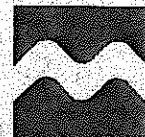


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MEMPHIS
ENVIRONMENTAL
CENTER, INC.



**CYPRESS CREEK SUB-AREA III
2004 INTERIM MEASURES INVESTIGATION**

Prepared For:

**Velsicol Chemical Corporation
Memphis, Tennessee**

Prepared By:

**Memphis Environmental Center, Inc.
Memphis, Tennessee**

January 2005

MEMPHIS ENVIRONMENTAL CENTER, INC.

5909 Shelby Oaks Drive, Suite 146
Memphis, Tennessee 38134
Phone: (901) 380-9995 Fax: (901) 380-9936



January 31, 2005

Mr. J. M. Apple, Director
Tennessee Department of Environment and Conservation
Division of Solid Waste Management
401 Church Street
Nashville, Tennessee 37243-1535

**Re: Cypress Creek Sub-Area III
2004 Interim Measures Investigation
Velsicol Chemical Corporation, Memphis, Tennessee
Tennessee Permit No. TNHW-109**

Dear Mr. Apple:

Enclosed, on behalf of Velsicol Chemical Corporation, is the Sub-Area III 2004 Interim Measures Investigation Report. This document describes the soil sampling and testing that was performed during August through November 2004 and related data evaluations.

If you have any questions on this report, please contact me at 901-380-9995, ext. 120.

Sincerely,

Memphis Environmental Center, Inc.

A handwritten signature in black ink that reads "Gary Hermann".

Gary J. Hermann, P.E.
Senior Environmental Projects Manager

Enclosures

c: Mike Apple, TDEC (3 copies and one electronic copy)
Jon Johnston, EPA
Phillip Davis, TDEC Memphis Field Office
Andy Felker, Velsicol
Paul Patterson, City of Memphis Public Works
Norman LaChapelle, Memphis and Shelby County Health Department
Chris Saranko, GeoSyntec Consultants

FILE COPY

June 2, 2005

Mr. J. M. Apple, Director
Tennessee Department of Environment and Conservation
Division of Solid Waste Management
L&C Tower, Fifth Floor
401 Church Street
Nashville, Tennessee 37243-1535

**Re: Revisions to Cypress Creek Sub-Area III, 2004 Interim Measures Investigation Report
Velsicol Chemical Corporation, Memphis Facility
Tennessee Permit No. TNHW-109
I.D. No.: TND 00-702 4664**

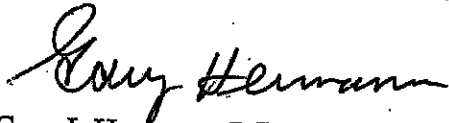
Dear Mr. Apple:

Enclosed, as requested by Mr. Doug Wright of your office, are copies of revised Figures 2-6 and 2-8 for MEC's January 31, 2005 report entitled Cypress Creek Sub-Area III 2004 Interim Measures Investigation. The following corrections and/or additions were made to the figures:

- On Figure 2-6, the locations for the samples collected on the Syed South property during 2004 were labeled as B-2 and C.
- On Figure 2-6, the sample location at 2320 Van Dale Ave. was added.
- On Figure 2-8, the sample location dot at the 925 Meagher St. property was changed from blue to green color.

Sincerely,

Memphis Environmental Center, Inc.



Gary J. Hermann, P.E.
Senior Environmental Projects Manager

Enclosures

c: Mike Apple, TDEC (3 copies and one electronic copy)
Jon Johnston, EPA
Philip Davis, TDEC Memphis Field Office
Andy Felker, Velsicol
Paul Patterson, City of Memphis Public Works
Norman LaChapelle, Memphis – Shelby County Health Department
Chris Saranko, GeoSyntec Consultants

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MEMPHIS ENVIRONMENTAL CENTER, INC.

**CYPRESS CREEK SUB-AREA III
2004 INTERIM MEASURES INVESTIGATION**

Prepared For:

**Velsicol Chemical Corporation
Memphis, Tennessee**

Prepared By:

**Memphis Environmental Center, Inc.
Memphis, Tennessee**

January 2005

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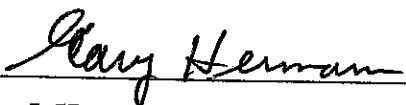
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- 2-2 Vegetable Test Results for 1930 Edward Ave.
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- B Data Quality Review Report

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



Gary J. Hermann, P.E.
Senior Environmental Projects Manager
Memphis Environmental Center, Inc.

Date: Jan. 31, 2005

1.0 INTRODUCTION AND BACKGROUND

This report presents the methods and findings of an environmental investigation performed by Velsicol Chemical Corporation of Cypress Creek Sub-Area III in Memphis, Tennessee during 2004 (the "2004 Investigation"). The investigation was performed as directed by the Tennessee Department and Environment and Conservation (TDEC) in an Interim Measures directive dated November 3, 2003. The investigation is part of an ongoing Resource Conservation and Recovery Act (RCRA) Corrective Action Program related to Velsicol's manufacturing plant at 1199 Warford Street in Memphis. It follows Velsicol's investigations of the area along most of Cypress Creek performed during 2001, the Cypress Middle School - University Park area during 2002 and Sub-Area III during 2003. Results of the "2001 Investigation" are presented in a report entitled Cypress Creek Drainage Channel Investigation and Preliminary Human Health Risk Evaluation, January 10, 2002. Results of the "2002 Investigation" are presented in a report entitled Cypress Middle School - University Park Area, Cypress Creek Investigation and Human Health Risk Evaluation, September 18, 2002. Results of the "2003 Investigation" are presented in a report entitled "Cypress Creek Sub-Area III Investigation", October 24, 2003.

The 2001 Investigation evaluated a 4.5-mile long reach of the Creek, from Scott Street near the Velsicol plant to the Wolf River. This investigation found that organochlorine pesticide concentrations in soil samples collected from overbank areas within a few feet of the Creek's concrete liner in the 2.4 mile-long Sub-Area III potentially exceed U.S. Environmental Protection Agency (EPA) target levels for long term (chronic) exposure and led to additional investigations. Sub-Area III is an area of predominantly residential land use along the concrete lined section of Cypress Creek from 200 feet downstream of Jackson Avenue to Evergreen Street. *Figure 1-1* shows the location of Cypress Creek, including Sub-Area III and the Cypress Middle School - University Park portion that was the focus of the 2002 Investigation. The "Study Area" addressed in this report is Sub-Area III, excluding the Cypress Middle School - University Park portion.

The 2003 Investigation included soil sample collection at 65 (44%) of the approximately 147 residential properties (including single family houses, duplexes, small undeveloped lots in residential areas and apartment complexes) adjacent to Cypress Creek in Sub-Area III. The objectives of the 2003 Investigation were to sample approximately every third residential property to determine the general nature and extent of contamination, with the expectation that additional sampling might be required in certain areas depending on the findings of that investigation. A summary of the 2003 Investigation results follows:

- Dieldrin was found to be the predominant compound of concern in the soil samples and was used as an indicator parameter for describing the Study Area contaminant levels and distribution.
- The conceptual model (i.e., contaminant levels are higher inside than outside of the historic construction easement) was found to be valid for two thirds of the sampled properties.
- Data evaluations found that contaminant levels vary along the channel and the contaminant levels at a number of locations warrant further evaluation based on chronic (long-term) exposure and health risk.
- A screening level value of 0.7 parts per million (ppm) dieldrin was established as a basis of selecting additional properties for soil testing. About one-third of the residential properties were found to have "elevated" contaminant levels (i.e., above 0.7 ppm dieldrin) in a sample, requiring additional investigation. Two-thirds of the residential properties were found to have contaminant levels less than the screening level.
- The contamination levels were found to not present an acute (short-term) health hazard at any of the tested properties.

Based on the results of the 2003 Investigation, TDEC directed Velsicol to perform Interim Measures to further assess the extent of contamination in Sub-Area III. The primary

objectives of this 2004 Investigation, as described in Velsicol's Revised Interim Measures Work Plan for Cypress Creek Sub-Area III, dated April 8, 2004, were as follows:

- Collect and test soil samples to investigate additional residential properties adjacent to properties sampled during 2003 that had "elevated" contaminant levels.
- Use the analytical data to further evaluate and characterize contaminant levels and distribution in the study area.

The findings of the 2003 Investigation also indicated the need for a human health risk assessment as part of the Sub-Area III Interim Measures. Velsicol began work on the risk assessment during July 2004, with submittal to TDEC due at the end of January 2005. The results of the 2004 Investigation were made available for use in the Sub-Area III Risk Assessment. GeoSyntec Consultants are performing the risk assessment work for Velsicol.

Note that the 0.7-ppm dieldrin screening level that was used in selecting properties for the additional investigation is not intended to be used as an action level for remedial action. The remedial action level for Sub-Area III residential properties is planned to be established as a result of the risk assessment.

This report was prepared by Velsicol's Memphis Environmental Center, Inc. (MEC), which also managed and performed the investigation.

Section 2 of this report describes the soil sampling methods and locations and analytical methods used in the investigation. **Section 3** presents the analytical results and characterizes the contaminant levels and distribution along the Creek.

During the course of planning and executing this investigation, Velsicol involved and informed the local community. These activities included meetings with the Cypress Creek Leadership Group during October 2003 and June and October 2004 and a community meeting at

the Christian Chapel Baptist Church during November 2004. Velsicol also prepared articles that were published in the Vollintine-Evergreen Community Association (VECA) newsletter.

2.0 SAMPLE COLLECTION AND ANALYSES

2.1 Sample Locations

The April 8, 2004 Interim Measures Work Plan envisioned that 78 soil samples (plus duplicates samples for quality control) would be collected from overbank areas at 50 properties. The sample locations were selected to evaluate conditions on properties adjacent to the properties where 2003 Investigation samples exceeded the 0.7-ppm screening level.

A total of 76 soil samples (plus duplicates) were collected and analyzed, representing 50 properties. Some of the initially selected properties were not sampled because the landowner could not be contacted or would not provided access. In these instances, MEC worked with TDEC to select alternate properties. The number of samples planned to be collected at each property varied from one to two, depending on location of the historic construction easement and general location relative to the Cypress Creek channel. Therefore, even though samples were collected at the planned number of properties, the total number of soil samples was two lower than originally planned. The location of the 2004 soil samples are shown on *Figures 2-1 through 2-9* along with the previous and relevant 2001 and 2003 sample.

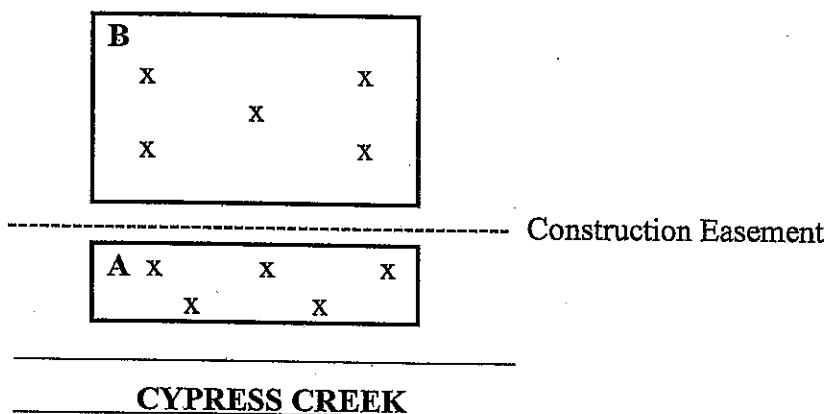
With the completion of the 2004 soil sampling, a total of 112 (76%) of the approximately 147 residential properties in Sub-Area III, have been tested. MEC obtained resident and/or landowner permission to sample each property. This was generally accomplished by first mailing a request letter to each resident and/or landowner with supporting information and a form to be returned granting access. Where necessary, this was followed up by phone calls and personal visits. MEC periodically communicated with TDEC regarding the selection of replacement properties to ensure compliance with project goals. TDEC supported Velsicol in this effort by contacting a few landowners/residents who did not grant access to MEC during the 2003 Investigation.

The general sample collection approach was to collect two samples from each property: one directly adjacent to the concrete liner in the historic construction easement, and one farther away from the Creek and outside of the construction easement. However, there were exceptions to this approach due to property shape and size and construction easement width. In addition during the course of the investigation, TDEC directed Velsicol to collect samples from two properties that back up to the Springdale Creek Apartment construction site (2510 Jackson Ave). Samples collected from within the construction easement and/or closest to the concrete liner were labeled with the extension "A" and those from immediately outside of the construction easement were labeled with the extension "B". Where a sampled property was not adjacent to the Creek channel or historic construction easement, a "C" extension was used in the sample label.

2.2 Sample Collection and Handling Methods

Soil samples were collected by MEC during the period of August 11 to November 1, 2004. Technicians from United States Environmental Services, L.L.C. (USES) supported MEC in this sample collection work. TDEC provided oversight and support each day of sample collection. *Table 2-1* lists the sample locations and collection dates. The list is presented in order from west to east or downstream to upstream, for the north side of the Creek and then the south side. Locations where duplicate samples were collected and other pertinent information are noted. Additional details on the 2004 sample locations are presented in *Appendix A*.

At each sample location, a 5-point composite sample was collected and thoroughly mixed in equal proportions in stainless steel bowls and then placed in glass jars for transportation and laboratory testing. To the extent practical, the five points were positioned similar to the positioning used in the 2003 Investigation. The general layouts of the 5-points were as shown in the following sketch, with the "B" sample layout at the top of the sketch and the "A" sample layout, which is adjacent to the Creek and inside the historic construction easement, lower in the sketch.



Soil samples collected from within the construction easement (i.e., the “A” area) were generally taken as follows: two of the 5-point composite sub-samples were collected 3 feet from the concrete liner, and the other three were collected at 20 feet from the liner. If the construction easement area was less than about 25 or 30 feet wide, such that the represented area extended outside of the construction easement area, the locations of the 5-point composite sub-sample locations in the outer area (i.e., the “B” area) were adjusted to avoid overlap. Due to the presence of buildings, the property shape and other conditions, the layouts had to be adjusted from the above plan at many locations, but this was done with the underlying goal of representing human exposure conditions. Hand-drawn sketches with survey tape measurements from permanent structures, photographs and global positioning satellite (GPS) coordinates were used to document the sample locations.

The sample collection and handling methods, including equipment decontamination procedures, were performed in accordance with the TDEC approved Sampling and Analysis Procedures for the RCRA Corrective Action Program (the SAP), as revised January 30, 2003, and the April 8, 2004 Interim Measures Work Plan, unless otherwise noted. The soil samples were collected from the 0- to 9-inch depth interval using hand operated soil augers. Where vegetated sod was encountered, the soil was shaken from the roots into the sample-mixing bowl and organic matter, such as roots and leaves, and inert material, such as gravel, were discarded.

As noted on *Table 2-1*, MEC collected four duplicate soil samples. Field rinse blanks were collected from sampling tools on the following dates: August 11, 12 and 18 and September 3 and 28, 2004. The samples were placed in coolers on ice in the field. The samples were

transported on ice and under chain of custody protocols by MEC or USES staff to GTW Analytical Services, LLC in Memphis for laboratory testing.

If middle aged to elderly residents were available at the time of sample collection or during contacting for access, and if they had resided at that location for many years, MEC asked if they had knowledge of the Creek conditions or concrete lining construction work and related sediment handling activities during the period of the early-1950's to the early 1970's. The objective of this interview was to determine if they had information related to where soils excavated from the channel bottom as part of the concrete lining work may have been deposited or handled outside of the channel. None of those interviewed were able to provide new information on this topic.

2.3 Soil Testing

GTW Analytical Services, LLC of Memphis, Tennessee analyzed the soil and rinse blank samples. All of the soil samples were analyzed in accordance with the TDEC-approved SAP, using the Gas Chromatography (GC) method, EPA SW-846 Method 8081A, as was used for all of Velsicol's previous Corrective Action Program testing. All of the soil samples were also analyzed for moisture content, using EPA SW-846 Method 3550B.

The five samples collected at the 920 Bingham St. property were also tested using the Gas Chromatography/Mass Spectrometry (GC/MS) method (EPA SW-846 Method 8270C). The objective of this additional testing was to determine if GC analyses give biased high readings or false positives for the analytes detected in this investigation. The same extract was used for the GC/MS test as was used for the GC test.

2.4 Garden Vegetable Testing

At the October 6, 2004 Cypress Creek Leadership Group meeting, Mr. Lois Frieson, who lives at 1930 Edward Ave. and where soil samples were collected during the 2003 Investigation, asked if his garden vegetables were safe to eat. Velsicol offered to collect and test samples of

vegetables from his garden to answer his question. This work was performed as part of the 2004 Investigation and included the collection and testing of another soil sample from his garden plot on November 1, 2004. Six different vegetables were sampled and tested at GTW Analytical Services. Velsicol provided a report to TDEC on the sample collection work on November 10, 2004. A copy of the laboratory report was provided to TDEC on December 2, 2004. A report with a summary of the test results was provided to Mr. Frieson on January 13, 2005 and included GeoSyntec Consultant's determination that the vegetables are safe to eat. FDA Method 303, E1 + DG1 was used to analyze the vegetable samples. A summary of the vegetable test results is presented in *Table 2-2*.

3.0 SOIL ANALYTICAL RESULTS

3.1 Laboratory Analytical Results

The laboratory analytical results from the 2004 soil testing are summarized in *Table 3-1*. Copies of the GTW laboratory reports were submitted to TDEC as follows:

- August 11, 12 and 25, 2004 sample dates, reports submitted on October 11, 2004.
- August 18 and 19 and September 3 and 28, 2004 sample dates, reports submitted on November 11, 2004.
- November 1, 2004 sample date, report submitted on November 17, 2004.

3.2 Data Quality Evaluations

The quality of the laboratory analytical data were evaluated by Premier Environmental Services, Inc., in accordance with the SAP, to achieve Data Quality Objective Level III prior to incorporation into the project database. Premier's Analytical Data Quality Assessment and Validation Report (Data Validation Report), which is provided in *Appendix B*, is summarized as follows:

- Sample Delivery - The samples were transported, handled, and analyzed per the requirements of the SAP.
- Holding Time Periods - Due to instrument problems, eighteen samples were analyzed past the required holding time. All pesticide results for each sample missing the holding time are qualified as either estimated (J) or estimated detection limit (UJ).
- Laboratory Blank Analyses - The Data Validation Report indicated that no laboratory contamination occurred during sample analyses.

- Blank Spike Analysis/Surrogate Compound Recovery – These evaluation factors assess the laboratory's performance and accuracy. The recoveries for both of these internal QA/QC tests were within control limits for the analytical methods.
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analyses – These factors evaluate the accuracy and precision on an individual sample basis. Due to the level of contamination in many of the samples and matrix interference, many MS and MSD recoveries were unavailable or outside acceptable recovery limits. Based on the data evaluations, it is believed that the MS/MSD failures are likely due to matrix interference and not due to laboratory systematic problems. Certain data were qualified as estimated based on this factor and flagged as "J".
- Rinse Blank Analyses - Five equipment rinse blanks were collected to verify the adequacy of decontamination procedures. Hexachloronorbornadiene was detected in three rinsate blank. However, the compound was not detected in the related samples and no qualification of the data was necessary.
- Field Duplicate Analyses - This factor evaluates the precision of the field sample collection procedures and laboratory analytical methods. Five field duplicate samples were collected and analyzed. Based on the evaluation, adequate precision was achieved. However, the Data Validation Report indicates that one compound detected was outside the Relative Percent Difference (RPD) control limits used to compare the results of the primary and duplicate sample. Endrin Ketone, the result outside the control limit for both the primary and duplicate sample, is usable, but both results are qualified as estimated and flagged as "J."
- Miscellaneous Quality Control - Method 8000 requires dual column confirmation comparison of detected compounds using an RPD value of less than or equal to 40. Several analytes did not pass the 40 percent difference requirement. The affected samples and analytes are qualified as estimated (J).

Five samples were reanalyzed using GCMS to confirm the presence of chlorinated pesticides. No data validation was performed on the GCMS results as they are intended for qualitative purposes only.

The practical quantitation limit for toxaphene was raised in all samples due to matrix interferences. No qualifiers are required as a result of this action.

- Data Completeness - Completeness is a measure of the amount of valid data compared to the amount expected under normal conditions. In most cases, the reported concentration and associated quality control results indicate that the data are of sufficient quality. Some analytical results were qualified as estimated due to duplicate failures, MS/MSD failures, or reporting below the detection limit. The estimated data are usable as qualified. The completeness of the data collected during this investigation is 100%, which achieves the SAP requirement of greater than 85%.

The EPA Region 4 Science and Ecosystem Support Division (SESD) Office of Quality Assurance is also performing a quality control review of GTW's analytical work. In accordance with the Work Plan, 10% (8) of the samples were selected by random drawing by MEC for this review and expanded laboratory data packages were assembled by GTW Analytical Services and sent to EPA for their review on December 30, 2004. The results of EPA's review were not available to include in this report.

3.3 Contaminant Levels and Distribution

The soil analytical results were evaluated by various means to characterize contaminant levels and distribution in the Cypress Creek Sub-Area III Study Area. The following evaluations were performed:

- Dieldrin concentrations were reviewed, using the combined 2004 and previous soil sample test data, to confirm whether or not dieldrin is the predominant compound of concern. GeoSyntec Consultants performed this evaluation as part of the risk evaluation. The results

are presented in GeoSyntec's report on the development of risk-based remedial action levels for Sub-Area III, which is being submitted concurrent with this 2004 Investigation report. This evaluation confirmed the 2003 Investigation finding that dieldrin is an appropriate indicator compound for evaluating contaminant levels and distribution.

- GeoSyntec also compared contaminant levels inside and outside the historic construction easement and confirmed the 2003 Investigation finding that the conceptual model (i.e., contaminant levels are higher inside than outside of the historic construction easement) is valid for the majority of the sampled properties. The results of this comparison are also presented in GeoSyntec's concurrent report.
- Spatial distribution of contaminants along the creek channel and distribution by concentration ranking were evaluated in a manner similar to that presented in Velsicol's 2003 Investigation report. The results of these evaluations follow.

3.3.1 Contaminant Distribution Along the Channel

Figures 3-1 and 3-2 depict dieldrin concentration trends along the north and south sides of the Cypress Creek channel in the Study Area, respectively. The following trends for the combined 2004 and previous test data can be seen on these Figures:

- Elevated contaminant levels (> 6 ppm dieldrin) were found on the north bank of the channel between Jackson Ave. and Hollywood St. and at about the 6,300-foot distance downstream of Scott St. On the south side, relatively high levels were found just upstream of Hollywood St. in the Vollintine Cove area, immediately downstream of University St., and at about 11,500 feet from Scott St., between McLean and Evergreen Sts.
- Long sections of relatively low contaminant levels (< 2 ppm dieldrin) were found on the south side of the channel between Jackson Ave. and Meagher St., from upstream of Springdale St. to University St. and between about 10,000- and 11,000-ft distance downstream of Scott St. On the north side, relatively long sections with low contamination were identified near

Springdale St., and, with one exception, from about 8,500 ft. downstream of Scott St., to the end of the Study Area at Evergreen St. The three properties tested on Edward Cove during 2003 were found to have low contaminant levels.

3.3.2 Contaminant Distribution By Concentration Ranking

Figure 3-3 shows a ranking of all the sampled properties by dieldrin concentration. This graph was developed using the higher of the two dieldrin concentrations, where more than one sample was collected on a property. As indicated by the shape of the graph, elevated contaminant concentrations were found on a small proportion of the properties, and the majority of the properties have relatively low contaminant levels.

3.4 Comparison of GC/MS to GC Analytical Results

As noted in *Section 2.3*, the five soil samples collected at 920 Bingham St. during 2004 were analyzed by the Gas Chromatography/Mass Spectrometry (GC/MS) method, in addition to the Gas Chromatography (GC) method that has been used throughout Velsicol's Cypress Creek investigations. The objective of performing the additional testing was to compare data from two different analysis methods. This information was used to evaluate if the GC method gives false high readings, as compared to the GC/MS method, in samples with relatively high contaminant levels. Such imprecise readings can occur in the GC method due to matrix interference and the presence of organic matter. These factors could cause interference and an increased detector response giving a higher data value than that which is actually present in a sample.

A summary of the comparison is presented in *Table 3-2*. The as-received, wet weight, analytical test results were used and ratios of the GC test results to the GC/MS test results were computed. As shown in the comparison, the GC method gave a higher concentration than the GC/MS method in all but a few instances. This indicates that some GC test results from the Cypress Creek investigations may be biased high on samples where the contamination levels are relatively high, such as at 920 Bingham St. This finding can be used in interpreting GC test results where relatively high contamination levels are measured. For example, where relatively

high contaminant levels are found using the GC method, data evaluators should recognize that the test results may be biased high.