Final

Site Investigation Report
Old Toxic Training Area, Parcel 188(7)

Fort McClellan
Calhoun County, Alabama

Prepared for:

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Task Order CK10
Contract No. DACA21-96-D-0018
Shaw Project No. 796887

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Revision 0

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Executive Summary

In accordance with Contract Number DACA21-96-D-0018, Task Order CK10, Shaw Environmental, Inc. (formerly IT Corporation) completed a site investigation (SI) at the Old Toxic Training Area, Parcel 188(7), at Fort McClellan (FTMC), in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site and, if present, whether the concentrations present an unacceptable risk to human health or the environment. The SI consisted of the collection and analysis of four surface soil samples, four subsurface soil samples, and four groundwater samples. In addition, four permanent monitoring wells were installed in the saturated zone to facilitate groundwater sample collection and to provide site-specific geological and hydrogeological characterization information.

Chemical analysis of samples collected at Parcel 188(7) indicates that metals, volatile organic compounds (VOC), and semivolatile organic compounds were detected in site media. Chemical warfare material breakdown products were not detected in site media. To evaluate whether the detected constituents pose an unacceptable risk to human health or the environment, the analytical results were compared to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for FTMC. A preliminary risk assessment (PRA) and preliminary ecological risk assessment (PERA) were also performed to further characterize the potential threat to human health and the environment, respectively.

Although the site is projected for mixed business reuse, the analytical data were screened against residential human health SSSLs to evaluate the site for unrestricted land reuse. Constituents of potential concern for the resident included six metals (aluminum, antimony, arsenic, chromium, iron, and vanadium) and benzo(a)pyrene in soils, and two metals (barium and nickel) in groundwater. The PRA concluded, however, that exposure to site media does not pose an unacceptable risk for the resident.

Constituents of potential ecological concern (COPEC) identified in the PERA were six metals (aluminum, arsenic, beryllium, copper, selenium, and zinc) and several organic compounds in surface soil. With the exception of aluminum, which was determined to be present at background levels, the metals COPECs had hazard quotients that only slightly exceeded the screening level threshold of one. The ESVs are highly conservative screening values based on no observed adverse effects. In addition, screening level hazard quotients were calculated using the maximum detected constituent concentration at the site. Therefore, these inorganic constituents were ultimately excluded from the list of COPECs.

Organic compounds identified as COPECs were only present at one sample location indicating that the contamination is limited in areal extent. Several organic constituents were identified as COPECs solely because ESVs do not exist for these compounds. Furthermore, Parcel 188(7) is located within the developed portion of the FTMC Main Post and is projected for mixed business reuse. Although species with small home ranges living or feeding in the vicinity of the soil contamination could experience adverse effects, the PERA concluded that larger animals with relatively large home ranges should not be adversely affected by the localized area of contamination.

Based on the results of the SI, past operations at the Old Toxic Training Area, Parcel 188(7), do not appear to have adversely impacted the environment. The metals and chemical compounds detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, Shaw Environmental, Inc. recommends "No Further Action" and unrestricted land reuse with regard to Comprehensive Environmental Response, Compensation, and Liability Act-related hazardous substances at the Old Toxic Training Area, Parcel 188(7).

1.0 Introduction

The U.S. Army has selected Fort McClellan (FTMC) located in Calhoun County, Alabama, for closure by the Base Realignment and Closure (BRAC) Commission under Public Laws 100-526 and 101-510. The 1990 Base Closure Act, Public Law 101-510, established the process by which U.S. Department of Defense (DOD) installations would be closed or realigned. The BRAC Environmental Restoration Program requires investigation and cleanup of federal properties prior to transfer to the public domain. The U.S. Army is conducting environmental studies of the impact of suspected contaminants at parcels at FTMC under the management of the U.S. Army Corps of Engineers (USACE), Mobile District. The USACE contracted Shaw Environmental, Inc. (Shaw) (formerly IT Corporation) to perform the site investigation (SI) at the Old Toxic Training Area, Parcel 188(7), under Contract Number DACA21-96-D-0018, Task Order CK10.

This SI report presents specific information and results compiled from the SI, including field sampling and analysis, and monitoring well installation activities, conducted at the Old Toxic Training Area, Parcel 188(7).

1.1 Project Description

The Old Toxic Training Area, Parcel 188(7), was identified as an area to be investigated prior to property transfer. The parcel was classified as a Category 7 parcel in the environmental baseline survey (EBS) (Environmental Science and Engineering, Inc. [ESE], 1998). Category 7 parcels are parcels that have not been evaluated or that require further evaluation.

A site-specific field sampling plan (SFSP) (IT, 2000a) and a site-specific safety and health plan (SSHP) were finalized in October 2000. The SFSP and SSHP were prepared to provide technical guidance for sample collection and analysis at the Old Toxic Training Area, Parcel 188(7). The SFSP was used in conjunction with the SSHP as attachments to the installation-wide work plan (IT, 1998) and the installation-wide sampling and analysis plan (SAP) (IT, 2000b; IT, 2002). The SAP includes the installation-wide safety and health plan, and quality assurance plan.

The SI included fieldwork to collect four surface soil samples, four subsurface soil samples, and four groundwater samples. Data from the field investigation were used to determine whether potential site-specific chemicals are present at the Old Toxic Training Area, Parcel 188(7).

1.2 Purpose and Objectives

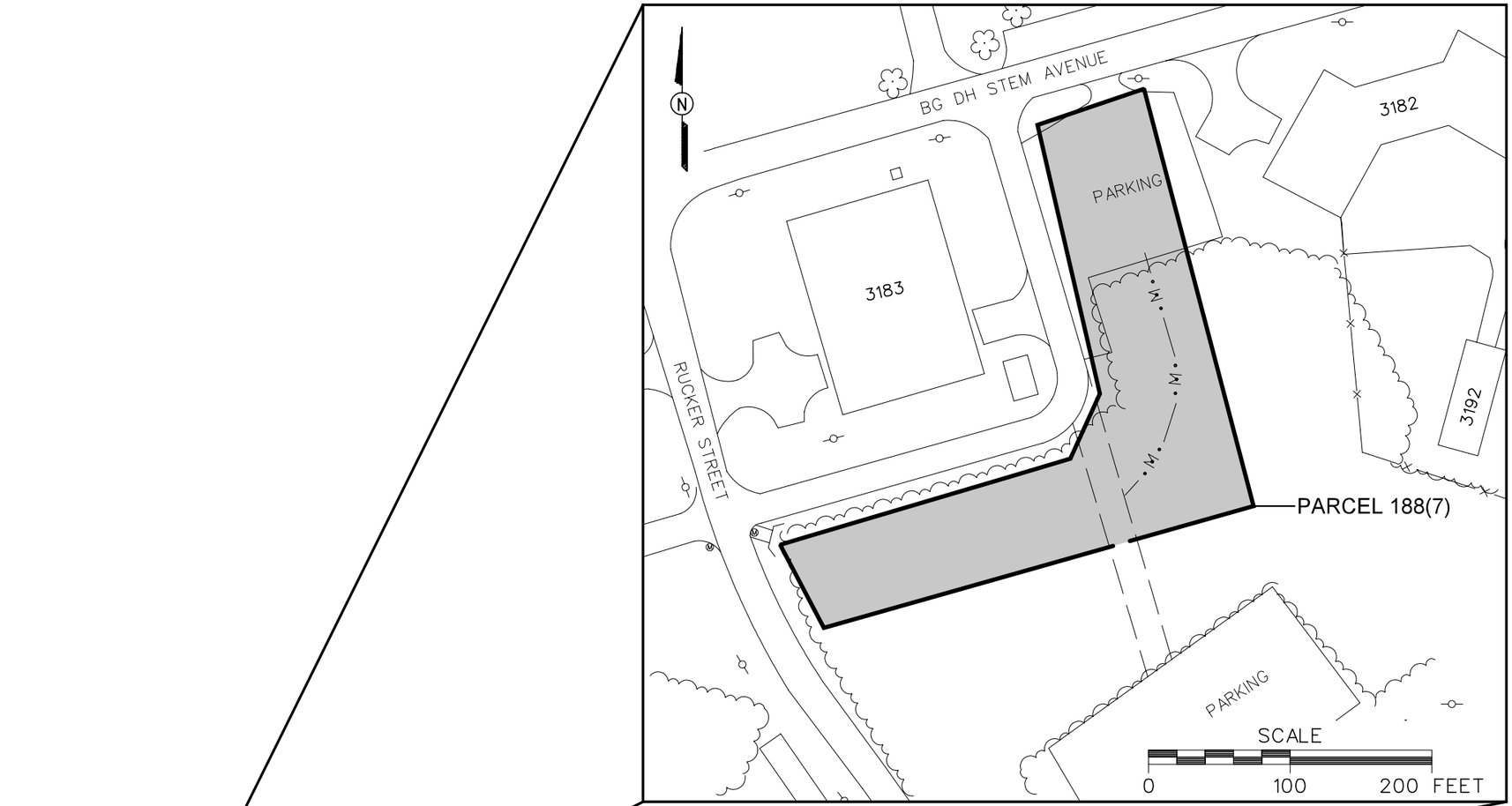
The SI program was designed to collect data from site media and provide a level of defensible data, and information in sufficient detail to determine whether chemical constituents are present at the Old Toxic Training Area, Parcel 188(7), at concentrations that present an unacceptable risk to human health or the environment. The conclusions of the SI in Chapter 6.0 are based on the comparison of the analytical results to human health site-specific screening levels (SSSL), ecological screening values (ESV) and background screening values for FTMC. The SSSLs and ESVs were developed as part of the human health and ecological risk evaluations associated with SIs being performed under the BRAC Environmental Restoration Program at FTMC. The SSSLs, ESVs, and polynuclear aromatic hydrocarbon (PAH) background screening values are presented in the *Final Human Health and Ecological Screening Values and PAH Background Summary Report* (IT, 2000c). The PAH background values were developed at the direction of the BRAC Cleanup Team (BCT) to address the occurrence of PAH compounds in surface soils as a result of anthropogenic activities at FTMC. Background metals screening values are presented in the *Final Background Metals Survey Report, Fort McClellan, Alabama* (Science Applications International Corporation [SAIC], 1998).

Based on the conclusions presented in this SI report, the BCT will decide either to propose "No Further Action" or to conduct additional work at the site.

1.3 Site Description and History

The Old Toxic Training Area, Parcel 188(7), is located near the intersection of BG DH Stem Avenue and Rucker Street on the Main Post of FTMC (Figure 1-1). The "L"-shaped parcel is situated south and east of Building 3183 (Figure 1-2). The site reportedly occupied an area of up to 10,000 square feet. The parcel size shown in the EBS is almost 1 acre (ESE, 1998). Parsons Engineering Science Inc. (Parsons) described the total area as being approximately 484 square feet (Parsons, 2002). The site was evidently used from the 1950s until at least the 1960s, although exact dates of operation could not be determined.

The site was reportedly used for training military personnel in the detection and identification of distilled mustard (HD), other chemical warfare material (CWM), and the use of decontamination agents, probably including supertropical bleach (STB), decontamination agent, noncorrosive (DANC), and/or decontamination solution number 2 (DS2). Some personnel recount training at this site using dilute HD, choking agents, blood agents, and nerve agent (VX). Training reportedly involved the use of small amounts of CWM (ESE, 1998).



LEGEND

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TREES / TREELINE
- PARCEL BOUNDARY
- MANMADE SURFACE DRAINAGE FEATURE
- UNERGROUND CULVERT WITH HEADWALL
- MANHOLE
- FENCE
- UTILITY POLE

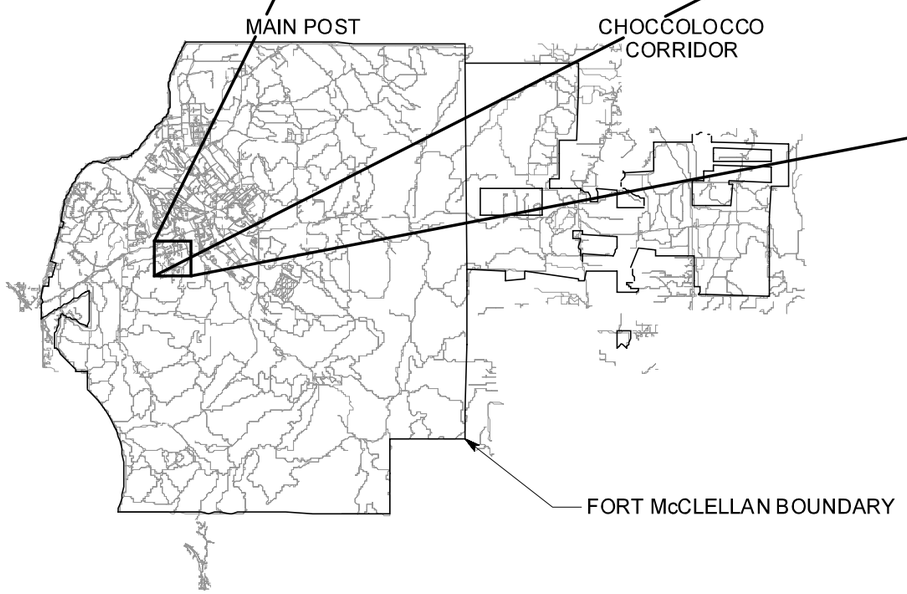


FIGURE 1-1
SITE LOCATION MAP
OLD TOXIC TRAINING AREA
PARCEL 188(7)

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

Shaw™ Shaw Environmental, Inc.

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ENGR. CHCK. BY: S. MORAN		PROJ. MGR.: J. YACOUB		PROJ. NO.: 796887	
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SOURCE: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION, 1993, "FORT McCLELLAN SITE INVESTIGATION REPORT", AUGUST.

FIGURE 1-2
SITE MAP
OLD TOXIC TRAINING AREA
PARCEL 188(7)

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

Shaw Environmental, Inc.

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SAIC reported that the site consisted of a ditch with an area of about 480 square feet used in training for detection of HD (SAIC, 1993). No spills were reported and decontamination was conducted after each exercise. Some personnel interviewed during the EBS recalled live CWM training in a ditch in the area; others did not. One individual interviewed believed that the Old Toxic Training Area was actually located east of Building 3183, not to the south as reported by others. Other personnel reported no knowledge of training activities at this location and relate walking across this location regularly during the 1960s and 1970s (ESE, 1998).

Previous investigations report that CWM was apparently placed on the ground and decontaminated with STB and DS2 (Weston, 1990). Training exercises conducted at this area were apparently similar to those at the Former Detection and Identification Area, and this area was only used when the Former Detection and Identification Area was not available.

An SI conducted by SAIC in 1993 included the collection of four soil samples from two locations at depths of between 1 and 5 feet. The two sampling locations were along the center of the ditch. The U.S. Army Technical Escort Unit (USATEU) screened the samples for HD using a miniature continuous air monitoring system (MINICAMS). However, CWM agents were not detected above background readings. Additionally, CWM degradation products were not detected in samples submitted for laboratory analysis (SAIC, 1993).

Analysis of historical aerial photographs shows no significant indication of activity at this site. A bare area that could be interpreted as a ditch is visible east of Building 3183 on a 1954 aerial photograph. There are no other anomalies that appear to be ditches (Parsons, 2002).

In February 1999, Parsons conducted a site visit and determined that the area east of Building 3183 is a paved parking lot/driveway. Historical reports reveal that live agent was not placed on the ground between 1961 and 1964. Agent was most likely placed on the ground prior to 1961 (Parsons, 2002).

Parsons collected soil samples from two hand-auger borings located east of Building 3183. The samples were collected at this location because some interviewees remembered the training area to be located east of Building 3183. Soil samples were collected from each boring at 0.5 to 1 foot below the surface, and at 3.5 to 4 feet below ground surface. Continuous air monitoring occurred during sampling. The samples were laboratory analyzed for sarin (GB) and HD. GB and HD were not detected in any of the samples collected (Parsons, 2002).

2.0 Previous Investigations

An EBS was conducted by ESE to document current environmental conditions of all FTMC property (ESE, 1998). The study was to identify sites that, based on available information, have no history of contamination and comply with DOD guidance for fast-track cleanup at closing installations. The EBS also provides a baseline picture of FTMC properties by identifying and categorizing the properties by seven criteria:

1. Areas where no storage, release, or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas).

2. Areas where only release or disposal of petroleum products has occurred.

3. Areas where release, disposal and/or migration of hazardous substances has occurred, but at concentrations that do not require a removal or remedial response.

4. Areas where release, disposal and/or migration of hazardous substances has occurred and all removal or remedial actions to protect human health and the environment have been taken.

5. Areas where release, disposal and/or migration of hazardous substances has occurred and removal or remedial actions are underway, but all required remedial actions have not yet been taken.

6. Areas where release, disposal and/or migration of hazardous substances has occurred, but required actions have not yet been implemented.

7. Areas that are not evaluated or require additional evaluation.

The EBS was conducted in accordance with Community Environmental Response Facilitation Act (CERFA) protocols (CERFA-Public Law 102-426) and DOD policy regarding contamination assessment. Record searches and reviews were performed on all reasonably available documents from FTMC, the Alabama Department of Environmental Management (ADEM), the U.S. Environmental Protection Agency (EPA) Region 4, and Calhoun County, as well as a database search of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-regulated substances, petroleum products and Resource Conservation and Recovery Act-regulated facilities. Available historical maps and aerial photographs were reviewed to document historical land uses. Personal and telephone interviews of past and present FTMC employees and military personnel were conducted. In addition, visual site inspections were carried out to verify conditions of specific property parcels.

The Old Toxic Training Area, Parcel 188(7), was categorized as a Category 7 CERFA parcel in the EBS. Category 7 CERFA parcels are areas that have not been evaluated or that require additional investigation. Previous investigations have been conducted at Parcel 188(7), as discussed below.

In 1993, SAIC conducted an SI at FTMC. Analysis of soil samples collected from two locations in the training area ditch did not indicate the presence of CWM breakdown products (SAIC, 1993).

In 1999, Parsons conducted an Engineering Evaluation/Cost Analysis (EE/CA) at the Old Toxic Training Area to address possible CWM reportedly used for agent training at a second location (east of Building 3183). Field activities included continuous air monitoring, soil sampling, and laboratory analysis of soil samples for chemical agents and breakdown products (Parsons, 2002). No CWM items were observed during the intrusive investigation and soil analytical results did not indicate the presence of chemical agents or breakdown products. Parsons concluded that human health risks from exposure to CWM at this site are very unlikely (Parsons, 2002).

3.0 Current Site Investigation Activities

This chapter summarizes SI activities conducted by Shaw at the Old Toxic Training Area, Parcel 188(7), including UXO/CWM surveys, environmental sampling and analysis, and groundwater monitoring well installation activities.

3.1 UXO and CWM Surveys

The Old Toxic Training Area, Parcel 188(7), was investigated for chemical agents in soil by Parsons and by the USACE-Huntsville (Parsons, 2002). Continuous air monitoring and laboratory analysis methods were used to screen soil for the presence of chemical agents. Agents were not detected. Therefore, it was not necessary to collect additional soil and groundwater samples nor to conduct additional air monitoring surveys.

UXO avoidance was performed at the Old Toxic Training Area, Parcel 188(7), following methodology outlined in the SAP. Shaw UXO personnel used a low-sensitivity magnetometer to perform a surface sweep of the parcel prior to site access. After the site was cleared for access, sample locations were monitored by UXO personnel following procedures outlined in the SAP.

3.2 Environmental Sampling

The environmental sampling performed during the SI at the Old Toxic Training Area, Parcel 188(7), included the collection of surface soil samples, subsurface soil samples, and groundwater samples for chemical analysis. The sample locations were determined by observing site physical characteristics during a site walk and by reviewing historical documents pertaining to activities conducted at the site. The sample locations, media, and rationale are summarized in Table 3-1. Sampling locations are shown on Figure 3-1. Samples were submitted for laboratory analysis of site-related parameters listed in Section 3.4. Shaw contracted Environmental Services Network, Inc, a direct-push technology (DPT) subcontractor, to assist in surface and subsurface soil sample collection.

3.2.1 Surface Soil Sampling

Surface soil samples were collected from four locations at the Old Toxic Training Area, Parcel 188(7), as shown on Figure 3-1. Soil sampling locations and rationale are presented in Table 3-1. Sample designations and analytical parameters are listed in Table 3-2. Soil sampling locations were determined in the field by the on-site geologist based on the sampling rationale, presence of surface structures, and site topography.

Table 3-1

Sampling Locations And Rationale
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
CWM-188-MW01	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected approximately 10 feet north of the training area ditch to determine if potential site-specific chemicals have impacted site media.
CWM-188-MW02	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected potentially downgradient and approximately 70 feet north of the training area ditch to determine if potential site-specific chemicals have impacted site media.
CWM-188-MW03	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected near the eastern boundary in the central area of the parcel to determine if potential site-specific chemicals have impacted site media.
CWM-188-MW04	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected near the northern end of the parcel to determine if potential site-specific chemicals have impacted site media.

LEGEND

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 5 FOOT)
- TREES / TREELINE
- PARCEL BOUNDARY
- UTILITY POLE
- MANHOLE
- UNDERGROUND CULVERT WITH HEADWALL
- MANMADE SURFACE DRAINAGE FEATURE
- HISTORICAL FEATURES, SAIC, 1993
- MONITORING WELL / GROUNDWATER, SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION
- EXISTING SAIC SUBSURFACE SOIL SAMPLE LOCATION, 1993
- EXISTING PARSONS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION, 1999

SOURCE: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION, 1993, "FORT McCLELLAN SITE INVESTIGATION REPORT", AUGUST.

FIGURE 3-1
SAMPLE LOCATION MAP
OLD TOXIC TRAINING AREA
PARCEL 188(7)

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

Shaw Environmental, Inc.

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INITIATOR: D. ALLAN
PROJ. MGR.: J. YACOUB
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Table 3-2

Soil Sample Designations and Analytical Parameters
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth (ft)	QA/QC Samples	Analytical Parameters
			Field Duplicates	
CWM-188-MW01	CWM-188-MW01-SS-TM0001-REG	0-1		Metals, VOCs, SVOCs, and CWM Breakdown Products
	CWM-188-MW01-DS-TM0002-REG	7-8		
CWM-188-MW02	CWM-188-MW02-SS-TM0003-REG	0-1		Metals, VOCs, SVOCs, and CWM Breakdown Products
	CWM-188-MW02-DS-TM0004-REG	5-6		
CWM-188-MW03	CWM-188-MW03-SS-TM0005-REG	0-1		Metals, VOCs, SVOCs, and CWM Breakdown Products
	CWM-188-MW03-DS-TM0006-REG	6-7		
CWM-188-MW04	CWM-188-MW04-SS-TM0007-REG	0-1	CWM-188-MW04-SS-TM0008-FD	Metals, VOCs, SVOCs, and CWM Breakdown Products
	CWM-188-MW04-DS-TM0009-REG	8-9		

CWM - Chemical warfare material.
FD - Field duplicate.
ft - Foot.
QA/QC - Quality assurance/quality control.
REG - Field sample.
SVOC - Semivolatile organic compound.
VOC - Volatile organic compound.

Sample Collection. Surface soil samples were collected from the uppermost foot of soil using a DPT sampling system following the methodology specified in the SAP. Surface soil samples were collected by first removing surface debris (e.g., rocks and vegetation) from the immediate sample area. The soil was collected with the sampling device and screened with a photoionization detector (PID) in accordance with procedures outlined in the SAP. The soil fraction for volatile organic compound (VOC) analysis was collected directly from the sampling device using three EnCore® samplers. The remaining soil was then transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

3.2.2 Subsurface Soil Sampling

Subsurface soil samples were collected from four soil borings at the Old Toxic Training Area, Parcel 188(7), as shown on Figure 3-1. Sampling locations and rationale are presented in Table 3-1. Sample designations, depths, and analytical parameters are listed in Table 3-2. Soil boring locations were determined in the field by the on-site geologist based on sampling rationale, presence of surface structures, site topography, and proximity to buried utilities.

Sample Collection. Subsurface soil samples were collected from soil borings at depths greater than one foot below ground surface (bgs) in the unsaturated zone. The soil borings were advanced and samples collected using the DPT sampling procedures specified in the SAP. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

Subsurface soil samples were collected continuously until DPT sampler refusal was encountered. Samples were field screened using a PID to measure volatile organic vapors in accordance with procedures outlined in the SAP. The sample displaying the highest reading was selected and sent to the laboratory for analysis; however, at those locations where PID readings were below background, the deepest sample interval above the saturated zone was submitted for analysis. The sample fraction for VOC analysis was collected directly from the sampling device using three EnCore samplers. The remaining soil was then transferred to a clean stainless-steel bowl, homogenized and placed in the appropriate sample containers. The on-site geologist constructed a detailed boring log for each soil boring. The boring logs are included in Appendix B. At the completion of soil sampling, boreholes were abandoned with bentonite pellets and hydrated with potable water following borehole abandonment procedures summarized in the SAP.

3.2.3 Monitoring Well Installation

Four permanent groundwater monitoring wells were installed in the saturated zone at the Old Toxic Training Area, Parcel 188(7), to collect groundwater samples for laboratory analysis. The well locations are shown on Figure 3-1. Table 3-3 summarizes construction details of the wells installed at the site. The well construction logs are included in Appendix B.

Shaw contracted Miller Drilling Company to install the permanent wells with a hollow-stem auger rig at the DPT soil boring locations. The wells were installed following procedures outlined in the SAP. The borehole at each well location was advanced with a 4.25-inch inside diameter (ID) hollow-stem auger from ground surface to the saturated zone. The borehole was augured to the completion depth of the DPT boring and samples were collected from that depth to the bottom of the borehole. A 2-foot-long, 2-inch ID carbon steel split-spoon sampler was driven at 5-foot intervals to collect residuum for observing and describing lithology. The samples were logged to determine lithologic changes and the approximate depth of groundwater encountered during drilling. This information was used to determine the optimal placement of the monitoring well screen interval and to provide site-specific geological and hydrogeological information. The boring log for each borehole is included in Appendix B.

Upon reaching the target depth in each borehole, a 15-foot-length of 2-inch ID, 0.010-inch continuous slot, Schedule 40 polyvinyl chloride (PVC) screen with PVC end cap was placed through the auger to the bottom of the borehole. The screen and end cap were attached to 2-inch ID, flush-threaded Schedule 40 PVC riser. A filter pack, consisting of number 1 filter sand (environmentally safe, clean fine sand, sieve size 20 to 40), was tremied around the well screen to approximately 3 feet above the top of the well screen as the augers were removed. A bentonite seal, consisting of approximately 3 feet of bentonite pellets, was placed immediately on top of the filter sand and hydrated with potable water. At wells where the bentonite seal was installed below the water table surface, the bentonite pellets were allowed to hydrate in the groundwater. The bentonite seal placement and hydration followed procedures in the SAP. Bentonite-cement grout was tremied into the annular space of the well from the top of the bentonite seal to the ground surface. A locking protective steel casing was placed over the PVC well riser and a concrete pad was constructed around the well. Four protective steel posts were installed around the well pad. A locking well cap was placed on the PVC well riser.

The monitoring wells were developed by surging and pumping with a 2-inch diameter submersible pump in accordance with methodology outlined in the SAP. The submersible pump used for well development was moved in an up-and-down fashion to encourage any residual well installation materials to enter the well. These materials were then pumped out of the well in

Table 3-3

Monitoring Well Construction Summary
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Well Location	Northing	Easting	Ground Elevation (ft amsl)	TOC Elevation (ft amsl)	Well Depth (ft bgs)	Screen Length (ft)	Screen Interval (ft bgs)	Well Material
CWM-188-MW01	1167028.50	668098.55	812.13	811.91	30	15	15 - 30	2" ID Sch. 40 PVC
CWM-188-MW02	1167106.61	668150.95	807.07	806.78	25	15	10 - 25	2" ID Sch. 40 PVC
CWM-188-MW03	1167098.93	668264.01	813.98	816.03	40	15	25 - 40	2" ID Sch. 40 PVC
CWM-188-MW04	1167273.55	668236.68	805.29	805.06	25	15	10 - 25	2" ID Sch. 40 PVC

Permanent wells installed using hollow-stem auger.
Horizontal coordinates referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983 (NAD83).
Elevations referenced to the North American Vertical Datum of 1988 (NAVD88).
2" ID Sch. 40 PVC - 2-inch inside diameter, Schedule 40, polyvinyl chloride.
amsl - Above mean sea level.
bgs - Below ground surface.
ft - Feet.

order to re-establish the natural hydraulic flow conditions. Development was performed until the water turbidity was less than or equal to 20 nephelometric turbidity units (NTU) or for a maximum of 8 hours. The well development logs are included in Appendix C.

3.2.4 Water Level Measurements

The depth to groundwater was measured in the permanent wells at the site on January 7, 2002, following procedures outlined in the SAP. Depth to groundwater was measured with an electronic water level meter. The meter probe and cable were cleaned before use at each well following decontamination methodology presented in the SAP. Measurements were referenced to the top of the PVC well casing, as summarized in Table 3-4.

3.2.5 Groundwater Sampling

Groundwater samples were collected from each of the four permanent wells installed at the site. The well/groundwater sampling locations are shown on Figure 3-1. The groundwater sampling locations and rationale are listed in Table 3-1. The groundwater sample designations and analytical parameters are listed in Table 3-5.

Sample Collection. Groundwater samples were collected using a peristaltic pump equipped with Teflon™ tubing following the procedures outlined in the SAP. Samples for VOC analysis were collected using the "tube evacuation" method described in the SAP (IT, 2002). Groundwater was sampled after purging a minimum of three well volumes and after field parameters (temperature, pH, dissolved oxygen, specific conductivity, oxidation-reduction potential and turbidity) stabilized. Field parameter readings are summarized in Table 3-6. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-5 using methods outlined in Section 3.4.

3.3 Surveying of Sample Locations

Sample locations were surveyed using global positioning system survey and conventional civil survey techniques described in the SAP. Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983. Elevations were referenced to the North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix D.

3.4 Analytical Program

Samples collected during the SI were analyzed for various chemical parameters based on potential site-specific chemicals and on EPA, ADEM, FTMC and USACE requirements.

Table 3-4

Groundwater Elevations
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Well Location	Date	Depth to Water (ft BTOC)	Top of Casing Elevation (ft amsl)	Ground Elevation (ft amsl)	Groundwater Elevation (ft amsl)
CWM-188-MW01	7-Jan-02	12.17	811.91	812.13	799.74
CWM-188-MW02	7-Jan-02	7.98	806.78	807.07	798.80
CWM-188-MW03	7-Jan-02	17.22	816.03	813.98	798.81
CWM-188-MW04	7-Jan-02	5.94	805.06	805.29	799.12

Elevations referenced to the North American Vertical Datum of 1988 (NAVD88).

amsl - Above mean sea level.
BTOC - Below top of casing.
ft - Feet.

Table 3-5

Groundwater Sample Designations and Analytical Parameters
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	QA/QC Samples		Analytical Parameters
		Field Duplicates	MS/MSD	
CWM-188-MW01	CWM-188-MW01-GW-TM3001-REG			VOCs, SVOCs, Metals, CWM Breakdown Products
CWM-188-MW02	CWM-188-MW02-GW-TM3002-REG			VOCs, SVOCs, Metals, CWM Breakdown Products
CWM-188-MW03	CWM-188-MW03-GW-TM3003-REG	CWM-188-MW03-GW-TM3004-FD		VOCs, SVOCs, Metals, CWM Breakdown Products
CWM-188-MW04	CWM-188-MW04-GW-TM3006-REG		CWM-188-MW04-GW-TM3006-MS/MSD	VOCs, SVOCs, Metals, CWM Breakdown Products

Groundwater samples were collected from the approximate midpoint of the saturated screened interval of the monitoring well.

CWM - Chemical warfare material
FD - Field duplicate.
ft - Foot.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.
SVOC - Semivolatile organic compound.
VOC - Volatile organic compound.

Table 3-6

Groundwater Field Parameters
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Date	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Temperature (°C)	Turbidity (NTU)	pH (SU)
CWM-188-MW01	1-Feb-02	0.251	0.86	135	16.9	8.3	5.88
CWM-188-MW02	31-Jan-02	0.362	2.63	241	18.7	1.0	7.30
CWM-188-MW03	31-Jan-02	0.285	1.49	254	16.8	6.8	7.61
CWM-188-MW04	30-Jan-02	0.530	0	82	21.1	1.8	6.99

mg/L - Milligrams per liter.
mS/cm - Millisiemens per centimeter.
mV - Millivolts.
NTU - Nephelometric turbidity units.
ORP - Oxidation-reduction potential.
SU - Standard units.

Samples collected at the Old Toxic Training Area, Parcel 188(7), were analyzed for the following parameters using EPA SW-846 methods, including Update III Methods where applicable:

- Target analyte list metals – EPA Method 6010B/7000
- TCL VOCs – EPA Method 8260B
- TCL semivolatile organic compounds (SVOC) - EPA Method 8270C
- CWM breakdown products (including orthosulfur compounds) - EPA Methods 8321 and 8270M.

3.5 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping followed requirements specified in the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SI are listed in Appendix B of the SAP. Sample documentation and chain-of-custody records were completed as specified in the SAP.

Completed analysis request and chain-of-custody records (Appendix A) were secured and included with each shipment of sample coolers to EMAX Laboratories, Inc. in Torrance, California or Quanterra Environmental Services in Sacramento, California.

3.6 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in the SAP. The IDW generated during the SI at the Old Toxic Training Area, Parcel 188(7), was segregated as follows:

- Drill cuttings
- Purge water from well development, sampling activities, and decontamination fluids
- Spent well materials and personal protective equipment.

Solid IDW was stored inside the fenced area surrounding Buildings 335 and 336 in lined roll-off bins prior to characterization and final disposal. Solid IDW was characterized using toxicity characteristic leaching procedure analysis. Based on the results, drill cuttings, spent well materials, and personal protective equipment generated during the SI were disposed as nonregulated waste at the Industrial Waste Landfill on the Main Post of FTMC.

Liquid IDW was contained in the 20,000-gallon sump associated with the Building T-338 vehicle washrack. Liquid IDW was characterized by VOC, SVOC, and metals analyses. Based on the analyses, liquid IDW was discharged as nonregulated waste to the FTMC wastewater treatment plant on the Main Post.

3.7 Variances/Nonconformances

No variances or nonconformances to the SFSP were recorded during completion of the SI at the Old Toxic Training Area, Parcel 188(7).

3.8 Data Quality

The field sample analytical data are presented in tabular form in Appendix E. The field samples were collected, documented, handled, analyzed, and reported in a manner consistent with the SI work plan, the FTMC SAP and installation-wide quality assurance plan, and standard, accepted methods and procedures. Data were reported and evaluated in accordance with Corps of Engineers South Atlantic Savannah Level B criteria (USACE, 1994) and the stipulated requirements for the generation of definitive data presented in the SAP. Chemical data were reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms.

Data Validation. The reported analytical data were validated in accordance with EPA National Functional Guidelines by Level III criteria. The data validation results are summarized in a quality assurance report, which includes the data validation summary report (Appendix F). Selected results were qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the report. The validation-assigned qualifiers were added to the FTMC IT Environmental Management System database for tracking and reporting. The qualified data were used in comparisons to the SSSLs and ESVs. Rejected data (assigned an "R" qualifier) were not used in the comparisons to the SSSLs and ESVs. The data presented in this report, except where qualified, meet the principle data quality objective for this SI.

4.0 Site Characterization

Subsurface investigations performed at the Old Toxic Training Area, Parcel 188(7), provided soil, bedrock, and groundwater data used to characterize the geology and hydrogeology of the site.

4.1 Regional and Site Geology

4.1.1 Regional Geology

Calhoun County includes parts of two physiographic provinces: the Piedmont Upland Province, and the Valley and Ridge Province. The Piedmont Upland Province occupies the extreme eastern and southeastern portions of the county, and is characterized by metamorphosed sedimentary rocks. The generally accepted range in age of these metamorphics is Cambrian to Devonian.

The majority of Calhoun County, including the Main Post of FTMC, lies within the Appalachian fold-and-thrust structural belt (Valley and Ridge Province) where southeastward-dipping thrust faults with associated minor folding are the predominant structural features. The fold and thrust belt consists of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted, with major structures and faults striking in a northeast-southwest direction.

Northwestward transport of the Paleozoic rock sequence along the thrust faults has resulted in the imbricate stacking of large slabs of rock referred to as thrust sheets. Within an individual thrust sheet, smaller faults may splay off the larger thrust fault, resulting in imbricate stacking of rock units within an individual thrust sheet (Osborne and Szabo, 1984). Geologic contacts in this region generally strike parallel to the faults, and repetition of lithologic units is common in vertical sequences. Geologic formations within the Valley and Ridge Province portion of Calhoun County have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992), and vary in age from Lower Cambrian to Pennsylvanian.

The basal unit of the sedimentary sequence in Calhoun County is the Cambrian Chilhowee Group. The Chilhowee Group consists of the Cochran, Nichols, Wilson Ridge and Weisner Formations (Osborne and Szabo, 1984) but in Calhoun County is either undifferentiated or divided into the Cochran and Nichols Formations and an upper undifferentiated Wilson Ridge and Weisner Formation. The Cochran is composed of poorly sorted arkosic sandstone and conglomerate with interbeds of greenish-gray siltstone and mudstone. Massive to laminated greenish-gray and black mudstone makes up the Nichols Formation, with thin interbeds of

siltstone and very fine-grained sandstone (Osborne et al., 1988). These two formations are mapped only in the eastern part of the county.

The Wilson Ridge and Weisner Formations are undifferentiated in Calhoun County and consist of both coarse-grained and fine-grained clastics. The coarse-grained facies appear to dominate the unit and consist primarily of coarse-grained, vitreous quartzite, and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consist of sandy and micaceous shale, and silty, micaceous mudstone, which are locally interbedded with the coarse clastic rocks. The abundance of orthoquartzitic sandstone and quartzite suggests that most of the Chilhowee Group bedrock in the vicinity of FTMC belongs to the Weisner Formation (Osborne and Szabo, 1984).

The Cambrian Shady Dolomite overlies the Weisner Formation northeast, east and southwest of the Main Post and consists of interlayered bluish-gray or pale yellowish-gray sandy dolomitic limestone and siliceous dolomite with coarsely crystalline porous chert (Osborne et al., 1989). A variegated shale and clayey silt have been included within the lower part of the Shady Dolomite (Cloud, 1966). Material similar to this lower shale unit was noted in core holes drilled by the Alabama Geologic Survey on FTMC (Osborne and Szabo, 1984). The character of the Shady Dolomite in the FTMC vicinity and the true assignment of the shale at this stratigraphic interval are still uncertain (Osborne, 1999).

The Rome Formation overlies the Shady Dolomite and locally occurs to the northwest and southeast of the Main Post as mapped by Warman and Causey (1962), and Osborne and Szabo (1984), and immediately to the west of Reilly Airfield (Osborne and Szabo, 1984). The Rome Formation consists of variegated, thinly interbedded grayish-red-purple mudstone, shale, siltstone, and greenish-red and light gray sandstone, with locally occurring limestone and dolomite. Weaver Cave, located approximately 1 mile west of the northwest boundary of the Main Post, is situated in gray dolomite and limestone mapped as the Rome Formation (Osborne et al., 1997). The Conasauga Formation overlies the Rome Formation and occurs along anticlinal axes in the northeastern portion of Pelham Range (Warman and Causey, 1962; Osborne and Szabo, 1984) and the northern portion of the Main Post (Osborne et al., 1997). The Conasauga Formation is composed of dark-gray, finely to coarsely crystalline medium- to thick-bedded dolomite with minor shale and chert (Osborne et al., 1989).

Overlying the Conasauga Formation is the Knox Group, which is composed of the Copper Ridge and Chepultepec dolomites of Cambro-Ordovician age. The Knox Group is undifferentiated in Calhoun County and consists of light medium gray, fine to medium crystalline, variably bedded

to laminated, siliceous dolomite and dolomitic limestone that weathers to a chert residuum (Osborne and Szabo, 1984). The Knox Group underlies a large portion of the Pelham Range area.

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone is comprised of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped as undifferentiated at FTMC and other parts of Calhoun County. The Athens Shale overlies the Ordovician limestone units. The Athens Shale consists of dark gray to black shale and graptolitic shale with localized interbedded dark gray limestone (Osborne et al., 1989). These units occur within an eroded "window" in the uppermost structural thrust sheet at FTMC and underlie much of the developed area of the Main Post.

Other Ordovician-aged bedrock units mapped in Calhoun County include the Greensport Formation, Colvin Mountain Sandstone and Sequatchie Formation. These units consist of various siltstones, sandstones, shales, dolomites and limestones, and are mapped as one, undifferentiated unit in some areas of Calhoun County. The only Silurian-age sedimentary formation mapped in Calhoun County is the Red Mountain Formation. This unit consists of interbedded red sandstone, siltstone and shale with greenish-gray to red silty and sandy limestone.

The Devonian Frog Mountain Sandstone consists of sandstone and quartzitic sandstone with shale interbeds, dolomudstone and glauconitic limestone (Osborne et al., 1988). This unit locally occurs in the western portion of Pelham Range.

The Mississippian Fort Payne Chert and the Maury Formation overlie the Frog Mountain Sandstone and are composed of dark to light gray limestone with abundant chert nodules and greenish-gray to grayish-red phosphatic shale, with increasing amounts of calcareous chert towards the upper portion of the formation (Osborne and Szabo, 1984). These units occur in the northwestern portion of Pelham Range. Overlying the Fort Payne Chert is the Floyd Shale, also of Mississippian age, which consists of thin-bedded, fissile brown to black shale with thin intercalated limestone layers and interbedded sandstone. Osborne and Szabo (1984) reassigned the Floyd Shale, which was mapped by Warman and Causey (1962) on the Main Post of FTMC, to the Ordovician Athens Shale based on fossil data.

The Pennsylvanian Parkwood Formation overlies the Floyd Shale and consists of a medium to dark gray, silty, clay, shale and mudstone with interbedded light to medium gray very fine to fine grained argillaceous, micaceous sandstone. Locally the Parkwood Formation also contains beds of medium to dark gray argillaceous, bioclastic to cherty limestone and beds of clayey coal up to a few inches thick (Raymond et al., 1988). The Parkwood Formation in Calhoun County is generally found within a structurally complex area known as the Coosa deformed belt. In the deformed belt, the Parkwood Formation and Floyd Shale are mapped as undifferentiated because their lithologic similarity and significant deformation make it impractical to map the contact (Thomas and Drahovzal, 1974; Osborne et al, 1988). The undifferentiated Parkwood Formation and Floyd Shale are found throughout the western quarter of Pelham Range.

The Jacksonville thrust fault is the most significant structural geological feature in the vicinity of the Main Post of FTMC, both for its role in determining the stratigraphic relationships in the area and for its contribution to regional water supplies. The trace of the fault extends northeastward for approximately 39 miles between Bynum, Alabama and Piedmont, Alabama. The fault is interpreted as a major splay of the Pell City fault (Osborne and Szabo, 1984). The Ordovician sequence that makes up the Eden thrust sheet is exposed at FTMC through an eroded window, or fenster, in the overlying thrust sheet. Rocks within the window display complex folding with the folds being overturned and tight to isoclinal. The carbonates and shales locally exhibit well-developed cleavage (Osborne and Szabo, 1984). The FTMC window is framed on the northwest by the Rome Formation, north by the Conasauga Formation, northeast, east, and southwest by the Shady Dolomite, and southeast and southwest by the Chilhowee Group (Osborne et al., 1997). Two small klippen of the Shady Dolomite, bounded by the Jacksonville fault, have been recognized adjacent to the Pell City fault at the FTMC window (Osborne et al., 1997).

The Pell City fault serves as a fault contact between the bedrock within the FTMC window and the Rome and Conasauga Formations. The trace of the Pell City fault is also exposed approximately nine miles west of the FTMC window on Pelham Range where it traverses northeast to southwest across the western quarter of Pelham Range. Here, the trace of the Pell City fault marks the boundary between the Pell City thrust sheet and the Coosa deformed belt.

The eastern three quarters of Pelham Range is located within the Pell City thrust sheet, while the remaining western quarter of Pelham Range is located within the Coosa deformed belt. The Pell City thrust sheet is a large-scale thrust sheet containing Cambrian and Ordovician rocks and is relatively less structurally complex than the Coosa deformed belt (Thomas and Neathery, 1982). The Pell City thrust sheet is exposed between the traces of the Jacksonville and Pell City faults along the western boundary of the FTMC window, and along the trace of the Pell City fault on

Pelham Range (Thomas and Neathery, 1982 and Osborne et al., 1988). The Coosa deformed belt is a narrow (approximately 5 to 20 miles wide) northeast- to-southwest-trending linear (approximately 90 miles in length) zone of complex structure consisting mainly of thin imbricate thrust slices. The structure within these imbricate thrust slices is often internally complicated by small-scale folding and additional thrust faults (Thomas and Drahovzal, 1974).

4.1.2 Site Geology

Soils at the Old Toxic Training Area, Parcel 188(7), are comprised of the Anniston and Allen Gravelly Loam. The Anniston and Allen series of soils consist of strongly acid, deep, well-drained, friable soils that have developed in old local alluvium on foot slopes and along the base of mountains. The parent material washed from the adjacent higher lying Linker, Muskingham, Enders and Montevallo soils, which developed from weathered sandstone, shale and quartzite. Fragments of sandstone and quartzite gravel and cobbles, as much as 8 inches in diameter are on the surface and throughout the soil. The color of the surface soil ranges from very dark brown and dark brown to reddish-brown and dark reddish-brown. The texture of subsoil ranges from light clay loam to clay or silty clay loam. The alluvium ranges in thickness from 2 feet to more than 8 feet. Infiltration and runoff are medium, permeability is moderate and the capacity for available moisture is high. Organic matter is moderately low (U.S. Department of Agriculture [USDA], 1961).

The Old Toxic Training Area, Parcel 188(7), is located within the southern portion of the Ordovician eroded "window" in the uppermost structural thrust sheet at FTMC. The rocks within this window display complex folding with the folds being overturned and tight to isoclinal. Bedrock at this site is mapped as Mississippian/Ordovician Floyd and Athens shale undifferentiated, underlain by the Ordovician Little Oak and Newala Limestones, which are mapped as undifferentiated on FTMC (Osborne et al., 1997).

The residuum encountered during drilling activities at Parcel 188(7) was a yellowish-orange to light-brown clay with varying amounts of silt, sand, and gravel. The gravel was composed of quartz-rich sandstone and limestone.

At CWM-188-MW01, CWM-188-MW03, and CWM-188-MW04, black weathered shale was encountered at depths of 25, 41.5, and 20 feet bgs, respectively, shortly before encountering hollow-stem auger refusal. Auger refusal was encountered at CWM-188-MW01, CWM-188-MW03, and CWM-188-MW04 at 30, 42, and 25 feet bgs, respectively, on more competent black shale.

4.2 Site Hydrology

4.2.1 Surface Hydrology

Precipitation in the form of rainfall averages about 54 inches annually in Anniston, Alabama, with infiltration rates annually exceeding evapotranspiration rates (U.S. Department of Commerce, 1998). The major surface water features at the Main Post of FTMC include Remount Creek, Cane Creek and Cave Creek. These waterways flow in a general northwest to westerly direction towards the Coosa River on the western boundary of Calhoun County.

Elevation of the Old Toxic Training Area, Parcel 188(7), ranges from approximately 800 to 815 feet above mean sea level. Surface water in the area of Parcel 188(7) is expected to flow to the northwest towards Remount Creek, which is a tributary to Cane Creek.

4.2.2 Hydrogeology

During soil boring and well installation activities, groundwater was encountered at depths ranging from approximately 20 to 25 feet bgs (Appendix B). Based on groundwater level data collected at the site on January 7, 2002 (Table 3-4), the water table underlying the site appears to be almost level. Groundwater flow direction at this site is expected to follow the topography resulting in flow to the north-northwest.

5.0 Summary of Analytical Results

The results of the chemical analysis of samples collected at the Old Toxic Training Area, Parcel 188(7), indicate that metals, VOCs, and SVOCs were detected in site media. CWM breakdown products were not detected in any of the samples collected at the site. To evaluate whether the detected constituents present an unacceptable risk to human health and the environment, the analytical results were compared to the human health SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed for human health and ecological risk evaluations as part of the on-going SIs being performed under the BRAC Environmental Restoration Program at FTMC.

Metals concentrations exceeding SSSLs and ESVs were subsequently compared to metals background screening values to determine if the metal concentrations are within natural background concentrations (SAIC, 1998). Summary statistics for background metals samples collected at FTMC are included in Appendix G. Additionally, SVOC (PAH compounds) concentrations in surface soils that exceeded SSSLs and ESVs were compared to PAH background screening values. The PAH background screening values were derived from PAH analytical data from 18 parcels at FTMC that were determined to represent anthropogenic activity (IT, 2000c). PAH background screening values were developed for two categories of surface soils: beneath asphalt and adjacent to asphalt. The PAH background screening values for soils adjacent to asphalt are the more conservative (i.e., lower) of the PAH background values and are the values used herein for comparison.

Six compounds were quantified by both SW-846 Method 8260B (as VOC) and Method 8270C (as SVOC), including 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, 1,3-dichlorobenzene, 1,2-dichlorobenzene, hexachlorobutadiene, and naphthalene. Method 8260B yields an RL of 0.005 milligrams per kilogram (mg/kg), while Method 8270C has an RL of 0.330 mg/kg, which is typical for a soil matrix sample. Because of the direct nature of the Method 8260B analysis and its resulting lower RL, this method should be considered superior to Method 8270C when quantifying low levels (0.005 to 0.330 mg/kg) of these compounds. Method 8270C and its associated methylene chloride extraction step is superior, however, when dealing with samples that contain higher concentrations (greater than 0.330 mg/kg) of these compounds. Therefore, all data were considered and none were categorically excluded. Data validation qualifiers were helpful in evaluating the usability of data, especially if calibration, blank contamination, precision, or accuracy indicator anomalies were encountered. The validation qualifiers and concentrations reported (e.g., whether concentrations were less than or greater than 0.330 mg/kg) were used to determine which analytical method was likely to return the more accurate result.

The following sections and Tables 5-1 through 5-3 summarize the results of the comparison of detected constituents to the SSSLs, ESVs, and background screening values. Complete analytical results are presented in Appendix E

5.1 Surface Soil Analytical Results

Four surface soil samples were collected for chemical analysis at the Old Toxic Training Area, Parcel 188(7). Surface soil samples were collected from the upper foot of soil at locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs, ESVs and metals background screening values as presented in Table 5-1.

Metals. Nineteen metals were detected in surface soil samples collected at the site. The concentrations of five metals (aluminum, arsenic, chromium, iron, and vanadium) exceeded SSSLs. Four of these metals also exceeded their respective background concentrations in one or more samples each. However, these metals concentrations were within the range of background values established by SAIC (Appendix G) except for the following:

- Iron (59,800 mg/kg) exceeded its SSSL (2,345 mg/kg) and upper background range (56,300 mg/kg) at one sample location (CWM-188-MW02). The iron result was flagged with a "J" data qualifier indicating that the metal was positively identified but that the concentration was estimated.

It should be noted that upper background range values are provided as additional information for risk managers.

The concentrations of ten metals (aluminum, arsenic, beryllium, chromium, copper, iron, manganese, selenium, vanadium, and zinc) exceeded ESVs. Eight of these metals also exceeded their respective background concentrations in one or more sample each. However, these metals concentrations were within the range of background values established by SAIC (Appendix G) except for the following:

- Beryllium (1.16 mg/kg) exceeded its ESV (1.1 mg/kg) and upper background range (0.87 mg/kg) at one sample location (CWM-188-MW02).
- Copper (66.7 mg/kg) exceeded its ESV (40 mg/kg) and upper background range (24 mg/kg) at one sample location (CWM-188-MW01).
- Selenium (3.93 and 2.09 mg/kg) exceeded its ESV (0.81 mg/kg) and upper background range (1.3 mg/kg) at two sample locations (CWM-188-MW01 and CWM-188-MW02).

Table 5-1

Surface Soil Analytical Results
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Sample Location						CWM-188-MW01						CWM-188-MW02					
Sample Number						TM0001						TM0003					
Sample Date						24-Oct-01						24-Oct-01					
Sample Depth (Feet)						0- 1						0- 1					
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	ESV[c]	Result	Qual	>UBR	>BKG	>SSSL	>ESV	Result	Qual	>UBR	>BKG	>SSSL	>ESV
METALS																	
Aluminum	mg/kg	3.99E+04	1.63E+04	7.80E+03	5.00E+01	2.62E+04			YES	YES	YES	3.24E+04			YES	YES	YES
Arsenic	mg/kg	4.90E+01	1.37E+01	4.26E-01	1.00E+01	8.51E+00				YES		1.69E+01			YES	YES	YES
Barium	mg/kg	2.88E+02	1.24E+02	5.47E+02	1.65E+02	1.63E+02	J		YES			9.55E+01	J				
Beryllium	mg/kg	8.70E-01	8.00E-01	9.60E+00	1.10E+00	1.16E+00	J	YES	YES		YES	7.36E-01	J				
Calcium	mg/kg	1.79E+04	1.72E+03	NA	NA	7.43E+03	J		YES			6.76E+02	J				
Chromium	mg/kg	1.34E+02	3.70E+01	2.32E+01	4.00E-01	2.18E+01					YES	3.22E+01				YES	YES
Cobalt	mg/kg	7.10E+01	1.52E+01	4.68E+02	2.00E+01	1.56E+00	J					6.88E+00					
Copper	mg/kg	2.40E+01	1.27E+01	3.13E+02	4.00E+01	6.67E+01		YES	YES		YES	3.73E+01		YES	YES		
Iron	mg/kg	5.63E+04	3.42E+04	2.34E+03	2.00E+02	2.71E+04	J			YES	YES	5.98E+04	J	YES	YES	YES	YES
Lead	mg/kg	8.30E+01	4.01E+01	4.00E+02	5.00E+01	2.70E+01	J					1.53E+01	J				
Magnesium	mg/kg	9.60E+03	1.03E+03	NA	4.40E+05	5.17E+03	J		YES			1.62E+03	J		YES		
Manganese	mg/kg	6.85E+03	1.58E+03	3.63E+02	1.00E+02	1.89E+01						9.20E+01					
Mercury	mg/kg	3.20E-01	8.00E-02	2.33E+00	1.00E-01	ND						6.40E-02	J				
Nickel	mg/kg	2.20E+01	1.03E+01	1.54E+02	3.00E+01	1.28E+01			YES			2.80E+01		YES	YES		
Potassium	mg/kg	6.01E+03	8.00E+02	NA	NA	3.78E+03	J		YES			1.27E+03	J		YES		
Selenium	mg/kg	1.30E+00	4.80E-01	3.91E+01	8.10E-01	3.93E+00		YES	YES		YES	2.09E+00		YES	YES		YES
Sodium	mg/kg	5.63E+02	6.34E+02	NA	NA	9.42E+01	J					1.19E+02	J				
Vanadium	mg/kg	1.58E+02	5.88E+01	5.31E+01	2.00E+00	6.63E+01			YES	YES	YES	7.31E+01			YES	YES	YES
Zinc	mg/kg	2.09E+02	4.06E+01	2.34E+03	5.00E+01	5.27E+01	J		YES		YES	5.20E+01	J		YES		YES
VOLATILE ORGANIC COMPOUNDS																	
1,2,4-Trimethylbenzene	mg/kg	NA	NA	3.88E+02	1.00E-01	3.30E+02					YES	ND					
1,2-Dimethylbenzene	mg/kg	NA	NA	1.55E+04	5.00E-02	8.00E+01					YES	ND					
1,3,5-Trimethylbenzene	mg/kg	NA	NA	3.88E+02	1.00E-01	1.10E+02					YES	ND					
2-Butanone	mg/kg	NA	NA	4.66E+03	8.96E+01	ND						ND					
4-Methyl-2-pentanone	mg/kg	NA	NA	6.21E+02	4.43E+02	ND						ND					
Acetone	mg/kg	NA	NA	7.76E+02	2.50E+00	1.60E-02	J					1.40E-02	J				
Cumene	mg/kg	NA	NA	7.77E+02	NA	1.20E+01						ND					
Ethylbenzene	mg/kg	NA	NA	7.77E+02	5.00E-02	4.00E+01					YES	ND					
Naphthalene	mg/kg	NA	NA	1.55E+02	1.00E-01	5.50E+01					YES	ND					
Toluene	mg/kg	NA	NA	1.55E+03	5.00E-02	2.60E+00	J				YES	ND					
n-Butylbenzene	mg/kg	NA	NA	7.77E+01	NA	2.80E+01						ND					
n-Propylbenzene	mg/kg	NA	NA	7.77E+01	NA	5.30E+01						ND					
p-Cymene	mg/kg	NA	NA	1.55E+03	NA	4.50E+00	J					ND					
sec-Butylbenzene	mg/kg	NA	NA	7.77E+01	NA	8.20E+00						ND					

Table 5-1

Surface Soil Analytical Results
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Sample Location						CWM-188-MW01						CWM-188-MW02					
Sample Number						TM0001						TM0003					
Sample Date						24-Oct-01						24-Oct-01					
Sample Depth (Feet)						0- 1						0- 1					
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	ESV[c]	Result	Qual	>UBR	>BKG	>SSSL	>ESV	Result	Qual	>UBR	>BKG	>SSSL	>ESV
SEMIVOLATILE ORGANIC COMPOUNDS																	
2-Methylnaphthalene	mg/kg	NA	NA	1.55E+02	NA	1.50E+01						ND					
Acenaphthene	mg/kg	NA	7.02E-01	4.63E+02	2.00E+01	ND						9.50E-02	J				
Anthracene	mg/kg	NA	9.35E-01	2.33E+03	1.00E-01	ND						1.10E-01	J				YES
Benzo(a)anthracene	mg/kg	NA	1.19E+00	8.51E-01	5.21E+00	ND						3.30E-01	J				
Benzo(a)pyrene	mg/kg	NA	1.42E+00	8.51E-02	1.00E-01	ND						3.00E-01	J			YES	YES
Benzo(b)fluoranthene	mg/kg	NA	1.66E+00	8.51E-01	5.98E+01	ND						4.30E-01					
Benzo(ghi)perylene	mg/kg	NA	9.55E-01	2.32E+02	1.19E+02	ND						2.40E-01	J				
Benzo(k)fluoranthene	mg/kg	NA	1.45E+00	8.51E+00	1.48E+02	ND						1.40E-01	J				
Carbazole	mg/kg	NA	NA	3.11E+01	NA	ND						8.40E-02	J				
Chrysene	mg/kg	NA	1.40E+00	8.61E+01	4.73E+00	ND						3.00E-01	J				
Dibenz(a,h)anthracene	mg/kg	NA	7.20E-01	8.61E-02	1.84E+01	ND						6.00E-02	J				
Fluoranthene	mg/kg	NA	2.03E+00	3.09E+02	1.00E-01	ND						7.70E-01					YES
Indeno(1,2,3-cd)pyrene	mg/kg	NA	9.37E-01	8.51E-01	1.09E+02	ND						2.40E-01	J				
Naphthalene	mg/kg	NA	3.30E-02	1.55E+02	1.00E-01	8.80E+00			YES		YES	ND					
Phenanthrene	mg/kg	NA	1.08E+00	2.32E+03	1.00E-01	ND						4.80E-01					YES
Pyrene	mg/kg	NA	1.63E+00	2.33E+02	1.00E-01	ND						5.60E-01					YES

Table 5-1

Surface Soil Analytical Results
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Sample Location						CWM-188-MW03						CWM-188-MW04					
Sample Number						TM0005						TM0007					
Sample Date						6-Nov-01						24-Oct-01					
Sample Depth (Feet)						0- 1						0- 1					
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	ESV[c]	Result	Qual	>UBR	>BKG	>SSSL	>ESV	Result	Qual	>UBR	>BKG	>SSSL	>ESV
METALS																	
Aluminum	mg/kg	3.99E+04	1.63E+04	7.80E+03	5.00E+01	1.90E+04			YES	YES	YES	1.19E+04				YES	YES
Arsenic	mg/kg	4.90E+01	1.37E+01	4.26E-01	1.00E+01	5.14E+00				YES		7.04E+00				YES	
Barium	mg/kg	2.88E+02	1.24E+02	5.47E+02	1.65E+02	7.54E+01						1.59E+02	J		YES		
Beryllium	mg/kg	8.70E-01	8.00E-01	9.60E+00	1.10E+00	4.48E-01	J					6.13E-01	J				
Calcium	mg/kg	1.79E+04	1.72E+03	NA	NA	2.00E+02						1.14E+04	J		YES		
Chromium	mg/kg	1.34E+02	3.70E+01	2.32E+01	4.00E-01	2.04E+01					YES	2.79E+01				YES	YES
Cobalt	mg/kg	7.10E+01	1.52E+01	4.68E+02	2.00E+01	6.42E+00						3.48E+00					
Copper	mg/kg	2.40E+01	1.27E+01	3.13E+02	4.00E+01	9.93E+00						8.69E+00					
Iron	mg/kg	5.63E+04	3.42E+04	2.34E+03	2.00E+02	1.56E+04				YES	YES	2.38E+04	J			YES	YES
Lead	mg/kg	8.30E+01	4.01E+01	4.00E+02	5.00E+01	1.18E+01						1.11E+01	J				
Magnesium	mg/kg	9.60E+03	1.03E+03	NA	4.40E+05	9.17E+02						7.14E+03	J		YES		
Manganese	mg/kg	6.85E+03	1.58E+03	3.63E+02	1.00E+02	2.11E+02					YES	1.54E+02	J				YES
Mercury	mg/kg	3.20E-01	8.00E-02	2.33E+00	1.00E-01	4.30E-02	J					ND					
Nickel	mg/kg	2.20E+01	1.03E+01	1.54E+02	3.00E+01	1.06E+01	J		YES			8.06E+00					
Potassium	mg/kg	6.01E+03	8.00E+02	NA	NA	8.72E+02			YES			1.06E+03	J		YES		
Selenium	mg/kg	1.30E+00	4.80E-01	3.91E+01	8.10E-01	1.09E+00	B		YES		YES	5.51E-01	J		YES		
Sodium	mg/kg	5.63E+02	6.34E+02	NA	NA	ND						5.23E+01	J				
Vanadium	mg/kg	1.58E+02	5.88E+01	5.31E+01	2.00E+00	3.70E+01					YES	3.81E+01					YES
Zinc	mg/kg	2.09E+02	4.06E+01	2.34E+03	5.00E+01	3.29E+01						1.78E+01	J				
VOLATILE ORGANIC COMPOUNDS																	
1,2,4-Trimethylbenzene	mg/kg	NA	NA	3.88E+02	1.00E-01	ND						ND					
1,2-Dimethylbenzene	mg/kg	NA	NA	1.55E+04	5.00E-02	ND						ND					
1,3,5-Trimethylbenzene	mg/kg	NA	NA	3.88E+02	1.00E-01	ND						ND					
2-Butanone	mg/kg	NA	NA	4.66E+03	8.96E+01	1.70E-02	J					ND					
4-Methyl-2-pentanone	mg/kg	NA	NA	6.21E+02	4.43E+02	ND						5.40E-03	J				
Acetone	mg/kg	NA	NA	7.76E+02	2.50E+00	6.10E-01	J					2.90E-02					
Cumene	mg/kg	NA	NA	7.77E+02	NA	ND						ND					
Ethylbenzene	mg/kg	NA	NA	7.77E+02	5.00E-02	ND						ND					
Naphthalene	mg/kg	NA	NA	1.55E+02	1.00E-01	ND						ND					
Toluene	mg/kg	NA	NA	1.55E+03	5.00E-02	2.00E-03	J					ND					
n-Butylbenzene	mg/kg	NA	NA	7.77E+01	NA	ND						ND					
n-Propylbenzene	mg/kg	NA	NA	7.77E+01	NA	ND						ND					
p-Cymene	mg/kg	NA	NA	1.55E+03	NA	1.20E-02						ND					
sec-Butylbenzene	mg/kg	NA	NA	7.77E+01	NA	ND						ND					

Table 5-1

Surface Soil Analytical Results
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Sample Location						CWM-188-MW03						CWM-188-MW04					
Sample Number						TM0005						TM0007					
Sample Date						6-Nov-01						24-Oct-01					
Sample Depth (Feet)						0- 1						0- 1					
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	ESV[c]	Result	Qual	>UBR	>BKG	>SSSL	>ESV	Result	Qual	>UBR	>BKG	>SSSL	>ESV
SEMIVOLATILE ORGANIC COMPOUNDS																	
2-Methylnaphthalene	mg/kg	NA	NA	1.55E+02	NA	ND						ND					
Acenaphthene	mg/kg	NA	7.02E-01	4.63E+02	2.00E+01	ND						ND					
Anthracene	mg/kg	NA	9.35E-01	2.33E+03	1.00E-01	ND						ND					
Benzo(a)anthracene	mg/kg	NA	1.19E+00	8.51E-01	5.21E+00	ND						ND					
Benzo(a)pyrene	mg/kg	NA	1.42E+00	8.51E-02	1.00E-01	ND						ND					
Benzo(b)fluoranthene	mg/kg	NA	1.66E+00	8.51E-01	5.98E+01	ND						ND					
Benzo(ghi)perylene	mg/kg	NA	9.55E-01	2.32E+02	1.19E+02	ND						ND					
Benzo(k)fluoranthene	mg/kg	NA	1.45E+00	8.51E+00	1.48E+02	ND						ND					
Carbazole	mg/kg	NA	NA	3.11E+01	NA	ND						ND					
Chrysene	mg/kg	NA	1.40E+00	8.61E+01	4.73E+00	ND						ND					
Dibenz(a,h)anthracene	mg/kg	NA	7.20E-01	8.61E-02	1.84E+01	ND						ND					
Fluoranthene	mg/kg	NA	2.03E+00	3.09E+02	1.00E-01	ND						ND					
Indeno(1,2,3-cd)pyrene	mg/kg	NA	9.37E-01	8.51E-01	1.09E+02	ND						ND					
Naphthalene	mg/kg	NA	3.30E-02	1.55E+02	1.00E-01	ND						ND					
Phenanthrene	mg/kg	NA	1.08E+00	2.32E+03	1.00E-01	ND						ND					
Pyrene	mg/kg	NA	1.63E+00	2.33E+02	1.00E-01	ND						ND					

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] UBR - Upper background range as given in Science Applications International Corporation (SAIC), 1998, *Final Background Metals Survey Report, Fort McClellan, Alabama*, July.

[b] BKG - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC, 1998. For SVOCs, concentration listed is the background screening value for soils adjacent to asphalt as given in IT Corporation (IT), 2000, *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama*, July.

[c] Residential human health site-specific screening level (SSSL) and ecological screening value (ESV) as given in IT, 2000.

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero).

J - Compound was positively identified; reported value is an estimated concentration.

mg/kg - Milligrams per kilogram.

NA - Not available.

ND - Not detected.

Qual - Data validation qualifier.

Table 5-2

Subsurface Soil Analytical Results
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Sample Location					CWM-188-MW01					CWM-188-MW02					CWM-188-MW03					CWM-188-MW04				
Sample Number					TM0002					TM0004					TM0006					TM0009				
Sample Date					24-Oct-01					24-Oct-01					6-Nov-01					24-Oct-01				
Sample Depth (Feet)					7 - 8					5 - 6					6 - 7					8 - 9				
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL
METALS																								
Aluminum	mg/kg	2.46E+04	1.36E+04	7.80E+03	2.55E+04		YES	YES	YES	2.23E+04			YES	YES	1.96E+04			YES	YES	4.78E+04		YES	YES	YES
Antimony	mg/kg	9.90E-01	1.31E+00	3.11E+00	ND					5.38E+00	J	YES	YES	YES	ND					ND				
Arsenic	mg/kg	3.80E+01	1.83E+01	4.26E-01	8.93E+00				YES	2.07E+01			YES	YES	7.73E+00				YES	1.99E+01			YES	YES
Barium	mg/kg	4.50E+03	2.34E+02	5.47E+02	1.26E+02	J				1.06E+02	J				4.71E+01					1.43E+02	J			
Beryllium	mg/kg	2.00E+00	8.60E-01	9.60E+00	1.39E+00			YES		8.33E-01	J				ND					1.53E+00			YES	
Calcium	mg/kg	3.65E+03	6.37E+02	NA	3.10E+01	B				6.58E+01	B				1.68E+01	B				2.35E+03	J		YES	
Chromium	mg/kg	5.50E+01	3.83E+01	2.32E+01	2.17E+01					2.43E+01				YES	2.19E+01					3.89E+01			YES	YES
Cobalt	mg/kg	9.60E+01	1.75E+01	4.68E+02	1.92E+00	J				9.16E+00					3.98E+00					1.35E+01				
Copper	mg/kg	6.10E+01	1.94E+01	3.13E+02	9.07E+01		YES	YES		3.35E+01			YES		1.07E+01					2.63E+01			YES	
Iron	mg/kg	4.80E+04	4.48E+04	2.34E+03	2.84E+04	J			YES	4.56E+04	J		YES	YES	2.06E+04				YES	5.06E+04	J	YES	YES	YES
Lead	mg/kg	5.00E+02	3.85E+01	4.00E+02	2.26E+01	J				3.85E+01	J				8.22E+00					1.45E+01	J			
Magnesium	mg/kg	5.94E+03	7.66E+02	NA	8.29E+02	J		YES		1.55E+03	J		YES		6.92E+02					3.64E+03	J		YES	
Manganese	mg/kg	1.90E+04	1.36E+03	3.63E+02	3.23E+00					4.00E+02				YES	4.45E+01					1.14E+02				
Nickel	mg/kg	3.80E+01	1.29E+01	1.54E+02	1.12E+01					3.25E+01			YES		9.46E+00	J				5.90E+01		YES	YES	
Potassium	mg/kg	6.15E+03	7.11E+02	NA	2.73E+03	J		YES		9.14E+02	J		YES		9.15E+02			YES		1.64E+03	J		YES	
Selenium	mg/kg	5.50E-01	4.70E-01	3.91E+01	4.93E+00		YES	YES		1.65E+00		YES	YES		9.98E-01	B	YES	YES		1.41E+00		YES	YES	
Sodium	mg/kg	6.43E+02	7.02E+02	NA	5.54E+01	J				9.48E+01	J				ND					1.69E+02				
Vanadium	mg/kg	9.90E+01	6.49E+01	5.31E+01	5.84E+01				YES	5.58E+01				YES	4.44E+01					8.93E+01			YES	YES
Zinc	mg/kg	8.90E+01	3.49E+01	2.34E+03	5.66E+01	J		YES		6.50E+01	J		YES		3.48E+01					9.41E+01	J	YES	YES	
VOLATILE ORGANIC COMPOUNDS																								
1,2,4-Trimethylbenzene	mg/kg	NA	NA	3.88E+02	1.00E-02					ND					ND					ND				
1,2-Dimethylbenzene	mg/kg	NA	NA	1.55E+04	4.10E-03	J				ND					ND					ND				
1,3,5-Trimethylbenzene	mg/kg	NA	NA	3.88E+02	2.90E-03	J				ND					ND					ND				
4-Methyl-2-pentanone	mg/kg	NA	NA	6.21E+02	ND					4.60E-03	J				ND					ND				
Acetone	mg/kg	NA	NA	7.76E+02	ND					1.40E-02	J				1.30E-02	J				4.70E-03	J			
Ethylbenzene	mg/kg	NA	NA	7.77E+02	1.40E-03	J				ND					ND					ND				
m,p-Xylenes	mg/kg	NA	NA	1.55E+04	5.50E-03	B				ND					ND					ND				

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] UBR - Upper background range as given in Science Applications International Corporation (SAIC), 1998, *Final Background Metals Survey Report, Fort McClellan, Alabama*, July.

[b] BKG - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC, 1998.

[c] Residential human health site-specific screening level (SSSL) as given in IT Corporation (2000), *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama*, July.

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero).

J - Compound was positively identified; reported value is an estimated concentration.

mg/kg - Milligrams per kilogram.

NA - Not available.

ND - Not detected.

Qual - Data validation qualifier.

Table 5-3

Groundwater Analytical Results
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Sample Location					CWM-188-MW01					CWM-188-MW02					CWM-188-MW03					CWM-188-MW04				
Sample Number					TM3001					TM3002					TM3003					TM3006				
Sample Date					1-Feb-02					31-Jan-02					31-Jan-02					30-Jan-02				
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL
METALS																								
Aluminum	mg/L	9.60E+00	2.34E+00	1.56E+00	5.23E-02	J				5.56E-02	J				6.42E-02	J				7.89E-02	J			
Barium	mg/L	4.01E-01	1.27E-01	1.10E-01	5.95E-02	J				9.14E-02	J				1.35E-01	J		YES	YES	1.39E-01	J		YES	YES
Calcium	mg/L	4.52E+02	5.65E+01	NA	1.38E+01	J				5.36E+01	J				4.09E+01	J				5.97E+01	J		YES	
Cobalt	mg/L	2.50E-02	2.34E-02	9.39E-02	1.64E-02	J				ND					ND					ND				
Iron	mg/L	2.58E+01	7.04E+00	4.69E-01	1.09E+00				YES	5.06E-02	J				4.73E-02	J				9.36E-02	J			
Magnesium	mg/L	1.49E+02	2.13E+01	NA	1.67E+01	J				1.12E+01	J				1.15E+01	J				8.45E+00	J			
Manganese	mg/L	5.82E+00	5.81E-01	7.35E-02	1.28E-01				YES	1.06E-01				YES	1.26E-01				YES	2.26E-01				YES
Nickel	mg/L	NA	NA	3.13E-02	3.71E-02				YES	ND					ND					ND				
Potassium	mg/L	6.85E+01	7.20E+00	NA	2.21E+00	J				1.35E+00	J				8.05E-01	J				1.35E+00	J			
Selenium	mg/L	NA	NA	7.82E-03	ND					ND					3.22E-03	J				ND				
Sodium	mg/L	6.47E+01	1.48E+01	NA	8.95E+00					3.32E+00					1.65E+00					4.42E+00				
Zinc	mg/L	1.16E+00	2.20E-01	4.69E-01	6.35E-02	J				ND					ND					ND				
VOLATILE ORGANIC COMPOUNDS																								
Carbon disulfide	mg/L	NA	NA	1.51E-01	ND					1.80E-03	J				ND					ND				
Carbon tetrachloride	mg/L	NA	NA	4.08E-04	ND					3.20E-04	J				ND					ND				
Methylene chloride	mg/L	NA	NA	7.85E-03	3.60E-04	B				3.50E-04	B				5.10E-04	B				2.80E-04	B			

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] UBR - Upper background range as given in Science Applications International Corporation (SAIC), 1998, *Final Background Metals Survey Report, Fort McClellan, Alabama*, July.

[b] BKG - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC, 1998.

[c] Residential human health site-specific screening level (SSSL) as given in IT Corporation (2000), *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama*, July.

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero).

J - Compound was positively identified; reported value is an estimated concentration.

mg/L - Milligrams per liter.

NA - Not available.

ND - Not detected.

Qual - Data validation qualifier.

- Iron (59,800 mg/kg) exceeded its ESV (200 mg/kg) and upper background range (56,300 mg/kg) at one sample location (CWM-188-MW02).

The beryllium and iron analytical results were flagged with a "J" data qualifier indicating that these metals were positively identified but that their concentrations were estimated.

VOCs. A total of 14 VOCs were detected in the surface soil samples collected at the site. No VOC concentrations exceeded SSSLs. The concentrations of six VOCs (1,2,4-trimethylbenzene, 1,2-dimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, naphthalene, and toluene) exceeded their respective ESVs at one sample location (CWM-188-MW01).

SVOCs. A total of 16 SVOCs, including fourteen PAHs, were detected in surface soil samples collected at the site. The concentration of one PAH (benzo[a]pyrene) exceeded its SSSL in one sample, but was below background. The concentrations of six PAHs (anthracene, benzo[a]pyrene, fluoranthene, naphthalene, phenanthrene and pyrene) exceeded their respective ESVs in one sample each but were below background values except for naphthalene in CWM-188-MW01.

CWM Breakdown Products. CWM breakdown products were not detected in the surface soil samples collected at the site.

5.2 Subsurface Soil Analytical Results

Four subsurface soil samples were collected for chemical analysis at the Old Toxic Training Area, Parcel 188(7). Subsurface soil samples were collected at depths greater than 1-foot bgs at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background screening values, as presented in Table 5-2.

Metals. Nineteen metals were detected in subsurface soil samples collected at the site. The concentrations of seven metals (aluminum, antimony, arsenic, chromium, iron, manganese, and vanadium) exceeded SSSLs. Six of these metals also exceeded their respective background concentrations in one or more samples each. However, these metals concentrations were within the range of background values except for the following:

- Aluminum (25,500 and 47,800 mg/kg) exceeded its SSSL (7,803 mg/kg) and upper background range (24,600 mg/kg) at two sample locations (CWM-188-MW01 and CWM-188-MW04).

- Antimony (5.38 mg/kg) exceeded is SSSL (3.1 mg/kg) and upper background range (0.99 mg/kg) at one sample location (CWM-188-MW02).

- Iron (50,600 mg/kg) exceeded its SSSL (2,345 mg/kg) and upper background range (48,000 mg/kg) at one sample location (CWM-188-MW02).

The antimony and iron analytical results were flagged with a "J" data qualifier indicating that these metals were positively identified but that their concentrations were estimated.

VOCs. A total of seven VOCs were detected in the subsurface soil samples collected at the site. The VOC concentrations in subsurface soils were below SSSLs.

SVOCs. SVOCs were not detected in the subsurface soil samples collected at the site.

CWM Breakdown Products. CWM breakdown products were not detected in the subsurface soil samples collected at the site.

5.3 Groundwater Analytical Results

Four groundwater samples were collected for chemical analysis at the Old Toxic Training Area, Parcel 188(7), at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background screening values, as presented in Table 5-3.

Metals. Twelve metals were detected in groundwater samples collected at the site. The concentrations of four metals (barium, iron, manganese, and nickel) exceeded SSSLs. With the exception of barium at two sample locations (CWM-188-MW03 and CWM-188-MW04), these metals results were below their respective background values (note: a background value for nickel was not available). The barium results, however, were within the upper background range.

VOCs. A total of three VOCs (carbon disulfide, carbon tetrachloride, and methylene chloride) were detected in the groundwater samples collected at the site. The VOC concentrations in groundwater were below SSSLs.

SVOCs. SVOCs were not detected in the groundwater samples collected at the site.

CWM Breakdown Products. CWM breakdown products were not detected in the groundwater samples collected at the site.

5.4 Preliminary Risk Assessment

A preliminary risk assessment (PRA) was performed to further characterize the potential threat to human health from exposure to environmental media at the Old Toxic Training Area, Parcel 188(7). The PRA approach was developed at the request of EPA and ADEM to provide a fast and inexpensive estimation of risk for relatively simple sites. It was derived from the streamlined risk assessment (SRA) protocol developed for FTMC and documented in the Installation-Wide Work Plan (IT, 1998). A PRA is a simplified version of a SRA, differing primarily in that the maximum detected concentration (MDC) rather than an estimate of average is adopted as the source-term concentration (STC) for use in the risk assessment. However, a PRA cannot be less conservative (protective) than a SRA and is generally more protective. The PRA for Parcel 188(7) is included as Appendix H. It discusses the environmental media of interest, selection of site-related chemicals, selection of chemicals of potential concern (COPC), risk characterization, and conclusions.

The foundation of the SRA (and the PRA) is the SSSL, which incorporates all the exposure and toxicological assumptions, and precision of a complete baseline risk assessment. SSSLs are receptor-, medium-, and chemical-specific risk-based concentrations that are used to screen media to select COPCs and to characterize the risk associated with exposure to site media (i.e., compute the incremental lifetime cancer risk [ILCR] and hazard index [HI] for non-cancer effects).

The SSSLs applied to a given site represent the most highly exposed receptor scenario for each of several plausible uses for the site. The groundskeeper, construction worker, and residential receptor scenarios were evaluated for Parcel 188(7). COPCs were selected from the site-related chemicals identified in the previous sections by comparing the MDC of the site-related chemical with the appropriate SSSL. Chemicals that were identified as not being site-related were dropped from further consideration because their presence was not attributed to site activities. The COPCs selected in this manner are the chemicals in each medium that may contribute significantly to cancer risk or to the potential for non-cancer effects. As noted above, the MDC was selected as the STC for use in risk characterization. ILCR and HI values were estimated for each COPC in each medium and were summed to obtain total ILCR and HI values for each receptor. The PRA for Parcel 188(7) was performed in two iterations: a first iteration and a refined assessment to more precisely evaluate the potential for noncancer effects.

Groundskeeper COPCs included aluminum, arsenic, and iron in surface soil. The PRA concluded, however, that exposure to site media is unlikely to pose unacceptable cancer risk or adverse noncancer health effects to a groundskeeper.

Construction worker COPCs identified during the first iteration of the PRA were arsenic and iron in soil. Following the refined assessment, the PRA concluded that exposure to site media is unlikely to pose unacceptable cancer risk or adverse noncancer health effects to a construction worker.

Resident COPCs identified during the first iteration of the PRA included four metals (aluminum, arsenic, iron, and vanadium) and one PAH (benzo[a]pyrene) in surface soil, and two metals (barium and nickel) in groundwater. Following the refined assessment, the PRA concluded that exposure to site media does not pose an unacceptable cancer risk or a threat of adverse noncancer health effects to a resident.

5.5 Preliminary Ecological Risk Assessment

A preliminary ecological risk assessment (PERA) was performed to further characterize the potential threat to ecological receptors from exposure to environmental media at the Old Toxic Training Area, Parcel 188(7). The PERA approach was derived from the Screening-Level Ecological Risk Assessment (SLERA) protocol developed for FTMC and documented in the Installation-Wide Work Plan (IT, 1998). The PERA for Parcel 188(7) is included as Appendix I. It discusses the ecological habitat, environmental media of interest and data selection, selection of constituents of potential ecological concern (COPEC), risk characterization, and conclusions.

The PERA identified the following COPECs in surface soil at the Old Toxic Training Area:

- aluminum
- arsenic
- beryllium
- copper
- selenium
- zinc
- 2-methylnaphthalene
- naphthalene
- 1,2,4-trimethylbenzene
- 1,2-dimethylbenzene
- 1,3,5-trimethylbenzene
- cumene
- ethylbenzene
- toluene
- n-butylbenzene
- n-propylbenzene
- p-cymene
- sec-butylbenzene.

There does appear to be a localized area of surface soil (in the vicinity of CWM-188-MW01) contaminated with VOCs (e.g., 1,2,4-trimethylbenzene, 1,2-dimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, naphthalene, and toluene). Although larger animals with relatively large home ranges and foraging habits would not be expected to be adversely affected by this localized area of contamination, species with small home ranges living or feeding in the vicinity of the soil contamination could experience adverse effects from the contaminants in the surface soil at the Old Toxic Training Area.

6.0 Summary, Conclusions, and Recommendations

Shaw Environmental, Inc., under contract to the USACE, completed a SI at the Old Toxic Training Area, Parcel 188(7), at FTMC in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at concentrations that present an unacceptable risk to human health or the environment. The SI consisted of the collection and analysis of 4 surface soil samples, 4 subsurface soil samples and 4 groundwater samples. In addition, 4 permanent monitoring wells were installed in the saturated zone to facilitate groundwater sample collection and to provide site-specific geological and hydrogeological characterization information.

Chemical analysis of samples collected at the Old Toxic Training Area, Parcel 188(7), indicated that metals, VOCs, and SVOCs were detected in site media. CWM breakdown products were not detected in any of the samples collected at the site. Analytical results were compared to the SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed for human health and ecological risk evaluations as part of the ongoing SIs being performed under the BRAC Environmental Restoration Program at FTMC. Additionally, metals concentrations exceeding SSSLs and ESVs were compared to media-specific background screening values (SAIC, 1998) and polynuclear aromatic hydrocarbon (PAH) concentrations in surface soil were compared to PAH background values (IT, 2000c). A PRA and PERA were also performed to further characterize the potential threat to human health and the environment.

Although the site is projected for mixed business reuse (EDAW, Inc., 1997), the analytical data were screened against residential human health SSSLs to evaluate the site for unrestricted land reuse. Constituents of potential concern for the resident included six metals (aluminum, antimony, arsenic, chromium, iron, and vanadium) and benzo(a)pyrene in soils, and barium and nickel in groundwater. The PRA concluded, however, that exposure to site media does not pose an unacceptable risk for the resident.

COPECs identified in the PERA were six metals (aluminum, arsenic, beryllium, copper, selenium, and zinc) and several organic compounds in surface soil. The metals COPECs had hazard quotients that only slightly exceeded the screening level threshold of one, except for aluminum, which was determined to be present at background levels. The ESVs are highly conservative screening values based on no observed adverse effects. In addition, screening level hazard quotients were calculated using the maximum detected constituent concentration at the site. Therefore, these inorganic constituents were excluded ultimately from the list of COPECs.

Organic compounds identified as COPECs were present at only one sample location indicating that the contamination is limited in areal extent. In addition, half of the organic constituents identified as COPECs were selected solely because ESVs do not exist for these compounds. Furthermore, Parcel 188(7) is located within the developed portion of the FTMC Main Post and is projected for mixed business reuse. Although species with small home ranges living or feeding in the vicinity of the soil contamination could experience adverse effects, the PERA concluded that larger animals with relatively large home ranges should not be adversely affected by the localized area of contamination.

Based on the results of the SI, past operations at the Old Toxic Training Area, Parcel 188(7), do not appear to have adversely impacted the environment. The metals and chemical compounds detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, Shaw Environmental, Inc. recommends "No Further Action" and unrestricted land reuse with regard to CERCLA-related hazardous substances at the Old Toxic Training Area, Parcel 188(7).

7.0 References

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ATTACHMENT 1

LIST OF ABBREVIATIONS AND ACRONYMS

List of Abbreviations and Acronyms

2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,4,5-TP	silvex
3D	3D International Environmental Group
AB	ambient blank
AbB3	Anniston gravelly clay loam, 2 to 6 percent slopes, severely eroded
AbC3	Anniston gravelly clay loam, 6 to 10 percent slopes, severely eroded
AbD3	Anniston and Allen gravelly clay loams, 10 to 15 percent slopes, eroded
Abs	skin absorption
ABS	dermal absorption factor
AC	hydrogen cyanide
ACAD	AutoCadd
AcB2	Anniston and Allen gravelly loams, 2 to 6 percent slopes, eroded
AcC2	Anniston and Allen gravelly loams, 6 to 10 percent slopes, eroded
AcD2	Anniston and Allen gravelly loams, 10 to 15 percent slopes, eroded
AcE2	Anniston and Allen gravelly loams, 15 to 25 percent slopes, eroded
ACGIH	American Conference of Governmental Industrial Hygienists
AdE	Anniston and Allen stony loam, 10 to 25 percent slope
ADEM	Alabama Department of Environmental Management
ADPH	Alabama Department of Public Health
AEC	U.S. Army Environmental Center
AEL	airborne exposure limit
AET	adverse effect threshold
AF	soil-to-skin adherence factor
AHA	ammunition holding area
AL	Alabama
ALARNG	Alabama Army National Guard
ALAD	d-aminolevulinic acid dehydratase
ALDOT	Alabama Department of Transportation
amb.	amber
amsl	above mean sea level
ANAD	Anniston Army Depot
AOC	area of concern
AP	armor piercing
APEC	areas of potential ecological concern
APT	armor-piercing tracer
AR	analysis request
ARAR	applicable or relevant and appropriate requirement
AREE	area requiring environmental evaluation
AS/SVE	air sparging/soil vapor extraction
ASP	Ammunition Supply Point
ASR	Archives Search Report
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
AT	averaging time
ATSDR	Agency for Toxic Substances and Disease Registry
ATV	all-terrain vehicle
AUF	area use factor
AWARE	Associated Water and Air Resources Engineers, Inc.
AWQC	ambient water quality criteria
AWWSB	Anniston Water Works and Sewer Board
'B'	Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero)
BCF	blank correction factor; bioconcentration factor
BCT	BRAC Cleanup Team
BERA	baseline ecological risk assessment
BEHP	bis(2-ethylhexyl)phthalate
BFB	bromofluorobenzene
BFE	base flood elevation
BG	Bacillus globigii
BGR	Bains Gap Road
bgs	below ground surface
BHC	hexachlorocyclohexane
BHHRA	baseline human health risk assessment
BIRTC	Branch Immaterial Replacement Training Center
bkg	background
bls	below land surface
BOD	biological oxygen demand
Bp	soil-to-plant biotransfer factors
BRAC	Base Realignment and Closure
Braun	Braun Intertec Corporation
BSAF	biota-to-sediment accumulation factors
BSC	background screening criterion
BTAG	Biological Technical Assistance Group
BTEX	benzene, toluene, ethyl benzene, and xylenes
BTOC	below top of casing
BTV	background threshold value
BW	biological warfare; body weight
BZ	breathing zone; 3-quinuclidinyl benzilate
C	ceiling limit value
Ca	carcinogen
$CaCO_3$	calcium carbonate
CAA	Clean Air Act
CAB	chemical warfare agent breakdown products
CAMU	corrective action management unit
CBR	chemical, biological, and radiological
CCAL	continuing calibration
CCB	continuing calibration blank
CCV	continuing calibration verification
CD	compact disc
CDTF	Chemical Defense Training Facility
CEHNC	U.S. Army Engineering and Support Center, Huntsville
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CESAS	Corps of Engineers South Atlantic Savannah
CF	conversion factor
CFC	chlorofluorocarbon
CFDP	Center for Domestic Preparedness
CFR	Code of Federal Regulations
CG	carbonyl chloride (phosgene)
CGI	combustible gas indicator
ch	inorganic clays of high plasticity
CHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
CK	cyanogen chloride
cl	inorganic clays of low to medium plasticity
Cl	chlorinated
CLP	Contract Laboratory Program
cm	centimeter
CN	chloroacetophenone
CNB	chloroacetophenone, benzene, and carbon tetrachloride
CNS	chloroacetophenone, chloropicrin, and chloroform
CO	carbon monoxide
CO_2	carbon dioxide
Co-60	cobalt-60
CoA	Code of Alabama
COC	chain of custody; chemical of concern
COE	Corps of Engineers
Con	skin or eye contact
COPC	chemical(s) of potential concern
COPEC	chemical(s)/constituent(s) of potential ecological concern
CPSS	chemicals present in site samples
CQCSM	Contract Quality Control System Manager
CRDL	contract-required detection limit
CRL	certified reporting limit
CRQL	contract-required quantitation limit
CRZ	contamination reduction zone
Cs-137	cesium-137
CS	ortho-chlorobenzylidene-malononitrile
CSEM	conceptual site exposure model
CSM	conceptual site model
CT	central tendency
ctr.	container
CWA	chemical warfare agent; Clean Water Act
CWM	chemical warfare material; clear, wide mouth
CX	dichloroformoxime
'D'	duplicate; dilution
D&I	detection and identification
DAAMS	depot area air monitoring system
DAF	dilution-attenuation factor
DANC	decontamination agent, non-corrosive
ºC	degrees Celsius
ºF	degrees Fahrenheit
DCA	dichloroethane
DCE	dichloroethene

List of Abbreviations and Acronyms *(Continued)*

DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DEH	Directorate of Engineering and Housing
DEP	depositional soil
DFTPP	decafluorotriphenylphosphine
DI	deionized
DID	data item description
DIMP	di-isopropylmethylphosphonate
DM	dry matter; adamsite
DMBA	dimethylbenz(a)anthracene
DMMP	dimethylmethylphosphonate
DO	dissolved oxygen
DOD	U.S. Department of Defense
DOJ	U.S. Department of Justice
DOT	U.S. Department of Transportation
DP	direct-push
DPDO	Defense Property Disposal Office
DPT	direct-push technology
DQO	data quality objective
DRMO	Defense Reutilization and Marketing Office
DRO	diesel range organics
DS	deep (subsurface) soil
DS2	Decontamination Solution Number 2
DSERTS	Defense Site Environmental Restoration Tracking System
DWEL	drinking water equivalent level
E&E	Ecology and Environment, Inc.
EB	equipment blank
EBS	environmental baseline survey
EC_{50}	effects concentration for 50 percent of a population
ECBC	Edgewood Chemical/Biological Command
ED	exposure duration
EDD	electronic data deliverable
EF	exposure frequency
EDQL	ecological data quality level
EE/CA	engineering evaluation and cost analysis
Elev.	elevation
EM	electromagnetic
EMI	Environmental Management Inc.
EM31	Geonics Limited EM31 Terrain Conductivity Meter
EM61	Geonics Limited EM61 High-Resolution Metal Detector
EOD	explosive ordnance disposal
EODT	explosive ordnance disposal team
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EPIC	Environmental Photographic Interpretation Center
EPRI	Electrical Power Research Institute
ER	equipment rinsate
ERA	ecological risk assessment
ER-L	effects range-low
ER-M	effects range-medium
ESE	Environmental Science and Engineering, Inc.
ESMP	Endangered Species Management Plan
ESN	Environmental Services Network, Inc.
ESV	ecological screening value
ET	exposure time
EU	exposure unit
Exp.	explosives
E-W	east to west
EZ	exclusion zone
FAR	Federal Acquisition Regulations
FB	field blank
FD	field duplicate
FDA	U.S. Food and Drug Administration
Fe^{+3}	ferric iron
Fe^{+2}	ferrous iron
FedEx	Federal Express, Inc.
FEMA	Federal Emergency Management Agency
FFCA	Federal Facilities Compliance Act
FFE	field flame expedient
FFS	focused feasibility study
FI	fraction of exposure
Fil	filtered
Flt	filtered
FMDC	Fort McClellan Development Commission
FML	flexible membrane liner
FMP 1300	Former Motor Pool 1300
f_{oc}	fraction organic carbon
FOMRA	Former Ordnance Motor Repair Area
FOST	Finding of Suitability to Transfer
Foster Wheeler	Foster Wheeler Environmental Corporation
FR	Federal Register
Frtn	fraction
FS	field split; feasibility study
FSP	field sampling plan
ft	feet
ft/day	feet per day
ft/ft	feet per foot
ft/yr	feet per year
FTA	Fire Training Area
FTMC	Fort McClellan
FTRRA	FTMC Reuse & Redevelopment Authority
g	gram
g/m^3	gram per cubic meter
G-856	Geometrics, Inc. G-856 magnetometer
G-858G	Geometrics, Inc. G-858G magnetic gradiometer
GAF	gastrointestinal absorption factor
gal	gallon
gal/min	gallons per minute
GB	sarin
gc	clay gravels; gravel-sand-clay mixtures
GC	gas chromatograph
GCL	geosynthetic clay liner
GC/MS	gas chromatograph/mass spectrometer
GCR	geosynthetic clay liner
GFAA	graphite furnace atomic absorption
GIS	Geographic Information System
gm	silty gravels; gravel-sand-silt mixtures
gp	poorly graded gravels; gravel-sand mixtures
gpm	gallons per minute
GPR	ground-penetrating radar
GPS	global positioning system
GRA	general response action
GS	ground scar
GSA	General Services Administration; Geologic Survey of Alabama
GSBP	Ground Scar Boiler Plant
GSSI	Geophysical Survey Systems, Inc.
GST	ground stain
GW	groundwater
gw	well-graded gravels; gravel-sand mixtures
H&S	health and safety
HA	hand auger
HCl	hydrochloric acid
HD	distilled mustard
HDPE	high-density polyethylene
HE	high explosive
HEAST	Health Effects Assessment Summary Tables
Herb.	herbicides
HHRA	human health risk assessment
HI	hazard index
H_2O_2	hydrogen peroxide
HPLC	high performance liquid chromatography
HNO_3	nitric acid
HQ	hazard quotient
HQ_{screen}	screening-level hazard quotient
hr	hour
HRC	hydrogen releasing compound
HSA	hollow-stem auger
HTRW	hazardous, toxic, and radioactive waste
‘I’	out of control, data rejected due to low recovery
IATA	International Air Transport Authority
ICAL	initial calibration
ICB	initial calibration blank
ICP	inductively-coupled plasma

List of Abbreviations and Acronyms *(Continued)*

ICRP	International Commission on Radiological Protection
ICS	interference check sample
ID	inside diameter
IDL	instrument detection limit
IDLH	immediately dangerous to life or health
IDM	investigative-derived media
IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
IF	ingestion factor; inhalation factor
ILCR	incremental lifetime cancer risk
IMPA	isopropylmethyl phosphonic acid
IMR	Iron Mountain Road
in.	inch
Ing	ingestion
Inh	inhalation
IP	ionization potential
IPS	International Pipe Standard
IR	ingestion rate
IRDMIS	Installation Restoration Data Management Information System
IRIS	Integrated Risk Information Service
IRP	Installation Restoration Program
IS	internal standard
ISCP	Installation Spill Contingency Plan
IT	IT Corporation
ITEMS	IT Environmental Management System™
'J'	estimated concentration
JeB2	Jefferson gravelly fine sandy loam, 2 to 6 percent slopes, eroded
JeC2	Jefferson gravelly fine sandy loam, 6 to 10 percent slopes, eroded
JfB	Jefferson stony fine sandy loam, 0 to 10 percent slopes have strong slopes
JPA	Joint Powers Authority
K	conductivity
K_d	soil-water distribution coefficient
kg	kilogram
KeV	kilo electron volt
K_{oc}	organic carbon partioning coefficient
K_{ow}	octonal-water partition coefficient
$KMnO_4$	potassium permanganate
L	lewisite; liter
L/kg/day	liters per kilogram per day
l	liter
LAW	light anti-tank weapon
lb	pound
LBP	lead-based paint
LC	liquid chromatography
LCS	laboratory control sample
LC_{50}	lethal concentration for 50 percent population tested
LD_{50}	lethal dose for 50 percent population tested
LEL	lower explosive limit
LOAEL	lowest-observed-advserse-effects-level
LRA	land redevelopment authority
LT	less than the certified reporting limit
LUC	land-use control
LUCAP	land-use control assurance plan
LUCIP	land-use control implementation plan
max	maximum
MB	method blank
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MCPA	4-chloro-2-methylphenoxyacetic acid
MCPP	2-(2-methyl-4-chlorophenoxy)propionic acid
MCS	media cleanup standard
MD	matrix duplicate
MDC	maximum detected concentration
MDCC	maximum detected constituent concentration
MDL	method detection limit
mg	milligrams
mg/kg	milligrams per kilogram
mg/kg/day	milligram per kilogram per day
mg/kgbw/day	milligrams per kilogram of body weight per day
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mh	inorganic silts, micaceous or diatomaceous fine, sandy or silt soils
MHz	megahertz
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
MeV	mega electron volt
min	minimum
MINICAMS	miniature continuous air monitoring system
ml	inorganic silts and very fine sands
mL	milliliter
mm	millimeter
MM	mounded material
MMBtu/hr	million Btu per hour
MNA	monitored natural attenuation
MnO_4-	permanganate ion
MOA	Memorandum of Agreement
MOGAS	motor vehicle gasoline
MOUT	Military Operations in Urban Terrain
MP	Military Police
MPA	methyl phosphonic acid
MPM	most probable munition
MQL	method quantitation limit
MR	molasses residue
MRL	method reporting limit
MS	matrix spike
mS/cm	millisiemens per centimeter
mS/m	millisiemens per meter
MSD	matrix spike duplicate
MTBE	methyl tertiary butyl ether
msl	mean sea level
MtD3	Montevallo shaly, silty clay loam, 10 to 40 percent slopes , severely eroded
mV	millivolts
MW	monitoring well
MWI&P	Monitoring Well Installation and Management Plan
Na	sodium
NA	not applicable; not available
NAD	North American Datum
NAD83	North American Datum of 1983
$NaMnO_4$	sodium permanganate
NAVD88	North American Vertical Datum of 1988
NAS	National Academy of Sciences
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurements
ND	not detected
NE	no evidence; northeast
ne	not evaluated
NEW	net explosive weight
NFA	No Further Action
NG	National Guard
NGP	National Guardsperson
ng/L	nanograms per liter
NGVD	National Geodetic Vertical Datum
Ni	nickel
NIC	notice of intended change
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NLM	National Library of Medicine
NO_3^-	nitrate
NPDES	National Pollutant Discharge Elimination System
NPW	net present worth
No.	number
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no-observed-adverse-effects-level
NR	not requested; not recorded; no risk
NRC	National Research Council
NRCC	National Research Council of Canada
NRHP	National Register of Historic Places
ns	nanosecond
N-S	north to south
NS	not surveyed
NSA	New South Associates, Inc.

List of Abbreviations and Acronyms *(Continued)*

nT	nanotesla
nT/m	nanoteslas per meter
NTU	nephelometric turbidity unit
nv	not validated
O_2	oxygen
O_3	ozone
O&G	oil and grease
O&M	operation and maintenance
OB/OD	open burning/open detonation
OD	outside diameter
OE	ordnance and explosives
oh	organic clays of medium to high plasticity
OH•	hydroxyl radical
ol	organic silts and organic silty clays of low plasticity
OP	organophosphorus
ORC	Oxygen Releasing Compound
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OVM-PID/FID	organic vapor meter-photoionization detector/flame ionization detector
OWS	oil/water separator
oz	ounce
PA	preliminary assessment
PAH	polynuclear aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
Parsons	Parsons Engineering Science, Inc.
Pb	lead
PBMS	performance-based measurement system
PC	permeability coefficient
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxins
PCDF	polychlorinated dibenzofurans
PCE	perchloroethene
PCP	pentachlorophenol
PDS	Personnel Decontamination Station
PEF	particulate emission factor
PEL	permissible exposure limit
PERA	preliminary ecological risk assessment
PES	potential explosive site
Pest.	pesticides
PETN	pentarey thritol tetranitrate
PFT	portable flamethrower
PG	professional geologist
PID	photoionization detector
PkA	Philo and Stendal soils local alluvium, 0 to 2 percent slopes
PM	project manager
POC	point of contact
POL	petroleum, oils, and lubricants
POTW	publicly owned treatment works
POW	prisoner of war
PP	peristaltic pump; Proposed Plan
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PPMP	Print Plant Motor Pool
ppt	parts per thousand
PR	potential risk
PRA	preliminary risk assessment
PRG	preliminary remediation goal
PS	chloropicrin
PSSC	potential site-specific chemical
pt	peat or other highly organic silts
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QAM	quality assurance manual
QAO	quality assurance officer
QAP	installation-wide quality assurance plan
QC	quality control
QST	QST Environmental, Inc.
qty	quantity
Qual	qualifier
R	rejected data; resample; retardation factor
R&A	relevant and appropriate
RA	remedial action
RAO	remedial action objective
RBC	risk-based concentration; red blood cell
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RDX	cyclotrimethylenetrinitramine
ReB3	Rarden silty clay loams
REG	regular field sample
REL	recommended exposure limit
RFA	request for analysis
RfC	reference concentration
RfD	reference dose
RGO	remedial goal option
RI	remedial investigation
RL	reporting limit
RME	reasonable maximum exposure
ROD	Record of Decision
RPD	relative percent difference
RRF	relative response factor
RSD	relative standard deviation
RTC	Recruiting Training Center
RTECS	Registry of Toxic Effects of Chemical Substances
RTK	real-time kinematic
SA	exposed skin surface area
SAD	South Atlantic Division
SAE	Society of Automotive Engineers
SAIC	Science Applications International Corporation
SAP	installation-wide sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act
sc	clayey sands; sand-clay mixtures
Sch.	Schedule
SCM	site conceptual model
SD	sediment
SDG	sample delivery group
SDWA	Safe Drinking Water Act
SDZ	safe distance zone; surface danger zone
SEMS	Southern Environmental Management & Specialties, Inc.
SF	cancer slope factor
SFSP	site-specific field sampling plan
SGF	standard grade fuels
SHP	installation-wide safety and health plan
SI	site investigation
SINA	Special Interest Natural Area
SL	standing liquid
SLERA	screening-level ecological risk assessment
sm	silty sands; sand-silt mixtures
SM	Serratia marcescens
SMDP	Scientific Management Decision Point
s/n	signal-to-noise ratio
SO_4^{-2}	sulfate
SOD	soil oxidant demand
SOP	standard operating procedure
SOPQAM	U.S. EPA's *Standard Operating Procedure/Quality Assurance Manual*
sp	poorly graded sands; gravelly sands
SP	submersible pump
SPCC	system performance calibration compound
SPCS	State Plane Coordinate System
SPM	sample planning module
SQRT	screening quick reference tables
Sr-90	strontium-90
SRA	streamlined human health risk assessment
SRM	standard reference material
Ss	stony rough land, sandstone series
SS	surface soil
SSC	site-specific chemical
SSHO	site safety and health officer
SSHP	site-specific safety and health plan
SSL	soil screening level
SSSL	site-specific screening level

SSSSL	site-specific soil screening level
STB	supertropical bleach
STC	source-term concentration
STD	standard deviation
STEL	short-term exposure limit
STL	Severn-Trent Laboratories
STOLS	Surface Towed Ordnance Locator System®
Std. units	standard units
SU	standard unit
SUXOS	senior UXO supervisor
SVOC	semivolatile organic compound
SW	surface water
SW-846	U.S. EPA's *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*
SWMU	solid waste management unit
SWPP	storm water pollution prevention plan
SZ	support zone
TAL	target analyte list
TAT	turn around time
TB	trip blank
TBC	to be considered
TCA	trichloroethane
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzofurans
TCE	trichloroethene
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TDEC	Tennessee Department of Environment and Conservation
TDGCL	thiodiglycol
TDGCLA	thiodiglycol chloroacetic acid
TEA	triethylaluminum
Tetryl	trinitrophenylmethylnitramine
TERC	Total Environmental Restoration Contract
THI	target hazard index
TIC	tentatively identified compound
TLV	threshold limit value
TN	Tennessee
TNT	trinitrotoluene
TOC	top of casing; total organic carbon
TPH	total petroleum hydrocarbons
TR	target cancer risk
TRADOC	U.S. Army Training and Doctrine Command
TRPH	total recoverable petroleum hydrocarbons
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
TWA	time-weighted average
UBR	upper background range
UCL	upper confidence limit
UCR	upper certified range
'U'	not detected above reporting limit
UIC	underground injection control
UF	uncertainty factor
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAEC	U.S. Army Environmental Center
USAEHA	U.S. Army Environmental Hygiene Agency
USACMLS	U.S. Army Chemical School
USAMPS	U.S. Army Military Police School
USATCES	U.S. Army Technical Center for Explosive Safety
USATEU	U.S. Army Technical Escort Unit
USATHAMA	U.S. Army Toxic and Hazardous Material Agency
USC	United States Code
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
UTL	upper tolerance level; upper tolerance limit
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Supervisor
UXOSO	UXO safety officer
V	vanadium
VC	vinyl chloride
VOA	volatile organic analyte
VOC	volatile organic compound
VOH	volatile organic hydrocarbon
VQlfr	validation qualifier
VQual	validation qualifier
VX	nerve agent (O-ethyl-S-[diisopropylaminoethyl]-methylphosphonothiolate)
WAC	Women's Army Corps
Weston	Roy F. Weston, Inc.
WP	installation-wide work plan
WRS	Wilcoxon rank sum
WS	watershed
WSA	Watershed Screening Assessment
WWI	World War I
WWII	World War II
XRF	x-ray fluorescence
yd^3	cubic yards