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WORK PLAN

Soil Arsenic and Lead Additional Delineation Work Plan for the Former Virginia-Carolina Chemical Company Phosphate/Fertilizer Plant, Wadesboro, North Carolina

Exxon Mobil Corporation
Houston, Texas

May 2002

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Appendix A Niton 700S-Series Multi-Element Analyzer

LIST OF ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order on Consent
Bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
ExxonMobil	Exxon Mobil Corporation
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
LOD	level of detection
QAPP	quality assurance project plan
SARA	Superfund Amendments and Reauthorization Act
TCLP	Toxicity Characteristic Leaching Procedure
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VCC	Virginia-Carolina Chemical Company
XRF	x-ray fluorescence

1. Introduction

1.1 Introduction

This Soil Arsenic and Lead Additional Delineation Work Plan (Work Plan) outlines the technical approach and methods for more completely delineating the magnitude and extent of soils containing arsenic and/or lead at concentrations greater than action levels at the former Virginia-Carolina Chemical Company (VCC) phosphate/fertilizer plant located in Wadesboro, North Carolina (the Site). Figure 1-1 identifies the site location on the U.S. Geological Survey (USGS) 7.5-minute quadrangle for Wadesboro, North Carolina.

The work will be completed in accordance with, and subject to, the terms, conditions, reservations of rights, denial of any admission of liability, and all other provisions of the Administrative Order on Consent (AOC) for Removal Action for the Site entered into voluntarily by Exxon Mobil Corporation (ExxonMobil), the successor in interest to the former VCC plant listed above, and the United States Environmental Protection Agency (USEPA) pursuant to the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). The Docket Number for the AOC is 01-06-C. The effective date of the AOC is December 29, 2000. This Work Plan has been prepared in accordance with the requirements of the AOC.

1.2 Project Objectives

Initial characterization (Tetra Tech EMI, 2000; BBL, 2001b) of the magnitude and horizontal and vertical extent of soil containing arsenic and/or lead at concentrations greater than action levels indicated that soil in the southern portion of the site in the vicinity of the former acid chambers generally contained the highest arsenic and lead concentrations. ExxonMobil is currently evaluating alternatives for remediation of these soils and desires to delineate more finely the arsenic and lead concentrations in these soils so that more accurate cost estimates can be prepared. Therefore, the objective of this work is to more completely and accurately delineate the magnitude and horizontal and vertical extent of soil at the Site previously identified as containing arsenic and/or lead at concentrations above action levels. The data generated during the activities will be used as the final delineation data for the Site; therefore, no further areal delineation will be performed.

1.3 Work Plan Organization

This Work Plan is organized into four sections, beginning with this introduction. Section 2 presents the delineation strategy to be employed and Section 3 summarizes the sample collection and analysis procedures that will be utilized during the work. Finally, Section 4 lists the references cited in this Work Plan. This Work Plan also contains one appendix. Appendix A contains information on the x-ray fluorescence instrument that will be used for field analysis of soil samples.

2. Delineation Strategy

2.1 Introduction

Initial characterization (Tetra Tech EMI, 2000; BBL, 2001b) of the magnitude and horizontal and vertical extent of soil containing arsenic and/or lead at concentrations greater than action levels indicated that soil in the southern portion of the site in the vicinity of the former acid chambers generally contained the highest arsenic and lead concentrations. The action levels for the Site are as follows:

	Action Levels (mg/kg)	
Analyte	On-Site	Off-Site
Arsenic	27	22
Lead	750	400

Existing data are presented in Tables 2-1 through 2-3 and shown on Figure 2-1.

During the evaluation of alternatives for the Site (BBL, 2002), Theissen polygons were drawn around each surface and subsurface soil sample to define the surface area that each sample represents (Figures 2-2 and 2-3). Surface areas and volumes of soil with arsenic and/or lead concentrations greater than action levels are presented in Tables 2-4 through 2-6. These data are used as the basis of the evaluation of the need for additional horizontal and vertical delineation discussed below.

2.2 Horizontal Delineation

As shown in Figure 2-1, the highest arsenic and lead concentrations are present in the soil in the southern area of the Site in the vicinity of the former acid chambers and an area of barren soil. Figures 2-2 and 2-3 show the polygons that depict the areas with soil arsenic and/or lead concentrations greater than action levels.

Additional horizontal delineation is needed within the shaded polygons to accurately identify the outer boundaries of the area of soil with arsenic and/or lead concentrations greater than action levels (Figure 2-4). Of particular interest are the polygons that make up the northern boundary of the shaded area (polygons SB9, SB11, SB12, and SB14), because samples from single soil borings within these polygons are used to represent relatively large surface areas.

Additional horizontal delineation is also needed around the borings along the southern perimeter of the property to fully define the extent of elevated arsenic and lead concentrations. Physical boundaries to soil transport exist in the form of the bed of the former railroad spur to the southwest and a hill to the southeast; however, additional delineation between the perimeter borings and these physical features is needed to fully characterize the limits of the arsenic- and lead-containing soil. Finally, additional delineation is needed within off-site polygon SB20 to more closely define the limits of arsenic- and lead-containing soil around boring WB-SB20 as well as in the dry drainage that drains the southern portion of the Site (polygons SD3 and SD4).

Table 2-7 summarizes the delineation program that will be implemented to define the boundaries of the soil containing arsenic and/or lead at concentrations above action levels. Additional sampling may be performed beyond that specified in Table 2-7 if necessary to complete the delineation to below action levels. The location and intervals for additional delineation will be determined in the field based on an evaluation of the generated data.

Additional delineation will only be performed for the metals that were present in the sample at concentrations above action levels (i.e., arsenic and/or lead). For example, at boring WB-SB09, only lead was present in the soil samples at concentrations exceeding action levels; therefore, additional delineation in polygon SB9 will only be performed for lead. Conversely, at boring WB-SB16, only arsenic was present in the soil samples at concentration exceeding action levels; therefore, additional delineation around this boring need only be performed for arsenic. Finally, both arsenic and lead will be measured around borings with samples that contained both of these metals at concentrations above action levels.

2.3 Vertical Delineation

During the site characterization (BBL, 2001b) soil samples were collected from each boring from the depths of 0-0.5 feet below ground surface (bgs), 2 – 4 feet bgs, 4 – 6 feet bgs, and in some borings 6 – 8 feet bgs and 8 – 10 feet bgs. The soil samples from the 0 – 0.5 foot bgs interval were collected as five-point composite samples of soil from the central soil boring and from four equally spaced surficial soil samples located approximately 20 feet from the central boring. The 0 – 0.5 and 2 – 4 feet bgs samples from every boring were analyzed. In borings where the 2 – 4 feet bgs samples contained potentially elevated arsenic and/or lead concentrations, samples from deeper intervals were also analyzed until arsenic and/or lead concentrations were no longer elevated. In this manner it was determined that soil containing arsenic and/or lead at concentrations greater than action levels was limited primarily to the upper two feet of soil, with elevated concentrations extending to no more than 4 feet bgs in only a few borings.

While the lower depth boundary of elevated arsenic and/or lead concentrations is generally well defined across the Site, additional vertical delineation is needed to further define the depth of impact from the 0.5 - 2 feet bgs depth interval. No data were collected from this depth interval during the site characterization; therefore, soil volume estimates made during the evaluation of alternatives for the site (BBL, 2002) made the assumption that the soil data from the 0 – 0.5 foot bgs soil interval was representative of the 0 – 2 feet bgs soil interval, which may have resulted an overestimate of the volume of impacted soil that needs to be remediated. Therefore, additional delineation of the 0.5 – 2 foot bgs interval is needed in numerous borings to determine the actual depth of impacted soil. Additional vertical delineation will be performed in 6-inch increments.

Table 2-7 summarizes the delineation program that will be implemented to more finely identify the vertical boundaries of the soil containing arsenic and/or lead at concentrations above action levels. As with the horizontal delineation activities, vertical delineation will be performed only for the metals that are present in that boring at concentrations greater than action levels.

3. Delineation Procedures

3.1 Introduction

This section provides the procedures that will be followed to collect and analyze the soil samples.

3.2 Sample Collection

Soil samples will be collected using either manual (i.e., via hand auger or manual advancement of split spoons) or mechanical (i.e., Geoprobe) techniques at the locations described in Table 2-7 and shown on Figure 2-4. Geoprobe sampling will be performed whenever possible so that the most accurate description of boring lithology can be obtained. Soil sample collection and equipment decontamination procedures will be in accordance with the methods provided in the USEPA-approved Site Characterization Work Plan (BBL, 2001a). Samples will be analyzed as specified in Section 3.3, below. Information on the observed lithology will be recorded, along with photographs of cores (as appropriate), to collect information that may prove useful in the visual identification of potentially-impacted soil during remedial activities. The core name, scale, and interval of sample collection will be identified in the photographs. The location of all soil borings will be surveyed as specified in the Work Plan (BBL, 2001a).

3.3 Sample Analyses

3.3.1 Field Analysis

Soil samples will be analyzed in the field via X-ray Fluorescence (XRF) to provide real-time arsenic and lead concentrations. A Niton 700S-series High Resolution Multi-Element Analyzer equipped with a ^{109}Cd isotope source (or equivalent) operated by a trained, licensed operator will be used to analyze samples in the field. This instrument is self-calibrating; therefore, field calibration is not necessary. Appendix A contains information on the Niton 700S-series Multi-Element Analyzer.

The lowest achievable limits of detection (LODs) for arsenic and lead in typical, homogenous soil matrices, as reported by Niton, along with the action levels for the Site, are as follows:

		Action Levels	
Analyte	**LOD**	**On-Site**	**Off-Site**
Arsenic	15	27	22
Lead	20	750	400

All units values in mg/kg

For an instrument to be useable for the delineation of arsenic and lead in soil, the LOD for each element should be lower than the lowest action level for that element. The Niton-reported LODs for arsenic and lead are both below the action levels, but to different degrees. The lead LOD is significantly (20 times) lower than the lowest action levels, while the lowest arsenic action level is only approximately 1.5 times the arsenic LOD. . Furthermore, according to Niton, the arsenic LOD will increase when higher concentrations of lead are present in a soil sample. Therefore, it is anticipated that at this site this instrument will be most useful for the measurement of soil lead concentrations and it could be less useful for the delineation of arsenic. This is not critical because lead is the element that is most widespread at the site at the highest concentrations; therefore, the need for additional lead data will drive most of the additional delineation efforts. In polygons where arsenic drives the additional delineation, if the XRF LODs are not low enough then samples will be sent to a fixed-base laboratory for analysis to confirm delineation.

3.3.2 Laboratory Analysis

A minimum of five percent (1 in 20) of all samples collected to delineate the final horizontal and vertical boundaries of the polygons will be sent to a fixed-base laboratory (TestAmerica of Nashville, Tennessee) for analysis. Samples will be analyzed for arsenic and/or lead as specified in Table 2-7. During the delineation of soil arsenic and/or lead concentrations in a polygon, the generated XRF data will be used as the sole means of delineation when the concentration of those metals in the soil (as measured by XRF) is less than or equal to 80% of the action level. Therefore, no samples will be collected for fixed-base laboratory analysis when on-site lead concentrations are less than or equal to 600 mg/kg (80% of 750 mg/kg) or when off-site concentrations are less than or equal to 320 mg/kg (80% of 400 mg/kg). Similarly, no samples will be collected for fixed-base laboratory analysis when on-site arsenic concentrations are less than or equal to 22 mg/kg (80% of 27 mg/kg) or when off-site arsenic concentrations are less than or equal to 18 mg/kg (80% of 22 mg/kg). If soil arsenic and/or lead concentrations measured via XRF are between 80% and 100% of the action level, one of the following two options will be implemented:

- Additional delineation will be performed using XRF soil analyses until arsenic and/or lead concentrations are less than or equal to 80% of the action level; or
- The samples will be sent for fixed-base laboratory analysis to confirm that the arsenic and/or lead concentration is below the action level.

It may be difficult to attain arsenic LODs that are low enough to make delineation decisions. If this becomes the case, then the affected samples used for final delineation of the boundaries of arsenic-impacted soil will be analyzed by the fixed-base laboratory. Samples will be analyzed in accordance with the methods and procedures specified in the Quality Assurance Project Plan (QAPP) included in the USEPA-approved Site Characterization Work Plan (BBL, 2001a).

3.4 Additional Physical Delineation

Additional physical delineation of impacted soil between delineation sampling points may be performed to further define the areal extent of impact. A two-foot deep trench will be excavated around the perimeter of the delineated boundary around the area of discolored soil to help further define the outer limits of impacted soil. The outer sidewalls will be inspected for the presence of physical characteristics representative of impacted soil, e.g., the presence of slag or discolored soil, that were identified during the sample collection and analysis activities. The trench will be backfilled with the excavated soil upon completion of the delineation and the location of the trench perimeter recorded via surveying.

3.5 TCLP Analysis

During the additional delineation activities samples will be collected and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals to provide data on metals leachability that will be used to determine potential treatment and/or disposal requirements. The number and location of the samples will be determined in the field based on the results of the additional delineation activities. TCLP analyses will be performed by TestAmerica of Nashville, Tennessee.

3.6 Treatability Test Samples

ExxonMobil is considering performing a treatability study for impacted soils to determine treatment alternatives to reduce the leachability of arsenic and lead. Reduction of the leachability of these metals to below 5 milligrams per liter (mg/L) would allow the soil to be disposed of at a RCRA Subtitle D landfill instead of a RCRA Subtitle C landfill. The corresponding significant reduction in transport and disposal costs may result in excavation and off-site disposal alternatives becoming more cost effective. The location and number of soil samples will be determined in the field based on the data generated during the delineation activities. Plastic,

sealable five-gallon buckets will be filled from the designated sample locations for shipment to the treatability study laboratory.

4. References

BBL. 2001a. Site Characterization Work Plan for the Former Virginia-Carolina Chemical Company Phosphate/Fertilizer Plant, Wadesboro, North Carolina. March 28, 2001.

BBL. 2001b. Site Characterization Report for the Former Virginia-Carolina Chemical Company Phosphate/Fertilizer Plant, Wadesboro, North Carolina (Revision 1). December 2001. Submitted to USEPA Region 4 on behalf of the Exxon Mobil Corporation.

BBL. 2002. Alternatives Evaluation Report, Wadesboro VCC Site, Wadesboro,, NC. April 2002. Submitted to USEPA Region 4 on behalf of the Exxon Mobil Corporation.

Tetra Tech EMI. 2000. Letter Report, Virginia Carolina Chemical Site, Wadesboro, Anson County, North Carolina. Letter from Steve Pierce, Tetra Tech EMI to John Nolen, USEPA. February 1, 2000.

Tables

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Table 2-1
Arsenic and Lead Concentrations in On-Site Soil Samples from USEPA Investigation, December 1999
Wadesboro VCC - Additional Delineation Work Plan

Analyte	Action Level: On-Site (mg/kg)	Sample Name, Description, and Depth (all results reported in mg/kg)							
		VC-01-SS discolored area; center (0.5 feet bgs)	VC-02-SB discolored area; center (1.5 feet bgs)	VC-03-SB discolored area; center (2.5 feet bgs)	VC-04-SS discolored area; NW corner (surficial)	VC-05-SS drainage ditch; pump house (surficial)	VC-06-SS concrete drainage path; NE RR spur (surficial)	VC-07-SS former acid chambers; SE corner (surficial)	VC-08-SS drainage ditch; 24" pipe (surficial)
Metals									
Arsenic	27	19.9	4	11.5	43.4	965	10.3	23.8	42.6
Lead	750	1,560	1,080	1,790	29,700	8,490	230	1,150	1,940

Notes:

bgs = below ground surface

Double-boxed values exceed on-site action levels

Table 2-2
Arsenic and Lead Concentrations in On-Site Site Characterization Soil Samples
Wadesboro VCC - Additional Delineation Work Plan

			Concentration in Sample:								
Analyte	On-site Action Level	Units	WB-SB01 0-0.5 ft bgs	WB-SB01 2-3.5 ft bgs	WB-SB02 0-0.5 ft bgs	WB-SB02 2-4 ft bgs	WB-SB03 0-0.5 ft bgs	WB-SB03 2-4 ft bgs	WB-SB04 0-0.5 ft bgs	WB-SB04 2-4 ft bgs	WB-SB05 0-0.5 ft bgs
Metals											
Arsenic	27	mg/kg	6.5	3.5	7.4	2.1 B	1.9 B	5.7	8.3	4.4	4.4
Lead	750	mg/kg	119 J	11.0 J	52.3	7.9	13.3	19.4	116 J	20.4 J	15.7 J
pH	--	S.U.	5.00	4.07	4.77	4.76	5.96	3.95	5.48	4.21	7.85

Table 2-2
Arsenic and Lead Concentrations in On-Site Site Characterization Soil Samples
Wadesboro VCC - Additional Delineation Work Plan

			Concentration in Sample:						
Analyte	On-site Action Level	Units	WB-SB05 2-4 ft bgs	WB-SB06 0-0.5 ft bgs	WB-SB06 2-4 ft bgs	WB-SB07 0-0.5 ft bgs	WB-SB07 2-3.5 ft bgs	WB-SB08 0-0.5 ft bgs	WB-SB08 2-4 ft bgs
Metals									
Arsenic	27	mg/kg	4.0	9.6	4.0	5.5	3.9	5.0	3.0
Lead	750	mg/kg	21.7 J	18.7 J	12.5 J	33.5 J	8.0 J	121	5.0
pH	--	S.U.	4.57	6.65	4.37	4.60	3.37	4.95	4.81

Table 2-2
Arsenic and Lead Concentrations in On-Site Site Characterization Soil Samples
Wadesboro VCC - Additional Delineation Work Plan

			Concentration in Sample:							
Analyte	On-site Action Level	Units	WB-SB09 0-0.5 ft bgs	WB-SB09 2-4 ft bgs	WB-SB10 0-0.5 ft bgs	WB-SB10 2-4 ft bgs	WB-SB11 0-0.5 ft bgs	WB-SB11 2-4 ft bgs	WB-SB12 0-0.5 ft bgs	WB-SB12 2-4 ft bgs
Metals										
Arsenic	27	mg/kg	14.8 J	7.3	10.9	7.8	33.7	8.6 J	8.5	14.9
Lead	750	mg/kg	1370 J	35.2	643 J	23.1 J	8520 J	15.3 J	32100 J	105 J
pH	--	S.U.	4.90	4.12	4.62	4.17	4.50	3.23	4.41	3.75

Table 2-2
Arsenic and Lead Concentrations in On-Site Site Characterization Soil Samples
Wadesboro VCC - Additional Delineation Work Plan

			Concentration in Sample:							
Analyte	On-site Action Level	Units	WB-SB13 0-0.5 ft bgs	WB-SB13 2-4 ft bgs	WB-SB14 0-0.5 ft bgs	WB-SB14 2-4 ft bgs	WB-SB15 0-0.5 ft bgs	WB-SB91[1] 0-0.5 ft bgs	WB-SB15 2-4 ft bgs	WB-SB90[2] 2-4 ft bgs
Metals										
Arsenic	27	mg/kg	54.8	4.1	84.1	8.3	25.6	21.2	91.2	55.1
Lead	750	mg/kg	453 J	7.7 J	1720 J	17.6 J	1410	1490 J	54.7 J	550 J
pH	--	S.U.	7.01	3.99	5.31	3.50	3.33	3.62	3.27	2.81

Table 2-2
Arsenic and Lead Concentrations in On-Site Site Characterization Soil Samples
Wadesboro VCC - Additional Delineation Work Plan

			Concentration in Sample:					
Analyte	On-site Action Level	Units	WB-SB15 4-6 ft bgs	WB-SB16 0-0.5 ft bgs	WB-SB16 2-4 ft bgs	WB-SB17 0-0.5 ft bgs	WB-SB17 2-4 ft bgs	WB-SB19 0-0.5 ft bgs
Metals								
Arsenic	27	mg/kg	6.4	44.6	4.7	34.2 J	6.4	112 J
Lead	750	mg/kg	15.1 J	664	8.4 J	658 J	20.7 J	19800 J
pH	--	S.U.	4.69	5.37	3.89	3.81	3.11	3.33

Table 2-2
Arsenic and Lead Concentrations in On-Site Site Characterization Soil Samples
Wadesboro VCC - Additional Delineation Work Plan

			Concentration in Sample:		
Analyte	On-site Action Level	Units	WB-SB92[13] 0-0.5 ft bgs	WB-SB19 2-4 ft bgs	WB-SB19 4-6 ft bgs
Metals					
Arsenic	27	mg/kg	122 J	38.9 J	6.2
Lead	750	mg/kg	80300 J	19.1 J	194
pH	--	S.U.	3.00	2.91	3.86

Table 2-2
Arsenic and Lead Concentrations in On-Site Site Characterization Soil Samples
Wadesboro VCC - Additional Delineation Work Plan

Notes:
\1 Blind field duplicate of sample WB-SB15 0-0.5 ft bgs
\2 Blind field duplicate of sample WB-SB15 2-4 ft bgs
\3 Blind field duplicate of sample WB-SB19 0-0.5 ft bgs
Double-boxed results exceed on-site action level

Table 2-3
Arsenic and Lead Concentrations in Off-Site Site Characterization Soil Samples
Wadesboro VCC - Additional Delineation Work Plan

			Concentration in Sample:					
Analyte	Off-site Action Level	Units	WB-SB18 2-4 ft bgs	WB-SB20 0-0.5 ft bgs	WB-SB20 2-4 ft bgs	WB-SB20 4-6 ft bgs	WB-SD03\1	WB-SD04\1
Metals								
Arsenic	22	mg/kg	3.5	14.2	72.4	21.6	17.7	51 J
Lead	400	mg/kg	8.5 J	162	478 J	147	408	611 J
pH	--	S.U.	3.48	6.80	4.85	5.80	4.58	4.11

Notes:

\1 Although these samples are numbered with a sediment sample convention, these samples were collected in a dry drainage ditch and are actually soil samples due to the absence of flow

Double-boxed results exceed off-site action level

Table 2-4
Soil Surface Area and Volume Above Site-Specific Action Levels: 0 - 2 Foot Depth Increment
Wadesboro VCC - Additional Delineation Work Plan

Polygon/ Sample Location	Polygon/ Sample ID	Polygon Area (sq. ft.)	Sample Depth (ft.)	Arsenic Conc. (mg/kg)	As Conc. > Action Level?	Lead Conc. (mg/kg)	Pb Conc. > Action Level?	Surface Area Above Action Level (sq. ft.)			In-Place Volume Above Action Level (cy)		
								Total	On Site	Off Site	Total	On Site	Off Site
On Site	WB-SB01	17,707	0 - 2	6.5	No	119 J	No	0	0	NA	0	0	NA
	WB-SB02	71,502	0 - 2	7.4	No	52.3	No	0	0	NA	0	0	NA
	WB-SB03	59,908	0 - 2	1.9 B	No	13.3	No	0	0	NA	0	0	NA
	WB-SB04	46,401	0 - 2	8.3	No	116 J	No	0	0	NA	0	0	NA
	WB-SB05	33,112	0 - 2	4.4	No	15.7 J	No	0	0	NA	0	0	NA
	WB-SB06	25,878	0 - 2	9.6	No	18.7 J	No	0	0	NA	0	0	NA
	WB-SB07	28,835	0 - 2	5.5	No	33.5 J	No	0	0	NA	0	0	NA
	WB-SB08	36,570	0 - 2	5	No	121	No	0	0	NA	0	0	NA
	WB-SB09	22,087	0 - 2	14.8 J	No	1,370 J	YES	22,087	22,087	NA	1,636	1,636	NA
	WB-SB10	14,322	0 - 2	10.9	No	643 J	No	0	0	NA	0	0	NA
	WB-SB11	14,357	0 - 2	33.7	YES	8,520 J	YES	14,357	14,357	NA	1,063	1,063	NA
	WB-SB12	20,150	0 - 2	8.5	No	32,100 J	YES	20,150	20,150	NA	1,493	1,493	NA
	WB-SB13	7,272	0 - 2	54.8	YES	453 J	No	7,272	7,272	NA	539	539	NA
	WB-SB14	5,046	.0 - 2	84.1	YES	1,720 J	YES	5,046	5,046	NA	374	374	NA
	WB-SB15	1,704	0 - 2	23.4	No	1,450 J	YES	1,704	1,704	NA	126	126	NA
	WB-SB16	2,407	0 - 2	44.6	YES	664	No	2,407	2,407	NA	178	178	NA
	WB-SB17	2,361	0 - 2	34.2 J	YES	658 J	No	2,361	2,361	NA	175	175	NA
	WB-SB19	1,330	0 - 2	117 J	YES	50,050 J	YES	1,330	1,330	NA	99	99	NA
	VC-01-SS	1,504	0 - 2	19.9	No	1,560	YES	1,504	1,504	NA	111	111	NA
	VC-04-SS	2,669	0 - 2	43.4	YES	29,700	YES	2,669	2,669	NA	198	198	NA
	VC-05-SS	3,318	0 - 2	965	YES	8,490	YES	3,318	3,318	NA	246	246	NA
	VC-06-SS	24,884	0 - 2	10.3	No	230	No	0	0	NA	0	0	NA
	VC-07-SS	9,494	0 - 2	23.8	No	1,150	YES	9,494	9,494	NA	703	703	NA
	VC-08-SS	1,181	0 - 2	42.6	YES	1,940	YES	1,181	1,181	NA	87	87	NA
Off Site	WB-SB18	11,856	0 - 2	20.3 J	No	174 J	No	0	NA	0	0	NA	0
	WB-SB20	11,577	0 - 2	14.2	No	162	No	0	NA	0	0	NA	0
	WB-SD03	1,600	0 - 2	17.7	No	408	YES	1,600	NA	1,600	119	NA	119
	WB-SD04	1,600	0 - 2	51 J	YES	611 J	YES	1,600	NA	1,600	119	NA	119
Totals:	**Totals:**	480,632	--	--		--		98,080	94,880	3,200	7,265	7,028	237

Table 2-4
Soil Surface Area and Volume Above Site-Specific Action Levels: 0 - 2 Foot Depth Increment
Wadesboro VCC - Additional Delineation Work Plan

Notes:

1. Polygon ID and area based on information shown on Figure 2-2.
2. For instances where a duplicate sample was available, the average of the samples was included in the table.
3. All calculations and rounding are performed by the computer software. Therefore, certain quantities in the above table are displayed as rounded numbers for table clarity.
4. Site-Specific Action Levels are:

	On-Site Soil	Off-Site Soil
Arsenic	27 mg/kg	22 mg/kg
Lead	750 mg/kg	400 mg/kg

NA = not applicable

Table 2-5
Soil Surface Area and Volume Above Site-Specific Action Levels: 2 - 4 Foot Depth Increment
Wadesboro VCC - Additional Delineation Work Plan

Polygon/ Sample Location	Polygon/ Sample ID	Polygon Area (sq. ft.)	Sample Depth (ft.)	Arsenic Conc. (mg/kg)	As Conc. > Action Level?	Lead Conc. (mg/kg)	Pb Conc. > Action Level?	Surface Area Above Action Level (sq. ft.)			In-Place Volume Above Action Level (cy)		
								Total	On Site	Off Site	Total	On Site	Off Site
On Site	WB-SB01	17,707	2 - 4	3.5	No	11.0 J	No	0	0	NA	0	0	NA
	WB-SB02	71,502	2 - 4	2.1 B	No	7.9	No	0	0	NA	0	0	NA
	WB-SB03	59,908	2 - 4	5.7	No	19.4	No	0	0	NA	0	0	NA
	WB-SB04	46,401	2 - 4	4.4	No	20.4 J	No	0	0	NA	0	0	NA
	WB-SB05	33,112	2 - 4	4.0	No	21.7 J	No	0	0	NA	0	0	NA
	WB-SB06	30,388	2 - 4	4.0	No	12.5 J	No	0	0	NA	0	0	NA
	WB-SB07	28,835	2 - 4	3.9	No	8.0 J	No	0	0	NA	0	0	NA
	WB-SB08	37,970	2 - 4	3.0	No	5.0	No	0	0	NA	0	0	NA
	WB-SB09	39,913	2 - 4	7.3	No	35.2	No	0	0	NA	0	0	NA
	WB-SB10	15,683	2 - 4	7.8	No	23.1 J	No	0	0	NA	0	0	NA
	WB-SB11	16,229	2 - 4	8.6 J	No	15.3 J	No	0	0	NA	0	0	NA
	WB-SB12	20,150	2 - 4	14.9	No	105 J	No	0	0	NA	0	0	NA
	WB-SB13	9,687	2 - 4	4.1	No	7.7 J	No	0	0	NA	0	0	NA
	WB-SB14	5,046	2 - 4	8.3	No	17.6 J	No	0	0	NA	0	0	NA
	WB-SB15	3,461	2 - 4	73.2	YES	302.4 J	No	3,461	3,461	NA	256	256	NA
	WB-SB16	3,433	2 - 4	4.7	No	8.4 J	No	0	0	NA	0	0	NA
	WB-SB17	9,398	2 - 4	6.4	No	20.7 J	No	0	0	NA	0	0	NA
	WB-SB19	5,179	2 - 4	38.9 J	YES	19.1 J	No	5,179	5,179	NA	384	384	NA
Off Site	WB-SB18	11,856	2 - 4	3.5	No	8.5 J	No	0	NA	0	0	NA	0
	WB-SB20	11,577	2 - 4	72.4	YES	478 J	YES	11,577	NA	11,577	858	NA	858
Totals:		477,435	--	--		--		20,217	8,640	11,577	1,498	640	858

Notes:
1. Polygon ID and area based on information shown on Figure 2-3.
2. For instances where a duplicate sample was available, the average of the samples was included in the table.
3. All calculations and rounding are performed by the computer software. Therefore, certain quantities in the above table are displayed as rounded numbers for table clarity.
4. Site-Specific Action Levels are:

	On-Site Soil	Off-Site Soil
Arsenic	27 mg/kg	22 mg/kg
Lead	750 mg/kg	400 mg/kg

NA = not applicable

Table 2-6
Soil Surface Area and Volume Site-Specific Action Levels: 4 - 6 Foot Depth Increment
Wadesboro VCC - Additional Delineation Work Plan

Polygon/ Sample Location	Polygon/ Sample ID	Polygon Area (sq. ft.)	Sample Depth (ft.)	Arsenic Conc. (mg/kg)	As Conc. > Action Level?	Lead Conc. (mg/kg)	Pb Conc. > Action Level?	Surface Area Above Action Level (sq. ft.)			In-Place Volume Above Action Level (cy)		
								Total	On Site	Off Site	Total	On Site	Off Site
On Site	WB-SB15	3,461	4 - 6	6.4	No	15.1 J	No	0	0	NA	0	0	NA
	WB-SB19	5,179	4 - 6	6.2	No	194.0	No	0	0	NA	0	0	NA
Off Site	WB-SB20	11,577	4 - 6	21.6	No	147	No	0	NA	0	0	NA	0
Totals:		20,217	--	--		--		0	0	0	0	0	0

Notes:

1. Polygon ID and area based on information shown on Figure 2-3.
2. All calculations and rounding are performed by the computer software. Therefore, certain quantities in the above table are displayed as rounded numbers for table clarity.
3. Site-Specific Action Levels are:

	On-Site Soil	Off-Site Soil
Arsenic	27 mg/kg	22 mg/kg
Lead	750 mg/kg	400 mg/kg

NA = not applicable

Table 2-7
Soil Sampling Plan
Wadesboro VCC - Additional Delineation Work Plan

Polygon/ Sample Location	On Site or Off Site	New Sample Location Increments	Sample Depth (ft.)[1]	Maximum Sample Depth (ft.)[1]	Analyte	Justification
WB-SB09	On Site	WB-SB09	0.5 - 1.0	2.0	Lead	Vertical delineation of lead to 2 feet
			1.0 - 1.5			Lead concentrations 0-0.5 ft bgs = 1,370 mg/kg; lead below the action level at 2-4 ft bgs
			1.5 - 2.0			All arsenic concentrations in this boring are below action level
		5 ft to the north	0 - 0.5	2.0	Lead	Horizontal delineation of lead around boring WB-SB09.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the southeast	0 - 0.5	2.0	Lead	Horizontal delineation of lead around boring WB-SB09.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the southwest	0 - 0.5	2.0	Lead	Horizontal delineation of lead around boring WB-SB09.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
WB-SB11	On Site	WB-SB11	0.5 - 1.0	2.0	Lead, Arsenic	Vertical delineation of lead and arsenic to 2 feet
			1.0 - 1.5			Lead concentrations 0-0.5 ft bgs = 8,520 mg/kg; lead below the action level at 2-4 ft bgs
			1.5 - 2.0			Arsenic concentrations 0-0.5 ft bgs = 33.7 mg/kg; lead below the action level at 2-4 ft bgs
		5 ft to the north	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring WB-SB11.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the southeast	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring WB-SB11.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the southwest	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring WB-SB11.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			

Table 2-7
Soil Sampling Plan
Wadesboro VCC - Additional Delineation Work Plan

Polygon/ Sample Location	On Site or Off Site	New Sample Location Increments	Sample Depth (ft.)[1]	Maximum Sample Depth (ft.)[1]	Analyte	Justification
WB-SB12	On Site	WB-SB12	0.5 - 1.0	2.0	Lead	Vertical delineation of lead to 2 feet
			1.0 - 1.5			Lead concentrations 0-0.5 ft bgs = 32,100 mg/kg; lead below the action level at 2-4 ft bgs
			1.5 - 2.0			All arsenic concentrations in this boring are below action level
		5 ft to the north	0 - 0.5	2.0	Lead	Horizontal delineation of lead around boring WB-SB12.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the southwest	0 - 0.5	2.0	Lead	Horizontal delineation of lead around boring WB-SB12.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the southeast	0 - 0.5	2.0	Lead	Horizontal delineation of lead around boring WB-SB12.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
WB-SB13	On Site	WB-SB13	0.5 - 1.0	2.0	Arsenic	Vertical delineation of arsenic to 2 feet
			1.0 - 1.5			Lead concentrations below action level at 0-0.5 and 2-4 ft bgs
			1.5 - 2.0			Arsenic concentrations 0-0.5 ft bgs = 54.8 mg/kg; lead below the action level at 2-4 ft bgs
		5 ft to the northeast	0 - 0.5	2.0	Arsenic	Horizontal delineation of arsenic around boring WB-SB13.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the northwest	0 - 0.5	2.0	Arsenic	Horizontal delineation of arsenic around boring WB-SB13.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the south	0 - 0.5	2.0	Arsenic	Horizontal delineation of arsenic around boring WB-SB13.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			

Table 2-7
Soil Sampling Plan
Wadesboro VCC - Additional Delineation Work Plan

Polygon/ Sample Location	On Site or Off Site	New Sample Location Increments	Sample Depth (ft.)[1]	Maximum Sample Depth (ft.)[1]	Analyte	Justification
WB-SB14	On Site	WB-SB14	0.5 - 1.0	2.0	Arsenic, Lead	Vertical delineation of lead and arsenic to 2 feet
			1.0 - 1.5			Lead concentrations 0-0.5 ft bgs = 1,720 mg/kg; lead below the action level at 2-4 ft bgs
			1.5 - 2.0			Arsenic concentrations 0-0.5 ft bgs = 84.1 mg/kg; lead below the action level at 2-4 ft bgs
		5 ft to the north	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring WB-SB14.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the southeast	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring WB-SB14.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the west (towards fence)	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring WB-SB14.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
WB-SB15 / VC-08-SS	On Site	WB-SB15 / VC-08-SS	2.0 - 2.5	4.0	Arsenic	Vertical delineation of arsenic between 2 and 4 feet
			2.5 - 3.0			Arsenic concentrations at WB-SB15 0-0.5 ft bgs = 25.6[21.2] mg/kg,
			3.0 - 3.5			2-4 ft bgs = 91.2[55.1] mg/kg, and below the action level at 4-6 ft bgs
			3.5 - 4.0			Arsenic concentrations at VC-08-SS (0.5 ft bgs) = 42.6 mg/kg
		5 ft to the south	2.0 - 2.5	4.0	Arsenic	Horizontal delineation of arsenic around borings WB-SB15/VC-08-SS
			2.5 - 3.0			Vertical delineation between 2 and 4 feet.
			3.0 - 3.5			
			3.5 - 4.0			
		5 ft to the east	2.0 - 2.5	4.0	Arsenic	Horizontal delineation of arsenic around borings WB-SB15/VC-08-SS
			2.5 - 3.0			Vertical delineation between 2 and 4 feet.
			3.0 - 3.5			
			3.5 - 4.0			
		5 ft to the west	2.0 - 2.5	4.0	Arsenic	Horizontal delineation of arsenic around borings WB-SB15/VC-08-SS
			2.5 - 3.0			Vertical delineation between 2 and 4 feet.
			3.0 - 3.5			
			3.5 - 4.0			

Table 2-7
Soil Sampling Plan
Wadesboro VCC - Additional Delineation Work Plan

Polygon/ Sample Location	On Site or Off Site	New Sample Location Increments	Sample Depth (ft.)[1]	Maximum Sample Depth (ft.)[1]	Analyte	Justification
WB-SB16	On Site	WB-SB16	0.5 - 1.0	2.0	Arsenic	Vertical delineation of arsenic to 2 feet
			1.0 - 1.5			All lead concentrations in this boring are below action level
			1.5 - 2.0			Arsenic concentrations 0-0.5 ft bgs = 44.6 mg/kg; arsenic below the action level at 2-4 ft bgs
		5 ft to the west (towards access road)	0 - 0.5	2.0	Arsenic	Horizontal delineation of arsenic around boring WB-SB16.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the northeast	0 - 0.5	2.0	Arsenic	Horizontal delineation of arsenic around boring WB-SB16.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the southeast	0 - 0.5	2.0	Arsenic	Horizontal delineation of arsenic around boring WB-SB16.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
WB-SB17	On Site	WB-SB17	0.5 - 1.0	2.0	Arsenic	Vertical delineation of arsenic to 2 feet
			1.0 - 1.5			All lead concentrations in this boring are below action level
			1.5 - 2.0			Arsenic concentrations 0-0.5 ft bgs = 44.6 mg/kg; arsenic below the action level at 2-4 ft bgs
		5 ft to the south/ southeast (towards fence)	0 - 0.5	2.0	Arsenic	Horizontal delineation of arsenic around boring WB-SB17.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the south/ southwest	0 - 0.5	2.0	Arsenic	Horizontal delineation of arsenic around boring WB-SB17.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the north	0 - 0.5	2.0	Arsenic	Horizontal delineation of arsenic around boring WB-SB17.
			0.5 - 1.0			Vertical delineation to 2 feet.
			1.0 - 1.5			
			1.5 - 2.0			

Table 2-7
Soil Sampling Plan
Wadesboro VCC - Additional Delineation Work Plan

Polygon/ Sample Location	On Site or Off Site	New Sample Location Increments	Sample Depth (ft.)[1]	Maximum Sample Depth (ft.)[1]	Analyte	Justification
WB-SB19 / VC-01-SS	On Site	WB-SB19 / VC-01-SS / VC-02-SS / VC-03-SS	2.0 - 2.5	4.0	Arsenic, Lead	Vertical delineation of lead and arsenic between 2 and 4 feet Maximum subsurface lead concentration = 19,800 mg/kg at 0-0.5 ft bgs Maximum subsurface arsenic concentration = 122 mg/kg at 0-0.5 ft bgs Lead and arsenic concentrations are below the action levels at 4-6 ft bgs
			2.5 - 3.0			
			3.0 - 3.5			
			3.5 - 4.0			
		5 ft to the west (towards fence)	2.0 - 2.5	4.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring WB-SB19 Vertical delineation to 4 feet.
			2.5 - 3.0			
			3.0 - 3.5			
			3.5 - 4.0			
		5 ft to the northeast	2.0 - 2.5	4.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring WB-SB19 Vertical delineation to 4 feet.
			2.5 - 3.0			
			3.0 - 3.5			
			3.5 - 4.0			
		5 ft to the southeast	2.0 - 2.5	4.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring WB-SB19 Vertical delineation to 4 feet.
			2.5 - 3.0			
			3.0 - 3.5			
			3.5 - 4.0			
VC-04-SS	On Site	VC-04-SS	0.5 - 1.0	2.0	Arsenic, Lead	Vertical delineation of lead and arsenic to 2 feet; may need to sample deeper due to absence of data below 0.5 ft bgs. Lead concentrations 0-0.5 ft bgs = 29,700 mg/kg Arsenic concentrations 0-0.5 ft bgs = 43.4 mg/kg
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the west (towards fence)	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring VC-04-SS Vertical delineation to 2 feet (or to same depth as vertical delineation at VC-04-SS).
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the northeast	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring VC-04-SS Vertical delineation to 2 feet (or to same depth as vertical delineation at VC-04-SS).
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the southeast	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring VC-04-SS Vertical delineation to 2 feet (or to same depth as vertical delineation at VC-04-SS).
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			

Table 2-7
Soil Sampling Plan
Wadesboro VCC - Additional Delineation Work Plan

Polygon/ Sample Location	On Site or Off Site	New Sample Location Increments	Sample Depth (ft.)[1]	Maximum Sample Depth (ft.)[1]	Analyte	Justification
VC-05-SS	On Site	VC-05-SS	0.5 - 1.0	2.0	Arsenic, Lead	Vertical delineation of lead and arsenic to 2 feet; may need to sample deeper due to absence of data below 0.5 ft bgs. Lead concentrations 0-0.5 ft bgs = 8,490 mg/kg Arsenic concentrations 0-0.5 ft bgs = 965 mg/kg
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the southeast (towards fence)	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring VC-05-SS. Vertical delineation to 2 feet (or to same depth as vertical delineation at VC-05-SS).
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the north	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring VC-05-SS. Vertical delineation to 2 feet (or to same depth as vertical delineation at VC-05-SS).
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the southwest	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring VC-05-SS. Vertical delineation to 2 feet (or to same depth as vertical delineation at VC-05-SS).
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			
VC-07-SS	On Site	VC-07-SS	0.5 - 1.0	2.0	Lead	Vertical delineation of lead to 2 feet; may need to sample deeper due to absence of data below 0.5 ft bgs. Lead concentrations 0-0.5 ft bgs = 1,150 mg/kg Arsenic concentrations are below the action level at 0-0.5 feet
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the east (towards fence)	0 - 0.5	2.0	Lead	Horizontal delineation of lead around boring VC-07-SS. Vertical delineation to 2 feet (or to same depth as vertical delineation at VC-07-SS).
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the northeast (towards SB-09)	0 - 0.5	2.0	Lead	Horizontal delineation of lead around boring VC-07-SS. Vertical delineation to 2 feet (or to same depth as vertical delineation at VC-07-SS).
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the west	0 - 0.5	2.0	Lead	Horizontal delineation of lead around boring VC-07-SS. Vertical delineation to 2 feet (or to same depth as vertical delineation at VC-07-SS).
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			

Table 2-7
Soil Sampling Plan
Wadesboro VCC - Additional Delineation Work Plan

Polygon/ Sample Location	On Site or Off Site	New Sample Location Increments	Sample Depth (ft.)[1]	Maximum Sample Depth (ft.)[1]	Analyte	Justification
WB-SB20	Off Site	WB-SB20	2.0 - 2.5	4.0	Arsenic, Lead	Vertical delineation of lead and arsenic to 4 feet Lead concentrations 2-4 ft bgs = 478 mg/kg; lead below the action level at 0-0.5 and 4-6 ft bgs. Arsenic concentrations 2-4 ft bgs = 72.4 mg/kg; arsenic below the action level at 0-0.5 and 4-6 ft bgs
			2.5 - 3.0			
			3.0 - 3.5			
			3.5 - 4.0			
		5 ft to the northeast (in road)	2.0 - 2.5	4.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring WB-SB20. Vertical delineation between 2 and 4 feet.
			2.5 - 3.0			
			3.0 - 3.5			
			3.5 - 4.0			
		5 ft to the northwest (in road)	2.0 - 2.5	4.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring WB-SB20. Vertical delineation between 2 and 4 feet.
			2.5 - 3.0			
			3.0 - 3.5			
			3.5 - 4.0			
		5 ft to the south (in road)	2.0 - 2.5	4.0	Arsenic, Lead	Horizontal delineation of lead and arsenic around boring WB-SB20. Vertical delineation between 2 and 4 feet.
			2.5 - 3.0			
			3.0 - 3.5			
			3.5 - 4.0			
WB-SD03	Off Site	WB-SD03	0.5 - 1.0	2.0	Lead	Vertical delineation of lead to 2 feet; may need to sample deeper due to absence of data below 0.5 ft bgs. Lead concentrations 0-2 ft bgs = 408 mg/kg Arsenic concentrations are below the action level at 0-2 ft bgs
			1.0 - 1.5			
			1.5 - 2.0			
		2 ft to the east (just outside of ditch)	0 - 0.5	2.0	Lead	Horizontal delineation of lead around boring WB-SD03. Vertical delineation to 2 feet (or same depth as vertical delineation at WB-SD03)
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the north (upstream in ditch)	0 - 0.5	2.0	Lead	Horizontal delineation of lead around boring WB-SD03. Vertical delineation to 2 feet (or same depth as vertical delineation at WB-SD03)
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the south (downstream in ditch)	0 - 0.5	2.0	Lead	Horizontal delineation of lead around boring WB-SD03. Vertical delineation to 2 feet (or same depth as vertical delineation at WB-SD03)
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			

Table 2-7
Soil Sampling Plan
Wadesboro VCC - Additional Delineation Work Plan

Polygon/ Sample Location	On Site or Off Site	New Sample Location Increments	Sample Depth (ft.)\1	Maximum Sample Depth (ft.)\1	Analyte	Justification
WB-SD04	Off Site	WB-SD04	0.5 - 1.0	2.0	Arsenic, Lead	Vertical delineation of lead and arsenic to 2 feet; may need to sample deeper due to absence of data below 0.5 ft bgs. Lead concentrations 0-2 ft bgs = 611 mg/kg; arsenic concentrations 0-2 ft bgs = 51 mg/kg
			1.0 - 1.5			
			1.5 - 2.0			
		2 ft to the east (just outside of ditch)	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead around boring WB-SD04. Vertical delineation to 2 feet (or same depth as vertical delineation at WB-SD04)
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the north (upstream in ditch)	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead around boring WB-SD04. Vertical delineation to 2 feet (or same depth as vertical delineation at WB-SD04)
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			
		5 ft to the south (downstream in ditch)	0 - 0.5	2.0	Arsenic, Lead	Horizontal delineation of lead around boring WB-SD04. Vertical delineation to 2 feet (or same depth as vertical delineation at WB-SD04)
			0.5 - 1.0			
			1.0 - 1.5			
			1.5 - 2.0			

Notes:

\1 Samples will be collected and analyzed at 0.5-foot intervals until the concentration of the metal-of-interest in that boring is below the applicable action level; therefore, it may not be necessary to collect and analyze samples from all depth intervals listed on this table.

Figures

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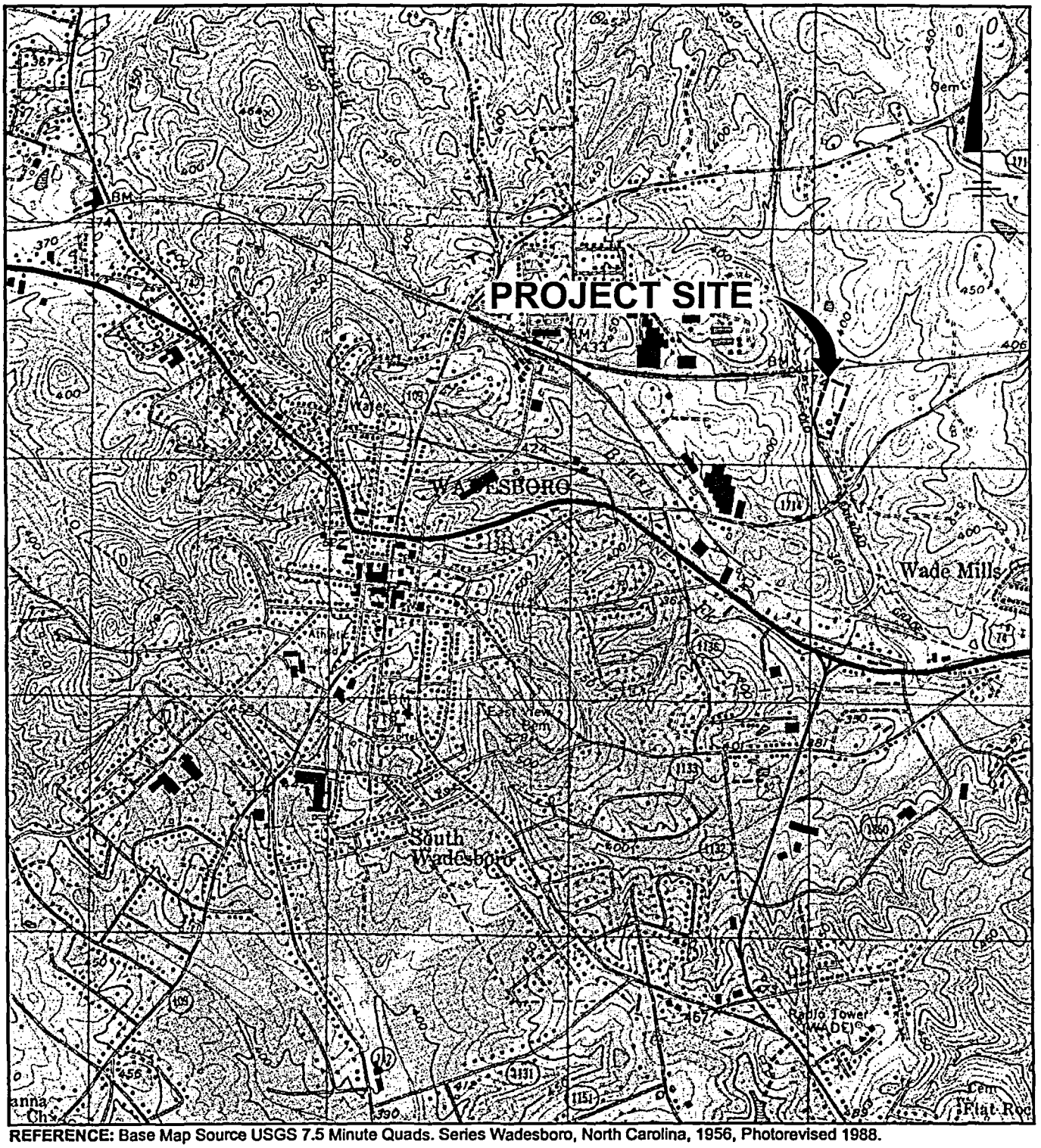


REFERENCE: Base Map Source USGS 7.5 Minute Quads. Series Wadesboro, North Carolina, 1956, Photorevised 1988.

2000' 0 2000'

Approximate Scale: 1" = 2000'

AREA LOCATION

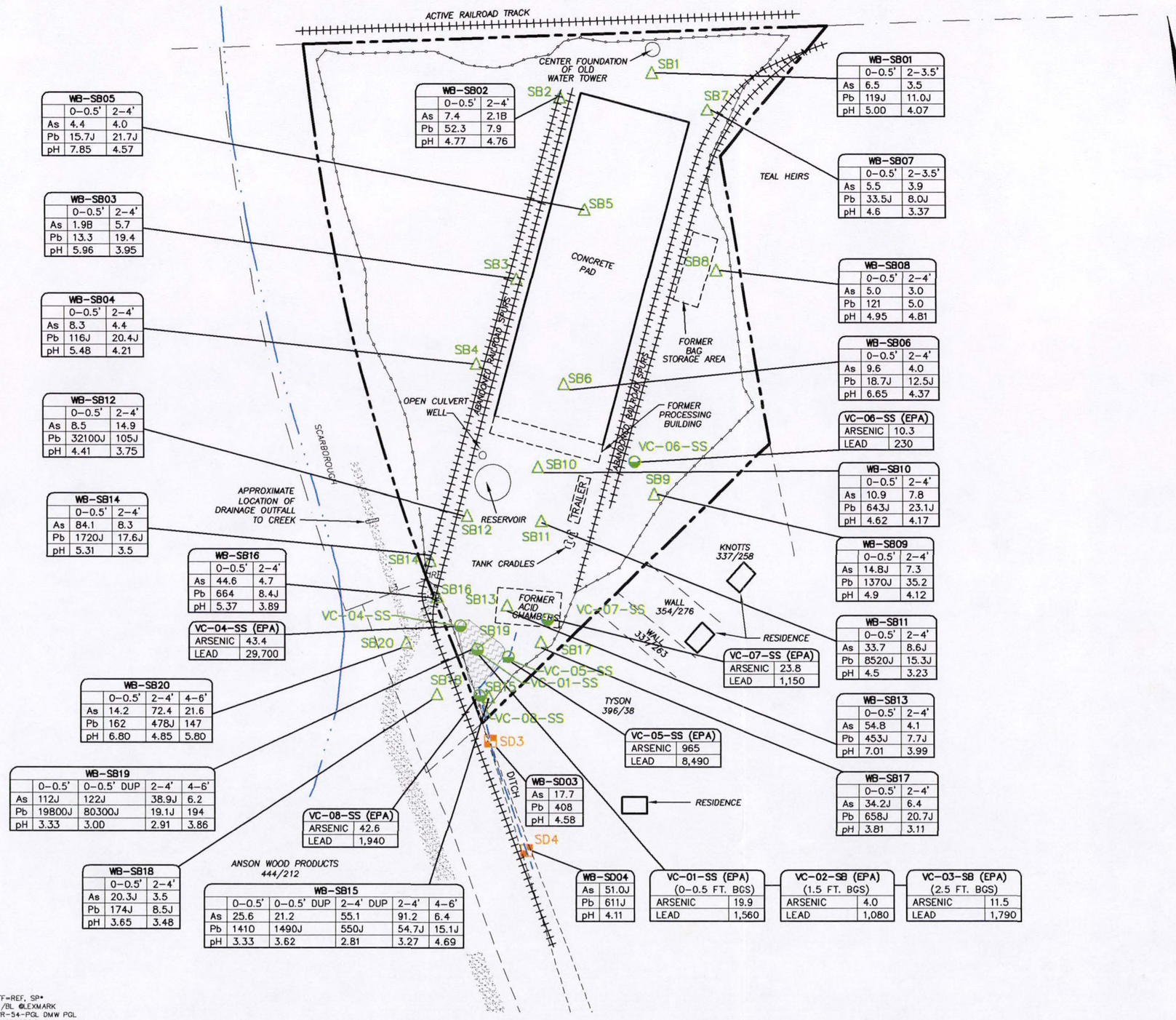
VIRGINIA-CAROLINA CHEMICAL CO. SITE
WADESBORO, NORTH CAROLINA

SITE LOCATION MAP

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
1-1

04/01/02 SYR-D54-LBR
54626003/54626n01.cdr



WB-SB01	0-0.5'	2-3.5'
As	6.5	3.5
Pb	119J	11.0J
pH	5.00	4.07

WB-SB02	0-0.5'	2-4'
As	7.4	2.1B
Pb	52.3	7.9
pH	4.77	4.76

WB-SB03	0-0.5'	2-4'
As	1.9B	5.7
Pb	13.3	19.4
pH	5.96	3.95

WB-SB04	0-0.5'	2-4'
As	8.3	4.4
Pb	116J	20.4J
pH	5.48	4.21

WB-SB05	0-0.5'	2-4'
As	4.4	4.0
Pb	15.7J	21.7J
pH	7.85	4.57

WB-SB06	0-0.5'	2-4'
As	9.6	4.0
Pb	18.7J	12.5J
pH	6.65	4.37

WB-SB07	0-0.5'	2-3.5'
As	5.5	3.9
Pb	33.5J	8.0J
pH	4.6	3.37

WB-SB08	0-0.5'	2-4'
As	5.0	3.0
Pb	121	5.0
pH	4.95	4.81

WB-SB09	0-0.5'	2-4'
As	14.8J	7.3
Pb	1370J	35.2
pH	4.9	4.12

WB-SB10	0-0.5'	2-4'
As	10.9	7.8
Pb	643J	23.1J
pH	4.62	4.17

WB-SB11	0-0.5'	2-4'
As	33.7	8.6J
Pb	8520J	15.3J
pH	4.5	3.23

WB-SB12	0-0.5'	2-4'
As	8.5	14.9
Pb	32100J	105J
pH	4.41	3.75

WB-SB13	0-0.5'	2-4'
As	54.8	4.1
Pb	453J	7.7J
pH	7.01	3.99

WB-SB14	0-0.5'	2-4'
As	84.1	8.3
Pb	1720J	17.6J
pH	5.31	3.5

WB-SB15	0-0.5'	0-0.5' DUP	2-4' DUP	2-4'	4-6'
As	25.6	21.2	55.1	91.2	6.4
Pb	1410	1490J	550J	54.7J	15.1J
pH	3.33	3.62	2.81	3.27	4.69

WB-SB16	0-0.5'	2-4'
As	44.6	4.7
Pb	664	8.4J
pH	5.37	3.89

WB-SB17	0-0.5'	2-4'
As	34.2J	6.4
Pb	658J	20.7J
pH	3.81	3.11

WB-SB18	0-0.5'	2-4'
As	20.3J	3.5
Pb	174J	8.5J
pH	3.65	3.48

WB-SB19	0-0.5'	0-0.5' DUP	2-4'	4-6'
As	112J	122J	38.9J	6.2
Pb	19800J	80300J	19.1J	194
pH	3.33	3.00	2.91	3.86

WB-SB20	0-0.5'	2-4'	4-6'
As	14.2	72.4	21.6
Pb	162	478J	147
pH	6.80	4.85	5.80

VC-04-SS (EPA)	
ARSENIC	43.4
LEAD	29,700

VC-05-SS (EPA)	
ARSENIC	965
LEAD	8,490

VC-06-SS (EPA)	
ARSENIC	10.3
LEAD	230

VC-07-SS (EPA)	
ARSENIC	23.8
LEAD	1,150

VC-08-SS (EPA)	
ARSENIC	42.6
LEAD	1,940

WB-SD03	
As	17.7
Pb	408
pH	4.58

WB-SD04	
As	51.0J
Pb	611J
pH	4.11

VC-01-SS (EPA) (0-0.5 FT. BGS)	
ARSENIC	19.9
LEAD	1,560

VC-02-SB (EPA) (1.5 FT. BGS)	
ARSENIC	4.0
LEAD	1,080

VC-03-SB (EPA) (2.5 FT. BGS)	
ARSENIC	11.5
LEAD	1,790

LEGEND:

- BUILDING
- TANK
- ROAD
- RAILROAD
- DITCH
- STREAM
- PROPERTY LINE
- APPROXIMATE LOCATION OF FORMER STRUCTURE
- CHAIN LINK FENCE
- ACCESS ROAD
- DISCOLORED SOIL
- SB1 SOIL BORING LOCATION
- SD3 SEDIMENT SAMPLE LOCATION
- VC-07-SS USEPA SURFACE (0-0.5 FT.) SOIL SAMPLE (12/99)

NOTES:

1. BASE MAP BY JAMES R. HARRINGTON AND ASSOCIATES AT A SCALE OF 1" = 100' SUPPLEMENTED BY BBL WITH FEATURES DIGITIZED FROM A DRAWING ENTITLED "FIGURE 3 – SAMPLING LOCATION MAP" BY TETRA TECH EMI (2000).
2. ALL SAMPLING DEPTHS ARE IN FEET BELOW GROUND SURFACE.
3. SD03 AND SD04 WERE TAKEN IN DRY DRAINAGE DITCH AND ARE ACTUALLY SOIL SAMPLES.
4. USEPA SAMPLE LOCATIONS ARE APPROXIMATE.
5. CONCENTRATIONS IN mg/kg.

0 150' 300'
GRAPHIC SCALE

VIRGINIA-CAROLINA CHEMICAL CO. SITE
WADESBORO, NORTH CAROLINA

ADDITIONAL DELINEATION WORK PLAN

ARSENIC AND LEAD CONCENTRATIONS AND pH IN SOIL

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 2-1

L: ON=*, OFF=REF, SP*
P: STD-PCP/BL @LEXMARK
5/22/02 SYR-54-PGL DMW PGL
54626006/54626C03.DWG

LEGEND:

- BUILDING
- TANK
- ROAD
- RAILROAD
- DITCH
- STREAM
- PROPERTY LINE
- APPROXIMATE LOCATION OF FORMER STRUCTURE
- CHAIN LINK FENCE
- ACCESS ROAD
- DISCOLORED SOIL
- SB1 SOIL BORING LOCATION
- SD1 SEDIMENT SAMPLE LOCATION
- VC-07-SS USEPA SURFACE (0-0.5 FT.) SOIL SAMPLE (12/99)
- HORIZONTAL LIMITS OF AREA ASSOCIATE WITH GIVEN SAMPLE, DEVELOPED USING THE THEISSEN POLYGON APPROACH.
- POLYGONS THAT EXCEED SITE-SPECIFIC ACTION LEVELS

NOTE:

BASE MAP BY JAMES R. HARRINGTON AND ASSOCIATES AT A SCALE OF 1" = 100' SUPPLEMENTED BY BBL WITH FEATURES DIGITIZED FROM A DRAWING ENTITLED "FIGURE 3 – SAMPLING LOCATION MAP" BY TETRA TECH EMI (2000).

0 150' 300'

GRAPHIC SCALE

VIRGINIA-CAROLINA CHEMICAL CO. SITE
WADESBORO, NORTH CAROLINA

ADDITIONAL DELINEATION WORK PLAN

SURFACE SOIL POLYGONS

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
2-2

X: NONE
L: ON=*, OFF=REF, SP*
P: PAGESET/BL
5/29/02 SYR-54-PGL DMW PGL
54626007/54626B12.DWG

LEGEND:

- BUILDING
- TANK
- ROAD
- RAILROAD
- DITCH
- STREAM
- PROPERTY LINE
- APPROXIMATE LOCATION OF FORMER STRUCTURE
- CHAIN LINK FENCE
- ACCESS ROAD
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0 150' 300'

GRAPHIC SCALE

VIRGINIA-CAROLINA CHEMICAL CO. SITE
WADESBORO, NORTH CAROLINA

ADDITIONAL DELINEATION WORK PLAN

SUBSURFACE SOIL POLYGONS

BBL
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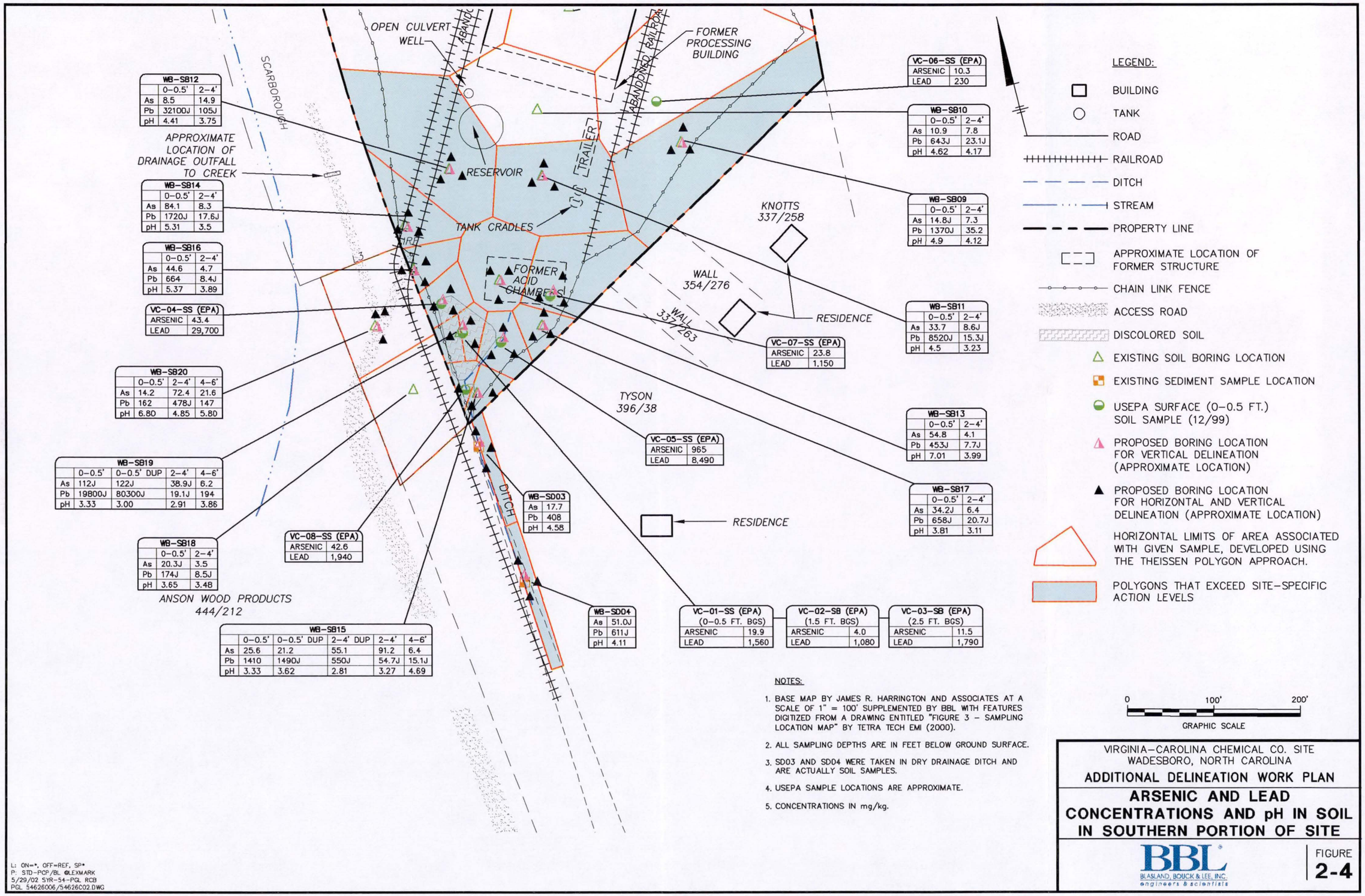
FIGURE
2-3

X: NONE
L: ON=*, OFF=REF, SP*
P: PAGESET/BL
5/29/02 SYR-54-PGL DMW PGL
54626007/54626B13.DWG



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5. CONCENTRATIONS IN mg/kg.

VIRGINIA-CAROLINA CHEMICAL CO. SITE
WADESBORO, NORTH CAROLINA

ADDITIONAL DELINEATION WORK PLAN

ARSENIC AND LEAD CONCENTRATIONS AND pH IN SOIL IN SOUTHERN PORTION OF SITE

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 2-4

L: ON=*, OFF=REF, SP*
P: STD-PCP/BL @LEXMARK
5/29/02 SYR-54-PGL RCB
PGL 54626006/54626C02.DWG

Appendix A

Niton 700S-Series Multi-Element Analyzer

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

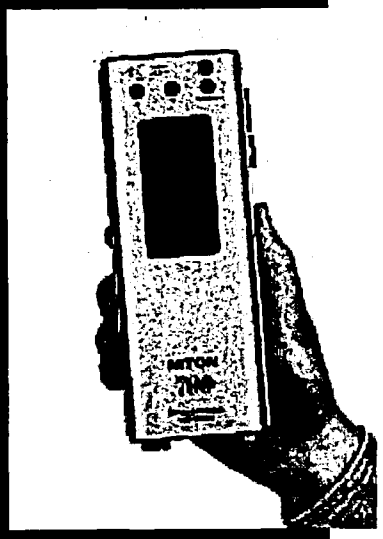
NITON 700 Series Multi-Element Analyzers

ON-SITE, ON-TARGET Analysis for Soils, Sediments, Coatings and Filter Media

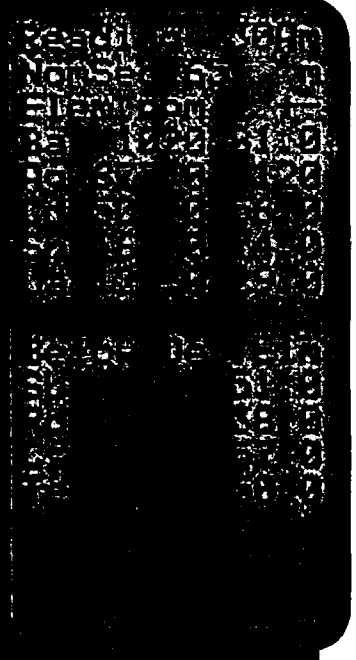
Analyzes up to 25 elements, *including all eight RCRA metals,* in seconds

NITON

LEADER IN PORTABLE XRF ANALYSIS



The XL-700 Series analyzer.



The XL-700 Series analyzers provide immediate results for up to 25 different elements and can be factory and/or user calibrated for a wide variety of sample types.

XL-700 Series: Introduction and Performance

NITON Corporation's XL-700 Series Multi-Element Analyzers set the industry standard for high performance and portability for XRF analyzers for on-site metal-contamination testing. NITON XL-700 Series analyzers are used by federal environmental protection agencies worldwide, including most US EPA field offices; military commands; US state and municipal environmental protection and health departments; leading environmental consulting firms; and leading universities and research institutions.

XL-700 Series analyzers offer testing modes for soil and other bulk samples; filters, wipes and other thin samples; and lead-based paint. Testing applications include management of remediation projects, site assessments, and compliance testing. The XL-700 Series provides simultaneous analysis of up to 25 elements, including all eight of the RCRA metals. NITON XL-700 Series analyzers are rugged, versatile, easy to use and economical to operate.

XL-700 Series Models and Analytical Modes

NITON XL-700 Series Multi-Element Analyzers can be equipped with one, two or three radioisotope sources and a range of test modes to meet your sample analysis requirements. The XL-700 Series is factory calibrated to measure the element sets listed for each isotope source in the table below. If you would like to measure elements with the XL-700 Series that are not found in the table, please contact NITON at +1-978-670-7460; or contact your local NITON representative. The XL-700 Series is calibrated for the standard packages of elements and isotope(s) shown in the table below. Additional elements, or substitutions, are possible depending on the isotope(s) selected.

Standard Element Set	Isotope Source
Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Pb, Hg, Rb, Sr, Zr, Mo	^{109}Cd, 10 mCi (370 MBq) standard activity
Cd, Ba, Ag, Sn, Sb, plus others	^{241}Am, 14 mCi (520 MBq) standard activity
K, Ti, Sc, V	^{55}Fe, 18 mCi (670 MBq) standard activity

XL-700 Series analyzers can be equipped with any combination of the following test modes:

- *Bulk-sample mode* for analysis of soil, sediment and other thick, homogeneous sample types
- *A suite of thin-sample modes* for the analysis of dust wipes, various filter media, and coatings
- *Lead-in-paint analysis mode*

The XL-700 Series Lead-in-Soil Analysis Accessory Kit includes portable test stand, calibration standards, and preparation and testing implements, shown with deluxe electric soil grinder.

In situ testing provides rapid, quantitative screening measurements for rapidly profiling contaminant levels and determining remediation boundaries with surgical precision.

Soil and Other Bulk Sample Analysis

All NITON XL-700 Series models XL-702, 722, 732, 742, 703, 723, 733, and 743 include hardware and software for testing bulk samples.

On-Site Soil and Sediment Analysis following EPA Method 6200[1]

- **Brownfields**
- **Site Investigation and Characterization**
- **Site Remediation and Clearance**
- **Emergency Response**
- **Hazardous Waste Disposal**

Testing Methods

In Situ Testing

NITON XL-700 Series Multi-Element Analyzers are designed for both *in situ* and *ex situ* soil testing. Choose the analysis that best suits your applications and data quality objectives. For *in situ* analysis, place the XL-700 Series directly on the ground, or test bagged soil samples. Since contamination patterns tend to be heterogeneous, the large number of data points produced using *in situ* testing typically provides a faster, more precise, and far more cost-effective way of delineating contamination patterns.

In situ testing with the XL-700 Series is in full compliance with US EPA Method 6200. *In situ* testing lets you test many locations in a short time and is ideal for:

- Rapid site-profiling
- Locating sources of contamination
- Monitoring and fine-tuning remediation efforts on-the-spot

XL-700 Series soil testing is ***non-destructive***, so accredited laboratories can reanalyze all prepared samples to confirm results.

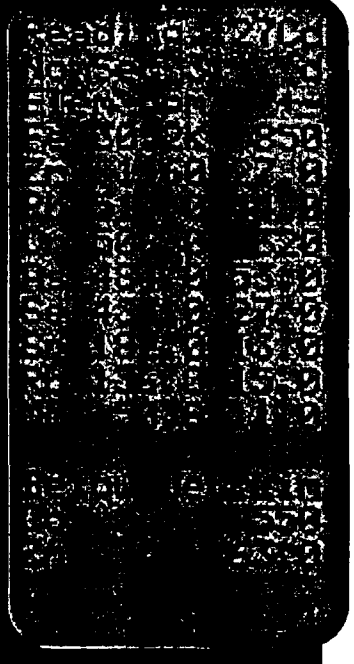
For both *in situ* and *ex situ* soil testing, the XL-700 Series ***never*** needs site-specific calibrations. Sophisticated software corrects automatically for variations in soil-sample chemistry and density.

Ex Situ Testing

Test prepared (ground, sifted, homogenized), representative soil samples for laboratory grade analysis whenever analytical-grade data quality is required. The XL-700 Series soil analyzer comes with sample-preparation protocols, and everything you need to prepare soil samples for *ex situ* testing.

[1] For more detailed information on soil testing methods, including EPA Method 6200, please request NITON's application bulletin "Metals in Soil Analysis with Portable XRF", or visit our web site www.niton.com.

The XL-700 Series Multi-Element Analyzer lets you rapidly determine the locations and types of metal contamination in Brownfields site-investigations and Phase-II assessments.



NITON XL-700 Series Multi-Element Analyzers report concentration levels for elements and 95%-precision values in ppm. Results are continuously updated, so you can end tests when you reach the levels of precision you need for target analytes.

Testing Applications

Brownfields, Site Investigations and Site Characterizations

The NITON XL-700 Series is an ideal tool for fast, accurate, economical site investigations. The XL-700 Series analyzes multiple elements simultaneously, with no user-input required. Rapidly determine which metals are present, and at what concentrations, at sites where complete soil contamination profiles are lacking. Test *in situ* to establish contamination profiles; then collect confirmatory samples, prepare them and test them *ex situ* in the field. Send *ex situ* samples to a laboratory to confirm results as needed.

- Avoid hit-or-miss collections of sample sets for off-site analysis – the XL-700 Series lets you locate contamination patterns and determine where to take representative confirmatory samples.
- The XL-700 Series offers *cost-effective, thorough* contamination profiling. You can save the entire cost of your XL-700 Series (in laboratory tests) with as little as 200 samples.

Site Remediation and Clearance

NITON XL-700 Series Multi-Element Analyzers are the instruments of choice for cost-effective management of remediation projects.

- Monitor and adjust remediation efforts on-the-spot with XL-700 Series to focus remediation efforts *only* where contamination exists.
- Eliminate failed clearances. Collect, prepare and analyze clearance samples on-site. Because the XL-700 Series samples non-destructively, you can send the *same samples* to the lab *only when* on-site analysis indicates clearance criteria are met.
- Use the XL-700 Series to minimize quantities of hazardous waste that require treatment and disposal — Determine TCLP waste classifications on-site — Further minimize hazardous waste volumes by monitoring remediation boundaries.

Superior Performance

NITON XL-700 Series Multi-Element Analyzers are:

- *Fast* – With results updated every three seconds, you can stop testing when desired testing times or precision levels are attained. Measure high concentrations in seconds.
- *Versatile* – Just point and shoot for quantitative field screening. *Proven, laboratory-quality* accuracy for prepared samples. Upgradeable for additional elements and/or *lead-based paint testing.*
- *Rugged and Dependable* – Designed for field use - *all day, every day.*
- *Hand-held* – 2.5 lbs (1.13 kg) complete. No cables, no separate processing units.
- *Self-calibrating* – XL-700 Series analyzers use fully automated Compton-normalization and/or Fundamental Parameters analysis with every measurement to correct for soil matrix and element interference effects. Calibrations are *never* required — Independent studies prove it.[2]

[2] For more information about US EPA Method 6200 and independent soil-assessment and abatement studies, please call us at 800-875-1578, +1-978-670-7460, or +49 89 3605 5680, or visit our web site at www.niton.com.

Thin Sample Analysis

All NITON XL-700 Series models XL-701, 721, 731, 741, 703, 723, 733, and 743 include hardware and software for testing thin samples.

Filter Media and Dust Wipes • Coatings • Lead-based Paint

NITON XL-700 Series Multi-Element Analyzers measure the elemental content of a variety of thin-sample media, including filters, dust wipes and coatings. Filter media applications include analysis of TSP, PM_{10} and $PM_{2.5}$ filter media for airborne metals, particulate and ion-exchange filter media for suspended and dissolved metals in liquids, and 37 mm diameter cellulose-ester filters used for OSHA compliance. The XL-700 Series is the *only* portable XRF listed in NIOSH Method 7702 for airborne lead monitoring.

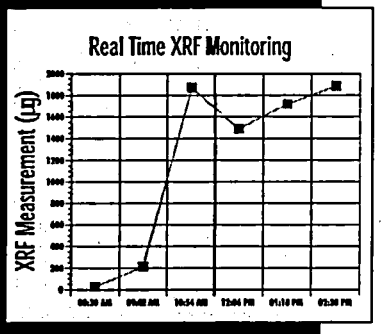
The XL-700 is pre-programmed for dust wipes, 37 mm diameter filters, TSP filters and coatings. Operators may also set up their own protocols using the screen shown above.

TSP and Particulate Monitoring

The NITON XL-700 Series includes calibration and analysis software for on-site testing of 8" x 10" TSP and PM_{10} filters. Analyze filters directly on their sample holders in minutes. The XL-700 Series reports results for all elements in µg — Simply convert results to µg/m^3 using the volumetric flow-rate and air-sampling time of the filter system.

On-site filter analysis with the XL-700 Series lets you verify that airborne-metal levels at abatement sites, remediation projects and construction sites are below regulatory levels. Published performance data demonstrate the XL-700 Series' value in monitoring the effectiveness of dust-containment systems.[3]

- Verify that dust containment systems are working correctly in hours, not days — This is a crucial benefit for lead-abatement work performed in densely populated areas.
- Monitor changes in airborne lead-dust levels caused by breakdowns in dust-control systems and weather changes.



On-site testing of TSP filters reveals poor dust containment within minutes, rather than days, as shown by testing data published by NYSDOT.

NITON XL-700 Series analyzers measure 47 mm diameter $PM_{2.5}$ filters, as well as 25 mm and 37 mm diameter filters commonly used for liquid-filtration and OSHA compliance. Results are displayed in µg/cm^2 or total µg, depending on the testing mode that is used.

Dust Wipes, OSHA Compliance

Clearance Testing – Metals

The NITON XL-700 Series helps lower abatement, renovation and decontamination/decommissioning costs by showing when contaminated dust levels will pass clearance *before* a remediation crew leaves a site. Independent studies show that on-site dust wipe testing using the XL-700 Series virtually eliminates failed clearances.[3]

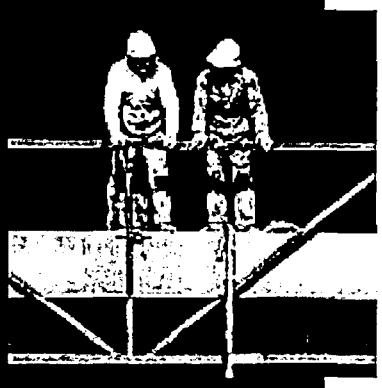
- Stop cleaning only when dust wipe readings indicate permissible levels.
- Use on-site testing to train abatement crews to achieve clearances more effectively.
- XL-700 Series dust wipe tests are *non-destructive*, so accredited laboratories can reanalyze all samples to confirm results.

On-site dust wipe testing with the XL-700 Series for dust clearance, decontamination, decommissioning, and risk assessment.

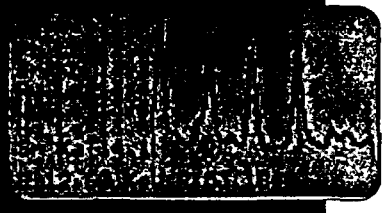
Negative Exposure and Risk Assessment

Use the NITON XL-700 Series to pinpoint the location of contaminated dust hazards in minutes — not days. Make detailed profiles throughout a property or dwelling. Confirm results to obtain regulatory compliance by sending selected dust-wipe samples to an accredited laboratory for reanalysis.

[3] Please contact NITON for dust wipe and air-filter studies or visit our website at www.niton.com.



On-site personal-air-monitoring filter testing with the XL-300 Series for OSHA compliance (NIOSH Method 7702).



The XL-700 Series is a complete spectrum analyzer. In addition to quantifying elemental concentrations, it displays, stores and downloads 1000 x-ray spectra.

The XL-700 Series is also a top-performing lead analyzer.

OSHA Compliance

NIOSH Method 7702 and other Airborne Exposure Monitoring

The NITON XL-700 Series and standard personal air-monitoring filters let you assess and continuously monitor worker exposure to airborne lead on-site. In compliance with NIOSH Method 7702, real time lead-level monitoring helps you maximize productivity and minimize costs by implementing worker protection procedures only when they are necessary. NITON XRF analyzers are the only ones listed by NIOSH for use with Method 7702. NIOSH is currently expanding their evaluation of airborne metals using portable XRF from lead-only to multiple metals, including those found in welding fumes, such as chromium, nickel, cobalt and cadmium.

Coatings

The NITON XL-700 Series can be used to analyze a variety of coatings and other thin samples for environmental, industrial and/or quality control applications. Results are reported in $\mu g/cm^2$. Applications include:

- Testing paints and other coatings for lead, cadmium, chromium and other hazardous RCRA metals.
- Analyzing metal coatings and platings for industrial applications, including coating thickness for nickel, chromium, zinc and other metals.

Lead-Based Paint Screening and Risk Assessment with Selected XL-700 Series Analyzers

Only NITON XL-700 Series models XL-701A, XL-702A and XL-703A include hardware and software for testing lead-based paint

Residential Lead-Inspection Testing

XL-700 Series paint-testing modes are ideal for Title-X and other lead-based-paint screening applications. The US EPA/HUD Performance Characteristic Sheet (PCS)[4] for the XL-701A, 702A and 703A reflects their unrivalled lead-based paint screening capabilities. Superior features and performance include:

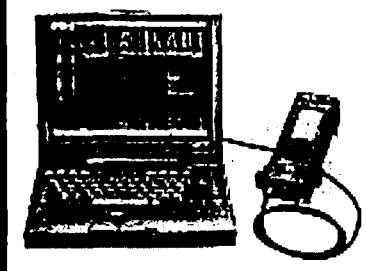
- Rapid, 95%-confident Positive/Negative determinations for lead-in-paint action-levels from 0.5 to 2.2 mg/cm^2. Results in as little as one second.
- No fixed reading times, no substrate corrections, no inconclusive ranges and no inconclusive results.
- Non-surface lead is distinguishable from lead in surface paint layers, which pose the greatest hazard.

Negative Exposure and Risk-Assessment Testing

XL-701A, 702A and 703A analyzers offer a precision-based paint-testing mode in which readings do not stop automatically when 95%-confident Positive/Negative classifications are achieved. Results are continuously displayed and updated, including precision data, K-shell and L-shell results, x-ray spectra, and the lead-in-paint Depth Index. Use the XL-700 Series to:

- Quantify low lead-levels in paint for worker-exposure assessment and waste-disposal analysis (TCLP).
- Conduct lead-based paint inspections before undertaking renovation or construction work.

[4] Dated April 17, 1998. For a copy of the XL-300 Series' PCS, please call us at 800-875-1578, +1-978-670-7460 or +49 89 3605 5680 or visit our website, www.niton.com; visit the HUD website, www.hud.gov/lea/pcs5_2.pdf; or call the National Lead Information Center Clearinghouse, at +1-800-424-5323.



XL-700 Series downloads to any PC (Windows™ or Windows NT ™). Downloads include reading precision, x-ray spectra, inspector name, test location, and sample-identification data for each reading.

Data Management and Reporting

Every NITON XL-700 Series Multi-Element Analyzer comes with a fully-automated, customizable data-entry system, PC-downloading hardware, and advanced report-generation software. XL-700 Series downloads include precision data and x-ray spectra, name of inspector, test location and sample-identification information for each reading.

- Use XL-700 Series standard reports, or export test results to your own spreadsheets and databases.
- NITON XL-700 Series software produces detailed, strongly defensible reports.

Please contact NITON's staff of applications experts to discuss your specialized XRF testing needs — Call our main office at +1-978-670-7460; or contact us via e-mail at xrf@niton.com.

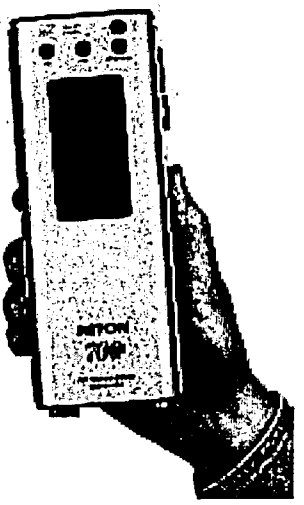
NITON

LEADER IN PORTABLE XRF ANALYSIS

XL-700 Series Specifications

Principles of operation	Simultaneous detection of multiple elements via x-ray fluorescence (XRF) induced by one or more radioisotope sources; digital signal processing; continuous spectral de-convolution and analysis, incorporating Fundamental Parameters (FP), Compton-normalization and automatic correction for aging of sources.
Radiation safety features	Shutter safety lock; shutter safety switch; automatic shutter closing mechanism engages when instrument is lifted from a surface (or test stand). To open shutter, disengage safety lock, depress safety switch, and place instrument on test surface (or test stand).
Radioactive sources	^{109}Cd. Maximum: 50 mCi (1850 MBq). Isotope half-life: 463 days. And/or ^{241}Am. Maximum: 20 MCi (740 MBq). Isotope half-life: 432.2 years. And/or ^{55}Fe. Maximum: 20 MCi (740 MBq). Isotope half-life: 2.73 years.
Radiation exposure	With safety shutter open during reading: exposure to user's hand <0.03 mR/hr (< 0.3 _Sv/hr). Plastic carrying case does not require radiation labeling.
Detector	High performance, electrically-cooled, solid-state detector optimized for L-shell and K-shell x-ray detection.
Microprocessors	CPU; DSP's with rise-time discrimination; MCA with 1,024 channels displayed.
Auto-calibration	Instrument self-calibrates at start-up of each test mode.
Instrument measurement window	1 cm x 2 cm, positioned to facilitate measurements on difficult-to-access surfaces.
Display	Back-lit LCD. Easy to read in all light conditions.
Element Limits of Detection	Optimal for soil, other bulk samples: 10–300 ppm, element, matrix dependent. Optimal for filters, dust-wipes, thin-film samples: 0.2–20µg/cm², element, matrix dependent. Optimal for lead-in-paint: 50 µg/cm² (0.05 mg/cm²).
Performance	Bulk sample, thin sample modes: Results for up to 25 elements with 95% confidence-intervals; detection limits (3 sigma) for undetected elements; full x-ray spectrum (2–90 KeV) with all readings; scroll spectrum to see additional elements. Paint modes: lead-based paint testing performance same as NITON XL-300 Series.
Audible signals	Audible signals at the end of each reading. Additional user-definable audible signals.
Memory	1000 bulk-sample-mode and/or thin-sample-mode test results and/or up to 3000 paint-mode test results. X-ray spectra and sample description data stored with all test results. Retrieve and display stored test results at any time.
Sample description data	Automated entry by barcode reader. Customizable barcodes provide data-entry flexibility.
Download readings	To PC in standard or ASCII formats. RS-232 cable provided.
Reporting software	Customizable PC-based reporting software
Batteries	Two rechargeable 8-hour nickel metal hydride battery packs. AC/DC battery charger included. Battery pack recharge time <2 hours. Internal lithium back-up battery.
Weight and size	2.5 lbs (1.13 kg), including battery pack. Dimensions: 8.25" x 3" x 1.875" (21.0 cm x 7.6 cm x 4.8 cm).
Operating conditions	Temperature range: 20° to 120° F (-7° to 49° C). Humidity range: 0 – 95% RH.
Carrying case	Waterproof, unbreakable plastic case with combination lock.
Shipping	Carry, ship and transport in case without exterior labeling. Conforms to 49 CFR 173.421 for "excepted package", instruments and articles, N.O.S. UN2910.
Training	U.S. only: Please call 800-875-1578 for no-cost radiation safety and instrument training. Outside U.S.: Please contact NITON or your local NITON representative.
License	Distributed under State of Rhode Island Specific License number 3A-105-01 and General License number 3G-105-02. Please contact NITON, your local NITON representative, or your local radiation authority for more information about pertinent licensing regulations in your area.
Warranty	12-month limited warranty on parts and labor. Batteries, radioisotope sources and accessories are not included.

XL-300 Series Lead Analyzer



XL-700 Series Multi-Element Analyzer

XL-800 Series Alloy Analyzer

The NITON Family of Portable XRF Analyzers.

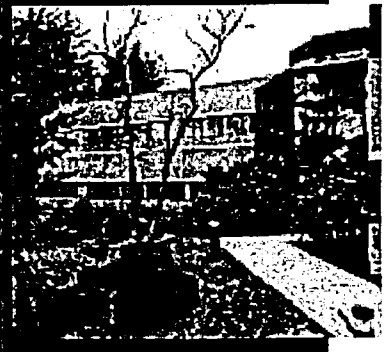
NITON

LEADER IN PORTABLE XRF ANALYSIS

NITON Corporation – The Leader in Portable XRF Technology

NITON Corporation's family of portable XRF analyzers are the product of a decade of continuous research and development in x-ray fluorescence (XRF) technology. In that time, NITON has sold well over a thousand XL-300 Series lead analyzers, and over 300 XL-700 Series analyzers worldwide to private consultants and industry; to federal, state, and local governments; and to leading universities and research institutions. Today, our award-winning analyzers are more versatile, faster, more accurate, and more reliable than ever before.

NITON Corporation introduced the first-ever high performance hand-held XRF analyzers in 1994. Today, NITON's portable XRF analyzers excel in many applications, including the analysis of paint, soil, powders, filters, coatings, mining samples and metal alloys. NITON also offers the rugged floor-standing XRT-800 Series. The x-ray-tube based XRT-800 Series provides high-speed, high-precision sample analysis for the most demanding industrial applications, including integration with other systems for automated process control and quality assurance. Every member of the NITON family of XRF analyzers is easy to use, economical to operate, and priced to provide unsurpassed value.



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NITON® XL-700 Series Standard Resolution Instruments

Elemental Limits of Detection in Soils, mg/kg (ppm)

XRF limits of detection (LOD's) are dependent upon: (1) testing time, (2) soil matrix, and (3) level of statistical confidence. NITON specifies detection limits following the EPA protocol of 99.7% confidence level, for the testing times shown. Individual LOD's improve as a function of the square root of the testing time.

Some instrument manufacturers may ONLY specify LOD's for optimal matrices such as SiO_2 (sand). These matrices are not representative of typical soil types, and therefore do not represent "real world" testing conditions. NITON specifies LOD data for typical soil matrices, represented by NIST Standard Reference Materials (SRM), as well as an optimal SiO_2 matrix.

LOD's will be higher in an SRM-type soil, especially for Cr and Mn, because of typically high levels of iron (2-3%).

	60 Second Testing Times		120 Second Testing Times	
Element	Sand Matrix	SRM Matrix	Sand Matrix	SRM Matrix
^{109}Cd Isotope				
Cr	1400	3500	1000	2500
Mn	1000	2200	600	1600
Fe	500	1000	350	600
Co	300	700	180	420
Ni	200	500	120	300
Cu	130	200	90	130
Zn	100	150	70	90
As[1]	60	100	45	60
Pb	45	70	35	45
Hg	50	70	35	45
Rb	30	45	20	30
Sr	20	30	15	20
Zr	20	30	15	30
Mo	20	25	15	30

^{241}Am Isotope

Cd
Ag
Ba
Sn
Sb

Analysis with ^{241}Am and ^{55}Fe requires the NITON High-Resolution System

^{55}Fe Isotope

V
Ti
Ca
K

[1] Data for As (arsenic) is representative of low levels of Pb (lead). High Pb levels will tend to increase As LOD's.

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