

ADDENDUM TO THE BEE CEE MANUFACTURING SITE

SECOND FIVE-YEAR REVIEW REPORT


May 2010

PREPARED BY:

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Approved by:


Date:



**Cecilia Tapia, Director
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6/7/10

Date



**Robert Geller, Director
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May 28, 2010

Date



This *Addendum to the Bee Cee Manufacturing Site Second Five-Year Review Report* documents progress made in meeting recommendations made in the *Second Five-Year Review Report for the Bee Cee Manufacturing Company Site, Malden, Dunklin County, Missouri* (Second Five-Year Review), approved by the Environmental Protection Agency (EPA) on July 30, 2009. In addition, statements of site protectiveness have been made based on additional information obtained.

PROGRESS SINCE THE SECOND FIVE-YEAR REVIEW COMPLETION DATE

Table 1 provides a listing of the recommendations made in the Second Five-Year Review, along with the status of each of those recommendations as of the date of this Addendum. With the submittal of this addendum, only recommendation #5 (Complete a ROD amendment, Explanation of Significant Difference or use other appropriate mechanisms to modify site groundwater remediation goals based on currently accepted risk and exposure data.) and recommendation #9 (If soils risk remains after completing recommendation #6, take necessary steps to begin addressing the issue.) remain to be completed.

The remainder of this Addendum will focus upon the completion of recommendation #6 (Conduct soil sampling and reassess risk to determine if soils risk remains.). Results obtained will be used to draw conclusions about the protectiveness of the remedy at the Bee Cee Manufacturing Company site.

SOIL SAMPLING

The Second Five-Year Review, finalized in July 2009, was inconclusive as to the protectiveness of the site remedy. This was due to potential risk remaining from the presence of hexavalent chromium in on-site soils. A Removal Action was conducted at the Bee Cee Manufacturing Company site by the EPA in 1992 to address on-site soil contamination. Contaminated soil above 180 mg/kg hexavalent chromium was removed from the site and replaced with clean soil. However, since the Removal Action, risk from hexavalent chromium in soil has been reevaluated by EPA. Current Regional Screening Levels (RSLs) for hexavalent chromium are 0.29 mg/kg for residential soils and 5.6 mg/kg for industrial site soils assuming a risk level of 10^{-6} , with cleanup generally being warranted if risk exceeds a 10^{-5} risk, or 2.9 mg/kg for residential soils and 56 mg/kg for industrial soils. The Second Five-Year Review recommended that soil sampling be conducted at the Bee Cee Manufacturing Company site to determine if risk related to the presence of hexavalent chromium contamination in soils remains. The remainder of this report documents the final sampling methodology, sampling results, and conclusions of the investigation conducted in March 2010.

METHODOLOGY

The *Sampling and Analysis Plan for Soils for the Bee Cee Manufacturing Site* (SAP) dated December 2009 (Attachment A) was approved January 22, 2010 as an attachment to the *Quality Assurance Project Plan for the Bee Cee Manufacturing Site* (QAPP). Due to funding constraints for the sampling project, and after consultation with EPA and the Missouri Department of Health and Senior Services (MDHSS), the sampling plan was modified from its original design. This modification is described below.

The originally approved sampling plan called for the collection of composite samples from 42 surface sampling units. The number of surface sampling units was reduced to 23 by making the following modifications to the sampling design (Figure 1):

1. Sampling units 1C, 1D, 2C and 2D were combined into a single sampling unit 100 feet by 100 feet in size. A total of 16 aliquots were taken from within this sampling unit.
2. Sampling units 1E, 1F, 2E, and 2F were combined into a single sampling unit 100 feet by 100 feet in size. A total of 16 aliquots were taken from within this sampling unit.
3. Sampling units 3A, 3B, 3G 3H and 5H were not sampled. XRF sampling conducted as part of the site removal action in the early 1990's indicated that total chromium levels in these areas were below the XRF detection limit of 255 ppm, which is significantly lower than the total chromium levels found within the remainder of the area to be sampled.

4. Sampling Units 7A, 7B, 7E, 7F, 7G and 7H were not sampled. There was no data in the file to support the need to sample these sampling units. However, they were originally included due to their proximity to the facility building.

The originally approved sampling plan called for the collection of samples from twelve vertical borings. The borings were to each be five feet in depth, and samples were to be collected at depths of 2 ½ and five feet. To further reduce sampling costs, the number of vertical soil borings was reduced from twelve to eight (Figure 2). Vertical borings B1, B4, B5 and B9 were not constructed. In addition, only one sample was collected from each boring, at a depth of 2 ½ to 3 feet below ground surface.

Prior to sampling at the site, a background sample was collected from a city park located approximately a mile south southeast of the site (Figure 3). This sample was collected on March 15, 2010, in accordance with the QAPP and SAP, at a location with the same soil type (Malden Series) as found at the Bee Cee Manufacturing Company site. The sample was collected by taking four aliquots from an area approximately 50 feet by 50 feet in size. One aliquot was taken from the NE, SE, SW and NW quadrants of the collection area.

Surface sampling at the Bee Cee Manufacturing Company site was conducted on March 16, 2010. Samples were collected by Evan Kifer, MDNR Project Manager, and Dan Gravatt, EPA Project Manager, in accordance with the approved QAPP and SAP, with the sampling plan modifications described above. Samples were placed on ice and delivered to the Environmental Services Program (ESP) lab on March 18, 2010 under chain of custody.

Eight vertical borings were drilled on March 23, 2010 by MDNR, Environmental Services Program (ESP) personnel per the approved QAPP and SAP, with the sampling plan modifications described above. ESP staff collected a sample from each boring at a depth of 2 ½ to 3 feet. Samples were placed on ice and delivered to the ESP lab on March 23, 2010 under chain of custody.

SAMPLING RESULTS

Table 2 shows laboratory results for surface soil sampling conducted at the Bee Cee Manufacturing Company site. Figure 4 graphically displays those results. The highest level of hexavalent chromium was detected in sampling unit 4B at a level of 23.6 mg/kg. Sampling units 4A, 4B, 4C, 4D, 5A and 5B all had sampling results above the EPA residential cleanup level of 2.9 mg/kg, however, all sampling results were below the commercial/industrial cleanup level of 56 mg/kg. Two sample duplicates were collected as part of the surface sampling effort. A comparison of duplicate results is presented in Table 3. A comparison of method duplicate results is presented in Table 4.

Table 5 shows laboratory results for hexavalent chromium in vertical boring samples collected from a depth of 2 ½ to 3 feet below ground surface. The highest level of hexavalent chromium detected in the eight soil borings collected was 1.59 mg/kg, which was detected in B12. All soil boring results were below the EPA residential cleanup level of 2.9 mg/kg.

Sampling results of both surface soil and vertical boring samples confirm that the Removal Action conducted in 1993 was successful in meeting its goal to remove all hexavalent chromium in excess of 180 mg/kg from the Bee Cee Manufacturing site.

CONCLUSIONS

Historic assessments of risk at the Bee Cee Manufacturing Company site have determined site cleanup levels assuming future site use will be residential. However, the Bee Cee Manufacturing Company Site is located within the Malden Industrial Park, and is currently zoned commercial/heavy industrial. Given the site's location and most logical long-term use scenario, it seems appropriate to clean up the site to levels appropriate for a commercial/heavy industrial site.

The MDHSS was asked to evaluate the analytical data presented in this report and comment on the protectiveness of the remedy assuming a long-term use of the site as industrial/commercial. Given that construction at the site is a distinct possibility in the future, MDHSS evaluated a cleanup level for the Bee Cee Manufacturing Company site for a construction worker. Utilizing a risk factor of 10^{-5} , the MDHSS determined that a cleanup level of 41.6 mg/kg

would be protective of a construction worker and an industrial/commercial use scenario. See Attachment D for additional detail on how this was determined.

All sampling results for hexavalent chromium in surface soils at the Bee Cee Manufacturing site are below the site cleanup level of 41.6 mg/kg. All sampling results for hexavalent chromium in subsurface soils (2 ½ to three feet) are below the site cleanup level of 41.6 mg/kg. Based on these results, as long as use of the Bee Cee Manufacturing site remains commercial/heavy industrial, no additional remediation of on-site soils is required.

ISSUES AND RECOMMENDATIONS

The site Record of Decision (ROD) document signed in 1997 assumed that the Removal Action for soils conducted in 1992 was complete and required no additional action to achieve a cleanup given a residential use scenario. Thus the ROD only addressed a remedy for site groundwater contamination. A ROD amendment (or other appropriate instrument) should be utilized to formally state the requirement that an Environmental Covenant be placed on the site restricting its long-term use to commercial/heavy industrial as protection against exposure to site soils. It is suggested that a paragraph 2D be added to the current site Environmental Covenant and wording similar to the following utilized: "2D. Use of the property shall remain commercial/industrial as long as hexavalent chromium contamination remains on site above residential cleanup levels at a risk of 10^{-5} ."

The recommendations made above are consistent with recommendations written into the Second Five-Year Review approved by EPA on July 30, 2009 and reproduced as Table 1 in this report. Per the Second Five-Year Review, the site Environmental Covenant should be revised as recommended above and be put in place by September 30, 2010 (recommendation #7). The ROD amendment (or other appropriate instrument) utilized to formally state the requirement for an Environmental Covenant restricting long-term use of the site is to be finalized by the date of the next site Five-Year Review, June 30, 2014.

PROTECTIVENESS STATEMENTS

The Second Five-Year Review made the following statements regarding the protectiveness of the remedy at the Bee Cee Manufacturing Company site:

"The groundwater remedy, as implemented, is protective--both short-term and long-term--of human health and the environment. However, since risk assumptions have changed, soils risk remaining at the site after the Removal Action cannot be determined without additional information. As this review encompasses risk from all media, overall site protectiveness--both short-term and long-term--cannot be determined at the Site until further information is obtained."

Based on the results of the sampling presented in this report, the protectiveness of the remedy at the Bee Cee Manufacturing Company site can be restated as follows:

"The groundwater remedy, as implemented, is protective—both short-term and long-term—of human health and the environment. Based on soil sampling conducted and presented in the *Addendum to the Bee Cee Manufacturing Site Second Five-Year Review Report*, the soils remedy is protective of human health and the environment in the short-term, given that the site is currently zoned industrial/commercial and there is no unacceptable risk present given an industrial/commercial use scenario. Given the possibility that long-term use of the site could change if the City of Malden were to sell its industrial complex, the soils remedy will remain protective only if the site Environmental Covenant is modified to assure that long-term use of the Bee Cee Manufacturing Company site remains industrial/commercial as long as hexavalent chromium levels remain in place above the EPA residential cleanup level."

NEXT FIVE-YEAR REVIEW

The next Five-Year Review will be completed on July 30, 2014, five years after the signature of the last Five-Year Review report.

Figures and Attachments:

Figure 1: Final Surface Soil Sampling Units

Figure 2: Final Vertical Boring Locations

Figure 3: Background Sample Location

Figure 4: Surface Sampling Laboratory Results (Not completed but to be included in final report)

Table 1: Current Status of Recommendations and Follow-up Actions

Table 2: Surface Soil Sampling Results

Table 3: Comparison of Duplicate Samples

Table 4: Comparison of Method Duplicates

Table 5: Vertical Boring Laboratory Results

Attachment A: Sampling and Analysis Plan For Soils dated December 2009

Attachment B: Field Notes

Attachment C: Laboratory Data

Attachment D: MDHSS Response Letter

Bee Cee Manufacturing


Dunklin County, Missouri



Figure 1
Final Surface Soil Sampling Units

Bee Cee Manufacturing
Harper Drive, Malden Industrial Park
Dunklin County, Missouri

Legend

 Sampling Unit for Composite Surface Soil Sample

Site Location



Created on November 25, 2008 by Steve Vance
This map is located at M:\Superfund\Bee Cee
Figure1_BeeCee_Soil_Sample_Map_GPS.mxd

Base Map: 2008 Digital Orthophoto Quarter-Quadrangle (DOQQ)

Although data are used to create this map have been compiled by the Missouri Department of Natural Resources, no warranty, expressed or implied, is made by the department as to the accuracy of the data and related materials. The act of distribution shall not constitute any such warranty, and no responsibility is assumed by the department in the use of these data or related materials.

Bee Cee Manufacturing

Dunklin County, Missouri

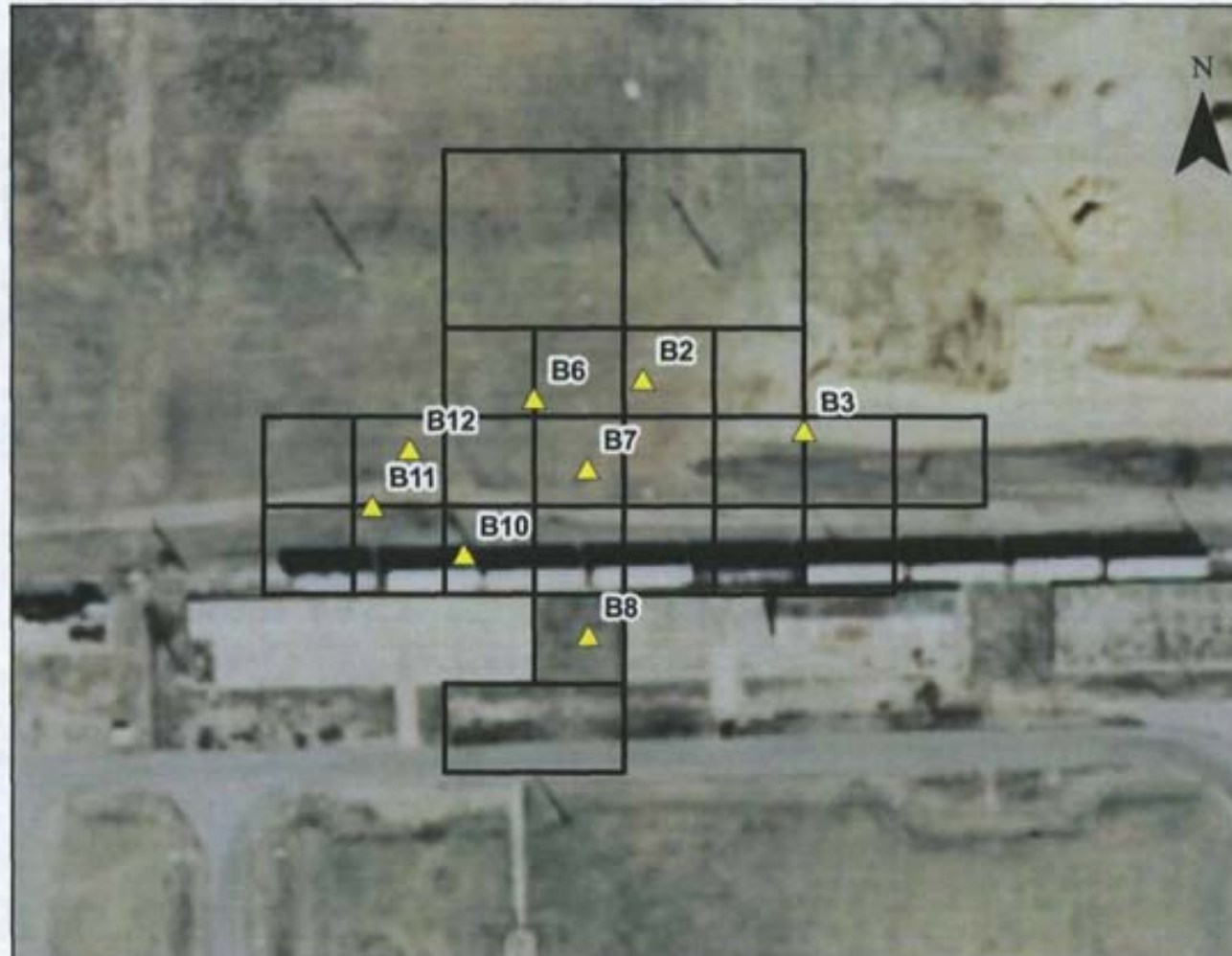




Figure 2
Final Vertical Soil Boring Locations

Bee Cee Manufacturing
Harper Drive, Malden Industrial Park
Dunklin County, Missouri

Legend

-  Vertical Boring Locations
-  Sampling Unit for Composite Surface Soil Sample

Site Location



Created on: November 25, 2009 by Steve Vance
This map is located at W:\Superfund\Bee Cee
Figure2_BeeCee_Soil_Sample_Vertical_Boring_Map.mxd

Bee Map: 2009 Digital Orthophoto Quarter-Quadangle (DOQQ)

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Bee Cee Manufacturing


Dunklin County, Missouri



Figure 3
Background Sample Location

Bee Cee Manufacturing
Harper Drive, Malden Industrial Park
Dunklin County, Missouri

Legend

 Sampling Unit for Composite Surface Soil Sample

Site Location



Created on: November 25, 2009 by Steve Vance
This map is located at M:\Superfund\Bee Cee
Figure3_Background_Sample_Location.mxd

Base Map: 2008 Digital Orthophoto Quarter Quadrangle (DOQQ)

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Bee Cee Manufacturing

Dunklin County, Missouri






Figure 4
Final Surface Soil Sampling Results

Bee Cee Manufacturing
Harper Drive, Malden Industrial Park
Dunklin County, Missouri

Legend

Final Surface Soil Sampling Results

-  Results above EPA residential cleanup level of 2.9 mg/kg
-  Results between three times background and the EPA residential cleanup level
-  Results less than three times background (below .156 mg/kg)

Site Location



Created on: April 30, 2008 by Steve Vance
This map is located at M:\Superfund\Bee Cee
Figure4_BeeCee_Surface_Soil_Sample_Results.mxd

Base Map: 2008 Digital Orthophoto Quarter-Quadangle (DOQQ)

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Table 1: Current Status of Recommendations and Follow-up Actions

Recommendations/ Follow-up Actions	Party Responsible	Projected Milestone Date	Current Status
1. Continue annual groundwater monitoring until the next Five-Year Review or until remediation goals are met for three consecutive years.	MDNR	4/30/2014	Ongoing.
2. 2007 data for MW-3 will not be utilized to determine if site remedial goals are met. In the future, laboratory personnel have been instructed to closely scrutinize data if analysis shows hexavalent chromium levels significantly higher than total chromium levels.	MDNR	Ongoing	Ongoing
3. Repair damaged protective casings/well bolsters as soon as practicable after noted.	MDNR	7/23/2008	Completed July 23, 2008.
4. Complete update of site QAPP by incorporating EPA comments and incorporating information on soils sampling.	MDNR	7/31/2009	Completed with final approval signature obtained January 22, 2010.
5. Complete a ROD amendment, Explanation of Significant Difference or use other appropriate mechanisms to modify site groundwater remediation goals based on currently accepted risk and exposure data.	EPA	9/30/2010	Path forward still to be determined.
6. Conduct soil sampling and reassess risk to determine if soils risk remains.	MDNR MDHSS	9/30/2009	Completed with submittal of this Addendum.
7. Finalize and put in place an Environmental Covenant on the site prior to the MDNR assuming responsibility for the site, assuring that all site risk is addressed.	EPA	9/30/2010	Environmental Covenant to address groundwater put in place June 23, 2009.

Recommendations/ Follow-up Actions	Party Responsible	Projected Milestone Date	Current Status
<p>8. To optimize the remedy, discontinue sampling in MW-1 and MW-2 since these wells are up gradient from the source area MW-3. It is also recommended that sampling be discontinued in MW-7, MW-8, MW-9 and MW-10 until the plume is detected above health-based site specific standards in MW-6. Further optimize the remedy by abandoning MW-1 and MW-2.</p>	MDNR	9/30/2010	<p>Optimization scheme for ongoing monitoring implemented beginning with the March 2010 annual sampling event. At the suggestion of EPA, MW-1 and MW-2 will not be abandoned until after groundwater sampling is completed to allow wells to be used to determine groundwater flow direction at the site.</p>
<p>9. If soils risk remains after completing recommendation #6, take necessary steps to begin addressing the issue.</p>	EPA	Next five-year review	<p>Path forward to be determined based on submittal of this Addendum.</p>

**TABLE 2: SURFACE SOIL SAMPLING RESULTS
BEE CEE MANUFACTURING COMPANY, DUNKLIN COUNTY, MISSOURI**

● All values listed in parts per million (mg/kg) dry weight. ● Sample results in bold and italics exceed the EPA Residential CL.
● Sample results in bold are significantly¹ above background concentrations

Sample ID	Background	1C/1D/2C/2D	1C/1D/2C/2D-DUP	1E/1F/2E/2F	3C	3D	3E	3E-METH DUP1	3E-METH DUP2	3F	EPA CL ²	
Date Collected	3/15/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	Res.	Ind.
Depth of Sample, inches	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2		
Laboratory Number	AB17307	AB17324	AB17325	AB17323	AB17327	AB17328	AB17333	AB17330	AB17332	AB17334		
Metals												
Hexavalent Chromium	.052	.367	.489	.131	1.73	.450	.213	.252	.246	.146	2.9	56

¹ Three times the background concentration.

² EPA CL - EPA Cleanup Level (1C⁵ risk), 2010, residential and industrial use.

**TABLE 2 (CONTINUED): SURFACE SOIL SAMPLING RESULTS
BEE CEE MANUFACTURING COMPANY, DUNKLIN COUNTY, MISSOURI**

● All values listed in parts per million (mg/kg) dry weight. ● Sample results in bold and italics exceed the EPA Residential CL.
● Sample results in bold are significantly¹ above background concentrations

Sample ID	4A	4B	4C	4D	4E	4E-DUP	4F	4G	4H	5A	EPA CL ²	
Date Collected	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	Res.	Ind.
Depth of Sample, inches	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2		
Laboratory Number	AB17311	AB17320	AB17321	AB17329	AB17322	AB17317	AB17326	AB17314	AB17331	AB17310		
Metals												
Hexavalent Chromium	11.7	23.6	7.07	8.08	.271	.385	.059	.255	.309	6.51	2.9	56

¹ Three times the background concentration.

² EPA CL - EPA Regional Cleanup Level (1C⁵ risk), 2010, residential and industrial use.

**TABLE 2 (CONTINUED): SURFACE SOIL SAMPLING RESULTS
BEE CEE MANUFACTURING COMPANY, DUNKLIN COUNTY, MISSOURI**

● All values listed in parts per million (mg/kg) dry weight. ● Sample results in bold and italics exceed the EPA Residential CL.
● Sample results in bold are significantly¹ above background concentrations

Sample ID	5B	5C	5D	5E	5F	5G	6D	7C/7D	EPA CL ²	
Date Collected	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	3/16/10	Res.	Ind.
Depth of Sample, inches	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2		
Laboratory Number	AB17316	AB17308	AB17309	AB17312	AB17313	AB17315	AB17319	AB17318		
Metals										
Hexavalent Chromium	5.26	.502	.289	.230	.310	.138	.362	.157	2.9	56

¹ Three times the background concentration.

² EPA CL - EPA Regional Cleanup Level (1C⁵ risk), 2010, residential and industrial use.

**TABLE 3: CALCULATION OF SAMPLE/SAMPLE DUPLICATE
RELATIVE PERCENT DIFFERENCE (RPD)
BEE CEE MANUFACTURING SITE, DUNKLIN COUNTY, MISSOURI**

Sample results are in mg/kg. RPD is the percent difference between samples.

Sample ID	1C/1D/2C/2D	1C/1D/2C/2D-DUP	RPD
Laboratory Number	AB17324	AB17325	
Metals			
Hexavalent Chromium	0.367	0.489	28.5
Sample ID	4E	4E-DUP	RPD
Laboratory Number	AB17322	AB17317	
Metals			
Hexavalent Chromium	0.271	0.385	34.8
Sample ID	B2	B2-DUP	RPD
Laboratory Number	AB17420	AB17421	
Metals			
Hexavalent Chromium	0.196	0.204	4.0

**TABLE 4: CALCULATION OF SAMPLE/SAMPLE METHOD DUPLICATE
RELATIVE PERCENT DIFFERENCE (RPD)
BEE CEE MANUFACTURING SITE, DUNKLIN COUNTY, MISSOURI**

Sample results are in mg/kg. RPD is the percent difference between samples.

Sample ID	3E	3E-METH DUP 1	RPD
Laboratory Number	AB17333	AB17330	
Metals			
Hexavalent Chromium	0.213	0.252	16.8
Sample ID	3E	3E-METH DUP 2	RPD
Laboratory Number	AB17333	AB17332	
Metals			
Hexavalent Chromium	0.213	0.246	14.4
Sample ID	3E-METH DUP 1	3E-METH DUP 2	RPD
Laboratory Number	AB17330	AB17332	
Metals			
Hexavalent Chromium	0.252	0.246	2.4

**TABLE 5: VERTICAL BORING SOIL SAMPLING RESULTS
BEE CEE MANUFACTURING COMPANY, DUNKLIN COUNTY, MISSOURI**

● All values listed in parts per million (mg/kg) dry weight. ● Sample results in bold and italics exceed the EPA Residential CL.
● Sample results in bold are significantly¹ above background concentrations

Sample ID	B2	B2-DUP	B3	B6	B7	B8	B10	B11	B12	EPA CL ²	
Date Collected	3/23/10	3/23/10	3/23/10	3/23/10	3/23/10	3/23/10	3/23/10	3/23/10	3/23/10		
Depth of Sample, feet	2.5-3.0	2.5-3.0	2.5-3.0	2.5-3.0	2.5-3.0	2.5-3.0	2.5-3.0	2.5-3.0	2.5-3.0	Res.	Ind.
Laboratory Number	AB17420	AB17421	AB17419	AB17422	AB17423	AB17418	AB17426	AB17425	AB17424		
Metals											
Hexavalent Chromium	.196	.204	.164	.847	.827	.154	.150	.832	1.59	2.9	56

¹ Three times the background concentration.

² EPA CL - EPA Regional Cleanup Level (10⁻⁵ risk), 2010, residential and industrial use.

Attachment A

Sampling and Analysis Plan for Soils

Sampling and Analysis Plan

For Soils

Bee Cee Manufacturing

December 2009

Prepared for:

Environmental Protection Agency

Prepared by:

**Missouri Department of Natural Resources
Division of Environmental Quality
Hazardous Waste Program**

1.0 Introduction

The June 2009 Second Five-Year Review for the Bee Cee Manufacturing Company site in Malden, Missouri recommended that soil sampling be conducted at the site to determine if hexavalent chromium in soils presents a risk to human health and the environment using current risk assumptions and analytical methods. This plan details the proposed soil sampling event.

2.0 Site Information

The Bee Cee Manufacturing Company Superfund site is located within the corporate limits of the city of Malden in Dunklin County, Missouri. Bee Cee was engaged in the electroplating of aluminum storm windows and doors from 1963 until the owners filed for bankruptcy in 1983. Untreated chromium wastewater originating from the facility was occasionally discharged onto the ground surface and into an on-site percolation pit.

3.0 Previous Sampling

A Removal Action was conducted in 1992 to address chromium contaminated soils. Approximately 356 tons of soil were removed from the site and replaced with clean soil. Action levels utilized for the Removal Action included 2000 mg/kg for total chromium and 180 mg/kg for hexavalent chromium.

Soil sampling was previously conducted prior to the site Removal Action. XRF was utilized by EPA contractors to determine the horizontal and vertical extent of total chromium contamination using a grid system. Additional soil sampling was conducted as part of the site Remedial Investigation. This sampling event included collecting samples at locations previously sampled by XRF and analyzing using laboratory methods for total chromium and hexavalent chromium. Collected data included samples taken at various depths from surface to approximately 4 ½ feet. A summary of previous site-wide sampling data is included as Appendix A

4.0 Field Activities

Field activities are to include the following:

1. Approximately 42 surface soil samples are to be collected from 50-foot square sampling units across the site (see Figure 1). A composite sample will be collected from each sampling unit utilizing an aliquot from each quadrant of the sampling unit. Since previous sampling data indicated there was no direct correlation between total chromium and hexavalent chromium levels at the Bee Cee Manufacturing site, samples are to be analyzed only for hexavalent chromium.
2. Twelve soil cores are to be taken across the site. Seven of these cores are to be taken within the former removal area. The remainders are to be taken around the remainder of the site (see Figure 2). Cores will be taken to a depth of approximately five feet below

ground surface. Samples are to be collected from approximately two and a half (2 ½) feet and five (5) feet below ground surface. Samples are to be analyzed only for hexavalent chromium.

4.1 Sampling Methods

All aspects of sampling will be performed using standard operating procedures as set forth in the Bee Cee Manufacturing Company QAPP.

The site will be divided into 42 sampling units (see Figure 1). A composite sample will be collected from each sampling unit, including an aliquot from each quadrant (NW, NE, SW and SE) of each sampling unit. The sample will be thoroughly homogenized, then a sample will be collected from that mixture for hexavalent chromium. The ESP laboratory in Jefferson City will submit the collected samples to a contract lab for hexavalent chromium analysis. Sampling is to follow SOP MDNR-FSS-010 for the collection of soil samples.

In addition to surface soil sampling, subsurface sampling will also be conducted. Soil cores will be taken from ground surface to a depth of approximately five feet below ground surface at twelve locations using direct push technology, seven within the area where soils were previously removed and replaced with clean fill, and five from outside the removal area (see Figure 2). Samples will be taken from a depth of approximately two and a half (2 ½) feet and five (5) feet below ground surface. To obtain adequate sample volume, it is anticipated that the 2 ½ foot sample will be collected from a depth range of approximately 2.25 feet to 2.75 feet. It is anticipated that the 5 foot sample will be collected from a depth range of approximately 4.5 feet to 5 feet. In the event staining is evident in a soil core, samples will be taken from the stained area if within a foot of the proposed sampling depth. Otherwise, an additional sample will be collected from the stained area. Samples will be analyzed for hexavalent chromium.

4.1.1 Boring Abandonment

Borings from which cores have been extracted shall be abandoned per 10 CSR 23-4.080(5). Each boring shall be filled to ground surface by slowly filling with approved bentonite grout. There is no reporting requirement for the abandonment of these holes.

4.2 Sample Quantity

Figure 1 shows the approximate location of surface soil sampling units. A composite sample will be collected from each of 42 sampling units, including an aliquot from each quadrant (NW, NE, SW and SE) of each sampling units. Adequate sample will be taken to allow for collection of a laboratory sample for hexavalent chromium and a duplicate from each sampling unit (at least 16 ounces). It is anticipated that about 47 laboratory samples will be collected (42 samples and 5 duplicates).

Subsurface sampling will include collecting 12 cores using a direct push rig from locations depicted in Figure 2. Table 1 provides X and Y distances in feet from the northeast corner of the concrete foundation of the former Bee Cee Manufacturing building. Soil cores will be taken from ground surface to a depth of approximately five feet below ground surface. Discrete samples will be taken at approximately two (2 ½) feet and five (5) feet below ground surface as detailed in Section 4.1. Approximately 8 ounces of soil will be collected from each sampling location. Locations that include a sample duplicate will require that 16 ounces of sample are collected. It is anticipated that approximately 27 laboratory samples will be collected (24 samples and 3 sample duplicates).

4.3 Analyses Requested

All laboratory samples will be analyzed by an MDNR, Environmental Services Program (ESP) contract laboratory. The table below shows analyses requested.

Matrix	Parameter Test	Method	# of samples requested	# of duplicates requested
Surface Soil Sampling				
Soil	Hexavalent Chromium	EPA Method SW 846-7199	42	5

Matrix	Parameter Test	Method	# of samples requested	# of duplicates requested
Vertical Core Sampling				
Soil	Hexavalent Chromium	EPA Method SW 846-7199	24	3
Soil*	Total Metals (Chromium)	SW 846 6010B/ICP	1	1
Soil*	TCLP Metals	SW 846 6010B/ICP Test Method 1311	1	1

* See section 6.1 for additional information about these samples.

4.4 Sample Container and Preservation Requirements

Refer to the following table for container and preservation requirements on all samples analyzed by the ESP contract laboratory.

Parameters	Matrix	Container(s)/Volume	Preservative	Holding Time
Hexavalent Chromium	S	8 oz glass jar	<4° C	28 days
Total Metals (Chromium)*	S	8 oz glass jar	<4° C	6 months
TCLP Metals (Chromium)*	S	8 oz glass jar (2)	<4° C	6 months

* See section 6.1 for additional information about these samples.

4.5 Chain-of-Custody

All samples to be analyzed by the ESP contract lab will be entered onto a chain-of-custody form indicating the description, location, date and time of collection, and analytes requested. Samples will be preserved as indicted in section 4.4. Custody of the samples will be retained until relinquished to the laboratory.

5.0 Data Quality

To help ensure precise, accurate, representative, complete and comparable data are obtained, all field work and analyses will be conducted in accordance with the Quality Assurance Project Plan for the Bee Cee Manufacturing Site.

5.1 Field Methods

Clean disposable nitrile gloves will be worn by sampling personnel and clean or field decontaminated equipment will be utilized for each separate sample collected to minimize the possibility of cross contamination.

Field personnel shall note all observations, sample locations, descriptions, and methods in a bound field logbook.

5.2 Field Decontamination

New or cleaned sampling spoons will be used for each soil sample collected. Cleaning will involve wiping the spoon clean with a dry paper towel and washing any remaining soil residue from the spoons by spraying with analconox soap solution, then rinsing with deionized water. Spoons will be thoroughly dried before use. Only clean sampling containers will be utilized to collect soil samples.

5.3 Quality Assurance/Quality Control (QA/QC) Samples

A minimum of 10% of samples collected for laboratory analysis will include collection of a duplicate sample.

6.0 Investigation Derived Wastes (IDW) Plan

Efforts will be made to minimize IDW generation. IDW may include soil and disposable personal protective equipment (PPE).

Field personnel will attempt to return unused surface soil to its immediate source after generation, or, if warranted, containerize and return to the ESP lab for proper disposal. Disposable PPE will be handled as solid waste, containerized, and properly disposed.

6.1 Core Disposal

Cores shall be containerized and a composite sample (and duplicate) collected and analyzed using the Toxic Characteristic Leaching Procedure (TCLP) method for chromium. If the sample passes TCLP (chromium less than 5 ppm) the cores shall be returned to the ESP lab for proper disposal. If the sample fails TCLP (chromium equal to or greater than 5 ppm) the cores shall be disposed of by a licensed contractor as hazardous waste.

7.0 Site Safety

All field personnel will have reviewed and will sign the site Health and Safety Plan prior to conducting field activities.

8.0 Reporting

Laboratory analytical results will be generated by the ESP contract laboratory and presented in a brief report to the attention of Evan Kifer at the Missouri Department of Natural Resources, Hazardous Waste Program, Superfund Section, P.O. Box 176, Jefferson City, MO 65102.

Figures

Bee Cee Manufacturing

Dunklin County, Missouri

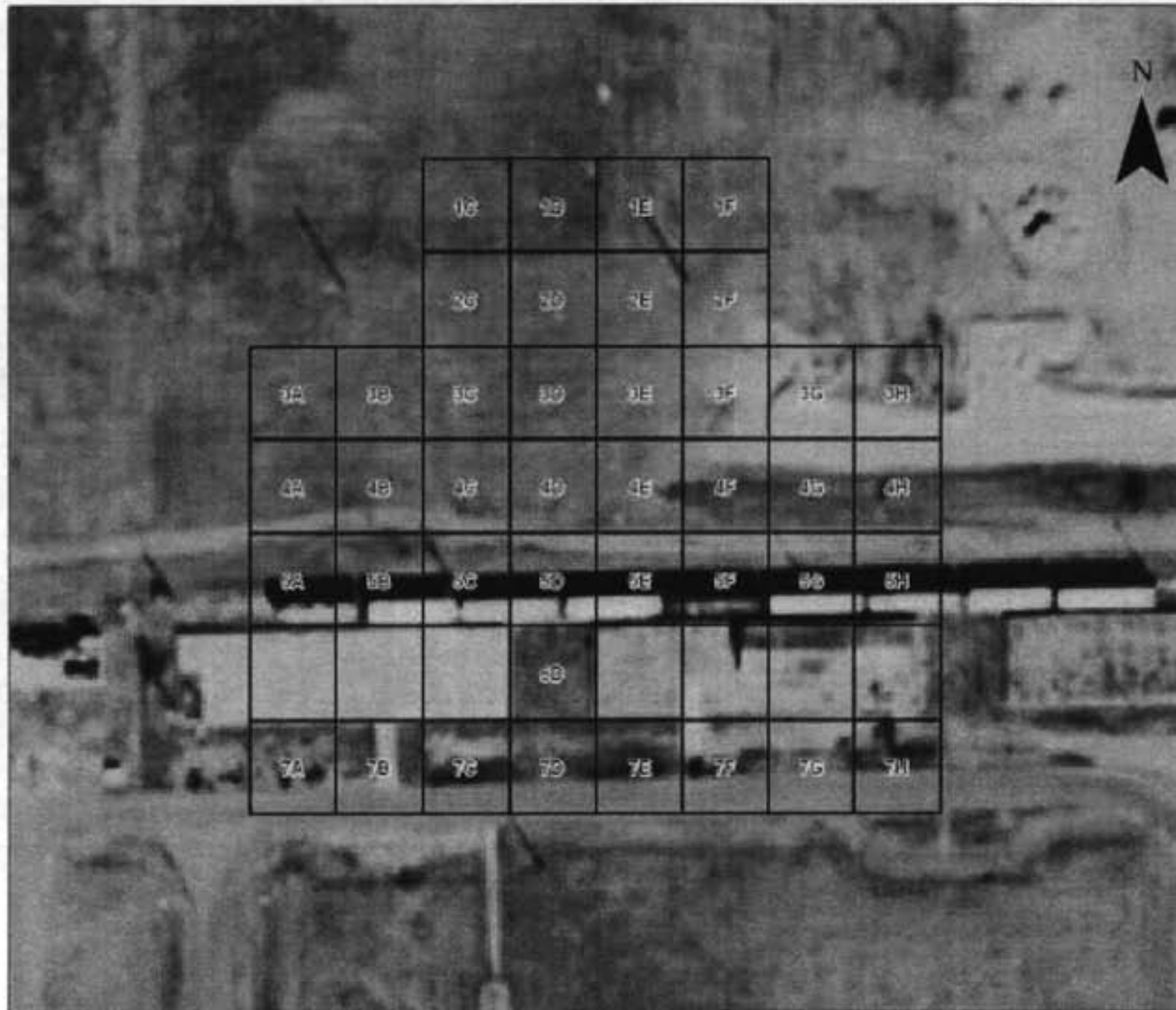



Figure 1
Proposed Surface Soil Sampling Units

Quality Assurance Project Plan
Addendum for Soil Sampling at
Bee Cee Manufacturing
Harper Drive, Malden Industrial Park
Dunklin County, Missouri

Legend

 Sampling Unit for Composite Surface Soil Sample

Site Location



Created on: November 25, 2009 by Steve Vance
The map is located at M:\Superfund\Bee Cee
Report_BeeCee_Soil_Samples.mxd

Base Map: 2000 Digital Orthophoto Quarter-Quadrangle (DOQQ)

All graphics used to create this map have been compiled by the Missouri Department of Natural Resources, or its agents, or are derived from data compiled or made by the department or its agents. The user of this product shall not attribute any results, errors, or responsibility to the Missouri Department of Natural Resources or its agents.

Bee Cee Manufacturing

Dunklin County, Missouri

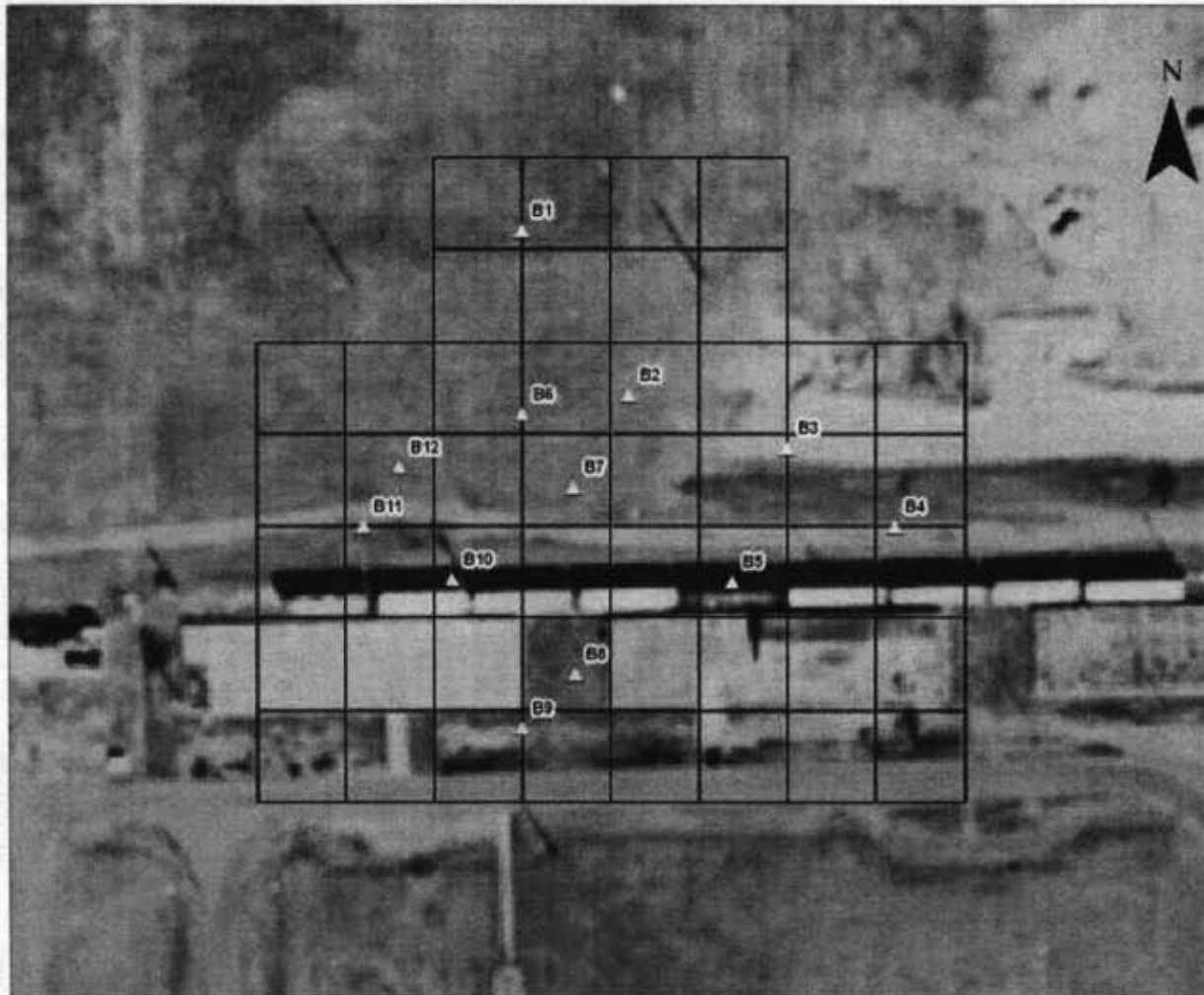




Figure 2
Proposed Vertical Soil Boring Locations

Quality Assurance Project Plan
Addendum for Soil Sampling at
Bee Cee Manufacturing
Harper Drive, Malden Industrial Park
Dunklin County, Missouri

Legend

-  Vertical Boring Locations
-  Sampling Unit for Composite Surface Soil Sample

Site Location



Created on: November 25, 2009 by Steve Vance
File name: H:\Support\Bee Cee
Figure2_BeeCee_Soil_Samples.mxd

Scale: 1:2000 Digital Orthophoto Quarter-Quadrangle (DOQQ)

Although data are used to create this map, the user is responsible for the accuracy, completeness, and reliability of the data and related information. The user of this data shall not attribute any responsibility, and no responsibility is assumed by the Department in the use of these data in related activities.

Tables

Table 1: Soil Core Locations. Location is relative to the northeast corner of the concrete slab of the former Bee Cee Manufacturing building.

Boring ID	X (feet)	X Dir (E/W)	Y (feet)	Y Dir (N/S)
B-1	0	N/A	210	N
B-2	60	E	120	N
B-3	150	E	90	N
B-4	210	E	50	N
B-5	120	E	20	N
B-6	0	N/A	110	N
B-7	30	E	70	N
B-8	30	E	30	S
B-9	0	N/A	60	S
B-10	40	W	20	N
B-11	90	W	50	N
B-12	70	W	80	N

Appendix A
Past Soil Sampling Data

**Soil Sampling Data Reported in the
Bee Cee Manufacturing Remedial Investigation Report**

TABLE 4-1
SvE, MDNR and EPA
SOIL RESULTS
(mg/kg)

	SvE/SWL Hexavalent Chromium	SvE/SWL Total Chromium	MDNR Total Chromium	EPA XRF Total Chromium
SS-1	0.01UJ	450		1,003
SS-2	0.012J	11,500		8,360
SS-3	0.025J	27,500		10,700
SS-4	0.015J	7,280		4,760
SS-5	0.01UJ	10.0		286
SS-6	0.01UJ	25.0		BDL
SS-7	0.01UJ	68.7	15	366
SS-8	0.01UJ	20.7		BDL
SS-9	0.01UJ	13.9	11	550
SS-10	0.014J	313	220	480
SS-11	0.014J	304		760
SS-12	0.01UJ	8.40		2,796
SS-13	0.011J	4,740		BDL
SS-14	0.019J	226		543
SS-15	0.53J	28.3		536
SS-16	0.01UJ	13.0		433
SS-17	0.030J	384		556
SS-18	0.011J	20.7		280
SS-19	0.033J	369		280
SS-20	0.050J	27.6		280
SS-21*		13.2	6	
SS-22	0.01U	8.20		
SS-23	0.01U	11.3		
SS-24	0.01U	14.6		280
SS-25	0.01U	7.10		280

TABLE 4-1 (Continued)

**SvE, MDNR and EPA
SOIL RESULTS
mg/l or ppm**

	SvE/SWL Hexavalent Chromium	SvE/SWL Total Chromium	MDNR Total Chromium	EPA XRF Total Chromium
SS-26	0.013	57.1		280
SS-27	0.01U	26.3		280
SS-28	0.01U	13.3		280
SS-29	0.031	160		276
SS-30	0.01U	25.4		BDL
SS-31	0.011	98.1		BDL
SS-32	0.01U	23.7		
SS-33	0.018	2,760		3,663
SS-34	0.01U	396		BDL
SS-35	0.026	718		520
SS-38	0.01U	502		
SS-39	0.01U	368		
SS-40	0.01U	77.1		
SS-41	0.01U	81.8		
SS-42	0.01U	922		

- ND = None Detected (Detection limit hexavalent chromium was 0.01 U)
- BDL = Below detection limit of 200 ppm on XRF
- * = Spike sample by MDNR
- SvE/SWL = Sverdrup Environmental/Southwest Laboratories
- MDNR = Missouri Department of Natural Resources
- EPA = Environmental Protection Agency
- XRF = X-Ray Fluorescence Spectrometer

**TABLE 4-2
SOIL SAMPLE DEPTHS AND CHROMIUM CONCENTRATIONS**

SOIL SAMPLE 0-3" DEPTHS AND CHROMIUM CONCENTRATIONS

Soil Sample	Hexavalent Chromium Concentration (mg/l)	Total Chromium Concentration (mg/kg)
SS-1	0.01 UJ	450
SS-2	0.012 J	11,500
SS-3	0.025 J	27,500
SS-4	0.015 J	7,280
SS-5	0.01 UJ	10.0
SS-13	0.011 J	4,740
SS-19*	0.033 J	369
SS-22	0.01 U	8.20
SS-23	0.01 U	11.3
SS-24	0.01 U	14.6
SS-27	0.01 U	26.3
SS-33	0.018	2,760
SS-34	0.01 U	396
SS-35	0.026	718

SOIL SAMPLE 3-6" DEPTH AND CHROMIUM CONCENTRATIONS

Soil Sample	Hexavalent Chromium Concentration (mg/l)	Total Chromium Concentration (mg/kg)
SS-10	0.014 J	313
SS-14***	0.019 J	226

U = Undetected

J = Estimated

* = Samples taken at same locations, but different depths

** = Samples taken at same locations, but different depths

*** = Samples taken at same locations, but different depths

TABLE 4-2 (Continued)

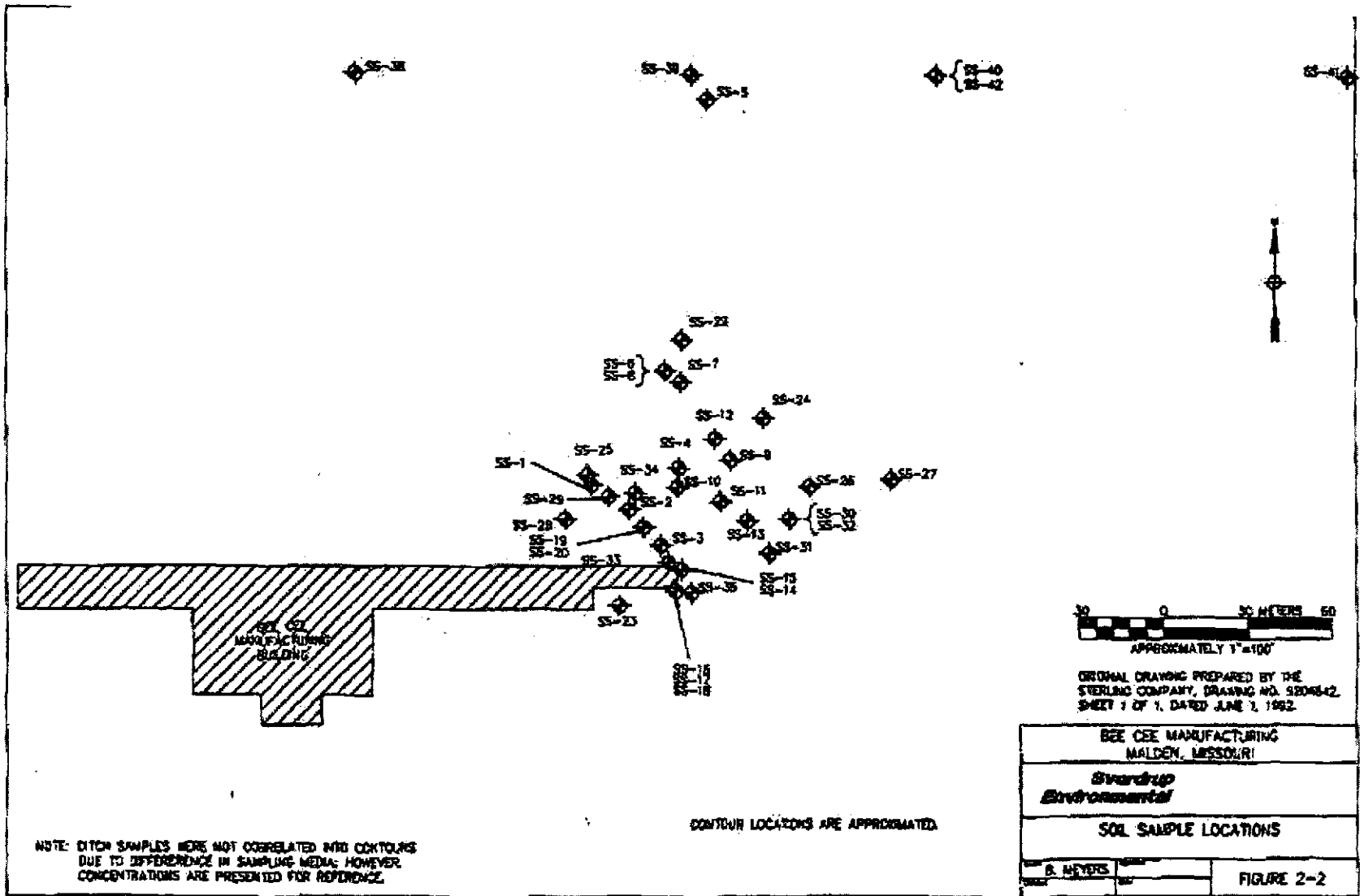
SOIL SAMPLE 6-18" DEPTH AND CHROMIUM CONCENTRATIONS

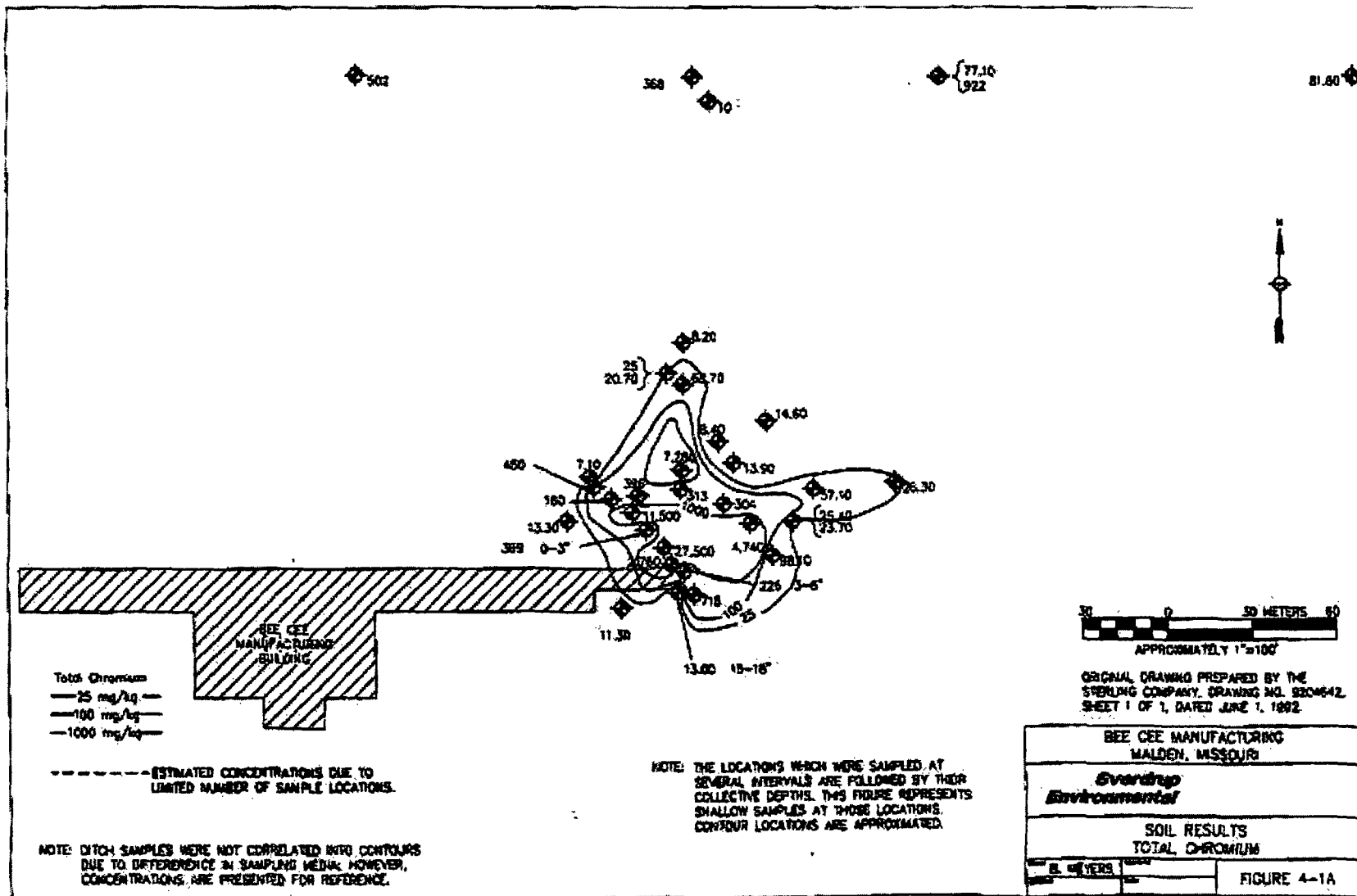
Soil Sample No. (Depth)	Hexavalent Chromium Concentration (mg/l)	Total Chromium Concentration (mg/kg)
SS-6 (6-18")	0.01 UJ	25.0
SS-8 (6-18")	0.01 UJ	20.7
SS-9 (12-18")	0.01 UJ	13.9
SS-11 (8-12")	0.014 J	304
SS-12 (9-12")	0.01 UJ	8.40
SS-16 (15-18")**	0.01 UJ	13.0
SS-18 (15-18")**	0.011 J	20.7
SS-20 (15-18")*	0.050 J	27.6
SS-21	SPIKE SAMPLE FROM MDNR	
SS-25 (9-12")	0.01 U	26.3
SS-26 (12-18")	0.013	57.1
SS-28 (12-18")	0.01 U	13.3
SS-31 (6-9")	0.011	98.1

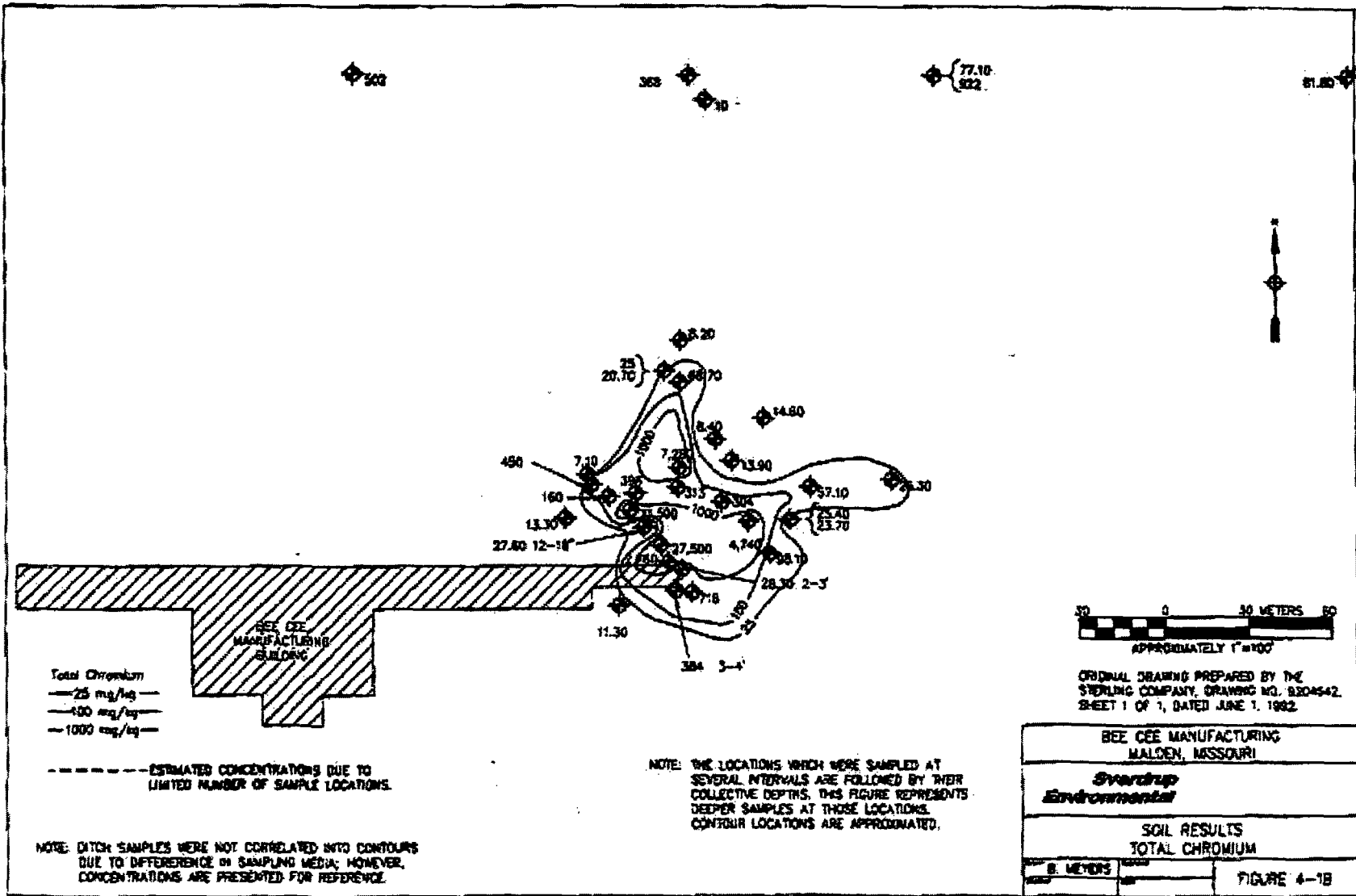
SOIL SAMPLE 1.5-4.5' DEPTH AND CHROMIUM CONCENTRATIONS

Soil Sample No. (Depth)	Hexavalent Chromium Concentration (mg/l)	Total Chromium Concentration (mg/kg)
SS-7 (4-4.5')	0.01 UJ	68.7
SS-15 (2-3')***	0.53 J	28.3
SS-17 (3-4')**	0.030 J	384
SS-29 (1.5-2')	0.031	160
SS-30 (3-4')	0.01 U	25.4
SS-32 (3-4')	0.01 U	23.7

- U = Undetected
- J = Estimated
- * = Samples taken at same locations, but different depths
- ** = Samples taken at same locations, but different depths
- *** = Samples taken at same locations, but different depths







Total Chromium
 — 25 mg/kg —
 — 100 mg/kg —
 — 1000 mg/kg —

----- ESTIMATED CONCENTRATIONS DUE TO LIMITED NUMBER OF SAMPLE LOCATIONS.

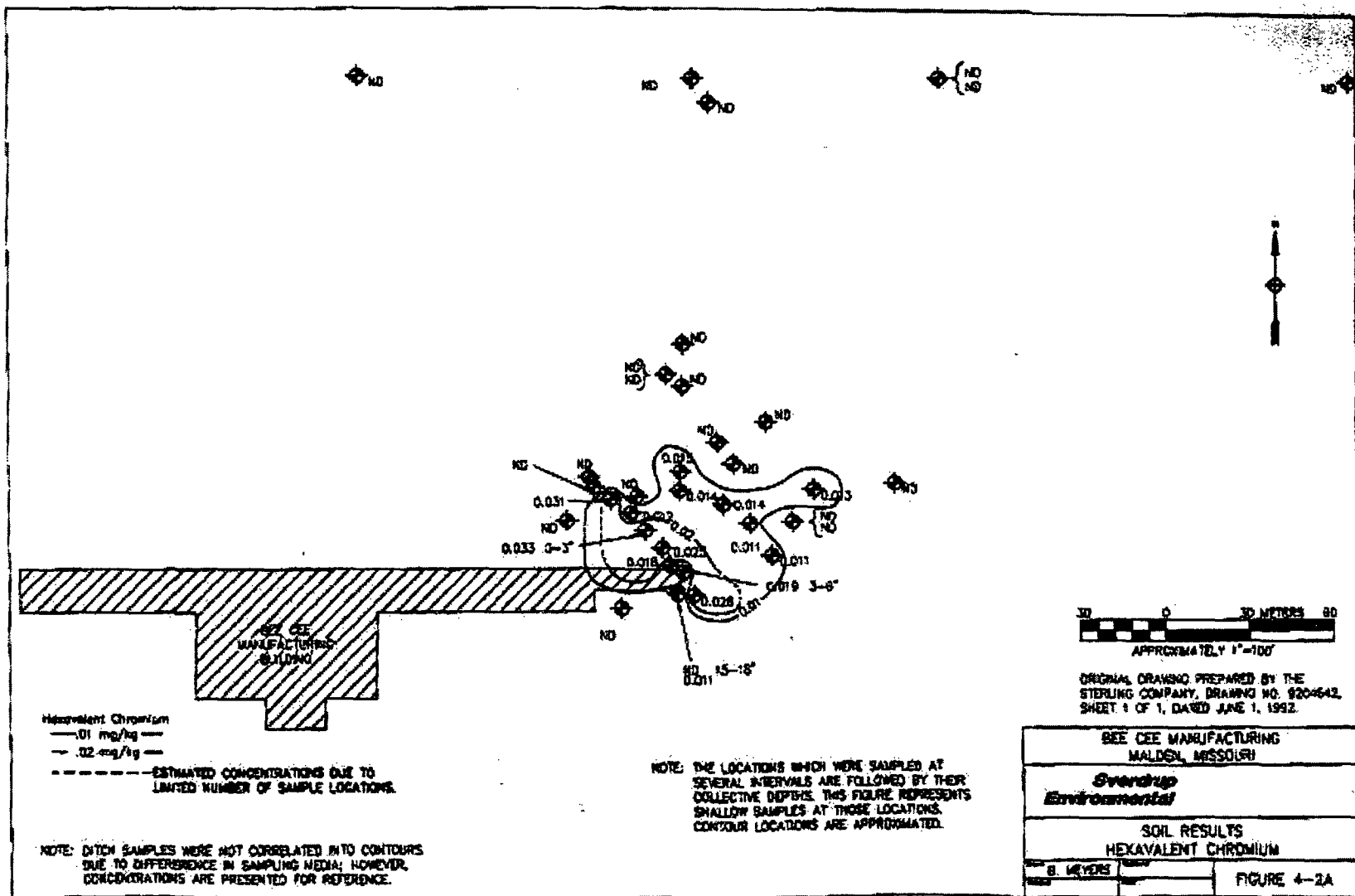
NOTE: DITCH SAMPLES WERE NOT CORRELATED INTO CONTOURS DUE TO DIFFERENCE IN SAMPLING MEDIA; HOWEVER, CONCENTRATIONS ARE PRESENTED FOR REFERENCE.

NOTE: THE LOCATIONS WHICH WERE SAMPLED AT SEVERAL INTERVALS ARE FOLLOWED BY THEIR COLLECTIVE DEPTHS. THIS FIGURE REPRESENTS DEEPER SAMPLES AT THOSE LOCATIONS. CONTOUR LOCATIONS ARE APPROXIMATED.



ORIGINAL DRAWING PREPARED BY THE STERLING COMPANY, DRAWING NO. S204542, SHEET 1 OF 1, DATED JUNE 1, 1982.

BEE CEE MANUFACTURING MALDEN, MASSACHUSETTS	
<i>Sverdrup</i> Environmental	
SOIL RESULTS TOTAL CHROMIUM	
8 METERS	FIGURE 4-1B



Hexavalent Chromium
 — 01 mg/kg —
 — 02 mg/kg —
 - - - ESTIMATED CONCENTRATIONS DUE TO LIMITED NUMBER OF SAMPLE LOCATIONS.

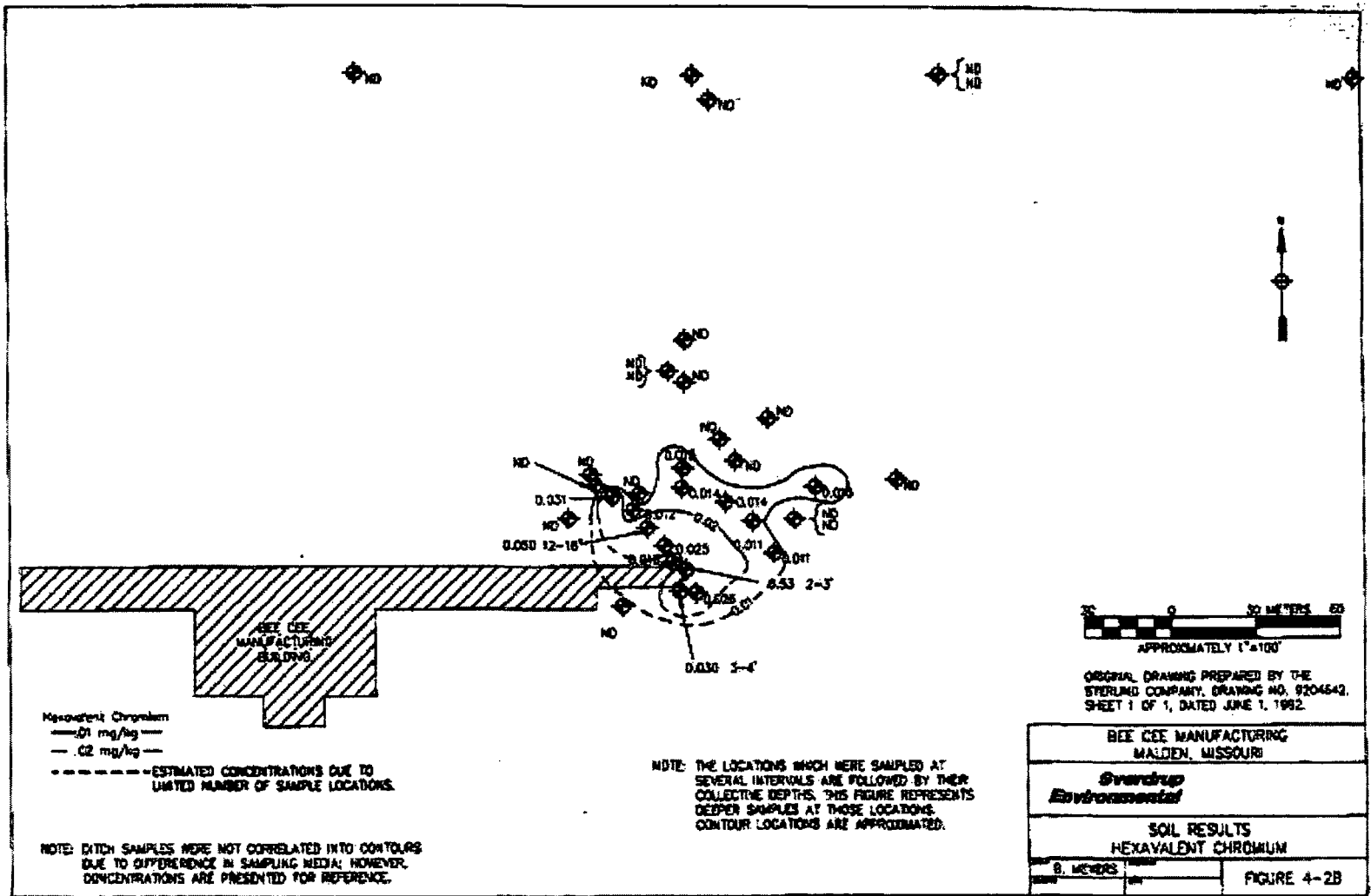
NOTE: DITCH SAMPLES WERE NOT CORRELATED INTO CONTOURS DUE TO DIFFERENCE IN SAMPLING MEDIA; HOWEVER, CONCENTRATIONS ARE PRESENTED FOR REFERENCE.

NOTE: THE LOCATIONS WHICH WERE SAMPLED AT SEVERAL INTERVALS ARE FOLLOWED BY THEIR COLLECTIVE DEPTHS. THIS FIGURE REPRESENTS SHALLOW SAMPLES AT THOSE LOCATIONS. CONTOUR LOCATIONS ARE APPROXIMATED.



ORIGINAL DRAWING PREPARED BY THE STERLING COMPANY, DRAWING NO. 9204642, SHEET 1 OF 1, DATED JUNE 1, 1992.

BEE CEE MANUFACTURING MALDEN, MISSOURI	
<i>Sverdrup</i> Environmental	
SOIL RESULTS HEXAVALENT CHROMIUM	
B. MEYERS	FIGURE 4-2A



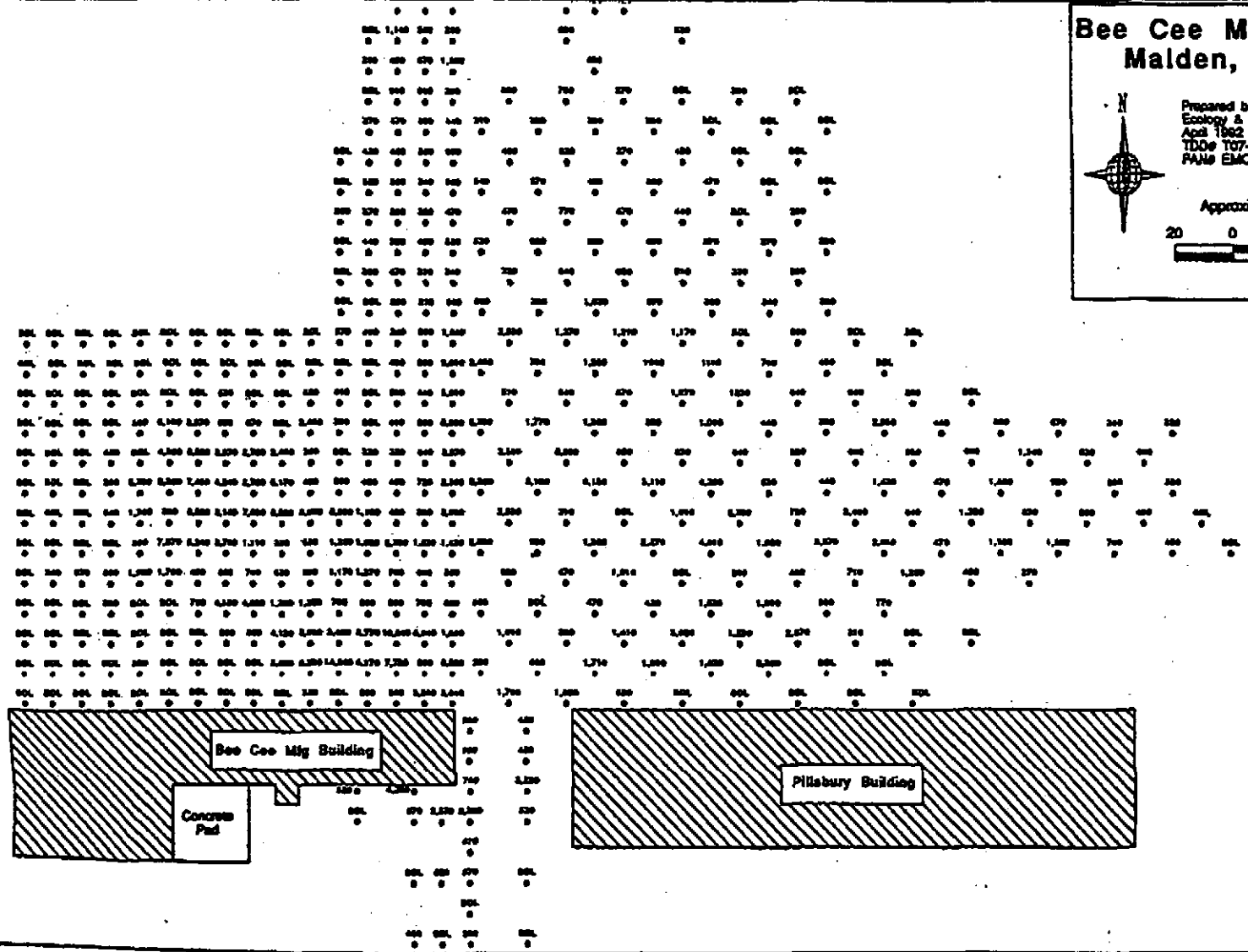
**Soil Sampling Data Reported in the
Bee Cee Manufacturing Final Removal Report**

Bee Cee Manufacturing Malden, Missouri



Prepared by Randy Schadmann
Ecology & Environment, Inc./TAT
April 1982
TDO# 107-9201-011
FAN# EM003405AA

Approximate Scale in Feet
20 0 20 40 60



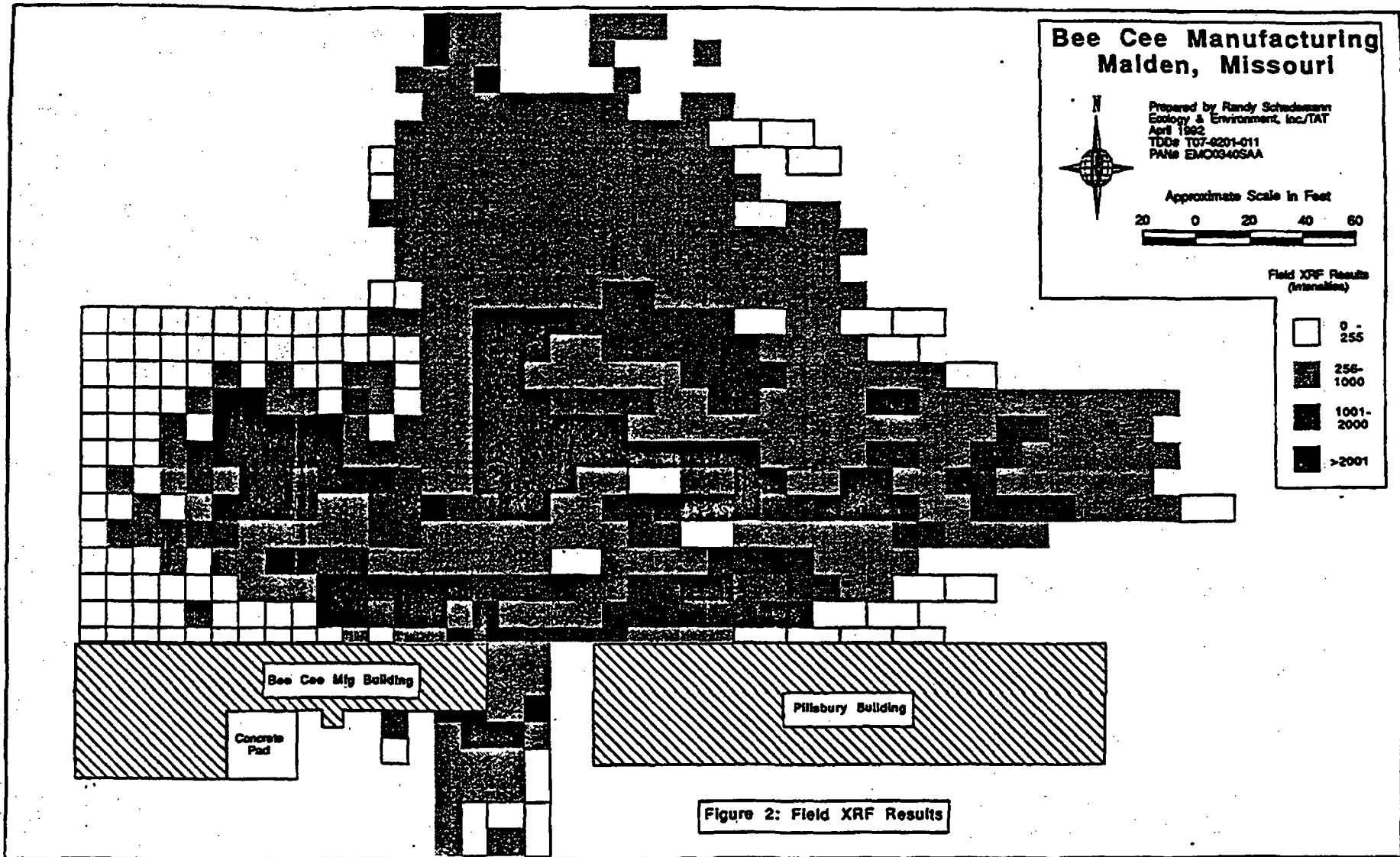


FIGURE 3:
Approximate Boundaries
of the Areas of Excavation

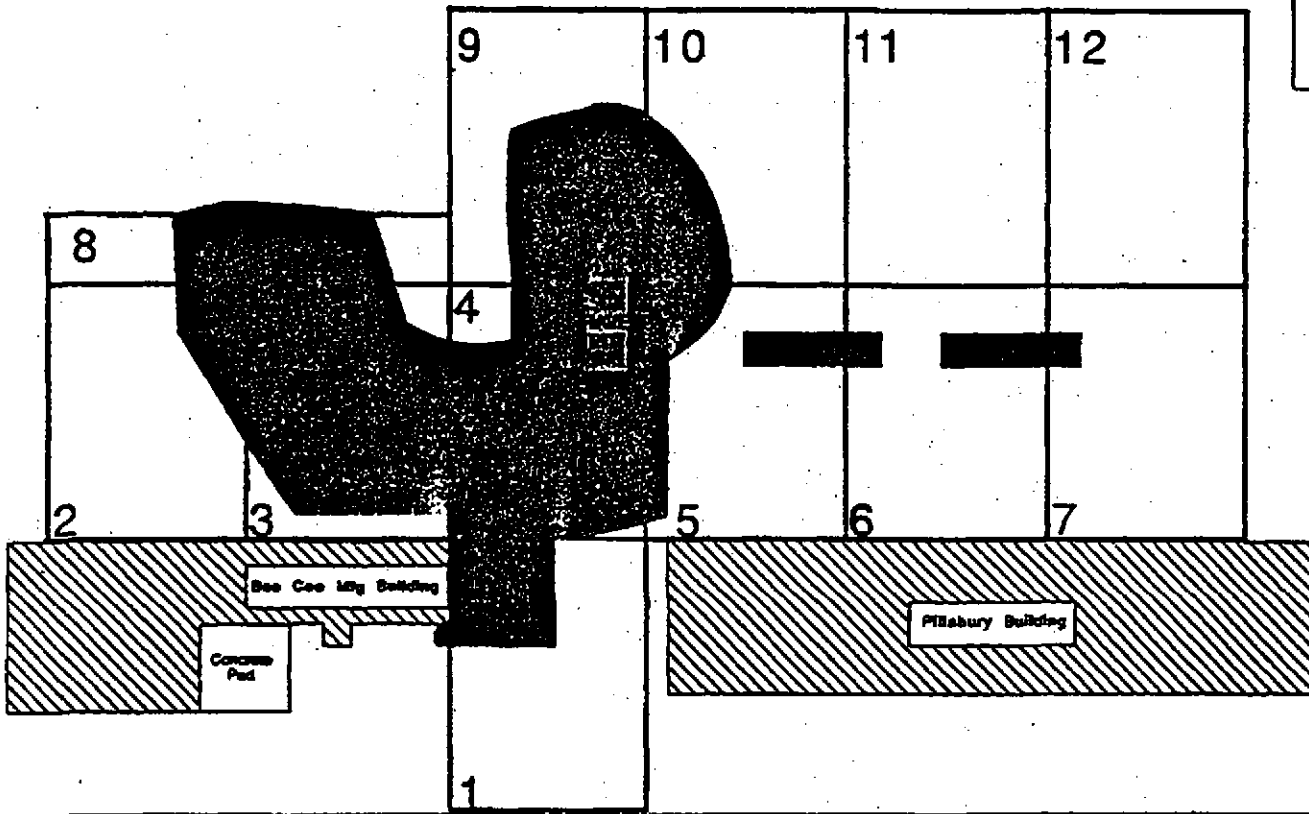
13

**Bee Cee Manufacturing
Malden, Missouri**



Ecology & Environment, Inc./OCT
August 1992
TDD# T07-6257-031
PAGE EMC0340FAA

Approximate Scale in Feet



Attachment B

Field Notes

MARCH 15, 2010
BEE CEE MANUFACTURING
SOIL SAMPLING

Kifer
ARRIVED AT LOCATION OF BACKGROUND
SAMPLE ~ 10:00 Collected 4 aliquots
in city park - 10 mile from site.

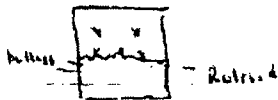
Drive to site. Placed 8 flags for
vertical borings. Left site ~ 1:15:00

Background
Sample # 1003381

MARCH 16, 2010
BEE CEE SOIL SAMPLING

Kifer
ARRIVED on site ~ 7:45. Began to
place flags for sampling when Dan Grovett,
EPA arrived on site. Flags were placed
at the center of each sampling unit. Where
areas larger than 50' x 50' were used as sampling
units, a flag was placed in center of each 50'
x 50' area.

Row 5 samples - railroad + ballast took
up southern 1/2 of sampling unit. Sampled
each as follows.



5A: Time 9:03 Sample #
Date Collected: 3-16-10 1003389
Collector: EK

5B: Time: 9:15 Sample #
Date: 3-16-10 1003390
Collector: EK

5C: Time: 9:35 Sample #
Date: 3-16-10 1003382
Collector: EK

5D: Time: 9:45 Sample #
Date: 3-16-10 1003383
Collector: EK

5E: Time: 10:15 Sample #
Date: 3-16-10 1003386
Collector: EK

5F: Time: 10:28 Sample #
Date: 3-16-10 1003387
Collector: EK

5G: Time: 10:55 Sample #
Date: 3-16-10 1003384
Collector: EK

4A. Time: 9:10 Sample #
Date: 3-16-10 1003385
Collector: DG

4B: Time: 9:20 Sample #
Date: 3-16-10 1003394
Collector: DG

4C: Time: 9:40 Sample #
Date: 3-16-10 1003395
Collector: DG

4D: Time: 9:55 Sample #
Date: 3-16-10 1003405
Collector: DG

4E: Time: 10:10 Sample #
Date: 3-16-10 1003396
Collector: DG

4E Dup: Time: 10:10 Sample #
Date: 3-16-10 1003391
Collector: DG

4F: Time: 10:25 Sample #
Date: 3-16-10 1003400
Collector: DG
Note: sample d. ff matl -
may not be native.

4G: Time: 10:55 Sample #
Date: 3-16-10 1003398
Collector: DG

Note: North 1/2 of sampling unit paved. Sample taken with 4 aliquots across southern half of unit. Also done for SU 4H

4H: Time: 11:10 Sample #
Date: 3-16-10 1003407
Collector: DG.

3C: Time: 11:30 Sample #
Date: 3-16-10 1003403
Collector: DG

3D: Time: 11:38 Sample #
Date: 3-16-10 1003404
Collector: DG

3E: Time: 11:45 Sample #
Date: 3-16-10 1003409
Collector: DG

3E Meth Dup 1: Time: 11:52
Date: 3-16-10 Sample #
Collector: DG 1003406

3E Meth Dup 2 : Time: 12:00
Date: 3-16-10 Sample #
Collector: DG 1003408

3F Time: 12:10 Sample #
Date: 3-16-10 1003410
Collector: DG

1C/1D/2C/2D: Time: 1330 Sample #
Date: 3-16-10 1003398
Collector: DG

1C/1D/2C/2D Dup - Time 13:30 Sample #
Date: 3-16-10 1003399
Collector: DG

1E/1F/2E/2F: Time: 14:00 Sample #
Date: 3-16-10 1003397
Collector: DG

6D: Time: 14:40 Sample #
Date: 3-16-10 1003393
Collector: DG

7C/7D: Time: 14:50 Sample #
Date: 3-16-10 1003392
Collector: DG

Note: Took aliquots for 7C/7D in
NE + NW quadrants of 7C and
NE + NW quadrants of 7D. Sampling
units were cut off in the middle by
the road. Mat 1 was more loose than
soil from most of the site.

Don Gravatt left the site ~ 15:40
Kifer left site ~ 16:00.

March 17 2010

Bee Cee Manufacturing Soil Sampling

Kifer sieved + bottled 27 samples
for analysis of hexavalent chromium.
Kifer stopped by Malden Library to ensure
the public record was current. Kifer
stopped by site + took several photos
Also: GPS + well location.

MW-1 4055183.03 m N
File bc-mw1 770134.53 m E

MW-2 4055300.70 m N
File bc-mw2 770508.08 m E

MW-3 + MW-4 4055152.79 m N
File bc-mw344 770225.39 m E

MW-5
bc-mw
4055120.71 m N
770302.29 m E

MW-6
bc-mw
4055092.24 m N
770328.74 m E

MW-7
bc-mw
4055072.95 m N
770347.38 m E

MW-8
bc-mw
4055066.44 m N
770353.67 m E

MW-9
bc-mw
4055060.45 m N
770359.61 m E

MW-100
bc-mw
4055044.93 m N
770355.27 m E

MARCH 23, 2010
BEE CEE

Arrived at site ~ 9:00

Core contains water logging in place
B8 - 5' core compressed to 3'6"
~9:40 Top 6" organic mat'l
Remainder fine-grained sand - ^{yellow-} brown
in color.

Took sample from middle of core

B3 - Compressed to 3'3"
Top 6" Dark asphaltic mat'l w/
~9:50 Top 2-3" ^{gray} rock - light yellow brown in color
Remainder - fine-grained yellow-brown sand
Took sample from middle of core.

~9:54 B2 - Compressed to 3'6"
Top 4" organic mat'l. Relatively
light organic color
Also
D. & O. mix
of 2 samples
Remainder fine sand
At approx 1'10" sand gets finer for 8". Then
gets coarser to bottom. "Core" is just
slightly more

C-2 - Extra core generated in error
Compressed to ~ 3'4"
Organic mat'l top 6" graded into
fine sand - yellow brown in color

③ B6 3' 2" compressed from 5'
Top 6" light brown organic
matl / soil.

About center of core sed grades
from fine sand to silty clay.
Then grades back to fine sand
yellow-brown color.

Sample was from finer silty clay
matl. Apparent to be harder.

④ B7 3' 5" compressed from 5'
Soil at top ~ 4"
Fine-grained sand to TD
Top portion of sandy soil brownish
cl. Grades to yellow-brown sand
at bottom.

⑤ B12 2' 8" compressed from 5'
Top 6" yellow-brown soil
Fine-grained sand to TD yellow-brown
Minimal organic matl. Sampling zone
- fine - sand.

⑥ B-11
~ 10:50

⑦ B10
~ 11:00

2' 5" compressed from 5'
Top 4" soil. Some dark black staining
mostly organic matl. Rest of core is fine-
grained sand. Nest 7" soil gray-yellow-brown.
Rest of core fine-grained sand yellow-brown.

3' 6" compressed from 5'
Soil 0-6". Yellow brown, fine
clayey sand.
Yellow brown color to TD
10" to 1' 5" finer clay zone
with sand below table.
In clay zone had darker black
streaks.

Sample taken just above clay
zone.

Groundwater sampling

MW-3

Sample collected ~ 11:25

WATER - 20 NTU, had slight chlorination (red)

Filtered sample clear

Use peristaltic pump until parameter stabilized
before collecting sample.

MW-4 - initially swt color
 Used peristaltic pump. water cleared
 before sample taken

Sample taken ~ 11:40

MW-5 - water clear upon start of
 purging. Used peristaltic pump
 Sample taken ~ 12:08

MW-6 - water clear upon start of purging.
 Used peristaltic pump.

Packed up equipment and left site ~
 12:40

EK

EK

Attachment C

Laboratory Data

April 15, 2010

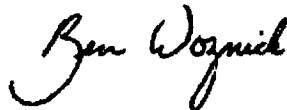
Ron Heckman
Missouri Department of Natural Resources
2710 W. Main St.
Jefferson City, MO 65109
(573) 522-9902

Dear Mr. Heckman,

Attached is the report associated with sixty-six (66) soil samples submitted for hexavalent chromium quantitation on March 29, 2010. The samples were received on March 30, 2010 in sealed coolers at 4.0°C, -0.2°C, and -0.4°C. The submitted samples were extracted using EPA Method 3060A and then analyzed for hexavalent chromium via ion chromatography inductively coupled plasma dynamic reaction cell mass spectrometry (IC-ICP-DRC-MS). Any analytical issues associated with the analysis are addressed in the following report.

If you have any questions, please feel free to contact me at your convenience.

Sincerely,



Ben Wozniak
Project Manager
Applied Speciation and Consulting, LLC

Applied Speciation and Consulting, LLC

Report Prepared for:

Ron Heckman
Missouri Department of Natural Resources
2710 W. Main St.
Jefferson City, MO 65109

April 15, 2010

1. Sample Reception

Sixty-six (66) soil samples were submitted in polypropylene jars (provided by Applied Speciation and Consulting) for hexavalent chromium quantitation on March 29, 2010. The samples were received in acceptable condition on March 30, 2010 in sealed coolers at 4.0°C, -0.2°C, and -0.4°C, respectively. All applied custody seals were intact upon receipt and no signs of tampering were evident.

All samples were received in a laminar flow clean hood void of trace metals contamination and ultra-violet radiation. Upon reception, all samples were designated discrete sample identifiers. It was noted upon receipt that the jar containing the sample identified as AB17322 was punctured, so this sample was transferred into a new polypropylene jar. All samples were then stored in a secure, monitored refrigerator (maintained at a temperature of $\leq 4^{\circ}\text{C}$) until all preparatory and analytical procedures could be performed.

2. Sample Preparation

All sample preparation is performed in laminar flow clean hoods known to be free from trace metals contamination. All applied water for dilutions and sample preservatives are monitored for contamination to account for any biases associated with the sample results.

Hexavalent Chromium Quantification by IC-ICP-DRC-MS Prior to analysis, all samples were extracted using EPA Method 3060A. The batches designated C1 and C2 were extracted on March 31st, whereas those designated C3 and C4 were extracted on April 7th. In summary, each sample was first spread into a thin layer on a clean surface and a known mass of each sample was then weighed into a polypropylene centrifuge tube by taking approximately fifteen random subsamples of the original sample. A buffered alkaline extraction solution, MgCl_2 , and a phosphate buffer solution were then applied to each sample. All vials were then heated at 90-95°C in a sonicating bath for a minimum of one (1) hour. The resulting extracts were cooled, filtered, and injected directly into sealed autosampler vials prior to analysis for hexavalent chromium.

3. Sample Analysis

All sample analysis is preceded by a minimum of a five-point calibration curve spanning the entire concentration range of interest. Calibration curves are performed at the beginning of each analytical day. All calibration curves, associated with each species of interest, are standardized by linear regression resulting in a response factor. All sample results are **instrument blank corrected** to account for any operational biases associated with the analytical platform. All sample results have also been **dry-weight corrected** using the measured total solids (percent moisture) values.

Prior to sample analysis, all calibration curves are verified using second source standards which are identified as initial calibration verification standards (ICV).

Ongoing instrument performance is identified by the analysis of continuing calibration verification standards (CCV) and continuing calibration blanks (CCB) at a minimal interval of every ten analytical runs.

Hexavalent Chromium Quantitation by IC-ICP-DRC-MS All sample extracts for hexavalent chromium quantitation were analyzed via a modified version of EPA Method 7199 employing ion chromatography inductively coupled plasma dynamic reaction cell mass spectrometry (IC-ICP-DRC-MS). Aliquots of each sample are injected onto an anion exchange column and mobilized by an alkaline (pH > 7) gradient. The eluting chromium species are then introduced into a radio frequency (RF) plasma where energy-transfer processes cause desolvation, atomization, and ionization. The ions are extracted from the plasma through a differentially-pumped vacuum interface and travel through a pressurized chamber (DRC) containing a specific reactive gas which preferentially reacts with interfering ions of the same target mass to charge (m/z) ratios. A solid-state detector detects ions transmitted through the mass analyzer, on the basis of their mass-to-charge ratio (m/z), and the resulting current is processed by a data handling system.

The retention time for hexavalent chromium is compared to known standards for species identification.

Total Solids (Percent Moisture) Analysis Approximately 1-2 grams of each sample was placed into a pre-weighed pan, and the combined mass of the sample and pan was recorded. All samples were then placed into a convection oven maintained at a temperature of 65-70°C. After drying for a minimum of eight (8) hours, all samples were briefly cooled and reweighed. The total solids percentage of each sample was calculated by dividing the weight of the dried sample by the weight of the original sample. The batches designated as S1, S3, and S4 were prepared on April 5th, whereas batch S2 was prepared on April 14th.

4. Analytical Issues

The overall analyses went very well and no significant analytical issues were encountered. All quality control parameters associated with these samples were within acceptance limits with the following exceptions described below.

One of the preparation blanks associated with batch C2, identified as PBS2, was determined to be an outlier for hexavalent chromium upon application of the Grubbs test. This preparation blank has been excluded from all calculations since it is deemed to be unrepresentative of the preparation blanks and the submitted samples.

Hexavalent Chromium Quantitation - Laboratory Control Samples Three laboratory control samples were extracted with each batch of submitted samples to identify the extraction efficiency and capacity of the extraction procedure to induce conversion of trivalent chromium to hexavalent chromium. The laboratory control samples spiked with an aqueous hexavalent chromium and a solid PbCrO_4 standard produced acceptable recoveries for each batch (ranging for 78.0-101.7%), indicating that the applied method effectively extracts and stabilizes the hexavalent chromium species. The third laboratory control sample spiked with an aqueous trivalent chromium standard solution resulted in hexavalent chromium recoveries ranging from 0.3-4.2% for the four batches of samples. Although the recovery associated with the Cr(III) LCS in Batch 1 was slightly elevated (4.2%), these relatively low recoveries for the trivalent chromium spikes demonstrate that the extraction procedure, under ideal conditions, induces minimal conversion of trivalent to hexavalent chromium.

Hexavalent Chromium Quantitation - Matrix Spike / Matrix Spike Duplicates (MS/MSDs) Similar to the laboratory control samples, three discrete sets of matrix spikes were extracted to identify the interaction of the sample matrix with trivalent and hexavalent chromium. The performance of the matrix spikes can assist in identifying chemical interferences associated with the sample matrix and the applied extraction procedure.

Hexavalent Chromium Quantitation - Cr(III) MS/MSDs The hexavalent chromium recoveries associated with the aqueous trivalent chromium MS and MSD performed with each batch did not exceed 6%. The fact that the recoveries of the Cr(III) matrix spikes were near or below those of the associated LCS for batches C1, C2, and C4 suggests that minimal oxidation of Cr(III) to Cr(VI) was induced by the spiked sample matrices. For batch C3 the recoveries of the Cr(III) matrix spikes were approximately 4% higher than those of the associated LCS, suggesting that partial oxidation of trivalent chromium to hexavalent chromium occurred in this spiked sample matrix during the extraction despite the application of the buffered MgCl_2 solution to all extracts.

The RPDs associated with the MSDs performed for batches C2 and C4 were above the established control limit of 25% (158.7% and 109.7%, respectively). These elevated RPDs are attributable to the fact that a minimal amount of the trivalent

chromium spikes was converted to hexavalent chromium during the applied extraction procedure, as expected, resulting in hexavalent chromium concentrations that represented an increase in Cr(VI) less than the ambient sample concentration. Since greater variability is expected as spike concentrations approach the ambient sample concentrations, the elevated RPDs are deemed to not impact the validity of the reported results.

Hexavalent Chromium Quantitation – Aqueous Cr(VI) and Solid PbCrO₄ MS/MSDs

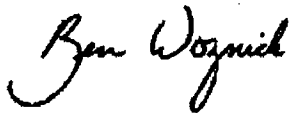
The hexavalent chromium recoveries associated with the matrix spikes performed for batches C1 and C2 were within acceptance limits for both the aqueous and insoluble hexavalent chromium matrix spikes. Similarly, the recoveries of the aqueous hexavalent chromium matrix spikes performed on the sample identified as AB17426 in batch C4 were acceptable. These recoveries suggest that the applied method effectively extracts and stabilizes hexavalent chromium in these particular spiked sample matrices.

For batches C3 and C4, although the recoveries of the insoluble hexavalent chromium matrix spikes were acceptable (ranging from 81.0-84.7%), the recoveries of the aqueous hexavalent chromium matrix spikes performed on AB17309 and AB17329 were biased low (57.5%-64.3%). As previously mentioned, the recoveries of both the aqueous and insoluble hexavalent chromium LCS were acceptable for each of these batches, demonstrating that the applied procedure both extracts and stabilizes Cr(VI) in solution. Since the low bias observed for these soluble Cr(VI) matrix spikes may therefore be attributed to interference from the spiked sample matrices, no further corrective action was deemed necessary. These MS/MSD results suggest that the sample matrices associated with AB17309 and AB17329 favor reduction of hexavalent chromium. However, for the sample identified as AB17329 it must also be noted that the concentrations of the applied soluble Cr(VI) matrix spikes were approximately three-quarters the ambient sample concentration.

It should be noted that the estimated method detection limit (eMDL) for hexavalent chromium for solids is generated using the standard deviation of the associated preparation blanks, in accordance with Applied Speciation and Consulting's SOP.

If you have any questions or concerns regarding this report, please feel free to contact me.

Sincerely,



Ben Wozniak
Project Manager
Applied Speciation and Consulting, LLC

Hexavalent Cr & Conventionals Results for the Missouri Department of Natural Resources
Contact: Ron Heckman

Date: April 15, 2010
Report Generated by: Ben Wozniak
Applied Speciation and Consulting, LLC

Sample Results

Sample ID	Batch Identifiers	Date & Time Analyzed for Cr(VI)*	Cr(VI) in mg/kg (dw)	% Solids
AB17412	C1, S1	4/1/2010 15:50	0.088	94.5
AB17413	C1, S1	4/1/2010 20:52	0.214	92.6
AB17414	C1, S1	4/1/2010 20:58	0.075	94.0
AB17415	C1, S1	4/1/2010 21:42	0.041	94.2
AB17416	C1, S1	4/1/2010 21:48	0.140	93.6
AB17417	C1, S1	4/1/2010 21:55	0.030	95.5
AB17418	C1, S1	4/1/2010 22:01	0.154	89.4
AB17419	C1, S1	4/1/2010 22:07	0.164	86.8
AB17420	C4, S1	4/8/2010 15:02	0.196	85.5
AB17421	C4, S1	4/8/2010 15:08	0.204	87.9
AB17422	C4, S1	4/8/2010 15:14	0.847	86.3
AB17423	C4, S1	4/8/2010 15:21	0.827	84.0
AB17424	C1, S1	4/1/2010 22:38	1.59	90.0
AB17425	C4, S1	4/8/2010 15:27	0.832	89.5
AB17426	C4, S1	4/8/2010 15:33	0.150	87.7
AB17434	C1, S1	4/1/2010 23:10	0.305	95.1
AB17435	C1, S1	4/1/2010 23:16	0.074	95.0
AB17436	C1, S1	4/1/2010 23:22	2.85	96.0
AB17437	C1, S1	4/1/2010 23:28	0.059	95.7
AB17438	C1, S1	4/1/2010 23:35	0.108	95.1

dw = dry weight

* Times reported in CST

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Hexavalent Cr & Conventional Results for the Missouri Department of Natural Resources
Contact: Ron Heckman

Date: April 15, 2010
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Sample Results

Sample ID	Batch Identifiers	Date & Time Analyzed for Cr(VI)*	Cr(VI) in mg/kg (dw)	% Solids
AB17439	C2, S2	4/2/2010 15:07	0.599	95.1
AB17440	C2, S2	4/2/2010 14:42	0.379	94.4
AB17441	C2, S2	4/2/2010 14:48	0.701	95.0
AB17442	C2, S2	4/2/2010 14:54	0.163	93.0
AB17443	C2, S2	4/2/2010 15:01	0.418	95.6
AB17444	C2, S2	4/2/2010 16:41	0.151	90.1
AB17445	C2, S2	4/2/2010 16:47	0.308	88.3
AB17446	C2, S2	4/2/2010 16:53	0.177	93.5
AB17447	C2, S2	4/2/2010 16:59	0.486	96.6
AB17448	C2, S2	4/2/2010 17:06	0.181	90.8
AB17449	C2, S2	4/2/2010 17:12	0.373	95.3
AB17450	C2, S2	4/2/2010 17:18	0.093	95.1
AB17451	C2, S2	4/2/2010 17:56	0.220	95.8
AB1752	C2, S2	4/2/2010 18:02	0.083	91.5
AB17453	C2, S2	4/2/2010 18:08	0.426	88.5
AB17454	C2, S2	4/2/2010 18:14	0.092	92.9
AB17455	C2, S2	4/2/2010 18:21	0.094	95.8
AB1756	C2, S2	4/2/2010 18:27	0.304	95.4
AB17307	C2, S2	4/2/2010 18:33	0.052	92.4
AB17308	C2, S3	4/2/2010 18:39	0.502	87.1

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Sample Results

Sample ID	Batch Identifiers	Date & Time Analyzed for Cr(VI)*	Cr(VI) in mg/kg (dw)	% Solids
AB17439	C2, S2	4/2/2010 15:07	0.599	95.1
AB17440	C2, S2	4/2/2010 14:42	0.379	94.4
AB17441	C2, S2	4/2/2010 14:48	0.701	95.0
AB17442	C2, S2	4/2/2010 14:54	0.163	93.0
AB17443	C2, S2	4/2/2010 15:01	0.418	95.6
AB17444	C2, S2	4/2/2010 16:41	0.151	90.1
AB17445	C2, S2	4/2/2010 16:47	0.308	88.3
AB17446	C2, S2	4/2/2010 16:53	0.177	93.5
AB17447	C2, S2	4/2/2010 16:59	0.486	96.6
AB17448	C2, S2	4/2/2010 17:06	0.181	90.8
AB17449	C2, S2	4/2/2010 17:12	0.373	95.3
AB17450	C2, S2	4/2/2010 17:18	0.093	95.1
AB17451	C2, S2	4/2/2010 17:56	0.220	95.8
AB1752	C2, S2	4/2/2010 18:02	0.083	91.5
AB17453	C2, S2	4/2/2010 18:08	0.426	88.5
AB17454	C2, S2	4/2/2010 18:14	0.092	92.9
AB17455	C2, S2	4/2/2010 18:21	0.094	95.8
AB1756	C2, S2	4/2/2010 18:27	0.304	95.4
AB17307	C2, S2	4/2/2010 18:33	0.052	92.4
AB17308	C2, S3	4/2/2010 18:39	0.502	87.1

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Hexavalent Cr & Conventional Results for the Missouri Department of Natural Resources
Contact: Ron Heckman

Date: April 15, 2010
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Sample Results

Sample ID	Batch Identifiers	Date & Time Analyzed for Cr(VI)*	Cr(VI) in mg/kg (dw)	% Solids
AB17309	C3, S3	4/7/2010 20:32	0.289	81.7
AB17310	C3, S3	4/7/2010 20:01	6.51	81.9
AB17311	C3, S3	4/7/2010 20:07	11.7	85.8
AB17312	C3, S3	4/7/2010 20:13	0.230	84.5
AB17313	C3, S3	4/7/2010 21:34	0.310	85.9
AB17314	C3, S3	4/7/2010 21:41	0.255	87.8
AB17315	C3, S3	4/7/2010 21:47	0.138	86.2
AB17316	C3, S3	4/7/2010 21:53	5.26	81.5
AB17317	C3, S3	4/7/2010 21:59	0.385	86.1
AB17318	C3, S3	4/7/2010 22:06	0.157	93.0
AB17319	C3, S3	4/7/2010 22:12	0.362	85.7
AB17320	C3, S3	4/7/2010 22:24	23.6	86.2
AB17321	C3, S3	4/7/2010 22:31	7.07	87.3
AB17322	C3, S3	4/7/2010 22:49	0.271	86.1
AB17323	C3, S3	4/7/2010 22:56	0.131	87.5
AB17324	C3, S3	4/7/2010 23:02	0.367	89.5
AB17325	C3, S3	4/7/2010 23:08	0.489	89.6
AB17326	C3, S3	4/7/2010 23:14	0.059	94.5
AB17327	C3, S4	4/7/2010 23:21	1.73	91.3
AB17328	C3, S4	4/7/2010 23:27	0.450	90.6

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Hexavalent Cr & Conventional Results for the Missouri Department of Natural Resources
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Sample Results

Sample ID	Batch Identifiers	Date & Time Analyzed for Cr(VI)*	Cr(VI) in mg/kg (dw)	% Solids
AB17329	C4, S4	4/8/2010 13:34	8.08	86.3
AB17330	C4, S4	4/8/2010 12:57	0.252	88.0
AB17331	C4, S4	4/8/2010 13:03	0.309	87.0
AB17332	C4, S4	4/8/2010 13:09	0.246	87.2
AB17333	C4, S4	4/8/2010 13:28	0.213	87.8
AB17334	C4, S4	4/8/2010 14:37	0.146	91.1

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Hexavalent Cr & Conventional Results for the Missouri Department of Natural Resources
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Quality Control Summary - Preparation Blank Summary

Analyte	Units	Batch	PBS1	PBS2	PBS3	PBS4	Mean	StdDev	eMDL	RL
Cr(VI)	mg/kg (dw)	C1	0.024	0.017	0.011	0.016	0.017	0.006	0.017	0.025
Cr(VI)	mg/kg (dw)	C2	0.015	1.281*	0.012	0.013	0.013	0.002	0.005	0.025
Cr(VI)	mg/kg (dw)	C3	0.014	0.012	0.011	0.013	0.012	0.001	0.004	0.025
Cr(VI)	mg/kg (dw)	C4	0.011	0.010	0.009	0.011	0.010	0.001	0.003	0.025

eMDL = Estimated Method Detection Limit

RL = Reporting Limit

* This preparation blank is identified as a Grubbs outlier and has been excluded from all calculations

Hexavalent Cr & Conventional Results for the Missouri Department of Natural Resources
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Quality Control Summary - Laboratory Control Samples

Analyte	Units	Batch	LCS	True Value	Result	Recovery
Cr(III)	mg/kg (dw)	C1	LCS	5.000	0.208	4.2
Cr(VI)	mg/kg (dw)	C1	LCS	5.000	4.277	85.5
PbCrO ₄	mg/kg (dw)	C1	LCS	6435	6543	101.7
Cr(III)	mg/kg (dw)	C2	LCS	5.000	0.040	0.8
Cr(VI)	mg/kg (dw)	C2	LCS	5.000	3.898	78.0
PbCrO ₄	mg/kg (dw)	C2	LCS	7272	6084	83.7
Cr(III)	mg/kg (dw)	C3	LCS	5.000	0.063	1.3
Cr(VI)	mg/kg (dw)	C3	LCS	5.000	4.947	98.9
PbCrO ₄	mg/kg (dw)	C3	LCS	6918	6363	92.0
Cr(III)	mg/kg (dw)	C4	LCS	5.000	0.016	0.3
Cr(VI)	mg/kg (dw)	C4	LCS	5.000	4.766	95.3
PbCrO ₄	mg/kg (dw)	C4	LCS	7368	6643	90.2

Hexavalent Cr & Conventional Results for the Missouri Department of Natural Resources
Contact: Ron Heckman

Date: April 15, 2010
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Applied Speciation and Consulting, LLC

Quality Control Summary - Matrix Duplicate

Analyte	Units	Batch	Sample ID	Rep 1	Rep 2	Mean	RPD
% Solids	%	S1	AB17412	94.54	94.20	94.37	0.4
% Solids	%	S1	AB17420	85.54	85.95	85.74	0.5
% Solids	%	S2	AB17439	95.11	95.07	95.09	0.0
% Solids	%	S3	AB17308	87.12	87.19	87.15	0.1
% Solids	%	S4	AB17327	91.27	91.33	91.30	0.1
Cr(VI)	mg/kg (dw)	C1	AB17412	0.088	0.074	0.081	17.9
Cr(VI)	mg/kg (dw)	C2	AB17439	0.599	0.573	0.586	4.5
Cr(VI)	mg/kg (dw)	C3	AB17309	0.289	0.226	0.258	24.4
Cr(VI)	mg/kg (dw)	C4	AB17329	8.079	6.865	7.472	16.2

NC = Value was not calculated due to one or more concentrations below the eMDL

* The RPD is above the established control limit of 25%; please see narrative.

Hexavalent Cr & Conventional Results for the Missouri Department of Natural Resources
 Contact: Ron Heckman

Date: April 15, 2010
 Report Generated by: Ben Wozniak
 Applied Speciation and Consulting, LLC

Quality Control Summary - Matrix Spike/ Matrix Spike Duplicate

Analyte	Units	Batch	Sample ID	Spike Conc	MS Result	Recovery	Spike Conc	MSD		RPD
								Result	Recovery	
Cr(III)	mg/kg (dw)	C1	AB17412	4.933	0.135	1.1	5.305	0.141	1.1	2.3
Cr(VI)	mg/kg (dw)	C1	AB17412	5.152	5.446	104.1	5.240	5.377	101.1	3.0
PbCrO ₄	mg/kg (dw)	C1	AB17412	10883	10870	99.9	6280	6971	111.0	10.5
Cr(III)	mg/kg (dw)	C2	AB17439	5.117	0.715	2.5	5.000	0.600	0.3	158.7**
Cr(VI)	mg/kg (dw)	C2	AB17439	5.114	4.675	80.0	5.309	4.825	79.9	0.1
PbCrO ₄	mg/kg (dw)	C2	AB17439	6650	5673	85.3	7516	5967	79.4	7.2
Cr(III)	mg/kg (dw)	C3	AB17309	6.070	0.596	5.6	5.976	0.606	5.8	4.5
Cr(VI)	mg/kg (dw)	C3	AB17309	5.939	3.674	57.5*	6.212	3.926	59.1*	2.6
PbCrO ₄	mg/kg (dw)	C3	AB17309	8309	6807	81.9	8921	7228	81.0	1.1
Cr(III)	mg/kg (dw)	C4	AB17329	5.551	7.263	-3.8	5.599	6.750	-12.9	109.7*
Cr(VI)	mg/kg (dw)	C4	AB17329	5.753	11.17	64.3*	5.691	10.92	60.6*	5.9
PbCrO ₄	mg/kg (dw)	C4	AB17329	7907	6705	84.7	8055	6799	84.3	0.5
Cr(VI)	mg/kg (dw)	C4	AB17426	5.670	5.492	94.2	5.419	5.299	95.0	0.9

* The recovery is below the established control limit of 75%; please see narrative.

** The RPD is above the established control limit of 25%; please see narrative.

NC = Value was not calculated due to one or more concentrations below the eMDL

Hexavalent Cr & Conventional Results for the Missouri Department of Natural Resources
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Quality Control Summary - Historical Calibration Standards

Cr(VI) True Value	Cr(VI) Measured Result	Percent Recovery
0.050	0.062	124.1
0.050	0.063	125.7
0.050	0.063	125.3
0.050	0.061	121.4
0.500	0.504	100.7
5.000	5.030	100.6
25.00	24.11	96.4
50.00	50.44	100.9
0.050	0.058	115.8
0.050	0.064	128.1
0.050	0.060	120.5
0.050	0.057	115.0
0.500	0.502	100.4
5.000	4.795	95.9
25.00	23.84	95.4
50.00	50.60	101.2
0.050	0.072	143.5
0.050	0.064	128.3
0.050	0.056	111.9
0.050	0.060	120.9
0.500	0.505	101.1
5.000	4.970	99.4
25.00	25.24	100.9
50.00	49.88	99.8

All results are reported in µg/L

Hexavalent Cr & Conventional Results for the Missouri Department of Natural Resources
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Applied Speciation and Consulting, LLC

Quality Control Summary - Historical CCV Standards

Cr(VI) True Value	Cr(VI) Measured Result	Percent Recovery
5.000	4.994	99.9
5.000	4.803	96.1
5.000	4.402	88.0
5.000	4.145	82.9
5.000	4.863	97.3
5.000	4.825	96.5
5.000	4.711	94.2
5.000	4.369	87.4
5.000	4.394	87.9
5.000	4.978	99.6
5.000	4.995	99.9
5.000	4.892	97.8
5.000	4.910	98.2
5.000	4.615	92.3
5.000	4.721	94.4
5.000	4.520	90.4
5.000	4.715	94.3
5.000	4.632	92.6
5.000	4.596	91.9
5.000	4.834	96.7

CCV = Continuing Calibration Verification

All results are reported in µg/L

Hexavalent Cr & Conventionals Results for the Missouri Department of Natural Resources
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Quality Control Summary - Historical Second Source Standards

Cr(VI) True Value	Cr(VI) Measured Result	Percent Recovery
5.000	5.107	102.1
100.0	95.38	95.4
5.000	4.932	98.6
5.000	4.706	94.1
20.00	20.30	101.5
5.000	5.029	100.6
100.0	107.2	107.2
5.000	5.369	107.4
5.000	5.557	111.1
5.000	4.986	99.7
5.000	5.474	109.5
5.000	5.445	108.9
5.000	4.546	90.9
5.000	5.037	100.7
5.000	4.277	85.5
5.000	3.898	78.0
5.000	4.947	98.9
5.000	4.766	95.3

Second source standard = Cr(VI) Blank Spike (from 3060A Extraction)

All results are reported in mg/kg

Hexavalent Cr & Conventionals Results for the Missouri Department of Natural Resources
 Contact: Ron Heckman

Date: April 15, 2010
 Report Generated by: Ben Wozniak
 Applied Speciation and Consulting, LLC

Quality Control Summary - Historical Matrix Spikes

Ambient Cr(VI) Conc.	MS Spike Conc.	MS Measured Result	MS Recovery	MSD Spike Conc.	MSD Measured Result	MSD Recovery	RPD
0.081	5.152	5.446	104.1	5.240	5.377	101.1	3.0
0.586	5.114	4.675	80.0	5.309	4.825	79.9	0.1
0.258	5.939	3.674	57.5	6.212	3.926	59.1	2.6
7.472	5.753	11.17	64.3	5.691	10.92	60.6	5.9
0.150	5.670	5.492	94.2	5.419	5.299	95.0	0.9
0.187	4.046	3.095	71.9	3.775	2.961	73.5	2.2
0.160	4.017	4.214	100.9	4.078	4.038	95.1	5.9
0.080	3.906	3.657	91.6	3.959	3.600	88.9	2.9
0.101	5.052	3.646	70.2	4.694	3.300	68.2	2.9
0.224	4.910	2.551	47.4	4.893	2.361	43.7	8.2
0.342	4.885	3.534	65.4	4.820	3.424	63.9	2.2
< 0.014 U	5.243	< 0.014 U	0.0	5.147	0.039	0.8	200.0
1.816	20.46	6.685	23.8	20.39	5.832	19.7	18.8
0.088	5.064	3.253	62.5	5.134	3.254	61.7	1.3
0.997	5.310	0.758	-4.5	5.319	1.060	1.2	342.7
0.466	5.064	0.427	-0.8	5.068	0.528	1.2	872.8
0.184	5.007	4.098	78.1	4.779	4.272	85.5	9.0
1.568	5.151	1.153	-8.1	5.133	1.575	0.1	206.4
0.476	4.838	5.336	100.5	4.953	5.520	101.8	1.4
0.421	6.646	6.483	91.2	7.036	6.656	88.6	2.9

All results are reported in mg/kg



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID:

Collector's Name: Transfer Chain of Custody to Applied Speciation and Consulting		Description of Shipment									
(Please Print)		<input checked="" type="checkbox"/> Shipped-Carrier: NEXT DAY-AIR <input checked="" type="checkbox"/> Tape sealed and initialed <input type="checkbox"/> Hand Delivered									
Affiliation: ESP KCRO NERO SERO SLRO SWRO WPP		No. Of Containers: 4									
(circle one) DGLS HWP Other:											
Sample Number	Sample Collected	Analyses						Sample Type	For Lab Use Only		
								Matrix:	Container	Preserved	
AB17412 (Sample A)	Date: 03/22/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	H ₂ SO ₄ HNO ₃ NAOH HCL 4° C (None) Disinfected Other
<i>For Lab Use Only</i>	Time: 14:20	D.O	Flow	pH	Spec. Cond.	Temp.	Other:				
AB17413 (Sample B)	Date: 03/22/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	H ₂ SO ₄ HNO ₃ NAOH HCL 4° C (None) Disinfected Other
<i>For Lab Use Only</i>	Time: 14:31	D.O	Flow	pH	Spec. Cond.	Temp.	Other:				
AB17414 (Sample C)	Date: 03/22/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	H ₂ SO ₄ HNO ₃ NAOH HCL 4° C (None) Disinfected Other
<i>For Lab Use Only</i>	Time: 14:39	D.O	Flow	pH	Spec. Cond.	Temp.	Other:				
AB17415 (Sample D)	Date: 03/22/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	H ₂ SO ₄ HNO ₃ NAOH HCL 4° C (None) Disinfected Other
<i>For Lab Use Only</i>	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:				
Relinquished By: Richard Kusch 3-29-10	Received By: Stefan Kern	Date: 3/30/10						Time: 1430			
Relinquished By:	Received By:	Date:						Time:			
Relinquished By:	Received By:	Date: 3/30/10						Time:			

*All custody seals intact upon arrival

• Cooler 1: ~~4.0°C~~ 4.0°C
 • cooler 2: ~~0.2°C~~ -0.2°C
 • cooler 3: -0.4°C



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID: _____

Collector's Name: Transfer Chain of Custody to Applied Speciation and Consulting								Description of Shipment				
(Please Print)								X Shipped-Carrier: NEXT DAY-AIR				
Affiliation: ESP KCRO NERO SERO SLRO SWRO WPP								X Tape sealed and initialed				
(circle one) DGLS HWP Other:								Hand Delivered				
								No. Of Containers: 4				
Sample Number	Sample Collected	Analyses						Sample Type	For Lab Use Only			
		Matrix	Container	Preserved								
AB17416 (Sample A)	Date: 03/22/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab	Water	1L amber	120 mL	H ₂ SO ₄
							X Composite	Soil	Cubitainer		HNO ₃	
For Lab Use Only	Time: 14:49	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass	Nalgene	NAOH	
								Sludge	8 oz glass	1L	HCL	
								Other:	VOA vial	500mL	4° C (None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17417 (Sample B)	Date: 03/22/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab	Water	1L amber	120 mL	H ₂ SO ₄
							X Composite	Soil	Cubitainer		HNO ₃	
For Lab Use Only	Time: 15:05	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass	Nalgene	NAOH	
								Sludge	8 oz glass	1L	HCL	
								Other:	VOA vial	500mL	4° C (None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17418 (Sample C)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab	Water	1L amber	120 mL	H ₂ SO ₄
							X Composite	Soil	Cubitainer		HNO ₃	
For Lab Use Only	Time: 9:39	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass	Nalgene	NAOH	
								Sludge	8 oz glass	1L	HCL	
								Other:	VOA vial	500mL	4° C (None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17419 (Sample D)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab	Water	1L amber	120 mL	H ₂ SO ₄
							X Composite	Soil	Cubitainer		HNO ₃	
For Lab Use Only	Time: 9:51	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass	Nalgene	NAOH	
								Sludge	8 oz glass	1L	HCL	
								Other:	VOA vial	500mL	4° C (None)	
									Encore	250mL	Disinfected	
									Other:		Other	
Relinquished By: <i>Richard Kersch 3-27-10</i>							Received By: <i>Stephan Kern</i>		Date: <i>3/30/10</i>		Time: <i>1430</i>	
Relinquished By:							Received By:		Date:		Time:	
Relinquished By:							Received By:		Date:		Time:	



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID:

Collector's Name: Transfer Chain of Custody to Applied Speciation and Consulting <i>(Please Print)</i>							Description of Shipment					
Affiliation: ESP KCR0 NERO SERO SLRO SWRO WPP <i>(circle one)</i> DGLS HWP Other:							<input checked="" type="checkbox"/> Shipped-Carrier: NEXT DAY-AIR <input checked="" type="checkbox"/> Tape sealed and initialed <input type="checkbox"/> Hand Delivered					
							No. Of Containers: 4					
Sample Number	Sample Collected	Analyses					Sample Type	For Lab Use Only				
								Matrix:	Container		Preserved	
AB17420 (Sample A)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					<input type="checkbox"/> Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified Other:	<input type="checkbox"/> Water <input type="checkbox"/> Soil <input type="checkbox"/> Organic <input type="checkbox"/> Sludge Other:	<input type="checkbox"/> 1L amber <input type="checkbox"/> Cubitainer <input type="checkbox"/> 2 oz glass Nalgene <input type="checkbox"/> 8 oz glass 1L <input type="checkbox"/> VOA vial 500mL <input type="checkbox"/> Encore 250mL Other:	<input type="checkbox"/> 120 mL <input type="checkbox"/> 1L <input type="checkbox"/> 1L <input type="checkbox"/> 1L <input type="checkbox"/> 500mL <input type="checkbox"/> 250mL Other:	<input type="checkbox"/> H ₂ SO ₄ <input type="checkbox"/> HNO ₃ <input type="checkbox"/> NAOH <input type="checkbox"/> HCl <input type="checkbox"/> 4° C (None) <input type="checkbox"/> Disinfected Other:	
<i>For Lab Use Only</i>	Time: 9:59	D.O	Flow	pH	Spec. Cond.	Temp.	Other:					
AB17421 (Sample B)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					<input type="checkbox"/> Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified Other:	<input type="checkbox"/> Water <input type="checkbox"/> Soil <input type="checkbox"/> Organic <input type="checkbox"/> Sludge Other:	<input type="checkbox"/> 1L amber <input type="checkbox"/> Cubitainer <input type="checkbox"/> 2 oz glass Nalgene <input type="checkbox"/> 8 oz glass 1L <input type="checkbox"/> VOA vial 500mL <input type="checkbox"/> Encore 250mL Other:	<input type="checkbox"/> 120 mL <input type="checkbox"/> 1L <input type="checkbox"/> 1L <input type="checkbox"/> 1L <input type="checkbox"/> 500mL <input type="checkbox"/> 250mL Other:	<input type="checkbox"/> H ₂ SO ₄ <input type="checkbox"/> HNO ₃ <input type="checkbox"/> NAOH <input type="checkbox"/> HCL <input type="checkbox"/> 4° C (None) <input type="checkbox"/> Disinfected Other:	
<i>For Lab Use Only</i>	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:					
AB17422 (Sample C)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					<input type="checkbox"/> Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified Other:	<input type="checkbox"/> Water <input type="checkbox"/> Soil <input type="checkbox"/> Organic <input type="checkbox"/> Sludge Other:	<input type="checkbox"/> 1L amber <input type="checkbox"/> Cubitainer <input type="checkbox"/> 2 oz glass Nalgene <input type="checkbox"/> 8 oz glass 1L <input type="checkbox"/> VOA vial 500mL <input type="checkbox"/> Encore 250mL Other:	<input type="checkbox"/> 120 mL <input type="checkbox"/> 1L <input type="checkbox"/> 1L <input type="checkbox"/> 1L <input type="checkbox"/> 500mL <input type="checkbox"/> 250mL Other:	<input type="checkbox"/> H ₂ SO ₄ <input type="checkbox"/> HNO ₃ <input type="checkbox"/> NAOH <input type="checkbox"/> HCL <input type="checkbox"/> 4° C (None) <input type="checkbox"/> Disinfected Other:	
<i>For Lab Use Only</i>	Time: 10:13	D.O	Flow	pH	Spec. Cond.	Temp.	Other:					
AB17423 (Sample D)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					<input type="checkbox"/> Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified Other:	<input type="checkbox"/> Water <input type="checkbox"/> Soil <input type="checkbox"/> Organic <input type="checkbox"/> Sludge Other:	<input type="checkbox"/> 1L amber <input type="checkbox"/> Cubitainer <input type="checkbox"/> 2 oz glass Nalgene <input type="checkbox"/> 8 oz glass 1L <input type="checkbox"/> VOA vial 500mL <input type="checkbox"/> Encore 250mL Other:	<input type="checkbox"/> 120 mL <input type="checkbox"/> 1L <input type="checkbox"/> 1L <input type="checkbox"/> 1L <input type="checkbox"/> 500mL <input type="checkbox"/> 250mL Other:	<input type="checkbox"/> H ₂ SO ₄ <input type="checkbox"/> HNO ₃ <input type="checkbox"/> NAOH <input type="checkbox"/> HCL <input type="checkbox"/> 4° C (None) <input type="checkbox"/> Disinfected Other:	
<i>For Lab Use Only</i>	Time: 10:22	D.O	Flow	pH	Spec. Cond.	Temp.	Other:					
Relinquished By: Richard K. K... 3-29-10						Received By: [Signature]		Date: 3/30/10		Time: 1430		
Relinquished By:						Received By:		Date:		Time:		
Relinquished By:						Received By:		Date:		Time:		



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID: _____

Collector's Name: Transfer Chain of Custody to Applied Speciation and Consulting <i>(Please Print)</i>								Description of Shipment				
Affiliation: ESP KCRO NERO SERO SLRO SWRO WPP <i>(circle one)</i> DGLS HWP Other: _____								<input checked="" type="checkbox"/> Shipped-Carrier: NEXT DAY--AIR <input checked="" type="checkbox"/> Tape sealed and initialed <input type="checkbox"/> Hand Delivered				
Sample Number	Sample Collected	Analyses						Sample Type	For Lab Use Only			
		Matrix	Container	Preserved								
AB17424 (Sample A)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified Other: _____	Water	1L amber	120 mL	H ₂ SO ₄
	Time: 10:39	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:		Soil	Cubitainer		HNO ₃
								Organic	2 oz glass	Nalgene	NAOH	
								Sludge	8 oz glass	1L	HCL	
								Other:	VOA vial	500mL	4° C(None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17425 (Sample B)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified Other: _____	Water	1L amber	120 mL	H ₂ SO ₄
	Time: 10:47	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:		Soil	Cubitainer		HNO ₃
								Organic	2 oz glass	Nalgene	NAOH	
								Sludge	8 oz glass	1L	HCL	
								Other:	VOA vial	500mL	4° C(None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17426 (Sample C)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified Other: _____	Water	1L amber	120 mL	H ₂ SO ₄
	Time: 11:01	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:		Soil	Cubitainer		HNO ₃
								Organic	2 oz glass	Nalgene	NAOH	
								Sludge	8 oz glass	1L	HCL	
								Other:	VOA vial	500mL	4° C(None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17434 (Sample D)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified Other: _____	Water	1L amber	120 mL	H ₂ SO ₄
	Time: 10:06	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:		Soil	Cubitainer		HNO ₃
								Organic	2 oz glass	Nalgene	NAOH	
								Sludge	8 oz glass	1L	HCL	
								Other:	VOA vial	500mL	4° C(None)	
									Encore	250mL	Disinfected	
									Other:		Other	
Relinquished By: Richard Kirsch 3-29-10						Received By: Stefan Kern		Date: 3/30/10	Time: 1430			
Relinquished By:						Received By:		Date:	Time:			
Relinquished By:						Received By:		Date:	Time:			



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID:

Collector's Name: Transfer Chain of Custody to Applied Speciation and Consulting <small>(Please Print)</small>							Description of Shipment						
Affiliation: ESP KCRO NERO SERO SLRO SWRO WPP <small>(circle one)</small> IGLS HWP Other:							<input checked="" type="checkbox"/> Shipped-Carrier: NEXT DAY--AIR <input checked="" type="checkbox"/> Tape sealed and initialed <input type="checkbox"/> Hand Delivered						
							No. Of Containers: 4						
Sample Number	Sample Collected	Analyzes					Sample Type	For Lab Use Only					
AB17435 (Sample A)	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					<input type="checkbox"/> Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified Other:	Matrix	Container	Preserved			
	03/23/10							Water	1L amber	120 mL	H ₂ SO ₄		
For Lab Use Only	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Soil	Cubitainer	HNO ₃			
	10:51							Organic	2 oz glass Nalgene	NAOH			
								Sludge	8 oz glass	HCL			
								Other:	VOA vial	500mL	4° C(None)		
									Encore	250mL	Disinfected		
									Other:		Other		
AB17436 (Sample B)	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					<input type="checkbox"/> Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified Other:	Matrix	Container	Preserved			
	03/23/10							Water	1L amber	120 mL	H ₂ SO ₄		
For Lab Use Only	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Soil	Cubitainer	HNO ₃			
	13:40							Organic	2 oz glass Nalgene	NAOH			
								Sludge	8 oz glass	HCL			
								Other:	VOA vial	500mL	4° C(None)		
									Encore	250mL	Disinfected		
									Other:		Other		
AB17437 (Sample C)	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					<input type="checkbox"/> Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified Other:	Matrix	Container	Preserved			
	03/23/10							Water	1L amber	120 mL	H ₂ SO ₄		
For Lab Use Only	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Soil	Cubitainer	HNO ₃			
	10:35							Organic	2 oz glass Nalgene	NAOH			
								Sludge	8 oz glass	HCL			
								Other:	VOA vial	500mL	4° C(None)		
									Encore	250mL	Disinfected		
									Other:		Other		
AB17438 (Sample D)	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					<input type="checkbox"/> Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified Other:	Matrix	Container	Preserved			
	03/23/10							Water	1L amber	120 mL	H ₂ SO ₄		
For Lab Use Only	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Soil	Cubitainer	HNO ₃			
	10:35							Organic	2 oz glass Nalgene	NAOH			
								Sludge	8 oz glass	HCL			
								Other:	VOA vial	500mL	4° C(None)		
									Encore	250mL	Disinfected		
									Other:		Other		
Relinquished By: <i>Richard K... 3-23-10</i>					Received By: <i>Anita Lem</i>					Date: <i>3/30/10</i>		Time: <i>1420</i>	
Relinquished By:					Received By:					Date:		Time:	
Relinquished By:					Received By:					Date:		Time:	

MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID:

Collector's Name: Transfer Chain of Custody to Applied Speciation and Consulting <small>(Please Print)</small>							Description of Shipment						
Affiliation: ESP KCRO NERO SERO SLRO SWRO WPP <small>(circle one)</small> DGLS HWP Other:							<input checked="" type="checkbox"/> Shipped-Carrier: NEXT DAY-AIR <input checked="" type="checkbox"/> Tape sealed and initialed Hard Delivered: _____ No. Of Containers: 4						
Sample Number	Sample Collected	Analyses					Sample Type	For Lab Use Only					
	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Matrix	Container		Preserved		
AB17439 (Sample A)	03/23/10						Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL 1L 1L 1L 500mL 250mL	H ₂ SO ₄ HNO ₃ NaOH HCl 4° C (None) Disinfected Other:		
For Lab Use Only	Time: 10:19	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:						
AB17440 (Sample B)	03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL 1L 1L 1L 500mL 250mL	H ₂ SO ₄ HNO ₃ NaOH HCl 4° C (None) Disinfected Other:		
For Lab Use Only	Time: 9:42	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:						
AB17441 (Sample C)	03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL 1L 1L 1L 500mL 250mL	H ₂ SO ₄ HNO ₃ NaOH HCl 4° C (None) Disinfected Other:		
For Lab Use Only	Time: 13:30	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:						
AB17442 (Sample D)	03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL 1L 1L 1L 500mL 250mL	H ₂ SO ₄ HNO ₃ NaOH HCl 4° C (None) Disinfected Other:		
For Lab Use Only	Time: 9:10	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:						
Relinquished By: <i>Richard Klink</i>					Received By: <i>Adam Kern</i>					Date: <i>3/30/10</i>		Time: <i>1420</i>	
Relinquished By:					Received By:					Date:		Time:	
Relinquished By:					Received By:					Date:		Time:	



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID:

Collector's Name: <u>Transfer Chain of Custody to Applied Speciation and Consulting</u>								Description of Shipment					
<i>(Please Print)</i> Affiliation: <u>ESP</u> <u>KCRO</u> <u>NERO</u> <u>SERO</u> <u>SLRO</u> <u>SWRO</u> <u>WPP</u>								<input checked="" type="checkbox"/> Shipped-Carrier: <u>NEXT DAY-AIR</u>					
<i>(circle one)</i> <u>DGLS</u> <u>HWP</u> Other: _____								<input checked="" type="checkbox"/> Tape sealed and initialed					
								<input type="checkbox"/> Hand Delivered					
								No. Of Containers: <u>4</u>					
Sample Number	Sample Collected	Analyses						Sample Type	For Lab Use Only				
	Date:								Matrix	Container		Preserved	
AB17443 (Sample A)	03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL	II ₂ SO ₄ HNO ₃ NAOH HCL 4° C (None) Disinfected Other	
<i>For Lab Use Only</i>	Time: 10:19	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Other:					
AB17444 (Sample B)	03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL	II ₂ SO ₄ HNO ₃ NAOH HCL 4° C (None) Disinfected Other	
<i>For Lab Use Only</i>	Time: 9:25	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Other:					
AB17445 (Sample C)	03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL	II ₂ SO ₄ HNO ₃ NAOH HCL 4° C (None) Disinfected Other	
<i>For Lab Use Only</i>	Time: 9:11	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Other:					
AB17446 (Sample D)	03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL	II ₂ SO ₄ HNO ₃ NAOH HCL 4° C (None) Disinfected Other	
<i>For Lab Use Only</i>	Time: 9:24	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Other:					
Relinquished By: <u>[Signature]</u>		Received By: <u>[Signature]</u>						Date: <u>7/30/10</u>	Time: <u>1430</u>				
Relinquished By:		Received By:						Date:	Time:				
Relinquished By:		Received By:						Date:	Time:				

MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID: _____

Collector's Name: Transfer Chain of Custody to Applied Speciation and Consulting <small>(Please Print)</small>							Description of Shipment					
Affiliation: ESP KCRO NERO SERO SLRO SWRO WPP <small>(circle one)</small> DGLS HWP Other:							<input checked="" type="checkbox"/> Shipped-Carrier: NEXT DAY-AIR <input checked="" type="checkbox"/> Tape sealed and initialed <input type="checkbox"/> Hand Delivered					
							No. Of Containers: 4					
Sample Number	Sample Collected	Analyses					Sample Type	For Lab Use Only				
								Matrix	Container		Preserved	
AB17447 (Sample A)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL	H_2SO_4 HNO_3 NAOH HCL 4° C (None) Disinfected Other	
<i>For Lab Use Only</i>	Time: 9:42	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:					
AB17448 (Sample B)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL	H_2SO_4 HNO_3 NAOH HCL 4° C (None) Disinfected Other	
<i>For Lab Use Only</i>	Time: 8:49	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:					
AB17449 (Sample C)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL	H_2SO_4 HNO_3 NAOH HCL 4° C (None) Disinfected Other	
<i>For Lab Use Only</i>	Time: 10:51	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:					
AB17450 (Sample D)	Date: 03/23/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500ml Encore 250mL Other:	120 mL	H_2SO_4 HNO_3 NAOH HCL 4° C (None) Disinfected Other	
<i>For Lab Use Only</i>	Time: 10:35	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:					
Relinquished By: <i>Shelby A. Kellum 3/23/10</i>							Received By: <i>Shelby Kellum</i>		Date: <i>3/30/10</i>	Time: <i>1426</i>		
Relinquished By:							Received By:		Date:	Time:		
Relinquished By:							Received By:		Date:	Time:		



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID: _____

Collector's Name: <u>Transfer Chain of Custody to Applied Speciation and Consulting</u> <small>(Please Print)</small>							Description of Shipment <input checked="" type="checkbox"/> Shipped-Carrier: <u>NEXT DAY-AIR</u> <input checked="" type="checkbox"/> Tape sealed and initialed <input type="checkbox"/> Hand Delivered					
Affiliation: <u>ESP</u> <u>KCRO</u> <u>NERO</u> <u>SERO</u> <u>SLRO</u> <u>SWRO</u> <u>WPP</u> <small>(circle one)</small> <u>DGLS</u> <u>HWP</u> Other: _____							No. Of Containers: <u>4</u>					
Sample Number	Sample Collected	Analyses					Sample Type	For Lab Use Only				
A1317451 (Sample A)	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Matrix	Container		Preserved	
	03/23/10							Water	1L amber	120 mL	H ₂ SO ₄	
For Lab Use Only	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Soil	Cubitainer	HNO ₃		
	10:06							Organic	2 oz glass Nalgene	NAOH		
								Sludge	8 oz glass	HCL		
								Other:	VOA vial	500mL	4° C(None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB1752 (Sample B)	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water	1L amber 120 mL		H ₂ SO ₄	
	03/23/10							Soil	Cubitainer	HNO ₃		
For Lab Use Only	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass Nalgene	NAOH		
	8:54							Sludge	8 oz glass	HCL		
								Other:	VOA vial	500mL	4° C(None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17453 (Sample C)	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water	1L amber 120 mL		H ₂ SO ₄	
	03/23/10							Soil	Cubitainer	HNO ₃		
For Lab Use Only	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass Nalgene	NAOH		
	9:11							Sludge	8 oz glass	HCL		
								Other:	VOA vial	500mL	4° C(None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17454 (Sample D)	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water	1L amber 120 mL		H ₂ SO ₄	
	03/23/10							Soil	Cubitainer	HNO ₃		
For Lab Use Only	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass Nalgene	NAOH		
	13:05							Sludge	8 oz glass	HCL		
								Other:	VOA vial	500mL	4° C(None)	
									Encore	250mL	Disinfected	
									Other:		Other	
Relinquished By: <u>David K. ...</u>					Received By: <u>Antonia Kern</u>		Date: <u>3/20/10</u>		Time: <u>1426</u>			
Relinquished By: _____					Received By: _____		Date: _____		Time: _____			
Relinquished By: _____					Received By: _____		Date: _____		Time: _____			



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID: _____

Collector's Name: <u>Transfer Chain of Custody to Applied Speciation and Consulting</u>								Description of Shipment			
<i>(Please Print)</i>								<input checked="" type="checkbox"/> Shipped-Carrier: <u>NEXT DAY--AIR</u>			
Affiliation: <u>ESP</u> <u>KCRO</u> <u>NERO</u> <u>SERO</u> <u>SIRO</u> <u>SWRO</u> <u>WPP</u>								<input checked="" type="checkbox"/> Tape sealed and initialed			
<i>(circle one)</i> <u>DGLS</u> <u>HWP</u> Other: _____								Hand Delivered _____ No. Of Containers: <u>4</u>			
Sample Number	Sample Collected	Analyses						Sample Type	For Lab Use Only		
									Matrix	Container	Preserved
AB17455 (Sample A)	Date: <u>03/23/10</u>	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified Other: _____	Water	<u>1L amber</u> <u>120 mL</u>	<u>H₂SO₄</u>
	Time: <u>13:35</u>	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:		Soil	<u>Cubitainer</u>	<u>HNO₃</u>
								Organic	<u>2 oz glass Nalgene</u>	<u>NAOH</u>	
								Sludge	<u>8 oz glass 1L</u>	<u>HCL</u>	
								Other:	<u>VOA vial 500mL</u>	<u>4° C(None)</u>	
									<u>Encore 250mL</u>	<u>Disinfected</u>	
									<u>Other:</u>	<u>Other</u>	
AB1756 (Sample B)	Date: <u>03/23/10</u>	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite Modified Other: _____	Water	<u>1L amber</u> <u>120 ml.</u>	<u>H₂SO₄</u>
	Time: <u>11:02</u>	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:		Soil	<u>Cubitainer</u>	<u>HNO₃</u>
								Organic	<u>2 oz glass Nalgene</u>	<u>NAOH</u>	
								Sludge	<u>8 oz glass 1L</u>	<u>HCL</u>	
								Other:	<u>VOA vial 500mL</u>	<u>4° C(None)</u>	
									<u>Encore 250mL</u>	<u>Disinfected</u>	
									<u>Other:</u>	<u>Other</u>	
(Sample C)	Date: _____	_____						Grab Composite Modified Other: _____	Water	<u>1L amber</u> <u>120 ml.</u>	<u>H₂SO₄</u>
	Time: _____	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:		Soil	<u>Cubitainer</u>	<u>HNO₃</u>
								Organic	<u>2 oz glass Nalgene</u>	<u>NAOH</u>	
								Sludge	<u>8 oz glass 1L</u>	<u>HCL</u>	
								Other:	<u>VOA vial 500mL</u>	<u>4° C(None)</u>	
									<u>Encore 250mL</u>	<u>Disinfected</u>	
									<u>Other:</u>	<u>Other</u>	
(Sample D)	Date: _____	_____						Grab Composite Modified Other: _____	Water	<u>1L amber</u> <u>120 mL</u>	<u>H₂SO₄</u>
	Time: _____	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:		Soil	<u>Cubitainer</u>	<u>HNO₃</u>
								Organic	<u>2 oz glass Nalgene</u>	<u>NAOH</u>	
								Sludge	<u>8 oz glass 1L</u>	<u>HCL</u>	
								Other:	<u>VOA vial 500mL</u>	<u>4° C(None)</u>	
									<u>Encore 250mL</u>	<u>Disinfected</u>	
									<u>Other:</u>	<u>Other</u>	
Relinquished By: _____				Received By: <u>[Signature]</u>				Date: <u>3/30/10</u>	Time: <u>1420</u>		
Relinquished By: _____				Received By: _____				Date: _____	Time: _____		
Relinquished By: _____				Received By: _____				Date: _____	Time: _____		



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID:

Collector's Name: Transfer Chain of Custody to Applied Speciation and Consulting <small>(Please Print)</small> Affiliation: ESP KCR0 NERO SERO SLRO SWRO WPP <small>(circle one)</small> DGLS HWP Other:							Description of Shipment <input checked="" type="checkbox"/> Shipped-Carrier: NEXT DAY-AIR <input checked="" type="checkbox"/> Tape sealed and initialed Hand Delivered					
							No. of Containers: 4					
Sample Number	Sample Collected	Analyses					Sample Type	For Lab Use Only				
	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab	Matrix	Container	Preserved		
AB17307 (Sample A)	03/15/10						<input checked="" type="checkbox"/> Composite Modified	Water	1L amber	120 ml.	H ₂ SO ₄	
<i>For Lab Use Only</i>	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Soil	Cubitainer	HNO ₃		
	16:00							Organic	2 oz glass Nalgene	NAOH		
								Sludge	8 oz glass 1L	HCL		
								Other:	VOA vial	500mL	4° C(None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17308 (Sample B)	03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab	Water	1L amber	120 mL	H ₂ SO ₄	
<i>For Lab Use Only</i>	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Soil	Cubitainer	HNO ₃		
	9:35							Organic	2 oz glass Nalgene	NAOH		
								Sludge	8 oz glass 1L	HCL		
								Other:	VOA vial	500mL	4° C(None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17309 (Sample C)	03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab	Water	1L amber	120 mL	H ₂ SO ₄	
<i>For Lab Use Only</i>	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Soil	Cubitainer	HNO ₃		
	9:45							Organic	2 oz glass Nalgene	NAOH		
								Sludge	8 oz glass 1L	HCL		
								Other:	VOA vial	500mL	4° C(None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17310 (Sample D)	03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab	Water	1L amber	120 ml.	H ₂ SO ₄	
<i>For Lab Use Only</i>	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Soil	Cubitainer	HNO ₃		
	9:03							Organic	2 oz glass Nalgene	NAOH		
								Sludge	8 oz glass 1L	HCL		
								Other:	VOA vial	500mL	4° C(None)	
									Encore	250mL	Disinfected	
									Other:		Other	
Relinquished By:		Received By:					Date:	Time:				
								3/30/10		1420		
Relinquished By:		Received By:					Date:	Time:				
Relinquished By:		Received By:					Date:	Time:				



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID: _____

Collector's Name: Transfer Chain of Custody to Applied Speciation and Consulting <small>(Please Print)</small>							Description of Shipment					
Affiliation: ESP KCRO NERO SERO SLRO SWRO WPP <small>(circle one)</small> DGLS IIWP Other:							<input checked="" type="checkbox"/> Shipped-Carrier: NEXT DAY-AIR <input checked="" type="checkbox"/> Tape sealed and initialed <input type="checkbox"/> Hand Delivered					
							No. Of Containers: 4					
Sample Number	Sample Collected	Analyses					Sample Type	For Lab Use Only				
								Matrix	Container		Preserved	
AB17311 (Sample A)	Date: 03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL H ₂ SO ₄ HNO ₃ NAOH HCL 4° C(None) Disinfected Other		
	<i>For Lab Use Only</i>	Time: 9:10	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:				
AB17312 (Sample B)	Date: 03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL H ₂ SO ₄ HNO ₃ NAOH HCL 4° C(None) Disinfected Other		
	<i>For Lab Use Only</i>	Time: 10:15	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:				
AB17313 (Sample C)	Date: 03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL H ₂ SO ₄ HNO ₃ NAOH HCL 4° C(None) Disinfected Other		
	<i>For Lab Use Only</i>	Time: 10:28	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:				
AB17314 (Sample D)	Date: 03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500mL Encore 250mL Other:	120 mL H ₂ SO ₄ HNO ₃ NAOH HCL 4° C(None) Disinfected Other		
	<i>For Lab Use Only</i>	Time: 10:55	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:				
Relinquished By: _____						Received By: <i>Antonia Lewis</i>						
Date: _____						Date: <i>3/16/10</i>						
Time: _____						Time: <i>1420</i>						
Relinquished By: _____						Received By: _____						
Date: _____						Date: _____						
Time: _____						Time: _____						
Relinquished By: _____						Received By: _____						
Date: _____						Date: _____						
Time: _____						Time: _____						



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID: _____

Collector's Name: Transfer Chain of Custody to Applied Speciation and Consulting <small>(Please Print)</small>							Description of Shipment					
Affiliation: ESP KCRO NERO SERO SLRO SWRO WPP <small>(circle one)</small> DGLS HWP Other: _____							<input checked="" type="checkbox"/> Shipped-Carrier: NEXT DAY--AIR <input checked="" type="checkbox"/> Tape sealed and initialed <input type="checkbox"/> Hand Delivered					
							No. Of Containers: 4					
Sample Number	Sample Collected	Analyses					Sample Type	For Lab Use Only				
	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Matrix:	Container		Preserved	
AB17315 (Sample A)	03/16/10						<input type="checkbox"/> Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified <input type="checkbox"/> Other:	<input type="checkbox"/> Water <input type="checkbox"/> Soil <input type="checkbox"/> Organic <input type="checkbox"/> Sludge <input type="checkbox"/> Other:	<input type="checkbox"/> 1L amber <input type="checkbox"/> Cubitainer <input type="checkbox"/> 2 oz glass Nalgene <input type="checkbox"/> 8 oz glass 1L <input type="checkbox"/> VOA vial <input type="checkbox"/> Encore <input type="checkbox"/> Other:	<input type="checkbox"/> 120 mL <input type="checkbox"/> 1L <input type="checkbox"/> 500mL <input type="checkbox"/> 250mL <input type="checkbox"/> Other:	<input type="checkbox"/> H ₂ SO ₄ <input type="checkbox"/> HNO ₃ <input type="checkbox"/> NaOH <input type="checkbox"/> HCl <input type="checkbox"/> 4° C (None) <input type="checkbox"/> Disinfected <input type="checkbox"/> Other:	
For Lab Use Only	Time: 10:55	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:					
AB17316 (Sample B)	03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					<input type="checkbox"/> Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified <input type="checkbox"/> Other:	<input type="checkbox"/> Water <input type="checkbox"/> Soil <input type="checkbox"/> Organic <input type="checkbox"/> Sludge <input type="checkbox"/> Other:	<input type="checkbox"/> 1L amber <input type="checkbox"/> Cubitainer <input type="checkbox"/> 2 oz glass Nalgene <input type="checkbox"/> 8 oz glass 1L <input type="checkbox"/> VOA vial <input type="checkbox"/> Encore <input type="checkbox"/> Other:	<input type="checkbox"/> 120 mL <input type="checkbox"/> 1L <input type="checkbox"/> 500mL <input type="checkbox"/> 250mL <input type="checkbox"/> Other:	<input type="checkbox"/> H ₂ SO ₄ <input type="checkbox"/> HNO ₃ <input type="checkbox"/> NaOH <input type="checkbox"/> HCl <input type="checkbox"/> 4° C (None) <input type="checkbox"/> Disinfected <input type="checkbox"/> Other:	
For Lab Use Only	Time: 9:15	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:					
AB17317 (Sample C)	03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					<input type="checkbox"/> Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified <input type="checkbox"/> Other:	<input type="checkbox"/> Water <input type="checkbox"/> Soil <input type="checkbox"/> Organic <input type="checkbox"/> Sludge <input type="checkbox"/> Other:	<input type="checkbox"/> 1L amber <input type="checkbox"/> Cubitainer <input type="checkbox"/> 2 oz glass Nalgene <input type="checkbox"/> 8 oz glass 1L <input type="checkbox"/> VOA vial <input type="checkbox"/> Encore <input type="checkbox"/> Other:	<input type="checkbox"/> 120 mL <input type="checkbox"/> 1L <input type="checkbox"/> 500mL <input type="checkbox"/> 250mL <input type="checkbox"/> Other:	<input type="checkbox"/> H ₂ SO ₄ <input type="checkbox"/> HNO ₃ <input type="checkbox"/> NaOH <input type="checkbox"/> HCl <input type="checkbox"/> 4° C (None) <input type="checkbox"/> Disinfected <input type="checkbox"/> Other:	
For Lab Use Only	Time: 10:10	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:					
AB17318 (Sample D)	03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					<input type="checkbox"/> Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified <input type="checkbox"/> Other:	<input type="checkbox"/> Water <input type="checkbox"/> Soil <input type="checkbox"/> Organic <input type="checkbox"/> Sludge <input type="checkbox"/> Other:	<input type="checkbox"/> 1L amber <input type="checkbox"/> Cubitainer <input type="checkbox"/> 2 oz glass Nalgene <input type="checkbox"/> 8 oz glass 1L <input type="checkbox"/> VOA vial <input type="checkbox"/> Encore <input type="checkbox"/> Other:	<input type="checkbox"/> 120 mL <input type="checkbox"/> 1L <input type="checkbox"/> 500mL <input type="checkbox"/> 250mL <input type="checkbox"/> Other:	<input type="checkbox"/> H ₂ SO ₄ <input type="checkbox"/> HNO ₃ <input type="checkbox"/> NaOH <input type="checkbox"/> HCl <input type="checkbox"/> 4° C (None) <input type="checkbox"/> Disinfected <input type="checkbox"/> Other:	
For Lab Use Only	Time: 14:50	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:					
Relinquished By: _____					Received By: <i>[Signature]</i>		Date: 3/16/10		Time: 14:20			
Relinquished By: _____					Received By: _____		Date: _____		Time: _____			
Relinquished By: _____					Received By: _____		Date: _____		Time: _____			



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID: _____

Collector's Name: <u>Transfer Chain of Custody to Applied Speciation and Consulting</u> <i>(Please Print)</i>								Description of Shipment				
Affiliation: <u>ESP</u> <u>KCRO</u> <u>NERO</u> <u>SERO</u> <u>SIRO</u> <u>SWRO</u> <u>WPP</u> <i>(circle one)</i> <u>DGLS</u> <u>IIWP</u> Other: _____								<input checked="" type="checkbox"/> Shipped-Carrier: <u>NEXT DAY-AIR</u> <input checked="" type="checkbox"/> Tape sealed and initialed <input type="checkbox"/> Hand Delivered				
Sample Number	Sample Collected	Analyses						Sample Type	For Lab Use Only			
									Matrix	Container	Preserved	
AB17319 (Sample A)	Date: 03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified Other: _____	Water	1L amber	120 ml.	H ₂ SO ₄
	Time: 14:40	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:		Soil	Cubitainer		HNO ₃
For Lab Use Only		D.O.	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass Nalgene		NAOH	
								Sludge	8 oz glass 1L		HCL	
								Other:	VOA vial	500mL	4° C (None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17320 (Sample B)	Date: 03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified Other: _____	Water	1L amber	120 ml.	H ₂ SO ₄
	Time: 9:20	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:		Soil	Cubitainer		HNO ₃
For Lab Use Only		D.O.	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass Nalgene		NAOH	
								Sludge	8 oz glass 1L		HCL	
								Other:	VOA vial	500mL	4° C (None)	
									Encore	250mL	Disinfected	
									Other:		Other	
AB17321 (Sample C)	Date: 03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified Other: _____	Water	1L amber	120 ml.	H ₂ SO ₄
	Time: 9:40	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:		Soil	Cubitainer		HNO ₃
For Lab Use Only		D.O.	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass Nalgene		NAOH	
								Sludge	8 oz glass 1L		HCL	
								Other:	VOA vial	500ml.	4° C (None)	
									Encore	250mL	Disinfected	
									Other:		Other	
* AB17322 (Sample D)	Date: 03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab <input checked="" type="checkbox"/> Composite <input type="checkbox"/> Modified Other: _____	Water	1L amber	120 ml.	H ₂ SO ₄
	Time: 10:10	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:		Soil	Cubitainer		HNO ₃
For Lab Use Only		D.O.	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass Nalgene		NAOH	
								Sludge	8 oz glass 1L		HCL	
								Other:	VOA vial	500mL	4° C (None)	
									Encore	250ml.	Disinfected	
									Other:		Other	
Relinquished By: _____				Received By: <u>[Signature]</u>				Date: 3/16/10	Time: 14:40			
Relinquished By: _____				Received By: _____				Date: _____	Time: _____			
Relinquished By: _____				Received By: _____				Date: _____	Time: _____			

* Original container broken - ASC transferred sample to same type of jar



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID: _____

Collector's Name: <i>(Please Print)</i> Transfer Chain of Custody to Applied Speciation and Consulting		Description of Shipment									
Affiliation: ESP KCRO NERO SERO SLRO SWRO WPP <i>(circle one)</i> DGLS HWP Other: _____		<input checked="" type="checkbox"/> Shipped-Carrier: NEXT DAY-AIR				<input checked="" type="checkbox"/> Tape sealed and initialed					
		Hand Delivered				No. Of Containers: 4					
Sample Number	Sample Collected	Analyses					Sample Type	For Lab Use Only			
AB17323 (Sample A)	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water	1L amber	120 mL	H ₂ SO ₄
	03/16/10							Soil	Cubitainer		HNO ₃
For Lab Use Only	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass	Nalgene	NaOH
	14:00							Sludge	8 oz glass	1L	HCl
								Other:	VOA vial	500mL	4° C(None)
									Encore	250ml.	Disinfected
									Other:		Other
AB17324 (Sample B)	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water	1L amber	120 mL	H ₂ SO ₄
	03/16/10							Soil	Cubitainer		HNO ₃
For Lab Use Only	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass	Nalgene	NaOH
	13:30							Sludge	8 oz glass	1L	HCl
								Other:	VOA vial	500mL	4° C(None)
									Encore	250ml.	Disinfected
									Other:		Other
AB17325 (Sample C)	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water	1L amber	120 mL	H ₂ SO ₄
	03/16/10							Soil	Cubitainer		HNO ₃
For Lab Use Only	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass	Nalgene	NaOH
	13:30							Sludge	8 oz glass	1L	HCl
								Other:	VOA vial	500mL	4° C(None)
									Encore	250mL	Disinfected
									Other:		Other
AB17326 (Sample D)	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture					Grab <input checked="" type="checkbox"/> Composite Modified	Water	1L amber	120 mL	H ₂ SO ₄
	03/16/10							Soil	Cubitainer		HNO ₃
For Lab Use Only	Time:	D.O	Flow	pH	Spec. Cond.	Temp.	Other:	Organic	2 oz glass	Nalgene	NaOH
	10:25							Sludge	8 oz glass	1L	HCl
								Other:	VOA vial	500ml.	4° C(None)
									Encore	250mL	Disinfected
									Other:		Other
Relinquished By:		Received By: <i>Asafa Lewis</i>				Date: <i>3/16/10</i>	Time: <i>14:00</i>				
Relinquished By:		Received By:				Date:	Time:				
Relinquished By:		Received By:				Date:	Time:				



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID: _____

Collector's Name: <u>Transfer Chain of Custody to Applied Speciation and Consulting</u>								Description of Shipment				
<i>(Please Print)</i>								X Shipped-Carrier: <u>NEXT DAY-AIR</u>				
Affiliation: FSP _____ KCRO _____ NERO _____ SERO _____ SIRO _____ SWRO _____ WIP _____								X Tape sealed and initialed				
<i>(circle one)</i> DGLS _____ IIWP _____ Other: _____								Hand Delivered _____ No. Of Containers: <u>4</u>				
Sample Number	Sample Collected	Analyses						Sample Type	For Lab Use Only			
								Matrix	Container		Preserved	
AB17327	Date: 03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab X Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500ml Encore 250ml Other:	120 mL	H ₂ SO ₄ HNO ₃ NaOH HCl 4° C (None) Disinfected Other
<i>For Lab Use Only</i>	Time: 11:30	D.O	Flow	pH	Spec. Cond.	Temp.	Other:					
AB17328	Date: 03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab X Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500ml Encore 250ml Other:	120 mL	H ₂ SO ₄ HNO ₃ NaOH HCl 4° C (None) Disinfected Other
<i>For Lab Use Only</i>	Time: 11:38	D.O	Flow	pH	Spec. Cond.	Temp.	Other:					
AB17329	Date: 03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab X Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500ml Encore 250ml Other:	120 mL	H ₂ SO ₄ HNO ₃ NaOH HCl 4° C (None) Disinfected Other
<i>For Lab Use Only</i>	Time: 9:55	D.O	Flow	pH	Spec. Cond.	Temp.	Other:					
AB17330	Date: 03/16/10	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Grab X Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial 500ml Encore 250ml Other:	120 mL	H ₂ SO ₄ HNO ₃ NaOH HCl 4° C (None) Disinfected Other
<i>For Lab Use Only</i>	Time: 11:52	D.O	Flow	pH	Spec. Cond.	Temp.	Other:					
Relinquished By: _____							Received By: <u>[Signature]</u>		Date: <u>3/16/10</u>		Time: <u>14:30</u>	
Relinquished By: _____							Received By: _____		Date: _____		Time: _____	
Relinquished By: _____							Received By: _____		Date: _____		Time: _____	



MISSOURI DEPARTMENT OF NATURAL RESOURCES
FIELD SHEET AND CHAIN-OF-CUSTODY RECORD

LABORATORY ORDER ID: _____

Collector's Name: <u>Transfer Chain of Custody to Applied Speciation and Consulting</u>		Description of Shipment									
<i>(Please Print)</i>		X Shipped-Carrier: <u>NEXT DAY-AIR</u>									
Affiliation: <u>ESP</u> <u>KCRO</u> <u>NERO</u> <u>SERO</u> <u>SLRO</u> <u>SWRO</u> <u>WPP</u>		X Tape sealed and initialed				No. Of Containers: <u>4</u>					
<i>(circle one)</i> <u>DGLS</u> <u>HWP</u> <u>Other:</u>		Hand Delivered									
Sample Number	Sample Collected	Analyses					Sample Type	For Lab Use Only			
	Date:	Hexavalent Chromium by EPA SW-846 Method 7199, Percent Moisture						Matrix	Container	Preserved	
AB17331 (Sample A)	03/16/10						Grab X Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial Encore Other:	120 mL 1L 1L 500mL 250mL	H ₂ SO ₄ HNO ₃ NAOH HCL 4° C (None) Disinfected Other
<i>For Lab Use Only</i>	Time: 11:10	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:				
AB17332 (Sample B)	03/16/10						Grab X Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial Encore Other:	120 ml 1L 1L 500mL 250mL	H ₂ SO ₄ HNO ₃ NAOH HCL 4° C (None) Disinfected Other
<i>For Lab Use Only</i>	Time: 12:00	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:				
AB17333 (Sample C)	03/16/10						Grab X Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial Encore Other:	120 mL 1L 1L 500mL 250mL	H ₂ SO ₄ HNO ₃ NAOH HCL 4° C (None) Disinfected Other
<i>For Lab Use Only</i>	Time: 11:45	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:				
AB17334 (Sample D)	03/16/10						Grab X Composite Modified	Water Soil Organic Sludge Other:	1L amber Cubitainer 2 oz glass Nalgene 8 oz glass 1L VOA vial Encore Other:	120 mL 1L 1L 500ml 250mL	H ₂ SO ₄ HNO ₃ NAOH HCL 4° C (None) Disinfected Other
<i>For Lab Use Only</i>	Time: 12:10	D.O.	Flow	pH	Spec. Cond.	Temp.	Other:				
Relinquished By: _____		Received By: <u>[Signature]</u>				Date: <u>3/16/10</u>	Time: <u>1:20</u>				
Relinquished By: _____		Received By: _____				Date: _____	Time: _____				
Relinquished By: _____		Received By: _____				Date: _____	Time: _____				

Attachment D

MDHSS Response Letter



Missouri Department of Health and Senior Services

P.O. Box 570, Jefferson City, MO 65102-0570 Phone: 573-751-6400 FAX: 573-751-6010
RELAY MISSOURI for Hearing and Speech Impaired 1-800-735-2966 VOICE 1-800-735-2466

Margaret T. Donnelly
Director



Jeremiah W. (Jay) Nixon
Governor

May 12, 2010

RECEIVED

Evan Kifer
Remedial Project Manager
Superfund Section
Hazardous Waste Program
Department of Natural Resources

HAZARDOUS WASTE PROGRAM
MO Dept. of Natural Resources

Re: Comments on the Report of the Soil Sampling Analytical Results for Hexavalent Chromium at the Bee Cee Manufacturing Site, Malden, Missouri.

Dear Mr. Kifer:

The Missouri Department of Health and Senior Services (DHSS) received your request dated April 19, 2010 to evaluate the analytical results for hexavalent chromium in soils at the Bee Cee Manufacturing Site, Malden, Missouri. You have requested that we review and comment on the protectiveness of the remedy assuming a long-term use of the site as industrial/commercial. We understand further that you anticipate modifying the Environmental Covenant, limiting the long-term use of the site to industrial / commercial. DHSS's comments are provided below.

Assuming an industrial/commercial use scenario, a number of soil sample results exceed the U.S. EPA Regional Screening Level of 5.6 mg/kg (at 1.0E-06) for industrial use. However, none of the sample results would exceed a screening level of 56 mg/kg at 1.0E-05 level. Of note as well is that many of the samples exceed site background levels by a factor of 3 or more.

Because construction is a distinct possibility at the site in the future, we developed a Cr⁶⁺ soil screening level for a construction scenario. The result was a screening level of 41.6 mg/kg (1.0E-05) for the construction worker (see attached for details). None of the sample results exceed this screening level. Based on these evaluations, DHSS concludes that the site does not appear to pose an unacceptable risk from soil exposure under an industrial/commercial use scenario.

We appreciate to be of assistance. If you have any questions, please contact Dennis Wambuguh or Michelle Hartman at (573) 751-6102.

Sincerely,

Cherri Baysinger, Chief
Bureau of Environmental Epidemiology

CB/JG/DW/mp

www.dhas.mo.gov

Healthy Missourians for life.

The Missouri Department of Health and Senior Services will be the leader in promoting, protecting and partnering for health

AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER. Services provided on a nondiscriminatory basis

Construction Worker Chromium VI Soil Screening Level (mg/kg)	47.6
--	------

SL_{Oral}	433.6
$SL_{Inhalation}$	46.0

Screening Level (mg/kg) = $1 / ((1/SL_{Oral}) + (1/SL_{Inhalation}))$, where:

$$SL_{Oral} = TR \times AT \times BW / SF_o \times IR \times CF_1 \times EF \times ED$$

$$SL_{Inhalation} = TR \times AT / UR_i \times CF_2 \times (1/PEF) \times EF \times ED \times (ET/24)$$

Toxicity Values

SF_o = Oral Slope Factor*	$(mg/kg\text{-day})^{-1}$	0.50
UR_i = Inhalation Unit Risk	$(\mu g/m^3)^{-1}$	8.40E-02

Exposure Parameters

TR = Target Cancer Risk	unitless	1.0E-05
AT = Averaging Time	days	25550
BW = Adult Body Weight	kg	70
IR = Soil Ingestion Rate	mg/day	330
CF_1 = Conversion Factor	kg/mg	1.00E-06
PEF = Particulate Emission Factor	m^3/kg	calculated
CF_2 = Conversion Factor	$\mu g/mg$	1000
EF = Exposure Frequency	days/year	250
ED = Exposure Duration	years	1
ET = Exposure Time	hours/day	8

Calculation of Particulate Emission Factor for Construction Worker Exposure

$$PEF (m^3/kg) = (Q/C_{gr}) \times (1/F_D) \times [(T \times A_R) / (556 \times (W/3)^{0.4} \times ((365d/y - p) / 365d/y) \times VKT)]$$

PEF = Particulate Emission Factor	m^3/kg	1.26E+06
Q/C_{gr} = Inverse of the Ratio of the 1-h Geometric Mean Air Concentration to the Emission Flux Along a Straight Road Segment Bisecting a Square Site	$g/m^2\text{-s per } kg/m^3$	23.02
F_D = Dispersion Correction Factor	unitless	0.186
T = Total Time Over Which Construction Occurs	s	7200000
A_R = Surface Area of Contaminated Road Segment	m^2	274.213
W = Mean Vehicle Weight	tons	8
p = Number of Days with at Least 0.01 inches of Precipitation	days/year	110
VKT = Sum of Fleet Vehicle Kilometers Traveled During the Exposure Duration	km	337.4

US EPA, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, 2002

* New Jersey Department of Environmental Protection (NJDEP Chromium Workgroup, 2009)