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June 17, 2013

Mr. Jason Metzger
Unit Coordinator
Georgia Environmental Protection Division Land Protection Branch
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Suite 1462 East
Atlanta, Georgia 30334

Subject: June 2013 Semi-Annual Voluntary Remediation Program Progress Report
Former Manchester Tank Company (HSI No. 10765)
Cedartown, Polk County, Georgia

Dear Mr. Metzger:

This Progress Report documents the activities completed for the Former Manchester Tank Company (Manchester Tank) site in Cedartown, Georgia from December 2012 through May 2013. This reporting schedule follows that prescribed by the Georgia Environmental Protection Division (EPD) in a letter dated June 4, 2010. This Progress Report includes the following:

- Work Performed This Period;
- Recent Sampling Results and Evaluations;
- Current Site Conceptual Model;
- Work Anticipated for the Next Period;
- Schedule; and
- Professional Certification.

Work Performed This Period

The following work was performed from December 2012 through May 2013:

- New access agreements were negotiated and executed with The Hon Company LLC, whose property is located immediately west of the former Manchester Tank site, and with Missouri Machine and Plow, LLC (Missouri M&P), whose property is located immediately east of the former Manchester Tank property.

- Two additional Unit C wells (MW-53C and MW-54C) were installed and sampled on the Hon property west of the site.
- An additional Unit D well (MW-55D) was installed and sampled on the Missouri M&P site.
- Soil vapor intrusion modeling was performed for the offsite residential area east of the Manchester Tank and Missouri M&P properties. Soil vapor samples were also collected in the offsite residential area.
- Statistical analyses were performed to further evaluate whether previously observed metals concentrations are attributable to background conditions. Based on the results of these analyses, focused additional soil sampling was completed.

Recent Sampling Results and Evaluations

During the previous 6-month period (June – December 2012), three phases of assessment activities were completed. These activities were primarily focused on delineating the extent of volatile organic compounds (VOCs) in groundwater, and the results were summarized in the December 2012 Progress Report. During the current period, additional activities were completed to address remaining data gaps before delineation to EPD criteria could be considered complete. Specifically, the objectives of the recent investigation and evaluation activities were to:

- Complete vertical delineation of VOCs in groundwater considering that MW-43D, a Unit D well previously installed to a depth of 251 feet on site, shows VOC detections above Type 1 Risk Reduction Standards (RRSs);
- Complete horizontal delineation of VOCs in groundwater to the west considering that MW-41C, a previously installed well located upgradient near the western property boundary, shows VOCs detections above Type 1 RRSs;
- Evaluate vapor intrusion risks for the offsite residences located east of the Manchester Tank and Missouri M&P properties; and
- Determine whether select metals are chemicals of concern based on site collected data.

Results from the recent investigation and evaluation activities are summarized in the following subsections.

New Well Installation and Sampling

During the last week in February and first week in March 2013, two new Unit C wells (MW-53C and MW-54C) were installed on the Hon property. Well locations are presented on **Figure 1**. MW-53C was completed into bedrock at a depth of 75 feet, and MW-54C was completed into bedrock at a depth of 51.5 feet. These wells were subsequently sampled, and associated results are presented in **Table 1** along with previous results. VOCs were not detected in groundwater samples from MW-53C or MW-54C with the exception of trichloroethene (TCE) at 6.8 micrograms per liter (ug/L) in the MW-54C sample. A separate sample of purge water from MW-54C showed no VOCs.

During the weeks of May 13th and 20th, 2013, an additional Unit D well (MW-55D) was installed on the Missouri M&P property. This well is presented on Figure 1 and was completed to a depth of 445 feet with steel casing installed to 250 feet deep. MW-55D was sampled on May 23rd, and associated results showing that the sample was below detection for all VOCs are presented in Table 1.

Soil Vapor Intrusion Analysis and Soil Gas Sampling

For offsite residences where VOCs in groundwater may be present, CDM Smith performed initial vapor intrusion analyses utilizing the U.S. Environmental Protection Agency's vapor intrusion screening level (VISL) calculator (Version 2.0, November 2012) and Johnson and Ettinger Model (JEM). Depending on which model and associated variants were used, TCE and vinyl chloride (VC) have the potential to exceed carcinogenic and non-carcinogenic target risks to occupants of the subject residences based on vapor intrusion from groundwater.

Based on the results of the initial analyses, CDM Smith concluded that soil gas sampling should be performed. To further evaluate whether or not TCE and VC pose potential risks, soil gas sampling was performed at three locations (SG-1, -2, and -3 shown on Figure 1) in the right-of-ways of the adjacent residences. These locations were selected for soil vapor sampling because they are located in the area of the highest VOC concentrations in groundwater in Unit A near the residential area based on data from GP-2A. The soil gas results are summarized in **Table 2**.

TCE, the most widespread VOC associated with the site, was not detected in any of the soil vapor samples. The TCE concentration previously reported in groundwater at GP-2A was 490 ug/L. In general, the detected VOCs in soil vapor were gasoline-related compounds with the exception of acetone, methyl ethyl ketone, and carbon disulfide, which were not detected in GP-2A either. CDM Smith believes that the VOCs detected in the soil vapor samples may originate from the sanitary sewer that flows through the residential area.

As shown in Table 2, CDM Smith applied the VISL calculator to assess the soil gas results. The VISL calculation sheets are included in **Attachment A**. Table 2 includes calculations of the residential land use target concentrations for indoor air and soil gas. One VOC, benzene, exceeded the calculated target soil gas concentration. However, benzene is not a site-related VOC. CDM Smith also calculated the indoor air concentrations from the soil gas results using the VISL calculator. For these calculations, the reporting level was used in the calculation for sample results that were below the reporting level. Carcinogenic risks and hazard quotients were also calculated from the calculated indoor air concentrations. As expected, benzene again showed a potential risk. The remainder of the detected VOCs showed acceptable risks. However, the reporting level for 1,1,2-trichloroethane of 11 mg/m^3 exceeded the target soil gas concentration of 2.1 mg/m^3. Neither benzene nor 1,1,2-trichloroethane were detected in groundwater at GP-2A.

Metals in Soil Delineation

EPD requires that contaminants in soil be delineated to the Type 1, unrestricted land use, RRSs or background, whichever is greater. Previous site investigations included metals in the laboratory analyses for soil on the Manchester Tank site, and several metals were found to exceed the Type 1 RRSs. Specifically, the metals that exceeded the Type 1 RRSs in soil were arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, vanadium, and zinc. Previous attempts to establish site-specific background metal concentrations using the samples collected from the Manchester Tank site did not reduce the number of metals on the site considered to be chemicals of potential concern (COPCs). However, most of the metals concentrations were low, and it appeared that many of these metal concentrations could have been associated with background.

Missouri M&P had also previously investigated metals in soil and concluded that the Missouri M&P metals results were background. EPD required no further action from Missouri M&P related to metals in soil. As a result, CDM Smith added the Missouri M&P soil data to the background database for Manchester Tank and developed revised background concentrations using a simplified approach whereby background equates to the average concentration plus two times the standard deviation. These revised background concentrations are included in **Table 3**. While the revised concentrations reduced the number of locations that exceeded the RRSs, they did not reduce the number of COPCs.

As a result, CDM Smith conducted a more in-depth statistical analysis of the data to assess the background soil concentrations. The complete analysis is included in **Attachment B**. In general, three types of data analyses were performed with each producing independent conclusions. The three types are summarized below and discussed in more detail in Attachment B.

UPL95 – The 95% confidence upper prediction limit (UPL95) was determined for the Manchester Tank background samples as an alternate background concentration. The UPL95 values were calculated using ProUCL Version 4.1, which is a widely accepted method for calculating background by the U.S. Environmental Protection Agency and other state agencies. These results are also summarized in Table 3, and when compared to the Manchester Tank samples, several metals were eliminated. The metals that were retained as COPCs include chromium and lead. Lead exceeded in only one sample. Cadmium was also retained because insufficient detections were available to support the analysis.

Manchester Tank / Missouri M&P Comparisons – The data from Manchester Tank were compared to the data from Missouri M&P under the assumption that the Missouri M&P data are representative of the background population. The comparison used probability plots to evaluate the data distributions. Based on this comparison, chromium and lead from Manchester Tank exceeded the corresponding distributions for these two metals on Missouri M&P.

Geochemical Association – Chromium and lead were also compared to vanadium, assumed to not be a site-related metal, using a geochemical association analysis and scatter plots. This analysis resulted in the same conclusion for chromium and lead: the data are possible mixtures of two populations. This concept is expanded upon below.

Expectation Maximization - This analysis uses only the data from Manchester Tank and applies an iterative estimation method to separate distributions from a dataset that contains multiple populations. The analysis concluded that chromium and lead consisted of two populations. The lower concentration population is inarguably assumed to represent natural background. The second population could represent background conditions that have resulted from anthropogenic effects related or unrelated to the site. Typically, it is expected that three populations would emerge from this analysis, natural background, anthropogenic background, and site-related, if site-related activities had affected the soil.

Assuming that a population associated with anthropogenic background is present, chromium remains as a COPC at SB-5 and SB-7 and lead remains as a COPC at SB-3. Cadmium remains a COPC because insufficient detections are available to allow any type of analysis. While the list of COPCs and the offending locations are reduced by this analysis, a few focused questions remained that CDM Smith attempted to resolve using a focused sampling program. **Figure 2** includes the historical sampling locations, the additional focused sampling locations (SB-10 through SB-18), and the locations exceeding the UPL95 background.

Cadmium has had only two detections and only one, the 6-foot sample at SB-3, exceeds the Type 1 RRS. This same sample is also the only one where the lead concentration of 312 mg/kg exceeds the UPL95 background concentration and is approximately double any other lead result from the site. CDM smith concluded that this sample was an outlier and, as a result, CDM Smith collected a sample intended to replicate the previous SB-3 sample to determine whether the result could be reproduced. The replicate sample from SB-11 was non-detect for cadmium, and lead was reported at 31.6 mg/kg and below the delineation criteria. As a result, CDM Smith concluded that the original SB-3 sample was an outlier and removed cadmium and lead from the COPC list with chromium being retained.

Ten additional soil samples were collected for chromium analyses. Four locations were selected to replicate the historical data as described above. These locations included SB-10 through SB-13. Previous exceedances at SB-2 and SB-5 were not reproduced while exceedances at SB-3 and SB-7 were reproduced. Several additional soil samples were collected for further chromium delineation and assessment of background. **Figure 3** includes a soil chromium delineation map that shows the area estimated to exceed the Type 1 RRS. Only one sample, SB-7, exceeds the assumed anthropogenic background concentration of 215 mg/kg. CDM Smith believes that the Type 1 RRS exceedances area is limited to the west because the elevation of the road is higher than the site, which would limit migration in this upgradient direction, and because site activities were not conducted on the roadway or beyond the west fence line.

Current Site Conceptual Model

The bedrock beneath the site is the Newala Limestone that is overlain by a thin veneer of weathered limestone residuum, and the bedrock is present at land surface at several locations. The site hydrogeology has been classified on a site-specific basis to include four units, as summarized below.

<u>Unit A Residuum</u> – This is the uppermost unit and is typically unsaturated but may contain groundwater under water table conditions where it is thick enough. The residuum ranges from sandy clay to clayey sand, has an average 12-foot thickness, and has a maximum observed thickness of 25 feet. Groundwater flow in the residuum is to the northwest toward Cedar Creek. The borings near Cedar Creek and a reconnaissance along the creek did not identify any alluvial deposits west of the creek. Rather, the west creek bank is composed of weathered limestone residuum and limestone. It appears that the channel of Cedar Creek has not historically migrated any further to the west than its present position.

<u>Unit B Upper Bedrock</u> - The uppermost bedrock typically contains groundwater under water table conditions. A definitive demarcation between Units B and underlying Unit C does not exist but Unit B is assumed to be limited to within approximately 30 feet of land surface. The Unit B limestone has few fractures, which tend to be thin and produce little groundwater. Unit A and B are mapped together and represent the uppermost groundwater, which is under water table conditions.

Unit C Bedrock – This unit is similar to Unit B except that the fractures tend to be less frequent, and groundwater in Unit C is presumed to be confined to some extent. A definitive demarcation between Units C and underlying Unit D does not exist but Unit C is assumed to be limited to within approximately 95 feet of land surface.

Unit D Bedrock - The limestone bedrock, believed to be the Newalla Limestone, is dense, hard, light gray to dark gray, and contains numerous styolites. Rock quality designations (RQDs) from cores obtained at MW-43D averaged 96% with no observed fractures. The bedding planes observed in the rock cores were horizontal. Drilling of deep exploratory well MW-43D indicated no fractures from approximately 95 feet until approximately 225 feet below land surface. Fractures were not indicated for the entire 450-foot depth drilled for MW-55D. Groundwater is present at depth in both wells. Unit D is primarily a semi-confining unit. However, microfractures and possibly the primary porosity of the limestone bedrock have allowed VOCs to migrate into this unit on site.

Figure 4 includes the Unit A/B potentiometric surface and distribution of TCE in groundwater. TCE was selected for presentation since it has the highest number of Type 1 RRS exceedances and in general, is detected in higher concentrations than other VOCs. As shown on Figure 4, the TCE plume in groundwater appears to be split into a north flow component toward MW-18B and a northeast flow component toward MW-5B. The source of VOCs has been assumed to be the former disposal pit located on the Manchester Tank site. In general, the recent investigation data supports this assumption. The November 2012 water levels indicate groundwater mounding in the vicinity of MW-3B, and the resulting groundwater flow patterns and TCE distribution correlate well. The extent of TCE is limited to the Manchester Tank and Missouri M&P properties with the exception of a small area near GP-2A.

TCE in Unit C groundwater (**Figure 5**) follows a similar pattern as Unit A/B groundwater except that the interpolated plume is shown as discontinuous. Whether this is true cannot be answered based on the current data. Concentrations observed in MW-51C, for example, may be attributable to the former disposal pit or to a small source near MW-51C. While the plume may or may not be continuous, delineation to Type 1 RRS delineation appears complete in all directions. The vertical delineation of VOCs in groundwater is also now complete based on the current data from MW-55D. In addition, no VOCs have been detected in MW-35D off site.

Work Anticipated for the Next Period

Based on the recent sampling results and site conceptual model, CDM Smith believes that the site has been properly delineated per EPD criteria. Preparation will now begin on a Corrective Action Plan (CAP). Submittal of a CAP and review by EPD is expected to comprise the majority or all of the next 6-month period.

Updated Schedule

The project is proceeding in general accordance with the schedule submitted with the December 2012 Progress Report. This includes submittal of a CAP on or before September 1st. As noted above, activities for the next six months are expected to be limited to CAP preparation, submittal, and EPD review. A corrective action implementation schedule will be included in the CAP.

Professional Certification

Attachment C contains the professional certification and summary of incurred professional engineer and geologist hours for the period from November 25, 2012 through June 1, 2013.

If you have any questions regarding this Progress Report, please do not hesitate to contact me at (423) 771-4495.

Sincerely,

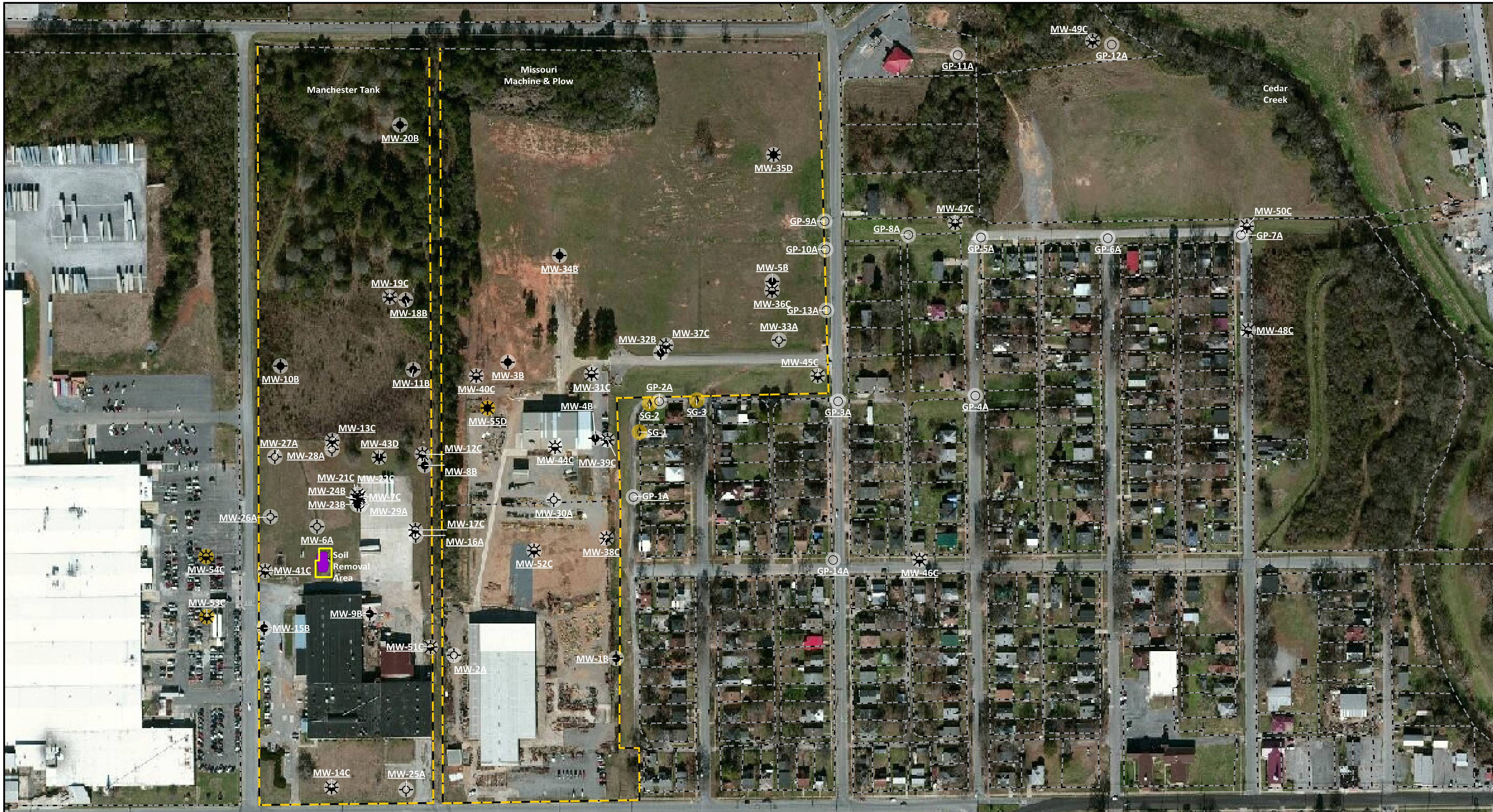
Andrew Romanek

Andrew P. Romanek, P.E., BCEE
Associate
CDM Smith Inc.

Attachments

cc: Jamie Schiff, Textron

Figures



Residuum Geoprobe, Zone A
Residuum Well, Zone A
Shallow Bedrock Water Table Well, Zone B
Current Investigation Locations
Previous Investigation Locations
Bedrock Well, Zone C
Deep Bedrock Well, Zone D
Soil Boring
Soil Vapor Sample

N

Scale in Feet

0 250 500

Figure 1: Recent Site Investigations

June 2013 Status Report

Former Manchester Tank Company Site

(HSI #10765)

Cedartown, Polk County, Georgia

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Background Soil Sample
Soil Sample Below Delineation Criteria
Soil Sample Exceeds Delineation Criteria

Delineation Criteria: The greater of the Type 1 Soil Risk Reduction Standard or background (95% confidence upper prediction limit).

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Figure 2
Soil Sample Locations
June 2013 Status Report
Former Manchester Tank Company Site
(HSI #10765)
Cedartown, Polk County, Georgia

Estimated Area Exceeding the Type 1 Chromium Soil Risk Reduction Standard

Soil Sample Below Chromium Type 1 RRS

Soil Sample Exceeds Type 1 Chromium RRS

Posted values are chromium in soil, mg/kg.

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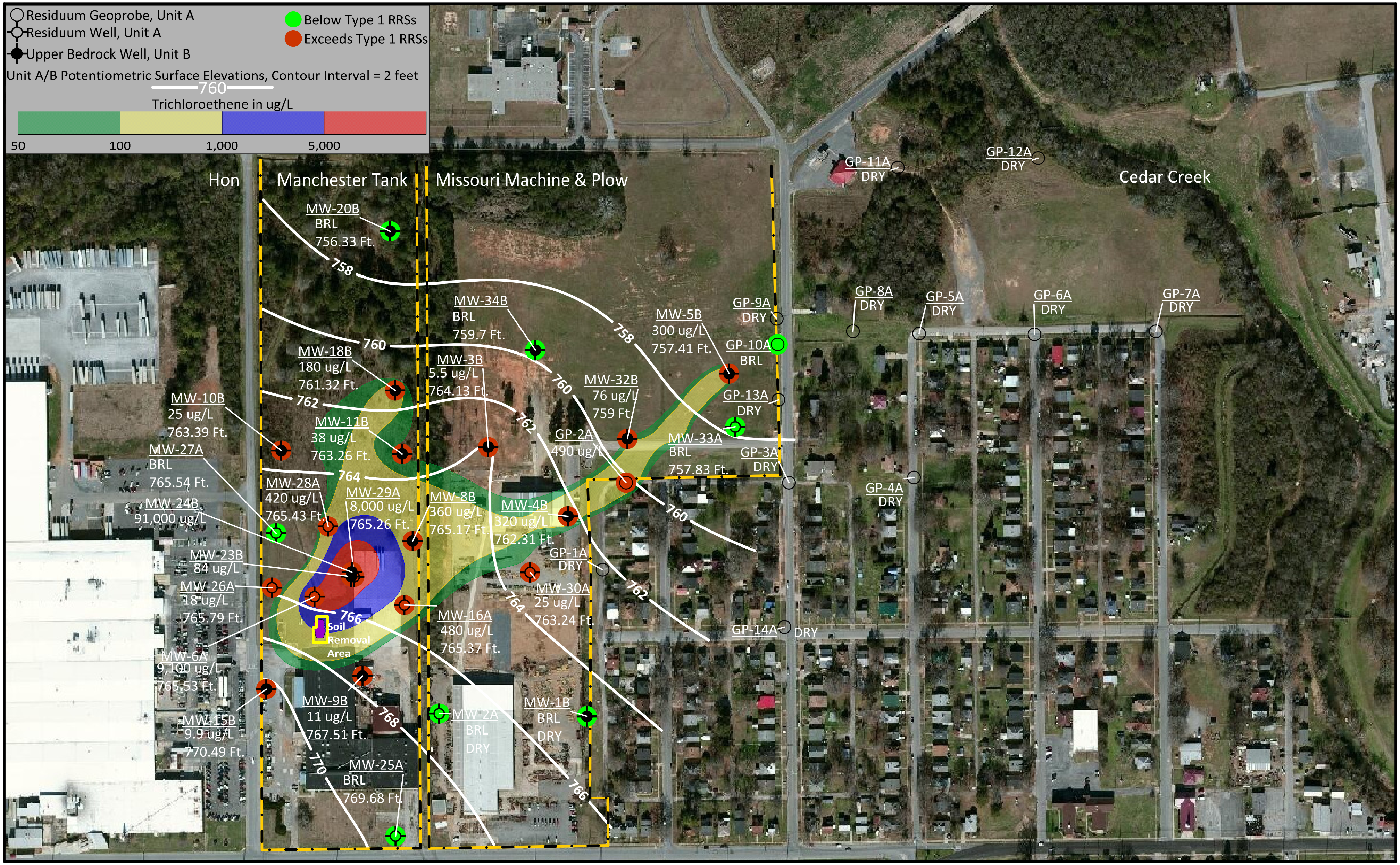
Figure 3

Soil Chromium Delineation

June 2013 Status Report

Former Manchester Tank Company Site (HSI #10765)

Cedartown, Polk County, Georgia



NOTE: Posted values are trichloroethene in groundwater and potentiometric surface.
Sampling was perfomed from 6/2012 to 10/2012 and water levels were recorded during 11/2012.

N

Scale in Feet

0 400 800

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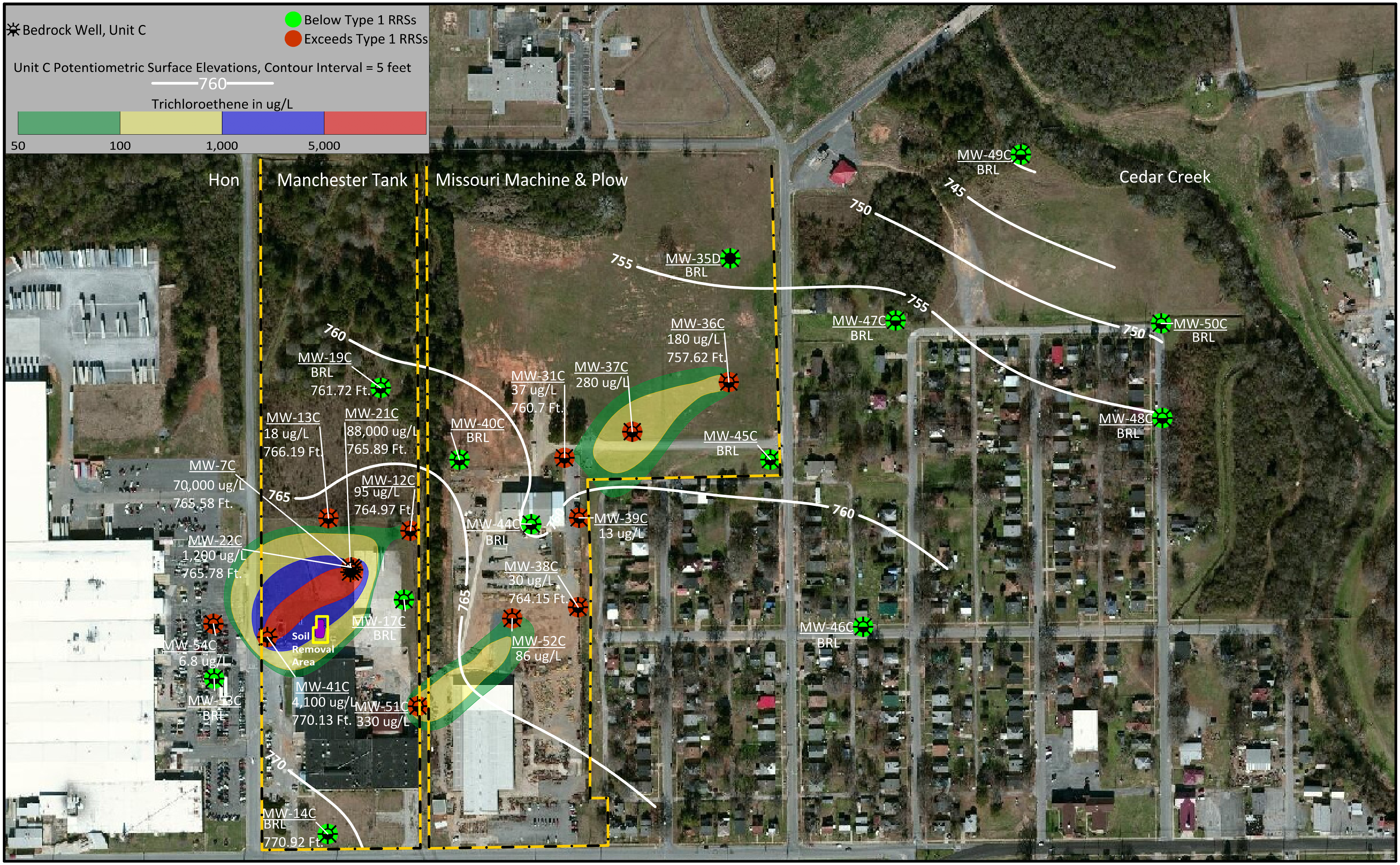
Figure 4: Unit A/B Investigation Results

June 2013 Status Report

Former Manchester Tank Company Site

(HSI #10765)

Cedartown, Polk County, Georgia



NOTE: Posted values are trichloroethene in groundwater and potentiometric surface.
Sampling was perfomed from 6/2012 to 3/2013 and water levels were recorded during 11/2012.

N

Scale in Feet

0 400 800

WATER + ENVIRONMENT + TRANSPORTATION + ENERGY + FACILITIES

Figure 5: Unit C Investigation Results

June 2013 Status Report

Former Manchester Tank Company Site

(HSI #10765)

Cedartown, Polk County, Georgia

Tables

Table 1

Groundwater Sampling Results Summary

June 2013 Progress Report

Former Manchester Tank Site

Cedartown, Georgia

Well ID	Sample Date	*Compounds and Type 1 Risk Reduction Standards in ug/L*														
		1,1,1-TCA	**1,1,2-TCA**	**1,1-DCA**	**1,1-DCE**	**1,2-DCA**	**cis-1,2-DCE**	**trans-1,2-DCE**	**Acetone**	**Isopropylbenzene**	**MEK**	**PCE**	**Toluene**	**TCE**	**Vinyl Chloride**	**Xylenes**
		200	5	4,000	7	5	70	100	4,000	*	2,000	5	1,000	5	2	10,000
Unit A / B Wells and Borings																
GP-2A	10/2/12	86			16		320	5.6						490		
GP-10A	10/3/12															
MW-1B	7/17/12															
MW-4B	7/17/12	43			9.7		170							320		
MW-5B	7/16/12	34			13		180							300		
MW-6A	7/18/12	49	11	110	440	5.2	11,000	160				7.3		9,100	93	
MW-8B	7/18/12	33			18		480	7						360		
MW-9B	7/18/12						190							11		
MW-10B	7/16/12						8.8							25		
	7/16/12 dup						6.6							24		
MW-11B	7/16/12						130							38		
MW-15B	7/18/12						52							9.9		
MW-16A	7/18/12	37			25		830	11						480		
MW-18B	7/16/12	5.8		5.3	10		620	6						180		
MW-20B	7/16/12															
MW-24B	7/19/12	1,200	81	520	2,300	35	140,000	2,100				19	57	91,000	330	33.3
MW-25A	7/17/12						6.4									
MW-26A	7/18/12						73							18		
MW-27A	7/18/12															
	7/18/12 dup															
MW-28A	7/18/12	23			17		210							420		
MW-29A	7/18/12	300	6	74	270		13,000	210						8,000	2.7	
	7/18/12 dup	340	7.5	100	330		15,000	240						8,100	3	
MW-30A	7/3/12						11							21		
	7/17/12						12							25		
MW-32B	7/1/12	16					80							96	2.6	
	7/17/12	21		5			160							76	3.4	
MW-33A	6/27/12															
	7/17/12															
MW-34B	7/17/12															

CDM Smith

Table 1
Groundwater Sampling Results Summary
June 2013 Progress Report
Former Manchester Tank Site
Cedartown, Georgia

Well ID	Sample Date	*Compounds and Type 1 Risk Reduction Standards in ug/L*														
		1,1,1-TCA	1,1,2-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	Acetone	Isopropylbenzene	MEK	PCE	Toluene	TCE	Vinyl Chloride	Xylenes
		200	5	4,000	7	5	70	100	4,000	*	2,000	5	1,000	5	2	10,000
Unit C																
MW-7C	7/18/12	200	24	510	1,400	17	63,000	600				6.8	7.7	70,000	50	
MW-12C	7/18/12						80							95		
MW-13C	7/18/12						21							18		
MW-14C	7/18/12															
MW-17C	7/18/12															
MW-19C	7/16/12															
MW-21C	7/19/12	98	12	340	1,000	9.3	29,000	270					22	88,000	62	
MW-22C	7/19/12	20		16	14		960	5.7	680		260			1,200		
MW-31C	7/1/12						16							19		
	7/17/12	5.7					25							37		
	7/17/12 dup						23							40		
MW-36C	7/16/12				9.2		55							180		
MW-37C	7/1/12						9.4							15		
	7/17/12	21					130							280		
MW-38C	7/2/12	20			10		150							290		
	7/17/12						17							30		
MW-39C	7/1/12				7.6		51							180		
	7/2/12															
	7/18/12													13		
MW-40C	7/17/12															
MW-41C	7/18/12	5.6		86	320		7,900	88						9,200	310	
	10/30/12			86	270		6,300	65						6,200	150	
	2/28/13			91	120		4,900	54						4,100	100	
MW-44C	10/30/12															
MW-45C	10/30/12															
MW-46C	10/15/12															
MW-47C	10/15/12															
MW-48C	10/15/12															
MW-49C	10/15/12															
MW-50C	10/15/12															
MW-51C	10/15/12						250			9.9				330	35	
MW-52C	10/15/12						21							86		
MW-53C	3/6/13															
MW-54C	3/6/13													6.8		

Table 1

Groundwater Sampling Results Summary

June 2013 Progress Report

Former Manchester Tank Site

Cedartown, Georgia

Well ID	Sample Date	*Compounds and Type 1 Risk Reduction Standards in ug/L*														
		1,1,1-TCA	**1,1,2-TCA**	**1,1-DCA**	**1,1-DCE**	**1,2-DCA**	**cis-1,2-DCE**	**trans-1,2-DCE**	**Acetone**	**Isopropylbenzene**	**MEK**	**PCE**	**Toluene**	**TCE**	**Vinyl Chloride**	**Xylenes**
		200	5	4,000	7	5	70	100	4,000	*	2,000	5	1,000	5	2	10,000
Unit D																
MW-35D	7/2/12															
	7/17/12															
MW-43D	10/15/12	26		10	54		290						20	1,400		20.4
	2/12/13	16		9.9	52		240						8.5	910		6.3
MW-55D	5/23/13															

Notes:

DCA - Dichloroethane PCE - Tetrachloroethene

DCE - Dichloroethene TCA - Trichloroethane

MEK - Methy Ethyl Ketone TCE - Trichloroethene

All units are micrograms per liter (ug/L)

Blank cells indicate that the compound was not detected above the practical quantitation limit (PQL). The PQL for all samples is 5 ug/L with the exception of acetone (50 ug/L), MEK (50 ug/L), and vinyl chloride (2 ug/L).

Highlighted cells indicate the concentration is greater than the EPD Type 1 Risk Reduction Standard (residential, standard exposure assumptions).

* A Risk Reduction Standard does not exist for isopropylbenzene. In this case, the RRS is the PQL, or 5 ug/L.

Table 2
Soil Vapor Data Summary
June 2013 Progress Report
Former Manchester Tank Site
Cedartown, Georgia

Analyte & Groundwater	Concentration (ug/L)[(1)]	Residential Target Indoor Air Concentration (ug/m³)	Residential Target Soil Gas Concentration (ug/m³)	Soil Gas Sample Results						Risk Calculations		
				SG-1		SG-2		SG-3		Calculated Maximum Indoor Air Concentration (ug/m³)	Calculated Vapor Intrusion Carcinogenic Risk	Calculated Vapor Intrusion Hazard Quotient
				Result (ug/m³)	RL	Result (ug/m³)	RL	Result (ug/m³)	RL			
1,1,1-Trichloroethane	86	5.2E+03	5.2E+04	BRL	1.1E+01	BRL	1.1E+01	BRL	1.1E+01	RL / 10 = 1.1	--	2.1E-04
1,1,2-Trichloroethane	BRL	2.1E-01	2.1E+00	BRL	1.1E+01	BRL	1.1E+01	BRL	1.1E+01	RL / 10 = 1.1	7.2E-06	5.3E+00
1,1-Dichloroethane	BRL	1.5E+01	1.5E+02	BRL	8.1E+00	BRL	8.1E+00	BRL	8.1E+00	RL / 10 = 0.81	5.3E-07	--
1,1-Dichloroethene	16	2.1E+02	2.1E+03	BRL	7.9E+00	BRL	7.9E+00	BRL	7.9E+00	RL / 10 = 0.79	--	3.8E-03
1,2-Dichloroethane	BRL	9.4E-01	9.4E+00	BRL	8.1E+00	BRL	8.1E+00	BRL	8.1E+00	RL / 10 = 0.81	8.7E-06	1.1E-01
Acetone	BRL	3.2E+04	3.2E+05	BRL	1.2E+02	BRL	1.2E+02	9.7E+02	1.2E+02	9.7E+01	--	3.0E-03
Benzene	BRL	3.1E+00	3.1E+01	BRL	6.4E+00	BRL	6.4E+00	2.5E+02	6.4E+00	2.5E+01	8.0E-05	8.0E-01
Carbon disulfide	BRL	7.3E+02	7.3E+03	BRL	1.6E+01	2.5E+01	1.6E+01	BRL	1.6E+01	2.5E+00	--	3.4E-03
cis-1,2-Dichloroethene	320	--	--	BRL	7.9E+00	BRL	7.9E+00	BRL	7.9E+00	RL / 10 = 0.79	--	--
Cyclohexane	BRL	6.3E+03	6.3E+04	BRL	6.9E+00	BRL	6.9E+00	7.3E+01	6.9E+00	7.3E+00	--	1.2E-03
Methyl Ethyl Ketone	BRL	5.2E+03	5.2E+04	1.6E+01	1.5E+01	BRL	1.5E+01	4.9E+01	1.5E+01	4.9E+00	--	9.4E-04
n-Butane	NA	--	--	1.7E+01	1.2E+01	BRL	1.2E+01	2.5E+03	1.2E+01	2.5E+02	--	--
n-Butyl benzene	BRL	--	--	1.1E+01	1.1E+01	BRL	1.1E+01	BRL	1.1E+01	1.1E+00	--	--
n-Heptane	NA	--	--	BRL	8.2E+00	BRL	8.2E+00	1.1E+02	8.2E+00	1.1E+01	--	--
n-Hexane	BRL	7.3E+02	7.3E+03	BRL	7.0E+00	BRL	7.0E+00	2.8E+02	7.0E+00	2.8E+01	--	3.8E-02
Tetrachloroethene	BRL	4.2E+01	4.2E+02	BRL	2.0E+00	BRL	2.0E+00	BRL	2.0E+00	RL / 10 = 0.2	2.1E-08	4.8E-03
Toluene	BRL	5.2E+03	5.2E+04	2.6E+01	7.5E+00	3.3E+01	7.5E+00	4.5E+01	7.5E+00	4.5E+00	--	8.6E-04
trans-1,2-Dichloroethene	5.6	6.3E+01	6.3E+02	BRL	7.9E+00	BRL	7.9E+00	BRL	7.9E+00	RL / 10 = 0.79	--	1.3E-02
Trichloroethene	490	2.1E+00	2.1E+01	BRL	1.1E+01	BRL	1.1E+01	BRL	1.1E+01	RL / 10 = 1.1	4.7E-06	5.3E-01
Vinyl Chloride	BRL	1.6E+00	1.6E+01	BRL	5.1E+00	BRL	5.1E+00	BRL	5.1E+00	RL / 10 = 0.51	3.2E-06	4.9E-03
Xylene (total)	BRL	1.0E+02	1.0E+03	1.0E+01	8.7E+00	2.7E+01	8.7E+00	2.0E+01	8.7E+00	2.70E+00	--	2.6E-02

[1] Groundwater concentration is from adjacent Unit A sample GP-2A.
ug/m3 - micrograms per cubic meter
RL - Reporting Limit
BRL - Below Reporting Limit
Bold analytes have been previously detected in groundwater.
NA - Not analyzed
-- Insufficient toxicity data to calculate

CDM Smith

Table 3
Soil Data Summary
June 2013 Progress Report
Former Manchester Tank Site
Cedartown, Georgia

Proposed Action	Not a COPC	Not a COPC	Not a COPC	Not a COPC	COPC	Not a COPC	Not a COPC	Not a COPC	Not a COPC	
Metal	**As**	**Ba**	**Be**	**Cd**	**Cr**	**Co**	**Pb**	**V**	**Zn**	
EPD's Type 1 RRS	20	1,000	2	2	100	20	75	100	100	
Site-Specific Background (1)	*41*	*270*	*3.6*	*(3)*	*78*	*40*	*97*	*130*	*120*	
Manchester Background UPL95 (2)	63	2,700	9.6	(3)	77	140	250	200	240	
Manchester and Missouri M&P Comparison	**XCDs**			(3)	**XCDs**		**XCDs**		**XCDs**	
Expectation Maximization Natural Background					48		131			
Expectation Maximization Population #2					215		221			**Remarks**
SB-1 (0-2')	35.9	*1,810*	<1.11	<1.11	46.7	*58.9*	*108*	*133*	25	Site Delineation Location Loading Dock Area
SB-1 (5-7')	15.9	86	<5.95	<5.95	62.4	<5.95	*120*	*150*	89	
SB-2 (0-2')	16.4	48.4	<1.22	<1.22	*108*	25.8	78.3	91	*155*	Site Delineation Location Soil Removal Area
SB-2 (5-7')	30.4	70.1	<5.81	<5.81	76.1	12.5	*106*	*181*	*160*	
SB-2 (10-12')	*46.2*	248	3.11	<1.25	71.6	20	80.7	109	*146*	
SB-3 (0-2')	15.9	101	<1.11	<1.11	*105*	20.2	*116*	95	41	Site Delineation Location West Fenceline
SB-3 (5-7')	36.9	*1,860*	<5.56	*6* (4)	38.4	124	*312* (4)	*197*	70	
SB-3 (14-16')	20.4	96.8	3.08	<1.35	25.5	8	46.2	68	94	
SB-4 (0-2')	7.13	111	<1.1	<1.1	25.6	10.6	36.5	36	23	Site Delineation Location Northwest Fenceline
SB-4 (5-6')	24.4	218	1.7	<1.19	27.7	15.1	66.4	85	55	
SB-5 (0-2')	13.5	134	<1.19	<1.19	*288*	10.9	74.6	87	*137*	Site Delineation Location North Fenceline
SB-5 (5-7')	24	254	<5.95	<5.95	98.8	15.2	*169*	*162*	43	
SB-5 (10-11')	25	94.9	2.69	<1.28	81.4	10.5	70.3	94	91	
SB-6 (0-2')	<12.2	211	<6.1	<6.1	82.2	12.2	*104*	*156*	88	Site Delineation Location East Parking Lot
SB-6 (5-7')	23.4	267	<6.41	<6.41	75.1	16.1	*102*	*159*	50	
SB-7 (0-2')	14.3	140	<1.14	<1.14	*231*	16.3	*104*	117	*176*	Site Delineation Location Stormwater Ditch
SB-7 (5-7')	21.8	305	1.21	<1.14	*162*	19.2	*108*	114	*133*	
SB-7 (14-16')	*45.4*	56.2	*4.2*	1.32	56.2	21.1	*122*	122	*208*	

Table 3
Soil Data Summary
June 2013 Progress Report
Former Manchester Tank Site
Cedartown, Georgia

Proposed Action	Not a COPC	Not a COPC	Not a COPC	Not a COPC	COPC	Not a COPC	Not a COPC	Not a COPC	Not a COPC	
Metal	**As**	**Ba**	**Be**	**Cd**	**Cr**	**Co**	**Pb**	**V**	**Zn**	
EPD's Type 1 RRS	20	1,000	2	2	100	20	75	100	100	
Site-Specific Background (1)	*41*	*270*	*3.6*	*(3)*	*78*	*40*	*97*	*130*	*120*	
Manchester Background UPL95 (2)	63	2,700	9.6	(3)	77	140	250	200	240	
Manchester and Missouri M&P Comparison	**XCDs**			(3)	**XCDs**		**XCDs**		**XCDs**	
Expectation Maximization Natural Background					48		131			
Expectation Maximization Population #2					215		221			**Remarks**
SB-9 (10-12')	13.5	73.8	1.57	<1.14	35.2	4.85	40.8	74	43	Site Delineation Location East Parking Lot
SB-10 (1')					48.3					Resample of SB-2 Exceedance
SB-11 (1')					*135*					Resample of SB-3 Exceedances
SB-11 (6')				<2.73			31.6			
SB-12 (1')					*73.3*					Resample of SB-5 Exceedance
SB-13 (1')					*157*					Resample of SB-7 Exceedances
SB-13 (6')					*64.1*					
SB-14 (1')				<2.67	*62.7*		66.8			Site Delineation Location
SB-15 (1')				<2.64	*125*		70.3			Site Delineation Location
SB-16 (1')				<2.9	31.7		34.8			Additional Background Location
SB-17 (1')				<2.77	41.3		44.5			Additional Background Location
SB-18 (1')				<2.87	*63.4*		47.9			Site Delineation Location

[1] Based on Manchester background and Missouri M&P site samples. Average plus 2 standard deviations.
[2] 95% confidence upper prediction limit (UPL95) for the Manchester background samples. Exceedances are highlighted.
[3] Insufficient number of detections
[4] Excluded as a COPC based on outlier sample
XCDs - Manchester site samples exceed Missouri M&P samples in normal probability plots.
COPC - Chemical of Potential Concern

Attachment A
VISL Calculations

OSWER VAPOR INTRUSION ASSESSMENT
Vapor Intrusion Screening Level (VISL) Calculator Version 2.0, November 2012 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-05	Enter target risk for carcinogens
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens
Average Groundwater Temperature (^oC)	Tgw	19.4	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

	CAS	Chemical Name	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Soil Source?	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Groundwater Source?	Target Indoor Air Conc. @ TCR = 10E-06 or THQ = 1	Toxicity Basis	Target Sub-Slab and Exterior Soil Gas Conc. @ TCR = 10E-06 or THQ = 1	Target Ground Water Conc. @ TCR = 10E-06 or THQ = 1	Is Target Ground Water Conc. < MCL?	Temperature for Groundwater Vapor Conc.	Lower Explosive Limit**	LEL Source	Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator	Target Indoor Air Conc. for Carcinogens @ TCR = 10E-06	Target Indoor Air Conc. for Non-Carcinogens @ THQ = 1
			Cvp > Cia,target/AFss?	Cvp > Cia,target/AFgw?	MIN(Cia,c;Cia,nc)		Csg	Cgw	Cgw<MCL?	Tgw or 25	LEL		IUR		RfC		i	Cia,c	Cia,nc
			Yes/No	Yes/No	(ug/m^3)	C/NC	(ug/m^3)	(ug/L)	Yes/No (MCL ug/L)	C	(% by vol)		$(ug/m^3)^{-1}$		(mg/m^3)			(ug/m^3)	(ug/m^3)
x	67-64-1	Acetone	Yes	Yes	3.2E+04	NC	3.2E+05	2.9E+07	--	19.4	2.6	E			3.10E+01	A			3.2E+04
x	71-43-2	Benzene	Yes	Yes	3.1E+00	C	3.1E+01	1.8E+01	No (5)	19.4	1.2	N	7.80E-06	I	3.00E-02	I		3.1E+00	3.1E+01
x	104-51-8	Butylbenzene, n-	No Inhal. Tox. Info	No Inhal. Tox. Info	--	--	--	--	--	19.4									
x	75-15-0	Carbon Disulfide	Yes	Yes	7.3E+02	NC	7.3E+03	1.5E+03	--	19.4	1.3	N			7.00E-01	I			7.3E+02
x	110-82-7	Cyclohexane	Yes	Yes	6.3E+03	NC	6.3E+04	1.3E+03	--	19.4					6.00E+00	I			6.3E+03
x	75-34-3	Dichloroethane, 1,1-	Yes	Yes	1.5E+01	C	1.5E+02	8.4E+01	--	19.4	5.4	N	1.60E-06	CA				1.5E+01	
x	107-06-2	Dichloroethane, 1,2-	Yes	Yes	9.4E-01	C	9.4E+00	2.5E+01	No (5)	19.4	6.2	N	2.60E-05	I	7.00E-03	P		9.4E-01	7.3E+00
x	75-35-4	Dichloroethylene, 1,1-	Yes	Yes	2.1E+02	NC	2.1E+03	2.4E+02	No (7)	19.4	6.5	N			2.00E-01	I			2.1E+02
x	540-59-0	Dichloroethylene, 1,2- (Mixed Isomers)	No Inhal. Tox. Info	No Inhal. Tox. Info	--	--	--	--	--	19.4									
x	156-59-2	Dichloroethylene, 1,2-cis-	No Inhal. Tox. Info	No Inhal. Tox. Info	--	--	--	--	No (70)	19.4	9.7	M							
x	156-60-5	Dichloroethylene, 1,2-trans-	Yes	Yes	6.3E+01	NC	6.3E+02	4.7E+02	No (100)	19.4	9.7	M			6.00E-02	P			6.3E+01
x	110-54-3	Hexane, N-	Yes	Yes	7.3E+02	NC	7.3E+03	1.3E+01	--	19.4	1.1	N			7.00E-01	I			7.3E+02
x	78-93-3	Methyl Ethyl Ketone (2-Butanone)	Yes	Yes	5.2E+03	NC	5.2E+04	2.9E+06	--	19.4	1.4	N			5.00E+00	I			5.2E+03
x	127-18-4	Tetrachloroethylene	Yes	Yes	4.2E+01	NC	4.2E+02	7.8E+01	No (5)	19.4			2.60E-07	I	4.00E-02	I		9.4E+01	4.2E+01
x	108-88-3	Toluene	Yes	Yes	5.2E+03	NC	5.2E+04	2.6E+04	No (1000)	19.4	1.1	N			5.00E+00	I			5.2E+03
x	71-55-6	Trichloroethane, 1,1,1-	Yes	Yes	5.2E+03	NC	5.2E+04	9.5E+03	No (200)	19.4	7.5	N			5.00E+00	I			5.2E+03
x	79-00-5	Trichloroethane, 1,1,2-	Yes	Yes	2.1E-01	NC	2.1E+00	8.4E+00	No (5)	19.4	6	N	1.60E-05	I	2.00E-04	X		1.5E+00	2.1E-01
x	79-01-6	Trichloroethylene	Yes	Yes	2.1E+00	NC	2.1E+01	6.8E+00	No (5)	19.4	8	N	4.10E-06	I	2.00E-03	I	Mut	2.3E+00	2.1E+00
x	75-01-4	Vinyl Chloride	Yes	Yes	1.6E+00	C	1.6E+01	1.7E+00	Yes (2)	19.4	3.6	N	4.40E-06	I	1.00E-01	I	VC	1.6E+00	1.0E+02
x	1330-20-7	Xylenes	Yes	Yes	1.0E+02	NC	1.0E+03	6.8E+02	Yes (10000)	19.4					1.00E-01	I			1.0E+02

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario in cell E5) Symbol	Selected Value
Averaging time for carcinogens	(yrs)	ATc_R	70	ATc_C	70	ATc	70
Averaging time for non-carcinogens	(yrs)	ATnc_R	30	ATnc_C	25	ATnc	30
Exposure duration	(yrs)	ED_R	30	ED_C	25	ED	30
Exposure frequency	(days/yr)	EF_R	350	EF_C	250	EF	350
Exposure time	(hr/day)	ET_R	24	ET_C	8	ET	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario in cell E5) Symbol	Selected Value
Groundwater	(-)	AFgw_R	0.001	AFgw_C	0.001	AFgw	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R	0.1	AFss_C	0.1	AFss	0.1

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario in cell E5) Symbol	Selected Value
	mIURTCE_R	1.00E-06	mIURTCE_C	0.00E+00	mIURTCE	1.00E-06
	IURTCE_R	3.10E-06	IURTCE_C	4.10E-06	IURTCE	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration (years)	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 30 years	14	1

Mutagenic-mode-of-action (MMOA) adjustment factor 76 This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:
NVT = Not sufficiently volatile and/or toxic to pose inhalation risk in selected exposure scenario for the indicated medium
C = Carcinogenic
NC = Non-carcinogenic
I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at:
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
E = The Engineering ToolBox. Available online at http://www.engineeringtoolbox.com/explosive-concentration-limits-d_423.html
N = Centers for Disease Control and Prevention (CDC) National Institute for Occupational Safety and Health (NIOSH). Pocket Guide to Chemical Hazards. Available online at:
M = Chemical-specific MSDS
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
**Lower explosive limit is the minimum concentration of the compound in air (% by volume) that is needed for the gas to ignite and explode.

OSWER VAPOR INTRUSION ASSESSMENT

Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 2.0, May 2012 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-05	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

	CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration Csg (ug/m^3)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR $(ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
x	67-64-1	Acetone	9.7E+02	9.70E+01	No IUR	3.0E-03			3.10E+01	A	
x	71-43-2	Benzene	2.5E+02	2.50E+01	**8.0E-05**	8.0E-01	7.80E-06	I	3.00E-02	I	
x	104-51-8	Butylbenzene, n-	1.1E+01	1.10E+00	No IUR	No RfC					
x	75-15-0	Carbon Disulfide	2.5E+01	2.50E+00	No IUR	3.4E-03			7.00E-01	I	
x	110-82-7	Cyclohexane	7.3E+01	7.30E+00	No IUR	1.2E-03			6.00E+00	I	
x	75-34-3	Dichloroethane, 1,1-	8.1E+00	8.10E-01	5.3E-07	No RfC	1.60E-06	CA			
x	107-06-2	Dichloroethane, 1,2-	8.1E+00	8.10E-01	8.7E-06	1.1E-01	2.60E-05	I	7.00E-03	P	
x	75-35-4	Dichloroethylene, 1,1-	7.9E+00	7.90E-01	No IUR	3.8E-03			2.00E-01	I	
x	540-59-0	Dichloroethylene, 1,2- (Mixed Isomers)	7.9E+00	7.90E-01	No IUR	No RfC					
x	156-59-2	Dichloroethylene, 1,2-cis-	7.9E+00	7.90E-01	No IUR	No RfC					
x	156-60-5	Dichloroethylene, 1,2-trans-	7.9E+00	7.90E-01	No IUR	1.3E-02			6.00E-02	P	
x	110-54-3	Hexane, N-	2.8E+02	2.80E+01	No IUR	3.8E-02			7.00E-01	I	
x	78-93-3	Methyl Ethyl Ketone (2-Butanone)	4.9E+01	4.90E+00	No IUR	9.4E-04			5.00E+00	I	
x	127-18-4	Tetrachloroethylene	2.0E+00	2.00E-01	2.1E-08	4.8E-03	2.60E-07	I	4.00E-02	I	
x	108-88-3	Toluene	4.5E+01	4.50E+00	No IUR	8.6E-04			5.00E+00	I	
x	71-55-6	Trichloroethane, 1,1,1-	1.1E+01	1.10E+00	No IUR	2.1E-04			5.00E+00	I	
x	79-00-5	Trichloroethane, 1,1,2-	1.1E+01	1.10E+00	7.2E-06	**5.3E+00**	1.60E-05	I	2.00E-04	X	
x	79-01-6	Trichloroethylene	1.1E+01	1.10E+00	4.7E-06	5.3E-01	4.10E-06	I	2.00E-03	I	Mut
x	75-01-4	Vinyl Chloride	5.1E+00	5.10E-01	3.2E-06	4.9E-03	4.40E-06	I	1.00E-01	I	VC
x	1330-20-7	Xylenes	2.7E+01	2.70E+00	No IUR	2.6E-02			1.00E-01	I	

x

x **Notes:**

x

x (1) **Inhalation Pathway Exposure Parameters (RME):**

	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected Value
Exposure Scenario							
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	30	ATnc_C_SG	25	ATnc_SG	30
Exposure duration	(yrs)	ED_R_SG	30	ED_C_SG	25	ED_SG	30
Exposure frequency	(days/yr)	EF_R_SG	350	EF_C_SG	250	EF_SG	350
Exposure time	(hr/day)	ET_R_SG	24	ET_C_SG	8	ET_SG	24

x

x (2) **Generic Attenuation Factors:**

		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected Value
Source Medium of Vapors							
Groundwater	(-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R_SG	0.1	AFss_C_SG	0.1	AFss_SG	0.1

x

x (3) **Formulas**

x Cia, target = MIN(Cia,c; Cia,nc)

x Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)

x Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

x

x (4) **Special Case Chemicals**

	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected Value
Trichloroethylene						
	mIURTCE_R_SG	1.00E-06	ıIURTCE_C_SG	0.00E+00	mIURTCE_SG	1.00E-06
	IURTCE_R_SG	3.10E-06	IURTCE_C_SG	4.10E-06	IURTCE_SG	3.10E-06

x

OSWER VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 2.0, May 2012 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-05	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration	Calculated Indoor Air Concentration	VI Carcinogenic Risk	VI Hazard	Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator
		Csg	Cia	CR	HQ	IUR		RfC		
		(ug/m^3)	(ug/m^3)			(ug/m^3)$^{-1}$		(mg/m^3)		i

x Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 30 years	14	1

Mutagenic-mode-of-action (MMOA) adjustment factor 76 — This factor is used in the equations for mutagenic chemicals.

x Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

x I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
x P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
x A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
x CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
x H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
x S = See RSL User Guide, Section 5
x X = PPRTV Appendix
x Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
x VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
x TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
x Yellow highlighting indicates site-specific parameters that may be edited by the user.
x Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be change
x Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

Attachment B
Background Metals Evaluation

TECHNICAL MEMORANDUM

TO: CDM Smith Project Team

FROM: Rick W. Chappell, Ph.D.
Environmental Science Solutions LLC

DATE: May 6, 2013

SUBJECT: Former Manchester Tank Company (HSI No. 10765)
Cedartown, GA
Background Metals Evaluation

1.0 Introduction

This technical memorandum (TM) provides an evaluation of background metals concentrations in soil at the subject site. This TM defines background (Section 2.0); provides comparisons with standards and limits (Section 3.0); provides comparisons with Missouri Machine and Plow (Missouri M&P) soil data (Section 4.0); and presents results of geochemical association analyses (Section 5.0) and expectation maximization (Section 6.0). References are provided in Section 7.0.

The dataset evaluated in this TM consists of soil samples analyzed for 16 metals. The dataset is further subdivided into three groups based on the locations that the samples were collected: (1) background-differentiated Manchester Tank samples, (2) undifferentiated Manchester Tank samples, and (3) samples collected from the adjacent Missouri M&P Site. **Table 1** in **Attachment A** provides a basic summary of the dataset.

2.0 Definition of Background

With regard to metals concentrations in soil at the subject site, and generally, the term "background" collectively refers to the following:

- Concentrations in soil and unconsolidated materials derived from natural physical, chemical, and biological processes acting on rocks of the earth's crust (i.e., naturally occurring background component).

- Concentrations in soil and unconsolidated materials derived from regional human activities, especially in developed or urban areas (i.e., anthropogenic background component).

It is important to recognize that (1) both of the above components of background represent concentrations unrelated to potential site contamination and hence are generally referred to as "ambient" background and (2) both components may be present as distinct and identifiable distributions in soil.

3.0 Comparison with Standards and Limits

As a first step in evaluating the dataset with regard to background, probability plots were constructed for each of the 16 metals. These are provided in **Attachment B**, alphabetical from Figure B-1 (antimony) to Figure B-16 (zinc). Each probability plot shows the individual metal concentrations for the Manchester Tank soil data (combination of background-differentiated and undifferentiated) as a group along with the concentrations for the Missouri M&P Site samples (where available) as another group. Concentrations are plotted on a logarithmic (base 10) scale. The probability plots were used to: (1) help in assessing the distributional shapes of the data groups, particularly for subsequent evaluation purposes; and (2) provide a visual means of comparing the data groups with various standards and limits (discussed below) as well as with each other.

Also provided on the probability plots is a screening level standard for each metal, shown on the plots as a vertical "RRS" line. This screening standard is the Type 1 Soil Risk Reduction Standards (RRSs) set forth by the Georgia Department of Natural Resources, Environmental Protection Division (EPD) and reproduced herein in **Table 2**. Also provided in the table is the number of cases where a detected concentration exceeds the RRSs.

Table 2
Comparison with EPD RRSs

Analyte	Units	EPD Type 1 RRS	Detections Exceeding RRS	
			Manchester Tank[1]	Missouri M&P Site
Antimony	mg/kg	4	0	0
Arsenic	mg/kg	20	17	17
Barium	mg/kg	1,000	3	0
Beryllium	mg/kg	2	7	6
Cadmium	mg/kg	2	1	0
Chromium	mg/kg	100	5	1
Cobalt	mg/kg	20	7	--[2]
Copper	mg/kg	100	3	0
Lead	mg/kg	75	17	3
Mercury	mg/kg	0.5	0	0
Nickel	mg/kg	50	0	0
Selenium	mg/kg	2	0	1
Silver	mg/kg	2	1	0
Thallium	mg/kg	2	0	0
Vanadium	mg/kg	100	13	--[2]
Zinc	mg/kg	100	8	4

[1] Includes both background-differentiated and undifferentiated groups. [2] No data available.

Table 2 and the probability plots (Attachment B) indicate many cases where detections in both Manchester Tank samples and Missouri M&P Site samples (which are accepted as background) exceed the RRS. Hence screening individual samples against the RRS is not meaningful for differentiating background, and also is not particularly useful for identifying chemicals of potential concern (COPCs). However, since the RRSs are ostensibly risk-based screening levels, it would probably be more appropriate to compare the 95% upper confidence limit of the mean (UCL95) for Manchester Tank samples with the RRS.

UCL95 values were calculated using program ProUCL Version 4.1 (USEPA 2010) and are also shown on the probability plots in Attachment B. **Table 3** summarizes the UCL95 values and indicates whether the UCL95 exceeds the RRS.

Table 3
UCL95 Comparison with EPD RRSs

Analyte	Manchester Tank UCL95[1]	Potential UCL to Use[2]	UCL95 > RRS
Antimony	--[3]	--[3]	--
Arsenic	27.06	95% KM (Percentile Bootstrap) UCL	YES
Barium	703.9	95% Chebyshev (Mean, Sd) UCL	--
Beryllium	2.218	95% KM (Percentile Bootstrap) UCL	YES
Cadmium	6	95% KM (BCA) UCL	YES
Chromium	94.28	95% Approximate Gamma UCL	--
Cobalt	40.81	95% KM (Chebyshev) UCL	YES
Copper	87.47	97.5% KM (Chebyshev) UCL	--
Lead	110.5	95% Approximate Gamma UCL	YES
Mercury	0.14	95% KM (Percentile Bootstrap) UCL	--
Nickel	26.2	95% Approximate Gamma UCL	--
Selenium	--[3]	--[3]	--
Silver	--[3]	--[3]	--
Thallium	--[3]	--[3]	--
Vanadium	122.6	95% Student's-t UCL	YES
Zinc	104.5	95% Approximate Gamma UCL	YES

[1] Includes both background-differentiated and undifferentiated groups. [2] Potential UCL to use as recommended by ProUCL Version 4.1. [3] Not applicable or an insufficient number of detections for calculation.

Table 3 indicates that seven metals exceed the UCL95 and hence could be considered COPCs. However, note that this comparison also does not directly evaluate background at the Manchester Tank. An alternative and possibly more meaningful approach would be to compare 95% confidence upper prediction limit (UPL95) for the background-differentiated Manchester Tank group with the undifferentiated Manchester Tank samples.

UPL95 values were calculated using ProUCL Version 4.1 and setting $k = 19$, where k is the number of samples in the undifferentiated Manchester Tank group, i.e., 95% confidence that all of the next k = 19 samples from the background population will not exceed this value. UPL95 values are also shown on the probability plots in Attachment B and the results are summarized in **Table 4**. Results in Table 4 indicate only three analytes where one or more detections exceed the UPL95: chromium, copper and lead.

Table 4
UPL95 Comparison

Analyte	Manchester Tank UPL95[1]	Potential UPL to Use[2]	Detections Exceeding UPL95
Antimony	--[3]	--[3]	--
Arsenic	62.94	95% Wilson Hilferty (WH) UPL	0
Barium	2699	95% Wilson Hilferty (WH) UPL	0
Beryllium	9.569	LN 95% UPL	0
Cadmium	--[3]	--[3]	--
Chromium	77.46	95% Wilson Hilferty (WH) UPL	8
Cobalt	136.4	95% Hawkins Wixley (HW) UPL	0
Copper	95.98	95% Wilson Hilferty (WH) UPL	3
Lead	250.8	95% Hawkins Wixley (HW) UPL	1
Mercury	0.163	LN 95% UPL	0
Nickel	133.2	95% Wilson Hilferty (WH) UPL	0
Selenium	--[3]	--[3]	--
Silver	--[3]	--[3]	--
Thallium	--[3]	--[3]	--
Vanadium	203.6	95% Hawkins Wixley (HW) UPL	0
Zinc	242.8	95% Wilson Hilferty (WH) UPL	0

[1] Calculated for background-differentiated group for $k = 19$. [2] Potential UPL to use as determined from ProUCL Version 4.1. [3] Not applicable or an insufficient number of detections for calculation.

4.0 Comparison with Missouri M&P Site Soils

The probability plots in Attachment B compare the distributions of the Missouri M&P Site group with the Manchester Tank group (combination of background-differentiated and undifferentiated samples). Hence differences between the two groups are indicated by the amount of separation between the distributions of points as shown on the probability plots. The separation can be formally tested to determine whether the difference is statistically significant.

The comparison testing was conducted using ProUCL Version 4.1 and results are provided in **Table 5**. The last column in Table 5 indicates whether a statistically significant difference between the two groups was determined based on a two-sided test at the 0.95 significance level. The p-value provided in Table 5 is the probability of obtaining the test statistic given no significant difference between the two groups. These results indicate five analytes where the two groups are significantly different (i.e., Manchester Tank group > Missouri M&P group): arsenic, chromium, lead, nickel and zinc.

Table 5
Manchester Tank and Missouri M&P Group Comparison

Analyte	p-value[1]	Comparison Test Method[2]	Significant Difference
Antimony	--[3]	--[3]	--
Arsenic	0.0459	Gehan	Yes
Barium	0.3500	Wilcoxon-Mann-Whitney	--
Beryllium	0.4620	Gehan	--
Cadmium	--[3]	--[3]	--
Chromium	1.6801E-4	Wilcoxon-Mann-Whitney	Yes
Cobalt	--[3]	--[3]	--
Copper	0.822	Gehan	--
Lead	3.0862E-7	Gehan	Yes
Mercury	0.0601	Gehan	--
Nickel	0.0410	Wilcoxon-Mann-Whitney	Yes
Selenium	--[3]	--[3]	--
Silver	--[3]	--[3]	--
Thallium	--[3]	--[3]	--
Vanadium	--[3]	--[3]	--
Zinc	0.0059	Wilcoxon-Mann-Whitney	Yes

[1] Two-sided for Ho: Manchester = Missouri M&P. [2] Determined using ProUCL Version 4.1. [3] Not applicable or an insufficient number of detections for calculation.

5.0 Geochemical Association

Other approaches are available to help in identifying background concentrations of metals in soil in cases, like that of the site, where background data from an appropriate site-representative reference area may not be available or adequate. One of these approaches is geochemical association analysis (NAVFAC, 2002, Section 3.2), the basic idea of which is that suspected COPC metals should exhibit an association with non-COPC metals in natural rocks and background soils, and that deviations (relatively anomalous concentrations) from such association may indicate site contamination. Ideally, major rock-forming metals such as calcium, aluminum, and iron would be plotted against suspected COPC metals to examine the association. However, results for these metals are not available for the site, and hence other metals typically present in uncontaminated soils must be used instead.

Given the data and results presented above, vanadium is likely the most appropriate metal to use for geochemical association analysis. Scatter plots of vanadium versus selected other metals are provided in **Attachment C**. For reference purposes the UPL95 for the Manchester Tank background-differentiated group is also provided on the plots. These plots were examined to identify cases that deviated significantly from a linear association, results of which are summarized in **Table 6**.

Table 6
Summary of Geochemical Association Analysis

Analyte	Attachment A Figure	Evaluation
Arsenic	C-1	No deviation from background indicated
Barium	C-2	3 samples exhibit deviation from background
Chromium	C-3	Possible mixture of two background populations
Cobalt	C-4	Possible mixture of two background populations
Copper	C-5	3 samples exhibit deviation from background
Lead	C-6	Possible mixture of two background populations
Nickel	C-7	No deviation from background indicated
Zinc	C-8	No deviation from background indicated

6.0 Expectation Maximization

Another useful approach for evaluating background in cases where only site data are available (i.e., no definitive background reference area) is expectation maximization (EM). This approach relies on iterative maximum likelihood estimation (MLE) to separate two (or more) distributions from a mixed population (Dempster and others, 1977; Peters and Walker, 1978; Gilbert, 1986; Helsel, 2005). In the case of the site data, the two distributions evaluated via EM/MLE are anticipated to be the natural and anthropogenic components of the ambient site background. The evaluation was conducted using an EXCEL workbook application to (1) separate the two background populations (components 1 and 2) followed by (2) plotting of the two components along with a simulated mixture on a probability plot. The probability plots are provided in **Attachment D**. The actual data points, which are also shown on the plot, are examined for deviations (anomalous concentrations) from the simulated mixture.

As indicated in Table 6, the geochemical association analysis identified three metals that could be indicative of a mixed population. Hence EM/MLE was used to evaluate these three cases. Results are summarized in **Table 7**.

Table 7
EM/MLE Results for Manchester Tank Soil

	Natural Background (Component 1)			Anthropogenic Background (Component 2)		
Analyte	Mean	SD	Fraction	Mean	SD	Fraction
Chromium	35.16	6.51	0.37	96.26	59.55	0.63
Cobalt	15.43	4.13	0.49	25.29	28.04	0.51
Lead	92.23	19.19	0.53	92.22	64.14	0.47

To illustrate interpretation of these results, chromium in Manchester Tank soil was determined to be a mixture of two components: 37% natural background with a mean of 35.16 and standard deviation of 6.51, and 63% anthropogenic background with a mean of 96.26 and standard deviation of 59.55. No anomalous values indicative of contamination deviating from these two components were identified. Similarly, the cobalt and lead results also did not identify any anomalous values indicative of contamination deviating from the two components.

7.0 References

Dempster, A.P., Laird, N.M. and D.B. Rubin, 1977, Maximum likelihood from incomplete data via the EM algorithm, J. Royal Stat. Soc, 39(1), 1-38.

Gilbert, R.O., 1987, Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold.

Helsel, D. R., 2005, Nondetects and Data Analysis, Statistics for Censored Environmental Data, Wiley.

NAVFAC, 2002, Guidance for Environmental Background Analysis, Volume 1: Soil, Naval Facilities Engineering Command, UG-2049-ENV.

Peters, B.C. and H.F. Walker, 1978, An iterative procedure for obtaining maximum-likelihood estimates of the parameters for a mixture of normal distributions, SIAM J. Appl. Math., 35(2), 362-378.

USEPA, 2002, Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites, EPA 540-R-01-003.

USEPA, 2010, ProUCL Version 4.1, User Guide, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations, EPA/600/R-07/041.

Attachment A

Table 1
Dataset Summary

Analyte[1]	Nondetects Count	Nondetects Min RL[2]	Nondetects Max RL[2]	Detects Count	Detects Min	Detects Max	Total Count
Manchester Tank Background							
Antimony	8	2.27	2.5	0	--	--	8
Arsenic	0	--	--	8	15.9	31.3	8
Barium	0	--	--	8	43.4	1020	8
Beryllium	3	1.14	1.15	5	1.26	2.57	8
Cadmium	8	1.14	1.25	0	--	--	8
Chromium	0	--	--	8	32.9	56.1	8
Cobalt	0	--	--	8	3.73	36	8
Copper	0	--	--	8	4.37	25.3	8
Lead	0	--	--	8	27	90.5	8
Mercury	5	0.114	0.125	3	0.135	0.142	8
Nickel	0	--	--	8	6.48	39	8
Selenium	8	2.27	2.5	0	--	--	8
Silver	8	1.14	1.25	0	--	--	8
Thallium	8	4.55	5	0	--	--	8
Vanadium	0	--	--	8	56.5	113	8
Zinc	0	--	--	8	29.7	115	8
Manchester Tank Undifferentiated							
Antimony	19	2.19	12.8	0	--	--	19
Arsenic	1	12.2	12.2	18	7.13	46.2	19
Barium	0	--	--	19	48.4	1860	19
Beryllium	12	1.1	6.41	7	1.21	4.2	19
Cadmium	17	1.1	6.41	2	1.32	6	19
Chromium	0	--	--	19	25.5	288	19
Cobalt	1	5.95	5.95	18	4.85	124	19
Copper	4	1.11	6.41	15	4.02	174	19
Lead	0	--	--	19	36.5	312	19
Mercury	18	0.11	0.135	1	0.135	0.135	19
Nickel	0	--	--	19	6.99	45.6	19
Selenium	19	2.19	12.8	0	--	--	19
Silver	18	1.1	6.41	1	3.03	3.03	19
Thallium	19	4.39	25.6	0	--	--	19
Vanadium	0	--	--	19	36.1	197	19
Zinc	0	--	--	19	23.3	208	19
Missouri M&P Background Samples							
Antimony	1	0.18	0.18	22	0.257	2.17	23
Arsenic	2	5.28	5.89	43	6.68	44.7	45
Barium	0	--	--	5	40.4	700	5
Beryllium	1	0.694	0.694	22	0.0824	4.03	23
Cadmium	19	0.0593	0.119	4	0.218	0.312	23
Chromium	0	--	--	28	15.3	149	28
Cobalt	0	--	--	0	--	--	0
Copper	0	--	--	23	3.37	54	23
Lead	1	6.08	6.08	27	10.3	79.8	28
Mercury	6	0.035	0.125	22	0.0349	0.239	28
Nickel	0	--	--	23	1.78	48.9	23
Selenium	18	0.124	0.251	5	0.195	2.26	23
Silver	6	0.022	0.0277	17	0.0292	1.05	23
Thallium	23	0.193	0.388	0	--	--	23
Vanadium	0	--	--	0	--	--	0
Zinc	0	--	--	23	10.1	131	23

[1] All concentrations in mg/kg. [2] RL = Reporting Limit.

Attachment B

Parallel Probability Plots

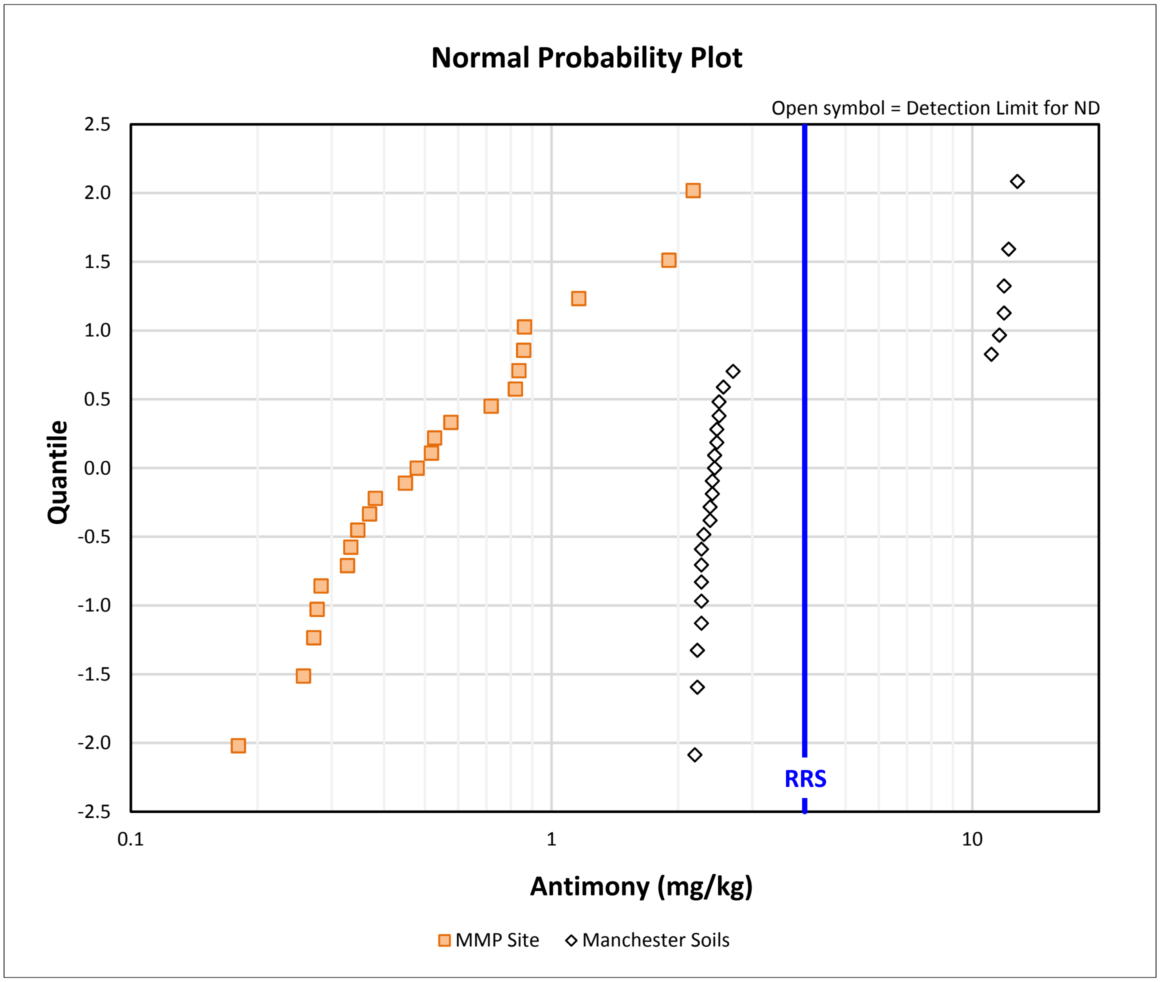


Figure B-1

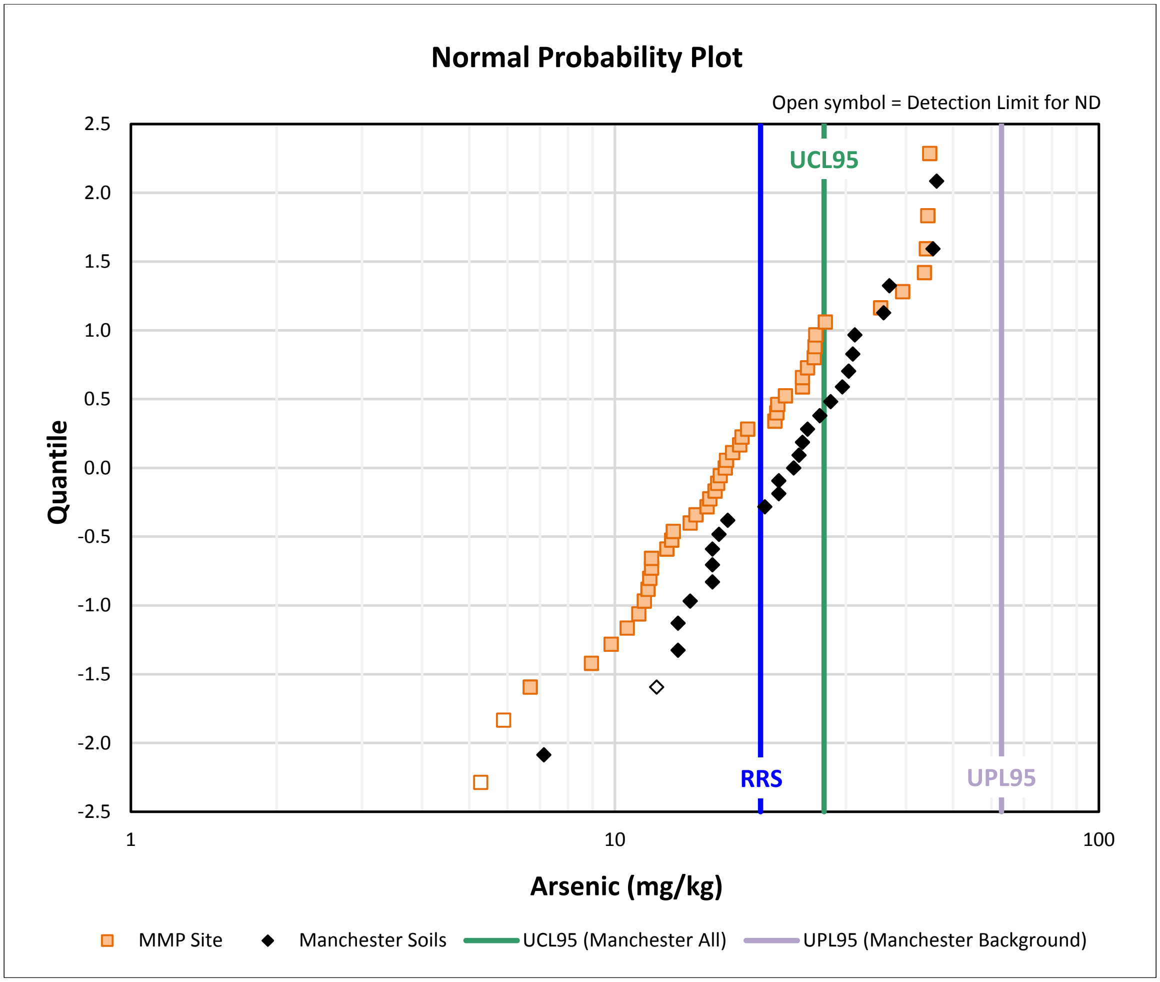
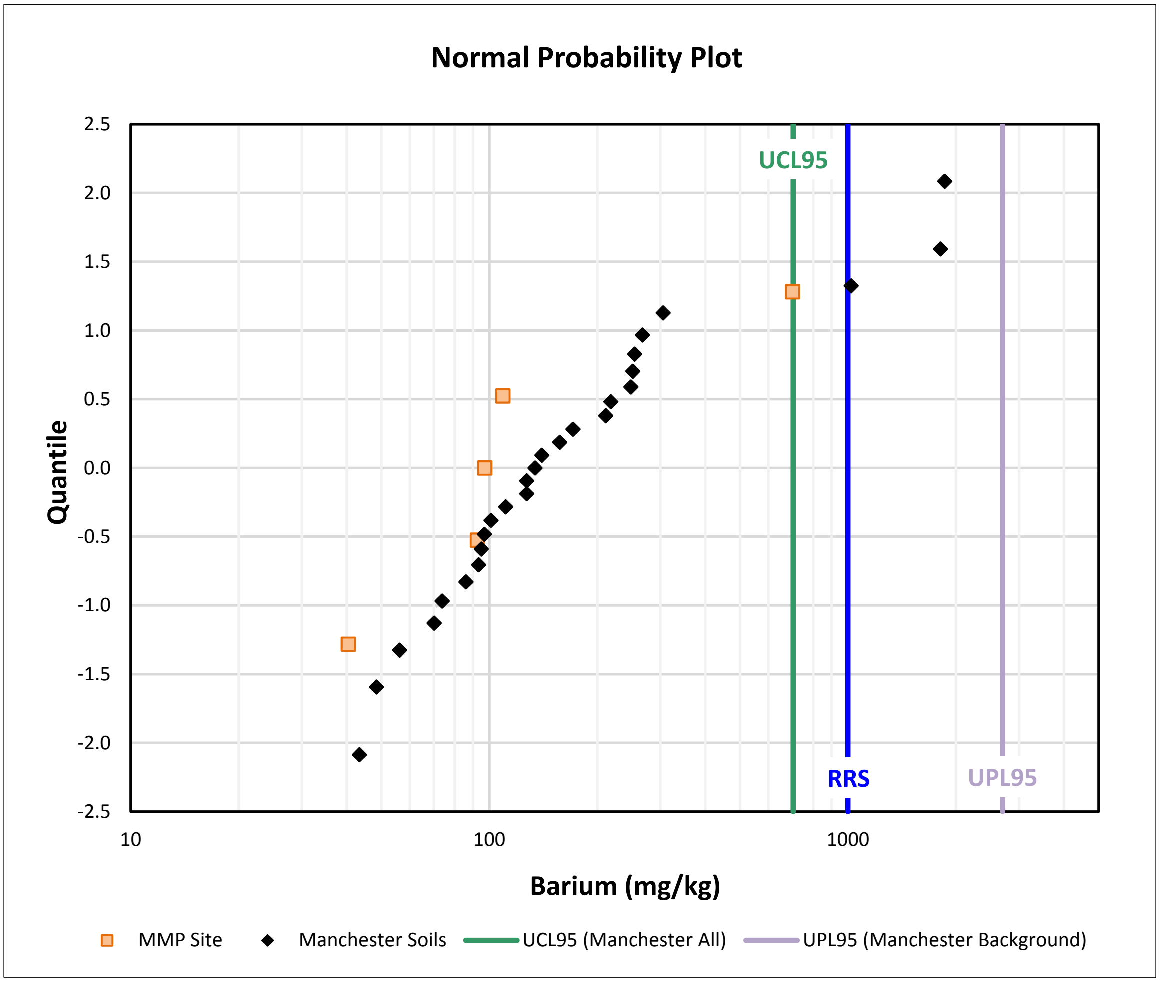

Normal Probability Plot
Open symbol = Detection Limit for ND
Quantile
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
UCL95
RRS
UPL95
1
10
100
Arsenic (mg/kg)
MMP Site
Manchester Soils
UCL95 (Manchester All)
UPL95 (Manchester Background)

Figure B-2



Normal Probability Plot
Quantile
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
10
100
1000
Barium (mg/kg)
UCL95
RRS
UPL95
MMP Site
Manchester Soils
UCL95 (Manchester All)
UPL95 (Manchester Background)

Figure B-3

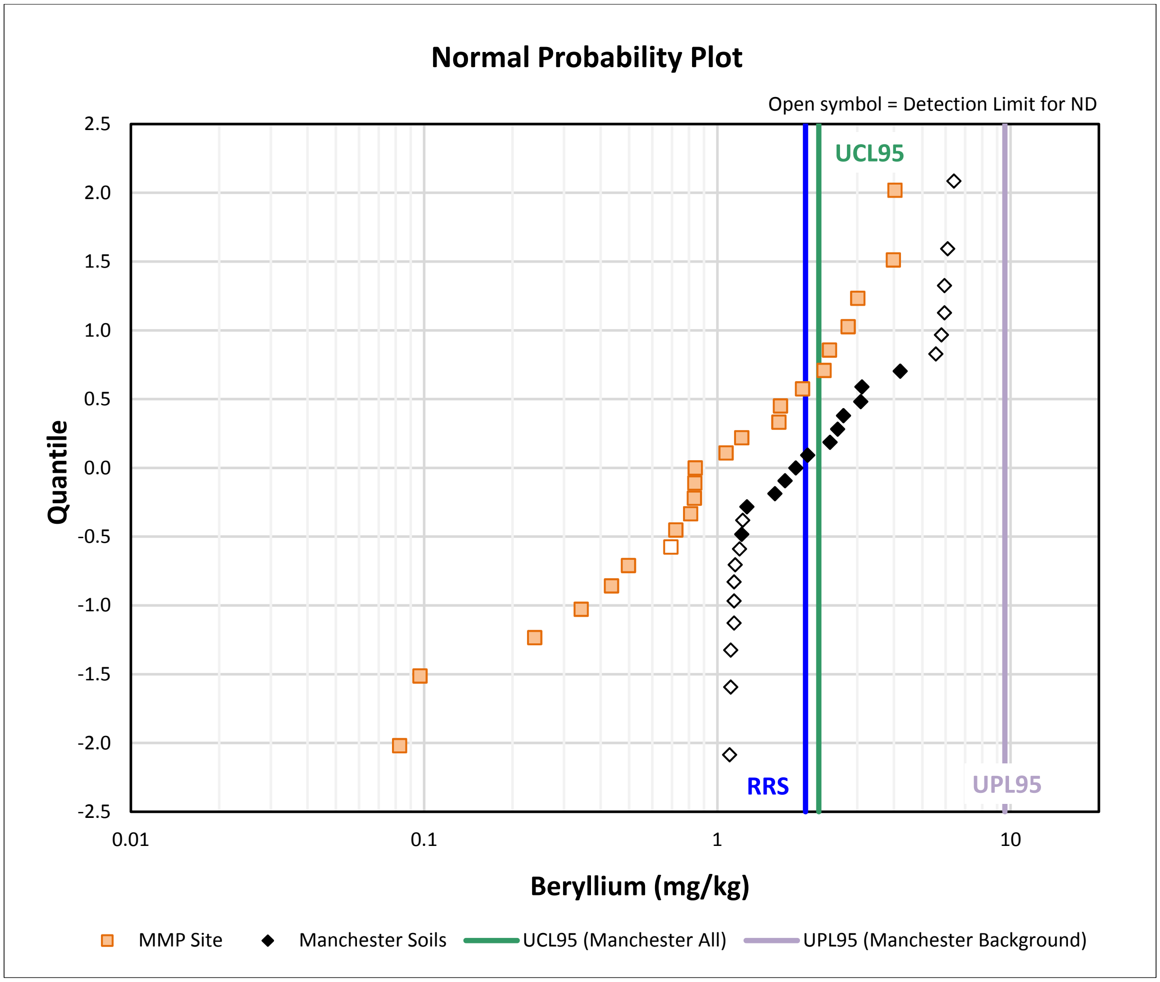
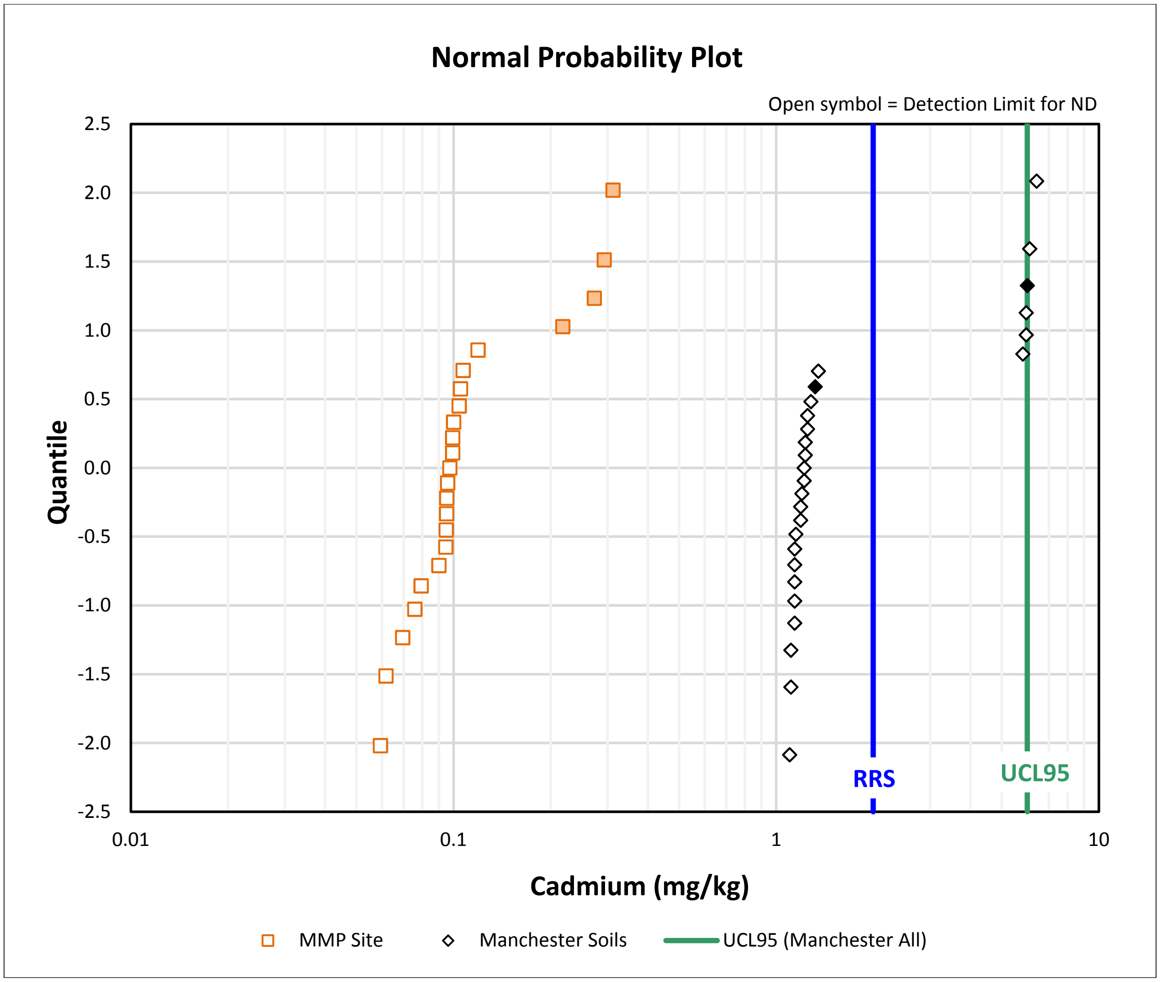
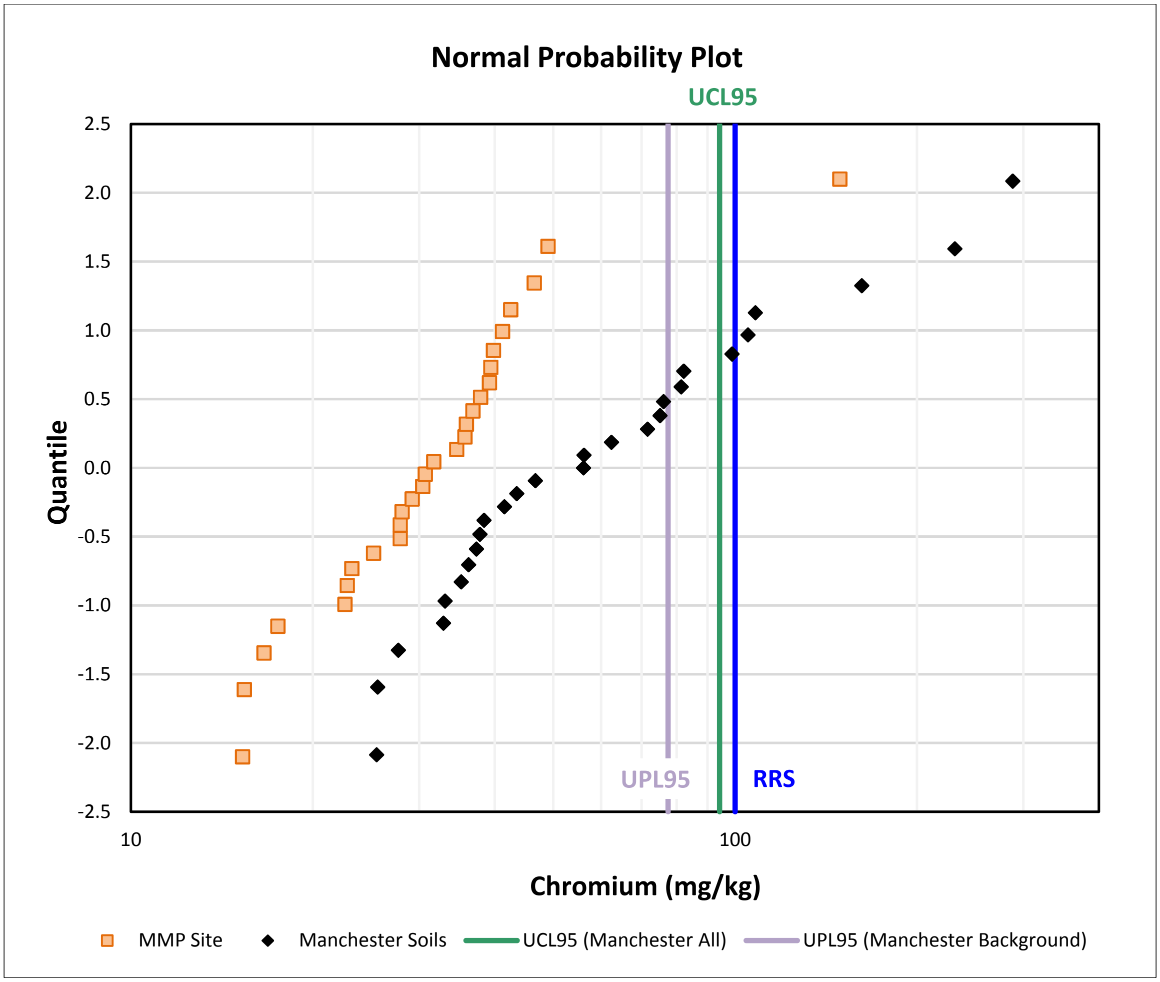

Normal Probability Plot
Open symbol = Detection Limit for ND
Quantile
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
0.01
0.1
1
10
UCL95
RRS
UPL95
Beryllium (mg/kg)
MMP Site
Manchester Soils
UCL95 (Manchester All)
UPL95 (Manchester Background)

Figure B-4



Normal Probability Plot
Open symbol = Detection Limit for ND
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
Quantile
0.01
0.1
1
10
Cadmium (mg/kg)
RRS
UCL95
MMP Site
Manchester Soils
UCL95 (Manchester All)

Figure B-5



Normal Probability Plot
UCL95
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
Quantile
UPL95
RRS
10
100
Chromium (mg/kg)
MMP Site
Manchester Soils
UCL95 (Manchester All)
UPL95 (Manchester Background)

Figure B-6

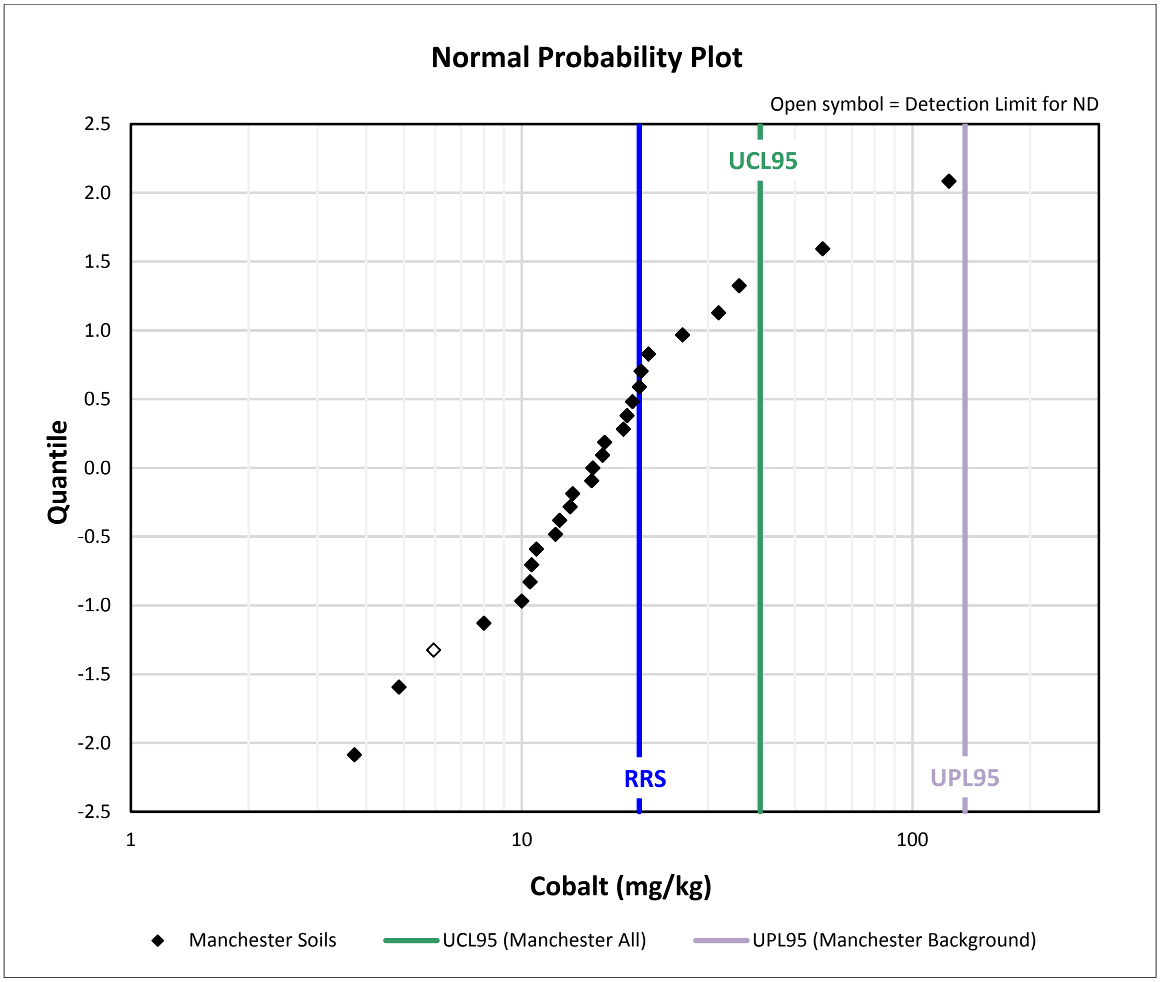
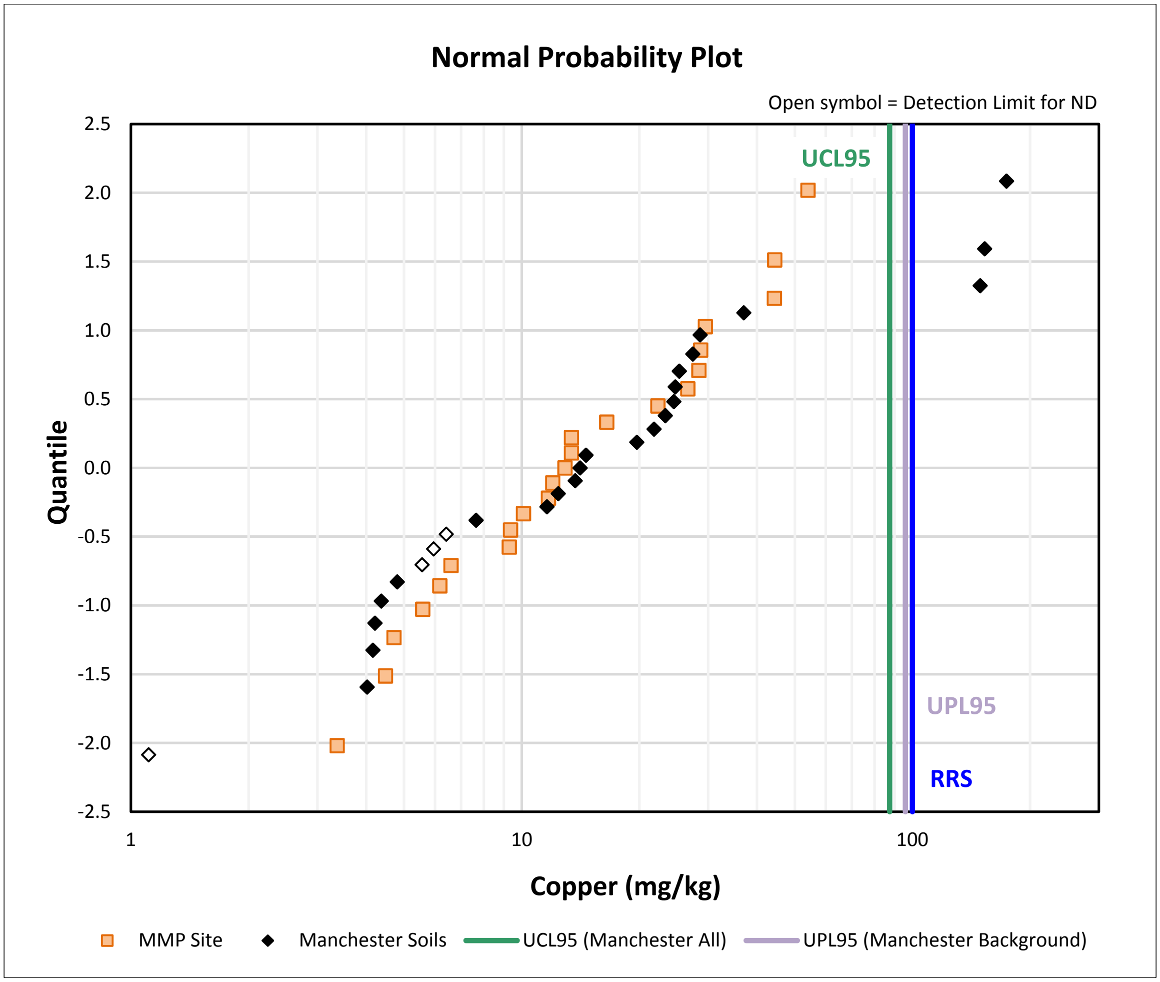

Normal Probability Plot
Open symbol = Detection Limit for ND
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
Quantile
UCL95
RRS
UPL95
1
10
100
Cobalt (mg/kg)
Manchester Soils
UCL95 (Manchester All)
UPL95 (Manchester Background)

Figure B-7



Normal Probability Plot
Open symbol = Detection Limit for ND
UCL95
UPL95
RRS
Quantile
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
1
10
100
Copper (mg/kg)
MMP Site
Manchester Soils
UCL95 (Manchester All)
UPL95 (Manchester Background)

Figure B-8

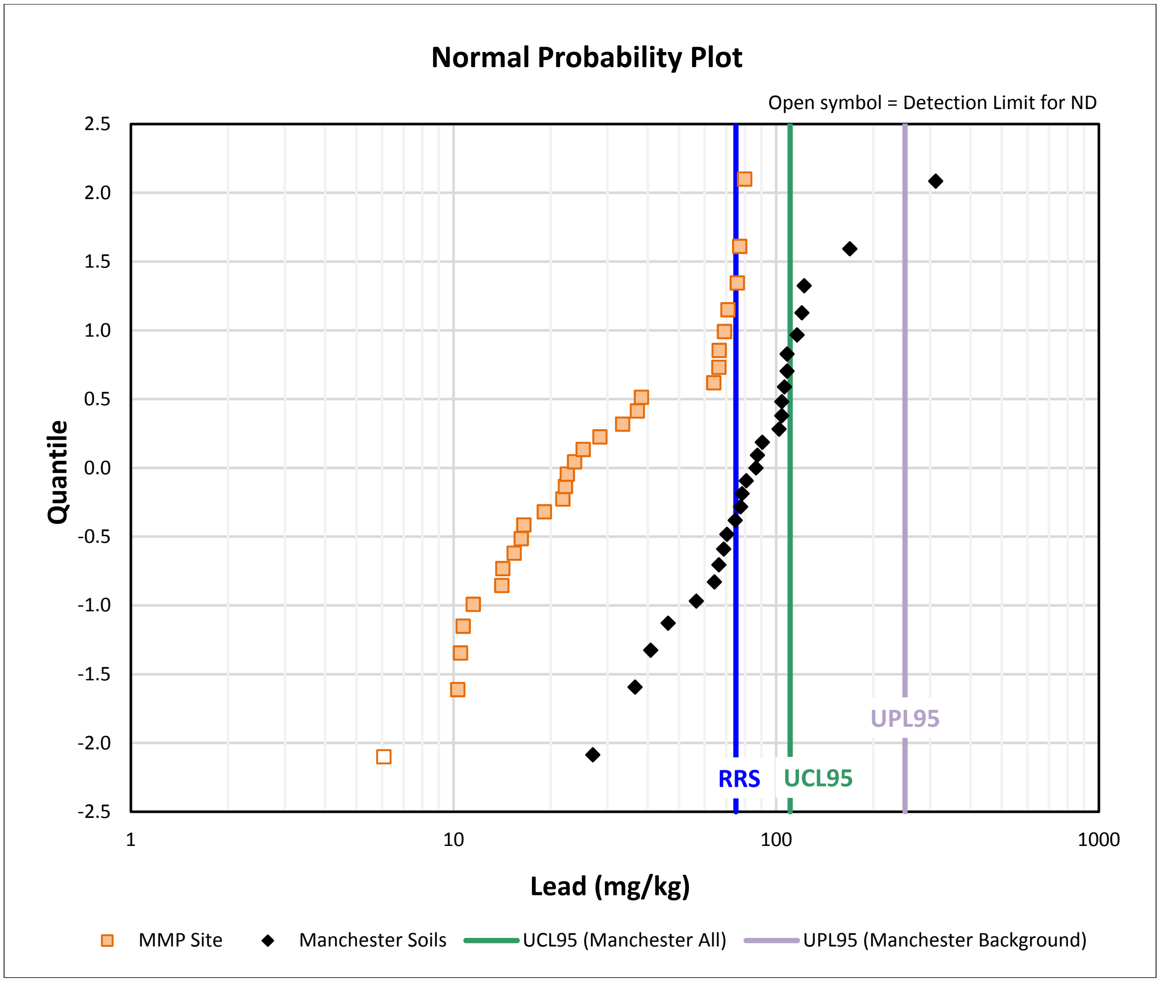

Normal Probability Plot
Open symbol = Detection Limit for ND
Quantile
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
RRS
UCL95
UPL95
1
10
100
1000
Lead (mg/kg)
MMP Site
Manchester Soils
UCL95 (Manchester All)
UPL95 (Manchester Background)

Figure B-9

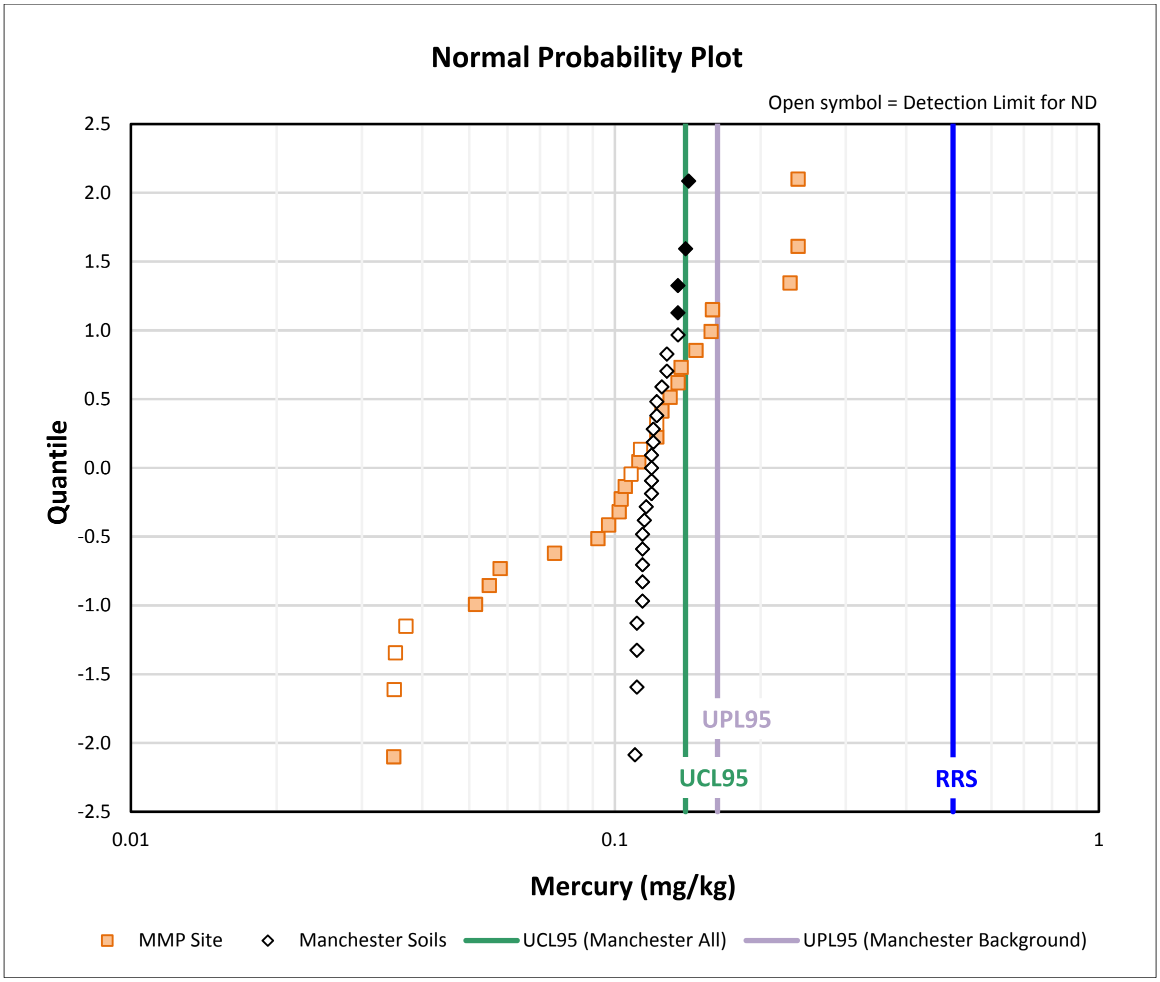

Normal Probability Plot
Open symbol = Detection Limit for ND
Quantile
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
0.01
0.1
1
Mercury (mg/kg)
UPL95
UCL95
RRS
MMP Site
Manchester Soils
UCL95 (Manchester All)
UPL95 (Manchester Background)

Figure B-10

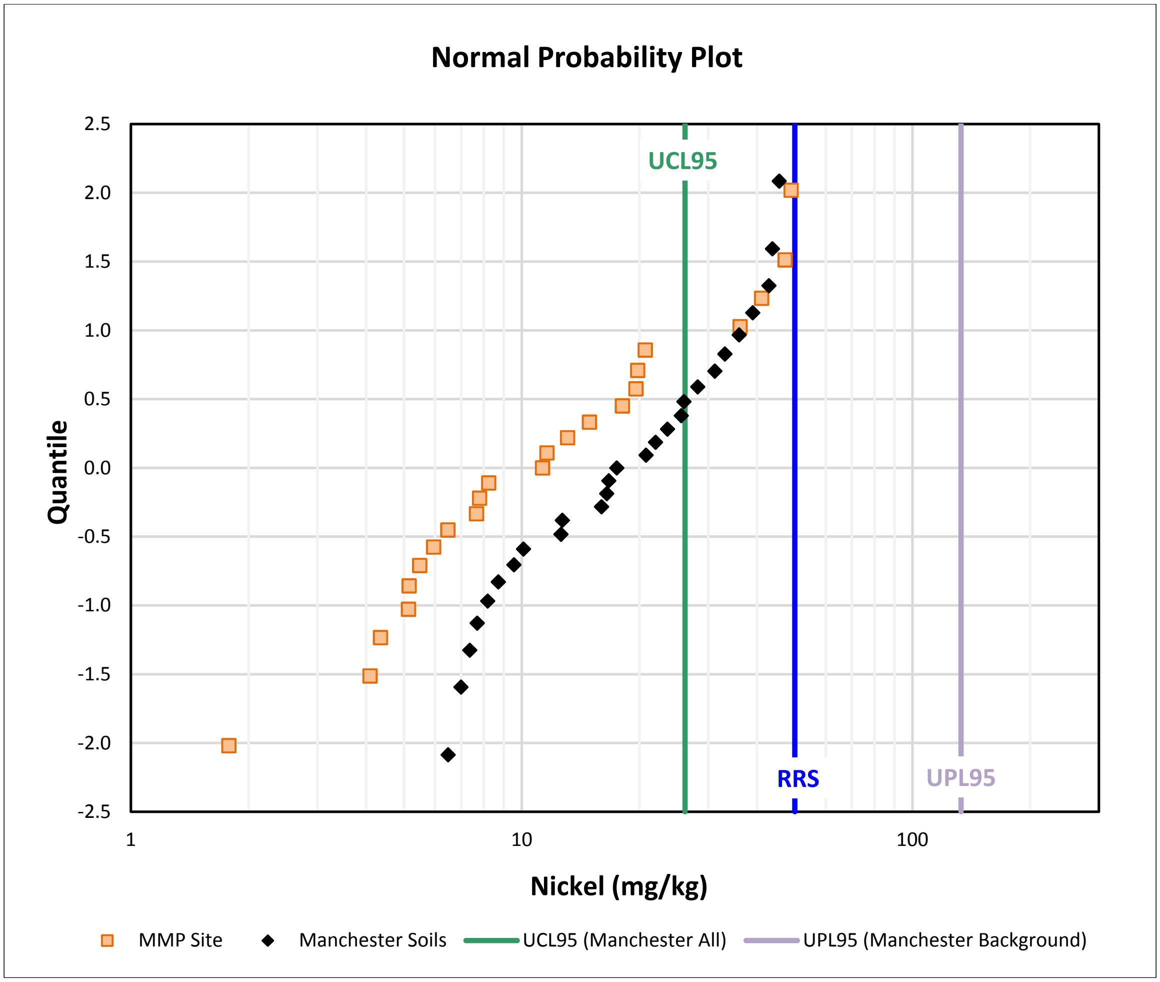
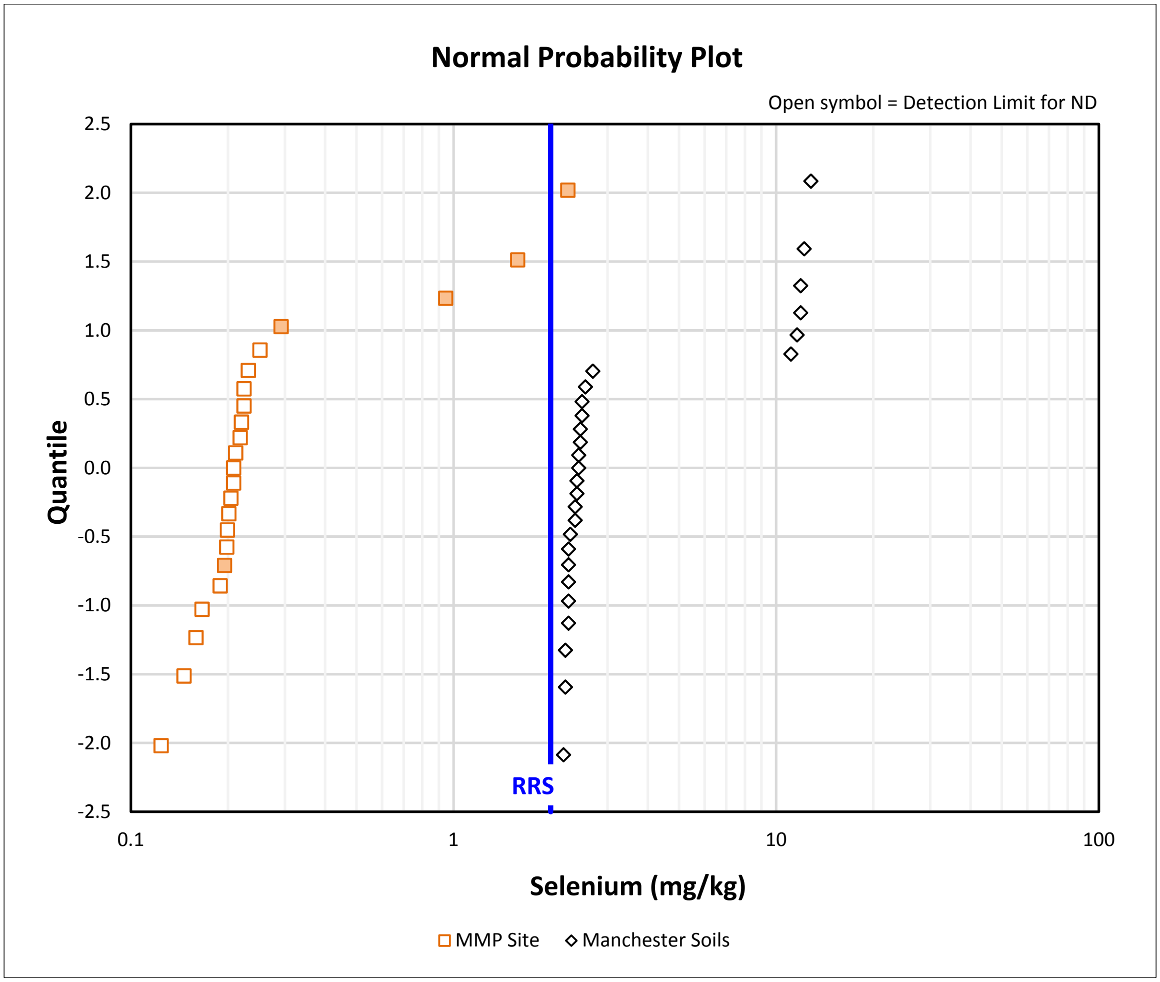

Normal Probability Plot
Quantile
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
1
10
100
UCL95
RRS
UPL95
Nickel (mg/kg)
MMP Site
Manchester Soils
UCL95 (Manchester All)
UPL95 (Manchester Background)

Figure B-11



Normal Probability Plot
Open symbol = Detection Limit for ND
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
Quantile
RRS
0.1
1
10
100
Selenium (mg/kg)
MMP Site
Manchester Soils

Figure B-12

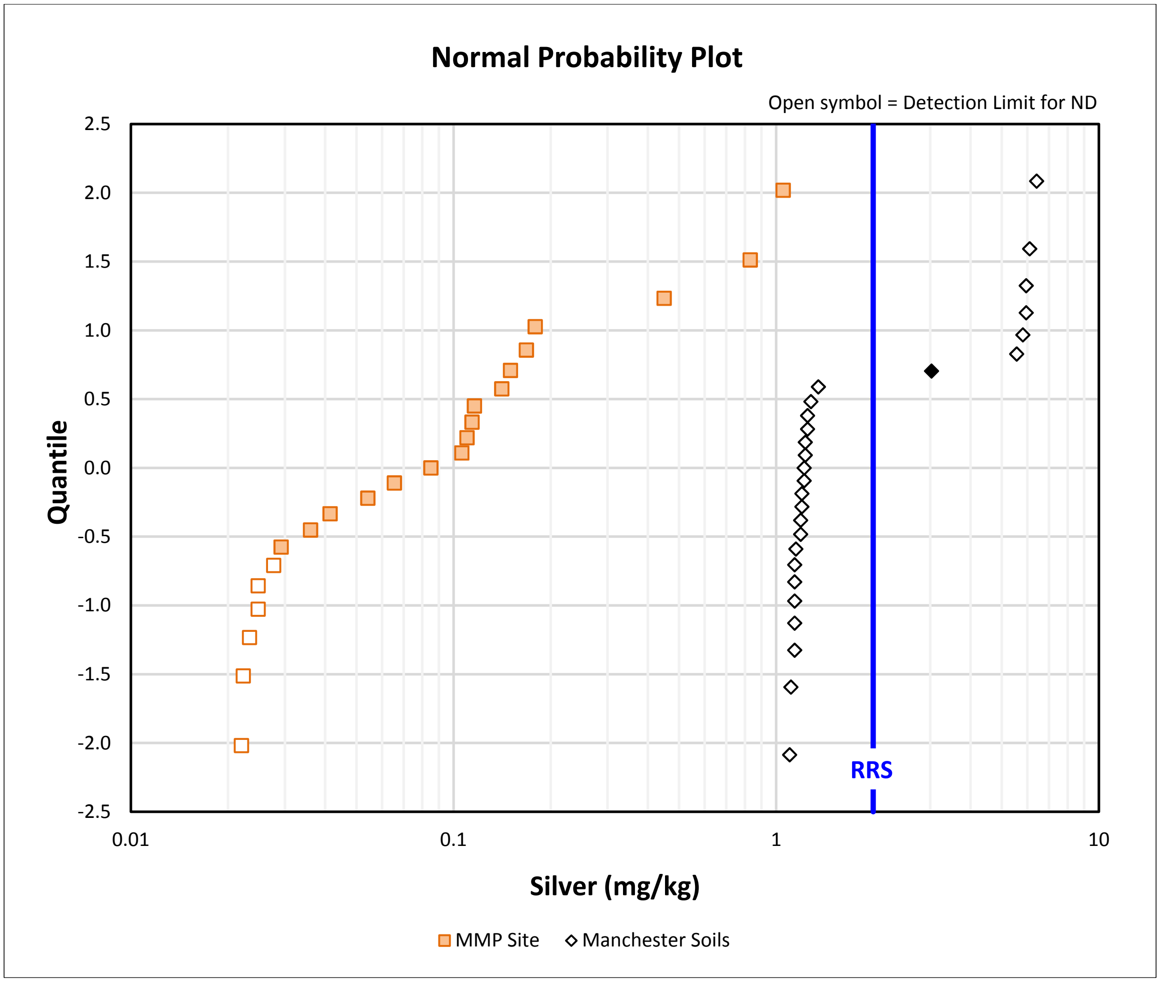

Normal Probability Plot
Open symbol = Detection Limit for ND
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
Quantile
RRS
0.01
0.1
1
10
Silver (mg/kg)
MMP Site
Manchester Soils

Figure B-13

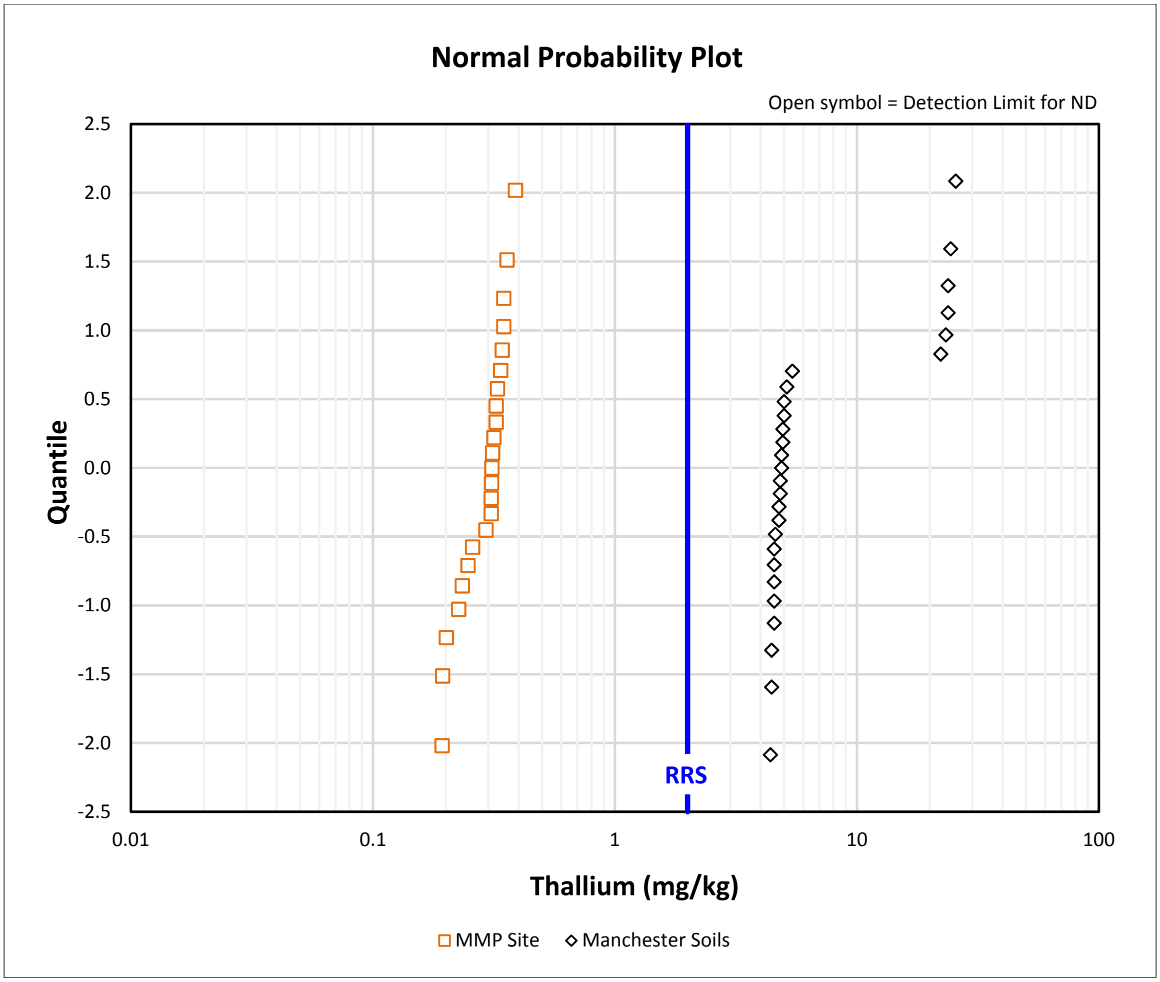
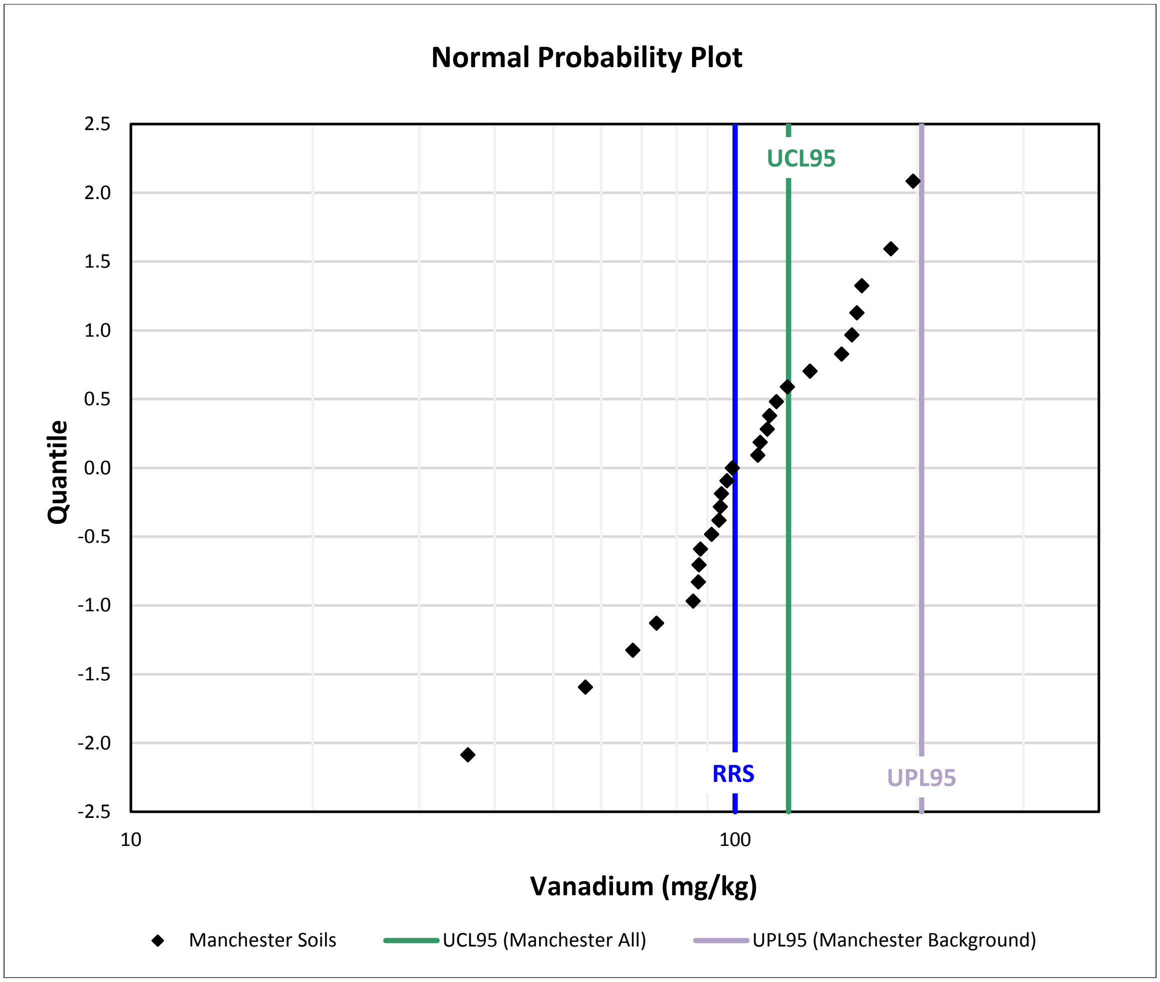
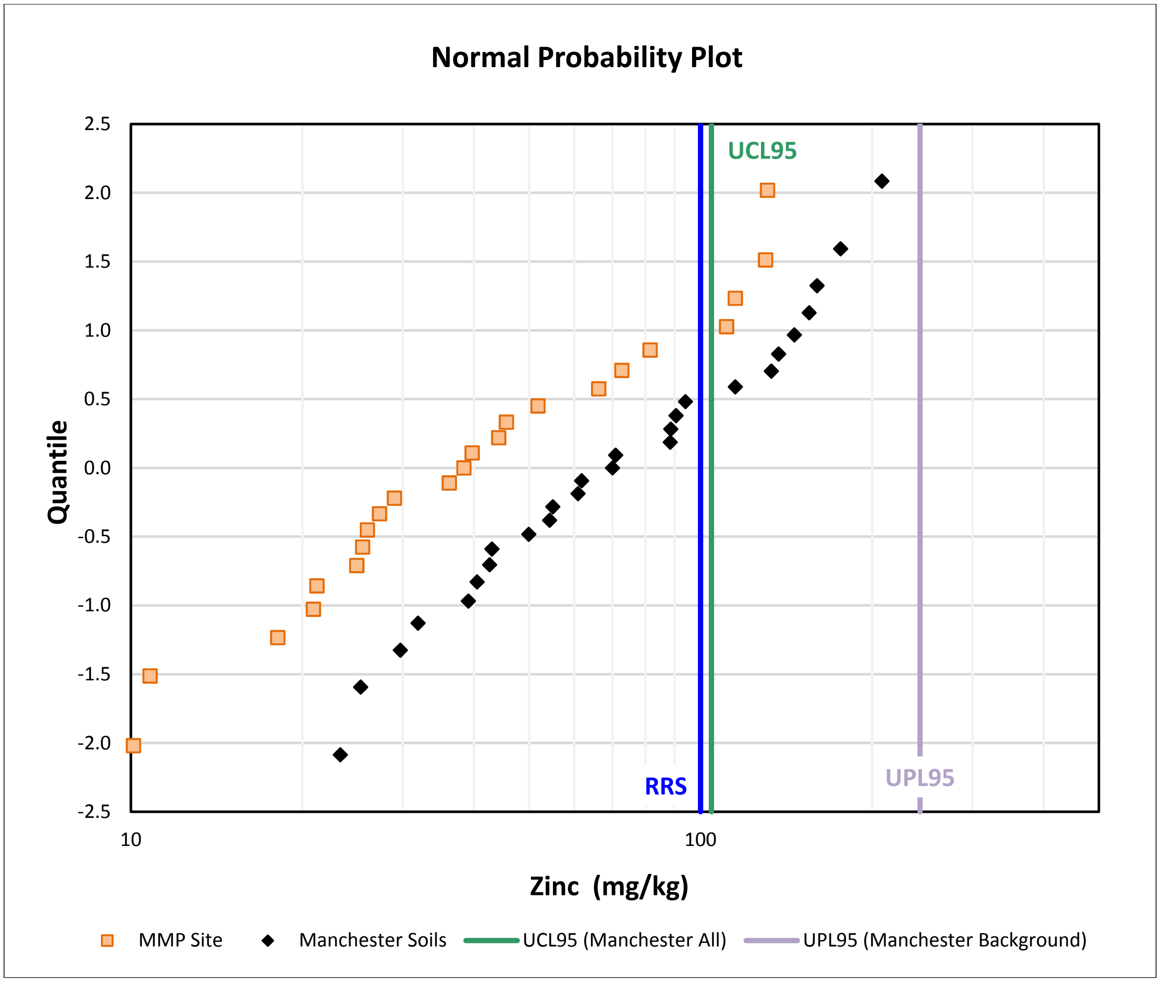

Normal Probability Plot
Open symbol = Detection Limit for ND
Quantile
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
RRS
0.01
0.1
1
10
100
Thallium (mg/kg)
MMP Site
Manchester Soils

Figure B-14



Normal Probability Plot
Quantile
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
10
100
UCL95
RRS
UPL95
Vanadium (mg/kg)
Manchester Soils
UCL95 (Manchester All)
UPL95 (Manchester Background)

Figure B-15



Normal Probability Plot
Quantile
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
10
100
Zinc (mg/kg)
UCL95
RRS
UPL95
MMP Site
Manchester Soils
UCL95 (Manchester All)
UPL95 (Manchester Background)

Figure B-16

Attachment C

Geochemical Method Scatter Plots

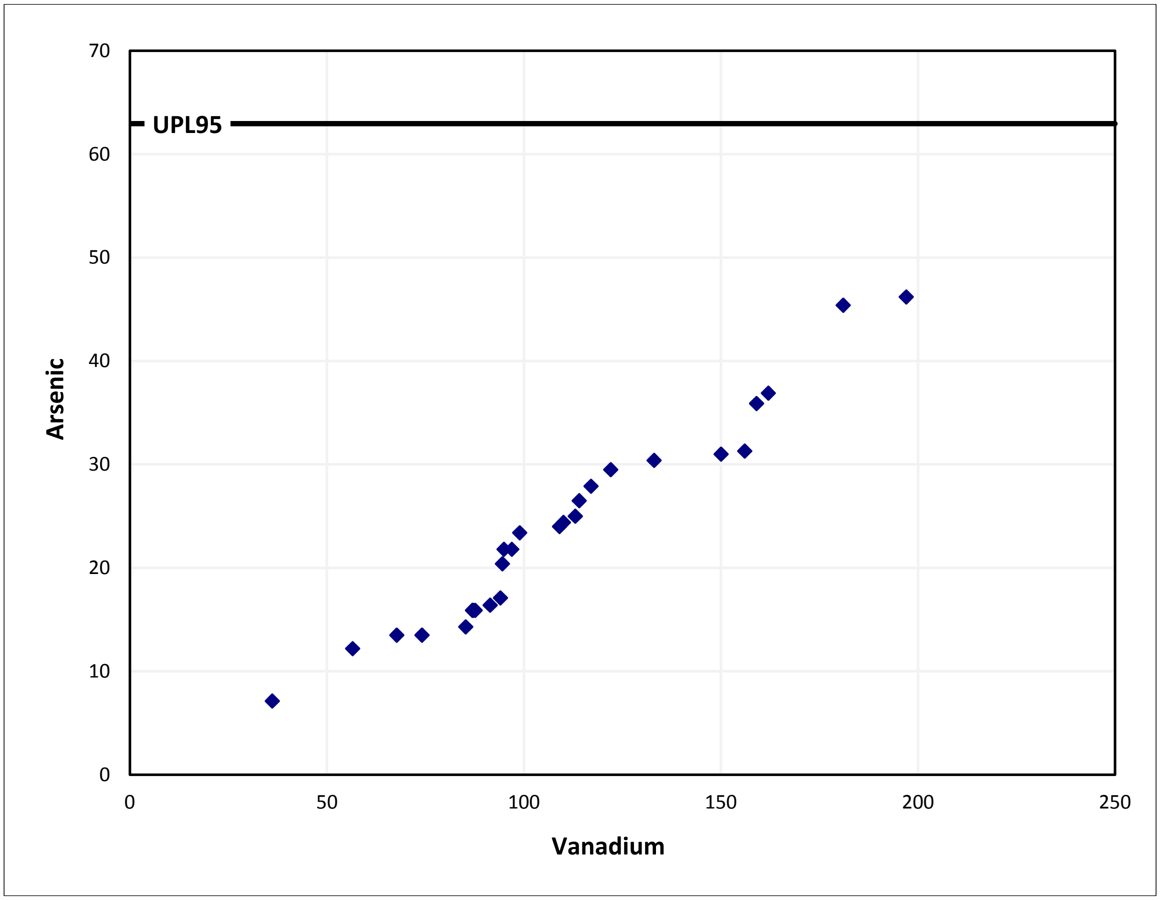
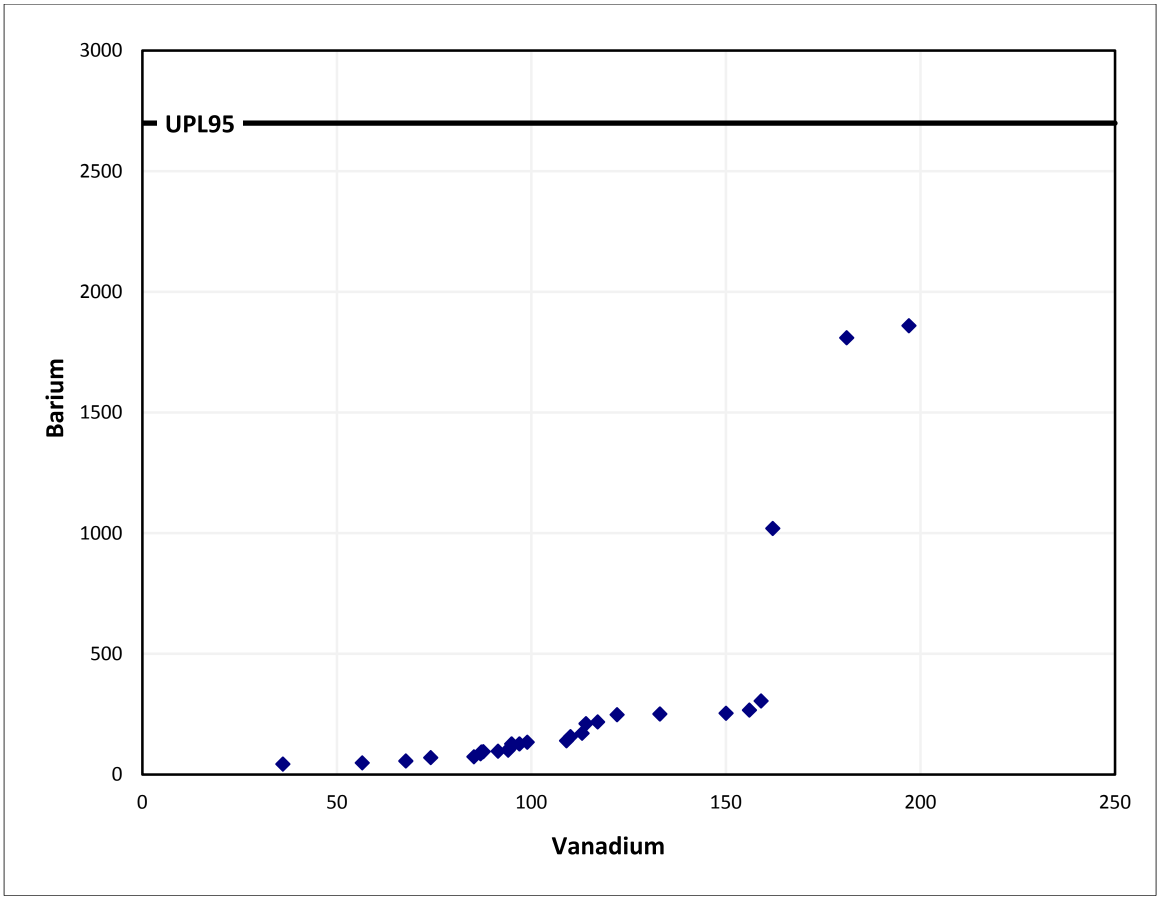
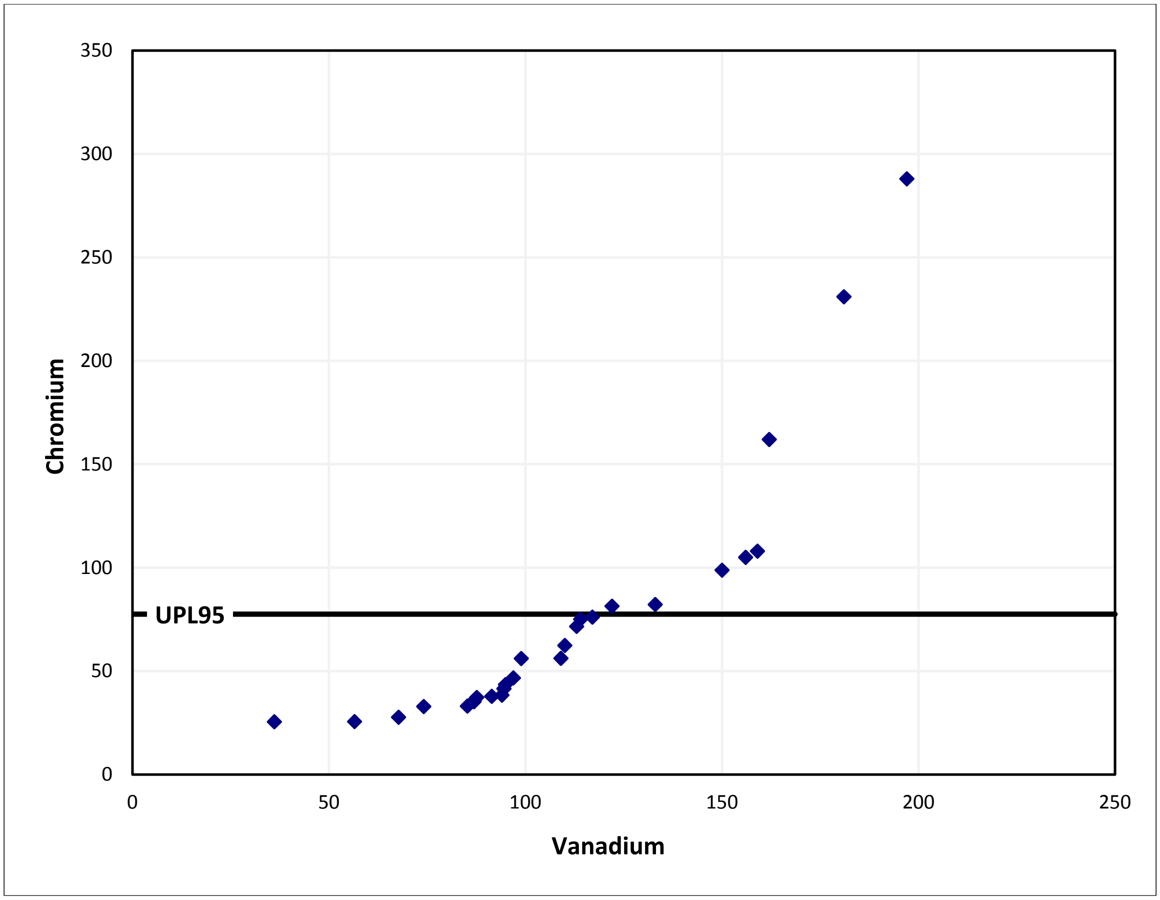


Figure C-1



3000
UPL95
2500
2000
1500
1000
500
0
Barium
0
50
100
150
200
250
Vanadium

Figure C-2



350
300
250
200
150
100
50
0
Chromium
UPL95
0
50
100
150
200
250
Vanadium

Figure C-3

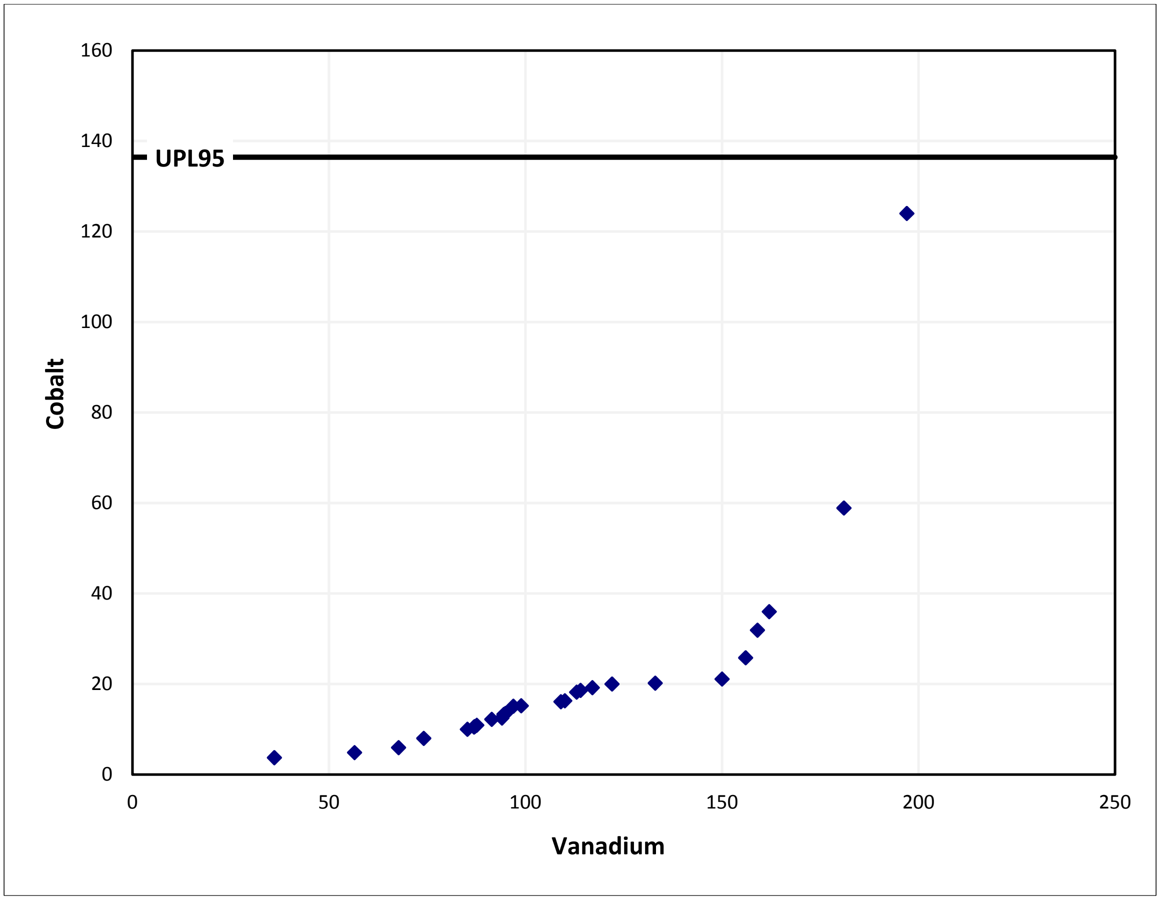

160
140
120
100
80
60
40
20
0
UPL95
Cobalt
0
50
100
150
200
250
Vanadium

Figure C-4

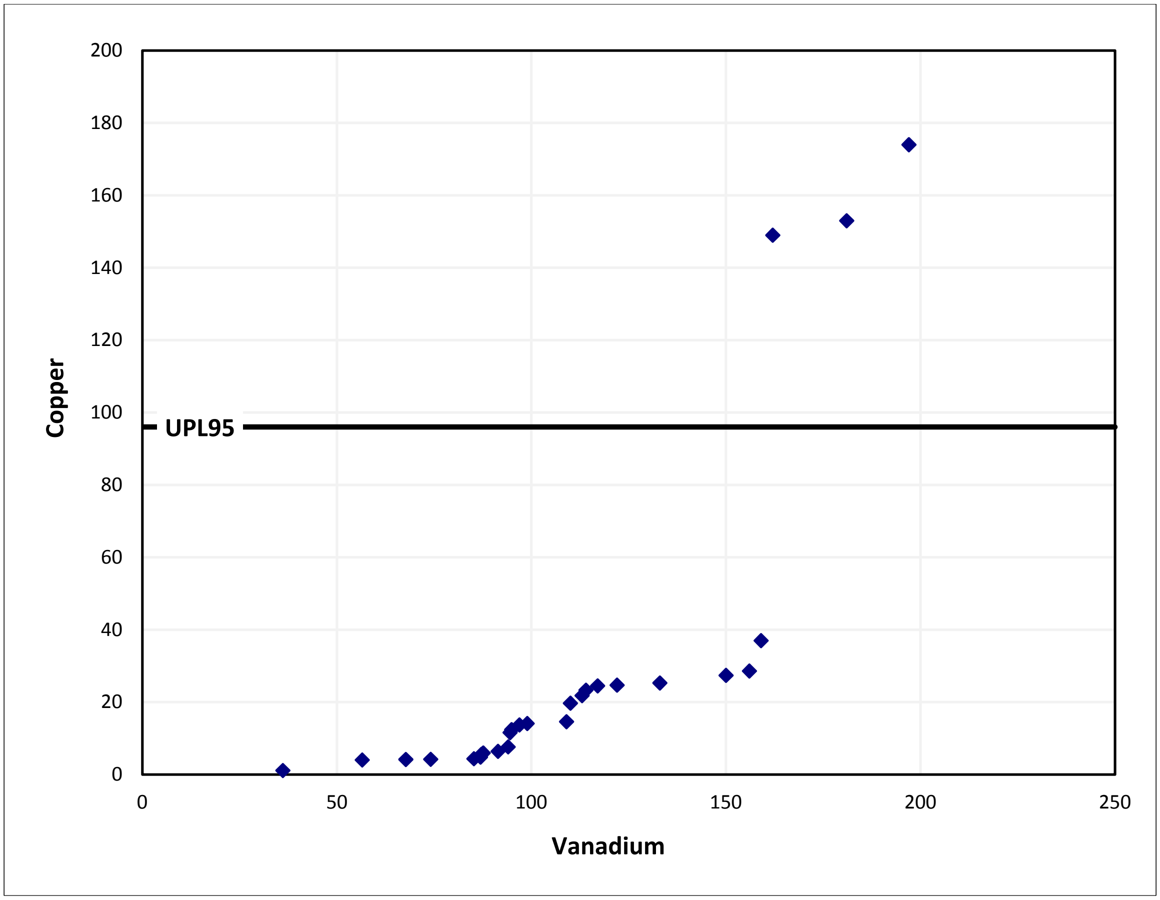
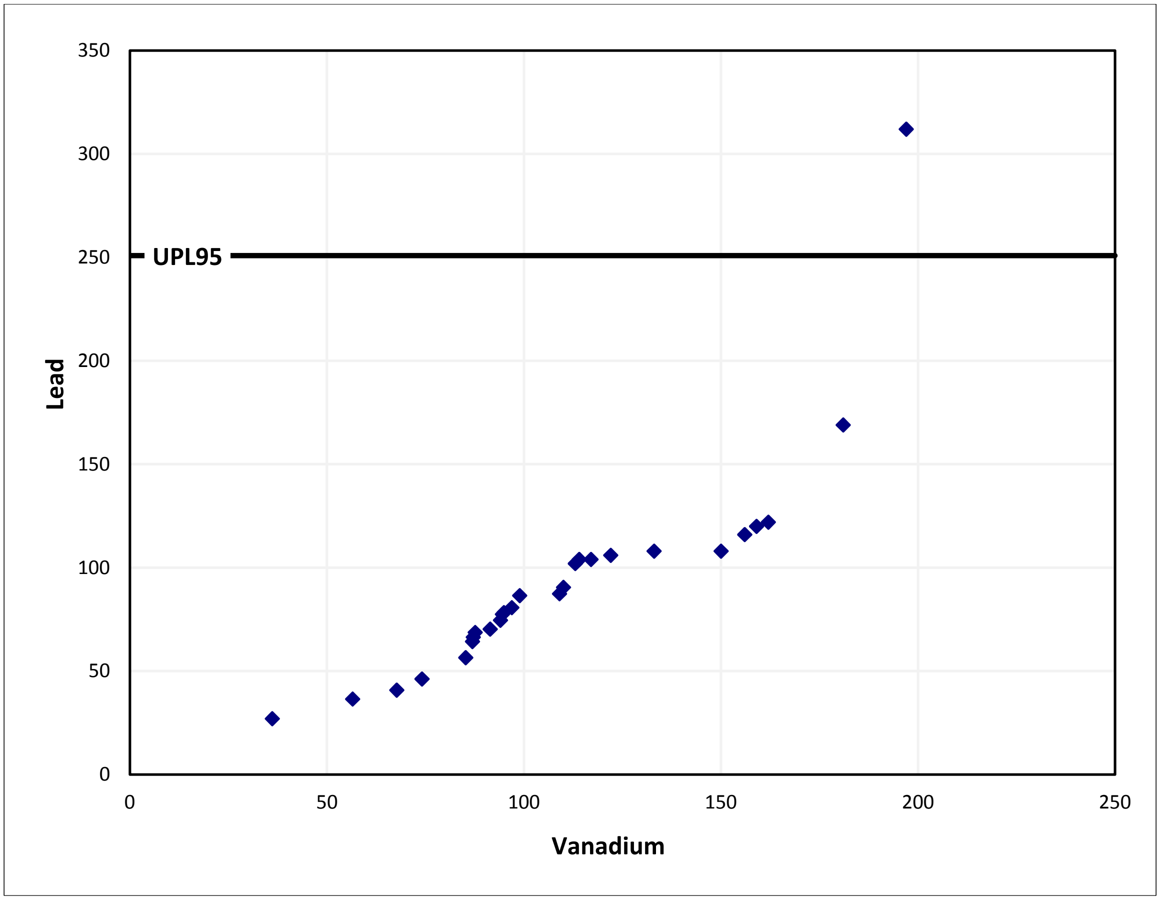
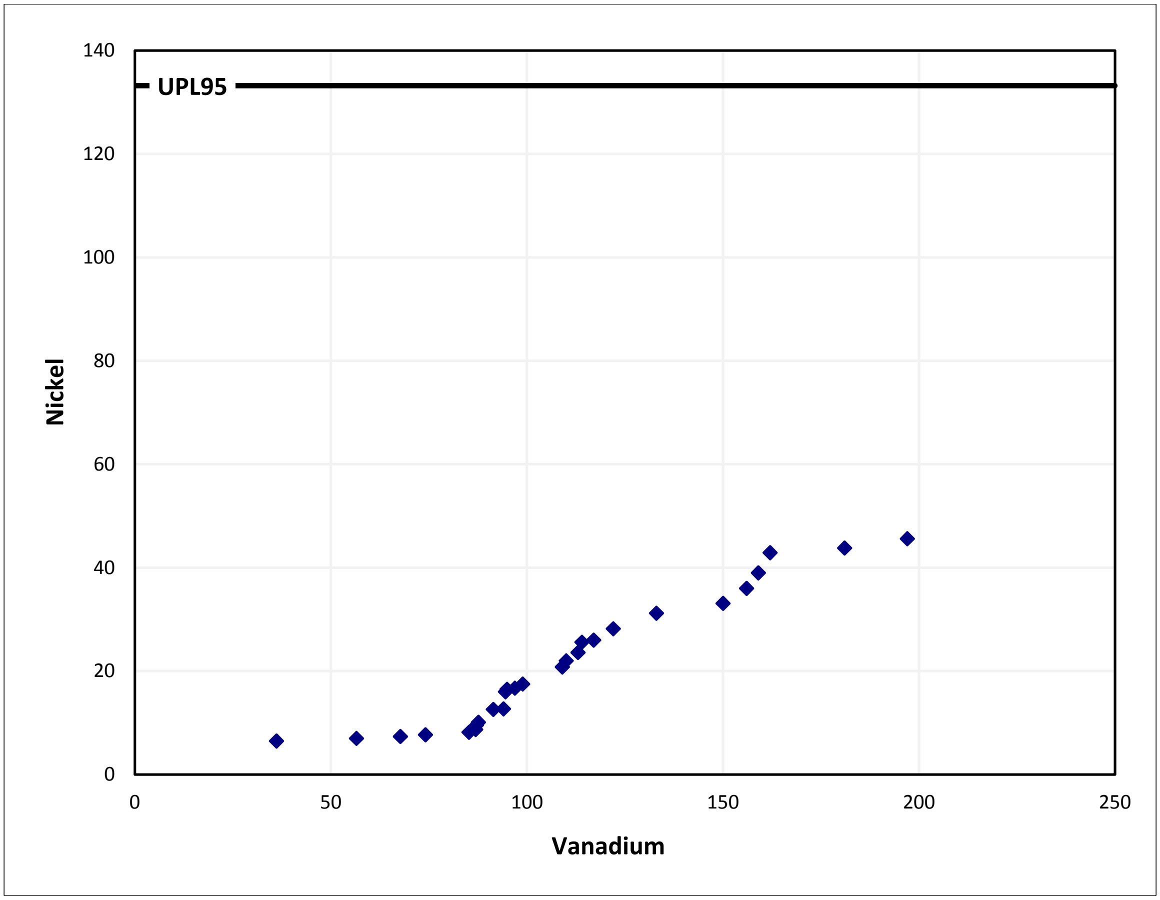

Copper
200
180
160
140
120
100
80
60
40
20
0
UPL95
0
50
100
150
200
250
Vanadium

Figure C-5



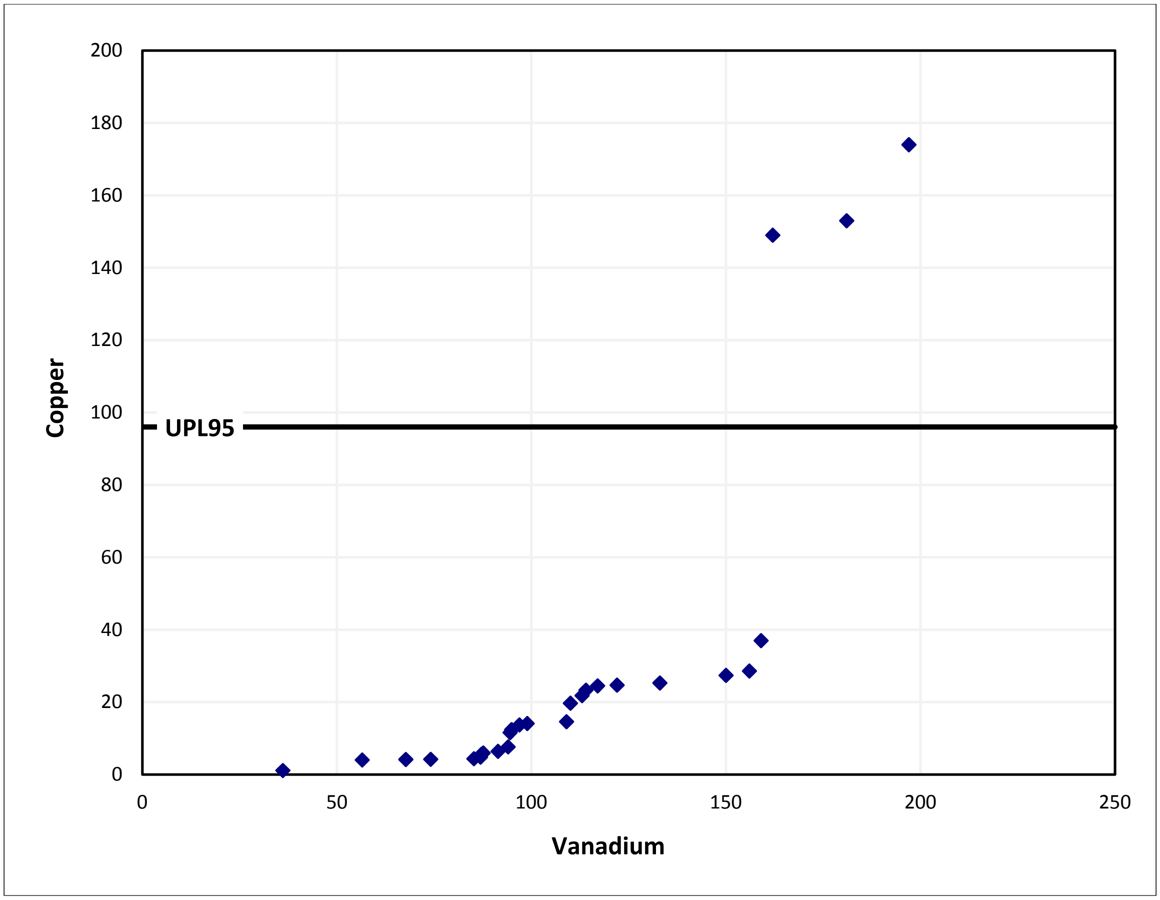
350
300
250
UPL95
200
150
100
50
0
Lead
0
50
100
150
200
250
Vanadium

Figure C-6



140
UPL95
120
100
80
60
40
20
0
Nickel
0
50
100
150
200
250
Vanadium

Figure C-7



200
180
160
140
120
100
80
60
40
20
0
Copper
UPL95
0
50
100
150
200
250
Vanadium

Figure C-8

Attachment D

Probability Plots with EM/MLE Simulated Mixtures

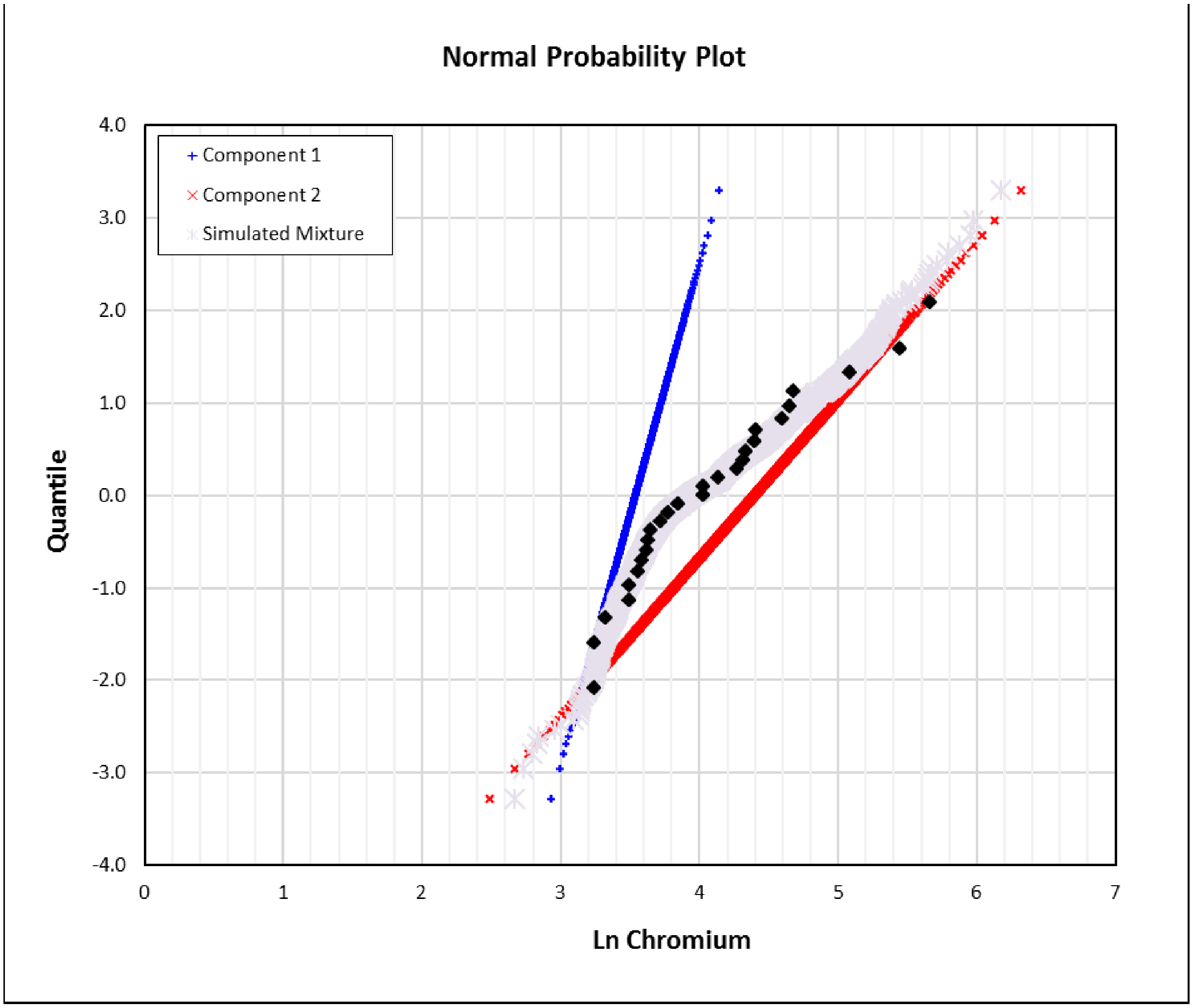


Figure D-1

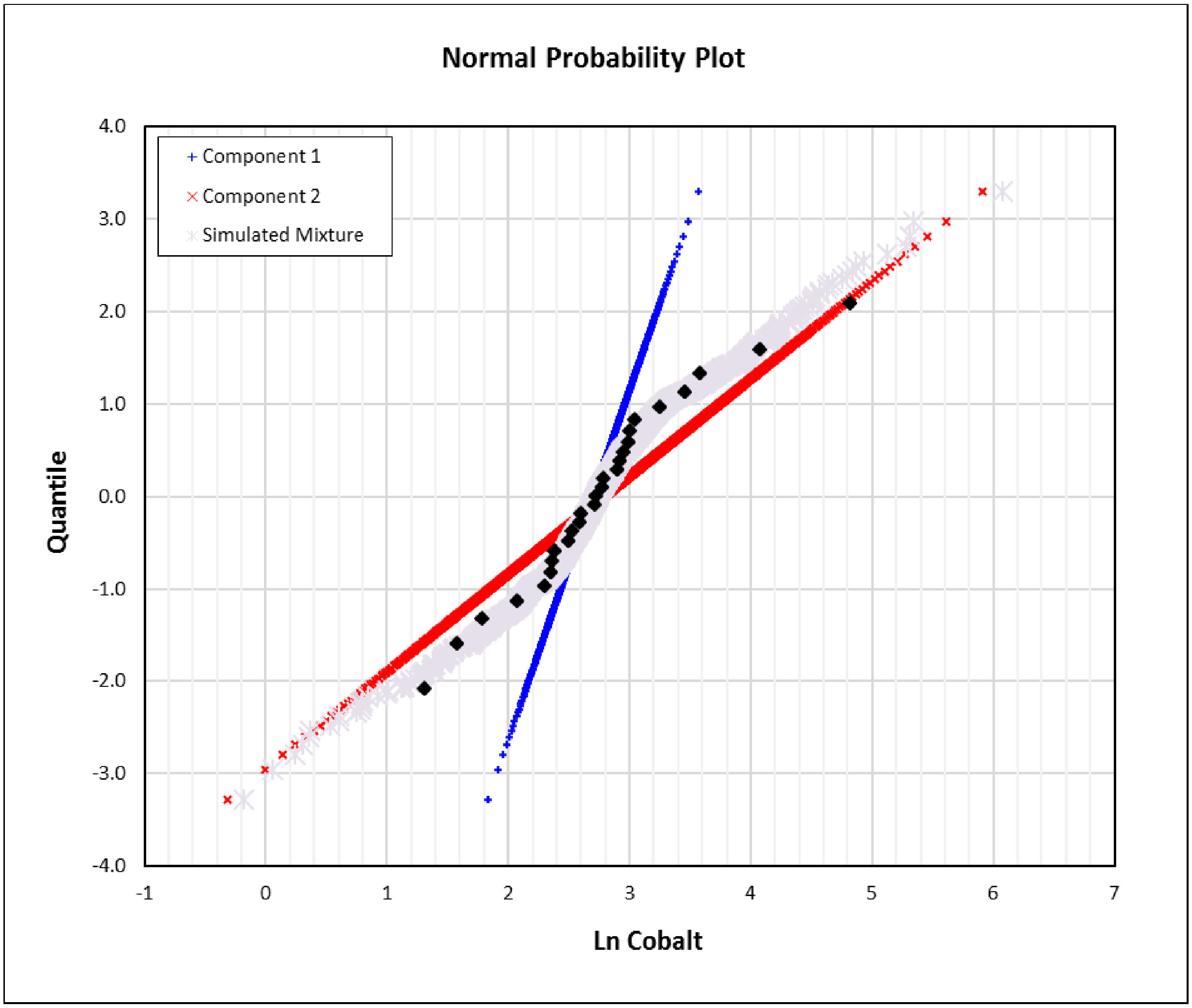
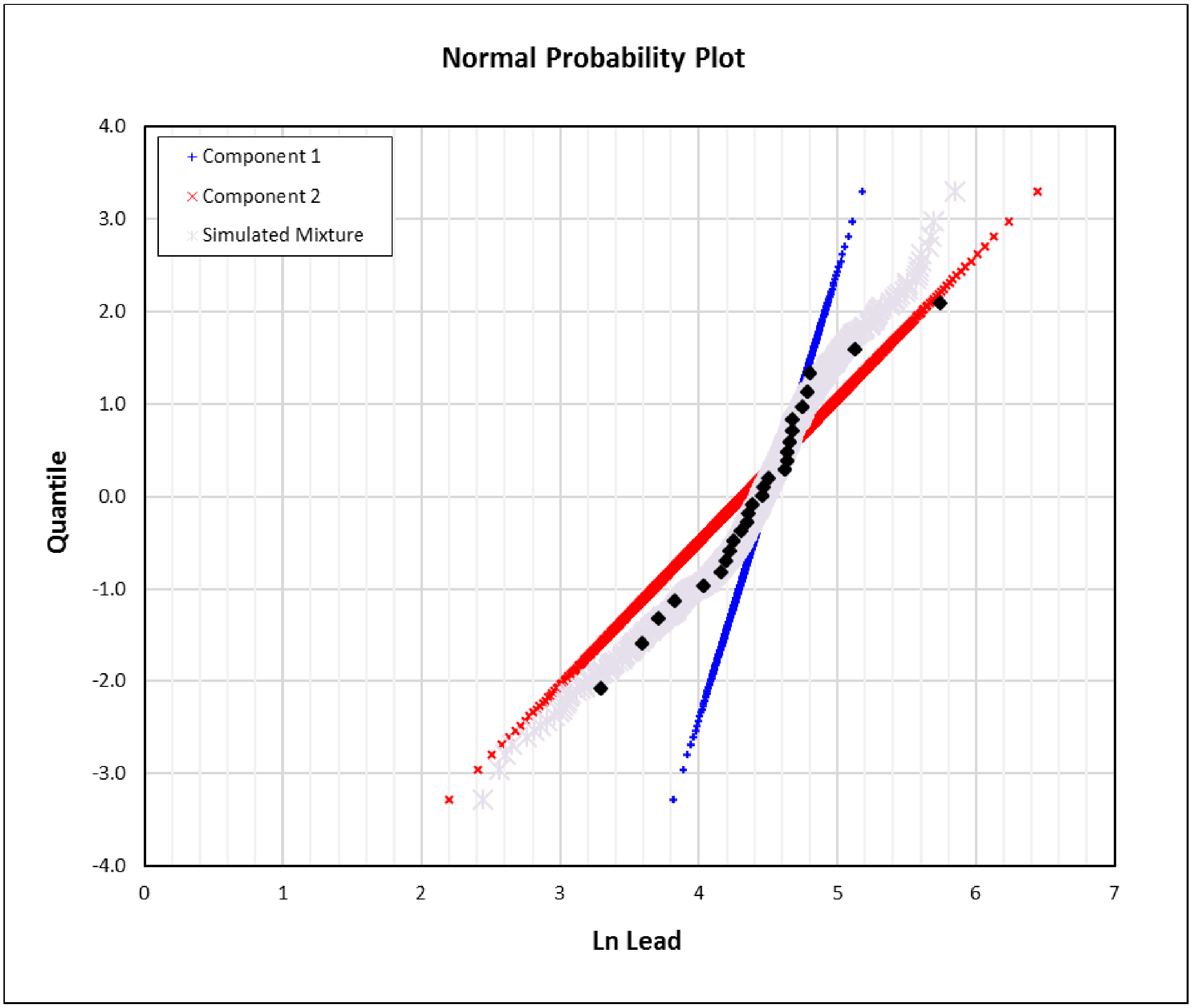

Normal Probability Plot
Component 1
Component 2
Simulated Mixture
Quantile
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-1
0
1
2
3
4
5
6
7
Ln Cobalt

Figure D-2



Normal Probability Plot
Component 1
Component 2
Simulated Mixture
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
Quantile
0
1
2
3
4
5
6
7
Ln Lead

Figure D-3

Attachment C
Professional Certification

Professional Certification

I certify under penalty of law that this report and all attachments were prepared by me or under my direct supervision in accordance with the Voluntary Remediation Program Act (O.C.G.A. Section 12-8-101, et seq.). I am a professional engineer / professional geologist who is registered with the Georgia State Board of Registration for Professional Engineers and Land Surveyors / Georgia State Board of Registration for Professional Geologists and I have the necessary experience and am in charge of the investigation and remediation of this release of regulated substances.

Furthermore, to document my direct oversight of the Voluntary Remediation Plan development, implementation of corrective action, and long term monitoring, I have attached a monthly summary of hours invoiced and description of services provided by me to the Voluntary Remediation Program participant since the previous submittal to the Georgia Environmental Protection Division.

The information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Andrew Romanek

Andrew P. Romanek, P.E.
Associate
CDM Smith

GEORGIA
REGISTERED
No. PE029287
PROFESSIONAL
ENGINEER
ANDREW PAUL ROMANEK

6/17/13

Date

Summary of Oversight Provided by Georgia Licensed Engineers and Geologists

Engineer / Geologist	License Type and No.	Week Ending Date	Number of Hours	Description of Hours
Tom Duffey	Geologist PG000899	12/1/12	1.5	Oversight of field investigations and data analysis and interpretation. This work includes, but is not limited to, access agreement support; health and safety; subcontractor oversight; field work coordination and oversight; data review; updates to the site conceptual model; and reporting.
		12/22/13	1	
		1/26/13	3	
		2/2/13	2	
		2/9/13	2.5	
		3/2/13	2	
		3/16/13	0.5	
		3/30/13	1.5	
		4/6/13	2	
		4/27/13	1	
		5/18/13	3.5	
		5/25/13	7	
		6/1/13	1	
John Reichling	Engineer PE017367	12/8/12	1	CDM Smith Officer in Charge and person overall responsible for project execution and quality. This includes oversight of field investigations and reporting, and adherence to CDM Smith's quality management procedures.
		1/5/13	1	
		1/26/13	1	
		2/9/13	1	
		2/16/13	1	
		3/9/13	1	
		3/23/13	1	
		4/13/13	1	
		4/20/13	1	
		4/27/13	1	
		5/4/13	1	
		5/11/13	1	
		5/18/13	1	
Andrew Romanek	Engineer PE029287	12/1/12	5	Oversight of field investigations and data analysis and interpretation. This work includes, but is not limited to, access agreement support; health and safety; subcontractor oversight; field work coordination and oversight; data review; updates to the site conceptual model; reporting; and project management.
		12/8/12	4	
		12/15/12	5	
		1/5/13	0.5	
		1/12/13	1.5	
		1/26/13	3	
		2/2/13	0.5	
		2/9/13	1	
		2/16/13	3	
		2/23/13	0.5	
		3/2/13	1	
		3/9/13	1	
		3/16/13	1	
		3/23/13	1	
		3/30/13	2	
		4/6/13	2.5	
		4/13/13	3	
		4/20/13	3	
		4/27/13	1	
		5/4/13	0.5	
		5/11/13	2	
		5/18/13	2.5	
		5/25/13	4	
		6/1/13	1	