FINAL

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SOIL SAMPLING REPORT FOR BUILDING 1056 AT

3d Inf Div (Mech)

SOLID WASTE MANAGEMENT UNIT 24B, OLD RADIATOR SHOP/PAINT BOOTH AT FORT STEWART, GEORGIA

Prepared for

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT

Contract No. DACA21-02-D-0004
Delivery Order 0048

September 2004

SAIC

04-177(E)/091704

DOCUMENT 5.5

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Prepared by

Science Applications International Corporation
151 Lafayette Drive
Oak Ridge, TN 37830

September 2004

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

CERTIFICATION

This *Soil Sampling Report for Building 1056 at Solid Waste Management Unit 24B, Old Radiator Shop/Paint Booth at Fort Stewart, Georgia*, has been prepared in accordance with Title 40, *Code of Federal Regulations,* Part 264 and Hazardous Waste Facility Permit No. HW-45(S&T), as renewed August 14, 1997.

The undersigned certifies that I am a qualified groundwater scientist who has received a baccalaureate or postgraduate degree in the natural sciences or engineering and that I have sufficient training and experience in groundwater hydrology and related fields, as demonstrated by state registration and completion of accredited university courses, to enable me to make sound professional judgments regarding groundwater monitoring and contaminant fate and transport. I further certify that this report was prepared by myself or by a subordinate working under my direction.

GEORGIA REGISTERED 22851 PROFESSIONAL ENGINEER P.A. STOLL

9/17/04

Patricia A. Stoll, P.E.
Technical Manager
Science Applications International Corporation

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FIGURES

TABLES

ACRONYMS

BGS	below ground surface
CAP	Corrective Action Plan
CMCOPC	contaminant migration constituent of potential concern
COC	constituent of concern
COPC	constituent of potential concern
CY	calendar year
DPW	Directorate of Public Works
EPA	U.S. Environmental Protection Agency
GEPD	Georgia Environmental Protection Division
GSSL	generic soil screening level
MCL	maximum contaminant level
RBC	risk-based concentration
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SRC	site-related constituent
SVOC	semivolatile organic compound
SWMU	solid waste management unit
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

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1.0 INTRODUCTION

This soil sampling report for Building 1056 for Solid Waste Management Unit (SWMU) 24B, Old Radiator Shop/Paint Booth at Fort Stewart, Georgia, presents the results of the soil sampling performed August 24, 2004. The soil sampling was conducted to meet the requirements of the Corrective Action Plan (CAP; SAIC 2002) that deferred the characterization of the soil under Building 1056 to the demolition of the building, which is tentatively scheduled for calendar year (CY) 2005. However, expedited soil sampling before the demolition of the building was initiated to determine the potential remedial path for soil before the actual demolition to allow the design and implementation of the potential corrective action to be coordinated with the demolition of Building 1056 and construction plans for that area. In accordance with the CAP, the soil results will be used to prepare an addendum to the CAP recommending additional actions and/or monitoring based on the new data and coordinating these actions with the final construction design and schedule. This report was prepared to present the soil sampling results to the decision makers to allow planning and coordination early in the process. This report presents a summary of the soil sampling results and identifies whether the soil under Building 1056 is of concern and requires remedial action. This report does not contain boring logs, chain-of-custody forms, or a complete analytical data package. These materials will be included in the addendum to the CAP for SWMU 24B.

This report has been prepared by Science Applications International Corporation (SAIC) for the U.S. Army Corps of Engineers (USACE), Savannah District under contract DACA21-02-D-0004, delivery order 0048. The groundwater sampling was conducted in accordance with Addendum #4 to the Sampling and Analysis Plan (SAP) for Phase II Resource Conservation and Recovery Act (RCRA) facility investigations (RFIs) of 16 SWMUs (SAIC 2004) and the SAP for 16 SWMUs (SAIC 1997), which were developed in accordance with USACE Guidance EM 200-1-3 (USACE 2001).

1.1 SITE BACKGROUND AND OPERATIONAL HISTORY

SWMU 24B, the Old Radiator Shop/Paint Booth, is located in Building 1056, which is in the southern portion of the garrison area on the eastern side of Tilton Avenue (Figure 1-1). Building 1056 housed a radiator shop and a paint booth in the past and is currently used for equipment repair and storage. The location of the paint booth in relation to Building 1056 and site features of SWMU 24B are presented in Figure 1-2. Current plans for the area around the SWMU 24B site include demolition of Building 1056 within the next 5 years under a military construction project involving upgrading of maintenance facilities. An RFI was conducted for SWMU 24B, and the results were reported in the *Addendum for SWMU 24B: Old Radiator Shop/Paint Booth to the Revised Final Phase II RCRA Facility Investigation Report for 16 Solid Waste Management Units at Fort Stewart, Georgia* (SAIC 2001).

The operational history of the site is vague. Building 1056 used to be a radiator shop. The area is currently used as an equipment repair and storage area. In 1993 long-time Building 1056 workers were interviewed regarding their knowledge of the history of former operations at this facility. One employee reported that an old paint booth had been located in the northern corner of the building, but that it had been out of use for about 18 years. Before use as a paint booth, the area reportedly housed the old radiator shop. Other employees indicated that they did not know what materials had been used in the old paint booth and were not aware of a radiator shop having been located in the building.

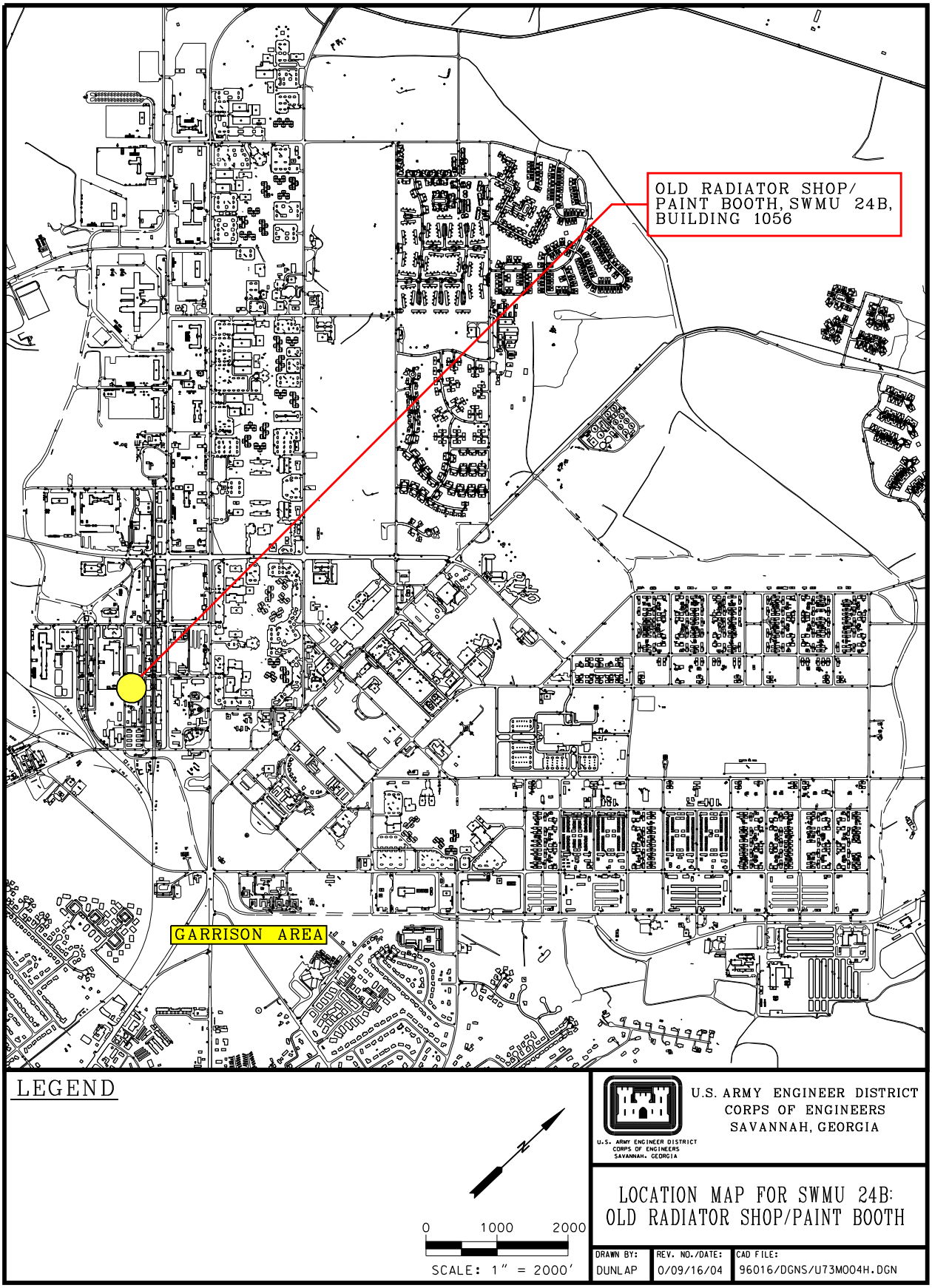

Figure 1-1. Location of SWMU 24B at Fort Stewart, Georgia

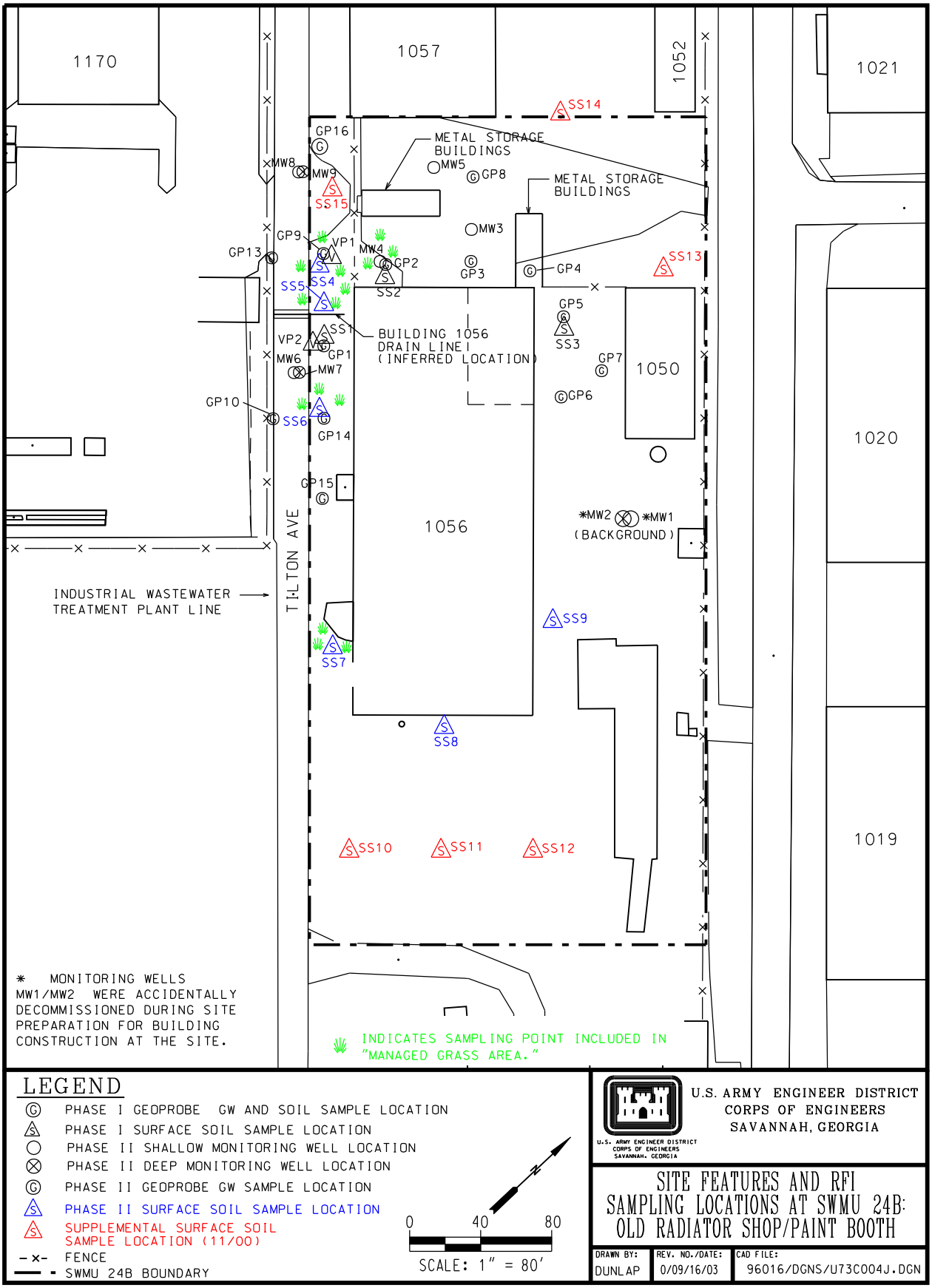

Figure 1-2. Site Features and RFI Sampling Locations at SWMU 24B

Other research into former operations at Building 1056 has indicated that a drainpipe led from the building and discharged into a ditch (Figure 1-2). It is unknown whether the drainpipe originally discharged to a ditch running parallel to Building 1056 or to the ditch on the west side of Tilton Avenue. It was reported that the Directorate of Engineering and Housing installed a pipe under Tilton Avenue that connected the drainpipe in Building 1056 to the industrial wastewater pipeline located on the west side of Tilton Avenue (Geraghty and Miller 1992), at which point the discharge was no longer routed to the ditch. The Fort Stewart Plumbing/Mechanical and Electrical Department was not able to determine when the piping from Building 1056 was connected to the industrial wastewater treatment plant drainage system or where the connection was located. There is a visible cut in the asphalt across Tilton Avenue approximately 15 ft southeast of the northwestern corner of Building 1056. It is believed that this is the location of the connection.

If the facility was previously used as a radiator repair shop, the wastes generated would probably have been the same as those generated under its current operations as an engine equipment repair facility. These wastes include caustic cleaning solution, sodium hydroxide, water-based fluorescein dye solution, and spent recirculation wastes from the wet-curtain spray paint booth.

SWMU 24B is generally level and is covered with concrete or gravel around Building 1056. The site is heavily congested with stored equipment (e.g., motors, metal boxes). The surface elevation of the site is approximately 85.5 ft above mean sea level.

Groundwater was encountered at approximately 6 to 8 ft below ground surface (BGS). The shallow surficial groundwater flow direction across the site is generally to the west. The deep surficial groundwater generally flows to the southwest to south. There are no surface water/sediment migration pathways at the site. Former drain lines from the facility might have discharged to a ditch alongside Building 1056 that is no longer present or a ditch alongside Tilton Avenue. The closest surface water feature is an approximately 6-ft-deep man-made drainage ditch located approximately 500 ft to the west. This ditch is capable of intercepting the shallow groundwater from the site. The drainage ditch ultimately discharges into Mill Creek, approximately 2,600 ft to the west. In addition, a tributary of Mill Creek is located approximately 1,200 ft to the south. The deep surficial groundwater might intercept this tributary.

1.2 SUMMARY OF PHASE I AND II RCRA FACILITY INVESTIGATIONS

A Phase I RFI was conducted at SWMU 24B in 1998 by SAIC. During the investigation five surface soil samples, four subsurface soil samples, and six groundwater samples were collected using direct-push technology techniques (Figure 1-2). The samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and RCRA metals.

A Phase II RFI was performed by SAIC in January 1999 and consisted of collecting eight groundwater screening samples to determine horizontal extent, collecting two vertical profiles to determine vertical extent, installing and sampling nine (six shallow and three deep) monitoring wells, sampling surface and subsurface soil during the installation of the monitoring wells, and collecting an additional six surface soil samples. The sampling locations from the Phase II investigations are shown in Figure 1-2. Supplemental groundwater sampling of all nine monitoring wells for VOCs and SVOCs was performed in November 2000.

1.2.1 Nature and Extent of Surface Soil Contamination

Four VOCs—carbon disulfide, butanone, acetone, and toluene—were detected in surface soil during the Phase I and Phase II RFIs. The Phase II RFI confirmed SVOC contamination in the shallow soil samples.

Seventeen SVOCs were detected in surface soil: 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, benzo(*g,h,i*)perylene, benzo(*k*)fluoranthene, chrysene, di-*N*-octylphthalate, fluoranthene, fluorine, indeno(*1,2,3-cd*)pyrene, naphthalene, phenanthrene, and pyrene. Arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver were detected at concentrations above their reference concentrations in at least one of the surface soil samples during the Phase I or Phase II RFI. Of the site-related constituents (SRCs) in surface soil, benzo(*a*)pyrene, benzo(*a*)anthracene, benzo(*b*)fluoranthene, and indeno(*1,2,3-cd*)pyrene were determined to be human health constituents of concern (COCs), and cadmium, chromium, and lead were determined to be contaminant migration COCs in surface soil requiring corrective action.

1.2.2 Nature and Extent of Subsurface Soil Contamination

In the subsurface soil, the VOCs detected were carbon disulfide, methylene chloride, tetrachloroethene, trichloroethene, and toluene. Only one SVOC, pyrene, was detected in the subsurface soil. The only metals detected at concentrations above their reference background criteria were mercury and selenium. None of the SRCs in subsurface soil was determined to be a COC requiring corrective action.

1.2.3 Nature and Extent of Groundwater Contamination

Low concentrations of three VOCs (methylene chloride, tetrachloroethene, and trichloroethene) were detected sporadically in groundwater from monitoring wells through the supplemental groundwater sampling of November 2000. No SVOCs were detected in groundwater.

Only one metal, chromium, was detected at concentrations above its reference background criterion in the shallow surficial groundwater. Two metals (chromium and barium) were detected at concentrations above their reference background criteria in the deep groundwater. None of the SRCs in groundwater was determined to be a COC requiring corrective action.

1.3 CORRECTIVE ACTION PLAN FOR SWMU 24B

In accordance with the recommendations of the Phase II RFI, a CAP was developed for SWMU 24B to evaluate potential remedial alternatives to address human health COCs in surface soil [benzo(*a*)pyrene, benzo(*a*)anthracene, benzo(*b*)fluoranthene, and indeno(*1,2,3-cd*)pyrene] and contaminant migration COCs (cadmium, chromium, and lead) (SAIC 2001).

Corrective action technologies were identified for contaminants [benzo(*a*)pyrene, benzo(*a*)anthracene, benzo(*b*)fluoranthene, and indeno(*1,2,3-cd*)pyrene] and metals (cadmium, chromium, and lead) in surface soil at SWMU 24B. The screened technologies for surface soil were combined to form remedial alternatives to meet the remedial response objective to minimize human contact with surface soil containing SVOCs at concentrations greater than the remedial levels, as developed in the revised final addendum to the RFI for SWMU 24B (SAIC 2001), within the boundaries of the SWMU. The recommended soil remedial levels are presented in Table 1-1. In addition, Building 1056 is tentatively scheduled to be demolished in 2005; therefore, no definitive decision can be made about surface soil contamination until soil samples have been collected from below the building and their results evaluated to determine whether the activities in the building contributed to the surface soil contamination (i.e., the purpose of this report). Implementation of institutional controls will restrict access to surface soil until the soil below the building can be sampled so that any previously undiscovered contamination can be addressed. Groundwater monitoring was included as part of the remedial alternatives even though no groundwater contaminants were identified to ensure that contaminants are not leaching to the groundwater table.

Table 1-1. Remedial Levels for COCs at SWMU 24B

COC	COC Type	Remedial Level (mg/kg)
Benzo(*a*)pyrene	HHCOC	0.89
Benzo(*a*)anthracene	HHCOC	8.93
Benzo(*b*)fluoranthene	HHCOC	8.93
Indeno(*1,2,3-cd*)pyrene	HHCOC	8.93
Cadmium	CMCOC	1.9
Chromium	CMCOC	11.6
Lead	CMCOC	11.1

COC = Constituent of concern.
CMCOC = Contaminant migration constituent of concern.
HHCOC = Human health constituent of concern.
SWMU = Solid waste management unit.

The following three corrective action alternatives were evaluated for surface soil contamination at SWMU 24B:

- Alternative 1: Institutional Controls and Groundwater Monitoring,
- Alternative 2: Concrete Cap with Institutional Controls and Groundwater Monitoring, and
- Alternative 3: Excavation with Institutional Controls and Groundwater Monitoring.

The selected corrective action alternative for remediation of surface soil was Alternative 1: Institutional Controls and Groundwater Monitoring. Implementation of this alternative will be coordinated with the demolition activities scheduled for the area. Building 1056 is tentatively scheduled to be demolished in CY 2005. Originally, the CAP indicated that following demolition of Building 1056, soil under the slab in the area of the former drain line from the former paint booth at the north end of Building 1056 would be sampled and analyzed for VOCs, SVOCs, and RCRA metals. However, as discussed in the introduction to this report, the soil sampling was conducted earlier in the process to allow decision makers the ability to plan and coordinate the remedial alternatives for surface soil at Building 1056 with the demolition and construction plans for the area. In accordance with the CAP, following analysis of the data from soil collected under the slab, an addendum to the CAP will be prepared recommending additional actions and/or monitoring based on the new data and coordinating these actions with the final construction design and schedule. This alternative was selected for remediation because it will meet the remedial response objective. The specific features of the alternative include those described below.

- Land-use restrictions will be used to prohibit excavation and groundwater use and construction within the property boundaries. Signs warning of the contamination will be posted approximately every 200 ft along Tilton Avenue and along existing fences around the site. During a site walkover in September 2003, the Georgia Environmental Protection Division (GEPD) indicated to the Fort Stewart Directorate of Public Works (DPW) that installation of the warning signs could be postponed until the completion of the demolition of Building 1056, which is presently scheduled for CY 2005.

- Groundwater monitoring will be conducted on a biannual basis (every other year) until Building 1056 has been demolished (scheduled to occur within the next 5 years) because of the potential for contaminants in soil under the slab to migrate to groundwater. Groundwater monitoring will consist of low-flow sampling of the six shallow surficial groundwater wells (MW1, MW3, MW4, MW5, MW6, and MW8). The groundwater samples will be analyzed for VOCs, SVOCs, and RCRA metals. VOCs and RCRA metals are not COCs at the site; however, they are the classes of

chemicals most likely to be associated with the paint booth and, therefore, the most likely to be present under the building slab.

- A CAP progress report will be issued annually to report the results of site inspection and maintenance. In years in which groundwater monitoring is performed (biannually), the CAP progress report will include the results of the groundwater monitoring.

- With GEPD's concurrence, all groundwater monitoring wells will be abandoned when concentrations are below remedial levels and the remediation is determined to be complete.

The CAP is presently under review by GEPD. The Fort Stewart DPW has elected to implement the alternative to ensure protectiveness of human health in anticipation of concurrence from GEPD with no major revisions.

1.4 REPORT ORGANIZATION

The report organization presented in this section provides an outline of the information required for the soil sampling for CY 2004. This report is organized as follows:

- Chapter 1.0: site background, operational history, and summary of Phase I and Phase II RFIs, supplemental groundwater sampling, and CAP;

- Chapter 2.0: groundwater sampling (August 2004) and data evaluation;

- Chapter 3.0: conclusions and recommendations; and

- Chapter 4.0: references.

Appendix A contains the protocol approved by GEPD for establishing remedial levels after GEPD has approved the RFI and CAP.

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2.0 SOIL SAMPLING AND EVALUATION

In accordance with the corrective action recommended in the CAP, soil samples were collected from eight boreholes installed underneath the concrete slab of Building 1056 to determine whether soil is contaminated and identify the potential impact to the alternatives selected in the CAP for SWMU 24B (SAIC 2002). The following sections present the results of the soil sampling.

2.1 SOIL SAMPLING (AUGUST 2004)

Eight soil borings were installed under the concrete slab in the area of the former drain line of Building 1056 (Figure 2-1). The borings were installed using a portable Geoprobe sampler as described in the SAP (SAIC 1997). Two soil samples were collected from each boring. The first sample from each boring was collected from the 0.5-to-2.0-ft interval under the slab and base of the building's foundation. The second sample from each boring was collected at the depth of the bottom of the drain line approximately 3 to 5 ft BGS.

The soil samples were sent to an off-site analytical laboratory (General Engineering Laboratories) for VOC, SVOC, and RCRA metals analyses and received expedited analysis (i.e., 24- to 48-hour turnaround) from the receipt of the last soil sample. The surface soil and subsurface analytical results are summarized in Tables 2-1 and 2-2, respectively, and are discussed in the following sections.

2.2 SURFACE SOIL

The surface soil interval was considered the first interval below the concrete slab and gravel base that made up the foundation of Building 1056; therefore, the surface soil interval ranged from 0.5 to 2.2 ft BGS.

VOCs. Two VOCs (tetrachloroethene and toluene) were detected in surface soil. Tetrachloroethene was detected in seven of eight surface soil samples at concentrations ranging from 0.0016 to 0.01 mg/kg. Toluene was detected only once at an estimated concentration of 0.00041J mg/kg. Tetrachloroethene and toluene are considered SRCs in surface soil from the CY 2004 sampling.

SVOCs. Only one SVOC was detected in surface soil. Benzoic acid was estimated in four of eight surface soil samples at concentrations ranging from 0.0366J to 0.057J mg/kg. Benzoic acid is considered an SRC in surface soil from the CY 2004 sampling.

RCRA Metals. Six RCRA metals (arsenic, barium, chromium, lead, mercury, and selenium) were detected or estimated in surface soil. Of these six, only two, mercury and selenium, were detected above reference background criteria. Mercury was detected in eight of eight surface soil samples at concentrations ranging from 0.016 to 0.035 mg/kg. Only one of the detections of mercury (0.035 mg/kg) was slightly above the reference background concentration (0.0342 mg/kg). Selenium was detected in one of eight surface soil samples at a concentration of 2.52 mg/kg, which was above the reference background concentration of 0.406 mg/kg. The remaining metals were not detected above reference background criteria. Mercury and selenium are considered SRCs in surface soil from the CY 2004 sampling.

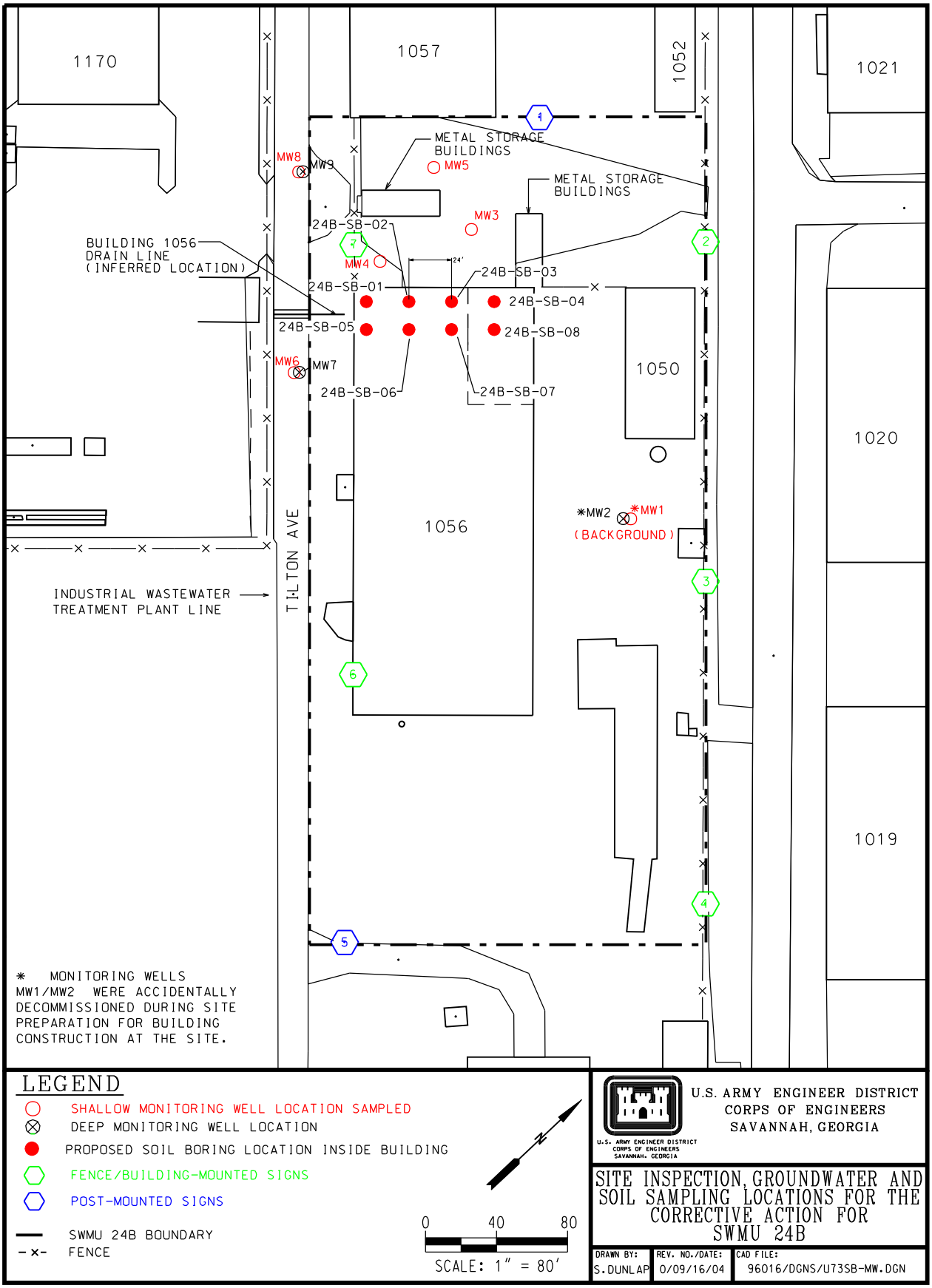

Figure 2-1. Locations of Soil Samples in Building 1056 of SWMU 24B

Table 2-1. Summary of Analytical Results for Surface Soil Collected under Building 1056 of SWMU 24B

Station	EPA Region 3 Res. Soil RBC (HQ = 1.10E-6)[a]	GSSL[b]	Ref. Bkgd. Conc.	Res. RBC Type	24B-SB-01	24B-SB-02	24B-SB-03	24B-SB-04	24B-SB-05	24B-SB-06	24B-SB-07	24B-SB-08
Sample ID					**241181**	**241281**	**241381**	**241481**	**241581**	**241681**	**241781**	**241881**
Date					**08/24/04**	**08/24/04**	**08/24/04**	**08/24/04**	**08/24/04**	**08/24/04**	**08/24/04**	**08/24/04**
Depth (ft)					**0.5 to 2.0**	**0.5 to 1.9**	**0.5 to 2.2**	**0.5 to 2.0**	**0.5 to 2.2**	**0.5 to 2.2**	**0.5 to 1.9**	**0.5 to 1.9**
Volatile Organic Compounds (mg/kg)												
Tetrachloroethene	1.183	0.06	0	C	<0.0013 U	**0.0022**	**0.0051**	**0.0086**	**0.0016**	**0.0034**	**0.01**	**0.0042**
Toluene	1564	12	0	N	<0.0013 U	<0.0011 U	<0.0012 U	<0.001 U	<0.0011 U	<0.0011 U	**0.00041 J**	<0.0012 U
Semivolatile Organic Compounds (mg/kg)												
Benzoic acid	31,290		0	N	<0.703 U	<0.701 U	**0.0366 J**	<0.71 U	<0.72 U	**0.0396 J**	**0.0495 J**	**0.057 J**
Metals (mg/kg)												
Arsenic	0.4258	1	2.1	C	<0.216 U	<0.215 U	<0.225 U	0.37 J	<0.222 U	<0.214 U	<0.223 U	<0.22 U
Barium	547.5	82	14.7	N	3.33	2.35	2.77	2.43	3.24	2.49	3.79	2.81
Chromium	23.46	2	6.21	N	2.5 J	3.2 J	3.02 J	2.55 J	3.62 J	2 J	3.07 J	1.97 J
Lead	400	400	8.81	T	1.5	1.32	2.32	1.64	2.01	1.47	2.11	1.8
Mercury	2.346	0.1	0.0342	N	0.019	0.017	0.031	**0.035**	0.029	0.016	0.023	0.019
Selenium	39.11	0.3	0.406	N	<0.17 U	<0.169 U	**2.52**	<0.171 U	<0.175 U	<0.168 U	<0.175 U	<0.173 U

[a]EPA Region 3 residential soil RBCs were updated as of April 2004 from the EPA Mid-Atlantic Hazardous Site Cleanup Web site (http://www.epa.gov/reg3hwmd/risk/index.htm).

[b]No remedial level was established in the Phase II RFI because the human health baseline risk assessment indicated that the calculated risk was below the incremental lifetime cancer risk of 1×10^{-6} and the hazard index of 1.0; therefore, the constituent was not a risk driver and was dismissed.

C = Cancer.
EPA = U.S. Environmental Protection Agency.
GSSL = Generic soil screening level.
HQ = Hazard quotient.
J = Estimated value.
N = Noncancer.
Ref. = Reference.
Res. = Residential.
RBC = Risk-based concentration.
SWMU = Solid waste management unit.
T = Technology-based.
U = Undetected value.
Bold indicated concentrations above the reference background criteria.

Table 2-2. Summary of Analytical Results for Subsurface Soil Collected under Building 1056 of SWMU 24B

Station	EPA Region 3 Res. Soil RBC (HQ=1.10E-6)[a]	GSSL[b]	Ref. Bkgd. Conc.	Res. RBC Type	24B-SB-01	24B-SB-02	24B-SB-03	24B-SB-04	24B-SB-05	24B-SB-06	24B-SB-07	24B-SB-08
Sample ID					**241182**	**241282**	**241382**	**241482**	**241582**	**241682**	**241782**	**241882**
Date					**08/24/04**	**08/24/04**	**08/24/04**	**08/24/04**	**08/24/04**	**08/24/04**	**08/24/04**	**08/24/04**
Depth (ft) BGS					**3.0 to 4.8**	**3.0 to 4.6**	**3.0 to 4.5**	**3.0 to 4.8**	**3.0 to 4.8**	**3.0 to 4.9**	**3.0 to 5.0**	**3.0 to 4.8**
Volatile Organics Compounds (mg/kg)												
Acetone	7,039	16	0	N	<0.0058 U	<0.0068 U	<0.0049 U	**0.0058 J**	<0.0053 U	**0.0087**	<0.0059 U	**0.0052 J**
Tetrachloroethene	1.183	0.06	0	C	<0.0012 U	<0.0014 U	<0.00098 U	**0.00077 J**	**0.0018**	**0.0014**	**0.00058 J**	<0.0013 U
Semivolatile Organic Compounds (mg/kg)												
No constituents detected.												
Metals (mg/kg)												
Arsenic	0.4258	1	8.04	C	<0.221 U	<0.229 U	0.293 J	0.569	<0.214 U	<0.218 U	<0.224 U	<0.217 U
Barium	547.5	82	17	N	5.5	3.3	7.91	6.51	5.91	6.72	7.27	3.04
Chromium	23.46	2	11.6	N	5.33 J	7.09 J	5.68 J	3.83 J	3.47 J	4.45 J	5.8 J	2.41 J
Lead	400	400	11.1	T	3.2	3.98	3.01 J	2.42	2.34	2.14	4.07	1.38
Mercury	2.346	0.1	0.048	N	0.032	0.048	0.017	0.021	0.008 J	0.014	**0.056**	0.012

[a]EPA Region 3 residential soil RBCs were updated as of April 2004 from the EPA Mid-Atlantic Hazardous Site Cleanup Web site (http://www.epa.gov/reg3hwmd/risk/index.htm).

[b]No remedial level was established in the Phase II RFI because the human health baseline risk assessment indicated that the calculated risk was below the incremental lifetime cancer risk of 1×10^{-6} and the hazard index of 1.0; therefore, the constituent was not a risk driver and was dismissed.

C = Cancer.
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SWMU = Solid waste management unit.
T = Technology-based.
U = Undetected value.
Bold indicated concentrations above the reference background criteria.

2.3 SUBSURFACE SOIL

The subsurface soil interval was the second interval collected and ranged from approximately 3 to 5 ft BGS so as to be aligned with the depth of the building drain.

VOCs. Two VOCs (acetone and tetrachloroethene) were detected in subsurface soil. Acetone was detected in three of eight subsurface soil samples at concentrations ranging from 0.0052J to 0.0087 mg/kg. Tetrachloroethene was detected in four of eight subsurface soil samples at concentrations ranging from 0.00058J to 0.0018 mg/kg. Acetone and tetrachloroethene are considered SRCs in subsurface soil from the CY 2004 sampling.

SVOCs. No SVOCs were detected in subsurface soil.

RCRA Metals. Five RCRA metals (arsenic, barium, chromium, lead, and mercury) were detected in subsurface soil. Of these five, only mercury was detected above reference background criteria. Mercury was detected in eight of eight surface soil samples at concentrations ranging from 0.008J to 0.056 mg/kg. Only one of the detections of mercury (0.056 mg/kg) was slightly above the reference background concentration (0.048 mg/kg). The remaining metals were not detected above reference background criteria. Mercury is considered an SRC in subsurface soil from the CY 2004 sampling.

2.4 SOIL DATA EVALUATION

A protocol and a decision flowchart for evaluating concentrations of SRCs identified in groundwater collected after the establishment of remedial levels through either an RFI report and/or a CAP were approved by GEPD in an e-mail dated May 4, 2001 (Appendix A). This protocol is also applicable for soil if the screening criteria are adjusted accordingly. For soil, the maximum concentration detected during the August 2004 sampling was compared to the (1) maximum concentration detected in surface and subsurface soil in the Phase II RFI, (2) U. S. Environmental Protection Agency (EPA) Region 3 residential soil risk-based concentration (RBC; EPA 2004) to determine whether the constituent is a potential COC requiring further evaluation, and (3) EPA generic soil screening levels (GSSLs; EPA 1996) to determine whether the constituent might leach to groundwater [i.e., is a contaminant migration constituent of potential concern (CMCOPC)]. The EPA Region 3 RBC and GSSL were developed using protocols established in the *Phase II RCRA Facility Investigation Report for 16 Solid Waste Management Units at Fort Stewart, Georgia* (SAIC 2000). The following sections present the data evaluation for surface and subsurface soil.

2.4.1 Surface Soil Data Evaluation

Table 2-3 presents the SRCs (tetrachloroethene, toluene, benzoic acid, mercury, and selenium) identified in surface soil during the August 2004 sampling event evaluated in accordance with the protocol established for evaluating concentrations of SRCs identified in media collected after the establishment of remedial levels through either an RFI report and/or a CAP (Appendix A). Each SRC is discussed below.

Tetrachloroethene was detected at a maximum concentration of 0.01 mg/kg, which was above the maximum concentration (nondetect) presented in the Phase II RFI report; however, the maximum concentration was below the EPA Region 3 residential soil RBC (1.183 mg/kg) and GSSL (0.06 mg/kg); therefore, no further evaluation is required.

Table 2-3. Evaluation of Site-Related Constituents in Surface Soil (August 2004), SWMU 24B

Analyte	Previous Maximum Detected	EPA Region 3 Residential RBC[a]	EPA Soil Screening Levels (DAF= 20 organics, DAF=1 metals)[b]	Maximum Detected August 2004	Station at Maximum Detect. August 2004	Present Remedial Level[c]	New COPC?	Justification
Site-Related Constituents (mg/kg)								
Tetrachloroethene	ND	1.183	0.06	0.01	SB-07	None	No	Concentration exceeds concentration presented in the Phase II RFI report (not detected). Concentration below EPA Region 3 residential soil RBC and GSSL; therefore, no further action required.
Toluene	0.142	1,564	12	0.00041J	SB-07	None	No	Concentration does not exceed maximum concentration indicated in RFI; therefore, no further evaluation required (Appendix A).
Benzoic Acid	ND	31,290	None	0.057J	SB-08	None	No	Concentration exceeds concentration presented in the Phase II RFI report (not detected). No GSSL available. Concentration significantly below EPA Region 3 residential soil RBC; therefore, no further action required (Appendix A).
Mercury	0.13	2.346	0.1	0.035	SB-04	None	No	Concentration does not exceed maximum concentration indicated in RFI; therefore, no further evaluation required (Appendix A).
Selenium	0.6	39.11	0.3	2.52	SB-03	None	No	Concentration exceeds concentration presented in the Phase II RFI report. Concentration below EPA Region 3 residential soil RBC by an order of magnitude. Maximum concentration above GSSL; however, given only one detection of selenium and that modeling in the Phase II RFI indicated selenium was unlikely to migrate to groundwater; no further action required.

[a]EPA Region 3 residential soil RBCs were updated as of April 2004 from the EPA Mid-Atlantic Hazardous Site Cleanup Web site (http://www.epa.gov/reg3hwmd/risk/index.htm).
[b]GSSL = EPA GSSL with a DAF of 1 for inorganics and a DAF of 20 for volatile and semivolatile organics. A DAF of 1 for inorganics was used because the average pH of groundwater is less than 5 (Table 7 and 14); unless otherwise indicated, GSSL was taken from *Soil Screening Guidance: Technical Background Document* (EPA 1996).
[c]No remedial level was established in the Phase II RFI because the human health baseline risk assessment indicated that the calculated risk was below the incremental lifetime cancer risk of 1×10^{-6} and the hazard index of 1.0; therefore, the constituent was not a risk driver and was dismissed.

COPC = Constituent of potential concern.
DAF = Dilution attenuation factor.
EPA = U.S. Environmental Protection Agency.
GSSL = Generic soil screening level.
J = Estimated value.
ND = Not detected.
RBC = Risk-based concentration.
RFI = Resource Conservation and Recovery Act facility investigation.
SWMU = Solid waste management unit.

The maximum concentration of toluene (0.00041J mg/kg) estimated during August 2004 was below the maximum concentration (0.142 mg/kg) detected during the Phase II RFI; therefore, in accordance with the protocol for evaluating constituents in media after approval of the RFI report or CAP (Appendix A), no further evaluation is required.

Benzoic acid was estimated at a maximum concentration of 0.057J mg/kg during the August 2004 sampling. Benzoic acid had previously not been detected (nondetect in Phase II RFI). The maximum concentration of benzoic acid was below the EPA Region 3 residential soil RBC (31,290 mg/kg). No GSSL was available for benzoic acid. No further evaluation is required for benzoic acid in surface soil.

The maximum concentration of mercury (0.035 mg/kg) detected during the August 2004 sampling was below the maximum concentration (0.13 mg/kg) detected during the Phase II RFI; therefore, in accordance with the protocol for evaluating constituents in media after approval of the RFI report or CAP (Appendix A), no further evaluation is required.

Selenium was detected at a maximum concentration of 2.52 mg/kg during the August 2004 sampling, which was above the maximum concentration (0.6 mg/kg) detected in the Phase II RFI. The maximum concentration of selenium (2.52 mg/kg) was significantly below (one order of magnitude) the EPA Region 3 residential soil RBC (39.11 mg/kg). However, the maximum concentration of selenium exceeded the GSSL (0.3 mg/kg). Given that there was only one detection of selenium in surface soil and that modeling in the Phase II RFI (SAIC 2001) indicated that selenium was unlikely to migrate to groundwater at levels above its maximum contaminant level (MCL), no further action is required.

2.4.2 Subsurface Soil Data Evaluation

Table 2-4 presents the SRCs (acetone, tetrachloroethene, and mercury) identified in subsurface soil during the August 2004 sampling event evaluated in accordance with the protocol established for evaluating concentrations of SRCs identified in media collected after the establishment of remedial levels through either an RFI report and/or a CAP (Appendix A). Each SRC is discussed below.

Acetone was detected at a maximum concentration of 0.0087 mg/kg. Acetone was detected above the maximum concentration (nondetect) presented in the Phase II RFI report; however, the maximum concentration was below the EPA Region 3 residential soil RBC (7039 mg/kg) and GSSL (16 mg/kg); therefore, no further evaluation is required.

The maximum concentration of tetrachloroethene (0.0018 mg/kg) detected during August 2004 was below the maximum concentration (0.004 mg/kg) detected during the Phase II RFI; therefore, in accordance with the protocol for evaluating constituents in media after approval of the RFI report or CAP (Appendix A), no further evaluation is required.

The maximum concentration of mercury (0.056 mg/kg) detected during August 2004 was below the maximum concentration (0.24 mg/kg) detected during the Phase II RFI; therefore, in accordance with the protocol for evaluating constituents in media after approval of the RFI report or CAP (Appendix A), no further evaluation is required.

Table 2-4. Evaluation of Site-Related Constituents in Subsurface Soil (August 2004), SWMU 24B

Analyte	Previous Maximum Detected	EPA Region 3 Residential RBC[a]	EPA Soil Screening Levels (DAF= 20 organics, DAF=1 metals)[b]	Maximum Detected August 2004	Station at Maximum Detect August 2004	Present Remedial Level[c]	New COPC?	Justification
Site-Related Constituents (mg/kg)								
Acetone	ND	7039	16	0.0087	SB-06	None	No	Acetone was not detected in subsurface soil previously. Concentration below EPA Region 3 residential soil RBC and GSSL; therefore, no further action required.
Tetrachloroethene	0.004	1.183	0.06	0.0018	SB-05	None	No	Concentration does not exceed maximum concentration indicated in RFI; therefore, no further evaluation is required (Appendix A).
Mercury	0.24	2.346	0.1	0.056	SB-07	None	No	Concentration does not exceed maximum concentration indicated in RFI; therefore, no further evaluation is required (Appendix A).

[a]EPA Region 3 residential soil RBCs were updated as of April 2004 from the EPA Mid-Atlantic Hazardous Site Cleanup Website (http://www.epa.gov/reg3hwmd/risk/index.htm).

[b]GSSL = EPA GSSL with a DAF of 1 for inorganics and a DAF of 20 for volatile and semivolatile organics. A DAF of 1 for inorganics was used because average pH of groundwater is less than 5; unless otherwise indicated, GSSL was taken from *Soil Screening Guidance: Technical Background Document* (EPA 1996).

[c]No remedial level was established in the Phase II RFI because the human health baseline risk assessment indicated that the calculated risk was below the incremental lifetime cancer risk of 1×10^{-6} and the hazard index of 1.0; therefore, the constituent was not a risk driver and was dismissed.

COPC = Constituent of potential concern.
DAF = Dilution attenuation factor.
EPA = U.S. Environmental Protection Agency.
GSSL = Generic soil screening level.
ND = Not detected.
RBC = Risk-based concentration.
RFI = Resource Conservation and Recovery Act facility investigation.
SWMU = Solid waste management unit.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 CONCLUSIONS

Surface and subsurface soil was collected in August 2004 from eight locations inside Building 1056 at SWMU 24B and analyzed for VOCs, SVOCs, and RCRA metals. The sampling was conducted in accordance with the selected remedial alternative recommended in the CAP for SWMU 24B (SAIC 2002), Addendum #4 to the SAP for Phase II RFIs of 16 SWMUs (SAIC 2004), and the SAP for 16 SWMUs (SAIC 1997), which were developed in accordance with USACE Guidance EM 200-1-3 (USACE 2001).

Surface Soil. Five constituents were identified as SRCs (tetrachloroethene, toluene, benzoic acid, mercury, and selenium) in surface soil. Toluene and mercury were not detected above the maximum concentrations previously detected in surface soil. Tetrachloroethene was detected above the previous maximum concentration (nondetect in the Phase II RFI); however, the maximum concentration was below the EPA Region 3 residential soil RBC and GSSL. Benzoic acid was estimated above the previous maximum concentration (nondetect in Phase II RFI); however, the maximum concentration of benzoic acid was below the EPA Region 3 residential soil RBC. No GSSL was available for benzoic acid. Selenium was detected above the maximum concentration detected in the Phase II RFI. The maximum concentration of selenium was significantly below (one order of magnitude) the EPA Region 3 residential soil RBC (39.11 mg/kg) but exceeded the GSSL. Modeling in the Phase II RFI (SAIC 2001) indicated that selenium was unlikely to migrate to groundwater at levels above its MCL. In addition, selenium was detected in only one surface soil sample during the August 2004 sampling. Tetrachloroethene, toluene, benzoic acid, mercury, and selenium are not constituents of potential concern (COPCs) in surface soil requiring further evaluation.

Subsurface Soil. Three constituents (acetone, tetrachloroethene, and mercury) were identified as SRCs in subsurface soil during the August 2004 sampling event. Tetrachloroethene and mercury were not detected above the maximum concentration previously detected in subsurface soil. Acetone was detected at a maximum concentration of 0.0087 mg/kg, which was above the maximum concentration (nondetect) presented in the Phase II RFI report; however, the maximum concentration was below the EPA Region 3 residential soil RBC and GSSL. Acetone, tetrachloroethene, and mercury are not COPCs in subsurface soil requiring further evaluation.

3.2 RECOMMENDATIONS

No COPCs or CMCOPCs were identified in surface or subsurface soil collected from underneath the concrete slab of Building 1056 from the August 2004 soil sampling. The RFI (SAIC 2001) indicated the presence of SVOCs in the surface soil surrounding Building 1056 at concentrations exceeding the risk-based levels. The RFI concluded that the SVOCs were not believed to be from an industrial process that resulted in systematic and routine releases from SWMU 24B but to activities occurring in the general area. The results from the soil sampling from underneath the slab at Building 1056 further confirm this hypothesis. SVOCs are a common soil constituent in heavily industrialized areas because a large number of activities can generate them. These activities include asphalt paving, equipment lubricants, dust suppression, and combustion processes. SVOC COCs in surface soil identified around Building 1056 were not constituents detected in soil collected beneath the slab. The remaining low concentrations and sporadic detections of VOCs and RCRA metals were below regulatory criteria.

Therefore, the COCs identified in surface soil in the RFI (SAIC 2001) were unchanged by the results of August 2004 sampling. The remedial alternatives developed for surface soil in the CAP (SAIC 2002) remain applicable. As discussed in Section 1.3, the following three corrective action alternatives were evaluated for surface soil contamination at SWMU 24B:

- Alternative 1: Institutional Controls and Groundwater Monitoring,
- Alternative 2: Concrete Cap with Institutional Controls and Groundwater Monitoring, and
- Alternative 3: Excavation with Institutional Controls and Groundwater Monitoring.

Alternative 1 is presently being implemented for surface soil until the soil underneath Building 1056 is sampled (the subject of this report) and its impact on the selection of the remedial alternative can be determined. In accordance with the CAP, an addendum to the CAP will be prepared recommending additional actions and/or monitoring based on the new data (soil and groundwater) and coordinating these actions with the final construction design and schedule for Building 1056.

4.0 REFERENCES

EPA (U.S. Environmental Protection Agency) 1996. *Soil Screening Guidance: Technical Background Document*, EPA/540/R-95/128, Office of Solid Waste and Emergency Response, May, available at <http://www.epa.gov/superfund/resources/soil/toc.htm>.

EPA 2004. *Risk-Based Concentration Table,* Mid-Atlantic Risk Assessment Center, updated April, available at <http://www.epa.gov/reg3hwmd/risk/index.htm>.

Geraghty and Miller, Inc. 1992. *RCRA Facility Investigation Final Work Plan, Fort Stewart, Georgia,* June.

SAIC (Science Applications International Corporation) 1997. *Sampling and Analysis Plan for Phase II RCRA Facility Investigation of 16 Solid Waste Management Units at Fort Stewart, Georgia*, Oak Ridge, Tennessee, October.

SAIC 2000. *Phase II RCRA Facility Investigation Report for 16 Solid Waste Management Units at Fort Stewart, Georgia*, Oak Ridge, Tennessee, April.

SAIC 2001. *Addendum for SWMU 24B: Old Radiator Shop/Paint Booth to the Revised Final Phase II RCRA Facility Investigation Report for 16 Solid Waste Management Units at Fort Stewart, Georgia*, Oak Ridge, Tennessee, June.

SAIC 2002. *Corrective Action Plan for the Old Radiator Shop/Paint Booth (Solid Waste Management Unit 24B) at Fort Stewart Military Reservation, Fort Stewart, Georgia*, Oak Ridge, Tennessee, July.

SAIC 2004. *Addendum #4 to the Sampling and Analysis Plan for Phase II RCRA Facility Investigations of 16 Solid Waste Management Units at Fort Stewart, Georgia*, Oak Ridge, Tennessee, August.

USACE (U. S. Army Corps of Engineers) 2001. *Requirements for the Preparation of Sampling and Analysis Plans*, EM 200-1-3, Department of the Army, Washington, D.C., February.

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APPENDIX A

APPENDIX A

PROTOCOL FOR ESTABLISHING REMEDIAL LEVELS

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Longaker, Jeff

From: Brent Rabon [brent_rabon@mail.dnr.state.ga.us]
Sent: Friday, May 04, 2001 3:06 PM
To: LittleDERA@aol.com
Subject: Re: Written Description which accompanies flowchart


Protocol.doc

Melanie, GA EPD has reviewed the Protocol proposed by Fort Stewart in your e-mail and facsimile (Little to Rabon) dated 30 April 2001 and 2 May 2001, respectively. Based upon that review and in order to expedite resolution of this issue, I have modified your version of the Written Description to accompany the flowchart (See attachment) and propose that some text be added (in bold) and deleted (struck out). Please note that modification of the hazardous constituents definition in the Written Description will also require modification of the one (1) applicable block in the flowchart.

The majority of the requested modifications are an attempt to make the proposal more generic for SWMUs which are not addressed by the Phase II RFI Report for 16 SWMUs dated April 2000 (e.g., SWMU 13). I do realize, however, that Fort Stewart may elect to modify the text in order to be more SWMU-specific when including this Protocol into a Corrective Action Plan.

Please do not hesitate to contact me should you have any questions concerning this e-mail.

Thank you,
Brent

>>> <LittleDERA@aol.com> 04/30/01 04:39PM >>>
See attached. Thanks, Melanie

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PROTOCOL FOR EVALUATING ADDITIONALLY DETECTED CONSTITUENTS IN GROUNDWATER AFTER APPROVAL OF A RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT

A.1 INTRODUCTION

Groundwater monitoring is typically suggested for solid waste management units (SWMUs) that have been recommended for a corrective action other than institutional controls to determine either the groundwater characteristics before development of the Corrective Action Plan (CAP) and/or as part of the remedial alternative [e.g., monitored natural attenuation (MNA)] recommended in the CAP. Additional groundwater monitoring might result in more constituents being detected in groundwater and/or at concentrations higher than those evaluated in the Georgia Environmental Protection Division (GEPD)–approved Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) report. Constituents identified as constituents of potential concern (COPCs) in the RFI report are evaluated in human health and ecological risk assessments, and their risk is quantified. COPCs determined to present a risk to human health and/or the environment are identified as constituents of concern (COCs), and remedial levels are developed. COCs indicated at concentrations above remedial levels (and the source media of the COCs) are identified in the CAP as constituents requiring remedial action. The following presents the potential methodology for evaluating additional constituents and/or constituents detected at concentrations higher than those previously detected and that might not have indicated risk or for which a remedial level might not have been developed in the Phase II RFI.

A.2 PROTOCOL

Groundwater sampling and monitoring results will be evaluated to determine whether significant changes are occurring in the types and concentrations of constituents present in the groundwater. An evaluation protocol has been developed to assess the potential increases in the groundwater concentrations of constituents not identified as COCs in the GEPD–approved RFI report. The accompanying decision chart (Figure A-1) presents the decision points required in the evaluation.

Identification. Initially the data will be evaluated to determine what constituents, if any, have increased concentrations in groundwater but were not addressed as COCs in the RFI, which would include constituents that were not detected during the RFI groundwater sampling. The maximum detected concentration from the monitoring data will be compared to the maximum detected concentration listed in the RFI. If the concentration is elevated (i.e., greater than the maximum detected concentration reported in the RFI), further evaluation will be required to determine whether this constituent should be addressed under the remedial action. All constituents not previously detected will be evaluated further.

Confirmation. Given that groundwater concentrations are likely to fluctuate, a single elevated value does not indicate that the concentration of the constituent is increasing over time. The value might be a statistical aberration or the result of a temporary change in environmental conditions. If the elevated concentration represents a single event, confirmation of the results is required, and no further evaluation of the constituent should be undertaken until the sampling results have been confirmed during the next groundwater monitoring sampling event.

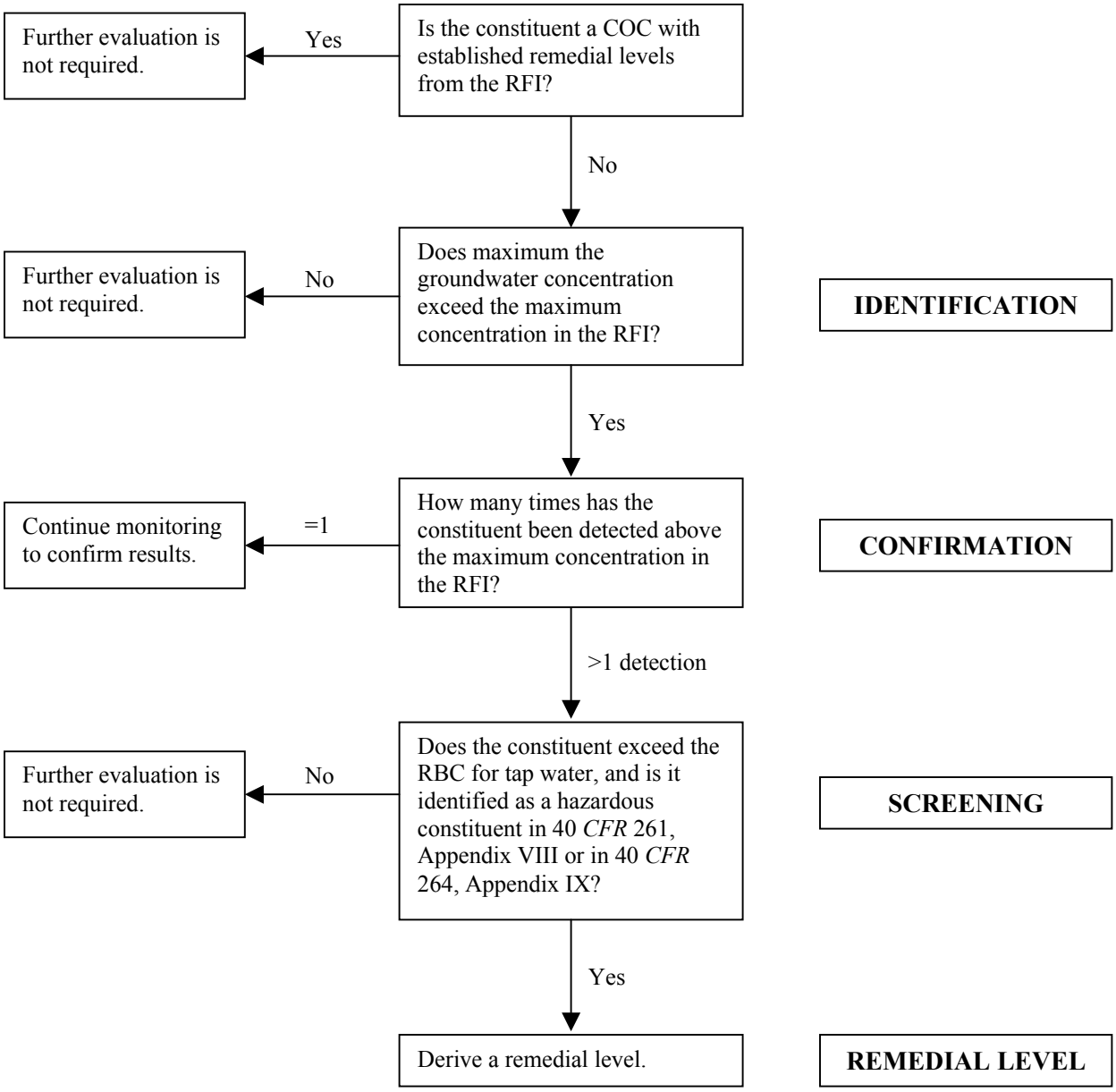

Figure A-1. Protocol for Developing a Remedial Level

Screening. Upon confirmation of the sampling results, the maximum concentration will be screened using the U.S. Environmental Protection Agency Region 3 risk-based concentrations (RBCs) for tap water as described in Section 7.3.2 ("Screening Values for Groundwater") of the revised final Phase II RFI report for 16 SWMUs at Fort Stewart, Georgia (SAIC 2000). These screening values were used in the Phase II RFI to identify human health COPCs in groundwater and will identify those constituents that might have an adverse effect on human health. In addition, if the constituent is not listed in Title 40, *Code of Federal Regulations (CFR),* Part 261, Appendix VIII or in 40 *CFR* 264, Appendix IX [see the definition of hazardous constituents in Section I.E of the Fort Stewart Hazardous Waste Facility Permit #HW-045(S&T)]**,** then it will not be considered a hazardous constituent and will be eliminated.

Remedial Level Development. A remedial level will be derived for each constituent with a maximum concentration that exceeds the RBC. The remedial level will be derived using the protocols established for that site in the Phase II RFI. If a risk-based remedial level is derived for the constituent, the total risk for exposure to groundwater constituent concentrations equal to the remedial levels should not exceed a hazard index of 3 or an incremental lifetime cancer risk of 1×10^{-4} (GEPD 1996).

Documentation. Groundwater monitoring data collected to determine present characteristics before development of the CAP will be evaluated in the CAP under the section "Supplemental Data Evaluation." The supplemental data evaluation will be presented as an appendix and summarized in Chapter 2.0 of the CAP. The evaluation of potential additional constituents and/or the detection of constituents at concentrations greater than previously reported and potential remedial level development will be presented in the supplemental data evaluation in the CAP.

Groundwater monitoring data collected as part of the selected and implemented remedial alternative will be reported to GEPD in CAP progress reports. The reporting period will be dictated by the remedial alternative being implemented. For example, MNA typically has an annual reporting schedule, while active remedial action alternatives (e.g., in situ chemical oxidation) may be reported after the performance of the remedial alternative and at subsequent intervals thereafter. The reports to be issued and the reporting schedule will be documented in the CAP. The evaluation of potential additional constituents and/or the detection of constituents at concentrations greater than previously reported and potential remedial level development will be presented in the CAP progress reports. This protocol will be presented and established in the operations and maintenance plan and MNA checklist (if MNA is selected), both of which will be appendices to the CAP.

A.3 REFERENCES

GEPD (Georgia Environmental Protection Division) 1996. *Guidance for Selecting Media Remediation Levels at RCRA Solid Waste Management Units*, Atlanta, Georgia, November.

SAIC (Science Applications International Corporation) 2000. *Phase II RCRA Facility Investigation Report for 16 Solid Waste Management Units at Fort Stewart, Georgia*, Oak Ridge, Tennessee, April.

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