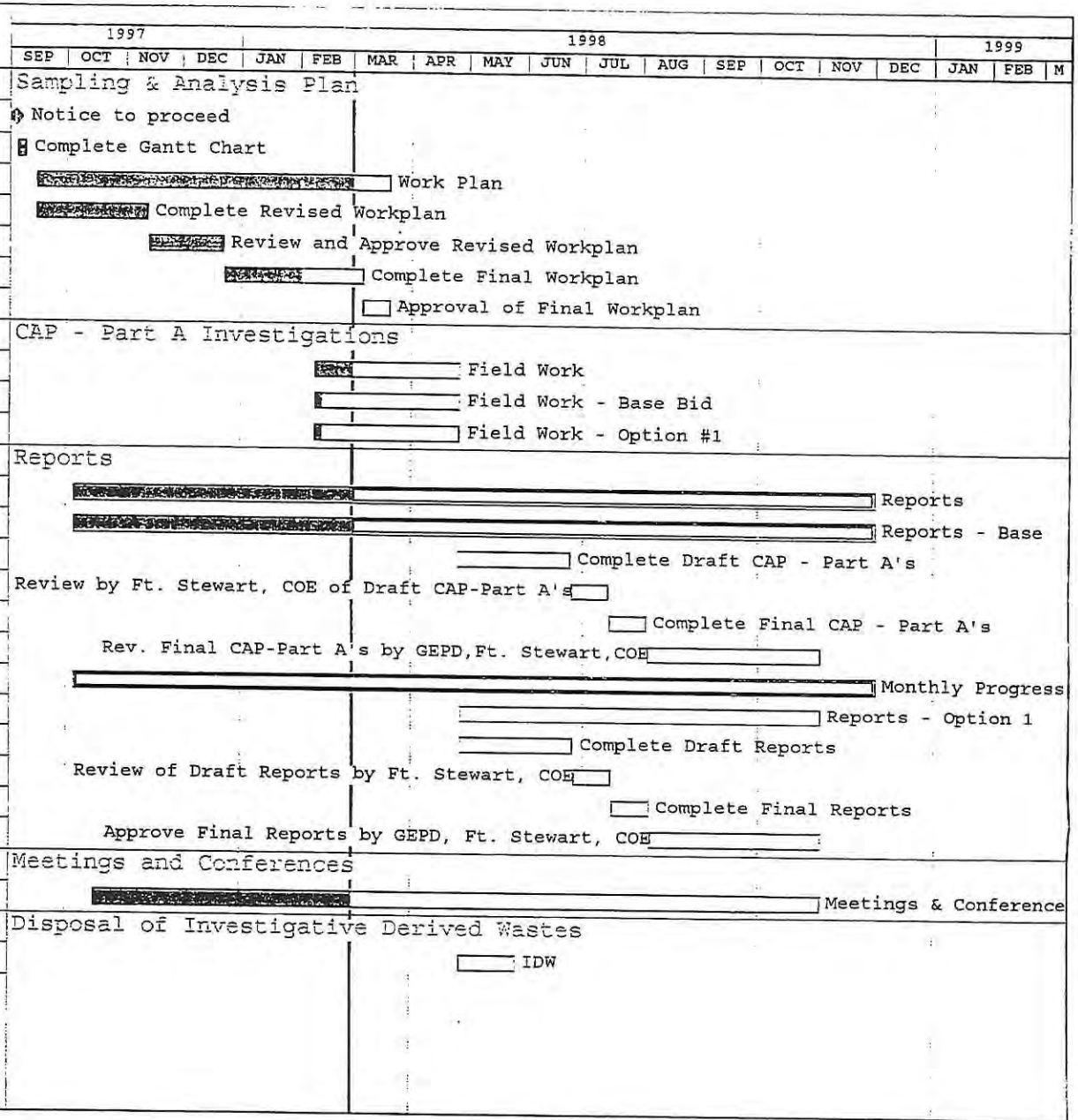
11.0 PROJECT SCHEDULE

The schedule for implementing the SAP and completing the CAP-Part A Reports is outlined in Figure 11.1. The project schedule presented in Figure 11.1 is based on receiving approval of the final SAP by March 20, 1998. The time scale on this figure is in months after Notice to Proceed (NTP).

ACTIVITY ID	EARLY START	EARLY FINISH	REM DUR
HC000000	4SEP97A		0
HC00_001	5SEP97A	9SEP97A	0
HC100_000	15SEP97A	20MAR98	20
HC100_002	15SEP97A	12NOV97A	0
HC100_003	13NOV97A	22DEC97A	0
HC100_004	23DEC97A	6MAR98	6
HC100_005	6MAR98	20MAR98	15
HC200_000	9FEB98A	26APR98	57
HC200_001	9FEB98A	26APR98	57
HC200_002	9FEB98A	26APR98	57
HC400_000	5OCT97A	1DEC98	276
HC400_100	5OCT97A	1DEC98	276
HC400_101	26APR98	24JUN98	60
HC400_102	25JUN98	14JUL98	20
HC400_103	15JUL98	3AUG98	20
HC400_104	4AUG98	2NOV98	91
HC400_105	5OCT97A	1DEC98	276
HC400_200	27APR98	2NOV98	190
HC400_201	27APR98	25JUN98	60
HC400_202	26JUN98	15JUL98	20
HC400_203	16JUL98	4AUG98	20
HC400_204	5AUG98	2NOV98	90
HC500_000	16OCT97A	2NOV98	247
HC600_000	27APR98	26MAY98	30



Activity Classification: ACTIVITY TYPE
NTE MILESTONE

Plot Date 27FEB98
Data Date 1MAR98
Project Start 1MAY97
Project Finish 1DEC98

Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

(c) Primavera Systems, Inc.

SAIC

CAP A's for UST's at Hunter AAF

DO 19: Hunter AAF - Project Schedule

Savannah COE

Date	Revision	Checked	Approved

Figure 11.1. Project Schedule for the CAP-Part A Reports for Former UST Sites at HAAF, Georgia

FIELD SAMPLING PLAN
FOR THE
CORRECTIVE ACTION PLAN-
PART A INVESTIGATIONS
FOR
FORMER UNDERGROUND STORAGE TANK SITES
AT HUNTER ARMY AIRFIELD, GEORGIA

APPENDIX A

REFERENCES

REFERENCES

Anderson Columbia Environmental, Inc. 1996. Closure Reports for Underground Storage Tanks, Hunter Army Airfield, Savannah, Georgia, December.

ASTM (American Society for Testing and Materials) 1995. Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, ASTM Designation E:1739-95, Annual Book of ASTM Standards, West Conshohocken, Pennsylvania.

Arora, R. 1984. Hydrologic Evaluation for Underground Injection Control in the Coastal Plain of Georgia, Department of Natural Resources, Environmental Protection Division, Georgia Geological Survey.

Clark, W.Z. Jr. and Zisa, A.C. 1976. Physiographic Map of Georgia, Department of Natural Resources, Environmental Protection Division, Georgia Geologic Survey.

I.S. Clark, C.M. Hacke, and M.F. Peck. 1990. Geology and Groundwater Resources of the Costal Area of Georgia, Department of Natural Resources, Environmental Protection Division, Georgia Geological Survey.

Furlow, J.W. 1969. Stratigraphy, Paleontology, and Economic Geology of the Eastern Chatham County Phosphate, Department of National Resources, Environmental Protection Division, Georgia Geological Survey.

Georgia Department of Natural Resources. 1995. Underground Storage Tank Management Program, Environmental Protection Division. August.

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

Huddleston, P.F. 1988. A Revision of the Lithostratigraphic Units of the Costal Plain of Georgia: the Miocene through the Holocene, Department of Natural Resources, Environmental Protection Division, Georgia Geologic Survey.

Huddleston 1987. (To Be Provided)

Looper, E.E. 1982. Soil Survey of Liberty and Long Counties, Georgia, U.S. Department of Agriculture, Soil Conservation.

Metcalf and Eddy 1996. Final Work Plan for RCRA Facility Investigation at Bulk Fuel Storage System, Wright Army Airfield, Fort Stewart, Georgia.

Miller, J.A. 1990. Groundwater Atlas of the United States, Segment 6, U.S. Department of the Interior, U.S. Geological Survey, Hydrologic Inventory Atlas 730G.

USACE (U.S. Army Corps of Engineers) 1994. Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3, September.

USAEHA (U.S. Army Environmental Hygiene Agency) 1988. Investigation of Soil Contamination, Hazardous Waste No. 37-26-0127-88.

U.S. Department of Commerce 1990. 1990 Census, Bureau of the Census.

FIELD SAMPLING PLAN
FOR THE
CORRECTIVE ACTION PLAN-PART A INVESTIGATIONS
FOR FORMER UNDERGROUND STORAGE TANK SITES
AT
HUNTER ARMY AIRFIELD, GEORGIA

APPENDIX B

RESUMES

SAIC PROGRAM MANAGER
GREGORY M. GRIM

GREGORY M. GRIM

Education

B.S., Civil (Environmental) Engineering, Mississippi State University, MS, 1982

Capabilities

Senior Civil Engineer
Program Manager
Supervisor Civil Engineer
Project Manager
TQM Manager

Experience Summary

Mr. Grim has 14 years of practical engineering, design, and management experience ranging from structural engineering design to environmental engineering/HTRW project and program management, and A-E contract selection, negotiation, and management. His responsibilities include project management, client relations, and business development for the U.S. Army Corps of Engineers. He provides direction and technical input to a variety of DOD and Corps of Engineers environmental engineering and HTRW projects. Before joining SAIC, he served the U.S. Army Engineer Division - Huntsville (USAEDH) for six years in various capacities, from Project Manager to Division Chief for the Environmental and Support Programs Division.

Key Projects

Relevant project experience includes:

- Program Manager for $10 million CPFF/CPAF and $50 million FFP A-E HTRW and environmental compliance service IDT for SAV.COE, including HTRW site investigations, environmental site assessments, remedial design and environment compliance investigations and designs at Army installations.

- Mr. Grim has served as Deputy Program Manager for $4.0 million FFP Environmental Compliance System (ECAS) Regulatory Compliance Assessment for Europe District, COE He has lead the assessments at five Battalion Support Bases (BSBs)/Area Support Groups (ASGs) facilities in Europe including facilities in Wiesbaden, Hohenfels and Darmstadt, Germany; Schinnen, Netherlands; and Chieveres, Belgium. OCONUS installations are assessed to document compliance with Host Nation (HN) Final Governing Standards (FBS), as well as DOD and Army policies in 19 environmental protocol areas.

- Total Quality (TQ) Manager for $42 million ID/IQ support contract to USACE, Huntsville Division, for environmental restoration services at Sharpe and Tracy Defense Depots.

- Project Management, USACE, Huntsville Division, of environmental restoration projects (investigation, design, remediation) at AMC and DLA installations. Monitored contractor activities; reviewed contract deliverables; coordinated and resolved technical and regulatory comments; developed contract acquisition plans, work statements, cost estimates, project schedules, and budgets; and reviewed contract payment requests. He was responsible for A-E contract negotiations and evaluations. Has a working knowledge of state and federal environmental regulations (40CFR, CERCLA, SARA, RCRA, HSWA, AR200-1,2, NEPA, TSCA, etc.). The project budget for both AMC and DLA installations totaled $15 million.
- Served as Program Manager/Business Development Manager for Environmental and Support Programs Division. Customer coordination, EPA, and state interface coordination, and new business development and served as Headquarters Point-of-Contact for HTRW, and the FUDs program manager. He planned, coordinated, evaluated, and reviewed all phases of project control and developed team building/partnering relationships with Huntsville Corps of Engineers' customers, EPA, and state agencies.

- Served as supervisor at USAEDH supervising nine personnel involved in environmental studies, remedial design, and remedial actions to correct environmental problems at active DOD installations. He provided engineering expertise in the assignment areas; planned, coordinated, evaluated, and reviewed all phases of project control, including interpretation of and compliance with criteria, laws, regulations, policies, and procedures; supervised availability and proper applications of funds; and assigned projects to project managers. Served as Alternate COR, member of the A-E Pre-Selection Board, member of the A-E Selection Board, and chaired the service/construction contract evaluation boards. The total division budget for HTRW was $70 million.

- Served as Program Manager on the Ranges and Training Land Program (RTLP) Mandatory Center of Expertise. The Huntsville Division was responsible for range modernization, standardization, and validation/inspection of designs and construction. Types of ranges included small arms, machine guns, and tanks. Specific responsibilities included validating program documentation (DD 1391 and Eng. Form 3086); developing and publishing manuals; conducting design reviews; performing construction inspection; and completing special studies. As program Manager, Mr. Grim was responsible for planning, projections, identification, funds management, contract awards and integrating all aspects of the program. Yearly budget for this work was approximately $4 million. Served as COR for RTLP (MCX). As Deputy Coordinator for RTLP, Mr. Grim was responsible for developing programmatic procedures, identifying COE policies, procedures, automation tools, and engineering criteria; managing the DA range safety reviews ; identifying stop work condition; developing cost avoidance/saving initiatives; developing and managing research elements; and providing programmatic guidance, programming, and budgeting management for tasks or functions provided by other Corps activities in support of the RTLP. Specifically responsible for all EAs and EIS for ranges within the United States.

Specialized Training and Certifications

1993, TQM, Huntsville, AL
1993, TERC Project Management, Huntsville, AL
1993, HTRW Overview, Huntsville, AL
1992, Leadership Management Intern Program, Huntsville, AL
1992, Managing Diversity, Huntsville, AL
1992, Environmental Laws and Regulations (HTRW), Cincinnati, OH

1992, Introduction to Apply Macintosh, Huntsville, AL
1991, Practical Project Management, Huntsville, AL
1991, Project Management Seminar, Orlando, FL
1990, Project Management, Norfolk, VA
1989, MC Project Management, Huntsville, AL
1989, A-E Contracting, Huntsville, AL
1989, Franklin Personal Product Seminar, Huntsville, AL
1988, CAD/CAM Training/Intergraph Engineering Mod. Sys., Huntsville, AL

SAIC PROJECT MANAGER
C. ALLISON BAILEY

CATHERINE A. BAILEY

EDUCATION:

Tennessee Technological University: B.S. Geology, 1987

SECURITY CLEARANCE:

L Clearance

WORK SUMMARY:

Ms. Bailey is a Registered Professional Geologist with over 10 years experience in environmental investigation, monitoring, assessment, evaluation, and project support and management. She has been involved with a variety of multi-disciplinary environmental Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and Underground Storage Tank (UST) projects for the Department of Energy's (DOE) Y-12 Weapons Facility, Oak Ridge National Laboratory (ORNL), and the East Tennessee Technology Park (ETTP), the Department of Defense (DOD) United States Army Corps of Engineers (USACE) Savannah and Nashville District and the Air National Guard Bureau, as well as with private industry in Tennessee and South Carolina.

Ms. Bailey has served as Project Manager for DOD contracts with the USACE Savannah District Contract for the Hunter Army Airfield Corrective Action Plan (CAP)-Part A UST Project and the Tennessee Air National Guard Bureau Memphis UST Project and for DOE contracts for the Lockheed Martin Energy Systems (LMES) Incentive Task Order (ITO) Lower East Fork Poplar Creek (LEFPC) Remedial Action Confirmatory Sampling Project, the Y-12 UST Program Support Task, the Remedial Investigation (RI) Field Activities for the Bear Creek Valley Operable Unit (BCV OU) 2, BCV OU 1, and BCV Floodplain Soil Sampling (BCV FPSS) Projects and for the preparation of the BCV OU 2 RI Report.

She was responsible for developing sampling and analysis plans, initial site characterization reports, closure reports, and CAP-Part A Reports for UST projects in Tennessee and Georgia, work plans for the Y-12 Plant BCV OU 1, OU 2, and OU 4, Upper East Fork Poplar Creek OU 3, and K-25 K-770 OU, project schedules, budgets, and cost estimates, and supported development of RI/Feasibility Study (FS) reports for the BCV, LEFPC, and Upper East Fork Poplar Creek (UEFPC) Operable Units. Ms. Bailey has also assisted the LMES Environmental Restoration Data Quality Program as a member of a Subcommittee responsible for preparing and reviewing Technical Procedures. She also served as geologist and field team leader for the installation of groundwater monitoring wells in both soil and bedrock, soil sampling, water sampling and conducted health and safety monitoring and quality control/quality assurance surveillances.

In addition, Ms. Bailey has aided commercial clients in environmental regulatory compliance, conducted environmental site assessments, due diligence property audit, and written and taught a training course for performing Phase II Environmental Site Assessments for the Department of Defense (DOD) Mentor Protege Program.

PROFESSIONAL EXPERIENCE:

November 1991 to present, Project Manager/Geologist, Science Applications International Corporation (SAIC). Ms. Bailey is a Project Manager/Geologist in the Engineering and Environmental Management Group at the Oak Ridge, Tennessee office and has participated in Project Management, project technical support, and field activities. Currently, Ms. Bailey is serving as Project Manager on the LMES ITO Contract for the LEFPC Remedial Action Confirmatory Sampling Project, the USACE Savannah District Hunter Army Airfield (HAAF) CAP-Part A UST Investigation Project, and the National Guard Bureau Tennessee Air National Guard Memphis UST Project.

The LEFPC Confirmatory Project is responsible for providing confirmation data to the DOE and Environmental Protection Agency proving that the remedial efforts to remove mercury contamination from the LEFPC floodplain sediments were successful. Ms. Bailey's responsibilities include preparing for conducting and participating in SAIC, LMES, DOE Readiness Reviews, managing the project field crew and subcontractors, setting up and maintaining a fully functional on-site laboratory and performing field screening analyses for mercury in sediment samples, evaluating data, making technical decisions associated with the project scope, producing and controlling the project budget and schedule, interacting and communicating with the LMES and DOE Project Manager, Remediation Contractor, Quality Assurance/Quality Control (QA/QC), Health and Safety (H&S), and data management personnel, as well as responding to and participating in LMES and DOE field surveillances. Ms. Bailey is also responsible for preparing weekly progress reports, monthly progress and financial reports, the final data reports associated the completion of the confirmatory sampling effort, and assisting with the preparation of the Remedial Action Report.

The HAAF CAP-Part A Project consists of conducting investigations at 15 separate former UST sites located at HAAF, Ga. As Project Manager, Ms. Bailey is responsible for preparing the sampling and analysis plan, managing the project field crew and subcontractors, evaluating the data, making technical decision associated with the project scope, producing and controlling the project budget, and schedule, and interacting and communicating with the USACE Project manager, QA/QC, H&S and data management personnel. Ms. Bailey is also responsible for preparing monthly progress and financial reports, and the CAP-Part A Reports.

The Memphis Air National Guard Project consists of managing the investigation, monitoring, and closure activities for a former UST located at the Base. As Project Manager, Ms. Bailey is

responsible for managing the project field crew and subcontractors, evaluating the data, making technical decision associated with the project scope, producing and controlling the project budget, and schedule, and interacting and communicating with the TANG Base Environmental Program Manager and Tennessee Department of Environment and Conservation Division of Underground Storage Tank (TDEC-DUST) regulatory personnel. Ms. Bailey is responsible for preparing the Initial Site Investigation report and providing an site evaluation using the TDEC-DUST Regulations to determine eligibility for the monitoring only program and site closure.

Ms. Bailey has also functioned as Project Manager for the Y-12 UST Program Support Task. Her responsibilities included informing and updating the client on a regular basis with current UST State Regulation, preparing Site Status Monitoring and Closure Reports, assisting the client with site monitoring activities, and preparing and maintaining UST Management Plans for both the Y-12 and ETTP sites.

Ms. Bailey also functioned as Project Manager for the LMES ETS Contract for the Oak Ridge Y-12 Plant BCV FPSS RI Field Activities. This RI incorporated a unique and innovative approach to the environmental investigation which allowed the sampling locations to be selected and the number of samples to be limited by using radiation screening and surveying technologies. The project consists of conducting an environmental investigation of the entire BCV FP by implementing the Sampling and Analysis Plan (SAP) and involved procuring multiple subcontractors, preparing for, conducting, and participating in SAIC and Y-12 Readiness Reviews, management and supervision of project personnel, and interacting and communicating with LMES project managers, technical support personnel adn QA/QC officers. As project manager, Ms. Bailey's responsibilities include managing field personnel and subcontractors, producing and controlling the project budget, interacting and communicating with the Energy Systems Project Manager, technical personnel, and Quality Assurance/Quality Control (QA/QC) personnel, and responding to and participating in Y-12 and DOE field surveillances. In addition, Ms. Bailey interacts directly with SAIC contracts, purchasing, and data management personnel, and makes project technical decisions based on her professional judgement and experience.

Ms. Bailey served as Deputy Project Manager and Field Operations Manager (FOM) for the ES ETS Contract for the Oak Ridge Y-12 Plant BCV OU 1 RI Field Activities. This RI utilized innovative waste minimization technologies by utilizing the Geoprobe direct push and water sampling methodologies. This technology allowed a smaller diameter soil core sample to be collected and permitted water samples to be collected directly from the borehole. This project consisted of conducting an environmental investigation of the S-3 Ponds, the Boneyard/Burn Yard, Sanitary Landfill I, Oil Landfill, and the Burial Grounds by implementing the RI Work Plan which Ms. Bailey assisted in writing. As Deputy Project Manger, Ms. Bailey was responsible for providing technical support to the project manager by procuring subcontractors, preparing for and participating in SAIC and Y-12 Readiness Reviews, training personnel, working with technical procedures, and tracking

the project budget. As FOM, Ms. Bailey's responsibilities included managing field personnel and subcontractors, interacting and communicating with Energy Systems Project Manager, technical personnel, and QA/QC personnel, and responding to and participating in Y-12 and DOE field surveillances.

Ms. Bailey served as Project Manager for the ES ETS Contract for the Oak Ridge Y-12 Plant BCV OU 2 RI which included conducting the field investigation and writing and completing the RI Report. The field activities portion of the project consisted of conducting an environmental investigation of the Rust Spoil Area, SY-200 Yard, and SA-1 by implementing the RI Work Plan which Ms. Bailey assisted in writing. Ms. Bailey was responsible for procuring the subcontractor, preparing for, conducting, and participating in SAIC and Y-12 Readiness Reviews, training personnel, mobilizing to the field, working with technical procedures, and making technical decisions associated with the project tasks. Ms. Bailey's responsibilities during the field effort also included managing field personnel and subcontractors, producing and controlling the project budget, interacting and communicating with the Energy Systems Project Manager, technical personnel, and QA/QC personnel, and responding to and participating in Y-12 and DOE field surveillances. In addition, Ms. Bailey interacted directly with SAIC contracts, purchasing, and data management personnel, and made project technical decisions based on her professional judgement and experience. After the field activities were completed, Ms. Bailey was responsible for the preparation and completion of the RI Report which included coordinating all document preparation and data validation, evaluation, and interpretation efforts between Y-12, SAIC, and FS personnel, developing, tracking, maintaining, and reporting the project budget, and responding to Y-12, DOE, Environmental Protection Agency (EPA), and Tennessee Department of Environment and Conservation (TDEC) document reviews through the Record of Decision (ROD). This was the first RI to be completed and receive a ROD at the Y-12 Plant.

Ms. Bailey has assisted in the development of CERCLA RI Work Plans for the DOE's Y-12 Plant and K-25 Site in Oak Ridge, Tennessee. The RIs included developing work plans to investigate groundwater, surface water, sediment, and soil contaminated with radiological, volatile organic compounds (VOC), metals including mercury, asbestos, and polychlorinated biphenols (PCBs) wastes for the Y-12 Plant's BCV OUs 1, 2, and 4 and Upper East Fork Poplar Creek (UEFPC) OU3 and the K-25 Site K-770 OU. Her responsibilities included compiling, reviewing, and summarizing existing data, characterizing and evaluating the history, current conditions, and environmental setting of the sites, and assisting in identifying site data needs and developing sampling and analysis plans. Two of the project tasks included developing schedules for the RI/FS through the Interim Record of Decision (IROD), work plan implementation schedules, and cost estimates. She has also prepared a mobilization plan and cost estimate for implementation of activities detailed in an RFI work plan developed for the DOE's Paducah Gaseous Diffusion Plant in Paducah, Kentucky.

Ms. Bailey has provided technical support to the USACE through preparation of RI work plans, site

responsible for managing the project field crew and subcontractors, evaluating the data, making technical decision associated with the project scope, producing and controlling the project budget, and schedule, and interacting and communicating with the TANG Base Environmental Program Manager and Tennessee Department of Environment and Conservation Division of Underground Storage Tank (TDEC-DUST) regulatory personnel. Ms. Bailey is responsible for preparing the Initial Site Investigation report and providing an site evaluation using the TDEC-DUST Regulations to determine eligibility for the monitoring only program and site closure.

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the project budget. As FOM, Ms. Bailey's responsibilities included managing field personnel and subcontractors, interacting and communicating with Energy Systems Project Manager, technical personnel, and QA/QC personnel, and responding to and participating in Y-12 and DOE field surveillances.

Ms. Bailey served as Project Manager for the ES ETS Contract for the Oak Ridge Y-12 Plant BCV OU 2 RI which included conducting the field investigation and writing and completing the RI Report. The field activities portion of the project consisted of conducting an environmental investigation of the Rust Spoil Area, SY-200 Yard, and SA-1 by implementing the RI Work Plan which Ms. Bailey assisted in writing. Ms. Bailey was responsible for procuring the subcontractor, preparing for, conducting, and participating in SAIC and Y-12 Readiness Reviews, training personnel, mobilizing to the field, working with technical procedures, and making technical decisions associated with the project tasks. Ms. Bailey's responsibilities during the field effort also included managing field personnel and subcontractors, producing and controlling the project budget, interacting and communicating with the Energy Systems Project Manager, technical personnel, and QA/QC personnel, and responding to and participating in Y-12 and DOE field surveillances. In addition, Ms. Bailey interacted directly with SAIC contracts, purchasing, and data management personnel, and made project technical decisions based on her professional judgement and experience. After the field activities were completed, Ms. Bailey was responsible for the preparation and completion of the RI Report which included coordinating all document preparation and data validation, evaluation, and interpretation efforts between Y-12, SAIC, and FS personnel, developing, tracking, maintaining, and reporting the project budget, and responding to Y-12, DOE, Environmental Protection Agency (EPA), and Tennessee Department of Environment and Conservation (TDEC) document reviews through the Record of Decision (ROD). This was the first RI to be completed and receive a ROD at the Y-12 Plant.

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Ms. Bailey has provided technical support to the USACE through preparation of RI work plans, site

40-hour Hazardous Waste Site Health and Safety Training Course, S&ME, Inc., Atlanta, Georgia, September 21-25, 1987. Update May 1996.

Hazardous Communications, Respiratory Protection, and Hearing Protection Training, SAIC, March 1995

Project Planning and Management System Training, January 1995.

Radiation Worker II Training, MK-Ferguson, Y-12 Plant, November 9, 1994.

Medical monitored for radionuclides including whole body count. ORNL, March 1989 through January 1990 and Y-12, October 1994.

General Employee Training, Martin Marietta Energy Systems. August 1994.

Hazardous Waste Site Supervisors and Managers Training, Roane State Community College, September 24, 1993.

RCRA Hazardous and Mixed Waste Generators Training, Martin Marietta Energy Systems, Inc., Y-12 Environmental Restoration, July 22, 1993.

Health, safety, and environmental training for workers in potential radioactive areas. 8-hour course given by ORNL, February 1989.

Advanced health, safety, and environmental training for workers in Category III or "C" zone areas. 8-hour course given by ORNL, December 1989.

PUBLICATIONS:

Hodges, Catherine Allison, and Solt, E.M. 1987. Tidal Inlet Facies within the Hartselle Formation at Cardwell Mountain, Warren County, Tennessee. Presented to the Tennessee Academy of Science, May 1987. Abstract published in Tennessee Academy of Science magazine, September 1987.

MISCELLANEOUS:

Foreign Language - French, read and write.

Geology Freshman of the Year, Tennessee Technology University, 1983.

CUSTOMERS:

Lockheed Martin Energy Systems (LMES)
Department of Energy (DOE)
Department of Defense (DOD)
United States Army Corps of Engineers (USACE)

REFERENCES:

Kurt Oschman, Operations Manager, Engineering and Environmental Management Group, (423) 481-8771

Steven Selecman, Environmental Services Division Manager, Engineering and Environmental Management Group, (423) 481-8761

32177
Group 116, Division 380, Location 739

SAIC TECHNICAL MANAGER
WILLIAM P. KEGLEY

WILLIAM P. KEGLEY

EDUCATION:

Clemson University, M.S., Hydrogeology; 1993 (GPA 3.9)
Tennessee Technological University: B.S., Geology, 1986 (GPA 3.1)

SECURITY CLEARANCE: DOE "Q"

WORK SUMMARY:

Mr. Kegley has served as a project manager and hydrogeologist with 10 years of experience in environmental restoration and compliance. Work experience includes project management of two large remedial investigations, development of RCRA Facility Investigation Reports, RCRA Closure Plans, and underground storage tank investigations. His position requires developing budgets, managing costs and personnel, and setting project goals. Mr. Kegley is exceptionally skilled at creating and motivating work teams to meet project objectives. He has the ability to interface with the client and to present ideas and project goals to regulatory agencies which are essential components of current assignments. He also provides leadership in mentoring junior employees on technical applications and project management. Mr. Kegley assists management in establishing business goals and identifying new business areas. He has a strong knowledge of RCRA and CERCLA regulations.

PROFESSIONAL EXPERIENCE:

May 1988 to present, Science Applications International Corporation Project Manager. Bear Creek Valley Operable Unit 1 Remedial Investigation for the Y-12 Plant; Oak Ridge, TN. Mr. Kegley supervised preparation of technical and cost proposal, developed budgets and managed costs, personnel, and subcontractors. The project involves extensive interaction with the client on a daily basis and commands a high awareness of CERCLA regulations. The project consists of motivating an interdisciplinary team of scientists in characterizing five mixed waste units including burial grounds, burn pits, and DNAPL sources.

Project Manager, S-3 Site Long-Term Pump and Treat Test. This project involves highly detailed technical analysis of the S-3 Site hydrologic system so that the mass transfer of contaminants from low permeability blocks to high flow fracture zones can be determined.

Project Manager, Upper East Fork Poplar Creek Operable Unit 3 Remedial Investigation for the Y-12 Plant; Oak Ridge, TN. Supervised preparation of technical and cost proposal, developed budgets, and managed costs. Provided leadership to a multi-disciplinary team of scientists and engineer in preparation of the RI Work Plan and facilitated a Data Quality Objective Workshop with the client and regulatory agencies.

Project Manager, Reduction of Mercury in Plant Effluent for the Y-12 Plant; Oak Ridge, TN. Directed the preparation of a quality assurance plan and sampling and analysis plan aimed at identifying mercury contamination within process equipment and piping.

Project Manager, Preparation of Quality Assurance Program Plan for the Y-12 Plant Oak Ridge TN. Prepared budget and managed costs as well as mentor junior employees on technical issues and project management. Project consisted of observing and identifying the work processes for one of the largest groundwater monitoring programs in the nation and recommending quality assurance requirements to ensure the goals of the program are achieved.

Project Manager, Preparation of Mercury Integration Strategy Plan for the Y-12 Plant Oak Ridge, TN. Prepared budget and managed costs and provided technical leadership to the project team. Project consisted of working with the client to establish a strategy for handling mercury issues.

Project Manager, Geotechnical Support Savannah River Site. Responsible for establishing project budget and creating and motivating a team of geologists to perform on-site geologic analysis of sediment core samples. Created a work team approach to quality assurance that has resulted in continued work and the hiring of additional staff.

Project Manager, M-Area Safety Analysis Report Chapter 3. Responsible for all aspects of the project. Supervised a technical staff of five and interfaced with the client on a daily basis. This project characterized the geography, demography, hydrology and geology for nuclear facilities at the Department of Energy's Savannah River Site.

Other previous work performed include: preparing RCRA closure plans, RFI work plans, underground storage tank site investigation plans, preliminary assessments, site investigations, aquifer analysis, monitoring well installation, soil sampling, and groundwater sampling.

April 1987 to May 1988, Advanced Sciences, Inc. Oak Ridge, TN. Mr. Kegley worked as a hydrogeologist in the Oak Ridge Office. He designed and supervised the installation of a monitoring well network, sampled groundwater and soils for the Fernald RI/FS, assisted with a shallow geophysical survey program, surveyed surface soils for radiation contamination using a pressurized ionization chamber, and provided technical oversight for an underground storage tank remediation project. He also prepared plans for decontamination and decommissioning of DOE surplus facilities and hazardous waste sites.

COMPUTER PROFICIENCY:

Microsoft Word, Word Perfect, Excel, Surfer, Grapher, McGridzo, Reflex, Granulo, Quattro Pro, Windows, Claris CAD, MacDraw Pro, Harvard Graphics, Graphic Impact,

MISCELLANEOUS:

1993 Adjunct professor to the Earth Sciences Department Tennessee Technological University. Presented lectures on
principals of groundwater flow and aquifer analysis for Hydrogeology 471/571.

Member, Association of Ground Water Scientists and Engineers

Professional Geologist, State of Tennessee No. TN0156
Professional Geologist, State of Georgia 1125
OSHA Health and Safety Training, 40 hours, 1987, Last 8 hour update Sept. 1993.
OSHA 8 hour Supervisors Training 1994
National Water Well Association Short Course: Principles of Groundwater Hydrology, January 23-25, 1989

Kegley, W.P., D.S. Snipes, S.M. Benson, W.C. Fallaw, V. Price, D. J. Colquhoun, 1992. Use of a minipermeameter to determine the spatial distribution of permeability in unconsolidated Tertiary sediments in the updip coastal plain of South Carolina: Geological Society of America, Abstracts with programs, southeastern section v. 24, n. 2, p. 23.
Kegley, W.P., S.M. Benson, D.S. Snipes, W. C. Fallaw, V. Price, 1993. Determination of the variability of permeability within unconsolidated sediment from the South Carolina Coastal Plain. American Geophysical Union 1993 Spring Meeting, EOS, April 20, page 142.

Kegley, W.P., S.M. Benson, D.S. Snipes, W. C. Fallaw, V. Price, 1993. Significance of Stratigraphic Controls on Groundwater Flow in The Coastal Plain of South Carolina. American Geophysical Union, EOS, Vol. 74, No 43, p 283.

Benson, S.M., J. Dagget, S. Brame, W. Kegley, J. Moore, R. White, D. Snipes, and V. Price, 1992. A high speed high-resolution data acquisition system for pump tests: Geological Society of America, Abstracts with programs, southeastern section v. 24, n. 2, p. 3.

Snipes, D.S., Stieve, A., Price, V., Fallaw, W.C., Kegley, W.P., and Dagget, J.S., 1992. Middle Eocene "green clay interval" at the Savannah River Site, South Carolina: Geological Society of America, Abstracts with programs, southeastern section v. 24, n. 2, p. 65.

Smith, N., W.C. Fallaw, W.P. Kegley, D.S. Snipes, and V. Price, 1992. Grain Morphology in Eocene sediments at the Savannah River Site, South Carolina: Geological Society of America, Abstracts with programs, southeastern section v. 24, n. 2, p. 65.

Fallaw, W.C., D.S. Snipes, W.P. Kegley, V. Price, 1993. Eocene hydrostratigraphic units in outcrop and in subsurface, Southwestern Coastal Plain of South Carolina. Accepted to Geological Society of America for national meeting in Boston.

CUSTOMERS:

Department of Energy
Department of Defense

REFERENCES:

AVAILABLE UPON REQUEST

SAIC FIELD MANAGER/CHEMICAL QUALITY ASSURANCE/QUALITY CONTROL OFFICER
KEN SWAIN

KENNETH W. SWAIN

EDUCATION:
University of North Carolina at Wilmington: M.S. Coastal Geology, 1993
Virginia Polytechnic Institute and State University: B.S. Geology, 1990

SECURITY CLEARANCE:

L-Clearance

WORK SUMMARY:

Mr. Swain is a professional geologist (TN) with five years of experience in environmental investigation, monitoring, assessment, evaluation and project support. He has been involved with a variety of multi-disciplinary environmental Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) projects for the U.S. Department of Energy and U.S. Department of Defense. Mr. Swain has experience as project manager, field operations manager, project geologist, field team leader, site health and safety officer, and groundwater modeler for projects in compliance with RCRA, CERCLA, and State regulations and co-authored Remedial Investigation Reports, Sampling and Analysis Plans, Groundwater Monitoring Programs and assisted in computer modelling of contaminant fate and transport for RI reports at various facilities.

In addition to environmental geology, Mr. Swain has three years experience in academic-based research of the Zeke's Island component of North Carolina National Estuarine Research Reserve coordinated through NOAA's National Estuarine Research Reserve System. His thesis research was primarily on assessing the effects of coastal engineering structures on near-shore and estuarine sediment transport and deposition. Changes in sediment budget were correlated to changing patterns of high and low marsh flora and fauna. He has served as surveyor and mapping coordinator on four topographical surveys of intertidal marsh areas in North and South Carolina. He has planned and implemented surface sampling and vibracoring schemes, assisted in diver-deployed vibracore retrieval in the near-shore environment, side-scan sonar surveys, constructed sediment budgets, and mapped saltmarsh growth using direct observance and remote sensing techniques.

PROFESSIONAL EXPERIENCE:

March 1993 to present, Geologist/Field Operations Manager, Science Applications International Corporation (SAIC). Mr. Swain has served as a geologist in the Engineering and Environmental Analysis Division at the Oak Ridge office and has participated in project technical support and field activities. Currently, Mr. Swain is the project manager of the Fort Campbell Woodlawn Road Landfill Groundwater Montioring and Assesment project under the USACE

Nashville office. In this position Mr. Swain is responsible for managing all aspects of compliance monitoring of groundwater for the landfill in the office and in the field. This position requires Mr. Swain to act as project manager, field operations manager, site health and safety officer, CCQC representative and QA/QC officer. He was field team leader for the characterization of the East Tennessee Technology Park Removal Action Ponds Sampling. Mr. Swain was instrumental in the approval and use of a vibracoring system to characterize the lateral and vertical nature and extent of contamination of the ETTP ponds and wetlands.

Mr. Swain was field operations manager of the Phase II RFI for Fort Knox Solid Waste Management Unit Groups 1 and 2 and coauthor of the Phase II RFI reports implemented through the USACE. Prior to this, Mr. Swain was the field team leader for fluvial and lacrusine sediment sampling as well as soil sampling for the Ravenna Army Arsenal Plant Phase I sampling for an R.I also under the USACE. He also served as Field Operations Manager during one third of the field activities.

Mr. Swain was field operations manager for the ES ETS Contract for the Oak Ridge Y-12 Plant Bear Creek Valley (BCV) Floodplain Soil Sampling (FPSS) RI Field Activities. This RI incorporated a unique and innovative approach to the environmental investigation which allowed the sampling locations to be selected and the number of characterization samples to be limited by radiation, PCB, and volatile organic screening technologies. Mr. Swain coauthored the Sampling and Analysis Plan (SAP) and ensured all aspects of the SAP were conducive to the interdisciplinary needs of the Y-12 Plant Environmental Restoration, Oak Ridge National Laboratory Environmental Services Division and SAIC. He was the project field operations manager and was responsible for daily field decisions following the observational approach written into the SAP, supervision and mentoring of the subcontractor field sampling team, interaction with the project manager and the client technical lead to ensure optimal characterization by sampling, and participating in SAIC, Y-12 Plant and DOE field surveillances. This project resulted in the identification of a previously unknown source area for which no historical records are known to exist.

Mr. Swain also served as Field Team Leader for the ES ETS Contract for the Oak Ridge Y-12 Plant BCV OU 1 RI FA. This RI utilized innovative waste minimization technologies by using the Geoprobe direct-push soil and water sampling methodologies. This project consisted of conducting an environmental investigation of the S-3 Ponds, the Boneyard/Burnyard, the Sanitary Landfill I, Oil Landfarm, and the Burial Grounds. Mr. Swain was responsible for ensuring that all activities were in compliance with DOE, Y-12 Plant, RCRA and CERCLA regulations as well as lithology logging, soil and groundwater sampling, defining water zones to be sampled, supervision of subcontractor personnel, participation in Y-12 Plant and DOE surveillances and interaction with the client technical lead.

Mr. Swain assisted in fate and transport modelling of the burial grounds at the K-25 Facility, Bear

Creek Valley Operable Units at the Y-12 Plant in Oak Ridge, TN, and other sites included in RIs for U.S. Army Arsenal Plants in Alabama, and the U.S. DOE Savannah River Site. His responsibilities included SESOIL, ODAST, HELP, CRAFLUSH and partitioning modeling of the source units, source term data and sensitivity analysis of the modelling. He also contributed in the writing of the RI report the associated reports.

Mr. Swain also served as project geologist for the ES ETS Contract for the Oak Ridge Y-12 Plant BCV OU 2 RI which included field investigation activities and coauthoring the RI report.
The field portion of the investigation consisted of conducting an investigation of the SY-200 yard, the RUST Spoil Area, and the Spoil Area 1 by implementing the RI Workplan. His responsibilities included subsurface soil sampling by split spoon, shelby tube and auger cutting collection; surface water sampling; groundwater well installation, development and sampling; sample management and shipping; and field team leader duties in the absence of the field team leader. After field activities, Mr. Swain evaluated soil data, performed fate and transport modelling, and coauthored the RI report.

August 1990 to March 1993, Research Assistant, The Center for Marine Science Research, University of North Carolina at Wilmington, NC. Through this position, Mr. Swain planned and implemented an interdisciplinary study on the effects of artificial inlet closure on sediment budget, coastal processes and circulation patterns in an adjacent estuary and on adjacent near-shore processes. His research has shown the value of the unique back-barrier dam at Fort Fisher, NC, for producing productive intertidal marsh communities as well as achieving inlet closure. His research has shown the importance of tidal prism in determining estuarine morphology and circulation patterns and the its importance in coastal hazard modeling programs and feasibility studies involving coastal engineering projects. He was also responsible for additional field and computer assistance to a marine geologist and a barrier island ecologist. His responsibilities included sample collection and lab analysis and working with the National Oceanic and Atmospheric Administration's National Undersea Research Program. He has extensive experience in various sedimentological laboratory procedures, intertidal and subtidal surveying, flora and lithologic mapping, surface sediment collection and subsurface sediment collection by land-based and diver-deployed vibracoring systems.

April, 1992, Mapping Coordinator and Surveyor, U.S. Army Corps of Engineers, University of North Carolina, Wilmington, NC,
In the spring of 1992, Mr. Swain was mapping coordinator and surveyor for a project funded by the U.S. Army Corps of Engineers. His responsibilities included training of assistants, equipment procurement, surveying, and production of a publishable topographic map. The results of this study are being used to formulate a method of determining marsh elevation from aerial photography. The effects of elevation on vegetation type in the absence of a salinity gradient are also being conducted using the data collected from the project.

May 1990 to June 1990, Field Assistant, Boston University's Geology Field Camp. Mr. Swain

was a field assistant for Boston University's geology field camp in the summer of 1990. He was responsible for the general welfare, transportation, and instruction assistance of 20 students. Instruction assistance included field mapping, map drafting, report writing, and rock and sediment identification in Nova Scotia (Bay of Fundy), Quebec and North Central Maine.

June 1981 to January 1986, Forestry Technician, Chesapeake Corporation, West Point, VA. Prior to beginning work on his B.S. in Geology in 1986, Mr. Swain worked in the forestry industry. He served as a forest technician, land management technician, heavy equipment operator, and woodyard manager for Chesapeake Corporation from 1981 to 1986.

COMPUTER PROFICIENCY:

Experience includes Word Perfect, Lotus 123, Survey Pac, Harvard Graphics, SESOIL, ODAST, Excel, PowerPoint and Surfer.

MISCELLANEOUS:

Registered Geologist with the State of Tennessee (TN 3358)

Member of East Tennessee Geological Society

Hazardous Materials Transportation Act (HM-126F)

40-hour OSHA Hazwoper (29 CFR 1910.120)

Rad Worker II Trained

United States Environmental Protection Agency Hazardous Waste Site Field Sampling Workshop

Attendee of National Ground Water Association Outdoor Action Conference and Exposition

Fixed Price Project Management Training

Publications

Swain, K. W. and W. J. Cleary, Artificial Inlet Closure and Estuary Evolution: Zeke's Island Estuary, NC, USA. 1994, 14TH International Sedimentological Congress, Recife, Brazil. Presentation and published abstract.

Swain, K. W., 1992, "The Rocks–An Engineering Feat and Benefit to All," American Society of Civil Engineers, Wilmington Chapter, Oral presentation.

Swain, K. W. and W. J. Cleary, 1992, Modification of a Coastal Plain/Bar-Built Estuary, Southeastern NC, (Abs.) Geol. Soc. Amer., Southeastern Sectional Meeting, Abs. with Programs, v.24, no.2, p. 69.

Swain, K. W., W. J. Cleary, and P.E. Hosier, 1991, Inlet Closure and Estuary Infilling within Zeke's Island National Estuarine Research Reserve, North Carolina (Abs.) Geol. Soc. Amer., Combined Northeastern and Southeastern Sectional Meeting, Abs. with Programs, v.23, p.136.

SAIC HEALTH AND SAFETY OFFICER
STEPHEN L. DAVIS

STEPHEN LAMAR DAVIS, CIH, CSP

Position with Company: Assistant Vice-President for Environmental Health and Safety Services

Education:
University of South Carolina: M.S.P.H., Industrial Hygiene, 1983
Valdosta State College: B.S., Zoology, 1975

Summary of Experience:
Mr. Davis has 15 years of experience in industrial hygiene and environmental health. This experience includes research, program management, project management and line management. He has delivered in excess of 200 training courses for clients such as the US Navy, US Army Corps of Engineers, US Environmental Protection Agency, state of California, state of Nevada, Martin Marietta Energy Systems, Boeing, Hughes Aircraft, McDonald Douglas, etc. Courses include; 40 hour Hazardous Waste Operations as required by 29 CFR 1910.120, Hazardous Waste Operations Refresher as required by 29 CFR 1910.120, Hazardous Waste Operations for Supervisors as required by 29 CFR 1910.120, the suite of Hazardous Material Response courses as required by 29 CFR 1910.120, Hazard Appraisal and Recognition Planning for state inspection personnel, Hazardous Materials Landfill Safety for state inspectors, Air Monitoring for Hazardous Materials, AHERA Asbestos Abatement Worker, and AHERA Asbestos Abatement Supervisor. He has also spoken at American Society for Testing and Materials (ASTM) sponsored meetings on protective clothing performance, at American Board of Industrial Hygiene sponsored meetings on hazardous waste and at U.S. Environmental Protection Association (EPA) sponsored meetings on design and construction issues at hazardous waste sites. He has performed hazard assessments in operations including; plastics manufacturing, metal working, cloth dyeing, carpet manufacturing, fabric production, paper production, vehicle maintenance, laboratory analysis, automotive parts production, food processing, and others. He has written or reviewed dozens of health and safety plans for remedial investigations and remedial actions involving contaminants such as uranium, thorium, technetium, plutonium, acidic sludge, dioxins, carbon disulfide, polychlorinated biphenyls, vinyl chloride, benzene, partially buried unexploded ordnance, etc. Tasks addressed in these plans include monitoring well installation, incineration, slurry wall installation, excavation, subsurface soil sampling, surface soil sampling, groundwater sampling, surface water sampling, lake water sampling from boats, macroinvertebrate sampling from boats, small mammal trapping, electrofishing, air sampling, waste lagoon sampling, waste treatability studies, underground storage tank removal, etc. He has served as site health and safety officer for spill responses and remedial projects involving PCBs, dioxins, gasoline, acid wastes, radioactive wastes, and miscellaneous solvents.

- On-site health and safety support for gasoline spill response. Served as SHSO and response team leader on a response to gasoline spilled from a tanker at a trucking facility immediately adjacent to a creek and residential area. The spilled gasoline reached into the back yards of several of the neighboring homesites. The onsite work began in the early evening and extended continuously for the next two days. Response activities included participating in options assessments (containment, residential fire potential, potential environmental damage), operating large skimmers, collecting gasoline-water mix into a phase-separation tank, placement and removal of boom and sorbent, and excavation.

- On-site health and safety support for methyl ethyl ketone spill. Served as SHSO for response to methyl ethyl ketone released from a box trailer on a truck stop parking lot. The response was initiated by the shipping company when the driver entered the trailer to investigate dripping liquid, became disoriented and fell from the back of the trailer. Response activities included locating and overpacking leaking drums.

- On-site health and safety support for dioxins remediation. Served as SHSO on a project involving remediation of dioxin contamination at a former herbicide plant. Activities included training, verifying safe operation, collecting air samples, and collecting soil samples.

- Industrial hygiene support for remedial investigation on the U.S. Department of Energy (DOE) Feed Materials Production Center, Fernald, Ohio. The primary objective of this activity was to attain compliance with the requirements of 29 CFR 1910.120, the Hazardous Waste Operations and Emergency Response standard. Site contaminants included uranium, technetium, thorium, kerosene, and trichloroethylene. Activities included detailed on-site hazard assessment, coordination with DOE representatives, air monitoring, and production of over 20 task-specific health and safety plans.

- Job hazard analyses for Ft. Bliss Army Post. Managed and participated in a project to perform hundreds of job hazard analyses at the Ft. Bliss Army Post for AIRHAS (HAZWRAP). On site work consisted of interviewing army personnel, observing operations, inventorying chemicals, assessing the nature and severity of potential exposures, and identifying issues that needed immediate attention. The project also included reducing the data to Army codes and entering the accumulated data into the Army's Health Hazard Information Module database.

- Compliance audit for Martin Marietta Energy Systems. Participated in an audit to assess the state of compliance with paragraph 8(e) of the Toxic Substances Control Act. This project included interviewing key personnel in the medical, industrial hygiene, and safety departments at five Department of Energy sites, assessing interview results to determine if information met the regulatory reporting requirements, and generating a final report containing a summary of results and recommendations on what data should be reported to the EPA.

- Participation in the development and delivery of "Air Surveillance for Hazardous Materials," a 4-day course conducted for the California Specialized Training Institute. The course was designed to enable students to calibrate and operate commonly used real-time instruments. The program included detailed interpretation of instrument readings in a variety of realistic field exercises. During these exercises each student used each type of monitoring instrument to reach conclusions about the identity and concentrations of airborne hazards. The field exercises were followed by intense classroom analysis in which the students made hazard assessments and defended their findings.

- Chemical spill response training. Participated in a project to provide 7 sessions of hazardous materials technician training to emergency squad members at the Department of Energy Y-12 site in Oak Ridge, TN. This training included site specific requirements such as multi-group interface, notification procedures, exotic chemical hazards, and radiological hazards.

- Hazardous waste training. Presented over fifteen 24 hour SARA/OSHA hazardous waste safety courses at the Department of Energy K-25 Site in Oak Ridge, TN. These courses consisted of modules developed by the K-25 Site training staff and included site specific hazards, alarms, and programs.

- Developed and delivered asbestos abatement worker training to meet the New Jersey asbestos abatement regulations. The course was specifically created to satisfy the stringent state requirements. A total of 11 presentations were made.

- Delivered asbestos abatement worker and supervisor training. Managed and participated in a program that delivered AHERA compliant training in multiple locations across the continental US.

Security Clearance:
Department of Energy Q clearance

Registration and Certifications:
Certified in the Comprehensive Practice of Industrial Hygiene by the American Board of Industrial Hygiene (#4213)
Certified Safety Professional by the Board of Certified Safety Professionals (#10044)

Professional Memberships:
American Academy of Industrial Hygiene
American Industrial Hygiene Association - Current member of Local Sections Council and current president of Tennessee Valley Section
American Society of Safety Engineers
American Society for Testing and Materials - Former member, Committee F-23 on Protective Clothing
American Society for Testing and Materials - Former member, Task Force on Environmental Suit Standardization
Hazardous Waste Action Coalition - Current member, Health and Safety Subcommittee

SAIC QUALITY ASSURANCE/QUALITY CONTROL OFFICER
C. GLEN COWART

C. GLEN COWART

EDUCATION

M.S., Library and Information Science, University of Tennessee, 1976
B.S., Business Administration, Auburn University, 1973

PROFESSIONAL SUMMARY

Nineteen years experience in Quality Assurance, Configuration Management, Information Management and Project Control. This includes managing and directing QA organization activities, evaluating technical projects for application of quality assurance program requirements, developing and implementing quality assurance plans and procedures, verifying compliance with quality assurance requirements through audit and surveillance, and reviewing support contractors QA programs. Additional expertise includes developing and managing document control systems; and implementation of configuration control systems through baseline maintenance, status reporting and configuration control board support.

PROFESSIONAL EXPERIENCE

Science Applications International Corporation (SAIC)
QA/QC Officer, 1992-Present

Responsible for oversight of all QA activities in the Engineering and Environmental Compliance Group (EECG) at SAIC to include:

- Maintaining and enhancing the EECG QA Program, to include the QA Program Plan, QA Administrative Procedures, other procedures assigned for document control to the QA Department. Approve QA documents and revisions thereto.
- Maintaining a close working relationship with the EECG field and laboratory QA staff.
- Managing the QA service center budget.
- Providing training in quality principles and practices to EECG staff.
- Maintaining EECG continuous improvement processes, e.g., NCR and Corrective Action systems, lessons learned coordination, self-assessment coordination, client assessment tracking and reporting, and the training database.
- Maintaining an annual self-assessment schedule (audit, surveillance, appraisal, assessment, review, etc.).
- Conducting, reporting, and following-up on assessments.
- Maintaining an interface with other SAIC quality organizations and with client quality representatives.
- Maintaining and enhancing operation of the EECG Central Records Facility.
- Managing and providing leadership to QA organization staff.
- Maintaining awareness of changes in quality philosophy and requirements.
- Assisting EECG organizations during assessment activities performed by clients, to include corrective action and root cause analysis, as needed.
- Providing regular reports of QA organization activities.
- Acting as QA/QC Officer for specific projects, as needed.
- Maintaining project-specific QA Program Plans and Procedures, as needed.

C. GLEN COWART

Tennessee Valley Authority
Information Systems Specialist, 1977-1980

Supervised retrieval activities in the Technical Information Center which covered extensive documentation on nuclear, fossil, and hydro power projects dating to the inception of TVA.

PERSONAL

Citizenship:	U.S.A.
Clearances:	Active DOE Q Inactive DoD Secret
Professional:	American Society for Quality Control ASQC Certified Quality Auditor (# 6141)

SAIC LABORATORY COORDINATOR
NILE A. LEUDTKE

NILE A. LUEDTKE

Current Position: Analytical Services Coordinator/Senior Analytical Chemist

SAIC Group/Division/Location: E&ECG, Environmental Information Analysis Division (1033), Oak Ridge

Years of Experience with SAIC: 3 (9/92 start date)

Years of Experience with Other Firms: 18 (1974-92)

Education:

University of Rhode Island, Kingston, RI: MS, Analytical Chemistry, 1975
Hartwick College, Oneonta NY: BA, Chemistry, 1972

Professional Registrations/Certifications (discipline and date for each state): None

Key Words: analytical chemistry, quality assurance, quality control, environmental programs, environmental data assessment, laboratory interfaces, data quality objectives, data quality assessments

OVERVIEW OF EXPERIENCE

Mr. Luedtke's experience encompasses analytical chemistry and Quality Assurance/Quality Control (QA/QC) aspects of a wide variety of environmental issues. His 20+ years of professional achievement have focused on the development and implementation of sampling and analytical QA/QC for nationally recognized environmental programs. Environmental sampling and analysis program interactions have encompassed the complete scope of governmental organizations, including DOE, DoD, EPA, NSF, and State Agencies. Work has included authorship and review of DOE Laboratory Management Division Analytical Sampling Program Supplements to the DOE Environmental Management, Quality Assurance Requirements and Description document addressing sampling protocol, analytical laboratory protocol, field assessment, laboratory assessment, and management assessment of environmental programs. Efforts have centered on the review and management of environmental program planning, sampling operations, analytical laboratory performance, data validation, data quality assessment and usability, and project reporting. The scope of these activities has included the organization and direction of professional staff to implement analytical laboratory and field surveillance for national programs review and to provide chemical and geological expertise to the environmental program management of DOE and DOD.

Analytical laboratory involvement has included extensive experience with atomic absorption spectroscopy, inductively coupled plasma emission spectroscopy, gamma spectroscopy, alpha spectroscopy, neutron activation analysis, classical and automated wet chemical methods, and radioactive tracer techniques. Responsibilities have included analytical method development, coordination of laboratory QA programs, and supervision of analytical laboratories supporting academic research, commercial environmental production, and Naval nuclear reactor prototype operations. Activities have encompassed analysis and characterization of environmental media (water, sediment, biological tissues, sludges, industrial waste effluent, and hazardous waste), implementation of environmental QA/QC programs, investigation of deep ocean hydrothermal processes, and geochemical flux studies of the near shore environments.

Senior Environmental Scientist, Energy Resources Co., Inc., (became ENSECO), Environmental Sciences Division, Cambridge, MA. 1/80-9/84.
Inorganic laboratory manager, environmental project manager, QA/QC Coordinator.

Marine Research Specialist, University of Rhode Island, Graduate School of Oceanography, Narragansett, RI. 8/74-12/79.
Near shore and deep ocean chemical and geochemical investigations.

PROFESSIONAL AFFILIATIONS:

American Chemical Society
American Society for Quality Control (Environmental Restoration Committee)
American Society for Testing and Materials (D-34 Committee)

PUBLICATIONS AND PRESENTATIONS:

J.H. Moyer, B.D. Nourse, N. Luedtke, J. Hodgins, "Application of Historical Waste Inventory Data from the Bear Creek Valley Burial Grounds to the Baseline Human Health Risk Assessment", DOE's Technical Information Exchange Quarterly, August 1995.

Luedtke, N. A., "Assessment of Analytical Data Quality to Provide Management Confidence", The Sixth International Environmental Quality and Waste Management Conference, Denver, Colorado, April 1995.

Luedtke, N. A. and Pardue, G. J., "Initiatives in Communication Between Environmental Projects and Analytical Laboratories to Improve Data Quality", Twentieth Annual National Energy and Environmental Quality Division Conference, Indian Wells, California, September 1993.

Luedtke, N. A., "Integrity and Auditing", Environmental Testing and Analysis, July/August 1993.

Luedtke, N. A., Barnard-Hatmaker, A., and Halouma, A. A., "Integration of Environmental Analytical Laboratory Review for the Oak Ridge DOE Complex," Presentation to 32nd. ORNL-DOE Conference on Analytical Chemistry and Energy Technology, October 1992.

Luedtke, N. A., "Programmatic Analytical Quality Control for Environmental Investigations," Presentation to 19th. Annual National Energy and Environmental Quality Division Conference, ASQC, September 1992.

Luedtke, N. A., "US DOE Environmental Management (EM) Analytical Services Program Analytical Laboratory Aspects Guidance for EM Environmental Sampling and Analysis Activities - Draft," August 1992.

Luedtke, N. A. and Bartling, M. H., "US DOE Environmental Management (EM) Sampling Aspects Guidance for EM Environmental Sampling and Analysis Activities - Draft," July 1992.

Luedtke, N. A., Maney, J. P., and Sayers W., "DOE Analytical Services Program QA Requirements Document for Environmental Sampling and Analysis Activities in Support of Environmental Restoration and Waste Management Programs," Draft Document, March 1992.

Luedtke, N. A. and Engels J. L., "Requirements for Quality Control of Analytical Data on Energy Systems Environmental Restoration Projects," ES/ER/TM-16 Draft, February 1992.

Luedtke, N. A. and Bender, M. L., "Tracer Studies of Sediment-Water Interactions in Estuaries." Estuarine and Coastal Marine Science, 9: 643-651, 1979.

Froelich, P. N., Klinkhammer, G. K., Bender, M. L., Luedtke, N. A., Heath, G. R., Dauphin, J. P., Cullen, J. D., Hammond, D., Hartman, B., and Maynard, V., "Early Oxidation of Organic Matter in Pelagic Sediments of the Eastern Equatorial Atlantic: Suboxic Diagenesis." Geochimica et Cosmochimica Acta, 43: 1075-1090, 1979.

Luedtke, N. A. and Bender, M. L., "Tracer Study of Sediment-Water Interactions in Estuaries." American Geophysical Union Conference, San Francisco, Fall 1977.

Luedtke, N. A., Fasching, J. L., Hammock, J. P., "Elemental Analysis of Selected Sediments by Neutron Activation Analysis (NAA) and Atomic Absorption Spectroscopy (AAS)." The Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, paper no. 120, 1975.

Luedtke, N. A., "A Preliminary Investigation into the Use of an Elemental Analysis in the Correlation of Sediments from Lake Rudolf, Kenya." Master's Thesis, University of Rhode Island, 1975.

SAIC DATA MANAGER
JAN M. COE

JAN M. COE

EDUCATION:

B.S., Environmental Science and Biology, Centre College of Kentucky, 1979, 3.6 GPA

SECURITY CLEARANCE:

DOE Q

WORK SUMMARY:

Ms. Coe has extensive experience in integrating data from multiple data bases and multiple platforms and formats into comprehensive and usable data systems. Ms. Coe has 17 years of experience in designing and building environmental data bases in support of Environmental Restoration studies, Environmental Compliance and Monitoring activities, and in support of fossil fuel and acid rain pollution research. She has provided statistical, graphical and modelling analysis support for environmental information involving remedial investigations under Resource Conservation and Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Formerly Utilized Sites Remedial Action Program (FUSRAP), Baseline Risk Assessments for both chemical and radiological waste, atmospheric deposition effects, streamwater chemistry, probability of fish presen for the development of procedures, processes, and programs related to all aspects of environmental data management. Ms. Coe served as Section Manager for the Environmental Data Management and the Data Evaluation and GIS Sections of the Environmental Information Analysis Division of SAIC. In this capacity she had line management responsibility for up to 14 employees. She served as data management task leader for the Y-12 Bear Creek Valley OU2 Remedial Investigation and provided data management oversight and analysis support to the K-25 Groundwater Operable Unit Workplan project. Ms. Coe served as project manager for Environmental Technical Support Data Base Management Support for Martin Marietta Energy Systems, Inc. Y-12 Plant Environmental Restoration Program, as overall data management task leader for FUSRAP at SAIC, as project manager for Data Base Management Support to OREIS, a fixed price contract, and as data management task leader for the Air Force's King Salmon Airport, AL Remedial Investigation/Feasibility Study (RI/FS) site. Ms. Coe provided general data management support to the Y-12 ER program, supervised project staff in collecting and reformatting data from a variety of sources and media into the Oak Ridge Environmental Information System (OREIS) structures and provided input to the formation of program-wide data management procedures. She has interfaced with other organizations and contractors to create inter-organization data management processes, procedures, and structures for the development of procedures, processes, and programs related to all aspects of environmental data management. Ms. Coe served as Section Manager for the Environmental Data Management and the Data Evaluation and GIS Sections of the Environmental Information Analysis Division of SAIC. In this capacity she had line management responsibility for up to 14 employees. She served as data management task leader for the Y-12 Bear Creek Valley OU2 Remedial Investigation and provided data management oversight and analysis support to the K-25 Groundwater Operable Unit Workplan project. Ms. Coe served as project manager for Environmental Technical Support Data Base Management Support for Martin Marietta Energy Systems, Inc. Y-12 Plant Environmental Restoration Program, as overall data management task leader for FUSRAP at SAIC, as project manager for Data Base Management Support to OREIS, a fixed price contract, and as data management task leader for the Air Force's King Salmon Airport, AL Remedial Investigation/Feasibility Study (RI/FS) site. Ms. Coe provided general data management support to the Y-12 ER program, supervised project staff in collecting and reformatting data from a variety of sources and media into the Oak Ridge Environmental Information System (OREIS) structures and provided input to the formation of program-wide data management procedures. She has interfaced with other organizations and contractors to create inter-organization data management processes, procedures, and structures.

May 1990 to January 1992, Staff Engineer, H&R Technical Associates, Inc. Ms. Coe served as project manager and provided data base programming support for data base management support to the Oak Ridge Reservation Hydrologic and Geologic Survey (ORRHAGS). She provided data base management support to the Y-12 Groundwater Protection Program. During this time she developed a menu-driven system to provide electronic (DMRs) for the Y-12 National Pollutant Discharge Elimination System (NPDES) program.

June 1979 to April 1990, Computer Analyst/Laboratory Technician, Martin Marietta Energy Systems, Inc./Union Carbide Corporation, Oak Ridge National Laboratory. Ms. Coe provided user support for the SAS® Software System and prepared and presented lectures/training on various topics relating to SAS®. She designed a menu-driven application to integrate and present data from Environmental Protection Agency's (EPA) Carbon Dioxide Global Effects Data base; provided data management services and statistical programming for EPA's Baseline Probability of Presence project; performed the roles of data base manager, programmer and coordinator in establishing EPA's National Stream Survey Data base, Pilot and Phase I, part of the National Surface Water Survey; designed data entry systems for field survey data; designed and established datasets containing field and laboratory analyses and quality assurance parameters; coordinated the flow of data from the field, analytical laboratories, and QA/QC personnel; performed quality assurance updates; and integrated the data to create the final published National Stream Survey Data base. Ms. Coe designed and implemented a data base and data entry and integration system, and provided data base management support for the atmospheric chemistry portion of the Integrated Forest Study, a baseline research project funded by the Electric Power Research Institute (EPRI). She also collected and analyzed samples, and provided data management and statistical analysis for atmospheric deposition research funded by EPRI; analyzed particulate atmospheric deposition, both qualitatively and quantitatively, using Scanning Electron Microscopy; and conducted a study on the significance of winter season corticular photosynthesis in four species of deciduous trees.

COMPUTER PROFICIENCY:

Software: SAS® Applications System with special emphasis in DATA step processing, SAS/GRAPH, SAS/AF, SAS/FSP and SAS® used for environmental data management. Oracle, Excel, WordPerfect, Microsoft Windows, Microsoft Word.

Operating Systems: DOS/MSDOS, MVS, TSO, VMS, UNIX, and Windows95.

Networks: Experience in setting up Novell Netware Local Area Network Software and hardware

Special training as a computer trainer and consultant.

MISCELLANEOUS:

Organizational Conflict of Interest Training; SAIC, Oak Ridge, TN; 1993

Environmental Project Management Training; SAIC, Oak Ridge, TN; 1992

MMES General Employee Training; MMES, Oak Ridge, TN; 1992

Training as a workshop facilitator.

Facility in Sign Language for the Deaf and training as a Sign Language Interpreter.

Coe, J. M. and S. B. McLaughlin, *Winter Season Corticular Photosynthesis in Cornus florida, Acer rubrum, Quercus alba, and Liriodendron tulipifera*. Forest Science. 26, 561-6. 1980.

Coe, J. M. and S. E. Lindberg, *The Morphology and Size Distribution of Atmospheric Particles Deposited on Foliage and Inert Surfaces*. Journal of the Air Pollution Control Association. 37, 237-43, 1987.

Eshleman, K. N., M. J. Sale and J. M. Coe, *Assessing the Regional Significance of Acidic Episodes in Surface Waters Through Application of Empirical Models*. Spring Meet. Am. Geophys. Union, Baltimore, May 18-22, 1987. Abstract.

Lindberg, S. E., J. M. Coe and W. A. Hoffman, *Dissociation of Weak Acids During Gran Plot Free Acidity Titrations*. Tellus 36B, 186-91. 1984.

Lindberg, S. E., G. M. Lovett and J. M. Coe, *Acid Deposition/Forest Canopy Interactions: Final Report to the Electric Power Research Institute (Project RP 1907-1) - Period Covered: 1 April 1981 to 31 December 1984.* ORNL/FPO-85/13. 1984.

Sale, M. J., J. M. Coe and J. Messer, *Data Base Development for the National Stream Survey Poster Session, Regionalization of Aquatic Impacts Using the Adirondack Region as a Case Study*, Paul Smith College, New York, Aug. 19-22, 1985. Abstract.

Sale, M. J., P. R. Kaufmann, H. I. Jager, J. M. Coe, K. A. Cougan, A. J. Kinney, M. E. Mitch, W. S. Overton. *Chemical Characteristics of Streams in the Mid-Atlantic and Southeastern Untied States (Results of the National Stream Survey - Phase I), Volume II: Streams Sampled, Descriptive Statistics, and Compendium of Physical and Chemical Data*. EPA/600/3-88/021b. U.S. Environmental Protection Agency, Washington, D.C.

Turner, R. R., S. E. Lindberg and J. M. Coe, *Comparative Analysis of Trace Metal Accumulation in Forest Ecosystems*. pp 356-58, Proceedings for the International Conference on Heavy Metals in the Environment, Athens, Greece, Sept. 10-13, 1985, CEP Consultants Ltd., Edinburgh, Great Britain, 1985.

CUSTOMERS:

Martin Marietta Energy Systems, Inc.
Department of Energy (DOE)

REFERENCES:

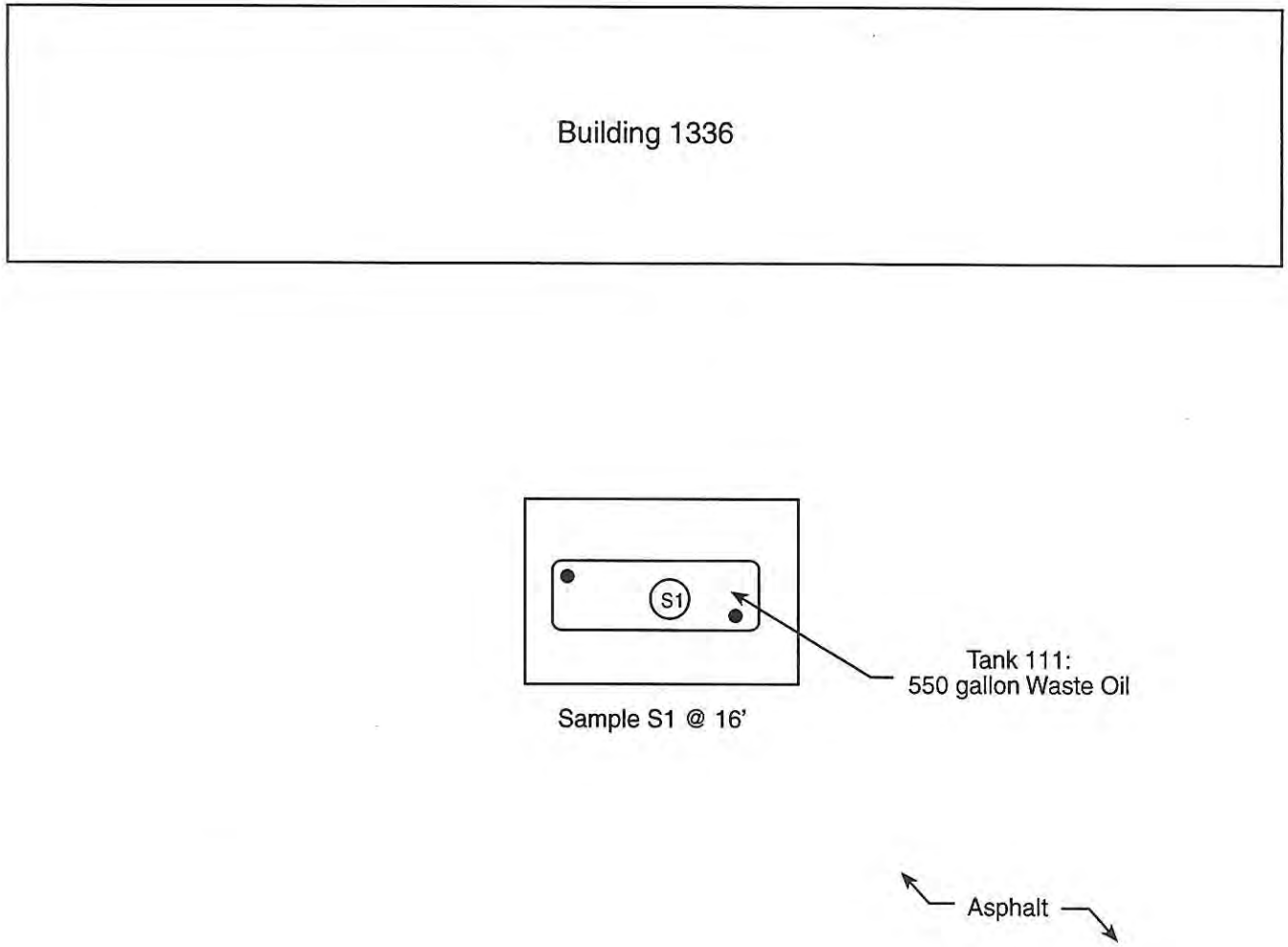
Tim Myrick, Deputy Group Manager of Programs, Engineering and Environmental Compliance Group, (423) 481-4676

Karen Daniels, Project Manager, Engineering and Environmental Compliance Group, (904) 651-1053

FIELD SAMPLING PLAN
FOR THE
CORRECTIVE ACTION PLAN-PART A INVESTIGATIONS
FOR FORMER UNDERGROUND STORAGE TANK SITES
AT
HUNTER ARMY AIRFIELD, GEORGIA

APPENDIX C

PROPOSED SAMPLING LOCATION FIGURES



Legend

- (S1) Location of Closure Sample
- ● Proposed Direct Push Sampling/Temporary Piezometer Location

Scale : 1" = 10'

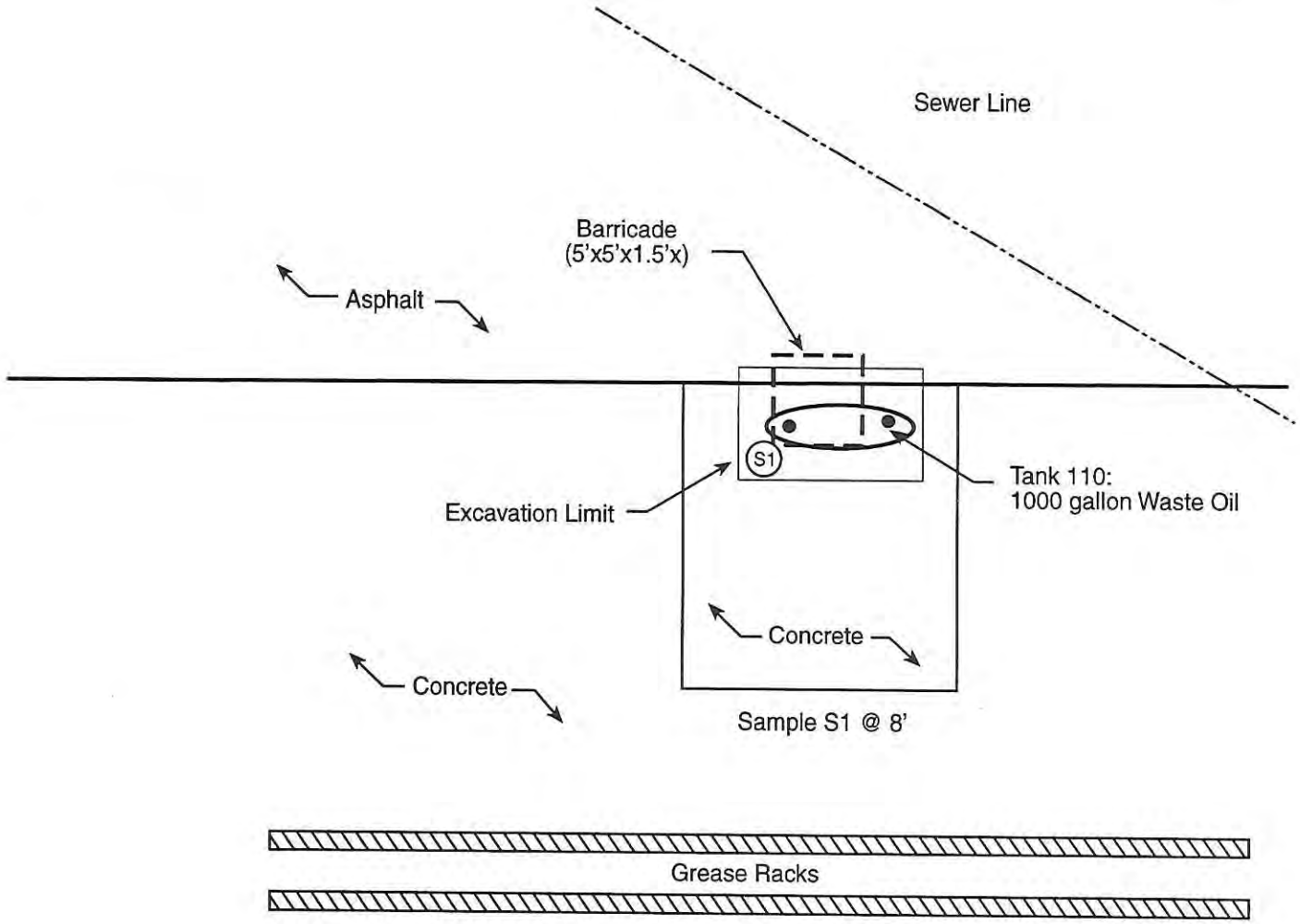
N

Source; Anderson Columbia Environmental, Inc., Tank Closure Report,1996

D. Lesslie 31-102797-063

U.S. Army Engineer District
Corps of Engineers
Savannah, Georgia
Hunter Army Airfield, GA

Figure C.1
Proposed Sampling Locations
Building 1336, Tank 111



Legend

- (S1) Location of Closure Sample
- ● Proposed Direct Push Sampling/Temporary Piezometer Location

Scale : 1" = 10'

N

Source: Anderson Columbia Environmental, Inc., Tank Closure Report, 1996

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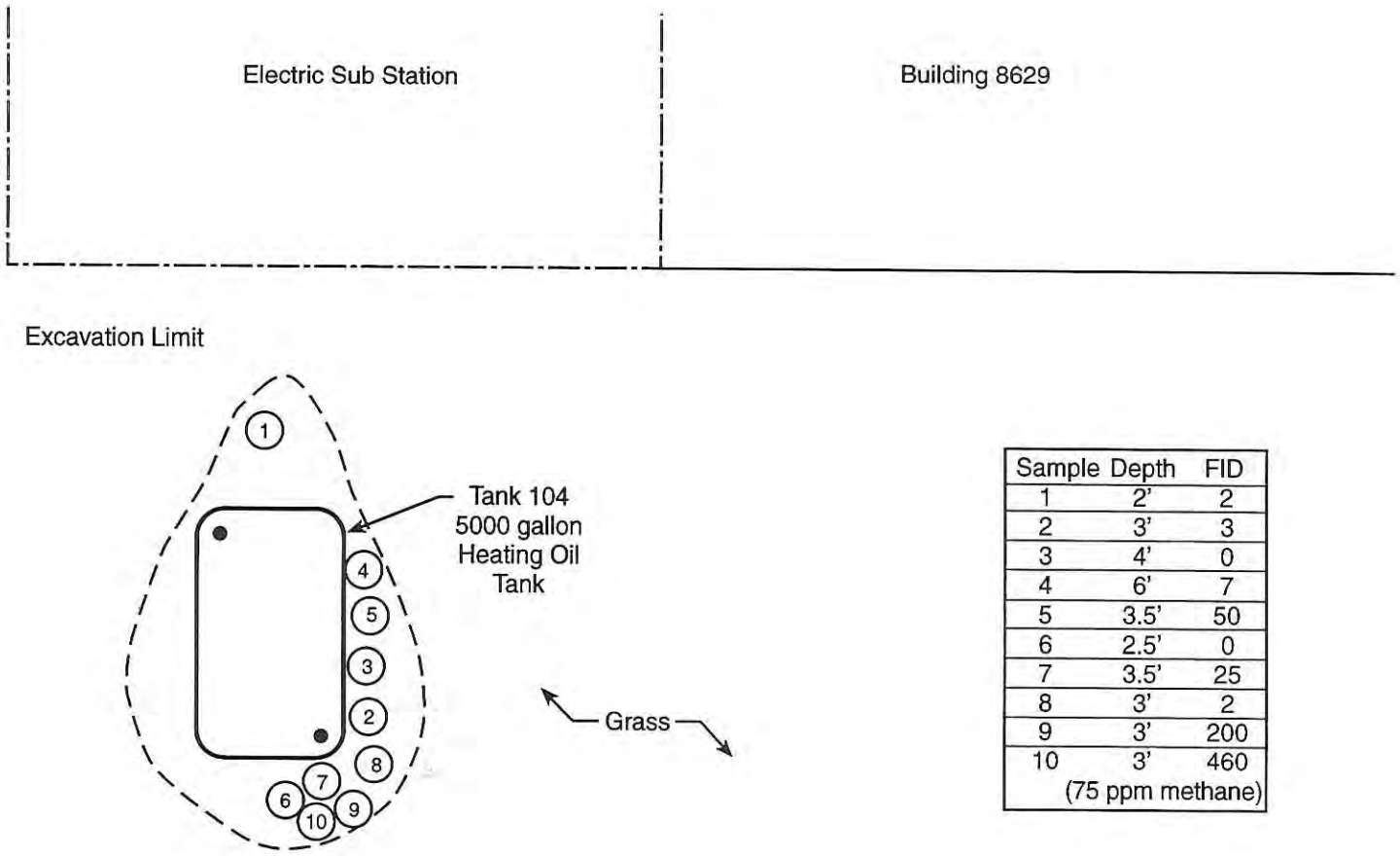
U.S. Army Engineer District
Corps of Engineers
Savannah, Georgia
Hunter Army Airfield, GA

Figure C.2
Proposed Sampling Locations
Building 1327, Tank 110



Sample	Depth	FID
1	2'	2
2	3'	3
3	4'	0
4	6'	7
5	3.5'	50
6	2.5'	0
7	3.5'	25
8	3'	2
9	3'	200
10	3'	460
(75 ppm methane)		

Legend

- (S1) Location of Closure Sample
- (4) Flame Ionization Detector (FID) Sample Location
- ● Proposed Direct Push Sampling/Temporary Piezometer Location

Scale : 1" = 10'

N

Source: Anderson Columbia Environmental, Inc., Tank Closure Report, 1996

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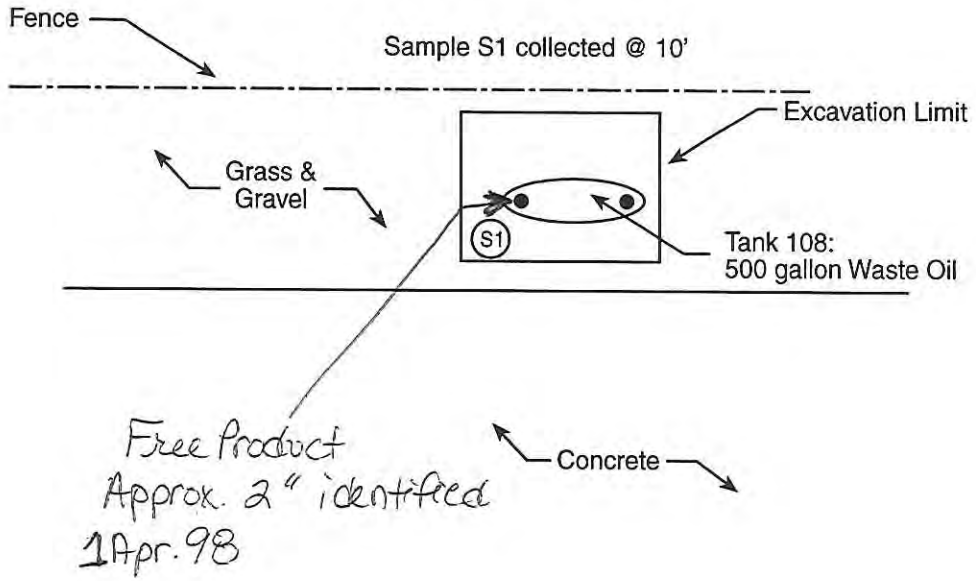
Corps of Engineers
Savannah, Georgia
Hunter Army Airfield, GA

Figure C.3
Proposed Sampling Locations
Building 8629, Tank 104



Legend

- (S1) Location of Closure Sample
- ● Proposed Direct Push Sampling/Temporary Piezometer Location

Scale : 1" = 10'

N

Source: Anderson Columbia Environmental, Inc., Tank Closure Report, 1996

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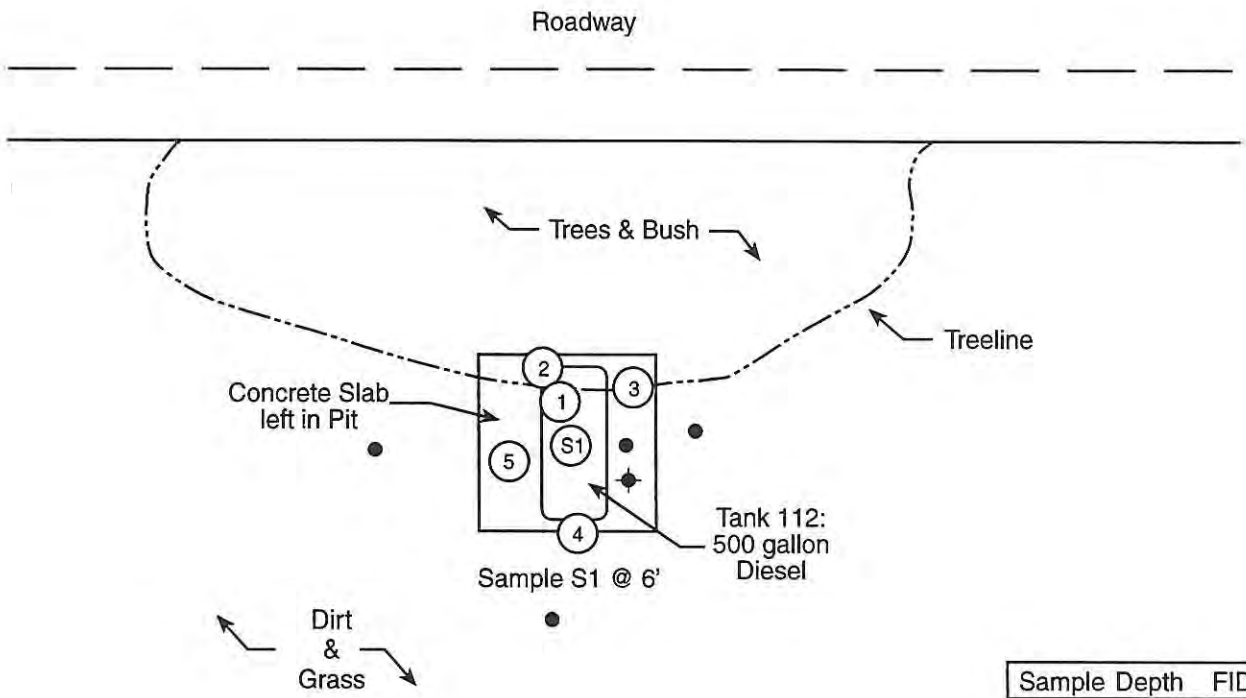
Figure C.4
Proposed Sampling Locations
Building 1346, Tank 108



Sample	Depth	FID
1	5'	140
2	3'	30
3	3'	110
4	4'	330
5	3'	30

Building 8464

Legend

- (S1) Location of Closure Sample
- (4) Flame Ionization Detector (FID) Sample Location
- • Proposed Direct Push Sampling/Temporary Piezometer Location
- ✦ Proposed Vertical Profile Boring

Scale : 1" = 10'

N

Source: Anderson Columbia Environmental, Inc., Tank Closure Report, 1996

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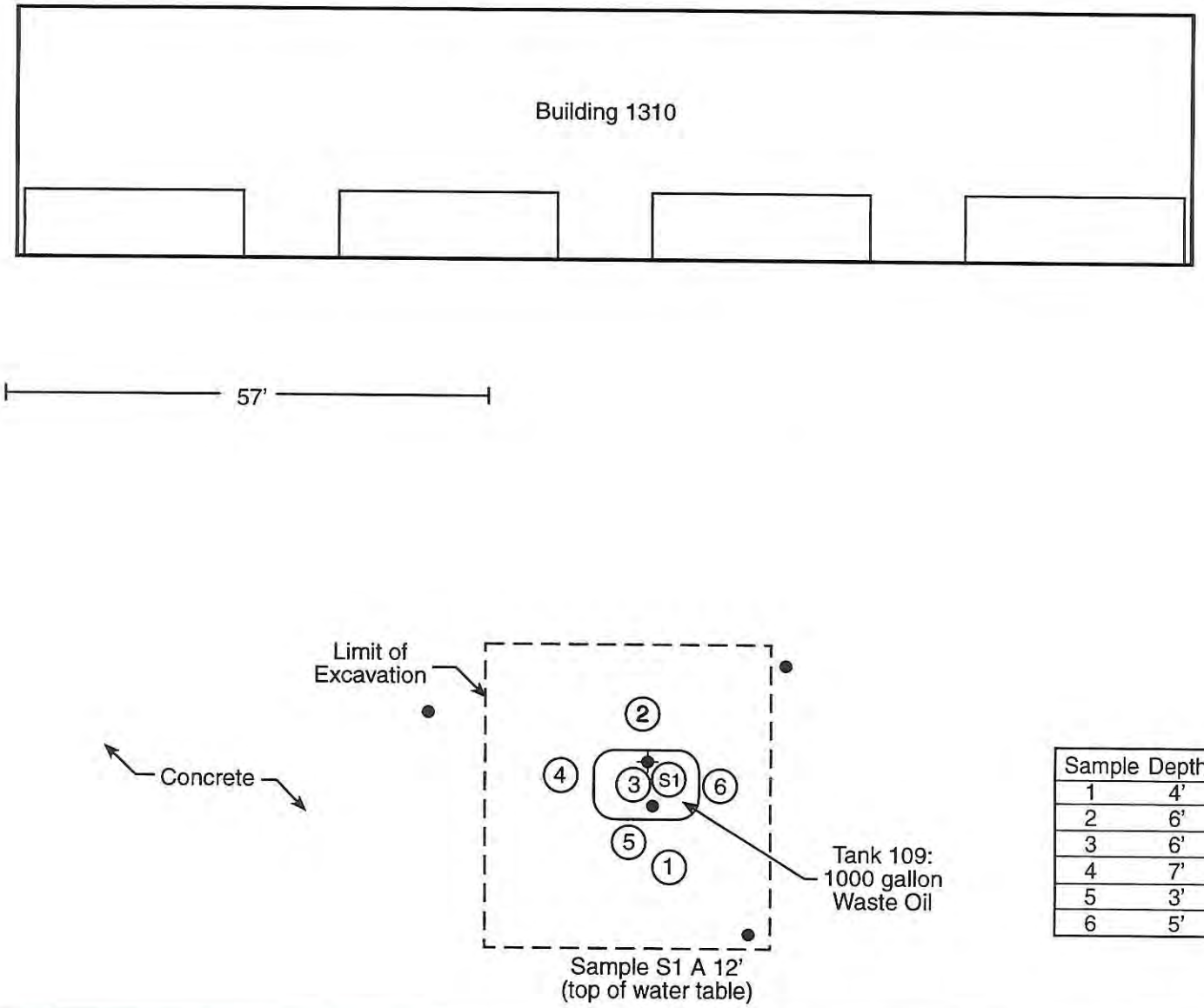
Figure C.5
Proposed Sample Locations
Building 8464, Tank 112



Sample	Depth	FID	Methane
1	4'	2600	
2	6'	2000	
3	6'	1500	
4	7'	1600	0
5	3'	1900	
6	5'	0	

Legend

- (4) Flame Ionization Detector (FID) Sample Location
- (S1) Location of Closure Sample
- Proposed Direct Push Sampling/Temporary Piezometer Location
- Proposed Vertical Profile Boring

Scale : 1" = 10'

N

Source: Anderson Columbia Environmental, Inc., Tank Closure Report, 1996

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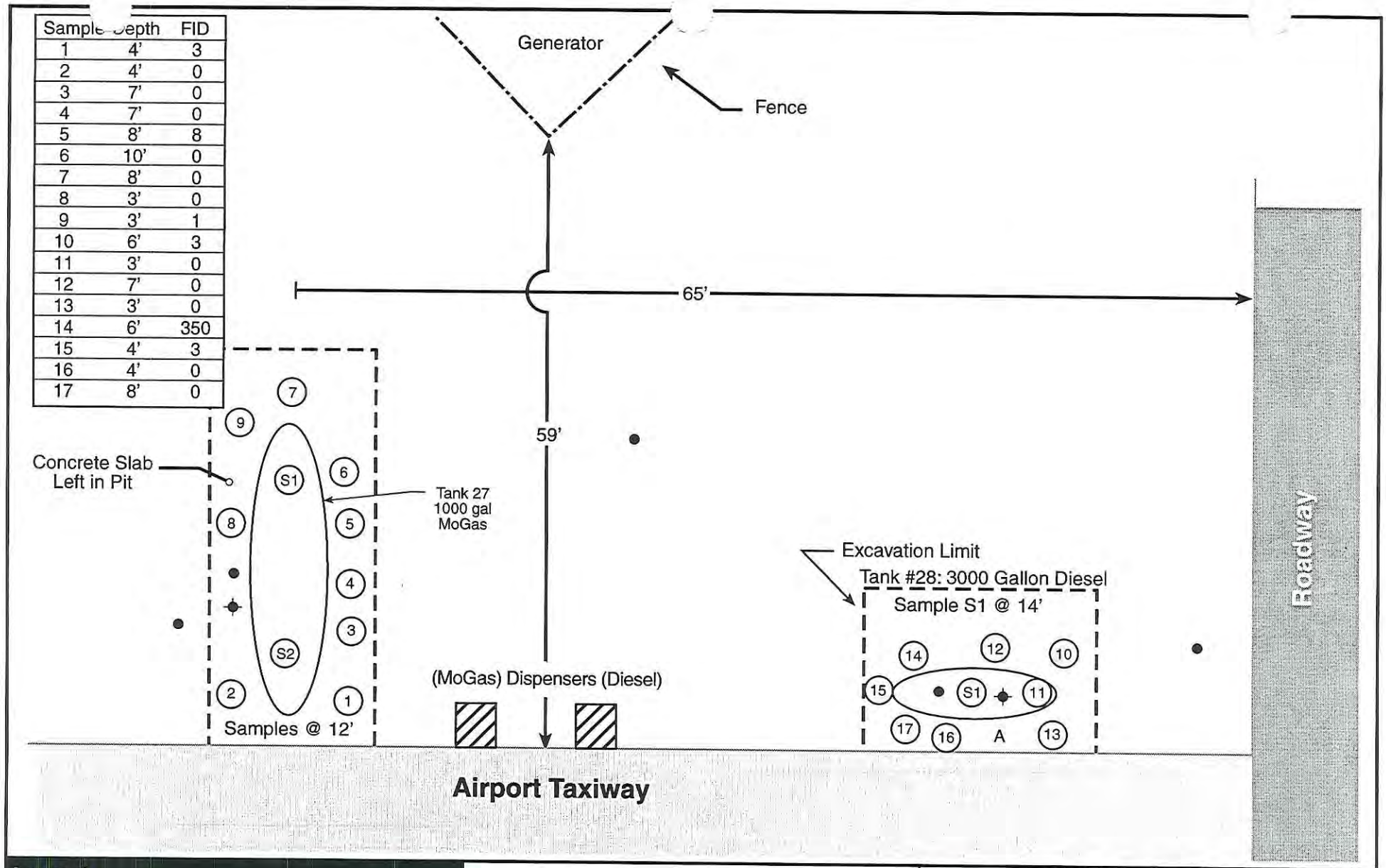
Figure C.6
Proposed Sampling Locations
Building 1310, Tank 109


Sample Depth FID
1 4' 3
2 4' 0
3 7' 0
4 7' 0
5 8' 8
6 10' 0
7 8' 0
8 3' 0
9 3' 1
10 6' 3
11 3' 0
12 7' 0
13 3' 0
14 6' 350
15 4' 3
16 4' 0
17 8' 0
Generator
Fence
65'
59'
Concrete Slab Left in Pit
Tank 27 1000 gal MoGas
Samples @ 12'
(MoGas) Dispensers (Diesel)
Excavation Limit
Tank #28: 3000 Gallon Diesel
Sample S1 @ 14'
A
Roadway
Airport Taxiway
Legend
Flame Ionization Detector (FID) Sample Location
Location of Closure Sample
Proposed Direct Push Sampling/Temporary Piezometer Location
Proposed Vertical Profile Boring
Scale : 1" = 10'
N
Source: Anderson Columbia Environmental, Inc., Tank Closure Report, 1996
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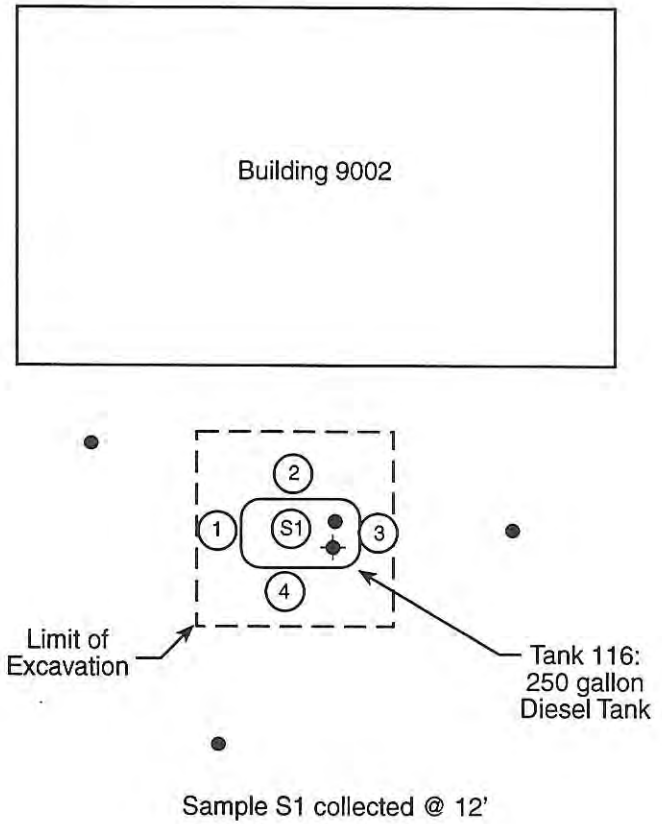
31-102797-063
U.S. Army Engineer District
Corps of Engineers
Savannah, Georgia
Hunter Army Airfield, GA
Figure C.7
Proposed Sampling Locations
Building 8059, Tanks 27 & 28

Sample	Depth	FID	Methane
1	5'	0	
2	4'	0	
3	4'	1	
4	4'	0	0
5	3'	0	
6	5'	0	



Legend

- (4) Flame Ionization Detector (FID) Sample Location
- (S1) Location of Closure Sample
- Proposed Direct Push Sampling/Temporary Piezometer Location
- Proposed Vertical Profile Boring

Scale : 1" = 10'

N

Source: Anderson Columbia Environmental, Inc., Tank Closure Report, 1996

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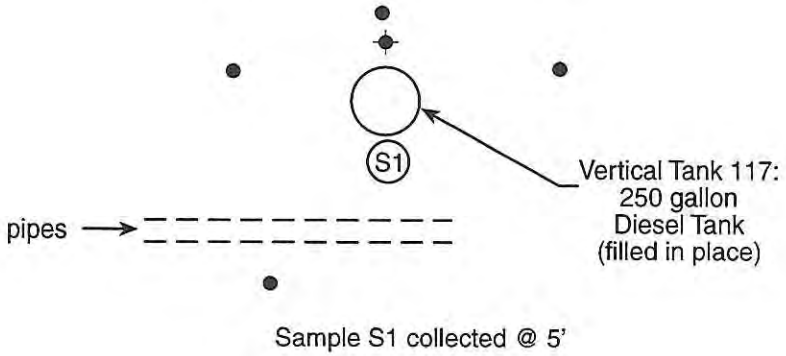
Savannah, Georgia
Hunter Army Airfield, GA

Figure C.8
Proposed Sampling Locations
Building 9002, Tank 116

Building 7002



Legend

- (S1) Location of Closure Sample
- ● Proposed Direct Push/Temporary Piezometer Location
- ✦ Proposed Vertical Profile Boring

Scale : 1" = 10'

N

Source: Anderson Columbia Environmental, Inc., Tank Closure Report, 1996

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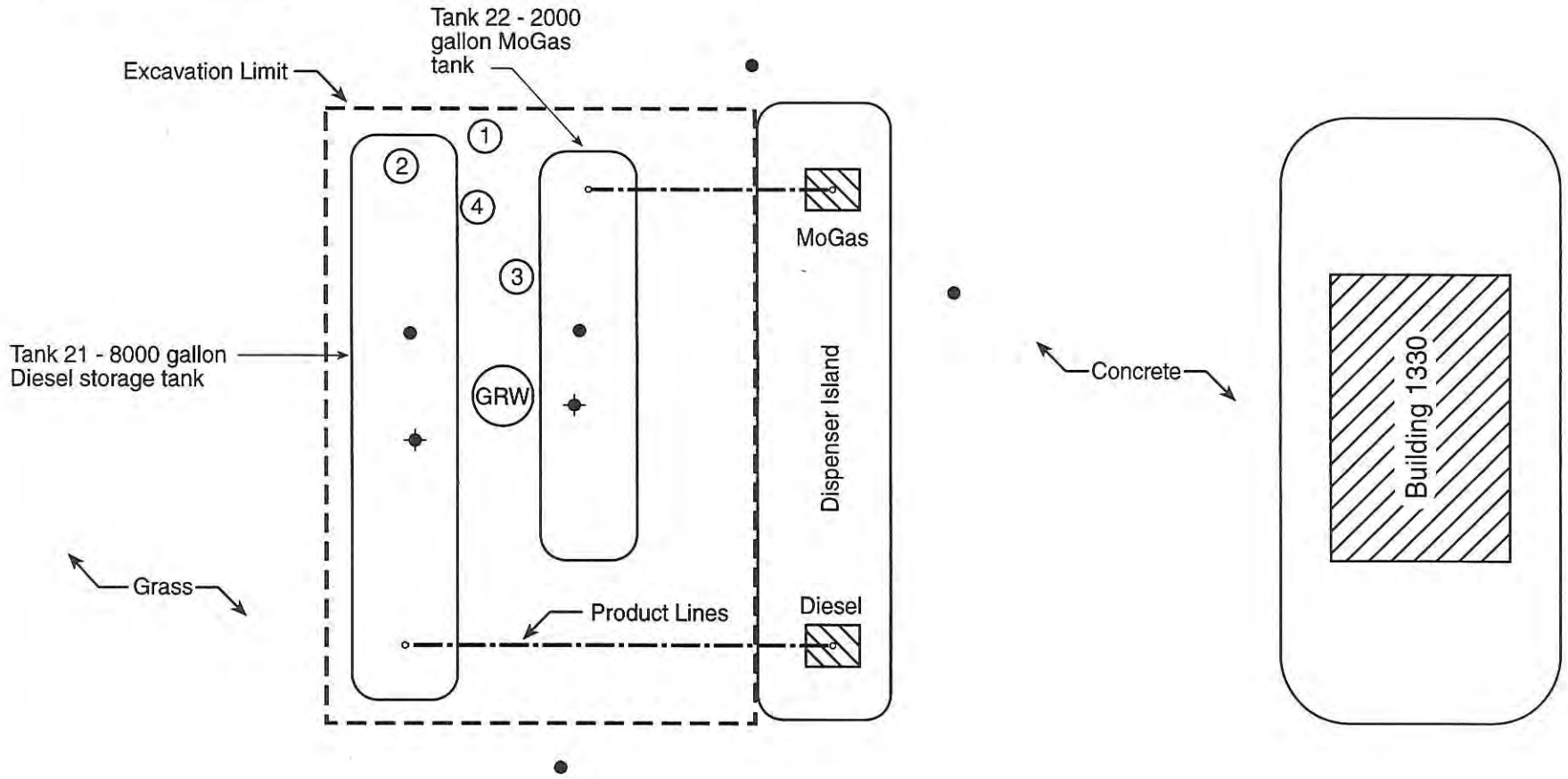
Hunter Army Airfield, GA

Figure C.9
Proposed Sampling Locations
Building 7002, Tank 117

Sample	Depth	FID
1	4'	>5000
2	1.5'	160
3	2'	210
4	7'	2200



Legend

- (4) Flame Ionization Detector (FID) Sample Location
- (GRW) Location of Closure Sample
- Proposed Direct Push Sampling/Temporary Piezometer Location
- Proposed Vertical Profile Boring

Scale : 1" = 10'

N

Source: Anderson Columbia Environmental, Inc., Tank Closure Report, 1996

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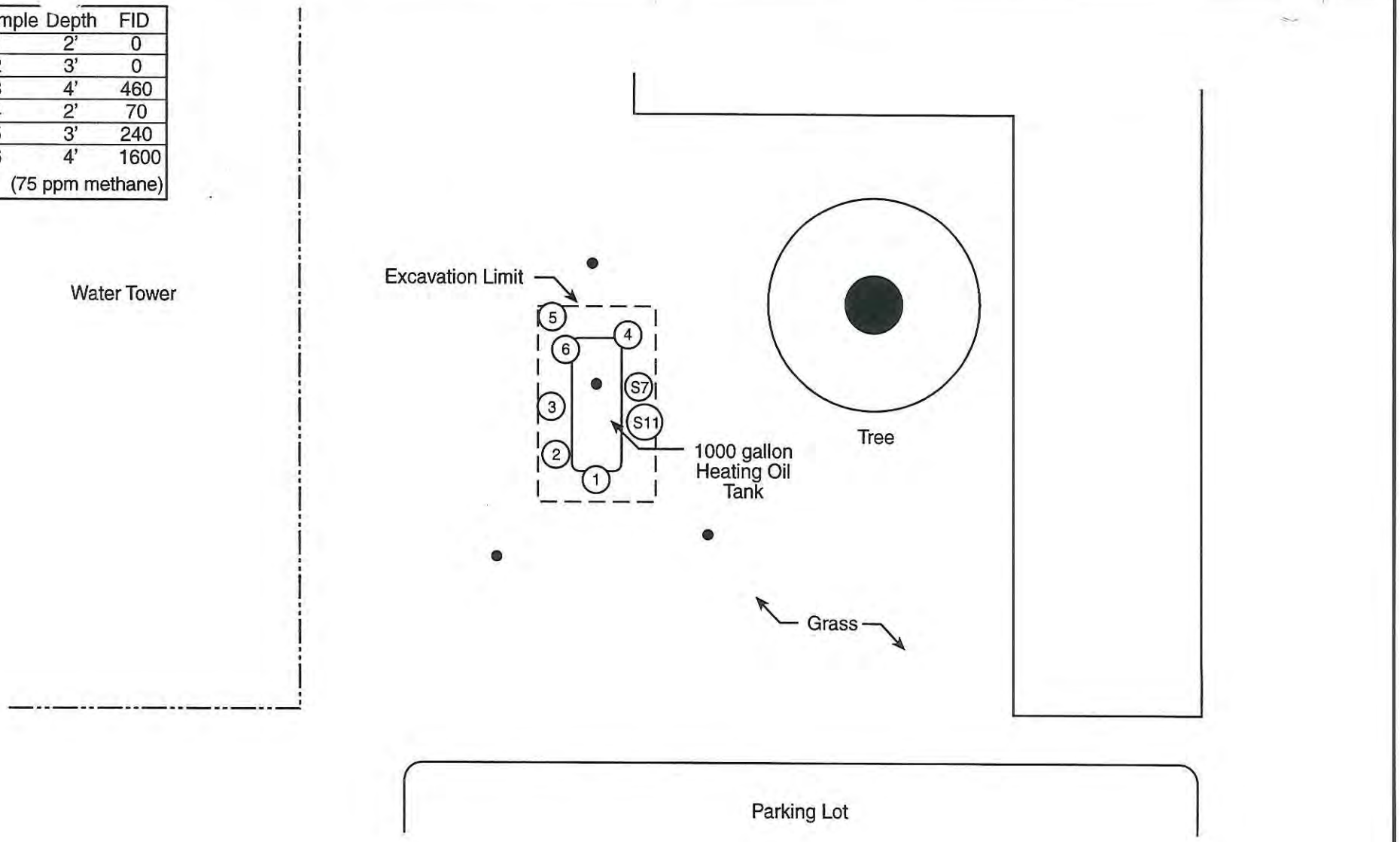
U.S. Army Engineer District
Corps of Engineers
Savannah, Georgia
Hunter Army Airfield, GA

Figure C.10
Proposed Sampling Locations
Building 1327, Tanks 21 & 22

Sample	Depth	FID
1	2'	0
2	3'	0
3	4'	460
4	2'	70
5	3'	240
6	4'	1600
(75 ppm methane)		



Legend

- (S7) Location of Closure Sample
- (4) Flame Ionization Detector (FID) Sample Location
- ● Proposed Direct Push Sampling/Temporary Piezometer Location

Scale : 1" = 10'

N

Source: Anderson Columbia Environmental, Inc., Tank Closure Report, 1996

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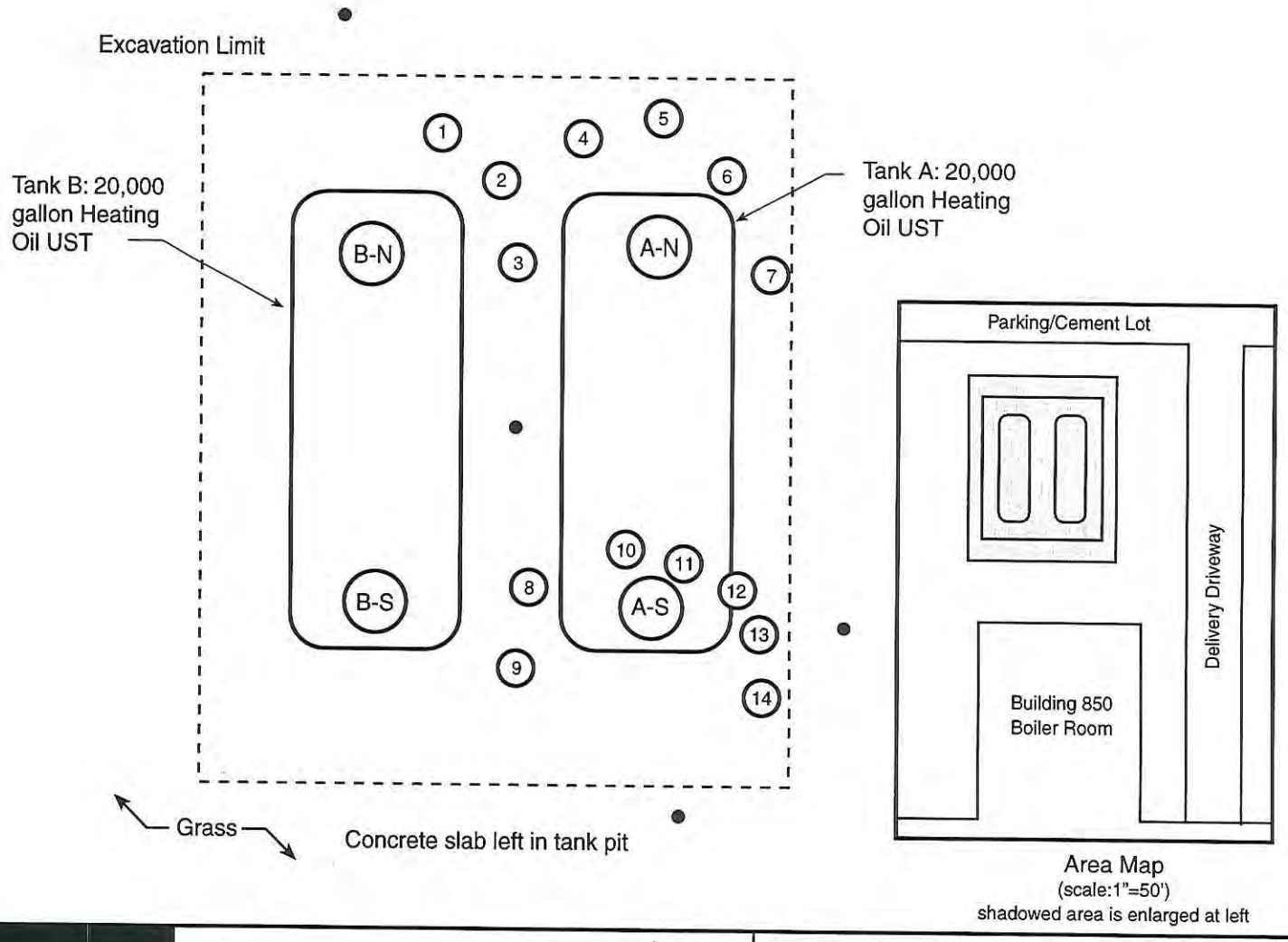
Savannah, Georgia
Hunter Army Airfield, GA

Figure C.11
Proposed Sampling Locations
Building 725, Tank X

Sample	Depth	FID
1	6'	>50
2	9'	40
3	7'	50
4	10'	160
5	11'	160
6	9'	270
7	8'	350
8	4'	50
9	7'	110
10	4'	20
11	3'	20
12	12'	1100
13	2'	50
14	7'	100
15	10' (150 methane)	1700

(some FID sample locations have been approximated)



Area Map
(scale:1"=50')
shadowed area is enlarged at left

Legend

- (4) Flame Ionization Detector (FID) Sample Location
- (B-N) Location of Closure Sample (Tank- Direction)
- ● Proposed Direct Push Sampling/Temporary Piezometer Location

Scale : 1" = 10'

N

Source: Anderson Columbia Environmental, Inc., Tank Closure Report, 1996

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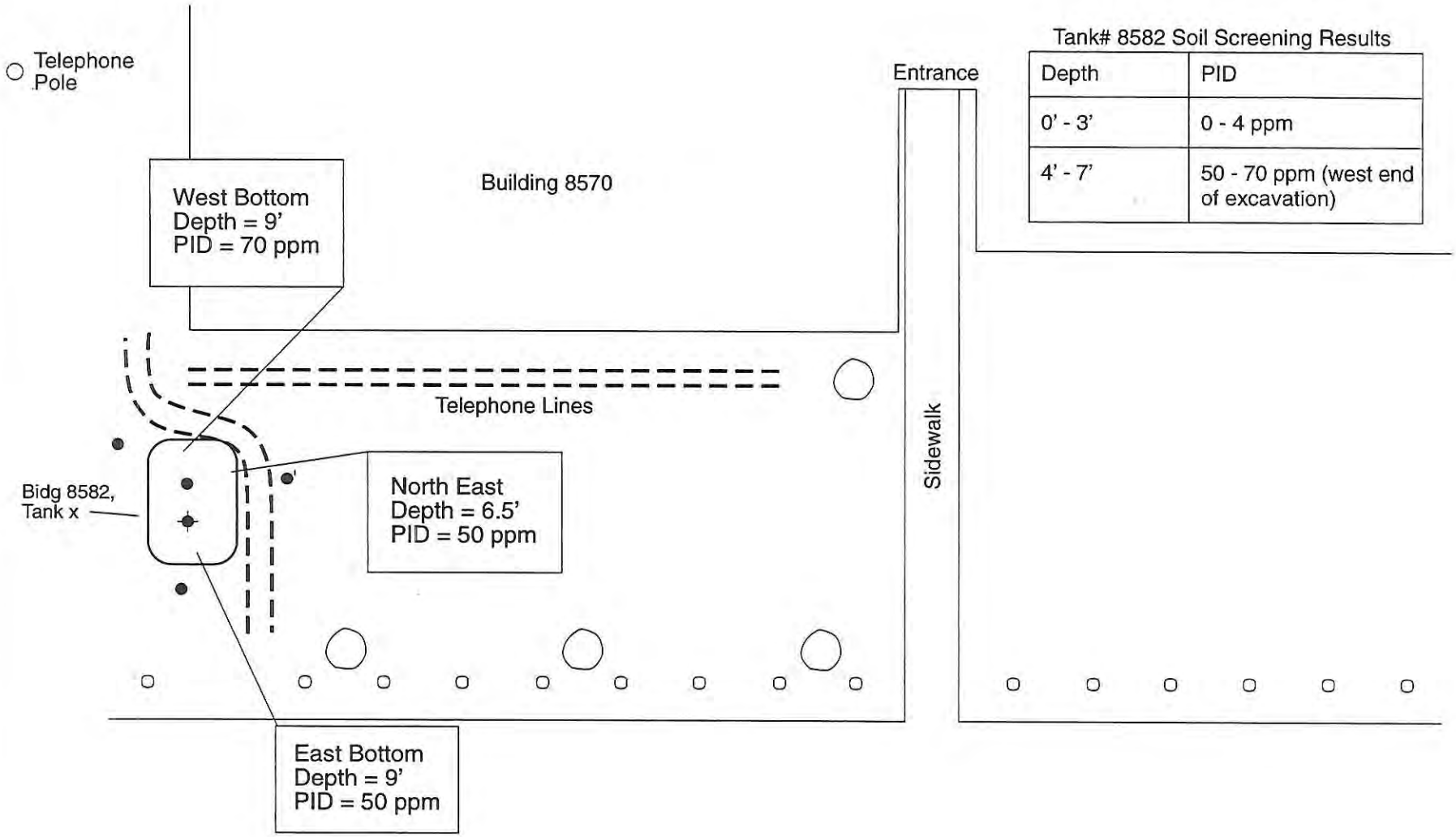
Savannah, Georgia
Hunter Army Airfield, GA

Figure C.12
Proposed Sampling Locations
Building 850, Tanks A & B



Tank# 8582 Soil Screening Results

Depth	PID
0' - 3'	0 - 4 ppm
4' - 7'	50 - 70 ppm (west end of excavation)

Legend

- Proposed Direct Push Sampling/Temporary Piezometer Location
- Proposed Vertical Profile Boring
- Boring may have to be off-set due to location of telecommunication lines.

Scale : 1" = 20'

All Locations Approximate

Source: Geosciences Inc.

N

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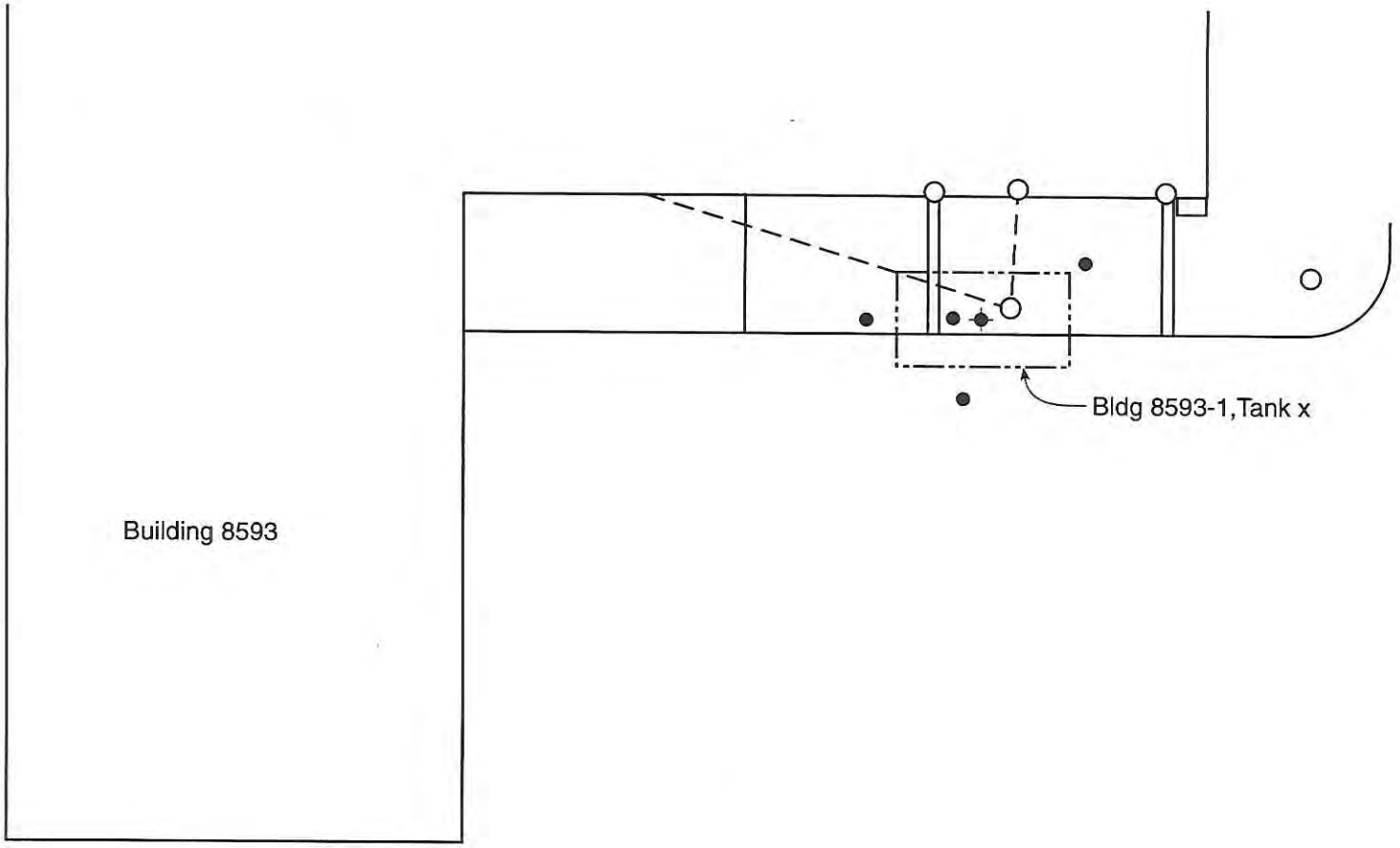
Figure C.13
Proposed Sampling Locations
Building 8582, Tank X



Legend

- Proposed Direct Push Sampling/Temporary Piezometer Location
- Proposed Vertical Profile Boring

Scale : 1" = 20'

All Locations Approximate

Source: Geosciences Inc.

N

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U.S. Army Engineer District
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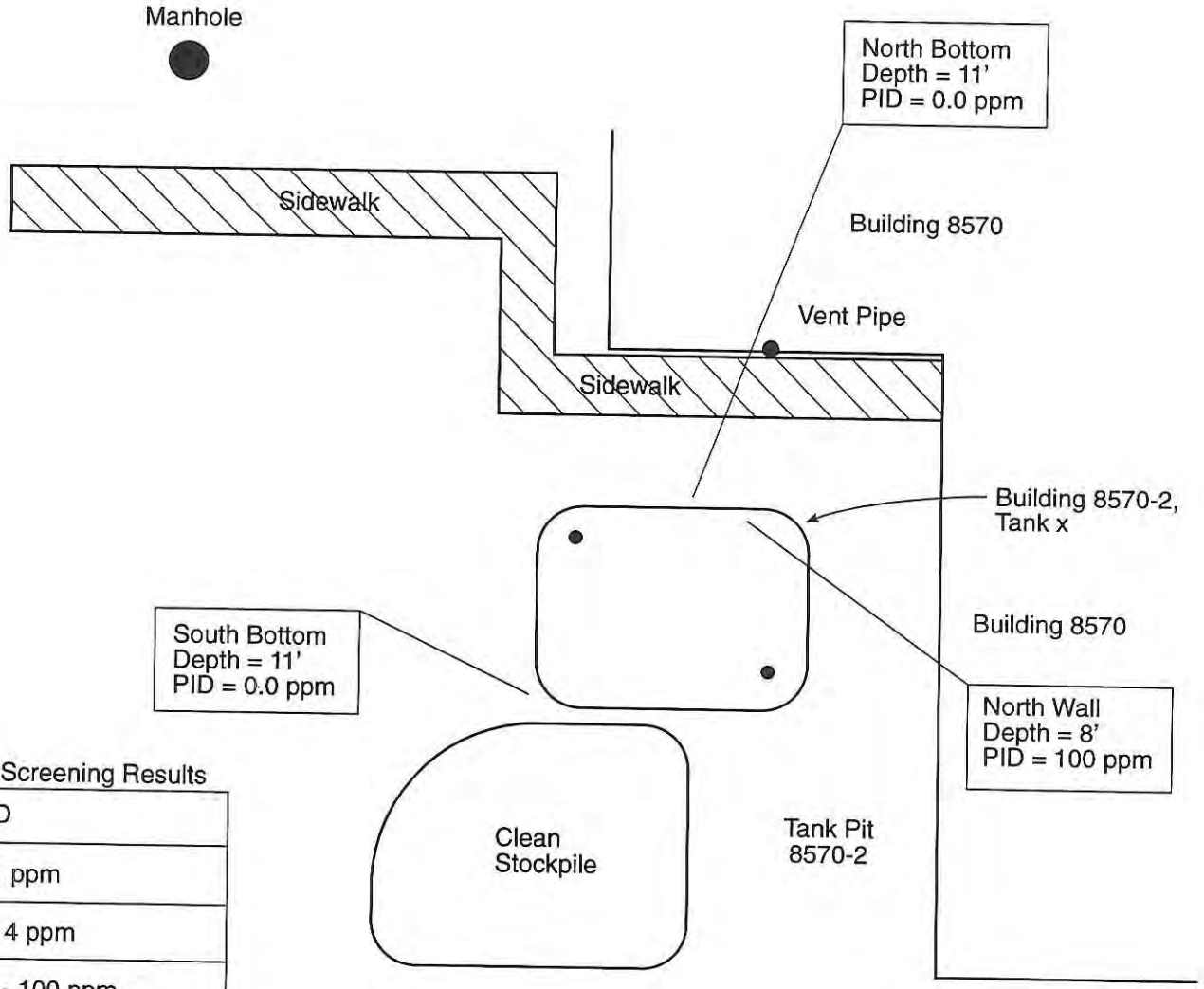
Savannah, Georgia
Hunter Army Airfield, GA

Figure C.14
Proposed Sampling Locations
Building 8593-1, Tank X



Tank# 8570-2 Soil Screening Results

Depth	PID
0' - 3'	0.1 ppm
3' - 6'	0 - 4 ppm
6' - 9'	16 - 100 ppm

Legend

- Proposed Direct Push Sampling/Temporary Piezometer Location

Scale : 1" = 10'

All Locations Approximate

Source: Geosciences Inc.

N

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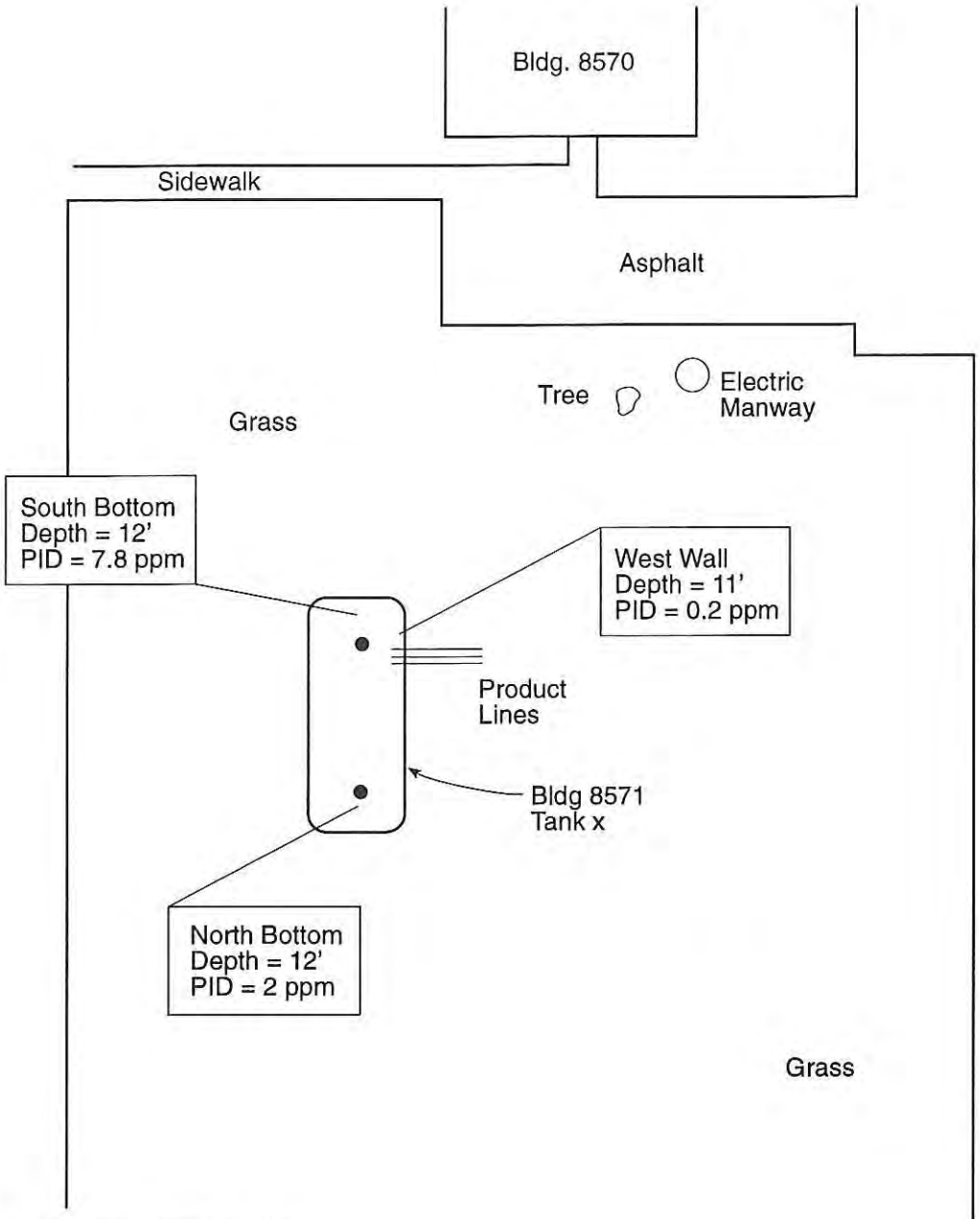
Hunter Army Airfield, GA

Figure C.15
Proposed Sampling Locations
Building 8570-2, Tank X



Tank# 8570-2 Soil Screening Results

Depth	PID
0' - 7.5'	0.0 - 0.5 ppm
7.5' - 8'	15 ppm
8' - 9'	36 ppm
9' - 11'	7.8 ppm

Legend

- Proposed Direct Push Sampling/ Temporary Piezometer Location

Scale : 1" = 30'

All Locations Approximate

Source: Geosciences Inc.

N

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U.S. Army Engineer District
Corps of Engineers
Savannah, Georgia
Hunter Army Airfield, GA

Figure C.16
Proposed Sampling Locations
Building 8571, Tank X

QUALITY ASSURANCE PROJECT PLAN
FOR
CORRECTIVE ACTION PLAN-PART A INVESTIGATIONS FOR FORMER UNDERGROUND STORAGE TANK SITES
AT
HUNTER ARMY AIRFIELD, GEORGIA

March 1998

CONTENTS

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List of Figures

1.0 PROJECT DESCRIPTION

This portion of the Sampling and Analysis Plan presents the Quality Assurance Project Plan (QAPP) for activities to be performed during the CAP-Part A Investigation activities to be performed at 16 former underground storage tank (UST) sites at Hunter Army Airfield (HAAF), Georgia. The United States Army Corps of Engineers (USACE) and the United States Environmental Protection Agency (EPA) require that all environmental monitoring and measurement efforts mandated or supported by these organizations participate in a centrally managed quality assurance (QA) program. Any party generating data for this project has the responsibility to implement minimum procedures to ensure that the precision, accuracy, completeness, and representativeness of its data are known and documented. To ensure that these responsibilities are met uniformly, each party must adhere to the QAPP.

This QAPP presents the organization, objectives, functional activities, and specific QA and quality control (QC) activities associated with the Field Sampling Plan (FSP) for the HAAF UST CAP-A Investigations. It describes the specific protocols that will be followed for sampling, sample handling and storage, chain of custody, and laboratory analysis. This plan also presents details regarding data quality objectives for the project, sampling and preservation procedures for samples collected in the field, field and sample documentation, sample packaging and shipping, and laboratory analytical procedures for all media sampled. Analytical activities and methodologies associated with chemical testing of QA split samples to be performed by the government laboratory assigned to this project by the USACE-Savannah District are not addressed within this QAPP.

All QA/QC procedures will be in accordance with applicable professional technical standards, EPA requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP is prepared by Science Applications International Corporation (SAIC) in accordance with EPA QAPP and USACE guidance documents, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (EPA 1991), *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations* (EPA 1994a), *Requirements for the Preparation of Sampling and Analysis Plans* (USACE 1994), and *USEPA Region IV Environmental Investigations Standard Operating Procedures and Quality Assurance Manual* (SOP/QAM, May 1996).

The FSP contains the project description and background information. Site history and background information along with past data collection activities and existing site data are contained in Section 1.0 of the FSP. Primary project organization and responsibilities are presented in Section 2.0 of the FSP, while the project scope and objectives are found in Section 3.0. Sampling design, procedures, methods, and rationales are discussed in detail in Section 4.0 of the FSP. Sample matrix types, analytical parameters, and analytical methods can be found in Section 4.0 of the FSP and are summarized in Table 1.1 of this QAPP. Specific delineation of sample numbers, QA sample frequencies, and field QC sample frequencies have been designated for each area under investigation.

Table 1.1. Sampling and Analytical Requirements for CAP-Part A Investigations for 16 Former UST Sites at HAAF, Georgia

Matrix	No. Field Smpls	QC Dup/ Splts	No. Field Rnsts	QC Trip Blnks[1]	Total Smpls	QA Dup/ Splts	QA Trip Blnks	Total QA Smpls	Analysis	Protocol	Analytical Procedures	Holding Time	Preservation Requirements	Sample Containers	Total Containers
Initial Groundwater Investigation Sites															
Soil (12 direct push borings at 2 samples per borehole)	24	3	0	0	27	2	0	2	VOC[2]	SW-846	EPA 8020	14 days	Ice to 4°C	2×40 mL gsv[7]	58
	24	3	0	0	27	2	0	2	PAH[3]	SW-846	EPA 8270	14/40 days	Ice to 4°C	8 oz cwm[4]	29
	24	3	0	0	27	2	0	2	TPH[5] (GRO)[6]	SW-846	EPA 8015 (5030)	14 days	Ice to 4°C	2×40 mL gsv[7]	58
	24	3	0	0	27	2	0	2	TPH[5] (DRO)[6]	SW-846	EPA 8015 (3550)	28 days	Ice to 4°C	1×8 oz cwm[4]	29
Groundwater (12 hydropunch borings at 1 sample per borehole)	12	1	0	2	15	1	2	3	VOC[1]	SW-846	EPA 8020	14 days	Ice to 4°C HCL to pH<2	2×40 mL gsv[7]	36
	12	1	0	0	13	1	0	1	PAH[3]	SW-846	EPA 8270	7/40 days	Ice to 4°C	2×1L G	28
CAP-Part A Investigation Sites															
Soil (46 direct push borings at 2 samples per borehole)	92	9	0	0	101	9	0	9	VOC[1]	SW-846	EPA 8020	14 days	Ice to 4°C	2×40 mL gsv[7]	220
	92	9	0	0	101	9	0	9	PAH[3]	SW-846	EPA 8270	14/40 days	Ice to 4°C	8 oz cwm[4]	110
	92	9	0	0	101	9	0	9	TPH[6] (GRO)4	SW-846	EPA 8015 (5030)	14 days	Ice to 4°C	2×40 mL gsv[7]	220
	92	9	0	0	101	9	0	9	TPH6 (DRO)[4]	SW-846	EPA 8015 (3550)	28 days	Ice to 4°C	1×8 oz cwm[4]	110
	12	0	0	0	12	0	0	0	Geotechnical[8]	Various[8]	Various[8]	None	None	Shelby Tube	12
Groundwater (46 hydropunch borings at 1 sample per borehole)	46	5	0	3	54	4	2	6	VOC[1]	SW-846	EPA 8020	14 days	Ice to 4°C HCL to pH<2	2×40 mL gsv[7]	120
	46	5	0	0	52	4	0	4	PAH[3]	SW-846	EPA 8270	7/40 days	Ice to 4°C	2×1L G	112

Table 1.1 (continued)

Matrix	No. Field Smpls	QC Dup/ Splts	No. Field Rnsts	QC Trip Blnks[1]	Total Smpls	QA Dup/ Splts	QA Trip Blnks	Total QA Smpls	Analysis	Protocol	Analytical Procedures	Holding Time	Preservation Requirements	Sample Containers	Total Containers
Groundwater (12 vertical profile borings at 4 samples per borehole)	48	5	0	2	55	5	2	7	VOC[1]	SW-846	EPA 8020	14 days	Ice to 4°C HCL to pH<2	2×40 mL gsv[7]	124
	48	5	0	0	53	5	0	5	PAH[3]	SW-846	EPA 8270	7/40 days	Ice to 4°C	2×1L G	116
Reserve Soil (10 direct push borings at 2 samples per borehole)	20	2	0	0	22	2	0	2	VOC[2]	SW-846	EPA 8020	14 days	Ice to 4°C	2×40 mL gsv[7]	48
	20	2	0	0	22	2	0	2	PAH[3]	SW-846	EPA8270	14/40 days	Ice to 4°C	8 oz cwm[4]	24
	20	2	0	0	22	2	0	2	TPH[5] (GRO)[6]	SW-846	EPA8015 (5030)	14 days	Ice to 4°C	2×40 mL gsv[7]	48
	20	2	0	0	22	2	0	2	TPH[5] (DRO)[6]	SW-846	EPA 8015 (3550)	28 days	Ice to 4°C	1×8 oz cwm[4]	24
Reserve Groundwater (10 hydropunch borings at 1 sample per boring)	10	1	0	1	12	1	1	2	VOC[2]	SW-846	EPA 8020	14 days	Ice to 4°C HCL to pH<2	2×40 mL gsv[7]	28
	10	1	0	0	11	1	0	1	PAH[3]	SW-846	EPA 8270	7/40 days	Ice to 4°C	2×1L G	24

1 One trip blank with each cooler containing water samples for VOC analysis
2 VOC = Volatile Organic Compounds
3 PAH = Polynuclear Aromatic Compounds
4 CWM = Clear widemouth jar
5 TPH = Total Petroleum Hydrocarbons
6 GRO = Gasoline Range Organics. DRO = Diesel Range Organics
7 gsv = Glass septa vial
8 Geotechnical analysis includes moisture content (ASTM D2216), grain size analysis (ASTM D422), hydraulic conductivity (ASTM D5084), porosity (ASTM D4612), and total organic carbon (EPA 9060)

Note: This table is in conformance with EM200-1-3.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The primary project organizational structure and responsibilities are discussed in Section 2.0 of the FSP. This portion of the QAPP focuses on the analytical subcontract organizations structure and responsibilities. Chemical laboratory support for this investigations has been designated to a single subcontractor, General Engineering Laboratories (GEL), based on a competitive bidding process. The selected subcontract laboratory is validated by the USACE Missouri River District (MRD) Hazardous, Toxic, and Radioactive Waste (HTRW) Center of Expertise (CX), Omaha, Nebraska. Relevant QA Manual, laboratory qualification statements, certifications, and license documentation are available.

The organization chart shown in Figure 2.1 outlines the key laboratory personnel and organization within the GEL management structure that will be used for implementation of these studies. The responsibilities of key personnel are described in the following paragraphs. The assignment of personnel to each position will be based on a combination of (1) experience in the type of work being performed, (2) experience working with USACE personnel and procedures, and (3) a demonstrated commitment to high quality and timely job performance.

All samples will be analyzed by the following laboratory:

General Engineering Laboratories, Inc.
P.O. Box 30712
2040 Savage Road
Charleston, South Carolina 29417

Prior to commencement of field activities for the project, SAIC will send a complete copy of the work plan including this QAPP to General Engineering Laboratories.

2.1 SAIC LABORATORY COORDINATOR

The responsibilities of the SAIC Laboratory Coordinator were previously discussed in Section 2.0 of the FSP.

2.2 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL MANAGER

The responsibilities of subcontract laboratory QA/QC Manager were previously discussed in Section 2.0 of the FSP.

2.3 LABORATORY PROJECT MANAGER

The responsibilities of each laboratory Project Manager include the following:

- Initiate and maintain contact with SAIC on individual job tasks.
- Prepare all laboratory-associated work plans, schedules, and manpower allocations.
- Initiate all laboratory-associated procurement for the project.

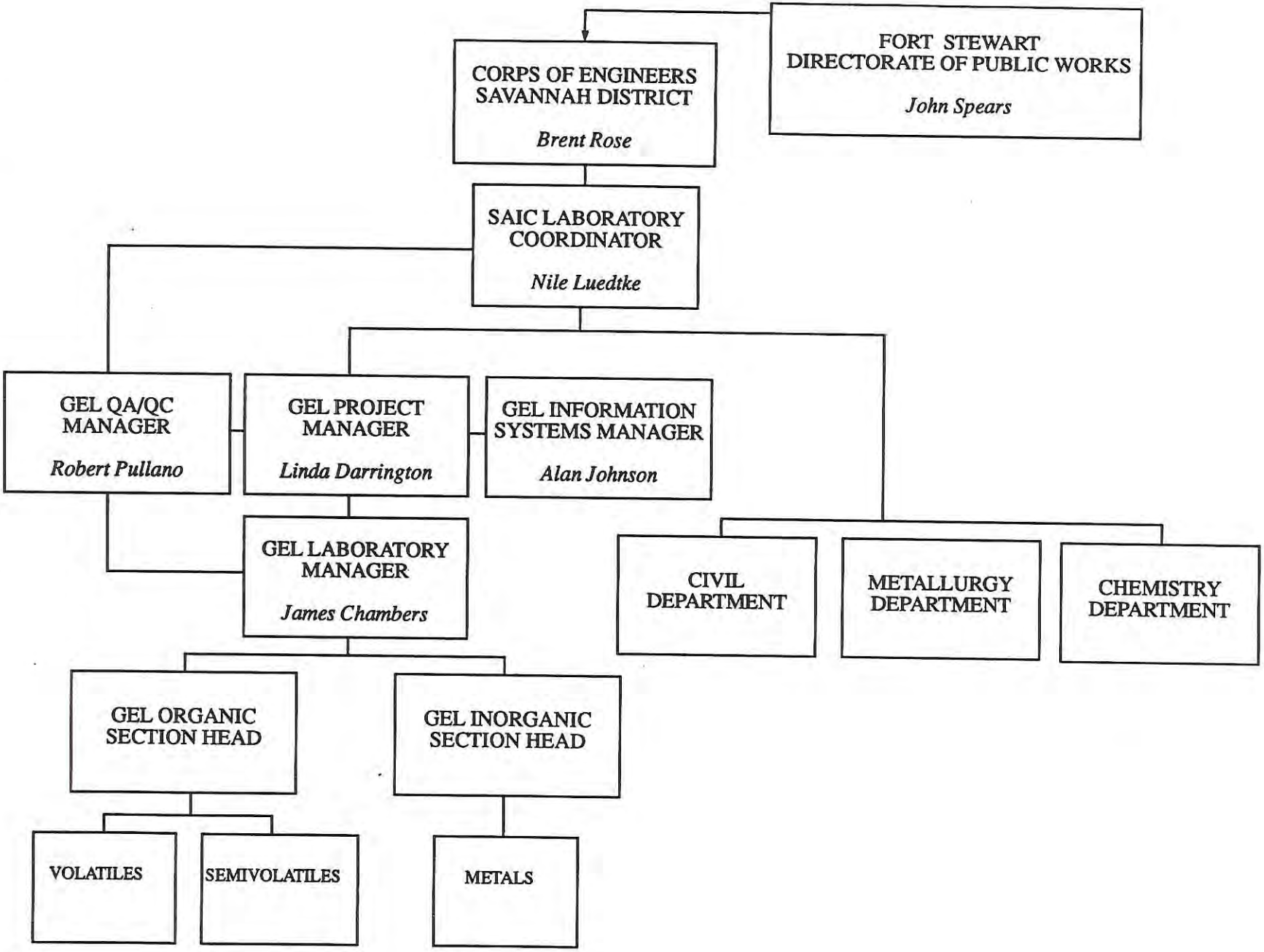

Figure 2.1. Laboratory Project Organizational Chart for the CAP-PART UST Investigations at HAAF, Georgia

- Provide day-to-day direction of the laboratory project team including analytical department managers, supervisors, QA personnel, and data management personnel.
- Coordinate all laboratory related financial and contractual aspects of the project.
- Provide formatting and technical review of all laboratory reports.
- Provide day-to-day communication with the client.
- Exercise final review and approval on all laboratory analytical reports to the client.
- Respond to all post project inquires.

2.4 LABORATORY MANAGER

The responsibilities of each laboratory's Laboratory Manager include the following:

- Coordinate all analytical production activities conducted within the analytical departments.
- Work with the Laboratory Project Manager to ensure all project objectives are met.
- Provide guidance to analytical department managers.
- Facilitate transfer of data produced by the analytical departments to the report preparation and review staff for final delivery to the client.

2.5 LABORATORY SECTION HEADS, DEPARTMENT MANAGERS, AND TECHNICAL LEADS

The responsibilities of each laboratory section or department include the following:

- Coordinate all analytical functions related to specific analytical areas.
- Provide technical information to and oversight of all analysis being performed.
- Review and approve all analytical results produced by their specific analytical area of expertise.
- Maintain all analytical records and information pertaining to the analysis being performed.

Based on the scope of laboratory analysis to be performed on soil and water samples collected during this project, the GEL sections participating in the project will be Volatiles and Semivolatiles. Technical personnel within these sections will be responsible for preparation, extraction, and analysis of environmental and field QC project samples in accordance with the requirements of this QAPP.

3.0 DATA QUALITY OBJECTIVES

The overall project objective is to develop and implement procedures for field sampling, chain of custody (COC), laboratory analysis, and reporting, which will provide results to be used in site evaluation and assessment and that are technically sound and legally defensible in a court of law. Specific procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. The purpose of this section is to address the specific objectives for data accuracy, precision, completeness, representativeness, and comparability.

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required to support decisions made during investigation activities, and are based on the end uses of the data being collected.

3.1 PROJECT OBJECTIVES

General objectives are as follows:

(1) To provide data of sufficient quality and quantity for comparison with state of Georgia UST site criteria and background values, determine the nature and extent of contamination, and complete site evaluations.

(2) To meet site regulatory requirements, risk-based criteria, and data needs for engineering requirements to determine the potential need for additional investigation and remediation.

(3) To analyze samples using well defined methods that will provide confident detection limits that are accurate enough to determine the presence or absence of contamination directly related to the site.

(4) To define precision and accuracy goals of data to provide defensible data.

(5) To ensure samples are collected using approved techniques and are representative of existing environmental conditions.

(6) To specify QA/QC procedures for both field and laboratory methodology to meet the USACE guidance document requirements.

3.2 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

An analytical DQO summary for these investigations is presented in Tables 3.1 and 3.2. All QC parameters stated in the specific SW-846 methods (i.e., percent recoveries) will be adhered to for each chemical listed. Laboratories are required to comply with all methods as written; recommendations are considered requirements.

As per the new EPA guidance (1993a), which now supersedes all other documents in this discipline, the previously used analytical Levels I through V are changed. These levels are now divided into two categories: (1) screening data with definitive confirmation (replaces Level I and II), and (2) definitive

Table 3.1. Soil/Sediment DQO Summary for CAP-Part A UST Sites at HAAF, Georgia

Data use	Sample type	Analytical method	Precision field dups	(RPD)* lab dups	Accuracy laboratory (MS)	Completeness
Screening for sample site selection	Discrete	FID/PID Volatile org.	+/- comparison	NA	±0.1 ppm	95%
Confirmation of contamination extent	Discrete	SW-8020 BTEX	<50 RPD	<35 RPD	50-150% recovery	90%
	Discrete or composite	SW-8270B PAHs	<50 RPD	<35 RPD	30-140% recovery	90%
		SW-8015 Mod. GRO	<50 RPD	<35 RPD	30-140% recovery	90%
		SW-8015 Mod. DRO	<50 RPD	<35 RPD	30-140% recovery	90%
Determination of geological regimes	Discrete	ASTM-D2216 Moisture content	NA	<20 RPD	NA	90%
		ASTM-D422 Grain size	NA	<20 RPD	NA	90%
		ASTM-D4318 Atterburg limits	NA	<40 RPD	NA	90%
IDW characterization	Composite	SW-1311 TCLP analytes	NA	>40 RPD	75-125% recovery	80%

* RPD=Relative Percent Difference, at values within five times the reporting level comparison is acceptable if values are plus or minus twice the reporting level.

Table 3.2. Groundwater Investigative DQO Summary for CAP-Part A UST Sites at HAAF, Georgia

Data use	Sample type	Analytical method	Precision field dups	(RPD)a lab dups	Accuracy laboratory (MS)	Completeness
Screening for sample site selection	Discrete	FID/PID Volatile org.	NA	NA	±0.1 ppm	95%
Determination of basic water characteristics	Discrete	EPA-120.1 Conductivity	<10 RPD	NA	±10μmhos/cm	95%
		EPA-150.1 PH	<10 RPD	NA	±0.1 s.u.	95%
		EPA-170.1 Temperature	<10RPD	NA	±0.1°C	95%
		Turbidity meter	<10 RPD	NA	NA	95%
Confirmation of contamination extent	Discrete	SW-8020 BTEX	<30 RPD	<20 RPD	50-150% recovery	90%
	Discrete or composite	SW-8270B PAHs	<30 RPD	<20 RPD	30-140% recovery	90%
		SW-8015 Mod. GRO	<30 RPD	<20 RPD	35-135% recovery	90%
		SW-8015 Mod. DRO	<30 RPD	<20 RPD	35-135% recovery	90%
IDW characterization	Composite	EPA-420.1 Phenols	<50 RPD	<50 RPD	70-130% recovery	90%
		EPA-413.2 Oil & grease	<50 RPD	50 RPD	70-130% recovery	90%
		EPA-418.1 TPH	<50 RPD	50 RPD	70-130% recovery	90%

[a] RPD=Relative Percent Difference, at values within five times the reporting level comparison is acceptable if values are plus or minus twice the reporting level.

data (replaces Levels III, IV, and V). Definitive data represent data generated under laboratory conditions using EPA-approved procedures. Data of this type, both qualitative and quantitative, are used for determination of source, extent, or characterization and to support evaluation of remedial technologies.

General analytical objectives for this work are as follows:

(1) Analyze soil and groundwater samples to provide additional data regarding the nature and extent of contamination at each site.

(2) Analyze groundwater samples collected from monitoring wells to determine the magnitude of contamination present at these sites.

3.2.1 Level of Quality Control Effort

To assess whether QA objectives have been achieved, analyses of specific field and laboratory QC samples will be required. These QC samples include field blanks, trip blanks, field duplicates, laboratory method blanks, laboratory control samples, laboratory duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples will be analyzed to assess the quality of the data resulting from the sampling program.

Equipment rinsate blanks and trip blanks will be submitted for analysis along with field duplicate (co-located) samples to provide a means to assess the quality of the data resulting from the field sampling program. Equipment rinsate blanks are used to assess the adequacy of equipment decontamination processes. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage. Criteria and evaluation of blank determinations are provided in Table 3.3 and Section 8.3. Field duplicate samples are analyzed to determine sample heterogeneity and sampling methodology reproducibility.

Laboratory method blanks and laboratory control samples are employed to determine the accuracy and precision of the analytical method implemented by the laboratory. Matrix spikes provide information about the effect of the sample matrix on the measurement methodology. Laboratory sample duplicates and MDSs assist in determining the analytical reproducibility and precision of the analysis for the samples of interest.

The general level of QC effort will be at least one field duplicate for every ten investigative samples. One volatile organic compound (VOC) analysis trip blank consisting of analyte-free water will be included along with each shipment of VOC water samples.

Table 3.3. Analytical Methods, Parameters, and Project Quantitation Limits for CAP-Part A UST Sites at HAAF, Georgia

Parameters	Analytical Methods		Project Quantitation Levels[a]	
	Water	Soil/Sediment	Water (μg/L)	Soil/Sediment (μg/kg)
Volatile Organic Compounds (BTEX)	SW 846-5030/8020A[b]	SW 846-5030/8020A[b]		Low Soil/Sediment[a]
Benzene			5	5
Toluene			5	5
Ethylbenzene			5	5
Xylenes (total)			5	5
Semivolatile Organic Compounds (PAHs)	SW 846-3520/8270B[b]	SW 846-3550/8270B[b]		Low Soil/Sediment[a]
Naphthalene			0.2	330
2-Chloronaphthalene			0.2	330
Acenaphthylene			0.2	330
Acenaphthene			0.2	330
Fluorene			0.2	800
Phenanthrene			0.2	330
Anthracene			0.2	330
Fluoranthene			0.2	330
Pyrene			0.2	330
Benzo(a)anthracene			0.2	330
Chrysene			0.2	330
Benzo(b)fluoranthene			0.2	330
Benzo(k)fluoranthene			0.2	330
Benzo(a)pyrene			0.2	330
Indeno(1,2,3-cd)pyrene			0.2	330
Dibenzo(a,h)anthracene			0.2	330
Benzo(g,h,i)perylene			0.2	330
Total Petroleum Hydrocarbons	SW-846 8015 Modified	SW-846 8015 Modified	μg/L	mg/Kg
Gasoline Range Organics			5.0	4
Diesel Range Organics			10	4

[a] These are expected quantitation limits based on reagent grade water or a purified solid matrix. Actual quantitation limits may be higher depending upon the nature of the sample matrix. The limit reported on final laboratory reports will take into account the actual sample volume or weight, percent solids (where applicable), and the dilution factor, if any. The quantitation limits for additional analytes to this list may vary, depending upon the results of laboratory studies.

[b] *Test Methods for Evaluating Solid Waste*, U.S. EPA, SW-846 Third Edition.

[c] *American Society for Testing and Materials, ASTM Standards*, Vol 04.08, Soil and Rock, 1996.

MS/MSD samples are investigative samples. Soil MS/MSD samples require no extra volume for VOCs or extractable organics. However, aqueous MS/MSD samples must be collected at double the volume for VOC and triple the volume for extractable organics. One MS/MSD sample will be designated in the field and collected for at least every 20 investigative samples per sample matrix (i.e., groundwater, soil).

The level of QC effort provided by the laboratory will be equivalent to the level of QC specified in each site-specific work plan. The goal is to provide a level of QC effort in conformance with the protocols of the EPA Contract Laboratory Program (CLP) for Routine Analytical Services (RAS) parameters. The level of QC effort for testing and analysis of parameters beyond the scope of the CLP protocols will conform to accepted methods, such as EPA SW-846 protocols (EPA 1993b), American Society for Testing and Materials (ASTM) protocols, and National Institute for Occupational Safety and Health (NIOSH) protocols.

The QC effort for in-field measurements, including temperature, conductivity, pH, oxidation reduction potential dissolved oxygen, and organic vapor concentration, will include daily calibration of the instrument using traceable standards and documented instrument manufacturer procedures. Field instruments and their method of calibration are discussed in the FSP and will be further identified in task-specific documentation.

3.2.2 Accuracy, Precision, and Sensitivity of Analysis

The fundamental QA objectives for accuracy, precision, and sensitivity of laboratory analytical data are the QC acceptance criteria of the analytical protocols. The accuracy and precision required for the specified analytical parameters are incorporated in Tables 3.1 and 3.2 and are consistent with the analytical protocols. The sensitivities required for the analyses are identified in Table 3.3.

Accuracy and precision goals for field to measurements of pH, oxidation reduction potential, conductivity, dissolved oxygen, temperature, and organic vapor concentration are listed in Table 3.2.

Analytical accuracy is expressed as the percent recovery of an analyte that has been added to a blank sample or environmental sample at a known concentration before analysis. Accuracy will be determined in the laboratory through the use of MS analyses, laboratory control sample (LCS) analyses, and/or blank spike analyses. The percent recoveries for specific target analytes will be calculated and used as an indication of the accuracy of the analyses performed.

Precision will be determined through the use of spike analyses conducted on duplicate pairs of environmental samples (MS/MSD) or comparison of positive duplicate pair responses. The relative percent difference (RPD) between the two results will be calculated and used as an indication of the precision of the analyses performed.

Sample collection precision will be measured in the laboratory by the analyses of field duplicates. Precision will be reported as the RPD for two measurements.

3.2.3 Completeness, Representativeness, and Comparability

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under normal conditions. It is expected that laboratories will

provide data meeting QC acceptance criteria for all samples tested. Overall project completeness goals are identified in Table 3.1.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that depends upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of site conditions. During development of this plan, consideration was given to site history, past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to the investigation of all related sites. The rationale of the sampling design is discussed in detail for each specific site investigation in the FSP.

Representativeness will be satisfied by ensuring that the FSP and its addenda are followed, proper sampling techniques are used, proper analytical procedures are followed, and holding times of the samples are not exceeded. Representativeness will be determined by assessing the combined aspects of the QA program, QC measures, and data evaluations.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends upon the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

4.0 SAMPLING LOCATIONS AND PROCEDURES

It is anticipated that investigations performed during the HAAF CAP-A UST Investigations will produce soil, groundwater, and investigative-derived waste (IDW) samples for analyses. Additional samples will be collected to complete field QC duplicate, field blank, and QA split sample analyses. Specific numbers of sample (including parameters and methods) are incorporated into Table 1.1. Investigation samples will require benzene, toluene, ethylbenzene, xylene (BTEX), polyaromatic hydrocarbon (PAH), gasoline range organics (GRO), diesel range organics (DRO), and other determinations, as represented in Table 1.1, 3.1, 3.2, and 3.3. Sampling procedures for the various media under investigation are discussed in detail in Section 4.0 of the FSP.

Identification of the primary field equipment and supporting materials to be used for these investigations is presented throughout Section 4.0 of the FSP. Several different types of field measurements will be performed during these investigations. Soil field measurements may determine soil classification and characteristics or volatile organic headspace gas concentrations. Groundwater field measurements may determine groundwater characteristics (pH, specific conductance, temperature, and dissolved oxygen), volatile organic headspace gas concentrations, and static groundwater levels. A description of the field instruments and associated calibration requirements and performance checks to be used for field measurements is presented in Section 4.0 of the FSP and Section 7.0 of this QAPP.

The locations of the borehole stations where soil and groundwater samples will be collected during these investigations, and the rationales for the selection of these stations, are presented in Section 4.0 of the FSP.

4.1 GENERAL INFORMATION AND DEFINITIONS

Contractor Laboratory

The laboratory subcontracted by SAIC performing analysis of the field samples will be GEL.

QA and QC Samples

These samples are analyzed for the purpose of assessing the quality of the sampling effort and of the reported analytical data. QA and QC samples to be used for this project are duplicates, rinsate blanks, trip blanks, and split samples.

QC Samples

These samples are collected by the sampling team for analysis by the contractor laboratory. The identity of duplicate QC samples is held blind to the analysts and the purpose of these samples is to provide site-specific, field-originated information regarding the homogeneity of the sampled matrix and the consistency of the sampling effort.

QA Split Samples

These samples are collected by the sampling team and sent to a USACE QA laboratory for analysis to provide an independent assessment of SAIC and contractor laboratory performance. SAIC will

coordinate with the designated QA laboratory (for this project, the South Atlantic Division Laboratory) not less than 48 hours before sampling to ensure that the laboratory is alerted to receive the QA samples and process them within the time limits specified by applicable regulations and guidelines.

Field Duplicate Samples

These samples are collected concurrently with the primary environmental samples and equally represent the medium at a given time and location. Duplicate samples will be collected at each of the areas addressed by this project and submitted to the contractor laboratory for analysis.

Trip Blank Samples

These samples consist of containers of organic-free reagent water that are kept with the field sample containers from the time they leave the laboratory until the time they are returned for analysis. The purpose of trip blanks is to determine whether samples are being contaminated during transit or sample collection. For this project, one trip blank will be placed into each cooler used to store and ship water samples designated for volatile organic analysis.

4.2 SAMPLE CONTAINERS, PRESERVATION PROCEDURES, AND HOLDING TIMES

Sample containers, chemical preservation techniques, and holding times for soil, surface water, leachate, and groundwater samples collected during these investigations are described in Tables 1.1. The specific number of containers required for this study will be estimated and supplied by the analytical facilities. Additional sample volumes will be collected and provided, when necessary, for the express purpose of performing associated laboratory QC (laboratory duplicates, MS/MSD).

All sample containers will be provided by GEL, which will provide required types and volumes of preservatives with new containers as they are delivered to SAIC. Temperature preservation will be maintained at 4°C (±2°C) immediately after collection and will be maintained at this temperature until the samples are analyzed. In the event that sample integrity, such as holding times, cooler temperatures, etc., is compromised, resampling will occur as directed by the USACE-Savannah District Project Manager.

4.3 FIELD DOCUMENTATION

4.3.1 Field Logbooks

Sufficient information will be recorded in the logbooks to permit reconstruction of all drilling and sampling activities conducted. Information recorded on other project documents will not be repeated in the logbooks except in summary form where determined necessary. All field logbooks will be kept in the possession of field personnel responsible for completing the logbooks, or in a secure place when not being used during field work. Upon completion of the field activities, all logbooks will become part of the final project evidence file. Refer to Section 5.0 of the FSP.

4.3.2 Sample Numbering System

A unique sample numbering scheme will be used to identify each sample designated for laboratory analysis. The purpose of this numbering scheme is to provide a tracking system for the retrieval of

analytical and field data on each sample. Sample identification numbers will be used on all sample labels or tags, field data sheets and/or logbooks, COC records, and all other applicable documentation used during the project. A listing of all sample identification numbers will be maintained in the field logbook. The sample numbers to be used for the project are discussed in Section 5.3 of the FSP.

4.3.3 Documentation Procedures

The tracking procedure to be used for documentation of all samples collected during the project will involve the steps outlined in Section 5.5 of the FSP.

4.4 FIELD VARIANCE SYSTEM

Procedures cannot fully encompass all conditions encountered during a field investigation. Variances from the operating procedures, field sampling plan, and/or safety and health plan may occur. All variances that occur during the field investigation will be documented on a field change order (FCO) form or a nonconformance report (NCR) and will be noted in the appropriate field logbooks. Examples of the FCO and NCR forms to be used for these investigations are presented in Section 10.0 of the FSP. If a variance is anticipated (e.g., because of a change in the field instrumentation), the applicable procedure will be modified and the change noted in the field logbooks. Field changes and corrective actions are outlined in Section 10.0 of the FSP.

5.0 SAMPLE CUSTODY AND HOLDING TIMES

It is the policy of SAIC and will be the intent of this investigation to follow EPA policy regarding sample custody and COC protocols as described in *NEIC Policies and Procedures* (EPA 1985). This custody is in three parts: sample collection, laboratory analysis, and final evidence files. Final evidence files, including originals of laboratory reports and electronic files, are maintained under document control in a secure area. A sample or evidence file is under your custody when it is

- in your possession;
- in your view, after being in your possession;
- in your possession and you place them in a secured location; or
- in a designated secure area.

5.1 SAMPLE DOCUMENTATION

The sample packaging and shipment procedures summarized below will ensure that samples will arrive at the laboratory with the COC intact. The protocol for specific sample numbering using case numbers and traffic report numbers (if applicable) and other sample designations are included in Section 5.3 of the FSP.

5.1.1 Field Procedures

The field sampler is responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples. Each sample container will be labeled with a sample number, date and time of collection, sampler, and sampling location. Sample labels are to be completed for each sample. The SAIC Project Manager, in conjunction with the USACE, will review all field activities to determine whether proper custody procedures were followed during the field work and to decide if additional samples are required.

5.1.2 Field Logbooks/Documentation

Samples will be collected following the sampling procedures documented in Section 4.0 of the FSP. When a sample is collected or a measurement is made, a detailed description of the location shall be recorded. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers. A sample identification number will be assigned before sample collection. Field duplicate samples and QA split samples, which will receive an entirely separate sample identification number, will be noted under sample description. Equipment employed to make field measurement will be identified along with their calibration dates.

5.1.3 Transfer of Custody and Shipment Procedures

Samples are accompanied by a properly completed COC form. The sample numbers and locations will be listed on the COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record will document transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area. An example of the COC form to be used for these investigations is illustrated in Figure 5.2 of the FSP.

All shipments will be accompanied by the COC record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler for return to project management and the project file. Whenever co-located or split samples are collected for comparison analysis by the USACE QA Laboratory or a government agency, a separate COC is prepared for those samples and marked to indicate with whom the samples are being split.

All shipments will be in compliance with applicable U.S. Department of Transportation (DOT) regulations for environmental samples. SAIC will discourage the shipping of samples on Fridays unless it is absolutely necessary, and the laboratory has assured SAIC that personnel will be present on Saturdays to receive and effect any necessary processing within the analytical holding times.

5.2 LABORATORY COC PROCEDURES

Custody procedures along with the holding time and sample preservative requirements for samples will be described in laboratory QA Plans. These documents will identify the laboratory custody procedures for sample receipt and log-in, sample storage, tracking during sample preparation and analysis, and laboratory storage of data.

5.2.1 Cooler Receipt Checklist

The condition of shipping coolers and enclosed sample containers will be documented upon receipt at the analytical laboratory. This documentation will be accomplished using the cooler receipt checklist presented in Figure 5.3 of the FSP. One of these checklists will be placed into each shipping cooler along with the completed COC form or provided to the laboratory at the start of the project. A copy of the checklist will be faxed to the SAIC Project Manager immediately after it has been completed at the laboratory. The original completed checklist will be transmitted with the final analytical results from the laboratory.

5.2.2 Letter of Receipt

The laboratory will confirm sample receipt and log-in information through transmission of a Letter-of-Receipt (LOR) to SAIC. This will include returning a copy of the completed COC, a copy of the cooler receipt checklist, and confirmation of the analytical log-in indicating laboratory sample and sample delivery group numbers.

5.3 FINAL EVIDENCE FILES CUSTODY PROCEDURES

SAIC is the custodian of the evidence file and will maintain the contents of evidence files for this investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, correspondence, laboratory logbooks, and COC forms. The evidence file will be stored in a secure, limited-access area and under custody of the SAIC Project Manager.

Analytical laboratories will retain all original raw data information (both hard copy and electronic) in a secure, limited-access area and under custody of the Laboratory Project Manager.

6.0 ANALYTICAL PROCEDURES

All samples collected during the investigation activities will be analyzed by laboratories reviewed and validated by the USACE MRD HTRW CX, Omaha, Nebraska. QA samples shall be collected of groundwater and soil and analyzed by the USACE South Atlantic Savannah (SAS) District Laboratory in Marietta, Georgia. Each laboratory supporting this work shall provide statements of qualifications including organizational structure, QA Manual, and standard operating procedures (SOPs).

6.1 LABORATORY ANALYSIS

Samples collected during the project will be analyzed by EPA SW-846 methods. Laboratory standard operating procedures are based on the methods as published by the EPA in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW846*, Third Edition (November 1986; Revision 1, July 1992; Revision 2, November 1992; and Update 1, August 1993b). Analytical parameters, methods, and quantitation or detection limits are listed in Table 3.3. Summarized information regarding each analytical method to be employed during these studies is presented in Appendix C.

Principal laboratory facilities will not subcontract or transfer any portion of this work to another facility, unless expressly permitted to do so in writing by SAIC.

If contaminant concentrations are high, or for matrices other than normal waters and soils, analytical protocols may be inadequate. In these cases, sample analysis may require modifications to defined methodology. Any proposed changes to analytical methods specified require written approval from SAIC and USACE. All analytical method variations will be identified in investigation-specific addenda. These may be submitted for regulatory review and approval when directed by the USACE Project Manager.

These SOPs must be adapted from and reference standard EPA SW-846 methods and thereby specify:

- procedures for sample preparation,
- instrument start-up and performance check,
- procedures to establish the actual and required detection limits for each parameter,
- initial and continuing calibration check requirements,
- specific methods for each sample matrix type, and
- required analyses and QC requirements.

6.2 FIELD SCREENING ANALYTICAL PROTOCOLS

Procedures for field measurement of pH, specific conductivity, temperature, and turbidity are described in Section 4.0 of the FSP and Section 7.0 of this document. Tabulation of the methodologies appears in Tables 3.1 and 3.2.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of all the instruments and measuring equipment that are used for conducting field tests and laboratory analyses. These instruments and equipment shall be calibrated before each use or on a scheduled, periodic basis according to manufacturer instructions.

7.1 FIELD INSTRUMENTS/EQUIPMENT

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. All field instruments for this purpose will have unique identifiers and each instrument will be logged in the Material and Testing Equipment (M&TE) Log Book before use in the field. The site safety and health officer or his/her designate will be responsible for performing and documenting daily calibration/checkout records for instruments used in the field.

Equipment to be used during the field sampling will be examined to certify that it is in operating condition. This will include checking the manufacturer's operating manual and instructions for each instrument to ensure that all maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notation on any prior equipment problems will not be overlooked, and all necessary repairs to equipment will be carried out. Spare parts or duplication of equipment will be available to the sampling effort.

Calibration of field instruments is governed by the specific SOP for the applicable field analysis method, and it will be performed at the intervals specified in the SOP. If no SOP is available, calibration of field instruments will be performed at intervals specified by the manufacturer or more frequently as conditions dictate. Calibration procedures and frequency will be recorded in a field logbook.

Field instruments will include a pH meter, temperature probe, specific conductivity meter, turbidity meter, and flame ionization detector (FID) or photoionization detector (PID) for organic vapor detection. If an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service and a back-up instrument will be calibrated and used in its place.

Detailed instructions on the proper calibration and use of each field instrument follow the guidelines established by the manufacturer. The technical procedures for each instrument used on this project include the manufacturer's instructions detailing the proper use and calibration of each instrument.

7.1.1 pH Meter Calibration

The pH meter will be calibrated according to the manufacturer's instructions using traceable standard buffer solutions before work in the field. Calibration will follow these steps:

- Temperature of sample and buffer should be the same.
- Connect pH electrode into pH meter and turn on pH meter.
- Adjust temperature setting based on the temperature of buffer; place electrode in first buffer solution.
- After reading has stabilized, adjust "CALIB" knob to display correct value.
- Repeat procedure for second buffer solution.
- Place pH electrode in the sample and record the pH as displayed.
- Remove pH electrode from sample and rinse off with distilled water.
- Recalibrate the pH meter every time it is turned off and turned back on, or if it starts giving erratic results.

Before use in the field, calibration of the pH meter will be checked against two standard buffer solutions. Calibration procedures, lot numbers of buffer solutions, and other pertinent calibration or checkout information will be recorded in the M&TE Log Book for the project. The calibrations performed, standard used, and sample pH values are to be recorded in the field notebook. Appropriate new batteries will be purchased and kept with the meters to facilitate immediate replacement in the field as necessary.

7.1.2 Temperature Calibration

Temperature measurements are carried out using a temperature probe. Mercury thermometers must be inspected before use to ensure that there is no mercury separation. Thermometers should be rechecked in the field before and after each use to see if the readings are logical and the mercury is still intact. All temperature probes should be checked biannually for calibration by immersing them in a bath of known temperature until equilibrium is reached. Temperature probes should be replaced if found to have more than 10 percent error. The reference thermometer used for bath calibration should be National Institute of Standards and Testing (NIST) traceable. Temperatures will be recorded in the M&TE Log Book, the Sample Log Book, or the Cooler Log Book, as appropriate.

7.1.3 Conductivity Meter Calibration

The conductivity cells of the specific conductivity meter will be cleaned according to manufacturer's recommendations and specifications and checked against known conductivity standard solutions before each sampling event. The instrument will be checked daily with NIST-traceable standard solutions. If the instrument is more than 10 percent out of calibration when compared with standard solutions, the instrument will be recalibrated. If this cannot be done in the field, the instrument will be returned to the manufacturer or supplier for recalibration and a back-up instrument will be used in its place. Daily calibration readings and other relevant information will be recorded daily in the M&TE Log Book.

Daily checks should be as follows:

- Fill a sample cup with the conductivity calibration standard solution.
- Set temperature knob for temperature of standard solution.
- Turn to appropriate scale and set the instrument for the value of calibration standard.
- Rinse out the cup with distilled water.

7.1.4 Organic Vapor Detection

Organic vapor detectors will be checked daily according to the manufacturer's instructions. FIDs will be checked daily by using the internal calibration mechanism. PIDs will be calibrated daily with a gas of known concentration. All daily calibration information will be recorded in the M&TE Log Book.

7.1.5 Turbidity Calibration

The turbidity meter will be calibrated each day against a known and traceable standard supplied by the instrument manufacturer prior to use in the field. In the field the instrument will be checked against the standard and adjusted, if necessary, each time the instrument is turned on. Calibration information will be recorded in the M&TE Log Book; checks made in the field will be recorded in the Sample Log Book.

7.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by laboratory personnel performing QC activities. These records will be filed at the location where the work is performed and will be subject to QA audit. Procedures and records of calibration will follow USACE MRD- and SAIC-reviewed laboratory-specific QA Plans.

In all cases where analyses are conducted according to the EPA CLP or SW 846 protocols, the calibration procedures and frequencies specified in the applicable CLP RAS Statement of Work (SOW) or SW 846 methods will be followed exactly. For analyses governed by SOPs, refer to the appropriate SOP for the required calibration procedures and frequencies.

Records of calibration will be kept as follows:

- If possible, each instrument will have a record of calibration with an assigned record number.
- A label will be affixed to each instrument showing identification numbers, manufacturer, model numbers, date of last calibration, signature of calibrating analyst, and due date of next calibration. Reports and compensation or correction figures will be maintained with instrument.
- A written step-wise calibration procedure will be available for each piece of test and measurement equipment.

- Any instrument that is not calibrated to the manufacturer's original specification will display a warning tag to alert the analyst that the device carries only a "Limited Calibration."

7.2.1 Organic Analyses

Summarized information for each analytical method to be employed during these investigations is presented in Appendix C.

7.2.2 Metals and Miscellaneous Analyses

Summarized information for each analytical method to be employed during these investigations is presented in Appendix C.

8.0 INTERNAL QUALITY CONTROL CHECKS

8.1 FIELD SAMPLE COLLECTION

The assessment of field sampling precision and accuracy will be made by collecting field duplicates and field blanks in accordance with the procedures described in the project FSP and at the frequency indicated in Section 4.0 of the FSP.

8.2 FIELD MEASUREMENT

QC procedures for most field measurements (i.e., pH, conductivity, temperature, dissolved oxygen, headspace, etc.) are limited to checking the reproducibility of the measurement by obtaining multiple readings on a single sample or standard and by calibrating the instruments. Refer to the FSP and Section 7.1 of this document for more detail regarding these measurements.

8.3 LABORATORY ANALYSIS

Analytical QC procedures for these investigations are specified in the individual method descriptions. These specifications include the types of QC checks normally required; method blanks, LCS, MS, MSD, calibration standards, internal standards, surrogate standards, calibration check standards, and laboratory duplicate analysis. Calibration compounds and concentrations to be used and the method of QC acceptance criteria for these parameters have been identified.

To ensure the production of analytical data of known and documented quality, laboratories associated with these investigations will implement all method QA and QC checks.

8.3.1 QA Program

All subcontracted analytical laboratories will have a written QA program that provides rules and guidelines to ensure the reliability and validity of work conducted at the laboratory. Compliance with the QA program is coordinated and monitored by the laboratory's QA department, which is independent of the operating departments. For these investigations GEL's Quality Assurance Plan, GL-QS-B-001, Rev.10 will be implemented in its entirety.

The stated objectives of the laboratory QA program are to:

- properly collect, preserve, and store all samples;
- maintain adequate custody records from sample collection through reporting and archiving of results;
- use properly trained analysts to analyze all samples by approved methods within holding times;
- produce defensible data with associated documentation to show that each system was calibrated and operating within precision and accuracy control limits;

- accurately calculate, check, report, and archive all data using the Laboratory Information Management System; and

- document all the above activities so that all data can be independently validated.

All laboratory procedures are documented in writing as SOPs, which are edited and controlled by the QA department. Internal QC measures for analysis will be conducted with their SOPs and the individual method requirements specified.

External QA shall be provided by the USACE SAS District Laboratory in Marietta, Georgia. The external QA laboratory shall receive QA sample splits as identified by Section 4.0 of the FSP and Table 1.1 of this QAPP.

8.3.2 QC Checks

Implementation of QC procedures during sample collection, analysis, and reporting ensures that the data obtained are consistent with its intended use. Both field QC and laboratory QC checks are performed throughout the work effort to generate data confidence. Analytical QC measures are used to determine if the analytical process is in control, as well as to determine the sample matrix effects on the data being generated.

Specifications include the types of QC required (duplicates, sample spikes, surrogate spikes, reference samples, controls, blanks, etc.), the frequency for implementation of each QC measure, compounds to be used for sample spikes and surrogate spikes, and the acceptance criteria for this QC.

Laboratories will provide documentation in each data package that both initial and ongoing instrument and analytical QC functions have been met. Any non-conforming analysis will be reanalyzed by the laboratory, if sufficient sample volume is available. It is expected that sufficient sample volumes will be collected to provide for reanalyses, if required.

8.3.2.1 Analytical Process QC

8.3.2.1.1 Method Blanks

A method blank is a sample of a noncontaminated substance of the matrix of interest (usually distilled/de-ionized water or silica sand) that is then subjected to all of the sample preparation (digestion, distillation, extraction) and analytical methodology applied to the samples. The purpose of the method blank is to check for contamination from within the laboratory that might be introduced during sample preparation and analysis that would adversely affect analytical results. A method blank must be analyzed with each analytical sample batch.

Analytical sensitivity goals are identified in Table 3.3 as practical quantitation limits. Method blank levels should be below these levels for all analytes, criteria are established at 2× these levels.

8.3.2.1.2 Laboratory Control Samples

The LCS contains known concentrations of analytes representative of the contaminants to be determined and is carried through the entire preparation and analysis process. Commercially available LCSs or those from EPA may be used. LCS standards that are prepared in-house must be made from a source independent of that of the calibration standards. For methods using surrogates, the method

blank may be used as the LCS. Each LCS analyte must be plotted on a control chart. The primary purpose of the LCS is to establish and monitor the laboratory's analytical process control. An LCS must be analyzed with each analytical sample batch.

8.3.2.2 Matrix and Sample-Specific QC

8.3.2.2.1 Laboratory Duplicates

Laboratory duplicates are separate aliquots of a single sample that are prepared and analyzed concurrently at the laboratory. This duplicate sample should not be a method blank, trip blank, or field blank. The primary purpose of the laboratory duplicate is to check the precision of the laboratory analyst, the sample preparation methodology, and the analytical methodology. If there are significant differences between the duplicates, the affected analytical results will be re-examined. One in 20 samples will be a laboratory duplicate, with fractions rounded to the next whole number.

8.3.2.2.2 Surrogate Spikes

A surrogate spike is prepared by adding a pure compound to a sample before extraction. The compound in the surrogate spike should be of a similar type to that being assayed in the sample. The purpose of a surrogate spike is to determine the efficiency of recovery of analytes in the sample preparation and analysis. The percent of recovery of the surrogate spike is then used to gauge the total accuracy of the analytical method for that sample.

8.3.2.2.3 Matrix Spikes and Matrix Spike Duplicates

An MS is an aliquot of a sample spiked with known quantities of analytes and subjected to the entire analytical procedure. It is used to indicate the appropriateness of the method for the matrix by measuring recovery or accuracy. Accuracy is the nearness of a result or the mean of a set of results to the true or accepted value. An MSD is a second aliquot of the same sample with known quantities of compounds added. The purpose of the MSD, when compared to the MS, is to determine method precision. Precision is the measure of the reproducibility of a set of replicate results among themselves or the agreement among repeat observations made under the same conditions. MSs and MSDs are performed per 20 samples of similar matrix.

8.3.2.2.4 Method-Specific QC

The laboratory must follow specific quality processes as defined by the method. These will include measures such as calibration verification samples, instrument blank analysis, internal standards implementation, tracer analysis, method of standard additions utilization, serial dilution analysis, post-digestion spike analysis, chemical carrier evaluation, etc.

9.0 CALCULATION OF DATA QUALITY INDICATORS

9.1 FIELD MEASUREMENTS DATA

Field data will be assessed by the site Chemical QC (CQC) Representative. The site CQC Representative will review the field results for compliance with the established QC criteria that are specified in the QAPP and FSP. Accuracy of the field measurements will be assessed using daily instrument calibration, calibration check, and analysis of blanks. Precision will be assessed on the basis of reproducibility by multiple reading of a single sample.

Field data completeness will be calculated using Equations (1a) and (1b).

Sample Collection (1a):

$$\text{Completeness} = \frac{\text{Number of Sample Points Sampled}}{\text{Number of Sample Points Planned}} \times 100\% \qquad \textbf{(1a)}$$

Field Measurements (1b):

$$\text{Completeness} = \frac{\text{Number of Valid Field Measurements Made}}{\text{Number of Field Measurements Planned}} \times 100\% \qquad \textbf{(1b)}$$

9.2 LABORATORY DATA

Laboratory results will be assessed for compliance with required precision, accuracy, completeness, and sensitivity as follows.

9.2.1 Precision

The precision of the laboratory analytical process will be determined through evaluation of LCS analyses. The standard deviation of these measurements over time will provide confidence that implementation of the analytical protocols was consistent and acceptable. These measurements will establish the precision of the laboratory analytical process.

Investigative sample matrix precision will be assessed by comparing the analytical results between MS/MSD for organic analysis and laboratory duplicate analyses for inorganic analysis. The RPD will be calculated for each pair of duplicate analysis using Equation (2). This precision measurement will include variables associated with the analytical process, influences related to sample matrix interferences, and sample heterogeneity.

$$RPD = \frac{S - D}{\frac{(S + D)}{2}} \times 100, \qquad \textbf{(2)}$$

where

S = first sample value (original or MS value),

D = second sample value (duplicate or MSD value).

9.2.2 Accuracy

The accuracy of the laboratory analytical measurement process will be determined by comparing the percent recovery for the LCS versus its documented true value.

Investigative sample accuracy will be assessed for compliance with the established QC criteria that are described in Section 3.0 of this QAPP using the analytical results of method blanks, reagent/preparation blank, MS/MSD samples, field blank, and bottle blanks. The percent recovery (%R) of MS samples will be calculated using Equation (3). This accuracy will include variables associated with the analytical process, influences related to sample matrix interferences, and sample heterogeneity.

$$\%R = \frac{A - B}{C} \times 100, \qquad (3)$$

where

A = the analyte concentration determined experimentally from the spiked sample,

B = the background level determined by a separate analysis of the unspiked sample,

C = the amount of the spike added.

9.2.3 Completeness

Data completeness of laboratory analyses will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using Equation (4).

$$\text{Completeness} = \frac{\text{Number of Valid Laboratory Measurements Made}}{\text{Number of Laboratory Measurements Planned}} \times 100\% \qquad (4)$$

9.2.4 Sensitivity

Achieving method detection limits depends on sample preparation techniques, instrumental sensitivity, and matrix effects. Therefore, it is important to determine actual method detection limits (MDLs) through the procedures outlined in 40 *CFR* 136, Appendix C. MDLs should be established for each major matrix under investigation (i.e., water, soil) through multiple determinations, leading to a statistical evaluation of the MDL.

It is important to monitor instrument sensitivity through calibration blanks and low concentration standards to ensure consistent instrument performance. It is also critical to monitor the analytical method sensitivity through analysis of method blanks, calibration check samples, and LCSs, etc.

9.3 PROJECT COMPLETENESS

Project completeness will be determined by evaluating the planned versus actual data. Consideration will be given for project changes and alterations during implementation. All data not flagged as rejected by the review, verification, validation, or assessment processes will be considered valid. Overall, the project completeness will be assessed relative to media, analyte, and area of investigation. Completeness objectives are listed in Table 3.1 (soil) and Table 3.2 (groundwater).

9.4 REPRESENTATIVENESS/COMPARABILITY

Representativeness expresses the degree to which data accurately reflect the analyte or parameter of interest for the environmental media examined at the site. It is a qualitative term most concerned with the proper design of the sampling program. Factors that affect the representativeness of analytical data include appropriate sample population definitions, proper sample collection and preservation techniques, analytical holding times, use of standard analytical methods, and determination of matrix or analyte interferences. Sample collection, preservation, analytical holding time, analytical method application, and matrix interferences will be evaluated by reviewing project documentation and QC analyses.

Comparability, like representativeness, is a qualitative term relative to a project data set as an individual. These investigations will employ narrowly defined sampling methodologies, site audits/surveillances, use of standard sampling devices, uniform training, documentation of sampling, standard analytical protocols/procedures, QC checks with standard control limits, and universally accepted data reporting units to ensure comparability to other data sets. Through proper implementation and documentation of these standard practices, the project will establish confidence that data will be comparable to other project and programmatic information.

Additional input to determine representativeness and comparability may be gained through statistical evaluation of data populations, chemical charge balances, compound evaluations, or dual measurement comparisons (e.g., total versus dissolved water analysis, field versus fixed laboratory analyses, etc.).

10.0 CORRECTIVE ACTIONS

Corrective actions may be required for two major types of problems: analytical/equipment problems and noncompliance with criteria. Analytical and equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, and data review. Noncompliance with specified criteria and analytical/equipment problems will be documented through a formal corrective action program at the time the problem is identified. The person identifying the problem is responsible for notifying the SAIC Project Manager and the USACE Project Manager. When the problem is analytical in nature, information on these problems will be promptly communicated to the SAIC Analytical Laboratory Coordinator. Implementation of corrective action will be confirmed in writing.

Any nonconformance with the established QC procedures in the QAPP or FSP will be identified and corrected in accordance with the QAPP. The SAIC Project Manager or his/her designee will issue an NCR for each nonconforming condition Figure 10.2 of the FSP.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are deemed insufficient, work may be stopped through a stop-work order issued by the SAIC Project Manager and the USACE Project Manager.

10.1 SAMPLE COLLECTION/FIELD MEASUREMENTS

Technical staff and project personnel will be responsible for reporting all suspected technical and QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the SAIC Project Manager or his/her designee. The manager will be responsible for assessing the suspected problems in consultation with the SAIC Project QA Manager to make a decision based on the potential for the situation to impact the quality of the data. When it is determined that the situation warrants a reportable nonconformance and corrective action, then an NCR will be initiated by the manager.

The manager will be responsible for ensuring that corrective actions for nonconformances are initiated by:

- evaluating all reported nonconformances,
- controlling additional work on nonconforming items,
- determining disposition or action to be taken,
- maintaining a log of nonconformances,
- reviewing NCRs and corrective actions taken, and
- ensuring that NCRs are included in the final site documentation project files.

If appropriate, the SAIC Project Manager will ensure that no additional work dependent on the nonconforming activity is performed until the corrective actions are completed.

Corrective action for field measurements may include:

- repeating the measurement to check the error,
- checking for all proper adjustments for ambient conditions such as temperature,
- checking the batteries,
- re-calibrating equipment,
- checking the calibration,
- modifying the analytical method including documentation and notification (i.e., standard additions),
- replacing the instrument or measurement devices, and
- stopping work (if necessary).

The SAIC Project Manager or his/her designee is responsible for all site activities. In this role, he/she may at times be required to adjust the site activities to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible person notifies the SAIC Project Manager of the anticipated change and implements the necessary changes after obtaining the approval of the SAIC Program Manager and the USACE Program Manager. All changes in the program will be documented on the FCO that will be signed by the initiators and the SAIC Project Manager (Figure 10.1 of the FSP). The FCO for each document will be numbered serially as required. The FCO shall be attached to the file copy of the affected document. The SAIC Project Manager must approve the change in writing or verbally before field implementation. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and action taken.

The SAIC Project Manager for the site is responsible for the controlling, tracking, and implementation of the identified changes. Reports on all changes will be distributed to all affected parties, including the USACE Project Manager. The USACE will be notified whenever program changes in the field are made.

10.2 LABORATORY ANALYSES

Each project investigation laboratory QA plan provides systematic procedures to identify out-of-control situations and corrective actions. Corrective actions shall be implemented to resolve problems and restore malfunctioning analytical systems. Laboratory personnel have received QA training and are aware that corrective actions are necessary when:

- QC data are outside warning or control windows for precision and accuracy.
- Blanks contain target analytes above acceptable levels and must be investigated (see Table 3.3).
- Undesirable trends are detected in spike recoveries or RPD between duplicates.

- There are unusual changes in detection limits.
- Deficiencies are detected by internal audits, external audits, or from performance evaluation samples results.
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the Laboratory Supervisor, Manager, and/or QA Department for further investigation. Once resolved, full documentation of the corrective action procedure is filed with project records and the QA Department, and the information is summarized within case narratives. Refer to Appendix C for potential method-related corrective actions.

Corrective actions may include

- re-analyzing the samples, if holding time criteria permit;
- evaluating blank contaminant sources, elimination of these sources, and reanalysis;
- modifying the analytical method (i.e., standard additions) with appropriate notification and documentation;
- resampling and analyzing;
- evaluating and amending sampling procedures; or
- accepting data and acknowledging the level of uncertainty.

If resampling is deemed necessary due to laboratory problems, the SAIC Project Manager will identify the necessary cost recovery approach to implement the additional sampling effort.

The following corrective action procedures will be required:

- Problems noted during sample receipt will be documented in the appropriate laboratory LOR. SAIC and USACE will be contacted immediately to determine problem resolution. All corrective actions will be thoroughly documented.
- When sample extraction/digestion or analytical holding times are not within method required specifications, SAIC and USACE will be notified immediately to determine problem resolution. All corrective actions will be thoroughly documented.
- All initial and continuing calibration sequences that do not meet method requirements will result in a review of the calibration. When appropriate, re-analysis of the standards or re-analysis of the affected samples back to the previous acceptable calibration check is warranted.
- All appropriate measures will be taken to prepare and clean up samples in an attempt to achieve the practical quantitation limits as stated. When difficulties arise in achieving these limits, the

laboratory will notify SAIC and the USACE to determine problem resolution. All corrective actions will be thoroughly documented.

- Any dilutions impacting the practical quantitation limits will be documented in case narratives along with revised quantitation limits for those analytes affected. Analytes detected above the method detection limits, but below the practical quantitation limits, will be reported as estimated values.

- Failure of method-required QC to meet the requirements specified in this project QAPP shall result in review of all affected data. Resulting corrective actions may encompass those identified earlier. SAIC and USACE will be notified as soon as possible to discuss possible corrective actions, particularly when unusual or difficult sample matrices are encountered.

- When calculation and reporting errors are noted within any given data package, reports will be reissued with applicable corrections. Case narratives will clearly state the reasons for reissuance of reports.

11.0 DATA REDUCTION, VALIDATION, AND REPORTING

11.1 DATA REDUCTION

11.1.1 Field Measurements and Sample Collection

Raw data from field measurements and sample collection activities will be appropriately recorded in field logbooks. Data to be used in project reports will be reduced and summarized. The methods of data reduction will be documented.

The SAIC Project Manager or his/her designee is responsible for data review of all field-generated data. This includes verifying that all field descriptive data are recorded properly, that all field instrument calibration requirements have been met, that all field QC data have met frequency and criteria goals, and that field data are entered accurately in all logbooks and worksheets.

11.1.2 Laboratory Services

All samples collected for these investigations will be sent to USACE MRD-qualified laboratories. Data reduction, evaluation, and reporting for samples analyzed by the laboratory will be performed according to specifications outlined in the laboratory's QA plan. Laboratory reports will include documentation verifying analytical holding time compliance.

Laboratories will perform in-house analytical data reduction under the direction of the Laboratory QA Officer. The Laboratory QA Officer is responsible for assessing data quality and informing SAIC and USACE of any data which are considered "unacceptable" or require caution on the part of the data user in terms of its reliability. Data will be reduced, evaluated, and reported as described in the laboratory QA plan. Data reduction, review, and reporting by the laboratory will be conducted as follows:

- Raw data are produced by the analyst who has primary responsibility for the correctness and completeness of the data. All data will be generated and reduced following the QAPP defined methods and implementing GEL SOP protocols.

- Level 1 technical data review is completed relative to an established set of guidelines by a peer analyst. The review shall ensure the completeness and correctness of the data while assuring all method QC measures have been implemented and were within appropriate criteria.

- Level 2 technical review is completed by the area supervisor or data review specialist. This reviews the data for attainment of QC criteria as outlined in the established methods and for overall reasonableness. It will ensure all calibration and QC data are in compliance and check at least 10 percent of the data calculations. This review shall document that the data package is complete and ready for reporting and archival.

- Upon acceptance of the raw data by the area supervisor, the report is generated and sent to the Laboratory Project Manager for Level 3 administrative data review. This review will ensure consistency and compliance with all laboratory instructions, the laboratory QA plan, the project laboratory SOW, and the project QAPP.

- The Laboratory Project Manager will complete a thorough review of all reports.

- Final reports will be generated and signed by the Laboratory Project Manager.
- Data will then be delivered to SAIC for data validation.

The data review process will include identification of any out-of-control data points and data omissions, as well as interactions with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project. The laboratory will provide flagged data to include such items as: (1) concentration below required detection limit, (2) estimated concentration due to poor spike recovery, and (3) concentration of chemical also found in laboratory blank.

Laboratories will prepare and retain full analytical and QC documentation for the project. Such retained documentation will be both hard (paper) copy and electronic storage media (e.g., magnetic tape) as dictated by the analytical methodologies employed. As needed, laboratories will supply hard copies of the retained information.

Laboratories will provide the following information to SAIC in each analytical data package submitted:

- cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis;
- tabulated results of inorganic and organic compounds identified and quantified;
- analytical results for QC sample spikes, sample duplicates, initial and continuous calibration verifications of standards and blanks, standard procedural blanks, LCSs and other deliverables as identified in Section 11.3; and
- tabulation of instrument detection limits determined in pure water.

11.2 DATA VALIDATION

11.2.1 Data Validation Approach

A systematic process for data verification and validation will be performed to ensure that the precision and accuracy of the analytical data are adequate for their intended use. The greatest uncertainty in a measurement is often a result of the sampling process and inherent variability in the environmental media rather than the analytical measurement. Therefore, analytical data validation will be performed only to the level necessary to minimize the potential of using false positive or false negative results in the decision-making process (i.e., to ensure accurate identification of detected versus non-detected compounds). This approach is consistent with the DQOs for the project, with the analytical methods, and for determining contaminants of concern and calculating risk.

Samples will be analyzed through implementation of "definitive" analytical methods. "Definitive data" will be reported consistent with the deliverables identified in Section 11.3, Tables 11.1 and 11.2. This report content is consistent with what is understood as an EPA Level III deliverable (data forms including laboratory QC and calibration information). This "Definitive data" will then be validated through the review process presented in Section 11.2.2. DQOs identified in Section 3.0 and

Table 11.1. Standard Data Deliverables

Method Requirements	Deliverables
Requirements for all methods:	
- Holding time information and methods requested	Signed COC forms
- Discussion of laboratory analysis, including any laboratory problems	Case narratives
- LCS results (run with each batch of samples processed)	Results
Organics: GC/MS analysis	
- Sample results, including TICs	CLP Form 1 or equivalent
- Surrogate recoveries	CLP Form 2 or equivalent
- Matrix spike/spike duplicate data	CLP Form 3 or equivalent
- Method blank data	CLP Form 4 or equivalent
- GC/MS tune	CLP Form 5 or equivalent
- GC/MS initial calibration data	CLP Form 6 or equivalent
- GC/MS continuing calibration data	CLP Form 7 or equivalent
- GC/MS internal standard area data	CLP Form 8 or equivalent
Organics: GC and HPLC analysis	
- Sample results	CLP Form 1 or equivalent
- Surrogate recoveries	CLP Form 2 or equivalent
- Matrix spike/spike duplicate data	CLP Form 3 or equivalent
- Method blank data	CLP Form 4 or equivalent
- Initial calibration data	CLP Form 6 or equivalent
If calibration factors are used	A form listing each analyte, the concentration of each standard, the relative calibration factor, the mean calibration factor, and the %RSD
- Calibration curve if used	Calibration curve and correlation coefficient
- Continuing calibration data	CLP Form 9 or equivalent
- Positive identification (second column confirmation GC)	CLP Form 10 or equivalent

Table 11.1 (continued)

Method Requirements	Deliverables
Metals	
- Sample results	CLP Form 1 or equivalent
- Initial and continuing calibration	CLP Form 2 or equivalent, dates of analyses and calibration curve, and the correlation coefficient factor
- Method blank	CLP Form 3 or equivalent and dates of analyses
- ICP interference check sample	CLP Form 4 or equivalent and dates of analyses
- Spike sample recovery	CLP Form 5A or equivalent
- Postdigestion spike sample recovery for ICP metals	CLP Form 5B or equivalent
- Postdigestion spike for GFAA	CLP Form 5B or equivalent
- Duplicates	CLP Form 6 or equivalent
- LCS	CLP Form 7 or equivalent
- Standard additions (when implemented)	CLP Form 8 or equivalent
- Holding times	CLP Form 13 or equivalent
- Run log	CLP Form 14 or equivalent
Wet Chemistry	
- Sample results	Report results
- Matrix spike recovery	% Recovery
- Matrix spike duplicate or duplicate	% Recovery and % RPD
- Method blank	Report results
- Initial calibration	Calibration curve and correlation coefficient
- Continuing calibration check	Recovery and % difference
- LCS	LCS result and control criteria

GC = gas chromatograph
GFAA = graphite furnace atomic absorption
MS = mass spectrometer
ICP = inductively coupled plasma
HPLC = high performance liquid chromatography
TIC = tentatively identified compounds

Table 11.2. Standard Electronic Data Deliverables

Column Position	Length	Field Description
		Header Record
1 - 20	20	SAIC Project Number
21- 28	8	Data Submission Data (MM/DD/YY)
29 - 33	6	Number of Records (Rows) in the file including header and terminating records
34 - 74	40	Submitting Laboratory Name
		Detail Record
1 - 20	20	SAIC Sample Identification Number
21 - 28	8	Date of Sample Collection (MM/DD/YY)
29 - 33	5	Time of Sample Collection (HH:MM military format)
34 - 48	15	Laboratory Analytical Batch/Sample Delivery Group (SDG) Number
49 - 56	8	Sample Matrix
57 - 76	20	Laboratory Sample Identification Number
77 - 84	8	Sample Extraction/Preparation Date (MM/DD/YY)
85 - 92	8	Sample Analysis Date (MM/DD/YY)
93 - 97	5	Sample Analysis Time (HH:MM military format)
98 - 100	3	Analysis/Result Type - This field is used to designate the type of analysis performed. Valid values are as follows: REG = Regular Sample Analysis DUP = Laboratory Duplicate Analysis DIL = Secondary Dilution Analysis REn = Re-analysis where "n" is a sequential number
101 - 112	12	Chemical Abstract Services (CAS) Number
113 - 142	30	Analysis Name
143 - 157	15	Analysis Method (Method numbers shall be the EPA, SW-846, NIOSH, etc. method number)
158 - 167	10	Result (Report detection limit if not detected)
168 - 172	5	Result Qualifier (U, J, etc.)
173 - 180	8	Unit of measure
181 - 190	10	Instrument Detection Limit
191 - 195	5	Percent Solids (Report "0" for water matrices)
196 - 200	5	Sample Weight/Volume
201 - 202	2	Sample Weight/Volume Units
203 - 207	5	Dilution
		Termination Record
1 - 3	3	$$$

Electronic deliverables must have the file structure defined in this table. The deliverable file may be either an ASCII text file, a dBASE compatible file (.DBF file extension), or an Excel spread sheet file (.XLS file extension). All fields must be present. Fields that are not applicable for the reported method shall be reported as blank.

method-specified criteria will be validated. Comprehensive analytical information will be retained by the subcontract laboratory.

Validation will be accomplished by comparing the contents of the data packages and QA/QC results to requirements contained in the requested analytical methods. The SAIC validation support staff will be responsible for these activities. The protocol for analyte data validation is presented in:

- SAIC Quality Assurance Technical Procedures (SAIC 1995);
- EPA CLP National Functional Guidelines for Organic Data Review (EPA 1994b); and
- EPA CLP National Functional Guidelines for Inorganic Data Review (EPA 1994c).

SAIC validation support staff will conduct a systematic review of the data for compliance with the established QC criteria based on the following categories:

- holding times,
- blanks,
- LCSs,
- surrogate recovery (organic methods),
- internal standards (primarily organic methods),
- furnace atomic absorption QC,
- calibration,
- sample reanalysis,
- secondary dilutions, and
- laboratory case narrative.

Consistent with the data quality requirements as defined in the DQOs, all project data and associated QC will be evaluated on these categories and qualified as per the outcome of the review. Information gathered during this validation process will be consistent with the information demonstrated by the USACE-Savannah District Data Validation Form (Figure 11.1). Either these forms or SAIC validation forms containing equivalent documentation will be completed and presented with the Quality Control Summary Report (QCSR).

11.2.2 Primary Analytical Data Validation Categories

11.2.2.1 Holding Times

Evaluation of holding times ascertains the validity of results based on the length of time from sample collection to sample preparation or sample analysis. Verification of sample preservation must be confirmed and accounted for in the evaluation of sample holding times. The evaluation of holding times is essential to establishing sample integrity and representativeness. Concerns regarding physical, chemical, or biochemical alteration of analyte concentrations can be eliminated or qualified through this evaluation.

11.2.2.2 Blanks

The assessment of blank analyses is performed to determine the existence and magnitude of contamination problems. The criteria for evaluation of blanks applies to any blank associated with the samples, including field, trip, equipment, and method blanks. Contamination during sampling or analysis, if not discovered, results in false-positive data.

DATA VALIDATION FORM, USACE, SAVANNAH DISTRICT

DATE: _____

REVIEWER NAME: _____

SIGNATURE: _____

TITLE: _____

DATA VALIDATION CHECKLIST

PROJECT NAME: _____

PROJECT NUMBER: _____

SAMPLE ID (NUMBERS): _____

SAMPLING TEAM: _____

SAMPLE MATRIX: _____

ANALYSES PERFORMED: _____

_____

CESAS DATA REPORTING LEVEL

FIELD DATA DOCUMENTATION:

FIELD SAMPLING LOGS:	REPORTED		ACCEPTABLE		NOT REQUIRED
	NO	YES	NO	YES	
1. SAMPLING DATES NOTED					
2. SAMPLING TEAM INDICATED					
3. SAMPLE ID TRACEABLE TO LOCATION					
4. SAMPLE LOCATION					
5. SAMPLE DEPTHS FOR SOILS					
6. COLLECTION TECHNIQUE (BAILER, PUMP, ETC.)					
7. SAMPLE TYPE (GRAB, COMPOSITE)					
8. SAMPLE CONTAINER					
9. SAMPLE PRESERVATION					
10. CHAIN OF CUSTODY FORM COMPLETED					
11. REQUIRED ANALYTICAL METHODS					
12. FIELD WATER AND SOIL SAMPLE LOGS COMPLETED					
13. NUMBER OF QA & QC SAMPLES COLLECTED					
14. FIELD EQUIPMENT CALIBRATION					
15. FIELD EQUIPMENT DECONTAMINATION					
16. SAMPLE SHIPPING					

COMMENTS: _____

_____

_____

_____

Figure 11.1. Savannah District Data Validation Form

LABORATORY DATA VALIDATION:	REPORTED		ACCEPTABLE		NOT REQUIRED
	NO	YES	NO	YES	
1. SAMPLE RESULTS					
2. PARAMETERS ANALYZED					
3. ANALYTICAL METHOD					
4. SIMPLE RECEIPT DATE					
5. SAMPLE PREPARATION DATE					
6. HOLDING TIMES					
7. CALIBRATION					
8. MS/MSD RPD OR SAMPLE LD RPD					
9. SURROGATE SPIKE RESULTS					
10. BLANKS					
A. RINSATES					
B. FIELD BLANKS					
C. TRIP BLANKS					
11. SAMPLE pH					
12. SAMPLE TEMPERATURE					
13. DETECTION LIMITS					
14. QC DATA					
A. INORGANIC					
B. ORGANIC					

ANALYTE: _____

FLAG: _____

REMARKS: _____

OVERALL COMMENTS: _____

DEFINITIONS:

U	Analyte not detected
J	Analyte identified, concentration is estimated value
UJ	Analyte not detected above estimated detection limits
B	Blank contaminated
R	Rejected value, presence or absence of analyte cannot be verified
UR	Rejected detection limits
MS	Matrix Spike
MSD	Matrix Spike Duplicate
RPD	Relative Percent Difference
LD	Laboratory Duplicate

Figure 11.1 (continued)

Blanks will be evaluated against quantitation limit goals as specified in Table 3.3. Analytical method blanks should be below 2× these levels. Field, trip, and equipment rinsate blanks will be evaluated against 5× these levels for most analytes and 10× these levels for common laboratory solvent analytes.

11.2.2.3 Laboratory Control Samples

The LCS serves as a monitor of the overall performance of the analytical process, including sample preparation, for a given set of samples. Evaluation of this standard provides confidence in or allows qualification of results based on a measurement of process control during each sample analysis.

11.2.2.4 Surrogate Recovery

System monitoring compounds are added to every sample, blank, matrix spike, MS, MSD, and standard. They are used to evaluate extraction, cleanup, and analytical efficiency by measuring recovery on a sample-specific basis. Poor system performance as indicated by low surrogate recoveries is one of the most common reasons for data qualification. Evaluation of surrogate recovery is critical to the provision of reliable sample-specific analytical results.

11.2.2.5 Internal Standards

Internal standards are utilized to evaluate and compensate for sample-specific influences on the analyte quantification. They are evaluated to determine if data require qualification due to excessive variation in acceptable internal standard quantitative or qualitative performance measures. For example, a decrease or increase in internal standard area counts for organics may reflect a change in sensitivity that can be attributed to the sample matrix. Because quantitative determination of analytes is based on the use of internal standards, evaluation is critical to the provision of reliable analytical results.

11.2.2.6 Furnace Atomic Absorption QC

Duplicate injections and furnace post-digestion spikes are evaluated to establish precision and accuracy of individual analytical determinations. Because of the nature of the furnace atomic absorption technique and because of the detailed decision tree and analysis scheme required for quantitation of the elements, evaluation of the QC is critical to ensuring reliable analytical results.

11.2.2.7 Calibration

The purpose of initial and continuing calibration verification analyses is to verify the linear dynamic range and stability of instrument response. Relative instrument response is used to quantitate the analyte results. If the relative response factor is outside acceptable limits, the data quantification is uncertain and requires appropriate qualification.

11.2.2.8 Sample Reanalysis

When instrument performance-monitoring standards indicate an analysis is out of control, the laboratory is required to reanalyze the sample. If the reanalysis does not solve the problem (i.e., surrogate compound recoveries are outside the limits for both analyses), the laboratory is required to submit data from both analyses. An independent review is required to determine which is the appropriate sample result.

11.2.2.9 Secondary Dilutions

When the concentration of any analyte in any sample exceeds the initial calibration range, a new aliquot of that sample must be diluted and reanalyzed. The laboratory is required to report data from both analyses. When this occurs, an independent review of the data is required to determine the appropriate results to be used for that sample. An evaluation of each analyte exceeding the calibration range must be made, including a review of the dilution analysis performed. Results chosen in this situation may be a combination of both the original results (i.e., analytes within initial calibration range) and the secondary dilution results.

11.2.2.10 Laboratory Case Narratives

Analytical laboratory case narratives are reviewed for specific information concerning the analytical process. This information is used to direct the data validator to potential problems with the data.

11.3 PROJECT ANALYTICAL DATA SET

Analytical data for this project will be screened electronically and validated by qualified chemists. Flags signifying the usability of data will be noted and entered into an analytical data base. Deficiencies in data deliverables will be corrected through direct communication with the field or laboratory, generating immediate response and resolution. All significant data discrepancies noted during the validation process will documented through NCRs, which are sent to the laboratory for clarification and correction. Refer to Figure 10.2 of the FSP.

Decisions to repeat sample collection and analyses may be made by the SAIC Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

All data generated for investigations will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include data flags in accordance with the above-referenced protocols as well as additional comments of the Data Review Team. The associated data flags will include such items as: (1) estimated concentration below-required reporting limit; (2) estimated concentration due to poor calibration, internal standard, or surrogate recoveries; (3) estimated concentration due to poor spike recovery; and (4) estimated concentration of chemical that was also determined in the laboratory blank.

SAIC data assessment will be accomplished by the joint efforts of the data validator, the data assessor, and the Project Manager. Data assessment by data management will be based on the criteria that the sample was properly collected and handled according to the FSP and Sections 4.0 and 5.0 of this QAPP. An evaluation of data accuracy, precision, sensitivity and completeness, based on criteria in Section 9.0 of this QAPP, will be performed by a data assessor and presented in the QCSR. This data quality assessment will indicate that data are: (1) usable as a quantitative concentration, (2) usable with caution as an estimated concentration, or (3) unusable due to out-of-control QC results.

Project investigation data sets will be available for controlled access by the SAIC Project Manager and authorized personnel. Each data set will be incorporated into investigation reports as required.

11.4 DATA REPORTING

Laboratories will prepare and submit analytical and QC data reports to SAIC in compliance with the requirements of this QAPP, including data forms listed in Table 11.1. An electronic copy of data will be provided in an ASCII data file, CLP format, or other compatible format for entry into the SAIC data base. An acceptable configuration is presented in Table 11.2 with all QA/QC sample data being provided in a companion ASCII file.

The landscaped or portrait sheets that contain the sample data will be ruled into columns. From the left, the first column will list from the top, the table number and title, sample location, field ID, matrix of sample, test method, concentration units, whether QC, blank, or lab control sample. Below that follows a list of all the compounds or metal elements tested by that test. On the bottom of the page in the same columns is listed, lab arrival time, lab name, test lab sample number, dates samples collected, date received, date extracted. To the right appears a column where either the regulatory limits and/or the quantitation limits, or the recovery or RPD, whatever is appropriate, are listed for each compound or element. To the right of that are listed the sample data in columns with a blank column between each column, where the SAS QA can insert their data for comparison.

An electronic copy in MS Excel will accompany the data report, and will be sent to Mr. James Nowland, SAS Laboratory, 611 South Cobb Drive, Marietta, Georgia 30060-3112, phone 770-919-5271.

The laboratory will be required to confirm sample receipt and log-in information. The laboratory will return a copy of the completed COC and confirmation of the laboratory's analytical log-in to SAIC within three days of sample receipt.

The subcontract analytical laboratory will prepare and retain full analytical and QC documentation similar to that required by CLP. Such retained documentation will include all hard copies and other storage media (e.g., magnetic tape). As needed, the subcontract analytical laboratory will make available all retained analytical data information.

12.0 PREVENTIVE MAINTENANCE PROCEDURES

12.1 FIELD INSTRUMENTS AND EQUIPMENT

The field equipment for this project may include temperature probes; pH meters; conductivity meters; organic vapor detectors (FID or PID); and combustible gas detectors capable of measuring the lower explosive limit, upper explosive limit, and/or oxygen levels. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturers. These procedures are included in the technical procedures governing the use of these instruments.

Field instruments will be checked and/or calibrated before they are shipped or carried to the field. Each field instrument will be checked daily against a traceable standard or reference with a known value to ensure that the instrument is in proper calibration. Instruments found to be out of calibration will be recalibrated before use in the field. If the instrument cannot be calibrated, it will be returned to the supplier or manufacturer for recalibration, and a back-up instrument will be used in its place. Calibration checks and calibrations will be documented on the Field Meter/Calibration Log Sheets in the M&TE Log Book. Any maintenance conducted on field equipment must be documented in the M&TE Log Book.

Critical spare parts such as tapes, papers, pH probes, electrodes, and batteries will be kept on site to minimize down time of malfunctioning instruments. Back-up instruments and equipment should be available on site or within 1-day shipment to avoid delays in the field schedules.

12.2 LABORATORY INSTRUMENTS

As part of their QA/QC Program, a routine preventive maintenance program will be conducted by all investigation-associated laboratories to minimize the occurrence of instrument failure and other system malfunctions. All laboratory instruments will be maintained in accordance with manufacturers' specifications and the requirements of the specific method employed. This maintenance will be carried out on a regular, scheduled basis and will be documented in the laboratory instrument service log book for each instrument. Emergency repair or scheduled manufacturer's maintenance will be provided under a repair and maintenance contract with factory representatives.

Refer to Appendix C of this QAPP for additional analytical method related information regarding routine and preventive maintenance for laboratory procedures and methods.

13.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the FSP and QAPP. Audits of laboratory activities will include both internal and external audits.

13.1 LABORATORY AUDITS

The MRD HTRW CX conducts on-site audits and validates laboratories on a regular basis. These USACE independent on-site systems audits in conjunction with performance evaluation samples (performance audits) qualify laboratories to perform USACE environmental analysis every 18 months.

These system audits include examining laboratory documentation of sample receiving, sample log-in, sample storage, COC procedures, sample preparation and analysis, instrument operating records, etc. Performance audits consist of sending performance evaluation samples to USACE laboratories for on-going assessment of laboratory precision and accuracy. The analytical results of the analysis of performance evaluation samples are evaluated by MRD HTRW CX to ensure that laboratories maintain an acceptable performance.

Internal performance and system audits of laboratories will be conducted by the Laboratory QA Officer as directed in the laboratory QA plan. These system audits will include examination of laboratory documentation of sample receiving, sample log-in, sample storage, COC procedures, sample preparation and analysis, instrument operating records, etc. Internal performance audits are also conducted on a regular basis. Single-blind performance samples are prepared and submitted along with project samples to the laboratory for analysis. The Laboratory QA Officer will evaluate the analytical results of these single-blind performance samples to ensure that the laboratory maintains acceptable performance.

Additional audits of laboratories may be planned and budgeted within specific USACE task scopes. These project-specific laboratory performance review audits would be conducted by SAIC at the direction of and in conjunction with the USACE-Savannah District, when requested.

External audits may be conducted in conjunction with or at the direction of EPA Region IV or the State of Georgia regulatory agency.

14.0 QA REPORTS TO MANAGEMENT

14.1 DAILY QUALITY CONTROL REPORTS

During the field investigation activities performed for this project, SAIC will prepare Daily Quality Control Reports (DQCRs), which will be signed and dated by the SAIC CQC Representative. An example of the DQCR format to be used by SAIC is illustrated in Figure 9.1 of the FSP. These reports will be submitted to the USACE-Savannah District Project Manager on a weekly basis. The contents of each DQCR will include a summary of activities performed at the project site, weather information, results of Contractor Chemical Quality Control (CCQC) activities performed including field instrument calibrations, departures from the approved Work Plan problems encountered during field activities, and any instructions received from government personnel. Any deviations that may affect the project data quality objectives will be immediately conveyed to the USACE-Savannah District Project Manager.

14.2 QUALITY ASSURANCE REPORTS

All performance and system audits of laboratory and field operations will be reported directly to SAIC project management, SAIC program management, and the USACE-Savannah District.

Each laboratory will provide LORs and analytical QC summary statements (case narratives) with each data package. All COC forms will be compared with samples received by the laboratory and a LOR will be prepared and sent to SAIC describing any differences in the COC forms and the sample labels or tags. All deviations will be identified on the receiving report such as broken or otherwise damaged containers. This report will be forwarded to SAIC within three days of sample receipt and will include the following: a signed copy of the COC form; itemized SAIC sample numbers; laboratory sample numbers; cooler temperature upon receipt; and itemization of analyses to be performed.

Summary QC statements will accompany analytical results as they are reported by the laboratory in the form of case narratives for each sample delivery group.

Any departures from approved plans will receive prior approval from the USACE-Savannah District Project Manager and will be documented with field change orders. These field change orders will be incorporated into the project evidence file.

SAIC will maintain custody of the project evidence file and will maintain the contents of files for this project, including all relevant records, reports, logs, field logbooks, pictures, subcontractor reports, correspondence, and COC forms, until this information is transferred to the USACE-Savannah District Project Manager. These files will be stored in a secure, limited access area and under custody of the SAIC Project Manager. Analytical laboratories will retain all original analytical raw data information (both hard copy and electronic) in a secure, limited access area and under custody of the laboratory Project Manager.

14.3 QUALITY CONTROL SUMMARY REPORTS

At the conclusion of field investigation activities and laboratory analysis, SAIC, in addition to any review conducted by the laboratory, will perform its own validation of the submitted data. This

activity will include assignment of flags to data, documentation of the reason(s) for the assignments, and description of any other data discrepancies. SAIC will then prepare QCSRs, which will be included as appendices to final reports. These reports will be submitted to the USACE-Savannah District Project Manager as determined by the project schedule. The contents of each QCSR will include data validation documentation and discussion of all data that may have been compromised or influenced by aberrations in the sampling and analytical processes. Both field and laboratory QC activities will be summarized, and all DQCR information will be consolidated. Problems encountered, corrective actions taken, and their impact on project DQOs will be determined.

The following are examples of elements to be included in the QCSR as appropriate.

- Laboratory QC evaluation and summary of the data quality for each analytical type and matrix. Part of the accuracy, precision, and sensitivity summarized in the data quality assessment.

- Field QC evaluation and summary of data quality relative to data useability. Part of the accuracy, precision, and sensitivity summarized in the data quality assessment.

- Overall data assessment and usability evaluation.

- DQCR consolidation and summary.

- Summary of lessons learned during project implementation.

Specific elements to be evaluated within the QCSR include the following:

- sample results,
- field and laboratory blank results,
- laboratory control sample percent recovery (method dependent),
- sample matrix spike percent recovery (method dependent),
- matrix spike/matrix spike duplicate or sample duplicate RPD (method dependent),
- analytical holding times, and
- surrogate recovery, when appropriate.

An example of the format that will be used by SAIC for preparation of the project QCSR is presented in Figure 14.1.

QUALITY CONTROL SUMMARY REPORT

1. Introduction

    1.1 Project Description
    1.2 Project Objectives
    1.3 Project Implementation
    1.4 Purpose of this Report

2. Quality Assurance Program

    2.1 Monthly Progress Reports
    2.2 Daily Quality Control Reports (DQCRs)
    2.3 Laboratory "Definitive" Level Data Reporting

3. Data Validation

    3.1 Field Data Validation
    3.2 Laboratory Data Validation
    3.3 Definition of Data Qualifiers (Flags)
    3.4 Data Acceptability

4. Data Evaluation

    4.1 Accuracy
        — Metals
        — Volatile Organic Compounds
        — Total Petroleum Hydrocarbon
        — etc.

    4.2 Precision
        — Laboratory Precision
        — Field Precision

    4.3 Sensitivity
    4.4 Representativeness and Comparability
    4.5 Completeness

5. Data Quality Assessment Summary

6. References

Figure 14.1. Quality Control Summary Report Format

QUALITY ASSURANCE PROJECT PLAN
FOR
CORRECTIVE ACTION PLAN-PART A INVESTIGATIONS
FOR
FORMER UNDERGROUND STORAGE TANK SITES
AT
HUNTER ARMY AIRFIELD, GEORGIA

APPENDIX A

REFERENCES

REFERENCES

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QUALITY ASSURANCE PROJECT PLAN
FOR
CORRECTIVE ACTION PLAN-PART A INVESTIGATIONS
FOR
FORMER UNDERGROUND STORAGE TANK SITES
AT
HUNTER ARMY AIRFIELD, GEORGIA

APPENDIX B

DATA MANAGEMENT PLAN

1.0 INTRODUCTION

This Appendix of the QAPP represents the Data Management Plan (DMP) for project activities to be performed by Science Applications International Corporation (SAIC) for the Corrective Action Plan-Part A Investigations at Former UST Sites at Hunter Army Airfield, Georgia. This plan describes the data management process to be implemented for this project. The DMP presents the process used for the planning, collection, tracking, verification, validation, analysis, presentation, and storage of site characterization data. The plan identifies required data documentation materials and procedures, as well as project file requirements. The plan also provides the reporting requirements for presenting the raw data and conclusions of the investigation.

Project activities will generate data, including sample locations, borehole information, measurements of field parameters, and results of sample analyses and data reviews. Important records regarding the collection and analysis of the samples and data will also be generated. The data management process requires the proper flow of data from field collection and processing by the analytical laboratory to those involved in the project evaluation and decision making. Figure 1.1 illustrates the flow of information for the project. This DMP will ensure the validity and accessibility of data to support environmental data analysis and the evaluation of corrective measures.

2.0 INVESTIGATION DATA

2.1 DATA TYPES

Sampling activities proposed for the project will result in the collection of multiple data types from multiple sources. Data collection activities will include acquisition of historical data as appropriate, entry of sample collection data and field measurements from logbooks, loading of analytical data from laboratory Electronic Data Deliverables, loading of civil survey results, and entry of data validation result qualifiers. In addition, critical project records such as chain-of-custody forms, laboratory data packages, and validation results will be maintained in the project file.

2.2 KEY IDENTIFIERS

The key identifiers for project sampling data will be the sample location/station and a unique sample identification number. All samples will be assigned an area and station to identify the specific point where the field measurements or samples were collected. Descriptions, geographic coordinates, and elevations will be obtained for these sampling stations.

Unique sample numbers are derived from the location, sampling station within the location, sample medium, sample type, plus a sequential number. Field duplicates represent a separate sample type, and distinct depths receive different sequential numbers so no duplication of sample numbers will occur. The sample identification will appear on the sample collection log sheet, sample label, chain-of-custody form, and on any correspondence related to the sample.

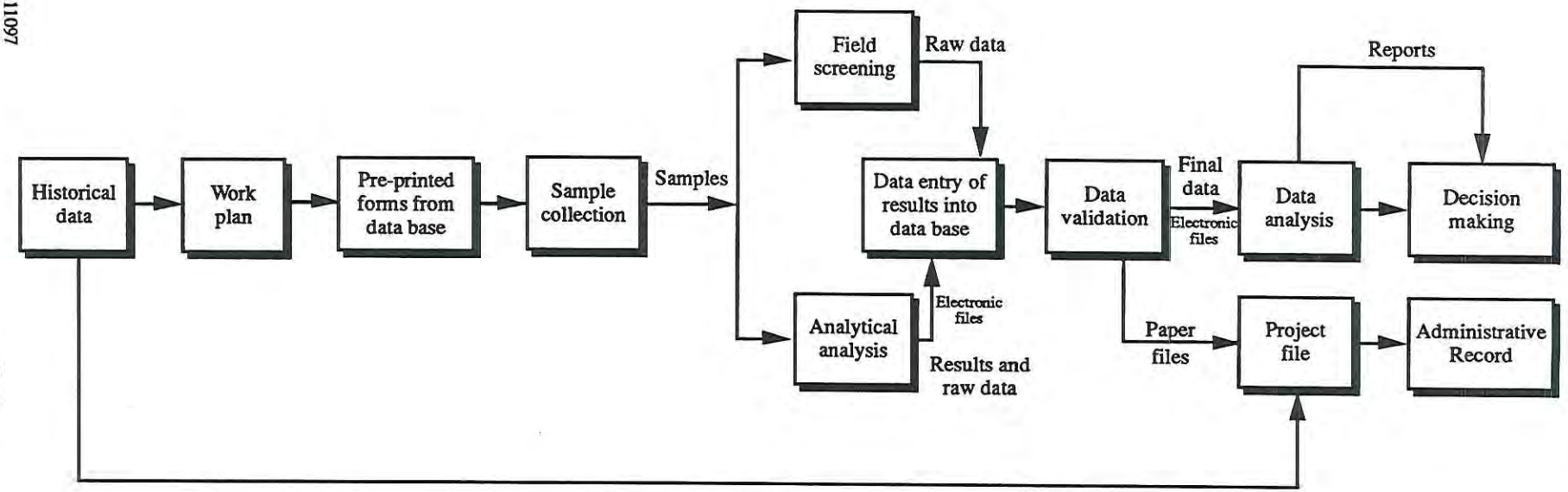

Figure 1.1. Project Information Flow Diagram for the CAP-Part A UST Investigations at HAAF, Georgia.

Additional information regarding sample identification is presented in Section 5.3 of the Field Sampling Plan.

3.0 DATA MANAGEMENT SYSTEM

The data management system facilitates the information flow by providing a means of tracking, organizing, reporting, and archiving data and information. The system has four primary components:

(1) A multi-disciplinary team of data management professionals.

(2) A process model that integrates activities relevant to ensuring that data are complete, consistent, and fully qualified, and minimizes the uncertainties associated with the data, data products, or interpretations of results.

(3) Guidance provided in the SAIC *Quality Assurance Technical Procedures Volume I: Data Management.*

(4) A standardized data base structure to support the collection, management, analysis, and presentation of site characterization data.

4.0 DATA MANAGEMENT AND TRACKING PROCESS

To meet the regulatory requirements for the acquisition of technically sound and legally admissible data, a traceable audit trail will be established from the development of the project Work Plan through the archiving of information and data. Each step or variation of the sampling and analytical process will be documented. Standardized formats for electronic transfer and reporting will be used. To meet this requirement, the following data management process will be followed throughout the collection, management, storage, analysis, and presentation of the site environmental characterization data.

4.1 SAMPLING AND ANALYSIS PLANNING

Plans for the collection of field and laboratory quality control samples are detailed in the FSP and the QAPP. These two plans together specify all applicable sampling and analytical data that will be entered into the data base.

The interface with the analytical laboratory is crucial in achieving the goal of generating technically sound data. Based upon the laboratory data quality objectives presented in the QAPP, the laboratory statement of work details analytical methods, validation criteria, deliverables, and deliverable formats required of the analytical laboratory. The analytical laboratories that have been contracted with for chemical and geotechnical testing are identified in the QAPP.

Prior to initiating field work, the project database will be populated with sample locations, sample numbers, analytical parameters and detection limits, and associated sampling and laboratory information based on the requirements of the FSP. A report of all planned samples will be generated for review by the SAIC Field Manager. After approval of the pre-sampling database, the data

coordinator will generate field sampling forms including preprinted sample information, bind and number the logbooks, and print and organize the required sample labels. This process will increase the accuracy of the final database and minimize the amount of information samplers must record in the field.

4.2 FIELD SAMPLE COLLECTION AND MEASUREMENT

Prior to beginning field sampling, field personnel will be trained as necessary and participate in a project specific readiness review. These activities ensure that standard procedures will be followed in sample collection and in completing field logbooks, chain-of-custody forms, labels, and custody seals. Documentation of training and readiness is submitted to the project file.

The master field investigation document will be the site field logbooks. The primary purpose of these documents is to record each day's field activities, personnel on each sampling team, and any administrative occurrences, conditions, or activities that may have affected the field work or data quality of any environmental samples for any given day.

Each field sampling team will have a field logbook in which it will record data collected in the field. To the extent possible, preprinted field logbook sheets will be generated from the data management system. If preprinted logbook sheets are not used for a given sample, required information will be recorded manually. As samples are collected in the field, the field sampling team members will complete the logbooks with sample collection data and required field measurements as specified in the FSP and QAPP. Standardized reporting formats will be used to document this information.

The field logbooks will be signed and dated by the data recorder and will specify whether field methods and procedures were followed. Entries will be verified by a sampling team member other than the recorder, or by the SAIC Field Manager, who will perform a quality assurance review and sign and date the logbook to document the review.

Backup photocopies of the field logbooks will be made and submitted to the project file. Sample collection and measurement information from the logbooks and data forms will be manually entered into the data base and checked for accuracy. Entries will be verified using double entry and comparing protocols. As necessary, the actual forms used will be modified to include the appropriate information codes to facilitate data entry. Completed logbooks and appropriate field forms will be submitted to the project file upon completion of the project.

At any point in the process of sample collection or data or document review, a Nonconformance Report (NCR) may be initiated if nonconformances are identified, and data entered into the data base may be flagged accordingly. Additional information regarding NCRs is presented in Section 10.0 of the FSP.

4.3 CHAIN-OF-CUSTODY DOCUMENTATION

Sample containers will be tracked from the field collection activities to the analytical laboratory following proper chain-of-custody protocols and using standardized chain-of-custody forms.

When the samples are received at the laboratory, the laboratory receiving staff will check and document the condition of the samples upon arrival, check that the sample identification numbers on

containers and chain-of-custody forms match, and assign laboratory sample identification numbers traceable back to the field identification numbers. Within 3 days of receipt of the sample containers, the laboratory will send a letter of receipt to the SAIC Laboratory Coordinator or his designee. This letter will provide the following information:

- sample receipt date,
- problems noted at the time of receipt,
- list of sample identification numbers and corresponding laboratory identification numbers for all samples received,
- analyses requested for each sample received, and
- completed cooler receipt checklists for each cooler received.

The letter of receipt will be accompanied by the completed and signed chain-of-custody form(s) for the samples, and both documents will be submitted to the project file. Sample information recorded on the chain-of-custody form and in the letter of receipt will be entered into the sample tracking data base. This data base will allow for tracking of the status of samples from the time of collection through analysis and validation. The data base tracking program will produce reports that will inform the project team of potential delays or problems related to sample analysis and validation.

4.4 ANALYTICAL LABORATORY DOCUMENT AND DATA SUBMISSION

Prior to release of a data package, the analytical laboratory supervisor will review the data package for precision, accuracy, and completeness and will attest that it meets all data analysis and reporting requirements for the specific method used. The supervisor will then sign the hard copy forms certifying that the data package and any electronic format deliverables were reviewed and are approved for release.

Analytical results will be submitted to the SAIC Laboratory Coordinator or his designee on standardized forms in data packages in accordance with the subcontract scope of work for analytical services. These forms will contain results and required quality assurance/quality control information applicable to the analytical laboratory method used for analysis. In addition, as required by the scope of work, results of analyses will also be provided in electronic format on diskettes. The data coordinator receiving laboratory deliverables will make a copy of each data package and/or diskette and submit the originals to the project file. Results will be transferred to the data base either electronically by diskette or manually from the hard copy into appropriate data tables within the data base.

4.5 DATA VERIFICATION AND VALIDATION

All data packages received from the analytical laboratory will be reviewed, verified, and validated by data management personnel. Details regarding the data verification and validation processes are presented in the project QAPP.

With regard to data reduction, any replicate measurements associated with a single sample will be averaged prior to further data reduction. Correction of extreme (outlier) values will be attempted if the cause for the outlier value can be documented. This type of data will be corrected if the outliers are caused by incorrect transcription and the correct values can be obtained and documented from valid records. If the values can be documented as resulting from a catastrophic event or a problem in methodology, the values will be appropriately qualified. Documentation and validation of the cause of outliers will accompany any attempt to correct or delete these data values. Outlier values will not be omitted from the raw data reported to the USACE - Savannah District, and valid values will be included in data summary tables. Analytical values determined to be at or below the detection limit will be reported numerically (e.g., </= 0.1 mg/L). The data presentation procedures will cite analytical methods used including appropriate detection limits.

4.6 DATA CENTRALIZATION AND STORAGE

Once the data for a given sample or group of samples are complete and entered into the data base, the data coordinator will check that logbooks, other field records, and all analytical data are complete and properly stored, including both the electronic form and associated data packages. Each piece of information will be documented as to its source, and hard copy information will be appropriately indexed and filed.

Procedure-based routines for establishing data security, backup, archival, and maintaining proper data base changes are also used to maintain data base integrity. Classes of users will be defined with access levels approved and controlled by the SAIC Data Manager. Once loaded, the data base will be secured from physical corruption (i.e., hardware or software failure) or from unauthorized access and illegal updating. Physical security requires recovery procedures, time-stamping, and other related standard operating processes and controls. Any changes made to the completed data base will be documented on standardized forms which will be placed into the project file.

4.7 DATA SUMMARIZATION AND REPORTING

When field sampling has been completed and the analytical data have been received, validated, and transferred into the project data base, project reports and Quality Control Summary Reports (QCSRs) will be generated for each of the sites investigated. Information regarding the format and content for QCSRs is presented in Section 14.0 of the QAPP.

Project data will be screened for potential data errors, compared to site-specific background values and applicable regulatory limits, summarized in both tabular and graphical form to facilitate data interpretation. Data reduction and summation will be accomplished using quality-controlled and documentable reporting programs. Data summaries will be generally produced using predefined report formats available within the data management system. Statistical summaries will be generated by transferring data to a SAS dataset and adapting exiting data analysis programs to include project-specific aggregation or screening criteria. Any new programs developed under this project will be tested, reviewed, and documented as error-free following SAIC quality assurance technical procedures. Data presented on maps, figures, or tables will be transferred electronically as far as possible to avoid introducing typographical errors.

4.8 RECORDS MANAGEMENT AND DOCUMENT CONTROL

Hard copies of all original site and field logbooks, chain-of-custody forms, data packages with analytical results and associated quality assurance/quality control information, data verification and validation forms, and other project-related information will be indexed, catalogued into appropriate file groups and series, and archived.

The SAIC Data Manager will archive the project data to the appropriate electronic media. A data archive information package will be prepared that describes the data system, file format, and method of archival. Sufficient documentation will accompany the archived data to fully describe the source, contents, and structure of the data to ensure future usability. Computer programs used to manipulate or report the archived data will also be included in the data archive information package to further enhance the data's future usability.

QUALITY ASSURANCE PROJECT PLAN
FOR
CORRECTIVE ACTION PLAN-PART A INVESTIGATIONS
FOR
FORMER UNDERGROUND STORAGE TANK SITES
AT
HUNTER ARMY AIRFIELD, GEORGIA

APPENDIX C

LABORATORY ANALYTICAL PROCEDURES

VOLATILE ORGANIC ANALYSIS (EPA SW-846 METHOD 8020)

This procedure encompasses the determination of low level purgeable aromatic compounds in a variety of matrices. Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) are included in this group of analytes. The volatile organic compounds are purged from the environmental matrix, absorbed onto a trapping media, desorbed from the trapping media, separated via gas chromatographic techniques, and then selectively quantified employing retention time and chromatographic peak area information. This method will quantitate the volatile aromatic compounds identified above.

Sample Preparation

EPA SW-846 Method 5030, Purge-and-Trap, is referenced in the analytical procedure as both a solid and liquid preparation methodology. In this instance both the preparation and analytical processes are instrumentally linked and sequential step in the overall analysis. An aliquot of water or solid sample is introduced to a sparging vessel (5 mL or 5 gm, respectively). For solid samples, 5 mL of organic free water is added to the vessel. An inert gas (normally helium) is bubbled through the solution to transfer the volatile components to the vapor phase. The vapor is swept through a sorbent column where the volatile components are trapped. After purging is complete, the sorbant column is heated and backflushed with the inert gas to desorb the volatile components onto a gas chromatographic column for analysis.

Analytical Method

This method will be used to analyze BTEX in soil samples. Compounds are extracted using SW-846 Method 5030, transferred onto a GC column where they are separated and quantified by peak retention time and area. No modifications to the method are anticipated.

Method Specific Data Quality Objectives

Refer to Tables 3-1, 3-2, and SW-846 Methods for method specific DQOs for accuracy, precision, and completeness. Tables 3-3 identifies objectives for analyte specific sensitivity.

Preventative Maintenance

Preventative maintenance on each GC system involves three basic areas; GC column maintenance, analyzer maintenance, and autosampler maintenance. GC column maintenance consists of partial removal of frontal column sections and injection port cleaning or replacement initiated when system sensitivity drops or air is present in the system. Routine baking of the chromatographic columns is employed on a daily basis. The analyzer is maintained through source monitoring and replacement as determined necessary due to the type and quantity of samples analyzed.

Each instrument has a maintenance logbook that includes the following information:

- Instrument model and serial number
- Instrument manufacturer
- Instrument identification number
- Service contact personnel and contract information
- Instrument maintenance records
- Service call documentation

Instrument Calibration and Frequency

A minimum of three standard concentration levels are prepared for each parameter of interest. One of the concentrations should be at a concentration near, but above the method detection level of the compound. Working calibration curves or calibration factors must be verified each day of operation. If response varies by more than 15 percent, a new calibration must be performed.

Internal Quality Control Checks

Quality control checks employed during analysis include initial and continuing calibration, method blank analysis, spike and spike duplicate analysis, Laboratory Control Standard (LCS) analysis, and surrogate spikes added to all standards, blanks, spikes, duplicates, and samples. Frequency of initial calibrations is determine from the analysis of continuing calibration performance, while continuing calibration standards are analyzed daily. Method blanks are required to be analyzed daily as are LCS samples. Matrix spike (MS) and matrix spike duplicate (MSD) analyses are performed with each analytical sample batch (maximum of 20 samples). Criteria as defined in SW-846 will apply.

Corrective Action

When method calibration or QC criteria are not met corrective action will be taken. When analytes do not meet initial calibration criteria, only those compounds failing need to be reanalyzed. If calibration is still not successful new standards or instrument maintenance may be required. If continuing calibration criteria are not achieved reanalysis of the standard, purge flow adjustment, or instrument maintenance may be warranted. If all attempts fail, a new multi-point calibration must be performed. When method blanks fail criteria the source or cause of contamination must be identified and eliminated. In any event, another method blank must be successfully analyzed prior to sample analysis. If the surrogate fails criteria, the sample must be reanalyzed. If the surrogate fails a second time, the failure is attributed to matrix effects.

Data Reduction, Validation, and Documentation

Compounds are identified by comparison of the standard reference for the suspected compound on the same GC system.

When a compound has been identified, the quantification of that compound will be based on the integrated abundance of the associated standard for that compound. Quantification will occur utilizing the internal standard relative to the given analyte as defined by the SW-846 protocol.

Sediment and soil samples are reported on a dry weight basis, while sludges and wastes are reported on a wet weight basis. Spike and spike duplicate data are reported for all results. Results are reported to two significant figures. Data is reported in units of μg/L for waters and μg/Kg for soils, sediments, sludges, and wastes. All data is stored by date, instrument, and analyst and routinely "backed up" on magnetic tape.

Analytical data review, validation and reporting criteria are established in General Engineering's Quality Assurance Plan, GEL QAP No.: GL-QS-B-001 - Rev. 9, Section VIII.

POLYAROMATIC HYDROCARBON ANALYSIS (EPA SW-846 METHOD 8270)

This procedure is used to determine low level solvent extractable organic compounds in a variety of matrices. Semivolatile organic compounds are extracted from the environmental matrix, concentrated in an organic solvent, separated via gas chromatographic techniques, and then selectively quantified using a mass spectrometer. This method will quantitate many semivolatile organic compounds that are soluble in methylene chloride and are able to be separated employing a slightly polar fused silica capillary GC column. Polyaromatic hydrocarbon compounds (PAHs) are included in this group of analytes.

Sample Preparation

EPA SW-846 Methods 3510 (Separatory Funnel Liquid-Liquid Extraction) and 3520 (Continuous Liquid-Liquid Extraction) are referenced in the analytical procedure for liquid sample preparation methodologies. In both instances a measured volume of sample, usually one liter, is adjusted to a specified pH and organic constituents are extracted into methylene chloride solvent. The extract is then chemically dried to remove residual water content, concentrated through evaporative techniques, subject to chemical cleanup procedures (if necessary), and finally placed into a sealed ampule prior to instrumental analysis.

EPA SW-846 Methods 3540 (Soxhlet Extraction) and 3550 (Ultrasonic Extraction) are referenced in the analytical procedure for solid sample preparation methodologies. In both instances a weighed portion of sample, usually 30 grams for low level concentrations and 2 grams for medium/high level concentrations, is mixed with anhydrous sodium sulfate and subsequently extracted with methylene chloride solvent. The Soxhlet extraction allows a continuous washing of the solid with solvent employing a refluxing apparatus, while an ultrasonic probe is used to extract organic compounds into sequential solvent aliquots during the ultrasonic extraction. The extract is then chemically dried to remove residual water content, concentrated through evaporative techniques, subject to chemical cleanup procedures (if necessary), and finally placed into a sealed ampule prior to instrumental analysis.

Analytical Method

This method will be used to analyze PAHs in soil and water samples. Compounds are extracted using SW-846 Method 3510, 3520, 3540, or 3550, transferred onto a GC capillary column where they are separated, and then analyzed employing a mass spectrometer (MS). No modifications to the method are anticipated.

Method Specific Data Quality Objectives

Refer to Tables 3-1, 3-2, and SW-846 Methods for method specific DQOs for accuracy, precision, and completeness. Table 3-3 identifies objectives for analyte specific sensitivity.

Preventative Maintenance

Preventative maintenance on each GC/MS system involves four basic areas; vacuum pumps, GC maintenance, analyzer maintenance, and autosampler maintenance. Vacuum pump maintenance

primarily includes oil changes every six months for mechanical, turbomolecular and diffusion pumps. GC maintenance consists of partial removal of frontal column sections and injection port cleaning or replacement initiated when system sensitivity drops or air is present in the system. Routine baking of the chromatographic columns is employed on a daily basis. The MS analyzer is maintained through ion source and electron multiplier cleaning or replacement as determined necessary due to the type and quantity of samples analyzed. Autosampler maintenance is performed by backflushing the systems trap and lines with methanol as needed based on the types and quantities of sample processed.

Each instrument has a maintenance logbook that includes the following information:

- Instrument model and serial number
- Instrument manufacturer
- Instrument identification number
- Service contact personnel and contract information
- Instrument maintenance records
- Service call documentation

Instrument Calibration and Frequency

Instrumentation is calibrated through a sequence of events. The MS is tuned daily to ensure an acceptable spectral pattern for decafluorotriphenylphosphine (DFTPP). Relative ion abundance criteria for DFTPP are listed in the method and criteria must be demonstrated each 12 hour shift. Prior to tuning or multi-point calibration of instrumentation, precautions are taken to ensure that the instrument is clean and functioning properly. Initial tuning injections will also include standards of 4,4'-DDT, pentachlorophenol, and benzidine to verify injection port inertness, and GC column performance.

A minimum of five standard concentration levels are run to establish average relative response factors (RRFs)for each target compound and internal standard. System performance is verified by ensuring that the minimum average response factor (RF) criteria are met in the initial and continuing calibrations for specified system performance check compounds (SPCCs). Specifically; N-nitroso-di-n-propylamine, hexachlorocyclopentadiene, 2,4-dinitro-phenol, and 4-nirophenol. The minimum acceptable RF will be 0.050.

An initial calibration will be monitored through the use of the following calibration check compounds (CCCs) each 12 hour shift: acenaphthene, 1,4-dichlorobenzene, hexaclhorobutadiene, N-Nitrosodiphenylamine, di-n-octyl phthalate, fluoranthene, benzo(a)pyrene, 4-chloro-3-methylphenol, 2,4-dichlorophenol, 2- nitrophenol, phenol, pentachlorophenol, and 2,4,6-trichlorophenol. The maximum allowable percent relative standard deviation (%RSD) for these CCCs will be 30%. Continuing calibrations will be assessed using percent difference (%D) values. The maximum allowable %D value for CCCs will be 25.0%.

Internal Quality Control Checks

Quality control checks employed during analysis include initial and continuing calibration, method blank analysis, spike and spike duplicate analysis, Laboratory Control Standard (LCS) analysis, and surrogate spikes added to all standards, blanks, spikes, duplicates, and samples. Frequency of initial calibrations is determine from the analysis of continuing calibration performance, while continuing calibration standards are analyzed every 12 hours. Method blanks are required to be analyzed every 12 hours as are LCS samples. Matrix spike (MS) and matrix spike duplicate (MSD) analyses are

performed with each analytical sample batch (maximum of 20 samples), and which are analyzed within the 12 hour tune window. Criteria as defined in SW-846 will apply.

Corrective Action

When method calibration or QC criteria are not met corrective action will be taken. When analytes do not meet initial calibration criteria, only those compounds failing need to be reanalyzed. If calibration is still not successful new standards or instrument maintenance may be required. If continuing calibration criteria are not achieved, retuning, reanalysis of the standard, purge flow adjustment, or instrument maintenance may be warranted. If all attempts fail, a new multi-point calibration must be performed. When method blanks fail criteria the source or cause of contamination must be identified and eliminated. In any event, another method blank must be successfully analyzed prior to sample analysis. If any two surrogates of the six identified fail criteria, the sample must be reanalyzed. If surrogates fail a second time, the failure is attributed to matrix effects.

Data Reduction, Validation, and Documentation

Compounds are identified by comparison of the sample mass spectrum to the mass spectrum of the standard reference for the suspected compound on the same GC/MS system and comparison of sample component elution relative retention time (RRT) to that of the standard compound. RRT values must compare within 30 seconds, run during the same 12 hour period. Particular attention must be given to potential co-elution possibilities.

For components not associated with targeted calibrated compounds, a library search may be performed to tentatively identify the component. A library search of all method blanks must be performed for contamination evaluation.

When a compound has been identified, the quantification of that compound will be based on the integrated abundance of the primary characteristic ions for that compound. Quantification will occur employing the internal standard nearest to the retention time of a given analyte as defined by the SW-846 protocol.

Sediment and soil samples are reported on a dry weight basis, while sludges and wastes are reported on a wet weight basis. Spike and spike duplicate data are reported for all results. Results are reported to at least two significant figures. Data is reported in units of μg/L for waters and μg/Kg for soils, sediments, sludges, and wastes. All data is stored by date, instrument, and analyst and routinely "backed up" on magnetic tape.

Analytical data review, validation and reporting criteria are established in General Engineering's Quality Assurance Plan, GEL QAP No.: GL-QS-B-001 - Rev. 9, Section VIII.

TOTAL PETROLEUM HYDROCARBON ANALYSIS (EPA SW-846 MODIFIED METHOD 8015)

Modifications to SW-846 Method 8015 will be implemented to determine the concentration of low boiling and high boiling range organics in water and solid matrices. The sample after purge and trap or methylene chloride extraction is subjected to gas chromatographic analysis. All chromatographic peaks within specified ranges are then integrated and quantification is based on direct comparison to

integrated areas over the same ranges for either a gasoline standard (low boiling) or a diesel fuel standard (high boiling).

Sample Preparation

Low Boiling Range Organics

EPA SW-846 Method 5030, Purge-and-Trap, is utilized in the analytical procedures for both solid and liquid preparation methodology. In this instance both the preparation and analytical processes are instrumentally linked and sequential steps in the overall analysis. An aliquot of water or solid sample is introduced to a sparging vessel (5 mL or 5 gm, respectively). For solid samples, 5 mL of organic free water is added to the vessel. An inert gas (normally helium) is bubbled through the solution to transfer the volatile components to the vapor phase. The vapor is swept through a sorbant column where the low boiling organic components are trapped. After purging is complete, the sorbant column is heated and backflushed with the inert gas to desorb the low boiling organic components onto a gas chromatographic column for analysis.

Solid samples with high concentrations of analytes can be extracted into methanol. An aliquot of the methanol extract is then combined with 5 mL of water in the sparge vessel and the mixture is purged as described.

High Boiling Range Organics

One liter of solution or approximately 25 grams of solid material is extracted with methylene chloride. The extracted is concentrated to a volume of 1 mL. A surrogate compound is added prior to extraction with an optional internal standard.

Analytical Method

Low boiling organic components correspond to an alkane range of approximately C_6 through C_{10} and a boiling point range between approximately 60 degrees C and 170 degrees C. High boiling organic components correspond to an alkane range of approximately C_{10} through C_{24}. Organic components are either purged onto (low boiling) or injected into (high boiling) a chromatographic column where integration of a selected sweet of chromatographic peaks are compared to either a gasoline standard or a diesel fuel standard, respectively.

Method Specific Data Quality Objectives

Refer to Tables 3-1, 3-2, and SW-846 Methods for method specific DQOs for accuracy, precision, and completeness. Table 3-3 identifies objectives for analyte specific sensitivity.

Preventative Maintenance

Preventative maintenance on each GC system involves daily injection port maintenance and periodic column maintenance. Column maintenance may consist of partial removal of frontal column sections, while injection port cleaning or replacement initiated when system sensitivity drops or air is present in the system. Routine baking of the chromatographic columns is employed on a routine basis or when the types and quantities of samples analyzed warrant. Autosampler maintenance is performed by backflushing the systems trap and lines with methanol as needed based on the types and quantities of samples processed.

Each instrument has a maintenance logbook that includes the following information:

- Instrument model and serial number
- Instrument manufacturer
- Instrument identification number
- Service contact personnel and contract information
- Instrument maintenance records
- Service call documentation

Instrument Calibration and Frequency

GC instrumentation is calibrated relative to selected gasoline or diesel standards. Precautions are taken to ensure that the instrument is clean and functioning properly. A single point or multiple point standardization may be performed to establish comparison integrated ranges for the targeted component ranges.

Internal Quality Control Checks

Quality control checks employed during analysis include a gasoline or diesel control standard, surrogate standard additions, method blank analysis, and LCS analysis. Sample spike and spike duplicate determination may also be employed. These control samples are performed with each analytical sample batch (maximum of 20 samples), and which are analyzed within the 12 hour tune window. Criteria as defined in SW-846 will apply.

Corrective Action

When method calibration or QC criteria are not met corrective action will be taken. When initial continuing calibration criteria are not met, reanalysis of the standard may be attempted. If calibration is still not successful new standards or instrument maintenance may be required.

Data Reduction, Validation, and Documentation

Integrated values for the range of components are identified by comparison of the standard employed.

Sediment and soil samples are reported on a dry weight basis, while sludges and wastes are reported on a wet weight basis. Spike and spike duplicate data are reported for all results. Data is reported in units of mg/L for waters and mg/Kg for soils, sediments, sludges, and wastes. All data is stored by date, instrument, and analyst and routinely "backed up" on magnetic tape.

Analytical data review, validation and reporting criteria are established in General Engineering's Quality Assurance Plan, GEL QAP No.: GL-QS-B-001 - Rev. 9, Section VIII.