = Dry Wgt.



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# LABORATORY CHRONICLE

Job Number: 212731

Date: 02/10/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TEST1 | ATTN: Alan Peirce

Lab ID: 212731-1 Client ID: SD-59 — Date Recvd: 01/27/2004 Sample Date: 01/26/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | | DILUTION |
|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion,Total (ICAP) | 1 | 23414 | | 01/28/2004 | 0900 | |
| LAC 107061B | Ammonia | 1 | 23662 | | 02/03/2004 | 0000 | 20 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 23447 | | 01/28/2004 | 0000 | |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 23447 | | 01/28/2004 | 0000 | 10 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 23505 | | 01/28/2004 | 0000 | 10 |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 23757 | 23414 | 02/04/2004 | 1553 | |
| | QC Metals Report, Level 2 | 1 | 23768 | | 02/05/2004 | 1030 | |
| | QC Wet Chemistry Report, Level 2 | 1 | 23665 | | 02/03/2004 | 0000 | |
| ASTM 1298 | Specific Gravity | 1 | 23719 | | 02/04/2004 | | |

Lab ID: 212731-2 Client ID: FM-59 — Date Recvd: 01/27/2004 Sample Date: 01/26/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | | DILUTION |
|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion,Total (ICAP) | 1 | 23414 | | 01/28/2004 | 0900 | |
| LAC 107061B | Ammonia | 1 | 23662 | | 02/03/2004 | | 20 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 23447 | | 01/28/2004 | 0000 | |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 23505 | | 01/28/2004 | 0000 | 10 |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 23757 | 23414 | 02/04/2004 | 1556 | |
| ASTM 1298 | Specific Gravity | 1 | 23719 | | 02/04/2004 | | |



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QUALITY CONTROL RESULTS

Job Number: 212731
Client: Olin Chemical

Units: mg/L

| Analyte | Sample Identification | MB RL | Sample RL | Sample Result | Spike Conc. | Matrix Spike | MS % Rec | Spike Dup | MSD % Rec | RPD | Q | Spike Limits | LCS TRUE | LCS Found | LCS % Rec | Q | LCS QC Limits | Da Anal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ammonia | 212728-99 | 0.1U | 0.1U | 0.13 | 10.0 | 10.1 | 100 | 9.83 | 97 | 3 | | 75-125 | 10 | 9.80 | 98 | | 85-115 | 02/0 |
| Sulfate† | 212727-24 | 2U | 20U | 18.8 | 200 | 239 | 110 | 239 | 110 | 0 | | 75-125 | 60 | 63.8 | 106 | | 85-1 | /2 |
| Chloride† | 212727-24 | 1U | 10U | 170 | 100 | 271 | 101 | 270 | 100 | 0 | | 75-125 | 30 | 30.6 | 102 | | 85-1 | /2 |
| Nitrate† | 212727-24 | 0.05U | 0.5U | 1.12 | 10.0 | 11.8 | 107 | 11.8 | 106 | 0 | | 75-125 | 3 | 3.16 | 105 | | 85-115 | 01/2 |
| Nitrite† | 212727-24 | 0.05U | 0.5U | 0.00 | 10.0 | 8.5 | 85 | 8.4 | 84 | 1 | | 75-125 | 3 | 2.87 | 96 | | 85-115 | 01/2 |

Comments: † = the quality control sample was run at a 10X dilution.



QUALITY CONTROL RESULTS

Job Number: 212731
Client: Olin Chemical

Units:

Extraction Batch: 23414
Analytical Batch: 23757

| Analyte | QC Sample Identification | MB RL | Sample RL | Sample Result | Sample Duplicate | RPD | Spike Conc. | Matrix Spike | MS % Rec | Q | Spike Limits | LCS TRUE | LCS found | LCS % Rec | Q | LCS QC Limits | Da Anal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 212745-1 | 50U | 50U | 4143 | 3969 | 4 | 1000 | 4885 | 74 | | 70-130 | 1000 | 923 | 92 | | 85-115 | 02/0 |
| Chromium | 212745-1 | 5U | 5U | 0 | 0 | 0 | 1000 | 833 | 83 | | 70-130 | 1000 | 921 | 92 | | 85-115 | 02/0 |
| Calcium | 212745-1 | 100U | 100U | 131045 | 125999 | 4 | 20000 | 145267 | 71 | | 70-130 | 20000 | 20399 | 102 | | 85-115 | 02/0 |
| Iron | 212745-1 | 50U | 50U | 6407 | 6138 | 4 | 1000 | 7079 | 67 | * | 70-130 | 1000 | 1007 | 101 | | 85-115 | 02/0 |
| Magnesium | 212745-1 | 100U | 100U | 29735 | 28467 | 4 | 20000 | 46952 | 86 | | 70-130 | 20000 | 20314 | 102 | | 85-115 | 02/0 |
| Sodium | 212745-1 | 1000U | 1000U | 498702 | 474763 | 5 | 20200 | 491650 | 0 | * | 70-130 | 20200 | 19546 | 97 | | 85-115 | 02/0 |

RPD =≤20

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT **STL** 00311

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(F) 413-572-3707
STL-WESTFIE_D

•149 Rangeway Ro
N. Billerica, MA 018
(P) 978-667-1400
(F) 978-667-7671
STL-BILLERICA

Client: Olin/Geomega
Address: 2995 Baseline Rd.
Boulder, CO 80303
Phone: 303-443-9117x14 Fax: 303-938-8123

Project #: C03303F colm. study
Project Manager: Dan Stone
Work ID:
Contact: Andrew Nicholson / Dan Stone

Job#: 21673 Quote#: PO#:

Shaded areas for office use

**Analysis Requested**
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

**Comments** (Special Instructions)

Analytes:
Cr, Al, Fe, Ca, Mg, Na
$SO_4$, Cl
Nitrate/Nitrite
Ammonia
Specific Gravity

**Requested Turn Around Time**
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

**Regulatory Classification / Special Report Format**
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-59 | GW | JW | 1/26/04 1530 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | ✓ | |
| FM-59 | GW | JW | 1/26/04 1530 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | ✓ | |

MJ 1/27/04

Sampled by (print): JASON WHITE 1/26/04 15:30 Signature: Jason White
Relinquished by: " " Date: 1/26/04 Time: 17:00 Received by: [signature] Date: 1/27/04 Time: 0955
Relinquished by: Date: Time: Received by: Date: Time:
Method of shipment: FedEx - 843275738479 **STL-Westfield**

Cooler: Y / N Samples iced: Y / N
Temp @ receipt:
Preservation pH checked:
By: Date:

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy

---

rpjsckl Job Sample Receipt Checklist Report V2

Job Number.: 212731 Location.: 57345 Check List Number.: 1 Description.:
Customer Job ID.....: Job Check List Date.: 01/27/2004
Project Number.: 20000348 Project Description.: Geomega Column Testing Date of the Report..: 01/27/2004
Customer.....: Olin Chemical Contact.: Alan Peirce Project Manager.....: bcm

| Questions ? | (Y/N) | Comments |
|---|---|---|
| Chain-of-Custody Present?..... | Y | |
| ...If "yes", completed properly?..... | Y | |
| Custody seal on shipping container?..... | N | |
| ...If "yes", custody seal intact?..... | | |
| Custody seals on sample containers?..... | N | |
| ...If "yes", custody seal intact?..... | | |
| Samples iced?..... | Y | |
| Temperature of cooler acceptable? (4 deg C +/- 2). | N | |
| ..Temperature at receipt _____..... | | 6.2c |
| Samples received intact (good condition)?..... | Y | |
| Volatile samples acceptable? (no headspace)..... | | |
| Is a Trip Blank required?..... | | |
| Was a Trip Blank provided?..... | | |
| Correct containers used?..... | Y | |
| Adequate sample volume provided?..... | Y | |
| Samples preserved correctly?..... | Y | |
| Samples received within holding-time?..... | Y | |
| Agreement between COC and sample labels?..... | Y | |
| Comments..... | | |
| If samples were shipped was there an air bill #?.. | Y | FedEx 843275738479 |
| Sample Custodian Signature/Date..... | | mjb 1/27/04 [signature] |

Page 1

# LABORATORY TEST RESULTS

Job Number: 212846

Date: 02/18/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TEST1 | ATTN: Alan Peirce

Customer Sample ID: SD-61
Date Sampled.....: 02/02/2004
Time Sampled.....: 15:10
Sample Matrix.....: Water

Laboratory Sample ID: 212846-1
Date Received.....: 02/03/2004
Time Received.....: 09:50

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 1.0000 | | 0.0001 | Ratio | 02/11/04 | sub |
| EPA300.0 PartA | Chloride | 120 | | 20 | mg/L | 02/04/04 | rwe |
| EPA300.0 PartA | Sulfate | 104 | | 40 | mg/L | 02/04/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.543 | | 0.050 | mg/L | 02/03/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 02/03/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 152 | | 2.0 | mg/L | 02/10/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1540 | | 50.0 | ug/L | 02/13/04 | bpg |
| | Calcium (Ca) | 25900 | | 100 | ug/L | 02/16/04 | rac |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 02/16/04 | rac |
| | Magnesium (Mg) | 8380 | | 100 | ug/L | 02/13/04 | bpg |
| | Sodium (Na) | 140000 | | 1000 | ug/L | 02/13/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 230 | | 5.0 | ug/L | 02/12/04 | bpg |

* In Description = Dry Wgt.



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# LABORATORY TEST RESULTS

Job Number: 212846

Date: 02/18/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TEST1 | ATTN: Alan Peirce

Customer Sample ID: FM-61
Date Sampled.....: 02/02/2004
Time Sampled.....: 15:10
Sample Matrix.....: Water

Laboratory Sample ID: 212846-2
Date Received.....: 02/03/2004
Time Received.....: 09:50

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 1.0000 | | 0.0001 | Ratio | 02/11/04 | sub |
| EPA300.0 PartA | Chloride | 62.6 | | 10 | mg/L | 02/03/04 | rwe |
| EPA300.0 PartA | Sulfate | 324 | | 20 | mg/L | 02/03/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.255 | | 0.050 | mg/L | 02/03/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 02/03/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 50.7 | | 2.0 | mg/L | 02/10/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 122 | | 50.0 | ug/L | 02/13/04 | bpg |
| | Calcium (Ca) | 43200 | | 100 | ug/L | 02/16/04 | rac |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 02/16/04 | rac |
| | Magnesium (Mg) | 4080 | | 100 | ug/L | 02/13/04 | bpg |
| | Sodium (Na) | 49400 | | 1000 | ug/L | 02/13/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 25 | | 5.0 | ug/L | 02/12/04 | bpg |

* In Description = Dry Wgt.



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## SAMPLE INFORMATION
Date: 02/24/2004

Job Number.: 213046
Customer....: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 213046-1 | SD-63 | Water | 02/09/2004 | 15:15 | 02/10/2004 | 12:35 |
| 213046-2 | FM-63 | Water | 02/09/2004 | 15:15 | 02/10/2004 | 12:35 |



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## LABORATORY TEST RESULTS
Job Number: 213046
Date: 02/24/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TESTI ATTN: Alan Peirce

Customer Sample ID: SD-63
Date Sampled.....: 02/09/2004
Time Sampled.....: 15:15
Sample Matrix.....: Water

Laboratory Sample ID: 213046-1
Date Received.....: 02/10/2004
Time Received.....: 12:35

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 0.9990 | | 0.0001 | Ratio | 02/17/04 | sub |
| EPA300.0 PartA | Chloride | 86.9 | | 10 | mg/L | 02/10/04 | rwe |
| EPA300.0 PartA | Sulfate | 560 | | 20 | mg/L | 02/10/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.843 | | 0.050 | mg/L | 02/10/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 02/10/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 58.8 | | 2.0 | mg/L | 02/18/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1030 | | 50.0 | ug/L | 02/17/04 | rac |
| | Calcium (Ca) | 24500 | | 100 | ug/L | 02/17/04 | rac |
| | Chromium (Cr) | 150 | | 5.0 | ug/L | 02/17/04 | rac |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 02/17/04 | rac |
| | Magnesium (Mg) | 6510 | | 100 | ug/L | 02/17/04 | rac |
| | Sodium (Na) | 112000 | | 1000 | ug/L | 02/17/04 | rac |

* In Description = Dry Wgt.



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N. Billerica, MA 01862
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Fax: (978) 667-7871

## LABORATORY TEST RESULTS

Job Number: 213046

Date: 02/24/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TEST1 ATTN: Alan Peirce

Customer Sample ID: FM-63
Date Sampled.....: 02/09/2004
Time Sampled.....: 15:15
Sample Matrix.....: Water

Laboratory Sample ID: 213046-2
Date Received.....: 02/10/2004
Time Received.....: 12:35

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 0.9980 | | 0.0001 | Ratio | 02/17/04 | sub |
| EPA300.0 PartA | Chloride | 63.6 | | 10 | mg/L | 02/10/04 | rwe |
| EPA300.0 PartA | Sulfate | 318 | | 20 | mg/L | 02/10/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.442 | | 0.050 | mg/L | 02/10/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 02/10/04 | rwe |
| LAC 1070618 | Ammonia (NH3), as N | 82.5 | J | 2.0 | mg/L | 02/18/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 142 | | 50.0 | ug/L | 02/17/04 | rac |
| | Calcium (Ca) | 44700 | | 100 | ug/L | 02/17/04 | rac |
| | Chromium (Cr) | 32 | | 5.0 | ug/L | 02/17/04 | rac |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 02/17/04 | rac |
| | Magnesium (Mg) | 3870 | | 100 | ug/L | 02/17/04 | rac |
| | Sodium (Na) | 45900 | | 1000 | ug/L | 02/17/04 | rac |

* In Description = Dry Wgt.



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## SAMPLE INFORMATION

Date: 03/09/2004

Job Number.: 213354
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TEST1
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 213354-1 | SD-67 | Water | 02/23/2004 | 14:30 | 02/24/2004 | 10:50 |
| 213354-2 | FM-67 | Water | 02/23/2004 | 14:30 | 02/24/2004 | 10:50 |



SEVERN TRENT STL
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STL Billerica Rangeway Rd. Iarica, MA 01862 (978) 667-1400 (978) 667-7871

# LABORATORY TEST RESULTS

Job Number: 213354

Date: 03/09/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TEST | ATTN: Steve Morrow

Customer Sample ID: SD-67
Date Sampled.....: 02/23/2004
Time Sampled.....: 14:30
Sample Matrix.....: Water

Laboratory Sample ID: 213354-1
Date Received.....: 02/24/2004
Time Received.....: 10:50

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 70.2 | | 10 | mg/L | 02/24/04 | rwe |
| EPA300.0 PartA | Sulfate | 389 | | 20 | mg/L | 02/24/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 1.31 | | 0.050 | mg/L | 02/24/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 02/24/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 3.47 | | 0.10 | mg/L | 02/27/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 18000 | | 100 | ug/L | 03/02/04 | bpg |
| | Iron (Fe) | ND | U | 50 | ug/L | 03/02/04 | bpg |
| | Magnesium (Mg) | 4400 | | 100 | ug/L | 03/02/04 | bpg |
| | Sodium (Na) | 83000 | | 1000 | ug/L | 03/02/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 810 | | 50 | ug/L | 03/02/04 | rac |
| | Chromium (Cr) | 110 | | 5.0 | ug/L | 03/02/04 | rac |

* In Description = Dry Wgt.



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# LABORATORY TEST RESULTS

Job Number: 213354

Date: 03/09/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TEST | ATTN: Steve Morrow

Customer Sample ID: FM-67
Date Sampled.....: 02/23/2004
Time Sampled.....: 14:30
Sample Matrix.....: Water

Laboratory Sample ID: 213354-2
Date Received.....: 02/24/2004
Time Received.....: 10:50

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 63.8 | | 10 | mg/L | 02/24/04 | rwe |
| EPA300.0 PartA | Sulfate | 273 | | 20 | mg/L | 02/24/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.999 | | 0.050 | mg/L | 02/24/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 02/24/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 0.46 | | 0.10 | mg/L | 02/27/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 45000 | | 100 | ug/L | 03/02/04 | bpg |
| | Iron (Fe) | ND | U | 50 | ug/L | 03/02/04 | bpg |
| | Magnesium (Mg) | 3700 | | 100 | ug/L | 03/02/04 | bpg |
| | Sodium (Na) | 51000 | | 1000 | ug/L | 03/02/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 120 | | 50 | ug/L | 03/02/04 | rac |
| | Chromium (Cr) | 19 | | 5.0 | ug/L | 03/02/04 | rac |

* In Description = Dry Wgt.



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## SAMPLE INFORMATION
Date: 03/22/2004

Job Number.: 213665
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 213665-1 | FM-71 | Water | 03/08/2004 | 14:00 | 03/09/2004 | 09:45 |



## LABORATORY TEST RESULTS

Job Number: 213665

Date: 03/22/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TESTI ATTN: Steve Morrow

Customer Sample ID: FM-71
Date Sampled.....: 03/08/2004
Time Sampled.....: 14:00
Sample Matrix.....: Water

Laboratory Sample ID: 213665-1
Date Received.....: 03/09/2004
Time Received.....: 09:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 64 | | 10 | mg/L | 03/09/04 | rwe |
| EPA300.0 PartA | Sulfate | 140 | | 20 | mg/L | 03/09/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 1.9 | | 0.50 | mg/L | 03/09/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 03/09/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 60 | | 1.0 | mg/L | 03/15/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | ND | U | 100 | ug/L | 03/16/04 | bpg |
| | Calcium (Ca) | 30000 | | 200 | ug/L | 03/15/04 | bpg |
| | Iron (Fe) | 220 | | 100 | ug/L | 03/15/04 | bpg |
| | Magnesium (Mg) | 2700 | | 200 | ug/L | 03/16/04 | bpg |
| | Sodium (Na) | 50000 | | 2000 | ug/L | 03/15/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 57 | | 10 | ug/L | 03/15/04 | bpg |

* In Description = Dry Wgt.

## SAMPLE INFORMATION

Date: 04/06/2004

Job Number.: 214000
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TEST1
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 214000-1 | FM-75 | Water | 03/22/2004 | 15:00 | 03/23/2004 | 10:05 |



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## LABORATORY TEST RESULTS

Job Number: 214000

Date: 04/06/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TEST1 | ATTN: Steve Morrow

Customer Sample ID: FM-75
Date Sampled.....: 03/22/2004
Time Sampled.....: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 214000-1
Date Received.....: 03/23/2004
Time Received.....: 10:05

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 68 | | 10 | mg/L | 03/24/04 | rwe |
| EPA300.0 PartA | Sulfate | 100 | | 20 | mg/L | 03/24/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 1.8 | | 0.050 | mg/L | 03/24/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 03/24/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 61 | J | 0.5 | mg/L | 03/24/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 33000 | | 100 | ug/L | 03/26/04 | bpg |
| | Iron (Fe) | 19 | B | 50 | ug/L | 03/26/04 | bpg |
| | Magnesium (Mg) | 2800 | | 100 | ug/L | 03/26/04 | bpg |
| | Sodium (Na) | 150000 | | 1000 | ug/L | 03/26/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 130 | | 50 | ug/L | 03/26/04 | bpg |
| | Chromium (Cr) | 24 | | 5.0 | ug/L | 03/26/04 | bpg |

* In Description = Dry Wgt.



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# SUBCONTRACTED DATA

SEVERN TRENT STL

STL Chicago
2417 Bond Street
University Park, IL 60466

Tel: 708 534 5200 Fax: 708 534 5211
www.stl-inc.com

## SEVERN TRENT LABORATORIES
## ANALYTICAL REPORT

JOB NUMBER: 224953

Prepared For:

Severn Trent Laboratories
Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

Project: STL Westfield

Attention: Becky Mason

Date: 03/17/2004

Bonnie Stadelmann
Signature

03/17/04
Date

Name: Bonnie M. Stadelmann

Title: Project Manager

E-Mail: bstadelmann@stl-inc.com

STL Chicago
2417 Bond Street
University Park, IL 60466

PHONE: (708) 534-5200
FAX..: (708) 534-5211

This Report Contains ( 1 ) Pages

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# LABORATORY TEST RESULTS

Job Number: 224953

Date:03/17/2004

CUSTOMER: Severn Trent Laboratories PROJECT: WESTFIELD 213720 ATTN: Becky Mason

Customer Sample ID: 213720-1
Date Sampled.....: 03/08/2004
Time Sampled.....: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 224953-1
Date Received.....: 03/11/2004
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | QT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 0.9990 | | | | 0.0001 | 1 | | 111803 | | 03/15/04 1135 | cls |

* In Description = Dry Wgt.



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# SAMPLE LOG

Date: 03/17/2004

Job Number.: 224953
Customer...: Severn Trent Laboratories
Attn.....: Becky Mason

Project Number.....: 20000230
Customer Project ID.....: WESTFIELD 213720
Project Description.....: STL Westfield

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 224953-1 | 213720-1 | Water | 03/08/2004 | 15:00 | 03/11/2004 | 11:00 |

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# LABORATORY TEST RESULTS

Job Number: 225286

Date:04/05/2004

CUSTOMER: Severn Trent Laboratories

PROJECT: WESTFIELD 214000

ATTN: Becky Mason

Customer Sample ID: 214000-1
Date Sampled.....: 03/22/2004
Time Sampled.....: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 225286-1
Date Received.....: 03/24/2004
Time Received.....: 10:30

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DF | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 0.9960 | | | | 0.0001 | 1 | | 113875 | | 04/05/04 0810 | cls |

* In Description = Dry Wgt.



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S A M P L E I N F O R M A T I O N

Date: 04/05/2004

Job Number.: 225286
Customer....: Severn Trent Laboratories
Attn.....: Becky Mason

Project Number.....: 20000230
Customer Project ID....: WESTFIELD 214000
Project Description....: STL Westfield

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 225286-1 | 214000-1 | Water | 03/22/2004 | 15:00 | 03/24/2004 | 10:30 |

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# LABORATORY TEST RESULTS

Job Number: 224555

Date:03/02/2004

CUSTOMER: Severn Trent Laboratories | PROJECT: WESTFIELD 213354 | ATTN: Becky Mason

Customer Sample ID: 213354-1
Date Sampled.....: 02/23/2004
Time Sampled.....: 14:30
Sample Matrix.....: Water

Laboratory Sample ID: 224555-1
Date Received.....: 02/25/2004
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 0.9970 | | | | 0.0001 | 1 | | 110469 | | 03/02/04 1105 | cls |

* In Description = Dry Wgt.



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S A M P L E I N F O R M A T I O N
Date: 03/02/2004

Job Number.: 224555
Customer...: Severn Trent Laboratories
Attn.....: Becky Mason

Project Number.....: 20000230
Customer Project ID....: WESTFIELD 213354
Project Description....: STL Westfield

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 224555-1 | 213354-1 | Water | 02/23/2004 | 14:30 | 02/25/2004 | 10:00 |
| 224555-2 | 213354-2 | Water | 02/23/2004 | 14:30 | 02/25/2004 | 10:00 |

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Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

02/18/2004

Report Number: 212846

Dear Alan Peirce,

The analysis of your sample(s) submitted on 02/03/2004 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your Project Manager, Rebecca C. Mason.

For questions, concerns or comments regarding our service, please do not hesitate to contact me directly. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL WESTFIELD

Technical Review: 2/18/04

Total number of pages in this report: 14

## MADEP MCP Analytical Method Report Certification Form

Laboratory Name: Severn Trent Laboratory (STL) Westfield Project #: 212846

Project Location: MADEP RTN[1]:

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
212846-1-2

| Sample Matrices: | Groundwater | Soil/Sediment | Drinking Water | Other: | | | |
|---|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used (check all that apply) | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) | |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | | |
| As specified in MADEP CAM Compendium of Analytical Methods (check all that apply) | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | (Yes) No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | (Yes) No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes (N/A) No[1] |
| D | VPH and EPH methods only: Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes (N/A) No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes (No[1]) |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes (N/A) No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

Signature: Position: Laboratory Director

Printed Name: Steven C. Hartmann Date: 2/18/04

MCP CASE NARRATIVE

Client: Olin Chemical

Report Number: 212846

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 2/3/04; the samples arrived in good condition, properly preserved and on ice.

**Subcontract**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago 2417 Bond Street, University Park, IL 60466.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**EPA 200.7**
At the request of the client, an abbreviated MCP analyte list was reported for this job.

Poor matrix spike recovery was noted for the MS result for Aluminum, Calcium, Iron and Sodium. The sample concentration overwhelmed the amount of spike added. The LCS recovered within acceptable control limits.

There were no additional QA/QC deviations or issues reported for this method.

**EPA 300.0 (Chloride)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Sulfate)**
There were no QA/QC deviations or issues reported for this method.



**EPA 300.0 (Nitrate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrite)**
There were no QA/QC deviations or issues reported for this method.

**LAC 107061B (ammonia)**
There were no QA/QC deviations or issues reported for this method.

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## SAMPLE INFORMATION
Date: 02/18/2004

Job Number.: 212846
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 212846-1 | SD-61 | Water | 02/02/2004 | 15:10 | 02/03/2004 | 09:50 |
| 212846-2 | FM-61 | Water | 02/02/2004 | 15:10 | 02/03/2004 | 09:50 |



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## LABORATORY TEST RESULTS
Job Number: 212846 Date: 02/18/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TESTI ATTN: Alan Peirce

Customer Sample ID: SD-61
Date Sampled.....: 02/02/2004
Time Sampled.....: 15:10
Sample Matrix.....: Water

Laboratory Sample ID: 212846-1
Date Received.....: 02/03/2004
Time Received.....: 09:50

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 1.0000 | | 0.0001 | Ratio | 02/11/04 | sub |
| EPA300.0 PartA | Chloride | 120 | | 20 | mg/L | 02/04/04 | rwe |
| EPA300.0 PartA | Sulfate | 104 | | 40 | mg/L | 02/04/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.543 | | 0.050 | mg/L | 02/03/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 02/03/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 152 | | 2.0 | mg/L | 02/10/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1540 | | 50.0 | ug/L | 02/13/04 | bpg |
| | Calcium (Ca) | 25900 | | 100 | ug/L | 02/16/04 | rac |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 02/16/04 | rac |
| | Magnesium (Mg) | 8380 | | 100 | ug/L | 02/13/04 | bpg |
| | Sodium (Na) | 140000 | | 1000 | ug/L | 02/13/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 230 | | 5.0 | ug/L | 02/12/04 | bpg |

* In Description = Dry Wgt.



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# LABORATORY TEST RESULTS

Job Number: 212846 Date: 02/18/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TEST1 ATTN: Alan Peirce

Customer Sample ID: FM-61
Date Sampled.....: 02/02/2004
Time Sampled.....: 15:10
Sample Matrix.....: Water

Laboratory Sample ID: 212846-2
Date Received.....: 02/03/2004
Time Received.....: 09:50

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 1.0000 | | 0.0001 | Ratio | 02/11/04 | sub |
| EPA300.0 PartA | Chloride | 62.6 | | 10 | mg/L | 02/03/04 | rwe |
| EPA300.0 PartA | Sulfate | 324 | | 20 | mg/L | 02/03/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.255 | | 0.050 | mg/L | 02/03/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 02/03/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 50.7 | | 2.0 | mg/L | 02/10/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 122 | | 50.0 | ug/L | 02/13/04 | bpg |
| | Calcium (Ca) | 43200 | | 100 | ug/L | 02/16/04 | rac |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 02/16/04 | rac |
| | Magnesium (Mg) | 4080 | | 100 | ug/L | 02/13/04 | bpg |
| | Sodium (Na) | 49400 | | 1000 | ug/L | 02/13/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 25 | | 5.0 | ug/L | 02/12/04 | bpg |

* In Description = Dry Wgt.



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MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD
NELAP FL E87912 TOX NY DOH 10843 NH DES 253901-A NELAP NY10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871

# LABORATORY CHRONICLE

Job Number: 212846 Date: 02/18/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TEST1 ATTN: Alan Peirce

Lab ID: 212846-1 Client ID: SD-61 Date Recvd: 02/03/2004 Sample Date: 02/02/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | | DILUTION |
|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion,Total (ICAP) | 1 | 23725 | | 02/05/2004 | 0900 | |
| LAC 107061B | Ammonia | 1 | 23965 | | 02/10/2004 | 0000 | 20 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 23751 | | 02/03/2004 | 0000 | |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 23752 | | 02/04/2004 | 0000 | 20 |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 24150 | 23725 | 02/13/2004 | 1750 | |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 24245 | 23725 | 02/16/2004 | 1557 | |
| EPA 200.7 | Metal Analysis Trace (ICP) | 1 | 24107 | 23725 | 02/12/2004 | 2146 | |
| | QC Metals Report, Level 2 | 1 | 24263 | | 02/17/2004 | 0000 | |
| | QC Wet Chemistry Report, Level 2 | 1 | 23961 | | 02/10/2004 | | |
| ASTM 1298 | Specific Gravity | 1 | 24140 | | 02/11/2004 | | |

Lab ID: 212846-2 Client ID: FM-61 Date Recvd: 02/03/2004 Sample Date: 02/02/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | | DILUTION |
|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion,Total (ICAP) | 1 | 23725 | | 02/05/2004 | 0900 | |
| LAC 107061B | Ammonia | 1 | 23965 | | 02/10/2004 | 0000 | 20 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 23751 | | 02/03/2004 | 0000 | |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 23752 | | 02/03/2004 | 0000 | 10 |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 24150 | 23725 | 02/13/2004 | 1754 | |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 24245 | 23725 | 02/16/2004 | 1610 | |
| EPA 200.7 | Metal Analysis Trace (ICP) | 1 | 24107 | 23725 | 02/12/2004 | 2154 | |
| ASTM 1298 | Specific Gravity | 1 | 24140 | | 02/11/2004 | | |



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD
NELAP FL E87912 TOX NY DOH 10843 NH DES 253901-A NELAP NY10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871

QUALITY CONTROL RESULTS

Job Number: 212846
Client: Olin Chemical

Units: mg/L

| Analyte | Sample Identification | MB RL | Sample RL | Sample Result | Spike Conc | Matrix Spike | MS % Rec | Spike Dup | MSD % Rec | RPD | Q | Spike Limits | LCS TRUE | LCS Found | LCS % Rec | Q | LCS QC Limits | D Anal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ammonia | 212726-4 | 0.1U | 0.1U | 0.88 | 10.0 | 10.1 | 92 | 9.62 | 87 | 5 | | 75-125 | 10 | 10.3 | 103 | | 85-115 | 02/1 |
| Sulfate | 212718-1 | 2U | 20U | 122 | 200 | 330 | 104 | 329 | 104 | 0 | | 75-125 | 60 | 61.4 | 102 | | 85-115 | 02/0 |
| Chloride | 212718-1 | 1U | 10U | 120 | 100 | 219 | 99 | 219 | 99 | 0 | | 75-125 | 30 | 30.8 | 103 | | 85-1 | 0 |
| Nitrate | 212718-1 | 0.05U | 0.5U | 0.23 | 10.0 | 10.1 | 99 | 10.0 | 98 | 0 | | 75-125 | 3 | 3.02 | 101 | | 85-11 | 0 |
| Nitrite | 212718-1 | 0.05U | 0.5U | 0.00 | 10.0 | 9.62 | 96 | 9.61 | 96 | 0 | | 75-125 | 3 | 3.01 | 100 | | 85-115 | 02/0 |



QUALITY CONTROL RESULTS

Job Number: 212846
Client: Olin Chemical

Units:ug/L

Extraction Batch: 23725
Analytical Batch: 24107, 24150, 24245

| Analyte | QC Sample Identification | MB RL | Sample RL | Sample Result | Sample Duplicate | RPD | Spike Conc | Matrix Spike | MS % Rec | Q | Spike Limits | LCS 1 | LCS found | LCS % Rec | Q | LCS QC Limits | Date Analyzed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 212718-2 | 100U | 100 | 17682 | 18344 | 4 | 1000 | 20671 | 299 | * | 70-130 | 1000 | 987 | 99 | | 85-115 | 2/13/04 |
| Calcium | 212718-2 | 200U | 200 | 224821 | 207999 | 8 | 21000 | 237209 | 59 | * | 70-130 | 21000 | 22427 | 107 | | 85-115 | 2/16/04 |
| Chromium | 212718-2 | 10U | 10 | 4746 | 4878 | 3 | 1000 | 5991 | 125 | | 70-130 | 1000 | 1058 | 106 | | 85-115 | 2/12/04 |
| Iron | 212718-2 | 50U | 50 | 37856 | 34208 | 10 | 1000 | 37156 | 0 | * | 70-130 | 1000 | 1082 | 108 | | 85-115 | 2/16/04 |
| Magnesium | 212718-2 | 200U | 200 | 40091 | 41138 | 3 | 21000 | 64248 | 115 | | 70-130 | 21000 | 22251 | 106 | | 85-115 | 2/13/04 |
| Sodium | 212718-2 | 1000U | 1000 | 447913 | 463541 | 3 | 20200 | 513426 | 324 | * | 70-130 | 20200 | 22372 | 111 | | 85-115 | 2/13/04 |

RPD =<20

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT **STL** 02618

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Job# 213-5110 | Quote# | PO#

Client: Olin/Geomega
Address: 2995 Baseline Rd. Suite 202
Boulder, CO 80303
Phone: Fax:

Project #: C03303F colm. study
Project Manager: Dan Stone
Work ID:
Contact: Andrew Nicholson / Dan Stone

Shaded areas for office use

**Analysis Requested**
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

**Comments**
(Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
SO4, Cl
Nitrate / Nitrite
Ammonia
Specific Gravity

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | Preservative: NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-61 | GW | JW | 2.2.04 1510 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-61 | GW | JW | 2.2.04 1510 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): JASON WHITE 2/2/04 15:10 Signature: Jason White

Relinquished by: " " Date: 2/2/04 Time: 17:00 Received by: [signature] Date: 2/3/04 Time: 0950

Relinquished by: Date: Time: Received by: Date: Time:

Method of shipment: FedEx 843275738490

**STL-Westfield**

Cooler? (Y) N Samples Iced? Y N
Temp @ receipt: 2.5
Preservation pH checked:
By: [initials] Date: 2/3/04

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245-360 (12/02)

---

rpjsckl — Job Sample Receipt Checklist Report — V2

Job Number.: 212846 Location.: 57345 Check List Number.: 1 Description.:
Customer Job ID.....: Job Check List Date.: 02/03/2004 Date of the Report..: 02/03/2004
Project Number.: 20000348 Project Description.: Geomega Column Testing Project Manager.....: bcm
Customer.....: Olin Chemical Contact.: Alan Peirce

| Questions ? | (Y/N) | Comments |
|---|---|---|
| Chain-of-Custody Present?..... | Y | |
| ...If "yes", completed properly?..... | Y | |
| Custody seal on shipping container?..... | N | |
| ...If "yes", custody seal intact?..... | | |
| Custody seals on sample containers?..... | N | |
| ...If "yes", custody seal intact?..... | | |
| Samples iced?..... | Y | |
| Temperature of cooler acceptable? (4 deg C +/- 2). | Y | |
| ...Temperature at receipt _____..... | | 3.9c |
| Samples received intact (good condition)?..... | Y | |
| Volatile samples acceptable? (no headspace)..... | | |
| Is a Trip Blank required?..... | | |
| Was a Trip Blank provided?..... | | |
| Correct containers used?..... | N | Only 1 x 1L unpreserved bottle received per sample |
| Adequate sample volume provided?..... | Y | |
| Samples preserved correctly?..... | N | samples poured off and preserved accordingly |
| Samples received within holding-time?..... | Y | |
| Agreement between COC and sample labels?..... | Y | |
| Comments..... | | |
| If samples were shipped was there an air bill #?.. | Y | FedEx 843275738490 |
| Sample Custodian Signature/Date..... | | mjb 2/3/04 [signature] 2/3/04 |

Page 1

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

02/10/2004

Report Number: 212731

Dear Alan Peirce,

The analysis of your sample(s) submitted on 01/27/2004 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: 2/11/04

Total number of pages in this report: 15

# ANALYTICAL REPORT

JOB NUMBER: 212731

Prepared For:

Olin Chemical
51 Eames Street
Wilmington, MA 01887

Attention: Alan Peirce

Date: 02/10/2004

Signature

Date 2/11/04

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

PHONE: 413-572-4000
FAX..: 413-572-3707

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | **Severn Trent Laboratory (STL) Westfield** | Project #: | **212731** |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
212731-1-2

| Sample Matrices: | **Groundwater** | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| As specified in MADEP Compendium of Analytical Methods Check all that apply | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes N/A No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes N/A No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes N/A No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** [signature] **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 2/11/04



## MCP CASE NARRATIVE

**Client: Olin Chemical**

**Report Number: 212731**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 1/27/04; the samples arrived in good condition, properly preserved and on ice.

Samples were poured off into appropriate containers and preserved as needed in the laboratory.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago 2417 Bond Street, University Park, IL 60466.

**Metals**
**EPA 200.7**
A Duplicate and MS analysis was performed as the batch QC for this job.
Poor matrix spike recovery was noted for the MS result for Iron and Sodium for the batch QC sample 212745-1. The sample concentrations overwhelmed the amount of spike added. The LCS recovered within acceptable control limits.

There were no additional QA/QC deviations or issues reported for this method.

**Inorganic**
**EPA 300.0 (Nitrate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrite)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Chloride)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Sulfate)**
There were no QA/QC deviations or issues reported for this method.

**LAC 107061B (Ammonia)**
There were no QA/QC deviations or issues reported for this method.

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Alan Peirce
Olin Chemical
51 Eames Street
Wilmington, MA 01887

Geomega

02/24/2004

Report Number: 213046

Dear Alan Peirce,

The analysis of your sample(s) submitted on 02/10/2004 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your Project Manager, Rebecca C. Mason.

For questions, concerns or comments regarding our service, please do not hesitate to contact me directly. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL WESTFIELD

Technical Review: SH 2/24/04

Total number of pages in this report: 14

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | **Severn Trent Laboratory (STL) Westfield** | Project #: | **213046** |
| Project Location: | **Geomega Column Testing** | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
213046-1-2

| Sample Matrices: | **Groundwater** | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| Specify MADEP Compendium of Analytical Methods Check all that apply | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | (Yes) No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | (Yes) No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes (N/A) No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes (N/A) No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes (No[1]) |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes (N/A) No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** [signature] **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 2/24/04



## MCP CASE NARRATIVE

**Client: Olin**

**Report Number: 213046**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 2/10/04; the samples arrived in good condition, properly preserved and on ice.

**Subcontract**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago 2417 Bond Street, University Park, IL 60466.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**EPA 200.7**
At the request of the client, an abbreviated MCP analyte list was reported for this job.

There were no additional QA/QC deviations or issues reported for this method.

**EPA 300.0 (Chloride)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Sulfate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrite)**
There were no QA/QC deviations or issues reported for this method.

**LAC 107061B (ammonia)**
Sample 212509-1 analyzed on 2/18/04 recovered low and outside method control limits for the MS analysis. The MSD and LCS recovered within acceptable limits.

Sample 213046-2 analyzed on 2/11/04 recovered low for the MS analysis and high for the MDS analysis and outside method control limits. The LCS recovered within acceptable limits matrix interference is presumed.

The RPD's for both of the above samples recovered high and outside the control limit of ≤20%.

There were no additional QA/QC deviations or issues reported for this method.



SAMPLE INFORMATION
Date: 02/24/2004

Job Number.: 213046
Customer...: Olin Chemical
Attn.....: Alan Peirce

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TEST!
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 213046-1 | SD-63 | Water | 02/09/2004 | 15:15 | 02/10/2004 | 12:35 |
| 213046-2 | FM-63 | Water | 02/09/2004 | 15:15 | 02/10/2004 | 12:35 |

# LABORATORY TEST RESULTS

Job Number: 213046

Date: 02/24/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TEST! | ATTN: Alan Peirce

Customer Sample ID: SD-63
Date Sampled.....: 02/09/2004
Time Sampled.....: 15:15
Sample Matrix.....: Water

Laboratory Sample ID: 213046-1
Date Received.....: 02/10/2004
Time Received.....: 12:35

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 0.9990 | | 0.0001 | Ratio | 02/17/04 | sub |
| EPA300.0 PartA | Chloride | 86.9 | | 10 | mg/L | 02/10/04 | rwe |
| EPA300.0 PartA | Sulfate | 560 | | 20 | mg/L | 02/10/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.843 | | 0.050 | mg/L | 02/10/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 02/10/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 58.8 | | 2.0 | mg/L | 02/18/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1030 | | 50.0 | ug/L | 02/17/04 | rac |
| | Calcium (Ca) | 24500 | | 100 | ug/L | 02/17/04 | rac |
| | Chromium (Cr) | 150 | | 5.0 | ug/L | 02/17/04 | rac |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 02/17/04 | rac |
| | Magnesium (Mg) | 6510 | | 100 | ug/L | 02/17/04 | rac |
| | Sodium (Na) | 112000 | | 1000 | ug/L | 02/17/04 | rac |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NELAP FL E87912 TOX
NY DOH 10843
NH DES 253901-A
NELAP NY10843
nelac
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

# LABORATORY TEST RESULTS

Job Number: 213046

Date: 02/24/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TEST! | ATTN: Alan Peirce

Customer Sample ID: FM-63
Date Sampled.....: 02/09/2004
Time Sampled.....: 15:15
Sample Matrix.....: Water

Laboratory Sample ID: 213046-2
Date Received.....: 02/10/2004
Time Received.....: 12:35

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav.(Hydrometer 25 C) | 0.9980 | | 0.0001 | Ratio | 02/17/04 | sub |
| EPA300.0 PartA | Chloride | 63.6 | | 10 | mg/L | 02/10/04 | rwe |
| EPA300.0 PartA | Sulfate | 318 | | 20 | mg/L | 02/10/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.442 | | 0.050 | mg/L | 02/10/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 02/10/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 82.5 | J | 2.0 | mg/L | 02/18/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 142 | | 50.0 | ug/L | 02/17/04 | rac |
| | Calcium (Ca) | 44700 | | 100 | ug/L | 02/17/04 | rac |
| | Chromium (Cr) | 32 | | 5.0 | ug/L | 02/17/04 | rac |
| | Iron (Fe) | ND | U | 50.0 | ug/L | 02/17/04 | rac |
| | Magnesium (Mg) | 3870 | | 100 | ug/L | 02/17/04 | rac |
| | Sodium (Na) | 45900 | | 1000 | ug/L | 02/17/04 | rac |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NELAP FL E87912 TOX
NY DOH 10843
NH DES 253901-A
NELAP NY10843
nelac
STL Westfield
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Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

# LABORATORY CHRONICLE

Job Number: 213046

Date: 02/24/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TESTI ATTN: Alan Peirce

Lab ID: 213046-1 Client ID: SD-63

| METHOD | DESCRIPTION |
|---|---|
| EPA 200.7 | Acid Digestion,Total (ICAP) |
| LAC 107061B | Ammonia |
| EPA300.0 PartA | Ion Chromatography Analysis |
| EPA300.0 PartA | Ion Chromatography Analysis |
| EPA 200.7 | Metal Analysis (ICP) |
| | QC Metals Report, Level 2 |
| | QC Wet Chemistry Report, Level 2 |
| ASTM 1298 | Specific Gravity |

Date Recvd: 02/10/2004 Sample Date: 02/09/2004

| RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | | DILUTION |
|---|---|---|---|---|---|
| 1 | 24109 | | 02/13/2004 | 0900 | |
| 1 | 24305 | | 02/18/2004 | 0000 | 20 |
| 1 | 24103 | | 02/10/2004 | 0000 | |
| 1 | 24105 | | 02/10/2004 | 0000 | 10 |
| 1 | 24306 | 24109 | 02/17/2004 | 1407 | |
| 1 | 24513 | | 02/23/0204 | 0000 | |
| 1 | 24312 | | 02/18/2004 | 0000 | |
| 1 | 24318 | | 02/17/2004 | | |

Lab ID: 213046-2 Client ID: FM-63

| METHOD | DESCRIPTION |
|---|---|
| EPA 200.7 | Acid Digestion,Total (ICAP) |
| LAC 107061B | Ammonia |
| EPA300.0 PartA | Ion Chromatography Analysis |
| EPA300.0 PartA | Ion Chromatography Analysis |
| EPA 200.7 | Metal Analysis (ICP) |
| ASTM 1298 | Specific Gravity |

Date Recvd: 02/10/2004 Sample Date: 02/09/2004

| RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | | DILUTION |
|---|---|---|---|---|---|
| 1 | 24109 | | 02/13/2004 | 0900 | |
| 1 | 24309 | | 02/18/2004 | 0000 | 20 |
| 1 | 24103 | | 02/10/2004 | 0000 | |
| 1 | 24105 | | 02/10/2004 | 0000 | 10 |
| 1 | 24306 | 24109 | 02/17/2004 | 1427 | |
| 1 | 24318 | | 02/17/2004 | | |



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# QUALITY ASSURANCE METHODS

## REFERENCES AND NOTES

Report Date: 02/24/2004

STL WESTFIELD
DATA REPORTING QUALIFIERS AND TERMINOLOGY

A number of data qualifiers are widely used within the environmental testing industry and may be utilized in our data reports. The majority of the qualifiers have evolved from the EPA Contract Laboratory Program (CLP).

Report Comments:

All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.

Soil, sediment and sludge sample results are reported on a "dry weight" basis.

Reporting limits are adjusted for sample size used, dilutions and moisture content, if applicable.

The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert.ID# 10843.

STL-Westfield Certifications: MADEP MA014, CT DPH 0494, NH DES 253901-A, NY DOH 10843, RI DOH 57, VT DECWSD. FL NELAC E87912 (TOX)

According to 40CFR Part 136.3, pH, Total Residual Chlorine and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When these parameters are not indicated as field analyses, they were not analyzed immediately, but as soon as possible on laboratory receipt.

Analytical result(s) reported as "ND", indicates that the analyte was analyzed for but "not detected."
Analytical result(s) reported as "TNTC" indicates that the microbiological test was "too numerous to count."

Glossary of Qualifiers:

Inorganic Qualifiers (Q-column):

- U Indicates that the analyte was analyzed for but not detected.
- E Indicates an estimated value due to the presence of interference. When applied to GFAA analysis, indicates the one-point method of addition recovered between 40-85 percent.
- B Indicates an estimated result value. The result was measured between the reporting limit and the method detection limit (MDL).

Organic Qualifiers (Q-column):

- U Indicates that the compound was analyzed for but not detected.
- J Indicates an estimated result value. This qualifier is used when mass spectral data indicated the presence of a compound that meets the identification criteria and the result is less than the specified quantitation limit, but greater than the method detection limit (MDL).
- B Indicates that the compound was found in both the sample and its associated laboratory blank. Indicates possible/probable blank contamination and warns the data user to exercise caution when applying the results to this compound.
- D Indicates all compounds identified in an analysis at a secondary dilution factor.
- E Indicates that the compound in an analysis has exceeded the instrument linear calibration range.

Glossary of Terms:

Surrogates (Surrogate Standards): An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but are not normally found in environmental samples. For semi-volatiles and pesticides/Arochlors, surrogate compounds are added to every blank, sample, matrix spike, matrix spiked duplicate, matrix spike blank (LCS), and standard. These compounds are used to evaluate analytical efficiency by measuring recovery. Poor surrogate recovery may indicate a problem with the sample composition.



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD
NELAP FL E87912 TOX NY DOH 10843 NH DES 253901-A NELAP NY10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
Billerica ngeway Rd. rica, MA 01862 78) 667-1400 Fax: (978) 667-7871

## QUALITY ASSURANCE METHODS
## REFERENCES AND NOTES

Report Date: 02/24/2004

Internal Standard: An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process. For GC/MS semi-volatiles and volatiles, internal standards are added to every blank, sample, matrix spike, matrix spike duplicate, matrix spike blank (LCS), and standard. Internal standard responses outside of established limits will adversely affect the quantitation and final concentration of target compounds.

Matrix Spike (MS): An aliquot of a sample (water or soil) fortified (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for matrix interference by measuring recovery. The spiking occurs prior to sample preparation and analysis. Poor spike recovery may indicate a problem with the sample composition.

Laboratory Control Sample (LCS): An aliquot of analyte-free reagent water or sand fortifed (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method efficiency.

Blank: An artificial sample of analyte-free water or solvent, designed to monitor the introduction of contaminates into the analytical process.

Method Dectection Limit (MDL): The minimum concentration of an analyte or compound that can be measured and reported with 99% confidence that the result concentration is greater than zero.

Petroleum Hydrocarbon Comments:
---

The following comments are specific to Diesel Range Organics (DRO), by GC/FID:

Results for DRO are based on chromatographable portions of the petroleum product. The Carbon Range refers to the approximate chromatographic region covered by the specified petroleum product in straight-chain carbon units between C9-C36.

Quantitation is based on the average response factors for a series of hydrocarbons standards. The sample result from the DRO fraction is independent of the target compound assignment.

Samples yielding chromatographic patterns that do not agree with any of the method targets are reported as "unmatched".



SEVERN TRENT STL

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rpjsckl — Job Sample Receipt Checklist Report — V2

Job Number.: 213046 Location.: 57345 Check List Number.: 1 Description.:
Customer Job ID.....: Job Check List Date.: 02/10/2004 Date of the Report..: 02/10/2004
Project Number.: 20000348 Project Description.: Geomega Column Testing Project Manager.....: bcm
Customer.....: Olin Chemical Contact.: Alan Peirce

| Questions ? | (Y/N) | Comments |
|---|---|---|
| Chain-of-Custody Present?..... | Y | |
| ...If "yes", completed properly?..... | Y | |
| Custody seal on shipping container?..... | N | |
| ...If "yes", custody seal intact?..... | | |
| Custody seals on sample containers?..... | N | |
| ...If "yes", custody seal intact?..... | | |
| Samples iced?..... | Y | |
| Temperature of cooler acceptable? (4 deg C +/- 2). | Y | |
| ...Temperature at receipt_____..... | | 3.8c |
| Samples received intact (good condition)?..... | Y | |
| Volatile samples acceptable? (no headspace)..... | | |
| Is a Trip Blank required?..... | | |
| Was a Trip Blank provided?..... | | |
| Correct containers used?..... | N | Received 1x1L plastic bottle per sample |
| Adequate sample volume provided?..... | Y | |
| Samples preserved correctly?..... | N | poured off and preserved accordingly |
| Samples received within holding-time?..... | Y | |
| Agreement between COC and sample labels?..... | Y | |
| Comments..... | | |
| If samples were shipped was there an air bill #?.. | Y | FedEd 843275738516 |
| Sample Custodian Signature/Date..... | | mjb 2/10/04 |

2/10/04

QUALITY CONTROL RESULTS

Job Number: 213046
Client: Olin Chemical

Units: mg/L

| Analyte | Sample Identification | MB RL | Sample RL | Sample Result | Spike Conc. | Matrix Spike | MS % Rec | Spike Dup | MSD % Rec | RPD | Q | Spike Limits | LCS TRUE | LCS Found | LCS % Rec | Q | LCS QC Limits | Date Analyz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ammonia | 212509-1 | 0.1U | 0.1U | 0.11 | 10.0 | 2.91 | 28 | 8.54 | 84 | 98 | * | 75-125 | 10 | 9.80 | 98 | | 85-115 | 02/18/ |
| Sulfate | 212885-2 | 2U | 40U | 0.00 | 400 | 437 | 109 | 434 | 108 | 1 | | 75-125 | 60 | 64.2 | 107 | | 85-115 | 1/ |
| Chloride | 212885-2 | 1U | 20U | 533 | 200 | 703 | 85 | 699 | 83 | 1 | | 75-125 | 30 | 31.5 | 105 | | 85-115 | / |
| Nitrate | 212885-2 | 0.05U | 1U | 1.08 | 20.0 | 22.4 | 107 | 22.2 | 106 | 1 | | 75-125 | 3 | 3.19 | 106 | | 85-115 | 02/11/ |
| Nitrite | 212885-2 | 0.05U | 1U | 0.00 | 20.0 | 19.5 | 98 | 19.3 | 97 | 0 | | 75-125 | 3 | 3.09 | 103 | | 85-115 | 02/11/ |
| Ammonia | 213046-2 | 0.1U | 2U | 82.5 | 10.0 | 29.5 | 0 | 404 | 3211 | 43 | * | 75-125 | 10 | 8.58 | 86 | | 85-115 | 02/11/ |



QUALITY CONTROL RESULTS

Job Number: 213046
Client: Olin Chemical

Units:ug/L

Extraction Batch:24109
Analytical Batch:24306

| Analyte | QC Sample Identification | MB RL | Sample RL | Sample Result | Sample Duplicate | RPD | Spike Conc. | Matrix Spike | MS % Rec | Q | Spike Limits | LCS 1 | LCS found | LCS % Rec | Q | LCS QC Limits | Date Analyzed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 213037-1 | 100U | 100U | 455 | 488 | 7 | 1000 | 1398 | 94 | | 70-130 | 1000 | 990 | 99 | | 85-115 | 2/17/04 |
| Calcium | 213037-1 | 200U | 200U | 37121 | 37168 | 0 | 21000 | 58847 | 103 | | 70-130 | 21000 | 23487 | 112 | | 85-115 | 2/17/04 |
| Chromium | 213037-1 | 10U | 10U | 0.00 | 0.00 | 0 | 1000 | 946 | 95 | | 70-130 | 1000 | 960 | 96 | | 85-115 | 2/17/04 |
| Iron | 213037-1 | 50U | 50U | 1004 | 1011 | 1 | 1000 | 2103 | 110 | | 70-130 | 1000 | 1138 | 114 | | 85-115 | 2/17/04 |
| Magnesium | 213037-1 | 200U | 200U | 2268 | 2383 | 5 | 20000 | 24888 | 113 | | 70-130 | 20000 | 22994 | 115 | | 85-115 | 2/17/04 |
| Sodium | 213037-1 | 1000U | 1000U | 5294 | 5333 | 1 | 20000 | 27186 | 109 | | 70-130 | 20000 | 22071 | 110 | | 85-115 | 2/17/04 |

RPD =<20

**Severn Trent Laboratories, Inc.**
**Chain of Custody Form**

SEVERN TRENT **STL**

00540

Client: Olin/Geomega
Address: 2995 Baseline Rd. Suite 202, Boulder CO 80303
Phone: 303-443-9117 Fax: 303-938-8123

Project #: C033037F calm study
Project Manager: Dan Stone
Work ID:
Contact: Andrew Nicholson / Dan Stone

Requested Turn Around Time: 10 Business Day (Std) ___; 15 Business Day ___; Rush TAT Requested: 24 hrs ___, 48 hrs ___, 72 hrs ___, 5 Day ___; Other ___

Regulatory Classification: NPDES ___; RCRA ___; Other ___; Drinking Water ___; MCP GW1/S1 ___
Special Report Format: DEP Form(s) ___; MWRA Smart Rpt ___; MCP QA/QC Rpt ___

Sample Type Codes: WW-Wastewater, DW-Drinking water, SW-Surfacewater, LW-Labwater, GW-Groundwater, A-Air, S-Solid / Soil, SL-Sludge, O-Oil, Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Collected | Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-63 | GW | JW | 3-9-04 | 15:15 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| FM-63 | GW | JW | 3-9-04 | 15:15 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Preservative

Shaded areas for office use: Job #: C3B0[illegible] Quotes: [illegible] PO#: [illegible]

Analysis Requested: Check analysis and specify method and analytes in comments section. For example: 500-series for drinking water; 600-series for waste water; 8000-series for haz/solid waste. Use comments section to further define.

Comments (Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
SO4, Cl
Nitrate/Nitrite
Ammonia
Specific Gravity

AMS 3-10-04

Sampled by (print): JASON WHITE
Signature:
Relinquished by: " " Date: 3/9/04 Time: 15:15
Received by: Date: Time:
Relinquished by: Date: 3/9/04 Time: 17:00
Received by: Date: 3-10-04 Time: 1220
Method of shipment: Fedex 8923 7773 8316
Cooler #: N/A Samples Intact: Y/N
Temp @ Receipt: [illegible]
Preservation Checked: [illegible]
By: [illegible] Date: [illegible]

STL-Westfield

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Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy

SEVERN TRENT **STL**


STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com


Steve Morrow
Olin Chemical
1186 Lower River Road
Charleston, TN 37310-0248

Geomega

03/09/2004

Report Number: 213354

Dear Steve Morrow,

The analysis of your sample(s) submitted on 02/24/2004 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your Project Manager, Rebecca C. Mason.

For questions, concerns or comments regarding our service, please do not hesitate to contact me directly. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL WESTFIELD

Technical Review: SCH 3/9/04

Total number of pages in this report: 21

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | **Severn Trent Laboratory (STL) Westfield** | Project #: | **213354** |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
213354-1-2

Sample Matrices: **Groundwater** Soil/Sediment Drinking Water Other:

| MCP SW-846 Methods Used | | | | | | |
|---|---|---|---|---|---|---|
| | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

Analytical Methods designated in the MCP Compendium of Analytical Methods (CAM) that are required to be reported (check all that apply):
1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | | | |
|---|---|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | ✓Yes | | No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | ✓Yes | | No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes | ✓N/A | No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes | ✓N/A | No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | | | |
|---|---|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | ✓Yes | | No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes | N/A | ✓No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** [signature] **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 3/9/04



## MCP CASE NARRATIVE

**Client: Olin Chemical**

**Report Number: 213354**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 2/24/04; the samples arrived in good condition, properly preserved and on ice.

**Subcontracted**
The ASTM 1298 Hydrometer analysis was performed at STL-Chicago 2417 Bond Street, University Park, IL 60466.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**EPA 200.7**
At the request of the client, an abbreviated MCP analyte list was reported for this job.

There were no additional QA/QC deviations or issues reported for this method.

**EPA 300.0 (Chloride)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Sulfate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrite)**
There were no QA/QC deviations or issues reported for this method.

**LAC 107061B (ammonia)**
There were no QA/QC deviations or issues reported for this method.

## SAMPLE INFORMATION
Date: 03/09/2004

Job Number.: 213354
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 213354-1 | SD-67 | Water | 02/23/2004 | 14:30 | 02/24/2004 | 10:50 |
| 213354-2 | FM-67 | Water | 02/23/2004 | 14:30 | 02/24/2004 | 10:50 |



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## LABORATORY TEST RESULTS
Job Number: 213354
Date: 03/09/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TESTI | ATTN: Steve Morrow

Customer Sample ID: SD-67
Date Sampled.....: 02/23/2004
Time Sampled.....: 14:30
Sample Matrix.....: Water

Laboratory Sample ID: 213354-1
Date Received.....: 02/24/2004
Time Received.....: 10:50

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 70.2 | | 10 | mg/L | 02/24/04 | rwe |
| EPA300.0 PartA | Sulfate | 389 | | 20 | mg/L | 02/24/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 1.31 | | 0.050 | mg/L | 02/24/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 02/24/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 3.47 | | 0.10 | mg/L | 02/27/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 18000 | | 100 | ug/L | 03/02/04 | bpg |
| | Iron (Fe) | ND | U | 50 | ug/L | 03/02/04 | bpg |
| | Magnesium (Mg) | 4400 | | 100 | ug/L | 03/02/04 | bpg |
| | Sodium (Na) | 83000 | | 1000 | ug/L | 03/02/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 810 | | 50 | ug/L | 03/02/04 | rac |
| | Chromium (Cr) | 110 | | 5.0 | ug/L | 03/02/04 | rac |

* In Description = Dry Wgt.



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# LABORATORY TEST RESULTS

Job Number: 213354

Date: 03/09/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TEST! ATTN: Steve Morrow

Customer Sample ID: FM-67
Date Sampled.....: 02/23/2004
Time Sampled.....: 14:30
Sample Matrix.....: Water

Laboratory Sample ID: 213354-2
Date Received.....: 02/24/2004
Time Received.....: 10:50

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 63.8 | | 10 | mg/L | 02/24/04 | rwe |
| EPA300.0 PartA | Sulfate | 273 | | 20 | mg/L | 02/24/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 0.999 | | 0.050 | mg/L | 02/24/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 02/24/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 0.46 | | 0.10 | mg/L | 02/27/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 45000 | | 100 | ug/L | 03/02/04 | bpg |
| | Iron (Fe) | ND | U | 50 | ug/L | 03/02/04 | bpg |
| | Magnesium (Mg) | 3700 | | 100 | ug/L | 03/02/04 | bpg |
| | Sodium (Na) | 51000 | | 1000 | ug/L | 03/02/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 120 | | 50 | ug/L | 03/02/04 | rac |
| | Chromium (Cr) | 19 | | 5.0 | ug/L | 03/02/04 | rac |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD
NELAP FL E87912 TOX NY DOH 10843 NH DES 253901-A NELAP NY10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871

# LABORATORY CHRONICLE

Job Number: 213354

Date: 03/09/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TEST! ATTN: Steve Morrow

Lab ID: 213354-1 Client ID: SD-67 Date Recvd: 02/24/2004 Sample Date: 02/23/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | | DILUTION |
|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion,Total (ICAP) | 1 | 24699 | | 02/27/2004 | 0900 | |
| LAC 107061B | Ammonia | 1 | 24737 | | 02/27/2004 | | |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 24607 | | 02/24/2004 | 0000 | |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 24608 | | 02/24/2004 | 0000 | 10 |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 24859 | 24699 | 03/02/2004 | 1314 | |
| EPA 200.7 | Metal Analysis Trace (ICP) | 1 | 24837 | 24699 | 03/02/2004 | 1336 | |
| | QC Metals Report, Level 2 | 1 | 25038 | | 03/09/2004 | 1400 | |
| | QC Wet Chemistry Report, Level 2 | 1 | 24741 | | 02/27/2004 | 0000 | |

Lab ID: 213354-2 Client ID: FM-67 Date Recvd: 02/24/2004 Sample Date: 02/23/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | | DILUTION |
|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion,Total (ICAP) | 1 | 24699 | | 02/27/2004 | 0900 | |
| LAC 107061B | Ammonia | 1 | 24737 | | 02/27/2004 | | |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 24607 | | 02/24/2004 | 0000 | |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 24608 | | 02/24/2004 | 0000 | 10 |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 24859 | 24699 | 03/02/2004 | 1356 | |
| EPA 200.7 | Metal Analysis Trace (ICP) | 1 | 24837 | 24699 | 03/02/2004 | 1343 | |



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Billerica ngeway Rd. erica, MA 01862 (978) 667-1400 Fax: (978) 667-7871

STL WESTFIELD
DATA REPORTING QUALIFIERS AND TERMINOLOGY

A number of data qualifiers are widely used within the environmental testing industry and may be utilized in our data reports. The majority of the qualifiers have evolved from the EPA Contract Laboratory Program (CLP).

Report Comments:

All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.

Soil, sediment and sludge sample results are reported on a "dry weight" basis.

Reporting limits are adjusted for sample size used, dilutions and moisture content, if applicable.

The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert.ID# 10843.

STL-Westfield Certifications: MADEP MA014, CT DPH 0494, NH DES 253901-A, NY DOH 10843, RI DOH 57, VT DECWSD. FL NELAC E87912 (TOX)
According to 40CFR Part 136.3, pH, Total Residual Chlorine and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When these parameters are not indicated as field analyses, they were not analyzed immediately, but as soon as possible on laboratory receipt.

Analytical result(s) reported as "ND", indicates that the analyte was analyzed for but "not detected."
Analytical result(s) reported as "TNTC" indicates that the microbiological test was "too numerous to count."

Glossary of Qualifiers:

Inorganic Qualifiers (Q-column):
U Indicates that the analyte was analyzed for but not detected.
E Indicates an estimated value due to the presence of interference. When applied to GFAA analysis, indicates the one-point method of addition recovered between 40-85 percent.
B Indicates an estimated result value. The result was measured between the reporting limit and the method detection limit (MDL).

Organic Qualifiers (Q-column):
U Indicates that the compound was analyzed for but not detected.
J Indicates an estimated result value. This qualifier is used when mass spectral data indicated the presence of a compound that meets the identification criteria and the result is less than the specified quantitation limit, but greater than the method detection limit (MDL).
B Indicates that the compound was found in both the sample and its associated laboratory blank. Indicates possible/probable blank contamination and warns the data user to exercise caution when applying the results to this compound.
D Indicates all compounds identified in an analysis at a secondary dilution factor.
E Indicates that the compound in an analysis has exceeded the instrument linear calibration range.

Glossary of Terms:

Surrogates (Surrogate Standards): An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but are not normally found in environmental samples. For semi-volatiles and pesticides/Arochlors, surrogate compounds are added to every blank, sample, matrix spike, matrix spiked duplicate, matrix spike blank (LCS), and standard. These compounds are used to evaluate analytical efficiency by measuring recovery. Poor surrogate recovery may indicate a problem with the sample composition.



SEVERN TRENT STL
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STL Westfield
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149 Rangeway Rd.
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Internal Standard: An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process. For GC/MS semi-volatiles and volatiles, internal standards are added to every blank, sample, matrix spike, matrix spike duplicate, matrix spike blank (LCS), and standard. Internal standard responses outside of established limits will adversely affect the quantitation and final concentration of target compounds.

Matrix Spike (MS): An aliquot of a sample (water or soil) fortified (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for matrix interference by measuring recovery. The spiking occurs prior to sample preparation and analysis. Poor spike recovery may indicate a problem with the sample composition.

Laboratory Control Sample (LCS): An aliquot of analyte-free reagent water or sand fortifed (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method efficiency.

Blank: An artificial sample of analyte-free water or solvent, designed to monitor the introduction of contaminates into the analytical process.

Method Dectection Limit (MDL): The minimum concentration of an analyte or compound that can be measured and reported with 99% confidence that the result concentration is greater than zero.

Petroleum Hydrocarbon Comments:

The following comments are specific to Diesel Range Organics (DRO), by GC/FID:

Results for DRO are based on chromatographable portions of the petroleum product. The Carbon Range refers to the approximate chromatographic region covered by the specified petroleum product in straight-chain carbon units between C9-C36.

Quantitation is based on the average response factors for a series of hydrocarbons standards. The sample result from the DRO fraction is independent of the target compound assignment.

Samples yielding chromatographic patterns that do not agree with any of the method targets are reported as "unmatched".



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149 Rangeway Rd.
N. Billerica, MA 01862
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Fax: (978) 667-7871

QUALITY CONTROL RESULTS

Job Number: 213354
Client: Olin Chemical

Units: mg/L

| Analyte | Sample Identification | MB RL | Sample RL | Sample Result | Spike Conc. | Matrix Spike | MS % Rec | Spike Dup | MSD % Rec | RPD | Q | Spike Limits | LCS TRUE | LCS Found | LCS % Rec | Q | LCS QC Limits | Date Analyz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ammonia | 213114-2 | 0.1U | 0.1U | 0.00 | 10.0 | 10.1 | 101 | 8.27 | 83 | 19 | | 75-125 | 10 | 10.3 | 103 | | 85-115 | 02/27 |
| Sulfate | 213215-1 | 2U | 100U | 0.00 | 1000 | 1042 | 104 | 1051 | 105 | 1 | | 75-125 | 60 | 60.9 | 101 | | 85-115 | '24 |
| Chloride | 213215-1 | 1U | 50U | 1609 | 500 | 2045 | 87 | 2060 | 90 | 1 | | 75-125 | 30 | 30.9 | 103 | | 85-11 | 4 |
| Nitrate | 213215-1 | 0.05U | 2.5U | 2.70 | 50.0 | 52.0 | 99 | 52.0 | 99 | 0 | | 75-125 | 3 | 2.95 | 98 | | 85-115 | 24 |
| Nitrite | 213215-1 | 0.05U | 2.5U | 0.00 | 50.00 | 50.1 | 100 | 50.7 | 101 | 1 | | 75-125 | 3 | 3.02 | 101 | | 85-115 | 02/24 |



QUALITY CONTROL RESULTS

Job Number: 213354
Client: Olin Chemical

Units:

Extraction Batch:24699
Analytical Batch:24837,24859

| Analyte | QC Sample Identification | MB RL | Sample RL | Sample Result | Sample Duplicate | RPD | Spike Conc. | Matrix Spike | MS % Rec | Q | Spike Limits | LCS TRUE | LCS found | LCS % Rec | Q | LCS QC Limits | Date Analyze |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 213299-1 | 50U | 50U | 911 | 1003 | 10 | 1000 | 2011 | 110 | | 70-130 | 1000 | 977 | 98 | | 85-115 | 03/02/0 |
| Chromium | 213299-1 | 5U | 5U | 0 | 0 | 0 | 1000 | 991 | 99 | | 70-130 | 1000 | 977 | 98 | | 85-115 | 03/02/0 |
| Calcium | 213299-1 | 100U | 100U | 18582 | 19640 | 6 | 20000 | 40475 | 109 | | 70-130 | 20000 | 22003 | 110 | | 85-115 | 03/02/0 |
| Iron | 213299-1 | 50U | 50U | 1080 | 1149 | 6 | 1000 | 2210 | 113 | | 70-130 | 1000 | 1147 | 115 | | 85-115 | 03/02/0 |
| Magnesium | 213299-1 | 100U | 100U | 6033 | 6331 | 5 | 20000 | 27399 | 107 | | 70-130 | 20000 | 21487 | 107 | | 85-115 | 03/02/0 |
| Sodium | 213299-1 | 1000U | 1000U | 50225 | 53170 | 6 | 21760 | 73358 | 106 | | 70-130 | 21760 | 23423 | 108 | | 85-115 | 03/02/0 |

RPD =≤20

# Subcontracted Data

SEVERN TRENT STL

STL Chicago
2417 Bond Street
University Park, IL 60466

Tel: 708 534 5200 Fax: 708 534 5211
www.stl-inc.com

## SEVERN TRENT LABORATORIES
## ANALYTICAL REPORT

JOB NUMBER: 224555

Prepared For:

Severn Trent Laboratories
Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

Project: STL Westfield

Attention: Becky Mason

Date: 03/02/2004

Bonnie Stadelmann
Signature

03/02/04
Date

Name: Bonnie M. Stadelmann

Title: Project Manager

E-Mail: bstadelmann@stl-inc.com

STL Chicago
2417 Bond Street
University Park, IL 60466

PHONE: (708) 534-5200
FAX..: (708) 534-5211

This Report Contains ( 8 ) Pages

STL Chicago is part of Severn Trent Laboratories, Inc.

# LABORATORY TEST RESULTS

Job Number: 224555

Date:03/02/2004

CUSTOMER: Severn Trent Laboratories PROJECT: WESTFIELD 213354 ATTN: Becky Mason

Customer Sample ID: 213354-1
Date Sampled.....: 02/23/2004
Time Sampled.....: 14:30
Sample Matrix.....: Water

Laboratory Sample ID: 224555-1
Date Received.....: 02/25/2004
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 0.9970 | | | | 0.0001 | 1 | | 110469 | | 03/02/04 1105 | cls |

* In Description = Dry Wgt.



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# SAMPLE RECEIPT LOG

Job Number.: 224555
Customer...: Severn Trent Laboratories
Attn.....: Becky Mason

Date: 03/02/2004

Project Number.....: 20000230
Customer Project ID....: WESTFIELD 213354
Project Description....: STL Westfield

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 224555-1 | 213354-1 | Water | 02/23/2004 | 14:30 | 02/25/2004 | 10:00 |
| 224555-2 | 213354-2 | Water | 02/23/2004 | 14:30 | 02/25/2004 | 10:00 |

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Job Number: 224555

# L A B O R A T O R Y  T E S T  R E S U L T S

Date:03/02/2004

CUSTOMER: Severn Trent Laboratories | PROJECT: WESTFIELD 213354 | ATTN: Becky Mason

Customer Sample ID: 213354-2
Date Sampled.....: 02/23/2004
Time Sampled.....: 14:30
Sample Matrix.....: Water

Laboratory Sample ID: 224555-2
Date Received.....: 02/25/2004
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | IQ FLAGS | MDL | RL | DILUTION | UNITS | BATCH BY | DATE/TIME | RECOR |
|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 0.9990 | | | 0.0001 | 1 | | 110469 | 03/02/04 1110 | cls |

* In Description = Dry Wgt.



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# L A B O R A T O R Y  C H R O N I C L E

Job Number: 224555

Date: 03/02/2004

CUSTOMER: Severn Trent Laboratories | PROJECT: WESTFIELD 213354 | ATTN: Becky Mason

Lab ID: 224555-1 Client ID: 213354-1 Date Recvd: 02/25/2004 Sample Date: 02/23/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT | #(S) | DATE/TIME ANALYZED | DILUTION |
|---|---|---|---|---|---|---|---|
| PKG INO (WC) | PKG INO (WET CHEMISTRY) | 1 | | | | | |
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C) | 1 | 110469 | 110469 | | 03/02/2004 1105 | |

Lab ID: 224555-2 Client ID: 213354-2 Date Recvd: 02/25/2004 Sample Date: 02/23/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT | #(S) | DATE/TIME ANALYZED | DILUTION |
|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C) | 1 | 110469 | 110469 | | 03/02/2004 1110 | |

REPORT COMMENTS

1) All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.
2) Soil, sediment and sludge sample results are reported on a "dry weight" basis except when analyzed for landfill disposal or incineration parameters. All other solid matrix samples are reported on an "as received" basis unless noted differently.
3) Reporting limits are adjusted for sample size used, dilutions and moisture content if applicable.
4) The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert. ID# 100201
5) According to 40CFR Part 136.3, pH, Chlorine Residual and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When those parameters are not indicated as field (e.g. pH Field) they were not analyzed immediately, but as soon as possible on laboratory receipt.

Glossary of flags, qualifiers and abbreviations (any number of which may appear in the report)

Inorganic Qualifiers (Q-Column)

U Analyte was not detected at or above the stated limit.
< Not detected at or above the reporting limit.
J Result is less than the RL, but greater than or equal to the method detection limit.
B Result is less than the CRDL/RL, but greater than or equal to the IDL/MDL.
S Result was determined by the Method of Standard Additions.
F AFCEE: Result is less than the RL, but greater than or equal to the method detection limit.

Inorganic Flags (Flag Column)

- ICV,CCV,ICB,CCB,ISA,ISB,CRI,CRA,MRL: Instrument related QC exceed the upper or lower control limits.
* LCS, LCD, MD: Batch QC exceeds the upper or lower control limits.
+ MSA correlation coefficient is less than 0.995.
4 MS, MSD: The analyte present in the original sample is 4 times greater than the matrix spike concentration; therefore, control limits are not applicable.
E SD: Serial dilution exceeds the control limits.
H MB, EB1, EB2, EB3: Batch QC is greater than reporting limit or had a negative instrument reading lower than the absolute value of the reporting limit.
N MS, MSD: Spike recovery exceeds the upper or lower control limits.
W AS(GFAA) Post-digestion spike was outside 85-115% control limits.

Organic Qualifiers (Q - Column)

U Analyte was not detected at or above the stated limit.
ND Compound not detected.
J Result is an estimated value below the reporting limit or a tentatively identified compound (TIC).
Q Result was qualitatively confirmed, but not quantified.
C Pesticide identification was confirmed by GC/MS.
Y The chromatographic response resembles a typical fuel pattern.
Z The chromatographic response does not resemble a typical fuel pattern.
E Result exceeded calibration range, secondary dilution required.
F AFCEE:Result is an estimated value below the reporting limit or a tentatively identified compound (TIC)

Organic Flags (Flags Column)

B MB: Batch QC is greater than reporting limit.
* LCS, LCD, ELC, ELD, CV, MS, MSD, Surrogate: Batch QC exceeds the upper or lower control limits.
- EB1, EB2, EB3, MLE: Batch QC is greater than reporting Limit
A Concentration exceeds the instrument calibration range
a Concentration is below the method Reporting Limit (RL)
B Compound was found in the blank and sample.
D Surrogate or matrix spike recoveries were not obtained because the extract was diluted for analysis; also compounds analyzed at a dilution will be flagged with a D.
H Alternate peak selection upon analytical review
I Indicates the presence of an interfence, recovery is not calculated.
M Manually integrated compound.
P The lower of the two values is reported when the % difference between the results of two GC columns is





greater than 25%.

Abbreviations

| | |
|---|---|
| AS | Post Digestion Spike (GFAA Samples - See Note 1 below) |
| Batch | Designation given to identify a specific extraction, digestion, preparation set, or analysis set |
| CAP | Capillary Column CCB Continuing Calibration Blank |
| CCV | Continuing Calibration Verification |
| CF | Confirmation analysis of original |
| C1 | Confirmation analysis of A1 or D1 |
| C2 | Confirmation analysis of A2 or D2 |
| C3 | Confirmation analysis of A3 or D3 |
| CRA | Low Level Standard Check - GFAA; Mercury |
| CRI | Low Level Standard Check - ICP |
| CV | Calilbration Verification Standard |
| Dil Fac | Dilution Factor - Secondary dilution analysis |
| D1 | Dilution 1 |
| D2 | Dilution 2 |
| D3 | Dilution 3 |
| DLFac | Detection Limit Factor |
| DSH | Distilled Standard - High Level |
| DSL | Distilled Standard - Low Level |
| DSM | Distilled Standard - Medium Level |
| EB1 | Extraction Blank 1 |
| EB2 | Extraction Blank 2 |
| EB3 | DI Blank |
| ELC | Method Extracted LCS |
| ELD | Method Extracted LCD |
| ICAL | Initial calibration |
| ICB | Initial Calibration Blank |
| ICV | Initial Calibration Verification |
| IDL | Instrument Detection Limit |
| ISA | Interference Check Sample A - ICAP |
| ISB | Interference Check Sample B - ICAP |
| Job No. | The first six digits of the sample ID which refers to a specific client, project and sample group Lab ID An 8 number unique laboratory identification |
| LCD | Laboratory Control Standard Duplicate |
| LCS | Laboratory Control Standard with reagent grade water or a matrix free from the analyte of interest |
| MB | Method Blank or (PB) Preparation Blank |
| MD | Method Duplicate |
| MDL | Method Detection Limit |
| MLE | Medium Level Extraction Blank |
| MRL | Method Reporting Limit Standard |
| MSA | Method of Standard Additions |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ND | Not Detected |
| PREPF | Preparation factor used by the Laboratory's Information Management System (LIMS) |
| PDS | Post Digestion Spike (ICAP) |
| RA | Re-analysis of original |
| A1 | Re-analysis of D1 |
| A2 | Re-analysis of D2 |
| A3 | Re-analysis of D3 |
| RD | Re-extraction of dilution |
| RE | Re-extraction of original |
| RC | Re-extraction Confirmation |
| RL | Reporting Limit |
| RPD | Relative Percent Difference of duplicate (unrounded) analyses |
| RRF | Relative Response Factor |
| RT | Retention Time |

## QUALITY ASSURANCE METHODS
## REFERENCES AND NOTES

Report Date: 03/02/2004

| | |
|---|---|
| RTW | Retention Time Window Sample ID A 9 digit number unique for each sample, the first six digits are referred as the job number |
| SCB | Seeded Control Blank |
| SD | Serial Dilution (Calculated when sample concentration exceeds 50 times the MDL) |
| UCB | Unseeded Control Blank |
| SSV | Second Source Verification Standard |
| SLCS | Solid Laboratory Control Standard(LCS) |
| PHC | pH Calibration Check LCSP pH Laboratory Control Sample |
| LCDP | pH Laboratory Control Sample Duplicate |
| MDPH | pH Sample Duplicate |
| MDFP | Flashpoint Sample Duplicate |
| LCFP | Flashpoint LCS |
| G1 | Gelex Check Standard Range 0-1 |
| G2 | Gelex Check Standard Range 1-10 |
| G3 | Gelex Check Standard Range 10-100 |
| G4 | Gelex Check Standard Range 100-1000 |

Note 1: The Post Spike Designation on Batch QC for GFAA is designated with an "S" added to the current abbreviation used. EX. LCS S=LCS Post Spike (GFAA); MSS=MS Post Spike (GFAA)
Note 2: The MD calculates an absolute difference (A) When the sample concentration is less than 5 times the reporting limit. The control limit is represented as +/- the RL.



rpjsckl — Job Sample Receipt Checklist Report — V2

Job Number.: 213354 Location.: 57345 Check List Number.: 1 Description.:
Customer Job ID.....: Job Check List Date.: 02/24/2004 Date of the Report..: 02/24/2004
Project Number.: 20000348 Project Description.: Geomega Column Testing Project Manager.....: bcm
Customer.....: Olin Chemical Contact.: Alan Peirce

| Questions ? | (Y/N) | Comments |
|---|---|---|
| Chain-of-Custody Present?..... | Y | |
| ...If "yes", completed properly?..... | Y | |
| Custody seal on shipping container?..... | N | |
| ...If "yes", custody seal intact?..... | | |
| Custody seals on sample containers?..... | N | |
| ...If "yes", custody seal intact?..... | | |
| Samples iced?..... | Y | |
| Temperature of cooler acceptable? (4 deg C +/- 2). | N | |
| ...Temperature at receipt_____..... | | 8.2c |
| Samples received intact (good condition)?..... | Y | |
| Volatile samples acceptable? (no headspace)..... | | |
| Is a Trip Blank required?..... | | |
| Was a Trip Blank provided?..... | | |
| Correct containers used?..... | N | Only 1x1L container received per sample |
| Adequate sample volume provided?..... | N | Only about 500mL's received for sample 2 |
| Samples preserved correctly?..... | N | Samples preserved at lab |
| Samples received within holding-time?..... | Y | |
| Agreement between COC and sample labels?..... | Y | |
| Comments..... | | |
| If samples were shipped was there an air bill #?.. | Y | FedEx 843275738571 |
| Sample Custodian Signature/Date..... | | mjb 2/24/04 2/24/04 |

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Colorimetric

Steve Morrow
Olin Chemical
1186 Lower River road
Charleston, TN 37310-0248

March 22, 2004

Report Number: 213665

**REVISED**

Dear Steve Morrow,

The revised report for the above referenced project is now complete. This revision replaces the original unsigned report.

If you should have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL Westfield

Technical Review: 3/22/04

Total number of pages in this report: 12

Leaders in Environmental Testing

Severn Trent Lab... ...s, Inc.

## Severn Trent Laboratories, Inc.
### Chain of Custody Form

SEVERN TRENT STL

00541

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: JASON WHITE
Address: 2995 Baseline Rd. Suite 202
Boulder, CO 80303
Phone: 303-443-9117 Fax: 303-938-8123

Project #: C03303F colm.study
Project Manager: Dan Stone
Work ID:
Contact: Andrew Nicholson / Dan Stone

Requested Turn Around Time
10 Business Day (Std) ____ Rush TAT Requested:
15 Business Day ____ 24 hrs ____ 72 hrs ____
Other ____ 48 hrs ____ 5 Day ____

Regulatory Classification / Special Report Format
NPDES ____ Drinking Water ____ DEP Form(s) ____
RCRA ____ MCP GW1/S1 ____ MWRA Smart Rpt ____
Other ____ MCP QA/QC Rpt ____

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
W-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
SO4, Cl
Nitrate / Nitrite
Ammonia
Specific Gravity

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-67 | GW | JW | 2.23.04 14:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | ✓ | |
| FM-67 | GW | JW | 2.23.04 14:30 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | ✓ | |

2/24/04

Sampled by (print): JASON WHITE 2/23/04 14:30 Signature: Jason White

Relinquished by: " " Date: 2/23/04 Time: 17:00 Received by: [illegible] Date: 2/24/04 Time: 1050

Relinquished by: Date: Time: Received by: Date: Time:

Method of shipment: STL-Westfield

Cooler Rec'd N. Samples Intact
Temp on receipt
Preservation checked
Bottles in good condition

Page ____ of ____

White = Lab file Yellow = Report copy Pink = Customer copy

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | **Severn Trent Laboratory (STL) Westfield** | Project #: | **213665** |
| Project Location: | | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
213665-1

| Sample Matrices: | **Groundwater** | Soil/Sediment | Drinking Water | Other: | | |
|---|---|---|---|---|---|---|
| MCP SW-846 Methods Used | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| Check all MADEP Compendium Analytical Methods that apply | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | Yes No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | Yes No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes N/A No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes N/A No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes No[1] |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes N/A No[1] |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** [signature] **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 3/22/04



**MCP CASE NARRATIVE**

**Client: Olin Chemical**

**Report Number: 213665**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 3/9/04; the samples arrived in good condition, properly preserved and on ice.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**EPA 200.7**
Aluminum recovered high and outside of method control limits for the matrix spike analysis. The LCS recovered within acceptable limits.

Poor matrix spike recovery was noted for the MS result for Sodium. The sample concentration overwhelmed the amount of spike added. The LCS recovered within acceptable control limits.

There were no additional QA/QC deviations or issues reported for this method.

**EPA 300.0 (Chloride)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Sulfate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrite)**
There were no QA/QC deviations or issues reported for this method.

**LAC 107061B (ammonia)**
The sample used for the batch QC (213761-1) recovered low for both the Matrix spike (40%) and matrix spike duplicate (2%) analyses. The LCS recovered within acceptable limits, matrix interference is presumed.

The RPD for this sample recovered high (183%) and outside the method control limit of 20%.

There were no additional QA/QC deviations or issues reported for this method.



## SAMPLE INFORMATION
Date: 03/22/2004

Job Number.: 213665
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 213665-1 | FM-71 | Water | 03/08/2004 | 14:00 | 03/09/2004 | 09:45 |

# LABORATORY TEST RESULTS

Job Number: 213665 Date: 03/22/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TESTI ATTN: Steve Morrow

Customer Sample ID: FM-71
Date Sampled.....: 03/08/2004
Time Sampled.....: 14:00
Sample Matrix.....: Water

Laboratory Sample ID: 213665-1
Date Received.....: 03/09/2004
Time Received.....: 09:45

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 64 | | 10 | mg/L | 03/09/04 | rwe |
| EPA300.0 PartA | Sulfate | 140 | | 20 | mg/L | 03/09/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 1.9 | | 0.50 | mg/L | 03/09/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 03/09/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 60 | | 1.0 | mg/L | 03/15/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | ND | U | 100 | ug/L | 03/16/04 | bpg |
| | Calcium (Ca) | 30000 | | 200 | ug/L | 03/15/04 | bpg |
| | Iron (Fe) | 220 | | 100 | ug/L | 03/15/04 | bpg |
| | Magnesium (Mg) | 2700 | | 200 | ug/L | 03/16/04 | bpg |
| | Sodium (Na) | 50000 | | 2000 | ug/L | 03/15/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 57 | | 10 | ug/L | 03/15/04 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD
NELAP FL E87912 TOX NY DOH 10843 NH DES 253901-A NELAP NY10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
STL Billerica 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871

# LABORATORY CHRONICLE

Job Number: 213665 Date: 03/22/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TESTI ATTN: Steve Morrow

Lab ID: 213665-1 Client ID: FM-71 Date Recvd: 03/09/2004 Sample Date: 03/08/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | | DILUTION |
|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion,Total (ICAP) | 1 | 25071 | | 03/10/2004 | 1000 | |
| LAC 107061B | Ammonia | 1 | 25285 | | 03/15/2004 | 0000 | 10 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 25173 | | 03/09/2004 | 0000 | 10 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 25161 | | 03/09/2004 | 1849 | 10 |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 25303 | 25071 | 03/15/2004 | 1210 | |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 25435 | 25071 | 03/16/2004 | 1227 | |
| EPA 200.7 | Metal Analysis Trace (ICP) | 1 | 25325 | 25071 | 03/15/2004 | 1255 | |
| | QC Metals Report, Level 2 | 1 | 25479 | | 03/17/2004 | 1601 | |
| | QC Wet Chemistry Report, Level 2 | 1 | 25290 | | 03/15/2004 | | |



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LABORATORY CERTIFICATIONS:

MADEP MA014, NY NELAC 10843, FL NELAC E87912 (TOX), CT DPH 0494, NY DOH 10843, NH DES 253901-A, VT DECWSD, RI DOH 57.

LOCATION:

STL Westfield: 53 Southampton Rd, Westfield, MA 01085. Phone: (413) 572-4000 Fax: (413) 572-3707

STL Service Center: 149 Rangeway Rd. N. Billerica, MA 01862. Phone: (978) 667-1400 Fax: (978) 667-7871

DATA REPORTING QUALIFIERS AND TERMINOLOGY:

A number of data qualifiers are widely used within the environmental testing industry and may be utilized in our data reports. The majority of the qualifiers have evolved from the EPA Contract Laboratory Program (CLP).

REPORT COMMENTS:

All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.

Soil, sediment and sludge sample results are reported on a "dry weight" basis.

Reporting limits are adjusted for sample size used, dilutions and moisture content, if applicable.

The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert.ID# 10843.

According to 40CFR Part 136.3, pH, Total Residual Chlorine and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When these parameters are not indicated as field analyses, they were not analyzed immediately, but as soon as possible on laboratory receipt.

Analytical result(s) reported as "ND", indicates that the analyte was analyzed for but "Not Detected."
Analytical result(s) reported as "TNTC" indicates that the microbiological test was "Too Numerous To Count."

GLOSSARY OF QUALIFIERS:

Inorganic Qualifiers (Q-column):
U Indicates that the analyte was analyzed for but not detected.
E Indicates an estimated value due to the presence of interference. When applied to GFAA analysis, indicates the one-point method of addition recovered between 40-85 percent.
B Indicates an estimated result value. The result was measured between the reporting limit and the method detection limit (MDL).
H Indicates the compound/element was found in both the sample and its associated laboratory blank. Indicates possible/probable blank contamination.

Organic Qualifiers (Q-column):
U Indicates that the compound was analyzed for but not detected.
J Indicates an estimated result value. This qualifier is used when mass spectral data indicated the presence of a compound that meets the identification criteria and the result is less than the specified quantitation limit, but greater than the method detection limit (MDL).
B Indicates that the compound was found in both the sample and its associated laboratory blank. Indicates possible/probable blank contamination and warns the data user to exercise caution when applying the results to this compound.
D Indicates all compounds identified in an analysis at a secondary dilution factor.
E Indicates that the compound in an analysis has exceeded the instrument linear calibration range.





GLOSSARY OF TERMS:

Surrogates (Surrogate Standards): An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but are not normally found in environmental samples. For semi-volatiles and pesticides/Arochlors, surrogate compounds are added to every blank, sample, matrix spike, matrix spiked duplicate, matrix spike blank (LCS), and standard. These compounds are used to evaluate analytical efficiency by measuring recovery. Poor surrogate recovery may indicate a problem with the sample composition.

Internal Standard: An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process. For GC/MS semi-volatiles and volatiles, internal standards are added to every blank, sample, matrix spike, matrix spike duplicate, matrix spike blank (LCS), and standard. Internal standard responses outside of established limits will adversely affect the quantitation and final concentration of target compounds.

Matrix Spike (MS): An aliquot of a sample (water or soil) fortified (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for matrix interference by measuring recovery. The spiking occurs prior to sample preparation and analysis. Poor spike recovery may indicate a problem with the sample composition.

Laboratory Control Sample (LCS): An aliquot of analyte-free reagent water or sand fortifed (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method efficiency.

Blank: An artificial sample of analyte-free water or solvent, designed to monitor the introduction of contaminates into the analytical process.

Method Dectection Limit (MDL): The minimum concentration of an analyte or compound that can be measured and reported with 99% confidence that the result concentration is greater than zero.

Petroleum Hydrocarbon Comments:

The following comments are specific to Diesel Range Organics (DRO), by GC/FID:

Results for DRO are based on chromatographable portions of the petroleum product. The Carbon Range refers to the approximate chromatographic region covered by the specified petroleum product in straight-chain carbon units between C9-C36.

Quantitation is based on the average response factors for a series of hydrocarbons standards. The sample result from the DRO fraction is independent of the target compound assignment.

Samples yielding chromatographic patterns that do not agree with any of the method targets are reported as "unmatched".

QUALITY CONTROL RESULTS

Job Number: 213665
Client: Olin Chemical

Units: mg/L

| Analyte | Sample Identification | MB RL | Sample RL | Sample Result | Sample Duplicate | RPD | Spike Conc. | Matrix Spike | MS % Rec | Q | Spike Limits | LCS TRUE | LCS Found | LCS % Rec | Q | LCS QC Limits | Date Analyzed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | 213665-1 | 2U | 20U | 139 | 132 | 6 | 200 | 348 | 104 | | 75-125 | 60 | 61.1 | 102 | | 85-115 | 03/09/04 |
| Chloride | 213665-1 | 1U | 10U | 64.4 | 61.3 | 5 | 100 | 167 | 103 | | 75-125 | 30 | 30.4 | 101 | | 85-115 | 03/09/04 |
| Nitrate | 213665-1 | 0.05U | 0.5U | 1.93 | 1.84 | 5 | 10.0 | 11.4 | 95 | | 75-125 | 3 | 2.99 | 100 | | 85-115 | 03/09/04 |
| Nitrite | 213665-1 | 0.05U | 0.5U | 0.00 | 0.00 | 0 | 10.0 | 10.1 | 101 | | 75-125 | 3 | 2.99 | 100 | | 85-115 | 03/09/04 |

RPD ≤20



QUALITY CONTROL RESULTS

Job Number: 213665
Client: Olin Chemical

Units: ug/L

Extraction Batch: 25071
Analytical Batch: 25325, 25435, 25303

| Analyte | QC Sample Identification | MB RL | Sample RL | Sample Result | Sample Duplicate | RPD | Spike Conc. | Matrix Spike | MS % Rec | Q | Spike Limits | LCS TRUE | LCS found | LCS % Rec | Q | LCS QC Limits | Date Analyzed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 213684-1 | 100U | 100U | 1173 | 1934 | 49 | 1000 | 2993 | 182 | * | 70-130 | 1000 | 906 | 91 | | 85-115 | 03/16/04 |
| Chromium | 213684-1 | 10U | 10U | 0 | 0 | 0 | 1000 | 997 | 100 | | 70-130 | 1000 | 1001 | 100 | | 85-115 | 03/15/04 |
| Calcium | 213684-1 | 200U | 200U | 32565 | 36793 | 12 | 22000 | 58017 | 116 | | 70-130 | 22000 | 21825 | 99 | | 85-115 | 03/15/04 |
| Iron | 213684-1 | 100U | 100U | 0 | 0 | 0 | 1000 | 1028 | 103 | | 70-130 | 1000 | 1019 | 102 | | 85-115 | 03/15/04 |
| Magnesium | 213684-1 | 200U | 200U | 4006 | 4445 | 10 | 22000 | 26325 | 101 | | 70-130 | 21000 | 21008 | 100 | | 85-115 | 03/16/04 |
| Sodium | 213684-1 | 2000U | 2000U | 115068 | 129962 | 12 | 20200 | 147377 | 160 | * | 70-130 | 20200 | 21733 | 108 | | 85-115 | 03/15/04 |

RPD =≤20

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Steve Morrow
Olin Chemical
1186 Lower River Road
Charleston, TN 37310-0248

Geomyn

03/19/2004

Report Number: 213720

Dear Steve Morrow,

The analysis of your sample(s) submitted on 03/10/2004 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your Project Manager, Rebecca C. Mason.

For questions, concerns or comments regarding our service, please do not hesitate to contact me directly. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL WESTFIELD

Technical Review: CFR 3/19/04

Total number of pages in this report: 11

Job Number: 213665
Client: Olin Chemical

QUALITY CONTROL RESULTS

Units: mg/L

| Analyte | Sample Identification | MB RL | Sample RL | Sample Result | Spike Conc. | Matrix Spike % Rec. | Spike Dup. | MSD % Rec. | RPD | Spike Q | Spike Limits | LCS TRUE | LCS Found | LCS % Rec. | LCSQ | Limits | Date Analyz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ammonia | 213746-1 | 0.1U | 0.1U | 0.00 | 10.00 | 4.00 | 40 | 0.18 | 2 | 183 | * | 75-125 | 10 | 9.05 | 91 | 85-115 | 03/15/0 |

## SAMPLE INFORMATION
Date: 03/19/2004

Job Number.: 213720
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 213720-1 | FM-71 | Water | 03/08/2004 | 15:00 | 03/10/2004 | 11:45 |



SEVERN TRENT STL

MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD

NELAP FL E87912 TOX
NY DOH 10843
NH DES 253901-A
NELAP NY10843

STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707

STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

# SUBCONTRACTED DATA

SEVERN TRENT STL

STL Chicago
2417 Bond Street
University Park, IL 60466

Tel: 708 534 5200 Fax: 708 534 5211
www.stl-inc.com

# SEVERN TRENT LABORATORIES
# ANALYTICAL REPORT

JOB NUMBER: 224953

Prepared For:

Severn Trent Laboratories
Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

Project: STL Westfield

Attention: Becky Mason

Date: 03/17/2004

Signature

Name: Bonnie M. Stadelmann

Title: Project Manager

E-Mail: bstadelmann@stl-inc.com

03/17/04
Date

STL Chicago
2417 Bond Street
University Park, IL 60466

PHONE: (708) 534-5200
FAX..: (708) 534-5211

This Report Contains (1) Pages



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S A M P L E  I N F O R M A T I O N
Date: 03/17/2004

Job Number.: 224953
Customer...: Severn Trent Laboratories
Attn.....: Becky Mason

Project Number.....: 20000230
Customer Project ID....: WESTFIELD 213720
Project Description....: STL Westfield

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 224953-1 | 213720-1 | Water | 03/08/2004 | 15:00 | 03/11/2004 | 11:00 |

STL Chicago is part of Severn Trent Laboratories, Inc.

L A B O R A T O R Y  C H R O N I C L E

Job Number: 224953

Date: 03/17/2004

CUSTOMER: Severn Trent Laboratories

PROJECT: WESTFIELD 213720

ATTN: Becky Mason

Lab ID: 224953-1  Client ID: 213720-1  Date Recvd: 03/11/2004  Sample Date: 03/08/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | DILUTION |
|---|---|---|---|---|---|---|
| PKG INO (WC) | PKG INO (WET CHEMISTRY) | 1 | | | | |
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C) | 1 | 111803 | 111803 | 03/15/2004 1135 | |



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L A B O R A T O R Y  T E S T  R E S U L T S

Job Number: 224953

Date:03/17/2004

CUSTOMER: Severn Trent Laboratories  PROJECT: WESTFIELD 213720  ATTN: Becky Mason

Customer Sample ID: 213720-1
Date Sampled.....: 03/08/2004
Time Sampled.....: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 224953-1
Date Received.....: 03/11/2004
Time Received.....: 11:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 0.9990 | | | | 0.0001 | 1 | | 111803 | | 03/15/04 1135 | cls |

* in Description = Dry Wgt.

REPORT COMMENTS

1) All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.
2) Soil, sediment and sludge sample results are reported on a "dry weight" basis except when analyzed for landfill disposal or incineration parameters. All other solid matrix samples are reported on an "as received" basis unless noted differently.
3) Reporting limits are adjusted for sample size used, dilutions and moisture content if applicable.
4) The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert. ID# 100201
5) According to 40CFR Part 136.3, pH, Chlorine Residual and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When these parameters are not indicated as field (e.g. pH Field) they were not analyzed immediately, but as soon as possible on laboratory receipt.

Glossary of flags, qualifiers and abbreviations (any number of which may appear in the report)

Inorganic Qualifiers (Q-Column)

U Analyte was not detected at or above the stated limit.
< Not detected at or above the reporting limit.
J Result is less than the RL, but greater than or equal to the method detection limit.
B Result is less than the CRDL/RL, but greater than or equal to the IDL/MDL.
S Result was determined by the Method of Standard Additions.
F AFCEE: Result is less than the RL, but greater than or equal to the method detection limit.

Inorganic Flags (Flag Column)

^ ICV,CCV,ICB,CCB,ISA,ISB,CRI,CRA,MRL: Instrument related QC exceed the upper or lower control limits.
* LCS, LCD, MD: Batch QC exceeds the upper or lower control limits.
+ MSA correlation coefficient is less than 0.995.
4 MS, MSD: The analyte present in the original sample is 4 times greater than the matrix spike concentration; therefore, control limits are not applicable.
E SD: Serial dilution exceeds the control limits.
H MB, EB1, EB2, EB3: Batch QC is greater than reporting limit or had a negative instrument reading lower than the absolute value of the reporting limit.
N MS, MSD: Spike recovery exceeds the upper or lower control limits.
W AS(GFAA) Post-digestion spike was outside 85-115% control limits.

Organic Qualifiers (Q - Column)

U Analyte was not detected at or above the stated limit.
ND Compound not detected.
J Result is an estimated value below the reporting limit or a tentatively identified compound (TIC).
Q Result was qualitatively confirmed, but not quantified.
C Pesticide identification was confirmed by GC/MS.
Y The chromatographic response resembles a typical fuel pattern.
Z The chromatographic response does not resemble a typical fuel pattern.
E Result exceeded calibration range, secondary dilution required.
F AFCEE:Result is an estimated value below the reporting limit or a tentatively identified compound (TIC)

Organic Flags (Flags Column)

B MB: Batch QC is greater than reporting limit.
* LCS, LCD, ELC, ELD, CV, MS, MSD, Surrogate: Batch QC exceeds the upper or lower control limits.
- EB1, EB2, EB3, MLE: Batch QC is greater than reporting Limit
A Concentration exceeds the instrument calibration range
a Concentration is below the method Reporting Limit (RL)
B Compound was found in the blank and sample.
D Surrogate or matrix spike recoveries were not obtained because the extract was diluted for analysis; also compounds analyzed at a dilution will be flagged with a D.
H Alternate peak selection upon analytical review
I Indicates the presence of an interference, recovery is not calculated.
M Manually integrated compound.
P The lower of the two values is reported when the % difference between the results of two GC columns is





greater than 25%.

Abbreviations

| | |
|---|---|
| AS | Post Digestion Spike (GFAA Samples - See Note 1 below) |
| Batch | Designation given to identify a specific extraction, digestion, preparation set, or analysis set |
| CAP | Capillary Column CCB Continuing Calibration Blank |
| CCV | Continuing Calibration Verification |
| CF | Confirmation analysis of original |
| C1 | Confirmation analysis of A1 or D1 |
| C2 | Confirmation analysis of A2 or D2 |
| C3 | Confirmation analysis of A3 or D3 |
| CRA | Low Level Standard Check - GFAA; Mercury |
| CRI | Low Level Standard Check - ICP |
| CV | Calibration Verification Standard |
| Dil Fac | Dilution Factor - Secondary dilution analysis |
| D1 | Dilution 1 |
| D2 | Dilution 2 |
| D3 | Dilution 3 |
| DLFac | Detection Limit Factor |
| DSH | Distilled Standard - High Level |
| DSL | Distilled Standard - Low Level |
| DSM | Distilled Standard - Medium Level |
| EB1 | Extraction Blank 1 |
| EB2 | Extraction Blank 2 |
| EB3 | DI Blank |
| ELC | Method Extracted LCS |
| ELD | Method Extracted LCD |
| ICAL | Initial calibration |
| ICB | Initial Calibration Blank |
| ICV | Initial Calibration Verification |
| IDL | Instrument Detection Limit |
| ISA | Interference Check Sample A - ICAP |
| ISB | Interference Check Sample B - ICAP |
| Job No. | The first six digits of the sample ID which refers to a specific client, project and sample group Lab ID An 8 number unique laboratory identification |
| LCD | Laboratory Control Standard Duplicate |
| LCS | Laboratory Control Standard with reagent grade water or a matrix free from the analyte of interest |
| MB | Method Blank or (PB) Preparation Blank |
| MD | Method Duplicate |
| MDL | Method Detection Limit |
| MLE | Medium Level Extraction Blank |
| MRL | Method Reporting Limit Standard |
| MSA | Method of Standard Additions |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ND | Not Detected |
| PREPF | Preparation factor used by the Laboratory's Information Management System (LIMS) |
| PDS | Post Digestion Spike (ICAP) |
| RA | Re-analysis of original |
| A1 | Re-analysis of D1 |
| A2 | Re-analysis of D2 |
| A3 | Re-analysis of D3 |
| RD | Re-extraction of dilution |
| RE | Re-extraction of original |
| RC | Re-extraction Confirmation |
| RL | Reporting Limit |
| RPD | Relative Percent Difference of duplicate (unrounded) analyses |
| RRF | Relative Response Factor |
| RT | Retention Time |

QUALITY ASSURANCE METHODS

REFERENCES AND NOTES

Report Date: 03/17/2004

| | |
|---|---|
| RTW | Retention Time Window Sample ID A 9 digit number unique for each sample, the first six digits are referred as the job number |
| SCB | Seeded Control Blank |
| SD | Serial Dilution (Calculated when sample concentration exceeds 50 times the MDL) |
| UCB | Unseeded Control Blank |
| SSV | Second Source Verification Standard |
| SLCS | Solid Laboratory Control Standard(LCS) |
| PHC | pH Calibration Check LCSP pH Laboratory Control Sample |
| LCDP | pH Laboratory Control Sample Duplicate |
| MDPH | pH Sample Duplicate |
| MDFP | Flashpoint Sample Duplicate |
| LCFP | Flashpoint LCS |
| G1 | Gelex Check Standard Range 0-1 |
| G2 | Gelex Check Standard Range 1-10 |
| G3 | Gelex Check Standard Range 10-100 |
| G4 | Gelex Check Standard Range 100-1000 |

Note 1: The Post Spike Designation on Batch QC for GFAA is designated with an "S" added to the current abbreviation used. EX. LCS S=LCS Post Spike (GFAA); MSS=MS Post Spike (GFAA)

Note 2: The MD calculates an absolute difference (A) when the sample concentration is less than 5 times the reporting limit. The control limit is represented as +/- the RL.



rpjsckl — Job Sample Receipt Checklist Report — V2

Job Number.: 213720 Location.: 57345 Check List Number.: 1 Description.:
Customer Job ID.....: Job Check List Date.: Date of the Report..: 03/10/2004
Project Number.: 20000348 Project Description.: Geomega Column Testing Project Manager.....: bcm
Customer.....: Olin Chemical Contact.: Steve Morrow

| Questions ? | (Y/N) | Comments |
|---|---|---|
| Chain-of-Custody Present?..... | Y | |
| ...If "yes", completed properly?..... | Y | |
| Custody seal on shipping container?..... | N | |
| ...If "yes", custody seal intact?..... | | |
| Custody seals on sample containers?..... | N | |
| ...If "yes", custody seal intact?..... | | |
| Samples iced?..... | Y | |
| Temperature of cooler acceptable? (4 deg C +/- 2). | Y | |
| ...Temperature at receipt_____..... | | 2.9C |
| Samples received intact (good condition)?..... | Y | |
| Volatile samples acceptable? (no headspace)..... | | |
| Is a Trip Blank required?..... | | |
| Was a Trip Blank provided?..... | | |
| Correct containers used?..... | Y | |
| Adequate sample volume provided?..... | Y | |
| Samples preserved correctly?..... | Y | |
| Samples received within holding-time?..... | Y | |
| Agreement between COC and sample labels?..... | Y | |
| Comments..... | | |
| If samples were shipped was there an air bill #?.. | Y | FedEx 843275738700 |
| Sample Custodian Signature/Date..... | | mjb 3/10/04 |

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

02615

Client: Olin/Geomega
Address: 2445 Baseline Rd. Suite 203 Boulder, CO 80303
Phone: 303 443 7117 Fax: 303 938 8123
Project #: C03303F
Project Manager: Dan Stone
Work ID:
Contact: Andrew Nicholson/Dan Stone

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day ___
Other ___
Rush TAT Requested: 24 hrs ___ 48 hrs ___ 72 hrs ___ 5 Day ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FM-71 | GW | JW | 3-8-04 15:00 | | | | ✓ | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Preservative

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
800-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

DENSITY only

Sampled by (print): JASON WHITE
Signature:
Relinquished by: Date: 3/9/04 Time: 17:00
Received by: Date: Time:
Relinquished by: Date: 3/9/04 Time: 17:00
Received by: Date: 3/10/04 Time: 1145
Method of shipment: Federal Express 7973 8700

STL-Westfield

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy


•53 Southampton Road Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD
•149 Rangeway Road N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA


SEVERN TRENT STL


STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com


Steve Morrow
Olin Chemical
1186 Lower River Road
Charleston, TN 37310-0248

Geomega

04/06/2004

Report Number: 214000

Dear Steve Morrow,

The analysis of your sample(s) submitted on 03/23/2004 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your Project Manager, Rebecca C. Mason.

For questions, concerns or comments regarding our service, please do not hesitate to contact me directly. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL WESTFIELD

Technical Review: 4/6/04

Total number of pages in this report: 20

## MADEP MCP Analytical Method Report Certification Form

| | | | |
|---|---|---|---|
| Laboratory Name: | **Severn Trent Laboratory (STL) Westfield** | Project #: | **214000** |
| Project Location: | **Geomega Column Testing** | MADEP RTN[1]: | |

This form provides certifications for the following data set:[list Laboratory Sample ID Number(s)]
214000-1

Sample Matrices: **Groundwater** Soil/Sediment Drinking Water Other:

| MCP/SW-846 Methods Used As specified in MADEP Compendium of Analytical Methods, check all that apply | | | | | | |
|---|---|---|---|---|---|---|
| | 8260B( ) | 8151A ( ) | 8330 ( ) | 6010B ( ) | 7470A/1A ( ) | Other ( x ) |
| | 8270C( ) | 8081A ( ) | VPH ( ) | 6020 ( ) | 9014M[2] ( ) | |
| | 8082 ( ) | 8021B ( ) | EPH ( ) | 7000 S[3]( ) | 7196A ( ) | |

1 List Release Tracking Number (RTN), if known
2 M - SW-846 Method 9014 or MADEP Physiologically Available Cyanide (PAC) Method
3 S - SW-846 Methods 7000 Series List individual method and analyte.

**An affirmative response to questions A, B, C and D is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| A | Were all samples received by the laboratory in a condition consistent with that described on the Chain-of-Custody documentation for the data set? | (Yes) No[1] |
| B | Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? | (Yes) No[1] |
| C | Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes (N/A) No[1] |
| D | **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? | Yes (N/A) No[1] |

**A response to questions E and F below is required for "Presumptive Certainty" status**

| | | |
|---|---|---|
| E | Were all QC performance standards and recommendations for the specified methods achieved? | Yes (No[1]) |
| F | Were results for all analyte-list compounds/elements for the specified method(s) reported? | Yes N/A (No[1]) |

[1] All Negative responses must be addressed in an attached Environmental Laboratory case narrative.

**I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.**

**Signature:** [signature] **Position:** Laboratory Director

**Printed Name:** Steven C. Hartmann **Date:** 4/6/04



**MCP CASE NARRATIVE**

**Client: Olin Chemical**

**Report Number: 214000**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 3/23/04; the samples arrived in good condition, properly preserved and on ice.

**Subcontracted**
Method ASTM 1298 was performed by STL Chicago 2417 Bond Street, University Park, IL 60466.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**EPA 200.7**
Poor matrix spike recovery was noted for the MS result for Sodium the sample concentration overwhelmed the amount of spike added. The LCS recovered within acceptable control limits.

At the request of the client, an abbreviated MCP analyte list was reported for this job. Sodium in not an MCP compound of concern.

There were no additional QA/QC deviations or issues reported for this method.

**EPA 300.0 (Chloride)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Sulfate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrite)**
There were no QA/QC deviations or issues reported for this method.

**LAC 107061B**
Sample FM-75 recovered low (65%) and outside method control limits for the MS analysis. Both the LCS and MSD recovered within acceptable limits. The RPD recovered high (27%) and outside the method control limit.

There were no additional QA/QC deviations or issues reported for this method.



SAMPLE INFORMATION
Date: 04/06/2004

Job Number.: 214000
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 214000-1 | FM-75 | Water | 03/22/2004 | 15:00 | 03/23/2004 | 10:05 |

# LABORATORY TEST RESULTS

Job Number: 214000

Date: 04/06/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TESTI | ATTN: Steve Morrow

Customer Sample ID: FM-75
Date Sampled.....: 03/22/2004
Time Sampled.....: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 214000-1
Date Received.....: 03/23/2004
Time Received.....: 10:05

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 68 | | 10 | mg/L | 03/24/04 | rwe |
| EPA300.0 PartA | Sulfate | 100 | | 20 | mg/L | 03/24/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 1.8 | | 0.050 | mg/L | 03/24/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 03/24/04 | rwe |
| LAC 107061B | Ammonia (NH3), as N | 61 | J | 0.5 | mg/L | 03/24/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 33000 | | 100 | ug/L | 03/26/04 | bpg |
| | Iron (Fe) | 19 | B | 50 | ug/L | 03/26/04 | bpg |
| | Magnesium (Mg) | 2800 | | 100 | ug/L | 03/26/04 | bpg |
| | Sodium (Na) | 150000 | | 1000 | ug/L | 03/26/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 130 | | 50 | ug/L | 03/26/04 | bpg |
| | Chromium (Cr) | 24 | | 5.0 | ug/L | 03/26/04 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NELAP FL E87912 TOX
NY DOH 10843
NH DES 253901-A
NELAP NY10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica-Service Center
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

# LABORATORY CHRONICLE

Job Number: 214000

Date: 04/06/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TESTI | ATTN: Steve Morrow

Lab ID: 214000-1 Client ID: FM-75 Date Recvd: 03/23/2004 Sample Date: 03/22/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | | DILUTION |
|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion,Total (ICAP) | 1 | 25743 | | 03/24/2004 | 0800 | |
| LAC 107061B | Ammonia | 1 | 25791 | | 03/24/2004 | 0000 | 5 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 25899 | | 03/24/2004 | 0000 | 10 |
| EPA300.0 PartA | Ion Chromatography Analysis | 1 | 25892 | | 03/24/2004 | 0224 | |
| EPA 200.7 | Metal Analysis (ICP) | 1 | 26230 | 25743 | 03/26/2004 | 1740 | |
| EPA 200.7 | Metal Analysis Trace (ICP) | 1 | 26231 | 25743 | 03/26/2004 | 1946 | |
| | QC Metals Report, Level 2 | 1 | 26233 | | 03/31/2004 | 1355 | |
| | QC Wet Chemistry Report, Level 2 | 1 | 25928 | | 03/26/2004 | 0000 | |



SEVERN TRENT STL
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Tel: (978) 667-1400
Fax: (978) 667-7871

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LABORATORY CERTIFICATIONS:

MADEP MA014, NY NELAC 10843, FL NELAC E87912 (TOX), CT DPH 0494, NY DOH 10843, NH DES 253901-A, VT DECWSD, RI DOH 57.

LOCATION:

STL Westfield: 53 Southampton Rd, Westfield, MA 01085. Phone: (413) 572-4000 Fax: (413) 572-3707

STL Service Center: 149 Rangeway Rd. N. Billerica, MA 01862. Phone: (978) 667-1400 Fax: (978) 667-7871

DATA REPORTING QUALIFIERS AND TERMINOLOGY:

A number of data qualifiers are widely used within the environmental testing industry and may be utilized in our data reports. The majority of the qualifiers have evolved from the EPA Contract Laboratory Program (CLP).

REPORT COMMENTS:

All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.

Soil, sediment and sludge sample results are reported on a "dry weight" basis.

Reporting limits are adjusted for sample size used, dilutions and moisture content, if applicable.

The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert.ID# 10843.

According to 40CFR Part 136.3, pH, Total Residual Chlorine and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When these parameters are not indicated as field analyses, they were not analyzed immediately, but as soon as possible on laboratory receipt.

Analytical result(s) reported as "ND", indicates that the analyte was analyzed for but "Not Detected."
Analytical result(s) reported as "TNTC" indicates that the microbiological test was "Too Numerous To Count."

GLOSSARY OF QUALIFIERS:

Inorganic Qualifiers (Q-column):
U Indicates that the analyte was analyzed for but not detected.
E Indicates an estimated value due to the presence of interference. When applied to GFAA analysis, indicates the one-point method of addition recovered between 40-85 percent.
B Indicates an estimated result value. The result was measured between the reporting limit and the method detection limit (MDL).
H Indicates the compound/element was found in both the sample and its associated laboratory blank. Indicates possible/probable blank contamination.

Organic Qualifiers (Q-column):
U Indicates that the compound was analyzed for but not detected.
J Indicates an estimated result value. This qualifier is used when mass spectral data indicated the presence of a compound that meets the identification criteria and the result is less than the specified quantitation limit, but greater than the method detection limit (MDL).
B Indicates that the compound was found in both the sample and its associated laboratory blank. Indicates possible/probable blank contamination and warns the data user to exercise caution when applying the results to this compound.
D Indicates all compounds identified in an analysis at a secondary dilution factor.
E Indicates that the compound in an analysis has exceeded the instrument linear calibration range.



SEVERN TRENT ST
MADEP MA014 IDOH57 TDPH 0494 VT DECWSD
NELAP FL E87912 TOX NY DOH 10843 NH DES 253901-A NELAP NY10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
STL Billerica-Service Center 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871



GLOSSARY OF TERMS:

Surrogates (Surrogate Standards): An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but are not normally found in environmental samples. For semi-volatiles and pesticides/Arochlors, surrogate compounds are added to every blank, sample, matrix spike, matrix spiked duplicate, matrix spike blank (LCS), and standard. These compounds are used to evaluate analytical efficiency by measuring recovery. Poor surrogate recovery may indicate a problem with the sample composition.

Internal Standard: An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process. For GC/MS semi-volatiles and volatiles, internal standards are added to every blank, sample, matrix spike, matrix spike duplicate, matrix spike blank (LCS), and standard. Internal standard responses outside of established limits will adversely affect the quantitation and final concentration of target compounds.

Matrix Spike (MS): An aliquot of a sample (water or soil) fortified (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for matrix interference by measuring recovery. The spiking occurs prior to sample preparation and analysis. Poor spike recovery may indicate a problem with the sample composition.

Laboratory Control Sample (LCS): An aliquot of analyte-free reagent water or sand fortifed (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method efficiency.

Blank: An artificial sample of analyte-free water or solvent, designed to monitor the introduction of contaminates into the analytical process.

Method Dectection Limit (MDL): The minimum concentration of an analyte or compound that can be measured and reported with 99% confidence that the result concentration is greater than zero.

Petroleum Hydrocarbon Comments:

The following comments are specific to Diesel Range Organics (DRO), by GC/FID:

Results for DRO are based on chromatographable portions of the petroleum product. The Carbon Range refers to the approximate chromatographic region covered by the specified petroleum product in straight-chain carbon units between C9-C36.

Quantitation is based on the average response factors for a series of hydrocarbons standards. The sample result from the DRO fraction is independent of the target compound assignment.

Samples yielding chromatographic patterns that do not agree with any of the method targets are reported as "unmatched".



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD
NELAP FL E87912 TOX NY DOH 10843 NH DES 253901-A NELAP NY10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
Billerica-Service Center angeway Rd. erica, MA 01862 978) 667-1400 (978) 667-7871

QUALITY CONTROL RESULTS

Job Number: 214000
Client: Olin Chemical

Units: mg/L

| Analyte | Sample Identification | MB RL | Sample RL | Sample Result | Spike Conc. | Matrix Spike | MS % Rec | Spike Dup | MSD % Rec | RPD | Q | Spike Limits | LCS TRUE | LCS Found | LCS % Rec | Q | LCS QC Limits | Dat Analy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ammonia | 214000-1 | 0.1U | 0.5U | 60.0 | 100 | 125 | 65 | 164 | 104 | 27 | * | 75-125 | 10.0 | 9.57 | 96 | | 85-115 | 03/2 |
| Sulfate | 213995-9 | 2U | 20U | 66.7 | 200 | 280 | 107 | 280 | 107 | 0 | | 75-125 | 60 | 62.3 | 104 | | 85-115 | 03/2 |
| Chloride | 213995-9 | 1U | 10U | 79.5 | 100 | 186 | 107 | 186 | 106 | 0 | | 75-125 | 30 | 31.0 | 103 | | 85-115 | 03/2 |
| Nitrate | 213995-9 | 0.05U | 0.5U | 0.00 | 10.0 | 10.1 | 101 | 10.1 | 101 | 0 | | 75-125 | 3 | 3.08 | 103 | | 85-115 | 03/2 |
| Nitrite | 213995-9 | 0.05U | 0.5U | 0.00 | 10.0 | 9.57 | 96 | 9.55 | 96 | 0 | | 75-125 | 3 | 3.04 | 101 | | 85-115 | 03/2 |

Comments:
† = the chloride result for the sample and spiked samples were over the range of the working curve.



QUALITY CONTROL RESULTS

Job Number: 214000
Client: Olin Chemical

Units:

Extraction Batch: 25743
Analytical Batch: 26230, 26231

| Analyte | QC Sample Identification | MB RL | Sample RL | Sample Result | Sample Duplicate | RPD | Spike Conc. | Matrix Spike | MS % Rec | Q | Spike Limits | LCS TRUE | LCS found | LCS % Rec | Q | LCS QC Limits | Date Analyz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 213890-1 | 50U | 50U | 3120.00 | 3050.00 | 2 | 1000 | 4212 | 109 | | 70-130 | 1000 | 1084 | 108 | | 85-115 | 03/26/ |
| Chromium | 213890-1 | 5U | 5U | 0.00 | 0.00 | 0 | 1000 | 855 | 86 | | 70-130 | 1000 | 1005 | 101 | | 85-115 | 03/26/ |
| Calcium | 213890-1 | 100U | 100U | 368 | 346 | 6 | 21000 | 20531 | 96 | | 70-130 | 21000 | 21592 | 103 | | 85-115 | 03/26/ |
| Iron | 213890-1 | 50U | 50U | 0 | 0 | 0 | 1000 | 954 | 95 | | 70-130 | 1000 | 1026 | 103 | | 85-115 | 03/26/ |
| Magnesium | 213890-1 | 100U | 100U | 0 | 0 | 0 | 21000 | 18967 | 90 | | 70-130 | 21000 | 20799 | 99 | | 85-115 | 03/26/ |
| Sodium | 213890-1 | 1000U | 1000U | 4790000 | 4790000 | 0 | 20200 | 4790000 | 0 | * | 70-130 | 20200 | 20024 | 99 | | 85-115 | 03/26/ |

RPD =≤20

# SUBCONTRACTED DATA

SEVERN TRENT STL

STL Chicago
2417 Bond Street
University Park, IL 60466

Tel: 708 534 5200 Fax: 708 534 5211
www.stl-inc.com

# SEVERN TRENT LABORATORIES ANALYTICAL REPORT

JOB NUMBER: 225286

Prepared For:

Severn Trent Laboratories
Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

Project: STL Westfield

Attention: Becky Mason

Date: 04/05/2004

Bonnie Stadelmann
Signature

4/5/04
Date

Name: Bonnie M. Stadelmann

Title: Project Manager

E-Mail: bstadelmann@stl-inc.com

STL Chicago
2417 Bond Street
University Park, IL 60466

PHONE: (708) 534-5200
FAX..: (708) 534-5211

This Report Contains ( 7 ) Pages

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# LABORATORY TEST RESULTS

Job Number: 225286

Date: 04/05/2004

CUSTOMER: Severn Trent Laboratories PROJECT: WESTFIELD 214000 ATTN: Becky Mason

Customer Sample ID: 214000-1
Date Sampled.....: 03/22/2004
Time Sampled.....: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 225286-1
Date Received.....: 03/24/2004
Time Received.....: 10:30

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DF | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C) | | | | | | | | | | | |
| | Spec.Grav.(Hydrometer 25 C) | 0.9960 | | | | 0.0001 | 1 | | 113875 | | 04/05/04 0810 | cls |

* In Description = Dry Wgt.



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# SAMPLE INFORMATION

Date: 04/05/2004

Job Number.: 225286
Customer....: Severn Trent Laboratories
Attn.....: Becky Mason

Project Number.....: 20000230
Customer Project ID....: WESTFIELD 214000
Project Description....: STL Westfield

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 225286-1 | 214000-1 | Water | 03/22/2004 | 15:00 | 03/24/2004 | 10:30 |

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## LABORATORY CHRONICLE

Job Number: 225286 Date: 04/05/2004

CUSTOMER: Severn Trent Laboratories PROJECT: WESTFIELD 214000 ATTN: Becky Mason

Lab ID: 225286-1 Client ID: 214000-1 Date Recvd: 03/24/2004 Sample Date: 03/22/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | DILUTION |
|---|---|---|---|---|---|---|
| PKG INO (WC) | PKG INO (WET CHEMISTRY) | 1 | | | | |
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C) | 1 | 113875 | 113875 | 04/05/2004 0810 | |



## QUALITY ASSURANCE METHODS

## REFERENCES AND NOTES

Report Date: 04/05/2004

### REPORT COMMENTS

1) All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.
2) Soil, sediment and sludge sample results are reported on a "dry weight" basis except when analyzed for landfill disposal or incineration parameters. All other solid matrix samples are reported on an "as received" basis unless noted differently.
3) Reporting limits are adjusted for sample size used, dilutions and moisture content if applicable.
4) The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert. ID# 100201
5) According to 40CFR Part 136.3, pH, Chlorine Residual and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When these parameters are not indicated as field (e.g. pH Field) they were not analyzed immediately, but as soon as possible on laboratory receipt.

Glossary of flags, qualifiers and abbreviations (any number of which may appear in the report)

Inorganic Qualifiers (Q-Column)

U Analyte was not detected at or above the stated limit.
< Not detected at or above the reporting limit.
J Result is less than the RL, but greater than or equal to the method detection limit.
B Result is less than the CRDL/RL, but greater than or equal to the IDL/MDL.
S Result was determined by the Method of Standard Additions.
F AFCEE: Result is less than the RL, but greater than or equal to the method detection limit.

Inorganic Flags (Flag Column)

' ICV,CCV,ICB,CCB,ISA,ISB,CRI,CRA,MRL: Instrument related QC exceed the upper or lower control limits.
* LCS, LCD, MD: Batch QC exceeds the upper or lower control limits.
+ MSA correlation coefficient is less than 0.995.
4 MS, MSD: The analyte present in the original sample is 4 times greater than the matrix spike concentration; therefore, control limits are not applicable.
E SD: Serial dilution exceeds the control limits.
H MB, EB1, EB2, EB3: Batch QC is greater than reporting limit or had a negative instrument reading lower than the absolute value of the reporting limit.
N MS, MSD: Spike recovery exceeds the upper or lower control limits.
W AS(GFAA) Post-digestion spike was outside 85-115% control limits.

Organic Qualifiers (Q - Column)

U Analyte was not detected at or above the stated limit.
ND Compound not detected.
J Result is an estimated value below the reporting limit or a tentatively identified compound (TIC).
Q Result was qualitatively confirmed, but not quantified.
C Pesticide identification was confirmed by GC/MS.
Y The chromatographic response resembles a typical fuel pattern.
Z The chromatographic response does not resemble a typical fuel pattern.
E Result exceeded calibration range, secondary dilution required.
F AFCEE:Result is an estimated value below the reporting limit or a tentatively identified compound (TIC)

Organic Flags (Flags Column)

B MB: Batch QC is greater than reporting limit.
* LCS, LCD, ELC, ELD, CV, MS, MSD, Surrogate: Batch QC exceeds the upper or lower control limits.
' EB1, EB2, EB3, MLE: Batch QC is greater than reporting Limit
A Concentration exceeds the instrument calibration range
a Concentration is below the method Reporting Limit (RL)
B Compound was found in the blank and sample.
D Surrogate or matrix spike recoveries were not obtained because the extract was diluted for analysis; also compounds analyzed at a dilution will be flagged with a D.
H Alternate peak selection upon analytical review
I Indicates the presence of an interfence, recovery is not calculated.
M Manually integrated compound.
P The lower of the two values is reported when the % difference between the results of two GC columns is

greater than 25%.

Abbreviations

| | |
|---|---|
| AS | Post Digestion Spike (GFAA Samples - See Note 1 below) |
| Batch | Designation given to identify a specific extraction, digestion, preparation set, or analysis set |
| CAP | Capillary Column CCB Continuing Calibration Blank |
| CCV | Continuing Calibration Verification |
| CF | Confirmation analysis of original |
| C1 | Confirmation analysis of A1 or D1 |
| C2 | Confirmation analysis of A2 or D2 |
| C3 | Confirmation analysis of A3 or D3 |
| CRA | Low Level Standard Check - GFAA; Mercury |
| CRI | Low Level Standard Check - ICP |
| CV | Calibration Verification Standard |
| Dil Fac | Dilution Factor - Secondary dilution analysis |
| D1 | Dilution 1 |
| D2 | Dilution 2 |
| D3 | Dilution 3 |
| DLFac | Detection Limit Factor |
| DSH | Distilled Standard - High Level |
| DSL | Distilled Standard - Low Level |
| DSM | Distilled Standard - Medium Level |
| EB1 | Extraction Blank 1 |
| EB2 | Extraction Blank 2 |
| EB3 | DI Blank |
| ELC | Method Extracted LCS |
| ELD | Method Extracted LCD |
| ICAL | Initial calibration |
| ICB | Initial Calibration Blank |
| ICV | Initial Calibration Verification |
| IDL | Instrument Detection Limit |
| ISA | Interference Check Sample A - ICAP |
| ISB | Interference Check Sample B - ICAP |
| Job No. | The first six digits of the sample ID which refers to a specific client, project and sample group Lab ID An 8 number unique laboratory identification |
| LCD | Laboratory Control Standard Duplicate |
| LCS | Laboratory Control Standard with reagent grade water or a matrix free from the analyte of interest |
| MB | Method Blank or (PB) Preparation Blank |
| MD | Method Duplicate |
| MDL | Method Detection Limit |
| MLE | Medium Level Extraction Blank |
| MRL | Method Reporting Limit Standard |
| MSA | Method of Standard Additions |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ND | Not Detected |
| PREPF | Preparation factor used by the Laboratory's Information Management System (LIMS) |
| PDS | Post Digestion Spike (ICAP) |
| RA | Re-analysis of original |
| A1 | Re-analysis of D1 |
| A2 | Re-analysis of D2 |
| A3 | Re-analysis of D3 |
| RD | Re-extraction of dilution |
| RE | Re-extraction of original |
| RC | Re-extraction Confirmation |
| RL | Reporting Limit |
| RPD | Relative Percent Difference of duplicate (unrounded) analyses |
| RRF | Relative Response Factor |
| RT | Retention Time |





| | |
|---|---|
| RTW | Retention Time Window Sample ID A 9 digit number unique for each sample, the first six digits are referred as the job number |
| SCB | Seeded Control Blank |
| SD | Serial Dilution (Calculated when sample concentration exceeds 50 times the MDL) |
| UCB | Unseeded Control Blank |
| SSV | Second Source Verification Standard |
| SLCS | Solid Laboratory Control Standard(LCS) |
| PHC | pH Calibration Check LCSP pH Laboratory Control Sample |
| LCDP | pH Laboratory Control Sample Duplicate |
| MDPH | pH Sample Duplicate |
| MDFP | Flashpoint Sample Duplicate |
| LCFP | Flashpoint LCS |
| G1 | Gelex Check Standard Range 0-1 |
| G2 | Gelex Check Standard Range 1-10 |
| G3 | Gelex Check Standard Range 10-100 |
| G4 | Gelex Check Standard Range 100-1000 |

Note 1: The Post Spike Designation on Batch QC for GFAA is designated with an "S" added to the current abbreviation used. EX. LCS S=LCS Post Spike (GFAA); MSS=MS Post Spike (GFAA)

Note 2: The MD calculates an absolute difference (A) when the sample concentration is less than 5 times the reporting limit. The control limit is represented as +/- the RL.

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT **STL** 00329

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Olin / Geomega
Address: 2995 Baseline Rd. Suite 202
Boulder, CO 80303
Phone: 3034439117 Fax: 3039388123

Project #: C03303F colm. study
Project Manager: Dan Stone
Work ID:
Contact: Craig Walker / Andrew Nicholson

Job#: 214000 Quote#: PO#:

Shaded areas for office use

**Analysis Requested**
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

**Comments** (Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$, Cl
Nitrate / Nitrite
Ammonia
Specific Gravity
[redacted] CRW

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested:
24 hrs 72 hrs
48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FM-75 | GW | JW | 3-22-04 15:00 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): JASON WHITE 3/22/04 15:00 Signature: Jason White
Relinquished by: " " Date: 3/22/04 Time: 17:00 Received by: [signature] Date: 3/23/04 Time: 1005
Relinquished by: Date: Time: Received by: Date: Time:
Method of shipment: FedEx 8932 7573 8928 **STL-Westfield**

Cooler: Y / N Samples Iced: Y / N
Temp @ receipt: 3.8 °C
Preservation pH checked
By: [signature] Date: 3/23/04

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy
STL 8245-360 (12/02)

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rpjsckl Job Sample Receipt Checklist Report V2

Job Number.: 214000 Location.: 57345 Check List Number.: 1 Description.:
Customer Job ID.....: Job Check List Date.:
Project Number.: 20000348 Project Description.: Geomega Column Testing
Customer.....: Olin Chemical Contact.: Steve Morrow

Date of the Report...: 03/23/2004
Project Manager.....: bcm

| Questions ? | (Y/N) Comments |
|---|---|
| Chain-of-Custody Present?..... | Y |
| ...If "yes", completed properly?..... | Y |
| Custody seal on shipping container?..... | N |
| ...If "yes", custody seal intact?..... | |
| Custody seals on sample containers?..... | N |
| ...If "yes", custody seal intact?..... | |
| Samples iced?..... | Y |
| Temperature of cooler acceptable? (4 deg C +/- 2). | Y |
| ...Temperature at receipt _____..... | 3.8C |
| Samples received intact (good condition)?..... | Y |
| Volatile samples acceptable? (no headspace)..... | |
| Is a Trip Blank required?..... | |
| Was a Trip Blank provided?..... | |
| Correct containers used?..... | N Only 1L bottle provided |
| Adequate sample volume provided?..... | Y |
| Samples preserved correctly?..... | N Sample received unpreserved |
| Samples received within holding-time?..... | Y |
| Agreement between COC and sample labels?..... | Y |
| Comments..... | |
| If samples were shipped was there an air bill #?.. | Y FedEx 843275738928 |
| Sample Custodian Signature/Date..... | mjb 2/23/04 [signature] 3/23/04 |

Page 1

Yes [✓] No [ ] N/A [ ] Comments:

☑ Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

☑ Container type noted ☑ Condition observed/☑ pH verified (where applicable) ☑ Field and lab IDs cross referenced

**ACTION**: If no, contact lab for submission of missing or incomplete documentation.

**1.5.1** Were the correct bottles and preservatives used?

Yes [ ] No [✓] N/A [ ] Comments: Aliquots for each analysis requested were ~~taken~~ poured off and preserved during sample receipt at the lab. 4/12/04

Ammonia,– 1 Liter polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Oil & Grease – 1 Liter glass/HCL to pH<2,cool to 4°C

Alkalinity – 1 Liter polyethylene/cool to 4°C

Chemical Oxygen Demand – 50 mL polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Chloride, pH, sulfate - 50 mL polyethylene/cool to 4°C

Organic Carbon – 500 mL amber glass bottle/HCl or $H_2SO_4$ to pH<2,cool to 4°C

Sulfide – 50 mL polyethylene/ZnAcetate + NaOH to pH>9, cool to 4°C
Specific conductance, TDS, TSS – 100 mL polyethylene/cool to 4°C

**ACTION:** If no, inform senior chemist. Document justification for change in container/volume (if applicable), qualify positive and non-detect data (J) data if cooler temperature exceeds 10°C. Rejection of data requires professional judgment

**1.5.2** Were all samples delivered to the laboratory without breakage?

Yes [✓] No [ ] N/A [ ] Comments:

**1.5.3** Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data?

Yes [✓] No [ ] N/A [ ] Comments: Insufficient sample volumes provided. Samples were preserved at the lab.





Reviewer/Date [signature] 4/12/04
Sr. Review/Date
Lab Report # 213044, 213354, 213665, 213720, 214001
Project # 630003.0008.13.02

chloride, sulfate, nitrate, nitrite, ammonia, specific gravity

**Note:** The following analyses will be evaluated according to the "MADEP QA/QC Guidelines for **Sampling, Data Evaluation and Reporting Activities.**" MADEP, however, may not list QA/QC criteria for every chemical analysis. Where not defined by MADEP, criteria will default to values stipulated in the QAPP. Where the QAPP does not define criteria, QA/QC requirements will default to limits employed by the laboratory.

## 1.0 Laboratory Deliverable Requirements

**1.1 Laboratory Information:** Was all of the following provided in the laboratory report? Check items received.

Yes [✓] No [ ] N/A [ ] Comments:

☑ *Name of Laboratory* ☑ *Address* ☑ *Project ID* ☑ *Phone #* ☑ *Sample identification – Field and Laboratory (IDs must be cross-referenced)*

Client Information: ☑ *Name* ☑ *Address* ☑ *Client Contact*

**ACTION**: If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement***

Yes [✓] No [ ] N/A [ ] Comments:

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:***

Yes [✓] No [ ] N/A [ ] Comments:

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☑ *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed?

Yes [✓] No [ ] N/A [ ] Comments:

Does the laboratory report include copies of Chain of Custody forms containing all samples in this SDG?

**NOTE:** Olin receives and maintains the *original* COC.

**ACTION**: If no, contact lab for submission of copy of missing completed COC.

**1.5 Sample Receipt Information (*Cooler Receipt Form*):** Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?

**OLIN-WILMINGTON**
**LEVEL I DATA QUALITY EVALUATION**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**WET CHEMISTRY PARAMETERS BY VARIOUS METHODS**

**1.6 Sample Results Section:** *Was the following information supplied in the laboratory report for each sample?* **Yes** [✓] No [ ] N/A [ ] Comments:

[✓] Field ID and Lab ID [✓] Date and time collected [✓] Analyst Initials [✓] Dilution Factor [N/A] % moisture or solids [✓] Reporting limits
[N/A] *Clean-up method* [✓] Analysis method [N/A] Preparation method [✓] Date of preparation/extraction/digestion clean-up and analysis, where applicable
[✓] Matrix [✓] Target analytes and concentrations [✓] Units (soils must be reported in dry weight)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**1.7 QA/QC Information:** Was the following information provided in the laboratory report for each sample batch? **Yes** [✓] No [ ] N/A [ ] Comments:

[✓] Method blank results [✓] LCS recoveries [✓] MS/MSD recoveries and RPDs [✓] Laboratory duplicate results (where applicable)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**2.0** **Holding Times** Yes [ ] **No** [✓] N/A [ ] Comments:

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? The holding times are as follows:

28 days = ammonia, chemical oxygen demand, chloride, organic carbon, oil & grease, specific conductance, total organic carbon and sulfate

Alkalinity = 14 days Sulfide, TDS, TSS = 7 days pH = analyze immediately Nitrate nitrogen as N = 48 hrs

Nitrite nitrogen as N = 48 hrs Nitrate + Nitrite as N = 28 days

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded qualify results (J). For water samples that are grossly exceeded (>2X hold time) reject (R) all non-detect results. Professi judgment used to qualify soils.

**3.0 Laboratory Method** **Yes** [✓] No [ ] N/A [ ] Comments:

3.1 Was the correct laboratory method used?

**ACTION:** If no, contact lab to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change or to request variance.

**ACTION:** If no, document discrepancy in case narrative and contact lab for justification. Consult senior chemist for action needed.

4.3 Is the method blank less than the PQL? (See Section 3.2 for PQLs). Yes [✓] No [ ] N/A [ ] Comments:

4.4 Do any method blanks have positive results for wet chemistry parameters? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

**ACTION:** If any blank has positive results, list all the concentrations detected and flagging level (flagging level = 5 × blank value) on the checklist. List all affected samples and their qualifiers.

**5.0 Laboratory Control Standards**

5.1 Was a laboratory control standard (LCS) run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call laboratory for LCS form submittal. If data is not available, use professional judgment to determine qualification actions for data associated with the batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

5.3 Is any wet chemistry analyte LCS recovery outside the control limits? Yes [ ] No [✓] N/A [ ] Comments:





3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☐ QAPP ☐ Lab? Yes [ ] No [✓] N/A [ ] Comments: The lab reported a for sulfate (2 mg/L) that is greater than the QAPP required PQL. All sulfate results are greater than the PQL. No further action required.

**Note:** *The MADEP QA/QC Guidelines do not yet list PQLs for wet chemistry analyses, therefore all criteria will default to values stipulated in the QAPP*. Where the QAPP does not define criteria, QA/QC requirements default to limits employed by the lab**. Other criteria may also apply.*

| | | | |
|---|---|---|---|
| Ammonia* ☑ = 0.1 mg/ L | Alkalinity** ☐ = 1 mg/L | Bicarbonate Alkalinity** ☐ = 1 mg/L | Carbonate Alkalinity** ☐ = 1 mg/L |
| Nitrate Nitrogen as N* ☑ = .05 mg/L | Nitrite Nitrogen as N* ☑ = .01 mg/L | Chloride* ☑ = 1 mg/L | Hardness * ☐ = 2 mg/L |
| Spec. Cond.** ☐ 3 umhos/cm | Total Organic Carbon** ☐ = 1 mg/L | Oil & Grease* ☐ = 3 mg/L | Sulfate (EPA 300.0)* ☑ = 0.1 mg/L |
| COD:* Low – 20 mg/L | COD* High - 50 mg/L ☐ | TDS* ☐ = 10 mg/L | TSS* ☐ = 5 mg/L |
| pH* ☐ < 2 to > 12 | | | |

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

**ACTION:** If no, evaluate change with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are the appropriate parameter results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If *dilutions were required, were dilution factors reported?* Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact the lab for submission.

**4.0 Method Blanks** Yes [✓] No [ ] N/A [ ] Comments:

4.1 Are the Method Blank Summaries present?

**ACTION:** If no, call the laboratory for submission of missing data.

4.2 Was a method blank analyzed for each analysis batch of wet chemistry field samples of 20 or less? Yes [✓] No [ ] N/A [ ] Comments:

6.3 Were matrix spikes analyzed at the required frequency of 1 per 20 samples per matrix?

Yes [✓] No [ ] N/A [ ] Comments:

**ACTION**: If any matrix spike data is missing, call lab for resubmission.

6.4 Are any wet chemistry analyte spike recoveries outside of the QC limits?

Yes [ ] No [✓] N/A [ ] Comments: The ammonia percent recoveries in samples FM-75 (214000-1) and FM-63 (213046-2) are outside of the control limits. The unspiked sample conc. in FM-63 (213046-2) is greater than 4x the spike conc. No further action required. The MS percent recovery (65) in sample FM-75 (214000-1) is less than the control limit. No further action required.

NOTE: $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample result; SR = Sample result; SA = Spike added

**MS/MSD Recovery Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia* (LACHAT) ☑ = 74-125% |
| Chloride*(SM 4500 Cl) ☑ = 77-116% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA |
| Oil & Grease* = NA | COD Low* ☐ = 61-142% | COD High* ☐ = 92-109% | Nitrate Nitrogen as N** ☑ = 75-119% |
| Nitrite Nitrogen as N** ☑ = 68-136% | Hardness* ☐ = 70-130% | Sulfate (EPA 300.0)* ☑ = 75-125% | pH* = NA TSS* = NA |

Other parameter(list) _____ % R = _____ ☐ Rec Limits = _____

* = Laboratory Limits ** = Olin QAPP Limits *(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**NOTES**: 1) If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.
2) If the MS/MSD was performed by the laboratory on a non-project sample, no qualification is required.

**ACTION**: MS/MSD flags only apply to the sample spiked. Do not evaluate if sample concentration is > 4X spike. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit but > 30%, qualify both positive results and non-detects (J). If the MS/MSD recovery is < 30% and the sample is non-detect, the results are considered unusable and flagged (R).

**ACTION**: Laboratory control limits apply when spiked sample results fall within the normal calibration range. If dilutions are required due to high sample concentrations, the data is evaluated, but no flags are applied.

6.5 Are any RPDs for MS/MSD recoveries outside of the QA/QC limits?

**NOTE**: $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where S = MS result, D = MSD result

Yes [✓] No [ ] N/A [ ] Comments: The ammonia RPDs in samples FM-63 (213046-2) (43) and FM-75 (214000-1) (27) exceed the control limit. Ammonia results in samples FM-63 (213046-2) and FM-75 (214000-1) were qualified estimated (J).





**LCS Limits:**

| | | | |
|---|---|---|---|
| Alkalinity** ☐ = 80-120% | Bicarbonate Alkalinity** ☐ = 80-120% | Carbonate Alkalinity** ☐ = 80-120% | Specific Conductivity *☐ = 80-120% |
| Total Organic Carbon** ☐ = 80-120% | TDS** ☐ = 80-120% | Oil & Grease* ☐ = 80-120% | Ammonia Nitrogen as N* ☑ = 80-120% |
| COD Low* ☐ = 80-120% | COD High* ☐ = 80-120% | Nitrate Nitrogen as N** ☑ = 85-115% | Nitrite Nitrogen as N** ☑ = 75-120% |
| Hardness* ☐ = 85-115% | Chloride* ☑ = 80-120% | Sulfate (EPA 300.0)* ☑ = 75-125% | pH* ☐ = 98-102% TSS* NA |

Other parameter(list) _____ %R = _____ ☐ Rec Limits= _____

Other parameter(list) _____ %R = _____ ☐ Rec Limits = _____

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**ACTION**: If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and no-detect results within the batch as (J). If LCS recovery is <10%, non-detect results are rejected (R).

## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs analyzed? List project samples that were spiked.

Yes [✓] No [ ] N/A [ ] Comments: MS/MSD analyses were performed on samples FM-75 (214000-1) and FM-63 (213046-2). MS analyses for sulfate, chloride, nitrite and nitrate were performed on sample FM-71 (213865-1).

**ACTION**: If no, contact senior chemist to see if any were specified.

6.2 Is the MS/MSD Recovery Form present?

Yes [✓] No [ ] N/A [ ] Comments:

**ACTION**: If no, contact lab for resubmission of missing data.

**ACTION:** Evaluate rinsate results vs. blank results to determine if contaminant may be laboratory-derived. If not lab-related, qualify according to the table below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

**9.0 Field Duplicates**

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP ☐ *MADEP Option 1(1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION**: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

Was any of the data qualified? Yes [✓] No [ ] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.





**MS/MSD RPD Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia** (LACHAT) ☒ = 8% |
| Chloride**(SM 4500 Cl) ☐ = 15% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA Total Organic Carbon* = NA |
| COD Low** ☐ = 14% | COD High** ☐ = 16% | Nitrate Nitrogen as N** ☐ 16% | Nitrite Nitrogen as N** ☐ = 16% |
| Oil & Grease* = NA | Hardness* = NA | Sulfate (EPA 300.0)* ☐ = 10% | pH* = NA TSS* = NA |

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

* = Laboratory Limits ** = Olin QAPP Limits

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**7.0 Laboratory Duplicate**

Are the RPDs for the laboratory duplicates <20% unless otherwise specified below? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION**: If the RPD is greater than specified limits, qualify all results for that analyte as estimated (J).

| | | | |
|---|---|---|---|
| Alkalinity* = 4% | Bicarbonate Alkalinity* = 4% | Carbonate alkalinity* = 4% | Oil & Grease* ☐ = 20% |
| pH* ☐ = 3% | Specific Conductivity *☐ = 5% | TSS** ☐ = 6% | TDS** ☐ = 6% |

**8.0 Sampling Accuracy**

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:

aluminum, calcium, chromium, iron, magnesium, sodium

## 1.0 Laboratory Deliverable Requirements

**1.1 Laboratory Information:** Was all of the following provided in the laboratory report? Yes [✓] No [ ] N/A [ ] Comments:
Check items received.

[✓] *Name of Laboratory* [✓] *Address* [✓] *Project ID* [✓] *Phone #* [✓] *Sample identification – Field and Laboratory*
Client Information: [✓] *Name* [✓] *Address* [✓] *Client Contact* *(IDs must be cross-referenced)*

**ACTION:** If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** *Yes [✓] No [ ] N/A [ ] Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** *Yes [✓] No [ ] N/A [ ] Comments:*

[✓] *Narrative serves as an exception report for the project and method QA/QC performance.* [✓] *Narrative includes an explanation of each discrepancy on the*

*Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** Olin receives and maintains the *original* COC.

**ACTION:** If no, contact lab for submission of copy of completed COC.

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**OLIN-WILMINGTON**
**LEVEL I DATA QUALITY EVALUATION**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**WET CHEMISTRY PARAMETERS BY VARIOUS METHODS**

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**REFERENCES**

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw, GA 30144. August 1999.

STL-Westfield, 2002. "Olin – General Chemistry Control Limits (Soil & Water)," Severn Trent Laboratories, Inc., 53 Southampton Road, Westfield, MA, 01085.

☑ Method blank results ☑ LCS recoveries ☑ MS/MSD recoveries and RPDs ☑ Laboratory duplicate results (where applicable)

ACTION: If no, contact lab for submission of missing or incomplete information.

## 2.0 Holding Times

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? Holding time for metals is 180 days from sample collection to analysis for both water and soil. Yes [ ] No [✓] N/A [ ] Comments:

NOTE: List samples that exceed hold time with # of days exceeded on checklist

ACTION: If technical holding times are exceeded, qualify all positive results (J) and non-detects (UJ). If grossly exceeded (2X holding time) reject (R) all non-detect results.

## 3.0 Laboratory Method

3.1 Was the correct laboratory method used? Yes [✓] No [ ] N/A [ ] Comments:

| | |
|---|---|
| Water Digestion | 3005A or 3010A or 3020A |
| Soil Digestion | 3050B |
| Metals | 6010B or 200.7 |

ACTION: If no, contact laboratory to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change and to request variance.

3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☑ QAPP ☐ Lab ☐ MADEP Yes [✓] No [ ] N/A [ ] Comments:

NOTE: *Verify that the reported metals match the target list specified on the COC.*





1.5 **Sample Receipt Information (*Cooler Receipt Form present?*):** Yes [✓] No [ ] N/A [ ] Comments:

Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?

☑ Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

☑ Container type noted ☑ sample condition observed ☒ pH verified (where applicable) ☑ Field and lab IDs cross referenced

ACTION: If no, contact lab for submission of missing or incomplete documentation.

1.5.1 Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

1.5.2 Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [✓] No [ ] N/A [ ] Comments: The samples were received by the lab unpreserved and inadequate in volume. The lab poured off a aliquot for analysis and preserved the samples.

1.6 **Sample Results Section:** *Was each of the following requirements supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

☑ Field ID and Lab ID ☑ *Date and time collected* ☑ Analyst Initials ☑ *Dilution Factor* ☒ % moisture or solids ☑ *Reporting limits*
☑ *Clean-up method* ☑ Analysis method ☑ *Preparation method* ☑ *Date of preparation/extraction/digestion clean-up and analysis, where applicable*
☑ Matrix ☑ Target analytes and concentrations ☑ Units (soils must be reported in dry weight)

ACTION: If no, contact lab for submission of missing or incomplete information.

1.7 **QA/QC Information:** Was each of the following information supplied in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

**ACTION:** For any blank with positive results, list all contaminants for each method blank including the concentration detected and the flagging level (flagging level = 5x the blank value) and the associated samples and qualifiers.

## 5.0 Laboratory Control Standard

5.1 Was a laboratory control standard run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *A full target, second source LCS is required by MADEP.*
**ACTION:** Call laboratory for LCS form submittal. If data are not available, use professional judgement to evaluate data accuracy associated with that batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

5.3 Is the recovery of any analyte outside of MADEP control limits? Yes [ ] No [✓] N/A [ ] Comments:

| Sample Type | MADEP % Rec |
|---|---|
| Water | 80-120 |
| Soil | within Lab generated limits |

**ACTION:** If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and non-detects results within the batch as (J). If LCS recovery is <30%, positive and non-detect results are rejected (R).

Comments:





**ACTION:** If no, evaluate variation with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If dilutions were required, were dilution factors reported? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact the lab for submission.

## 4.0 Method Blanks

4.1 Is the Method Blank Summary present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call the laboratory for submission of missing data.

4.2 Frequency of Analysis: Was a method blank analyzed for each digestion batch of < 20 field samples? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact laboratory for justification. Consult senior chemist for action needed. Narrate non-compliance.

4.3 Is the method blank less than the PQLs for all target elements? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *MADEP requires the method blank to be matrix matched and digested with the samples*

4.4 Do any method blanks have positive results for metals? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.

**ACTION:** MS/MSD flags only apply to the sample spiked. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit, qualify positive results and non-detects (J).

6.5 Are any RPDs for MS/MSD recoveries outside of the QC limits? Yes [ ] No [ ] N/A [✓] Comments:

**NOTE:** $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where: S = MS sample result, D = MSD sample result

**NOTE:** If dilutions are required due to high sample concentrations, the data are evaluated, but no flags are applied.

**ACTION:** If the RPD exceeds the control limit, qualify positive results and non-detects (J).

## 7.0 Laboratory Duplicate

7.1 Was a laboratory duplicate sample analyzed? If so, is the Laboratory Duplicate Sample Form present? Yes [ ] No [✓] N/A [ ] Comments: The lab did not perform duplicate analyses on project specific samples.

***NOTE:** MADEP refers to this sample as a "matrix duplicate".*

**ACTION:** If not analyzed, qualification is not needed. If data is missing, contact laboratory for resubmission of report. Narrate non-compliance.

7.2 Is the RPD between the result for the laboratory duplicate sample and the result for the parent sample outside of the QA/QC limits? Yes [ ] No [ ] N/A [✓] Comments:





## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs ~~collected?~~ analyzed? List project samples that were spiked. 4/11/04 Yes [ ] No [✓] N/A [ ] Comments:

**ACTION:** If no, contact senior chemist to see if any were specified.

6.2 Is the Matrix Spike/Matrix Spike Duplicate Recovery Form present? Yes [ ] No [ ] N/A [✓] Comments:

**NOTE:** *A full target, second source MS/MSD is required by MADEP.*
**ACTION:** If any matrix spike data are missing, call lab for resubmission.

6.3 Were matrix spikes analyzed as indicated on the COC and project schedule? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If any matrix spike data are missing, call lab for resubmission. If none, no qualification is needed. Narrate non-compliance.

6.4 Are any metal spike recoveries outside of the QC limits? Yes [ ] No [ ] N/A [✓] Comments:

| Sample Type | *MADEP % Rec* | QAPP % Rec | Method |
|---|---|---|---|
| Water | *75-125* | N/A | 6010B |
| Water | *N/A* | 70-130 | 200.7 |
| Soil | *75-125* | 75-125 | 6010B |

**NOTE:** $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample result, SR = Sample result, SA = Spike added

**NOTE:** If dilutions are required due to high sample concentrations (> 4X spike), the data are evaluated, but no flags are applied.

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP *(1 per 10)* ☐ *MADEP Option 1 (1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

## 10.0 Special QA/QC

10.1 Were both total and dissolved metals analysis performed? If so, the dissolved metal concentration should not exceed that of the total metal. Yes [ ] No [✓] N/A [ ] Comments:

**ACTION:** If results for both total and dissolved are ≥ 5x the PQL **and** the dissolved concentration is 10% higher than the total, flag both results as estimated (J). If total and dissolved concentrations are less than 5x the PQL **and** the **difference** exceeds 2x the PQL, flag both results as estimated (J)



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ICP METALS BY METHOD 6010B/200.7

| *MADEP Laboratory Duplicate Sample RPD Criteria:* | QAPP RPD |
|---|---|
| *For aqueous results > 5x RL, RPD must be ± 20%* | 20 |
| *For aqueous results < 5x RL, RPD must be ≤ RL* | 20 |
| *For soil/sediment results > 5x RL, RPD must be ± 35%* | 20 |
| *For soil/sediment results < 5x RL, RPD must be ≤ 2x RL* | 20 |

**ACTION:** If the RPD exceeds the limits, qualify both positive results and non-detects as estimated and flag them J. Narrate non-compliance

## 8.0 Sampling Accuracy

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

**ACTION:** Evaluate rinsate results against blank results to determine if contaminant may be laboratory-derived. If results are not lab-related, qualify according to below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

## 9.0 Field Duplicates

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

Specific gravity, chloride, sulfate, nitrate, nitrite, ammonia

**Note:** The following analyses will be evaluated according to the "MADEP QA/QC Guidelines for **Sampling, Data Evaluation and Reporting Activities.**" MADEP, however, may not list QA/QC criteria for every chemical analysis. Where not defined by MADEP, criteria will default to values stipulated in the QAPP. Where the QAPP does not define criteria, QA/QC requirements will default to limits employed by the laboratory.

## 1.0 Laboratory Deliverable Requirements

**1.1 Laboratory Information**: Was all of the following provided in the laboratory report? Yes [✓] No [ ] N/A [ ] Comments:
Check items received.

☑ *Name of Laboratory* ☑ *Address* ☑ *Project ID* ☑ *Phone #* ☑ *Sample identification – Field and Laboratory*
Client Information: ☑ *Name* ☑ *Address* ☑ *Client Contact* *(IDs must be cross-referenced)*

ACTION: If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** *Yes [✓] No [ ] N/A [ ] Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** *Yes [✓] No [ ] N/A [ ] Comments:*

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☐ *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed? Yes [✓] No [ ] N/A [ ] Comments:

Does the laboratory report include copies of Chain of Custody forms containing all samples in this SDG?

**NOTE:** Olin receives and maintains the *original* COC.

ACTION: If no, contact lab for submission of copy of missing completed COC.

**1.5 Sample Receipt Information (*Cooler Receipt Form*):** Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?



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**LEVEL I DATA QUALITY EVALUATION – OPTION 1**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**ICP METALS BY METHOD 6010B/200.7**

## 10.0 Application of Validation Qualifiers

Was any of the data qualified? Yes [ ] No [✓] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.

## REFERENCES

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw, GA 30144. August 1999

U.S. Environmental Protection Agency (USEPA), 1989. "Region 1 Laboratory Data Validation Functional Guidelines For Evaluating Inorganic Analyses"; Hazardous Site Evaluation Division; February 1989.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Massachusetts Quality Assurance and Quality Control (QA/QC) Requirements." BWSC-CAM, Interim Final Draft, Revision No. 2, 5 October 2001.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Quality Assurance and Quality Control Guidelines for Sampling, Data Evaluation and Reporting Activities," BWSC-CAM, Section VII, Public Comment Draft, Revision No. 0, 21 December 2001.

**1.6 Sample Results Section:** *Was the following information supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

[✓] Field ID and Lab ID [✓] Date and time collected [✓] Analyst Initials [✓] Dilution Factor [✓] % moisture or solids [✓] Repo
[✓] *Clean-up method* [✓] Analysis method [✓] Preparation method [✓] Date of preparation/extraction/digestion clean-up and analysis, where applicab
[✓] Matrix [✓] Target analytes and concentrations [✓] Units (soils must be reported in dry weight)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**1.7 QA/QC Information:** Was the following information provided in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

[✓] Method blank results [✓] LCS recoveries [✓] MS/MSD recoveries and RPDs [✓] Laboratory duplicate results (where applicable)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**2.0 Holding Times** Yes [ ] No [✓] N/A [ ] Comments:

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? The holding times are as follows:

28 days = ammonia, chemical oxygen demand, chloride, organic carbon, oil & grease, specific conductance, total organic carbon and sulfate

Alkalinity = 14 days | Sulfide, TDS, TSS = 7 days | pH = analyze immediately | Nitrate nitrogen as N = 48 hrs

Nitrite nitrogen as N = 48 hrs | Nitrate + Nitrite as N = 28 days

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded qualify results (J). For water samples that are grossly exceeded (>2X hold time) reject (R) all non-detect results. Professional judgment used to qualify soils.

**3.0 Laboratory Method** Yes [✓] No [ ] N/A [ ] Comments:

3.1 Was the correct laboratory method used?

**ACTION:** If no, contact lab to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change or to request variance.



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Yes [✓] No [ ] N/A [ ] Comments:

[✓] Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

[✓] Container type noted [✓] Condition observed [✓] pH verified (where applicable) [✓] Field and lab IDs cross referenced

**ACTION:** If no, contact lab for submission of missing or incomplete documentation.

**1.5.1** Were the correct bottles and preservatives used? Yes [ ] No [✓] N/A [ ] Comments: Samples were collected in a one liter, unpreserved, plastic container. Upon receipt by the lab, aliquots were transferred to appropriate containers and properly preserved.

Ammonia,– 1 Liter polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Oil & Grease – 1 Liter glass/HCL to pH<2,cool to 4°C

Alkalinity – 1 Liter polyethylene/cool to 4°C

Chemical Oxygen Demand – 50 mL polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Chloride, pH, sulfate - 50 mL polyethylene/cool to 4°C

Organic Carbon – 500 mL amber glass bottle/HCl or $H_2SO_4$ to pH<2,cool to 4°C

Sulfide – 50 mL polyethylene/ZnAcetate + NaOH to pH>9, cool to 4°C
Specific conductance, TDS, TSS – 100 mL polyethylene/cool to 4°C

**ACTION:** If no, inform senior chemist. Document justification for change in container/volume (if applicable), qualify positive and non-detect data (J) data if cooler temperature exceeds 10°C. Rejection of data requires professional judgment

**1.5.2** Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

**1.5.3** Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [✓] No [ ] N/A [ ] Comments: Analyte aliquots were preserved at the lab.

ACTION: If no, document discrepancy in case narrative and contact lab for justification. Consult senior chemist for action needed.

4.3 Is the method blank less than the PQL? (See Section 3.2 for PQLs). Yes [✓] No [ ] N/A [ ] Comments:

4.4 Do any method blanks have positive results for wet chemistry parameters? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

ACTION: If any blank has positive results, list all the concentrations detected and flagging level (flagging level = 5 × blank value) on the checklist. List all affected samples and their qualifiers.

## 5.0 Laboratory Control Standards

5.1 Was a laboratory control standard (LCS) run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, call laboratory for LCS form submittal. If data is not available, use professional judgment to determine qualification actions for data associated with the batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, contact lab for resubmission of missing data.

5.3 Is any wet chemistry analyte LCS recovery outside the control limits? Yes [ ] No [✓] N/A [ ] Comments:





3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☑ QAPP ☐ Lab? Yes [ ] No [✓] N/A [ ] Comments: The lab reported PQL for sulfate (2.0 mg/L) that is greater than the QAPP required PQL. All sulfate results are greater than the PQL. No further action requir

**Note:** *The MADEP QA/QC Guidelines do not yet list PQLs for wet chemistry analyses, therefore all criteria will default to values stipulated in the QAPP*. Where the QAPP does not define criteria, QA/QC requirements default to limits employed by the lab**. Other criteria may also apply.*

| | | | |
|---|---|---|---|
| Ammonia* ☑ = 0.1 mg/ L | Alkalinity** ☐ = 1 mg/L | Bicarbonate Alkalinity** ☐ = 1 mg/L | Carbonate Alkalinity** ☐ = 1 mg/L |
| Nitrate Nitrogen as N* ☑ = .05 mg/L | Nitrite Nitrogen as N* ☑ = .01 mg/L | Chloride* ☑ = 1 mg/L | Hardness * ☐ = 2 mg/L |
| Spec. Cond.** ☐ 3 umhos/cm | Total Organic Carbon** ☐ = 1 mg/L | Oil & Grease* ☐ = 3 mg/L | Sulfate (EPA 300.0)* ☒ = 0.1 mg/L |
| COD:* Low – 20 mg/L | COD* High - 50 mg/L ☐ | TDS* ☐ = 10 mg/L | TSS* ☐ = 5 mg/L |
| pH* ☐ < 2 to > 12 | | | |

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

ACTION: If no, evaluate change with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are the appropriate parameter results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If *dilutions were required, were dilution factors reported?* Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, contact the lab for submission.

## 4.0 Method Blanks

Yes [✓] No [ ] N/A [ ] Comments:

4.1 Are the Method Blank Summaries present?

ACTION: If no, call the laboratory for submission of missing data.

4.2 Was a method blank analyzed for each analysis batch of wet chemistry field samples of 20 or less? Yes [✓] No [ ] N/A [ ] Comments:

6.3 Were matrix spikes analyzed at the required frequency of 1 per 20 samples per matrix? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If any matrix spike data is missing, call lab for resubmission.

6.4 Are any wet chemistry analyte spike recoveries outside of the QC limits? Yes [ ] No [ ] N/A [✓] Comments:

NOTE: $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample result; SR = Sample result; SA = Spike added

**MS/MSD Recovery Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia* (LACHAT) ☐ = 74-125% |
| Chloride*(SM 4500 Cl) ☐= 77-116% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA |
| Oil & Grease* = NA | COD Low* ☐ = 61-142% | COD High* ☐ = 92-109% | Nitrate Nitrogen as N** ☐ = 75-119% |
| Nitrite Nitrogen as N** ☐ = 68-136% | Hardness* ☐ = 70-130% | Sulfate (EPA 300.0)* ☐ = 75-125% | pH* = NA TSS* = NA |

Other parameter(list) _____ % R = _____ ☐ Rec Limits = _____

* = Laboratory Limits ** = Olin QAPP Limits *(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**NOTES:** 1) If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.
2) If the MS/MSD was performed by the laboratory on a non-project sample, no qualification is required.

**ACTION:** MS/MSD flags only apply to the sample spiked. Do not evaluate if sample concentration is > 4X spike. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit but > 30%, qualify both positive results and non-detects (J). If the MS/MSD recovery is < 30% and the sample is non-detect, the results are considered unusable and flagged (R).

**ACTION:** Laboratory control limits apply when spiked sample results fall within the normal calibration range. If dilutions are required due to high sample concentrations, the data is evaluated, but no flags are applied.

6.5 Are any RPDs for MS/MSD recoveries outside of the QA/QC limits? Yes [ ] No [ ] N/A [✓] Comments:

NOTE: $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where S = MS result, D = MSD result





**LCS Limits:**

| | | | |
|---|---|---|---|
| Alkalinity** ☐ = 80-120% | Bicarbonate Alkalinity** ☐ = 80-120% | Carbonate Alkalinity** ☐ = 80-120% | Specific Conductivity *☐ = 80-120% |
| Total Organic Carbon** ☐ = 80-120% | TDS** ☐ = 80-120% | Oil & Grease* ☐ = 80-120% | Ammonia Nitrogen as N* ☑ = 80-120% |
| COD Low* ☐ = 80-120% | COD High* ☐ = 80-120% | Nitrate Nitrogen as N**☑ = 85-115% | Nitrite Nitrogen as N** ☑ = 75-120% |
| Hardness* ☐ = 85-115% | Chloride* ☑ = 80-120% | Sulfate (EPA 300.0)* ☑ = 75-125% | pH* ☐ = 98-102% TSS* NA |

Other parameter(list) _____ %R = _____ ☐ Rec Limits= _____

Other parameter(list) _____ %R = _____ ☐ Rec Limits = _____

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**ACTION:** If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and no-detect results within the batch as (J). If LCS recovery is <10%, non-detect results are rejected (R).

## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs analyzed? List project samples that were spiked. Yes [ ] No [✓] N/A [ ] Comments:

**ACTION:** If no, contact senior chemist to see if any were specified.

6.2 Is the MS/MSD Recovery Form present? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

**ACTION:** Evaluate rinsate results vs. blank results to determine if contaminant may be laboratory-derived. If not lab-related, qualify according to the table below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

**9.0 Field Duplicates**

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP ☐ *MADEP Option 1(1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

Was any of the data qualified? Yes [ ] **No** [✓] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.





**MS/MSD RPD Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia** (LACHAT) ☐ = 8% |
| Chloride**(SM 4500 Cl) ☐ = 15% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA Total Organic Carbon* = NA |
| COD Low** ☐ = 14% | COD High** ☐ = 16% | Nitrate Nitrogen as N** ☐ 16% | Nitrite Nitrogen as N** ☐ = 16% |
| Oil & Grease* = NA | Hardness* = NA | Sulfate (EPA 300.0)* ☐ = 10% | pH* = NA TSS* = NA |

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

* = Laboratory Limits ** = Olin QAPP Limits

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**7.0 Laboratory Duplicate**

Are the RPDs for the laboratory duplicates <20% unless otherwise specified below? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If the RPD is greater than specified limits, qualify all results for that analyte as estimated (J).

| | | | |
|---|---|---|---|
| Alkalinity* = 4% | Bicarbonate Alkalinity* = 4% | Carbonate alkalinity* = 4% | Oil & Grease* ☐ = 20% |
| pH* ☐ = 3% | Specific Conductivity *☐ = 5% | TSS** ☐ = 6% | TDS** ☐ = 6% |

**8.0 Sampling Accuracy**

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] **No** [ ] N/A [✓] Comments:

Reviewer/Date [illegible] 3/9/04
Sr. Review/Date
Lab Report # 212731
Project # 630003 0208.13.02

Aluminum, calcium, chromium, iron, magnesium, sodium

1.0 **Laboratory Deliverable Requirements**

**1.1 Laboratory Information**: Was all of the following provided in the laboratory report? Yes [✓] No [ ] N/A [ ] Comments:
Check items received.

☑ *Name of Laboratory* ☑ *Address* ☑ *Project ID* ☑ *Phone #* ☑ *Sample identification -- Field and Laboratory*
Client Information: ☑ *Name* ☑ *Address* ☑ *Client Contact* *(IDs must be cross-referenced)*

ACTION: If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** *Yes [✓] No [ ] N/A [ ] Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** *Yes [✓] No [ ] N/A [ ] Comments:*

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☐ *Narrative includes an explanation of each discrepancy on the*

*Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** Olin receives and maintains the *original COC.*

ACTION: If no, contact lab for submission of copy of completed *COC.*

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**OLIN-WILMINGTON**
**LEVEL I DATA QUALITY EVALUATION**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**WET CHEMISTRY PARAMETERS BY VARIOUS METHODS**

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**REFERENCES**

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw GA 30144. August 1999.

STL-Westfield, 2002. "Olin – General Chemistry Control Limits (Soil & Water)," Severn Trent Laboratories, Inc., 53 Southampton Road, Westfield, MA, 01085.

☑ Method blank results ☑ LCS recoveries ☑ MS/MSD recoveries and RPDs ☑ Laboratory duplicate results (where applicable)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

## 2.0 Holding Times

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? Holding time for metals is 180 days from sample collection to analysis for both water and soil. Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded, qualify all positive results (J) and non-detects (UJ). If grossly exceeded (2X holding time) reject (R) all non-detect results.

## 3.0 Laboratory Method

3.1 Was the correct laboratory method used? Yes [✓] No [ ] N/A [ ] Comments:

| | |
|---|---|
| Water Digestion | 3005A or 3010A or 3020A |
| Soil Digestion | 3050B |
| Metals | 6010B or 200.7 |

**ACTION:** If no, contact laboratory to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change and to request variance.

3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☒ QAPP ☐ Lab ☐ MADEP Yes [ ] No [✓] N/A [ ] Comments: The lab reported PQL for aluminum (50 ug/L), calcium (100 ug/L), chromium (5 ug/L) and magnesium (100 ug/L) that are less than the QAPP required PQLs. No further action required.

**NOTE:** *Verify that the reported metals match the target list specified on the COC.*





**1.5 Sample Receipt Information (*Cooler Receipt Form present?*):** Yes [✓] No [ ] N/A [ ] Comments:

Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?

☑ Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

☑ Container type noted ☑ sample condition observed ☑ pH verified (where applicable) ☑ Field and lab IDs cross referenced

**ACTION:** If no, contact lab for submission of missing or incomplete documentation.

1.5.1 Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

1.5.2 Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [✓] No [ ] N/A [ ] Comments: Analyte aliquots were separated and preserved at the lab upon receipt of the samples.

**1.6 Sample Results Section:** *Was each of the following requirements supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

☑ Field ID and Lab ID ☑ *Date and time collected* ☑ Analyst Initials ☑ *Dilution Factor* ☑ % moisture or solids ☑ *Reporting lim*
☑ *Clean-up method* ☑ Analysis method ☑ *Preparation method* ☑ *Date of preparation/extraction/digestion clean-up and analysis, where applicab*
☑ Matrix ☑ Target analytes and concentrations ☑ Units (soils must be reported in dry weight)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**1.7 QA/QC Information:** Was each of the following information supplied in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

**ACTION:** For any blank with positive results, list all contaminants for each method blank including the concentration detected and the flagging level (flagging level = 5x the blank value) and the associated samples and qualifiers.

## 5.0 Laboratory Control Standard

5.1 Was a laboratory control standard run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *A full target, second source LCS is required by MADEP.*
**ACTION:** Call laboratory for LCS form submittal. If data are not available, use professional judgement to evaluate data accuracy associated with that batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

5.3 Is the recovery of any analyte outside of MADEP control limits? Yes [ ] No [✓] N/A [ ] Comments:

| Sample Type | MADEP % Rec |
|---|---|
| Water | 80-120 |
| Soil | within Lab generated limits |

**ACTION:** If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and non-detects results within the batch as (J). If LCS recovery is <30%, positive and non-detect results are rejected (R).

Comments:





**ACTION:** If no, evaluate variation with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If dilutions were required, were dilution factors reported? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact the lab for submission.

## 4.0 Method Blanks

4.1 Is the Method Blank Summary present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call the laboratory for submission of missing data.

4.2 Frequency of Analysis: Was a method blank analyzed for each digestion batch of < 20 field samples? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact laboratory for justification. Consult senior chemist for action needed. Narrate non-compliance.

4.3 Is the method blank less than the PQLs for all target elements? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *MADEP requires the method blank to be matrix matched and digested with the samples*

4.4 Do any method blanks have positive results for metals? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.

**ACTION:** MS/MSD flags only apply to the sample spiked. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit, qualify positive results and non-detects (J).

6.5 Are any RPDs for MS/MSD recoveries outside of the QC limits? Yes [ ] No [ ] N/A [✓] Comments:

**NOTE:** $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where: S = MS sample result, D = MSD sample result

**NOTE:** If dilutions are required due to high sample concentrations, the data are evaluated, but no flags are applied.

**ACTION:** If the RPD exceeds the control limit, qualify positive results and non-detects (J).

## 7.0 Laboratory Duplicate

7.1 Was a laboratory duplicate sample analyzed? If so, is the Laboratory Duplicate Sample Form present? Yes [ ] No [✓] N/A [ ] Comments: The lab performed duplicate analyses on non-project specific samples.

***NOTE:** MADEP refers to this sample as a "matrix duplicate".*

**ACTION:** If not analyzed, qualification is not needed. If data is missing, contact laboratory for resubmission of report. Narrate non-compliance.

7.2 Is the RPD between the result for the laboratory duplicate sample and the result for the parent sample outside of the QA/QC limits? Yes [ ] No [ ] N/A [✓] Comments:





## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs ~~collected~~ analyzed? List project samples that were spiked. Yes [ ] No [✓] N/A [ ] Comments:
(JD) 3/9/04

**ACTION:** If no, contact senior chemist to see if any were specified.

6.2 Is the Matrix Spike/Matrix Spike Duplicate Recovery Form present? Yes [ ] No [ ] N/A [✓] Comments:

**NOTE:** *A full target, second source MS/MSD is required by MADEP.*
**ACTION:** If any matrix spike data are missing, call lab for resubmission.

6.3 Were matrix spikes analyzed as indicated on the COC and project schedule? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If any matrix spike data are missing, call lab for resubmission. If none, no qualification is needed. Narrate non-compliance.

6.4 Are any metal spike recoveries outside of the QC limits? Yes [ ] No [ ] N/A [✓] Comments:

| Sample Type | *MADEP % Rec* | QAPP % Rec | Method |
|---|---|---|---|
| Water | *75-125* | N/A | 6010B |
| Water | *N/A* | 70-130 | 200.7 |
| Soil | *75-125* | 75-125 | 6010B |

**NOTE:** $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample result, SR = Sample result, SA = Spike added

**NOTE:** If dilutions are required due to high sample concentrations (> 4X spike), the data are evaluated, but no flags are applied.

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP *(1 per 10)* ☐ *MADEP Option 1 (1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION**: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

## 10.0 Special QA/QC

10.1 Were both total and dissolved metals analysis performed? If so, the dissolved metal concentration should not exceed that of the total metal. Yes [ ] No [✓] N/A [ ] Comments:

**ACTION:** If results for both total and dissolved are ≥ 5x the PQL **and** the dissolved concentration is 10% higher than the total, flag both results as estimated (J). If total and dissolved concentrations are less than 5x the PQL **and** the **difference** exceeds 2x the PQL, flag both results as estimated (J)





| *MADEP Laboratory Duplicate Sample RPD Criteria:* | QAPP RPD |
|---|---|
| *For aqueous results > 5× RL, RPD must be ± 20%* | 20 |
| *For aqueous results < 5× RL, RPD must be ≤ RL* | 20 |
| *For soil/sediment results > 5× RL, RPD must be ± 35%* | 20 |
| *For soil/sediment results < 5× RL, RPD must be ≤ 2× RL* | 20 |

**ACTION**: If the RPD exceeds the limits, qualify both positive results and non-detects as estimated and flag them J. Narrate non-compliance

## 8.0 Sampling Accuracy

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

**ACTION:** Evaluate rinsate results against blank results to determine if contaminant may be laboratory-derived. If results are not lab-related, qualify according to below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

## 9.0 Field Duplicates

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

**LEVEL I DATA QUALITY EVALUATION**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**WET CHEMISTRY PARAMETERS BY VARIOUS METHODS**

Sr. Review/Date /
Lab Report # 212846
Project # 63 0003 0003 .13.02

Specific gravity, chloride, sulfate, nitrate, nitrite, ammonia

**Note:** The following analyses will be evaluated according to the "MADEP QA/QC Guidelines for **Sampling, Data Evaluation and Reporting Activities.**" MADEP, however, may not list QA/QC criteria for every chemical analysis. Where not defined by MADEP, criteria will default to values stipulated in the QAPP. Where the QAPP does not define criteria, QA/QC requirements will default to limits employed by the laboratory.

## 1.0 Laboratory Deliverable Requirements

**1.1 Laboratory Information:** Was all of the following provided in the laboratory report? Yes [✓] No [ ] N/A [ ] Comments:
Check items received.

☑ *Name of Laboratory* ☑ *Address* ☑ *Project ID* ☑ *Phone #* ☑ *Sample identification – Field and Laboratory*
Client Information: ☑ *Name* ☑ *Address* ☑ *Client Contact* *(IDs must be cross-referenced)*

**ACTION:** If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** **Yes** [✓] No [ ] N/A [ ] *Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** **Yes** [✓] No [ ] N/A [ ] *Comments:*

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☐ *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed? Yes [✓] No [ ] N/A [ ] Comments:

Does the laboratory report include copies of Chain of Custody forms containing all samples in this SDG?

**NOTE:** Olin receives and maintains the *original* COC.

**ACTION:** If no, contact lab for submission of copy of missing completed COC.

**1.5 Sample Receipt Information (*Cooler Receipt Form*):** Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?



**OLIN CORPORATION**
**LEVEL I DATA QUALITY EVALUATION – OPTION 1**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**ICP METALS BY METHOD 6010B/200.7**

## 10.0 Application of Validation Qualifiers

Was any of the data qualified? Yes [ ] **No** [✓] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.

## REFERENCES

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw, GA 30144. August 1999

U.S. Environmental Protection Agency (USEPA), 1989. "Region 1 Laboratory Data Validation Functional Guidelines For Evaluating Inorganic Analyses"; Hazardous Site Evaluation Division; February 1989.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Massachusetts Quality Assurance and Quality Control (QA/QC) Requirements." BWSC-CAM, Interim Final Draft, Revision No. 2, 5 October 2001.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Quality Assurance and Quality Control Guidelines for Sampling, Data Evaluation and Reporting Activities," BWSC-CAM, Section VII, Public Comment Draft, Revision No. 0, 21 December 2001.

**1.6 Sample Results Section:** *Was the following information supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

[✓] Field ID and Lab ID [✓] Date and time collected [✓] Analyst Initials [✓] Dilution Factor [✓] % moisture or solids [✓] Reporting Limits
[✓] *Clean-up method* [✓] Analysis method [✓] Preparation method [✓] Date of preparation/extraction/digestion clean-up and analysis, where applicable
[✓] Matrix [✓] Target analytes and concentrations [✓] Units (soils must be reported in dry weight)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**1.7 QA/QC Information:** Was the following information provided in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

[✓] Method blank results [✓] LCS recoveries [✓] MS/MSD recoveries and RPDs [✓] Laboratory duplicate results (where applicable)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**2.0 Holding Times** Yes [ ] No [✓] N/A [ ] Comments:

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? The holding times are as follows:

28 days = ammonia, chemical oxygen demand, chloride, organic carbon, oil & grease, specific conductance, total organic carbon and sulfate

Alkalinity = 14 days | Sulfide, TDS, TSS = 7 days | pH = analyze immediately | Nitrate nitrogen as N = 48 hrs

Nitrite nitrogen as N = 48 hrs | Nitrate + Nitrite as N = 28 days

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded qualify results (J). For water samples that are grossly exceeded (>2X hold time) reject (R) all non-detect results. Professional judgment used to qualify soils.

**3.0 Laboratory Method** Yes [✓] No [ ] N/A [ ] Comments:

3.1 Was the correct laboratory method used?

**ACTION:** If no, contact lab to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change or to request variance.



OLIN-WILMINGTON
LEVEL I DATA QUALITY EVALUATION
STANDARD OPERATING PROCEDURE AND CHECKLIST
WET CHEMISTRY PARAMETERS BY VARIOUS METHODS

Yes [✓] No [ ] N/A [ ] Comments:

[✓] Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

[✓] Container type noted [✓] Condition observed [✓] pH verified (where applicable) [✓] Field and lab IDs cross referenced

**ACTION:** If no, contact lab for submission of missing or incomplete documentation.

**1.5.1** Were the correct bottles and preservatives used? Yes [ ] No [✓] N/A [ ] Comments: Samples were provided to the lab in unpreserved, one liter, plastic containers. Upon receipt by the lab, analytical aliquots were taken and properly preserved.

Ammonia,– 1 Liter polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Oil & Grease – 1 Liter glass/HCL to pH<2,cool to 4°C

Alkalinity – 1 Liter polyethylene/cool to 4°C

Chemical Oxygen Demand – 50 mL polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Chloride, pH, sulfate - 50 mL polyethylene/cool to 4°C

Organic Carbon – 500 mL amber glass bottle/HCl or $H_2SO_4$ to pH<2,cool to 4°C

Sulfide – 50 mL polyethylene/ZnAcetate + NaOH to pH>9, cool to 4°C
Specific conductance, TDS, TSS – 100 mL polyethylene/cool to 4°C

**ACTION:** If no, inform senior chemist. Document justification for change in container/volume (if applicable), qualify positive and non-detect data (J) data if cooler temperature exceeds 10°C. Rejection of data requires professional judgment

**1.5.2** Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

**1.5.3** Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [ ] No [✓] N/A [ ] Comments:

ACTION: If no, document discrepancy in case narrative and contact lab for justification. Consult senior chemist for action needed.

4.3 Is the method blank less than the PQL? (See Section 3.2 for PQLs). Yes [✓] No [ ] N/A [ ] Comments:

4.4 Do any method blanks have positive results for wet chemistry parameters? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

ACTION: If any blank has positive results, list all the concentrations detected and flagging level (flagging level = 5 × blank value) on the checklist. List all affected samples and their qualifiers.

## 5.0 Laboratory Control Standards

5.1 Was a laboratory control standard (LCS) run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, call laboratory for LCS form submittal. If data is not available, use professional judgment to determine qualification actions for data associated with the batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, contact lab for resubmission of missing data.

5.3 Is any wet chemistry analyte LCS recovery outside the control limits? Yes [ ] No [✓] N/A [ ] Comments:





3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☑ QAPP ☐ Lab? Yes [ ] No [✓] N/A [ ] Comments: The lab reported a P. for sulfate (2mg/L) that is greater than the QAPP required PQL. All sulfate results are greater than the PQL. No further action required.

Note: *The MADEP QA/QC Guidelines do not yet list PQLs for wet chemistry analyses, therefore all criteria will default to values stipulated in the QAPP*. Where the QAPP does not define criteria, QA/QC requirements default to limits employed by the lab**. Other criteria may also apply.*

| | | | |
|---|---|---|---|
| Ammonia* ☑ = 0.1 mg/ L | Alkalinity** ☐ = 1 mg/L | Bicarbonate Alkalinity** ☐ = 1 mg/L | Carbonate Alkalinity** ☐ = 1 mg/L |
| Nitrate Nitrogen as N* ☑ = .05 mg/L | Nitrite Nitrogen as N* ☑ = .01 mg/L | Chloride* ☑ = 1 mg/L | Hardness * ☐ = 2 mg/L |
| Spec. Cond.** ☐ 3 umhos/cm | Total Organic Carbon** ☐ = 1 mg/L | Oil & Grease* ☐ = 3 mg/L | Sulfate (EPA 300.0)* ☒ = 0.1 mg/L |
| COD:* Low – 20 mg/L | COD* High - 50 mg/L ☐ | TDS* ☐ = 10 mg/L | TSS* ☐ = 5 mg/L |
| pH* ☐ < 2 to > 12 | | | |

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

ACTION: If no, evaluate change with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are the appropriate parameter results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If *dilutions were required, were dilution factors reported?* Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, contact the lab for submission.

## 4.0 Method Blanks

Yes [✓] No [ ] N/A [ ] Comments:

4.1 Are the Method Blank Summaries present?

ACTION: If no, call the laboratory for submission of missing data.

4.2 Was a method blank analyzed for each analysis batch of wet chemistry field samples of 20 or less? Yes [✓] No [ ] N/A [ ] Comments:

6.3 Were matrix spikes analyzed at the required frequency of 1 per 20 samples per matrix? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If any matrix spike data is missing, call lab for resubmission.

6.4 Are any wet chemistry analyte spike recoveries outside of the QC limits? Yes [ ] No [ ] N/A [✓] Comments:

NOTE: $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample result; SR = Sample result; SA = Spike added

**MS/MSD Recovery Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia* (LACHAT) ☐ = 74-125% |
| Chloride*(SM 4500 Cl) ☐= 77-116% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA |
| Oil & Grease* = NA | COD Low* ☐ = 61-142% | COD High* ☐ = 92-109% | Nitrate Nitrogen as N** ☐ = 75-119% |
| Nitrite Nitrogen as N** ☐ = 68-136% | Hardness* ☐ = 70-130% | Sulfate (EPA 300.0)* ☐ = 75-125% | pH* = NA TSS* = NA |

Other parameter(list) _____ % R = _____ ☐ Rec Limits = _____

* = Laboratory Limits ** = Olin QAPP Limits *(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**NOTES:** 1) If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.
2) If the MS/MSD was performed by the laboratory on a non-project sample, no qualification is required.

**ACTION:** MS/MSD flags only apply to the sample spiked. Do not evaluate if sample concentration is > 4X spike. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit but > 30%, qualify both positive results and non-detects (J). If the MS/MSD recovery is < 30% and the sample is non-detect, the results are considered unusable and flagged (R).

**ACTION:** Laboratory control limits apply when spiked sample results fall within the normal calibration range. If dilutions are required due to high sample concentrations, the data is evaluated, but no flags are applied.

6.5 Are any RPDs for MS/MSD recoveries outside of the QA/QC limits? Yes [ ] No [ ] N/A [✓] Comments:

**NOTE:** $RPD = \frac{S - D}{(S + D)/2} \times 100\%$ Where S = MS result, D = MSD result





**LCS Limits:**

| | | | |
|---|---|---|---|
| Alkalinity** ☐ = 80-120% | Bicarbonate Alkalinity** ☐ = 80-120% | Carbonate Alkalinity** ☐ = 80-120% | Specific Conductivity *☐ = 80-120% |
| Total Organic Carbon** ☐ = 80-120% | TDS** ☐ = 80-120% | Oil & Grease* ☐ = 80-120% | Ammonia Nitrogen as N* ☑ = 80-120% |
| COD Low* ☐ = 80-120% | COD High* ☐ = 80-120% | Nitrate Nitrogen as N** ☑ = 85-115% | Nitrite Nitrogen as N** ☑ = 75-120% |
| Hardness* ☐ = 85-115% | Chloride* ☑ = 80-120% | Sulfate (EPA 300.0)* ☑ = 75-125% | pH* ☐ = 98-102% TSS* NA |

Other parameter(list) _____ %R = _____ ☐ Rec Limits= _____

Other parameter(list) _____ %R = _____ ☐ Rec Limits = _____

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**ACTION:** If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and no-detect results within the batch as (J). If LCS recovery is <10%, non-detect results are rejected (R).

## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs analyzed? List project samples that were spiked. Yes [ ] No [✓] N/A [ ] Comments:

**ACTION:** If no, contact senior chemist to see if any were specified.

6.2 Is the MS/MSD Recovery Form present? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

**ACTION:** Evaluate rinsate results vs. blank results to determine if contaminant may be laboratory-derived. If not lab-related, qualify according to the table below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

**9.0 Field Duplicates**

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP ☐ *MADEP Option 1(1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION**: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

Was any of the data qualified? Yes [ ] **No** [✓] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.





**MS/MSD RPD Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia** (LACHAT) ☐ = 8% |
| Chloride**(SM 4500 Cl) ☐ = 15% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA Total Organic Carbon* = NA |
| COD Low** ☐ = 14% | COD High** ☐ = 16% | Nitrate Nitrogen as N** ☐ 16% | Nitrite Nitrogen as N** ☐ = 16% |
| Oil & Grease* = NA | Hardness* = NA | Sulfate (EPA 300.0)* ☐ = 10% | pH* = NA TSS* = NA |

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

* = Laboratory Limits ** = Olin QAPP Limits

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**7.0 Laboratory Duplicate**

Are the RPDs for the laboratory duplicates <20% unless otherwise specified below? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION**: If the RPD is greater than specified limits, qualify all results for that analyte as estimated (J).

| | | | |
|---|---|---|---|
| Alkalinity* = 4% | Bicarbonate Alkalinity* = 4% | Carbonate alkalinity* = 4% | Oil & Grease* ☐ = 20% |
| pH* ☐ = 3% | Specific Conductivity *☐ = 5% | TSS** ☐ = 6% | TDS** ☐ = 6% |

**8.0 Sampling Accuracy**

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] **No** [ ] N/A [✓] Comments:

aluminum, calcium, iron, magnesium, sodium, chromium

**1.0 Laboratory Deliverable Requirements**

**1.1 Laboratory Information:** Was all of the following provided in the laboratory report? Yes [✓] No [ ] N/A [ ] Comments:
Check items received.

☑ *Name of Laboratory* ☑ *Address* ☑ *Project ID* ☑ *Phone #* ☑ *Sample identification – Field and Laboratory*
Client Information: ☑ *Name* ☑ *Address* ☑ *Client Contact* *(IDs must be cross-referenced)*

**ACTION:** If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** *Yes [✓] No [ ] N/A [ ] Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** *Yes [✓] No [ ] N/A [ ] Comments:*

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☐ *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** Olin receives and maintains the *original* COC.

**ACTION:** If no, contact lab for submission of copy of completed COC.

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**OLIN-WILMINGTON**
**LEVEL I DATA QUALITY EVALUATION**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**WET CHEMISTRY PARAMETERS BY VARIOUS METHODS**

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**REFERENCES**

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw, GA 30144. August 1999.

STL-Westfield, 2002. "Olin – General Chemistry Control Limits (Soil & Water)," Severn Trent Laboratories, Inc., 53 Southampton Road, Westfield, MA, 01085.

☑ Method blank results ☑ LCS recoveries ☑ MS/MSD recoveries and RPDs ☑ Laboratory duplicate results (where applicable)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

## 2.0 Holding Times

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? Holding time for metals is 180 days from sample collection to analysis for both water and soil. Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded, qualify all positive results (J) and non-detects (UJ). If grossly exceeded (2X holding time) reject (R) all non-detect results.

## 3.0 Laboratory Method

3.1 Was the correct laboratory method used? Yes [✓] No [ ] N/A [ ] Comments:

| | |
|---|---|
| Water Digestion | 3005A or 3010A or 3020A |
| Soil Digestion | 3050B |
| Metals | 6010B or 200.7 |

**ACTION:** If no, contact laboratory to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change and to request variance.

3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☒ QAPP ☐ Lab ☐ MADEP Yes [ ] No [✓] N/A [ ] Comments: The lab reported PQLs for aluminum (50 ug/L) and magnesium (100 ug/L) that are less than the QAPP required PQLs. No further action required.

**NOTE:** *Verify that the reported metals match the target list specified on the COC.*





1.5 **Sample Receipt Information (*Cooler Receipt Form present?*):** Yes [✓] No [ ] N/A [ ] Comments:

Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?

☑ Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

☑ Container type noted ☑ sample condition observed, ☑ pH verified (where applicable) ☑ Field and lab IDs cross referenced

**ACTION:** If no, contact lab for submission of missing or incomplete documentation.

1.5.1 Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

1.5.2 Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [ ] No [✓] N/A [ ] Comments:

1.6 **Sample Results Section:** *Was each of the following requirements supplied in the laboratory report for each sample?* Yes [ ] No [ ] N/A [ ] Comments:

☑ Field ID and Lab ID ☑ *Date and time collected* ☑ Analyst Initials ☑ *Dilution Factor* ☑ % moisture or solids ☑ *Reporting limit*
☑ *Clean-up method* ☑ Analysis method ☑ *Preparation method* ☑ *Date of preparation/extraction/digestion clean-up and analysis, where applicabl*
☑ Matrix ☑ Target analytes and concentrations ☑ Units (soils must be reported in dry weight)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

1.7 **QA/QC Information:** Was each of the following information supplied in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

**ACTION:** For any blank with positive results, list all contaminants for each method blank including the concentration detected and the flagging level (flagging level = 5x the blank value) and the associated samples and qualifiers.

## 5.0 Laboratory Control Standard

5.1 Was a laboratory control standard run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *A full target, second source LCS is required by MADEP.*
**ACTION:** Call laboratory for LCS form submittal. If data are not available, use professional judgement to evaluate data accuracy associated with that batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

5.3 Is the recovery of any analyte outside of MADEP control limits? Yes [ ] No [✓] N/A [ ] Comments:

| Sample Type | MADEP % Rec |
|---|---|
| Water | 80-120 |
| Soil | within Lab generated limits |

**ACTION:** If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and non-detects results within the batch as (J). If LCS recovery is <30%, positive and non-detect results are rejected (R).

Comments:





**ACTION:** If no, evaluate variation with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If dilutions were required, were dilution factors reported? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If no, contact the lab for submission.

## 4.0 Method Blanks

4.1 Is the Method Blank Summary present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call the laboratory for submission of missing data.

4.2 Frequency of Analysis: Was a method blank analyzed for each digestion batch of < 20 field samples? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact laboratory for justification. Consult senior chemist for action needed. Narrate non-compliance.

4.3 Is the method blank less than the PQLs for all target elements? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *MADEP requires the method blank to be matrix matched and digested with the samples*

4.4 Do any method blanks have positive results for metals? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.

**ACTION:** MS/MSD flags only apply to the sample spiked. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit, qualify positive results and non-detects (J).

**6.5** Are any RPDs for MS/MSD recoveries outside of the QC limits? Yes [ ] No [✓] N/A [✓] Comments:

(2) 3/8/04

**NOTE:** RPD = $\frac{S-D}{(S+D)/2}$ x 100% Where: S = MS sample result, D = MSD sample result

**NOTE:** If dilutions are required due to high sample concentrations, the data are evaluated, but no flags are applied.

**ACTION:** If the RPD exceeds the control limit, qualify positive results and non-detects (J).

## 7.0 Laboratory Duplicate

**7.1** Was a laboratory duplicate sample analyzed? If so, is the Laboratory Duplicate Sample Form present? Yes [ ] No [✓] N/A [ ] Comments: The lab did not perform a duplicate analysis on project specific samples.

***NOTE:*** *MADEP refers to this sample as a "matrix duplicate".*

**ACTION:** If not analyzed, qualification is not needed. If data is missing, contact laboratory for resubmission of report. Narrate non-compliance.

**7.2** Is the RPD between the result for the laboratory duplicate sample and the result for the parent sample outside of the QA/QC limits? Yes [ ] No [ ] N/A [✓] Comments:





## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

**6.1** Were project-specific MS/MSDs ~~collected~~ analyzed? List project samples that were spiked. Yes [ ] No [✓] N/A [ ] Comments:

(2) 3/8/04

**ACTION:** If no, contact senior chemist to see if any were specified.

**6.2** Is the Matrix Spike/Matrix Spike Duplicate Recovery Form present? Yes [ ] No [ ] N/A [✓] Comments:

**NOTE:** *A full target, second source MS/MSD is required by MADEP.*
**ACTION:** If any matrix spike data are missing, call lab for resubmission.

**6.3** Were matrix spikes analyzed as indicated on the COC and project schedule? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If any matrix spike data are missing, call lab for resubmission. If none, no qualification is needed. Narrate non-compliance.

**6.4** Are any metal spike recoveries outside of the QC limits? Yes [ ] No [ ] N/A [✓] Comments:

| Sample Type | *MADEP % Rec* | QAPP % Rec | Method |
|---|---|---|---|
| Water | *75-125* | N/A | 6010B |
| Water | *N/A* | 70-130 | 200.7 |
| Soil | *75-125* | 75-125 | 6010B |

**NOTE:** %R = $\frac{(SSR-SR)}{SA}$ x 100% Where: SSR = Spiked sample result, SR = Sample result, SA = Spike added

**NOTE:** If dilutions are required due to high sample concentrations (> 4X spike), the data are evaluated, but no flags are applied.

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP *(1 per 10)* ☐ *MADEP Option 1 (1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

ACTION: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

## 10.0 Special QA/QC

10.1 Were both total and dissolved metals analysis performed? If so, the dissolved metal concentration should not exceed that of the total metal. Yes [ ] No [✓] N/A [ ] Comments:

ACTION: If results for both total and dissolved are ≥ 5x the PQL **and** the dissolved concentration is 10% higher than the total, flag both results as estimated (J). If total and dissolved concentrations are less than 5x the PQL **and** the **difference** exceeds 2x the PQL, flag both results as estimated (J)





| *MADEP Laboratory Duplicate Sample RPD Criteria:* | QAPP RPD |
|---|---|
| *For aqueous results > 5x RL, RPD must be ± 20%* | 20 |
| *For aqueous results < 5x RL, RPD must be ≤ RL* | 20 |
| *For soil/sediment results > 5x RL, RPD must be ± 35%* | 20 |
| *For soil/sediment results < 5x RL, RPD must be ≤ 2x RL* | 20 |

ACTION: If the RPD exceeds the limits, qualify both positive results and non-detects as estimated and flag them J. Narrate non-compliance

## 8.0 Sampling Accuracy

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

ACTION: Evaluate rinsate results against blank results to determine if contaminant may be laboratory-derived. If results are not lab-related, qualify according to below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

## 9.0 Field Duplicates

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

## 10.0 Application of Validation Qualifiers

Was any of the data qualified? Yes [ ] No [ ] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.

## REFERENCES

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw, GA 30144. August 1999

U.S. Environmental Protection Agency (USEPA), 1989. "Region 1 Laboratory Data Validation Functional Guidelines For Evaluating Inorganic Analyses"; Hazardous Site Evaluation Division; February 1989.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Massachusetts Quality Assurance and Quality Control (QA/QC) Requirements." BWSC-CAM, Interim Final Draft, Revision No. 2, 5 October 2001.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Quality Assurance and Quality Control Guidelines for Sampling, Data Evaluation and Reporting Activities," BWSC-CAM, Section VII, Public Comment Draft, Revision No. 0, 21 December 2001.

**Severn Trent Laboratory**
**213718**

**Geomega Water Column Study (Li)**
**Dates Sampled: 1/21/04**

MACTEC

Engineering and Consulting, Inc.
511 Congress Street
P.O. Box 7050
Portland, Maine 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow

From: Chris Ricardi

Date: 4/20/04

Subject: Olin Wilmington Geomega Lithium Analyses - March 04

**Data Validation Summary**
**STL Data Sets 213718**

This sample set contained results for three water samples identified as DAPL-Li, SD2-Li, and DZW-Li. The samples were collected on January 21, 2004 and analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for lithium by Method 6010B.

The laboratory provided a data package with QC reports and back up data for the sample analyses. The results were reviewed by a chemist to evaluate the accuracy and precision of the reported results, and to confirm the detection of lithium in the samples. With the exception of the items discussed below the results are determined to be usable as reported by the laboratory.

**Validation Actions and Observations**

The matrix spike percent recovery of lithium for sample DZW-Li was 142 percent. This is above the upper limit control limit of 130 percent used for Method 6010B indicating a slight high bias. Lithium was reported at 1.2 B µg/L in the un-spiked sample and this result was qualified estimated (J).

One continuing calibration verification check standard in the data set had a percent recovery for lithium at 87 percent. This is slightly lower than the Method 6010 limit of 90 percent. This calibration standard did not directly bracket samples. The verification check standards bracketing the samples were within control limits and no other results were qualified.

A low concentration positive interference was reported in the interference check sample (ICS) run with these samples. The ICS indicates that low concentration lithium detections (approximately 5 µg/L) may occur in samples with interference from aluminum, calcium, iron, or magnesium. The samples did contain moderate concentrations of these elements; however, concentrations were lower than the ICS and interference from these elements would not account for the higher concentration of lithium reported in samples DAPL-Li and SD2-Li.

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Steve Morrow
Olin Chemical
1186 Lower River Road
Charleston, TN 37310-0248

03/22/2004

Report Number: 213718

Dear Steve Morrow,

The analysis of your sample(s) submitted on 03/10/2004 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your Project Manager, Rebecca C. Mason.

For questions, concerns or comments regarding our service, please do not hesitate to contact me directly. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL WESTFIELD

Technical Review: SH 4/7/04

Total number of pages in this report: 70

## MCP CASE NARRATIVE

**Client: Olin Chemical**

**Report Number: 213718**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 3/10/04; the samples arrived in good condition, properly preserved and on ice.

**Subcontracted**
EPA method 200.7 for Lithium was performed at STL Newburgh, 315 Fullerton Avenue, Newburgh, NY 12550. A separate case narrative accompanies this report. STL Newburgh noted failures in recovering Lithium within control limits in the final CCVs. The suppression of the CCV result was probably due to the matrix of the client's samples. Unfortunately, the last CCV bracketed the batch LCS. STL Westfield asked for a re-analysis on this sample to demonstrate that the preparation procedure was in compliance with the method. A second subcontracted package, which was analyzed on 04/06/04, is attached.

## SAMPLE INFORMATION
Date: 03/22/2004

Job Number.: 213718
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 213718-1 | DAPL-Li | Water | 03/09/2004 | 14:45 | 03/10/2004 | 11:45 |
| 213718-2 | SD2-Li | Water | 03/09/2004 | 14:45 | 03/10/2004 | 11:45 |
| 213718-3 | DZW-Li | Water | 03/09/2004 | 14:45 | 03/10/2004 | 11:45 |



SEVERN TRENT STL

MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD

NELAP FL E87912 TOX
NY DOH 10843
NH DES 253901-A
NELAP NY10843

STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707

STL Billerica
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

**STL - Westfield**
**213718**

**Private Wells – Lithium**
**Date Sampled: 1/20/2004**

# SUBCONTRACTED DATA

**STL Westfield**
**Westfield, MA**
**Project: 213718**
**STL Lab. # 234144**
**Matrix: Water**
**1 of 1**

SEVERN TRENT STL

03/19/2004

STL Westfield
Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

Attn: Becky Mason

SUBJECT: Case Narrative, 213718,
STL Job Number 234144.

Dear Becky Mason:

Enclosed are the analytical results for the 213718 project. The samples were received on 03/11/2004. The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. The reports were completed according to contract specific reporting requirements.

Any exceptions to NELAP requirements are noted in the attached case narrative. The case narrative is an integral part of this report.

I certify that this package is in compliance with the terms and conditions of the contract both technically and for completeness, for other than the conditions detailed above. Release has been authorized by the Laboratory Director or her designee, as verified by the following signature.

STL NEWBURGH

Patricia Chany

Patricia Chany
Laboratory Director



**CASE NARRATIVE**
**Client:** STL Westfield
**Date:** 03/18/04
**STL Lab No.:** 234144
**Page 1 of 1**

## Inorganics

### ICP

Matrix Spike/Duplicate

The percent spike recovery of lithium in spike sample number DZW-LiMS (234144-03MS) is outside of the established control limits. The data is qualified accordingly. As per the protocol, a post digestion spike was analyzed for lithium.

Continuing Calibration Verification

Due to laboratory oversight, the lithium CCV3 was inadvertently omitted from the analytical sequence.

The percent recovery of lithium in the CCV4 is outside of the established control limits.

Other

Due to the effects of the sample matrix on the ICP, the samples in laboratory number 234144 were analyzed several times. As a result the final ICP analytical sequence submitted does contain some anomalies.

## SAMPLE INFORMATION
Date: 03/19/2004

Job Number.: 234144
Customer...: STL Westfield
Attn.....: Becky Mason

Project Number.....: 20000232
Customer Project ID....: 213718
Project Description....: STL Westfield

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 234144-1 | DAPL-Li | Water | 03/09/2004 | 14:45 | 03/11/2004 | 09:05 |
| 234144-2 | SD2-Li | Water | 03/09/2004 | 14:45 | 03/11/2004 | 09:05 |
| 234144-3 | DZW-Li | Water | 03/09/2004 | 14:45 | 03/11/2004 | 09:05 |



## DATA REPORTING QUALIFIERS

Data qualifiers are used in the analytical report for organics and inorganics. The qualifiers are equivalent to those used by the USEPA in its Contract Laboratory Program.

### ORGANIC QUALIFIERS

U - Indicates that the compound was analyzed for but not detected. The sample detection limit is corrected for dilution and percent moisture. This detection limit is not necessarily the instrument detection limit.

J - Indicates an estimated value. This qualifier is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria and the result is less than the specified detection limit but greater than zero.

B - Indicates that the analyte was found in both the sample and its associated laboratory blank. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

C - This qualifier applies to pesticide parameters where the identification has been confirmed by gas chromatography/mass spectrometry.

E - This qualifier indicates compounds whose concentrations exceed the calibration range of the instrument for the specific analysis.

D - Indicates all compounds identified in an analysis at a secondary dilution factor.

DL - This suffix indicates a diluted sample and is appended to the sample number on the result form.

N - Indicates presumptive evidence of a compound. This flag is only used for tentatively identified compounds, where the identification is based on a mass spectral library search. It is applied to all TIC results. For generic characterization of a TIC, such as chlorinated hydrocarbon, the N code is not used.

P - This flag is used for a pesticide/Aroclor target analyte when there is greater than 25% difference for detected concentration between the two GC columns (see Form X). The lower of the two values is reported on Form I and flagged with an "P".

A - This flag indicates that a TIC is a suspected aldol-condensation product.

RE - This suffix indicates a re-analyzed sample and is appended to the sample number on the result form.

## DATA REPORTING QUALIFIERS

Page 2

RR - This suffix indicates a re-extracted and re-analyzed sample and is appended to the sample number on the result form.

## INORGANICS

Concentration Qualifiers (C)

U - Indicates that the analyte was analyzed for but not detected.

B - The reported value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL).

Quality Qualifiers (Q)

E - Indicates an estimated value because of the presence of interference.

M - Duplicate injection precision not met.

N - Spiked sample recovery not within control limits.

S - The reported value was determined by the Method of Standard Additions (MSA).

W - Post digestion spike for furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

* - Duplicate analysis not within control limits.

\+ - Correlation coefficient for the MSA is less than 0.995.

Method Qualifiers (M)

P - for ICP.
A - for Flame AA.
F - for Furnace AA.
PM - for ICP when Microwave Digestion is used.
AM - for Flame AA when Microwave Digestion is used.
FM - for Furnace AA when Microwave Digestion is used.
CV - for Manual Cold Vapor AA.
AV - for Automated Cold Vapor AA.
AS - for Semi-Automated Spectrophotometric
C - for Manual Spectrophotometric
T - for Titrimetric.
NR - if the analyte is not required to be analyzed.



STL Newburgh
315 Fullerton Avenue
Newburgh, NY 12550
Tel (845) 562-0890
Fax (845) 562-0841

600000

Job Number: 234144

LABORATORY TEST RESULTS

Date:03/19/2004

CUSTOMER: STL Westfield

PROJECT: 243710

ATTN: Becky Mason

Customer Sample ID: DAPL-Li
Date Sampled.....: 03/09/2004
Time Sampled.....: 14:45
Sample Matrix.....: Water

Laboratory Sample ID: 234144-1
Date Received.....: 03/11/2004
Time Received.....: 09:05

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q FLAGS | IDL | RL | DILUTION | UNITS | DT | DATE | TEC |
|---|---|---|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion (ICP) | Complete | | | | 1 | Text | | 03/11/04 | mmc |
| EPA 200.7 | Metals Analysis (ICP) Lithium (Li) | 2710 | N | 6.0 | 6.0 | 10.00 | ug/L | | 03/15/04 | mad |

* In Description = Dry Wgt.

LABORATORY TEST RESULTS

Job Number: 234144 Date:03/19/2004

CUSTOMER: STL Westfield PROJECT: 213718 ATTN: Becky Mason

Customer Sample ID: DZW-Li
Date Sampled.....: 03/09/2004
Time Sampled.....: 14:45
Sample Matrix.....: Water

Laboratory Sample ID: 234144-3
Date Received.....: 03/11/2004
Time Received.....: 09:05

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | IDL | RL | DILUTION | UNITS | DT | DATE | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion (ICP) | Complete | | | | | 1 | Text | | 03/11/04 | rmc |
| EPA 200.7 | Metals Analysis (ICP)<br>Lithium (Li) | 1.2 | | N | 0.60 | 0.60 | 1 | ug/L | | 03/15/04 | mad |

000041

* In Description = Dry Wgt.



LABORATORY TEST RESULTS

Job Number: 234144 Date:03/19/2004

CUSTOMER: STL Westfield PROJECT: 213718 ATTN: Becky Mason

Customer Sample ID: SD2-Li
Date Sampled.....: 03/09/2004
Time Sampled.....: 14:45
Sample Matrix.....: Water

Laboratory Sample ID: 234144-2
Date Received.....: 03/11/2004
Time Received.....: 09:05

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | IDL | RL | DILUTION | UNITS | DT | DATE | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EPA 200.7 | Acid Digestion (ICP) | Complete | | | | | 1 | Text | | 03/11/04 | rmc |
| EPA 200.7 | Metals Analysis (ICP)<br>Lithium (Li) | 2130 | | N | 6.0 | 6.0 | 10.00 | ug/L | | 03/15/04 | mad |

000040

* In Description = Dry Wgt.

Version 1.2, Nov 2002

**OLIN-WILMINGTON**
**LEVEL I DATA QUALITY EVALUATION**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**ICP METALS BY METHOD 6010B/200.7**

Reviewer/Date Jge Cunningham / 4/13/04
Sr. Review/Date Chris Ricciardi 4/20/04
Lab Report #
Project # 630003 0008
Task 13.02

Geomega Li DR.

## 1.0 Laboratory Deliverable Requirements

**1.1 Laboratory Information**: Was all of the following provided in the laboratory report? **Yes** [ ] No [ ] N/A [ ] Comments:
Check items received.

☑ *Name of Laboratory* ☑ *Address* ☑ *Project ID* ☑ *Phone #* ☑ *Sample identification – Field and Laboratory*
Client Information: ☑ *Name* ☑ *Address* ☑ *Client Contact* *(IDs must be cross-referenced)*

**ACTION**: If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** ***Yes*** [✓] *No* [ ] *N/A* [ ] *Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** ***Yes*** [✓] *No* [ ] *N/A* [ ] *Comments:*

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☑ *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed **Yes** [✓] No [ ] N/A [ ] Comments:

**NOTE:** Olin receives and maintains the *original COC.*

**ACTION**: If no, contact lab for submission of copy of completed *COC.*

---

**Severn Trent Laboratories, Inc.**
**Chain of Custody Form**

SEVERN TRENT STL 00542

•53 Southampton Road, Westfield, MA 01085, (P) 413-572-4000, (F) 413-572-3707, STL-WESTFIELD
•14 Ingeway Road, N. B a, MA 01862, (P) 978-667-1400, (F) 978-667-7871, STL-BILLERICA

Client: Olin / Geomega
Address: 2995 Baseline Rd. Suite 202, Boulder, CO 80303
Phone: 3034439117 Fax: 3039388123
Project #: C03303F
Project Manager: Dan Stone
Work ID:
Contact: Andrew Nicholson / Dan Stone
Job#: Quote#: PO#:

Requested Turn Around Time: 0 Business Day (Std) ___ 5 Business Day ___ Other ___ Rush TAT Requested: 24 hrs X 72 hrs ___ 48 hrs ___ 5 Day ___

Regulatory Classification / Special Report Format: NPDES ___ Drinking Water ___ DEP Form(s) ___ RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___ Other ___ MCP QA/QC Rpt ___

Shaded areas for office use.

**Analysis Requested**
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

**Comments** (Special Instructions)

Lithium only

Sample Type Codes: WW-Wastewater DW-Drinking water SW-Surfacewater W-Labwater GW-Groundwater A-Air S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DAPL - Li | GW | JW | 3-9-04 14:45 | | | | ✓ | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| SD2 - Li | GW | JW | 3-9-04 14:45 | | | | ✓ | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| DZW - Li | GW | JW | 3-9-04 14:45 | | | | ✓ | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): JASON WHITE 3/9/04 14:45 Signature:
Relinquished by: " " Date: 3/9/04 Time: 17:00 Received by: Date: 3-10-04 Time: 1145
Relinquished by: Date: Time: Received by: Date: Time:
Method of shipment: FedEx 8432 7573 8700 **STL-Westfield**

Cooler: (Y) N Samples iced: (Y) N
Temp @ receipt: 2.3 °C
Preservation/pH checked:
By: Date:

Page ___ of ___

White = Lab file Yellow = Report copy Pink = Customer copy

☑ Method blank results ☑ LCS recoveries ☑ MS/~~MSD~~ recoveries and ~~RPDs~~ ☑ Laboratory duplicate results (where applicable)

**ACTION**: If no, contact lab for submission of missing or incomplete information.

## 2.0 Holding Times

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? Holding time for metals is 180 days from sample collection to analysis for both water and soil. Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded, qualify all positive results (J) and non-detects (UJ). If grossly exceeded (2X holding time) reject (R) all non-detect results.

## 3.0 Laboratory Method

**3.1** Was the correct laboratory method used? Yes [✓] No [ ] N/A [ ] Comments:

| | |
|---|---|
| Water Digestion | 3005A or 3010A or 3020A |
| Soil Digestion | 3050B |
| Metals | 6010B or 200.7 |

3005A water digestion not used, method EPA 200.7 used.

**ACTION**: If no, contact laboratory to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change and to request variance.

**3.2** Are the practical quantitation limits the same as those specified by the ☐ SOW ☐ QAPP ☐ Lab ☐ MADEP Yes [ ] No [ ] N/A [✓] Comments:

**NOTE:** *Verify that the reported metals match the target list specified on the COC.*





**1.5 Sample Receipt Information (*Cooler Receipt Form present?*):** Yes [✓] No [ ] N/A [ ] Comments:

Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?

☑ Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

☐ Container type noted ☑ sample condition observed ☑ pH verified (where applicable) ☑ Field and lab IDs cross referenced

**ACTION**: If no, contact lab for submission of missing or incomplete documentation.

**1.5.1** Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

**1.5.2** Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [ ] No [✓] N/A [ ] Comments:

**1.6 Sample Results Section:** *Was each of the following requirements supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

☑ Field ID and Lab ID ☑ *Date and time collected* ☑ Analyst Initials ☑ *Dilution Factor* ☐ % moisture or solids ☑ *Reporting limits*
N/A ☐ *Clean-up method* ☑ Analysis method ☑ *Preparation method* ☑ *Date of preparation/extraction/digestion clean-up and analysis, where applicable*
☑ Matrix ☑ Target analytes and concentrations ☐ Units (soils must be reported in dry weight)

**ACTION**: If no, contact lab for submission of missing or incomplete information.

**1.7 QA/QC Information:** Was each of the following information supplied in the laboratory report for each sample batch? Yes [ ] No [ ] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

**ACTION:** For any blank with positive results, list all contaminants for each method blank including the concentration detected and the flagging level (flagging level = 5x the blank value) and the associated samples and qualifiers.

**5.0 Laboratory Control Standard**

**5.1** Was a laboratory control standard run with each analytical batch of 20 samples or less? **Yes** [✓] No [ ] N/A [ ] Comments:

**NOTE:** *A full target, second source LCS is required by MADEP.*
**ACTION:** Call laboratory for LCS form submittal. If data are not available, use professional judgement to evaluate data accuracy associated with that batch.

**5.2** Is a LCS Summary Form present? **Yes** [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

**5.3** Is the recovery of any analyte outside of MADEP control limits? Yes [ ] **No** [✓] N/A [ ] Comments:

| Sample Type | MADEP % Rec |
|---|---|
| Water | 80-120 |
| Soil | within Lab generated limits |

**ACTION:** If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and non-detects results within the batch as (J). If LCS recovery is <30%, positive and non-detect results are rejected (R).

Comments:





**ACTION:** If no, evaluate variation with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

**3.3** Are results present for each sample in the SDG? **Yes** [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

**3.4** If dilutions were required, were dilution factors reported? **Yes** [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact the lab for submission.

**4.0 Method Blanks**

**4.1** Is the Method Blank Summary present? **Yes** [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call the laboratory for submission of missing data.

**4.2** Frequency of Analysis: Was a method blank analyzed for each digestion batch of < 20 field samples? **Yes** [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact laboratory for justification. Consult senior chemist for action needed. Narrate non-compliance.

**4.3** Is the method blank less than the PQLs for all target elements? **Yes** [✓] No [ ] N/A [ ] Comments:

**NOTE:** *MADEP requires the method blank to be matrix matched and digested with the samples*

**4.4** Do any method blanks have positive results for metals? Qualify data according to the following: Yes [ ] **No** [✓] N/A [ ] Comments:

**NOTE:** If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.

**ACTION:** MS/MSD flags only apply to the sample spiked. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit, qualify positive results and non-detects (J).

**6.5** Are any RPDs for MS/MSD recoveries outside of the QC limits? Yes [ ] **No** [ ] N/A [✓] Comments:

on one spike sample analyzed

**NOTE:** RPD = $\frac{S-D}{(S+D)/2}$ x 100% Where: S = MS sample result, D = MSD sample result

**NOTE:** If dilutions are required due to high sample concentrations, the data are evaluated, but no flags are applied.

**ACTION:** If the RPD exceeds the control limit, qualify positive results and non-detects (J).

## 7.0 Laboratory Duplicate

**7.1** Was a laboratory duplicate sample analyzed? If so, is the Laboratory Duplicate Sample Form present? **Yes** [✓] No [ ] N/A [ ] Comments:

***NOTE:*** *MADEP refers to this sample as a "matrix duplicate".*

**ACTION:** If not analyzed, qualification is not needed. If data is missing, contact laboratory for resubmission of report. Narrate non-compliance.

**7.2** Is the RPD between the result for the laboratory duplicate sample and the result for the parent sample outside of the QA/QC limits? Yes [ ] **No** [✓] N/A [ ] Comments:





## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

**6.1** Were project-specific MS/MSDs collected? List project samples that were spiked. **Yes** [ ] No [✓] N/A [ ] Comments:

DZW-Li S was used for spike sample recovery

**ACTION**: If no, contact senior chemist to see if any were specified.

**6.2** Is the Matrix Spike/Matrix Spike Duplicate Recovery Form present? **Yes** [✓] No [ ] N/A [ ] Comments:

**NOTE:** *A full target, second source MS/MSD is required by MADEP.*
**ACTION:** If any matrix spike data are missing, call lab for resubmission.

**6.3** Were matrix spikes analyzed as indicated on the COC and project schedule? **Yes** [✓] No [ ] N/A [ ] Comments:

**ACTION**: If any matrix spike data are missing, call lab for resubmission. If none, no qualification is needed. Narrate non-compliance.

*6.4 Are any metal spike recoveries outside of the QC limits? Yes [✓] **No** [ ] N/A [ ] Comments:

| Sample Type | ***MADEP % Rec*** | QAPP % Rec | Method |
|---|---|---|---|
| Water | *75-125* | N/A | 6010B |
| Water | *N/A* | 70-130 | 200.7 |
| Soil | *75-125* | 75-125 | 6010B |

Action: Sample DZW-Li was qualified estimated J at the reported value of 1.1981 mg/l

**NOTE:** %R = $\frac{(SSR-SR)}{SA}$ x 100% Where: SSR = Spiked sample result, SR = Sample result, SA = Spike added

Post spike recovery on DZW-Li was for Lithium

**NOTE:** If dilutions are required due to high sample concentrations (> 4X spike), the data are evaluated, but no flags are applied.

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP *(1 per 10)* ☐ *MADEP Option 1 (1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION**: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

## 10.0 Special QA/QC

10.1 Were both total and dissolved metals analysis performed? If so, the dissolved metal concentration should not exceed that of the total metal. Yes [ ] No [✓] N/A [ ] Comments:

**ACTION:** If results for both total and dissolved are ≥ 5x the PQL **and** the dissolved concentration is 10% higher than the total, flag both results as estimated (J). If total and dissolved concentrations are less than 5x the PQL **and** the **difference** exceeds 2x the PQL, flag both results as estimated (J)





| *MADEP Laboratory Duplicate Sample RPD Criteria:* | QAPP RPD |
|---|---|
| *For aqueous results > 5x RL, RPD must be ± 20%* | 20 |
| *For aqueous results < 5x RL, RPD must be ≤ RL* | 20 |
| *For soil/sediment results > 5x RL, RPD must be ± 35%* | 20 |
| *For soil/sediment results < 5x RL, RPD must be ≤ 2x RL* | 20 |

**ACTION**: If the RPD exceeds the limits, qualify both positive results and non-detects as estimated and flag them J. Narrate non-compliance

## 8.0 Sampling Accuracy

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [ ] N/A [✓] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:

***NOTE**: MADEP does not require the collection of rinsate blanks.*

**ACTION:** Evaluate rinsate results against blank results to determine if contaminant may be laboratory-derived. If results are not lab-related, qualify according to below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

## 9.0 Field Duplicates

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

**10.0 Application of Validation Qualifiers**

Was any of the data qualified? Yes [✓] **No** [ ] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.

Sample DZW-Li qualified estimated (J) due to high spike recovery result.

**REFERENCES**

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw, GA 30144. August 1999

U.S. Environmental Protection Agency (USEPA), 1989. "Region 1 Laboratory Data Validation Functional Guidelines For Evaluating Inorganic Analyses"; Hazardous Site Evaluation Division; February 1989.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Massachusetts Quality Assurance and Quality Control (QA/QC) Requirements." BWSC-CAM, Interim Final Draft, Revision No. 2, 5 October 2001.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Quality Assurance and Quality Control Guidelines for Sampling, Data Evaluation and Reporting Activities," BWSC-CAM, Section VII, Public Comment Draft, Revision No. 0, 21 December 2001.

Version 2, April 2003

**OLIN-WILMINGTON**
**LEVEL I DATA QUALITY EVALUATION**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**WET CHEMISTRY PARAMETERS BY VARIOUS METHODS**

Reviewer/Date [illegible] 6/1/04
Sr. Review/Date Chris Ricardi 7/19/04
Lab Report # 214362, 216375, 215499, 215498
Project # 63 00030066.13.02

chloride, sulfate, nitrate, nitrite, ammonia, specific gravity

**Note:** The following analyses will be evaluated according to the "MADEP QA/QC Guidelines for **Sampling, Data Evaluation and Reporting Activities.**" MADEP, however, may not list QA/QC criteria for every chemical analysis. Where not defined by MADEP, criteria will default to values stipulated in the QAPP. Where the QAPP does not define criteria, QA/QC requirements will default to limits employed by the laboratory.

## 1.0 Laboratory Deliverable Requirements

**1.1 Laboratory Information:** Was all of the following provided in the laboratory report? Yes [✓] No [ ] N/A [ ] Comments:
Check items received.

- [✓] *Name of Laboratory*
- [✓] *Address*
- [✓] *Project ID*
- [✓] *Phone #*
- [✓] *Sample identification – Field and Laboratory (IDs must be cross-referenced)*

Client Information:
- [✓] *Name*
- [✓] *Address*
- [✓] *Client Contact*

ACTION: If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** *Yes [✓] No [ ] N/A [ ] Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** *Yes [✓] No [ ] N/A [ ] Comments:*

- [✓] *Narrative serves as an exception report for the project and method QA/QC performance.*
- [✓] *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed? Yes [✓] No [ ] N/A [ ] Comments:

Does the laboratory report include copies of Chain of Custody forms containing all samples in this SDG?

**NOTE:** Olin receives and maintains the *original* COC.

ACTION: If no, contact lab for submission of copy of missing completed COC.

**1.5 Sample Receipt Information (*Cooler Receipt Form*):** Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?



MACTEC
Engineering and Consulting, Inc.
511 Congress Street
P.O. Box 7050
Portland, Maine 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow
From: Chris Ricardi
Date: 12/15/03
Subject: Olin Wilmington – Geomega DAPL Column Test Samples

**Data Validation Summary**
**Sets 214362, 215498, 215499, and 216375**

These sample sets contained results for aqueous samples generated by Geomega from the effluent stream of their laboratory column tests completed on DAPL saturated soil cores collected from the Olin Wilmington site. The samples were identified as FM-77, SD-68, SD-70, and SD-74. The samples were generated during testing completed during April through June 2004, and were analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for selected metals (aluminum, calcium, chromium, iron, magnesium, and sodium) and water chemistry parameters including chloride, sulfate, nitrite, nitrate, and ammonia.

The Olin Wilmington QAPP was used as a reference during the review. Results were reviewed using the Data Quality Evaluation checklists that were developed for the Olin Wilmington annual and quarterly groundwater monitoring tasks.

In data set 216375 the sample was reported by the laboratory with a sample ID of SD-7A. The correct sample ID should be SD-74. The ID was corrected in the final data.

**Validation Actions**

No data quality issues were identified during validation and the results are interpreted to be usable as reported by the laboratory.

**1.6 Sample Results Section:** *Was the following information supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

[✓] Field ID and Lab ID [✓] Date and time collected [✓] Analyst Initials [✓] Dilution Factor [N/A] % moisture or solids [✓] Reporting
[N/A] Clean-up method [✓] Analysis method [N/A] Preparation method [✓] Date of preparation/extraction/digestion clean-up and analysis, where applicable
[✓] Matrix [✓] Target analytes and concentrations [✓] Units (soils must be reported in dry weight)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**1.7 QA/QC Information:** Was the following information provided in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

[✓] Method blank results [✓] LCS recoveries [✓] MS/MSD recoveries and RPDs [N/A] Laboratory duplicate results (where applicable)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**2.0 Holding Times** Yes [ ] No [✓] N/A [ ] Comments:

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? The holding times are as follows:

✓ 28 days = ammonia, chemical oxygen demand, chloride, organic carbon, oil & grease, specific conductance, total organic carbon and sulfate

Alkalinity = 14 days Sulfide, TDS, TSS = 7 days pH = analyze immediately ✓ Nitrate nitrogen as N = 48 hrs

✓ Nitrite nitrogen as N = 48 hrs Nitrate + Nitrite as N = 28 days

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded qualify results (J). For water samples that are grossly exceeded (>2X hold time) reject (R) all non-detect results. Professional judgment used to qualify soils.

**3.0 Laboratory Method** Yes [✓] No [ ] N/A [ ] Comments:

3.1 Was the correct laboratory method used?

**ACTION:** If no, contact lab to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change or to request variance.

OLIN-WILMINGTON
LEVEL I DATA QUALITY EVALUATION
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Yes [✓] No [ ] N/A [ ] Comments:

[✓] Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

[✓] Container type noted [✓] Condition observed [N/A] pH verified (where applicable) [✓] Field and lab IDs cross referenced

**ACTION:** If no, contact lab for submission of missing or incomplete documentation.

**1.5.1** Were the correct bottles and preservatives used? Yes [ ] No [✓] N/A [ ] Comments: Samples were poured off into proper containers and preservatives were added at the laboratory

Ammonia,– 1 Liter polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Oil & Grease – 1 Liter glass/HCL to pH<2,cool to 4°C

Alkalinity – 1 Liter polyethylene/cool to 4°C

Chemical Oxygen Demand – 50 mL polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Chloride, pH, sulfate - 50 mL polyethylene/cool to 4°C

Organic Carbon – 500 mL amber glass bottle/HCl or $H_2SO_4$ to pH<2,cool to 4°C

Sulfide – 50 mL polyethylene/ZnAcetate + NaOH to pH>9, cool to 4°C
Specific conductance, TDS, TSS – 100 mL polyethylene/cool to 4°C

**ACTION:** If no, inform senior chemist. Document justification for change in container/volume (if applicable), qualify positive and non-detect data (J) data if cooler temperature exceeds 10°C. Rejection of data requires professional judgment

**1.5.2** Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

**1.5.3** Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [✓] No [ ] N/A [ ] Comments: See comments in section 1.5.1 previous.

**ACTION:** If no, document discrepancy in case narrative and contact lab for justification. Consult senior chemist for action needed.

4.3 Is the method blank less than the PQL? (See Section 3.2 for PQLs). Yes [✓] No [ ] N/A [ ] Comments:

4.4 Do any method blanks have positive results for wet chemistry parameters? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

**ACTION:** If any blank has positive results, list all the concentrations detected and flagging level (flagging level = 5 × blank value) on the checklist. List all affected samples and their qualifiers.

## 5.0 Laboratory Control Standards

5.1 Was a laboratory control standard (LCS) run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call laboratory for LCS form submittal. If data is not available, use professional judgment to determine qualification actions for data associated with the batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

5.3 Is any wet chemistry analyte LCS recovery outside the control limits? Yes [ ] No [✓] N/A [ ] Comments:





3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☑ QAPP ☐ Lab? Yes [ ] No [✓] N/A [ ] Comments: The lab reported a PQL for sulfate (2 mg/L) that is greater than the QAPP required PQL of 0.10 mg/L. Sulfate results are greater than the PQL. No further action required.

**Note:** *The MADEP QA/QC Guidelines do not yet list PQLs for wet chemistry analyses, therefore all criteria will default to values stipulated in the QAPP*. Where the QAPP does not define criteria, QA/QC requirements default to limits employed by the lab**. Other criteria may also apply.*

| | | | |
|---|---|---|---|
| Ammonia* ☑ = 0.1 mg/ L | Alkalinity** ☐ = 1 mg/L | Bicarbonate Alkalinity** ☐ = 1 mg/L | Carbonate Alkalinity** ☐ = 1 mg/L |
| Nitrate Nitrogen as N* ☑ = .05 mg/L | Nitrite Nitrogen as N* ☑ = .01 mg/L | Chloride* ☑ = 1 mg/L | Hardness * ☐ = 2 mg/L |
| Spec. Cond.** ☐ 3 umhos/cm | Total Organic Carbon** ☐ = 1 mg/L | Oil & Grease* ☐ = 3 mg/L | Sulfate (EPA 300.0)* ☒ = 0.1 mg/L |
| COD:* Low – 20 mg/L | COD* High - 50 mg/L ☐ | TDS* ☐ = 10 mg/L | TSS* ☐ = 5 mg/L |
| pH* ☐ < 2 to > 12 | | | |

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

**ACTION:** If no, evaluate change with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are the appropriate parameter results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If *dilutions were required, were dilution factors reported?* Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact the lab for submission.

## 4.0 Method Blanks

4.1 Are the Method Blank Summaries present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call the laboratory for submission of missing data.

4.2 Was a method blank analyzed for each analysis batch of wet chemistry field samples of 20 or less? Yes [✓] No [ ] N/A [ ] Comments:

6.3 Were matrix spikes analyzed at the required frequency of 1 per 20 samples per matrix? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If any matrix spike data is missing, call lab for resubmission.

6.4 Are any wet chemistry analyte spike recoveries outside of the QC limits? Yes [ ] No [✓] N/A [ ] Comments:

NOTE: $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample result, SR = Sample result, SA = Spike added

**MS/MSD Recovery Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia* (LACHAT) ☐ = 74-125% |
| Chloride*(SM 4500 Cl) ☐ = 77-116% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA |
| Oil & Grease* = NA | COD Low* ☐ = 61-142% | COD High* ☐ = 92-109% | Nitrate Nitrogen as N** ☐ = 75-119% |
| Nitrite Nitrogen as N** ☐ = 68-136% | Hardness* ☐ = 70-130% | Sulfate (EPA 300.0)* ☑ = 75-125% | pH* = NA TSS* = NA |

Other parameter(list) _____ % R = _____ ☐ Rec Limits = _____

* = Laboratory Limits ** = Olin QAPP Limits *(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**NOTES:** 1) If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.
2) If the MS/MSD was performed by the laboratory on a non-project sample, no qualification is required.

**ACTION:** MS/MSD flags only apply to the sample spiked. Do not evaluate if sample concentration is > 4X spike. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit but > 30%, qualify both positive results and non-detects (J). If the MS/MSD recovery is < 30% and the sample is non-detect, the results are considered unusable and flagged (R).

**ACTION:** Laboratory control limits apply when spiked sample results fall within the normal calibration range. If dilutions are required due to high sample concentrations, the data is evaluated, but no flags are applied.

6.5 Are any RPDs for MS/MSD recoveries outside of the QA/QC limits? Yes [ ] No [✓] N/A [ ] Comments:

NOTE: $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where S = MS result, D = MSD result

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LEVEL I DATA QUALITY EVALUATION
STANDARD OPERATING PROCEDURE AND CHECKLIST
WET CHEMISTRY PARAMETERS BY VARIOUS METHODS

**LCS Limits:**

| | | | |
|---|---|---|---|
| Alkalinity** ☐ = 80-120% | Bicarbonate Alkalinity** ☐ = 80-120% | Carbonate Alkalinity** ☐ = 80-120% | Specific Conductivity *☐ = 80-120% |
| Total Organic Carbon** ☐ = 80-120% | TDS** ☐ = 80-120% | Oil & Grease* ☐ = 80-120% | Ammonia Nitrogen as N* ☑ = 80-120% |
| COD Low* ☐ = 80-120% | COD High* ☐ = 80-120% | Nitrate Nitrogen as N** ☑ = 85-115% | Nitrite Nitrogen as N** ☑ = 75-120% |
| Hardness* ☐ = 85-115% | Chloride* ☑ = 80-120% | Sulfate (EPA 300.0)* ☑ = 75-125% | pH* ☐ = 98-102% TSS* NA |

Other parameter(list) _____ %R = _____ ☐ Rec Limits= _____

Other parameter(list) _____ %R = _____ ☐ Rec Limits = _____

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**ACTION:** If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and no-detect results within the batch as (J). If LCS recovery is <10%, non-detect results are rejected (R).

## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs analyzed? List project samples that were spiked. Yes [✓] No [ ] N/A [ ] Comments: The lab perform MS/MSD analysis for sulfate on sample FM-77 (214302-15).

**ACTION:** If no, contact senior chemist to see if any were specified.

6.2 Is the MS/MSD Recovery Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

**ACTION:** Evaluate rinsate results vs. blank results to determine if contaminant may be laboratory-derived. If not lab-related, qualify according to the table below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

*NOTE: MADEP does not require the collection of rinsate blanks.*

**9.0 Field Duplicates**

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP ☐ *MADEP Option 1(1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

Was any of the data qualified? Yes [ ] No [✓] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.





**MS/MSD RPD Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia** (LACHAT) ☐ = 8% |
| Chloride**(SM 4500 Cl) ☐ = 15% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA Total Organic Carbon* = NA |
| COD Low** ☐ = 14% | COD High** ☐ = 16% | Nitrate Nitrogen as N** ☐ 16% | Nitrite Nitrogen as N** ☐ = 16% |
| Oil & Grease* = NA | Hardness* = NA | Sulfate (EPA 300.0)* ☑ = 10% | pH* = NA TSS* = NA |

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

* = Laboratory Limits ** = Olin QAPP Limits

(*MADEP has not yet defined LCS recovery limits for wet chemistry analyses.*)

**7.0 Laboratory Duplicate**

Are the RPDs for the laboratory duplicates <20% unless otherwise specified below? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If the RPD is greater than specified limits, qualify all results for that analyte as estimated (J).

| | | | |
|---|---|---|---|
| Alkalinity* = 4% | Bicarbonate Alkalinity* = 4% | Carbonate alkalinity* = 4% | Oil & Grease* ☐ = 20% |
| pH* ☐ = 3% | Specific Conductivity *☐ = 5% | TSS** ☐ = 6% | TDS** ☐ = 6% |

**8.0 Sampling Accuracy**

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:

## Calicchio, Wolfgang

**From:** Ricardi, Christian
**Sent:** Tuesday, June 01, 2004 10:40 AM
**To:** 'JWickham@stl-inc.com'
**Cc:** Calicchio, Wolfgang
**Subject:** RE: Olin 214362 lab question.

Thanks Jamie. We should be all set with your email and we will edit hardcopy.

-----Original Message-----
**From:** JWickham@stl-inc.com [mailto:JWickham@stl-inc.com]
**Sent:** Tuesday, June 01, 2004 10:12 AM
**To:** Ricardi, Christian
**Subject:** RE: Olin 214362 lab question.

Hi Chris,
Here it is.
The LCS for sulfate recovered within control limits at 104%. (p.10). The data point was in LIMS, but unfortunately set not to report. Do you require a revised report?

Please note, this qc report (attached) was run under a reporting format that reports non-detects at the standard reporting limit, not the MDL.

jtw

-----Original Message-----
**From:** Ricardi, Christian [mailto:CSRicardi@mactec.com]
**Sent:** Tuesday, June 01, 2004 9:17 AM
**To:** Wickham, Jamie; Mason, Becky
**Subject:** FW: Olin 214362 lab question.

Hi Jamie,

I received the question below from one of our chemists. Please review. Thanks.

Chris

-----Original Message-----
**From:** Calicchio, Wolfgang
**Sent:** Thursday, May 27, 2004 1:53 PM
**To:** Ricardi, Christian
**Subject:** Olin 214362 lab question.

Hello Chris. The inorganics QC report for sulfate indicates that LCS result is 0.075 U. The run date and time for that LCS (W04DSTK001) is the same as the method blank (which is also reported as 0.075 U). The percent recovery for sulfate is zero in the LCS. The case narrative indicates that there are no QA/QC deviations for the sulfate analysis; obviously this does not agree. Please have the lab review this and make corrections as necessary. Thank you.

Wolfgang Calicchio, Project Environmental Scientist

MACTEC Engineering and Consulting, Inc.



**OLIN-WILMINGTON**
**LEVEL I DATA QUALITY EVALUATION**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**WET CHEMISTRY PARAMETERS BY VARIOUS METHODS**

**REFERENCES**

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw, GA 30144, August 1999.

STL-Westfield, 2002. "Olin – General Chemistry Control Limits (Soil & Water)," Severn Trent Laboratories, Inc., 53 Southampton Road, Westfield, MA, 01085.

FW: Olin 214362 lab question.

511 Congress Street
PO Box 7050
Portland, Maine 04112-7050
Office 207 775-5401
Direct 207 828-3466
Fax 207 772-4762
Cell 207 837-1216
email wdcalicchio@mactec.com
web www.mactec.com

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Version 1.2, Nov 2002

**OLIN-WILMINGTON**
**LEVEL I DATA QUALITY EVALUATION**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**ICP METALS BY METHOD 6010B/200.7**

Reviewer/Date [illegible]
Sr. Review/Date Chris Ricordi 7/19/04
Lab Report # 214362, 216375, 215499
Project # 63 0003 0009.13.02 215498

aluminum, calcium, chromium, iron, magnesium, sodium

.0 **Laboratory Deliverable Requirements**

**1.1 Laboratory Information:** Was all of the following provided in the laboratory report? Yes [✓] No [ ] N/A [ ] Comments:
Check items received.

[✓] *Name of Laboratory* [✓] *Address* [✓] *Project ID* [✓] *Phone #* [✓] *Sample identification – Field and Laboratory*
Client Information: [✓] *Name* [✓] *Address* [✓] *Client Contact* *(IDs must be cross-referenced)*

**ACTION:** If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** *Yes [✓] No [ ] N/A [ ] Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** *Yes [✓] No [ ] N/A [ ] Comments:*

[✓] *Narrative serves as an exception report for the project and method QA/QC performance.* [✓] *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** Olin receives and maintains the *original* COC.

**ACTION:** If no, contact lab for submission of copy of completed COC.

☑ Method blank results ☑ LCS recoveries ☑ MS/MSD recoveries and RPDs ☑ Laboratory duplicate results (where applicable)

ACTION: If no, contact lab for submission of missing or incomplete information.

## 2.0 Holding Times

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? Holding time for metals is 180 days from sample collection to analysis for both water and soil. Yes [ ] No [✓] N/A [ ] Comments:

NOTE: List samples that exceed hold time with # of days exceeded on checklist

ACTION: If technical holding times are exceeded, qualify all positive results (J) and non-detects (UJ). If grossly exceeded (2X holding time) reject (R) all non-detect results.

## 3.0 Laboratory Method

3.1 Was the correct laboratory method used? Yes [✓] No [ ] N/A [ ] Comments:

| | |
|---|---|
| Water Digestion | 3005A or 3010A or 3020A |
| Soil Digestion | 3050B |
| Metals | 6010B or 200.7 |

ACTION: If no, contact laboratory to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change and to request variance.

3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☑ QAPP ☐ Lab ☐ MADEP Yes [ ] No [✓] N/A [ ] Comments: The lab reported PQLs for aluminum (50 ug/L), calcium (100 ug/L) and magnesium (100 that are less than the QAPP required PQLs. No fur action required.

NOTE: *Verify that the reported metals match the target list specified on the COC.*





1.5 **Sample Receipt Information (*Cooler Receipt Form present?*):** Yes [✓] No [ ] N/A [ ] Comments:

Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?

☑ Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

☑ Container type noted ☑ sample condition observed ☐ N/A pH verified (where applicable) ☑ Field and lab IDs cross referenced

ACTION: If no, contact lab for submission of missing or incomplete documentation.

1.5.1 Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

1.5.2 Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [✓] No [ ] N/A [ ] Comments: Samples were poured o into proper containers a preservatives were added at th laboratory.

1.6 **Sample Results Section:** *Was each of the following requirements supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

☑ Field ID and Lab ID ☑ *Clean-up method* ☑ Matrix ☑ *Date and time collected* ☑ Analysis method ☑ Target analytes and concentrations ☑ Analyst Initials ☑ *Preparation method* ☑ *Dilution Factor* ☑ *Date of preparation/extraction/digestion clean-up and analysis, where applicable* ☑ Units (soils must be reported in dry weight) ☑ N/A % moisture or solids ☑ *Reporting limits*

ACTION: If no, contact lab for submission of missing or incomplete information.

1.7 **QA/QC Information:** Was each of the following information supplied in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

ACTION: For any blank with positive results, list all contaminants for each method blank including the concentration detected and the flagging level (flagging level = 5x the blank value) and the associated samples and qualifiers.

## 5.0 Laboratory Control Standard

5.1 Was a laboratory control standard run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

NOTE: *A full target, second source LCS is required by MADEP.*
ACTION: Call laboratory for LCS form submittal. If data are not available, use professional judgement to evaluate data accuracy associated with that batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, contact lab for resubmission of missing data.

5.3 Is the recovery of any analyte outside of MADEP control limits? Yes [ ] No [✓] N/A [ ] Comments:

| Sample Type | MADEP % Rec |
|---|---|
| Water | 80-120 |
| Soil | within Lab generated limits |

ACTION: If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and non-detects results within the batch as (J). If LCS recovery is <30%, positive and non-detect results are rejected (R).

Comments:





ACTION: If no, evaluate variation with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If dilutions were required, were dilution factors reported? Yes [ ] No [ ] N/A [✓] Comments:

ACTION: If no, contact the lab for submission.

## 4.0 Method Blanks

4.1 Is the Method Blank Summary present? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, call the laboratory for submission of missing data.

4.2 Frequency of Analysis: Was a method blank analyzed for each digestion batch of < 20 field samples? Yes [✓] No [ ] N/A [ ] Comments:

ACTION: If no, contact laboratory for justification. Consult senior chemist for action needed. Narrate non-compliance.

4.3 Is the method blank less than the PQLs for all target elements? Yes [✓] No [ ] N/A [ ] Comments:

NOTE: *MADEP requires the method blank to be matrix matched and digested with the samples*

4.4 Do any method blanks have positive results for metals? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.

**ACTION:** MS/MSD flags only apply to the sample spiked. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit, qualify positive results and non-detects (J).

6.5 Are any RPDs for MS/MSD recoveries outside of the QC limits? Yes [ ] No [ ] N/A [✓] Comments: The lab did not perform an MSD analysis. See lab dup.

**NOTE:** $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where: S = MS sample result, D = MSD sample result

**NOTE:** If dilutions are required due to high sample concentrations, the data are evaluated, but no flags are applied.

**ACTION:** If the RPD exceeds the control limit, qualify positive results and non-detects (J).

## 7.0 Laboratory Duplicate

7.1 Was a laboratory duplicate sample analyzed? If so, is the Laboratory Duplicate Sample Form present? Yes [✓] No [ ] N/A [ ] Comments:

***NOTE:*** *MADEP refers to this sample as a "matrix duplicate".*

**ACTION:** If not analyzed, qualification is not needed. If data is missing, contact laboratory for resubmission of report. Narrate non-compliance.

7.2 Is the RPD between the result for the laboratory duplicate sample and the result for the parent sample outside of the QA/QC limits? Yes [ ] No [✓] N/A [ ] Comments:





## .0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or risk specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs ~~collected~~ analyzed? List project samples that were spiked. 6/27/04 Yes [✓] No [ ] N/A [ ] Comments: The lab performed an MS analysis on sample FM-77 (2143427-1).

**ACTION:** If no, contact senior chemist to see if any were specified.

6.2 Is the Matrix Spike/Matrix Spike Duplicate Recovery Form present? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *A full target, second source MS/MSD is required by MADEP.*
**ACTION:** If any matrix spike data are missing, call lab for resubmission.

6.3 Were matrix spikes analyzed as indicated on the COC and project schedule? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If any matrix spike data are missing, call lab for resubmission. If none, no qualification is needed. Narrate non-compliance.

6.4 Are any metal spike recoveries outside of the QC limits? Yes [ ] No [✓] N/A [ ] Comments:

| Sample Type | *MADEP % Rec* | QAPP % Rec | Method |
|---|---|---|---|
| Water | *75-125* | N/A | 6010B |
| Water | *N/A* | 70-130 | 200.7 |
| Soil | *75-125* | 75-125 | 6010B |

**NOTE:** $\%R = \frac{(SSR-SR)}{SA} \times 100\%$ Where: SSR = Spiked sample result, SR = Sample result, SA = Spike added

**NOTE:** If dilutions are required due to high sample concentrations (> 4X spike), the data are evaluated, but no flags are applied.

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP *(1 per 10)* ☐ *MADEP Option 1 (1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

ACTION: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

## 10.0 Special QA/QC

10.1 Were both total and dissolved metals analysis performed? If so, the dissolved metal concentration should not exceed that of the total metal. Yes [ ] No [✓] N/A [ ] Comments:

**ACTION:** If results for both total and dissolved are ≥ 5x the PQL **and** the dissolved concentration is 10% higher than the total, flag both results as estimated (J). If total and dissolved concentrations are less than 5x the PQL **and** the **difference** exceeds 2x the PQL, flag both results as estimated (J)





| *MADEP Laboratory Duplicate Sample RPD Criteria:* | QAPP RPD |
|---|---|
| *For aqueous results > 5× RL, RPD must be ± 20%* | 20 |
| *For aqueous results < 5× RL, RPD must be ≤ RL* | 20 |
| *For soil/sediment results > 5× RL, RPD must be ± 35%* | 20 |
| *For soil/sediment results < 5× RL, RPD must be ≤ 2× RL* | 20 |

**ACTION:** If the RPD exceeds the limits, qualify both positive results and non-detects as estimated and flag them J. Narrate non-compliance

## 8.0 Sampling Accuracy

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

**ACTION:** Evaluate rinsate results against blank results to determine if contaminant may be laboratory-derived. If results are not lab-related, qualify according to below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

## 9.0 Field Duplicates

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

Severn Trent Laboratory
214362

Water Column Study - Geomega
Dates Sampled: 4/6/04

OLIN CORPORATION
LEVEL I DATA QUALITY EVALUATION – OPTION 1
STANDARD OPERATING PROCEDURE AND CHECKLIST
ICP METALS BY METHOD 6010B/200.7

**0.0 Application of Validation Qualifiers**

Was any of the data qualified? Yes [ ] No [✓] N/A [ ] Comments:

f so, apply data qualifiers directly to the DQE copy of laboratory report and flag pages for entry in database.

**REFERENCES**


LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw, GA 30144. August 1999

U.S. Environmental Protection Agency (USEPA), 1989. "Region 1 Laboratory Data Validation Functional Guidelines For Evaluating Inorganic Analyses"; Hazardous Site Evaluation Division; February 1989.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Massachusetts Quality Assurance and Quality Control (QA/QC) Requirements." BWSC-CAM, Interim Final Draft, Revision No. 2, 5 October 2001.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Quality Assurance and Quality Control Guidelines for Sampling, Data Evaluation and Reporting Activities," BWSC-CAM, Section VII, Public Comment Draft, Revision No. 0, 21 December 2001.

MACTEC

Engineering and Consulting, Inc.
511 Congress Street
P.O. Box 7050
Portland, Maine 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow
From: Chris Ricardi
Date: 12/15/03
Subject: Olin Wilmington – Geomega DAPL Column Test Samples

**Data Validation Summary**
**Sets 214362, 215498, 215499, and 216375**

These sample sets contained results for aqueous samples generated by Geomega from the effluent stream of their laboratory column tests completed on DAPL saturated soil cores collected from the Olin Wilmington site. The samples were identified as FM-77, SD-68, SD-70, and SD-74. The samples were generated during testing completed during April through June 2004, and were analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for selected metals (aluminum, calcium, chromium, iron, magnesium, and sodium) and water chemistry parameters including chloride, sulfate, nitrite, nitrate, and ammonia.

The Olin Wilmington QAPP was used as a reference during the review. Results were reviewed using the Data Quality Evaluation checklists that were developed for the Olin Wilmington annual and quarterly groundwater monitoring tasks.

In data set 216375 the sample was reported by the laboratory with a sample ID of SD-7A. The correct sample ID should be SD-74. The ID was corrected in the final data.

**Validation Actions**

No data quality issues were identified during validation and the results are interpreted to be usable as reported by the laboratory.

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Steve Morrow
Olin Chemical
1186 Lower River Road
PO Box 248
Charleston, TN 37310-0248

Geomega

04/20/2004

Report Number: 214362

Dear Steve Morrow,

The analysis of your sample(s) submitted on 04/06/2004 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your Project Manager, Rebecca C. Mason.

For questions, concerns or comments regarding our service, please do not hesitate to contact me directly. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL WESTFIELD

Technical Review: 4/20/04

Total number of pages in this report: 23

MCP CASE NARRATIVE

**Client: Olin Chemical**

**Report Number: 214362**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 04/06/04; the samples arrived in good condition, properly preserved and on ice.

**Subcontracted**

The Specific Gravity analyses were performed at STL-Chicago, 2417 Bond Street, University Park, IL 60466.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**EPA 200.7**
There were no QA/QC deviations or issues reported for this method

**EPA 300.0 (Chloride)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Sulfate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrite)**
There were no QA/QC deviations or issues reported for this method.

**LAC 107061B Ammonia**
There were no QA/QC deviations or issues reported for this method.



SAMPLE INFORMATION
Date: 04/20/2004

Job Number.: 214362
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 214362-1 | FM-77 | Water | 04/05/2004 | 17:00 | 04/06/2004 | 10:20 |



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD
NELAP FL E87912 TOX NY DOH 10843 NH DES 253901-A NELAP NY10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
Billerica-Service Center Rangeway Rd. Ilerica, MA 01862 (978) 667-1400 Fax: (978) 667-7871

LABORATORY TEST RESULTS

Job Number: 214362

Date: 04/20/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TEST1 ATTN: Steve Morrow

Customer Sample ID: FM-77
Date Sampled.....: 04/05/2004
Time Sampled.....: 17:00
Sample Matrix.....: Water

Laboratory Sample ID: 214362-1
Date Received.....: 04/06/2004
Time Received.....: 10:20

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 64 | | 10 | mg/L | 04/06/04 | rwe |
| EPA300.0 PartA | Sulfate | 94 | | 2.0 | mg/L | 04/06/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 2.7 | | 0.050 | mg/L | 04/06/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.10 | mg/L | 04/06/04 | rwe |
| LAC 10-107061B | Ammonia (NH3), as N | 30 | | 0.20 | mg/L | 04/12/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 270 | | 50 | ug/L | 04/16/04 | rac |
| | Calcium (Ca) | 33000 | | 100 | ug/L | 04/16/04 | rac |
| | Chromium (Cr) | 31 | | 10 | ug/L | 04/16/04 | rac |
| | Iron (Fe) | ND | U | 50 | ug/L | 04/16/04 | rac |
| | Magnesium (Mg) | 3100 | | 100 | ug/L | 04/16/04 | rac |
| | Sodium (Na) | 250000 | | 1000 | ug/L | 04/16/04 | rac |

* In Description = Dry Wgt.



SEVERN TRENT STL

MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD

NELAP FL E87912 TOX
NY DOH 10843
NH DES 253901-A
NELAP NY10843

STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707

STL Billerica-Service Center
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

# SUBCONTRACTED DATA

**STL – Chicago**
**225636**

**Water Column Study – Geomega**
**Specific Gravity**
**Date Sampled: 4/5/2004**

SEVERN TRENT STL

STL Chicago
2417 Bond Street
University Park, IL 60466

Tel: 708 534 5200 Fax: 708 534 5211
www.stl-inc.com

# SEVERN TRENT LABORATORIES
# ANALYTICAL REPORT

JOB NUMBER: 225636

Prepared For:

Severn Trent Laboratories
Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

Project: STL Westfield

Attention: Becky Mason

Date: 04/15/2004

Bonnie Stadelmann
Signature

04/15/04
Date

Name: Bonnie M. Stadelmann

Title: Project Manager

E-Mail: bstadelmann@stl-inc.com

STL Chicago
2417 Bond Street
University Park, IL 60466

PHONE: (708) 534-5200
FAX..: (708) 534-5211

This Report Contains ( 7 ) Pages

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# LABORATORY TEST RESULTS

Job Number: 225636

Date:04/15/2004

CUSTOMER: Severn Trent Laboratories | PROJECT: WESTFIELD 214362 | ATTN: Becky Mason

Customer Sample ID: 214362-1
Date Sampled.....: 04/05/2004
Time Sampled.....: 17:00
Sample Matrix.....: Water

Laboratory Sample ID: 225636-1
Date Received.....: 04/07/2004
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | QT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 0.9990 | | | | 0.0001 | 1 | | 114744 | | 04/15/04 1015 | cls |

* In Description = Dry Wgt.



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SAMPLE INFORMATION
Date: 04/15/2004

Job Number.: 225636
Customer...: Severn Trent Laboratories
Attn.....: Becky Mason

Project Number.....: 20000230
Customer Project ID....: WESTFIELD 214362
Project Description....: STL Westfield

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 225636-1 | 214362-1 | Water | 04/05/2004 | 17:00 | 04/07/2004 | 10:00 |

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## L A B O R A T O R Y  C H R O N I C L E

Job Number: 225636

Date: 04/15/2004

CUSTOMER: Severn Trent Laboratories  PROJECT: WESTFIELD 214362  ATTN: Becky Mason

Lab ID: 225636-1  Client ID: 214362-1  Date Recvd: 04/07/2004  Sample Date: 04/05/2004

| METHOD | DESCRIPTION | RUN# | BATCH# | PREP BT #(S) | DATE/TIME ANALYZED | DILUTION |
|---|---|---|---|---|---|---|
| PKG INO (WC) | PKG INO (WET CHEMISTRY) | 1 | | | | |
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C) | 1 | 114744 | 114744 | 04/15/2004 1015 | |



## Q U A L I T Y  A S S U R A N C E  M E T H O D S
## R E F E R E N C E S  A N D  N O T E S

Report Date: 04/15/2004

### REPORT COMMENTS

1) All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.
2) Soil, sediment and sludge sample results are reported on a "dry weight" basis except when analyzed for landfill disposal or incineration parameters. All other solid matrix samples are reported on an "as received" basis unless noted differently.
3) Reporting limits are adjusted for sample size used, dilutions and moisture content if applicable.
4) The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert. ID# 100201
5) According to 40CFR Part 136.3, pH, Chlorine Residual and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When these parameters are not indicated as field (e.g. pH Field) they were not analyzed immediately, but as soon as possible on laboratory receipt.

Glossary of flags, qualifiers and abbreviations (any number of which may appear in the report)

Inorganic Qualifiers (Q-Column)

U Analyte was not detected at or above the stated limit.
< Not detected at or above the reporting limit.
J Result is less than the RL, but greater than or equal to the method detection limit.
B Result is less than the CRDL/RL, but greater than or equal to the IDL/MDL.
S Result was determined by the Method of Standard Additions.
F AFCEE: Result is less than the RL, but greater than or equal to the method detection limit.

Inorganic Flags (Flag Column)

\- ICV,CCV,ICB,CCB,ISA,ISB,CRI,CRA,MRL: Instrument related QC exceed the upper or lower control limits.
* LCS, LCD, MD: Batch QC exceeds the upper or lower control limits.
\+ MSA correlation coefficient is less than 0.995.
4 MS, MSD: The analyte present in the original sample is 4 times greater than the matrix spike concentration; therefore, control limits are not applicable.
E SD: Serial dilution exceeds the control limits.
H MB, EB1, EB2, EB3: Batch QC is greater than reporting limit or had a negative instrument reading lower than the absolute value of the reporting limit.
N MS, MSD: Spike recovery exceeds the upper or lower control limits.
W AS(GFAA) Post-digestion spike was outside 85-115% control limits.

Organic Qualifiers (Q - Column)

U Analyte was not detected at or above the stated limit.
ND Compound not detected.
J Result is an estimated value below the reporting limit or a tentatively identified compound (TIC).
Q Result was qualitatively confirmed, but not quantified.
C Pesticide identification was confirmed by GC/MS.
Y The chromatographic response resembles a typical fuel pattern.
Z The chromatographic response does not resemble a typical fuel pattern.
E Result exceeded calibration range, secondary dilution required.
F AFCEE:Result is an estimated value below the reporting limit or a tentatively identified compound (TIC)

Organic Flags (Flags Column)

B MB: Batch QC is greater than reporting limit.
* LCS, LCD, ELC, ELD, CV, MS, MSD, Surrogate: Batch QC exceeds the upper or lower control limits.
\- EB1, EB2, EB3, MLE: Batch QC is greater than reporting Limit
A Concentration exceeds the instrument calibration range
a Concentration is below the method Reporting Limit (RL)
B Compound was found in the blank and sample.
D Surrogate or matrix spike recoveries were not obtained because the extract was diluted for analysis; also compounds analyzed at a dilution will be flagged with a D.
H Alternate peak selection upon analytical review
I Indicates the presence of an interfence, recovery is not calculated.
M Manually integrated compound.
P The lower of the two values is reported when the % difference between the results of two GC columns is

Severn Trent Laboratory
215498

Water Column Study - Geomega
Dates Sampled: 5/18/04

**Severn Trent Laboratories, Inc.**
**Chain of Custody Form**

SEVERN TRENT STL

02614


•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

Langeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA


Client: Geomega
Address: 8995 Baseline Rd Ste 202
Boulder, CO 80303
Phone: 303 443 9117 Fax: 303 938-8123

Project #: C03303F
Project Manager: Dan Stone
Work ID:
Contact: Andrew Nicholson / Dan Stone

Job#: Quote#: PO#:

Shaded areas for office use

**Analysis Requested**
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

**Comments**
(Special Instructions)

Analytes:
Cr, Al, Fe, Ca, Mg, Na
$SO_4^-$, $Cl^-$
Nitrate
Nitrite
Ammonia
Specific Gravity

Requested Turn Around Time
10 Business Day (Std) ____ Rush TAT Requested:
15 Business Day ____ 24 hrs ____ 72 hrs ____
Other ____ 48 hrs ____ 5 Day ____

Regulatory Classification / Special Report Format
NPDES ____ Drinking Water ____ DEP Form(s) ____
RCRA ____ MCP GW1/S1 ____ MWRA Smart Rpt ____
Other ____ MCP QA/QC Rpt ____

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | Preservative: NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FM-77 | GW | CW | 4-5-04 1700 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): Craig R. Walker 4/5/04 1705 Signature:

| Relinquished by: | Date: | Time: | Received by: | Date: | Time: |
|---|---|---|---|---|---|
| | | | | 4-6-04 | 1020 |
| Relinquished by: | Date: | Time: | Received by: | Date: | Time: |

Method of shipment: **STL-Westfield**

Cooler: Y / N Samples Iced? Y / N
Temp @ receipt: 2.8 °C
Preservation/pH checked:
By: Date: 4/6/04

Page ____ of ____

White = Lab file Yellow = Report copy Pink = Customer copy

MACTEC

Engineering and Consulting, Inc.
511 Congress Street
P.O. Box 7050
Portland, Maine 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow
From: Chris Ricardi
Date: 12/15/03
Subject: Olin Wilmington – Geomega DAPL Column Test Samples

**Data Validation Summary**
**Sets 214362, 215498, 215499, and 216375**

These sample sets contained results for aqueous samples generated by Geomega from the effluent stream of their laboratory column tests completed on DAPL saturated soil cores collected from the Olin Wilmington site. The samples were identified as FM-77, SD-68, SD-70, and SD-74. The samples were generated during testing completed during April through June 2004, and were analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for selected metals (aluminum, calcium, chromium, iron, magnesium, and sodium) and water chemistry parameters including chloride, sulfate, nitrite, nitrate, and ammonia.

The Olin Wilmington QAPP was used as a reference during the review. Results were reviewed using the Data Quality Evaluation checklists that were developed for the Olin Wilmington annual and quarterly groundwater monitoring tasks.

In data set 216375 the sample was reported by the laboratory with a sample ID of SD-7A. The correct sample ID should be SD-74. The ID was corrected in the final data.

**Validation Actions**

No data quality issues were identified during validation and the results are interpreted to be usable as reported by the laboratory.



SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Steve Morrow
Olin Chemical
1186 Lower River Road
PO Box 248
Charleston, TN 37310-0248

Geomega

06/03/2004

Report Number: 215498

Dear Steve Morrow,

The analysis of your sample(s) submitted on 05/18/2004 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your Project Manager, Rebecca C. Mason.

For questions, concerns or comments regarding our service, please do not hesitate to contact me directly. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL WESTFIELD

Technical Review: SH 6/3/04

Total number of pages in this report: 32

MCP CASE NARRATIVE

Client: Olin Chemical

Report Number: 215498

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 5/18/04; the samples arrived in good condition, properly preserved and on ice.

**Subcontract**
Specific gravity was performed by STL Chicago 2417 Bond Street, University Park IL 60466.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**EPA 200.7**
There were no QA/QC deviations or issues reported for this method.

**LAC 10-107061B**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrite)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Sulfate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Chloride)**
There were no QA/QC deviations or issues reported for this method.



SAMPLE INFORMATION
Date: 06/03/2004

Job Number.: 215498
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 215498-1 | SD-68 | Water | 05/17/2004 | 12:00 | 05/18/2004 | 10:55 |



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD NH DES 253903-A
NELAP FL E87912 TOX NELAP NJ MA008 TOX NELAP NY10843 NY DOH 10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
STL Billerica-Service Center 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871

# LABORATORY TEST RESULTS

Job Number: 215498

Date: 06/03/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TEST1 ATTN: Steve Morrow

Customer Sample ID: SD-68
Date Sampled.....: 05/17/2004
Time Sampled.....: 12:00
Sample Matrix.....: Water

Laboratory Sample ID: 215498-1
Date Received.....: 05/18/2004
Time Received.....: 10:55

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 74 | | 10 | mg/L | 05/18/04 | rwe |
| EPA300.0 PartA | Sulfate | 580 | | 20 | mg/L | 05/18/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 5.7 | | 0.50 | mg/L | 05/18/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 05/18/04 | rwe |
| LAC 10-107061B | Ammonia (NH3), as N | 120 | | 2.0 | mg/L | 05/21/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1100 | | 50 | ug/L | 06/02/04 | bpg |
| | Calcium (Ca) | 33000 | | 100 | ug/L | 05/27/04 | bpg |
| | Iron (Fe) | 1200 | | 50 | ug/L | 05/27/04 | bpg |
| | Magnesium (Mg) | 6600 | | 100 | ug/L | 05/27/04 | bpg |
| | Sodium (Na) | 97000 | | 1000 | ug/L | 05/27/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Chromium (Cr) | 130 | | 5.0 | ug/L | 05/25/04 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT ST

DEP MA014
CH57
UPH 0494
DECWSD
NH DES 253903-A

NELAP FL E87912 TOX
NELAP NJ MA008 TOX
NELAP NY10843
NY DOH 10843

STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707

STL Billerica-Service Center
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

# SUBCONTRACTED DATA

**STL - Chicago**
**226879**

**Water Column Study – Geomega**
**Specific Gravity**
**Date Sampled: 5/17/2004**

SEVERN TRENT STL

STL Chicago
2417 Bond Street
University Park, IL 60466

Tel: 708 534 5200 Fax: 708 534 5211
www.stl-inc.com

# SEVERN TRENT LABORATORIES
# ANALYTICAL REPORT

JOB NUMBER: 226879

Prepared For:

Severn Trent Laboratories
Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

Project: STL Westfield

Attention: Becky Mason

Date: 06/02/2004

Signature

Date: 06/02/04

Name: Bonnie M. Stadelmann

Title: Project Manager

E-Mail: bstadelmann@stl-inc.com

STL Chicago
2417 Bond Street
University Park, IL 60466

PHONE: (708) 534-5200
FAX..: (708) 534-5211

This Report Contains ( 7 ) Pages

STL Chicago is part of Severn Trent Laboratories, Inc.

# LABORATORY TEST RESULTS

Job Number: 226879

Date:06/02/2004

CUSTOMER: Severn Trent Laboratories | PROJECT: WESTFIELD 215498 | ATTN: Becky Mason

Customer Sample ID: 215498-1
Date Sampled.....: 05/17/2004
Time Sampled.....: 12:00
Sample Matrix.....: Water

Laboratory Sample ID: 226879-1
Date Received.....: 05/19/2004
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 1.000 | | | | 0.0001 | 1 | | 119557 | | 06/02/04 1030 | cls |

* In Description = Dry Wgt.



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# SAMPLE IDENTIFICATION

Date:06/02/2004

Job Number..: 226879
Customer....: Severn Trent Laboratories
Attn.....: Becky Mason

Project Number.....: 20000230
Customer Project ID....: WESTFIELD 215498
Project Description....: STL Westfield

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 226879-1 | 215498-1 | Water | 05/17/2004 | 12:00 | 05/19/2004 | 10:00 |

Severn Trent Laboratory
215499

Water Column Study - Geomega
Dates Sampled: 5/18/04

# Severn Tr..t Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

00531

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•149 ..eway Road
N. B MA 01862
(P) ..-667-1400
(F) 978-667-7871
STL-BILLERICA

Job #: Quote #: PO#:

Client: Olin/Geomega
Address: 2995 Baseline Rd. Suite 202
Boulder CO 80303
Phone: 303-443-9117 Fax: 303-

Project #: C03303F
Project Manager: Dan Stone
Work ID:
Contact: Andrew Nicholson / Dan Stone

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested:
24 hrs 72 hrs
48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Shaded areas for office use only

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Analytes:
Cr, Al, Fe, Ca, Mg, Na
SO4 Cl
Nitrate
Nitrite
Ammonia
Specific Gravity

NOTE:
Hold times have expired on some analytes; please proceed with analysis anyway.
Thank You,
JW

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | Preservative: NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-68 | GW | JW | 5/17/04 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): JASON WHITE 5/17/04
Signature: Jason White

Relinquished by: " " Date: 5/17/04 Time: 1700
Received by: [illegible] Date: 5/18/04 Time: 1055

Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment: Fed Ex
8432 7573 9096

STL-Westfield

Cooler rec'd: Y / N Samples iced: Y / N
Temp @ rec'pt: °C
Preservation/pH checked:
By: Date:

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy

MACTEC

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Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow
From: Chris Ricardi
Date: 12/15/03
Subject: Olin Wilmington – Geomega DAPL Column Test Samples

**Data Validation Summary**
**Sets 214362, 215498, 215499, and 216375**

These sample sets contained results for aqueous samples generated by Geomega from the effluent stream of their laboratory column tests completed on DAPL saturated soil cores collected from the Olin Wilmington site. The samples were identified as FM-77, SD-68, SD-70, and SD-74. The samples were generated during testing completed during April through June 2004, and were analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for selected metals (aluminum, calcium, chromium, iron, magnesium, and sodium) and water chemistry parameters including chloride, sulfate, nitrite, nitrate, and ammonia.

The Olin Wilmington QAPP was used as a reference during the review. Results were reviewed using the Data Quality Evaluation checklists that were developed for the Olin Wilmington annual and quarterly groundwater monitoring tasks.

In data set 216375 the sample was reported by the laboratory with a sample ID of SD-7A. The correct sample ID should be SD-74. The ID was corrected in the final data.

**Validation Actions**

No data quality issues were identified during validation and the results are interpreted to be usable as reported by the laboratory.

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Steve Morrow
Olin Chemical
1186 Lower River Road
PO Box 248
Charleston, TN 37310-0248

Geomega

06/03/2004

Report Number: 215499

Dear Steve Morrow,

The analysis of your sample(s) submitted on 05/18/2004 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your Project Manager, Rebecca C. Mason.

For questions, concerns or comments regarding our service, please do not hesitate to contact me directly. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL WESTFIELD

Technical Review: 6/3/04

Total number of pages in this report: 33

**MCP CASE NARRATIVE**

**Client: Olin Chemical**

**Report Number: 215499**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 5/18/04; the samples arrived in good condition, properly preserved and on ice.

**Subcontract**
Specific gravity was performed by STL Chicago 2417 Bond Street, University Park IL 60466.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**EPA 200.7**
There were no QA/QC deviations or issues reported for this method.

**LAC 10-107061B**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrite)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Sulfate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Chloride)**
The batch QC sample recovered low and outside method control limits for both the MS and MSD analyses. This was a non-SDG sample. The LCS recovered within acceptable limits.

There were no additional QA/QC deviations or issues reported for this method.



**SAMPLE INFORMATION**
Date: 06/03/2004

Job Number.: 215499
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TEST!
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 215499-1 | SD-70 | Water | 05/17/2004 | 10:00 | 05/18/2004 | 10:50 |



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD NH DES 253903-A
NELAP FL E87912 TOX NELAP NJ MA008 TOX NELAP NY10843 NY DOH 10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
STL Billerica-Service Center 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL 02616

•53 Southampton Road, Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD

•1 Rangeway Road N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

SSS# 5 Quote# PO#

Client: Geomega / Olin
Address: 2995 Baseline Rd. Ste. 202
Boulder, CO 80303
Phone: 303-443-4117 Fax: 303-938-8123

Project #: C03303F
Project Manager: Dan Stone
Work ID:
Contact: Andrew Nicholson / Dan Stone

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Analytes:
Cr, Al, Fe, Ca, Mg, Na
$SO_4^-$ $Cl^-$
Nitrate
Nitrite
Ammonia
Specific Gravity

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-70 | GW | JW | 5-17-04 10:00 am | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Sampled by (print): JASON WHITE 5/17/04 10:00 Signature:
Relinquished by: " " Date: 5/17/04 Time: 11:00 Received by: Date: Time:
Relinquished by: Date: Time: Received by: Date: 5/18/04 Time: 1050
Method of shipment: FedEx 7432 7573 9085 STL-Westfield

Cooler ✓ Y N Samples Iced ✓ Y N
Temp @ receipt: °C
Preservation pH checked
By: Date:

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy

---

LABORATORY TEST RESULTS

Job Number: 215499 Date: 06/03/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TEST ATTN: Steve Morrow

Customer Sample ID: SD-70
Date Sampled.....: 05/17/2004
Time Sampled.....: 10:00
Sample Matrix.....: Water

Laboratory Sample ID: 215499-1
Date Received.....: 05/18/2004
Time Received.....: 10:50

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 73 | | 10 | mg/L | 05/18/04 | rwe |
| EPA300.0 PartA | Sulfate | 590 | | 20 | mg/L | 05/18/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 3.8 | | 0.050 | mg/L | 05/18/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 05/18/04 | rwe |
| LAC 10-107061B | Ammonia (NH3), as N | 110 | | 2.0 | mg/L | 05/21/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | 06/02/04 | bpg |
| | Aluminum (Al) | 1400 | | 50 | ug/L | 05/27/04 | bpg |
| | Calcium (Ca) | 41000 | | 100 | ug/L | 05/27/04 | bpg |
| | Iron (Fe) | 130 | | 50 | ug/L | 05/27/04 | bpg |
| | Magnesium (Mg) | 8500 | | 100 | ug/L | 05/27/04 | bpg |
| | Sodium (Na) | 120000 | | 1000 | ug/L | 05/27/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | 05/25/04 | bpg |
| | Chromium (Cr) | 170 | | 5.0 | ug/L | | |

* In Description = Dry Wgt.



STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707

STL Billerica-Service Center
1 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

DEP MA014
JHS7
PH 0494
DECWSD
NH DES 253903-A

NELAP FL E87912 TOX
NELAP NJ MA008 TOX
NELAP NY10843
NY DOH 10843

SEVERN TRENT STL

# SUBCONTRACTED DATA

**STL - Chicago**
**226880**

**Water Column Study – Geomega**
**Specific Gravity**
**Date Sampled: 5/17/2004**

SEVERN TRENT STL

STL Chicago
2417 Bond Street
University Park, IL 60466

Tel: 708 534 5200 Fax: 708 534 5211
www.stl-inc.com

# SEVERN TRENT LABORATORIES
# ANALYTICAL REPORT

JOB NUMBER: 226880

Prepared For:

Severn Trent Laboratories
Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

Project: STL Westfield

Attention: Becky Mason

Date: 06/02/2004

Bonnie Stadelmann
Signature

06/02/04
Date

Name: Bonnie M. Stadelmann

Title: Project Manager

E-Mail: bstadelmann@stl-inc.com

STL Chicago
2417 Bond Street
University Park, IL 60466

PHONE: (708) 534-5200
FAX..: (708) 534-5211

This Report Contains ( 8 ) Pages



STL Chicago is part of Severn Trent Laboratories, Inc.

SAMPLE INFORMATION
Date: 06/02/2004

Job Number.: 226880
Customer...: Severn Trent Laboratories
Attn.....: Becky Mason

Project Number.....: 20000230
Customer Project ID....: WESTFIELD 215499
Project Description....: STL Westfield

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 226880-1 | 215499-1 | Water | 05/17/2004 | 10:00 | 05/19/2004 | 10:00 |

Severn Trent Laboratory
216375

Water Column Study - Geomega
Dates Sampled: 6/16/04

STL Chicago is part of Severn Trent Laboratories, Inc.

LABORATORY TEST RESULTS

Job Number: 226880

Date:06/02/2004

CUSTOMER: Severn Trent Laboratories

PROJECT: WESTFIELD 215499

ATTN: Becky Mason

Customer Sample ID: 215499-1
Date Sampled.....: 05/17/2004
Time Sampled.....: 10:00
Sample Matrix.....: Water

Laboratory Sample ID: 226880-1
Date Received.....: 05/19/2004
Time Received.....: 10:00

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 1.002 | | | | 0.0001 | 1 | | 119557 | | 06/02/04 1032 | cls |

* In Description = Dry Wgt.

MACTEC

Engineering and Consulting, Inc.
511 Congress Street
P.O. Box 7050
Portland, Maine 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow
From: Chris Ricardi
Date: 12/15/03
Subject: Olin Wilmington – Geomega DAPL Column Test Samples

**Data Validation Summary**
**Sets 214362, 215498, 215499, and 216375**

These sample sets contained results for aqueous samples generated by Geomega from the effluent stream of their laboratory column tests completed on DAPL saturated soil cores collected from the Olin Wilmington site. The samples were identified as FM-77, SD-68, SD-70, and SD-74. The samples were generated during testing completed during April through June 2004, and were analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for selected metals (aluminum, calcium, chromium, iron, magnesium, and sodium) and water chemistry parameters including chloride, sulfate, nitrite, nitrate, and ammonia.

The Olin Wilmington QAPP was used as a reference during the review. Results were reviewed using the Data Quality Evaluation checklists that were developed for the Olin Wilmington annual and quarterly groundwater monitoring tasks.

In data set 216375 the sample was reported by the laboratory with a sample ID of SD-7A. The correct sample ID should be SD-74. The ID was corrected in the final data.

**Validation Actions**

No data quality issues were identified during validation and the results are interpreted to be usable as reported by the laboratory.

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Steve Morrow
Olin Chemical
1186 Lower River Road
PO Box 248
Charleston, TN 37310-0248

07/01/2004

Geomega

Report Number: 216375

Dear Steve Morrow,

The analysis of your sample(s) submitted on 06/16/2004 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your Project Manager, Rebecca C. Mason.

For questions, concerns or comments regarding our service, please do not hesitate to contact me directly. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL WESTFIELD

Technical Review: SH 7/1/04

Total number of pages in this report: 31

## MCP CASE NARRATIVE

**Client: Olin Chemical**

**Report Number: 216375**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

It should be noted that samples with elevated Reporting Limits (RLs) as a result of a dilution may not be able to satisfy "MCP program" reporting limits in some cases if the "adjusted" RL is greater that the applicable MCP standards or criterion to which the concentration is being compared. Such increases in the RLs are unavoidable but acceptable consequence of sample dilution that enables quantification of target analytes, which exceed the calibration range.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 6/16/04; the samples arrived in good condition, properly preserved and on ice.

**Subcontract**
ASTM 1298 was performed by STL Chicago 24107 Bond Street , University park, IL 60466.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

**EPA 200.7**
There were no QA/QC deviations or issues reported for this method.

**LAC –10-107061B**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrate)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Nitrite)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Chloride)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (sulfate)**
There were no QA/QC deviations or issues reported for this method.



SAMPLE INFORMATION
Date: 07/01/2004

Job Number.: 216375
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 216375-1 | SD-7A<br>SD-74 | Water | 06/15/2004 | 15:30 | 06/16/2004 | 10:38 |



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD NH DES 253903-A
NELAP FL E87912 TOX NELAP NJ MA008 TOX NELAP NY 10843 NY DOH 10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
STL Billerica-Service Center 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871

LABORATORY TEST RESULTS

Job Number: 216375 Date: 07/01/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TEST1 ATTN: Steve Morrow

Customer Sample ID: SD-7~~4~~4
Date Sampled.....: 06/15/2004
Time Sampled.....: 15:30
Sample Matrix.....: Water

Laboratory Sample ID: 216375-1
Date Received.....: 06/16/2004
Time Received.....: 10:38

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 68 | | 20 | mg/L | 06/28/04 | rwe |
| EPA300.0 PartA | Sulfate | 310 | | 40 | mg/L | 06/28/04 | rwe |
| EPA300.0 PartA | Nitrate as N (NO3-N) | 2.8 | | 0.050 | mg/L | 06/16/04 | rwe |
| EPA300.0 PartA | Nitrite as N (NO2-N) | ND | U | 0.010 | mg/L | 06/16/04 | rwe |
| LAC 10-107061B | Ammonia (NH3), as N | 79 | | 2.0 | mg/L | 06/23/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Calcium (Ca) | 33000 | | 100 | ug/L | 06/30/04 | bpg |
| | Iron (Fe) | 36 | B | 50 | ug/L | 06/30/04 | bpg |
| | Magnesium (Mg) | 6800 | | 100 | ug/L | 06/30/04 | bpg |
| | Sodium (Na) | 150000 | | 1000 | ug/L | 06/30/04 | bpg |
| EPA 200.7 | Metal Analysis Trace (ICP) | | | | | | |
| | Aluminum (Al) | 1300 | | 50 | ug/L | 06/23/04 | bpg |
| | Chromium (Cr) | 110 | | 5.0 | ug/L | 06/23/04 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT ST

EP MA014
H57
PH 0494
DECWSD
NH DES 253903-A

NELAP FL E87512 TOX
NELAP NJ MA008 TOX
NELAP NY 10843
NY DOH 10843

STL Westfield
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Westfield, MA 01085
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149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

# SUBCONTRACTED DATA

**STL - Chicago**
**227735**

**Water Column Study – Geomega**
**Specific Gravity**
**Date Sampled: 6/15/2004**

SEVERN TRENT STL

STL Chicago
2417 Bond Street
University Park, IL 60466

Tel: 708 534 5200 Fax: 708 534 5211
www.stl-inc.com

# SEVERN TRENT LABORATORIES
# ANALYTICAL REPORT

JOB NUMBER: 227735

Prepared For:

Severn Trent Laboratories
Westfield Executive Park
53 Southampton Road
Westfield, MA 01085

Project: STL Westfield

Attention: Becky Mason

Date: 06/29/2004

Bonnie Stadelmann
Signature

06/29/04
Date

Name: Bonnie M. Stadelmann

Title: Project Manager

E-Mail: bstadelmann@stl-inc.com

STL Chicago
2417 Bond Street
University Park, IL 60466

PHONE: (708) 534-5200
FAX..: (708) 534-5211

This Report Contains ( 8 ) Pages

STL Chicago is part of Severn Trent Laboratories, Inc.

# LABORATORY TEST RESULTS

Job Number: 227735

Date:06/29/2004

CUSTOMER: Severn Trent Laboratories PROJECT: WESTFIELD 216375 ATTN: Becky Mason

Customer Sample ID: 216375-1
Date Sampled.....: 06/15/2004
Time Sampled.....: 12:00
Sample Matrix.....: Water

Laboratory Sample ID: 227735-1
Date Received.....: 06/17/2004
Time Received.....: 09:30

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | FLAGS | MDL | RL | DILUTION | UNITS | BATCH | DT | DATE/TIME | TECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASTM 1298 | Spec. Grav. (Hydrometer 25 C)<br>Spec.Grav.(Hydrometer 25 C) | 1.0010 | | | | 0.0001 | 1 | | 121903 | | 06/28/04 0930 | cls |

* In Description = Dry Wgt.



STL Chicago is part of Severn Trent Laboratories, Inc.

S A M P L E I N F O R M A T I O N
Date: 06/29/2004

Job Number.: 227735
Customer...: Severn Trent Laboratories
Attn.....: Becky Mason

Project Number.....: 20000230
Customer Project ID....: WESTFIELD 216375
Project Description....: STL Westfield

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 227735-1 | 216375-1 | Water | 06/15/2004 | 12:00 | 06/17/2004 | 09:30 |

# Severn Trent Laboratories, Inc.
## Chain of Custody Form

SEVERN TRENT STL

00538

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•14 [illegible]eway Road
N. B[illegible], MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Olin / Geomega
Address: 2995 Baseline Rd Ste 202
Boulder, CO 80303
Phone: 3034439117 Fax: 3039389123

Project #: C03303F
Project Manager: Dan Stone
Work ID:
Contact: Craig Walker / Dan Stone

Job #: Quote #: PO#:

Shaded areas for office use only

**Analysis Requested**
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

**Comments**
(Special Instructions)

Analytes:
- Cr, Al, Fe, Ca, Mg, Na
- $SO_4$, $Cl^-$
- Nitrate / Nitrite
- Ammonia
- Specific Gravity

Sampling time is 1530
pending walk[illegible]
[illegible]/14/04

**Requested Turn Around Time**
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested:
24 hrs 72 hrs
48 hrs 5 Day

**Regulatory Classification / Special Report Format**
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4° C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-74 | GW | CHW | 6/15/04 1530 | ✓ | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |

Preservative

Sampled by (print): Craig R Walker 6/15/04 1600
Signature: [illegible]

Relinquished by: Date: Time:
Received by: [illegible] Date: 6/16/04 Time: 1035

Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment: **STL-Westfield**

Cooler: Y / N Samples Iced: Y / N
Temp @ receipt: °C
Preservation pH checked:
By: Date:



White = Lab file Yellow = Report copy Pink = Customer copy

**Severn Trent Laboratories**
**217827**

**Water Column Study - Geomega**
**Dates Sampled: 5/7/04 – 7/7/04**

MACTEC

**Engineering and Consulting, Inc.**
511 Congress Street
P.O. Box 7050
Portland, Maine 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

To: Margret Hanley and Steve Morrow
From: Chris Ricardi
Date: 8/30/04
Subject: 51 Eames Street – Geomega DAPL Column Test Samples

**Data Validation Summary**
**Sets 217827**

These sample sets contained results for aqueous samples generated by Geomega from the effluent stream of their laboratory column tests completed on DAPL saturated soil cores collected from the 51 Eames Street site. The samples were identified as SD-69, SD-72, SD-76, and SD-79. The samples were generated during testing completed during May through July 2004, and were analyzed by Severn Trent Laboratories (STL) in Westfield, Massachusetts. The analytical program included analysis for selected metals (aluminum, calcium, chromium, iron, magnesium, and sodium) and water chemistry parameters including chloride, sulfate, and ammonia.

The Olin Wilmington QAPP was used as a reference during the review. Results were reviewed using the Data Quality Evaluation checklists that were developed for the Olin Wilmington annual and quarterly groundwater monitoring tasks. Unless specified below, the results are interpreted to be usable as reported by the laboratory.

**Validation Actions and Observations**

All samples for chloride, sulfate, and ammonia were submitted to the laboratory after analysis holding times had expired. Based on a request by Geomega, the laboratory completed the analysis. Samples were sent to the laboratory without preservation. Samples were preserved at the time of arrival by the laboratory. All chloride, sulfate, and ammonia results have been qualified as estimated (J). Holding times for chloride and sulfate are summarized below. Ammonia analysis was completed one day sooner than times listed below.

| Sample | Days to Analysis |
|---|---|
| SD-69 | 95 |
| SD-72 | 77 |
| SD-76 | 43 |
| SD-79 | 34 |

The samples collected for metals were not acid preserved prior to shipment to the laboratory. The laboratory prepared an acid preserved aliquot after receipt at the laboratory by pouring 250 mL from the unpreserved bottle. There is the potential for loss due to settling/precipitation or absorption of elements to the bottles. Results for all elements were qualified estimated (J).

SEVERN TRENT STL

STL Westfield
53 Southampton Road
Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707
www.stl-inc.com

Steve Morrow
Olin Chemical
1186 Lower River Road
PO Box 248
Charleston, TN 37310-0248

08/20/2004

Report Number: 217827

Geomegh

Dear Steve Morrow,

The analysis of your sample(s) submitted on 08/06/2004 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your Project Manager, Rebecca C. Mason.

For questions, concerns or comments regarding our service, please do not hesitate to contact me directly. Thank you for selecting STL Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann
Laboratory Director
STL WESTFIELD

Technical Review: SH 8/20/04

Total number of pages in this report: 36



## MCP CASE NARRATIVE

**Client: Olin Chemical**

**Report Number: 217827**

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

It should be noted that samples with elevated Reporting Limits (RLs) as a result of a dilution may not be able to satisfy "MCP program" reporting limits in some cases if the "adjusted" RL is greater that the applicable MCP standards or criterion to which the concentration is being compared. Such increases in the RLs are unavoidable but acceptable consequence of sample dilution that enables quantification of target analytes, which exceed the calibration range.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 8/6/04; the samples arrived in good condition, properly preserved and on ice.

**Subcontracted**
ASTM method 1298 for specific gravity was performed by STL Chicago 24717 Bond Street, University Park, IL 60466.

**The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).**

The analyses for Chloride, Sulfate and Ammonia were received over the analytical holding times. The client requested that the analyses proceed.

**EPA 200.7**
The LCS for sodium recovered high (115.9, 85-115%) and outside method control limits. The LCSD analysis recovered within acceptable limits.

There were no additional QA/QC deviations or issues reported for this method.

**LAC 10-107061B**
Sample 217796-1, a non-client specific sample recovered low (17 and 0%) and outside method control limits for the MS and MSD analysis. The LCS recovered within acceptable limits.

There were no additional QA/QC deviations or issues reported for this method.

**EPA 300.0 (Chloride)**
There were no QA/QC deviations or issues reported for this method.

**EPA 300.0 (Sulfate)**
There were no QA/QC deviations or issues reported for this method.



## SAMPLE INFORMATION
Date: 08/20/2004

Job Number.: 217827
Customer...: Olin Chemical
Attn.....: Steve Morrow

Project Number.....: 20000348
Customer Project ID....: GEOMEGA COLUMN TESTI
Project Description....: Geomega Column Testing

| Laboratory Sample ID | Customer Sample ID | Sample Matrix | Date Sampled | Time Sampled | Date Received | Time Received |
|---|---|---|---|---|---|---|
| 217827-1 | SD-69 | Water | 05/07/2004 | 12:00 | 08/06/2004 | 10:10 |
| 217827-2 | SD-72 | Water | 05/25/2004 | 12:00 | 08/06/2004 | 10:10 |
| 217827-3 | SD-76 | Water | 06/28/2004 | 12:00 | 08/06/2004 | 10:10 |
| 217827-4 | SD-79 | Water | 07/07/2004 | 12:00 | 08/06/2004 | 10:10 |



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STL Billerica-Service Center 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400

# LABORATORY TEST RESULTS

Job Number: 217827

Date: 08/20/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TESTI | ATTN: Steve Morrow

Customer Sample ID: SD-69
Date Sampled.....: 05/07/2004
Time Sampled.....: 12:00
Sample Matrix.....: Water

Laboratory Sample ID: 217827-1
Date Received.....: 08/06/2004
Time Received.....: 10:10

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 96 | | 10 | mg/L | 08/10/04 | rwe |
| EPA300.0 PartA | Sulfate | 650 | | 20 | mg/L | 08/10/04 | rwe |
| LAC 10-107061B | Ammonia (NH3), as N | 110 | | 1.0 | mg/L | 08/09/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1500 | | 100 | ug/L | 08/13/04 | bpg |
| | Calcium (Ca) | 38000 | | 100 | ug/L | 08/13/04 | bpg |
| | Chromium (Cr) | 170 | | 10 | ug/L | 08/13/04 | bpg |
| | Iron (Fe) | 320 | | 50 | ug/L | 08/13/04 | bpg |
| | Magnesium (Mg) | 8100 | | 100 | ug/L | 08/13/04 | bpg |
| | Sodium (Na) | 120000 | | 1000 | ug/L | 08/13/04 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
MA014 / 57 / RI 0494 / VT DECWSD
NELAP FL E87912 TOX
NELAP NJ MA008 TOX
NELAP NY 10843
NY DOH 10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
STL Billerica-Service Center
149 Rangeway Rd.
N. Billerica, MA 01862
Tel: (978) 667-1400
Fax: (978) 667-7871

# LABORATORY TEST RESULTS

Job Number: 217827

Date: 08/20/2004

CUSTOMER: Olin Chemical | PROJECT: GEOMEGA COLUMN TESTI | ATTN: Steve Morrow

Customer Sample ID: SD-72
Date Sampled.....: 05/25/2004
Time Sampled.....: 12:00
Sample Matrix.....: Water

Laboratory Sample ID: 217827-2
Date Received.....: 08/06/2004
Time Received.....: 10:10

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 78 | | 10 | mg/L | 08/10/04 | rwe |
| EPA300.0 PartA | Sulfate | 230 | | 20 | mg/L | 08/10/04 | rwe |
| LAC 10-107061B | Ammonia (NH3), as N | 100 | | 1.0 | mg/L | 08/09/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1100 | | 100 | ug/L | 08/13/04 | bpg |
| | Calcium (Ca) | 30000 | | 100 | ug/L | 08/13/04 | bpg |
| | Chromium (Cr) | 93 | | 10 | ug/L | 08/13/04 | bpg |
| | Iron (Fe) | ND | U | 50 | ug/L | 08/13/04 | bpg |
| | Magnesium (Mg) | 6400 | | 100 | ug/L | 08/13/04 | bpg |
| | Sodium (Na) | 120000 | | 1000 | ug/L | 08/13/04 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014
RIDOH57
CTDPH 0494
VT DECWSD
NELAP FL E87912 TOX
NELAP NJ MA008 TOX
NELAP NY 10843
NY DOH 10843
STL Westfield
53 Southampton Rd.
Westfield, MA 01085
Tel: (413) 572-4000
Fax: (413) 572-3707
rica-Service Center
jeway Rd.
ica, MA 01862
(978) 667-1400
Fax: (978) 667-7871

# LABORATORY TEST RESULTS

Job Number: 217827 Date: 08/20/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TEST! ATTN: Steve Morrow

Customer Sample ID: SD-76
Date Sampled.....: 06/28/2004
Time Sampled.....: 12:00
Sample Matrix.....: Water

Laboratory Sample ID: 217827-3
Date Received.....: 08/06/2004
Time Received.....: 10:10

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 76 | | 10 | mg/L | 08/10/04 | rwe |
| EPA300.0 PartA | Sulfate | 260 | | 20 | mg/L | 08/10/04 | rwe |
| LAC 10-107061B | Ammonia (NH3), as N | 91 | | 1.0 | mg/L | 08/09/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1100 | | 100 | ug/L | 08/13/04 | bpg |
| | Calcium (Ca) | 32000 | | 100 | ug/L | 08/13/04 | bpg |
| | Chromium (Cr) | 95 | | 10 | ug/L | 08/13/04 | bpg |
| | Iron (Fe) | ND | | 50 | ug/L | 08/13/04 | bpg |
| | Magnesium (Mg) | 6400 | | 100 | ug/L | 08/13/04 | bpg |
| | Sodium (Na) | 190000 | | 1000 | ug/L | 08/13/04 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD NH DES 253903-A
NELAP FL E87912 TOX NELAP NJ MA008 TOX NELAP NY 10843 NY DOH 10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
STL Billerica-Service Center 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871

# LABORATORY TEST RESULTS

Job Number: 217827 Date: 08/20/2004

CUSTOMER: Olin Chemical PROJECT: GEOMEGA COLUMN TEST! ATTN: Steve Morrow

Customer Sample ID: SD-79
Date Sampled.....: 07/07/2004
Time Sampled.....: 12:00
Sample Matrix.....: Water

Laboratory Sample ID: 217827-4
Date Received.....: 08/06/2004
Time Received.....: 10:10

| TEST METHOD | PARAMETER/TEST DESCRIPTION | SAMPLE RESULT | Q | REPORTING LIMIT | UNITS | DATE | TECH |
|---|---|---|---|---|---|---|---|
| EPA300.0 PartA | Chloride | 78 | | 10 | mg/L | 08/10/04 | rwe |
| EPA300.0 PartA | Sulfate | 230 | | 20 | mg/L | 08/10/04 | rwe |
| LAC 10-107061B | Ammonia (NH3), as N | 90 | | 1.0 | mg/L | 08/09/04 | kmm |
| EPA 200.7 | Metal Analysis (ICP) | | | | | | |
| | Aluminum (Al) | 1100 | | 100 | ug/L | 08/13/04 | bpg |
| | Calcium (Ca) | 33000 | | 100 | ug/L | 08/13/04 | bpg |
| | Chromium (Cr) | 90 | | 10 | ug/L | 08/13/04 | bpg |
| | Iron (Fe) | ND | | 50 | ug/L | 08/13/04 | bpg |
| | Magnesium (Mg) | 6200 | | 100 | ug/L | 08/13/04 | bpg |
| | Sodium (Na) | 220000 | | 1000 | ug/L | 08/13/04 | bpg |

* In Description = Dry Wgt.



SEVERN TRENT STL
MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD NH DES 253903-A
NELAP FL E87912 TOX NELAP NJ MA008 TOX NELAP NY 10843 NY DOH 10843
STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707
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Version 1.2, Nov 2002

**OLIN-WILMINGTON**
**LEVEL I DATA QUALITY EVALUATION**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**ICP METALS BY METHOD 6010B/200.7**

Reviewer/Date Chris Ocarth 8/30/10
Sr. Review/Date
Lab Report # 217827
Project # 6300030008

## 1.0 Laboratory Deliverable Requirements

**1.1 Laboratory Information:** Was all of the following provided in the laboratory report? Yes [✓] No [ ] N/A [ ] Comments:
Check items received.

☑ *Name of Laboratory* ☑ *Address* ☑ *Project ID* ☑ *Phone #* ☑ *Sample identification – Field and Laboratory*
Client Information: ☑ *Name* ☑ *Address* ☑ *Client Contact* *(IDs must be cross-referenced)*

**ACTION:** If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** *Yes [✓] No [ ] N/A [ ] Comments:*

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** *Yes [✓] No [ ] N/A [ ] Comments:*

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☑ *Narrative includes an explanation of each discrepancy on the Certification Statement.*

Short list inorganics. based on proj request

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** Olin receives and maintains the *original* COC.

**ACTION:** If no, contact lab for submission of copy of completed *COC*.

---

**Severn Trent Laboratories, Inc.**
**Chain of Custody Form**

SEVERN TRENT STL 00530

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Olin / Geomega
Address: 2995 Baseline Rd Ste 202
Boulder CO 80303
Phone: 303 4439117 Fax: 303 938 8123

Project #: C03303F
Project Manager: Dan Stone
Work ID:
Contact: Andrew Nicholson / Craig Walker

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
W-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

| Sample ID | Sample Type | Sampler's Initials | Date Time Collected | Grab | Comp. | # Containers | Plastic(P) or Glass(G) | NaHSO4/MeOH | HNO3 to pH <2 | H2SO4 to pH <2 | HCl to pH <2 | NaOH to pH >12 | Na2S2O3 | None / 4°C | Volatiles 524 / 624 | Volatiles 8260 / 8021 | Semivoa 625 | Semivoa 8270 | PCB / Pesticides | EPH / VPH | DRO / GRO | Metals 6010 / 200.7 | General Chemistry | Bacteriological | Toxicity | Oil & Grease / TOC | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-69 | G | CRW | 5/7/4 | | • | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| SD-72 | ↓ | ↓ | 5/25/4 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ↓ |
| SD-76 | ↓ | ↓ | 6/23/4 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ↓ |
| SD-79 | ↓ | ↓ | 7/7/4 | | | 1 | P | | | | | | | ✓ | | | | | | | | | | | | | ↓ |

Analytes:
Cr, Al, Fe, Ca, Mg, Na
$SO_4^{2-}$
$Cl^-$
~~Nitrate~~
~~Nitrite~~
Ammonia
Specific Gravity

Note:
Hold times have expired on some analytes; please proceed with analyses.
Thanks, CRW

Sampled by (print): Craig R. Walker Signature:
Relinquished by: Date: Time: Received by: Date: Time:
Relinquished by: Date: Time: Received by: Date: 8/6/04 Time: 1010
Method of shipment: STL-Westfield

Page 1 of 1

White = Lab file Yellow = Report copy Pink = Customer copy

☑ Method blank results ☑ LCS recoveries ☑ MS/MSD recoveries and RPDs ☐ Laboratory duplicate results (where applicable)
Batch only NO See LCSD

ACTION: If no, contact lab for submission of missing or incomplete information.

## 2.0 Holding Times

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? Holding time for metals is 180 days from sample collection to analysis for both water and soil. Yes [ ] No [✓] N/A [ ] Comments: Samples were not preserved with acid until receipt at the lab. (J estimated)

NOTE: List samples that exceed hold time with # of days exceeded on checklist

ACTION: If technical holding times are exceeded, qualify all positive results (J) and non-detects (UJ). If grossly exceeded (2X holding time) reject (R) all non-detect results.

## 3.0 Laboratory Method

3.1 Was the correct laboratory method used? Yes [✓] No [ ] N/A [ ] Comments:

| | |
|---|---|
| Water Digestion | 3005A or 3010A or 3020A |
| Soil Digestion | 3050B |
| Metals | 6010B or 200.7 |

ACTION: If no, contact laboratory to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change and to request variance.

3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☑ QAPP ☐ Lab ☐ MADEP Yes [✓] No [ ] N/A [ ] Comments:

NOTE: *Verify that the reported metals match the target list specified on the COC.*





1.5 **Sample Receipt Information (*Cooler Receipt Form present?*):** Yes [✓] No [ ] N/A [ ] Comments:

Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?

☑ Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

☑ Container type noted ☐ sample condition observed ☑ pH verified (where applicable) ☑ Field and lab IDs cross referenced
After receipt

ACTION: If no, contact lab for submission of missing or incomplete documentation.

1.5.1 Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

1.5.2 Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [ ] No [✓] N/A [ ] Comments:

1.6 **Sample Results Section:** *Was each of the following requirements supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

☑ Field ID and Lab ID ☑ *Date and time collected* ☑ Analyst Initials ☐ *Dilution Factor* NA ☐ % moisture or solids NA ☑ *Reporting limits*
NA ☐ *Clean-up method* ☑ Analysis method ☑ *Preparation method* ☑ *Date of preparation/extraction/digestion clean-up and analysis, where applicable*
☑ Matrix ☑ Target analytes and concentrations ☑ Units (soils must be reported in dry weight)

ACTION: If no, contact lab for submission of missing or incomplete information.

1.7 **QA/QC Information:** Was each of the following information supplied in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

**ACTION:** For any blank with positive results, list all contaminants for each method blank including the concentration detected and the flagging level (flagging level = 5x the blank value) and the associated samples and qualifiers.

## 5.0 Laboratory Control Standard

5.1 Was a laboratory control standard run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *A full target, second source LCS is required by MADEP.*
**ACTION:** Call laboratory for LCS form submittal. If data are not available, use professional judgement to evaluate data accuracy associated with that batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

5.3 Is the recovery of any analyte outside of MADEP control limits? Yes [ ] No [✓] N/A [ ] Comments:

| Sample Type | MADEP % Rec |
|---|---|
| Water | 80-120 |
| Soil | within Lab generated limits |

**ACTION:** If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and non-detects results within the batch as (J). If LCS recovery is <30%, positive and non-detect results are rejected (R).

Comments:





**ACTION:** If no, evaluate variation with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If dilutions were required, were dilution factors reported? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If no, contact the lab for submission.

## 4.0 Method Blanks

4.1 Is the Method Blank Summary present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call the laboratory for submission of missing data.

4.2 Frequency of Analysis: Was a method blank analyzed for each digestion batch of < 20 field samples? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact laboratory for justification. Consult senior chemist for action needed. Narrate non-compliance.

4.3 Is the method blank less than the PQLs for all target elements? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *MADEP requires the method blank to be matrix matched and digested with the samples*

4.4 Do any method blanks have positive results for metals? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.

**ACTION:** MS/MSD flags only apply to the sample spiked. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit, qualify positive results and non-detects (J).

6.5 Are any RPDs for MS/MSD recoveries outside of the QC limits? Yes [ ] No [✓] N/A [ ] Comments:

**NOTE:** $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where: S = MS sample result, D = MSD sample result

**NOTE:** If dilutions are required due to high sample concentrations, the data are evaluated, but no flags are applied.

**ACTION:** If the RPD exceeds the control limit, qualify positive results and non-detects (J).

## 7.0 Laboratory Duplicate

7.1 Was a laboratory duplicate sample analyzed? If so, is the Laboratory Duplicate Sample Form present? Yes [ ] No [✓] N/A [ ] Comments: See MS/MSD or LCSD

***NOTE:*** *MADEP refers to this sample as a "matrix duplicate".*

**ACTION:** If not analyzed, qualification is not needed. If data is missing, contact laboratory for resubmission of report. Narrate non-compliance.

7.2 Is the RPD between the result for the laboratory duplicate sample and the result for the parent sample outside of the QA/QC limits? Yes [ ] No [ ] N/A [✓] Comments:





## 6.0 Matrix Spikes

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs collected? List project samples that were spiked. Yes [ ] No [✓] N/A [ ] Comments: Batch QC only

**ACTION:** If no, contact senior chemist to see if any were specified.

6.2 Is the Matrix Spike/Matrix Spike Duplicate Recovery Form present? Yes [✓] No [ ] N/A [ ] Comments:

**NOTE:** *A full target, second source MS/MSD is required by MADEP.*
**ACTION:** If any matrix spike data are missing, call lab for resubmission.

6.3 Were matrix spikes analyzed as indicated on the COC and project schedule? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If any matrix spike data are missing, call lab for resubmission. If none, no qualification is needed. Narrate non-compliance.

6.4 Are any metal spike recoveries outside of the QC limits? Yes [ ] No [✓] N/A [ ] Comments:

| Sample Type | *MADEP % Rec* | QAPP % Rec | Method |
|---|---|---|---|
| Water | *75-125* | N/A | 6010B |
| Water | *N/A* | 70-130 | 200.7 |
| Soil | *75-125* | 75-125 | 6010B |

**NOTE:** $\%R = \frac{SSR-SR}{SA} \times 100\%$ Where: SSR = Spiked sample result, SR = Sample result, SA = Spike added

**NOTE:** If dilutions are required due to high sample concentrations (> 4X spike), the data are evaluated, but no flags are applied.

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP *(1 per 10)* ☐ *MADEP Option 1 (1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

ACTION: RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

## 10.0 Special QA/QC

10.1 Were both total and dissolved metals analysis performed? If so, the dissolved metal concentration should not exceed that of the total metal. Yes [ ] No [✓] N/A [ ] Comments:

ACTION: If results for both total and dissolved are ≥ 5x the PQL **and** the dissolved concentration is 10% higher than the total, flag both results as estimated (J). If total and dissolved concentrations are less than 5x the PQL **and** the **difference** exceeds 2x the PQL, flag both results as estimated (J)





| *MADEP Laboratory Duplicate Sample RPD Criteria:* | QAPP RPD |
|---|---|
| *For aqueous results > 5× RL, RPD must be ± 20%* | 20 |
| *For aqueous results < 5× RL, RPD must be ≤ RL* | 20 |
| *For soil/sediment results > 5× RL, RPD must be ± 35%* | 20 |
| *For soil/sediment results < 5× RL, RPD must be ≤ 2× RL* | 20 |

ACTION: If the RPD exceeds the limits, qualify both positive results and non-detects as estimated and flag them J. Narrate non-compliance

## 8.0 Sampling Accuracy

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

ACTION: Evaluate rinsate results against blank results to determine if contaminant may be laboratory-derived. If results are not lab-related, qualify according to below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

## 9.0 Field Duplicates

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [ ] Comments:

Note: The following analyses will be evaluated according to the "MADEP QA/QC Guidelines for **Sampling, Data Evaluation and Reporting Activities.**" MADEP, however, may not list QA/QC criteria for every chemical analysis. Where not defined by MADEP, criteria will default to values stipulated in the QAPP. Where the QAPP does not define criteria, QA/QC requirements will default to limits employed by the laboratory.

1.0 **Laboratory Deliverable Requirements**

**1.1 Laboratory Information**: Was all of the following provided in the laboratory report? Yes [✓] No [ ] N/A [ ] Comments:
Check items received.

☑ *Name of Laboratory* ☑ *Address* ☑ *Project ID* ☑ *Phone #* ☑ *Sample identification – Field and Laboratory*
Client Information: ☑ *Name* ☑ *Address* ☑ *Client Contact* *(IDs must be cross-referenced)*

ACTION: If no, contact lab for submission of missing or illegible information.

***1.2 Laboratory Report Certification Statement*** *Yes [✓] No [ ] N/A [ ] Comments:* Short list identified for inorganics

*Does the laboratory report include a completed Analytical Report Certification in the required format?*

***ACTION:*** *If no, contact lab for submission of missing certification or certification with correct format.*

***1.3 Laboratory Case Narrative:*** *Yes [✓] No [ ] N/A [ ] Comments:*

☑ *Narrative serves as an exception report for the project and method QA/QC performance.* ☑ *Narrative includes an explanation of each discrepancy on the Certification Statement.*

***ACTION:*** *If no, contact lab for submission of missing or illegible information.*

**1.4 Chain of Custody (COC)** copy present with all documentation completed? Yes [✓] No [ ] N/A [ ] Comments:

Does the laboratory report include copies of Chain of Custody forms containing all samples in this SDG?

**NOTE:** Olin receives and maintains the *original* COC.

ACTION: If no, contact lab for submission of copy of missing completed COC.

COC not completed with date/time of release.

**1.5 Sample Receipt Information (*Cooler Receipt Form*):** Were each of the following tasks completed and recorded upon receipt of the sample(s) into the laboratory?



**OLIN CORPORATION**
**LEVEL I DATA QUALITY EVALUATION – OPTION 1**
**STANDARD OPERATING PROCEDURE AND CHECKLIST**
**ICP METALS BY METHOD 6010B/200.7**

10.0 **Application of Validation Qualifiers**

Was any of the data qualified? Yes [✓] No [ ] N/A [ ] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.

due to preservation

**REFERENCES**

LAW, 1999, "Final Quality Assurance Project Plan, Olin Wilmington Property, 51 Eames Street, Wilmington, MA", LAW Engineering and Environmental Services, Kennesaw, GA 30144. August 1999

U.S. Environmental Protection Agency (USEPA), 1989. "Region 1 Laboratory Data Validation Functional Guidelines For Evaluating Inorganic Analyses"; Hazardous Site Evaluation Division; February 1989.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Massachusetts Quality Assurance and Quality Control (QA/QC) Requirements." BWSC-CAM, Interim Final Draft, Revision No. 2, 5 October 2001.

MADEP, 2001. Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, "Quality Assurance and Quality Control Guidelines for Sampling, Data Evaluation and Reporting Activities," BWSC-CAM, Section VII, Public Comment Draft, Revision No. 0, 21 December 2001.

**1.6 Sample Results Section:** *Was the following information supplied in the laboratory report for each sample?* Yes [✓] No [ ] N/A [ ] Comments:

☑ Field ID and Lab ID ☑ Date and time collected ☑ Analyst Initials ☑ Dilution Factor NA ☐ % moisture or solids ☑ Rep mi
NA ☐ *Clean-up method* ☑ Analysis method NA ☐ Preparation method NA ☐ Date of preparation/extraction/digestion clean-up and analysis, where applica.
☑ Matrix ☑ Target analytes and concentrations ☑ Units (soils must be reported in dry weight)

**ACTION:** If no, contact lab for submission of missing or incomplete information.

**1.7 QA/QC Information:** Was the following information provided in the laboratory report for each sample batch? Yes [✓] No [ ] N/A [ ] Comments:

☑ Method blank results ☑ LCS recoveries ☑ MS/MSD recoveries and RPDs ☐ Laboratory duplicate results (where applicable) NA

Batch only

**ACTION:** If no, contact lab for submission of missing or incomplete information.

All outside HT. J estimated

Collected / And.
5/7 SD-69 8/10 9
5/25 SD-72
6/28 SD-76
7/7 SD-79

**2.0 Holding Times** Yes [✓] No [ ] N/A [ ] Comments:

Have any technical holding times, determined from date of collection to date of analysis, been exceeded? The holding times are as follows:

28 days = ammonia, chemical oxygen demand, chloride, organic carbon, oil & grease, specific conductance, total organic carbon and sulfate

Alkalinity = 14 days Sulfide, TDS, TSS = 7 days pH = analyze immediately Nitrate nitrogen as N = 48 hrs

Nitrite nitrogen as N = 48 hrs Nitrate + Nitrite as N = 28 days

94 days for NH.

**NOTE:** List samples that exceed hold time with # of days exceeded on checklist

**ACTION:** If technical holding times are exceeded qualify results (J). For water samples that are grossly exceeded (>2X hold time) reject (R) all non-detect results. Professional judgment used to qualify soils.

**3.0 Laboratory Method** Yes [✓] No [ ] N/A [ ] Comments:

3.1 Was the correct laboratory method used?

**ACTION:** If no, contact lab to provide justification for method change compared to the requested method. Contact senior chemist to inform Client of change or to request variance.





Yes [✓] No [ ] N/A [ ] Comments:

☑ Sample temperature confirmed: must be 1° – 10° C. (If samples were sent by courier and delivered on the same day as collection, temperature requirement does not apply).

☑ Container type noted ☑ Condition observed ☐ pH verified (where applicable) ☑ Field and lab IDs cross referenced

**ACTION:** If no, contact lab for submission of missing or incomplete documentation.

**1.5.1** Were the correct bottles and preservatives used? Yes [ ] No [✓] N/A [ ] Comments:

Ammonia,– 1 Liter polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Oil & Grease – 1 Liter glass/HCL to pH<2,cool to 4°C

Alkalinity – 1 Liter polyethylene/cool to 4°C

Chemical Oxygen Demand – 50 mL polyethylene/$H_2SO_4$ to pH<2,cool to 4°C

Chloride, pH, sulfate - 50 mL polyethylene/cool to 4°C

Organic Carbon – 500 mL amber glass bottle/HCl or $H_2SO_4$ to pH<2,cool to 4°C

Sulfide – 50 mL polyethylene/ZnAcetate + NaOH to pH>9, cool to 4°C

Specific conductance, TDS, TSS – 100 mL polyethylene/cool to 4°C

Ammonia not preserved. Sample Collected in one unpreserved Poly bottle.

**ACTION:** If no, inform senior chemist. Document justification for change in container/volume (if applicable), qualify positive and non-detect data (J) data if cooler temperature exceeds 10°C. Rejection of data requires professional judgment

**1.5.2** Were all samples delivered to the laboratory without breakage? Yes [✓] No [ ] N/A [ ] Comments:

**1.5.3** Does the *Cooler Receipt Form* or Lab Narrative indicate other problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data? Yes [✓] No [ ] N/A [ ] Comments:

Some samples had missed hold times at time of receipt.

**ACTION:** If no, document discrepancy in case narrative and contact lab for justification. Consult senior chemist for action needed.

4.3 Is the method blank less than the PQL? (See Section 3.2 for PQLs). Yes [✓] No [ ] N/A [ ] Comments:

4.4 Do any method blanks have positive results for wet chemistry parameters? Qualify data according to the following: Yes [ ] No [✓] N/A [ ] Comments:

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

**ACTION:** If any blank has positive results, list all the concentrations detected and flagging level (flagging level = 5 × blank value) on the checklist. List all affected samples and their qualifiers.

**5.0 Laboratory Control Standards**

5.1 Was a laboratory control standard (LCS) run with each analytical batch of 20 samples or less? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, call laboratory for LCS form submittal. If data is not available, use professional judgment to determine qualification actions for data associated with the batch.

5.2 Is a LCS Summary Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact lab for resubmission of missing data.

5.3 Is any wet chemistry analyte LCS recovery outside the control limits? Yes [ ] No [✓] N/A [ ] Comments:





3.2 Are the practical quantitation limits the same as those specified by the ☐ SOW ☑ QAPP ☐ Lab? Yes [✓] No [ ] N/A [ ] Comments: (X) Positive detections in all sample.

**Note:** *The MADEP QA/QC Guidelines do not yet list PQLs for wet chemistry analyses, therefore all criteria will default to values stipulated in the QAPP*. Where the QAPP does not define criteria, QA/QC requirements default to limits employed by the lab**. Other criteria may also apply.*

| | | | |
|---|---|---|---|
| Ammonia* ☐ = 0.1 mg/ L | Alkalinity**☐ = 1 mg/L | Bicarbonate Alkalinity** ☐ = 1 mg/L | Carbonate Alkalinity** ☐ = 1 mg/L |
| Nitrate Nitrogen as N* ☐ = .05 mg/L | Nitrite Nitrogen as N* ☐ = .01 mg/L | Chloride* ☐ = 1 mg/L | Hardness *☐ = 2 mg/L |
| Spec. Cond.** ☐ 3 umhos/cm | Total Organic Carbon** ☐ = 1 mg/L | Oil & Grease* ☐ = 3 mg/L | Sulfate (EPA 300.0)* ☐ = 0.1 mg/L |
| COD:* Low – 20 mg/L | COD* High - 50 mg/L ☐ | TDS* ☐ = 10 mg/L | TSS* ☐ = 5 mg/L |
| pH* ☐ < 2 to > 12 | | | |

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

Other parameter(list) _____ PQL = _____ ☐ Source of PQL = _____

**ACTION:** If no, evaluate change with respect to sample matrix, preparation, dilution, moisture, etc. If sample PQL is indeterminate, contact lab for explanation.

3.3 Are the appropriate parameter results present for each sample in the SDG? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, check Request for Analysis to verify if method was ordered and COC to verify that it was sent, and contact lab for resubmission of the missing data

3.4 If *dilutions were required, were dilution factors reported?* Yes [✓] No [ ] N/A [ ] Comments:

**ACTION:** If no, contact the lab for submission.

**4.0 Method Blanks** Yes [✓] No [ ] N/A [ ] Comments:

4.1 Are the Method Blank Summaries present?

**ACTION:** If no, call the laboratory for submission of missing data.

4.2 Was a method blank analyzed for each analysis batch of wet chemistry field samples of 20 or less? Yes [✓] No [ ] N/A [ ] Comments:

6.3 Were matrix spikes analyzed at the required frequency of 1 per 20 samples per matrix? Yes [✓] No [ ] N/A [ ] Comments: NH3 Batch QC very low %R.

**ACTION**: If any matrix spike data is missing, call lab for resubmission.

6.4 Are any wet chemistry analyte spike recoveries outside of the QC limits? Yes [ ] No [✓] N/A [ ] Comments: No action! on Batch LCS.

NOTE: $\%R_{SA} = \frac{(SSR-SR)}{} \times 100\%$ Where: SSR = Spiked sample result; SR = Sample result; SA = Spike added

**MS/MSD Recovery Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia* (LACHAT) ☐ = 74-125% out |
| Chloride*(SM 4500 Cl) ☑ = 77-116% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA |
| Oil & Grease* = NA | COD Low* ☐ = 61-142% | COD High* ☐ = 92-109% | Nitrate Nitrogen as N** ☐ = 75-119% |
| Nitrite Nitrogen as N** ☐ = 68-136% | Hardness* ☐ = 70-130% | Sulfate (EPA 300.0)* ☑ = 75-125% | pH* = NA TSS* = NA |

Other parameter(list) _____ % R = _____ ☐ Rec Limits = _____

* = Laboratory Limits ** = Olin QAPP Limits *(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**NOTES**: 1) If only one of the recoveries for an MS/MSD pair is outside of the control limits, no qualification is necessary. Use professional judgment for the MS/MSD flags.
2) If the MS/MSD was performed by the laboratory on a non-project sample, no qualification is required.

**ACTION**: MS/MSD flags only apply to the sample spiked. Do not evaluate if sample concentration is > 4X spike. If the recoveries of the MS and MSD exceed the upper control limit, qualify positive results as estimated (J). If the recoveries of the MS and MSD are lower than the lower control limit but > 30%, qualify both positive results and non-detects (J). If the MS/MSD recovery is < 30% and the sample is non-detect, the results are considered unusable and flagged (R).

**ACTION**: Laboratory control limits apply when spiked sample results fall within the normal calibration range. If dilutions are required due to high sample concentrations, the data is evaluated, but no flags are applied.

6.5 Are any RPDs for MS/MSD recoveries outside of the QA/QC limits? Yes [ ] No [✓] N/A [ ] Comments:

**NOTE**: $RPD = \frac{S-D}{(S+D)/2} \times 100\%$ Where S = MS result, D = MSD result





**LCS Limits:**

| | | | |
|---|---|---|---|
| Alkalinity** ☐ = 80-120% | Bicarbonate Alkalinity** ☐ = 80-120% | Carbonate Alkalinity** ☐ = 80-120% | Specific Conductivity *☐ = 80-120% |
| Total Organic Carbon** ☐ = 80-120% | TDS** ☐ = 80-120% | Oil & Grease* ☐ = 80-120% | Ammonia Nitrogen as N* ☐ = 80-120% |
| COD Low* ☐ = 80-120% | COD High* ☐ = 80-120% | Nitrate Nitrogen as N**☐ = 85-115% | Nitrite Nitrogen as N** ☐= 75-120% |
| Hardness* ☐ = 85-115% | Chloride* ☐ = 80-120% | Sulfate (EPA 300.0)* ☐ = 75-125% | pH* ☐ = 98-102% TSS* NA |

Other parameter(list) _____ %R = _____ ☐ Rec Limits= _____

Other parameter(list) _____ %R = _____ ☐ Rec Limits = _____

*(MADEP has not yet defined LCS recovery limits for wet chemistry analyses.)*

**ACTION**: If recovery is above the upper limit, qualify all positive sample results within the batch as (J). If recovery is below the lower limit, qualify all positive and no-detect results within the batch as (J). If LCS recovery is <10%, non-detect results are rejected (R).

## 6.0 Matrix Spikes

Batch only

Matrix spikes may be collected at different frequencies based on monthly, quarterly, or task specific schedules. Confirm spike requirements for each set with the senior chemist.

6.1 Were project-specific MS/MSDs analyzed? List project samples that were spiked. Yes [ ] No [✓] N/A [ ] Comments:

**ACTION**: If no, contact senior chemist to see if any were specified.

6.2 Is the MS/MSD Recovery Form present? Yes [✓] No [ ] N/A [ ] Comments:

**ACTION**: If no, contact lab for resubmission of missing data.

**ACTION:** Evaluate rinsate results vs. blank results to determine if contaminant may be laboratory-derived. If not lab-related, qualify according to the table below.

If the sample concentration is < 5 × blank value, flag sample result non-detect "U" at the PQL or the concentration reported if greater than the PQL.

If the sample concentration is > 5 × blank value, no qualification is needed.

***NOTE:*** *MADEP does not require the collection of rinsate blanks.*

**9.0 Field Duplicates**

9.1 Were field duplicate samples collected? Obtain a list of samples and their associated field duplicates. Yes [ ] No [✓] N/A [✓] Comments:

9.2 Were field duplicates collected per the required frequency? Yes [ ] No [ ] N/A [✓] Comments:

SOW ☐ QAPP ☐ *MADEP Option 1(1 per 20)* ☐ *MADEP Option 3 (1 per 10)* ☐

9.3 Was the RPD ≤ 50% for soils or waters? Calculate the RPD for all results and attach to this review. Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** RPD must be ≤50% for soil and water. Qualify data (J) for both sample results if the RPD exceeds 50%.

Was any of the data qualified? Yes [✓] No [ ] N/A [✓] Comments:

If so, apply data qualifiers directly to the DQE copy of laboratory report and **flag pages** for entry in database.

Holding time





9.1 estimate

**MS/MSD RPD Limits:**

| | | | |
|---|---|---|---|
| Alkalinity* = NA | Bicarbonate Alkalinity* = NA | Carbonate alkalinity* = NA | Ammonia** (LACHAT) ☐ = 8% |
| Chloride**(SM 4500 Cl)* ☐ = 15% | Specific Conductivity * = NA | Total Organic Carbon* = NA | TDS** = NA ~~Total Organic~~ Carbon* = NA |
| COD Low** ☐ = 14% | COD High** ☐ = 16% | Nitrate Nitrogen as N** ☑ 16% | Nitrite Nitrogen as N** ☐ = 16% |
| Oil & Grease* = NA | Hardness* = NA | Sulfate (EPA 300.0)* ☑ = 10% | pH* = NA TSS* = NA |

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

Other parameter(list) _____ RPD = _____ ☐ RPD limit = _____

* = Laboratory Limits ** = Olin QAPP Limits

(*MADEP has not yet defined LCS recovery limits for wet chemistry analyses.*)

**7.0 Laboratory Duplicate**

Are the RPDs for the laboratory duplicates <20% unless otherwise specified below? Yes [ ] No [ ] N/A [✓] Comments:

**ACTION:** If the RPD is greater than specified limits, qualify all results for that analyte as estimated (J).

| | | | |
|---|---|---|---|
| Alkalinity* = 4% | Bicarbonate Alkalinity* = 4% | Carbonate alkalinity* = 4% | Oil & Grease* ☐ = 20% |
| pH* ☐ = 3% | Specific Conductivity *☐ = 5% | TSS** ☐ = 6% | TDS** ☐ = 6% |

**8.0 Sampling Accuracy**

The majority of ground water samples are collected directly from a tap, process stream, or with dedicated tubing. Rinse blanks will not be collected.

8.1 Were rinsate blanks collected? Prior to evaluating rinsate blanks, obtain a list of the associated samples from the senior chemist. Yes [ ] No [✓] N/A [ ] Comments:

8.2 Do any rinsate blanks have positive results? Yes [ ] No [ ] N/A [✓] Comments:

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# Appendix B

## Appendix B- Pore Volume Calculation

The pore volume of the system (the volume of water that is contained in the system) is a key parameter used in extrapolating column test data to the field. Interim Report findings (Geomega 2004) regarding porosity and other hydraulic parameters, such as hydraulic conductivity, were based on an estimated porosity of 0.30. By using data from tracer tests and knowledge of the column system, the estimated pore volume, porosity, and other hydraulic parameters of the system can be refined. This appendix describes the procedure used to interpret tracer test data to determine the pore volume of the system.

A tracer test was conducted at the end of the column experiment, using sodium bromide as the tracer[1]. Interpreted results from the tracer test indicate that the column porosities are ~0.30 in the SCC and ~0.34 in the LCC. These ranges of porosity are similar to the porosities determined in the partitioning tests in the initial report (Geomega 2004), and match the porosities observed in field conditions. This similarity between laboratory and field porosity makes extrapolation of these results from the laboratory to field conditions generally suitable and appropriate for evaluating DAPL extraction.

### 1. Background on Tracer Tests

Tracer tests are commonly conducted in column tests to measure the rate of water movement through porous media (e. g. Kent et al. 2002, Quanrud et al. 2003, Gerke et al. 2004, Christiansen et al. 2004). Theoretically, an inert constituent introduced with influent water will move through the column at the same rate as the water. Concentrations of the tracer are determined in samples of column effluent, and a breakthrough curve is constructed. The shape and timing of the breakthrough curve can then be used to assess the system porosity, flow rate, and hydraulic characteristics. Tracers need to be introduced at high-enough concentrations to be distinguishable in the system. Lithium, chloride, bromide, and some radioactive species are common tracers that are applied in these systems, as they are generally inert elements. In a simple, one-

[1] Bromide analyses were performed by Geomega's in-house laboratory and were not conducted by STL Laboratories. Results of these analyses are presented in Table 3 of the main report.

dimensional column system, tracer breakthrough at 50% of the influent concentration is indicative of the passage of one pore volume through the system.

As described in sections 2.2.4 and 3.1, a tracer test using 1,000 mg/l bromide was conducted at the end of the column experiment, when it was possible to clearly define the bromide breakthrough curve using routine laboratory measurements. Such a study would have been infeasible in the early stages of the test due to the high sulfate concentrations in the water and subsequent interferences with the bromide.

## 2. Ideal Tracer Test Behavior

Each column complex had four tracer input locations: input directly to the central column and inputs to each of the three side columns, which subsequently fed into the central column. (In the Large Column Complex, each "side column" consisted of a set of two columns connected in series). Effluent was drained and collected from the bottom of the central column.

The multi-input location design of the system, under ideal conditions, results in a staged breakthrough of the tracer. Ideal behavior for the system includes: equal flow through all columns, the lack of any headspace in the columns, no shortcutting of flow through channels in the columns, and no attenuation of tracers. Ideally, with the start of flushing, the first slug of tracer to break through is from the direct input to the central column. If the flow through all four columns is equal, this first breakthrough is one-fourth of the input concentration, because the influent feeding directly into the central column is diluted by the influent from the other three side columns. Theoretically, this first breakthrough occurs after 1 central-column pore volume (PV) is flushed. Complete breakthrough, or breakthrough of the tracer from the side column input locations, occurs only after the tracer has moved through the side columns and the central column. Because all four columns are roughly the same volume, complete breakthrough occurs after a total of 5 central-column flushings (1 side-column PV and 4 central-column PV), or 1.25 total-complex PV.

In the Small Column Complex (SCC), the Interim Report (Geomega 2004) estimated the side columns (Porthos, Athos, and Aramis) and the central column (D'Artagnan) to each have a pore volume of ~1,500 ml +/- 150 ml. Therefore, the initial tracer breakthrough from the input directly to the central column was anticipated at ~1,500 ml of flushing. Because all three of the side columns were approximately the same volume, breakthrough from each side column was expected to occur at about the same time. This complete breakthrough was anticipated at ~7,500 ml of total flow.

In the Large Column Complex (LCC), the previous estimates of the pore volume for each side column (the sum of the pore volumes for the two columns that made up each side column) and the pore volume of the central column were each about 3,000 ml (Geomega 2004). Therefore, initial breakthrough was anticipated at ~ 3,000 ml, and complete breakthrough at ~15,000 ml of total flow.

## 3. Tracer Test Results

The bromide tracer test conducted in the SCC shows that initial bromide breakthrough did not occur until ~3,000 ml. Complete breakthrough did not occur until ~8,000 ml (Figure B-1). The difference between the theoretical behavior and the observed behavior is attributed to column system behaviors that are not accounted for in the ideal conceptualization. These behaviors are described in the following section.

In the LCC, initial breakthrough of the bromide tracer occurred at ~3,500 ml (close to the predicted time) but complete breakthrough was not observed by the time the test was stopped (at 16,000 ml), as seen in Figure B-2. Again, differences between the actual and assumed conditions in the columns are the likely cause of this delayed breakthrough.

## 4. Assessment of Non-Ideal Tracer Test Behavior

Two experimental factors were concluded to have affected column behavior: uneven flow through the different columns in each complex, and settling of the solids in the columns, resulting in the formation of headspace. These factors were incorporated into the pore

volume calculations, and considered in the analysis of tracer-test data. The possibility that bromide was attenuated in the column systems was not evaluated because it is well documented in the literature that bromide transport is generally conservative (e.g., Fox et al. 2004).

An iterative "calibration" process was used to identify the theoretical scenario that best represented the system. This process involved adjusting numerical parameters of a spreadsheet model describing the idealized flow system, and assessing the match of the idealized model to the measured data. The fitting process considered both the reproduction of breakthrough curve timing and matching the overall shape of the curves[2]. The iterative, trial-and-error process of parameter adjustment continued until a qualitatively acceptable solution was found. A more rigorous, exact-fit solution was not sought in this case, because the tracer breakthrough calculations did not include the effects of dispersion [3]. The best-fit solution is presented in Figures B-1 and B-2.

## 4.1 Uneven flow

Uneven flow through the central and side columns was determined to contribute to non-ideal behavior in the SCC, possibly due to different lithologies and hydraulic conductivities in the individual columns. The variations in flow from different columns would result in different-than-predicted concentrations and arrival times of tracer fronts. For example, if flows through the side columns are greater than the flow through the central column, the initial breakthrough from direct input into the central column will be more dilute and arrive at a later time than if flows are equal in all columns. Conversely, if the flow through the central column is greater than in the side columns, the initial

[2] For example, in the SCC, the delayed breakthrough of initial tracer can be explained by either a larger than expected pore volume in the central column or uneven flow. However, these two effects would result in different concentration profiles, so parameters were adjusted to match both the delayed breakthrough and the concentration profile of the bromide effluent.

[3] Dispersion is often not evaluated in column tests, as extrapolating column dispersion to field situations is notoriously difficult and unreliable (Van Wesenbeeck and Kachanoski 1991).

breakthrough will arrive sooner and at a higher concentration, as it will be less diluted by side-column flow[4].

In the SCC, the initial breakthrough occurred much later than was anticipated. To evaluate the possibility of uneven flow through the columns, theoretical breakthrough curves for varying proportions of total flow through the central column were plotted with the observed data (Figure B-3). When observed data were compared to the theoretical curves for the different flow proportions, flow directly into the central column (D'Artagnan) was found to be 40% less than into the side columns. The interpretation of uneven flow is based on both shape and breakthrough times of the curves.

The initial breakthrough in the LCC was slightly later than anticipated. This later arrival appears not to be a function of uneven flow (Figure B-4), but rather the result of the column porosity being slightly higher than initially estimated (see Section 5 below). This conclusion is made based on the curve shapes of the unequal flow scenarios.

## 4.2 Settling and Reservoir Formation

After preparation of the columns and the onset of flushing, some internal settling was observed. The result of this settling was the formation of void space, or headspace, at the top of each column (generally ~3 cm). These headspaces could affect the tracer breakthroughs in the columns in two ways: delayed breakthroughs, and reduced concentrations of the tracer slugs in column effluent. Tracer slugs must pass through the volume in these small headspace reservoirs, and this volume serves as a mixing zone that smoothes out the leading edge of the tracer front.

The nature of mixing that takes place in the headspace can also affect the breakthrough of the tracer. There are essentially two end-member possibilities for headspace mixing

[4] Uneven flow through columns is somewhat similar to the likely situation in the field, where aquifer heterogeneities are anticipated to provide different amounts of groundwater to the extraction well. When evaluating these data, it is important to note that though the different column sets had different proportional flow, the rate of DAPL removal as a function of pore volume is very similar for both column sets. Therefore, uneven flow may affect the timing of tracer breakthrough, but is likely to be a secondary factor in a field setting related to mass removal.

behavior: no mixing and complete mixing. If there were no mixing in the headspace, the tracer would move through the headspace as plug flow and the tracer front would be relatively sharp. The tracer would only move out of the headspace and into the column once the tracer replaced the entire volume of headspace. On the other hand, if mixing in the headspace were complete, the tracer would enter the column material rapidly after entering the headspace. However, the concentration of tracer upon initial breakthrough would be much lower (due to dilution with water in the headspace) and would increase asymptotically to approach the influent concentration. The mixing behavior in each complex was evaluated, and was best simulated assuming complete mixing in the headspace at the top of each column (Figures B-5 and B-6). It should be also noted that the effects of headspace mixing are only a laboratory phenomenon, and would not occur under field conditions. The volume in this headspace is not considered a part of the volume used in calculation of the number of pore volumes flushed through the system.

## 5. Estimation of Porosity and Pore Volume

The calibration calculations described above provided an estimate of the porosity (and thus the pore volume) of each column complex. These values were compared to the previously estimated porosity values, as described in the interim report (Geomega 2004). If the estimated porosity used to predict ideal behavior is too low, the resulting calculated pore volume will be smaller than the actual pore volume, and the theoretical tracer breakthrough will occur before the observed tracer breakthrough. Conversely, if the estimated porosity is too high, the calculated pore volume will be larger than the actual pore volume, and the theoretical tracer breakthrough will be later than the observed breakthrough.

The best-fit calibration curve (i.e., the curve that most closely matched both the breakthrough time and the concentration profile) for the SCC corresponds to a porosity of 0.30 (Figure B-7). The best-fit calibration curve for the LCC corresponds to a porosity of 0.34 (Figure B-8).

The estimation of overall column-complex pore volume was accomplished by evaluating the shape of the breakthrough curves along with physical measurements of the system. The final calculated pore volumes were 5.9 liters for the SCC and 12 liters for the LCC. Both of these values are within 10% of the estimated values in the Interim Report (Geomega 2004). The calculated porosities (0.30 and 0.34) are similar to the range of porosity (0.18 to 0.31) observed in the partitioning tests (Geomega 2004) and are consistent with reported hydrologic characteristics of unconsolidated deposits in the Wilmington–Reading area of Massachusetts (Baker et al. 1964).

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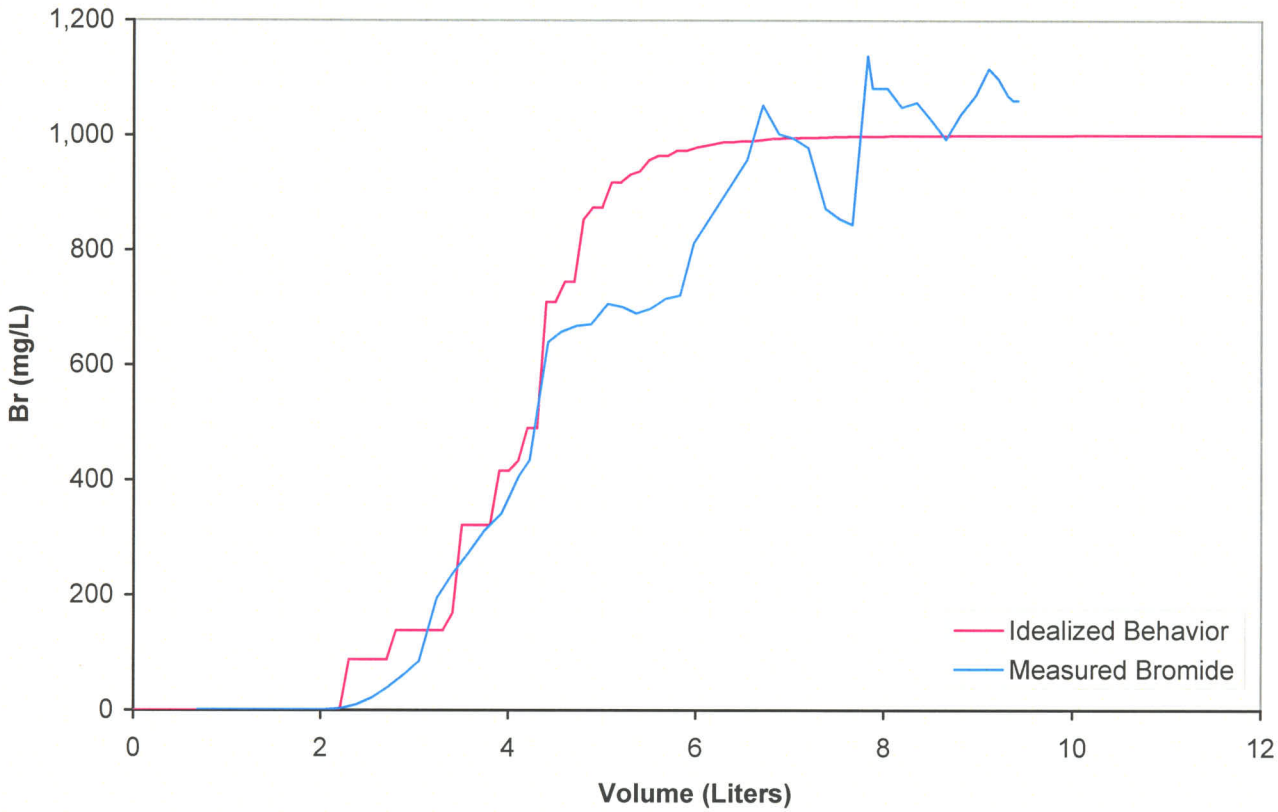


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Bromide tracer results with idealized calibrated breakthrough for the SCC.

**Figure**
B-1

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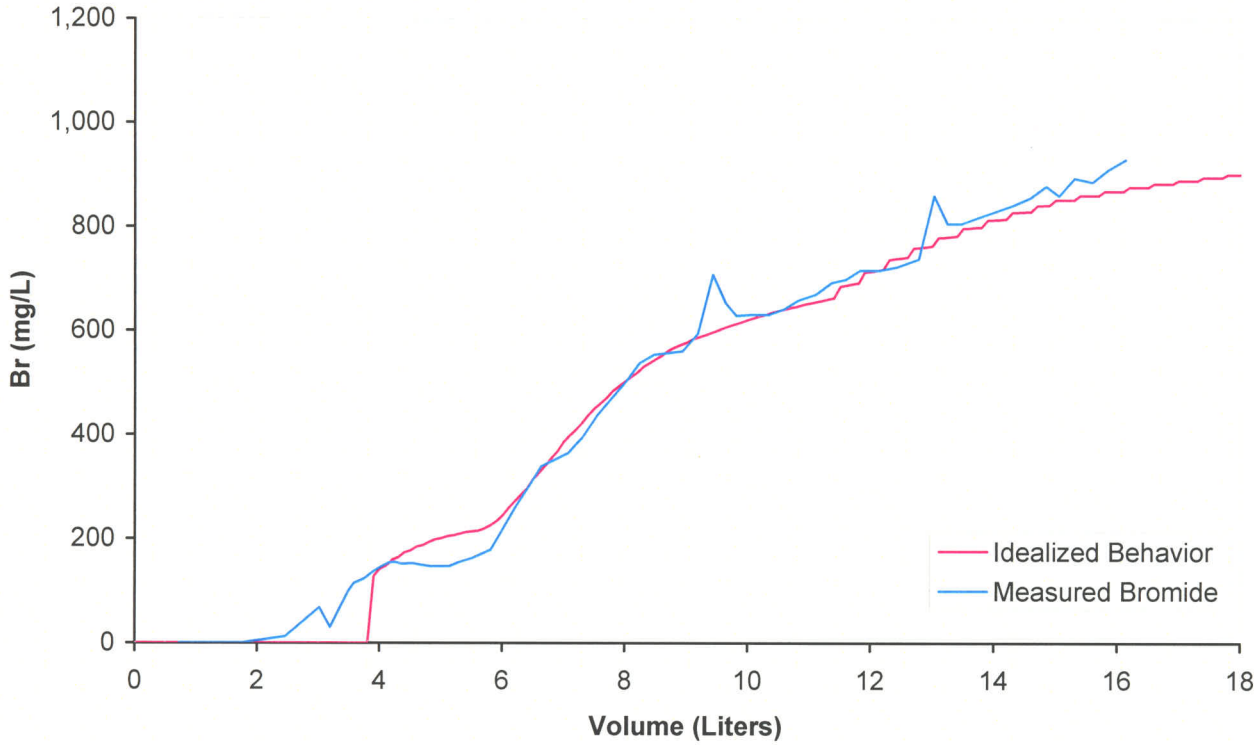


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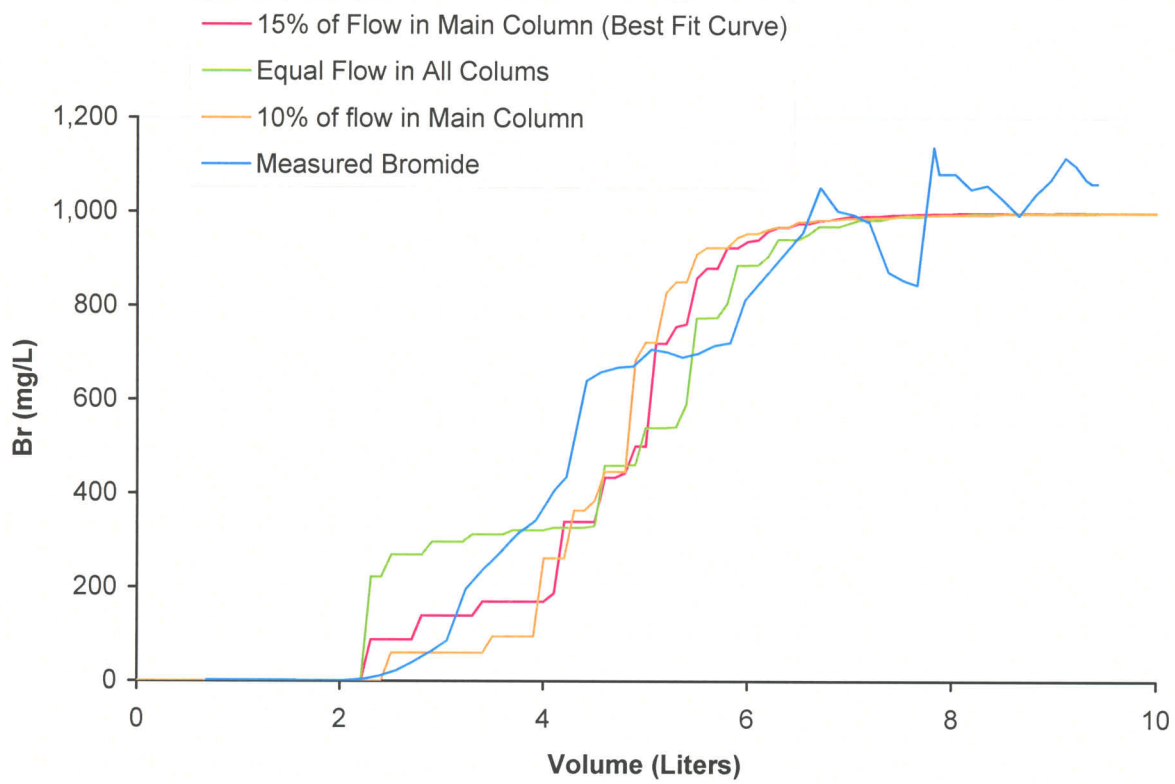
Bromide tracer results with idealized calibrated breakthrough for the LCC.

**Figure**
B-2

JM o:\Olin\DAPL Report 11-04\SD pore volume calcs calibration.xls

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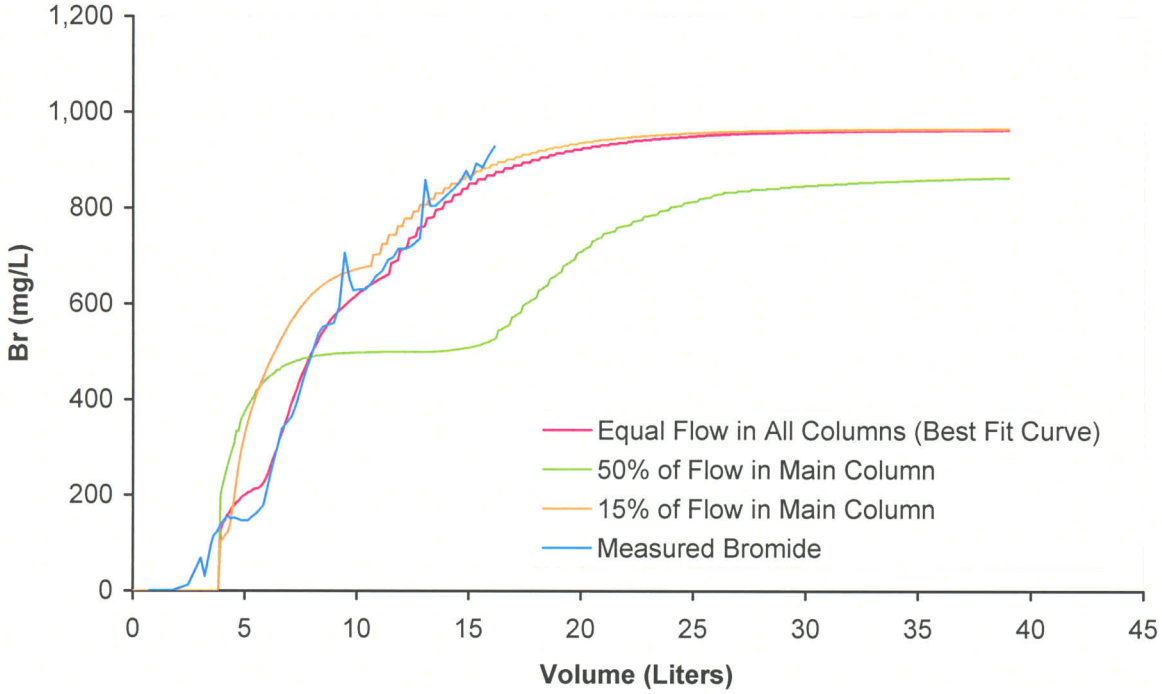
Calibration of the proportion of flow through different column channels in the SCC.

**Figure**
B-3

JM o:\Olin\DAPL Report 11-04\FM Bromide.xls

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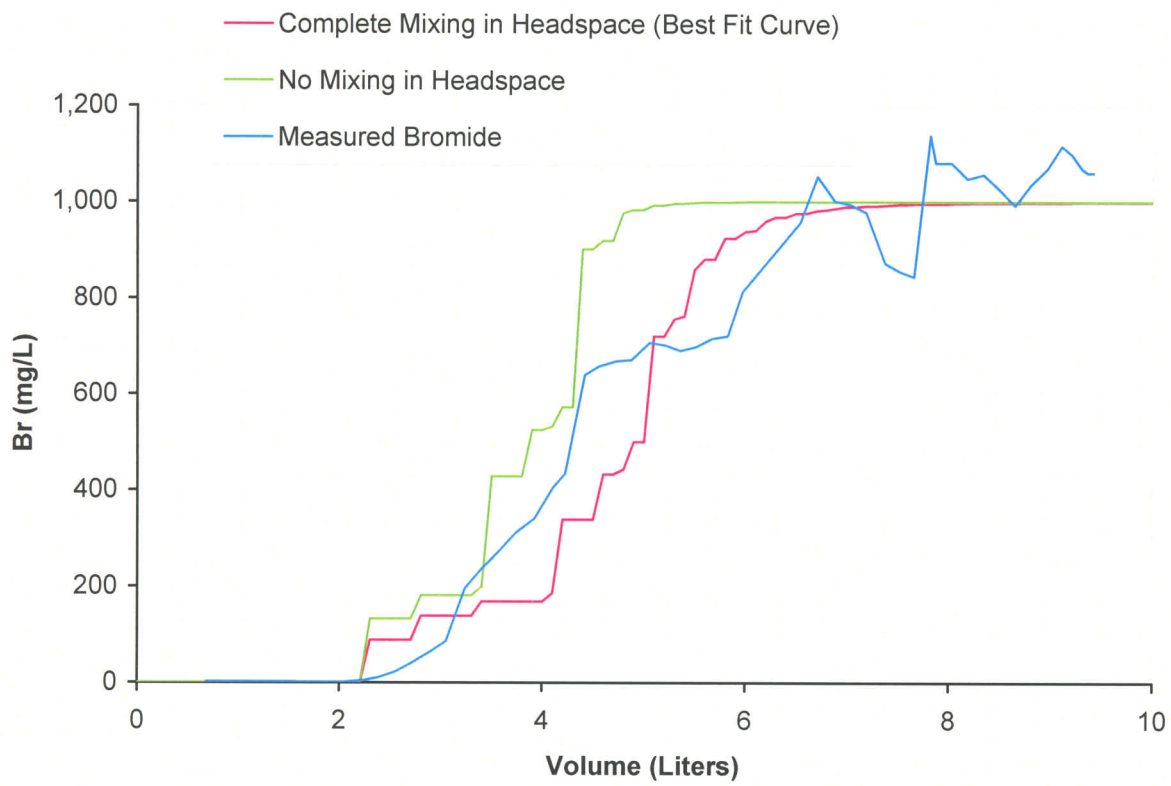
Calibration of the proportion of flow through different column channels in the LCC.

**Figure**
B-4

JM o:\Olin\DAPL Report 11-04\SD pore volume calcs calibration-App B.xls

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Calibration of headspace mixing behavior in the SCC.

**Figure**
B-5

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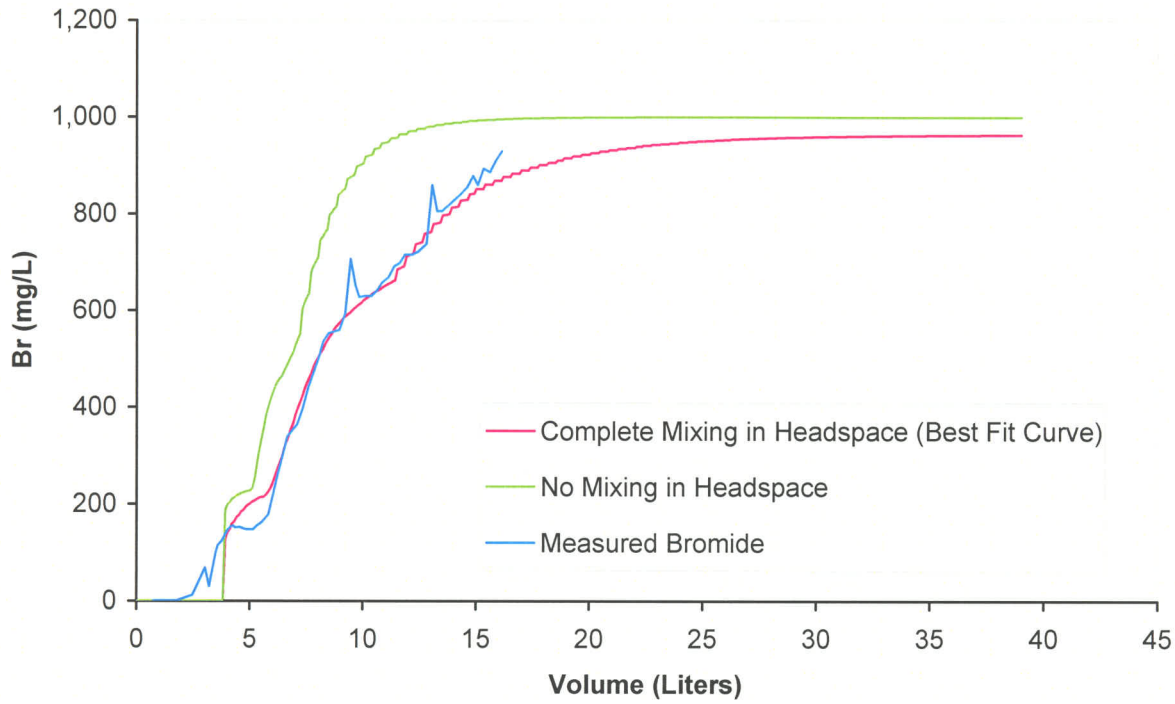


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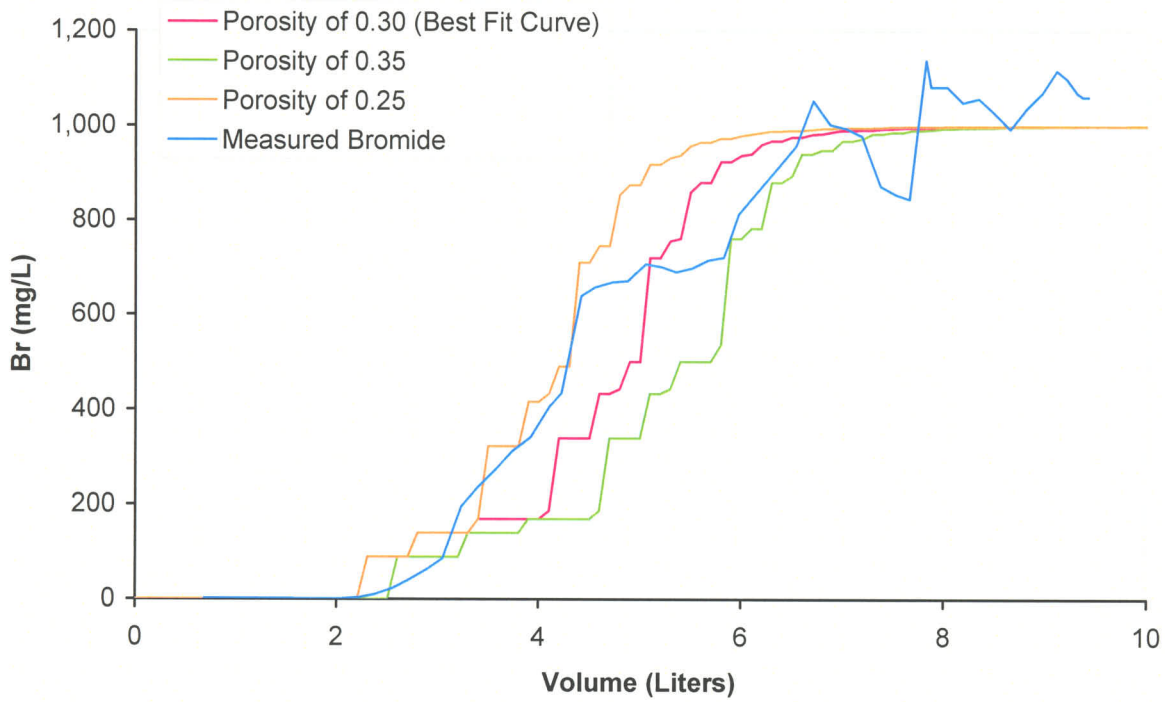
Calibration of headspace mixing behavior in the LCC.

**Figure**
B-6

JM o:\Olin\DAPL Report 11-04\SD pore volume calcs calibration-App B.xls

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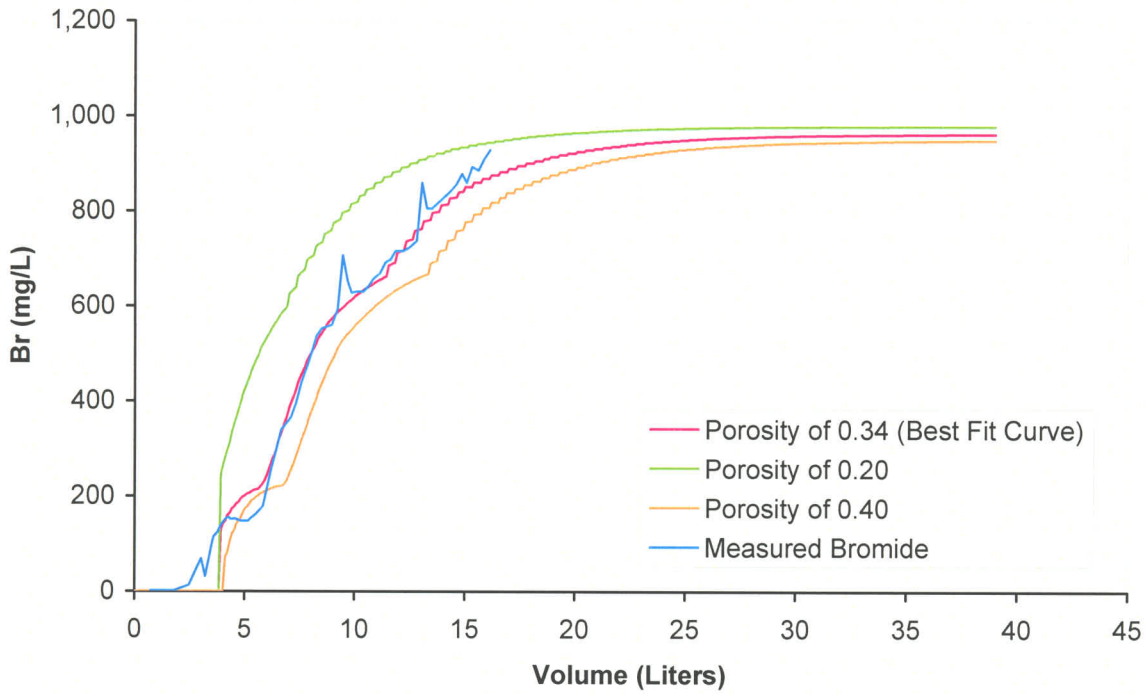
Calibration of column porosity for the SCC.

**Figure**
B-7

JM o:\Olin\DAPL Report 11-04\FM Bromide.xls

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Calibration of column porosity for the LCC.

**Figure**
B-8

JM o:\Olin\DAPL Report 11-04\SD pore volume calcs calibration-App B.xls